



[POWER SUPPLY]
[NOISE FILTER]

2016
2017

PRODUCT CATALOG



Before using our product

■ Warning

- ◆ When the product is in operation, inside there are components which have high voltage and high temperature. They may cause electrical shock or burn if you touch the internal components.
- ◆ Do not modify, disassemble or remove the enclosure of the product. This may cause electrical shock, burn or fire hazard.
- ◆ When the product is operating, keep your hands and face away from it. This may cause injury by accident.

■ Attention

- ◆ It is necessary to read the instruction manual and catalog. Please confirm the content of the catalog and instruction manual before you use our products.
- ◆ We make every effort to improve quality and reliability of our products. However the product may accidentally malfunction or fail. Therefore, please ensure fail safe function of your product when our product is used in equipment where high reliability is required (such as nuclear control, aerospace, life-support, traffic control etc.).
- ◆ If the product is used in an environment where water, moisture, dust, strong electromagnetic field or corrosive gas is present, it may cause the failure of the internal components of the product.
- ◆ The life-limited components (such as electrolytic capacitor, internal fan.) should be replaced periodically. Please arrange for the appropriate overhaul period depending on the usage environment.
- ◆ When you export the product, please comply with all appropriate export-related laws, and procedures.

* The content of the catalog may be changed without advanced notice.
If necessary, please request product specification from our representatives before ordering.

Environmentally Friendly Products and its Symbol

We have developed a new internal evaluation system on environmental burdens in order to provide our customers with information on our products and our efforts to promote the development of environmentally friendly products since 2010.

We are looking at the following 3 items in evaluating our products to reduce their environmental burdens.

- (1) Environmental burdens generated when our products are in operation at customers' site.
- (2) Environmental burdens generated when our products are manufactured at our factories.
- (3) Environmental burdens generated when materials and components we purchase are manufactured.

Based on the above 3 items, we set our own criteria to certify and register products which satisfy our criteria as "Eco Products." These Eco Products are highly efficient in reducing environmental burdens. To promote Eco Products, we developed the following symbol which represent Eco Products.



We will proactively expand our Eco Products to create an environmentally friendly low-carbon recycling-oriented society and to continue to grow with our customers.



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PCA
PBA/PBW
PLA
ADA
FETA
SC
LFA
LGA
LFP
LEP
LEB
LDC
SPLFA
TUHS
MG
SUS/SUCS
SFS/SFCS
SFLS
VAF
VAA
STMG
BRNS
BRFS/BRDS
CHS
CE/CQ
CQHS
CDS
CBS
DHS
DBS
TUNS
TUXS
DPG
DPF
SNTU
SNDPG
SNDPF
SNDHS
SNDBS
ACE
MAX
KH
KL
KR
LMA
GHA
PMA
ACE-H
EMI/EMC Filter
Option

OUTLINE



■ Head office



■ Tateyama factory

Company Guidance

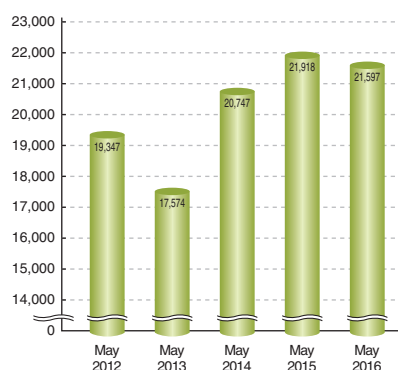
- Established : July 26, 1969.
- Paid Capital : 2,055 Million Yen
- CEO : Masato Tanikawa
- Annual Sales : 21,597 Million Yen (As of May 2016)
(Consolidated)
- Employees : 449 (As of May 2016)
- Subsidiaries : COSEL U.S.A., INC.
COSEL EUROPE GmbH
COSEL ASIA LTD.
COSEL (SHANGHAI) ELECTRONICS CO., LTD.
WUXI COSEL ELECTRONICS CO., LTD.
SHANGHAI COSEL INTERNATIONAL TRADING CO., LTD.
COSEL VIETNAM CO., LTD
TAIYO DENSHI KOGYO CO., LTD.

- History : J u l . 1969 Established ELCO CO., LTD.
- Apr. 1978 Introduced QC circle activities.
- J u n . 1978 Became Pure-Power Supply Business-Play.
- May. 1982 Introduced TQC activities (Now changed to TQM activities).
- J u n . 1983 Introduced Hoshin Management (Business Goal Management) activities.
- Mar. 1988 Introduced Toyota Production System activities.
- Mar. 1989 Tateyama Factory completed.
- Apr. 1990 Established COSEL U. S. A., INC. (Former U. S. ELCO INC.) in San Jose, USA.
- Apr. 1992 Changed company name to COSEL CO., LTD. from ELCO CO., LTD.
- J u n . 1993 Acquired ISO9001.
- May. 1995 Set a representative in Hong Kong, China.
- May. 1996 Introduced TPM (Total Plant Maintenance) activities.
- J u l . 1997 Established COSEL EUROPE GmbH in Frankfurt, Germany.
- May. 1998 Established COSEL ASIA LTD. in Hong Kong, China.
- J a n . 1999 Shares listed on the Second Sections of the Tokyo Stock Exchange and Nagoya Stock Exchange both.
- Dec. 1999 Acquired ISO14001.
- May. 2000 Shares listed on the First Section of the Tokyo Stock Exchange.
- Nov. 2002 Established COSEL (SHANGHAI) ELECTRONICS CO., LTD. in Shanghai, China.
- Mar. 2005 Entering EMI filter Business.
- Feb. 2006 Successfully completed the RoHS Directive conformity.
- Nov. 2011 Established SHANGHAI COSEL INTERNATIONAL TRADING CO., LTD. in Shanghai, China.
- Dec. 2011 Established WUXI COSEL ELECTRONICS CO., LTD. in Wuxi, China.
- Aug. 2015 Established COSEL VEITNAM CO., LTD in Ho Chi Minh City, Vietnam.

Data

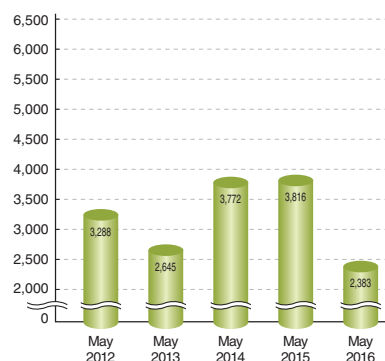
Annual sales

(Consolidated)
(Unit: Million Yen)



Net profit/loss before tax

(Consolidated)
(Unit: Million Yen)



AC-DC Power Supplies

Enclosed Type	Single output				
	PBA series 	PLA series 	ADA series 	FETA series 	FCA series WEB
	Multiple output		Front-end		
	PBW series 	SC series 	STA series WEB		
	Configurable Type				
	Single/Multiple output				
	ACE series 		MAX series 		




Open Frame / Enclosed Type	Single output				
	LFP series 	LFA series 	LEP series 	LEA series WEB	LDA series WEB



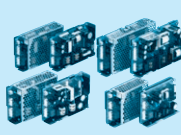

PCB Mount Type	Single/Multiple output				
	TUHS series 	VAF series 	VAA series 	YAS-YAW series WEB	YS-YW series WEB


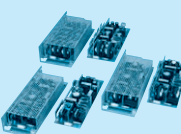
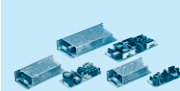
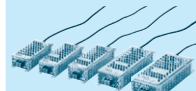
DC-DC Converters

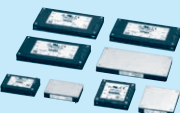



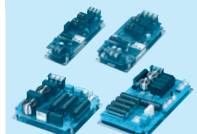
PCB Mount Type	Single/Multiple output				
	MG series 	SUS-SUW/SUCS-SUCW SUTS-SUTW series 	SFS/SFCS series 	SFLS series 	ZUS-ZUW ZTS-ZTW series WEB

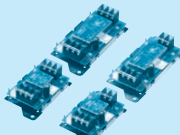

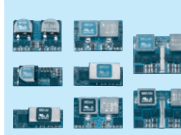
Bus Converter- Power Module Type	Single output				
	CHS series 	CES-CQS series 	CQHS series 	CBS series 	CDS series



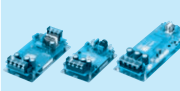
DIN Rail Type	Single output	Redundancy Module	
	KH series	KL series	KR series
			

Medical Type	Single/Multiple output			
	LMA series	GHA series	PMA series	ACE-H series
				

LGA series	Multiple output		Value-added
	LEB series	LDC series	SPLFA series
			

Bus Converter- Power Module Type	Single output	PFC Front-end module		Value-added
	TUNS series	TUXS series	DPG series	DPF series
				
	SNTU-SNDPG SNDPF series			
				

Value-added	POL Type	Single output
STMG series		BRNS series
		BRFS/BRDS series
		
		

DHS series	DBS series	Value-added
		SNDHS- SNDBS series
		

[Notice]

[WEB](#) : Specifications available on the Cosel website only.

UL :UL C-UL :UL C-UL SP® :CSA TÜV :TÜV DEMKO :DEMKO PSE :PSE CE :CE RoHS :RoHS

Configurable Type

Multiple

Input Voltage Range	Outputs	Series	Output Power [W]	Release Year	Main Feature	Safety Standard · RoHS
AC100V AC200V AC400V			20 40 60 100 200 300 400 500 600 700 800 900 1k 2k 3k 4k			
	4	ACE	300	'01	Available to select 4-6 channels among many output · current modules.	.FAL. △ CE RoHS
	5		400 600			
	6		800			
	4	MAX	1k	'00	Available to select 1-4 channels among many output · current modules.	.FAL. △ CE RoHS
	8		2k	'01	Available to select 1-8 channels among many output · current modules. Three-phase	
	4		3k	'02	Available to select 1-4 channels among many output · current modules. Three-phase	

Open Frame/Enclosed Type

Single

AC100V AC200V AC400V			5 10 15 20 40 80 100 150 200 300 400 500 1000 1500			
	1	LFP	300	'12 '13	Peak current function. Succeeding series of LEP series.	.FAL. △ CE RoHS
	1	LEP	100 200 300	'02	Peak current function.	
	1	LFA	10 20 40 80 100 150 200 300 400	'09 '10	Open frame type power supplies for general purpose. Succeeding series of LEA series.	.FAL. △ CE RoHS
		SPLFA	40 80 100 150 200 300	'11	PSE standard approved type of LFA series.	
	1	LEA	80 100 150 200 300	'99	Open frame type power supplies for general purpose.	.FAL. △ CE RoHS
	1	LDA	10 20 40 80 100 150 200 300 400	'94 '95 '97	Open frame type power supplies for general purpose.	
	1	LGA	100 200 300 400 500	'08	AC100V input open frame type power supplies for general purpose.	.FAL. △ CE RoHS

Multiple

	2	LEB	100 200 300	'00	2 Outputs of LEA series.	.FAL. △ CE RoHS
	3	LDC	40 80 100	'94 '95	3 Outputs of LDA series.	.FAL. △ CE RoHS

Medical Type

Single

AC100V AC200V AC400V			10 20 40 60 80 100 150 200 250 300 400 500 600 700 800 900 1000 1500			
	1	LMA	100 150 200	'14	Open frame type Peak current function. For medical applications.	.FAL. ① CE RoHS
	1	GHA	250 400 500	'13 '15 '16	Open frame type 3X5 inches. Conduction cooling. For medical applications -SNF: Optional with FAN.	
	1	PMA	20 40 60 80 100	'10	Enclosed type For medical applications.	.FAL. △ CE RoHS
AC100V AC200V AC400V			20 40 60 100 200 300 400 500 600 700 800 900 1k 2k 3k 4k 5k 6k 7k over			
	4	ACE-H	300	'11	Multiple output in large power with 1-4CH(ACE300F), 1-5CH(ACE450F,650F) 1-6CH(ACE900F) Harmonic attenuator Universal input voltage range.	.FAL. △ CE RoHS
	5		400 600			
	6		800			

PCA
PBA/PBW
PLA
ADA
FETA
SC
LFA
LGA
LFP
LEP
LEB
LDC
SPLFA
TUHS
MG
SUS/UNT
SPS/SPCS
SFLS
VAF
VAA
STMG
BRNS
BRNS/BRIS
CHS
CE/CQ
CQHS
CDS
CBS
DHS
DBS
TUNS
TUXS
DPG
DPF
SNTU
SNDPG
SNDPF
SNDHS
SNDBS
ACE
MAX
KH
KL
KR
LMA
GHA
PMA
ACE-H
EMI/EMC Filter

POL Type

Single

Input Voltage Range	Outputs	Series	Output Current [A]								Released Year	Main Feature	Safety Standard · RoHS	
			6	12	20	30	40	50	60	100				
DC3~14.4V	1	BRNS	●	●	●						'13	Compact size · Wide input		
DC4.5~14.0V	1	BRFS				●		●			'13	Compact size · Fast transient response		
							●		●	●	'14	Compact size · Fast transient response		
DC4.5~14.0V	1	BRDS					●		●	●	'15	Compact size · Fast transient response, PMBus		

Bus Converter · Power Module Type

Single

Input Voltage Range	Outputs	Series	Output Power [W]										Released Year	Main Feature	Safety Standard · RoHS			
DC3V DC3.3V DC4.5V DC5V DC6V DC12V DC15V DC24V DC28V DC48V AC100V AC200V			5	10	15	20	40	80	100	150	200	300	400	500	1000			
		1														'11 '13 '14 '15 '16	DC24V • 48V input bus converter, brick size	
		1														'03	DC24V • 48V input bus converter, 1/8 brick size	
		1														'03	DC24V • 48V input bus converter, 1/4 brick Size	
		1														'10 '13 '14	DC48V input, brick Size	
		1														'01 '05	DC24V • 48V input, half brick size	
		1														'00 '01	DC24V • 48V input, full brick size	
		1														'10 '09	DC110V input, small brick size DC280V input, small brick size	
		1														'03 '00	DC110V input, full function and full brick size DC280V input, full function and full brick size	
		1														'12 '14 '15	AC100/200V input. Complied with harmonic regulations. Isolated type. Brick size	
		1														'15	AC100/200V input. High efficiency. Complied with harmonic regulations. Isolated type.	
		1														'10	AC100/200V input. Compact size. Complied with harmonic regulations.	
		1														'00	AC100/200V input. High wattage. Complied with harmonic regulations.	
		1														'13	Value-added type of TUNS series	
		1														'11	Value-added type of DPG series	
		1														'12	Value-added type of DPF series	
		1														'12 '11	Value-added type of DHS series (DC110V input) Value-added type of DHS series (DC280V input)	
		1														'12	Value-added type of DBS series	

Input Voltage Range	Outputs	Series	Output Power [W]										Released Year	Main Feature	Safety Standard · RoHS			
DC9V DC12V DC15V DC24V AC100V AC100V AC200V			1.5	3	5	6	10	15	20	25	30							
	NEW	1	MGS									●	'10	Global standard DC/DC converter for general purpose.			RoHS	
				●	●		●	●					●		'16			RoHS
		1	MGFS									●	●	'10	Wide-input global standard DC/DC converter for general purpose.			RoHS
		1	STMG									●	●	'13	Value-added type of MGFS series			RoHS
		1	SUS/SUCS	●	●		●	●						'04	Compact and thin DC/DC Converter for general purpose			RoHS
		1	SUTS		●		●	●						'09	Vertical type of SUCS series			RoHS
		1	SFS						●			●	'05	Thin SMD/DIP type DC/DC converter			RoHS	
							●	●		●	'03							
									●			'05						
		1	SFCS						●			●	'07	SFS series with metal cover			RoHS	
		1	SFLS					●	●			●	'07	Thin SMD type DC/DC converter			RoHS	
		1	ZUS	●	●		●	●					'96	DC/DC converter for general purpose			RoHS	
									●			●	'93					
		1	ZTS	●	●								'98	Vertical type of ZUS series			RoHS	
	NEW	1	TUHS		●	●		●				●	'14	AC100/200V input, compact size			RoHS	
										●			'15					
		1	VAF			●		●					'99	AC100/200V input			RoHS	
		1	VAA			●		●					'98	AC100V input			RoHS	
		1	YAS			●		●					'91	AC 100/200V input			RoHS	
		1	YS			●		●	●				'89	AC 100V input			RoHS	
		2	MGW						●			●	'10	2 outputs of MG series			RoHS	
		2	MGFW						●			●	'10	2 outputs of MGF series			RoHS	
		2	STMG						●			●	'13	Value-added type of MGFW series			RoHS	
		2	SUW/SUCW	●	●		●	●					'04	SU series with metal cover			RoHS	
		2	SUTW		●		●	●					'09	Vertical type of SUCW series			RoHS	
		2	ZUW	●	●		●	●					'96	2 outputs of ZU series			RoHS	
									●			●	'93					
		2	ZTW	●	●								'98	Vertical type of ZUW series			RoHS	
		2	YAW			●		●					'91	2 outputs of YA series			RoHS	
		2	YW			●		●	●				'89	2 outputs of Y series			RoHS	

When a failure in product is found, contact our distributors or our sales subsidiaries.

1. Free Repair

Repair is free of charge when the following cases apply:

- (1) If the product returned is still within warranty period and damages are due to component failure.
- (2) Damages are due to Cosel's manufacturing and design errors.

2. Charged Repair

Repair is charged when the following cases apply:

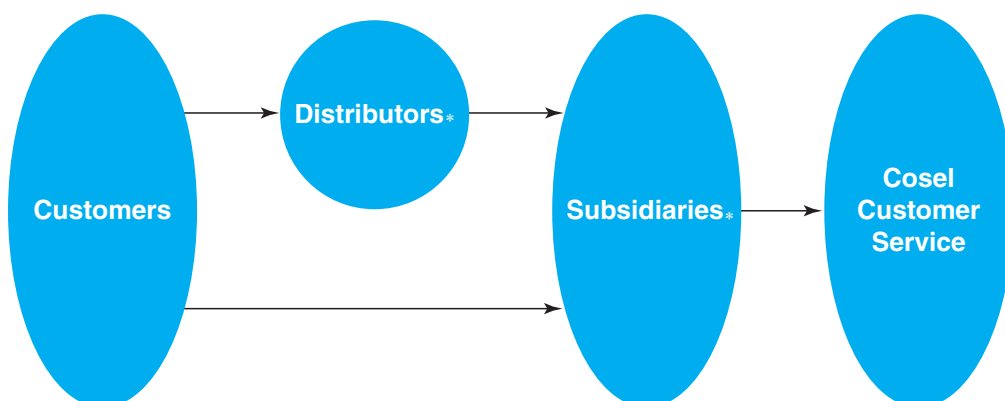
- (1) Products' warranty period has expired.
- (2) Electrical or physical damages are caused by customer.
- (3) The product returned is over 6months from first operation but no problem is found after analysis.
- (4) Damages are due to use outside of our published specifications.
- (5) Damages are caused by Acts of God such as fire, flood, earthquake, etc.
- (6) Time—deteriorating parts such as electrolytic capacitors, cooling fans, etc. are replaced.

3. Warranty After Repair

- (1) As for the products whose regular warranty period has expired, the repaired products will have a 3—month warranty.

4. Repair and Service Network

When a failure in product is found, please return the products in the following way:



* Please refer to Sales Network in this catalog.

AC-DC Power Supplies Enclosed Type

COSEL

Power
Factor
Correction

World wide

Safety
Approvals

EMI

Inrush
current
limiting

OCP

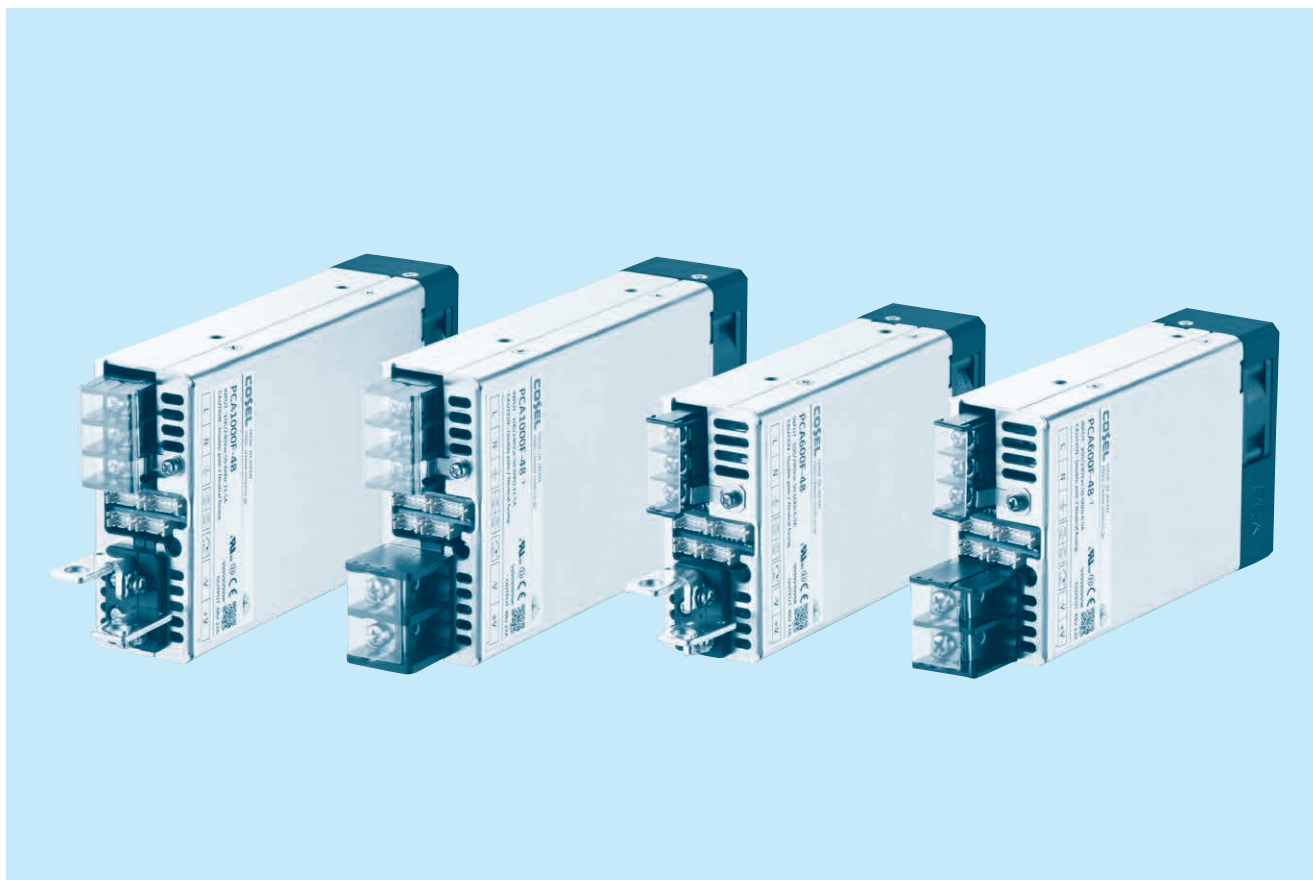


OVP

Remote
ON/OFFParallel
Operation

1U

PCA-series



Feature

Low profile (41mm, 1.61 inch = meet to 1U height)
 Universal input (AC85 - 264V)
 For medical electric equipment
 (ANSI/AAMI ES60601-1, EN60601-1 3rd)
 With AUX
 Constant current regulation
 Built-in Alarm
 Parallel Operation / Parallel Redundancy Operation

Safety agency approvals

UL60950-1, C-UL(CSA60950-1), EN60950-1,
 ANSI/AAMI EN60601-1, EN60601-1 3rd

CE marking

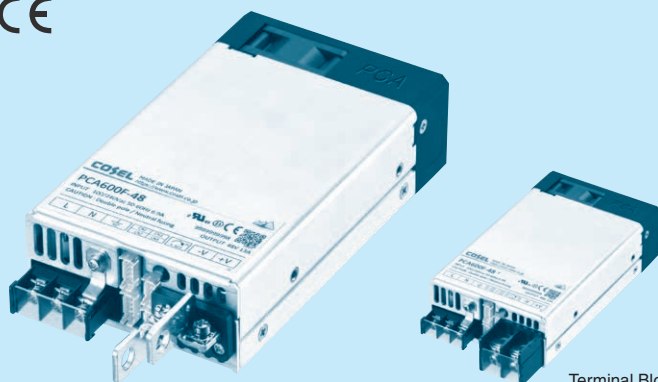
Low Voltage Directive

EMI

Complies with FCC-B, CISPR22-B, EN55011-B,
 EN55022-B, VCCI-B
 (Additional EMI/EMS Filter required by PCA1000F)

EMS Compliance : EN61204-3, EN61000-6-2

EN61000-4-2
 EN61000-4-3
 EN61000-4-4
 EN61000-4-5
 EN61000-4-6
 EN61000-4-8
 EN61000-4-11



Terminal Block Style

Example recommended EMI/EMC filter
NAC-16-472

High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *5

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PCA600F-5	PCA600F-12	PCA600F-15	PCA600F-24	PCA600F-48
MAX OUTPUT WATTAGE[W]	600	636	645	648	624
DC OUTPUT	5V 120A	12V 53A	15V 43A	24V 27A	48V 13A

SPECIFICATIONS

	MODEL		PCA600F-5	PCA600F-12	PCA600F-15	PCA600F-24	PCA600F-48	
INPUT	VOLTAGE[V]		AC85 - 264 1 φ					
	CURRENT[A]	ACIN 100V	7.3typ					
		ACIN 230V	3.2typ					
	FREQUENCY[Hz]		50/60 (45 - 66)					
	EFFICIENCY[%]	ACIN 100V	(Io=50%)	91typ	91typ	91typ	91typ	92typ
			(Io=100%)	89typ	90typ	90typ	90typ	91typ
		ACIN 230V	(Io=50%)	92typ	93typ	93typ	93typ	93typ
			(Io=100%)	91typ	92typ	92typ	93typ	93typ
	POWER FACTOR	ACIN 100V	0.98typ (Io=100%)					
ACIN 230V		0.95typ (Io=100%)						
INRUSH CURRENT[A]	ACIN 100V *1	20/40 typ (Io=100%) (Primary inrush current / Secondary inrush current) (More than 3 sec. to re-start)						
	ACIN 230V *1	40/40 typ (Io=100%) (Primary inrush current / Secondary inrush current) (More than 3 sec. to re-start)						
LEAKAGE CURRENT[ma]		0.5max (ACIN 240V 60Hz, Io=100%, According to IEC60601-1, DENAN)						
OUTPUT	VOLTAGE[V]		5	12	15	24	48	
	CURRENT[A]		120	53	43	27	13	
	LINE REGULATION[mV]		20max	48max	60max	96max	192max	
	LOAD REGULATION[mV]		40max	100max	120max	150max	300max	
	RIPPLE[mVp-p]	0 to +50℃ *2	80max	120max	120max	120max	150max	
		-20 - 0℃ *2	140max	160max	160max	160max	400max	
	RIPPLE NOISE[mVp-p]	0 to +50℃ *2	120max	150max	150max	150max	200max	
		-20 - 0℃ *2	160max	180max	180max	180max	500max	
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	120max	150max	240max	480max	
		-20 to +50℃	75max	180max	180max	290max	600max	
	DRIFT[mV]		*3	20max	48max	60max	96max	
	START-UP TIME[ms]		400typ (ACIN 100/230V Io=100%)					
	HOLD-UP TIME[ms]		20typ (ACIN 230V Io=80%) / 16typ (ACIN 230V Io=100%)					
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		3.00 to 6.00	7.20 to 14.40	9.00 to 18.00	14.40 to 28.80	28.80 to 57.60		
OUTPUT VOLTAGE SETTING[V]		5.00 to 5.15	12.00 to 12.48	15.00 to 15.60	24.00 to 24.96	48.00 to 49.92		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating (Recovers automatically, Intermittent overcurrent)					
	OVERVOLTAGE PROTECTION		Provided					
	REMOTE SENSING		Provided					
	REMOTE ON/OFF		Provided					
ISOLATION	INPUT-OUTPUT · RC · AUX · PG		AC4,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)					
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)					
	OUTPUT-FG		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)					
	OUTPUT-RC · AUX · PG		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)					
ENVIRONMENT	OPERATING TEMP.,HUMIDITY.AND ALTITUDE		-20 to +70℃, 20 - 90%RH (Non condensing)					
	STORAGE TEMP.,HUMIDITY.AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing)					
	VIBRATION		10 - 55Hz 19.6m/s ² (2G) 3minutes period, 60minutes each along X, Y and Z axis					
	IMPACT		196.1m/s ² (20G) 11ms, once each X, Y and Z axis					
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1, ANSI/AAMI ES60601-1, EN60601-1 3rd					
	CONDUCTED NOISE		Complies with FCC Part15 classB, VCCI-B, CISPR22-B, EN55011-B, EN55022-B					
	HARMONIC ATTENUATOR *4		Complies with IEC61000-3-2 (class A)					

SPECIFICATIONS

OTHERS	CASE SIZE/WEIGHT	89×41×152mm [3.50×1.61×5.98 inches] (without terminal block and screw) (W×H×D) / 840g max
	COOLING METHOD	Forced cooling (internal fan)

*1 The value is primary surge. The current of input surge to a built-in EMI/EMS Filter(0.2ms or less) is excluded.

*2 Measured by 20MHz oscilloscope or Ripple-Noise meter (equivalent to KEISOKU-GIKEN:RM103).

*3 Drift is the change in DC output for an eight hours period after a half-hour warm-up at 25°C.

*4 Please contact us about another class.

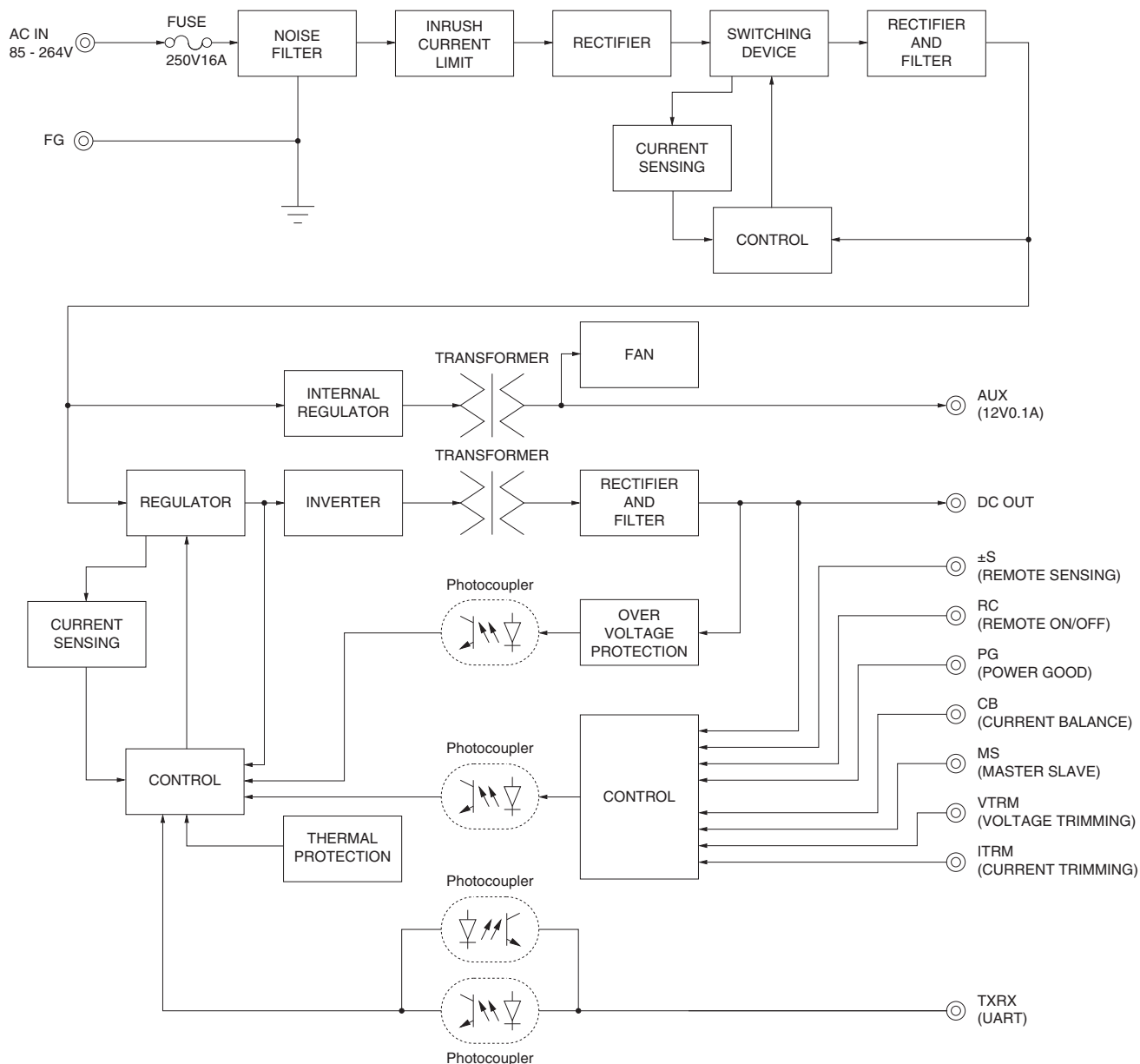
*5 The listed options products may affect the published standard specifications. Please contact us for detailed product specifications and safety approvals.

- * A sound may occur from power supply at pulse loading.

Features

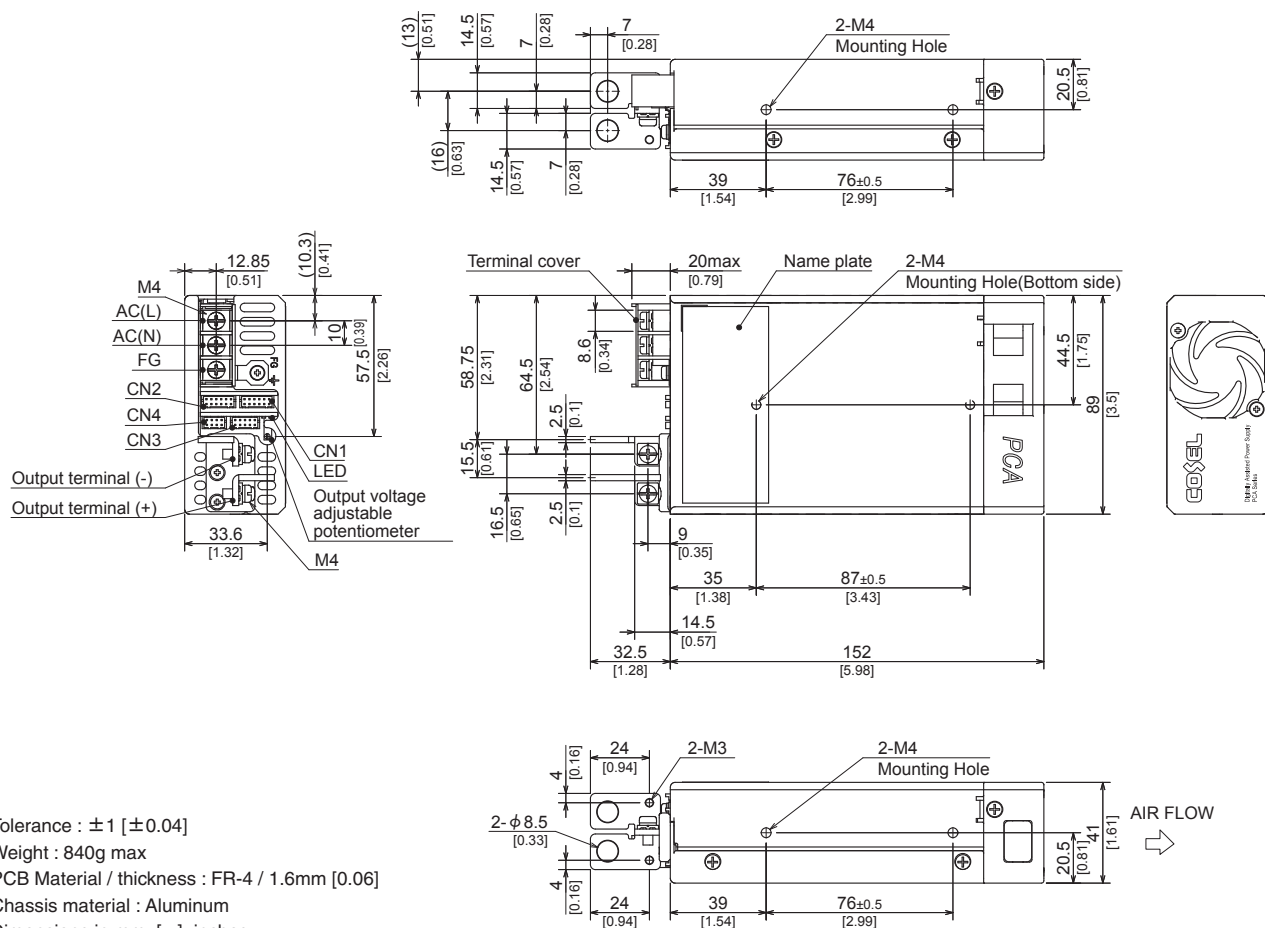
- Low profile (41mm, 1.61 inch = meet to 1U height)
- Universal input (AC85 - 264V)
- For medical electrical equipment (ANSI/AAMI ES60601-1, EN60601-1 3rd)
- With AUX
- Constant current regulation
- Built-in Alarm
- Parallel Operation / Parallel Redundancy Operation

Block diagram



External view

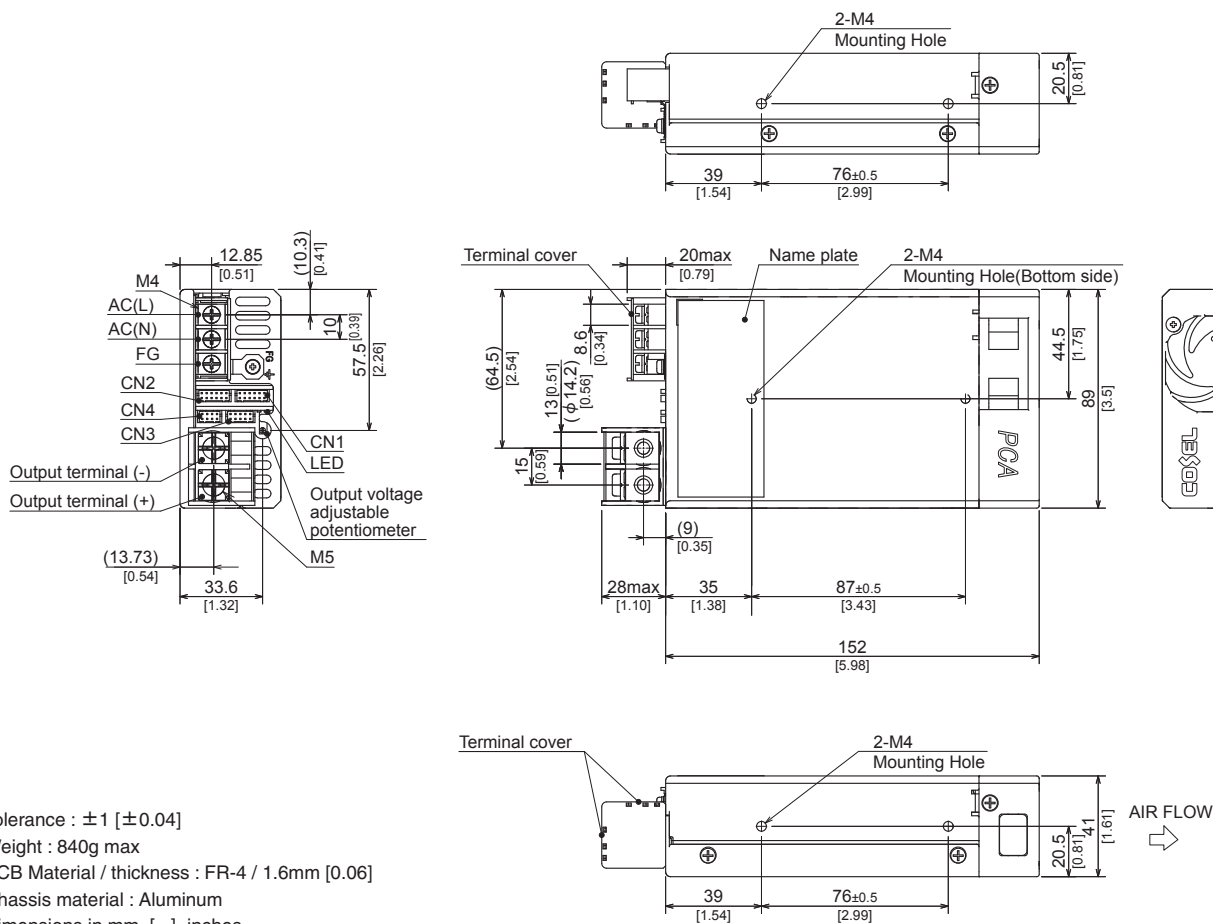
<PCA600F-□ (Bus Bar Style) >



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 840g max
- ※ PCB Material / thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Dimensions in mm, []=inches
- ※ Mounting torque : $1.2\text{N} \cdot \text{m}$ max
- ※ Screw tightening torque : M4 $1.6\text{N} \cdot \text{m}$ max
- ※ Please connect safety ground to FG terminal on the unit.

External view

<PCA600F-□-T (Terminal Block Style) >



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 840g max
- ※ PCB Material / thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Dimensions in mm, []=inches
- ※ Mounting torque : 1.2N·m max
- ※ Screw tightening torque : M4 1.6N·m max
M5 2.5N·m max
- ※ Please connect safety ground to FG terminal on the unit.

PCA1000F PRELIMINARY

PC A 1000 F -5 -□

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Terminal Block Style

Example recommended EMI/EMC filter
NAC-20-472

High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *5

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PCA1000F-5	PCA1000F-12	PCA1000F-15	PCA1000F-24	PCA1000F-48
MAX OUTPUT WATTAGE[W]	1000	1056	1050	1056	1056
DC OUTPUT	5V 200A	12V 88A	15V 70A	24V 44A	48V 22A

SPECIFICATIONS

	MODEL		PCA1000F-5	PCA1000F-12	PCA1000F-15	PCA1000F-24	PCA1000F-48	
INPUT	VOLTAGE[V]		AC85 - 264 1 φ					
	CURRENT[A]	ACIN 100V	11.8typ					
		ACIN 230V	5.1typ					
	FREQUENCY[Hz]		50/60 (45 - 66)					
	EFFICIENCY[%]	ACIN 100V	(Io=50%)	91typ	91typ	91typ	92typ	92typ
			(Io=100%)	89typ	91typ	91typ	91typ	91typ
		ACIN 230V	(Io=50%)	92typ	93typ	93typ	93typ	93typ
			(Io=100%)	91typ	93typ	93typ	94typ	94typ
	POWER FACTOR	ACIN 100V	0.98typ (Io=100%)					
		ACIN 230V	0.95typ (Io=100%)					
INRUSH CURRENT[A]	ACIN 100V *1	20/40 typ (Io=100%) (Primary inrush current / Secondary inrush current) (More than 3 sec. to re-start)						
	ACIN 230V *1	40/40 typ (Io=100%) (Primary inrush current / Secondary inrush current) (More than 3 sec. to re-start)						
LEAKAGE CURRENT[ma]		0.5max (ACIN 240V 60Hz, Io=100%, According to IEC60601-1, DENAN)						
OUTPUT	VOLTAGE[V]		5	12	15	24	48	
	CURRENT[A]		200	88	70	44	22	
	LINE REGULATION[mV]		20max	48max	60max	96max	192max	
	LOAD REGULATION[mV]		40max	100max	120max	150max	300max	
	RIPPLE[mVp-p]	0 to +50℃ *2	80max	120max	120max	120max	150max	
		-20 - 0℃ *2	140max	160max	160max	160max	400max	
	RIPPLE NOISE[mVp-p]	0 to +50℃ *2	120max	150max	150max	150max	200max	
		-20 - 0℃ *2	160max	180max	180max	180max	500max	
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	120max	150max	240max	480max	
		-20 to +50℃	75max	180max	180max	290max	600max	
	DRIFT[mV]		*3	20max	48max	60max	96max	
	START-UP TIME[ms]		400typ (ACIN 100/230V Io=100%)					
	HOLD-UP TIME[ms]		20typ (ACIN 230V Io=80%) / 16typ (ACIN 230V Io=100%)					
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		3.00 to 6.00	7.20 to 14.40	9.00 to 18.00	14.40 to 28.80	28.80 to 57.60		
OUTPUT VOLTAGE SETTING[V]		5.00 to 5.15	12.00 to 12.48	15.00 to 15.60	24.00 to 24.96	48.00 to 49.92		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating					
	OVERVOLTAGE PROTECTION		Provided					
	REMOTE SENSING		Provided					
	REMOTE ON/OFF		Provided					
ISOLATION	INPUT-OUTPUT · RC · AUX · PG		AC4,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)					
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)					
	OUTPUT-FG		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)					
	OUTPUT-RC · AUX · PG		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)					
ENVIRONMENT	OPERATING TEMP.,HUMIDITY.AND ALTITUDE		-20 to +70℃, 20 - 90%RH (Non condensing)					
	STORAGE TEMP.,HUMIDITY.AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing)					
	VIBRATION		10 - 55Hz 19.6m/s ² (2G) 3minutes period, 60minutes each along X, Y and Z axis					
	IMPACT		196.1m/s ² (20G) 11ms, once each X, Y and Z axis					
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1, ANSI/AAMI ES60601-1, EN60601-1 3rd					
	CONDUCTED NOISE		Complies with FCC Part15 classB, VCCI-B, CISPR22-B, EN55011-B, EN55022-B, additional EMI/EMS Filter required					
	HARMONIC ATTENUATOR *4		Complies with IEC61000-3-2 (class A)					

SPECIFICATIONS

OTHERS	CASE SIZE/WEIGHT	102 X 41 X 178mm [4.02 X 1.61 X 7.01 inches] (without terminal block and screw) (W X H X D) / 1.2kg max
	COOLING METHOD	Forced cooling (internal fan)

*1 The value is primary surge. The current of input surge to a built-in EMI/EMS Filter(0.2ms or less) is excluded.

*2 Measured by 20MHz oscilloscope or Ripple-Noise meter (equivalent to KEISOKU-GIKEN:RM103).

*3 Drift is the change in DC output for an eight hours period after a half-hour warm-up at 25°C.

*4 Please contact us about another class.

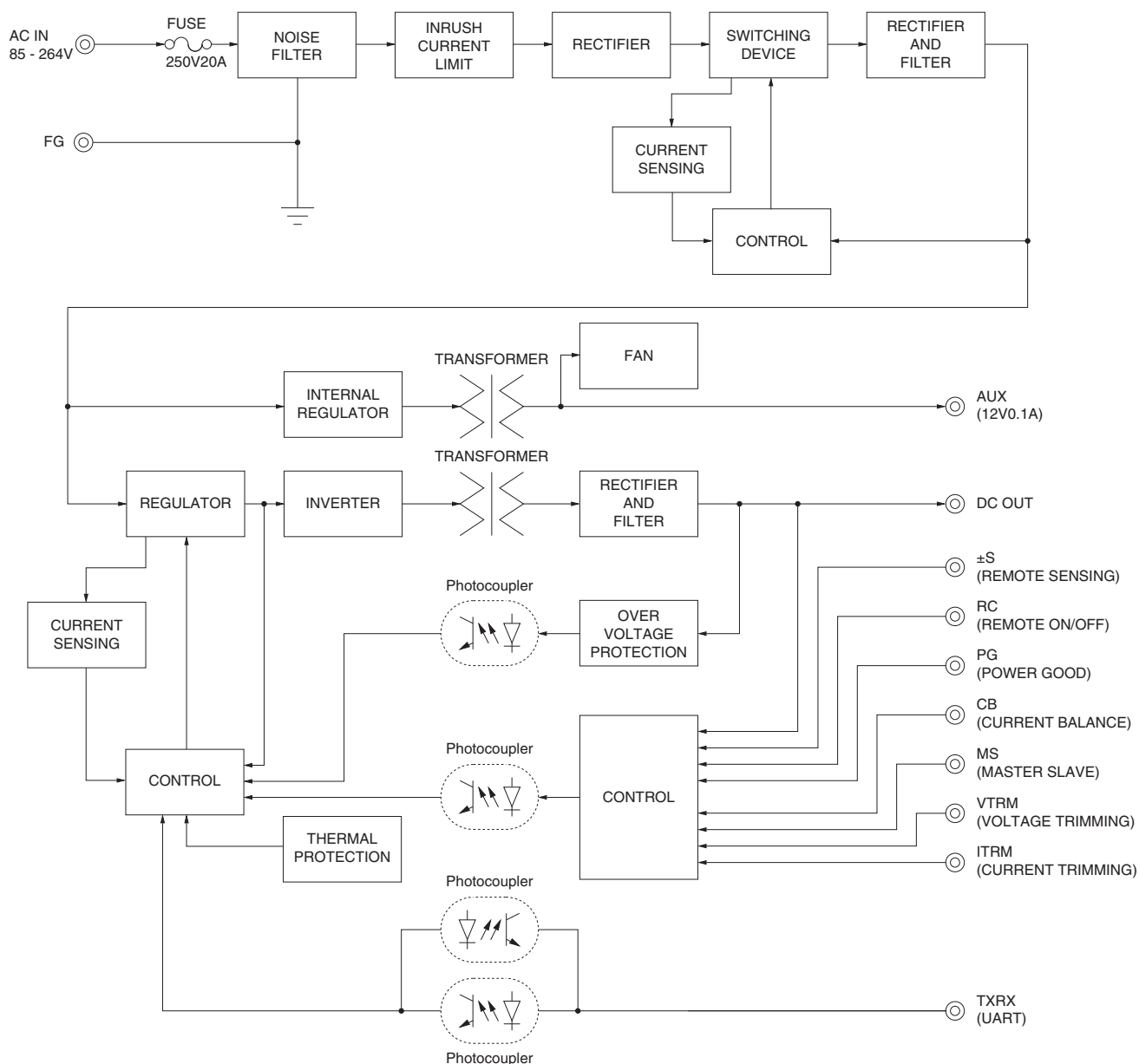
*5 The listed options products may affect the published standard specifications. Please contact us for detailed product specifications and safety approvals.

- * A sound may occur from power supply at pulse loading.

Features

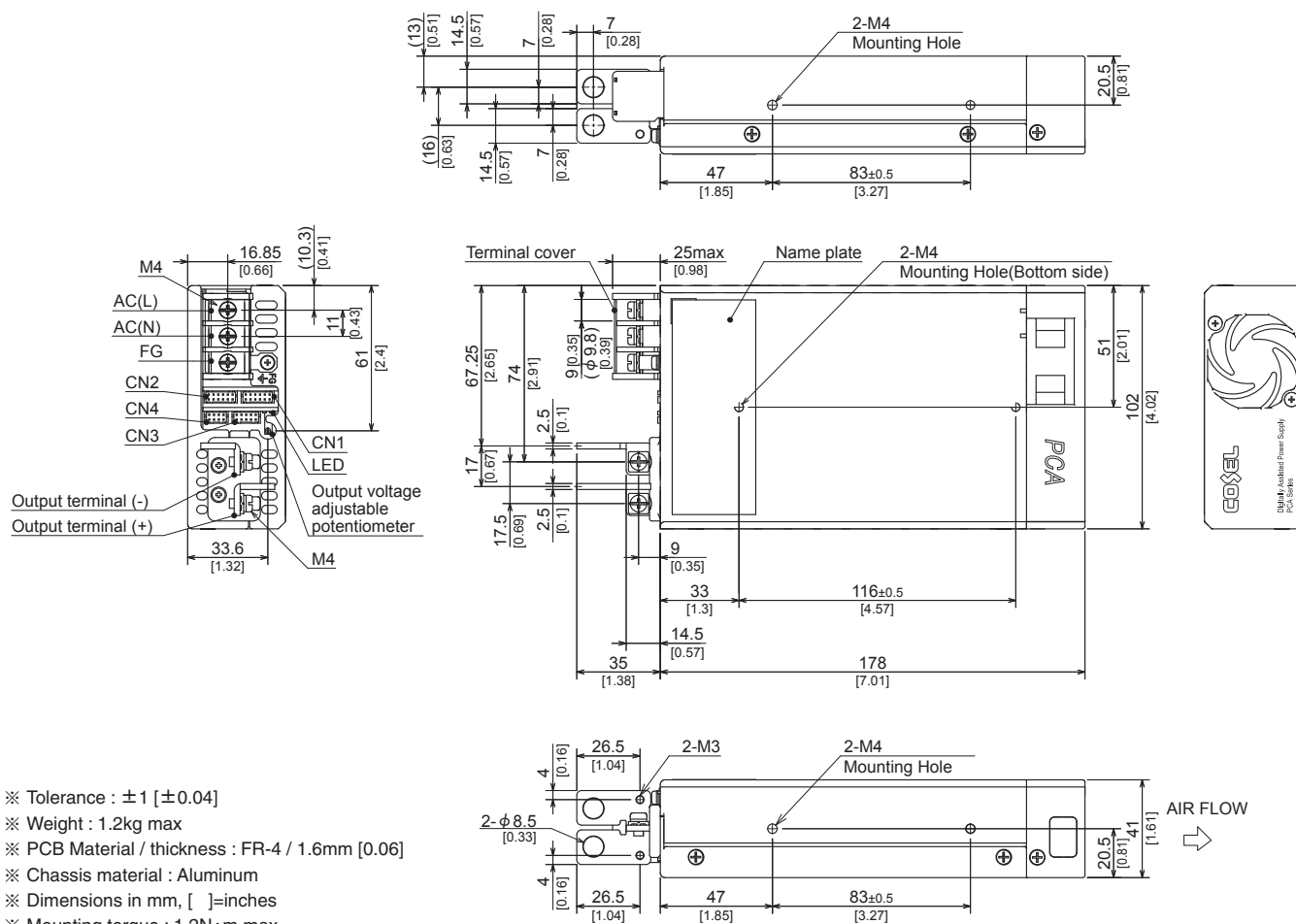
- Low profile (41mm, 1.61 inch = meet to 1U height)
- Universal input (AC85 - 264V)
- For medical electrical equipment (ANSI/AAMI ES60601-1, EN60601-1 3rd)
- With AUX
- Constant current regulation
- Built-in Alarm
- Parallel Operation / Parallel Redundancy Operation

Block diagram



External view

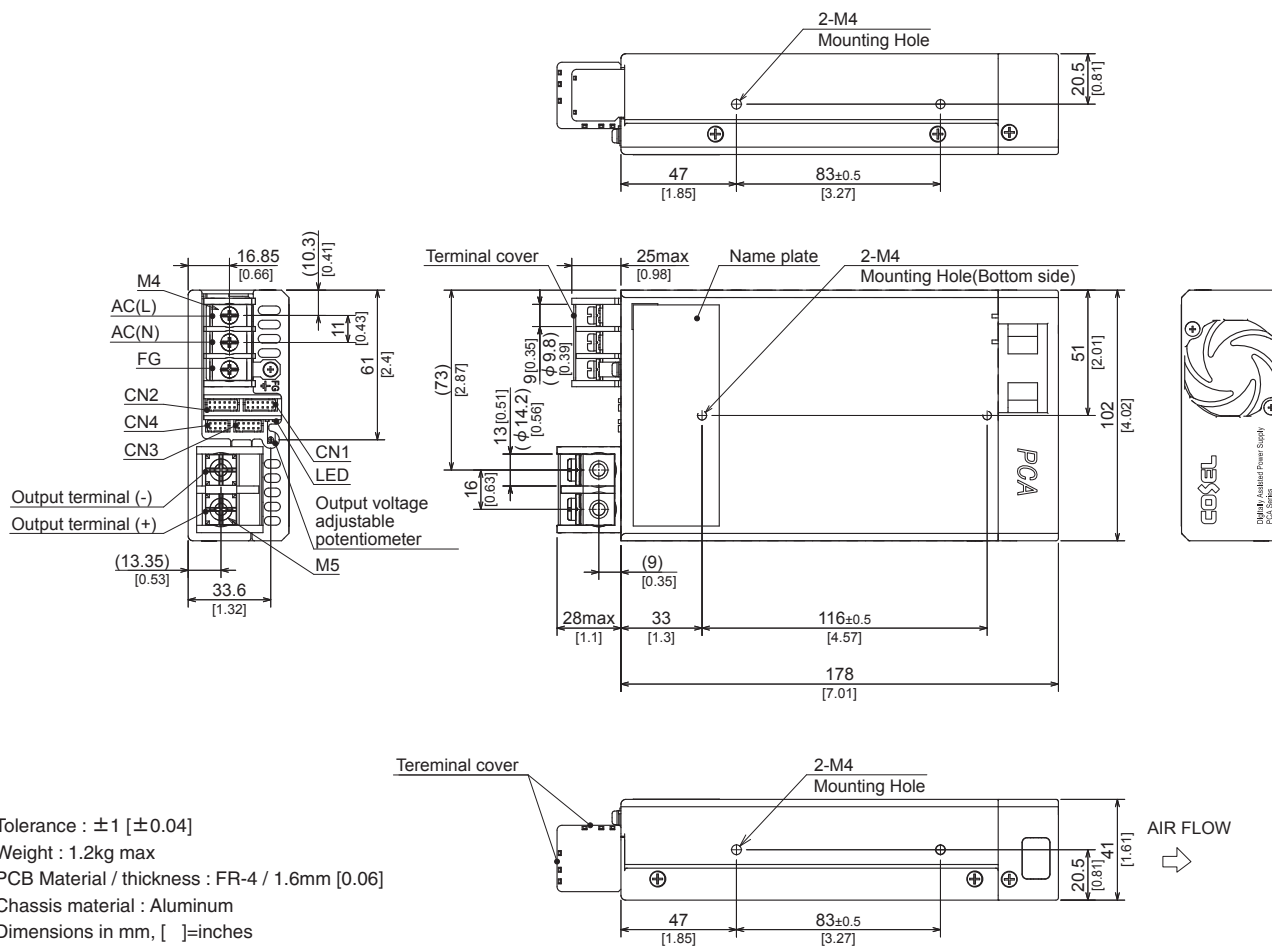
<PCA1000F-□ (Bus Bar Style) >



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 1.2kg max
- ※ PCB Material / thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Dimensions in mm, []=inches
- ※ Mounting torque : 1.2N·m max
- ※ Screw tightening torque : M4 1.6N·m max
- ※ Please connect safety ground to FG terminal on the unit.

External view

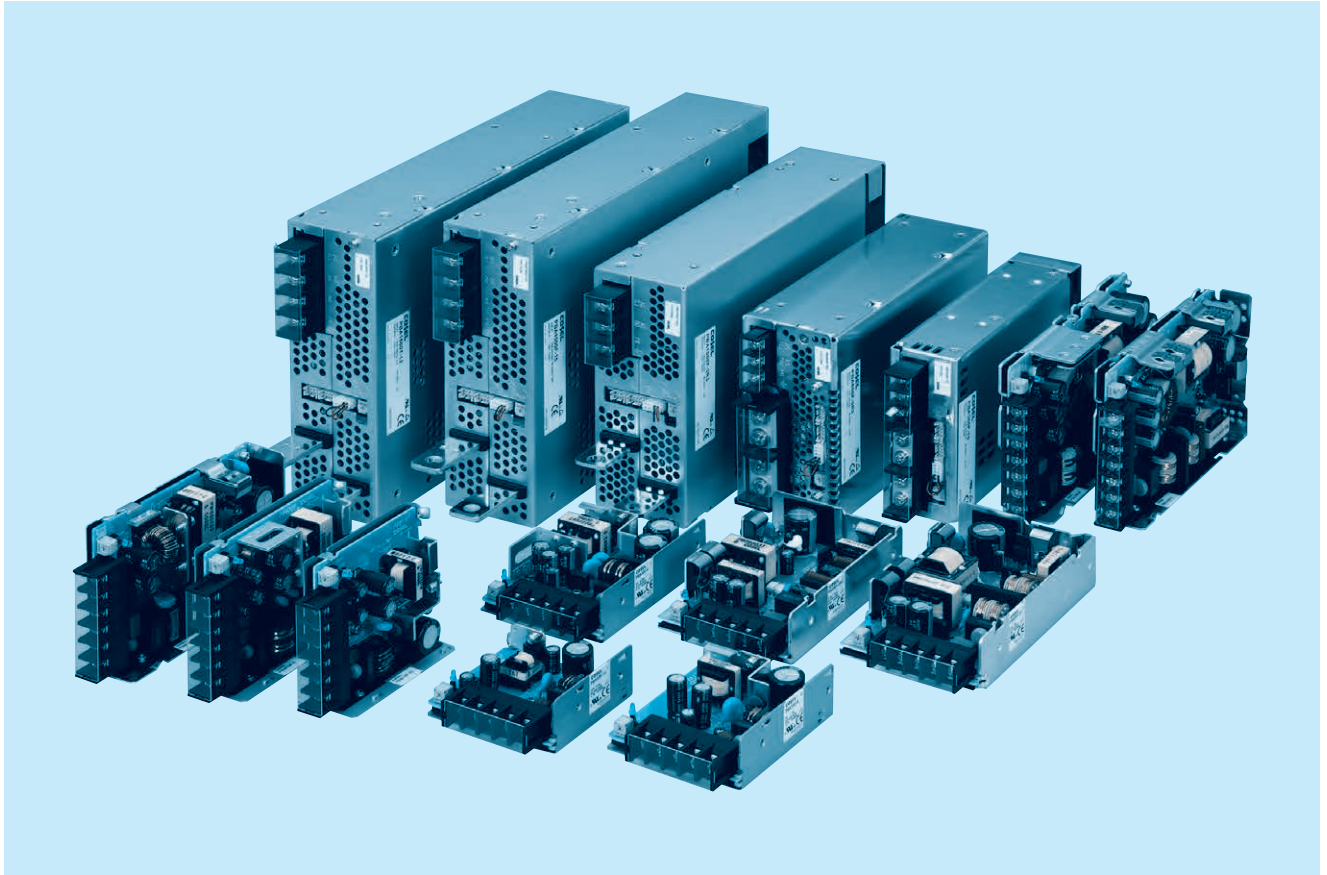
<PCA1000F-□-T (Terminal Block Style) >



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 1.2kg max
- ※ PCB Material / thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque : 1.2N · m max
- ※ Screw tightening torque : M4 1.6N · m max
M5 2.5N · m max
- ※ Please connect safety ground to FG terminal on the unit.



PBA, PBW-series



Feature

Super small-size & light weight
 Harmonic attenuator (Complies with IEC61000-3-2) : except PBA1500T
 Universal input (AC85 - 264V) : PBA1500T(AC170 - 264V 3 ϕ)
 Efficiency increased with synchronous rectification technology (PBA50F - 150F)
 Variety of option (PBA10F - 150F, PBW15F - 50F)
 Parallel operation and Parallel redundancy operation (PBA300F - 1500F, PBA1500T)
 Fan alarm, Remote ON/OFF and other functions (PBA300F - 1500F, PBA1500T)

Safety agency approvals

UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178
 UL508 (PBA10F - 150F, -24, with cover)
 Complies with DEN-AN

EMI

Complies with FCC-B, CISPR22-B, EN55011-B, EN55022-B, VCCI-B

5-year warranty (refer to Instruction Manual)

CE marking

Low Voltage Directive

EMS Compliance : EN61204-3, EN61000-6-2

EN61000-4-2
 EN61000-4-3
 EN61000-4-4
 EN61000-4-5
 EN61000-4-6
 EN61000-4-8
 EN61000-4-11

PBA10F

Ordering information

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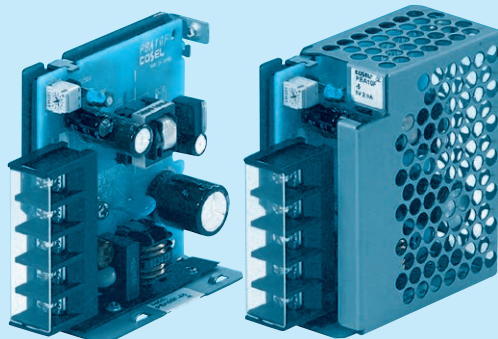
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Example recommended EMI/EMC filter
NAC-06-472

High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

Cover is optional

- ① Series name
 - ② Single output
 - ③ Output wattage
 - ④ Universal input
 - ⑤ Output voltage
 - ⑥ Optional *5
- C : with Coating
G : Low leakage current
E : Low leakage current
and EMI class A
T : Vertical terminal block
J : Connector type
N : with Cover
(UL508 is acquired)
NI : with DIN rail and Cover
V : Output voltage setting
potentiometer external-
ly

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PBA10F-5	PBA10F-12	PBA10F-24
MAX OUTPUT WATTAGE[W]	10	10.8	12
DC OUTPUT	5V 2A	12V 0.9A	24V 0.5A

SPECIFICATIONS

	MODEL	PBA10F-5	PBA10F-12	PBA10F-24	
INPUT	VOLTAGE[V]	AC85 - 264 1 ϕ or DC110 - 370 (AC50 or DC70 Please refer to the instruction manual 2.1 Input voltage *3)			
	CURRENT[A]	ACIN 100V	0.30typ (Io=100%)		
		ACIN 200V	0.20typ (Io=100%)		
	FREQUENCY[Hz]	50/60 (47 - 440) or DC			
	EFFICIENCY[%]	ACIN 100V	74typ	77typ	
		ACIN 200V	74typ	77typ	
	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%)		
	ACIN 200V	30typ (Io=100%)			
	LEAKAGE CURRENT[mA]	0.15/0.30max (ACIN 100V/240V 60Hz, Io=100%, According to IEC60950-1.DENAN)			
OUTPUT	VOLTAGE[V]	5	12	24	
	CURRENT[A]	2	0.9	0.5	
	LINE REGULATION[mV] *6	20max	48max	96max	
	LOAD REGULATION[mV] *6	40max	100max	150max	
	RIPPLE[mVp-p]	0 to +50℃ *1	80max	120max	120max
		-10 - 0℃ *1	140max	160max	160max
	RIPPLE NOISE[mVp-p]	0 to +50℃ *1	120max	150max	150max
		-10 - 0℃ *1	160max	180max	180max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	120max	240max
		-10 to +50℃	60max	150max	290max
	DRIFT[mV] *2	20max	48max	96max	
	START-UP TIME[ms]	200typ(ACIN 100V, Io=100%) *Start-up time is 700ms typ for less than 1minute of applying input again from turning off the input voltage.			
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)			
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	4.50 - 5.50	10.0 - 13.2	19.2 - 27.0		
OUTPUT VOLTAGE SETTING[V]	5.00 - 5.15	12.00 - 12.48	24.00 - 24.96		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rated current and recovers automatically			
	OVERVOLTAGE PROTECTION[V]	5.75 - 7.00	15.0 - 18.0	30.0 - 37.0	
	OPERATING INDICATION	LED (Green)			
	REMOTE ON/OFF	None			
ISOLATION	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)			
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)			
	OUTPUT-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50M Ω min (At Room Temperature)			
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-10 to +71℃ (Required Derating), 20 - 90%RH (Non condensing) 3,000m (10,000feet) max			
	STORAGE TEMP.,HUMID.AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing) 9,000m (30,000feet) max			
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis			
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis			
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN			
	CONDUCTED NOISE	Complies with FCC Part15 classB, VCCI-B, CISPR22-B, EN55011-B, EN55022-B			
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Not built-in to active filter *4) *7			
OTHERS	CASE SIZE/WEIGHT	31 x 78 x 68mm [1.22 x 3.07 x 2.68 inches] (without terminal block) (W x H x D) / 150g max (with cover : 180g max)			
	COOLING METHOD	Convection			

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter(equivalent to KEISOKU-GIKEN :RM101).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

*3 Derating is required.

*4 When two or more units are used,they may not comply with the harmonic attenuator. Please contact us for details.

*5 Please contact us about safety approvals for the model with option.

*6 Please contact us about dynamic load and input response.

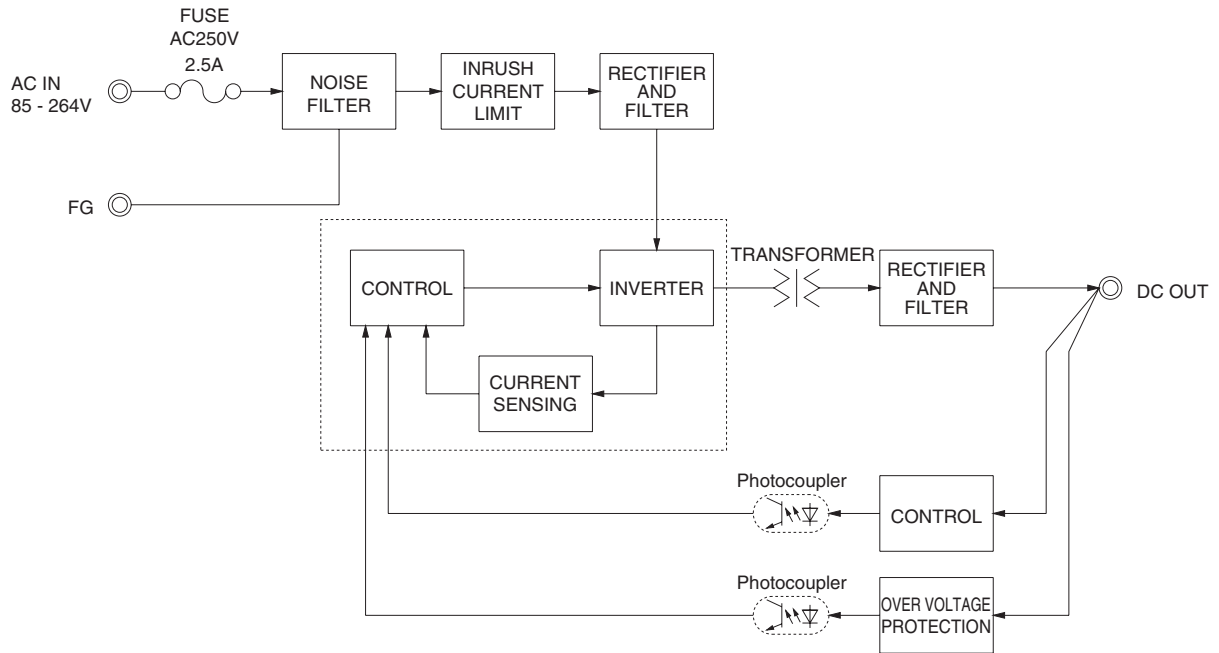
*7 Please contact us about class C.

* Parallel operation with other model is not possible.

* Derating is required when operated with cover.

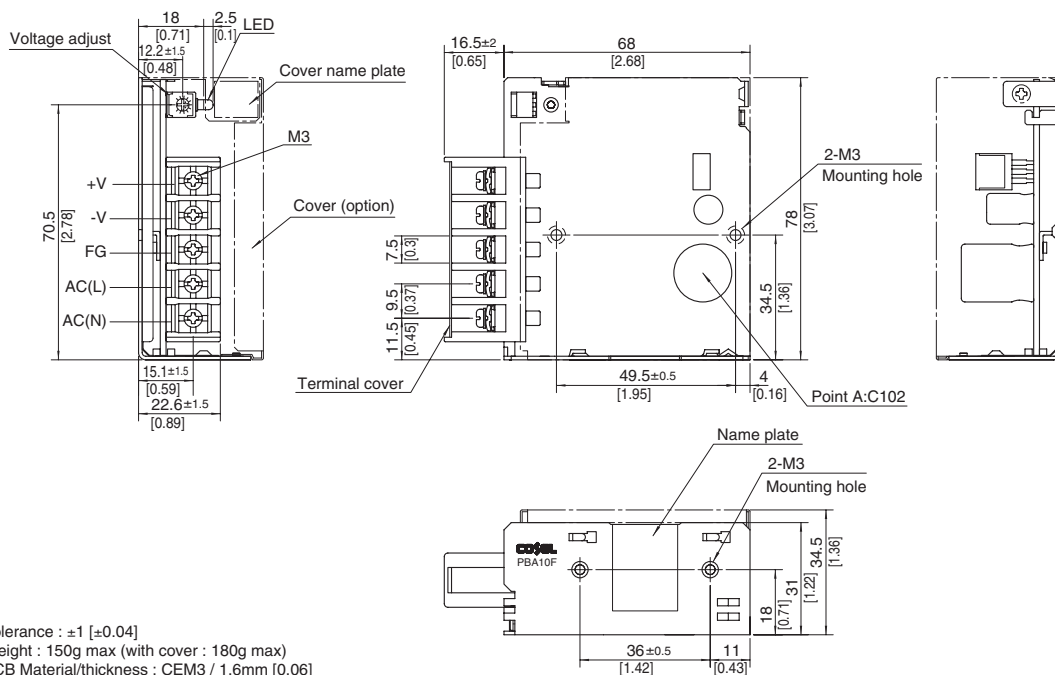
* A sound may occur from power supply at peak loading.

Block diagram



External view

※ External size of option T,J,N,N1 and V is different from standard model and refer to 7 Option of instruction manual for details.



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 150g max (with cover : 180g max)
- ※ PCB Material/thickness : CEM3 / 1.6mm [0.06]
- ※ Chassis material : Electric galvanizing steel board
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque : 0.6N • m (6.3kgf • cm) max
- ※ Screw tightening torque : M3 0.8N • m (8.5kgf • cm) max
- ※ Please connect safety ground to the unit in 2-M3 holes.

PBA15F

Ordering information

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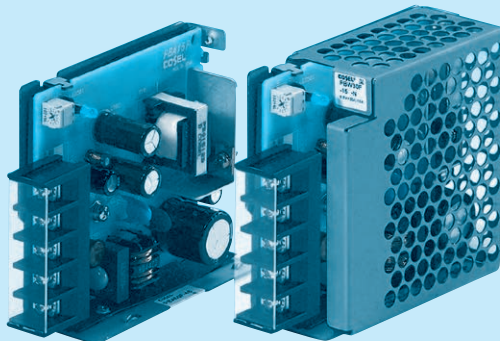
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Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

Cover is optional

- ① Series name
 - ② Single output
 - ③ Output wattage
 - ④ Universal input
 - ⑤ Output voltage
 - ⑥ Optional *5
- C : with Coating
G : Low leakage current
E : Low leakage current and EMI class A
T : Vertical terminal block
J : Connector type
N : with Cover (UL508 is acquired [5V, 12V, 24V])
N1 : with DIN rail and Cover
V : Output voltage setting potentiometer externally

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PBA15F-3R3	PBA15F-5	PBA15F-9	PBA15F-12	PBA15F-15	PBA15F-24	PBA15F-48
MAX OUTPUT WATTAGE[W]	9.9	15	15.3	15.6	15	16.8	16.8
DC OUTPUT	3.3V 3A	5V 3A	9V 1.7A	12V 1.3A	15V 1A	24V 0.7A	48V 0.35A

SPECIFICATIONS

	MODEL	PBA15F-3R3	PBA15F-5	PBA15F-9	PBA15F-12	PBA15F-15	PBA15F-24	PBA15F-48	
INPUT	VOLTAGE[V]		AC85 - 264 1 ϕ or DC110 - 370 (AC50 or DC70 Please refer to the instruction manual 2.1 Input voltage *3)						
	CURRENT[A]	ACIN 100V	0.30typ (Io=100%)	0.4typ (Io=100%)					
		ACIN 200V	0.15typ (Io=100%)	0.2typ (Io=100%)					
	FREQUENCY[Hz]		50/60 (47 - 440) or DC						
	EFFICIENCY[%]	ACIN 100V	68typ	74typ	75typ	75typ	77typ	75typ	
		ACIN 200V	68typ	75typ	77typ	78typ	80typ	78typ	
	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start)						
ACIN 200V		30typ (Io=100%) (At cold start)							
LEAKAGE CURRENT[mA]		0.15/0.30max (ACIN 100V/240V 60Hz, Io=100%, According to IEC60950-1.DENAN)							
OUTPUT	VOLTAGE[V]		3.3	5	9	12	15	24	48
	CURRENT[A]		3	3	1.7	1.3	1	0.7	0.35
	LINE REGULATION[mV] *6		20max	20max	36max	48max	60max	96max	192max
	LOAD REGULATION[mV] *6		40max	40max	100max	100max	120max	150max	240max
	RIPPLE[mVp-p]	0 to +50℃ *1	80max	80max	120max	120max	120max	120max	150max
		-10 - 0℃ *1	140max	140max	160max	160max	160max	160max	200max
	RIPPLE NOISE[mVp-p]	0 to +50℃ *1	120max	120max	150max	150max	150max	150max	250max
		-10 - 0℃ *1	160max	160max	180max	180max	180max	180max	300max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	50max	90max	120max	150max	240max	480max
		-10 to +50℃	60max	60max	120max	150max	180max	290max	600max
	DRIFT[mV] *2		20max	20max	36max	48max	60max	96max	192max
	START-UP TIME[ms]		200typ(ACIN 100V, Io=100%) *Start-up time is 700ms typ for less than 1minute of applying input again from turning off the input voltage.						
	HOLD-UP TIME[ms]		20typ (ACIN 100V, Io=100%)						
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		2.85 - 3.60	4.50 - 5.50	7.50 - 10.0	10.0 - 13.2	13.2 - 18.0	19.2 - 27.0	39.0 - 53.0	
OUTPUT VOLTAGE SETTING[V]		3.30 - 3.40	5.00 - 5.15	9.00 - 9.36	12.00 - 12.48	15.00 - 15.60	24.00 - 24.96	48.00 - 49.92	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rated current and recovers automatically						
	OVERVOLTAGE PROTECTION[V]		4.00 - 5.25	5.75 - 7.00	11.5 - 14.0	15.0 - 18.0	20.0 - 25.0	30.0 - 37.0	58.0 - 65.0
	OPERATING INDICATION		LED (Green)						
	REMOTE ON/OFF		None						
ISOLATION	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)						
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)						
	OUTPUT-FG		AC500V 1minute, Cutoff current = 25mA, DC500V 50M Ω min (At Room Temperature)						
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE		-10 to +71℃ (Required Derating), 20 - 90%RH (Non condensing) 3,000m (10,000feet) max						
	STORAGE TEMP.,HUMID.AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing) 9,000m (30,000feet) max						
	VIBRATION		10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis						
	IMPACT		196.1m/s ² (20G), 11ms, once each X, Y and Z axis						
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS (At only AC input)		UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN						
	CONDUCTED NOISE		Complies with FCC Part15 classB, VCCI-B, CISPR22-B, EN55011-B, EN55022-B						
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 (Not built-in to active filter *4) *7						
OTHERS	CASE SIZE/WEIGHT		31 x 78 x 85mm [1.22 x 3.07 x 3.35 inches] (without terminal block) (W×H×D) / 200g max (with cover : 235g max)						
	COOLING METHOD		Convection						

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter(equivalent to KEISOKU-GIKEN :RM101).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

*3 Derating is required.

*4 When two or more units are used, they may not comply with the harmonic attenuator. Please contact us for details.

*5 Please contact us about safety approvals for the model with option.

*6 Please contact us about dynamic load and input response.

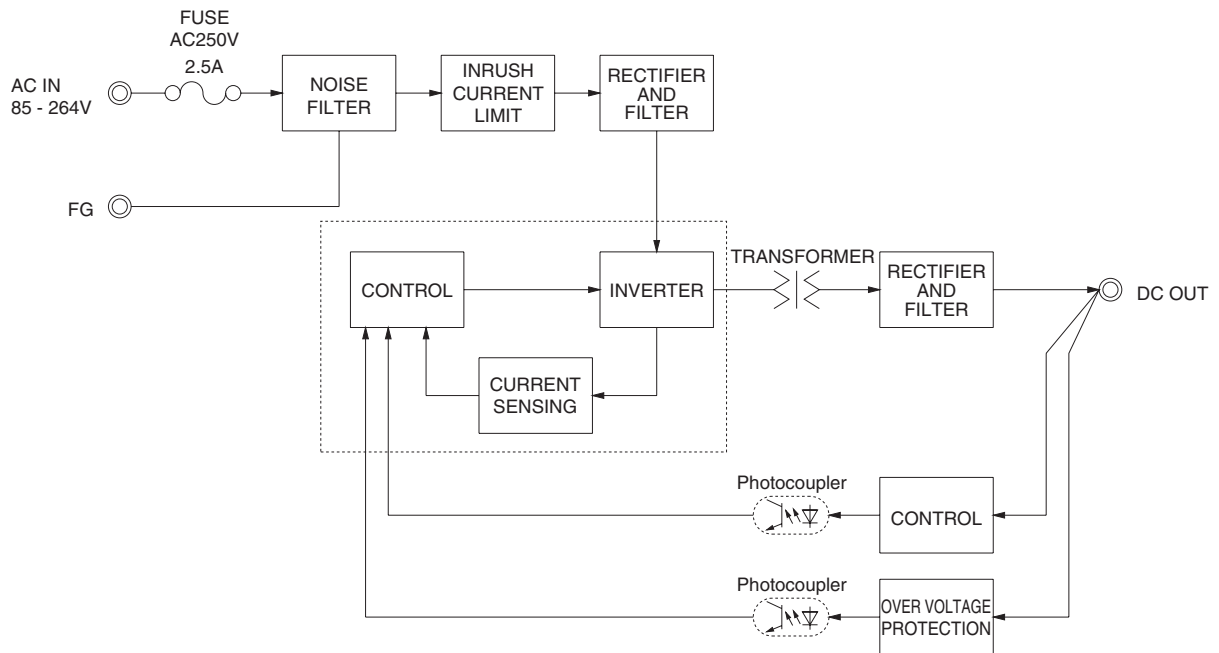
*7 Please contact us about class C.

* Parallel operation with other model is not possible.

* Derating is required when operated with cover.

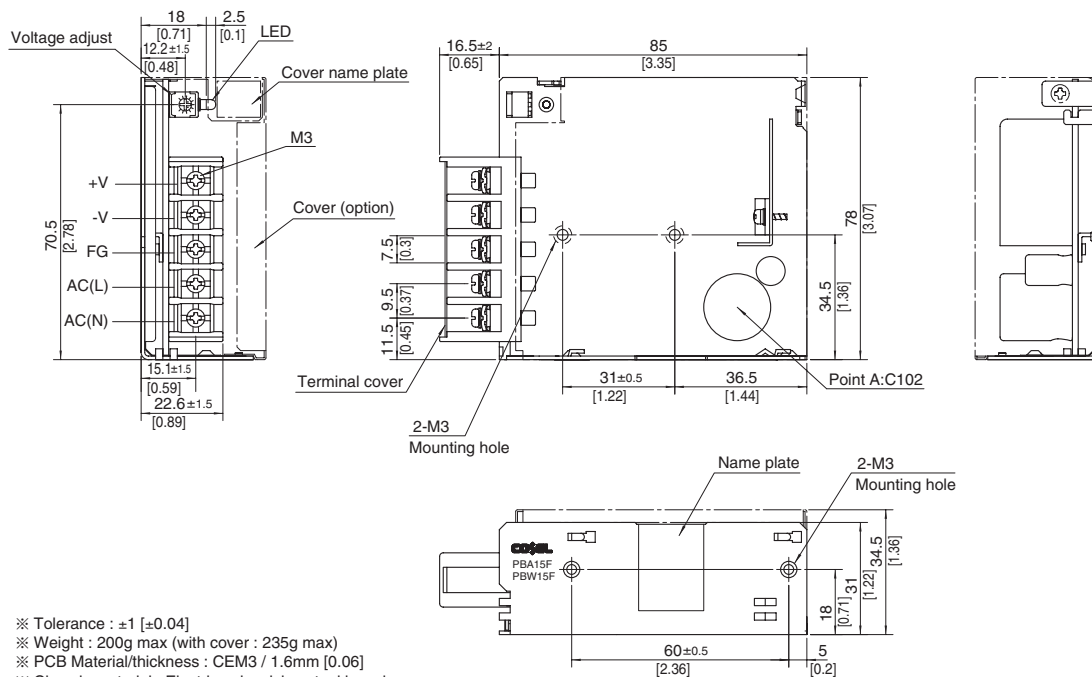
* A sound may occur from power supply at peak loading.

Block diagram



External view

※ External size of option T,J,N,N1 and V is different from standard model and refer to 7 Option of instruction manual for details.



- ※ Tolerance : ±1 [±0.04]
- ※ Weight : 200g max (with cover : 235g max)
- ※ PCB Material/thickness : CEM3 / 1.6mm [0.06]
- ※ Chassis material : Electric galvanizing steel board
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque : 0.6N • m (6.3kgf • cm) max
- ※ Screw tightening torque : M3 0.8N • m (8.5kgf • cm) max
- ※ Please connect safety ground to the unit in 2-M3 holes.

PBA30F

Ordering information

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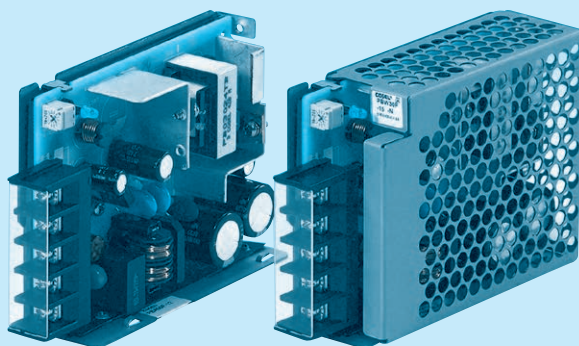
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Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

Cover is optional

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *5
C : with Coating
G : Low leakage current
E : Low leakage current
and EMI class A
T : Vertical terminal block
J : Connector type
N : with Cover
(UL508 is acquired
[5V, 12V, 24V])
N1 : with DIN rail and Cover
V : Output voltage setting
potentiometer external-
ly

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PBA30F-3R3	PBA30F-5	PBA30F-9	PBA30F-12	PBA30F-15	PBA30F-24	PBA30F-48
MAX OUTPUT WATTAGE[W]	19.8	30	30.6	30	30	31.2	31.2
DC OUTPUT	3.3V 6A	5V 6A	9V 3.4A	12V 2.5A	15V 2A	24V 1.3A	48V 0.65A

SPECIFICATIONS

	MODEL	PBA30F-3R3	PBA30F-5	PBA30F-9	PBA30F-12	PBA30F-15	PBA30F-24	PBA30F-48
INPUT	VOLTAGE[V]	AC85 - 264 1 ϕ or DC110 - 370 (AC50 or DC70 Please refer to the instruction manual 2.1 Input voltage *3)						
	CURRENT[A]	ACIN 100V	0.50typ (Io=100%)	0.70typ (Io=100%)				
		ACIN 200V	0.30typ (Io=100%)	0.40typ (Io=100%)				
	FREQUENCY[Hz]	50/60 (47 - 440) or DC						
	EFFICIENCY[%]	ACIN 100V	68typ	74typ	75typ	76typ	78typ	79typ
		ACIN 200V	69typ	77typ	77typ	78typ	81typ	81typ
OUTPUT	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start)					
		ACIN 200V	30typ (Io=100%) (At cold start)					
	LEAKAGE CURRENT[ma]	0.30/0.65max (ACIN 100V/240V 60Hz, Io=100%, According to IEC60950-1.DENAN)						
	VOLTAGE[V]	3.3	5	9	12	15	24	48
	CURRENT[A]	6	6	3.4	2.5	2	1.3	0.65
	LINE REGULATION[mV] *6	20max	20max	36max	48max	60max	96max	192max
	LOAD REGULATION[mV] *6	40max	40max	100max	100max	120max	150max	240max
	RIPPLE[mVp-p]	0 to +50°C *1	80max	80max	120max	120max	120max	150max
		-10 - 0°C *1	140max	140max	160max	160max	160max	200max
	RIPPLE NOISE[mVp-p]	0 to +50°C *1	120max	120max	150max	150max	150max	250max
		-10 - 0°C *1	160max	160max	180max	180max	180max	300max
	TEMPERATURE REGULATION[mV]	0 to +50°C	50max	50max	90max	120max	150max	240max
		-10 to +50°C	60max	60max	120max	150max	180max	290max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *2	20max	20max	36max	48max	60max	96max	192max
	START-UP TIME[ms]	200typ (ACIN 100V, Io=100%) *Start-up time is 700ms typ for less than 1minute of applying input again from turning off the input voltage.						
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)						
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.85 - 3.60	4.50 - 5.50	7.50 - 10.0	10.0 - 13.2	13.2 - 18.0	19.2 - 27.0	39.0 - 53.0
	OUTPUT VOLTAGE SETTING[V]	3.30 - 3.40	5.00 - 5.15	9.00 - 9.36	12.00 - 12.48	15.00 - 15.60	24.00 - 24.96	48.00 - 49.92
	OVERCURRENT PROTECTION	Works over 105% of rated current and recovers automatically						
	OVERVOLTAGE PROTECTION[V]	4.00 - 5.25	5.75 - 7.00	11.5 - 14.0	15.0 - 18.0	20.0 - 25.0	30.0 - 37.0	58.0 - 65.0
	OPERATING INDICATION	LED (Green)						
	REMOTE ON/OFF	None						
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)						
ISOLATION	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)						
	OUTPUT-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50M Ω min (At Room Temperature)						
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +71°C (Required Derating), 20 - 90%RH (Non condensing) 3,000m (10,000feet) max						
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing) 9,000m (30,000feet) max						
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis						
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis						
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN						
	CONDUCTED NOISE	Complies with FCC Part15 classB, VCCI-B, CISPR22-B, EN55011-B, EN55022-B						
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Not built-in to active filter *4) *7						
OTHERS	CASE SIZE/WEIGHT	31 x 78 x 103mm [1.22 x 3.07 x 4.06 inches] (without terminal block) (W x H x D) / 270g max (with cover : 310g max)						
	COOLING METHOD	Convection						

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter(equivalent to KEISOKU-GIKEN :RM101).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

*3 Derating is required.

*4 When two or more units are used, they may not comply with the harmonic attenuator. Please contact us for details.

*5 Please contact us about safety approvals for the model with option.

*6 Please contact us about dynamic load and input response.

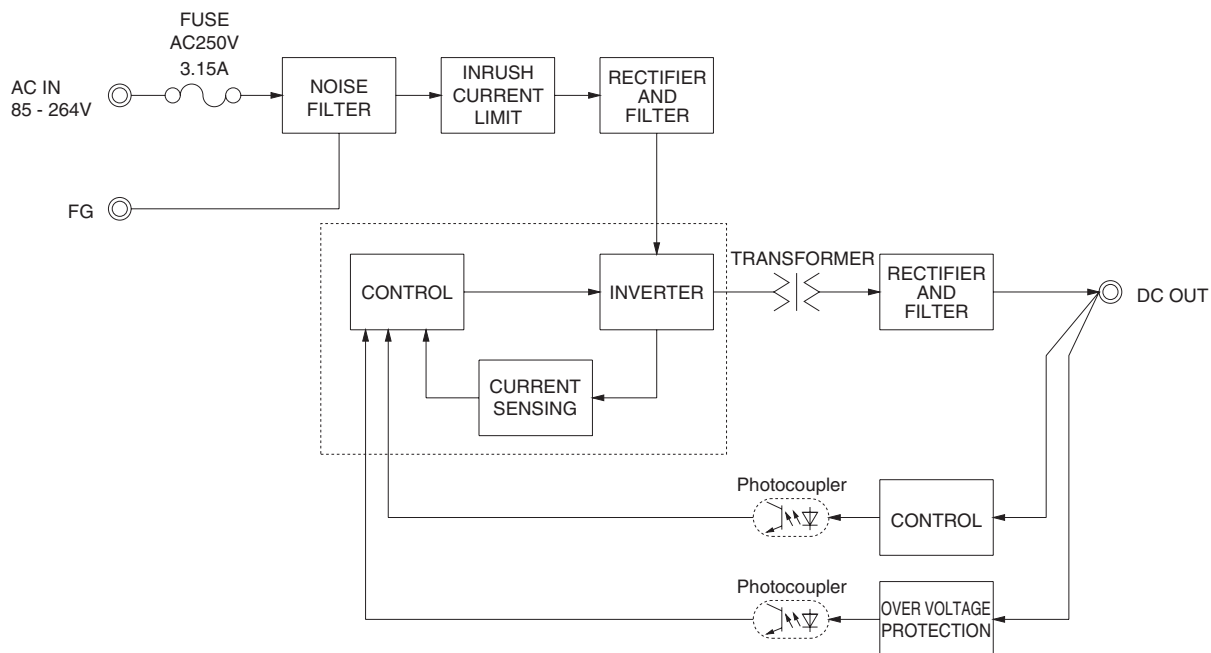
*7 Please contact us about class C.

* Parallel operation with other model is not possible.

* Derating is required when operated with cover.

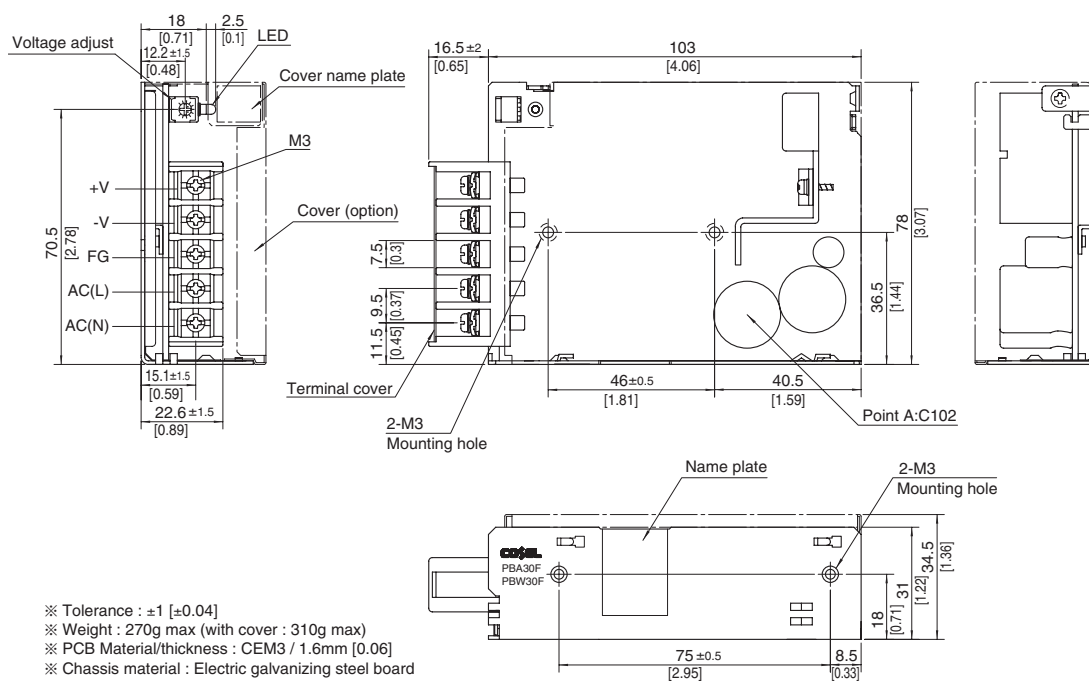
* A sound may occur from power supply at peak loading.

Block diagram



External view

※ External size of option T,J,N,N1 and V is different from standard model and refer to 7 Option of instruction manual for details.



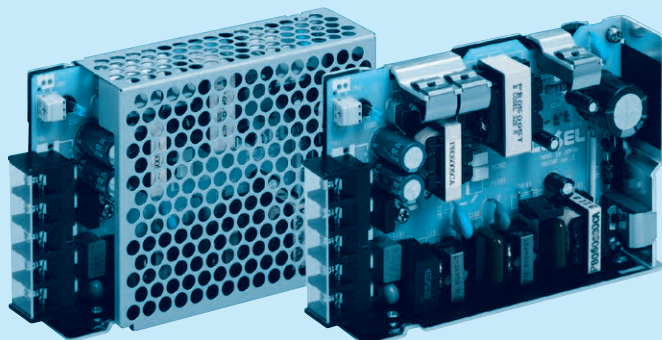
- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 270g max (with cover : 310g max)
- ※ PCB Material/thickness : CEM3 / 1.6mm [0.06]
- ※ Chassis material : Electric galvanizing steel board
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque : 0.6N • m (6.3kgf • cm) max
- ※ Screw tightening torque : M3 0.8N • m (8.5kgf • cm) max
- ※ Please connect safety ground to the unit in 2-M3 holes.

PBA50F

Ordering information

PB A 50 F -5 -□

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Example recommended EMI/EMC filter
NAC-06-472

High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *5
C : with Coating
G : Low leakage current (0.15mA max / ACIN 240V)
E : Low leakage current and EMI class A (0.5mA max / ACIN 240V)
T : Vertical terminal block
J : Connector type
R : with Remote ON/OFF
N : with Cover (Only 24V UL508 is acquired)
Nt : with DIN rail and Cover
V : Output voltage setting potentiometer externally

Cover is optional

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PBA50F-3R3	PBA50F-5	PBA50F-9	PBA50F-12	PBA50F-15	PBA50F-24	PBA50F-36	PBA50F-48
MAX OUTPUT WATTAGE[W]	33	50	50.4	51.6	52.5	52.8	50.4	52.8
DC OUTPUT	3.3V 10A	5V 10A	9V 5.6A	12V 4.3A	15V 3.5A	24V 2.2A	36V 1.4A	48V 1.1A

SPECIFICATIONS

	MODEL	PBA50F-3R3	PBA50F-5	PBA50F-9	PBA50F-12	PBA50F-15	PBA50F-24	PBA50F-36	PBA50F-48	
INPUT	VOLTAGE[V]	AC85 - 264 1 φ or DC120 - 370 (AC50 or DC70 Please refer to the instruction manual 2.1 Input voltage *4)								
	CURRENT[A]	ACIN 100V	0.5typ	0.7typ						
		ACIN 200V	0.3typ	0.4typ						
	FREQUENCY[Hz]	50/60 (47 - 63)								
	EFFICIENCY[%]	ACIN 100V	75typ	80typ	79typ	80typ	81typ	82typ	83typ	
		ACIN 200V	76typ	82typ	81typ	82typ	83typ	84typ	85typ	
	POWER FACTOR(lo=100%)	ACIN 100V	0.98typ	0.99typ						
		ACIN 200V	0.87typ	0.93typ						
INRUSH CURRENT[A]	ACIN 100V	15typ (lo=100%) (At cold start)								
	ACIN 200V	30typ (lo=100%) (At cold start)								
	LEAKAGE CURRENT[mA]	0.4/0.75max (ACIN 100V/240V 60Hz, lo=100%, According to IEC60950-1.DENAN)								
OUTPUT	VOLTAGE[V]	3.3	5	9	12	15	24	36	48	
	CURRENT[A]	10	10	5.6	4.3	3.5	2.2	1.4	1.1	
	LINE REGULATION[mV]	20max	20max	36max	48max	60max	96max	144max	192max	
	LOAD REGULATION[mV]	40max	40max	100max	100max	120max	150max	240max	240max	
	RIPPLE[mVp-p]	0 to +50℃ *1	80max	80max	120max	120max	120max	150max	150max	
		-10 - 0℃ *1	140max	140max	160max	160max	160max	200max	200max	
	RIPPLE NOISE[mVp-p]	0 to +50℃ *1	120max	120max	150max	150max	150max	250max	250max	
		-10 - 0℃ *1	160max	160max	180max	180max	180max	300max	300max	
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	50max	90max	120max	150max	240max	360max	
		-10 to +50℃	60max	60max	120max	150max	180max	290max	450max	
	DRIFT[mV]	*2	20max	20max	36max	48max	60max	96max	144max	
	START-UP TIME[ms]	350typ(ACIN 100V, lo=100%)								
HOLD-UP TIME[ms]	20typ (ACIN 100V, lo=100%)									
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.85 - 3.63	4.00 - 5.50	7.50 - 10.0	10.0 - 13.2	13.2 - 18.0	19.2 - 27.0	28.8 - 39.6	39.0 - 53.0	
	OUTPUT VOLTAGE SETTING[V]	3.30 - 3.40	5.00 - 5.15	9.00 - 9.36	12.00 - 12.48	15.00 - 15.60	24.00 - 24.96	35.00 - 37.44	48.00 - 49.92	
	OVERCURRENT PROTECTION	Works over 105% of rated current and recovers automatically								
	OVERVOLTAGE PROTECTION[V]	4.00 - 5.25	5.75 - 7.00	11.5 - 14.0	15.0 - 18.0	20.0 - 25.0	30.0 - 37.0	43.0 - 50.0	58.0 - 65.0	
ISOLATION	OPERATING INDICATION	LED (Green)								
	REMOTE ON/OFF	Optional (Required external power source)								
	INPUT-OUTPUT · RC	*3	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩmin (At Room Temperature)							
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩmin (At Room Temperature)							
ENVIRONMENT	OUTPUT · RC-FG	*3	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩmin (At Room Temperature)							
	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +71℃ (Required Derating), 20 - 90%RH (Non condensing) 3,000m (10,000feet) max								
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing) 9,000m (30,000feet) max								
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis								
SAFETY AND NOISE REGULATIONS	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis								
	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN								
	CONDUCTED NOISE	Complies with FCC Part15 classB, VCCI-B, CISPR22-B, EN55011-B, EN55022-B								
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 *6								
OTHERS	CASE SIZE/WEIGHT	31 x 82 x 120mm [1.22 x 3.23 x 4.72 inches] (without terminal block) (W x H x D) / 280g max (with cover : 325g max)								
	COOLING METHOD	Convection								

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter(equivalent to KEISOKU-GIKEN :RM101).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

*3 Applicable when Remote ON/OFF(optional) is added. RC is insulated with input, output and FG.

*4 Derating is required.

*5 Please contact us about safety approvals for the model with option.

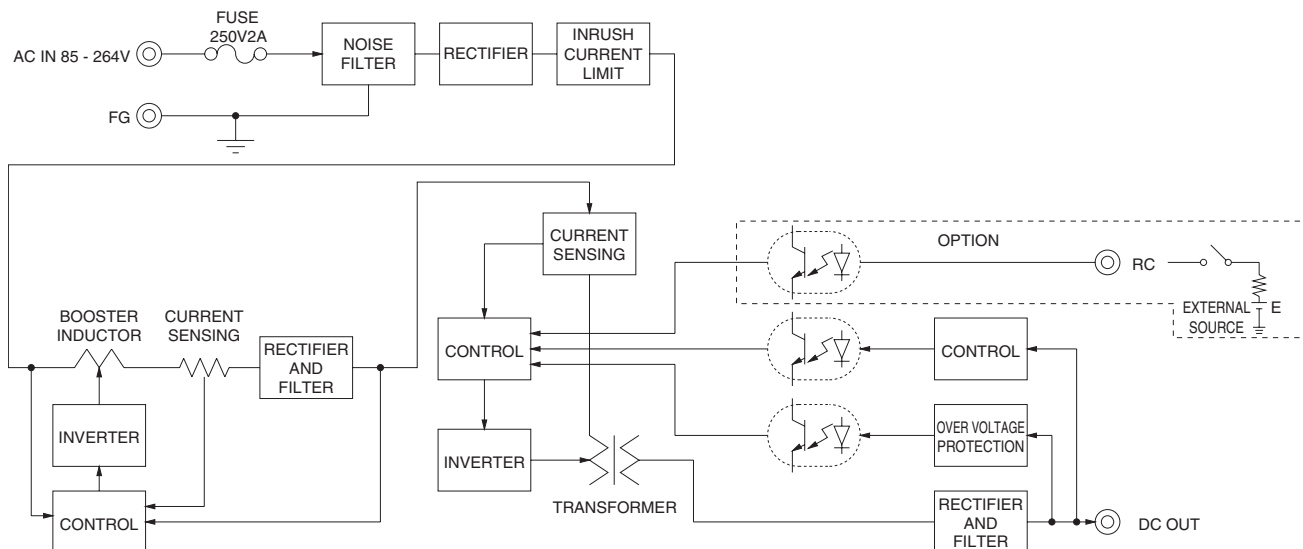
*6 Please contact us about class C.

* Parallel operation with other model is not possible.

* Derating is required when operated with cover.

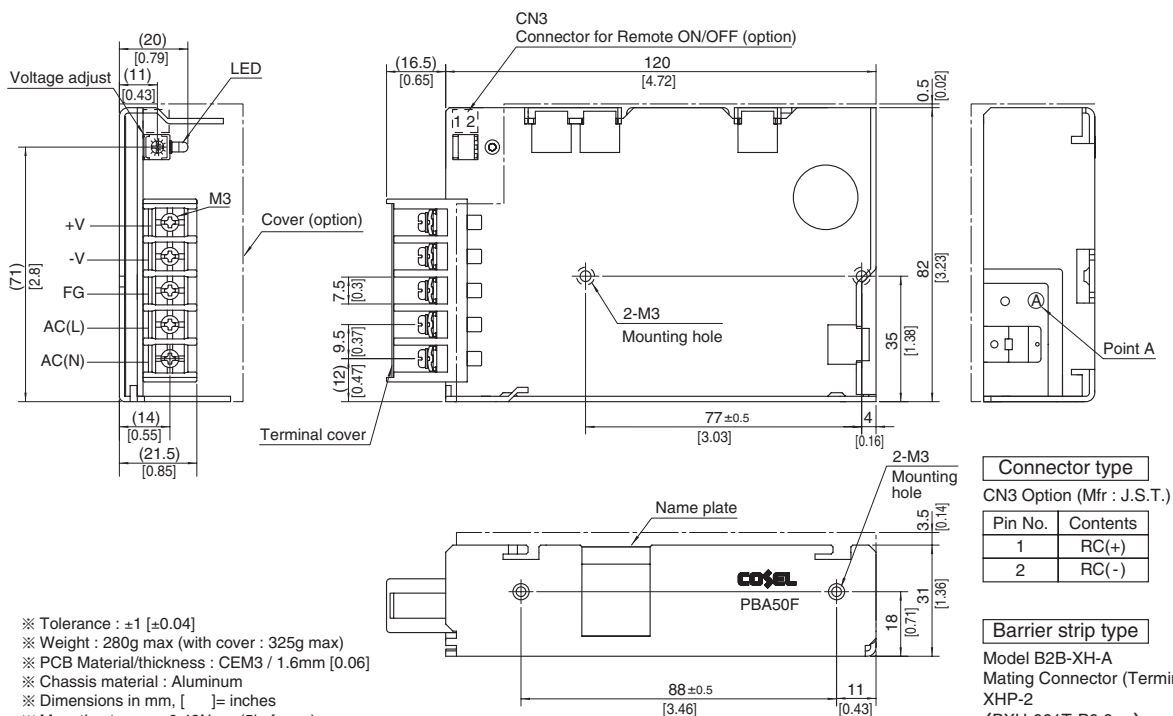
* A sound may occur from power supply at peak loading.

Block diagram



External view

※ External size of option T,J,R,N,N1 and V is different from standard model and refer to 7 Option of instruction manual for details.



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 280g max (with cover : 325g max)
- ※ PCB Material/thickness : CEM3 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque : 0.49N • m (5kgf • cm) max
- ※ Screw tightening torque : M3 0.8N • m (8.5kgf • cm) max
- ※ Please connect safety ground to the unit in 2-M3 holes.

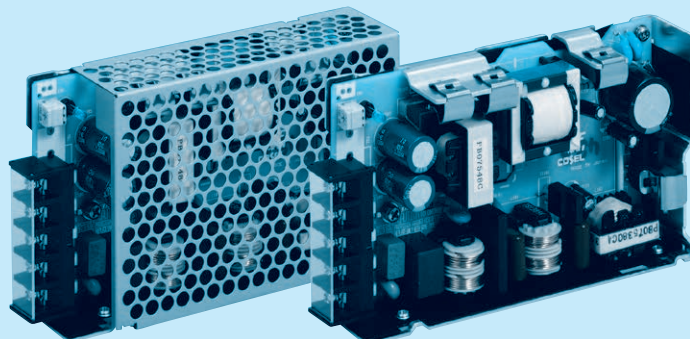
PBA75F

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RoHS

Example recommended EMI/EMC filter
NAC-06-472

High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional *5
C : with Coating
G : Low leakage current
(0.15mA max / ACIN 240V)
E : Low leakage current
and EMI class A
(0.5mA max / ACIN 240V)
T : Vertical terminal block
J : Connector type
R : with Remote ON/OFF
N : with Cover
(Only 24V UL508 is acquired)
Nt : with DIN rail and Cover
V : Output voltage setting
potentiometer external-ly

Cover is optional

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PBA75F-3R3	PBA75F-5	PBA75F-9	PBA75F-12	PBA75F-15	PBA75F-24	PBA75F-36	PBA75F-48
MAX OUTPUT WATTAGE[W]	49.5	75	75.6	75.6	75	76.8	75.6	76.8
DC OUTPUT	3.3V 15A	5V 15A	9V 8.4A	12V 6.3A	15V 5A	24V 3.2A	36V 2.1A	48V 1.6A

SPECIFICATIONS

MODEL	PBA75F-3R3	PBA75F-5	PBA75F-9	PBA75F-12	PBA75F-15	PBA75F-24	PBA75F-36	PBA75F-48
INPUT	VOLTAGE[V]	AC85 - 264 1 φ or DC120 - 370 (AC50 or DC70 Please refer to the instruction manual 2.1 Input voltage *4)						
	CURRENT[A]	ACIN 100V 0.7typ ACIN 200V 0.4typ	1.0typ 0.5typ					
	FREQUENCY[Hz]	50/60 (47 - 63)						
	EFFICIENCY[%]	ACIN 100V 77typ ACIN 200V 78typ	81typ 83typ	80typ 82typ	81typ 83typ	82typ 84typ	83typ 85typ	84typ 86typ
	POWER FACTOR(lo=100%)	ACIN 100V 0.98typ ACIN 200V 0.87typ	0.99typ 0.93typ					
	INRUSH CURRENT[A]	ACIN 100V 15typ (lo=100%) (At cold start) ACIN 200V 30typ (lo=100%) (At cold start)						
	LEAKAGE CURRENT[ma]	0.4/0.75max (ACIN 100V/240V 60Hz, lo=100%, According to IEC60950-1.DENAN)						
OUTPUT	VOLTAGE[V]	3.3	5	9	12	15	24	36
	CURRENT[A]	15	15	8.4	6.3	5	3.2	2.1
	LINE REGULATION[mV]	20max	20max	36max	48max	60max	96max	144max
	LOAD REGULATION[mV]	40max	40max	100max	100max	120max	150max	240max
	RIPPLE[mVp-p]	0 to +50°C *1 80max -10 - 0°C *1 140max	80max 140max	120max 160max	120max 160max	120max 160max	120max 160max	150max 200max
	RIPPLE NOISE[mVp-p]	0 to +50°C *1 120max -10 - 0°C *1 160max	120max 160max	150max 180max	150max 180max	150max 180max	150max 180max	250max 300max
	TEMPERATURE REGULATION[mV]	0 to +50°C 50max -10 to +50°C 60max	50max 60max	90max 120max	120max 150max	150max 180max	240max 290max	360max 450max
	DRIFT[mV]	*2 20max	20max	36max	48max	60max	96max	144max
	START-UP TIME[ms]	350typ (ACIN 100V, lo=100%)						
	HOLD-UP TIME[ms]	20typ (ACIN 100V, lo=100%)						
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.85 - 3.63	4.00 - 5.50	7.50 - 10.0	10.0 - 13.2	13.2 - 18.0	19.2 - 27.0	28.8 - 39.6
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE SETTING[V]	3.30 - 3.40	5.00 - 5.15	9.00 - 9.36	12.00 - 12.48	15.00 - 15.60	24.00 - 24.96	36.00 - 37.44
	OVERCURRENT PROTECTION	Works over 105% of rated current and recovers automatically						
	OVERVOLTAGE PROTECTION[V]	4.00 - 5.25	5.75 - 7.00	11.5 - 14.0	15.0 - 18.0	20.0 - 25.0	30.0 - 37.0	43.0 - 50.0
ISOLATION	OPERATING INDICATION	LED (Green)						
	REMOTE ON/OFF	Optional (Required external power source)						
	INPUT-OUTPUT · RC	*3 AC3.000V 1minute, Cutoff current = 10mA, DC500V 50MΩmin (At Room Temperature)						
ENVIRONMENT	INPUT-FG	AC2.000V 1minute, Cutoff current = 10mA, DC500V 50MΩmin (At Room Temperature)						
	OUTPUT · RC-FG	*3 AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩmin (At Room Temperature)						
	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +71°C (Required Derating), 20 - 90%RH (Non condensing) 3,000m (10,000feet) max						
SAFETY AND NOISE REGULATIONS	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing) 9,000m (30,000feet) max						
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis						
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis						
OTHERS	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN						
	CONDUCTED NOISE	Complies with FCC Part15 classB, VCCI-B, CISPR22-B, EN55011-B, EN55022-B						
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 *6						
OTHERS	CASE SIZE/WEIGHT	32 x 82 x 135mm [1.26 x 3.23 x 5.31 inches] (without terminal block) (W x H x D) / 350g max (with cover : 400g max)						
	COOLING METHOD	Convection						

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter(equivalent to KEISOKU-GIKEN :RM101).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

*3 Applicable when Remote ON/OFF(optional) is added. RC is insulated with input, output and FG.

*4 Derating is required.

*5 Please contact us about safety approvals for the model with option.

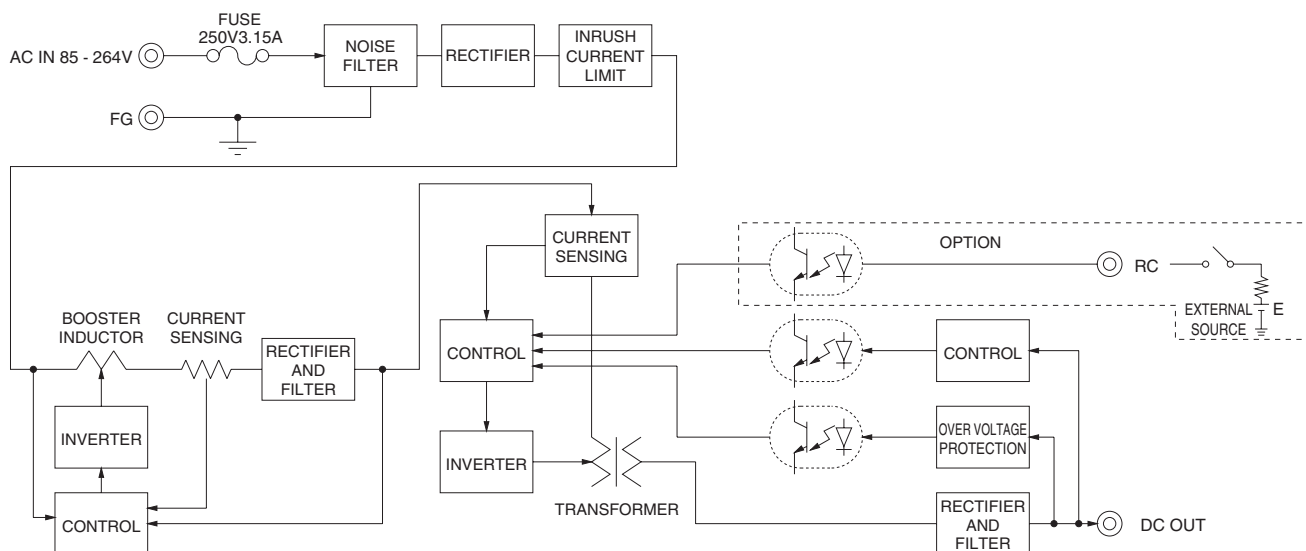
*6 Please contact us about class C.

* Parallel operation with other model is not possible.

* Derating is required when operated with cover.

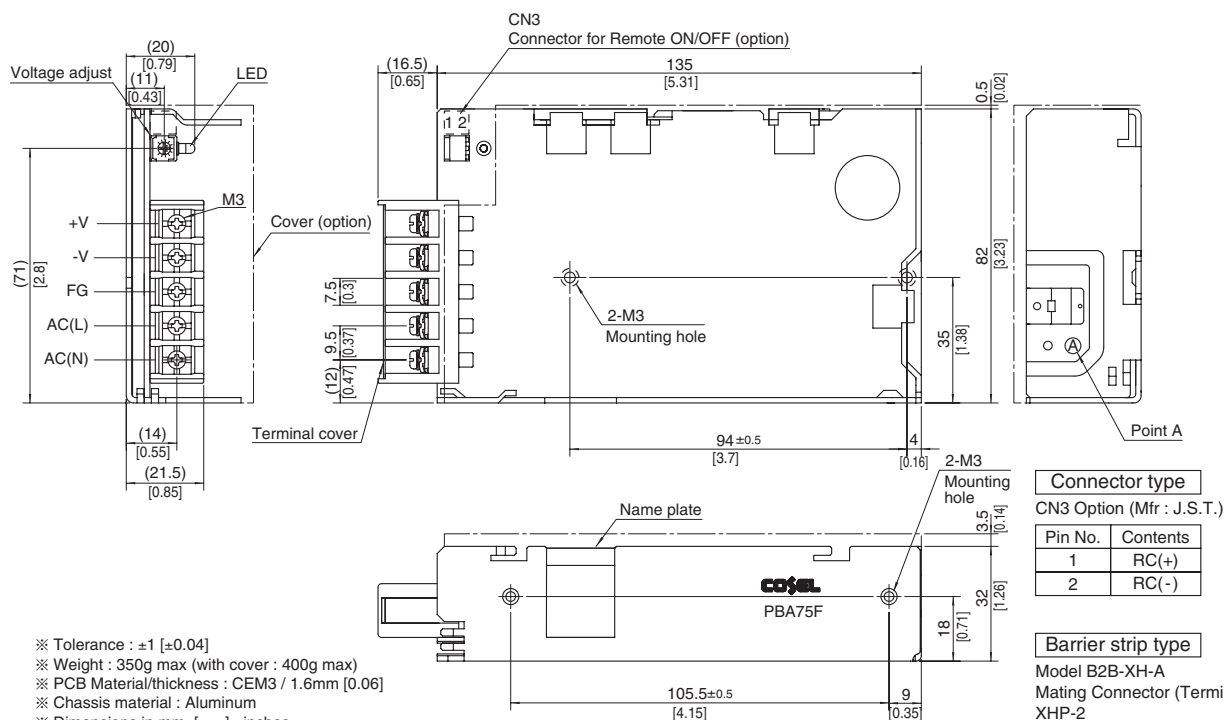
* A sound may occur from power supply at peak loading.

Block diagram



External view

※ External size of option T, J, R, N, N1 and V is different from standard model and refer to 7 Option of instruction manual for details.



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 350g max (with cover : 400g max)
- ※ PCB Material/thickness : CEM3 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque : $0.49\text{N} \cdot \text{m}$ ($5\text{kgf} \cdot \text{cm}$) max
- ※ Screw tightening torque : M3 $0.8\text{N} \cdot \text{m}$ ($8.5\text{kgf} \cdot \text{cm}$) max
- ※ Please connect safety ground to the unit in 2-M3 holes.

PBA100F

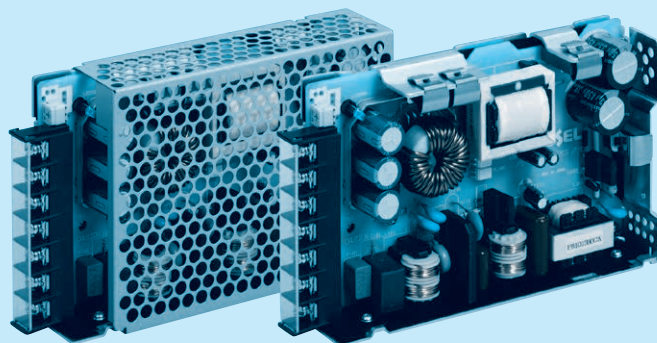
Ordering information

PB A 100 F -5 -□

① ② ③ ④ ⑤ ⑥



RoHS

Example recommended EMI/EMC filter
NAC-06-472

High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *5
C : with Coating
G : Low leakage current
(0.15mA max / ACIN 240V)
E : Low leakage current
and EMI class A
(0.5mA max / ACIN 240V)
T : Vertical terminal block
J : Connector type
(Only -12, -15, -24, -36, -48)
R : with Remote ON/OFF
N : with Cover
(Only 24V UL508 is acquired)
NI : with DIN rail and Cover
V : Output voltage setting
potentiometer external-
ly

Cover is optional

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PBA100F-3R3	PBA100F-5	PBA100F-9	PBA100F-12	PBA100F-15	PBA100F-24	PBA100F-36	PBA100F-48
MAX OUTPUT WATTAGE[W]	66	100	94.5	102	105	108	100.8	100.8
DC OUTPUT	3.3V 20A	5V 20A	9V 10.5A	12V 8.5A	15V 7A	24V 4.5A	36V 2.8A	48V 2.1A

SPECIFICATIONS

	MODEL	PBA100F-3R3	PBA100F-5	PBA100F-9	PBA100F-12	PBA100F-15	PBA100F-24	PBA100F-36	PBA100F-48	
INPUT	VOLTAGE[V]	AC85 - 264 1 φ or DC120 - 370 (AC50 or DC70 Please refer to the instruction manual 2.1 Input voltage ※4)								
	CURRENT[A]	ACIN 100V	0.9typ	1.3typ						
		ACIN 200V	0.5typ	0.7typ						
	FREQUENCY[Hz]	50/60 (47 - 63)								
	EFFICIENCY[%]	ACIN 100V	77typ	82typ	80typ	81typ	83typ	84typ	84typ	
		ACIN 200V	79typ	84typ	82typ	83typ	86typ	86typ	86typ	
	POWER FACTOR(lo=100%)	ACIN 100V	0.98typ	0.99typ						
		ACIN 200V	0.87typ	0.93typ						
INRUSH CURRENT[A]	ACIN 100V	20typ (lo=100%) (At cold start)								
	ACIN 200V	40typ (lo=100%) (At cold start)								
LEAKAGE CURRENT[mA]	0.4/0.75max (ACIN 100V/240V 60Hz, lo=100%, According to IEC60950-1.DENAN)									
OUTPUT	VOLTAGE[V]	3.3	5	9	12	15	24	36	48	
	CURRENT[A]	20	20	10.5	8.5	7	4.5	2.8	2.1	
	LINE REGULATION[mV]	20max	20max	36max	48max	60max	96max	144max	192max	
	LOAD REGULATION[mV]	40max	40max	100max	100max	120max	150max	240max	240max	
	RIPPLE[mVp-p]	0 to +50℃ ※1	80max	80max	120max	120max	120max	120max	150max	150max
		-10 - 0℃ ※1	140max	140max	160max	160max	160max	160max	200max	200max
	RIPPLE NOISE[mVp-p]	0 to +50℃ ※1	120max	120max	150max	150max	150max	150max	250max	250max
		-10 - 0℃ ※1	160max	160max	180max	180max	180max	180max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	50max	90max	120max	150max	240max	360max	480max
		-10 to +50℃	60max	60max	120max	150max	180max	290max	450max	600max
	DRIFT[mV]	※2	20max	20max	36max	48max	60max	96max	144max	192max
	START-UP TIME[ms]	350typ(ACIN 100V, lo=100%)								
	HOLD-UP TIME[ms]	20typ (ACIN 100V, lo=100%)								
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.85 - 3.63 4.00 - 5.50 7.50 - 10.0 10.0 - 13.2 13.2 - 18.0 19.2 - 27.0 28.8 - 39.6 39.0 - 53.0								
	OUTPUT VOLTAGE SETTING[V]	3.20 - 3.40 5.00 - 5.15 9.00 - 9.36 12.00 - 12.48 15.00 - 15.60 24.00 - 24.96 36.00 - 37.44 48.00 - 49.92								
	PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rated current and recovers automatically							
OVERVOLTAGE PROTECTION[V]		4.00 - 5.25 5.75 - 7.00 11.5 - 14.0 15.0 - 18.0 20.0 - 25.0 30.0 - 37.0 43.0 - 50.0 58.0 - 65.0								
OPERATING INDICATION		LED (Green)								
REMOTE SENSING		Optional (Only -3R3, -5 Option -K)								
ISOLATION	REMOTE ON/OFF	Optional (Required external power source)								
	INPUT-OUTPUT · RC	※3	AC3.000V 1minute, Cutoff current = 10mA, DC500V 50MΩmin (At Room Temperature)							
	INPUT-FG		AC2.000V 1minute, Cutoff current = 10mA, DC500V 50MΩmin (At Room Temperature)							
	OUTPUT · RC-FG	※3	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩmin (At Room Temperature)							
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-10 to +71℃ (Required Derating), 20 - 90%RH (Non condensing) 3.000m (10.000feet) max								
	STORAGE TEMP.,HUMID.AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing) 9.000m (30.000feet) max								
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis								
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis								
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN								
	CONDUCTED NOISE	Complies with FCC Part15 classB, VCCI-B, CISPR22-B, EN55011-B, EN55022-B								
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 ※6								
OTHERS	CASE SIZE/WEIGHT	32×93×147mm [1.26×3.66×5.79 inches] (without terminal block) (W×H×D) / 440g max (with cover : 500g max)								
	COOLING METHOD	Convection								

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter(equivalent to KEISOKU-GIKEN :RM101).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

*3 Applicable when Remote ON/OFF(optional) is added. RC is insulated with input, output and FG.

*4 Derating is required.

*5 Please contact us about safety approvals for the model with option.

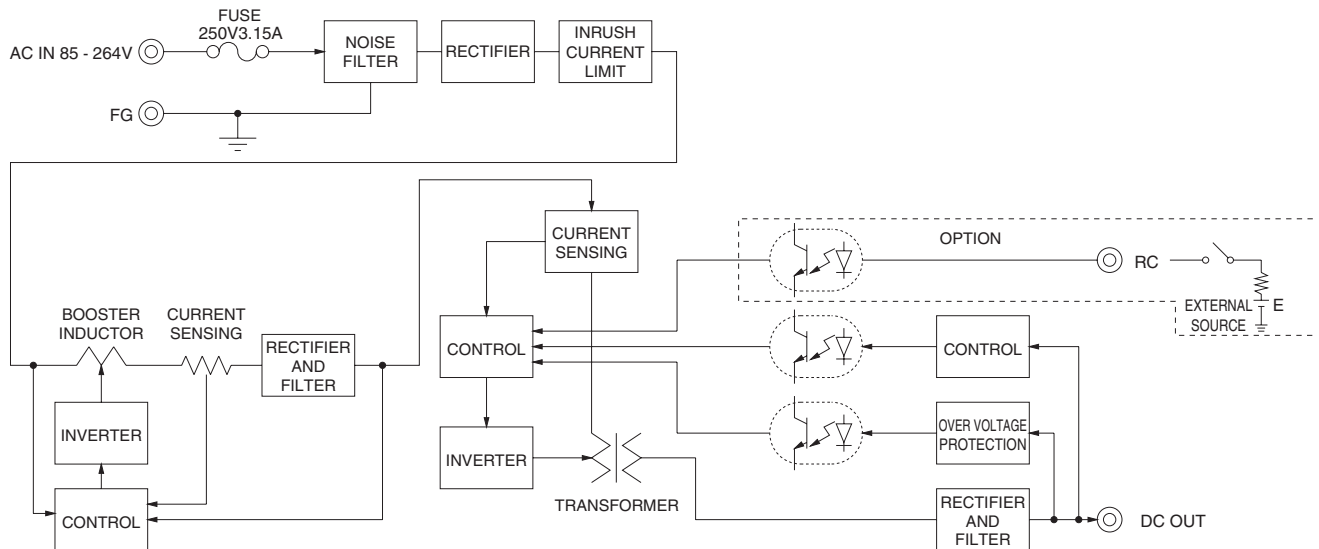
*6 Please contact us about class C.

* Parallel operation with other model is not possible.

* Derating is required when operated with cover.

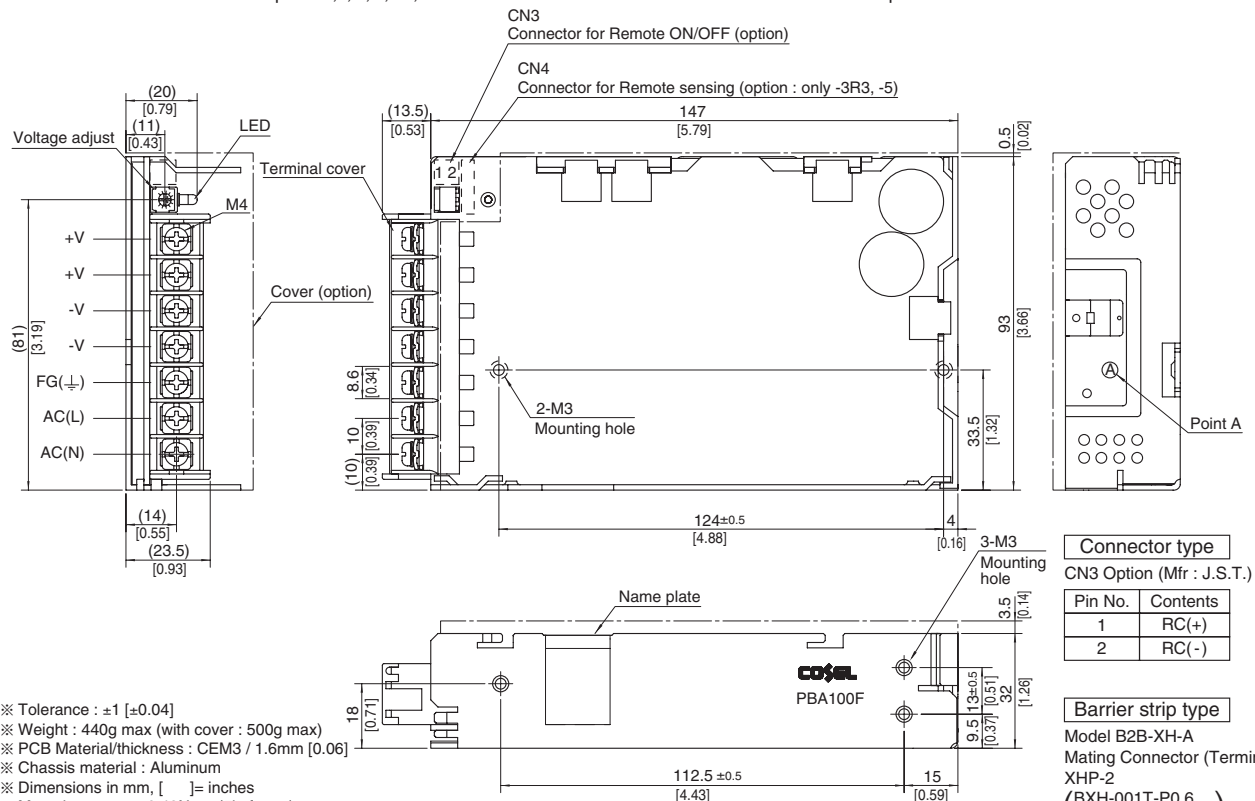
* A sound may occur from power supply at peak loading.

Block diagram



External view

※ External size of option T,J,R,N,N1,V and K is different from standard model and refer to 7 Option of instruction manual for details.



- ※ Tolerance : ±1 [±0.04]
 ※ Weight : 440g max (with cover : 500g max)
 ※ PCB Material/thickness : CEM3 / 1.6mm [0.06]
 ※ Chassis material : Aluminum
 ※ Dimensions in mm, [] = inches
 ※ Mounting torque : 0.49N · m(5kgf · cm)max
 ※ Mounting torque : M4:1.6N · m(16.9kgf · cm)max
 ※ Please connect safety ground from FG terminal on the unit.

Connector type	
CN3 Option (Mfr : J.S.T.)	
Pin No.	Contents
1	RC(+)
2	RC(-)

Barrier strip type
Model B2B-XH-A
Mating Connector (Terminal)
XHP-2
(BXH-001T-P0.6
or SXH-001T-P0.6)

PBA150F

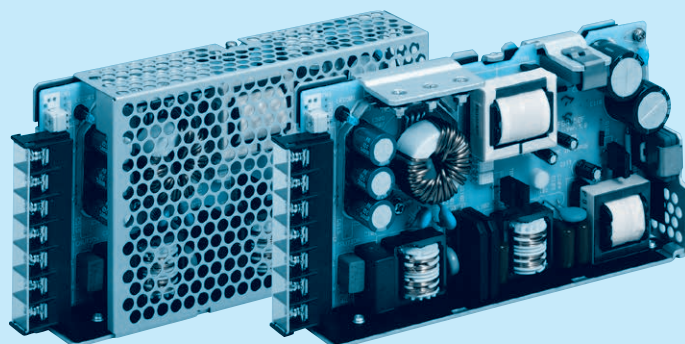
Ordering information

PB A 150 F -5 -□

① ② ③ ④ ⑤ ⑥



RoHS



Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *5
C : with Coating
G : Low leakage current
(0.15mA max / ACIN 240V)
E : Low leakage current
and EMI class A
(0.5mA max / ACIN 240V)
T : Vertical terminal block
J : Connector type
(Only -12, -15, -24, -36, -48)
R : with Remote ON/OFF
N : with Cover
(Only 24V UL508 is acquired)
NI : with DIN rail and Cover
V : Output voltage setting
potentiometer external-ly

Cover is optional

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PBA150F-3R3	PBA150F-5	PBA150F-9	PBA150F-12	PBA150F-15	PBA150F-24	PBA150F-36	PBA150F-48
MAX OUTPUT WATTAGE[W]	99	150	150.3	156	150	156	154.8	158.4
DC OUTPUT	3.3V 30A	5V 30A	9V 16.7A	12V 13A	15V 10A	24V 6.5A	36V 4.3A	48V 3.3A

SPECIFICATIONS

	MODEL	PBA150F-3R3	PBA150F-5	PBA150F-9	PBA150F-12	PBA150F-15	PBA150F-24	PBA150F-36	PBA150F-48	
INPUT	VOLTAGE[V]	AC85 - 264 1 φ or DC120 - 370 (AC50 or DC70 Please refer to the instruction manual 2.1 Input voltage *4)								
	CURRENT[A]	ACIN 100V	1.3typ	2.0typ						
		ACIN 200V	0.7typ	1.0typ						
	FREQUENCY[Hz]	50/60 (47 - 63)								
	EFFICIENCY[%]	ACIN 100V	80typ	83typ	82typ	83typ	84typ	85typ	85typ	
		ACIN 200V	82typ	86typ	85typ	86typ	87typ	88typ	88typ	
	POWER FACTOR(lo=100%)	ACIN 100V	0.98typ	0.99typ						
		ACIN 200V	0.87typ	0.93typ						
INRUSH CURRENT[A]	ACIN 100V	20typ (lo=100%) (At cold start)								
	ACIN 200V	40typ (lo=100%) (At cold start)								
LEAKAGE CURRENT[mA]	0.4/0.75max (ACIN 100V/240V 60Hz, lo=100%, According to IEC60950-1.DENAN)									
OUTPUT	VOLTAGE[V]	3.3	5	9	12	15	24	36	48	
	CURRENT[A]	30	30	16.7	13	10	6.5	4.3	3.3	
	LINE REGULATION[mV]	20max	20max	36max	48max	60max	96max	144max	192max	
	LOAD REGULATION[mV]	40max	40max	100max	100max	120max	150max	240max	240max	
	RIPPLE[mVp-p]	0 to +50℃ *1	80max	80max	120max	120max	120max	150max	150max	
		-10 - 0℃ *1	140max	140max	160max	160max	160max	200max	200max	
	RIPPLE NOISE[mVp-p]	0 to +50℃ *1	120max	120max	150max	150max	150max	250max	250max	
		-10 - 0℃ *1	160max	160max	180max	180max	180max	300max	300max	
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	50max	90max	120max	150max	240max	360max	
		-10 to +50℃	60max	60max	120max	150max	180max	290max	450max	
	DRIFT[mV]	*2	20max	20max	36max	48max	60max	96max	144max	
	START-UP TIME[ms]	350typ(ACIN 100V, lo=100%)								
	HOLD-UP TIME[ms]	20typ (ACIN 100V, lo=100%)								
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.85 - 3.63 4.00 - 5.50 7.50 - 10.0 10.0 - 13.2 13.2 - 18.0 19.2 - 27.0 28.8 - 39.6 39.0 - 53.0									
OUTPUT VOLTAGE SETTING[V]	3.30 - 3.40 5.00 - 5.15 9.00 - 9.36 12.00 - 12.48 15.00 - 15.60 24.00 - 24.96 36.00 - 37.44 48.00 - 49.92									
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rated current and recovers automatically								
	OVERVOLTAGE PROTECTION[V]	4.00 - 5.25 5.75 - 7.00 11.5 - 14.0 15.0 - 18.0 20.0 - 25.0 30.0 - 37.0 43.0 - 50.0 58.0 - 65.0								
	OPERATING INDICATION	LED (Green)								
	REMOTE SENSING	Optional (Only -3R3, -5 Option -K)								
ISOLATION	REMOTE ON/OFF	Optional (Required external power source)								
	INPUT-OUTPUT · RC	*3	AC3.000V 1minute, Cutoff current = 10mA, DC500V 50MΩmin (At Room Temperature)							
	INPUT-FG		AC2.000V 1minute, Cutoff current = 10mA, DC500V 50MΩmin (At Room Temperature)							
	OUTPUT · RC-FG	*3	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩmin (At Room Temperature)							
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-10 to +71℃ (Required Derating), 20 - 90%RH (Non condensing) 3.000m (10.000feet) max								
	STORAGE TEMP.,HUMID.AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing) 9.000m (30.000feet) max								
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis								
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis								
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN								
	CONDUCTED NOISE	Complies with FCC Part15 classB, VCCI-B, CISPR22-B, EN55011-B, EN55022-B								
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 *6								
OTHERS	CASE SIZE/WEIGHT	34×93×168mm [1.34×3.66×6.61 inches] (without terminal block) (W×H×D) / 560g max (with cover : 630g max)								
	COOLING METHOD	Convection								

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter(equivalent to KEISOKU-GIKEN :RM101).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

*3 Applicable when Remote ON/OFF(optional) is added. RC is insulated with input, output and FG.

*4 Derating is required.

*5 Please contact us about safety approvals for the model with option.

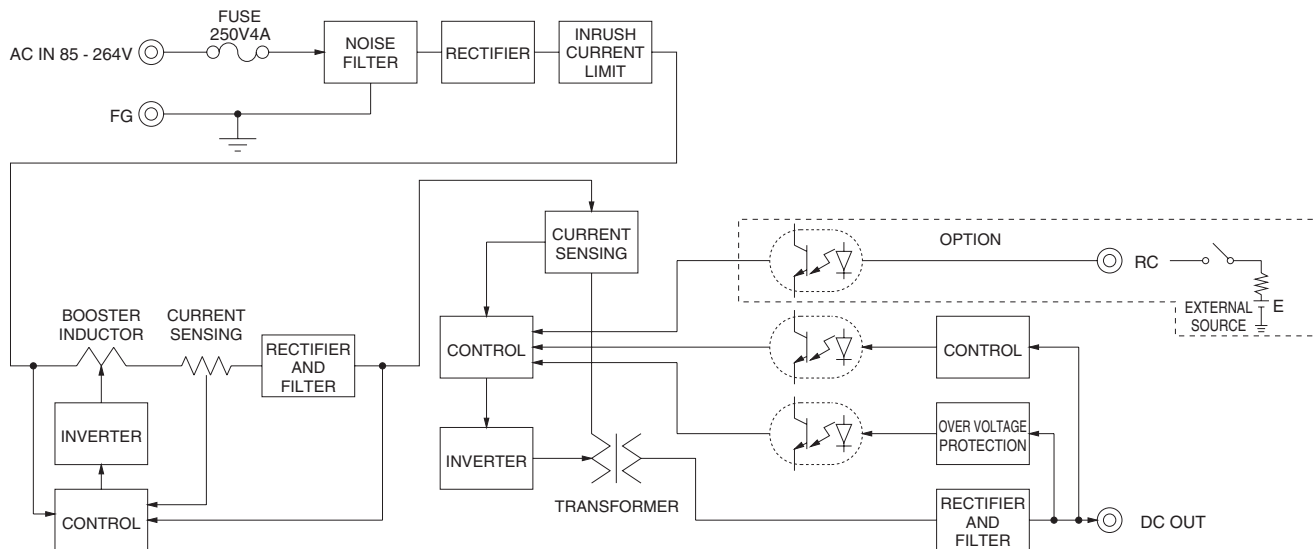
*6 Please contact us about class C.

* Parallel operation with other model is not possible.

* Derating is required when operated with cover.

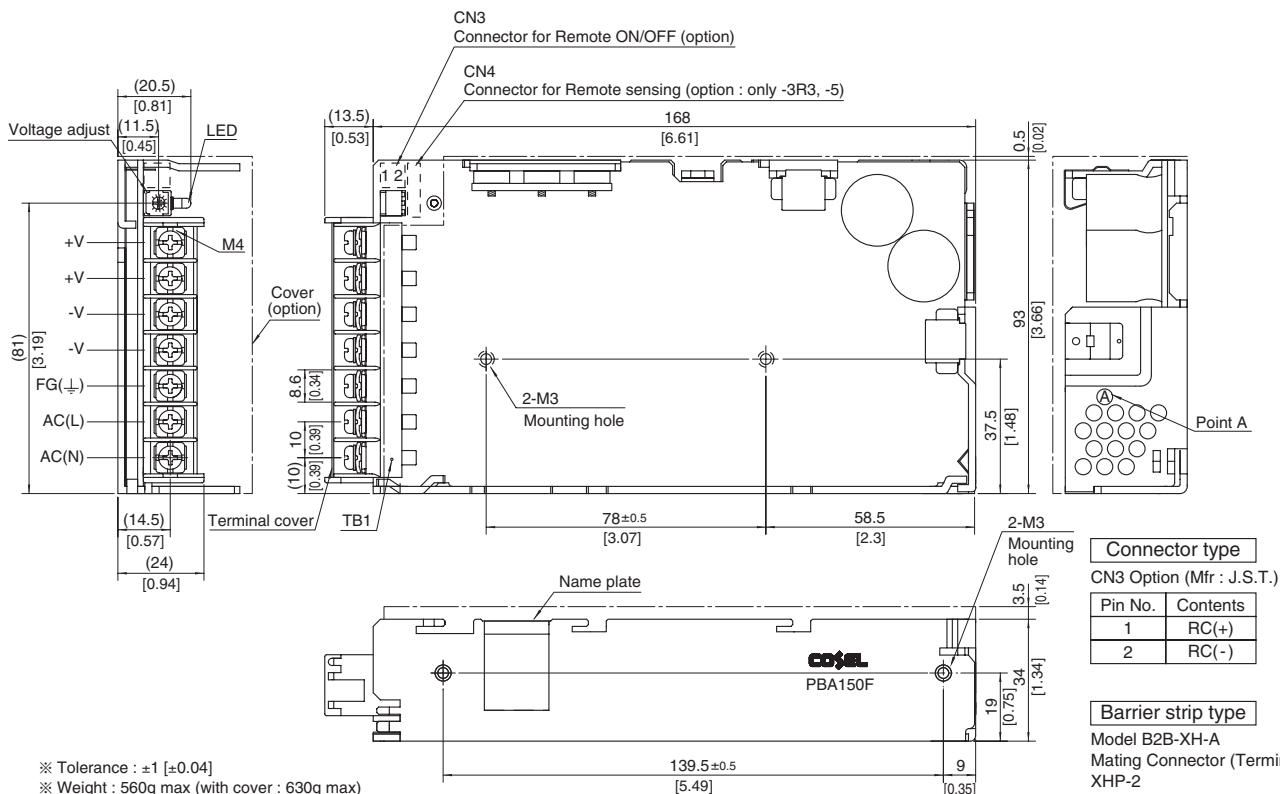
* A sound may occur from power supply at peak loading.

Block diagram



External view

※ External size of option T,J,R,N,N1,V and K is different from standard model and refer to 7 Option of instruction manual for details.



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 560g max (with cover : 630g max)
- ※ PCB Material/thickness : CEM3 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque : $0.49\text{N} \cdot \text{m}$ (5kgf \cdot cm) max
- ※ Mounting torque : $\text{M4: } 1.6\text{N} \cdot \text{m}$ (16.9kgf \cdot cm) max
- ※ Keep drawing current per pin below 20A for TB1.
- ※ Please connect safety ground to FG terminal on the unit.

Connector type	
CN3 Option (Mfr : J.S.T.)	
Pin No.	Contents
1	RC(+)
2	RC(-)

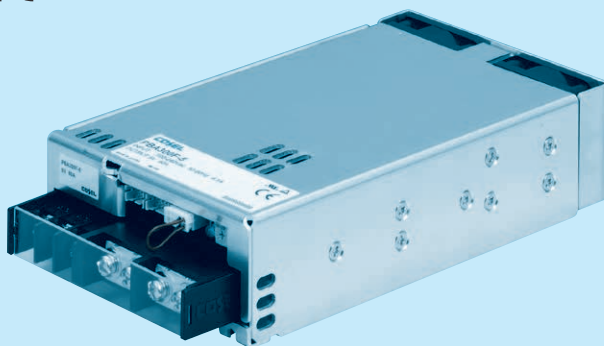
Barrier strip type
Model B2B-XH-A
Mating Connector (Terminal)
XHP-2
(BXH-001T-P0.6
or SXH-001T-P0.6)

PBA300F

Ordering information

PB A 300 F -5 -□

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *5
C : with Coating
G : Low leakage current
U : Operation stop voltage is set at a lower value
F3 : Reverse air exhaust type
F4 : Low speed fan
N1 : with DIN rail

Refer to instruction manual 7.1.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL		PBA300F-3R3	PBA300F-5	PBA300F-7R5	PBA300F-12	PBA300F-15	PBA300F-24	PBA300F-36	PBA300F-48
MAX OUTPUT WATTAGE[W]		198	300	300	324	330	336	324	336
DC OUTPUT	ACIN 100V	3.3V 60A	5V 60A	7.5V 40A	12V 27A	15V 22A	24V 14A	36V 9A	48V 7A
	ACIN 200V *3	3.3V 60A	5V 60A	7.5V 40A	12V 27A	15V 22A	24V 14(16.5)A	36V 9A	48V 7A

SPECIFICATIONS

	MODEL	PBA300F-3R3	PBA300F-5	PBA300F-7R5	PBA300F-12	PBA300F-15	PBA300F-24	PBA300F-36	PBA300F-48	
INPUT	VOLTAGE[V]	AC85 - 264 1 φ or DC120 - 350 (AC50 or DC70 Please refer to the instruction manual 7. option *4)								
	CURRENT[A]	ACIN 100V	3typ	4.1typ						
		ACIN 200V	1.6typ	2typ						
	FREQUENCY[Hz]	50/60 (47 - 63)								
	EFFICIENCY[%]	ACIN 100V	68typ	74typ	76typ	78typ	78typ	79typ	81typ	79typ
		ACIN 200V	71typ	77typ	79typ	81typ	81typ	82typ	84typ	82typ
	POWER FACTOR	ACIN 100V	0.98typ (lo=100%)							
		ACIN 200V	0.95typ (lo=100%)							
INRUSH CURRENT[A]	ACIN 100V	20/40typ (lo=100%) (Primary inrush current /Secondary inrush current) (More then 3 sec. to re-start)								
	ACIN 200V	40/40typ (lo=100%) (Primary inrush current /Secondary inrush current) (More then 3 sec. to re-start)								
LEAKAGE CURRENT[mA]		0.45/0.75max (ACIN 100V/240V 60Hz, lo=100%, According to IEC60950-1.DENAN)								
OUTPUT	VOLTAGE[V]	3.3	5	7.5	12	15	24	36	48	
	CURRENT[A]	ACIN 100V	60	60	40	27	22	14	9	7
		ACIN 200V *3	60	60	40	27	22	14(16.5)	9	7
	LINE REGULATION[mV]	20max	20max	36max	48max	60max	96max	144max	192max	
	LOAD REGULATION[mV]	40max	40max	60max	100max	120max	150max	150max	300max	
	RIPPLE[mVp-p]	0 to +50℃ *1	80max	80max	120max	120max	120max	150max	150max	150max
		-20 - 0℃ *1	140max	140max	160max	160max	160max	160max	160max	400max
	RIPPLE NOISE[mVp-p]	0 to +50℃ *1	120max	120max	150max	150max	150max	150max	200max	200max
		-20 - 0℃ *1	160max	160max	180max	180max	180max	180max	240max	500max
	TEMPERATURE REGULATION[mV]	0 to +50℃	40max	50max	75max	120max	150max	240max	360max	480max
		-20 to +30℃	60max	75max	120max	180max	180max	290max	440max	600max
	DRIFT[mV]	*2	12max	20max	30max	48max	60max	96max	144max	192max
	START-UP TIME[ms]		300typ(ACIN 100/200V, lo=100%) *Start-up time is 500ms typ for less than 1minute of applying input again from turning off the input voltage.							
HOLD-UP TIME[ms]		20typ (ACIN 100/200V, lo=100%)								
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		2.64 - 3.96	3.96 - 6.00	5.25 - 8.25	8.25 - 13.20	10.50 - 16.50	16.50 - 26.40	25.20 - 39.60	38.40 - 56.00	
OUTPUT VOLTAGE SETTING[V]		3.30 - 3.40	5.00 - 5.15	7.50 - 7.80	12.00 - 12.48	15.00 - 15.60	24.00 - 24.96	36.00 - 37.44	48.00 - 49.92	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rated current or 101% of peak current and recovers automatically								
	OVERVOLTAGE PROTECTION[V]	4.3 - 6.3	6.5 - 8.0	9.0 - 11.6	14.4 - 18.6	18.0 - 23.3	28.8 - 37.2	43.2 - 54.0	57.6 - 80.0	
	OPERATING INDICATION	LED (Green)								
	REMOTE SENSING	Provided								
	REMOTE ON/OFF	Provided								
ISOLATION	INPUT-OUTPUT · RC	AC3.000V 1minute, Cutoff current = 10mA, DC500V 50MΩmin (At Room Temperature)								
	INPUT-FG	AC2.000V 1minute, Cutoff current = 10mA, DC500V 50MΩmin (At Room Temperature)								
	OUTPUT · RC · AUX-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩmin (At Room Temperature)								
	OUTPUT-RC · AUX	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩmin (At Room Temperature)								
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-20 to +71℃ (Required Derating), 20 - 90%RH (Non condensing) 3,000m (10,000feet) max								
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing) 9,000m (30,000feet) max								
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis								
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis								
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN								
	CONDUCTED NOISE	Complies with FCC Part15 classB, VCCI-B, CISPR22-B, EN55011-B, EN55022-B								
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 *6								
OTHERS	CASE SIZE/WEIGHT	102×42×170mm [4.02×1.65×6.69 inches] (without terminal block and screw) (W×H×D) /1.0kg max								
	COOLING METHOD	Forced cooling (internal fan)								

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter(equivalent to KEISOKU-GIKEN :RM101).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃.

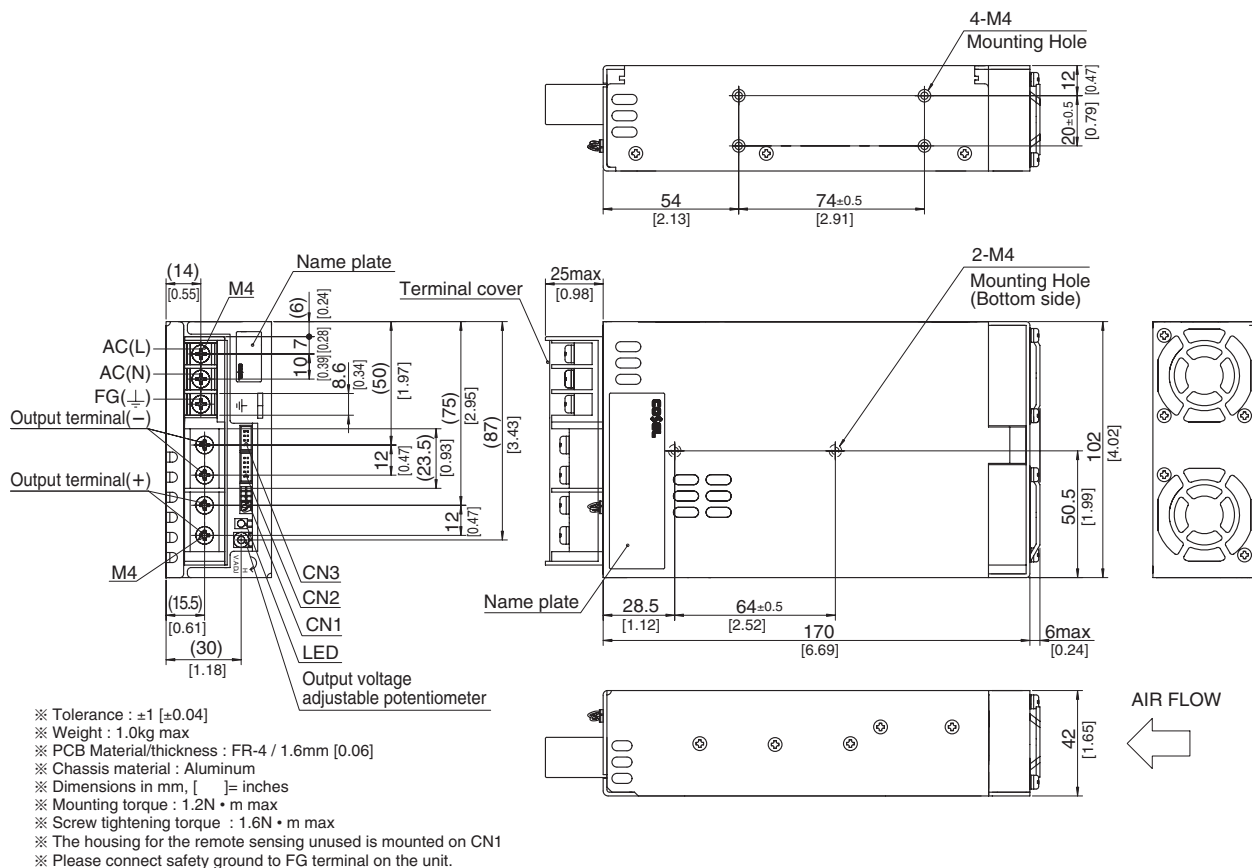
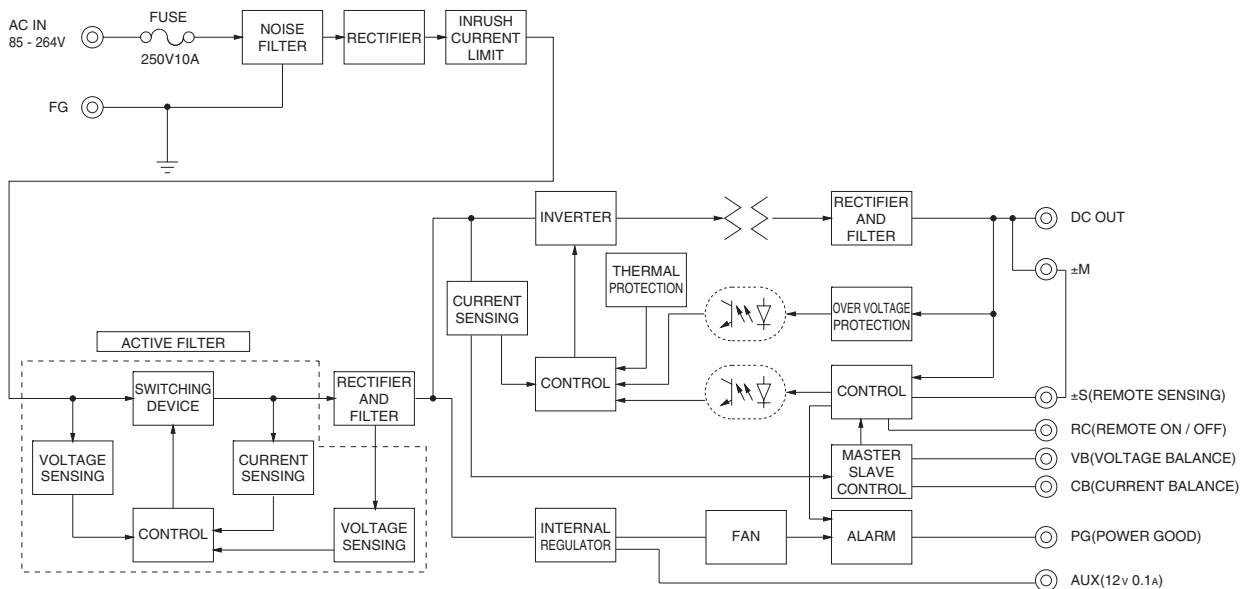
*3 () means peak current. Peak loading for 10s. And Duty 35% max, refer to Instruction manual in detail.

*4 Derating is required.Consult us for details.

*5 Please contact us about safety approvals for the model with option.

*6 Please contact us about class C.

* A sound may occur from power supply at pulse loading.

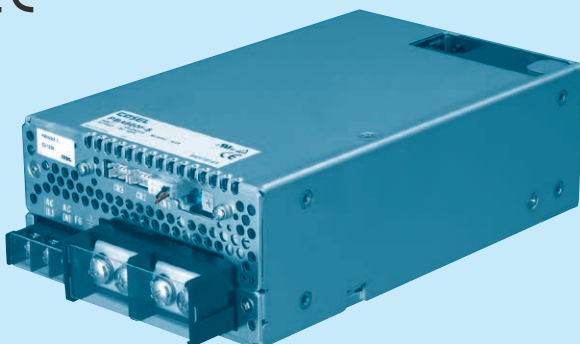


PBA600F

Ordering information

PB A 600 F -5 -□

① ② ③ ④ ⑤ ⑥

Example recommended EMI/EMC filter
NAC-16-472

High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *6
C : with Coating
G : Low leakage current
U : Operation stop voltage
is set at a lower value
F1 : With Long-Life fan
F3 : Reverse air exhaust
type
F4 : Low speed fan

Refer to instruction manual
7.1.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PBA600F-3R3	PBA600F-5	PBA600F-7R5	PBA600F-12	PBA600F-15	PBA600F-24	PBA600F-36	PBA600F-48
MAX OUTPUT WATTAGE[W]	396	600	600	636	645	648	648	624
DC OUTPUT	ACIN 100V	3.3V 120A	5V 120A	7.5V 80A	12V 53A	15V 43A	24V 27A	36V 18A
	ACIN 200V *3	3.3V 120A	5V 120A	7.5V 80A	12V 53A	15V 43A	24V 27(31)A	36V 18A

SPECIFICATIONS

	MODEL	PBA600F-3R3	PBA600F-5	PBA600F-7R5	PBA600F-12	PBA600F-15	PBA600F-24	PBA600F-36	PBA600F-48	
INPUT	VOLTAGE[V]	AC85 - 264 1 ϕ or DC120 - 350 (AC50 or DC70 Please refer to the instruction manual 7. option *5)								
	CURRENT[A]	ACIN 100V	5.8typ	8.2typ						
		ACIN 200V	3typ	4.1typ						
	FREQUENCY[Hz]	50/60 (47 - 63)								
	EFFICIENCY[%]	ACIN 100V	70typ	75typ	76typ	79typ	79typ	81typ	82typ	81typ
		ACIN 200V	72typ	77typ	79typ	82typ	82typ	84typ	84typ	83typ
	POWER FACTOR	ACIN 100V	0.98typ (Io=100%)							
		ACIN 200V	0.95typ (Io=100%)							
INRUSH CURRENT[A]	ACIN 100V	20/40typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 3 sec. to re-start)								
	ACIN 200V	40/40typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 3 sec. to re-start)								
LEAKAGE CURRENT[mA]	0.45/0.75max (ACIN 100V/240V 60Hz, Io=100%, According to IEC60950-1, DENAN)									
OUTPUT	VOLTAGE[V]	3.3	5	7.5	12	15	24	36	48	
	CURRENT[A]	ACIN 100V	120	120	80	53	43	27	18	13
		ACIN 200V *3	120	120	80	53	43	27(31)	18	13
	LINE REGULATION[mV]	20max		20max	36max	48max	60max	96max	144max	192max
	LOAD REGULATION[mV]	40max		40max	60max	100max	120max	150max	150max	300max
	RIPPLE[mVp-p]	0 to +50℃ *1	80max	80max	120max	120max	120max	120max	150max	150max
		-20 - 0℃ *1	140max	140max	160max	160max	160max	160max	160max	400max
	RIPPLE NOISE[mVp-p]	0 to +50℃ *1	120max	120max	150max	150max	150max	150max	200max	200max
		-20 - 0℃ *1	160max	160max	180max	180max	180max	180max	240max	500max
	TEMPERATURE REGULATION[mV]	0 to +50℃	40max	50max	75max	120max	150max	240max	360max	480max
		-20 to +50℃	60max	75max	120max	180max	180max	290max	440max	600max
	DRIFT[mV]	*2	12max	20max	30max	48max	60max	96max	144max	192max
	START-UP TIME[ms]	400typ(ACIN 100/200V, Io=100%) *Start-up time is 500ms typ for less than 1minute of applying input again from turning off the input voltage.								
	HOLD-UP TIME[ms]	20typ (ACIN 100/200V, Io=100%)								
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.64 - 3.96		3.96 - 6.00	5.25 - 8.25	8.25 - 13.20	10.50 - 16.50	16.50 - 26.40	25.20 - 39.60	38.40 - 56.00	
OUTPUT VOLTAGE SETTING[V]	3.30 - 3.40		5.00 - 5.15	7.50 - 7.80	12.00 - 12.48	15.00 - 15.60	24.00 - 24.96	36.00 - 37.44	48.00 - 49.92	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rated current or 101% of peak current and recovers automatically								
	OVERVOLTAGE PROTECTION[V] *4	Vo+0.66 - 1.32	Vo+1.0 - 2.0	Vo+1.5 - 3.0	Vo+2.4 - 4.8	Vo+3.0 - 6.0	Vo+4.8 - 9.6	Vo+7.2 - 14.4	Vo+4.8 - 12.0	
	OPERATING INDICATION	LED (Green)								
	REMOTE SENSING	Provided								
	REMOTE ON/OFF	Provided								
ISOLATION	INPUT-OUTPUT · RC	AC3.000V 1minute, Cutoff current = 10mA, DC500V 50MΩmin (At Room Temperature)								
	INPUT-FG	AC2.000V 1minute, Cutoff current = 10mA, DC500V 50MΩmin (At Room Temperature)								
	OUTPUT · RC · AUX-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩmin (At Room Temperature)								
	OUTPUT-RC · AUX	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩmin (At Room Temperature)								
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-20 to +71℃ (Required Derating), 20 - 90%RH (Non condensing) 3,000m (10,000feet) max								
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing) 9,000m (30,000feet) max								
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis								
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis								
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN								
	CONDUCTED NOISE	Complies with FCC Part15 classB, VCCI-B, CISPR22-B, EN55011-B, EN55022-B								
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 *7								
OTHERS	CASE SIZE/WEIGHT	120×61×190mm [4.72×2.4×7.48 inches] (without terminal block and screw) (W×H×D) /1.6kg max								
	COOLING METHOD	Forced cooling (internal fan)								

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter(equivalent to KEISOKU-GIKEN :RM101).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.
*3 () means peak current. Peak loading for 10s. And Duty 35% max, refer to Instruction manual in detail.

*4 Overvoltage protection circuit to follow to output voltage setting. Standard overvoltage protection circuit is please contact us for details.

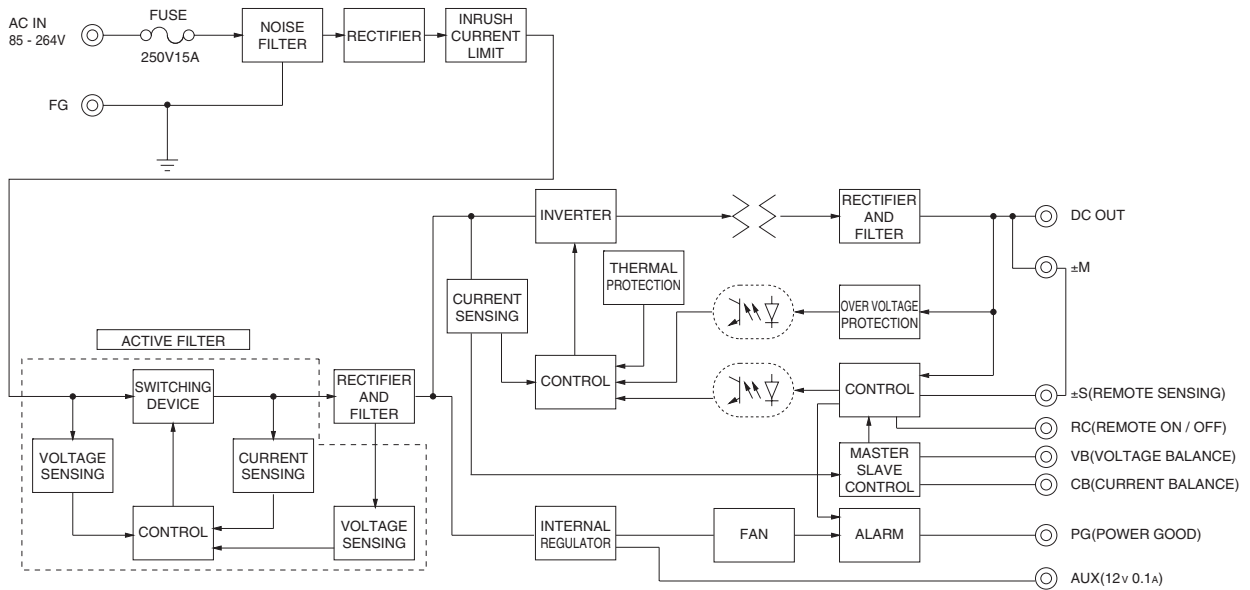
*5 Derating is required. Consult us for details.

*6 Please contact us about safety approvals for the model with option.

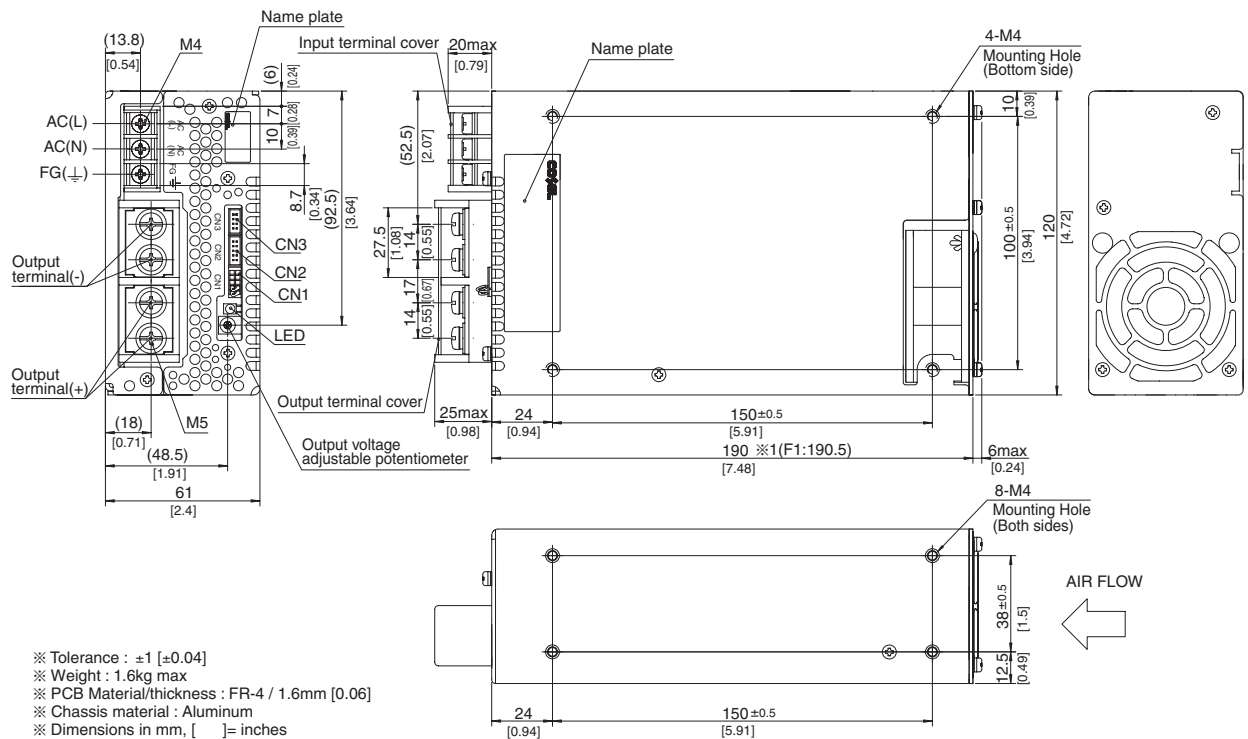
*7 Please contact us about class C.

* A sound may occur from power supply at pulse loading.

Block diagram



External view



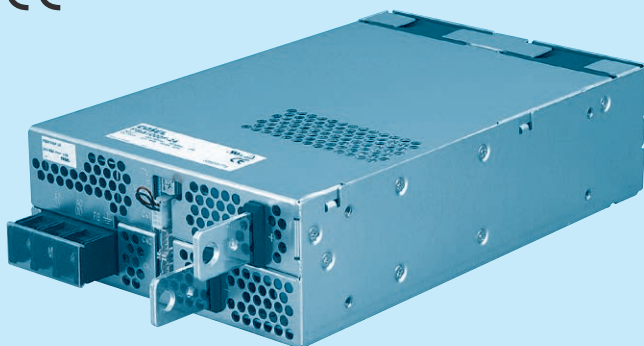
- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 1.6kg max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque : 1.2N · m (12.8kgf · cm) max
- ※ Screw tightening torque : M4 1.6N · m (16.9kgf · cm) max
M5 2.5N · m (24.5kgf · cm) max
- ※ The housing for the remote sensing unused is mounted on CN1
- ※ 1 F1(Optional):190.5
- ※ Please connect safety ground to FG terminal on the unit.

PBA1000F

Ordering information

PB A 1000 F -5 -□

① ② ③ ④ ⑤ ⑥

Example recommended EMI/EMC filter
NAC-20-472

High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *6
C : with Coating
G : Low leakage current
U : Operation stop voltage
is set at a lower value
F1 : With Long-Life fan
F3 : Reverse air exhaust
type
F4 : Low speed fan

Refer to instruction manual
7.1.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL		PBA1000F-3R3	PBA1000F-5	PBA1000F-7R5	PBA1000F-12	PBA1000F-15	PBA1000F-24	PBA1000F-36	PBA1000F-48
MAX OUTPUT WATTAGE[W]		660	1000	1005	1056	1050	1056	1044	1056
DC OUTPUT	ACIN 100V	3.3V 200A	5V 200A	7.5V 134A	12V 88A	15V 70A	24V 44A	36V 29A	48V 22A
	ACIN 200V *3	3.3V 200A	5V 200A	7.5V 134A	12V 88A	15V 70A	24V 44(51)A	36V 29A	48V 22A

SPECIFICATIONS

	MODEL	PBA1000F-3R3	PBA1000F-5	PBA1000F-7R5	PBA1000F-12	PBA1000F-15	PBA1000F-24	PBA1000F-36	PBA1000F-48								
INPUT	VOLTAGE[V]	AC85 - 264 1 ϕ or DC120 - 350 (AC50 or DC70 Please refer to the instruction manual 7. option *5)															
	CURRENT[A]	ACIN 100V	9typ	13typ													
		ACIN 200V	5typ	7typ													
	FREQUENCY[Hz]	50/60 (47 - 63)															
	EFFICIENCY[%]	ACIN 100V	74typ	79typ	80typ	82typ	82typ	84typ	84typ								
		ACIN 200V	76typ	81typ	83typ	84typ	84typ	86typ	86typ								
	POWER FACTOR	ACIN 100V	0.98typ (Io=100%)														
	ACIN 200V	0.95typ (Io=100%)															
	ACIN 100V	20/40typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 10 sec. to re-start)															
	ACIN 200V	40/40typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 10 sec. to re-start)															
	LEAKAGE CURRENT[mA]	0.5/1.0max (ACIN 100V/240V 60Hz, Io=100%, According to IEC60950-1, DENAN)															
OUTPUT	VOLTAGE[V]	3.3	5	7.5	12	15	24	36	48								
	CURRENT[A]	ACIN 100V	200	200	134	88	70	44	29	22							
		ACIN 200V *3	200	200	134	88	70	44(51)	29	22							
	LINE REGULATION[mV]	20max	20max	36max	48max	60max	96max	144max	192max								
	LOAD REGULATION[mV]	40max	40max	60max	100max	120max	150max	150max	300max								
	RIPPLE[mVp-p]	0 to +50℃ *1	80max	80max	120max	120max	120max	120max	150max	150max							
		-20 - 0℃ *1	140max	140max	160max	160max	160max	160max	160max	400max							
	RIPPLE NOISE[mVp-p]	0 to +50℃ *1	120max	120max	150max	150max	150max	150max	200max	200max							
		-20 - 0℃ *1	160max	160max	180max	180max	180max	180max	240max	500max							
	TEMPERATURE REGULATION[mV]	0 to +50℃	40max	50max	75max	120max	150max	240max	360max	480max							
		-20 to +50℃	60max	75max	120max	180max	180max	290max	440max	600max							
	DRIFT[mV]	*2	12max	20max	30max	48max	60max	96max	144max	192max							
	START-UP TIME[ms]	400typ(ACIN 100/200V, Io=100%) *Start-up time is 500ms typ for less than 1minute of applying input again from turning off the input voltage.															
HOLD-UP TIME[ms]	20typ (ACIN 100/200V, Io=100%)																
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.64 - 3.96		3.96 - 6.00		5.25 - 8.25		8.25 - 13.20		10.50 - 16.50		16.50 - 26.40		25.20 - 39.60		38.40 - 56.00		
OUTPUT VOLTAGE SETTING[V]	3.30 - 3.40		5.00 - 5.15		7.50 - 7.80		12.00 - 12.48		15.00 - 15.60		24.00 - 24.96		36.00 - 37.44		48.00 - 49.92		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rated current or 101% of peak current and recovers automatically															
	OVERVOLTAGE PROTECTION[V] *4	Vo+0.66 - 1.32		Vo+1.0 - 2.0		Vo+1.5 - 3.0		Vo+2.4 - 4.8		Vo+3.0 - 6.0		Vo+4.8 - 9.6		Vo+7.2 - 14.4		Vo+4.8 - 12.0	
	OPERATING INDICATION	LED (Green)															
	REMOTE SENSING	Provided															
	REMOTE ON/OFF	Provided															
ISOLATION	INPUT-OUTPUT · RC	AC3.000V 1minute, Cutoff current = 25mA, DC500V 50MΩmin (At Room Temperature)															
	INPUT-FG	AC2.000V 1minute, Cutoff current = 25mA, DC500V 50MΩmin (At Room Temperature)															
	OUTPUT · RC · AUX-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩmin (At Room Temperature)															
	OUTPUT-RC · AUX	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩmin (At Room Temperature)															
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-20 to +71℃ (Required Derating), 20 - 90%RH (Non condensing) 3,000m (10,000feet) max															
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing) 9,000m (30,000feet) max															
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis															
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis															
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN															
	CONDUCTED NOISE	Complies with FCC Part15 classB, VCCI-B, CISPR22-B, EN55011-B, EN55022-B															
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 *7															
OTHERS	CASE SIZE/WEIGHT	150×61×240mm [5.91×2.4×9.45 inches] (without terminal block and screw) (W×H×D) /2.2kg max															
	COOLING METHOD	Forced cooling (internal fan)															

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter (equivalent to KEISOKU-GIKEN :RM101).

Ripple and ripple noise is measured on measuring board with capacitor of 22 μF within 150mm from the output terminal.

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

*3 () means peak current. Peak loading for 10s. And Duty 35% max, refer to Instruction manual in detail.

*4 Overvoltage protection circuit to follow to output voltage setting. Standard overvoltage protection circuit is please contact us for details.

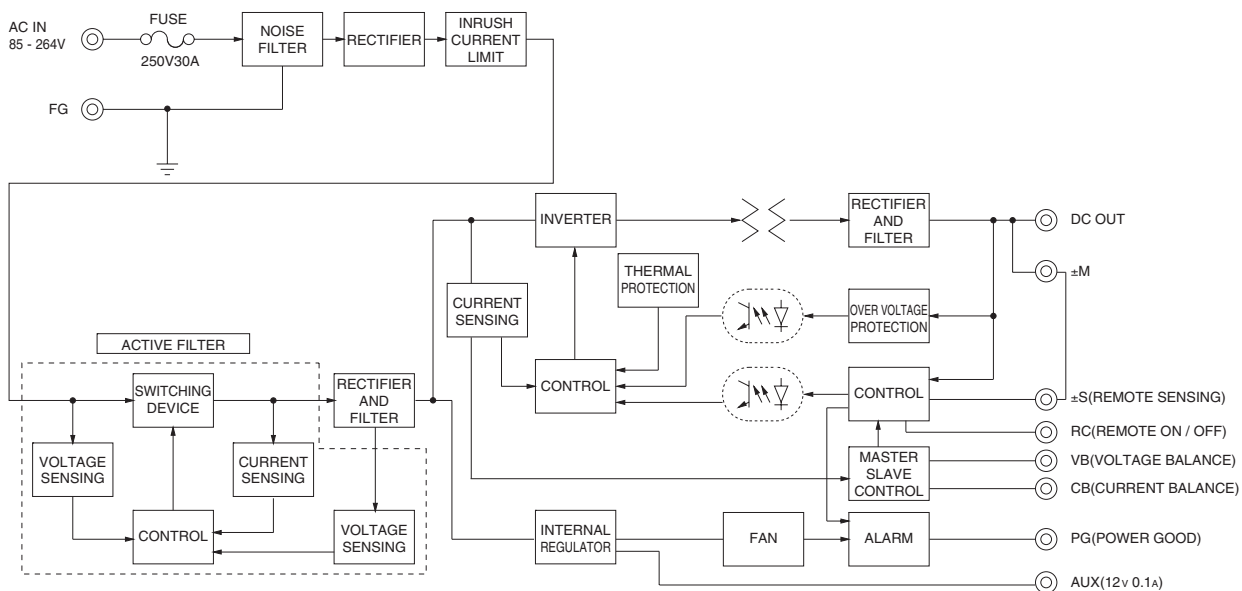
*5 Derating is required. Consult us for details.

*6 Please contact us about safety approvals for the model with option.

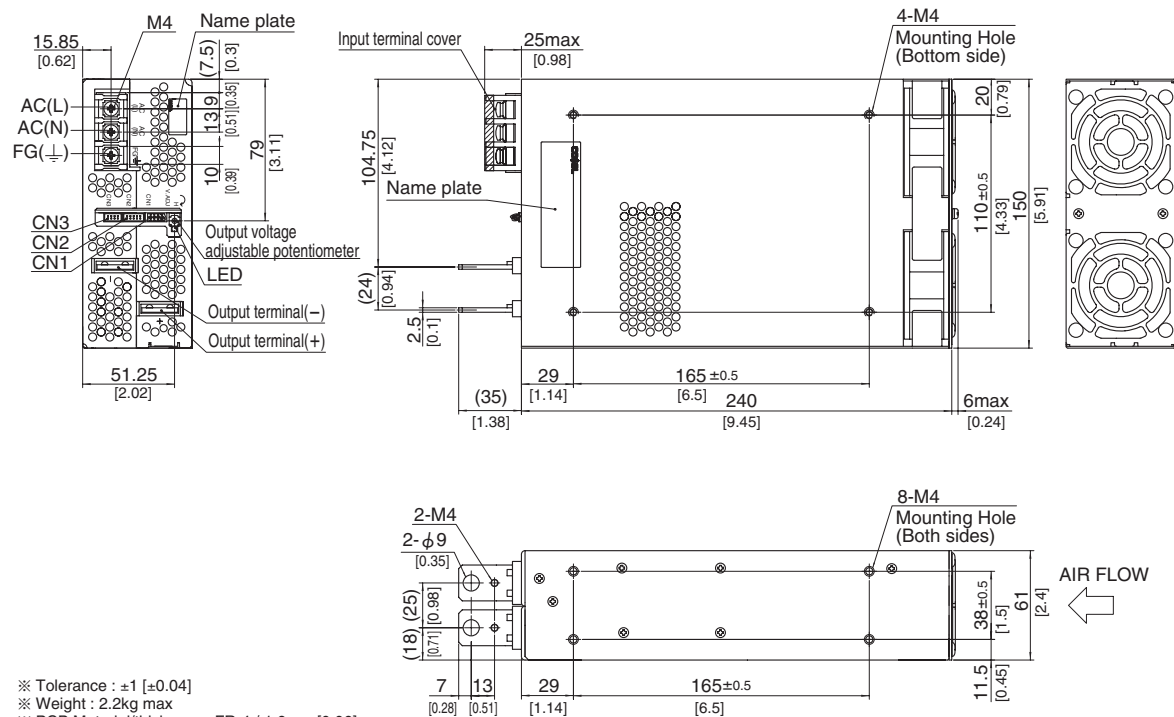
*7 Please contact us about class C.

* A sound may occur from power supply at pulse loading.

Block diagram



External view

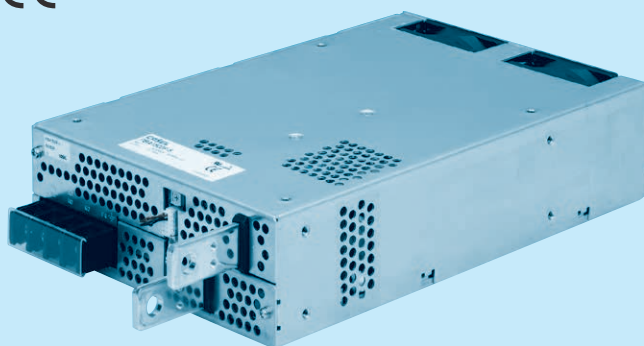


- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 2.2kg max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque : 1.2N • m (12.8kgf • cm) max
- ※ Screw tightening torque : 1.6N • m (16.9kgf • cm) max
- ※ The housing for the remote sensing unused is mounted on CN1
- ※ Please connect safety ground to FG terminal on the unit.

PBA1500F

PB A 1500 F -5 -□

① ② ③ ④ ⑤ ⑥

Example recommended EMI/EMC filter
NAC-20-472

High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *6
C : with Coating
G : Low leakage current
U : Operation stop voltage
is set at a lower value
F1 : With Long-Life fan
F3 : Reverse air exhaust
type
F4 : Low speed fan

Refer to instruction manual
7.1.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PBA1500F-3R3	PBA1500F-5	PBA1500F-7R5	PBA1500F-12	PBA1500F-15	PBA1500F-24	PBA1500F-36	PBA1500F-48
MAX OUTPUT WATTAGE[W]	990	1500	1500	1500	1500	1680	1692	1680
DC OUTPUT	ACIN 100V	3.3V 300A	5V 300A	7.5V 200A	12V 125A	15V 100A	24V 65A	36V 42A
	ACIN 200V *3	3.3V 300A	5V 300A	7.5V 200A	12V 125A	15V 100A	24V 70(105)A	36V 47(70)A

SPECIFICATIONS

	MODEL	PBA1500F-3R3	PBA1500F-5	PBA1500F-7R5	PBA1500F-12	PBA1500F-15	PBA1500F-24	PBA1500F-36	PBA1500F-48	
INPUT	VOLTAGE[V]	AC85 - 264 1 φ or DC120 - 370 (AC50 or DC70 Please refer to the instruction manual 7. option *5)								
	CURRENT[A]	ACIN 100V	15typ	19typ						
		ACIN 200V	8typ	10typ						
	FREQUENCY[Hz]	50/60 (47 - 63)								
	EFFICIENCY[%]	ACIN 100V	72typ	77typ	81typ	81typ	83typ	84typ	84typ	
		ACIN 200V	75typ	81typ	83typ	84typ	86typ	87typ	87typ	
	POWER FACTOR	ACIN 100V	0.98typ (Io=100%)							
		ACIN 200V	0.95typ (Io=100%)							
INRUSH CURRENT[A]	ACIN 100V	20/40typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 10 sec. to re-start)								
	ACIN 200V	40/40typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 10 sec. to re-start)								
LEAKAGE CURRENT[mA]	0.9/1.5max (ACIN 100V/240V 60Hz, Io=100%, According to IEC60950-1, DENAN)									
OUTPUT	VOLTAGE[V]	3.3	5	7.5	12	15	24	36	48	
	CURRENT[A]	ACIN 100V	300	300	200	125	100	65	42	32
		ACIN 200V *3	300	300	200	125	100	70(105)	47(70)	35
	LINE REGULATION[mV]	20max		20max	36max	48max	60max	96max	144max	192max
	LOAD REGULATION[mV]	40max		40max	60max	100max	120max	150max	150max	300max
	RIPPLE[mVp-p]	0 to +50℃ *1	80max	80max	120max	120max	120max	120max	150max	150max
		-20 - 0℃ *1	140max	140max	160max	160max	160max	160max	160max	400max
	RIPPLE NOISE[mVp-p]	0 to +50℃ *1	120max	120max	150max	150max	150max	150max	200max	200max
		-20 - 0℃ *1	160max	160max	180max	180max	180max	180max	240max	500max
	TEMPERATURE REGULATION[mV]	0 to +50℃	40max	50max	75max	120max	150max	240max	360max	480max
		-20 to +30℃	60max	75max	120max	180max	180max	290max	440max	600max
	DRIFT[mV]	*2	12max	20max	30max	48max	60max	96max	144max	192max
	START-UP TIME[ms]	600typ(ACIN 100/200V, Io=100%)								
	HOLD-UP TIME[ms]	20typ (ACIN 100/200V, Io=100%)								
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.64 - 3.96		3.96 - 6.00	5.25 - 8.25	8.25 - 13.20	10.50 - 16.50	16.50 - 26.40	25.20 - 39.60	38.40 - 56.00	
OUTPUT VOLTAGE SETTING[V]	3.30 - 3.40		5.00 - 5.15	7.50 - 7.80	12.00 - 12.48	15.00 - 15.60	24.00 - 24.96	36.00 - 37.44	48.00 - 49.92	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rated current or 101% of peak current and recovers automatically								
	OVERVOLTAGE PROTECTION[V] *4	Vo+0.66 - 1.32	Vo+1.0 - 2.0	Vo+1.5 - 3.0	Vo+2.4 - 4.8	Vo+3.0 - 6.0	Vo+4.8 - 9.6	Vo+7.2 - 14.4	Vo+4.8 - 12.0	
	OPERATING INDICATION	LED (Green)								
	REMOTE SENSING	Provided								
	REMOTE ON/OFF	Provided								
ISOLATION	INPUT-OUTPUT · RC	AC3.000V 1minute, Cutoff current = 25mA, DC500V 50MΩmin (At Room Temperature)								
	INPUT-FG	AC2.000V 1minute, Cutoff current = 25mA, DC500V 50MΩmin (At Room Temperature)								
	OUTPUT · RC · AUX-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩmin (At Room Temperature)								
	OUTPUT-RC · AUX	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩmin (At Room Temperature)								
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-20 to +71℃ (Required Derating), 20 - 90%RH (Non condensing) 3.000m (10,000feet) max								
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing) 9.000m (30,000feet) max								
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis								
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis								
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN								
	CONDUCTED NOISE	Complies with FCC Part15 classB, VCCI-B, CISPR22-B, EN55011-B, EN55022-B, additional EMI/EMC Filter required for meeting class B								
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 *7								
OTHERS	CASE SIZE/WEIGHT	178×61×268mm [7.01×2.4×10.55 inches] (without terminal block and screw) (W×H×D) /3.4kg max								
	COOLING METHOD	Forced cooling (internal fan)								

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter(equivalent to KEISOKU-GIKEN :RM101).

Ripple and ripple noise is measured on measuring board with capacitor of 22μF within 150mm from the output terminal.

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃.

*3 () means peak current. Peak loading for 10s. And Duty 35% max, refer to Instruction manual in detail.

*4 Overvoltage protection circuit to follow to output voltage setting. Standard overvoltage protection circuit is please contact us for details.

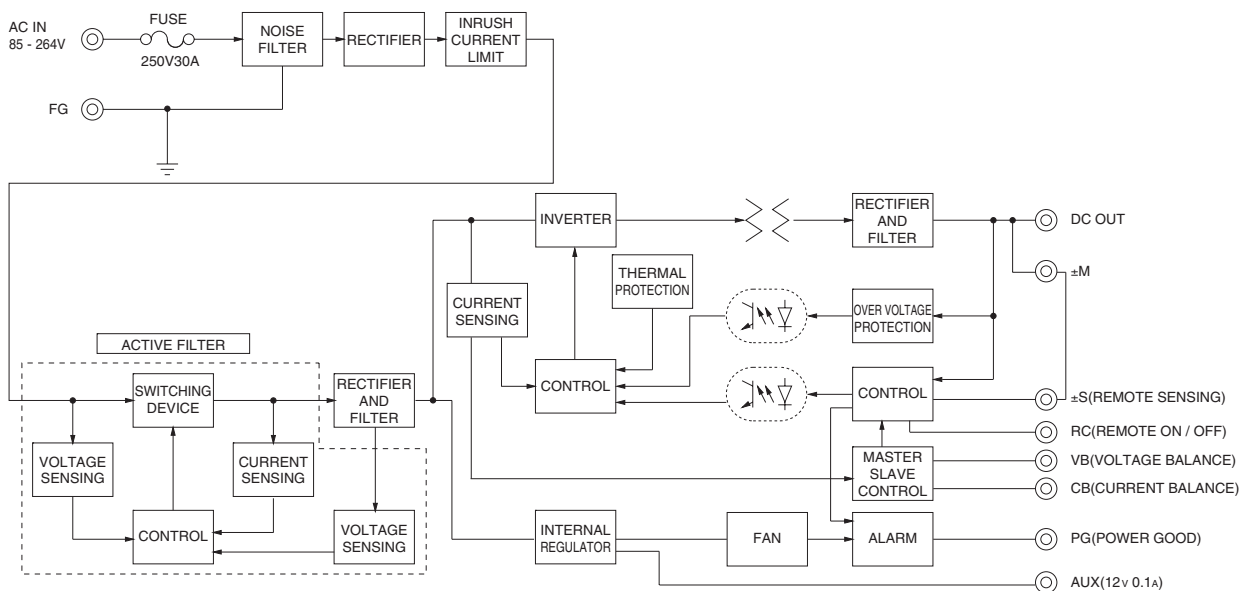
*5 Derating is required. Consult us for details.

*6 Please contact us about safety approvals for the model with option.

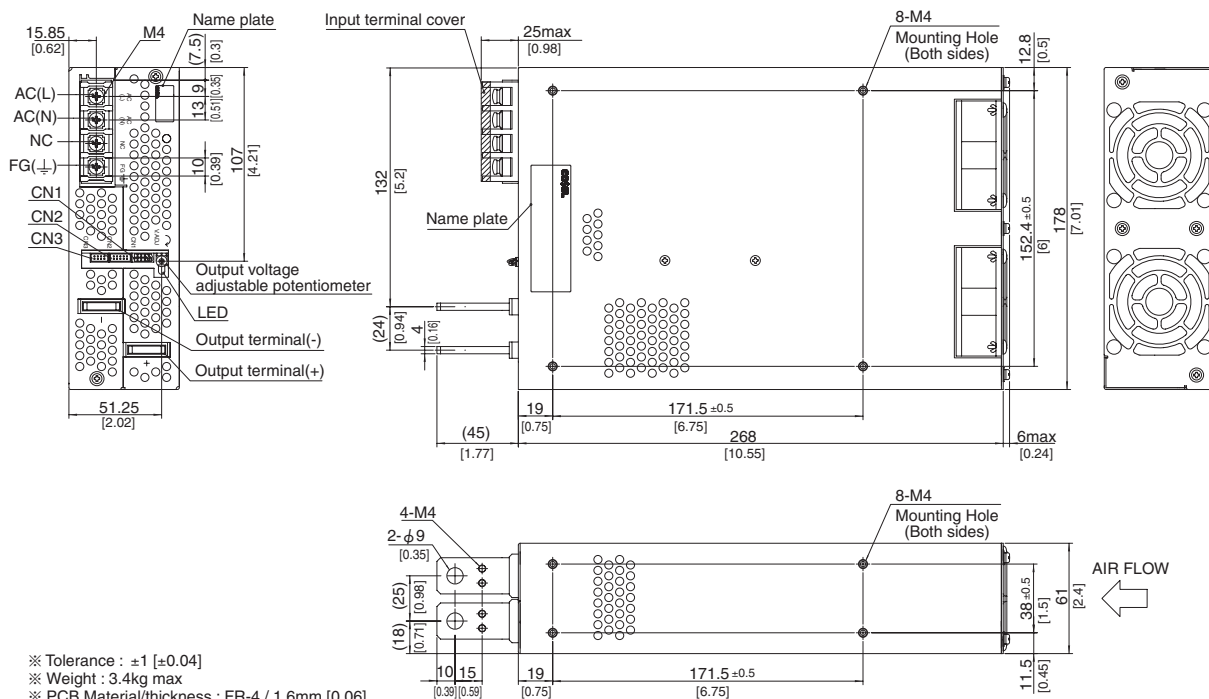
*7 Please contact us about class C.

* A sound may occur from power supply at pulse loading.

Block diagram



External view



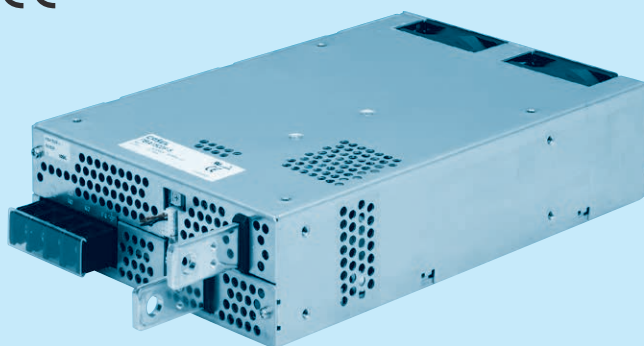
- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 3.4kg max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque : 1.2N · m (12.8kgf · cm) max
- ※ Screw tightening torque : 1.6N · m (16.9kgf · cm) max
- ※ The housing for the remote sensing unused is mounted on CN1
- ※ Please connect safety ground to FG terminal on the unit.

PBA1500T

Ordering information

PB A 1500 T -5 -□

① ② ③ ④ ⑤ ⑥

Example recommended EMI/EMC filter
TAC-10-683

* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Triple input phase
- ⑤ Output voltage
- ⑥ Optional *6
- C : with Coating
- G : Low leakage current
- U : Operation stop voltage is set at a lower value
- F1 : With Long-Life fan
- F3 : Reverse air exhaust type
- F4 : Low speed fan

Refer to instruction manual 7.1.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PBA1500T-5	PBA1500T-12	PBA1500T-24	PBA1500T-48
MAX OUTPUT WATTAGE[W]	1500	1500	1680	1680
DC OUTPUT	ACIN 200V *3 5V 300A	12V 125A	24V 70(105)A	48V 35A

SPECIFICATIONS

	MODEL	PBA1500T-5	PBA1500T-12	PBA1500T-24	PBA1500T-48
INPUT	VOLTAGE[V]	AC170 - 264 3φ (AC100 Please refer to the instruction manual 7. option *5)			
	CURRENT[A]	ACIN 200V 6typ			
	FREQUENCY[Hz]	50/60 (47 - 63)			
	EFFICIENCY[%]	ACIN 200V 81typ	84typ	87typ	87typ
	POWER FACTOR	ACIN 200V 0.95typ (Io=100%)			
	INRUSH CURRENT[A]	ACIN 200V 40/40typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 10 sec. to re-start)			
OUTPUT	LEAKAGE CURRENT[mA]	1.5max (ACIN 240V 60Hz, Io=100%, According to IEC60950-1, DENAN)			
	VOLTAGE[V]	5	12	24	48
	CURRENT[A]	ACIN 200V *3 300	125	70(105)	35
	LINE REGULATION[mV]	20max	48max	96max	192max
	LOAD REGULATION[mV]	40max	100max	150max	300max
	RIPPLE[mVp-p]	0 to +50°C *1 80max -20 - 0°C *1 140max	120max 160max	120max 160max	150max 400max
	RIPPLE NOISE[mVp-p]	0 to +50°C *1 120max -20 - 0°C *1 160max	150max 180max	150max 180max	200max 500max
	TEMPERATURE REGULATION[mV]	0 to +50°C 50max -20 to +50°C 75max	120max 180max	240max 290max	480max 600max
	DRIFT[mV]	*2 20max	48max	96max	192max
	START-UP TIME[ms]	300typ(ACIN 200V, Io=100%) * Start-up time is 500ms typ for less than 1 minute of applying input again from turning off the input voltage.			
	HOLD-UP TIME[ms]	20typ (ACIN 200V, Io=100%)			
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	3.96 - 6.00	8.25 - 13.20	16.50 - 26.40	38.40 - 56.00
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE SETTING[V]	5.00 - 5.15	12.00 - 12.48	24.00 - 24.96	48.00 - 49.92
	OVERCURRENT PROTECTION	Works over 105% of rated current or 101% of peak current and recovers automatically			
	OVERVOLTAGE PROTECTION[V] *4	Vo+1.0 - 2.0	Vo+2.4 - 4.8	Vo+4.8 - 9.6	Vo+2.0 - 12.0
	OPERATING INDICATION	LED (Green)			
ISOLATION	REMOTE SENSING	Provided			
	REMOTE ON/OFF	Provided			
	INPUT-OUTPUT · RC	AC3,000V 1minute, Cutoff current = 25mA, DC500V 50MΩmin (At Room Temperature)			
	INPUT-FG	AC2,000V 1minute, Cutoff current = 25mA, DC500V 50MΩmin (At Room Temperature)			
ENVIRONMENT	OUTPUT · RC · AUX-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩmin (At Room Temperature)			
	OUTPUT-RC · AUX	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩmin (At Room Temperature)			
SAFETY AND NOISE REGULATIONS	OPERATING TEMP., HUMID. AND ALTITUDE	-20 to +71°C (Required Derating), 20 - 90%RH (Non condensing) 3,000m (10,000feet) max			
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing) 9,000m (30,000feet) max			
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis			
OTHERS	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis			
	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN			
	CONDUCTED NOISE	Complies with FCC Part15 classB, VCCI-B, CISPR22-B, EN55011-B, EN55022-B, additional EMI/EMC Filter required for meeting class B			
OTHERS	CASE SIZE/WEIGHT	178×61×268mm [7.01×2.4×10.55 inches] (without terminal block and screw) (W×H×D) /3.4kg max			
	COOLING METHOD	Forced cooling (internal fan)			

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter(equivalent to KEISOKU-GIKEN :RM101).

Ripple and ripple noise is measured on measuring board with capacitor of 22 μF within 150mm from the output terminal.

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

*3 () means peak current. Peak loading for 10s. And Duty 35% max, refer to Instruction manual in detail.

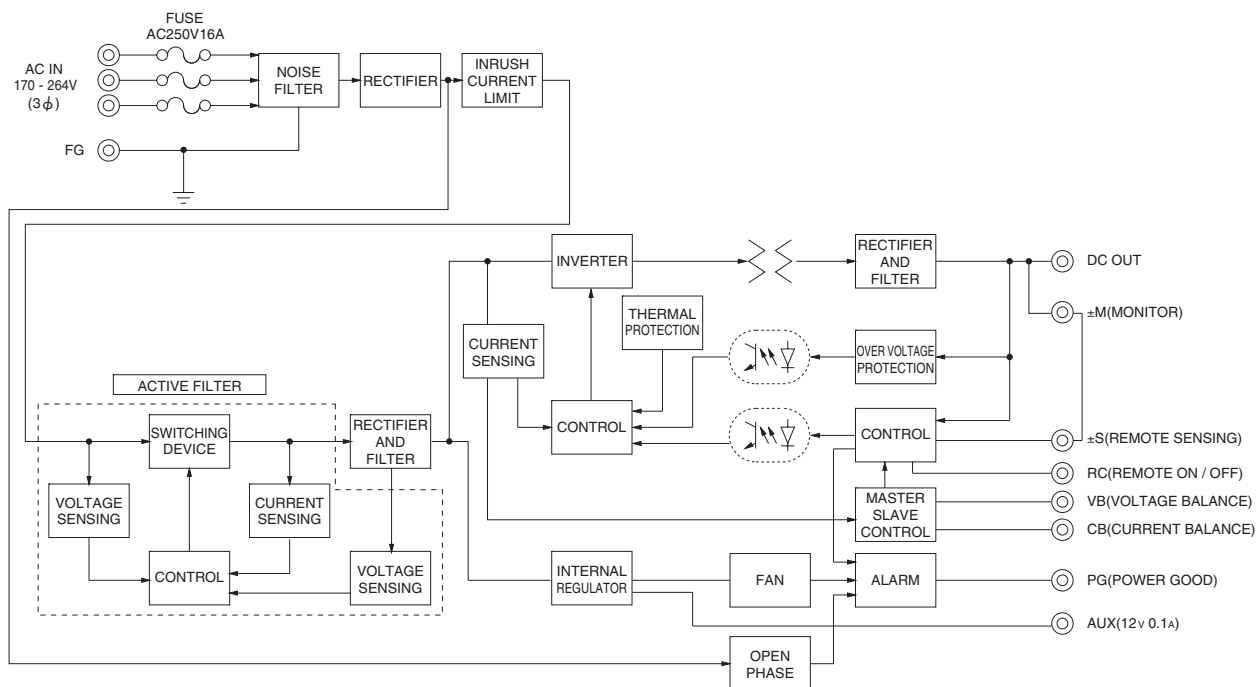
*4 Overvoltage protection circuit to follow to output voltage setting. Standard overvoltage protection circuit is please contact us for details.

*5 Derating is required. Consult us for details.

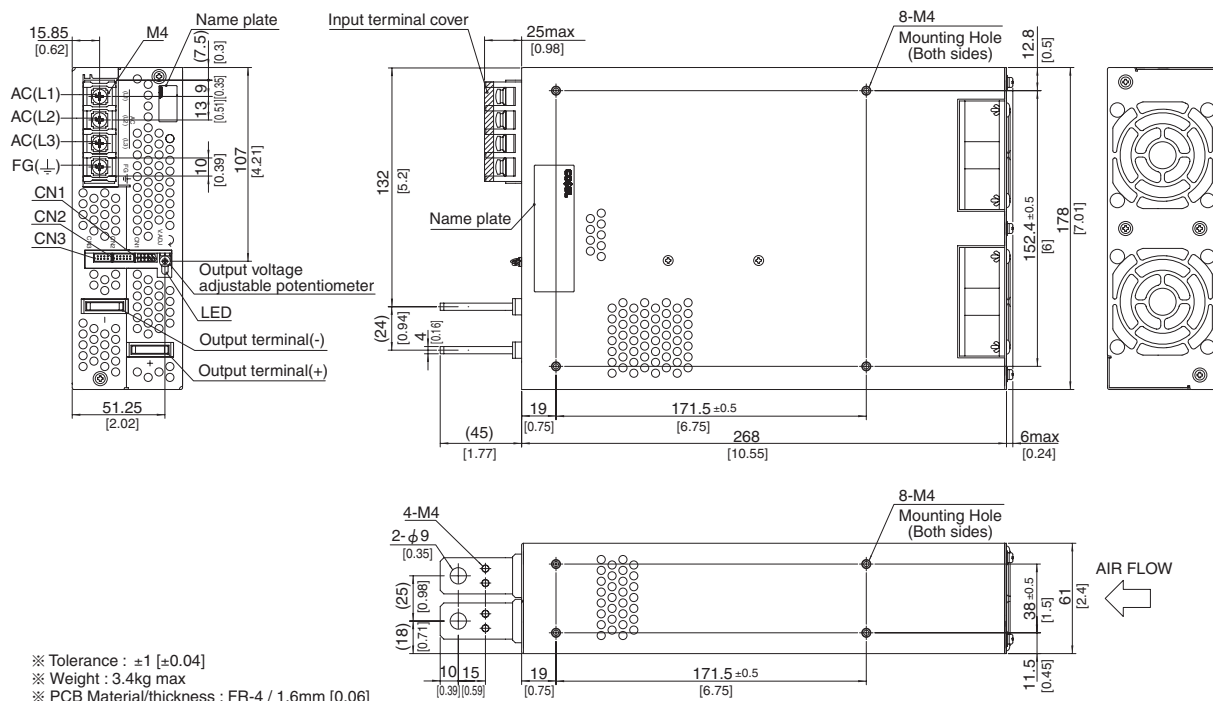
*6 Please contact us about safety approvals for the model with option.

* A sound may occur from power supply at pulse loading.

Block diagram



External view



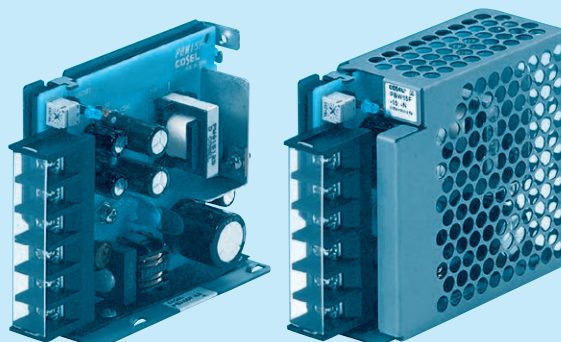
- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 3.4kg max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque : 1.2N • m (12.8kgf • cm) max
- ※ Screw tightening torque : 1.6N • m (16.9kgf • cm) max
- ※ The housing for the remote sensing unused is mounted on CN1
- ※ Please connect safety ground to unit in M4 holes.

PBW15F

Ordering information

PB W 15 F -□ -□

① ② ③ ④ ⑤ ⑧



Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
② Dual output
③ Output wattage
④ Universal input
⑤ Output voltage
⑧ Optional *10
C : with Coating
G : Low leakage current

E : Low leakage current and EMI class A

T : Vertical terminal block
J : Connector type
N : with Cover
NI : with DIN rail
V : Output voltage setting potentiometer externally

Cover is optional

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PBW15F-12	PBW15F-15
MAX OUTPUT WATTAGE[W]	16.8	15.0
DC OUTPUT	VOLTAGE[V] ±12 (+24) CURRENT1[A] 0.7 CURRENT2[A] 1.4	±15 (+30) 0.5 1.0

SPECIFICATIONS

	MODEL	PBW15F-12	PBW15F-15
INPUT	VOLTAGE[V]	AC85 - 264 1 φ or DC110 - 370 (AC50 or DC70 Please refer to the instruction manual 2.1 Input voltage *8)	
	CURRENT[A]	ACIN 100V 0.40typ (CURRENT1) ACIN 200V 0.20typ (CURRENT1)	
	FREQUENCY[Hz]	50/60 (47 - 440) or DC	
	EFFICIENCY[%]	ACIN 100V 74typ (CURRENT1) ACIN 200V 77typ (CURRENT1)	78typ (CURRENT1) 80typ (CURRENT1)
	INRUSH CURRENT[A]	ACIN 100V 15typ (CURRENT1) (At cold start) ACIN 200V 30typ (CURRENT1) (At cold start)	
	LEAKAGE CURRENT[mA]	0.15/0.30max (ACIN 100V/240V 60Hz, Io=100%, According to IEC60950-1.DENAN)	
OUTPUT	VOLTAGE[V]	±12 / (+24V reference number)	±15 / (+30V reference number)
	CURRENT1[A]	0.7 / 0.7	0.5 / 0.5
	CURRENT2[A]	1.4 / -	1.0 / -
	LINE REGULATION[mV]	60max / 96max	60max / 96max
	LOAD REGULATION 1[mV]	600max / 150max	600max / 150max
	LOAD REGULATION 2[mV]	750max / -	750max / -
	RIPPLE[mVp-p]	0 to +50°C 120max / 240max -10 - 0°C 160max / 320max	120max / 240max 160max / 320max
	RIPPLE NOISE[mVp-p]	0 to +50°C 150max / 300max -10 - 0°C 180max / 360max	150max / 300max 180max / 360max
	TEMPERATURE REGULATION[mV]	0 to +50°C 120max -10 to +50°C 150max	150max 180max
	DRIFT[mV]	48max	60max
	START-UP TIME[ms]	200typ (ACIN 100V, Io=100%) *Start-up time is 700ms typ for less than 1minute of applying input again from turning off the input voltage.	
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)	
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	9.60 - 13.2 (+V and -V are simultaneously adjusted)	13.2 - 16.5 (+V and -V are simultaneously adjusted)
	OUTPUT VOLTAGE SETTING[V]	11.5 - 12.5 (+V and -V CURRENT1)	14.4 - 15.6 (+V and -V CURRENT1)
	OVERCURRENT PROTECTION	Works over 105% of rated current and recovers automatically	
	OVERVOLTAGE PROTECTION[V]	16.8 - 24.0	20.0 - 29.0
ISOLATION	OPERATING INDICATION	LED (Green)	
	REMOTE ON/OFF	None	
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)	
ENVIRONMENT	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)	
	OUTPUT-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)	
	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +71°C (Required Derating), 20 - 90%RH (Non condensing) 3,000m (10,000feet) max	
SAFETY AND NOISE REGULATIONS	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing) 9,000m (30,000feet) max	
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis	
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis	
OTHERS	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN	
	CONDUCTED NOISE	Complies with FCC Part15 classB, VCCI-B, CISPR22-B, EN55011-B, EN55022-B	
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Not built-in to active filter *7) *12	
OTHERS	CASE SIZE/WEIGHT	31 X 78 X 85mm [1.22 X 3.07 X 3.35 inches] (without terminal block) (W X H X D) / 200g max (with cover : 235g max)	
	COOLING METHOD	Convection	

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter (equivalent to KEISOKU-GIKEN : RM101).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

*3 Figures for 0 to rated current 1. The current not measured side is fixed.

*4 Figures for 0 to rated current 2. The current not measured

side is fixed.

*5 The sum of +power -power must be less than output power.

*6 ±12, ±15 can be used as +24 and +30.

*7 When two or more units are used, they may not comply with the harmonic attenuator. Please contact us for details.

*8 Derating is required.

*9 Figures to rated current 1.

*10 Please contact us about safety approvals for the model with option.

*11 Please contact us about dynamic load and input response.

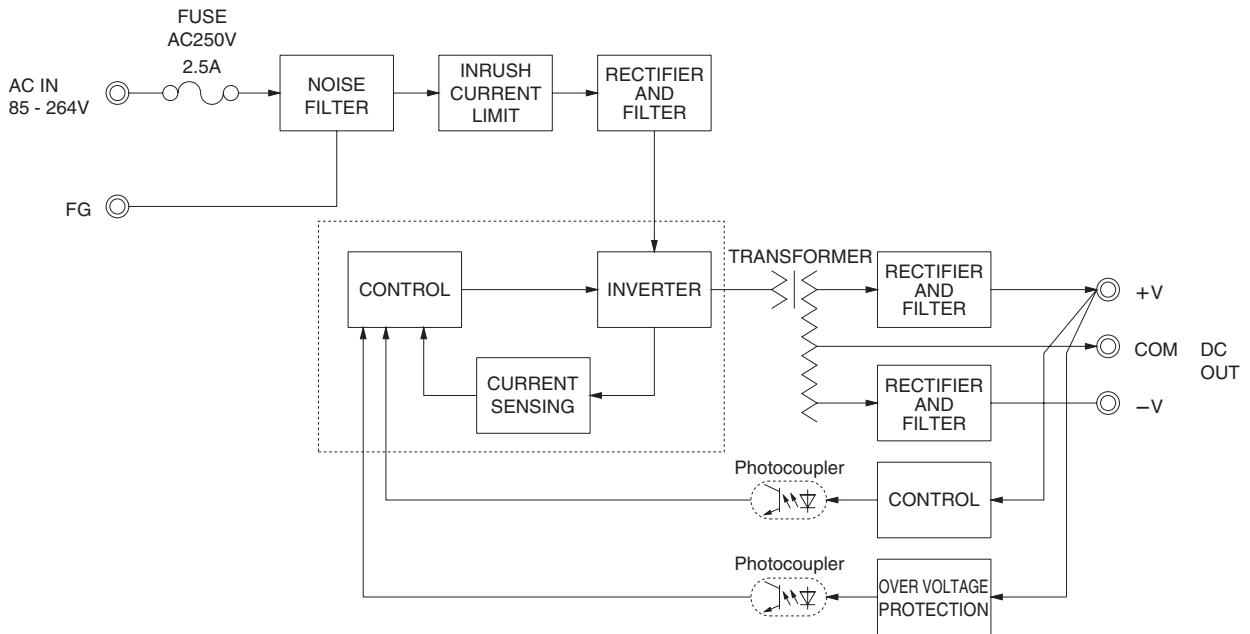
*12 Please contact us about class C.

* Parallel operation with other model is not possible.

* Derating is required when operated with cover.

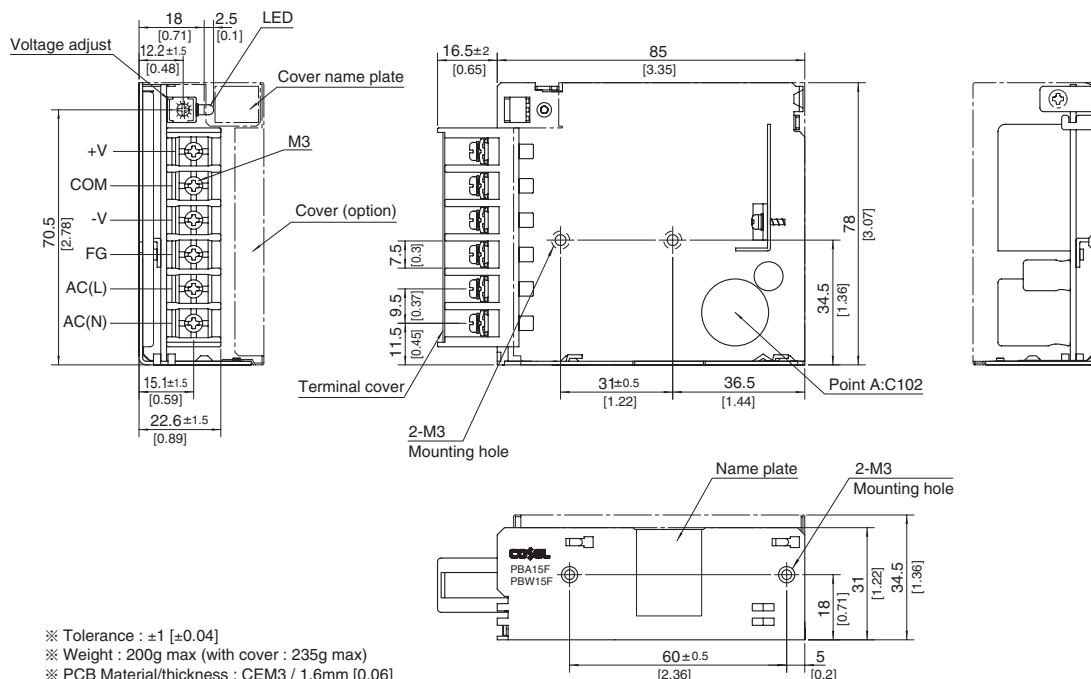
* A sound may occur from power supply at peak loading.

Block diagram



External view

※ External size of option T,J,N,N1 and V is different from standard model and refer to 7 Option of instruction manual for details.



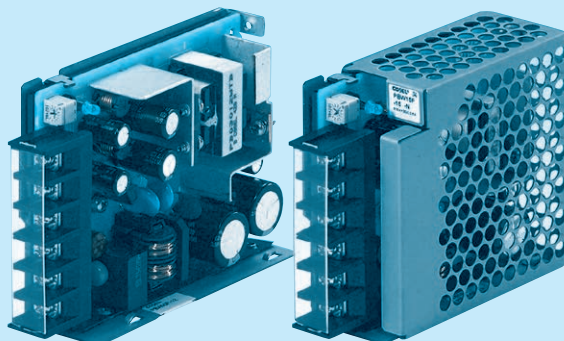
- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 200g max (with cover : 235g max)
- ※ PCB Material/thickness : CEM3 / 1.6mm [0.06]
- ※ Chassis material : Electric galvanizing steel board
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque : 0.6N • m (6.3kgf • cm) max
- ※ Screw tightening torque : M3 0.8N • m (8.5kgf • cm) max
- ※ Please connect safety ground to the unit in 2-M3 holes.

PBW30F

Ordering information

PB W 30 F - -

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
② Dual output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *10
C : with Coating
G : Low leakage current

E : Low leakage current and EMI class A

T : Vertical terminal block
J : Connector type
N : with Cover
NI : with DIN rail
V : Output voltage setting potentiometer externally

Cover is optional

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PBW30F-5	PBW30F-12	PBW30F-15
MAX OUTPUT WATTAGE[W]	15	31.2	30.0
VOLTAGE[V]	±5 (+10)	±12 (+24)	±15 (+30)
DC OUTPUT	CURRENT1[A] 1.5	1.3	1.0
	CURRENT2[A] 2.0	1.7	1.4

SPECIFICATIONS

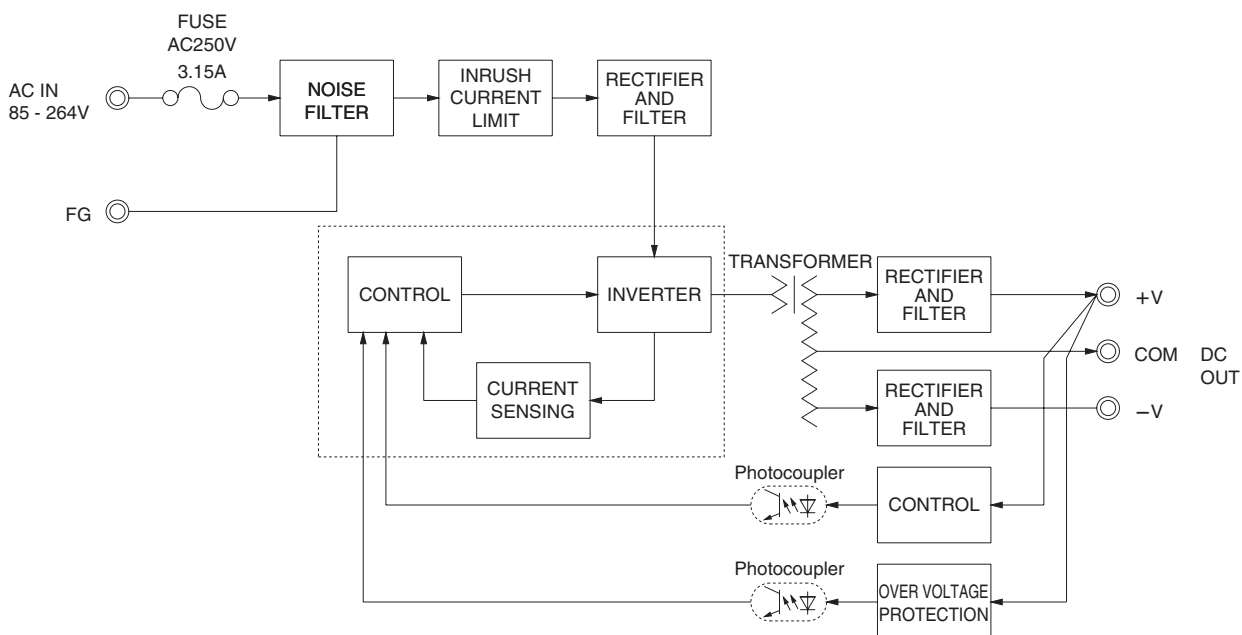
	MODEL	PBW30F-5	PBW30F-12	PBW30F-15	
INPUT	VOLTAGE[V]	AC85 - 264 1 φ or DC110 - 370 (AC50 or DC70 Please refer to the instruction manual 2.1 Input voltage *8)			
	CURRENT[A]	ACIN 100V ACIN 200V	0.4typ (CURRENT1) 0.25typ (CURRENT1)	0.7typ (CURRENT1) 0.4typ (CURRENT1)	
	FREQUENCY[Hz]	50/60 (47 - 440) or DC			
	EFFICIENCY[%]	ACIN 100V ACIN 200V	75typ (CURRENT1) 75typ (CURRENT1)	77typ (CURRENT1) 81typ (CURRENT1)	78typ (CURRENT1) 79typ (CURRENT1)
	INRUSH CURRENT[A]	ACIN 100V ACIN 200V	15typ (CURRENT1) (At cold start) 30typ (CURRENT1) (At cold start)		
	LEAKAGE CURRENT[mA]	0.30/0.65max (ACIN 100V/240V 60Hz, Io=100%, According to IEC60950-1.DENAN)			
	OUTPUT	VOLTAGE[V]	±5 / (+10V reference number)	±12 / (+24V reference number)	±15 / (+30V reference number)
CURRENT1[A]		1.5 / 1.5	1.3 / 1.3	1.0 / 1.0	
CURRENT2[A]		2.0 / -	1.7 / -	1.4 / -	
LINE REGULATION[mV]		20max / 36max	60max / 96max	60max / 96max	
LOAD REGULATION 1[mV]		250max / 100max	600max / 150max	600max / 150max	
LOAD REGULATION 2[mV]		500max / -	750max / -	750max / -	
RIPPLE[mVp-p]		0 to +50℃ *1 -10 - 0℃ *1	80max / 240max 140max / 320max	120max / 240max 160max / 320max	120max / 240max 160max / 320max
RIPPLE NOISE[mVp-p]		0 to +50℃ *1 -10 - 0℃ *1	120max / 300max 160max / 360max	150max / 300max 180max / 360max	150max / 300max 180max / 360max
TEMPERATURE REGULATION[mV]		0 to +50℃ -10 to +50℃	50max 60max	120max 150max	150max 180max
DRIFT[mV]		20max	48max	60max	
START-UP TIME[ms]		200typ(ACIN 100V, Io=100%) *Start-up time is 700ms typ for less than 1minute of applying input again from turning off the input voltage.			
HOLD-UP TIME[ms]		20typ (ACIN 100V, Io=100%)			
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	4.99 - 6.00 (+V and -V are simultaneously adjusted)	9.60 - 13.2 (+V and -V are simultaneously adjusted)	13.2 - 16.5 (+V and -V are simultaneously adjusted)		
OUTPUT VOLTAGE SETTING[V]	4.99 - 5.30 (+V and -V CURRENT1)	11.5 - 12.5 (+V and -V CURRENT1)	14.4 - 15.6 (+V and -V CURRENT1)		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rated current and recovers automatically			
	OVERVOLTAGE PROTECTION[V]	6.90 - 10.0	16.8 - 24.0	20.0 - 29.0	
	OPERATING INDICATION	LED (Green)			
ISOLATION	REMOTE ON/OFF	None			
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)			
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)			
ENVIRONMENT	OUTPUT-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)			
	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +71℃ (Required Derating), 20 - 90%RH (Non condensing) 3,000m (10,000feet) max			
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing) 9,000m (30,000feet) max			
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis			
SAFETY AND NOISE REGULATIONS	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis			
	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN			
	CONDUCTED NOISE	Complies with FCC Part15 classB, VCCI-B, CISPR22-B, EN55011-B, EN55022-B			
OTHERS	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Not built-in to active filter *7) *12			
	CASE SIZE/WEIGHT	31 x 78 x 103mm [1.22 x 3.07 x 4.06 inches] (without terminal block) (W x H x D) / 270g max (with cover : 310g max)			
	COOLING METHOD	Convection			

- *1 Measured by 20MHz oscilloscope or Ripple-Noise meter(equivalent to KEISOKU-GIKEN : RM101).
*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.
*3 Figures for 0 to rated current 1. The current not measured side is fixed.
*4 Figures for 0 to rated current 2. The current not measured

- side is fixed.
*5 The sum of +power -power must be less than output power.
*6 ±5, ±12, ±15 can be used as +10, +24 and +30.
*7 When two or more units are used, they may not comply with the harmonic attenuator. Please contact us for details.
*8 Derating is required.
*9 Figures to rated current 1.

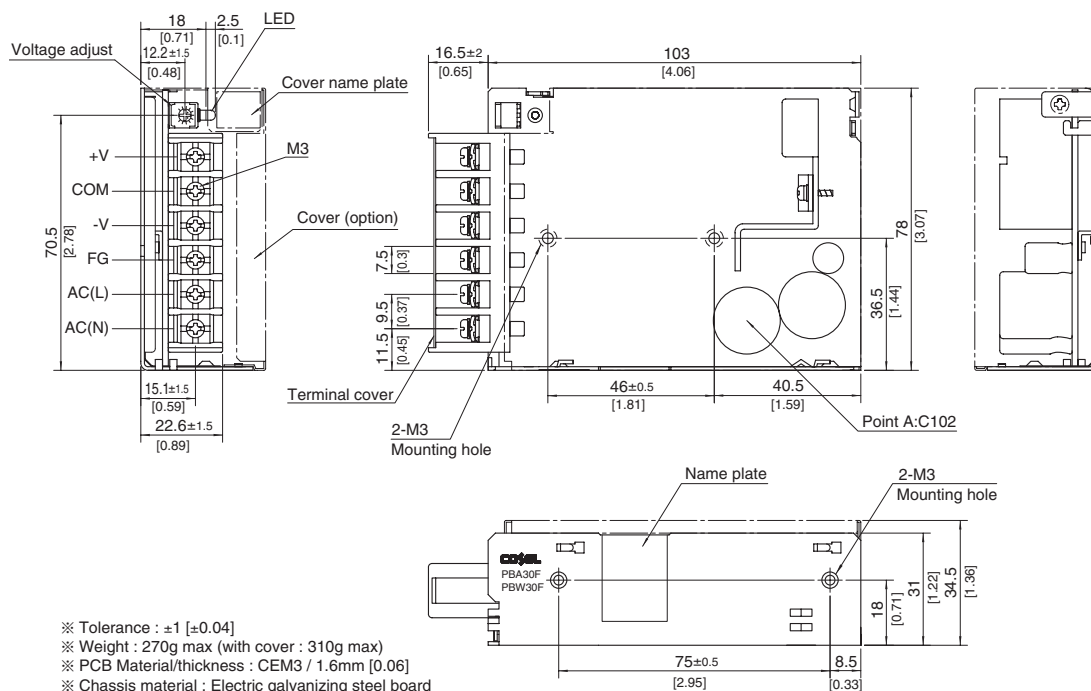
- *10 Please contact us about safety approvals for the model with option.
*11 Please contact us about dynamic load and input response.
*12 Please contact us about class C.
* Parallel operation with other model is not possible.
* Derating is required when operated with cover.
* A sound may occur from power supply at peak loading.

Block diagram



External view

※ External size of option T,J,N,N1 and V is different from standard model and refer to 7 Option of instruction manual for details.



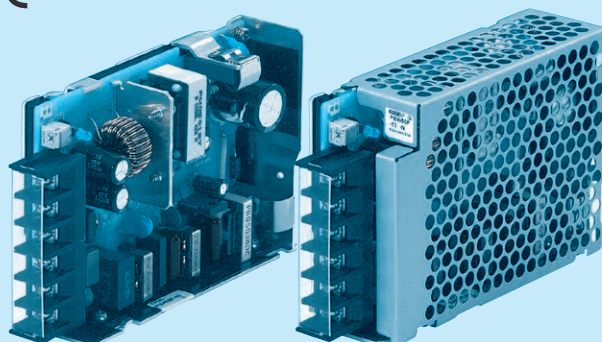
- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 270g max (with cover : 310g max)
- ※ PCB Material/thickness : CEM3 / 1.6mm [0.06]
- ※ Chassis material : Electric galvanizing steel board
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque : $0.6\text{N} \cdot \text{m}$ (6.3kgf \cdot cm) max
- ※ Screw tightening torque : M3 $0.8\text{N} \cdot \text{m}$ (8.5kgf \cdot cm) max
- ※ Please connect safety ground to the unit in 2-M3 holes.

PBW50F

Ordering information

PB W 50 F -□ -□

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

Cover is optional

- ① Series name
② Dual output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *9
C : with Coating
G : Low leakage current (0.15mA max / ACIN 240V)
E : Low leakage current and EMI class A (0.5mA max / ACIN 240V)
T : Vertical terminal block
J : Connector type
R : with Remote ON/OFF
N : with Cover
Nt : with DIN rail
V : Output voltage setting potentiometer external-ly

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PBW50F-5	PBW50F-12	PBW50F-15
MAX OUTPUT WATTAGE[W]	30	50.4	51
VOLTAGE[V]	±5 (+10)	±12 (+24)	±15 (+30)
DC OUTPUT	CURRENT1[A]	2.1	1.7
	CURRENT2[A]	2.7	2.4

SPECIFICATIONS

	MODEL	PBW50F-5	PBW50F-12	PBW50F-15
INPUT	VOLTAGE[V]	AC85 - 264 1φ or DC120 - 370 (AC50 or DC70 Please refer to the instruction manual 2.1 Input voltage *3)		
	CURRENT[A]	ACIN 100V	0.45typ (CURRENT1)	0.70typ (CURRENT1)
		ACIN 200V	0.30typ (CURRENT1)	0.40typ (CURRENT1)
	FREQUENCY[Hz]	50/60 (47 - 63)		
	EFFICIENCY[%]	ACIN 100V	76typ (CURRENT1)	81typ (CURRENT1)
		ACIN 200V	77typ (CURRENT1)	83typ (CURRENT1)
	POWER FACTOR(lo=100%)	ACIN 100V	0.98typ	0.99typ
OUTPUT	INRUSH CURRENT[A]	ACIN 200V	0.87typ	0.93typ
		ACIN 100V	15typ (CURRENT1) (At cold start)	83typ (CURRENT1)
	LEAKAGE CURRENT[mA]	ACIN 200V	30typ (CURRENT1) (At cold start)	83typ (CURRENT1)
		ACIN 100V	0.40/0.75max (ACIN 100V/240V 60Hz, lo=100%, According to IEC60950-1.DENAN)	83typ (CURRENT1)
	VOLTAGE[V]	±5	±12	±15
	CURRENT1[A]	3.0	2.1	1.7
	CURRENT2[A]	4.0	2.7	2.4
PROTECTION CIRCUIT AND OTHERS	LINE REGULATION[mV]	20max	48max	60max
	LOAD REGULATION 1[mV]	250max	600max	600max
	LOAD REGULATION 2[mV]	500max	750max	750max
	RIPPLE[mVp-p]	0 to +50°C	80max	120max
		-10 to 0°C	140max	160max
	RIPPLE NOISE[mVp-p]	0 to +50°C	120max	150max
		-10 to 0°C	160max	180max
	TEMPERATURE REGULATION[mV]	0 to +50°C	50max	120max
		-10 to +50°C	60max	150max
	DRIFT[mV]	20max	48max	60max
ISOLATION	START-UP TIME[ms]	350typ (ACIN 100V, lo=100%)		
	HOLD-UP TIME[ms]	20typ (ACIN 100V, lo=100%)		
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	4.99 - 6.00 (+V and -V are simultaneously adjusted)	9.60 - 13.2 (+V and -V are simultaneously adjusted)	13.2 - 16.5 (+V and -V are simultaneously adjusted)
	OUTPUT VOLTAGE SETTING[V]	4.99 - 5.30 (+V and -V CURRENT1)	11.5 - 12.5 (+V and -V CURRENT1)	14.4 - 15.6 (+V and -V CURRENT1)
	OVERCURRENT PROTECTION	Works over 105% of rated current and recovers automatically		
	OVERVOLTAGE PROTECTION[V]	6.90 - 10.0	16.8 - 24.0	20.0 - 29.0
	OPERATING INDICATION	LED (Green)		
	REMOTE ON/OFF	Optional (Required external power source)		
	INPUT-OUTPUT · RC	AC3.000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)		
	INPUT-FG	AC2.000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)		
ENVIRONMENT	OUTPUT · RC-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)		
	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +71°C (Required Derating), 20 - 90%RH (Non condensing) 3,000m (10,000feet) max		
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing) 9,000m (30,000feet) max		
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis		
	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN		
	CONDUCTED NOISE	Complies with FCC Part15 classB, VCCI-B, CISPR22-B, EN55011-B, EN55022-B		
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 *10		
OTHERS	CASE SIZE/WEIGHT	31 x 82 x 120mm [1.22 x 3.23 x 4.72 inches] (without terminal block) (W x H x D) / 280g max (with cover : 325g max)		
	COOLING METHOD	Convection		

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter (equivalent to KEISOKU-GIKEN : RM101).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

*3 Derating is required.

*4 Figures for 0 to rated current 1. The current not measured side is fixed.

*5 Figures for 0 to rated current 2. The current not measured side is fixed.

*6 The sum of +power -power must be less than output power.

*7 RC is applied to remote ON/OFF option. RC is isolated with input/output and FG.

*8 ±5, ±12, ±15 can be used as +10, +24 and +30.

*9 Please contact us about safety approvals for the model with option.

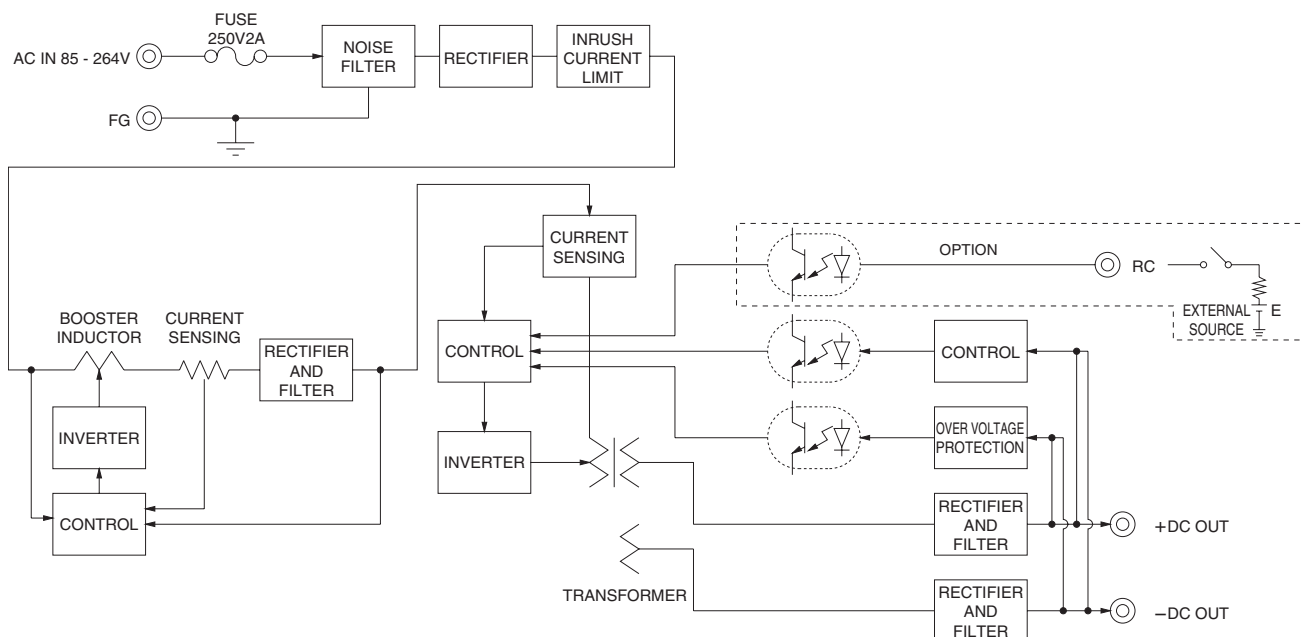
*10 Please contact us about class C.

* Parallel operation with other model is not possible.

* Derating is required when operated with cover.

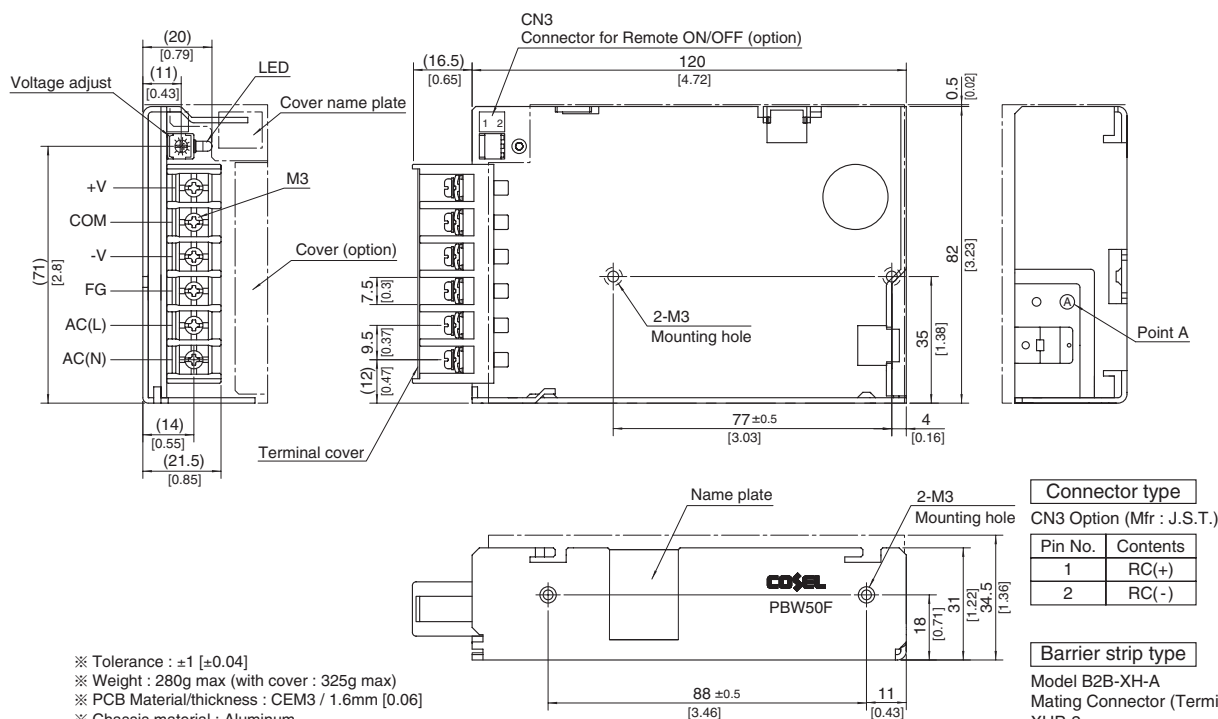
* A sound may occur from power supply at peak loading.

Block diagram



External view

※ External size of option T,J,R,N,N1 and V is different from standard model and refer to 7 Option of instruction manual for details.



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 280g max (with cover : 325g max)
- ※ PCB Material/thickness : CEM3 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque : 0.49N • m (5kgf • cm) max
- ※ Screw tightening torque : M3 0.8N • m (8.5kgf • cm) max
- ※ Please connect safety ground to the unit in 2-M3 holes.

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection circuit	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
PBA10F	Flyback converter	100	0.3	250V 2.5A	LF	CEM-3	Yes		Yes	* 1
PBA15F	Flyback converter	100	0.4		Thermistor	CEM-3	Yes		Yes	* 1
PBA30F	Flyback converter	100	0.7	250V 3.15A	Thermistor	CEM-3	Yes		Yes	* 1
PBA50F	Active filter	60 - 550	0.7	250V 2A	Thermistor	CEM-3	Yes		Yes	* 1
	Forward converter	130								
PBA75F	Active filter	60 - 550	1.0	250V 3.15A	Thermistor	CEM-3	Yes		Yes	* 1
	Forward converter	120								
PBA100F	Active filter	60 - 550	1.3		Thermistor	CEM-3	Yes		Yes	* 1
	Forward converter	120								
PBA150F	Active filter	60 - 550	2.0	250V 4A	Thermistor	CEM-3	Yes		Yes	* 1
	Forward converter	120								
PBA300F	Active filter	230	4.1	250V 10A	SCR	FR-4		Yes	Yes	Yes
	Forward converter	330								
PBA600F	Active filter	130	8.2	250V 15A	SCR	FR-4		Yes	Yes	Yes
	Forward converter	330								
PBA1000F	Active filter	130	13	250V 30A	SCR	FR-4		Yes	Yes	Yes
	Forward converter	280								
PBA1500F	Active filter	130	19		SCR	FR-4		Yes	Yes	Yes
	Forward converter	200								
PBA1500T	Active filter	130	6	250V 16A	SCR	FR-4		Yes	Yes	Yes
	Forward converter	200								
PBW15F	Flyback converter	100	0.4	250V 2.5A	Thermistor	CEM-3	Yes		Yes	* 1
PBW30F	Flyback converter	100	0.7	250V 3.15A	Thermistor	CEM-3	Yes		Yes	* 1
PBW50F	Active filter	60 - 550	0.7	250V 2A	Thermistor	CEM-3	Yes		Yes	* 1
	Forward converter	130								

*1 Refer to Series/Parallel Operation of Instruction Manual.

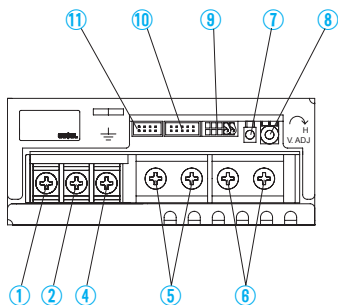
* The value of input current is at ACIN 100V and rated load, ACIN 200V 3 ϕ and rated load in PBA1500T.

1	Terminal Blocks	PBA/PBW-34
2	Functions	PBA/PBW-35
2.1	Input Voltage Range	PBA/PBW-35
2.2	Inrush Current Limiting	PBA/PBW-35
2.3	Overcurrent Protection	PBA/PBW-36
2.4	Overvoltage Protection	PBA/PBW-36
2.5	Thermal Protection	PBA/PBW-36
2.6	Output Voltage Adjustment	PBA/PBW-36
2.7	Remote ON/OFF	PBA/PBW-37
2.8	Remote Sensing	PBA/PBW-37
2.9	Alarms	PBA/PBW-38
3	Peak Current	PBA/PBW-39
4	Series/Parallel Operation	PBA/PBW-39
4.1	Series Operation	PBA/PBW-39
4.2	Parallel Operation/Master-slave Operation	PBA/PBW-39
4.3	N+1 Parallel Redundancy Operation	PBA/PBW-40
5	Assembling and Installation	PBA/PBW-40
5.1	Installation	PBA/PBW-40
5.2	Derating	PBA/PBW-41
5.3	Expected Life and Warranty	PBA/PBW-42
6	Others	PBA/PBW-42
6.1	Output Current Monitor	PBA/PBW-42
6.2	External Capacity	PBA/PBW-43
6.3	Isolation	PBA/PBW-43
6.4	Auxiliary Power	PBA/PBW-43
6.5	External Component (EMI/EMC Filter)	PBA/PBW-43
7	Options	PBA/PBW-43
7.1	Outline of Options	PBA/PBW-43

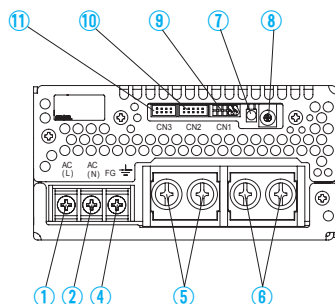
1 Terminal Blocks

*The following information covers PBA300F - 1500F. Please see External View for PBA10F - 150F and PBW15F - 50F.

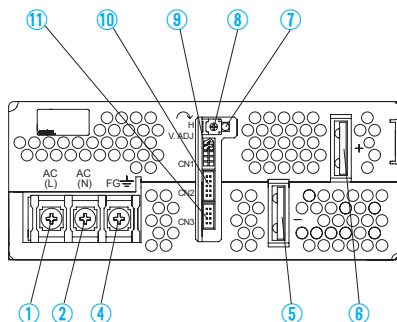
● PBA300F



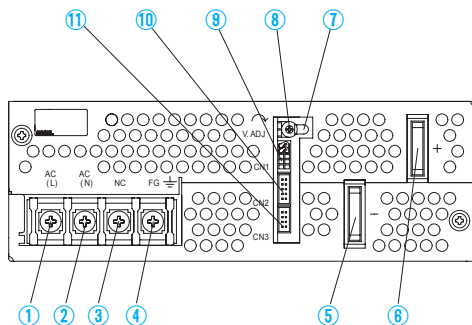
● PBA600F



● PBA1000F



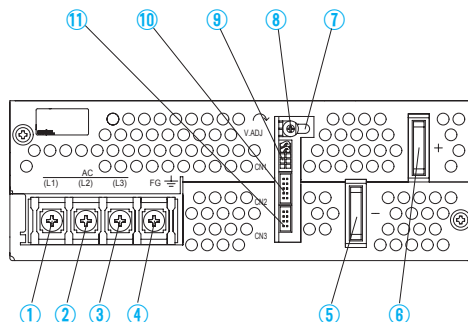
● PBA1500F



- ① AC (L) } Input Terminals AC85 - 264V ϕ 47 - 63Hz
- ② AC (N) } (M4)
- ③ NC
- ④ Frame ground (M4 \perp)
- ⑤ -Output
- ⑥ +Output
- ⑦ LED
- ⑧ Output voltage adjustable potentiometer
- ⑨ CN1 } Connectors
- ⑩ CN2 }
- ⑪ CN3 }

* Please see Optional Parts for dedicated harnesses.

● PBA1500T



- ① AC (L1)
- ② AC (L2)
- ③ AC (L3)
- ④ Frame ground (M4 \perp)
- ⑤ -Output
- ⑥ +Output
- ⑦ LED
- ⑧ Output voltage adjustable potentiometer
- ⑨ CN1 } Connectors
- ⑩ CN2 }
- ⑪ CN3 }

Pin Configuration and Functions of CN1

Pin No.	Function
1	+M : Self sensing terminal. (Do not wire for external connection.)
2	+S : +Sensing
3	-M : Self sensing terminal. (Do not wire for external connection.)
4	-S : -Sensing
5	VB : Voltage balance
6	CB : Current balance
7	TRM : Adjustment of output voltage
8	-S : -Sensing
9	RC2 : Remote ON/OFF
10	RCG : Remote ON/OFF (GND)

Pin Configuration and Functions of CN2

Pin No.	Function
1	+M : Self sensing terminal. (Do not wire for external connection.)
2	+S : +Sensing
3	-M : Self sensing terminal. (Do not wire for external connection.)
4	-S : -Sensing
5	VB : Voltage balance
6	CB : Current balance
7	TRM : Adjustment of output voltage
8	-S : -Sensing
9	RC2 : Remote ON/OFF
10	RCG : Remote ON/OFF (GND)

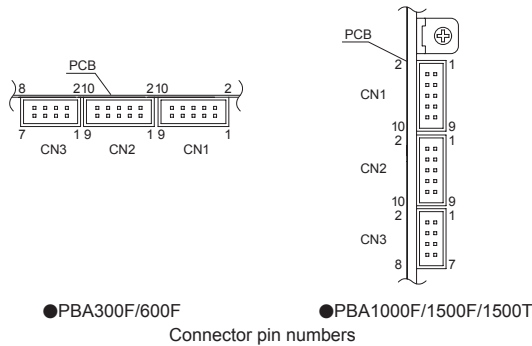
Pin Configuration and Functions of CN3

Pin No.	Function
1	-S : -Sensing
2	-S : -Sensing
3	AUX : Auxiliary output (12V 0.1A)
4	RC1 : Remote ON/OFF
5	AUXG : Auxiliary output (GND)
6	N.C. : No connection
7	PG : Alarm
8	PGG : Alarm (GND)

* Common signs among CN1, CN2 and CN3 such as -S represent the same potential.

Matching connectors and terminals on CN1, CN2 and CN3

Connector	Housing	Terminal	Mfr.
CN1	S10B-PHDSS	PHDR-10VS	J.S.T.
CN2	S8B-PHDSS	Reel : SPHD-002T-P0.5	
CN3		Loose : BPHD-001T-P0.5	



2 Functions

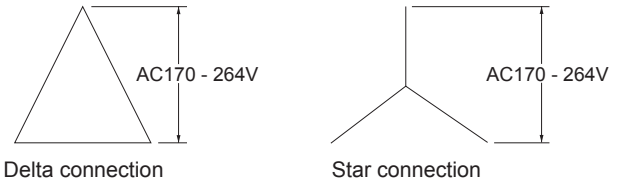
2.1 Input Voltage Range

- **PBA10F, PBA15F, PBW15F, PBA30F, PBW30F, PBA50F, PBW50F, PBA75F, PBA100F, PBA150F, PBA300F, PBA600F, PBA1000F and PBA1500F**

- Input voltage range of the power supplies is from AC85V to AC264V or DC (please see SPECIFICATIONS for details).
- In cases that conform with safety standard, input voltage range is AC100-AC240V (50/60Hz).
- If input value doesn't fall within above range, a unit may not operate in accordance with specifications and/or start hunting or fail. If you need to apply a square waveform input voltage, which is commonly used in UPS and inverters, please contact us.
- When the input voltage changes suddenly, the output voltage accuracy might exceed the specification. Please contact us.

● PBA1500T

- The input voltage range is AC170-264V (three-phase).
- In cases that conform with safety standard, input voltage range is AC200-AC240V (50/60Hz).
- The input phase line shall not be specified, it can be connected to any input terminal.
- In the case of three-phase four-wire system, connect the three wires to input terminal (L1, L2, L3), except ground wire.



- If the wrong input or single phase input is applied, the unit will not operate properly and/or may be damaged. If you need to apply a square waveform input voltage, which is commonly used in UPS and inverters, please contact us.

● **PBA10F, PBA15F, PBW15F, PBA30F and PBW30F**

- A power factor improvement circuit (active filter) is not built-in. If you use multiple units for a single system, standards for input harmonic current may not be satisfied. Please contact us for details.

● **PBA10F, PBA15F, PBW15F, PBA30F, PBW30F, PBA50F, PBW50F, PBA75F, PBA100F and PBA150F**

- Operation stop voltage is set at a lower value than that of a standard version (derating is needed).

· Use Conditions

		Output () 3.3V, ±5V	
PBA10F	5W	PBA50F	15W (10W)
PBA15F	7.5W (5W)	PBW50F	15W (10W)
PBW15F	7.5W	PBA75F	35W (20W)
PBA30F	10W (7.5W)	PBA100F	50W (30W)
PBW30F	10W (7.5W)	PBA150F	65W (40W)
		Input AC50V (DC70V)	
		Duty 1s/30s	

- * Please avoid using continuously for more than 1 second under above conditions. Doing so may cause a failure.
- * PBA10F, PBA15F, PBA30F and PBW30F become only AC200V. If you use the unit at AC100V, please contact us.

● **PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T**

- You can use a unit with an input voltage lower than AC85V and DC120V (PBA1500T is AC170V 3φ) by option (please see 7. Options). If you do so, load derating is necessary. Please contact us for details.

2.2 Inrush Current Limiting

- An inrush current limiting circuit is built-in.
- If you need to use a switch on the input side, please select one that can withstand an input inrush current.

● PBA10F

- Resistance for load factor is used for inrush current limiting.

● **PBA15F, PBW15F, PBA30F, PBW30F, PBA50F, PBW50F, PBA75F, PBA100F and PBA150F**

- Thermistor is used in the inrush current limiting circuit. When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that a power supply cools down before being turned on.

● PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T

- Thyristor technique is used in the inrush current limiting circuit. When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that the inrush current limiting circuit becomes operative.
- When the switch of the input is turned on, the primary inrush current and secondary inrush current will be generated because the thyristor technique is used for the inrush current limiting circuit.

2.3 Overcurrent Protection

- An overcurrent protection circuit is built-in and activated at 105% of the rated current or 101% of the peak current. A unit automatically recovers when a fault condition is removed. Please do not use a unit in short circuit and/or under an overcurrent condition.
- Intermittent Operation Mode
When the overcurrent protection circuit is activated and the output voltage drops to a certain extent, the output becomes intermittent so that the average current will also decrease.

● PBA1000F, PBA1500F and PBA1500T

- Output Voltage Shutdown
If the overcurrent protection circuit operates continuously for 5 seconds, the output voltage will shut down. To recover the output voltage, remove a condition that is causing an overcurrent, shut down the input voltage, wait more than 3 minutes and turn on the AC input again.

2.4 Overvoltage Protection

- An overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait more than 3 minutes and turn on the AC input again to recover the output voltage. Recovery time varies depending on such factors as input voltage value at the time of the operation.

● PBA600F, PBA1000F, PBA1500F and PBA1500T

- In addition to a standard overvoltage protection circuit, an overvoltage protection circuit to follow to output voltage is built-in. If an output voltage exceeds a pre-set value, the overvoltage protection circuit to follow to output voltage is activated and shut down the output voltage.
*The Overvoltage protection circuit to follow to output voltage is optional for PBA300F.

Note :

- Please avoid applying a voltage exceeding the rated voltage to an output terminal. Doing so may cause a power supply to malfunction or fail. If you cannot avoid doing so, for example, if you need to operate a motor, etc., please install an external diode on the output terminal to protect the unit.
- In PBA600F, 1000F, PBA1500F and PBA1500T series, the overvoltage protection circuit is a tracking method in which the detec-

tion point is set depending on output voltage setting. However, even if a sensing line makes open or external voltage is applied to output terminal in order to activate the function at receiving inspection, the tracking function does not work, so the function is activated with higher value in a catalog.

Therefore, do not perform the function test to avoid the any trouble.

- The follow type overvoltage circuit doesn't operate when the remote sensing comes off. In this case, a standard overvoltage protection circuit operates. When the overvoltage protection circuit operates due to the breakdown of the power supply, it is similar. Standard overvoltage protection circuit is please contact us for details.

2.5 Thermal Protection

● PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T

- A thermal protection circuit is built-in.
The thermal protection circuit may be activated under following conditions and shut down the output.
① When a current and a temperature continue to exceed the values determined by the derating curve.
② When a fan stops or air flow is blocked from the fan and weakens.
If the thermal protection circuit is activated, shut off the input voltage and eliminate all the overheating conditions. To recover the output voltage, have enough time to cool down the unit before turning on the input voltage again.

2.6 Output Voltage Adjustment

- To increase an output voltage, turn a built-in potentiometer clockwise. To decrease the output voltage, turn it counterclockwise.

● PBA10F, PBA15F, PBW15F, PBA30F, PBW30F, PBA50F, PBW50F, PBA75F, PBA100F and PBA150F

- We are offering an Option -V, which doesn't have a built-in potentiometer but instead enables you to adjust the output voltage by using an external potentiometer (please see 7 Options).

● PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T

- The power supplies have an external output voltage control function. The output voltage can be adjusted within a 110% range from almost 0V by changing the voltage between the terminal TRM and the terminal -S on CN1. You can decrease the voltage by drawing a current from the TRM terminal.

You can calculate the output voltage in this case from formula ① below.

Please note that the formula ① gives you only an estimate. Please contact us if you need accurate numbers.

$$\text{Output voltage} = \frac{\text{The voltage between TRM and -S}}{2.5 [\text{V}]} \times \text{rated output voltage} \cdots \textcircled{1}$$

Please do not apply an external voltage of -0.7V or less or 3.0V or more.

There is more than one method to adjust the output voltage, including the methods to use external resistors and external power supplies. Since each method has different characteristic, please contact us for details.

■ If the terminal TRM opens while the external output voltage control function is in use, a unit generates the rated voltage.

If the terminal VB and the terminal -S are connected and the terminal TRM opens as shown in Fig.2.1, the unit stops generating the output voltage.

■ You can change the control voltage of TRM from 0 - 2.75V to 0 - 5.5V by serially connecting 1.73Ω to the TRM terminal as shown in Fig.2.2.

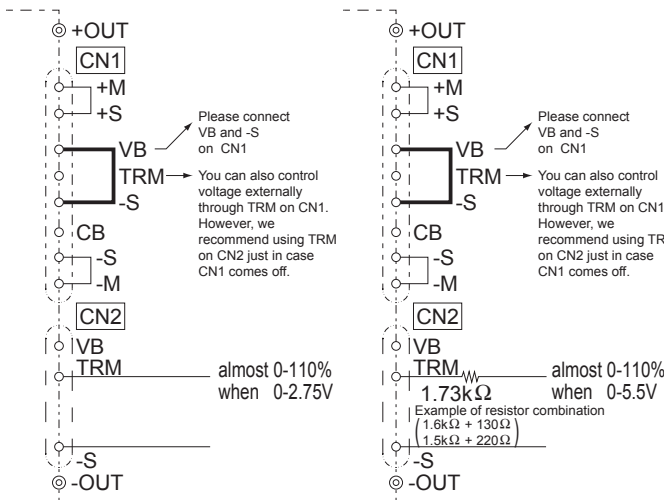


Fig.2.1 Wiring 1

Fig.2.2 Wiring 2

(When TRM control voltage is 0 - 2.75V) (When TRM control voltage is 0 - 5.5V)

■ If the output voltage decreases to almost 0V, a fan may stop, output ripple may become large and PG signals may turn to "High."

■ Please do not change TRM voltage rapidly.

2.7 Remote ON/OFF

● PBA10F, PBA15F, PBW15F, PBA30F and PBW30F

■ These models do not have a remote ON/OFF function.

● PBA50F, PBW50F, PBA75F, PBA100F and PBA150F

■ Option -R is available to provide a remote ON/OFF function. Please see "7. Options" for details.

● PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T

■ These models have a remote ON/OFF function.

You can operate the remote ON/OFF function by sending signals to CN1. Please see Table 2.1 for specifications and Fig.2.3 for connecting examples.

■ Remote ON/OFF circuits (RC2 and RCG) are isolated from input,

output, FG and AUX.

■ Please note the followings when using the remote ON/OFF function.

① The output stops when a current flows to RC.

② The current flow to RC is a 5mA type (maximum 12mA).

③ If the output voltage is turned off through the remote ON/OFF circuit, the built-in fan stops.

In the case of PBA300F, the fan slows down when the output voltage is turned off through the remote ON/OFF circuit.

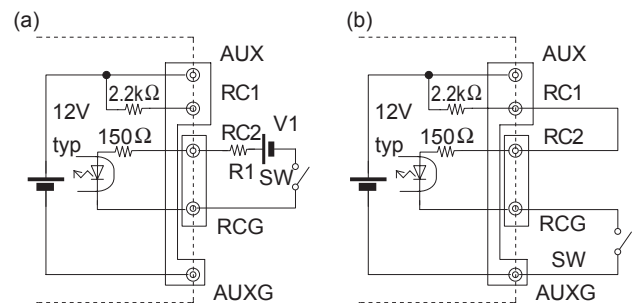
④ If the output voltage is turned off through the remote ON/OFF circuit, PG signals turn to "High."

⑤ Description in this section is based on the assumption that you will use one unit alone. If you are planning to use the units in parallel operation or use multiple units for a single system, please check necessary voltage and current values.

⑥ If voltage or current of a value not listed in Table 2.1 is applied between RC2 and RCG, the output voltage may not be generated normally.

Table 2.1 Specifications of remote ON/OFF

Connection method	Fig.2.3 (a)	Fig.2.3 (b)	Fig.2.3 (c)
SW Logic	Output on	SW open (0.1mA max)	SW close (0.5V max)
	Output off	SW close (3mA min)	SW open (0.1mA max)
pin	RCG	AUXG	RCG, AUXG
Optional harness	·H-SN-20 (or H-SN-21)	·H-SN-20 (or H-SN-21)	·H-SN-20 (or H-SN-21)
		·H-SN-22 Both needed	·H-SN-24 Both needed



(Example V1:5V R1:620Ω)

Fig.2.3 Examples of connecting remote ON/OFF circuit

2.8 Remote Sensing

● PBA10F, PBA15F, PBW15F, PBA30F, PBW30F, PBA50F, PBW50F and PBA75F

■ These models do not have a remote sensing function.

● PBA100F and PBA150F

■ Option -K is available (for -3R3 and -5) to support a remote sensing function. Please see "7. Options" for details.

● PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T

■ These models have a built-in remote sensing function.

If you do not use the remote sensing function, you can short out between +S and +M and between -S and -M on CN1.

When the power supplies are shipped from a factory, they come with a dedicated harness (H-SN-19) being mounted on CN1. If you do not use the remote sensing function, you can use the power supplies as they are.

■ Please see Fig.2.4 if you do not use the remote sensing function.

Please see Fig.2.5 if you use the remote sensing function.

■ When you use the remote sensing function, please wire from +S and -S on CN1. Harnesses are available for your purchase. Please contact us for details.

When you use the remote sensing, please note the followings.

① Wire carefully. When a connection of a load line becomes loose (due to such factors as loose screw), the load current flows to the sensing line and internal circuits of the power supply may be damaged.

② Use a sufficiently thick wire to connect between the power supply and the load and keep the line drop at 0.3V or below.

③ If the sensing line is long, connect C1 and R1.

④ Use a twisted pair wire or a shielded wire as the sensing line.

⑤ Do not draw the output current from +M, -M, +S or -S.

⑥ When the remote sensing function is used, the output voltage of the power supply may show an oscillating waveform or the output voltage may dramatically fluctuate because of an impedance of wiring and load conditions.

Please check and evaluate carefully before using the remote sensing function.

If the output voltage becomes unstable, we suggest you to try the followings.

- Remove the remote sensing line on the minus side and short out between -S and -M.
- Connect C1, R1 and R2.

Please contact us for details.

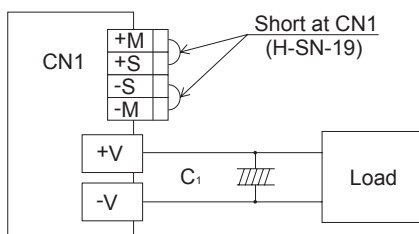


Fig.2.4 When not using remote sensing function

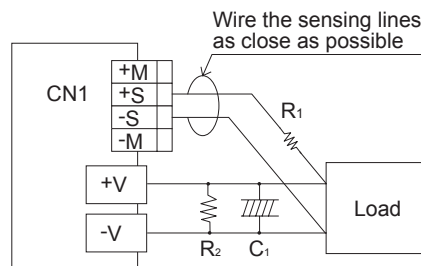


Fig.2.5 When using remote sensing function

2.9 Alarms

● PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T

■ Alarms (PG signal) are generated from CN3. Please see Table 2.2 for the functions of the alarms. The objective of the PG signals is to detect whether or not a certain function of a power supply is working. It takes several seconds to generate the alarm signals and the timing when the alarm signals are generated is inconsistent. Please check if the objective of the alarm is achieved.

Table 2.2 Description of the alarms (PG signal)

Alarm		Output of Alarm
PG	The PG signals are "Low" when the power supply operates normally.	Open collector method Good: Low (0.5V max at 10mA)
	The signals turn "High" when the fan stops or the power supply stops as a result of output voltage decrease/stop, activation of thermal protection, overvoltage protection or overcurrent protection functions. One of three phase is open (PBA1500T)	Bad : High or Open 50V 10mA max

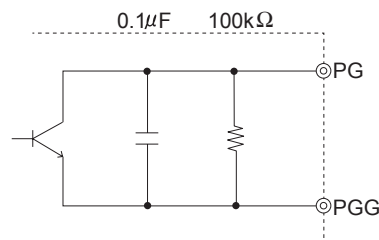


Fig.2.6 Internal circuit of PG

■ Please note the followings when you use the alarms (PG signal).

① The time it takes until the PG signals turn "High" vary depending on models and conditions.

PBA300F and PBA600F less than 1 second

PBA1000F, PBA1500F and PBA1500T less than 10 second

② If the output voltage is turned off through a remote ON/OFF circuit, the PG signals turn "High".

③ The PG signal may turn "High", if the output current of one unit becomes 10% or below of the rated current in parallel operation (in this case, the fan also stops).

④ If the output voltage is decreased to almost 0V or decreased rapidly through an external adjustment mechanism when load is light, The PG signal may turn "High".

■ The PG signal (Alarm) circuit is isolated from input, output, FG, RC and AUX.

3 Peak Current

● PBA300F-24, PBA600F-24, PBA1000F-24, PBA1500F-24/36 and PBA1500T-24

■ The units can generate the peak current under the following conditions.

- AC170 - 264V
- $t1 \leq 10$ [sec]
- $I_p \leq \text{Rated peak current}$
- $I_{ave} \leq \text{Rated current}$
- $\text{Duty} = \frac{t1}{t1+t2} \times 100 [\%] \leq 35\%$

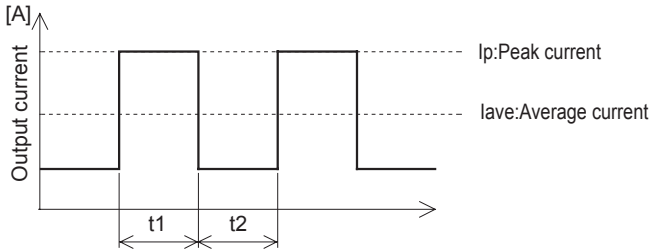


Fig.3.1 Peak current

4 Series/Parallel Operation

4.1 Series Operation

■ You can use a power supply in series operation. The output current in series operation should be lower than the rated current of a power supply with the lowest rated current among power supplies that are serially connected. Please make sure that no current exceeding the rated current flows into a power supply.

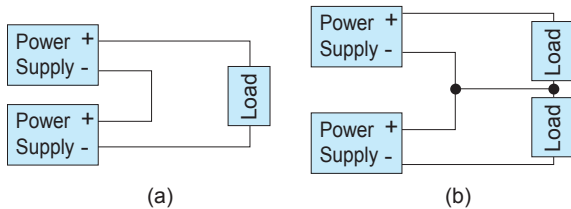


Fig.4.1 Examples of connecting in series operation

4.2 Parallel Operation/Master-slave Operation

● PBA10F, PBA15F, PBW15F, PBA30F, PBW30F, PBA50F, PBW50F, PBA75F, PBA100F and PBA150F

■ Parallel operation is not possible.

■ Redundancy operation is available by wiring as shown below.

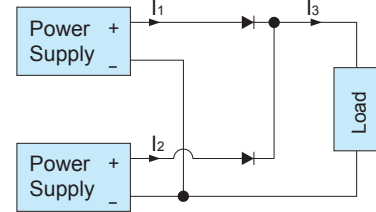


Fig.4.2 Example of connecting in redundancy operation

■ Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .

Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{rated current value}$$

● PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T

■ You can use the power supplies in parallel operation by connecting units as shown in Fig.4.3.

Please parallelly connect $\pm S$, VB and CB of each power supply in parallel operation and connect $\pm S$ and $\pm M$ on CN1 of the master power supply.

When the power supplies are shipped from a factory, they come with a dedicated harness (H-SN-19) being mounted on CN1.

Please remove the dedicated harness (H-SN-19), which is mounted on CN1 of the slave power supply, and use an optional harness, H-PA-3, to connect $\pm S$, VB and CB parallelly.

Differences in the output current values among the power supplies in parallel connection are 10% at most. Please make sure that the sum of the output current values does not exceed a value obtained from the right side of the following equation.

$$\begin{aligned} & \text{(Output current in parallel operation)} \\ & = (\text{Rated current per unit}) \times (\text{Number of units}) \times 0.9 \end{aligned}$$

■ When the number of units in parallel operation increases, the input current also increases. Please design input circuitry (including circuit pattern, wiring and current capacity for equipment) carefully.

■ Please make sure that the wiring impedance of a load from each power supply becomes even. Otherwise, the output current balance circuit may become inoperative.

■ The maximum number of units you can use in parallel operation is 5.

■ You can adjust the output voltage in parallel operation by adjusting a potentiometer of just one power supply.

To do so, select one power supply as the master unit and turn the potentiometers of the other (slave) power supplies clockwise to the end.

Once you have done this, you can adjust the output voltage by turning the potentiometer of the master unit.

■ If you use the remote sensing function in parallel operation, connect parallelly +S and -S of slave power supplies must be connected to master and connect the sensing wire from the master unit to the load.

■ You cannot parallelly operate power supplies with different output voltage or electrical power.

■ If an output stops (through the remote ON/OFF circuit or due to an input shutoff or failure) in parallel operation, the LED of the stopped unit lights off.

■ When the output current of one unit becomes 10% or less of the rated current, the PG signals may turn "High" and the fan may stop.

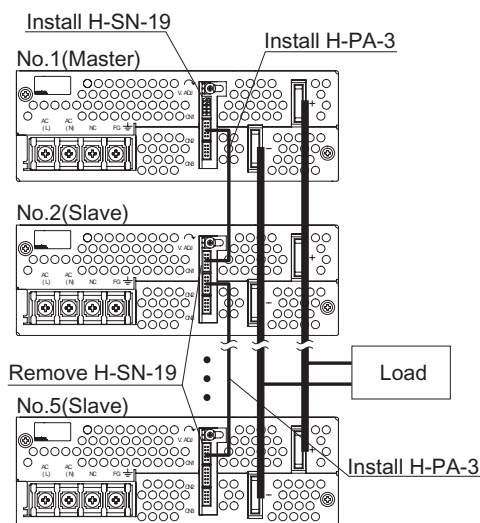


Fig.4.3 Example of parallel connection
(PBA1500F)

4.3 N+1 Parallel Redundancy Operation

● PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T

■ You can have N+1 redundancy operation for improved system reliability.

■ If you add one extra power supply in parallel operation, even if one of the power supplies in your system fails, the remaining non-failed power supplies continue to sustain the system. If one of the power supplies stops operating, the output voltage may change about 5%.

■ When unit replacement is required due to unit failure, input voltage for all units must be cut off.

■ After replacement, please make sure that all wirings are completed correctly, before re-applying input voltage.

■ Hot-swap or Hot-plug is not available.

■ If 2 or more units failed, sufficient power could not be provided to the system. Therefore, please replace the failed unit immediately in case where unit failure is found.

■ If you have any questions about series, parallel and N+1 redundancy operations, please contact us.

5 Assembling and Installation

5.1 Installation

■ Do not insert a screw more than 6mm from the outside of a power supply to keep enough insulation distance between the screw and internal components.

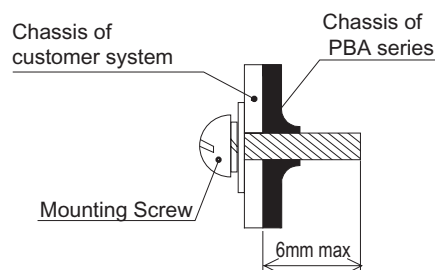


Fig.5.1 Mounting screw

● PBA10F, PBA15F, PBW15F, PBA30F, PBW30F, PBA50F, PBW50F, PBA75F, PBA100F and PBA150F

■ If you use two or more power supplies side by side, please keep a sufficient distance between them to allow enough air ventilation. Ambient temperature around each power supply should not exceed the temperature range shown in the derating curve.

● PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T

■ The power supplies have a built-in forced cooling fan. Do not block ventilation at the suction side (terminal block side) and its opposite side (fan installation side).

If you need to secure a power supply by screws, securely fix it, taking into consideration of its weight. You can install it in any direction.

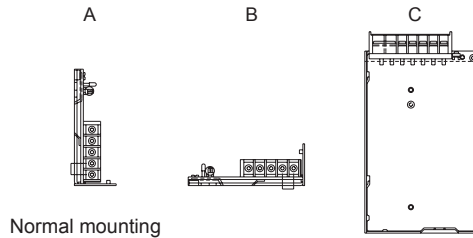
■ If you use a power supply in a dusty environment, it can give a cause for a failure. Please consider taking such countermeasures as installing an air filter near the suction area of the system to prevent a failure.

■ In PBA300F, PBA1500F and PBA1500T, ventilation holes are located on the mounting side. If you would like to install the unit by using that side, please contact us for details.

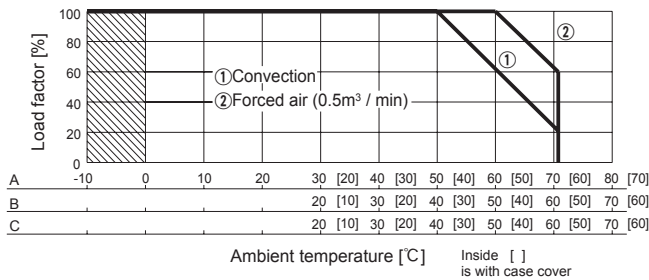
5.2 Derating

- PBA10F, PBA15F, PBW15F, PBA30F, PBW30F, PBA50F, PBW50F, PBA75F, PBA100F and PBA150F

■ Mounting Method



■ Derating Curve



*Specifications for ripple and ripple noise changes in the shaded area.

- PBA10F, PBA15F, PBW15F, PBA30F and PBW30F

■ Input Voltage Derating Curve

Input voltage derating curve is shown in Fig.5.2.

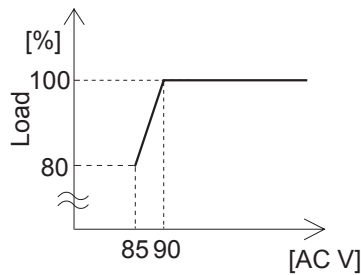


Fig.5.2 Input voltage derating curve

■ Standard for Cooling

- PBA10F, PBA15F, PBW15F, PBA30F, PBW30F, PBA50F, PBW50F, PBA75F, PBA100F and PBA150F

■ Please make sure that the temperature of Point A (see External View) falls under a temperature specified in Table 5.1.

■ The temperatures shown in Table 5.1 for PBA10F, PBA15F, PBW15F, PBA30F and PBW30F are those for their capacitors.

■ Point A is engraved on the chassis of PBA50F, PBW50F, PBA75F, PBA100F and PBA150F.

Table 5.1 Temperatures of Point A

Model Name	Point A	
	Ambient Temperature: 50°C	Ambient Temperature: 71°C
PBA10F	58°C or less	74°C or less
PBA15F and PBW15F	64°C or less	73°C or less
PBA30F and PBW30F	73°C or less	82°C or less
PBA50F and PBW50F	72°C or less	82°C or less
PBA75F	83°C or less	84°C or less
PBA100F	87°C or less	83°C or less
PBA150F	89°C or less	85°C or less

- PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T

■ Ambient Temperature Derating Curve

Derating curve depending on an ambient temperature (temperature of air sucked in for a cooling purpose) is shown in Fig.5.3.

*Specifications for ripple and ripple noise changes in the shaded area.

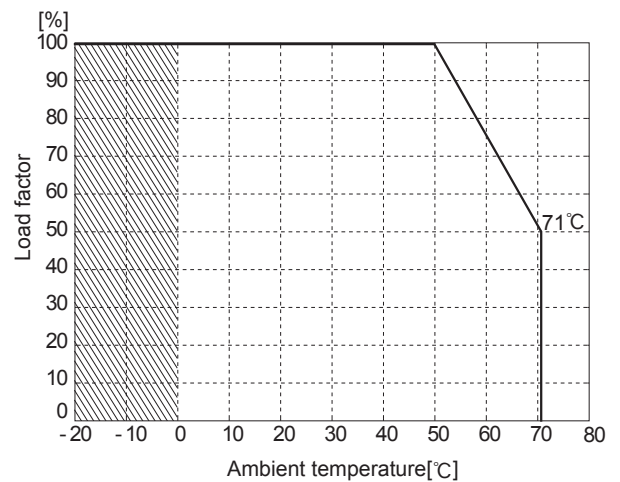


Fig.5.3 Ambient temperature derating curve

- PBA1500F

■ Input Voltage Derating Curve

Input voltage derating curve is shown in Fig.5.4.

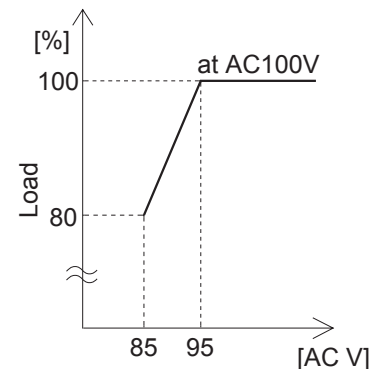


Fig.5.4 Input voltage derating curve

5.3 Expected Life and Warranty

■ Expected Life

Please see the following tables for expected life.

- PBA10F, PBA15F, PBW15F, PBA30F, PBW30F, PBA50F, PBW50F, PBA75F, PBA100F and PBA150F

Mounting Method	Annual Average of Ambient Temperatures	Load Factor	
		50%	100%
A	Ta = 30°C or less	10 years or more	10 years or more
	Ta = 40°C	10 years or more	6 years
	Ta = 50°C	5 years	3 years
B and C	Ta = 20°C or less	10 years or more	10 years or more
	Ta = 30°C	10 years or more	6 years
	Ta = 40°C	5 years	3 years

- PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T

	Annual Average of Ambient Temperatures	Load Factor	
		50%	100%
All Mounting Methods	Ta = 40°C or less	7 years*	7 years*
	Ta = 50°C	6 years*	5 years

*Values with * are based on the assumption that fan maintenance will be properly done.

- PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T

■ Fans should be exchanged on a regular basis because their life expectancy (R (t) = 90%) vary depending on use conditions as shown in Fig.5.5. Please see "Optional Parts" for details about fan units.

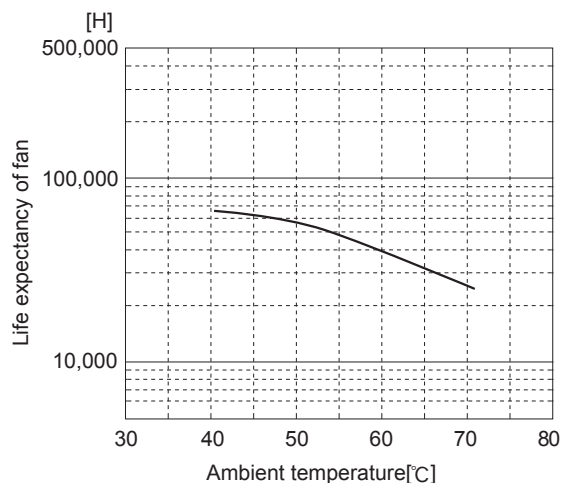


Fig.5.5 Life expectancy of fan

■ Warranty

- PBA10F, PBA15F, PBW15F, PBA30F, PBW30F, PBA50F, PBW50F, PBA75F, PBA100F and PBA150F

Mounting Method	Annual Average of Ambient Temperatures	Load Factor	
		50%	100%
A	Ta = 40°C or less	5 years	5 years
	Ta = 50°C	5 years	3 years
B and C	Ta = 30°C or less	5 years	5 years
	Ta = 40°C	5 years	3 years

- PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T

■ The warranty period is 5 years if a power supply is used within a derating curve.

6 Others

6.1 Output Current Monitor

- PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T

■ You can monitor an output current by measuring a voltage between the terminal CB and the terminal -S on either CN1 or CN2.

■ Fig.6.1 shows the relationship between the voltage of the terminal CB and the output current.

Fig.6.1 shows a typical characteristic of PBA1500F-5. Please contact us for the characteristics of the other models.

The output current shown in Fig.6.1 should be used only as a guide.

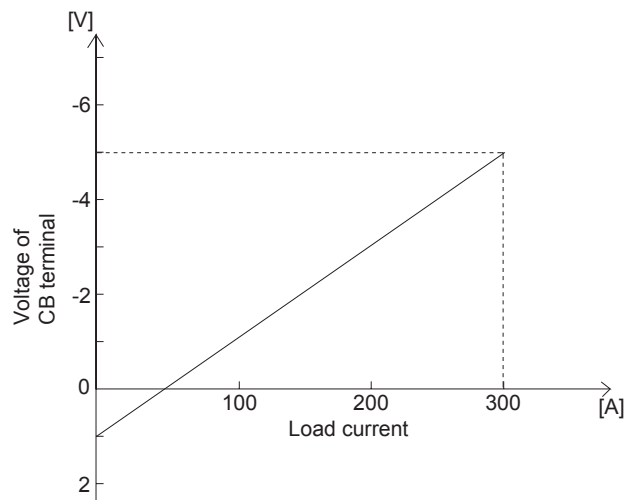


Fig.6.1 Load current conversion graph(PBA1500F-5)

■ Please note the followings when measuring the voltage of the terminal CB.

- Wire carefully to avoid malfunction caused by noise.
- Use a measuring instrument whose input impedance is 500kΩ or more.
- Do not short-circuit between CB terminal and -S terminal. Doing so could cause a failure.

6.2 External Capacity

● PBA10F, PBA15F, PBW15F, PBA30F and PBW30F

■ When a capacitor with large capacity is connected to the load side, a power supply may stop or start hunting. Please contact us for details.

6.3 Isolation

■ When you run a Hi-Pot test as receiving inspection, gradually increase the voltage to start. When you shut down, decrease the voltage gradually by using a dial. Please avoid a Hi-Pot tester with a timer because, when the timer is turned ON or OFF, it may generate a voltage a few times higher than the applied voltage.

■ When you test a unit for isolation between the input and output or between the output and the terminal FG, short-circuit between the output and the terminals RCG, PGG and AUXG.

6.4 Auxiliary Power (AUX)

● PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T

■ The power supplies can generate an auxiliary power (AUX: 12V 0.1A) from CN3 to provide for remote ON/OFF and attached circuits.

■ AUX circuit is isolated from other (input, output, FG, RC and PG) circuits.

■ Please do not draw a current of 0.1A or higher from the auxiliary power because doing so could damage the internal circuits or cause malfunction.

When you connect a DC-DC converter, a current a few times higher than normal current may flow at start-up. Please check the current.

6.5 External Component (EMI/EMC Filter)

● PBA1500F and PBA1500T

■ You can have the power supplies comply with FCC Part 15 class B and EN55022-B by connecting an external EMI/EMC Filter.

Recommended EMI/EMC Filter

PBA1500F : NAC-20-472 (COSEL)

PBA1500T : TAC-10-683 (COSEL)

7 Options

7.1 Outline of Options

- * Please inquire us for details of specifications and delivery timing.
- * You can combine multiple options. Some options, however, cannot be combined with other options. Please contact us for details.

● -C

- Option -C units have coated internal PCB for better moisture resistance.

● -E and -G

- Options -E and -G units are low leakage current type.
- Differences from standard versions are summarized in Table 7.1.

Table 7.1 Low leakage current type

	-E *	-G
Leakage Current (AC240V)	0.5mA max	0.15mA max
Conducted Noise	Class A	N/A
Output Ripple Noise	150% of standard units	200% of standard units

* PBA50F, PBW50F, PBA75F, PBA100F and PBA150F

● -U (PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T)

- Operation stop voltage of Option -U units is set at a lower value than that of a standard version to support low input voltage.
- Use Conditions

		Output	
PBA300F	125W (83W)	PBA1000F	500W (330W)
PBA600F	250W (165W)		
		Input AC50V (DC70V)	
		Duty 1s/30s	

		Output	
PBA1500F	750W (495W)	PBA1500T	750W
		Input AC50V(DC70V)	
		Input AC100V 3 φ	
		Duty 1s/30s	

- * Please avoid using continuously for more than 1 second under above conditions. Doing so may cause a failure.

● -F1 (PBA600F, PBA1000F, PBA1500F and PBA1500T)

- Option -F1 units have a longer-life fan instead of a standard fan. This option is not available for PBA300F.
- Differences from standard versions are summarized in Fig.7.1 (Life expectancy of fan).
- Appearance of PBA600F changes in Option -F. Please see External View for details.

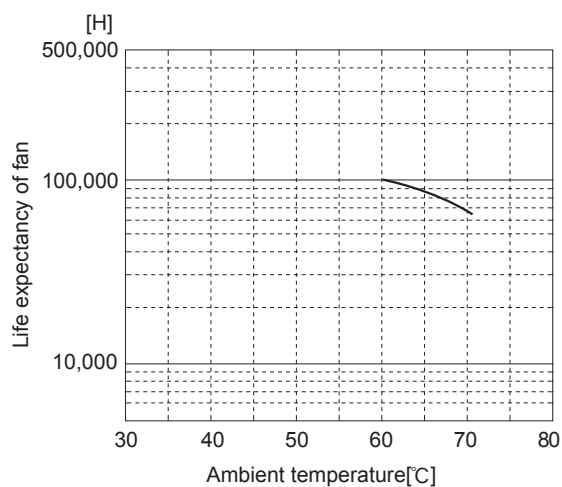


Fig.7.1 Life expectancy of long-lived fan

● -F3 (PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T)

- Option -F3 units have a reverse air fan instead of a standard fan.
- Differences from standard versions are summarized in Fig.7.2 and Fig.7.3.
- Please contact us for details about life expectancy of fan.



Fig.7.2 Air flow(-F3)

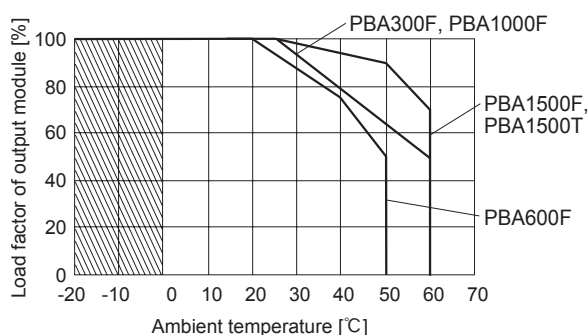


Fig.7.3 Ambient temperature derating curve (-F3)

● -F4 (PBA300F, PBA600F, PBA1000F, PBA1500F and PBA1500T)

- Option -F4 units have a low-speed low-noise fan instead of a standard fan.
- Differences from standard versions are summarized in Fig.7.4.

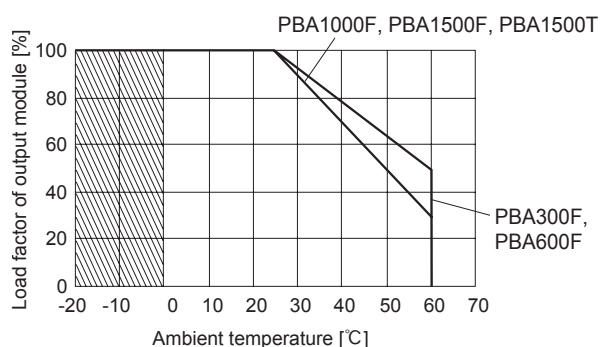


Fig.7.4 Ambient temperature derating curve (-F4)

● -T (PBA10F, PBA15F, PBW15F, PBA30F, PBW30F, PBA50F, PBW50F, PBA75F, PBA100F and PBA150F)

- Option -T units have vertically positioned screws on a terminal block.
- Please contact us for details about appearance.

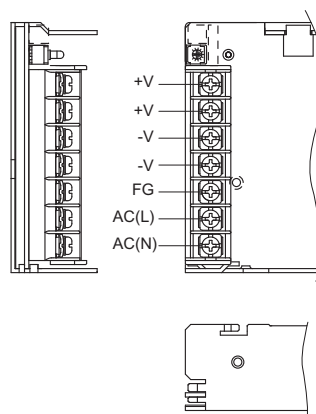


Fig.7.5 Example of option -T (PBA100F)

● -J (PBA10F, PBA15F, PBW15F, PBA30F, PBW30F, PBA50F, PBW50F, PBA75F, PBA100F and PBA150F)

- Option -J units have Molex connectors instead of a terminal block.
- Dedicated harnesses are available for your purchase. Please see Optional Parts for details.
- Please contact us for details about appearance.
- For PBA100F and PBA150F, this option is available in -12, -15, -24, -36 and -48 types.
- Please do not apply more than 5A per 1 pin.

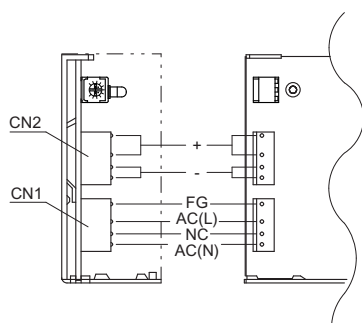


Fig.7.6 Image of option -J (PBA50F)

(1) Matching Molex Connectors and Terminals for PBA10F, PBA15F, PBW15F, PBA30F, PBW30F, PBA50F and PBW50F.

I/O Connector	Matching Housing	Terminal
CN1	10-31-1048	10-63-3044
		Reel : 08-70-1031 Loose : 08-70-1030
CN2	09-65-2049	09-50-1043
		Reel : 08-70-1031 Loose : 08-70-1030

(2) Matching Molex Connectors and Terminals for PBA75F, PBA100F and PBA150F.

I/O Connector	Matching Housing	Terminal
CN1	10-31-1048	10-63-3044
		Reel : 08-70-1031 Loose : 08-70-1030
CN2	09-65-2069	09-50-1063
		Reel : 08-70-1031 Loose : 08-70-1030

● -R (PBA50F, PBW50F, PBA75F, PBA100F and PBA150F)

- You can control output ON/OFF remotely in Option -R units. To do so, connect an external DC power supply and apply a voltage to a remote ON/OFF connector, which is available as option.

Model Name	Built-in Resistor Ri [Ω]	Voltage between RC (+) and RC (-) [V]		Input Current [mA]
		Output ON	Output OFF	
PBA50F, PBW50F, PBA75F, PBA100F and PBA150F	780	4.5 - 12.5	0 - 0.5	(20max)

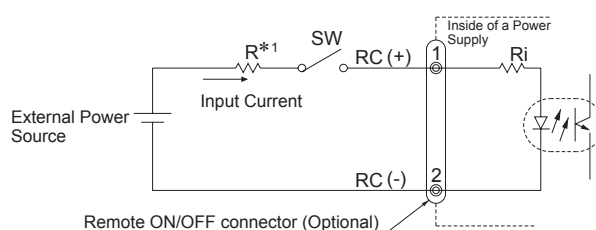


Fig.7.7 Example of using a remote ON/OFF circuit

- Dedicated harnesses are available for your purchase. Please see Optional Parts for details.

*1 If the output of an external power supply is within the range of 4.5 - 12.5V, you do not need a current limiting resistor R. If the output exceeds 12.5V, however, please connect the current limiting resistor R.

To calculate a current limiting resistance value, please use the following equation.

$$R[\Omega] = \frac{V_{cc} - (1.1 + R_i \times 0.005)}{0.005}$$

* Please wire carefully. If you wire wrongly, the internal components of a unit may be damaged.

■ Remote ON/OFF circuits (RC+ and RC-) are isolated from input, output and FG.

● -N (PBA10F, PBA15F, PBW15F, PBA30F, PBW30F, PBA50F, PBW50F, PBA75F, PBA100F and PBA150F)

- Option -N units come with a cover.
- Appearance of Option -N units is different from that of standard units. Please see External View for details.
- Derating curve for Option -N units is different from that for standard units. Please see 5.2 Derating Curve for details.
- UL508 is acquired (5V/ 12V/ 24V type in PBA10F/ PBA15F/ PBA30F with -N option, only 24V type in PBA50F/ PBA75F/ PBA100F/ PBA150F with -N option).

* Safety agency approvals will be void if the cover is attached after the unit is ex-factoryed.

● -N1 (PBA10F, PBA15F, PBW15F, PBA30F, PBW30F, PBA50F, PBW50F, PBA75F, PBA100F and PBA150F)

- Option -N1 units come with a dedicated DIN rail attachment.
- Please contact us for details about appearance.
- Option -N1 units come with a cover (Option -N).
- Each model has its own vibration and shock specifications.

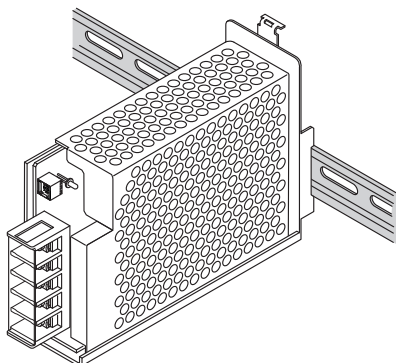


Fig.7.8 Power supply installed on a DIN rail

*External views are different among models.

● -V (PBA10F, PBA15F, PBW15F, PBA30F, PBW30F, PBA50F, PBW50F, PBA75F, PBA100F and PBA150F)

- Option -V units have connector for external potentiometer instead of a built-in potentiometer.
- Appearance of Option -V units is different from that of standard units. Please contact us for details.
- If power is turned on while CN5 is open, output voltage decreases significantly.

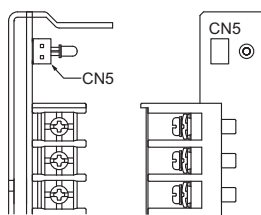


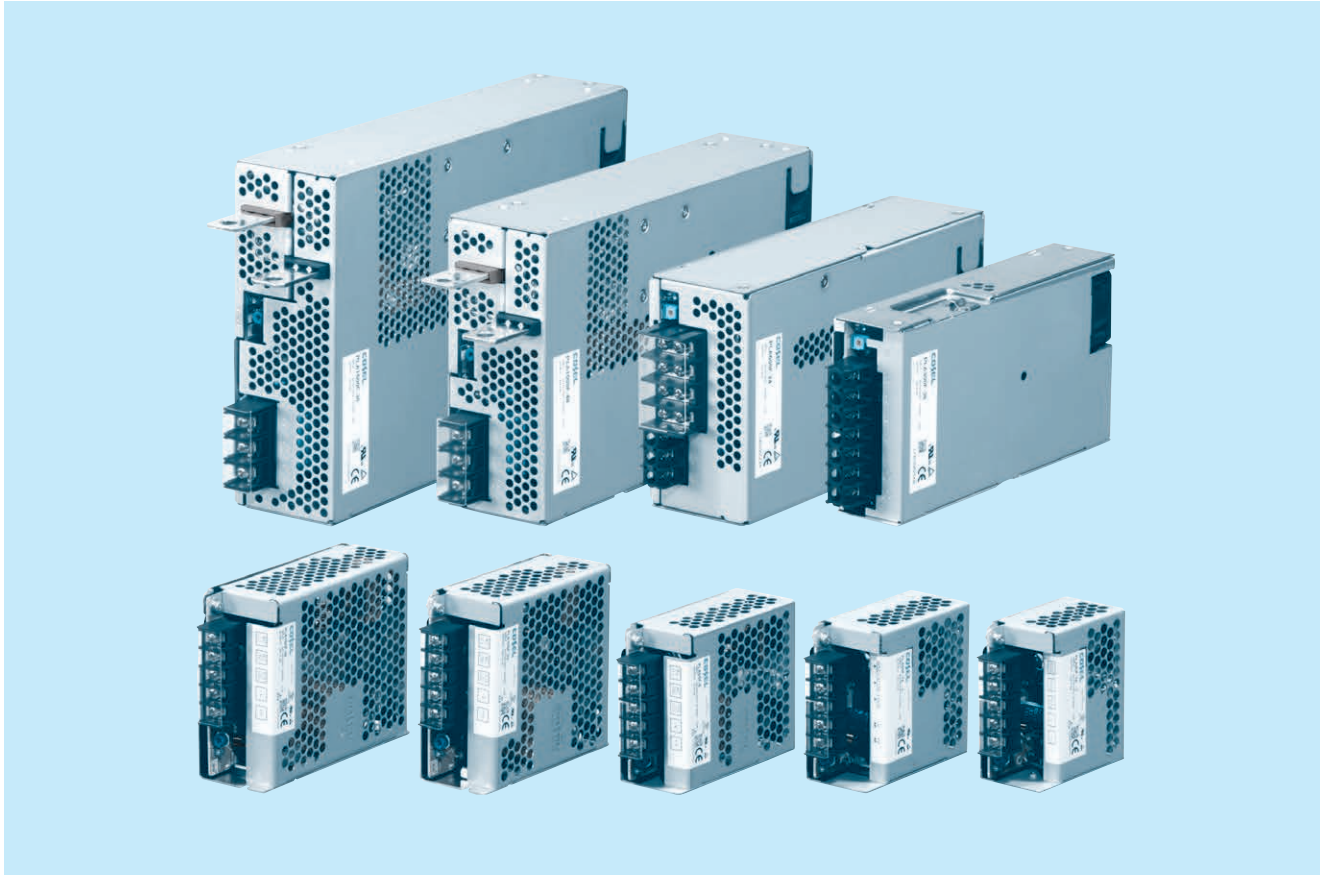
Fig.7.9 Upper view of option -V

● -K (PBA100F/PBA150F/-3R3/-5 Only)

- Option -K units have a remote sensing function. Please note that this option is not available for all models.
- Please contact us for details.



PLA-series



Feature

Low Profile (15, 30, 50, 100, 150, 300W : 1U size.
600, 1000, 1500W : 2U size)
Wide temperature range (-20°C to +70°C, Derating is required)
Harmonic attenuator (Complies with IEC61000-3-2 class A)
Universal input (AC85 - 264V, Derating is required)
Low power consumption at no load
Screw hold type terminal block (Only PLA300F and PLA600F)
Complies with SEMI F-47 (Option -U : Refer to instruction manual)
Many optional functions

Safety agency approvals

UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178
UL508 (PLA15F-150F) approved
Complies with DEN-AN

5-year warranty (See Instruction Manual)

CE marking

Low Voltage Directive

EMI

Complies with FCC-B, CISPR22-B, EN55011-B, EN55022-B, VCCI-B
PLA1500F meets class B by additional EMI/EMC Filter.
Standard of PLA1500F is class A.

EMS Compliance : EN61204-3, EN61000-6-2

EN61000-4-2
EN61000-4-3
EN61000-4-4
EN61000-4-5
EN61000-4-6
EN61000-4-8
EN61000-4-11

PLA15F

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Example recommended EMI/EMC filter
NAC-04-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *7
C : with Coating
J : Connector interface
T : Vertical terminal block
N1 : with DIN rail

See 5.1 in Instruction Manual.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

SPECIFICATIONS

	MODEL	PLA15F-5	PLA15F-12	PLA15F-15	PLA15F-24
INPUT	VOLTAGE[V]	AC85 - 264 1 φ (Output derating is required at AC85V - 115V. See 1.1 and 3.2 in Instruction Manual) *3			
	CURRENT[A]	ACIN 100V	0.4typ (Io=90%)		
		ACIN 115V	0.4typ (Io=100%)		
		ACIN 230V	0.25typ (Io=100%)		
	FREQUENCY[Hz]	50 / 60 (47 - 63)			
	EFFICIENCY[%]	ACIN 100V	72.5typ (Io=90%)	77.0typ (Io=90%)	78.0typ (Io=90%)
		ACIN 115V	73.5typ (Io=100%)	77.0typ (Io=100%)	78.5typ (Io=100%)
		ACIN 230V	75.5typ (Io=100%)	78.5typ (Io=100%)	79.5typ (Io=100%)
	INRUSH CURRENT[A]	ACIN 100V	16typ (Io=90%) Ta=25°C at cold start		
		ACIN 115V	16typ (Io=100%) Ta=25°C at cold start		
		ACIN 230V	32typ (Io=100%) Ta=25°C at cold start		
	LEAKAGE CURRENT[ma]	0.30max (ACIN 115V / 240V, 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)			
OUTPUT	VOLTAGE[V]	5	12	15	24
	CURRENT[A]	3	1.3	1	0.7
	WATTAGE[W]	ACIN 85-115V	Output derating is required at ACIN 115V or less (refer to instruction manual 3.2)		
		ACIN 115V-264V	15.0	15.6	15.0
	LINE REGULATION[mV] *4	20max	48max	60max	96max
	LOAD REGULATION[mV] *4	40max	100max	120max	150max
	RIPPLE[mVp-p] *1	0 to +50°C	80max	120max	120max
		-10 to 0°C	140max	160max	160max
		Io=0 to 35%	160max	240max	280max
	RIPPLE NOISE[mVp-p] *1	0 to +50°C	120max	150max	150max
		-10 to 0°C	160max	180max	180max
		Io=0 to 35%	240max	300max	320max
	TEMPERATURE REGULATION[mV]	0 to +50°C	50max	120max	150max
		-10 to +50°C	60max	150max	180max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *2	20max	48max	60max	96max
	START-UP TIME[ms]	200typ (ACIN 115V, Io=100%)	* Start-up time is 700 ms typ for less than 1 minute of applying input again from turning off the input voltage.		
	HOLD-UP TIME[ms]	20typ (ACIN 115V, Io=100%)			
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	4.50 to 5.50	10.80 to 13.20	13.50 to 16.50	21.60 to 26.40
	OUTPUT VOLTAGE SETTING[V]	5.00 to 5.15	12.00 to 12.48	15.00 to 15.60	24.00 to 24.96
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically			
	OVERVOLTAGE PROTECTION[V]	5.75 to 7.00	13.80 to 16.80	17.25 to 21.00	27.60 to 33.60
ISOLATION	OPERATING INDICATION	LED (Green)			
	REMOTE SENSING	Not provided			
	REMOTE ON/OFF	Not provided			
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At room temperature)			
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At room temperature)			
	OUTPUT-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At room temperature)			
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE *5	-20 to +70°C, 20 - 90%RH (Non condensing), 3,000m (10,000 feet) max			
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000 feet) max			
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axes			
SAFETY AND NOISE REGULATIONS	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axes			
	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178, UL508 (Except option -J) Complies with DEN-AN			
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B			
	HARMONIC ATTENUATOR *8	Complies with IEC61000-3-2 class A			

SPECIFICATIONS

OTHERS	CASE SIZE/WEIGHT	38×80×73mm [1.50×3.15×2.87 inches] (Excluding terminal block and screw) (W×H×D) / 250g max
	COOLING METHOD	Convection
WARRANTY	WARRANTY	*6 5 years (subject to the operating conditions)

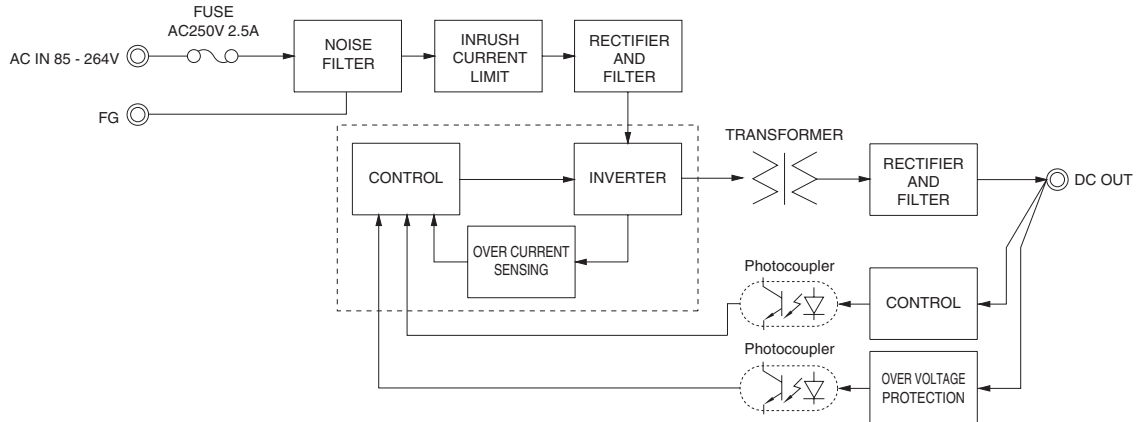
- *1 This is the result of measurement of the testing board with capacitors of 22 μ F and 0.1 μ F placed at 150 mm from the output terminals by a 20 MHz oscilloscope or a ripple-noise meter equivalent to Keisoku-Giken RM103.
See 1.6 of Instruction Manual for more details.
When the load factor is 0 - 35%, the switching power loss is reduced by burst operation, which will cause ripple and ripple noise to go beyond the specifications.
- *2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.
- *3 Output power derating is required. As for DC input, consult us for advice.
- *4 Consult us about dynamic load and input response. Measure the output voltage by using the average mode of the tester to deal with the burst operation at 35% load or less.

- *5 Output power derating is required. See 3.2 in Instruction Manual.
- *6 See 3.3 in Instruction Manual for more details.
- *7 Consult us about safety agency approvals for the models with optional functions.
- *8 Consult us about other classes.
- * Do not use the power supply in overcurrent conditions or in unspecified input voltage ranges. Otherwise the internal components may be damaged.
- * Parallel operation is not possible with this mode.
- * Sound noise may be heard from the power supply when used for pulse load.

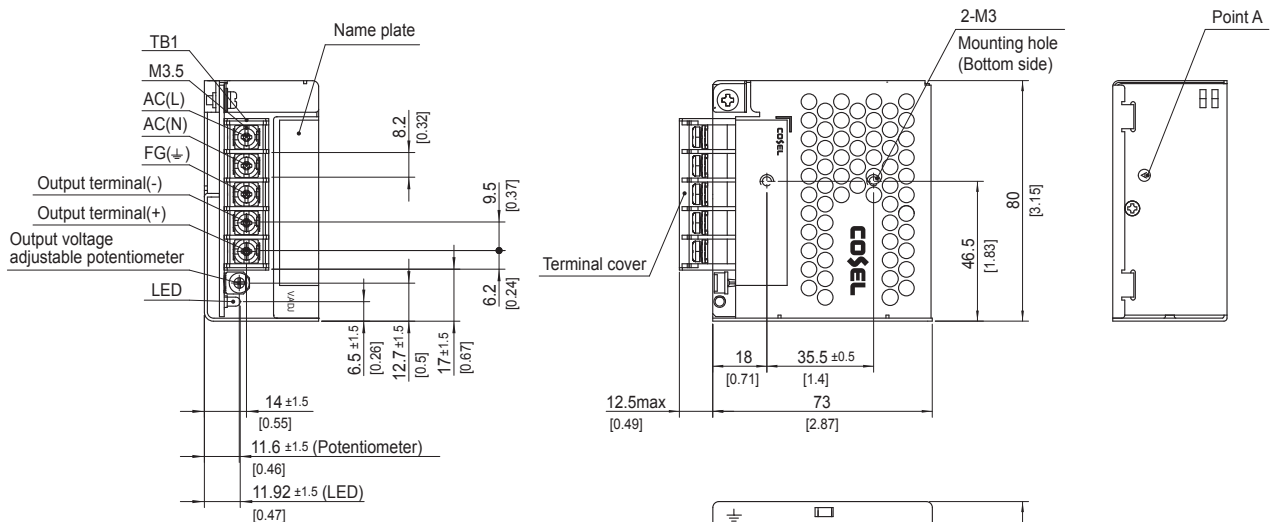
Features

- Compact design (Depth: 73mm 2.87inches)
- Low power consumption (1.0W typ AC240Vin, no load at standard model)
- UL508 approved (Except option -J), and complies with SEMI F47
- Various connection interface options (vertical terminal [-T], AMP connector [-J])

Block diagram



External view



- ※ Tolerance : ± 1 [± 0.04]
 ※ Weight : 250g max
 ※ PCB Material/thickness : CEM-3 / 1.6mm [0.06inches]
 ※ Chassis material : Electric galvaning steel board
 ※ Case material : Electric galvaning steel board
 ※ Dimensions in mm, []=inches
 ※ Mounting torque : 0.6N · m max
 ※ Screw tightening torque : 1.0N · m max

PLA30F

Ordering information

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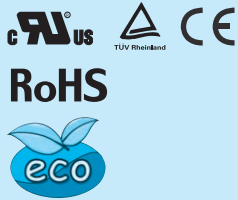
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Example recommended EMI/EMC filter
NAC-04-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *7
C : with Coating
J : Connector interface
T : Vertical terminal block
N1 : with DIN rail

See 5.1 in Instruction Manual.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

SPECIFICATIONS

MODEL		PLA30F-5	PLA30F-12	PLA30F-15	PLA30F-24
INPUT	VOLTAGE[V]	AC85 - 264 1 φ (Output derating is required at AC85V - 115V. See 1.1 and 3.2 in Instruction Manual) *3			
	CURRENT[A]	ACIN 100V	0.7typ (Io=90%)		
		ACIN 115V	0.7typ (Io=100%)		
		ACIN 230V	0.4typ (Io=100%)		
	FREQUENCY[Hz]	50 / 60 (47 - 63)			
	EFFICIENCY[%]	ACIN 100V	73.0typ (Io=90%)	80.0typ (Io=90%)	81.0typ (Io=90%)
		ACIN 115V	74.0typ (Io=100%)	80.5typ (Io=100%)	81.5typ (Io=100%)
		ACIN 230V	77.0typ (Io=100%)	81.0typ (Io=100%)	82.0typ (Io=100%)
	INRUSH CURRENT[A]	ACIN 100V	16typ (Io=90%) Ta=25°C at cold start		
		ACIN 115V	16typ (Io=100%) Ta=25°C at cold start		
		ACIN 230V	32typ (Io=100%) Ta=25°C at cold start		
	LEAKAGE CURRENT[ma]	0.65max (ACIN 115V / 240V, 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)			
OUTPUT	VOLTAGE[V]	5	12	15	24
	CURRENT[A]	6	2.5	2	1.3
	WATTAGE[W]	ACIN 85-115V	Output derating is required at ACIN 115V or less (refer to instruction manual 3.2)		
		ACIN 115V-264V	30.0	30.0	31.2
	LINE REGULATION[mV] *4	20max	48max	60max	96max
	LOAD REGULATION[mV] *4	40max	100max	120max	150max
	RIPPLE[mVp-p] *1	0 to +50°C	80max	120max	120max
		-10 to 0°C	140max	160max	160max
	RIPPLE NOISE[mVp-p] *1	0 to +50°C	120max	150max	150max
		-10 to 0°C	160max	180max	180max
	TEMPERATURE REGULATION[mV]	0 to +50°C	50max	120max	150max
		-10 to +50°C	60max	150max	180max
	DRIFT[mV] *2	20max	48max	60max	96max
	START-UP TIME[ms]	150typ (ACIN 115V, Io=100%)			
	HOLD-UP TIME[ms]	20typ (ACIN 115V, Io=100%)			
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	4.50 to 5.50	10.80 to 13.20	13.50 to 16.50	21.60 to 26.40
	OUTPUT VOLTAGE SETTING[V]	5.00 to 5.15	12.00 to 12.48	15.00 to 15.60	24.00 to 24.96
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically			
	OVERVOLTAGE PROTECTION[V]	5.75 to 7.00	13.80 to 16.80	17.25 to 21.00	27.60 to 33.60
	OPERATING INDICATION	LED (Green)			
ISOLATION	REMOTE SENSING	Not provided			
	REMOTE ON/OFF	Not provided			
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At room temperature)			
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At room temperature)			
ENVIRONMENT	OUTPUT-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At room temperature)			
	OPERATING TEMP., HUMID. AND ALTITUDE *5	-20 to +70°C, 20 - 90%RH (Non condensing), 3,000m (10,000 feet) max			
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000 feet) max			
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axes			
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axes			
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178, UL508 (Except option -J) Complies with DEN-AN			
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B			
	HARMONIC ATTENUATOR *8	Complies with IEC61000-3-2 class A			

SPECIFICATIONS

OTHERS	CASE SIZE/WEIGHT	38×80×88mm [1.50×3.15×3.46 inches] (Excluding terminal block and screw) (W×H×D) / 330g max
	COOLING METHOD	Convection
WARRANTY	WARRANTY	*6 5 years (subject to the operating conditions)

*1 This is the result of measurement of the testing board with capacitors of 22 μ F and 0.1 μ F placed at 150 mm from the output terminals by a 20 MHz oscilloscope or a ripple-noise meter equivalent to Keisoku-Giken RM103.
See 1.6 of Instruction Manual for more details.

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

*3 Output power derating is required. As for DC input, consult us for advice.

*4 Consult us about dynamic load and input response.

*5 Output power derating is required. See 3.2 in Instruction Manual.

*6 See 3.3 in Instruction Manual for more details.

*7 Consult us about safety agency approvals for the models with optional functions.

*8 Consult us about other classes.

* Do not use the power supply in overcurrent conditions or in unspecified input voltage ranges. Otherwise the internal components may be damaged.

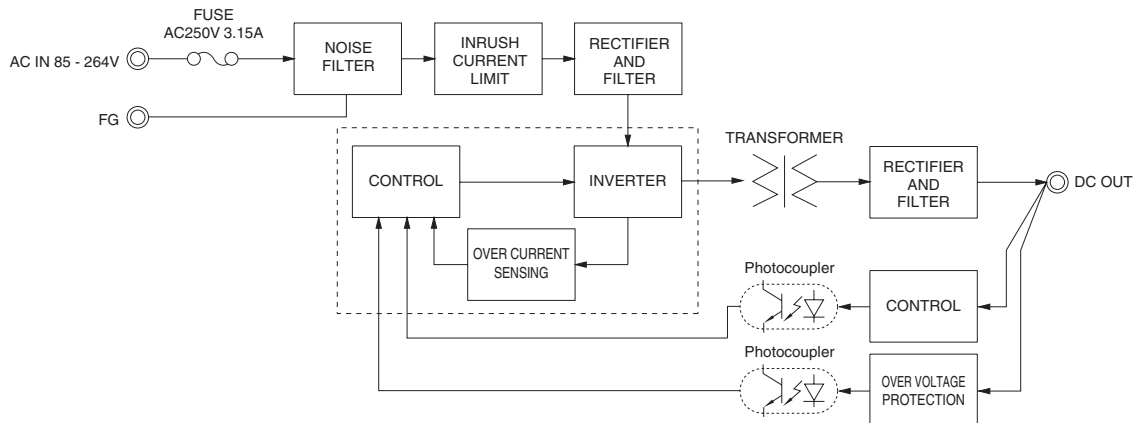
* Parallel operation is not possible with this mode.

* Sound noise may be heard from the power supply when used for pulse load.

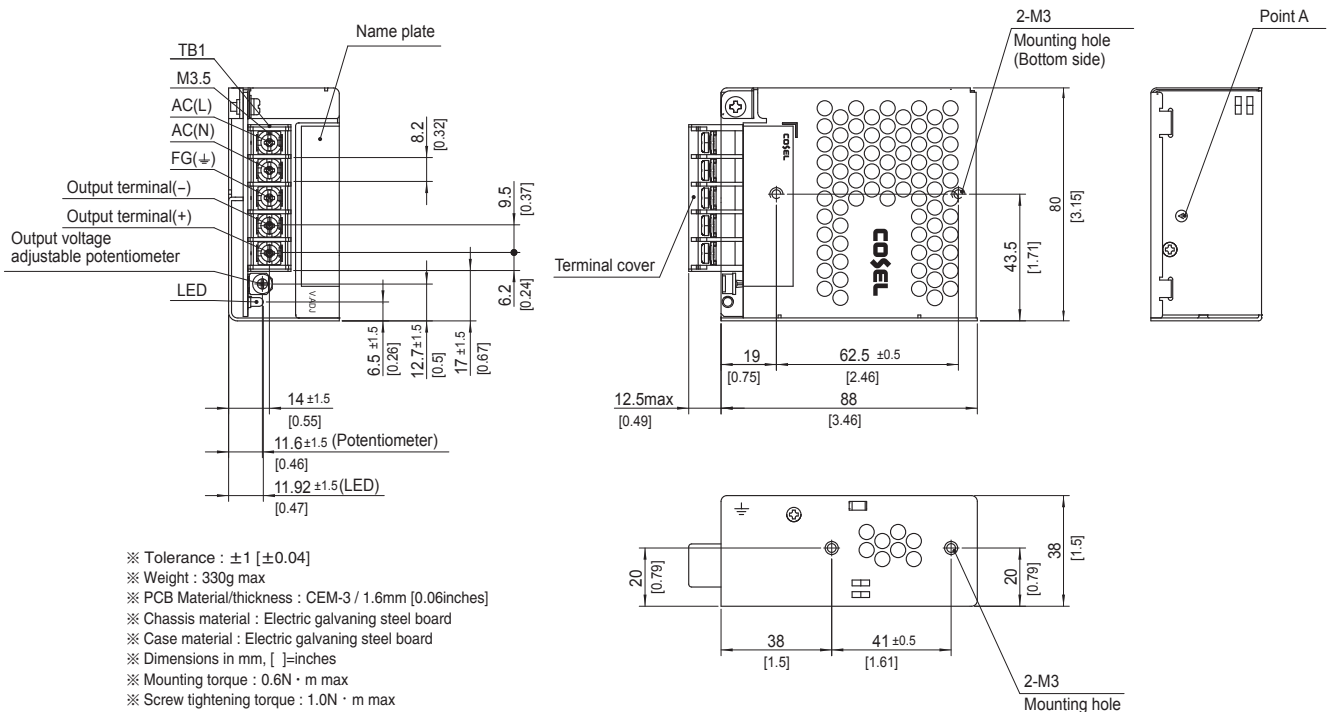
Features

- Compact design (Depth: 88mm 3.46inches)
- UL508 approved (Except option -J), and complies with SEMI F47
- Various connection interface options (vertical terminal [-T], AMP connector [-J])

Block diagram



External view



PLA50F

Ordering information

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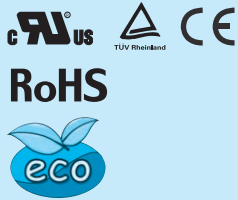
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Example recommended EMI/EMC filter
NAC-04-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *7
C : with Coating
J : Connector interface
T : Vertical terminal block
N1 : with DIN rail

See 5.1 in Instruction Manual.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

SPECIFICATIONS

	MODEL	PLA50F-5	PLA50F-12	PLA50F-15	PLA50F-24
INPUT	VOLTAGE[V]	AC85 - 264 1 φ (Output derating is required at AC85V - 115V. See 1.1 and 3.2 in Instruction Manual) *3			
	CURRENT[A]	ACIN 100V	0.6typ (Io=90%)	0.7typ (Io=90%)	
		ACIN 115V	0.6typ (Io=100%)	0.7typ (Io=100%)	
		ACIN 230V	0.3typ (Io=100%)	0.4typ (Io=100%)	
	FREQUENCY[Hz]	50 / 60 (47 - 63)			
	EFFICIENCY[%]	ACIN 100V	74.5typ (Io=90%)	80.0typ (Io=90%)	81.5typ (Io=90%)
		ACIN 115V	75.0typ (Io=100%)	80.5typ (Io=100%)	82.0typ (Io=100%)
		ACIN 230V	76.5typ (Io=100%)	82.0typ (Io=100%)	84.0typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.97typ (Io=90%)	0.98typ (Io=90%)	
		ACIN 115V	0.97typ (Io=100%)	0.98typ (Io=100%)	
		ACIN 230V	0.85typ (Io=100%)	0.87typ (Io=100%)	
OUTPUT	INRUSH CURRENT[A]	ACIN 100V	16typ (Io=90%) Ta=25°C at cold start		
		ACIN 115V	16typ (Io=100%) Ta=25°C at cold start		
		ACIN 230V	32typ (Io=100%) Ta=25°C at cold start		
	LEAKAGE CURRENT[ma]	0.75max (ACIN 115V / 240V, 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)			
	VOLTAGE[V]	5	12	15	24
	CURRENT[A]	8	4.3	3.5	2.2
	WATTAGE[W]	ACIN 85-115V	Output derating is required at ACIN 115V or less (refer to instruction manual 3.2)		
		ACIN 115V-264V	40.0	51.6	52.5
	LINE REGULATION[mV]	*4	20max	48max	60max
	LOAD REGULATION[mV]	*4	40max	100max	120max
	RIPPLE[mVp-p]	*1	0 to +45°C	80max	120max
			-10 to 0°C	140max	160max
	RIPPLE NOISE[mVp-p]	*1	0 to +45°C	120max	150max
			-10 to 0°C	160max	180max
	TEMPERATURE REGULATION[mV]		0 to +45°C	50max	120max
			-10 to +45°C	60max	150max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV]	*2	20max	48max	60max
	START-UP TIME[ms]	350typ (ACIN 115V, Io=100%)			
	HOLD-UP TIME[ms]	20typ (ACIN 115V, Io=100%)			
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	4.50 to 5.50	10.80 to 13.20	13.50 to 16.50	21.60 to 26.40
	OUTPUT VOLTAGE SETTING[V]	5.00 to 5.15	12.00 to 12.48	15.00 to 15.60	24.00 to 24.96
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically			
	OVERVOLTAGE PROTECTION[V]	5.75 to 7.00	13.80 to 16.80	17.25 to 21.00	27.60 to 33.60
	OPERATING INDICATION	LED (Green)			
	REMOTE SENSING	Not provided			
	REMOTE ON/OFF	Not provided			
ISOLATION	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At room temperature)			
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At room temperature)			
	OUTPUT-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At room temperature)			
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE *5	-20 to +70°C, 20 - 90%RH (Non condensing), 3,000m (10,000 feet) max			
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000 feet) max			
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axes			
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axes			
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178, UL508 (Except option -J) Complies with DEN-AN			
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B			
	HARMONIC ATTENUATOR *8	Complies with IEC61000-3-2 class A			

PLA100F

PL A 100 F - -

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-04-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional *7
C : with Coating
R : Remote on/off
(Required external
power source)
J : Connector interface
T : Vertical terminal block
N1 : with DIN rail

See 5.1 in Instruction Manual.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

SPECIFICATIONS

* Please consider "PBA100F-5-N" about 5V output with case cover.

	MODEL		PLA100F-12	PLA100F-15	PLA100F-24	PLA100F-36	PLA100F-48
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Output derating is required at AC85V - 115V. See 1.1 and 3.2 in Instruction Manual) *3				
	CURRENT[A]	ACIN 100V	1.2typ (Io=90%)				
		ACIN 115V	1.1typ (Io=100%)				
		ACIN 230V	0.6typ (Io=100%)				
	FREQUENCY[Hz]		50 / 60 (47 - 63)				
	EFFICIENCY[%]	ACIN 100V	82typ (Io=90%)	83typ (Io=90%)	85typ (Io=90%)	86typ (Io=90%)	86typ (Io=90%)
		ACIN 115V	82typ (Io=100%)	83typ (Io=100%)	85typ (Io=100%)	86typ (Io=100%)	86typ (Io=100%)
		ACIN 230V	85typ (Io=100%)	86typ (Io=100%)	88typ (Io=100%)	89typ (Io=100%)	89typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.98typ (Io=90%)				
		ACIN 115V	0.98typ (Io=100%)				
ACIN 230V		0.95typ (Io=100%) * Power factor correction is stopped at AC250V or more.					
INRUSH CURRENT[A]	ACIN 100V	16typ (Io=90%) Ta=25℃ at cold start					
	ACIN 115V	16typ (Io=100%) Ta=25℃ at cold start					
	ACIN 230V	32typ (Io=100%) Ta=25℃ at cold start					
LEAKAGE CURRENT[ma]		0.75max (ACIN 115V / 240V, 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)					
OUTPUT	VOLTAGE[V]		12	15	24	36	48
	CURRENT[A]	ACIN 85-115V	Output derating is required at ACIN 115V or less (refer to instruction manual 3.2)				
		ACIN 115V-264V	8.4	6.7	4.3	2.8	2.1
	WATTAGE[W]	ACIN 85-115V	Output derating is required at ACIN 115V or less (refer to instruction manual 3.2)				
		ACIN 115V-264V	100.8	100.5	103.2	100.8	100.8
	LINE REGULATION[mV] *4		48max	60max	96max	144max	192max
	LOAD REGULATION [mV] *4	Io=30 to 100%	100max	120max	150max	150max	300max
		Io=0 to 30%	Burst operation (Please contact us about detail)				
	RIPPLE[mVp-p] *1	0 to +40℃	120max	120max	120max	150max	150max
		-10 to 0℃	160max	160max	160max	200max	400max
		Io: load factor	500max	500max	500max	500max	500max
	RIPPLE NOISE[mVp-p] *1	0 to +40℃	150max	150max	150max	200max	200max
		-10 to 0℃	180max	180max	180max	240max	500max
		Io: load factor	600max	600max	600max	600max	600max
	TEMPERATURE REGULATION[mV]	0 to +40℃	120max	150max	240max	360max	480max
		-10 to +40℃	180max	180max	290max	440max	600max
DRIFT[mV] *2		48max	60max	96max	144max	192max	
START-UP TIME[ms]		500typ (ACIN 115V, Io=100%) Ta=25℃					
HOLD-UP TIME[ms]		20typ (ACIN 115V, Io=100%)					
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		10.80 to 13.20	13.50 to 16.50	21.60 to 26.40	32.40 to 39.60	43.20 to 52.80	
OUTPUT VOLTAGE SETTING[V]		12.00 to 12.48	15.00 to 15.60	24.00 to 24.96	36.00 to 37.44	48.00 to 49.92	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically				
	OVERVOLTAGE PROTECTION[V]		13.80 to 16.80	17.25 to 21.00	27.60 to 33.60	41.40 to 50.40	54.00 to 67.20
	OPERATING INDICATION		LED (Green)				
	REMOTE SENSING		Not provided				
	REMOTE ON/OFF		Optional (Required external power source. Option -R)				
ISOLATION	INPUT-OUTPUT • RC *9		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At room temperature)				
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At room temperature)				
	OUTPUT • RC-FG *9		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At room temperature)				
	OUTPUT-RC *9		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At room temperature)				
ENVIRONMENT	OPERATING TEMP., HUMID.AND ALTITUDE *5		-20 to +70℃ (Output derating is required), 20 - 90%RH (Non condensing), 3,000m (10,000 feet) max				
	STORAGE TEMP., HUMID.AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000 feet) max				
	VIBRATION		10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axes				
	IMPACT		196.1m/s ² (20G), 11ms, once each X, Y and Z axes				
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178, UL508 (Except option -J) Complies with DEN-AN				
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B				
	HARMONIC ATTENUATOR *8		Complies with IEC61000-3-2 class A				

SPECIFICATIONS

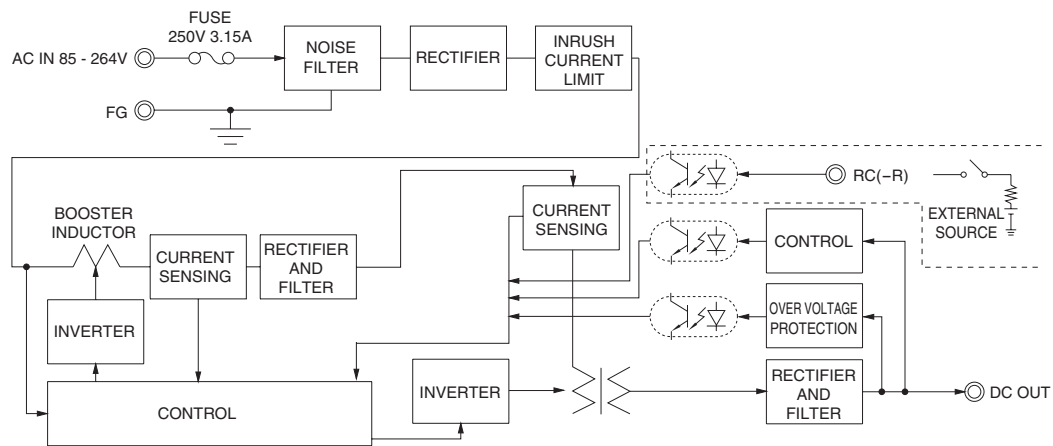
OTHERS	CASE SIZE/WEIGHT	41 X 97 X 109mm [1.61 X 3.82 X 4.29 inches] (Excluding terminal block and screw) (W X H X D) / 500g max
	COOLING METHOD	Convection
WARRANTY	WARRANTY	*6 5 years (subject to the operating conditions)

- | | | |
|--|---|---|
| <p>*1 This is the result of measurement of the testing board with capacitors of 22 μF and 0.1 μF placed at 150 mm from the output terminals by a 20 MHz oscilloscope or a ripple-noise meter equivalent to Keisoku-Giken RM103.
See 1.6 of Instruction Manual for more details.
When the load factor is 0 - 30%, the switching power loss is reduced by burst operation, which will cause ripple and ripple noise to go beyond the specifications.</p> | <p>hour warm-up at 25°C.
*3 Output power derating is required. As for DC input, consult us for advice.
*4 Consult us about dynamic load and input response. Measure the output voltage by using the average mode of the tester to deal with the burst operation at 30% load or less.
*5 Output power derating is required. See 3.2 in Instruction Manual.
*6 See 3.3 in Instruction Manual for more details.
*7 Consult us about safety agency approvals for the models with optional functions.
*8 Consult us about other classes.</p> | <p>*9 The RC terminal is added to option -R models. The RC terminal is isolated from input, output, and FG.
* Do not use the power supply in overcurrent conditions or in unspecified input voltage ranges. Otherwise the internal components may be damaged.
* Parallel operation is not possible with this mode.
* Sound noise may be heard from the power supply when used for pulse load.</p> |
| <p>*2 Drift is the change in DC output for an eight hour period after a half-</p> | | |

Features

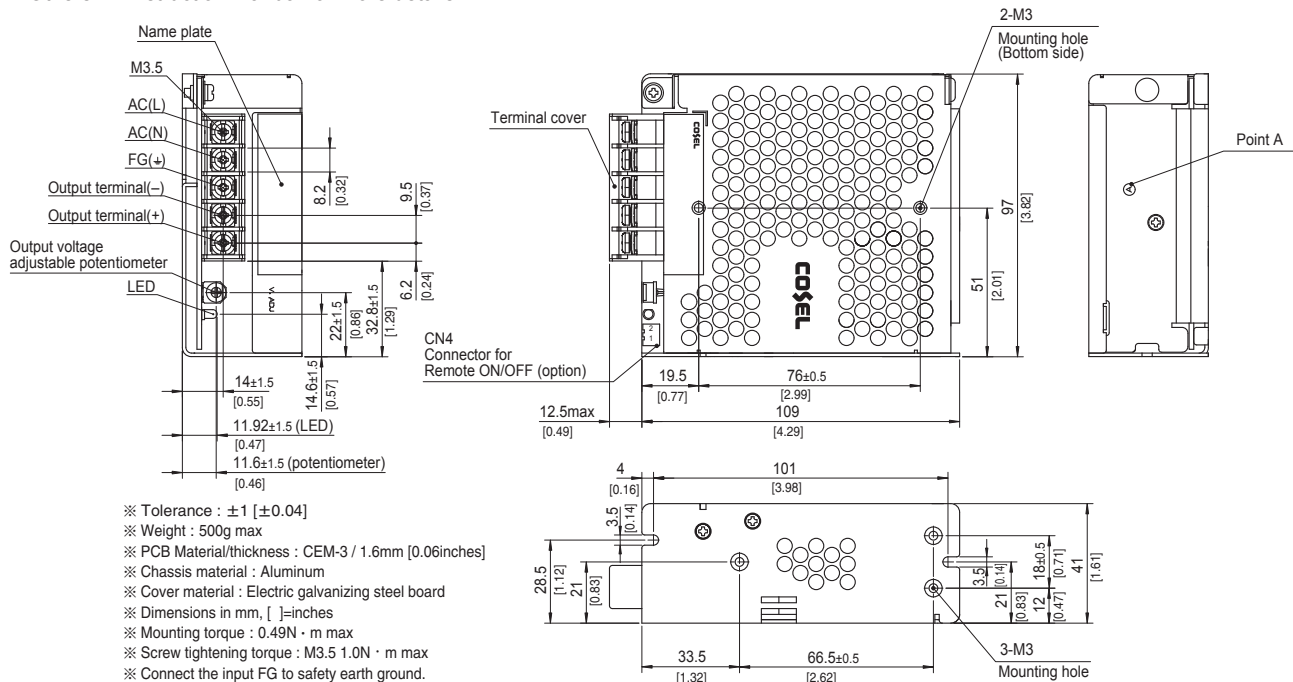
- Compact design (Depth: 109mm 4.29inches)
- High efficiency (88%typ PLA100F-24, AC230Vin, 100% load)
- Low power consumption (1.5W typ AC240Vin, no load at standard model)
- UL508 approved (Except option -J), and complies with SEMI F47 (see instruction manual 1.1)
- Various connection interface options (vertical terminal [-T], AMP connector [-J])

Block diagram



External view

The external size of -R option, -J option, -N1 option and -T option models is different from the standard model. See "5. Options and Others" in Instruction Manual for more details.





Example recommended EMI/EMC filter
NAC-04-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *7
C : with Coating
R : Remote on/off
(Required external
power source)
J : Connector interface
T : Vertical terminal block
N1 : with DIN rail

See 5.1 in Instruction Manual.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

SPECIFICATIONS

* Please consider "PBA150F-5-N" about 5V output with case cover.

	MODEL		PLA150F-12	PLA150F-15	PLA150F-24	PLA150F-36	PLA150F-48
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Output derating is required at AC85V - 115V. See 1.1 and 3.2 in Instruction Manual) *3				
	CURRENT[A]	ACIN 100V	1.7typ (Io=90%)				
		ACIN 115V	1.6typ (Io=100%)				
		ACIN 230V	0.8typ (Io=100%)				
	FREQUENCY[Hz]		50 / 60 (47 - 63)				
	EFFICIENCY[%]	ACIN 100V	84typ (Io=90%)	84typ (Io=90%)	87typ (Io=90%)	87typ (Io=90%)	87typ (Io=90%)
		ACIN 115V	84typ (Io=100%)	84typ (Io=100%)	87typ (Io=100%)	87typ (Io=100%)	87typ (Io=100%)
		ACIN 230V	87typ (Io=100%)	87typ (Io=100%)	90typ (Io=100%)	90typ (Io=100%)	90typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.98typ (Io=90%)				
		ACIN 115V	0.98typ (Io=100%)				
ACIN 230V		0.95typ (Io=100%) * Power factor correction is stopped at AC250V or more.					
INRUSH CURRENT[A]	ACIN 100V	16typ (Io=90%) Ta=25℃ at cold start					
	ACIN 115V	16typ (Io=100%) Ta=25℃ at cold start					
	ACIN 230V	32typ (Io=100%) Ta=25℃ at cold start					
LEAKAGE CURRENT[ma]		0.75max (ACIN 115V / 240V, 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)					
OUTPUT	VOLTAGE[V]		12	15	24	36	48
	CURRENT[A]	ACIN 85-115V	Output derating is required at ACIN 115V or less (refer to instruction manual 3.2)				
		ACIN 115V-264V	12.5	10	6.4	4.2	3.2
	WATTAGE[W]	ACIN 85-115V	Output derating is required at ACIN 115V or less (refer to instruction manual 3.2)				
		ACIN 115V-264V	150.0	150.0	153.6	151.2	153.6
	LINE REGULATION[mV] *4		48max	60max	96max	144max	192max
	LOAD REGULATION [mV] *4	Io=30 to 100%	100max	120max	150max	150max	300max
		Io=0 to 30%	Burst operation (Please contact us about detail)				
	RIPPLE[mVp-p] *1	0 to +40℃	120max	120max	120max	150max	150max
		-10 to 0℃	160max	160max	160max	200max	400max
		Io: load factor Io=0 to 30%	500max	500max	500max	500max	500max
	RIPPLE NOISE[mVp-p] *1	0 to +40℃	150max	150max	150max	200max	200max
		-10 to 0℃	180max	180max	180max	240max	500max
		Io: load factor Io=0 to 30%	600max	600max	600max	600max	600max
	TEMPERATURE REGULATION[mV]	0 to +40℃	120max	150max	240max	360max	480max
		-10 to +40℃	180max	180max	290max	440max	600max
	DRIFT[mV] *2		48max	60max	96max	144max	192max
START-UP TIME[ms]		500typ (ACIN 115V, Io=100%) Ta=25℃					
HOLD-UP TIME[ms]		20typ (ACIN 115V, Io=100%)					
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		10.80 to 13.20	13.50 to 16.50	21.60 to 26.40	32.40 to 39.60	43.20 to 52.80	
OUTPUT VOLTAGE SETTING[V]		12.00 to 12.48	15.00 to 15.60	24.00 to 24.96	36.00 to 37.44	48.00 to 49.92	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically				
	OVERVOLTAGE PROTECTION[V]		13.80 to 16.80	17.25 to 21.00	27.60 to 33.60	41.40 to 50.40	54.00 to 67.20
	OPERATING INDICATION		LED (Green)				
	REMOTE SENSING		Not provided				
	REMOTE ON/OFF		Optional (Required external power source. Option -R)				
ISOLATION	INPUT-OUTPUT • RC *9		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At room temperature)				
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At room temperature)				
	OUTPUT • RC-FG *9		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At room temperature)				
	OUTPUT-RC *9		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At room temperature)				
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE *5		-20 to +70℃ (Output derating is required), 20 - 90%RH (Non condensing), 3,000m (10,000 feet) max				
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000 feet) max				
	VIBRATION		10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axes				
	IMPACT		196.1m/s ² (20G), 11ms, once each X, Y and Z axes				
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178, UL508 (Except option -J) Complies with DEN-AN				
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B				
	HARMONIC ATTENUATOR *8		Complies with IEC61000-3-2 class A				

SPECIFICATIONS

OTHERS	CASE SIZE/WEIGHT	41 × 97 × 129mm [1.61 × 3.82 × 5.08 inches] (Excluding terminal block and screw) (W×H×D) / 600g max
	COOLING METHOD	Convection
WARRANTY	WARRANTY	5 years (subject to the operating conditions)

*1 This is the result of measurement of the testing board with capacitors of 22 μ F and 0.1 μ F placed at 150 mm from the output terminals by a 20 MHz oscilloscope or a ripple-noise meter equivalent to Keisoku-Giken RM103.
See 1.6 of Instruction Manual for more details.
When the load factor is 0 - 30%, the switching power loss is reduced by burst operation, which will cause ripple and ripple noise to go beyond the specifications.
*2 Drift is the change in DC output for an eight hour period after a half-

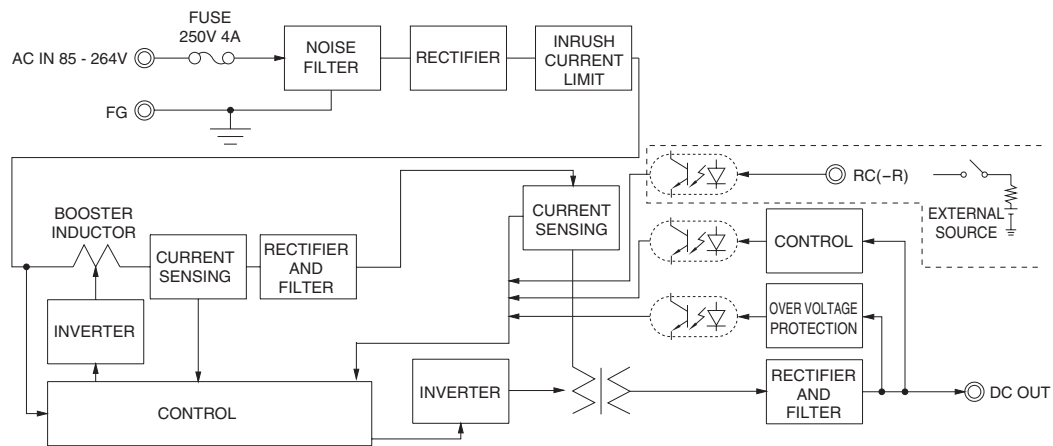
hour warm-up at 25°C.
*3 Output power derating is required. As for DC input, consult us for advice.
*4 Consult us about dynamic load and input response. Measure the output voltage by using the average mode of the tester to deal with the burst operation at 30% load or less.
*5 Output power derating is required. See 3.2 in Instruction Manual.
*6 See 3.3 in Instruction Manual for more details.
*7 Consult us about safety agency approvals for the models with optional functions.
*8 Consult us about other classes.

*9 The RC terminal is added to option -R models. The RC terminal is isolated from input, output, and FG.
* Do not use the power supply in overcurrent conditions or in unspecified input voltage ranges. Otherwise the internal components may be damaged.
* Parallel operation is not possible with this mode.
* Sound noise may be heard from the power supply when used for pulse load.

Features

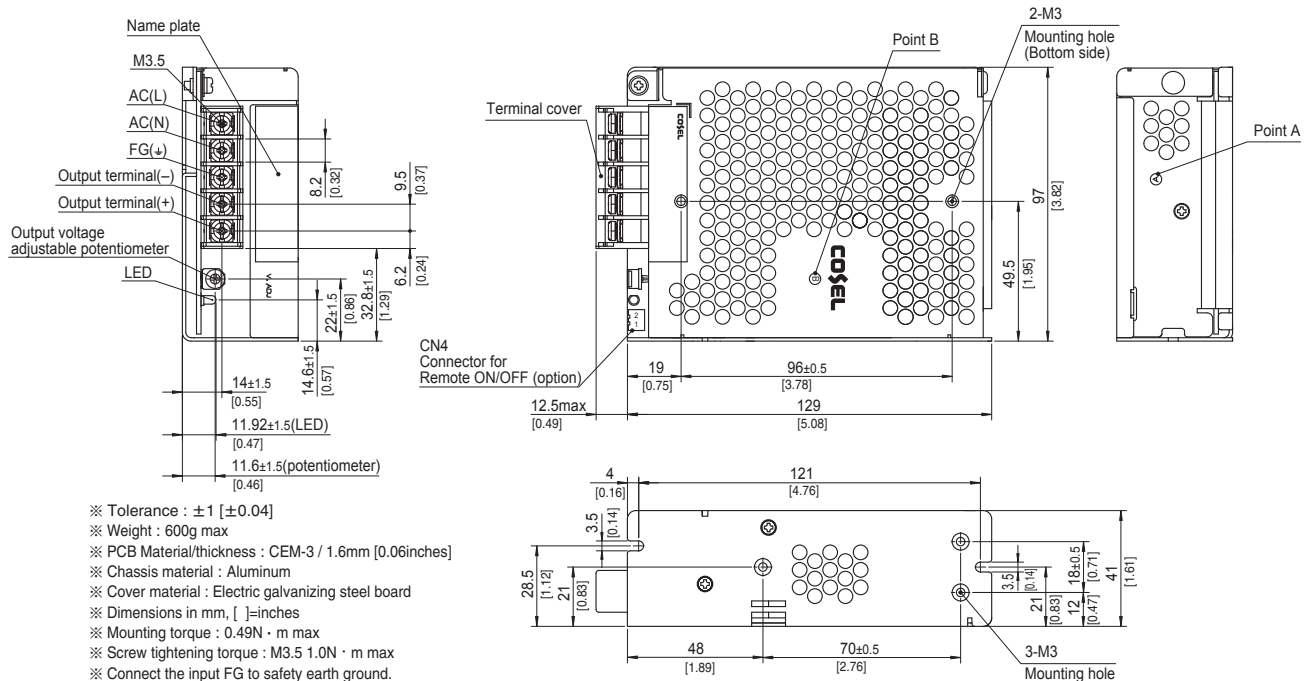
- Compact design (Depth: 129mm 5.08inches)
- High efficiency (90%typ PLA150F-24, AC230Vin, 100% load)
- Low power consumption (1.5W typ AC240Vin, no load at standard model)
- UL508 approved (Except option -J), and complies with SEMI F47 (see instruction manual 1.1)
- Various connection interface options (vertical terminal [-T], AMP connector [-J])

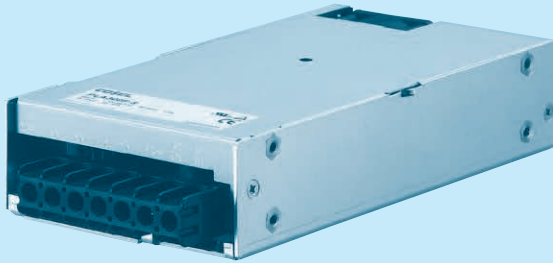
Block diagram



External view

The external size of -R option, -J option, -N1 option and -T option models is different from the standard model. See "5. Options and Others" in Instruction Manual for more details.





Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *7
C : with Coating
G : Low leakage current
V : External potentiometer for output voltage adjustment
U : Low input voltage stop (Complies with SEMI F-47)
R : Remote on/off (Required external power source)
F4 : Low speed fan
T2 : Horizontal terminal block (non-screw-hold type)

See 5.1 in Instruction Manual.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

SPECIFICATIONS

	MODEL		PLA300F-5	PLA300F-12	PLA300F-15	PLA300F-24	PLA300F-36	PLA300F-48
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Output derating is required at AC85V - 115V. See 1.1 and 3.2 in Instruction Manual) *3					
	CURRENT[A]	ACIN 100V	3.1typ (Io=90%)	3.4typ (Io=90%)				
		ACIN 115V	3.0typ (Io=100%)	3.3typ (Io=100%)				
		ACIN 230V	1.5typ (Io=100%)	1.7typ (Io=100%)				
	FREQUENCY[Hz]		50 / 60 (47 - 63)					
	EFFICIENCY[%]	ACIN 100V	73typ (Io=90%)	78typ (Io=90%)	80typ (Io=90%)	84typ (Io=90%)	84typ (Io=90%)	84typ (Io=90%)
		ACIN 115V	74typ (Io=100%)	78typ (Io=100%)	80typ (Io=100%)	84typ (Io=100%)	84typ (Io=100%)	84typ (Io=100%)
		ACIN 230V	77typ (Io=100%)	81typ (Io=100%)	83typ (Io=100%)	87typ (Io=100%)	87typ (Io=100%)	87typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.98typ (Io=90%)					
		ACIN 115V	0.98typ (Io=100%)					
ACIN 230V		0.95typ (Io=100%)						
INRUSH CURRENT[A]	ACIN 100V	20typ (Io=90%) Ta=25℃ at cold start						
	ACIN 115V	20typ (Io=100%) Ta=25℃ at cold start						
	ACIN 230V	40typ (Io=100%) Ta=25℃ at cold start						
LEAKAGE CURRENT[ma]		0.75max (ACIN 115V / 240V, 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)						
OUTPUT	VOLTAGE[V]		5	12	15	24	36	48
	CURRENT[A]	ACIN 85-115V	Output derating is required at ACIN 115V or less (refer to instruction manual 3.2)					
		ACIN 115V-264V	50	25	20	12.5	8.4	6.3
	WATTAGE[W]	ACIN 85-115V	Output derating is required at ACIN 115V or less (refer to instruction manual 3.2)					
		ACIN 115V-264V	250	300	300	300	302.4	302.4
	LINE REGULATION[mV] *4		20max	48max	60max	96max	144max	192max
	LOAD REGULATION[mV] *4		40max	100max	120max	150max	150max	300max
	RIPPLE[mVp-p] *1	0 to +50℃	80max	120max	120max	120max	150max	150max
		-10 to 0℃	140max	160max	160max	160max	160max	400max
	RIPPLE NOISE[mVp-p] *1	0 to +50℃	120max	150max	150max	150max	200max	200max
		-10 to 0℃	160max	180max	180max	180max	240max	500max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	120max	150max	240max	360max	480max
		-10 to +50℃	75max	180max	180max	290max	440max	600max
	DRIFT[mV] *2		20max	48max	60max	96max	144max	192max
	START-UP TIME[ms]		300typ (ACIN 115V, Io=100%)					
	HOLD-UP TIME[ms]		20typ (ACIN 115V, Io=100%)					
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		4.50 to 5.50	10.80 to 13.20	13.50 to 16.50	21.60 to 26.40	32.40 to 39.60	43.20 to 52.80	
OUTPUT VOLTAGE SETTING[V]		5.00 to 5.15	12.00 to 12.48	15.00 to 15.60	24.00 to 24.96	36.00 to 37.44	48.00 to 49.92	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically					
	OVERVOLTAGE PROTECTION[V]		5.75 to 7.00	13.80 to 16.80	17.25 to 21.00	27.60 to 33.60	41.40 to 50.40	55.20 to 67.20
	OPERATING INDICATION		LED (Green)					
	REMOTE SENSING		Not provided					
	REMOTE ON/OFF		Optional (Required external power source. Option -R)					
ISOLATION	INPUT-OUTPUT • RC *10	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At room temperature)						
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At room temperature)						
	OUTPUT • RC-FG *10	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At room temperature)						
	OUTPUT-RC *10	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At room temperature)						
ENVIRONMENT	OPERATING TEMP., HUMID.AND ALTITUDE *5		-20 to +70℃ (Output derating is required), 20 - 90%RH (Non condensing), 3,000m (10,000 feet) max					
	STORAGE TEMP., HUMID.AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000 feet) max					
	VIBRATION		10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axes					
	IMPACT		196.1m/s² (20G), 11ms, once each X, Y and Z axes					
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN					
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B					
	HARMONIC ATTENUATOR *9		Complies with IEC61000-3-2 class A					

SPECIFICATIONS

OTHERS	CASE SIZE/WEIGHT	102 X 41 X 190mm [4.02 X 1.61 X 7.48 inches] (Excluding terminal block and screw) (W X H X D) / 1.0kg max
	COOLING METHOD	*8 Forced cooling (internal fan)
WARRANTY	WARRANTY	*6 5 years (subject to the operating conditions)

- *1 This is the result of measurement of the testing board with capacitors of 22 μ F and 0.1 μ F placed at 150 mm from the output terminals by a 20 MHz oscilloscope or a ripple-noise meter equivalent to Keisoku-Giken RM103.
See 1.6 of Instruction Manual for more details.
- *2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.
- *3 Output power derating is required. As for DC input, consult us for advice.

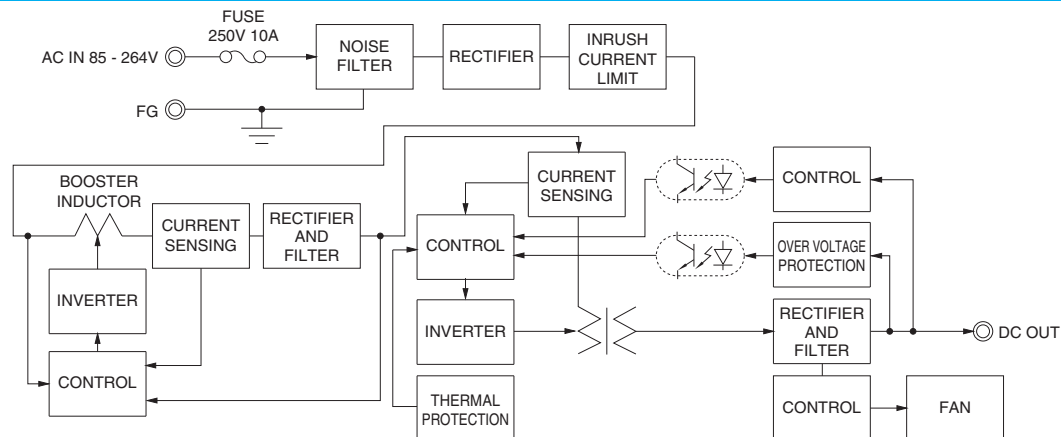
- *4 Consult us about dynamic load and input response.
- *5 Output power derating is required. See 3.2 in Instruction Manual.
- *6 See 3.3 in Instruction Manual for more details.
- *7 Consult us about safety agency approvals for the models with optional functions.
- *8 The fan speed slows down at no load.
- *9 Consult us about other classes.
- *10 The RC terminal is added to option -R models. The RC terminal is isolated from input, output, and FG.

- * Do not use the power supply in overcurrent conditions or in unspecified input voltage ranges. Otherwise the internal components may be damaged.
- * Parallel operation is not possible with this mode.
- * Sound noise may be heard from the power supply when used for pulse load.

Features

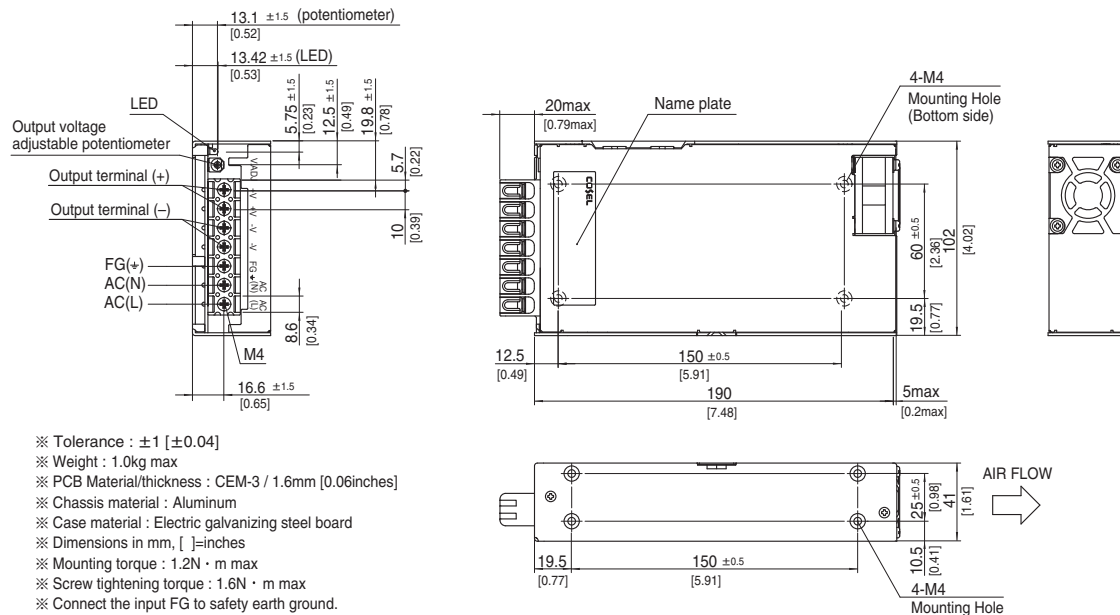
- Cost-effective
- Longer life (see Instruction Manual)
- Low profile (meets 1U height = 41 mm or 1.61 inches)
- Wide operating temperature range (-20°C to +70°C see instruction manual)
- Screw hold type terminal block
- Slow fan speed at no load
- Many optional functions
- Complies with SEMI F-47 (-U option, see Instruction Manual for details)

Block diagram

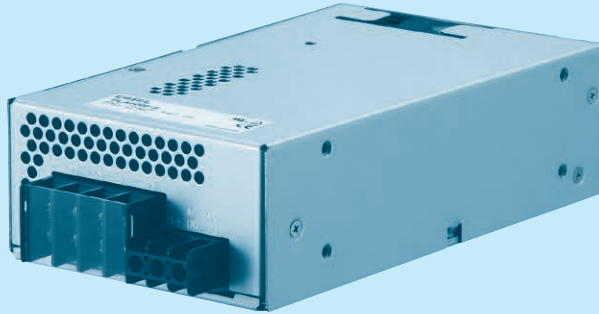


External view

The external size of -V option, -R option, and -T2 option models is different from the standard model. See "5. Options and Others" in Instruction Manual for more details.



- ※ Tolerance : ± 1 [± 0.04]
 ※ Weight : 1.0kg max
 ※ PCB Material/thickness : CEM-3 / 1.6mm [0.06inches]
 ※ Chassis material : Aluminum
 ※ Case material : Electric galvanizing steel board
 ※ Dimensions in mm, []=inches
 ※ Mounting torque : 1.2N · m max
 ※ Screw tightening torque : 1.6N · m max
 ※ Connect the input FG to safety earth ground.



Example recommended EMI/EMC filter
NAC-16-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series

* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *7
C : with Coating
G : Low leakage current
V : External potentiometer for output voltage adjustment
U : Low input voltage stop (Complies with SEMI F-47)
W : Parallel operation, LV alarm Remote sensing
R : Remote on/off (Required external power source)
F4 : Low speed fan
T2 : Horizontal terminal block (non-screw-hold type)

See 5.1 in Instruction Manual.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

SPECIFICATIONS

	MODEL		PLA600F-5	PLA600F-12	PLA600F-15	PLA600F-24	PLA600F-36	PLA600F-48
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Output derating is required at AC85V - 115V. See 1.1 and 3.2 in Instruction Manual) *4					
	CURRENT[A]	ACIN 100V	6.2typ (Io=90%)	6.7typ (Io=90%)				
		ACIN 115V	6.0typ (Io=100%)	6.5typ (Io=100%)				
		ACIN 230V	3.0typ (Io=100%)	3.2typ (Io=100%)				
	FREQUENCY[Hz]		50 / 60 (47 - 63)					
	EFFICIENCY[%]	ACIN 100V	74typ (Io=90%)	81typ (Io=90%)	81typ (Io=90%)	84typ (Io=90%)	85typ (Io=90%)	85typ (Io=90%)
		ACIN 115V	75typ (Io=100%)	81typ (Io=100%)	81typ (Io=100%)	84typ (Io=100%)	85typ (Io=100%)	85typ (Io=100%)
		ACIN 230V	77typ (Io=100%)	84typ (Io=100%)	84typ (Io=100%)	88typ (Io=100%)	88typ (Io=100%)	88typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.98typ (Io=90%)					
		ACIN 115V	0.98typ (Io=100%)					
ACIN 230V		0.95typ (Io=100%)						
INRUSH CURRENT[A]	ACIN 100V	20/40typ (Io=90%) (Primary inrush current /Secondary inrush current) (More than 3sec to re-start)						
	ACIN 115V	20/40typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 3sec to re-start)						
	ACIN 230V	40/40typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 3sec to re-start)						
LEAKAGE CURRENT[ma]		1.5max (ACIN 115V / 240V, 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)						
OUTPUT	VOLTAGE[V]		5	12	15	24	36	48
	CURRENT[A]	ACIN 85-115V	Output derating is required at ACIN 115V or less (refer to instruction manual 3.2)					
		ACIN 115V-264V	100	50	40	25	16.7	12.5
	WATTAGE[W]	ACIN 85-115V	Output derating is required at ACIN 115V or less (refer to instruction manual 3.2)					
		ACIN 115V-264V	500	600	600	600	601.2	600
	LINE REGULATION[mV] *8		20max	48max	60max	96max	144max	192max
	LOAD REGULATION[mV] *8		40max	100max	120max	150max	150max	300max
	RIPPLE[mVp-p] *1	0 to +50℃	80max	120max	120max	120max	150max	150max
		-20 to 0℃	140max	160max	160max	160max	160max	400max
	RIPPLE NOISE[mVp-p] *1	0 to +50℃	120max	150max	150max	150max	200max	200max
		-20 to 0℃	160max	180max	180max	180max	240max	500max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	120max	150max	240max	360max	480max
		-20 to +50℃	75max	180max	180max	290max	440max	600max
	DRIFT[mV] *2		20max	48max	60max	96max	144max	192max
	START-UP TIME[ms]		300typ (ACIN 115V, Io=100%)					
	HOLD-UP TIME[ms]		20typ (ACIN 115V, Io=100%)					
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		4.50 to 5.50	10.80 to 13.20	13.50 to 16.50	21.60 to 26.40	32.40 to 39.60	43.20 to 52.80	
OUTPUT VOLTAGE SETTING[V]		5.00 to 5.15	12.00 to 12.48	15.00 to 15.60	24.00 to 24.96	36.00 to 37.44	48.00 to 49.92	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically					
	OVERVOLTAGE PROTECTION[V]		5.75 to 7.00	13.80 to 16.80	17.25 to 21.00	27.60 to 33.60	41.40 to 50.40	55.20 to 67.20
	OPERATING INDICATION		LED (Green)					
	REMOTE SENSING		Optional (Option -W)					
	REMOTE ON/OFF		Optional (Required external power source. Option -R)					
ISOLATION	INPUT-OUTPUT • RC *3	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At room temperature)						
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At room temperature)						
	OUTPUT • RC-FG *3	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At room temperature)						
	OUTPUT-RC *3	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At room temperature)						
ENVIRONMENT	OPERATING TEMP., HUMID.AND ALTITUDE *5	-20 to +70℃ (Output derating is required), 20 - 90%RH (Non condensing), 3,000m (10,000 feet) max						
	STORAGE TEMP., HUMID.AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000 feet) max						
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axes						
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axes						
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN					
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B					
	HARMONIC ATTENUATOR *10		Complies with IEC61000-3-2 class A					

SPECIFICATIONS

OTHERS	CASE SIZE/WEIGHT	120×61×215mm [4.72×2.40×8.46 inches] (Excluding terminal block and screw) (W×H×D) / 2.0kg max
	COOLING METHOD	*9 Forced cooling (internal fan)
WARRANTY	WARRANTY	*6 5 years (subject to the operating conditions)

*1 This is the result of measurement of the testing board with capacitors of 22 μ F and 0.1 μ F placed at 150 mm from the output terminals by a 20 MHz oscilloscope or a ripple-noise meter equivalent to Keisoku-Giken RM103.
See 1.6 of Instruction Manual for more details.

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

*3 The RC terminal is added to option -R models. The RC terminal is isolated from input, output, and FG.

*4 Output power derating is required. As for DC input, consult us for advice.

*5 Output power derating is required. See 3.2 in Instruction Manual.

*6 See 3.3 in Instruction Manual for more details.

*7 Consult us about safety agency approvals for the models with optional functions.

*8 Consult us about dynamic load and input response.

*9 The fan speed slows down at no load.

*10 Consult us about other classes.

* Do not use the power supply in overcurrent conditions or in unspecified input voltage ranges. Otherwise the internal components may be damaged.

* Parallel operation is allowed for PLA600F models with the -W option only.

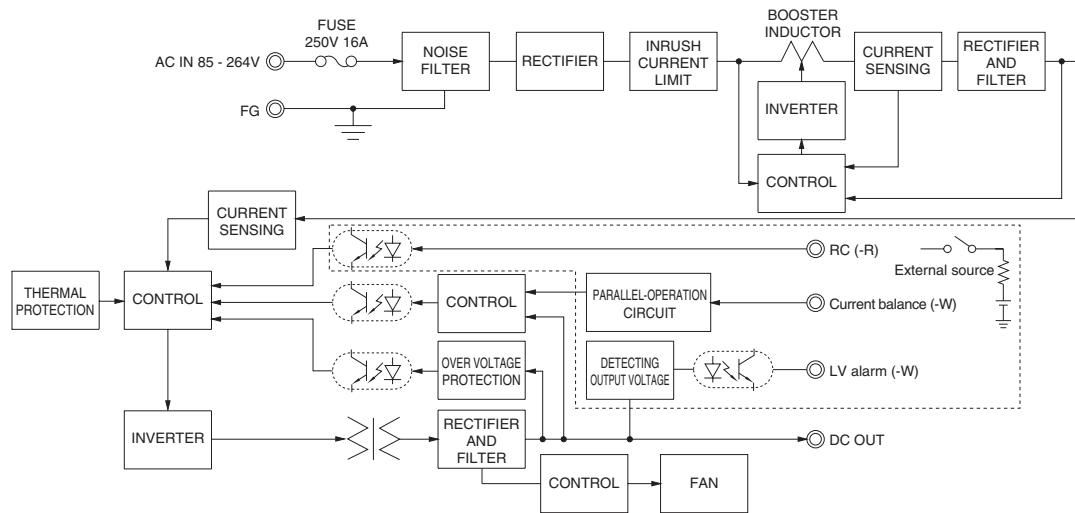
* Sound noise may be heard from the power supply when used for pulse load.

Features

- Cost-effective
- Longer life (see Instruction Manual)
- Low profile (meets 2U height = 61 mm or 2.40 inches)
- Wide operating temperature range (-20°C to +70°C see instruction manual)

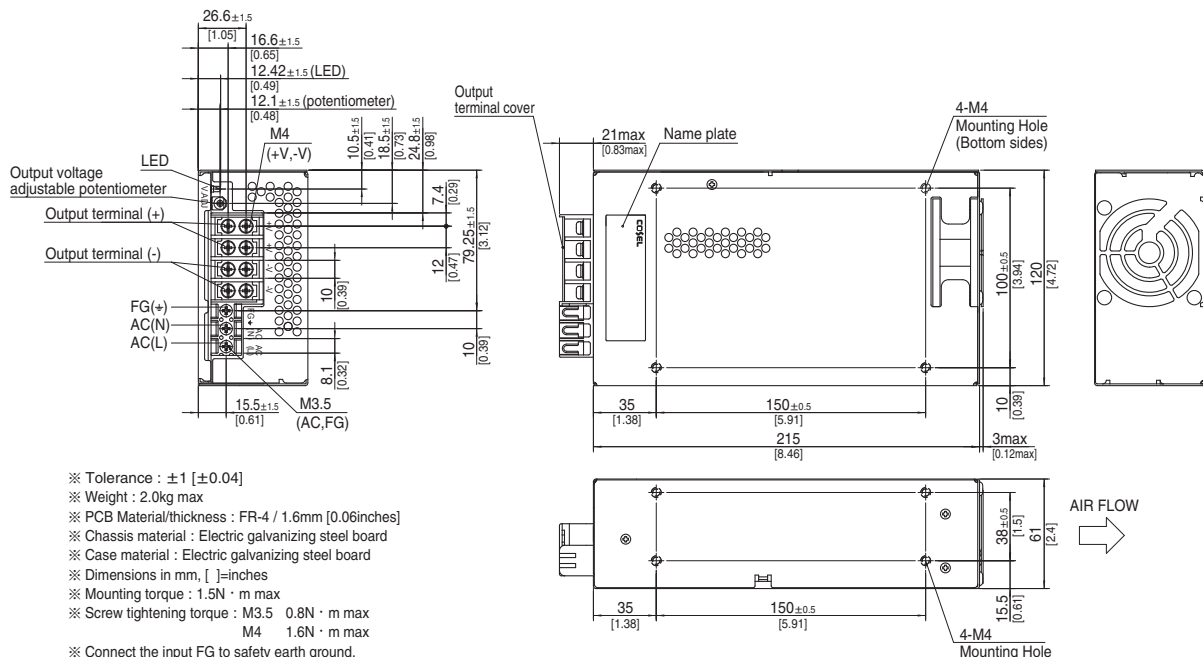
- Screw hold type terminal block
- Slow fan speed at no load
- Many optional functions
- Complies with SEMI F-47 (-U option, see Instruction Manual for details)

Block diagram



External view

The external size of -V option, -W option, -R option, and -T2 option is different from the standard model. See "5. Options and Others" in Instruction Manual for more details.



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Example recommended EMI/EMC filter
NAC-20-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *7
C : with Coating
G : Low leakage current
V : External potentiometer for
output voltage adjustment
W : Parallel operation,
LV alarm Remote sensing
R : Remote on/off
(Required external power source
or Option -Z□)
Z□ : AUX Output
Z1 : 5V
Z2 : 12V
Z3 : 24V

See 5.1 in Instruction Manual.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

SPECIFICATIONS

	MODEL		PLA1000F-12	PLA1000F-15	PLA1000F-24	PLA1000F-36	PLA1000F-48
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Output derating is required at AC85V - 115V. See 1.1 and 3.2 in Instruction Manual) *4				
	CURRENT[A]	ACIN 100V	12.5typ (Io=90%)				
		ACIN 115V	11.0typ (Io=100%)				
		ACIN 230V	5.5typ (Io=100%)				
	FREQUENCY[Hz]		50 / 60 (47 - 63)				
	EFFICIENCY[%]	ACIN 100V	82typ (Io=90%)	82typ (Io=90%)	85typ (Io=90%)	85typ (Io=90%)	84typ (Io=90%)
		ACIN 115V	82typ (Io=100%)	82typ (Io=100%)	85typ (Io=100%)	85typ (Io=100%)	84typ (Io=100%)
		ACIN 230V	85typ (Io=100%)	85typ (Io=100%)	88typ (Io=100%)	88typ (Io=100%)	87typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.98typ (Io=90%)				
		ACIN 115V	0.98typ (Io=100%)				
ACIN 230V		0.95typ (Io=100%)					
INRUSH CURRENT[A]	ACIN 100V	15/30typ (Io=90%) (Primary inrush current /Secondary inrush current) (More than 10sec to re-start)					
	ACIN 115V	15/30typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 10sec to re-start)					
	ACIN 230V	30/30typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 10sec to re-start)					
LEAKAGE CURRENT[ma]		1.5max (ACIN 115V / 240V, 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)					
OUTPUT	VOLTAGE[V]		12	15	24	36	48
	CURRENT[A]	ACIN 85-115V	Output derating is required at ACIN 115V or less (refer to instruction manual 3.2)				
		ACIN 115V-264V	84	67	42	28	21
	WATTAGE[W]	ACIN 85-115V	Output derating is required at ACIN 115V or less (refer to instruction manual 3.2)				
		ACIN 115V-264V	1008	1005	1008	1008	1008
	LINE REGULATION[mV] *8		48max	60max	96max	144max	192max
	LOAD REGULATION[mV] *8		100max	120max	150max	150max	300max
	RIPPLE[mVp-p]	0 to +50℃	120max	120max	120max	150max	150max
		*1 -20 to 0℃	160max	160max	160max	160max	400max
	RIPPLE NOISE[mVp-p]	0 to +50℃	150max	150max	150max	200max	200max
		*1 -20 to 0℃	180max	180max	180max	240max	500max
	TEMPERATURE REGULATION[mV]	0 to +50℃	120max	150max	240max	360max	480max
		-20 to +50℃	180max	180max	290max	440max	600max
	DRIFT[mV] *2		48max	60max	96max	144max	192max
START-UP TIME[ms]		700typ (ACIN 115V, Io=100%)					
HOLD-UP TIME[ms]		20typ (ACIN 115V, Io=100%)					
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		10.20 to 13.50	13.50 to 17.30	20.40 to 28.50	30.60 to 40.80	40.80 to 55.20	
OUTPUT VOLTAGE SETTING[V]		12.00 to 12.48	15.00 to 15.60	24.00 to 24.96	36.00 to 37.44	48.00 to 49.92	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically				
	OVERVOLTAGE PROTECTION[V]		14.40 to 17.40	18.00 to 21.80	28.80 to 34.80	43.20 to 52.20	57.00 to 67.20
	OPERATING INDICATION		LED (Green)				
	AUXILIARY OUTPUT		Optional (Option -Z□)				
	REMOTE SENSING		Optional (Option -W)				
	REMOTE ON/OFF		Optional (Option -R) Required external power source or auxiliary output (Option -Z□).				
ISOLATION	INPUT-OUTPUT • RC *3		AC3,000V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At room temperature)				
	INPUT-FG		AC2,000V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At room temperature)				
	OUTPUT • RC • AUX-FG *3		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At room temperature)				
	OUTPUT-RC • AUX *3		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At room temperature)				
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE *5		-20 to +70℃ (Output derating is required), 20 - 90%RH (Non condensing), 3,000m (10,000 feet) max				
	STORAGE TEMP.,HUMID.AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000 feet) max				
	VIBRATION		10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axes				
SAFETY AND NOISE REGULATIONS	IMPACT		196.1m/s² (20G), 11ms, once each X, Y and Z axes				
	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN				
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B				
HARMONIC ATTENUATOR *10		Complies with IEC61000-3-2 class A					

SPECIFICATIONS

OTHERS	CASE SIZE/WEIGHT	150×61×240mm [5.91×2.40×9.45 inches] (Excluding terminal block and screw) (W×H×D) / 2.8kg max
	COOLING METHOD	*9 Forced cooling (internal fan)
WARRANTY	WARRANTY	*6 5 years (subject to the operating conditions)

*1 This is the result of measurement of the testing board with capacitors of 22 μ F and 0.1 μ F placed at 150 mm from the output terminals by a 20 MHz oscilloscope or a ripple-noise meter equivalent to Keisoku-Giken RM103.
See 1.6 of Instruction Manual for more details.

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

*3 The RC/AUX terminal are added to option -R/-Z models. The RC/AUX terminals are isolated from input, output, and FG.

*4 Output power derating is required. As for DC input, consult us for advice.

*5 Output power derating is required. See 3.2 in Instruction Manual.

*6 See 3.3 in Instruction Manual for more details.

*7 Consult us about safety agency approvals for the models with optional functions.

*8 Consult us about dynamic load and input response.

*9 The fan speed slows down at no load.

*10 Consult us about other classes.

* Do not use the power supply in overcurrent conditions or in unspecified input voltage ranges. Otherwise the internal components may be damaged.

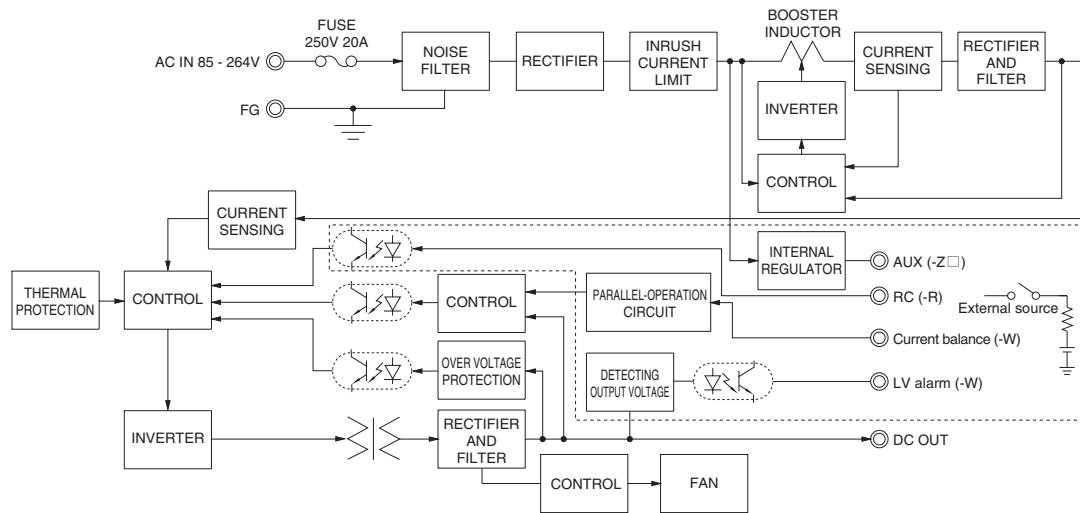
* Parallel operation is allowed for PLA1000F models with the -W option only.

* Sound noise may be heard from the power supply when used for pulse load.

Features

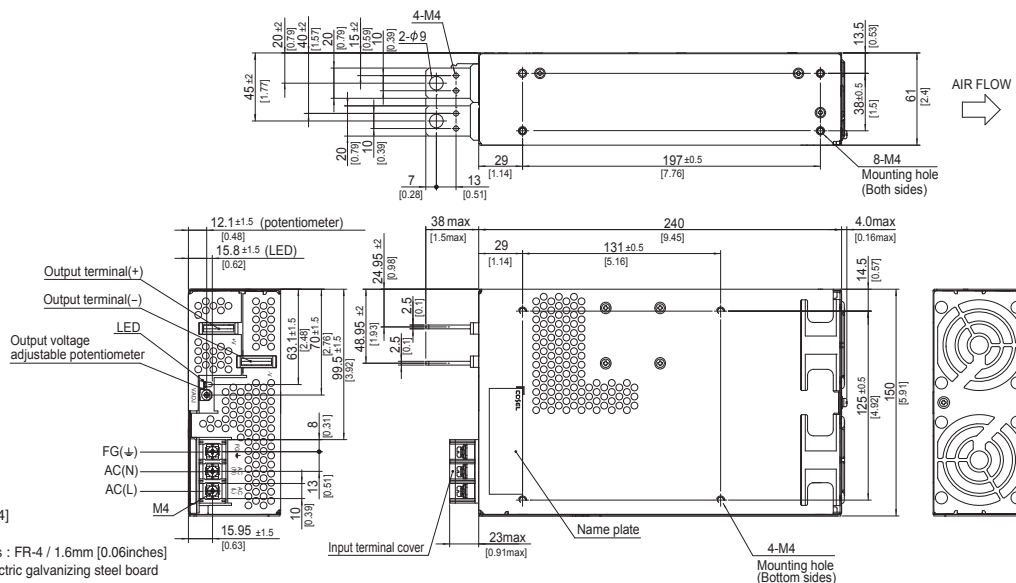
- Cost-effective
- Longer life (see Instruction Manual)
- Low profile (meets 2U height = 61 mm or 2.4 inches)
- Wide operating temperature range (-20°C to +70°C see instruction manual)
- Slow fan speed at no load
- Many optional functions

Block diagram



External view

The external size of -V option, -W option, -R option, and -Z□ option is different from the standard model. See "5. Options and Others" in Instruction Manual for more details.



- ※ Tolerance : $\pm 1 [\pm 0.04]$
- ※ Weight : 2.8kg max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06inches]
- ※ Chassis material : Electric galvanizing steel board
- ※ Case material : Electric galvanizing steel board
- ※ Dimensions in mm, []=inches
- ※ Mounting torque : 1.5N · m max
- ※ Screw tightening torque : 1.6N · m max
- ※ Connect the input FG to safety earth ground.

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Example recommended EMI/EMC filter
NAC-20-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series

* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *7
C : with Coating
G : Low leakage current
V : External potentiometer for
output voltage adjustment
W: Parallel operation,
LV alarm Remote sensing
R : Remote on/off
(Required external power source
or Option -Z□)
Z□ : AUX Output
Z1 : 5V
Z2 : 12V
Z3 : 24V

See 5.1 in Instruction Manual.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

SPECIFICATIONS

	MODEL		PLA1500F-12	PLA1500F-15	PLA1500F-24	PLA1500F-36	PLA1500F-48
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Output derating is required at AC85V - 115V. See 1.1 and 3.2 in Instruction Manual) *4				
	CURRENT[A]	ACIN 100V	18typ (Io=90%)				
		ACIN 115V	16typ (Io=100%)				
		ACIN 230V	8typ (Io=100%)				
	FREQUENCY[Hz]		50 / 60 (47 - 63)				
	EFFICIENCY[%]	ACIN 100V	82typ (Io=90%)	82typ (Io=90%)	85typ (Io=90%)	85typ (Io=90%)	84typ (Io=90%)
		ACIN 115V	82typ (Io=100%)	82typ (Io=100%)	85typ (Io=100%)	85typ (Io=100%)	84typ (Io=100%)
		ACIN 230V	85typ (Io=100%)	85typ (Io=100%)	88typ (Io=100%)	88typ (Io=100%)	87typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.98typ (Io=90%)				
		ACIN 115V	0.98typ (Io=100%)				
ACIN 230V		0.95typ (Io=100%)					
INRUSH CURRENT[A]	ACIN 100V	15/30typ (Io=90%) (Primary inrush current /Secondary inrush current) (More than 10sec to re-start)					
	ACIN 115V	15/30typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 10sec to re-start)					
	ACIN 230V	30/30typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 10sec to re-start)					
LEAKAGE CURRENT[ma]		1.5max (ACIN 115V / 240V, 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)					
OUTPUT	VOLTAGE[V]		12	15	24	36	48
	CURRENT[A]	ACIN 85-115V	Output derating is required at ACIN 115V or less (refer to instruction manual 3.2)				
		ACIN 115V-264V	125	100	64	42	32
	WATTAGE[W]	ACIN 85-115V	Output derating is required at ACIN 115V or less (refer to instruction manual 3.2)				
		ACIN 115V-264V	1500	1500	1536	1512	1536
	LINE REGULATION[mV] *8		48max	60max	96max	144max	192max
	LOAD REGULATION[mV] *8		100max	120max	150max	150max	300max
	RIPPLE[mVp-p] *1	0 to +50℃	120max	120max	120max	150max	150max
		-20 to 0℃	160max	160max	160max	160max	400max
	RIPPLE NOISE[mVp-p] *1	0 to +50℃	150max	150max	150max	200max	200max
		-20 to 0℃	180max	180max	180max	240max	500max
	TEMPERATURE REGULATION[mV]	0 to +50℃	120max	150max	240max	360max	480max
		-20 to +50℃	180max	180max	290max	440max	600max
	DRIFT[mV] *2		48max	60max	96max	144max	192max
	START-UP TIME[ms]		700typ (ACIN 115V, Io=100%)				
	HOLD-UP TIME[ms]		20typ (ACIN 115V, Io=100%)				
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		10.20 to 13.50	13.50 to 17.30	20.40 to 28.50	30.60 to 40.80	40.80 to 55.20	
OUTPUT VOLTAGE SETTING[V]		12.00 to 12.48	15.00 to 15.60	24.00 to 24.96	36.00 to 37.44	48.00 to 49.92	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically				
	OVERVOLTAGE PROTECTION[V]		14.40 to 17.40	18.00 to 21.80	28.80 to 34.80	43.20 to 52.20	57.00 to 67.20
	OPERATING INDICATION		LED (Green)				
	AUXILIARY OUTPUT		Optional (Option -Z□)				
	REMOTE SENSING		Optional (Option -W)				
	REMOTE ON/OFF		Optional (Option -R) Required external power source or auxiliary output (Option -Z□).				
ISOLATION	INPUT-OUTPUT • RC *3		AC3,000V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At room temperature)				
	INPUT-FG		AC2,000V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At room temperature)				
	OUTPUT • RC-FG *3		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At room temperature)				
	OUTPUT-RC *3		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At room temperature)				
ENVIRONMENT	OPERATING TEMP., HUMID.AND ALTITUDE *5		-20 to +70℃ (Output derating is required), 20 - 90%RH (Non condensing), 3,000m (10,000 feet) max				
	STORAGE TEMP., HUMID.AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000 feet) max				
	VIBRATION		10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axes				
	IMPACT		196.1m/s ² (20G), 11ms, once each X, Y and Z axes				
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN				
	CONDUCTED NOISE		Complies with FCC Part15 classA, VCCI-A, CISPR22-A, EN55011-A, EN55022-A, additional EMI/EMC Filter required for meeting class B				
	HARMONIC ATTENUATOR *10		Complies with IEC61000-3-2 class A				

SPECIFICATIONS

OTHERS	CASE SIZE/WEIGHT	178×61×268mm [7.01×2.40×10.55 inches] (Excluding terminal block and screw) (W×H×D) / 3.5kg max
	COOLING METHOD	*9 Forced cooling (internal fan)
WARRANTY	WARRANTY	*6 5 years (subject to the operating conditions)

*1 This is the result of measurement of the testing board with capacitors of 22 μ F and 0.1 μ F placed at 150 mm from the output terminals by a 20 MHz oscilloscope or a ripple-noise meter equivalent to Keisoku-Giken RM103.
See 1.6 of Instruction Manual for more details.

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

*3 The RC/AUX terminal are added to option -R/-Z models. The RC/AUX terminals are isolated from input, output, and FG.

*4 Output power derating is required. As for DC input, consult us for advice.

*5 Output power derating is required. See 3.2 in Instruction Manual.

*6 See 3.3 in Instruction Manual for more details.

*7 Consult us about safety agency approvals for the models with optional functions.

*8 Consult us about dynamic load and input response.

*9 The fan speed slows down at no load.

*10 Consult us about other classes.

* Do not use the power supply in overcurrent conditions or in unspecified input voltage ranges. Otherwise the internal components may be damaged.

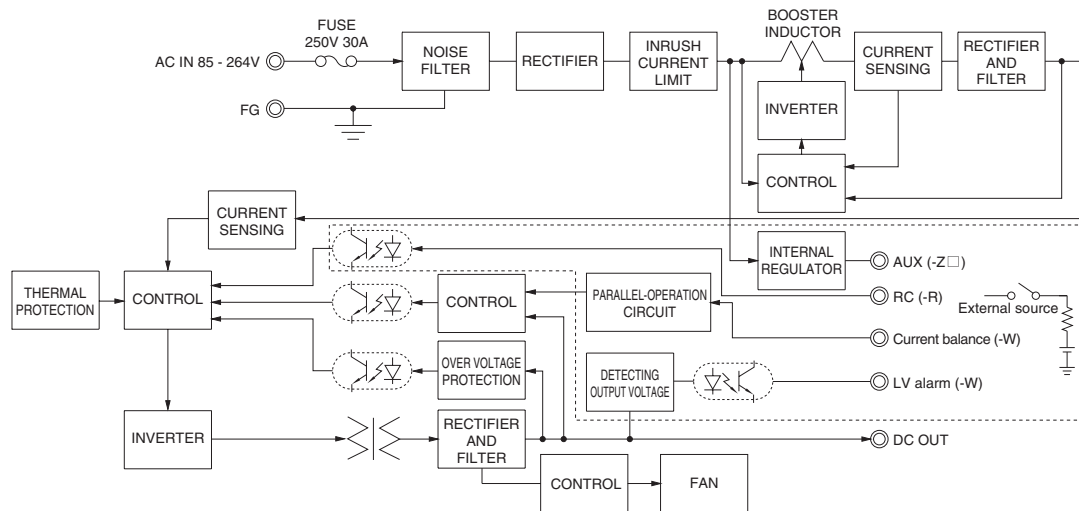
* Parallel operation is allowed for PLA1500F models with the -W option only.

* Sound noise may be heard from the power supply when used for pulse load.

Features

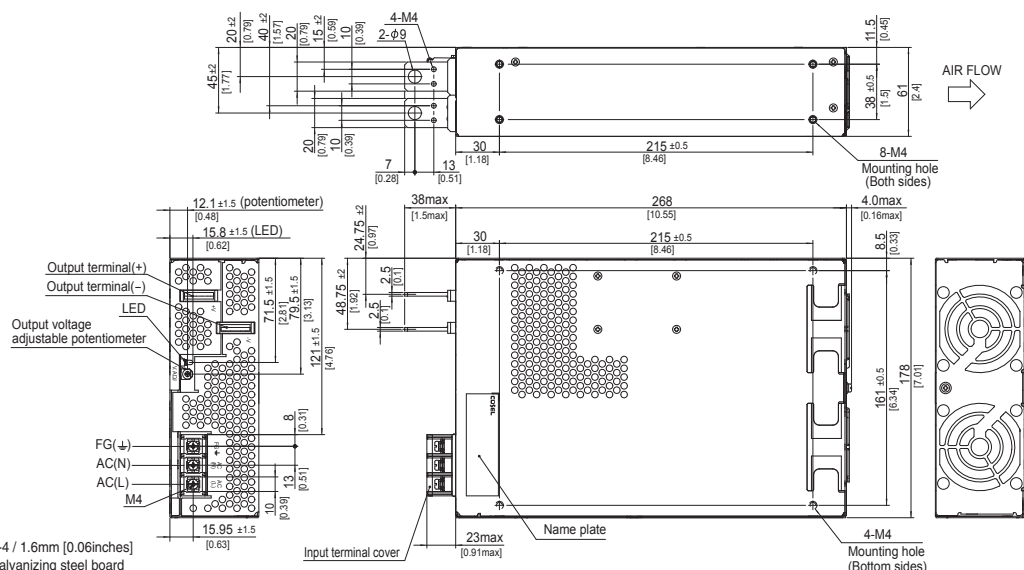
- Cost-effective
- Longer life (see Instruction Manual)
- Low profile (meets 2U height = 61 mm or 2.4 inches)
- Wide operating temperature range (-20°C to +70°C see instruction manual)
- Slow fan speed at no load
- Many optional functions

Block diagram



External view

The external size of -V option, -W option, -R option, and -Z□ option is different from the standard model. See "5. Options and Others" in Instruction Manual for more details.



※ Tolerance : ± 1 [±0.04]
 ※ Weight : 3.5kg max
 ※ PCB Material/thickness : FR-4 / 1.6mm [0.06inches]
 ※ Chassis material : Electric galvanizing steel board
 ※ Case material : Electric galvanizing steel board
 ※ Dimensions in mm, [] =inches
 ※ Mounting torque : 1.5N · m max
 ※ Screw tightening torque : 1.6N · m max
 ※ Connect the input FG to safety earth ground.

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection circuit	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
PLA15F	Flyback converter	100	0.4 *1	250V 2.5A	Thermistor	CEM-3	Yes		Yes	No
PLA30F	Flyback converter	130	0.7 *1	250V 3.15A	Thermistor	CEM-3	Yes		Yes	No
PLA50F	Active filter	60 to 440	0.7 *1	250V 2.5A	Thermistor	CEM-3	Yes		Yes	No
	Flyback converter	130								
PLA100F	Active filter	40 to 160	1.2 *2	250V 3.15A	Thermistor	CEM-3	Yes		Yes	No
	Flyback converter	20 to 150 *3								
PLA150F	Active filter	40 to 160	1.7 *2	250V 4A	Thermistor	CEM-3	Yes		Yes	No
	Flyback converter	20 to 150 *3								
PLA300F	Active filter	60	3.4 *2	250V 10A	Thermistor	CEM-3	Yes		Yes	No
	Forward converter	140								
PLA600F	Active filter	60	6.7 *2	250V 16A	SCR	FR-4		Yes	Yes	*4
	Forward converter	220								
PLA1000F	Active filter	65	12.5 *2	250V 20A	TRIAC	FR-4		Yes	Yes	*4
	Forward converter	210								
PLA1500F	Active filter	65	18.0 *2	250V 30A	TRIAC	FR-4		Yes	Yes	*4
	Forward converter	210								

*1 The input current shown is at ACIN 100V and 100% load.

*2 The input current shown is at ACIN 100V and 90% load.

*3 The burst mode frequency varies according to the operating conditions. Consult us for more details.

*4 Parallel operation is possible with the -W option. See "5. Options and Others" in Instruction Manual.

1	Function	PLA-22
1.1	Input Voltage Range	PLA-22
1.2	Inrush Current Limiting	PLA-22
1.3	Overcurrent Protection	PLA-22
1.4	Overvoltage Protection	PLA-22
1.5	Thermal Protection	PLA-23
1.6	Output Ripple and Ripple Noise	PLA-23
1.7	Output Voltage Adjustment	PLA-23
1.8	Isolation	PLA-23
1.9	Low Power Consumption	PLA-23
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2	Series Operation and Parallel Operation	PLA-24
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3	Assembling and Installation Method	PLA-24
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1 Function

1.1 Input Voltage Range

- The rated input voltage range of the power supply is AC85-264V (See SPECIFICATIONS for more details).
- To comply with the safety standards, use the power supply with the input voltage range of AC100-240V (50/60Hz).
- If the input voltage is outside the rated range, the power supply may not operate in accordance with the specifications and/or start hunting or fail.
- If the input voltage changes suddenly, the output voltage may go out of the specifications. Consult us for more details.
- When the power supply is used with DC voltage input, an external DC fuse is required for protection. Consult us for more details.

● PLA15F, PLA30F

- Power factor correction is not built-in. If multiple units are used in a same system, the input harmonic current standard may not be met. Consult us more details.

● PLA100F, PLA150F

- If the input voltage is more than AC250V, power factor correction does not work and the power factor deteriorates. Consult us for more details.

● PLA15F, PLA30F, PLA50F, PLA100F, PLA150F

- The power supply is designed to handle instant voltage dip but output power derating is necessary.

· Use Conditions

Maximum output power	
PLA15F	7.5W
PLA30F	10W
PLA50F	15W
PLA100F	40W
PLA150F	60W
Input AC50V (DC70V) Duty 1s/30s	

*Avoid using the power supply under the above-mentioned conditions for more than 1 second continuously as the power supply may be damaged.

● PLA300F, PLA600F

- The -U option is available for PLA300F and PLA600F to handle instant voltage dip of less than AC85V but output power derating is necessary. (See 5. Options and Others.)

1.2 Inrush Current Limiting

- Inrush current protection is built-in.
- If you need to use a switch on the input side, select one that can withstand an input inrush current.

● PLA15F, PLA30F, PLA50F, PLA100F, PLA150F, PLA300F

- Thermistor is used in the inrush current limiting circuit. When you turn the power supply on and off repeatedly within a short period of time, have enough intervals for the power supply to cool down before being turned on again.

● PLA600F, PLA1000F, PLA1500F

- Thyristor and TRIAC technique is used in the inrush current limiting circuit. When you turn the power supply on and off repeatedly within a short period of time, have enough intervals for the inrush current protection to become active.
- There will be primary inrush current and secondary inrush current flowing because thyristor and TRIAC technique is used for the inrush current limiting circuit.

1.3 Overcurrent Protection

- Overcurrent protection is built-in. It works at more than 105% of the rated output current. The power supply recovers automatically when the overcurrent condition is removed. Do not use the power supply under a short-circuit or overcurrent condition.
- Intermittent Operation Mode
When overcurrent protection works and the output voltage drops, the output voltage goes into intermittent mode so that the average output current can decrease.
- If the power supply is turned on with an overcurrent load, it will immediately go into intermittent mode and may not start up. See the characteristics below. (PLA15F, 30F, 50F, 100F, and 150F)

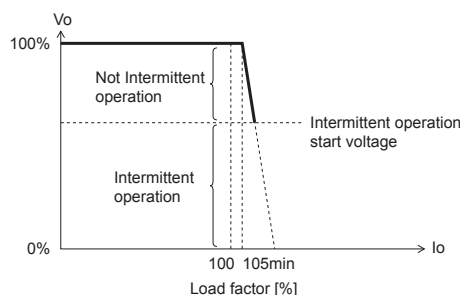


Fig.1.1 Overcurrent protection characteristics

1.4 Overvoltage Protection

- Overvoltage protection is built-in. If overvoltage protection works, shut down the input voltage, wait more than Table 1.1, and turn on the input voltage again to recover the output voltage. The recovery time varies depending on the input voltage, etc.

Table 1.1 Recovery time

Model name	Recovery time
PLA15F, PLA30F, PLA50F, PLA100F, PLA150F, PLA300F, PLA600F	3 minutes
PLA1000F, PLA1500F	4 minutes

Remarks :

Avoid applying an overrated voltage to the output terminals as it may cause the power supply to malfunction or fail. In case the above-mentioned situation is expected in operating such loads as a motor, for example, consult us for advice.

1.5 Thermal Protection

● PLA15F, PLA30F, PLA50F, PLA100F, PLA150F

■ These models are not equipped with thermal protection.

● PLA300F, PLA600F, PLA1000F, PLA1500F

■ Thermal protection is built-in.

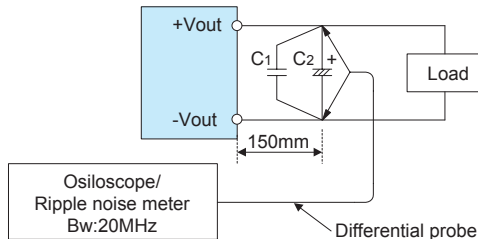
Thermal protection will work under the following conditions and the power supply will shut down.

- ① When the operating temperature and the output current greatly exceed the derating curve.
- ② When the built-in cooling fan stops or the air flow from the fan is obstructed.

If thermal protection works, switch off the input voltage and eliminate the conditions causing thermal protection to work. Allow enough time for the unit to cool off before switching on the input voltage again to recover the output voltage.

1.6 Output Ripple and Ripple Noise

■ Output ripple noise may be influenced by the measuring environment. The measuring method shown in Fig. 1.2 is recommended.



C1: Film capacitor 0.1µF

C2: Aluminum electrolytic capacitor 22µF

Fig.1.2 Measuring method of Ripple and Ripple Noise

Remarks :

When measuring output ripple or ripple noise with an oscilloscope, do not let the oscilloscope's GND cable cross the magnetic flux from the power supply. Otherwise there may be electrical potential generated on the GND cable and the measuring result may not be accurate.

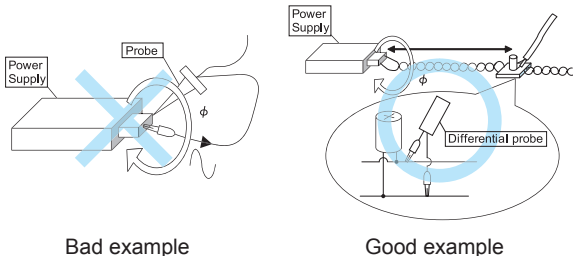


Fig.1.3 Example of measuring output ripple and ripple noise

1.7 Output Voltage Adjustment

■ The output voltage can be adjusted within the specified range by turning the built-in potentiometer clockwise (up) or counterclockwise (down).

■ Please operate the potentiometer slowly.

● PLA300F, PLA600F, PLA1000F, PLA1500F

■ With the option -V, the power supply comes with an external potentiometer instead of a built-in potentiometer. (See 5 Options and Others).

1.8 Isolation

■ For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for the start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

1.9 Low Power Consumption

● PLA15F, PLA100F, PLA150F

■ These power supplies are designed for low power consumption at no load. (No load power consumption: PLA15F:1.0W typ, PLA100F/150F:1.5W typ)

■ When the load factor is 0 - 35% (PLA15F) and 0- 30% (PLA100F and PLA150F), the switching power loss is reduced by burst operation, which will cause ripple and ripple noise to go beyond the specifications.

■ Ripple and ripple noise during burst operation will change depending on the input voltage and the output current. Consult us for advice on how to reduce ripple and ripple noise.

■ When there is a need to measure the stand-by power consumption, measure it by using the average mode of the tester. The measuring environment may influence the result. Consult us for more details.

1.10 Remote ON/OFF

● PLA15F, PLA30F, PLA50F

■ These models do not have the remote ON/OFF function.

● PLA100F, PLA150F, PLA300F, PLA600F, PLA1000F, PLA1500F

■ The -R option is available for these models. With the -R option, remote ON/OFF is possible. See "5 Options and Others" for more details.

1.11 Remote Sensing

● PLA15F, PLA30F, PLA50F, PLA100F, PLA150F, PLA300F

■ These models do not have the remote sensing function.

● PLA600F, PLA1000F, PLA1500F

■ The -W option is available. With the -W option, remote sensing is possible. See "5 Options and Others" for more details.

1.12 LV Alarm

● PLA15F, PLA30F, PLA50F, PLA100F, PLA150F, PLA300F

■ These models do not have the LV alarm function.

● PLA600F, PLA1000F, PLA1500F

■The -W option is available. With the -W option, the power supply can give an LV alarm. See "5 Options and Others" for more details.

2 Series Operation and Parallel Operation

2.1 Series Operation

■The power supplies can be used in series connection. The output current in series operation must be lower than the rated current of the power supply with the lowest rated current among the power supplies connected in series. Make sure no current exceeding the rated current flows into a power supply.

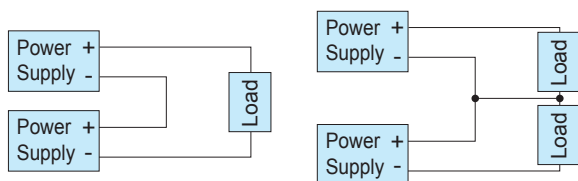


Fig.2.1 Examples of connecting in series operation

2.2 Parallel Operation

■Redundant operation is possible by wiring as shown below.

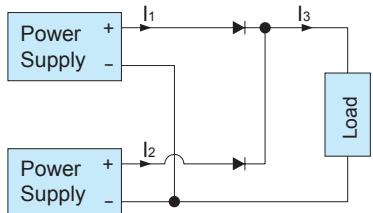


Fig.2.2 Example of redundancy operation

■Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .

Make sure the value of I_3 does not exceed the rated output current of the power supply.

$$I_3 \leq \text{the rated current value}$$

● PLA15F, PLA30F, PLA50F, PLA100F, PLA150F, PLA300F

■Parallel operation is not possible.

● PLA600F, PLA1000F, PLA1500F

■The -W option is available. With the -W option, parallel operation is possible. See "5 Options and Others" for more details.

3 Assembling and Installation Method

3.1 Installation Method

■Do not insert a screw more than 6mm away from the outside of a power supply to keep enough insulation distance between the screw and internal components.

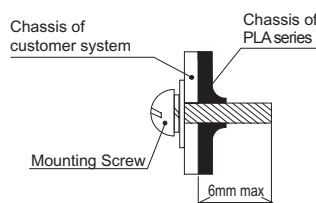
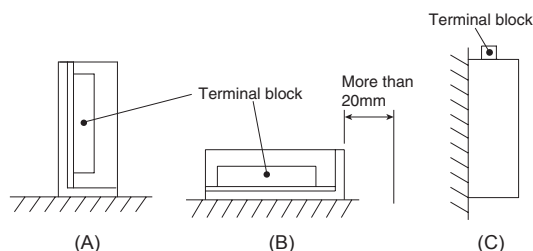


Fig.3.1 Mounting screw

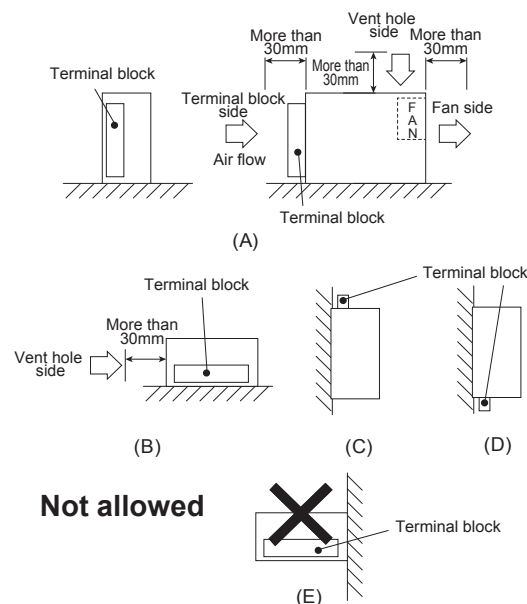
● PLA15F, PLA30F, PLA50F, PLA100F, PLA150F



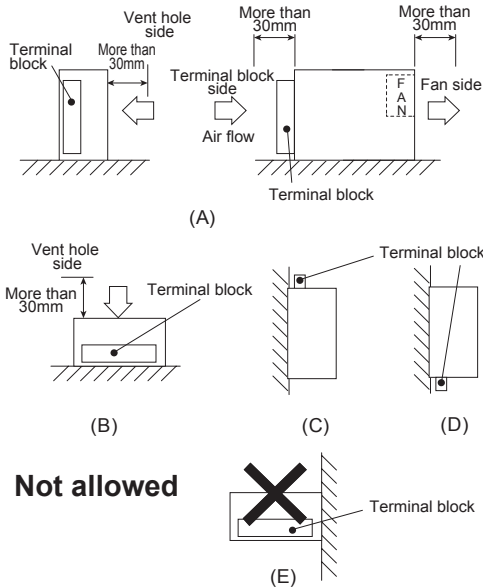
■If you use two or more power supplies side by side, please keep a sufficient distance between them to allow enough air ventilation.

■Ambient temperature around each power supply should not exceed the temperature range shown in the derating curve.

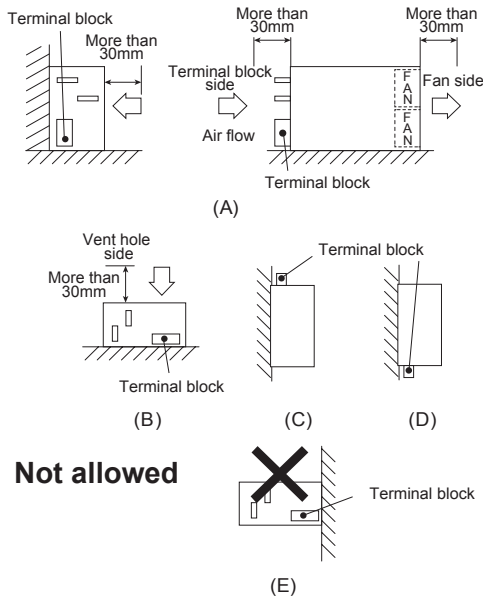
● PLA300F



● PLA600F



● PLA1000F, PLA1500F



- Avoid installation method (E) as it gives excessive stress to the mounting holes.
- Do not block air flow of the built-in fan (terminal block and ventilation hole).
- If the power supply is used in a dusty environment, use an air-filter. Make sure air flow is not blocked.
- If the built-in fan stops, thermal protection will work and the output will stop. Periodic maintenance of the built-in fan is necessary to enhance the power supply's reliability.
- The expected life (R(t)=90%) of the built-in fan varies depending on the operating condition.

3.2 Derating

■ Input Voltage Derating Curve

The input voltage derating curve is shown in Fig. 3.2.

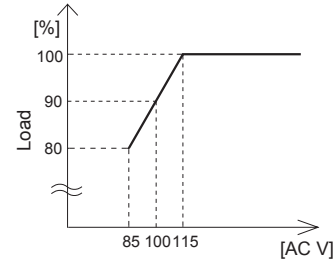


Fig.3.2 Input voltage derating curve

■ Ambient Temperature Derating Curve

The derating curves by the ambient temperature are shown in Fig. 3.3 to Fig. 3.10.

*The specifications of ripple and ripple noise change in the shaded area.

(1) Temperature at Point A and Point B

● PLA15F, PLA30F, PLA50F, PLA100F, PLA150F

■ The operating temperature can also be designed by the case temperature with these models.

The temperatures in the tables show not the limit of use but the temperature of an expected life.

■ Make sure the case temperature at point A and point B is less than the temperatures shown in Table 3.1 to Table 3.5.

■ When the power supply is used with a forced cooling, make sure the case temperature requirements shown in Table 3.1 to Table 3.5 are met.

■ The expected life of the power supply at the highest allowed temperature at point A and point B is 3 years. See "3.3 Expected Life and Warranty" to prolong the expected life.

See External View for the position of Point A and Point B.

Table 3.1 Temperature of Point A PLA15F-□

Mounting Method	Load factor	Max temperature [°C]
A, B, C	50% < $I_o \leq 100\%$	78
	$I_o \leq 50\%$	85

Table 3.2 Temperature of Point A PLA30F-□

Mounting Method	Load factor	Max temperature [°C]
A	50% < $I_o \leq 100\%$	80
	$I_o \leq 50\%$	88
B, C	50% < $I_o \leq 100\%$	72
	$I_o \leq 50\%$	82

Table 3.3 Temperature of Point A PLA50F-□

Mounting Method	Load factor	Max temperature [°C]
A	50% < $I_o \leq 100\%$	78
	$I_o \leq 50\%$	81
B, C	50% < $I_o \leq 100\%$	66
	$I_o \leq 50\%$	71

Table 3.4 Temperature of Point A PLA100F-□

Mounting Method	Load factor	Max temperature [°C]
A, B, C	$I_o \leq 100\%$	81

Table 3.5 Temperature of Point A, Point B PLA150F-□

Mounting Method	Load factor	Max temperature [°C]	
		Point A	Point B
A, B, C	$I_o \leq 100\%$	85	78

(2) Derating Curves by Ambient Temperature

■ The derating curve by the ambient temperature shows the operating temperature range for a 3-year continuous use. It shows not the limit of use but the temperature of an expected life. Consult us for the operation limit temperature.

● PLA15F

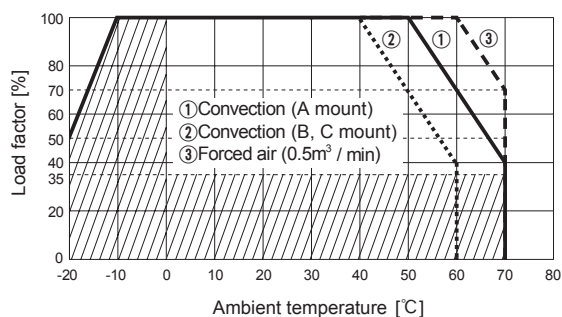


Fig.3.3 Ambient temperature derating curve for PLA15F

● PLA30F

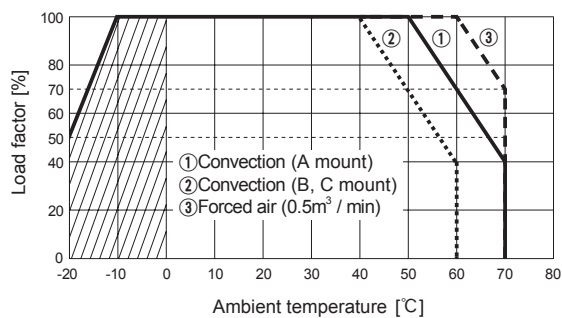


Fig.3.4 Ambient temperature derating curve for PLA30F

● PLA50F

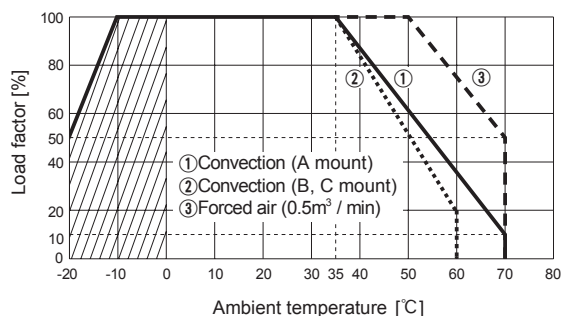


Fig.3.5 Ambient temperature derating curve for PLA50F-5

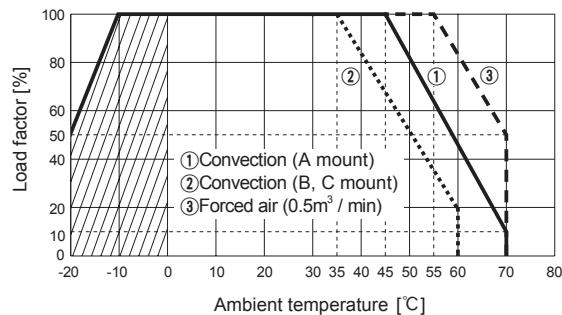


Fig.3.6 Ambient temperature derating curve for PLA50F-12, -15, -24

● PLA100F, PLA150F

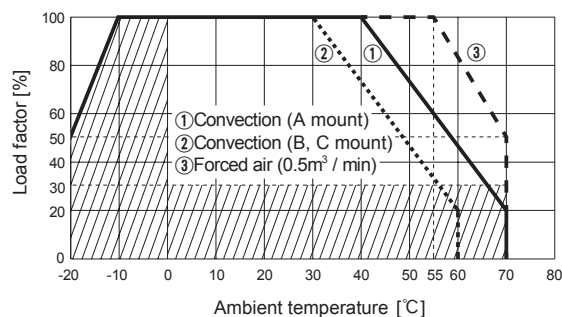


Fig.3.7 Ambient temperature derating curve for PLA100F/150F-12, -15

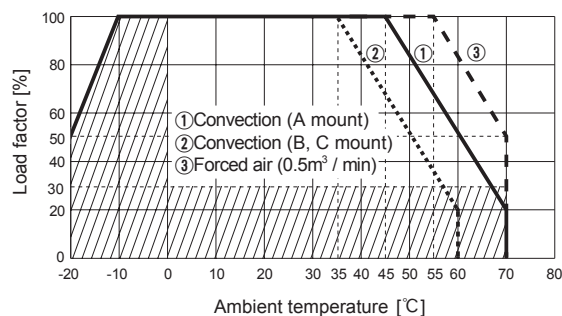


Fig.3.8 Ambient temperature derating curve for PLA100F/150F-24, -36, -48

● PLA15F, PLA30F, PLA50F, PLA100F, PLA150F

■ The ambient temperature should be measured 5 to 10 cm away from the power supply so that it won't be influenced by the heat from the power supply. Please consult us for more details.

● PLA300F

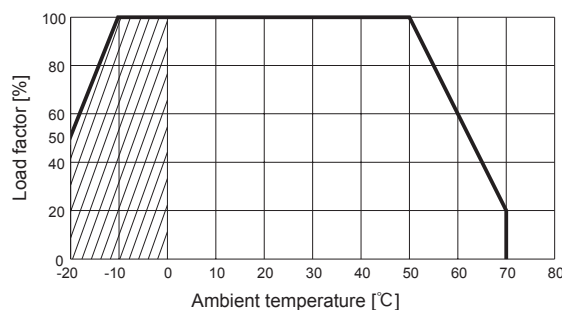


Fig.3.9 Ambient temperature derating curve for PLA300F

● PLA600F, PLA1000F, PLA1500F

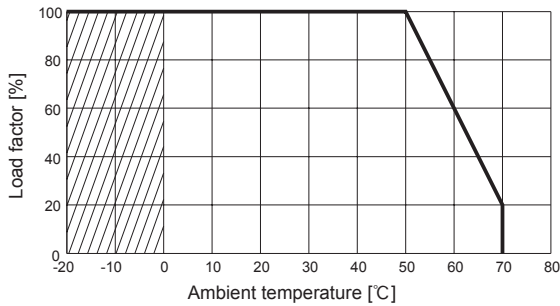


Fig.3.10 Ambient temperature derating curve for PLA600F/PLA1000F/PLA1500F

● PLA300F, PLA600F, PLA1000F, PLA1500F

■ The ambient temperature is defined as the temperature of the air (at the terminal block side) that the built-in cooling fan blows into the power supply. Please pay attention to the heat generated by the input and output wires. Please consult us for more details.

3.3 Expected Life and Warranty

■ Expected Life

The expected life of the power supply is shown below.

● PLA15F, PLA30F

Table 3.6 Expected lifetime (PLA15F, PLA30F)

Mounting Method	Cooling Method	Average ambient temperature	Expected lifetime [years]	
			$I_o \leq 50\%$	$I_o \leq 100\%$
A	Convection	Ta = 40°C	7	5
		Ta = 50°C	5	3
B, C	Convection	Ta = 30°C	7	5
		Ta = 40°C	5	3
A, B, C	Forced air cooling	Ta = 50°C	5	5
		Ta = 60°C	5	3

● PLA50F

Table 3.7 Expected lifetime (PLA50F-5)

Mounting Method	Cooling Method	Average ambient temperature	Expected lifetime [years]	
			$I_o \leq 50\%$	$I_o \leq 100\%$
A, B, C	Convection	Ta = 25°C	7	5
		Ta = 35°C	5	3
A, B, C	Forced air cooling	Ta = 40°C	7	5
		Ta = 50°C	7	3

Table 3.8 Expected lifetime (PLA50F-12, -15, -24)

Mounting Method	Cooling Method	Average ambient temperature	Expected lifetime [years]	
			$I_o \leq 50\%$	$I_o \leq 100\%$
A	Convection	Ta = 35°C	7	5
		Ta = 45°C	5	3
B, C	Convection	Ta = 25°C	7	5
		Ta = 35°C	5	3
A, B, C	Forced air cooling	Ta = 45°C	7	5
		Ta = 55°C	7	3

● PLA100F, PLA150F

Table 3.9 Expected lifetime (PLA100F/PLA150F)

Mounting Method	Cooling Method	Average ambient temperature	Expected lifetime [years]	
			$I_o \leq 50\%$	$I_o \leq 100\%$
A	Convection	Ta = 30°C	10	5
		Ta = 40°C	5	3
B, C	Convection	Ta = 20°C	10	5
		Ta = 30°C	5	3
A, B, C	Forced air cooling	Ta = 40°C	10	5
		Ta = 55°C	5	3

● PLA300F, PLA600F, PLA1000F, PLA1500F

Table 3.10 Expected lifetime (PLA300F/PLA600F/PLA1000F/PLA1500F)

Mounting Method	Cooling method	Average ambient temperature	Expected lifetime [years]	
			$I_o \leq 50\%$	$I_o \leq 100\%$
All direction	Forced air cooling (internal fan)	Ta = 30°C	10	7
		Ta = 40°C	7	5
		Ta = 50°C	5	3

* This lifetime includes a built-in fan lifetime.

■ The built-in cooling fan should be changed periodically. The expected life time (R(t) = 90%) of the built-in fan depends on the operating condition as shown in Fig. 3.11 (PLA300F/PLA600F), Fig. 3.12 (PLA1000F/PLA1500F).

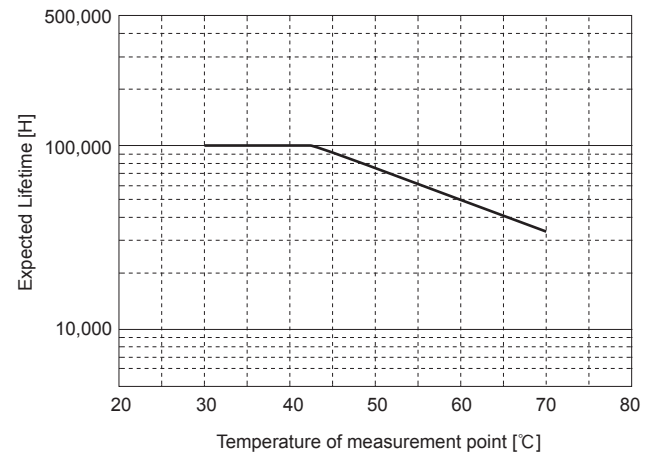


Fig.3.11 Expected lifetime of fan (PLA300F/PLA600F)

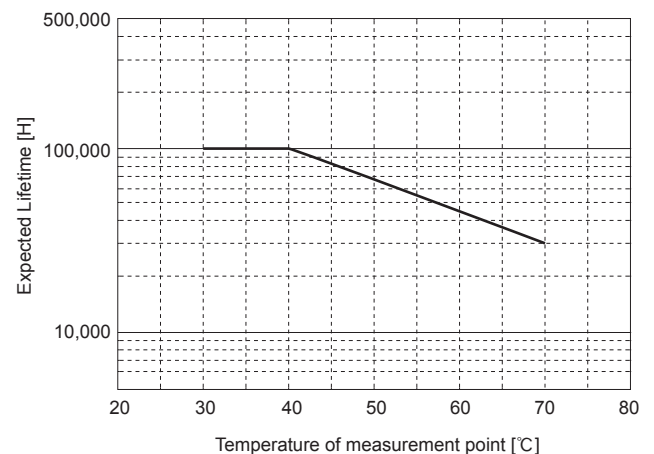


Fig.3.12 Expected lifetime of fan (PLA1000F/PLA1500F)

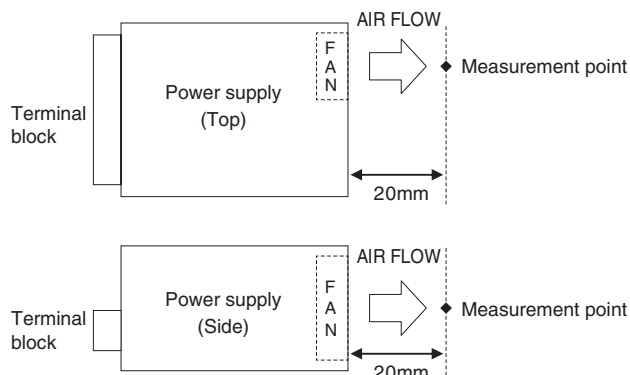


Fig.3.13 Temperature of measurement point for fan lifetime (PLA300F, PLA600F)

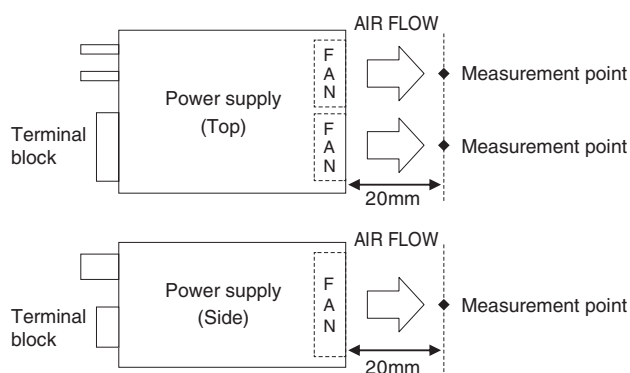


Fig.3.14 Temperature of measurement point for fan lifetime (PLA1000F, PLA1500F)

■ Warranty

The maximum warranty period is 5 years as shown in Table 3.11 to Table 3.15.

● PLA15F, PLA30F

Table 3.11 Warranty (PLA15F/PLA30F)

Mounting	Cooling method	Average ambient temperature	Warranty [years]	
			Io ≤ 50%	Io ≤ 100%
A	Convection	Ta = 40°C	5	5
		Ta = 50°C	5	3
B, C	Convection	Ta = 30°C	5	5
		Ta = 40°C	5	3
A, B, C	Forced air cooling	Ta = 50°C	5	5
		Ta = 60°C	5	3

● PLA50F

Table 3.12 Warranty (PLA50F-5)

Mounting	Cooling method	Average ambient temperature	Warranty [years]	
			Io ≤ 50%	Io ≤ 100%
A, B, C	Convection	Ta = 25°C	5	5
		Ta = 35°C	5	3
A, B, C	Forced air cooling	Ta = 40°C	5	5
		Ta = 50°C	5	3

Table 3.13 Warranty (PLA50F-12, -15, -24)

Mounting	Cooling method	Average ambient temperature	Warranty [years]	
			Io ≤ 50%	Io ≤ 100%
A	Convection	Ta = 35°C	5	5
		Ta = 45°C	5	3
B, C	Convection	Ta = 25°C	5	5
		Ta = 35°C	5	3
A, B, C	Forced air cooling	Ta = 45°C	5	5
		Ta = 55°C	5	3

● PLA100F, PLA150F

Table 3.14 Warranty (PLA100F/PLA150F)

Mounting	Cooling method	Average ambient temperature	Warranty [years]	
			Io ≤ 50%	Io ≤ 100%
A	Convection	Ta = 30°C	5	5
		Ta = 40°C	5	3
B, C	Convection	Ta = 20°C	5	5
		Ta = 30°C	5	3
A, B, C	Forced air cooling	Ta = 40°C	5	5
		Ta = 55°C	5	3

● PLA300F, PLA600F, PLA1000F, PLA1500F

Table 3.15 Warranty (PLA300F/PLA600F/PLA1000F/PLA1500F)

Mounting	Cooling method	Average ambient temperature	Warranty [years]	
			Io ≤ 50%	Io ≤ 100%
All direction	Forced air cooling (internal fan)	Ta = 40°C	5	5
		Ta = 50°C	5	3

4 Ground

■ When installing the power supply, make sure the FG terminal and the chassis (at more than 2 places) are connected to the safety earth ground.

5 Options and Others

5.1 Outline of Options

● -C (PLA15F, PLA30F, PLA50F, PLA100F, PLA150F, PLA300F, PLA600F, PLA1000F, PLA1500F)

· With the -C option, the internal PCB has a conformal coating for anti-humidity.

● -G (PLA300F, PLA600F, PLA1000F, PLA1500F)

- With the -G option, the leakage current of the power supply is reduced.
- The differences between the option -G models and the standard models are shown below.

Table 5.1 Low leakage current type

Leakage Current (AC240V 60Hz)	0.15mA max
Conducted Noise	N/A
Output Ripple Noise	Please contact us for details about Ripple Noise

* This is the result of measurement of the testing board with capacitors of 22μF and 0.1μF placed at 150 mm from the output terminals by a 20 MHz oscilloscope or a ripple-noise meter equivalent to Keisoku-Giken RM103.

● -V (PLA300F, PLA600F, PLA1000F, PLA1500F)

- With the -V option, the power supply comes with an external potentiometer connector instead of a built-in potentiometer.
- The appearance of the -V models is different from that of the standard models. Contact us for more details.
- Note that if the power supply is turned on with CN3 open, the output voltage will make a big drop.

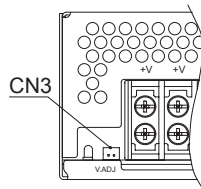


Fig.5.1 Front view of option-V (PLA300F, PLA600F)

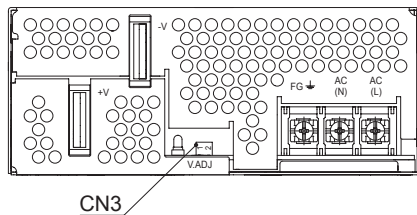


Fig.5.2 Front view of option-V (PLA1000F, PLA1500F)

● -U (PLA300F, PLA600F)

- With the -U option, the power supply can handle an instantaneous input voltage dip (output power derating is required).
- Operating condition (as per SEMI F-47)

Maximum output power * () is 5V output model.

PLA300F	120W (100W)
PLA600F	240W (200W)
Input AC50V	
Duty 1s/30s	

* Do not continue the above-mentioned operating conditions for more than 1 second. Otherwise the power supply may be damaged.

● -R (PLA100F, PLA150F, PLA300F, PLA600F, PLA1000F, PLA1500F)

- The -R option makes it possible to switch on or off the output by applying voltage to the RC terminals of the power supply from an external power source.
- The appearance of the option -R models is different from that of the standard models.
- Designated harnesses for the RC terminals are available for sale. See Optional Parts for more details.
- The -R option models have extra connectors. Please contact us for more details.

Table 5.2 Remote on/off operating conditions

Model Name	Built-in Resistor Ri [Ω]	Voltage between RC and RCG [V]		Input Current [mA]
		Output ON	Output OFF	
PLA100F, PLA150F, PLA300F, PLA600F PLA1000F, PLA1500F	780	4.5 - 12.5	0 - 0.5	(20max)

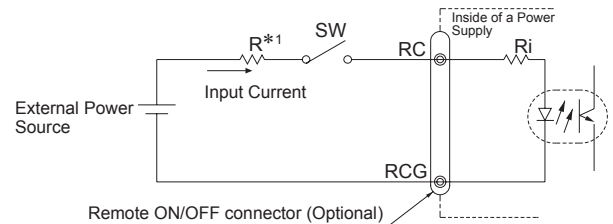


Fig.5.3 Example of using a remote ON/OFF circuit

*1 If the external voltage applied to the -RC terminals is 4.5 - 12.5V, the current limiting resistor is not necessary. If the voltage applied is more than 12.5V, make sure the current limiting resistor R is used.

The value of the current limiting resistor is obtained by the following formula:

$$R[\Omega] = \frac{V_{cc} \cdot (1.1 + R_i \times 0.005)}{0.005} \quad V_{cc} : \text{External Power Source}$$

* Note that reversed connection damages internal components of the power supply.

* The remote control circuit is isolated from input, output and FG.

■Remote on/off control for PLA100F, PLA150F, and PLA300F

- Remote control connectors are added. Contact us for more details.
- Make sure there is an interval of more than 2 seconds in the on/off cycle. If the interval is shorter, the start-up time may become longer (approx. 2 seconds).

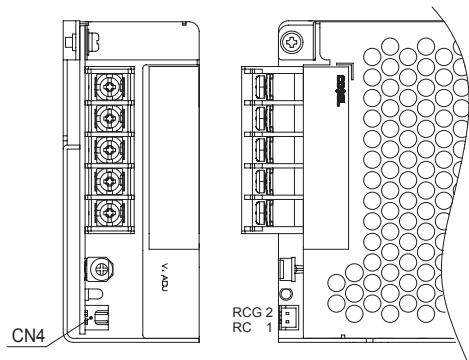


Fig.5.4 Example of option -R (PLA100F, PLA150F)

Table 5.3 Pin configuration and function of CN4

PIN	FUNCTION
1	RC :Remote ON/OFF
2	RCG:Remote ON/OFF (GND)

Table 5.4 Mating connectors and terminals on CN4

Connector	Housing	Terminal	Mfr
CN4	B2B-XH-AM	XHP-2	
		BXH-001T-P0.6 or SXH-001T-P0.6	J.S.T.

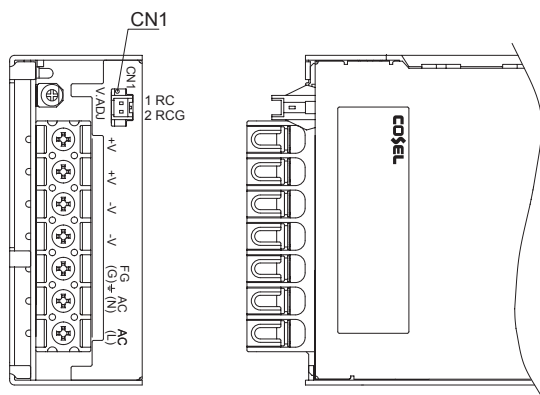


Fig.5.5 Example of option -R (PLA300F)

Table 5.5 Pin configuration and function of CN1

PIN	FUNCTION
1	RC :Remote ON/OFF
2	RCG:Remote ON/OFF (GND)

Table 5.6 Mating connectors and terminals on CN1

Connector	Housing	Terminal	Mfr
CN1	XARR-02V	XAP-02V-1	
		SXA-001T-P0.6	J.S.T.

■Remote on/off control for PLA600F

- The appearance of the -R option model is different from that of the standard model as CN1 is added. Contact us for more details.

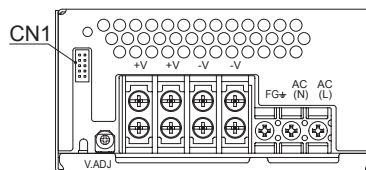


Fig.5.6 Front view of option -R (PLA600F)

■Remote on/off control for PLA1000F and PLA1500F

- The appearance of the -R option model is different from that of the standard model as CN1 is added. Contact us for more details.

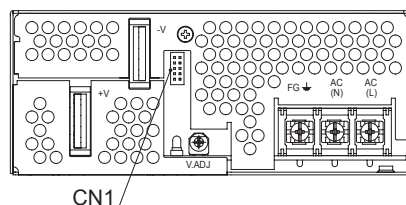


Fig.5.7 Front view of option -R (PLA1000F, PLA1500F)

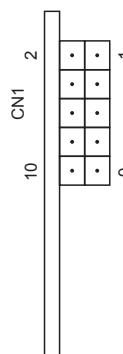


Fig.5.8 Pin number

Table 5.7 Pin configuration and function of CN1

PIN	FUNCTION
1	- :N.C.
2	- :N.C.
3	RC :Remote ON/OFF
4	RCG:Remote ON/OFF(GND)
5	- :N.C.
6	- :N.C.
7	- :N.C.
8	- :N.C.
9	- :N.C.
10	- :N.C.

Table 5.8 Mating connectors and terminals on CN1

Connector	Housing	Terminal	Mfr
CN1	S10B-PHDSS	PHDR-10VS	
		Reel :SPHD-002T-P0.5 Loose :BPHD-001T-P0.5 :BPHD-002T-P0.5	J.S.T.

● -W (PLA600F, PLA1000F, PLA1500F)

- The -W option model provides remote sensing, low output voltage alarm (LV alarm), and parallel operation.
- The appearance of the -W option model is different from that of the standard mode. Contact us for more details.
- Designated harnesses are available for sale. See Optional Parts.
- The differences from the standard model are shown in Table 5.9.

Table 5.9 Specification differences of Option -W

Load regulation	1.5 times of standard spec.
Ripple	1.5 times of standard spec.
Ripple noise	1.5 times of standard spec.

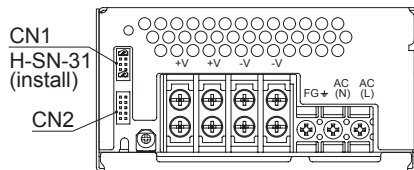


Fig.5.9 Front view of option -W (PLA600F)

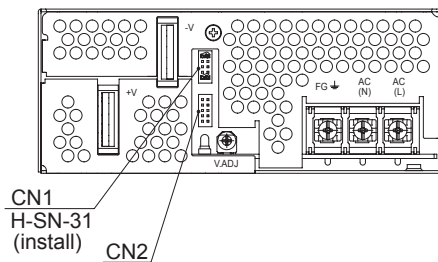


Fig.5.10 Front view of option -W (PLA1000F, PLA1500F)

Table 5.10 Pin configuration and function of CN1 and CN2

PIN	FUNCTION
1	+M :Self sensing terminal (Don't wire for external function)
2	+S :+Sensing
3	- :N.C.
4	- :N.C.
5	LV :LV alarm
6	LVG :LV alarm (GND)
7	CB :Current balance
8	- :N.C.
9	-M :Self sensing terminal (Don't wire for external function)
10	-S :-Sensing

Fig.5.11 Pin number

Table 5.11 Mating connectors and terminals on CN1 and CN2

Connector	Housing	Terminal	Mfr
CN1	S10B-PHDSS	Reel :SPHD-002T-P0.5	J.S.T.
CN2	PHDR-10VS	Loose :BPHD-001T-P0.5 :BPHD-002T-P0.5	

■ LV alarm

The operating conditions of the LV alarm are shown in Table 5.12. The internal circuit of the LV alarm is shown in Fig. 5.12. The LV alarm is isolated from input, output, and FG.

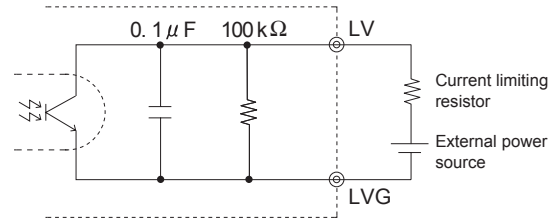


Fig.5.12 LV internal circuit

Table 5.12 LV alarm operating conditions

	Alarm	Output of alarm
LV	If the output voltage drops or stops, the LV and LVG terminals give an alarm signal. Note : ①In case of overcurrent, the alarm signal will be unstable. ②The alarm signal won't be given in parallel operation if OR diodes are not used.	Open collector method Good : Low (0 - 0.8V, 10mA max) Fail : High or Open 50V 10mA max

■ Parallel operation

For parallel operation, please take the following steps:

- ① (Before wiring) set the output voltage of each unit to the desired value. The output voltage difference between the units must be less than 0.1V or 1% of the rated output voltage, whichever is smaller.
- ② Wire the power supplies as shown in Fig. 5.13. Make sure the output wires of the units connected in parallel are of the same length and the same type.
- ③ Make sure the total output current does not exceed the value determined by the following formula:

$$\left[\text{Output current in parallel operation} \right] = \left[\frac{\text{The rated current per unit}}{\text{current per unit}} \right] \times (\text{Number of unit}) \times 0.85$$

* Make sure the current drawn from each unit is less than the rated output current.

- When adjusting the output voltage after wiring, repeat the above-mentioned steps (① to ③).
- If the number of units in parallel increases, the input current increases as well. Make sure the input equipment and wires have enough current capacity.
- The maximum number of units for parallel connection is 5.
- Master-Booster operation is not possible.

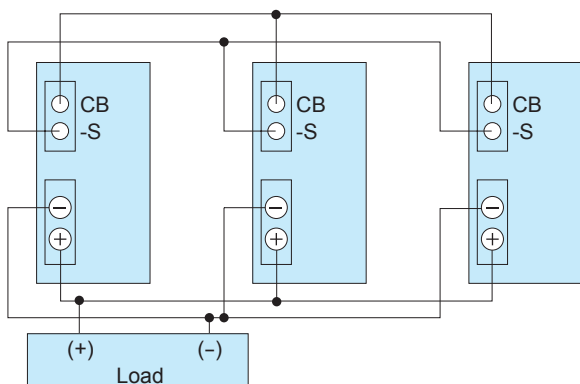


Fig.5.13 Parallel operation condition

- If the output current is less than 10% of the rated output current, the output voltage may fluctuate.

The required minimum current is different depending on the model and the number of units in parallel. Consult us for more details.

- If the length of the output wires of each unit is different, the output current from each unit will be unbalanced. Make sure to use output wires of the same length for all units in parallel.

■ Remote sensing

- These models are equipped with a remote sensing function. If the remote sensing is not used, the following terminals of CN1 must be shorted:

+S and +M

–S and –M

When the power supply is shipped from our factory, a designated harness (H-SN-31) is attached to CN1. If remote sensing is not used, there is no need to remove the harness.

- The wire connection when remote sensing is used or not used is shown in Fig. 5.14 - Fig. 5.15.
- When using remote sensing, make sure to finish wiring +S and –S first. The designated harness is available for sale. Contact us for more details.
- When using remote sensing, pay attention to the following:

- ① Wiring must be done carefully. If there is bad connection on the load lines due to loose screws, etc., the load current flows into the sensing lines and the internal circuit of the power supply may be damaged.
- ② Make sure the wires between the load and the power supply are thick enough to keep the line drop less than 0.3V.
- ③ If the sensing wires are long, place C1 and R1 across the load lines.
- ④ Use a twisted pair wire or a shielded wire for the sensing lines.
- ⑤ Do not draw the output current from +M, –M, +S or –S.
- ⑥ The impedance of the wiring or the load may cause the output voltage to oscillate or fluctuate.

Test to confirm remote sensing works fine. If the output voltage is found to be unstable, the following methods are recommended:

- Remove the remote sensing line on the minus side and short –S and –M.
- Use C1, R1, and R2.

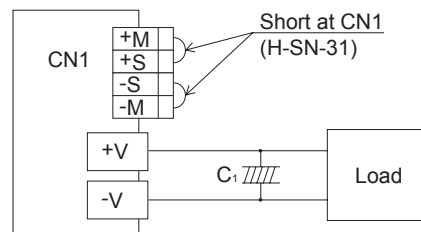


Fig.5.14 When not using remote sensing function

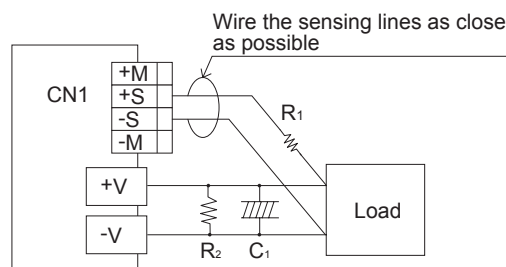


Fig.5.15 When using remote sensing function

● –T (PLA15F, PLA30F, PLA50F, PLA100F, PLA150F)

- The –T option models come with a vertical terminal block. The appearance is different from that of the standard models. Contact us for more details.

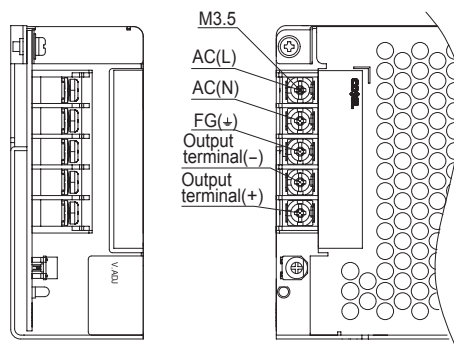


Fig.5.16 Example of option -T(PLA100F)

● –T2 (PLA300F, PLA600F)

- The –T2 option models come with a normal (non-screw-hold type) terminal block. The appearance is different from that of the standard models. Contact us for more details.

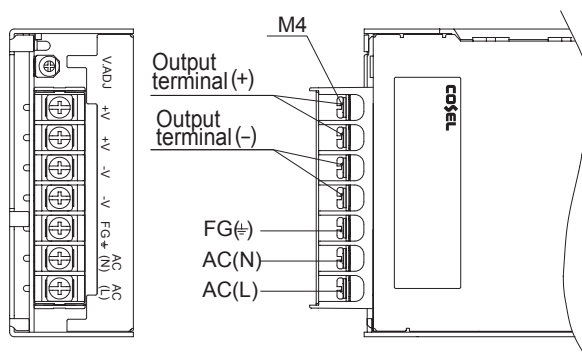


Fig.5.17 Example of option -T2(PLA300F)

● -J (PLA15F, PLA30F, PLA50F, PLA100F, PLA150F)

- The -J option models come with AMP connectors instead of a terminal block.
- The designated harnesses are available for sale. See Optional Parts for more details.
- The appearance is different from that of the standard models. Contact us for more details.
- Keep the drawing current less than 5A per pin.
- UL508 does not apply to the -J option models.

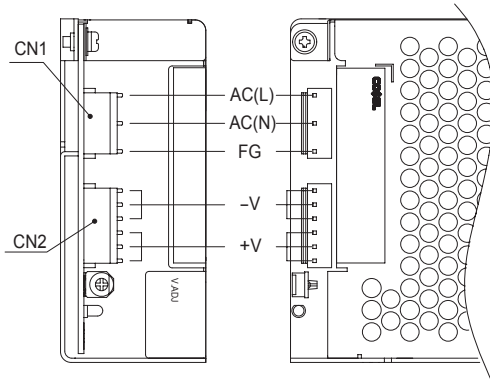


Fig.5.18 Example of option -J (PLA100F)

Table 5.13 Mating connectors and terminals on CN1 and CN2 in option -J (PLA15F, PLA30F, PLA50F)

I/O Connector	Matching Housing	Terminal
CN1	1-1123724-3	Reel : 1123721-1
		Loose : 1318912-1
CN2	1-1123723-4	Reel : 1123721-1
		Loose : 1318912-1

(Mfr. Tyco electronics AMP)

Table 5.14 Mating connectors and terminals on CN1 and CN2 in option -J (PLA100F, PLA150F)

I/O Connector	Matching Housing	Terminal
CN1	1-1123724-3	Reel : 1123721-1
		Loose : 1318912-1
CN2	1-1123723-6	Reel : 1123721-1
		Loose : 1318912-1

(Mfr. Tyco electronics AMP)

● -F4 (PLA300F, PLA600F)

- The -F4 option models come with a low-speed fan to reduce the fan noise.
- The differences from the standard fan versions are shown in Fig. 5.19 - Fig. 5.20.

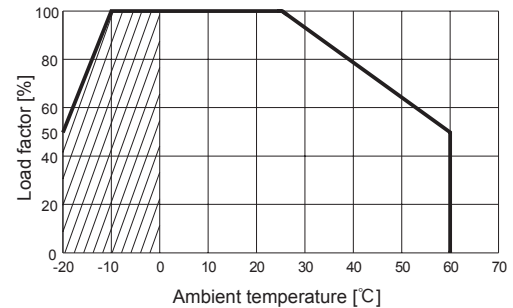


Fig.5.19 Ambient temperature derating curve for PLA300F (Option-F4)

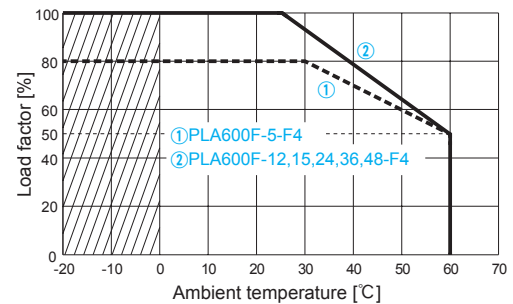


Fig.5.20 Ambient temperature derating curve for PLA600F (Option-F4)

● -N1 (PLA15F, PLA30F, PLA50F, PLA100F, PLA150F)

- The -N1 option models come with a DIN rail mount attachment.
- The appearance is different from that of the standard models. Contact us for more details.
- The -N1 option models have different vibration and shock specifications. Consult us for more details.
- Contact us for safety agency approvals.

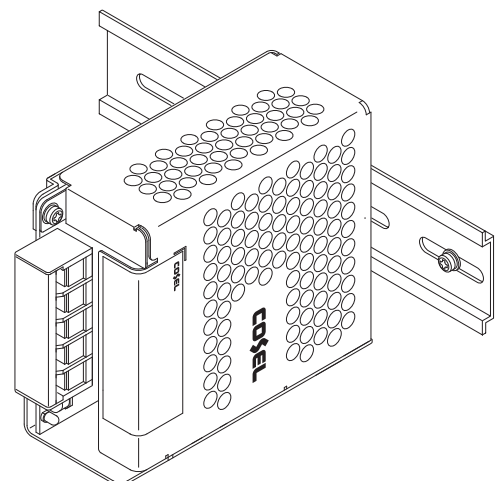


Fig.5.21 Power supply installed on a DIN rail (PLA50F)

● -Z□ (PLA1000F, PLA1500F)

- The -Z□ option models come with auxiliary output.
- The appearance is different from that of the standard models. Contact us for details.
- Please select the preferred AUX output voltage from the table below.
- Please contact us for more information and AUX output current.

Table 5.15 Output specification of option -Z□

Option symbol	-Z1	-Z2	-Z3
AUX Output Voltage	5V	12V	24V

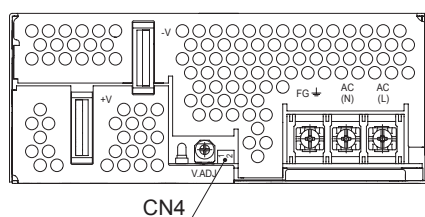


Fig.5.22 Front view of option -Z (PLA1000F, PLA1500F)

Table 5.16 Pin configuration and function of CN4

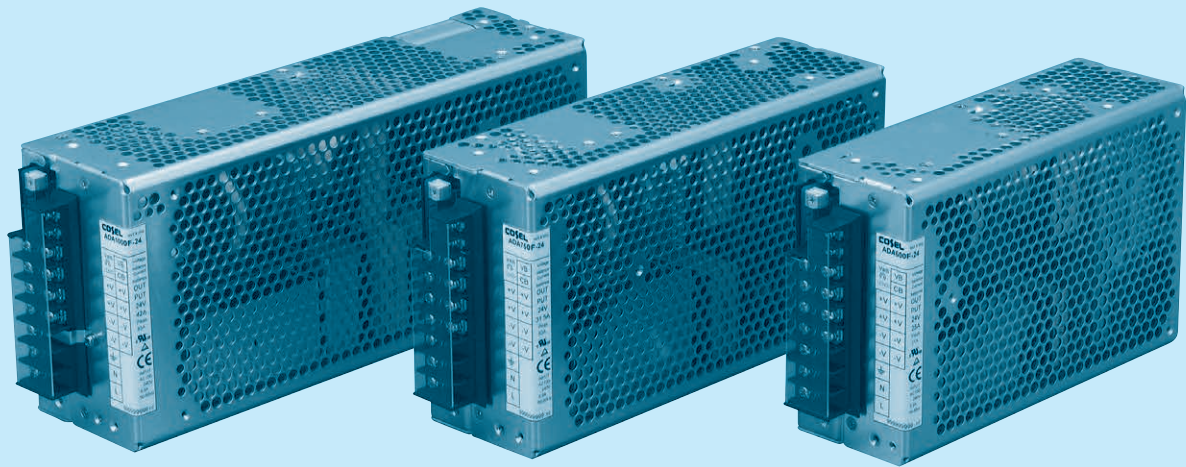
PIN	FUNCTION
1	AUX : Auxiliary output
2	AUXG : Auxiliary output (GND)

5.2 Others

- Note that the case of the power supply remains hot for a while after it is turned off.
- If large capacitors are connected to the output terminals (load side), the output voltage may stop or become unstable. Consult us for advice.
- If the power supply is turned off at no load, the output voltage remains for a few minutes as the power supply is designed for low internal power consumption. Be careful of electrical shock at the time of maintenance.
- If the built-in cooling fan in PLA300F/PLA600F/PLA1000F/PLA1500F stops, the built-in thermal protection may work and the output voltage may stop. Periodic maintenance of the built-in fan is necessary to enhance the power supply's reliability.
- When more than two units are connected in parallel at the input, the total capacitance between the lines becomes larger and a discharge resistance may be necessary to meet the safety agency approvals. Consult us for advice.



ADA-series



Feature

- High power & peak power
- Power up with fan (optional)
- Parallel operation / master-slave operation / N+1 redundant (optional)
- Harmonic attenuator (Complies with IEC61000-3-2)
- Universal input voltage (AC85 - 264V)
- Optional : remote ON/OFF, alarms
- Current monitor
- DIN rail (35mm) optional

Safety agency approvals

- UL60950-1, C-UL(CSA60950-1) recognized, TÜV approved
- Complies with DEN-AN

EMI

- Complies with FCC-B, CISPR22-B, EN55022-B, VCCI-B

5-year warranty (refer to Instruction Manual)

Optional parts

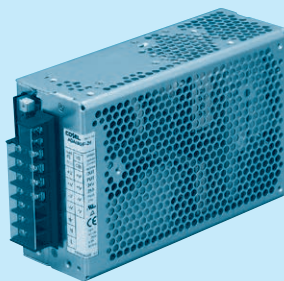
- Harness
- Fan unit
- Attachment

CE marking

- Low Voltage Directive

EMS Compliance : EN61204-3, EN61000-6-2

- EN55022-B
- EN61000-3-2
- EN61000-4-2
- EN61000-4-3
- EN61000-4-4
- EN61000-4-5
- EN61000-4-6
- EN61000-4-8
- EN61000-4-11



Example recommended EMI/EMC filter
NAC-20-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Output wattage
③ Universal input
④ Output voltage
⑤ Optional *7
G : Low leakage current
E : Low leakage current
and EMI class A
F : with Fan unit
T : Vertical terminal block
J : Connector type
C : with Coating
R : Remote ON/OFF
N1 : DIN rail
W : Alarms and Redundant
operation
Specification is changed at
option, refer to Instruction
Manual.

Please refer to derating curve, because the rated load current depends on cooling method that is convection cooling or forced air.

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

SPECIFICATIONS

	MODEL	ADA600F-24	ADA600F-30	ADA600F-36	ADA600F-48	
INPUT	VOLTAGE[V]	AC85 - 264 1 φ or DC 120 - 350 (AC64 or DC90 optionally available ※6)				
	FREQUENCY[Hz]	50/60 (47 - 63) or DC				
	EFFICIENCY[%]	ACIN 100V	84typ (Io=100%)	86typ (Io=100%)	86typ (Io=100%)	86typ (Io=100%)
		ACIN 200V	86typ (Io=100%)	87typ (Io=100%)	87typ (Io=100%)	89typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.99typ (Io=100%)			
		ACIN 200V	0.98typ (Io=100%)			
	INRUSH CURRENT[A]	ACIN 100V ※1	20typ (Io=100%) (More than 3sec.to re-start)			
ACIN 200V ※1		40typ (Io=100%) (More than 3sec.to re-start)				
	LEAKAGE CURRENT[ma]	0.75max (60Hz, According to IEC60950 and DEN-AN) (Io=100%)				
OUTPUT	VOLTAGE[V]	24	30	36	48	
	CURRENT[A]	ACIN 100V ※2	14 (Peak 25) convection	11 (Peak 20) convection	9 (Peak 16.5) convection	6.5 (Peak 12.5) convection
		ACIN 100V ※2	21 (Peak 25) forced air	16.5 (Peak 20) forced air	14 (Peak 16.5) forced air	10.5 (Peak 12.5) forced air
		ACIN 200V ※2	15 (Peak 31) convection	12 (Peak 24.5) convection	10 (Peak 20.5) convection	7 (Peak 15.5) convection
		ACIN 200V ※2	25 (Peak 31) forced air	20 (Peak 24.5) forced air	16.5 (Peak 20.5) forced air	12.5 (Peak 15.5) forced air
	LINE REGULATION[mV]	96max	120max	144max	192max	
	LOAD REGULATION[mV]	150max	180max	240max	300max	
	RIPPLE[mVp-p]	0 to +50℃ ※3	120max	160max	200max	200max
		-10 - 0℃ ※3	160max	230max	260max	300max
	RIPPLE NOISE[mVp-p]	0 to +50℃ ※3	150max	190max	230max	250max
		-10 - 0℃ ※3	180max	250max	280max	400max
	TEMPERATURE REGULATION[mV]	0 to +50℃	240max	300max	360max	480max
	DRIFT[mV]	※4 96max	120max	144max	192max	
	START-UP TIME[ms]	500max (ACIN 100V, Io=100%)				
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)				
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	21.6 - 27.0	27.0 - 33.0	33.0 - 41.0	41.0 - 52.8	
	OUTPUT VOLTAGE SETTING[V]	23.5 - 24.5	29.0 - 31.0	35.0 - 37.0	47.0 - 49.0	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 101% of peak current and recovers automatically				
	OVERVOLTAGE PROTECTION[V]	31 - 34.5	40 - 48	51 - 60	64 - 76	
	OPERATING INDICATION	LED (Green)				
	ALARM OUTPUT	Detecting low input voltage(PF), detecting low output voltage(LV). (Optional : -W, refer to Instruction Manual 5)				
	REMOTE ON/OFF(RC)	Requirement for external source (Option : -R, refer to Instruction Manual 5)				
ISOLATION	INPUT-OUTPUT · RC	※5 AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)				
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)				
	OUTPUT · RC-FG	※5 AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)				
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +71℃, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max				
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max				
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis				
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis				
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN60065, EN50178 Complies with DEN-AN and IEC60950-1 (At only AC input)				
	CONDUCTED NOISE	Complies with FCC-B, CISPR22-B, EN55022-B, VCCI-B				
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 ※8				
OTHERS	CASE SIZE/WEIGHT	65 x 127 x 195mm [2.56 x 5 x 7.68 inches] (W x H x D) (without terminal block) /1.5kg max				
	COOLING METHOD	Convection/Forced air				

*1 The value is primary surge. The current of input surge to a built-in EMI/EMC Filter (0.2ms or less) is excluded.

*2 Peak loading for 10sec. And Duty 35% max. Refer to Instruction Manual 4. Forced air is shown in Instruction Manual 2.3.

*3 This is the value that measured on measuring board with capacitor of 22 μF within 150mm from output terminal. Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM101).

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

*5 Applicable when remote control (optional) is added.

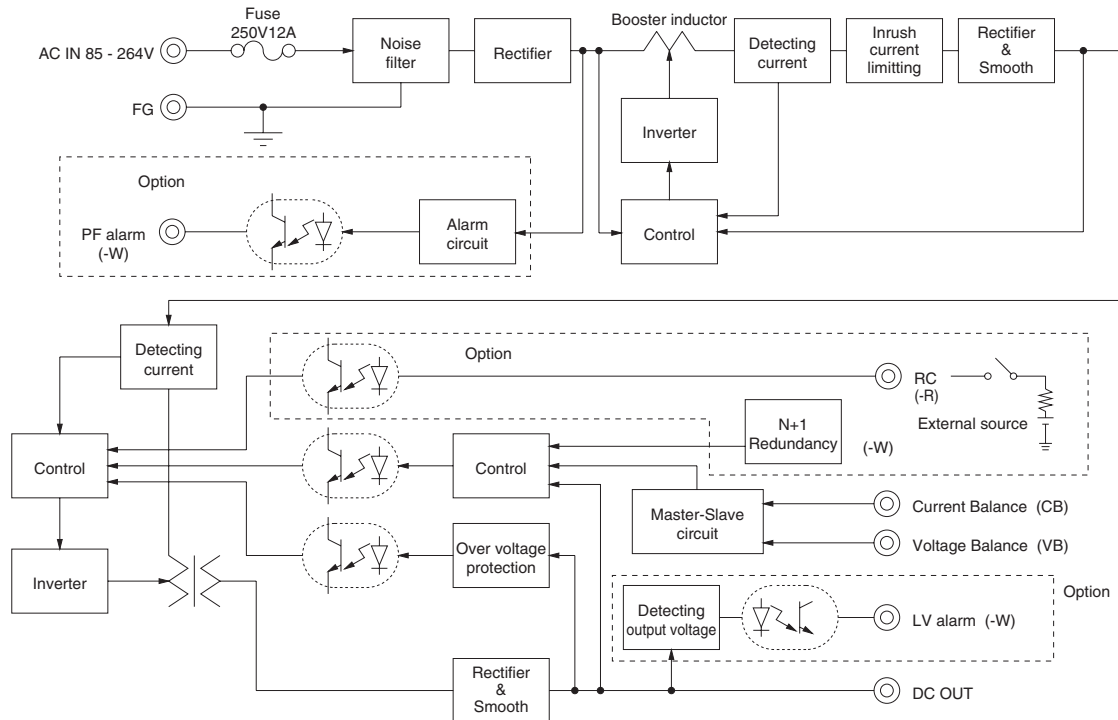
*6 Derating is required. Consult us for details.

*7 Please contact us about safety approvals for the model with option.

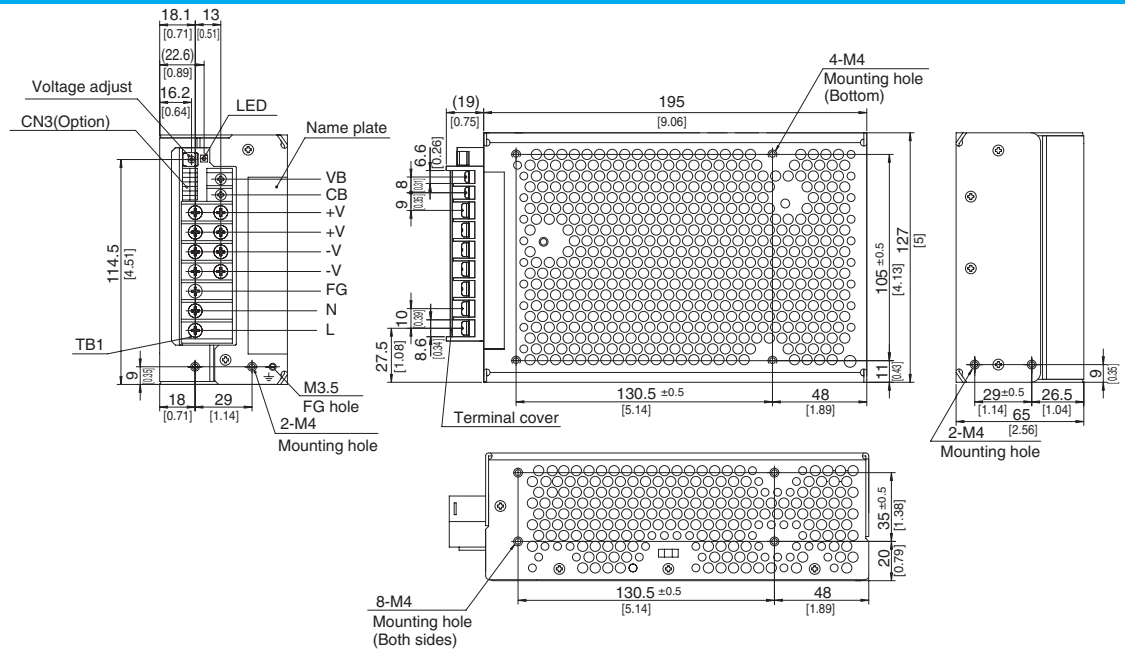
*8 Please contact us about class C.

* A sound may occur from power supply at pulse loading.

Block diagram



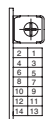
External view



※ Pin assign

Symbol	Function	Screw type
VB	Voltage balance	M3
CB	Current balance	M3
+V	Output terminal(+)	M4
+V	Output terminal(+)	M4
-V	Output terminal(-)	M4
-V	Output terminal(-)	M4
FG	Frame ground	M4
N	AC(N)	M4
L	AC(L)	M4

Average 21A max per pin for TB1



CN3(Optional)

Pin No.	Function
1	RC+ : Remote ON/OFF+(-R)
2	RC- : Remote ON/OFF-(-R)
3-8	NC : N.C.
9	LV+ : LV Alarm(-W)
10	LV- : LV Alarm ground(-W)
11-12	NC : N.C.
13	PF+ : PF Alarm(-W)
14	PF- : PF Alarm ground(-W)

Connector	Mating connector	Terminal	Mfr.
CN3	S14B-PHDS	Chain:SPHD-002T-P0.5	J.S.T
		Loose:BPHD-001T-P0.5	
		BPHD-002T-P0.5	

※ 1 Ratchet Hand is nothing

※ Tolerance : ±1 [±0.04]

※ Weight : 1.5kg max

※ PCB material / thickness : FR-4 / 1.6mm [0.06]

※ Chassis and cover material : aluminium

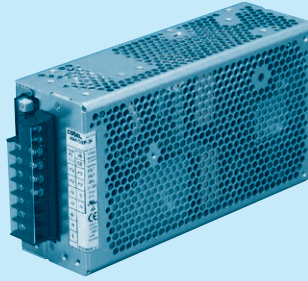
※ Dimensions in mm, [] = inches

※ Mounting torque : 1.2N • m(12.8kgf • cm) max

※ Screw tightening torque

M4 : 1.6N • m(16.9kgf • cm) max, M3 : 0.8N • m(8.5kgf • cm) max

※ I/O terminal for option-J and -T is shown in Instruction Manual 5.



Example recommended EMI/EMC filter
NAC-20-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Output wattage
③ Universal input
④ Output voltage
⑤ Optional *7
G : Low leakage current
E : Low leakage current and EMI class A
F : with Fan unit
T : Vertical terminal block
J : Connector type
C : with Coating
R : Remote ON/OFF
N1 : DIN rail
W : Alarms and Redundant operation
Specification is changed at option, refer to Instruction Manual.

Please refer to derating curve, because the rated load current depends on cooling method that is convection cooling or forced air.

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

SPECIFICATIONS

	MODEL	ADA750F-24	ADA750F-30	ADA750F-36	ADA750F-48	
INPUT	VOLTAGE[V]	AC85 - 264 1 ϕ or DC 120 - 350 (AC64 or DC90 optionally available *6)				
	FREQUENCY[Hz]	50/60 (47 - 63) or DC				
	EFFICIENCY[%]	ACIN 100V	86typ (Io=100%)	86typ (Io=100%)	87typ (Io=100%)	87typ (Io=100%)
		ACIN 200V	88typ (Io=100%)	88typ (Io=100%)	89typ (Io=100%)	89typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.99typ (Io=100%)			
		ACIN 200V	0.98typ (Io=100%)			
	INRUSH CURRENT[A]	ACIN 100V *1	20typ (Io=100%) (More than 3sec.to re-start)			
ACIN 200V *1		40typ (Io=100%) (More than 3sec.to re-start)				
	LEAKAGE CURRENT[ma]	0.75max (60Hz, According to IEC60950 and DEN-AN) (Io=100%)				
OUTPUT	VOLTAGE[V]	24	30	36	48	
	CURRENT[A]	ACIN 100V *2	17 (Peak 42) convection	13.5 (Peak 33.5) convection	11 (Peak 28) convection	8 (Peak 21) convection
		ACIN 100V *2	25 (Peak 42) forced air	20 (Peak 33.5) forced air	16.5 (Peak 28) forced air	12.5 (Peak 21) forced air
		ACIN 200V *2	19 (Peak 63) convection	15 (Peak 50) convection	12.5 (Peak 42) convection	9 (Peak 31.5) convection
		ACIN 200V *2	31.5 (Peak 63) forced air	24.5 (Peak 50) forced air	20.5 (Peak 42) forced air	15.5 (Peak 31.5) forced air
	LINE REGULATION[mV]	96max	120max	144max	192max	
	LOAD REGULATION[mV]	150max	180max	240max	300max	
	RIPPLE[mVp-p]	0 to +50°C *3	120max	160max	200max	200max
		-10 - 0°C *3	160max	230max	260max	300max
	RIPPLE NOISE[mVp-p]	0 to +50°C *3	150max	190max	230max	250max
		-10 - 0°C *3	180max	250max	280max	400max
	TEMPERATURE REGULATION[mV]	0 to +50°C	240max	300max	360max	480max
	DRIFT[mV]	*4	96max	120max	144max	192max
		START-UP TIME[ms]	500max (ACIN 100V, Io=100%)			
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)				
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	21.6 - 27.0	27.0 - 33.0	33.0 - 41.0	41.0 - 52.8	
	OUTPUT VOLTAGE SETTING[V]	23.5 - 24.5	29.0 - 31.0	35.0 - 37.0	47.0 - 49.0	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 101% of peak current and recovers automatically				
	OVERVOLTAGE PROTECTION[V]	31 - 34.5	40 - 48	51 - 60	64 - 76	
	OPERATING INDICATION	LED (Green)				
	ALARM OUTPUT	Detecting low input voltage(PF), detecting low output voltage(LV). (Optional : -W, refer to Instruction Manual 5)				
	REMOTE ON/OFF(RC)	Requirement for external source (Option : -R, refer to Instruction Manual 5)				
ISOLATION	INPUT-OUTPUT · RC	*5 AC3,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)				
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)				
	OUTPUT · RC-FG	*5 AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (At Room Temperature)				
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-10 to +71°C, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max				
	STORAGE TEMP.,HUMID.AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max				
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis				
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis				
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN60065, EN50178 Complies with DEN-AN and IEC60950-1 (At only AC input)				
	CONDUCTED NOISE	Complies with FCC-B, CISPR22-B, EN55022-B, VCCI-B				
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 *8				
OTHERS	CASE SIZE/WEIGHT	70 x 127 x 230mm [2.76 x 5 x 9.06 inches] (W x H x D) (without terminal block) /1.9kg max				
	COOLING METHOD	Convection/Forced air				

*1 The value is primary surge. The current of input surge to a built-in EMI/EMC Filter (0.2ms or less) is excluded.

*2 Peak loading for 10sec. And Duty 35% max. Refer to Instruction Manual 4. Forced air is shown in Instruction Manual 2.3.

*3 This is the value that measured on measuring board with capacitor of 22 μ F within 150mm from output terminal. Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM101).

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*5 Applicable when remote control (optional) is added.

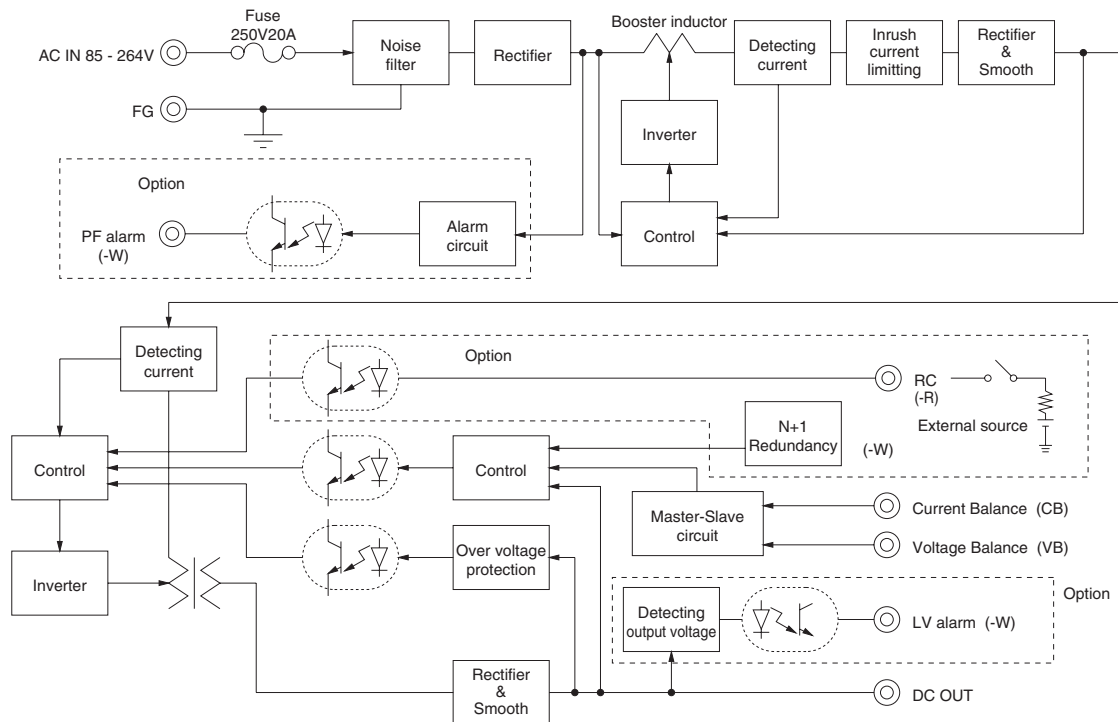
*6 Derating is required. Consult us for details.

*7 Please contact us about safety approvals for the model with option.

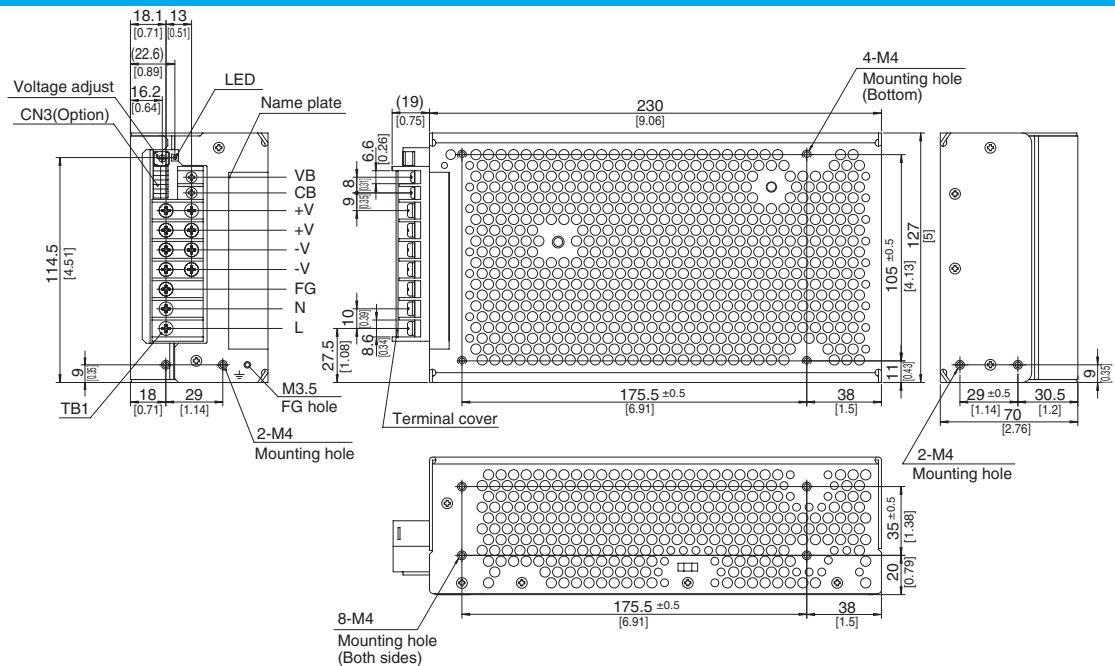
*8 Please contact us about class C.

* A sound may occur from power supply at pulse loading.

Block diagram



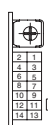
External view



※ Pin assign

Symbol	Function	Screw type
VB	Voltage balance	M3
CB	Current balance	
+V	Output terminal(+)	M4
+V	Output terminal(+)	
-V	Output terminal(-)	
-V	Output terminal(-)	
FG	Frame ground	
N	AC(N)	
L	AC(L)	

Average 21A max per pin for TB1



CN3(Optional)

Pin No.	Function
1	RC+ : Remote ON/OFF+(+R)
2	RC- : Remote ON/OFF(-R)
3-8	NC : N.C.
9	LV+ : LV Alarm(+W)
10	LV- : LV Alarm ground(-W)
11-12	NC : N.C.
13	PF+ : PF Alarm(+W)
14	PF- : PF Alarm ground(-W)

	Connector	Mating connector	Terminal	Mfr.
CN3	S14B-PHDS	PHDR-14VS	Chain:SPHD-002T-P0.5 Loose:BPHD-001T-P0.5 BPHD-002T-P0.5 *	J.S.T

*1 Ratchet Hand is nothing

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 1.9kg max
- ※ PCB material / thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis and cover material : aluminium
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque : 1.2N · m (12.8kgf · cm) max
- ※ Screw tightening torque
 - M4 : 1.6N · m (16.9kgf · cm) max, M3 : 0.8N · m (8.5kgf · cm) max
 - ※ I/O terminal for option-J and -T is shown in Instruction Manual 5.

ADA1000F

ADA 1000 F -24 -□

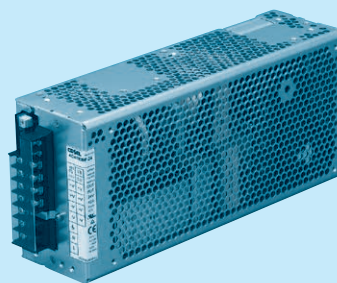
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②

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⑤

Example recommended EMI/EMC filter
NAC-20-472

High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Output wattage
③ Universal input
④ Output voltage
⑤ Optional *7
G : Low leakage current
E : Low leakage current and EMI class A
F : with Fan unit
T : Vertical terminal block
J : Connector type
C : with Coating
R : Remote ON/OFF
N1 : DIN rail
W : Alarms and Redundant operation
Specification is changed at option, refer to Instruction Manual.

Please refer to derating curve, because the rated load current depends on cooling method that is convection cooling or forced air.

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

SPECIFICATIONS

	MODEL	ADA1000F-24	ADA1000F-30	ADA1000F-36	ADA1000F-48	
INPUT	VOLTAGE[V]	AC85 - 264 1 ϕ or DC 120 - 350 (AC64 or DC90 optionally available *6)				
	FREQUENCY[Hz]	50/60 (47 - 63) or DC				
	EFFICIENCY[%]	ACIN 100V	86typ (Io=100%)	86typ (Io=100%)	87typ (Io=100%)	87typ (Io=100%)
		ACIN 200V	88typ (Io=100%)	88typ (Io=100%)	89typ (Io=100%)	89typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.99typ (Io=100%)			
		ACIN 200V	0.98typ (Io=100%)			
	INRUSH CURRENT[A]	ACIN 100V *1	20typ (Io=100%) (More than 3sec.to re-start)			
ACIN 200V *1		40typ (Io=100%) (More than 3sec.to re-start)				
	LEAKAGE CURRENT[ma]	0.75max (60Hz, According to IEC60950 and DEN-AN) (Io=100%)				
OUTPUT	VOLTAGE[V]	24	30	36	48	
	CURRENT[A]	ACIN 100V *2	21 (Peak 63) convection	16.5 (Peak 50) convection	14 (Peak 42) convection	10.5 (Peak 31.5) convection
		ACIN 100V *2	33 (Peak 63) forced air	26 (Peak 50) forced air	22 (Peak 42) forced air	16.5 (Peak 31.5) forced air
		ACIN 200V *2	25 (Peak 83) convection	20 (Peak 66) convection	16.5 (Peak 55) convection	11.5 (Peak 41.5) convection
		ACIN 200V *2	42 (Peak 83) forced air	33.5 (Peak 66) forced air	28 (Peak 55) forced air	21 (Peak 41.5) forced air
	LINE REGULATION[mV]	96max	120max	144max	192max	
	LOAD REGULATION[mV]	150max	180max	240max	300max	
	RIPPLE[mVp-p]	0 to +50℃ *3	120max	160max	200max	200max
		-10 - 0℃ *3	160max	230max	260max	300max
	RIPPLE NOISE[mVp-p]	0 to +50℃ *3	150max	190max	230max	250max
		-10 - 0℃ *3	180max	250max	280max	400max
	TEMPERATURE REGULATION[mV]	0 to +50℃	240max	300max	360max	480max
	DRIFT[mV]	*4	96max	120max	144max	192max
START-UP TIME[ms]	500max (ACIN 100V, Io=100%)					
HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)					
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	21.6 - 27.0		27.0 - 33.0	33.0 - 41.0	41.0 - 52.8	
OUTPUT VOLTAGE SETTING[V]	23.5 - 24.5		29.0 - 31.0	35.0 - 37.0	47 - 49	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 101% of peak current and recovers automatically				
	OVERVOLTAGE PROTECTION[V]	31 - 34.5	40 - 48	51 - 60	64 - 76	
	OPERATING INDICATION	LED (Green)				
	ALARM OUTPUT	Detecting low input voltage(PF), detecting low output voltage(LV). (Optional : -W, refer to Instruction Manual 5)				
	REMOTE ON/OFF(RC)	Requirement for external source (Option : -R, refer to Instruction Manual 5)				
ISOLATION	INPUT-OUTPUT · RC *5	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)				
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)				
	OUTPUT · RC-FG *5	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (At Room Temperature)				
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +71℃, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max				
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max				
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis				
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis				
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN60065, EN50178 Complies with DEN-AN and IEC60950-1 (At only AC input)				
	CONDUCTED NOISE	Complies with FCC-B, CISPR22-B, EN55022-B, VCCI-B				
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 *8				
OTHERS	CASE SIZE/WEIGHT	75 x 127 x 280mm [2.95 x 5 x 11.02 inches] (W x H x D) (without terminal block) /2.5kg max				
	COOLING METHOD	Convection/Forced air				

*1 The value is primary surge. The current of input surge to a built-in EMI/EMC Filter (0.2ms or less) is excluded.

*2 Peak loading for 10sec. And Duty 35% max. Refer to Instruction Manual 4. Forced air is shown in Instruction Manual 2.3.

*3 This is the value that measured on measuring board with capacitor of 22 μ F within 150mm from output terminal. Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM101).

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*5 Applicable when remote control (optional) is added.

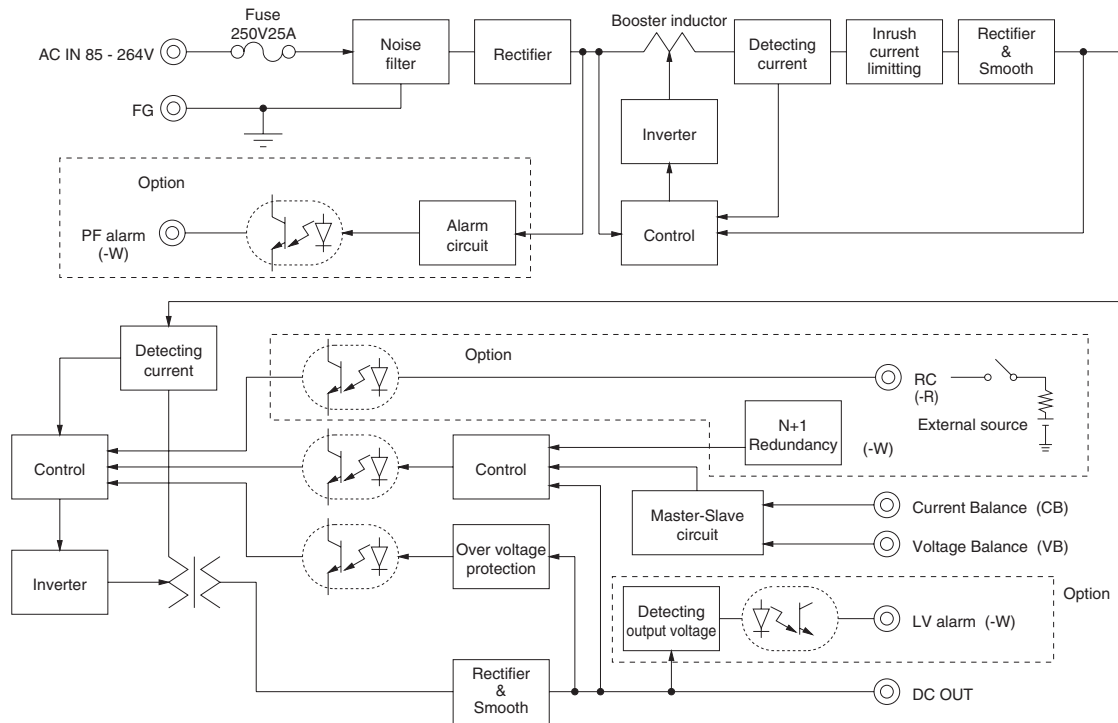
*6 Derating is required. Consult us for details.

*7 Please contact us about safety approvals for the model with option.

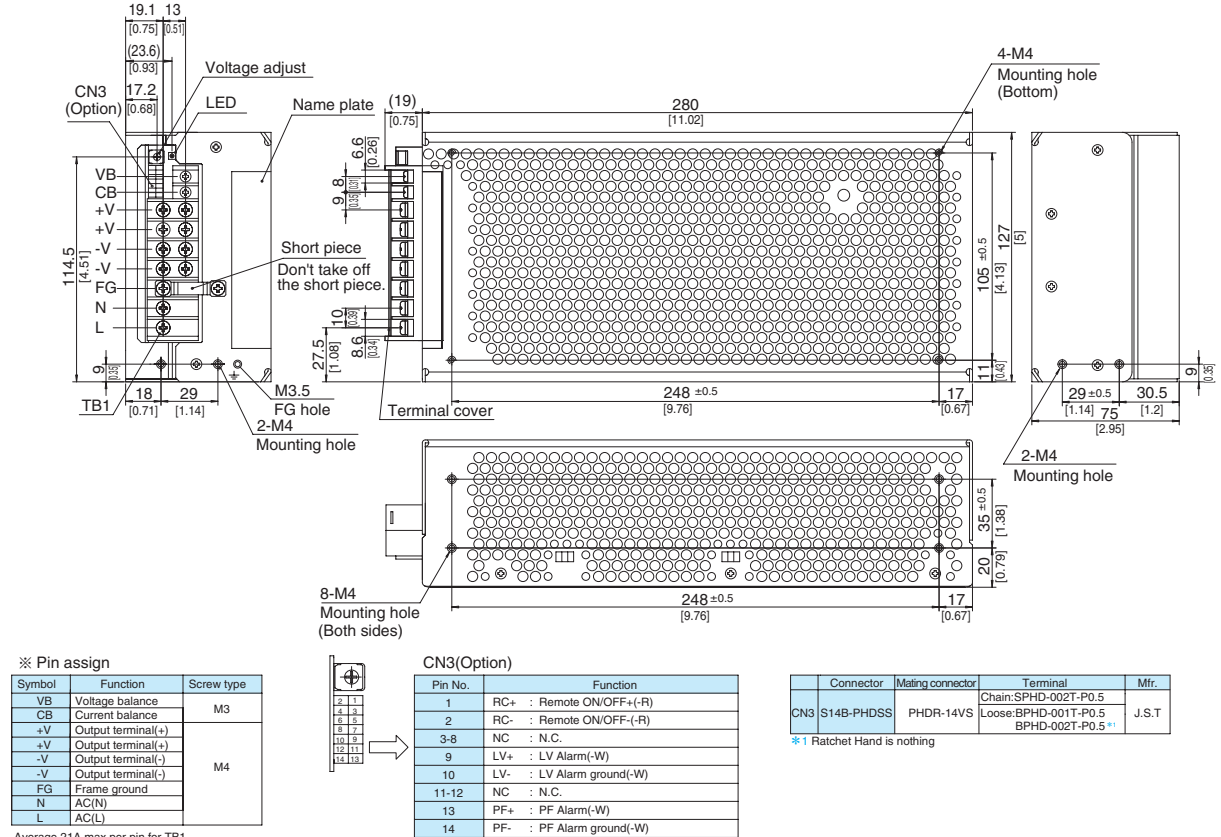
*8 Please contact us about class C.

* A sound may occur from power supply at pulse loading.

Block diagram



External view



Average 21A max per pin for TB1

※ Tolerance : ±1 [±0.04]
 ※ Weight : 2.5kg max
 ※ PCB material / thickness : FR-4 / 1.6mm [0.06]
 ※ Chassis and cover material : aluminium
 ※ Dimensions in mm, [] = inches
 ※ Mounting torque : 1.2N・m(12.8kgf・cm) max
 ※ Screw tightening torque
 M4 : 1.8N・m(16.9kgf・cm) max, M3 : 0.8N・m(8.5kgf・cm) max
 ※ I/O terminal for option-J and -T is shown in Instruction Manual 5.

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
ADA600F	Active filter	85	5.9 (Peak 7.0)	250V 12A	SCR	FR-4		Yes	Yes	Yes
	Forward converter	130								
ADA750F	Active filter	85	6.9 (Peak 11.8)	250V 20A	SCR	FR-4		Yes	Yes	Yes
	Forward converter	130								
ADA1000F	Active filter	85	9.5 (Peak 18.2)	250V 25A	SCR	FR-4		Yes	Yes	Yes
	Forward converter	130								

* Refer to Instruction Manual.

* The value of input current is at ACIN 100V and rated load (peak).

1 Function ADA-10

1.1	Input voltage range	ADA-10
1.2	Inrush current limiting	ADA-10
1.3	Overcurrent protection	ADA-10
1.4	Peakcurrent protection	ADA-10
1.5	Thermal protection	ADA-10
1.6	Overvoltage protection	ADA-10
1.7	Output voltage adjustment range	ADA-10
1.8	Isolation	ADA-10

2 Assembling and Installation Method ADA-10

2.1	Installation method	ADA-10
2.2	Mounting screw	ADA-10
2.3	Derating	ADA-11
2.4	Expectancy life and warranty	ADA-12
2.5	Current monitor	ADA-12

3 Series Operation and Parallel Operation ADA-12

3.1	Series operation	ADA-12
3.2	Parallel operation/master-slave operation	ADA-12

4 Peak Loading ADA-13

5 Option ADA-13

1 Function

1.1 Input voltage range

- The range is from 85 VAC to 264 VAC or 120 VDC to 350 VDC.
- In cases that conform with safety standard, input voltage range is AC100-AC240V(50/60Hz).
- AC input voltage must have a range from 85 VAC to 264 VAC for normal operation. If the wrong input is applied, the unit will not operate properly and/or may be damaged.

1.2 Inrush current limiting

- Inrush current limiting is built-in.
- If a switch is being used for input, ensure that it is configured to handle the input inrush current.
- A thyristor is used for protection from inrush current. When turning the power OFF and then ON again within a short period of time, inrush current limiting may be disabled; therefore ensure enough time before switching ON.

1.3 Overcurrent protection

- Overcurrent protection is built-in and comes into effect at over 101% of the peak current in. Overcurrent protection prevents the unit from short circuit and overcurrent condition. The unit automatically recovers when the fault condition is cleared.

● Intermittent current characteristics

- When the output voltage drops more than 50% of the rated output voltage value at overcurrent, the average output current is reduced by intermittent operation of power supply.

1.4 Peakcurrent protection

- Peakcurrent protection is built-in (The protection circuit operates when load current exceeds the rating current and the use deviates from the condition in Instruction Manual 4).
If this function comes into effect, the output is shut down (delayed shut down).
The minimum interval of AC recycling for recovery is 3 to 4 minutes (*).
*The recovery time varies depending on the voltage and load at the time the protection activated.

1.5 Thermal protection

- Thermal protection circuit is built-in and shut down under following condition.
 - ① When the current and the temperature which exceed from the derating curve.
 - ② The case FAN stops or air flow is interrupted and the amount of the wind decreases.
 If the thermal protection activates, shut off input voltage, remove the cause of the overheating, wait for the unit to cool down, and recycle to recover output voltage.

1.6 Overvoltage protection

- Overvoltage protection is built in. When the overvoltage protection activates, shut off input, wait for at least 3 to 4 minutes, and recycle to recover output voltage(*).
- *The recovery time varies depending on input voltage.

Remarks : Please avoid applying the over-rated voltage to the output terminal. Power supply may operate incorrectly or fail. In case of operating a motor etc. , please install an external diode on the output terminal to protect the unit.

1.7 Output voltage adjustment range

- Adjustment of output voltage is possible by using potentiometer.
- Output voltage is increased by turning potentiometer clockwise and is decreased by turning potentiometer counterclockwise.

1.8 Isolation

- For a receiving inspection, such as Hi-Pot test gradually increase (decrease) the voltage for the start (shut down).
Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.
If the unit is tested on the isolation between input & output and output & FG, remote ON/OFF (option) must be shorted to outputs.

2 Assembling and Installation Method

2.1 Installation method

- When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Ambient temperature around each power supply should not exceed the temperature range shown in derating curve.
- Fix firmly, considering weight, though it can be used by the installation method shown in Fig.2.2.

2.2 Mounting screw

- The screw should be inserted up to 6mm max from outside of the power supply to keep a distance between inside parts and an isolation (Fig.2.1).

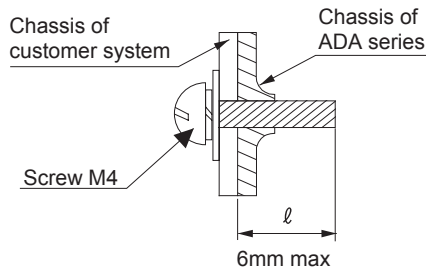


Fig.2.1 Mounting screw

2.3 Derating

Derating by ambient temperature

Load factor 100% in each derating curve means rating current in Specifications. Please note load factor 100% depends on input voltage and cooling method.

In the hatched area the specification of Ripple, Ripple Noise is different from other area.

Convection cooling

- ① Install the unit to apply enough convection as shown in Fig.2.2.
- ② Do not block the ventilation hole.

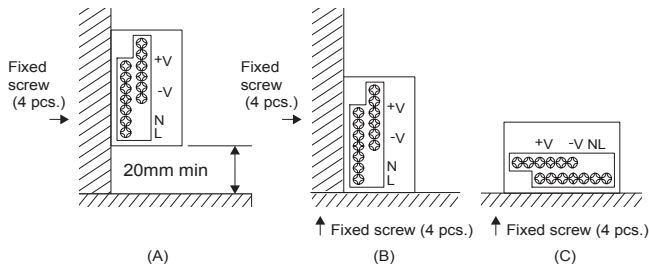
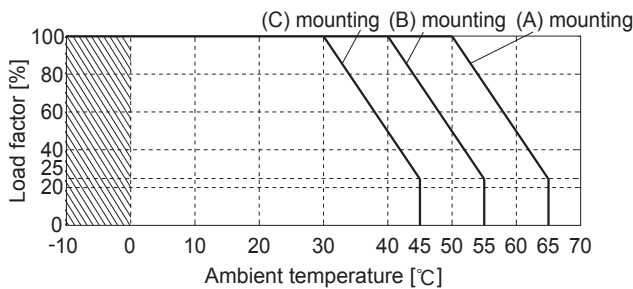


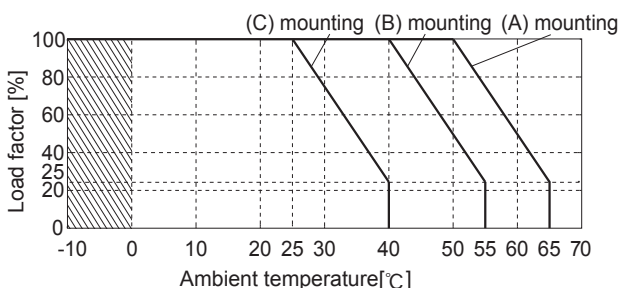
Fig.2.2 Installation method

ADA600F (convection cooling)



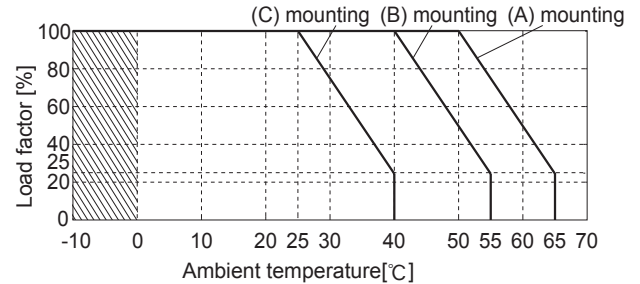
* In case of ADA600F-24, load factor 100% means output 24V, 14A at ACIN100V, 24V, 15A at ACIN200V.

ADA750F (convection cooling)



* In case of ADA750F-24, load factor 100% means output 24V, 17A at ACIN100V, 24V, 19A at ACIN200V.

ADA1000F (convection cooling)



* In case of ADA1000F-24, load factor 100% means output 24V, 21A at ACIN100V, 24V, 25A at ACIN200V.

Forced air cooling

- ① Please give the entire power supply in ventilation so that the temperature of point A and B in Fig.2.3 is made below a specified temperature. Point A and B are displayed in chassis.

- Point A 60°C or less and point B 65°C or less at Ta = 50°C
- Point A 80°C or less and point B 80°C or less at Ta = 71°C

Remarks : Please avoid cooling only bottom chassis.

- ② Ventilation is done evenly and do not block the ventilation hole.
- ③ The confirmation of point A and B is unnecessary when optional fan unit is used. Refer to 5.Option.

* The derating curve at forced air is common in ADA600F to ADA1000F.

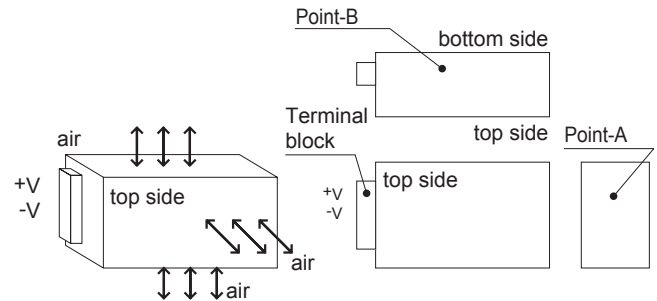
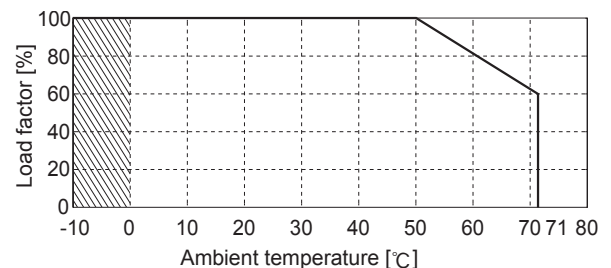


Fig.2.3 Forced air cooling

ADA600F - ADA1000F (forced air)



* In case of ADA600F-24, load factor 100% means output 24V, 21A at ACIN100V, 24V, 25A at ACIN200V.

* In case of ADA750F-24, load factor 100% means output 24V, 25A at ACIN100V, 24V, 31.5A at ACIN200V.

* In case of ADA1000F-24, load factor 100% means output 24V, 33A at ACIN100V, 24V, 42A at ACIN200V.

2.4 Expectancy life and warranty

■ Expectancy life

The expectancy life is as follows. The mean of load factor 100% depends on installation condition, refer to SPECIFICATION.

Installation condition	Average ambient temperature (year)	Load factor	
		50%	100%
Convection * (Installation A)	Ta = 30℃	More than 10 years	More than 10 years
	Ta = 40℃	More than 10 years	6 years
	Ta = 50℃	5 years	3 years
Forced air *	Ta = 30℃	More than 10 years	More than 10 years
	Ta = 40℃	More than 10 years	6 years
	Ta = 50℃	5 years	3 years

* Refer to 2.3 Derating

■ Warranty

The warranty is 5 years when average ambient temperature of year is Ta = 40℃ or less and load factor is average 50% or less. However, the warranty is 3 years when average ambient temperature of year is Ta = 50℃ or less and load factor is series 100%.

2.5 Current monitor

■ It is possible to monitor load current by measuring CB voltage that is between CB terminal and -V terminal. The relation between CB voltage and load current is shown in Figs.2.4 to 2.6.

Note : Figs.2.4 to 2.6 are references, and are not meant to be taken as guaranteed values.

■ Ensure that voltage measurement between CB and -V terminals is carried out with equipment that has sufficient input impedance (testers, etc.). If this equipment has low input impedance, then the relationship between CB voltage and output current will change. Additionally, please be aware that a short between terminals may result in damage to internal components.

■ Please use twist pair cable or shield cable between CB terminal and -V terminal, or the operation may be malfunction.

■ Please use an oscilloscope for pulse loads.

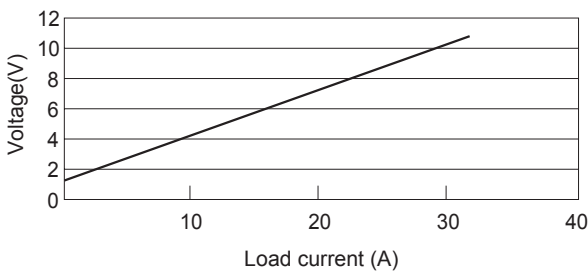


Fig.2.4 Load current conversion graph (ADA600F-24)

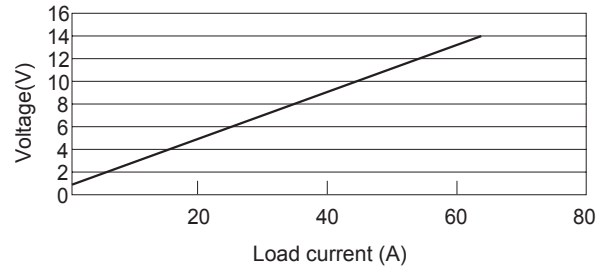


Fig.2.5 Load current conversion graph (ADA750F-24)

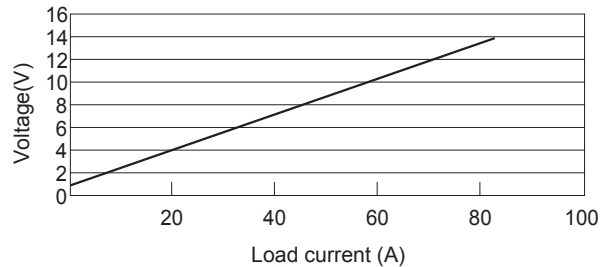


Fig.2.6 Load current conversion graph (ADA1000F-24)

3 Series Operation and Parallel Operation

3.1 Series operation

■ Series operation is available by connecting the outputs of two or more power supplies with the same output voltage, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

■ Parallel operation is shown in Fig.3.1.

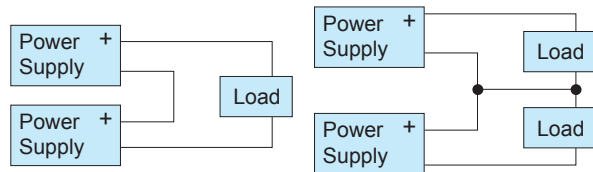


Fig.3.1 Examples of series operation

3.2 Parallel operation/master-slave operation

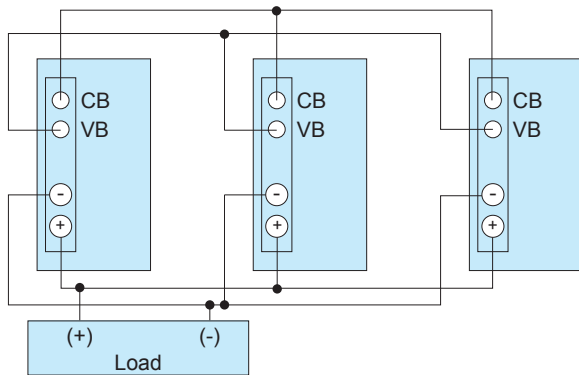
■ Parallel operation is available by connecting below.

■ As variance of output current drawn from each power supply is maximum 10%, the total output current must not exceed the value determined by the following equation.

$$\left[\text{Output current in parallel operation} \right] = \left[\frac{\text{The rated current per unit}}{\text{}} \right] \times (\text{Number of unit}) \times 0.9$$

When the number of units in parallel operation increases, input current increases at the same time. Adequate wiring design for input circuitry is required, such as circuit pattern, wiring and current capacity for equipment.

In parallel operation, the maximum operative number of units is 5.



■ Output voltage in parallel operation is adjustable by using the potentiometer of the "master" unit. Select one power supply to be the master, and turn the potentiometer of the other, "slave" power supplies, clockwise to the end. Then use the potentiometer of the master to adjust output voltage.

■ When the output current is less than 5 to 9% of rated output current (ACIN200V at forced air), the output voltage fluctuates occasionally. The minimum current is different depend on the model and the number of parallel operation, so please consult us at any time.

■ In parallel operation, output voltage increases like stairs due to a delay of the rise time of output voltage at turn on.

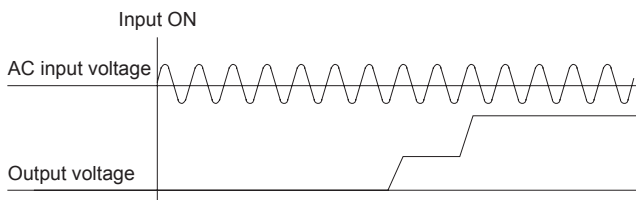


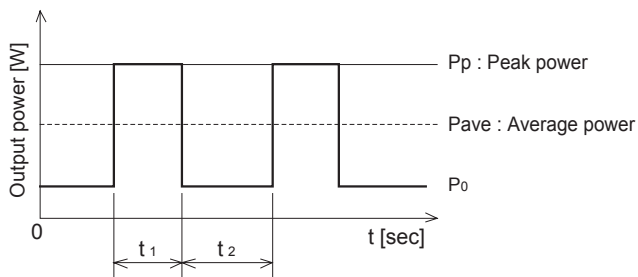
Fig.3.2 Start-up wave form in series and/or parallel operation

4 Peak Loading

■ Peak load is possible to draw as below.

■ Ensure that the device is used in accordance with the following conditions, as failure to do so may result in damage to internal components.

■ Due to the nature of a pulse load, a power supply may make a sound (noise). If the unit is used in a quiet place, consult factory for the load condition in advance.



$$t_1 \leq 10 \text{ [second]}, P_{ave} = \frac{P_{pt1} + P_{ot2}}{t_1 + t_2} \leq \text{rated power}$$

$$\text{Duty} = \frac{t_1}{t_1 + t_2} \leq 0.35 \text{ (Refer to below chart)}$$

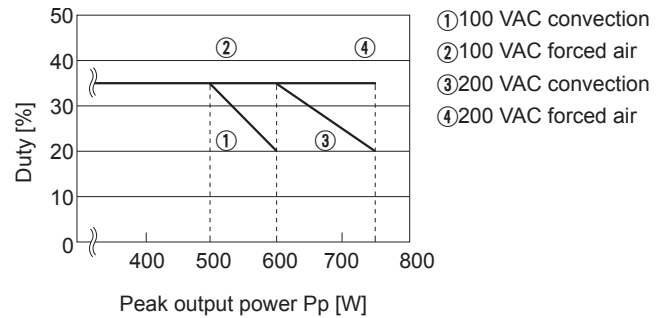


Fig.4.1 Relation between Peak power and Duty (ADA600F)

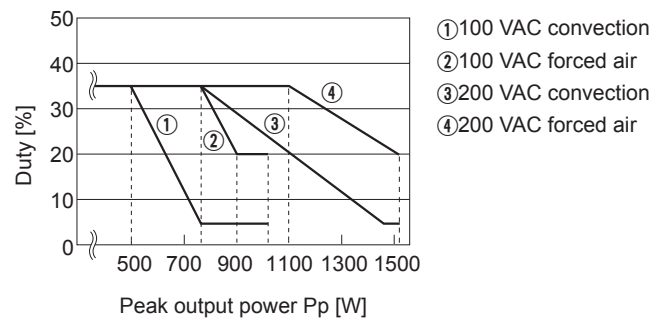


Fig.4.2 Relation between Peak power and Duty (ADA750F)

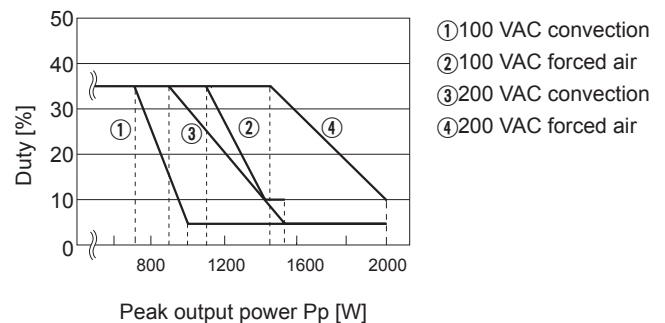


Fig.4.3 Relation between Peak power and Duty (ADA1000F)

5 Option

5.1 Option outline

■ Consult us detailed option and delivery before hand.

■ While some combinations of options are possible, some combinations are not. Please consult us for details.

● -E, -G

• Low leakage current type.

• The difference from standard is shown Table 5.1.

Table.5.1 Low leakage type

	-E	-G
Leakage current (230 VAC)	0.5mA max	0.15mA max
Conducted Noise	Class A	Not available
Ripple Noise	1.5 times standard	2.0 times standard

- F (It is not possible combine with option -J)
 - Option -F means fan unit is attached to standard model.
 - Power for the fan unit is supplied from the main unit; therefore fan ripple voltage may appear in the output voltage.
 - Consult us external view in detail.
 - Regular maintenance is required for fan unit.
 - Consult us life expentancy of fan.

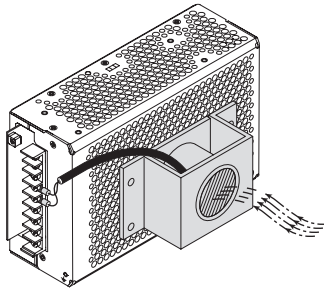


Fig. 5.1 Option -F

- T
 - T means terminal block is changed from horizontal to vertical position.
 - Please be aware that the number of pins for output terminals differs from standard products.
 - Consult us external view in details.

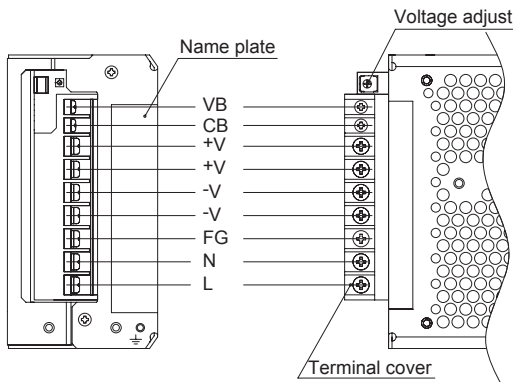
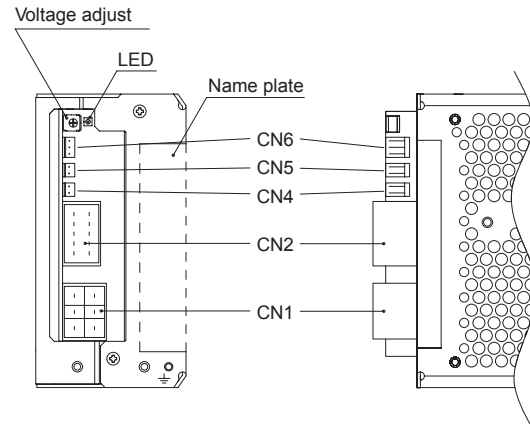


Fig.5.2 Part around terminal block (-T)

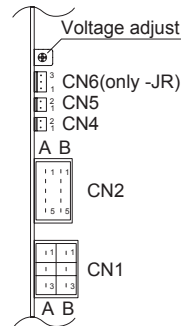
- J (Combinations with -W and -F are not possible)
 - J means terminal block is changed to connector.
 - Special harness is prepared. Refer to option parts.
 - Consult us external view in details.



CN1 does not have a FG terminal; therefore, when connecting a power supply, connect the \perp mark on the cover to the chassis earth.

Fig. 5.3 Option -J

CN1			CN2		
Pin No.	Input		Pin No.	Output	
A	1	N	1	+V	
	2	NC	2	+V	
	3	L	3	-V	
B	1	N	4	-V	
	2	NC	5	-V	
	3	L	1	+V	



Mating connector(terminal)
Mfr : AMP
1-178129-6
(1-175218-5 equivalent goods)

Mating connector(terminal)
Mfr : AMP
178289-5
(1-353717-5 equivalent goods)
*Keep drawing current per pin below 8.5A

CN4,5			CN6(only -JR)		
Pin No.	Signal		Pin No.	Remote ON/OFF	
1	CB		1	RC-	
2	VB		2	NC	
			3	RC+	

Mating connector(terminal)
Mfr : AMP
171822-2
(170204-2 equivalent goods)

Mating connector(terminal)
Mfr : AMP
171822-3
(170204-2 equivalent goods)

- C
 - C means internal PCB is coated.
 - (Improved moisture resistance)

- R
 - Option "-R" is available for remote ON/OFF.

Between RC (+) and RC (-)	Output
SW ON (4.5 - 12.5V)	ON
SW OFF (0 - 0.5V)	OFF

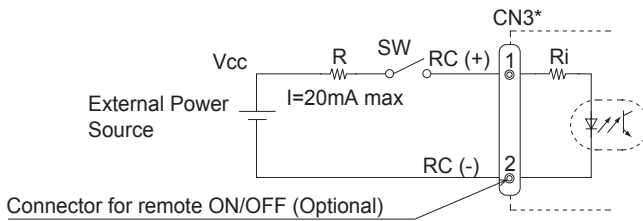


Fig.5.4 Example of use remote ON/OFF

*This connector is different if used with option -J. Refer to Fig. 5.3 for pin arrangements.

■When external power source is in the range of 4.5 - 12.5V, current limit resistance R is not required. However, when external power source exceeds 12.5V, current limit resistance R must be connected.

To calculate the current limit resistance, use the following equation:

$$R [\Omega] = \frac{V_{cc} - (1.1 + R_i \times 0.005)}{0.005}$$

Where ;

V_{cc} = External Power Source

R_i = The internal resistance (780Ω)

■A wrong connection may damage the internal components of the unit.

■Remote ON/OFF circuit (RC (+), RC (-)) is isolated from input, output and FG.

●-N1

- A type with a fitting supporting a dedicated DIN rail.
- Consult us external view in details.
- A type in which terminal block screws are aligned vertically (option: -T).

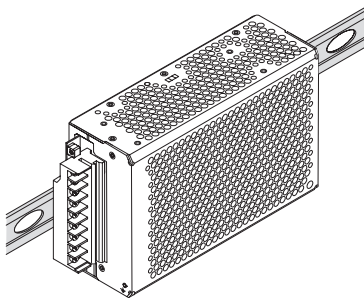


Fig. 5.5 Din Rail Attachment

●-W (It is not possible to combine with option -J)

- -W is available for detecting low input alarm (PF), detecting low output voltage (LV) and operating N+1 redundancy.
- Alarm specification is shown Table 5.2.
- Special harness is prepared, refer to option parts.
- Consult us external view in details.
- Each alarm (PF, LV) is isolated from input, output and FG.

Table 5.2 Explanation of alarms

	Alarm	Output of alarm
PF	When line voltage is abnormal (low input voltage out of range), the alarm outputs from CN3.	Open collector method Good : Low (0 - 0.8V, 1mA max) Fail : 50V max
LV	If the output voltage drops below the rating, the alarm signal is output from CN3. Note : ① This becomes unstable in the event of output overcurrent (intermittent overcurrent). ② The alarm signal is not output for parallel operation that does not use OR diodes.	Open collector method Good : Low (0 - 0.8V, 1mA max) Fail : 50V max

Please consult us details.

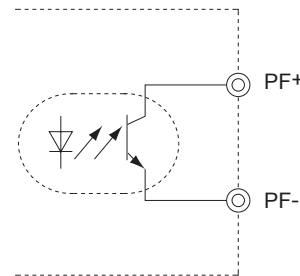


Fig.5.6 PF internal circuit

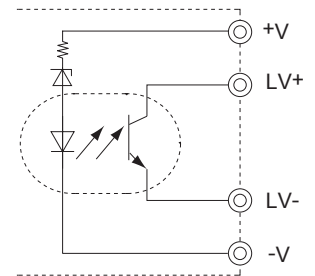


Fig.5.7 LV internal circuit

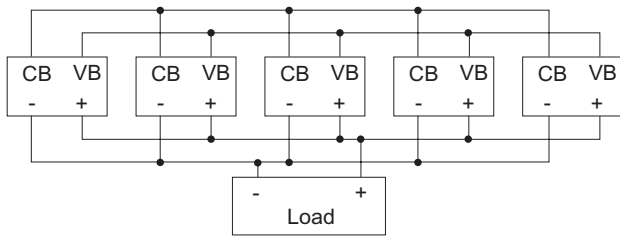


Fig.5.8 N+1 redundant operation

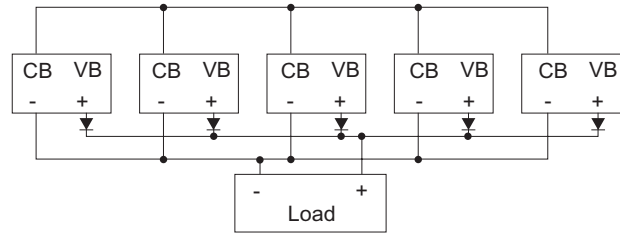


Fig.5.9 N+1 redundant operation which uses diode

■ In the event of one power supply failing and ceasing output of power, use of N+1 parallel redundancy means that output voltage is guaranteed through a backup; therefore, the system can continue with normal operation.

However, please consider the following condition.

- ① 5% or less of the output voltage decrease when one power supply stops.
- ② Even if one or several power supplies stop, output current that meets the following formula is required from the remaining normally operating power supplies.

$$\left[\text{Output current in parallel operation} \right] \leq \left[\frac{\text{The rated current per unit}}{\text{current per unit}} \right] \times (\text{Number of unit}) \times 0.9$$

In parallel operation, the maximum operative number of units is 5.

- ③ Please detach or exchange the broke down power supply after intercepting the input voltage (impossible hot swap).
- ④ The broke down power supply is detached or exchanged, and after output voltage of new one is adjusted alone, the power supply should be connected load (your system).

* Parallel operation cannot be done with standard model.

· The following electric specifications are different from standard model.

Output Voltage(V)		24	30	36	48
ADA600F	Load Regulation (mV)	240 max	300 max	360 max	480 max
ADA750F					
ADA1000F					

- ⑤ If diodes are used to configure a circuit to achieve even higher reliability, use connections as in Fig. 5.9.

- Please connect the diode with +V.
- Please do not connect VB of the power supply mutually.
In this case, master-slave operation cannot be done.
- Please adjust to become 100mV or less the difference of setting VB voltage of each power supply by the potentiometer for the output voltage setting to suppress the change of the output voltage to about 5% or less when one stops.



FETA-series



Feature

High power density (1.76W/cm³ FETA2500B-48)
 Low profile (41mm, 1.61 inch = meet to 1U height)
 High efficiency (92.5%typ FETA2500B-48, AC230Vin, 50% load)
 Harmonic attenuator (Complies with IEC61000-3-2 classA)
 Complies with SEMI F47
 Parallel Operation / Parallel Redundancy Operation
 Alarm signals, Remote ON / OFF and other functions

Safety agency approvals

UL60950-1, C-UL(CSA60950-1), EN60950-1

EMI

Complies with FCC Part15-A, CISPR22-A, EN55011-A,
 EN55022-A, VCCI-A

3-year warranty (Refer to Instruction Manual)

CE marking

Low voltage Directive

EMS Compliance : EN61204-3, EN61000-6-2

EN61000-4-2
 EN61000-4-3
 EN61000-4-4
 EN61000-4-5
 EN61000-4-6
 EN61000-4-8
 EN61000-4-11

FETA2500B

FE T A 2500 B -□□

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-20-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
② External form
T: Terminal block interface
③ Single output
④ Output wattage
⑤ 200/230V input
⑥ Output voltage

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	FETA2500B-36	FETA2500B-48
MAX OUTPUT WATTAGE[W]	*1 1980	2496
DC OUTPUT	36V 55A	48V 52A

SPECIFICATIONS

	MODEL	FETA2500B-36	FETA2500B-48
INPUT	VOLTAGE[V]	AC170 - 264 1 φ (Output derating is required at AC170V - 180V. Refer to instruction manual 4.2)	
	CURRENT[A]	11.3typ	
	FREQUENCY[Hz]	50 / 60 (47 - 63)	
	EFFICIENCY[%]	ACIN 200V	80typ (Io=10%)
		ACIN 230V	87typ (Io=20%)
		ACIN 230V	91typ (Io=50%)
		ACIN 230V	90typ (Io=100%)
OUTPUT	POWER FACTOR	ACIN 230V	0.98typ (Io=100%)
	INRUSH CURRENT[A]	ACIN 200V	*2 20max / 60max (Primary inrush current /Secondary inrush current) (More than 10 sec. to re-start)
	LEAKAGE CURRENT[ma]	0.85max (ACIN 240V 60Hz, Io=100%, According to IEC60950-1)	
	VOLTAGE[V]	36	48
	CURRENT[A]	ACIN 170V-180V	Output derating is required at ACIN 180V or less (refer to instruction manual 4.2)
		ACIN 180V-264V	55
	LINE REGULATION[mV]	144max	192max
	LOAD REGULATION[mV]	360max	480max
	RIPPLE[mVp-p]	0 to +50°C	*3 300max
		-10 to 0°C	*3 360max
	RIPPLE NOISE[mVp-p]	0 to +50°C	*3 360max
		-10 to 0°C	*3 480max
	TEMPERATURE REGULATION[mV]	0 to +50°C	360max
		-10 to +50°C	440max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV]	*4 144max	192max
	START-UP TIME[s]	*10 1.7max (ACIN 200V, Io=100%)	
	HOLD-UP TIME[ms]	ACIN 200V	10typ (Io=100%)
			20typ (Io=50%)
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	*5 32.40 - 39.60	43.20 - 52.80
	OUTPUT VOLTAGE SETTING[V]	36.00 - 37.44	48.00 - 49.92
ISOLATION	OVERCURRENT PROTECTION	Activate over 105% - 120% of rated current and recovers automatically. (Shut down if low-voltage protection activated)	
	OVERVOLTAGE PROTECTION[V]	*7 42.00 - 45.00	56.00 - 60.00
	LOW-VOLTAGE PROTECTION[V]	*7 21.60 - 25.20	28.80 - 33.60
	DC OK LAMP	LED (Green)	
	ALARM LAMP	LED (Amber)	
ENVIRONMENT	REMOTE ON/OFF	Provided	
	INPUT-OUTPUT-AUX-RC-WRN-PG	AC3,000V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At room temperature)	
	INPUT-FG	AC2,000V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At room temperature)	
	OUTPUT-AUX-RC-WRN-PG-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At room temperature)	
SAFETY AND NOISE REGULATIONS	OUTPUT-AUX-RC-WRN-PG	AC100V 1minute, Cutoff current = 100mA, DC100V 50MΩ min (At room temperature)	
	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +70°C (Output derating is required), 20 - 90%RH (Non condensing), 3,000m (10,000 feet) max	
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +85°C, 20 - 90%RH (Non condensing), 9,000m (30,000 feet) max	
	VIBRATION	10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis	
OTHERS	IMPACT	196.1m/s² (20G), 11ms, once each along X, Y and Z axis	
	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1	
	CONDUCTED NOISE	Complies with FCC Part15-A, CISPR22-A, EN55011-A, EN55022-A, VCCI-A	
OTHERS	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 Class A	
	CASE SIZE/WEIGHT	*9 102 X 41 X 340mm [4.02 X 1.61 X 13.39 inches] (W X H X D) / 2.3kg max	
OTHERS	COOLING METHOD	Forced cooling (internal fan)	

*1 AUX output power is not included.

*2 The current of input surge to a built-in noise filter (0.2ms or less) is excluded.

*3 Measured by 500MHz oscilloscope.

Ripple and ripple noise is measured on measuring board with capacitor of 22μF within 150mm from the output terminal.

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*5 Can not be used above the rated output current and the rated output power.

*6 When the output voltage is adjusted to higher than 49.92V and the load factor is over 70% of the rated current, if the load current changes quickly (< 200msec), the output voltage drops approximately 5V below the setting voltage.

*7 To recover output voltage, recycle input voltage after 10 or more seconds.

*8 Please contact us about another class.

*9 Case size contains neither the terminal blocks, connector and screw nor.

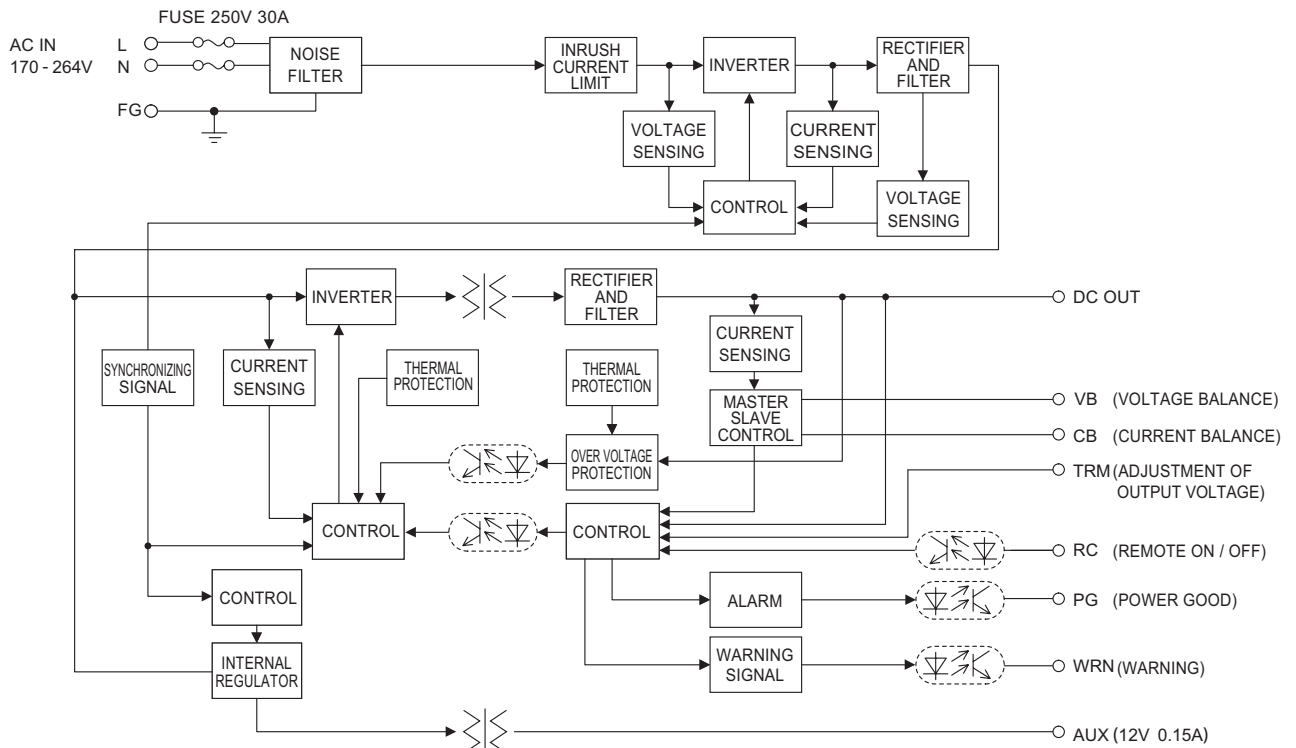
*10 When input voltage recycling is needed for output recovery, AC power shall be removed and cycled after 10 seconds to reset the protection circuit.

Please contact us when it's necessary to restart the power supply in less than 10 seconds.

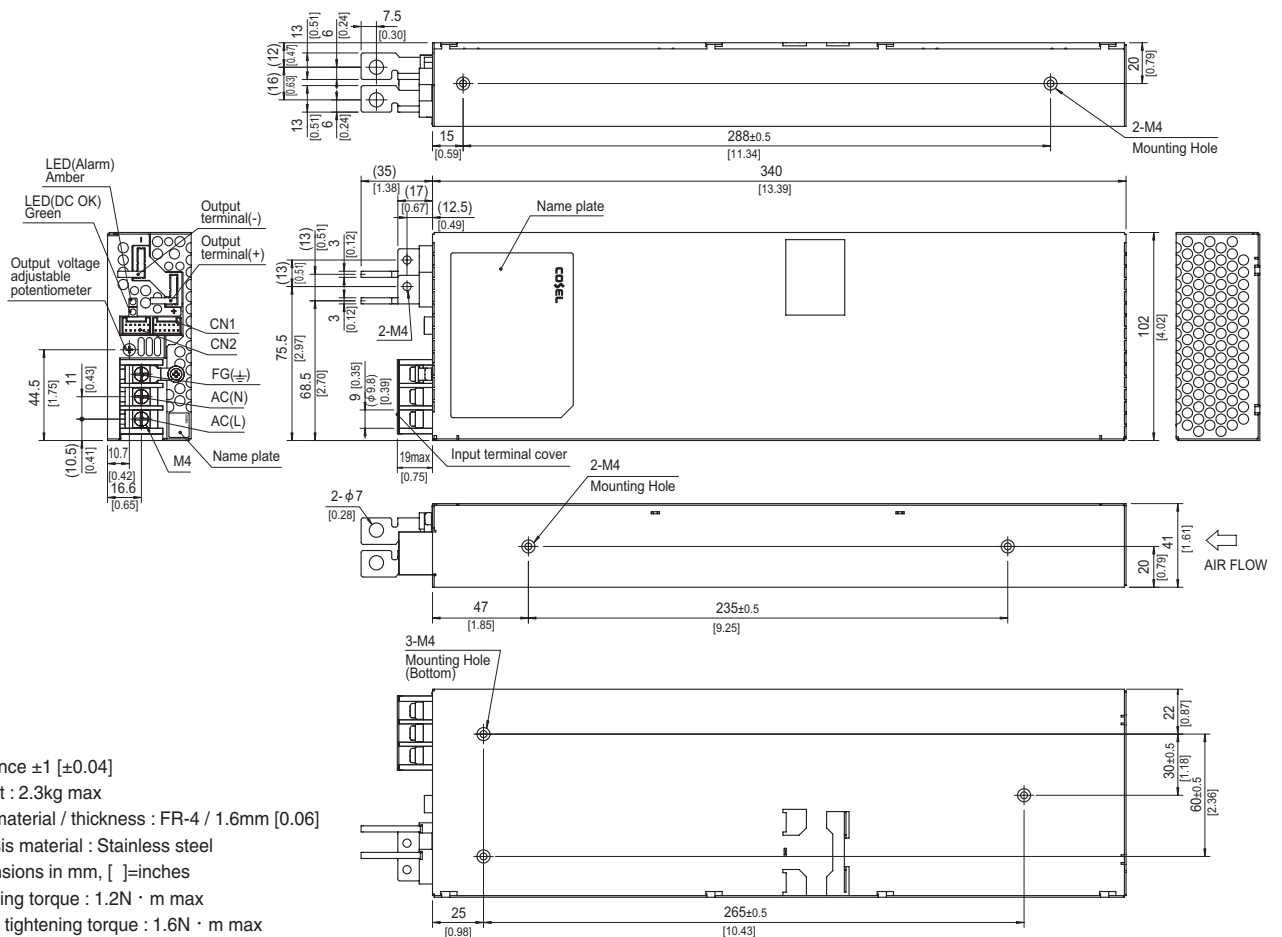
To meet the specifications. Do not operate over-loaded condition.

A sound may occur from power supply at peak loading.

Block diagram



External view



- * Tolerance ± 1 [± 0.04]
- * Weight : 2.3kg max
- * PCB material / thickness : FR-4 / 1.6mm [0.06]
- * Chassis material : Stainless steel
- * Dimensions in mm, []=inches
- * Mounting torque : 1.2N · m max
- * Screw tightening torque : 1.6N · m max
- * Please connect safety ground to FG terminal on the unit.

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection circuit	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
FETA2500B	Active filter	47	13.8	250V 30A	Relay	FR-4		Yes	Yes	Yes
	Phase-shift Full-bridge converter	94								

* The value of input current is at ACIN 200V and rated load.

1 Terminal Blocks

FETA-6

2 Functions

FETA-6

2.1	Input Voltage Range	FETA-6
2.2	Inrush Current Limiting	FETA-6
2.3	Overcurrent Protection	FETA-6
2.4	Overvoltage Protection	FETA-6
2.5	Low-voltage Protection	FETA-6
2.6	Thermal Protection	FETA-7
2.7	Output Voltage Adjustment Range	FETA-7
2.8	Output Ripple and Ripple Noise	FETA-7
2.9	Remote ON/OFF	FETA-7
2.10	Isolation	FETA-8
2.11	Signal Output (LED / Warning / Alarm)	FETA-8
2.12	Sequence Diagram	FETA-9

3 Series/Parallel Operation

FETA-9

3.1	Series Operation	FETA-9
3.2	Parallel Operation/Master-slave Operation	FETA-10
3.3	N+1 Parallel Redundancy Operation	FETA-10

4 Assembling and Installation Method

FETA-10

4.1	Installation Method	FETA-10
4.2	Derating	FETA-11
4.3	Expected Life and Warranty	FETA-11

5 Others

FETA-12

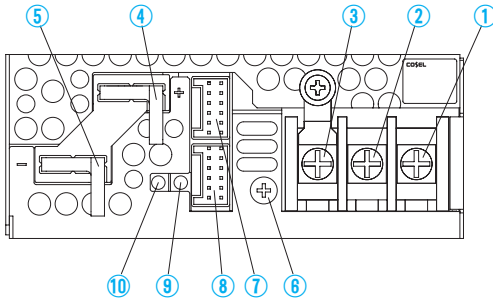
5.1	Output Current Monitor	FETA-12
5.2	Auxiliary Power (AUX)	FETA-12
5.3	Output Capacitive Load Considerations	FETA-12
5.4	External Component (EMI/EMC Filter)	FETA-12
5.5	Ground	FETA-12
5.6	Variable Speed Fan	FETA-12

6 Options

FETA-13

6.1	Outline of Options	FETA-13
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1 Terminal Blocks



- ①AC (L) } Input Terminals AC170 - 264V 1 ϕ 47 - 63Hz
- ②AC (N) } (M4)
- ③Frame ground (M4 \perp)
- ④+Output
- ⑤-Output
- ⑥Output voltage adjustable potentiometer
- ⑦CN1 } Connectors
- ⑧CN2 }
- ⑨LED for output voltage confirmation (DC_OK)
- ⑩LED for fault condition detection (ALARM)

Table 1.1 Pin Configuration and Functions of CN1, CN2

Pin No.	Pin Name	Function
1	AUXG	Auxiliary power output (GND)
2	AUX	Auxiliary power output
3	WRNG	Warning signal (GND)
4	WRN	Warning signal
5	PGG	Alarm signal (GND)
6	PG	Alarm signal
7	RCG	Remote ON/OFF (GND)
8	RC	Remote ON/OFF
9	COM	Signal ground
10	TRM	Adjustment of output voltage
11	VB	Voltage Balance
12	CB	Current Balance

Table 1.2 Matching connectors and terminals on CN1, CN2

Connector	Housing	Terminal	Mfr.
CN1	S12B-PUDSS-1	Reel : SPUD-001T-P0.5 or SPUD-002T-P0.5	J.S.T
CN2			

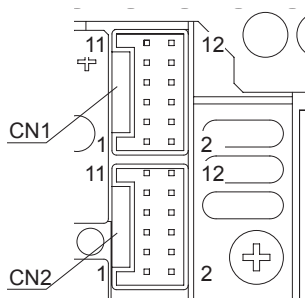


Fig.1.1 Connector pin numbers

2 Functions

2.1 Input Voltage Range

- Input voltage range of the power supplies is from AC170V to AC264V.
- In cases that conform with safety standard, input voltage range is AC200-AC240V (50/60Hz).
- If input value doesn't fall within above range, a unit may not operate in accordance with specifications and/or start hunting or fail. If you need to apply a square waveform input voltage, which is commonly used in UPS and inverters, please contact us.
- When the input voltage changes suddenly, the output voltage accuracy might exceed the specification. Please contact us.

2.2 Inrush Current Limiting

- An inrush current limiting circuit is built-in.
- If you need to use a switch on the input side, please select one that can withstand an input inrush current.
- Relay technique is used in the inrush current limiting circuit. When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that the inrush current limiting circuit becomes operative.
- When the switch of the input is turned on, the primary inrush current and secondary inrush current will be generated because the relay technique is used for the inrush current limiting circuit.

2.3 Overcurrent Protection

- An overcurrent protection circuit is built-in and activated at 105% - 120% of the rated current. A unit automatically recovers when a fault condition is removed. Please do not use a unit in short circuit and/or under an overcurrent condition.
- Low-voltage protection is activated when output voltage is reduced by over current protection under the low-voltage protection value.

2.4 Overvoltage Protection

- An overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait 10 or more seconds and turn on the AC input again to recover the output voltage.

Note :

- Please avoid applying a voltage exceeding the rated voltage to an output terminal. Doing so may cause a power supply to malfunction or fail. If you cannot avoid doing so, for example, if you need to operate a motor, etc., please install an external diode on the output terminal to protect the unit.

2.5 Low-voltage Protection

- Low-voltage protection is built-in. This protection will shut down the output with the activation. To restart the output, recycle AC input after 10 or more seconds.

2.6 Thermal Protection

■ A thermal protection circuit is built-in.

The thermal protection circuit may be activated under following conditions and shut down the output.

- ① When a current and a temperature continue to exceed the values determined by the derating curve.
- ② When a fan stops or air flow weakens by intake port or exhaust port is blocked.

If the thermal protection circuit is activated, shut off the input voltage and eliminate all the overheating conditions. To recover the output voltage, have enough time to cool down the unit before turning on the input voltage again.

2.7 Output Voltage Adjustment Range

■ To increase an output voltage, turn a built-in potentiometer clockwise. To decrease the output voltage, turn it counterclockwise.

■ The power supplies have an external output voltage control function. The output voltage can be adjusted by changing the voltage between the terminal TRM and the terminal COM on CN1/CN2. You can decrease the voltage by drawing a current from the TRM terminal.

You can calculate the output voltage in this case from formula ① below.

Please note that the formula ① gives you only an estimate. Please contact us if you need accurate numbers.

Please do not apply negative Voltage to TRM terminal.

There is more than one method to adjust the output voltage, including the methods to use external resistors and external power supplies. Since each method has different characteristic, please contact us for details.

$$\text{Output voltage} = \frac{\text{The voltage between TRM and COM}}{2.5 [\text{V}]} \times \text{rated output voltage} \cdots \textcircled{1}$$

Table 2.1 Output voltage adjustment range

Model	Output voltage adjustment range [V]
W/O option "Y1"	43.2 to 52.8
W/ option "Y1"	approximately 0 to 52.8

2.8 Output Ripple and Ripple Noise

■ Output ripple noise may be influenced by measurement environment, measuring method Fig.2.1 is recommended.

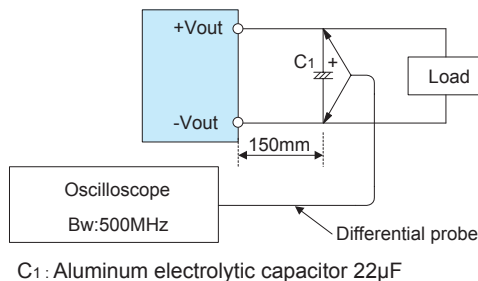


Fig.2.1 Measuring method of Ripple and Ripple Noise

Remarks :

When GND cable of probe with flux of magnetic force from power supply are crossing, ripple and ripple noise might not measure correctly.

Please note the measuring environment.

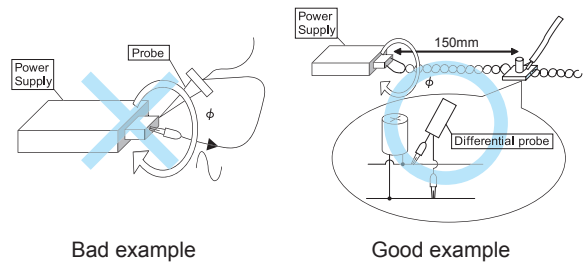


Fig.2.2. Example of measuring output ripple and ripple noise

2.9 Remote ON/OFF

■ These models have a remote ON/OFF function.

■ You can operate the remote ON/OFF function by sending signals to CN1/CN2. Please see Table 2.2 and Table 2.3 for specifications and Fig.2.3 for connecting examples.

■ Please note the followings when using the remote ON/OFF function.

- ① The output stops when a current flows to RC.

* Reverse logic option (-R) also available. Refer to section 6.Option.

- ② The current flown to RC is a 20mA max.

- ③ When the output voltage is turned off through the remote ON/OFF circuit, the built-in fan slows down.

- ④ If the output voltage is turned off through the remote ON/OFF circuit, the WRN signals and the PG signals keep "Low".

- ⑤ Description in this section is based on the assumption that you will use one unit alone. If you are planning to use the units in parallel operation or use multiple units for a single system, please check necessary voltage and current values.

■ Please wire carefully. If you are wrongly, the internal components of a unit may be damaged.

■ Remote ON/OFF circuits (RC and RCG) are isolated from input, output, FG, AUX, WRN and PG.

Table 2.2 Specifications of remote ON/OFF (RC-RCG)

Output voltage	Between RC and RCG
ON	L level (0 to 0.5V) or open
OFF	H level (4.5 to 12.5V)

Table 2.3 Specifications of remote ON/OFF (Case of Fig.2.3)

Connection method	Fig.2.3 (a)	Fig.2.3 (b)	Fig.2.3 (c)
Power ON	SW open (0.1mA max)	SW open (0.1mA max)	SW close (0.5V max)
Power OFF	SW close (3mA min)	SW close (3mA min)	SW open (0.1mA max)
Base pin	RCG	AUXG	RCG, AUXG

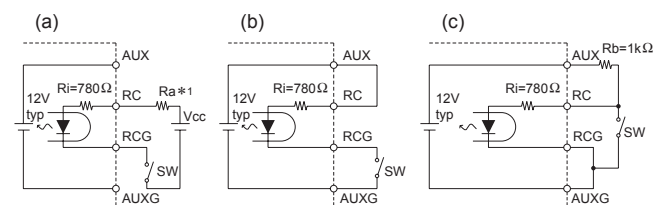


Fig.2.3 Examples of connecting remote ON/OFF circuit

*1 If the output of an external power supply is within the range of 4.5 - 12.5V, you do not need a current limiting resistor Ra. If the output exceeds 12.5V, however, please connect the current limiting resistor Ra.

To calculate a current limiting resistance value, please use the following equation.

$$Ra[\Omega] = \frac{V_{cc} - (1.1 + Ri \times 0.005)}{0.005}$$

2.10 Isolation

■When you run a Hi-Pot test as receiving inspection, gradually increase the voltage to start. When you shut down, decrease the voltage gradually by using a dial. Please avoid a Hi-Pot tester with a timer because, when the timer is turned ON or OFF, it may generate a voltage a few times higher than the applied voltage.

2.11 Signal Output (LED/Warning/Alarm)

■Functions of LED indicators and Output of Warning/Alarm are shown below. LED indicators and Output of Warning/Alarm are signals to check the presence/absence of voltage at the output terminal of a power supply and to detect warning/fault conditions. The timing of signals might be vary depending on input and load conditions. Please make sure enough evaluation.

Table 2.4 Description of LED indicator

LED indicator	Condition	Output voltage
OFF	Input power not present	OFF
Green - ON	Normal condition	ON
Green - Blinking	DC OFF by RC signal	OFF
Amber - Blinking	Warning condition (refer to Table.2.5)	ON
Amber - ON	Fault condition (refer to Table.2.6)	OFF

Table 2.5 Description of the Warnings (WRN signal)

Warning	Output of Warning
The WRN signals are "Low" when the power supply operates normally.	Open collector method Good : L level (0 to 0.5V at 3mA)
The signals turn "High" when AC input voltage is wrong (AC<170V, AC>264V) or DC output voltage is wrong (DC output voltage is out of voltage adjustment range.) or fan alarm/thermal warning is detected.	Bad : H level or Open (35Vmax)

Table 2.6 Description of the alarms (PG signal)

Alarm	Output of Alarm
The PG signals are "Low" when the power supply operates normally.	Open collector method Good : L level (0 to 0.5V at 3mA)
The signals turn "High" when the fan stops or the power supply stops as a result of output voltage decrease/stop, activation of thermal protection, overvoltage protection, Low-Voltage protection functions or wrong input voltage is applied.	Bad : H level or Open (35Vmax)

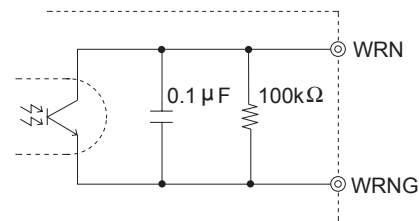


Fig.2.4 Internal circuit of WRN

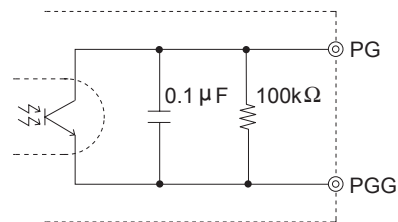


Fig.2.5 Internal circuit of PG

■Please note the followings when you use the warnings (WRN signal) and the alarms (PG signal).

- ① The time it takes until the WRN signals and the PG signals turn "High" vary depending on conditions.
- ② If the output voltage is turned off through a remote ON/OFF circuit, the WRN signals and the PG signals keep "Low".

■The WRN signal (Warning) circuit and the PG signal (Alarm) circuit are isolated from input, output, FG, RC and AUX.

2.12 Sequence Diagram

(1) Turn ON/OFF by Remote ON/OFF control

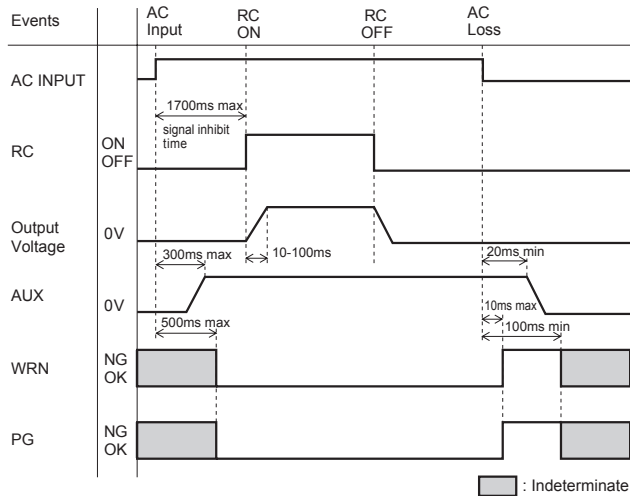


Fig.2.6 Sequence time chart by Remote ON/OFF control

(2) Turn ON/OFF by AC Input / Loss

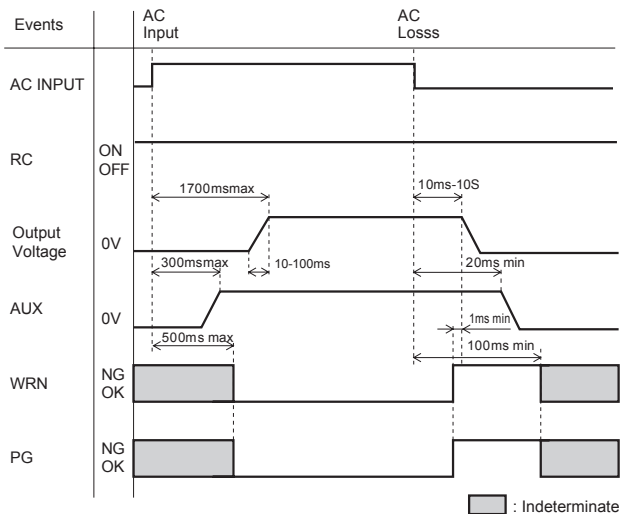


Fig.2.7 Sequence time chart by AC Input / Loss

3 Series/Parallel Operation

3.1 Series Operation

It is possible to connect multiple output voltages in series in order to obtain higher output voltage. However care should be taken as follows:

Notes of (a) and (b) :

- Please note that the maximum current available to the load is equal to the current of the lowest rated supply in the string.
- In case of malfunction (Failure or protection circuit activation), please stop the operation and replace the failed power supply.

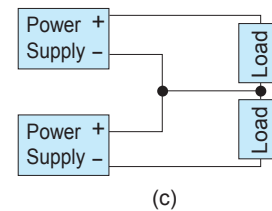
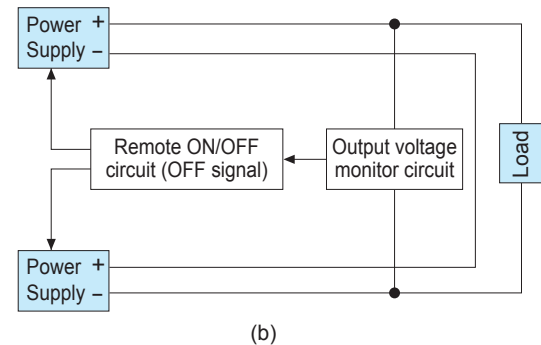
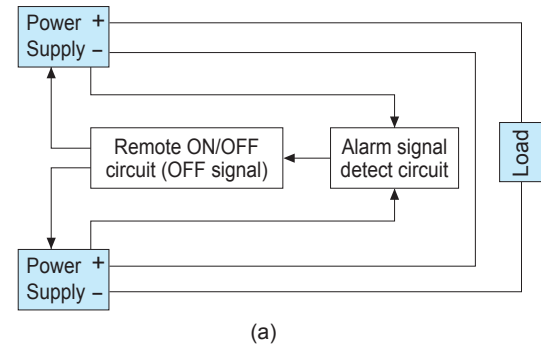


Fig.3.1 Examples of connecting in series operation

FETA

3.2 Parallel Operation/Master-slave Operation

■ You can use the power supplies in parallel operation by connecting units as shown in Fig.3.2.

Please parallelly connect VB, CB and COM of each power supply in parallel operation.

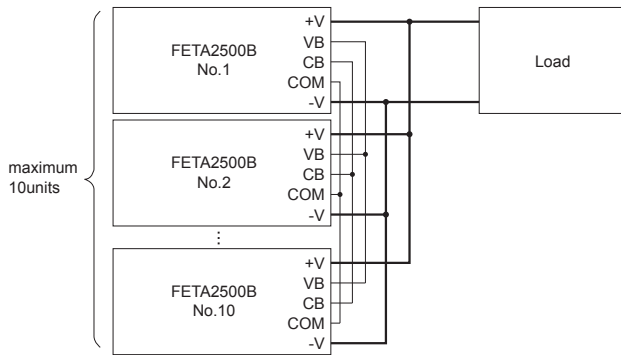


Fig.3.2 Example of parallel connection

■ Differences in the output current values among the power supplies in parallel connection are 5% at most. Please make sure that the sum of the output current values does not exceed a value obtained from the following equation.

$$\begin{aligned} & \text{(Output current in parallel operation)} \\ & = (\text{Rated current per unit}) \times (\text{Number of units}) \times 0.95 \end{aligned}$$

■ When the number of units in parallel operation increases, the input current also increases. Please design input circuitry (including circuit pattern, wiring and current capacity for equipment) carefully.

■ Please make sure that the wiring impedance of a load from each power supply becomes even. Otherwise, the output current balance circuit may become inoperative.

■ The maximum number of units you can use in parallel operation is 10.

■ You can adjust the output voltage in parallel operation by adjusting a potentiometer of just one power supply.

To do so, select one power supply as the master unit and turn the potentiometers of the other (slave) power supplies clockwise to the end.

Once you have done this, you can adjust the output voltage by turning the potentiometer of the master unit.

■ Parallel connection with other products is not allowed.

3.3 N+1 Parallel Redundancy Operation

■ You can have N+1 redundancy operation for improved system reliability.

■ N+1 redundancy operation is possible by connecting units as shown in Fig.3.3.

VB, CB and COM are also connected together between all units in parallel.

■ Output current calculation is required based on following equation.

The current has to be more over normal operation current even if one power supply fails.

$$\text{Maximum output current} \leq \text{Rated current per unit} \times \text{Numbers of normal operated units} \times 0.95$$

■ If you add one extra power supply in parallel operation, even if one of the power supplies in your system fails, the remaining non-failed power supplies continue to sustain the system. If one of the power supplies stops operating, the output voltage may change about 5%.

■ Parallel with other products is not allowed.

■ Please shut off the input voltage when you replace a failed power supply.

■ After replacement, please make sure that all wirings are completed correctly, before re-applying input voltage.

■ Hot-swap or Hot-plug is not available.

■ 2 or more power supplies failures may cause the output voltage to decrease, lending the application system to shut down. Immediate replacement is recommended when a power supply has failed.

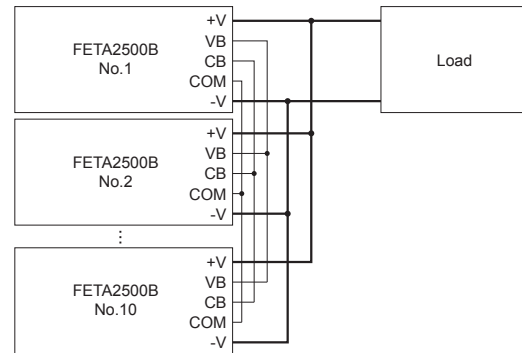


Fig.3.3 Example of N+1 redundancy operating connection

■ If you have any questions about series, parallel and N+1 redundancy operations, please contact us.

4 Assembling and Installation Method

4.1 Installation Method

■ Screw mounting has to be consider the product weight for safety fixture.

■ To keep enough insulation distance between screws and internal components, length of the mounting screw should not exceed recommendation as following Table4.1.

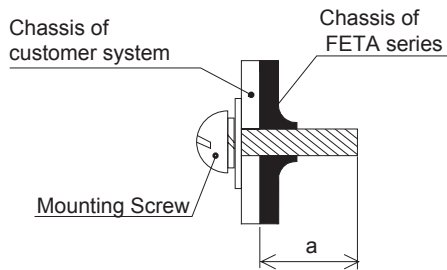
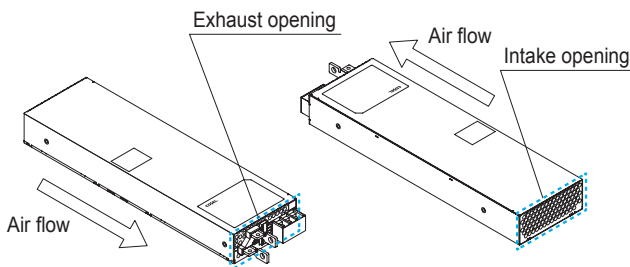


Fig.4.1 Mounting screw

Table 4.1 Max penetration length

Mounting hole	a (Max penetration length)
Bottom	6mm max
Side	4.5mm max

- The power supplies have a built-in forced cooling fan. Do not block ventilation at the suction side and its opposite side.
- * Option with reversed airflow (-F2) is also available. Refer to section 6.Option.
- If you use a power supply in a dusty environment, it can give a cause for a failure. Please consider taking such countermeasures as installing an air filter near the suction area of the system to prevent a failure.



(a) Front side (b) Rear side

Fig.4.2 Location of intake port and exhaust port

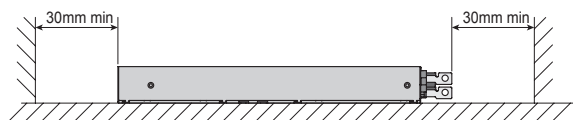


Fig.4.3 Clearance of intake port and exhaust port

- When mounting the power supply with screws, it is recommended that this be done as shown in Fig.4.4. If other methods are used, be sure the weight of the power supply is taken into account.

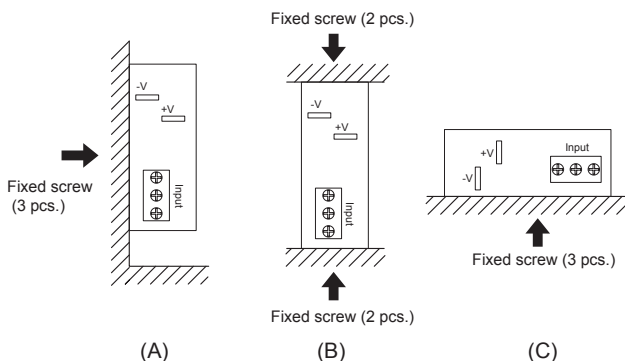


Fig.4.4 Installation method

4.2 Derating

■ Input Voltage Derating Curve

Input voltage derating curve is shown in Fig.4.5.

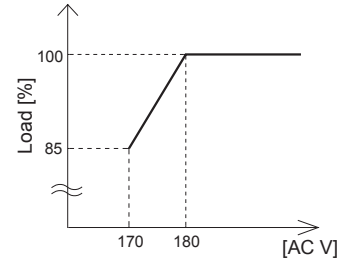


Fig.4.5 Input voltage derating curve

■ Ambient Temperature Derating Curve

Derating curve depending on an ambient temperature is shown in Fig.4.6.

* Specifications for ripple and ripple noise changes in the shaded area.

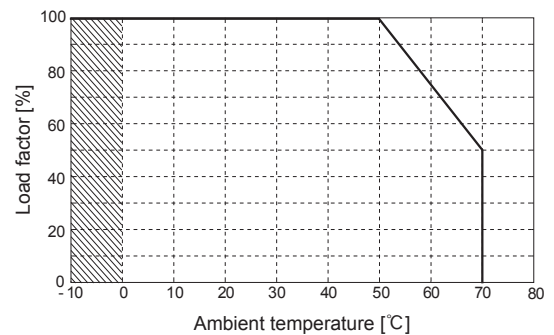


Fig.4.6 Ambient temperature derating curve

4.3 Expected Life and Warranty

■ Expected Life

Please see the following tables for expected life.

Table.4.2 Expected lifetime

Mounting	Cooling method	Average ambient temperature	Expected lifetime [years]	
			Io = 50%	Io = 100%
All direction	Forced air cooling (internal fan)	Ta = 35°C or less	6	5
		Ta = 50°C	4	3
		Ta = 70°C	2	—

* This lifetime includes a built-in fan lifetime.

■ Life expectancy ($R(t)=90\%$) of fan depends on use conditions as shown in Fig.4.7.

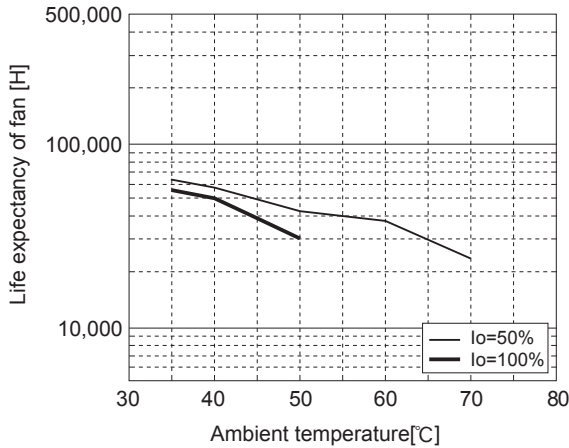


Fig.4.7 Life expectancy of fan

■ Warranty

Please see the following table for warranty. The warranty period is 5 years maximum.

Table.4.3 Warranty

Mounting	Cooling method	Average ambient temperature	Warranty [years]	
			Io = 50%	Io = 100%
All direction	Forced air cooling (internal fan)	Ta = 35°C or less	5	5
		Ta = 50°C	3	3
		Ta = 70°C	1	—

5 Others

5.1 Output Current Monitor

■ You can monitor an output current by measuring a voltage between the terminal CB and COM.

■ Fig.5.1 shows the relationship between the voltage of the terminal CB and the output current.

The output current shown in Fig.5.1 should be used only as a guide.

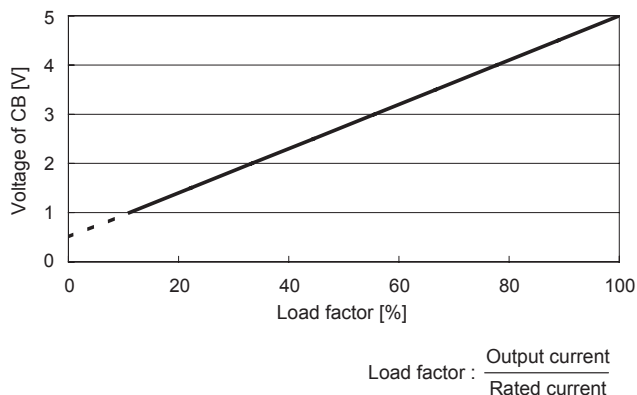


Fig.5.1 Load factor conversion graph

Note:

- Careful wire connection is needed to avoid a malfunction caused by noise.
- Use a measuring instrument which has 500kΩ input impedance or more.
- Do not short between CB and COM because of possibility of failure.

5.2 Auxiliary Power (AUX)

■ The power supplies can generate an auxiliary power (AUX: 12V 0.15A) from CN1/CN2 to provide for remote ON/OFF and attached circuits.

■ AUX circuit is isolated from other (input, output, FG, RC, WRN and PG) circuits.

■ Please do not draw a current of 0.15A or higher from the auxiliary power because doing so could damage the internal circuits or cause malfunction.

When you connect a DC-DC converter, a current a few times higher than normal current may flow at start-up. Please check the current.

5.3 Output Capacitive Load Considerations

■ The maximum of 22,000 μF can be connected to the load side.

If you need to connect more than 22,000 μF, please contact us for the assistance.

5.4 External Component (EMI/EMC Filter)

■ You can have the power supplies comply with FCC Part 15 class B and CISPR22-B, EN55011-B, EN55022-B, VCCI-B by connecting an external EMI/EMC Filter.

Recommended EMI/EMC Filter
NAC-20-472 (COSEL)

5.5 Ground

■ When installing the power supply with your unit, ensure that the input FG terminal is connected to safety ground of the unit.

5.6 Variable Speed Fan

■ The power supply has built-in variable speed cooling fan. The fan speed is a function of load and ambient temperature.

6 Options

6.1 Outline of Options

- *Please inquire us for details of specifications and delivery timing.
- *You can combine multiple options. Some options, however, can not be combined with other options. Please contact us for details.

● -R

- Specification with reversed logic for remote ON/OFF operation. Remote ON/OFF specification of Option-R is on Table 6.1 and Table 6.2.

Table 6.1 Remote ON/OFF specification of Option-R (RC-RCG)

Output Voltage	Between RC and RCG
OFF	L level (0 to 0.5V) or Open
ON	H level (4.5 to 12.5V)

Table 6.2 Remote ON/OFF specification of Option-R (Case of Fig.2.3)

Connection method	Fig.2.3 (a)	Fig.2.3 (b)	Fig.2.3 (c)
Power OFF	SW open (0.1mA max)	SW close (0.5V max)	SW close (0.5V max)
Power ON	SW close (3mA min)	SW open (0.1mA max)	SW open (0.1mA max)
Base pin	RCG	AUXG	RCG, AUXG

● -Y1

- The output voltage can be adjusted from approximately 0V to 110% by changing the voltage between the terminal TRM and the terminal COM.

The calculation formula is ① as following.

$$\text{Output voltage} = \frac{\text{The voltage between TRM and COM}}{2.5\text{V}} \times \text{rated output voltage} \cdots \textcircled{1}$$

- Output voltage factory setting is 48.00 - 49.92[V] (FETA2500B-48-Y1) / 36.00 - 37.44[V] (FETA2500B-36-Y1).
- Normal output voltage adjustment range is within 80-110% of the rated output voltage via built-in potentiometer.
- Negative voltage to TRM terminal may cause failure.
- The fan speed is higher than standard product under light load condition.
- Option -Y1 unit's derating curve depending on an ambient temperature is shown in Fig.6.1.

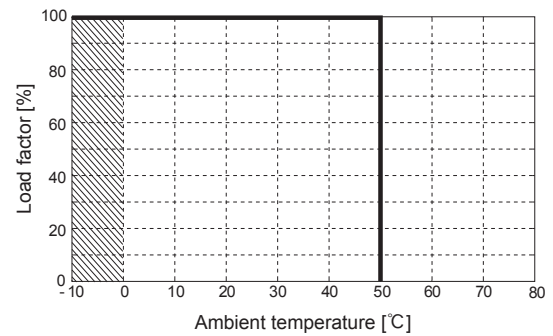


Fig.6.1 Ambient temperature derating curve

- Option -Y1 unit's electrical characteristic (efficiency, ripple) are different from standard products.

● -F2

- Specification with reversed air exhaust.
- Differences from standard products are shown in Fig.6.2 and Fig.6.3.
- Fan operates at higher speed compare to standard product at low ambient temperature.
- Please contact us for details about life expectancy of fan.

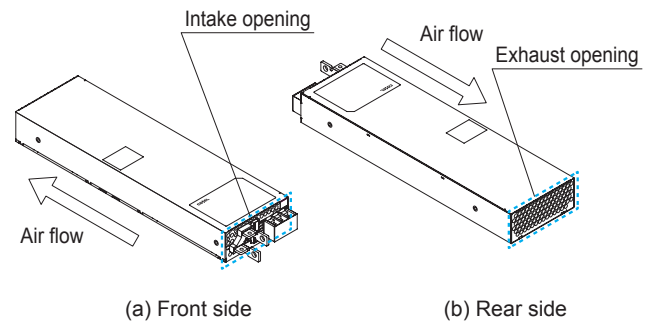


Fig.6.2 Location of intake port and exhaust port

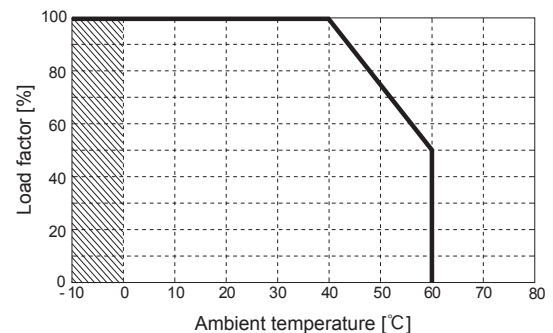
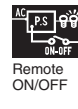
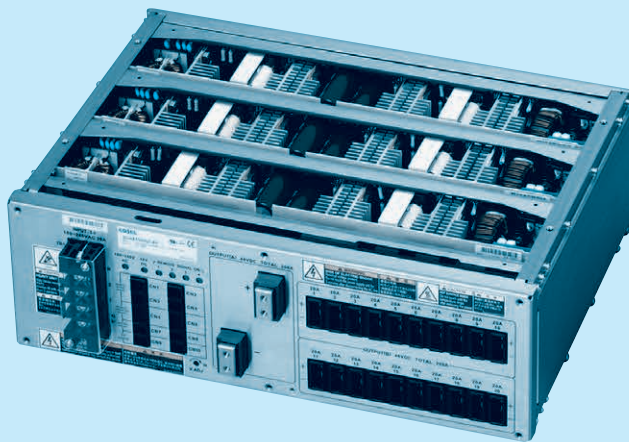


Fig.6.3 Ambient temperature derating curve



SC-series

DC48V Front end power supply



SCHA10000T



SCDA10000T

Feature

- High power, AC-DC front end power supply
- Three-phase input(AC160 - 264V 3 ϕ)
- High efficiency (90%), High power factor (0.99)
- Harmonic attenuator (Complies with IEC61000-3-12)
- Complies with SEMI F47
- Wide output voltage adjustable range approximately 0 to 52.8V (Optional)
- Constant current regulation provided with additional external components (Optional)
- Parallel operation and Parallel redundancy operation (SCHA10000T)
- System ON / OFF (Remote ON / OFF)
- Alarms
- Output Voltage Monitor
- Parallel Control (Start in / out)
- Remote Signal ON / OFF

Safety agency approvals

UL60950-1, C-UL, EN60950-1

3-year warranty

CE marking

Low Voltage Directive

EMI

Complies with EN55011 Group1-A, EN55022-A, CISPR22-A, FCC Part15 classA

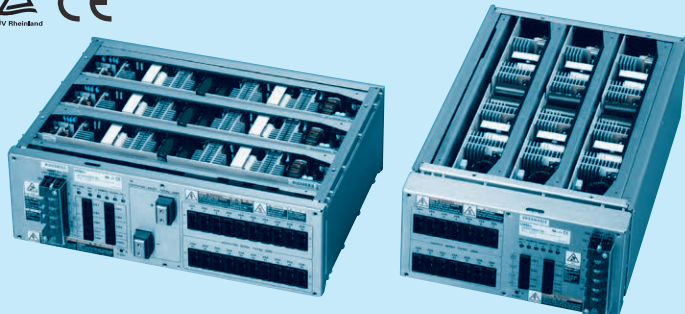
EMS Compliance

EN61000-4-2
EN61000-4-3
EN61000-4-4
EN61000-4-5
EN61000-4-6
EN61000-4-8
EN61000-4-11

SCHA 10000T/SCDA 10000T

SC H A 10000 T -48 -□

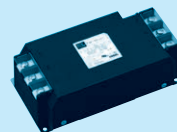
SC



SCHA10000T

SCDA10000T

Example recommended EMI/EMC filter
Filter TAC-50-223



* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
- ② External form
- ③ Single output
- ④ Output wattage
- ⑤ Three-phase input
- ⑥ Output voltage
- ⑦ Optional

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

SPECIFICATIONS

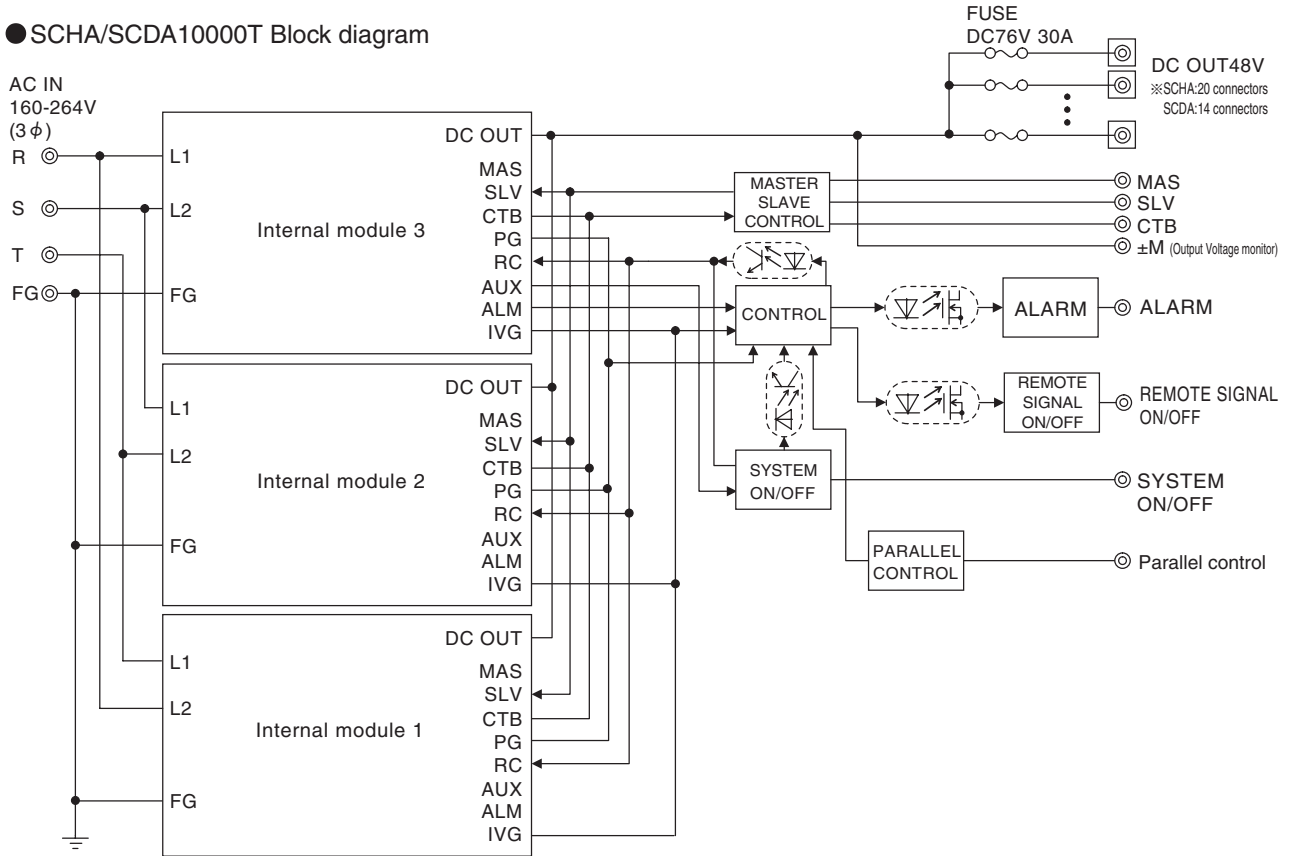
	MODEL	SCHA10000T-48	SCDA10000T-48
INPUT	VOLTAGE[V]	AC160 - 264 3 φ	
	CURRENT[A]	ACIN200V	35typ
	FREQUENCY[Hz]	50/60 (47 - 63)	
	EFFICIENCY[%]	ACIN200-240V	90typ
	POWER FACTOR	ACIN200-240V	0.99typ (Io=100%)
	INRUSH CURRENT[A]	ACIN240V *1	60typ / 80typ (Primary inrush current /Secondary inrush current) (More than 3 sec. to re-start)
	LEAKAGE CURRENT[mA]	5.0max (ACIN 240V 60Hz, Io=0 - 100%, According to IEC60950-1)	
OUTPUT	VOLTAGE[V]	48	
	CURRENT[A]	208	
	WATTAGE[W]	9,984	
	LINE REGULATION[mV]	192max	
	LOAD REGULATION[mV]	720max	
	RIPPLE[mVp-p]	0 to +50°C *2	150max
	RIPPLE NOISE[mVp-p]	0 to +50°C *2	200max (BW:500MHz)
	TEMPERATURE REGULATION[mV]	0 to +30°C	240max
	DRIFT[mV]	*3	192max
	START-UP TIME[ms]	*6	750max (ACIN 200V, Io=100%)
	HOLD-UP TIME[ms]	20typ (ACIN200V, Io=100%)	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Activate over 105% - 120% of rated current and recovers automatically. (Shut down if low-voltage protection activated)	
	OVERVOLTAGE PROTECTION[V]	*4	56.0 - 59.0 (shut down)
	LOW-VOLTAGE PROTECTION[V]	*4	28.8 - 33.6 (shut down)
	OPERATING INDICATION	LED : Green (48VDC output), White (AC IN)	
	ALARM OUTPUT	Detecting low input voltage, detecting open phase, detecting low output voltage	
	REMOTE ON/OFF (SYSTEM ON/OFF)	Provided	
ISOLATION	(INPUT) - (OUTPUT · SYSTEM ON/OFF · REMOTE SIGNAL ON/OFF · ALARM)	AC3,000V 1minute, Cutoff current = 100mA, DC2,200V 1minute, Cutoff current = 1mA (At Room Temperature) DC500V 50MΩ min (At Room Temperature)	
	(INPUT) - (FG)	AC2,000V 1minute, Cutoff current = 100mA, DC2,200V 1minute, Cutoff current = 1mA (At Room Temperature) DC500V 50MΩ min (At Room Temperature)	
	(OUTPUT · SYSTEM ON/OFF · REMOTE SIGNAL ON/OFF · ALARM) - (FG)	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)	
	(OUTPUT) - (SYSTEM ON/OFF · REMOTE SIGNAL ON/OFF · ALARM)	AC100V 1minute, Cutoff current = 50mA, DC100V 10MΩ min (At Room Temperature)	
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	0 to +50°C, 20 - 85%RH (Non condensing), 3,000m(10,000feet) max (Refer to Cooling method)	
	STORAGE TEMP., HUMID. AND ALTITUDE	-25 to +85°C, 20 - 90%RH (Non condensing), 9,000m(30,000feet) max	
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 30 minutes each along X, Y and Z axis	
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis	
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1 complies	
	CONDUCTED NOISE	Complies with EN55011 Group1-A, EN55022-A, CISPR22-A, FCC part15 classA, additional EMI/EMC Filter required for meeting class B	
	HARMONIC ATTENUATOR	Complies with IEC61000-3-12	
OTHERS	CASE SIZE/WEIGHT *5	459 X 150 X 320mm [18.07 X 5.91 X 12.6 inches] (W X H X D)/23kg max	310.5 X 150 X 510mm [12.22 X 5.91 X 20.08 inches] (W X H X D)/20kg max
	COOLING METHOD	Forced cooling (require external fan)	

- *1 The current of input surge to a built-in noise filter (0.2ms or less) is excluded.
- *2 Measured by 500MHz oscilloscope.
- *3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
- *4 To recover output voltage, recycle input voltage after 3 or more seconds.

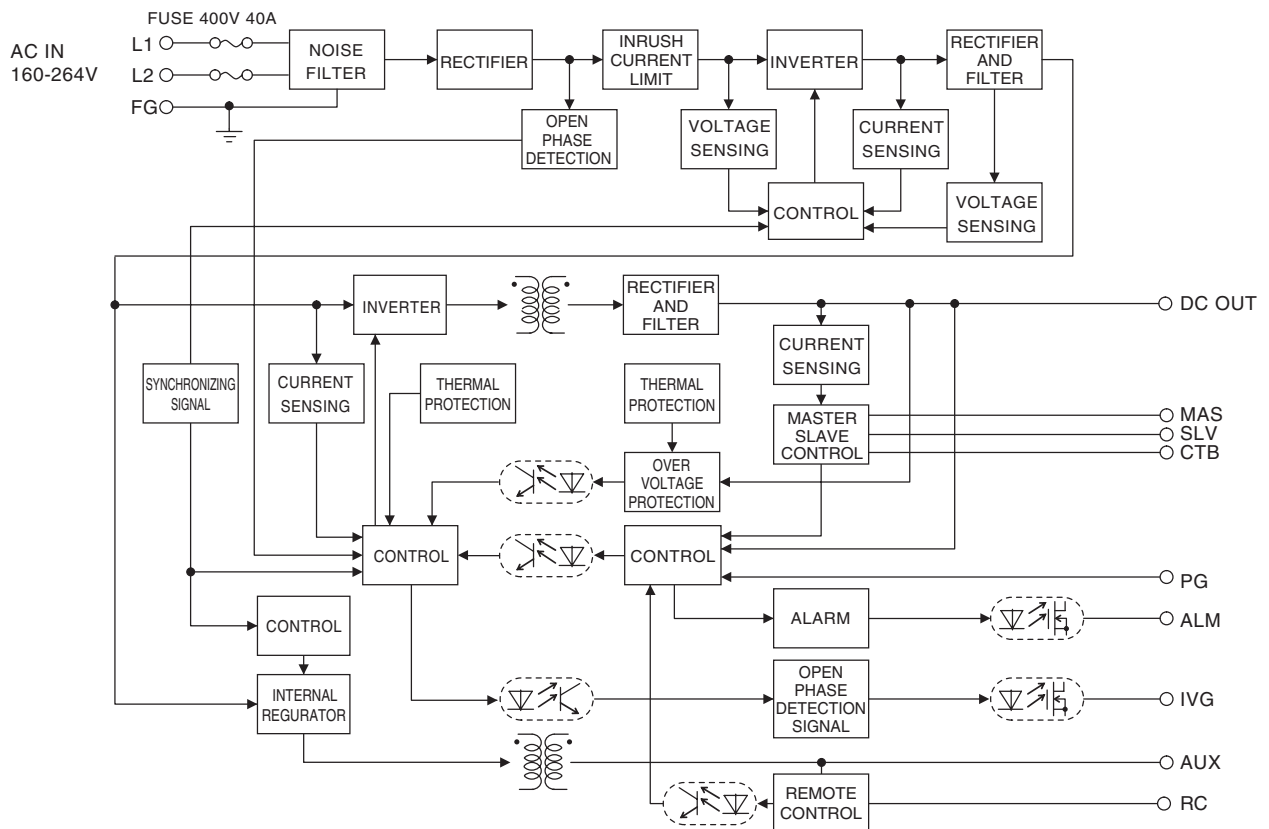
- *5 Case size contains neither the terminal blocks, connector and screw nor.
 - *6 When input voltage recycling is needed for output recovery, AC power shall be removed and cycled after 3 seconds to reset the protection circuit.
- Please contact us when it's necessary to restart the power supply in less than 3 seconds.

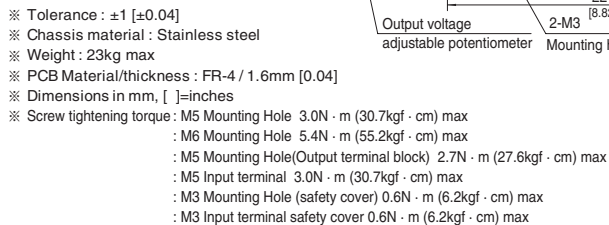
SCHA/SCDA10000T Block diagram

● SCHA/SCDA10000T Block diagram



● Internal module Block diagram

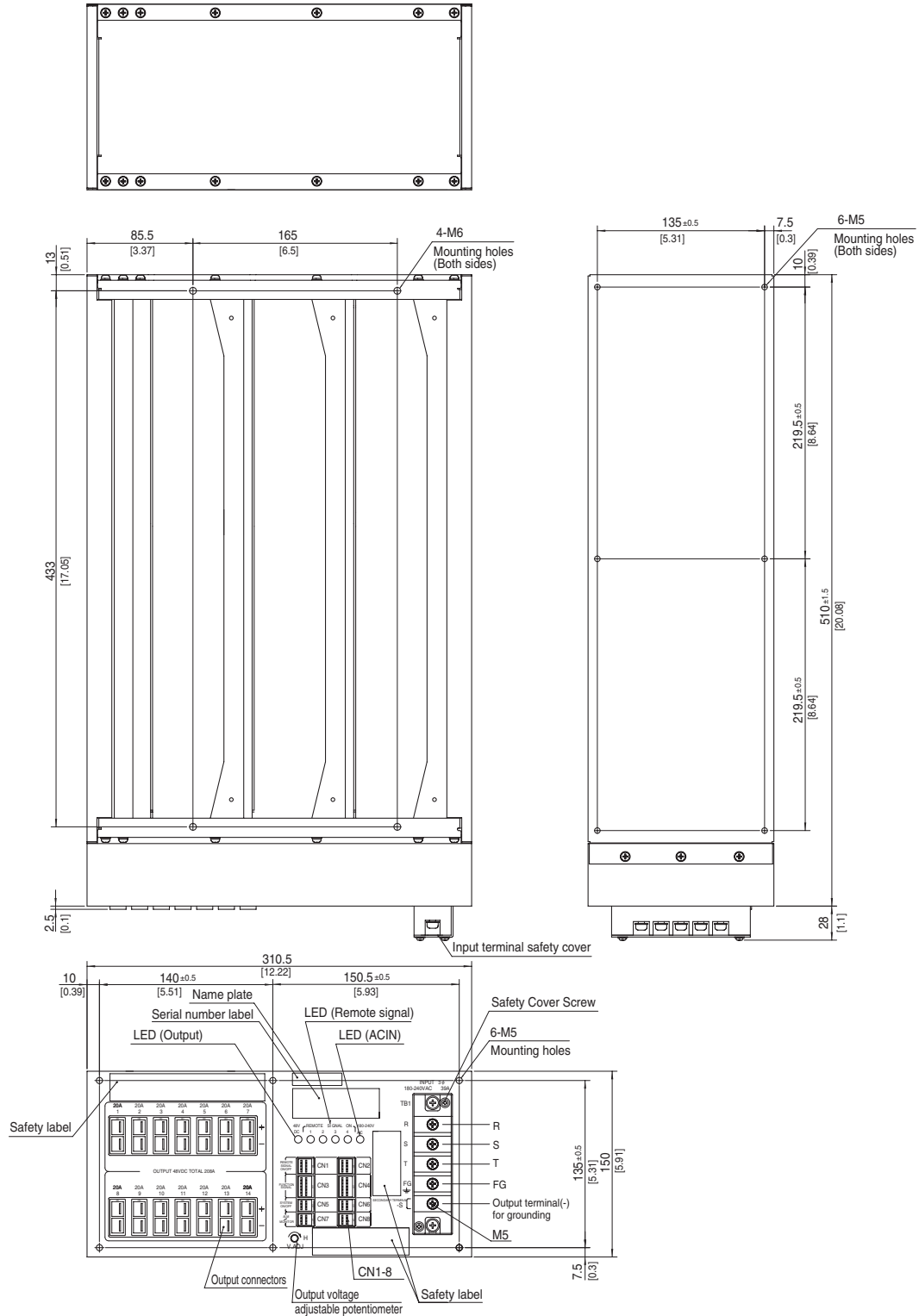




※1 Bus-bar safety cover, optional accessory.

SCDA10000T external view

SC



※ Tolerance : ± 1 [± 0.04]

※ Chassis material : Stainless steel

※ Weight : 20kg max

※ PCB Material/thickness : FR-4 / 1.6mm [0.04]

※ Dimensions in mm, []=inches

※ Screw tightening torque : M5 Mounting Hole 3.0N · m (30.7kgf · cm) max
 : M6 Mounting Hole 5.4N · m (55.2kgf · cm) max
 : M5 Input terminal 3.0N · m (30.7kgf · cm) max
 : M3 Input terminal safety cover 0.6N · m (6.2kgf · cm) max

※ LED (ACIN) : White with AC input

※ LED (Output) : Green with 48VDC output

※ LED (Remote signal) : Green (Indicates Remote signal status)

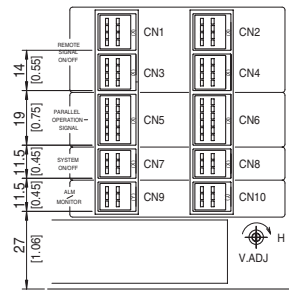
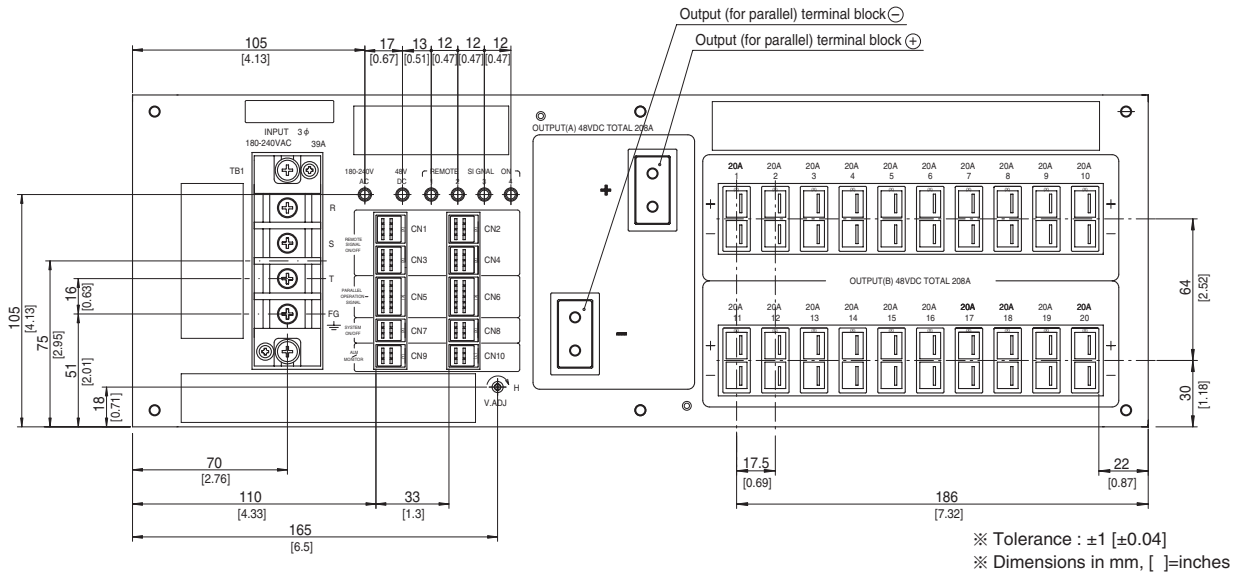
※ Output terminal(-) for grounding

· Output terminal(-) is internally connected to DC48V Output (-).

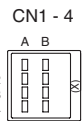
· Output terminal(-) : For grounding to stabilize secondary output by connecting to system ground (earth).

· Can not draw current through output terminal(-) for grounding.

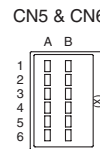
SCHA10000T external view (front panel)



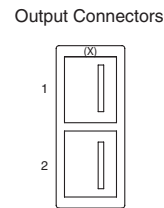
CN1-10 location dimensions



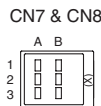
CN1 - 4



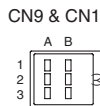
CN5 & CN6



Output Connectors



CN7 & CN8



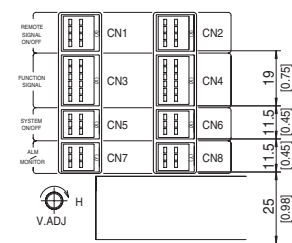
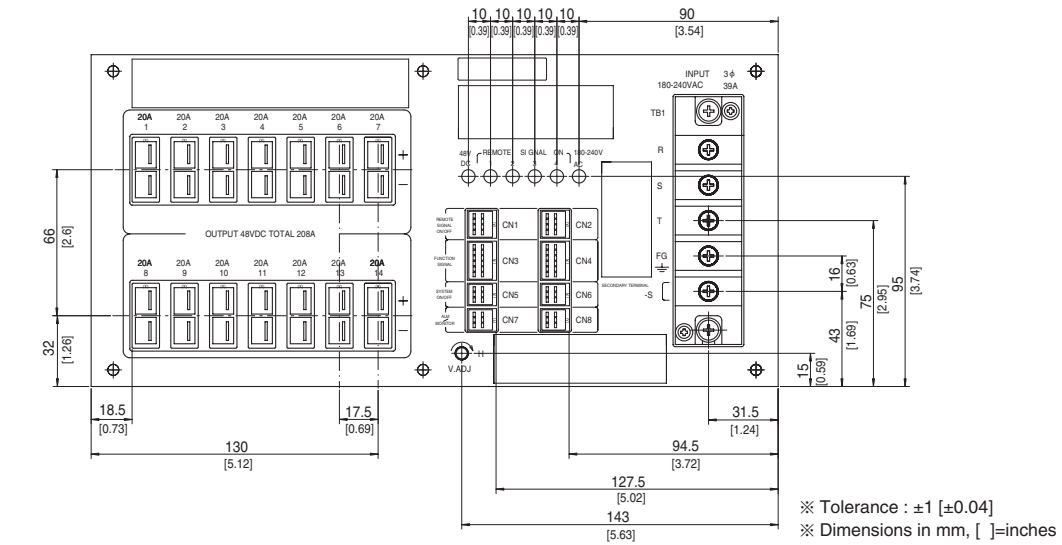
CN9 & CN10

Connector pin numbers

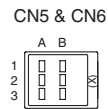
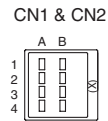
SCHA10000T Functions & Connectors

Connector		Housing	Mfr.	Pin No.	Function
Output connector	1-353080-2	1-179958-2	Tyco Electronics AMP	1	Output (+)
				2	Output (-)
CN1-CN4	1318125-1	1-1318119-4	Tyco Electronics AMP	1A	Remote signal ON/OFF 1+
				1B	Remote signal ON/OFF 1-
				2A	Remote signal ON/OFF 2+
				2B	Remote signal ON/OFF 2-
				3A	Remote signal ON/OFF 3+
				3B	Remote signal ON/OFF 3-
				4A	Remote signal ON/OFF 4+
				4B	Remote signal ON/OFF 4-
CN5 & CN6	1318126-1	1-1318118-6	Tyco Electronics AMP	1A,1B	MAS: Master
				2A,2B	SLV: Slave
				3A,3B	CTB: Current balance
				4A,4B	PCNT: Parallel control
				5A,5B	COM:GND
				6A,6B	N.C.
CN7 & CN8	1318124-1	1-1318119-3	Tyco Electronics AMP	1A,1B	System ON/OFF +
				3A,3B	System ON/OFF -
				2A,2B	N.C.
CN9 & CN10	1318124-2	2-1318119-3	Tyco Electronics AMP	1A,1B	Alarm +
				3A,3B	Alarm -
				2A	+M: Output voltage monitor+
				2B	-M: Output voltage monitor-

SCDA10000T external view (front panel)

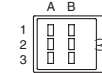
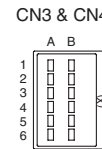


CN1-8 location dimensions



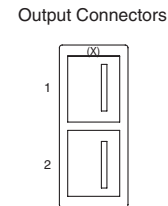
CN1 & CN2

CN5 & CN6



CN3 & CN4

CN7 & CN8



Output Connectors

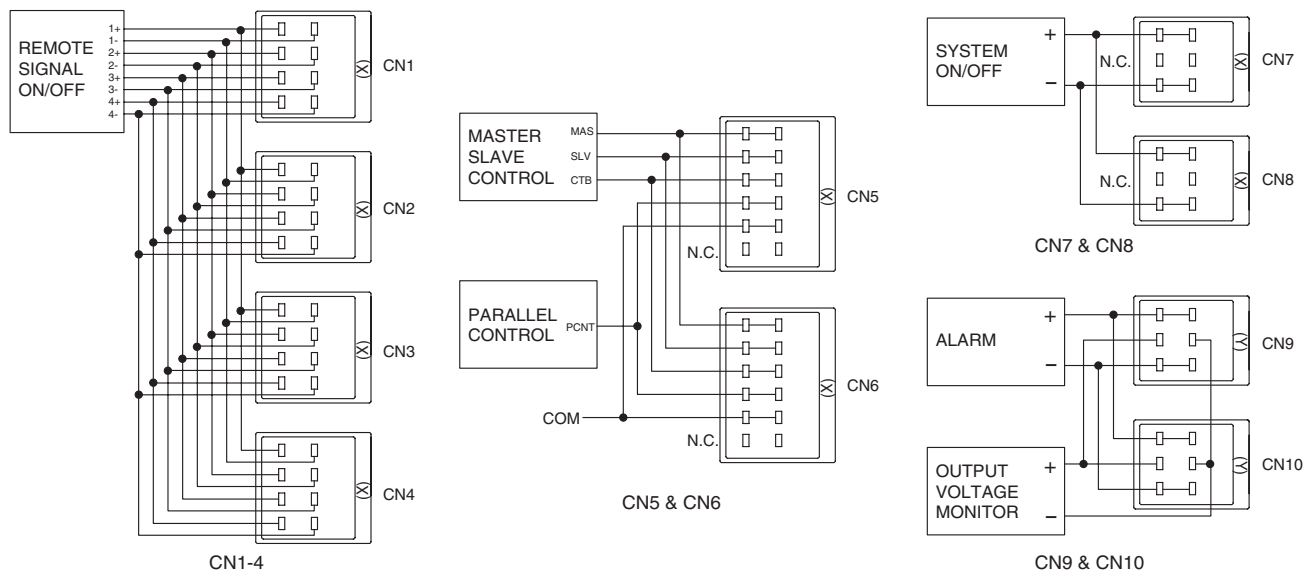
Connector pin numbers

SCDA10000T Functions & Connectors

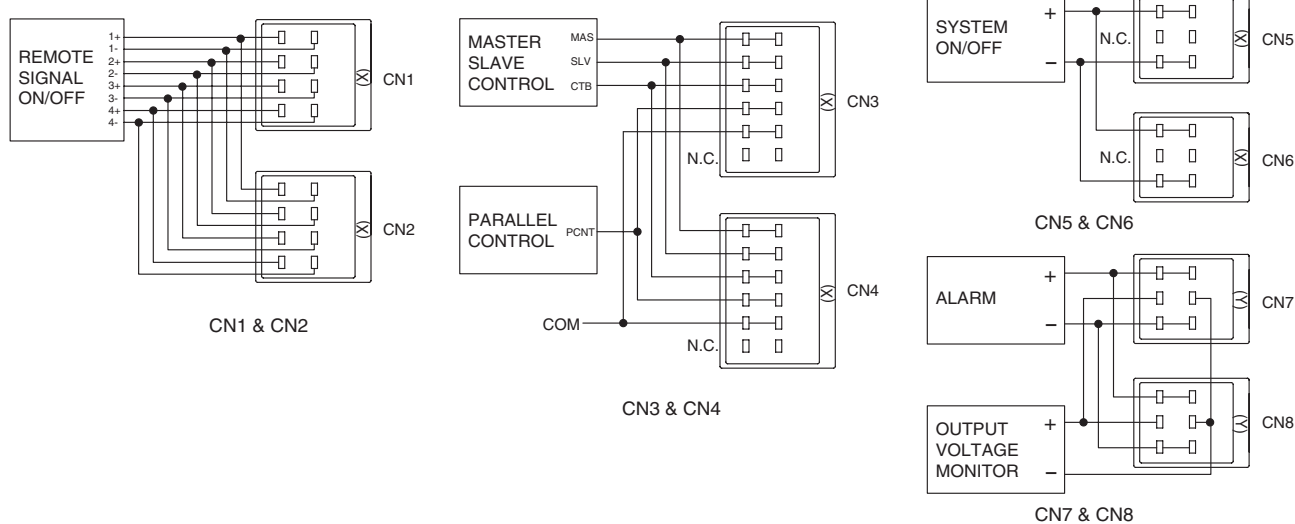
Connector		Housing	Mfr.	Pin No.	Function
Output connector	1-353080-2	1-179958-2	Tyco Electronics AMP	1	Output (+)
				2	Output (-)
CN1 & CN2	1318125-1	1-1318119-4	Tyco Electronics AMP	1A	Remote signal ON/OFF 1+
				1B	Remote signal ON/OFF 1-
				2A	Remote signal ON/OFF 2+
				2B	Remote signal ON/OFF 2-
				3A	Remote signal ON/OFF 3+
				3B	Remote signal ON/OFF 3-
				4A	Remote signal ON/OFF 4+
				4B	Remote signal ON/OFF 4-
CN3 & CN4	1318126-1	1-1318118-6	Tyco Electronics AMP	1A,1B	MAS: Master
				2A,2B	SLV: Slave
				3A,3B	CTB: Current balance
				4A,4B	PCNT: Parallel control
				5A,5B	COM:GND
				6A,6B	N.C.
CN5 & CN6	1318124-1	1-1318119-3	Tyco Electronics AMP	1A,1B	System ON/OFF +
				3A,3B	System ON/OFF -
				2A,2B	N.C.
CN7 & CN8	1318124-2	2-1318119-3	Tyco Electronics AMP	1A,1B	Alarm +
				3A,3B	Alarm -
				2A	+M: Output voltage monitor+
				2B	-M: Output voltage monitor-

Connection diagram of function connectors

● SCHA10000T



● SCDA10000T



Basic characteristics data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection circuit	PCB/Pattern		
						Material	Single sided	Double sided
SCHA 10000T	Active filter	65	35	400V 40A	SCR	FR-4		Double and Multi
	Forward converter	130						
SCDA 10000T	Active filter	65	35	400V 40A	SCR	FR-4		Double and Multi
	Forward converter	130						

* The value of input current is at ACIN 200V 3 φ and rated load.

1 Functions SC-10

1.1	Input Voltage Range	SC-10
1.2	Inrush Current Limiting	SC-10
1.3	Overcurrent Protection	SC-10
1.4	Overvoltage Protection	SC-10
1.5	Low-voltage Protection	SC-10
1.6	Thermal Protection	SC-10
1.7	Output Voltage Adjustment	SC-10
1.8	System ON/OFF	SC-11
1.9	Remote Signal ON/OFF	SC-11
1.10	Alarms	SC-11
1.11	Parallel Control (Start in / out)	SC-12
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2 Single / Parallel / Series Operation SC-12

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2.3	N+1 Parallel Redundancy Operation	SC-14
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3 Assembling and Installation SC-15

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4 Others SC-16

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1 Functions

1.1 Input Voltage Range

- The input voltage range is AC160-264V (three-phase).
- In cases that conform with safety standard, input voltage range is AC180-AC240V (50/60Hz).
- In the case of three-phase four-wire system, connect the three wires to input terminal, except ground wire.
- If the wrong input or single phase input is applied, the unit will not operate properly and/or may be damaged.

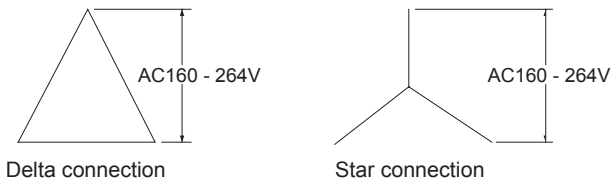


Fig.1.1 Connection method

1.2 Inrush Current Limiting

- An inrush current limiting circuit is built-in.
- If you need to use a switch on the input side, please select one that can withstand an input inrush current.
- Thyristor technique is used in the inrush current limiting circuit. When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that the inrush current limiting circuit becomes operative.
- When the switch of the input is turned on, the primary inrush current and secondary inrush current will be generated because the thyristor technique is used for the inrush current limiting circuit.

1.3 Overcurrent Protection

- An overcurrent protection circuit is built-in and activated at 105% - 120% of the rated current. A unit automatically recovers when a fault condition is removed. Please do not use a unit in short circuit and/or under an overcurrent condition.
- Low-voltage protection is activated when output voltage is reduced by over current protection under the low-voltage protection value.

1.4 Overvoltage Protection

- An overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait more than 3 seconds and turn on the AC input again to recover the output voltage.

Note :

- Please avoid applying a voltage exceeding the rated voltage to an output terminal. Doing so may cause a power supply to malfunction or fail. If you cannot avoid doing so, for example, if you need

to operate a motor, etc., please install an external diode on the output terminal to protect the unit.

1.5 Low-voltage Protection

- Low-voltage protection is built-in. This protection will shut down the output with the activation. To restart the output, recycle AC input after 3 or more seconds.

1.6 Thermal Protection

- A thermal protection circuit is built-in. The thermal protection circuit may be activated under following conditions and shut down the output.
 - ① Continuous over current 208A or more.
 - ② Continuous over wattage 9984W or more.
 - ③ When the cooling which deviates from referred to 3.2 are consecutive.
 - ④ When a fan stops or air flow is blocked from the fan and weakens.

If the thermal protection circuit is activated, shut off the input voltage and eliminate all the overheating conditions. To recover the output voltage, have enough time to cool down the unit before turning on the input voltage again.

1.7 Output Voltage Adjustment

- To increase an output voltage, turn a built-in potentiometer clockwise. To decrease the output voltage, turn it counterclockwise.
- Output Voltage Adjustment is 43.2 - 52.8V.
- Output Voltage factory setting is 47.0 - 49.0V.

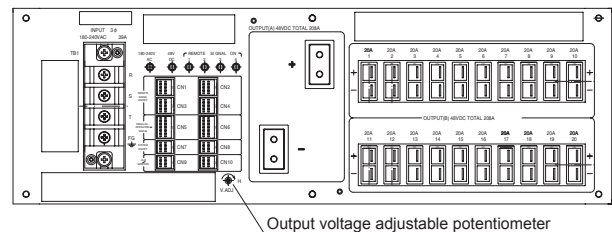


Fig.1.2 SCHA10000T Output voltage adjustable potentiometer

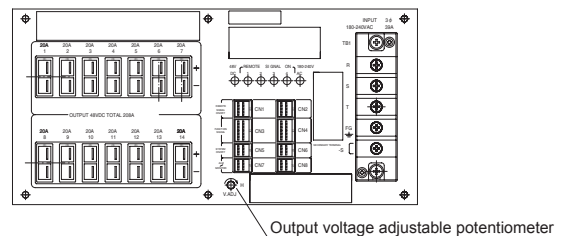


Fig.1.3 SCDA10000T Output voltage adjustable potentiometer

1.8 System ON/OFF

■ System ON/OFF controls output voltage On/Off and Remote signal ON/OFF by open/short terminals (SCHA10000T : CN7,8 SCDA10000T : CN5,6).

System ON/OFF specification is on Table1.1.

A connection example is on Figure1.4. Connector locations and pin assignment are shown on the external view.

■ System ON/OFF circuit is isolated from all of the others which are input, output, FG, Remote signal ON/OFF and Alarms.

■ System ON/OFF sequence diagram is explained in 1.12.

Table1.1 Specifications of system ON/OFF

Output	System ON/OFF	Remote signal ON/OFF
ON	Short(Low) (Less than 1V, less than 5mA)	Low (0-0.5V, less than 1000mA)
OFF	Open(High) (Open voltage 2.5V-5.0V) (Absolute maximum rating 30V)	High or Open (Absolute maximum rating 30V)

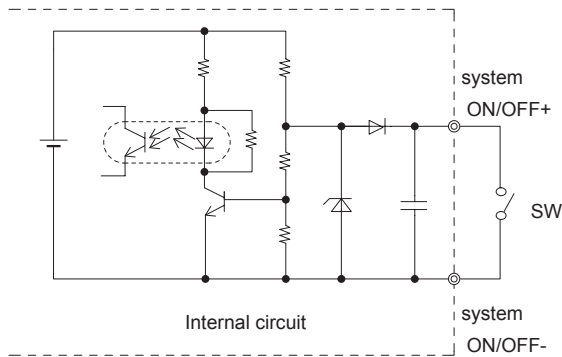


Fig.1.4 Example of System ON/OFF

1.9 Remote Signal ON/OFF

■ Remote signal ON/OFF switches an external power supply ON/OFF such as DC/DC converter (SCHA10000T : CN1 - 4, SCDA10000T : CN1,2).

The internal circuit is on Figure 1.5.

Remote signal specification is on Table1.1.

Connector locations and pin assignment are shown on the external view.

■ The remote signal ON/OFF circuit is isolated from all of the others which are input, output, FG, System ON/OFF and Alarms.

■ Remote signal ON/OFF sequence diagram is explained in 1.12.

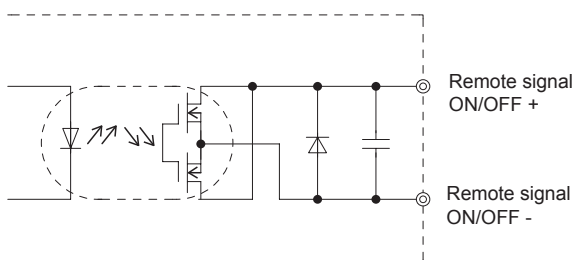


Fig.1.5 Internal circuit of Remote signal ON/OFF

1.10 Alarms

■ The alarm signal detailed on Table1.2 is sent out from the alarm terminal (SCHA10000T : CN9,10 SCDA10000T : CN7,8). Pin assignment is shown on external view.

Alarm specification is on Table1.3.

The internal circuit is on Figure 1.6.

■ Alarm diagram is explained in 1.12.

Table1.2 An alarm generated condition

An alarm generated condition
(1)Low input voltage (AC160V or less) or disconnection of one phase of three phase line.
(2)Thermal protection is activated and shuts down the output voltage.
(3)Decreased output voltage and the low-voltage protection is activated.
(4)Shut down output voltage and the low-voltage protection is activated.
(5)Overvoltage protection is activated and shuts down the output voltage.
(6)Over current protection is activated and decreases the output voltage.
(7)Turn off AC power source, then recycle AC within 3 seconds. This condition keeps off the output voltage with sending out the alarm.

Table1.3 Specifications of alarm

condition of power supply	Output of Alarm
good	Low (0-0.5V, less than 200mA)
bad	High or Open (Absolute maximum rating 30V)

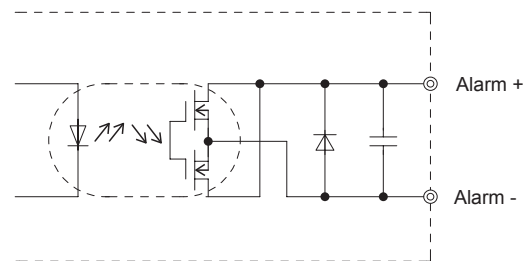


Fig.1.6 Internal circuit of Alarm

■ Alarm circuit is isolated from input, output, FG, system ON/OFF and Remote signal ON/OFF.

SC 1.11 Parallel Control (Start in / out)

■By connecting PCNT pin, difference of start-up voltage and stop voltage can be prevented.

■Total number of units should be no more than 10 units.

1.12 Sequence Diagram

①System ON / OFF is Short (Low) before turning on AC.

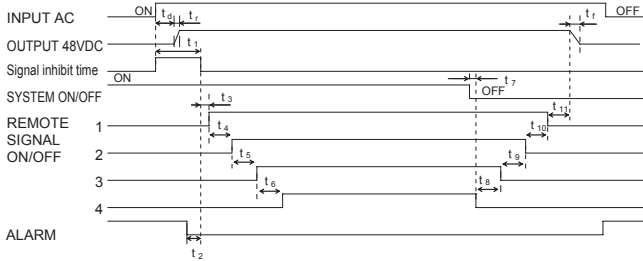


Fig.1.7 Timing diagram 1

②System ON / OFF is Short (Low) after turned on AC.

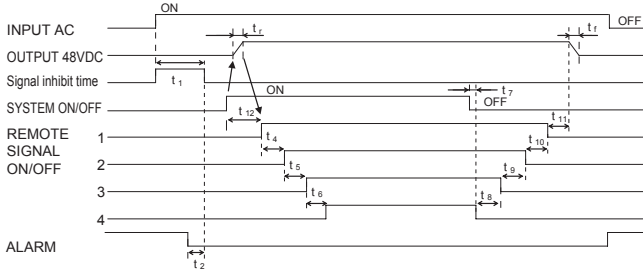


Fig.1.8 Timing diagram 2

③Abnormal condition

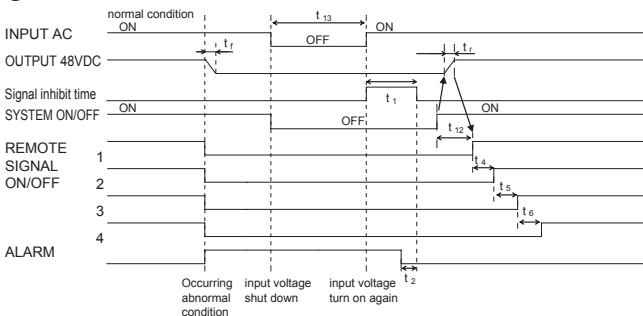


Fig.1.9 Timing diagram 3

t_r : Rise time

30ms max (DC48V External Capacity is less than 50,000 μ F, at rated load)

70ms max (DC48V External Capacity is less than 150,000 μ F, at rated load)

$t_o + t_r$: Start-up time 750ms max

t_f : Fall time 500ms max (Load factor more than 10%)

t_1 Signal inhibit time : 0.75 - 1.15s

t_2 : 100ms min $t_4 - t_6, t_8 - t_{11}$: 0.6s \pm 10%

t_3, t_7, t_{12} : 100ms max t_{13} : 3s min

* Remote signal ON/OFF sequence follows ① if System ON/OFF is turned Short (Low) during inhibit time.

* t_{12} : 48V turns on within 100ms after turned Short (Low) System ON/OFF. Then the Remote signal ON/OFF 1 turns Low.

* With shorted output condition, the output voltage will shut off and send out the alarm.

* In parallel, both output are synchronized ON/OFF with PCNT connection between both.

2 Single / Parallel / Series Operation

2.1 Single Operation

● SCHA1000T

■OUTPUT(A) and OUTPUT(B), both are able to draw output current up to 208 amps in total.

■Fuses are built-in, and connected to each connector as shown in Fig.2.2.

■OUTPUT(B) has 20 amps drawing capability per each connector.

■Internal output fuse may open with over current.

To repair the opened fuse, please return the unit to us with a Co-sel issued RMA.

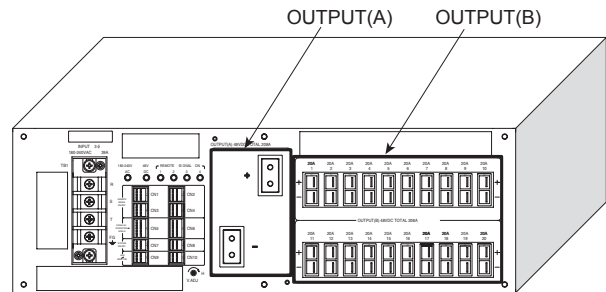


Fig.2.1 Output of SCHA1000T

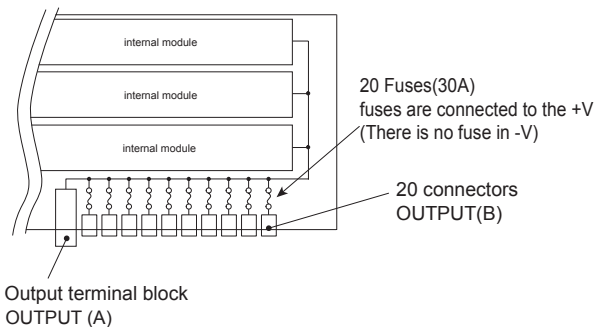


Fig.2.2 Output part block diagram

● SCDA1000T

■Output connectors are able to draw output current up to 208 amps in total.

■Fuses are built-in, and connected to each connectors as shown in Fig.2.4.

■Output connectors has 20 amps drawing capability per each connector.

■Internal output fuse may open with over current.

To repair the opened fuse, please return the unit to us with a Cosel issued RMA.

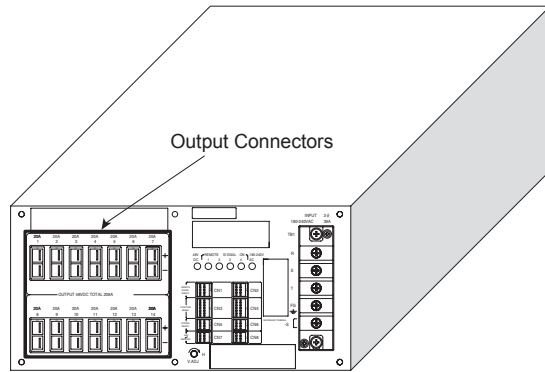


Fig.2.3 Output of SCDA1000T

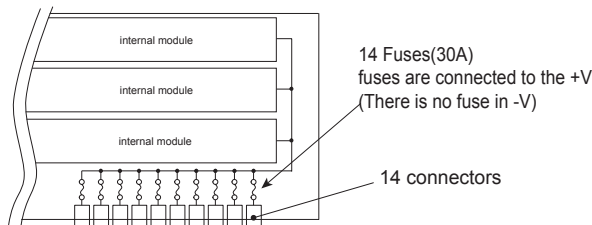


Fig.2.4 Output part block diagram

2.2 Parallel Operation

● SCDA1000T

■Parallel operation is up to 3 units as following Figure2.5.

Each output terminal block [OUTPUT(A)] should be connected parallel and CTB/COM as well. MAS of the master unit and SLV of all slave units must be connected with H-PA-8, H-PA-7.

■Differences in the output current values among the power supplies in parallel connection are 5% at most. Please make sure that the sum of the output current values does not exceed a value obtained from the following equation.

$$\begin{aligned} & \text{(Output current in parallel operation)} \\ & = (\text{Rated current per unit}) \times (\text{Number of units}) \times 0.95 \end{aligned}$$

■Each connector of OUTPUT(B) of each unit which is connected in parallel has 20 amps drawing capability.

■Internal output fuse may open with over current.

To repair the opened fuse, please return the unit to us with Cosel issued RMA.

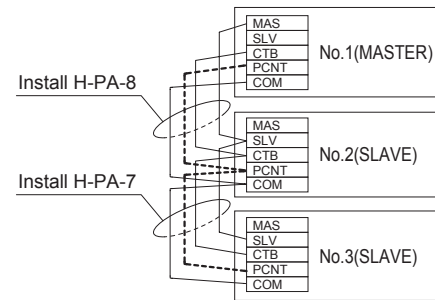
■Output voltage is adjustable by adjusting the master unit potentiometer (One control mode).

■Parallel connection with other products is not allowed.

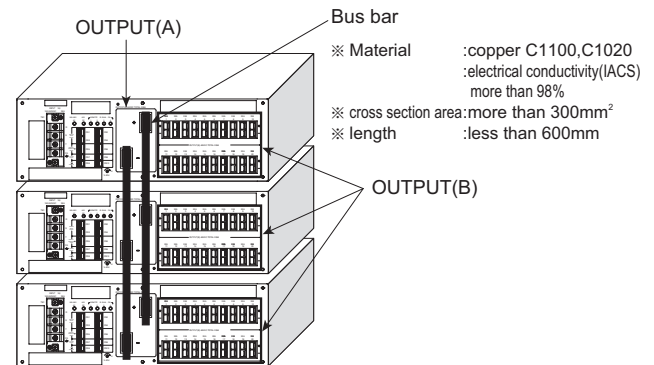
■In case of use PCNT, all of power supplies will stop, if either of the power supply fail.

■In case of the parallel operated connection without the bus bar as shown in Fig.2.5, the difference of impedance of load wires of each unit and connectors causes difference of output current of each unit and connectors.

Therefore, connection using the parallel bus bar as shown in Fig.2.5 is required to parallel operation.



(a)Connection of signal



(b)Connection of bus bar

Fig.2.5 Example of parallel connection

● SCDA1000T

■Parallel operation is not possible.

SC 2.3 N+1 Parallel Redundancy Operation

● SCHA10000T

■ N+1 redundancy operation is possible by connecting units as shown in Fig.2.6. Each output voltage difference has to be adjusted within +/- 200mV before connecting both units. Output terminal block [OUTPUT(A)] has to be connected together, with bus bar. CTB and COM are also connected together between all units in parallel.

■ Output current calculation is required based on following equation. The current has to be more over normal operation current even if one power supply fails.

$$\text{Maximum output current} \leq \text{Rated current per unit} \times \text{Numbers of normal operated units} \times 0.95$$

■ Each connector of OUTPUT(B) of each unit which is connected in parallel has 20 amps drawing capability.

■ Internal output fuse may open with over current.

To repair the opened fuse, please return the unit to us with Cosel issued RMA.

■ Parallel with other products is not allowed.

■ Please shut off the input voltage when you replace a failed power supply.

■ Load disconnection and output voltage adjustment are required when a failed power supply is replaced. The voltage adjustment requirement is within +/-200mV between output voltage in parallel before connecting to the load.

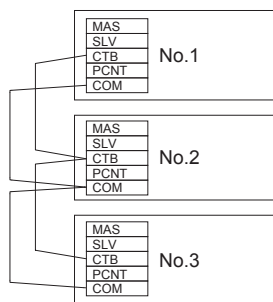
■ 2 or more power supplies failures may cause the output voltage to decrease, lending the application system to shut down. Immediate replacement is recommended when a power supply has failed.

■ Do not connect MAS/SLV and PCNT to any connector for N+1 redundancy operation.

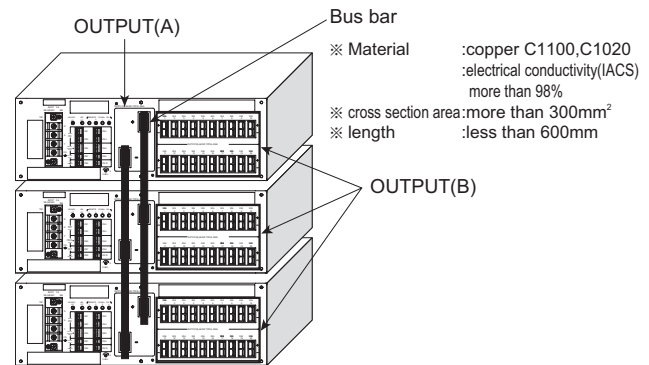
■ Master Slave operation is not available for N+1 redundancy operation (N/A one control mode operation), you have to adjust the output voltage before the output connection.

■ In case of the parallel operated connection without the bus bar as shown in Fig.2.6, the difference of impedance of load wires of each unit and connectors causes difference of output current of each unit and connectors.

Therefore, connection using the parallel bus bar as shown in Fig.2.6 is required to parallel operation.



(a)Connection of signal



(b)Connection of bus bar

Fig.2.6 Example of N+1 redundancy operating connection

● SCDA10000T

■ N+1 redundancy operation is not possible.

2.4 Series Operation

● SCHA10000T

■ Series operation is available by connecting the outputs of two or more power supplies with the same output voltage, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

In case of series operation, it have to be connected OUTPUT(A)s each other.

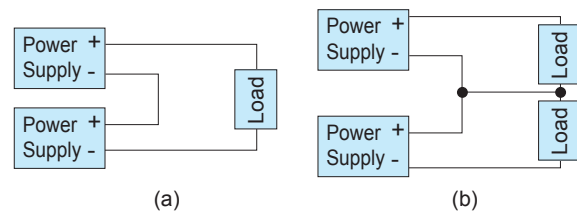


Fig.2.8 Examples of connecting in series operation

● SCDA10000T

■ Series operation is not possible.

3 Assembling and Installation

3.1 Installation

- Screw mounting has to be consider the product weight for safety fixture.
- To keep enough insulation distance between screws and internal components, length of the mounting screw should not exceed recommendation as following Table3.1.

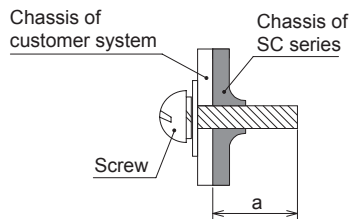


Table 3.1 Max penetration length

Mounting hole	Diameter	a (Max penetration length)
Chassis	M6	8mm max
	M5	7mm max
Output terminal block (SCHA10000T)	M5	10mm max
Safety cover (Bus bar) (SCHA10000T)	M3	7mm max

3.2 Cooling Method

This power supply unit is designed for assuming external cooling fans. Follow instruction of cooling condition as follows.

- Built into cooling air flow line in the system(Duct structure air cooling) for uniform cooling air flow.
- Number of stacked units is up to 3, as shown in Fig. 3.2 and Fig 3.3.
- Air flow direction is either Up or Down as shown in Fig. 3.2 and Fig 3.3.
- Clearance between stacked units is $1.5\text{mm} \leq d \leq 6\text{mm}$.
- Fig. 3.1 to Fig. 3.3 show the position of cooling fan units.
- Contact us for more information if your design utilizes other cooling methods.

①Cooling methods for use of single unit

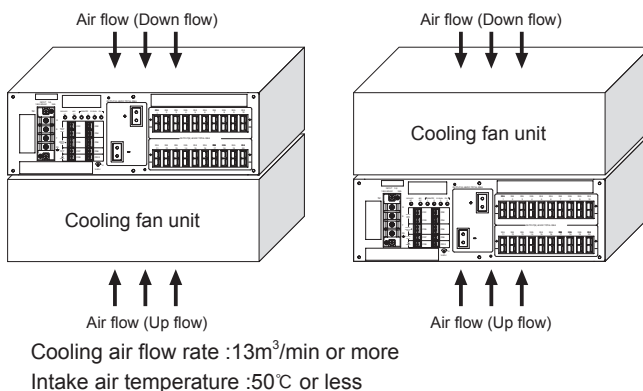
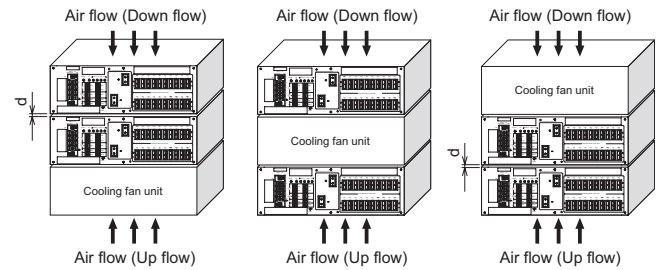


Fig.3.1 Cooling methods for use of single unit

②Cooling methods for use of 2 units



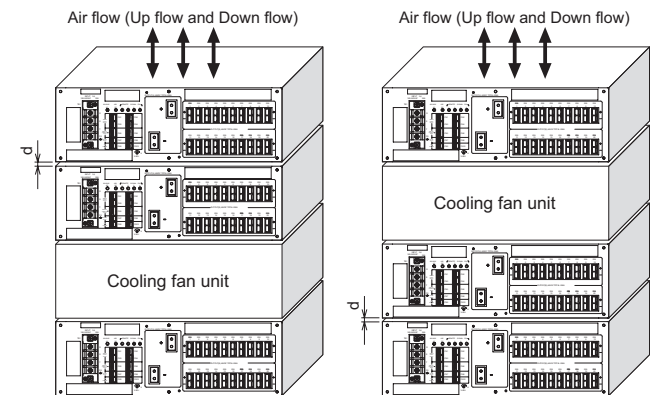
d :gap of power supply units. ($1.5\text{mm} \leq d \leq 6\text{mm}$)

Cooling air flow rate :13m³/min or more

Intake air temperature :35°C or less

Fig.3.2 Cooling methods for use of 2 units

③Cooling methods for use of 3 units



d :gap of power supply units. ($1.5\text{mm} \leq d \leq 6\text{mm}$)

Cooling air flow rate :13m³/min or more

Intake air temperature :35°C or less

Fig.3.3 Cooling methods for use of 3 units

- Stacking 4 or more units is not allowed.

3.3 Expected Life

- Expected Life is 10 years based on the cooling condition 3.2.

3.4 Warranty

- Warranty is 3 years.

4 Others

4.1 Output Voltage Monitor

- Output voltage monitor (+M, -M) is available for use (SCHA10000T : CN9,10, SCDA10000T : CN7,8) . Connector locations and pin assignment are shown on the external view.
- Fig.4.1 shows the internal circuit of monitor (+M, -M) terminal.
- Not allow to draw output current from +M, -M.

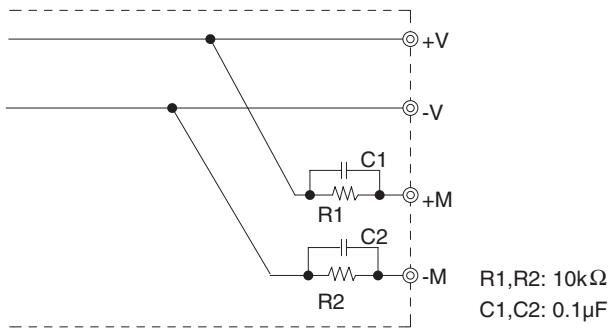


Fig.4.1 Internal circuit of output voltage monitor

4.2 Output Current Monitor

- You can monitor an output current by measuring a voltage between the terminal CTB (SCHA10000T : CN5,6, SCDA10000T : CN3,4) and -V (COM). Connector locations and pin assignment are shown on the external view.
- Fig.4.2 shows the relationship between the voltage of the terminal CTB and the load factor.
- The output current shown in Fig.4.2 should be used only as a guide.

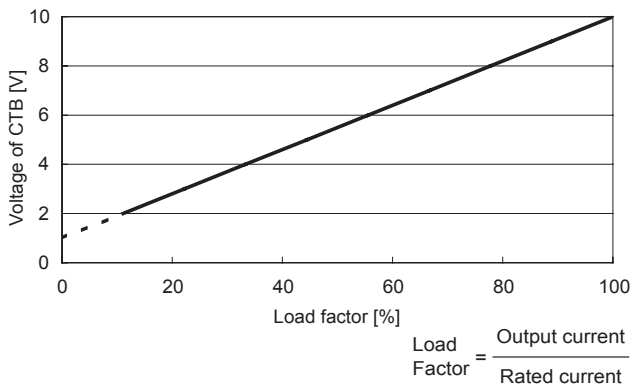


Fig.4.2 Load factor conversion graph

Note :

- Careful wire connection is needed to avoid a malfunction caused by noise.
- Use a measuring instrument which has 500kΩ input impedance or more.
- Do not short between CTB and -V (COM) because of possibility of failure.

4.3 External output voltage control function/ Constant current regulation

- The power supplies have an external output voltage control function.
- The output voltage can be adjusted by applying external voltage between the terminal SLV and COM.
- The calculation formula is ① as following.

$$\text{Output Voltage} = (\text{The voltage between SLV and COM}) \times 10 \text{ [V]} \quad \text{..... ①}$$

Table 4.1 Outout voltage adjustment range

Model	Output voltage adjustment range [V]
W/O option "-Y1"	35.0 - 52.8
W/ option "-Y1"	approximately 0 - 58.8

- Negative voltage to SLV terminal may cause failure.
- There is more than one method to adjust the output voltage, including the methods to use external resistors and external power supplies. Since each method has different characteristic, please contact us for details.
- SC series can be used as a constant current power supply by using output current monitor function and external output voltage control function.
- To use the SC series as a constant current power supply, the external control circuit is necessary. Please contact us for details of external circuit.
- To use SC series as a constant current power supply, it is necessary to order Option-Y1 units.

4.4 Isolation

- When you run a Hi-Pot test as receiving inspection, gradually increase the voltage to start. When you shut down, decrease the voltage gradually by using a dial. Please avoid a Hi-Pot tester with a timer because, when the timer is turned ON or OFF, it may generate a voltage a few times higher than the applied voltage.
- When you test a unit for isolation between the input and output or between the output and the terminal FG, short-circuit between the output, System ON/OFF, Remote signal ON/OFF and Alarm.
- When you test a unit for isolation between the output and System ON/OFF or between the output and Remote signal ON/OFF or between the output and Alarm, short-circuit between the System ON/OFF, Remote signal ON/OFF and Alarm.

4.5 External Component (EMI/EMC Filter)

- You can have the power supplies comply with EN55011 Group1-B, EN55022-B, CISPR22-B, and FCC-B by connecting an external EMI/EMC Filter.

Recommended EMI/EMC Filter : TAC-50-223 (COSEL)

5 Options

5.1 Outline of Options

- *Please inquire us for details of specifications and delivery timing.
- *You can combine multiple options. Some options, however, cannot be combined with other options. Please contact us for details.

● -R

- Specification with reversed logic for System ON/OFF operation. System ON/OFF specification of Option-R is on Table5.1. The internal circuit is on Fig.1.4.

Table 5.1 System ON/OFF specification of Option-R

Output	System ON/OFF	Remote signal ON/OFF
ON	Open (High) (Open voltage 2.5V - 5.0V) (Absolute maximum rating 30V)	Low (0 - 0.5V, less than 1000mA)
OFF	Short (Low) (Less than 1V, less than 5mA)	High or Open (Absolute maximum rating 30V)

● -Y1

- The output voltage can be adjusted up to 58.8V from approximately 0V by applying external voltage between the terminal SLV and COM.
- Output voltage is accordance with Fig.5.1 against the external voltage. The calculation formula is ① as following.

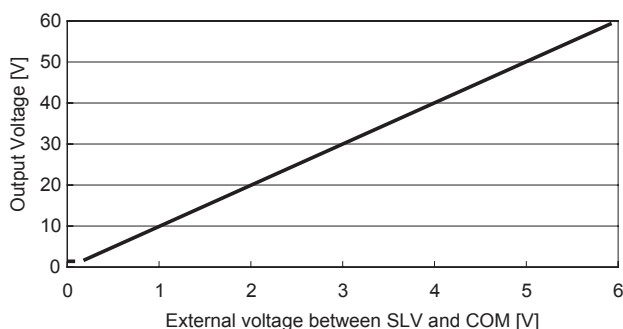


Fig.5.1 Relationship between the voltage of the terminal SLV and the output

$$\text{Output Voltage} = (\text{The voltage between SLV and COM}) \times 10 \text{ [V]} \quad \text{①}$$

- In case of using external resistor, the upper output voltage adjustment range is limited up to the voltage adjusted by output voltage adjustable potentiometer.

In advance, Maximum output voltage should be adjusted by output voltage adjustable potentiometer.

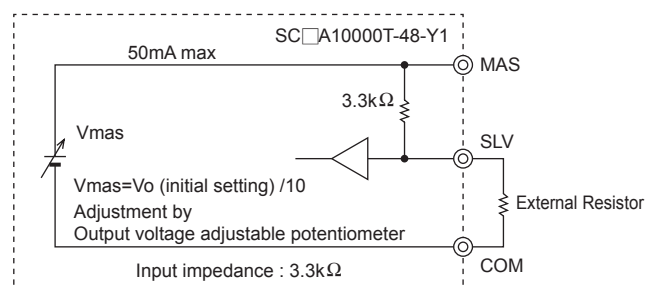


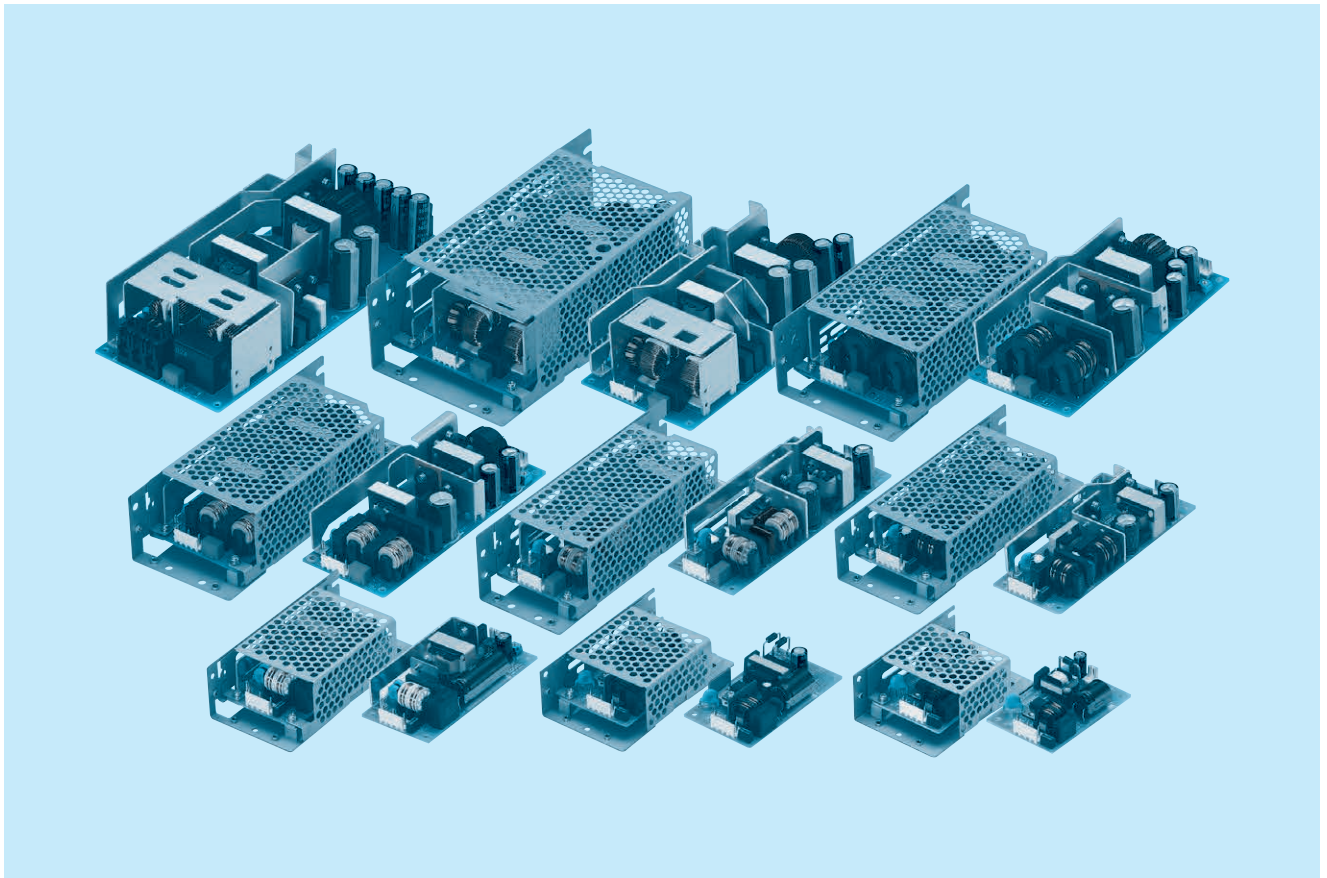
Fig.5.2 The internal circuit of SLV

- Output voltage factory setting is 47.0 - 49.0V.
- Normal output voltage adjustment range is with in 45.0 - 58.8V by output voltage adjustable potentiometer.
- Low-voltage protection function is disabled.
- Negative voltage to SLV terminal may cause failure.
- If you need any further detail, please contact us for the assistance.



LFA-series

LFA



Feature

Small and compact PCB construction
 Built-in inrush current, overcurrent and overvoltage protection circuits
 Harmonic attenuator (Complies with IEC61000-3-2)
 Universal input (AC85-264V)
 Power factor correction (LFA50F-300F)
 Built-in reducing standby power circuit (LFA10F, 15F)

Safety agency approvals

UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178, EN60065
 Complies with DEN-AN

EMI

Complies with FCC-B, CISPR22-B, EN55011-B, EN55022-B, VCCI-B

5-year warranty (refer to Instruction Manual)

CE marking

Low Voltage Directive

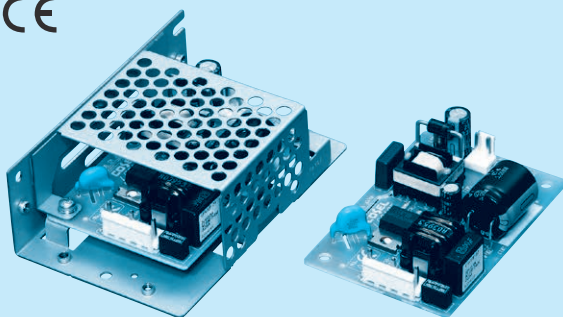
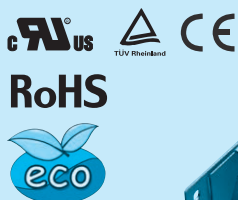
EMS Compliance : EN61204-3, EN61000-6-2

EN61000-4-2
 EN61000-4-3
 EN61000-4-4
 EN61000-4-5
 EN61000-4-6
 EN61000-4-8
 EN61000-4-11

LFA10F

LF A 10 F -□ -□

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-04-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional
- C : with Coating
- G : Low leakage current
- J1 : VH(J.S.T.)connector type
- S : with Chassis
- SN : with Chassis & cover
- Y : with Potentiometer

Specification is changed at
option, refer to Instruction
Manual.

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LFA10F-3R3-Y	LFA10F-5	LFA10F-12	LFA10F-15	LFA10F-24
MAX OUTPUT WATTAGE[W]	6.6	10	10.8	10.5	12
DC OUTPUT	3.3V 2A	5V 2A	12V 0.9A	15V 0.7A	24V 0.5A

SPECIFICATIONS

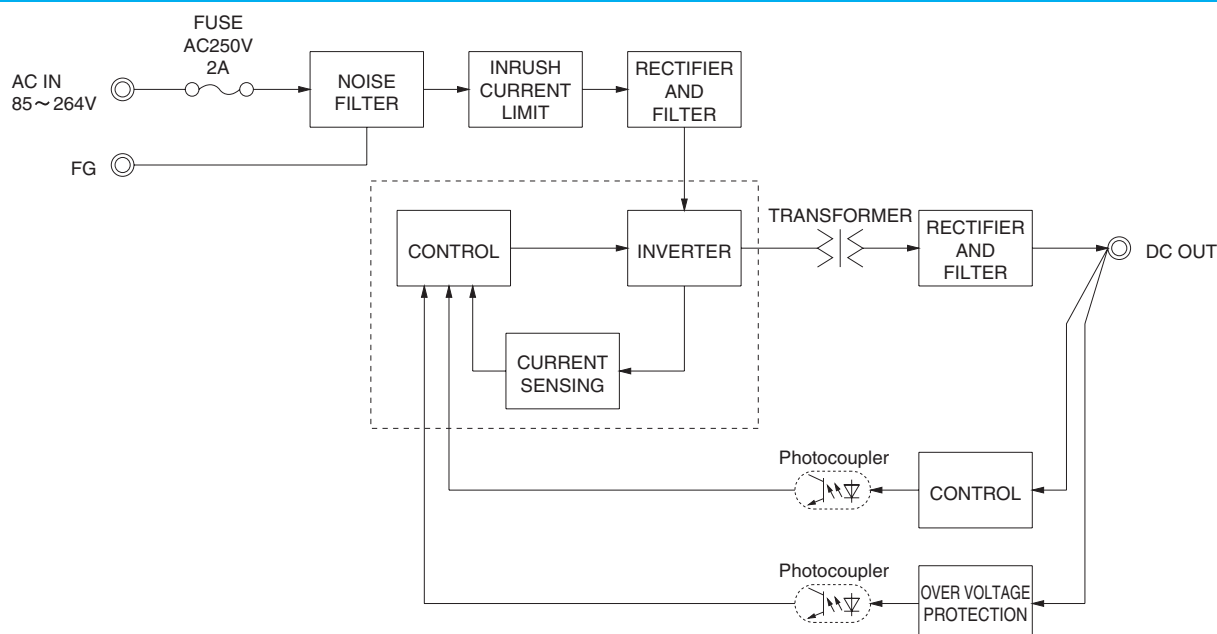
	MODEL	LFA10F-3R3-Y	LFA10F-5	LFA10F-12	LFA10F-15	LFA10F-24
INPUT	VOLTAGE[V]	AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.2) *3				
	CURRENT[A]	ACIN 100V	0.18typ (Io=100%)	0.26typ (Io=100%)		
		ACIN 200V	0.11typ (Io=100%)	0.16typ (Io=100%)		
	FREQUENCY[Hz]	50 / 60 (47 - 440)				
	EFFICIENCY[%]	ACIN 100V	68.0typ	74.0typ	76.5typ	77.5typ
		ACIN 200V	68.5typ	76.0typ	79.0typ	80.0typ
	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%)			
OUTPUT		ACIN 200V	30typ (Io=100%)			
	LEAKAGE CURRENT[ma]	0.15/0.30max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)				
	VOLTAGE[V]	3.3	5	12	15	24
	CURRENT[A]	2.0	2.0	0.9	0.7	0.5
	LINE REGULATION[mV]	*5 20max	20max	48max	60max	96max
	LOAD REGULATION[mV]	*5 40max	40max	100max	120max	150max
	RIPPLE[mVp-p]	0 to +50°C	80max	80max	120max	120max
		-10 - 0°C	140max	140max	160max	160max
		Io=0 - 35%	190max	160max	240max	280max
	RIPPLE NOISE[mVp-p]	0 to +50°C	120max	120max	150max	150max
		-10 - 0°C	160max	160max	180max	180max
		Io=0 - 35%	240max	240max	300max	320max
	TEMPERATURE REGULATION[mV]	0 to +50°C	50max	50max	120max	150max
		-10 to +50°C	60max	60max	150max	180max
	DRIFT[mV]	*2 20max	20max	48max	60max	96max
	START-UP TIME[ms]	200typ (ACIN 100V, Io=100%) * Start-up time is 700ms typ for less than 1minute of applying input again from turning off the input voltage.				
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)				
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.85 to 3.63	Fixed ("Y"option is available for adjusting output voltage between ±10%)			
	OUTPUT VOLTAGE SETTING[V]	3.30 to 3.40	4.90 to 5.30	11.50 to 12.50	14.40 to 15.60	23.00 to 25.00
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically				
	OVERVOLTAGE PROTECTION	4.00 to 5.25	5.75 to 7.00	13.80 to 16.80	17.25 to 21.00	27.60 to 33.60
	OPERATING INDICATION	Not provided				
	REMOTE SENSING	Not provided				
ISOLATION	REMOTE ON/OFF	Not provided				
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)				
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)				
ENVIRONMENT	OUTPUT-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)				
	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +70°C, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000 feet) max *3				
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000 feet) max				
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis				
SAFETY AND NOISE REGULATIONS	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis				
	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN60065, EN50178 Complies with DEN-AN				
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR-B, EN55011-B, EN55022-B				
OTHERS	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *6 (Not built-in to active filter) *4				
	CASE SIZE/WEIGHT	50×22×73.5mm [1.97×0.87×2.89 inches] (W×H×D) / 55g max (with chassis & cover : 150g max)				
	COOLING METHOD	Convection (Refer to Instruction Manual 3.1 and 3.2) *3				

*1 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).
A circuit reducing standby power is built in this unit.
Therefore, the internal switch element is intermittent operated, and the Ripple/Ripple Noise specification in load

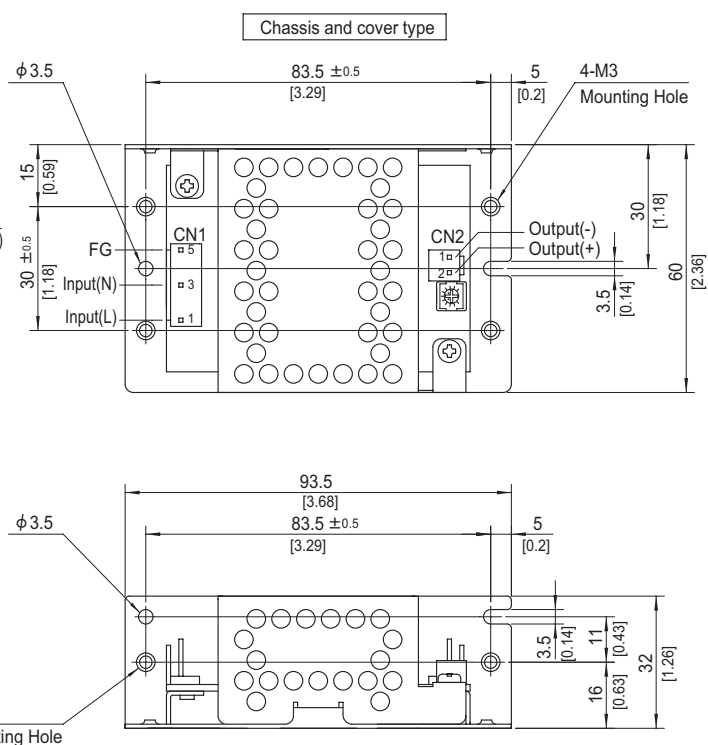
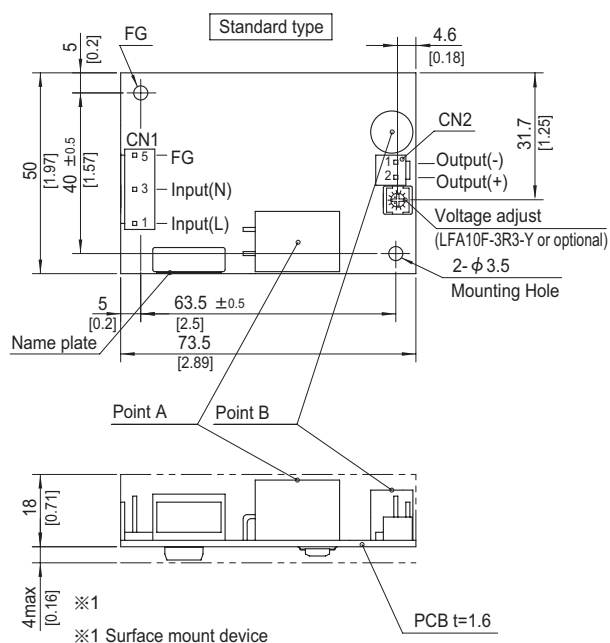
factor Io=0-35% is different.
Please refer to the Instruction Manual 1.7.
*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
Derating is required.
*3 When two or more units are operating it may not comply with the IEC61000-3-2.

Please contact us for details.
*5 Please contact us about dynamic load and input response.
*6 Please contact us about another class.
* To meet the specifications. Do not operate over-loaded condition.
Parallel operation is not possible.
Derating is required when operated with chassis and cover.
Sound noise may be generated by power supply in case of pulse load.

Block diagram



External view



※ The back side of P.C.B. of the power supply is assembled some SMDs.

Be attention not to bump against the attached area by vibration.

※ Use the spacer of 8mm length or more regarding insulation.

And do not use press-fitting bush.

※ Point A, Point B are thermometry points. Please refer to Instruction Manual 3.

I/O Connector		Mating connector	Terminal	
CN1	1-1123724-3	1-1123722-5	Chain	1123721-1
			Loose	1318912-1
CN2	1-1123723-2	1-1123722-2	Chain	1123721-1
			Loose	1318912-1

(Mfr:Tyco Electronics)

<PIN CONNECTION>

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

Pin No.	Output
1	-V
2	+V

※ Tolerance : ± 1 [± 0.04]

※ Weight : 55g max (with chassis & cover : 150g max)

※ PCB material / thickness : CEM3 / 1.6mm

※ Optional chassis and cover material : Electric galvanizing steel board.

※ Dimensions in mm, []=inches

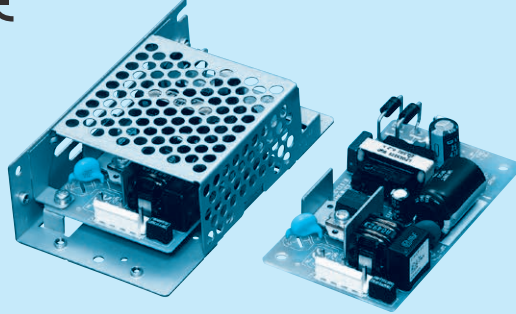
※ Mounting torque (Mounting hole of chassis) : 0.6N · m (6.3kgf · cm) max

※ I/O Connector is Mfr. Tyco Electronics

※ Option:-J1:(J.S.T) connector type. Refer to Instruction Manual 5.

LFA15F

LF A 15 F -□ -□
① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-04-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional
- C : with Coating
- G : Low leakage current
- J1 : VH(J.S.T.)connector type
- S : with Chassis
- SN : with Chassis & cover
- Y : with Potentiometer

Specification is changed at
option, refer to Instruction
Manual.

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LFA15F-3R3-Y	LFA15F-5	LFA15F-12	LFA15F-15	LFA15F-24
MAX OUTPUT WATTAGE[W]	9.9	15	15.6	15	16.8
DC OUTPUT	3.3V 3A	5V 3A	12V 1.3A	15V 1A	24V 0.7A

SPECIFICATIONS

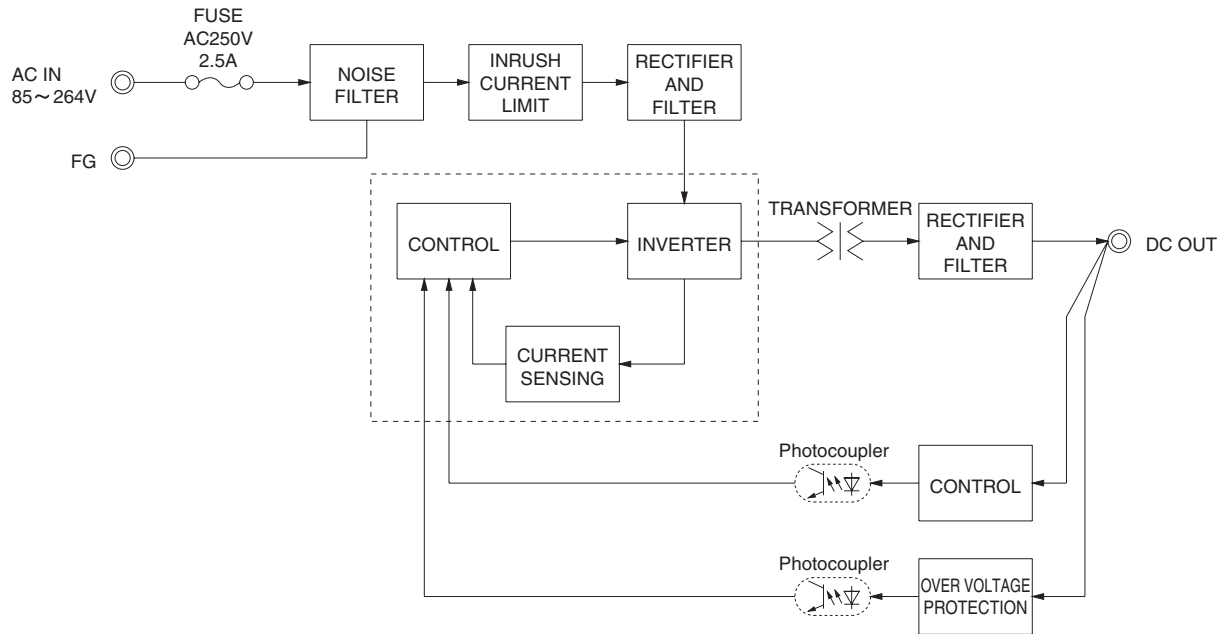
	MODEL	LFA15F-3R3-Y	LFA15F-5	LFA15F-12	LFA15F-15	LFA15F-24
INPUT	VOLTAGE[V]	AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.2) *3				
	CURRENT[A]	ACIN 100V	0.24typ (Io=100%)	0.35typ (Io=100%)		
		ACIN 200V	0.15typ (Io=100%)	0.20typ (Io=100%)		
	FREQUENCY[Hz]	50 / 60 (47 - 440)				
	EFFICIENCY[%]	ACIN 100V	68.0typ	73.0typ	76.0typ	77.0typ
		ACIN 200V	69.0typ	76.0typ	78.5typ	80.0typ
	INRUSH CURRENT[A]	15typ (Io=100%) (At cold start) (Ta=25°C)				
OUTPUT		ACIN 200V	30typ (Io=100%) (At cold start) (Ta=25°C)			
	LEAKAGE CURRENT[ma]	0.15/0.30max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)				
	VOLTAGE[V]	3.3	5	12	15	24
	CURRENT[A]	3.0	3.0	1.3	1.0	0.7
	LINE REGULATION[mV]	*5 20max	20max	48max	60max	96max
	LOAD REGULATION[mV]	*5 40max	40max	100max	120max	150max
	RIPPLE[mVp-p]	0 to +50°C	80max	80max	120max	120max
		-10 - 0°C	140max	140max	160max	160max
		Io=0 - 35%	190max	160max	240max	280max
	RIPPLE NOISE[mVp-p]	0 to +50°C	120max	120max	150max	150max
		-10 - 0°C	160max	160max	180max	180max
		Io=0 - 35%	240max	240max	300max	320max
	TEMPERATURE REGULATION[mV]	0 to +50°C	50max	50max	120max	150max
		-10 to +50°C	60max	60max	150max	180max
	DRIFT[mV]	*2 20max	20max	48max	60max	96max
	START-UP TIME[ms]	200typ (ACIN 100V, Io=100%) *Start-up time is 700ms typ for less than 1minute of applying input again from turning off the input voltage.				
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)				
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.85 to 3.63	Fixed ("Y"option is available for adjusting output voltage between ±10%)			
	OUTPUT VOLTAGE SETTING[V]	3.30 to 3.40	4.90 to 5.30	11.50 to 12.50	14.40 to 15.60	23.00 to 25.00
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically				
	OVERVOLTAGE PROTECTION	4.00 to 5.25	5.75 to 7.00	13.80 to 16.80	17.25 to 21.00	27.60 to 33.60
	OPERATING INDICATION	Not provided				
	REMOTE SENSING	Not provided				
ISOLATION	REMOTE ON/OFF	Not provided				
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)				
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)				
ENVIRONMENT	OUTPUT-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)				
	OPERATING TEMP.,HUMID.AND ALTITUDE	-10 to +70°C, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000 feet) max *3				
	STORAGE TEMP.,HUMID.AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000 feet) max				
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis				
SAFETY AND NOISE REGULATIONS	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis				
	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN60065, EN50178 Complies with DEN-AN				
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR-B, EN55011-B, EN55022-B				
OTHERS	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *6 (Not built-in to active filter) *4				
	CASE SIZE/WEIGHT	50×22×87.5mm [1.97×0.87×3.44 inches] (W×H×D) / 80g max (with chassis & cover : 190g max)				
	COOLING METHOD	Convection (Refer to Instruction Manual 3.1 and 3.2) *3				

*1 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).
A circuit reducing standby power is built in this unit.
Therefore, the internal switch element is intermittent operated, and the Ripple/Ripple Noise specification in load

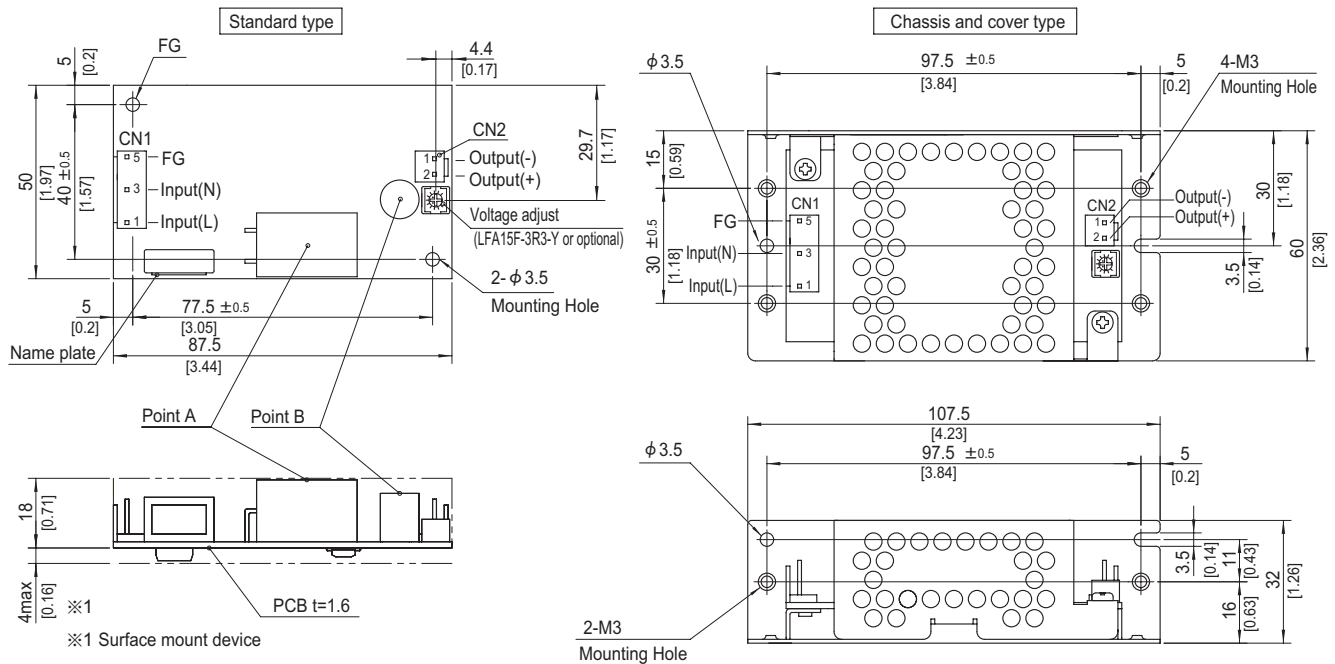
factor Io=0-35% is different.
Please refer to the Instruction Manual 1.7.
*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
Derating is required.
*3 When two or more units are operating it may not comply with the IEC61000-3-2.

Please contact us for details.
*5 Please contact us about dynamic load and input response.
*6 Please contact us about another class.
* To meet the specifications. Do not operate over-loaded condition.
* Parallel operation is not possible.
* Derating is required when operated with chassis and cover.
* Sound noise may be generated by power supply in case of pulse load.

Block diagram



External view



- ※ The back side of P.C.B. of the power supply is assembled some SMDs.
Be attention not to bump against the attached area by vibration.
- ※ Use the spacer of 8mm length or more regarding insulation.
And do not use press-fitting bush.
- ※ Point A, Point B are thermometry points. Please refer to Instruction Manual 3.

I/O Connector	Mating connector	Terminal
CN1	1-1123724-3	1-1123722-5
		Chain Loose 1318912-1
		Chain 1123721-1
CN2	1-1123723-2	1-1123722-2
		Loose 1318912-1

(Mfr:Tyco Electronics)

- ※ I/O Connector is Mfr. Tyco Electronics
- ※ Option:-J1:(J.S.T) connector type. Refer to Instruction Manual 5.

<PIN CONNECTION>

CN1

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

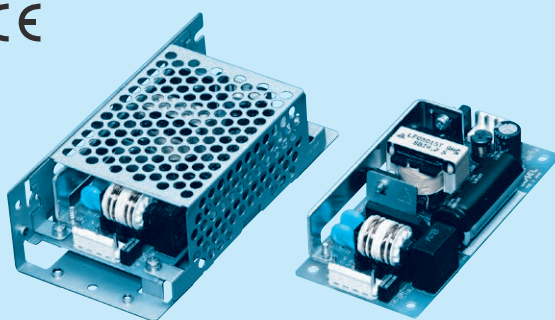
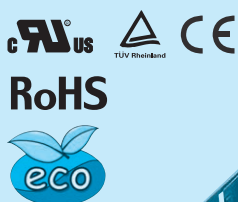
CN2

Pin No.	Output
1	-V
2	+V

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 80g max (with chassis & cover : 190g max)
- ※ PCB material / thickness : CEM3 / 1.6mm
- ※ Optional chassis and cover material : Electric galvanizing steel board.
- ※ Dimensions in mm, []=inches
- ※ Mounting torque (Mounting hole of chassis) : $0.6N \cdot m$ (6.3kgf \cdot cm) max

LFA30F

LF A 30 F -□ -□
① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-04-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional
- C : with Coating
- G : Low leakage current
- J1 : VH(J.S.T.)connector type
- S : with Chassis
- SN : with Chassis & cover
- Y : with Potentiometer

Specification is changed at
option, refer to Instruction
Manual.

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.
* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LFA30F-3R3-Y	LFA30F-5	LFA30F-12	LFA30F-15	LFA30F-24
MAX OUTPUT WATTAGE[W]	19.8	30.0	30.0	30.0	31.2
DC OUTPUT	3.3V 6A	5V 6A	12V 2.5A	15V 2A	24V 1.3A

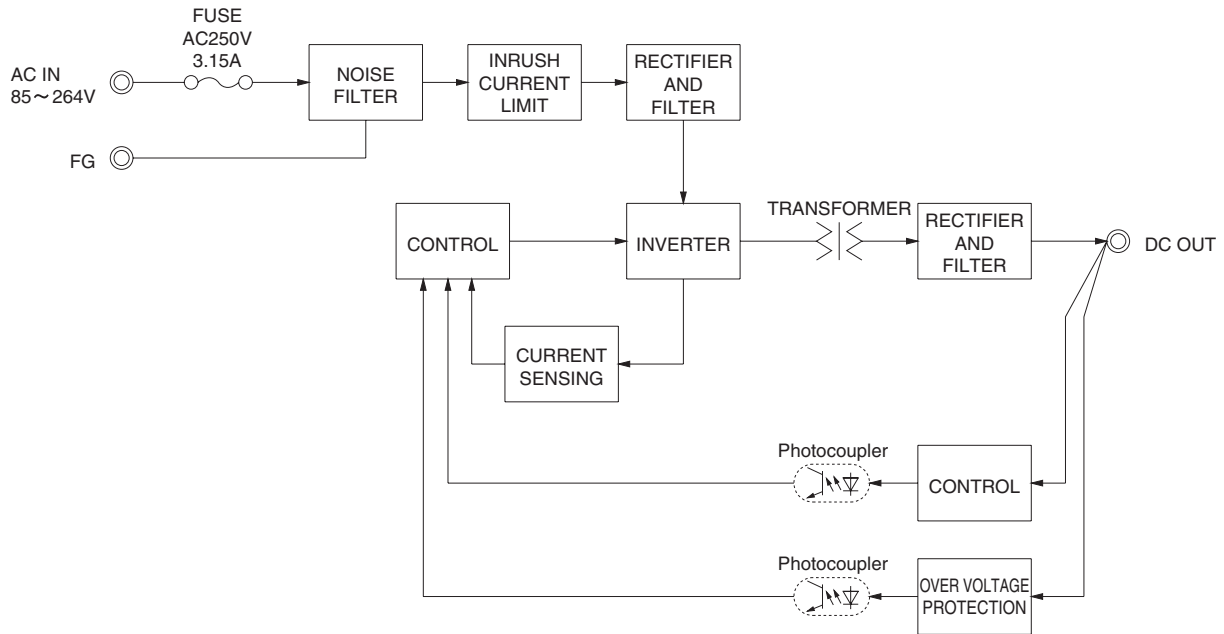
SPECIFICATIONS

	MODEL	LFA30F-3R3-Y	LFA30F-5	LFA30F-12	LFA30F-15	LFA30F-24	
INPUT	VOLTAGE[V]	AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.2) *3					
	CURRENT[A]	ACIN 100V	0.50typ (Io=100%)	0.65typ (Io=100%)			
		ACIN 200V	0.30typ (Io=100%)	0.35typ (Io=100%)			
	FREQUENCY[Hz]	50 / 60 (47 - 440)					
	EFFICIENCY[%]	ACIN 100V	73typ	76typ	79typ	81typ	82typ
		ACIN 200V	75typ	79typ	81typ	83typ	84typ
	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25°C)				
ACIN 200V		30typ (Io=100%) (At cold start) (Ta=25°C)					
	LEAKAGE CURRENT[mA]	0.30 / 0.65max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)					
OUTPUT	VOLTAGE[V]	3.3	5	12	15	24	
	CURRENT[A]	6.0	6.0	2.5	2.0	1.3	
	LINE REGULATION[mV] *5	20max	20max	48max	60max	96max	
	LOAD REGULATION[mV] *5	40max	40max	100max	120max	150max	
	RIPPLE[mVp-p]	0 to +50℃ *1	80max	80max	120max	120max	120max
		-10 - 0℃ *1	140max	140max	160max	160max	160max
	RIPPLE NOISE[mVp-p]	0 to +50℃ *1	120max	120max	150max	150max	150max
		-10 - 0℃ *1	160max	160max	180max	180max	180max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	50max	120max	150max	240max
		-10 to +50℃	60max	60max	150max	180max	290max
	DRIFT[mV] *2	20max	20max	48max	60max	96max	
	START-UP TIME[ms]	150typ (ACIN 100V, Io=100%)					
HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)						
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.85 to 3.63		Fixed ("Y"option is available for adjusting output voltage between ±10%)				
OUTPUT VOLTAGE SETTING[V]	3.30 to 3.40		4.90 to 5.30	11.50 to 12.50	14.40 to 15.60	23.00 to 25.00	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically					
	OVERVOLTAGE PROTECTION	4.00 to 5.25	5.75 to 7.00	13.80 to 16.80	17.25 to 21.00	27.60 to 33.60	
	OPERATING INDICATION	Not provided					
	REMOTE SENSING	Not provided					
	REMOTE ON/OFF	Not provided					
ISOLATION	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)					
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)					
	OUTPUT-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)					
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +70℃, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000feet) max *3					
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max					
	VIBRATION	10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis					
	IMPACT	196.1m/s² (20G), 11ms, once each X, Y and Z axis					
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN60065, EN50178 Complies with DEN-AN					
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR-B, EN55011-B, EN55022-B					
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *6 (Not built-in to active filter) *4					
OTHERS	CASE SIZE/WEIGHT	50 X 26.5 X 105mm [1.97 X 1.04 X 4.13 inches] (W X H X D) / 130g max (with chassis & cover : 260g max)					
	COOLING METHOD	Convection (Refer to Instruction Manual 3.1 and 3.2) *3					

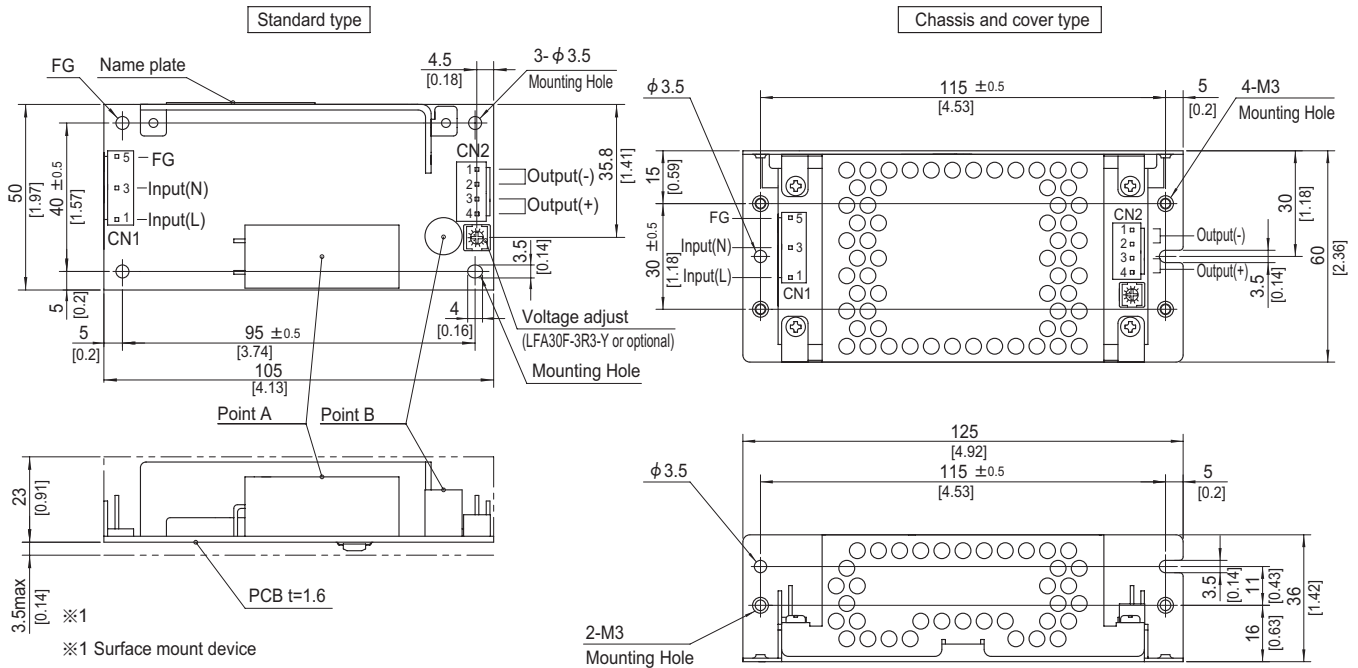
*1 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).
*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
*3 Derating is required.

*4 When two or more units are operating it may not comply with the IEC61000-3-2. Please contact us for details.
*5 Please contact us about dynamic load and input response.
*6 Please contact us about another class.
* To meet the specifications. Do not operate over-loaded condition.
* Parallel operation is not possible.
* Derating is required when operated with chassis and cover.
* Sound noise may be generated by power supply in case of pulse load.

Block diagram



External view



※ 4 Mounting holes are existing.

※ The back side of P.C.B. of the power supply is assembled some SMDs.

Be attention not to bump against the attached area by vibration.

※ Use the spacer of 8mm length or more regarding insulation.

And do not use press-fitting bush.

※ Point A, Point B are thermometry points. Please refer to Instruction Manual 3.

I/O Connector	Mating connector	Terminal
CN1	1-1123724-3	1-1123722-5
		Loose 1318912-1
CN2	1-1123723-4	1-1123722-4
		Loose 1318912-1

(Mfr:Tyco Electronics)

※ I/O Connector is Mfr. Tyco Electronics

※ Option: J1(J.S.T) connector type. Refer to Instruction Manual 5.

<PIN CONNECTION>

CN1

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

CN2

Pin No.	Output
1, 2	-V
3, 4	+V

※ Tolerance : ± 1 [± 0.04]

※ Weight: 130g max (with chassis & cover : 260g max)

※ PCB material / thickness : CEM3 / 1.6mm

※ Optional chassis and cover material : Electric galvanizing steel board.

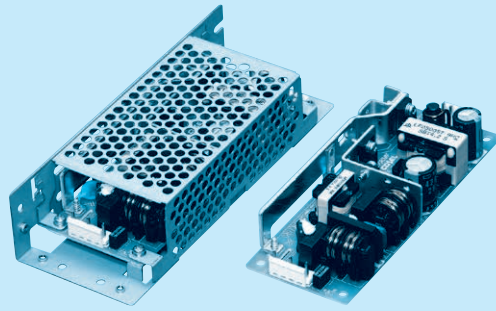
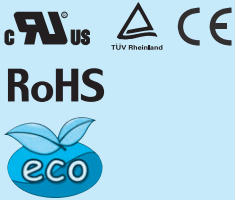
※ Dimensions in mm, []=inches

※ Mounting torque (Mounting hole of chassis) : 0.6N · m (6.3kgf · cm) max

※ Keep drawing current per pin below 5A for CN2.

LFA50F

LF A 50 F -□ -□
① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-04-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional
- C : with Coating
- G : Low leakage current
- J1 : VH(J.S.T.)connector type
- S : with Chassis
- SN : with Chassis & cover
- Y : with Potentiometer

Specification is changed at option, refer to Instruction Manual.

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LFA50F-3R3-Y	LFA50F-5	LFA50F-12	LFA50F-15	LFA50F-24	LFA50F-36	LFA50F-48
MAX OUTPUT WATTAGE[W]	33	50	51.6	52.5	50.4	50.4	52.8
DC OUTPUT	3.3V 10A	5V 10A	12V 4.3A	15V 3.5A	24V 2.1A	36V 1.4A	48V 1.1A

SPECIFICATIONS

	MODEL	LFA50F-3R3-Y	LFA50F-5	LFA50F-12	LFA50F-15	LFA50F-24	LFA50F-36	LFA50F-48	
INPUT	VOLTAGE[V]	AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.2) *3							
	CURRENT[A]	ACIN 100V	0.47typ (Io=100%)	0.67typ (Io=100%)					
		ACIN 200V	0.27typ (Io=100%)	0.36typ (Io=100%)					
	FREQUENCY[Hz]	50 / 60 (47 - 63)							
	EFFICIENCY[%]	ACIN 100V	73.5typ	77.5typ	80.0typ	80.5typ	81.5typ	82.0typ	81.0typ
		ACIN 200V	74.0typ	79.0typ	81.5typ	81.5typ	83.0typ	83.5typ	82.5typ
	POWER FACTOR (Io=100%)	ACIN 100V	0.96typ	0.97typ					
		ACIN 200V	0.83typ	0.90typ					
INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25℃)							
	ACIN 200V	30typ (Io=100%) (At cold start) (Ta=25℃)							
LEAKAGE CURRENT[mA]	0.40 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)								
OUTPUT	VOLTAGE[V]	3.3	5	12	15	24	36	48	
	CURRENT[A]	10.0	10.0	4.3	3.5	2.1	1.4	1.1	
	LINE REGULATION[mV] *4	20max	20max	48max	60max	96max	144max	192max	
	LOAD REGULATION[mV] *4	40max	40max	100max	120max	150max	240max	240max	
	RIPPLE[mVp-p]	0 to +50℃ *1	80max	80max	120max	120max	120max	150max	150max
		-10-0℃ *1	140max	140max	160max	160max	160max	200max	200max
	RIPPLE NOISE[mVp-p]	0 to +50℃ *1	120max	120max	150max	150max	150max	250max	250max
		-10-0℃ *1	160max	160max	180max	180max	180max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	50max	120max	150max	240max	360max	480max
		-10 to +50℃	60max	60max	150max	180max	290max	450max	600max
	DRIFT[mV] *2	20max	20max	48max	60max	96max	144max	192max	
	START-UP TIME[ms]	350typ (ACIN 100V, Io=100%)							
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.85 to 3.63	Fixed ("Y" option is available for adjusting output voltage between ±10%)						
OUTPUT VOLTAGE SETTING[V]	3.30 to 3.40	4.90 to 5.30	11.50 to 12.50	14.40 to 15.60	23.00 to 25.00	34.50 to 37.50	46.00 to 50.00		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	OVERVOLTAGE PROTECTION	4.00 to 5.25	5.75 to 7.00	13.80 to 16.80	17.25 to 21.00	27.60 to 33.60	41.40 to 50.40	55.20 to 67.20	
	OPERATING INDICATION	Not provided							
	REMOTE SENSING	Not provided							
ISOLATION	REMOTE ON/OFF	Not provided							
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)							
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)							
ENVIRONMENT	OUTPUT-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)							
	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +70℃, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000feet) max *3							
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION	10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis							
SAFETY AND NOISE REGULATIONS	IMPACT	196.1m/s² (20G), 11ms, once each X, Y and Z axis							
	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN60065, EN50178 Complies with DEN-AN							
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR-B, EN55011-B, EN55022-B							
OTHERS	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *5							
	CASE SIZE/WEIGHT	50 X 26.5 X 132mm [1.97 X 1.04 X 5.20 inches] (W X H X D) / 165g max (with chassis & cover : 325g max)							
	COOLING METHOD	Convection (Refer to Instruction Manual 3.1 and 3.2) *3							

*1 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*3 Derating is required.

*4 Please contact us about dynamic load and input response.

*5 Please contact us about another class.

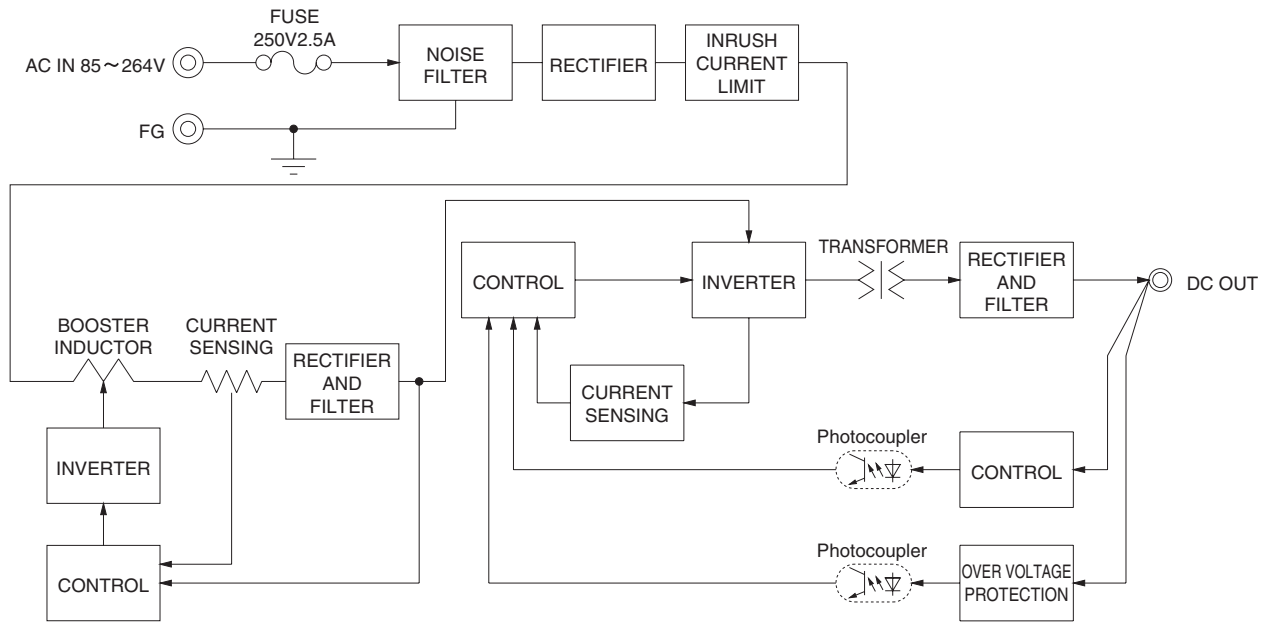
* To meet the specifications, Do not operate over-loaded condition.

* Parallel operation is not possible.

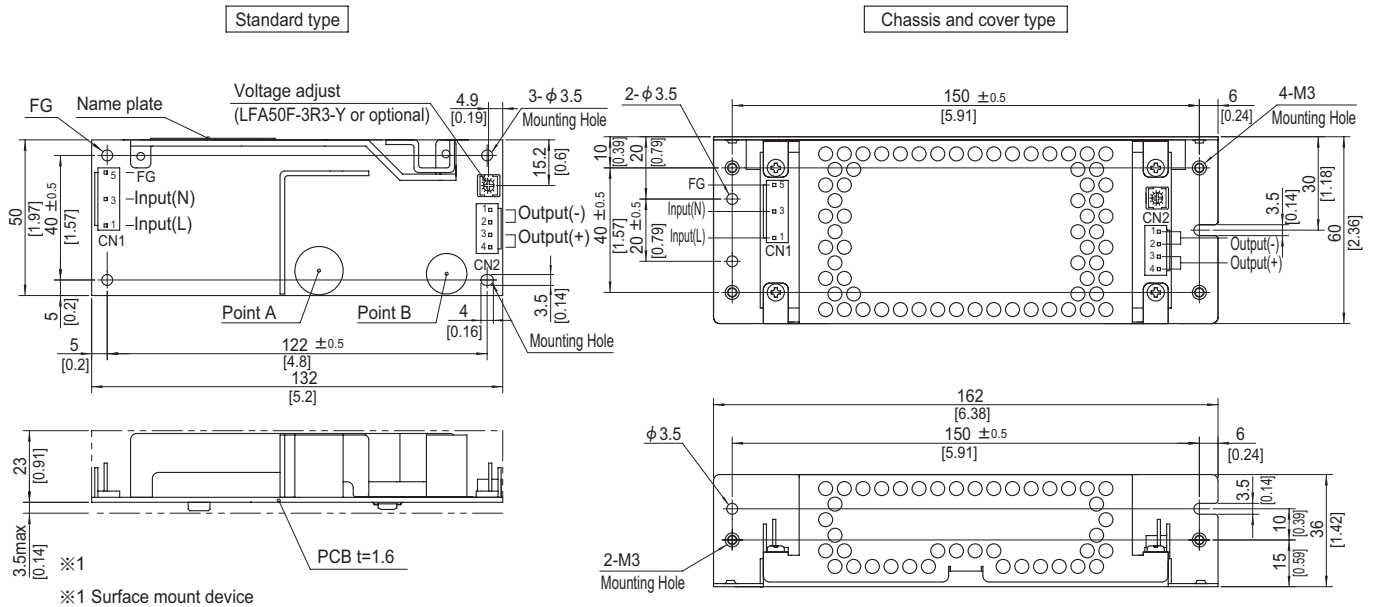
* Derating is required when operated with chassis and cover.

* Sound noise may be generated by power supply in case of pulse load.

Block diagram



External view



- ※ 4 Mounting holes are existing.
- ※ The back side of P.C.B. of the power supply is assembled some SMDs.
- Be attention not to bump against the attached area by vibration.
- ※ Use the spacer of 8mm length or more regarding insulation.
- And do not use press-fitting bush.
- ※ Point A, Point B are thermometry points. Please refer to Instruction Manual 3.

I/O Connector	Mating connector	Terminal	
CN1	1-1123724-3	Chain	1123721-1
		Loose	1318912-1
CN2	1-1123724-4	Chain	1123721-1
		Loose	1318912-1

(Mfr:Tyco Electronics)

- ※ I/O Connector is Mfr. Tyco Electronics
- ※ Option:-J1:(J.S.T) connector type. Refer to Instruction Manual 5.

<PIN CONNECTION>

CN1

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

CN2

Pin No.	Output
1, 2	-V
3, 4	+V

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 165g max (with chassis & cover : 325g max)
- ※ PCB material / thickness : CEM3 / 1.6mm
- ※ Optional chassis and cover material : Electric galvanizing steel board.
- ※ Dimensions in mm, []=inches
- ※ Mounting torque (Mounting hole of chassis) : $0.6N \cdot m$ (6.3kgf \cdot cm) max

※ Keep drawing current per pin below 5A for CN2.

LFA75F

LF

A

75

F

-□

-□

①

②

③

④

⑤

⑥

Example recommended EMI/EMC filter
NAC-04-472

High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional
 - C : with Coating
 - G : Low leakage current
 - J1 : VH(J.S.T.)connector type
 - S : with Chassis
 - SN : with Chassis & cover
 - Y : with Potentiometer

Specification is changed at
option, refer to Instruction
Manual.

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.
* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LFA75F-3R3-Y	LFA75F-5	LFA75F-12	LFA75F-15	LFA75F-24	LFA75F-36	LFA75F-48
MAX OUTPUT WATTAGE[W]	49.5	75	75.6	75	76.8	75.6	76.8
DC OUTPUT	3.3V 15A	5V 15A	12V 6.3A	15V 5A	24V 3.2A	36V 2.1A	48V 1.6A

SPECIFICATIONS

	MODEL	LFA75F-3R3-Y	LFA75F-5	LFA75F-12	LFA75F-15	LFA75F-24	LFA75F-36	LFA75F-48
INPUT	VOLTAGE[V]	AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.2) *3						
	CURRENT[A]	ACIN 100V	0.70typ (Io=100%)	1.00typ (Io=100%)				
		ACIN 200V	0.40typ (Io=100%)	0.50typ (Io=100%)				
	FREQUENCY[Hz]	50 / 60 (47 - 63)						
	EFFICIENCY[%]	ACIN 100V	73.5typ	78.0typ	81.5typ	81.5typ	82.5typ	82.5typ
		ACIN 200V	75.0typ	80.0typ	83.0typ	83.0typ	84.5typ	84.5typ
	POWER FACTOR (Io=100%)	ACIN 100V	0.96typ	0.97typ				
		ACIN 200V	0.83typ	0.90typ				
OUTPUT	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25°C)					
		ACIN 200V	30typ (Io=100%) (At cold start) (Ta=25°C)					
	LEAKAGE CURRENT[mA]	0.40 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)						
	VOLTAGE[V]	3.3	5	12	15	24	36	48
	CURRENT[A]	15.0	15.0	6.3	5.0	3.2	2.1	1.6
	LINE REGULATION[mV] *4	20max	20max	48max	60max	96max	144max	192max
	LOAD REGULATION[mV] *4	40max	40max	100max	120max	150max	240max	240max
	RIPPLE[mVp-p]	0 to +50°C *1	80max	80max	120max	120max	150max	150max
PROTECTION CIRCUIT AND OTHERS	RIPPLE NOISE[mVp-p]	-10 - 0°C *1	140max	140max	160max	160max	200max	200max
		0 to +50°C *1	120max	120max	150max	150max	250max	250max
	TEMPERATURE REGULATION[mV]	-10 to +50°C	50max	50max	120max	150max	240max	480max
		-10 to +50°C	60max	60max	150max	180max	290max	450max
	DRIFT[mV] *2	20max	20max	48max	60max	96max	144max	192max
	START-UP TIME[ms]	350typ (ACIN 100V, Io=100%)						
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)						
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.85 to 3.63	Fixed ("Y" option is available for adjusting output voltage between ±10%)					
ISOLATION	OUTPUT VOLTAGE SETTING[V]	3.30 to 3.40	4.90 to 5.30	11.50 to 12.50	14.40 to 15.60	23.00 to 25.00	34.50 to 37.50	46.00 to 50.00
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically						
	OVERVOLTAGE PROTECTION	4.00 to 5.25	5.75 to 7.00	13.80 to 16.80	17.25 to 21.00	27.60 to 33.60	41.40 to 50.40	55.20 to 67.20
	OPERATING INDICATION	Not provided						
	REMOTE SENSING	Not provided						
ENVIRONMENT	REMOTE ON/OFF	Not provided						
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)						
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)						
SAFETY AND NOISE REGULATIONS	OUTPUT-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)						
	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +70°C, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000feet) max *3						
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max						
	VIBRATION	10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis						
OTHERS	IMPACT	196.1m/s² (20G), 11ms, once each X, Y and Z axis						
	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN60065, EN50178 Complies with DEN-AN						
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR-B, EN55011-B, EN55022-B						
COOLING METHOD	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *5						
	CASE SIZE/WEIGHT	50 X 33.5 X 150mm [1.97 X 1.32 X 5.91 inches] (W X H X D) / 230g max (with chassis & cover : 440g max)						

*1 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*3 Derating is required.

*4 Please contact us about dynamic load and input response.

*5 Please contact us about another class.

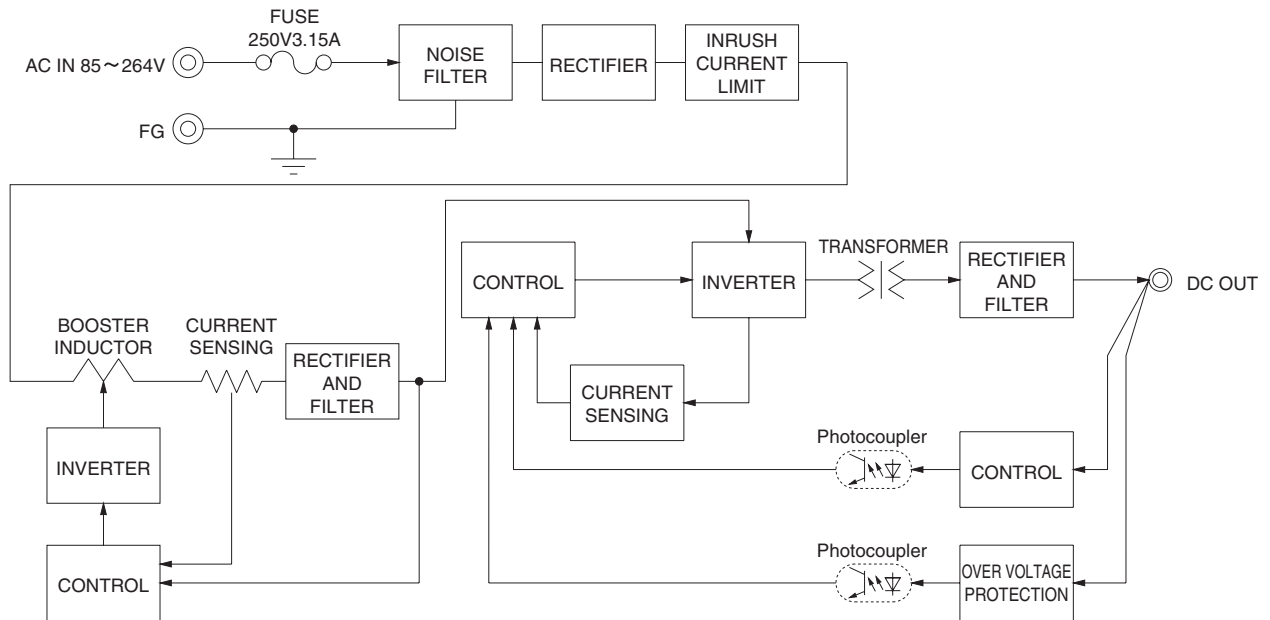
* To meet the specifications, Do not operate over-loaded condition.

* Parallel operation is not possible.

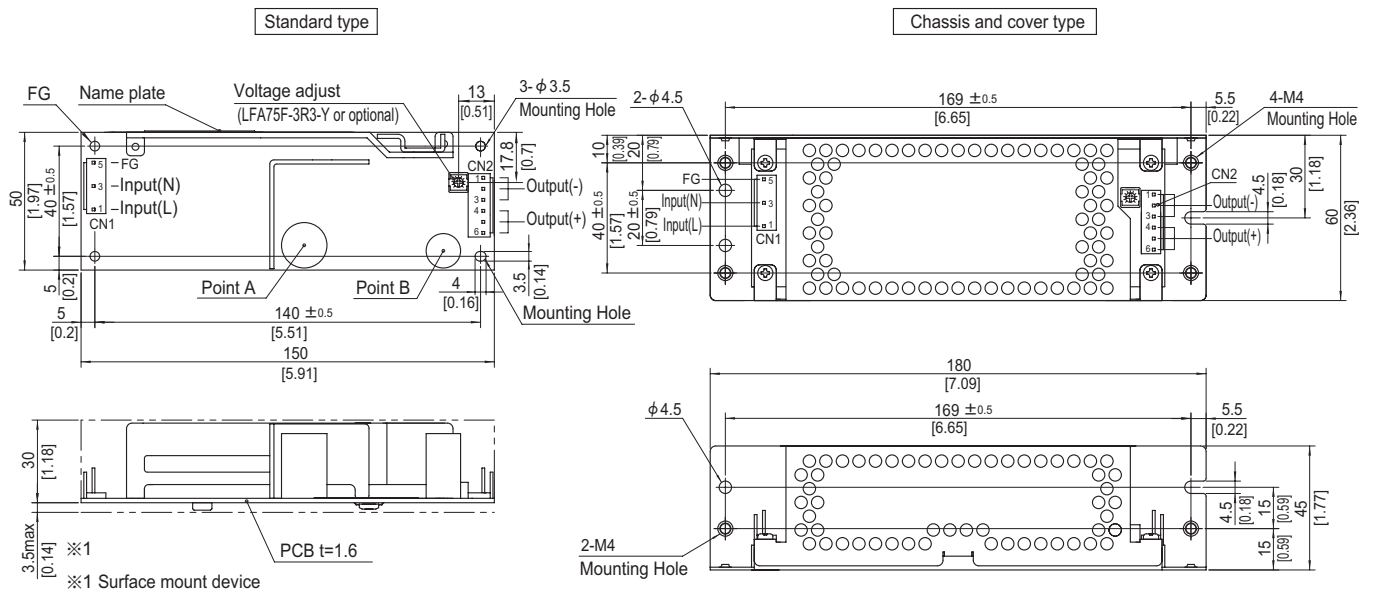
* Derating is required when operated with chassis and cover.

* Sound noise may be generated by power supply in case of pulse load.

Block diagram



External view



- ※ 4 Mounting holes are existing.
- ※ The back side of P.C.B. of the power supply is assembled some SMDs.
Be attention not to bump against the attached area by vibration.
- ※ Use the spacer of 8mm length or more regarding insulation.
And do not use press-fitting bush.
- ※ Point A, Point B are thermometry points. Please refer to Instruction Manual 3.

I/O Connector	Mating connector	Terminal
CN1	1-1123724-3	Chain 1123721-1 Loose 1318912-1
CN2	1-1123723-6	Chain 1123721-1 Loose 1318912-1

(Mfr:Tyco Electronics)

- ※ I/O Connector is Mfr. Tyco Electronics
- ※ Option:-J1:(J.S.T) connector type. Refer to Instruction Manual 5.

<PIN CONNECTION>

CN1

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

CN2

Pin No.	Output
1 to 3	-V
4 to 6	+V

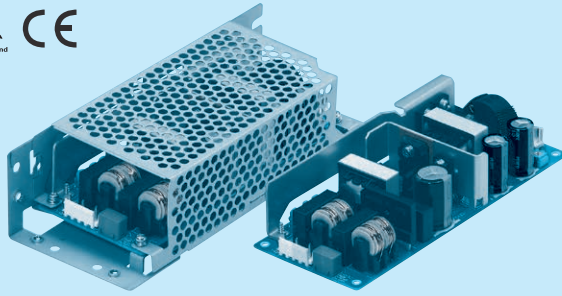
- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 230g max (with chassis & cover : 440g max)
- ※ PCB material / thickness : CEM3 / 1.6mm
- ※ Optional chassis and cover material : Electric galvanizing steel board.
- ※ Dimensions in mm, []=inches
- ※ Mounting torque (Mounting hole of chassis) : 1.5N · m (16kgf · cm) max

※ Keep drawing current per pin below 5A for CN2.

LFA100F

LF A 100 F -□ -□

① ② ③ ④ ⑤ ⑥

Example recommended EMI/EMC filter
NAC-04-472

High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *1
C : with Coating
G : Low leakage current
H : with the function to be acceptable to output peak current (only 24V)
J1 : VH(J.S.T.)connector type
R : with Remote ON/OFF
R2 : with Remote ON/OFF
S : with Chassis
SN : with Chassis & cover
Y : with Potentiometer

Please refer to Instruction manual 5.

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LFA100F-3R3-Y	LFA100F-5-Y	LFA100F-12	LFA100F-15	LFA100F-24	LFA100F-24-H	LFA100F-36	LFA100F-48
MAX OUTPUT WATTAGE[W]	*5 66	100	102	100.5	103.2	103.2 (129.6)	100.8	100.8
DC OUTPUT	*5 3.3V 20A	5V 20A	12V 8.5A	15V 6.7A	24V 4.3A	24V 4.3 (5.4)A	36V 2.8A	48V 2.1A

SPECIFICATIONS

	MODEL	LFA100F-3R3-Y	LFA100F-5-Y	LFA100F-12	LFA100F-15	LFA100F-24	LFA100F-24-H	LFA100F-36	LFA100F-48	
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.2) *4							
	CURRENT[A]	ACIN 100V	0.9typ (Io=100%) 1.3typ (Io=100%)							
		ACIN 200V	0.5typ (Io=100%) 0.7typ (Io=100%)							
	FREQUENCY[Hz]		50 / 60 (47 - 63)							
	EFFICIENCY[%]	ACIN 100V	77.0typ	82.0typ	82.0typ	83.0typ	84.0typ	84.0typ	84.5typ	
		ACIN 200V	79.0typ	84.0typ	84.5typ	85.5typ	87.0typ	87.0typ	87.0typ	
	POWER FACTOR (Io=100%)	ACIN 100V	0.98typ 0.99typ							
		ACIN 200V	0.92typ 0.95typ							
	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25℃)							
		ACIN 200V	30typ (Io=100%) (At cold start) (Ta=25℃)							
	LEAKAGE CURRENT[ma]		0.40 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)							
OUTPUT	VOLTAGE[V]		3.3	5	12	15	24	24	36	48
	CURRENT[A] *5		20	20	8.5	6.7	4.3	4.3 (Peak 5.4)	2.8	2.1
	LINE REGULATION[mV] *7		20max	20max	48max	60max	96max	96max	144max	192max
	LOAD REGULATION[mV] *7		40max	40max	100max	120max	150max	150max	240max	240max
	RIPPLE[mVp-p]	0 to +50℃ *2	80max	80max	120max	120max	120max	240max	150max	150max
		-10 - 0℃ *2	140max	140max	160max	160max	160max	320max	200max	200max
	RIPPLE NOISE[mVp-p]	0 to +50℃ *2	120max	120max	150max	150max	150max	300max	250max	250max
		-10 - 0℃ *2	160max	160max	180max	180max	180max	360max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	50max	120max	150max	240max	240max	360max	480max
		-10 to +50℃	60max	60max	150max	180max	290max	290max	450max	600max
	DRIFT[mV] *3		20max	20max	48max	60max	96max	96max	144max	192max
	START-UP TIME[ms]		350typ (ACIN 100V, Io=100%)							
	HOLD-UP TIME[ms]		20typ (ACIN 100V, Io=100%)							
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		2.85 to 3.63 4.50 to 5.50 Fixed ("Y"option is available for adjusting output voltage)								
OUTPUT VOLTAGE SETTING[V]		3.30 to 3.40	5.00 to 5.15	11.50 to 12.50	14.40 to 15.60	23.00 to 25.00	23.00 to 25.00	34.50 to 37.50	46.00 to 50.00	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating (works over 101% of peak current at option -H) and recovers automatically							
	OVERVOLTAGE PROTECTION		4.00 to 5.25	5.75 to 7.00	13.80 to 16.80	17.25 to 21.00	27.60 to 33.60	27.60 to 33.60	41.40 to 50.40	55.20 to 67.20
	OPERATING INDICATION		Not provided							
	REMOTE SENSING		Not provided							
REMOTE ON/OFF		Option (Refer to Instruction Manual)								
ISOLATION	INPUT-OUTPUT-RC *6		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)							
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)							
	OUTPUT-RC-FG *6		AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)							
	OUTPUT-RC *6		AC100V 1minute, Cutoff current = 25mA, DC100V 10MΩ min (At Room Temperature)							
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE *4		-10 to +70℃, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000feet) max							
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION		10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis							
	IMPACT		196.1m/s ² (20G), 11ms, once each X, Y and Z axis							
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1, EN60065, EN50178 Complies with DEN-AN							
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR-B, EN55011-B, EN55022-B							
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 (Class A) *8							
OTHERS	CASE SIZE/WEIGHT		62 X 33.5 X 155mm [2.44 X 1.32 X 6.10 inches] (W X H X D) / 280g max (with chassis & cover : 480g max)							
	COOLING METHOD		Convection (Refer to Instruction Manual 3.1 and 3.2) *4							

*1 Specification is changed at option, refer to Instruction Manual.

*2 This is the value that measured on measuring board with capacitor of 22μF at 150mm from output terminal.

Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant

at the rated input/output.

*4 Derating is required.

*5 () means peak current. There is a possibility that an internal device is damaged when the specification is exceeded. Please contact us about the detail.

*6 Applicable when Remote ON/OFF (optional) is added.

*7 Please contact us about dynamic load and input response.

*8 Please contact us about another class.

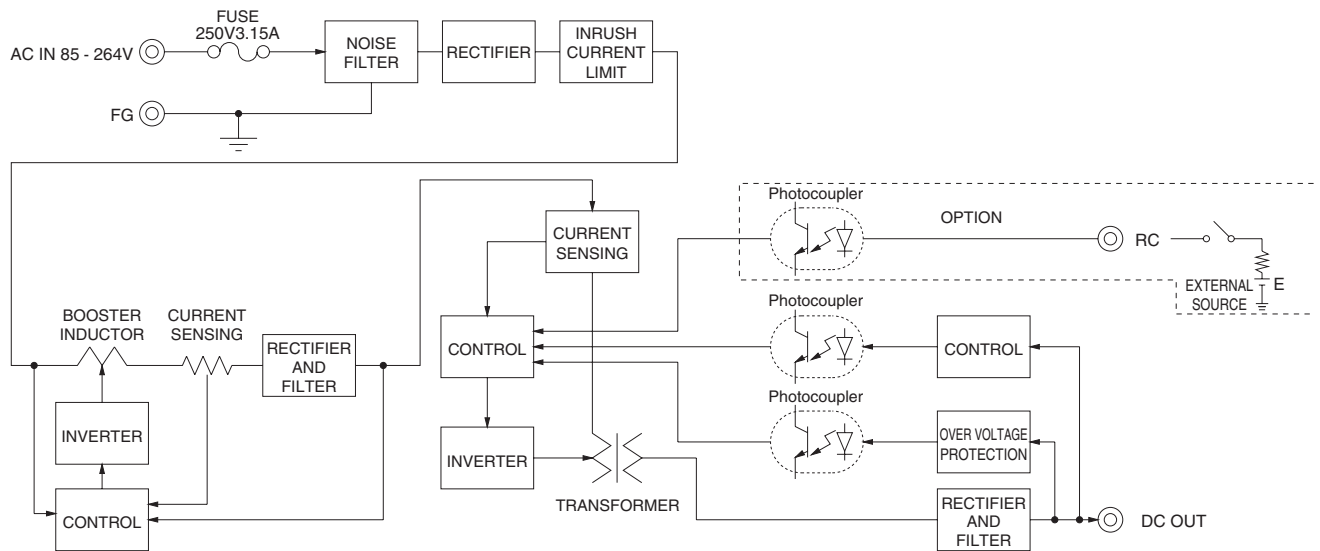
* To meet the specifications. Do not operate over-loaded condition.

* Parallel operation is not possible.

* Derating is required when operated with chassis and cover.

* Sound noise may be generated by power supply in case of pulse load.

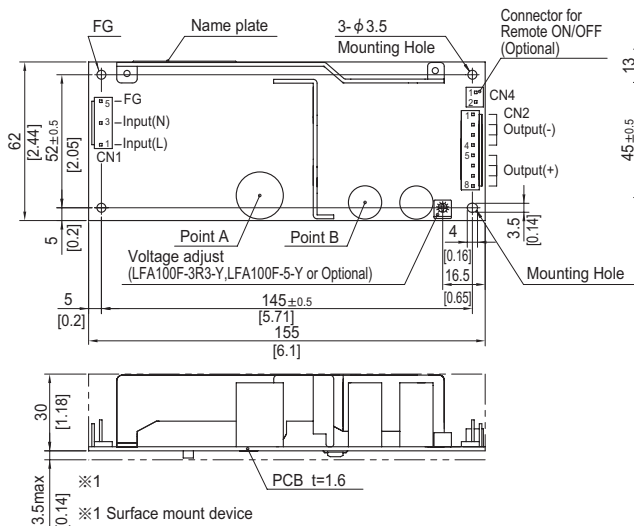
Block diagram



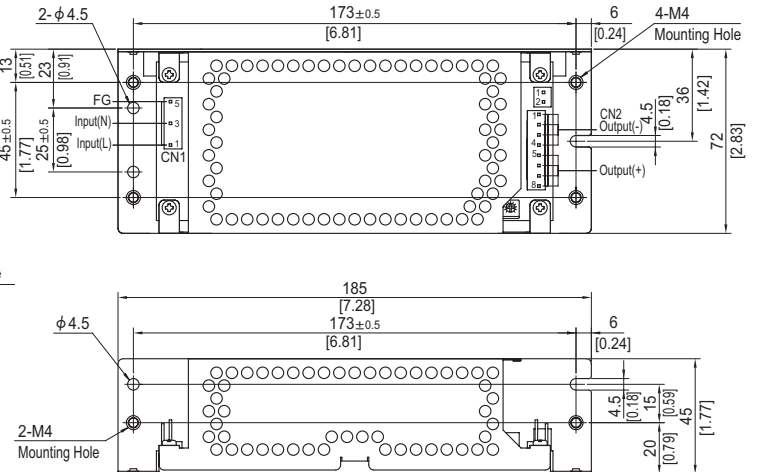
External view

※ External size of option is different from standard model.

Standard type



Chassis and cover type



- ※ 4 Mounting holes are existing.
- ※ The back side of P.C.B. of the power supply is assembled some SMDs.
Be attention not to bump against the attached area by vibration.
- ※ Use the spacer of 8mm length or more regarding insulation.
And do not use press-fitting bush.
- ※ Point A, Point B are thermometry points. Please refer to Instruction Manual 3.

I/O Connector	Mating connector	Terminal
CN1	1-1123724-3	1-1123722-5
CN2	1-1123723-8	1-1123722-8

(Mfr:Tyco Electronics)

- ※ I/O Connector is Mfr. Tyco Electronics
- ※ Option:-J1:VH(J.S.T) connector type.

<PIN CONNECTION>

CN1

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

CN2

Pin No.	Output
1 to 4	-V
5 to 8	+V

※ Keep drawing current per pin below 5A for CN2.

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 280g max (with chassis & cover : 480g max)
- ※ PCB material : CEM3
- ※ Optional chassis and cover material : Electric galvanizing steel board.
- ※ Dimensions in mm, [] =inches
- ※ Mounting torque (Mounting hole of chassis): $1.5N \cdot m$ (16kgf \cdot cm) max

Connector type

CN4 Option (Mfr:J.S.T)

PIN No.	Contents
1	RC(+)
2	RC(-)

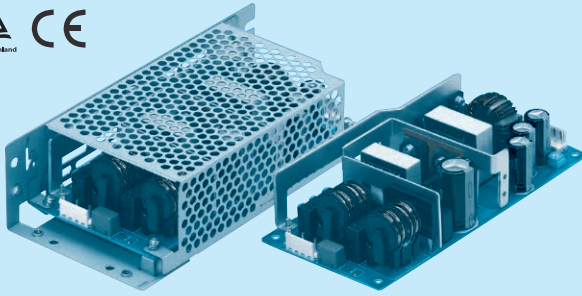
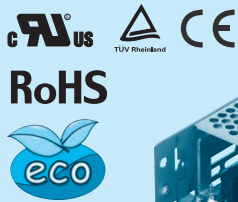
Barrier strip type

Model B2B-XH-A
Mating Connector (Terminal)
XHP-2
(BXH-001T-P0.6
or SXH-001T-P0.6)

LFA150F

LF A 150 F -□ -□

① ② ③ ④ ⑤ ⑥

Example recommended EMI/EMC filter
NAC-04-472

High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *1
C : with Coating
G : Low leakage current
H : with the function to be acceptable
to output peak current (only 24V)
J1 : VH(J.S.T.)connector type
R : with Remote ON/OFF
R2 : with Remote ON/OFF
S : with Chassis
SN : with Chassis & cover
Y : with Potentiometer
Please refer to Instruction
manual 5.

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LFA150F-3R3-Y	LFA150F-5-Y	LFA150F-12	LFA150F-15	LFA150F-24	LFA150F-24-H	LFA150F-36	LFA150F-48
MAX OUTPUT WATTAGE[W]	99	150	150	150	151.2	151.2 (189.6)	151.2	153.6
DC OUTPUT	3.3V 30A	5V 30A	12V 12.5A	15V 10A	24V 6.3A	24V 6.3 (7.9)A	36V 4.2A	48V 3.2A

SPECIFICATIONS

	MODEL	LFA150F-3R3-Y	LFA150F-5-Y	LFA150F-12	LFA150F-15	LFA150F-24	LFA150F-24-H	LFA150F-36	LFA150F-48	
INPUT	VOLTAGE[V]	AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.2) *4								
	CURRENT[A]	ACIN 100V	1.4typ (Io=100%)		2.0typ (Io=100%)					
		ACIN 200V	0.7typ (Io=100%)		1.0typ (Io=100%)					
	FREQUENCY[Hz]	50 / 60 (47 - 63)								
	EFFICIENCY[%]	ACIN 100V	80.0typ	82.5typ	82.5typ	84.0typ	85.0typ	85.0typ	85.5typ	
		ACIN 200V	82.0typ	85.5typ	85.0typ	86.5typ	87.5typ	87.5typ	88.0typ	
	POWER FACTOR (Io=100%)	ACIN 100V	0.98typ		0.99typ					
		ACIN 200V	0.92typ		0.95typ					
	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25℃)							
		ACIN 200V	30typ (Io=100%) (At cold start) (Ta=25℃)							
	LEAKAGE CURRENT[ma]	0.40 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)								
OUTPUT	VOLTAGE[V]	3.3	5	12	15	24	24	36	48	
	CURRENT[A]	*5 30	30	12.5	10	6.3	6.3 (Peak 7.9)	4.2	3.2	
	LINE REGULATION[mV]	*7 20max	20max	48max	60max	96max	96max	144max	192max	
	LOAD REGULATION[mV]	*7 40max	40max	100max	120max	150max	150max	240max	240max	
	RIPPLE[mVp-p]	0 to +40℃ *2	80max	80max	120max	120max	120max	240max	150max	150max
		-10 - 0℃ *2	140max	140max	160max	160max	160max	320max	200max	200max
	RIPPLE NOISE[mVp-p]	0 to +40℃ *2	120max	120max	150max	150max	150max	300max	250max	250max
		-10 - 0℃ *2	160max	160max	180max	180max	180max	360max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +40℃	50max	50max	120max	150max	240max	240max	360max	480max
		-10 to +40℃	60max	60max	150max	180max	290max	290max	450max	600max
	DRIFT[mV]	*3 20max	20max	48max	60max	96max	96max	144max	192max	
		START-UP TIME[ms]	350typ (ACIN 100V, Io=100%)							
		HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.85 to 3.63 4.50 to 5.50 Fixed ("Y"option is available for adjusting output voltage)								
	OUTPUT VOLTAGE SETTING[V]	3.30 to 3.40	5.00 to 5.15	11.50 to 12.50	14.40 to 15.60	23.00 to 25.00	23.00 to 25.00	34.50 to 37.50	46.00 to 50.00	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating (works over 101% of peak current at option -H) and recovers automatically								
	OVERVOLTAGE PROTECTION	4.00 to 5.25	5.75 to 7.00	13.80 to 16.80	17.25 to 21.00	27.60 to 33.60	27.60 to 33.60	41.40 to 50.40	55.20 to 67.20	
	OPERATING INDICATION	Not provided								
	REMOTE SENSING	Not provided								
	REMOTE ON/OFF	Option (Refer to Instruction Manual)								
ISOLATION	INPUT-OUTPUT-RC	*6 AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)								
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)								
	OUTPUT-RC-FG	*6 AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)								
	OUTPUT-RC	*6 AC100V 1minute, Cutoff current = 25mA, DC100V 10MΩ min (At Room Temperature)								
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	*4 -10 to +70℃, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000feet) max								
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max								
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis								
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis								
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN60065, EN50178 Complies with DEN-AN								
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR-B, EN55011-B, EN55022-B								
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *8								
OTHERS	CASE SIZE/WEIGHT	75 X 37.0 X 160mm [2.95 X 1.46 X 6.30 inches] (W X H X D) / 390g max (with chassis & cover : 650g max)								
	COOLING METHOD	Convection (Refer to Instruction Manual 3.1 and 3.2) *4								

*1 Specification is changed at option, refer to Instruction Manual.

*2 This is the value that measured on measuring board with capacitor of 22μF at 150mm from output terminal.

Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant

at the rated input/output.

*4 Derating is required.

*5 () means peak current. There is a possibility that an internal device is damaged when the specification is exceeded. Please contact us about the detail.

*6 Applicable when remote control (optional) is added.

*7 Please contact us about dynamic load and input response.

*8 Please contact us about another class.

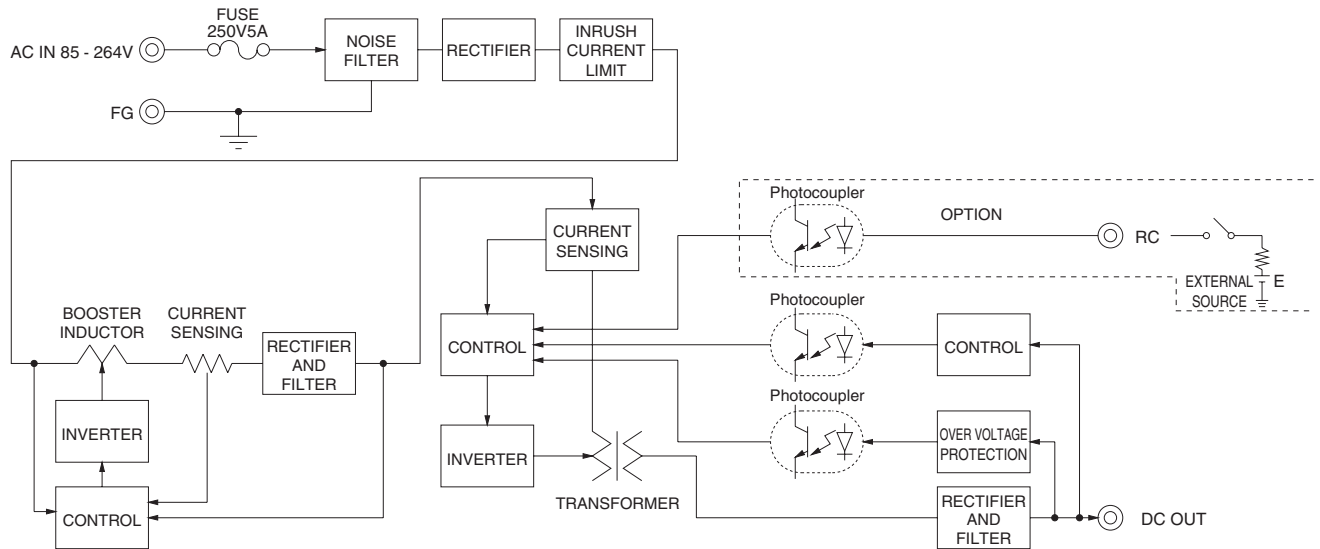
* To meet the specifications. Do not operate over-loaded condition.

* Parallel operation is not possible.

* Derating is required when operated with chassis and cover.

* Sound noise may be generated by power supply in case of pulse load.

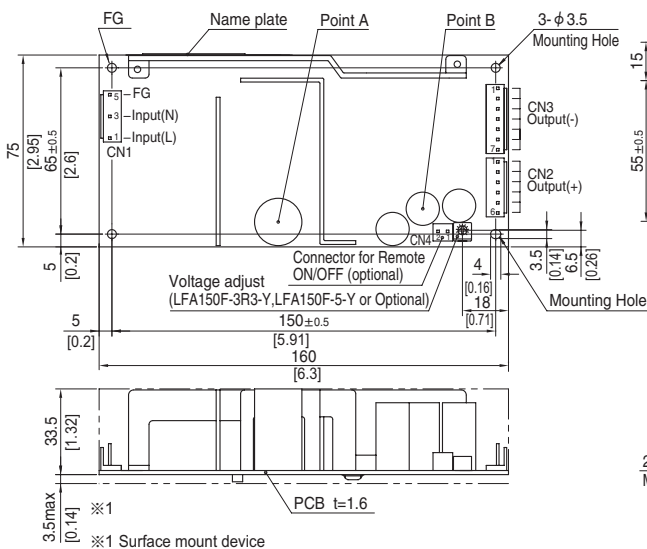
Block diagram



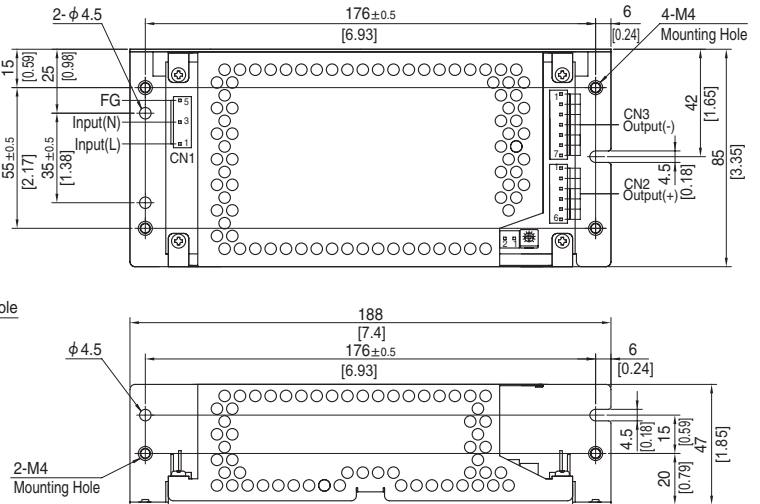
External view

※ External size of option is different from standard model.

Standard type



Chassis and cover type



- ※ 4 Mounting holes are existing.
- ※ The back side of P.C.B. of the power supply is assembled some SMDs.
- Be attention not to bump against the attached area by vibration.
- ※ Use the spacer of 8mm length or more regarding insulation.
- And do not use press-fitting bush.
- ※ Point A, Point B are thermometry points. Please refer to Instruction Manual 3.

I/O Connector	Mating connector	Terminal
CN1	1-1123724-3	1-1123722-5
		Chain 1123721-1
		Loose 1318912-1
CN2	1-1123723-6	1-1123722-6
		Chain 1123721-1
		Loose 1318912-1
CN3	1-1123723-7	1-1123722-7
		Chain 1123721-1
		Loose 1318912-1

(Mfr:Tyco Electronics)

- ※ I/O Connector is Mfr. Tyco Electronics
- ※ Option:-J1:VH(J.S.T) connector type.

<PIN CONNECTION>

CN1	CN2	CN3
Pin No.	Pin No.	Pin No.
1		
2		
3		
4		
5		
	1 to 6	1 to 7
	+V	-V

※ Keep drawing current per pin below 5A for CN2,CN3.

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 390g max (with chassis & cover : 650g max)
- ※ PCB material : CEM3
- ※ Optional chassis and cover material : Electric galvanizing steel board.
- ※ Dimensions in mm, [] =inches
- ※ Mounting torque (Mounting hole of chassis) : 1.5N · m (16kgf · cm) max

Connector type

CN4 Option (Mfr.J.S.T)

PIN No.	Contents
1	RC(+)
2	RC(-)

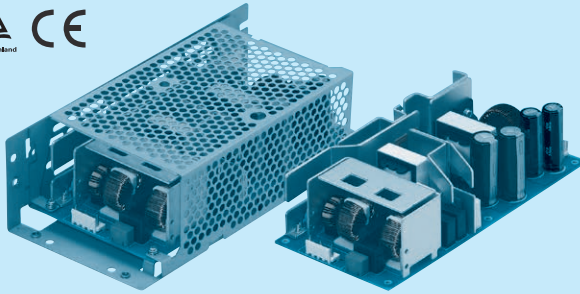
Barrier strip type

Model B2B-XH-A
Mating Connector (Terminal)
XHP-2
(BXH-001T-P0.6
or SXH-001T-P0.6)

LFA240F

LF A 240 F -□ -□

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
 - ② Single output
 - ③ Output wattage
 - ④ Universal input
 - ⑤ Output voltage
 - ⑥ Optional *1
- C : with Coating
G : Low leakage current
H : with the function to be acceptable to output peak current (only 24V)
J1 : VH(J.S.T.)connector type
R : with Remote ON/OFF
R2 : with Remote ON/OFF
S : with Chassis
SN : with Chassis & cover
T : Vertical terminal block
Y : with Potentiometer

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.
* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

Please refer to Instruction manual 5.

MODEL	LFA240F-24	LFA240F-24-H	LFA240F-36	LFA240F-48
MAX OUTPUT WATTAGE[W]	240	240 (300)	241.2	240
DC OUTPUT	24V 10A	24V 10 (12.5)A	36V 6.7A	48V 5A

SPECIFICATIONS

	MODEL		LFA240F-24	LFA240F-24-H	LFA240F-36	LFA240F-48
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.2) *4			
	CURRENT[A]	ACIN 100V	3.3typ (Io=100%)			
		ACIN 200V	1.7typ (Io=100%)			
	FREQUENCY[Hz]		50 / 60 (47 - 63)			
	EFFICIENCY[%]	ACIN 100V	84.5typ	84.5typ	84.5typ	84.5typ
		ACIN 200V	87.5typ	87.5typ	87.5typ	87.5typ
	POWER FACTOR (Io=100%)	ACIN 100V	0.99typ			
		ACIN 200V	0.95typ			
	INRUSH CURRENT[A]	ACIN 100V	15 / 30typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 3 sec. to re-start)			
ACIN 200V		30 / 30typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 3 sec. to re-start)				
LEAKAGE CURRENT[ma]		0.40 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)				
OUTPUT	VOLTAGE[V]		24	24	36	48
	CURRENT[A]		*5 10	10 (Peak12.5)	6.7	5
	LINE REGULATION[mV]		*7 96max	96max	144max	192max
	LOAD REGULATION[mV]		*7 150max	150max	240max	240max
	RIPPLE[mVp-p]	0 to +40℃ *2	120max	240max	150max	150max
		-10 - 0℃ *2	160max	320max	200max	200max
	RIPPLE NOISE[mVp-p]	0 to +40℃ *2	150max	300max	250max	250max
		-10 - 0℃ *2	180max	360max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +40℃	240max	240max	360max	480max
		-10 to +40℃	290max	290max	450max	600max
	DRIFT[mV]		*3 96max	96max	144max	192max
	START-UP TIME[ms]		350typ (ACIN 100V, Io=100%)			
	HOLD-UP TIME[ms]		20typ (ACIN 100V, Io=100%)			
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		Fixed ("Y"option is available for adjusting output voltage)			
OUTPUT VOLTAGE SETTING[V]		23.00 to 25.00	23.00 to 25.00	34.50 to 37.50	46.00 to 50.00	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating (works over 101% of peak current at option -H) and recovers automatically			
	OVERVOLTAGE PROTECTION		27.60 to 33.60	27.60 to 33.60	41.40 to 50.40	55.20 to 67.20
	OPERATING INDICATION		Not provided			
	REMOTE SENSING		Not provided			
	REMOTE ON/OFF		Option (Refer to Instruction Manual)			
ISOLATION	INPUT-OUTPUT-RC		*6 AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)			
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)			
	OUTPUT-RC-FG		*6 AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)			
	OUTPUT-RC		*6 AC100V 1minute, Cutoff current = 25mA, DC100V 10MΩ min (At Room Temperature)			
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE		*4 -10 to +70℃, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000feet) max			
	STORAGE TEMP.,HUMID.AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max			
	VIBRATION		10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis			
	IMPACT		196.1m/s² (20G), 11ms, once each X, Y and Z axis			
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1, EN60065, EN50178 Complies with DEN-AN			
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR-B, EN55011-B, EN55022-B			
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 (Class A) *8			
OTHERS	CASE SIZE/WEIGHT		84 X 46.5 X 180mm [3.31 X 1.83 X 7.09 inches] (W X H X D) / 550g max (with chassis & cover : 880g max)			
	COOLING METHOD		Convection (Refer to Instruction Manual 3.1 and 3.2) *4			

*1 Specification is changed at option, refer to Instruction Manual.

*2 This is the value that measured on measuring board with capacitor of 22μF at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant

at the rated input/output.

*4 Derating is required.

*5 () means peak current. There is a possibility that an internal device is damaged when the specification is exceeded. Please contact us about the detail.

*6 Applicable when remote control (optional) is added.

*7 Please contact us about dynamic load and input response.

*8 Please contact us about another class.

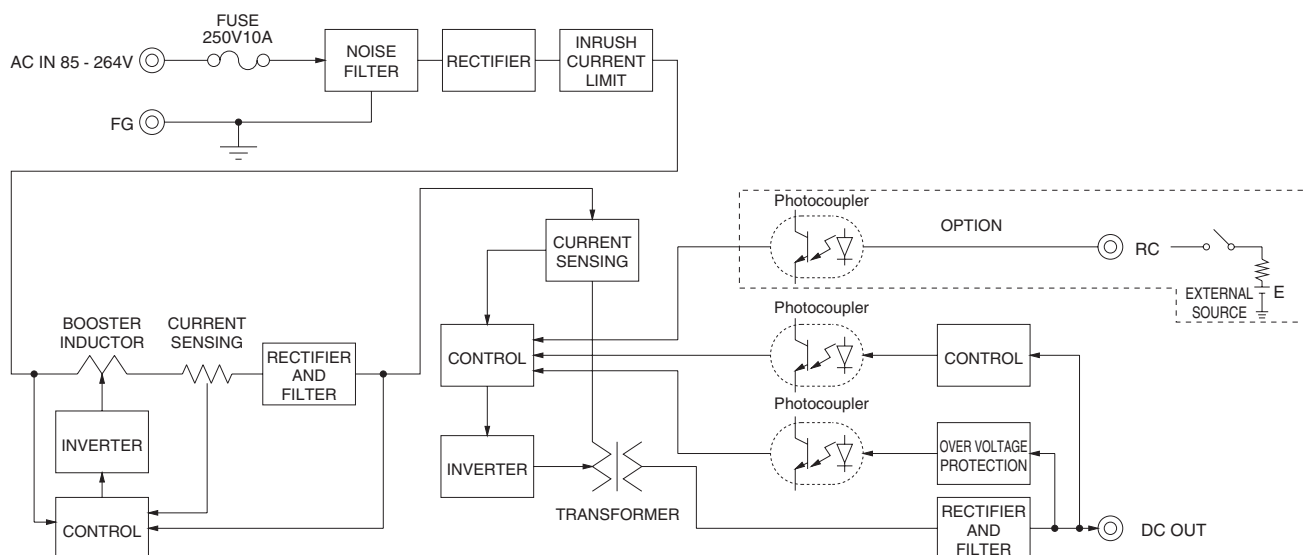
* To meet the specifications. Do not operate over-loaded condition.

* Parallel operation is not possible.

* Derating is required when operated with chassis and cover.

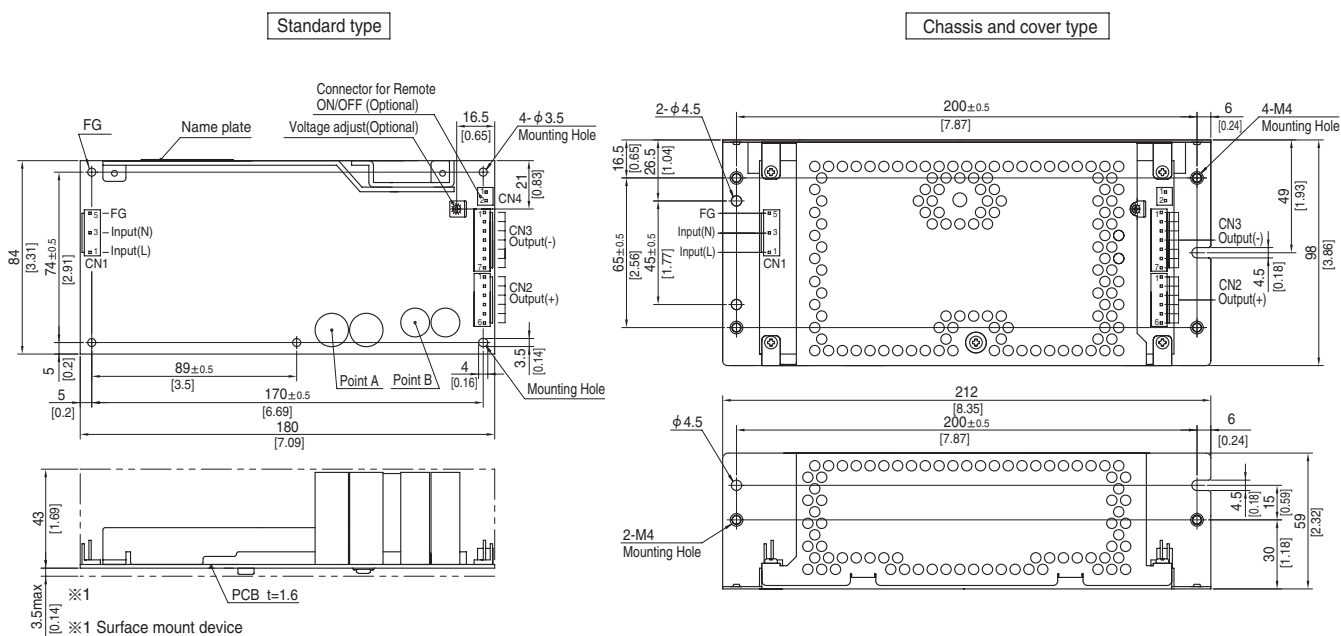
* Sound noise may be generated by power supply in case of pulse load.

Block diagram



External view

※ External size of option is different from standard model.



- ※ 5 Mounting holes are existing.
- ※ The back side of P.C.B. of the power supply is assembled some SMDs.
Be attention not to bump against the attached area by vibration.
- ※ Use the spacer of 8mm length or more regarding insulation.
And do not use press-fitting bush.
- ※ Point A, Point B are thermometry points. Please refer to Instruction Manual 3.

I/O Connector		Mating connector	Terminal	
CN1	1-1123724-3	1-1123722-5	Chain	1123721-1
			Loose	1318912-1
CN2	1-1123723-6	1-1123722-6	Chain	1123721-1
			Loose	1318912-1
CN3	1-1123723-7	1-1123722-7	Chain	1123721-1
			Loose	1318912-1

(Mfr:Tyco Electronics)

- ※ I/O Connector is Mfr. Tyco Electronics
※ Option:-J1:VH(J.S.T) connector type.

<PIN CONNECTION>

CN1		CN2		CN3	
Pin No.	Input	Pin No.	Output	Pin No.	Output
1	AC(L)	1 to 6	+V	1 to 7	-V
2					
3	AC(N)				
4					
5	FG				

- ※ Keep drawing current per pin below 5A for CN2,CN3.
- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 550g max (with chassis & cover : 880g max)
- ※ PCB material : CEM3
- ※ Optional chassis and cover material : Electric galvanizing steel board.
- ※ Dimensions in mm, []=inches
- ※ Mounting torque (Mounting hole of chassis): 1.5N · m (16kgf · cm) max

Connector type

PIN No.	Contents
1	RC(+)
2	RC(-)

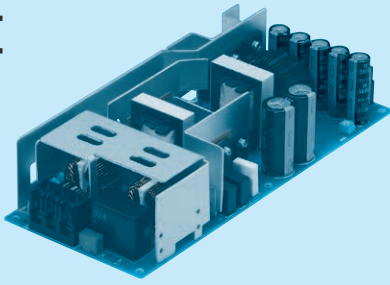
Barrier strip type

Model B2B-XH-A
Mating Connector (Terminal)
XHP-2
(BXH-001T-P0.6
or SXH-001T-P0.6

LFA300F

LF A 300 F -□ -□

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
 - ② Single output
 - ③ Output wattage
 - ④ Universal input
 - ⑤ Output voltage
 - ⑥ Optional *1
- C : with Coating
G : Low leakage current
H : with the function to be acceptable to output peak current
(Only 24V, 30V, 36V and 48V)
J : EP (Tyco Electronics) connector type (Except 3.3V and 5V)
J1 : VH (J.S.T.) connector type (Except 3.3V and 5V)
R : with Remote ON/OFF
R2 : with Remote ON/OFF
S : with Chassis
SNF : with Chassis & cover & fan (Only 5V, 12V and 24V)
T1 : Horizontal terminal block

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

Please refer to Instruction manual 5.

MODEL		LFA300F-3R3-TY	LFA300F-5-TY	LFA300F-12-TY	LFA300F-15-TY	LFA300F-24-TY	LFA300F-24-HTY	LFA300F-30-TY	LFA300F-36-TY	LFA300F-48-TY
MAX OUTPUT WATTAGE[W]	*5	198	300	324	330	336	336 (456)	330	338.4	336
DC OUTPUT	Convection	3.3V 40A	5V 40A	12V 17A	15V 14A	24V 12.5A	24V 12.5 (19)A	30V 10A	36V 8.4A	48V 6.3A
	Forced air	3.3V 60A	5V 60A	12V 27A	15V 22A	24V 14A	24V 14 (19)A	30V 11A	36V 9.4A	48V 7A

SPECIFICATIONS

	MODEL	LFA300F-3R3-TY	LFA300F-5-TY	LFA300F-12-TY	LFA300F-15-TY	LFA300F-24-TY	LFA300F-24-HTY	LFA300F-30-TY	LFA300F-36-TY	LFA300F-48-TY	
INPUT	VOLTAGE[V]	AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.2) *4									
	CURRENT[A]	ACIN 100V	2.7typ (Io=100%) 4.1typ (Io=100%)								
		ACIN 200V	1.4typ (Io=100%) 2.0typ (Io=100%)								
	FREQUENCY[Hz]	50 / 60 (47 - 63)									
	EFFICIENCY[%]	ACIN 100V	75.0typ	79.0typ	80.0typ	81.5typ	85.0typ	85.0typ	85.5typ	85.5typ	
		ACIN 200V	77.0typ	82.5typ	83.0typ	84.5typ	88.0typ	88.0typ	88.0typ	88.0typ	
	POWER FACTOR (Io=100%)	ACIN 100V	0.98typ	0.99typ							
		ACIN 200V	0.92typ	0.95typ							
INRUSH CURRENT[A]	ACIN 100V	15 / 30typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 3 sec. to re-start)									
	ACIN 200V	30 / 30typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 3 sec. to re-start)									
LEAKAGE CURRENT[ma]	0.45 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)										
OUTPUT	VOLTAGE[V]	3.3	5	12	15	24	24	30	36	48	
	CURRENT[A]	Convection	40	40	17	14	12.5	12.5 (Peak19)	10	8.4	6.3
		Forced air	60	60	27	22	14	14 (Peak19)	11	9.4	7
	LINE REGULATION[mV]	*7	20max	20max	48max	60max	96max	96max	144max	144max	192max
	LOAD REGULATION[mV]	*7	40max	40max	100max	120max	150max	150max	240max	240max	240max
	RIPPLE[mVp-p]	0 to +40℃ *2	80max	80max	120max	120max	120max	240max	150max	150max	150max
		-10 - 0℃ *2	140max	140max	160max	160max	160max	320max	200max	200max	200max
	RIPPLE NOISE[mVp-p]	0 to +40℃ *2	120max	120max	150max	150max	150max	300max	250max	250max	250max
		-10 - 0℃ *2	160max	160max	180max	180max	180max	360max	300max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +40℃	50max	50max	120max	150max	240max	240max	360max	360max	480max
		-10 to +40℃	60max	60max	150max	180max	290max	290max	450max	450max	600max
	DRIFT[mV]	*3	20max	20max	48max	60max	96max	96max	144max	144max	192max
	START-UP TIME[ms]	350typ (ACIN 100V, Io=100%)									
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)									
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.85 to 3.63 4.50 to 5.50 10.80 to 13.20 13.50 to 16.50 21.60 to 27.50 21.60 to 27.50 27.00 to 33.00 32.40 to 39.60 39.60 to 52.80										
OUTPUT VOLTAGE SETTING[V]	3.30 to 3.40 5.00 to 5.15 12.00 to 12.48 15.00 to 15.60 24.00 to 24.96 24.00 to 24.96 30.00 to 31.20 36.00 to 37.44 48.00 to 49.92										
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating (works over 101% of peak current at option -H) and recovers automatically									
	OVERVOLTAGE PROTECTION	4.00 to 5.25 5.75 to 7.00 13.80 to 16.80 17.25 to 21.00 27.60 to 33.60 27.60 to 33.60 34.50 to 42.00 41.40 to 50.40 55.20 to 67.20									
	OPERATING INDICATION	Not provided									
	REMOTE SENSING	Not provided									
REMOTE ON/OFF	Option (Refer to Instruction Manual)										
ISOLATION	INPUT-OUTPUT-RC	*6	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)								
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)								
	OUTPUT-RC-FG	*6	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)								
	OUTPUT-RC	*6	AC100V 1minute, Cutoff current = 25mA, DC100V 10MΩ min (At Room Temperature)								
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	*4	-10 to +70℃, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000feet) max								
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max								
	VIBRATION		10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis								
	IMPACT		196.1m/s ² (20G), 11ms, once each X, Y and Z axis								
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN60065, EN50178 Complies with DEN-AN									
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR-B, EN55011-B, EN55022-B									
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *8									
OTHERS	CASE SIZE/WEIGHT	95×52.5×222mm [3.74×2.07×8.74 inches] (W×H×D) (without terminal block) / 810g max (with chassis & cover : 1,270g max)									
	COOLING METHOD	Convection / Forced air (Refer to Instruction Manual 3.1 and 3.2) *4									

*1 Specification is changed at option, refer to Instruction Manual.

*2 This is the value that measured on measuring board with capacitor of 22μF at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant

at the rated input/output.

*4 Derating is required.

*5 () means peak current. There is a possibility that an internal device is damaged when the specification is exceeded. Please contact us about the detail.

*6 Applicable when remote control (optional) is added.

*7 Please contact us about dynamic load and input response.

*8 Please contact us about another class.

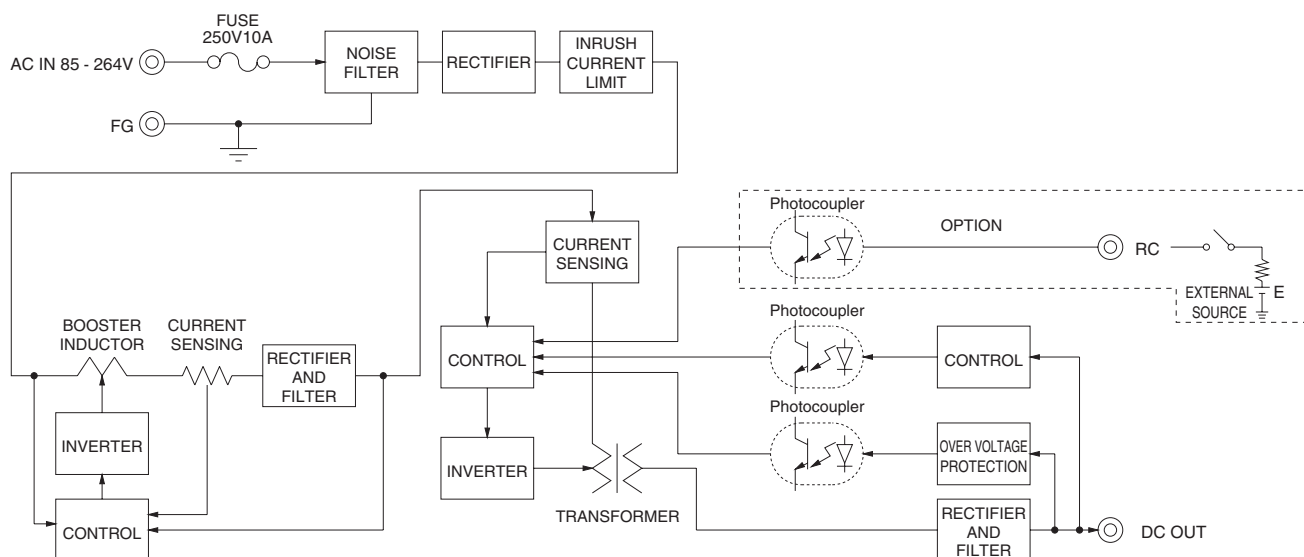
* To meet the specifications. Do not operate over-loaded condition.

* Parallel operation is not possible.

* Derating is required when operated with chassis and cover.

* Sound noise may be generated by power supply in case of pulse load.

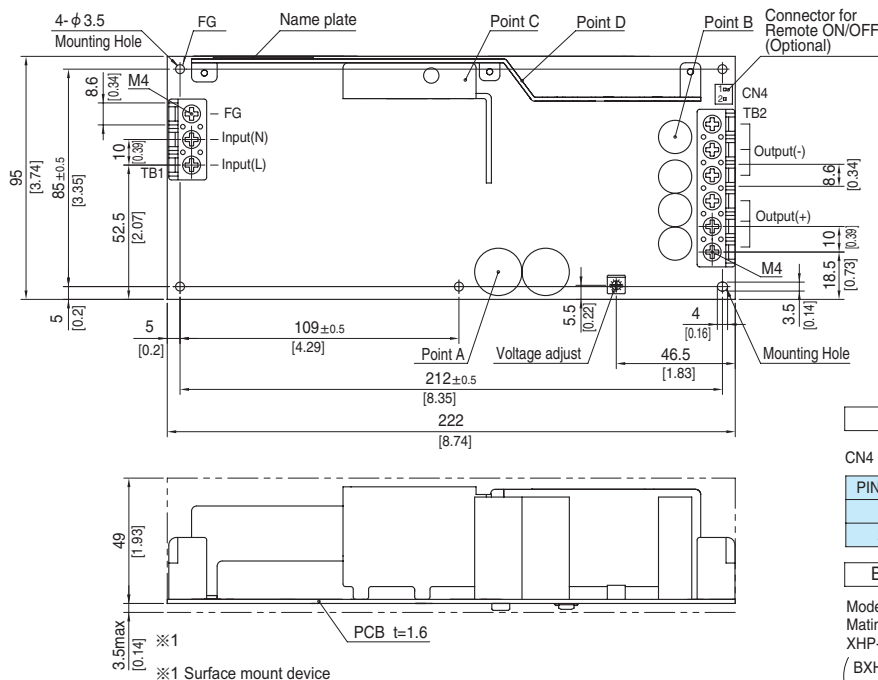
Block diagram



External view

※ External size of option is different from standard model.

Standard type



- ※ 5 Mounting holes are existing.
- ※ The back side of P.C.B. of the power supply is assembled some SMDs.
Be attention not to bump against the attached area by vibration.
- ※ Use the spacer of 8mm length or more regarding insulation.
And do not use press-fitting bush.
- ※ Point A, Point B, Point C, Point D are thermometry points.
Please refer to Instruction Manual 3.
- ※ Keep drawing current per pin below 20A for TB2.

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 810g max (with chassis & cover : 1,270g max)
- ※ PCB material : CEM3
- ※ Dimensions in mm, []=inches
- ※ Screw tightening torque : M4 1.6N · m (16.9kgf · cm) max

Connector type

CN4 Option (Mfr:J.S.T)

PIN No.	Contents
1	RC(+)
2	RC(-)

Barrier strip type

Model B2B-XH-A
Mating Connector (Terminal)
XHP-2
(BXH-001T-P0.6
or SXH-001T-P0.6)

Basic Characteristics Data

LFA

Model	Circuit method	Switching frequency [kHz]	Input current *1 [A]	Inrush current protection	PCB/Pattern			Series/Parallel operation availability *2	
					Material	Single sided	Double sided	Series operation	Parallel operation
LFA10F	Flyback converter	100	0.26	LF	CEM-3	Yes		Yes	No
LFA15F	Flyback converter	100	0.35	Thermistor	CEM-3	Yes		Yes	No
LFA30F	Flyback converter	130	0.65	Thermistor	CEM-3	Yes		Yes	No
LFA50F	Active filter	60-440	0.67	Thermistor	CEM-3	Yes		Yes	No
	Flyback converter	130							
LFA75F	Active filter	60-440	1.0	Thermistor	CEM-3	Yes		Yes	No
	Flyback converter	130							
LFA100F	Active filter	60	1.3	Thermistor	CEM-3		Yes	Yes	No
	Forward converter	140							
LFA150F	Active filter	60	2.0	Thermistor	CEM-3		Yes	Yes	No
	Forward converter	140							
LFA240F	Active filter	60	3.3	SCR	CEM-3		Yes	Yes	No
	Forward converter	140							
LFA300F	Active filter	60	4.1	SCR	CEM-3		Yes	Yes	No
	Forward converter	140							

*1 The value of input current is at ACIN 100V and rated load.

*2 Refer to Instruction Manual 2.

1 Function

LFA-22

- 1.1 Input voltage range LFA-22
- 1.2 Inrush current limiting LFA-22
- 1.3 Overcurrent protection LFA-22
- 1.4 Overvoltage protection LFA-22
- 1.5 Output voltage adjustment range LFA-22
- 1.6 Output ripple and ripple noise LFA-23
- 1.7 Isolation LFA-23
- 1.8 Reducing standby power LFA-23

2 Series Operation and Parallel Operation

LFA-23

- 2.1 Series Operation LFA-23
- 2.2 Parallel Operation LFA-24

3 Assembling and Installation Method

LFA-24

- 3.1 Installation method LFA-24
- 3.2 Derating LFA-24
- 3.3 Mounting screw LFA-28
- 3.4 Expectancy life and warranty LFA-28

4 Ground

LFA-30

5 Option and Others

LFA-30

- 5.1 Outline of options LFA-30
- 5.2 Others LFA-32

1 Function

1.1 Input voltage range

- The range is from AC85V to AC264V or DC120V to DC370V (please see SPECIFICATIONS for details).
- In cases that conform with safety standard, input voltage range is AC100-AC240V (50/60Hz).
- If input value doesn't fall within above range, a unit may not operate in accordance with specifications and/or start hunting or fail. If you need to apply a square waveform input voltage, which is commonly used in UPS and inverters, please contact us.
- When the input voltage changes suddenly, the output voltage accuracy might exceed the specification. Please contact us.

● LFA10F, LFA15F, LFA30F

- A power factor improvement circuit (active filter) is not built-in. If you use multiple units for a single system, standards for input harmonic current may not be satisfied. Please contact us for details.

● LFA10F, LFA15F, LFA30F, LFA50F, LFA75F, LFA100F, LFA150F, LFA240F, LFA300F

- Operation stop voltage is set at a lower value than that of a standard version (derating is needed).
- Use Conditions

	Output () 3.3V	
LFA10F	5W	(3W)
LFA15F	7.5W	(5W)
LFA30F	10W	(7.5W)
LFA50F	15W	(10W)
LFA75F	25W	(15W)
LFA100F	30W	(20W)
LFA150F	50W	(30W)
LFA240F	80W	
LFA300F	100W	(75W)

Input AC50V or DC70V
Duty 1s/30s

*Please avoid using continuously for more than 1 second under above conditions. Doing so may cause a failure.

1.2 Inrush current limiting

- An inrush current limiting circuit is built-in.
- If you need to use a switch on the input side, please select one that can withstand an input inrush current.

● LFA10F

- Resistance for line filter is used for inrush current limiting.

● LFA15F, LFA30F, LFA50F, LFA75F, LFA100F, LFA150F

- Thermistor is used in the inrush current limiting circuit. When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that a power supply cools down before being turned on.

● LFA240F, LFA300F

- Thyristor technique is used in the inrush current limiting circuit. When you turn power ON/OFF repeatedly within a short period of time, please have enough intervals so that the inrush current limiting circuit becomes operative.
- When the switch of the input is turned on, the primary inrush current and secondary inrush current will be generated because the thyristor technique is used for the inrush current limiting circuit.

1.3 Overcurrent protection

- An overcurrent protection circuit is built-in and activated at 105% of the rated current or 101% of the peak current. A unit automatically recovers when a fault condition is removed. Please do not use a unit in short circuit and/or under an overcurrent condition.
- Intermittent Operation Mode
Intermittent operation for overcurrent protection is included in a part of series. When the overcurrent protection circuit is activated and the output voltage drops to a certain extent, the output becomes intermittent so that the average current will also decrease.

1.4 Overvoltage protection

- An overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait more than 3 minutes and turn on the AC input again to recover the output voltage. Recovery time varies depending on such factors as input voltage value at the time of the operation.
- In option -R2, overvoltage protection is removed by toggling ON/OFF signal of remote control.

Remarks :

Please avoid applying a voltage exceeding the rated voltage to an output terminal. Doing so may cause a power supply to malfunction or fail. If you cannot avoid doing so, for example, if you need to operate a motor, etc., please install an external diode on the output terminal to protect the unit.

1.5 Output voltage adjustment range

- Adjustment of output voltage is possible by using potentiometer. Please refer to instruction manual 5.1.
- Option "-Y" is recommended which can adjust the output voltage.

1.6 Output ripple and ripple noise

■ Output ripple noise may be influenced by measurement environment, measuring method fig.1.1 is recommended.

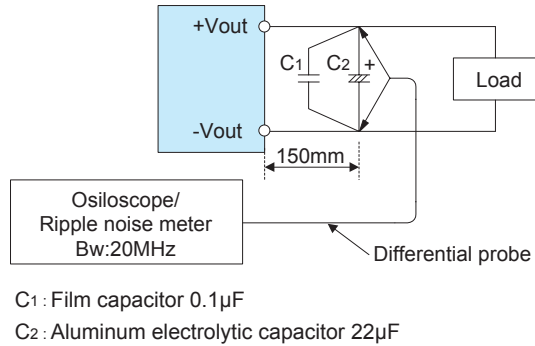


Fig.1.1 Measuring method of Ripple and Ripple Noise

Remarks :

When GND cable of probe with flux of magnetic force from power supply are crossing, ripple and ripple noise might not measure correctly.

Please note the measuring environment.

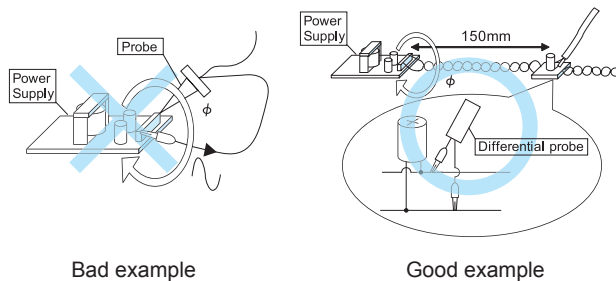


Fig.1.2. Example of measuring output ripple and ripple noise

1.7 Isolation

■ For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for the start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

1.8 Reducing standby power

● LFA10F, LFA15F

■ A circuit reducing standby power is built in LFA10F and LFA15F. (standby power : 0.5W typ)

The load factor: $I_o=0-35\%$, the internal switch element is intermittent operated, and the switching loss is decreased.

The specification of the Ripple/Ripple Noise changes by this intermittent operation. The value of the ripple/ripple Noise when intermittent operates changes in the input voltage and the output current.

Please contact us for details.

● LFA100F, LFA150F, LFA240F, LFA300F

■ As for option -R2, reducing standby power is possible by OFF signal of the remote control.

Please refer to instruction manual 5.1.

2 Series Operation and Parallel Operation

2.1 Series Operation

● LFA10F, LFA15F, LFA30F, LFA50F, LFA75F

■ Series operation is available by connecting the outputs of two or more power supplies with the same output voltage, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

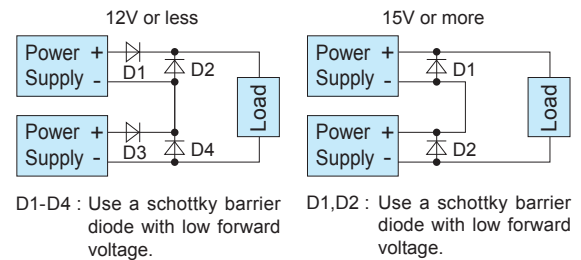


Fig.2.1 Examples of connecting in series operation (a)

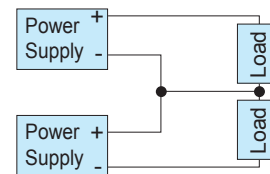


Fig.2.2 Examples of connecting in series operation (b)

● LFA100F, LFA150F, LFA240F, LFA300F

■ You can use a power supply in series operation. The output current in series operation should be lower than the rated current of a power supply with the lowest rated current among power supplies that are serially connected. Please make sure that no current exceeding the rated current flows into a power supply.

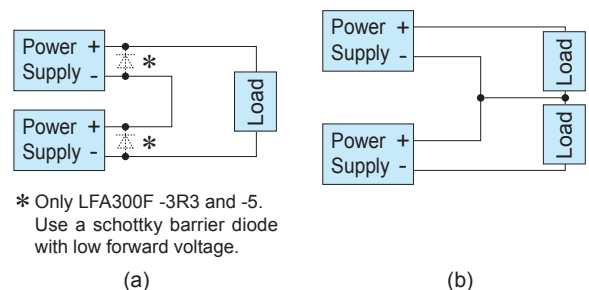


Fig.2.3 Examples of connecting in series operation

2.2 Parallel Operation

- Parallel operation is not possible.
- Redundancy operation is available by wiring as shown below.

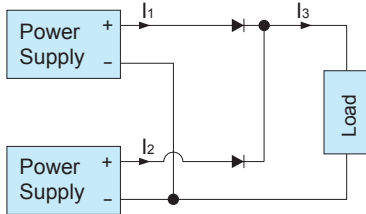


Fig.2.4 Example of redundancy operation

- Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 . Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

3 Assembling and Installation Method

3.1 Installation method

- This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit,so handle the unit with care.
- In case of metal chassis, keep the distance between d_1 & d_2 for to insulate between lead of component and metal chassis, use the spacer of 8mm or more between d_1 . If it is less than d_1 & d_2 , insert the insulation sheet between power supply and metal chassis.

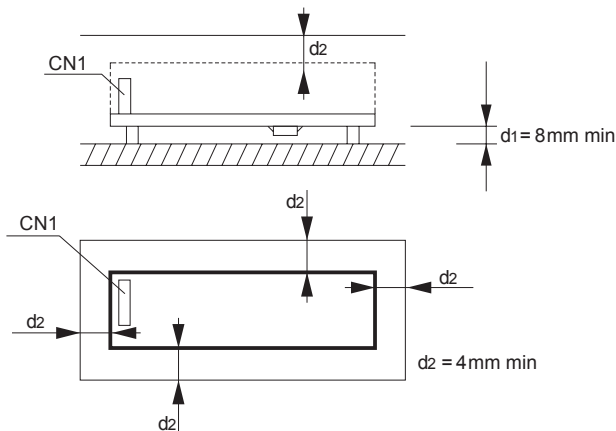


Fig.3.1 Installation method

- There is a possibility that it is not possible to cool enough when the power supply is used by the sealing up space as showing in Figure 3.2.

Please use it after confirming the temperature of point A and point B of Instruction Manual 3.2.

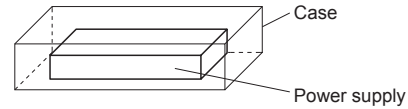


Fig.3.2 Installation example

3.2 Derating

- Environment to use it and Installation environment

When using it,it is necessary to radiate heat by the heat of the power supply.

Table 3.1 - 3.9 shows the relation between the upper limit temperature (Point A and Point B) and load factors.

Please consider the ventilation so that the convection which is enough for the whole power supply is provided.

And temperature of Point A and Point B please become lower than upper limit temperature.

The expectancy life in the upper bound temperature (Point A and Point B) is three years or more.

Please refer to External View for the position of Point A and Point B. In case of with Chassis and Cover, please contact our sales office for getting more information.

Remarks:

- *Please be careful of electric shock or earth leakage in case of temperature measurement, because Point A and Point B is live potential.
- *Please refer to 3.4 if you want to extend the longevity of the expectancy life.

Table 3.1 Temperatures of Point A, Point B LFA10F-□

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	20%<lo≤100%	70	84
		lo≤20%	75	79
B	Convection	20%<lo≤100%	70	81
		lo≤20%	73	77
C	Convection	20%<lo≤100%	76	80
		lo≤20%	76	77
D	Convection	20%<lo≤100%	70	78
		lo≤20%	75	77
E	Convection	20%<lo≤100%	73	84
		lo≤20%	76	79
F	Convection	20%<lo≤100%	74	80
		lo≤20%	76	78
A,B,C,D,E,F	Forced air	70%<lo≤100%	75	75
		lo≤70%	75	75

Table 3.2 Temperatures of Point A, Point B LFA15F-□

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	40%<lo≤100%	72	80
		lo≤40%	77	81
B	Convection	40%<lo≤100%	68	73
		lo≤40%	74	78
C	Convection	40%<lo≤100%	75	84
		lo≤40%	78	81
D	Convection	40%<lo≤100%	71	77
		lo≤40%	76	79
E	Convection	40%<lo≤100%	70	79
		lo≤40%	76	81
F	Convection	40%<lo≤100%	71	78
		lo≤40%	76	80
A,B,C,D,E,F	Forced air	70%<lo≤100%	75	75
		lo≤70%	75	75

Table 3.3 Temperatures of Point A, Point B LFA30F-□

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	70%<lo≤100%	73	73
		lo≤70%	79	77
B	Convection	60%<lo≤100%	73	74
		lo≤60%	80	82
C	Convection	70%<lo≤100%	80	77
		lo≤70%	83	80
D	Convection	70%<lo≤100%	72	70
		20%<lo≤70%	80	77
		lo≤20%	79	80
E	Convection	70%<lo≤100%	73	79
		20%<lo≤70%	79	85
		lo≤20%	77	81
F	Convection	70%<lo≤100%	73	75
		lo≤70%	79	79
A,B,C,D,E,F	Forced air	70%<lo≤100%	75	75
		lo≤70%	75	75

Table 3.4 Temperatures of Point A, Point B LFA50F-□

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	70%<lo≤100%	86	68
		lo≤70%	86	77
B	Convection	70%<lo≤100%	72	65
		lo≤70%	77	70
C	Convection	50%<lo≤100%	78	71
		lo≤50%	84	77
D	Convection	50%<lo≤100%	83	68
		lo≤50%	85	72
E	Convection	50%<lo≤100%	76	75
		lo≤50%	83	81
F	Convection	50%<lo≤100%	80	78
		lo≤50%	84	76
A,B,C,D,E,F	Forced air	70%<lo≤100%	75	75
		lo≤70%	75	75

Table 3.5 Temperatures of Point A, Point B LFA75F-□

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	70%<lo≤100%	85	70
		lo≤70%	86	76
B	Convection	70%<lo≤100%	77	65
		lo≤70%	81	71
C	Convection	70%<lo≤100%	81	68
		lo≤70%	83	72
D	Convection	70%<lo≤100%	78	58
		10%<lo≤70%	80	63
		lo≤10%	84	72
E	Convection	70%<lo≤100%	73	66
		10%<lo≤70%	83	68
		lo≤10%	83	79
F	Convection	70%<lo≤100%	74	59
		lo≤70%	83	71
A,B,C,D,E,F	Forced air	70%<lo≤100%	75	75
		lo≤70%	75	75

Table 3.6 Temperatures of Point A, Point B LFA100F-□

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	70%<lo≤100%	85	74
		50%<lo≤70%	88	79
		lo≤50%	88	83
B	Convection	70%<lo≤100%	77	72
		50%<lo≤70%	87	82
		lo≤50%	88	86
C	Convection	70%<lo≤100%	87	82
		lo≤70%	88	85
D	Convection	70%<lo≤100%	80	70
		lo≤70%	85	80
E	Convection	70%<lo≤100%	74	85
		lo≤70%	80	88
F	Convection	70%<lo≤100%	79	71
		50%<lo≤70%	88	77
		lo≤50%	88	79
A,B,C,D,E,F	Forced air	70%<lo≤100%	75	75
		lo≤70%	75	75

Table 3.7 Temperatures of Point A, Point B LFA150F-□

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	60%<lo≤100%	79	75
		20%<lo≤60%	86	85
		lo≤20%	87	87
B	Convection	70%<lo≤100%	75	70
		30%<lo≤70%	85	78
		lo≤30%	86	81
C	Convection	60%<lo≤100%	81	75
		30%<lo≤60%	86	81
		lo≤30%	87	83
D, F	Convection	70%<lo≤100%	73	67
		30%<lo≤70%	83	76
		lo≤30%	84	77
E	Convection	70%<lo≤100%	73	75
		30%<lo≤70%	82	83
		lo≤30%	83	84
A,B,C,D,E,F	Forced air	70%<lo≤100%	75	75
		lo≤70%	75	75

Table 3.8 Temperatures of Point A, Point B LFA240F-□

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	75%<lo≤100%	75	70
		50%<lo≤75%	82	79
		lo≤50%	86	85
B	Convection	75%<lo≤100%	63	61
		50%<lo≤75%	73	73
		lo≤50%	81	83
C	Convection	75%<lo≤100%	76	73
		50%<lo≤75%	81	79
		lo≤50%	87	85
D	Convection	75%<lo≤100%	66	55
		50%<lo≤75%	74	65
		lo≤50%	84	78
E	Convection	75%<lo≤100%	62	62
		50%<lo≤75%	73	74
		lo≤50%	81	84
F	Convection	75%<lo≤100%	68	62
		50%<lo≤75%	77	73
		lo≤50%	84	83
A,B,C,D,E,F	Forced air	70%<lo≤100%	75	75
		lo≤70%	75	75

Table 3.9 Temperatures of Point A, Point B, Point C, Point D LFA300F-□

Mounting Method	Cooling Method	Load factor	Max temperature			
			Point A[°C]	Point B[°C]	Point C[°C]	Point D[°C]
A	Convection	80%<lo≤100%	70	86		
		60%<lo≤80%	75	88		
		lo≤60%	79	89		
B	Convection	80%<lo≤100%	57	68		
		60%<lo≤80%	62	71		
		lo≤60%	71	79		
C	Convection	80%<lo≤100%	69	75		
		60%<lo≤80%	74	75		
		lo≤60%	83	82		
D	Convection	80%<lo≤100%	58	62		
		60%<lo≤80%	64	66		
		lo≤60%	75	75		
E	Convection	80%<lo≤100%	57	80		
		60%<lo≤80%	63	83		
		lo≤60%	74	88		
F	Convection	80%<lo≤100%	61	68		
		60%<lo≤80%	68	71		
		lo≤60%	76	80		
A,B,C,D,E and F (3.3V/5V/12V/15V)	Forced air	50%<lo≤100%	75	75	85	85
		lo≤50%	75	75	85	85
A,B,C,D,E and F (24V/30V/36V/48V)	Forced air	50%<lo≤100%	75	75	85	85
		lo≤50%	75	75	85	85

■ The operative ambient temperature is different by with / without chassis cover or mounting position. Derating curve is shown below.
Note: In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

LFA10F

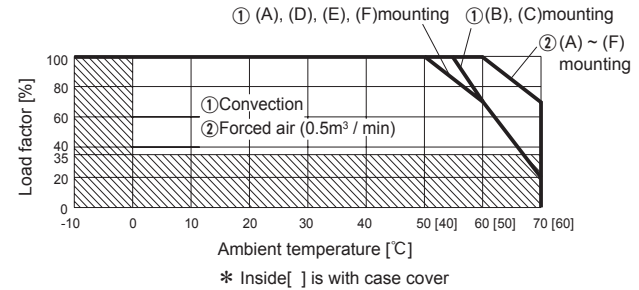


Fig.3.3 Ambient temperature derating curve (refer to Table 3.1)

LFA15F

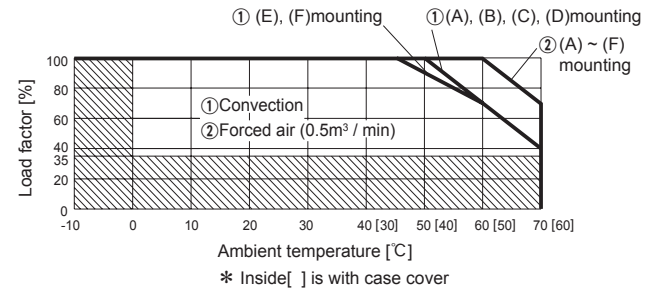


Fig.3.4 Ambient temperature derating curve (refer to Table 3.2)

LFA30F

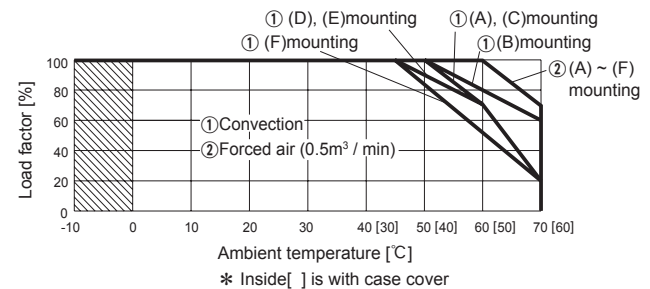


Fig.3.5 Ambient temperature derating curve (refer to Table 3.3)

LFA50F

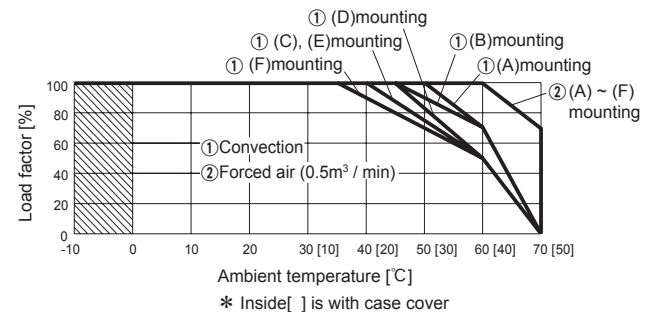


Fig.3.6 Ambient temperature derating curve (refer to Table 3.4)

● LFA75F

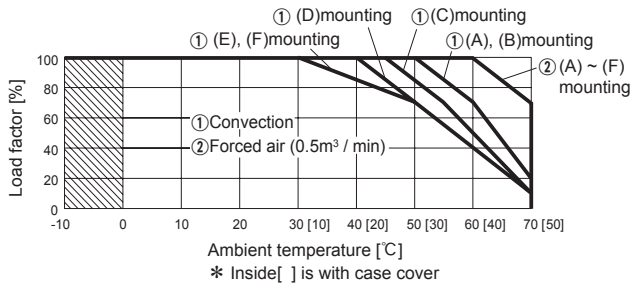


Fig.3.7 Ambient temperature derating curve (refer to Table 3.5)

● LFA100F

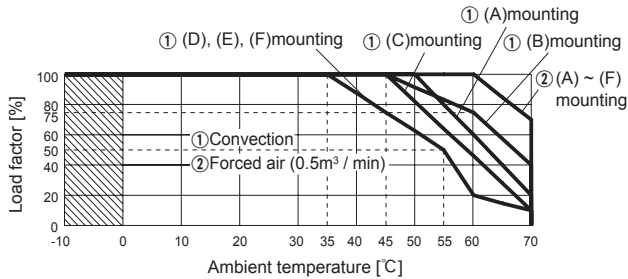


Fig.3.8 Ambient temperature derating curve (refer to Table 3.6)

● LFA100F-□-SN

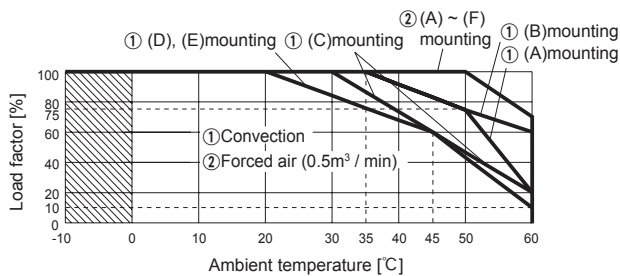


Fig.3.9 Ambient temperature derating curve

● LFA150F

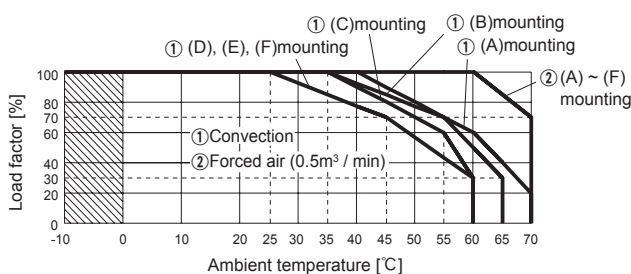


Fig.3.10 Ambient temperature derating curve (refer to Table 3.7)

● LFA150F-□-SN

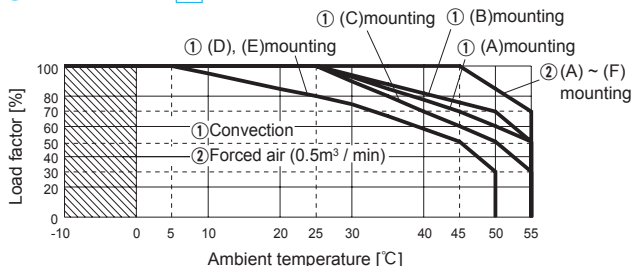


Fig.3.11 Ambient temperature derating curve

● LFA240F

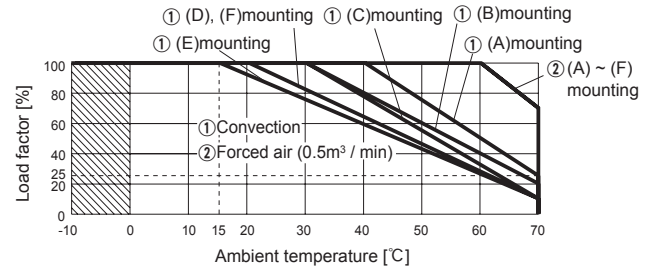


Fig.3.12 Ambient temperature derating curve (refer to Table 3.8)

● LFA240F-□-SN

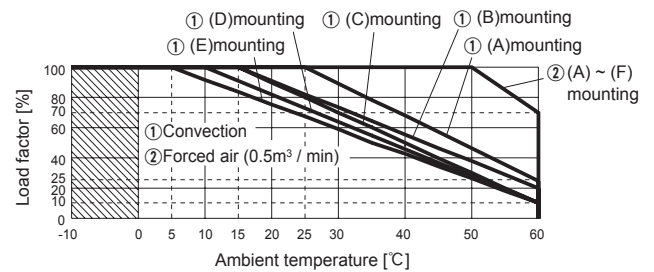
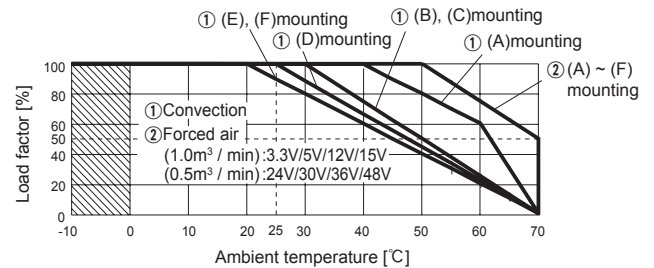


Fig.3.13 Ambient temperature derating curve

● LFA300F



Output voltage	Output power[W]	
	①Convection	②Forced air
3.3V	132.0	198.0
5V	200.0	300.0
12V	204.0	324.0
15V	210.0	330.0
24V	300.0	336.0
30V	300.0	330.0
36V	302.4	338.4
48V	302.4	336.0

Fig.3.14 Ambient temperature derating curve (refer to Table 3.9)

■ Derating curve depending on input voltage

Derating curve depending on input voltage is shown in Fig.3.8.

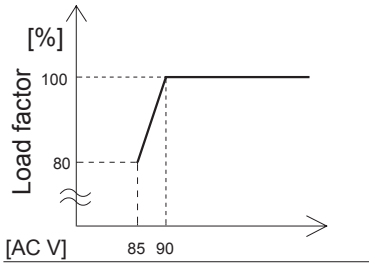


Fig.3.17 Derating curve depending on input voltage

■ Mounting method

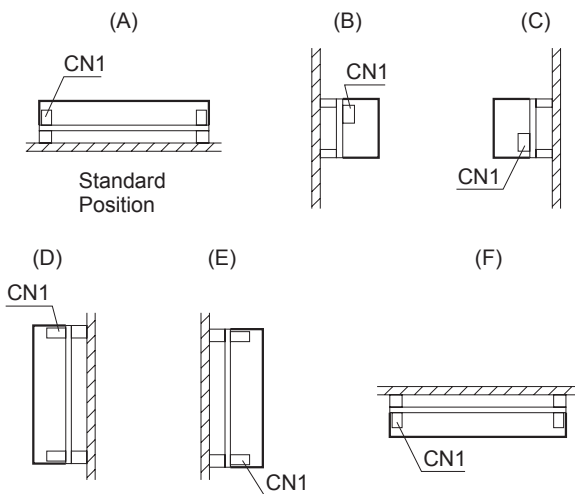


Fig.3.18 Mounting method

■ (F) mounting is not possible when unit is with case cover, but if need to operate unit by (F) positioning with case cover, temperature / load derating is necessary. For more details, please contact our sales or engineering departments.

3.3 Mounting screw

■ The mounting screw should be M3. The hatched area shows the allowance of metal parts for mounting.

■ If metallic fittings are used on the component side of the board, ensure there is no contact with surface mounted components.

■ This product uses SMD technology.

Please avoid the PCB installation method which includes the twisting stress or the bending stress.

* Recommendation to electrically connect FG to metal chassis for reducing noise.

● LFA10F, LFA15F

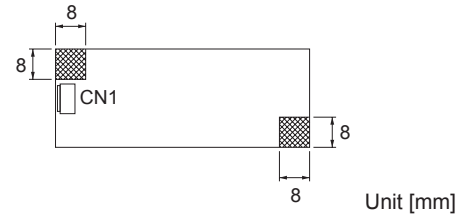


Fig.3.19 Allowance of metal parts for mounting (LFA10F, LFA15F)

● LFA30F, LFA50F, LFA75F, LFA100F, LFA150F

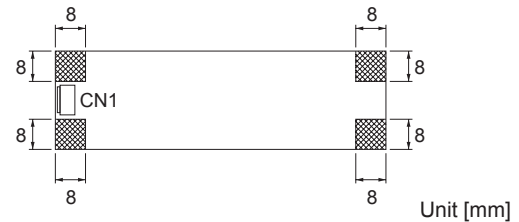


Fig.3.20 Allowance of metal parts for mounting (LFA30F, LFA50F, LFA75F, LFA100F, LFA150F)

● LFA240F, LFA300F

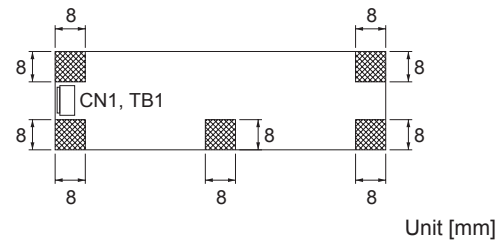


Fig.3.21 Allowance of metal parts for mounting (LFA240F, LFA300F)

3.4 Expectancy life and warranty

■ Expectancy Life.

Table 3.10 Expectancy Life (LFA10F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Expectancy Life	
			$I_o \leq 75\%$	$75\% < I_o \leq 100\%$
A, D, E, F	Convection	Ta = 40°C or less	6years	6years
		Ta = 50°C	5years	3years
B, C	Convection	Ta = 45°C or less	6years	6years
		Ta = 55°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.11 Expectancy Life (LFA15F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Expectancy Life	
			$I_o \leq 75\%$	$75\% < I_o \leq 100\%$
A, B, C, D	Convection	Ta = 40°C or less	6years	6years
		Ta = 50°C	5years	3years
E, F	Convection	Ta = 35°C or less	6years	6years
		Ta = 45°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.12 Expectancy Life (LFA30F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Expectancy Life	
			lo ≤ 75%	75% < lo ≤ 100%
A, B, C	Convection	Ta = 40°C or less	6years	6years
		Ta = 50°C	5years	3years
D, E, F	Convection	Ta = 35°C or less	6years	6years
		Ta = 45°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.13 Expectancy Life (LFA50F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Expectancy Life	
			lo ≤ 75%	75% < lo ≤ 100%
A	Convection	Ta = 40°C or less	6years	6years
		Ta = 50°C	5years	3years
B, D	Convection	Ta = 35°C or less	6years	6years
		Ta = 45°C	5years	3years
C, E	Convection	Ta = 30°C or less	6years	6years
		Ta = 40°C	5years	3years
F	Convection	Ta = 25°C or less	6years	6years
		Ta = 35°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.14 Expectancy Life (LFA75F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Expectancy Life	
			lo ≤ 75%	75% < lo ≤ 100%
A, B	Convection	Ta = 40°C or less	6years	6years
		Ta = 50°C	5years	3years
C	Convection	Ta = 35°C or less	6years	6years
		Ta = 45°C	5years	3years
D	Convection	Ta = 30°C or less	6years	6years
		Ta = 40°C	5years	3years
E, F	Convection	Ta = 20°C or less	6years	6years
		Ta = 30°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.15 Expectancy Life (LFA100F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Expectancy Life	
			lo ≤ 75%	75% < lo ≤ 100%
A	Convection	Ta = 40°C or less	6years	6years
		Ta = 50°C	5years	3years
B, C	Convection	Ta = 35°C or less	6years	6years
		Ta = 45°C	5years	3years
D, E, F	Convection	Ta = 35°C or less	6years	6years
		Ta = 45°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.16 Expectancy Life (LFA150F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Expectancy Life	
			lo ≤ 75%	75% < lo ≤ 100%
A	Convection	Ta = 30°C or less	6years	6years
		Ta = 40°C	6years	5years
B	Convection	Ta = 25°C or less	6years	6years
		Ta = 35°C	6years	6years
C	Convection	Ta = 25°C or less	6years	6years
		Ta = 35°C	6years	5years
D, F	Convection	Ta = 25°C or less	6years	6years
E	Convection	Ta = 25°C or less	6years	5years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	5years

Table 3.17 Expectancy Life (LFA240F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Expectancy Life	
			lo ≤ 75%	75% < lo ≤ 100%
A	Convection	Ta = 30°C or less	6years	6years
		Ta = 40°C	5years	3years
B, C	Convection	Ta = 20°C or less	6years	6years
		Ta = 30°C	5years	3years
D, F	Convection	Ta = 20°C or less	6years	5years
E	Convection	Ta = 15°C or less	6years	5years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.18 Expectancy Life (LFA300F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Expectancy Life	
			lo ≤ 75%	75% < lo ≤ 100%
A	Convection	Ta = 30°C or less	6years	6years
		Ta = 40°C	5years	3years
B, C	Convection	Ta = 20°C or less	6years	6years
		Ta = 30°C	5years	3years
D	Convection	Ta = 25°C or less	6years	5years
E, F	Convection	Ta = 20°C or less	6years	5years
A,B,C,D,E,F	Forced air	Ta = 50°C	5years	3years

Warranty

Table 3.19 Warranty (LFA10F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			lo ≤ 75%	75% < lo ≤ 100%
A, D, E, F	Convection	Ta = 40°C or less	5years	5years
		Ta = 50°C	5years	3years
B, C	Convection	Ta = 45°C or less	5years	5years
		Ta = 55°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.20 Warranty (LFA15F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			lo ≤ 75%	75% < lo ≤ 100%
A, B, C, D	Convection	Ta = 40°C or less	5years	5years
		Ta = 50°C	5years	3years
E, F	Convection	Ta = 35°C or less	5years	5years
		Ta = 45°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.21 Warranty (LFA30F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			lo ≤ 75%	75% < lo ≤ 100%
A, B, C	Convection	Ta = 40°C or less	5years	5years
		Ta = 50°C	5years	3years
D, E, F	Convection	Ta = 35°C or less	5years	5years
		Ta = 45°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.22 Warranty (LFA50F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			Io ≤ 75%	75% < Io ≤ 100%
A	Convection	Ta = 40°C or less	5years	5years
		Ta = 50°C	5years	3years
B, D	Convection	Ta = 35°C or less	5years	5years
		Ta = 45°C	5years	3years
C, E	Convection	Ta = 30°C or less	5years	5years
		Ta = 40°C	5years	3years
F	Convection	Ta = 25°C or less	5years	5years
		Ta = 35°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.23 Warranty (LFA75F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			Io ≤ 75%	75% < Io ≤ 100%
A, B	Convection	Ta = 40°C or less	5years	5years
		Ta = 50°C	5years	3years
C	Convection	Ta = 35°C or less	5years	5years
		Ta = 45°C	5years	3years
D	Convection	Ta = 30°C or less	5years	5years
		Ta = 40°C	5years	3years
E, F	Convection	Ta = 20°C or less	5years	5years
		Ta = 30°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.24 Warranty (LFA100F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			Io ≤ 75%	75% < Io ≤ 100%
A	Convection	Ta = 40°C or less	5years	5years
		Ta = 50°C	5years	3years
B, C	Convection	Ta = 35°C or less	5years	5years
		Ta = 45°C	5years	3years
D, E, F	Convection	Ta = 25°C or less	5years	5years
		Ta = 35°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.25 Warranty (LFA150F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			Io ≤ 75%	75% < Io ≤ 100%
A	Convection	Ta = 30°C or less	5years	5years
		Ta = 40°C	5years	5years
B	Convection	Ta = 25°C or less	5years	5years
		Ta = 35°C	5years	5years
C	Convection	Ta = 25°C or less	5years	5years
		Ta = 35°C	5years	3years
D, F	Convection	Ta = 25°C or less	5years	5years
E	Convection	Ta = 25°C or less	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.26 Warranty (LFA240F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			Io ≤ 75%	75% < Io ≤ 100%
A	Convection	Ta = 30°C or less	5years	5years
		Ta = 40°C	5years	3years
B, C	Convection	Ta = 20°C or less	5years	5years
		Ta = 30°C	5years	3years
D, F	Convection	Ta = 20°C or less	5years	3years
E	Convection	Ta = 15°C or less	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.27 Warranty (LFA300F-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			Io ≤ 75%	75% < Io ≤ 100%
A	Convection	Ta = 30°C or less	5years	5years
		Ta = 40°C	5years	3years
B, C	Convection	Ta = 20°C or less	5years	5years
		Ta = 30°C	5years	3years
D	Convection	Ta = 25°C or less	5years	3years
E, F	Convection	Ta = 20°C or less	5years	3years
A,B,C,D,E,F	Forced air	Ta = 50°C	5years	3years

4 Ground

■ When installing the power supply with your unit, ensure that the input FG terminal of CN1 or mounting hole FG is connected to safety ground of the unit.

5 Option and Others

5.1 Outline of options

- * Please inquire us for details of specifications and delivery timing.
- * You can combine multiple options. Some options, however, cannot be combined with other options. Please contact us for details.

● -C

- Option -C units have coated internal PCB for better moisture resistance.

● -G

- Option -G units are low leakage current type.
- Differences from standard versions are summarized in Table 5.1.

Table 5.1 Low leakage current type

Leakage Current (AC240V 60Hz)	0.15mA max
Conducted Noise	N/A
Output Ripple Noise	Please contact us for details about Ripple Noise

* This is the value that measured on measuring board with capacitor of 22μF at 150mm from output connector.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN:RM-103).

● -H (LFA100F-24, LFA150F-24, LFA240F-24, LFA300F-24/30/36/48-TY)

- Option -H units can output the peak current.
- Peak load is possible to draw as below.

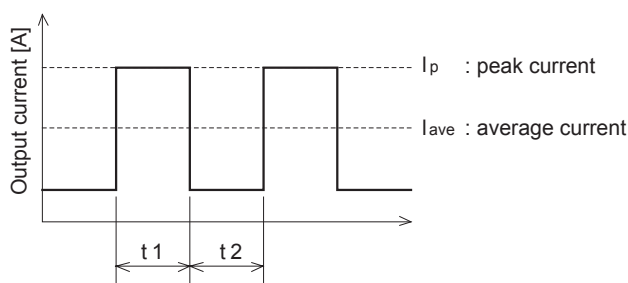


Fig.5.1 Peak current

Input voltage is AC90V to AC264V.

$t1 \leq 10[\text{sec}]$

$I_p \leq \text{rated peak current}$

$I_{ave} \leq \text{rated output current}$

$$\text{Duty} = \frac{t1}{t1+t2} \times 100[\%] \leq 35\%$$

In case of LFA300F duty is depended on peak wattage.

Please contact us about the detail.

Remarks:

- *There is possibility that an internal device is damaged when the specification is exceeded.

● -J (LFA300F)

- Option -J units, the input and output connector are changed to EP connectors (Mfr. Tyco Electronics).
- The appearance in option -J units is different from the standard units. Please contact us about the detail.

● -J1

- Option -J1 units, the Input and Output connector is VH connectors (Mfr. J.S.T.).
- LFA300F appearance of option -J units is different from the standard appearance. Please contact us about the detail.

● -S · -SN

- S indicates a type with chassis, and -SN indicates a type with chassis and cover (Refer to external view). Refer to "Derating Curves" in Section 3.2.
- Please contact us about the detail of LFA300F.

● -SNF (LFA300F-5/12/24-TY)

- In option -SNF, the cover, chassis and cooling fan are added.
- The appearance of option -J units is different from the standard appearance. Please contact us about the detail.
- Oil and other chemical liquid splashing environment may cause the performance degradation and failure.

● -Y

- Option -Y units can adjust the output voltage by the potentiometer is attached.
- Refer to the adjustable range to the table 5.2 and table 5.3.

■ LFA10F, LFA15F, LFA30F, LFA50F, LFA75F

Table 5.2 Output voltage adjustment range

Output voltage	Output voltage adjustment range[V]
3.3V*	2.85 to 3.63
5V	4.5 to 5.5
12V	10.8 to 13.2
15V	13.5 to 16.5
24V	21.6 to 26.4
36V	32.4 to 39.6
48V	43.2 to 52.8

* Some of the product, -Y is standard equipment.

(LFA10F-3R3-Y, LFA15F-3R3-Y, LFA30F-3R3-Y, LFA50F-3R3-Y, LFA75F-3R3-Y)

■ LFA100F, LFA150F, LFA240F, LFA300F

Table 5.3 Output voltage adjustment range

Output voltage	Output voltage adjustment range[V]
3.3V*	2.85 to 3.63
5V*	4.5 to 5.5
12V	10.8 to 13.2
15V	13.5 to 16.5
24V	21.6 to 27.5
30V (LFA300F)	27.0 to 33.0
36V	32.4 to 39.6
48V	39.6 to 52.8

* Some of the product, -Y is standard equipment.

(LFA100F-3R3-Y, LFA100F-5-Y, LFA150F-3R3-Y, LFA150F-5-Y, LFA300F-□-TY)

- To increase an output voltage, turn a built-in potentiometer clockwise.
- To decrease the output voltage, turn it counterclockwise.
- Please take care when you adjust output voltage by potentiometer, because there is possibility of electric shock and the breakdown as contacting to other internal circuit by electrically conductive tool.

● -R (LFA100F, LFA150F, LFA240F, LFA300F)

LFA

- You can control output ON/OFF remotely in Option -R units. To do so, connect an external DC power supply and apply a voltage to a remote ON/OFF connector, which is available as option.

Model Name	Built-in Resistor Ri [Ω]	Voltage between RC (+) and RC (-) [V]		Input Current [mA]
		Output ON	Output OFF	
LFA100F, LFA150F, LFA240F, LFA300F	780	4.5 - 12.5	0 - 0.5	20max

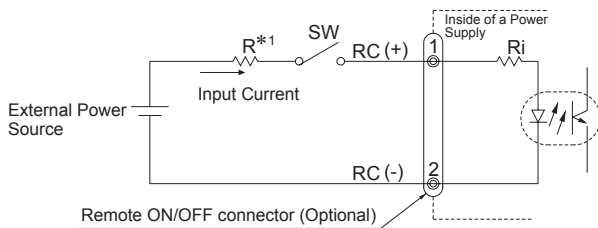


Fig. 5.2 Example of using a remote ON/OFF circuit

- Dedicated harnesses are available for your purchase. Please see Optional Parts for details.

*1 If the output of an external power supply is within the range of 4.5 - 12.5V, you do not need a current limiting resistor R. If the output exceeds 12.5V, however, please connect the current limiting resistor R.

To calculate a current limiting resistance value, please use the following equation.

$$R[\Omega] = \frac{V_{cc} - (1.1 + R_i \times 0.005)}{0.005}$$

*Please wire carefully. If you wire wrongly, the internal components of a unit may be damaged.

■ Remote ON/OFF circuits (RC+ and RC-) are isolated from input, output and FG.

● -R2 (LFA100F, LFA150F, LFA240F, LFA300F)

- The usage is the same as option -R, please refer to Option -R.
- Reducing standby power is possible by OFF signal of the remote control.
- Start up time by ON signal in remote control is 350ms(typ).
- The latch condition in overvoltage protection is removed by toggling ON/OFF signal of remote control.
- Standby power
LFA100F, LFA150F, LFA240F
0.2Wtyp (AC100V), 0.7Wtyp (AC200V)
LFA300F
0.25Wtyp (AC100V), 1.1Wtyp (AC200V)

● -T (LFA240F, LFA300F)

- Option -T units have vertically positioned screws on a terminal block.
- Please contact us for details about appearance.

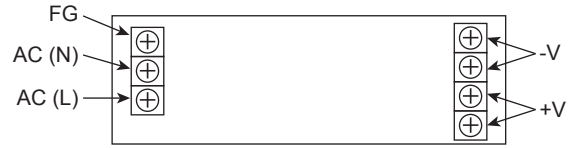


Fig. 5.3 Example of option -T

■ The screw can be held to terminal block by inserting and lifting the screwdriver from the side of terminal block.

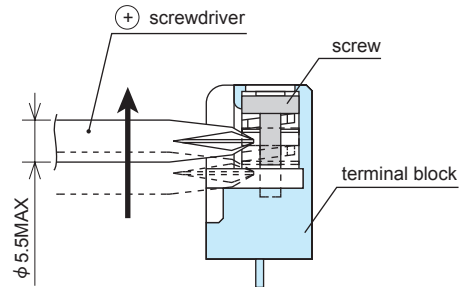


Fig. 5.4 lifting method

● -T1 (LFA300F)

- Option -T units have horizontally positioned screws on a terminal block.
- Please contact us for details about appearance.

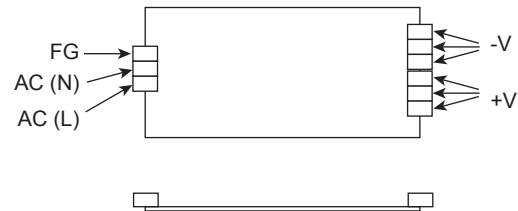


Fig. 5.5 Example of option -T1

5.2 Others

■ This power supply is the rugged PCB type. Do not drop conductive objects in the power supply.

■ At light load, there remains high voltage inside the power supply for a few minutes after power OFF.

So, at maintenance, take care about electric shock.

■ This power supply is manufactured by SMD technology. The stress to PCB like twisting or bending causes the defect of the unit, so handle the unit with care.

- Tighten all the screws in the screw hole.
- Install it so that PCB may become parallel to the clamp face.
- Avoid the impact such as drops.

■ While turning on the electricity, and for a while after turning off, please don't touch the inside of a power supply because there are some hot parts in that.

■ When a mass capacitor is connected with the output terminal (load side), the output might become the stop or an unstable operation. Please contact us for details when you connect the capacitor.

● LFA10F, LFA15F

■ When these power supplies are connected to the input terminal in parallel, the total capacitance between line and line becomes big. Therefore, the electrical discharge resistance on the safety standard might become necessary.

Please contact us for details when safety standard is necessary at multiple units usage.

Cost
EffectiveRugged
PCB typeSafety
Approvals

EMI

Inrush
current
limiting

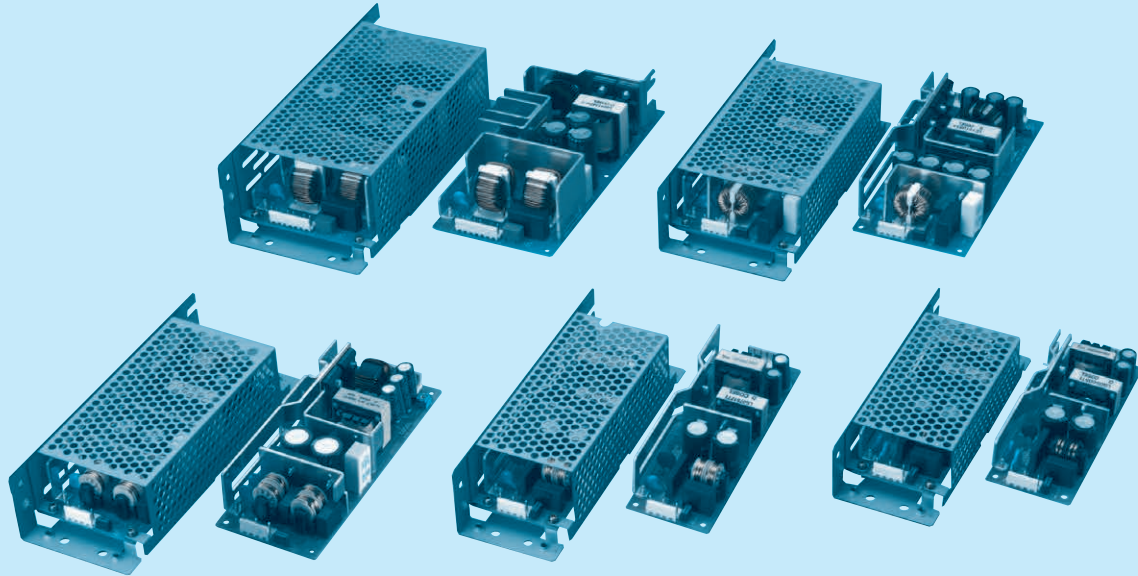
OCP



OVP

LGA-series

LGA



Feature

Small and compact PCB construction
Built-in inrush current, overcurrent and overvoltage protection circuits

Safety agency approvals

UL60950-1, C-UL(CSA60950-1) recognized, EN60950-1 approved
Complies with DEN-AN

EMI

Complies with FCC-B, CISPR22-B, EN55011-B, EN55022-B, VCCI-B

5-year warranty (refer to Instruction Manual)

CE marking

Low Voltage Directive

EMS Compliance : EN61204-3, EN61000-6-2

EN61000-4-2
EN61000-4-3
EN61000-4-4
EN61000-4-5
EN61000-4-6
EN61000-4-8
EN61000-4-11

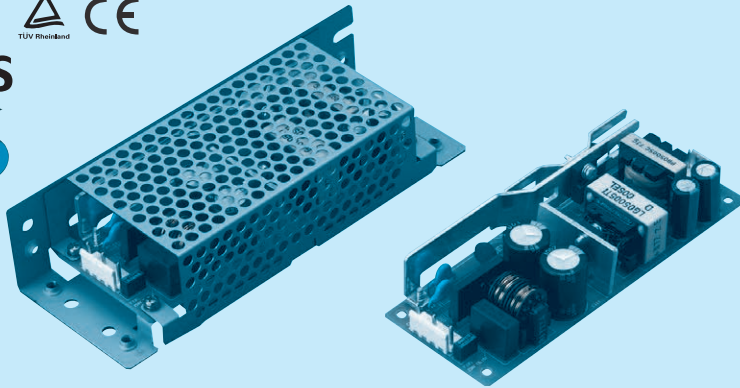
LGA50A

LG A 50 A -5 -□

① ② ③ ④ ⑤ ⑥



RoHS



Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ 100/120V input
- ⑤ Output voltage
- ⑥ Optional
- C :with Coating
- G :Low leakage current
- H :with the function to be acceptable to output peak current (only 24V)
- J1:VH(J.S.T.)connector type
- S :with Chassis
- SN:with Chassis & cover
- Y :with Potentiometer

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LGA50A-3R3-Y	LGA50A-5	LGA50A-12	LGA50A-15	LGA50A-24	LGA50A-24-H	LGA50A-48
MAX OUTPUT WATTAGE[W]	33	50	51.6	52.5	60	60	62.4
DC OUTPUT	3.3V 10A	5V 10A	12V 4.3A	15V 3.5A	24V 2.5A	24V 2.5 (Peak 3.2) A	48V 1.3A

SPECIFICATIONS

	MODEL	LGA50A-3R3-Y	LGA50A-5	LGA50A-12	LGA50A-15	LGA50A-24	LGA50A-24-H	LGA50A-48
INPUT	VOLTAGE[V]	AC85 - 132 1 φ (Refer to Instruction Manual 1.1, and 3.2 Derating)						
	CURRENT[A]	ACIN 100V 0.8typ (Io=100%) 1.3typ (Io=100%)						
	FREQUENCY[Hz]	47 - 440 (Refer to Instruction Manual 1.1)						
	EFFICIENCY[%]	ACIN 100V 74.0typ (Io=100%) 79.0typ (Io=100%) 82.0typ (Io=100%) 83.0typ (Io=100%) 85.0typ (Io=100%) 85.0typ (Io=100%) 85.0typ (Io=100%)						
	INRUSH CURRENT[A]	ACIN 100V 30typ (Io=100%), (At cold start), (Ta= 25°C)						
OUTPUT	LEAKAGE CURRENT[ma]	0.5max (ACIN 100V, 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)						
	VOLTAGE[V]	3.3	5	12	15	24	24	48
	CURRENT[A]	*3 10.0	10.0	4.3	3.5	2.5	2.5 (Peak 3.2)	1.3
	LINE REGULATION[mV]	20max	20max	48max	60max	96max	96max	192max
	LOAD REGULATION[mV]	40max	40max	100max	120max	150max	150max	300max
	RIPPLE[mVp-p]	0 to +50°C *1 80max	80max	120max	120max	120max	240max	150max
	RIPPLE NOISE[mVp-p]	-10 - 0°C *1 140max	140max	160max	160max	160max	320max	200max
		0 to +50°C *1 120max	120max	150max	150max	150max	300max	350max
		-10 - 0°C *1 160max	160max	180max	180max	180max	360max	400max
	TEMPERATURE REGULATION[mV]	0 to +50°C *4 50max	50max	120max	150max	240max	240max	480max
		-10 to +50°C *4 60max	60max	150max	180max	290max	290max	600max
	DRIFT[mV]	*2 20max	20max	48max	60max	96max	96max	192max
	START-UP TIME[ms]	200max (ACIN 100V, Io=100%)						
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)						
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.85 - 3.63	Fixed ("Y" which can be adjusted the output is available as optional ± 10%)					
	OUTPUT VOLTAGE SETTING[V]	3.30 - 3.40	4.90 - 5.30	11.50 - 12.50	14.40 - 15.60	23.00 - 25.00	23.00 - 25.00	46.00 - 50.00
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating (works over 101% of peak current at option -H) and recovers automatically						
	OVERVOLTAGE PROTECTION	4.00 - 5.25	5.75 - 7.00	13.80 - 16.80	17.30 - 21.00	27.60 - 35.00	27.60 - 35.00	55.20 - 67.20
	OPERATING INDICATION	Not provided						
	REMOTE SENSING	Not provided						
ISOLATION	REMOTE ON/OFF	Not provided						
	INPUT-OUTPUT	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)						
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)						
ENVIRONMENT	OUTPUT-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)						
	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +60°C, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000feet) max						
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max						
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis						
SAFETY AND NOISE REGULATIONS	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis						
	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1 Complies with DEN-AN						
OTHERS	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR-B, EN55011-B, EN55022-B						
	CASE SIZE/WEIGHT	50 x 28.5 x 132mm [1.97 x 1.12 x 5.2 inches] (W x H x D) / 160g max (with chassis & cover : 320g max)						
	COOLING METHOD	Convection (Refer to Instruction Manual 3.2)						

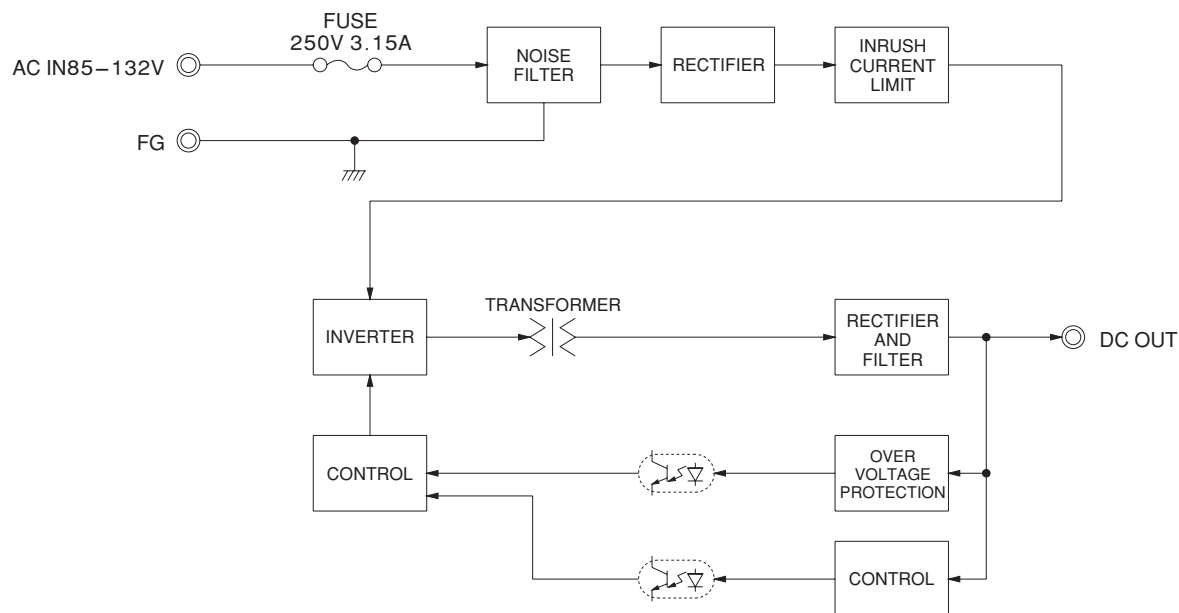
*1 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM-103).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

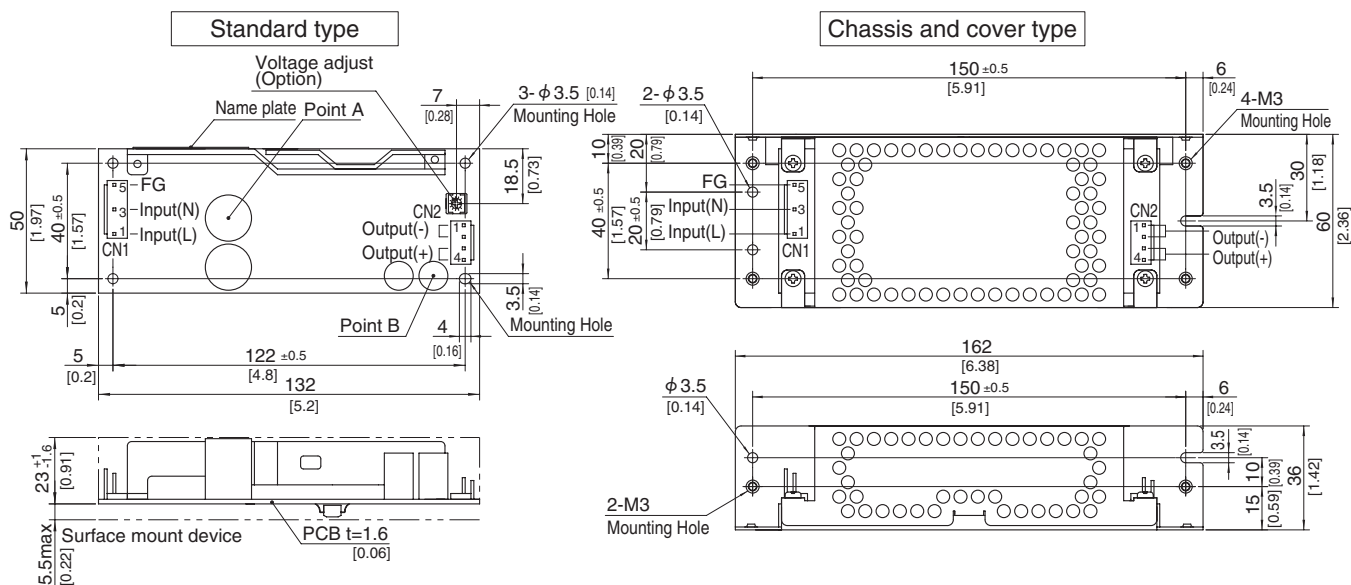
*3 Peak loading for 10sec. And Duty 35% max. or less is acceptable if the total wattage is less than the rated wattage (24V:60W).
Refer to instruction Manual 5. In detail.

*4 Only output 24V and 48V DC models are applied that the upper temperature limit is 45°C.
* Avoid prolonged use under over - load.
* Parallel operation with other model is not possible.
* Derating is required when operated with chassis and cover.
* A sound may occur from power supply at pulse loading.

Block diagram



External view



※ This power supply is manufactured by SMD technology.
The stress to P.C.B like twisting or bending causes the defect of the unit,so handle the unit with care.
Take care for SMD parts on the back to come in contact because of the vibration and not to break down.

※ Use the spacer of 8mm length or more.

※4 Mounting holes are existing.

I/O Connector		Mating connector	Terminal	
CN1	1-1123724-3	1-1123722-5	Chain	1123721-1
			Loose	1318912-1
CN2	1-1123723-4	1-1123722-4	Chain	1123721-1
			Loose	1318912-1

(Mfr:Tyco Electronics AMP)

※I/O Connector is Mfr Tyco Electronics AMP

※Option:-J1:VH(J.S.T) connector type.

Refer to instruction Manual 5.

※Mounting torque:0.6N.m(6.3kgf.cm)max

<PIN CONNECTION>

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

Pin No.	Output
1, 2	-V
3, 4	+V

※Keep drawing current per pin below 5A for CN2.

※Tolerance : ± 1 [± 0.04]

※Weight : 160g max (with chassis & cover : 320g max)

※PCB material / thickness : CEM3 / 1.6mm [0.06]

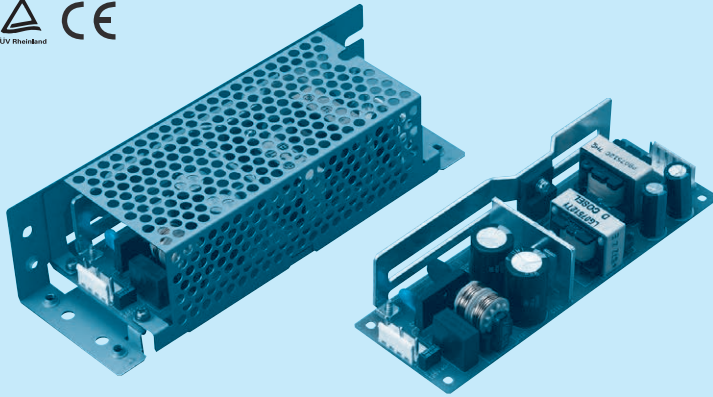
※Optional chassis and cover material : Electric galvanizing steel board.

※Dimensions in mm, []=inches

LGA75A

LG A 75 A -5 -□

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ 100/120V input
- ⑤ Output voltage
- ⑥ Optional
- C :with Coating
- G :Low leakage current
- H :with the function to be acceptable to output peak current (only 24V)
- J1:VH(J.S.T.)connector type
- S :with Chassis
- SN:with Chassis & cover
- Y :with Potentiometer

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LGA75A-3R3-Y	LGA75A-5	LGA75A-12	LGA75A-15	LGA75A-24	LGA75A-24-H	LGA75A-48
MAX OUTPUT WATTAGE[W]	49.5	75	75.6	75	76.8	76.8	76.8
DC OUTPUT	3.3V 15A	5V 15A	12V 6.3A	15V 5A	24V 3.2A	24V 3.2 (Peak 4.2) A	48V 1.6A

SPECIFICATIONS

	MODEL	LGA75A-3R3-Y	LGA75A-5	LGA75A-12	LGA75A-15	LGA75A-24	LGA75A-24-H	LGA75A-48	
INPUT	VOLTAGE[V]	AC85 - 132 1 φ (Refer to Instruction Manual 1.1, and 3.2 Derating)							
	CURRENT[A]	ACIN 100V	1.3typ (Io=100%)	1.7typ (Io=100%)					
	FREQUENCY[Hz]		47 - 440 (Refer to Instruction Manual 1.1)						
	EFFICIENCY[%]	ACIN 100V	75.0typ (Io=100%)	79.0typ (Io=100%)	83.0typ (Io=100%)	84.0typ (Io=100%)	86.0typ (Io=100%)	86.0typ (Io=100%)	86.0typ (Io=100%)
	INRUSH CURRENT[A]	ACIN 100V	30typ (Io=100%), (At cold start), (Ta= 25℃)						
	LEAKAGE CURRENT[ma]		0.5max (ACIN 100V, 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)						
OUTPUT	VOLTAGE[V]		3.3	5	12	15	24	24	48
	CURRENT[A]	*3	15.0	15.0	6.3	5.0	3.2	3.2 (Peak 4.2)	1.6
	LINE REGULATION[mV]		20max	20max	48max	60max	96max	96max	192max
	LOAD REGULATION[mV]		40max	40max	100max	120max	150max	150max	300max
	RIPPLE[mVp-p]	0 to +50℃ *1	80max	80max	120max	120max	120max	240max	150max
		-10 - 0℃ *1	140max	140max	160max	160max	160max	320max	200max
	RIPPLE NOISE[mVp-p]	0 to +50℃ *1	120max	120max	150max	150max	150max	300max	350max
		-10 - 0℃ *1	160max	160max	180max	180max	180max	360max	400max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	50max	120max	150max	240max	240max	480max
		-10 to +50℃	60max	60max	150max	180max	290max	290max	600max
	DRIFT[mV]	*2	20max	20max	48max	60max	96max	96max	192max
	START-UP TIME[ms]		200max (ACIN 100V, Io=100%)						
	HOLD-UP TIME[ms]		20typ (ACIN 100V, Io=100%)						
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		2.85 - 3.63	Fixed (*Y"which can be adjusted the output is available as optional ± 10%)					
	OUTPUT VOLTAGE SETTING[V]		3.30 - 3.40	4.90 - 5.30	11.50 - 12.50	14.40 - 15.60	23.00 - 25.00	23.00 - 25.00	46.00 - 50.00
	OVERCURRENT PROTECTION		Works over 105% of rating (works over 101% of peak current at option -H) and recovers automatically						
	OVERVOLTAGE PROTECTION		4.00 - 5.25	5.75 - 7.00	13.80 - 16.80	17.30 - 21.00	27.60 - 35.00	27.60 - 35.00	55.20 - 67.20
	OPERATING INDICATION		Not provided						
	REMOTE SENSING		Not provided						
ISOLATION	REMOTE ON/OFF		Not provided						
	INPUT-OUTPUT		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)						
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)						
	OUTPUT-FG		AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)						
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE		-10 to +60℃, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000feet) max						
	STORAGE TEMP.,HUMID.AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max						
	VIBRATION		10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis						
	IMPACT		196.1m/s² (20G), 11ms, once each X, Y and Z axis						
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1 Complies with DEN-AN						
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR-B, EN55011-B, EN55022-B						
OTHERS	CASE SIZE/WEIGHT		50 x 34.5 x 150mm [1.97 x 1.36 x 5.91 inches] (W x H x D) / 200g max (with chassis & cover : 410g max)						
	COOLING METHOD		Convection (Refer to Instruction Manual 3.2)						

*1 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.

Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM-103).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*3 Peak loading for 10sec. And Duty 35% max. or less is acceptable if the total wattage is less than the rated wattage.

Refer to instruction Manual 5. In detail.

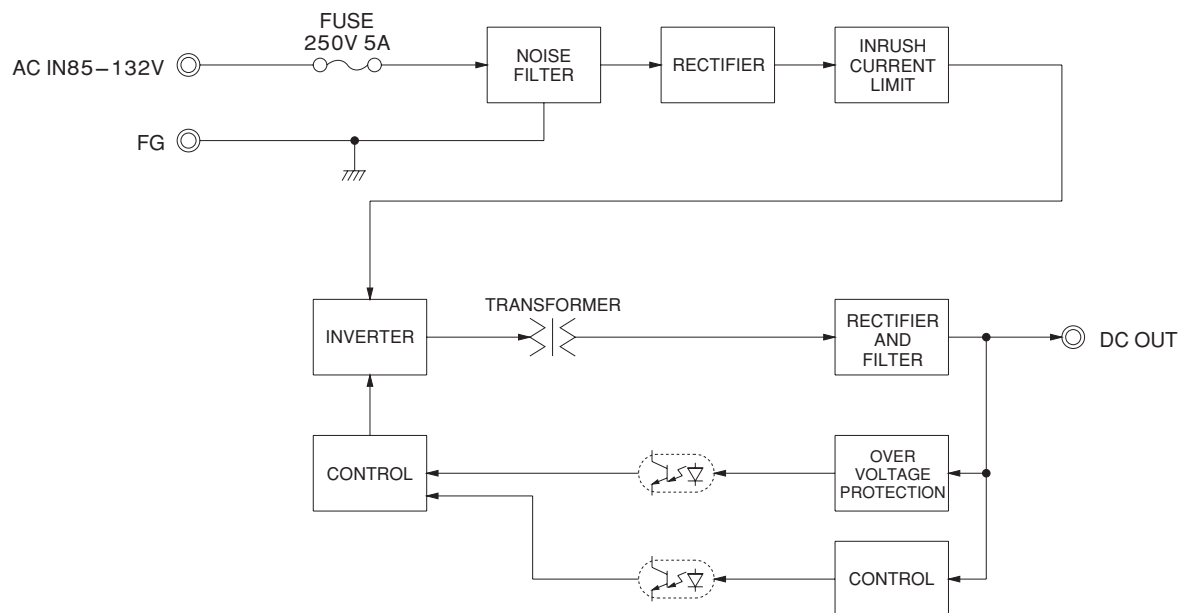
* Avoid prolonged use under over - load.

* Parallel operation with other model is not possible.

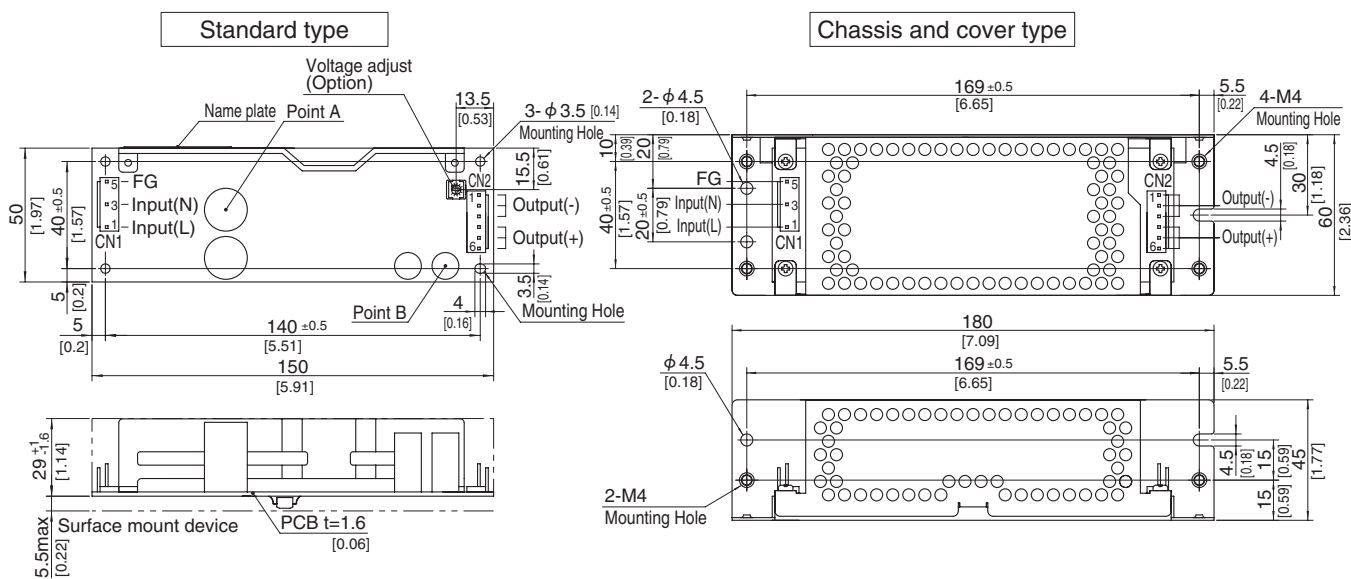
* Derating is required when operated with chassis and cover.

* A sound may occur from power supply at pulse loading.

Block diagram



External view



※ This power supply is manufactured by SMD technology.
The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.
Take care for SMD parts on the back to come in contact because of the vibration and not to break down.

※ Use the spacer of 8mm length or more.

※ 4 Mounting holes are existing.

I/O Connector	Mating connector	Terminal	
CN1	1-1123724-3	Chain	1123721-1
		Loose	1318912-1
CN2	1-1123723-6	Chain	1123721-1
		Loose	1318912-1

(Mfr: Tyco Electronics AMP)

※ I/O Connector is Mfr Tyco Electronics AMP

※ Option: -J1: VH(J.S.T) connector type.

Refer to instruction Manual 5.

※ Mounting torque: 1.5N•m (16kgf•cm) max

<PIN CONNECTION>

CN1

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

CN2

Pin No.	Output
1 to 3	-V
4 to 6	+V

※ Tolerance : ± 1 [± 0.04]

※ Weight : 200g max (with chassis & cover : 410g max)

※ PCB material / thickness : CEM3 / 1.6mm [0.06]

※ Optional chassis and cover material : Electric galvanizing steel board.

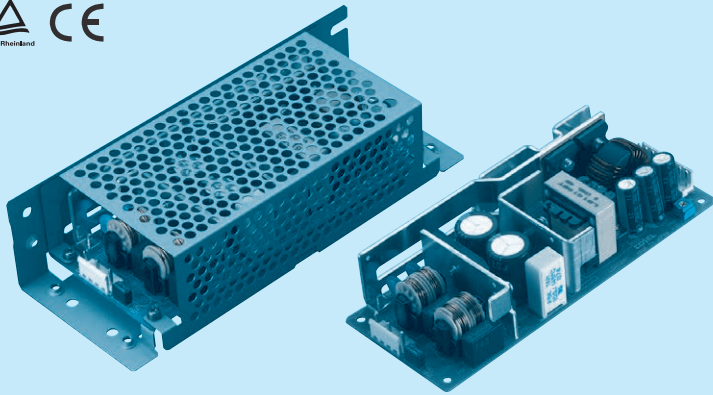
※ Dimensions in mm, [] = inches

※ Keep drawing current per pin below 5A for CN2.

LGA100A

LG A 100 A -5 -□

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ 100/120V input
- ⑤ Output voltage
- ⑥ Optional
- C :with Coating
- G :Low leakage current
- H :with the function to be acceptable to output peak current (only 24V)
- J1:VH(J.S.T.)connector type
- S :with Chassis
- SN:with Chassis & cover
- Y :with Potentiometer

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LGA100A-3R3-Y	LGA100A-5-Y	LGA100A-12	LGA100A-15	LGA100A-24	LGA100A-24-H	LGA100A-48
MAX OUTPUT WATTAGE[W]	66	100	102	105	103.2	103.2	100.8
DC OUTPUT	3.3V 20A	5V 20A	12V 8.5A	15V 7A	24V 4.3A	24V 4.3 (Peak 5.4) A	48V 2.1A

SPECIFICATIONS

	MODEL	LGA100A-3R3-Y	LGA100A-5-Y	LGA100A-12	LGA100A-15	LGA100A-24	LGA100A-24-H	LGA100A-48	
INPUT	VOLTAGE[V]	AC85 - 132 1 φ (Refer to Instruction Manual 1.1, and 3.2 Derating)							
	CURRENT[A]	ACIN 100V	1.6typ (Io=100%)	2.4typ (Io=100%)					
	FREQUENCY[Hz]		47 - 440 (Refer to Instruction Manual 1.1)						
	EFFICIENCY[%]	ACIN 100V	76.0typ (Io=100%)	80.0typ (Io=100%)	83.0typ (Io=100%)	84.0typ (Io=100%)	85.5typ (Io=100%)	85.5typ (Io=100%)	85.5typ (Io=100%)
	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%, More than 10sec. to re-start)						
	LEAKAGE CURRENT[ma]		0.5max (ACIN 100V, 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)						
OUTPUT	VOLTAGE[V]		3.3	5	12	15	24	24	48
	CURRENT[A]	*3	20.0	20.0	8.5	7.0	4.3	4.3 (Peak 5.4)	2.1
	LINE REGULATION[mV]		20max	20max	48max	60max	96max	96max	192max
	LOAD REGULATION[mV]		40max	40max	100max	120max	150max	150max	300max
	RIPPLE[mVp-p]	0 to +50℃ *1	80max	80max	120max	120max	120max	240max	150max
		-10 - 0℃ *1	140max	140max	160max	160max	160max	320max	200max
	RIPPLE NOISE[mVp-p]	0 to +50℃ *1	120max	120max	150max	150max	150max	300max	350max
		-10 - 0℃ *1	160max	160max	180max	180max	180max	360max	400max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	50max	120max	150max	240max	240max	480max
		-10 to +50℃	60max	60max	150max	180max	290max	290max	600max
	DRIFT[mV]	*2	20max	20max	48max	60max	96max	96max	192max
	START-UP TIME[ms]		200max (ACIN 100V, Io=100%)						
	HOLD-UP TIME[ms]		20typ (ACIN 100V, Io=100%)						
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		2.85 - 3.63	4.50 - 5.50	Fixed ("Y"which can be adjusted the output is available as optional ±10%)					
OUTPUT VOLTAGE SETTING[V]		3.30 - 3.40	5.00 - 5.15	11.50 - 12.50	14.40 - 15.60	23.00 - 25.00	23.00 - 25.00	46.00 - 50.00	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating (works over 101% of peak current at option -H) and recovers automatically							
	OVERVOLTAGE PROTECTION	4.00 - 5.25	5.75 - 7.00	13.80 - 16.80	17.30 - 21.00	27.60 - 35.00	27.60 - 35.00	55.20 - 67.20	
	OPERATING INDICATION	Not provided							
	REMOTE SENSING	Not provided							
ISOLATION	REMOTE ON/OFF	Not provided							
	INPUT-OUTPUT	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)							
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)							
	OUTPUT-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)							
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-10 to +60℃, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000feet) max							
	STORAGE TEMP.,HUMID.AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION	10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis							
	IMPACT	196.1m/s² (20G), 11ms, once each X, Y and Z axis							
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1 Complies with DEN-AN							
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR-B, EN55011-B, EN55022-B							
OTHERS	CASE SIZE/WEIGHT	62 X 35.5 X 155mm [2.44 X 1.4 X 6.1 inches] (W X H X D) / 300g max (with chassis & cover : 530g max)							
	COOLING METHOD	Convection (Refer to Instruction Manual 3.2)							

*1 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.

Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM-103).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

*3 Peak loading for 10sec. And Duty 35% max. or less is acceptable if the total wattage is less than the rated wattage.

Refer to instruction Manual 5. In detail.

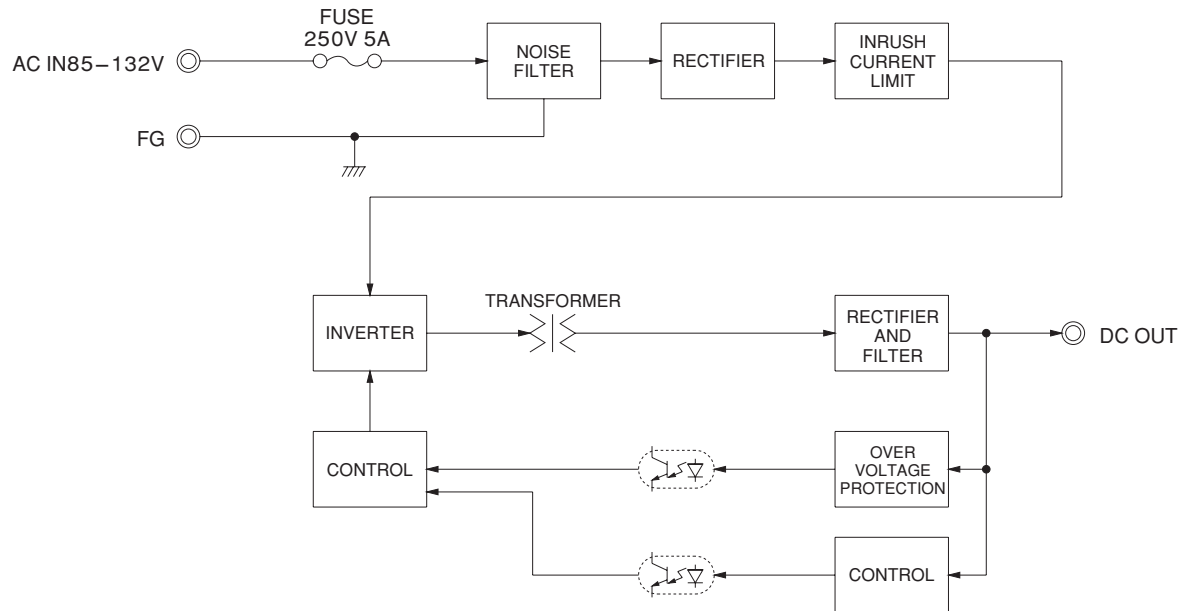
* Avoid prolonged use under over - load.

* Parallel operation with other model is not possible.

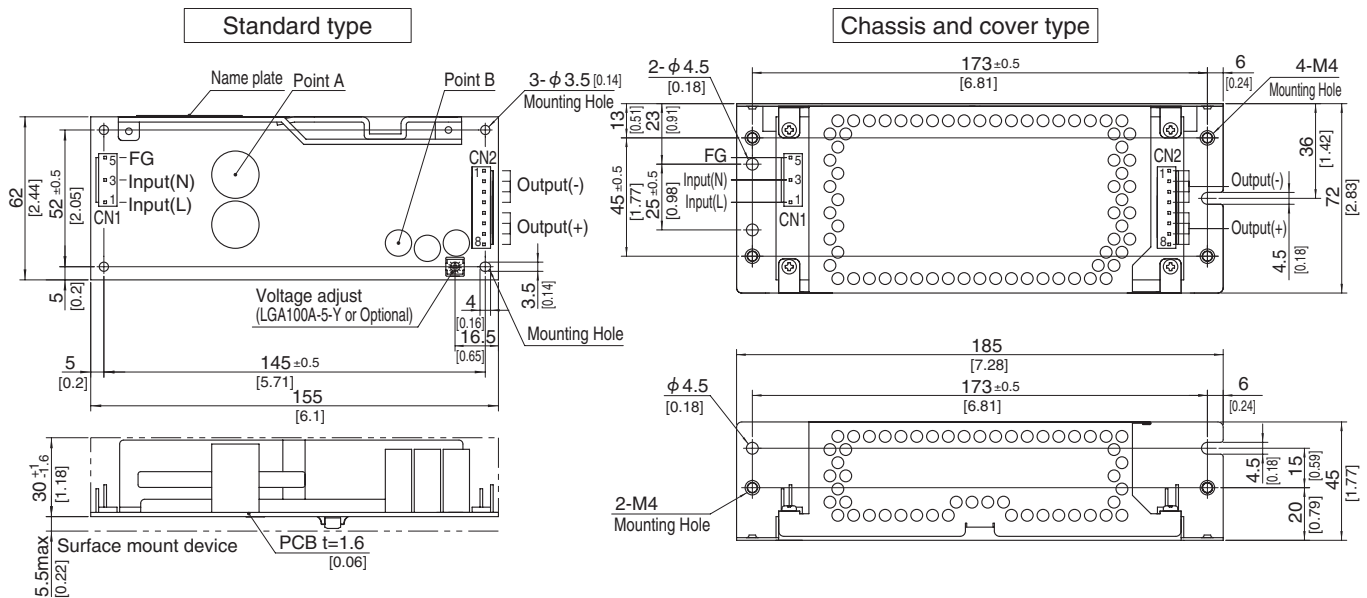
* Derating is required when operated with chassis and cover.

* A sound may occur from power supply at pulse loading.

Block diagram



External view



※ This power supply is manufactured by SMD technology.
The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.
Take care for SMD parts on the back to come in contact because of the vibration and not to break down.

※ Use the spacer of 8mm length or more.

※ 4 Mounting holes are existing.

I/O Connector	Mating connector	Terminal
CN1	1-1123724-3	1-1123722-5
CN2	1-1123723-8	1-1123722-8

(Mfr: Tyco Electronics AMP)

※ I/O Connector is Mfr Tyco Electronics AMP

※ Option: J1: VH(J.S.T) connector type.

Refer to instruction Manual 5.

<PIN CONNECTION>

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

Pin No.	Output
1 to 4	-V
5 to 8	+V

※ Keep drawing current per pin below 5A for CN2.

※ Mounting torque: 1.5N•m (16kgf•cm) max

※ Tolerance : ± 1 [± 0.04]

※ Weight : 300g max (with chassis & cover : 530g max)

※ PCB material / thickness : CEM3 / 1.6mm [0.06]

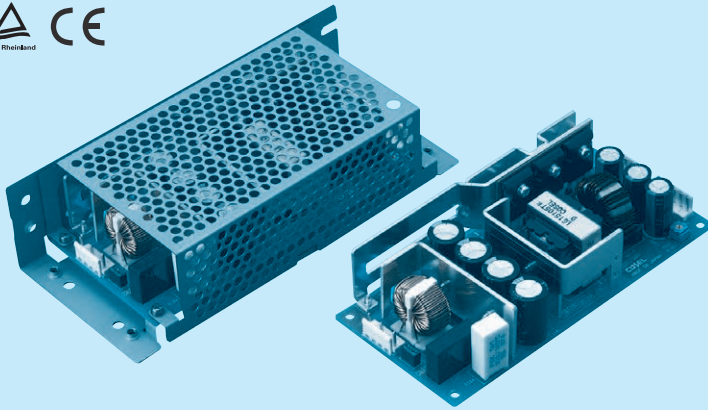
※ Optional chassis and cover material : Electric galvanizing steel board.

※ Dimensions in mm, [] = inches

LGA150A

LG A 150 A -5 -□

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ 100/120V input
- ⑤ Output voltage
- ⑥ Optional
- C : with Coating
- G : Low leakage current
- H : with the function to be acceptable to output peak current (only 24V)
- J1 : VH(J.S.T.)connector type
- S : with Chassis
- SN:with Chassis & cover
- Y : with Potentiometer

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LGA150A-3R3-Y	LGA150A-5-Y	LGA150A-12	LGA150A-15	LGA150A-24	LGA150A-24-H	LGA150A-48
MAX OUTPUT WATTAGE[W]	99	150	150	150	151.2	151.2	153.6
DC OUTPUT	3.3V 30A	5V 30A	12V 12.5A	15V 10A	24V 6.3A	24V 6.3 (Peak 7.9) A	48V 3.2A

SPECIFICATIONS

	MODEL	LGA150A-3R3-Y	LGA150A-5-Y	LGA150A-12	LGA150A-15	LGA150A-24	LGA150A-24-H	LGA150A-48	
INPUT	VOLTAGE[V]	AC85 - 132 1 ϕ (Refer to Instruction Manual 1.1, and 3.2 Derating)							
	CURRENT[A]	ACIN 100V	2.6typ (Io=100%)	3.6typ (Io=100%)					
	FREQUENCY[Hz]	47 - 440 (Refer to Instruction Manual 1.1)							
	EFFICIENCY[%]	ACIN 100V	76.0typ (Io=100%)	82.0typ (Io=100%)	84.5typ (Io=100%)	85.5typ (Io=100%)	87.0typ (Io=100%)	87.0typ (Io=100%)	
	INRUSH CURRENT[A]	ACIN 100V	15 / 15 typ (Primary / Secondary Surge Current, Io=100%, More than 10sec. to re-start)						
	LEAKAGE CURRENT[ma]	0.5max (ACIN 100V, 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)							
OUTPUT	VOLTAGE[V]	3.3	5	12	15	24	24	48	
	CURRENT[A]	*3 30.0	30.0	12.5	10.0	6.3	6.3 (Peak 7.9)	3.2	
	LINE REGULATION[mV]	20max	20max	48max	60max	96max	96max	192max	
	LOAD REGULATION[mV]	40max	40max	100max	120max	150max	150max	300max	
	RIPPLE[mVp-p]	0 to +40℃ *1	80max	80max	120max	120max	120max	240max	150max
		-10 - 0℃ *1	140max	140max	160max	160max	160max	320max	200max
	RIPPLE NOISE[mVp-p]	0 to +40℃ *1	120max	120max	150max	150max	150max	300max	350max
		-10 - 0℃ *1	160max	160max	180max	180max	180max	360max	400max
	TEMPERATURE REGULATION[mV]	0 to +40℃	50max	50max	120max	150max	240max	240max	480max
		-10 to +40℃	60max	60max	150max	180max	290max	290max	600max
	DRIFT[mV]	*2 20max	20max	48max	60max	96max	96max	192max	
	START-UP TIME[ms]	200max (ACIN 100V, Io=100%)							
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)							
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.85 - 3.63	4.50 - 5.50	Fixed ("Y"which can be adjusted the output is available as optional $\pm 10\%$)						
OUTPUT VOLTAGE SETTING[V]	3.30 - 3.40	5.00 - 5.15	11.50 - 12.50	14.40 - 15.60	23.00 - 25.00	23.00 - 25.00	46.00 - 50.00		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating (works over 101% of peak current at option -H) and recovers automatically							
	OVERVOLTAGE PROTECTION	4.00 - 5.25	5.75 - 7.00	13.80 - 16.80	17.30 - 21.00	27.60 - 35.00	27.60 - 35.00	55.20 - 67.20	
	OPERATING INDICATION	Not provided							
	REMOTE SENSING	Not provided							
ISOLATION	REMOTE ON/OFF	Not provided							
	INPUT-OUTPUT	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)							
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)							
	OUTPUT-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50M Ω min (At Room Temperature)							
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-10 to +60℃, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000feet) max							
	STORAGE TEMP.,HUMID.AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis							
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis							
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1 Complies with DEN-AN							
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR-B, EN55011-B, EN55022-B							
OTHERS	CASE SIZE/WEIGHT	75 x 39 x 160mm [2.95 x 1.54 x 6.3 inches] (W x H x D) / 420g max (with chassis & cover : 650g max)							
	COOLING METHOD	Convection (Refer to Instruction Manual 3.2)							

*1 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.

Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM-103).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

*3 Peak loading for 10sec. And Duty 35% max. or less is acceptable if the total wattage is less than the rated wattage.

Refer to instruction Manual 5. In detail.

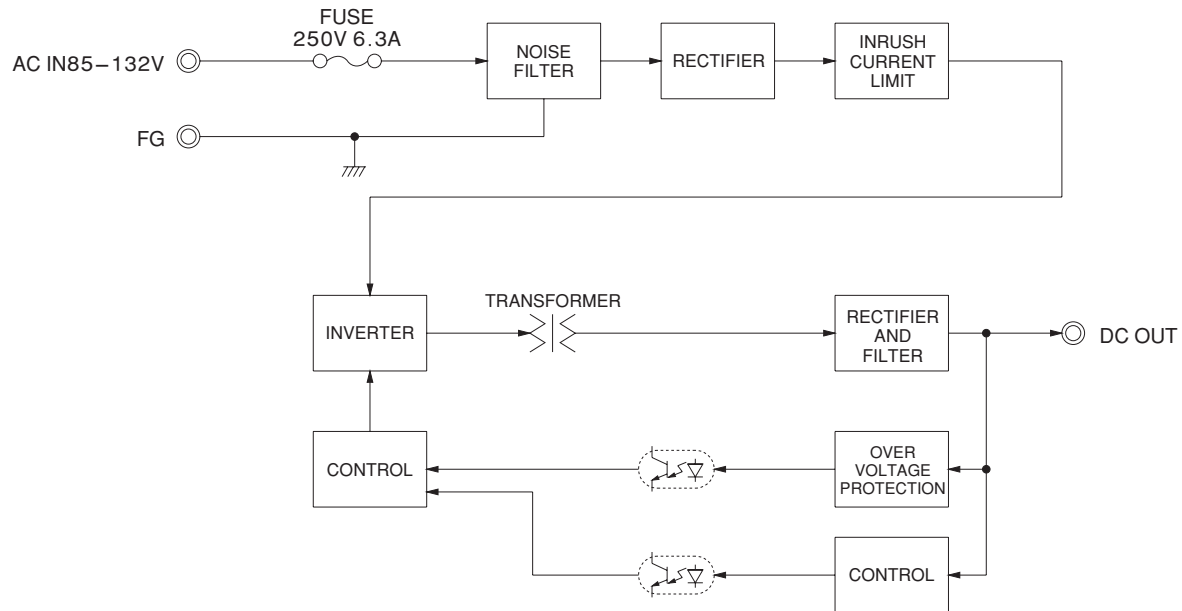
* Avoid prolonged use under over - load.

* Parallel operation with other model is not possible.

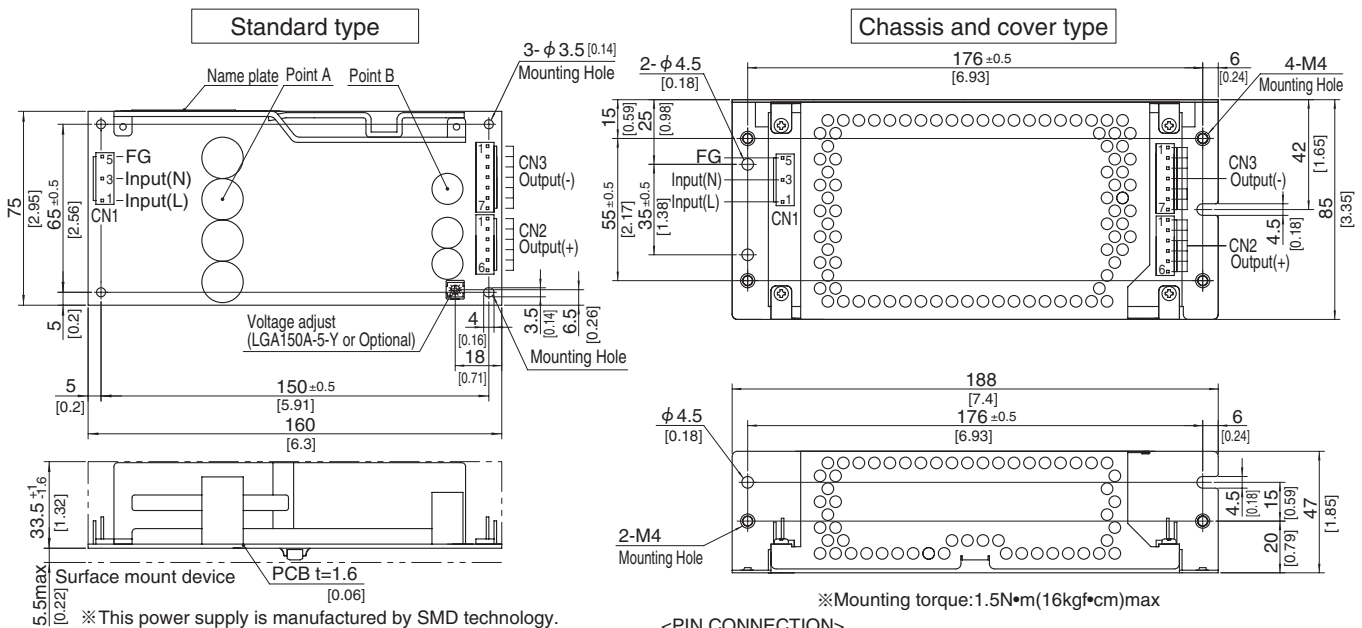
* Derating is required when operated with chassis and cover.

* A sound may occur from power supply at pulse loading.

Block diagram



External view



- ※ This power supply is manufactured by SMD technology.
The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.
Take care for SMD parts on the back to come in contact because of the vibration and not to break down.
※ Use the spacer of 8mm length or more.
※ 4 Mounting holes are existing.

I/O Connector	Mating connector	Terminal
CN1	1-1123724-3	Chain 1123721-1
		Loose 1318912-1
CN2	1-1123723-6	Chain 1123721-1
		Loose 1318912-1
CN3	1-1123723-7	Chain 1123721-1
		Loose 1318912-1

(Mfr: Tyco Electronics AMP)

※ I/O Connector is Mfr Tyco Electronics AMP
※ Option: J1: VH(J.S.T) connector type.
Refer to instruction Manual 5.

<PIN CONNECTION>

CN1		CN2		CN3	
Pin No.	Input	Pin No.	Output	Pin No.	Output
1	AC(L)	1 to 6	+V	1 to 7	-V
2					
3	AC(N)				
4					
5	FG				

※ Keep drawing current per pin below 5A for CN2, CN3.

※ Tolerance : ± 1 [± 0.04]

※ Weight : 420g max (with chassis & cover : 650g max)

※ PCB material / thickness : CEM3 / 1.6mm [0.06]

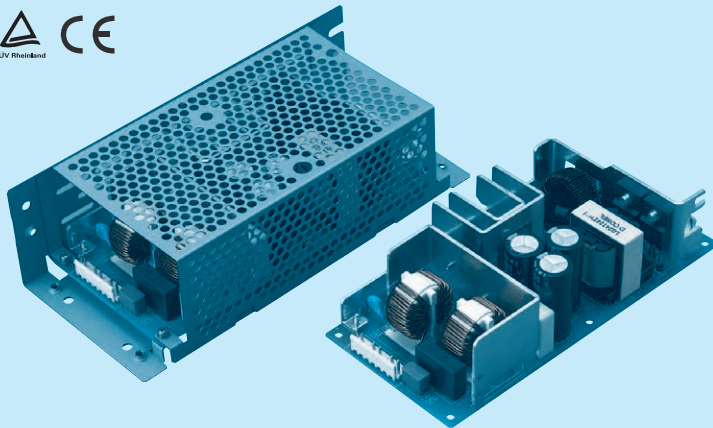
※ Optional chassis and cover material : Electric galvanizing steel board.

※ Dimensions in mm, []=inches

LGA240A

LG A 240 A -5 -

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-16-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ 100/120V input
- ⑤ Output voltage
- ⑥ Optional
- C :with Coating
- G :Low leakage current
- H :with the function to be acceptable to output peak current (only 24V)
- J1:VH(J.S.T.)connector type
- S :with Chassis
- SN:with Chassis & cover
- T :Vertical terminal block
- Y :with Potentiometer

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LGA240A-24	LGA240A-24-H
MAX OUTPUT WATTAGE[W]	240	240
DC OUTPUT	24V 10A	24V 10 (Peak 12.5) A

SPECIFICATIONS

	MODEL	LGA240A-24	LGA240A-24-H
INPUT	VOLTAGE[V]	AC85 - 132 1 ϕ (Refer to Instruction Manual 1.1, and 3.2 Derating)	
	CURRENT[A]	ACIN 100V	5.0typ (Io=100%)
	FREQUENCY[Hz]	47 - 440 (Refer to Instruction Manual 1.1)	
	EFFICIENCY[%]	ACIN 100V	86.5typ (Io=100%)
	INRUSH CURRENT[A]	ACIN 100V	15 / 20 typ (Primary / Secondary Surge Current, Io=100%, More than 10sec. to re-start)
OUTPUT	LEAKAGE CURRENT[ma]	0.5max (ACIN 100V, 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)	
	VOLTAGE[V]	24	24
	CURRENT[A]	*3 10.0	10.0 (Peak 12.5)
	LINE REGULATION[mV]	96max	96max
	LOAD REGULATION[mV]	150max	150max
	RIPPLE[mVp-p]	0 to +40°C *1	120max
		-10 - 0°C *1	160max
	RIPPLE NOISE[mVp-p]	0 to +40°C *1	150max
		-10 - 0°C *1	180max
	TEMPERATURE REGULATION[mV]	0 to +40°C	240max
		-10 to +40°C	290max
	DRIFT[mV]	*2 96max	96max
	START-UP TIME[ms]	200max (ACIN 100V, Io=100%)	
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)	
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed ("Y" which can be adjusted the output is available as optional $\pm 10\%$)	
	OUTPUT VOLTAGE SETTING[V]	23.00 - 25.00	23.00 - 25.00
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating (works over 101% of peak current at option -H) and recovers automatically	
	OVERVOLTAGE PROTECTION	27.60 - 35.00	27.60 - 35.00
	OPERATING INDICATION	Not provided	
	REMOTE SENSING	Not provided	
ISOLATION	REMOTE ON/OFF	Not provided	
	INPUT-OUTPUT	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)	
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)	
ENVIRONMENT	OUTPUT-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50M Ω min (At Room Temperature)	
	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +60°C, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000feet) max	
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max	
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis	
SAFETY AND NOISE REGULATIONS	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis	
	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1 Complies with DEN-AN	
OTHERS	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR-B, EN55011-B, EN55022-B	
	CASE SIZE/WEIGHT	84 x 48.5 x 180mm [3.31 x 1.91 x 7.09 inches] (W x H x D) / 590g max (with chassis & cover : 880g max)	
	COOLING METHOD	Convection (Refer to Instruction Manual 3.2)	

*1 This is the value that measured on measuring board with capacitor of 22 μ F at 150mm from output terminal.

Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM-103).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*3 Peak loading for 10sec. And Duty 35% max. or less is acceptable if the total wattage is less than the rated wattage.

Refer to instruction Manual 5. In detail.

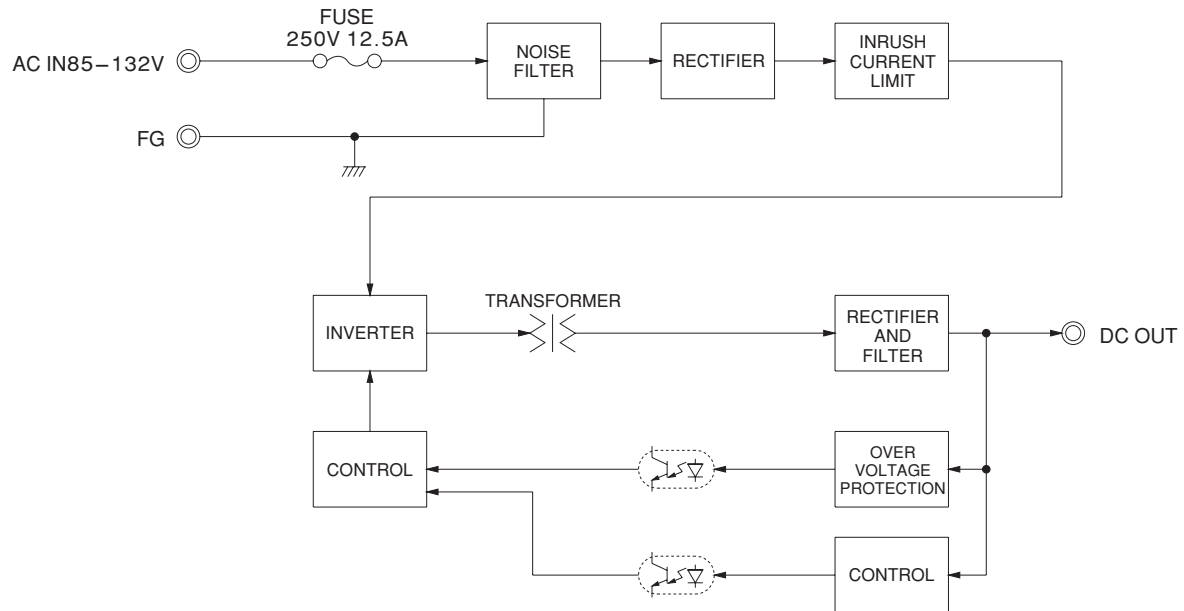
* Avoid prolonged use under over - load.

* Parallel operation with other model is not possible.

* Derating is required when operated with chassis and cover.

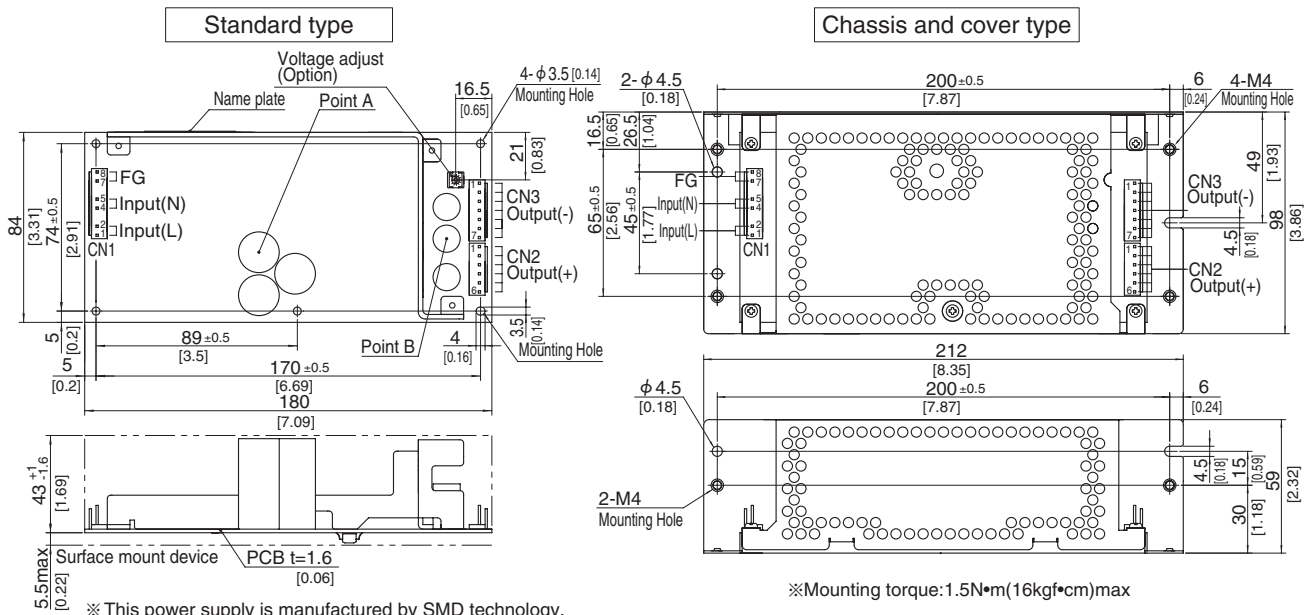
* A sound may occur from power supply at pulse loading.

Block diagram



LGA

External view



- ※ This power supply is manufactured by SMD technology.
The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.
Take care for SMD parts on the back to come in contact because of the vibration and not to break down.
※ Use the spacer of 8mm length or more.
※ 5 Mounting holes are existing.

I/O Connector	Mating connector	Terminal
CN1	7-1565036-6	1-1123722-8
		Chain 1123721-1
		Loose 1318912-1
CN2	1-1123723-6	1-1123722-6
		Chain 1123721-1
		Loose 1318912-1
CN3	1-1123723-7	1-1123722-7
		Chain 1123721-1
		Loose 1318912-1

(Mfr: Tyco Electronics AMP)

- ※ I/O Connector is Mfr Tyco Electronics AMP
※ Option: -J1: VH(J.S.T) connector type.
Refer to instruction Manual 5.

<PIN CONNECTION>

Pin No.	Input	Pin No.	Output	Pin No.	Output
1, 2	AC(L)	1 to 6	+V	1 to 7	-V
3					
4, 5	AC(N)				
6					
7, 8	FG				

※Keep drawing current per pin below 5A for CN1, CN2 and CN3.

※Tolerance : ±1 [±0.04]

※Weight : 590g max (with chassis & cover : 880g max)

※PCB material / thickness : CEM3 / 1.6mm [0.06]

※Optional chassis and cover material : Electric galvanizing steel board.

※Dimensions in mm, []=inches

Basic Characteristics Data

LGA

Model	Circuit method	Switching frequency [kHz]	Input current *1 [A]	Inrush current protection	PCB/Pattern			Series/Parallel operation availability *2	
					Material	Single sided	Double sided	Series operation	Parallel operation
LGA50A	Forward Converter	130	1.3	Thermistor	CEM-3	Yes		Yes	No
LGA75A	Forward Converter	130	1.7	Thermistor	CEM-3	Yes		Yes	No
LGA100A	Forward Converter	130	2.4	SCR	CEM-3	Yes		Yes	No
LGA150A	Forward Converter	130	3.6	SCR	CEM-3	Yes		Yes	No
LGA240A	Forward Converter	130	5.0	SCR	CEM-3	Yes		Yes	No

*1 The value of input current is at ACIN 100V and rated load.

*2 Refer to Instruction Manual 2.

1 Function LGA-14

- 1.1 Input voltage range LGA-14
- 1.2 Inrush current limiting LGA-14
- 1.3 Overcurrent protection LGA-14
- 1.4 Overvoltage protection LGA-14
- 1.5 Output voltage adjustment range LGA-14
- 1.6 Isolation LGA-14

2 Series Operation and Parallel Operation LGA-14**3** Assembling and Installation Method LGA-15

- 3.1 Installation method LGA-15
- 3.2 Derating LGA-15
- 3.3 Mounting screw LGA-18
- 3.4 Expectancy life and warranty LGA-18

4 Ground LGA-19**5** Option and Others LGA-19

- 5.1 Outline of options LGA-19
- 5.2 Others LGA-20

1 Function

LGA

1.1 Input voltage range

- The range is from AC85V to AC132V.
- AC input voltage must have a range from AC85V to AC132V for normal operation. If the wrong input is applied, the unit will not operate properly and/or may be damaged.
- In cases that conform with safety standard, input voltage range is AC100-AC120V(50/60Hz).

1.2 Inrush current limiting

- Inrush current limiting is built-in.
- If a switch is being used for input, ensure that it is configured to handle the input inrush current.

● LGA50A, LGA75A

- If the unit is shut down, recycling AC line has to be done after cooling down the unit since thermistor is used for the protection from the inrush current.

● LGA100A, LGA150A, LGA240A

- The SCR is used for protection from inrush current. When power is turned ON/OFF repeatedly within a short period of time, it is necessary to have enough time between power ON and OFF to operate resistance circuit for inrush current.

1.3 Overcurrent protection

- Overcurrent protection is built-in and comes into effect at over 105%(-H is 101% or more of the peak current) of the rated current. Overcurrent protection prevents the unit from short circuit and overcurrent condition of less than 15 seconds. The unit automatically recovers when the fault condition is cleared.

● LGA50A-3R3-Y, LGA50A-5, LGA75A-3R3-Y, LGA75A-5, LGA100A-3R3-Y, LGA100A-5-Y, LGA150A-3R3-Y, LGA150A-5-Y

- Intermittent current characteristics.
- When the output voltage drops at overcurrent, the average output current is reduced by intermittent operation of power supply.

1.4 Overvoltage protection

- An overvoltage protection circuit is built-in. The AC input should be shut down if overvoltage protection is in operation. The minimum interval of AC recycling for recovery is 1.5 minutes (LGA240A is 3minutes).

* The recovery time varies depending on input voltage.

Remarks:

Please avoid applying the over-rated voltage to the output terminal. Power supply may operate incorrectly or fail. In case of operating a motor etc., please install an external diode on the output terminal to protect the unit.

1.5 Output voltage adjustment range

- Adjustment of output voltage is possible by using potentiometer. Please refer to instruction manual 5.1.
- Option "-Y" is recommended which can adjust the output voltage.

1.6 Isolation

- For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for the start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

2 Series Operation and Parallel Operation

- Series operation is available by connecting the outputs of two or more power supplies with the same output voltage, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

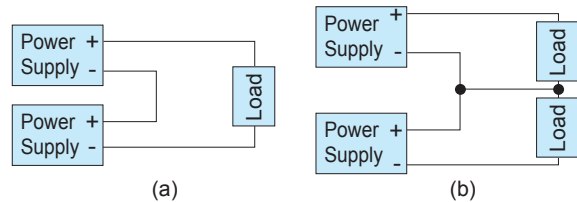


Fig.2.1 Examples of connecting in series operation

- Parallel operation is not possible.
- Redundancy operation is available by wiring as shown below.

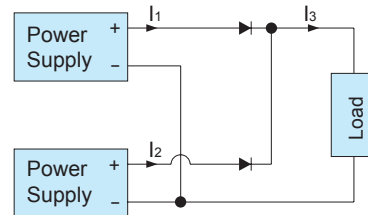


Fig.2.2 Example of redundancy operation

- Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 . Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

3 Assembling and Installation Method

3.1 Installation method

- This power supply is manufactured by SMD technology.
The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.
- In case of metal chassis, keep the distance between d_1 & d_2 for to insulate between lead of component and metal chassis, use the spacer of 8mm or more between d_1 . If it is less than d_1 & d_2 , insert the insulation sheet between power supply and metal chassis.

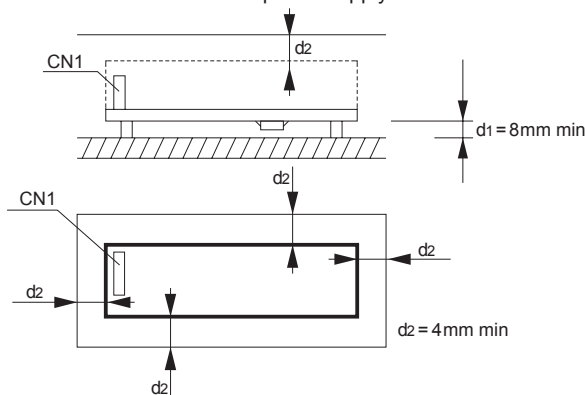
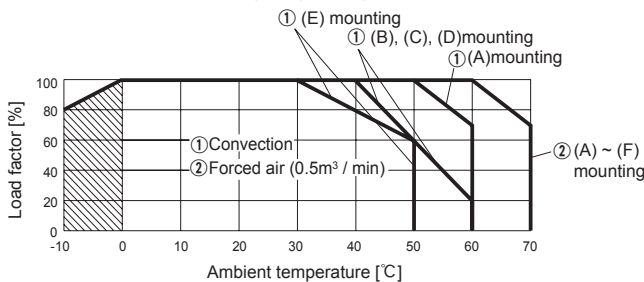


Fig.3.1 Installation method

3.2 Derating

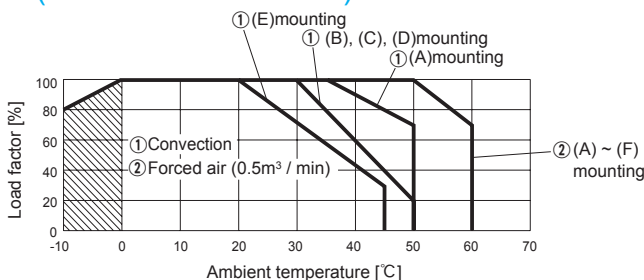
- The operative ambient temperature is different by with / without chassis cover or mounting position. Please refer drawings as below.
Note: In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

● LGA50A-3R3-Y, -5, -12, -15



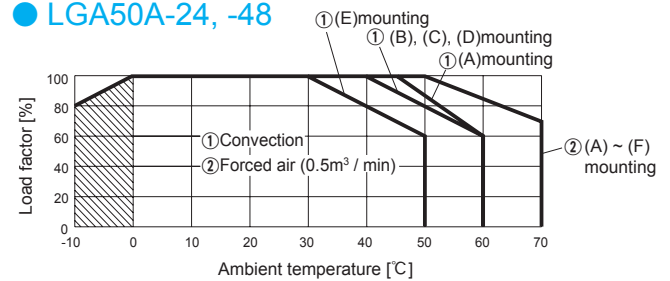
* [F] mounting should be operated by Forced air.
Fig.3.2 Ambient temperature derating curve

● LGA50A-3R3-Y, -5, -12, -15 -SN (with Chassis & Cover)



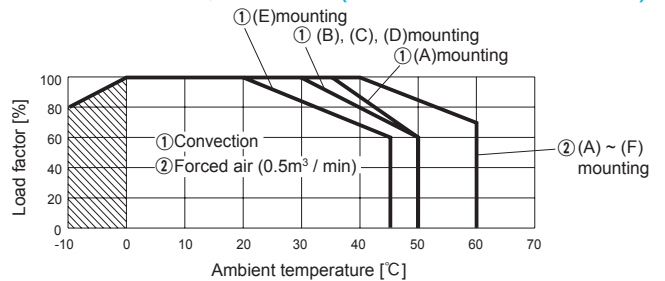
* [F] mounting should be operated by Forced air.
Fig.3.3 Ambient temperature derating curve

● LGA50A-24, -48



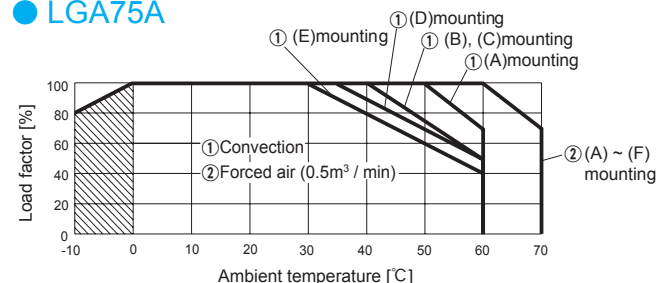
* [F] mounting should be operated by Forced air.
Fig.3.4 Ambient temperature derating curve

● LGA50A-24, -48 -SN (with Chassis & Cover)



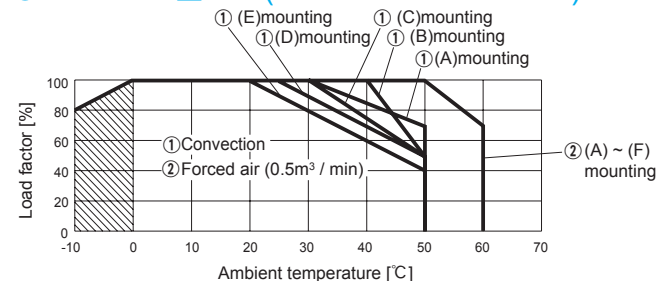
* [F] mounting should be operated by Forced air.
Fig.3.5 Ambient temperature derating curve

● LGA75A



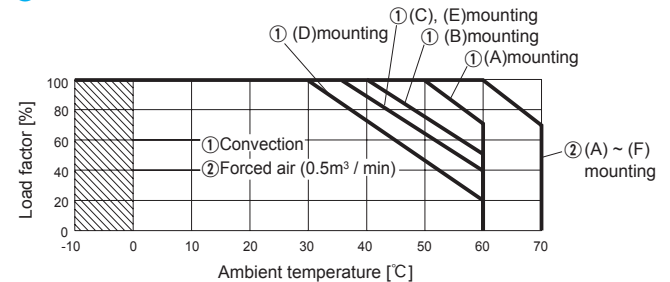
* [F] mounting should be operated by Forced air.
Fig.3.6 Ambient temperature derating curve

● LGA75A-□-SN (with Chassis & Cover)



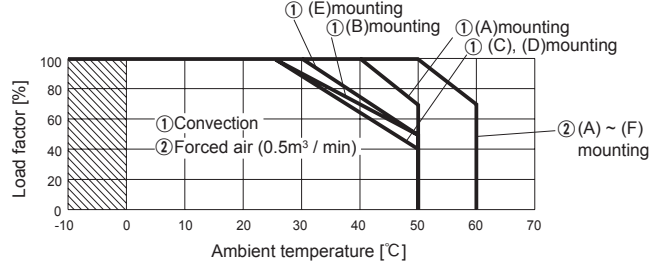
* [F] mounting should be operated by Forced air.
Fig.3.7 Ambient temperature derating curve

● LGA100A



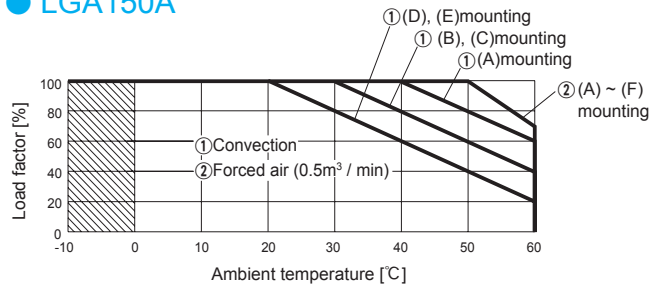
* [F] mounting should be operated by Forced air.
Fig.3.8 Ambient temperature derating curve

● LGA100A-□-SN (with Chassis & Cover)



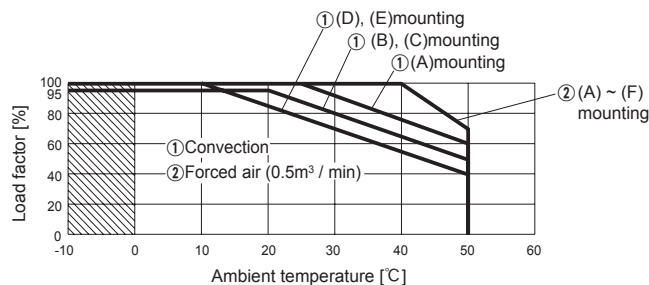
* [F] mounting should be operated by Forced air.
Fig.3.9 Ambient temperature derating curve

● LGA150A



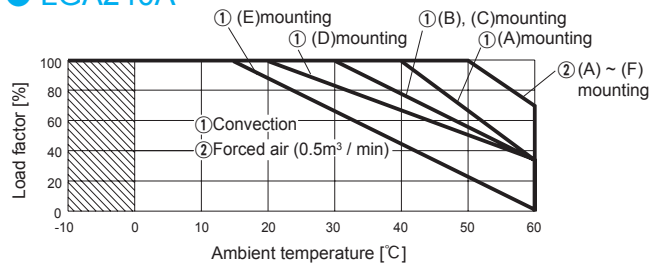
* [F] mounting should be operated by Forced air.
Fig.3.10 Ambient temperature derating curve

● LGA150A-□-SN (with Chassis & Cover)



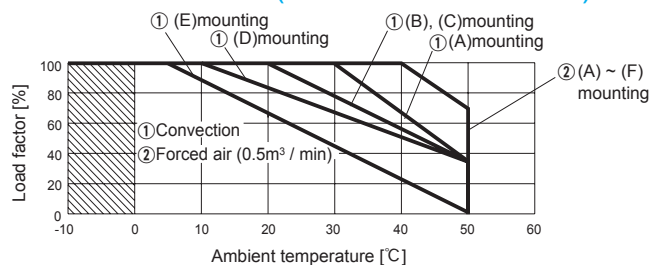
* [F] mounting should be operated by Forced air.
Fig.3.11 Ambient temperature derating curve

● LGA240A



* [F] mounting should be operated by Forced air.
Fig.3.12 Ambient temperature derating curve

● LGA240A-□-SN (with Chassis & Cover)



* [F] mounting should be operated by Forced air.
Fig.3.13 Ambient temperature derating curve

■ Derating curve depending on input voltage

Derating curve depending on input voltage is shown in Fig.3.14.

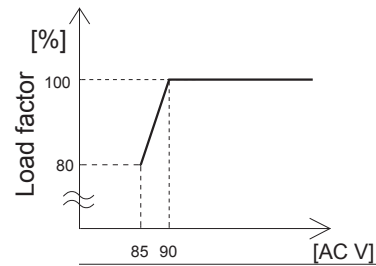
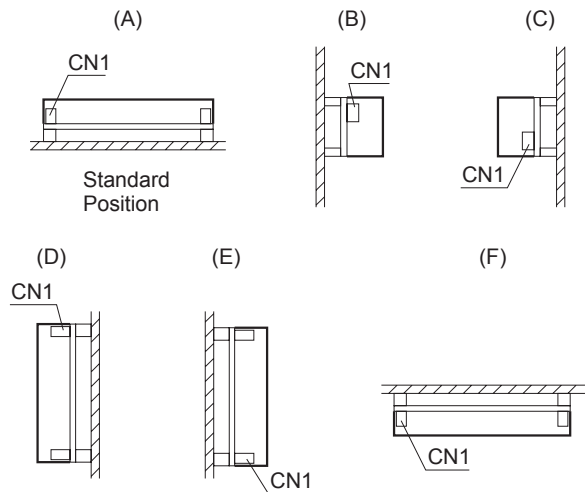


Fig.3.14 Derating curve depending on input voltage

■ Mounting method



* (F) mounting should be operated by Forced air.

Fig.3.15 Mounting method

■ The guideline for air cooling

It shows the upper temperatures of Point A and B on Table 3.1 to Table 3.6.

Please take care to keep those temperatures below the points of the tables by air convection.

And please be attentive to keep that the entire power supply is well ventilated.

At the upper temperatures of Point A and Point B (refer to External View) on Table 3.1 to Table 3.6, the expectancy life is 3 years or more. In case of with Chassis and Cover, please contact our sales office for getting more information.

Remarks:

*Please be careful of electric shock or earth leakage in case of temperature measurement, because Point A and Point B is live potential.

*Please refer to 3.4 if you want to extend the longevity of the expectancy life.

Table 3.1 Temperatures of Point A, Point B LGA50A-3R3-Y, -5, -12, -15

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	70%<lo≤100%	85	80
		lo≤70%	84	80
B	Convection	20%<lo≤100%	76	81
		lo≤20%	72	74
C	Convection	20%<lo≤100%	68	68
		lo≤20%	65	65
D	Convection	20%<lo≤100%	84	72
		lo≤20%	76	61
E	Convection	60%<lo≤100%	66	71
		lo≤60%	61	70
A,B,C,D,E,F	Forced air	70%<lo≤100%	85	80
		lo≤70%	80	75

Table 3.2 Temperatures of Point A, Point B LGA50A-24, -48

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	60%<lo≤100%	83	62
		lo≤60%	82	71
B	Convection	60%<lo≤100%	76	62
		lo≤60%	82	75
C	Convection	60%<lo≤100%	71	55
		lo≤60%	80	69
D	Convection	60%<lo≤100%	82	55
		lo≤60%	85	69
E	Convection	60%<lo≤100%	77	67
		lo≤60%	82	80
A,B,C,D,E,F	Forced air	70%<lo≤100%	85	80
		lo≤70%	80	75

Table 3.3 Temperatures of Point A, Point B LGA75A-□

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	70%<lo≤100%	83	78
		lo≤70%	87	78
B	Convection	50%<lo≤100%	64	66
		lo≤50%	74	70
C	Convection	50%<lo≤100%	67	74
		lo≤50%	76	76
D	Convection	50%<lo≤100%	81	68
		lo≤50%	85	73
E	Convection	40%<lo≤100%	66	77
		lo≤40%	75	81
A,B,C,D,E,F	Forced air	70%<lo≤100%	85	80
		lo≤70%	80	75

Table 3.4 Temperatures of Point A, Point B LGA100A-□

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	70%<lo≤100%	85	80
		lo≤70%	80	78
B	Convection	50%<lo≤100%	77	74
		lo≤50%	75	70
C	Convection	40%<lo≤100%	76	76
		lo≤40%	72	72
D	Convection	20%<lo≤100%	84	68
		lo≤20%	76	65
E	Convection	40%<lo≤100%	78	78
		lo≤40%	72	75
A,B,C,D,E,F	Forced air	70%<lo≤100%	85	80
		lo≤70%	80	75

Table 3.5 Temperatures of Point A, Point B LGA150A-□

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	60%<lo≤100%	83	80
		lo≤60%	82	78
B	Convection	40%<lo≤100%	81	74
		lo≤40%	77	72
C	Convection	40%<lo≤100%	77	79
		lo≤40%	77	74
D	Convection	20%<lo≤100%	85	70
		lo≤20%	77	65
E	Convection	20%<lo≤100%	77	79
		lo≤20%	68	70
A,B,C,D,E,F	Forced air	70%<lo≤100%	85	80
		lo≤70%	80	75

Table 3.6 Temperatures of Point A, Point B LGA240A-□

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	35%<lo≤100%	77	77
		lo≤35%	75	76
B	Convection	35%<lo≤100%	71	74
		lo≤35%	71	74
C	Convection	35%<lo≤100%	77	72
		lo≤35%	77	72
D	Convection	35%<lo≤100%	82	71
		lo≤35%	82	71
E	Convection	35%<lo≤100%	61	79
		lo≤35%	65	74
A,B,C,D,E,F	Forced air	70%<lo≤100%	80	75
		lo≤70%	75	70

3.3 Mounting screw

■ The mounting screw should be M3. The hatched area shows the allowance of metal parts for mounting.

■ If metallic fittings are used on the component side of the board, ensure there is no contact with surface mounted components.

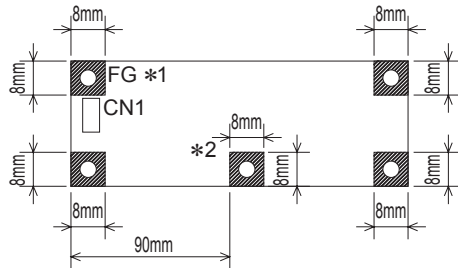


Fig.3.16 Allowance of metal parts for mounting

*1 Recommendation to electrically connect FG to metal chassis for reducing noise.

*2 LGA240A only

Refer to External view for location

3.4 Expectancy life and warranty

■ Expectancy Life.

Table 3.7 Expectancy Life (LGA50A-3R3-Y, -5, -12, -15)

Mounting Method	Cooling Method	Average ambient temperature (year)	Load factor	
			$I_o \leq 75\%$	$75\% < I_o \leq 100\%$
A	Convection	Ta = 40°C or less	6years	6years
		Ta = 50°C	5years	3years
B, C, D	Convection	Ta = 30°C or less	6years	6years
		Ta = 40°C	5years	3years
E	Convection	Ta = 20°C or less	6years	6years
		Ta = 30°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.8 Expectancy Life (LGA50A-24, -48)

Mounting Method	Cooling Method	Average ambient temperature (year)	Load factor	
			$I_o \leq 75\%$	$75\% < I_o \leq 100\%$
A	Convection	Ta = 35°C or less	6years	6years
		Ta = 45°C	5years	3years
B, C, D	Convection	Ta = 30°C or less	6years	6years
		Ta = 40°C	5years	3years
E	Convection	Ta = 20°C or less	6years	6years
		Ta = 30°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 50°C	5years	3years

Table 3.9 Expectancy Life (LGA75A-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Load factor	
			$I_o \leq 75\%$	$75\% < I_o \leq 100\%$
A	Convection	Ta = 40°C or less	6years	6years
		Ta = 50°C	5years	3years
B, C	Convection	Ta = 30°C or less	6years	6years
		Ta = 40°C	5years	3years
D	Convection	Ta = 25°C or less	6years	6years
		Ta = 35°C	5years	3years
E	Convection	Ta = 20°C or less	6years	6years
		Ta = 30°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.10 Expectancy Life (LGA100A-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Load factor	
			$I_o \leq 75\%$	$75\% < I_o \leq 100\%$
A	Convection	Ta = 40°C or less	6years	6years
		Ta = 50°C	5years	3years
B	Convection	Ta = 30°C or less	6years	6years
		Ta = 40°C	5years	3years
C, E	Convection	Ta = 25°C or less	6years	6years
		Ta = 35°C	5years	3years
D	Convection	Ta = 30°C or less	6years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.11 Expectancy Life (LGA150A-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Load factor	
			$I_o \leq 75\%$	$75\% < I_o \leq 100\%$
A	Convection	Ta = 30°C or less	6years	6years
		Ta = 40°C	5years	3years
B, C	Convection	Ta = 20°C or less	6years	6years
		Ta = 30°C	5years	3years
D, E	Convection	Ta = 20°C or less	6years	3years
A,B,C,D,E,F	Forced air	Ta = 50°C	5years	3years

Table 3.12 Expectancy Life (LGA240A-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Load factor	
			$I_o \leq 75\%$	$75\% < I_o \leq 100\%$
A	Convection	Ta = 30°C or less	6years	6years
		Ta = 40°C	5years	3years
B, C	Convection	Ta = 20°C or less	6years	6years
		Ta = 30°C	5years	3years
D	Convection	Ta = 20°C or less	6years	3years
E	Convection	Ta = 15°C or less	6years	3years
A,B,C,D,E,F	Forced air	Ta = 50°C	5years	3years

■ Warranty

Table 3.13 Warranty (LGA50A-3R3-Y, -5, -12, -15)

Mounting Method	Cooling Method	Average ambient temperature (year)	Load factor	
			$I_o \leq 75\%$	$75\% < I_o \leq 100\%$
A	Convection	Ta = 40°C or less	5years	5years
		Ta = 50°C	5years	3years
B, C, D	Convection	Ta = 30°C or less	5years	5years
		Ta = 40°C	5years	3years
E	Convection	Ta = 20°C or less	5years	5years
		Ta = 30°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.14 Warranty (LGA50A-24, -48)

Mounting Method	Cooling Method	Average ambient temperature (year)	Load factor	
			$Io \leq 75\%$	$75\% < Io \leq 100\%$
A	Convection	Ta = 35°C or less	5years	5years
		Ta = 45°C	5years	3years
B, C, D	Convection	Ta = 30°C or less	5years	5years
		Ta = 40°C	5years	3years
E	Convection	Ta = 20°C or less	5years	5years
		Ta = 30°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 50°C	5years	3years

Table 3.15 Warranty (LGA75A-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Load factor	
			$Io \leq 75\%$	$75\% < Io \leq 100\%$
A	Convection	Ta = 40°C or less	5years	5years
		Ta = 50°C	5years	3years
B, C	Convection	Ta = 30°C or less	5years	5years
		Ta = 40°C	5years	3years
D	Convection	Ta = 25°C or less	5years	5years
		Ta = 35°C	5years	3years
E	Convection	Ta = 20°C or less	5years	5years
		Ta = 30°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.16 Warranty (LGA100A-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Load factor	
			$Io \leq 75\%$	$75\% < Io \leq 100\%$
A	Convection	Ta = 40°C or less	5years	5years
		Ta = 50°C	5years	3years
B	Convection	Ta = 30°C or less	5years	5years
		Ta = 40°C	5years	3years
C, E	Convection	Ta = 25°C or less	5years	5years
		Ta = 35°C	5years	3years
D	Convection	Ta = 30°C or less	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.17 Warranty (LGA150A-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Load factor	
			$Io \leq 75\%$	$75\% < Io \leq 100\%$
A	Convection	Ta = 30°C or less	5years	5years
		Ta = 40°C	5years	3years
B, C	Convection	Ta = 20°C or less	5years	5years
		Ta = 30°C	5years	3years
D, E	Convection	Ta = 20°C or less	5years	3years
A,B,C,D,E,F	Forced air	Ta = 50°C	5years	3years

Table 3.18 Warranty (LGA240A-□)

Mounting Method	Cooling Method	Average ambient temperature (year)	Load factor	
			$Io \leq 75\%$	$75\% < Io \leq 100\%$
A	Convection	Ta = 30°C or less	5years	5years
		Ta = 40°C	5years	3years
B, C	Convection	Ta = 20°C or less	5years	5years
		Ta = 30°C	5years	3years
D	Convection	Ta = 20°C or less	5years	3years
E	Convection	Ta = 15°C or less	5years	3years
A,B,C,D,E,F	Forced air	Ta = 50°C	5years	3years

4 Ground

LGA

■ When installing the power supply with your unit, ensure that the input FG terminal of CN1 or mounting hole FG is connected to safety ground of the unit.

However when applying the safety agency, connect the input FG terminal of CN1 to safety ground of the unit.



Fig.4.1 Ground

5 Option and Others

5.1 Outline of options

- * Please inquire us for details of specifications and delivery timing.
- * You can combine multiple options. Some options, however, cannot be combined with other options. Please contact us for details.

● -C

- Option -C units have coated internal PCB for better moisture resistance.

● -G

- Option -G units are low leakage current type.
- Differences from standard versions are summarized in Table 5.1.

Table 5.1 Low leakage current type

	-5	-12	-24
Leakage Current (AC100/120V 60Hz)	0.1mA max		
Conducted Noise	N/A		
Output Ripple Noise [mVp-p]	0 to +50°C *1	150max	200max
	-10 to 0°C *2	200max	250max

*1 LGA50A-24 and LGA50A-48 are applied that the upper temperature limit is 45°C.

LGA150A and LGA240A are applied that the upper for temperature limit is 40°C.

*2 This is the value that measured on measuring board with capacitor of 22μF at 150mm from output connector. Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN:RM-103).

● -H(LGA50A-24,LGA75A-24,LGA100A-24,LGA150A-24,LGA240A-24)

LGA

- Option -H units can output the peak current.
- Peak load is possible to draw as below.

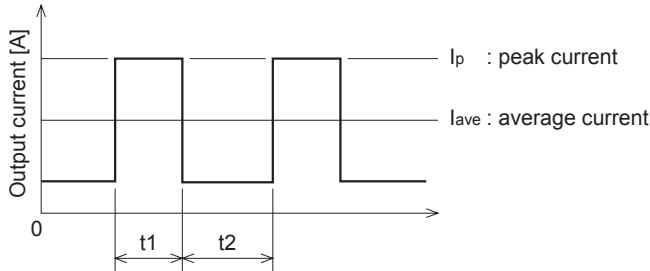


Fig.5.1 Peak current

$$t_1 \leq 10 [\text{sec}]$$

$$I_p \leq \text{rated peak current}$$

$$I_{ave} \leq \text{rated output current}$$

$$\frac{t_1}{t_1 + t_2} \leq 0.35$$

Input voltage is AC90V to AC132V.

Remarks:

There is a possibility that an internal device is damaged when the specification is exceeded.

● -J1

- Option -J units, the Input and Output connector is VH connectors (Mfr. J.S.T.).

● -S · -SN

- S indicates a type with chassis, and -SN indicates a type with chassis and cover (Refer to external view). Refer to "Derating Curves" in Section 3.2.

● -Y

- Option -Y units can adjust the output voltage by the potentiometer is attached.
- Refer to the adjustable range to the table 5.2.

Table 5.2 Output voltage adjustment range

Output voltage	Output voltage adjustment range[V]
3.3V*	2.85 to 3.63
5V*	4.5 to 5.5
12V	10.8 to 13.2
15V	13.5 to 16.5
24V	21.6 to 26.4
48V	43.2 to 52.8

* Some of the product, -Y is standard equipment.

(LGA50A-3R3-Y, LGA75A-3R3-Y, LGA100A-3R3-Y
LGA100A-5-Y, LGA150A-3R3-Y, LGA150A-5-Y)

- To increase the output voltage, turn a built-in potentiometer clockwise.
- To decrease the output voltage, turn it counterclockwise.
- Please take care when you adjust output voltage by potentiometer, because there is possibility of electric shock and the breakdown as contacting to other internal circuit by electrically conductive tool.

5.2 Others

■ This power supply is the rugged PCB type. Do not drop conductive objects in the power supply.

■ At light load, there remains high voltage inside the power supply for a few minutes after power OFF.

So, at maintenance, take care about electric shock.

■ This power supply is manufactured by SMD technology. The stress to PCB like twisting or bending causes the defect of the unit, so handle the unit with care.

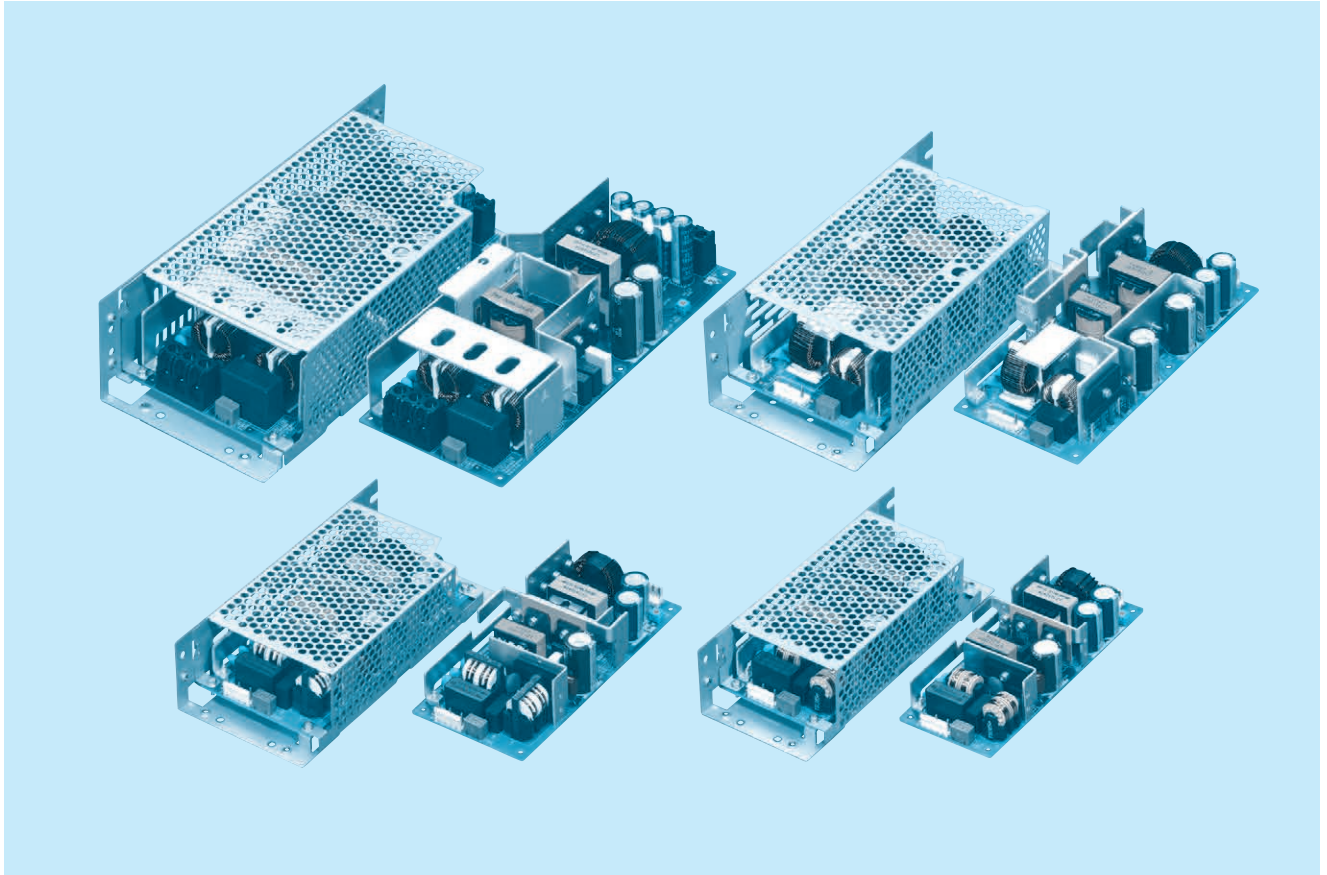
- Tighten all the screws in the screw hole.
- Install it so that PCB may become parallel to the clamp face.
- Avoid the impact such as drops.

■ While turning on the electricity, and for a while after turning off, please don't touch the inside of a power supply because there are some hot parts in that.



LFP-series

LFP



Feature

- High power & peak power
- Small and compact PCB construction
- Built-in inrush current, overcurrent and overvoltage protection circuits
- Harmonic attenuator (Complies with IEC61000-3-2 class A)
- Universal input (AC85-264V)
- Power factor correction

Safety agency approvals

UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178
Complies with DEN-AN

EMI

Complies with FCC-B, CISPR22-B, EN55011-B, EN55022-B, VCCI-B

5-year warranty (refer to Instruction Manual)

CE marking

Low Voltage Directive

EMS Compliance : EN61204-3, EN61000-6-2

EN61000-4-2
EN61000-4-3
EN61000-4-4
EN61000-4-5
EN61000-4-6
EN61000-4-8
EN61000-4-11

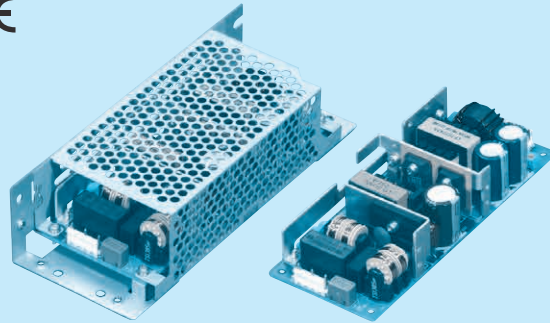
LFP100F

LF P 100 F - -

① ② ③ ④ ⑤ ⑥



RoHS



Example recommended EMI/EMC filter
NAC-04-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional *1
- C : with Coating
- G : Low leakage current
- J1 : VH(J.S.T.)connector type
- R : with Remote ON/OFF
- R2 : with Remote ON/OFF
- S : with Chassis
- SN : with Chassis & cover

Please refer to Instruction manual 6.

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.
* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LFP100F-24-Y	LFP100F-36-Y	LFP100F-48-Y
MAX OUTPUT WATTAGE[W]	*2 103.2 (206.4)	100.8 (201.6)	100.8 (201.6)
DC OUTPUT	*2 24V 4.3A (8.6A)	36V 2.8A (5.6A)	48V 2.1A (4.2A)

SPECIFICATIONS

	MODEL		LFP100F-24-Y	LFP100F-36-Y	LFP100F-48-Y
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.2) *5		
	CURRENT[A]	ACIN 100V	1.3typ (Io=100%)		
		ACIN 200V	0.7typ (Io=100%)		
	FREQUENCY[Hz]		50 / 60 (47 - 63)		
	EFFICIENCY[%]	ACIN 100V	84.0typ (Io=100%)	84.0typ (Io=100%)	84.0typ (Io=100%)
		ACIN 200V	87.0typ (Io=100%)	87.0typ (Io=100%)	87.0typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.99typ (Io=100%)		
		ACIN 200V	0.95typ (Io=100%)		
	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25℃)			
	ACIN 200V	30typ (Io=100%) (At cold start) (Ta=25℃)			
LEAKAGE CURRENT[mA]		0.40 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)			
OUTPUT	VOLTAGE[V]		24	36	48
	CURRENT[A] *2		4.3 (Peak 8.6)	2.8 (Peak 5.6)	2.1 (Peak 4.2)
	LINE REGULATION[mV] *7		96max	144max	192max
	LOAD REGULATION[mV] *7		150max	240max	240max
	RIPPLE[mVp-p] *3	0 to +50℃	120max	150max	150max
		-10 - 0℃	160max	200max	200max
	RIPPLE NOISE[mVp-p]*3	0 to +50℃	150max	250max	250max
		-10 - 0℃	180max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +50℃	240max	360max	480max
		-10 to +50℃	290max	450max	600max
	DRIFT[mV] *4		96max	144max	192max
	START-UP TIME[ms]		350typ (ACIN 100V, Io=100%)		
	HOLD-UP TIME[ms]		20typ (ACIN 100V, Io=100%)		
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		21.60 to 27.50	32.40 to 39.60	39.60 to 52.80
OUTPUT VOLTAGE SETTING[V]		24.00 to 24.96	36.00 to 37.44	48.00 to 49.92	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 101% of rating and recovers automatically		
	OVERVOLTAGE PROTECTION[V]		27.60 to 33.60	41.40 to 50.40	55.20 to 67.20
	OPERATING INDICATION		Not provided		
	REMOTE SENSING		Not provided		
	REMOTE ON/OFF		Option (Refer to Instruction Manual 6)		
ISOLATION	INPUT-OUTPUT-RC *6		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)		
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)		
	OUTPUT-RC-FG *6		AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)		
	OUTPUT-RC *6		AC100V 1minute, Cutoff current = 25mA, DC100V 10MΩ min (At Room Temperature)		
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE *5		-10 to +70℃, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000feet) max		
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max		
	VIBRATION		10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT		196.1m/s² (20G), 11ms, once each X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS (At only AC input)		UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN		
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B		
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 (Class A) *8		
OTHERS	CASE SIZE/WEIGHT		62 X 33 X 155mm [2.44 X 1.30 X 6.10 inches] (W X H X D) / 290g max (with chassis & cover : 480g max)		
	COOLING METHOD		Convection (Refer to Instruction Manual 3.1 and 3.2) *5		

*1 Specification is changed at option, refer to Instruction Manual.

*2 Peak loading for 10sec. And Duty 40% max, refer to Instruction Manual 5. In detail.

() means peak current. There is a possibility that an internal device is damaged when the specification is exceeded.

*3 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.

Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

*5 Derating is required.

*6 Applicable when remote control (optional) is added.

*7 Please contact us about dynamic load and input response.

*8 Please contact us about another class.

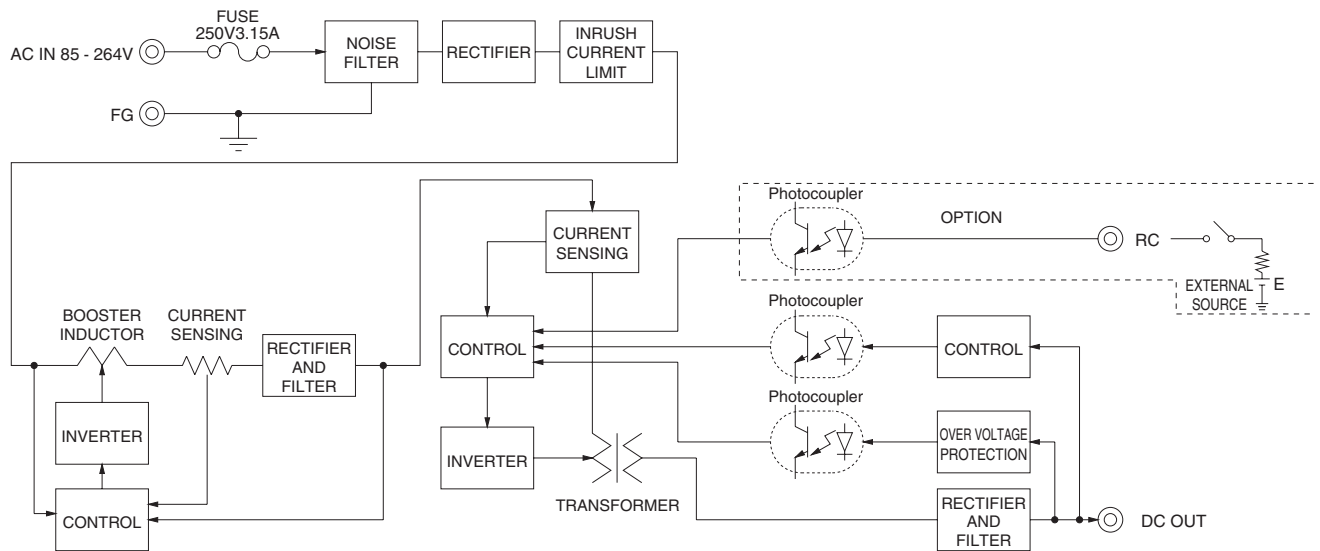
* To meet the specifications. Do not operate over-loaded condition.

* Parallel operation is not possible.

* Derating is required when operated with chassis and cover.

* Sound noise may be generated by power supply in case of pulse load.

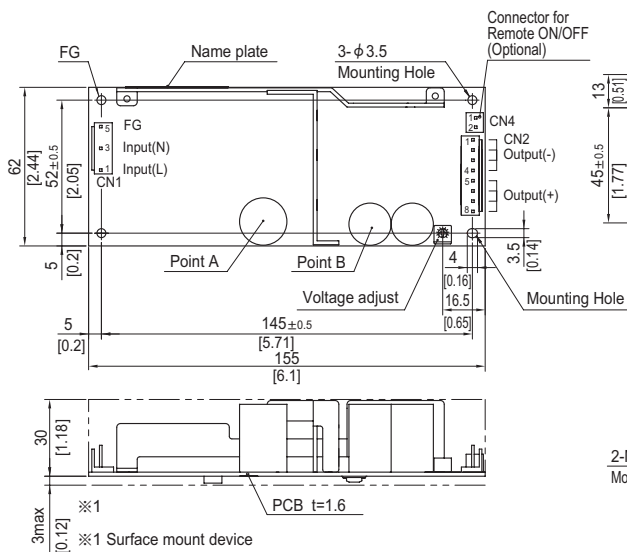
Block diagram



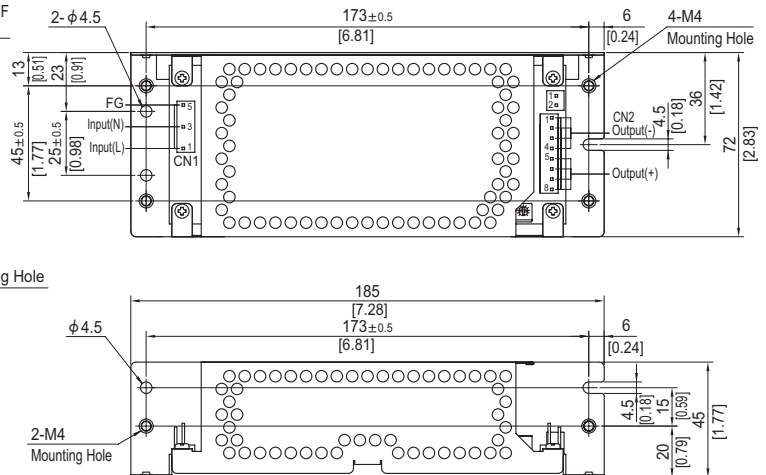
External view

※ External size of option is different from standard model.

Standard type



Chassis and cover type



※ 4 Mounting holes are existing.

※ The back side of P.C.B. of the power supply is assembled some SMDs.

Be attention not to bump against the attached area by vibration.

※ Use the spacer of 8mm length or more regarding insulation. And do not use press-fitting bush.

※ Point A, Point B are thermometry points. Please refer to Instruction Manual 3.

I/O Connector	Mating connector	Terminal
CN1	1-1123724-3	Chain 1123721-1 Loose 1318912-1
CN2	1-1123723-8	Chain 1123721-1 Loose 1318912-1

(Mfr:Tyco Electronics)

※ I/O Connector is Mfr. Tyco Electronics

※ Option:-J1:VH(J.S.T) connector type.

<PIN CONNECTION>

CN1

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

CN2

Pin No.	Output
1 to 4	-V
5 to 8	+V

※ Keep drawing current per pin below 5A for CN2.

※ Tolerance : ± 1 [± 0.04]

※ Weight : 290g max (with chassis & cover : 480g max)

※ PCB material : CEM3

※ Optional chassis and cover material : Electric galvanizing steel board.

※ Dimensions in mm, [] =inches

※ Mounting torque (Mounting hole of chassis) : 1.5N · m (16kgf · cm) max

Connector type

CN4 Option (Mfr:J.S.T)

PIN No.	Contents
1	RC(+)
2	RC(-)

Barrier strip type

Model B2B-XH-A
Mating Connector (Terminal)
XHP-2

(BXH-001T-P0.6
or SXH-001T-P0.6)

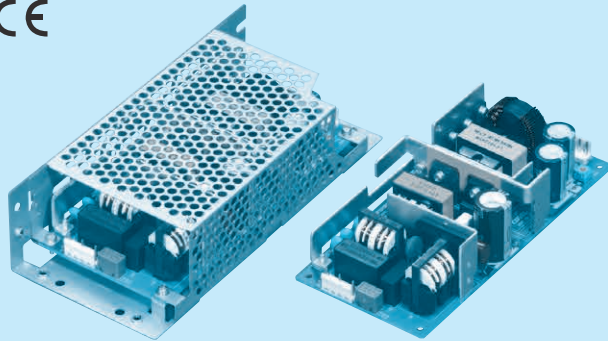
LFP150F

LF P 150 F - -

① ② ③ ④ ⑤ ⑥



RoHS



Example recommended EMI/EMC filter
NAC-04-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional *1
- C : with Coating
- G : Low leakage current
- J1 : VH(J.S.T.)connector type
- R : with Remote ON/OFF
- R2 : with Remote ON/OFF
- S : with Chassis
- SN : with Chassis & cover

Please refer to Instruction manual 6.

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.
* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LFP150F-24-Y	LFP150F-36-Y	LFP150F-48-Y
MAX OUTPUT WATTAGE[W]	*2 151.2 (302.4)	151.2 (302.4)	153.6 (307.2)
DC OUTPUT	*2 24V 6.3A (12.6A)	36V 4.2A (8.4A)	48V 3.2A (6.4A)

SPECIFICATIONS

	MODEL		LFP150F-24-Y	LFP150F-36-Y	LFP150F-48-Y
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.2) *5		
	CURRENT[A]	ACIN 100V	2.0typ (Io=100%)		85.5typ (Io=100%)
		ACIN 200V	1.0typ (Io=100%)		
	FREQUENCY[Hz]		50 / 60 (47 - 63)		
	EFFICIENCY[%]	ACIN 100V	85.5typ (Io=100%)		85.5typ (Io=100%)
		ACIN 200V	88.0typ (Io=100%)		88.0typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.99typ (Io=100%)		88.0typ (Io=100%)
		ACIN 200V	0.95typ (Io=100%)		
INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25°C)			
	ACIN 200V	30typ (Io=100%) (At cold start) (Ta=25°C)			
LEAKAGE CURRENT[mA]		0.40 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)			
OUTPUT	VOLTAGE[V]		24	36	48
	CURRENT[A]		*2 6.3 (Peak 12.6)	4.2 (Peak 8.4)	3.2 (Peak 6.4)
	LINE REGULATION[mV]		*7 96max	144max	192max
	LOAD REGULATION[mV]		*7 150max	240max	240max
	RIPPLE[mVp-p]	*3 0 to +50°C	120max	150max	150max
		-10 - 0°C	160max	200max	200max
	RIPPLE NOISE[mVp-p]*3	0 to +50°C	150max	250max	250max
		-10 - 0°C	180max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +50°C	240max	360max	480max
		-10 to +50°C	290max	450max	600max
	DRIFT[mV]		*4 96max	144max	192max
	START-UP TIME[ms]		350typ (ACIN 100V, Io=100%)		
HOLD-UP TIME[ms]		20typ (ACIN 100V, Io=100%)			
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		21.60 to 27.50	32.40 to 39.60	39.60 to 52.80	
OUTPUT VOLTAGE SETTING[V]		24.00 to 24.96	36.00 to 37.44	48.00 to 49.92	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 101% of rating and recovers automatically		
	OVERVOLTAGE PROTECTION[V]		27.60 to 33.60	41.40 to 50.40	55.20 to 67.20
	OPERATING INDICATION		Not provided		
	REMOTE SENSING		Not provided		
ISOLATION	REMOTE ON/OFF		Option (Refer to Instruction Manual 6)		
	INPUT-OUTPUT-RC		*6 AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)		
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)		
	OUTPUT-RC-FG		*6 AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)		
	OUTPUT-RC		*6 AC100V 1minute, Cutoff current = 25mA, DC100V 10MΩ min (At Room Temperature)		
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE		*5 -10 to +70°C, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000feet) max		
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max		
	VIBRATION		10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	IMPACT		196.1m/s² (20G), 11ms, once each X, Y and Z axis		
	AGENCY APPROVALS (At only AC input)		UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN		
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B		
OTHERS	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 (Class A) *8		
	CASE SIZE/WEIGHT		75 X 36.5 X 160mm [2.95 X 1.44 X 6.30 inches] (W X H X D) / 380g max (with chassis & cover : 610g max)		
	COOLING METHOD		Convection (Refer to Instruction Manual 3.1 and 3.2) *5		

*1 Specification is changed at option, refer to Instruction Manual.

*2 Peak loading for 10sec. And Duty 40% max, refer to Instruction Manual 5. In detail.

() means peak current. There is a possibility that an internal device is damaged when the specification is exceeded.

*3 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.

Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*5 Derating is required.

*6 Applicable when remote control (optional) is added.

*7 Please contact us about dynamic load and input response.

*8 Please contact us about another class.

* To meet the specifications. Do not operate over-loaded condition.

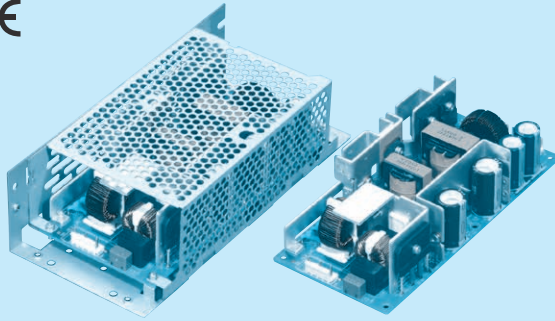
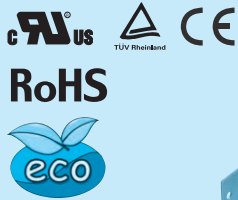
* Parallel operation is not possible.

* Derating is required when operated with chassis and cover.

* Sound noise may be generated by power supply in case of pulse load.

LFP240F

LF P 240 F -□ -□
① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
 - ② Single output
 - ③ Output wattage
 - ④ Universal input
 - ⑤ Output voltage
 - ⑥ Optional *1
- C : with Coating
G : Low leakage current
J1 : VH(J.S.T.)connector type
R : with Remote ON/OFF
R2 : with Remote ON/OFF
S : with Chassis
SN : with Chassis & cover
T : Vertical terminal block
U1 : Can be attached the external capacitor unit

Please refer to Instruction manual 6.

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.
* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LFP240F-24-Y	LFP240F-30-Y	LFP240F-36-Y	LFP240F-48-Y
MAX OUTPUT WATTAGE[W]	300 (480)	300 (480)	302.4 (482.4)	302.4 (480)
DC OUTPUT	Convection	24V 10A (20A)	30V 8A (16A)	36V 6.7A (13.4A)
	Forced air	24V 12.5A (20A)	30V 10A (16A)	36V 8.4A (13.4A)

SPECIFICATIONS

	MODEL	LFP240F-24-Y	LFP240F-30-Y	LFP240F-36-Y	LFP240F-48-Y
INPUT	VOLTAGE[V]	AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.2) *5			
	CURRENT[A]	ACIN 100V	3.6typ (Io=100%)		
		ACIN 200V	1.8typ (Io=100%)		
	FREQUENCY[Hz]	50 / 60 (47 - 63)			
	EFFICIENCY[%]	ACIN 100V	86.0typ (Io=100%)	86.0typ (Io=100%)	86.0typ (Io=100%)
		ACIN 200V	88.5typ (Io=100%)	88.5typ (Io=100%)	89.0typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.99typ (Io=100%)		
OUTPUT		ACIN 200V	0.95typ (Io=100%)		
	INRUSH CURRENT[A]	ACIN 100V	15 / 30typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 3 sec. to re-start)		
		ACIN 200V	30 / 30typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 3 sec. to re-start)		
	LEAKAGE CURRENT[ma]	0.40 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)			
	VOLTAGE[V]	24	30	36	48
	CURRENT[A]	Convection *2	10 (Peak 20)	8 (Peak 16)	6.7 (Peak 13.4)
		Forced air *2	12.5 (Peak 20)	10 (Peak 16)	8.4 (Peak 13.4)
PROTECTION CIRCUIT AND OTHERS	LINE REGULATION[mV]	*7	96max	144max	144max
	LOAD REGULATION[mV]	*7	150max	240max	240max
	RIPPLE[mVp-p]	0 to +50°C	120max	150max	150max
		-10 - 0°C	160max	200max	200max
	RIPPLE NOISE[mVp-p]*3	0 to +50°C	150max	250max	250max
		-10 - 0°C	180max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +50°C	240max	360max	480max
ISOLATION		-10 to +50°C	290max	450max	600max
	DRIFT[mV]	*4	96max	144max	144max
	START-UP TIME[ms]	350typ (ACIN 100V, Io=100%)			
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)			
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	21.60 to 27.50			
	OUTPUT VOLTAGE SETTING[V]	24.00 to 24.96			
	OVERCURRENT PROTECTION	Works over 101% of rating and recovers automatically			
ENVIRONMENT	OVERVOLTAGE PROTECTION[V]	27.60 to 33.60			
	OPERATING INDICATION	Not provided			
	REMOTE SENSING	Not provided			
	REMOTE ON/OFF	Option (Refer to Instruction Manual 6)			
	INPUT-OUTPUT-RC	*6 AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)			
	INPUT-FG	*6 AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)			
	OUTPUT-RC-FG	*6 AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)			
SAFETY AND NOISE REGULATIONS	OUTPUT-RC	*6 AC100V 1minute, Cutoff current = 25mA, DC100V 10MΩ min (At Room Temperature)			
	OPERATING TEMP., HUMID. AND ALTITUDE	*5 -10 to +70°C, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000feet) max			
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max			
	VIBRATION	10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis			
	IMPACT	196.1m/s² (20G), 11ms, once each X, Y and Z axis			
	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN			
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B			
OTHERS	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *8			
	CASE SIZE/WEIGHT	84 X 46 X 180mm [3.31 X 1.81 X 7.09 inches] (W X H X D) / 540g max (with chassis & cover : 860g max)			
	COOLING METHOD	Convection / Forced air (Refer to Instruction Manual 3.1 and 3.2) *5			

*1 Specification is changed at option, refer to Instruction Manual.

*2 Peak loading for 10sec. And Duty 40% max, refer to Instruction Manual 5. In detail.

() means peak current. There is a possibility that an internal device is damaged when the specification is exceeded.

*3 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.

Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*5 Derating is required.

*6 Applicable when remote control (optional) is added.

*7 Please contact us about dynamic load and input response.

*8 Please contact us about another class.

*9 By attaching an external capacitor unit, it is possible to extend the hold-up time.

To meet the specifications. Do not operate over-loaded condition. Parallel operation is not possible.

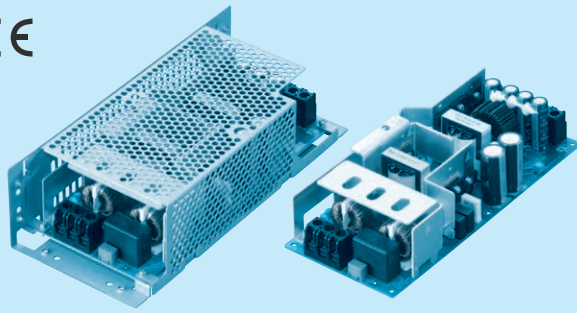
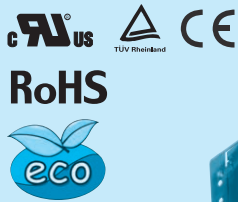
* Derating is required when operated with chassis and cover.

* Sound noise may be generated by power supply in case of pulse load.

LFP300F

LF P 300 F - -

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional *1
- C : with Coating
- G : Low leakage current
- J : EP (Tyco Electronics) connector type
- J1 : VH (J.S.T.) connector type
- R : with Remote ON/OFF
- R2 : with Remote ON/OFF
- S : with Chassis
- SN : with Chassis & cover
- SNF : with Chassis & cover & fan (Only 24V)
- T1 : Horizontal terminal block
- U1 : Can be attached the external capacitor unit

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.
* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

Please refer to Instruction manual 6.

MODEL		LFP300F-24-TY	LFP300F-30-TY	LFP300F-36-TY	LFP300F-48-TY
MAX OUTPUT WATTAGE[W]	*2	360 (600)	360 (600)	360 (604.8)	360 (604.8)
DC OUTPUT	Convection	24V 12.5A (25A)	30V 10A (20A)	36V 8.4A (16.8A)	48V 6.3A (12.6A)
	Forced air	24V 15A (25A)	30V 12A (20A)	36V 10A (16.8A)	48V 7.5A (12.6A)

SPECIFICATIONS

	MODEL		LFP300F-24-TY	LFP300F-30-TY	LFP300F-36-TY	LFP300F-48-TY
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.2) *5			
	CURRENT[A]	ACIN 100V	4.3typ (Io=100%)			
		ACIN 200V	2.2typ (Io=100%)			
	FREQUENCY[Hz]		50 / 60 (47 - 63)			
	EFFICIENCY[%]	ACIN 100V	85.0typ (Io=100%)	85.5typ (Io=100%)	85.5typ (Io=100%)	85.5typ (Io=100%)
		ACIN 200V	88.0typ (Io=100%)	88.0typ (Io=100%)	88.0typ (Io=100%)	88.0typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.99typ (Io=100%)			
		ACIN 200V	0.95typ (Io=100%)			
INRUSH CURRENT[A]	ACIN 100V	15 / 30typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 3 sec. to re-start)				
	ACIN 200V	30 / 30typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 3 sec. to re-start)				
LEAKAGE CURRENT[ma]		0.45 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)				
OUTPUT	VOLTAGE[V]		24	30	36	48
	CURRENT[A]	ACIN 100V *2	12.5 (Peak 22) Convection	10 (Peak 18) Convection	8.4 (Peak 14.6) Convection	6.3 (Peak 11) Convection
			15 (Peak 22) Forced air	12 (Peak 18) Forced air	10 (Peak 14.6) Forced air	7.5 (Peak 11) Forced air
		ACIN 200V *2	12.5 (Peak 25) Convection	10 (Peak 20) Convection	8.4 (Peak 16.8) Convection	6.3 (Peak 12.6) Convection
			15 (Peak 25) Forced air	12 (Peak 20) Forced air	10 (Peak 16.8) Forced air	7.5 (Peak 12.6) Forced air
	LINE REGULATION[mV] *7		96max	144max	144max	192max
	LOAD REGULATION[mV] *7		150max	240max	240max	240max
	RIPPLE[mVp-p] *3	0 to +40℃	120max	150max	150max	150max
		-10 - 0℃	160max	200max	200max	200max
	RIPPLE NOISE[mVp-p]*3	0 to +40℃	150max	250max	250max	250max
		-10 - 0℃	180max	300max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +40℃	240max	360max	360max	480max
		-10 to +40℃	290max	450max	450max	600max
	DRIFT[mV] *4		96max	144max	144max	192max
	START-UP TIME[ms]		350typ (ACIN 100V, Io=100%)			
	HOLD-UP TIME[ms] *9		20typ (ACIN 100V, Io=100%)			
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		21.60 to 27.50	27.00 to 33.00	32.40 to 39.60	39.60 to 52.80
OUTPUT VOLTAGE SETTING[V]		24.00 to 24.96	30.00 to 31.20	36.00 to 37.44	48.00 to 49.92	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 101% of rating and recovers automatically			
	OVERVOLTAGE PROTECTION[V]		27.60 to 33.60	34.50 to 42.00	41.40 to 50.40	55.20 to 67.20
	OPERATING INDICATION		Not provided			
	REMOTE SENSING		Not provided			
	REMOTE ON/OFF		Option (Refer to Instruction Manual 6)			
ISOLATION	INPUT-OUTPUT-RC *6		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)			
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)			
	OUTPUT-RC-FG *6		AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)			
	OUTPUT-RC *6		AC100V 1minute, Cutoff current = 25mA, DC100V 10MΩ min (At Room Temperature)			
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE *5		-10 to +70℃, 20 - 90%RH (Non condensing) (Refer to Instruction Manual 3.2), 3,000m (10,000feet) max			
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max			
	VIBRATION		10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis			
	IMPACT		196.1m/s ² (20G), 11ms, once each X, Y and Z axis			
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS (At only AC input)		UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN			
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B			
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 (Class A) *8			
OTHERS	CASE SIZE/WEIGHT		95×52.5×222mm [3.74×2.07×8.74 inches] (W×H×D) (without terminal block) / 810g max (with chassis & cover : 1,270g max)			
	COOLING METHOD		Convection / Forced air (Refer to Instruction Manual 3.1 and 3.2) *5			

*1 Specification is changed at option, refer to Instruction Manual.

*2 Peak loading for 10sec. And Duty 40% max, refer to Instruction Manual 5. In detail.

() means peak current. There is a possibility that an internal device is damaged when the specification is exceeded.

*3 This is the value that measured on measuring board with capacitor of 22 μ F at 150mm from output terminal.

Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*5 Derating is required.

*6 Applicable when remote control (optional) is added.

*7 Please contact us about dynamic load and input response.

*8 Please contact us about another class.

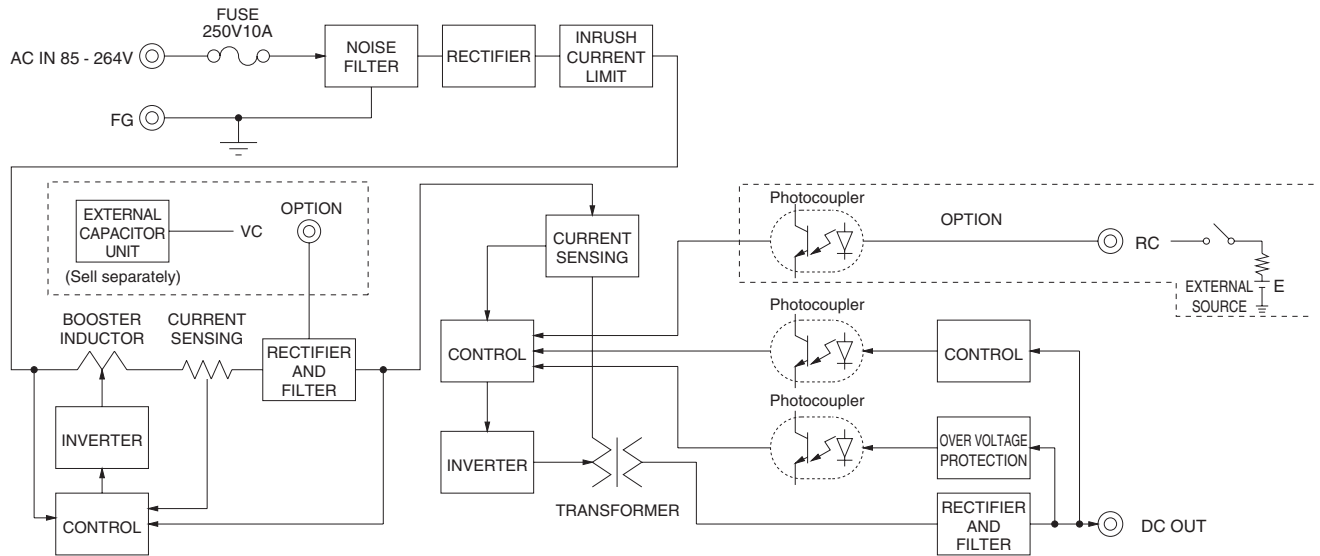
*9 By attaching an external capacitor unit, it is possible to extend the hold-up time.

* To meet the specifications. Do not operate over-loaded condition. Parallel operation is not possible.

* Derating is required when operated with chassis and cover.

* Sound noise may be generated by power supply in case of pulse load.

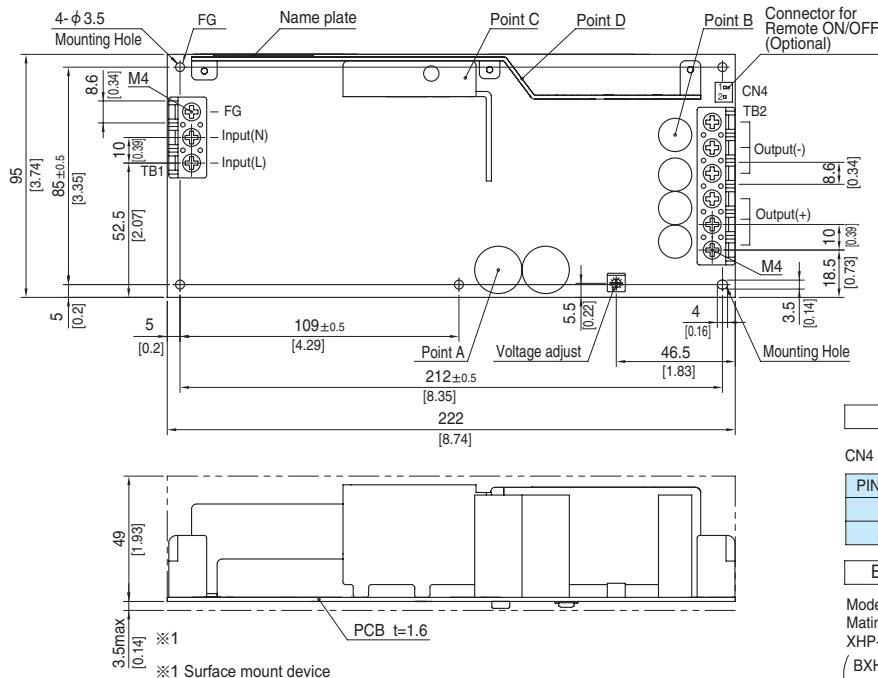
Block diagram



External view

※ External size of option is different from standard model.

Standard type



- ※ 5 Mounting holes are existing.
- ※ The back side of P.C.B. of the power supply is assembled some SMDs.
Be attention not to bump against the attached area by vibration.
- ※ Use the spacer of 8mm length or more regarding insulation.
And do not use press-fitting bush.
- ※ Point A, Point B, Point C, Point D are thermometry points.
Please refer to Instruction Manual 3.
- ※ Keep drawing current per pin below 20A for TB2.

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 810g max (with chassis & cover : 1,270g max)
- ※ PCB material : CEM3
- ※ Dimensions in mm, []=inches
- ※ Screw tightening torque : M4 1.6N · m (16.9kgf · cm) max

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current *1 [A]	Inrush current protection	PCB/Pattern			Series/Parallel operation availability *2	
					Material	Single sided	Double sided	Series operation	Parallel operation
LFP100F	Active filter	60	1.3	Thermistor	CEM-3		Yes	Yes	No
	Forward converter	130							
LFP150F	Active filter	60	2.0	Thermistor	CEM-3		Yes	Yes	No
	Forward converter	130							
LFP240F	Active filter	60	3.6	SCR	CEM-3		Yes	Yes	No
	Forward converter	130							
LFP300F	Active filter	60	4.3	SCR	CEM-3		Yes	Yes	No
	Forward converter	140							

*1 The value of input current is at ACIN 100V and rated load.

*2 Refer to Instruction Manual 2.

1 Function LFP-12

1.1	Input voltage range	LFP-12
1.2	Inrush current limiting	LFP-12
1.3	Overcurrent protection	LFP-12
1.4	Overvoltage protection	LFP-12
1.5	Thermal protection	LFP-12
1.6	Output voltage adjustment range	LFP-12
1.7	Output ripple and ripple noise	LFP-12
1.8	Isolation	LFP-13
1.9	Reducing standby power	LFP-13

LFP

2 Series Operation and Parallel Operation LFP-13

2.1	Series Operation	LFP-13
2.2	Parallel Operation	LFP-13

3 Assembling and Installation Method LFP-13

3.1	Installation method	LFP-13
3.2	Derating	LFP-13
3.3	Mounting screw	LFP-15
3.4	Expectancy life and warranty	LFP-16

4 Ground LFP-16

5 Peak loading LFP-17

6 Option and Others LFP-17

6.1	Outline of options	LFP-17
6.2	Others	LFP-19

1 Function

LFP 1.1 Input voltage range

- The range is from AC85V to AC264V or DC120V to DC370V (please see SPECIFICATIONS for details).
- In cases that conform with safety standard, input voltage range is AC100-AC240V (50/60Hz).
- If input value doesn't fall within above range, a unit may not operate in accordance with specifications and/or start hunting or fail. If you need to apply a square waveform input voltage, which is commonly used in UPS and inverters, please contact us.
- When the input voltage changes suddenly, the output voltage accuracy might exceed the specification. Please contact us.
- Operation stop voltage is set at a lower value than that of a standard version (derating is needed).

· Use Conditions

Output		*Please avoid using continuously for more than 1 second under above conditions. Doing so may cause a failure.
LFP100F	30W	
LFP150F	50W	
LFP240F	80W	
LFP300F	100W	
Input AC50V or DC70V Duty 1s/30s		

1.2 Inrush current limiting

- An inrush current limiting circuit is built-in.
- If you need to use a switch on the input side, please select one that can withstand an input inrush current.

● LFP100F, LFP150F

- Thermistor is used in the inrush current limiting circuit. When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that a power supply cools down before being turned on.

● LFP240F, LFP300F

- Thyristor technique is used in the inrush current limiting circuit. When you turn power ON/OFF repeatedly within a short period of time, please have enough intervals so that the inrush current limiting circuit becomes operative.
- When the switch of the input is turned on, the primary inrush current and secondary inrush current will be generated because the thyristor technique is used for the inrush current limiting circuit.

1.3 Overcurrent protection

- An overcurrent protection circuit is built-in and activated at 101% of the peak current. A unit automatically recovers when a fault condition is removed. Please do not use a unit in short circuit and/or under an overcurrent condition.
- Intermittent Operation Mode
Intermittent operation for overcurrent protection is included in a part of series. When the overcurrent protection circuit is activated and the output voltage drops to a certain extent, the output becomes intermittent so that the average current will also decrease.

1.4 Overvoltage protection

- An overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait more than 3 minutes and turn on the AC input again to recover the output voltage. Recovery time varies depending on such factors as input voltage value at the time of the operation.
- In option -R2, overvoltage protection is removed by toggling ON/OFF signal of remote control.

Remarks :

Please avoid applying a voltage exceeding the rated voltage to an output terminal. Doing so may cause a power supply to malfunction or fail. If you cannot avoid doing so, for example, if you need to operate a motor, etc., please install an external diode on the output terminal to protect the unit.

1.5 Thermal protection

- A thermal protection circuit is built-in.
The thermal protection circuit may be activated under the following conditions and shut down the output.
 - ① When a temperature continue to exceed the values determined by the derating curve.
 - ② When a current exceeding the rated current is applied.
 - ③ When convection stops.
 - ④ When peak load is applied in conditions other than those shown in Section 5.

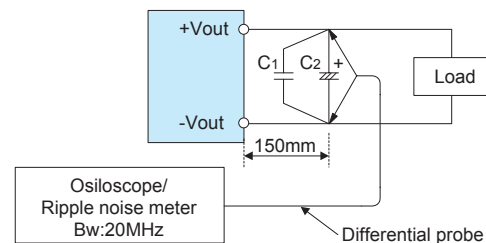
If the thermal protection circuit is activated, shut off the input voltage and eliminate all the overheating conditions. To recover the output voltage, have enough time to cool down the unit before turning on the input voltage again.

1.6 Output voltage adjustment range

- Adjustment of output voltage is possible by using potentiometer.

1.7 Output ripple and ripple noise

- Output ripple noise may be influenced by measurement environment, measuring method fig.1.1 is recommended.



C1 : Film capacitor 0.1μF

C2 : Aluminum electrolytic capacitor 22μF

Fig.1.1 Measuring method of Ripple and Ripple Noise

Remarks :

When GND cable of probe with flux of magnetic force from power supply are crossing, ripple and ripple noise might not measure correctly.

Please note the measuring environment.

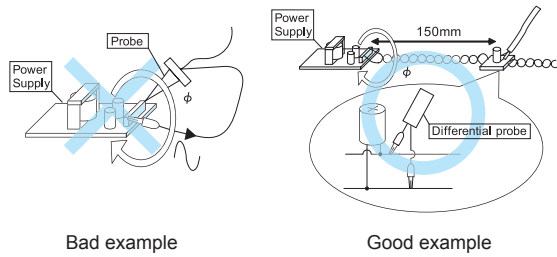


Fig.1.2. Example of measuring output ripple and ripple noise

1.8 Isolation

■For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for the start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

1.9 Reducing standby power

■As for option -R2, reducing standby power is possible by OFF signal of the remote control.
Please refer to instruction manual 6.1.

2 Series Operation and Parallel Operation

2.1 Series Operation

■You can use a power supply in series operation. The output current in series operation should be lower than the rated current of a power supply with the lowest rated current among power supplies that are serially connected. Please make sure that no current exceeding the rated current flows into a power supply.

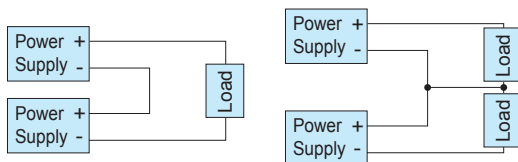


Fig.2.1 Examples of connecting in series operation

2.2 Parallel Operation

■Parallel operation is not possible.
■Redundancy operation is available by wiring as shown below.

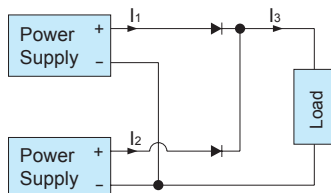


Fig.2.2 Example of redundancy operation

■Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .
Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

LFP

3 Assembling and Installation Method

3.1 Installation method

■This power supply is manufactured by SMD technology.
The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.
■In case of metal chassis, keep the distance between d_1 & d_2 for to insulate between lead of component and metal chassis, use the spacer of 8mm or more between d_1 . If it is less than d_1 & d_2 , insert the insulation sheet between power supply and metal chassis.

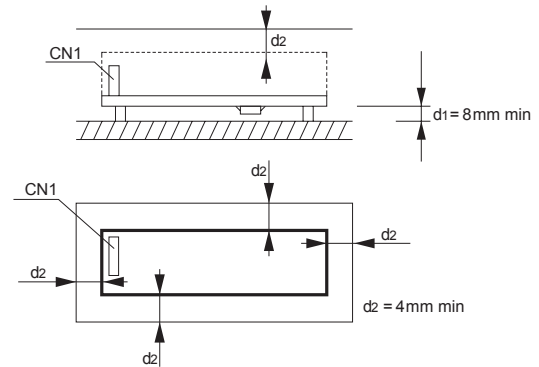


Fig.3.1 Installation method

■There is a possibility that it is not possible to cool enough when the power supply is used by the sealing up space as showing in Figure 3.2.

Please use it after confirming the temperature of point A and point B of Instruction Manual 3.2.

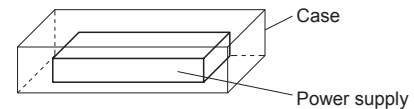


Fig.3.2 Installation example

3.2 Derating

■Environment to use it and Installation environment

When using it, it is necessary to radiate heat by the heat of the power supply.

Table 3.1 - 3.4 shows the relation between the upper limit temperature (Point A and Point B) and load factors.

Please consider the ventilation so that the convection which is enough for the whole power supply is provided.

And temperature of Point A and Point B please become lower than upper limit temperature.

The expectancy life in the upper bound temperature (Point A and Point B) is three years or more.

Please refer to External View for the position of Point A and Point B. In case of with Chassis and Cover, please contact our sales office for getting more information.

Remarks:

*Please be careful of electric shock or earth leakage in case of temperature measurement, because Point A and Point B is live potential.

*Please refer to 3.4 if you want to extend the longevity of the expectancy life.

Table 3.1 Temperatures of Point A, Point B LFP100F-□-Y

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	75%<lo≤100%	88	86
		50%<lo≤75%	89	89
		0%<lo≤50%	89	89
B	Convection	75%<lo≤100%	82	81
		50%<lo≤75%	89	89
		0%<lo≤50%	89	89
C	Convection	75%<lo≤100%	85	86
		50%<lo≤75%	89	89
		0%<lo≤50%	89	89
D	Convection	75%<lo≤100%	84	76
		50%<lo≤75%	89	86
		0%<lo≤50%	89	89
E	Convection	75%<lo≤100%	81	89
		50%<lo≤75%	86	89
		0%<lo≤50%	87	89
F	Convection	75%<lo≤100%	80	77
		50%<lo≤75%	85	86
		0%<lo≤50%	88	89
A,B,C,D,E,F	Forced air	70%<lo≤100%	75	75
		0%<lo≤70%	75	75

Table 3.2 Temperatures of Point A, Point B LFP150F-□-Y

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	75%<lo≤100%	84	81
		50%<lo≤75%	89	89
		0%<lo≤50%	89	89
B	Convection	75%<lo≤100%	83	81
		50%<lo≤75%	89	89
		0%<lo≤50%	89	89
C	Convection	75%<lo≤100%	87	85
		50%<lo≤75%	89	89
		0%<lo≤50%	89	89
D	Convection	75%<lo≤100%	83	65
		50%<lo≤75%	89	75
		0%<lo≤50%	89	85
E	Convection	75%<lo≤100%	77	86
		50%<lo≤75%	81	89
		0%<lo≤50%	86	89
F	Convection	75%<lo≤100%	78	76
		50%<lo≤75%	82	82
		0%<lo≤50%	89	89
A,B,C,D,E,F	Forced air	70%<lo≤100%	75	75
		0%<lo≤70%	75	75

Table 3.3 Temperatures of Point A, Point B, Point C LFP240F-□-Y

Mounting Method	Cooling Method	Load factor	Max temperature		
			Point A[°C]	Point B[°C]	Point C[°C]
A	Convection	75%<lo≤100%	89	82	
		50%<lo≤75%	89	88	
		0%<lo≤50%	89	89	
B	Convection	75%<lo≤100%	85	74	
		50%<lo≤75%	89	82	
		0%<lo≤50%	89	89	
C	Convection	75%<lo≤100%	89	83	
		50%<lo≤75%	89	88	
		0%<lo≤50%	89	89	
D	Convection	75%<lo≤100%	88	74	
		50%<lo≤75%	89	85	
		0%<lo≤50%	89	89	
E	Convection	75%<lo≤100%	89	86	
		50%<lo≤75%	89	89	
		0%<lo≤50%	89	89	
F	Convection	75%<lo≤100%	79	68	
		50%<lo≤75%	86	77	
		0%<lo≤50%	89	89	
A,B,C,D,E,F	Forced air	70%<lo≤100%	75	75	85
		0%<lo≤70%	75	75	85

Table 3.4 Temperatures of Point A, Point B, Point C, Point D LFP300F-□-TY

Mounting Method	Cooling Method	Load factor	Max temperature			
			Point A[°C]	Point B[°C]	Point C[°C]	Point D[°C]
A	Convection	80%<lo≤100%	70	86		
		60%<lo≤80%	75	88		
		lo≤60%	79	89		
B	Convection	80%<lo≤100%	59	68		
		60%<lo≤80%	68	76		
		lo≤60%	76	86		
C	Convection	80%<lo≤100%	70	84		
		60%<lo≤80%	77	89		
		lo≤60%	80	89		
D	Convection	80%<lo≤100%	57	64		
		60%<lo≤80%	65	73		
		lo≤60%	77	83		
E	Convection	80%<lo≤100%	60	79		
		60%<lo≤80%	66	81		
		lo≤60%	76	88		
A,B,C,D and E	Forced air	50%<lo≤100%	75	75	85	85
		lo≤50%	75	75	85	85

■The operative ambient temperature is different by with / without chassis cover or mounting position. Derating curve is shown below.

Note: In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

● LFP100F

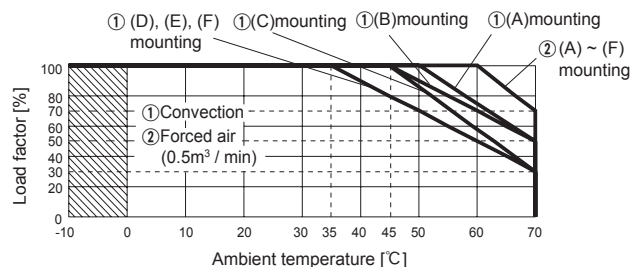


Fig.3.3 Ambient temperature derating curve (refer to Table 3.1)

LFP150F

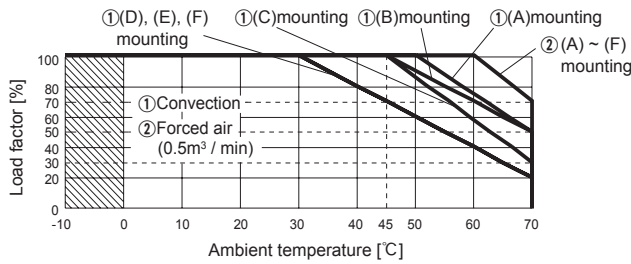
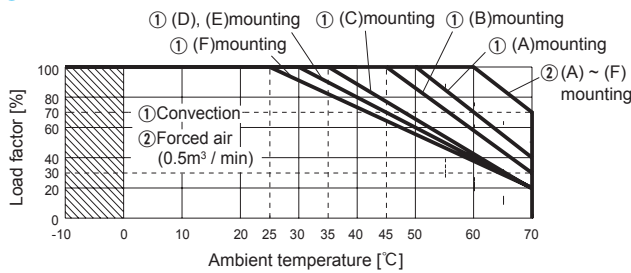


Fig.3.4 Ambient temperature derating curve (refer to Table 3.2)

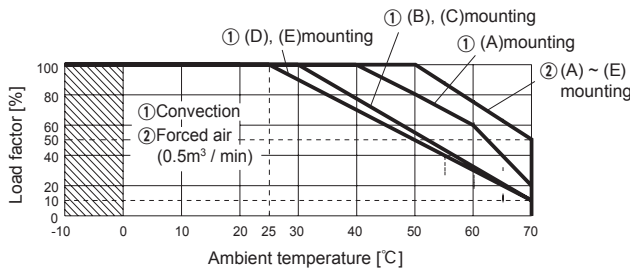
LFP240F



Output voltage	Output power[W]	
	①Convection	②Forced air
24V	240.0	300.0
30V	240.0	300.0
36V	241.2	302.4
48V	240.0	302.4

Fig.3.5 Ambient temperature derating curve (refer to Table 3.3)

LFP300F



Output voltage	Output power[W]	
	①Convection	②Forced air
24V	300.0	360.0
30V	300.0	360.0
36V	302.4	360.0
48V	302.4	360.0

Fig.3.6 Ambient temperature derating curve (refer to Table 3.4)

Derating curve depending on input voltage

Derating curve depending on input voltage is shown in Fig.3.7.

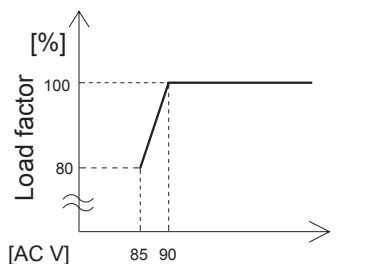


Fig.3.7 Derating curve depending on input voltage

Mounting method

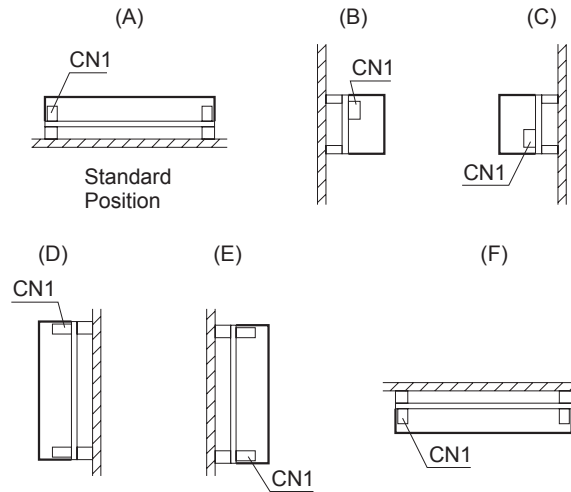


Fig.3.8 Mounting method

■(F) of LFP300F is not possible. (F) mounting is not possible when unit is with case cover, but if need to operate unit by (F) positioning with case cover, temperature / load derating is necessary. For more details, please contact our sales or engineering departments.

3.3 Mounting screw

■The mounting screw should be M3. The hatched area shows the allowance of metal parts for mounting.

■If metallic fittings are used on the component side of the board, ensure there is no contact with surface mounted components.

■This product uses SMD technology.

Please avoid the PCB installation method which includes the twisting stress or the bending stress.

*Recommendation to electrically connect FG to metal chassis for reducing noise.

LFP100F, LFP150F

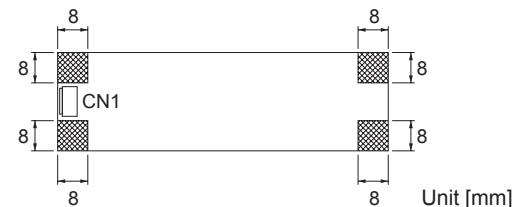


Fig.3.9 Allowance of metal for mounting

LFP240F, LFP300F

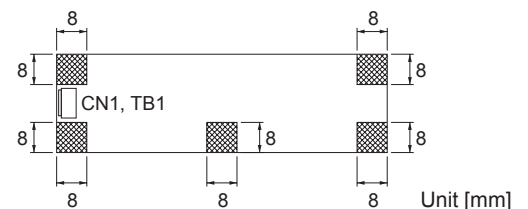


Fig.3.10 Allowance of metal for mounting

3.4 Expectancy life and warranty

■Expectancy Life.

Table 3.5 Expectancy Life (LFP100F-□-Y)

Mounting Method	Cooling Method	Average ambient temperature (year)	Expectancy Life	
			lo ≤ 75%	75% < lo ≤ 100%
A	Convection	Ta = 40°C or less	6years	6years
		Ta = 50°C	6years	5years
B	Convection	Ta = 35°C or less	6years	6years
		Ta = 45°C	6years	5years
C	Convection	Ta = 35°C or less	5years	5years
		Ta = 45°C	5years	3years
D, E, F	Convection	Ta = 25°C or less	5years	5years
		Ta = 35°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.6 Expectancy Life (LFP150F-□-Y)

Mounting Method	Cooling Method	Average ambient temperature (year)	Expectancy Life	
			lo ≤ 75%	75% < lo ≤ 100%
A	Convection	Ta = 40°C or less	6years	6years
		Ta = 50°C	6years	5years
B	Convection	Ta = 35°C or less	6years	6years
		Ta = 45°C	6years	5years
C	Convection	Ta = 35°C or less	5years	5years
		Ta = 45°C	5years	3years
D, E, F	Convection	Ta = 20°C or less	5years	5years
		Ta = 30°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.7 Expectancy Life (LFP240F-□-Y)

Mounting Method	Cooling Method	Average ambient temperature (year)	Expectancy Life	
			lo ≤ 75%	75% < lo ≤ 100%
A	Convection	Ta = 40°C or less	6years	6years
		Ta = 50°C	6years	5years
B	Convection	Ta = 35°C or less	6years	6years
		Ta = 45°C	6years	5years
C	Convection	Ta = 25°C or less	5years	5years
		Ta = 35°C	5years	3years
D, E	Convection	Ta = 20°C or less	5years	5years
		Ta = 30°C	5years	3years
F	Convection	Ta = 25°C or less	5years	3years
		Ta = 60°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.8 Expectancy Life (LFP300F-□-TY)

Mounting Method	Cooling Method	Average ambient temperature (year)	Expectancy Life	
			lo ≤ 75%	75% < lo ≤ 100%
A	Convection	Ta = 30°C or less	6years	6years
		Ta = 40°C	5years	3years
B, C	Convection	Ta = 20°C or less	6years	6years
		Ta = 30°C	5years	3years
D, E	Convection	Ta = 25°C or less	6years	5years
		Ta = 50°C	5years	3years
A,B,C,D,E	Forced air	Ta = 50°C	5years	3years

■Warranty

Table 3.9 Warranty (LFP100F-□-Y)

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			lo ≤ 75%	75% < lo ≤ 100%
A	Convection	Ta = 40°C or less	5years	5years
		Ta = 50°C	5years	3years
B	Convection	Ta = 35°C or less	5years	5years
		Ta = 45°C	5years	3years
C	Convection	Ta = 35°C or less	5years	5years
		Ta = 45°C	5years	3years
D, E, F	Convection	Ta = 25°C or less	5years	5years
		Ta = 35°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.10 Warranty (LFP150F-□-Y)

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			lo ≤ 75%	75% < lo ≤ 100%
A	Convection	Ta = 40°C or less	5years	5years
		Ta = 50°C	5years	3years
B	Convection	Ta = 35°C or less	5years	5years
		Ta = 45°C	5years	3years
C	Convection	Ta = 35°C or less	5years	5years
		Ta = 45°C	5years	3years
D, E, F	Convection	Ta = 20°C or less	5years	5years
		Ta = 30°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.11 Warranty (LFP240F-□-Y)

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			lo ≤ 75%	75% < lo ≤ 100%
A	Convection	Ta = 40°C or less	5years	5years
		Ta = 50°C	5years	3years
B	Convection	Ta = 35°C or less	5years	5years
		Ta = 45°C	5years	3years
C	Convection	Ta = 25°C or less	5years	5years
		Ta = 35°C	5years	3years
D, E	Convection	Ta = 20°C or less	5years	5years
		Ta = 30°C	5years	3years
F	Convection	Ta = 25°C or less	5years	3years
		Ta = 60°C	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.12 Warranty (LFP300F-□-TY)

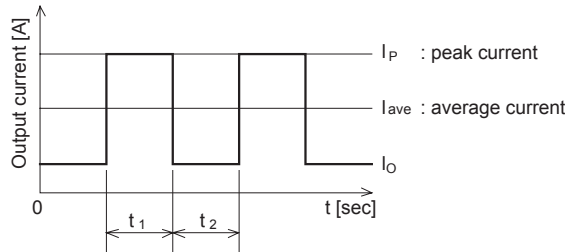
Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			lo ≤ 75%	75% < lo ≤ 100%
A	Convection	Ta = 30°C or less	5years	5years
		Ta = 40°C	5years	3years
B, C	Convection	Ta = 20°C or less	5years	5years
		Ta = 30°C	5years	3years
D, E	Convection	Ta = 25°C or less	5years	3years
		Ta = 50°C	5years	3years
A,B,C,D,E	Forced air	Ta = 50°C	5years	3years

4 Ground

■When installing the power supply with your unit, ensure that the input FG terminal of CN1 or mounting hole FG is connected to safety ground of the unit.

5 Peak loading

■ Peak load is possible to draw as below.



$$t_1 \leq 10 \text{ [sec]}, I_{ave} = \frac{I_P t_1 + I_O t_2}{t_1 + t_2} \leq \text{rated current},$$

$$\frac{t_1}{t_1 + t_2} \leq 0.40 \text{ (Refer to below chart)}$$

Duty is depended on peak load, refer to below chart.

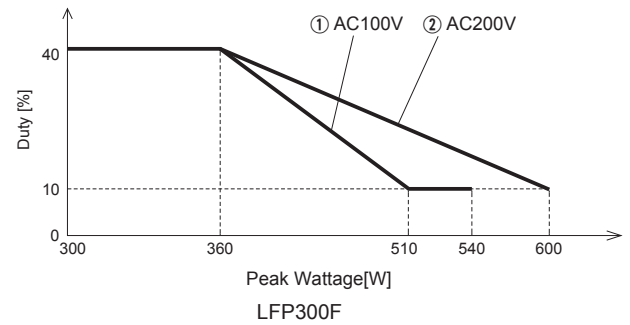
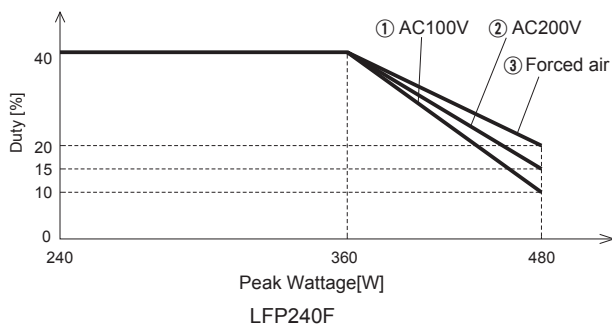
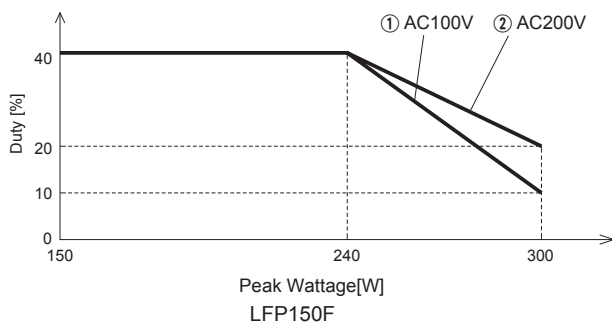
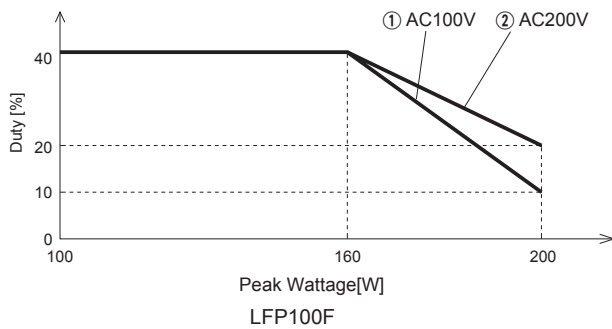


Fig.5.1 Derating of peak loading

6 Option and Others

6.1 Outline of option

● -C

- Option -C units have coated internal PCB for better moisture resistance.

● -G

- Option -G units are low leakage current type.
- Differences from standard versions are summarized in Table 6.1.

Table 6.1 Low leakage current type

Leakage Current (AC240V 60Hz)	0.15mA max
Conducted Noise	N/A
Output Ripple Noise	Please contact us for details about Ripple Noise

* This is the value that measured on measuring board with capacitor of 22μF at 150mm from output connector.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN:RM-103).

● -J (LFP300F)

- Option -J units, the input and output connector are changed to EP connectors (Mfr. Tyco Electronics).
- The appearance in option -J units is different from the standard units. Please contact us about the detail.

● -J1

- Option -J1 units, the Input and Output connector is VH connectors (Mfr. J.S.T.).
- LFP300F appearance of option -J1 units is different from the standard appearance. Please contact us about the detail.

● -S · -SN

- S indicates a type with chassis, and -SN indicates a type with chassis and cover (Refer to external view).
Please contact us about the detail of derating curve.
- Please contact us about the detail of LFP300F.

● -SNF (LFP300F-24-TY)

- In option -SNF, the cover, chassis and cooling fan are added.
- The appearance of option -J and -J1 units is different from the of standard appearance. Please contact us about the detail.
- Oil and other chemical liquid splashing environment may cause the performance degradation and failure.

● -R

- You can control output ON/OFF remotely in Option -R units. To do so, connect an external DC power supply and apply a voltage to a remote ON/OFF connector, which is available as option.

Model Name	Built-in Resistor Ri [Ω]	Voltage between RC (+) and RC (-) [V]		Input Current [mA]
		Output ON	Output OFF	
LFP100F, LFP150F LFP240F, LFP300F	780	4.5 - 12.5	0 - 0.5	20max

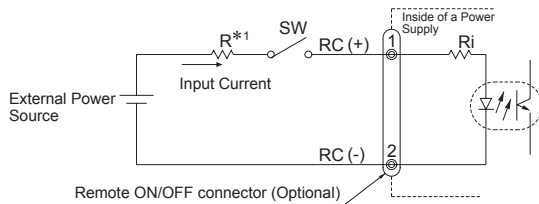


Fig.6.1 Example of using a remote ON/OFF circuit

- Dedicated harnesses are available for your purchase. Please see Optional Parts for details.

*1 If the output of an external power supply is within the range of 4.5 - 12.5V, you do not need a current limiting resistor R. If the output exceeds 12.5V, however, please connect the current limiting resistor R.

To calculate a current limiting resistance value, please use the following equation.

$$R[\Omega] = \frac{V_{cc} - (1.1 + R_i \times 0.005)}{0.005}$$

* Please wire carefully. If you wire wrongly, the internal components of a unit may be damaged.

■ Remote ON/OFF circuits (RC+ and RC-) are isolated from input, output and FG.

● -R2

- The usage is the same as option -R, please refer to Option -R.
- Reducing standby power is possible by OFF signal of the remote control.
- Start up time by ON signal in remote control is 350ms(typ).
- The latch condition in overvoltage protection is removed by toggling ON/OFF signal of remote control.
- Standby power

LFP100F, LFP150F, LFP240F
0.2Wtyp (AC100V), 0.7Wtyp (AC200V)
LFP300F
0.25Wtyp (AC100V), 1.1Wtyp (AC200V)

● -T (LFP240F, LFP300F)

- Option -T units have vertically positioned screws on a terminal block.
- Please contact us for details about appearance.

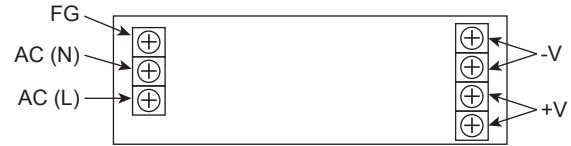


Fig.6.2 Example of option -T

■ The screw can be held to terminal block by inserting and lifting the screwdriver from the side of terminal block.

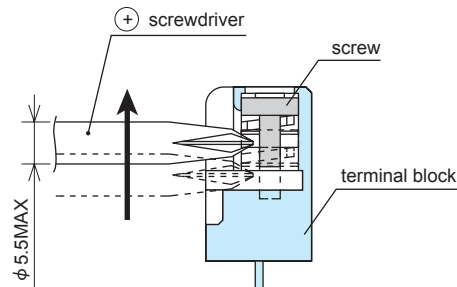


Fig.6.3 lifting method

● -T1 (LFP300F)

- Option -T1 units have horizontally positioned screws on a terminal block.
- Please contact us for details about appearance.

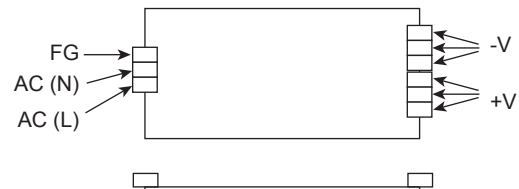


Fig.6.4 Example of option -T1

● -U1 (LFP240F, LFP300F)

■ By connecting the external capacitor unit CR-HUT(optional parts), Hold-up time is extensible.

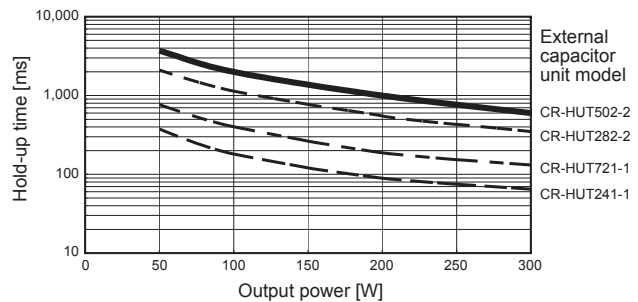


Fig.6.5 Hold-up time by LFP240F-□U1Y(Reference data).

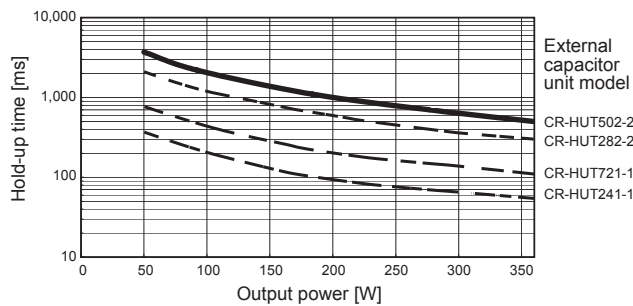


Fig.6.6 Hold-up time by LFP300F-□-TU1Y(Reference data).

■ Connection method

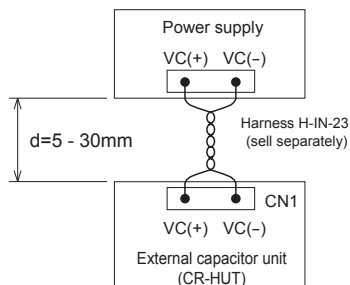


Fig.6.7 Connection method

● Caution

- (1) Distance between the external capacitor unit and power supply unit must be secured more than 5mm.
- (2) It must be 30mm or less, since the noise is generated from the wire which is connecting the external capacitor unit and power supply. And, it is necessary to twist the wire as short as possible.
- (3) It is necessary to use wires which rated voltage is 600V or more.
- (4) It must be used with the external capacitor unit (CR-HUT).
- (5) For more information about the external capacitor unit and harness, please refer to the page to optional parts.

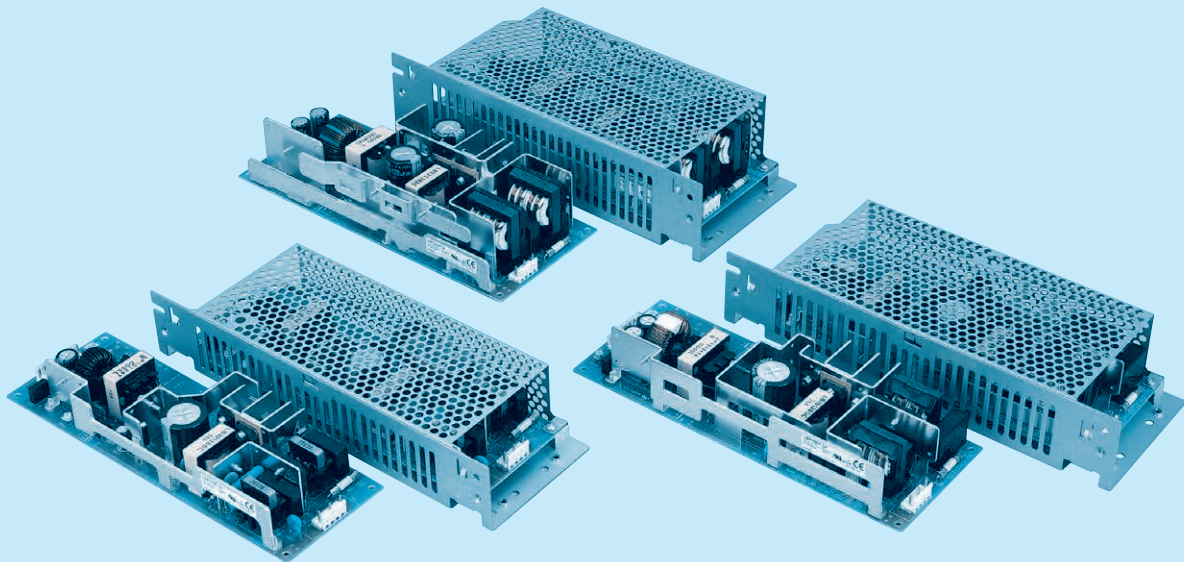
6.2 Others

- This power supply is the rugged PCB type. Do not drop conductive objects in the power supply.
- At light load, there remains high voltage inside the power supply for a few minutes after power OFF.
So, at maintenance, take care about electric shock.
- This power supply is manufactured by SMD technology. The stress to PCB like twisting or bending causes the defect of the unit, so handle the unit with care.
 - Tighten all the screws in the screw hole.
 - Install it so that PCB may become parallel to the clamp face.
 - Avoid the impact such as drops.
- While turning on the electricity, and for a while after turning off, please don't touch the inside of a power supply because there are some hot parts in that.
- When a mass capacitor is connected with the output terminal (load side), the output might become the stop or an unstable operation. Please contact us for details when you connect the capacitor.



LEP-series

LEP



Feature

High power & peak power
Rugged PCB type (CEM)
Harmonic attenuator (Complies with IEC61000-3-2)
Universal input voltage (AC85 - 264V)
Remote ON/OFF (Option)

Safety agency approvals

UL60950-1, C-UL(CSA60950-1) recognized, TÜV approved
Complies with DEN-AN

EMI

Complies with FCC-B, CISPR22-B, EN55022-B, VCCI-B

2-year warranty

Optional parts

Chassis and cover, harness (refer to page of option parts)

CE marking

Low Voltage Directive

EMS Compliance : EN61204-3, EN61000-6-2

EN55022-B
EN61000-3-2
EN61000-4-2
EN61000-4-3
EN61000-4-4
EN61000-4-5
EN61000-4-6
EN61000-4-8
EN61000-4-11

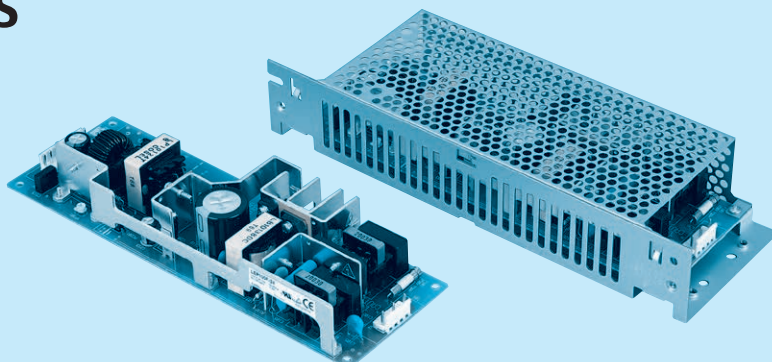
LEP100F

LEP 100 F -24 -□

① ② ③ ④ ⑤



RoHS



Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
 - ② Output wattage
 - ③ Universal input
 - ④ Output voltage
 - ⑤ Optional *1 *6
- G : Low leakage current
R : with Remote ON/OFF
S : with Chassis
SN : with Chassis & cover
T : Vertical terminal block
U : Operating stop voltage is set at a lower value
Z : with ZT

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LEP100F-24	LEP100F-36	LEP100F-48
DC OUTPUT	+24V 4.2(Peak 7)A	+36V 2.8(Peak 4.7)A	+48V 2.1(Peak 3.5)A

SPECIFICATIONS

	MODEL	LEP100F-24	LEP100F-36	LEP100F-48	
INPUT	VOLTAGE[V]	AC85 - 264 1 ϕ or DC 120 - 370			
	CURRENT[A]	ACIN 100V	1.4typ (Io=100%)		
		ACIN 200V	0.7typ (Io=100%)		
	FREQUENCY[Hz]	50/60 (47 - 63) or DC			
	EFFICIENCY[%]	ACIN 100V	81typ (Io=100%)	82typ (Io=100%)	83typ (Io=100%)
		ACIN 200V	84typ (Io=100%)	85typ (Io=100%)	85typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.98typ (Io=100%)		
		ACIN 200V	0.93typ (Io=100%)		
INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25℃)			
	ACIN 200V	30typ (Io=100%) (At cold start) (Ta=25℃)			
	LEAKAGE CURRENT[ma]	0.75max (60Hz, According to IEC60950 and DEN-AN)			
OUTPUT	VOLTAGE[V]	+24	+36	+48	
	CURRENT[A]	*2 0 - 4.2 (Peak 7)	0 - 2.8 (Peak 4.7)	0 - 2.1 (Peak 3.5)	
	WATTAGE[W]	100.8 (Peak 168)	100.8 (Peak 169.2)	100.8 (Peak 168)	
	LINE REGULATION[mV]	48max	48max	48max	
	LOAD REGULATION[mV]	76max	90max	150max	
	RIPPLE[mVp-p]	0 to +50℃ *3	120max	120max	150max
		-10 - 0℃ *3	160max	160max	300max
	RIPPLE NOISE[mVp-p]	0 to +50℃ *3	150max	150max	250max
		-10 - 0℃ *3	180max	180max	350max
	TEMPERATURE REGULATION[mV]	0 to +50℃	120max	150max	240max
		-10 to +50℃	145max	180max	300max
	DRIFT[mV]	*4 48max	48max	48max	
	START-UP TIME[ms]	500max (ACIN 100V, Io=100%)			
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)			
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	21.4 - 26.4	26.4 - 39.6	39.6 - 52.8	
OUTPUT VOLTAGE SETTING[V]	23.0 - 25.0	35.0 - 37.0	46.0 - 50.0		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 101% of peak current and recovers automatically			
	OVERVOLTAGE PROTECTION	Works at 115 - 140% of rating			
	REMOTE ON/OFF	Option (Refer to Instruction Manual)			
ISOLATION	INPUT-OUTPUT · RC	*5 AC3.000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)			
	INPUT-FG	AC2.000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)			
	OUTPUT · RC-FG	*5 AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (At Room Temperature)			
	OUTPUT-RC	*5 AC100V 1minute, Cutoff current = 100mA, DC100V 10M Ω min (At Room Temperature)			
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +70℃, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max			
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max			
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis			
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis			
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN60065, EN50178 Complies with DEN-AN and IEC60950-1 (At only AC input)			
	CONDUCTED NOISE	Complies with FCC-B, CISPR22-B, EN55022-B, VCCI-B			
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 *7			
OTHERS	CASE SIZE/WEIGHT	75 x 35 x 222mm [2.95 x 1.38 x 8.74 inches] (W x H x D) /380g max (with chassis & cover : 650g max)			
	COOLING METHOD	Convection			

*1 Specification is changed at option, refer to Instruction Manual 6.

*2 Peak loading for 10sec. And Duty 35% max, refer to Instruction Manual 5. In detail.

*3 This is the value that measured on measuring board with capacitor of 22 μ F within 150mm from output terminal. Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM101).

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*5 Applicable when remote control (optional) is added.

*6 Please contact us about safety approvals for the model with option.

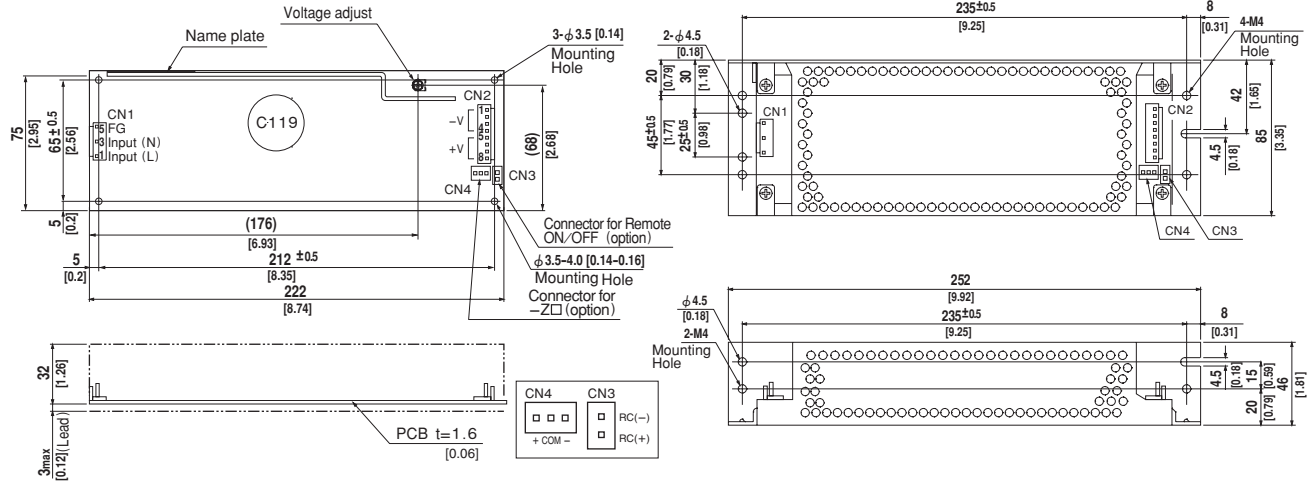
*7 Please contact us about class C.

* Parallel operation with other model is not possible.

* Derating is required when operated with chassis and cover.

* A sound may occur from power supply at peak loading.

External view



LEP

I / O Connector	Mating Connector	Terminal
CN1	B3P5-VH	VHR-5N
		Chain: SVH-21T-P1.1
		Loose: BVH-21T-P1.1
CN2	B8P-VH	VHR-8N
		Chain: SVH-21T-P1.1
		Loose: BVH-21T-P1.1
CN3 (Option)	B2B-XH-A	XHP-2
		Chain: SXH-001T-P0.6
		Loose: BXH-001T-P0.6
CN4 (Option)	B3B-XH-A	XHP-3
		Chain: SXH-001T-P0.6
		Loose: BXH-001T-P0.6

(Mfr: J.S.T.)

CN1

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

(PIN CONNECTION)

CN2

Pin No.	Output
1, 2, 3, 4	-V
5, 6, 7, 8	+V

CN3 (Option)

Pin No.	Remote ON/OFF
1	RC(+)
2	RC(-)

CN4 (Option)

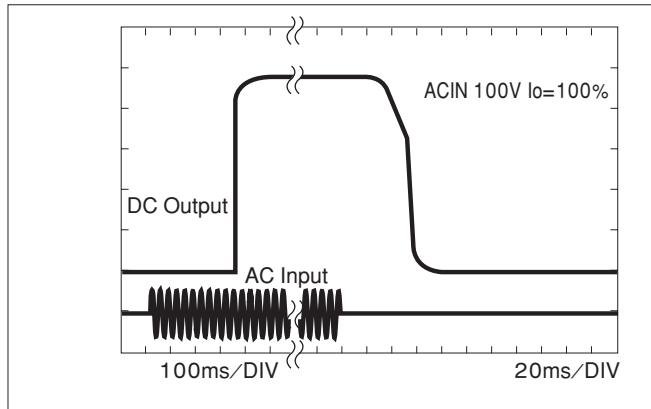
Pin No.	-Z □
1	+
2	COM
3	-

- ※Weight: 380g max
(with chassis & cover : 650g max)
- ※Tolerance: ± 1 [± 0.04]
- ※Dimensions in mm, []=inches
- ※PCB Material : CEM3
- ※Chassis and cover is optional.
- ※Mounting torque: 1.5N · m(16kgf · cm)max

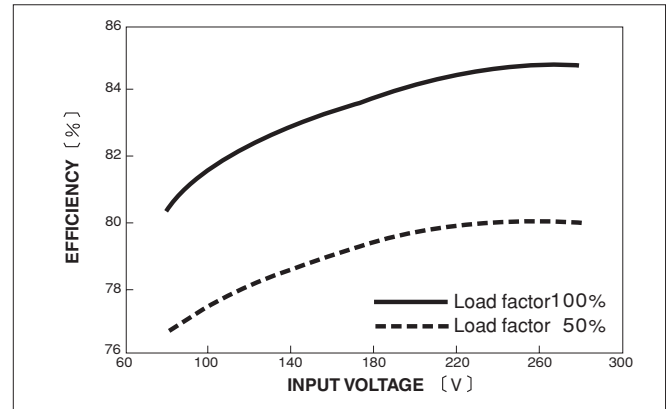
※Keep drawing current per pin below 5A(7A at peak load)for CN2

Performance data

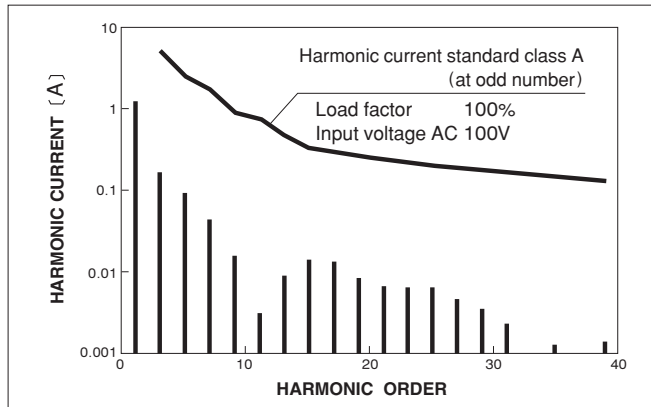
RISE TIME & FALL TIME (LEP100F-24)



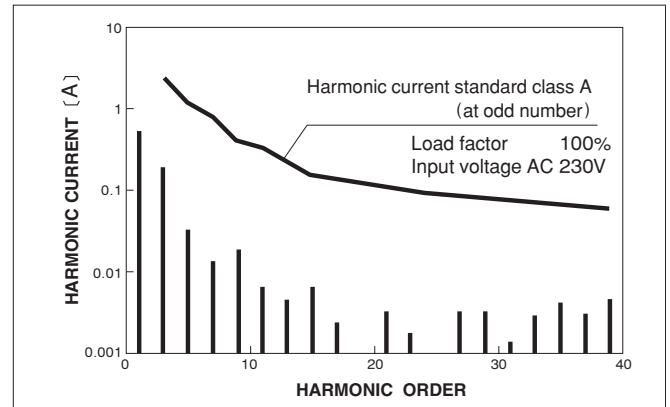
EFFICIENCY (LEP100F-24)



INPUT HARMONIC CURRENT (LEP100F-24)



INPUT HARMONIC CURRENT (LEP100F-24)



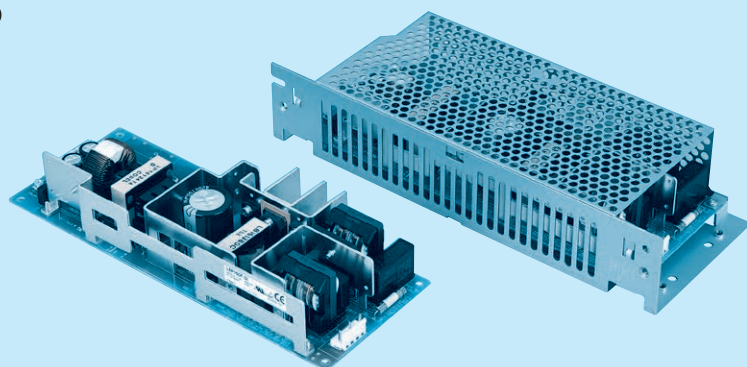
LEP150F

LEP 150 F -24 -□

① ② ③ ④ ⑤



LEP


**Example recommended EMI/EMC filter
NAC-06-472**


High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Output wattage
③ Universal input
④ Output voltage
⑤ Optional *1 *6
G : Low leakage current
R : with Remote ON/OFF
S : with Chassis
SN : with Chassis & cover
T : Vertical terminal block
U : Operating stop voltage
is set at a lower value
Z : with ZT

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LEP150F-24	LEP150F-36	LEP150F-48
DC OUTPUT	+24V 6.3(Peak 12)A	+36V 4.2(Peak 8)A	+48V 3.2(Peak 6)A

SPECIFICATIONS

	MODEL	LEP150F-24	LEP150F-36	LEP150F-48	
INPUT	VOLTAGE[V]	AC85 - 264 1 φ or DC 120 - 370			
	CURRENT[A]	ACIN 100V	2.0typ (Io=100%)		
		ACIN 200V	1.0typ (Io=100%)		
	FREQUENCY[Hz]	50/60 (47 - 63) or DC			
	EFFICIENCY[%]	ACIN 100V	82typ (Io=100%)	83typ (Io=100%)	84typ (Io=100%)
		ACIN 200V	85typ (Io=100%)	86typ (Io=100%)	87typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.98typ (Io=100%)		
		ACIN 200V	0.93typ (Io=100%)		
INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25℃)			
	ACIN 200V	30typ (Io=100%) (At cold start) (Ta=25℃)			
	LEAKAGE CURRENT[ma]	0.75max (60Hz, According to IEC60950 and DEN-AN)			
OUTPUT	VOLTAGE[V]	+24	+36	+48	
	CURRENT[A]	*2 0 - 6.3 (Peak 12)	0 - 4.2 (Peak 8)	0 - 3.2 (Peak 6)	
	WATTAGE[W]	151.2 (Peak 288)	151.2 (Peak 288)	153.6 (Peak 288)	
	LINE REGULATION[mV]	48max	48max	48max	
	LOAD REGULATION[mV]	76max	90max	150max	
	RIPPLE[mVp-p]	0 to +45℃ *3	120max	120max	150max
		-10 - 0℃ *3	160max	160max	300max
	RIPPLE NOISE[mVp-p]	0 to +45℃ *3	150max	150max	250max
		-10 - 0℃ *3	180max	180max	350max
	TEMPERATURE REGULATION[mV]	0 to +45℃	120max	150max	240max
		-10 to +45℃	145max	180max	300max
	DRIFT[mV]	*4 48max	48max	48max	
	START-UP TIME[ms]	500max (ACIN 100V, Io=100%)			
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)			
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	21.4 - 26.4	26.4 - 39.6	39.6 - 52.8	
OUTPUT VOLTAGE SETTING[V]	23.0 - 25.0	35.0 - 37.0	46.0 - 50.0		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 101% of peak current and recovers automatically			
	OVERVOLTAGE PROTECTION	Works at 115 - 140% of rating			
	REMOTE ON/OFF	Option (Refer to Instruction Manual)			
ISOLATION	INPUT-OUTPUT · RC	*5 AC3.000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)			
	INPUT-FG	AC2.000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)			
	OUTPUT · RC-FG	*5 AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)			
	OUTPUT-RC	*5 AC100V 1minute, Cutoff current = 100mA, DC100V 10MΩ min (At Room Temperature)			
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +70℃, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max			
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max			
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis			
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis			
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN60065, EN50178 Complies with DEN-AN and IEC60950-1 (At only AC input)			
	CONDUCTED NOISE	Complies with FCC-B, CISPR22-B, EN55022-B, VCCI-B			
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 *7			
OTHERS	CASE SIZE/WEIGHT	85 x 40 x 222mm [3.35 x 1.57 x 8.74 inches] (W x H x D) /490g max (with chassis & cover : 830g max)			
	COOLING METHOD	Convection			

*1 Specification is changed at option, refer to Instruction Manual 6.

*2 Peak loading for 10sec. And Duty 35% max, refer to Instruction Manual 5. In detail.

*3 This is the value that measured on measuring board with capacitor of 22 μF within 150mm from output terminal. Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM101).

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*5 Applicable when remote control (optional) is added.

*6 Please contact us about safety approvals for the model with option.

*7 Please contact us about class C.

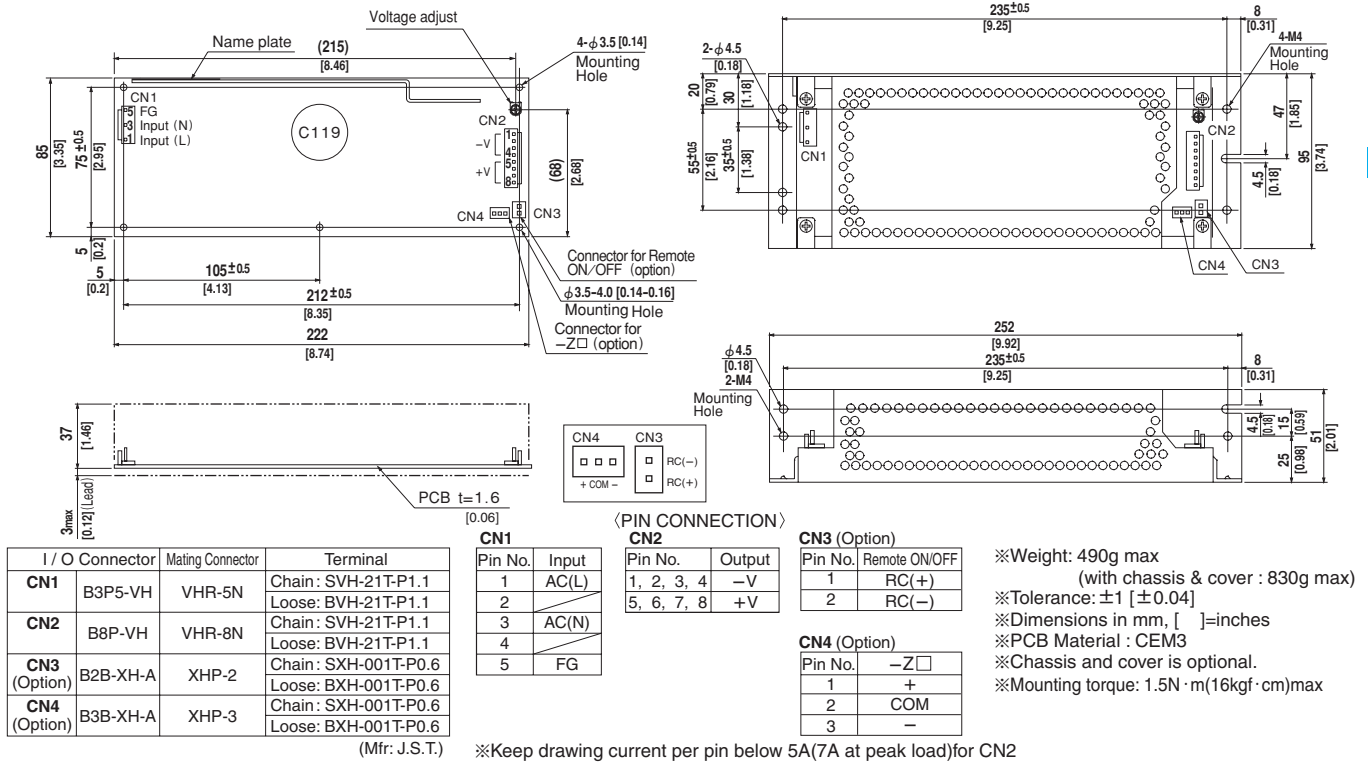
* Parallel operation with other model is not possible.

* Derating is required when operated with chassis and cover.

* A sound may occur from power supply at peak loading.

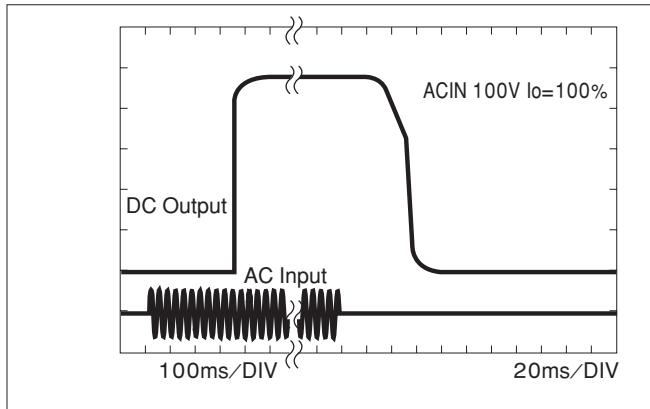
External view

LEP

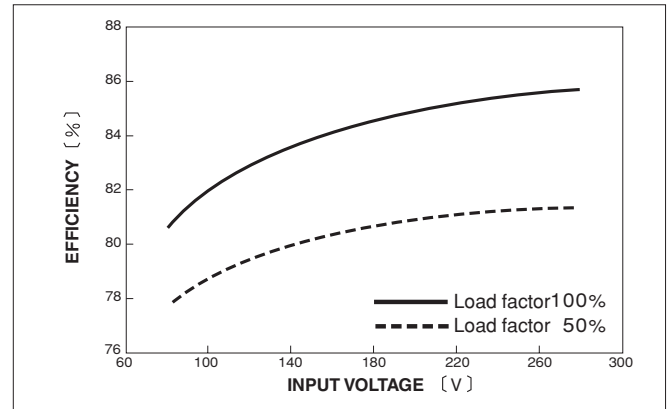


Performance data

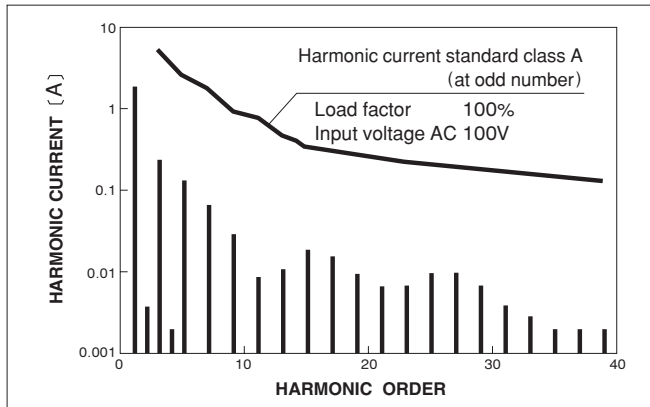
RISE TIME & FALL TIME (LEP150F-24)



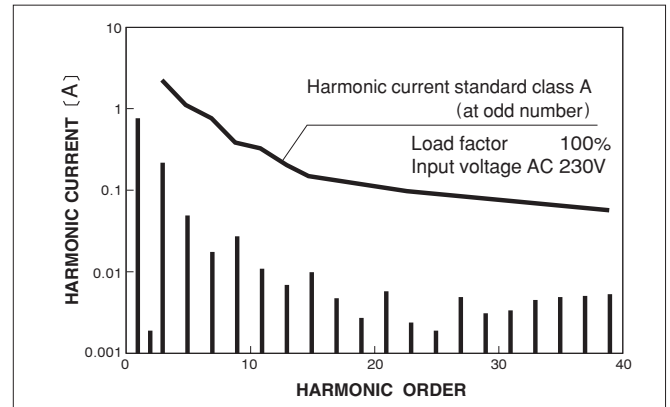
EFFICIENCY (LEP150F-24)



INPUT HARMONIC CURRENT (LEP150F-24)



INPUT HARMONIC CURRENT (LEP150F-24)



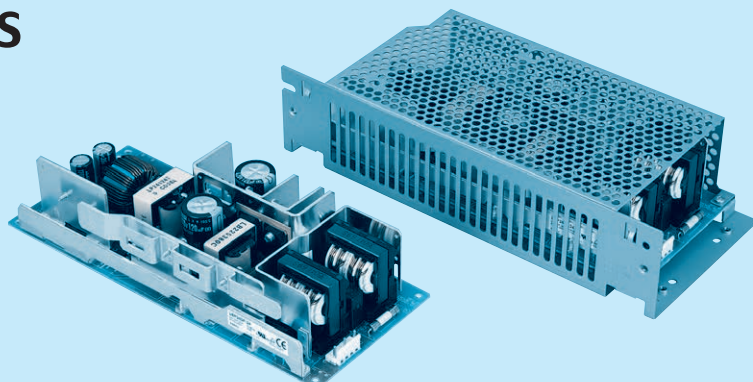
LEP240F

LEP 240 F -24 -□

① ② ③ ④ ⑤



RoHS



Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
 - ② Output wattage
 - ③ Universal input
 - ④ Output voltage
 - ⑤ Optional *1 *6
- G : Low leakage current
R : with Remote ON/OFF
S : with Chassis
SN : with Chassis & cover
T : Vertical terminal block
U : Operating stop voltage
is set at a lower value
Z : with ZT

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LEP240F-24	LEP240F-36	LEP240F-48
DC OUTPUT	+24V 10(Peak 20)A	+36V 6.7(Peak 13.4)A	+48V 5(Peak 10)A

SPECIFICATIONS

	MODEL	LEP240F-24	LEP240F-36	LEP240F-48	
INPUT	VOLTAGE[V]	AC85 - 264 1 φ or DC 120 - 370			
	CURRENT[A]	ACIN 100V	3.3typ (Io=100%)		
		ACIN 200V	1.7typ (Io=100%)		
	FREQUENCY[Hz]	50/60 (47 - 63) or DC			
	EFFICIENCY[%]	ACIN 100V	83typ (Io=100%)	84typ (Io=100%)	84typ (Io=100%)
		ACIN 200V	86typ (Io=100%)	87typ (Io=100%)	87typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.98typ (Io=100%)		
		ACIN 200V	0.93typ (Io=100%)		
INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (More than 3sec.to re-start)			
	ACIN 200V	30typ (Io=100%) (More than 3sec.to re-start)			
	LEAKAGE CURRENT[ma]	0.75max (60Hz, According to IEC60950 and DEN-AN)			
OUTPUT	VOLTAGE[V]	+24	+36	+48	
	CURRENT[A]	*2 0 - 10 (Peak 20)	0 - 6.7 (Peak 13.4)	0 - 5 (Peak 10)	
	WATTAGE[W]	240.0 (Peak 480)	241.2 (Peak 482.4)	240.0 (Peak 480)	
	LINE REGULATION[mV]	48max	48max	48max	
	LOAD REGULATION[mV]	76max	90max	150max	
	RIPPLE[mVp-p]	0 to +40℃ *3	120max	120max	150max
		-10 - 0℃ *3	160max	160max	300max
	RIPPLE NOISE[mVp-p]	0 to +40℃ *3	150max	150max	250max
		-10 - 0℃ *3	180max	180max	350max
	TEMPERATURE REGULATION[mV]	0 to +40℃	120max	150max	240max
		-10 to +40℃	145max	180max	300max
	DRIFT[mV]	*4 48max	48max	48max	
	START-UP TIME[ms]	500max (ACIN 100V, Io=100%)			
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)			
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	21.4 - 26.4	26.4 - 39.6	39.6 - 52.8		
OUTPUT VOLTAGE SETTING[V]	23.0 - 25.0	35.0 - 37.0	46.0 - 50.0		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 101% of peak current and recovers automatically			
	OVERVOLTAGE PROTECTION	Works at 115 - 140% of rating			
	REMOTE ON/OFF	Option (Refer to Instruction Manual)			
ISOLATION	INPUT-OUTPUT · RC	*5 AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)			
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)			
	OUTPUT · RC-FG	*5 AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)			
	OUTPUT-RC	*5 AC100V 1minute, Cutoff current = 100mA, DC100V 10MΩ min (At Room Temperature)			
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-10 to +70℃, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max			
	STORAGE TEMP.,HUMID.AND ALTITUDE	-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max			
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis			
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis			
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN60065, EN50178 Complies with DEN-AN and IEC60950-1 (At only AC input)			
	CONDUCTED NOISE	Complies with FCC-B, CISPR22-B, EN55022-B, VCCI-B			
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 *7			
OTHERS	CASE SIZE/WEIGHT	95 x 45 x 222mm [3.74 x 1.77 x 8.74 inches] (W x H x D) /690g max (with chassis & cover : 1,070g max)			
	COOLING METHOD	Convection			

*1 Specification is changed at option, refer to Instruction Manual 6.

*2 Peak loading for 10sec. And Duty 35% max, refer to Instruction Manual 5. In detail.

*3 This is the value that measured on measuring board with capacitor of 22 μF within 150mm from output terminal.Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM101).

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*5 Applicable when remote control (optional) is added.

*6 Please contact us about safety approvals for the model with option.

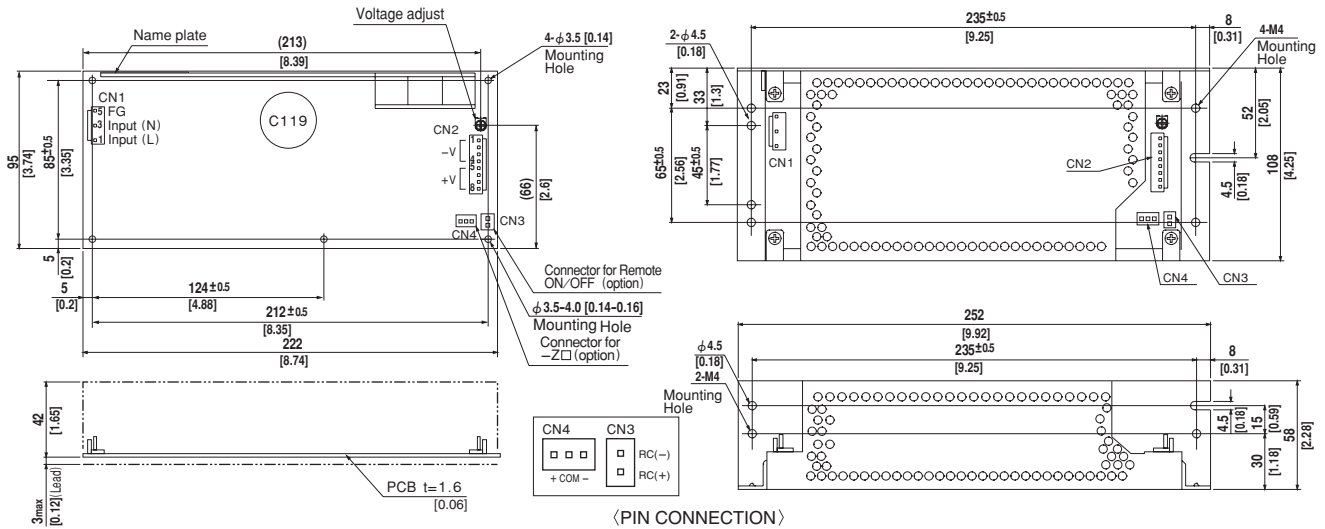
*7 Please contact us about class C.

* Parallel operation with other model is not possible.

* Derating is required when operated with chassis and cover.

* A sound may occur from power supply at peak loading.

External view



I / O Connector	Mating Connector	Terminal
CN1	B3P5-VH	VHR-5N
		Chain: SVH-21T-P1.1
		Loose: BVH-21T-P1.1
CN2	B8P-VH	VHR-8N
		Chain: SVH-21T-P1.1
		Loose: BVH-21T-P1.1
CN3 (Option)	B2B-XH-A	XHP-2
		Chain: SXH-001T-P0.6
		Loose: BXH-001T-P0.6
CN4 (Option)	B3B-XH-A	XHP-3
		Chain: SXH-001T-P0.6
		Loose: BXH-001T-P0.6

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

(PIN CONNECTION)

Pin No.	Output
1, 2, 3, 4	-V
5, 6, 7, 8	+V

Pin No.	Remote ON/OFF
1	RC(+)
2	RC(-)

Pin No.	-Z□
1	+
2	COM
3	-

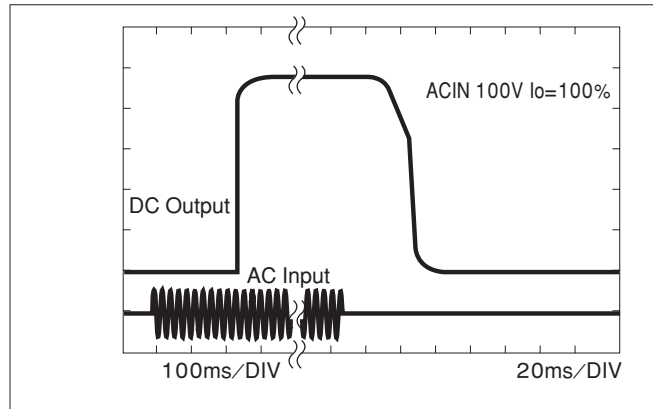
※Weight: 690g max
(with chassis & cover : 1,070g max)
※Tolerance: ±1 [±0.04]
※Dimensions in mm, []=inches
※PCB Material : CEM3
※Chassis and cover is optional.
※Mounting torque: 1.5N·m(16kgf·cm)max

(Mfr: J.S.T.)

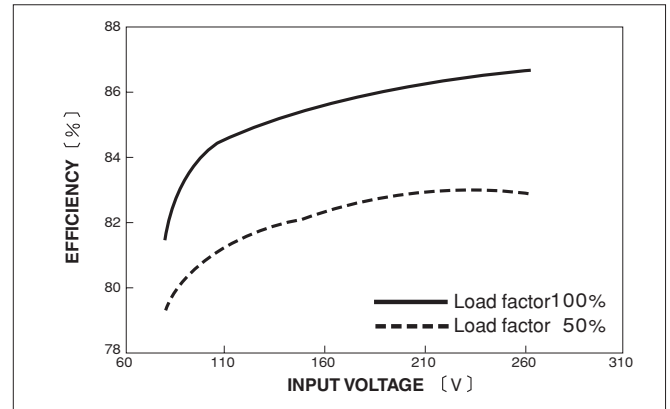
※Keep drawing current per pin below 5A(7A at peak load)for CN2

Performance data

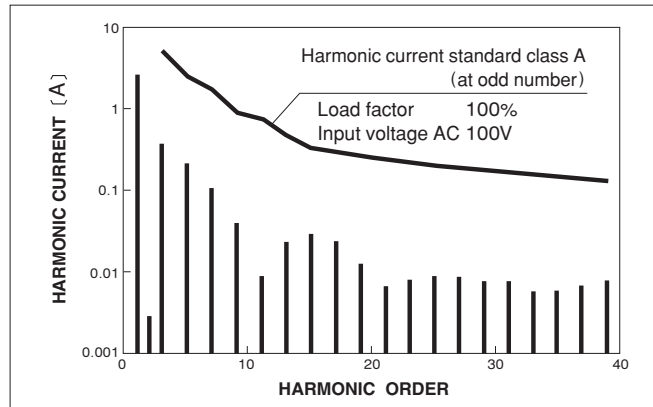
RISE TIME & FALL TIME (LEP240F-24)



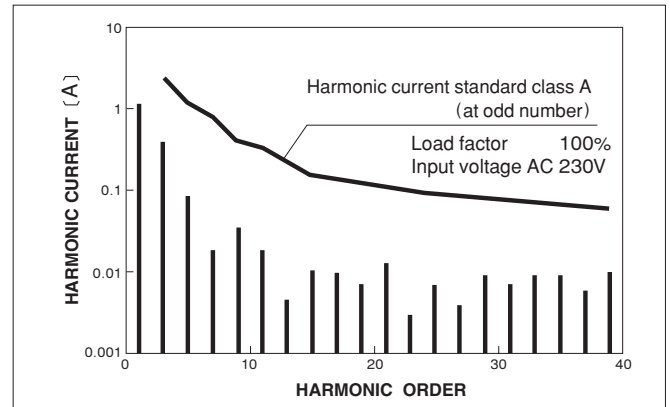
EFFICIENCY (LEP240F-24)



INPUT HARMONIC CURRENT (LEP240F-24)



INPUT HARMONIC CURRENT (LEP240F-24)



Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current *2 [A]	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
LEP100F	Active filter	80	1.4	250V 5A	Thermistor	CEM-3	Yes		Yes	*1
	Forward converter	120								
LEP150F	Active filter	80	2.0	250V 6.3A	Thermistor	CEM-3	Yes		Yes	*1
	Forward converter	130								
LEP240F	Active filter	80	3.3	250V 10A	SCR	CEM-3	Yes		Yes	*1
	Forward converter	120								

*1 Refer to Instruction Manual.

*2 The value of input current is at ACIN 100V and rated load.

1 Function LEP-10

- 1.1 Input voltage range LEP-10
- 1.2 Inrush current limiting LEP-10
- 1.3 Overcurrent protection LEP-10
- 1.4 Peakcurrent protection LEP-10
- 1.5 Overvoltage protection LEP-10
- 1.6 Output voltage adjustment range LEP-10
- 1.7 Isolation LEP-10

2 Series Operation and Parallel Operation LEP-11

3 Assembling and Installation Method LEP-11

- 3.1 Installation method LEP-11
- 3.2 Derating LEP-11
- 3.3 Mounting screw LEP-12

4 Ground LEP-13

5 Peak loading LEP-13

6 Option and others LEP-13

- 6.1 Outline of option LEP-13
- 6.2 Others LEP-14

1 Function

1.1 Input voltage range

- LEP** ■ The range is from 85 VAC to 264 VAC or 120 VDC to 370 VDC.
- In cases that conform with safety standard, input voltage range is AC100-AC240V(50/60Hz).
- AC input voltage must have a range from 85 VAC to 264 VAC for normal operation. If the wrong input is applied, the unit will not operate properly and/or may be damaged.
- In addition, it is possible to correspond Low input voltage or Instantaneous line drop (optional : -U). Consult with us.

1.2 Inrush current limiting

- Inrush current limiting is built-in.
- If a switch is being used for input, ensure that it is configured to handle the input inrush current.

● LEP100F · LEP150F

- The thermistor is used for protection from inrush current. When power is turned ON/OFF repeatedly within a short period of time, it is necessary to have enough time for power supply to cool down.

● LEP240F

- A thyristor is used for protection from inrush current. When turning the power OFF and then ON again within a short period of time, inrush current limiting may be disabled; therefore ensure enough time before switching ON.

1.3 Overcurrent protection

- Overcurrent protection is built-in and comes into effect at over 101% of the peak current in. Overcurrent protection prevents the unit from short circuit and overcurrent condition.
- The unit automatically recovers when the fault condition is cleared.

● Intermittent current characteristics

- When the output voltage drops more than 50% of the rated output voltage value at overcurrent, the average output current is reduced by intermittent operation of power supply.

1.4 Peakcurrent protection

- Peakcurrent protection is built-in (refer to Instruction Manual 5. for Peak loading).
- If this function comes into effect, the output is shut down.
- The minimum interval of AC recycling for recovery is 2 to 3 minutes (★).
- ★ The recovery time varies depending on input voltage and load condition.

1.5 Overvoltage protection

- Output
- Working overvoltage protection.
- Overvoltage protection is built-in and comes into effect at 115-140% of the rated voltage.
- The AC input should be shut down if overvoltage protection is in operation.
- The minimum interval of AC recycling for recovery is 2 to 3 minutes (★).
- ★ The recovery time varies depending on input voltage.

Remarks:

Please avoid applying the over-rated voltage to the output terminal. Power supply may operate incorrectly or fail. In case of operating a motor etc. , please install an external diode on the output terminal to protect the unit.

1.6 Output voltage adjustment range

- Adjustment of output voltage is possible by using potentiometer.
- Output voltage is increased by turning potentiometer clockwise and is decreased by turning potentiometer counterclockwise.

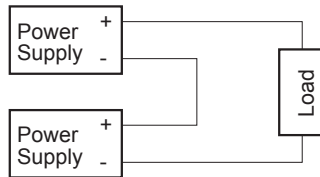
1.7 Isolation

- For a receiving inspection, such as Hi-Pot test gradually increase (decrease) the voltage for the start (shut down).
- Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.
- If the unit is tested on the isolation between input & output and output & FG, remote ON/OFF (option) must be shorted to outputs.

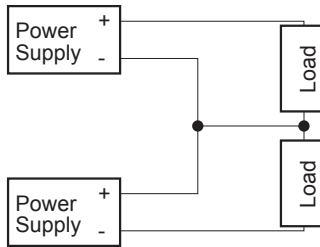
2 Series Operation and Parallel Operation

■ Series operation is available by connecting the outputs of two or more power supplies with the same output voltage, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

(a)

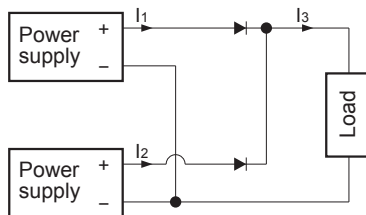


(b)



■ Parallel operation is not possible.

■ Redundancy operation is available by wiring as shown below.



■ Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .

Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

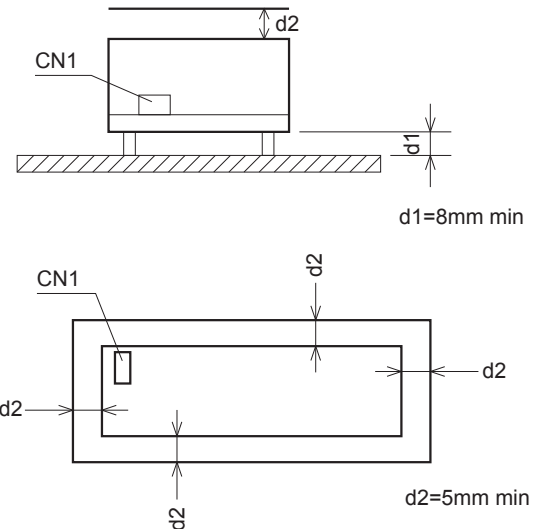
3 Assembling and Installation Method

LEP

3.1 Installation method

■ When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Ambient temperature around each power supply should not exceed the temperature range shown in derating curve.

■ If using a metal chassis, ensure a gap of $d1$ and $d2$ between the parts lead and the metal chassis for insulation. If the gap is smaller than $d1$ and $d2$, then ensure that insulation sheet is used between the power supply and the chassis in order to ensure insulation.



3.2 Derating

■ In the hatched area the specification of Ripple, Ripple Noise is different from other area.

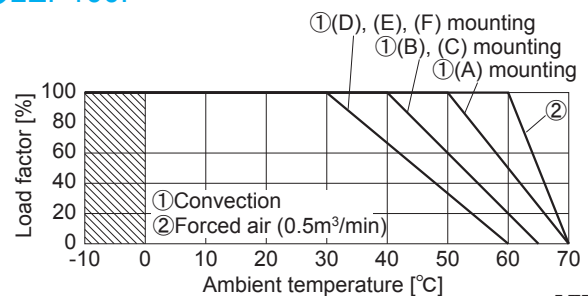
■ In case②, ventilation must keep the temperature of C119 below 85°C. See External View for the location of C119.

■ The operative ambient temperature is different by with/without case cover or mounting position.

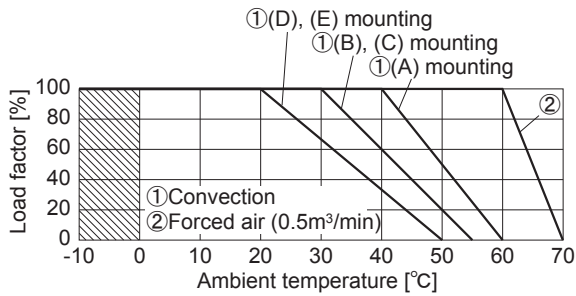
Please refer to drawings as below.

★ Please be careful of electric shock or earth leakage in case of temperature measurement, because C119 is live potential.

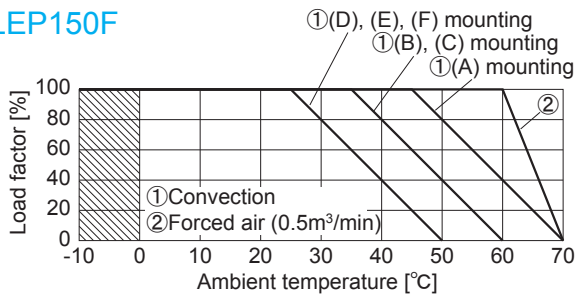
● LEP100F



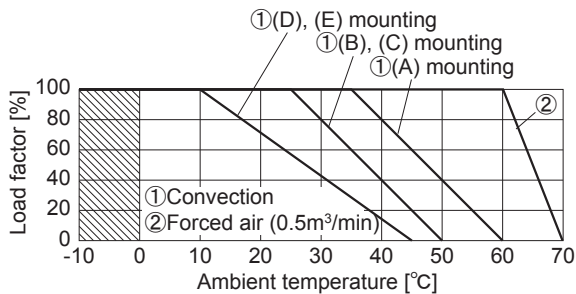
●LEP100F- □-SN (requirement: Min. 90 VAC)



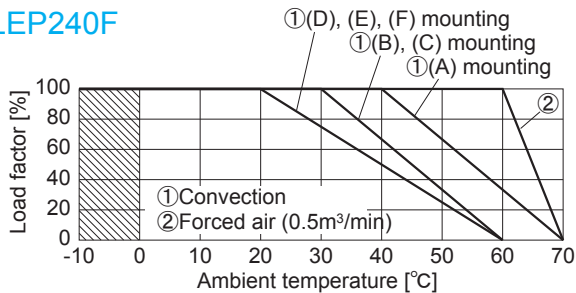
●LEP150F



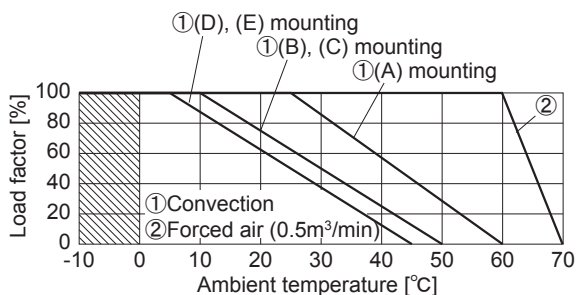
●LEP150F- □-SN (requirement: Min. 90 VAC)



●LEP240F



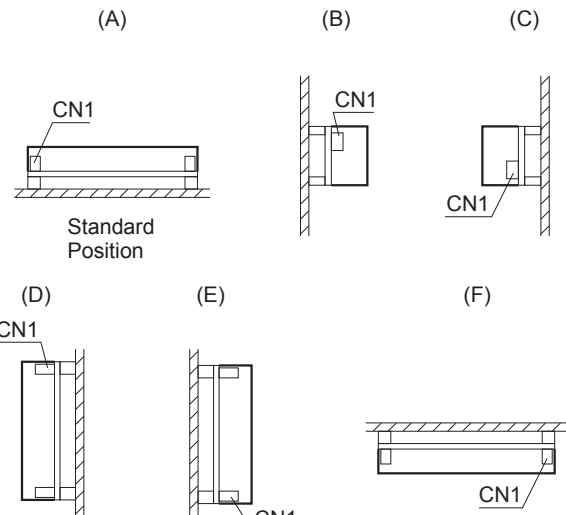
●LEP240F- □-SN (requirement: Min. 90 VAC)



■Use an input voltage of 90 VAC or more when using SN (with chassis cover). This has impaired convection; therefore usage of forced air cooling is recommended.

■When unit mounted except below drawings, it is required to consider ventilated environment by forced air cooling for temperature / load derating. For details, please consult our sales or engineering departments.

■(F) mounting is not possible when a case cover is used. If such mounting can not be avoided, then either forced air cooling to prevent buildup of heat, or temperature and load derating are necessary. For more details, please consult our engineering department.

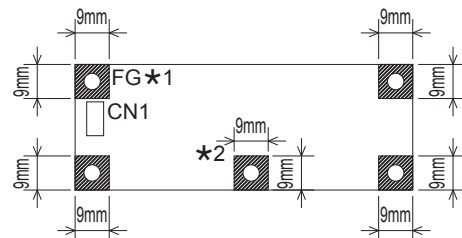


3.3 Mounting screw

■The mounting screw should be M3. The hatched area shows the allowance of metal parts for mounting.

■If metallic fittings are used on the component side of the board, ensure there is no contact with surface mounted components.

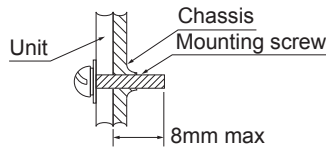
■Keep isolation distance between screw and internal components in case of option "-S", "-SN" as below chart.



★1 Recommendation to electrically connect FG to metal chassis for reducing noise.

★2 LEP150F and LEP240F only

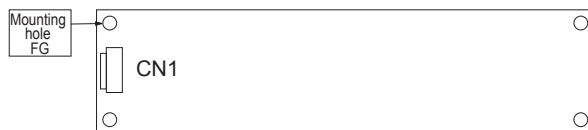
Refer to External view for location



4 Ground

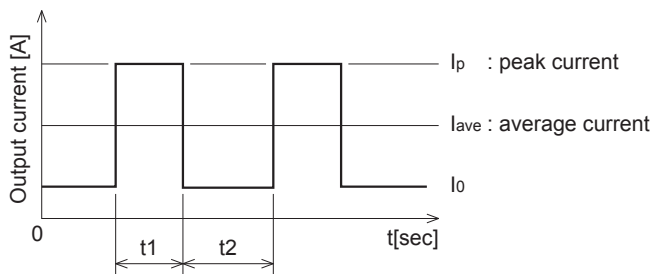
■When installing the power supply with your unit, ensure that the input FG terminal of CN1 or mounting hole FG is connected to safety ground of the unit.

However when applying the safety agency, connect the input FG terminal of CN1 to safety ground of the unit.



5 Peak loading

■Peak load is possible to draw as below.

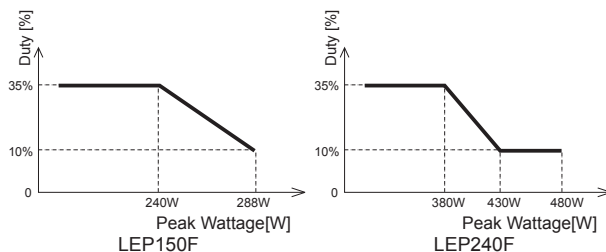


$$t_1 \leq 10 [\text{sec}], I_{\text{ave}} = \frac{I_p t_1 + I_o t_2}{t_1 + t_2} \leq \text{rated current},$$

$$\frac{t_1}{t_1 + t_2} \leq 0.35 \text{ (at LEP100F)}$$

$$\frac{t_1}{t_1 + t_2} \leq \text{Duty (at LEP150F, LEP240F)}$$

In case of LEP150F, LEP240F, Duty is depended on peak load, refer to below chart.



6 Option and others

6.1 Outline of option

●-G

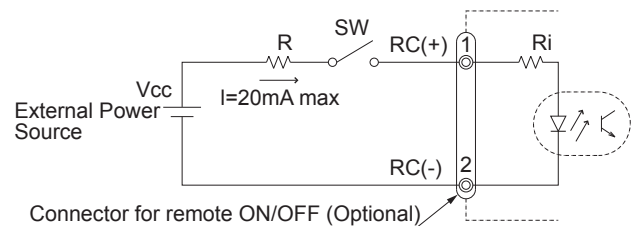
■Option "-G" means leakage current is smaller than standard model by reducing the value of earth capacitor at input filter circuit.

Leakage current	0.1mA max
Conducted noise	Not available

●-R

■Option "-R" is available for remote ON/OFF.

Between RC(+) and RC(-)	Output
SW ON (4.5 - 12.5V)	ON
SW OFF (0 - 0.5V)	OFF



■When external power source is in the range of 4.5 - 12.5V, current limit resistance R is not required. However, when external power source exceeds 12.5V, current limit resistance R must be connected.

To calculate the current limit resistance, use the following equation:

$$R[\Omega] = \frac{V_{cc} - (1.1 + R_i \times 0.005)}{0.005}$$

Where;

V_{cc} = External Power Source

R_i = The internal resistance (780Ω)

■A wrong connection may damage the internal components of the unit.

■Remote ON/OFF circuit (RC(+), RC(-)) is isolated from input, output and FG.

●-S · -SN

■-S indicates a type with chassis, and -SN indicates a type with chassis and cover. (Refer external diagram) Refer to "Derating Curves" in Section 3.2.

LEP

●-T

■Option "-T" means input and output interface are changed "Connector" to "Terminal block".



●-U

· Specifications for support of instantaneous voltage dips (low input voltage support).

Use condition

Input	AC50V(DC70V)	
	Duty 1s/30s	
Output	LEP100F	75W
	LEP150F	114W
	LEP240F	180W

★Avoid continuous use at low input voltage for more than 1 second, as such use can lead to damage to the power supply.

●-Z □

■Our ZT3 series product can be equipped as an option. Refer to the external diagram for the output interface. Refer to the full catalog for ZT specifications. ZT can be selected from the following.

Optional symbol	-Z31	-Z32	-Z33	-Z34	-Z35
Mounted Power supply	ZTS3 2405	ZTS3 2412	ZTS3 2415	ZTW3 2412	ZTW3 2415
Notice	Output voltage in LEP series is 24[V], 36[V].				
Optional symbol	-Z41	-Z42	-Z43	-Z44	-Z45
Mounted Power supply	ZTS3 4805	ZTS3 4812	ZTS3 4815	ZTW3 4812	ZTW3 4815
Notice	Output voltage in LEP series is 48[V].				

6.2 Others

■This power supply is the rugged PCB type. Do not drop conductive objects in the power supply.

■At light load, there remains high voltage inside the power supply for a few minutes after power OFF.

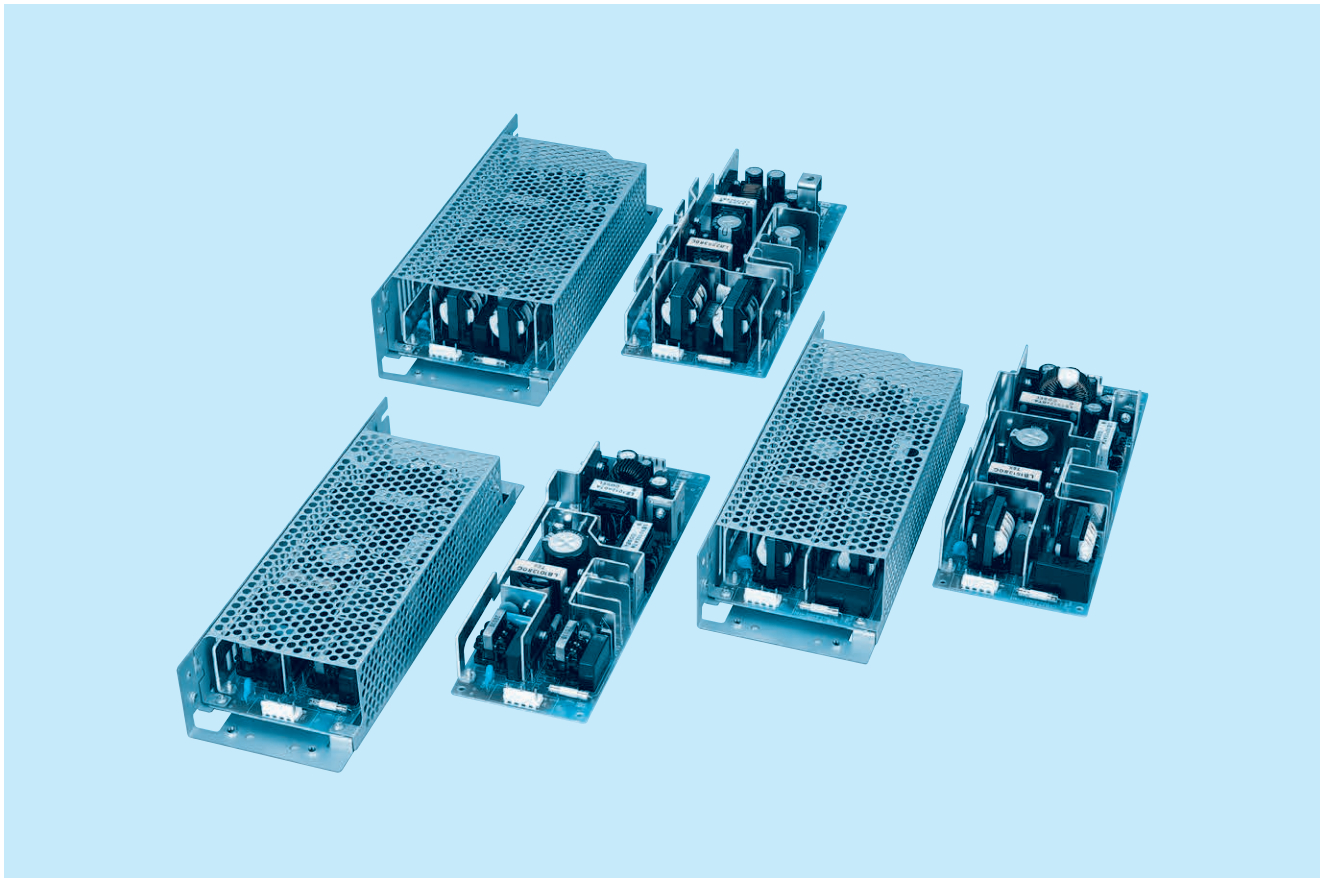
So, at maintenance, take care about electric shock.

■This power supply is manufactured by SMD technology. The stress to PCB like twisting or bending causes the defect of the unit, so handle the unit with care.



LEB-series

LEB



Feature

Rugged PCB type (CEM)
 Harmonic attenuator (Complies with IEC61000-3-2)
 Universal input voltage (AC85 - 264V)
 Remote ON/OFF (Option)

Safety agency approvals

UL60950-1, C-UL recognized, TÜV approved
 Complies with DEN-AN

EMI

Complies with FCC-B, CISPR22-B, EN55022-B, VCCI-B

2-year warranty

Optional parts

Optional parts	Model	Remarks
Chassis and cover	LEB100F, LEB150F, LEB225F	
Harness for-J type	LEB100F, LEB150F, LEB225F	Refer to page of optional parts

CE marking

Low Voltage Directive

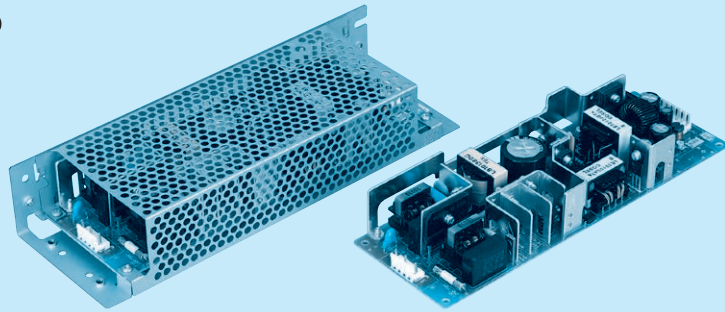
EMS Compliance : EN61204-3, EN61000-6-2

EN55022-B
 EN61000-3-2
 EN61000-4-2
 EN61000-4-3
 EN61000-4-4
 EN61000-4-5
 EN61000-4-6
 EN61000-4-8
 EN61000-4-11

LEB100F

LEB 100 F -05 24 -□

① ② ③ ④ ⑤ ⑥

Example recommended EMI/EMC filter
NAC-06-472

High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Output wattage
③ Universal input
④ V1 Output voltage
⑤ V2 Output voltage
⑥ Optional *1 *8
G : Low leakage current
R : with Remote ON/OFF
S : with Chassis
SN : with Chassis & cover
T : Vertical terminal block
Y : with Potentiometer
Z : with ZT

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LEB100F-0512	LEB100F-0324	LEB100F-0524	LEB100F-0530	LEB100F-0536
DC OUTPUT	V1	V1	V1	V1	V1
	V2	V2	V2	V2	V2

SPECIFICATIONS

INPUT	MODEL		LEB100F-0512		LEB100F-0324		LEB100F-0524		LEB100F-0530		LEB100F-0536		
	VOLTAGE[V]		AC85 - 264 1 φ or DC 120 - 370										
	CURRENT[A]		ACIN 100V	1.2typ (Io=100%)	1.4typ (Io=100%)								
			ACIN 200V	0.6typ (Io=100%)	0.7typ (Io=100%)								
	FREQUENCY[Hz]		50/60 (47 - 63) or DC										
	EFFICIENCY[%]		ACIN 100V	74typ (Io=100%)	78typ (Io=100%)	78typ (Io=100%)		78typ (Io=100%)		78typ (Io=100%)			
			ACIN 200V	76typ (Io=100%)	80typ (Io=100%)	80typ (Io=100%)		80typ (Io=100%)		80typ (Io=100%)			
	POWER FACTOR		ACIN 100V	0.98typ	0.99typ								
			ACIN 200V	0.93typ									
	INRUSH CURRENT[A]		ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25℃)									
ACIN 200V			30typ (Io=100%) (At cold start) (Ta=25℃)										
LEAKAGE CURRENT[mA]		0.75max (60Hz, According to IEC60950 and DEN-AN)											
OUTPUT	VOLTAGE[V]		+5	+12	+3.3	+24	+5	+24	+5	+30	+5	+36	
	CURRENT[A]		*2 0 - 5	0 - 5 (Peak 10)	0 - 5	0 - 4 (Peak 7)	0 - 5	0 - 4 (Peak 7)	0 - 5	0 - 3.2 (Peak 5.6)	0 - 5	0 - 2.7 (Peak 4.7)	
	TOTAL OUTPUT WATTAGE[W]		*3 85 (Peak 145)		100 (Peak 172)		100 (Peak 172)		100 (Peak 172)		100 (Peak 172)		
	LINE REGULATION[mV]		20max	48max	20max	96max	20max	96max	20max	120max	20max	144max	
	LOAD REGULATION[mV]		40max	100max	40max	150max	40max	150max	40max	180max	40max	180max	
	RIPPLE[mVp-p]		0 to +50℃ *4	80max	120max	80max	120max	80max	120max	80max	200max	80max	200max
			-10 - 0℃ *4	140max	160max	140max	160max	140max	160max	140max	240max	140max	240max
	RIPPLE NOISE[mVp-p]		0 to +50℃ *4	120max	150max	120max	150max	120max	150max	120max	300max	120max	300max
			-10 - 0℃ *4	160max	180max	160max	180max	160max	180max	160max	360max	160max	360max
	TEMPERATURE REGULATION[mV]		0 to +50℃	50max	120max	50max	240max	50max	240max	50max	300max	50max	300max
			-10 to +50℃	60max	150max	60max	290max	60max	290max	60max	350max	60max	350max
	DRIFT[mV]		*5 20max	48max	20max	96max	20max	96max	20max	120max	20max	144max	
	START-UP TIME[ms]		*6 250max	500max	250max	500max	250max	500max	250max	500max	250max	500max	
	HOLD-UP TIME[ms]		*6 40typ	20typ	40typ	20typ	40typ	20typ	40typ	20typ	40typ	20typ	
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		4.5 - 5.5	Fixed	2.85 - 3.60	Fixed	4.5 - 5.5	Fixed	4.5 - 5.5	Fixed	4.5 - 5.5	Fixed	
OUTPUT VOLTAGE SETTING[V]		—	11.5 - 12.5	—	23.0 - 25.0	—	23.0 - 25.0	—	28.7 - 31.5	—	34.5 - 37.5		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		V1	Works over 105% of rating current and recovers automatically									
			V2	Works over 101% of peak current and recovers automatically									
	OVERVOLTAGE PROTECTION		V1	Works over 115% of rating, by zener diode clamping									
			V2	Works at 115 - 140% of rating									
		REMOTE ON/OFF		Option (Refer to Instruction Manual)									
ISOLATION	INPUT-OUTPUT · RC		*7 AC3.000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)										
	INPUT-FG		AC2.000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)										
	OUTPUT · RC-FG		*7 AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)										
	OUTPUT-OUTPUT(V1 · RC-V2)		*7 AC100V 1minute, Cutoff current = 100mA, DC100V 10MΩ min (At Room Temperature)										
ENVIRONMENT	OPERATING TEMP,HUMID.AND ALTITUDE		-10 to +70℃, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max										
	STORAGE TEMP,HUMID.AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max										
	VIBRATION		10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis										
	IMPACT		196.1m/s ² (20G), 11ms, once each X, Y and Z axis										
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL, EN60950-1, EN50178 Complies with DEN-AN and IEC60950-1 (At only AC input)										
	CONDUCTED NOISE		Complies with FCC-B, CISPR22-B, EN55022-B, VCCI-B										
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 *9										
OTHERS	CASE SIZE/WEIGHT		75 x 35 x 222mm [2.95 x 1.38 x 8.74 inches] (W x H x D) /420g max (with chassis & cover : 690g max)										
	COOLING METHOD		Convection										

*1 Specification is changed at option, refer to Instruction Manual 5.

*2 Peak loading for 10sec. And Duty 35% max, refer to Instruction Manual 4. In detail.

*3 Refer to Instruction Manual 2.2 in detail.

*4 This is the value that measured on measuring board with capacitor of 22 μF within 150mm from output terminal. Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM101).

*5 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*6 ACIN 100V, Io=100%

*7 Applicable when remote control (optional) is added.

*8 Please contact us about safety approvals for the model with option.

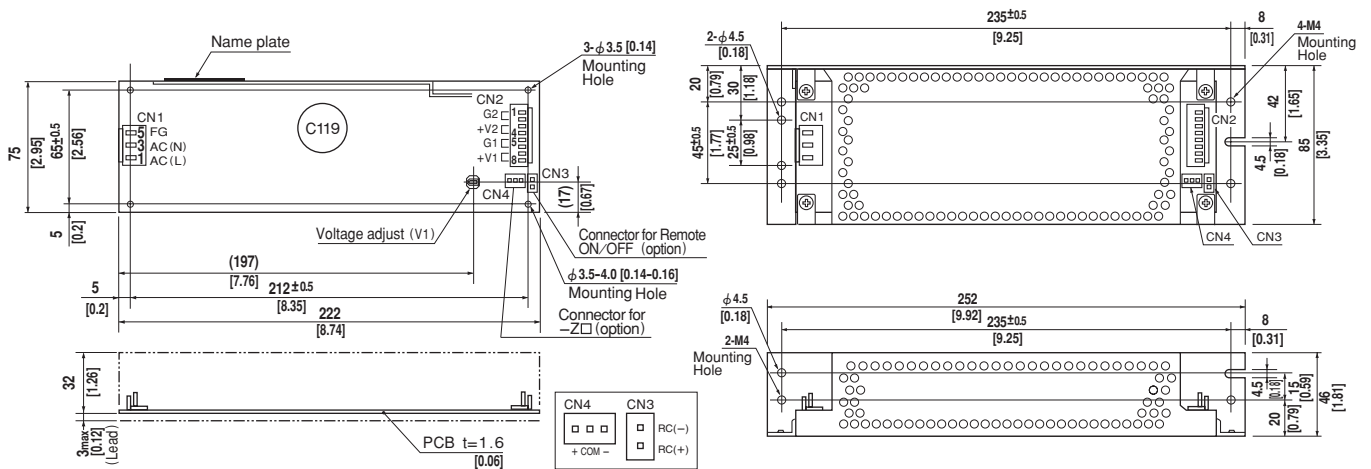
*9 Please contact us about class C.

* Series/Parallel operation is not possible.

* Derating is required when operated with chassis and cover.

* A sound may occur from power supply at peak loading.



External view



I / O Connector		Mating Connector	Terminal
CN1	B3P5-VH	VHR-5N	Chain: SVH-21T-P1.1 Loose: BVH-21T-P1.1
CN2	B8P-VH	VHR-8N	Chain: SVH-21T-P1.1 Loose: BVH-21T-P1.1
CN3 (Option)	B2B-XH-A	XHP-2	Chain: SXH-001T-P0.6 Loose: BXH-001T-P0.6
CN4 (Option)	B3B-XH-A	XHP-3	Chain: SXH-001T-P0.6 Loose: BXH-001T-P0.6

(Mfr: J.S.T.)

〈PIN CONNECTION〉

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

Pin No.	Output
1, 2	G 2
3, 4	V 2
5, 6	G 1
7, 8	V 1

CN3 (Option)

Pin No.	Remote ON/OFF
1	RC(+)
2	RC(-)

CN4 (Option)

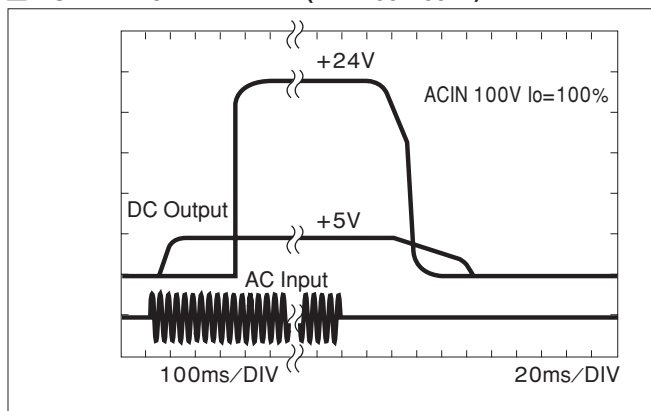
Pin No.	-Z□
1	+
2	COM
3	-

- ※Weight: 420g max
(with chassis & cover : 690g max)
- ※Tolerance: ± 1 [± 0.04]
- ※Dimensions in mm, [] = inches
- ※PCB Material : CEM3
- ※Chassis and cover is optional.
- ※Mounting torque: 1.5N·m(16kgf·cm)max

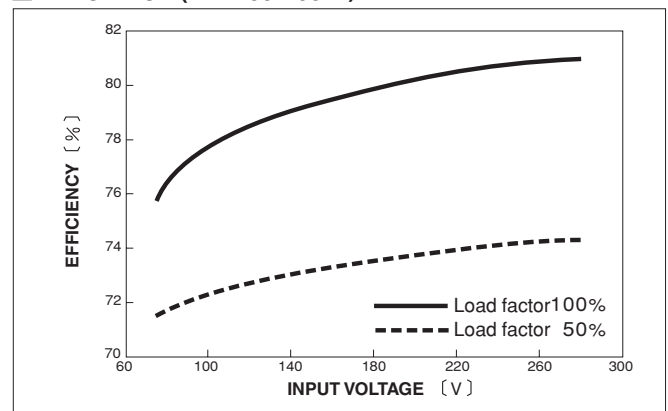
※Keep drawing current per pin below 5A for CN2

Performance data

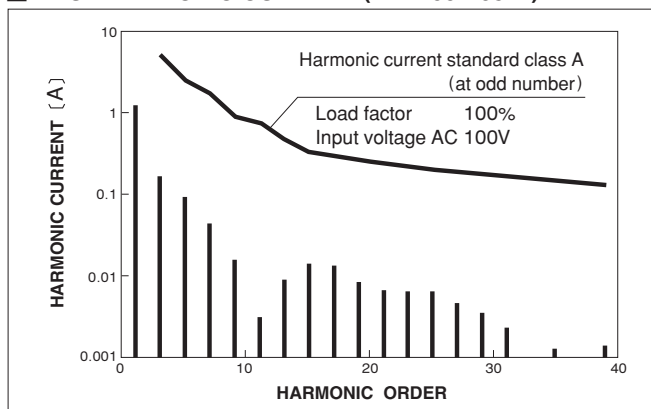
■ RISE TIME & FALL TIME (LEB100F-0524)



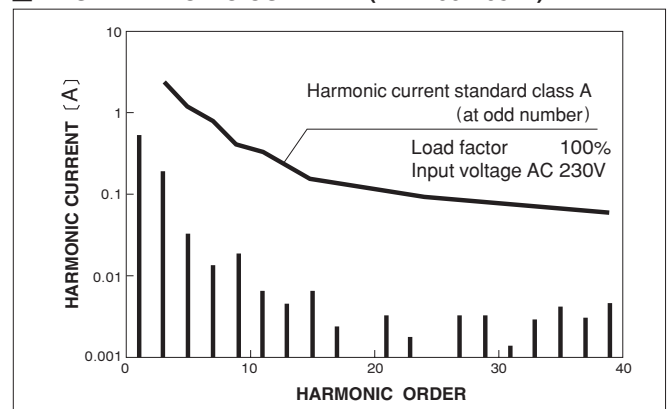
■ EFFICIENCY (LEB100F-0524)

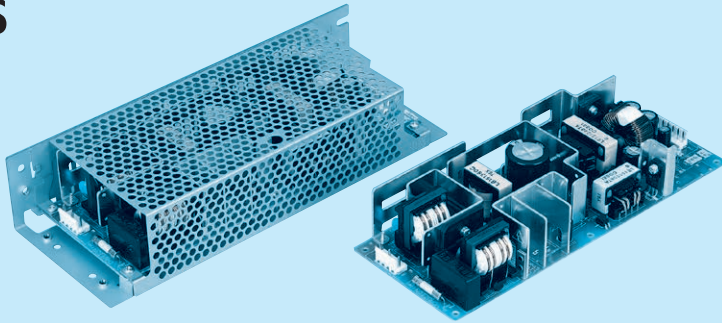


■ INPUT HARMONIC CURRENT (LEB100F-0524)



■ INPUT HARMONIC CURRENT (LEB100F-0524)





Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
- ② Output wattage
- ③ Universal input
- ④ V1 Output voltage
- ⑤ V2 Output voltage
- ⑥ Optional *1 *8
G : Low leakage current
R : with Remote ON/OFF
S : with Chassis
SN : with Chassis & cover
T : Vertical terminal block
Y : with Potentiometer
Z : with ZT

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LEB150F-0512	LEB150F-0324	LEB150F-0524	LEB150F-0530	LEB150F-0536
DC OUTPUT	V1 +5V 5A	+3.3V 5A	+5V 5A	+5V 5A	+5V 5A
	V2 +12V 7.5(Peak 14)A	+24V 6(Peak 10)A	+24V 6(Peak 10)A	+30V 4.8(Peak 8)A	+36V 4(Peak 6.7)A

SPECIFICATIONS

INPUT	MODEL		LEB150F-0512		LEB150F-0324		LEB150F-0524		LEB150F-0530		LEB150F-0536	
	VOLTAGE[V]		AC85 - 264 1 φ or DC 120 - 370									
	CURRENT[A]	ACIN 100V	1.6typ (Io=100%)		2.0typ (Io=100%)							
		ACIN 200V	0.8typ (Io=100%)		1.0typ (Io=100%)							
	FREQUENCY[Hz]		50/60 (47 - 63) or DC									
	EFFICIENCY[%]	ACIN 100V	76typ (Io=100%)		79typ (Io=100%)		79typ (Io=100%)		79typ (Io=100%)		79typ (Io=100%)	
		ACIN 200V	79typ (Io=100%)		82typ (Io=100%)		82typ (Io=100%)		82typ (Io=100%)		82typ (Io=100%)	
	POWER FACTOR	ACIN 100V	0.98typ		0.99typ							
		ACIN 200V	0.93typ									
INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25℃)										
	ACIN 200V	30typ (Io=100%) (At cold start) (Ta=25℃)										
LEAKAGE CURRENT[mA]		0.75max (60Hz, According to IEC60950 and DEN-AN)										
OUTPUT	VOLTAGE[V]		+5	+12	+3.3	+24	+5	+24	+5	+30	+5	+36
	CURRENT[A]		*2 0 - 5	0 - 7.5 (Peak 14)	0 - 5	0 - 6 (Peak 10)	0 - 5	0 - 6 (Peak 10)	0 - 5	0 - 4.8 (Peak 8)	0 - 5	0 - 4 (Peak 6.7)
	TOTAL OUTPUT WATTAGE[W]		*3 115 (Peak 193)		150 (Peak 246)		150 (Peak 246)		150 (Peak 246)		150 (Peak 246)	
	LINE REGULATION[mV]		20max	48max	20max	96max	20max	96max	20max	120max	20max	144max
	LOAD REGULATION[mV]		40max	100max	40max	150max	40max	150max	40max	180max	40max	180max
	RIPPLE[mVp-p]	0 to +45℃ *4	80max	120max	80max	120max	80max	120max	80max	200max	80max	200max
		-10 - 0℃ *4	140max	160max	140max	160max	140max	160max	140max	240max	140max	240max
	RIPPLE NOISE[mVp-p]	0 to +45℃ *4	120max	150max	120max	150max	120max	150max	120max	300max	120max	300max
		-10 - 0℃ *4	160max	180max	160max	180max	160max	180max	160max	360max	160max	360max
	TEMPERATURE REGULATION[mV]	0 to +45℃	50max	120max	50max	240max	50max	240max	50max	300max	50max	300max
		-10 to +45℃	60max	150max	60max	290max	60max	290max	60max	350max	60max	350max
	DRIFT[mV]		*5 20max	48max	20max	96max	20max	96max	20max	120max	20max	144max
	START-UP TIME[ms]		*6 250max	500max	250max	500max	250max	500max	250max	500max	250max	500max
HOLD-UP TIME[ms]		*6 40typ	20typ	40typ	20typ	40typ	20typ	40typ	20typ	40typ	20typ	
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		4.5 - 5.5	Fixed	2.85 - 3.60	Fixed	4.5 - 5.5	Fixed	4.5 - 5.5	Fixed	4.5 - 5.5	Fixed	
OUTPUT VOLTAGE SETTING[V]		—	11.5 - 12.5	—	23.0 - 25.0	—	23.0 - 25.0	—	28.7 - 31.5	—	34.5 - 37.5	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	V1	Works over 105% of rating current and recovers automatically									
		V2	Works over 101% of peak current and recovers automatically									
	OVERVOLTAGE PROTECTION	V1	Works over 115% of rating, by zener diode clamping									
		V2	Works at 115 - 140% of rating									
REMOTE ON/OFF		Option (Refer to Instruction Manual)										
ISOLATION	INPUT-OUTPUT - RC		*7 AC3.000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)									
	INPUT-FG		AC2.000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)									
	OUTPUT - RC-FG		*7 AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)									
	OUTPUT-OUTPUT(V1 - RC-V2)		*7 AC100V 1minute, Cutoff current = 100mA, DC100V 10MΩ min (At Room Temperature)									
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE		-10 to +70℃, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max									
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max									
	VIBRATION		10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis									
IMPACT		196.1m/s ² (20G), 11ms, once each X, Y and Z axis										
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL, EN60950-1, EN50178 Complies with DEN-AN and IEC60950-1 (At only AC input)									
	CONDUCTED NOISE		Complies with FCC-B, CISPR22-B, EN55022-B, VCCI-B									
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 *9									
OTHERS	CASE SIZE/WEIGHT		85 x 40 x 222mm [3.35 x 1.57 x 8.74 inches] (W x H x D) /530g max (with chassis & cover : 870g max)									
	COOLING METHOD		Convection									

*1 Specification is changed at option, refer to Instruction Manual 5.

*2 Peak loading for 10sec. And Duty 35% max, refer to Instruction Manual 4. In detail.

*3 Refer to Instruction Manual 2.2 in detail.

*4 This is the value that measured on measuring board with capacitor of 22 μF within 150mm from output terminal. Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM101).

*5 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*6 ACIN 100V, Io=100%

*7 Applicable when remote control (optional) is added.

*8 Please contact us about safety approvals for the model with option.

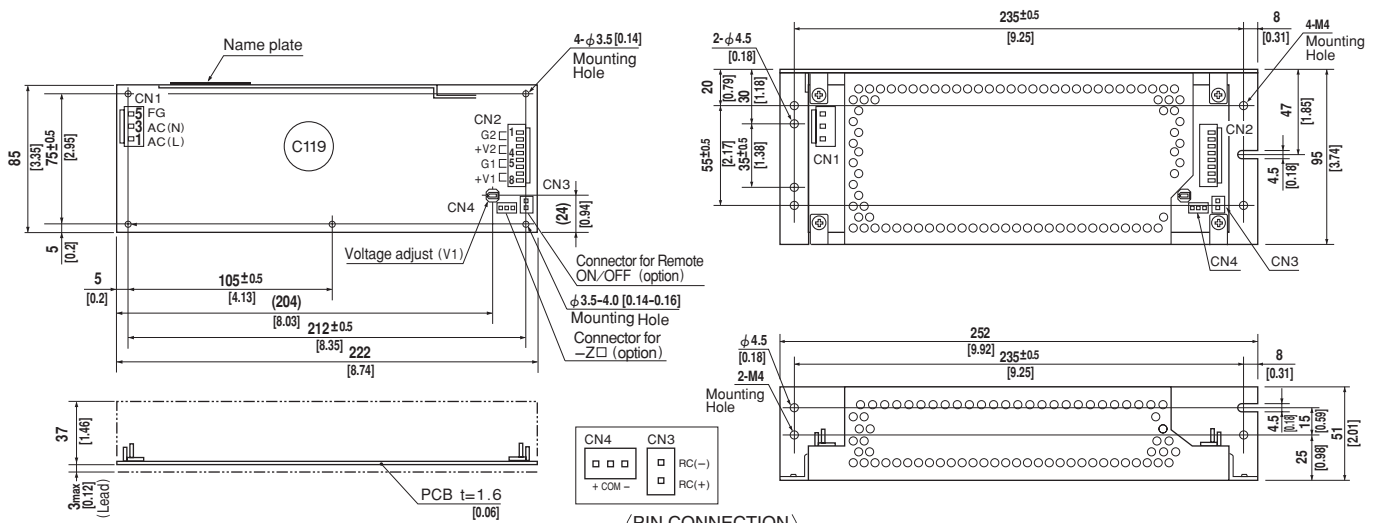
*9 Please contact us about class C.

* Series/Parallel operation is not possible.

* Derating is required when operated with chassis and cover.

* A sound may occur from power supply at peak loading.

External view



I / O Connector		Mating Connector	Terminal
CN1	B3P5-VH	VHR-5N	Chain: SVH-21T-P1.1 Loose: BVH-21T-P1.1
CN2	B8P-VH	VHR-8N	Chain: SVH-21T-P1.1 Loose: BVH-21T-P1.1
CN3 (Option)	B2B-XH-A	XHP-2	Chain: SXH-001T-P0.6 Loose: BXH-001T-P0.6
CN4 (Option)	B3B-XH-A	XHP-3	Chain: SXH-001T-P0.6 Loose: BXH-001T-P0.6

(Mfr: J.S.T.)

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

Pin No.	Output
1, 2	G 2
3, 4	V 2
5, 6	G 1
7, 8	V 1

Pin No.	Remote ON/OFF
1	RC(+)
2	RC(-)

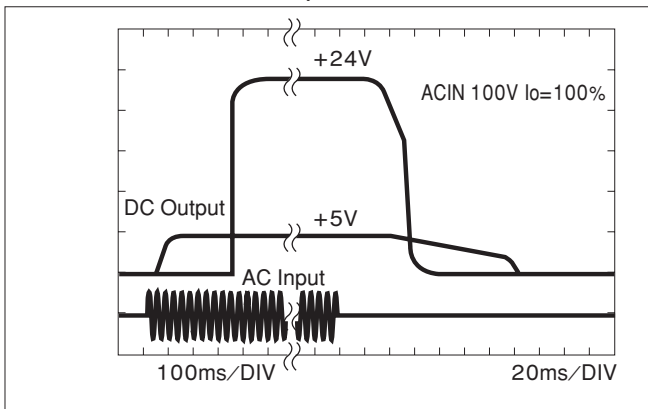
Pin No.	
1	+
2	COM
3	-

- ※Weight: 530g max
(with chassis & cover : 870g max)
- ※Tolerance: ± 1 [± 0.04]
- ※Dimensions in mm, [] = inches
- ※PCB Material : CEM3
- ※Chassis and cover is optional.
- ※Mounting torque: 1.5N·m(16kgf·cm)max

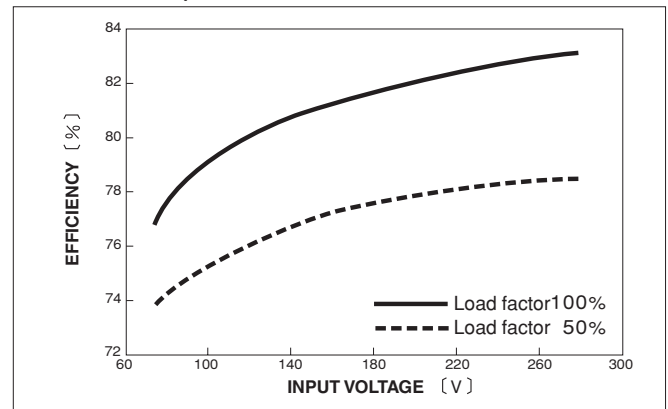
※Keep drawing current per pin below 5A(7A at peak load)for CN2

Performance data

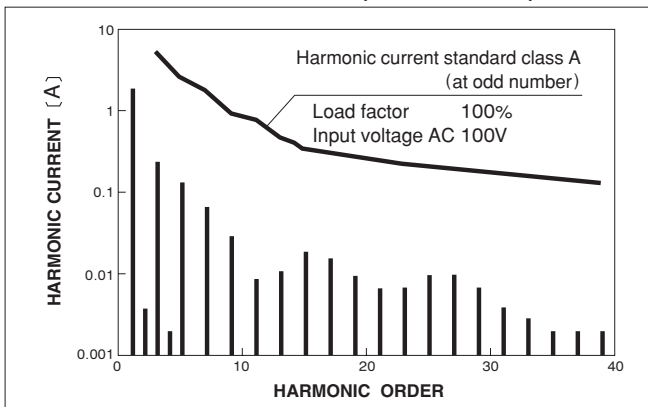
■ RISE TIME & FALL TIME (LEB150F-0524)



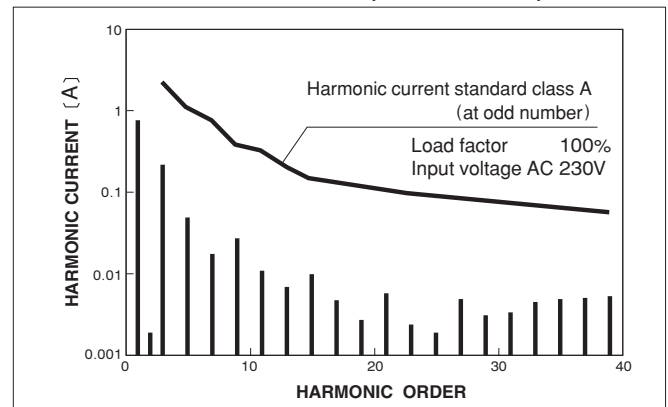
■ EFFICIENCY (LEB150F-0524)

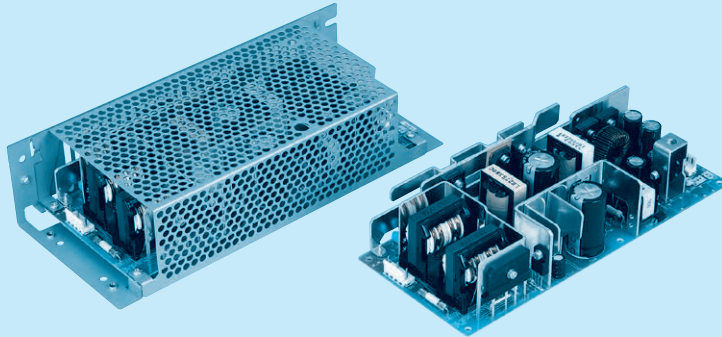


■ INPUT HARMONIC CURRENT (LEB150F-0524)



■ INPUT HARMONIC CURRENT (LEB150F-0524)





Example recommended EMI/EMC filter
NAC-06-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
- ② Output wattage
- ③ Universal input
- ④ V1 Output voltage
- ⑤ V2 Output voltage
- ⑥ Optional *1 *8
G : Low leakage current
R : with Remote ON/OFF
S : with Chassis
SN : with Chassis & cover
T : Vertical terminal block
Y : with Potentiometer
Z : with ZT

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL		LEB225F-0512	LEB225F-0324	LEB225F-0524	LEB225F-0530	LEB225F-0536
DC OUTPUT	V1	+5V 5A	+3.3V 5A	+5V 5A	+5V 5A	+5V 5A
	V2	+12V 10(Peak 20)A	+24V 9(Peak 14)A	+24V 9(Peak 14)A	+30V 7.2(Peak 11)A	+36V 6(Peak 9.3)A

SPECIFICATIONS

INPUT	MODEL		LEB225F-0512		★LEB225F-0324		LEB225F-0524		LEB225F-0530		★LEB225F-0536	
	VOLTAGE[V]		AC85 - 264 1 φ or DC 120 - 370									
	CURRENT[A]	ACIN 100V	1.9typ (Io=100%)		3.0typ (Io=100%)							
		ACIN 200V	1.0typ (Io=100%)		1.5typ (Io=100%)							
	FREQUENCY[Hz]		50/60 (47 - 63) or DC									
	EFFICIENCY[%]	ACIN 100V	77typ (Io=100%)		81typ (Io=100%)		81typ (Io=100%)		81typ (Io=100%)		81typ (Io=100%)	
		ACIN 200V	79typ (Io=100%)		83typ (Io=100%)		83typ (Io=100%)		83typ (Io=100%)		83typ (Io=100%)	
	POWER FACTOR	ACIN 100V	0.98typ		0.99typ							
		ACIN 200V	0.93typ									
INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (More than 3sec.to re-start)										
	ACIN 200V	30typ (Io=100%) (More than 3sec.to re-start)										
LEAKAGE CURRENT[mA]		0.75max (60Hz, According to IEC60950 and DEN-AN)										
OUTPUT	VOLTAGE[V]		+5	+12	+3.3	+24	+5	+24	+5	+30	+5	+36
	CURRENT[A]		*2 0 - 5	0 - 10 (Peak 20)	0 - 5	0 - 9 (Peak 14)	0 - 5	0 - 9 (Peak 14)	0 - 5	0 - 7.2 (Peak 11)	0 - 5	0 - 6 (Peak 9.3)
	TOTAL OUTPUT WATTAGE[W]		*3 145 (Peak 265)		225 (Peak 345)		225 (Peak 345)		225 (Peak 345)		225 (Peak 345)	
	LINE REGULATION[mV]		20max	48max	20max	96max	20max	96max	20max	120max	20max	144max
	LOAD REGULATION[mV]		40max	100max	40max	150max	40max	150max	40max	180max	40max	180max
	RIPPLE[mVp-p]	0 to +40°C	*4 80max	120max	80max	120max	80max	120max	80max	200max	80max	200max
		-10 - 0°C	*4 140max	160max	140max	160max	140max	160max	140max	240max	140max	240max
	RIPPLE NOISE[mVp-p]	0 to +40°C	*4 120max	150max	120max	150max	120max	150max	120max	300max	120max	300max
		-10 - 0°C	*4 160max	180max	160max	180max	160max	180max	160max	360max	160max	360max
	TEMPERATURE REGULATION[mV]	0 to +40°C	50max	120max	50max	240max	50max	240max	50max	300max	50max	300max
		-10 to +40°C	60max	150max	60max	290max	60max	290max	60max	350max	60max	350max
	DRIFT[mV]		*5 20max	48max	20max	96max	20max	96max	20max	120max	20max	144max
	START-UP TIME[ms]		*6 250max	500max	250max	500max	250max	500max	250max	500max	250max	500max
HOLD-UP TIME[ms]		*6 40typ	20typ	40typ	20typ	40typ	20typ	40typ	20typ	40typ	20typ	
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		4.5 - 5.5	Fixed	2.85 - 3.60	Fixed	4.5 - 5.5	Fixed	4.5 - 5.5	Fixed	4.5 - 5.5	Fixed	
OUTPUT VOLTAGE SETTING[V]		—	11.5 - 12.5	—	23.0 - 25.0	—	23.0 - 25.0	—	28.7 - 31.5	—	34.5 - 37.5	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	V1	Works over 105% of rating current and recovers automatically									
		V2	Works over 101% of peak current and recovers automatically									
	OVERVOLTAGE PROTECTION	V1	Works over 115% of rating, by zener diode clamping									
		V2	Works at 115 - 140% of rating									
REMOTE ON/OFF		Option (Refer to Instruction Manual)										
ISOLATION	INPUT-OUTPUT · RC		*7 AC3.000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)									
	INPUT-FG		AC2.000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)									
	OUTPUT · RC-FG		*7 AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)									
	OUTPUT-OUTPUT(V1 · RC-V2)		*7 AC100V 1minute, Cutoff current = 100mA, DC100V 10MΩ min (At Room Temperature)									
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE		-10 to +70°C, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max									
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max									
	VIBRATION		10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis									
	IMPACT		196.1m/s ² (20G), 11ms, once each X, Y and Z axis									
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL, EN60950-1, EN50178 Complies with DEN-AN and IEC60950-1 (At only AC input)									
	CONDUCTED NOISE		Complies with FCC-B, CISPR22-B, EN55022-B, VCCI-B									
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 *9									
OTHERS	CASE SIZE/WEIGHT		95 x 45 x 222mm [3.74 x 1.77 x 8.74 inches] (W x H x D) /700g max (with chassis & cover : 1,080g max)									
	COOLING METHOD		Convection									

*1 Specification is changed at option, refer to Instruction Manual 5.

*2 Peak loading for 10sec. And Duty 35% max, refer to Instruction Manual 4. In detail.

*3 Refer to Instruction Manual 2.2 in detail.

*4 This is the value that measured on measuring board with capacitor of 22 μF within 150mm from output terminal. Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM101).

*5 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*6 ACIN 100V, Io=100%

*7 Applicable when remote control (optional) is added.

*8 Please contact us about safety approvals for the model with option.

*9 Please contact us about class C.

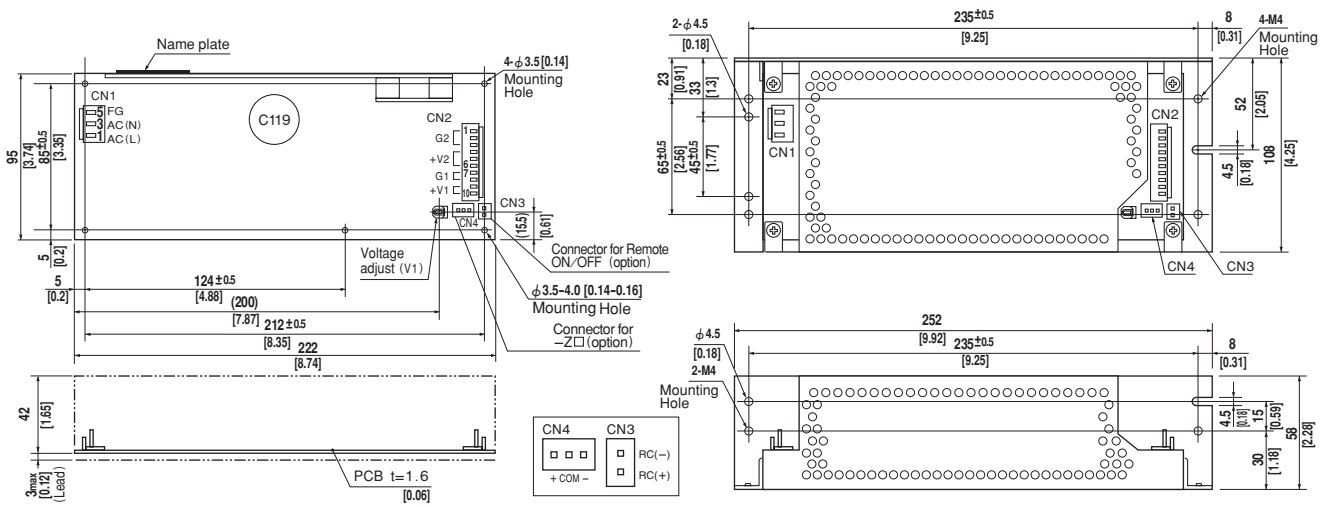
* Series/Parallel operation is not possible.

* Derating is required when operated with chassis and cover.



* A sound may occur from power supply at peak loading.

*marked models are pending for safety approvals. Consult with us for delivery.

External view



I / O Connector		Mating Connector	Terminal
CN1	B3P5-VH	VHR-5N	Chain: SVH-21T-P1.1 Loose: BVH-21T-P1.1
CN2	B10P-VH	VHR-10N	Chain: SVH-21T-P1.1 Loose: BVH-21T-P1.1
CN3 (Option)	B2B-XH-A	XHP-2	Chain: SXH-001T-P0.6 Loose: BXH-001T-P0.6
CN4 (Option)	B3B-XH-A	XHP-3	Chain: SXH-001T-P0.6 Loose: BXH-001T-P0.6

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

IN CONNECTION>

Pin No.	Output
1, 2, 3	G 2
4, 5, 6	V 2
7, 8	G 1
9, 10	V 1

Pin No.	Remote ON/OFF
1	RC(+)
2	RC(-)

Pin No.	
1	+
2	COM
3	-

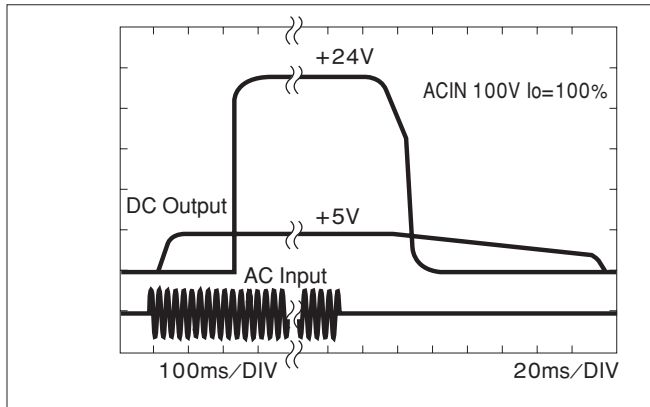
- ※Weight: 700g max
(with chassis & cover : 1,080g max)
- ※Tolerance: ± 1 [± 0.04]
- ※Dimensions in mm, [] = inches
- ※PCB Material : CEM3
- ※Chassis and cover is optional.
- ※Mounting torque: 1.5N · m(16kgf · cm)max

(Mfr: J.S.T.)

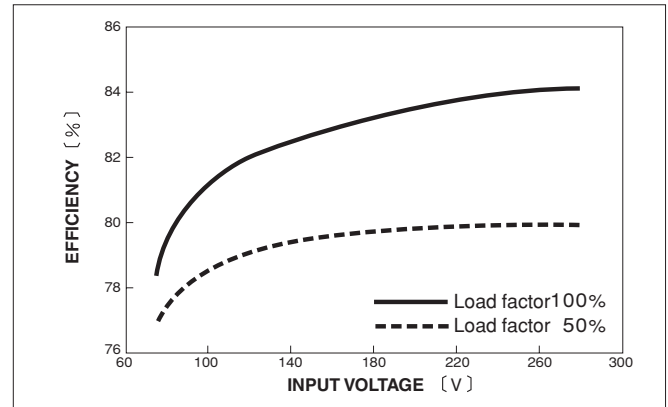
※Keep drawing current per pin below 5A (7A at peak load) for CN2

Performance data

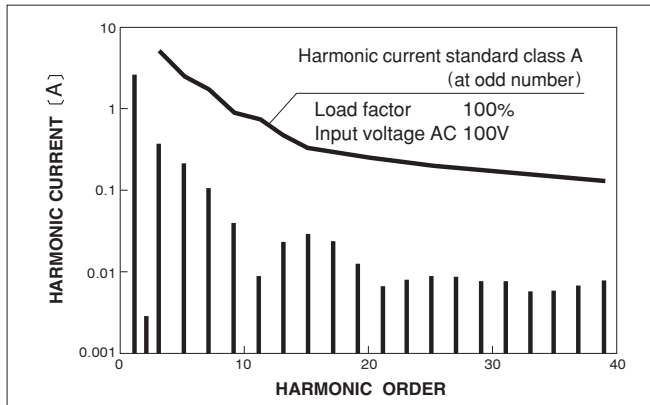
■ RISE TIME & FALL TIME (LEB225F-0524)



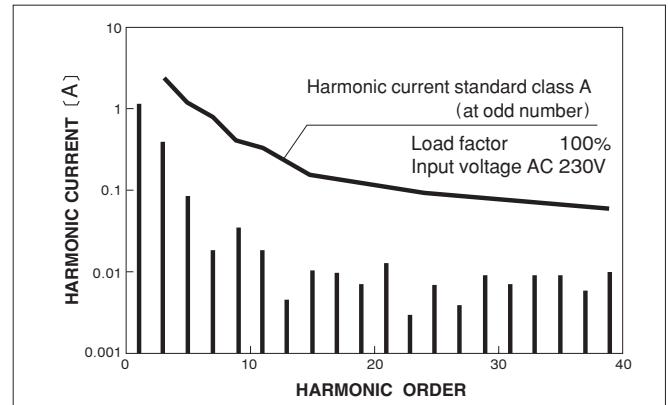
■ EFFICIENCY (LEB225F-0524)



■ INPUT HARMONIC CURRENT (LEB225F-0524)



■ INPUT HARMONIC CURRENT (LEB225F-0524)



Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current * 1 [A]	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
LEB100F	Active filter	80	1.4	250V 5A	Thermistor	CEM-3	Yes		No	No
	Flyback converter	90 - 500								
	Forward converter	120								
LEB150F	Active filter	80	2.0	250V 6.3A	Thermistor	CEM-3	Yes		No	No
	Flyback converter	90 - 500								
	Forward converter	130								
LEB225F	Active filter	80	3.0	250V 8A	SCR	CEM-3	Yes		No	No
	Flyback converter	90 - 500								
	Forward converter	120								

* 1 The value of input current is at ACIN 100V and rated load at LEB□F-0524.

1 Function LEB-10

- 1.1 Input voltage range LEB-10
- 1.2 Inrush current limiting LEB-10
- 1.3 Overcurrent protection LEB-10
- 1.4 Peakcurrent protection LEB-10
- 1.5 Thermal protection LEB-10
- 1.6 Overvoltage protection LEB-10
- 1.7 Output voltage adjustment range LEB-11
- 1.8 Isolation LEB-11

2 Assembling and Installation Method LEB-11

- 2.1 Installation method LEB-11
- 2.2 Derating LEB-11
- 2.3 Mounting screw LEB-13

3 Ground LEB-13

4 Peak loading LEB-13

5 Option and others LEB-13

- 5.1 Outline of option LEB-13
- 5.2 Others LEB-14

LEB

1 Function

1.1 Input voltage range

- The range is from AC85V to AC264V or DC120V to DC370V.
- In cases that conform with safety standard, input voltage range is AC100-AC240V(50/60Hz).
- AC input voltage must have a range from AC85V to AC264V for normal operation. If the wrong input is applied, the unit will not operate properly and/or may be damaged.

1.2 Inrush current limiting

- Inrush current limiting is built-in.
- If a switch on the input side is installed, it has to be the one handling the input inrush current.

●LEB100F · LEB150F

- The thermistor is used for protection from inrush current. When power is turned ON/OFF repeatedly within a short period of time, it is necessary to have enough time for power supply to cool down.

●LEB225F

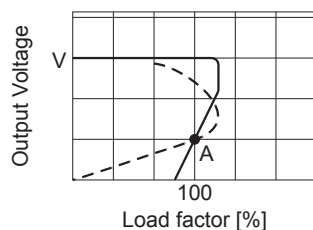
- The thyristor technique is used for protection from inrush current. When power is turned ON/OFF repeatedly within a short period of time, it is necessary to have enough time between power ON and OFF to operate resistance circuit for inrush current.

1.3 Overcurrent protection

- Overcurrent protection is built-in and comes into effect at over 105% of the rated current in V1 and at over 101% of the peak current in V2. Overcurrent protection prevents the unit from short circuit and overcurrent condition.
- The unit automatically recovers when the fault condition is cleared.

●Foklbak characteristics (V1)

- The power supply with a current foklbak characteristics may not start up when connected to nonlinear load such as a lamp, motor constant current load. See the characteristics below.



- : Load characteristics of power supply.
- : Characteristics of load (lamp, motor, constant current load, etc.).
- Note: In case of nonlinear load, the output is locked out at A point.

●Intermittent current characteristics (V2)

- When the output voltage drops more than 50% of the rated output voltage value at overcurrent, the average output current is reduced by intermittent operation of power supply.

1.4 Peakcurrent protection (V2)

●LEB100F · LEB150F

- Peakcurrent protection is built-in (refer to Instruction Manual 4. for Peak loading).
- If this function comes into effect, the output V2 is shut down (but output V1 is not shut down).
- The minimum interval of AC recycling for recovery is 2 to 3 minutes (★).
- ★ The recovery time varies depending on input voltage and load condition.

1.5 Thermal protection (V2)

●LEB225F

- Thermal protection is built-in. If the power supply is operated under the following conditions, this function comes into effect and the output V2 is shut down (but output V1 is not shut down).
- ① Over rated temperature
- ② Poor ventilation
- ③ Over peak load based on Instruction Manual 4. for Peak loading
- If this function is in operation, turn off power, eliminate all possible causes of overheating, and drop the temperature to normal level.
- Output voltage recovers after applying input voltage.

1.6 Overvoltage protection

■Output V1

- Overvoltage protection circuit, clamping the output voltage by zener diode, is built-in and comes into effect at over 115% of the rated voltage. The unit in an overvoltage protection mode cannot be recovered by a user; it must be repaired at the factory.
- Overvoltage protection (diode) also comes into effect if the voltage is externally applied to the output side.
- Avoid applying voltage to the output side.

■Output V2

- Overvoltage protection is built-in and comes into effect at 115-140% of the rated voltage.
- The AC input should be shut down if overvoltage protection is in operation.
- The minimum interval of AC recycling for recovery is 2 to 3 minutes (★).
- ★ The recovery time varies depending on input voltage.

Remarks:

Please avoid applying the over-rated voltage to the output terminal. Power supply may operate incorrectly or fail. In case of operating a motor etc., please install an external diode on the output terminal to protect the unit.

Note:

Overvoltage protection is built-in each output.

If overvoltage protection in V1 or V2 comes into effect, both of output V1 and V2 are not shut down.

Each overvoltage protection is independent of each other.

1.7 Output voltage adjustment range

■ Adjustment of output voltage is possible by using potentiometer (only available V1 output).

■ Output voltage is increased by turning potentiometer clockwise and is decreased by turning potentiometer counterclockwise.

1.8 Isolation

■ For a receiving inspection, such as Hi-Pot test gradually increase (decrease) the voltage for the start (shut down).

Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

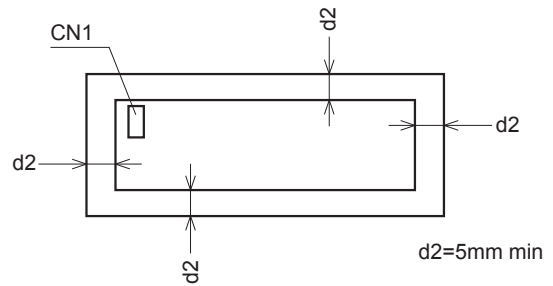
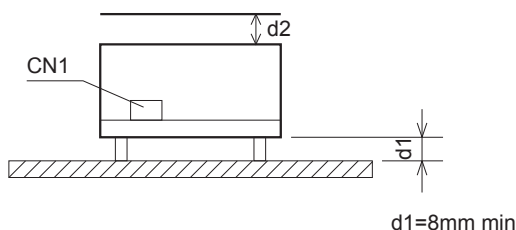
If the unit is tested on the isolation between input & output and output & FG, remote ON/OFF (option) must be shorted to outputs.

2 Assembling and Installation Method

2.1 Installation method

■ When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Ambient temperature around each power supply should not exceed the temperature range shown in derating curve.

■ In case of metal chassis, keep the distance between d1 and d2 for to insulate between lead of component and metal chassis. If it is less than d1 and d2, insert the insulation sheet between power supply and metal chassis.



2.2 Derating

■ In the hatched area the specification of Ripple, Ripple Noise is different from other area.

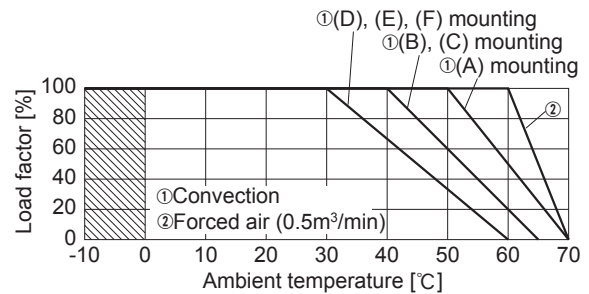
■ In case ②, ventilation must keep the temperature of C119 below 85°C. See External View for the location of C119.

■ The operative ambient temperature is different by with/without case cover or mounting position.

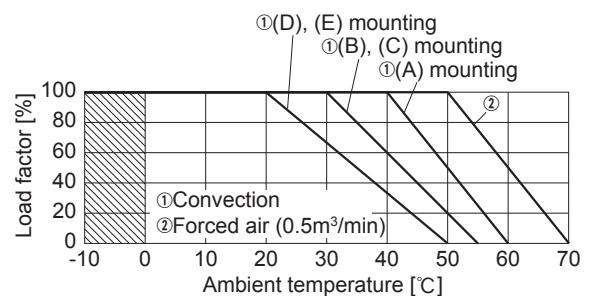
Please refer to drawings as below.

★ Please be careful of electric shock or earth leakage in case of temperature measurement, because C119 is live potential.

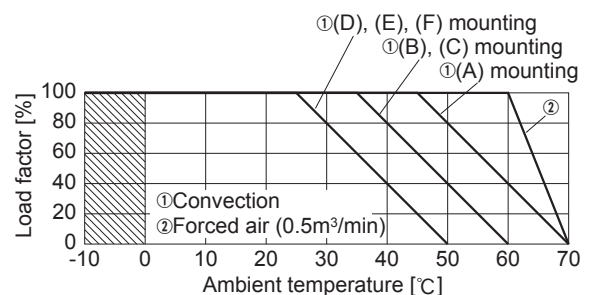
● LEB100F



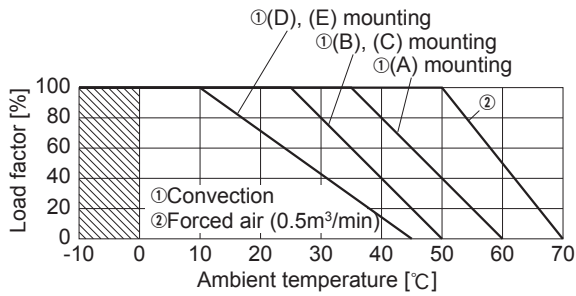
● LEB100F-□-SN (requirement: Min. AC90V)



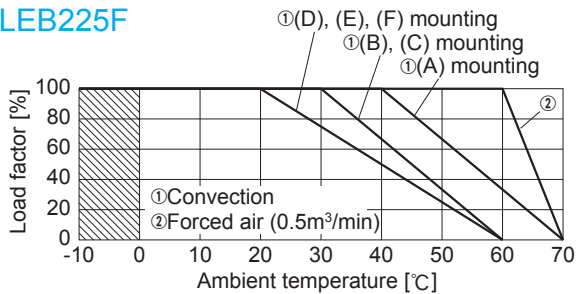
● LEB150F



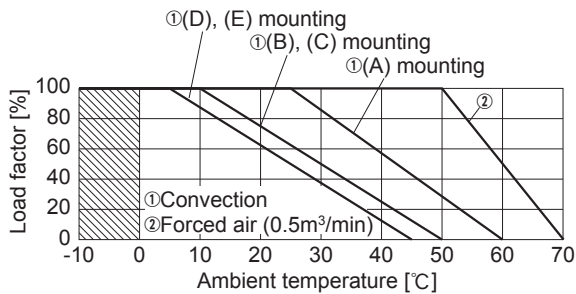
●LEB150F-□-SN (requirement: Min. AC90V)



●LEB225F



●LEB225F-□-SN (requirement: Min. AC90V)



■Option "-SN" is easy to be full of heat air inside power supply. The ventilation design with derating or forced air is recommended.

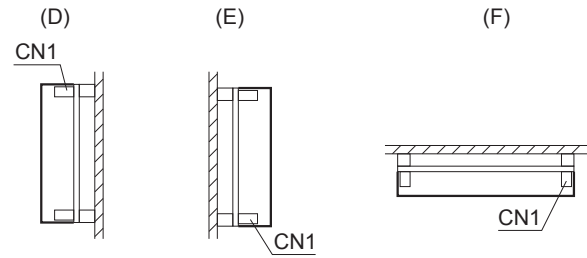
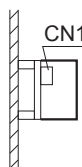
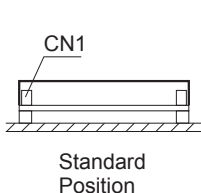
■When unit mounted except below drawings, it is required to consider ventilated environment by forced air cooling for temperature / load derating. For details, please consult our sales or engineering departments.

■(F) mounting is not possible when unit is with case cover, but if need to operate unit by (F) positioning with case cover, temperature / load derating is necessary. For more details, please consult our sales or engineering department.

(A)

(B)

(C)



■Definition of load factor

$$A_1 = I_{O1} / I_1 \times 100 \quad A_2 = I_{O2} / I_2 \times 100$$

$$A_3 = (V_1 \times I_{O1} + V_2 \times I_{O2}) / (\text{TOTAL OUTPUT WATTAGE}) \times 100$$

where:

V_1 : VOLTAGE OF OUTPUT V_1 , I_{O1} : CURRENT OF OUTPUT V_1 ,

I_1 : RATED CURRENT OF OUTPUT V_1

V_2 : VOLTAGE OF OUTPUT V_2 , I_{O2} : CURRENT OF OUTPUT V_2 ,

I_2 : RATED CURRENT OF OUTPUT V_2

NOTE:

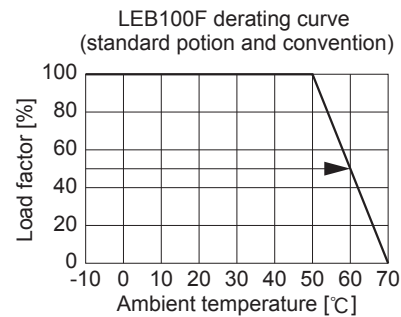
Refer to SPECIFICATION for TOTAL OUTPUT WATTAGE and OTHERS

Load factor[%]=Maximum value in A_1 , A_2 , A_3

[ex.1] The method which seeks for the upper limit of ambient temperature in LEB100F-0524 as following conditions,

Load condition: $V_1=5V$, $I_{O1}=0.2A$ $V_2=24V$, $I_{O2}=2A$

Installation: standard position and conventional cooling



Calculating A_1 , A_2 , A_3

$$A_1 = I_{O1} / I_1 \times 100 = 0.2 / 5 \times 100 = 4$$

$$A_2 = I_{O2} / I_2 \times 100 = 2 / 4 \times 100 = 50$$

$$A_3 = (V_1 \times I_{O1} + V_2 \times I_{O2}) / (\text{TOTAL OUTPUT WATTAGE}) \times 100 \\ = (5 \times 0.2 + 24 \times 2) / 100 \times 100 = 49$$

Accordingly load factor is 50[%] which is maximum value in A_1 , A_2 , A_3 and the upper limit of ambient temperature is 60°C by derating curve.

[ex.2] The method which seeks for the upper limit of V_2 output current as I_{O2} in LEB100F-0524 as following conditions,

Load condition: $V_1=5V, I_{O1}=4A$ $V_2=24V$

Ambient temperature: 50°C

Installation: standard potion and conventional cooling

Load factor is 100[%] at ambient temperature= 50°C by derating curve, In this case the value of each A_1, A_2, A_3 is required less than 100[%].

$$100 \geq A_1 = I_{O1}/I_1 \times 100 \quad 100 \geq A_2 = I_{O2}/I_2 \times 100$$

$$100 \geq A_3 = (V_1 \times I_{O1} + V_2 \times I_{O2}) / (\text{TOTAL OUTPUT WATTAGE}) \times 100$$

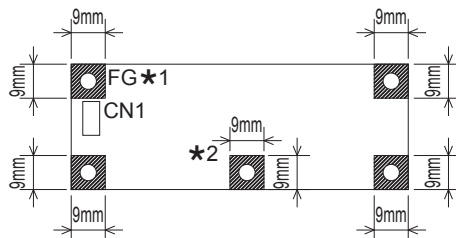
$$100 \geq 4/5 \times 100 \quad 100 \geq I_{O2}/4 \times 100$$

$$100 \geq (5 \times 4 + 24 \times I_{O2}) / 100 \times 100$$

according $I_{O2} \leq 3.3A$ and as a result the upper limit of V_2 output current as I_2 is less than 3.3A.

2.3 Mounting screw

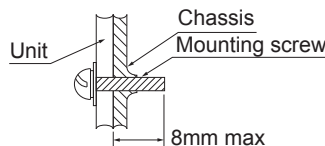
- The mounting screw should be M3. The hatched area shows the allowance of metal parts for mounting.
- Please be carefull with that metal parts do not touch mounted parts at front side, where major components are mounted, when a power supply is installed with them.
- Keep isolation distance between screw and internal components in case of option "-S", "-SN" as below chart.



★1 Recommendation to electrically connect FG to metal chassis for reducing noise.

★2 LEB150F and LEB225F only

Refer to External view for location



3 Ground

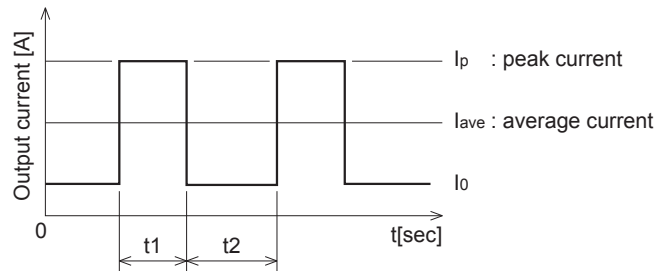
■When installing the power supply with your unit, ensure that the input FG terminal of CN1 or mounting hole FG is connected to safety ground of the unit.

However when applying the safety agency, connect the input FG terminal of CN1 to safety ground of the unit.



4 Peak loading

■Peak load (V_2) is possible to draw as below.



$$t1 \leq 10 [\text{sec}], I_{ave} = \frac{I_p t1 + I_o t2}{t1 + t2} \leq \text{rated current}, \frac{t1}{t1 + t2} \leq 0.35$$

5 Option and others

5.1 Outline of option

●-G

■Option "-G" means leakage current is smaller than standard model by reducing the value of earth capacitor at input filter circuit.

Leakage current	0.1mA max
Conducted noise	Not available

●-R

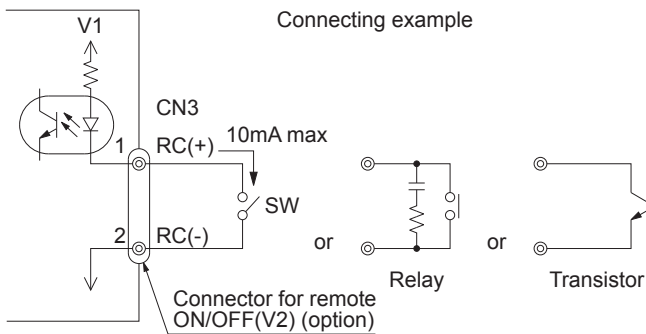
■Option "-R" means output remote ON/OFF (V2) is made possible.

- ★ Remote ON/OFF circuit (RC(+), RC(-)) is isolated from input and FG but not isolated from output V1.

Please consult our sales or engineering departments in other application.

■A wrong connection may damage the internal components of the unit.

Between RC (+) and RC (-)	Output (V2)
SW ON (0 - 0.5V)	ON
SW OFF (at shipping) (4.5 - 5.5V)	OFF



●-S · -SN

■Option "-S" means chassis is attached to standard model.

■Option "-SN" means chassis and cover is attached to standard model. Refer to 2.2 Derating for derating curve.

●-T

■Option "-T" means input and output interface are changed "Connector" to "Terminal block".



●-Z □

■Option "-Z □" means ZT3 series in COSEL is mounted on standard model.

Refer to external view for output terminal.

Refer to COSEL catalog about ZT specification in detail.

It is possible to select ZT as below chart.

Optional symbol	-Z31	-Z32	-Z33	-Z34	-Z35
Mounted Power supply	ZTS3 2405	ZTS3 2412	ZTS3 2415	ZTW3 2412	ZTW3 2415
Notice	V2=24[V], 30[V], 36[V] model				
Optional symbol	-Z21	-Z22	-Z23	-Z24	-Z25
Mounted Power supply	ZTS3 1205	ZTS3 1212	ZTS3 1215	ZTW3 1212	ZTW3 1215
Notice	V2=12[V] model				

5.2 Others

■This power supply is the rugged PCB type. Do not drop conductive objects in the power supply.

■At light load, there remains high voltage inside the power supply for a few minutes after power OFF.

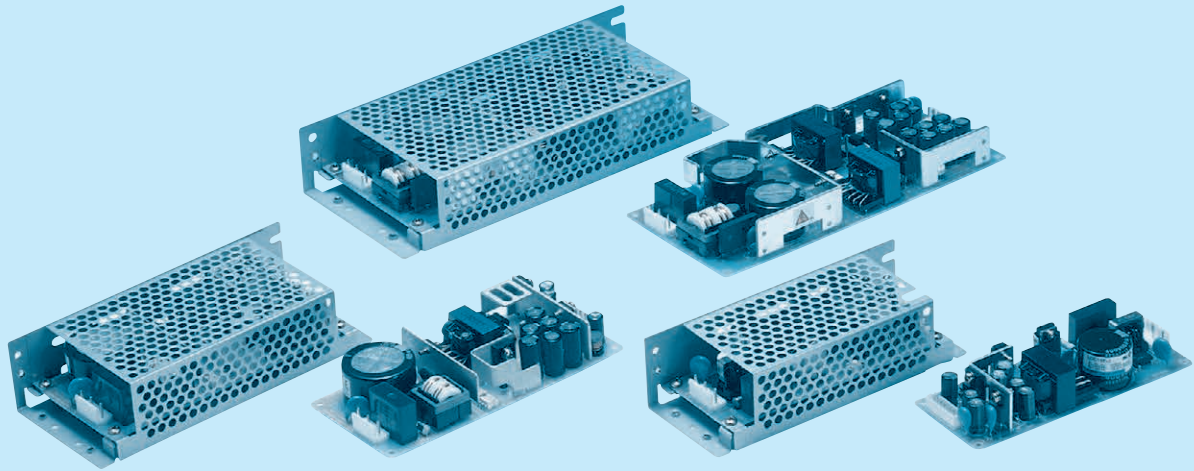
So, at maintenance, take care about electric shock.

■This power supply is manufactured by SMD technology. The stress to PCB like twisting or bending causes the defect of the unit, so handle the unit with care.



LDC-series

LDC



Feature

Small and compact PCB construction
 Universal input voltage (AC85 - 264V)
 UL recognized, TÜV approved, CSA certified
 Built-in inrush current, overcurrent and overvoltage protection circuits

Safety agency approvals

UL60950-1, CSA C22.2 No.60950-1, EN60950-1, EN50178
 Complies with DEN-AN

EMI

FCC-B, VCCI-B, CISPR22-B, EN55022-B

2-year warranty

Optional parts

Optional parts	Model	Remarks
Chassis and cover	LDC15F, LDC30F, LDC60F	
Harness for-J type	LDC15F, LDC30F, LDC60F	Refer to page of optional parts

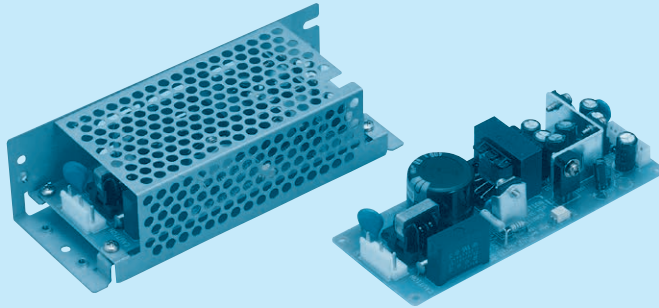
CE marking

Low Voltage Directive

LDC15F

LD C 15 F -1 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Multiple output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage combination
- ⑥ Optional *4
C :with Coating
G :Low leakage current
S :with Chassis
SN:with Chassis & cover
Y :with Potentiometer

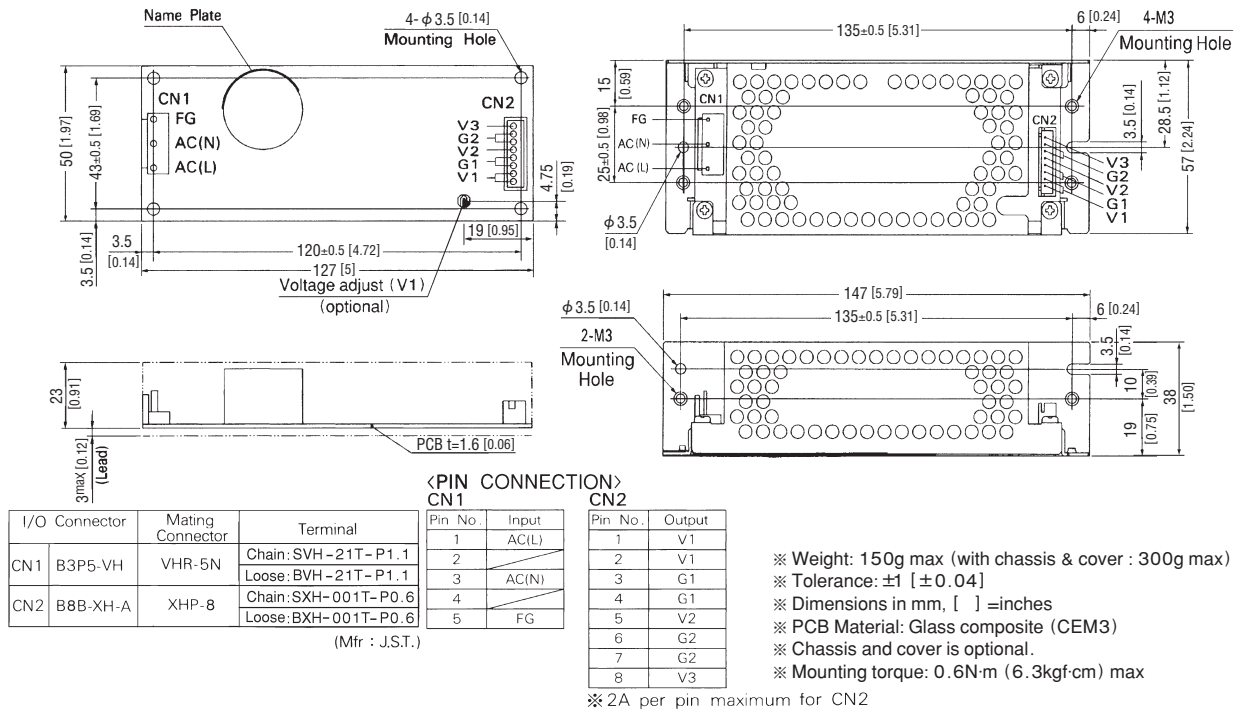
MODEL	LDC15F-1	LDC15F-2
DC OUTPUT	V1 +5V 2.0(Peak 3.0)A V2 +12V 0.3(Peak 0.6)A V3 -12V 0.2(Peak 0.3)A	+5V 2.0(Peak 3.0)A +15V 0.3(Peak 0.6)A -15V 0.2(Peak 0.3)A

SPECIFICATIONS

	MODEL	LDC15F-1			LDC15F-2			
INPUT	VOLTAGE[V]		AC85 - 264 1 ϕ or DC110 - 370					
	CURRENT[A]	ACIN 100V	0.4typ (Io=100%)					
	FREQUENCY[Hz]		47 - 440 or DC					
	EFFICIENCY[%]	ACIN 100V	70typ (Io=100%)					
	INRUSH CURRENT[A]	ACIN 100V	25typ (Io=100%)					
		ACIN 200V	50typ (Io=100%)					
	LEAKAGE CURRENT[mA]		0.75max (60Hz, According to UL, CSA, VDE and DEN-AN)					
OUTPUT	VOLTAGE[V]		+5	+12	-12	+5	+15	-15
	CURRENT[A]		*1 0 - 2.0 (Peak 3.0)	0 - 0.3 (Peak 0.6)	0 - 0.2 (Peak 0.3)	0 - 2.0 (Peak 3.0)	0 - 0.3 (Peak 0.6)	0 - 0.2 (Peak 0.3)
	LINE REGULATION[mV]		20max	48max	48max	20max	60max	60max
	LOAD REGULATION[mV]		100max	120max	120max	100max	150max	150max
	RIPPLE[mVp-p]	0 to +50°C *2	100max	120max	120max	100max	120max	120max
		-10 - 0°C *2	140max	160max	160max	140max	160max	160max
	RIPPLE NOISE[mVp-p]	0 to +50°C *2	120max	150max	150max	120max	150max	150max
		-10 - 0°C *2	160max	180max	180max	160max	180max	180max
	TEMPERATURE REGULATION[mV]	0 to +50°C	50max	350max	350max	50max	350max	350max
		-10 to +50°C	60max	420max	420max	60max	420max	420max
	DRIFT[mV]		*3 20max	—	—	20max	—	—
	START-UP TIME[ms]		100max (ACIN 85V, Io=100%)					
HOLD-UP TIME[ms]		10typ (ACIN 85V, Io=100%), 20typ (ACIN 100V, Io=100%), 100typ (ACIN 200V, Io=100%)						
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	
OUTPUT VOLTAGE SETTING[V]		4.9 to 5.3	11.4 to 12.6	-11.4 to -12.6	4.9 to 5.3	14.25 to 15.75	-14.25 to -15.75	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically					
	OVERVOLTAGE PROTECTION		Works over 115% of rating by zener diode clamping (+5V only)					
	OPERATING INDICATION		Not provided					
	REMOTE SENSING		Not provided					
	REMOTE ON/OFF		Not provided					
ISOLATION	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)					
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)					
	OUTPUT-FG		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)					
	OUTPUT-OUTPUT(V1-V2,V3)		AC100V 1minute, Cutoff current = 100mA, DC100V 10MΩ min (At Room Temperature)					
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE		-10 to +60°C, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet)					
	STORAGE TEMP.,HUMID.AND ALTITUDE		-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet)					
	VIBRATION		10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis					
	IMPACT		196.1m/s² (20G), 11ms, once each X, Y and Z axis					
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, EN60950-1, EN50178, CSA C22.2 No.60950-1 Complies with DEN-AN and IEC60950-1					
	CONDUCTED NOISE		Complies with FCC-B, CISPR22-B, EN55022-B, VCCI-B					
OTHERS	CASE SIZE/WEIGHT		50×26×127mm [1.97×1.02×5 inches] (W×H×D) /150g max (with chassis & cover : 300g max)					
	COOLING METHOD		Convection					

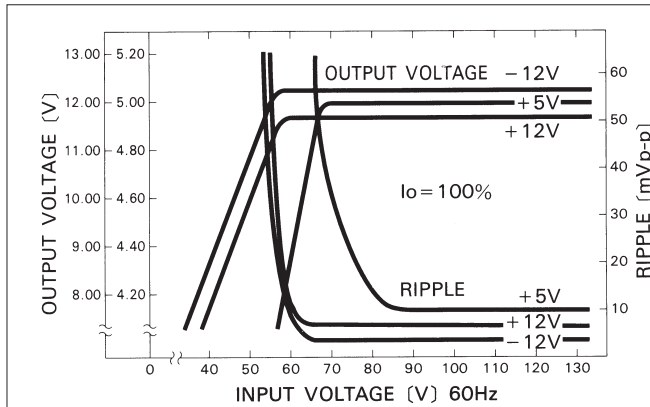
- *1 Peak load for 10sec. or less is acceptable if the total wattage is less than the rated wattage(-1: 16W, -2: 17.5W).When the load of +5V is OA, other output can be drawn by 80% of rated current.
- *2 Measured by 20MHz oscilloscope or Ripple-Noise meter (equivalent to KEISOKU-GIKEN:RM101).
- *3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C with the input voltage held constant at the rated input/output.
- *4 Please contact us about safety approvals for the model with option.
- * Avoid prolonged use under over-load.
- * Derating is required when operated with chassis and cover.

External view

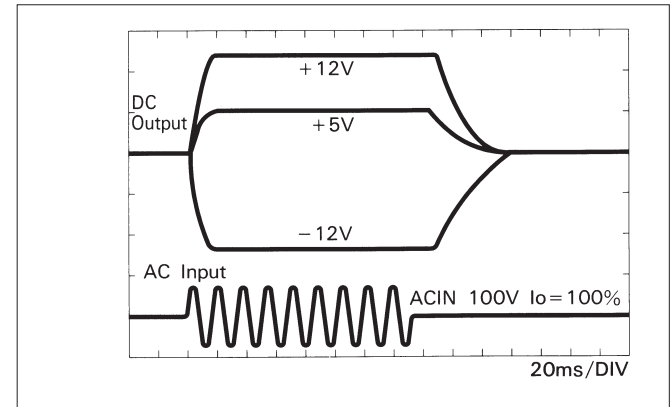


Performance data

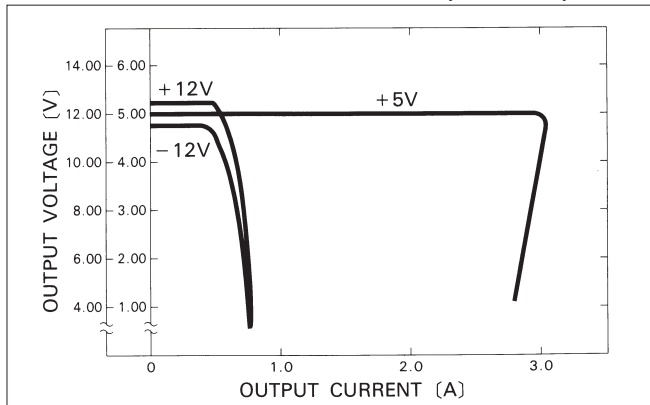
■ STATIC CHARACTERISTICS (LDC15F-1)



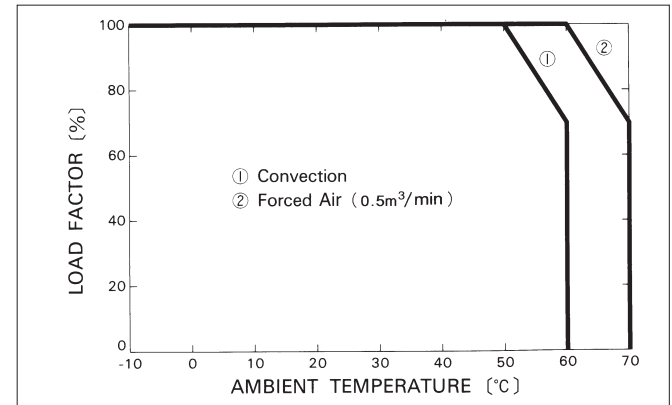
■ RISE TIME & FALL TIME (LDC15F-1)



■ OVERCURRENT CHARACTERISTICS (LDC15F-1)



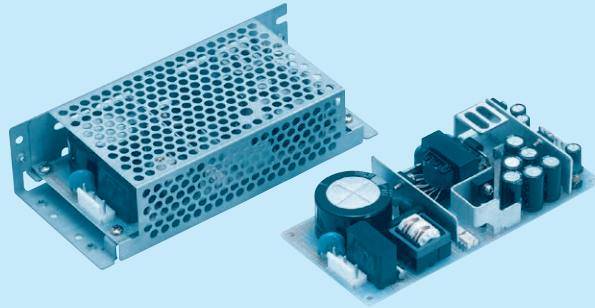
■ DERATING CURVE



LDC30F

LD C 30 F -1 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Multiple output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage combination
- ⑥ Optional *4
C :with Coating
G :Low leakage current
S :with Chassis
SN:with Chassis & cover
Y :with Potentiometer

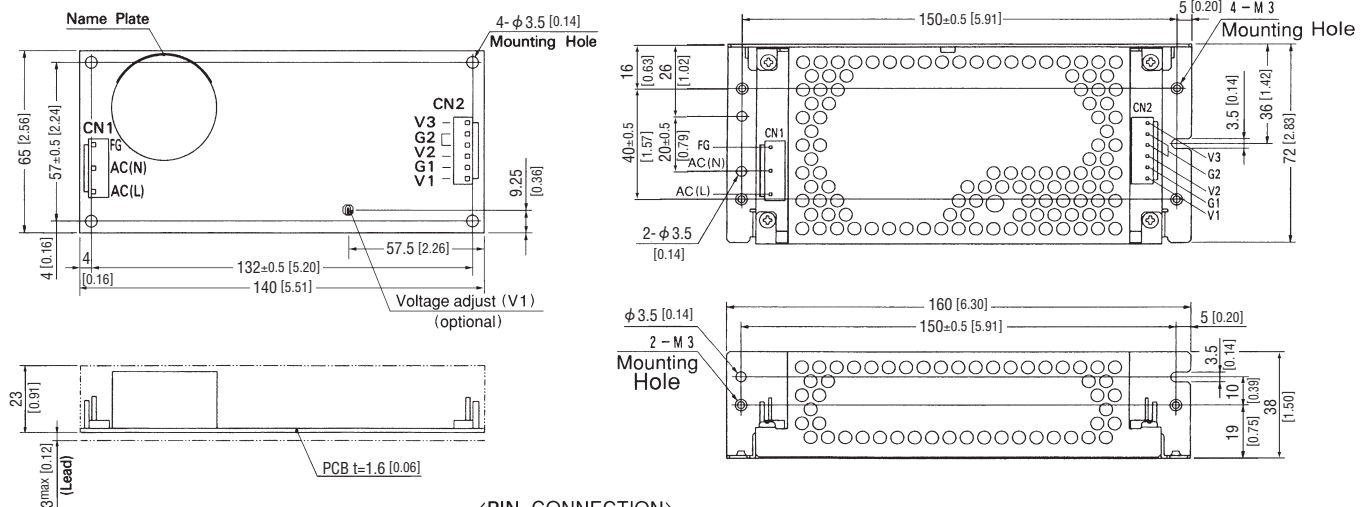
MODEL	LDC30F-1	LDC30F-2
DC OUTPUT	V1 +5V 3.0(Peak 4.5)A V2 +12V 1.2(Peak 2.0)A V3 -12V 0.3(Peak 0.45)A	+5V 3.0(Peak 4.5)A +15V 1.0(Peak 2.0)A -15V 0.3(Peak 0.45)A

SPECIFICATIONS

	MODEL	LDC30F-1			LDC30F-2			
INPUT	VOLTAGE[V]		AC85 - 264 1 ϕ or DC110 - 370					
	CURRENT[A]	ACIN 100V	0.8typ (Io=100%)					
	FREQUENCY[Hz]		47 - 440 or DC					
	EFFICIENCY[%]	ACIN 100V	72typ (Io=100%)					
	INRUSH CURRENT[A]	ACIN 100V	25typ (Io=100%) (At cold start)					
		ACIN 200V	50typ (Io=100%) (At cold start)					
	LEAKAGE CURRENT[ma]		0.75max (60Hz, According to UL, CSA, VDE and DEN-AN)					
OUTPUT	VOLTAGE[V]		+5	+12	-12	+5	+15	-15
	CURRENT[A]		*1 0 - 3.0 (Peak 4.5)	0 - 1.2 (Peak 2.0)	0 - 0.3 (Peak 0.45)	0 - 3.0 (Peak 4.5)	0 - 1.0 (Peak 2.0)	0 - 0.3 (Peak 0.45)
	LINE REGULATION[mV]		20max	48max	48max	20max	60max	60max
	LOAD REGULATION[mV]		100max	120max	150max	100max	120max	150max
	RIPPLE[mVp-p]	0 to +50°C *2	100max	120max	120max	100max	120max	120max
		-10 - 0°C *2	150max	160max	160max	150max	160max	160max
	RIPPLE NOISE[mVp-p]	0 to +50°C *2	120max	150max	150max	120max	150max	150max
		-10 - 0°C *2	170max	180max	180max	170max	180max	180max
	TEMPERATURE REGULATION[mV]	0 to +50°C	50max	350max	350max	50max	350max	350max
		-10 to +50°C	60max	420max	420max	60max	420max	420max
	DRIFT[mV]		*3 20max	—	—	20max	—	—
	START-UP TIME[ms]		100max (ACIN 85V, Io=100%)					
HOLD-UP TIME[ms]		10typ (ACIN 85V, Io=100%), 20typ (ACIN 100V, Io=100%), 100typ (ACIN 200V, Io=100%)						
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	
OUTPUT VOLTAGE SETTING[V]		4.9 to 5.3	11.4 to 12.6	-11.4 to -12.6	4.9 to 5.3	14.25 to 15.75	-14.25 to -15.75	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically					
	OVERVOLTAGE PROTECTION		Works at 115 - 140% of rating (+5V only)					
	OPERATING INDICATION		Not provided					
	REMOTE SENSING		Not provided					
	REMOTE ON/OFF		Not provided					
ISOLATION	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)					
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)					
	OUTPUT-FG		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)					
	OUTPUT-OUTPUT(V1-V2,V3)		AC100V 1minute, Cutoff current = 100mA, DC100V 10MΩ min (At Room Temperature)					
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE		-10 to +60°C, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet)					
	STORAGE TEMP.,HUMID.AND ALTITUDE		-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet)					
	VIBRATION		10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis					
	IMPACT		196.1m/s² (20G), 11ms, once each X, Y and Z axis					
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, EN60950-1, EN50178, CSA C22.2 No.60950-1 Complies with DEN-AN and IEC60950-1					
	CONDUCTED NOISE		Complies with FCC-B, CISPR22-B, EN55022-B, VCCI-B					
OTHERS	CASE SIZE/WEIGHT		65 x 26 x 140mm [2.56 x 1.02 x 5.51 inches] (W x H x D) / 220g max (with chassis & cover : 400g max)					
	COOLING METHOD		Convection					

- *1 Peak load for 10sec. or less is acceptable if the total wattage is less than the rated wattage(-1: 33W, -2: 34.5W).When the load of +5V is OA, other output can be drawn by 80% of rated current.
- *2 Measured by 20MHz oscilloscope or Ripple-Noise meter (equivalent to KEISOKU-GIKEN:RM101).
- *3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C with the input voltage held constant at the rated input/output.
- *4 Please contact us about safety approvals for the model with option.
- * Avoid prolonged use under over-load.
- * Derating is required when operated with chassis and cover.

External view



<PIN CONNECTION>

CN1	
Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

CN2	
Pin No.	Output
1	V3
2	G2
3	G2
4	V2
5	G1
6	V1

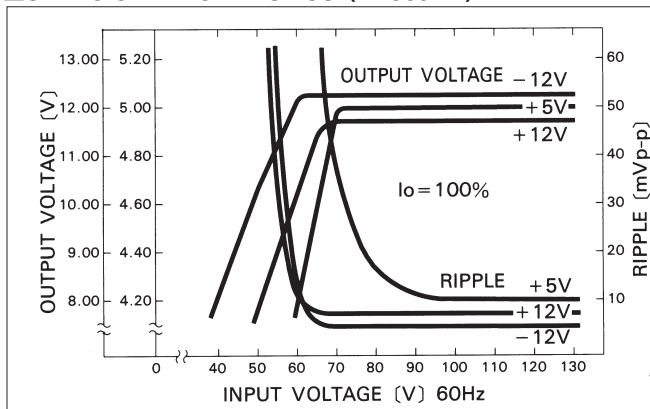
I/O Connector	Mating Connector	Terminal
CN1	B3P5-VH	VHR-5N
CN2	B6P-VH	VHR-6N

Chain: SVH-21T-P1.1
Loose: BVH-21T-P1.1
(Mfr : J.S.T.)

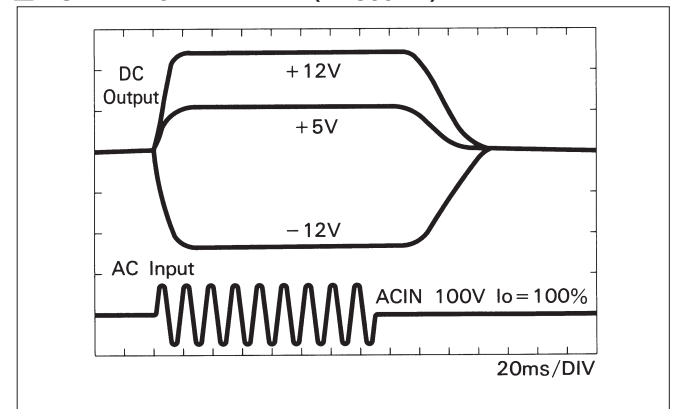
- ※ Weight: 220g max (with chassis & cover : 400g max)
- ※ Tolerance: ± 1 [± 0.04]
- ※ Dimensions in mm, [] = inches
- ※ PCB Material: Glass composite (CEM3)
- ※ Chassis and cover is optional.
- ※ Mounting torque: 0.6N-m (6.3kgf-cm) max

Performance data

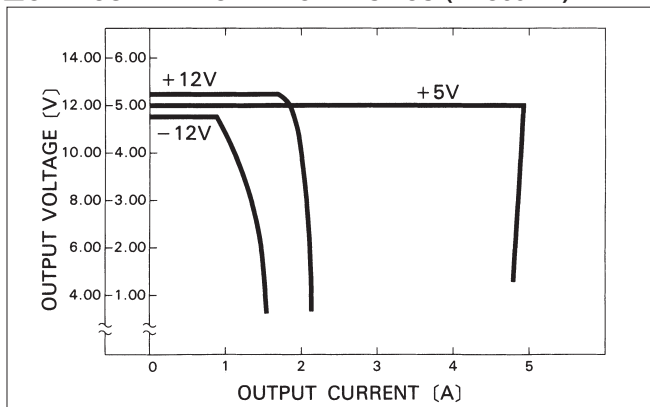
■ STATIC CHARACTERISTICS (LDC30F-1)



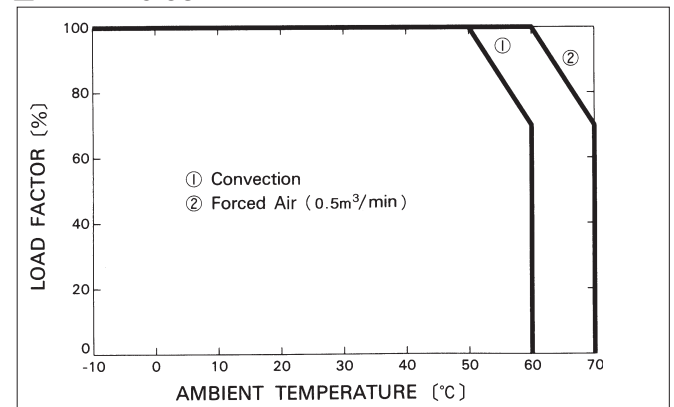
■ RISE TIME & FALL TIME (LDC30F-1)



■ OVERCURRENT CHARACTERISTICS (LDC30F-1)



■ DERATING CURVE



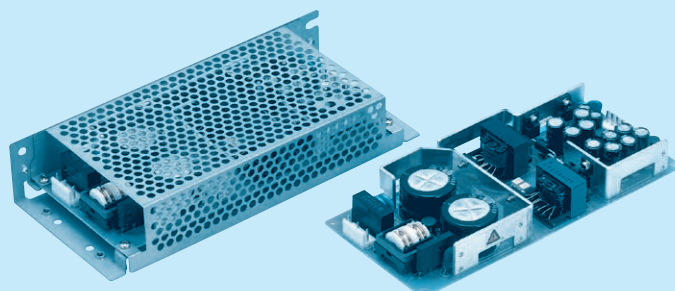
LDC60F

LD C 60 F -1 -□

① ② ③ ④ ⑤ ⑥



RoHS



- ① Series name
- ② Multiple output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage combination
- ⑥ Optional *4
C :with Coating
G :Low leakage current
S :with Chassis
SN:with Chassis & cover
Y :with Potentiometer

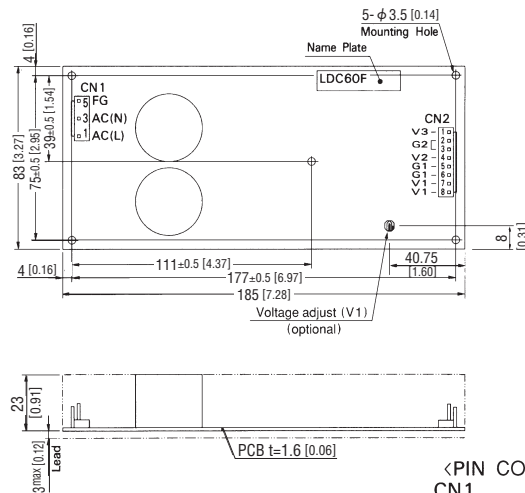
MODEL	LDC60F-1	LDC60F-2
DC OUTPUT	V1 +5V 5.0(Peak 7.0)A V2 +12V 2.5(Peak 3.5)A V3 -12V 0.5(Peak 0.7)A	+5V 5.0(Peak 7.0)A +15V 2.0(Peak 3.5)A -15V 0.5(Peak 0.7)A

SPECIFICATIONS

	MODEL	LDC60F-1	LDC60F-2					
INPUT	VOLTAGE[V]	AC85 - 264 1 ϕ or DC110 - 370						
	CURRENT[A]	ACIN 100V	1.4typ (Io=100%)					
	FREQUENCY[Hz]		47 - 440 or DC					
	EFFICIENCY[%]	ACIN 100V	72typ (Io=100%)					
	INRUSH CURRENT[A]	ACIN 100V	30typ (Io=100%) (At cold start)					
		ACIN 200V	60typ (Io=100%) (At cold start)					
	LEAKAGE CURRENT[mA]	0.75max (60Hz, According to UL, CSA, VDE and DEN-AN)						
OUTPUT	VOLTAGE[V]	+5	+12	-12	+5	+15	-15	
	CURRENT[A]	*1 0 - 5.0 (Peak 7.0)	0 - 2.5 (Peak 3.5)	0 - 0.5 (Peak 0.7)	0 - 5.0 (Peak 7.0)	0 - 2.0 (Peak 3.5)	0 - 0.5 (Peak 0.7)	
	LINE REGULATION[mV]	20max	48max	48max	20max	60max	60max	
	LOAD REGULATION[mV]	100max	150max	150max	100max	150max	150max	
	RIPPLE[mVp-p]	0 to +50°C *2	100max	120max	120max	100max	120max	120max
		-10 - 0°C *2	150max	160max	160max	150max	160max	160max
	RIPPLE NOISE[mVp-p]	0 to +50°C *2	120max	150max	150max	120max	150max	150max
		-10 - 0°C *2	170max	180max	180max	170max	180max	180max
	TEMPERATURE REGULATION[mV]	0 to +50°C	50max	350max	350max	50max	350max	350max
		-10 to +50°C	60max	420max	420max	60max	420max	420max
	DRIFT[mV]	*3 20max	——	——	20max	——	——	
	START-UP TIME[ms]	200max (ACIN 85V, Io=100%)						
HOLD-UP TIME[ms]	10typ (ACIN 85V, Io=100%), 20typ (ACIN 100V, Io=100%), 100typ (ACIN 200V, Io=100%)							
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed		
OUTPUT VOLTAGE SETTING[V]	4.9 to 5.3	11.4 to 12.6	-11.4 to -12.6	4.9 to 5.3	14.25 to 15.75	-14.25 to -15.75		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically						
	OVERVOLTAGE PROTECTION	Works over 115% of rating by zener diode clamping (only available with V1, V2)						
	OPERATING INDICATION	Not provided						
	REMOTE SENSING	Not provided						
	REMOTE ON/OFF	Not provided						
ISOLATION	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)						
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)						
	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (At Room Temperature)						
	OUTPUT-OUTPUT(V1-V2,V3)	AC100V 1minute, Cutoff current = 100mA, DC100V 10M Ω min (At Room Temperature)						
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-10 to +60°C, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet)						
	STORAGE TEMP.,HUMID.AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet)						
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis						
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis						
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, EN60950-1, EN50178, CSA C22.2 No.60950-1 Complies with DEN-AN and IEC60950-1						
	CONDUCTED NOISE	Complies with FCC-B, CISPR22-B, EN55022-B, VCCI-B						
OTHERS	CASE SIZE/WEIGHT	83 x 26 x 185mm [3.27 x 1.02 x 7.28 inches] (W x H x D) / 300g max (with chassis & cover : 550g max)						
	COOLING METHOD	Convection						

- *1 Peak load for 10sec. or less is acceptable if the total wattage is less than the rated wattage(-1: 61W, -2: 62.5W).When the load of +5V is OA, other output can be drawn by 80% of rated current.
- *2 Measured by 20MHz oscilloscope or Ripple-Noise meter (equivalent to KEISOKU-GIKEN:RM101).
- *3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C with the input voltage held constant at the rated input/output.
- *4 Please contact us about safety approvals for the model with option.
- * Avoid prolonged use under over-load.
- * Derating is required when operated with chassis and cover.

External view



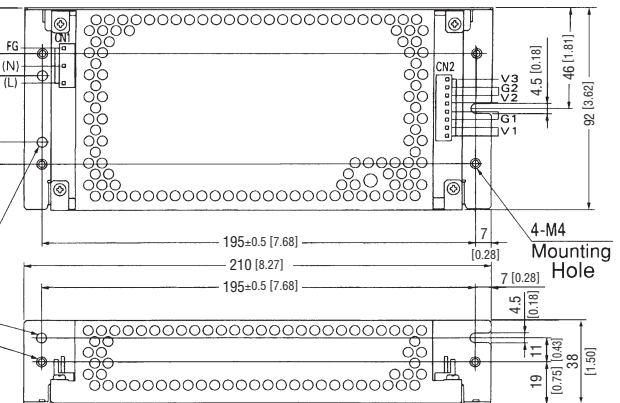
I/O Connector	Mating Connector	Terminal
CN1	B3P5-VH	VHR-5N
		Chain: SVH-21T-P1.1
		Loose: BVH-21T-P1.1
CN2	B8P-VH	VHR-8N
		Chain: SVH-21T-P1.1
		Loose: BVH-21T-P1.1

(Mfr : J.S.T.)

<PIN CONNECTION>

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

※ Keep drawing current per pin below 5A for CN2.

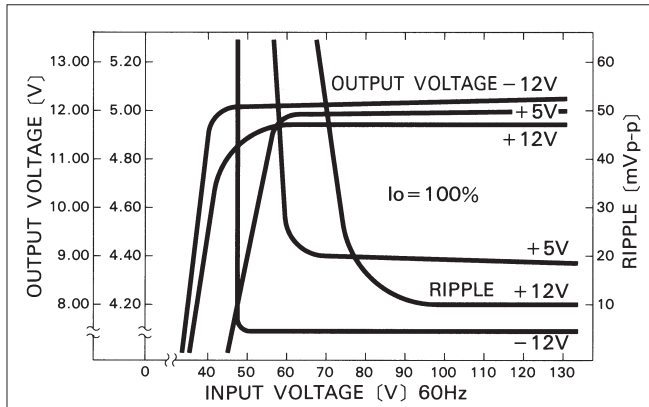


Pin No.	Output
1	V3
2	G2
3	G2
4	V2
5	G1
6	G1
7	V1
8	V1

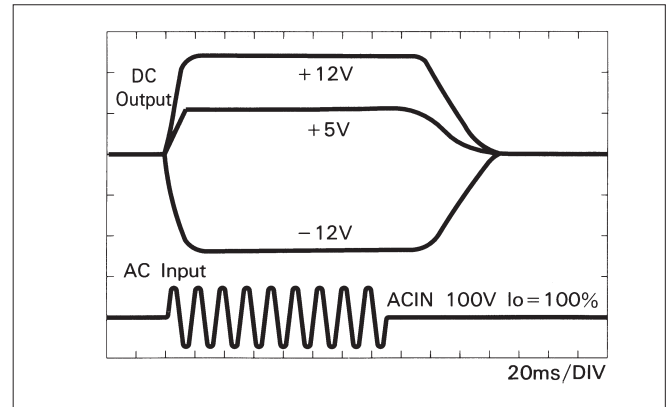
- ※ Weight: 300g max (with chassis & cover : 550g max)
- ※ Tolerance: ± 1 [± 0.04]
- ※ Dimensions in mm, [] = inches
- ※ PCB Material: Glass composite (CEM3)
- ※ Chassis and cover is optional.
- ※ Mounting torque: 1.5N·m (16kgf·cm) max

Performance data

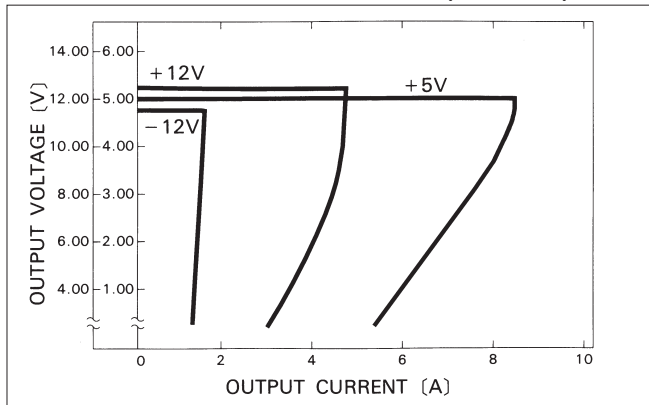
■ STATIC CHARACTERISTICS (LDC60F-1)



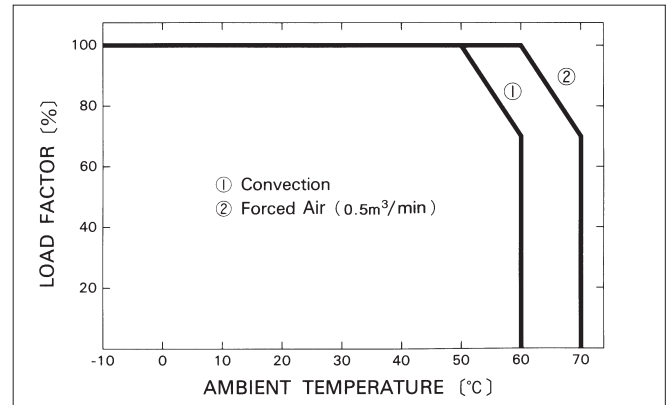
■ RISE TIME & FALL TIME (LDC60F-1)



■ OVERCURRENT CHARACTERISTICS (LDC60F-1)



■ DERATING CURVE



Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Fuse [A]	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
LDC15F	Flyback converter	40 - 350	0.4	2	Resistance of line filter	CEM-3	Yes		*1	No
LDC30F	Flyback converter	40 - 400	0.8	3	Thermistor	CEM-3	Yes		*1	No
LDC60F	Flyback converter	30 - 500	1.4	3	Thermistor	CEM-3	Yes		*1	No

*1 Refer to Instruction Manual.

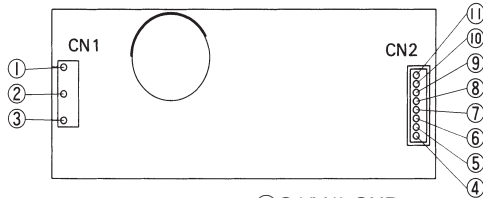
* The value of input current shown is at AC IN 100V and rated load.

* Switching frequency of flyback converter depends on input voltage and load factor.

1	Terminal Block	LDC-10
2	Function	LDC-10
2.1	Input voltage range	LDC-10
2.2	Inrush current limiting	LDC-10
2.3	Overcurrent protection	LDC-10
2.4	Overvoltage protection	LDC-11
2.5	Output voltage adjustment range	LDC-11
2.6	Minimum output current	LDC-11
3	Series Operation and Parallel Operation	LDC-11
4	Assembling and Installation Method	LDC-11
4.1	Installation method	LDC-11
4.2	Derating	LDC-12
4.3	Mounting screw	LDC-12
5	Peak Loading	LDC-13
6	Ground	LDC-13
7	Others	LDC-13

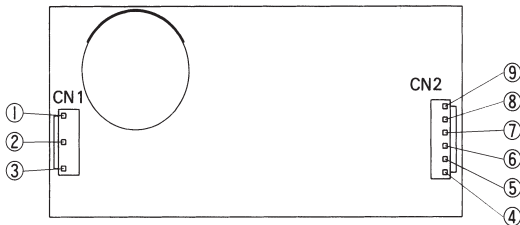
1 Terminal Block

●LDC15F



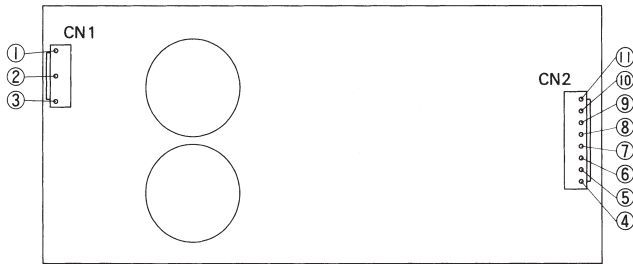
- ①Frame ground
- ②AC(N)
- ③AC(L)
- ④V1 Output
- ⑤V1 Output
- ⑥G1(V1) GND
- ⑦G1(V1) GND
- ⑧V2 Output
- ⑨G2(V2, V3) GND
- ⑩G2(V2, V3) GND
- ⑪V3 Output

●LDC30F



- ①Frame ground
- ②AC(N)
- ③AC(L)
- ④V1 Output
- ⑤G1(V1) GND
- ⑥V2 Output
- ⑦G2(V2, V3) GND
- ⑧G2(V2, V3) GND
- ⑨V3 Output

●LDC60F



- ①Frame ground
- ②AC(N)
- ③AC(L)
- ④V1 Output
- ⑤V1 Output
- ⑥G1(V1) GND
- ⑦G1(V1) GND
- ⑧V2 Output
- ⑨G2(V2, V3) GND
- ⑩G2(V2, V3) GND
- ⑪V3 Output

2 Function

2.1 Input voltage range

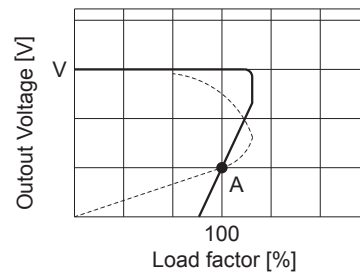
- The range is from AC85V to AC264V or DC110V to DC370V.
- AC input voltage must have a range from AC85V to AC264V or DC110V to DC370V for normal operation. If the wrong input is applied, the unit will not operate properly and/or may be damaged.
- In cases that conform with safety standard, input voltage range is AC100-AC240V(50/60Hz).

2.2 Inrush current limiting

- Inrush current limiting is built-in.
- If a switch on the input side is installed, it has to be the one handling the input inrush current.
- The thermistor is used for protection from inrush current. When power is turned ON/OFF repeatedly within a short period of time, it is necessary to have enough time for power supply to cool down.

2.3 Overcurrent protection

- Overcurrent protection is built-in and comes into effect at over 105% of the rated current. Overcurrent protection prevents the unit from short circuit and overcurrent condition of less than 10 seconds. The unit automatically recovers when the fault condition is cleared.
- When the overcurrent/short circuit condition continues more than 10 seconds, it may damage devices inside the power supply.
- The power supply which has a current foldback characteristics may not start up when connected to nonlinear load such as lamp, motor or constant current load. See the characteristics below.



- : Load characteristics of power supply.
- : Characteristics of load (lamp, motor, constant current load, etc.).
- Note: In case of nonlinear load, the output is locked out at A point.

Fig.2.1 Current foldback characteristics

●LDC60F

- When overcurrent protection comes into effect only for V1, the output voltage of V2 & V3 will not drop.

2.4 Overvoltage protection

●LDC30F

■In V1, the overvoltage protection circuit is built-in and comes into effect at 115 - 140% of the rated voltage. The AC input should be shut down if overvoltage protection is in operation. The minimum interval of AC recycling for recovery is 5 minutes (★).

★ The recovery time varies depending on input voltage.

●LDC15F · LDC60F

■Overvoltage protection circuit, clamping the output voltage by zener diode, is built-in and comes into effect at over 115% of the rated voltage (except LDC15F V₂, V₃ and LDC60F V₃). The unit in an overvoltage protection mode cannot be recovered by a user; it must be repaired at the factory. Overvoltage protection (diode) also comes into effect.

Moreover, when the overvoltage is applied to output of power supply from outside, this diode operates, please avoid applying overvoltage externally.

Remarks:

Please avoid applying the over-rated voltage to the output terminal. Power supply may operate incorrectly or fail. In case of operating a motor etc., please install an external diode on the output terminal to protect the unit.

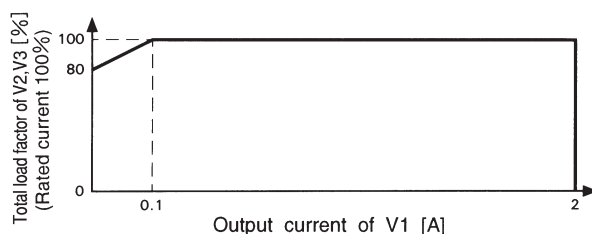
2.5 Output voltage adjustment range

- Adjustment of output voltage for V1 is possible by using potentiometer.
- Output voltage is increased by turning potentiometer clockwise and is decreased by turning potentiometer counterclockwise.
- Modified unit "-Y" is recommended which can adjust the output voltage.

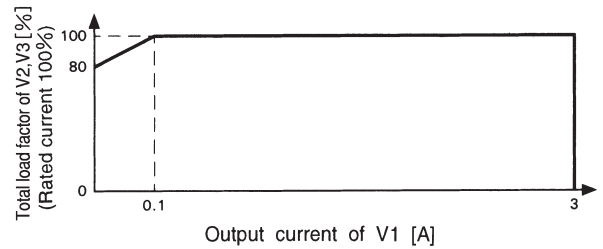
2.6 Minimum output current

■By V1 (+5V) load condition, the load factor of V2 and V3 are changed as below.

●LDC15F

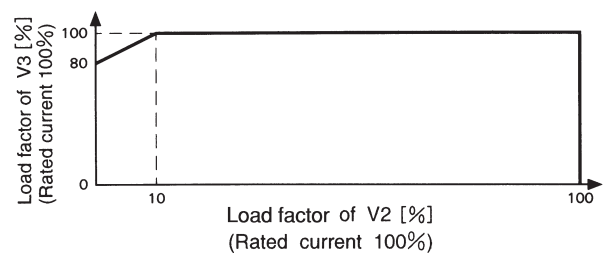


●LDC30F



■By V2 load condition, the load factor of V3 is changed as below.

●LDC60F



3 Series Operation and Parallel Operation

- Series operation with V2 and V3 is available by connecting the outputs of the unit as shown below. Output current in series connection should be lower than the lowest output current of the unit.
- Series operation with other model is not possible.
- By adding diode externally at the output side, series operation with V2 and V3 is available. For details, please contact our sales or engineering departments.
- Parallel operation is not possible.

4 Assembling and Installation Method

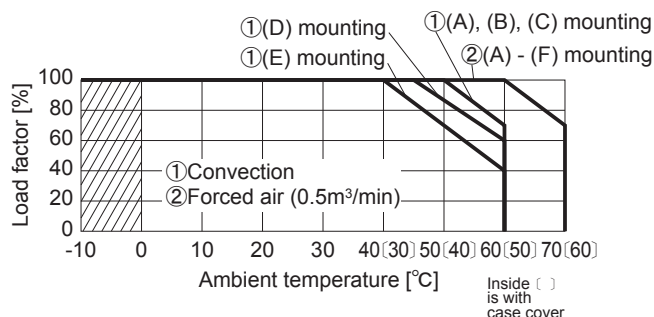
4.1 Installation method

- When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Ambient temperature around each power supply should not exceed the temperature range shown in derating curve.
- Please be careful with that metal parts do not touch mounted parts at front side, where major components are mounted, when a power supply is installed with them.

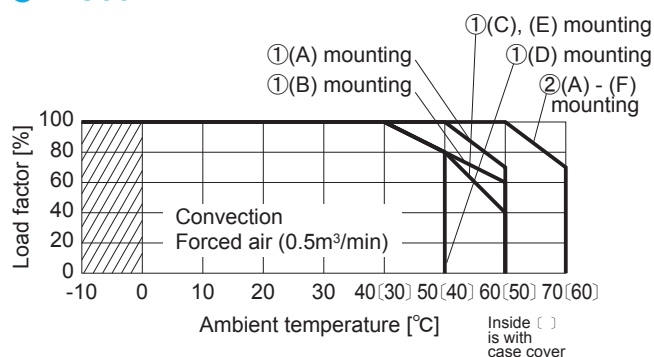
4.2 Derating

■The operative ambient temperature is different by with/without case cover or mounting position. Please refer drawings as below.

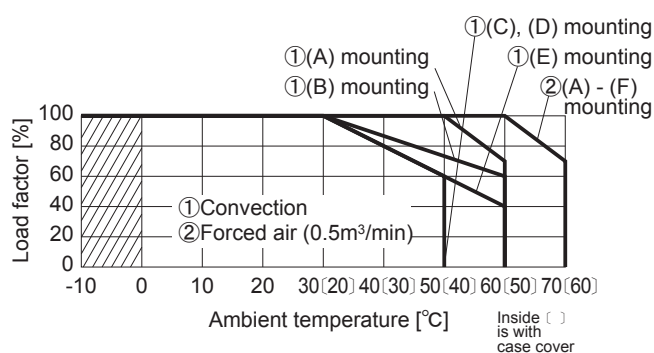
●LDC15F



●LDC30F



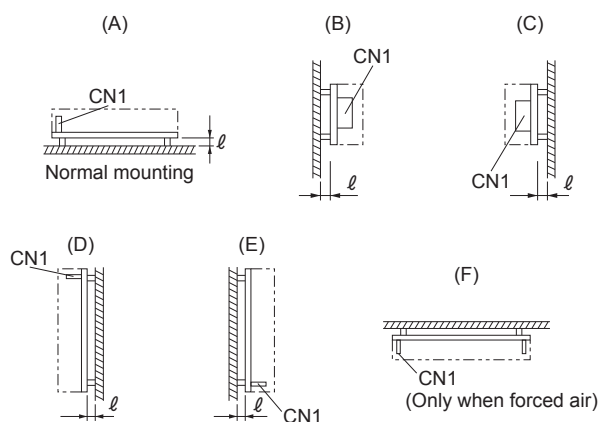
●LDC60F



Note:

In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

■ When unit mounted except below drawings, it is required to consider ventilated environment by forced air cooling or temperature/load derating. For details, please consult our sales or engineering departments.



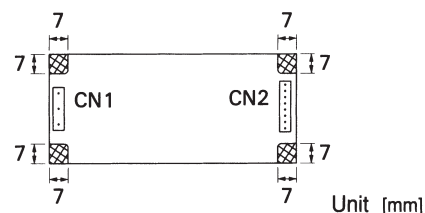
■ In case of metal chassis, keep more than 8mm for the part of l_2 to insulate between lead of component and metal chassis. If it is less than 8mm, insert the insulation sheet between power supply and metal chassis.

4.3 Mounting screw

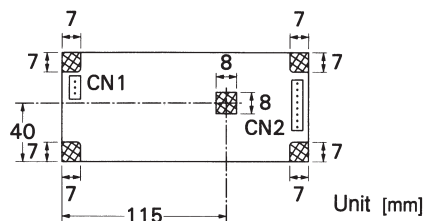
■ The mounting screw should be M3. The hatched area shows the allowance of metal parts for mounting.

■ Keep isolation distance between metal parts for mounting and internal components.

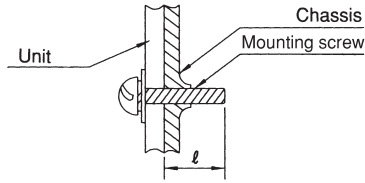
●LDC15F・LDC30F



●LDC60F



- Keep isolation distance between screw and internal components, as below chart.



Unit:[mm]

Model	l max
LDC15F- □ -SN	8
LDC30F- □ -SN	8
LDC60F- □ -SN	8

5 Peak Loading

- Peak load current is possible to draw 10 seconds subject the average current should be less than the rated current. It will damage devices inside the power supply when the peak load current continues more than 10 seconds.

6 Ground

- When installing the power supply with your unit, ensure that the input FG terminal or mounting hole FG is connected to safety ground of the unit. However, when applying the safety agency, connect the input FG terminal to safety ground of the unit.

7 Others

- This power supply is the rugged PCB type. Do not drop conductive objects in the power supply.
- At light load, there remains high voltage inside the power supply for a few minutes after power OFF. So at maintenance, take care about electric shock.
- This power supply is manufactured by SMD technology. The stress to PCB like twisting or bending causes the defect of the unit, so handle the unit with care.

● LDC60F

- When overcurrent protection works at V1 only, the output voltage of V2 and V3 will not be dropped.

Power
Factor
Correction

World wide

Safety
Approvals

EMI

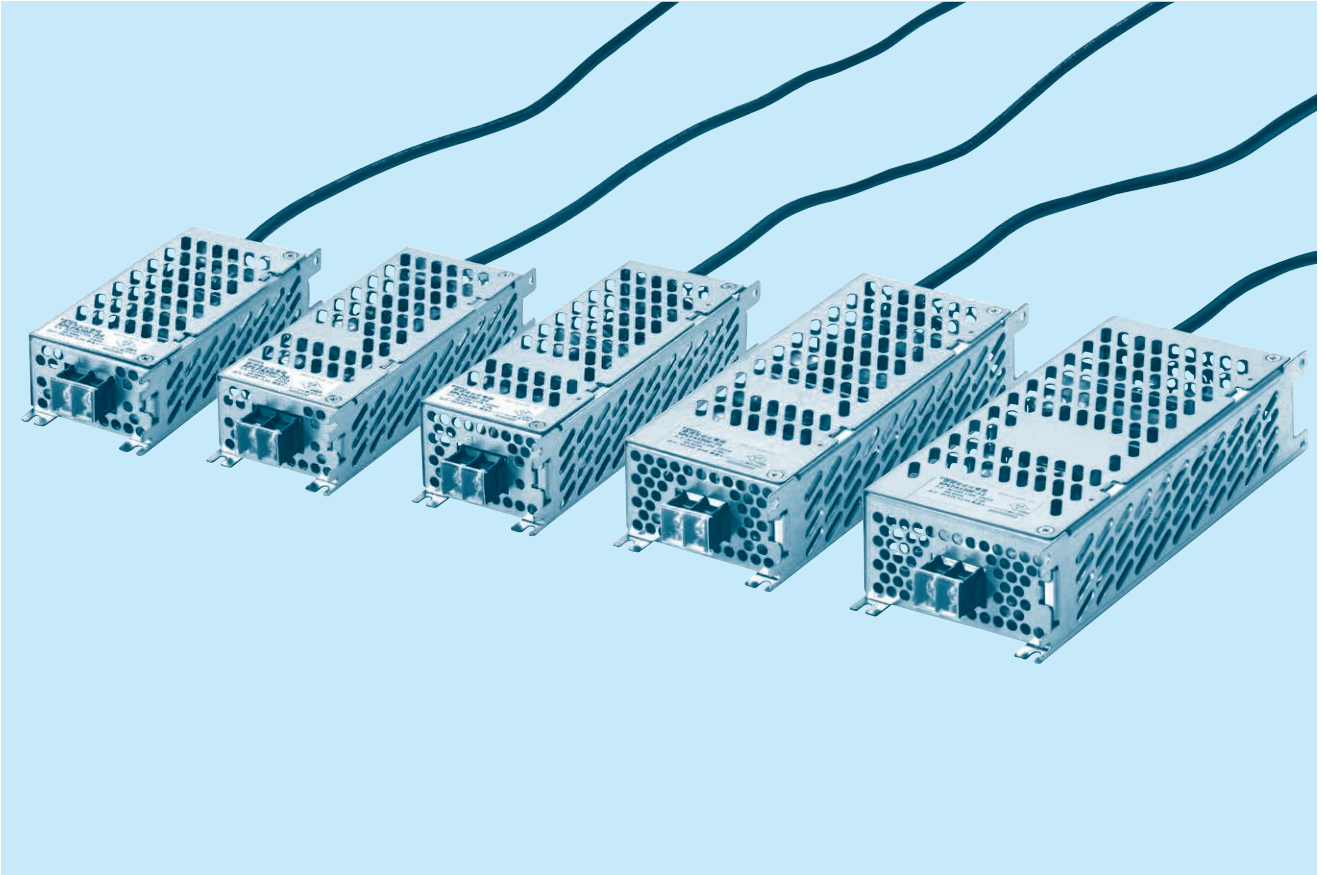
Inrush
current
limiting

OCP



OVP

SPLFA-series



SPLFA

Feature

- Universal input (AC85-264V)
- Approved with DEN-AN (at AC100V-120V input)
- Small and compact size
- Harmonic attenuator (Complies with IEC61000-3-2)
- Power factor correction (SPLFA50F-75F-100F-150F)
- Built-in inrush current, overcurrent and overvoltage protection circuits

Safety agency approvals

DEN-AN approved PSE marking

Environment

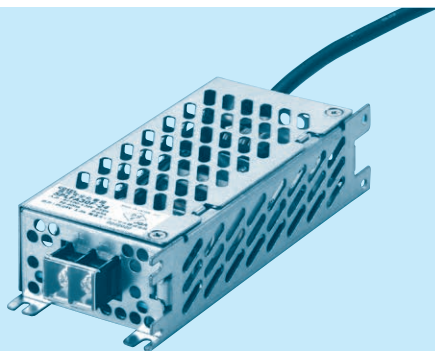
RoHS directive

3-year warranty

SPLFA30F

SPLF A 30 F - -

① ② ③ ④ ⑤ ⑥



- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional
C : with Coating

MODEL	SPLFA30F-5	SPLFA30F-12	SPLFA30F-24
MAX OUTPUT WATTAGE[W]	30.0	30.0	31.2
DC OUTPUT	5V 6A	12V 2.5A	24V 1.3A

SPECIFICATIONS

	MODEL		SPLFA30F-5	SPLFA30F-12	SPLFA30F-24
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.1) *3		
	CURRENT[A]	ACIN 100V	0.65typ (Io=100%)		
		ACIN 200V	0.35typ (Io=100%)		
	FREQUENCY[Hz]		50 / 60 (47 - 440)		
	EFFICIENCY[%]	ACIN 100V	75.0typ	78.0typ	81.0typ
		ACIN 200V	77.0typ	80.0typ	83.0typ
	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25℃)		
ACIN 200V		30typ (Io=100%) (At cold start) (Ta=25℃)			
LEAKAGE CURRENT[mA]		0.30 / 0.65max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)			
OUTPUT	VOLTAGE[V]		5	12	24
	CURRENT[A]		6.0	2.5	1.3
	LINE REGULATION[mV] *5		20max	48max	96max
	LOAD REGULATION[mV] *5		100max	100max	150max
	RIPPLE[mVp-p]	0 to +50℃ *1	100max	120max	120max
		-10 - 0℃ *1	140max	160max	160max
	RIPPLE NOISE[mVp-p]	0 to +50℃ *1	250max	250max	250max
		-10 - 0℃ *1	300max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	120max	240max
		-10 to +50℃	60max	150max	290max
	DRIFT[mV] *2		20max	48max	96max
	START-UP TIME[ms]		150typ (ACIN 100V, Io=100%)		
HOLD-UP TIME[ms]		20typ (ACIN 100V, Io=100%)			
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE SETTING[V]		4.90 to 5.30	11.50 to 12.50	23.00 to 25.00
	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically		
	OVERVOLTAGE PROTECTION[V]		5.75 to 7.00	13.80 to 16.80	27.60 to 33.60
	OPERATING INDICATION		LED (Green)		
	REMOTE SENSING		Not provided		
ISOLATION	REMOTE ON/OFF		Not provided		
	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)		
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)		
ENVIRONMENT	OUTPUT-FG		AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)		
	OPERATING TEMP., HUMID. AND ALTITUDE		-10 to +60℃, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max *3		
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max		
	VIBRATION		10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	IMPACT		196.1m/s ² (20G), 11ms, once each X, Y and Z axis		
	AGENCY APPROVALS		DEN-AN		
	CONDUCTED NOISE/POWER		Complies with DEN-AN		
OTHERS	HARMONIC ATTENUATOR *4		Complies with IEC61000-3-2 class A (Not built-in to active filter)		
	CASE SIZE/WEIGHT		61 X 36 X 150mm [2.40 X 1.42 X 5.91 inches] (W X H X D) / 370g max		
	COOLING METHOD		Convection		

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*3 Derating is required.

*4 When two or more units are operating it may not comply with the IEC61000-3-2. Please contact us about another class.

*5 Please contact us about dynamic load and input response.

* To meet the specifications. Do not operate over-loaded condition.

* Parallel operation is not possible.

* Derating is required when operated with chassis and cover.

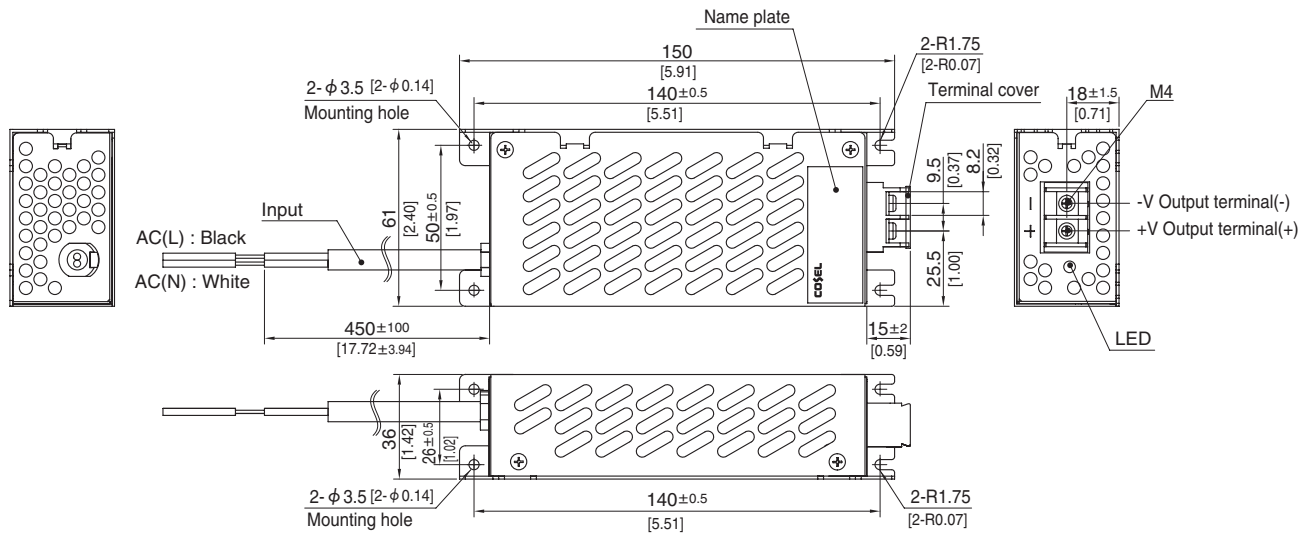
* Sound noise may be generated by power supply in case of pulse load.

Block diagram



SPLFA

External view

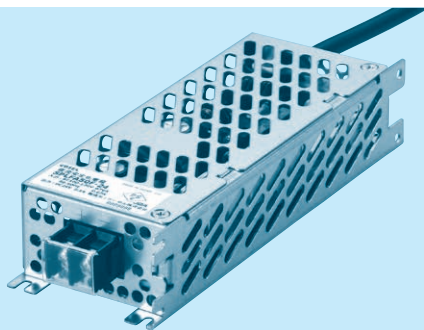


- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 370g max
- ※ PCB material/thickness : CEM3 / 1.6mm [0.06]
- ※ Chassis and cover material : Electric galvanizing steel board
- ※ Dimensions in mm, []=inches
- ※ Mounting torque : M4 : 1.6N · m (16.9kgf · cm) max
- ※ Input wire : VCTF 0.75sq X2C

SPLFA50F

SPLF A 50 F - -

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional
- C : with Coating

MODEL	SPLFA50F-5	SPLFA50F-12	SPLFA50F-24
MAX OUTPUT WATTAGE[W]	50	51.6	50.4
DC OUTPUT	5V 10A	12V 4.3A	24V 2.1A

SPECIFICATIONS

	MODEL	SPLFA50F-5	SPLFA50F-12	SPLFA50F-24	
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.1) *3		
	CURRENT[A]	ACIN 100V	0.67typ (Io=100%)		
		ACIN 200V	0.36typ (Io=100%)		
	FREQUENCY[Hz]		50 / 60 (47 - 63)		
	EFFICIENCY[%]	ACIN 100V	76.5typ	79.0typ	80.5typ
		ACIN 200V	78.0typ	80.5typ	82.0typ
	POWER FACTOR (Io=100%)	ACIN 100V	0.97typ		
		ACIN 200V	0.90typ		
INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25℃)			
	ACIN 200V	30typ (Io=100%) (At cold start) (Ta=25℃)			
LEAKAGE CURRENT[ma]		0.40 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)			
OUTPUT	VOLTAGE[V]		5	12	24
	CURRENT[A]		10.0	4.3	2.1
	LINE REGULATION[mV] *4		20max	48max	96max
	LOAD REGULATION[mV] *4		150max	150max	150max
	RIPPLE[mVp-p]	0 to +50℃ *1	100max	120max	120max
		-10 - 0℃ *1	140max	160max	160max
	RIPPLE NOISE[mVp-p]	0 to +50℃ *1	250max	250max	250max
		-10 - 0℃ *1	300max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	120max	240max
		-10 to +50℃	60max	150max	290max
	DRIFT[mV] *2		20max	48max	96max
	START-UP TIME[ms]		350typ (ACIN 100V, Io=100%)		
HOLD-UP TIME[ms]		20typ (ACIN 100V, Io=100%)			
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE SETTING[V]		4.90 to 5.30	11.50 to 12.50	23.00 to 25.00
	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically		
	OVERVOLTAGE PROTECTION[V]		5.75 to 7.00	13.80 to 16.80	27.60 to 33.60
	OPERATING INDICATION		LED (Green)		
	REMOTE SENSING		Not provided		
ISOLATION	REMOTE ON/OFF		Not provided		
	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)		
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)		
	OUTPUT-FG		AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)		
ENVIRONMENT	OPERATING TEMP., HUMID.AND ALTITUDE		-10 to +50℃, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max *3		
	STORAGE TEMP., HUMID.AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max		
	VIBRATION		10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT		196.1m/s² (20G), 11ms, once each X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		DEN-AN		
	CONDUCTED NOISE/POWER		Complies with DEN-AN		
	HARMONIC ATTENUATOR *5		Complies with IEC61000-3-2 (class A)		
OTHERS	CASE SIZE/WEIGHT		61 X 36 X 174mm [2.40 X 1.42 X 6.85 inches] (W X H X D) / 440g max		
	COOLING METHOD		Convection		

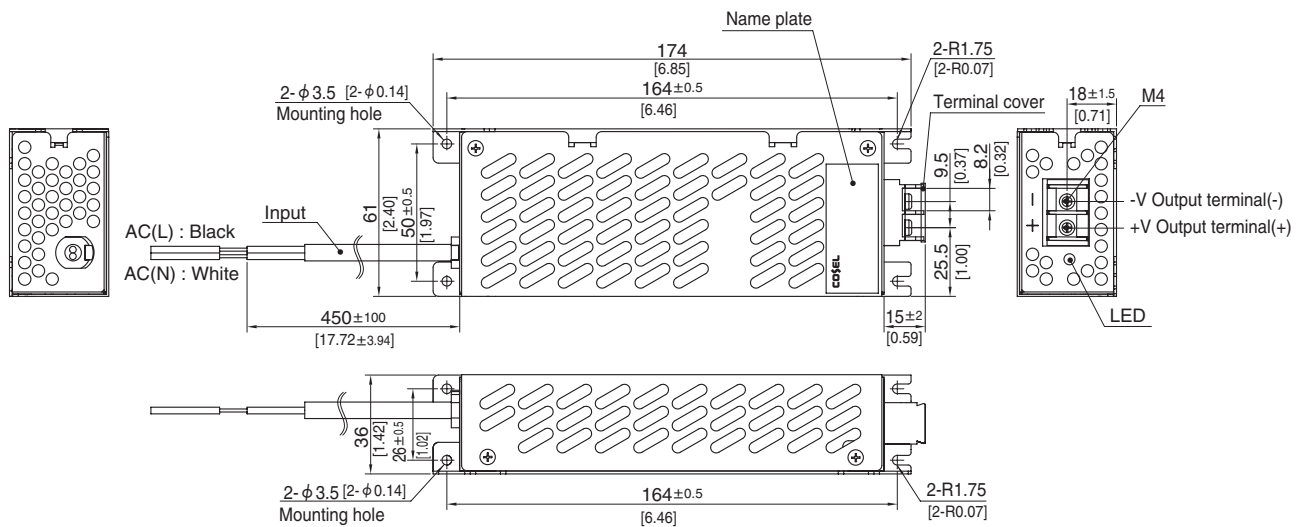
- *1 Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).
- *2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
- *3 Derating is required.
- *4 Please contact us about dynamic load and input response.
- *5 When two or more units are operating it may not comply with the IEC61000-3-2. Please contact us about another class.
- * To meet the specifications. Do not operate over-loaded condition.
- * Parallel operation is not possible.
- * Derating is required when operated with chassis and cover.
- * Sound noise may be generated by power supply in case of pulse load.

Block diagram



SPLFA

External view

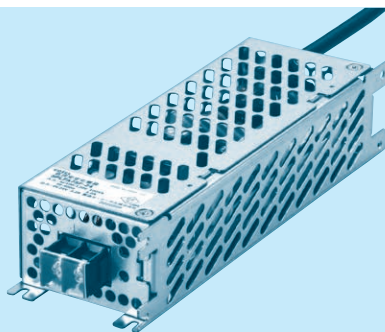


- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 440g max
- ※ PCB material/thickness : CEM3 / 1.6mm [0.06]
- ※ Chassis and cover material : Electric galvanizing steel board
- ※ Dimensions in mm, []=inches
- ※ Mounting torque : M4 : 1.6N · m (16.9kgf · cm) max
- ※ Input wire : VCTF 0.75sq X2C

SPLFA75F

SPLF A 75 F -□ -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional
- C : with Coating

MODEL	SPLFA75F-5	SPLFA75F-12	SPLFA75F-24
MAX OUTPUT WATTAGE[W]	75	75.6	76.8
DC OUTPUT	5V 15A	12V 6.3A	24V 3.2A

SPECIFICATIONS

	MODEL	SPLFA75F-5	SPLFA75F-12	SPLFA75F-24	
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.1) *3		
	CURRENT[A]	ACIN 100V	1.00typ (Io=100%)		
		ACIN 200V	0.50typ (Io=100%)		
	FREQUENCY[Hz]		50 / 60 (47 - 63)		
	EFFICIENCY[%]	ACIN 100V	75.0typ	80.0typ	81.5typ
		ACIN 200V	77.0typ	82.0typ	83.5typ
	POWER FACTOR (Io=100%)	ACIN 100V	0.97typ		
		ACIN 200V	0.90typ		
INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25℃)			
	ACIN 200V	30typ (Io=100%) (At cold start) (Ta=25℃)			
LEAKAGE CURRENT[ma]		0.40 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)			
OUTPUT	VOLTAGE[V]		5	12	24
	CURRENT[A]		15.0	6.3	3.2
	LINE REGULATION[mV] *4		20max	48max	96max
	LOAD REGULATION[mV] *4		150max	150max	150max
	RIPPLE[mVp-p]	0 to +50℃ *1	100max	120max	120max
		-10 - 0℃ *1	140max	160max	160max
	RIPPLE NOISE[mVp-p]	0 to +50℃ *1	250max	250max	250max
		-10 - 0℃ *1	300max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	120max	240max
		-10 to +50℃	60max	150max	290max
	DRIFT[mV] *2		20max	48max	96max
	START-UP TIME[ms]		350typ (ACIN 100V, Io=100%)		
HOLD-UP TIME[ms]		20typ (ACIN 100V, Io=100%)			
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE SETTING[V]		4.90 to 5.30	11.50 to 12.50	23.00 to 25.00
	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically		
	OVERVOLTAGE PROTECTION[V]		5.75 to 7.00	13.80 to 16.80	27.60 to 33.60
	OPERATING INDICATION		LED (Green)		
	REMOTE SENSING		Not provided		
ISOLATION	REMOTE ON/OFF		Not provided		
	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)		
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)		
ENVIRONMENT	OUTPUT-FG		AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)		
	OPERATING TEMP., HUMID.AND ALTITUDE		-10 to +50℃, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max *3		
	STORAGE TEMP., HUMID.AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max		
	VIBRATION		10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	IMPACT		196.1m/s² (20G), 11ms, once each X, Y and Z axis		
	AGENCY APPROVALS		DEN-AN		
	CONDUCTED NOISE/POWER		Complies with DEN-AN		
OTHERS	HARMONIC ATTENUATOR *5		Complies with IEC61000-3-2 (class A)		
	CASE SIZE/WEIGHT		61 X 42 X 192mm [2.40 X 1.65 X 7.56 inches] (W X H X D) / 540g max		
	COOLING METHOD		Convection		

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*3 Derating is required.

*4 Please contact us about dynamic load and input response.

*5 When two or more units are operating it may not comply with the IEC61000-3-2. Please contact us about another class.

* To meet the specifications. Do not operate over-loaded condition.

* Parallel operation is not possible.

* Derating is required when operated with chassis and cover.

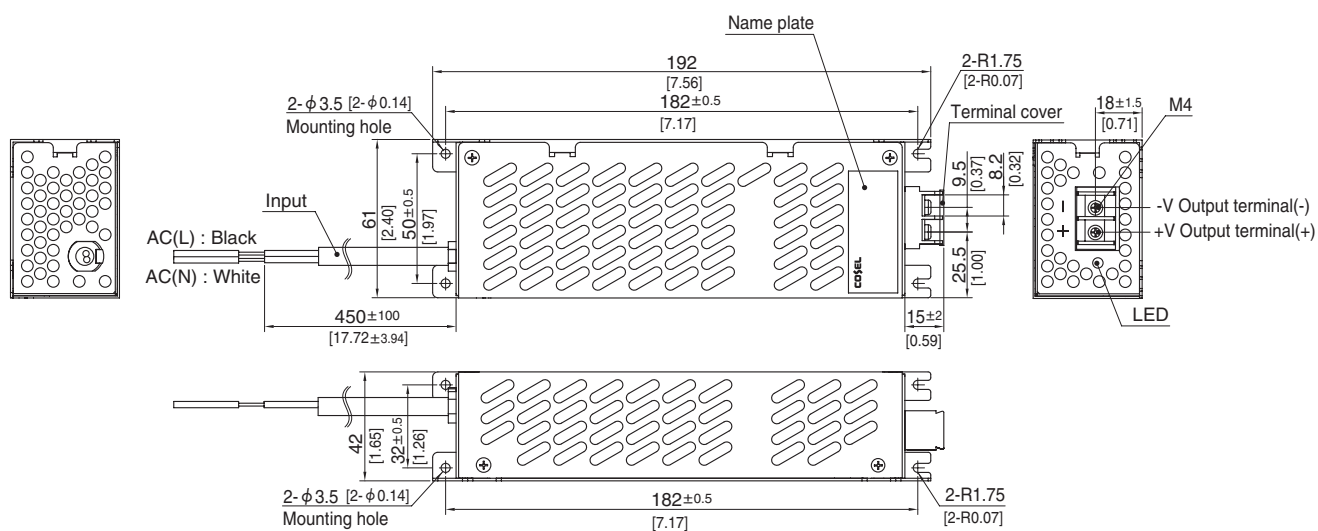
* Sound noise may be generated by power supply in case of pulse load.

Block diagram



SPLFA

External view

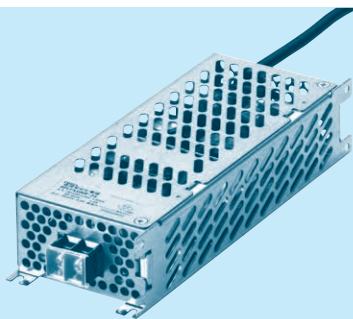


- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 540g max
- ※ PCB material/thickness : CEM3 / 1.6mm [0.06]
- ※ Chassis and cover material : Electric galvanizing steel board
- ※ Dimensions in mm, []=inches
- ※ Mounting torque : M4 : $1.6\text{N} \cdot \text{m}$ (16.9kgf \cdot cm) max
- ※ Input wire : VCTF 0.75sq X2C

SPLFA100F

SPLF A 100 F - -

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional
- C : with Coating

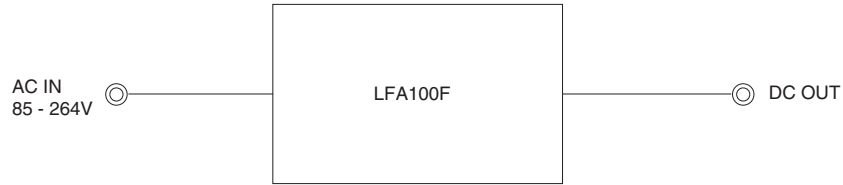
MODEL	SPLFA100F-12	SPLFA100F-24
MAX OUTPUT WATTAGE[W]	102.0	103.2
DC OUTPUT	12V 8.5A	24V 4.3A

SPECIFICATIONS

INPUT	MODEL		SPLFA100F-12		SPLFA100F-24	
	VOLTAGE[V]		AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.1) *3			
	CURRENT[A]	ACIN 100V	1.3typ (Io=100%)			
		ACIN 200V	0.7typ (Io=100%)			
	FREQUENCY[Hz]		50 / 60 (47 - 63)			
	EFFICIENCY[%]	ACIN 100V	80.5typ		83.0typ	
		ACIN 200V	83.5typ		86.0typ	
	POWER FACTOR (Io=100%)	ACIN 100V	0.97typ			
ACIN 200V		0.90typ				
INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25℃)				
	ACIN 200V	30typ (Io=100%) (At cold start) (Ta=25℃)				
LEAKAGE CURRENT[ma]		0.40 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)				
OUTPUT	VOLTAGE[V]		12		24	
	CURRENT[A]		8.5		4.3	
	LINE REGULATION[mV] *4		48max		96max	
	LOAD REGULATION[mV] *4		150max		150max	
	RIPPLE[mVp-p]	0 to +50℃ *1	120max		120max	
		-10 - 0℃ *1	160max		160max	
	RIPPLE NOISE[mVp-p]	0 to +50℃ *1	250max		250max	
		-10 - 0℃ *1	300max		300max	
	TEMPERATURE REGULATION[mV]	0 to +50℃	120max		240max	
		-10 to +50℃	150max		290max	
	DRIFT[mV] *2		48max		96max	
	START-UP TIME[ms]		350typ (ACIN 100V, Io=100%)			
HOLD-UP TIME[ms]		20typ (ACIN 100V, Io=100%)				
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE SETTING[V]		11.50 to 12.50		23.00 to 25.00	
	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically			
	OVERVOLTAGE PROTECTION[V]		13.80 to 16.80		27.60 to 33.60	
	OPERATING INDICATION		LED (Green)			
	REMOTE SENSING		Not provided			
ISOLATION	REMOTE ON/OFF		Not provided			
	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)			
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)			
	OUTPUT-FG		AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)			
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE		-10 to +50℃, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max *3			
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max			
	VIBRATION		10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis			
	IMPACT		196.1m/s ² (20G), 11ms, once each X, Y and Z axis			
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		DEN-AN			
	CONDUCTED NOISE/POWER		Complies with DEN-AN			
	HARMONIC ATTENUATOR *5		Complies with IEC61000-3-2 (class A)			
OTHERS	CASE SIZE/WEIGHT		73 × 42 × 197mm [2.87 × 1.65 × 7.76 inches] (W × H × D) / 670g max			
	COOLING METHOD		Convection			

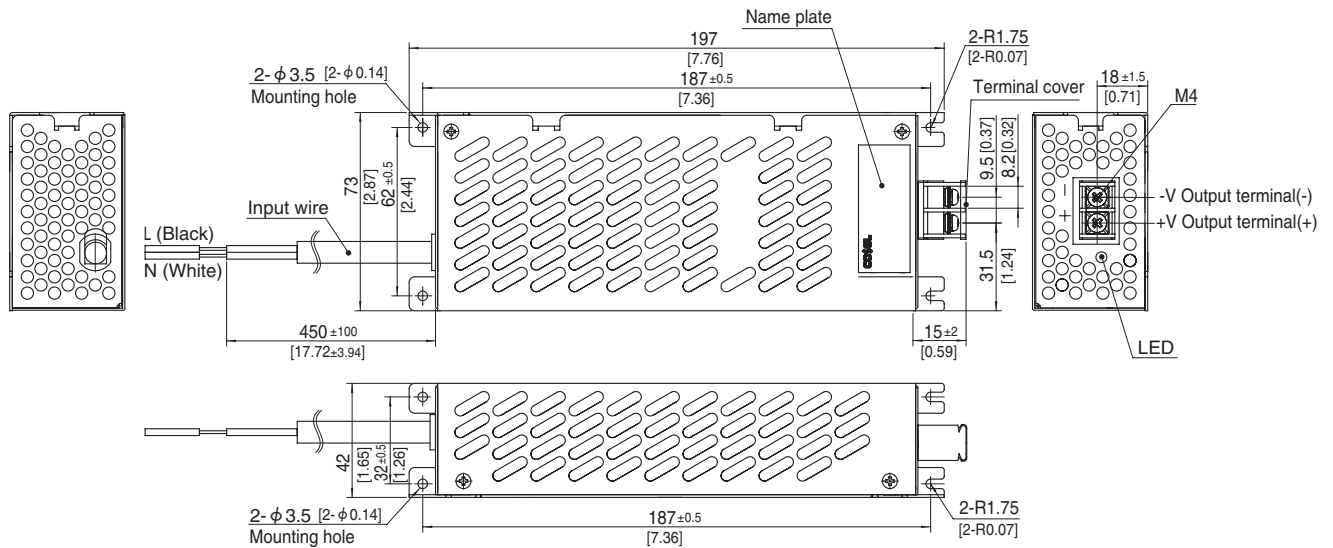
- *1 Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).
- *2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
- *3 Derating is required.
- *4 Please contact us about dynamic load and input response.
- *5 When two or more units are operating it may not comply with the IEC61000-3-2. Please contact us about another class.
- * To meet the specifications. Do not operate over-loaded condition.
- * Parallel operation is not possible.
- * Derating is required when operated with chassis and cover.
- * Sound noise may be generated by power supply in case of pulse load.

Block diagram



SPLFA

External view

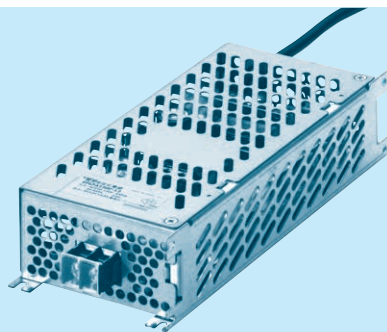


- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 670g max
- ※ Dimensions in mm, []=inches
- ※ Chassis material : Galvanized Steel board
- ※ Screw tightening torque : M4 : 1.6N · m (16.9kgf · cm) max
- ※ Input wire : VCTF 0.75sq X 2C

SPLFA150F

SPLF A 150 F - -

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional
- C : with Coating

MODEL	SPLFA150F-12	SPLFA150F-24
MAX OUTPUT WATTAGE[W]	150	151.2
DC OUTPUT	12V 12.5A	24V 6.3A

SPECIFICATIONS

	MODEL	SPLFA150F-12	SPLFA150F-24
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Refer to Instruction Manual 1.1 and 3.1) *3
	CURRENT[A]	ACIN 100V	2.0typ (Io=100%)
		ACIN 200V	1.0typ (Io=100%)
	FREQUENCY[Hz]		50 / 60 (47 - 63)
	EFFICIENCY[%]	ACIN 100V	81.0typ
		ACIN 200V	84.0typ
	POWER FACTOR (Io=100%)	ACIN 100V	0.97typ
		ACIN 200V	0.90typ
INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25℃)	
	ACIN 200V	30typ (Io=100%) (At cold start) (Ta=25℃)	
LEAKAGE CURRENT[ma]		0.40 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)	
OUTPUT	VOLTAGE[V]		12
	CURRENT[A]		12.5
	LINE REGULATION[mV] *4		48max
	LOAD REGULATION[mV] *4		150max
	RIPPLE[mVp-p]	0 to +50℃ *1	120max
		-10 - 0℃ *1	160max
	RIPPLE NOISE[mVp-p]	0 to +50℃ *1	250max
		-10 - 0℃ *1	300max
	TEMPERATURE REGULATION[mV]	0 to +50℃	120max
		-10 to +50℃	150max
	DRIFT[mV] *2		48max
	START-UP TIME[ms]		350typ (ACIN 100V, Io=100%)
HOLD-UP TIME[ms]		20typ (ACIN 100V, Io=100%)	
OUTPUT VOLTAGE SETTING[V]		11.50 to 12.50	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically
	OVERVOLTAGE PROTECTION[V]		13.80 to 16.80
	OPERATING INDICATION		LED (Green)
	REMOTE SENSING		Not provided
	REMOTE ON/OFF		Not provided
ISOLATION	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)
	OUTPUT-FG		AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE		-10 to +50℃, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max *3
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION		10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT		196.1m/s² (20G), 11ms, once each X, Y and Z axis
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		DEN-AN
	CONDUCTED NOISE/POWER		Complies with DEN-AN
	HARMONIC ATTENUATOR *5		Complies with IEC61000-3-2 (class A)
OTHERS	CASE SIZE/WEIGHT		86 X 47 X 202mm [3.39 X 1.85 X 7.95 inches] (W X H X D) / 850g max
	COOLING METHOD		Convection

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*3 Derating is required.

*4 Please contact us about dynamic load and input response.

*5 When two or more units are operating it may not comply with the IEC61000-3-2. Please contact us about another class.

* To meet the specifications. Do not operate over-loaded condition.

* Parallel operation is not possible.

* Derating is required when operated with chassis and cover.

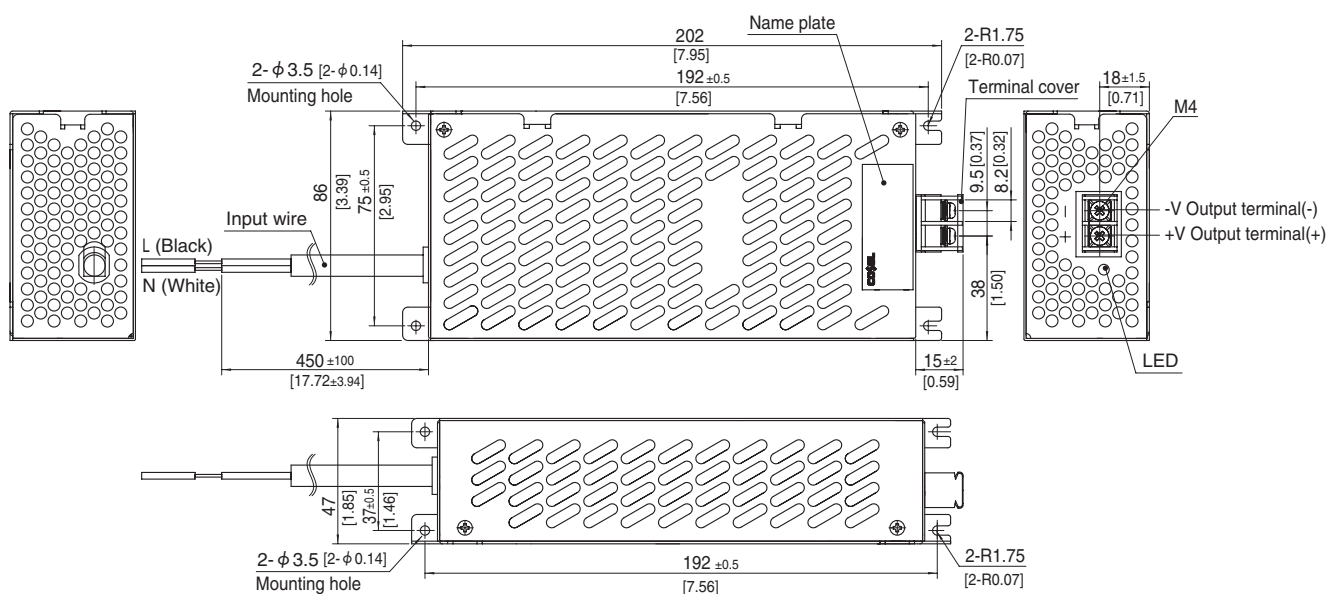
* Sound noise may be generated by power supply in case of pulse load.

Block diagram



SPLFA

External view



- ※ Tolerance : ±1 [±0.04]
- ※ Weight : 850g max
- ※ Dimensions in mm, []=inches
- ※ Chassis material : Galvanized Steel board
- ※ Screw tightening torque : M4 : 1.6N · m (16.9kgf · cm) max
- ※ Input wire : VCTF 0.75sq X 2C

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current *1 [A]	Inrush current protection	PCB/Pattern			Series/Parallel operation availability *2	
					Material	Single sided	Double sided	Series operation	Parallel operation
SPLFA30F	Flyback converter	130	0.65	Thermistor	CEM-3	Yes		Yes	No
SPLFA50F	Active filter	60 - 440	0.67	Thermistor	CEM-3	Yes		Yes	No
	Flyback converter	130							
SPLFA75F	Active filter	60 - 440	1.0	Thermistor	CEM-3	Yes		Yes	No
	Flyback converter	130							
SPLFA100F	Active filter	60	1.3	Thermistor	CEM-3	Yes *3	Yes *4	Yes	No
	Forward converter	140							
SPLFA150F	Active filter	60	2.0	Thermistor	CEM-3	Yes *3	Yes *4	Yes	No
	Forward converter	140							

*1 The value of input current is at ACIN 100V and rated load.

*2 Refer to Instruction Manual 2.

*3 Output side PCB.

*4 Built-in power supply PCB.

1 Function SPLFA-14

- 1.1 Input voltage range SPLFA-14
- 1.2 Inrush current limiting SPLFA-14
- 1.3 Overcurrent protection SPLFA-14
- 1.4 Overvoltage protection SPLFA-14
- 1.5 Isolation SPLFA-14

SPLFA

2 Series Operation and Parallel Operation SPLFA-15

- 2.1 Series Operation SPLFA-15
- 2.2 Parallel Operation SPLFA-15

3 Assembling and Installation Method SPLFA-15

- 3.1 Derating SPLFA-15
- 3.2 Installation method SPLFA-16

4 Option and Others SPLFA-16

- 4.1 Outline of options SPLFA-16
- 4.2 Others SPLFA-16

1 Function

1.1 Input voltage range

- Input voltage range of the power supplies is from AC85V to AC264V (please see SPECIFICATIONS for details).
- In cases that conform with safety standard DEN-AN, input voltage range is AC100-AC120V (50/60Hz).
- If input value doesn't fall within above range, a unit may not operate in accordance with specifications and/or start hunting or fail. If you need to apply a square waveform input voltage, which is commonly used in UPS and inverters, please contact us.
- When the input voltage changes suddenly, the output voltage accuracy might exceed the specification. Please contact us.

● SPLFA30F

- A power factor improvement circuit (active filter) is not built-in. If you use multiple units for a single system, standards for input harmonic current may not be satisfied. Please contact us for details.

● SPLFA30F, SPLFA50F, SPLFA75F, SPLFA100F, SPLFA150F

- Operation stop voltage is set at a lower value than that of a standard version (derating is needed).
- Use Conditions

SPLFA30F	10W
SPLFA50F	15W
SPLFA75F	25W
SPLFA100F	30W
SPLFA150F	50W
Input AC50V	
Duty 1s/30s	

*Please avoid using continuously for more than 1 second under above conditions. Doing so may cause a failure.

1.2 Inrush current limiting

- An inrush current limiting circuit is built-in.
- If you need to use a switch on the input side, please select one that can withstand an input inrush current.

● SPLFA30F, SPLFA50F, SPLFA75F, SPLFA100F, SPLFA150F

- Thermistor is used in the inrush current limiting circuit. When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that a power supply cools down before being turned on.

1.3 Overcurrent protection

- An overcurrent protection circuit is built-in and activated at 105% of the rated current or 101% of the peak current. A unit automatically recovers when a fault condition is removed. Please do not use a unit in short circuit and/or under an overcurrent condition.
- Intermittent Operation Mode
Intermittent operation for overcurrent protection is included in a part of series. When the overcurrent protection circuit is activated and the output voltage drops to a certain extent, the output becomes intermittent so that the average current will also decrease.

1.4 Overvoltage protection

- An overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait more than 3 minutes and turn on the AC input again to recover the output voltage. Recovery time varies depending on such factors as input voltage value at the time of the operation.

1.5 Isolation

- For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for the start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

2 Series Operation and Parallel Operation

2.1 Series Operation

● SPLFA30F, SPLFA50F, SPLFA75F

■ Series operation is available by connecting the outputs of two or more power supplies with the same output voltage, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

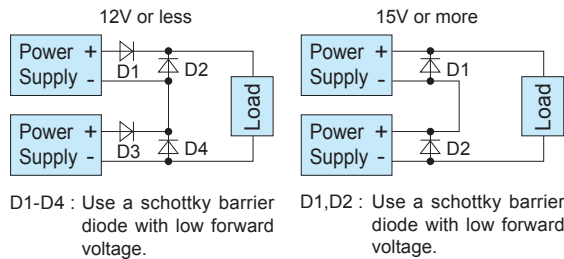


Fig.2.1 Examples of connecting in series operation (a)

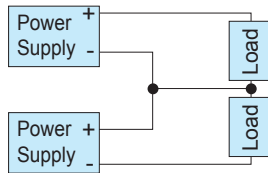


Fig.2.2 Examples of connecting in series operation (b)

● SPLFA100F, SPLFA150F

■ You can use a power supply in series operation. The output current in series operation should be lower than the rated current of a power supply with the lowest rated current among power supplies that are serially connected. Please make sure that no current exceeding the rated current flows into a power supply.

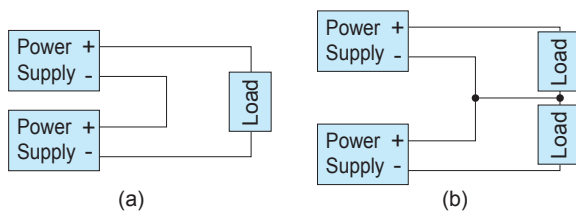


Fig.2.3 Examples of connecting in series operation

2.2 Parallel Operation

■ Parallel operation is not possible.

■ Redundancy operation is available by wiring as shown below.

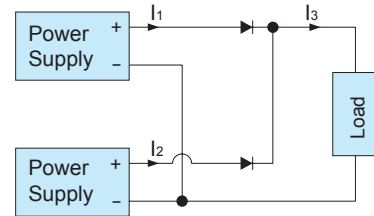


Fig.2.4 Example of redundancy operation

■ Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .

Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

3 Assembling and Installation Method

3.1 Derating

■ The operative ambient temperature is different mounting position. Derating curve is shown below.

Note: In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

● SPLFA30F

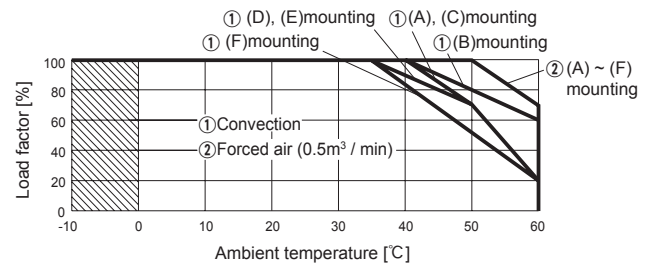


Fig.3.1 Ambient temperature derating curve

● SPLFA50F

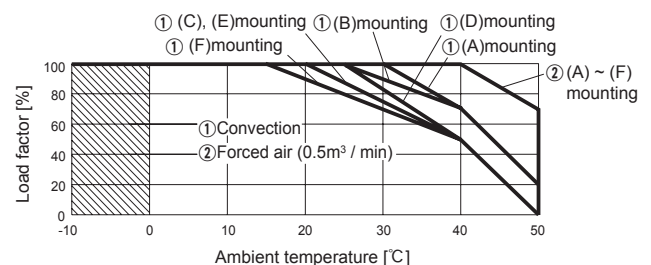


Fig.3.2 Ambient temperature derating curve

● SPLFA75F

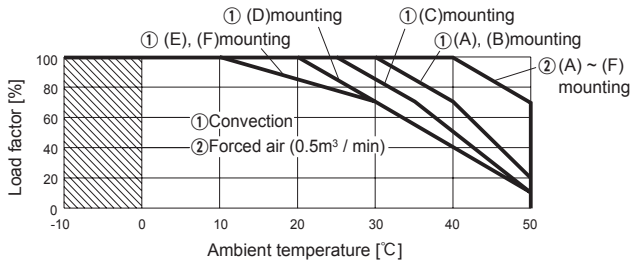


Fig.3.3 Ambient temperature derating curve

● SPLFA100F

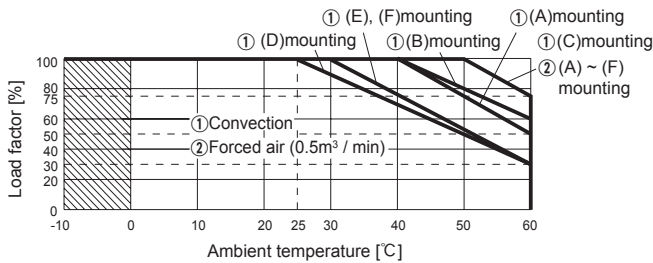


Fig.3.4 Ambient temperature derating curve

● SPLFA150F

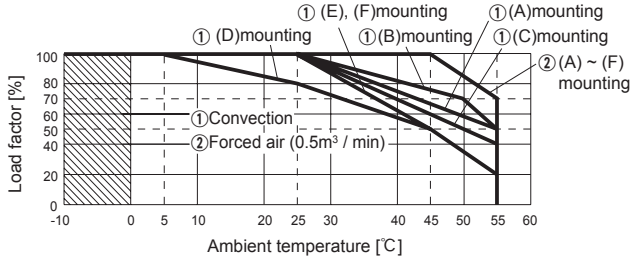


Fig.3.5 Ambient temperature derating curve

■ Derating curve depending on input voltage

Derating curve depending on input voltage is shown in Fig.3.4.

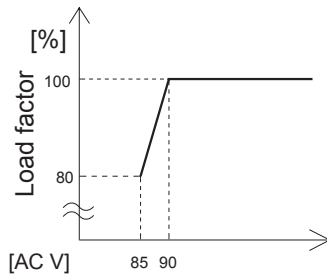


Fig.3.6 Derating curve depending on input voltage

■ Mounting method

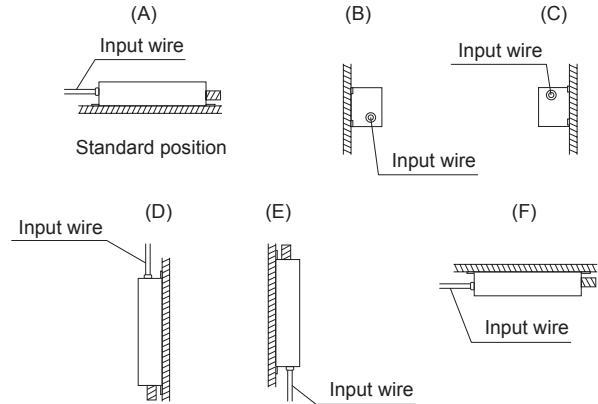


Fig.3.7 Mounting method

3.2 Installation method

■ Installation Method

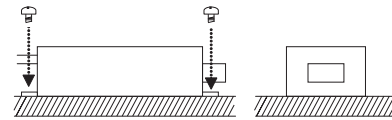


Fig.3.8 Installation Method

*Please fix the power supply with screws at installation.

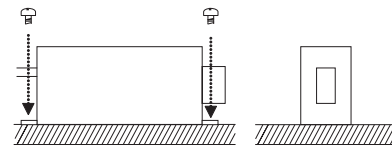


Fig.3.9 Installation Method

*Please fix the power supply with screws at installation.

*Derating curve changes in the case of attachment of Fig.3.9.

Please contact us for details.

4 Option and Others

4.1 Outline of options

● -C

- Option -C units have coated internal PCB for better moisture resistance.

4.2 Others

■ While turning on the electricity, and for a while after turning off, please don't touch the power supply because that may be hot.

■ When a mass capacitor is connected with the output terminal (load side), the output might become the stop or an unstable operation. Please contact us for details when you connect the capacitor.



World wide



Isolated

Safety
Approvals

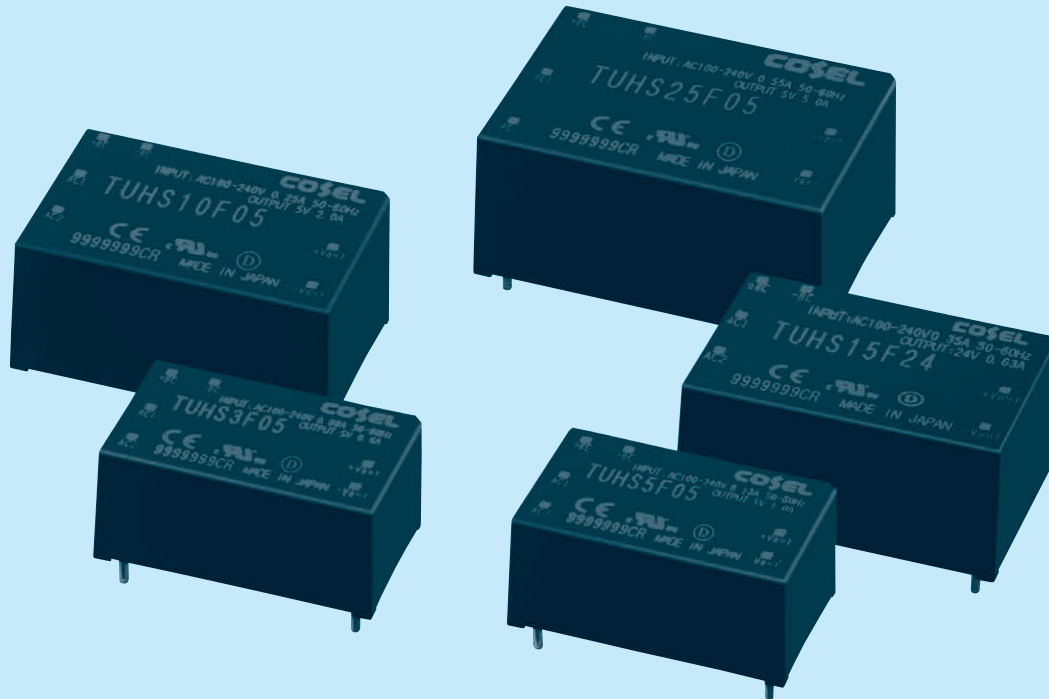
OCP



OVP

TUHS-series

TUHS



Feature

- P.C.board mount AC-DC Converter
- Design flexibility for Hold-Up time and expected life
- Small size
- Built-in overcurrent and overvoltage protection circuits
- High efficiency by synchronous rectification technology (TUHS25)
- Not built-in aluminum and tantalum electrolytic capacitor

CE marking

Low voltage directive

Safety Approval

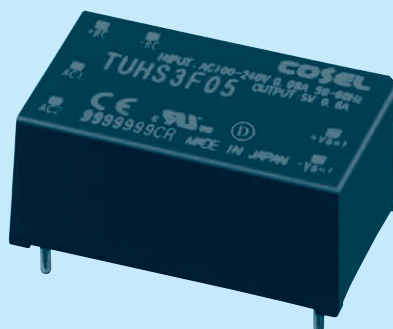
UL60950-1, C-UL, EN60950-1

5-year warranty

TUHS3

TUH S 3 F 05

① ② ③ ④ ⑤



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal Input
- ⑤ Output voltage

□ Class II

* Avoid short circuit between +BC and -BC. It may cause the failure of inside components.
* To use TUHS, external components are required. Refer to the instruction manual for details.

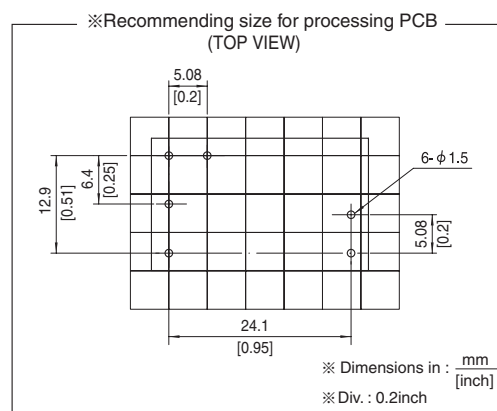
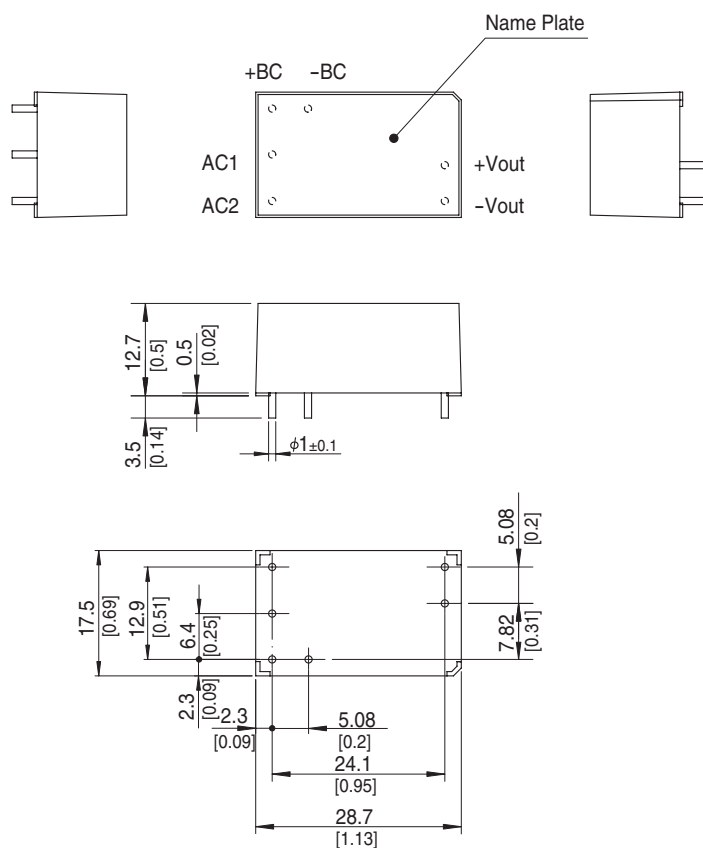
MODEL	TUHS3F05	TUHS3F12	TUHS3F24
MAX OUTPUT WATTAGE[W]	3.00	3.00	3.12
DC OUTPUT	5V 0.6A	12V 0.25A	24V 0.13A

SPECIFICATIONS

	MODEL	TUHS3F05	TUHS3F12	TUHS3F24	
INPUT	VOLTAGE[V]		AC85 - 264 1 φ DC120 - 370		
	CURRENT[A]	ACIN 100V	0.08typ (Io=100%)		
		ACIN 200V	0.05typ (Io=100%)		
	FREQUENCY[Hz]		50/60 (47 - 63)		
	EFFICIENCY[%]	ACIN 100V	79typ	81typ	81typ
		ACIN 200V	78typ	79typ	79typ
INRUSH CURRENT		Limited by external components			
OUTPUT	VOLTAGE[V]		5	12	24
	CURRENT[A]		0.6	0.25	0.13
	LINE REGULATION[mV]		20max	48max	96max
	LOAD REGULATION[mV]		40max	100max	150max
	RIPPLE[mVp-p]	30 to 100% Load *1	120max	160max	200max
		0 to 30% Load AC85V - 240V *1	400max	480max	580max
	RIPPLE NOISE[mVp-p]	30 to 100% Load *1	160max	200max	240max
		0 to 30% Load AC85V - 240V *1	480max	560max	660max
	TEMPERATURE REGULATION[mV]	0 to +85℃	100max	180max	360max
		-40 to +85℃	150max	270max	480max
	DRIFT[mV] *2		20max	48max	96max
OUTPUT VOLTAGE SETTING[V]		4.90 - 5.30	11.40 - 12.60	23.00 - 25.00	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recover automatically		
	OVERVOLTAGE PROTECTION[V]		5.50 - 8.00	13.20 - 19.20	26.40 - 38.40
ISOLATION	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)		
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE		-40 to +85℃, 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max		
	STORAGE TEMP., HUMID. AND ALTITUDE		-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max		
	VIBRATION		10 - 55Hz, 49.0m/s² (5G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT		196.1m/s² (20G), 11ms, once each along X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1		
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR-B, EN55022-B *3		
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 (Class A) (Not built-in to active filter)		
OTHERS	CASE SIZE/WEIGHT		28.7 X 12.7 X 17.5mm[1.13 X 0.50 X 0.69 inches] (W X H X D) / 15g max		
	COOLING METHOD		Convection / Forced air		

- *1 Refer to instruction manual for measuring method of electric characteristics.
- *2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated value.
- *3 Do not ground secondly circuit, in case of a standard adapted.
- * Measured with 18μF capacitor as Cbc.

External view



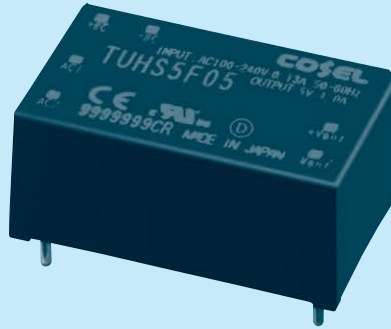
- ※ Tolerance : ± 0.5 [± 0.02]
- ※ Weight : 15g max
- ※ Case material : PBT
- ※ Pin material : Copper
- ※ Plating treatment of pin : Lead free plating
- ※ Dimensions in mm, []=inches

TUHS

TUHS5

TUH S 5 F 05

① ② ③ ④ ⑤



① Series name
② Single output
③ Output wattage
④ Universal Input
⑤ Output voltage

□ Class II

* Avoid short circuit between +BC and -BC. It may cause the failure of inside components.
* To use TUHS, external components are required. Refer to the instruction manual for details.

MODEL	TUHS5F05	TUHS5F12	TUHS5F24
MAX OUTPUT WATTAGE[W]	5.00	5.40	5.28
DC OUTPUT	5V 1A	12V 0.45A	24V 0.22A

SPECIFICATIONS

	MODEL	TUHS5F05	TUHS5F12	TUHS5F24	
INPUT	VOLTAGE[V]		AC85 - 264 1 φ DC120 - 370		
	CURRENT[A]	ACIN 100V	0.13typ (Io=100%)		
		ACIN 200V	0.08yp (Io=100%)		
	FREQUENCY[Hz]		50/60 (47 - 63)		
	EFFICIENCY[%]	ACIN 100V	78typ	82typ	83typ
		ACIN 200V	79typ	82typ	83typ
INRUSH CURRENT		Limited by external components			
OUTPUT	VOLTAGE[V]		5	12	24
	CURRENT[A]		1	0.45	0.22
	LINE REGULATION[mV]		20max	48max	96max
	LOAD REGULATION[mV]		40max	100max	150max
	RIPPLE[mVp-p]	30 to 100% Load *1	120max	160max	200max
		0 to 30% Load AC85V - 240V *1	400max	480max	580max
	RIPPLE NOISE[mVp-p]	30 to 100% Load *1	160max	200max	240max
		0 to 30% Load AC85V - 240V *1	480max	560max	660max
	TEMPERATURE REGULATION[mV]	0 to +80℃	100max	180max	360max
		-40 to +80℃	150max	270max	480max
DRIFT[mV] *2		20max	48max	96max	
OUTPUT VOLTAGE SETTING[V]		4.90 - 5.30	11.40 - 12.60	23.00 - 25.00	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recover automatically		
	OVERVOLTAGE PROTECTION[V]		5.50 - 8.00	13.20 - 19.20	26.40 - 38.40
ISOLATION	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)		
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE		-40 to +85℃, 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max		
	STORAGE TEMP., HUMID. AND ALTITUDE		-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max		
	VIBRATION		10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT		196.1m/s ² (20G), 11ms, once each along X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1		
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR-B, EN55022-B *3		
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 (Class A) (Not built-in to active filter)		
OTHERS	CASE SIZE/WEIGHT		28.7 X 12.7 X 17.5mm[1.13 X 0.50 X 0.69 inches] (W X H X D) / 15g max		
	COOLING METHOD		Convection / Forced air		

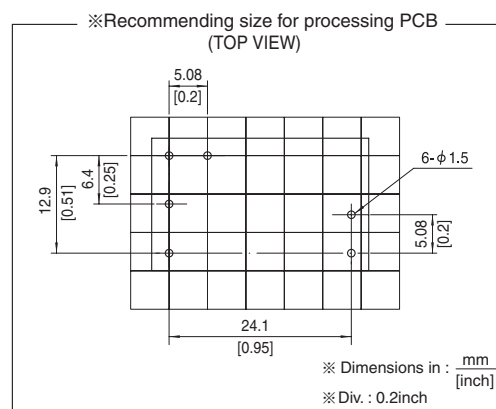
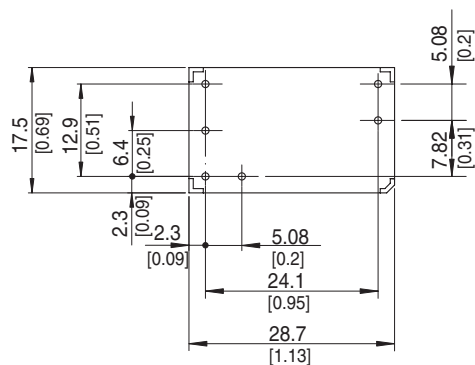
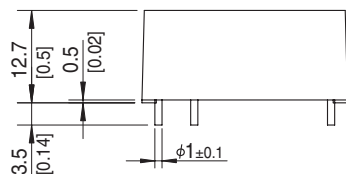
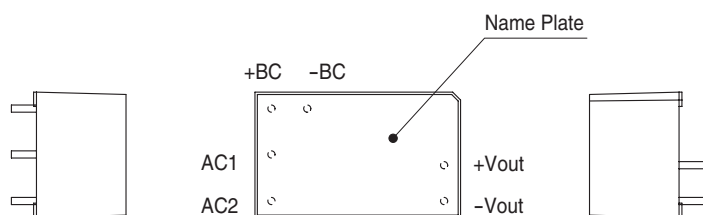
*1 Refer to instruction manual for measuring method of electric characteristics.

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated value.

*3 Do not ground secondly circuit, in case of a standard adapted.

* Measured with 22μF capacitor as Cbc.

External view



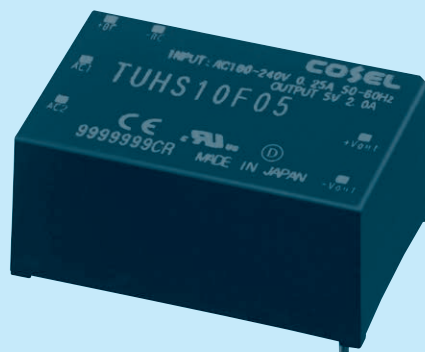
- ※ Tolerance : ± 0.5 [± 0.02]
- ※ Weight : 15g max
- ※ Case material : PBT
- ※ Pin material : Copper
- ※ Plating treatment of pin : Lead free plating
- ※ Dimensions in mm, []=inches

TUHS

TUHS10

TUH S 10 F 05

① ② ③ ④ ⑤



① Series name
② Single output
③ Output wattage
④ Universal Input
⑤ Output voltage

□ Class II

* Avoid short circuit between +BC and -BC. It may cause the failure of inside components.
* To use TUHS, external components are required. Refer to the instruction manual for details.

MODEL	TUHS10F05	TUHS10F12	TUHS10F24
MAX OUTPUT WATTAGE[W]	10.00	10.80	10.80
DC OUTPUT	5V 2A	12V 0.9A	24V 0.45A

SPECIFICATIONS

	MODEL	TUHS10F05	TUHS10F12	TUHS10F24	
INPUT	VOLTAGE[V]		AC85 - 264 1 φ DC120 - 370		
	CURRENT[A]	ACIN 100V	0.25typ (Io=100%)		
		ACIN 200V	0.14typ (Io=100%)		
	FREQUENCY[Hz]		50/60 (47 - 63)		
	EFFICIENCY[%]	ACIN 100V	81typ	85typ	86typ
		ACIN 200V	82typ	85typ	87typ
INRUSH CURRENT		Limited by external components			
OUTPUT	VOLTAGE[V]		5	12	24
	CURRENT[A]		2	0.9	0.45
	LINE REGULATION[mV]		20max	48max	96max
	LOAD REGULATION[mV]		40max	100max	150max
	RIPPLE[mVp-p]	30 to 100% Load *1	120max	160max	200max
		0 to 30% Load AC85V - 240V *1	400max	480max	580max
	RIPPLE NOISE[mVp-p]	30 to 100% Load *1	160max	200max	240max
		0 to 30% Load AC85V - 240V *1	480max	560max	660max
	TEMPERATURE REGULATION[mV]	0 to +70℃	100max	180max	360max
		-40 to +70℃	150max	270max	480max
DRIFT[mV] *2		20max	48max	96max	
OUTPUT VOLTAGE SETTING[V]		4.90 - 5.30	11.40 - 12.60	23.00 - 25.00	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recover automatically		
	OVERVOLTAGE PROTECTION[V]		5.50 - 8.00	13.20 - 19.20	26.40 - 38.40
ISOLATION	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)		
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE		-40 to +85℃, 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max		
	STORAGE TEMP., HUMID. AND ALTITUDE		-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max		
	VIBRATION		10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT		196.1m/s ² (20G), 11ms, once each along X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1		
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR-B, EN55022-B *3		
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 (Class A) (Not built-in to active filter)		
OTHERS	CASE SIZE/WEIGHT		33.0×15.0×22.0mm[1.3×0.59×0.86 inches] (W×H×D) / 25g max		
	COOLING METHOD		Convection / Forced air		

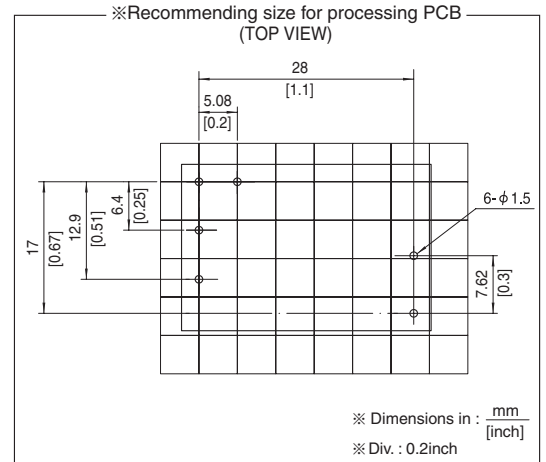
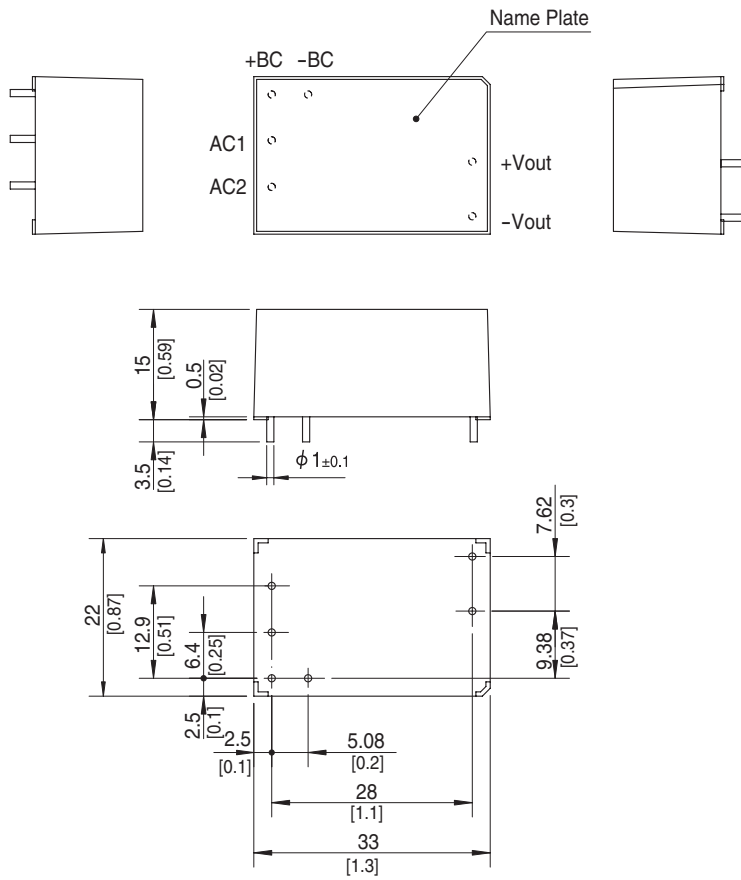
*1 Refer to instruction manual for measuring method of electric characteristics.

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated value.

*3 Do not ground secondly circuit, in case of a standard adapted.

* Measured with 47μF capacitor as Cbc.

External view

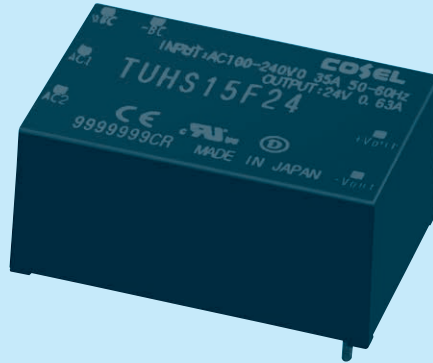


- ※ Tolerance : ± 0.5 [± 0.02]
- ※ Weight : 25g max
- ※ Case material : PBT
- ※ Pin material : Copper
- ※ Plating treatment of pin : Lead free plating
- ※ Dimensions in mm, []=inches

TUHS15

TUH S 15 F 12

① ② ③ ④ ⑤



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal Input
- ⑤ Output voltage

□ Class II

* Avoid short circuit between +BC and -BC. It may cause the failure of inside components.
* To use TUHS, external components are required. Refer to the instruction manual for details.

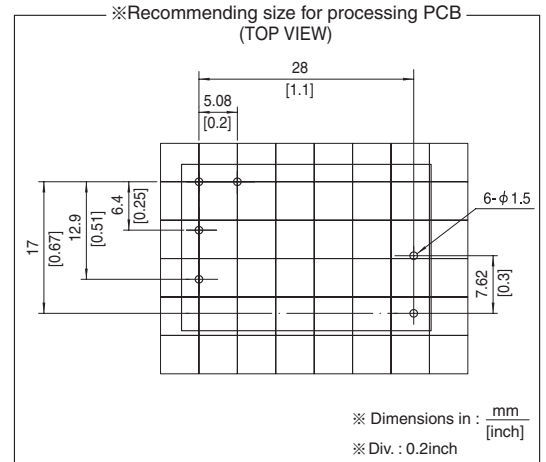
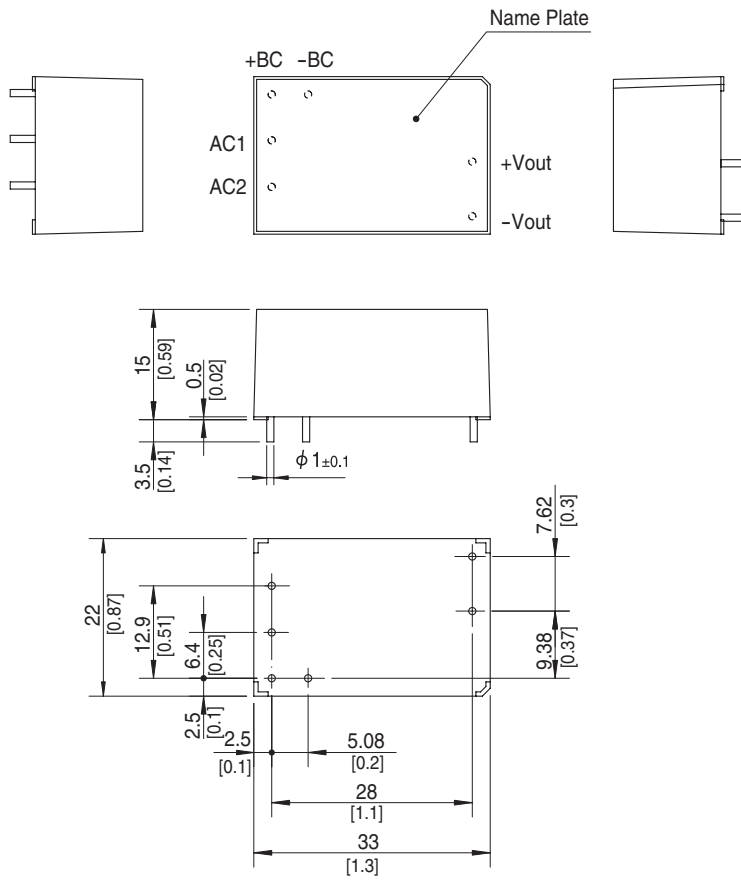
MODEL	TUHS15F12	TUHS15F24
MAX OUTPUT WATTAGE[W]	15.00	15.12
DC OUTPUT	12V 1.25A	24V 0.63A

SPECIFICATIONS

	MODEL	TUHS15F12	TUHS15F24
INPUT	VOLTAGE[V]	AC85 - 264 1 φ DC120 - 370	
	CURRENT[A]	ACIN 100V	0.35typ (Io=100%)
		ACIN 200V	0.18typ (Io=100%)
	FREQUENCY[Hz]	50/60 (47 - 63)	
	EFFICIENCY[%]	ACIN 100V	85typ
		ACIN 200V	87typ
	INRUSH CURRENT	Limited by external components	
OUTPUT	VOLTAGE[V]	12	24
	CURRENT[A]	1.25	0.63
	LINE REGULATION[mV]	48max	96max
	LOAD REGULATION[mV]	100max	150max
	RIPPLE[mVp-p]	30 to 100% Load *1	160max
		0 to 30% Load AC85V - 240V *1	480max
	RIPPLE NOISE[mVp-p]	30 to 100% Load *1	200max
		0 to 30% Load AC85V - 240V *1	560max
	TEMPERATURE REGULATION[mV]	0 to +50℃	180max
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recover automatically	
	OVERVOLTAGE PROTECTION[V]	13.20 - 19.20	26.40 - 38.40
	ISOLATION	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)	
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85℃, 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max	
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max	
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis	
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis	
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1	
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR-B, EN55022-B *3	
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) (Not built-in to active filter)	
OTHERS	CASE SIZE/WEIGHT	33.0×15.0×22.0mm[1.3×0.59×0.86 inches] (W×H×D) / 25g max	
	COOLING METHOD	Convection / Forced air	

- *1 Refer to instruction manual for measuring method of electric characteristics.
- *2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated value.
- *3 Do not ground secondly circuit, in case of a standard adapted.
- * Measured with 68μF capacitor as Cbc.

External view

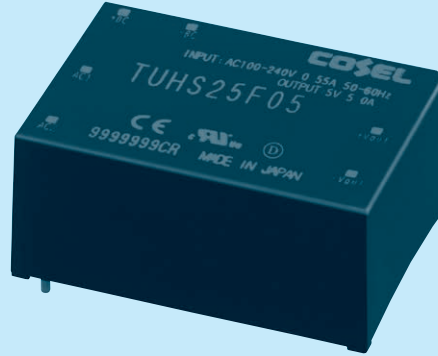


- ※ Tolerance : ± 0.5 [± 0.02]
- ※ Weight : 25g max
- ※ Case material : PBT
- ※ Pin material : Copper
- ※ Plating treatment of pin : Lead free plating
- ※ Dimensions in mm, []=inches

TUHS25

TUH S 25 F 05

① ② ③ ④ ⑤



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal Input
- ⑤ Output voltage

□ Class II

* Avoid short circuit between +BC and -BC. It may cause the failure of inside components.
* To use TUHS, external components are required. Refer to the instruction manual for details.

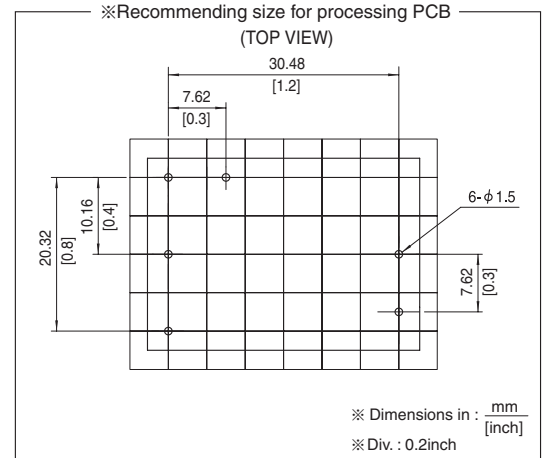
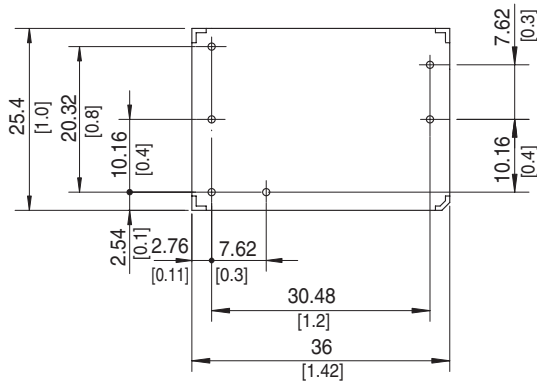
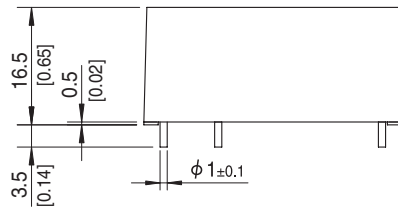
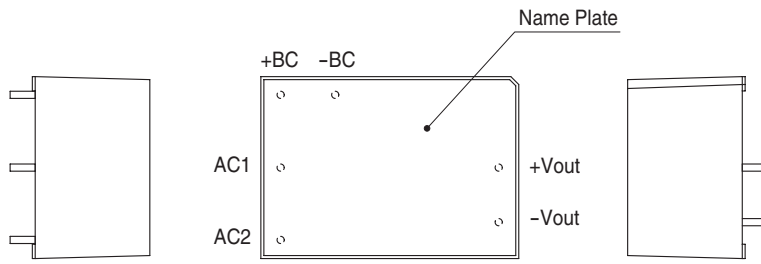
MODEL	TUHS25F05	TUHS25F12	TUHS25F24
MAX OUTPUT WATTAGE[W]	25.00	25.20	26.40
DC OUTPUT	5V 5A	12V 2.1A	24V 1.1A

SPECIFICATIONS

	MODEL	TUHS25F05	TUHS25F12	TUHS25F24	
INPUT	VOLTAGE[V]		AC85 - 264 1 φ DC120 - 370		
	CURRENT[A]	ACIN 100V	0.55typ (Io=100%)		
		ACIN 200V	0.35typ (Io=100%)		
	FREQUENCY[Hz]		50/60 (47 - 63)		
	EFFICIENCY[%]	ACIN 100V	87typ	88typ	89typ
		ACIN 200V	87typ	88typ	90typ
INRUSH CURRENT		Limited by external components			
OUTPUT	VOLTAGE[V]		5	12	24
	CURRENT[A]		5	2.1	1.1
	LINE REGULATION[mV]		20max	48max	96max
	LOAD REGULATION[mV]		40max	100max	150max
	RIPPLE[mVp-p]	30 to 100% Load *1	120max	160max	200max
		0 to 30% Load AC85V - 240V *1	400max	480max	580max
	RIPPLE NOISE[mVp-p]	30 to 100% Load *1	160max	200max	240max
		0 to 30% Load AC85V - 240V *1	480max	560max	660max
	TEMPERATURE REGULATION[mV]	0 to +50℃	100max	180max	360max
		-40 to +50℃	150max	270max	480max
DRIFT[mV] *2		20max	48max	96max	
OUTPUT VOLTAGE SETTING[V]		4.90 - 5.30	11.40 - 12.60	23.00 - 25.00	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recover automatically		
	OVERVOLTAGE PROTECTION[V]		5.50 - 8.00	13.20 - 19.20	26.40 - 38.40
ISOLATION	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)		
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE		-40 to +85℃, 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max		
	STORAGE TEMP.,HUMID.AND ALTITUDE		-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max		
	VIBRATION		10 - 55Hz, 49.0m/s² (5G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT		196.1m/s² (20G), 11ms, once each along X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1		
	CONDUCTED NOISE		Complies with FCC-B,VCCI-B,CISPR-B,EN55022-B *3		
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 (Class A) (Not built-in to active filter)		
OTHERS	CASE SIZE/WEIGHT		36.0 X 16.5 X 25.4mm[1.42 X 0.65 X 1.0 inches] (W X H X D) / 40g max		
	COOLING METHOD		Convection / Forced air		

- *1 Refer to instruction manual for measuring method of electric characteristics.
- *2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated value.
- *3 Do not ground secondly circuit, in case of a standard adapted.
- * Measured with 120μF capacitor as Cbc.

External view



- ※ Tolerance : ± 0.5 [± 0.02]
- ※ Weight : 40g max
- ※ Case material : PBT
- ※ Pin material : Copper
- ※ Plating treatment of pin : Lead free plating
- ※ Dimensions in mm, []=inches

TUHS

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Inrush current protection circuit	PCB/Pattern			Series/Parallel operation availability	
					Material	Single sided	Double sided	Series operation	Parallel operation
TUHS3F	Flyback converter	80-250 *3	*1	Resistor	glass fabric base,epoxy resin		Yes	Yes	*2
TUHS5F	Flyback converter	80-250 *3	*1	Resistor	glass fabric base,epoxy resin		Yes	Yes	*2
TUHS10F	Flyback converter	80-250 *3	*1	Resistor	glass fabric base,epoxy resin		Yes	Yes	*2
TUHS15F	Flyback converter	80-250 *3	*1	Resistor	glass fabric base,epoxy resin		Yes	Yes	*2
TUHS25F	Flyback converter	80-250 *3	*1	Thermistor	glass fabric base,epoxy resin		Yes	Yes	*2

*1 Refer to Specification.

*2 Refer to instruction manual.

*3 The value changes depending on input and load.

1 Pin Connection

TUHS-14

2 Connection for Standard Use

TUHS-14

3 Wiring Input/Output Pin

TUHS-15

- 3.1 Wiring input pin TUHS-15
- 3.2 Wiring output pin TUHS-16

TUHS

4 Function

TUHS-16

- 4.1 Input voltage range TUHS-16
- 4.2 Overcurrent protection TUHS-17
- 4.3 Overvoltage protection TUHS-17
- 4.4 Isolation TUHS-17
- 4.5 Reducing standby power TUHS-17

5 Series and Parallel Operation

TUHS-17

- 5.1 Series operation TUHS-17
- 5.2 Parallel operation TUHS-17
- 5.3 Various connection methods TUHS-18
- 5.4 Long hold-up time connection TUHS-18

6 Implementation · Mounting Method

TUHS-18

- 6.1 Mounting method TUHS-18
- 6.2 Stress onto the pins TUHS-18
- 6.3 Cleaning TUHS-18
- 6.4 Soldering TUHS-18

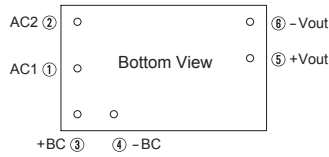
7 Derating

TUHS-19

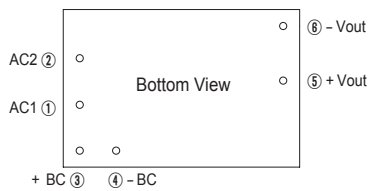
- 7.1 TUHS3 Derating Curve TUHS-19
- 7.2 TUHS5 Derating Curve TUHS-19
- 7.3 TUHS10 Derating Curve TUHS-19
- 7.4 TUHS15 Derating Curve TUHS-20
- 7.5 TUHS25 Derating Curve TUHS-20

1 Pin Connection

●TUHS3/TUHS5



●TUHS10/TUHS15



●TUHS25

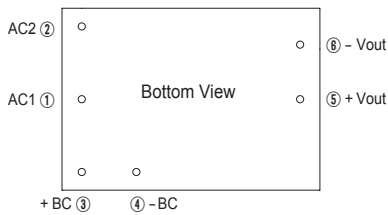


Fig.1.1 Pin connection (bottom view)

Table 1.1 Pin connection and function

No.	Pin Connection	Function
①	AC1	AC input
②	AC2	AC input
③	+BC	+BC output
④	-BC	-BC output
⑤	+VOUT	+DC output
⑥	-VOUT	-DC output

2 Connection for Standard Use

■To use TUHS series, connection shown in Fig.2.1 (a) or (b) and external components are required.

●AC input or DC input

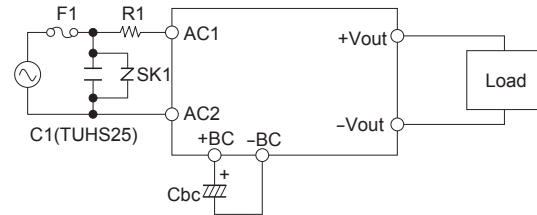


Fig.2.1(a) Connection for standard use (AC input or DC input)

Table 2.1 External components

No.	Symbol	Components	Reference
1	F1	Input fuse	3.1 "Wiring input pin (1)"
2	C1	Input Capacitor	3.1 "Wiring input pin (2)"
3	Cbc	Smoothing Capacitor	3.1 "Wiring input pin (3)"
4	R1	Inrush current protection resistor	3.1 "Wiring input pin (4)"
5	SK1	Surge Protective Device	3.1 "Wiring input pin (5)"

●DC input

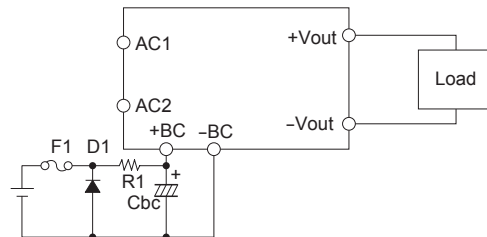


Fig.2.1(b) Connection for standard use (DC input)

3 Wiring Input/Output Pin

3.1 Wiring input pin

(1) F1: External fuse

■ Fuse is not built-in on input side. In order to protect the unit, install the slow-blow type fuse on input side (as shown in Table 3.1).
In the case of using DC input, please use a DC fuse.

Table 3.1(a) Recommended fuse (AC input)

Model	TUHS3	TUHS5	TUHS10	TUHS15	TUHS25
Rated current	2A	2A	2A	2A	3.15A

Table 3.1(b) Recommended fuse (DC input)

Model	TUHS3	TUHS5	TUHS10	TUHS15	TUHS25
Rated current	2A	2A	2A	2A	2A

(2) C1: Input Capacitor(TUHS25)

To comply with conducted noise CISPR22-B, EN55022-B, connect capacitor C1 which is 0.1 μ F or more at AC input terminal.

(3) Cbc: Smoothing capacitor

- In order to smooth voltage, connect Cbc between +BC and -BC. Recommended capacitance of Cbc is shown in Table 3.2. Hold-up time and load factor is shown in figure 3.1-figure 3.10.
- Keep the capacitance within the allowable external capacitance.
- Select a capacitor of which the ripple voltage does not exceed 25Vp-p.
- When the power supply is operated under -20degC, it may cause the smoothing voltage unstable due to the characteristic of equivalent series resistor. Please choose the capacitor which has more than recommended capacitance.

Table 3.2 Input Capacitor C1

No.	Model	Rated Input Voltage	Cbc	Allowable capacitance range
1	TUHS3	DC400V or more (AC200V _{in})	18 μ F	4.7 μ F to 68 μ F
2	TUHS5		22 μ F	10 μ F to 68 μ F
3	TUHS10		47 μ F	22 μ F to 150 μ F
4	TUHS15	DC200V or more (AC100V _{in})	68 μ F	33 μ F to 220 μ F
5	TUHS25		120 μ F	47 μ F to 390 μ F

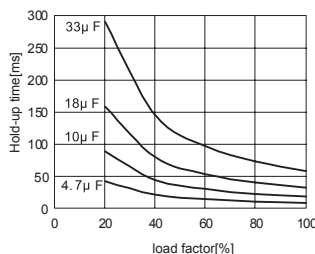


Fig.3.1 TUHS3 hold-up time(AC100V)

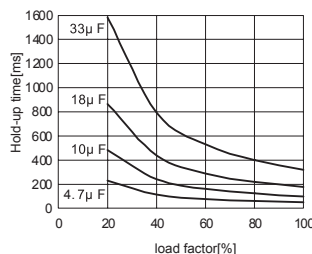


Fig.3.2 TUHS3 hold-up time(AC200V)

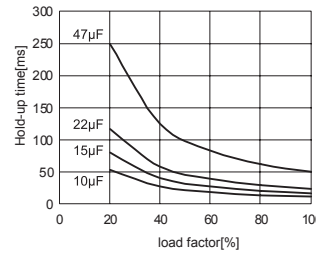


Fig.3.3 TUHS5 hold-up time(AC100V)

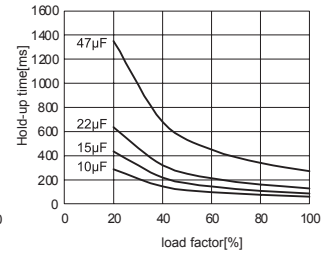


Fig.3.4 TUHS5 hold-up time(AC200V)

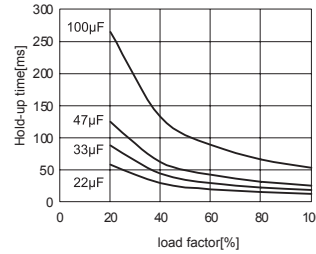


Fig.3.5 TUHS10 hold-up time(AC100V)

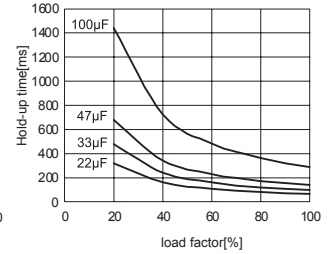


Fig.3.6 TUHS10 hold-up time(AC200V)

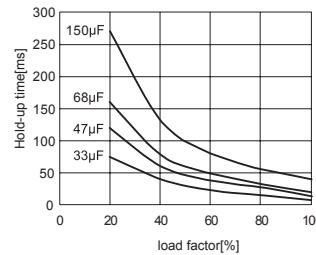


Fig.3.7 TUHS15 hold-up time(AC100V)

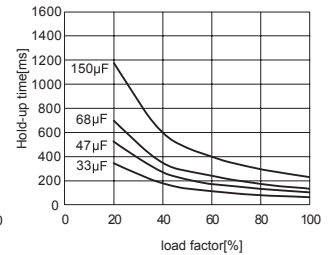


Fig.3.8 TUHS15 hold-up time(AC200V)

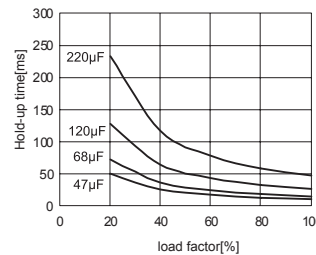


Fig.3.9 TUHS25 hold-up time(AC100V)

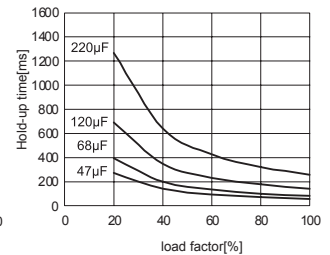


Fig.3.10 TUHS25 hold-up time(AC200V)

(4) R1: Inrush current limiting resistor

- Connect resistor R1 between AC input and power supply to limit inrush current to 50A(TUHS3/5/10/15) and 60A(TUHS25). Select a resistor which has enough permissible current capability.
- The power thermistors are heat-generating components. Pay attention to the rated operating temperature when using the power thermistors.
- When the power turns ON/OFF repeatedly within a short term, please keep enough interval to cool down the power supply before turning it on again.
- In this case, recommend using thermistor with thermal resistor in parallel or inrush current limiting circuit by triac.

(5) SK1: Surge Protective Device

- Connect a surge protective device to improve Surge immunity.

(6) D1: Reverse Input Voltage Protection(DC input)

■Avoid the reverse polarity input voltage. It cause the power supply failure. It is possible to protect the unit from the reverse input voltage by installing an external diode.

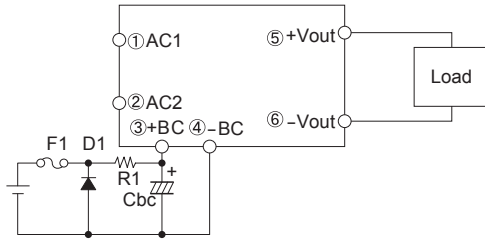


Fig.3.11 Reverse input voltage protection

3.2 Wiring output pin

(1) Co:Output capacitor

■In the TUHS series, the output capacitor is basically unnecessary. Reduce the ripple voltage by connecting the output capacitor.

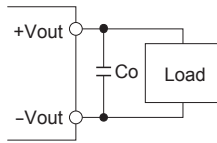


Fig.3.12 Connecting Example of an External Capacitor to the Output Side

■Install an external capacitor Co between +VOUT and -VOUT pins for stable operation of the power supply.

Recommended capacitance of Co is shown in Table 3.3.

■If output current decreases rapidly, output voltage rises transiently and the overvoltage protection circuit may operate. In this case, please install a capacitor Co.

Table 3.3 Recommended capacitance Co

No.	output voltage	TUHS3	TUHS5	TUHS10	TUHS15	TUHS25
1	5V	0 - 100 μ F	0 - 100 μ F	0 - 330 μ F	—	0 - 1000 μ F
2	12V	0 - 47 μ F	0 - 47 μ F	0 - 150 μ F	0 - 150 μ F	0 - 470 μ F
3	24V	0 - 22 μ F	0 - 22 μ F	0 - 68 μ F	0 - 68 μ F	0 - 220 μ F

■The specified ripple and ripple noise are measured by the method introduced in Fig.3.13.

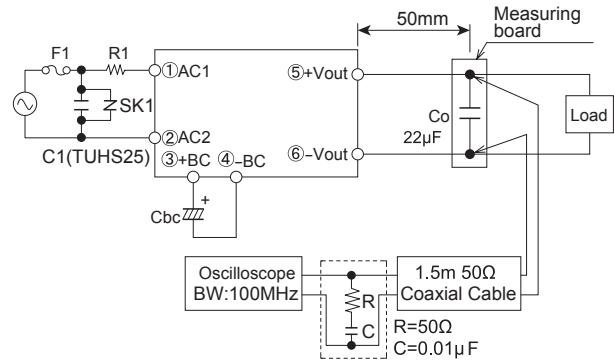


Fig.3.13 Method of Measuring Output Ripple and Ripple noise

■When connect the output to FG of an equipment, a noise may become big. The noise can be reduced by connecting external filter and grounding capacitor on the input side.

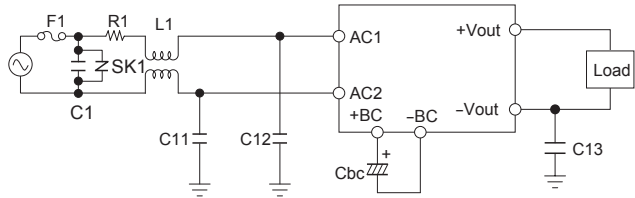


Fig.3.14 Recommended circuit of connect output to FG

4 Function

4.1 Input voltage range

■The range is from AC85V to AC264V or DC120V to DC370V (please see SPECIFICATIONS for details).

■In case of less than AC85V or DC120V, it is possible to operate continuously by input voltage derating as shown Fig.4.1.

■In cases that conform with safety standard, input voltage range is AC100-AC240V (50/60Hz) and DC120-DC370V.

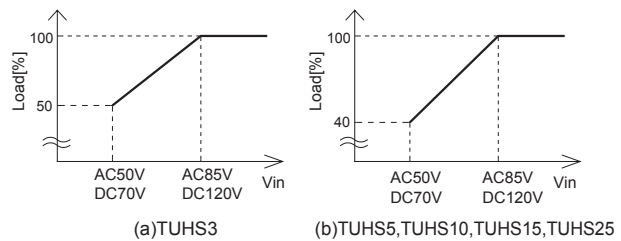


Fig.4.1 Input voltage derating

4.2 Overcurrent protection

■ Overcurrent protection is built-in and comes into effect at over 105% of the rated current.

Overcurrent protection prevents the unit from short circuit and overcurrent condition. The unit automatically recovers when the fault condition is cleared.

■ When the output voltage drops at overcurrent, the average output current is reduced by intermittent operation of power supply.

4.3 Overvoltage protection

■ The overvoltage protection circuit is built-in and comes into effect at 110% to 160% of the rated output voltage. When the load factor is less than 30%, output voltage may be increased more than maximum voltage depending on the failure mode.

■ Please note that devices inside the power supply might fail when voltage more than rated output voltage is applied to output pin of the power supply. This could happen when the customer tests the overvoltage performance of the unit.

4.4 Isolation

■ For a receiving inspection, such as Hi-Pot test, increase (decrease) the voltage gradually for a start (shut down). Avoid using Hi-Pot tester with timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

4.5 Reducing standby power

■ A circuit reducing standby power is built in TUHS.
(standby power of AC100V input : 0.5W max)

The load factor: $I_o=0-30\%$, the internal switch element is intermittent operated, and the switching loss is decreased. The specification of the Ripple/Ripple Noise changes by this intermittent operation. The value of the ripple/ripple Noise when intermittent operates changes in the input voltage and the output current. Please contact us for details.

5 Series and Parallel Operation

5.1 Series operation

■ Series operation is available by connecting the outputs of two or more power supplies as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

TUHS

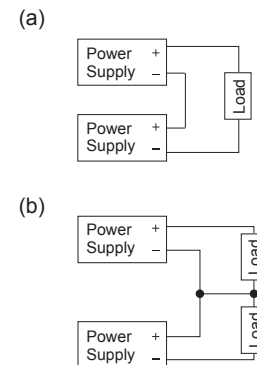


Fig.5.1 Examples of series operation

5.2 Parallel operation

■ Parallel operation is not possible.

■ Redundancy operation is available by wiring as shown below.

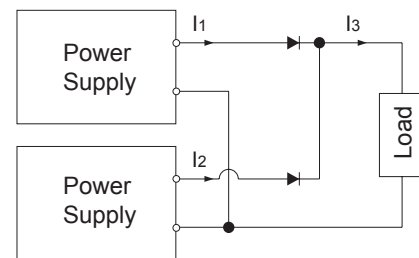


Fig.5.2 Example of Redundancy Operation

■ Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .

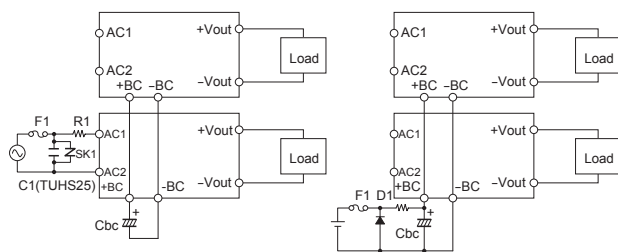
Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

5.3 Various connection methods

- Using one smoothing capacitor, up to two TUHS can be operated. Shown an example in Fig.5.3.
- Total output wattage must be less than the maximum wattage of TUHS which AC is supplied.
- When connect different wattage of TUHS, please input AC into the power supply which the wattage is higher.
- When smoothing capacitor is commonly used, noise may become big because of the length of the power line. The noise can be attenuate by connecting Line Filter between TUHS and R1.
- Avoid connecting AC input and DC input at the same time because it may damage the TUHS or an equipment(Fig.5.4).

TUHS



(a) AC input , Cbc common (b) DC input , Cbc common
Fig.5.3 TUHS connect method

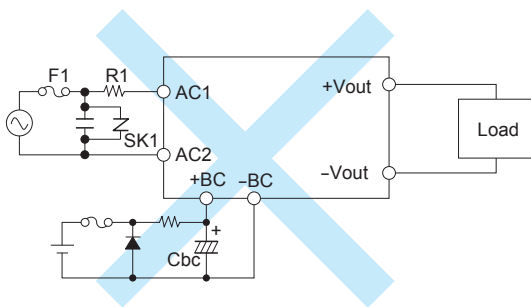


Fig.5.4 TUHS Connection prohibition

5.4 Long hold-up time connection

- It is possible that setting the hold-up time of the power supply for a long time by connecting like Fig.5.5. Please set the charge current of the CL to become less than 1A. Please use the diode which reverse voltage is 600V or more. Please contact us for detail.

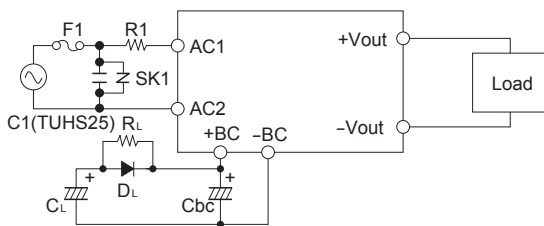


Fig.5.5 Long hold-up time connection

6 Implementation · Mounting Method

6.1 Mounting method

- The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. The temperature around each power supply should not exceed the temperature range shown in derating curve.
- Avoid placing the AC input line pattern layout underneath the unit. It will increase the line conducted noise. Make sure to leave an ample distance between the line pattern layout and the unit. Also avoid placing the DC output line pattern underneath the unit because it may increase the output noise. Lay out the pattern away from the unit.
- Avoid placing the signal line pattern layout underneath the unit because the power supply might become unstable. Lay out the pattern away from the unit.

6.2 Stress to the pins

- Applying excessive stress to the input or output pins of the power module may damage internal connections. Avoid applying stress in excess of that shown in Fig. 6.1.
- Input/output pin are soldered to the PCB internally. Do not pull or bend a lead powerfully.
- If it is expected that stress is applied to the input/output pin due to vibration or impact, reduce the stress to the pin by taking such measures as fixing the unit to the PCB by silicone rubber, etc.

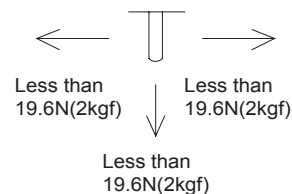


Fig. 6.1 Stress to the pins

6.3 Cleaning

- If you need to clean the unit, please clean it under the following conditions. Cleaning Method: Varnishing, Ultrasonic or Vapor Cleaning Cleaning agent: IPA (Solvent type) Cleaning Time: Within total 2 minutes for varnishing, ultrasonic and vapor cleaning
- Please dry the unit sufficiently after cleaning.
- If you do ultrasonic cleaning, please keep the ultrasonic output at 15W/l or below.

6.4 Soldering

- Flow soldering: 260°C for up to 15 seconds.
- Soldering iron (26W): 450°C for up to 5 seconds.

7 Derating

■It is necessary to note thermal fatigue life by power cycle.

Please reduce the temperature fluctuation range as much as possible when the up and down of temperature are frequently generated.

■Please have sufficient ventilation to keep the temperature of point A in Fig.7.1 at Table7.1 or below. Please also make sure that the ambient temperature does not exceed 85°C.

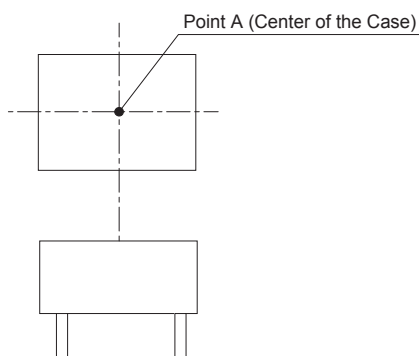


Fig.7.1 Temperature Measuring Point on the case (Top View)

Table 7.1 Point A Temperature

Model	TUHS3	TUHS5	TUHS10	TUHS15	TUHS25
Point A	105°C	105°C	105°C	100°C	100°C

7.1 Derating curve(TUHS3)

■Derating curve is shown below. Note: In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

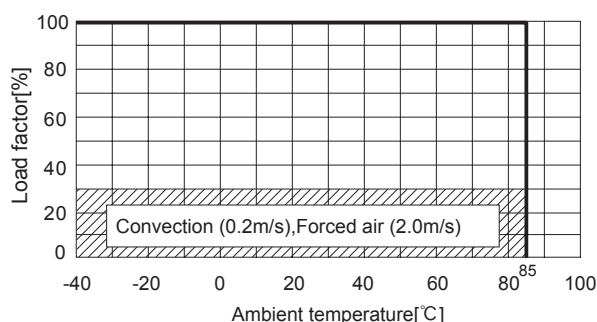


Fig.7.2 Ambient temperature Derating curve(TUHS3)

7.2 Derating curve(TUHS5)

■Derating curve is shown below. Note: In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

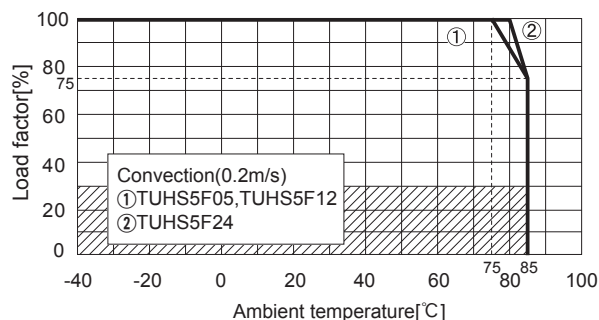


Fig.7.3 Ambient temperature Derating curve(convection cooling)

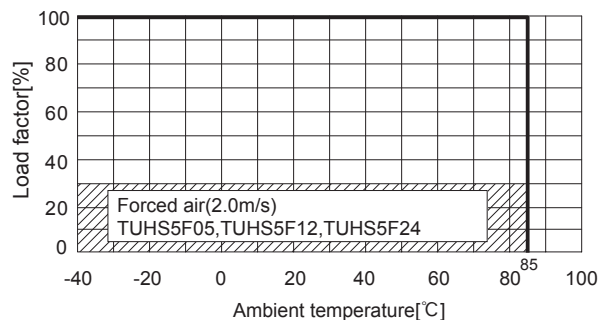


Fig.7.4 Ambient temperature Derating curve(Forced air)

7.3 Derating curve(TUHS10)

■Derating curve is shown below. Note: In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

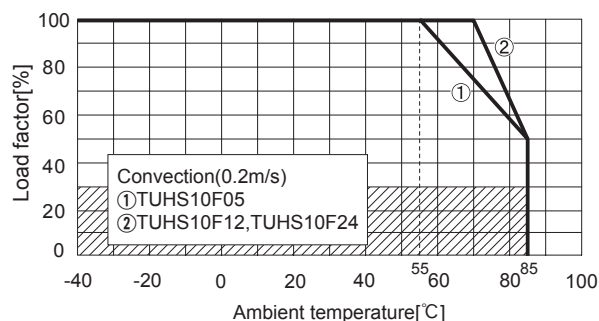


Fig.7.5 Ambient temperature Derating curve(convection cooling)

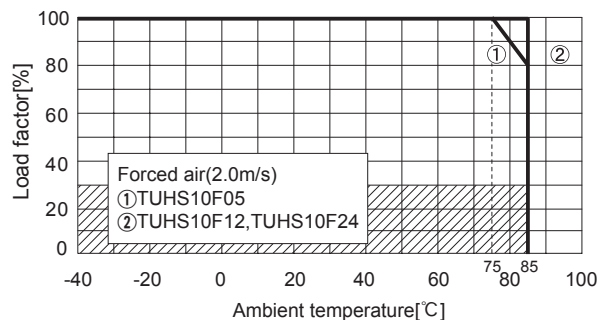


Fig.7.6 Ambient temperature Derating curve(Forced air)

7.4 Derating curve(TUHS15)

■ Derating curve is shown below. Note: In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

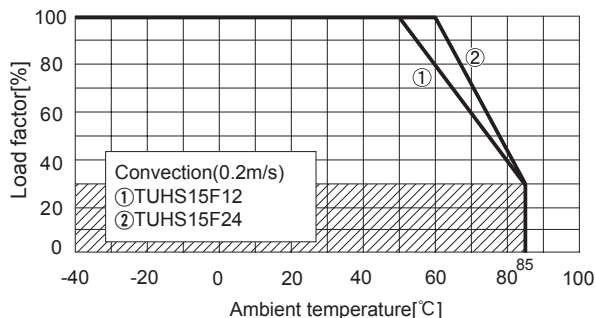


Fig.7.7 Ambient temperature Derating curve(convection cooling)

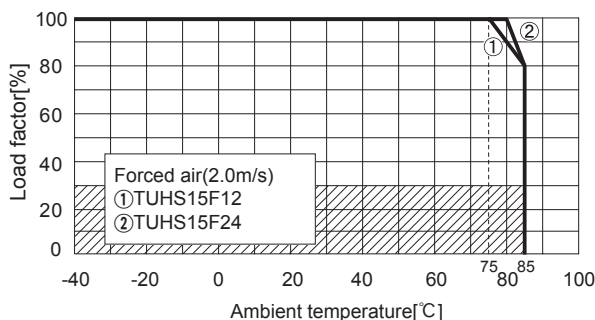


Fig.7.8 Ambient temperature Derating curve(Forced air)

7.5 Derating curve(TUHS25)

■ Derating curve is shown below. Note: In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

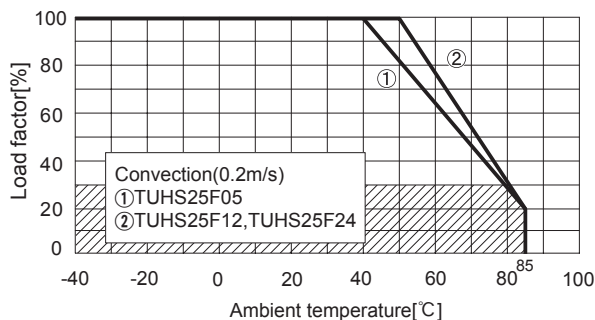


Fig.7.9 Ambient temperature Derating curve(convection cooling)

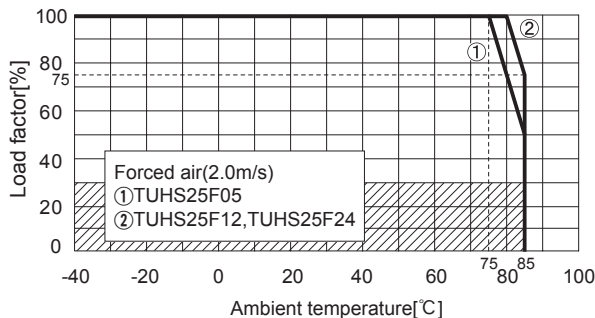


Fig.7.10 Ambient temperature Derating curve(Forced air)

Application manuals available at our website.

Recommended external components are also introduced for your reference.



Low Profile



Isolated

Safety
Approvals

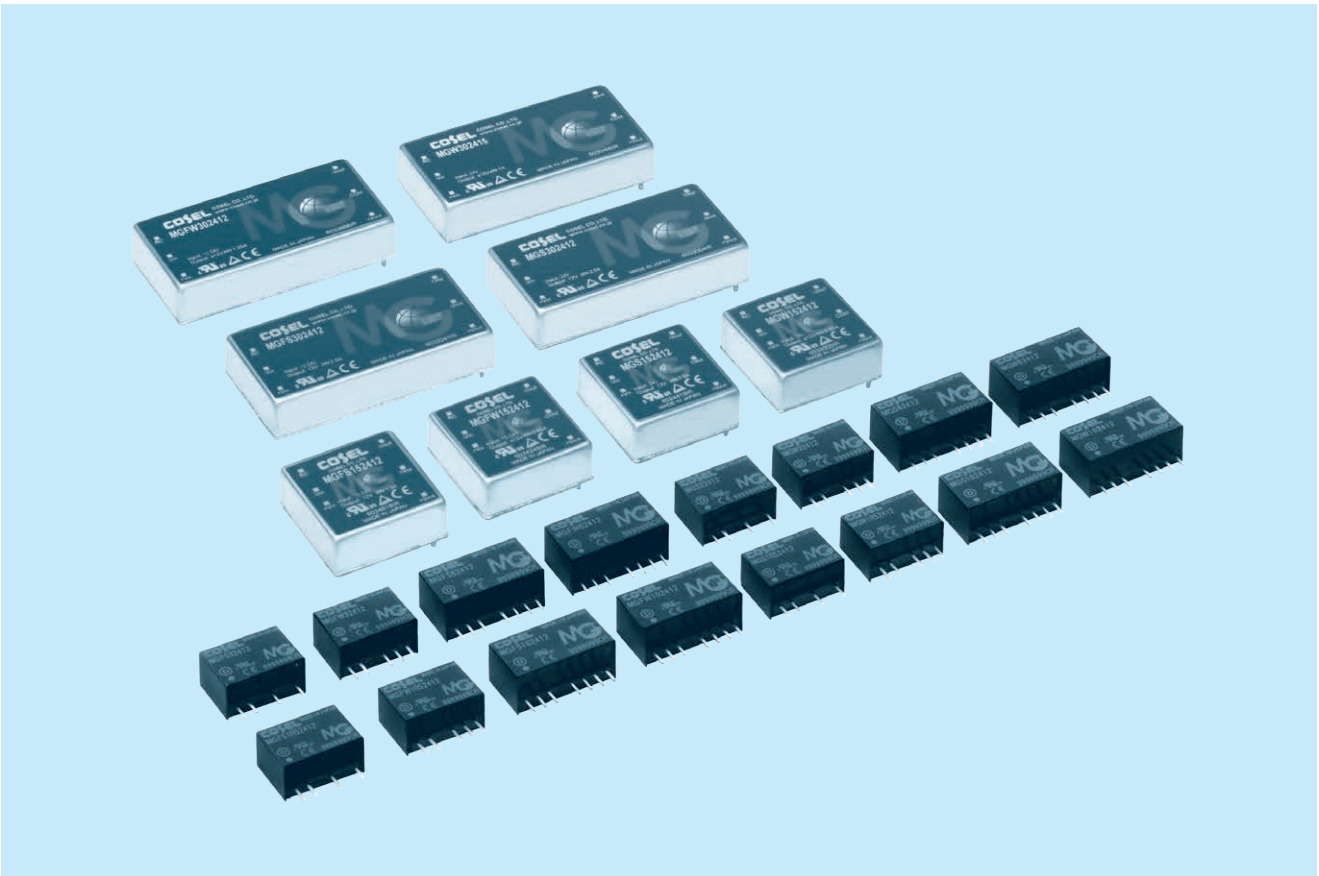
OCP



OVP

Remote
ON/OFFWide 4 :1
input

MG-series



MG

Feature

- Industrial Standard SIP6 (MG1R5/MG3), SIP8 (MG6/MG10), 1" X 1" (MG15), 1" X 2" (MG30)
- Wide input range DC9-36V/DC18-76 (MGFS/MGFW)
- High efficiency by synchronized rectification circuit (MGS10/MGS15/MGFS15/MGS30/MGFS30)
- 6 sided shield (MG15/MG30)
- I/O isolation voltage DC1,500V (1 minute)
- Built-in overcurrent protection circuits (recovers automatically)
- Built-in overvoltage protection circuits (MG30)
- Built-in remote ON/OFF (MG6/MG10/MG15/MG30)
- Output voltage adjustability by external variable resistor (MGS15/MGFS15/MGS30/MGFS30)
- High reliability : not built-in aluminum and tantalum electrolytic capacitor

CE marking

Low Voltage Directive

Safety agency approvals

UL60950-1, C-UL, EN60950-1

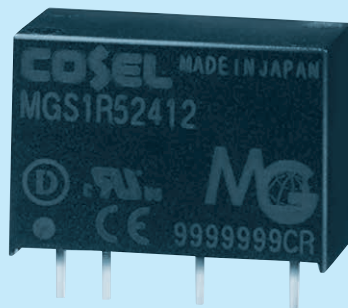
10-year warranty

Refer to the instruction manual

MGS1R5

MG S 1R5 24 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage
- ⑥ Optional

MODEL	MGS1R5053R3	MGS1R50505	MGS1R50512	MGS1R50515	MGS1R5123R3	MGS1R51205	MGS1R51212	MGS1R51215
MAX OUTPUT WATTAGE[W]	1.32	1.50	1.56	1.50	1.32	1.50	1.56	1.50
DC OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12
	CURRENT[A]	0.4	0.3	0.13	0.1	0.4	0.3	0.1

SPECIFICATIONS

	MODEL	MGS1R5053R3	MGS1R50505	MGS1R50512	MGS1R50515	MGS1R5123R3	MGS1R51205	MGS1R51212	MGS1R51215
INPUT	VOLTAGE[V]	DC4.5 - 9 (Surge voltage 12.5V, 100ms max)				DC9 - 18 (Surge voltage 25V, 100ms max)			
	CURRENT[A]	*1 0.33typ	0.37typ	0.37typ	0.36typ	0.14typ	0.15typ	0.16typ	0.15typ
	EFFICIENCY[%]	*1 80typ	82typ	85typ	84typ	80typ	83typ	84typ	84typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	0.4	0.3	0.13	0.1	0.4	0.3	0.13	0.1
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	RIPPLE[mVp-p]	*2 120max	120max	150max	150max	120max	120max	150max	150max
	RIPPLE NOISE[mVp-p]	*2 200max	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +85°C 50max	50max	150max	180max	50max	50max	150max	180max
	REGULATION[mV]	-40 to +85°C 80max	80max	240max	290max	80max	80max	240max	290max
	DRIFT[mV]	*3 20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	30max (Minimum input, Io=100%)							
PROTECTION CIRCUIT	OUTPUT VOLTAGE SETTING[V]	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							

MODEL	MGS1R5243R3	MGS1R52405	MGS1R52412	MGS1R52415	MGS1R5483R3	MGS1R54805	MGS1R54812	MGS1R54815
MAX OUTPUT WATTAGE[W]	1.32	1.50	1.56	1.50	1.32	1.50	1.56	1.50
DC OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12
	CURRENT[A]	0.4	0.3	0.13	0.1	0.4	0.3	0.1

SPECIFICATIONS

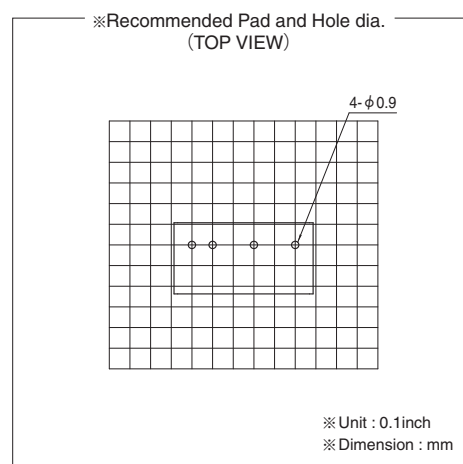
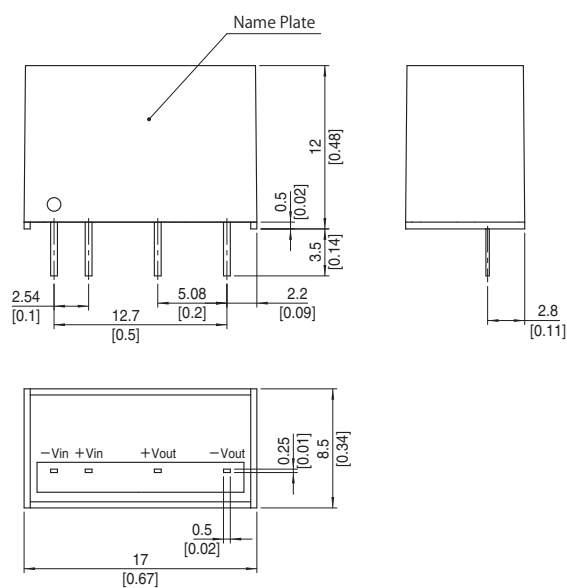
	MODEL	MGS1R5243R3	MGS1R52405	MGS1R52412	MGS1R52415	MGS1R5483R3	MGS1R54805	MGS1R54812	MGS1R54815
INPUT	VOLTAGE[V]	DC18 - 36 (Surge voltage 50V, 100ms max)				DC36 - 76 (Surge voltage 100V, 100ms max)			
	CURRENT[A]	*1 0.071typ	0.079typ	0.080typ	0.077typ	0.036typ	0.040typ	0.040typ	0.039typ
	EFFICIENCY[%]	*1 78typ	80typ	82typ	82typ	77typ	80typ	82typ	82typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	0.4	0.3	0.13	0.1	0.4	0.3	0.13	0.1
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	RIPPLE[mVp-p]	*2 120max	120max	150max	150max	120max	120max	150max	150max
	RIPPLE NOISE[mVp-p]	*2 200max	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +85°C 50max	50max	150max	180max	50max	50max	150max	180max
	REGULATION[mV]	-40 to +85°C 80max	80max	240max	290max	80max	80max	240max	290max
	DRIFT[mV]	*3 20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	30max (Minimum input, Io=100%)							
PROTECTION CIRCUIT	OUTPUT VOLTAGE SETTING[V]	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							

GENERAL SPECIFICATIONS

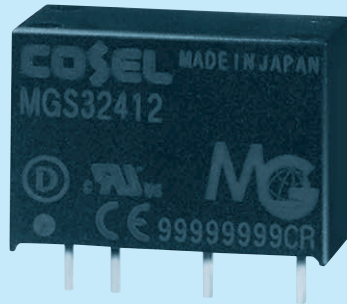
ISOLATION	INPUT-OUTPUT	DC1,500V or AC1,000V 1minute, Cutoff current=10mA, DC500V 1,000MΩ min (20±15℃)
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85℃, 20 to 95%RH (Non condensing) (Required derating), 3,000m (10,000feet) max
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100℃, 20 to 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz 98.0m/s² (10G), 3minute period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s² (50G) 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	17.0×12.0×8.5mm [0.67×0.48×0.34 inches] (W×H×D) / 4g max
	COOLING METHOD	Convection/Forced air

- *1 Rated input 5V, 12V, 24V or 48V DC $I_o=100\%$
- *2 Ripple and ripple noise is measured by using test board with ceramic capacitor $1\mu F$ at 50mm from output pins. (20MHz Oscilloscope)
- *3 Drift is the DC output accuracy for eight hours period after a half-hour warm-up at $25^\circ C$.
- * Parallel operation with other model is not possible.

External view



- ※ Tolerance ± 0.5 [± 0.02]
- ※ Dimensions in mm, []= inches
- ※ Pin terminal material : Copper
- ※ Planting treatment of terminal : Lead free plating
- ※ Case material : PBT
- ※ Weight 4g max



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage
- ⑥ Optional

MODEL	MGS3053R3	MGS30505	MGS30512	MGS30515	MGS3123R3	MGS31205	MGS31212	MGS31215
MAX OUTPUT WATTAGE[W]	2.64	3.0	3.0	3.0	2.64	3.0	3.0	3.0
DC OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12
	CURRENT[A]	0.8	0.6	0.25	0.2	0.8	0.6	0.2

SPECIFICATIONS

	MODEL	MGS3053R3	MGS30505	MGS30512	MGS30515	MGS3123R3	MGS31205	MGS31212	MGS31215
INPUT	VOLTAGE[V]	DC4.5 - 9 (Surge voltage 12.5V, 100ms max)				DC9 - 18 (Surge voltage 25V, 100ms max)			
	CURRENT[A]	*1 0.67typ	0.73typ	0.71typ	0.71typ	0.28typ	0.30typ	0.29typ	0.30typ
	EFFICIENCY[%]	*1 79typ	82typ	85typ	85typ	80typ	83typ	86typ	85typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	0.8	0.6	0.25	0.2	0.8	0.6	0.25	0.2
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	RIPPLE[mVp-p]	*2 120max	120max	150max	150max	120max	120max	150max	150max
	RIPPLE NOISE[mVp-p]	*2 200max	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE	-20 to +85°C	50max	50max	150max	180max	50max	50max	180max
	REGULATION[mV]	-40 to +85°C	80max	80max	240max	290max	80max	80max	240max
	DRIFT[mV]	*3 20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	30max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE SETTING[V]	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
PROTECTION CIRCUIT	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							

MODEL	MGS3243R3	MGS32405	MGS32412	MGS32415	MGS3483R3	MGS34805	MGS34812	MGS34815
MAX OUTPUT WATTAGE[W]	2.64	3.0	3.0	3.0	2.64	3.0	3.0	3.0
DC OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12
	CURRENT[A]	0.8	0.6	0.25	0.2	0.8	0.6	0.2

SPECIFICATIONS

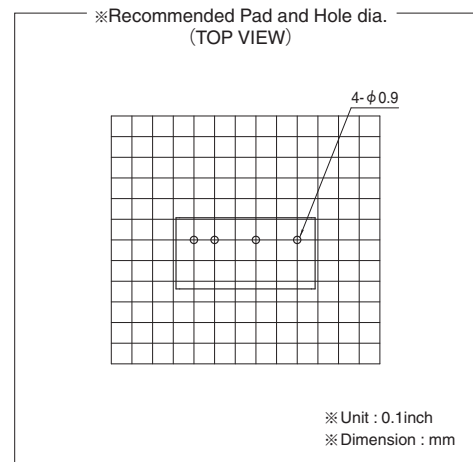
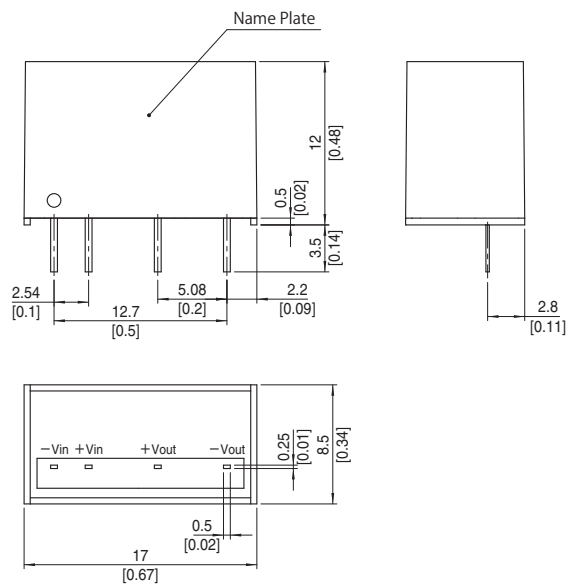
	MODEL	MGS3243R3	MGS32405	MGS32412	MGS32415	MGS3483R3	MGS34805	MGS34812	MGS34815
INPUT	VOLTAGE[V]	DC18 - 36 (Surge voltage 50V, 100ms max)				DC36 - 76 (Surge voltage 100V, 100ms max)			
	CURRENT[A]	*1 0.14typ	0.15typ	0.15typ	0.15typ	0.071typ	0.079typ	0.074typ	0.074typ
	EFFICIENCY[%]	*1 80typ	82typ	85typ	85typ	78typ	80typ	85typ	85typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	0.8	0.6	0.25	0.2	0.8	0.6	0.25	0.2
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	RIPPLE[mVp-p]	*2 120max	120max	150max	150max	120max	120max	150max	150max
	RIPPLE NOISE[mVp-p]	*2 200max	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE	-20 to +85°C	50max	50max	150max	180max	50max	50max	180max
	REGULATION[mV]	-40 to +85°C	80max	80max	240max	290max	80max	80max	240max
	DRIFT[mV]	*3 20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	30max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE SETTING[V]	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
PROTECTION CIRCUIT	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							

GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	DC1,500V or AC1,000V 1minute, Cutoff current=10mA, DC500V 1,000MΩ min (20±15℃)
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85℃, 20 to 95%RH (Non condensing) (Required derating), 3,000m (10,000feet) max
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100℃, 20 to 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz 98.0m/s² (10G), 3minute period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s² (50G) 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	17.0×12.0×8.5mm [0.67×0.48×0.34 inches] (W×H×D) / 4g max
	COOLING METHOD	Convection/Forced air

- *1 Rated input 5V, 12V, 24V or 48V DC $I_o=100\%$
- *2 Ripple and ripple noise is measured by using test board with ceramic capacitor $1\mu F$ at 50mm from output pins. (20MHz Oscilloscope)
- *3 Drift is the DC output accuracy for eight hours period after a half-hour warm-up at $25^\circ C$.
- * Parallel operation with other model is not possible.

External view

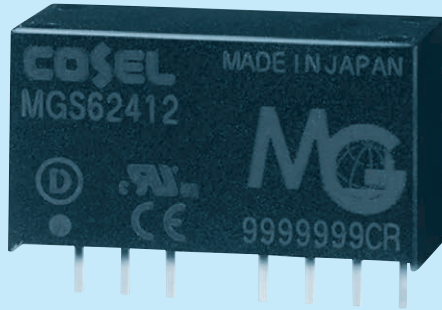


- ※ Tolerance ± 0.5 [± 0.02]
- ※ Dimensions in mm, []= inches
- ※ Pin terminal material : Copper
- ※ Planting treatment of terminal : Lead free plating
- ※ Case material : PBT
- ※ Weight 4g max

MGS6

MG S 6 24 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage
- ⑥ Optional

MODEL	MGS6053R3	MGS60505	MGS60512	MGS60515	MGS6123R3	MGS61205	MGS61212	MGS61215
MAX OUTPUT WATTAGE[W]	5.28	6.0	6.0	6.0	5.28	6.0	6.0	6.0
DC OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12
	CURRENT[A]	1.6	1.2	0.5	0.4	1.6	1.2	0.5

SPECIFICATIONS

	MODEL	MGS6053R3	MGS60505	MGS60512	MGS60515	MGS6123R3	MGS61205	MGS61212	MGS61215
INPUT	VOLTAGE[V]	DC4.5 - 9 (Surge voltage 12.5V, 100ms max)				DC9 - 18 (Surge voltage 25V, 100ms max)			
	CURRENT[A]	*1 1.32typ	1.43typ	1.38typ	1.38typ	0.54typ	0.59typ	0.57typ	0.57typ
	EFFICIENCY[%]	*1 80typ	84typ	87typ	87typ	81typ	85typ	88typ	88typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	1.6	1.2	0.5	0.4	1.6	1.2	0.5	0.4
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	RIPPLE[mVp-p]	*2 lo=30% - 75max		75max	100max	100max	75max	75max	100max
	RIPPLE NOISE[mVp-p]	lo=30% - 225max		225max	300max	300max	225max	225max	300max
		lo=30% - 120max		120max	150max	150max	120max	120max	150max
	TEMPERATURE REGULATION[mV]	*2 lo=0 - 30% 300max		300max	400max	400max	300max	300max	400max
		-20 to +60°C 50max		50max	180max	180max	50max	50max	180max
	DRIFT[mV]	-40 to +60°C 80max		80max	240max	290max	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							
	START-UP TIME[ms]	30max (Minimum input, lo=100%)							
	OUTPUT VOLTAGE SETTING[V]	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45

MODEL	MGS6243R3	MGS62405	MGS62412	MGS62415	MGS6483R3	MGS64805	MGS64812	MGS64815
MAX OUTPUT WATTAGE[W]	5.28	6.0	6.0	6.0	5.28	6.0	6.0	6.0
DC OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12
	CURRENT[A]	1.6	1.2	0.5	0.4	1.6	1.2	0.5

SPECIFICATIONS

	MODEL	MGS6243R3	MGS62405	MGS62412	MGS62415	MGS6483R3	MGS64805	MGS64812	MGS64815
INPUT	VOLTAGE[V]	DC18 - 36 (Surge voltage 50V, 100ms max)				DC36 - 76 (Surge voltage 100V, 100ms max)			
	CURRENT[A]	*1 0.27typ	0.29typ	0.28typ	0.28typ	0.14typ	0.15typ	0.14typ	0.14typ
	EFFICIENCY[%]	*1 81typ	85typ	88typ	88typ	81typ	85typ	88typ	88typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	1.6	1.2	0.5	0.4	1.6	1.2	0.5	0.4
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	RIPPLE[mVp-p]	*2 lo=30% - 75max		75max	100max	100max	75max	75max	100max
	RIPPLE NOISE[mVp-p]	lo=30% - 225max		225max	300max	300max	225max	225max	300max
		lo=30% - 120max		120max	150max	150max	120max	120max	150max
	TEMPERATURE REGULATION[mV]	*2 lo=0 - 30% 300max		300max	400max	400max	300max	300max	400max
		-20 to +60°C 50max		50max	180max	180max	50max	50max	180max
	DRIFT[mV]	-40 to +60°C 80max		80max	240max	290max	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							
	START-UP TIME[ms]	30max (Minimum input, lo=100%)							
	OUTPUT VOLTAGE SETTING[V]	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45

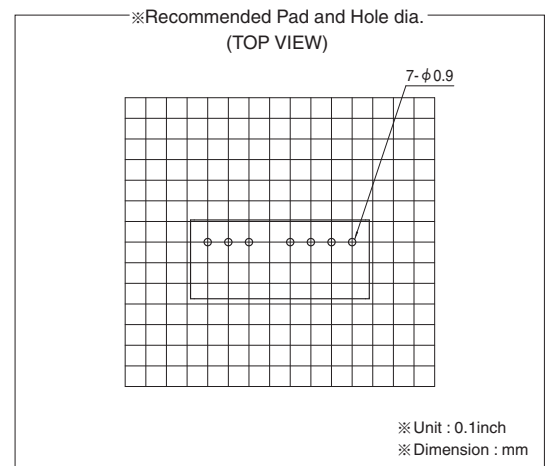
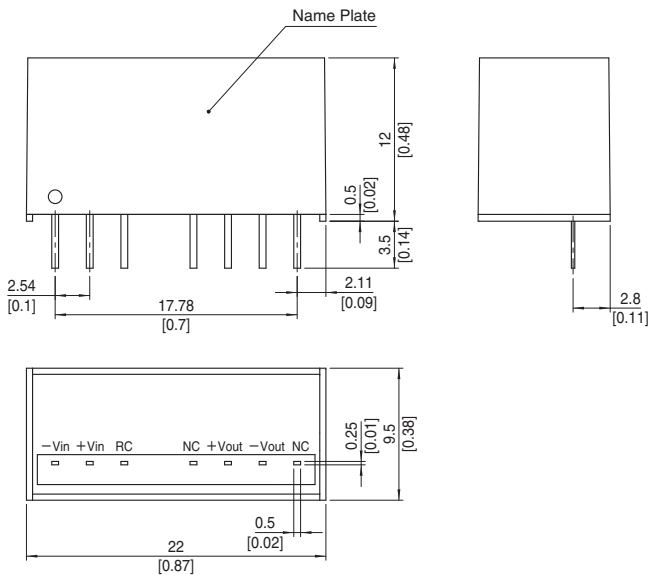
GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	DC1,500V or AC1,000V 1minute, Cutoff current=10mA, DC500V 1,000M Ω min (20 \pm 15°C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 to 95%RH (Non condensing) (Required derating), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 to 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz 98.0m/s ² (10G), 3minute period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s ² (50G) 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	22.0 \times 12.0 \times 9.5mm [0.87 \times 0.48 \times 0.38 inches] (W \times H \times D) / 7g max
	COOLING METHOD	Convection/Forced air

- *1 Rated input 5V, 12V, 24V or 48V DC I_o=100%
 *2 Ripple and ripple noise is measured by using test board with ceramic capacitor 1 μ F at 50mm from output pins. (20MHz Oscilloscope)
 *3 Drift is the DC output accuracy for eight hours period after a half-hour warm-up at 25°C.
 * Parallel operation with other model is not possible.

MG

External view

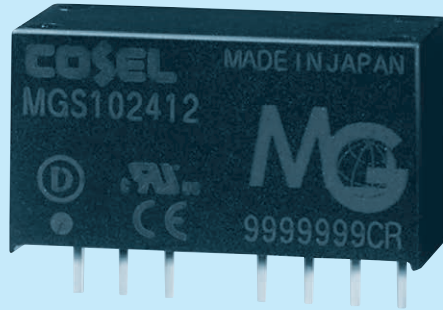


- ※ Tolerance ± 0.5 [± 0.02]
 ※ Dimensions in mm, [] = inches
 ※ Pin terminal material : Copper
 ※ Plating treatment of terminal : Lead free plating
 ※ Case material : PBT
 ※ Weight 7g max

MGS10

MG S 10 24 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage
- ⑥ Optional

MODEL	MGS10053R3	MGS100505	MGS100512	MGS100515	MGS10123R3	MGS101205	MGS101212	MGS101215
MAX OUTPUT WATTAGE[W]	8.58	10.0	10.8	10.5	8.58	10.0	10.8	10.5
DC OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12
	CURRENT[A]	2.6	2.0	0.9	0.7	2.6	2.0	0.9

SPECIFICATIONS

	MODEL	MGS10053R3	MGS100505	MGS100512	MGS100515	MGS10123R3	MGS101205	MGS101212	MGS101215
INPUT	VOLTAGE[V]	DC4.5 - 9 (Surge voltage 12.5V, 100ms max)				DC9 - 18 (Surge voltage 25V, 100ms max)			
	CURRENT[A]	*1 2.02typ	2.30typ	2.45typ	2.39typ	0.83typ	0.95typ	1.01typ	0.98typ
	EFFICIENCY[%]	*1 85typ	87typ	88typ	88typ	86typ	88typ	89typ	89typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	2.6	2.0	0.9	0.7	2.6	2.0	0.9	0.7
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	RIPPLE[mVp-p]	*2 lo=30% - 75max		75max	100max	100max	75max	75max	100max
	RIPPLE NOISE[mVp-p]	lo=0 - 30% 225max		225max	300max	300max	225max	300max	300max
		lo=30% - 120max		120max	150max	120max	120max	150max	150max
	TEMPERATURE REGULATION[mV]	*2 lo=0 - 30% 300max		300max	400max	400max	300max	400max	400max
		-20 to +50°C 50max		50max	180max	50max	50max	150max	180max
	DRIFT[mV]	-40 to +50°C 80max		80max	240max	80max	80max	240max	290max
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							
	START-UP TIME[ms]	30max (Minimum input, lo=100%)							
	OUTPUT VOLTAGE SETTING[V]	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45

MODEL	MGS10243R3	MGS102405	MGS102412	MGS102415	MGS10483R3	MGS104805	MGS104812	MGS104815
MAX OUTPUT WATTAGE[W]	8.58	10.0	10.8	10.5	8.58	10.0	10.8	10.5
DC OUTPUT	VOLTAGE[V]	*1 3.3	5	12	15	3.3	5	12
	CURRENT[A]	2.6	2.0	0.9	0.7	2.6	2.0	0.9

SPECIFICATIONS

	MODEL	MGS10243R3	MGS102405	MGS102412	MGS102415	MGS10483R3	MGS104805	MGS104812	MGS104815
INPUT	VOLTAGE[V]	DC18 - 36 (Surge voltage 50V, 100ms max)				DC36 - 76 (Surge voltage 100V, 100ms max)			
	CURRENT[A]	*1 0.42typ	0.47typ	0.51typ	0.49typ	0.21typ	0.24typ	0.25typ	0.25typ
	EFFICIENCY[%]	*1 86typ	88typ	89typ	89typ	86typ	88typ	89typ	89typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	2.6	2.0	0.9	0.7	2.6	2.0	0.9	0.7
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	RIPPLE[mVp-p]	*2 lo=30% - 75max		75max	100max	100max	75max	75max	100max
	RIPPLE NOISE[mVp-p]	lo=0 - 30% 225max		225max	300max	300max	225max	300max	300max
		lo=30% - 120max		120max	150max	120max	120max	150max	150max
	TEMPERATURE REGULATION[mV]	*2 lo=0 - 30% 300max		300max	400max	400max	300max	400max	400max
		-20 to +50°C 50max		50max	180max	50max	50max	150max	180max
	DRIFT[mV]	-40 to +50°C 80max		80max	240max	80max	80max	240max	290max
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							
	START-UP TIME[ms]	30max (Minimum input, lo=100%)							
	OUTPUT VOLTAGE SETTING[V]	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45

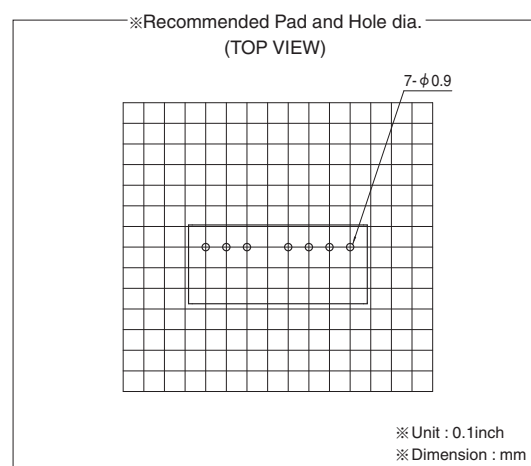
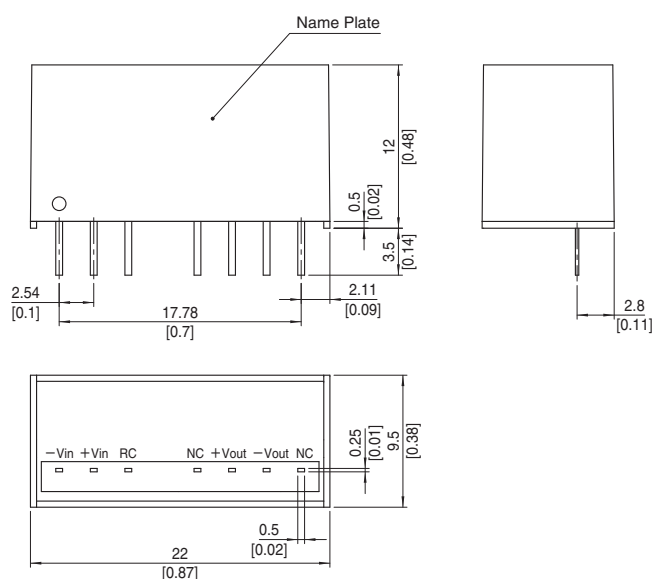
GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	DC1,500V or AC1,000V 1minute, Cutoff current=10mA, DC500V 1,000M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 to 95%RH (Non condensing) (Required derating), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 to 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz 98.0m/s 2 (10G), 3minute period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s 2 (50G) 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	22.0 \times 12.0 \times 9.5mm [0.87 \times 0.48 \times 0.38 inches] (W \times H \times D) / 7g max
	COOLING METHOD	Convection/Forced air

- *1 Rated input 5V, 12V, 24V or 48V DC Io=100%
- *2 Ripple and ripple noise is measured by using test board with ceramic capacitor 1 μ F at 50mm from output pins. (20MHz Oscilloscope)
- *3 Drift is the DC output accuracy for eight hours period after a half-hour warm-up at 25 $^{\circ}$ C.
- * Parallel operation with other model is not possible.

MG

External view



- ※ Tolerance ± 0.5 [± 0.02]
- ※ Dimensions in mm, [] = inches
- ※ Pin terminal material : Copper
- ※ Plating treatment of terminal : Lead free plating
- ※ Case material : PBT
- ※ Weight 7g max

MGS15

MG S 15 24 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
② Single output
③ Output wattage
④ Input voltage
⑤ Output voltage
⑥ Optional
G: Capacitor between
Input and Output is removed.
R: with Remote ON/OFF
(Positive logic control)

MODEL		MGS15123R3	MGS151205	MGS151212	MGS151215	MGS15243R3	MGS152405	MGS152412	MGS152415
MAX OUTPUT WATTAGE[W]		13.2	15	15.6	15	13.2	15	15.6	15
DC OUTPUT	VOLTAGE[V]※1	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	4	3	1.3	1	4	3	1.3	1

SPECIFICATIONS

	MODEL	MGS15123R3	MGS151205	MGS151212	MGS151215	MGS15243R3	MGS152405	MGS152412	MGS152415
INPUT	VOLTAGE[V]	DC9 - 18				DC18 - 36			
	CURRENT[A] *2	1.28typ	1.44typ	1.49typ	1.42typ	0.63typ	0.70typ	0.73typ	0.70typ
	EFFICIENCY[%] *2	86typ	87typ	87typ	88typ	87typ	89typ	89typ	89typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	4	3	1.3	1	4	3	1.3	1
	LINE REGULATION[mV]	13.2max	20max	48max	60max	13.2max	20max	48max	60max
	LOAD REGULATION[mV]	13.2max	20max	48max	60max	13.2max	20max	48max	60max
	RIPPLE[mVp-p] *3	-20 to +60°C	75max	75max	100max	100max	75max	75max	100max
		-40 to -20°C	100max	100max	120max	120max	100max	120max	120max
	RIPPLE NOISE[mVp-p] *3	-20 to +60°C	75max	75max	100max	100max	75max	100max	100max
		-40 to -20°C	150max	150max	150max	150max	150max	150max	150max
	TEMPERATURE REGULATION[mV]	-20 to +60°C	50max	50max	150max	180max	50max	50max	150max
		-40 to +60°C	80max	80max	240max	290max	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	30max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) Available to adjust $\pm 10\%$ by external variable resistor							
	OUTPUT VOLTAGE SETTING[V] *5	3.296 - 3.404	4.975 - 5.137	11.857 - 12.243	14.839 - 15.321	3.296 - 3.404	4.975 - 5.137	11.857 - 12.243	14.839 - 15.321
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
PROTECTION CIRCUIT AND OTHERS	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)							

MODEL		MGS15483R3	MGS154805	MGS154812	MGS154815
MAX OUTPUT WATTAGE[W]		13.2	15	15.6	15
DC OUTPUT	VOLTAGE[V]※1	3.3	5	12	15
	CURRENT[A]	4	3	1.3	1

SPECIFICATIONS

	MODEL	MGS15483R3	MGS154805	MGS154812	MGS154815	
INPUT	VOLTAGE[V]	DC36 - 76				
	CURRENT[A]	*2 0.32typ	0.35typ	0.36typ	0.35typ	
	EFFICIENCY[%]	*2 87typ	89typ	90typ	90typ	
OUTPUT	VOLTAGE[V]	3.3	5	12	15	
	CURRENT[A]	4	3	1.3	1	
	LINE REGULATION[mV]	13.2max	20max	48max	60max	
	LOAD REGULATION[mV]	13.2max	20max	48max	60max	
	RIPPLE[mVp-p]	-20 to +60℃	75max	75max	100max	100max
		*3 -40 to -20℃	100max	100max	120max	120max
	RIPPLE NOISE[mVp-p]	-20 to +60℃	75max	75max	100max	100max
		*3 -40 to -20℃	150max	150max	150max	150max
	TEMPERATURE REGULATION[mV]	-20 to +60℃	50max	50max	150max	180max
		-40 to +60℃	80max	80max	240max	290max
	DRIFT[mV]	*4 20max	20max	48max	60max	
	START-UP TIME[ms]	30max (Minimum input, Io=100%)				
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±10% adjustable by external VR				
OUTPUT VOLTAGE SETTING[V]	*5 3.296 - 3.404	4.975 - 5.137	11.857 - 12.243	14.839 - 15.321		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically				
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)				

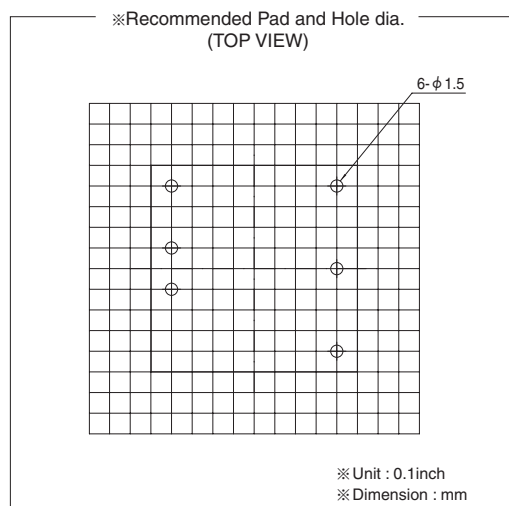
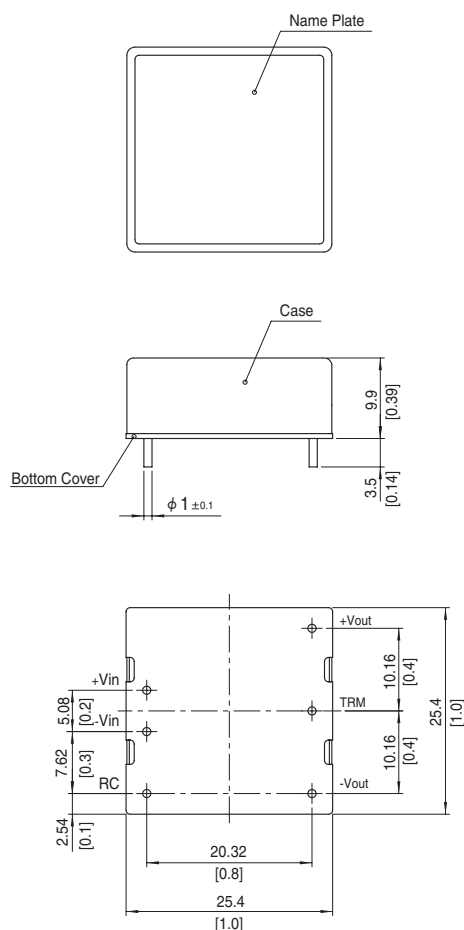
GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	DC1,500V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)
	INPUT-CASE	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)
	OUTPUT-CASE	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85℃, 20 to 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100℃, 20 to 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	25.4 X 9.9 X 25.4mm [1 X 0.39 X 1 inches] (W X H X D) / 20g max
	COOLING METHOD	Convection/Forced air

- *1 MGW15xx05/MGW15xx12/MGW15xx15 is available as single output, +10V/+24V/+30V
- *2 Rated input 12V, 24V or 48V DC I_o=100%
- *3 Ripple and Ripple Noise is measured by using test board with ceramic capacitor 22μF at 50mm from output pins. (20MHz Oscilloscope)
- *4 Drift is the DC output accuracy for eight hours period after a half-hour warm-up at 25℃.
- *5 Rated input voltage (DC12V, DC24V, DC48V), rated output wattage, ambient temperature at 25℃.
- * Parallel operation with other model is not possible.

MG

External view

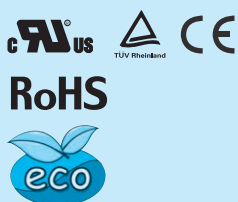


- ※ Tolerance ±0.5 [±0.02]
- ※ Dimensions in mm, []=inches
- ※ Pin terminal material : Copper
- ※ Plating treatment of terminal : Lead free plating
- ※ Case material : Brass
- ※ Plating treatment of case : Nickel plating
- ※ Bottom Cover : FR4 (t=0.6) [t=0.024]
- ※ Please keep enough creepage distance with the pattern on PCB and other components.
- ※ Weight 20g max

MGS30

MG S 30 24 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage
- ⑥ Optional
- G: Capacitor between Input and Output is removed.
- R: with Remote ON/OFF (Positive logic control)

MG

MODEL	MGS30123R3	MGS301205	MGS301212	MGS301215	MGS30243R3	MGS302405	MGS302412	MGS302415
MAX OUTPUT WATTAGE[W]	26.4	30	30	30	26.4	30	30	30
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12
	CURRENT[A]	8	6	2.5	2	8	6	2.5

SPECIFICATIONS

	MODEL	MGS30123R3	MGS301205	MGS301212	MGS301215	MGS30243R3	MGS302405	MGS302412	MGS302415
INPUT	VOLTAGE[V]	DC9 - 18				DC18 - 36			
	CURRENT[A] *2	2.45typ	2.75typ	2.78typ	2.78typ	1.21typ	1.36typ	1.36typ	1.36typ
	EFFICIENCY[%] *2	90typ	91typ	90typ	90typ	91typ	92typ	92typ	92typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	8	6	2.5	2	8	6	2.5	2
	LINE REGULATION[mV]	13.2max	20max	48max	60max	13.2max	20max	48max	60max
	LOAD REGULATION[mV]	13.2max	20max	48max	60max	13.2max	20max	48max	60max
	RIPPLE[mVp-p] *3	-20 to +60°C	75max	75max	100max	100max	75max	75max	100max
		-40 to -20°C	100max	100max	120max	120max	100max	100max	120max
	RIPPLE NOISE[mVp-p] *3	-20 to +60°C	75max	75max	100max	100max	75max	75max	100max
		-40 to -20°C	150max	150max	150max	150max	150max	150max	150max
	TEMPERATURE REGULATION[mV]	-20 to +60°C	50max	50max	180max	50max	50max	150max	180max
		-40 to +60°C	80max	80max	240max	80max	80max	240max	290max
	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	30max (Minimum input, Io=100%)							
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±10% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] *5	3.296 - 3.404	4.975 - 5.137	11.857 - 12.243	14.839 - 15.321	3.296 - 3.404	4.975 - 5.137	11.857 - 12.243	14.839 - 15.321
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	OVERVOLTAGE PROTECTION[V]	Works over 120 to 160% of rating							
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)							

MODEL	MGS30483R3	MGS304805	MGS304812	MGS304815
MAX OUTPUT WATTAGE[W]	26.4	30	30	30
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12
	CURRENT[A]	8	6	2.5

SPECIFICATIONS

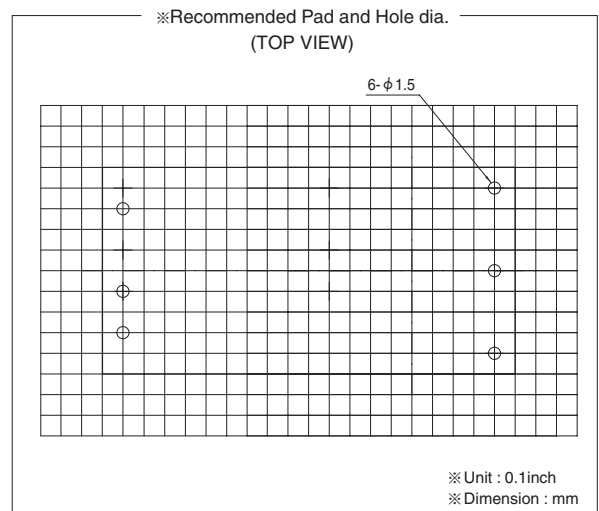
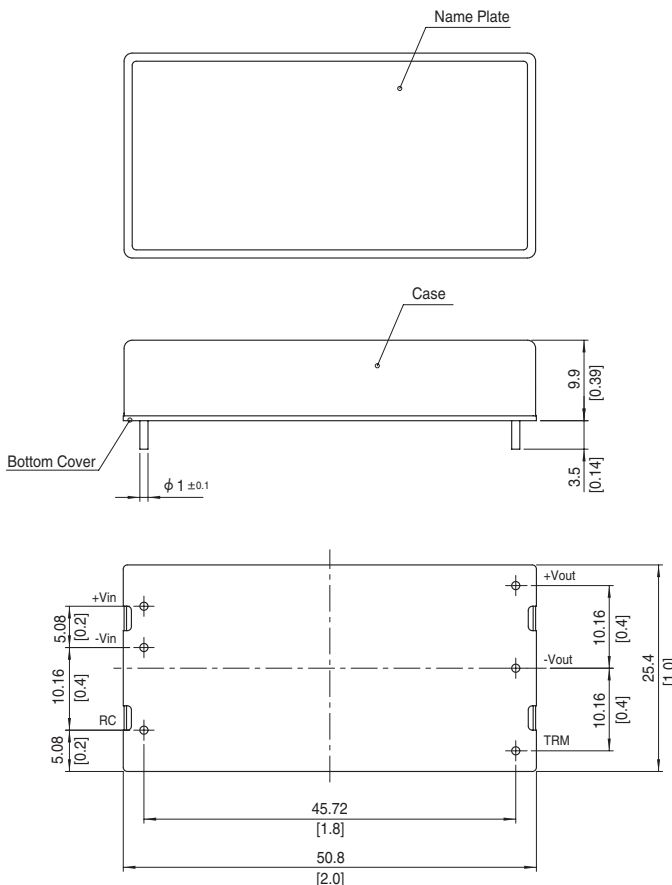
	MODEL	MGS30483R3	MGS304805	MGS304812	MGS304815
INPUT	VOLTAGE[V]	DC36 - 76			
	CURRENT[A] *2	0.61typ	0.68typ	0.68typ	0.68typ
	EFFICIENCY[%] *2	91typ	92typ	92typ	92typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15
	CURRENT[A]	8	6	2.5	2
	LINE REGULATION[mV]	13.2max	20max	48max	60max
	LOAD REGULATION[mV]	13.2max	20max	48max	60max
	RIPPLE[mVp-p] *3	-20 to +60°C	75max	75max	100max
		-40 to -20°C	100max	100max	120max
	RIPPLE NOISE[mVp-p] *3	-20 to +60°C	75max	75max	100max
		-40 to -20°C	150max	150max	150max
	TEMPERATURE REGULATION[mV]	-20 to +60°C	50max	50max	180max
		-40 to +60°C	80max	80max	240max
	DRIFT[mV] *4	20max	20max	48max	60max
	START-UP TIME[ms]	30max (Minimum input, Io=100%)			
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±10% adjustable by external VR			
	OUTPUT VOLTAGE SETTING[V] *5	3.296 - 3.404	4.975 - 5.137	11.857 - 12.243	14.839 - 15.321
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically			
	OVERVOLTAGE PROTECTION[V]	Works over 120 to 160% of rating			
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)			

GENERAL SPECIFICATIONS

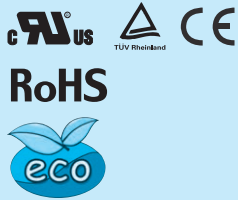
ISOLATION	INPUT-OUTPUT	DC1,500V 1minute, Cutoff current = 10mA, DC500V 1,000M Ω min (20 \pm 15 $^{\circ}$ C)
	INPUT-CASE	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000M Ω min (20 \pm 15 $^{\circ}$ C)
	OUTPUT-CASE	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 to 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 to 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 98.0m/s 2 (10G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s 2 (50G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	25.4 X 9.9 X 50.8mm [1 X 0.39 X 2 inches] (W X H X D) / 40g max
	COOLING METHOD	Convection/Forced air

- *1 MGW30xx05/MGW30xx12/MGW30xx15 is available as single output, +10V/+24V/+30V
- *2 Rated input 12V, 24V or 48V DC $I_o=100\%$
- *3 Ripple and Ripple Noise is measured by using test board with ceramic capacitor 22 μ F at 50mm from output pins. (20MHz Oscilloscope)
- *4 Drift is the DC output accuracy for eight hours period after a half-hour warm-up at 25 $^{\circ}$ C.
- *5 Rated input voltage (DC12V, DC24V, DC48V), rated output wattage, ambient temperature at 25 $^{\circ}$ C.
- * Parallel operation with other model is not possible.

External view



- ※ Tolerance ± 0.5 [± 0.02]
- ※ Dimensions in mm, []=inches
- ※ Pin terminal material : Copper
- ※ Plating treatment of terminal : Lead free plating
- ※ Case material : Brass
- ※ Plating treatment of case : Nickel plating
- ※ Bottom Cover : FR4 (t=0.6) [t=0.024]
- ※ Please keep enough creepage distance with the pattern on PCB and other components.
- ※ Weight 40g max



- ① Series name
- ② Dual output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage
- ⑥ Optional
- G: Capacitor between Input and Output is removed.
- R: with Remote ON/OFF (Positive logic control)

MODEL		MGW151205	MGW151212	MGW151215	MGW152405	MGW152412	MGW152415	MGW154805	MGW154812	MGW154815
MAX OUTPUT WATTAGE[W]		15	15.6	15	15	15.6	15	15	15.6	15
DC OUTPUT	VOLTAGE[V] *1	±5 or +10	±12 or +24	±15 or +30	±5 or +10	±12 or +24	±15 or +30	±5 or +10	±12 or +24	±15 or +30
	CURRENT[A]	1.5	0.65	0.5	1.5	0.65	0.5	1.5	0.65	0.5

SPECIFICATIONS

	MODEL	MGW151205	MGW151212	MGW151215	MGW152405	MGW152412	MGW152415	MGW154805	MGW154812	MGW154815
INPUT	VOLTAGE[V]	DC9 - 18			DC18 - 36			DC36 - 76		
	CURRENT[A] *2	1.48typ	1.49typ	1.42typ	0.74typ	0.74typ	0.70typ	0.37typ	0.37typ	0.35typ
	EFFICIENCY[%] *2	84typ	87typ	88typ	84typ	88typ	89typ	84typ	89typ	89typ
OUTPUT	VOLTAGE[V]	±5(+10)	±12(+24)	±15(+30)	±5(+10)	±12(+24)	±15(+30)	±5(+10)	±12(+24)	±15(+30)
	CURRENT[A]	1.5	0.65	0.5	1.5	0.65	0.5	1.5	0.65	0.5
	LINE REGULATION[mV]	40max	60max	75max	40max	60max	75max	40max	60max	75max
	LOAD REGULATION[mV]	*3 500max *5	600max	750max	500max *5	600max	750max	500max *5	600max	750max
		*4 250max	480max	600max	250max	480max	600max	250max	480max	600max
	RIPPLE[mVp-p] *6	-20 to +60°C	100max	100max	100max	100max	100max	100max	100max	100max
		-40 to -20°C	120max	120max	120max	120max	120max	120max	120max	120max
	RIPPLE NOISE[mVp-p] *6	-20 to +60°C	100max	100max	100max	100max	100max	100max	100max	100max
		-40 to -20°C	150max	150max	150max	150max	150max	150max	150max	150max
	TEMPERATURE REGULATION[mV]	-20 to +60°C	50max	150max	180max	50max	150max	180max	50max	150max
		-40 to +60°C	80max	240max	290max	80max	240max	290max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *7	50max	50max	60max	50max	50max	60max	50max	50max	60max
	START-UP TIME[ms]	30max (Minimum input, Io=100%)								
	OUTPUT VOLTAGE SETTING[V] *8	4.935 - 5.240	11.765 - 12.492	14.602 - 15.505	4.935 - 5.240	11.765 - 12.492	14.602 - 15.505	4.935 - 5.240	11.765 - 12.492	14.602 - 15.505
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically								
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)								
ISOLATION	INPUT-OUTPUT	DC1,500V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15°C)								
	INPUT-CASE	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15°C)								
	OUTPUT-CASE	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15°C)								
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 to 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max								
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 to 95%RH (Non condensing), 9,000m (30,000feet) max								
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis								
	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis								
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1								
OTHERS	CASE SIZE/WEIGHT	25.4×9.9×25.4mm [1×0.39×1 inches] (W×H×D) / 20g max								
	COOLING METHOD	Convection/Forced air								

*1 Single output +10V, +24V, +30V with no use of COM.

*2 Rated input 12V, 24V or 48V Io=100%

*3 An output load is 100%, the other load is 5% to 100%.

*4 An output load is 100%, the other load is 20% to 100%.

*5 Refer to the instruction manual 11.

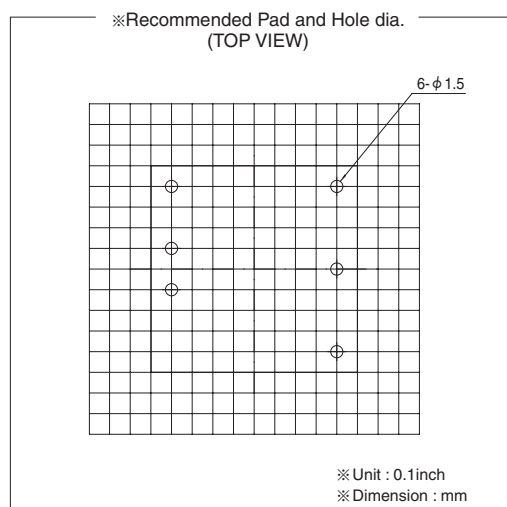
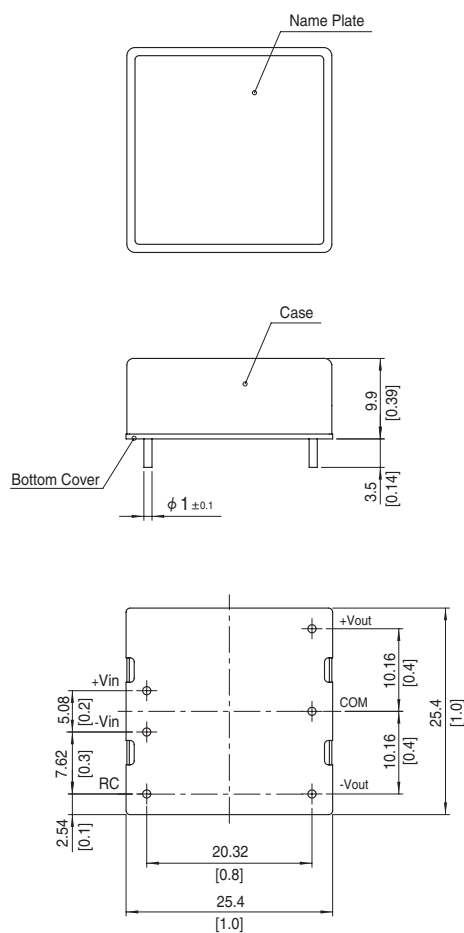
*6 Ripple and Ripple Noise is measured by using test board with ceramic capacitor 22μF at 50mm from output pins. (20MHz Oscilloscope)

*7 Drift is the DC output accuracy for eight hours period after a half-hour warm-up at 25°C.

*8 Rated input voltage (DC12V, DC24V, DC48V), rated output wattage, ambient temperature at 25°C.

* Parallel operation with other model is not possible.

External view

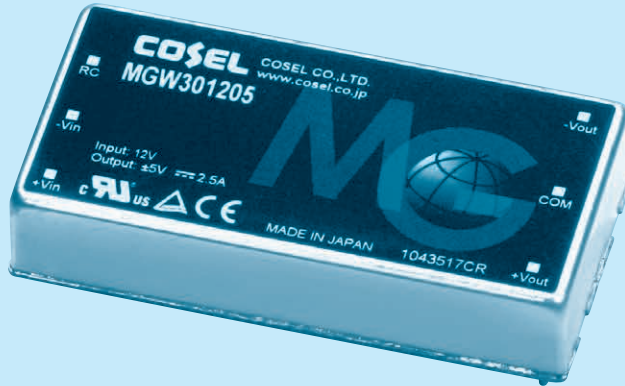
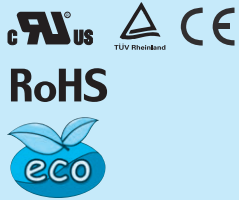


- ※ Tolerance ± 0.5 [± 0.02]
- ※ Dimensions in mm, []=inches
- ※ Pin terminal material : Copper
- ※ Plating treatment of terminal : Lead free plating
- ※ Case material : Brass
- ※ Plating treatment of case : Nickel plating
- ※ Bottom Cover : FR4 (t=0.6) [t=0.024]
- ※ Please keep enough creepage distance with the pattern on PCB and other components.
- ※ Weight 20g max

MGW30

MG W 30 24 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
② Dual output
③ Output wattage
④ Input voltage
⑤ Output voltage
⑥ Optional
G: Capacitor between
Input and Output is removed.
R: with Remote ON/OFF
(Positive logic control)

MODEL		MGW301205	MGW301212	MGW301215	MGW302405	MGW302412	MGW302415	MGW304805	MGW304812	MGW304815
MAX OUTPUT WATTAGE[W]		25	30	30	25	30	30	25	30	30
DC OUTPUT	VOLTAGE[V] *1	±5 or +10	±12 or +24	±15 or +30	±5 or +10	±12 or +24	±15 or +30	±5 or +10	±12 or +24	±15 or +30
	CURRENT[A]	2.5	1.25	1	2.5	1.25	1	2.5	1.25	1

SPECIFICATIONS

	MODEL	MGW301205	MGW301212	MGW301215	MGW302405	MGW302412	MGW302415	MGW304805	MGW304812	MGW304815
INPUT	VOLTAGE[V]	DC9 - 18			DC18 - 36			DC36 - 76		
	CURRENT[A] *2	2.42typ	2.78typ	2.78typ	1.20typ	1.38typ	1.38typ	0.60typ	0.70typ	0.70typ
	EFFICIENCY[%] *2	86typ	90typ	90typ	87typ	91typ	91typ	87typ	90typ	90typ
OUTPUT	VOLTAGE[V]	±5(+10)	±12(+24)	±15(+30)	±5(+10)	±12(+24)	±15(+30)	±5(+10)	±12(+24)	±15(+30)
	CURRENT[A]	2.5	1.25	1	2.5	1.25	1	2.5	1.25	1
	LINE REGULATION[mV]	40max	60max	75max	40max	60max	75max	40max	60max	75max
	LOAD REGULATION[mV]	*3 500max *5	600max	750max	500max *5	600max	750max	500max *5	600max	750max
		*4 250max	480max	600max	250max	480max	600max	250max	480max	600max
	RIPPLE[mVp-p]	-20 to +60°C	100max	100max	100max	100max	100max	100max	100max	100max
		-40 to -20°C	120max	120max	120max	120max	120max	120max	120max	120max
	RIPPLE NOISE[mVp-p]	-20 to +60°C	100max	100max	100max	100max	100max	100max	100max	100max
		-40 to -20°C	150max	150max	150max	150max	150max	150max	150max	150max
	TEMPERATURE REGULATION[mV]	50max	150max	180max	50max	150max	180max	50max	150max	180max
		-40 to +60°C	80max	240max	290max	80max	240max	290max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *7	50max	50max	60max	50max	50max	60max	50max	50max	60max
	START-UP TIME[ms]	30max (Minimum input, Io=100%)								
	OUTPUT VOLTAGE SETTING[V] *8	4.935 - 5.240	11.765 - 12.492	14.602 - 15.505	4.935 - 5.240	11.765 - 12.492	14.602 - 15.505	4.935 - 5.240	11.765 - 12.492	14.602 - 15.505
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically								
ISOLATION	OVERVOLTAGE PROTECTION[V]	Works over 120 to 160% of rating (Total of +V and -V)								
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)								
	INPUT-OUTPUT	DC1,500V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15°C)								
ENVIRONMENT	INPUT-CASE	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15°C)								
	OUTPUT-CASE	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15°C)								
	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 to 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max								
SAFETY	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 to 95%RH (Non condensing), 9,000m (30,000feet) max								
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis								
	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis								
OTHERS	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1								
	CASE SIZE/WEIGHT	25.4×9.9×50.8mm [1×0.39×2 inches] (W×H×D) / 40g max								
	COOLING METHOD	Convection/Forced air								

*1 Single output +10V, +24V, +30V with no use of COM.

*2 Rated input 12V, 24V or 48V DC Io=100%

*3 Symmetrical loading from 5% to 100%.

*4 Symmetrical loading from 20% to 100%.

*5 Refer to the instruction manual 11.

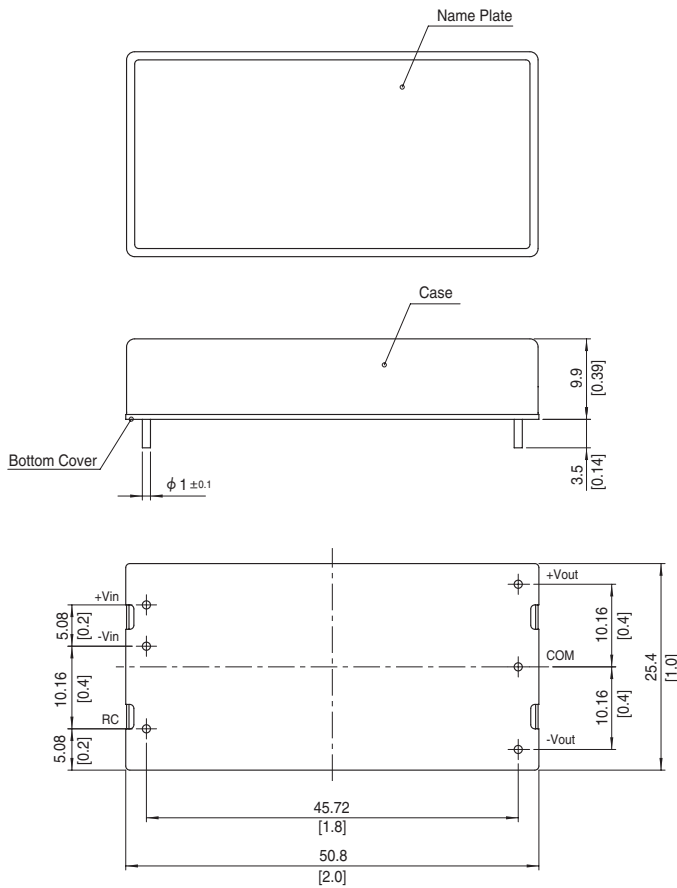
*6 Ripple and Ripple Noise is measured by using test board with ceramic capacitor 22μF at 50mm from output pins. (20MHz Oscilloscope)

*7 Drift is the DC output accuracy for eight hours period after a half-hour warm-up at 25°C.

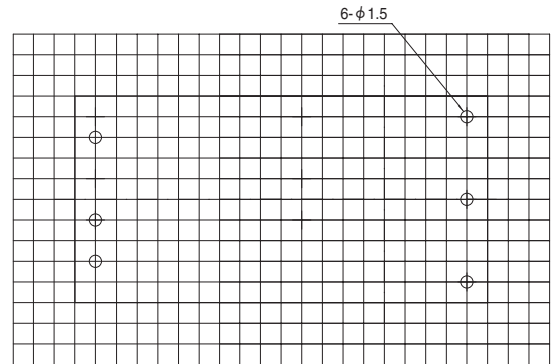
*8 Rated input voltage (DC12V, DC24V, DC48V), rated output wattage, ambient temperature at 25°C.

* Parallel operation with other model is not possible.

External view



※Recommended Pad and Hole dia.
(TOP VIEW)



※ Unit : 0.1inch
※ Dimension : mm

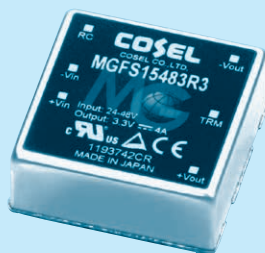
- ※ Tolerance ± 0.5 [± 0.02]
- ※ Dimensions in mm, []=inches
- ※ Pin terminal material : Copper
- ※ Plating treatment of terminal : Lead free plating
- ※ Case material : Brass
- ※ Plating treatment of case : Nickel plating
- ※ Bottom Cover : FR4 (t=0.6) [t=0.024]
- ※ Please keep enough creepage distance with the pattern on PCB and other components.
- ※ Weight 40g max

MG

MGFS15

MGF S 15 24 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
 ② Single output
 ③ Output wattage
 ④ Input voltage
 ⑤ Output voltage
 ⑥ Optional
 G: Capacitor between
 Input and Output is removed.
 R: with Remote ON/OFF
 (Positive logic control)

MODEL	MGFS15243R3	MGFS152405	MGFS152412	MGFS152415
MAX OUTPUT WATTAGE[W]	13.2	15	15.6	15
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12
	CURRENT[A]	4	3	1.3

SPECIFICATIONS

	MODEL	MGFS15243R3	MGFS152405	MGFS152412	MGFS152415
INPUT	VOLTAGE[V]	DC9 - 36			
	CURRENT[A] *2	0.63typ	0.71typ	0.73typ	0.70typ
	EFFICIENCY[%] *2	87typ	88typ	89typ	89typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15
	CURRENT[A]	4	3	1.3	1
	LINE REGULATION[mV]	13.2max	20max	48max	60max
	LOAD REGULATION[mV]	13.2max	20max	48max	60max
	RIPPLE[mVp-p] *3	-20 to +60°C	75max	75max	100max
		-40 to -20°C	100max	100max	120max
	RIPPLE NOISE[mVp-p] *3	-20 to +60°C	75max	75max	100max
		-40 to -20°C	150max	150max	150max
	TEMPERATURE REGULATION[mV]	-20 to +60°C	50max	50max	150max
		-40 to +60°C	80max	80max	240max
	DRIFT[mV] *4	20max	20max	48max	60max
PROTECTION CIRCUIT AND OTHERS	START-UP TIME[ms]	30max (Minimum input, Io=100%)			
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±10% adjustable by external VR			
	OUTPUT VOLTAGE SETTING[V] *5	3.296 - 3.404	4.975 - 5.137	11.857 - 12.243	14.839 - 15.321
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically			
PROTECTION CIRCUIT AND OTHERS	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)			

MODEL	MGFS15483R3	MGFS154805	MGFS154812	MGFS154815
MAX OUTPUT WATTAGE[W]	13.2	15	15.6	15
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12
	CURRENT[A]	4	3	1.3

SPECIFICATIONS

	MODEL	MGFS15483R3	MGFS154805	MGFS154812	MGFS154815
INPUT	VOLTAGE[V]	DC18 - 76			
	CURRENT[A] *2	0.32typ	0.36typ	0.37typ	0.35typ
	EFFICIENCY[%] *2	87typ	88typ	88typ	89typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15
	CURRENT[A]	4	3	1.3	1
	LINE REGULATION[mV]	13.2max	20max	48max	60max
	LOAD REGULATION[mV]	13.2max	20max	48max	60max
	RIPPLE[mVp-p] *3	-20 to +60°C	75max	75max	100max
		-40 to -20°C	100max	100max	120max
	RIPPLE NOISE[mVp-p] *3	-20 to +60°C	75max	75max	100max
		-40 to -20°C	150max	150max	150max
	TEMPERATURE REGULATION[mV]	-20 to +60°C	50max	50max	150max
		-40 to +60°C	80max	80max	240max
	DRIFT[mV] *4	20max	20max	48max	60max
PROTECTION CIRCUIT AND OTHERS	START-UP TIME[ms]	30max (Minimum input, Io=100%)			
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±10% adjustable by external VR			
	OUTPUT VOLTAGE SETTING[V] *5	3.296 - 3.404	4.975 - 5.137	11.857 - 12.243	14.839 - 15.321
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically			
PROTECTION CIRCUIT AND OTHERS	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)			

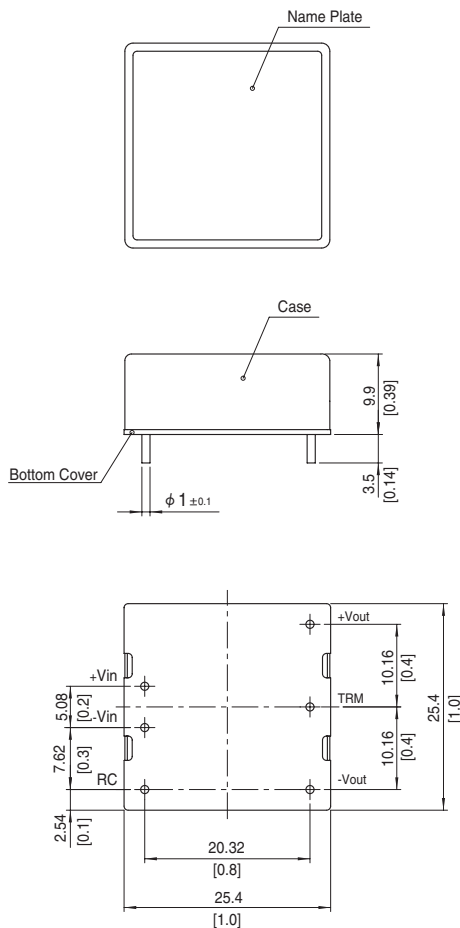
GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	DC1,500V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)
	INPUT-CASE	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)
	OUTPUT-CASE	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85℃, 20 to 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100℃, 20 to 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	25.4 X 9.9 X 25.4mm [1 X 0.39 X 1 inches] (W X H X D) / 20g max
	COOLING METHOD	Convection/Forced air

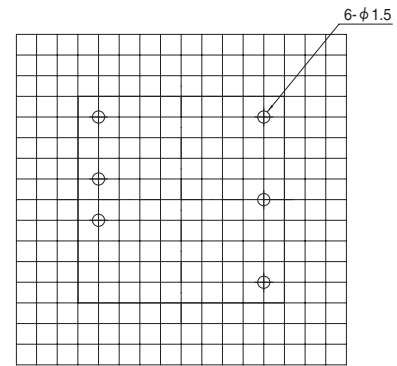
- *1 MGFW15xx05/MGFW15xx12/MGFW15xx15 is available as single output, +10V/+24V/+30V
- *2 Rated input 12V, 24V or 48V DC I_o=100%
- *3 Ripple and Ripple Noise is measured by using test board with ceramic capacitor 22μF at 50mm from output pins. (20MHz Oscilloscope)
- *4 Drift is the DC output accuracy for eight hours period after a half-hour warm-up at 25℃.
- *5 Rated input voltage (DC24V, DC48V), rated output wattage, ambient temperature at 25℃.
- * Parallel operation with other model is not possible.

MG

External view



※Recommended Pad and Hole dia.
(TOP VIEW)



※ Unit : 0.1inch
※ Dimension : mm

- ※ Tolerance ±0.5 [±0.02]
- ※ Dimensions in mm, []=inches
- ※ Pin terminal material : Copper
- ※ Plating treatment of terminal : Lead free plating
- ※ Case material : Brass
- ※ Plating treatment of case : Nickel plating
- ※ Bottom Cover : FR4 (t=0.6) [t=0.024]
- ※ Please keep enough creepage distance with the pattern on PCB and other components.
- ※ Weight 20g max

MGFS30

MGF S 30 24 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
② Single output
③ Output wattage
④ Input voltage
⑤ Output voltage
⑥ Optional
G: Capacitor between
Input and Output is removed.
R: with Remote ON/OFF
(Positive logic control)

MG

MODEL	MGFS30243R3	MGFS302405	MGFS302412	MGFS302415
MAX OUTPUT WATTAGE[W]	24.75	30	30	30
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12
	CURRENT[A]	7.5	6	2.5

SPECIFICATIONS

	MODEL	MGFS30243R3	MGFS302405	MGFS302412	MGFS302415
INPUT	VOLTAGE[V]	DC9 - 36			
	CURRENT[A] *2	1.16typ	1.39typ	1.40typ	1.40typ
	EFFICIENCY[%] *2	89typ	90typ	89typ	89typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15
	CURRENT[A]	7.5	6	2.5	2
	LINE REGULATION[mV]	13.2max	20max	48max	60max
	LOAD REGULATION[mV]	13.2max	20max	48max	60max
	RIPPLE[mVp-p] *3	-20 to +60°C 75max	75max	100max	100max
		-40 to -20°C 100max	100max	120max	120max
	RIPPLE NOISE[mVp-p] *3	-20 to +60°C 75max	75max	100max	100max
		-40 to -20°C 150max	150max	150max	150max
	TEMPERATURE REGULATION[mV]	-20 to +60°C 50max	50max	150max	180max
		-40 to +60°C 80max	80max	240max	290max
	DRIFT[mV] *4	20max	20max	48max	60max
PROTECTION CIRCUIT AND OTHERS	START-UP TIME[ms]	30max (Minimum input, Io=100%)			
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±10% adjustable by external VR			
	OUTPUT VOLTAGE SETTING[V] *5	3.296 - 3.404	4.975 - 5.137	11.857 - 12.243	14.839 - 15.321
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically			
PROTECTION CIRCUIT AND OTHERS	OVERVOLTAGE PROTECTION[V]	Works over 120 to 160% of rating			
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)			

MODEL	MGFS30483R3	MGFS304805	MGFS304812	MGFS304815
MAX OUTPUT WATTAGE[W]	24.75	30	30	30
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12
	CURRENT[A]	7.5	6	2.5

SPECIFICATIONS

	MODEL	MGFS30483R3	MGFS304805	MGFS304812	MGFS304815
INPUT	VOLTAGE[V]	DC18 - 76			
	CURRENT[A] *2	0.58typ	0.70typ	0.70typ	0.70typ
	EFFICIENCY[%] *2	89typ	90typ	89typ	89typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15
	CURRENT[A]	7.5	6	2.5	2
	LINE REGULATION[mV]	13.2max	20max	48max	60max
	LOAD REGULATION[mV]	13.2max	20max	48max	60max
	RIPPLE[mVp-p] *3	-20 to +60°C 75max	75max	100max	100max
		-40 to -20°C 100max	100max	120max	120max
	RIPPLE NOISE[mVp-p] *3	-20 to +60°C 75max	75max	100max	100max
		-40 to -20°C 150max	150max	150max	150max
	TEMPERATURE REGULATION[mV]	-20 to +60°C 50max	50max	150max	180max
		-40 to +60°C 80max	80max	240max	290max
	DRIFT[mV] *4	20max	20max	48max	60max
PROTECTION CIRCUIT AND OTHERS	START-UP TIME[ms]	30max (Minimum input, Io=100%)			
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±10% adjustable by external VR			
	OUTPUT VOLTAGE SETTING[V] *5	3.296 - 3.404	4.975 - 5.137	11.857 - 12.243	14.839 - 15.321
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically			
PROTECTION CIRCUIT AND OTHERS	OVERVOLTAGE PROTECTION[V]	Works over 120 to 160% of rating			
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)			

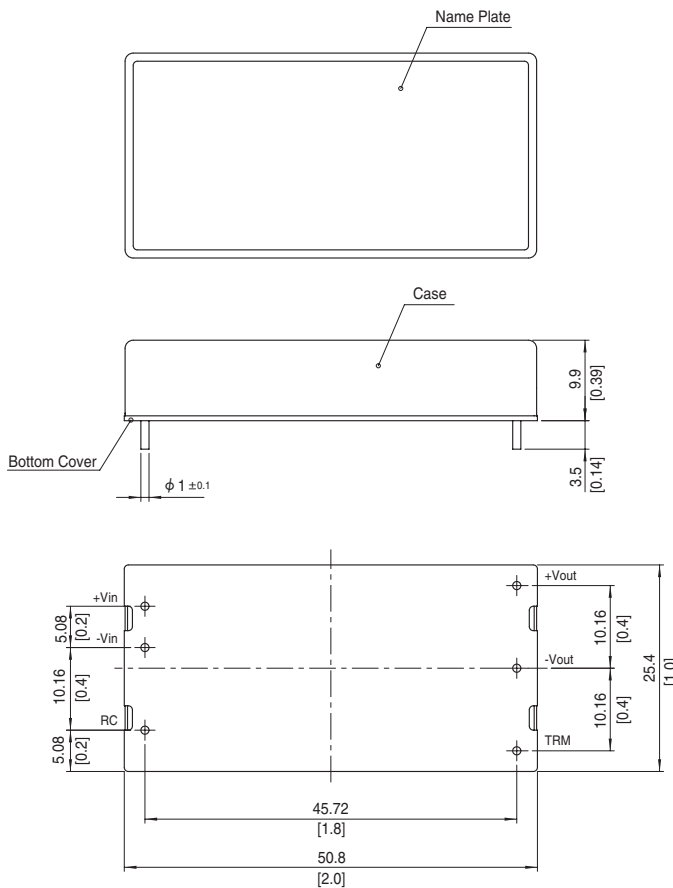
GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	DC1,500V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)
	INPUT-CASE	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)
	OUTPUT-CASE	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85℃, 20 to 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100℃, 20 to 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	25.4 X 9.9 X 50.8mm [1 X 0.39 X 2 inches] (W X H X D) / 40g max
	COOLING METHOD	Convection/Forced air

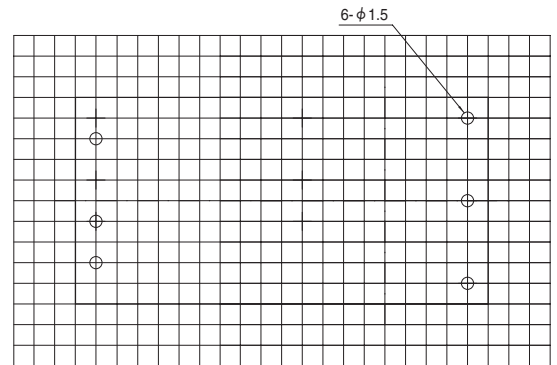
- *1 MGFW30xx05/MGFW30xx12/MGFW30xx15 is available as single output, +10V/+24V/+30V
- *2 Rated input 12V, 24V or 48V DC Io=100%
- *3 Ripple and Ripple Noise is measured by using test board with ceramic capacitor 22μF at 50mm from output pins. (20MHz Oscilloscope)
- *4 Drift is the DC output accuracy for eight hours period after a half-hour warm-up at 25℃.
- *5 Rated input voltage (DC24V, DC48V), rated output wattage, ambient temperature at 25℃.
- * Parallel operation with other model is not possible.

MG

External view



※Recommended Pad and Hole dia.
(TOP VIEW)



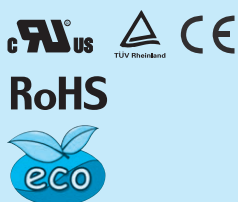
※ Unit : 0.1inch
※ Dimension : mm

- ※ Tolerance ±0.5 [±0.02]
- ※ Dimensions in mm, []=inches
- ※ Pin terminal material : Copper
- ※ Plating treatment of terminal : Lead free plating
- ※ Case material : Brass
- ※ Plating treatment of case : Nickel plating
- ※ Bottom Cover : FR4 (t=0.6) [t=0.024]
- ※ Please keep enough creepage distance with the pattern on PCB and other components.
- ※ Weight 40g max

MGFW15

MGFW152405-□

① ② ③ ④ ⑤ ⑥



- ① Series name
 ② Dual output
 ③ Output wattage
 ④ Input voltage
 ⑤ Output voltage
 ⑥ Optional
 G: Capacitor between
 Input and Output is removed.
 R: with Remote ON/OFF
 (Positive logic control)

MODEL	MGFW152405	MGFW152412	MGFW152415	MGFW154805	MGFW154812	MGFW154815
MAX OUTPUT WATTAGE[W]	15	15.6	15	15	15.6	15
DC OUTPUT	VOLTAGE[V] *1	±5 or +10	±12 or +24	±15 or +30	±5 or +10	±12 or +24
	CURRENT[A]	1.5	0.65	0.5	1.5	0.65

SPECIFICATIONS

	MODEL	MGFW152405	MGFW152412	MGFW152415	MGFW154805	MGFW154812	MGFW154815
INPUT	VOLTAGE[V]	DC9 - 36			DC18 - 76		
	CURRENT[A] *2	0.74typ	0.74typ	0.70typ	0.37typ	0.37typ	0.36typ
	EFFICIENCY[%] *2	84typ	88typ	89typ	84typ	87typ	88typ
OUTPUT	VOLTAGE[V]	±5(+10)	±12(+24)	±15(+30)	±5(+10)	±12(+24)	±15(+30)
	CURRENT[A]	1.5	0.65	0.5	1.5	0.65	0.5
	LINE REGULATION[mV]	40max	60max	75max	40max	60max	75max
	LOAD REGULATION[mV]	*3 500max *5	600max	750max	500max *5	600max	750max
		*4 250max	480max	600max	250max	480max	600max
	RIPPLE[mVp-p] *6	-20 to +60°C 100max	100max	100max	100max	100max	100max
		-40 to -20°C 120max	120max	120max	120max	120max	120max
	RIPPLE NOISE[mVp-p] *6	-20 to +60°C 100max	100max	100max	100max	100max	100max
		-40 to -20°C 150max	150max	150max	150max	150max	150max
	TEMPERATURE REGULATION[mV]	-20 to +60°C 50max	150max	180max	50max	150max	180max
		-40 to +60°C 80max	240max	290max	80max	240max	290max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *7	50max	50max	60max	50max	50max	60max
	START-UP TIME[ms]	30max (Minimum input, Io=100%)					
	OUTPUT VOLTAGE SETTING[V] *8	4.935 - 5.240	11.765 - 12.492	14.602 - 15.505	4.935 - 5.240	11.765 - 12.492	14.602 - 15.505
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically					
ISOLATION	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)					
	INPUT-OUTPUT	DC1,500V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15°C)					
	INPUT-CASE	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15°C)					
ENVIRONMENT	OUTPUT-CASE	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15°C)					
	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 to 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max					
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 to 95%RH (Non condensing), 9,000m (30,000feet) max					
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis					
SAFETY	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis					
	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1					
OTHERS	CASE SIZE/WEIGHT	25.4×9.9×25.4mm [1×0.39×1 inches] (W×H×D) / 20g max					
	COOLING METHOD	Convection/Forced air					

*1 Single output +10V, +24V, +30V with no use of COM.

*2 Rated input 12V, 24V or 48V DC Io=100%

*3 Symmetrical loading from 5% to 100%.

*4 Symmetrical loading from 20% to 100%.

*5 Refer to the instruction manual 11.

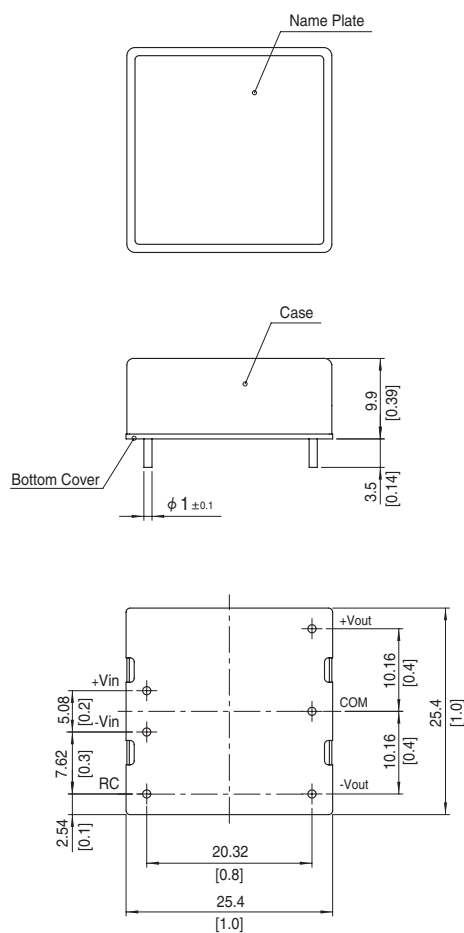
*6 Ripple and Ripple Noise is measured by using test board with ceramic capacitor 22μF at 50mm from output pins. (20MHz Oscilloscope)

*7 Drift is the DC output accuracy for eight hours period after a half-hour warm-up at 25°C.

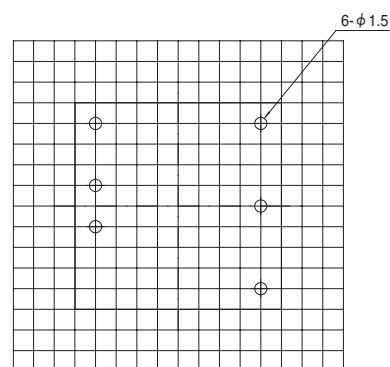
*8 Rated input voltage (DC24V, DC48V), rated output wattage, ambient temperature at 25°C.

* Parallel operation with other model is not possible.

External view



※Recommended Pad and Hole dia.
(TOP VIEW)



※ Unit : 0.1inch
※ Dimension : mm

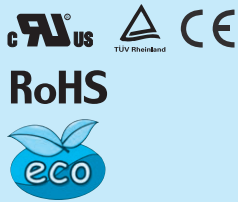
- ※ Tolerance ± 0.5 [± 0.02]
- ※ Dimensions in mm, []=inches
- ※ Pin terminal material : Copper
- ※ Plating treatment of terminal : Lead free plating
- ※ Case material : Brass
- ※ Plating treatment of case : Nickel plating
- ※ Bottom Cover : FR4 (t=0.6) [t=0.024]
- ※ Please keep enough creepage distance with the pattern on PCB and other components.
- ※ Weight 20g max

MG

MGFW30

MGF W 30 24 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
② Dual output
③ Output wattage
④ Input voltage
⑤ Output voltage
⑥ Optional
G: Capacitor between Input and Output is removed.
R: with Remote ON/OFF (Positive logic control)

MODEL	MGFW302405	MGFW302412	MGFW302415	MGFW304805	MGFW304812	MGFW304815
MAX OUTPUT WATTAGE[W]	20	30	30	20	30	30
DC OUTPUT	VOLTAGE[V] *1	±5 or +10	±12 or +24	±15 or +30	±5 or +10	±12 or +24
	CURRENT[A]	2	1.25	1	2	1.25

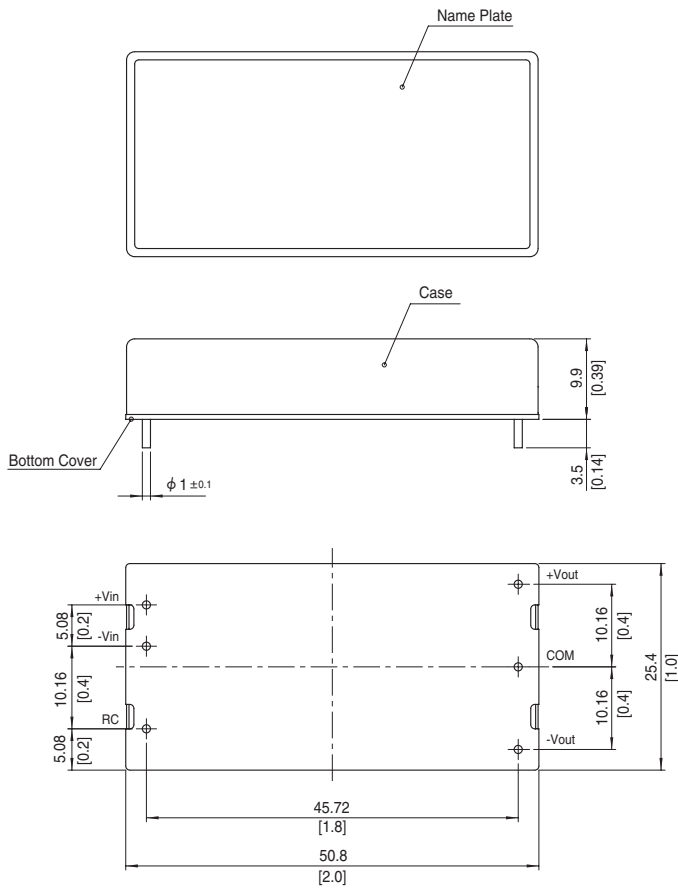
SPECIFICATIONS

	MODEL	MGFW302405	MGFW302412	MGFW302415	MGFW304805	MGFW304812	MGFW304815
INPUT	VOLTAGE[V]	DC9 - 36			DC18 - 76		
	CURRENT[A] *2	0.98typ	1.42typ	1.44typ	0.49typ	0.71typ	0.72typ
	EFFICIENCY[%] *2	85typ	88typ	87typ	85typ	88typ	87typ
OUTPUT	VOLTAGE[V]	±5(+10)	±12(+24)	±15(+30)	±5(+10)	±12(+24)	±15(+30)
	CURRENT[A]	2	1.25	1	2	1.25	1
	LINE REGULATION[mV]	40max	60max	75max	40max	60max	75max
	LOAD REGULATION[mV]	*3 500max *5	600max	750max	500max *5	600max	750max
		*4 250max	480max	600max	250max	480max	600max
	RIPPLE[mVp-p]	-20 to +60°C 100max	100max	100max	100max	100max	100max
		-40 to -20°C 120max	120max	120max	120max	120max	120max
	RIPPLE NOISE[mVp-p]	-20 to +60°C 100max	100max	100max	100max	100max	100max
		-40 to -20°C 150max	150max	150max	150max	150max	150max
	TEMPERATURE REGULATION[mV]	-20 to +60°C 50max	150max	180max	50max	150max	180max
		-40 to +60°C 80max	240max	290max	80max	240max	290max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *7	50max	50max	60max	50max	50max	60max
	START-UP TIME[ms]	30max (Minimum input, Io=100%)					
	OUTPUT VOLTAGE SETTING[V]*8	4.935 - 5.240	11.765 - 12.492	14.602 - 15.505	4.935 - 5.240	11.765 - 12.492	14.602 - 15.505
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically					
ISOLATION	OVERVOLTAGE PROTECTION[V]	Works over 120 to 160% of rating (Total of +V and -V)					
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)					
	INPUT-OUTPUT	DC1,500V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15°C)					
ENVIRONMENT	INPUT-CASE	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15°C)					
	OUTPUT-CASE	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15°C)					
	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 to 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max					
SAFETY	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 to 95%RH (Non condensing), 9,000m (30,000feet) max					
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis					
	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis					
OTHERS	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1					
	CASE SIZE/WEIGHT	25.4×9.9×50.8mm [1×0.39×2 inches] (W×H×D) / 40g max					
	COOLING METHOD	Convection/Forced air					

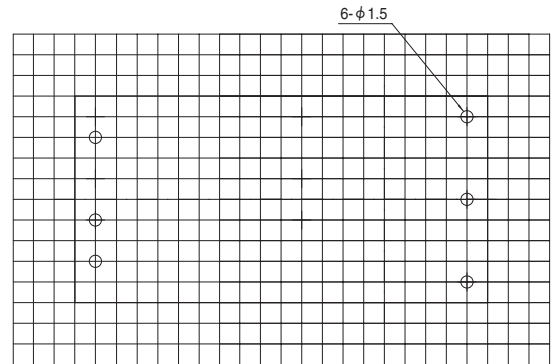
- *1 Single output +10V, +24V, +30V with no use of COM.
*2 Rated input 12V, 24V or 48V DC Io=100%
*3 Symmetrical loading from 5% to 100%.
*4 Symmetrical loading from 20% to 100%.
*5 Refer to the instruction manual 11.
*6 Ripple and Ripple Noise is measured by using test board with ceramic capacitor 22μF at 50mm from output pins. (20MHz Oscilloscope)

- *7 Drift is the DC output accuracy for eight hours period after a half-hour warm-up at 25°C.
*8 Rated input voltage (DC24V, DC48V), rated output wattage, ambient temperature at 25°C.
* Parallel operation with other model is not possible.

External view



※Recommended Pad and Hole dia.
(TOP VIEW)



※ Unit : 0.1inch
※ Dimension : mm

- ※ Tolerance ± 0.5 [± 0.02]
- ※ Dimensions in mm, []=inches
- ※ Pin terminal material : Copper
- ※ Plating treatment of terminal : Lead free plating
- ※ Case material : Brass
- ※ Plating treatment of case : Nickel plating
- ※ Bottom Cover : FR4 (t=0.6) [t=0.024]
- ※ Please keep enough creepage distance with the pattern on PCB and other components.
- ※ Weight 40g max

MG

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz] (reference)	Input current [A]	Inrush current protection	PCB/Pattern			Series/Parallel operation	
					Material	Single sided	Double sided	Series operation	Parallel operation
MG1R5	Flyback converter	200-1500 *3	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MG3	Flyback converter	200-1500 *3	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MG15	Flyback converter	445-495	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MGF15	Flyback converter	445-495	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MG30	Forward converter	380-460	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2
MGF30	Forward converter	380-460	*1	-	glass fabric base,epoxy resin		Yes	Yes	*2

*1 Refer to Specification.

*2 Refer to Instruction Manual.

*3 The value changes depending on input and load.

MG1R5, MG3

1	Pin Configuration	MG-28
2	Function	MG-28
2.1	Input Voltage Range	MG-28
2.2	Overcurrent Protection	MG-28
2.3	Isolation	MG-28
3	Wiring to Input/Output Pin	MG-29
3.1	Wiring input pin	MG-29
3.2	Wiring output pin	MG-29
4	Series/Redundancy Operation	MG-30
4.1	Series Operation	MG-30
4.2	Redundancy Operation	MG-30
5	Input Voltage/Current Range	MG-30
6	Assembling and Installation	MG-30
6.1	Installation	MG-30
6.2	Soldering Conditions	MG-30
6.3	Stress to Pin	MG-30
6.4	Cleaning	MG-31
7	Safety Standards	MG-31
8	Derating	MG-31
8.1	MGS1R5 Derating Curve	MG-31
8.2	MGS3 Derating Curve	MG-31
9	Lifetime expectancy depends on stress by temperature difference	MG-32
9.1	MG1R5/MG3 Lifetime expectancy depends on stress by temperature difference	MG-32

MG15, MG30

1	Pin Configuration	MG-33
2	Function	MG-33
2.1	Input Voltage Range	MG-33
2.2	Overcurrent Protection	MG-33
2.3	Overvoltage Protection	MG-33
2.4	Isolation	MG-34
2.5	Output Voltage Adjustment Range	MG-34
2.6	Remote ON/OFF	MG-34
3	Wiring to Input/Output Pin	MG-34
3.1	Wiring input pin	MG-34
3.2	Wiring output pin	MG-35
4	Series/Parallel Operation	MG-35
4.1	Series Operation	MG-35
4.2	Redundancy Operation	MG-36
5	Input Voltage/Current Range	MG-36
6	Assembling and Installation	MG-36
6.1	Installation	MG-36
6.2	Hand Mounting	MG-36
6.3	Soldering Conditions	MG-36
6.4	Stress to Pin	MG-36
6.5	Cleaning	MG-36
7	Safety Standards	MG-37
8	Derating	MG-37
8.1	MG15/MGF15 Derating Curve	MG-37
8.2	MG30/MGF30 Derating Curve	MG-37
9	Peak Current (Pulse Load)	MG-38
10	Using DC-DC Converters	MG-39
11	Note to use $\pm 5V$ output	MG-40
12	Lifetime expectancy depends on stress by temperature difference	MG-40
12.1	MG15/MGF15 Lifetime expectancy depends on stress by temperature difference	MG-40
12.2	MG30/MGF30 Lifetime expectancy depends on stress by temperature difference	MG-40

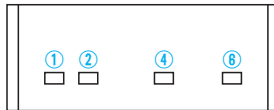
MG

1 Pin Configuration

Table 1.1 Pin Configuration and Functions(MG1R5/MG3)

Pin No.	Pin Name	Function
①	-VIN	-DC Input
②	+VIN	+DC Input
④	+VOUT	+DC Output
⑥	-VOUT	-DC Output

<Bottom View>



(a) Single Output

Fig.1.1 Pin Configuration(MG1R5/MG3)

2 Function

2.1 Input Voltage Range

■ If output voltage value doesn't fall within specifications, a unit may not operate in accordance with specifications and/or fail.

2.2 Overcurrent Protection

■ Overcurrent protection is built-in and comes into effect at over 105% of the rated current.

Overcurrent protection prevents the unit from short circuit and overcurrent condition. The unit automatically recovers when the fault condition is cleared.

2.3 Isolation

■ For a receiving inspection, such as Hi-Pot test, increase (decrease) the voltage gradually for a start (shut down). Avoid using Hi-Pot tester with timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

■ In the case of use in locations exposed to constant voltage between primary and secondary is applied, please contact us.

3 Wiring to Input/Output Pin

3.1 Wiring input pin

(1) External fuse

- Fuse is not built-in on input side. In order to protect the unit, install the normal-blow type fuse on input side.
- When the input voltage from a front end unit is supplied to multiple units, install the normal-blow type fuse in each unit.

Table 3.1 Recommended fuse (Normal-blow type)

Model VIN	MG1R5	MG3
5	2.0A	3.15A
12	1.6A	2.0A
24	1.0A	1.6A

(2) External capacitor on the input side

- Basically, MG series does not need any external capacitor. Adding a capacitor C_i near the input pin terminal and reduce reflected input noise from a converter. Please connect the capacitor as needed.
- When you use a capacitor C_i , please use the one with high frequency and good temperature characteristics.
- If the power supply is to be turned ON/OFF directly with a switch, inductance from the input line will induce a surge voltage several times that of the input voltage and it may damage the power supply. Make sure that the surge is absorbed, for example, by connecting an electrolytic capacitor between the input pins.
- If an external filter containing L (inductance) is added to the input line, or a wire from the input source to the DC-DC converter is long, not only the reflected input noise becomes large, but also the output of the converter may become unstable. In such case, connecting C_i to the input pin terminal is recommended.
- If you use an aluminum electrolytic capacitor, please pay attention to its ripple current rating.

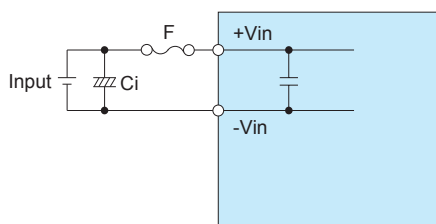


Fig3.1 Connecting an Example Capacitor to the Input Side

Table 3.2 Recommended Capacitance of an External Capacitor on the Input Side [μ F]

Model VIN	MG1R5	MG3
5	10 - 220	10 - 220
12	10 - 100	10 - 100
24	10 - 47	10 - 47

* Please adjust the capacitance in accordance with a degree of the effect you want to achieve.

(3) Reverse input voltage protection

- If a reverse polarity voltage is applied to the input pin terminal, the power supply will fail. If there is a possibility that a reverse polarity voltage is applied, connect a protection circuit externally as described below.

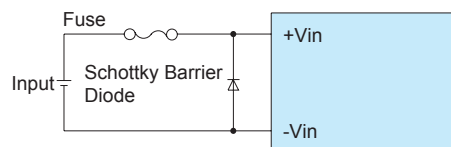


Fig3.2 Reverse input voltage protection

3.2 Wiring output pin

- If you want to further reduce the output ripple noise, connect an electrolytic capacitor or a ceramic capacitor C_o to the output pin terminal as shown below.

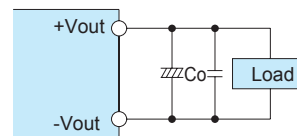


Fig3.3 Connecting Example of an External Capacitor to the Output Side

Table 3.3 Recommended Capacitance of External Capacitor on the Output Side [μ F]

Model VIN	MG1R5	MG3
3.3	0 - 220	0 - 220
5	0 - 220	0 - 220
12	0 - 100	0 - 100
15	0 - 100	0 - 100

* If you use a ceramic capacitor, keep the capacitance within the range between about 0.1 to 22 μ F.

* Please adjust the capacitance in light of the effect you want to achieve.

* If you need to use an external capacitor whose capacitance exceeds the range provided in Table 3.3, please contact us.

■ If the distance between the output and the load is long and therefore noise is created on the load side, connect a capacitor externally to the load as shown below.

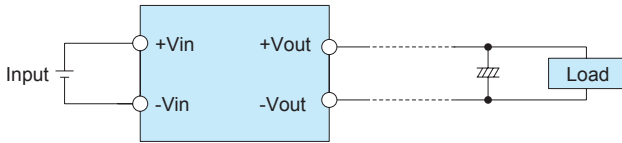


Fig.3.4 Connecting Example

MG

4 Series/Redundancy Operation

4.1 Series Operation

■ Series operation is available by connecting the outputs of two or more power supplies, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

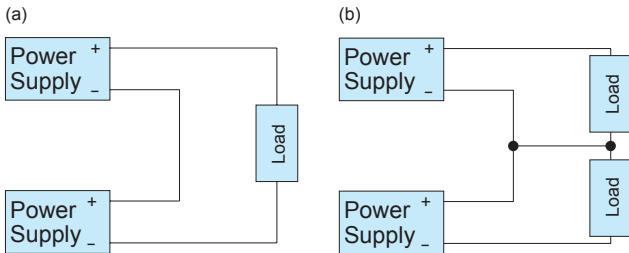


Fig.4.1 Examples of series operation

4.2 Redundancy Operation

■ Parallel operation is not possible.
■ Redundancy operation is available by wiring as shown below.

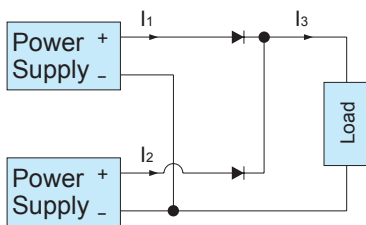


Fig.4.2 Redundancy operation

■ Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 . Please make sure that the value of I_3 does not exceed the rated current for each power supply.

$$I_3 \leq \text{Rated Current Value}$$

5 Input Voltage/Current Range

■ If you use a non-regulated power source for input, please check and make sure that its voltage fluctuation range and ripple voltage do not exceed the input voltage range shown in specifications.
■ Please select an input power source with enough capacity, taking into consideration of the start-up current (I_p), which flows when a DC-DC converter starts up.

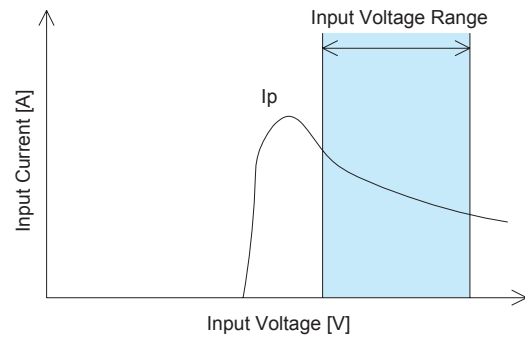


Fig.5.1 Input Current Characteristics

6 Assembling and Installation

6.1 Installation

■ When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Ambient temperature around each power supply should not exceed the temperature range shown in derating curve.

6.2 Soldering Conditions

- (1) Flow Soldering : 260°C 15 seconds or less
- (2) Soldering Iron : maximum 360°C 5 seconds or less

6.3 Stress to Pin

■ Applying excessive stress to the input or output pins of the power module may damage internal connections. Avoid applying stress in excess of that shown in Fig. 6.1.
■ Input/output pin are soldered to the PCB internally.
Do not pull or bend a lead powerfully.

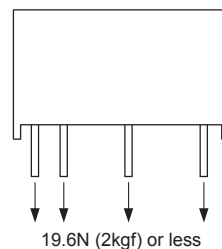


Fig.6.1 Stress onto Pins

- If it is expected that stress is applied to the input/output pin due to vibration or impact, reduce the stress to the pin by taking such measures as fixing the unit to the PCB by silicone rubber, etc.
- Due to prevent failure, PS should not be pulled after soldering with PCB.

6.4 Cleaning

- If you need to clean the unit, please clean it under the following conditions.
Cleaning Method: Varnishing, Ultrasonic or Vapor Cleaning
Cleaning agent: IPA (Solvent type)
Cleaning Time: Within total 2 minutes for varnishing, ultrasonic and vapor cleaning
- Please dry the unit sufficiently after cleaning.
- If you do ultrasonic cleaning, please keep the ultrasonic output at 15W/ℓ or below.

7 Safety Standards

- To apply for a safety standard approval using the power supply, please meet the following conditions. Please contact us for details.
- Please use the unit as a component of an end device.
- The area between the input and the output of the unit is isolated functionally. Depending upon the input voltage, basic insulation, dual insulation or enhanced insulation may be needed. In such case, please take care of it within the structure of your end-device. Please contact us for details.
- Safety approved fuse must be externally installed on input side.

8 Derating

- It is necessary to note thermal fatigue life by power cycle.
Please reduce the temperature fluctuation range as much as possible when the up and down of temperature are frequently generated.
- Please have sufficient ventilation to keep the temperature of point A in Fig.8.1 at Table8.1 or below. Please also make sure that the ambient temperature does not exceed 85°C.

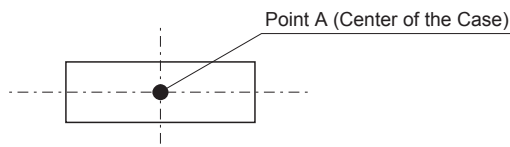


Fig.8.1 Temperature Measuring Point on the case (Top View)

Table 8.1 Point A Temperature

Model	MG1R5	MG3
Point A	110°C	110°C

8.1 MG1R5 Derating Curve

- If you derate the output current, you can use the unit in the temperature range from -40°C to the maximum temperature shown below.

(1) In the case of Convection Cooling

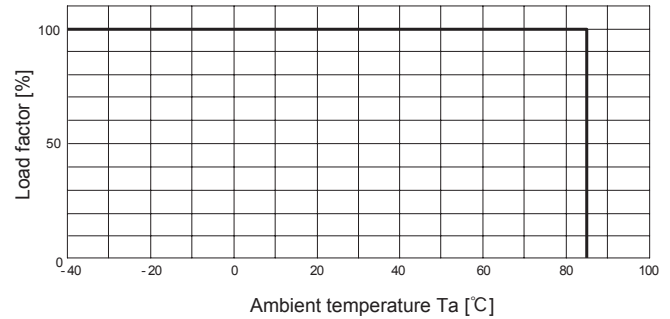


Fig.8.2 Derating Curve for Convection Cooling (Rated Input Voltage)

(2) In the case of Forced Air Cooling (1.0m/s)

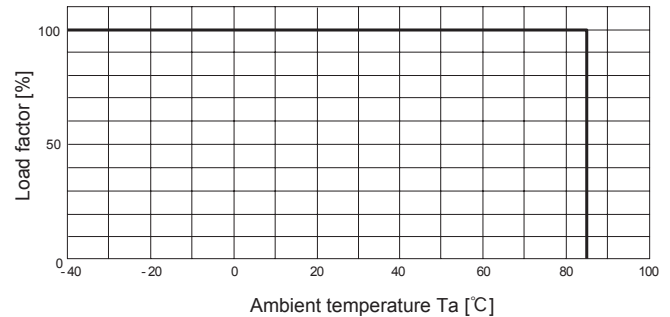


Fig.8.3 Derating Curve for Forced Air Cooling (1.0m/s) (Rated Input Voltage)

8.2 MG3 Derating Curve

- If you derate the output current, you can use the unit in the temperature range from -40°C to the maximum temperature shown below.

(1) In the case of Convection Cooling

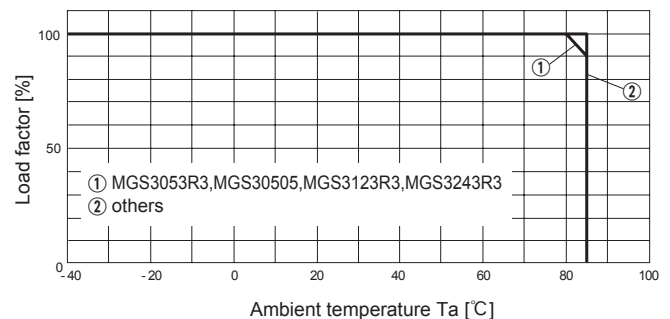


Fig.8.4 Derating Curve for Convection Cooling (Rated Input Voltage)

(2) In the case of Forced Air Cooling (1.0m/s)

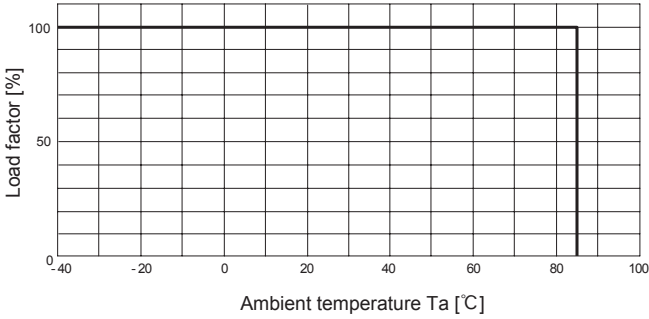


Fig.8.5 Derating Curve for Forced Air Cooling (1.0m/s) (Rated Input Voltage)

9 Lifetime expectancy depends on stress by temperature difference

■ Regarding lifetime expectancy design of solder joint, following contents must be considered. Be careful that the soldering joint is not stressed by temperature rise and down which occurs by self-heating and ambient temperature change. The stress is accelerated by thermal-cycling, therefore the temperature difference should be minimized as much as possible if temperature rise and down occurs frequently.

9.1 MG1R5/MG3 Lifetime expectancy depends on stress by temperature difference

■ Product lifetime expectancy depends on case temperature difference (T_c) and number of cycling in a day is shown in Fig.9.1, Fig.9.2 (It is calculated based on our accelerated process test result.) If case temperature changes frequently by changing output load factor etc., the above the lifetime expectancy design should be applied as well. And point A which is shown in Fig.9.3 must keep below 110°C.

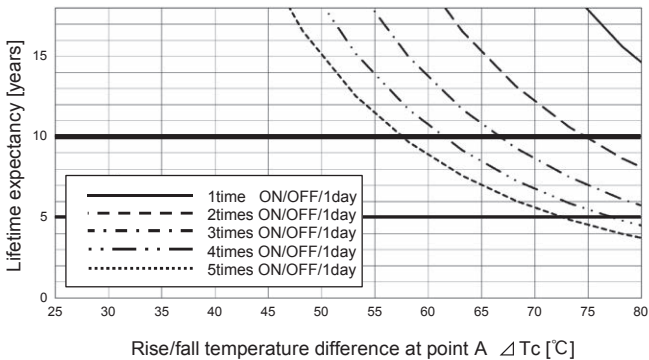


Fig.9.1 Lifetime expectancy against rise/fall temperature difference (MG1R5)

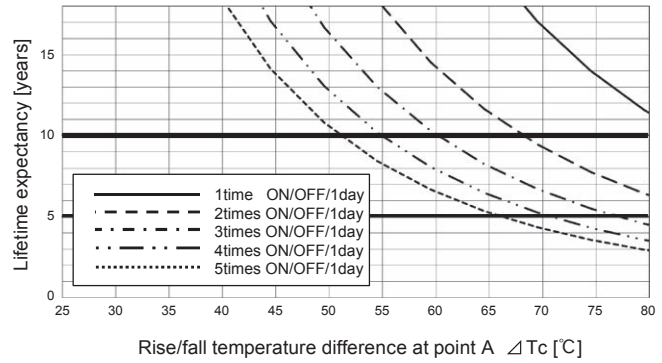


Fig.9.2 Lifetime expectancy against rise/fall temperature difference (MG3)

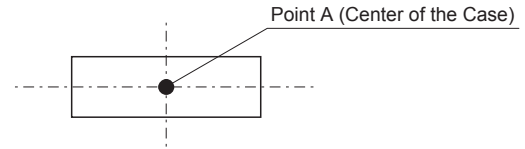


Fig.9.3 Temperature Measuring Point on the case (Top View)

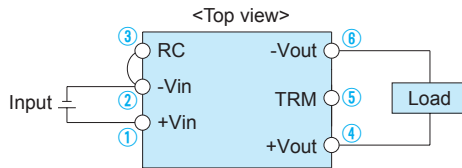
■ The warranty period is basically 10 years, however it depends on the lifetime expectancy which is shown in Fig.9.1, Fig.9.2 if it is less than 10 years.

1 Pin Configuration

Table 1.1 Pin Configuration and Functions (MG15)

Pin No.	Pin Name	Function
①	+Vin	+DC Input
②	-Vin	-DC Input
③	RC	Remote ON/OFF
④	+Vout	+DC Output
⑤	TRM	Output Voltage Adjustment (please see 2.5)
⑥	COM	GND of Output Voltage (for Dual Output)
⑦	-Vout	-DC Output

●Single Output



●Dual(±)Output

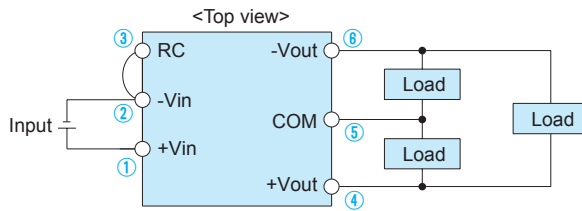


Fig.1.1 Pin Configuration (MG15)

Table 1.2 Pin Configuration and Functions (MG30)

Pin No.	Pin Name	Function
①	+Vin	+DC Input
②	-Vin	-DC Input
③	RC	Remote ON/OFF
④	+Vout	+DC Output
⑤	-Vout	-DC Output (for Single Output)
⑥	COM	GND of Output Voltage (for Dual Output)
⑦	TRM	Output Voltage Adjustment (please see 2.5)
⑧	-Vout	-DC Output (for Dual Output)

●Single Output



●Dual(±)Output

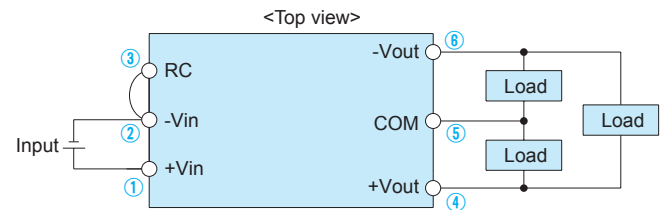


Fig.1.2 Pin Configuration (MG30)

2 Function

2.1 Input Voltage Range

■If output voltage value doesn't fall within specifications, a unit may not operate in accordance with specifications and/or fail.

2.2 Overcurrent Protection

■Overcurrent Operation

An overcurrent protection circuit is built-in and activated at 105% of the rated current or above. It prevents the unit from short circuit and overcurrent for less than 20 seconds. The output voltage of the power supply will recover automatically if the fault causing over current is corrected.

When the output voltage drops after OCP works, the power supply enters a "hiccup mode" where it repeatedly turns on and off at a certain frequency.

2.3 Overvoltage Protection (Excluding MG15)

■Over Voltage Protection (OVP) is built in. When OVP works, output voltage can be recovered by shutting down DC input for at least one second or by turning off the remote control switch for one second without shutting down the DC input. The recovery time varies according to input voltage and input capacitance.

Remarks :

Note that devices inside the power supply may fail when a voltage greater than the rated output voltage is applied from an external power supply to the output terminal of the power supply. This could happen in in-coming inspections that include OVP function test or when voltage is applied from the load circuit.

2.4 Isolation

■When you run a Hi-Pot test as receiving inspection, gradually increase the voltage to start. When you shut down, decrease the voltage gradually by using a dial. Please avoid a Hi-Pot tester with a timer because, when the timer is turned ON or OFF, it may generate a voltage a few times higher than the applied voltage.

2.5 Output Voltage Adjustment Range(MGS/MGFS Only)

■The output voltage is adjustable through an external potentiometer. Adjust only within the range of $\pm 10\%$ of the rated voltage.

■To increase the output voltage, turn the potentiometer clockwise and connect in such a way that the resistance value between 2 and 3 becomes small.

To decrease the output voltage, turn the potentiometer counter-clockwise.

■Please use a wire as short as possible to connect to the potentiometer and connect it from the pin on the power supply side. Temperature coefficient deteriorates when some types of resistors and potentiometers are used. Please use the following types.

Resistor..... Metal Film Type, Temperature Coefficient of $\leq 100\text{ppm}/^\circ\text{C}$ or below

Potentiometer... Cermet Type, Temperature Coefficient of $\leq 300\text{ppm}/^\circ\text{C}$ or below

■If output voltage adjustment is not required, open the TRM pin.

■Output voltage adjustment may increase to overvoltage protection activation range based on determined external resistor values.

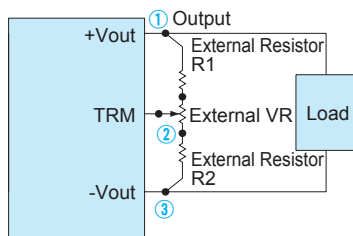


Fig.2.1 Connecting External Devices

Table 2.1 List of External Devices

Item #	Output Voltage	Constant of External Device [Ω] (Adjustable within $\pm 10\%$)		
		VR	R1	R2
1	3.3V	1k	100	100
2	5V	1k	100	270
3	12V	5k	10k	1.5k
4	15V	5k	10k	1k
5	$\pm 5\text{V}$			
6	$\pm 12\text{V}$			
7	$\pm 15\text{V}$			

2.6 Remote ON/OFF

■The remote ON/OFF function is incorporated in the input circuit and operated with RC and -Vin. If positive logic control is required, order the power supply with “-R” option.

Table 2.2 Remote ON/OFF Specifications

	ON/OFF logic	Between RC and -Vin	Output voltage
Standard	Negative	L level (0 - 1.2V) or short	ON
		H level (3 - 12V) or open	OFF
Optional -R	Positive	L level (0 - 1.2V) or short	OFF
		H level (3 - 12V) or open	ON

■When RC is at low level, a current of 0.5mA typ will flow out.

■When remote ON/OFF is not used, short RC and -Vin.

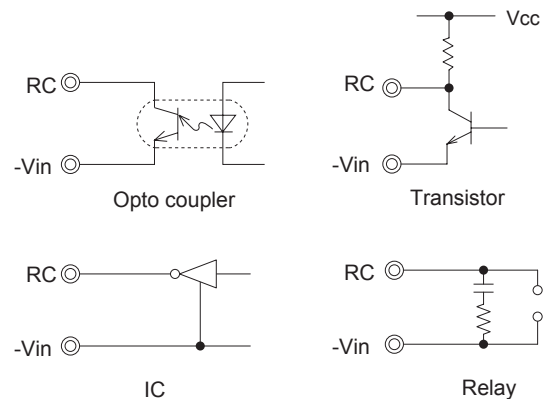


Fig.2.2 RC Connection Example

3 Wiring to Input/Output Pin

3.1 Wiring input pin

■MG series has Pi-shaped filter internally.

You can add a capacitor C_i near the input pin terminal and reduce reflected input noise from the converter. Please connect the capacitor as needed.

■When you use a capacitor C_i , please use the one with high frequency and good temperature characteristics.

■If the power supply is to be turned ON/OFF directly with a switch, inductance from the input line will induce a surge voltage several times that of the input voltage and it may damage the power supply. Make sure that the surge is absorbed, for example, by connecting an electrolytic capacitor between the input pins.

■ If an external filter containing L (inductance) is added to the input line or a wire from the input source to the MG series is long, not only the reflected input noise becomes large, but also the output of the converter may become unstable. In such case, connecting Ci to the input pin is recommended.

■ If you use an aluminum electrolytic capacitor, please pay attention to the ripple current rating.

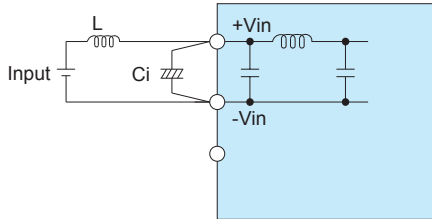


Fig.3.1 Connecting an External Capacitor to the Input Side

Table 3.1 Recommended Capacitance of an External Capacitor on the Input Side [μ F]

Model Input Voltage[V]	MG15	MG30
12	220	220
24	100	100
48	47	47
12 - 24	100	100
24 - 48	47	47

* Please adjust the capacitance in accordance with a degree of the effect you want to achieve.

■ If a reverse polarity voltage is applied to the input pin, the power supply will fail.

If there is a possibility that a reverse polarity voltage is applied, connect a protection circuit externally as described below.

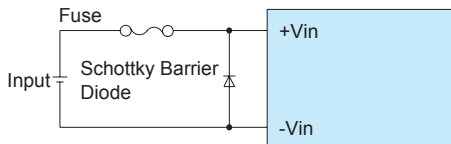


Fig.3.2 Connecting a Reverse Voltage Protection Circuit

3.2 Wiring output pin

■ If you want to further reduce the output ripple noise, connect an electrolytic capacitor or a ceramic capacitor Co to the output pin as shown below.

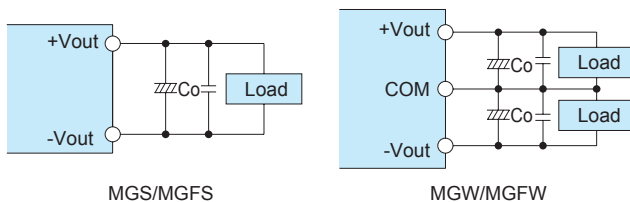


Fig.3.3 Connecting Example of an External Capacitor to the Output Side

Table 3.2 Recommended Capacitance of External Capacitor on the Output Side [μ F]

Model Output Voltage[V]	MG15	MG30
3.3	470	470
5	470	470
12	150	150
15	100	100
± 5	330	330
± 12	100	100
± 15	47	47

* If you use a ceramic capacitor, keep the capacitance within the range between about 0.1 to 22 μ F.

* Please adjust the capacitance in light of the effect you want to achieve.

* If you need to use an unproven external capacitor which capacitance moreover the range provided in Table 3.2, please contact us for the assistance.

■ If the distance between the output and the load is long and therefore the noise is generated on the load side, connect a capacitor externally to the load as shown below.

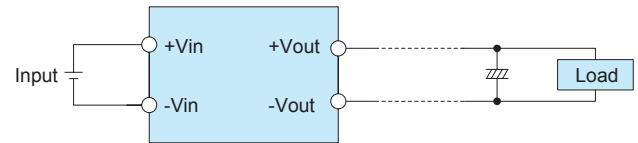


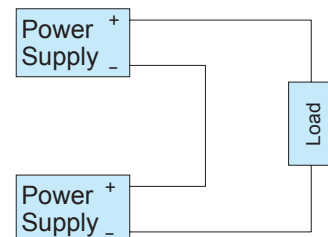
Fig.3.4 Connecting Example

4 Series/Parallel Operation

4.1 Series Operation

■ You can use the power supplies in series operation by wiring as shown below. In the case of (a) below, the output current should be lower than the rated current for each power supply with the lowest rated current among power supplies that are serially connected. Please make sure that no current exceeding the rated current flows into a power supply.

(a)



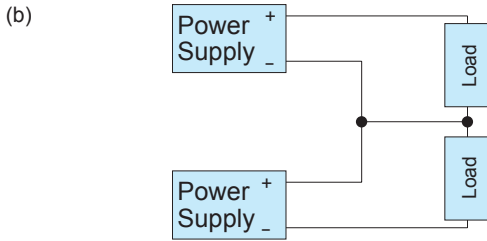


Fig.4.1 Series Operation

4.2 Redundancy Operation

MG ■ You can use the power supplies in redundancy operation by wiring as shown below.

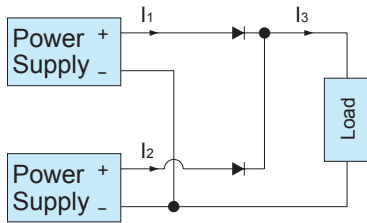


Fig.4.2 Redundancy Operation

■ Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 . Please make sure that the value of I_3 does not exceed the rated current for each power supply.

$$I_3 \leq \text{Rated Current Value}$$

5 Input Voltage/Current Range

- If you use a non-regulated power source for input, please check and make sure that its voltage fluctuation range and ripple voltage do not exceed the input voltage range shown in specifications.
- Please select an input power source with enough capacity, taking into consideration of the start-up current (I_p), which flows when a DC-DC converter starts up.

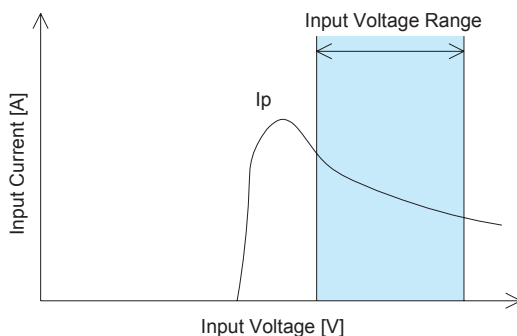


Fig.5.1 Input Current Characteristics

6 Assembling and Installation

6.1 Installation

■ When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Ambient temperature around each power supply should not exceed the temperature range shown in derating curve.

6.2 Hand Mounting

■ Due to prevent failure, PS should not be pull after soldering with PCB.

6.3 Soldering Conditions

- | | | |
|--------------------|-----------------|--------------------|
| (1) Flow Soldering | : 260°C | 15 seconds or less |
| (2) Soldering Iron | : maximum 360°C | 5 seconds or less |

6.4 Stress to Pin

- Applying excessive stress to the input or output pins of the power module may damage internal connections. Avoid applying stress in excess of that shown in Fig. 6.1.
- Input/output pin are soldered to the PCB internally. Do not pull or bend a lead powerfully.
- If it is expected that stress is applied to the input/output pin due to vibration or impact, reduce the stress to the pin by taking such measures as fixing the unit to the PCB by silicone rubber, etc.

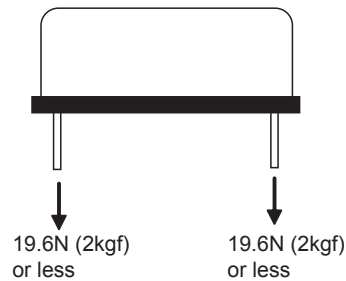


Fig.6.1 Stress onto Pins

6.5 Cleaning

- If you need to clean the unit, please clean it under the following conditions.
 - Cleaning Method: Varnishing, Ultrasonic or Vapor Cleaning
 - Cleaning agent: IPA (Solvent type)
 - Cleaning Time: Within total 2 minutes for varnishing, ultrasonic and vapor cleaning
- Please dry the unit sufficiently after cleaning.
- If you do ultrasonic cleaning, please keep the ultrasonic output at 15W/l or below.

7 Safety Standards

- To apply for a safety standard approval using the power supply, please meet the following conditions. Please contact us for details.
- Please use the unit as a component of an end device.
- The area between the input and the output of the unit is isolated functionally. Depending upon the input voltage, basic insulation, dual insulation or enhanced insulation may be needed. In such case, please take care of it within the structure of your end-device. Please contact us for details.

8 Derating

8.1 MG15 / MGF15 Derating Curve

- If you derate the output current, you can use the unit in the temperature range from -40°C to the maximum temperature shown below.

(1) In the case of Convection Cooling

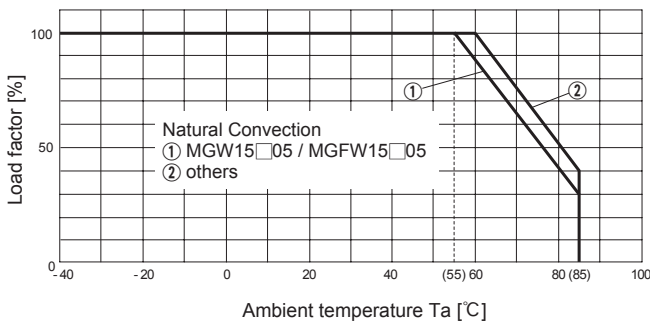


Fig.8.1 Derating Curve for Convection Cooling (Rated Input Voltage)

(2) In the case of Forced Air Cooling (1.0m/s)(Excluding MGW15□05/MGF15□05)

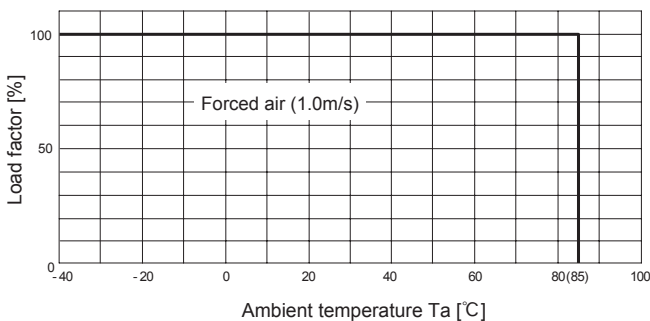


Fig.8.2 Derating Curve for Forced Air Cooling (1.0m/s) (Rated Input Voltage)

(3) In the case of Forced Air Cooling (1.0m/s, 2.5m/s)(MGW15□05/ MGF15□05)

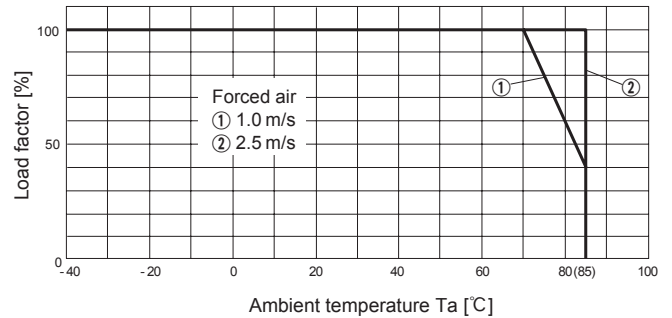


Fig.8.3 Derating Curve for Forced Air Cooling (1.0m/s, 2.5m/s) (Rated Input Voltage)

(4) Temperature Measuring Point on the case.

- In case of forced air cooling, please have sufficient ventilation to keep the temperature of point A in Fig.8.4 at 105°C or below. Please also make sure that the ambient temperature does not exceed 85°C.

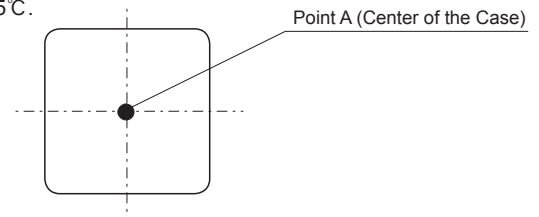


Fig.8.4 Temperature Measuring Point on the case (Top View)

8.2 MG30 / MGF30 Derating Curve

- If you derate the output current, you can use the unit in the temperature range from -40°C to the maximum temperature shown below.

(1) In the case of Convection Cooling

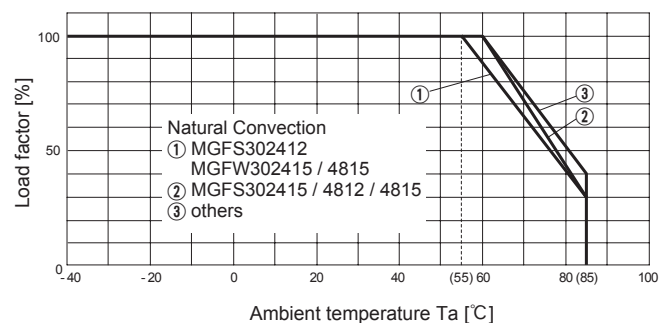


Fig.8.5 Derating Curve for Convection Cooling (Rated Input Voltage)

(2) In the case of Forced Air Cooling (1.0m/s)(Excluding MGW30□05 and MGFW30□12/15)

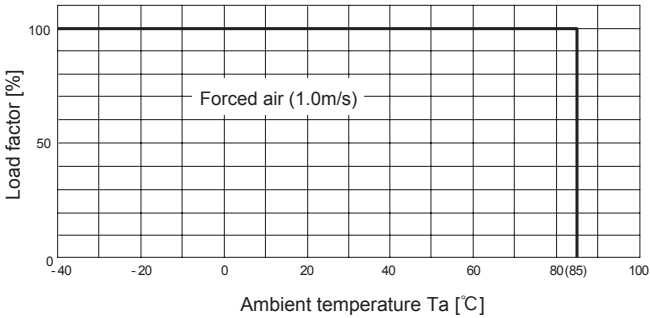


Fig.8.6 Derating Curve for Forced Air Cooling (1.0m/s) (Rated Input Voltage)

(3) In the case of Forced Air Cooling (1.0m/s, 1.5m/s)(MGW30□05 and MGFW30□12/15)

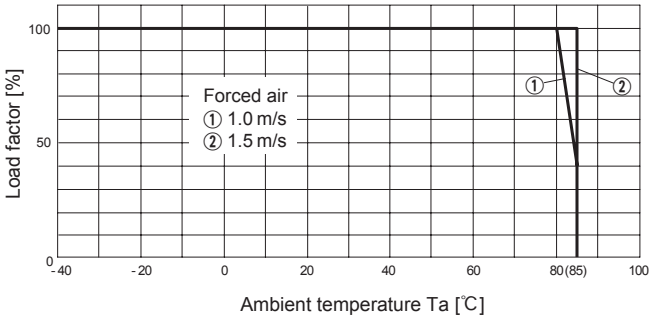


Fig.8.7 Derating Curve for Forced Air Cooling (1.0m/s, 1.5m/s) (Rated Input Voltage)

(4) Temperature Measuring Point on the case.

■ In case of forced air cooling, please have sufficient ventilation to keep the temperature of point A in Fig.8.8 at 110°C or below.

Please also make sure that the ambient temperature does not exceed 85°C.

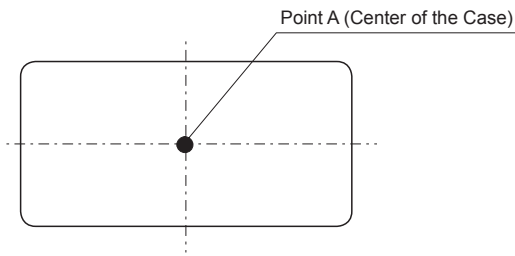
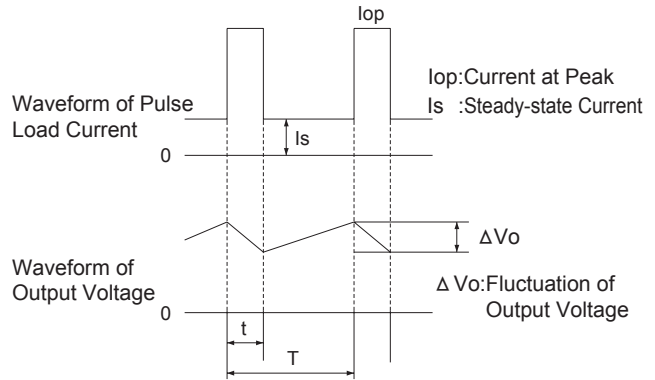
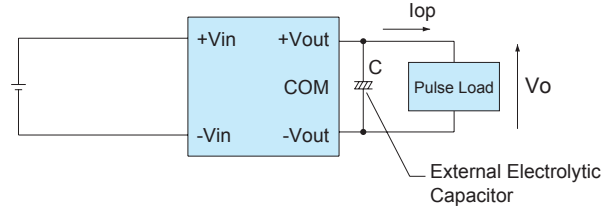


Fig.8.8 Temperature Measuring Point on the case (Top View)

9 Peak Current (Pulse Load)

■ If a load connected to a converter is a pulse load, you can provide a pulse current by connecting an electrolytic capacitor externally to the output side.



■ The average output current I_{av} is expressed in the following formula.

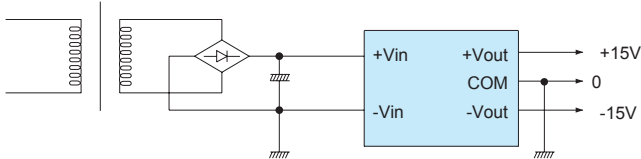
$$I_{av} = I_s + \frac{(I_{op} - I_s) \times t}{T}$$

■ Required electrolytic capacitor C can be obtained from the following formula.

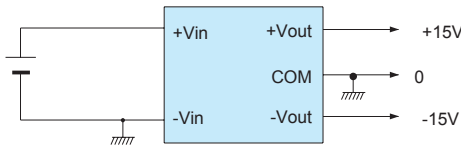
$$C = \frac{(I_{op} - I_{av}) \times t}{\Delta V_o}$$

10 Using DC-DC Converters

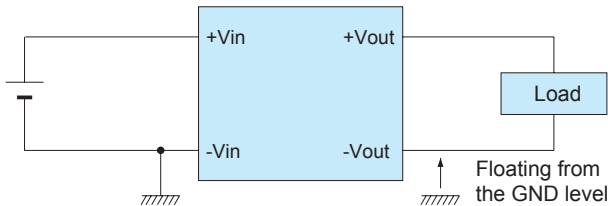
■When using AC power source



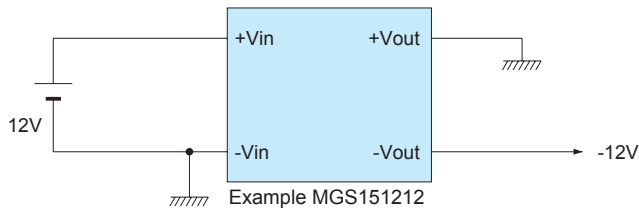
■When using a battery-operated device



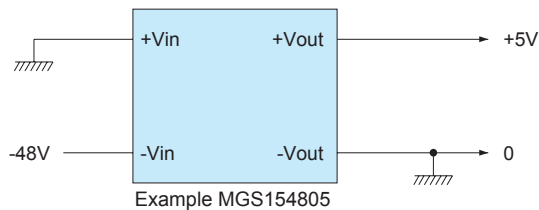
■When a floating mechanism is required for the output circuit



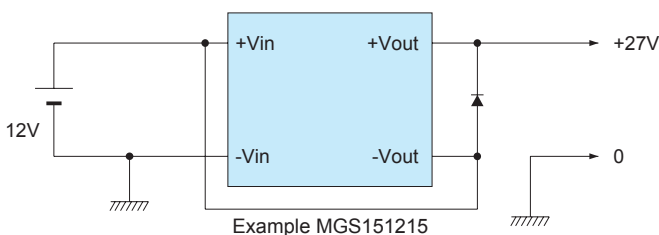
■To draw a reverse polarity output



■To provide a negative voltage to -Vin by using +Vin side of the converter as GND potential (0V)



■To draw the sum of input voltage and plus output voltage

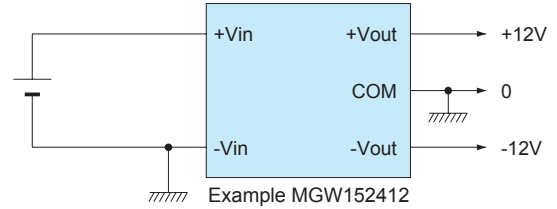


*Output current should be the same as the rated output current of the converter.

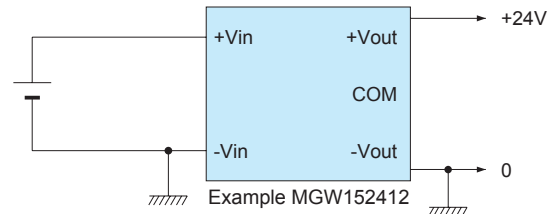
*Output current fluctuation is the sum of the input voltage fluctuation and the output voltage fluctuation of the converter.

■To use a dual output type

*Dual output type is typically used in the following manner.

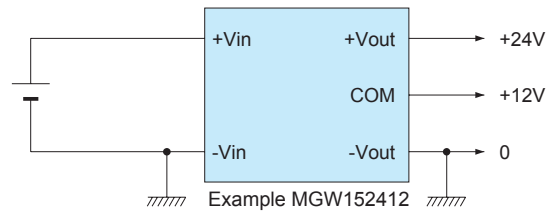


*The unit can be used as a 24V type single output power supply as follows.

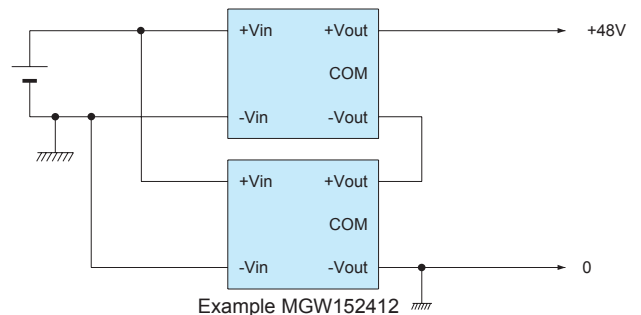


*Another way to use the unit is described below.

*The sum of +12V and +24V flows to the 0V line. Please make sure that this value does not exceed the rated output current of the converter.



■To draw 48V output



11 Note to use $\pm 5V$ output

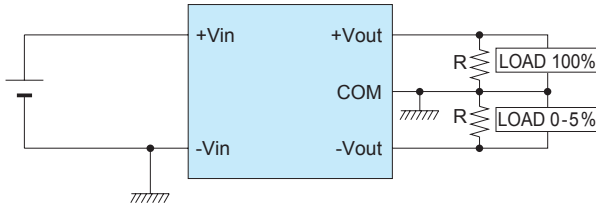


Fig. 11.1 Example of decreasing the fluctuation of output voltage.

- If an output current is 0% to 5% of the rated current, the output is influenced by the other output load condition. 20% output voltage fluctuation may occur. To avoid the fluctuation, external bleeding resistor is required to draw sufficient current.

12 Lifetime expectancy depends on stress by temperature difference

- Regarding lifetime expectancy design of solder joint, following contents must be considered.
It must be careful that the soldering joint is stressed by temperature rise and down which is occurred by self-heating and ambient temperature change.
The stress is accelerated by thermal-cycling, therefore the temperature difference should be minimized as much as possible if temperature rise and down is occurred frequently.

12.1 MG15 / MGF15 Lifetime expectancy depends on stress by temperature difference

- Product lifetime expectancy depends on case temperature difference (ΔT_c) and number of cycling in a day is shown in Fig. 12.1 (It is calculated based on our accelerated process test result.)
If case temperature changes frequently by changing output load factor etc., the above the lifetime expectancy design should be applied as well. And point A which is shown in Fig. 12.2 must keep below 105°C .

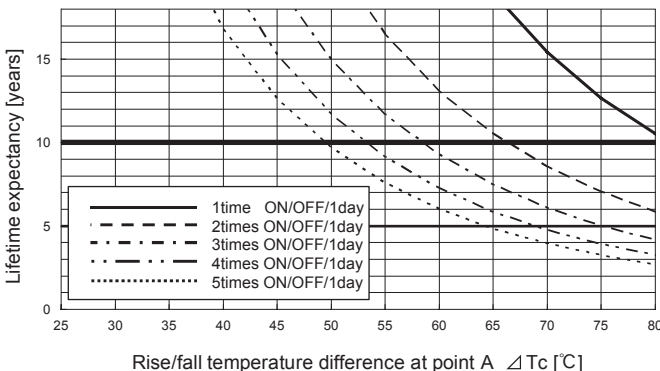


Fig. 12.1 Lifetime expectancy against rise/fall temperature difference

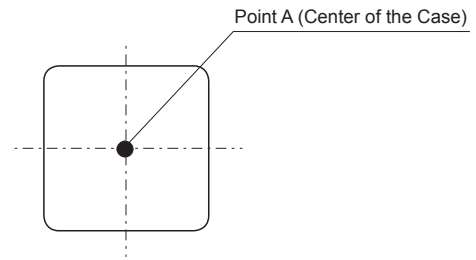


Fig. 12.2 Temperature measuring point (Top View)

- The warranty period is basically 10 years, however it depends on the lifetime expectancy which is shown in Fig. 12.1 if it is less than 10 years.

12.2 MG30 / MGF30 Lifetime expectancy depends on stress by temperature difference

- Product lifetime expectancy depends on case temperature difference (ΔT_c) and number of cycling in a day is shown in Fig. 12.3 (It is calculated based on our accelerated process test result.)
If case temperature changes frequently by changing output load factor etc., the above the lifetime expectancy design should be applied as well. And point A which is shown in Fig. 12.4 must keep below 110°C .

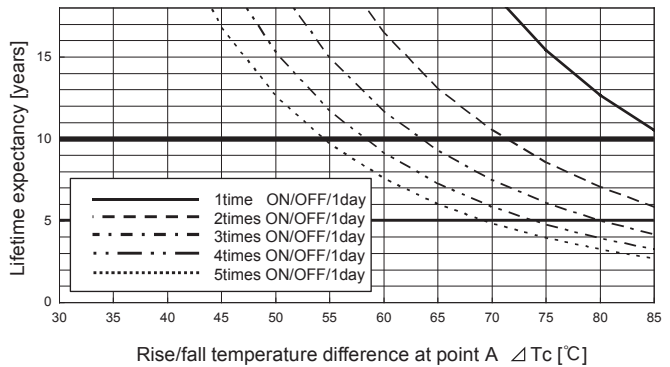


Fig. 12.3 Lifetime expectancy against rise/fall temperature difference

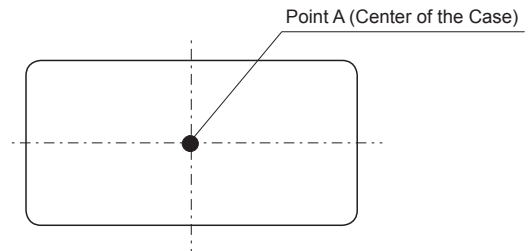


Fig. 12.4 Temperature measuring point (Top View)

- The warranty period is basically 10 years, however it depends on the lifetime expectancy which is shown in Fig. 12.3 if it is less than 10 years.



Low Profile



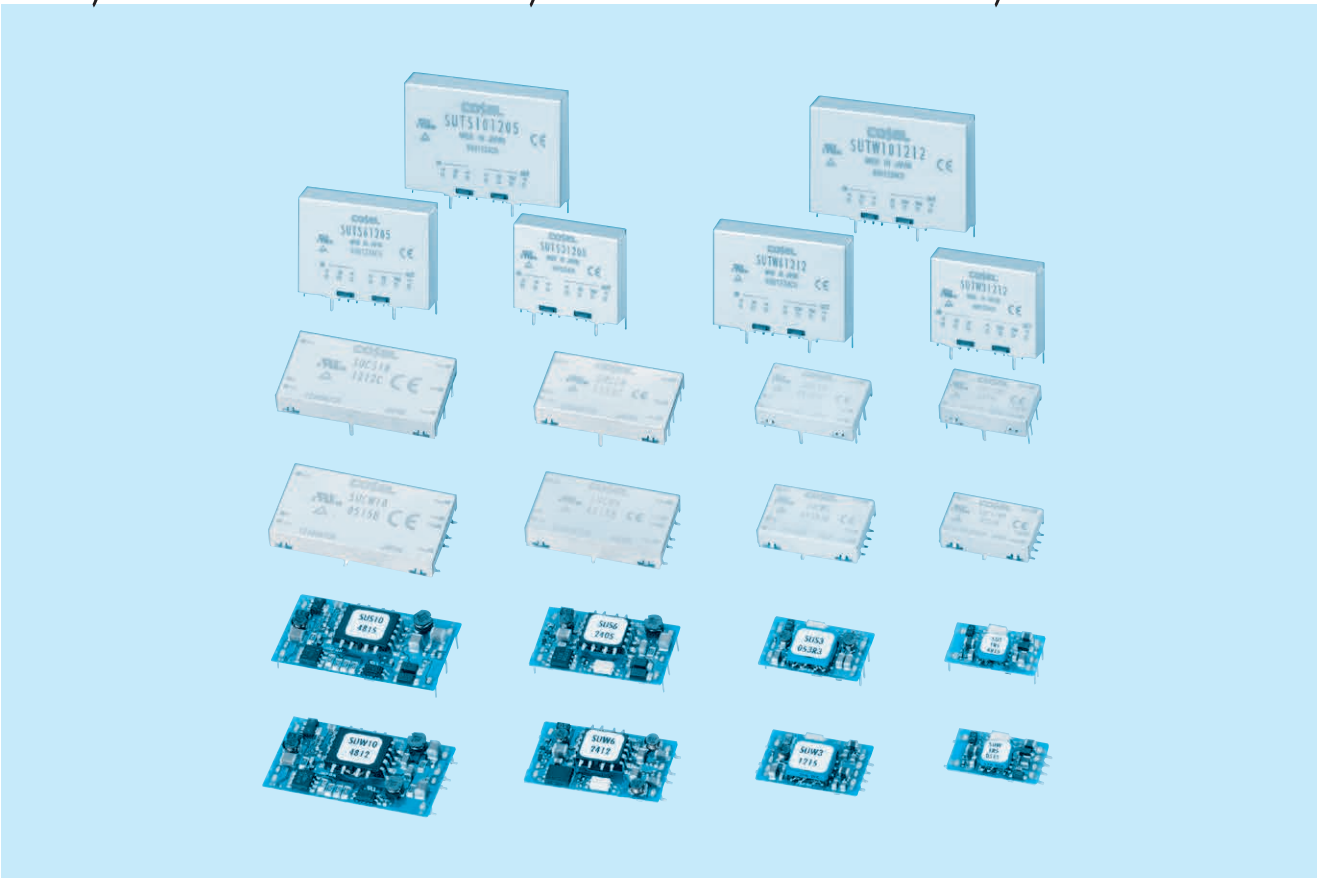
Isolated



OCP

Safety
Approvals

SUS, SUW-series / SUCS, SUCW-series / SUTS, SUTW-series



SU·SUC·SUT

Feature

- SMD mounting type and through-hole mounting type
- High efficiency (synchronous rectifier circuit)
- Built-in overcurrent protection circuits
- Built-in remote ON/OFF (SU / SUC / SUT 3-10)
- High reliability : not built-in aluminum and tantalum electrolytic capacitor

CE marking

Low Voltage Directive

Safety agency approvals

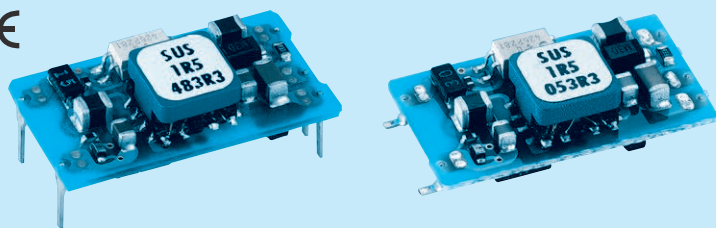
UL60950-1, C-UL, EN60950-1

5-year warranty

SUS1R5

SU S 1R5 12 05 B P

① ② ③ ④ ⑤ ⑥ ⑦



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage
- ⑥ Mounting type
B :SMD
C :DIP
- ⑦ Packing form
Blank:Plastic cover
P :Tray (SMD type)

MODEL	SUS1R5053R3	SUS1R50505	SUS1R50512	SUS1R50515	SUS1R5123R3	SUS1R51205	SUS1R51212	SUS1R51215
MAX OUTPUT WATTAGE[W]	1.32	1.5	1.56	1.5	1.32	1.5	1.56	1.5
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12
	CURRENT[A]	0.4	0.3	0.13	0.1	0.4	0.3	0.1

SPECIFICATIONS

	MODEL	SUS1R5053R3	SUS1R50505	SUS1R50512	SUS1R50515	SUS1R5123R3	SUS1R51205	SUS1R51212	SUS1R51215
INPUT	VOLTAGE[V]	DC4.5 - 9				DC9 - 18			
	CURRENT[A] *2	0.377typ	0.405typ	0.422typ	0.405typ	0.153typ	0.164typ	0.171typ	0.164typ
	EFFICIENCY[%] *2	70typ	74typ	74typ	74typ	72typ	76typ	76typ	76typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	0.4	0.3	0.13	0.1	0.4	0.3	0.13	0.1
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55°C *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20°C *3	120max	120max	150max	150max	120max	120max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	120max	120max	150max	150max	120max	120max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	50max	50max	150max	180max	50max	50max	150max
		-40 to +55°C	80max	80max	240max	290max	80max	80max	240max
	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
PROTECTION CIRCUIT AND OTHERS		OVERCURRENT PROTECTION Works over 105% of rating and recovers automatically							

MODEL	SUS1R5243R3	SUS1R52405	SUS1R52412	SUS1R52415	SUS1R5483R3	SUS1R54805	SUS1R54812	SUS1R54815
MAX OUTPUT WATTAGE[W]	1.32	1.5	1.56	1.5	1.32	1.5	1.56	1.5
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12
	CURRENT[A]	0.4	0.3	0.13	0.1	0.4	0.3	0.1

SPECIFICATIONS

	MODEL	SUS1R5243R3	SUS1R52405	SUS1R52412	SUS1R52415	SUS1R5483R3	SUS1R54805	SUS1R54812	SUS1R54815
INPUT	VOLTAGE[V]	DC18 - 36				DC36 - 76			
	CURRENT[A] *2	0.076typ	0.082typ	0.084typ	0.081typ	0.038typ	0.041typ	0.042typ	0.041typ
	EFFICIENCY[%] *2	72typ	76typ	77typ	77typ	72typ	76typ	77typ	77typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	0.4	0.3	0.13	0.1	0.4	0.3	0.13	0.1
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55°C *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20°C *3	120max	120max	150max	150max	120max	120max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	120max	120max	150max	150max	120max	120max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	50max	50max	150max	180max	50max	50max	150max
		-40 to +55°C	80max	80max	240max	290max	80max	80max	240max
	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
PROTECTION CIRCUIT AND OTHERS		OVERCURRENT PROTECTION Works over 105% of rating and recovers automatically							

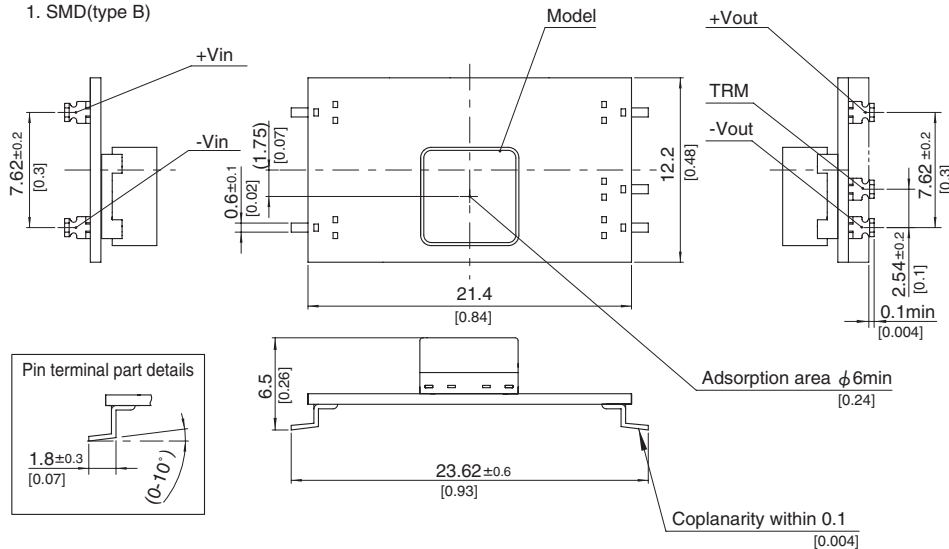
GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	21.4 X 6.5 X 12.2mm [0.84 X 0.26 X 0.48 inches] (W X H X D) / 2g max
	COOLING METHOD	Convection/Forced air

- *1 SUW1R5xx12/SUW1R5xx15 is available as single output, +24V/+30V.
- *2 Rated input 5V, 12V, 24V or 48V DC Io=100%
- *3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.
- *4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25 $^{\circ}$ C.
- * Parallel operation with other model is not possible.

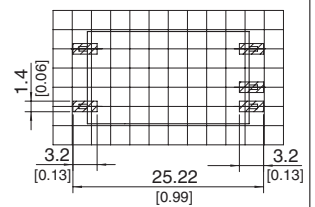
External view

1. SMD(type B)

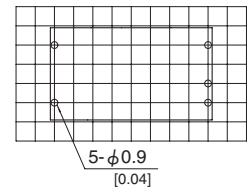


Recommended Pad and Hole dia. (TOP VIEW)

type B



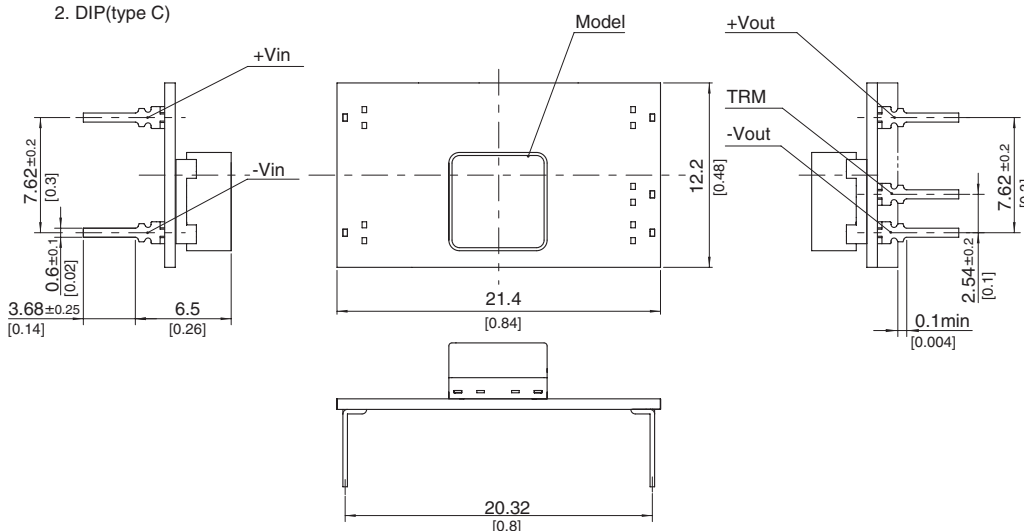
type C



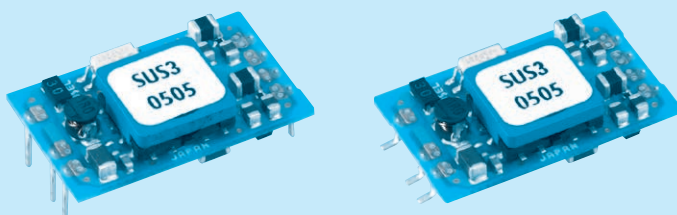
Unit : 0.1inch

Dimensions in mm, []=inches

2. DIP(type C)



- ※ Tolerance \pm 0.5 [\pm 0.02]
- ※ Dimensions in mm, []=inches
- ※ Pin terminal thickness : 0.3 \pm 0.1 [0.012]
- ※ Pin terminal material : Copper alloy
- ※ Plating treatment of terminal : Lead free plating
- ※ Weight : 2g max



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage
- ⑥ Mounting type
- ⑦ Packing form
- Blank: Plastic cover
- P : Tray (SMD type)
- ⑧ Optional
- G : Capacitor between Input and Output is removed.

MODEL	SUS3053R3	SUS30505	SUS30512	SUS30515	SUS3123R3	SUS31205	SUS31212	SUS31215
MAX OUTPUT WATTAGE[W]	1.98	3	3	3	1.98	3	3	3
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12
	CURRENT[A]	0.6	0.6	0.25	0.2	0.6	0.6	0.25

SPECIFICATIONS

	MODEL	SUS3053R3	SUS30505	SUS30512	SUS30515	SUS3123R3	SUS31205	SUS31212	SUS31215
INPUT	VOLTAGE[V]	DC4.5 - 9				DC9 - 18			
	CURRENT[A] *2	0.536typ	0.780typ	0.760typ	0.760typ	0.218typ	0.317typ	0.309typ	0.313typ
	EFFICIENCY[%] *2	74typ	77typ	79typ	79typ	76typ	79typ	81typ	80typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	0.6	0.6	0.25	0.2	0.6	0.6	0.25	0.2
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55°C *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20°C *3	120max	120max	150max	150max	120max	120max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	120max	120max	150max	150max	120max	120max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	50max	50max	150max	180max	50max	50max	150max
		-40 to +55°C	80max	80max	240max	290max	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) $\pm 5\%$ adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] ($\pm 3\%$)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

MODEL	SUS3243R3	SUS32405	SUS32412	SUS32415	SUS3483R3	SUS34805	SUS34812	SUS34815
MAX OUTPUT WATTAGE[W]	1.98	3	3	3	1.98	3	3	3
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12
	CURRENT[A]	0.6	0.6	0.25	0.2	0.6	0.6	0.25

SPECIFICATIONS

	MODEL	SUS3243R3	SUS32405	SUS32412	SUS32415	SUS3483R3	SUS34805	SUS34812	SUS34815
INPUT	VOLTAGE[V]	DC18 - 36				DC36 - 76			
	CURRENT[A] *2	0.110typ	0.159typ	0.155typ	0.157typ	0.056typ	0.080typ	0.078typ	0.078typ
	EFFICIENCY[%] *2	75typ	79typ	81typ	80typ	74typ	79typ	81typ	81typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	0.6	0.6	0.25	0.2	0.6	0.6	0.25	0.2
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55°C *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20°C *3	120max	120max	150max	150max	120max	120max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	120max	120max	150max	150max	120max	120max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	50max	50max	150max	180max	50max	50max	150max
		-40 to +55°C	80max	80max	240max	290max	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) $\pm 5\%$ adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] ($\pm 3\%$)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

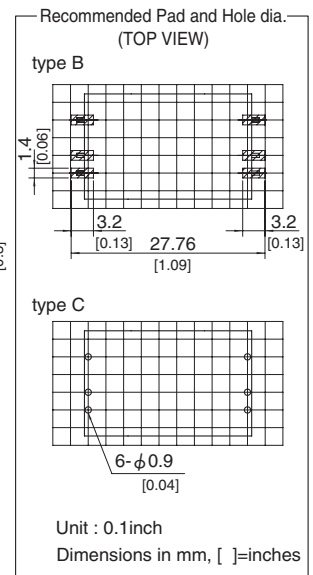
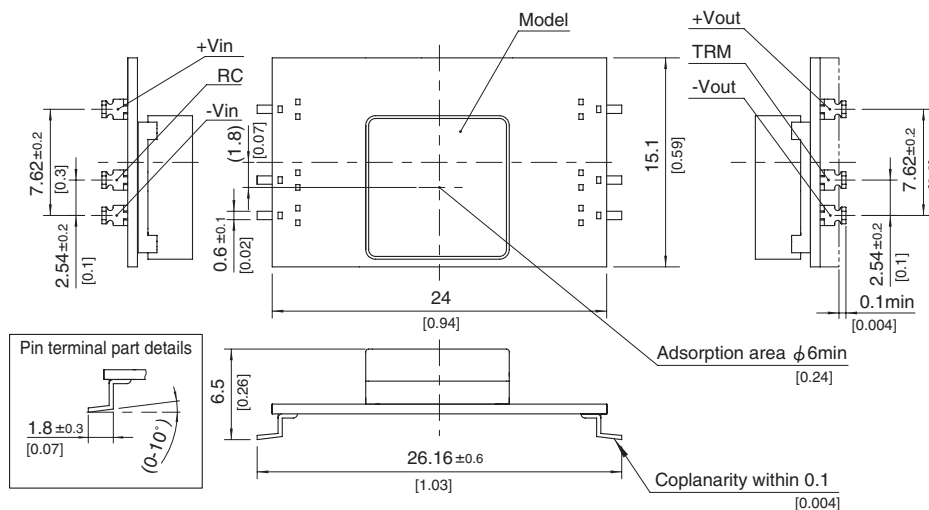
GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	24X6.5X15.1mm [0.94X0.26X0.59 inches] (WxHxD) / 3g max
	COOLING METHOD	Convection/Forced air

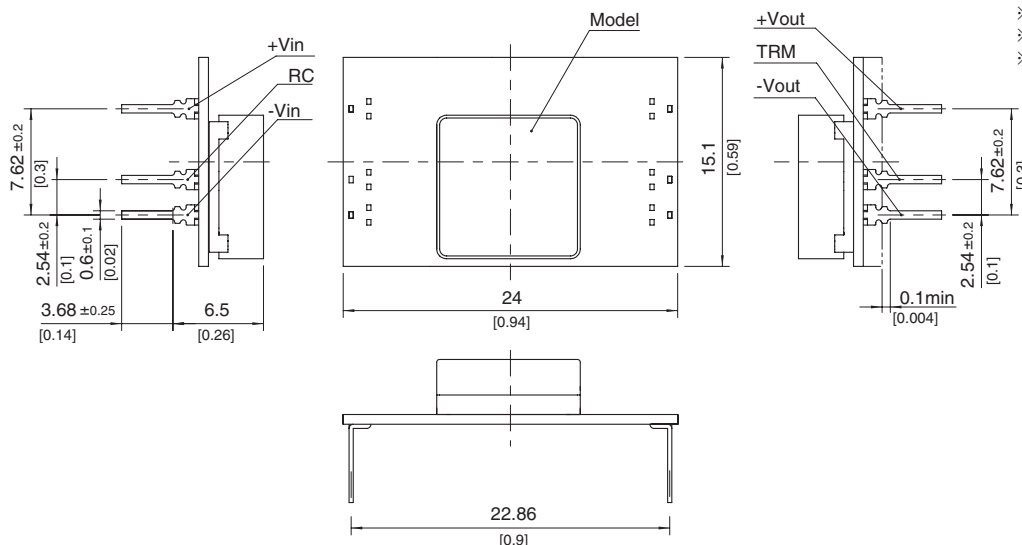
- *1 SUW3xx12/SUW3xx15 is available as single output, +24V/+30V.
- *2 Rated input 5V, 12V, 24V or 48V DC I_o=100%
- *3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.
- *4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25 $^{\circ}$ C.
- * Parallel operation with other model is not possible.

External view

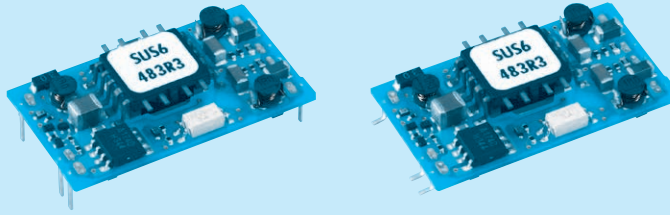
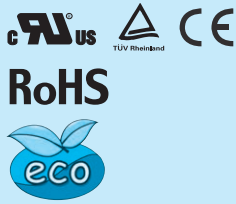
1.SMD(type B)



2.DIP(type C)



- ※ Tolerance ± 0.5 [± 0.02]
- ※ Dimensions in mm, []=inches
- ※ Pin terminal thickness : 0.3 ± 0.1 [0.012]
- ※ Pin terminal material : Copper alloy
- ※ Plating treatment of terminal : Lead free plating
- ※ Weight : 3g max



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage
- ⑥ Mounting type
- B : SMD
- C : DIP
- ⑦ Packing form
- Blank: Plastic cover
- P : Tray (SMD type)
- ⑧ Optional
- G : Capacitor between Input and Output is removed.

MODEL	SUS6053R3	SUS60505	SUS60512	SUS60515	SUS6123R3	SUS61205	SUS61212	SUS61215
MAX OUTPUT WATTAGE[W]	3.96	5	6	6	4.46	6	6	6
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12
	CURRENT[A]	1.2	1	0.5	0.4	1.35	1.2	0.5

SPECIFICATIONS

	MODEL	SUS6053R3	SUS60505	SUS60512	SUS60515	SUS6123R3	SUS61205	SUS61212	SUS61215
INPUT	VOLTAGE[V]	DC4.5 - 9				DC9 - 18			
	CURRENT[A] *2	1.100typ	1.316typ	1.500typ	1.500typ	0.502typ	0.617typ	0.588typ	0.588typ
	EFFICIENCY[%] *2	72typ	76typ	80typ	80typ	74typ	81typ	85typ	85typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	1.2	1	0.5	0.4	1.35	1.2	0.5	0.4
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55°C *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20°C *3	120max	120max	150max	150max	120max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	120max	120max	150max	150max	120max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	50max	50max	150max	180max	50max	50max	150max
		-40 to +55°C	80max	80max	240max	290max	80max	80max	240max
	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

MODEL	SUS6243R3	SUS62405	SUS62412	SUS62415	SUS6483R3	SUS64805	SUS64812	SUS64815
MAX OUTPUT WATTAGE[W]	4.46	6	6	6	4.46	6	6	6
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12
	CURRENT[A]	1.35	1.2	0.5	0.4	1.35	1.2	0.5

SPECIFICATIONS

	MODEL	SUS6243R3	SUS62405	SUS62412	SUS62415	SUS6483R3	SUS64805	SUS64812	SUS64815
INPUT	VOLTAGE[V]	DC18 - 36				DC36 - 76			
	CURRENT[A] *2	0.248typ	0.309typ	0.291typ	0.291typ	0.121typ	0.154typ	0.145typ	0.145typ
	EFFICIENCY[%] *2	75typ	81typ	86typ	86typ	77typ	81typ	86typ	86typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	1.35	1.2	0.5	0.4	1.35	1.2	0.5	0.4
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55°C *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20°C *3	120max	120max	150max	150max	120max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	120max	120max	150max	150max	120max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	50max	50max	150max	180max	50max	50max	150max
		-40 to +55°C	80max	80max	240max	290max	80max	80max	240max
	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 98.0m/s 2 (10G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s 2 (50G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	31.6 \times 6.5 \times 18.1mm [1.24 \times 0.26 \times 0.71 inches] (W \times H \times D) / 4g max
	COOLING METHOD	Convection/Forced air

*1 SUW6xx12/SUW6xx15 is available as single output, +24V/+30V.

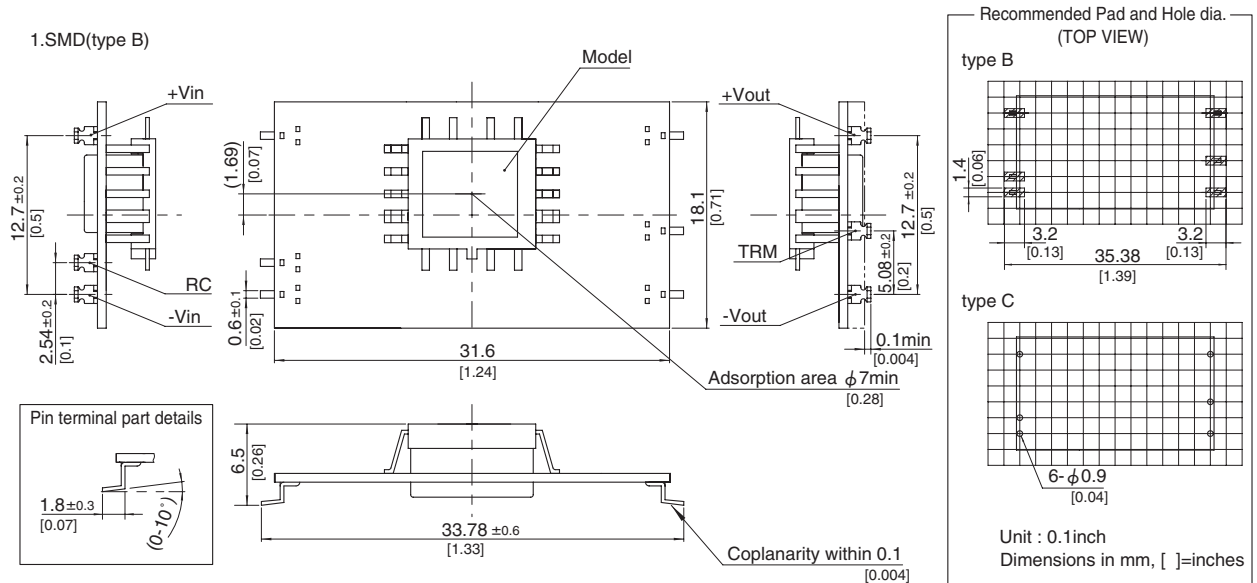
*2 Rated input 5V, 12V, 24V or 48V DC $I_o=100\%$

*3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.

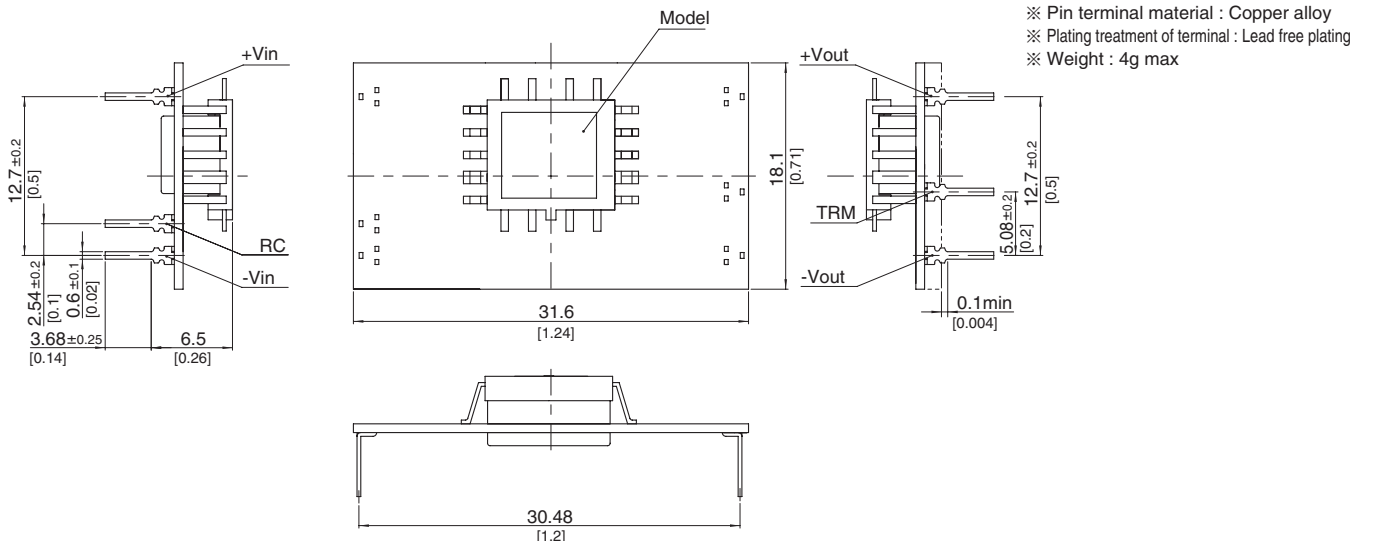
*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25 $^{\circ}$ C.

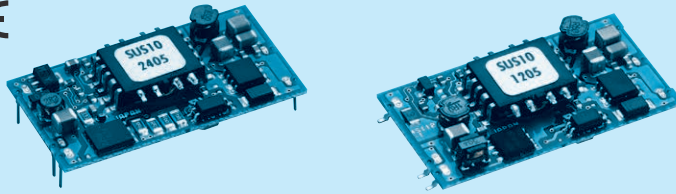
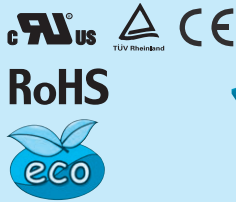
* Parallel operation with other model is not possible.

External view



2. DIP(type C)





- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage
- ⑥ Mounting type
B : SMD
C : DIP
- ⑦ Packing form
Blank: Plastic cover
P : Tray (SMD type)
- ⑧ Optional
G : Capacitor between Input and Output is removed.

MODEL		SUS10053R3	SUS100505	SUS100512	SUS100515	SUS10123R3	SUS101205	SUS101212	SUS101215
MAX OUTPUT WATTAGE[W]		8.58	10	10.8	10.5	8.58	10	12	12
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	2.6	2	0.9	0.7	2.6	2	1	0.8

SPECIFICATIONS

	MODEL	SUS10053R3	SUS100505	SUS100512	SUS100515	SUS10123R3	SUS101205	SUS101212	SUS101215
INPUT	VOLTAGE[V]	DC4.5 - 9				DC9 - 18			
	CURRENT[A] *2	2.12typ	2.41typ	2.54typ	2.47typ	0.872typ	0.980typ	1.15typ	1.15typ
	EFFICIENCY[%] *2	81typ	83typ	85typ	85typ	82typ	85typ	87typ	87typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	2.6	2	0.9	0.7	2.6	2	1	0.8
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55°C *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20°C *3	120max	120max	150max	150max	120max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	120max	120max	150max	150max	120max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	50max	50max	150max	180max	50max	50max	150max
		-40 to +55°C	80max	80max	240max	290max	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

MODEL		SUS10243R3	SUS102405	SUS102412	SUS102415	SUS10483R3	SUS104805	SUS104812	SUS104815
MAX OUTPUT WATTAGE[W]		8.58	10	12	12	8.58	10	12	12
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	2.6	2	1	0.8	2.6	2	1	0.8

SPECIFICATIONS

	MODEL	SUS10243R3	SUS102405	SUS102412	SUS102415	SUS10483R3	SUS104805	SUS104812	SUS104815
INPUT	VOLTAGE[V]	DC18 - 36				DC36 - 76			
	CURRENT[A] *2	0.436typ	0.490typ	0.575typ	0.575typ	0.218typ	0.245typ	0.287typ	0.287typ
	EFFICIENCY[%] *2	82typ	85typ	87typ	87typ	82typ	85typ	87typ	87typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	2.6	2	1	0.8	2.6	2	1	0.8
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55°C *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20°C *3	120max	120max	150max	150max	120max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	120max	120max	150max	150max	120max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	50max	50max	150max	180max	50max	50max	150max
		-40 to +55°C	80max	80max	240max	290max	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	39.2X6.5X21.0mm [1.54X0.26X0.83 inches] (WxHxD) / 6g max
	COOLING METHOD	Convection/Forced air

*1 SUW10xx12/SUW10xx15 is available as single output, +24V/+30V.

*2 Rated input 5V, 12V, 24V or 48V DC I_o=100%

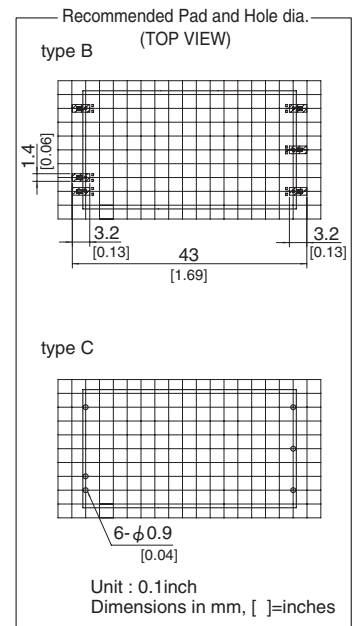
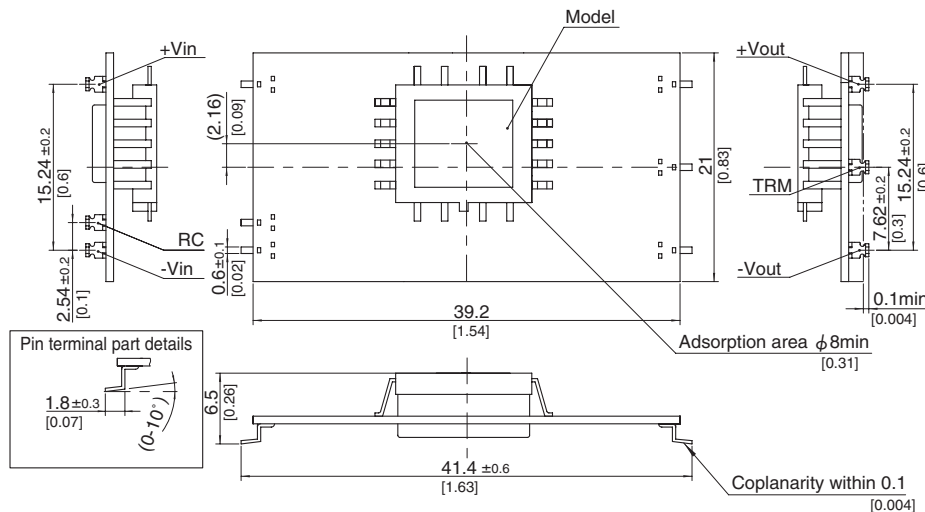
*3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25 $^{\circ}$ C.

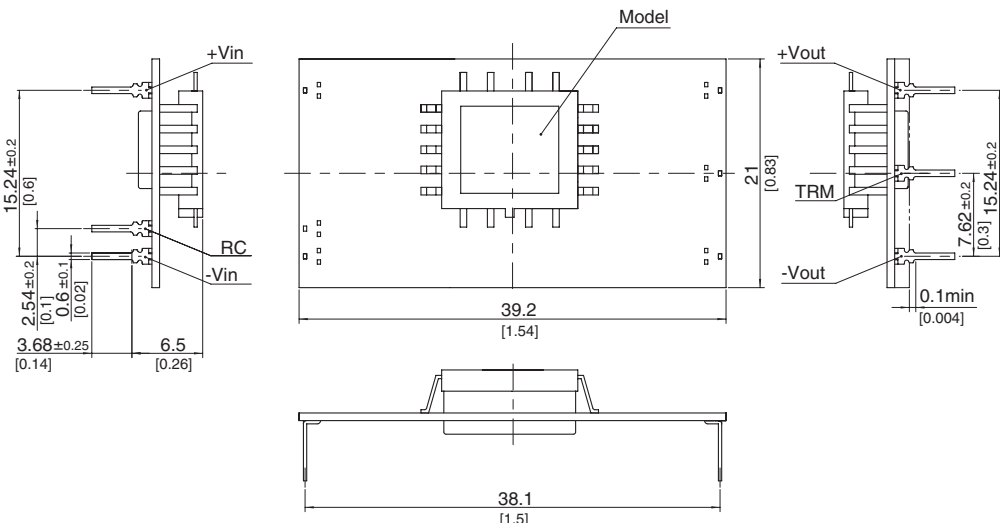
* Parallel operation with other model is not possible.

External view

1. SMD(type B)



2. DIP(type C)

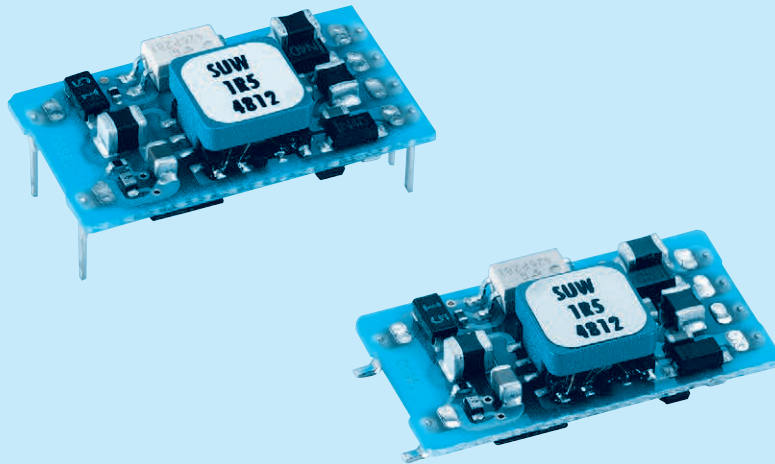


- * Tolerance \pm 0.5 [\pm 0.02]
- * Dimensions in mm, []=inches
- * Pin terminal thickness : 0.3 \pm 0.1 [0.012]
- * Pin terminal material : Copper alloy
- * Plating treatment of terminal : Lead free plating
- * Weight : 6g max

SUW1R5

SU W 1R5 12 12 B P

① ② ③ ④ ⑤ ⑥ ⑦



- ① Series name
 ② Dual output
 ③ Output wattage
 ④ Input voltage
 ⑤ Output voltage
 ⑥ Mounting type
 B : SMD
 C : DIP
 ⑦ Packing form
 Blank: Plastic cover
 P : Tray (SMD type)

MODEL	SUW1R50512	SUW1R50515	SUW1R51212	SUW1R51215	SUW1R52412	SUW1R52415	SUW1R54812	SUW1R54815
MAX OUTPUT WATTAGE[W]	1.56	1.5	1.56	1.5	1.56	1.5	1.56	1.5
DC OUTPUT	VOLTAGE[V] *1	± 12 or +24	± 15 or +30	± 12 or +24	± 15 or +30	± 12 or +24	± 15 or +30	± 12 or +24
	CURRENT[A]	0.065	0.05	0.065	0.05	0.065	0.05	0.065

SPECIFICATIONS

	MODEL	SUW1R50512	SUW1R50515	SUW1R51212	SUW1R51215	SUW1R52412	SUW1R52415	SUW1R54812	SUW1R54815
INPUT	VOLTAGE[V]	DC4.5 - 9		DC9 - 18		DC18 - 36		DC36 - 76	
	CURRENT[A] *2	0.433typ	0.417typ	0.173typ	0.167typ	0.087typ	0.083typ	0.043typ	0.042typ
	EFFICIENCY[%] *2	72typ	72typ	75typ	75typ	75typ	75typ	75typ	75typ
OUTPUT	VOLTAGE[V]	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)
	CURRENT[A]	0.065	0.05	0.065	0.05	0.065	0.05	0.065	0.05
	LINE REGULATION[mV]	60max	75max	60max	75max	60max	75max	60max	75max
	LOAD REGULATION[mV]	600max	750max	600max	750max	600max	750max	600max	750max
	RIPPLE[mVp-p]	-20 to +55°C *3	120max	120max	120max	120max	120max	120max	120max
		-40 to -20°C *3	150max	150max	150max	150max	150max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	150max	150max	150max	150max	150max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	150max	180max	150max	180max	150max	180max	180max
		-40 to +55°C	240max	290max	240max	290max	240max	290max	290max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	50max	60max	50max	60max	50max	60max	50max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±5%)	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75
ISOLATION	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
ENVIRONMENT	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max							
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis							
SAFETY	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis							
	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1							
OTHERS	CASE SIZE/WEIGHT	21.4 × 6.5 × 12.2mm [0.84 × 0.26 × 0.48 inches] (W × H × D) / 2g max							
	COOLING METHOD	Convection/Forced air							

*1 Output pins can be connected in series to make a 24V/30V output.

*2 Rated input 5V, 12V, 24V or 48V DC Io=100%

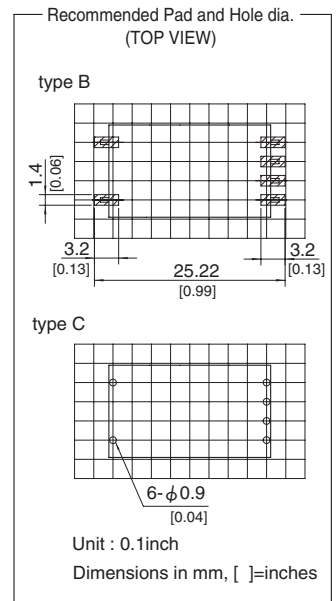
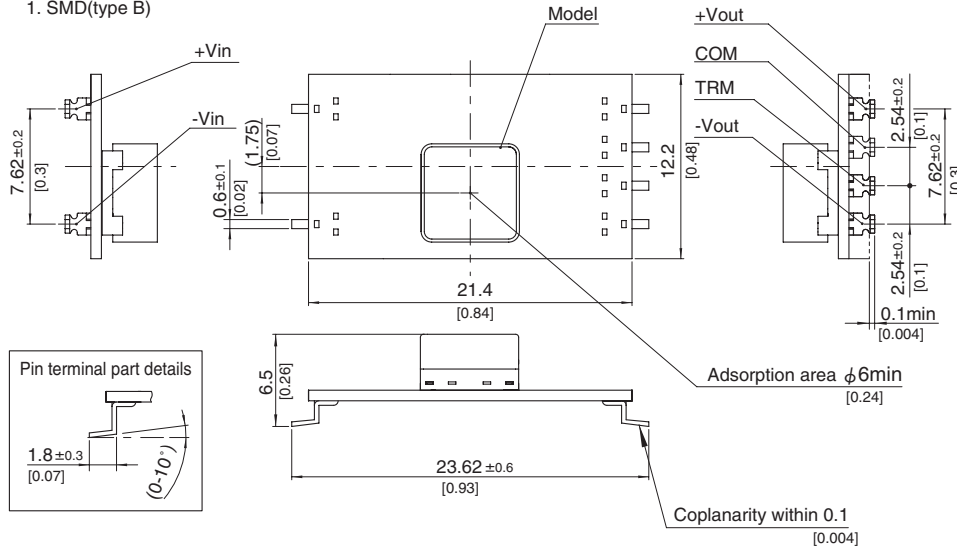
*3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

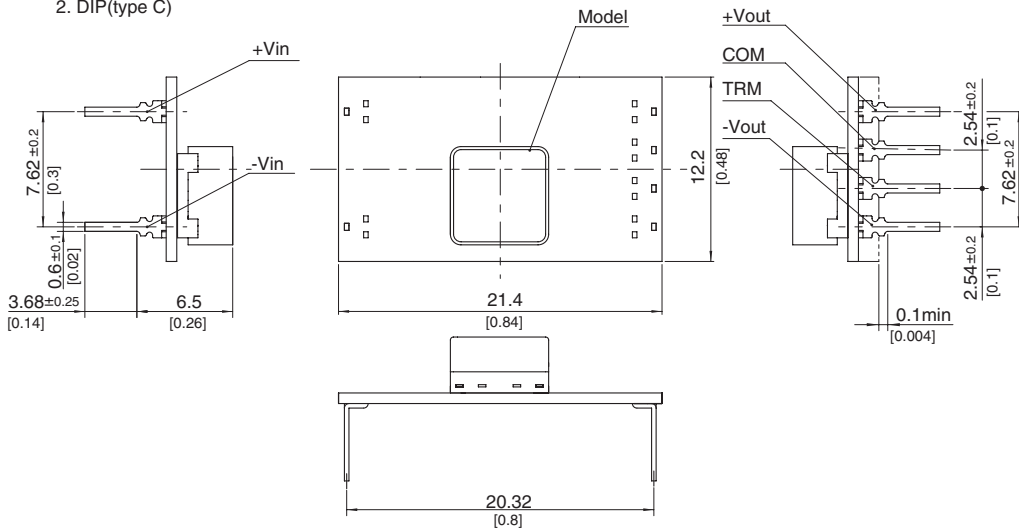
* Parallel operation with other model is not possible.

External view

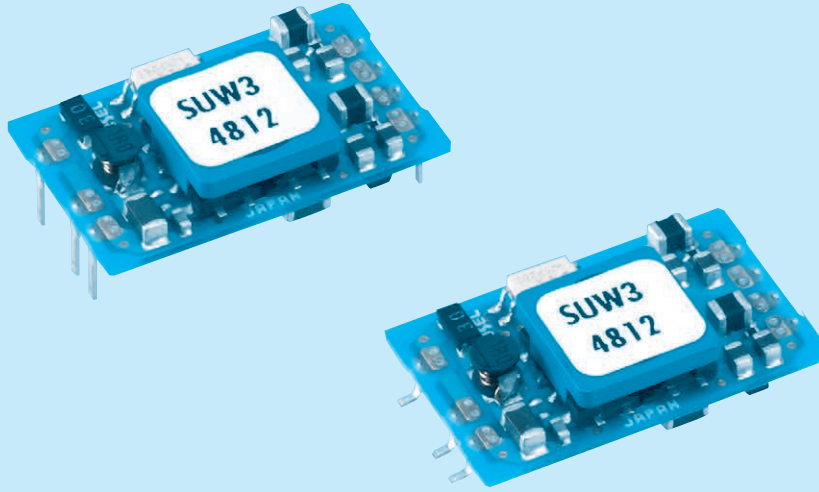
1. SMD(type B)



2. DIP(type C)



- ※ Tolerance ±0.5 [±0.02]
- ※ Dimensions in mm, []=inches
- ※ Pin terminal thickness : 0.3±0.1 [0.012]
- ※ Pin terminal material : Copper alloy
- ※ Plating treatment of terminal : Lead free plating
- ※ Weight : 2g max



- ① Series name
- ② Dual output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage
- ⑥ Mounting type
B : SMD
C : DIP
- ⑦ Packing form
Blank: Plastic cover
P : Tray (SMD type)
- ⑧ Optional
G : Capacitor between Input and Output is removed.

MODEL		SUW30512	SUW30515	SUW31212	SUW31215	SUW32412	SUW32415	SUW34812	SUW34815
MAX OUTPUT WATTAGE[W]		3.12	3	3.12	3	3.12	3	3.12	3
DC OUTPUT	VOLTAGE[V] *1	±12 or +24	±15 or +30	±12 or +24	±15 or +30	±12 or +24	±15 or +30	±12 or +24	±15 or +30
	CURRENT[A]	0.13	0.1	0.13	0.1	0.13	0.1	0.13	0.1

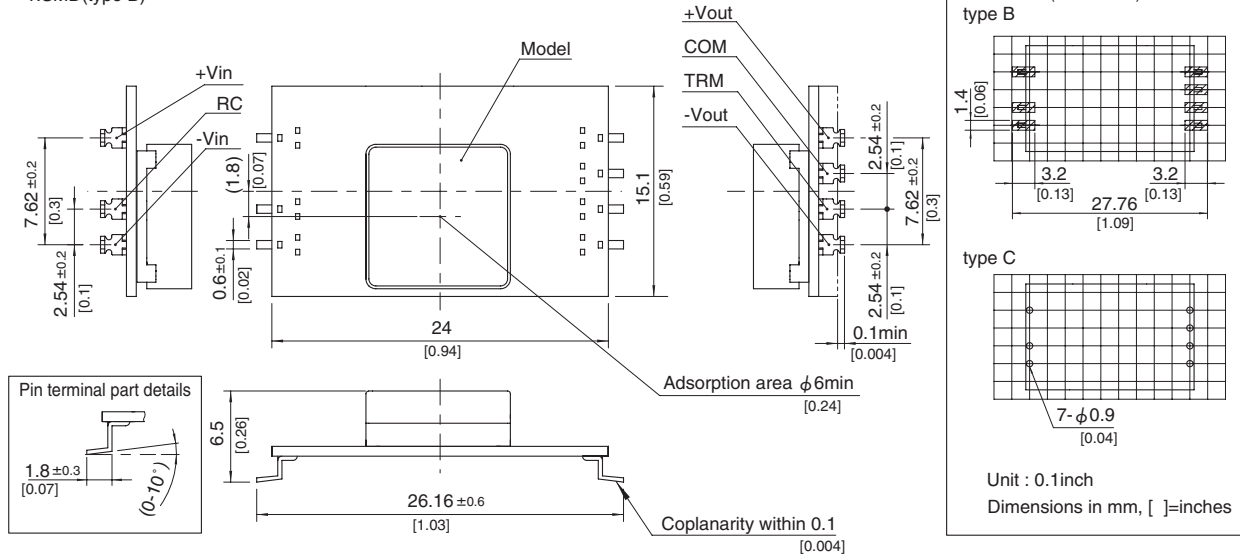
SPECIFICATIONS

	MODEL	SUW30512	SUW30515	SUW31212	SUW31215	SUW32412	SUW32415	SUW34812	SUW34815
INPUT	VOLTAGE[V]	DC4.5 - 9		DC9 - 18		DC18 - 36		DC36 - 76	
	CURRENT[A] *2	0.822typ	0.790typ	0.334typ	0.321typ	0.167typ	0.161typ	0.084typ	0.081typ
	EFFICIENCY[%] *2	76typ	76typ	78typ	78typ	78typ	78typ	78typ	78typ
OUTPUT	VOLTAGE[V]	±12(+24)	±15(+30)	±12(+24)	±15(+30)	±12(+24)	±15(+30)	±12(+24)	±15(+30)
	CURRENT[A]	0.13	0.1	0.13	0.1	0.13	0.1	0.13	0.1
	LINE REGULATION[mV]	60max	75max	60max	75max	60max	75max	60max	75max
	LOAD REGULATION[mV]	600max	750max	600max	750max	600max	750max	600max	750max
	RIPPLE[mVp-p]	-20 to +55°C *3	120max	120max	120max	120max	120max	120max	120max
		-40 to -20°C *3	150max	150max	150max	150max	150max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	150max	150max	150max	150max	150max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	150max	180max	150max	180max	150max	180max	180max
		-40 to +55°C	240max	290max	240max	290max	240max	290max	290max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	50max	60max	50max	60max	50max	60max	50max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±5%)	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
ISOLATION	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							
	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max							
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis							
	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis							
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1							
OTHERS	CASE SIZE/WEIGHT	24 × 6.5 × 15.1mm [0.94 × 0.26 × 0.59 inches] (W × H × D) / 3g max							
	COOLING METHOD	Convection/Forced air							

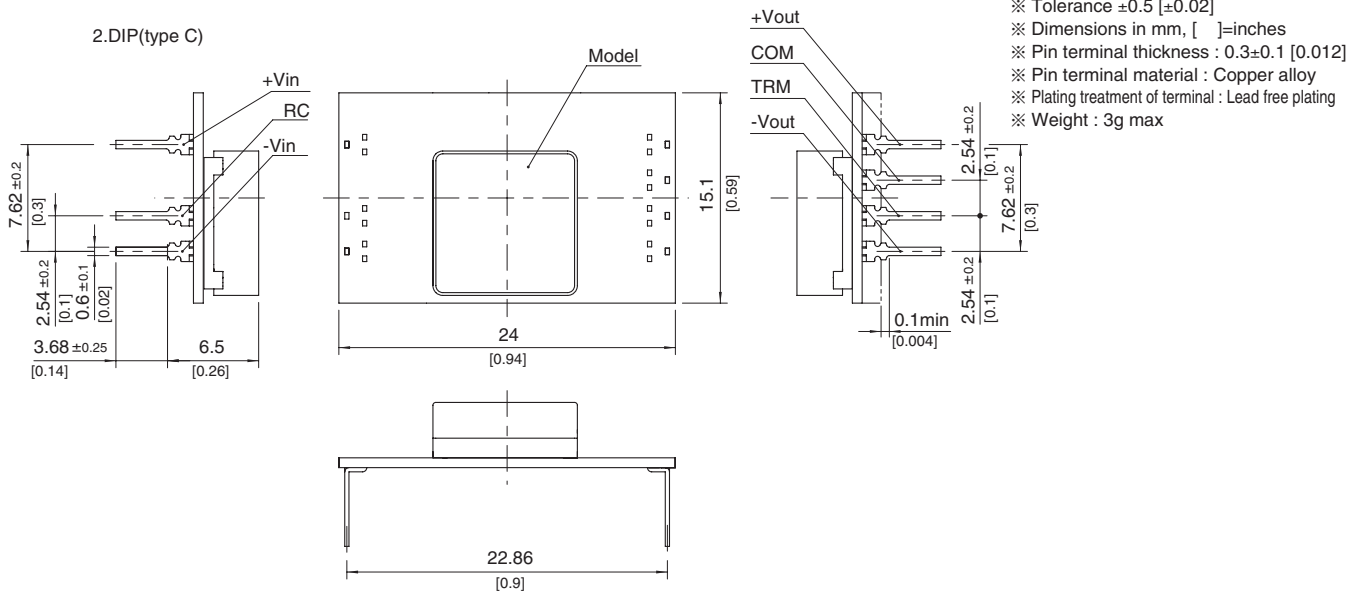
*1 Output pins can be connected in series to make a 24V/30V output.
 *2 Rated input 5V, 12V, 24V or 48V DC Io=100%
 *3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.
 *4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.
 * Parallel operation with other model is not possible.

External view

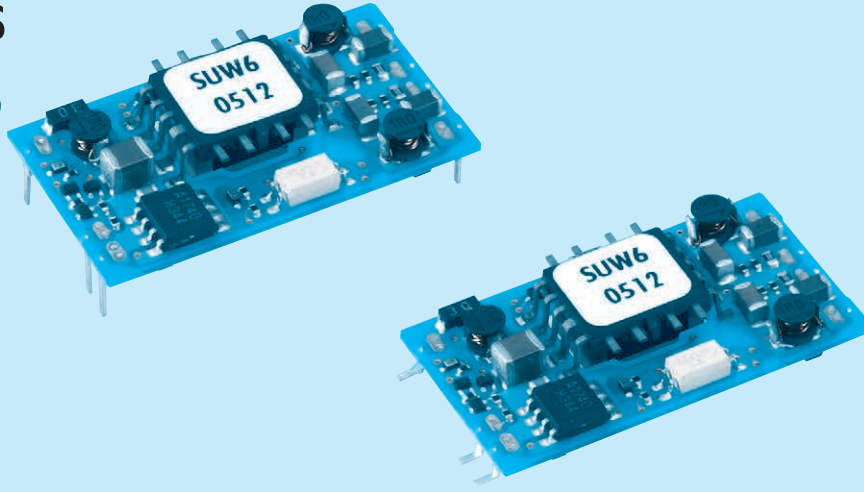
1.SMD(type B)



2.DIP(type C)



- ※ Tolerance ± 0.5 [± 0.02]
- ※ Dimensions in mm, [] = inches
- ※ Pin terminal thickness : 0.3 ± 0.1 [0.012]
- ※ Pin terminal material : Copper alloy
- ※ Plating treatment of terminal : Lead free plating
- ※ Weight : 3g max



- ① Series name
 ② Dual output
 ③ Output wattage
 ④ Input voltage
 ⑤ Output voltage
 ⑥ Mounting type
 B : SMD
 C : DIP
 ⑦ Packing form
 Blank: Plastic cover
 P : Tray (SMD type)
 ⑧ Optional
 G : Capacitor between Input and Output is removed.

MODEL		SUW60512	SUW60515	SUW61212	SUW61215	SUW62412	SUW62415	SUW64812	SUW64815
MAX OUTPUT WATTAGE[W]		6	6	6	6	6	6	6	6
DC OUTPUT	VOLTAGE[V] *1	± 12 or +24	± 15 or +30	± 12 or +24	± 15 or +30	± 12 or +24	± 15 or +30	± 12 or +24	± 15 or +30
	CURRENT[A]	0.25	0.2	0.25	0.2	0.25	0.2	0.25	0.2

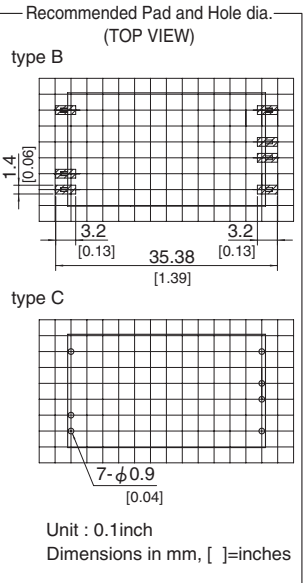
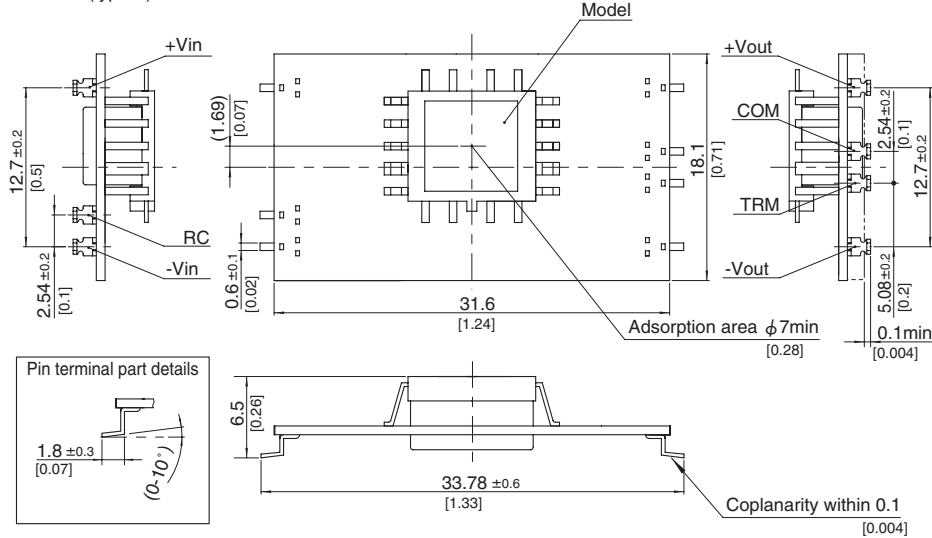
SPECIFICATIONS

	MODEL	SUW60512	SUW60515	SUW61212	SUW61215	SUW62412	SUW62415	SUW64812	SUW64815
INPUT	VOLTAGE[V]	DC4.5 - 9		DC9 - 18		DC18 - 36		DC36 - 76	
	CURRENT[A] *2	1.538typ	1.538typ	0.588typ	0.588typ	0.291typ	0.291typ	0.145typ	0.145typ
	EFFICIENCY[%] *2	78typ	78typ	85typ	85typ	86typ	86typ	86typ	86typ
OUTPUT	VOLTAGE[V]	±12(+24)	±15(+30)	±12(+24)	±15(+30)	±12(+24)	±15(+30)	±12(+24)	±15(+30)
	CURRENT[A]	0.25	0.2	0.25	0.2	0.25	0.2	0.25	0.2
	LINE REGULATION[mV]	60max	75max	60max	75max	60max	75max	60max	75max
	LOAD REGULATION[mV]	600max	750max	600max	750max	600max	750max	600max	750max
	RIPPLE[mVp-p]	-20 to +55°C *3	120max	120max	120max	120max	120max	120max	120max
		-40 to -20°C *3	150max	150max	150max	150max	150max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	150max	150max	150max	150max	150max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	150max	180max	150max	180max	150max	180max	180max
		-40 to +55°C	240max	290max	240max	290max	240max	290max	290max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	50max	60max	50max	60max	50max	60max	50max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±5%)	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
ISOLATION	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							
	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max							
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis							
	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis							
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1							
OTHERS	CASE SIZE/WEIGHT	31.6×6.5×18.1mm [1.24×0.26×0.71 inches] (W×H×D) / 4g max							
	COOLING METHOD	Convection/Forced air							

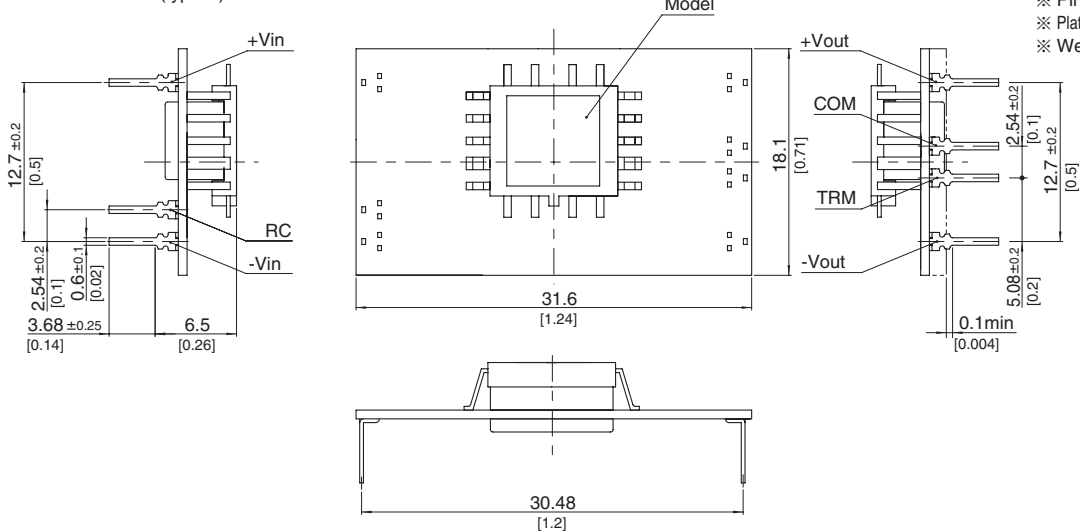
- *1 Output pins can be connected in series to make a 24V/30V output.
 *2 Rated input 5V, 12V, 24V or 48V DC Io=100%
 *3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.
 *4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.
 * Parallel operation with other model is not possible.

External view

1.SMD(type B)



2.DIP(type C)

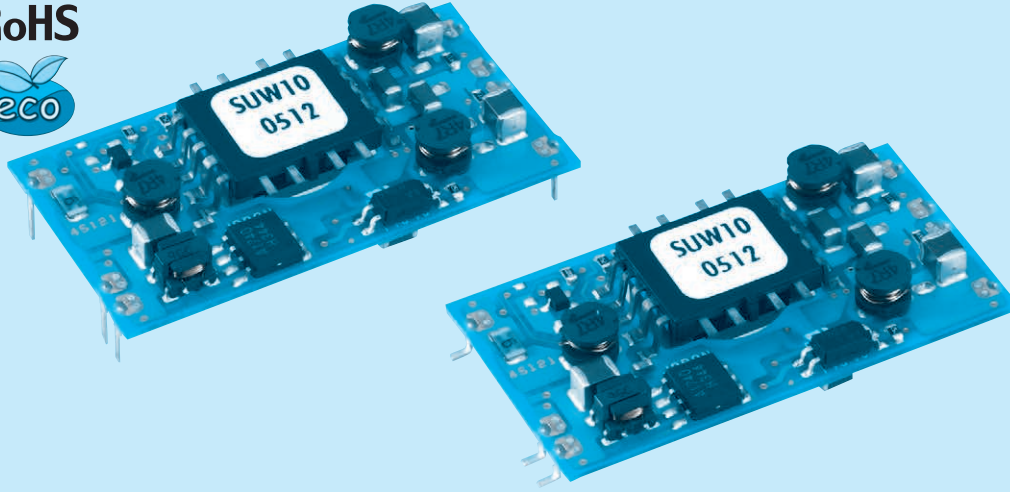


- ※ Tolerance ± 0.5 [± 0.02]
- ※ Dimensions in mm, []=inches
- ※ Pin terminal thickness : 0.3 ± 0.1 [0.012]
- ※ Pin terminal material : Copper alloy
- ※ Plating treatment of terminal : Lead free plating
- ※ Weight : 4g max

SUW10

SU W 10 12 12 B P - ☐

① ② ③ ④ ⑤ ⑥ ⑦ ⑧



- ① Series name
- ② Dual output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage
- ⑥ Mounting type
B : SMD
C : DIP
- ⑦ Packing form
Blank: Plastic cover
P : Tray (SMD type)
- ⑧ Optional
G : Capacitor between Input and Output is removed.

MODEL	SUW100512	SUW100515	SUW101212	SUW101215	SUW102412	SUW102415	SUW104812	SUW104815
MAX OUTPUT WATTAGE[W]	10.8	10.5	10.8	10.5	10.8	10.5	10.8	10.5
DC OUTPUT	VOLTAGE[V] *1	±12 or +24	±15 or +30	±12 or +24	±15 or +30	±12 or +24	±15 or +30	±12 or +24
	CURRENT[A]	0.45	0.35	0.45	0.35	0.45	0.35	0.45

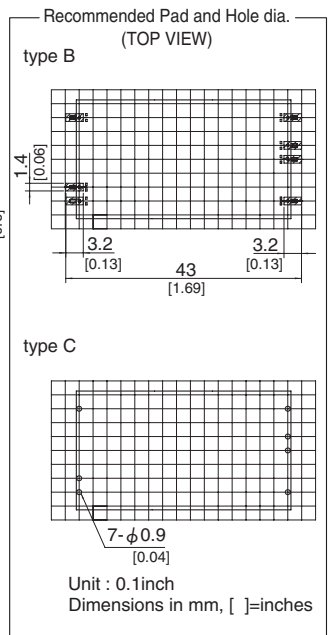
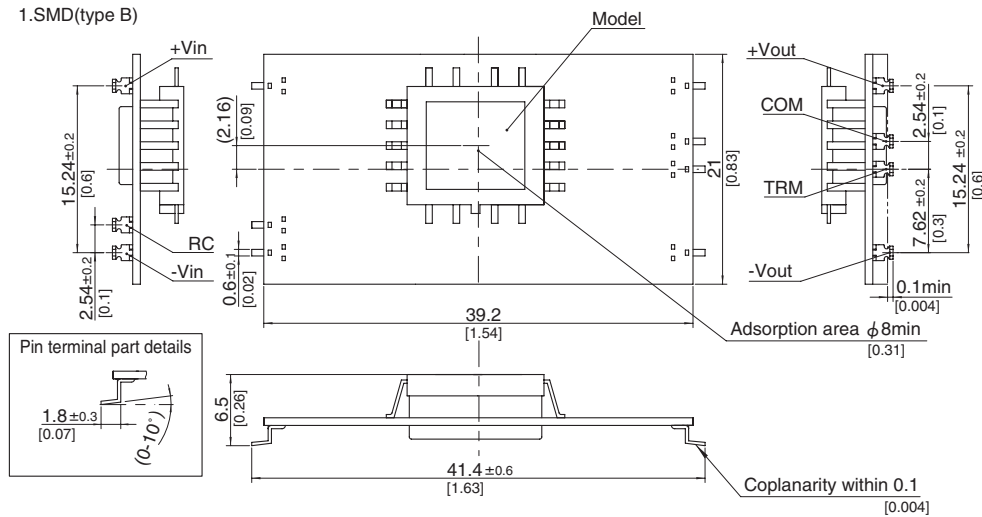
SPECIFICATIONS

	MODEL	SUW100512	SUW100515	SUW101212	SUW101215	SUW102412	SUW102415	SUW104812	SUW104815
INPUT	VOLTAGE[V]	DC4.5 - 9		DC9 - 18		DC18 - 36		DC36 - 76	
	CURRENT[A] *2	2.51typ	2.44typ	1.05typ	1.02typ	0.523typ	0.509typ	0.262typ	0.254typ
	EFFICIENCY[%] *2	86typ	86typ	86typ	86typ	86typ	86typ	86typ	86typ
OUTPUT	VOLTAGE[V]	±12(+24)	±15(+30)	±12(+24)	±15(+30)	±12(+24)	±15(+30)	±12(+24)	±15(+30)
	CURRENT[A]	0.45	0.35	0.45	0.35	0.45	0.35	0.45	0.35
	LINE REGULATION[mV]	60max	75max	60max	75max	60max	75max	60max	75max
	LOAD REGULATION[mV]	600max	750max	600max	750max	600max	750max	600max	750max
	RIPPLE[mVp-p]	-20 to +55°C *3	120max	120max	120max	120max	120max	120max	120max
		-40 to -20°C *3	150max	150max	150max	150max	150max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	150max	150max	150max	150max	150max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	150max	180max	150max	180max	150max	180max	180max
		-40 to +55°C	240max	290max	240max	290max	240max	290max	290max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	50max	60max	50max	60max	50max	60max	50max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±5%)	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
ISOLATION	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							
	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max							
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis							
	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis							
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1							
OTHERS	CASE SIZE/WEIGHT	39.2 × 6.5 × 21.0mm [1.54 × 0.26 × 0.83 inches] (W × H × D) / 6g max							
	COOLING METHOD	Convection/Forced air							

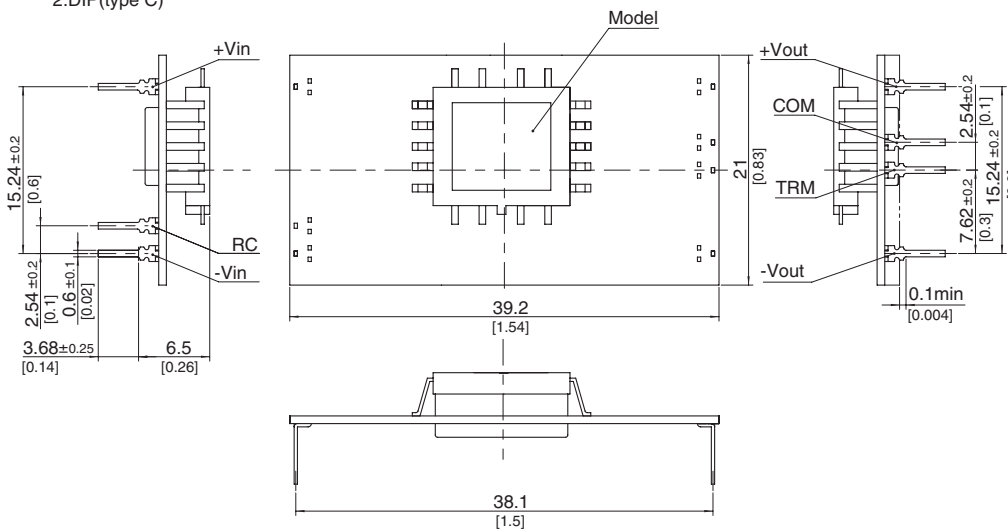
- *1 Output pins can be connected in series to make a 24V/30V output.
- *2 Rated input 5V, 12V, 24V or 48V DC Io=100%
- *3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.
- *4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.
- * Parallel operation with other model is not possible.

External view

1.SMD(type B)



2.DIP(type C)

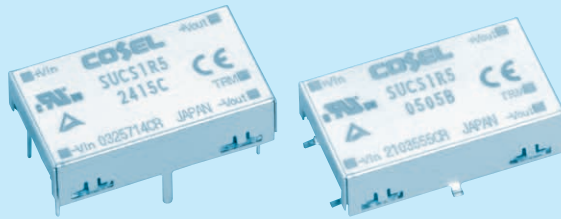
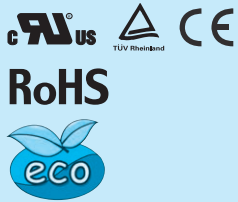


- ※ Tolerance ±0.5 [±0.02]
- ※ Dimensions in mm, []=inches
- ※ Pin terminal thickness : 0.3±0.1 [0.012]
- ※ Pin terminal material : Copper alloy
- ※ Plating treatment of terminal : Lead free plating
- ※ Weight : 6g max

SUCS1R5

SUC S 1R5 12 05 B P -□

① ② ③ ④ ⑤ ⑥ ⑦ ⑧



- ① Series name
② Single output
③ Output wattage
④ Input voltage
⑤ Output voltage
⑥ Mounting type
B : SMD
C : DIP
⑦ Packing form
Blank: Plastic cover
P : Tray (SMD type)
⑧ Optional
C : with coating (only DIP type)*
*Safety standards are pending

MODEL	SUCS1R5053R3	SUCS1R50505	SUCS1R50512	SUCS1R50515	SUCS1R5123R3	SUCS1R51205	SUCS1R51212	SUCS1R51215
MAX OUTPUT WATTAGE[W]	1.32	1.5	1.56	1.5	1.32	1.5	1.56	1.5
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12
	CURRENT[A]	0.4	0.3	0.13	0.1	0.4	0.3	0.1

SPECIFICATIONS

	MODEL	SUCS1R5053R3	SUCS1R50505	SUCS1R50512	SUCS1R50515	SUCS1R5123R3	SUCS1R51205	SUCS1R51212	SUCS1R51215
INPUT	VOLTAGE[V]	DC4.5 - 9				DC9 - 18			
	CURRENT[A] *2	0.388typ	0.417typ	0.433typ	0.417typ	0.157typ	0.169typ	0.176typ	0.169typ
	EFFICIENCY[%] *2	68typ	72typ	72typ	72typ	70typ	74typ	74typ	74typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	0.4	0.3	0.13	0.1	0.4	0.3	0.13	0.1
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55°C *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20°C *3	120max	120max	150max	150max	120max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	120max	120max	150max	150max	120max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	50max	50max	150max	180max	50max	50max	150max
		-40 to +55°C	80max	80max	240max	290max	80max	80max	240max
	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
PROTECTION CIRCUIT AND OTHERS		OVERCURRENT PROTECTION Works over 105% of rating and recovers automatically							

MODEL	SUCS1R5243R3	SUCS1R52405	SUCS1R52412	SUCS1R52415	SUCS1R5483R3	SUCS1R54805	SUCS1R54812	SUCS1R54815
MAX OUTPUT WATTAGE[W]	1.32	1.5	1.56	1.5	1.32	1.5	1.56	1.5
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12
	CURRENT[A]	0.4	0.3	0.13	0.1	0.4	0.3	0.1

SPECIFICATIONS

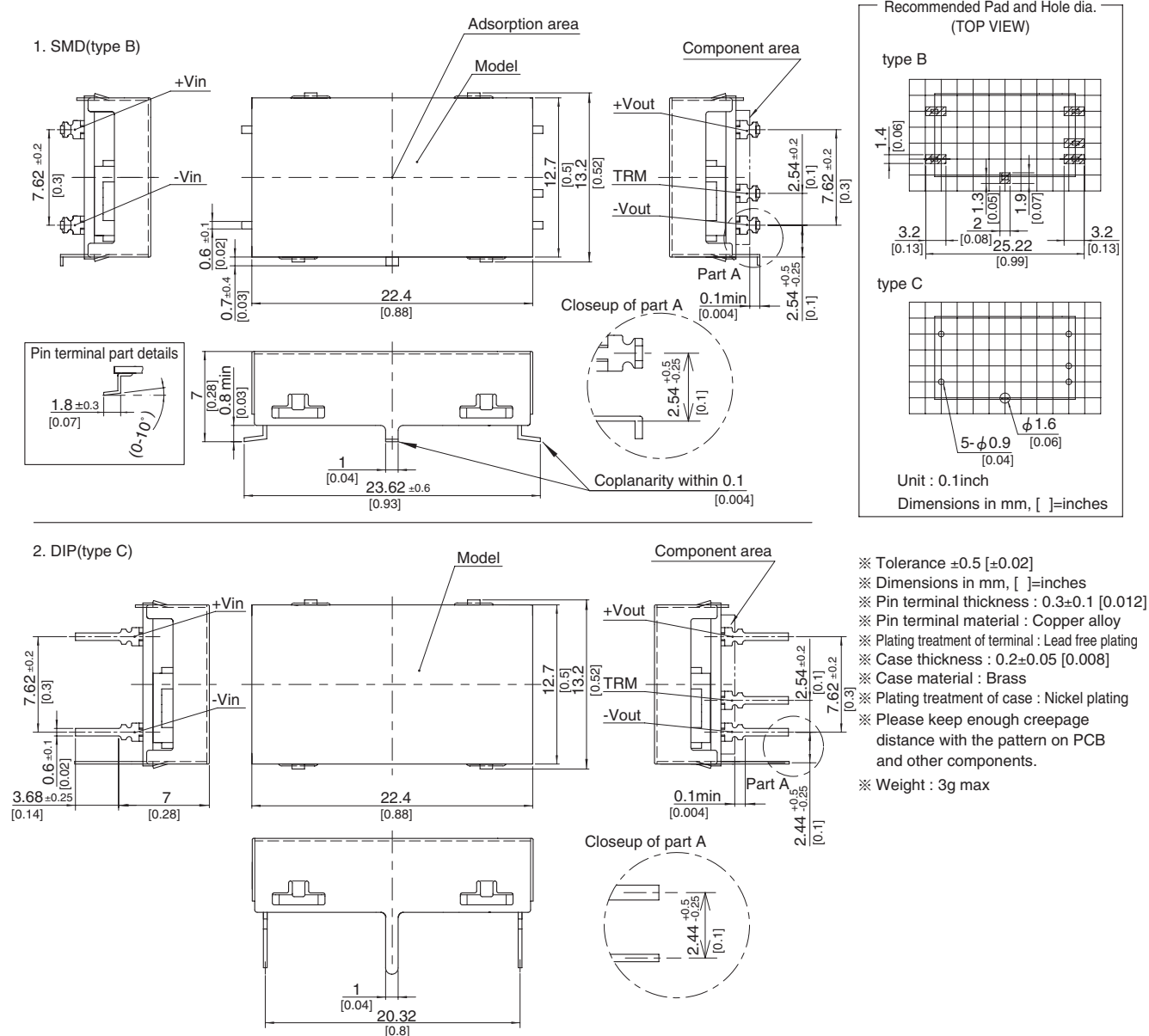
	MODEL	SUCS1R5243R3	SUCS1R52405	SUCS1R52412	SUCS1R52415	SUCS1R5483R3	SUCS1R54805	SUCS1R54812	SUCS1R54815
INPUT	VOLTAGE[V]	DC18 - 36				DC36 - 76			
	CURRENT[A] *2	0.079typ	0.084typ	0.087typ	0.083typ	0.039typ	0.042typ	0.043typ	0.042typ
	EFFICIENCY[%] *2	70typ	74typ	75typ	75typ	70typ	74typ	75typ	75typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	0.4	0.3	0.13	0.1	0.4	0.3	0.13	0.1
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55°C *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20°C *3	120max	120max	150max	150max	120max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	120max	120max	150max	150max	120max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	50max	50max	150max	180max	50max	50max	150max
		-40 to +55°C	80max	80max	240max	290max	80max	80max	240max
	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
PROTECTION CIRCUIT AND OTHERS		OVERCURRENT PROTECTION Works over 105% of rating and recovers automatically							

GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
	INPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
	OUTPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 98.0m/s 2 (10G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s 2 (50G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	22.4 \times 7.0 \times 13.2mm [0.88 \times 0.28 \times 0.52 inches] (W \times H \times D) / 3g max
	COOLING METHOD	Convection/Forced air

- *1 SUCW1R5xx12/SUCW1R5xx15 is available as single output, +24V/+30V.
- *2 Rated input 5V, 12V, 24V or 48V DC $I_o=100\%$
- *3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.
- *4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.
- * Parallel operation with other model is not possible.

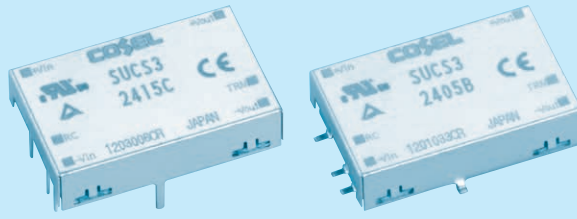
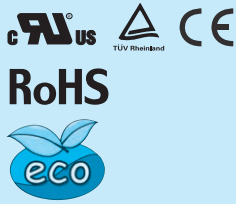
External view



SUCS3

SUC S 3 12 05 B P - ☐

① ② ③ ④ ⑤ ⑥ ⑦ ⑧



- ① Series name
② Single output
③ Output wattage
④ Input voltage
⑤ Output voltage
⑥ Mounting type
B : SMD
C : DIP
⑦ Packing form
Blank: Plastic cover
P : Tray (SMD type)
- ⑧ Optional
G : Capacitor between Input and Output is removed.
C : with coating (only DIP type)*
* Safety standards are pending

MODEL	SUCS3053R3	SUCS30505	SUCS30512	SUCS30515	SUCS3123R3	SUCS31205	SUCS31212	SUCS31215
MAX OUTPUT WATTAGE[W]	1.98	3	3	3	1.98	3	3	3
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12
	CURRENT[A]	0.6	0.6	0.25	0.2	0.6	0.6	0.25

SPECIFICATIONS

	MODEL	SUCS3053R3	SUCS30505	SUCS30512	SUCS30515	SUCS3123R3	SUCS31205	SUCS31212	SUCS31215
INPUT	VOLTAGE[V]	DC4.5 - 9				DC9 - 18			
	CURRENT[A] *2	0.550typ	0.800typ	0.780typ	0.780typ	0.223typ	0.325typ	0.317typ	0.321typ
	EFFICIENCY[%] *2	72typ	75typ	77typ	77typ	74typ	77typ	79typ	78typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	0.6	0.6	0.25	0.2	0.6	0.6	0.25	0.2
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55°C *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20°C *3	120max	120max	150max	150max	120max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	120max	120max	150max	150max	120max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	50max	50max	150max	180max	50max	50max	150max
		-40 to +55°C	80max	80max	240max	290max	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

MODEL	SUCS3243R3	SUCS32405	SUCS32412	SUCS32415	SUCS3483R3	SUCS34805	SUCS34812	SUCS34815
MAX OUTPUT WATTAGE[W]	1.98	3	3	3	1.98	3	3	3
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12
	CURRENT[A]	0.6	0.6	0.25	0.2	0.6	0.6	0.25

SPECIFICATIONS

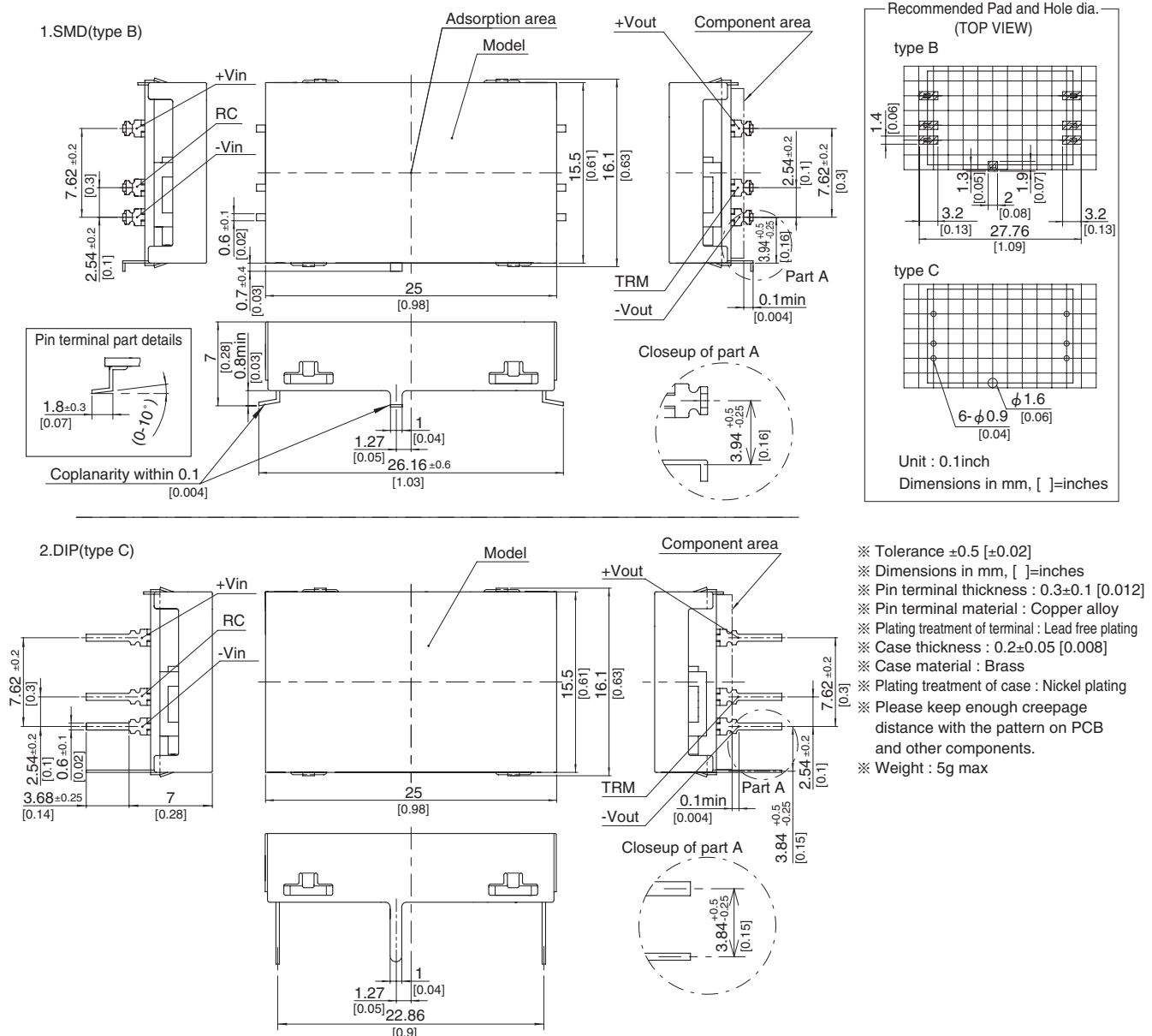
	MODEL	SUCS3243R3	SUCS32405	SUCS32412	SUCS32415	SUCS3483R3	SUCS34805	SUCS34812	SUCS34815
INPUT	VOLTAGE[V]	DC18 - 36				DC36 - 76			
	CURRENT[A] *2	0.114typ	0.163typ	0.159typ	0.161typ	0.057typ	0.082typ	0.080typ	0.080typ
	EFFICIENCY[%] *2	73typ	77typ	79typ	78typ	72typ	77typ	79typ	79typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	0.6	0.6	0.25	0.2	0.6	0.6	0.25	0.2
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55°C *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20°C *3	120max	120max	150max	150max	120max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	120max	120max	150max	150max	120max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	50max	50max	150max	180max	50max	50max	150max
		-40 to +55°C	80max	80max	240max	290max	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
	INPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
	OUTPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP.HUMID.AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max
	STORAGE TEMP.HUMID.AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	25 \times 7.0 \times 16.1mm [0.98 \times 0.28 \times 0.63 inches] (W \times H \times D) / 5g max
	COOLING METHOD	Convection/Forced air

- *1 SUCW3xx12/SUCW3xx15 is available as single output, +24V/+30V.
- *2 Rated input 5V, 12V, 24V or 48V DC I_o=100%
- *3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.
- *4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.
- * Parallel operation with other model is not possible.

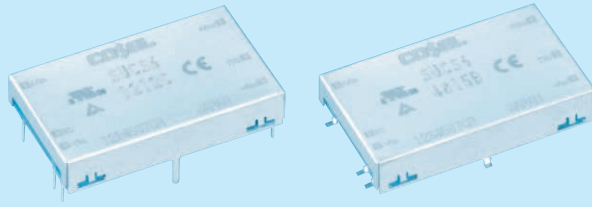
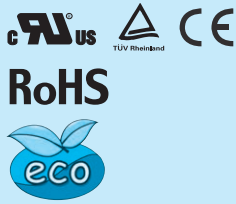
External view



SUCS6

SUC S 6 12 05 B P - ☐

① ② ③ ④ ⑤ ⑥ ⑦ ⑧



- ① Series name
② Single output
③ Output wattage
④ Input voltage
⑤ Output voltage
⑥ Mounting type
B : SMD
C : DIP
⑦ Packing form
Blank: Plastic cover
P : Tray (SMD type)
- ⑧ Optional
G : Capacitor between Input and Output is removed.
C : with coating (only DIP type)*
* Safety standards are pending

MODEL	SUCS6053R3	SUCS60505	SUCS60512	SUCS60515	SUCS6123R3	SUCS61205	SUCS61212	SUCS61215
MAX OUTPUT WATTAGE[W]	3.96	5	6	6	4.46	6	6	6
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12
	CURRENT[A]	1.2	1	0.5	0.4	1.35	1.2	0.5

SPECIFICATIONS

	MODEL	SUCS6053R3	SUCS60505	SUCS60512	SUCS60515	SUCS6123R3	SUCS61205	SUCS61212	SUCS61215
INPUT	VOLTAGE[V]	DC4.5 - 9				DC9 - 18			
	CURRENT[A] *2	1.100typ	1.316typ	1.500typ	1.500typ	0.502typ	0.617typ	0.588typ	0.588typ
	EFFICIENCY[%] *2	72typ	76typ	80typ	80typ	74typ	81typ	85typ	85typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	1.2	1	0.5	0.4	1.35	1.2	0.5	0.4
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55°C *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20°C *3	120max	120max	150max	150max	120max	120max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	120max	120max	150max	150max	120max	120max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	50max	50max	150max	180max	50max	50max	150max
		-40 to +55°C	80max	80max	240max	290max	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

MODEL	SUCS6243R3	SUCS62405	SUCS62412	SUCS62415	SUCS6483R3	SUCS64805	SUCS64812	SUCS64815
MAX OUTPUT WATTAGE[W]	4.46	6	6	6	4.46	6	6	6
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12
	CURRENT[A]	1.35	1.2	0.5	0.4	1.35	1.2	0.5

SPECIFICATIONS

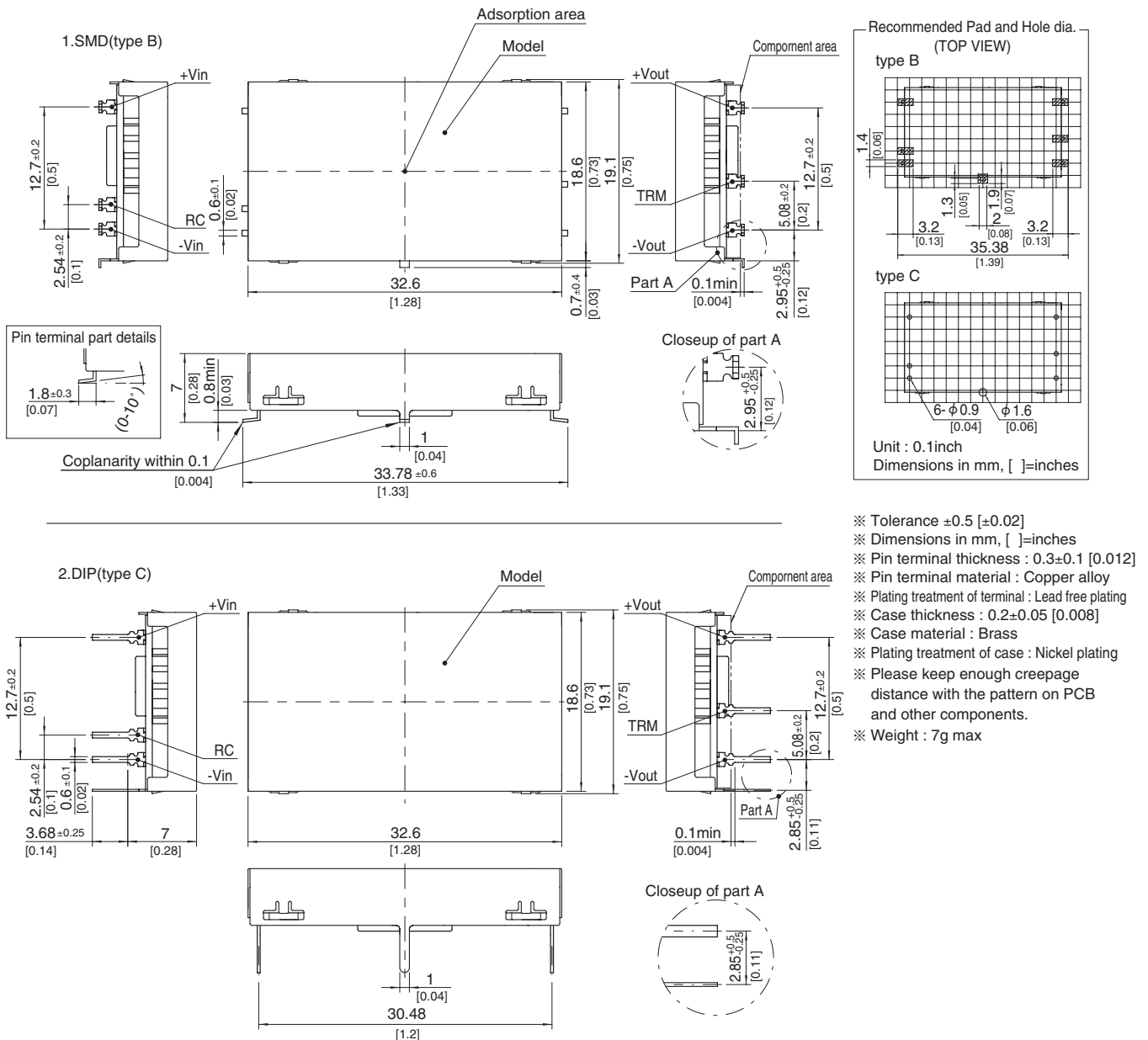
	MODEL	SUCS6243R3	SUCS62405	SUCS62412	SUCS62415	SUCS6483R3	SUCS64805	SUCS64812	SUCS64815
INPUT	VOLTAGE[V]	DC18 - 36				DC36 - 76			
	CURRENT[A] *2	0.248typ	0.309typ	0.291typ	0.291typ	0.121typ	0.154typ	0.145typ	0.145typ
	EFFICIENCY[%] *2	75typ	81typ	86typ	86typ	77typ	81typ	86typ	86typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	1.35	1.2	0.5	0.4	1.35	1.2	0.5	0.4
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55°C *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20°C *3	120max	120max	150max	150max	120max	120max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	120max	120max	150max	150max	120max	120max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	50max	50max	150max	180max	50max	50max	150max
		-40 to +55°C	80max	80max	240max	290max	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
	INPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
	OUTPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	32.6 \times 7.0 \times 19.1mm [1.28 \times 0.28 \times 0.75 inches] (W \times H \times D) / 7g max
	COOLING METHOD	Convection/Forced air

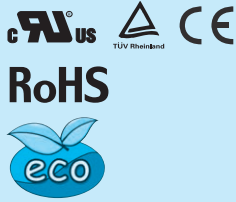
- *1 SUCW6xx12/SUCW6xx15 is available as single output, +24V/+30V.
- *2 Rated input 5V, 12V, 24V or 48V DC Io=100%
- *3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.
- *4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25 $^{\circ}$ C.
- * Parallel operation with other model is not possible.

External view



SUCS10

SUC S 10 12 05 B P - ☐



- ① Series name
② Single output
③ Output wattage
④ Input voltage
⑤ Output voltage
⑥ Mounting type
⑦ Packing form
⑧ Optional
G : Capacitor between Input and Output is removed.
C : with coating (only DIP type)*
* Safety standards are pending
- B : SMD
C : DIP
Blank: Plastic cover
P : Tray (SMD type)

MODEL	SUCS10053R3	SUCS100505	SUCS100512	SUCS100515	SUCS10123R3	SUCS101205	SUCS101212	SUCS101215
MAX OUTPUT WATTAGE[W]	8.58	10	10.8	10.5	8.58	10	12	12
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12
	CURRENT[A]	2.6	2	0.9	0.7	2.6	2	0.8

SPECIFICATIONS

	MODEL	SUCS10053R3	SUCS100505	SUCS100512	SUCS100515	SUCS10123R3	SUCS101205	SUCS101212	SUCS101215
INPUT	VOLTAGE[V]	DC4.5 - 9				DC9 - 18			
	CURRENT[A] *2	2.12typ	2.41typ	2.54typ	2.47typ	0.872typ	0.980typ	1.15typ	1.15typ
	EFFICIENCY[%] *2	81typ	83typ	85typ	85typ	82typ	85typ	87typ	87typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	2.6	2	0.9	0.7	2.6	2	1	0.8
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55°C *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20°C *3	120max	120max	150max	150max	120max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	120max	120max	150max	150max	120max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	50max	50max	150max	180max	50max	50max	150max
		-40 to +55°C	80max	80max	240max	290max	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

MODEL	SUCS10243R3	SUCS102405	SUCS102412	SUCS102415	SUCS10483R3	SUCS104805	SUCS104812	SUCS104815
MAX OUTPUT WATTAGE[W]	8.58	10	12	12	8.58	10	12	12
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12
	CURRENT[A]	2.6	2	1	0.8	2.6	2	0.8

SPECIFICATIONS

	MODEL	SUCS10243R3	SUCS102405	SUCS102412	SUCS102415	SUCS10483R3	SUCS104805	SUCS104812	SUCS104815
INPUT	VOLTAGE[V]	DC18 - 36				DC36 - 76			
	CURRENT[A] *2	0.436typ	0.490typ	0.575typ	0.575typ	0.218typ	0.245typ	0.287typ	0.287typ
	EFFICIENCY[%] *2	82typ	85typ	87typ	87typ	82typ	85typ	87typ	87typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	2.6	2	1	0.8	2.6	2	1	0.8
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55°C *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20°C *3	120max	120max	150max	150max	120max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	120max	120max	150max	150max	120max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	50max	50max	150max	180max	50max	50max	150max
		-40 to +55°C	80max	80max	240max	290max	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

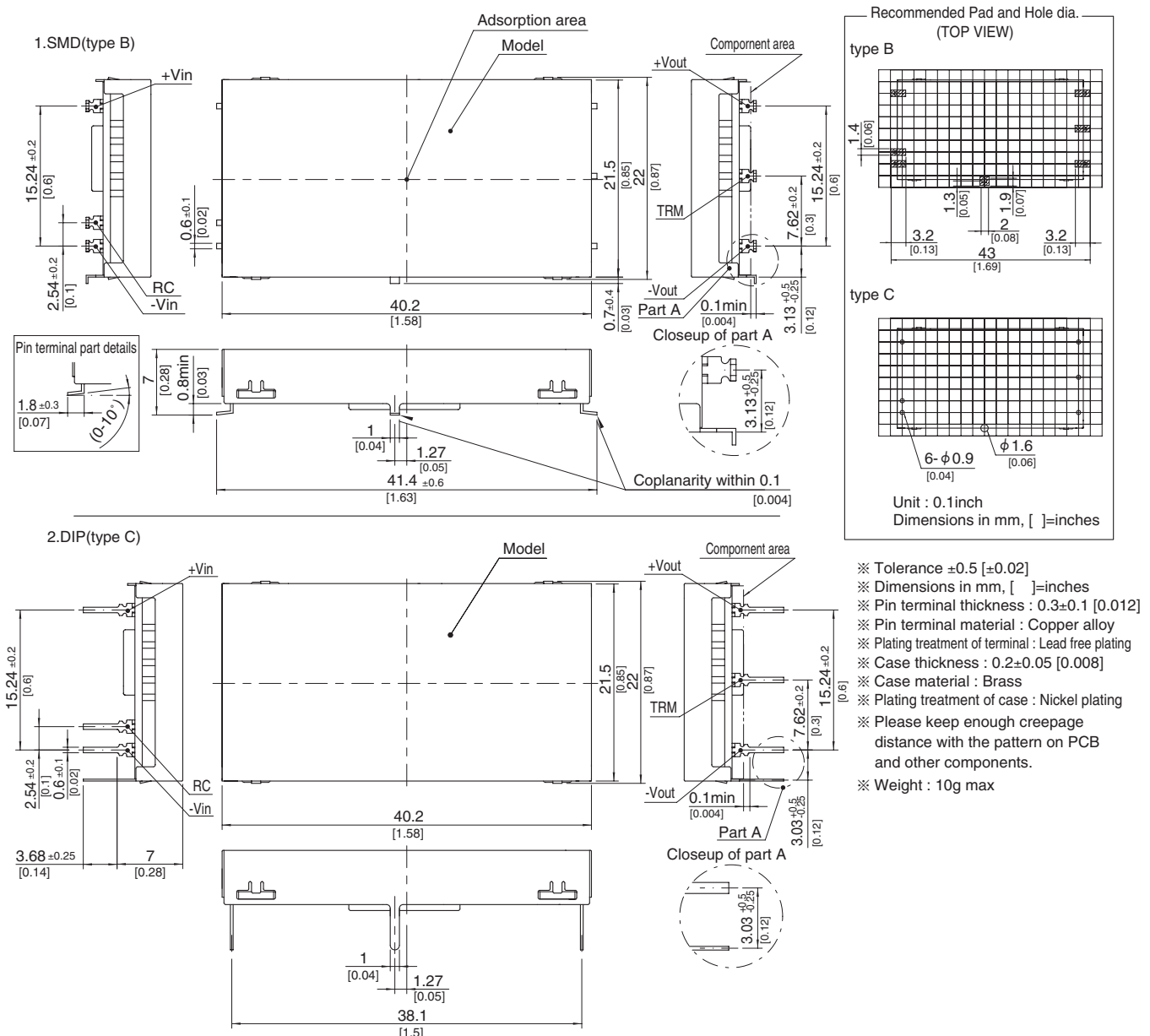
GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
	INPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
	OUTPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 98.0m/s 2 (10G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s 2 (50G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	40.2 \times 7.0 \times 22.0mm [1.58 \times 0.28 \times 0.87 inches] (W \times H \times D) / 10g max
	COOLING METHOD	Convection/Forced air

- *1 SUCW10xx12/SUCW10xx15 is available as single output, +24V/+30V.
- *2 Rated input 5V, 12V, 24V or 48V DC Io=100%
- *3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.
- *4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25 $^{\circ}$ C.
- * Parallel operation with other model is not possible.

External view

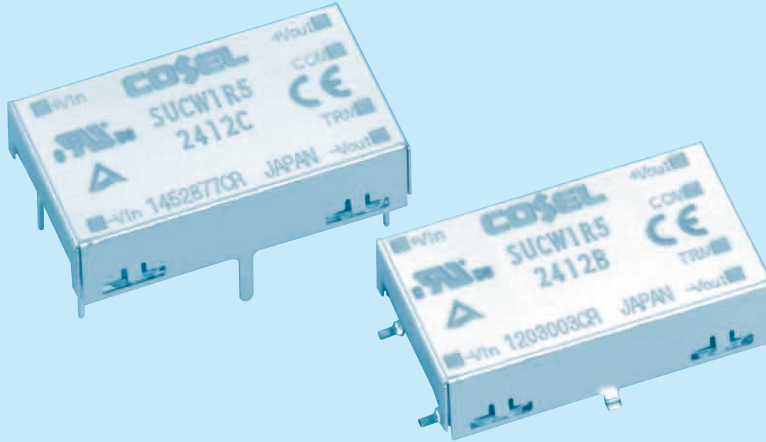
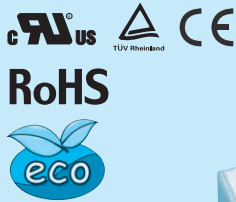
SUCSUT



SUCW1R5

SUC W 1R5 12 12 B P - ☐

① ② ③ ④ ⑤ ⑥ ⑦ ⑧



- ① Series name
 - ② Dual output
 - ③ Output wattage
 - ④ Input voltage
 - ⑤ Output voltage
 - ⑥ Mounting type
B : SMD
C : DIP
 - ⑦ Packing form
Blank: Plastic cover
P : Tray (SMD type)
 - ⑧ Optional
C : with coating (only DIP type)*
- * Safety standards are pending

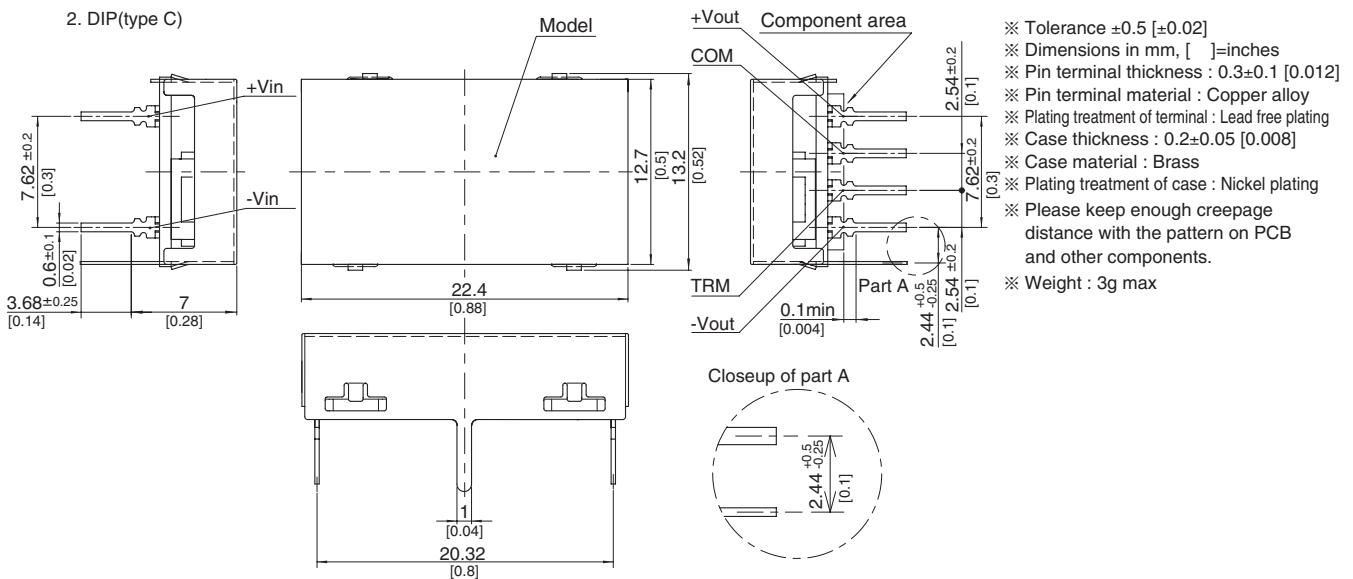
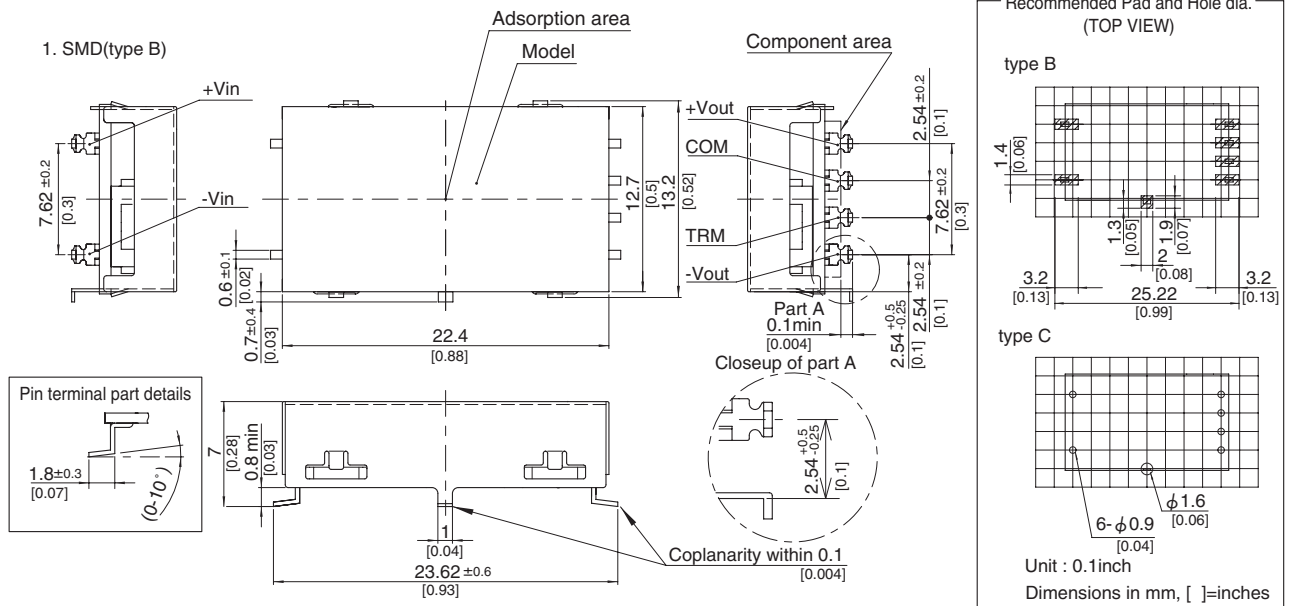
MODEL		SUCW1R50512	SUCW1R50515	SUCW1R51212	SUCW1R51215	SUCW1R52412	SUCW1R52415	SUCW1R54812	SUCW1R54815
MAX OUTPUT WATTAGE[W]		1.56	1.5	1.56	1.5	1.56	1.5	1.56	1.5
DC OUTPUT	VOLTAGE[V]※1	±12 or +24	±15 or +30	±12 or +24	±15 or +30	±12 or +24	±15 or +30	±12 or +24	±15 or +30
	CURRENT[A]	0.065	0.05	0.065	0.05	0.065	0.05	0.065	0.05

SPECIFICATIONS

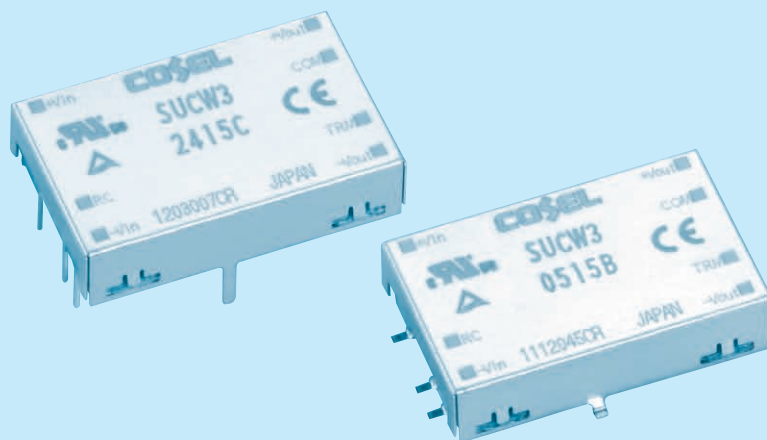
	MODEL	SUCW1R50512	SUCW1R50515	SUCW1R51212	SUCW1R51215	SUCW1R52412	SUCW1R52415	SUCW1R54812	SUCW1R54815
INPUT	VOLTAGE[V]	DC4.5 - 9		DC9 - 18		DC18 - 36		DC36 - 76	
	CURRENT[A] *2	0.446typ	0.429typ	0.178typ	0.171typ	0.089typ	0.086typ	0.045typ	0.043typ
	EFFICIENCY[%] *2	70typ	70typ	73typ	73typ	73typ	73typ	73typ	73typ
OUTPUT	VOLTAGE[V]	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)
	CURRENT[A]	0.065	0.05	0.065	0.05	0.065	0.05	0.065	0.05
	LINE REGULATION[mV]	60max	75max	60max	75max	60max	75max	60max	75max
	LOAD REGULATION[mV]	600max	750max	600max	750max	600max	750max	600max	750max
	RIPPLE[mVp-p]	-20 to +55°C *3	120max	120max	120max	120max	120max	120max	120max
		-40 to -20°C *3	150max	150max	150max	150max	150max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	150max	150max	150max	150max	150max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	150max	180max	150max	180max	150max	180max	150max
		-40 to +55°C	240max	290max	240max	290max	240max	290max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	50max	60max	50max	60max	50max	60max	50max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±5%)	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
ISOLATION	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	INPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	OUTPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max							
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis							
	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis							
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1							
OTHERS	CASE SIZE/WEIGHT	22.4 × 7.0 × 13.2mm [0.88 × 0.28 × 0.52 inches] (W × H × D) / 3g max							
	COOLING METHOD	Convection/Forced air							

- *1 Output pins can be connected in series to make a 24V/30V output.
- *2 Rated input 5V, 12V, 24V or 48V DC Io=100%
- *3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.
- *4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.
- * Parallel operation with other model is not possible.

External view



- ※ Tolerance ± 0.5 [± 0.02]
- ※ Dimensions in mm, [] =inches
- ※ Pin terminal thickness : 0.3 ± 0.1 [0.012]
- ※ Pin terminal material : Copper alloy
- ※ Plating treatment of terminal : Lead free plating
- ※ Case thickness : 0.2 ± 0.05 [0.008]
- ※ Case material : Brass
- ※ Plating treatment of case : Nickel plating
- ※ Please keep enough creepage distance with the pattern on PCB and other components.
- ※ Weight : 3g max



- ① Series name
 - ② Dual output
 - ③ Output wattage
 - ④ Input voltage
 - ⑤ Output voltage
 - ⑥ Mounting type
B : SMD
C : DIP
 - ⑦ Packing form
Blank: Plastic cover
P : Tray (SMD type)
 - ⑧ Optional
G : Capacitor between Input and Output is removed.
C : with coating (only DIP type)*
- * Safety standards are pending

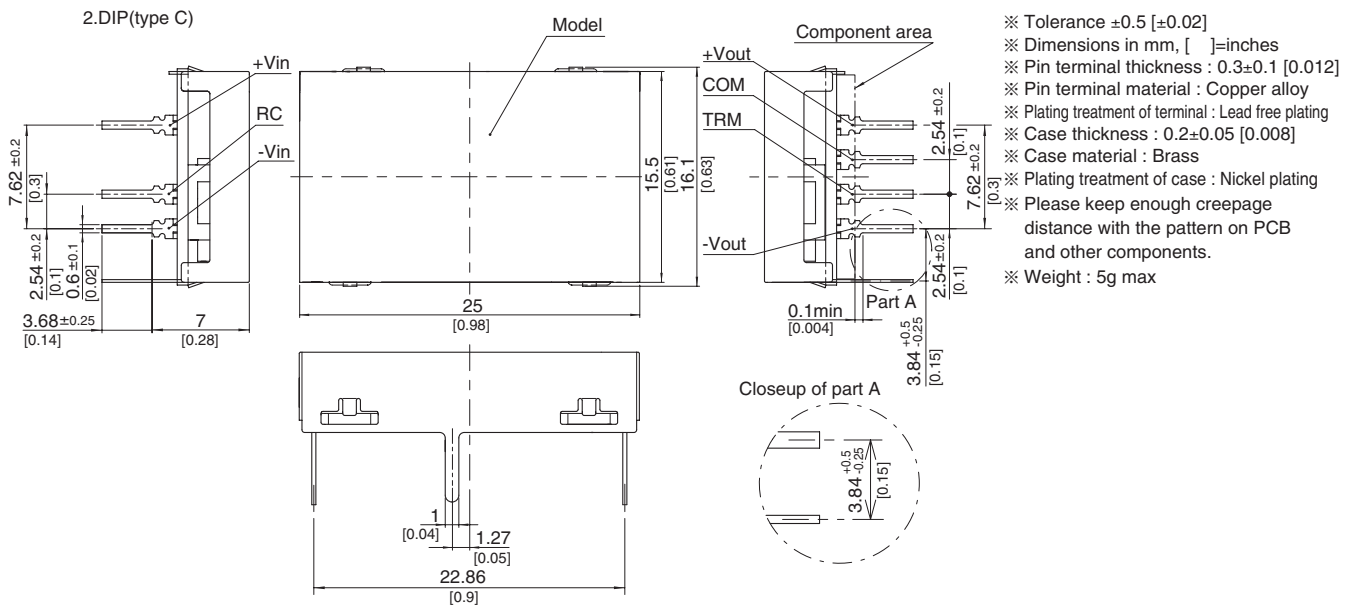
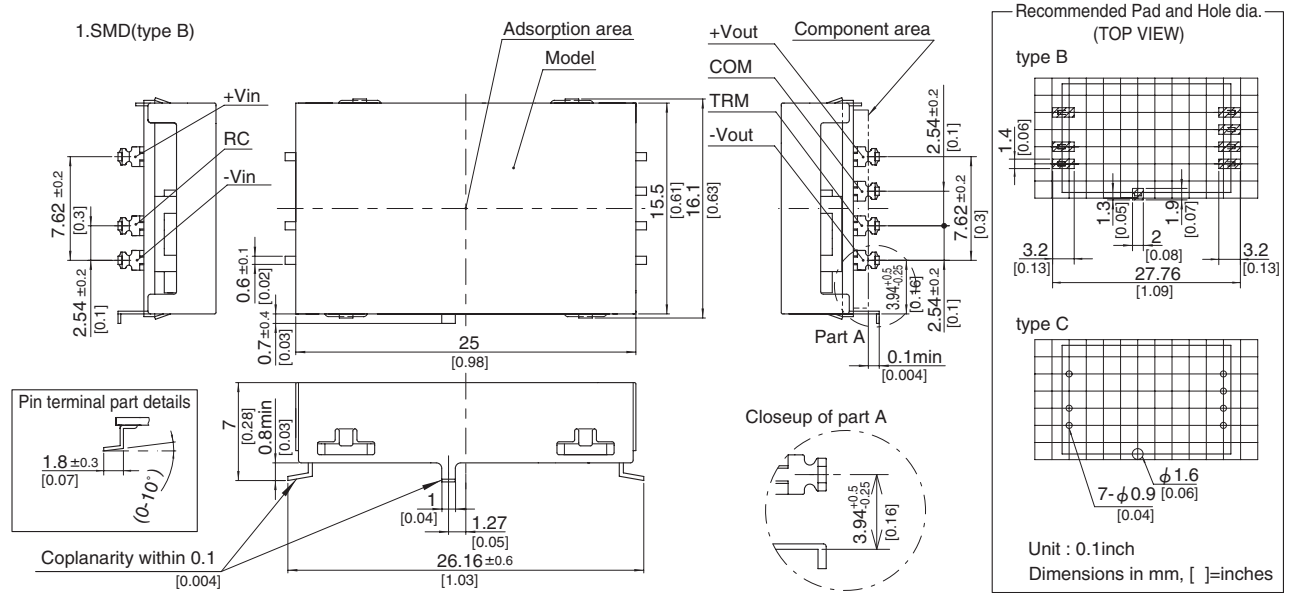
MODEL	SUCW30512	SUCW30515	SUCW31212	SUCW31215	SUCW32412	SUCW32415	SUCW34812	SUCW34815
MAX OUTPUT WATTAGE[W]	3.12	3	3.12	3	3.12	3	3.12	3
DC OUTPUT	VOLTAGE[V] *1	± 12 or +24	± 15 or +30	± 12 or +24	± 15 or +30	± 12 or +24	± 15 or +30	± 12 or +24
	CURRENT[A]	0.13	0.1	0.13	0.1	0.13	0.1	0.13

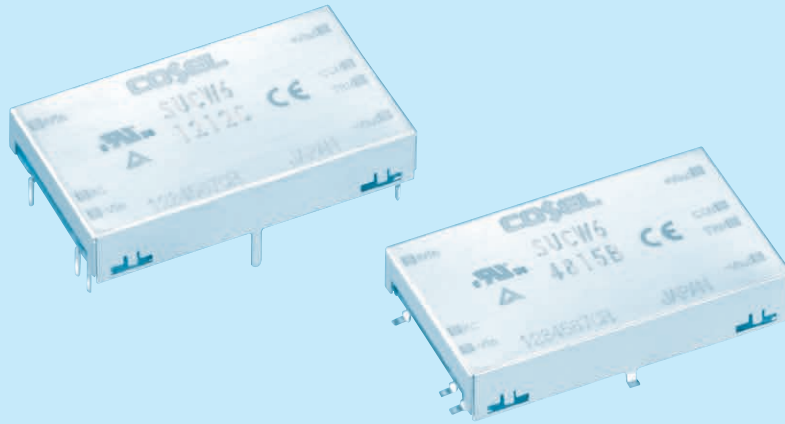
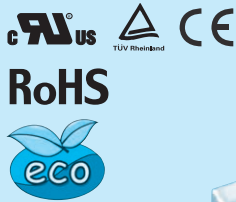
SPECIFICATIONS

	MODEL	SUCW30512	SUCW30515	SUCW31212	SUCW31215	SUCW32412	SUCW32415	SUCW34812	SUCW34815
INPUT	VOLTAGE[V]	DC4.5 - 9		DC9 - 18		DC18 - 36		DC36 - 76	
	CURRENT[A] *2	0.844typ	0.811typ	0.343typ	0.329typ	0.172typ	0.165typ	0.086typ	0.083typ
	EFFICIENCY[%] *2	74typ	74typ	76typ	76typ	76typ	76typ	76typ	76typ
OUTPUT	VOLTAGE[V]	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)
	CURRENT[A]	0.13	0.1	0.13	0.1	0.13	0.1	0.13	0.1
	LINE REGULATION[mV]	60max	75max	60max	75max	60max	75max	60max	75max
	LOAD REGULATION[mV]	600max	750max	600max	750max	600max	750max	600max	750max
	RIPPLE[mVp-p]	-20 to +55°C *3	120max	120max	120max	120max	120max	120max	120max
		-40 to -20°C *3	150max	150max	150max	150max	150max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	150max	150max	150max	150max	150max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	150max	180max	150max	180max	150max	180max	150max
		-40 to +55°C	240max	290max	240max	290max	240max	290max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	50max	60max	50max	60max	50max	60max	50max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±5%)	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
ISOLATION	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							
	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	INPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
ENVIRONMENT	OUTPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max							
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis							
SAFETY	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis							
	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1							
OTHERS	CASE SIZE/WEIGHT	25 × 7.0 × 16.1mm [0.98 × 0.28 × 0.63 inches] (W × H × D) / 5g max							
	COOLING METHOD	Convection/Forced air							

- *1 Output pins can be connected in series to make a 24V/30V output.
- *2 Rated input 5V, 12V, 24V or 48V DC Io=100%
- *3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.
- *4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.
- * Parallel operation with other model is not possible.

External view





- ① Series name
 - ② Dual output
 - ③ Output wattage
 - ④ Input voltage
 - ⑤ Output voltage
 - ⑥ Mounting type
B : SMD
C : DIP
 - ⑦ Packing form
Blank: Plastic cover
P : Tray (SMD type)
 - ⑧ Optional
G : Capacitor between Input and Output is removed.
C : with coating (only DIP type)*
- * Safety standards are pending

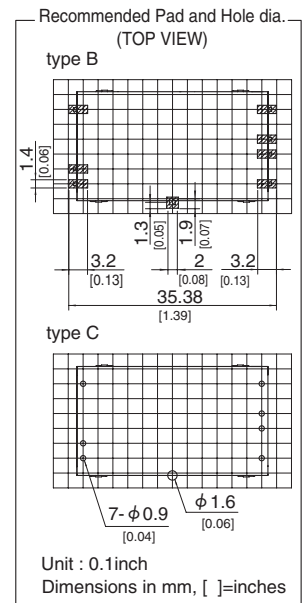
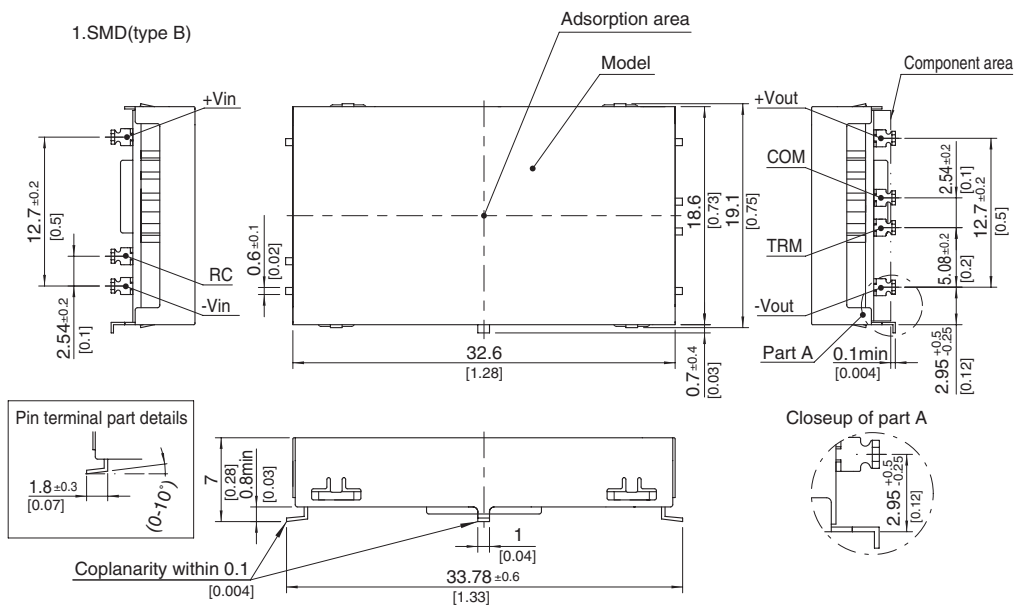
MODEL		SUCW60512	SUCW60515	SUCW61212	SUCW61215	SUCW62412	SUCW62415	SUCW64812	SUCW64815
MAX OUTPUT WATTAGE[W]		6	6	6	6	6	6	6	6
DC OUTPUT	VOLTAGE[V] *1	± 12 or +24	± 15 or +30	± 12 or +24	± 15 or +30	± 12 or +24	± 15 or +30	± 12 or +24	± 15 or +30
	CURRENT[A]	0.25	0.2	0.25	0.2	0.25	0.2	0.25	0.2

SPECIFICATIONS

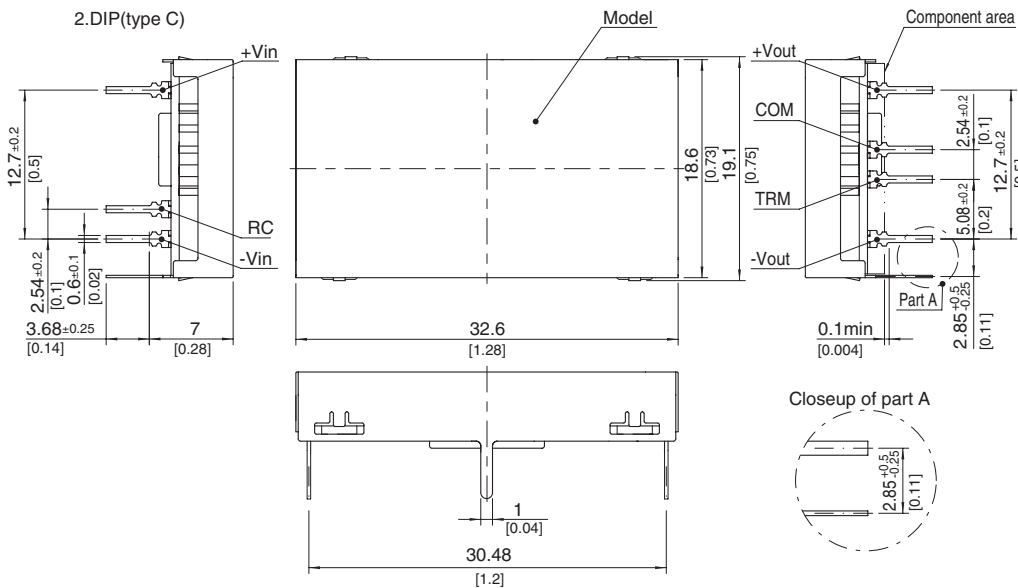
	MODEL	SUCW60512	SUCW60515	SUCW61212	SUCW61215	SUCW62412	SUCW62415	SUCW64812	SUCW64815
INPUT	VOLTAGE[V]	DC4.5 - 9		DC9 - 18		DC18 - 36		DC36 - 76	
	CURRENT[A] *2	1.538typ	1.538typ	0.588typ	0.588typ	0.291typ	0.291typ	0.145typ	0.145typ
	EFFICIENCY[%] *2	78typ	78typ	85typ	85typ	86typ	86typ	86typ	86typ
OUTPUT	VOLTAGE[V]	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)
	CURRENT[A]	0.25	0.2	0.25	0.2	0.25	0.2	0.25	0.2
	LINE REGULATION[mV]	60max	75max	60max	75max	60max	75max	60max	75max
	LOAD REGULATION[mV]	600max	750max	600max	750max	600max	750max	600max	750max
	RIPPLE[mVp-p]	-20 to +55°C *3	120max	120max	120max	120max	120max	120max	120max
		-40 to -20°C *3	150max	150max	150max	150max	150max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	150max	150max	150max	150max	150max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	150max	180max	150max	180max	150max	180max	150max
		-40 to +55°C	240max	290max	240max	290max	240max	290max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	50max	60max	50max	60max	50max	60max	50max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±5%)	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
ISOLATION	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							
	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	INPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
ENVIRONMENT	OUTPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max							
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis							
SAFETY	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis							
	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1							
OTHERS	CASE SIZE/WEIGHT	32.6 × 7.0 × 19.1mm [1.28 × 0.28 × 0.75 inches] (W × H × D) / 7g max							
	COOLING METHOD	Convection/Forced air							

*1 Output pins can be connected in series to make a 24V/30V output.
 *2 Rated input 5V, 12V, 24V or 48V DC Io=100%
 *3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.
 *4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.
 * Parallel operation with other model is not possible.

External view



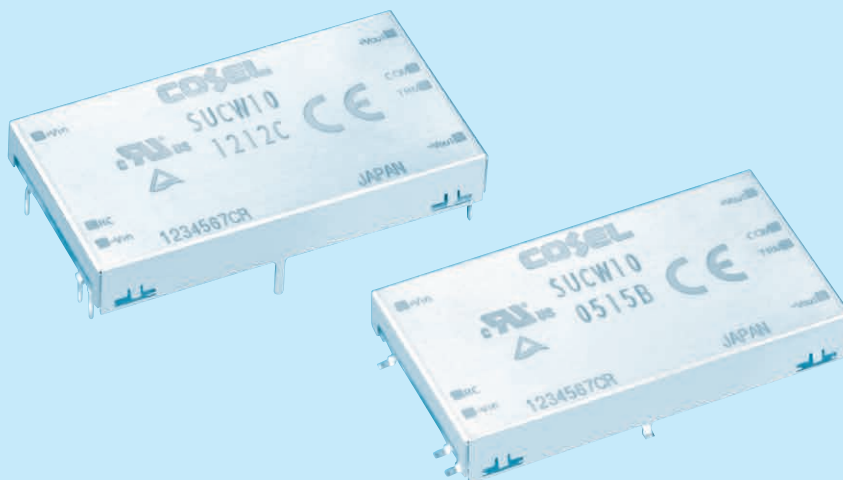
SU-SUC/SUT



- ※ Tolerance ± 0.5 [± 0.02]
- ※ Dimensions in mm, []=inches
- ※ Pin terminal thickness: 0.3 ± 0.1 [0.012]
- ※ Pin terminal material: Copper alloy
- ※ Plating treatment of terminal: Lead free plating
- ※ Case thickness: 0.2 ± 0.05 [0.008]
- ※ Case material: Brass
- ※ Plating treatment of case: Nickel plating
- ※ Please keep enough creepage distance with the pattern on PCB and other components.
- ※ Weight : 7g max

SUC W 10 12 12 B P - ☐

① ② ③ ④ ⑤ ⑥ ⑦ ⑧



- ① Series name
 - ② Dual output
 - ③ Output wattage
 - ④ Input voltage
 - ⑤ Output voltage
 - ⑥ Mounting type
B : SMD
C : DIP
 - ⑦ Packing form
Blank: Plastic cover
P : Tray (SMD type)
 - ⑧ Optional
G : Capacitor between Input and Output is removed.
C : with coating (only DIP type)*
- * Safety standards are pending

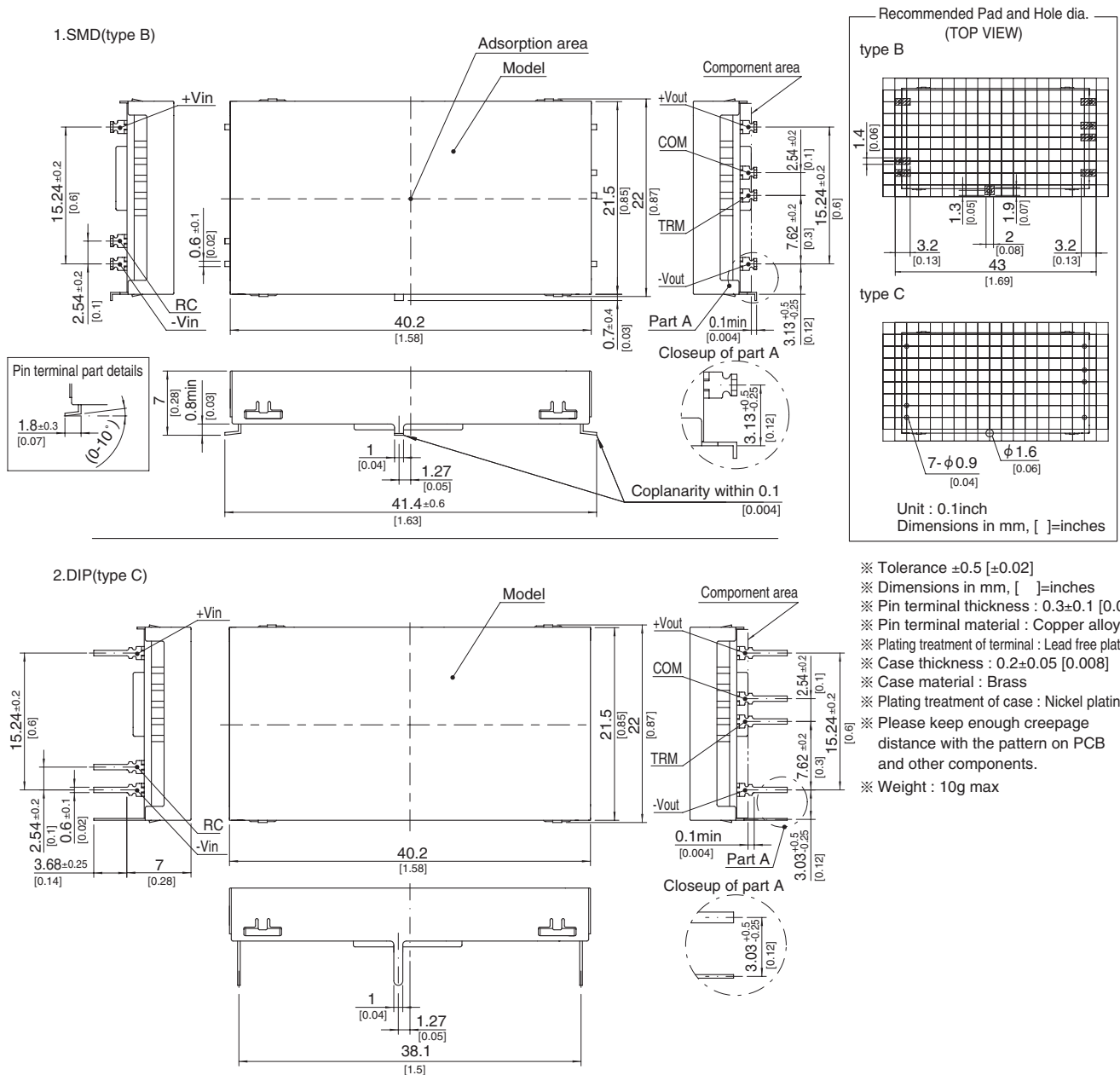
MODEL	SUCW100512	SUCW100515	SUCW101212	SUCW101215	SUCW102412	SUCW102415	SUCW104812	SUCW104815
MAX OUTPUT WATTAGE[W]	10.8	10.5	10.8	10.5	10.8	10.5	10.8	10.5
DC OUTPUT	VOLTAGE[V] *1	± 12 or +24	± 15 or +30	± 12 or +24	± 15 or +30	± 12 or +24	± 15 or +30	± 12 or +24
	CURRENT[A]	0.45	0.35	0.45	0.35	0.45	0.35	0.45

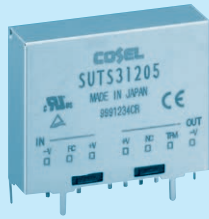
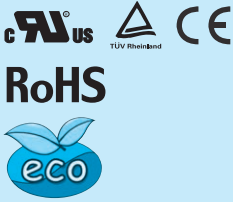
SPECIFICATIONS

	MODEL	SUCW100512	SUCW100515	SUCW101212	SUCW101215	SUCW102412	SUCW102415	SUCW104812	SUCW104815
INPUT	VOLTAGE[V]	DC4.5 - 9		DC9 - 18		DC18 - 36		DC36 - 76	
	CURRENT[A] *2	2.51typ	2.44typ	1.05typ	1.02typ	0.523typ	0.509typ	0.262typ	0.254typ
	EFFICIENCY[%] *2	86typ	86typ	86typ	86typ	86typ	86typ	86typ	86typ
OUTPUT	VOLTAGE[V]	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)
	CURRENT[A]	0.45	0.35	0.45	0.35	0.45	0.35	0.45	0.35
	LINE REGULATION[mV]	60max	75max	60max	75max	60max	75max	60max	75max
	LOAD REGULATION[mV]	600max	750max	600max	750max	600max	750max	600max	750max
	RIPPLE[mVp-p]	-20 to +55°C *3	120max	120max	120max	120max	120max	120max	120max
		-40 to -20°C *3	150max	150max	150max	150max	150max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	150max	150max	150max	150max	150max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	150max	180max	150max	180max	150max	180max	150max
		-40 to +55°C	240max	290max	240max	290max	240max	290max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	50max	60max	50max	60max	50max	60max	50max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±5%)	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
ISOLATION	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							
	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	INPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
ENVIRONMENT	OUTPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max							
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis							
SAFETY	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis							
	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1							
OTHERS	CASE SIZE/WEIGHT	40.2 × 7.0 × 22.0mm [1.58 × 0.28 × 0.87 inches] (W × H × D) / 10g max							
	COOLING METHOD	Convection/Forced air							

- *1 Output pins can be connected in series to make a 24V/30V output.
- *2 Rated input 5V, 12V, 24V or 48V DC Io=100%
- *3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.
- *4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.
- * Parallel operation with other model is not possible.

External view





- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage
- ⑥ Optional
- G :Capacitor between Input and Output is removed.

MODEL	SUTS3053R3	SUTS30505	SUTS30512	SUTS30515	SUTS3123R3	SUTS31205	SUTS31212	SUTS31215
MAX OUTPUT WATTAGE[W]	1.98	3	3	3	1.98	3	3	3
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12
	CURRENT[A]	0.6	0.6	0.25	0.2	0.6	0.6	0.25

SPECIFICATIONS

	MODEL	SUTS3053R3	SUTS30505	SUTS30512	SUTS30515	SUTS3123R3	SUTS31205	SUTS31212	SUTS31215
INPUT	VOLTAGE[V]	DC4.5 - 9				DC9 - 18			
	CURRENT[A] *2	0.550typ	0.800typ	0.780typ	0.780typ	0.223typ	0.325typ	0.317typ	0.321typ
	EFFICIENCY[%] *2	72typ	75typ	77typ	77typ	74typ	77typ	79typ	78typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	0.6	0.6	0.25	0.2	0.6	0.6	0.25	0.2
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55℃ *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20℃ *3	120max	120max	150max	150max	120max	120max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55℃ *3	120max	120max	150max	150max	120max	120max	150max
		-40 to -20℃ *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55℃	50max	50max	150max	180max	50max	50max	150max
		-40 to +55℃	80max	80max	240max	290max	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

MODEL	SUTS3243R3	SUTS32405	SUTS32412	SUTS32415	SUTS3483R3	SUTS34805	SUTS34812	SUTS34815
MAX OUTPUT WATTAGE[W]	1.98	3	3	3	1.98	3	3	3
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12
	CURRENT[A]	0.6	0.6	0.25	0.2	0.6	0.6	0.25

SPECIFICATIONS

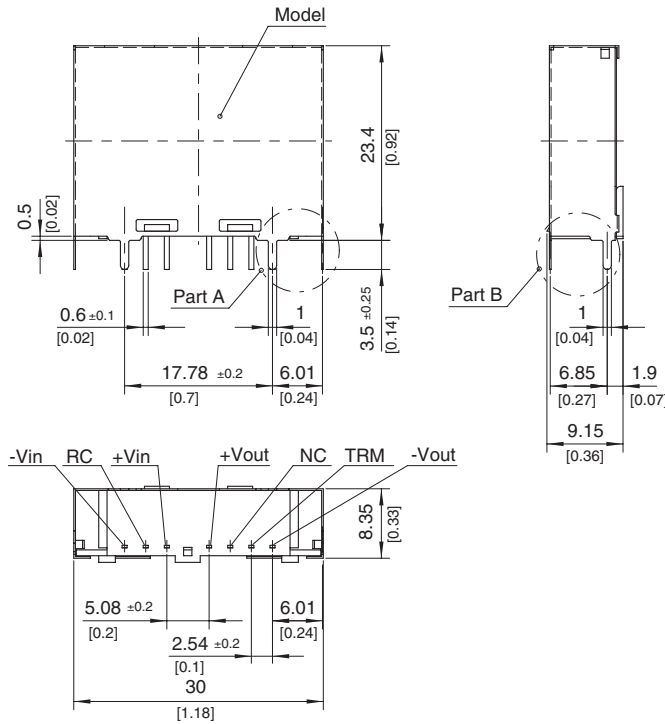
	MODEL	SUTS3243R3	SUTS32405	SUTS32412	SUTS32415	SUTS3483R3	SUTS34805	SUTS34812	SUTS34815
INPUT	VOLTAGE[V]	DC18 - 36				DC36 - 76			
	CURRENT[A] *2	0.114typ	0.163typ	0.159typ	0.161typ	0.057typ	0.082typ	0.080typ	0.080typ
	EFFICIENCY[%] *2	73typ	77typ	79typ	78typ	72typ	77typ	79typ	79typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	0.6	0.6	0.25	0.2	0.6	0.6	0.25	0.2
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55℃ *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20℃ *3	120max	120max	150max	150max	120max	120max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55℃ *3	120max	120max	150max	150max	120max	120max	150max
		-40 to -20℃ *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55℃	50max	50max	150max	180max	50max	50max	150max
		-40 to +55℃	80max	80max	240max	290max	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

GENERAL SPECIFICATIONS

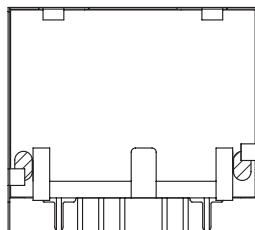
ISOLATION	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
	INPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
	OUTPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 98.0m/s 2 (10G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s 2 (50G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	30.0 \times 23.4 \times 9.15mm [1.18 \times 0.92 \times 0.36 inches] (W \times H \times D) / 8g max
	COOLING METHOD	Convection/Forced air

- *1 SUTW3xx12/SUTW3xx15 is available as single output, +24V/+30V.
 *2 Rated input 5V, 12V, 24V or 48V DC Io=100%
 *3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.
 *4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25 $^{\circ}$ C.
 * Parallel operation with other model is not possible.

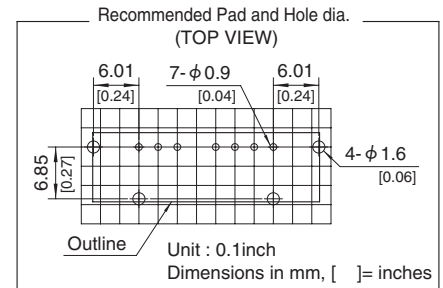
External view



※ Back View

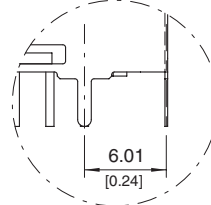


▨ : Conduction Area

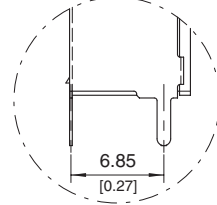


- ※ Tolerance ± 0.5 [± 0.02]
 ※ Dimensions in mm, [] = inches
 ※ Pin terminal thickness : 0.3 ± 0.1 [0.012]
 ※ Pin terminal material : Copper alloy
 ※ Plating treatment of terminal : Lead free plating
 ※ Case thickness : 0.2 ± 0.05 [0.008]
 ※ Case material : Brass
 ※ Plating treatment of case : Nickel plating
 ※ Please keep enough creepage distance with the pattern on PCB and other components.
 ※ Weight : 8g max

Closeup of part A



Closeup of part B



SUTS6

SUT S 6 12 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
 - ② Single output
 - ③ Output wattage
 - ④ Input voltage
 - ⑤ Output voltage
 - ⑥ Optional
- G :Capacitor between Input and Output is removed.

MODEL		SUTS6053R3	SUTS60505	SUTS60512	SUTS60515	SUTS6123R3	SUTS61205	SUTS61212	SUTS61215
MAX OUTPUT WATTAGE[W]		3.96	5	6	6	4.46	6	6	6
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	1.2	1	0.5	0.4	1.35	1.2	0.5	0.4

SPECIFICATIONS

	MODEL	SUTS6053R3	SUTS60505	SUTS60512	SUTS60515	SUTS6123R3	SUTS61205	SUTS61212	SUTS61215
INPUT	VOLTAGE[V]	DC4.5 - 9				DC9 - 18			
	CURRENT[A] *2	1.100typ	1.316typ	1.500typ	1.500typ	0.502typ	0.617typ	0.588typ	0.588typ
	EFFICIENCY[%] *2	72typ	76typ	80typ	80typ	74typ	81typ	85typ	85typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	1.2	1	0.5	0.4	1.35	1.2	0.5	0.4
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55℃ *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20℃ *3	120max	120max	150max	150max	120max	120max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55℃ *3	120max	120max	150max	150max	120max	120max	150max
		-40 to -20℃ *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55℃	50max	50max	150max	180max	50max	50max	150max
		-40 to +55℃	80max	80max	240max	290max	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

MODEL		SUTS6243R3	SUTS62405	SUTS62412	SUTS62415	SUTS6483R3	SUTS64805	SUTS64812	SUTS64815
MAX OUTPUT WATTAGE[W]		4.46	6	6	6	4.46	6	6	6
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	1.35	1.2	0.5	0.4	1.35	1.2	0.5	0.4

SPECIFICATIONS

	MODEL	SUTS6243R3	SUTS62405	SUTS62412	SUTS62415	SUTS6483R3	SUTS64805	SUTS64812	SUTS64815
INPUT	VOLTAGE[V]	DC18 - 36				DC36 - 76			
	CURRENT[A] *2	0.248typ	0.309typ	0.291typ	0.291typ	0.121typ	0.154typ	0.145typ	0.145typ
	EFFICIENCY[%] *2	75typ	81typ	86typ	86typ	77typ	81typ	86typ	86typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	1.35	1.2	0.5	0.4	1.35	1.2	0.5	0.4
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55℃ *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20℃ *3	120max	120max	150max	150max	120max	120max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55℃ *3	120max	120max	150max	150max	120max	120max	150max
		-40 to -20℃ *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55℃	50max	50max	150max	180max	50max	50max	150max
		-40 to +55℃	80max	80max	240max	290max	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

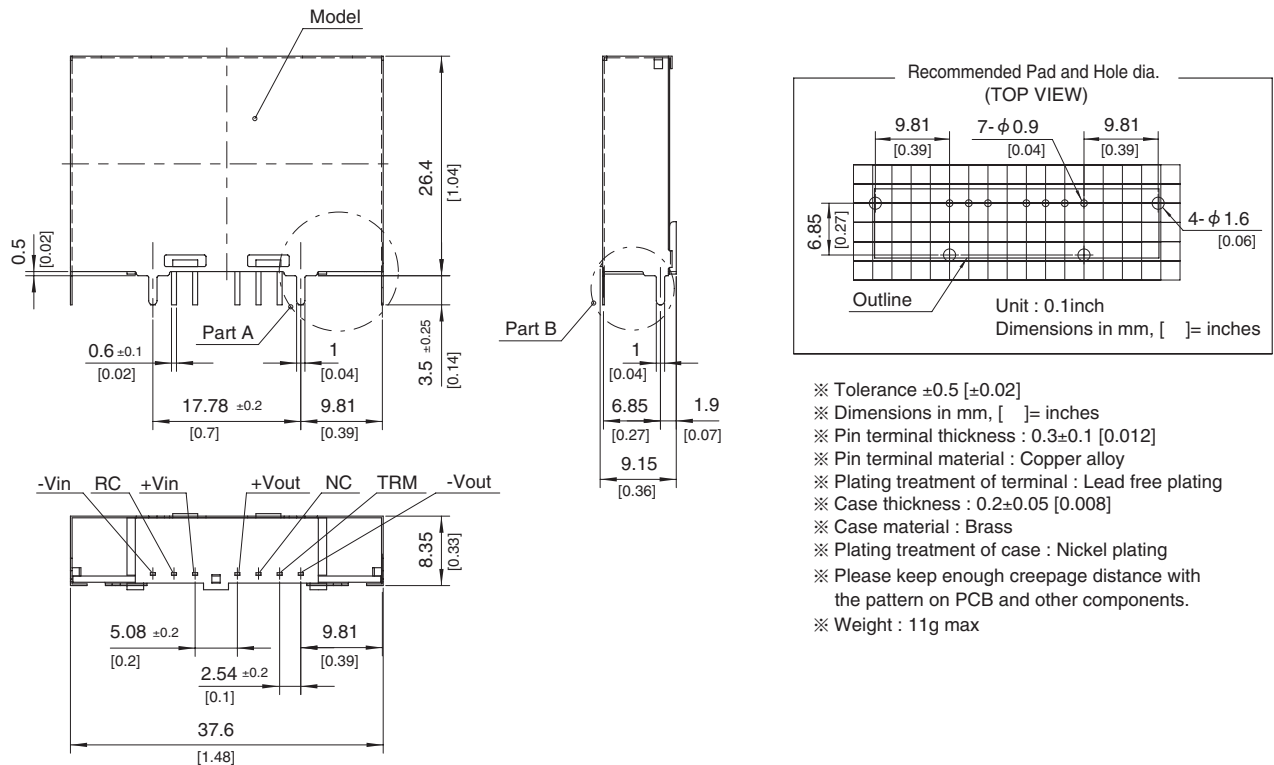
GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
	INPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
	OUTPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	37.6 \times 26.4 \times 9.15mm [1.48 \times 1.04 \times 0.36 inches] (W \times H \times D) / 11g max
	COOLING METHOD	Convection/Forced air

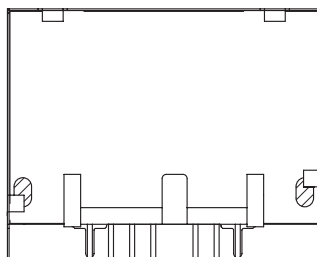
- *1 SUTW6xx12/SUTW6xx15 is available as single output, +24V/+30V.
 *2 Rated input 5V, 12V, 24V or 48V DC Io=100%
 *3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.
 *4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25 $^{\circ}$ C.
 * Parallel operation with other model is not possible.

External view

SU-SUC/SUT

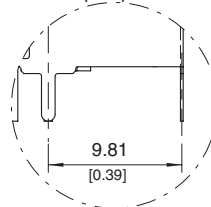


※ Back View

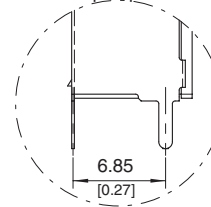


: Conduction Area

Closeup of part A



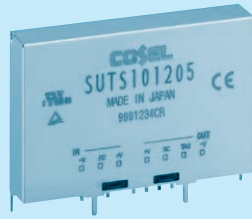
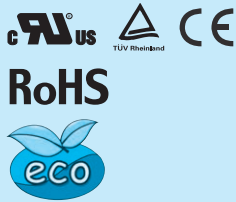
Closeup of part B



SUTS10

SUT S 10 12 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage
- ⑥ Optional
- G : Capacitor between Input and Output is removed.

MODEL		SUTS10053R3	SUTS100505	SUTS100512	SUTS100515	SUTS10123R3	SUTS101205	SUTS101212	SUTS101215
MAX OUTPUT WATTAGE[W]		8.58	10	10.8	10.5	8.58	10	12	12
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	2.6	2	0.9	0.7	2.6	2	1	0.8

SPECIFICATIONS

	MODEL	SUTS10053R3	SUTS100505	SUTS100512	SUTS100515	SUTS10123R3	SUTS101205	SUTS101212	SUTS101215
INPUT	VOLTAGE[V]	DC4.5 - 9				DC9 - 18			
	CURRENT[A] *2	2.12typ	2.41typ	2.54typ	2.47typ	0.872typ	0.980typ	1.15typ	1.15typ
	EFFICIENCY[%] *2	81typ	83typ	85typ	85typ	82typ	85typ	87typ	87typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	2.6	2	0.9	0.7	2.6	2	1	0.8
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55℃ *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20℃ *3	120max	120max	150max	150max	120max	120max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55℃ *3	120max	120max	150max	150max	120max	120max	150max
		-40 to -20℃ *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55℃	50max	50max	150max	180max	50max	50max	150max
		-40 to +55℃	80max	80max	240max	290max	80max	80max	240max
	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

MODEL		SUTS10243R3	SUTS102405	SUTS102412	SUTS102415	SUTS10483R3	SUTS104805	SUTS104812	SUTS104815
MAX OUTPUT WATTAGE[W]		8.58	10	12	12	8.58	10	12	12
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	2.6	2	1	0.8	2.6	2	1	0.8

SPECIFICATIONS

	MODEL	SUTS10243R3	SUTS102405	SUTS102412	SUTS102415	SUTS10483R3	SUTS104805	SUTS104812	SUTS104815
INPUT	VOLTAGE[V]	DC18 - 36				DC36 - 76			
	CURRENT[A] *2	0.436typ	0.490typ	0.575typ	0.575typ	0.218typ	0.245typ	0.287typ	0.287typ
	EFFICIENCY[%] *2	82typ	85typ	87typ	87typ	82typ	85typ	87typ	87typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	2.6	2	1	0.8	2.6	2	1	0.8
	LINE REGULATION[mV]	20max	20max	48max	60max	20max	20max	48max	60max
	LOAD REGULATION[mV]	40max	40max	100max	120max	40max	40max	100max	120max
	RIPPLE[mVp-p]	-20 to +55℃ *3	80max	80max	120max	120max	80max	80max	120max
		-40 to -20℃ *3	120max	120max	150max	150max	120max	120max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55℃ *3	120max	120max	150max	150max	120max	120max	150max
		-40 to -20℃ *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55℃	50max	50max	150max	180max	50max	50max	150max
		-40 to +55℃	80max	80max	240max	290max	80max	80max	240max
	DRIFT[mV] *4	20max	20max	48max	60max	20max	20max	48max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±3%)	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45	3.21 - 3.42	4.90 - 5.21	11.64 - 12.36	14.55 - 15.45
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

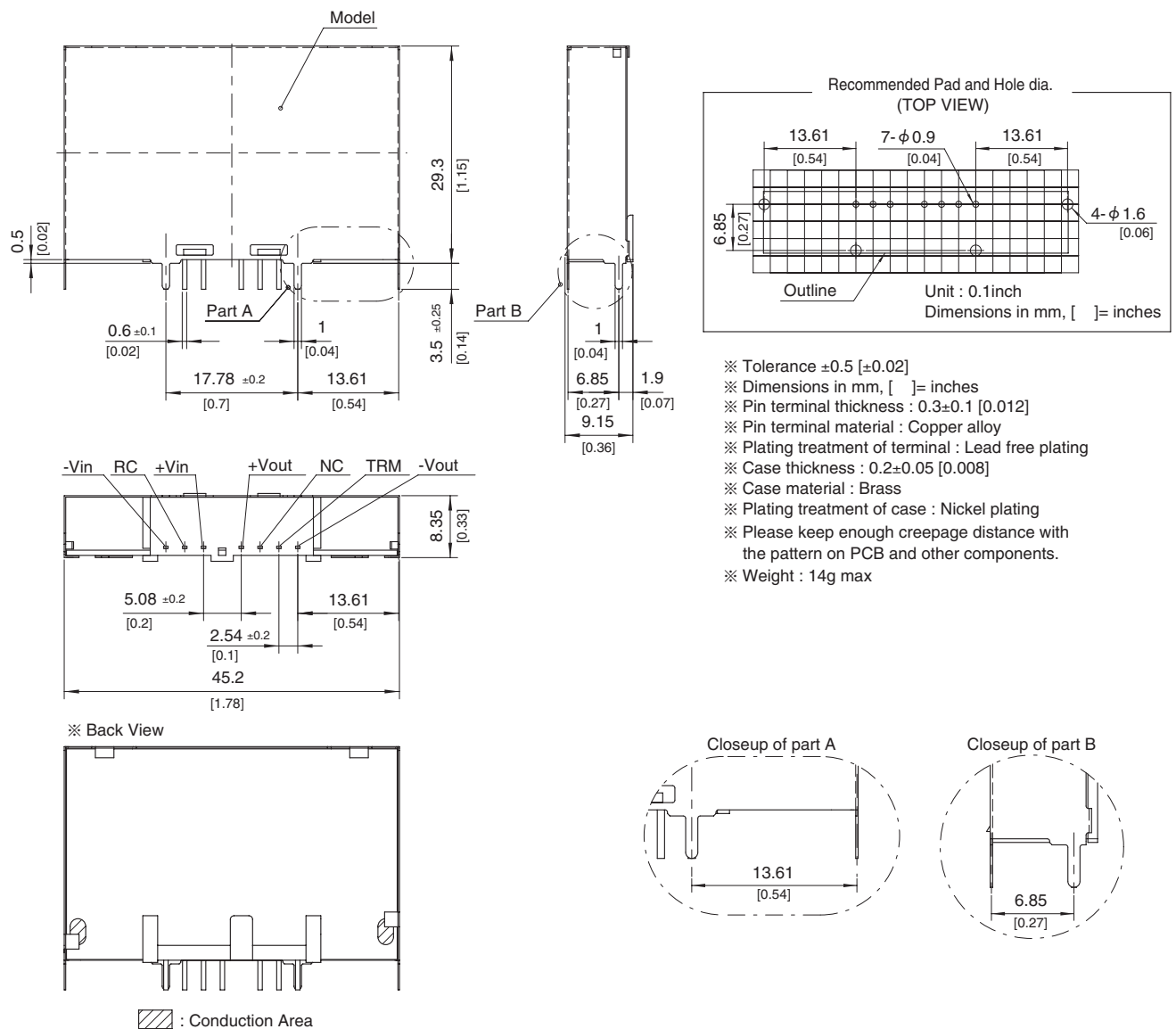
GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
	INPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
	OUTPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	45.2 \times 29.3 \times 9.15mm [1.78 \times 1.15 \times 0.36 inches] (W \times H \times D) / 14g max
	COOLING METHOD	Convection/Forced air

- *1 SUTW10xx12/SUTW10xx15 is available as single output, +24V/+30V.
 *2 Rated input 5V, 12V, 24V or 48V DC Io=100%
 *3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.
 *4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25 $^{\circ}$ C.
 * Parallel operation with other model is not possible.

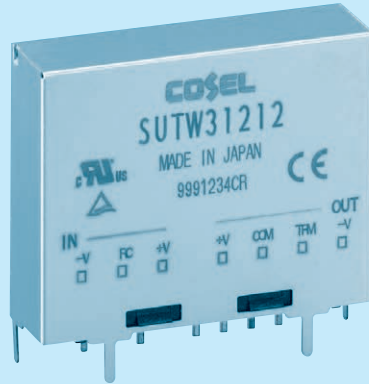
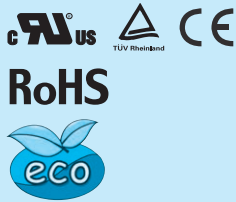
External view

SU-SUC/SUT



SUT W 3 12 12 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
 ② Dual output
 ③ Output wattage
 ④ Input voltage
 ⑤ Output voltage
 ⑥ Optional
 G : Capacitor between Input and Output is removed.

MODEL	SUTW30512	SUTW30515	SUTW31212	SUTW31215	SUTW32412	SUTW32415	SUTW34812	SUTW34815
MAX OUTPUT WATTAGE[W]	3.12	3	3.12	3	3.12	3	3.12	3
DC OUTPUT	VOLTAGE[V] *1	±12 or +24	±15 or +30	±12 or +24	±15 or +30	±12 or +24	±15 or +30	±12 or +24
	CURRENT[A]	0.13	0.1	0.13	0.1	0.13	0.1	0.13

SPECIFICATIONS

	MODEL	SUTW30512	SUTW30515	SUTW31212	SUTW31215	SUTW32412	SUTW32415	SUTW34812	SUTW34815
INPUT	VOLTAGE[V]	DC4.5 - 9		DC9 - 18		DC18 - 36		DC36 - 76	
	CURRENT[A] *2	0.844typ	0.811typ	0.343typ	0.329typ	0.172typ	0.165typ	0.086typ	0.083typ
	EFFICIENCY[%] *2	74typ	74typ	76typ	76typ	76typ	76typ	76typ	76typ
OUTPUT	VOLTAGE[V]	±12(+24)	±15(+30)	±12(+24)	±15(+30)	±12(+24)	±15(+30)	±12(+24)	±15(+30)
	CURRENT[A]	0.13	0.1	0.13	0.1	0.13	0.1	0.13	0.1
	LINE REGULATION[mV]	60max	75max	60max	75max	60max	75max	60max	75max
	LOAD REGULATION[mV]	600max	750max	600max	750max	600max	750max	600max	750max
	RIPPLE[mVp-p]	-20 to +55°C *3	120max	120max	120max	120max	120max	120max	120max
		-40 to -20°C *3	150max	150max	150max	150max	150max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	150max	150max	150max	150max	150max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	150max	180max	150max	180max	150max	180max	150max
		-40 to +55°C	240max	290max	240max	290max	240max	290max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	50max	60max	50max	60max	50max	60max	50max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±5%)	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
ISOLATION	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							
	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	INPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
ENVIRONMENT	OUTPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max							
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis							
SAFETY	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis							
	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1							
OTHERS	CASE SIZE/WEIGHT	30.0 × 23.4 × 9.15mm [1.18 × 0.92 × 0.36 inches] (W × H × D) / 8g max							
	COOLING METHOD	Convection/Forced air							

*1 Output pins can be connected in series to make a 24V/30V output.

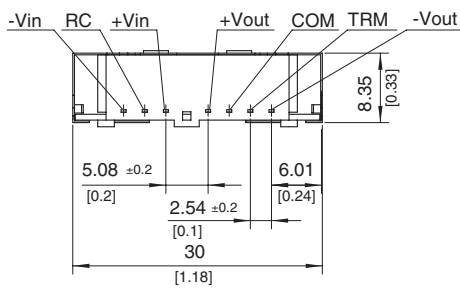
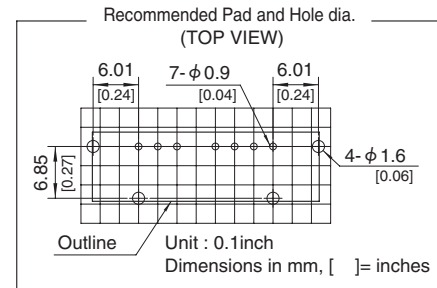
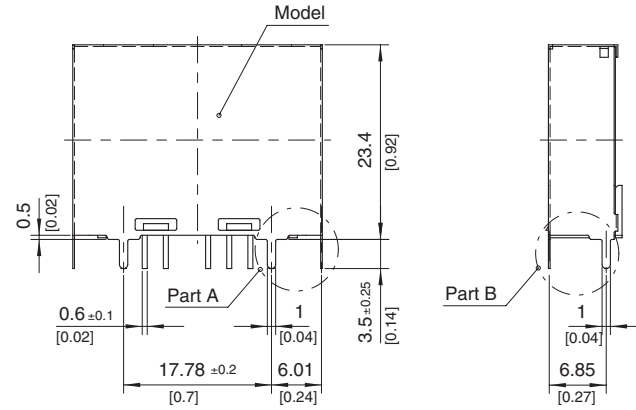
*2 Rated input 5V, 12V, 24V or 48V DC Io=100%

*3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

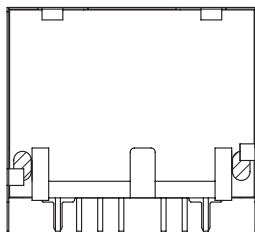
* Parallel operation with other model is not possible.

External view



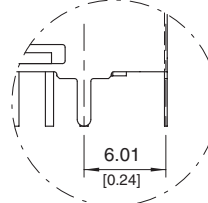
- ※ Tolerance ± 0.5 [± 0.02]
- ※ Dimensions in mm, [] = inches
- ※ Pin terminal thickness : 0.3 ± 0.1 [0.012]
- ※ Pin terminal material : Copper alloy
- ※ Plating treatment of terminal : Lead free plating
- ※ Case thickness : 0.2 ± 0.05 [0.008]
- ※ Case material : Brass
- ※ Plating treatment of case : Nickel plating
- ※ Please keep enough creepage distance with the pattern on PCB and other components.
- ※ Weight : 8g max

※ Back View

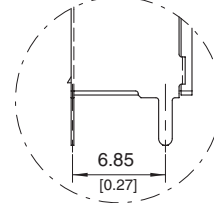


▨ : Conduction Area

Closeup of part A



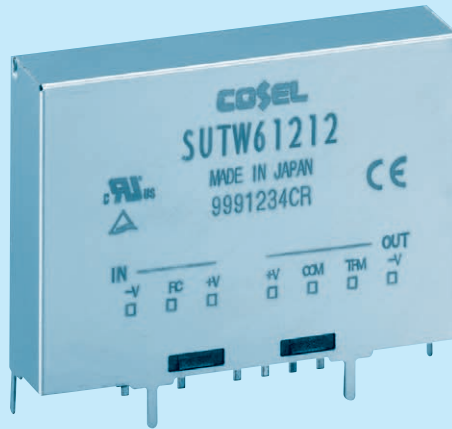
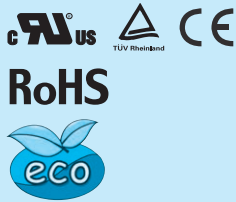
Closeup of part B



SUTW6

SUT W 6 12 12 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
 ② Dual output
 ③ Output wattage
 ④ Input voltage
 ⑤ Output voltage
 ⑥ Optional
 G : Capacitor between Input and Output is removed.

MODEL	SUTW60512	SUTW60515	SUTW61212	SUTW61215	SUTW62412	SUTW62415	SUTW64812	SUTW64815
MAX OUTPUT WATTAGE[W]	6	6	6	6	6	6	6	6
DC OUTPUT	VOLTAGE[V] *1	± 12 or +24	± 15 or +30	± 12 or +24	± 15 or +30	± 12 or +24	± 15 or +30	± 12 or +24
	CURRENT[A]	0.25	0.2	0.25	0.2	0.25	0.2	0.25

SPECIFICATIONS

	MODEL	SUTW60512	SUTW60515	SUTW61212	SUTW61215	SUTW62412	SUTW62415	SUTW64812	SUTW64815
INPUT	VOLTAGE[V]	DC4.5 - 9		DC9 - 18		DC18 - 36		DC36 - 76	
	CURRENT[A] *2	1.538typ	1.538typ	0.588typ	0.588typ	0.291typ	0.291typ	0.145typ	0.145typ
	EFFICIENCY[%] *2	78typ	78typ	85typ	85typ	86typ	86typ	86typ	86typ
OUTPUT	VOLTAGE[V]	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)
	CURRENT[A]	0.25	0.2	0.25	0.2	0.25	0.2	0.25	0.2
	LINE REGULATION[mV]	60max	75max	60max	75max	60max	75max	60max	75max
	LOAD REGULATION[mV]	600max	750max	600max	750max	600max	750max	600max	750max
	RIPPLE[mVp-p]	-20 to +55°C *3	120max	120max	120max	120max	120max	120max	120max
		-40 to -20°C *3	150max	150max	150max	150max	150max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	150max	150max	150max	150max	150max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	150max	180max	150max	180max	150max	180max	150max
		-40 to +55°C	240max	290max	240max	290max	240max	290max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	50max	60max	50max	60max	50max	60max	50max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±5%)	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
ISOLATION	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							
	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	INPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
ENVIRONMENT	OUTPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max							
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis							
SAFETY	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis							
	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1							
OTHERS	CASE SIZE/WEIGHT	37.6 × 26.4 × 9.15mm [1.84 × 1.04 × 0.36 inches] (W × H × D) / 11g max							
	COOLING METHOD	Convection/Forced air							

*1 Output pins can be connected in series to make a 24V/30V output.

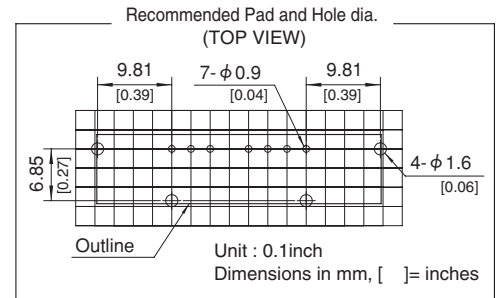
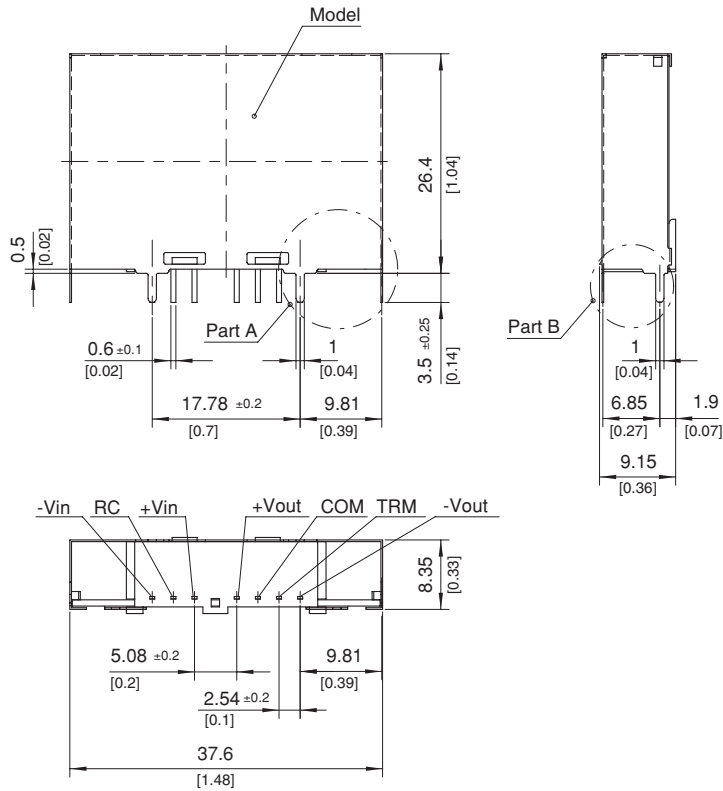
*2 Rated input 5V, 12V, 24V or 48V DC Io=100%

*3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

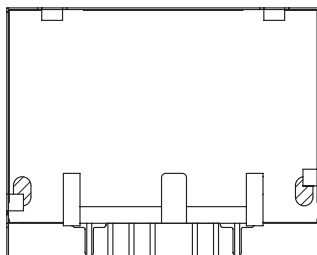
* Parallel operation with other model is not possible.

External view



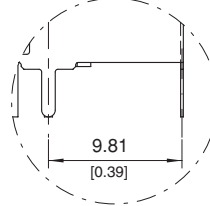
- ※ Tolerance ±0.5 [±0.02]
- ※ Dimensions in mm, []= inches
- ※ Pin terminal thickness : 0.3±0.1 [0.012]
- ※ Pin terminal material : Copper alloy
- ※ Plating treatment of terminal : Lead free plating
- ※ Case thickness : 0.2±0.05 [0.008]
- ※ Case material : Brass
- ※ Plating treatment of case : Nickel plating
- ※ Please keep enough creepage distance with the pattern on PCB and other components.
- ※ Weight : 11g max

※ Back View

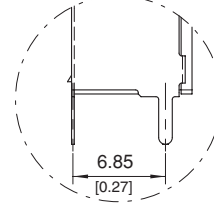


▨ : Conduction Area

Closeup of part A



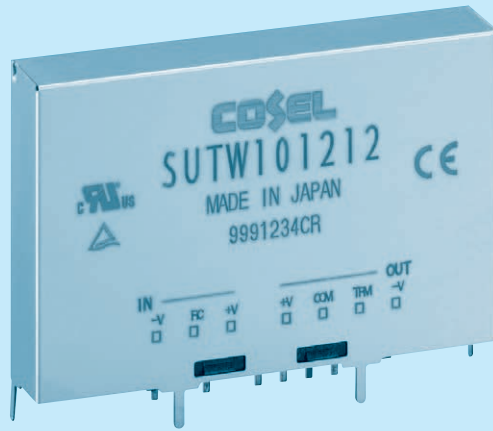
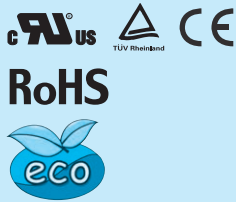
Closeup of part B



SUTW10

SUT W 10 12 12 - ☐

① ② ③ ④ ⑤ ⑥



- ① Series name
 ② Dual output
 ③ Output wattage
 ④ Input voltage
 ⑤ Output voltage
 ⑥ Optional
 G :Capacitor between Input and Output is removed.

MODEL	SUTW100512	SUTW100515	SUTW101212	SUTW101215	SUTW102412	SUTW102415	SUTW104812	SUTW104815
MAX OUTPUT WATTAGE[W]	10.8	10.5	10.8	10.5	10.8	10.5	10.8	10.5
DC OUTPUT	VOLTAGE[V] *1	± 12 or +24	± 15 or +30	± 12 or +24	± 15 or +30	± 12 or +24	± 15 or +30	± 12 or +24
	CURRENT[A]	0.45	0.35	0.45	0.35	0.45	0.35	0.45

SPECIFICATIONS

	MODEL	SUTW100512	SUTW100515	SUTW101212	SUTW101215	SUTW102412	SUTW102415	SUTW104812	SUTW104815
INPUT	VOLTAGE[V]	DC4.5 - 9		DC9 - 18		DC18 - 36		DC36 - 76	
	CURRENT[A] *2	2.51typ	2.44typ	1.05typ	1.02typ	0.523typ	0.509typ	0.262typ	0.254typ
	EFFICIENCY[%] *2	86typ	86typ	86typ	86typ	86typ	86typ	86typ	86typ
OUTPUT	VOLTAGE[V]	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)	± 12(+24)	± 15(+30)
	CURRENT[A]	0.45	0.35	0.45	0.35	0.45	0.35	0.45	0.35
	LINE REGULATION[mV]	60max	75max	60max	75max	60max	75max	60max	75max
	LOAD REGULATION[mV]	600max	750max	600max	750max	600max	750max	600max	750max
	RIPPLE[mVp-p]	-20 to +55°C *3	120max	120max	120max	120max	120max	120max	120max
		-40 to -20°C *3	150max	150max	150max	150max	150max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +55°C *3	150max	150max	150max	150max	150max	150max	150max
		-40 to -20°C *3	200max	200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	-20 to +55°C	150max	180max	150max	180max	150max	180max	150max
		-40 to +55°C	240max	290max	240max	290max	240max	290max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	50max	60max	50max	60max	50max	60max	50max	60max
	START-UP TIME[ms]	20max (Minimum input, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open) ±5% adjustable by external VR							
	OUTPUT VOLTAGE SETTING[V] (±5%)	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75	11.40 - 12.60	14.25 - 15.75
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
ISOLATION	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							
	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	INPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
ENVIRONMENT	OUTPUT-CASE	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 - 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max							
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION	10 - 55Hz, 98.0m/s ² (10G), 3minutes period, 60minutes each along X, Y and Z axis							
SAFETY	IMPACT	490.3m/s ² (50G), 11ms, once each along X, Y and Z axis							
	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1							
OTHERS	CASE SIZE/WEIGHT	45.2 × 29.3 × 9.15mm [1.78 × 1.15 × 0.36 inches] (W × H × D) / 14g max							
	COOLING METHOD	Convection/Forced air							

*1 Output pins can be connected in series to make a 24V/30V output.

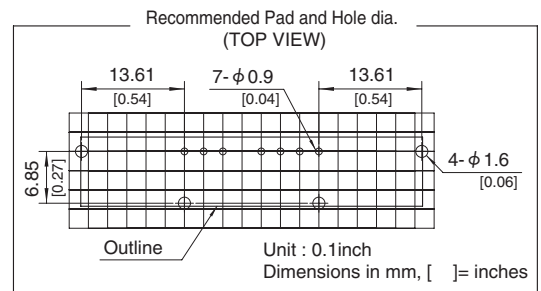
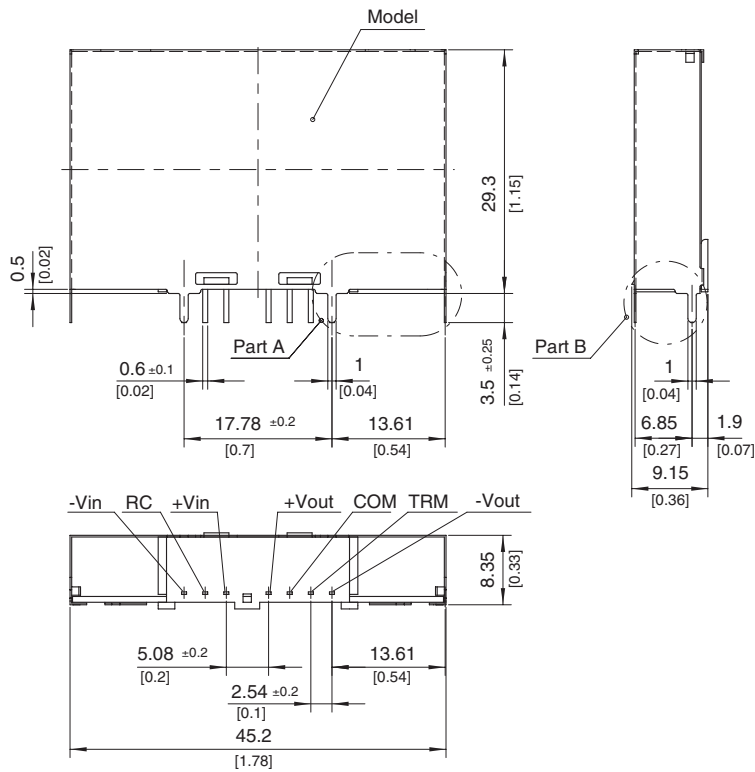
*2 Rated input 5V, 12V, 24V or 48V DC Io=100%

*3 Ripple and Ripple Noise is measured by using measuring board with capacitor with in 25mm from output pin terminals.

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.

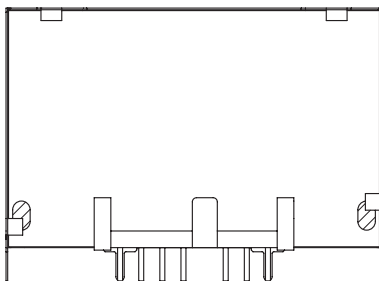
* Parallel operation with other model is not possible.

External view

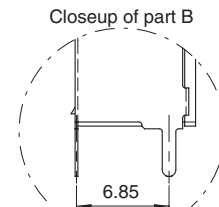
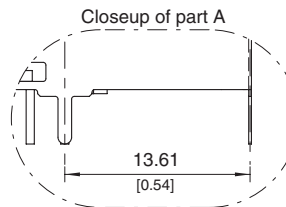


- ※ Tolerance ±0.5 [±0.02]
- ※ Dimensions in mm, []= inches
- ※ Pin terminal thickness : 0.3±0.1 [0.012]
- ※ Pin terminal material : Copper alloy
- ※ Plating treatment of terminal : Lead free plating
- ※ Case thickness : 0.2±0.05 [0.008]
- ※ Case material : Brass
- ※ Plating treatment of case : Nickel plating
- ※ Please keep enough creepage distance with the pattern on PCB and other components.
- ※ Weight : 14g max

※ Back View



▨ : Conduction Area



Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz] (reference)	Input current [A]	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
					Material	Single sided	Double sided	Series operation	Parallel operation
SU/SUC1R5	Flyback converter	350 - 1900	Refer to Table1,2	-	glass fabric base,epoxy resin		Yes	Yes	* 1
SU/SUC3	Flyback converter	200 - 1400	Refer to Table1,2	-	glass fabric base,epoxy resin		Yes	Yes	* 1
SU/SUC6	Flyback converter	230 - 1950	Refer to Table1,2	-	glass fabric base,epoxy resin		Yes	Yes	* 1
SU/SUC10	Flyback converter	250 - 300	Refer to Table1,2	-	glass fabric base,epoxy resin		Yes	Yes	* 1
SUT3	Flyback converter	200 - 1400	Refer to Table1,2	-	glass fabric base,epoxy resin		Yes	Yes	* 1
SUT6	Flyback converter	230 - 1950	Refer to Table1,2	-	glass fabric base,epoxy resin		Yes	Yes	* 1
SUT10	Flyback converter	250 - 300	Refer to Table1,2	-	glass fabric base,epoxy resin		Yes	Yes	* 1

* 1 Refer to Instruction Manual.

* The value of input current is measured at rated input and load.

Table1 (SUS*** +5V output)

[A]

Output Power	Input Voltage			
	5V	12V	24V	48V
1.5W	0.41	0.16	0.08	0.04
3W	0.78	0.32	0.16	0.08
6W	1.32	0.62	0.31	0.15
10W	2.41	0.98	0.49	0.25

Table2 (SUW*** ±12V output)

[A]

Output Power	Input Voltage			
	5V	12V	24V	48V
1.5W	0.43	0.17	0.09	0.04
3W	0.82	0.33	0.17	0.08
6W	1.54	0.59	0.29	0.15
10W	2.51	1.05	0.52	0.26

1 Pin Terminal Configuration SU/SUC/SUT-48**2** Functions SU/SUC/SUT-48

- 2.1 Input Voltage Range SU/SUC/SUT-48
- 2.2 Overcurrent Protection SU/SUC/SUT-48
- 2.3 Isolation SU/SUC/SUT-48
- 2.4 Output Voltage Adjustment Range SU/SUC/SUT-49
- 2.5 Remote ON/OFF SU/SUC/SUT-49

3 Wiring to Input/Output Pin Terminals SU/SUC/SUT-50**4** Series/Parallel Operation SU/SUC/SUT-51

- 4.1 Series Operation SU/SUC/SUT-51
- 4.2 Redundancy Operation SU/SUC/SUT-51

5 Input Voltage/Current Range SU/SUC/SUT-51**6** Assembling and Installation SU/SUC/SUT-51

- 6.1 Installation SU/SUC/SUT-51
- 6.2 Automatic Mounting SU/SUC/SUT-52
- 6.3 Hand Mounting SU/SUC/SUT-52
- 6.4 Soldering Conditions SU/SUC/SUT-52
- 6.5 Stress to Pin Terminals SU/SUC/SUT-52
- 6.6 Cleaning SU/SUC/SUT-53

7 Safety Standards SU/SUC/SUT-53**8** Derating SU/SUC/SUT-54

- 8.1 SU/SUC1R5 Derating Curve SU/SUC/SUT-54
- 8.2 SU/SUC3 Derating Curve SU/SUC/SUT-54
- 8.3 SU/SUC6 Derating Curve SU/SUC/SUT-55
- 8.4 SU/SUC10 Derating Curve SU/SUC/SUT-56
- 8.5 SUT3 Derating Curve SU/SUC/SUT-57
- 8.6 SUT6 Derating Curve SU/SUC/SUT-57
- 8.7 SUT10 Derating Curve SU/SUC/SUT-58

9 Peak Current (Pulse Load) SU/SUC/SUT-59**10** Using DC-DC Converters SU/SUC/SUT-59**11** Options SU/SUC/SUT-60

- 11.1 Outline of Options SU/SUC/SUT-60

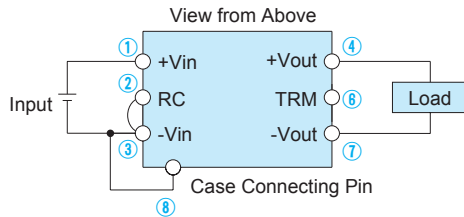
12 Delivery Package Information SU/SUC/SUT-61

1 Pin Terminal Configuration

Table 1.1 Pin Terminal Configuration and Functions

Pin No.	Pin Terminal Name	Function
①	+Vin	+DC Input
②	RC	Remote ON/OFF (excluding 1R5)
③	-Vin	-DC Input
④	+Vout	+DC Output
⑤	COM	GND of Output Voltage (for Dual Output)
⑥	TRM	Output Voltage Adjustment (please see 2.4)
⑦	-Vout	-DC Output
⑧	Case Connecting Pin	If connected to -Vin, a case potential becomes fixed and radiation noise decreases (applicable only to SUC series).

Single Output



Dual(±)Output

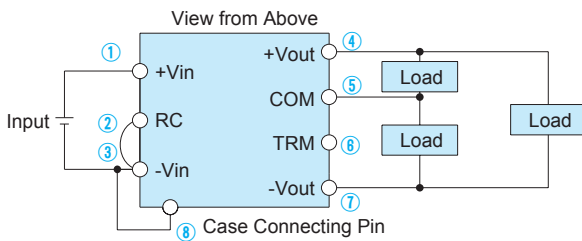


Fig.1.1 Pin Configuration

Table 1.2 Pin Terminal Configuration and Functions

Pin No.	Pin Terminal Name	Function
①	-Vin	-DC Input
②	RC	Remote ON/OFF
③	+Vin	+DC Input
④	+Vout	+DC Output
⑤	NC (Single output) COM (Dual output)	GND of Output Voltage
⑥	TRM	Output Voltage Adjustment
⑦	-Vout	-DC Output
⑧	Case Connecting Pin	If connected to -Vin, a case potential becomes fixed and radiation noise decreases.

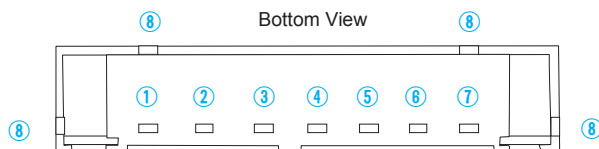


Fig.1.2 Pin Terminal Configuration

Case Connecting Pin Terminal

Units come with a case connecting pin terminal. If this pin terminal is connected to -Vin, radiation noise from the main body decreases. Solder the case connecting pin terminal to PCB to improve reliability.

2 Functions

2.1 Input Voltage Range

■ If output voltage value doesn't fall within specifications, a unit may not operate in accordance with specifications and/or fail.

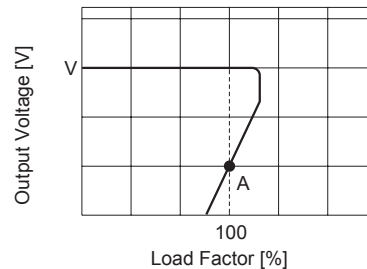
2.2 Overcurrent Protection

Overcurrent Operation

An overcurrent protection circuit is built-in and activated at 105% of the rated current or above. It prevents the unit from short circuit and overcurrent for less than 20 seconds. The unit automatically recovers when the fault condition is removed.

Current Foldback Characteristic

If a model that has a current foldback characteristic is connected to a non-linear load such as lamp or motor, or to a constant current load, it may not start up. Please see the characteristics below.



———— : Load Characteristic of Power Supply

----- : Characteristic of Load (Lamp, Motor or Constant Current Load, etc.)

Note : The output may be locked out at Point A when the unit is connected to a lamp, motor or constant current load.

Fig.2.1 Current Foldback Characteristic

2.3 Isolation

■ When you run a Hi-Pot test as receiving inspection, gradually increase the voltage to start. When you shut down, decrease the voltage gradually by using a dial. Please avoid a Hi-Pot tester with a timer because, when the timer is turned ON or OFF, it may generate a voltage a few times higher than the applied voltage.

■ In the case of use in locations exposed to constant voltage between the input and the output of the unit is applied, please contact us.

2.4 Output Voltage Adjustment Range

■ The output voltage is adjustable through an external potentiometer. Adjust only within the range of $\pm 5\%$ of the rated voltage.

■ To increase the output voltage, turn the potentiometer clockwise and connect in such a way that the resistance value between ② and ③ becomes small.

To decrease the output voltage, turn the potentiometer counter-clockwise.

■ Please use a wire as short as possible to connect to the potentiometer and connect it from the pin terminal on the power supply side. Temperature coefficient deteriorates when some types of resistors and potentiometers are used. Please use the following types.

Resistor.....Metal Film Type, Temperature Coefficient of $\pm 100\text{ppm}/^\circ\text{C}$ or below

Potentiometer...Cermet Type, Temperature Coefficient of $\pm 300\text{ppm}/^\circ\text{C}$ or below

■ If output voltage adjustment is not required, open the pin terminal TRM.

■ In the case of dual output, \pm voltages are adjusted simultaneously.

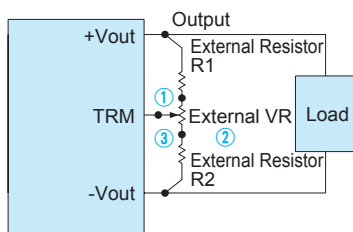


Fig.2.2 Connecting External Devices

Table 2.1 List of External Devices

Item #	Output Voltage	Constant of External Device [Ω] (Adjustable within $\pm 5\%$)		
		VR	R1	R2
1	3.3V	1K	100	100
2	5V	1K	100	270
3	12V	5K	10K	1.2K
4	15V	5K	10K	470
5	$\pm 12\text{V}$	5K	18K	470
6	$\pm 15\text{V}$	5K	18K	470

2.5 Remote ON/OFF (Excluding 1R5)

■ You can turn the power supply ON or OFF without turning the input power ON or OFF through the pin terminal RC.

(1) SU/SUC3/SUT3 and SU/SUC6/SUT6

■ The output of the power supply turns ON when the pin terminal RC is connected to the pin terminal -Vin. When the voltage of the pin terminal RC is between 2.0 to 9.0V, the output of the power supply goes OFF.

■ When the voltage of the pin terminal RC is between 0.3 to 2.0V, the output voltage value may be an uncertain value which is less than the rated voltage.

■ Please see the following diagram for how to use the pin terminal RC.

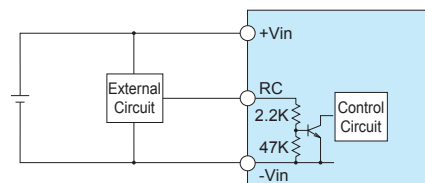


Fig.2.3 Internal Circuits of Remote ON/OFF

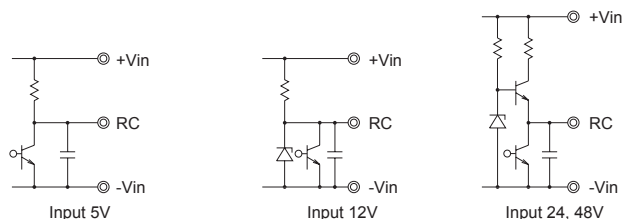


Fig.2.4 Examples of Using an External Remote ON/OFF Circuit

Table 2.2 Specification of Remote ON/OFF

Voltage Level of the pin terminal RC (V_{RC})	SU/SUC3/SUT3, SU/SUC6/SUT6 Output
Open or Short or $0V \leq V_{RC} \leq 0.3V$	ON
$2.0V \leq V_{RC} \leq 9.0V$	OFF

■ Please keep the voltage level of the pin terminal RC (V_{RC}) at 9.0V or below.

■ If you do not use the Remote ON/OFF function, please short out between the pin terminals RC and -Vin to prevent malfunction.

(2) SU/SUC10/SUT10

■ The output of the power supply turns ON when the pin terminal RC is connected to the pin terminal -Vin. When the pin terminal RC is open or the voltage of the pin terminal RC is between 2.4 to 7.0 V, the output of the power supply goes OFF.

■ When the voltage of the pin terminal RC is between 1.2 to 2.4V, an output voltage value may be an uncertain value which is less than the rated voltage.

■ Please see the following diagram for how to use the pin terminal RC.

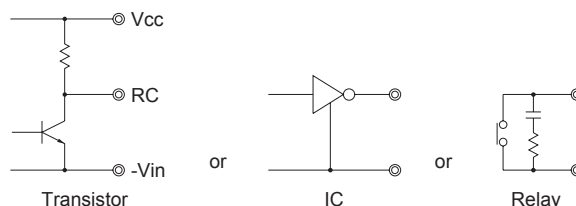


Fig.2.5 Examples of Using an External Remote ON/OFF Circuit

Table 2.3 Specification of Remote ON/OFF

Voltage Level of the pin terminal RC (V_{RC})	SU/SUC10/SUT10 Output
Short or $0V \leq V_{RC} \leq 1.2V$	ON
Open or $2.4V \leq V_{RC} \leq 7.0V$	OFF

■ When the pin terminal RC is at the "Low" level, outflowing current is 0.5mA typ. When Vcc is used, please make sure that the voltage of Vcc is 7.0V or less.

■ If you do not use the Remote ON/OFF function, please short out between the pin terminals RC and -Vin.

3 Wiring to Input/Output Pin Terminals

- Basically, SU/SUC/SUT series do not need any external capacitor. However, you can create a π -shaped filter circuit by adding a capacitor C_i near the input pin terminal and reduce reflected input noise from a converter. Please connect the capacitor as needed.
- When you use a capacitor C_i , please use the one with high frequency and good temperature characteristics.
- If the power module is to be turned ON/OFF directly with a switch, inductance from the input line will induce a surge voltage several times that of the input voltage and it may damage the power module. Make sure that the surge is absorbed, for example, by connecting an electrolytic capacitor between the input pins.
- If an external filter containing L (inductance) is added to the input line or a wire from the input source to the DC-DC converter is long, not only the reflected input noise becomes large, but also the output of the converter may become unstable. In such case, connecting C_i to the input pin terminal is recommended.
- If you use an aluminum electrolytic capacitor, please pay attention to its ripple current rating.

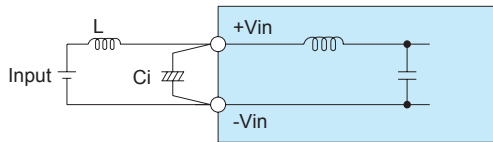


Fig.3.1 Connecting an External Capacitor to the Input Side

Table 3.1 Recommended Capacitance of an External Capacitor on the Input Side [μ F]

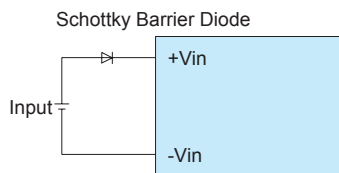
Model Input Voltage(V)	SU/SUC1R5	SU/SUC3/SUT3	SU/SUC6/SUT6	SU/SUC10/SUT10
5	10 - 100	10 - 220	10 - 470	10 - 470
12	10 - 47	10 - 100	10 - 220	10 - 220
24	10 - 33	10 - 47	10 - 100	10 - 100
48	4.7 - 10	10 - 22	10 - 47	10 - 47

* Please adjust the capacitance in accordance with a degree of the effect you want to achieve.

- If a reverse polarity voltage is applied to the input pin terminal, the power supply will fail.

If there is a possibility that a reverse polarity voltage is applied, connect a protection circuit externally as described below.

(a)



Schottky barrier diode generates a power loss of input current multiplied by forward voltage.

(b)

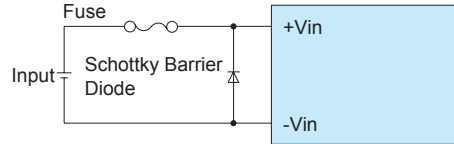


Fig.3.2 Connecting a Reverse Voltage Protection Circuit

- Basically, SU/SUC/SUT series do not need any external capacitor. However, if you want to further reduce the output ripple noise, connect an electrolytic capacitor or a ceramic capacitor C_o to the output pin terminal as shown below.

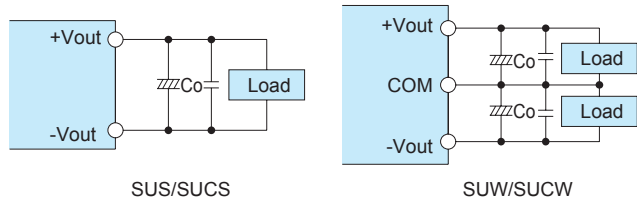


Fig.3.3 Connecting Example of an External Capacitor to the Output Side

Table 3.2 Recommended Capacitance of External Capacitor on the Output Side [μ F]

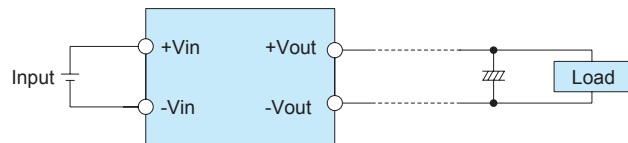
Model Output Voltage(V)	SU/SUC1R5	SU/SUC3/SUT3	SU/SUC6/SUT6	SU/SUC10/SUT10
3.3	1 - 100	1 - 220	1 - 220	1 - 220
5	1 - 100	1 - 220	1 - 220	1 - 220
12	1 - 100	1 - 100	1 - 100	1 - 100
15	1 - 100	1 - 100	1 - 100	1 - 100

* If you use a ceramic capacitor, keep the capacitance within the range between about 0.1 to 10 μ F.

* Please adjust the capacitance in light of the effect you want to achieve.

* If you need to use an external capacitor whose capacitance exceeds the range provided in Table 3.2, please contact us.

- If the distance between the output and the load is long and therefore the noise is created on the load side, connect a capacitor externally to the load as shown below.

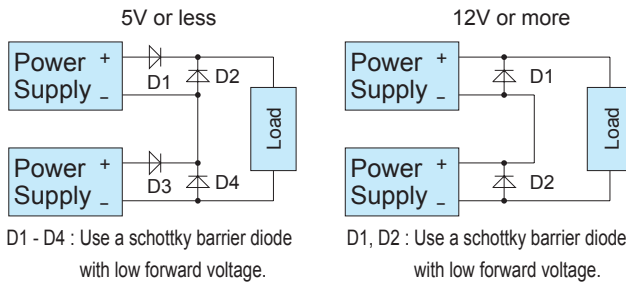


4 Series/Parallel Operation

4.1 Series Operation

■ You can use the power supplies in series operation by wiring as shown below. In the case of (a) below, the output current should be lower than the rated current of a power supply with the lowest rated current among power supplies that are serially connected. Please make sure that no current exceeding the rated current flows into a power supply.

(a)



(b)

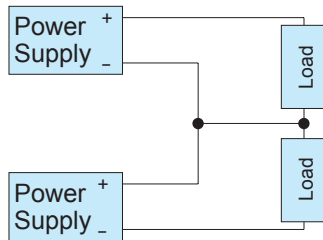


Fig.4.1 Series Operation

4.2 Redundancy Operation

■ You can use the power supplies in redundancy operation by wiring as shown below.

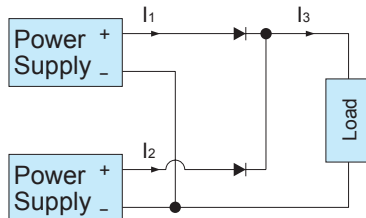


Fig.4.2 Redundancy Operation

■ Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 . Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{Rated Current Value}$$

5 Input Voltage/Current Range

■ If you use a non-regulated power source for input, please check and make sure that its voltage fluctuation range and ripple voltage do not exceed the input voltage range shown in specifications.

■ Please select an input power source with enough capacity, taking into consideration of the start-up current (I_p), which flows when a DC-DC converter starts up.

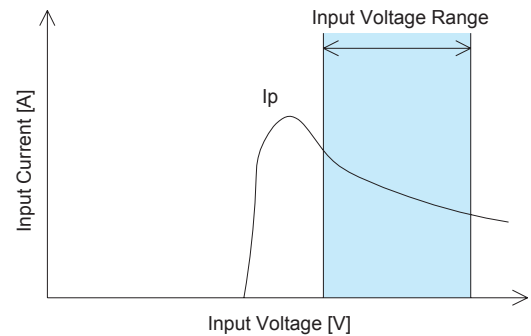


Fig.5.1 Input Current Characteristics

6 Assembling and Installation

6.1 Installation

■ You can install the units in any direction. Place them in such a way that there is enough ventilation so that heat does not get accumulated around them.

■ Do not place a rand or a pattern layout in the hatched area shown in Fig. 6.1, 6.2. Doing so may cause insulation failure on the PCB surface on which the power supply is mounted.

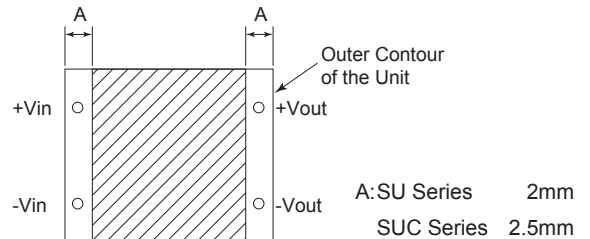


Fig.6.1 Area where Pattern Layout should not be Placed for SU/SUC

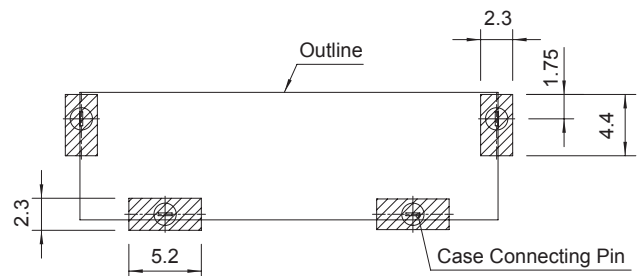


Fig.6.2 Area where Pattern Layout should not be Placed for SUT

6.2 Automatic Mounting (TYPE: BP)

■ To mount SU series automatically, use the transformer area near the center of the PCB as a pickup point. To mount SUC series automatically, use the central area of the case as a pickup point. If the bottom dead point of a suction nozzle is too low when mounting, excessive force is applied to the transformer, which could cause damage. Please mount carefully.
Please see the External View for details of the pickup point.

6.3 Hand Mounting (TYPE:B,C SUT)

■ To mount SU series manually, it must be push the transformer placed center of PS.
■ To mount SUC series manually, it must be push the center of case.
■ Due to prevent failure, PS should not be pull after soldering with PCB.

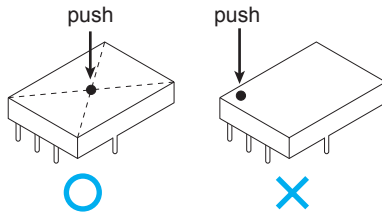


Fig.6.3 Hand mounting

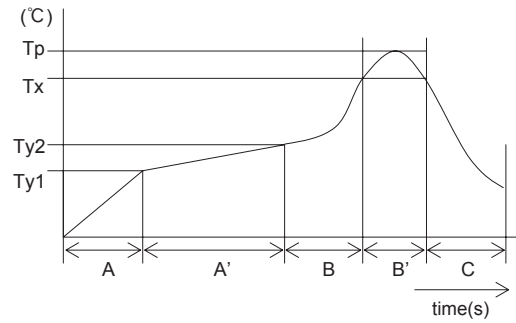
6.4 Soldering Conditions

(1) Reflow Soldering (except SUT, SUC□□C-C)

■ Fig.6.4 shows conditions for the reflow soldering for SU/SUC series. Please make sure that the temperatures of pin terminals +Vin and -Vout shown in Fig.6.4 do not exceed the temperatures shown in Fig.6.5.
■ If time or temperature of the reflow soldering goes beyond the conditions, reliability of internal components may be compromised. Please use the unit under the recommended reflow conditions.
■ With this reflow profile, internal solder melts down. When transporting the unit within the reflow oven, please do not give vibration to the unit.
■ Please avoid reflow soldering after applying adhesive or coating to the unit.
■ You can reflow solder up to 2 times. Do not reflow solder when the power supply is mounted on the back surface of the PCB because the unit may drop.



Fig.6.4 Temperature Measuring Points when Setting Reflow Soldering Conditions
(View from Above)



A	1.0 - 5.0°C/s
A'	Ty1 : 160 ±20°C
	Ty2 : 180 ±20°C
B	Ty1 - Ty2 : 120s max
	1.0 - 5.0°C/s
B'	Tp : Max 245°C 10s max
	Tx : 220°C or more : 70s max
C	1.0 - 5.0°C/s

Fig.6.5 Recommend Reflow Soldering Conditions

(2) Flow Soldering : 260°C 15 seconds or less
(3) Soldering Iron : maximum 360°C 5 seconds or less

6.5 Stress to Pin Terminals

■ If too much stress is applied to input/output pin terminals of the power supply, internal connection may come down. If you apply stress as shown below, please kept it at 19.6N (2kgf) or less vertically.
■ Input/output pin terminals are soldered to the PCB internally. Do not pull or bend a lead powerfully.
■ If it is expected that stress is applied to the input/output pin terminals due to vibration or impact, reduce the stress to the pin terminals by taking such measures as fixing the unit to the PCB by silicone rubber, etc.

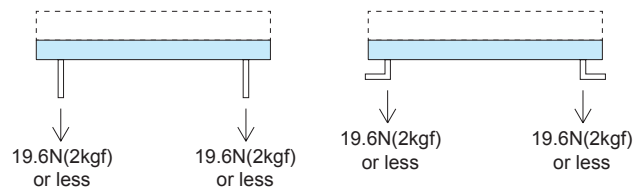


Fig.6.6 Strength of Input/Output Pin Terminals for SU/SUC

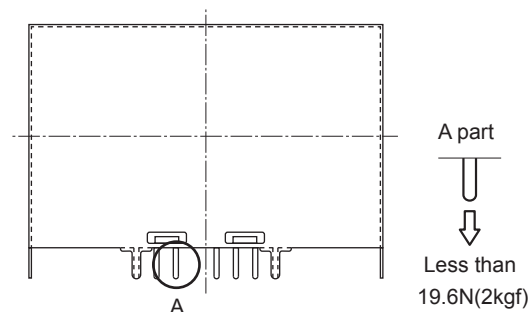


Fig.6.7 Strength of Input/Output Pin Terminals for SUT

6.6 Cleaning (except SUS□□C-C)

■If you need to clean the unit, please clean it under the following conditions.

Cleaning Method: Varnishing, Ultrasonic or Vapor Cleaning

Cleaning agent: IPA (Solvent type)

Cleaning Time: Within total 2 minutes for varnishing, ultrasonic and vapor cleaning

■Please dry the unit sufficiently after cleaning.

■If you do ultrasonic cleaning, please keep the ultrasonic output at 15W/ℓ or below.

7 Safety Standards

■To apply for a safety standard approval using the power supply, please meet the following conditions. Please contact us for details.

●Please use the unit as a component of an end device.

●The area between the input and the output of the unit is isolated functionally. Depending upon the input voltage, basic insulation, dual insulation or enhanced insulation may be needed. In such case, please take care of it within the structure of your end-device. Please contact us for details.

■Please use the following model names when you apply for a safety standard approval.

●SU/SUC1R5

SUS1R5053R3	SUS1R5123R3	SUS1R5243R3	SUS1R5483R3
SUS1R50505	SUS1R51205	SUS1R52405	SUS1R54805
SUS1R50512	SUS1R51212	SUS1R52412	SUS1R54812
SUS1R50515	SUS1R51215	SUS1R52415	SUS1R54815
SUW1R50512	SUW1R51212	SUW1R52412	SUW1R54812
SUW1R50515	SUW1R51215	SUW1R52415	SUW1R54815

SUCS1R5053R3	SUCS1R5123R3	SUCS1R5243R3	SUCS1R5483R3
SUCS1R50505	SUCS1R51205	SUCS1R52405	SUCS1R54805
SUCS1R50512	SUCS1R51212	SUCS1R52412	SUCS1R54812
SUCS1R50515	SUCS1R51215	SUCS1R52415	SUCS1R54815
SUCW1R50512	SUCW1R51212	SUCW1R52412	SUCW1R54812
SUCW1R50515	SUCW1R51215	SUCW1R52415	SUCW1R54815

●SU/SUC3

SUS3053R3	SUS3123R3	SUS3243R3	SUS3483R3
SUS30505	SUS31205	SUS32405	SUS34805
SUS30512	SUS31212	SUS32412	SUS34812
SUS30515	SUS31215	SUS32415	SUS34815
SUW30512	SUW31212	SUW32412	SUW34812
SUW30515	SUW31215	SUW32415	SUW34815

SUCS3053R3	SUCS3123R3	SUCS3243R3	SUCS3483R3
SUCS30505	SUCS31205	SUCS32405	SUCS34805
SUCS30512	SUCS31212	SUCS32412	SUCS34812
SUCS30515	SUCS31215	SUCS32415	SUCS34815
SUCW30512	SUCW31212	SUCW32412	SUCW34812
SUCW30515	SUCW31215	SUCW32415	SUCW34815

●SU/SUC6

SUS6053R3	SUS6123R3	SUS6243R3	SUS6483R3
SUS60505	SUS61205	SUS62405	SUS64805
SUS60512	SUS61212	SUS62412	SUS64812
SUS60515	SUS61215	SUS62415	SUS64815
SUW60512	SUW61212	SUW62412	SUW64812
SUW60515	SUW61215	SUW62415	SUW64815

SUCS6053R3	SUCS6123R3	SUCS6243R3	SUCS6483R3
SUCS60505	SUCS61205	SUCS62405	SUCS64805
SUCS60512	SUCS61212	SUCS62412	SUCS64812
SUCS60515	SUCS61215	SUCS62415	SUCS64815
SUCW60512	SUCW61212	SUCW62412	SUCW64812
SUCW60515	SUCW61215	SUCW62415	SUCW64815

●SU/SUC10

SUS10053R3	SUS10123R3	SUS10243R3	SUS10483R3
SUS100505	SUS101205	SUS102405	SUS104805
SUS100512	SUS101212	SUS102412	SUS104812
SUS100515	SUS101215	SUS102415	SUS104815
SUW100512	SUW101212	SUW102412	SUW104812
SUW100515	SUW101215	SUW102415	SUW104815

SUCS10053R3	SUCS10123R3	SUCS10243R3	SUCS10483R3
SUCS100505	SUCS101205	SUCS102405	SUCS104805
SUCS100512	SUCS101212	SUCS102412	SUCS104812
SUCS100515	SUCS101215	SUCS102415	SUCS104815
SUCW100512	SUCW101212	SUCW102412	SUCW104812
SUCW100515	SUCW101215	SUCW102415	SUCW104815

●SUT3

SUTS3053R3	SUTS3123R3	SUTS3243R3	SUTS3483R3
SUTS30505	SUTS31205	SUTS32405	SUTS34805
SUTS30512	SUTS31212	SUTS32412	SUTS34812
SUTS30515	SUTS31215	SUTS32415	SUTS34815
SUTW30512	SUTW31212	SUTW32412	SUTW34812
SUTW30515	SUTW31215	SUTW32415	SUTW34815

●SUT6

SUTS6053R3	SUTS6123R3	SUTS6243R3	SUTS6483R3
SUTS60505	SUTS61205	SUTS62405	SUTS64805
SUTS60512	SUTS61212	SUTS62412	SUTS64812
SUTS60515	SUTS61215	SUTS62415	SUTS64815
SUTW60512	SUTW61212	SUTW62412	SUTW64812
SUTW60515	SUTW61215	SUTW62415	SUTW64815

●SUT10

SUTS10053R3	SUTS10123R3	SUTS10243R3	SUTS10483R3
SUTS100505	SUTS101205	SUTS102405	SUTS104805
SUTS100512	SUTS101212	SUTS102412	SUTS104812
SUTS100515	SUTS101215	SUTS102415	SUTS104815
SUTW100512	SUTW101212	SUTW102412	SUTW104812
SUTW100515	SUTW101215	SUTW102415	SUTW104815

8 Derating

■ It is necessary to note thermal fatigue life by power cycle.

Please reduce the temperature fluctuation range as much as possible when the up and down of temperature are frequently generated.

8.1 SU/SUC1R5 Derating Curve

■ If you derate the output current, you can use the unit in the temperature range from -40°C to the maximum temperature shown below.

(1) In the case of Convection Cooling

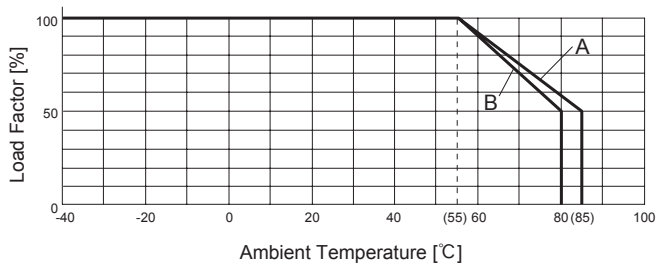


Fig.8.1 Derating Curve for Convection Cooling (SU/SUC1R5)

(2) In the case of Forced Air Cooling (1m/s)

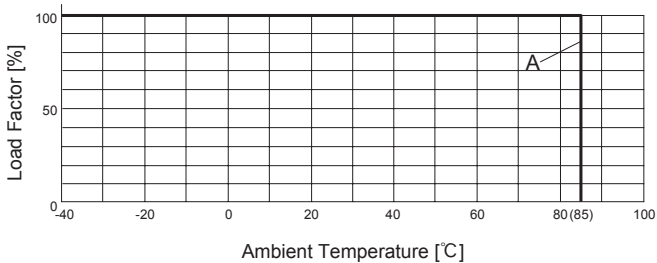


Fig.8.2 Derating Curve for Forced Air Cooling (1m/s) (SU/SUC1R5)

(3) Temperature Measuring Points in the case of Forced Air Cooling (1m/s)

① SU1R5

■ In the case of forced air cooling, please have sufficient ventilation to keep the temperature of point A in Fig.8.3 at 105°C or below.

Please also make sure that the ambient temperature does not exceed 85°C.

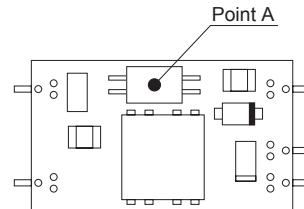


Fig.8.3 Temperature Measuring Point in the case of Forced Air Cooling

② SUC1R5

■ In the case of forced air cooling, please have sufficient ventilation to keep the temperature of point B in Fig.8.4 at 95°C or below.

Please also make sure that the ambient temperature does not exceed 85°C.

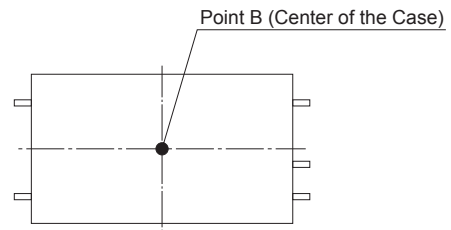
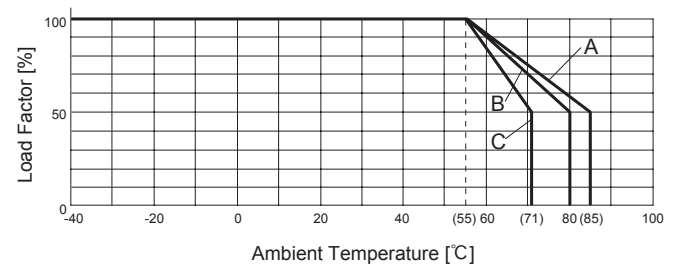


Fig.8.4 Temperature Measuring Point in the case of Forced Air Cooling (Upper Surface of the Case)

8.2 SU/SUC3 Derating Curve

■ If you derate the output current, you can use the unit in the temperature range from -40°C to the maximum temperature shown below.

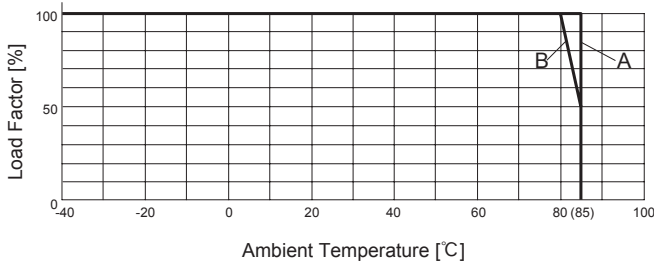
(1) In the case of Convection Cooling



Output Voltage(V) Input Voltage(V)	3.3	5	12	15	±12	±15
5	A	A	B	B	A	B
12	A	A	B	B	A	B
24	A	A	B	B	A	B
48	B	B	B	B	A	C

Fig.8.5 Derating Curve for Convection Cooling (SU/SUC3)

(2) In the case of Forced Air Cooling (1m/s)



Output Voltage(V) Input Voltage(V)	3.3	5	12	15	±12	±15
5	A	B	B	B	B	B
12	A	A	A	A	A	B
24	A	A	B	A	A	B
48	A	A	A	A	A	B

Fig.8.6 Derating Curve for Forced Air Cooling (1m/s) (SU/SUC3)

(3) Temperature Measuring Points in the case of Forced Air Cooling (1m/s)

① SU3

■ In the case of forced air cooling, please have sufficient ventilation to keep the temperature of point A in Fig.8.7 at 115°C or below and that of Point B at 120°C or below.

Please also make sure that the ambient temperature does not exceed 85°C.

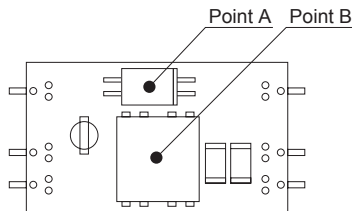


Fig.8.7 Temperature Measuring Points in the case of Forced Air Cooling

② SUC3

■ In the case of forced air cooling, please have sufficient ventilation to keep the temperature of point C in Fig.8.8 at 100°C or below.

Please also make sure that the ambient temperature does not exceed 85°C.

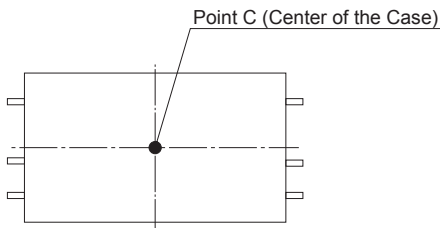
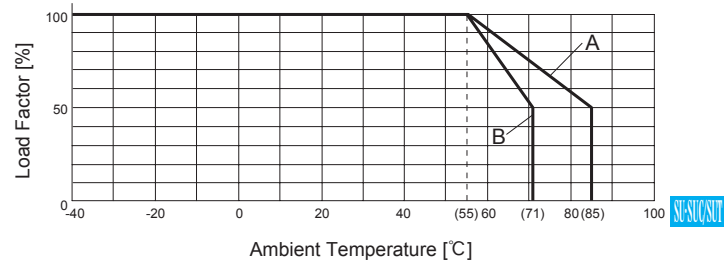


Fig.8.8 Temperature Measuring Point in the case of Forced Air Cooling (Upper Surface of the Case)

8.3 SU/SUC6 Derating Curve

■ If you derate the output current, you can use the unit in the temperature range from -40°C to the maximum temperature shown below.

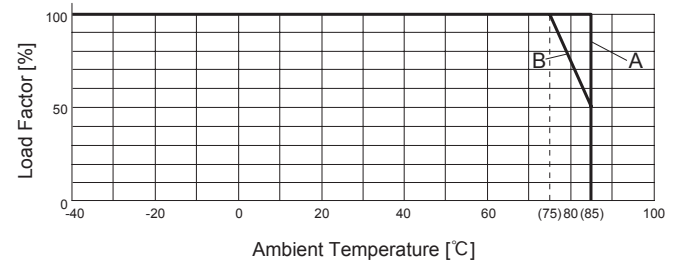
(1) In the case of Convection Cooling



Output Voltage(V) Input Voltage(V)	3.3	5	12	15	±12	±15
5	B	B	B	B	B	B
12	B	B	B	B	B	B
24	B	B	B	B	B	B
48	B	B	A	A	A	A

Fig.8.9 Derating Curve for Convection Cooling (SU/SUC6)

(2) In the case of Forced Air Cooling (1m/s)



Output Voltage(V) Input Voltage(V)	3.3	5	12	15	±12	±15
5	B	B	A	A	A	A
12	B	B	A	A	A	A
24	B	B	A	A	A	A
48	B	B	A	A	A	A

Fig.8.10 Derating Curve for Forced Air Cooling (1m/s) (SU/SUC6)

(3) Temperature Measuring Points in the case of Forced Air Cooling (1m/s)

① SU6

■ In the case of forced air cooling, please have sufficient ventilation to keep the temperature of point A in Fig.8.11 at 95°C or below and that of Point B at 115°C or below.

Please also make sure that the ambient temperature does not exceed 85°C.

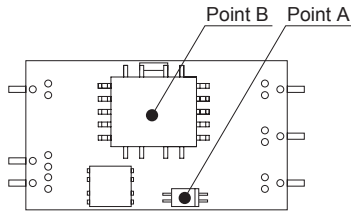


Fig.8.11 Temperature Measuring Points in the case of Forced Air Cooling

② SUC6

■ In the case of forced air cooling, please have sufficient ventilation to keep the temperature of point C in Fig.8.12 at 95°C or below.

Please also make sure that the ambient temperature does not exceed 85°C.

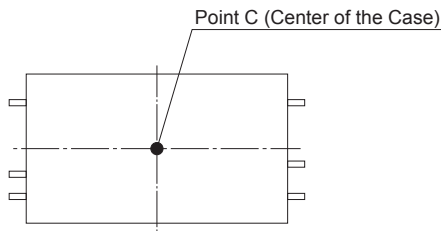
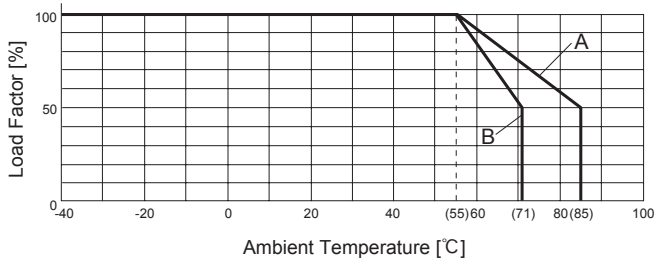


Fig.8.12 Temperature Measuring Point in the case of Forced Air Cooling (Upper Surface of the Case)

8.4 SU/SUC10 Derating Curve

■ If you derate the output current, you can use the unit in the temperature range from -40°C to the maximum temperature shown below.

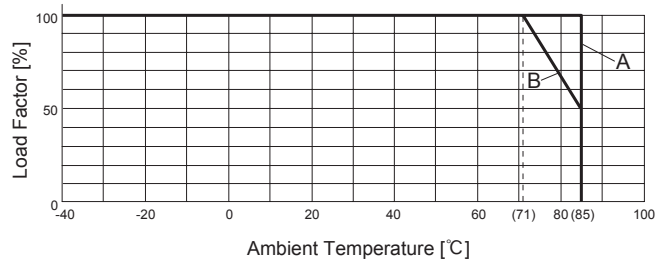
(1) In the case of Convection Cooling



Output Voltage(V) Input Voltage(V)	3.3	5	12	15	±12	±15
5	B	A	A	A	A	A
12	B	A	A	A	A	A
24	B	A	A	A	A	A
48	B	B	B	B	B	B

Fig.8.13 Derating Curve for Convection Cooling (SU/SUC10)

(2) In the case of Forced Air Cooling (1m/s)



Output Voltage(V) Input Voltage(V)	3.3	5	12	15	±12	±15
5	B	B	B	B	A	A
12	B	B	B	B	A	A
24	B	B	B	B	A	A
48	B	B	B	B	B	B

Fig.8.14 Derating Curve for Forced Air Cooling (1m/s) (SU/SUC10)

(3) Temperature Measuring Points in the case of Forced Air Cooling (1m/s)

① SU10

■ In the case of forced air cooling, please have sufficient ventilation to keep the temperature of point A in Fig.8.15 at 105°C or below.

Please also make sure that the ambient temperature does not exceed 85°C.

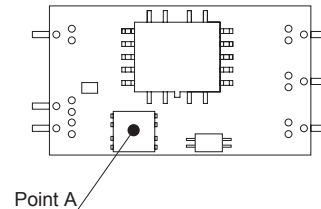


Fig.8.15 Temperature Measuring Point in the case of Forced Air Cooling

② SUC10

■ In the case of forced air cooling, please have sufficient ventilation to keep the temperature of point B in Fig.8.16 at 95°C or below.

Please also make sure that the ambient temperature does not exceed 85°C.

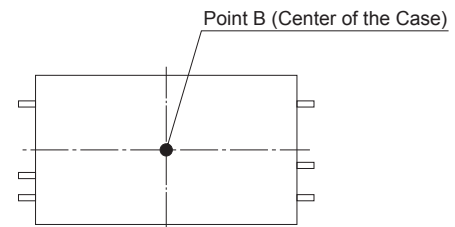
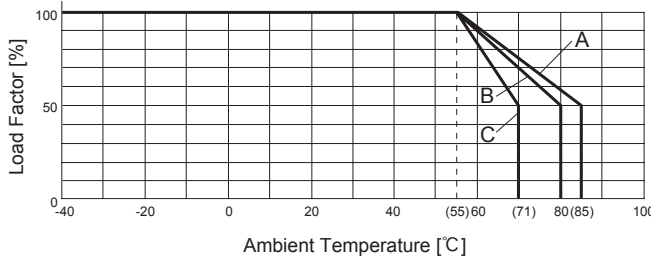


Fig.8.16 Temperature Measuring Point in the case of Forced Air Cooling (Upper Surface of the Case)

8.5 SUT3 Derating Curve

■ If you derate the output current, you can use the unit in the temperature range from -40°C to the maximum temperature shown below.

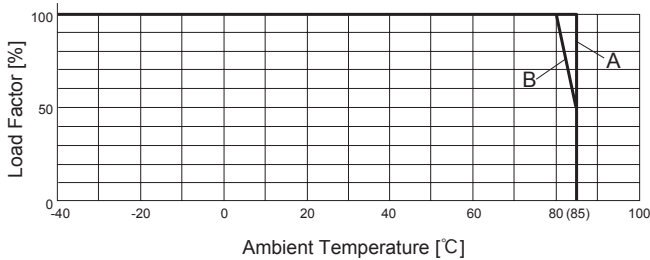
(1) In the case of Convection Cooling



Output Voltage(V) Input Voltage(V)	3.3	5	12	15	±12	±15
5	A	A	B	B	A	B
12	A	A	B	B	A	B
24	A	A	B	B	A	B
48	B	B	B	B	A	C

Fig.8.17 Derating Curve for Convection Cooling (SUT3)

(2) In the case of Forced Air Cooling (1m/s)



Output Voltage(V) Input Voltage(V)	3.3	5	12	15	±12	±15
5	A	B	B	B	B	B
12	A	A	A	A	A	B
24	A	A	B	A	A	B
48	A	A	A	A	A	B

Fig.8.18 Derating Curve for Forced Air Cooling (1m/s) (SUT3)

(3) Temperature Measuring Points in the case of Forced Air Cooling (1m/s)

■ In the case of forced air cooling, please have sufficient ventilation to keep the temperature of point A in Fig.8.19 at 100°C or below. Please also make sure that the ambient temperature does not exceed 85°C.

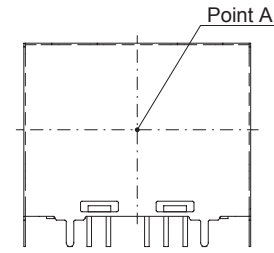
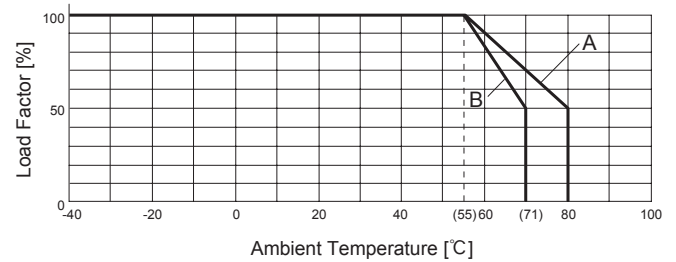


Fig.8.19 Temperature Measuring Point in the case of Forced Air Cooling

8.6 SUT6 Derating Curve

■ If you derate the output current, you can use the unit in the temperature range from -40°C to the maximum temperature shown below.

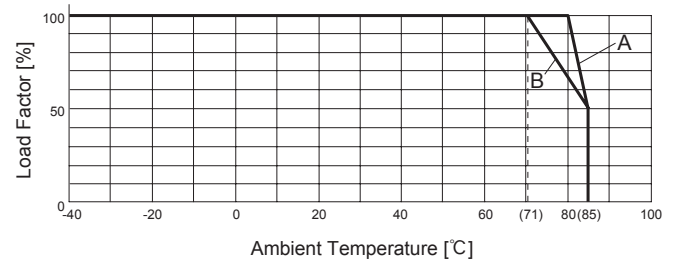
(1) In the case of Convection Cooling



Output Voltage(V) Input Voltage(V)	3.3	5	12	15	±12	±15
5	B	B	B	B	B	B
12	B	B	B	B	B	B
24	B	B	B	B	B	B
48	B	B	A	A	A	A

Fig.8.20 Derating Curve for Convection Cooling (SUT6)

(2) In the case of Forced Air Cooling (1m/s)



Output Voltage(V) Input Voltage(V)	3.3	5	12	15	±12	±15
5	B	B	B	B	B	B
12	B	B	A	A	A	A
24	B	B	A	A	A	A
48	B	B	A	A	A	A

Fig.8.21 Derating Curve for Forced Air Cooling (1m/s) (SUT6)

(3) Temperature Measuring Points in the case of Forced Air Cooling (1m/s)

■ In the case of forced air cooling, please have sufficient ventilation to keep the temperature of point A in Fig.8.22 at 95°C or below. Please also make sure that the ambient temperature does not exceed 85°C.

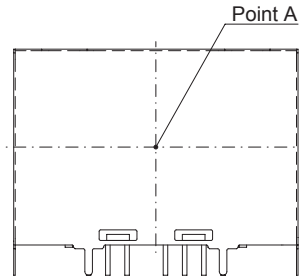
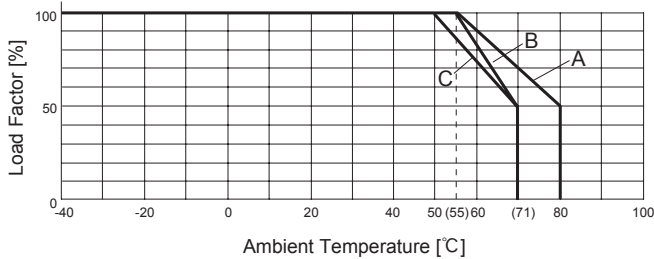


Fig.8.22 Temperature Measuring Point in the case of Forced Air Cooling

8.7 SUT10 Derating Curve

■ If you derate the output current, you can use the unit in the temperature range from -40°C to the maximum temperature shown below.

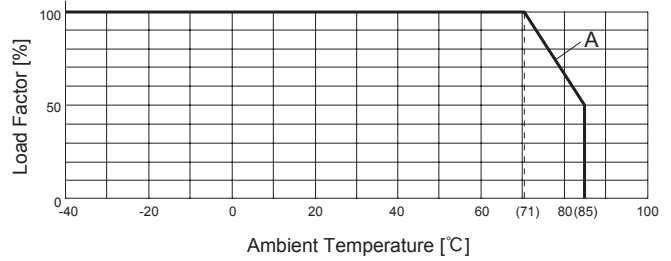
(1) In the case of Convection Cooling



Output Voltage(V) Input Voltage(V)	3.3	5	12	15	±12	±15
5	C	C	A	A	C	C
12	B	A	A	A	B	A
24	C	C	C	C	C	B
48	C	C	C	C	C	C

Fig.8.23 Derating Curve for Convection Cooling (SUT10)

(2) In the case of Forced Air Cooling (1m/s)



Output Voltage(V) Input Voltage(V)	3.3	5	12	15	±12	±15
5	A	A	A	A	A	A
12	A	A	A	A	A	A
24	A	A	A	A	A	A
48	A	A	A	A	A	A

Fig.8.24 Derating Curve for Forced Air Cooling (1m/s) (SUT10)

(3) Temperature Measuring Points in the case of Forced Air Cooling (1m/s)

■ In the case of forced air cooling, please have sufficient ventilation to keep the temperature of point A in Fig.8.25 at 95°C or below. Please also make sure that the ambient temperature does not exceed 85°C.

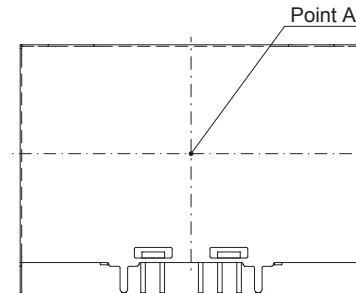
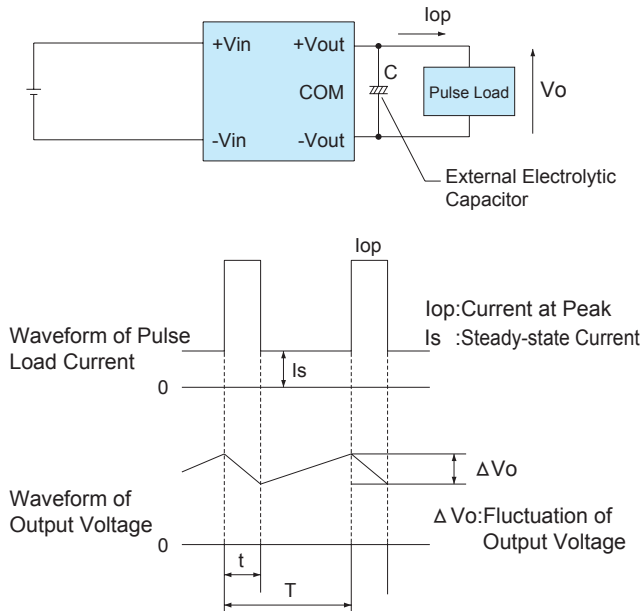


Fig.8.25 Temperature Measuring Point in the case of Forced Air Cooling

9 Peak Current (Pulse Load)

■ If a load connected to a converter is a pulse load, you can provide a pulse current by connecting an electrolytic capacitor externally to the output side.



■ The average output current I_{av} is expressed in the following formula.

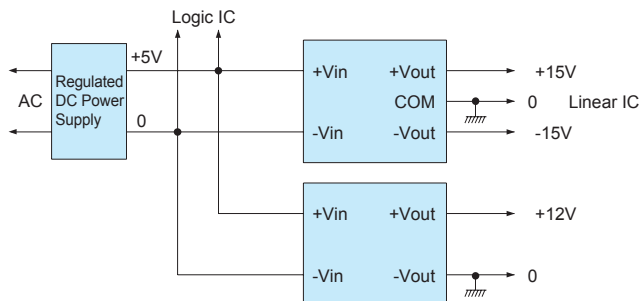
$$I_{av} = I_s + \frac{(I_{op} - I_s) \times t}{T}$$

■ Required electrolytic capacitor C can be obtained from the following formula.

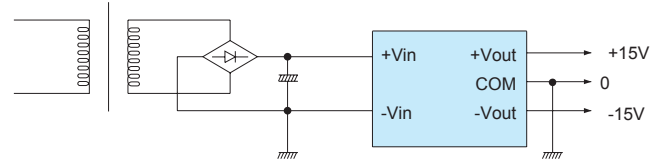
$$C = \frac{(I_{op} - I_{av}) \times t}{\Delta V_o}$$

10 Using DC-DC Converters

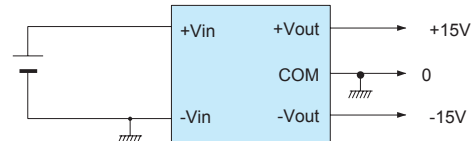
■ To Operate a Linear IC from 5V Output Power Supply



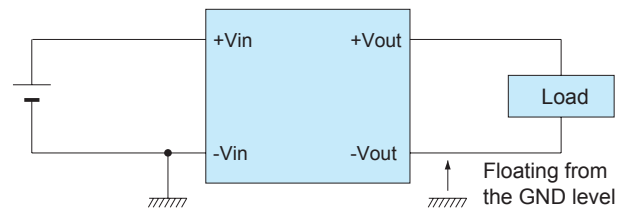
■ When Using a Non-regulated Power Source



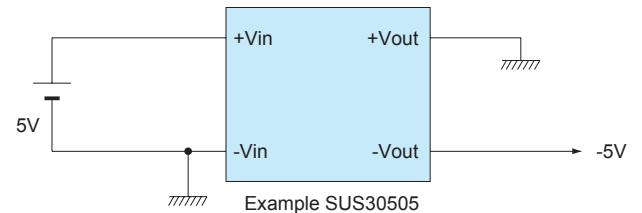
■ When Using a Battery-operated Device



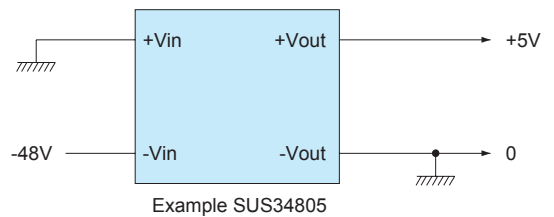
■ When a Floating Mechanism is Required for the Output Circuit



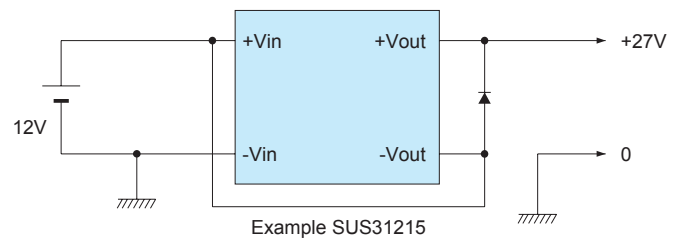
■ To Draw a Reverse Polarity Output



■ To provide a negative voltage to -Vin by using +Vin side of the converter as GND potential (0V)



■ To Draw the Sum of Input Voltage and Plus Output Voltage

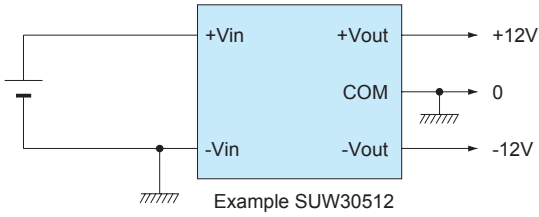


* Output current should be the same as the rated output current of the converter.

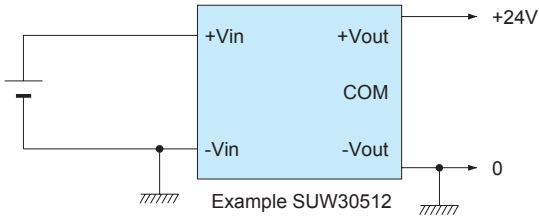
* Output current fluctuation is the sum of the input voltage fluctuation and the output voltage fluctuation of the converter.

■ To Use a Dual Output Type

* Dual output type is typically used in the following manner.

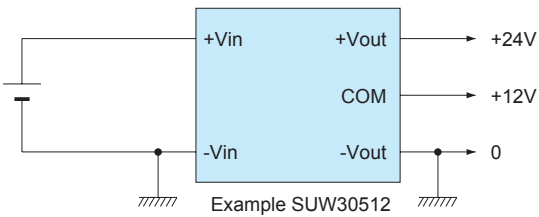


* The unit can be used as a 24V type single output power supply as follows.

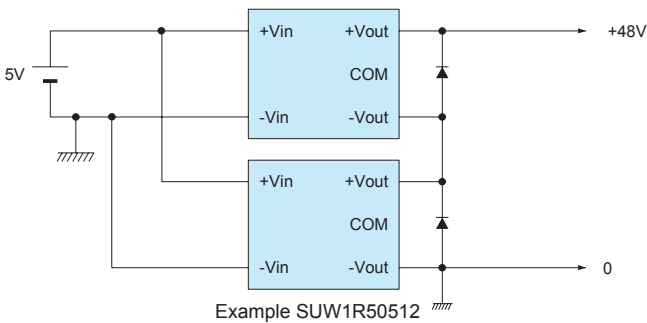


* Another way to use the unit is described below.

* The sum of +12V and +24V flows to the 0V line. Please make sure that this value does not exceed the rated output current of the converter.



■ To Draw 48V Output



11 Options

11.1 Outline of Options

* Please inquire us for details of specifications and delivery timing.

● -C (Only SUC□□C)

- Conformal coating is applied to PCB and parts.
For excessive harsh environment with corrosive gases condition such as H_2S .
- Differences from standard versions are summarized in Table 11.1.

Table 11.1 Coating Type

Clearance to user board	0.05mm min (Refer to Fig.11.1)
Safety Standards	no approvals

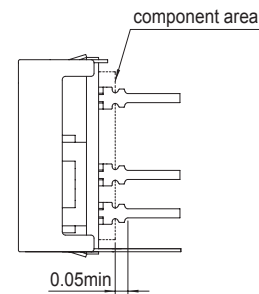


Fig.11.1 Clearance to user board

12 Delivery Package Information

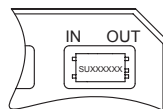
■ These are packed in a tray. (Fig.12.1)

Please order "SU□□□□BP" for tray type packaging.

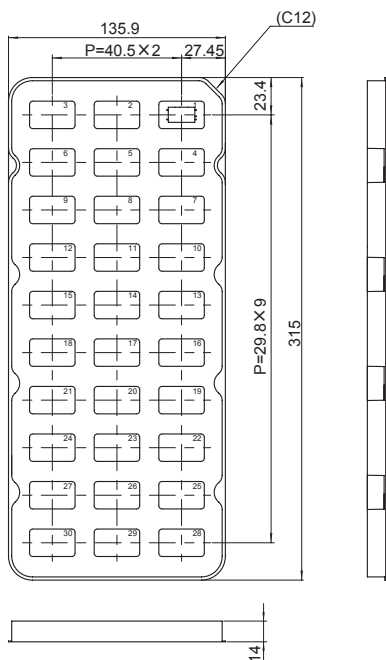
Table 12.1 Capacity of the tray (pcs/tray)

SU1R5	30max
SU3	30max
SU6	20max
SU10	20max

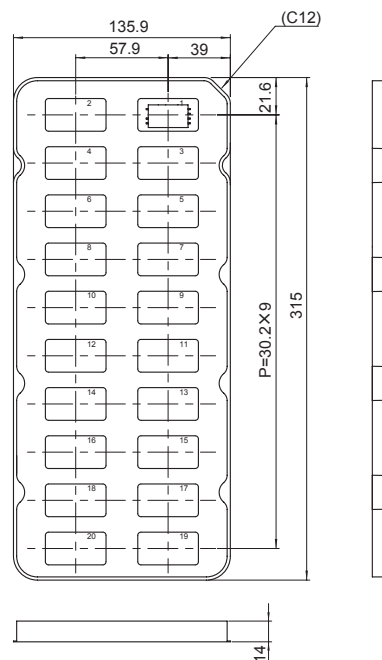
In case of fractions, the units are stored in numerical order.



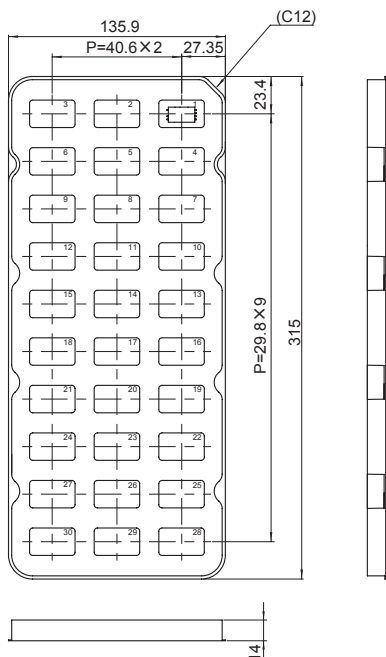
SU□□1R5□□□BP



SU□□6□□□BP



SU□□3□□□BP



SU□□10□□□BP

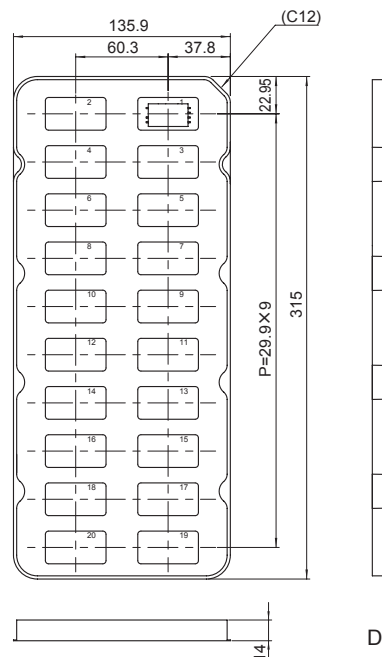


Fig.12.1 Delivery package information

Dimension in mm
Material : Conductive PS



Low Profile



Isolated

Safety
Approvals

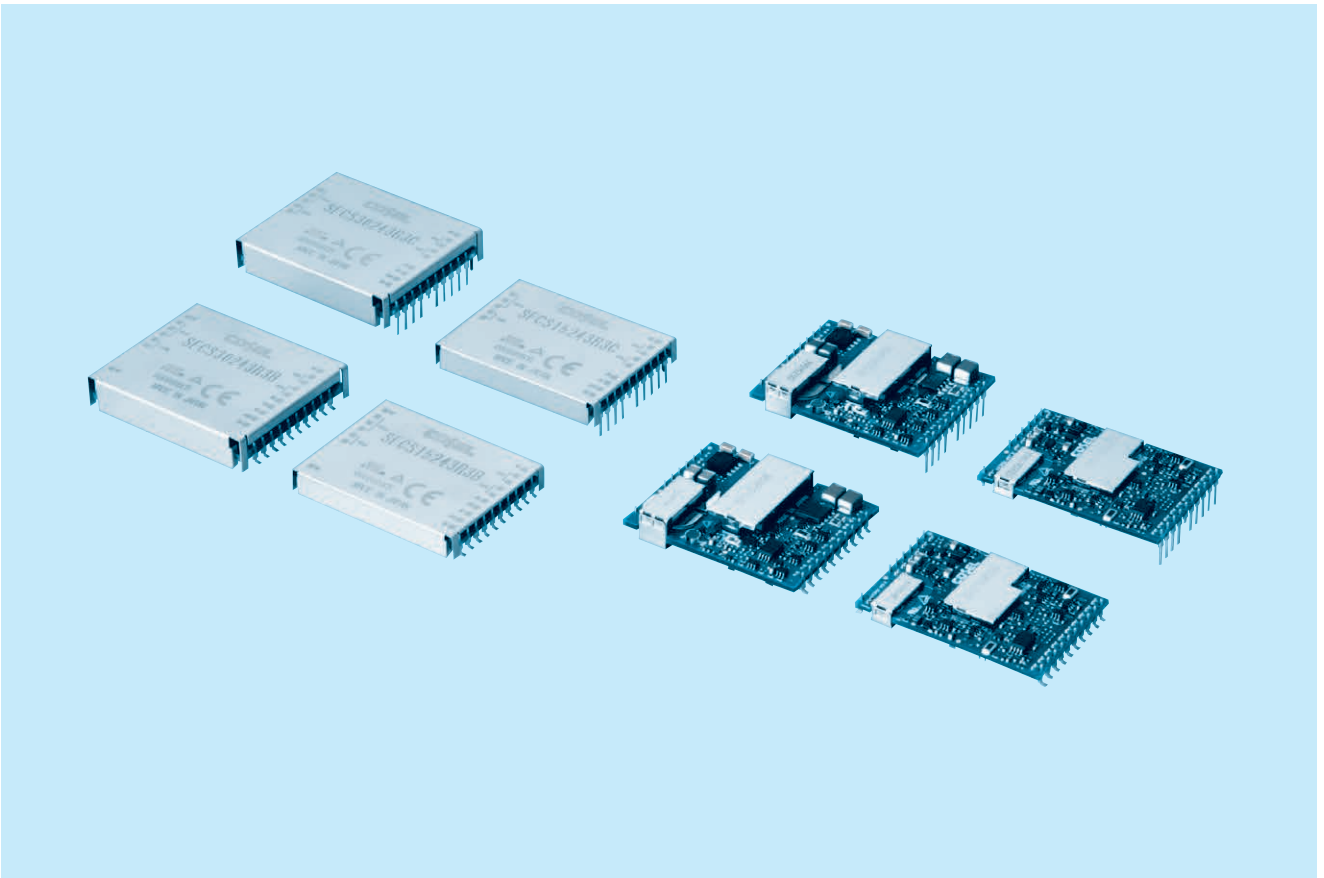
OCP



OVP

Remote
ON/OFFParallel
Operation

SFS-series / SFCS-series



SFS/SFCS

Feature

- SMD mounting type and through-hole mounting type
- High efficiency (synchronous rectifier circuit)
- Parallel operation is possible
- Built-in overcurrent, overvoltage and lowvoltage circuits
- Built-in remote ON/OFF, alarm
- High reliability : not built-in aluminum and tantalum electrolytic capacitor

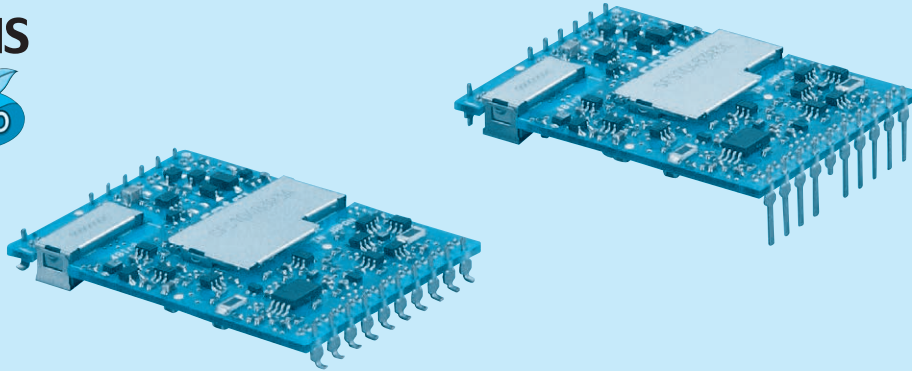
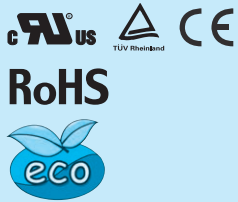
CE marking

- Low Voltage Directive

Safety agency approvals

- UL60950-1, C-UL, EN60950-1

5-year warranty



- ① Series name
② Single output
③ Output wattage
④ Input voltage
48:DC36 - 76V
⑤ Output voltage
⑥ Mounting type
(Soldering process)
B :SMD(Pb-free solder)
C :DIP(Pb-free solder)

MODEL	SFS10481R2	SFS10481R5	SFS10481R8	SFS10482R5	SFS10483R3	SFS104805	SFS104812	SFS104815
MAX OUTPUT WATTAGE[W]	4.2	5.25	5.4	7.5	9.9	10.0	10.8	10.5
DC OUTPUT	1.2V 3.5A	1.5V 3.5A	1.8V 3A	2.5V 3A	3.3V 3A	5V 2A	12V 0.9A	15V 0.7A

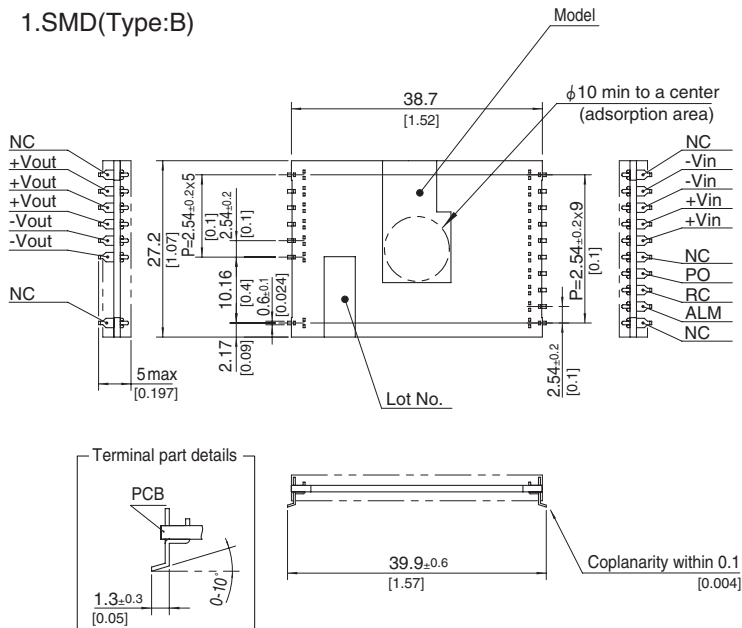
SPECIFICATIONS

	MODEL	SFS10481R2	SFS10481R5	SFS10481R8	SFS10482R5	SFS10483R3	SFS104805	SFS104812	SFS104815
INPUT	VOLTAGE[V]	DC36 - 76							
	CURRENT[A]	*1 0.11typ	0.13typ	0.13typ	0.18typ	0.23typ	0.23typ	0.26typ	0.25typ
	EFFICIENCY[%]	*1 80typ	82typ	84typ	86typ	88typ	89typ	88typ	88typ
	START-UP VOLTAGE[V]	DC32 - 36							
	HYSTERESIS VOLTAGE[V]	DC2 min							
OUTPUT	VOLTAGE[V]	1.2	1.5	1.8	2.5	3.3	5	12	15
	CURRENT[A]	3.5	3.5	3	3	3	2	0.9	0.7
	VOLTAGE ACCURACY[%]	+5, -3							
	RIPPLE[mVp-p]	25max						120max	
	RIPPLE NOISE[mVp-p]	50max						150max	
	START-UP TIME[ms]	20 - 200max (DCIN 48V, Io=100%)							
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE SETTING *1	±1% of rated output voltage							
	OVERCURRENT PROTECTION	Works over 103% of rating							
	OVERVOLTAGE PROTECTION	Works at 120 - 140% of rating							
	LOWVOLTAGE PROTECTION	Works at 90% max of rating							
	REMOTE ON/OFF	Provided(RC open : ON, short between RC and +Vin : OFF)							
ISOLATION	INPUT-OUTPUT	DC1,500V 1minute, DC500V 50MΩ min (20±15℃)							
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85℃, 20 - 95%RH (Non condensing), 3,000m (10,000feet) max							
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max (SMD:Refer to the Instruction Manual)							
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis							
SAFETY	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis							
	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1							
OTHERS	CASE SIZE/WEIGHT	38.7×5.0×27.2mm [1.52×0.197×1.07 inches] (W×H×D) /12g max							
	COOLING METHOD	Convection							

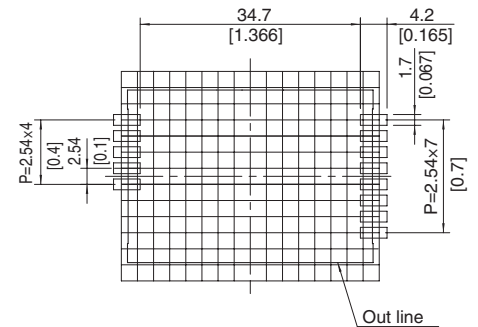
*1 At rated input(DC48V), rated load and 25°C

External view

1.SMD(Type:B)



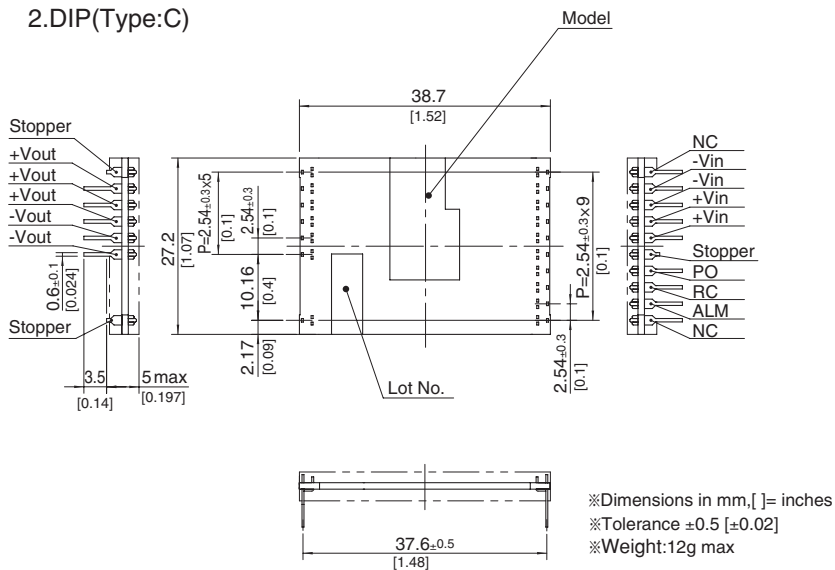
Recommended size for processing PCB -
(TOP VIEW)



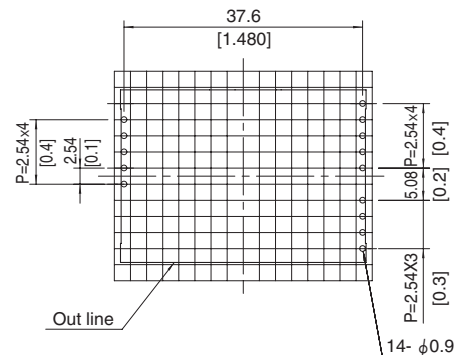
※Dimensions in: $\frac{\text{mm}}{[\text{inch}]}$

※Div.: 0.1inch

2.DIP(Type:C)



Recommended size for processing PCB –
(TOP VIEW)



※Dimensions in: $\frac{\text{mm}}{[\text{inch}]}$

※Div.: 0.1inch

SFS15

SF

S

15

48

3R3

B

①

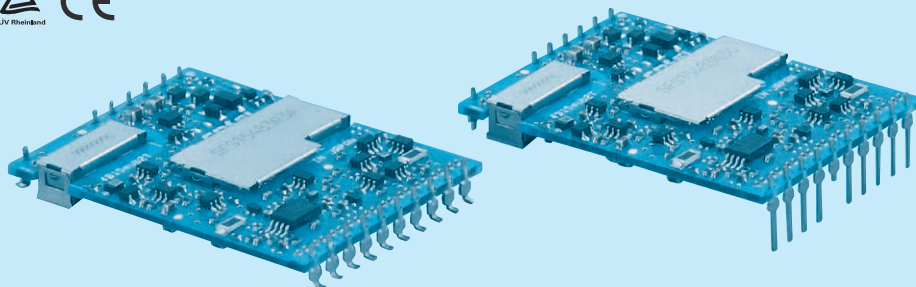
②

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- ① Series name
 ② Single output
 ③ Output wattage
 ④ Input voltage
 24:DC18 - 36V
 48:DC36 - 76V
 ⑤ Output voltage
 ⑥ Mounting type
 (Soldering process)
 B : SMD (Pb-free solder)
 C : DIP (Pb-free solder)

MODEL	SFS15242R5	SFS15243R3	SFS152405	SFS152412	SFS152415
MAX OUTPUT WATTAGE[W]	11.25	14.85	15.0	15.0	15.0
DC OUTPUT	2.5V 4.5A	3.3V 4.5A	5V 3A	12V 1.25A	15V 1A

SPECIFICATIONS

	MODEL	SFS15242R5	SFS15243R3	SFS152405	SFS152412	SFS152415
INPUT	VOLTAGE[V]	DC18 - 36				
	CURRENT[A]	0.54typ	0.7typ	0.69typ	0.7typ	0.7typ
	EFFICIENCY[%]	87typ	89typ	90typ	89typ	89typ
	START-UP VOLTAGE[V]	DC16 - 18				
	HYSTERESIS VOLTAGE[V]	DC1 min				
OUTPUT	VOLTAGE[V]	2.5	3.3	5	12	15
	CURRENT[A]	4.5	4.5	3	1.25	1
	VOLTAGE ACCURACY[%]	+5, -3				
	RIPPLE[mVp-p]	25max			120max	
	RIPPLE NOISE[mVp-p]	50max			150max	
	START-UP TIME[ms]	20 - 200max (DCIN 24V, Io=100%)				
	OUTPUT VOLTAGE SETTING	±1% of rated output voltage				
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 103% of rating				
	OVERVOLTAGE PROTECTION	Works at 120 - 140% of rating				
	LOWVOLTAGE PROTECTION	Works at 90% max of rating				
	REMOTE ON/OFF	Provided(RC open : ON, short between RC and +Vin : OFF)				

MODEL	SFS15481R2	SFS15481R5	SFS15481R8	SFS15482R5	SFS15483R3	SFS154805	SFS154812	SFS154815
MAX OUTPUT WATTAGE[W]	6.24	7.8	8.1	11.25	14.85	15.0	15.0	15.0
DC OUTPUT	1.2V 5.2A	1.5V 5.2A	1.8V 4.5A	2.5V 4.5A	3.3V 4.5A	5V 3A	12V 1.25A	15V 1A

SPECIFICATIONS

	MODEL	SFS15481R2	SFS15481R5	SFS15481R8	SFS15482R5	SFS15483R3	SFS154805	SFS154812	SFS154815
INPUT	VOLTAGE[V]	DC36 - 76							
	CURRENT[A]	*1 0.16typ	0.2typ	0.2typ	0.27typ	0.35typ	0.35typ	0.35typ	0.35typ
	EFFICIENCY[%]	*1 82typ	83typ	85typ	87typ	89typ	90typ	89typ	89typ
	START-UP VOLTAGE[V]	DC32 - 36							
	HYSTERESIS VOLTAGE[V]	DC2 min							
OUTPUT	VOLTAGE[V]	1.2	1.5	1.8	2.5	3.3	5	12	15
	CURRENT[A]	5.2	5.2	4.5	4.5	4.5	3	1.25	1
	VOLTAGE ACCURACY[%]	+5, -3							
	RIPPLE[mVp-p]	25max						120max	
	RIPPLE NOISE[mVp-p]	50max						150max	
	START-UP TIME[ms]	20 - 200max (DCIN 48V, Io=100%)							
	OUTPUT VOLTAGE SETTING *1	±1% of rated output voltage							
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 103% of rating							
	OVERVOLTAGE PROTECTION	Works at 120 - 140% of rating							
	LOWVOLTAGE PROTECTION	Works at 90% max of rating							
	REMOTE ON/OFF	Provided(RC open : ON, short between RC and +Vin : OFF)							

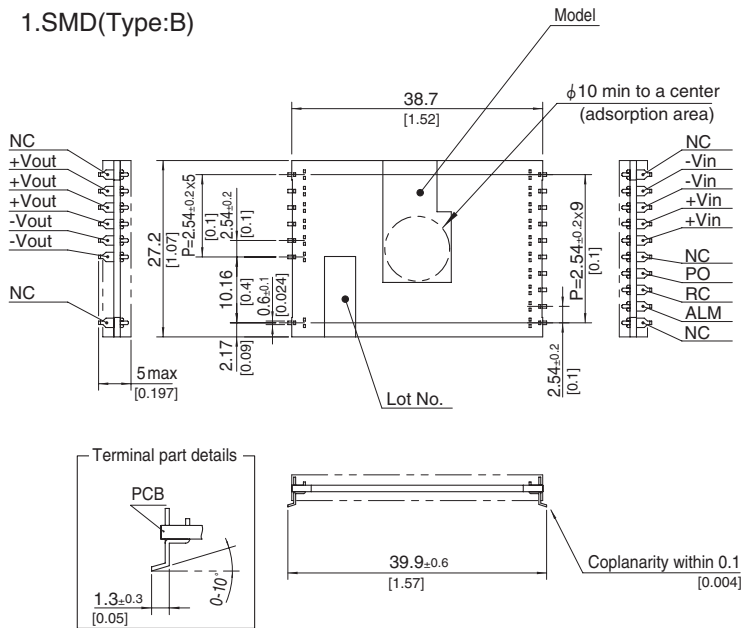
GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	DC1,500V 1minute, DC500V 50MΩ min (20±15°C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 - 95%RH (Non condensing), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max (SMD: Refer to the Instruction Manual)
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1
OTHERS	CASE SIZE/WEIGHT	38.7×5.0×27.2mm [1.52×0.197×1.07 inches] (W×H×D) /12g max
	COOLING METHOD	Convection

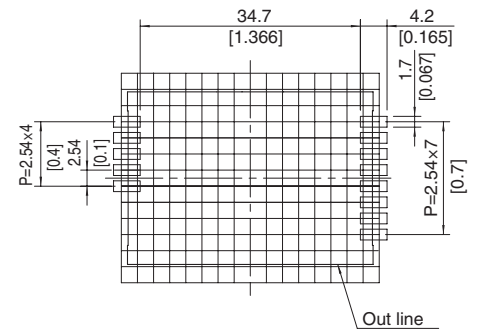
*1 At rated input(DC24V, DC48V), rated load and 25°C

External view

1.SMD(Type:B)



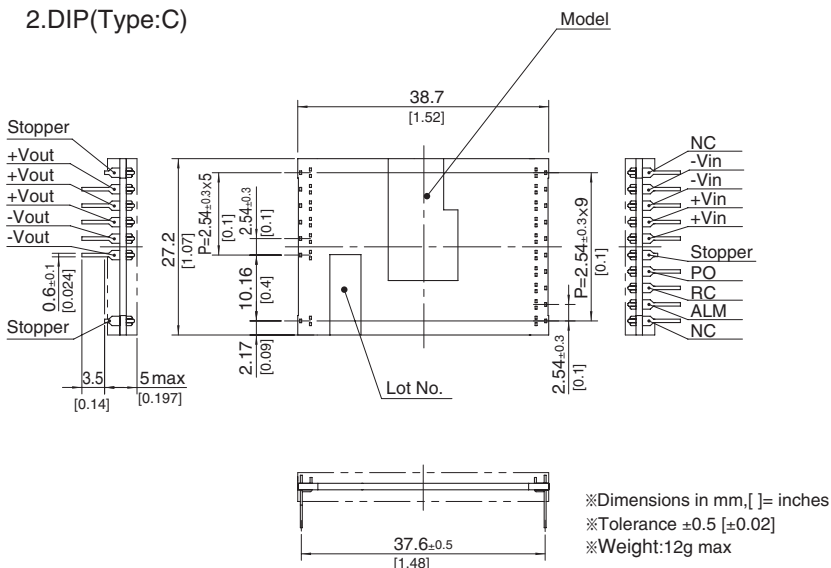
Recommended size for processing PCB (TOP VIEW)



※Dimensions in: mm
[inch]

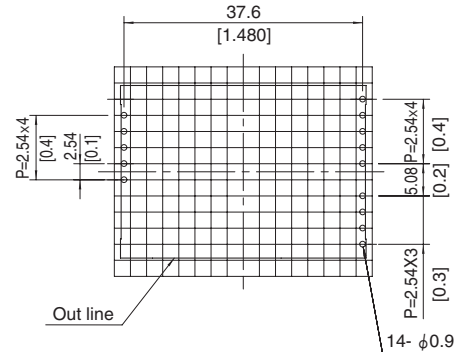
※Div.: 0.1inch

2.DIP(Type:C)



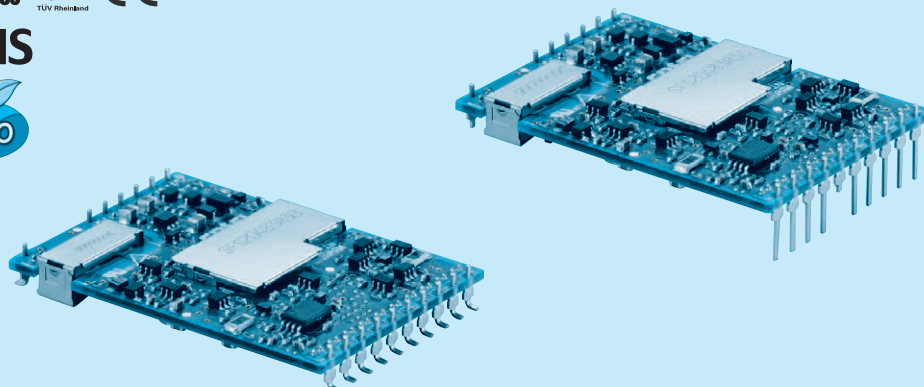
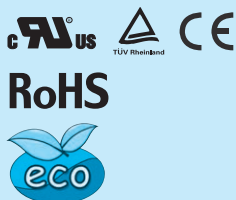
※Dimensions in mm, [] = inches
※Tolerance ±0.5 [±0.02]
※Weight: 12g max

Recommended size for processing PCB (TOP VIEW)



※Dimensions in: mm
[inch]

※Div.: 0.1inch



- ① Series name
② Single output
③ Output wattage
④ Input voltage
48:DC36 - 76V
⑤ Output voltage
⑥ Mounting type
(Soldering process)
B :SMD(Pb-free solder)
C :DIP(Pb-free solder)

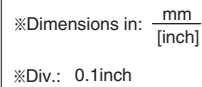
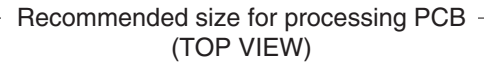
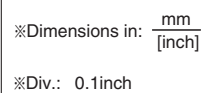
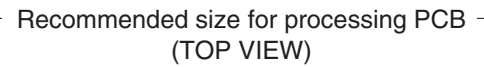
MODEL	SFS20481R5	SFS20481R8	SFS20482R5	SFS20483R3	SFS204805
MAX OUTPUT WATTAGE[W]	13.5	14.4	17.5	19.8	20.0
DC OUTPUT	1.5V 9A	1.8V 8A	2.5V 7A	3.3V 6A	5V 4A

SPECIFICATIONS

	MODEL	SFS20481R5	SFS20481R8	SFS20482R5	SFS20483R3	SFS204805
INPUT	VOLTAGE[V]	DC36 - 76				
	CURRENT[A]	*1 0.33typ	0.35typ	0.41typ	0.46typ	0.46typ
	EFFICIENCY[%]	*1 86typ	85typ	88typ	90typ	90typ
	START-UP VOLTAGE[V]	DC32 - 36				
	HYSTERESIS VOLTAGE[V]	DC2 min				
OUTPUT	VOLTAGE[V]	1.5	1.8	2.5	3.3	5
	CURRENT[A]	9	8	7	6	4
	VOLTAGE ACCURACY[%]	+5, -3				
	RIPPLE[mVp-p]	50max				
	RIPPLE NOISE[mVp-p]	50max				
	START-UP TIME[ms]	20 - 200max (DCIN 48V, Io=100%)				
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE SETTING *1	+2, -1% of rated output voltage				
	OVERCURRENT PROTECTION	Works over 103% of rating				
	OVERVOLTAGE PROTECTION	Works at 115 - 145% of rating				
	LOWVOLTAGE PROTECTION	Works at 95% max of rating				
ISOLATION	REMOTE ON/OFF	Provided(RC open : ON, short between RC and +Vin : OFF)				
	INPUT-OUTPUT	DC1,500V 1minute, DC500V 50MΩ min (20±15℃)				
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85℃, 20 - 95%RH (Non condensing), 3,000m (10,000feet) max				
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max (SMD:Refer to the Instruction Manual)				
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis				
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis				
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL(CSA60950-1), EN60950-1				
OTHERS	CASE SIZE/WEIGHT	38.7×5.0×27.2mm [1.52×0.197×1.07 inches] (W×H×D) /12g max				
	COOLING METHOD	Convection/Forced air				

*1 At rated input(DC48V), rated load and 25℃

1.SMD(Type:B)

[illegible]

SFS30

SF

S

30

48

3R3

B

①

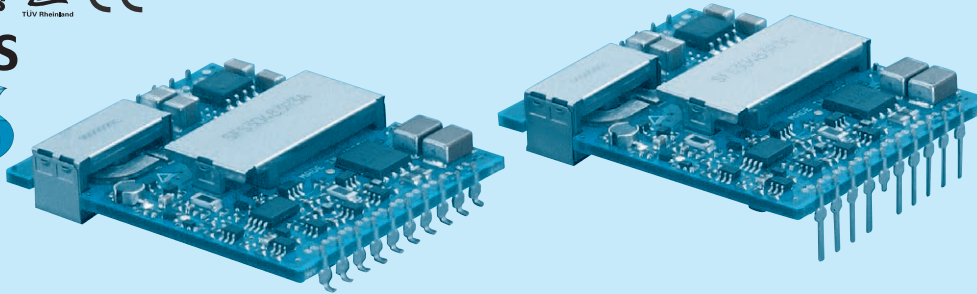
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- ① Series name
② Single output
③ Output wattage
④ Input voltage
24:DC18 - 36V
48:DC36 - 76V
⑤ Output voltage
⑥ Mounting type
(Soldering process)
B : SMD(Pb-free solder)
C : DIP(Pb-free solder)

MODEL	SFS30242R5	SFS30243R3	SFS302405	SFS302412	SFS302415
MAX OUTPUT WATTAGE[W]	22.5	29.7	30.0	30.0	30.0
DC OUTPUT	2.5V 9A	3.3V 9A	5V 6A	12V 2.5A	15V 2A

SPECIFICATIONS

	MODEL	SFS30242R5	SFS30243R3	SFS302405	SFS302412	SFS302415
INPUT	VOLTAGE[V]	DC18 - 36				
	CURRENT[A]	1.04typ	1.36typ	1.36typ	1.36typ	1.39typ
	EFFICIENCY[%]	90typ	91typ	92typ	92typ	90typ
	START-UP VOLTAGE[V]	DC16 - 18				
	HYSTERESIS VOLTAGE[V]	DC1 min				
OUTPUT	VOLTAGE[V]	2.5	3.3	5	12	15
	CURRENT[A]	9	9	6	2.5	2
	VOLTAGE ACCURACY[%]	+5, -3				
	RIPPLE[mVp-p]	25max			120max	
	RIPPLE NOISE[mVp-p]	50max			150max	
	START-UP TIME[ms]	20 - 200max (DCIN 24V, Io=100%)				
	OUTPUT VOLTAGE SETTING	± 1% of rated output voltage				
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 103% of rating				
	OVERVOLTAGE PROTECTION	Works at 120 - 140% of rating				
	LOWVOLTAGE PROTECTION	Works at 90% max of rating				
	REMOTE ON/OFF	Provided(RC open : ON, short between RC and +Vin : OFF)				

MODEL	SFS30481R2	SFS30481R5	SFS30481R8	SFS30482R5	SFS30483R3	SFS304805	SFS304810	SFS304812	SFS304815
MAX OUTPUT WATTAGE[W]	12.48	15.6	16.2	22.5	29.7	30.0	30.0	30.0	30.0
DC OUTPUT	1.2V 10.4A	1.5V 10.4A	1.8V 9A	2.5V 9A	3.3V 9A	5V 6A	10V 3A	12V 2.5A	15V 2A

SPECIFICATIONS

	MODEL	SFS30481R2	SFS30481R5	SFS30481R8	SFS30482R5	SFS30483R3	SFS304805	SFS304810	SFS304812	SFS304815
INPUT	VOLTAGE[V]	DC36 - 76								
	CURRENT[A]	*1 0.30typ	0.37typ	0.38typ	0.52typ	0.67typ	0.68typ	0.69typ	0.68typ	0.68typ
	EFFICIENCY[%]	*1 86typ	87.5typ	89typ	91typ	92typ	92.5typ	91typ	92typ	92typ
	START-UP VOLTAGE[V]	DC32 - 36								
	HYSTERESIS VOLTAGE[V]	DC2 min								
OUTPUT	VOLTAGE[V]	1.2	1.5	1.8	2.5	3.3	5	10	12	15
	CURRENT[A]	10.4	10.4	9	9	9	6	3	2.5	2
	VOLTAGE ACCURACY[%]	+5, -3								
	RIPPLE[mVp-p]	25max						120max		
	RIPPLE NOISE[mVp-p]	50max						150max		
	START-UP TIME[ms]	20 - 200max (DCIN 48V, Io=100%)								
	OUTPUT VOLTAGE SETTING *1	± 1% of rated output voltage								
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 103% of rating								
	OVERVOLTAGE PROTECTION	Works at 120 - 140% of rating								
	LOWVOLTAGE PROTECTION	Works at 90% max of rating								
	REMOTE ON/OFF	Provided(RC open : ON, short between RC and +Vin : OFF)								

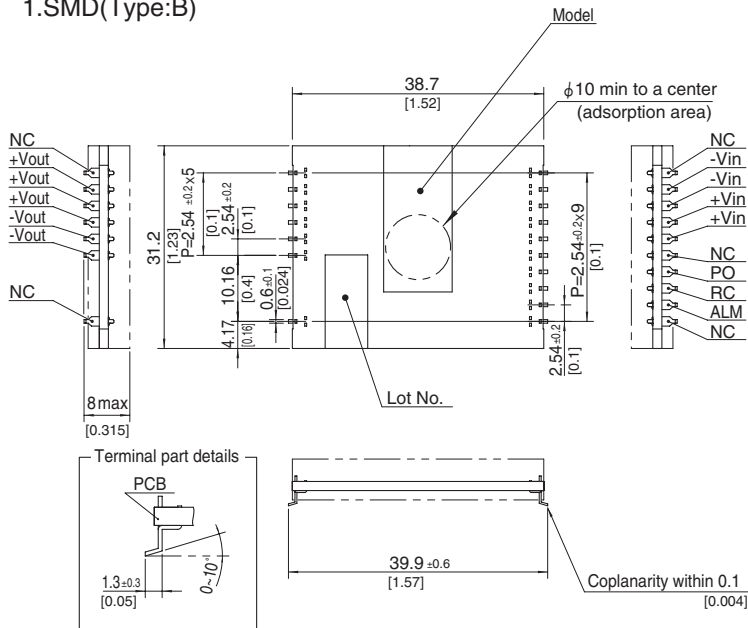
GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	DC1,500V 1minute, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 - 95%RH (Non condensing), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max (SMD: Refer to the Instruction Manual)
	VIBRATION	10 - 55Hz, 49.0m/s 2 (5G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	196.1m/s 2 (20G), 11ms, once each X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1
OTHERS	CASE SIZE/WEIGHT	38.7 \times 8.0 \times 31.2mm [1.52 \times 0.315 \times 1.23 inches] (W \times H \times D) /20g max
	COOLING METHOD	Convection/Forced air

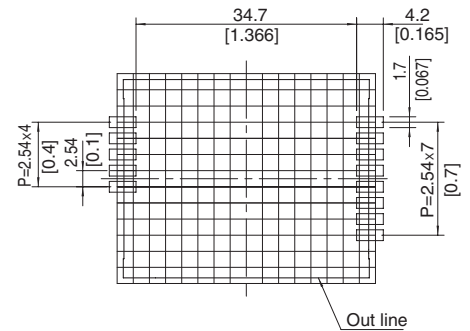
*1 At rated input(DC24V, DC48V), rated load and 25 $^{\circ}$ C

External view

1.SMD(Type:B)



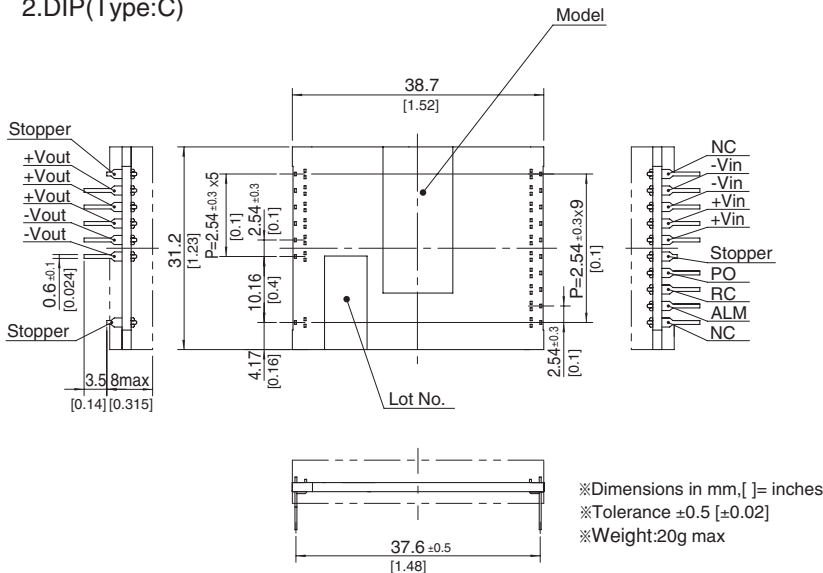
Recommended size for processing PCB (TOP VIEW)



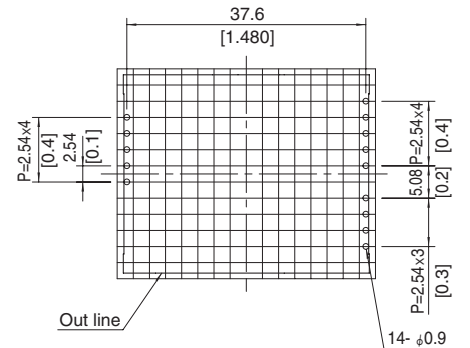
※Dimensions in: $\frac{\text{mm}}{[\text{inch}]}$

※Div.: 0.1inch

2.DIP(Type:C)



Recommended size for processing PCB (TOP VIEW)

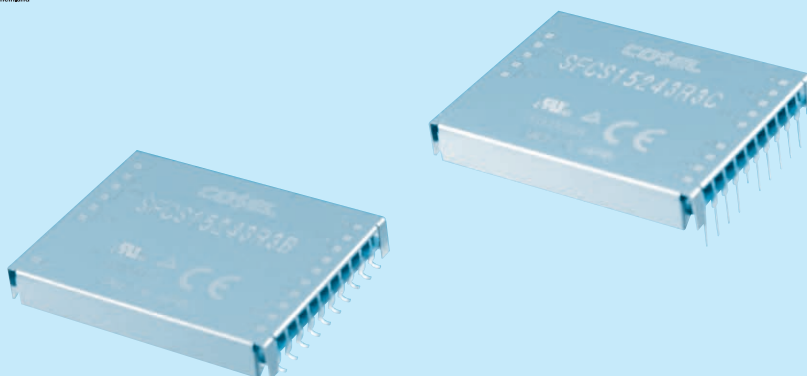


※Dimensions in: $\frac{\text{mm}}{[\text{inch}]}$

※Div.: 0.1inch



RoHS



- ① Series name
 ② Single output
 ③ Output wattage
 ④ Input voltage
 24:DC18 - 36V
 48:DC36 - 76V
 ⑤ Output voltage
 ⑥ Mounting type
 B :SMD
 C :DIP

MODEL	SFCS15243R3	SFCS152405	SFCS152412	SFCS152415	SFCS15483R3	SFCS154805	SFCS154812	SFCS154815
MAX OUTPUT WATTAGE[W]	14.85	15.0	15.0	15.0	14.85	15.0	15.0	15.0
DC OUTPUT	3.3V 4.5A	5V 3A	12V 1.25A	15V 1A	3.3V 4.5A	5V 3A	12V 1.25A	15V 1A

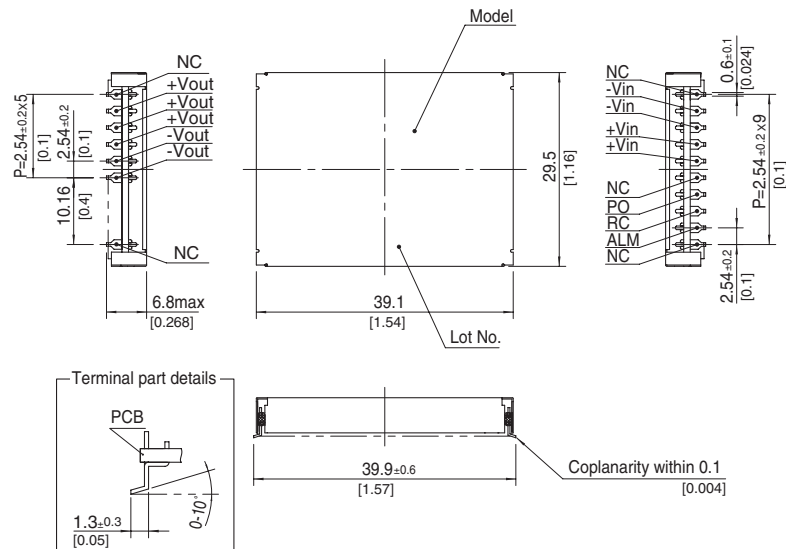
SPECIFICATIONS

	MODEL	SFCS15243R3	SFCS152405	SFCS152412	SFCS152415	SFCS15483R3	SFCS154805	SFCS154812	SFCS154815
INPUT	VOLTAGE[V]	DC18 - 36				DC36 - 76			
	CURRENT[A]	*1 0.7typ	0.69typ	0.7typ	0.7typ	0.35typ	0.35typ	0.35typ	0.35typ
	EFFICIENCY[%]	*1 89typ	90typ	89typ	89typ	89typ	90typ	89typ	89typ
	START-UP VOLTAGE[V]	DC16 - 18				DC32 - 36			
	HYSTERESIS VOLTAGE[V]	DC1 min				DC2 min			
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	4.5	3	1.25	1	4.5	3	1.25	1
	VOLTAGE ACCURACY[%]	+5, -3							
	RIPPLE[mVp-p]	25max		120max		25max		120max	
	RIPPLE NOISE[mVp-p]	50max		150max		50max		150max	
	START-UP TIME[ms]	20 - 200max (DCIN 24V, Io=100%)				20 - 200max (DCIN 48V, Io=100%)			
	OUTPUT VOLTAGE SETTING *1	± 1% of rated output voltage							
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 103% of rating							
	OVERVOLTAGE PROTECTION	Works at 120 - 140% of rating							
	LOWVOLTAGE PROTECTION	Works at 90% max of rating							
	REMOTE ON/OFF	Provided(RC open : ON, short between RC and +Vin : OFF)							
ISOLATION	INPUT-OUTPUT	DC1,000V or AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)							
	INPUT-CASE	DC500V or AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)							
	OUTPUT-CASE	DC500V or AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)							
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85℃, 20 - 95%RH (Non condensing), 3,000m (10,000feet) max							
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max (SMD:Refer to the Instruction Manual)							
	VIBRATION	10 - 55Hz, 49.0m/s² (5G), 3minutes period, 60minutes each along X, Y and Z axis							
	IMPACT	196.1m/s² (20G), 11ms, once each X, Y and Z axis							
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1							
OTHERS	CASE SIZE/WEIGHT	39.1×6.8×29.5mm [1.54×0.268×1.16 inches] (W×H×D) /16g max							
	COOLING METHOD	Convection							

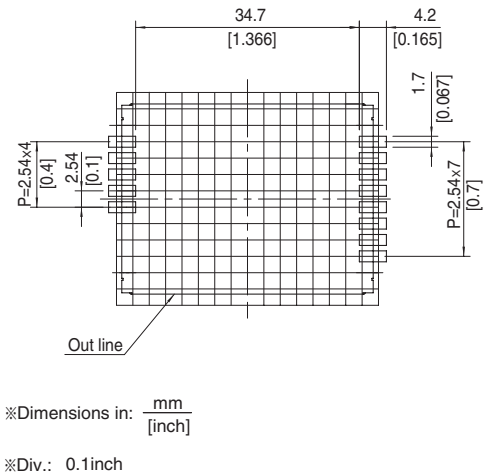
*1 At rated input(DC24V, DC48V), rated load and 25℃

External view

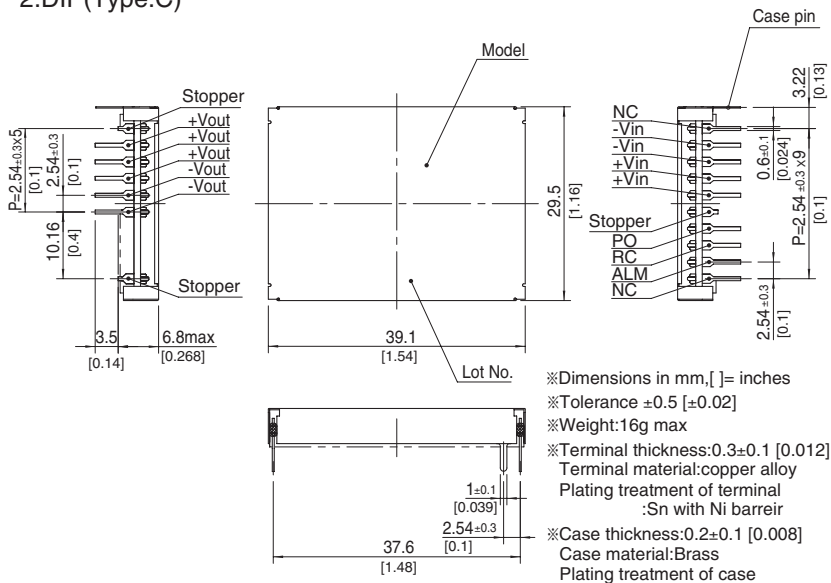
1.SMD(Type:B)



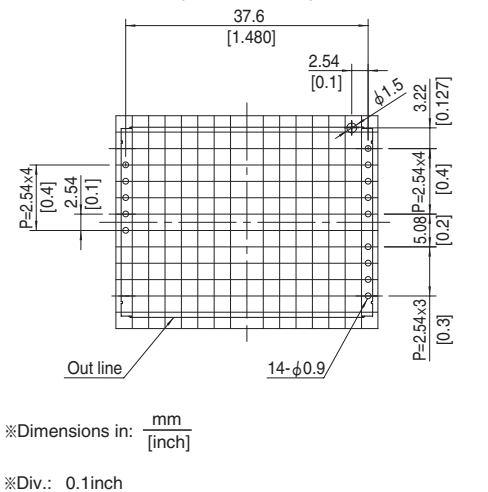
Recommended size for processing PCB -
(TOP VIEW)



2.DIP(Type:C)



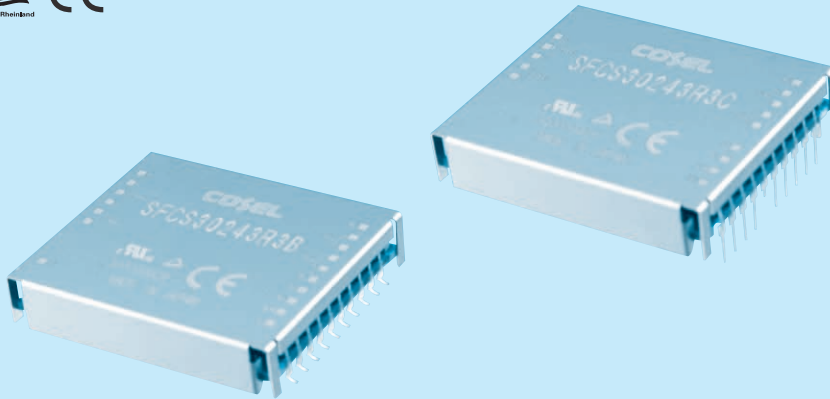
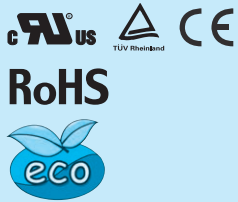
Recommended size for processing PCB -
(TOP VIEW)



SFC S30

SFC S 30 24 3R3 C

① ② ③ ④ ⑤ ⑥



- ① Series name
 ② Single output
 ③ Output wattage
 ④ Input voltage
 24:DC18 - 36V
 48:DC36 - 76V
 ⑤ Output voltage
 ⑥ Mounting type
 B :SMD
 C :DIP

MODEL	SFCS30243R3	SFCS302405	SFCS302412	SFCS302415	SFCS30483R3	SFCS304805	SFCS304812	SFCS304815
MAX OUTPUT WATTAGE[W]	29.7	30.0	30.0	30.0	29.7	30.0	30.0	30.0
DC OUTPUT	3.3V 9A	5V 6A	12V 2.5A	15V 2A	3.3V 9A	5V 6A	12V 2.5A	15V 2A

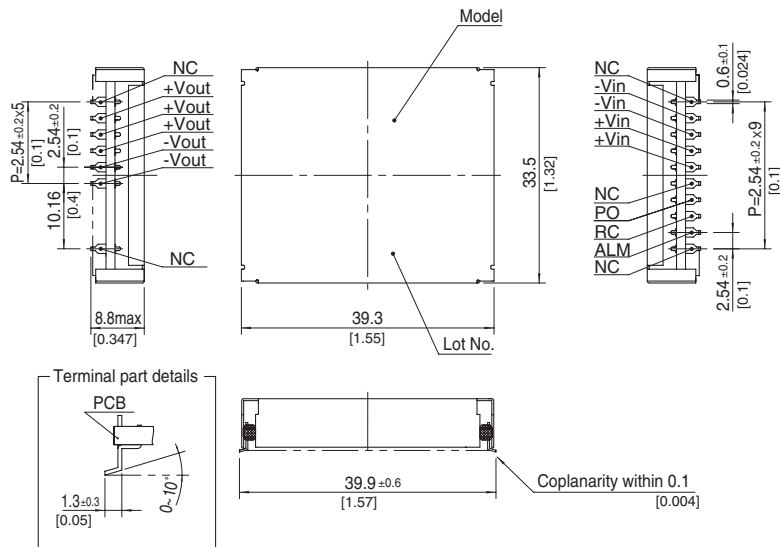
SPECIFICATIONS

	MODEL	SFCS30243R3	SFCS302405	SFCS302412	SFCS302415	SFCS30483R3	SFCS304805	SFCS304812	SFCS304815
INPUT	VOLTAGE[V]	DC18 - 36				DC36 - 76			
	CURRENT[A]	1.36typ	1.36typ	1.36typ	1.39typ	0.67typ	0.68typ	0.68typ	0.68typ
	EFFICIENCY[%]	91typ	92typ	92typ	90typ	92typ	92.5typ	92typ	92typ
	START-UP VOLTAGE[V]	DC16 - 18				DC32 - 36			
	HYSTERESIS VOLTAGE[V]	DC1 min				DC2 min			
OUTPUT	VOLTAGE[V]	3.3	5	12	15	3.3	5	12	15
	CURRENT[A]	9	6	2.5	2	9	6	2.5	2
	VOLTAGE ACCURACY[%]	+5, -3							
	RIPPLE[mVp-p]	25max		120max		25max		120max	
	RIPPLE NOISE[mVp-p]	50max		150max		50max		150max	
	START-UP TIME[ms]	20 - 200max (DCIN 24V, Io=100%)				20 - 200max (DCIN 48V, Io=100%)			
	OUTPUT VOLTAGE SETTING	± 1% of rated output voltage							
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 103% of rating							
	OVERVOLTAGE PROTECTION	Works at 120 - 140% of rating							
	LOWVOLTAGE PROTECTION	Works at 90% max of rating							
	REMOTE ON/OFF	Provided(RC open : ON, short between RC and +Vin : OFF)							
ISOLATION	INPUT-OUTPUT	DC1,000V or AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)							
	INPUT-CASE	DC500V or AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)							
	OUTPUT-CASE	DC500V or AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)							
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85℃, 20 - 95%RH (Non condensing), 3,000m (10,000feet) max							
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max (SMD:Refer to the Instruction Manual)							
	VIBRATION	10 - 55Hz, 49.0m/s² (5G), 3minutes period, 60minutes each along X, Y and Z axis							
	IMPACT	196.1m/s² (20G), 11ms, once each X, Y and Z axis							
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1							
OTHERS	CASE SIZE/WEIGHT	39.3×8.8×33.5mm [1.55×0.347×1.32 inches] (W×H×D) /25g max							
	COOLING METHOD	Convection / Forced air							

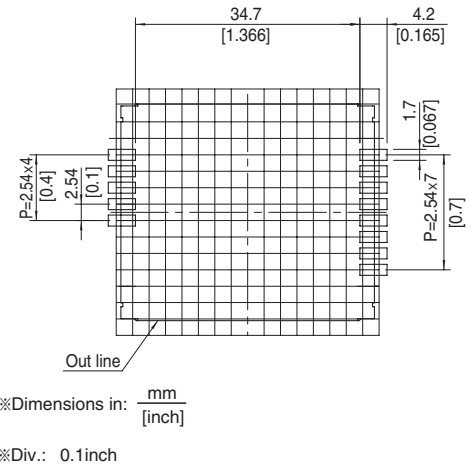
*1 At rated input(DC24V, DC48V), rated load and 25℃

External view

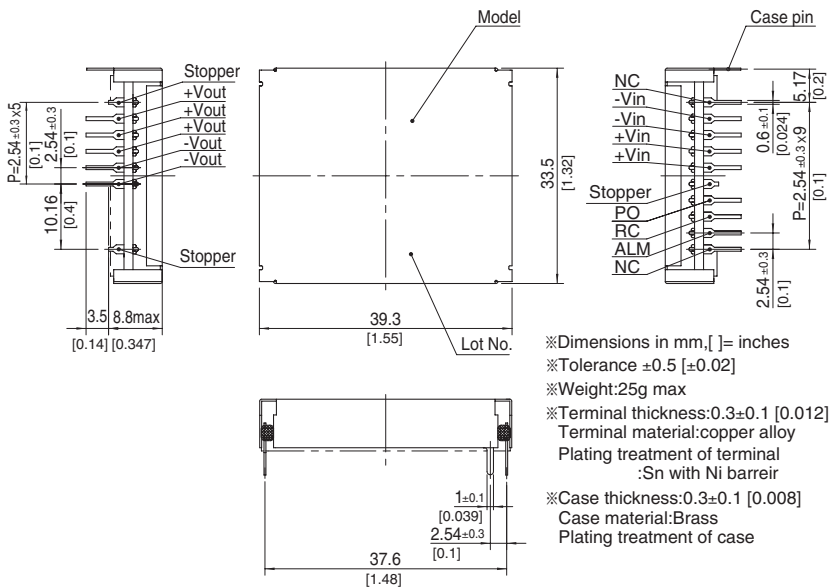
1.SMD(Type:B)



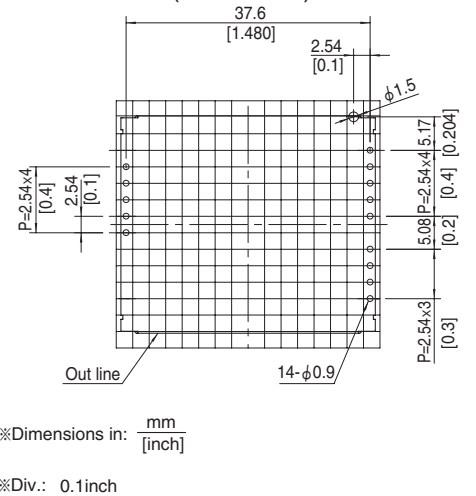
Recommended size for processing PCB (TOP VIEW)



2.DIP(Type:C)



Recommended size for processing PCB (TOP VIEW)



Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
SFS10	Single ended forward converter	570 - 670	* 1	-	-	glass fabric base,epoxy resin		Multilayer	Yes	Yes
SFS15 SFCS15	Single ended forward converter	570 - 670	* 1	-	-	glass fabric base,epoxy resin		Multilayer	Yes	Yes
SFS20	Single ended forward converter	570 - 670	* 1	-	-	glass fabric base,epoxy resin		Multilayer	Yes	Yes
SFS30 SFCS30	Single ended forward converter	440 - 530	* 1	-	-	glass fabric base,epoxy resin		Multilayer	Yes	Yes

* 1 Refer to Specification.

1	Pin Configuration	SFS/SFCS-16
2	Connection for Standard Use	SFS/SFCS-16
3	Wiring Input / Output Pin	SFS/SFCS-16
3.1	Wiring input pin	SFS/SFCS-16
3.2	Wiring output pin	SFS/SFCS-17
4	Function	SFS/SFCS-18
4.1	Overcurrent protection (OCP) and Low voltage protection (LVP)	SFS/SFCS-18
4.2	Overvoltage protection (OVP)	SFS/SFCS-18
4.3	Remote ON / OFF (RC pin)	SFS/SFCS-18
4.4	Alarm (ALM pin)	SFS/SFCS-18
4.5	Start in / out (PO pin)	SFS/SFCS-19
4.6	Sequence	SFS/SFCS-19
4.7	Isolation	SFS/SFCS-19
5	Series and Parallel Operation	SFS/SFCS-19
5.1	Series operation	SFS/SFCS-19
5.2	Parallel operation	SFS/SFCS-20
6	Implementation · Mounting Method	SFS/SFCS-20
6.1	Automatic mounting	SFS/SFCS-20
6.2	Soldering temperature	SFS/SFCS-20
6.3	Cleaning	SFS/SFCS-20
6.4	Mounting method	SFS/SFCS-21
6.5	Storage method	SFS/SFCS-21
6.6	Stress to the product	SFS/SFCS-21
7	Safety Considerations	SFS/SFCS-21
8	Derating	SFS/SFCS-21
8.1	Derating curve (SFS1048, SFS1548)	SFS/SFCS-21
8.2	Derating curve (SFS1524, SFCS15)	SFS/SFCS-22
8.3	Derating curve (SFS2048)	SFS/SFCS-22
8.4	Derating curve (SFS3024, SFCS30)	SFS/SFCS-22
8.5	Derating curve (SFS3048)	SFS/SFCS-23
9	SMD type Package Information	SFS/SFCS-25
9.1	Delivery package information (SFS series SMD type)	SFS/SFCS-25
9.2	Delivery package information (SFCS series SMD type)	SFS/SFCS-25

1 Pin Configuration

●SFS10 / SFS15 / SFS20 / SFCS15

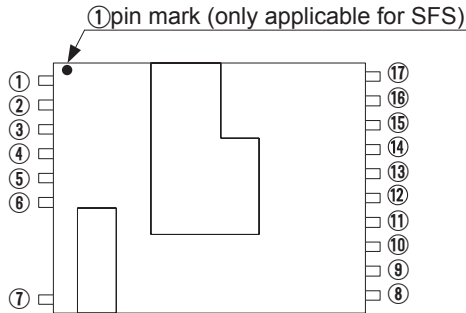


Fig.1.1 Pin configuration (SFS10 / SFS15 / SFS20 / SFCS15)

●SFS30 / SFCS30

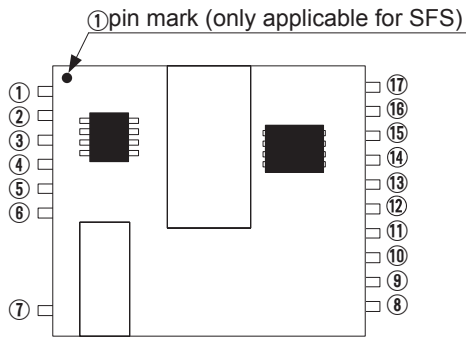


Fig.1.2 Pin configuration (SFS30 / SFCS30)

Table 1.1 Pin configuration and function

No.	Pin Name	Function
①	NC(SMD) Stopper(DIP)	Not connected / Adhesive dispensing Stopper
②	+Vout	+DC output
③	+Vout	+DC output
④	+Vout	+DC output
⑤	-Vout	-DC output
⑥	-Vout	-DC output
⑦	NC(SMD) Stopper(DIP)	Not connected / Adhesive dispensing Stopper
⑧	NC(SMD) NC(DIP)	Not connected / Adhesive dispensing Not connected
⑨	ALM	Alarm
⑩	RC	Remote ON / OFF
⑪	PO	Start in / out
⑫	NC(SMD) Stopper(DIP)	Not connected Stopper
⑬	+Vin	+DC input
⑭	+Vin	+DC input
⑮	-Vin	-DC input
⑯	-Vin	-DC input
⑰	NC(SMD) NC(DIP)	Not connected / Adhesive dispensing Not connected
Case connecting pin		Isolated from internal circuit Only applicable for SFCS type C (DIP)

2 Connection for Standard Use

■In order to use the power supply, it is necessary to wire as shown in Fig.2.1.

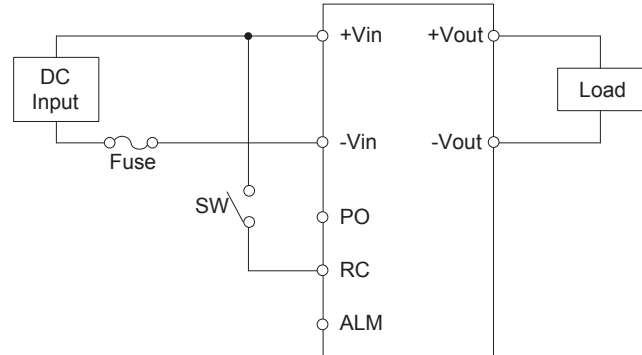


Fig.2.1 Connection for standard use

- When remote ON / OFF function is not used, please open RC pin or short between RC and -Vin pin.
- When alarm function is not used, please open ALM pin.
- In parallel and series operation, connect each PO pin mutually. When PO function is not used, please open PO pin.
- The SFS / SFCS series handles only the DC input. Avoid applying AC input directly. !! It will damage the power supply. !!
- Operate with the convection or forced air cooling. [Reference : 8 "Derating"]

3 Wiring Input/Output Pin

3.1 Wiring input pin

(1) External fuse

- The SFS / SFCS series is not internally fused. To ensure safe operation and to receive each Safety Standards approvals, please install an external fuse (fast-blow type).
- When the input voltage from a front end unit is supplied to multiple units, install a fast-blow type fuse in each unit.
- Fuse must be connected to the +Vin side if to -Vin side is used as ground, or fuse must be connected to -Vin side if +Vin side is used as a ground.

Table 3.1 Recommended fuse (fast-blow type)

Model	SFS1524 / SFCS1524	SFS3024 / SFCS3024
Rated current	2A	4A
Model	SFS1048/SFS1548/SFCS1548	SFS2048/SFS3048/SFCS3048
Rated current	1A	2A

(2) External capacitor on the input side

■When the distance from the DC line to the unit is greatly extended, it makes the input feedback noise much higher and the input voltage several times higher than the normal level when turned ON. If this happens, the output power also becomes unstable. In order to prevent the unit from failing in this way; please connect C_i to the input pin. In addition, when the filter with "L" is used, please C_i to the input pin.

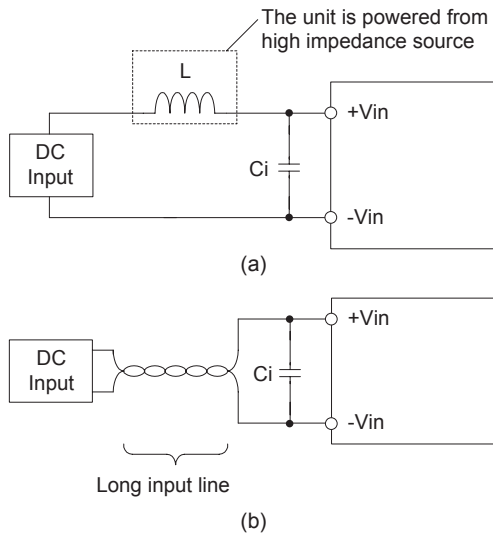


Fig.3.1 Connection method of capacitor at input pin

Table 3.2 Recommended capacitance C_i

Model	SFS1524 / SFCS1524	SFS3024/SFCS3024
C_i	33 μ F	68 μ F
Model	SFS1048/SFS1548/SFS2048/SFCS1548	SFS3048/SFCS3048
C_i	10 μ F	22 μ F

[$T_a = -20$ to $+85^\circ\text{C}$ Electrolytic or Ceramic capacitor]
[$T_a = -40$ to $+85^\circ\text{C}$ Ceramic capacitor]

Note:

When input line inductance becomes excessively high due to insertion of choke coil, operation of the unit could become unstable. In this case, increase C_i value more than the value indicated above.

(3) Conducted noise

■Install an external input filter as shown in Fig.3.2 in order to reduce conducted noise.

The result for this solution is shown in Fig.3.3.

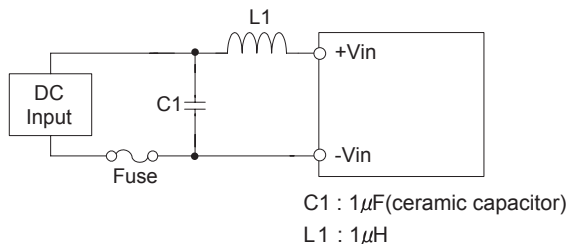


Fig.3.2 Recommended external input filter

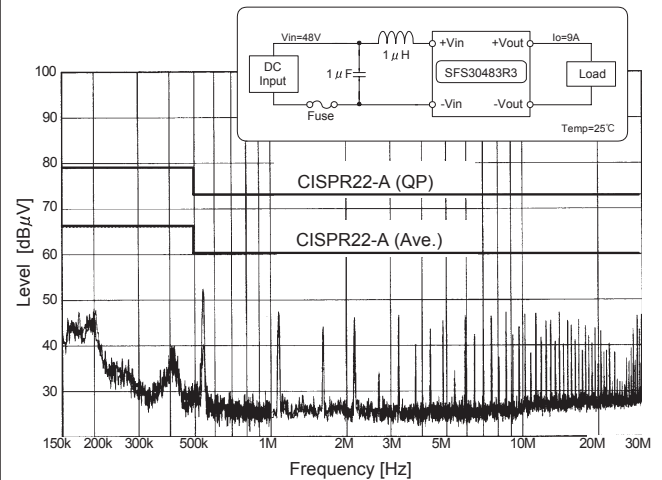


Fig.3.3 Example of conducted noise (SFS30483R3)

(4) Reverse input voltage protection

■Avoid the reverse polarity input voltage. It will damage the unit. It is possible to protect the unit from the reverse input voltage by installing an external diode as shown in Fig.3.4.

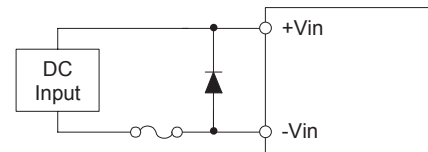
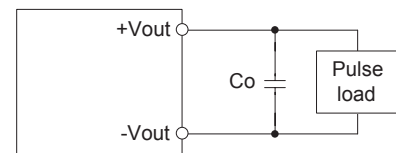


Fig.3.4 Reverse input voltage protection

3.2 Wiring output pin

■When the SFS / SFCS series supplies the pulse current for the pulse load, please install capacitor C_o between +Vout and -Vout pins.



Recommended capacitance (C_o)
1.2 - 5Vout : 22 - 4700 μ F
10 - 15Vout : 22 - 2200 μ F

Fig.3.5 Connection for pulse load

■Output ripple and start-up waveform may be influenced by ESR · ESL of capacitor and the wiring impedance.

■Ripple and ripple noise are measured, as shown in the Fig.3.6, by connecting Co and JEITA attachment.

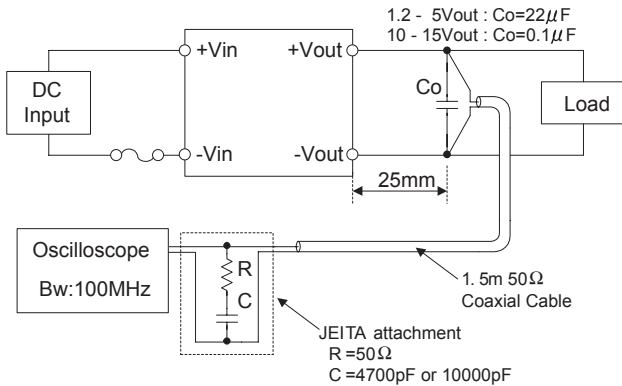


Fig.3.6 Measuring method of ripple and ripple noise

4 Function

4.1 Overcurrent protection (OCP) and Low voltage protection (LVP)

- OCP and LVP circuits is built-in. LVP will trigger after 200ms typ delay when OCP activates and output voltage drops down 90% max (SFS20 : 95% max) of the rated output voltage.
- When LVP is activated, ALM signal will becomes low impedance.
- Recovery from the protection is accomplished by applying 5VDC or less input for at least 1 second, or toggling remote ON / OFF signal for at least 1 second.

4.2 Overvoltage protection (OVP)

- The overvoltage protection circuit is built-in and comes into effect at 120% to 140% (SFS20 : 115% to 145%) of the rated output voltage. When the load factor is less than 50%, output voltage may be increased more than maximum voltage by the failure mode.
- Normal or abnormal operation of the unit can be monitored by using the ALM pin. When OVP is activated, ALM signal will become low level.
- The DC input should be shut down if overvoltage protection is in operation.
- Please note that devices inside the power supply might fail when voltage more than rated output voltage is applied to output pin of the power supply. This could happen when the customer tests the overvoltage performance of the unit.

4.3 Remote ON / OFF (RC pin)

- Remote ON / OFF circuits is built-in on input side.
- When remote ON / OFF function is not use, please open-circuit between RC and +Vin or short-circuit between RC and -Vin.
- Recovery from the protection is accomplished by applying 5VDC or less input for at least 1 second, or toggling remote ON / OFF signal for at least 1 second.

(1) RC connection example 1

■Remote ON / OFF connection and specification refer to below.

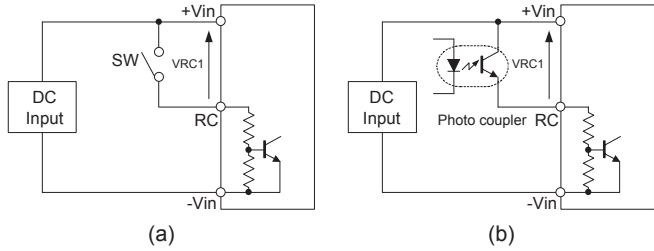
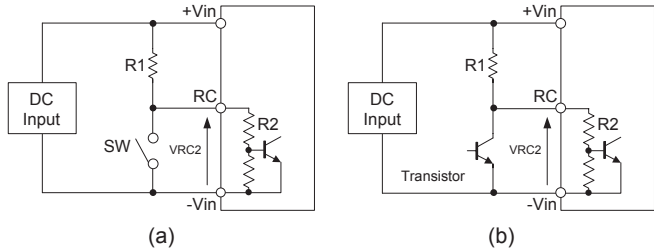


Fig.4.1 RC connection example 1

Table 4.1 Specification of example 1 (connection method Fig.4.1 (a), (b))

Between RC and +Vin (VRC1)	Output voltage
Open	ON
$0V \leq VRC1 \leq 1.2V$ or Short	OFF

(2) RC connection example 2



Recommended value of R1

Model	SFS□24	SFS□48
R1	22kΩ	220kΩ

Value of R2

Model	SFS□24	SFS□48
R2	200kΩ	360kΩ

Fig.4.2 RC connection example 2

Table 4.2 Specification of example 2 (connection method Fig.4.2 (a), (b))

Between RC and -Vin (VRC2)	Output voltage
10V or more (SFS□24 / SFCS□24) 20V or more (SFS□48 / SFCS□48) or Open	OFF
$0V \leq VRC2 \leq 1.2V$ or Short	ON

4.4 Alarm (ALM pin)

- Normal or abnormal operation of the unit can be monitored by using the ALM pin.
- When OVP or LVP are activated, ALM pin becomes same level as -Vin pin.
- The sink current of ALM pin is 10mA max.

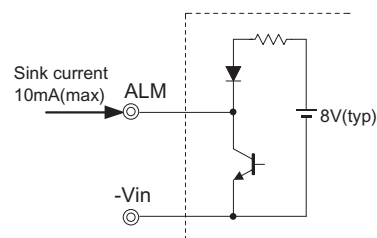


Fig.4.3 ALM circuit

- By connecting ALM pin in parallel and series operation, when one unit has shut down by overvoltage protection or low voltage protection, other units will be shut down.
- When alarm function is not use, please open ALM pin.
- Total number of units should be no more than 20 pieces.

4.5 Start in / out (PO pin)

- By connecting PO pin, difference of start-up voltage and stop voltage can be prevented.
- In parallel and series operation, please connect each PO pin mutually.
- Total number of units should be no more than 20 pieces.

4.6 Sequence

- The sequence time chart of Vin, Vout, PO, ALM and RC pins is shown in Fig.4.4.

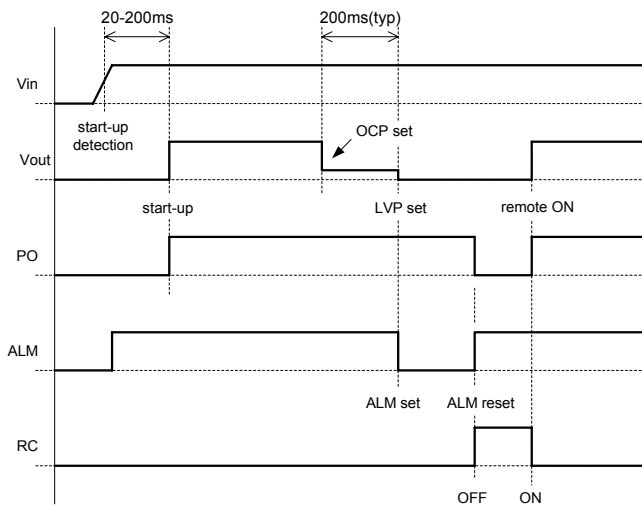


Fig.4.4 Sequence time chart

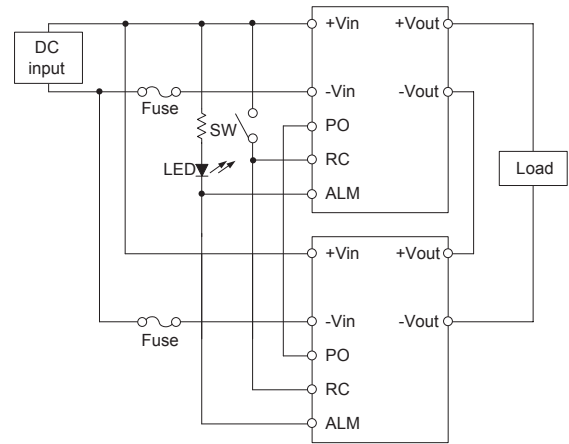
4.7 Isolation

- For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for a start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON / OFF of a timer.

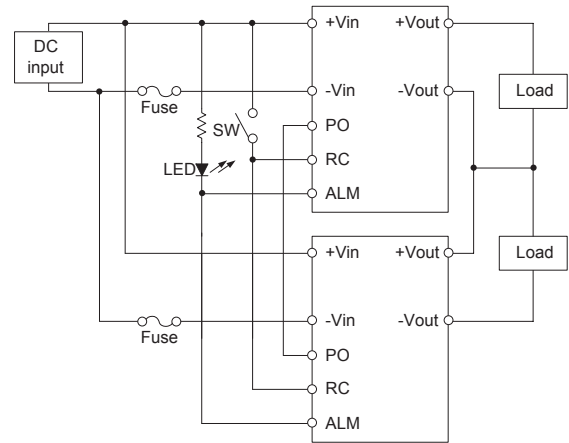
5 Series and Parallel Operation

5.1 Series operation

- In series operation, connect each PO and ALM pin mutually, wiring as Fig.5.1.



(a) Connection 1



(b) Connection 2

Fig.5.1 Examples of series operation

5.2 Parallel operation

- In parallel operation, connect each PO and ALM pin mutually, wiring as Fig.5.2.
- To improve the load sharing of each unit, please use the same length from each unit to the load.
- Total number of units should be no more than 10 pieces.

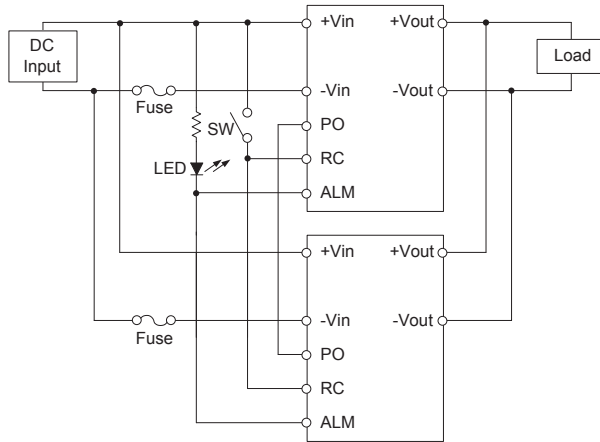


Fig.5.2 Example of parallel operation

6 Implementation · Mounting Method

6.1 Automatic mounting

- SFS / SFCS series is designed to have a large flat area in the center of the top surface to serve as a pick up point for automated vacuum pick and place equipment.
- An excessively low bottom dead point of the suction nozzle imposes great force on the core of SFS series during mounting, causing cracked core. So during mounting, take enough care.

6.2 Soldering temperature

(1) Reflow soldering

- Fig.6.1 and 6.2 show the conditions of reflow soldering. Please verify the temperature of the ALM pin and +Vout pin satisfy to reflow condition.
- Improper reflow condition may degrade the reliability of the internal components.
- While soldering, having vibration or impact on the unit should be avoided, because of solder melting.

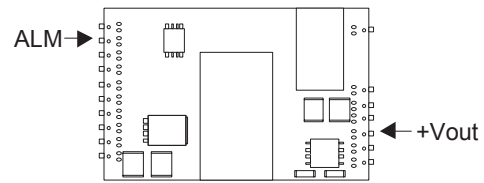
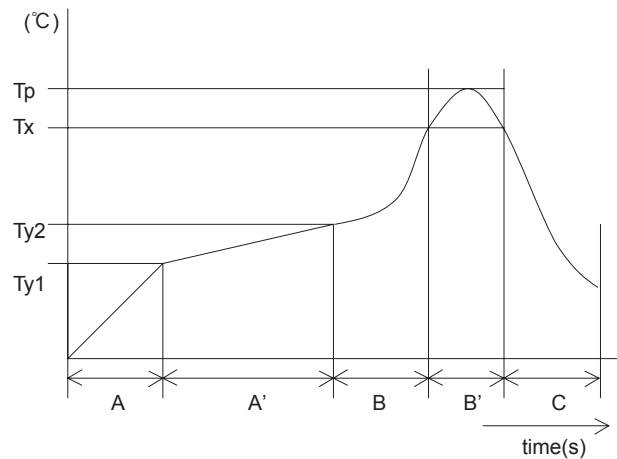


Fig.6.1 Measuring point



A	1.0 - 5.0°C/ s
A'	Ty1 : 160±10°C Ty2 : 180±10°C Ty1 - Ty2 : 120s max
B	1.0 - 5.0°C/ s
B'	Tp : Max245°C 10s max Tx : 220°C or more : 70s max
C	1.0 - 5.0°C/ s

Fig.6.2 Recommended reflow condition of soldering
(Temperature of the pins)

(2) Flow soldering

- 260°C, less than 15 seconds.

(3) Soldering iron

- 340°C to 360°C, less than 5 seconds.

6.3 Cleaning

- When cleaning is necessary, follow the undermentioned condition.
Method: Varnishing, ultrasonic wave and vapor
Cleaning agents: IPA (Solvent type)
Total time: 2 minutes or less
- After cleaning, dry them enough.

6.4 Mounting method

- Avoid placing pattern layout in hatched area in Fig.6.3 to insulate between pattern and power supply.

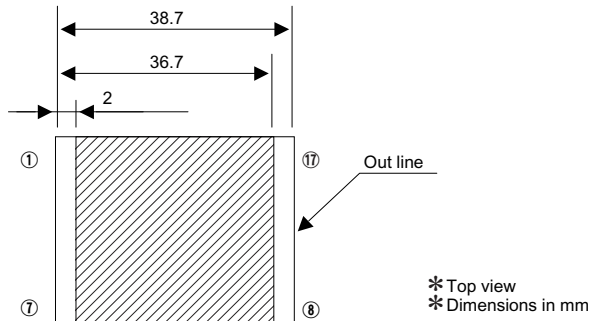


Fig.6.3 Prohibition area of pattern lay out

6.5 Storage method

- To stock unpacked products in your inventory, it is recommended to be kept under controlled condition, 5-30°C, 60%RH and be used within a year.
- 24-hours-baking is recommended at 125°C, if unpacked products was kept under uncontrol condition, in which 30°C, 60%RH or higher.
Original tray is not heat-resistant, please move them to heat-resistant tray preparing to bake them.
To check moisture condition in the pack, silica gel packet has some moisture condition indicator particle.
Indicated blue means good. Pink means alarm to bake it.
- Notification. the tray will be deformed and the power supply might be damaged, if the vacuum pressure is too much to reseal.

6.6 Stress to the product

- SFS/SFCS series transformer core and choke coil core are attached by glue, and there is a cover over the core, which is attached by a clasp.
There is a possibility that the core will be removed and power supply will be damaged when it took stress by the fall or some kind of stress.

7 Safety Considerations

- To apply for safety standard approval using this power supply, the following conditions must be met.
 - This unit must be used as a component of the end-use equipment.
 - The equipment does neither contain any basic nor double / reinforced insulation between input and output.
If the input voltage is greater than 60VDC, this has to be provided by the end-use equipment according to the final build in condition.
 - Safety approved fuse must be externally installed on input side.

8 Derating

- It is necessary to note thermal fatigue life by power cycle.
Please reduce the temperature fluctuation range as much as possible when the up and down of temperature are frequently generated.

8.1 Derating curve (SFS1048, SFS1548)

(1) Single and series operation

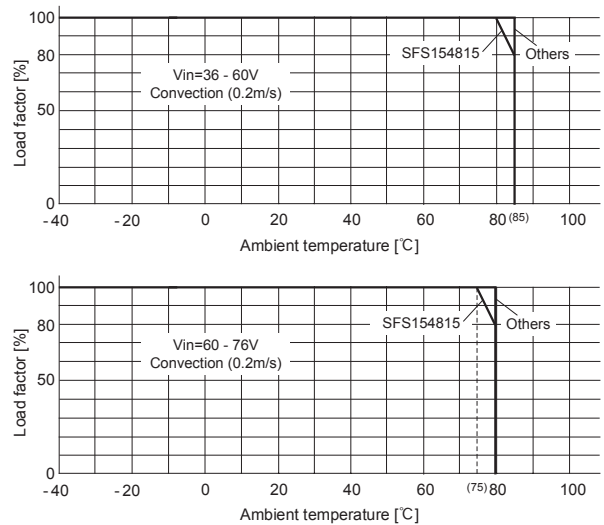


Fig.8.1 Derating curve

(2) Parallel operation

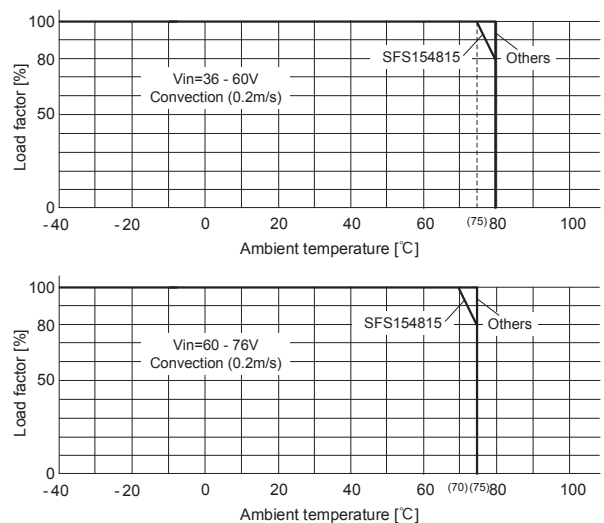


Fig.8.2 Derating curve (Parallel operation)

8.2 Derating curve (SFS1524, SFCS15)

(1) Single and series operation

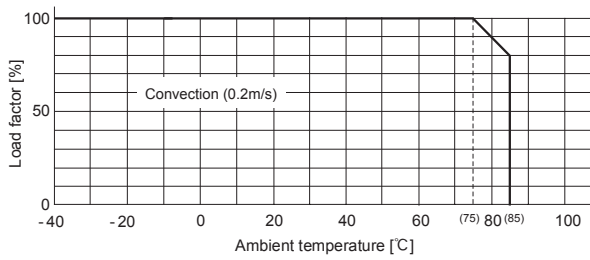


Fig.8.3 Derating curve

(2) Parallel operation

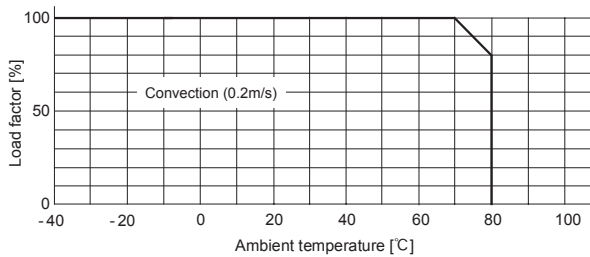


Fig.8.4 Derating curve (Parallel operation)

8.3 Derating curve (SFS2048)

(1) Single, series and parallel operation

① Natural convection cooling (0.2m/s)

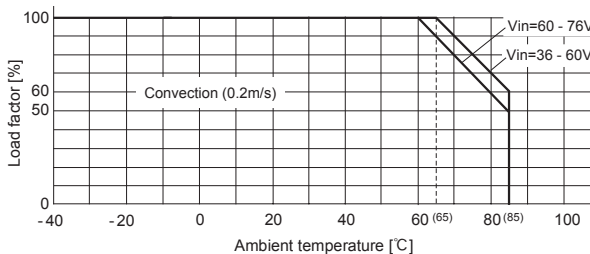


Fig.8.5 Derating curve (Convection)

② Forced air cooling (0.8m/s)

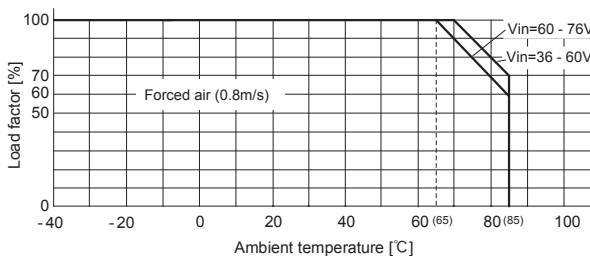


Fig.8.6 Derating curve (Forced air 0.8m/s)

③ Forced air cooling (1.2m/s)

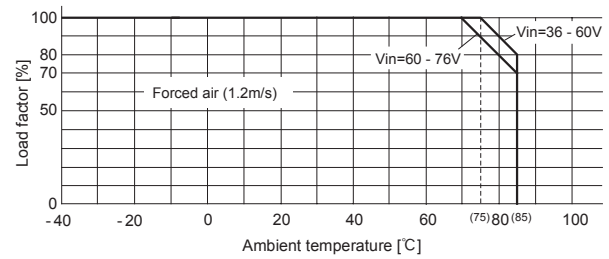


Fig.8.7 Derating curve (Forced air 1.2m/s)

8.4 Derating curve (SFS3024, SFCS30)

(1) Single and series operation

① Natural convection cooling (0.2m/s)

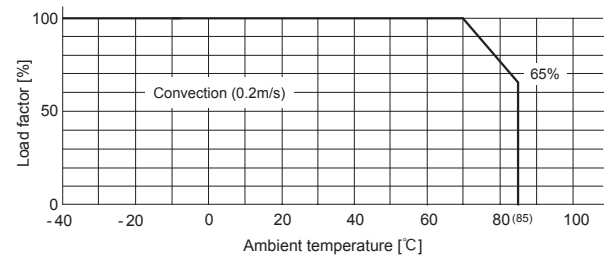


Fig.8.8 Derating curve (Convection)

② Forced air cooling (0.8m/s)

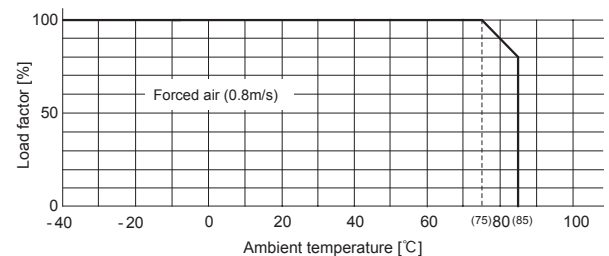


Fig.8.9 Derating curve (Forced air 0.8m/s)

③ Forced air cooling (1.2m/s)

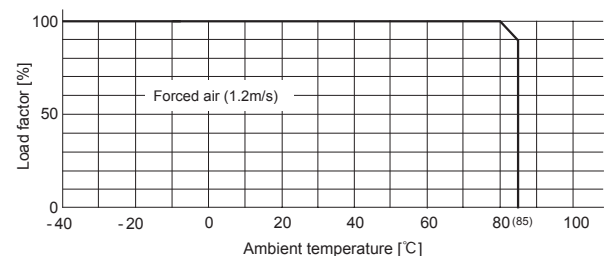


Fig.8.10 Derating curve (Forced air 1.2m/s)

(2) Parallel operation

① Natural convection cooling (0.2m/s)

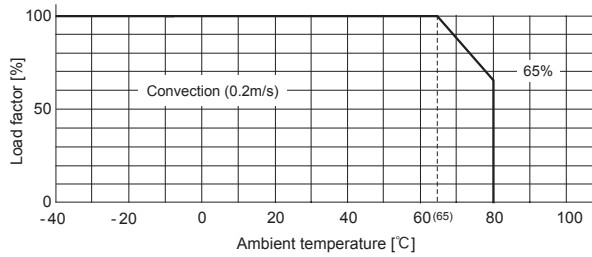


Fig.8.11 Derating curve (Convection)

② Forced air cooling (0.8m/s)

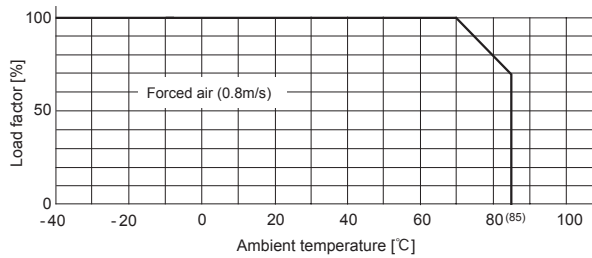


Fig.8.12 Derating curve (Forced air 0.8m/s)

③ Forced air cooling (1.2m/s)

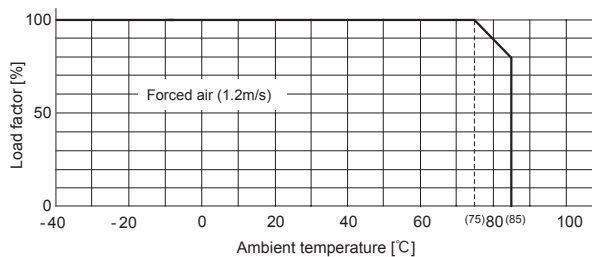


Fig.8.13 Derating curve (Forced air 1.2m/s)

8.5 Derating curve (SFS3048)

(1) Single and series operation

① Natural convection cooling (0.2m/s)

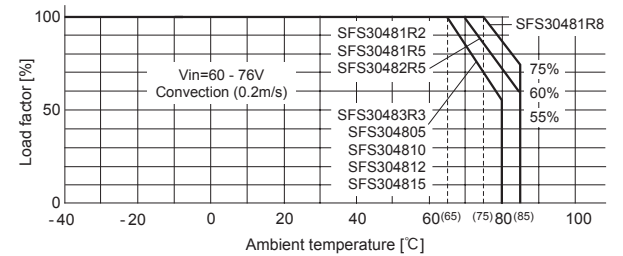
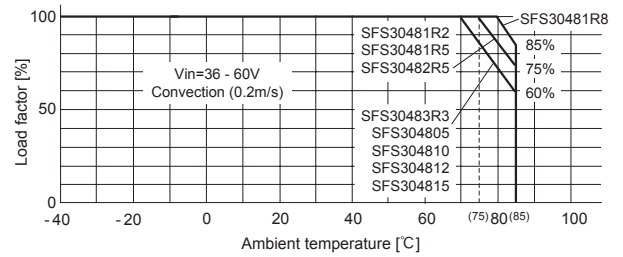


Fig.8.14 Derating curve (Convection)

② Forced air cooling (0.8m/s)

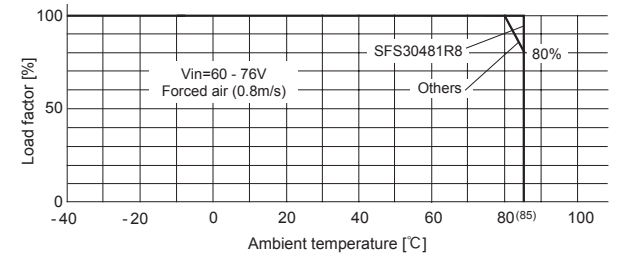
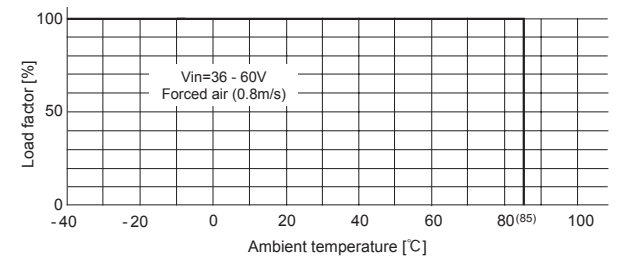


Fig.8.15 Derating curve (Forced air 0.8m/s)

③ Forced air cooling (1.2m/s)

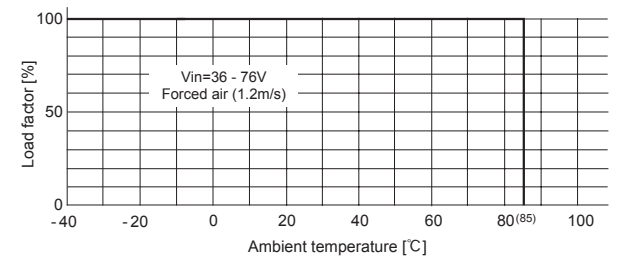


Fig.8.16 Derating curve (Forced air 1.2m/s)

(2) Parallel operation

① Natural convection cooling (0.2m/s)

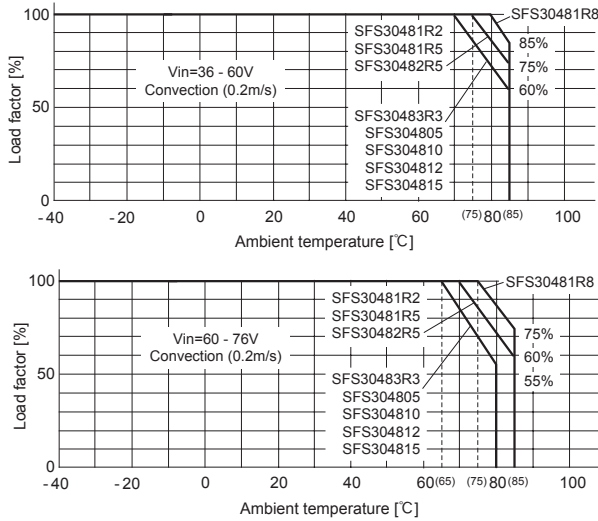


Fig.8.17 Derating curve (Convection)

② Forced air cooling (0.8m/s)

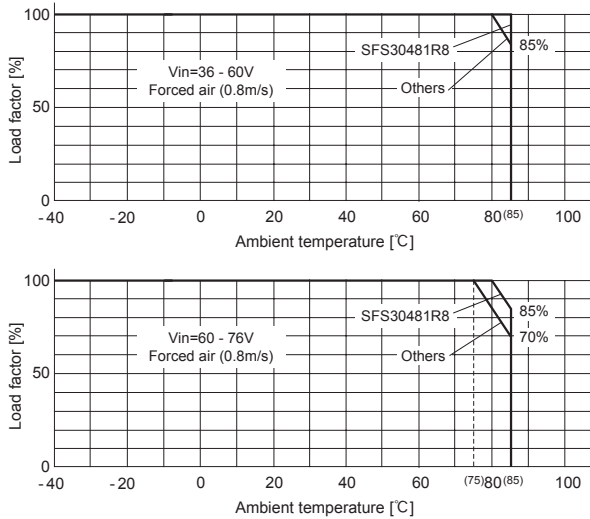


Fig.8.18 Derating curve (Forced air 0.8m/s)

③ Forced air cooling (1.2m/s)

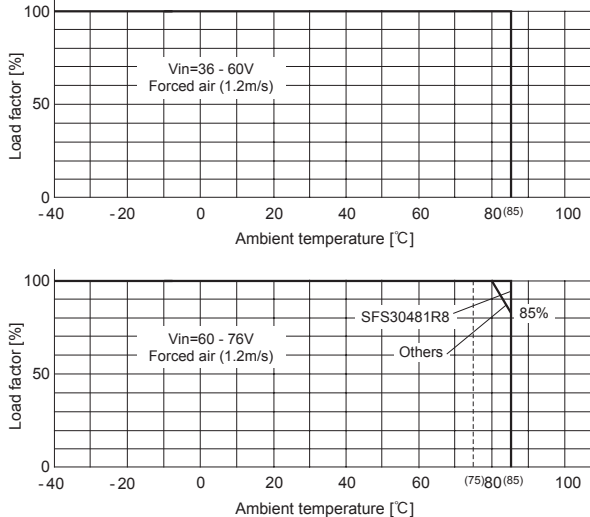


Fig.8.19 Derating curve (Forced air 1.2m/s)

(3) Measuring point in forced air cooling

■ In case of forced air, ventilation must keep the temperature of point A and B below 120°C. Refer to Fig.8.20 for the location of point A and B.

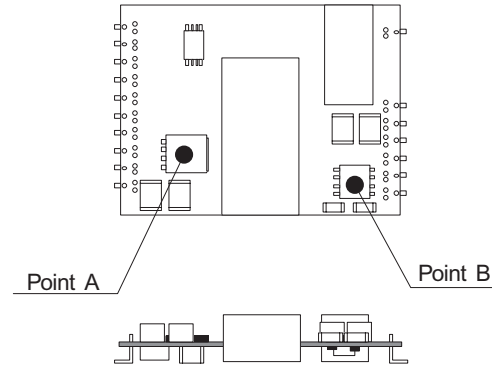


Fig.8.20 Location of point A and B

9 SMD type Package Information

9.1 Delivery package information (SFS series SMD type)

■ These are packed in a tray (Fig.9.1, 9.2).

■ Capacity of the tray is 15 max.

In case of fractions, the units are stored in numerical order.

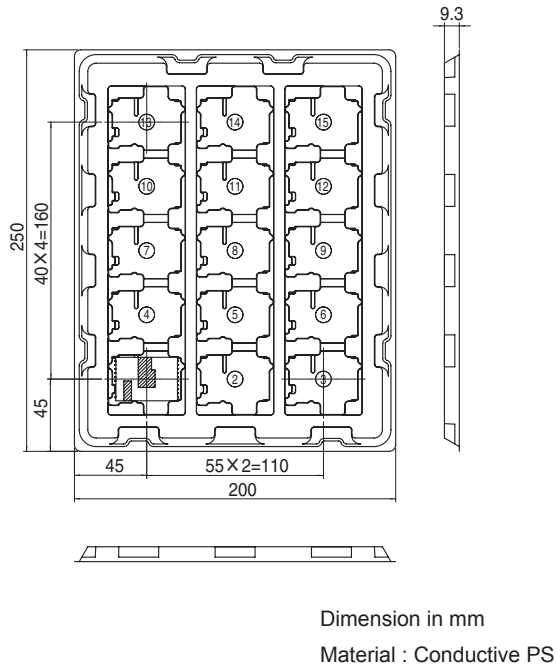


Fig.9.1 Delivery package information(SFS10/SFS15/SFS20)

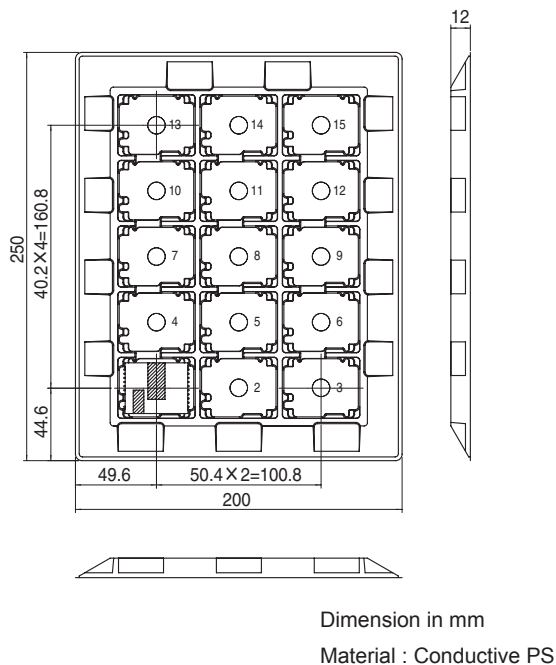


Fig.9.2 Delivery package information(SFS30)

■ Tray is stacked with alternating opposite direction to prevent products from contacting against the bottom of trays.
Do not cut or deform the tray.

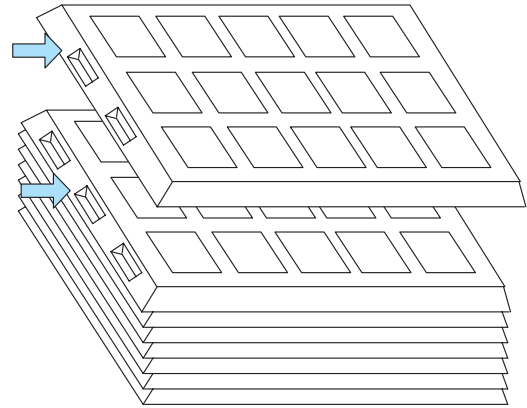


Fig.9.3 Stacking pattern of trays

9.2 Delivery package information (SFCS series SMD type)

■ These are packed in a tray (Fig.9.4).

SFCS15 and SFCS30 can be used in the same pallet tray.

But the orientation of the power supplies is different.

■ Capacity of the tray is 10 max.

In case of fractions, the units are stored in numerical order.

■ Do not cut or deform the tray.

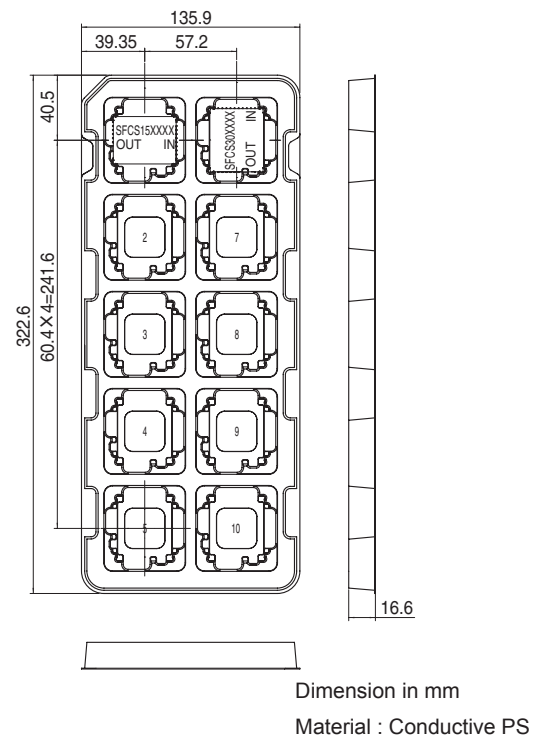


Fig.9.4 Delivery package information(SFCS15/SFCS30)



Low Profile



Isolated

Safety
Approvals

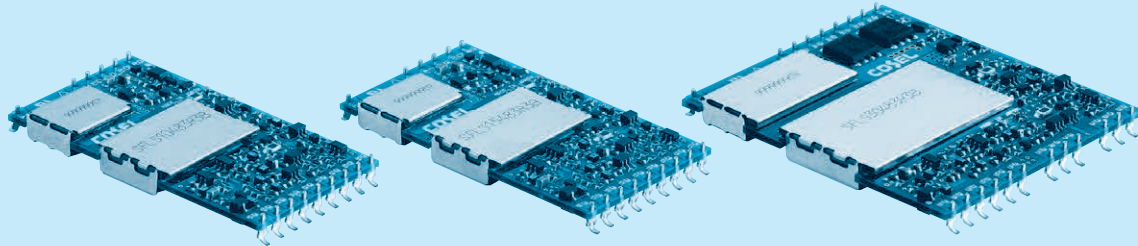
OCP



OVP

Remote
ON/OFFParallel
Operation

SFLS-series



SFLS

Feature

- Low profile SMD mounting type
- High efficiency (synchronous rectifier circuit)
- Parallel operation is possible
- Built-in overcurrent, overvoltage and lowvoltage circuits
- Built-in remote ON/OFF, alarm
- Built-in Power ready / Sequence control

CE marking

- Low Voltage Directive

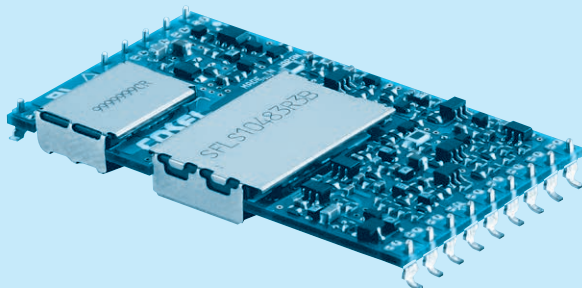
Safety agency approvals

- UL60950-1, C-UL, EN60950-1

5-year warranty



RoHS



- ① Series name
 ② Single output
 ③ Output wattage
 ④ Input voltage
 48:DC36 - 76V
 ⑤ Output voltage
 ⑥ Mounting type
 B :SMD

SFLS

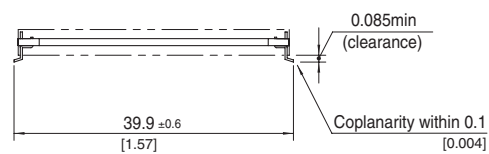
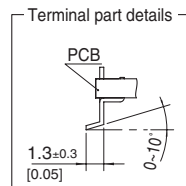
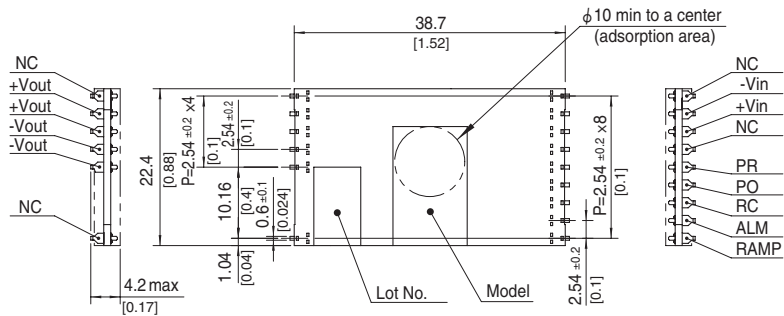
MODEL	SFLS10482R5	SFLS10483R3	SFLS104805
MAX OUTPUT WATTAGE[W]	7.5	9.9	10.0
DC OUTPUT	2.5V 3A	3.3V 3A	5V 2A

SPECIFICATIONS

	MODEL	SFLS10482R5	SFLS10483R3	SFLS104805
INPUT	VOLTAGE[V]	DC36 - 76		
	CURRENT[A]	*1 0.18typ	0.24typ	0.24typ
	EFFICIENCY[%]	*1 86typ	87typ	88typ
	START-UP VOLTAGE[V]	DC32 - 36		
	HYSTERESIS VOLTAGE[V]	DC2 min		
OUTPUT	VOLTAGE[V]	2.5	3.3	5
	CURRENT[A]	3	3	2
	VOLTAGE ACCURACY[%]	+5, -3		
	RIPPLE[mVp-p]	25max		
	RIPPLE NOISE[mVp-p]	50max		
PROTECTION CIRCUIT AND OTHERS	START-UP TIME[ms]	20 - 100max (DCIN 48V, Io=100%)		
	OVERCURRENT PROTECTION	Works over 103% of rating		
	OVERVOLTAGE PROTECTION	Works at 115 - 150% of rating		
	LOWVOLTAGE PROTECTION	Works at 93% max of rating		
	REMOTE ON/OFF	Provided(RC open : ON, short between RC and +Vin : OFF)		
ISOLATION	INPUT-OUTPUT	DC1,500V 1minute, DC500V 50MΩ min (20±15℃)		
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85℃, 20 - 95%RH (Non condensing), 3,000m (10,000feet) max		
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max (Refer to the Instruction Manual)		
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis		
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1		
OTHERS	CASE SIZE/WEIGHT	38.7×4.2×22.4mm [1.52×0.166×0.88 inches] (W×H×D) / 8g max		
	COOLING METHOD	Convection		

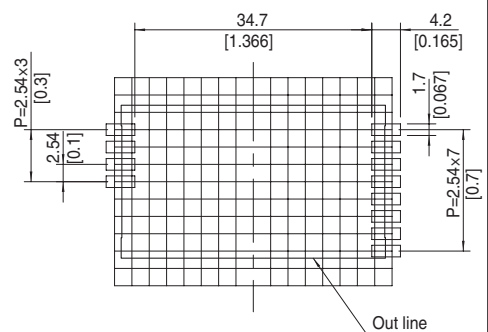
*1 At rated input(DC48V), rated load and 25℃

External view



※Dimensions in mm, []= inches
 ※Tolerance ± 0.5 [± 0.02]
 ※Weight: 8g max
 ※Terminal thickness: 0.3 ± 0.1 [0.012]
 Terminal material: copper alloy
 Plating treatment of terminal
 :Sn with Ni barreir

Recommended size for processing PCB (TOP VIEW)

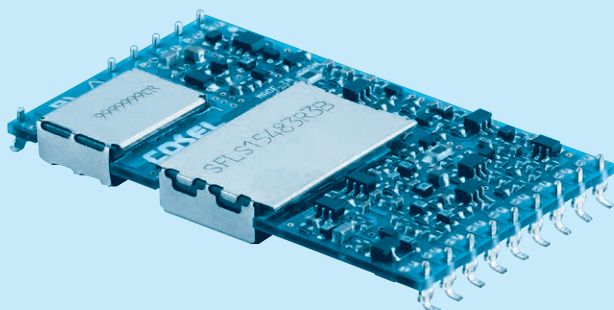


※Dimensions in: $\frac{\text{mm}}{\text{inch}}$

※Div.: 0.1inch



RoHS



- ① Series name
 ② Single output
 ③ Output wattage
 ④ Input voltage
 48:DC36 - 76V
 ⑤ Output voltage
 ⑥ Mounting type
 B :SMD

SFLS

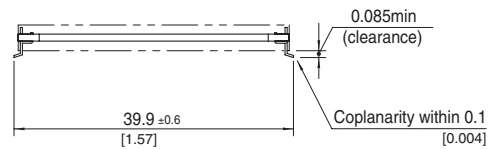
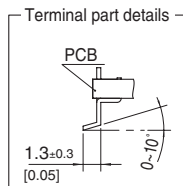
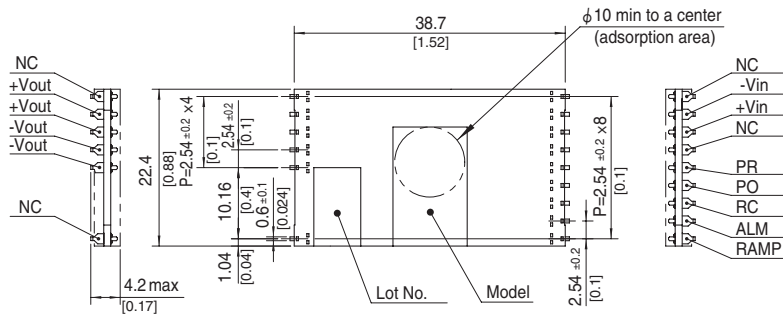
MODEL	SFLS15481R2	SFLS15481R5	SFLS15481R8	SFLS15482R5	SFLS15483R3	SFLS154805	SFLS15485R2	SFLS154812
MAX OUTPUT WATTAGE[W]	6.24	7.8	8.1	11.25	14.85	15.0	15.6	15.0
DC OUTPUT	1.2V 5.2A	1.5V 5.2A	1.8V 4.5A	2.5V 4.5A	3.3V 4.5A	5V 3A	5.2V 3A	12V 1.25A

SPECIFICATIONS

	MODEL	SFLS15481R2	SFLS15481R5	SFLS15481R8	SFLS15482R5	SFLS15483R3	SFLS154805	SFLS15485R2	SFLS154812	
INPUT	VOLTAGE[V]	DC36 - 76								
	CURRENT[A]	*1 0.16typ	0.20typ	0.20typ	0.27typ	0.35typ	0.35typ	0.37typ	0.35typ	
	EFFICIENCY[%]	*1 81typ	82typ	85typ	87typ	89typ	89typ	89typ	89typ	
	START-UP VOLTAGE[V]	DC32 - 36								
	HYSTERESIS VOLTAGE[V]	DC2 min								
OUTPUT	VOLTAGE[V]	1.2	1.5	1.8	2.5	3.3	5	5.2	12	
	CURRENT[A]	5.2	5.2	4.5	4.5	4.5	3	3	1.25	
	VOLTAGE ACCURACY[%]	+5, -3								
	RIPPLE[mVp-p]	25max								120max
	RIPPLE NOISE[mVp-p]	50max								150max
	START-UP TIME[ms]	20 - 100max (DCIN 48V, Io=100%)								
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 103% of rating								
	OVERVOLTAGE PROTECTION	Works at 115 - 160% of rating			Works at 115 - 150% of rating					
	LOWVOLTAGE PROTECTION	Works at 93% max of rating								
	REMOTE ON/OFF	Provided(RC open : ON, short between RC and +Vin : OFF)								
ISOLATION	INPUT-OUTPUT	DC1,500V 1minute, DC500V 50MΩ min (20±15℃)								
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85℃, 20 - 95%RH (Non condensing), 3,000m (10,000feet) max								
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max (Refer to the Instruction Manual)								
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis								
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis								
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1								
OTHERS	CASE SIZE/WEIGHT	38.7×4.2×22.4mm [1.52×0.166×0.88 inches] (W×H×D) / 8g max								
	COOLING METHOD	Convection								

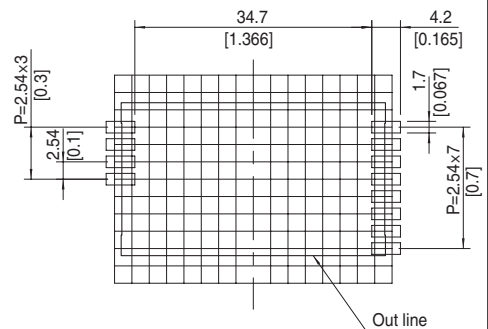
*1 At rated input(DC48V), rated load and 25℃

External view



※Dimensions in mm,[]= inches
 ※Tolerance ± 0.5 [± 0.02]
 ※Weight:8g max
 ※Terminal thickness:0.3 \pm 0.1 [0.012]
 Terminal material:copper alloy
 Plating treatment of terminal
 :Sn with Ni barreir

Recommended size for processing PCB -
(TOP VIEW)

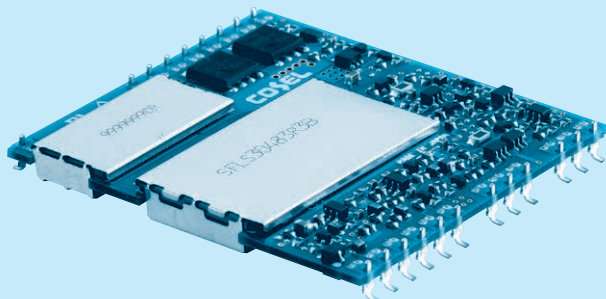


※Dimensions in: $\frac{\text{mm}}{[\text{inch}]}$

※Div.: 0.1inch



RoHS



- ① Series name
 ② Single output
 ③ Output wattage
 ④ Input voltage
 48:DC36 - 76V
 ⑤ Output voltage
 ⑥ Mounting type
 B :SMD

SFLS

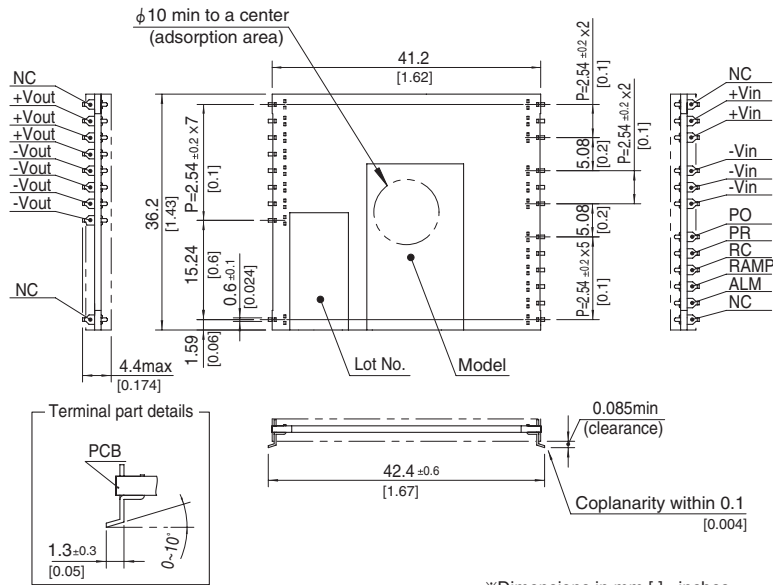
MODEL	SFLS30481R2	SFLS30481R5	SFLS30481R8	SFLS30482R5	SFLS30483R3	SFLS304805
MAX OUTPUT WATTAGE[W]	14.4	16.5	19.8	25.0	29.7	30.0
DC OUTPUT	1.2V 12A	1.5V 11A	1.8V 11A	2.5V 10A	3.3V 9A	5V 6A

SPECIFICATIONS

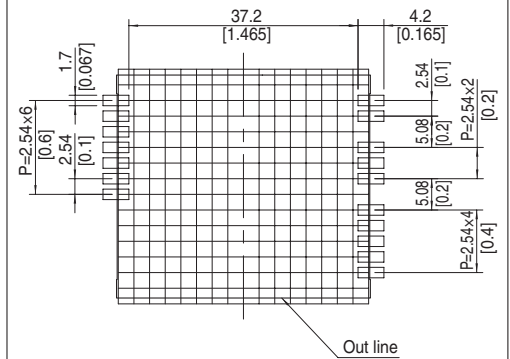
	MODEL	SFLS30481R2	SFLS30481R5	SFLS30481R8	SFLS30482R5	SFLS30483R3	SFLS304805
INPUT	VOLTAGE[V]	DC36 - 76					
	CURRENT[A]	0.36typ	0.40typ	0.47typ	0.58typ	0.68typ	0.69typ
	EFFICIENCY[%]	84typ	86typ	88typ	90typ	91typ	91typ
	START-UP VOLTAGE[V]	DC32 - 36					
	HYSTERESIS VOLTAGE[V]	DC2 min					
OUTPUT	VOLTAGE[V]	1.2	1.5	1.8	2.5	3.3	5
	CURRENT[A]	12	11	11	10	9	6
	VOLTAGE ACCURACY[%]	+5, -3					
	RIPPLE[mVp-p]	25max					
	RIPPLE NOISE[mVp-p]	50max					
	START-UP TIME[ms]	20 - 100max (DCIN 48V, Io=100%)					
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 103% of rating					
	OVERVOLTAGE PROTECTION	Works at 115 - 160% of rating		Works at 115 - 150% of rating			
	LOWVOLTAGE PROTECTION	Works at 93% max of rating					
	REMOTE ON/OFF	Provided(RC open : ON, short between RC and +Vin : OFF)					
ISOLATION	INPUT-OUTPUT	DC1,500V 1minute, DC500V 50MΩ min (20±15℃)					
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85℃, 20 - 95%RH (Non condensing), 3,000m (10,000feet) max					
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max (Refer to the Instruction Manual)					
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis					
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis					
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1					
OTHERS	CASE SIZE/WEIGHT	41.2×4.4×36.2mm [1.62×0.174×1.43 inches] (W×H×D) / 16g max					
	COOLING METHOD	Convection					

*1 At rated input(DC48V), rated load and 25℃

External view



Recommended size for processing PCB (TOP VIEW)



※Dimensions in: $\frac{\text{mm}}{[\text{inch}]}$

※Div.: 0.1inch

※Dimensions in mm, []= inches
 ※Tolerance ±0.5 [±0.02]
 ※Weight: 16g max
 ※Terminal thickness: 0.3±0.1 [0.012]
 Terminal material: copper alloy
 Plating treatment of terminal
 : Sn with Ni barrier

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
SFLS10	Single ended forward converter	630 - 710	* 1	-	-	glass fabric base,epoxy resin		Multilayer	Yes	Yes
SFLS15	Single ended forward converter	630 - 710	* 1	-	-	glass fabric base,epoxy resin		Multilayer	Yes	Yes
SFLS30	Single ended forward converter	480 - 540	* 1	-	-	glass fabric base,epoxy resin		Multilayer	Yes	Yes

* 1 Refer to Specification.

1	Pin Configuration	SFLS-10
2	Connection for Standard Use	SFLS-10
3	Wiring Input / Output Pin	SFLS-10
3.1	Wiring input pin	SFLS-10
3.2	Wiring output pin	SFLS-11
4	Function	SFLS-12
4.1	Overcurrent protection (OCP) and Low voltage protection (LVP)	SFLS-12
4.2	Overvoltage protection (OVP)	SFLS-12
4.3	Remote ON / OFF (RC pin)	SFLS-12
4.4	Alarm (ALM pin)	SFLS-12
4.5	Start in / out (PO pin)	SFLS-12
4.6	Power ready / Sequence control (PR pin)	SFLS-13
4.7	Ramp-rate control (RAMP pin)	SFLS-13
4.8	Sequence	SFLS-13
4.9	Isolation	SFLS-13
5	Series and Parallel Operation	SFLS-13
5.1	Series operation	SFLS-13
5.2	Parallel operation	SFLS-14
6	Implementation · Mounting Method	SFLS-14
6.1	Automatic mounting	SFLS-14
6.2	Soldering temperature	SFLS-14
6.3	Cleaning	SFLS-15
6.4	Mounting method	SFLS-15
6.5	Storage method	SFLS-15
6.6	Stress to the product	SFLS-15
7	Safety Considerations	SFLS-15
8	Derating	SFLS-15
8.1	Derating curve of SFLS10, SFLS15 and SFLS30	SFLS-15
9	Delivery Package Information	SFLS-16

1 Pin Configuration

●SFLS10 / SFLS15

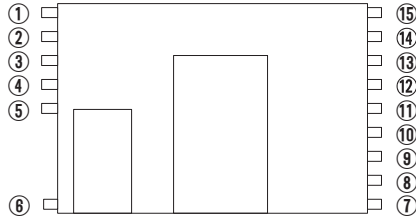


Fig.1.1 Pin configuration (SFLS10 / SFLS15)

Table 1.1 Pin configuration and function(SFLS10 / SFLS15)

No.	Pin Name	Function
①	NC	Not connected / Adhesive dispensing
②,③	+Vout	+DC output
④,⑤	-Vout	-DC output
⑥	NC	Not connected / Adhesive dispensing
⑦	RAMP	Ramp-rate control
⑧	ALM	Alarm
⑨	RC	Remote ON/OFF
⑩	PO	Start in/out
⑪	PR	Power ready / Sequence control
⑫	NC	Not connected
⑬	+Vin	+DC input
⑭	-Vin	-DC input
⑮	NC	Not connected / Adhesive dispensing

●SFLS30

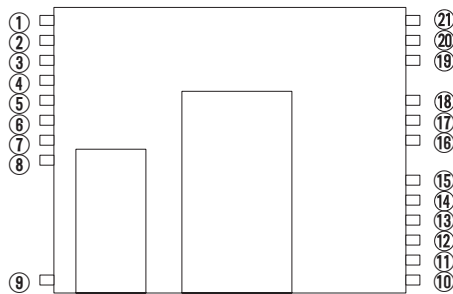


Fig.1.2 Pin configuration (SFLS30)

Table 1.2 Pin configuration and function(SFLS30)

No.	Pin Name	Function
①	NC	Not connected / Adhesive dispensing
②,③,④	+Vout	+DC output
⑤,⑥,⑦,⑧	-Vout	-DC output
⑨,⑩	NC	Not connected / Adhesive dispensing
⑪	ALM	Alarm
⑫	RAMP	Ramp-rate control
⑬	RC	Remote ON/OFF
⑭	PR	Power ready / Sequence control
⑮	PO	Start in/out
⑯, ⑰, ⑱	-Vin	-DC input
⑲, ⑳	+Vin	+DC input
㉑	NC	Not connected / Adhesive dispensing

2 Connection for Standard Use

■In order to use the power supply, it is necessary to wire as shown in Fig.2.1.

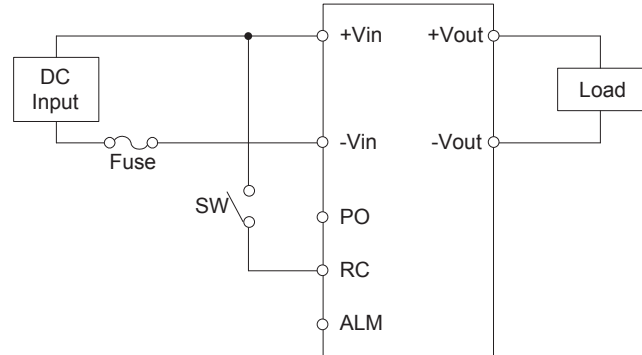


Fig.2.1 Connection for standard use

■When remote ON / OFF function is not used, please open RC pin or short between RC and -Vin pin.

■When alarm function is not used, please open ALM pin.

■In parallel and series operation, connect each PO pin mutually. When PO function is not used, please open PO pin.

■The SFLS series handles only the DC input.

Avoid applying AC input directly.

!! It will damage the power supply. !!

■Operate with the natural convection.

[Reference : 8 "Derating"]

3 Wiring Input/Output Pin

3.1 Wiring input pin

(1) External fuse

■The SFLS series is not internally fused. To ensure safe operation and to receive each Safety Standards approvals, please install an external fuse (fast-blow type).

■When the input voltage from a front end unit is supplied to multiple units, install a fast-blow type fuse in each unit.

■Fuse must be connected to the +Vin side if to -Vin side is used as ground, or fuse must be connected to -Vin side if +Vin side is used as a ground.

Table 3.1 Recommended fuse (fast-blow type)

Model	SFLS10	SFLS15	SFLS30
Rated current	1A	1A	2A

(2) External capacitor on the input side

■When the distance from the DC line to the unit is greatly extended, it makes the input feedback noise much higher and the input voltage several times higher than the normal level when turned ON. If this happens, the output power also becomes unstable. In order to prevent the unit from failing in this way; please connect C_i to the input pin. In addition, when the filter with "L" is used, please C_i to the input pin.

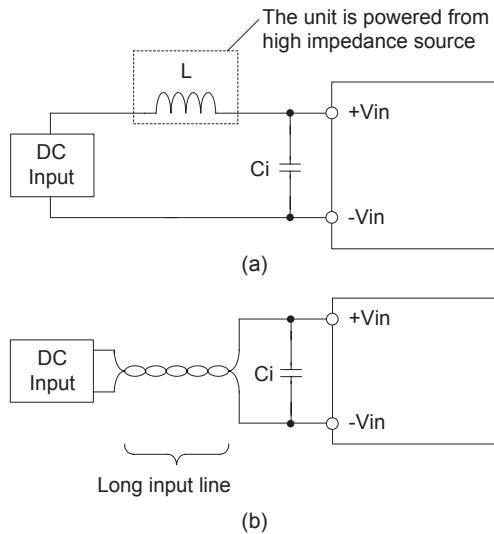


Fig.3.1 Connection method of capacitor at input pin

Table 3.2 Recommended capacitance C_i

Model	SFLS10	SFLS15	SFLS30
C_i	10 μ F	10 μ F	22 μ F

Note:

When input line inductance becomes excessively high due to insertion of choke coil, operation of the unit could become unstable. In this case, increase C_i value more than the value indicated above.

(3) Conducted noise

■Install an external input filter as shown in Fig.3.2 in order to reduce conducted noise.

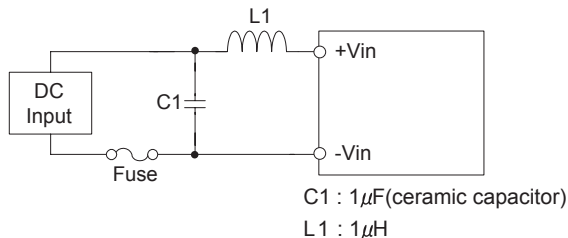


Fig.3.2 Recommended external input filter

(4) Reverse input voltage protection

■Avoid the reverse polarity input voltage. It will damage the unit. It is possible to protect the unit from the reverse input voltage by installing an external diode as shown in Fig.3.3.

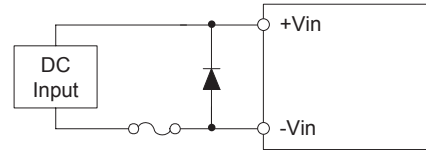


Fig.3.3 Reverse input voltage protection

3.2 Wiring output pin

■When SFLS series supplies the pulse current for the pulse load, please install capacitor C_o between +Vout and -Vout pins.

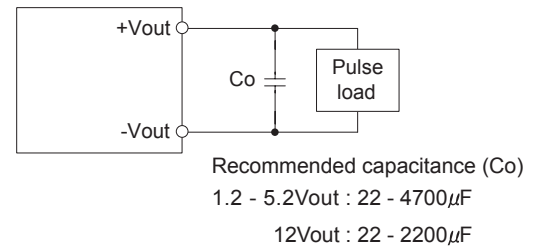


Fig.3.4 Connection for pulse load

■Output ripple and start-up waveform may be influenced by ESR · ESL of capacitor and the wiring impedance.

■Ripple and ripple noise are measured, as shown in the Fig.3.5, by connecting C_o and JEITA attachment.

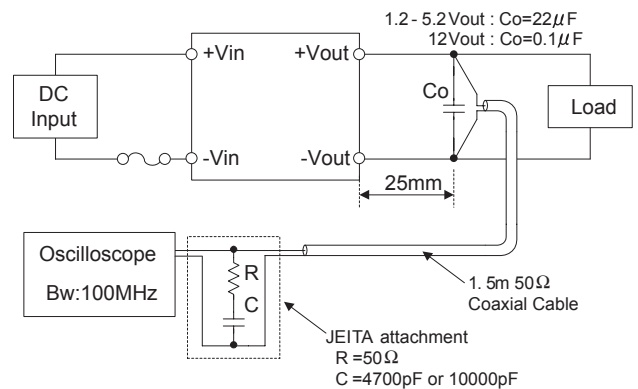


Fig.3.5 Measuring method of ripple and ripple noise

4 Function

4.1 Overcurrent protection (OCP) and Low voltage protection (LVP)

- OCP and LVP circuits is built-in. LVP will trigger after 200ms typ delay when OCP activates and output voltage drops down 93% max of the rated output voltage.
- When LVP is activated, ALM signal will becomes low impedance.
- Recovery from the protection is accomplished by applying 5VDC or less input for at least 0.3 second, or toggling remote ON / OFF signal for at least 0.3 second.

4.2 Overvoltage protection (OVP)

- The overvoltage protection circuit is built-in and comes into effect at 115% to 150% (1.2V, 1.5Vout : 115% to 160%) of the rated output voltage.
- Normal or abnormal operation of the unit can be monitored by using the ALM pin. When OVP is activated, ALM signal will become low level.
- The DC input should be shut down if overvoltage protection is in operation.
- Please note that devices inside the power supply might fail when voltage more than rated output voltage is applied to output pin of the power supply. This could happen when the customer tests the overvoltage performance of the unit.

4.3 Remote ON / OFF (RC pin)

- Remote ON / OFF circuits is built-in on input side.
- When remote ON / OFF function is not use, please open-circuit between RC and +Vin or short-circuit between RC and -Vin.
- Recovery from the protection is accomplished by applying 5VDC or less input for at least 0.3 second, or toggling remote ON / OFF signal for at least 0.3 second.
- Remote ON / OFF connection and specification refer to below.

(1) RC connection example 1

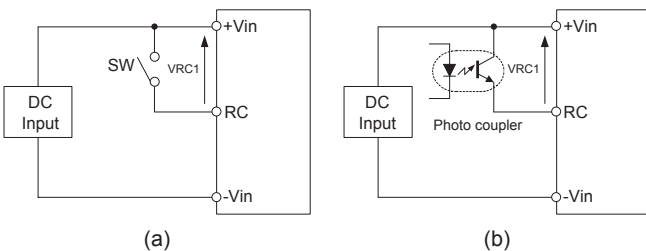


Fig.4.1 RC connection example 1

Table 4.1 Specification of example 1 (connection method Fig.4.1 (a), (b))

Between RC and +Vin (VRC1)	Output voltage
Open	ON
$0V \leq VRC1 \leq 1.2V$ or Short	OFF

(2) RC connection example 2

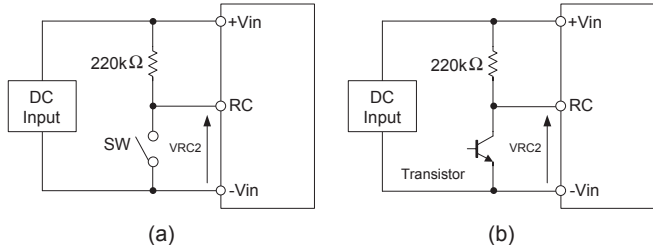


Fig.4.2 RC connection example 2

Table 4.2 Specification of example 2 (connection method Fig.4.2 (a), (b))

Between RC and -Vin (VRC2)	Output voltage
20V or more or Open	OFF
$0V \leq VRC2 \leq 1.2V$ or Short	ON

4.4 Alarm (ALM pin)

- Normal or abnormal operation of the unit can be monitored by using the ALM pin.
- When OVP or LVP are activated, ALM pin becomes same level as -Vin pin.
- The sink current of ALM pin is 10mA max.

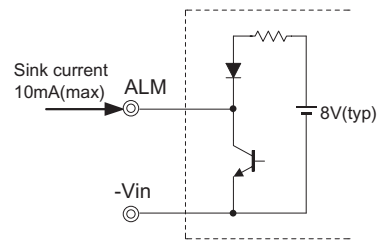


Fig.4.3 ALM circuit

- By connecting ALM pin in parallel and series operation, when one unit has shut down by overvoltage protection or low voltage protection, other units will be shut down.
- When alarm function is not used, please open ALM pin.
- Total number of units should be no more than 20 pieces.

4.5 Start in / out (PO pin)

- By connecting PO pin, difference of start-up voltage and stop voltage can be prevented.
- In parallel and series operation, please connect each PO pin mutually.
- Total number of units should be no more than 20 pieces.
- When the function is not used, please open PO pin.

4.6 Power ready / Sequence control (PR pin)

■When output voltage rise up more than $75 \pm 20\%$ (output voltage 2.5V - 12V) or $65 \pm 30\%$ (output voltage 1.2V - 1.8V) of rated output voltage, the level is set to "H"(open collector). Maximum applicable voltage of PR pin is 15V and maximum sink current of PR pin is 3mA.

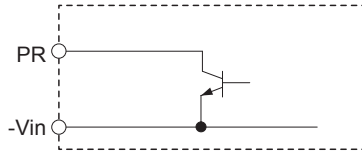


Fig.4.4 PR circuit

- By connecting short-circuit between PR and PO pin, start-up time can be controlled.
- Total number of units should be no more than 20 pieces.
- When the function is not used, please open PR pin.

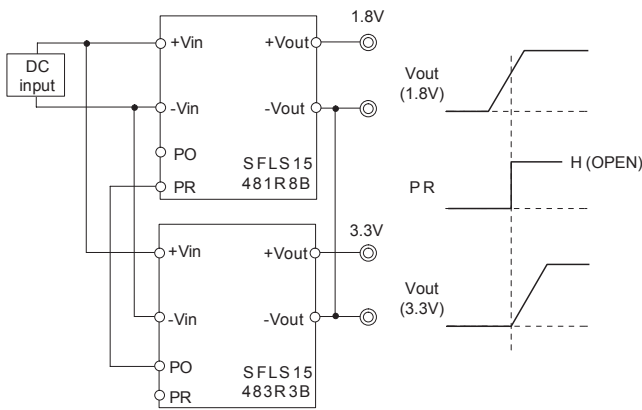


Fig.4.5 PR connection example

4.7 Ramp-rate control (RAMP pin)

- By connecting external capacitor C_{RAMP} between RAMP and -Vin pin, ramp-rate can be controlled. Maximum applicable voltage of RAMP pin is 2.5V.
- If the function is used, install C_{RAMP} of less than $2.2\mu F$ (output voltage 1.2V - 1.8V) or $1\mu F$ (output voltage 2.5V - 12V). When the function is used with 3.3 to 12Vout, minimum load requirement will be asked according with C_{RAMP} capacitor size.
- When the function is not used, please open RAMP pin.

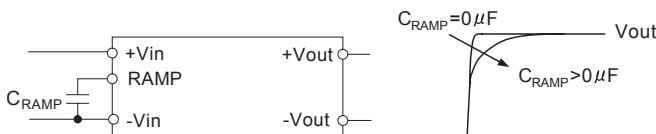


Fig.4.6 Connection method of C_{RAMP}

4.8 Sequence

■The sequence time chart of Vin, Vout, PO, PR, ALM and RC pins is shown in Fig.4.7.

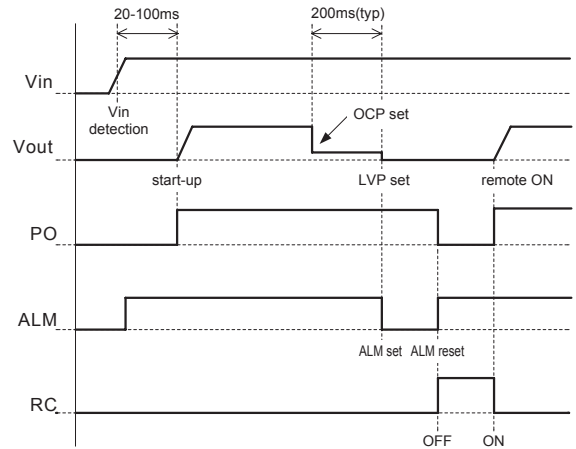


Fig.4.7 Sequence time chart

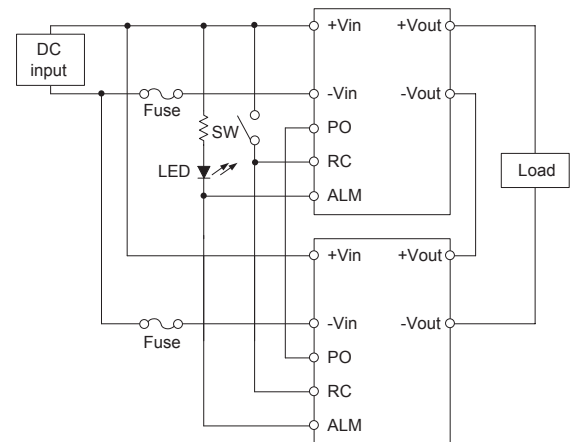
4.9 Isolation

- For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for a start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON / OFF of a timer.

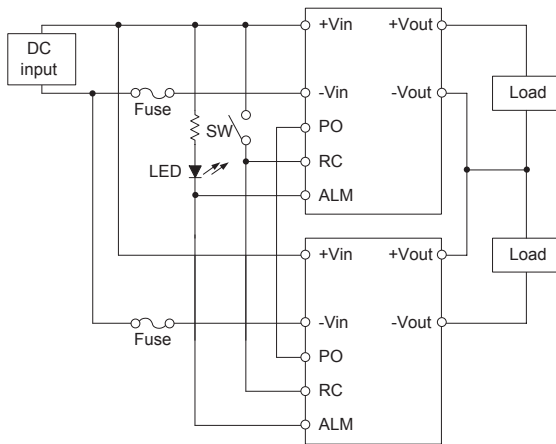
5 Series and Parallel Operation

5.1 Series operation

- In series operation, connect each PO and ALM pin mutually, wiring as Fig.5.1.



(a) Connection 1



(b) Connection 2

Fig.5.1 Examples of series operation

5.2 Parallel operation

- In parallel operation, connect each PO and ALM pin mutually, wiring as Fig.5.2.
- To improve the load sharing of each unit, please use the same length from each unit to the load.
- Total number of units should be no more than 20 pieces.

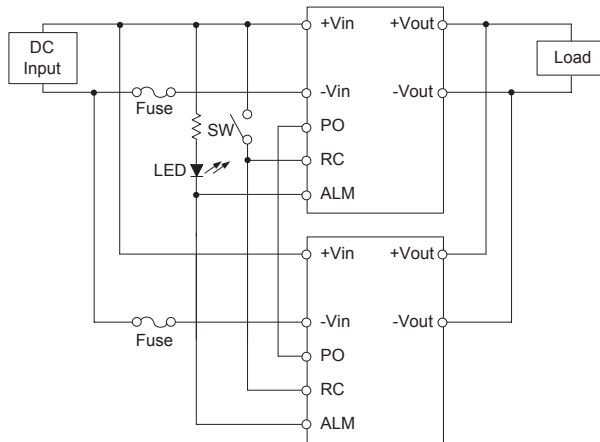


Fig.5.2 Example of parallel operation

6 Implementation · Mounting Method

6.1 Automatic mounting

- SFLS series is designed to have a large flat area in the center of the top surface to serve as a pick up point for automated vacuum pick and place equipment.
- An excessively low bottom dead point of the suction nozzle imposes great force on the core during mounting, causing cracked core. So during mounting, take enough care.

6.2 Soldering temperature

(1) Reflow soldering

- Fig.6.1 and 6.2 show the conditions of reflow soldering. Please verify the temperature of the ALM pin and +Vout pin satisfy to reflow condition.
- Improper reflow condition may degrade the reliability of the internal components.
- While soldering, having vibration or impact on the unit should be avoided, because of solder melting.

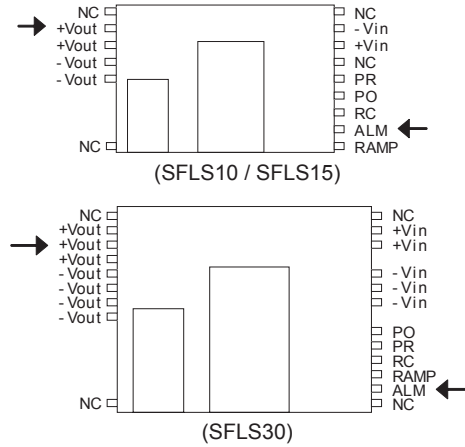
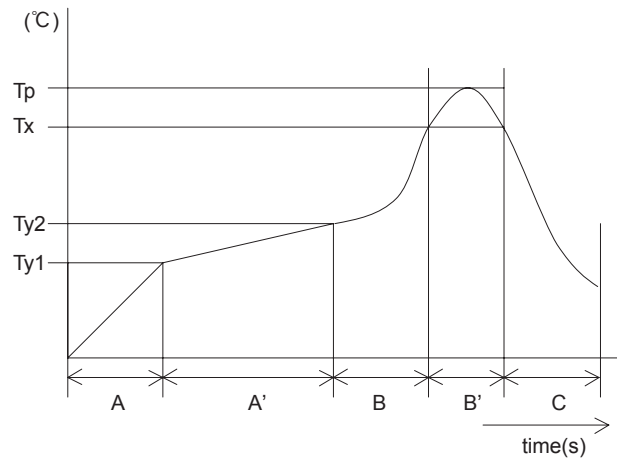


Fig.6.1 Measuring point



A	1.0 - 5.0°C/ s
A'	Ty1 : 160±10°C Ty2 : 180±10°C Ty1 - Ty2 : 120s max
B	1.0 - 5.0°C/ s
B'	Tp : Max245°C 10s max Tx : 220°C or more : 70s max
C	1.0 - 5.0°C/ s

Fig.6.2 Recommended reflow condition of soldering
(Temperature of the pins)

(2) Soldering iron

- 340°C to 360°C, less than 5 seconds.

6.3 Cleaning

- When cleaning is necessary, follow the undermentioned condition.
 Method: Varnishing, ultrasonic wave and vapor
 Cleaning agents: IPA (Solvent type)
 Total time: 2 minutes or less
- After cleaning, dry them enough.

6.4 Mounting method

- Avoid placing pattern layout in hatched area in Fig.6.3 to insulate between pattern and power supply.

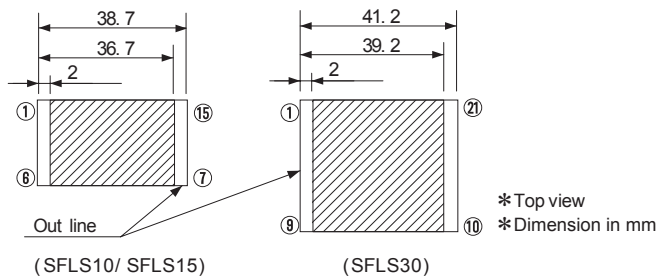


Fig.6.3 Prohibition area of pattern lay out

6.5 Storage method

- To stock unpacked products in your inventory, it is recommended to be kept under controlled condition, 5-30°C, 60%RH and be used within a year.
- 24-hours-baking is recommended at 125°C, if unpacked products was kept under uncontrol condition, in which 30°C, 60%RH or higher.
 Original tray is not heat-resistant, please move them to heat-resistant tray preparing to bake them.
 To check moisture condition in the pack, silica gel packet has some moisture condition indicator particle.
 Indicated blue means good. Pink means alarm to bake it.
- Notification. the tray will be deformed and the power supply might be damaged, if the vacuum pressure is too much to reseal.

6.6 Stress to the product

- SFLS series transformer core and choke coil core are attached by glue, and there is a cover over the core, which is attached by a clasp.
 There is a possibility that the core will be removed and power supply will be damaged when it took stress by the fall or some kind of stress.

7 Safety Considerations

- To apply for safety standard approval using this power supply, the following conditions must be met.
- This unit must be used as a component of the end-use equipment.
- The equipment does neither contain any basic nor double / reinforced insulation between input and output.
 If the input voltage is greater than 60VDC, this has to be provided by the end-use equipment according to the final build in condition.
- Safety approved fuse must be externally installed on input side.

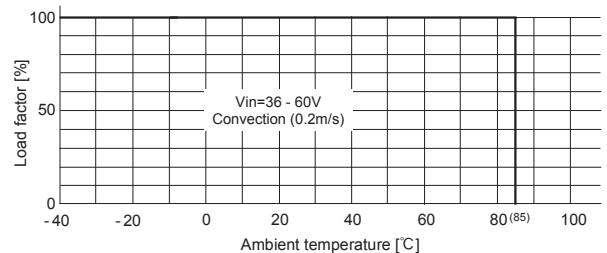
8 Derating

SFLS

- It is necessary to note thermal fatigue life by power cycle.
 Please reduce the temperature fluctuation range as much as possible when the up and down of temperature are frequently generated.

8.1 Derating curve of SFLS10, SFLS15 and SFLS30

① Vin=DC36V - 60V



② Vin=DC60V - 76V

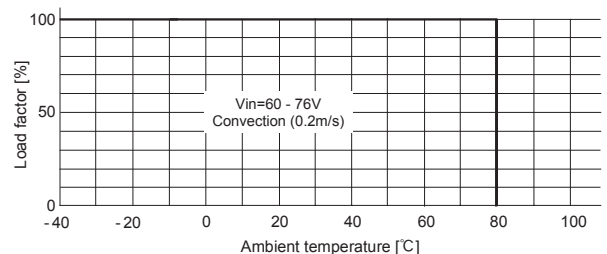


Fig.8.1 Derating curve of natural convection cooling (0.2m/s)

9 Delivery Package Information

■ These are packed in a tray (Fig.9.1, 9.2).

■ Do not cut or deform the tray.

Table 9.1 Capacity of the tray (pcs/tray)

SFLS10/SFLS15	15 max
SFLS30	12 max

In case of fractions, the units are stored in numerical order.

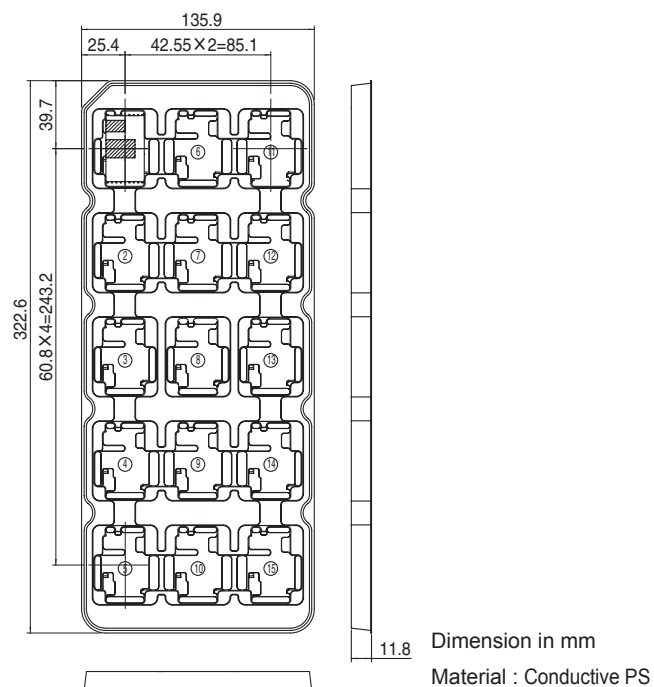


Fig.9.1 Delivery package information (SFLS10/SFLS15)

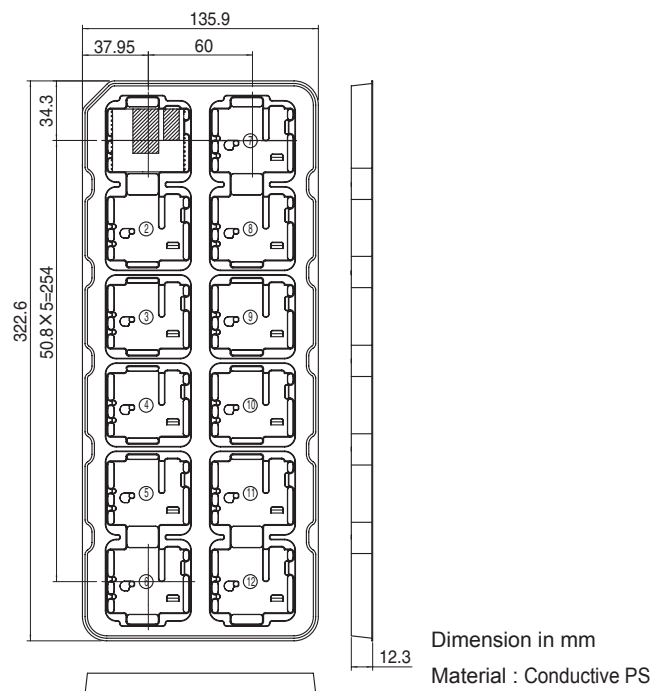


Fig.9.2 Delivery package information (SFLS30)

Cost
EffectiveRugged
PCB type

Isolated

Safety
Approvals

EMI

Inrush
current
limiting

OCP



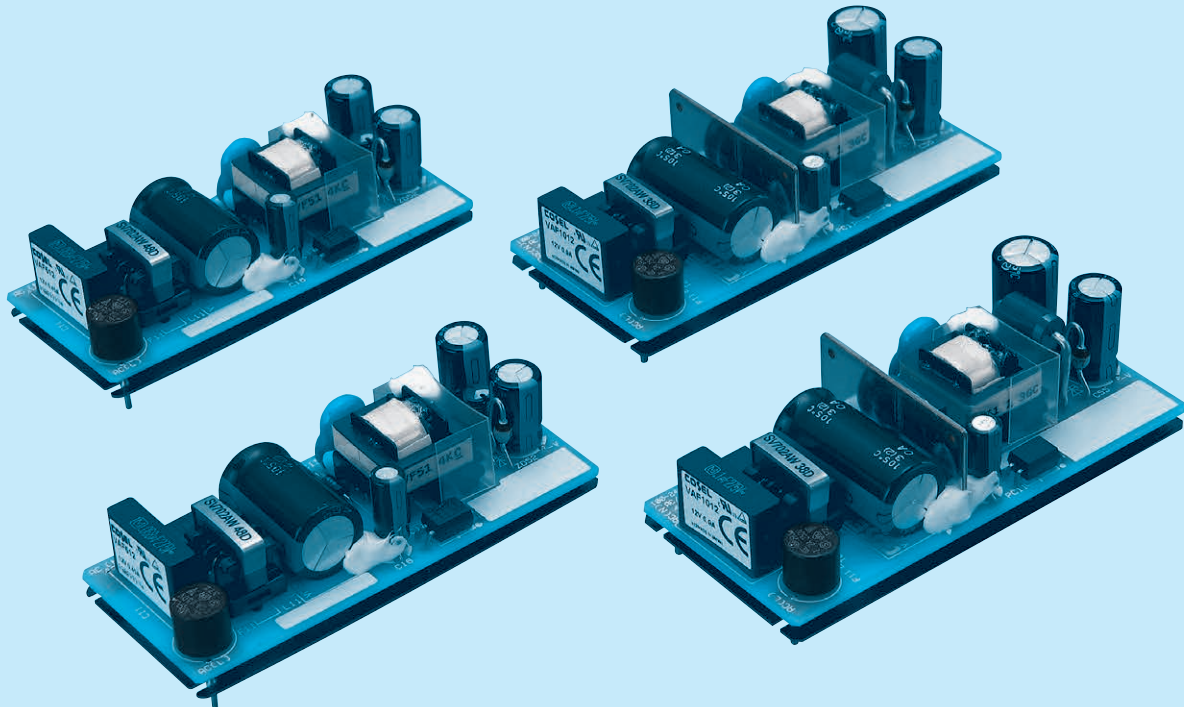
OVP



World wide

VAF-series

VAF



Feature

P.C. board mount AC/DC converter
Built-in inrush current and overcurrent protection circuits
Small and compact size

Safety agency approvals

UL60950-1, C-UL recognized TÜV approved
Complies with DEN-AN

EMI

FCC-B, VCCI-B, CISPR22-B (EN55022-B)

3-year warranty

EMC Compliance

EN55022-B
EN61000-4-2
EN61000-4-3
EN61000-4-4
EN61000-4-5
EN61000-4-6
EN61000-4-8
EN61000-4-11

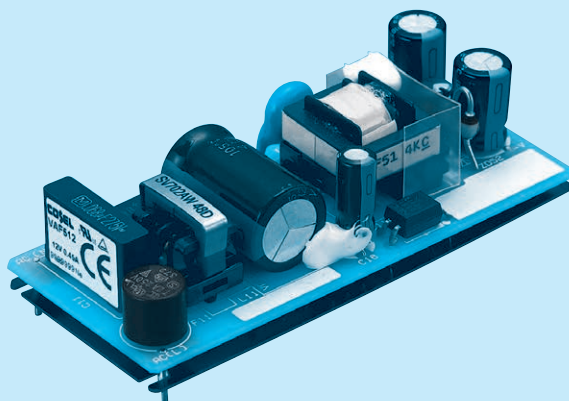
CE marking

Low Voltage Directive

VAF5

VAF 5 05

① ② ③



① Series name
② Output wattage
③ Output voltage

VAF

MODEL	VAF503	VAF505	VAF512	VAF515	VAF524
MAX OUTPUT WATTAGE[W]	3.3	5.0	5.4	5.25	5.28
DC OUTPUT	VOLTAGE[V]	3.3	5	12	15
	CURRENT[A]	1.0 (Peak 1.2)	1.0 (Peak 1.2)	0.45 (Peak 0.54)	0.35 (Peak 0.42)
				0.22 (Peak 0.27)	

SPECIFICATIONS

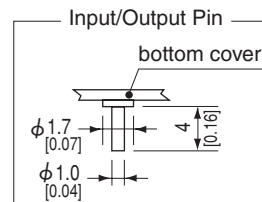
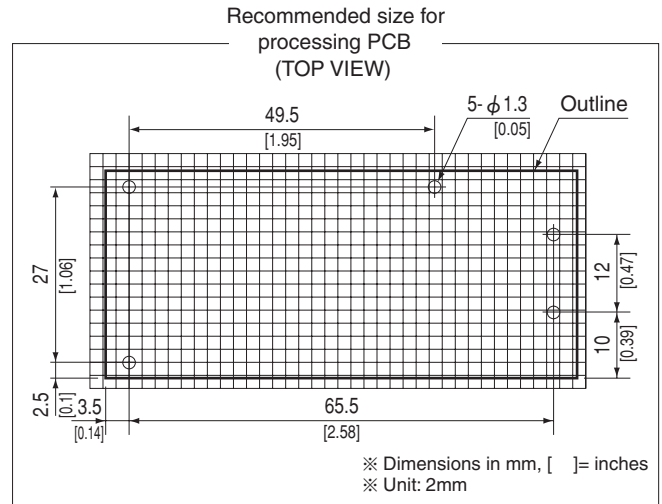
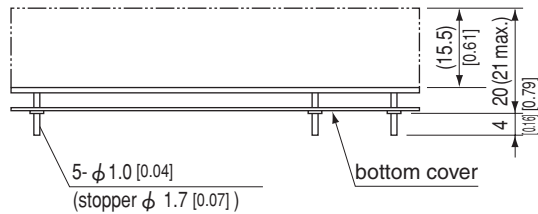
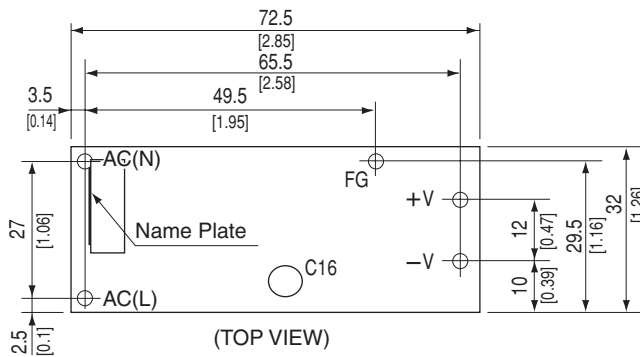
	MODEL	VAF503	VAF505	VAF512	VAF515	VAF524		
INPUT	VOLTAGE[V]		AC85 - 264 1 ϕ or DC110 - 370					
	CURRENT[A]	ACIN 100V	0.15typ (Io=100%)					
		ACIN 200V	0.10typ (Io=100%)					
	FREQUENCY[Hz]		47 - 440 or DC					
	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%)					
		ACIN 200V	30typ (Io=100%)					
	LEAKAGE CURRENT[mA]		0.5max (60Hz, According to IEC60950 and DEN-AN)					
	EFFICIENCY[%]		68typ	77typ	78typ	81typ		
OUTPUT	VOLTAGE[V]		3.3	5	12	15	24	
	CURRENT[A]		*1 1.0 (Peak 1.2)	1.0 (Peak 1.2)	0.45 (Peak 0.54)	0.35 (Peak 0.42)	0.22 (Peak 0.27)	
	LINE REGULATION[mV]		20max	20max	48max	60max	96max	
	LOAD REGULATION[mV]		40max	40max	100max	120max	150max	
	RIPPLE[mVp-p]	0 to +55°C *2	80max	80max	120max	120max	150max	
		-10 - 0°C *2	140max	140max	160max	160max	200max	
		Io=100 - 120% *2	180max	180max	200max	200max	240max	
	RIPPLE NOISE[mVp-p]	0 to +55°C *2	120max	120max	150max	150max	200max	
		-10 - 0°C *2	160max	160max	180max	180max	230max	
		Io=100 - 120% *2	200max	200max	220max	220max	260max	
	TEMPERATURE COEFFICIENT[mV]		-10 to +55°C	100max	50max	120max	150max	300max
	DRIFT[mV]		*3 20max	20max	48max	60max	96max	
	OUTPUT VOLTAGE SETTING[V]		3.19 - 3.47	4.90 - 5.30	11.40 - 12.60	14.25 - 15.75	23.0 - 25.0	
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		Fixed					
START-UP TIME[ms]		700max (ACIN 85V, Io=100%)						
HOLD-UP TIME[ms]		10typ (ACIN 85V, Io=100%), 20typ (ACIN 100V, Io=100%)						
PROTECTION CIRCUIT	OVERCURRENT PROTECTION		Works over 125% of rating and recovers automatically					
	OVERVOLTAGE PROTECTION		Works over 115% of rating (By zener diode clamping)					
ISOLATION	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)					
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)					
	OUTPUT-FG		AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (At Room Temperature)					
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE		-10 to +71°C, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max					
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max					
	VIBRATION		19.6m/s ² 10 - 55Hz, 3minutes period, 60minutes each along X, Y and Z axis (Non operating)					
	IMPACT		196.1m/s ² 11ms, once each X, Y and Z axis (Non operating)					
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL, EN60950-1, EN50178 Complies with DEN-AN and IEC60950-1					
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR22-B, EN55022-B					
OTHERS	CASE SIZE/WEIGHT		32 x 20 x 72.5mm [1.26 x 0.79 x 2.85 inches] (W x H x D) / 30g max					
	COOLING METHOD		Convection					

*1 Peak load for 10sec. or less in acceptable if the total wattage is less than the rated wattage.

*2 This is the value that measured on measuring board with capacitor of 22 μ F. Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM101).

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

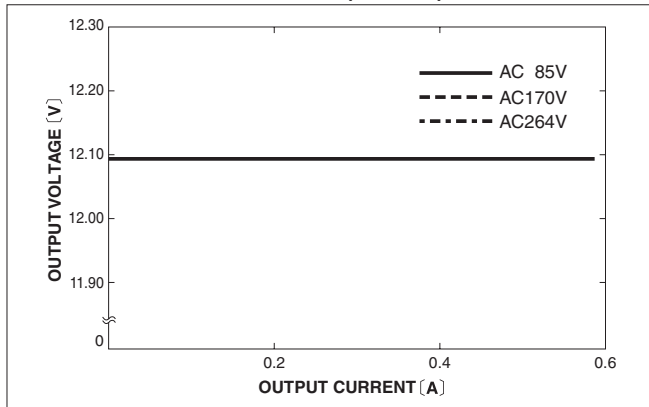
External view



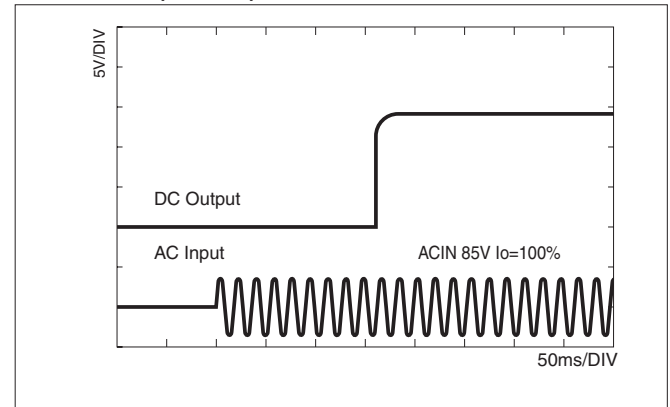
- ※Weight: 30g max
- ※Tolerance: ± 0.5 [± 0.02]
- ※PCB material: CEM-3
- ※PCB thickness: $t=1.0$ [0.04]
- ※Pin material: CPW with solder plated
- ※Recommended hole dia. to PCB: ϕ 1.3
- ※Dimensions in mm, [] = inches

Performance data

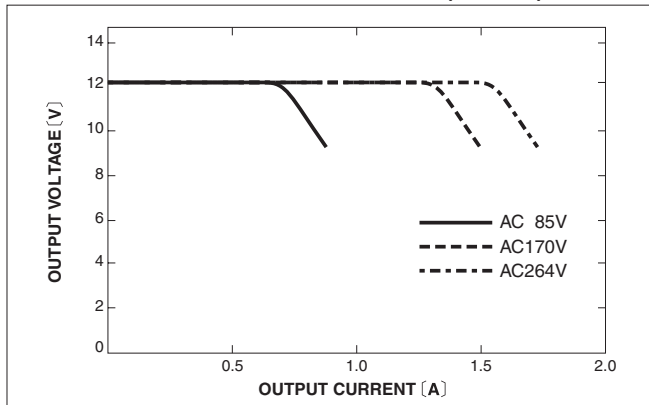
STATIC CHARACTERISTICS (VAF512)



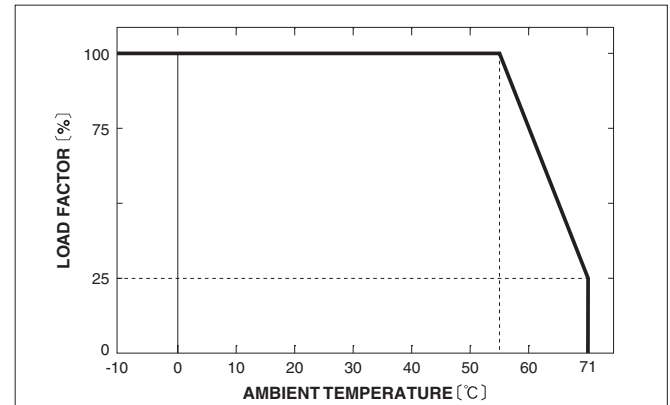
RISE TIME (VAF512)



OVERCURRENT CHARACTERISTICS (VAF512)



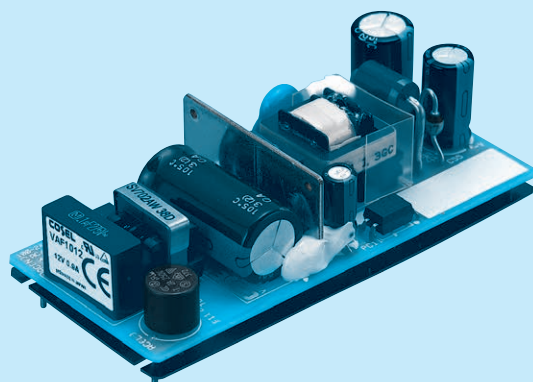
DERATING CURVE



VAF10

VAF 10 05

① ② ③



① Series name
② Output wattage
③ Output voltage

VAF

MODEL	VAF1003	VAF1005	VAF1012	VAF1015	VAF1024
MAX OUTPUT WATTAGE[W]	6.6	10.0	10.8	10.5	10.8
DC OUTPUT	VOLTAGE[V]	3.3	5	12	15
	CURRENT[A]	2.0 (Peak 2.4)	2.0 (Peak 2.4)	0.9 (Peak 1.08)	0.7 (Peak 0.84)

SPECIFICATIONS

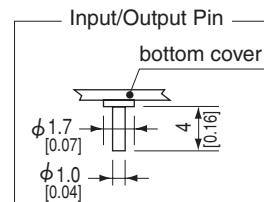
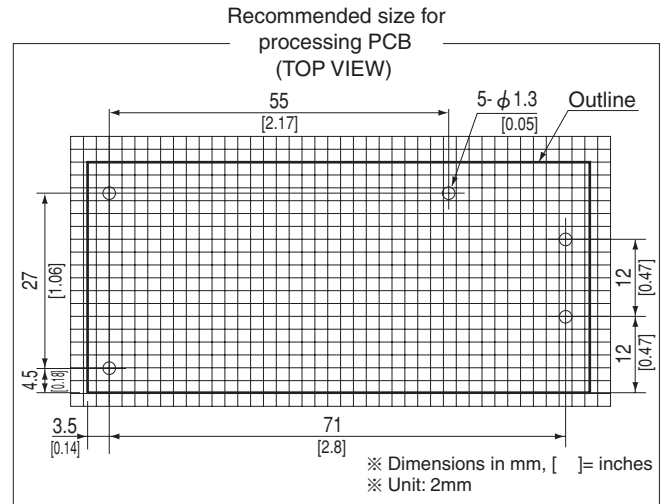
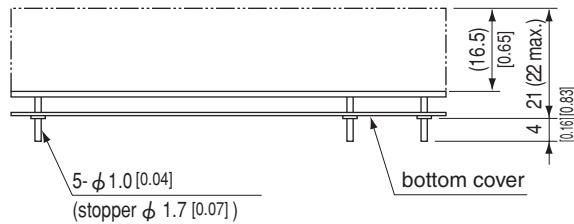
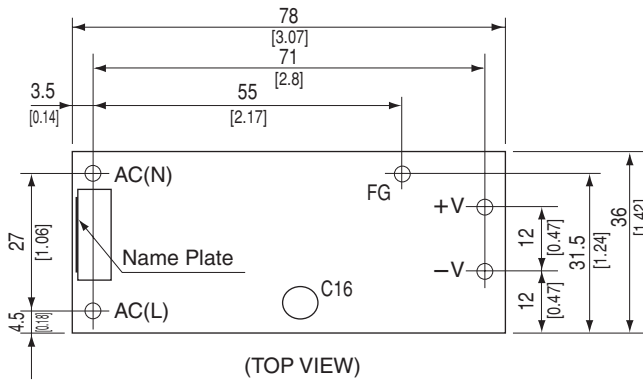
	MODEL	VAF1003	VAF1005	VAF1012	VAF1015	VAF1024		
INPUT	VOLTAGE[V]		AC85 - 264 1 ϕ or DC110 - 370					
	CURRENT[A]	ACIN 100V	0.3typ (Io=100%)					
		ACIN 200V	0.2typ (Io=100%)					
	FREQUENCY[Hz]		47 - 440 or DC					
	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%)					
		ACIN 200V	30typ (Io=100%)					
	LEAKAGE CURRENT[mA]		0.5max (60Hz, According to IEC60950 and DEN-AN)					
	EFFICIENCY[%]		65typ	74typ	78typ	81typ		
OUTPUT	VOLTAGE[V]		3.3	5	12	15	24	
	CURRENT[A]		*1 2.0 (Peak 2.4)	2.0 (Peak 2.4)	0.9 (Peak 1.08)	0.7 (Peak 0.84)	0.45 (Peak 0.54)	
	LINE REGULATION[mV]		20max	20max	48max	60max	96max	
	LOAD REGULATION[mV]		40max	40max	100max	120max	150max	
	RIPPLE[mVp-p]	0 to +55℃ *2	80max	80max	120max	120max	150max	
		-10 - 0℃ *2	140max	140max	160max	160max	200max	
		Io=100 - 120% *2	180max	180max	200max	200max	240max	
	RIPPLE NOISE[mVp-p]	0 to +55℃ *2	120max	120max	150max	150max	200max	
		-10 - 0℃ *2	160max	160max	180max	180max	230max	
		Io=100 - 120% *2	200max	200max	220max	220max	260max	
	TEMPERATURE COEFFICIENT[mV]		-10 to +55℃	100max	50max	120max	150max	300max
	DRIFT[mV]		*3 20max	20max	48max	60max	96max	
	OUTPUT VOLTAGE SETTING[V]		3.19 - 3.47	4.90 - 5.30	11.40 - 12.60	14.25 - 15.75	23.0 - 25.0	
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		Fixed					
	START-UP TIME[ms]		700max (ACIN 85V, Io=100%)					
	HOLD-UP TIME[ms]		10typ (ACIN 85V, Io=100%), 20typ (ACIN 100V, Io=100%)					
	PROTECTION CIRCUIT	OVERCURRENT PROTECTION		Works over 125% of rating and recovers automatically				
		OVERVOLTAGE PROTECTION		Works over 115% of rating (By zener diode clamping)				
ISOLATION	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)					
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)					
	OUTPUT-FG		AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (At Room Temperature)					
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE		-10 to +71℃, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max					
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max					
	VIBRATION		19.6m/s ² 10 - 55Hz, 3minutes period, 60minutes each along X, Y and Z axis (Non operating)					
	IMPACT		196.1m/s ² 11ms, once each X, Y and Z axis (Non operating)					
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL, EN60950-1, EN50178 Complies with DEN-AN and IEC60950-1					
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR22-B, EN55022-B					
OTHERS	CASE SIZE/WEIGHT		36 x 21 x 78mm [1.42 x 0.83 x 3.07 inches] (W x H x D) / 40g max					
	COOLING METHOD		Convection					

*1 Peak load for 10sec. or less in acceptable if the total wattage is less than the rated wattage.

*2 This is the value that measured on measuring board with capacitor of 22 μ F. Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM101).

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

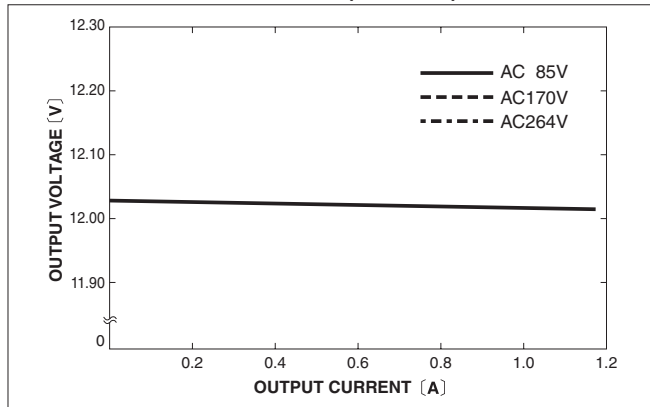
External view



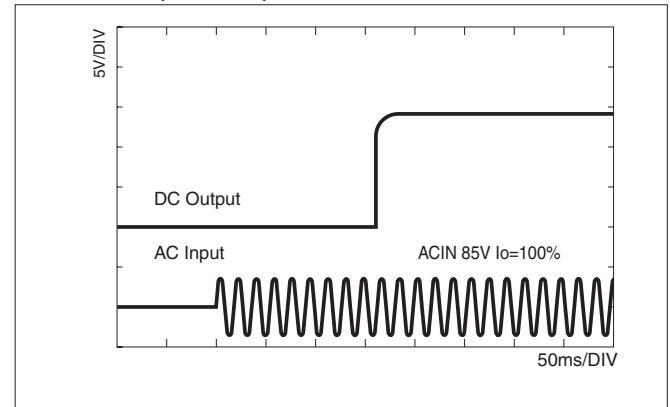
- ※ Weight: 40g max
- ※ Tolerance: ± 0.5 [± 0.02]
- ※ PCB material: CEM-3
- ※ PCB thickness: $t=1.0$ [0.04]
- ※ Pin material: CPW with solder plated
- ※ Recommended hole dia. to PCB: ϕ 1.3
- ※ Dimensions in mm, []= inches

Performance data

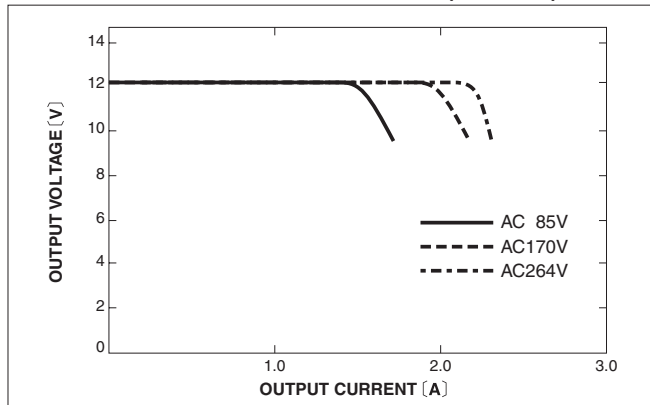
STATIC CHARACTERISTICS (VAF1012)



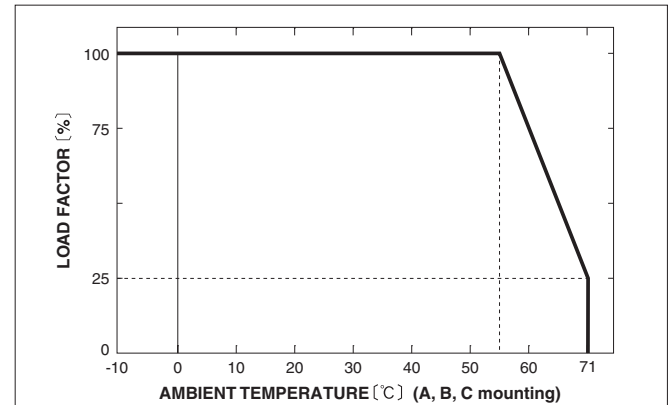
RISE TIME (VAF1012)



OVERCURRENT CHARACTERISTICS (VAF1012)



DERATING CURVE



Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current *1 [A]	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
VAF5	Flyback converter	100	0.15	250V 2A	Resistor	CEM-3	Yes		Yes	*2
VAF10	Flyback converter	100	0.3	250V 2A	Resistor	CEM-3	Yes		Yes	*2

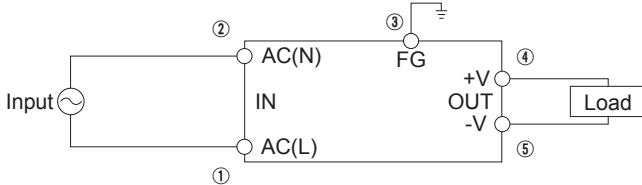
*1 The value of input current is at ACIN 100V and rated load.

*2 Refer to Instruction Manual.

1	Pin Connection	VAF-8
2	Function	VAF-8
2.1	Input voltage range	VAF-8
2.2	Inrush current limiting	VAF-8
2.3	Peak current	VAF-8
2.4	Overcurrent protection	VAF-8
2.5	Overvoltage protection	VAF-8
2.6	Thermal protection	VAF-8
2.7	Isolation	VAF-8
3	Wiring to Input/Output Pin	VAF-8
4	Series Operation and Parallel Operation	VAF-9
4.1	Series operation	VAF-9
4.2	Redundancy operation	VAF-9
5	Input Condition	VAF-9
6	Assembling and Installation Method	VAF-9
6.1	Installation method	VAF-9
6.2	Derating	VAF-10
7	Cleaning	VAF-10
8	Soldering	VAF-10
9	Input/Output Pin	VAF-10
10	Ground	VAF-10
11	Others	VAF-11

1 Pin Connection

No.	Pin connection	Function
①	AC(L)	Input pin AC85 - 264V 1 ϕ 47 - 440Hz or DC110 - 370V
②	AC(N)	
③	FG	Frame ground
④	OUT +V	+Output
⑤	OUT -V	-Output



VAF

2 Function

2.1 Input voltage range

■ Input voltage range of the power supplies is from AC85-AC264V or DC110-DC370V. In cases that conform with safety standard, input voltage range is AC100-AC240V(50/60Hz).

2.2 Inrush current limiting

■ Inrush current limiting is built-in.
 ■ If a switch on the input side is installed, it has to be the one handling the input inrush current.

2.3 Peak current

■ Fig.2.1 shows the available range of peak output current.

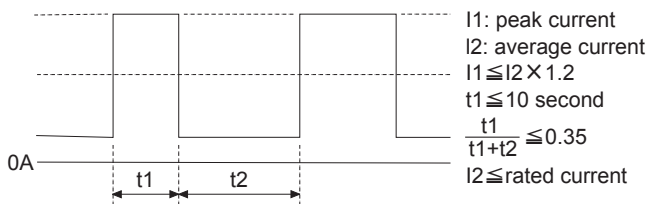


Fig.2.1 Peak current

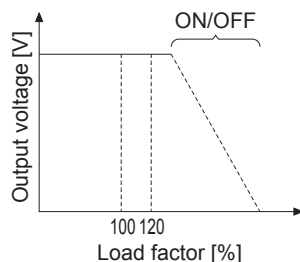


Fig.2.2 Overcurrent characteristics

2.4 Overcurrent protection

■ Overcurrent protection circuit is built-in to be operated over 125% of the rated current. Overcurrent protection prevents the unit from short circuit and over current condition.
 The unit automatically recovers when the fault condition is cleared.

2.5 Overvoltage protection

■ Overvoltage protection circuit, clamping the output voltage by zener diode, is built-in comes into effect at over 115% of the rated voltage. (For 3V type, overvoltage protection kicks in at over 4V.)
 The unit in an overvoltage protection mode cannot be recovered by a user, it must be repaired at the factory.
 Overvoltage protection (diode) also comes into effect if the voltage is externally applied to the output side. Avoid applying voltage to the output side.

2.6 Thermal protection

■ Thermal protection is built-in. If this function comes into effect, shut down the output, eliminate all possible cause of overheating, and drop the temperature to normal level. Output voltage recovers after applying input voltage. To prevent the unit from overheating, avoid using the unit in a dusty, poorly ventilated environment.

2.7 Isolation

■ For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for the start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

3 Wiring to Input/ Output Pin

■ To decrease output ripple voltage more, install external capacitor C_o at output terminal as below.

Table 3.1 Capacity of external capacitor at output terminal: C_o [μ F]

Output voltage C_o	3.3V/5V	12V/15V	24V
Recommended value	220	100	47
Maximum value	2,200	1,000	470

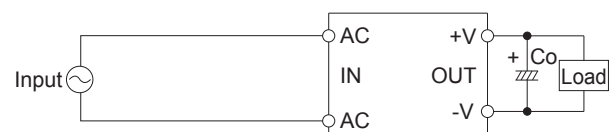


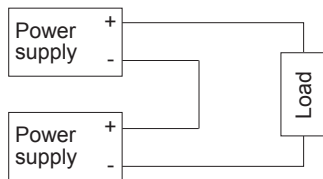
Fig.3.1 Connecting method of external capacitor at output terminal

4 Series Operation and Parallel Operation

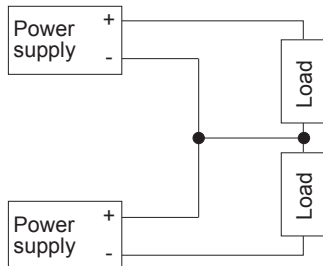
4.1 Series operation

■Series operation is available by connecting the output of two or more power supplies, as shown below. Output current in series connection should be lower than the lowest rated in each unit.

(a)

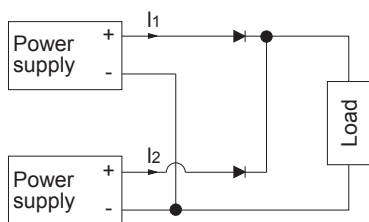


(b)



4.2 Redundancy operation

■Redundancy operation is available by connecting the unit as shown below.



5 Input Condition

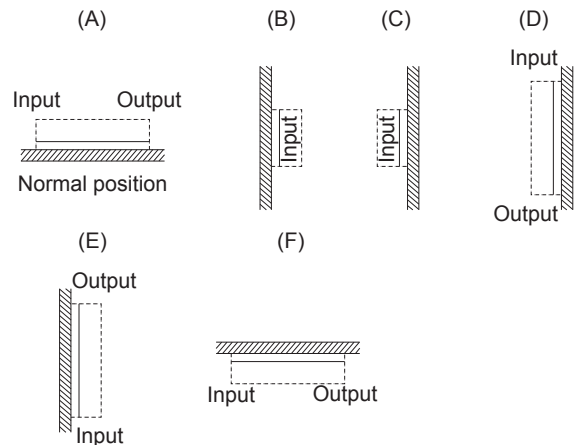
Following should be prohibited to avoid failure or malfunction.

- To continuously apply other than rated input voltage.
- To install the phase advance capacitor. (High voltage is generated when the input voltage is ON/OFF.)
- To apply input voltage less than AC60V.
(It makes output voltage turn on/off one after another in short period of time. This malfunction is also caused by installing a switch/SSR with a capacitor on input line.)
- To apply square waveform input voltage, which is commonly used in UPS and Inverter.

6 Assembling and Installation Method

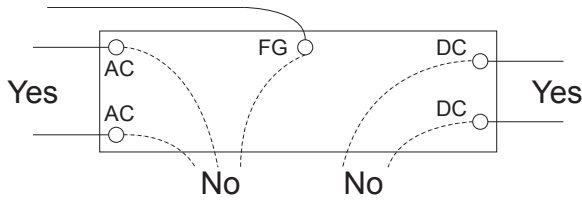
6.1 Installation method

■When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Ambient temperature around each power supply should not exceed the temperature range shown in derating curve.



■When installing the components (inclusive chassis) or pattern which is a foreign potentials around the unit, keep the distance for more than 5mm. If this distance can not be kept, insert the insulation sheet between them.

■Avoid placing the AC input line pattern lay out underneath the unit as it will increase the line conducted noise. Make sure to leave an ample distance between the line pattern lay out and the unit. Also, avoid placing the DC output line pattern underneath the unit because it may increase the output noise. Lay out the pattern away from the unit..



6.2 Derating

■When unit mounted except below drawings, it is required to consider ventilated environment by forced air cooling for temperature/load derating. For details, please consult our sales or engineering departments.

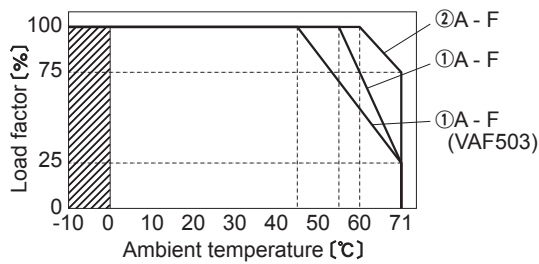


Fig.6.1 VAF5 Derating curve

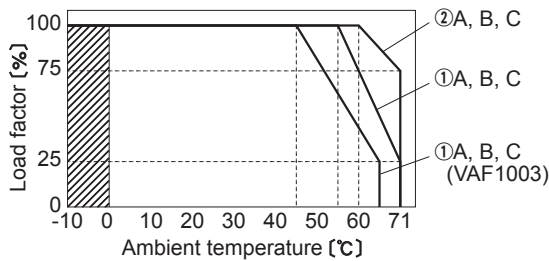


Fig.6.2 VAF10 Derating curve

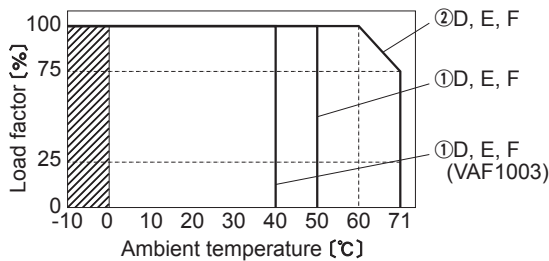


Fig.6.3 VAF10 Derating curve

- ① Convection
- ② Forced Air(0.5m³/min)

In case ②, ventilation must keep the temperature of C16 below 80°C. Refer to External View for the location of C16.

Note:

In the hatched area, the specification of Ripple, Ripple Noise are different from the other.

7 Cleaning

- Cleaning agents: IPA (Solvent type)
- Cleaning period : When cleaning the unit, the unit must be washed with a brush, and IPA must be kept out of the unit.
- After cleaning, dry them enough.

8 Soldering

- Dip soldering : 260°C less than 10 seconds.
- Soldering iron : 350°C less than 3 seconds.

9 Input/Output Pin

- When too much stress is applied on the input/output pins of the unit, the internal connection may be weakened. As below Fig.9.1, avoid applying stress of more than 9.8N (1kgf) on the pins horizontally and more than 19.6N (2kgf) vertically.
- The input/output pins are soldered on PCB internally, therefore, do not pull or bend them with abnormal forces.
- When additional stress is expected to be put on the input/output pins because of vibration or impacts, fix the unit on PCB (using silicone rubber or fixing fittings) to reduce the stress onto the input/output pins.

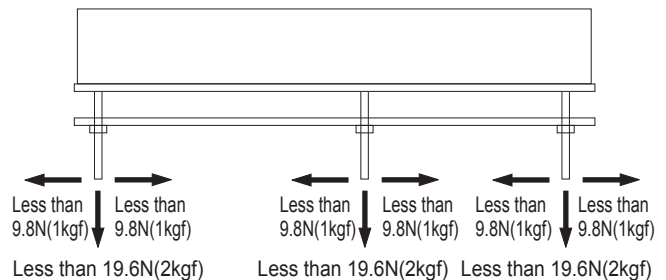


Fig.9.1 Stress on to the pins

10 Ground

- When installing the power supply with your unit, ensure that the input FG terminal is connected to safety ground of the unit. However, when applying the safety agency, connect the input FG terminal to safety ground of the unit.

11 Others

- This power supply is rugged PCB. Do not drop conductive object in the power supply.
- At light load, there remains high voltage inside the power supply for a few minutes after power OFF. So at maintenance, take care about electric shock.
- This power supply is manufactured by SMD technology. The stress to PCB like twisting or bending causes the defect of the unit, so handle the unit with care.

Cost
EffectiveRugged
PCB type

Isolated

Safety
Approvals

EMI

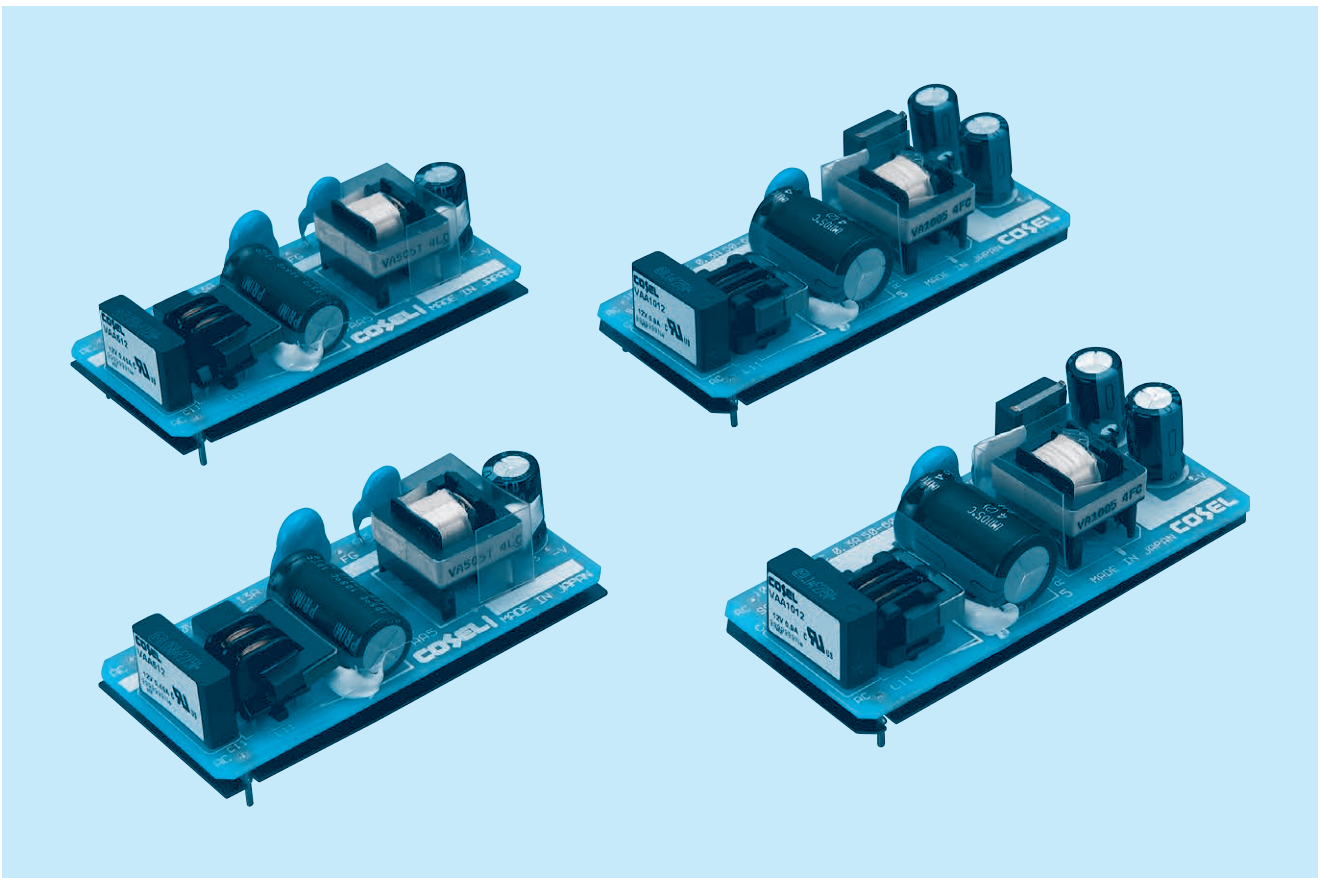
Inrush
current
limiting

OCP



OVP

VAA-series



VAA

Feature

P.C. board mount AC/DC converter
Built-in inrush current and overcurrent protection circuits
Small and compact size

Safety agency approvals

UL60950-1, C-UL recognized
Complies with DEN-AN

EMI

FCC-B, VCCI-A
(Additional capacitors required for meeting VCCI classB)

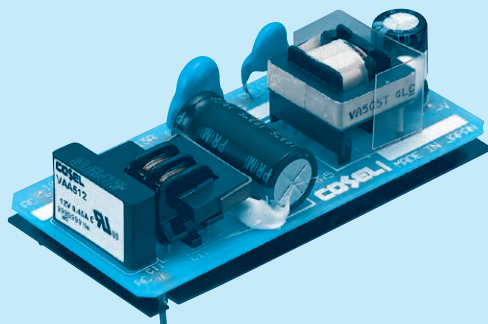
2-year warranty

VAA5

VAA 5 05

① ② ③

RoHS



① Series name
② Output wattage
③ Output voltage

MODEL	VAA505	VAA512
MAX OUTPUT WATTAGE[W]	5.0	5.4
DC OUTPUT	VOLTAGE[V] 5 CURRENT[A] 1.0	12 0.45

SPECIFICATIONS

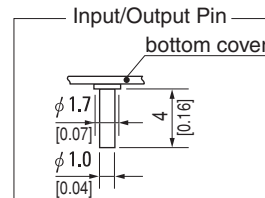
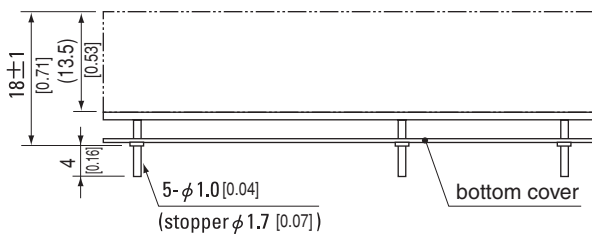
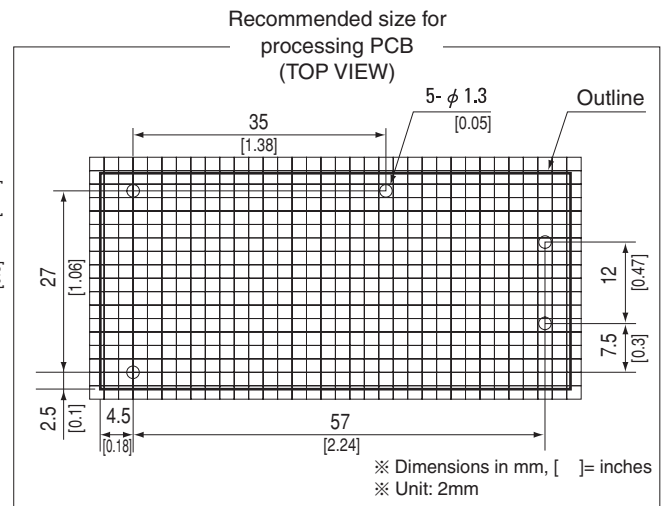
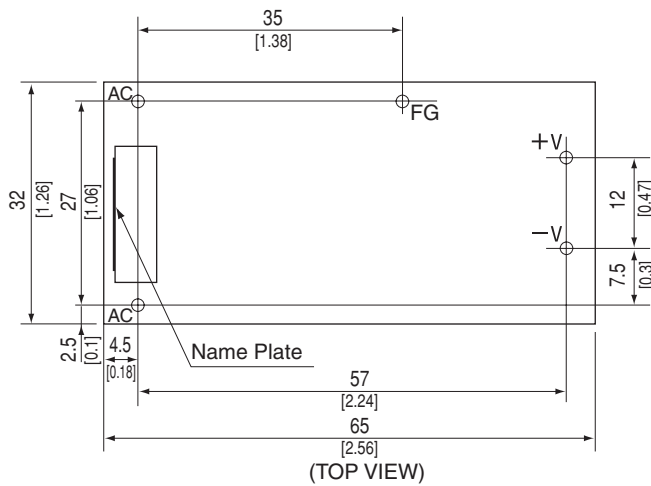
	MODEL	VAA505	VAA512
INPUT	VOLTAGE[V]	AC85 - 132 1 ϕ or DC110 - 170	
	CURRENT[A]	*1 0.13typ (ACIN 100V, Io=100%)	
	EFFICIENCY[%]	*1 75typ	77typ
	FREQUENCY[Hz]	47 - 440 or DC	
	INRUSH CURRENT[A]	*1 15typ (ACIN 100V, Io=100%)	
	LEAKAGE CURRENT[μ A]	0.5max (60Hz According to UL and DEN-AN)	
OUTPUT	VOLTAGE[V]	5	12
	CURRENT[A]	1.0	0.45
	LINE REGULATION[mV]	20max	48max
	LOAD REGULATION[mV]	40max	100max
	RIPPLE[mVp-p]	0 to +55°C *2 80max -10 - 0°C *2 140max	120max 160max
	RIPPLE NOISE[mVp-p]	0 to +55°C *2 120max -10 - 0°C *2 160max	150max 180max
	TEMPERATURE COEFFICIENT[mV]	-10 to +55°C 50max	120max
	DRIFT[mV]	*3 20max	48max
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed	
	START-UP TIME[ms]	200max (ACIN 85V, Io=100%)	
	HOLD-UP TIME[ms]	10typ (ACIN 85V, Io=100%), 20typ (ACIN 100V, Io=100%)	
	OUTPUT VOLTAGE SETTING[V]	*1 4.90 - 5.30	11.40 - 12.60
PROTECTION CIRCUIT	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically	
	OVERVOLTAGE PROTECTION	Works over 115% of rating (by zener diode clamping)	
ISOLATION	INPUT-OUTPUT	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)	
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)	
	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (At Room Temperature)	
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +70°C, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max	
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max	
	VIBRATION	19.6m/s ² 10 - 55Hz, 3minutes period, 60minutes each along X, Y and Z axis (Non operating)	
	IMPACT	196.1m/s ² 11ms, once each X, Y and Z axis (Non operating)	
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL Complies with DEN-AN (External Fuse is required)	
	CONDUCTED NOISE	Complies with FCC-B, additional capacitors required for meeting VCCI class B	
OTHERS	CASE SIZE/WEIGHT	32 X 18 X 65mm [1.26 X 0.71 X 2.56 inches] (W X H X D) / 30g max	
	COOLING METHOD	Convection	

*1 Rated input/output Ta=25°C

*2 This is the value that measured on measuring board with capacitor of 22 μ F. Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM101).

*3 Drift is the charge in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

External view

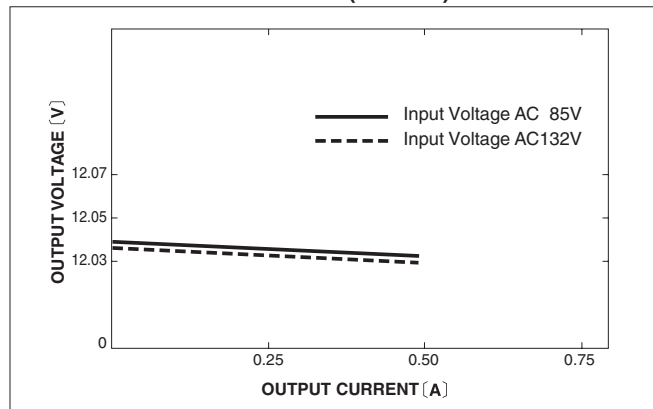


- ※ Weight: 30g max
- ※ Tolerance: ± 0.5 [± 0.02]
- ※ PCB material: CEM-3
- ※ PCB thickness: $t=1.0$ [0.04]
- ※ Pin material: CPW with solder plated
- ※ Recommended hole dia. to PCB: ϕ 1.3
- ※ Dimensions in mm, []= inches

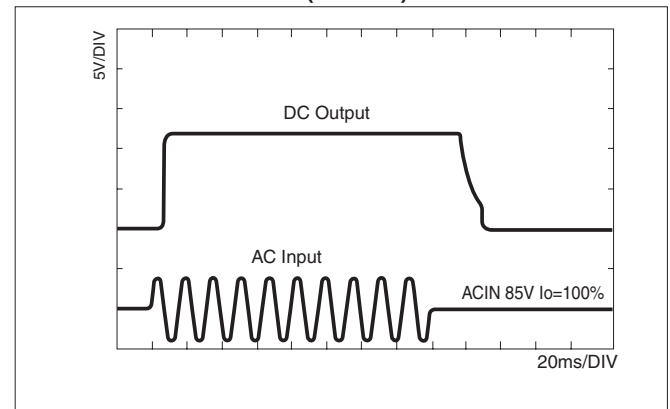
VAA

Performance data

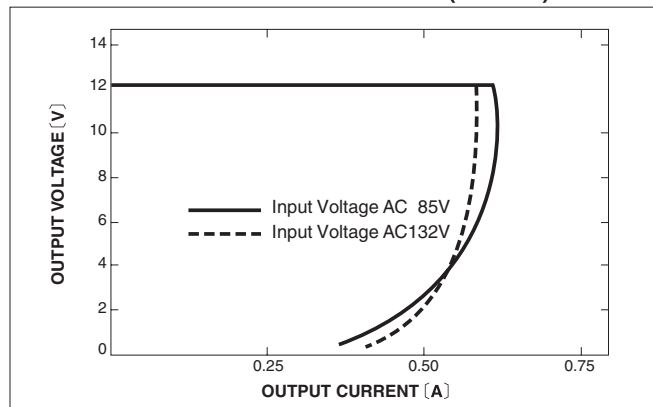
■ STATIC CHARACTERISTICS (VAA512)



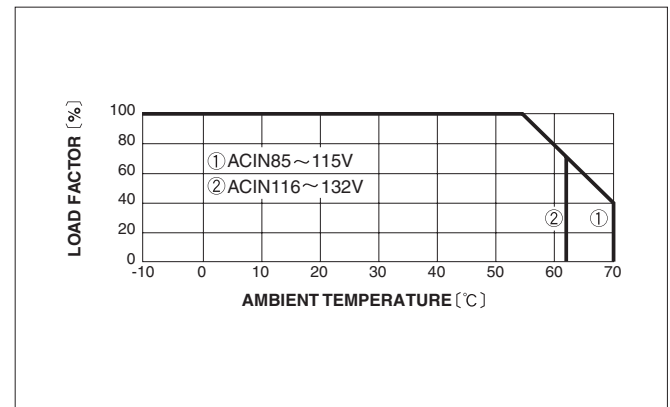
■ RISE TIME & FALL TIME (VAA512)



■ OVERCURRENT CHARACTERISTICS (VAA512)



■ DERATING CURVE

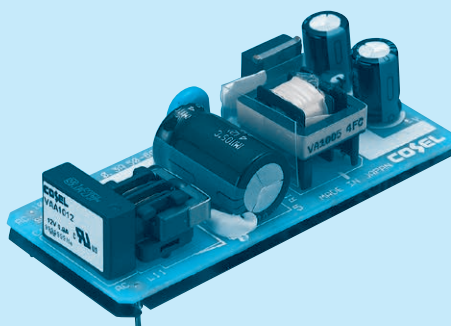


VAA10

VAA 10 05

① ② ③

RoHS



① Series name
② Output wattage
③ Output voltage

MODEL	VAA1005	VAA1012
MAX OUTPUT WATTAGE[W]	10.0	10.8
DC OUTPUT	VOLTAGE[V] 5 CURRENT[A] 2.0	12 0.9

SPECIFICATIONS

	MODEL	VAA1005	VAA1012
INPUT	VOLTAGE[V]	AC85 - 132 1 ϕ or DC110 - 170	
	CURRENT[A]	*1 0.3typ (ACIN 100V, Io=100%)	
	EFFICIENCY[%]	*1 76typ	77typ
	FREQUENCY[Hz]	47 - 440 or DC	
	INRUSH CURRENT[A]	*1 15typ (ACIN 100V, Io=100%)	
	LEAKAGE CURRENT[μ A]	0.5max (60Hz According to UL and DEN-AN)	
OUTPUT	VOLTAGE[V]	5	12
	CURRENT[A]	2.0	0.9
	LINE REGULATION[mV]	20max	48max
	LOAD REGULATION[mV]	40max	100max
	RIPPLE[mVp-p]	0 to +55°C *2 80max -10 - 0°C *2 140max	120max 160max
	RIPPLE NOISE[mVp-p]	0 to +55°C *2 120max -10 - 0°C *2 160max	150max 180max
	TEMPERATURE COEFFICIENT[mV]	-10 to +55°C 50max	120max
	DRIFT[mV]	*3 20max	48max
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed	
	START-UP TIME[ms]	200max (ACIN 85V, Io=100%)	
	HOLD-UP TIME[ms]	10typ (ACIN 85V, Io=100%), 20typ (ACIN 100V, Io=100%)	
	OUTPUT VOLTAGE SETTING[V]	*1 4.90 - 5.30	11.40 - 12.60
PROTECTION CIRCUIT	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically	
	OVERVOLTAGE PROTECTION	Works over 115% of rating (by zener diode clamping)	
ISOLATION	INPUT-OUTPUT	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)	
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)	
	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (At Room Temperature)	
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-10 to +70°C, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max	
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max	
	VIBRATION	19.6m/s ² 10 - 55Hz, 3minutes period, 60minutes each along X, Y and Z axis (Non operating)	
	IMPACT	196.1m/s ² 11ms, once each X, Y and Z axis (Non operating)	
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL Complies with DEN-AN (External Fuse is required)	
	CONDUCTED NOISE	Complies with FCC-B, additional capacitors required for meeting VCCI class B	
OTHERS	CASE SIZE/WEIGHT	32 X 18 X 72.5mm [1.26 X 0.71 X 2.85 inches] (W X H X D) / 35g max	
	COOLING METHOD	Convection	

*1 Rated input/output Ta=25°C

*2 This is the value that measured on measuring board with capacitor of 22 μ F. Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM101).

*3 Drift is the charge in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

Basic Characteristics Data

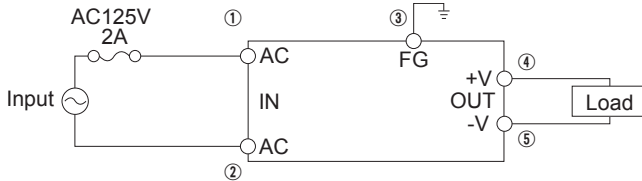
Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
VAA5	Flyback converter	100 - 500	0.13	-	Resistor	CEM-3	Yes		*1	*1
VAA10	Flyback converter	100 - 600	0.3	-	Resistor	CEM-3	Yes		*1	*1

*1 Refer to Instruction Manual

1	Pin Connection	VAA-8
2	Function	VAA-8
2.1	Input voltage range	VAA-8
2.2	Inrush current limiting	VAA-8
2.3	Overcurrent protection	VAA-8
2.4	Overvoltage protection	VAA-8
2.5	Isolation	VAA-8
3	Wiring to Input/Output Pin	VAA-8
4	Series Operation and Parallel Operation	VAA-9
4.1	Series operation	VAA-9
4.2	Redundancy operation	VAA-9
5	Assembling and Installation Method	VAA-9
5.1	Installation method	VAA-9
5.2	Derating	VAA-10
6	Cleaning	VAA-10
7	Soldering	VAA-10
8	Input/Output Pin	VAA-10
9	External Fuse	VAA-10
10	Ground	VAA-10
11	Others	VAA-11

1 Pin Connection

No.	Pin connection	Function
①	AC	Input pin AC85 - 132V 1 ϕ
②	AC	47 - 440Hz or DC110 - 170V
③	FG	Frame ground
④	OUT +V	+Output
⑤	OUT -V	-Output



VAA

2 Function

2.1 Input voltage range

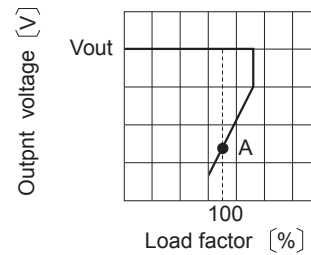
- Input voltage range of the power supplies is from AC85-AC132V or DC110-DC170V. In cases that conform with safety standard, input voltage range is AC100-AC120V(50/60Hz).
- AC input voltage must have a from AC85V to AC132V or DC110V to DC170V for normal operation. If the wrong input is applied, the unit will not operate properly and/or may be damage.

2.2 Inrush current limiting

- Inrush current limiting is built-in.
- If a switch on the input side is installed, it has to be the one handling the input inrush current.

2.3 Overcurrent protection

- Overcurrent protection circuit is built-in to be operated over 105% of the rated current. Overcurrent protection prevents the unit from short circuit and overcurrent condition of less than 20sec. The unit automatically recovers when the fault condition is cleared.
- When the overcurrent/short circuit condition continues more than 20 sec., it may damage devices inside the power supply.
- The power supply which has a current foldback characteristics may not start up when connected to non-linear load such as lamp, motor or constant current load. See the characteristics above.



—: Load characteristics of power supply.
 -----: Characteristics of load (lamp, motor, constant current load, etc.).
 Note: In case of non-linear load, the output is locked out at A point.

Fig.2.1 Current foldback characteristics

2.4 Overvoltage protection

- Overvoltage protection circuit, clamping the output voltage by zener diode, is built-in and comes into effect at over 115% of the rated voltage.
- The unit in an overvoltage protection mode cannot be recovered by a user, it must be repaired at the factory.
- Overvoltage protection (diode) also comes into effect if the voltage is externally applied to the output side. Avoid applying voltage to the output side.

2.5 Isolation

- For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for the start (shut-down).
- Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

3 Wiring to Input/ Output Pin

- To decrease output ripple voltage more, install external capacitor Co at output terminal as below.

Table 3.1 Capacity of external capacitor
at output terminal: Co[μ F]

Model Output voltage(V)	VAA5	VAA10
5	220	220
12	100	100

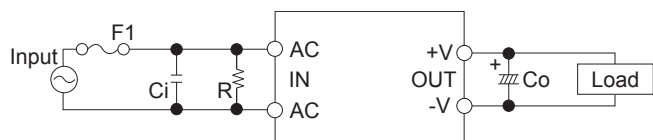


Fig.3.1 Connecting method of external capacitor at output terminal

■Conduction noise

This unit can comply with VCCI class B of conduction noise by attaching capacitor Ci at AC input terminal. To meet with agency approval, the Ci should be agency approved capacitor. Moreover, discharge resistor is required. Please refer Fig.3.1.

Ci : AC250V, 0.47 μ F (Agency approved unit)

R : 1/2W 220K Ω

(Rated: Max. operative voltage: More than 200V)

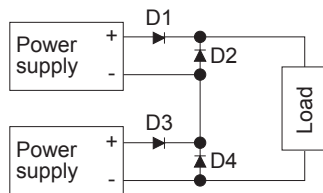
F1 : AC125V2A (Time-delay type)

4 Series Operation and Parallel Operation

4.1 Series operation

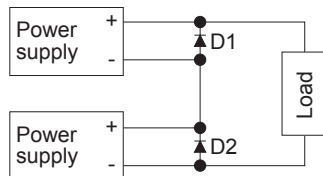
■Series operation is available by connecting the outputs of two or more power supplies, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

(a) When the output voltage is less than 5V.



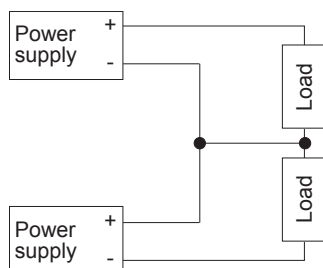
D1 - D4: Please use Schottky Barrier Diode which has lower forward voltage.

(b) When the output voltage is more than 12V.



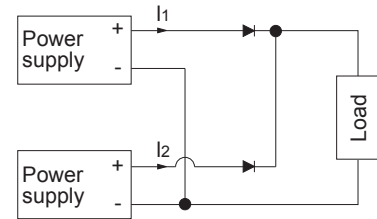
D1 · D2: Please use Schottky Barrier Diode which has lower forward voltage.

(c)



4.2 Redundancy operation

■Redundancy operation is available by connecting the unit as shown below.

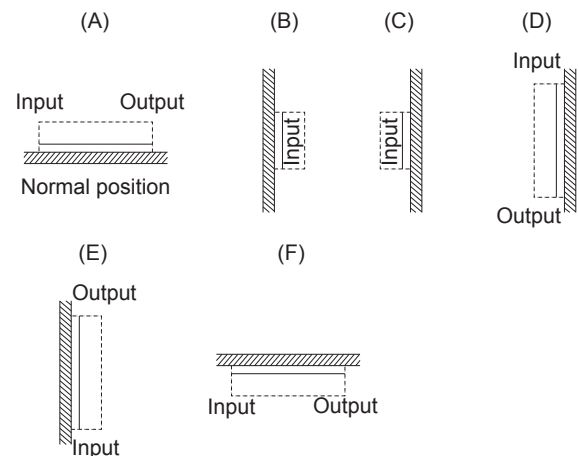


5 Assembling and Installation Method

VAA

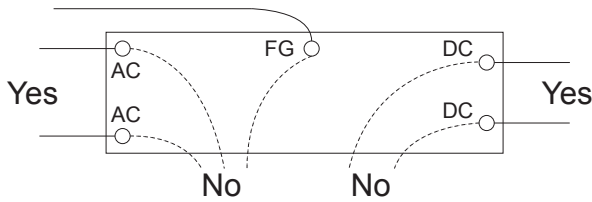
5.1 Installation method

■When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Ambient temperature around each power supply should not exceed the temperature range shown in derating curve.



■When installing the components (inclusive chassis) or pattern which is a foreign potentials around the unit, keep the distance for more than 5mm. If this distance can not be kept, insert the insulation sheet between them.

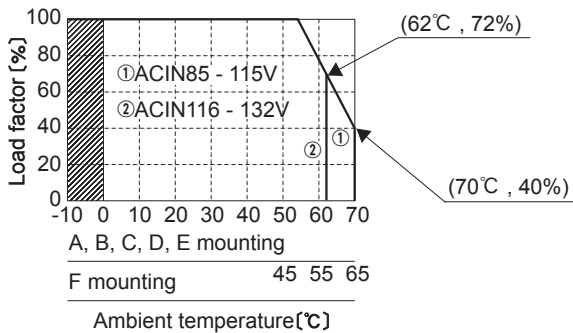
■Avoid placing the AC input line pattern lay out underneath the unit as it will increase the line conducted noise. Make sure to leave an ample distance between the line pattern lay out and the unit. Also, avoid placing the DC output line pattern underneath the unit because it may increase the output noise. Lay out the pattern away from the unit.



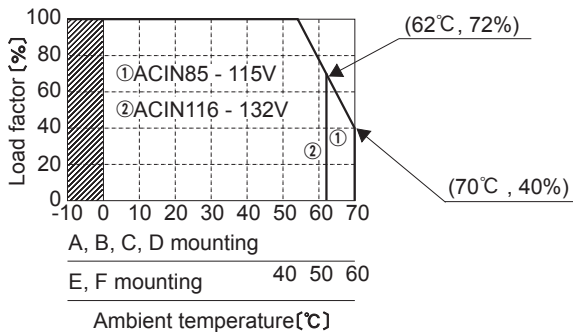
5.2 Derating

■When unit mounted except below drawings, it is required to consider ventilated environment by forced air cooling for temperature/load derating. For details, please consult our sales or engineering departments.

●VAA5



●VAA10



Note:

In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

6 Cleaning

- Cleaning agents : IPA (Solvent type)
- Cleaning period : When cleaning the unit, the unit must be washed with a brush, and IPA must be kept out of the unit.
- After cleaning, dry them enough.

7 Soldering

- Dip soldering : 260°C less than 10 seconds.
- Soldering iron : 350°C less than 3 seconds.

8 Input/Output Pin

- When too much stress is applied on the input/output pins of the unit, the internal connection may be weakened. As below Fig.8.1, avoid applying stress of more than 9.8N (1kgf) on the pins horizontally and more than 19.6N (2kgf) vertically.
- The input/output pins are soldered on PCB internally, therefore, do not pull or bend them with abnormal forces.
- When additional stress is expected to be put on the input/output pins because of vibration or impacts, fix the unit on PCB (using silicone rubber or fixing fittings) to reduce the stress onto the input/output pins.

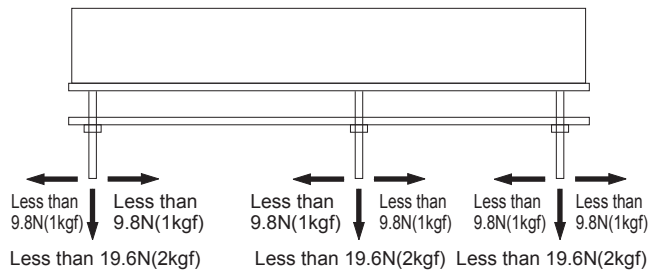


Fig.8.1 Stress on to the pins

9 External Fuse

- Fuse is not built-in on the input side. In order to secure the safety of the unit, install a slow-blow type fuse on the input side.

Model	VAA5	VAA10
Rated current	125V 2A	125V 2A

10 Ground

- When installing the power supply with your unit, ensure that the input FG terminal is connected to safety ground of the unit. However, when applying the safety agency, connect the input FG terminal to safety ground of the unit.

11 Others

- This power supply is rugged PCB. Do not drop conductive objects in the power supply.
- At light load, there remains high voltage inside the power supply for a few minutes after power OFF. So at maintenance, take care about electric shock.
- This power supply is manufactured by SMD technology. The stress to PCB like twisting or bending causes the defect of the unit, so handle the unit with care.



Isolated



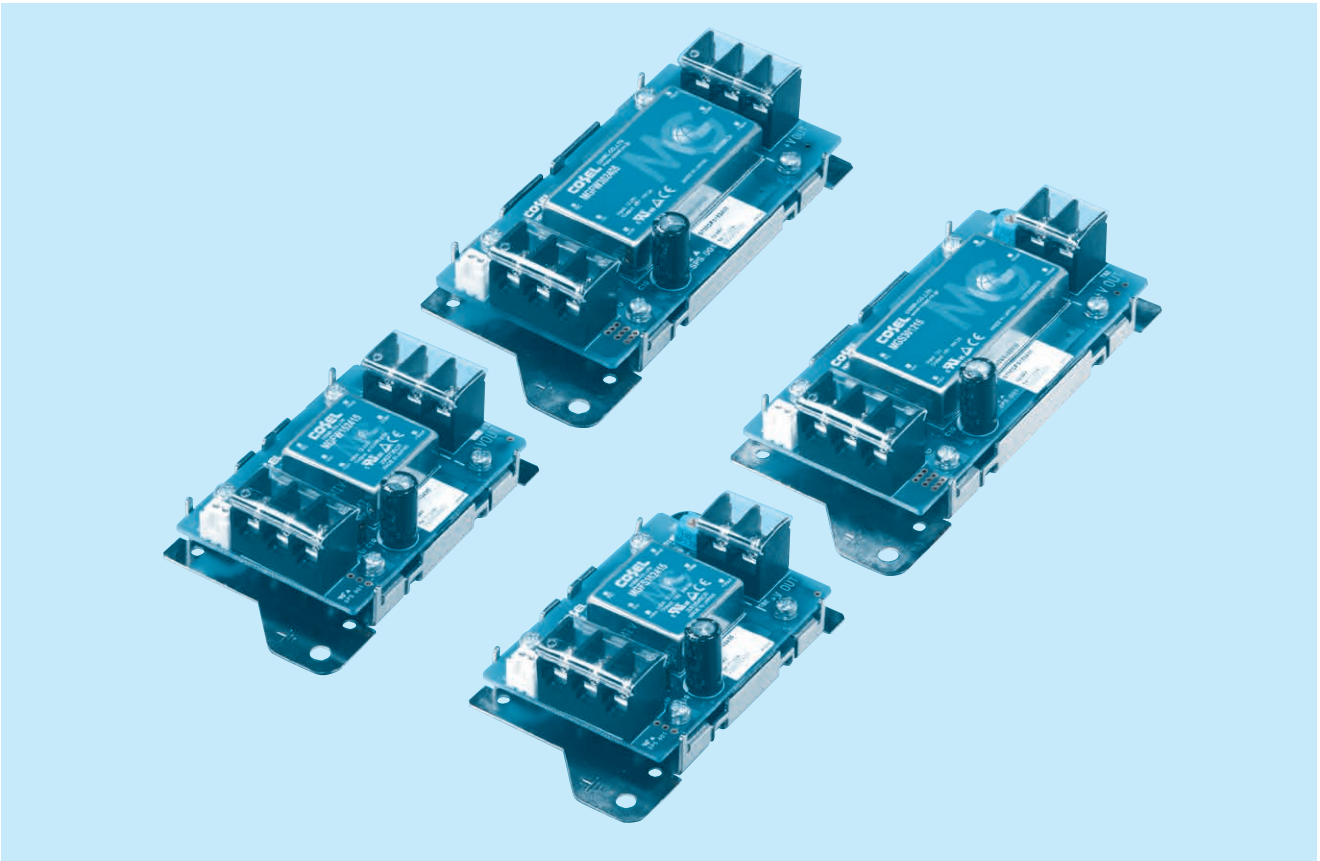
OCP



OVP

Remote
ON/OFFWide 4 : 1
input

STMG-series



STMG

Feature

- Isolated unit type DC-DC converter
- Wide input voltage DC9-36V/DC18-76V
- Various lineups
- Available connector interface (option)
- Available case cover (option)
- Available DIN rail attachment (option)
- Built in Overcurrent protection (recovery automatically)
- Built in Overvoltage protection (for STMG30)
- Built in Remote ON/OFF
- Built in Output voltage adjustment (for single output, $\pm 10\%$)

Safety agency approvals

UL60950-1 C-UL EN60950-1 Complies

CE marking

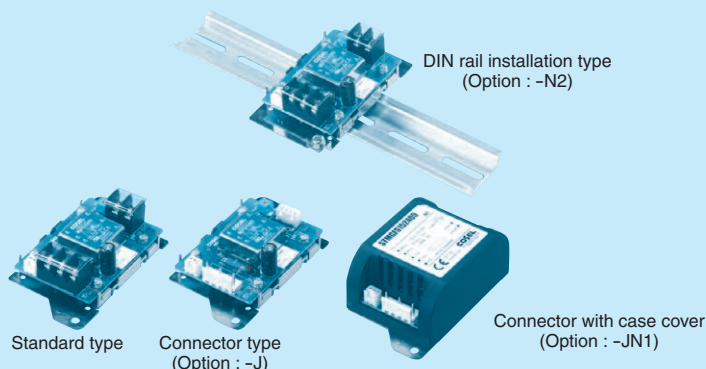
Low voltage Directive

5-year warranty (refer to Instruction Manual)

STMGFS15

STMGF S 15 24 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage
- ⑥ Optional
 - G : Capacitor between Input and Output is removed.
 - R : with Remote ON/OFF (Positive logic control)
 - J : Input/Output Connector
 - JN1 : Connector with case cover
 - N2 : With DIN rail installation type
 - JN3 : Connector with cover(plastic) and DIN rail installation type
 - V : Output voltage setting potentiometer externally

* Please remove short piece on CN4 to enable remote ON/OFF function.

* When the option is set specifications may vary.

MODEL	STMGFS15243R3	STMGFS152405	STMGFS152412	STMGFS152415
MAX OUTPUT WATTAGE[W]	13.2	15	15.6	15
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12
	CURRENT[A]	4	3	1.3

SPECIFICATIONS

	MODEL	STMGFS15243R3	STMGFS152405	STMGFS152412	STMGFS152415
INPUT	VOLTAGE[V]	DC9 - 36			
	CURRENT[A] *2	0.63typ	0.71typ	0.73typ	0.70typ
	EFFICIENCY[%] *2	87typ	88typ	89typ	89typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15
	CURRENT[A]	4	3	1.3	1
	LINE REGULATION[mV]	13.2max	20max	48max	60max
	LOAD REGULATION[mV]	60max	60max	100max	120max
	RIPPLE[mVp-p] *3	0 to +60°C 75max	75max	100max	100max
		-20 to +60°C 100max	100max	120max	120max
	RIPPLE NOISE[mVp-p] *3	0 to +60°C 120max	120max	150max	150max
		-20 to +60°C 200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	0 to +60°C 50max	50max	150max	180max
		-20 to +60°C 80max	80max	240max	290max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max
	START-UP TIME[ms]	30max (Minimum input, I _o =100%)			
	OUTPUT VOLTAGE ADJUSTMENT RANGE	2.97 - 3.63	4.50 - 5.50	10.80 - 13.20	13.50 - 16.50
	OUTPUT VOLTAGE SETTING[V] *5	3.29 - 3.41	4.97 - 5.14	11.85 - 12.25	14.83 - 15.33
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically			
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)			

MODEL	STMGFS15483R3	STMGFS154805	STMGFS154812	STMGFS154815
MAX OUTPUT WATTAGE[W]	13.2	15	15.6	15
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12
	CURRENT[A]	4	3	1.3

SPECIFICATIONS

	MODEL	STMGFS15483R3	STMGFS154805	STMGFS154812	STMGFS154815
INPUT	VOLTAGE[V]	DC18 - 76			
	CURRENT[A] *2	0.32typ	0.36typ	0.37typ	0.35typ
	EFFICIENCY[%] *2	87typ	88typ	88typ	89typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15
	CURRENT[A]	4	3	1.3	1
	LINE REGULATION[mV]	13.2max	20max	48max	60max
	LOAD REGULATION[mV]	60max	60max	100max	120max
	RIPPLE[mVp-p] *3	0 to +60°C 75max	75max	100max	100max
		-20 to +60°C 100max	100max	120max	120max
	RIPPLE NOISE[mVp-p] *3	0 to +60°C 120max	120max	150max	150max
		-20 to +60°C 200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	0 to +60°C 50max	50max	150max	180max
		-20 to +60°C 80max	80max	240max	290max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max
	START-UP TIME[ms]	30max (Minimum input, I _o =100%)			
	OUTPUT VOLTAGE ADJUSTMENT RANGE	2.97 - 3.63	4.50 - 5.50	10.80 - 13.20	13.50 - 16.50
	OUTPUT VOLTAGE SETTING[V] *5	3.29 - 3.41	4.97 - 5.14	11.85 - 12.25	14.83 - 15.33
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically			
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)			

GENERAL SPECIFICATIONS

ISOLATION	INPUT · RC-OUTPUT	DC1,500V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)
	INPUT · RC-FG	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)
	OUTPUT-FG	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-20 to +70℃, 20 to 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max
	STORAGE TEMP.,HUMID.AND ALTITUDE	-20 to +75℃, 20 to 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 19.6m/s²(2G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	196.1m/s² (20G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1 Complies
OTHERS	CASE SIZE/WEIGHT	52×27×93mm [2.05×1.06×3.66 inches] (W×H×D) / 110g max (When the option is set, refer to the page STMG-6)
	COOLING METHOD	Convection/Forced air

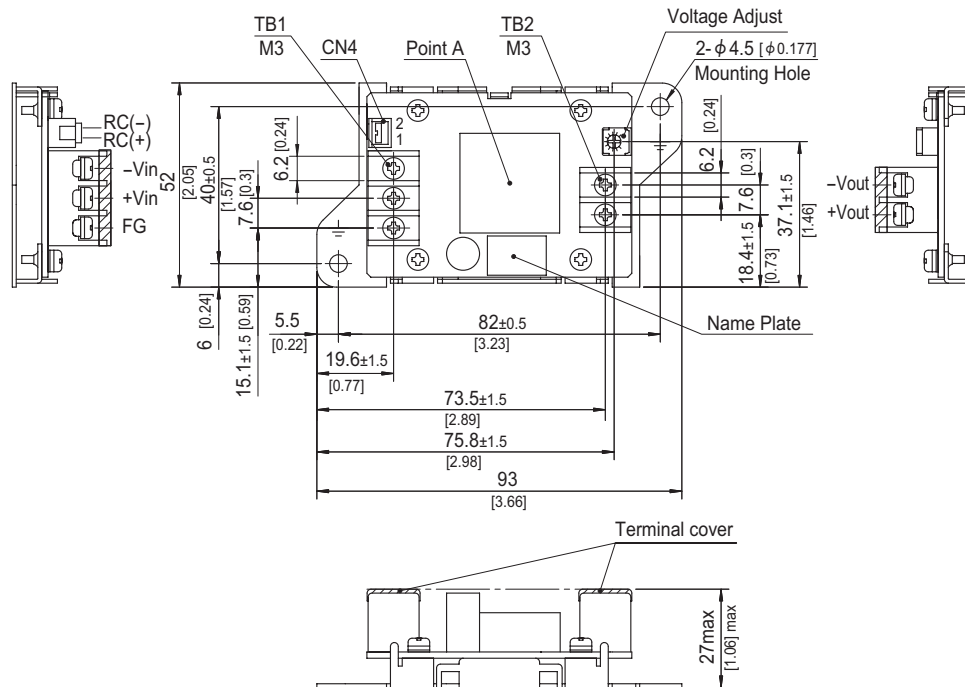
- *1 STMGFW15xx05/STMGFW15xx12/STMGFW15xx15 is available as single output, +10V/+24V/+30V
- *2 Rated input 12V, 24V or 48V DC lo=100%
- *3 Measured by 100MHz oscilloscope or Ripple-Noise meter (Equivalent to KIKUSUI-GIKEN : RM103).
- *4 Drift is the DC output accuracy for eight hours period after a half-hour warm-up at 25°C.
- *5 Rated input voltage (DC24V, DC48V), rated output wattage, ambient temperature at 25°C.
- * Parallel operation with other model is not possible.

External view

Standard type

* External view of option G, R are the same as standard model.
External view of other type options, please refer to the page STMG-6.

STMG



	I/O Connector		Mating Connector	Terminal
Remote ON/OFF	CN4	B2B-XH	XHP-2	Chain : SXH-001T-P0.6
				Loose : BXH-001T-P0.6

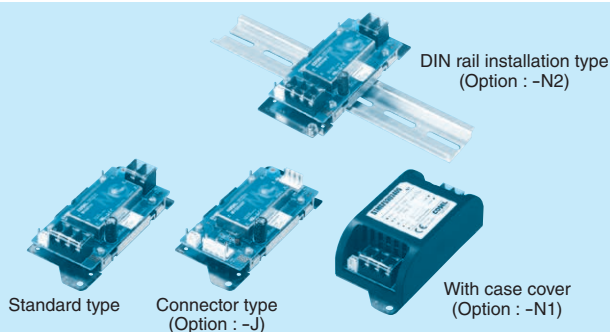
(Mfr.:J.S.T.)

- * Tolerance ± 1
- * Dimensions in mm, []=inches
- * Weight : 110g max
- * PCB material / thickness : FR-4 / 1.6mm
- * Mounting plate : Iron (surface finishing : nickel plating) $t=1.0$ [0.04]
- * Terminal block screw tightening torque M3 : $0.8N \cdot m$ (8.5kgf \cdot cm) max
- * CN4 has been installed short piece as factory setting (Except option R).
When remote ON/OFF is used, please remove the installed short piece.

STMGFS30

STMGF S 30 24 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
② Single output
③ Output wattage
④ Input voltage
⑤ Output voltage
⑥ Optional
G : Capacitor between Input and Output is removed.
R : with Remote ON/OFF (Positive logic control)
J : Input/Output Connector
N1 : With case cover
N2 : With DIN rail installation type
N3 : With cover(plastic) and DIN rail installation type
V : Output voltage setting potentiometer externally
*When the option is set specifications may vary.

*Please remove short piece on CN4 to enable remote ON/OFF function.

MODEL	STMGFS30243R3	STMGFS302405	STMGFS302412	STMGFS302415
MAX OUTPUT WATTAGE[W]	24.75	30	30	30
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12
	CURRENT[A]	7.5	6	2.5

SPECIFICATIONS

	MODEL	STMGFS30243R3	STMGFS302405	STMGFS302412	STMGFS302415
INPUT	VOLTAGE[V]	DC9 - 36			
	CURRENT[A] *2	1.16typ	1.39typ	1.40typ	1.40typ
	EFFICIENCY[%] *2	89typ	90typ	89typ	89typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15
	CURRENT[A]	7.5	6	2.5	2
	LINE REGULATION[mV]	13.2max	20max	48max	60max
	LOAD REGULATION[mV]	60max	60max	100max	120max
	RIPPLE[mVp-p] *3	0 to +60°C	75max	75max	100max
		-20 to +60°C	100max	100max	120max
	RIPPLE NOISE[mVp-p] *3	0 to +60°C	120max	120max	150max
		-20 to +60°C	200max	200max	200max
	TEMPERATURE REGULATION[mV]	0 to +60°C	50max	50max	150max
		-20 to +60°C	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max
	START-UP TIME[ms]	30max (Minimum input, I _o =100%)			
	OUTPUT VOLTAGE ADJUSTMENT RANGE	2.97 - 3.63	4.50 - 5.50	10.80 - 13.20	13.50 - 16.50
	OUTPUT VOLTAGE SETTING[V] *5	3.29 - 3.41	4.97 - 5.14	11.85 - 12.25	14.83 - 15.33
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically			
PROTECTION CIRCUIT AND OTHERS	OVERVOLTAGE PROTECTION[V]	Works over 120 to 160% of rating			
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)			

MODEL	STMGFS30483R3	STMGFS304805	STMGFS304812	STMGFS304815
MAX OUTPUT WATTAGE[W]	24.75	30	30	30
DC OUTPUT	VOLTAGE[V] *1	3.3	5	12
	CURRENT[A]	7.5	6	2.5

SPECIFICATIONS

	MODEL	STMGFS30483R3	STMGFS304805	STMGFS304812	STMGFS304815
INPUT	VOLTAGE[V]	DC18 - 76			
	CURRENT[A] *2	0.58typ	0.70typ	0.70typ	0.70typ
	EFFICIENCY[%] *2	89typ	90typ	89typ	89typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15
	CURRENT[A]	7.5	6	2.5	2
	LINE REGULATION[mV]	13.2max	20max	48max	60max
	LOAD REGULATION[mV]	60max	60max	100max	120max
	RIPPLE[mVp-p] *3	0 to +60°C	75max	75max	100max
		-20 to +60°C	100max	100max	120max
	RIPPLE NOISE[mVp-p] *3	0 to +60°C	120max	120max	150max
		-20 to +60°C	200max	200max	200max
	TEMPERATURE REGULATION[mV]	0 to +60°C	50max	50max	150max
		-20 to +60°C	80max	80max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	20max	20max	48max	60max
	START-UP TIME[ms]	30max (Minimum input, I _o =100%)			
	OUTPUT VOLTAGE ADJUSTMENT RANGE	2.97 - 3.63	4.50 - 5.50	10.80 - 13.20	13.50 - 16.50
	OUTPUT VOLTAGE SETTING[V] *5	3.29 - 3.41	4.97 - 5.14	11.85 - 12.25	14.83 - 15.33
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically			
PROTECTION CIRCUIT AND OTHERS	OVERVOLTAGE PROTECTION[V]	Works over 120 to 160% of rating			
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)			

GENERAL SPECIFICATIONS

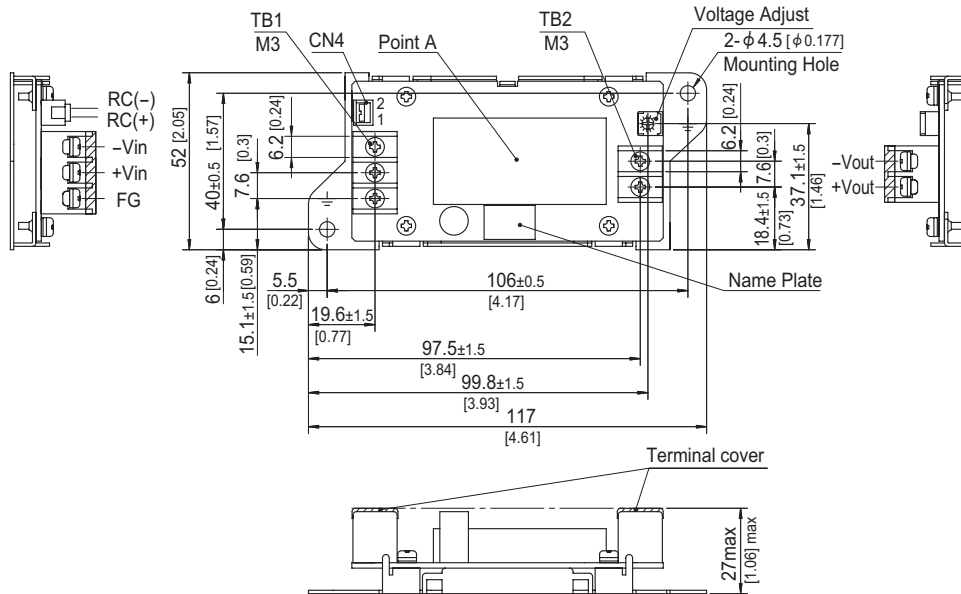
ISOLATION	INPUT · RC-OUTPUT	DC1,500V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)
	INPUT · RC-FG	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)
	OUTPUT-FG	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-20 to +70℃, 20 to 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75℃, 20 to 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1 Complies
OTHERS	CASE SIZE/WEIGHT	52×27×117mm [2.05×1.06×4.61 inches] (W×H×D) / 140g max (When the option is set, refer to the page STMG-7)
	COOLING METHOD	Convection/Forced air

- *1 STMGFW30xx05/STMGFW30xx12/STMGFW30xx15 is available as single output, +10V/+24V/+30V
- *2 Rated input 12V, 24V or 48V DC Io=100%
- *3 Measured by 100MHz oscilloscope or Ripple-Noise meter (Equivalent to KIKUSUI-GIKEN : RM103).
- *4 Drift is the DC output accuracy for eight hours period after a half-hour warm-up at 25℃.
- *5 Rated input voltage (DC24V, DC48V), rated output wattage, ambient temperature at 25℃.
- * Parallel operation with other model is not possible.

External view

Standard type

* External view of option G, R are the same as standard model.
External view of other type options, please refer to the page STMG-7.



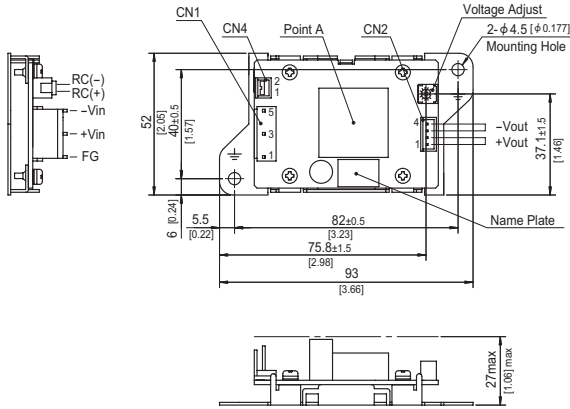
	I/O Connector		Mating Connector	Terminal
Remote ON/OFF	CN4	B2B-XH	XHP-2	Chain : SXH-001T-P0.6 Loose : BXH-001T-P0.6

(Mfr.: J.S.T.)

- * Tolerance ±1
- * Dimensions in mm, []=inches
- * Weight : 140g max
- * PCB material / thickness : FR-4 / 1.6mm
- * Mounting plate : Iron (surface finishing : nickel plating) t=1.0 [0.04]
- * Terminal block screw tightening torque M3 : 0.8N · m (8.5kgf · cm) max
- * CN4 has been installed jumper as factory setting (Except option R).
- When remote ON/OFF is used , please remove the installed jumper.

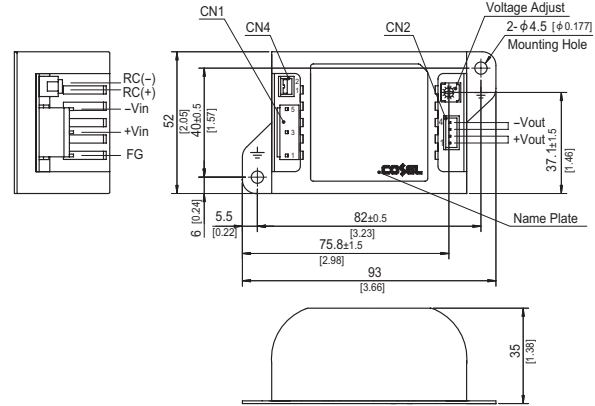
External view (Option type)

Connector type (-J)

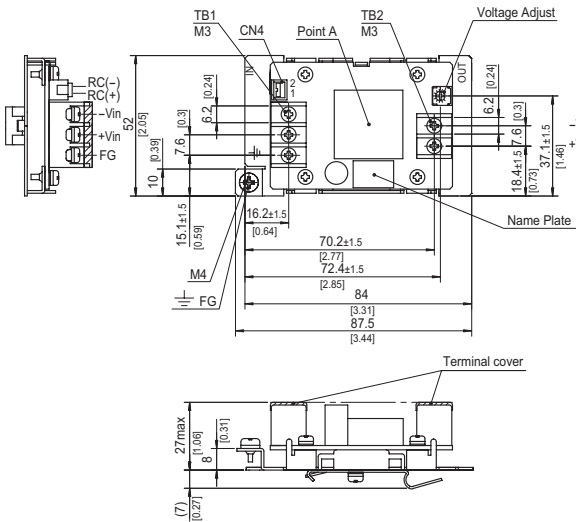


Case cover and connector type (-JN1)

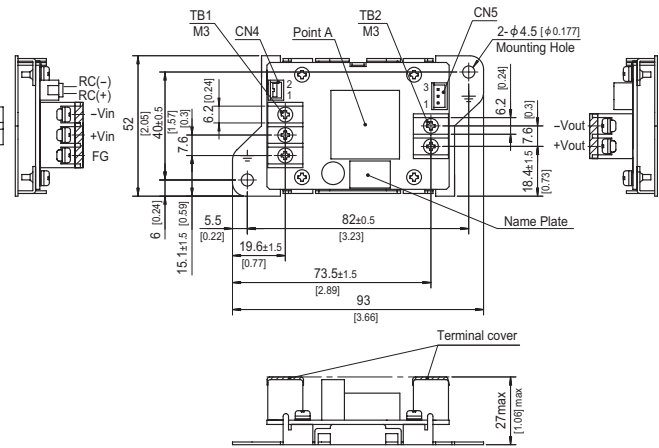
* The specifications of terminal block and Case cover type can not be set.



DIN rail installation type (-N2)



External voltage variable volume type (-V)



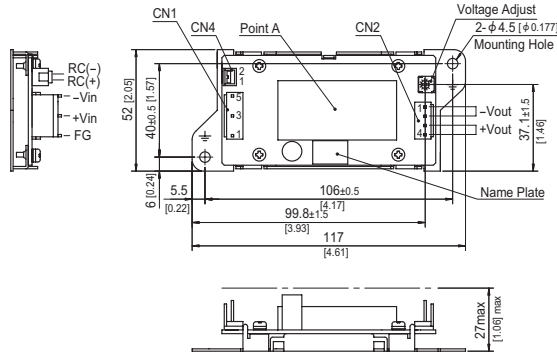
	I/O Connector		Mating Connector	Terminal
Connector Type Input	CN1	B3P5-VH	VHR-5N	Chain : SVH-21T-P1.1 Loose : BVH-21T-P1.1
Connector Type Output	CN2	B4P-XH	XHP-4	Chain : SXH-001T-P0.6 Loose : BXH-001T-P0.6
Remote ON/OFF	CN4	B2B-XH	XHP-2	Chain : SXH-001T-P0.6 Loose : BXH-001T-P0.6
External voltage variable volume type	CN5	B3B-XH	XHP-3	Chain : SXH-001T-P0.6 Loose : BXH-001T-P0.6

(Mfr.:J.S.T.)

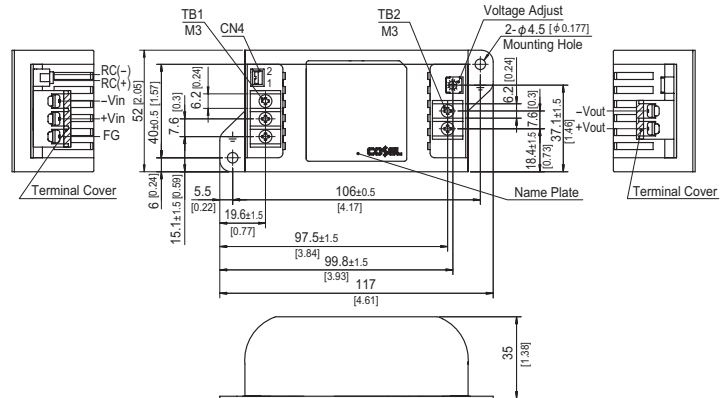
- * Tolerance ± 1
- * Dimensions in mm, []=inches
- * Weight : Standard & Connector type 110g max
Case cover & DIN rail installation type 120g max
- * PCB material / thickness : FR-4 / 1.6mm
- * Mounting plate : Iron (surface finishing : nickel plating) $t=1.0$ [0.04]
- * Case : PBT
- * Terminal block screw tightening torque M3 : $0.8N \cdot m$ (8.5kgf \cdot cm) max
- * CN4 has been installed jumper as factory setting (Except option R).
When remote ON/OFF is used , please remove the installed jumper.
- * Connector Type : Keep drawing current per pin below 2.5A for CN2.

External view (Option type)

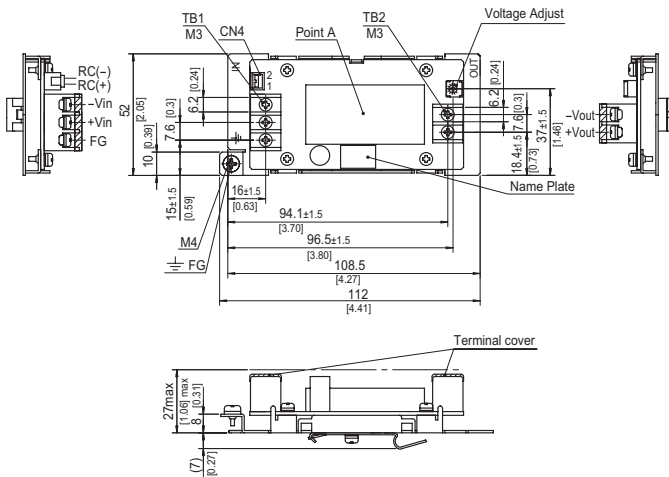
Connector type (-J)



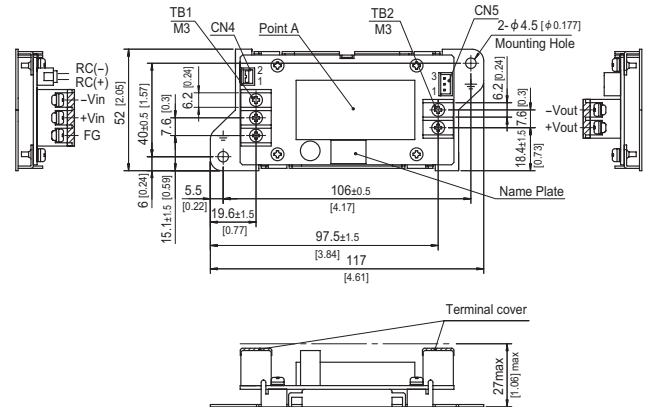
Case cover type (-N1)



DIN rail installation type (-N2)



External voltage variable volume type (-V)



	I/O Connector		Mating Connector	Terminal
Connector Type Input	CN1	B3P5-VH	VHR-5N	Chain : SVH-21T-P1.1 Loose : BVH-21T-P1.1
Connector Type Output	CN2	B4P-VH	VHR-4N	Chain : SVH-21T-P1.1 Loose : BVH-21T-P1.1
Remote ON/OFF	CN4	B2B-XH	XHP-2	Chain : SXH-001T-P0.6 Loose : BXH-001T-P0.6
External voltage variable volume type	CN5	B3B-XH	XHP-3	Chain : SXH-001T-P0.6 Loose : BXH-001T-P0.6

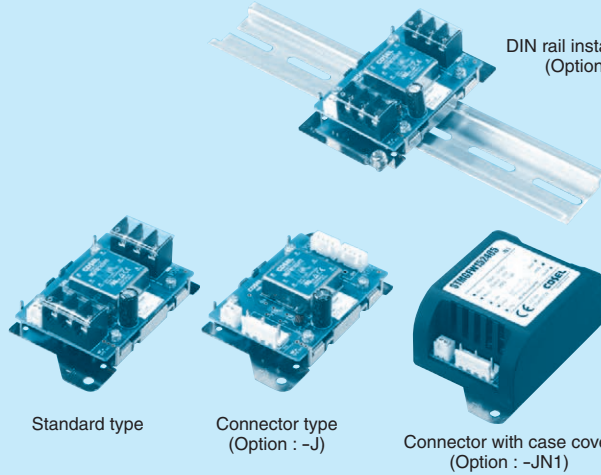
(Mfr.:J.S.T.)

- * Tolerance ±1
- * Dimensions in mm, []=inches
- * Weight : Standard & Connector type 140g max
Case cover & DIN rail installation type 160g max
- * PCB material / thickness : FR-4 / 1.6mm
- * Mounting plate : Iron (surface finishing : nickel plating) t=1.0 [0.04]
- * Case : PBT
- * Terminal block screw tightening torque M3 : 0.8N · m (8.5kgf · cm) max
- * CN4 has been installed jumper as factory setting (Except option R).
When remote ON/OFF is used, please remove the installed jumper.
- * Connector Type : Keep drawing current per pin below 5A for CN2.

STMGFW15

STMGF W 15 24 05 -□

① ② ③ ④ ⑤ ⑥


DIN rail installation type
(Option : -N2)

- ① Series name
- ② Dual output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage
- ⑥ Optional
 - G : Capacitor between Input and Output is removed.
 - R : with Remote ON/OFF (Positive logic control)
 - J : Input/Output Connector
 - JN1 : Connector with case cover
 - N2 : With DIN rail installation type
 - JN3 : Connector with cover(plastic) and DIN rail installation type

*When the option is set specifications may vary.

*Please remove short piece on CN4 to enable remote ON/OFF function.

MODEL	STMGFW152405	STMGFW152412	STMGFW152415	STMGFW154805	STMGFW154812	STMGFW154815
MAX OUTPUT WATTAGE[W]	15	15.6	15	15	15.6	15
DC OUTPUT	VOLTAGE[V] *1	±5 or +10	±12 or +24	±15 or +30	±5 or +10	±12 or +24
	CURRENT[A]	1.5	0.65	0.5	1.5	0.65

SPECIFICATIONS

	MODEL	STMGFW152405	STMGFW152412	STMGFW152415	STMGFW154805	STMGFW154812	STMGFW154815
INPUT	VOLTAGE[V]	DC9 - 36			DC18 - 76		
	CURRENT[A] *2	0.74typ	0.74typ	0.70typ	0.37typ	0.37typ	0.36typ
	EFFICIENCY[%] *2	84typ	88typ	89typ	84typ	87typ	88typ
OUTPUT	VOLTAGE[V]	±5(+10)	±12(+24)	±15(+30)	±5(+10)	±12(+24)	±15(+30)
	CURRENT[A]	1.5	0.65	0.5	1.5	0.65	0.5
	LINE REGULATION[mV]	40max	60max	75max	40max	60max	75max
	LOAD REGULATION[mV]	*3 500max *5	600max	750max	500max *5	600max	750max
		*4 250max	480max	600max	250max	480max	600max
	RIPPLE[mVp-p] *6	0 to +60℃ 100max	100max	100max	100max	100max	100max
		-20 to +60℃ 120max	120max	120max	120max	120max	120max
	RIPPLE NOISE[mVp-p] *6	0 to +60℃ 150max	150max	150max	150max	150max	150max
		-20 to +60℃ 200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	0 to +60℃ 50max	150max	180max	50max	150max	180max
PROTECTION CIRCUIT AND OTHERS		-20 to +60℃ 80max	240max	290max	80max	240max	290max
	DRIFT[mV] *7	50max	50max	60max	50max	50max	60max
	START-UP TIME[ms]	30max (Minimum input, Io=100%)					
	OUTPUT VOLTAGE SETTING[V] *8	4.93 - 5.24	11.76 - 12.50	14.60 - 15.51	4.93 - 5.24	11.76 - 12.50	14.60 - 15.51
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically					
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)					
	INPUT · RC-OUTPUT	DC1,500V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)					
	INPUT · RC-FG	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)					
	OUTPUT-FG	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)					
	OPERATING TEMP., HUMID. AND ALTITUDE	-20 to +70℃, 20 to 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max					
ENVIRONMENT	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75℃, 20 to 95%RH (Non condensing), 9,000m (30,000feet) max					
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis					
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis					
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1 Complies					
OTHERS	CASE SIZE/WEIGHT	52×27×93mm [2.05×1.06×3.66 inches] (W×H×D) / 110g max (When the option is set, refer to the page STMG-9)					
	COOLING METHOD	Convection/Forced air					

*1 Single output +10V, +24V, +30V with no use of COM.

*2 Rated input 12V, 24V or 48V DC Io=100%

*3 Symmetrical loading from 5% to 100%.

*4 Symmetrical loading from 20% to 100%.

*5 Refer to the instruction manual 6.

*6 Measured by 100MHz oscilloscope or Ripple-Noise meter (Equivalent to KIKUSUI-GIKEN : RM103).

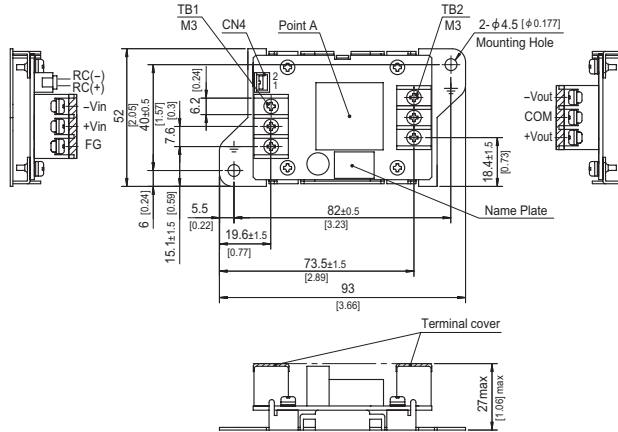
*7 Drift is the DC output accuracy for eight hours period after a half-hour warm-up at 25℃.

*8 Rated input voltage (DC24V, DC48V), rated output wattage, ambient temperature at 25℃. Parallel operation with other model is not possible.

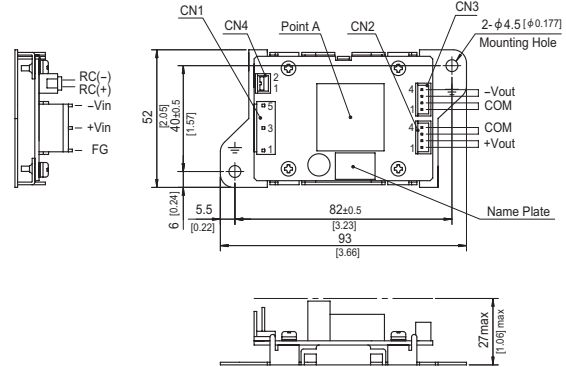
External view

Standard type

* External view of option G, R are the same as standard model.



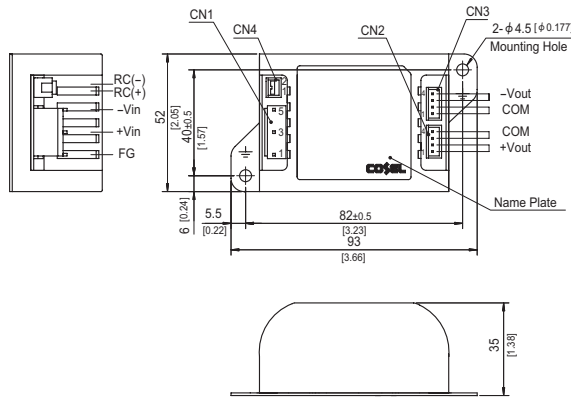
Connector type (-J)



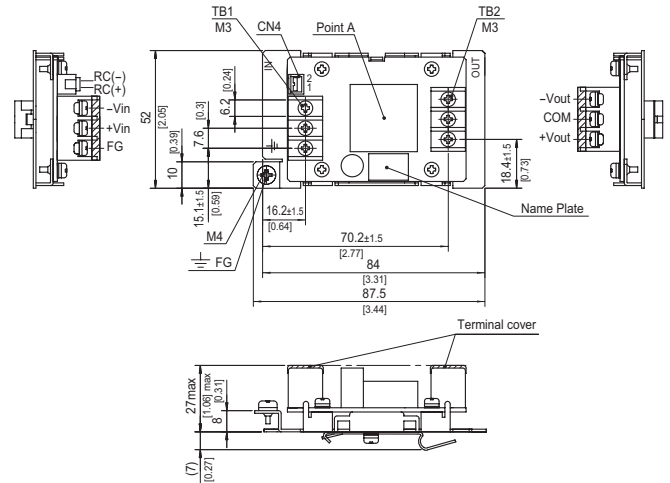
STMG

Case cover and connector type (-JN1)

* The specifications of terminal block and Case cover type can not be set.



DIN rail installation type (-N2)



	I/O Connector		Mating Connector	Terminal
Connector Type Input	CN1	B3P5-VH	VHR-5N	Chain : SVH-21T-P1.1 Loose : BVH-21T-P1.1
Connector Type Output	CN2, CN3	B4B-XH	XHP-4	Chain : SXH-001T-P0.6 Loose : BXH-001T-P0.6
Remote ON/OFF	CN4	B2B-XH	XHP-2	Chain : SXH-001T-P0.6 Loose : BXH-001T-P0.6

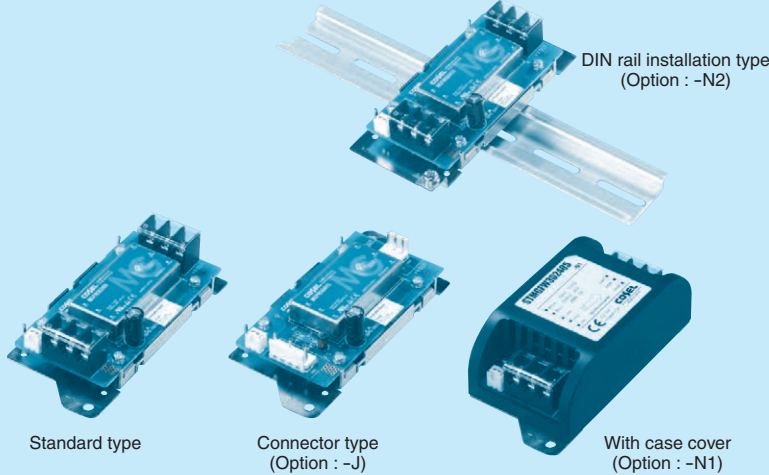
(Mfr.:J.S.T.)

- * Tolerance ± 1
- * Dimensions in mm, []=inches
- * Weight : Standard & Connector type 110g max
Case cover & DIN rail installation type 120g max
- * PCB material / thickness : FR-4 / 1.6mm
- * Mounting plate : Iron (surface finishing : nickel plating) $t=1.0$ [0.04]
- * Case : PBT
- * Terminal block screw tightning torque M3 : $0.8N \cdot m$ (8.5kgf \cdot cm) max
- * CN4 has been installed jumper as factory setting (Except option R).
When remoto ON/OFF is used , please remove the installed jumper.
- * Connector Type : Keep drawing current per pin below 2.5A for CN2,CN3.

STMGFW30

STMGF W 30 24 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Dual output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage
- ⑥ Optional
 - G: Capacitor between Input and Output is removed.
 - R: with Remote ON/OFF (Positive logic control)
 - J: Input/Output Connector
 - N1: With case cover
 - N2: With DIN rail installation type
 - N3: With cover(plastic) and DIN rail installation type

*When the option is set specifications may vary.

*Please remove short piece on CN4 to enable remote ON/OFF function.

MODEL	STMGFW302405	STMGFW302412	STMGFW302415	STMGFW304805	STMGFW304812	STMGFW304815
MAX OUTPUT WATTAGE[W]	20	30	30	20	30	30
DC OUTPUT	VOLTAGE[V] *1	±5 or +10	±12 or +24	±15 or +30	±5 or +10	±12 or +24
	CURRENT[A]	2	1.25	1	2	1.25

SPECIFICATIONS

	MODEL	STMGFW302405	STMGFW302412	STMGFW302415	STMGFW304805	STMGFW304812	STMGFW304815
INPUT	VOLTAGE[V]	DC9 - 36			DC18 - 76		
	CURRENT[A] *2	0.98typ	1.42typ	1.44typ	0.49typ	0.71typ	0.72typ
	EFFICIENCY[%] *2	85typ	88typ	87typ	85typ	88typ	87typ
OUTPUT	VOLTAGE[V]	±5(+10)	±12(+24)	±15(+30)	±5(+10)	±12(+24)	±15(+30)
	CURRENT[A]	2	1.25	1	2	1.25	1
	LINE REGULATION[mV]	40max	60max	75max	40max	60max	75max
	LOAD REGULATION[mV]	*3 500max *5	600max	750max	500max *5	600max	750max
		*4 250max	480max	600max	250max	480max	600max
	RIPPLE[mVp-p]	0 to +60℃ 100max	100max	100max	100max	100max	100max
		-20 to +60℃ 120max	120max	120max	120max	120max	120max
	RIPPLE NOISE[mVp-p]	0 to +60℃ 150max	150max	150max	150max	150max	150max
		-20 to +60℃ 200max	200max	200max	200max	200max	200max
	TEMPERATURE REGULATION[mV]	0 to +60℃ 50max	150max	180max	50max	150max	180max
		-20 to +60℃ 80max	240max	290max	80max	240max	290max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *7	50max	50max	60max	50max	50max	60max
	START-UP TIME[ms]	30max (Minimum input, Io=100%)					
	OUTPUT VOLTAGE SETTING[V] *8	4.93 - 5.24	11.76 - 12.50	14.60 - 15.51	4.93 - 5.24	11.76 - 12.50	14.60 - 15.51
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically					
ISOLATION	OVERVOLTAGE PROTECTION[V]	Works over 120 to 160% of rating (Total of +V and -V)					
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)					
	INPUT · RC-OUTPUT	DC1,500V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)					
ENVIRONMENT	INPUT · RC-FG	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)					
	OUTPUT-FG	DC1,000V 1minute, Cutoff current = 10mA, DC500V 1,000MΩ min (20±15℃)					
	OPERATING TEMP., HUMID. AND ALTITUDE	-20 to +70℃, 20 to 95%RH (Non condensing) (Required Derating), 3,000m (10,000feet) max					
SAFETY	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75℃, 20 to 95%RH (Non condensing), 9,000m (30,000feet) max					
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis					
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis					
OTHERS	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1 Complies					
	CASE SIZE/WEIGHT	52 X 27 X 117mm [2.05 X 1.06 X 4.61 inches] (W X H X D) / 140g max (When the option is set, refer to the page STMG-11)					
	COOLING METHOD	Convection/Forced air					

*1 Single output +10V, +24V, +30V with no use of COM.

*2 Rated input 12V, 24V or 48V DC Io=100%

*3 Symmetrical loading from 5% to 100%.

*4 Symmetrical loading from 20% to 100%.

*5 Refer to the instruction manual 6.

*6 Measured by 100MHz oscilloscope or Ripple-Noise meter (Equivalent to KIKUSUI-GIKEN : RM103).

*7 Drift is the DC output accuracy for eight hours period after a half-hour warm-up at 25℃.

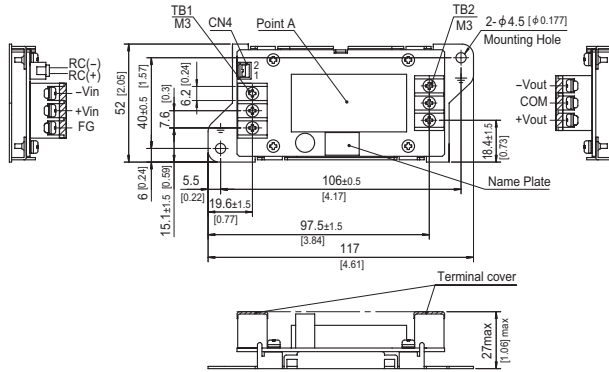
*8 Rated input voltage (DC24V, DC48V), rated output wattage, ambient temperature at 25℃.

* Parallel operation with other model is not possible.

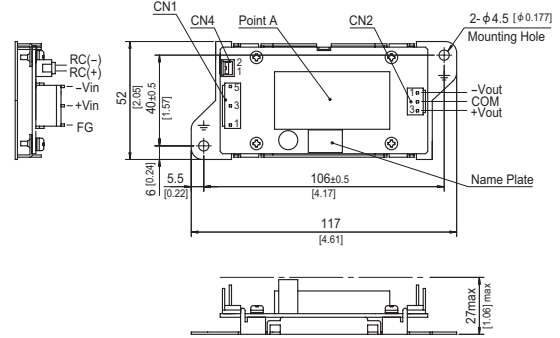
External view

Standard type

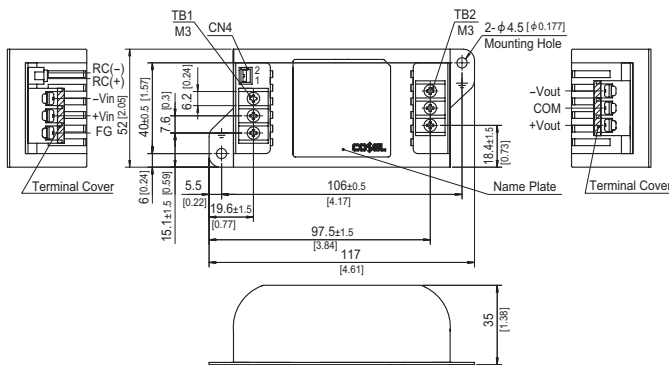
* External view of option G, R are the same as standard model.



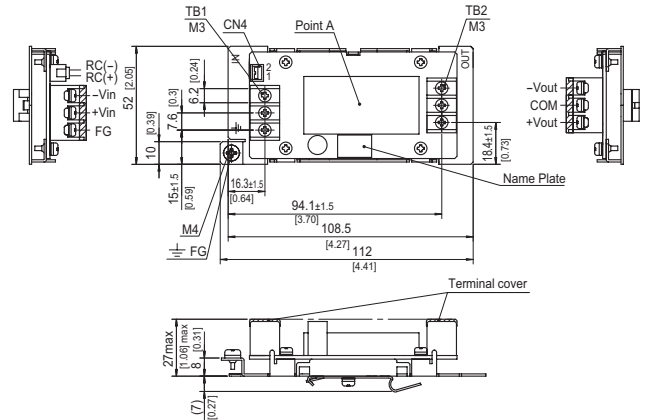
Connector type (-J)



Case cover type (-N1)



DIN rail installation type (-N2)



	I/O Connector		Mating Connector	Terminal
Connector Type Input	CN1	B3P5-VH	VHR-5N	Chain : SVH-21T-P1.1 Loose : BVH-21T-P1.1
Connector Type Output	CN2	B3P-VH	VHR-3N	Chain : SVH-21T-P1.1 Loose : BVH-21T-P1.1
Remote ON/OFF	CN4	B2B-XH	XHP-2	Chain : SXH-001T-P0.6 Loose : BXH-001T-P0.6

(Mfr.:J.S.T.)

- * Tolerance ± 1
- * Dimensions in mm, []=inches
- * Weight : Standard & Connector type 140g max
Case cover & DIN rail installation type 160g max
- * PCB material / thickness : FR-4 / 1.6mm
- * Mounting plate : Iron (surface finishing : nickel plating) $t=1.0$ [0.04]
- * Case : PBT
- * Terminal block screw tightning torque M3 : $0.8N \cdot m$ (8.5kgf \cdot cm) max
- * CN4 has been installed jumper as factory setting (Except option R).
When remote ON/OFF is used, please remove the installed jumper.
- * Connector Type : Keep drawing current per pin below 5A for CN2.

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz] (reference)	Input current [A]	Inrush current protection	PCB/Pattern *3			Series/Parallel operation	
					Material	Single sided	Double sided	Series operation	Parallel operation
STMGF15	Flyback converter	445-495	*1	-	glass fabric base,epoxy resin		○	Yes	*2
STMGF30	Forward converter	380-460	*1	-	glass fabric base,epoxy resin		○	Yes	*2

*1 Refer to Specification.

*2 Refer to the Instruction Manual.

*3 MG series with the power supply unit, please refer to the basic characteristics of the MG series data.

1 Function STMG-14

- 1.1 Input Voltage Range STMG-14
- 1.2 Overcurrent Protection STMG-14
- 1.3 Overvoltage Protection (STMGFS30/STMGFW30) STMG-14
- 1.4 Isolation STMG-14
- 1.5 Output Voltage Adjustment Range (STMGFS15/STMGFS30) STMG-14
- 1.6 Remote ON/OFF STMG-14
- 1.7 Output ripple and ripple noise STMG-14

2 Wiring Input terminal STMG-15

3 Input Voltage/Current Range STMG-15

4 Series/Parallel Operation STMG-15

- 4.1 Series Operation STMG-15
- 4.2 Parallel Operation STMG-15

5 Assembling and Installation STMG-16

- 5.1 Installation STMG-16
- 5.2 STMGFS15/STMGFW15 Derating Curve STMG-16
- 5.3 STMGFS30/STMGFW30 Derating Curve STMG-17
- 5.4 Warranty STMG-18

6 Note to use $\pm 5V$ output STMG-18

7 Options STMG-18

- 7.1 Outline of Options STMG-18

STMG

1 Functions

1.1 Input Voltage Range

■ If output voltage value doesn't fall within specifications, a unit may not operate in accordance with specifications and/or fail.

1.2 Overcurrent Protection

■ Overcurrent Operation

An overcurrent protection circuit is built-in and activated at 105% of the rated current or above. It prevents the unit from short circuit and overcurrent for less than 20 seconds. The output voltage of the power supply will recover automatically if the fault causing over current is corrected.

When the output voltage drops after OCP works, the power supply enters a "hiccup mode" where it repeatedly turns on and off at a certain frequency.

STMG

1.3 Overvoltage Protection (STMGFS30/ STMGFW30)

■ Over Voltage Protection (OVP) is built in. When OVP works, output voltage can be recovered by shutting down DC input for at least one second or by turning off the remote control switch for one second without shutting down the DC input. The recovery time varies according to input voltage and input capacitance.

Remarks :

Note that devices inside the power supply may fail when a voltage greater than the rated output voltage is applied from an external power supply to the output terminal of the power supply. This could happen in in-coming inspections that include OVP function test or when voltage is applied from the load circuit.

1.4 Isolation

■ When you run a Hi-Pot test as receiving inspection, gradually increase the voltage to start. When you shut down, decrease the voltage gradually by using a dial. Please avoid a Hi-Pot tester with a timer because, when the timer is turned ON or OFF, it may generate a voltage a few times higher than the applied voltage.

1.5 Output Voltage Adjustment (STMGFS15/ STMGFS30)

■ To increase an output voltage, turn a built-in potentiometer clockwise. To decrease the output voltage, turn it counterclockwise.

■ We are offering an Option -V, which doesn't have a built-in potentiometer but instead enables you to adjust the output voltage by using an external potentiometer (please see 7 Options).

1.6 Remote ON/OFF

■ The remote ON/OFF function is incorporated in the input circuit and operated with RC(+) and RC(-). If positive logic control is required, order the power supply with "-R" option.

Table 1.1 Remote ON/OFF Specifications

	ON/OFF logic	Between RC(+) and RC(-)	Output voltage
Standard	Negative	L level (0 - 1.2V) or short	ON
		H level (3 - 12V) or open	OFF
Optional -R	Positive	L level (0 - 1.2V) or short	OFF
		H level (3 - 12V) or open	ON

■ When RC is at low level, a current of 1mA typ will flow out.

RC(-) terminal is connected to the -VIN internally.

■ A short piece for remote ON/OFF function is installed on CN4 when power supply is shipped from factory.

Please remove the short piece on CN4 to enable remote ON/OFF function (Option -R does not come with the short piece).

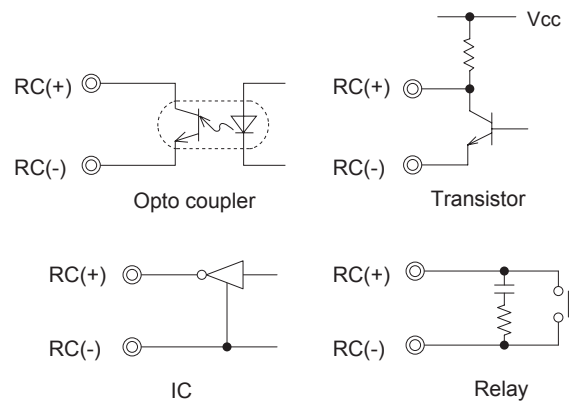


Fig1.1 Rc Connection Example

1.7 Output ripple and ripple noise

■ The specified ripple and ripple noise are measured by the method introduced in Fig 1.2.

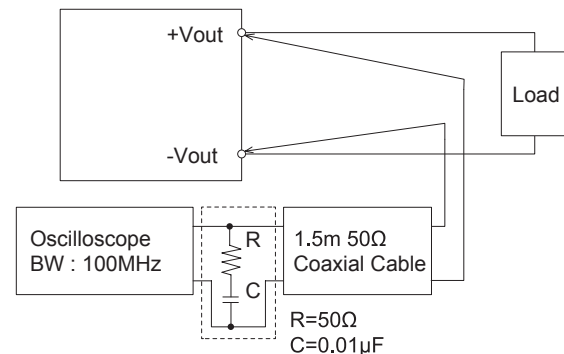


Fig1.2 Method of Measuring Output Ripple and Ripple Noise

2 Wiring Input terminal

- If the power supply is to be turned ON/OFF directly with a switch, inductance from the input line will induce a surge voltage several times that of the input voltage and it may damage the power supply. Make sure that the surge is absorbed, for example, by connecting an electrolytic capacitor between the input terminals.
- If an external filter containing L (inductance) is added to the input line or a wire from the input source to the STMG series is long, not only the reflected input noise becomes large, but also the output of the converter may become unstable. In such case, connecting C_i to the input terminal is recommended.
- If you use an aluminum electrolytic capacitor, please pay attention to the ripple current rating.

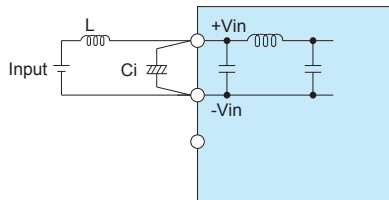


Fig.2.1 Connecting an External Capacitor to the Input Side

- If a reverse polarity voltage is applied to the input pin, the power supply will fail. If there is a possibility that a reverse polarity voltage is applied, connect a protection circuit externally as described below.

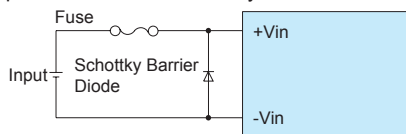


Fig.2.2 Connecting a Reverse Voltage Protection Circuit

3 Input Voltage/Current Range

- If you use a non-regulated power source for input, please check and make sure that its voltage fluctuation range and ripple voltage do not exceed the input voltage range shown in specifications.
- Please select an input power source with enough capacity, taking into consideration of the start-up current (I_p), which flows when a DC-DC converter starts up.

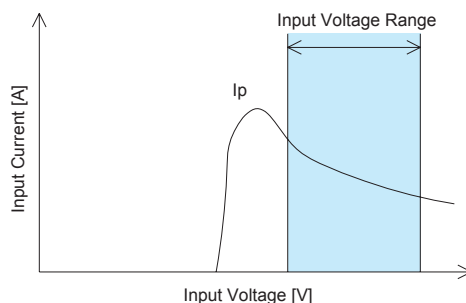


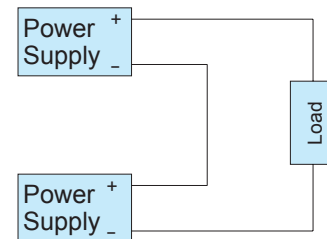
Fig.3.1 Input Current Characteristics

4 Series/Parallel Operation

4.1 Series Operation

- You can use the power supplies in series operation by wiring as shown below. In the case of (a) below, the output current should be lower than the rated current for each power supply with the lowest rated current among power supplies that are serially connected. Please make sure that no current exceeding the rated current flows into a power supply.

(a)



(b)

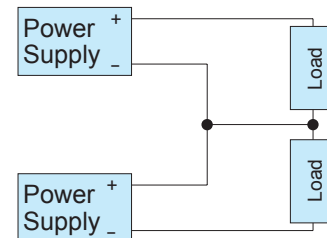


Fig.4.1 Series Operation

4.2 Parallel Operation

- Parallel operation is not possible.
- You can use the power supplies in redundancy operation by wiring as shown below.

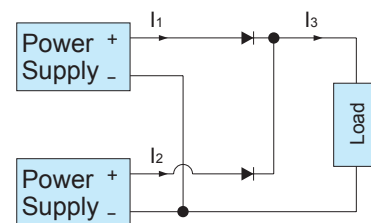


Fig.4.2 Redundancy Operation

- Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 . Please make sure that the value of I_3 does not exceed the rated current for each power supply.

$$I_3 \leq \text{Rated Current Value}$$

5 Assembling and Installation

5.1 Installation

■ Derating curve varies depending on the mounting direction.
Refer to 5.2 (STMGFS15/STMGFW15), Refer to 5.3 (STMGFS15/STMGFW30).

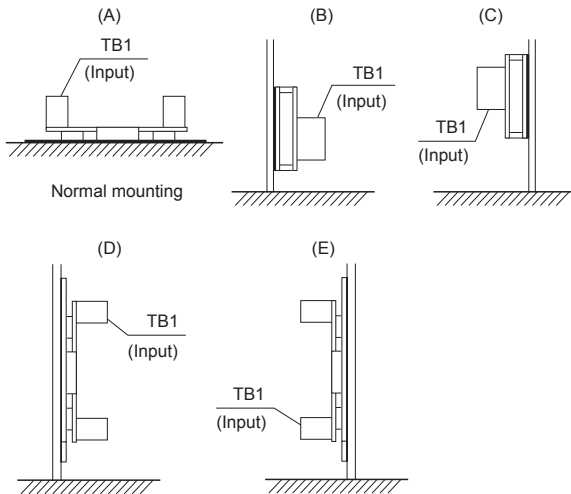


Fig.5.1 Mounting direction

■ Please note that a power supply and chassis will become hot depending on mounting direction or operating condition.
■ In case of metal chassis, keep the distance between d1 for to insulate between lead of component and metal chassis. If it is less than d1, insert the insulation sheet between power supply and metal chassis.

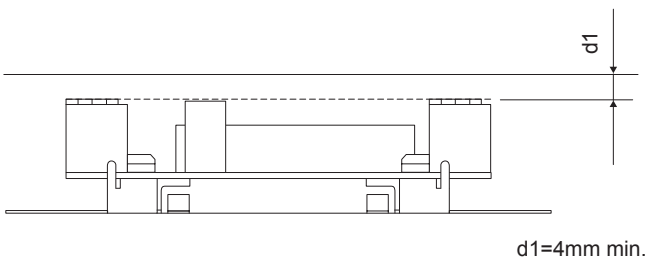


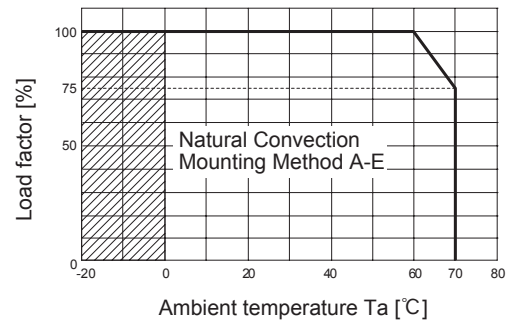
Fig.5.2 Mounting Method

5.2 STMGFS15/STMGFW15 Derating Curve

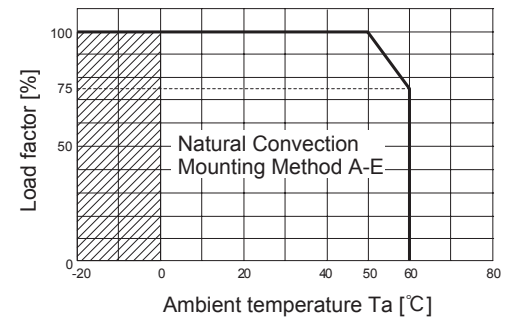
(1) In the case of Convection Cooling

■ If you derate the output current, you can use the unit in the temperature range from -20°C to the maximum temperature shown below.

* Specifications for ripple and ripple noise changes in the shaded area.



(1) Standard type (No Case cover type)



(2) Case cover type

Fig.5.3 STMGFS15/STMGFW15 Derating Curve for Convection Cooling

(2) In the case of Forced Air Cooling

■ In case of forced air cooling, please have sufficient ventilation to keep the temperature of point A in Fig.5.4 at 105°C or below.

Please also make sure that the ambient temperature does not exceed the range shown in Figure 5.5.

* Specifications for ripple and ripple noise changes in the shaded area.

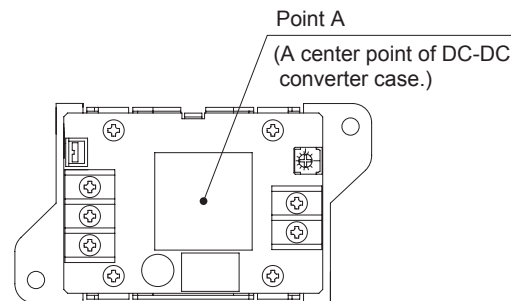
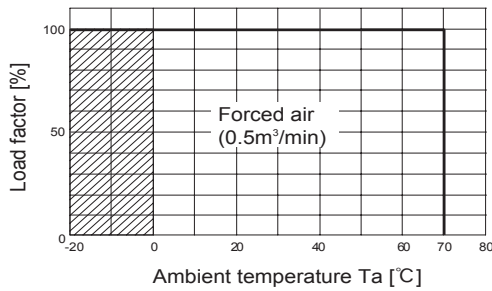
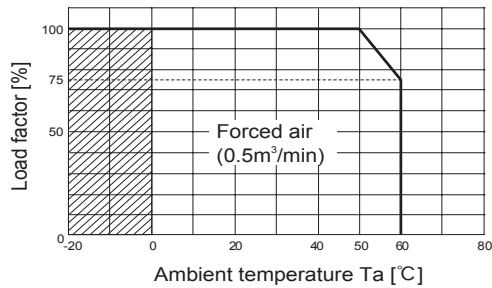


Fig.5.4 STMGFS15/STMGFW15 Temperature Measuring Point



(1) Standard type (No Case cover type)



(2) Case cover type

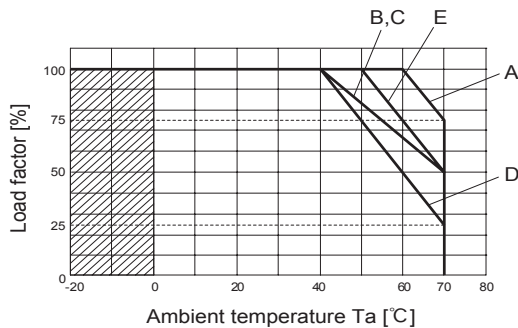
Fig.5.5 STMGFS15/STMGEW15 Derating Curve for Forced Air Cooling

5.3 STMGFS30/STMGEW30 Derating Curve

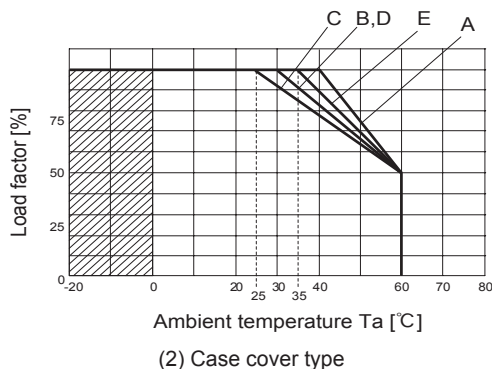
(1) In the case of Convection Cooling

■ If you derate the output current, you can use the unit in the temperature range from -20°C to the maximum temperature shown below.

* Specifications for ripple and ripple noise change in the shaded area.



(1) Standard type (No Case cover type)



(2) Case cover type

Fig.5.6 STMGFS30/STMGEW30 Derating Curve for Convection Cooling

(2) In the case of Forced Air Cooling

■ In case of forced air cooling, please have sufficient ventilation to keep the temperature of point A in Fig.5.7 at 110°C or below.

Please also make sure that the ambient temperature does not exceed the range shown in Figure 5.8.

* Specifications for ripple and ripple noise change in the shaded area.

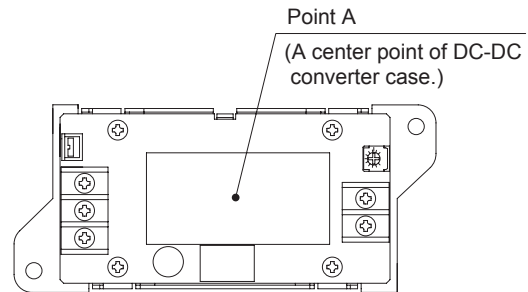
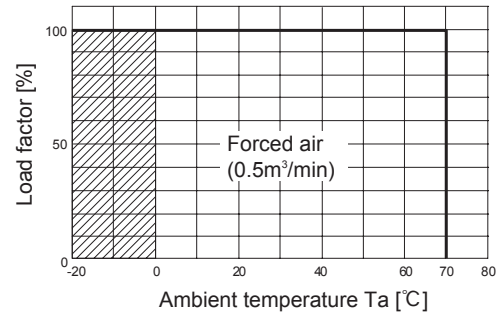
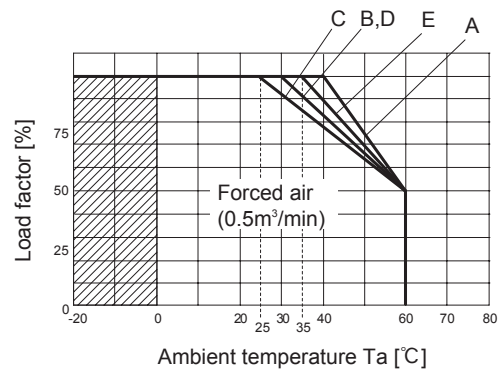


Fig.5.7 STMGFS30/STMGEW30 Temperature Measuring Point



(1) Standard type (No Case cover type)



(2) Case cover type

Fig.5.8 STMGFS30/STMGEW30 Derating Curve for Forced Air Cooling

5.4 Warranty

Table 5.1 Warranty STMGFS15/STMGFW15 Standard type
(No Case cover type)

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			$I_o \leq 75\%$	$75\% < I_o \leq 100\%$
A - E	Convection	Ta = 50°C or less	5years	5years
		Ta = 60°C	5years	3years
A - E	Forced air	Ta = 60°C or less	5years	5years
		Ta = 70°C	3years	3years

Table 5.2 Warranty STMGFS15/STMGFW15 Case cover type

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			$I_o \leq 75\%$	$75\% < I_o \leq 100\%$
A - E	Convection	Ta = 40°C or less	5years	5years
	Forced air	Ta = 50°C	5years	3years

Table 5.3 Warranty STMGFS30/STMGFW30 Standard type
(No Case cover type)

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			$I_o \leq 75\%$	$75\% < I_o \leq 100\%$
A	Convection	Ta = 50°C or less	5years	5years
		Ta = 60°C	3years	3years
B, C, D	Convection	Ta = 30°C or less	5years	5years
		Ta = 40°C	5years	3years
E	Convection	Ta = 40°C or less	5years	5years
		Ta = 50°C	5years	3years
A - E	Forced air	Ta = 60°C or less	5years	5years
		Ta = 70°C	3years	3years

Table 5.4 Warranty STMGFS30/STMGFW30 Case cover type

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			$I_o \leq 75\%$	$75\% < I_o \leq 100\%$
A	Convection	Ta = 30°C or less	5years	5years
	Forced air	Ta = 40°C	5years	3years
B, D	Convection	Ta = 20°C or less	5years	5years
	Forced air	Ta = 30°C	5years	3years
C	Convection	Ta = 15°C or less	5years	5years
	Forced air	Ta = 25°C	5years	3years
E	Convection	Ta = 25°C or less	5years	5years
	Forced air	Ta = 35°C	5years	3years

6 Note to use $\pm 5V$ output

■ If an output current is 0% to 5% of the rated current, the output is influenced by the other output load condition.
20% output voltage fluctuation may occur.
To avoid the fluctuation, external bleeding resistor is required to draw sufficient current.

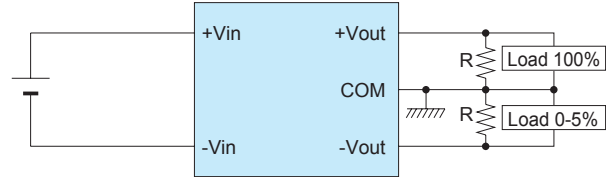


Fig.6.1 Example of decreasing the fluctuation of output voltage.

7 Options

7.1 Outline of Options

* Please inquire us for details of specifications and delivery timing.
* You can combine multiple options. Some options, however, cannot be combined with other options. Please contact us for details.

● -G

■ Option -G units, removed the capacitor located in between input and output.

● -R

■ Option -R units, a reversed logic (positive logic) for remote ON/OFF function (Refer to 1.6).

● -J

■ Option -J units, the INPUT AND OUTPUT terminal block are changed to connector.

■ Please do not apply more than 2.5A per 1 pin (STMGFS15/STMGFW15).

Please do not apply more than 5A per 1 pin (STMGFS30/STMGFW30).

■ Ripple, ripple noise, the capacitor located within 150mm from output terminal

It is the value measured by the measuring plate provided 22μF.

● -N1

- Option -N1 units come with a cover (plastic).
- Only connector type is available in STMGFS15/STMGFW15 (Option -J).

● -N2

- Option -N2 units come with a dedicated DIN rail attachment.

● -N3

- Option -N3 units come with a cover (plastic) and DIN rail attachment.
- Only connector type is available in STMGFS15/STMGFW15 (Option -J).

● -V (STMGFS15/STMGFS30)

- Option -V units have connector (CN5) for external potentiometer instead of a built-in potentiometer.
 - The output voltage is adjustable through an external potentiometer VR. Adjust only within the range of $\pm 10\%$ of the rated voltage.
 - To increase the output voltage, turn the potentiometer clockwise and connect in such a way that the resistance value between 2 and 3 becomes small.
- To decrease the output voltage, turn the potentiometer counter-clockwise.

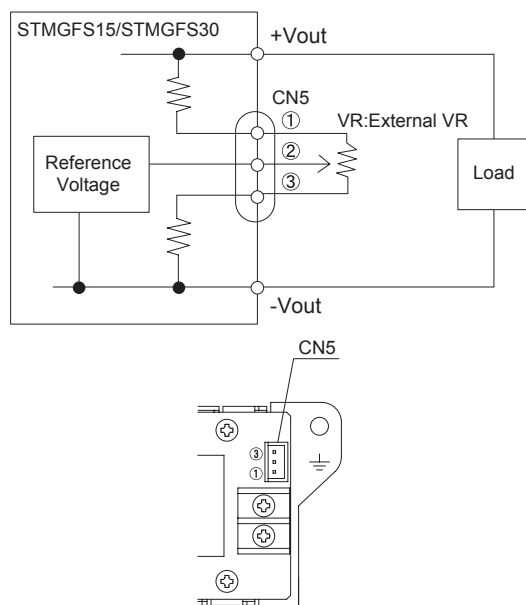


Fig.7.1 Connecting External Potentiometer

Table 7.1 List of External Potentiometer

Output Voltage	External VR
3.3V, 5V	1 [k Ω]
12V, 15V	5 [k Ω]



Low Profile

Safety
Approvals

OCP

Remote
ON/OFF

BRNS-series



BRNS

Feature

- Small size and high efficiency non-isolated DC-DC converter.
- Wide input voltage 3.0V to 14.4V.
- Adjustment of the gain control depending on external capacitor is unnecessary.
- Built-in remote ON/OFF, Power good, Frequency synchronization.
- Built-in overcurrent and thermal protection (auto recovery type) functions.

CE marking

Safety agency approvals

UL60950-1, C-UL, EN60950-1

5-year warranty



- ① Series name
- ② Single output
- ③ Output current
6: 6A
12: 12A
20: 20A
- ④ Optional
R: Positive logic remote on/off
I: No clock output for frequency synchronization
Y1: Suitable control for external capacitor over 470 μ F

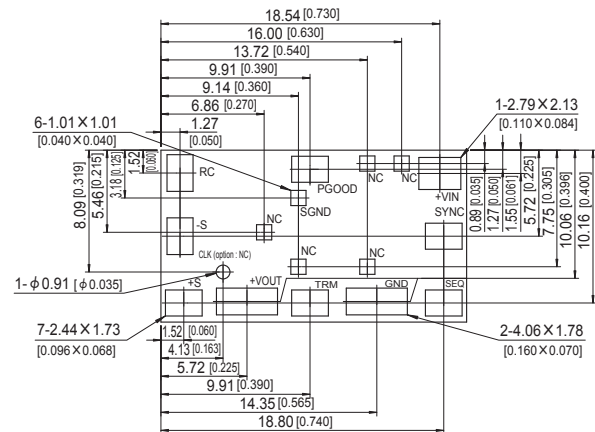
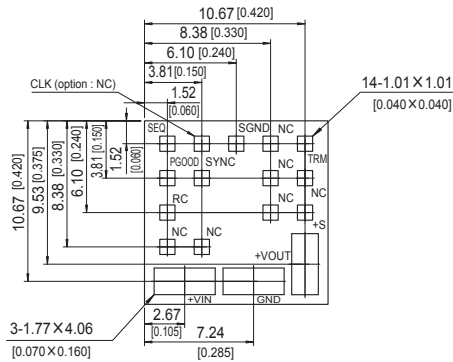
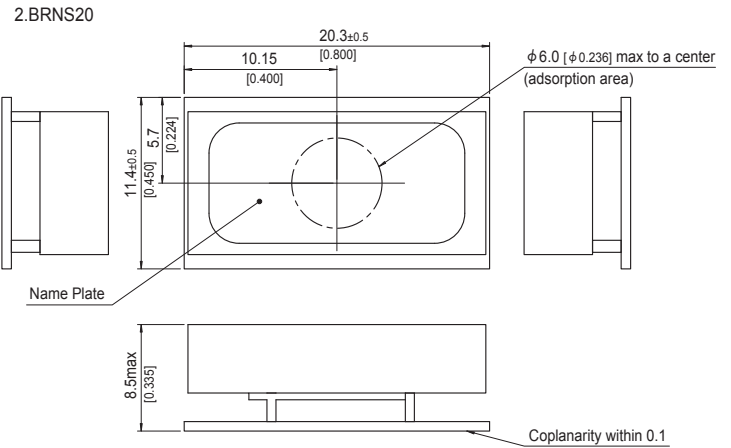
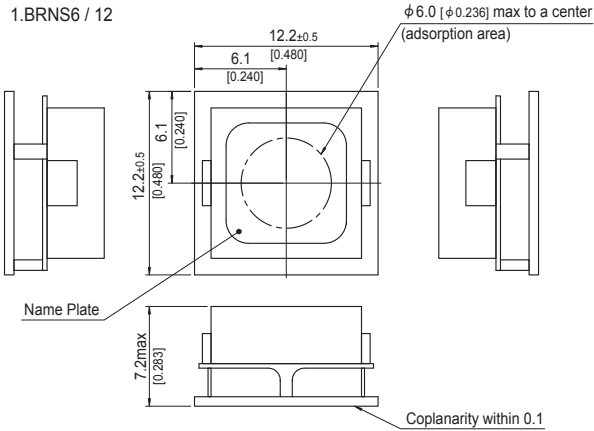
MODEL	BRNS6	BRNS12	BRNS20
MAX OUTPUT CURRENT[A]	6.0	12.0	20.0
DC OUTPUT	0.6 - 5.5		

SPECIFICATIONS

	MODEL	BRNS6	BRNS12	BRNS20
INPUT	VOLTAGE[V]	DC3.0 - 14.4		
	CURRENT[A]	*1 0.70 typ	1.40 typ	2.30 typ
	EFFICIENCY[%]	*1 86 typ	86 typ	87 typ
OUTPUT	VOLTAGE[V]	*2 0.6 - 5.5	0.6 - 5.5	0.6 - 5.5
	CURRENT[A]	6	12	20
	LINE REGULATION1[mV] Vo \leq 1.8V	10		
	LINE REGULATION2[%Vo] Vo > 1.8V	0.5		
	LOAD REGULATION1[mV] Vo \leq 1.8V	10		
	LOAD REGULATION2[%Vo] Vo > 1.8V	0.5		
	OUTPUT VOLTAGE SETTING [%Vo]	\pm 1.0		
	RIPPLE[mVp-p]	*3 25		
	RIPPLE NOISE[mVp-p]	*3 50		
	DRIFT[%Vo]	*4 \pm 0.5		
	START-UP TIME[ms]	4.5 typ		
	OUTPUT VOLTAGE ADJUSTMENT RANGE [V]	Adjustable by external resistor 0.6 - 5.5		
	OUTPUT VOLTAGE REGULATION [%Vo]*5	\pm 3.0		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating (auto recovery type)		
	REMOTE SENSING	Available (+S only)		Available
	REMOTE ON/OFF	Available Negative logic L:ON, H:OFF		
ISOLATION	INPUT-OUTPUT	non-isolated		
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20-95%RH (Non condensing) (Refer to DERATING CURVE) 3,000m (10,000feet) max		
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20-95%RH (Non condensing), 9,000m (30,000feet) max		
	VIBRATION	10-55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis		
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL(CSA60950-1), EN60950		
OTHERS	CASE SIZE/WEIGHT	12.2 \times 7.2 \times 12.2mm [0.48 \times 0.28 \times 0.48 inches] (W \times H \times D) / 4g max		20.3 \times 8.5 \times 11.4mm [0.80 \times 0.35 \times 0.45 inches] (W \times H \times D) / 6g max
	COOLING METHOD	Convection / Forced air		

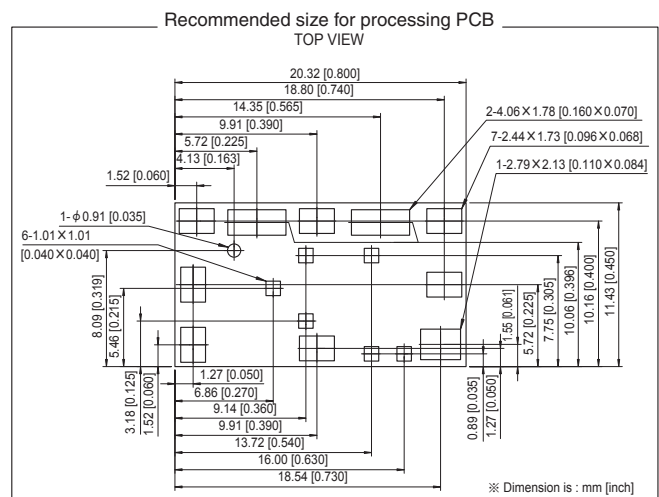
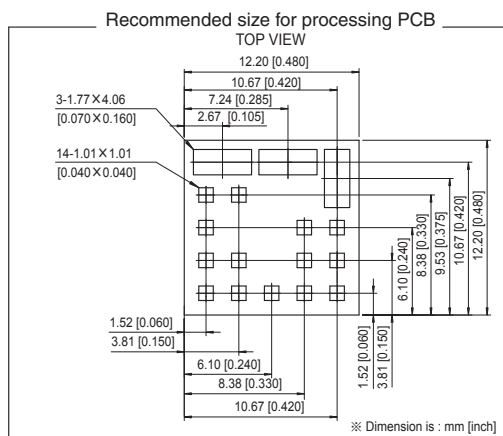
- *1 At rated input (DC12V) and rated output (1.2V) Ta=25°C.
- *2 Output voltage is adjusted to the minimum when TRM is opened.
- *3 Ripple and ripple noise is measured by using measuring board with ceramic capacitor at 25mm from output pin.
At rated input (DC12V) and rated output (1.2V).
- *4 Drift is the change in DC output for an eight hour period after a half - hour warm - up at 25°C, with the input voltage held.
- *5 Output voltage setting is added line regulation and load regulation and temperature regulation used resistance of the 0.5% tolerance.

External view



- ※ Tolerance : ± 0.3
- ※ Dimensions in mm, []=inches
- ※ Weight : 4.0g max
- ※ Terminal material : PCB pattern
- ※ Plating treatment of terminal
: Gold flashing

- ※ Tolerance : ± 0.3
- ※ Dimensions in mm, []=inches
- ※ Weight : 6.0g max
- ※ Terminal material : PCB pattern
- ※ Plating treatment of terminal
: Gold flashing



Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz] (reference)	Input current [A]	Inrush current protection	PCB/Pattern			Series/Parallel operation	
					Material	Single sided	Double sided	Series operation	Parallel operation
BRNS6	Buck Converter	600	*1	-	glass fabric base,epoxy resin	-	Multilayer	-	-
BRNS12	Buck Converter	600	*1	-	glass fabric base,epoxy resin	-	Multilayer	-	-
BRNS20	Buck Converter	600	*1	-	glass fabric base,epoxy resin	-	Multilayer	-	-

*1 Refer to Specification.

1 Pin Connection BRNS-6**2** Connection for Standard Use BRNS-6**3** Wiring Input / Output Pin BRNS-6

3.1 Wiring input pin BRNS-6

3.2 Wiring output pin BRNS-7

4 Function BRNS-8

4.1 Overcurrent protection BRNS-8

4.2 Remote ON/OFF BRNS-8

4.3 Remote sensing BRNS-8

4.4 Adjustable voltage range BRNS-8

4.5 Softstart/Start-up sequence BRNS-9

4.6 Power good BRNS-10

4.7 Sequence BRNS-10

4.8 Frequency synchronization BRNS-10

5 Series and Parallel Operation BRNS-11

5.1 Series operation BRNS-11

5.2 Parallel operation BRNS-11

6 Implementation · Mounting Method BRNS-11

6.1 Mounting Method BRNS-11

6.2 Automatic Mounting BRNS-11

6.3 Soldering BRNS-11

6.4 Cleaning BRNS-11

6.5 Storage method BRNS-11

7 Safety Considerations BRNS-12**8** Derating BRNS-12

8.1 BRNS series Derating BRNS-12

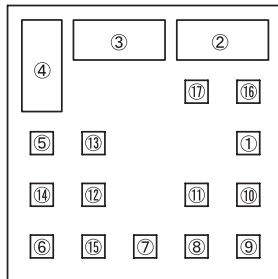
9 Package information BRNS-13

1 Pin Connection

Table 1.1 Pin connection and function

Pin No.		Pin Connection	Function
BRNS 6/12	BRNS 20		
①		RC	Remote ON/OFF
②		+VIN	+DC input
③	④	GND	GND(-DC input, -DC output)
④	⑥	+VOUT	+DC output
⑤	⑦	+S	+Remote sensing
⑥	⑤	TRM	Adjustment of output voltage
⑦	⑭	SGND	Signal GND
⑧	⑰	CLK(NC)	Clock output
⑨	③	SEQ	Control of Start up time and turn
⑩	⑨	PGOOD	Power good
⑪	⑩	SYNC	Input for frequency synchronization
⑫	⑧	-S	NC : BRNS6/12 -Remote sensing : BRNS20
⑬	⑪	NC	NC
⑭	⑬	NC	NC
⑮	⑫	NC	NC
⑯	⑯	NC	NC
⑰	⑮	NC	NC

■BRNS6/12



■BRNS20

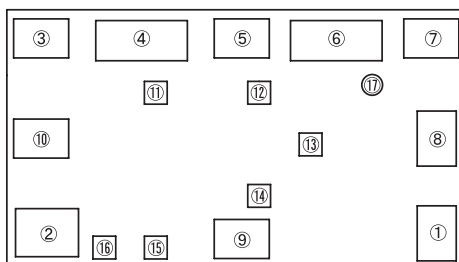


Fig.1.1 Pin Connection (Bottom View)

2 Connection for Standard Use

■In order to use power supply, it is necessary to wire as shown in Fig 2.1.

[Reference 3 "Wiring Input/Output Pin"
8 "Derating"]

■Short the following pins to turn on the power supply.

[Reference 4.3 "Remote Sensing"]

■Connect resistance to set the output voltage between TRM and GND

[Reference 4.4 "Adjustment output voltage"]

■Between input and output is not isolated.

■The BRNS series handle only the DC input.

Avoid applying AC input directly.

It will damaged the power supply.

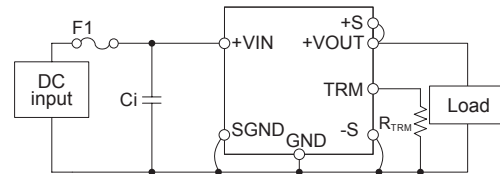


Fig.2.1 Connection for standard use

Table 2.1 External parts

No.	parts	Reference
1	F1:Fuse	3.1 (1)External fuse
2	Ci:External output capacitor	3.1 (2)External input capacitor
3	RTRM:Resistance for adjustment output voltage	4.4 Adjustable voltage range

3 Wiring Input / Output Pin

3.1 Wiring input pin

(1) External fuse

■Fuse is not built-in on input side. in order to protect the unit, install the normal-blow type fuse on input side.

■When the input voltage from a front end unit is supplied to multiple units, install the normal-blow type fuse in each unit.

■When the fuse is open, power good signal is not outputted.

Table 3.1 Recommended fuse

Model	BRNS6	BRNS12	BRNS20
Rated current	15A	20A	40A

(2) External capacitor on the input side

■ Install an external capacitor C_{in} , between +VIN and GND input pins for low line-noise and for stable operation of the power supply.

Table 3.2 Recommended external input capacitor(Ceramic)

Model	BRNS6	BRNS12	BRNS20
C_{in}	$22\mu F \times 2$	$22\mu F \times 2$	$22\mu F \times 3$

■ C_{in} is within 5mm for pins. Make sure that ripple current of C_{in} is less than its rating.

■ When an impedance and inductance level of the input line become higher, the input voltage may become unstable.

In that case, the input voltage becomes stable by increasing C_{in} .

(3) Recommendation for noise-filter

■ Install an external input filter as shown in Fig.3.1 in order to reduce conducted noise. C_{in} is shown in Table 3.2

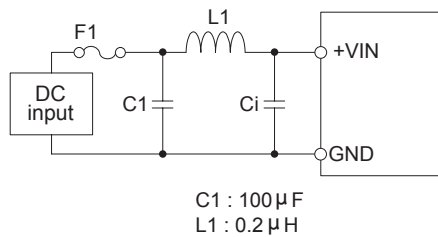


Fig.3.1 Example of Recommended external input filter

(4) Reverse input voltage protection

■ Avoid the reverse polarity input voltage. It will damage the power supply.

It is possible to protect the unit from the reverse input voltage by installing an external diode as shown in Fig 3.2

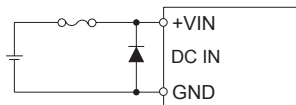


Fig.3.2 Reverse input voltage protection

3.2 Wiring output pin

■ When the BRNS series supplies the pulse current for the pulse load, please install a capacitor C_o between +VOUT and GND pins.

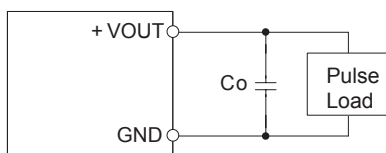


Fig.3.3 wiring external output capacitor

Table 3.3 Recommended capacitor and max C_o

No.	Model	Recommended	Max C_o
1	BRNS6	$47\mu F \times 1 + 100\mu F \times 1$	$1,000\mu F$
2	BRNS12	$47\mu F \times 1 + 100\mu F \times 1$	$1,000\mu F$
3	BRNS20	$100\mu F \times 2$	$1,000\mu F$

■ The output ripple voltage may grow big by resonance with C_o and ESL of the wiring. If resonance frequency and switching frequency are close.

■ Ripple and Ripple Noise are measured, as shown in the Fig.3.4. C_{in} is shown in Table3.2, C_{o1} and C_{o2} is shown in Table 3.4.

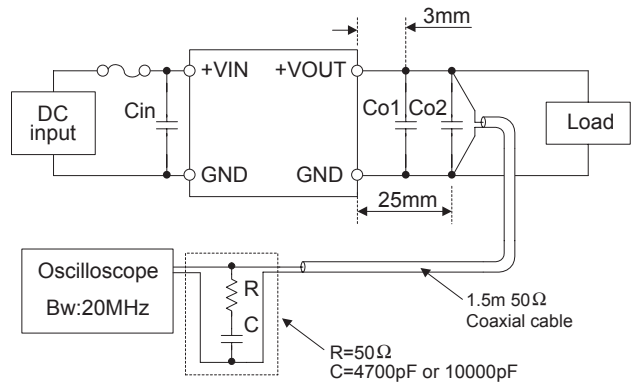


Fig.3.4 Measuring method of Ripple and Ripple Noise

Table 3.4 C_{o1} and C_{o2} which is used in measuring

No.	Model	V_o	C_{o1}	C_{o2}
1	BRNS6	0.6-3.3V	$47\mu F \times 1$	$100\mu F \times 1$
2		3.3-5.5V	$22\mu F \times 1$	$22\mu F \times 1$
3	BRNS12	0.6-3.3V	$47\mu F \times 1$	$100\mu F \times 1$
4		3.3-5.5V	$22\mu F \times 1$	$22\mu F \times 2$
5	BRNS20	0.6-3.3V	$100\mu F \times 1$	$100\mu F \times 1$
6		3.3-5.5V	$22\mu F \times 2$	$22\mu F \times 2$

4 Function

4.1 Overcurrent protection

■Over Current Protection (OCP) is built-in and works at 105% of the rated current or higher. However, use in an overcurrent situation must be avoided whenever possible.

The output voltage of the power module will recover automatically when the fault causing overcurrent is corrected.

When the output voltage drops after OCP works, the power module enters a "hiccup mode" where it repeatedly turns on and off at a certain frequency.

4.2 Remote ON/OFF

■The remote ON/OFF function is incorporated in the circuit and operated with RC and -Vin. If positive logic control is required, order the power supply with "-R" option.

Table 4.1 Specification of Remote ON/OFF

	ON/OFF logic	Between RC and GND	Output voltage
Standard	Negative	L level (-0.2-0.8V) or short or open	ON
		H level (3.0-VIN)	OFF
Optional -R	Positive	L level (-0.2-0.3V) or short	OFF
		H level (3.0-VIN) or open	ON

■When remote on/off function is not used, please open RC or connected to the GND terminal.

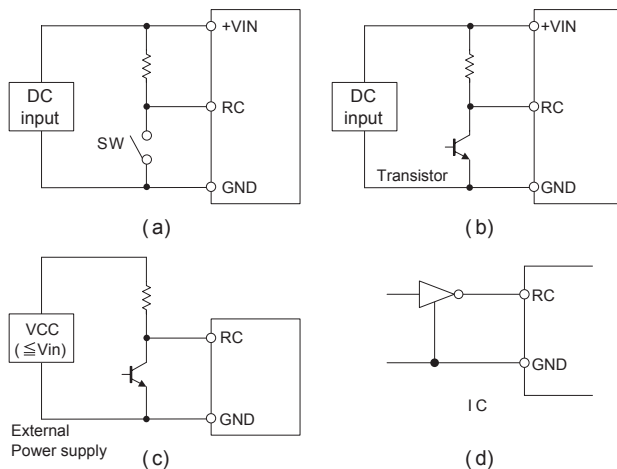


Fig.4.1 RC connection example

4.3 Remote sensing

(1) When the remote sensing function is not in use

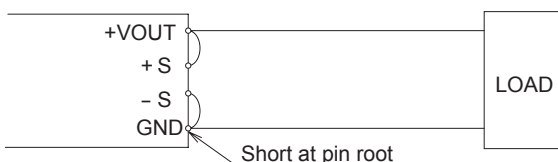


Fig.4.2 Connection when the remote sensing is in use

■When the remote sensing function is not in use, it is necessary to confirm that pins are shorted between +S & +VOUT and between -S & GND.

■Wire between +S & +VOUT and between -S & GND as short as possible.

Loop wiring should be avoided.

This power supply might become unstable by the noise coming from poor wiring.

(2) When the remote sensing function is in use

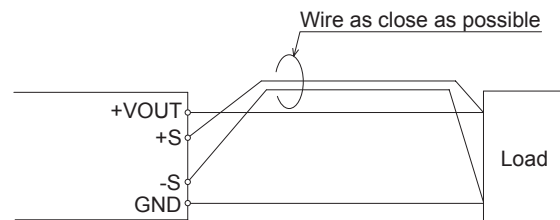


Fig.4.3 Connection when the remote sensing is in use

■Twisted-pair wire or shield wire should be used for sensing wire.

■Thick wire should be used for wiring between the power supply and a load.

Line drop should be less than 0.5V.

Voltage between +VOUT and GND should remain within the output voltage adjustment range.

■If the sensing patterns are short, heavy-current is drawn and the pattern may be damaged.

The pattern disconnection can be prevented by installing the protection parts as close as possible to a load.

4.4 Adjustable voltage range

■Output voltage is adjustable by the external resistor.

■The temperature coefficient could become worse, depending on the type of a resistor.

Resistor · · · Metal film type, coefficient of less than ±100ppm/°C

■When TRM is opened, output voltage is 0.6V.

■R_{TRM} is calculated in the following expressions.

$$R_{TRM} = \frac{12}{V_{out} - 0.6} [k\Omega]$$

Table.4.2 Calculation result of R_{TRM}

No.	+VOUT	R _{TRM}
1	0.6	OPEN
2	1.2	20.00kΩ
3	1.8	10.00kΩ
4	2.5	6.32kΩ
5	3.3	4.44kΩ
6	5.0	2.73kΩ

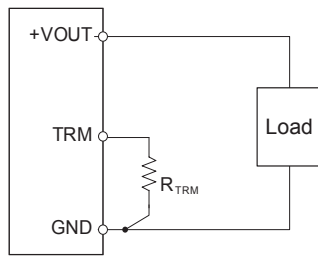


Fig.4.4 Connecting R_{TRM}

- Please use the output voltage in the operating area of Fig.4.5. Transient response may worsen when used in vicinity of the border of the operating area.
- Only for output voltage is rising and output current is small, there is a possibility that the ripple voltage is high value. If the ripple voltage value is problem, connecting a capacitor of table 3.4 value.

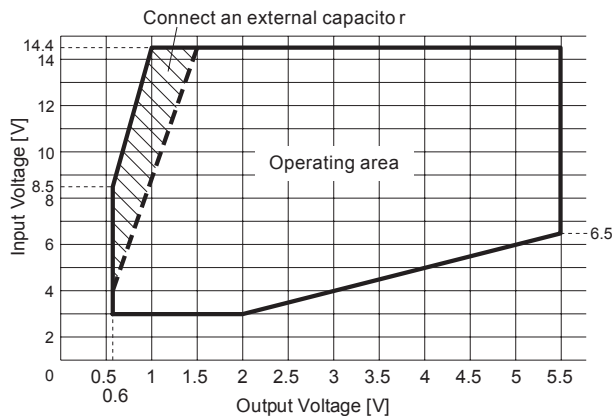


Fig.4.5 Operating area of BRNS series

- When start of DC INPUT is slow, BRNS may start on the outside of the operating area. By the circuit of the Fig.4.6, you can raise the start-up voltage.

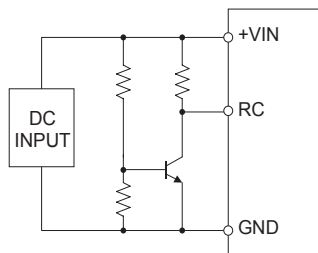


Fig.4.6 RC circuit for start up

4.5 Softstart / Start-up sequence

- The adjustment of the rise time is possible by connecting C_{SEQ}.

$$C_{SEQ}[\text{nF}] = 6 \times T_{RISE}[\text{ms}] - 15$$

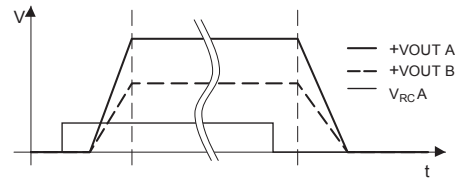
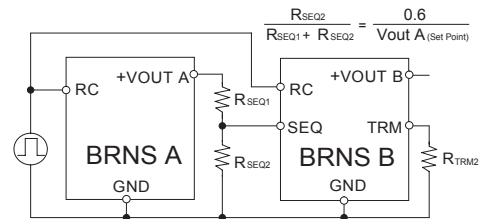
- C_{SEQ} should be less than 1μsec.
- At the time of start, the output voltage follows the SEQ voltage. Output voltage and SEQ voltage are expressed in the following calculation.

$$V_{OUT} = V_{SEQ} \times \left(\frac{20k\Omega}{R_{TRM}} + 1 \right)$$

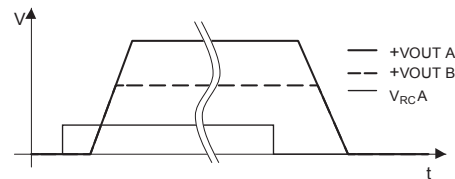
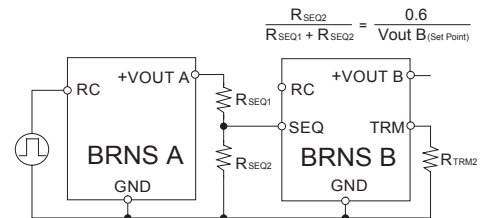
$$* V_{SEQ} < 0.6V$$

- With the voltage to input into SEQ pin, you can control a start sequence of plural BRNS.

(1) The same time



(2) The same voltage



(3) The time lag

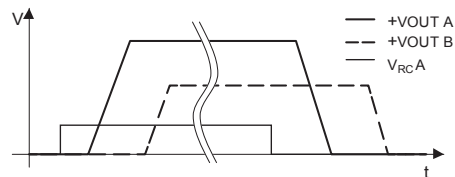
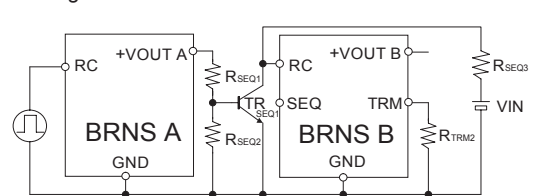


Fig.4.7 Example of sequence control

- If this function is unnecessary, please make SEQ pin open.

4.6 Power good

- By using PGOOD, it is possible to monitor power supply whether normal operation or abnormal operation.
- PGOOD terminal inside is comprised of an open drain.
- Sink current of PGOOD is 50μA min.

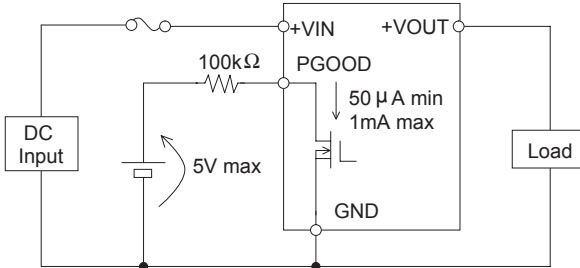


Fig.4.8 Example of PGOOD circuit

- Voltage of PGOOD pin become low when over current protection circuit is work, or output voltage is different from a set point more than ±10%.
- If this function is unnecessary, please make PGOOD pin open.

4.7 Sequence

- Fig.4.9 is a sequence chart of each function of BRNS.

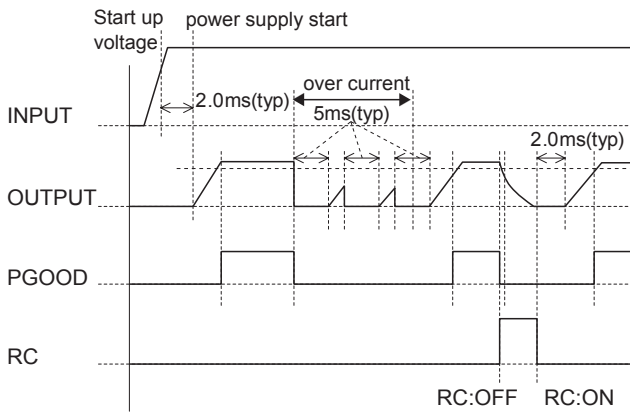


Fig.4.9 Sequence chart of BRNS

4.8 Frequency synchronization

- BRNS can operate at the switching frequency that synchronized to frequency of square wave input into SYNC pin.
- There is a delay of 300nsec.
- Fig.4.10 is example of frequency synchronization. And recommended wave form of SYNC pin is shown in Fig.4.11
- If this function is unnecessary, please make PGOOD pin open or short to GND.
- Please wire the input pin of both power supplies which is synchronizing to the same pattern and voltage.

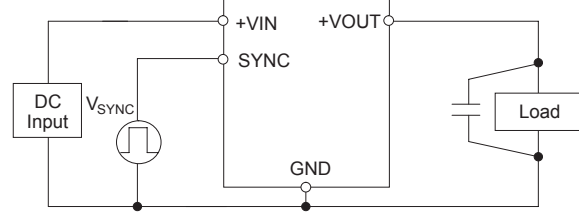


Fig 4.10 Example of frequency synchronization

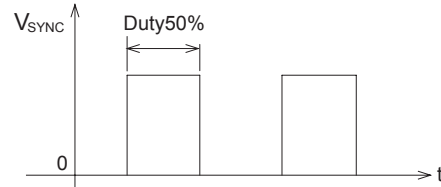


Fig 4.11 Recommended wave form of SYNC

Table 4.3 Specification of SYNC pin voltage

No.	VIN	V _{SYNC}			
		Lo level		Hi level	
		min	max	min	max
1	≤5.5V	-0.2V	0.3V	2.0V	VIN-1.0V
2	>5.5V				4.5V

- As shown in Fig.4.12, frequency synchronization is possible without using an outside clock.

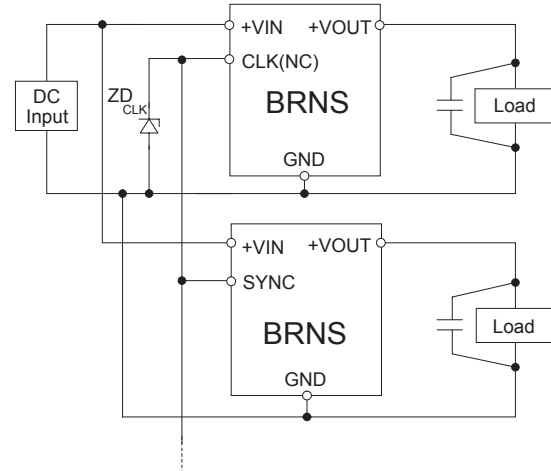


Fig.4.12 Example of CLK pin connection.

- The maximum synchronization number is 5.
- After the power supply which output CLK started, please start the synchronizing power supplies. And when stop power supplies, you should stop the powersupply which output CLK at first.
- The max voltage of CLK pin is DC input voltage.
- Please connect ZD_{CLK} when the voltage more than 5.5V is input into SYNC pin.(refer to Table.4.3)
- It is not possible to shorten rise time when not using this function.

5 Series and Parellel operation

5.1 Series operation

■ Series operation is not possible.

5.2 Parallel operation

■ Parallel operation is not possible.

■ Redundancy operation is available by wiring as shown below.

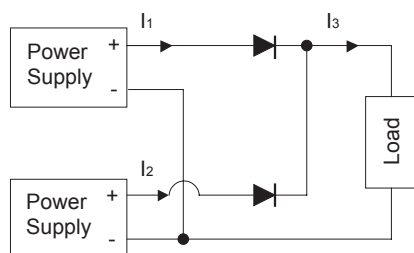


Fig.5.1 Redundancy operation

■ Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .

Please make sure that the value of I_3 does not exceed the rated current of the power supply.

$$I_3 \leq \text{the rated current value}$$

6 Implementation · Mounting Method

6.1 Mounting method

■ The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. The temperature around each power supply should not exceed the temperature range shown in derating curve.

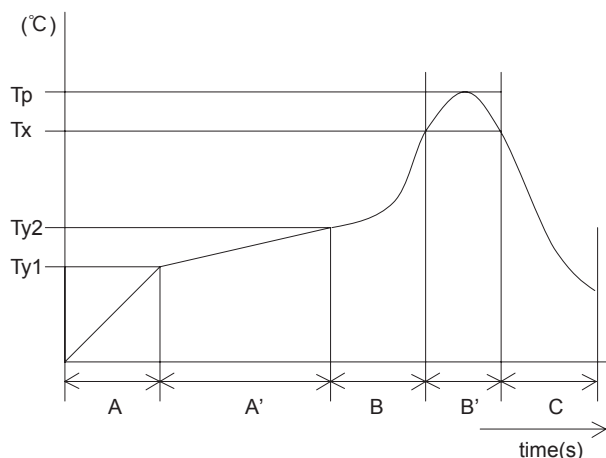
6.2 Automatic Mounting

■ To mount BRNS series automatically, use the coil area near the center of the PCB as an adsorption point. Please see the External View for details of the adsorption point.

6.3 Soldering

■ Fig.6.1 shows condition for reflow of BRNS series. Please make sure that the temperature of board's pattern near by +VOUT and GND terminal.

■ While soldering, having vibration or impact on the unit should be avoided, because of solder melting.



A	1.0 - 5.0°C / s
A'	Ty1 : 160±10°C Ty2 : 180±10°C Ty1 - Ty2 : 120s max
B	1.0 - 5.0°C / s
B'	Tp : Max245°C 10s max Tx : 220°C or more : 70s max
C	1.0 - 5.0°C / s

Fig.6.1 Recommended reflow soldering condition

6.4 Cleaning

■ When cleaning is necessary, clean under the following conditions.

Method : Varnishing, ultrasonic wave and vapor
Cleaning agents : IPA (Solvent type)
Total time : 2 minutes or less

■ Do not apply pressure to the lead and name plate with a brush or scratch it during the cleaning.

■ After cleaning, dry them enough.

6.5 Storage method

■ To stock unpacked products in your inventory, it is recommended to keep them under controlled condition, 5-30°C, 60%RH and use them within a year.

■ 24-hour baking is recommended at 125°C, if unpacked products were kept under uncontrolled condition, which is 30°C, 60%RH or higher.

Original reels are not heat-resistant. Please move them to heat-resistant trays in preparation to bake.

To check moisture condition in the pack. Silica gel packet has some moisture condition indicator particles.

Indicated blue means good. Pink means alarm to bake it.

■ The reels will be deformed and the power supply might be damaged, if the vacuum pressure is too much to reseal.

BRNS

7 Safety Considerations

- To apply for safety standard approval using this power supply, the following conditions must be met.
- This unit must be used as a component of the end-use equipment.
- The equipment must contain basic insulation between input and output. If double or reinforced insulation is required, it has to be provided by the end-use equipment in accordance with the final build-in condition.
- Safety approved fuse must be externally installed on input side.

8 Derating

8.1 BRNS series Derating

- Make sure the temperatures measurement locations shown from Fig.8.2 and Fig.8.3 below are on or under the derating curve in Fig.8.1.

Ambient temperature must be kept at 85°C or under.

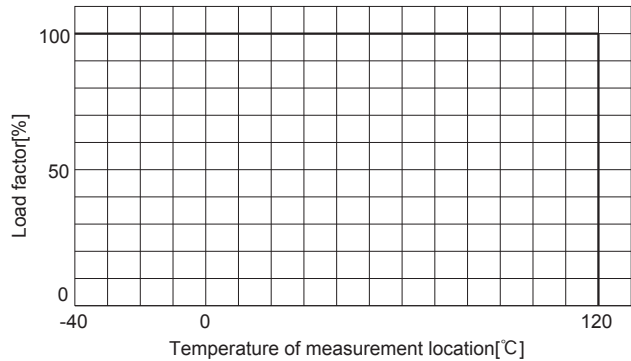
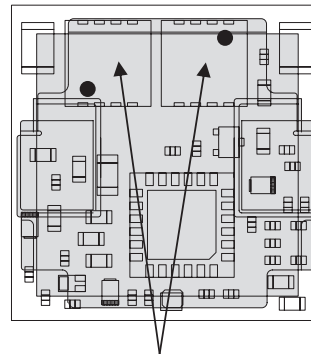
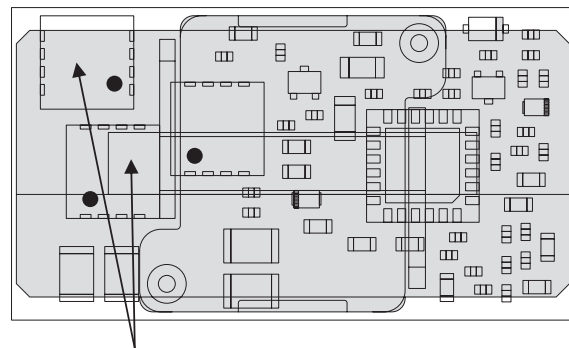


Fig.8.1 Derating curve



Temperature measurement location

Fig.8.2 Temperature measurement location (BRNS6/12)



Temperature measurement location

Fig.8.3 Temperature measurement location (BRNS20)

9 Package Information

■ Please refer to a Fig.9.1 to Fig.9.3 for Package form (Reel).

■ The packed number is 200.

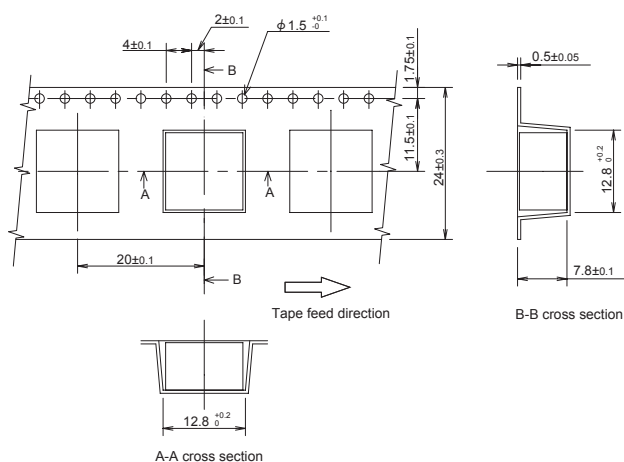


Fig.9.1 Taping dimensions of BRNS6/12

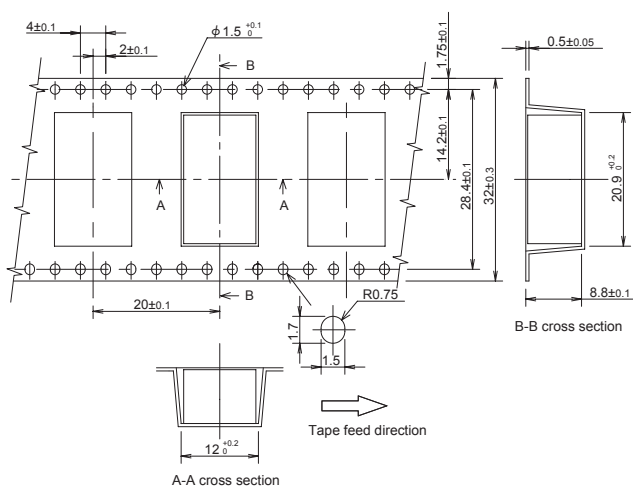
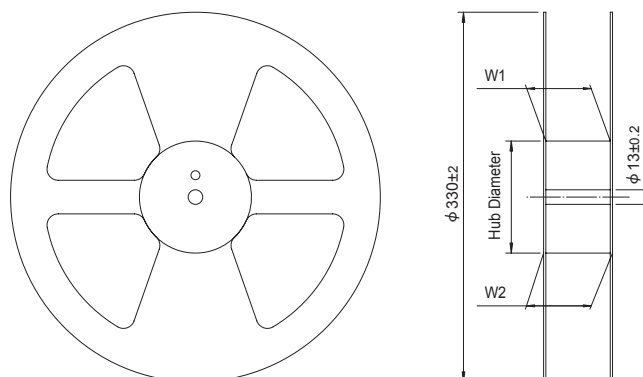


Fig.9.2 Taping dimensions of BRNS20



Model	Tape width [mm]	W1 [mm]	W2 [mm]
BRNS6	24	25.5±1.0	29.5±1.0
BRNS12	24	25.5±1.0	29.5±1.0
BRNS20	32	33.5±1.0	37.5±1.0

Fig.9.3 Reel dimensions of BRNS

■ Please refer to specifications for the details of package information

BRNS



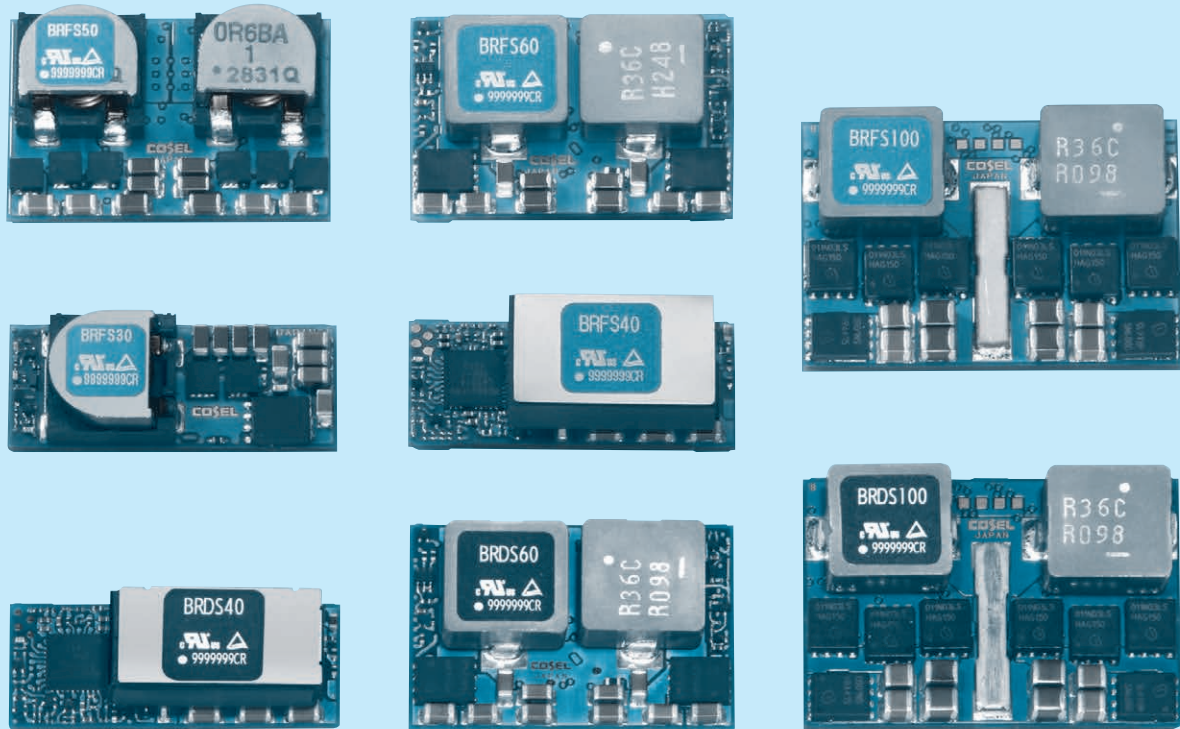
Low Profile

Safety
Approvals

OCP

Remote
ON/OFF

BRFS/BRDS-series



BRFS/BRDS

Feature

- Small size and high efficiency non-isolated DC-DC converter.
- Wide input voltage 4.5V to 14.0V.
- Fast transient response by Robust control.
- Built-in remote ON/OFF, Power good, Start-up sequence.
- Built-in overcurrent and thermal protection (auto recovery type) functions.
- PMBus interface for programming, margining, and telemetry (BRDS-series).

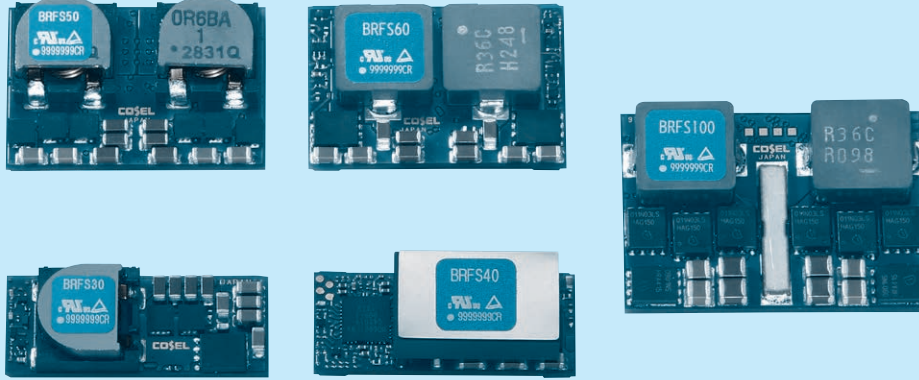
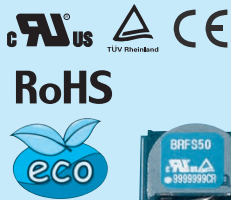
CE marking

Low Voltage Directive

Safety agency approvals

UL60950-1, C-UL, EN60950-1

5-year warranty



- ① Series name
 ② Single output
 ③ Output current
 30:30A
 40:40A
 50:50A
 60:60A
 100:100A
 ④ Type
 Blank : Standard type
 L : Low profile type (only 50A)
 ⑤ Optional
 R : Positive logic remote on/off
 I : POWERGOOD (only BRFS30/40)
 *Other models has POWERGOOD function normally.
 P : Parallel operation (only BRFS40)

MODEL	BRFS30	BRFS40	BRFS50	BRFS50L	BRFS60	BRFS100
MAX OUTPUT CURRENT[A]	30.0	40.0	50.0	50.0	60.0	100.0
DC OUTPUT	0.8 - 3.63V	0.6 - 2.0V	0.7 - 2.0V	0.7 - 2.0V	0.7 - 2.0V	0.7 - 2.0V

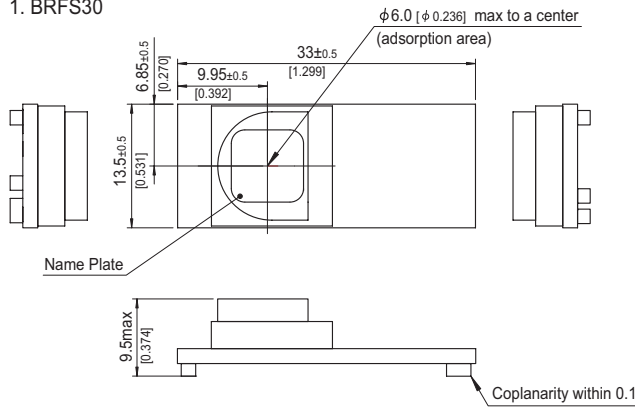
SPECIFICATIONS

	MODEL	BRFS30	BRFS40	BRFS50	BRFS50L	BRFS60	BRFS100					
INPUT	VOLTAGE[V]	DC4.5 - 14.0										
	CURRENT[A]	*1 3.41 typ	4.52 typ	5.68 typ	5.68 typ	6.82 typ	11.24 typ					
	EFFICIENCY[%]	*1 88 typ	88.5 typ	88 typ	88 typ	88 typ	89 typ					
OUTPUT	VOLTAGE[V]	*2 0.8 - 3.63	0.6 - 2.0	0.7 - 2.0	0.7 - 2.0	0.7 - 2.0	0.7 - 2.0					
	CURRENT[A]	30	40	50	50	60	100					
	LINE REGULATION[mV]	5										
	LOAD REGULATION[mV]	5										
	RIPPLE[mVp-p]	*3 25										
	RIPPLE NOISE[mVp-p]	*3 50										
	OUTPUT VOLTAGE SETTING [%Vo]	±1										
	DRIFT[mV]	*4 5										
	START-UP TIME[ms]	8.0 typ										
	OUTPUT VOLTAGE ADJUSTMENT RANGE [V]	Adjustable by external resistor										
		0.8 - 3.63						0.6 - 2.0	0.7 - 2.0	0.7 - 2.0	0.7 - 2.0	0.7 - 2.0
	OUTPUT VOLTAGE TOTAL REGULATION [%Vo]*5	±3										
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating (auto recovery type)										
	REMOTE SENSING	Available (+S only)		Available								
	REMOTE ON/OFF	Available Negative logic L:ON, H:OFF										
ISOLATION	INPUT-OUTPUT	non-isolated										
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85℃, 20-95%RH (Non condensing) (Refer to DERATING CURVE) 3,000m (10,000feet) max										
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100℃, 20-95%RH (Non condensing), 9,000m (30,000feet) max										
	VIBRATION	10-55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis										
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis										
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950										
OTHERS	CASE SIZE/WEIGHT	33.0×9.5×13.5mm [1.3×0.37×0.53 inches] (W×H×D) / 10g max	33.0×10.9×13.5mm [1.3×0.43×0.53 inches] (W×H×D) / 12g max	33.0×9.5×22.9mm [1.3×0.37×0.9 inches] (W×H×D) / 15g max	33.0×7.0×22.9mm [1.3×0.28×0.9 inches] (W×H×D) / 12g max	33.0×8.0×22.9mm [1.3×0.31×0.9 inches] (W×H×D) / 15g max	38.0×8.5×27.7mm [1.5×0.33×1.09 inches] (W×H×D) / 22g max					
	COOLING METHOD	Convection / Forced air										

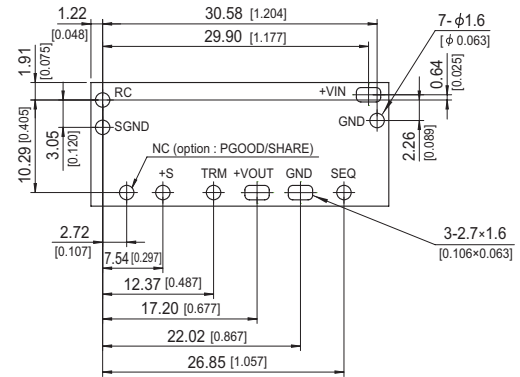
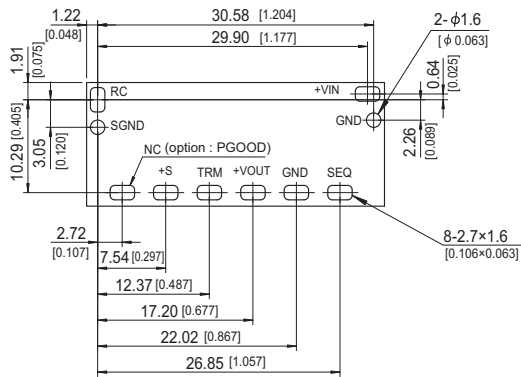
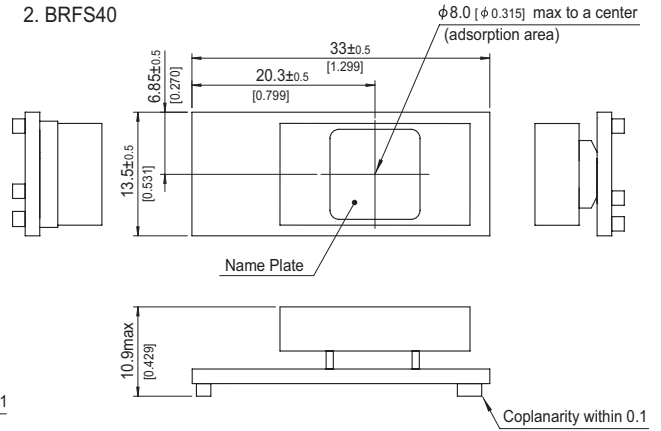
- *1 At rated input (DC12V) and rated output (1.2V) Ta=25°C.
 *2 Output voltage is adjusted to the minimum when TRM is opened.
 *3 Ripple and ripple noise is measured by using measuring board with ceramic capacitor at 50mm from output pin.
 *4 Drift is the change in DC output for an eight hour period after a half - hour warm - up at 25°C, with the input voltage held.
 *5 Output voltage setting is added line regulation and load regulation and temperature regulation used resistance of the 0.5% tolerance.

External view

1. BRFS30

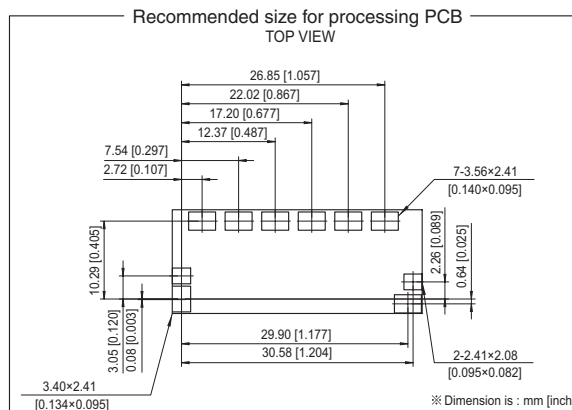


2. BRFS40



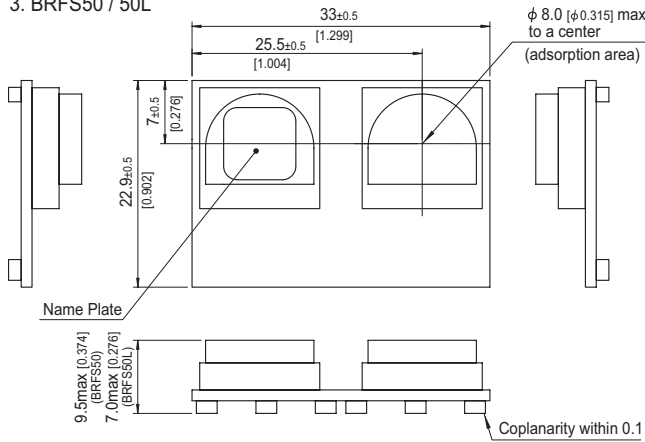
※ Tolerance : ± 0.3 [± 0.012]
 ※ Dimensions in mm, []=inches
 ※ Weight : 10g max
 ※ Terminal material : copper
 ※ Plating treatment of terminal : Lead free plating

※ Tolerance : ± 0.3 [± 0.012]
 ※ Dimensions in mm, []=inches
 ※ Weight : 12g max
 ※ Terminal material : copper
 ※ Plating treatment of terminal : Lead free plating

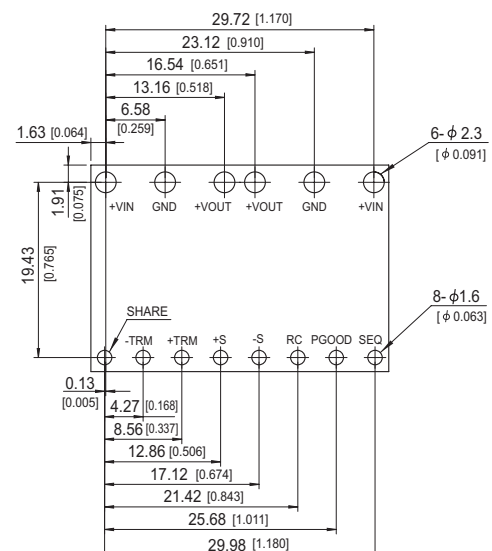
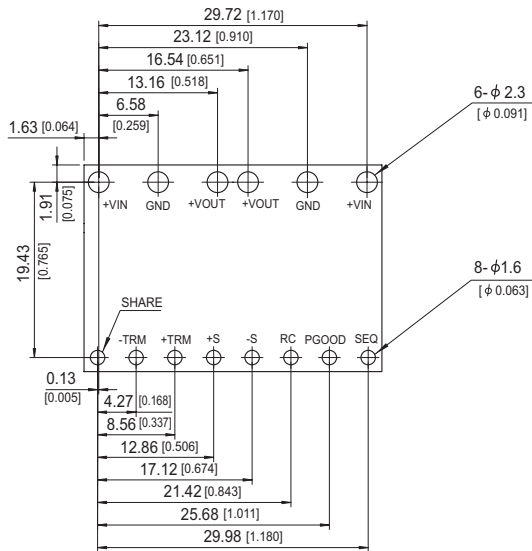
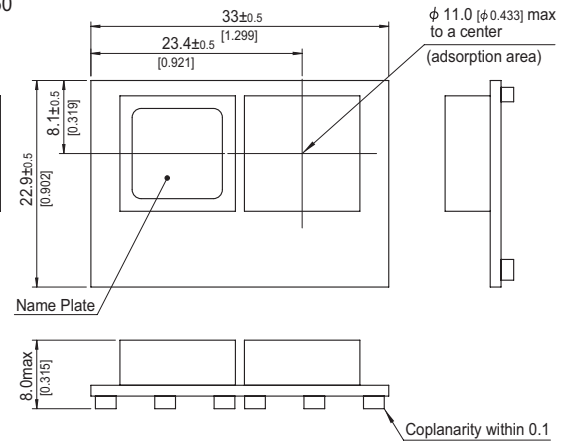


External view

3. BRFS50 / 50L

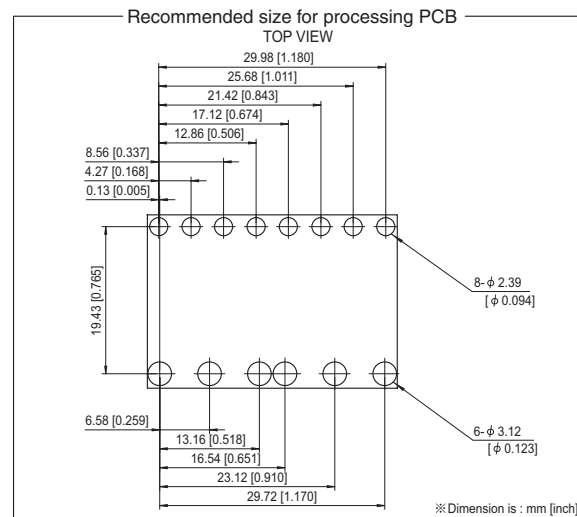


4. BRFS60



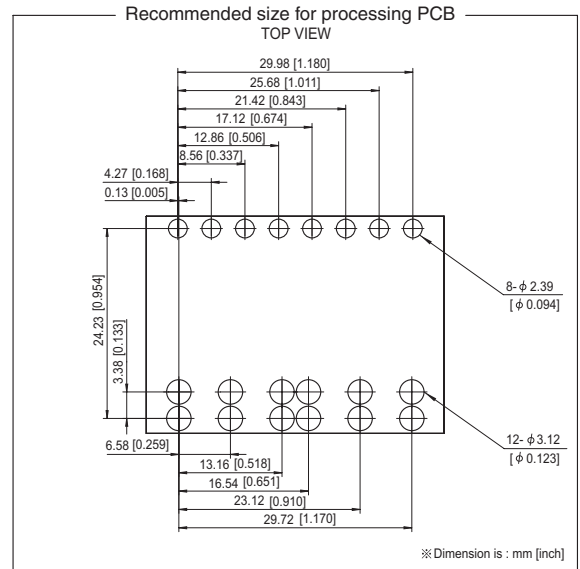
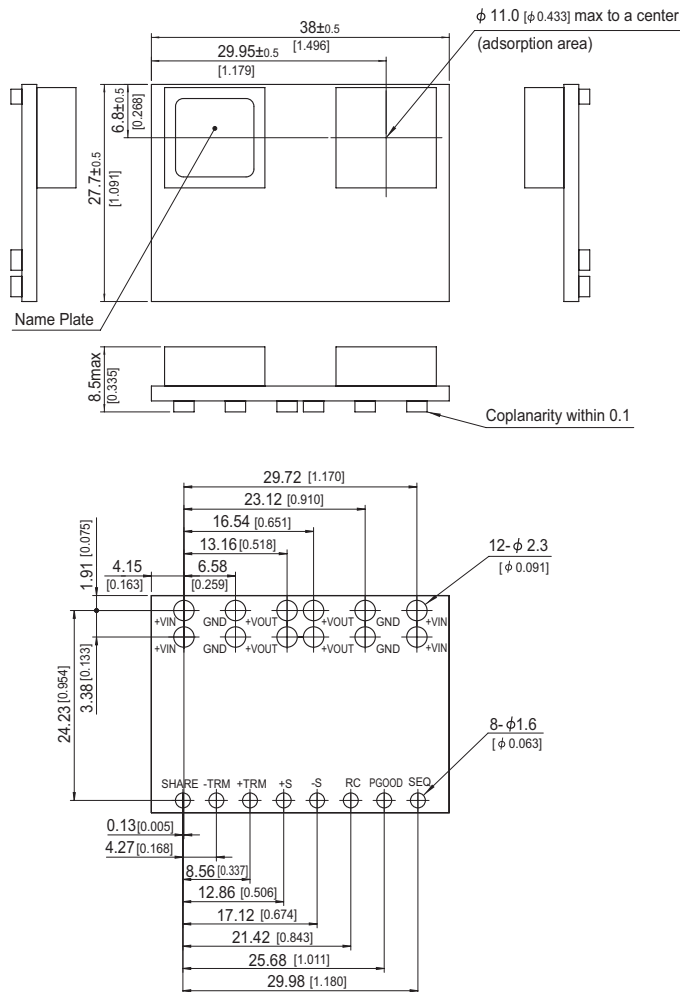
※ Tolerance : ±0.3 [±0.012]
 ※ Dimensions in mm, []=inches
 ※ Weight : 15g max (BRFS50)
 12g max (BRFS50L)
 ※ Terminal material : copper
 ※ Plating treatment of terminal
 : Lead free plating

※ Tolerance : ±0.3 [±0.012]
 ※ Dimensions in mm, []=inches
 ※ Weight : 15g max
 ※ Terminal material : copper
 ※ Plating treatment of terminal
 : Lead free plating

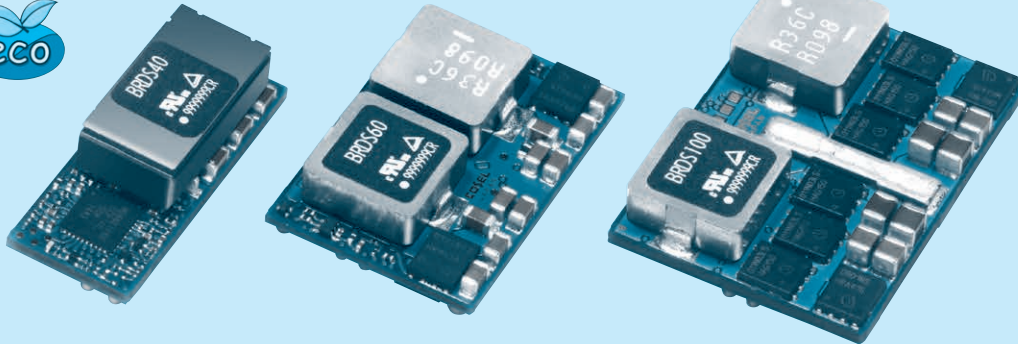


External view

5. BRFS100



- ※ Tolerance : ± 0.3 [± 0.012]
- ※ Dimensions in mm, []=inches
- ※ Weight : 22g max
- ※ Terminal material : copper
- ※ Plating treatment of terminal : Lead free plating



- ① Series name
- ② Single output
- ③ Output current
40:40A
60:60A
100:100A
- ④ Optional
R: Positive logic remote on/off

MODEL	BRDS40	BRDS60	BRDS100
MAX OUTPUT CURRENT[A]	40.0	60.0	100.0
DC OUTPUT	0.6 - 2.0V	0.7 - 2.0V	0.7 - 2.0V

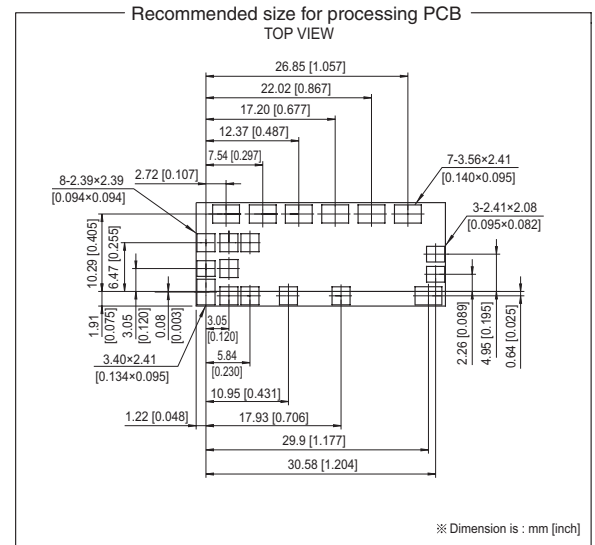
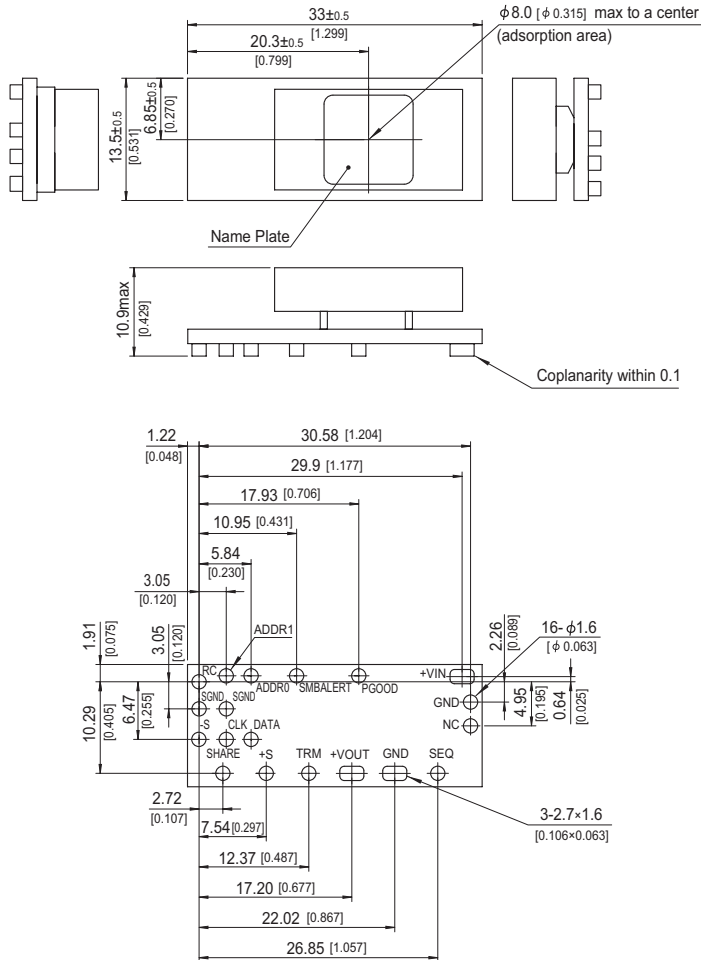
SPECIFICATIONS

	MODEL	BRDS40	BRDS60	BRDS100
INPUT	VOLTAGE[V]	DC4.5 - 14.0		
	CURRENT[A]	*1 4.52 typ	6.82 typ	11.24 typ
	EFFICIENCY[%]	*1 88.5 typ	88 typ	89 typ
OUTPUT	VOLTAGE[V]	*2 0.6 - 2.0	0.7 - 2.0	0.7 - 2.0
	CURRENT[A]	40	60	100
	LINE REGULATION[mV]	5		
	LOAD REGULATION[mV]	5		
	RIPPLE[mVp-p]	*3 25		
	RIPPLE NOISE[mVp-p]	*3 50		
	OUTPUT VOLTAGE SETTING [%Vo]	±1		
	DRIFT[mV]	*4 5		
	START-UP TIME[ms]	12.0 typ		
	OUTPUT VOLTAGE ADJUSTMENT RANGE [V]	Adjustable by external resistor		
		0.6 - 2.0	0.7 - 2.0	0.7 - 2.0
	OUTPUT VOLTAGE TOTAL REGULATION [%Vo]*5	±3		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating (auto recovery type)		
	REMOTE SENSING	Available		
	REMOTE ON/OFF	Available Negative logic L:ON, H:OFF		
ISOLATION	INPUT-OUTPUT	non-isolated		
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85℃, 20-95%RH (Non condensing) (Refer to DERATING CURVE) 3,000m (10,000feet) max		
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100℃, 20-95%RH (Non condensing), 9,000m (30,000feet) max		
	VIBRATION	10-55Hz, 49.0m/s² (5G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT	196.1m/s² (20G), 11ms, once each along X, Y and Z axis		
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950		
OTHERS	CASE SIZE/WEIGHT	33.0×10.9×13.5mm [1.3×0.43×0.53 inches] (W×H×D) / 12g max	33.0×8.0×22.9mm [1.3×0.31×0.9 inches] (W×H×D) / 15g max	38.0×8.5×27.7mm [1.5×0.33×1.09 inches] (W×H×D) / 22g max
	COOLING METHOD	Convection / Forced air		

- *1 At rated input (DC12V) and rated output (1.2V) Ta=25°C.
- *2 Output voltage is adjusted to the minimum when TRM is opened.
- *3 Ripple and ripple noise is measured by using measuring board with ceramic capacitor at 50mm from output pin.
- *4 Drift is the change in DC output for an eight hour period after a half - hour warm - up at 25°C, with the input voltage held.
- *5 Output voltage setting is added line regulation and load regulation and temperature regulation used resistance of the 0.5% tolerance.
- * This product is subject to a license from PAI Capital LLC related to digital power technology patents owned by PAI Capital LLC.

External view

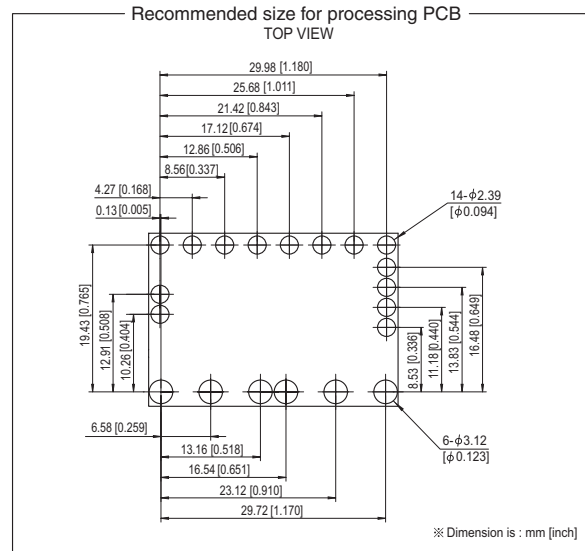
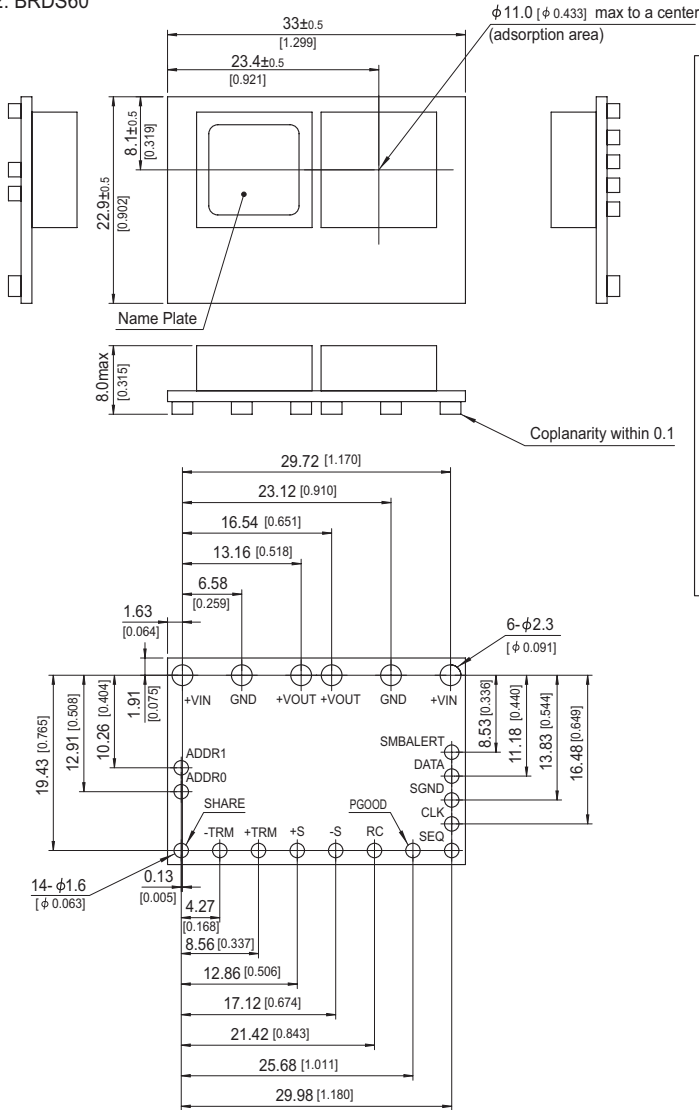
1. BRDS40



- ※ Tolerance : ± 0.3 [± 0.012]
- ※ Dimensions in mm, [] = inches
- ※ Weight : 12g max
- ※ Terminal material : copper
- ※ Plating treatment of terminal : Lead free plating

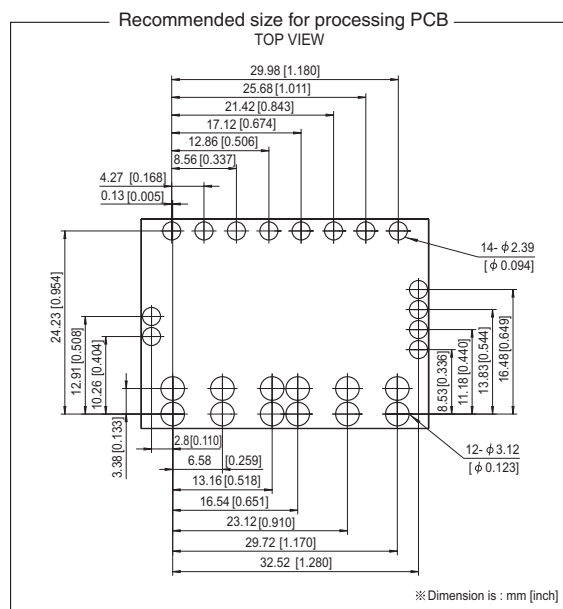
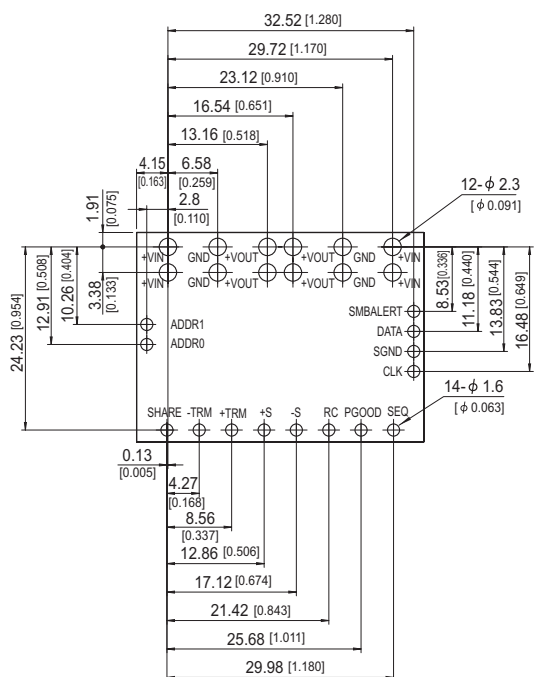
External view

2. BRDS60



- ※ Tolerance : ± 0.3 [± 0.012]
- ※ Dimensions in mm, [] = inches
- ※ Weight : 15g max
- ※ Terminal material : copper
- ※ Plating treatment of terminal : Lead free plating

Technical drawing of the front view of the device. The drawing shows a rectangular main body with a central square feature and a smaller square feature to its right. A vertical dimension line on the left indicates a height of 27.7 ± 0.5 [1.081]. A horizontal dimension line at the top indicates a width of 38 ± 0.5 [1.496]. A horizontal dimension line below the top one indicates a width of 29.95 ± 0.5 [1.179]. A vertical dimension line on the left indicates a height of 6.8 ± 0.5 [0.269]. A callout line points to the central square feature with the text $\phi 11.0$ [$\phi 0.433$] max to a center (adsorption area). A callout line points to the bottom edge of the main body with the text Coplanarity within 0.1. A callout line points to the bottom edge of the main body with the text Name Plate. A horizontal dimension line at the bottom indicates a width of 8.5 max [0.335].



- ※ Tolerance : ± 0.3 [± 0.012]
- ※ Dimensions in mm, [] = inches
- ※ Weight : 22g max
- ※ Terminal material : copper
- ※ Plating treatment of terminal
: Lead free plating

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz] (reference)	Input current [A]	Inrush current protection	PCB/Pattern			Series/Parallel operation	
					Material	Single sided	Double sided	Series operation	Parallel operation
BRFS30	Buck Converter	300	*1	-	glass fabric base,epoxy resin	-	Multilayer	-	*3
BRFS40	Buck Converter	300	*1	-	glass fabric base,epoxy resin	-	Multilayer	-	*3
BRFS50	Buck Converter	300 *2	*1	-	glass fabric base,epoxy resin	-	Multilayer	-	*3
BRFS50L	Buck Converter	300 *2	*1	-	glass fabric base,epoxy resin	-	Multilayer	-	*3
BRFS60	Buck Converter	300 *2	*1	-	glass fabric base,epoxy resin	-	Multilayer	-	*3
BRFS100	Buck Converter	300 *2	*1	-	glass fabric base,epoxy resin	-	Multilayer	-	*3
BRDS40	Buck Converter	300	*1	-	glass fabric base,epoxy resin	-	Multilayer	-	*3
BRDS60	Buck Converter	300 *2	*1	-	glass fabric base,epoxy resin	-	Multilayer	-	*3
BRDS100	Buck Converter	300 *2	*1	-	glass fabric base,epoxy resin	-	Multilayer	-	*3

*1 Refer to Specification.

*2 These models have 2 Phase Interleaving inverters, the frequency of ripple is 600kHz.

*3 Refer to the Instruction Manual.

1	Pin Configuration	BRFS/BRDS-12
2	Connection for Standard Use	BRFS/BRDS-13
3	Wiring Input / Output Pin	BRFS/BRDS-13
3.1	Wiring input pin	BRFS/BRDS-13
3.2	Wiring output pin	BRFS/BRDS-14
4	Function	BRFS/BRDS-14
4.1	Overcurrent protection	BRFS/BRDS-14
4.2	Thermal protection	BRFS/BRDS-14
4.3	Remote ON / OFF	BRFS/BRDS-14
4.4	Remote sensing	BRFS/BRDS-15
4.5	Adjustable voltage range	BRFS/BRDS-15
4.6	Softstart/Start-up sequence	BRFS/BRDS-15
4.7	Power good	BRFS/BRDS-16
4.8	Sequence	BRFS/BRDS-16
4.9	PMBus communication	BRFS/BRDS-16
5	Series and Parallel Operation	BRFS/BRDS-17
5.1	Series operation	BRFS/BRDS-17
5.2	Parallel operation	BRFS/BRDS-17
6	Implementation · Mounting Method	BRFS/BRDS-17
6.1	Mounting method	BRFS/BRDS-17
6.2	Automatic mounting	BRFS/BRDS-17
6.3	Soldering	BRFS/BRDS-17
6.4	Cleaning	BRFS/BRDS-18
6.5	Storage method	BRFS/BRDS-18
7	Safety Considerations	BRFS/BRDS-18
8	Derating	BRFS/BRDS-18
8.1	BRFS/BRDS series Derating	BRFS/BRDS-18
9	Package Information	BRFS/BRDS-19

1 Pin Configuration

Table 1.1 Pin connection and function of BRFS30/40

Pin No.	Pin Connection	Function
①	RC	Remote ON/OFF
②	+VIN	+DC input
③	SEQ	Control of Start up time and turn
④	GND	GND (-DC input, -DC output)
⑤	+VOUT	+DC output
⑥	TRM	Adjustment of output voltage
⑦	+S	+Remote sensing
⑧	GND	GND (-DC input, -DC output)
⑨	NC(PGOOD/SHARE)	NC (optional : Power good (BRFS30/40), SHARE (BRFS40))
⑩	SGND	Signal GND

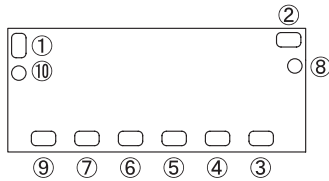
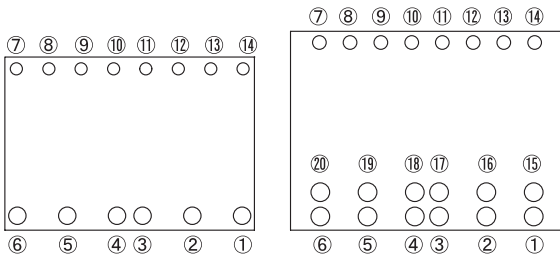


Fig.1.1 Pin connection of BRFS30/40 (BOTTOM VIEW)

Table 1.2 Pin connection and function of BRFS50/50L/60/100

Pin No.	Pin Connection	Function
① ⑮	+VIN	+DC input
② ⑯	GND	GND (-DC input, -DC output)
③ ⑰	+VOUT	+DC output
④ ⑱	+VOUT	+DC output
⑤ ⑲	GND	GND (-DC input, -DC output)
⑥ ⑳	+VIN	+DC input
⑦	SEQ	Control of Start up time and turn
⑧	PGOOD	Power good
⑨	RC	Remote ON/OFF
⑩	-S	-Remote sensing
⑪	+S	+Remote sensing
⑫	+TRM	+Adjustment of output voltage
⑬	-TRM	-Adjustment of output voltage
⑭	SHARE	Parallel operation



(a) BRFS50/50L/60

(b) BRFS100

Fig.1.2 Pin connection of BRFS50/50L/60/100 (BOTTOM VIEW)

Table 1.3 Pin connection and function of BRDS40

Pin No.	Pin Connection	Function
①	RC	Remote ON/OFF
②	+VIN	+DC input
③	SEQ	Control of Start up time and turn
④	GND	GND (-DC input, -DC output)
⑤	+VOUT	+DC output
⑥	TRM	Adjustment of output voltage
⑦	+S	+Remote sensing
⑧	GND	GND (-DC input, -DC output)
⑨	SHARE	Parallel operation
⑩	SGND	Signal GND
⑪	SGND	Signal GND
⑫	-S	-Remote sensing
⑬	CLK	PMBus communication clock input
⑭	DATA	PMBus communication data input & output
⑮	NC	NC
⑯	PGOOD	Power good
⑰	SMBALERT	PMBus alarm output
⑱	ADDR0	Address setting
⑲	ADDR1	Address setting

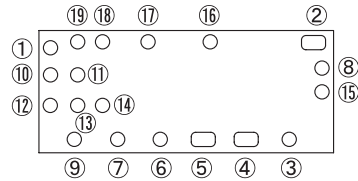
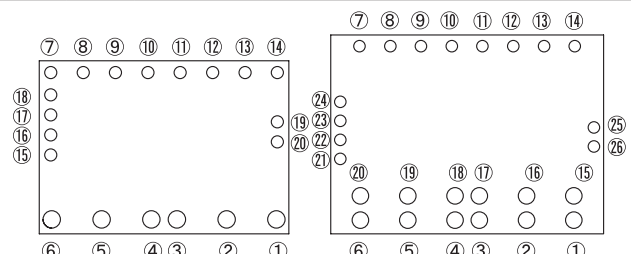


Fig.1.3 Pin connection of BRDS40 (BOTTOM VIEW)

Table 1.4 Pin connection and function of BRDS60/100

Pin No.	Pin Connection	Function
BRDS60 ① ⑮	+VIN	+DC input
BRDS60 ② ⑯	GND	GND (-DC input, -DC output)
BRDS60 ③ ⑰	+VOUT	+DC output
BRDS60 ④ ⑱	+VOUT	+DC output
BRDS60 ⑤ ⑲	GND	GND (-DC input, -DC output)
BRDS60 ⑥ ⑳	+VIN	+DC input
BRDS60 ⑦	SEQ	Control of Start up time and turn
BRDS60 ⑧	PGOOD	Power good
BRDS60 ⑨	RC	Remote ON/OFF
BRDS60 ⑩	-S	-Remote sensing
BRDS60 ⑪	+S	+Remote sensing
BRDS60 ⑫	+TRM	+Adjustment of output voltage
BRDS60 ⑬	-TRM	-Adjustment of output voltage
BRDS60 ⑭	SHARE	Parallel operation
BRDS60 ⑮	SMBALERT	PMBus alarm output
BRDS60 ⑯	DATA	PMBus communication data input & output
BRDS60 ⑰	SGND	Signal GND
BRDS60 ⑱	CLK	PMBus communication clock input
BRDS60 ⑲	ADDR0	Address setting
BRDS60 ⑳	ADDR1	Address setting



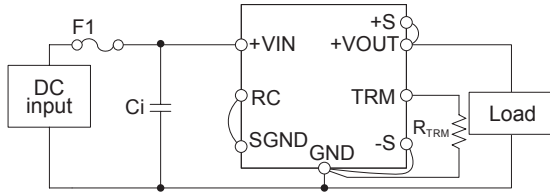
(a) BRDS60

(b) BRDS100

Fig.1.4 Pin connection of BRDS60/100 (BOTTOM VIEW)

2 Connection for Standard Use

■ In order to use power supply, it is necessary to wire as shown in Fig.2.1 and Fig.2.2.



*SGND is connected to GND inside the power supply.
*Short the -S and GND only BRDS40.

Fig.2.1 Connection for standard use of BRFS30/40 · BRDS40

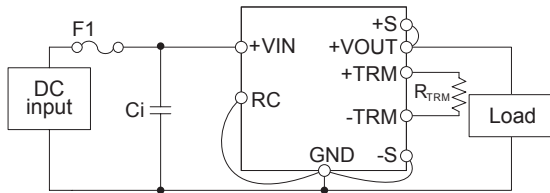


Fig.2.2 Connection for standard use of BRFS50/50L/60/100 · BRDS60/100

Reference	3	"Wiring Input/Output Pin"
	8	"Derating"

■ Short the following pins to turn on the power supply.

● BRFS30/40

SGND↔RC, +VOUT↔+S

● BRFS50/50L/60/100 · BRDS40/60/100

GND↔RC (SGND↔RC of BRDS40), +VOUT↔+S, GND↔-S

Reference	4.3	"Remote ON/OFF"
	4.4	"Remote sensing"

■ Connect resistance to set the output voltage as below.

● BRFS30/40 · BRDS40

GND↔TRM

● BRFS50/50L/60/100 · BRDS60/100

+TRM↔-TRM

Reference	4.5	"Adjustable voltage range"
-----------	-----	----------------------------

■ Between input and output is not isolated.

■ The BRFS/BRDS series handle only the DC input.

Avoid applying AC input directly.

It will damaged the power supply.

Table 2.1 External parts

No.	Parts	Reference
1	F1:Fuse	3.1(1) External fuse
2	Ci:External output capacitor	3.1(2) External input capacitor
3	R _{TRM} :Resistance for adjustment output voltage	4.4 Adjustable voltage range

3 Wiring Input/Output Pin

3.1 Wiring input pin

(1) External fuse

■ Fuse is not built-in on input side. In order to protect the unit, install the normal-blow type fuse on input side.

Table 3.1 Recommended fuse (normal-blow type)

Model	BRFS30/40 · BRDS40	BRFS50/50L	BRFS60 · BRDS60	BRFS100 · BRDS100
Rated current	40A	40A	60A	80A

■ When the input voltage from a front end unit is supplied to multiple units, install the normal-blow type fuse in each unit.

■ When the fuse is open, power good signal is not outputted.

(2) External capacitor on the input side

■ Install an external capacitor Cin, between +VIN and GND input pins for low line-noise and for stable operation of the power supply.

Table 3.2 Recommended external input capacitor(Ceramic)

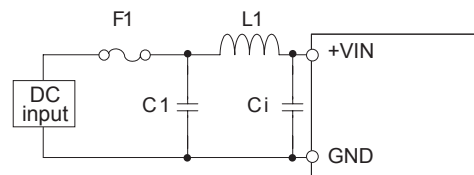
Model	Recommended Ci	
	Vin=5V	Vin=12V
BRFS30/40 · BRDS40	8×22 μF	4×22 μF
BRFS50/50L	8×22 μF	4×22 μF
BRFS60 · BRDS60	8×22 μF	4×22 μF
BRFS100 · BRDS100	8×22 μF	4×22 μF

■ Cin is within 5mm for pins. Make sure that ripple current of Cin is less than its rating.

■ When an impedance and inductance level of the input line become higher, the input voltage may become unstable. In that case, the input voltage becomes stable by increasing Cin.

(3) Recommendation for noise-filter

■ Install an external input filter as shown in Fig.3.1 in order to reduce conducted noise. Cin is shown in Table 3.2.



C1 :220 μF(BRFS30/50/50L)

:470 μF(BRFS40/60/100 · BRDS40/60/100)

L1 :0.3 μH

Fig.3.1 Example of recommended external input filter

(4) Reverse input voltage protection

■ Avoid the reverse polarity input voltage. It will damage the power supply.

It is possible to protect the unit from the reverse input voltage by installing an external diode as shown in Fig.3.2.

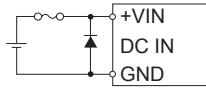


Fig.3.2 Reverse input voltage protection

3.2 Wiring output pin

■ When the BRFS/BRDS series supplies the pulse current for the pulse load, please install a capacitor C_o between +VOUT and GND pins.

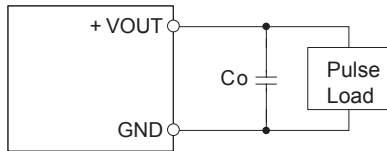


Fig.3.3 wiring external output capacitor

Table 3.3 Recommended Capacitor and max C_o

Model	Recommended C_o	MAX C_o
BRFS30/40 · BRDS40	$3 \times 100 \mu F$	$10,000 \mu F$
BRFS50/50L	$2 \times 100 \mu F$	$10,000 \mu F$
BRFS60 · BRDS60	$2 \times 100 \mu F$	$10,000 \mu F$
BRFS100 · BRDS100	$4 \times 100 \mu F$	$20,000 \mu F$

■ The output ripple voltage may grow big by resonance with C_o and ESL of the wiring, if resonance frequency and switching frequency are close.

■ Ripple and Ripple Noise are measured, as shown in the Fig.3.4. C_o0 , C_o1 , C_o2 and C_o3 is shown in Table 3.4.

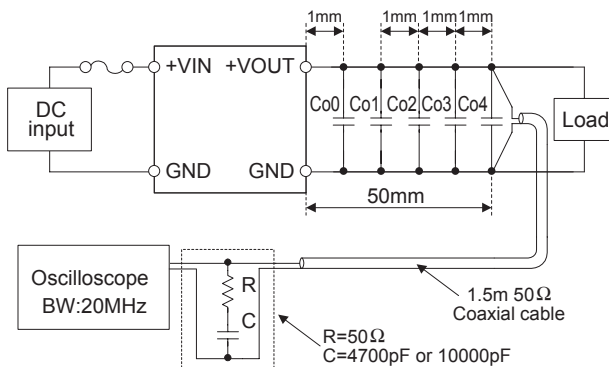


Fig.3.4 Measuring method of Ripple and Ripple Noise

Table 3.4 C_o0 , C_o1 , C_o2 and C_o3 which is used in measuring

No.	Model	C_o0	C_o1	C_o2	C_o3	C_o4
1	BRFS30	—	—	$100 \mu F$	$100 \mu F$	$100 \mu F$
2	BRFS40 · BRDS40	$100 \mu F$	—	$100 \mu F$	$100 \mu F$	$100 \mu F$
3	BRFS50/50L/60 · BRDS60	—	—	—	$100 \mu F$	$100 \mu F$
4	BRFS100 · BRDS100	—	$100 \mu F$	$100 \mu F$	$100 \mu F$	$100 \mu F$

4 Function

4.1 Overcurrent protection

■ Over Current Protection (OCP) is built-in and works at 105% of the rated current or higher. However, use in an overcurrent situation must be avoided whenever possible.

The output voltage of the power module will recover automatically when the fault causing overcurrent is corrected.

When the output voltage drops after OCP works, the power module enters a "hiccup mode" where it repeatedly turns on and off at a certain frequency.

4.2 Thermal protection

■ When the power supply temperature is kept above $120^\circ C$, the thermal protection will be activated and simultaneously shut down the output.

The output voltage of the power supply will recover automatically when the unit is cool down.

4.3 Remote ON/OFF

■ The remote ON/OFF function is incorporated in the input circuit and operated with RC and GND. If positive logic control is required, order the power supply with "R" option.

Table4.1 Specification of Remote ON/OFF

	ON/OFF logic	Between RC and GND	Output voltage
Standard	Negative	L level($-0.2 - 0.6V$) or short	ON
		H level($3.0 - V_{IN}$) or open	OFF
Optional -R	Positive	L level($-0.2 - 0.6V$) or short	OFF
		H level($3.0 - V_{IN}$) or open	ON

*Source current from RC pin is 0.5mA(max).

■ When remote on/off function is not used, please short GND and RC.

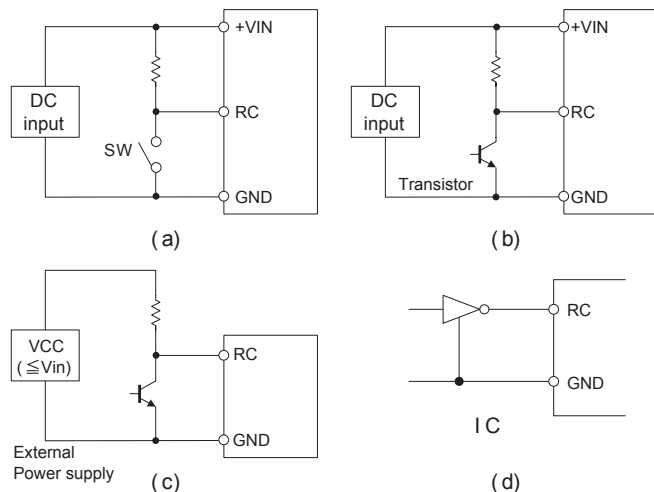


Fig.4.1 RC connection example

4.4 Remote sensing

(1) When the remote sensing function is not in use

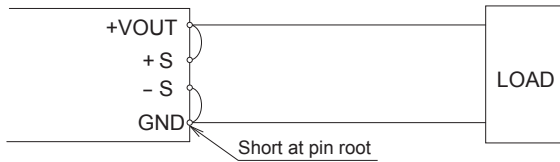


Fig.4.2 Connection when the remote sensing is not in use

■ When the remote sensing function is not in use, it is necessary to confirm that pins are shorted between +S & +VOUT and between -S & GND.

■ Wire between +S & +VOUT and between -S & GND as short as possible.

Loop wiring should be avoided.

This power supply might become unstable by the noise coming from poor wiring.

(2) When the remote sensing function is in use

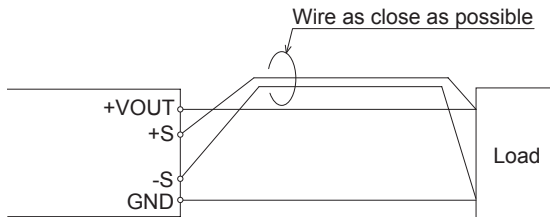


Fig.4.3 Connection when the remote sensing is in use

■ Twisted-pair wire or shield wire should be used for sensing wire.

■ Thick wire should be used for wiring between the power supply and a load.

Line drop should be less than 0.5V.

Voltage between +VOUT and GND should remain within the output voltage adjustment range.

■ If the sensing patterns are short, heavy-current is drawn and the pattern may be damaged.

The pattern disconnection can be prevented by installing the protection parts as close as a load.

4.5 Adjustable voltage range

■ Output voltage is adjustable by the external resistor.

■ The temperature coefficient could become worse, depending on the type of a resistor.

Resistor.....Metal film type, coefficient of less than $\pm 100\text{ppm}/^\circ\text{C}$

■ When TRM is opened, output voltage is adjusted to the minimum.

■ R_{TRM} is calculated in the following expressions.

$$\begin{aligned} \text{BRFS30} & \quad \text{BRFS40} \cdot \text{BRDS40} & \text{BRFS50/50L/60/100} \cdot \text{BRDS60/100} \\ R_{\text{TRM}} = \frac{8}{V_{\text{OUT}} - 0.8} [\text{k}\Omega] & R_{\text{TRM}} = \frac{12}{V_{\text{OUT}} - 0.6} [\text{k}\Omega] & R_{\text{TRM}} = \frac{14}{V_{\text{OUT}} - 0.7} [\text{k}\Omega] \end{aligned}$$

Table 4.2 Calculation result of BRFS30

No	VOUT	R_{TRM}
1	0.8	OPEN
2	1.0	40.0k Ω
3	1.2	20.0k Ω
4	1.5	11.429k Ω
5	1.8	8.0k Ω
6	2.5	4.706k Ω
7	3.3	3.2k Ω

Table 4.3 Calculation result of BRFS40 · BRDS40

No	VOUT	R_{TRM}
1	0.6	OPEN
2	1.0	30.0k Ω
3	1.2	20.0k Ω
4	1.5	13.3k Ω
5	1.8	10.0k Ω

Table 4.4 Calculation result of BRFS50/50L/60/100 · BRDS60/100

No	VOUT	R_{TRM}
1	0.7	OPEN
2	1.0	46.6k Ω
3	1.2	28.0k Ω
4	1.5	17.5k Ω
5	1.8	12.7k Ω

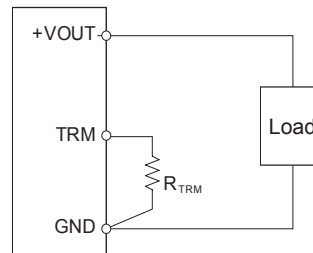


Fig.4.4 Connecting BRFS30/40 · BRDS40

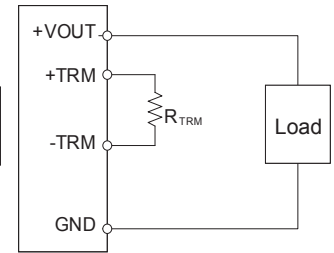


Fig.4.5 Connecting BRFS50/50L/60/100 · BRDS60/100

4.6 Softstart/Start-up sequence

■ The adjustment of the rise time is possible by connecting C_{SEQ} .

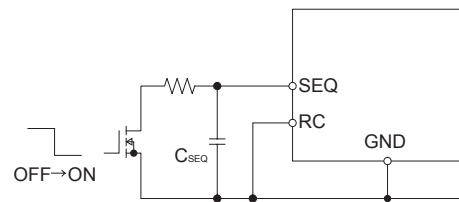


Fig.4.6 Example of soft start circuit

■ When the voltage is applied to the terminal SEQ, the output voltage tracks this voltage until the output reaches the set-point voltage. SEQ terminal voltage vs output voltage is calculated the following formula.

Avoid SEQ terminal voltage is set below the set voltage output by R_{TRM} , the output voltage does not rise to set output voltage. Maximum applicable voltage of terminal SEQ is V_{in} . When the function is not used, open terminal SEQ.

$$C_{\text{SEQ}} [\mu\text{F}] = (0.284 \div V_{\text{O}}[\text{V}] - 0.06) \times T[\text{ms}]$$

$$(0.6\text{V} \leq V_{\text{O}} \leq 2.0\text{V})$$

$$C_{\text{SEQ}} [\mu\text{F}] = (0.284 \div V_{\text{O}}[\text{V}] - 0.047) \times T[\text{ms}]$$

$$(2.0\text{V} < V_{\text{O}} \leq 3.63\text{V} \text{ only BRFS30})$$

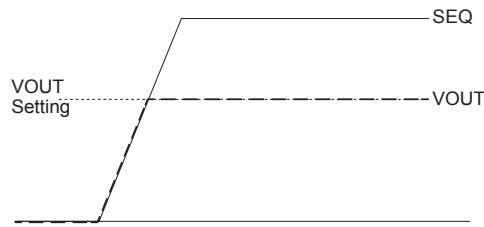


Fig.4.7 SEQ > Vout setting

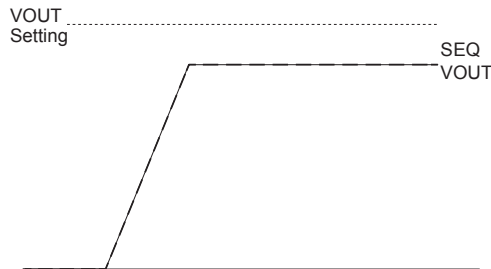
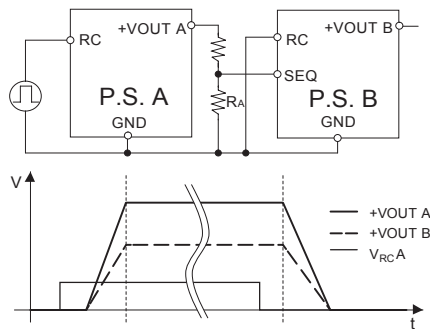


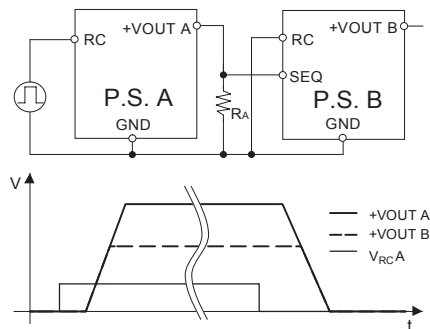
Fig.4.8 SEQ < Vout setting (not recommended)

■ With the voltage to input into SEQ pin, you can control a start sequence of plural power supplies.

(a) The same time



(b) The same voltage



(c) The time lag

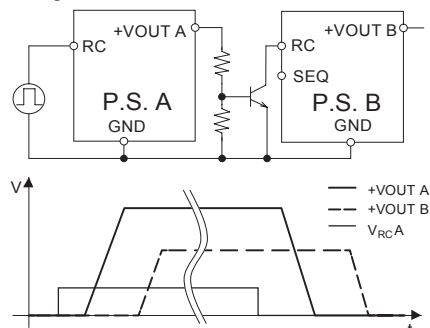


Fig.4.9 Example of sequence control

■ If this function is unnecessary, please make SEQ pin open.

■ It is not possible to shorten the rise time when not using this function.

4.7 Power good

■ By using PGOOD, it is possible to monitor power supply whether normal operation or abnormal operation.

■ PGOOD circuit is designed as shown in Fig.4.10.

Sink current of PGOOD is 10mA max.

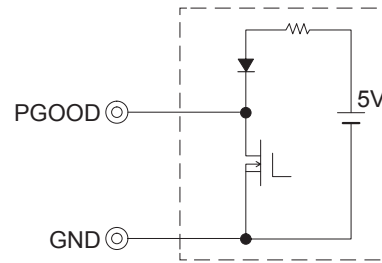


Fig.4.10 Internal PGOOD circuit

■ Voltage of PGOOD pin become low when over current protection circuit is work, or output voltage is different from a set point more than $\pm 12.5\%$.

■ If this function is unnecessary, please make PGOOD pin open.

4.8 Sequence

■ Fig.4.11 is a sequence chart of each function of BRFS/BRDS.

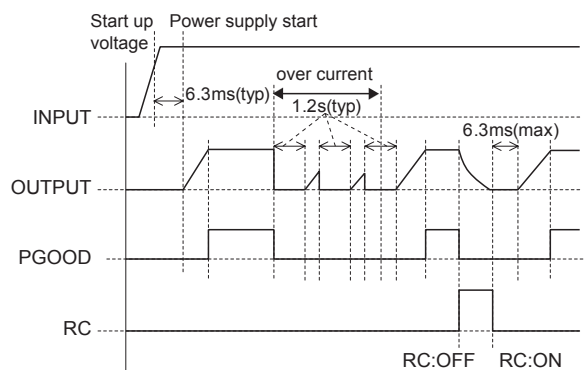


Fig.4.11 Sequence chart of BRFS/BRDS

4.9 PMBus communication

■ PMBus communication is possible BRDS series.

For more information please contact us.

5 Series and Parallel Operation

5.1 Series operation

■ Series operation is not possible.

5.2 Parallel operation

■ Parallel operation is possible BRFS50/50L/60/100 · BRDS series (BRFS30/40 is not possible). BRFS40 has a parallel operation "P".

■ In parallel operation, wiring as Fig.5.1

■ Make the +S and -S of the slave power supply unconnected.

■ To improve the load sharing of each unit, use the same length and same wire size from each unit to the load.

■ As variance of output current drew from each power supply is maximum 10%, the total output current must not exceed the value determined by the following equation.

(Output current at parallel operation)

$$= (\text{the rated current per unit}) \times (\text{number of unit}) \times 0.9$$

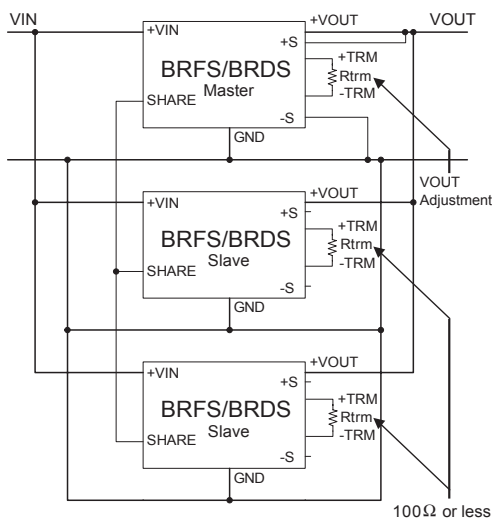


Fig.5.1 Example of wiring method in parallel operation

■ Make power supply from the same input power supply.

■ Total number of units should be no more than 5 pieces.

■ PGOOD of slave power supply output the operating conditions. When power supply is in operation, PGOOD output high level. At the time of stop, it output low level.

■ Please connect each other's SEQ pins if you use SEQ pin.

■ Voltage drop from a power supply to the sensing point should be less than 0.2V for stable control.

■ Only use RC pin of the master power supply, RC pin of the slave power supply should be short to GND. Or let RC pin's of the master power supply and the slave power supply short, and please use it.

■ If this function is unnecessary, please make SHARE pin open.

■ In parallel operation, please use a single model together. When it is necessary to use different model together, please contact us.

■ In the case of stop using the SEQ function in parallel operation, the power supply will immediately stop when SEQ terminal voltage is below the output voltage set by the R_{TRM} .

6 Implementation · Mounting Method

6.1 Mounting method

■ The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. The temperature around each power supply should not exceed the temperature range shown in derating curve.

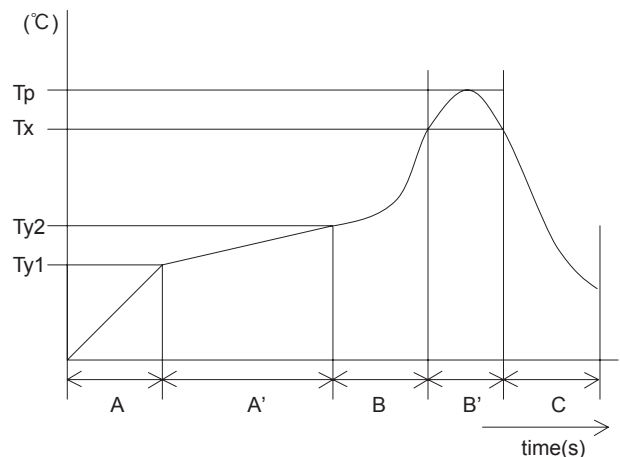
6.2 Automatic Mounting

■ To mount BRFS/BRDS series automatically, use the coil area near the center of the PCB as an adsorption point. Please see the External View for details of the adsorption point.

6.3 Soldering

■ Fig.6.1 shows condition for reflow of BRFS/BRDS series. Please make sure that the temperature of pin shown in Fig.6.2 do not exceed the temperatures shown in Fig.6.1.

■ While soldering, having vibration or impact on the unit should be avoided, because of solder melting.



A	1.0 - 5.0°C/ s
A'	Ty1 : 160±10°C Ty2 : 180±10°C Ty1 - Ty2 : 120s max
B	1.0 - 5.0°C/ s
B'	Tp : Max245°C 10s max Tx : 220°C or more : 70s max
C	1.0 - 5.0°C/ s

Fig.6.1 Recommended reflow soldering condition

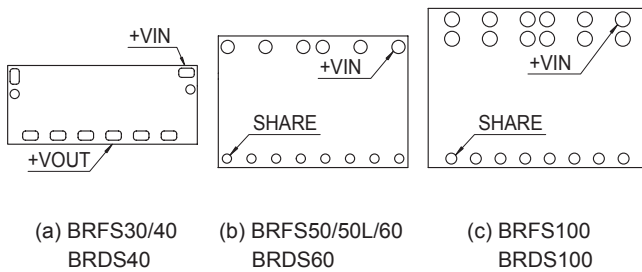


Fig.6.2 Measurement point of temperature

- Please do not do the implementation except the reflow.
- Because some parts drops, please do not do reflow of the back side.

6.4 Cleaning

- When cleaning is necessary, clean under the following conditions.
 - Method : Varnishing, ultrasonic wave and vapor
 - Cleaning agents : IPA (Solvent type)
 - Total time : 2 minutes or less
- Do not apply pressure to the lead and name plate with a brush or scratch it during the cleaning.
- After cleaning, dry them enough.

6.5 Storage method

- To stock unpacked products in your inventory, it is recommended to keep them under controlled condition, 5-30°C, 60%RH and use them within a year.
- 24-hour baking is recommended at 125°C, if unpacked products were kept under uncontrolled condition, which is 30°C, 60%RH or higher.
 - Original reels are not heat-resistant. Please move them to heat-resistant trays in preparation to bake.
 - To check moisture condition in the pack, silica gel packet has some moisture condition indicator particles.
 - Indicated blue means good. Pink means alarm to bake it.
- The reels will be deformed and the power supply might be damaged, if the vacuum pressure is too much to reseal.

7 Safety Considerations

- To apply for safety standard approval using this power supply, the following conditions must be met.
- This unit must be used as a component of the end-use equipment.
- Safety approved fuse must be externally installed on input side.

8 Derating

8.1 BRFS/BRDS series Derating

- Make sure the temperatures measurement locations shown from Fig.8.2 to Fig.8.6 below are on or under the derating curve in Fig.8.1.
- Ambient temperature must be kept at 85°C or under.

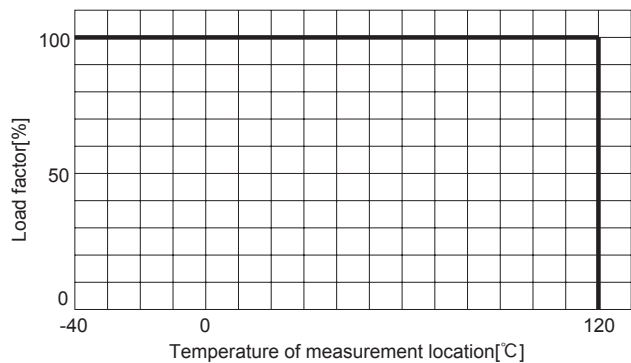


Fig.8.1 Derating curve

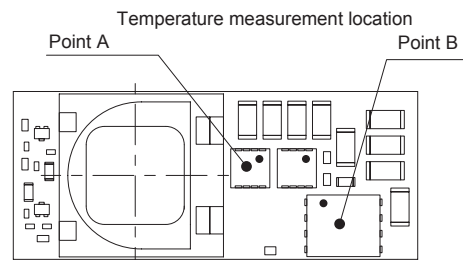


Fig.8.2 Temperature measurement location (BRFS30)

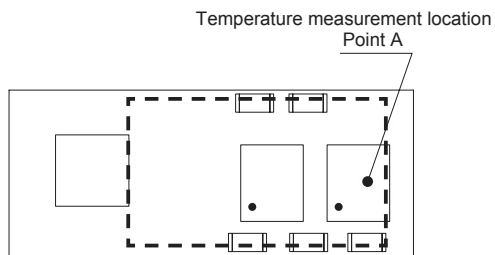


Fig.8.3 Temperature measurement location (BRFS40 · BRDS40)

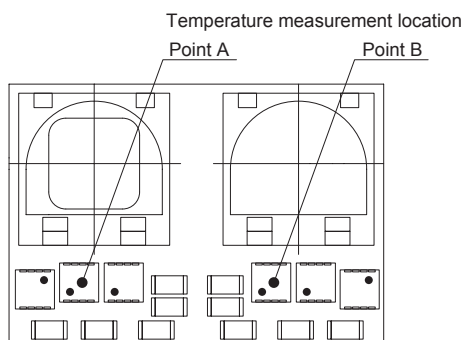


Fig.8.4 Temperature measurement location (BRFS50/50L)

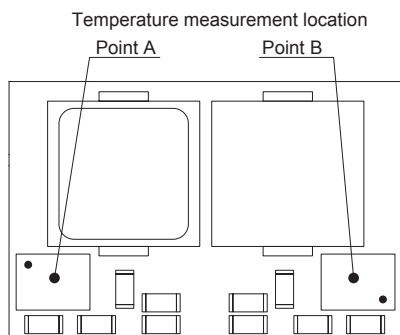


Fig.8.5 Temperature measurement location (BRFS60 · BRDS60)

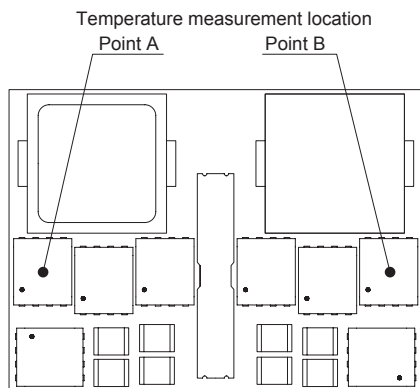


Fig.8.6 Temperature measurement location (BRFS100 · BRDS100)

9 Package Information

- Please refer to a Fig.9.1 to Fig.9.4 for Package form (Reel).
- The packed number is 200 (BRFS30/40 · BRDS40), 100 (BRFS50/50L/60 · BRDS60), 80 (BRFS100 · BRDS100).

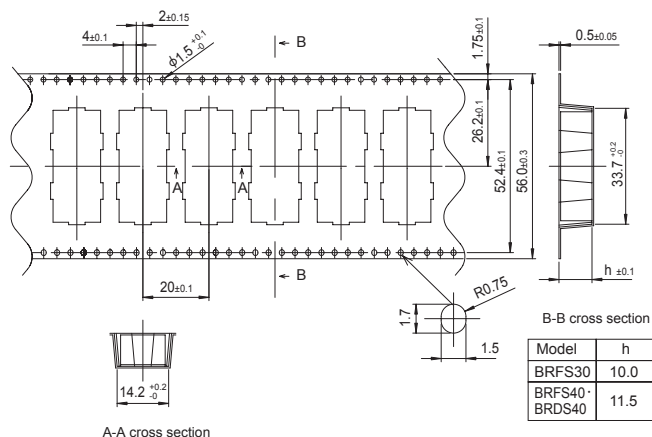


Fig.9.1 Taping dimensions of BRFS30/40 · BRDS40

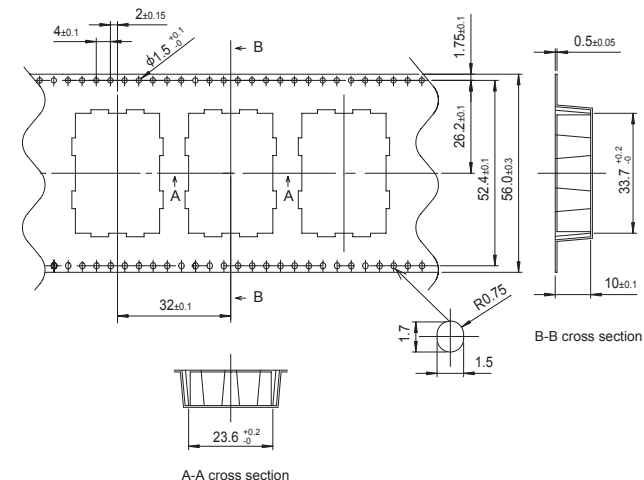


Fig.9.2 Taping dimensions of BRFS50/50L/60 · BRDS60

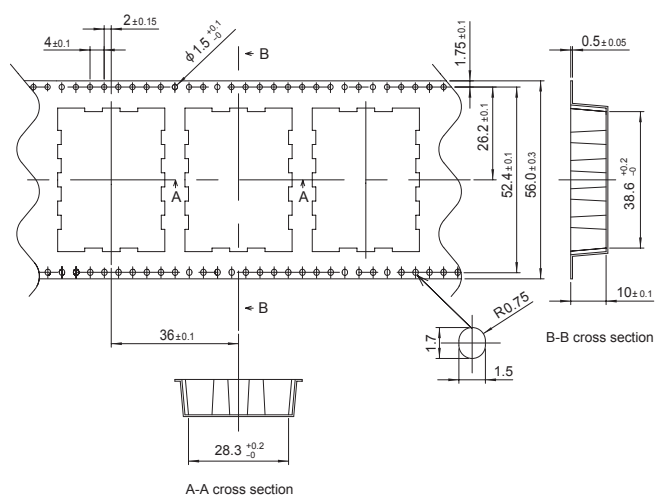
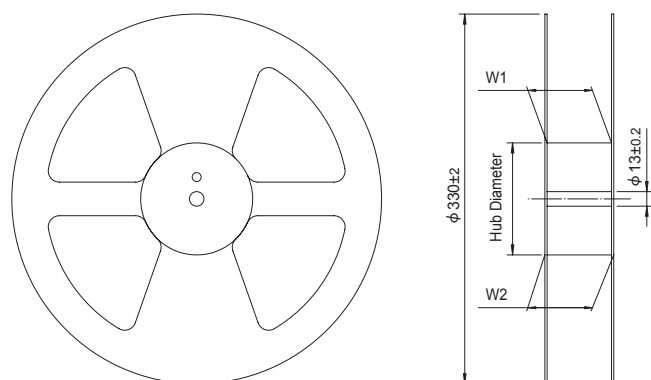


Fig.9.3 Taping dimensions of BRFS100 · BRDS100



Model	Tape Width [mm]	Hub Diameter [mm]	W1 [mm]	W2 [mm]
BRFS30/40 · BRDS40	56	100	57.4 ± 1.0	61.4 ± 1.0
BRFS50/50L/60 · BRDS60	56	150	57.5 ± 1.0	61.5 ± 1.0
BRFS100 · BRDS100	56	150	57.5 ± 1.0	61.5 ± 1.0

Fig.9.4 Reel dimensions

■ Please refer to specifications for the details of package information



Low Profile



Isolated

Safety
Approvals

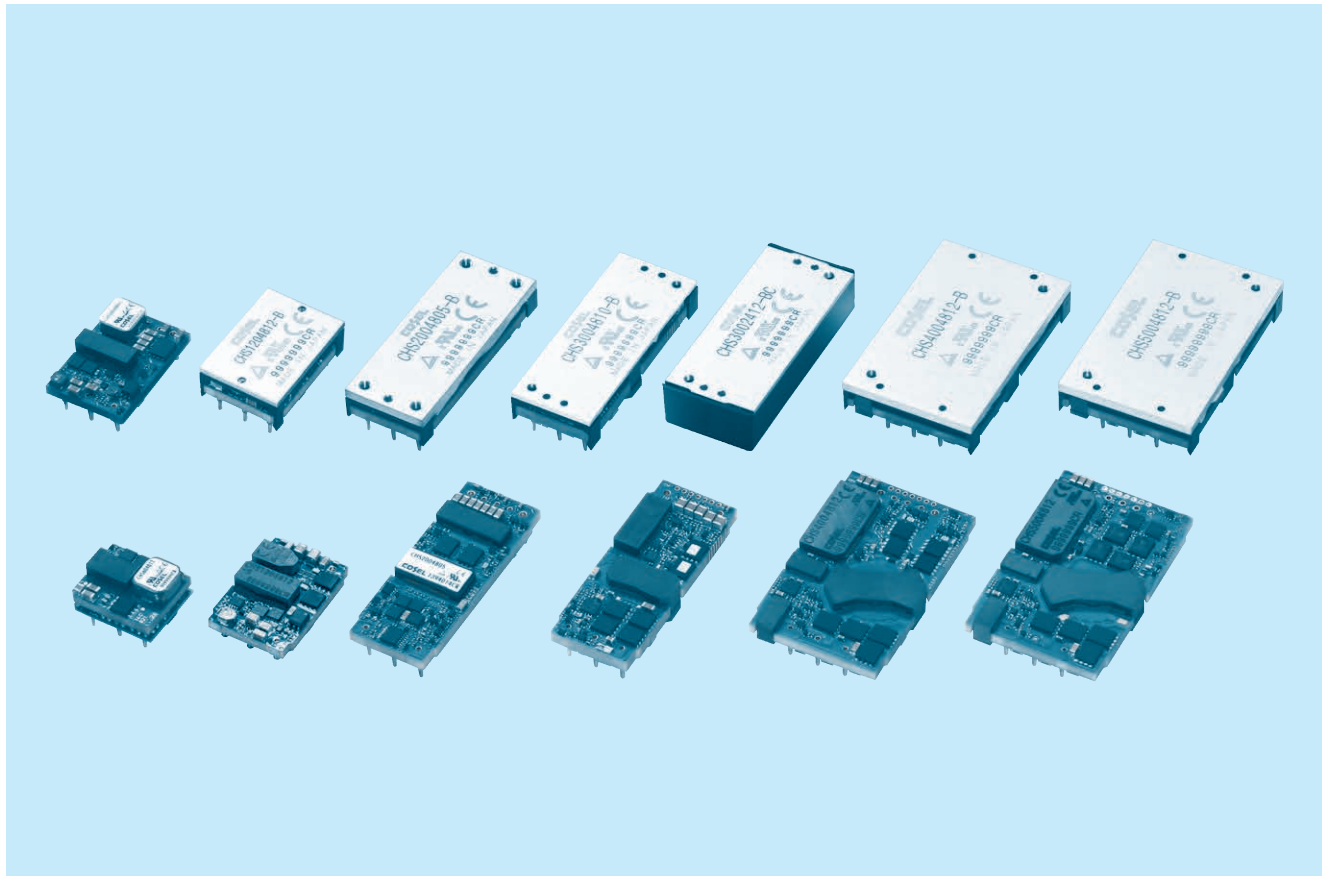
OCP



OVP

Remote
ON/OFF

CHS-series



CHS

Feature

- High efficiency 95% (CHS4004812)
- Compact DC-DC Converter, "BRICK SIZE" which has been standard size for Telecommunication Market
- High density
- High reliability : not built-in aluminum and tantalum electrolytic capacitor
- Built-in overcurrent, overvoltage and thermal protection circuits
- Built-in remote ON/OFF

CE marking

Low Voltage Directive

Safety agency approvals

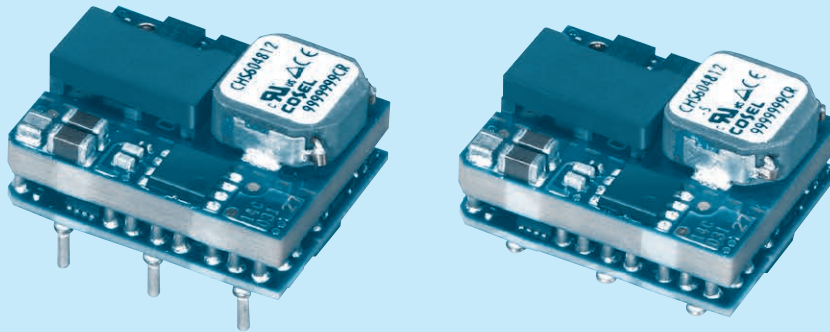
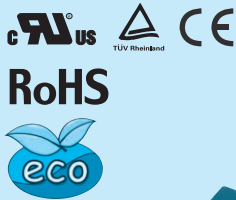
UL60950-1, C-UL, TÜV approved

5-year warranty

CHS60

CH S 60 48 3R3 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output power
- ④ Input voltage
48:DC36 - 76V
- ⑤ Output voltage
3R3:3.3V
05:5.0V
12:12V
- ⑥ Optional
R :with Remote ON/OFF
Positive logic control
U :Shut down in protection
circuit working
S :SMD

MODEL	CHS60483R3	CHS604805	CHS604812
MAX OUTPUT WATTAGE[W]	59.4	60.0	72.0
DC OUTPUT	3.3V 18A	5V 12A	12V 6A

SPECIFICATIONS

	MODEL	CHS60483R3	CHS604805	CHS604812
INPUT	VOLTAGE[V]	DC36 - 76		
	CURRENT[A]	*1 1.36typ	1.34typ	1.63typ
	EFFICIENCY[%]	*1 91.5typ	93.0typ	92.5typ
OUTPUT	VOLTAGE[V]	3.3	5	12
	CURRENT[A]	18	12	6
	LINE REGULATION[mV]	10max		
	LOAD REGULATION[mV]	10max		
	RIPPLE	[mVrms] *2 30max	30max	50max
		[mVp-p] *2 80max	100max	150max
	RIPPLE NOISE[mVp-p]	*2 120max	150max	180max
	TEMPERATURE REGULATION[mV]	66max	100max	240max
	DRIFT[mV]	*3 16max	20max	40max
	START-UP TIME[ms]	50max (DCIN 48V, Io=100%)		
	OUTPUT VOLTAGE ADJUSTMENT RANGE *4	Fixed (TRM pin open), adjustable by external resistor		
		-10% / +15%	-10% / +20%	-20% / +10%
	OUTPUT VOLTAGE SETTING	±1.6%		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating (Auto restart)		
	OVERVOLTAGE PROTECTION	120% - 140% (Auto restart)	125% - 145% (Auto restart)	115% - 135% (Auto restart)
	REMOTE SENSING	Provided		
	REMOTE ON/OFF	Provided (Negative Logic L : ON, H : OFF)		
ISOLATION	INPUT-OUTPUT	DC2,250V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)		
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85℃, 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 5,000m (16,000 feet) max		
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max		
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis		
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1		
OTHERS	CASE SIZE/WEIGHT	19.05 × 12.7 × 23.36mm [0.75 × 0.5 × 0.92 inches] (W × H × D) / 15g max		
	COOLING METHOD	Convection / Forced air		

*1 At rated input (DC48V) and rated load. Ta=25℃, 2m/s.

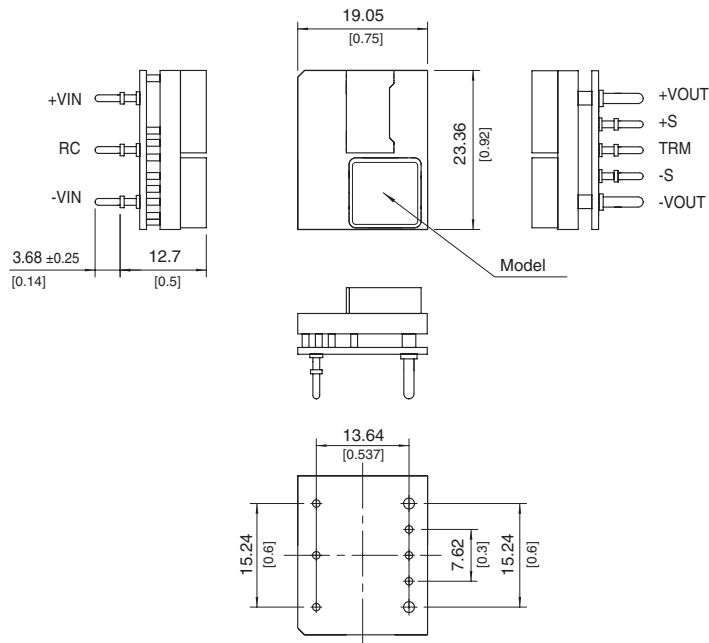
*2 Ripple and ripple noise is measured by using measuring board with ceramic capacitor 22 μF.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

*4 Refer to the instruction manual for input voltage derating.

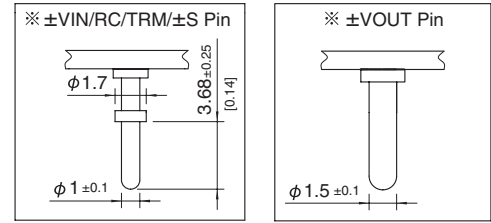
External view

1. DIP

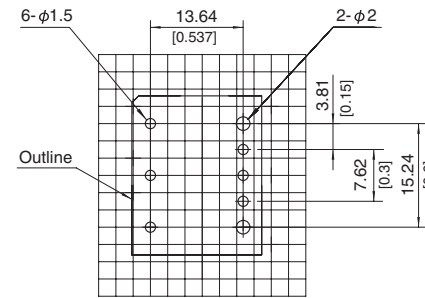


※ Tolerance: ±0.5 [±0.02]

※ Dimensions in mm, [] = inches



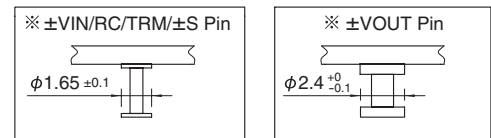
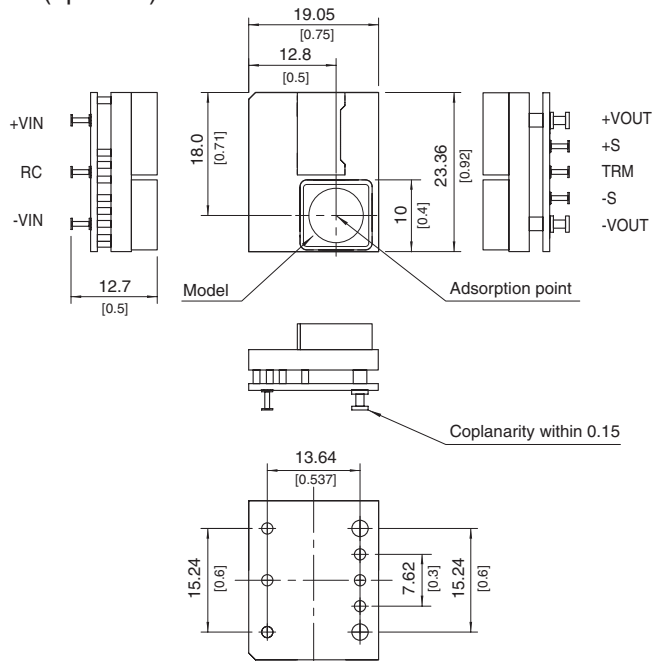
※ Recommended size for processing PCB (TOP VIEW)



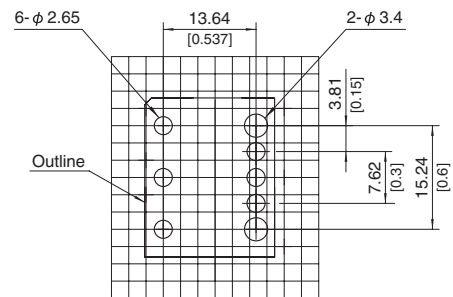
※ Dimensions in: $\frac{\text{mm}}{\text{[inch]}}$

※ Div.: 0.1inch

2. SMD (option S)



※ Recommended size for processing PCB (TOP VIEW)



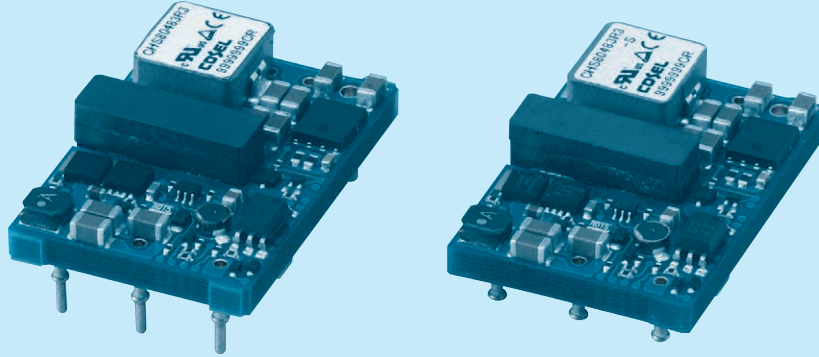
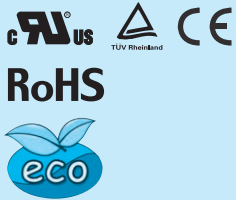
※ Dimensions in: $\frac{\text{mm}}{\text{[inch]}}$

※ Div.: 0.1inch

CHS80

CH S 80 48 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output power
- ④ Input voltage
- 48:DC36-76V
- ⑤ Output voltage
- 3R3:3.3V
- 05:5.0V
- 12:12V
- ⑥ Optional
- R :with Remote ON/OFF
- Positive logic control
- U :Shut down in protection
- circuit working
- S :SMD

MODEL	CHS80483R3	CHS804805	CHS804812
MAX OUTPUT WATTAGE[W]	82.5	80.0	90.0
DC OUTPUT	3.3V 25A	5.0V 16A	12V 7.5A

SPECIFICATIONS

	MODEL	CHS80483R3	CHS804805	CHS804812
INPUT	VOLTAGE[V]	DC36 - 76		
	CURRENT[A]	*1 1.86typ	1.81typ	2.03typ
	EFFICIENCY[%]	*1 92typ	92typ	92typ
OUTPUT	VOLTAGE[V]	3.3	5	12
	CURRENT[A]	25	16	7.5
	LINE REGULATION[mV]	± 10max		
	LOAD REGULATION[mV]	± 10max		
	RIPPLE	[mVrms] *2 30max	30max	50max
		[mVp-p] *2 80max	100max	150max
	RIPPLE NOISE[mVp-p]	*2 120max	150max	180max
	TEMPERATURE REGULATION[mV]	66max	100max	240max
	DRIFT[mV]	*3 16max	20max	40max
	START-UP TIME[ms]	200max (DCIN 48V, Io=100%)		
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open), adjustable by external resistor		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating (Auto restart)		
	OVERVOLTAGE PROTECTION	120% - 140% (Auto restart)	125% - 145% (Auto restart)	115% - 135% (Auto restart)
	REMOTE SENSING	Provided		
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)		
ISOLATION	INPUT-OUTPUT	DC2,250V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)		
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85℃, 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max		
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max		
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis		
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1		
OTHERS	CASE SIZE/WEIGHT	33.0 × 10.5 × 22.76mm [1.3 × 0.41 × 0.9 inches] (W×H×D) / 21g max		
	COOLING METHOD	Convection / Forced air		

*1 At rated input(DC48V) and rated load. Ta=25℃, 2m/s.

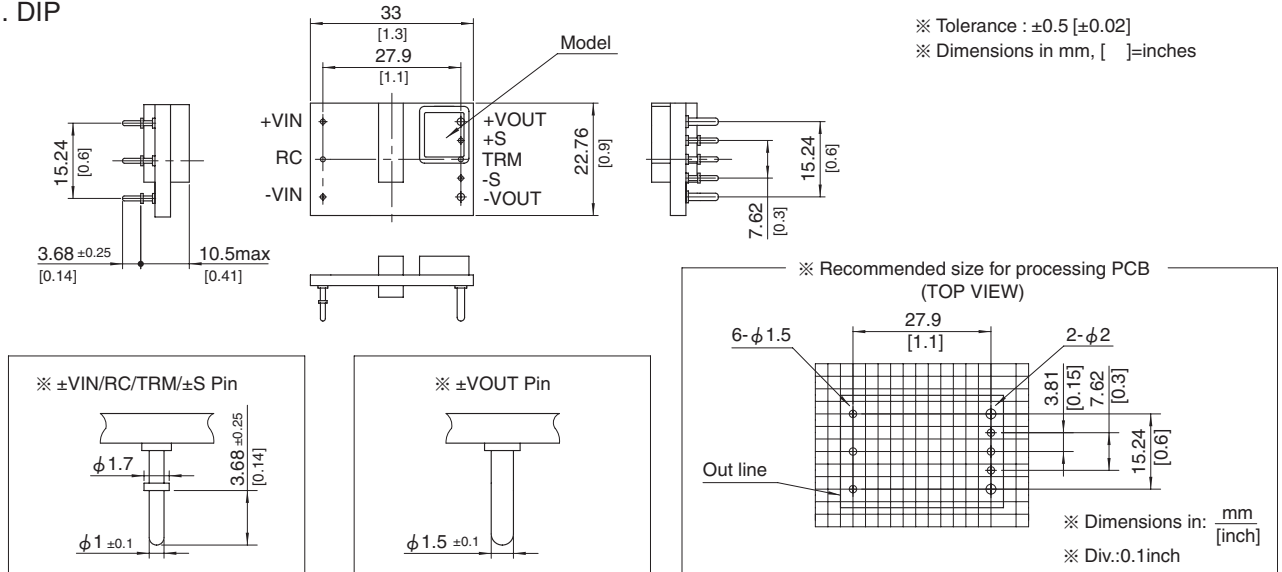
*2 Ripple and ripple noise is measured by using measuring board with ceramic capacitor 22μF.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

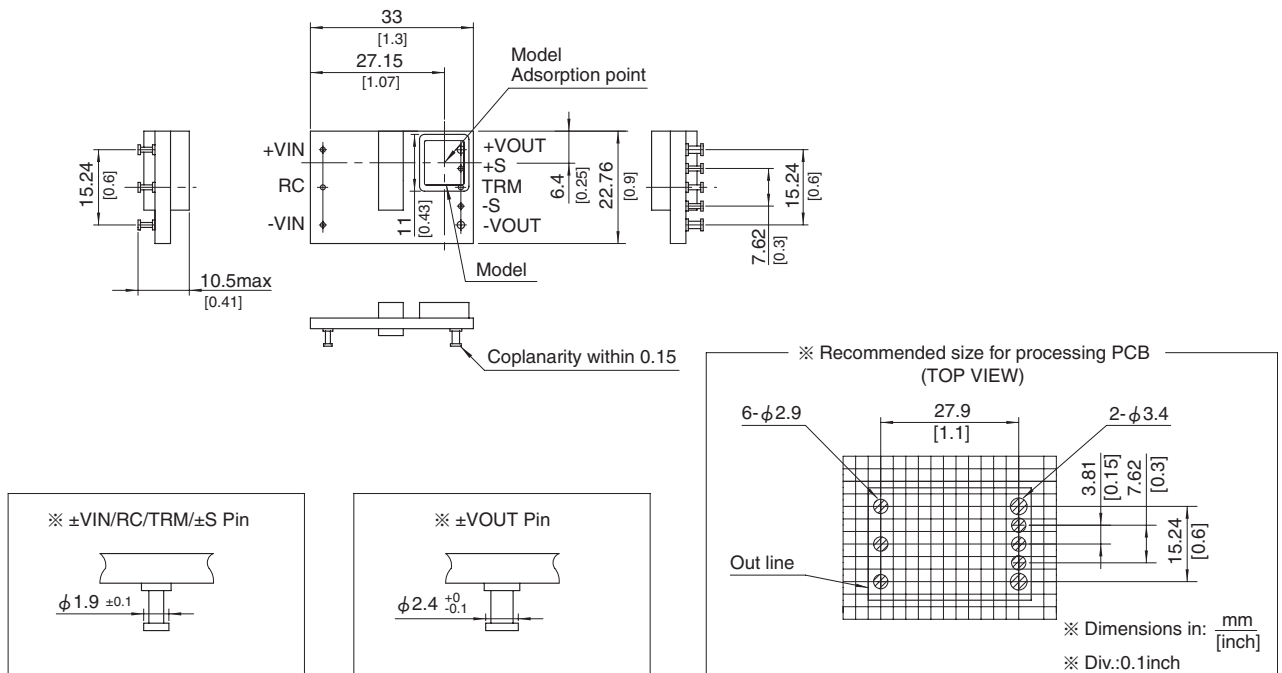
*4 Refer to the instruction manual for input voltage derating.

External view

1. DIP



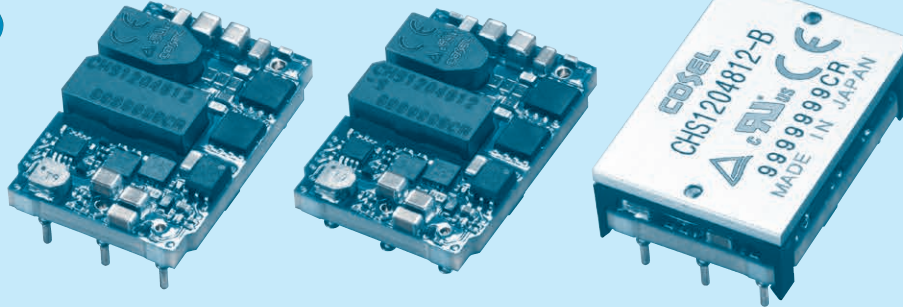
2. SMD (optionS)



CHS120

CH S 120 48 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output power
- ④ Input voltage
48:DC36-76V
- ⑤ Output voltage
3R3:3.3V
05:5.0V
12:12V
- ⑥ Optional
R :with Remote ON/OFF
Positive logic control
U :Shut down in protection
circuit working
S :SMD
B :BasePlate option
L2:Pin length 5.3mm
L5:5pins option
(+S,-S,TRM less)

MODEL	CHS120483R3	CHS1204805	CHS1204812
MAX OUTPUT WATTAGE[W]	99.0	120.0	120.0
DC OUTPUT	3.3V 30A	5V 24A	12V 10A

SPECIFICATIONS

MODEL	CHS120483R3	CHS1204805	CHS1204812
INPUT	VOLTAGE[V]	DC36 - 76	
	CURRENT[A]	2.23typ	2.69typ
	EFFICIENCY[%]	92.5typ	93typ
OUTPUT	VOLTAGE[V]	3.3	5
	CURRENT[A]	30	24
	LINE REGULATION[mV]	±10max	
	LOAD REGULATION[mV]	±10max	
	RIPPLE		
	[mVrms]	30max	30max
	[mVp-p]	80max	100max
	RIPPLE NOISE[mVp-p]	120max	150max
	TEMPERATURE REGULATION[mV]	66max	100max
	DRIFT[mV]	16max	20max
	START-UP TIME[ms]	50max (DCIN 48V, I _o =100%)	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating (Auto restart)	
	OVERVOLTAGE PROTECTION	120% - 140% (Auto restart)	125% - 145% (Auto restart)
	REMOTE SENSING	Provided	
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)	
ISOLATION	INPUT-OUTPUT	DC2,250V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)	
	INPUT-BASEPLATE	DC2,250V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)	
	OUTPUT-BASEPLATE	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)	
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85℃, 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 5,000m (16,000feet) max	
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max	
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis	
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis	
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1	
OTHERS	CASE SIZE/WEIGHT	33.0 × 10.5 × 22.86mm [1.3 × 0.41 × 0.9 inches] (W × H × D) / 19g max	
	COOLING METHOD	Convection / Forced air / Conduction	

*1 At rated input(DC48V) and rated load. Ta=25℃, 2m/s.

*2 Ripple and ripple noise is measured by using measuring board with ceramic capacitor 22 μF.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

*4 Refer to the instruction manual for input voltage derating.

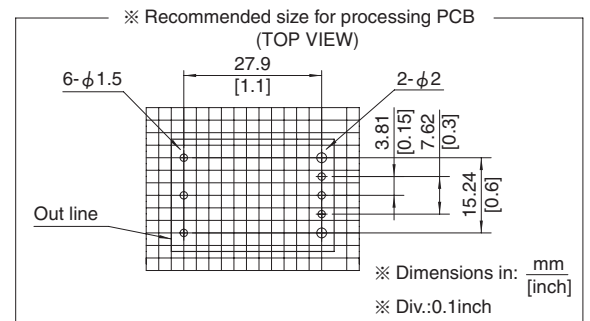
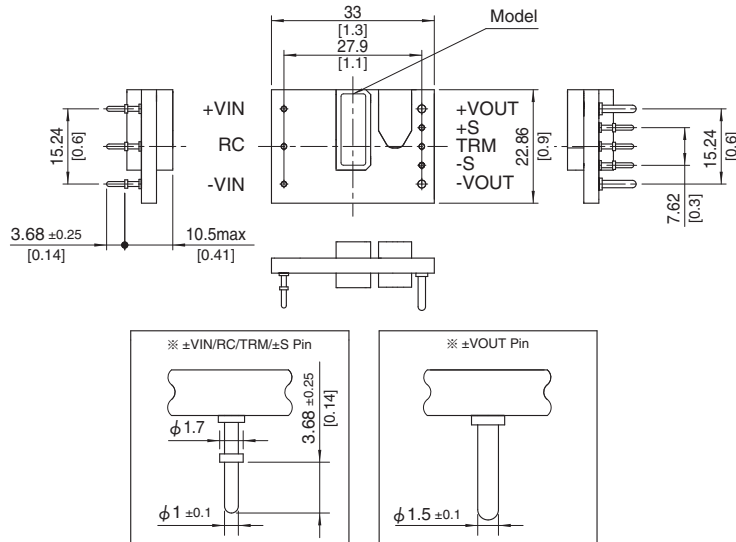
*5 BasePlate Option.

External view

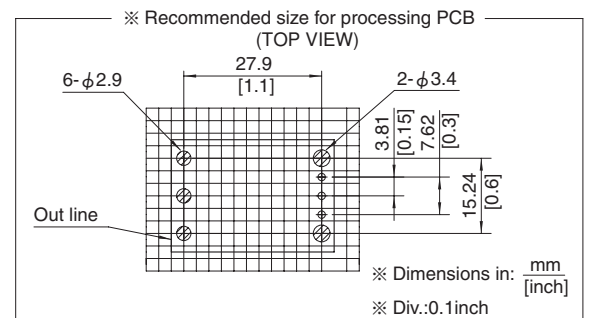
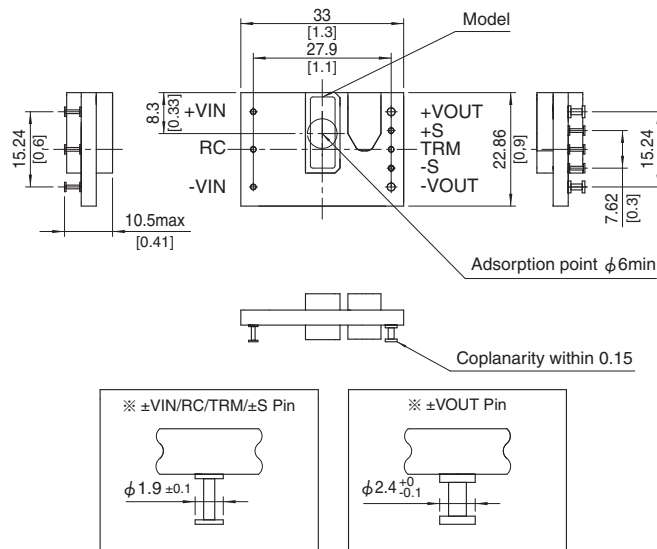
1. DIP

※ Tolerance : ± 0.5

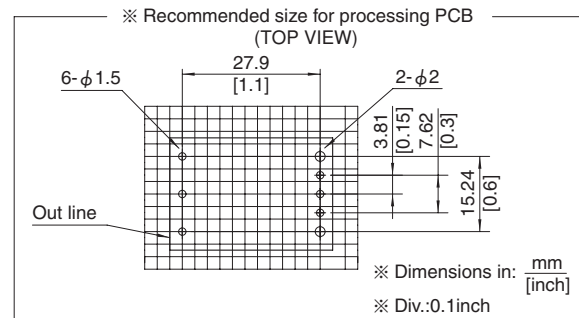
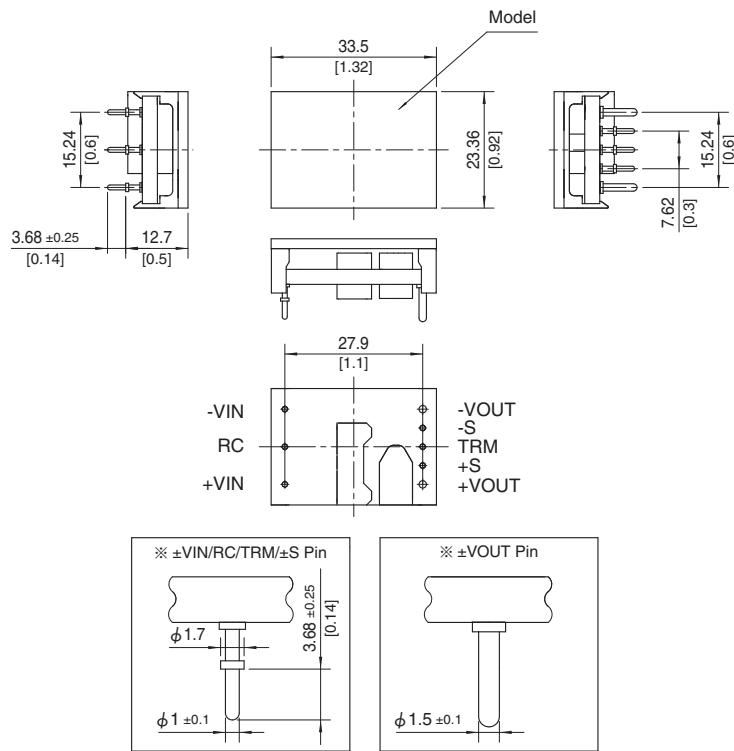
※ Dimensions in mm, []=inches



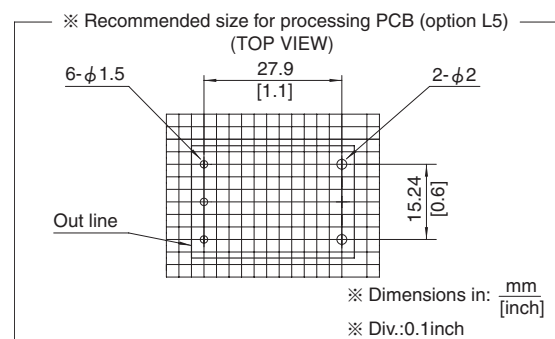
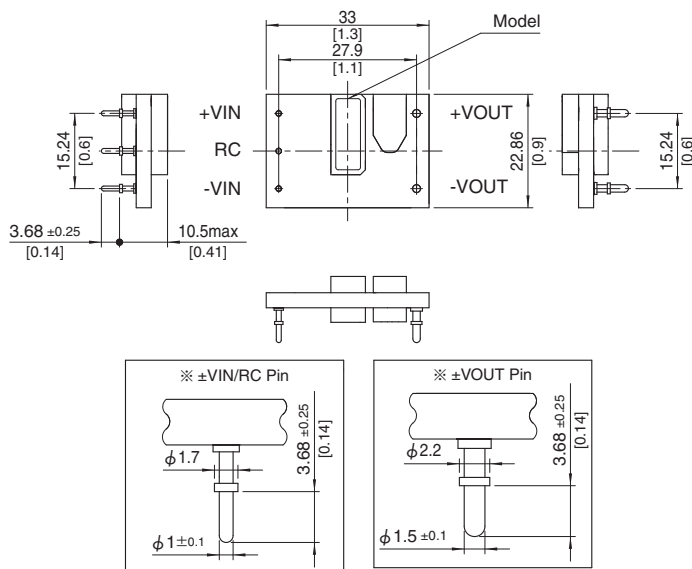
2. SMD (option S)



3. BasePlate (optionB)



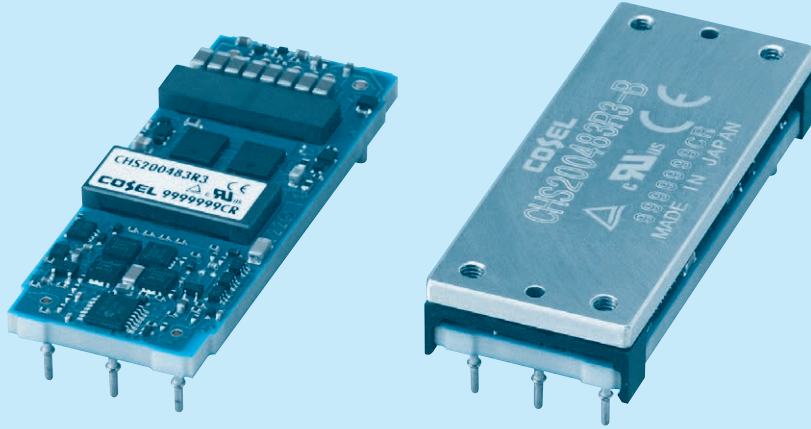
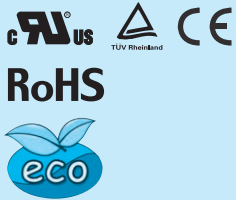
4. 5pins type (option L5)



CHS200

CH S 200 48 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output power
- ④ Input voltage
48:DC36-76V
- ⑤ Output voltage
3R3:3.3V
05:5.0V
12:12V
- ⑥ Optional
R :with Remote ON/OFF
Positive logic control
U :Shut down in protection
circuit working
B :BasePlate option with
Mounting hole M3
L2:Pin length 5.3mm
L5:5pins option
(+S,-S,TRM less)

MODEL	CHS200483R3	CHS2004805	CHS2004812
MAX OUTPUT WATTAGE[W]	165.0	200.0	192.0
DC OUTPUT	3.3V 50A	5.0V 40A	12V 16A

SPECIFICATIONS

MODEL	CHS200483R3	CHS2004805	CHS2004812
INPUT	VOLTAGE[V]	DC36 - 76	
	CURRENT[A]	3.70typ	4.43typ
	EFFICIENCY[%]	93typ	94typ
OUTPUT	VOLTAGE[V]	3.3	5
	CURRENT[A]	50	40
	LINE REGULATION[mV]	±10max	
	LOAD REGULATION[mV]	±10max	
	RIPPLE	[mVrms]	30max
		[mVp-p]	80max
	RIPPLE NOISE[mVp-p]	120max	150max
	TEMPERATURE REGULATION[mV]	66max	100max
	DRIFT[mV]	16max	20max
	START-UP TIME[ms]	200max (DCIN 48V, Io=100%)	
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open), adjustable by external resistor	
	ADJUSTMENT RANGE	-10% / +15%	-10% / +20%
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating (Auto restart)	
	OVERVOLTAGE PROTECTION	120% - 140% (Auto restart)	125% - 145% (Auto restart)
	REMOTE SENSING	Provided	
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)	
ISOLATION	INPUT-OUTPUT	DC2,250V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)	
	INPUT-BASEPLATE	DC2,250V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)	
	OUTPUT-BASEPLATE	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)	
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85℃, 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max	
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max	
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis	
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis	
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1	
OTHERS	CASE SIZE/WEIGHT	57.9 × 10.5 × 22.76mm [2.28 × 0.41 × 0.9 inches] (W × H × D) / 30g max	
	COOLING METHOD	Convection / Forced air / Conduction	

*1 At rated input(DC48V) and rated load. Ta=25℃, 2m/s.

*2 Ripple and ripple noise is measured by using measuring board with ceramic capacitor 22μF.

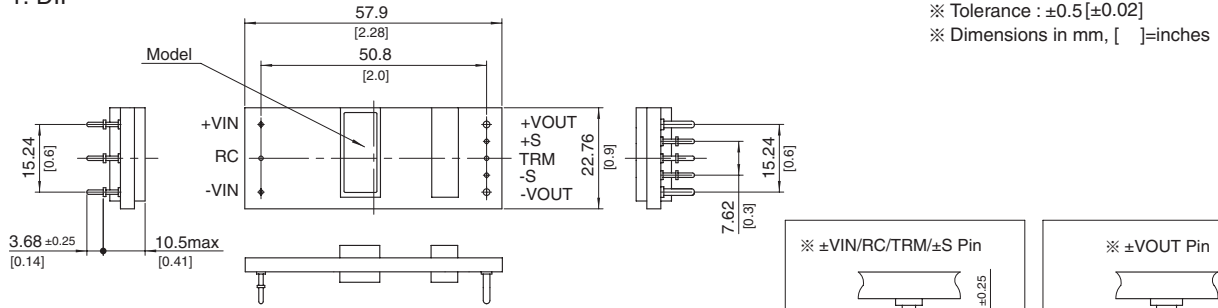
*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

*4 Refer to the instruction manual for input voltage derating.

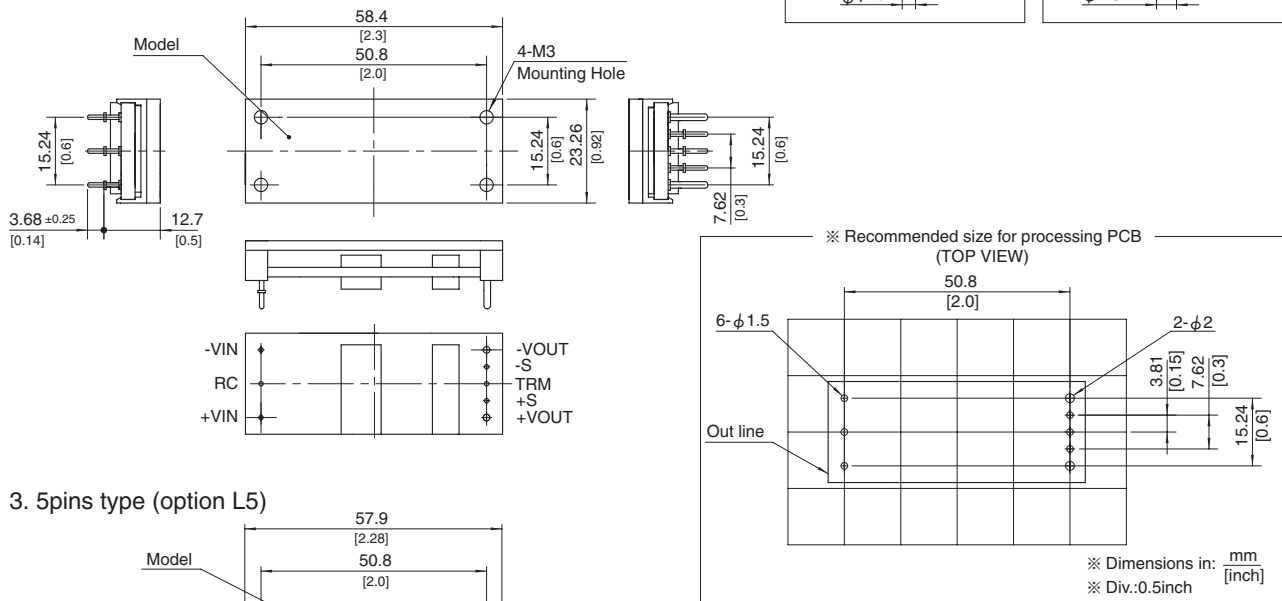
*5 BasePlate Option.

External view

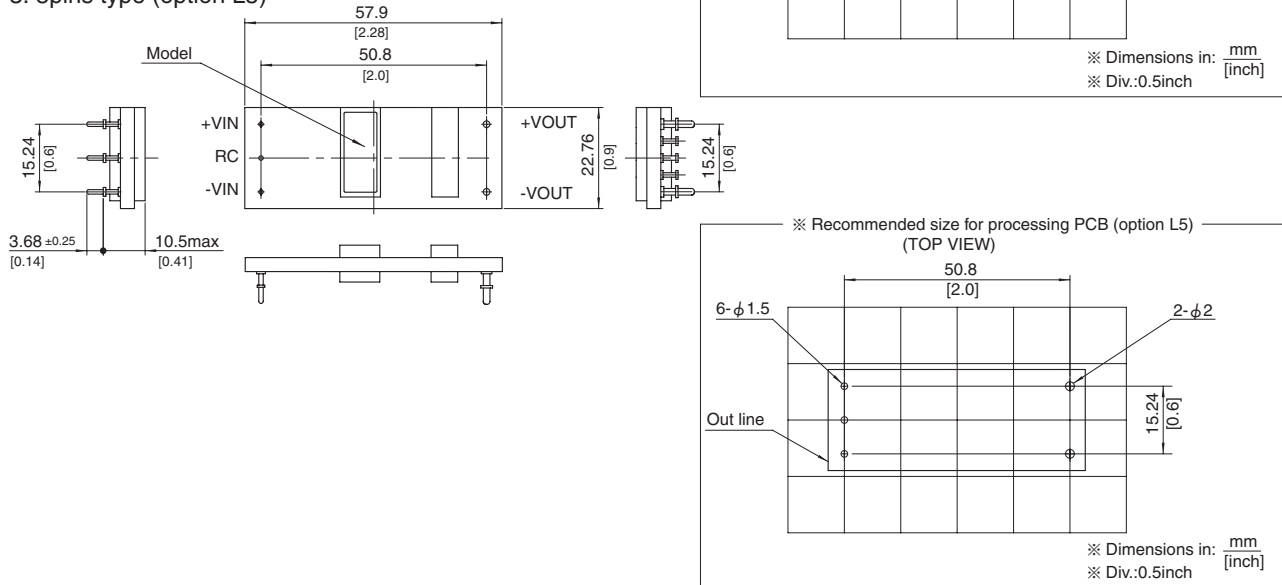
1. DIP



2. BasePlate (optionB)



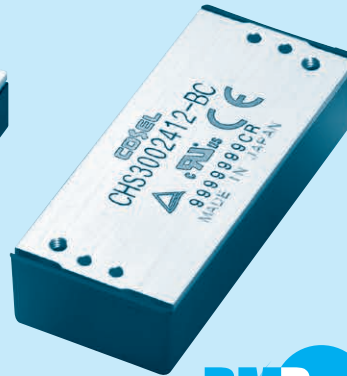
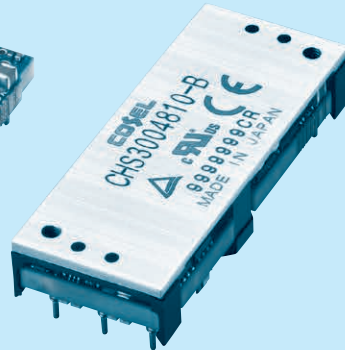
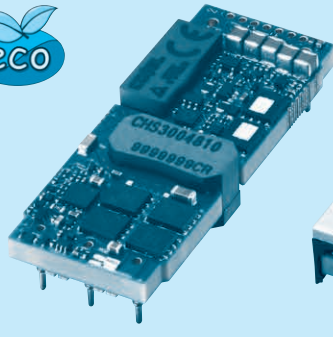
3. 5pins type (option L5)



CHS300

CH S 300 48 10 - ☐

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output power
- ④ Input voltage
24:DC18 - 36V
48:DC36 - 76V
- ⑤ Output voltage
05:5V
10:10V
12:12V
12H: 12V (High efficiency type)
15:15V
- ⑥ Optional
R :with Remote ON/OFF
Positive logic control
U :Shut down in protection
circuit working
B :Baseplate option with
mounting hole M3
BC:Baseplate and case option
with mounting hole M3
(only CHS30024)
L2:Pin length 5.3mm
L5:5pins option
(+S,-S,TRM less)
I :with the PMBus interface
(only CHS3004810/4812)

MODEL	CHS3002405	CHS3002412	CHS3002415
MAX OUTPUT WATTAGE[W]	200.0	200.4	202.5
DC OUTPUT	5V 40A	12V 16.7A	15V 13.5A

SPECIFICATIONS

	MODEL	CHS3002405	CHS3002412	CHS3002415
INPUT	VOLTAGE[V]	DC18 - 36		
	CURRENT[A]	*1 8.91typ	9.08typ	9.02typ
	EFFICIENCY[%]	*1 93.5typ	92.0typ	93.5typ
OUTPUT	VOLTAGE[V]	5	12	15
	CURRENT[A]	40	16.7	13.5
	LINE REGULATION[mV]	10max	24max	30max
	LOAD REGULATION[mV]	10max	24max	30max
	RIPPLE	[mVrms] *2 40max	50max	100max
		[mVp-p] *2 120max	150max	280max
	RIPPLE NOISE[mVp-p]	*2 150max	180max	300max
	TEMPERATURE REGULATION[mV]	120max	240max	300max
	DRIFT[mV]	*3 20max	40max	50max
	START-UP TIME[ms]	50max (DCIN 24V, Io=100%)		
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open), adjustable by external resistor -20% / +20%		
	OUTPUT VOLTAGE SETTING	*1 ±1.6%	-20% / +10%	-20% / +5%
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating (Auto restart)		
	OVERVOLTAGE PROTECTION	125% - 145% (Auto restart)	115% - 135% (Auto restart)	110% - 130% (Auto restart)
	REMOTE SENSING	Provided		
	REMOTE ON/OFF	Provided (Negative Logic L : ON, H :OFF)		

MODEL	CHS3004810	CHS3004812	CHS3004812H
MAX OUTPUT WATTAGE[W]	300.0	300.0	300.0
DC OUTPUT	10V 30A	12V 25A	12V 25A

SPECIFICATIONS

	MODEL	CHS3004810	CHS3004812	CHS3004812H
INPUT	VOLTAGE[V]	DC36 - 76		
	CURRENT[A]	*1 6.61typ	6.61typ	6.55typ
	EFFICIENCY[%]	*1 94.5typ	94.5typ	95.5typ
OUTPUT	VOLTAGE[V]	10	12	12
	CURRENT[A]	30	25	25
	LINE REGULATION[mV]	*6 20max	24max	24max
	LOAD REGULATION[mV]	*6 20max	24max	24max
	RIPPLE	[mVrms] *2 40max	50max	50max
		[mVp-p] *2 120max	150max	150max
	RIPPLE NOISE[mVp-p]	*2 150max	180max	180max
	TEMPERATURE REGULATION[mV]	200max	240max	240max
	DRIFT[mV]	*3 30max	40max	40max
	START-UP TIME[ms]	50max (DCIN 48V, Io=100%)		
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open), adjustable by external resistor -10% / +10%		
	OUTPUT VOLTAGE SETTING	*1 ±1.6%		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating (Auto restart)		
	OVERVOLTAGE PROTECTION	115% - 135% (Auto restart)		
	REMOTE SENSING	Provided		
	REMOTE ON/OFF	Provided (Negative Logic L : ON, H :OFF)		

GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	DC2,250V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
	INPUT-BASEPLATE *5,*7	DC2,250V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
	OUTPUT-BASEPLATE *5,*7	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 5,000m (16,000 feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1
OTHERS	CASE SIZE/WEIGHT	58.4 X 11.0 X 22.86mm [2.3 X 0.43 X 0.9 inches] (W X H X D) / 38g max
		58.9 X 12.7 X 23.26mm [2.32 X 0.5 X 0.92 inches] (W X H X D) / 50g max *5
		61.1 X 14.3 X 26.1 [2.41 X 0.56 X 1.03 inches] (W X H X D) / 57g max *7
	COOLING METHOD	Convection / Forced air / Conduction

*1 At rated input (DC24V, DC48V) and rated load. Ta=25 $^{\circ}$ C, 2m/s.

*2 Ripple and ripple noise is measured by using measuring board with ceramic capacitor 22 μ F.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25 $^{\circ}$ C, with the input voltage held constant at the rated input/output.

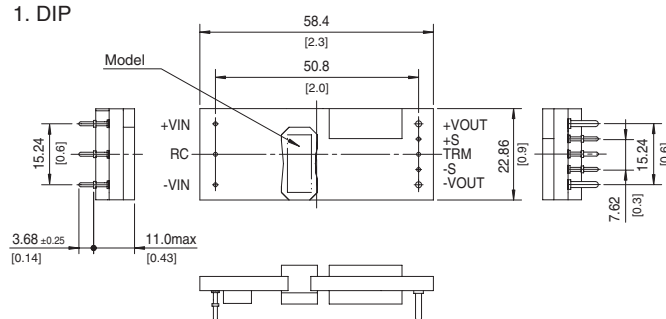
*4 Refer to the instruction manual for input voltage derating.

*5 BasePlate Option.

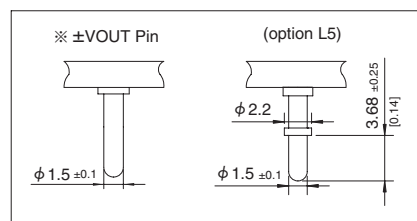
*6 At input voltage DC36 - 76V (CHS3004810, CHS3004812), DC40 - 76V (CHS3004812H).

*7 Baseplate and case option.

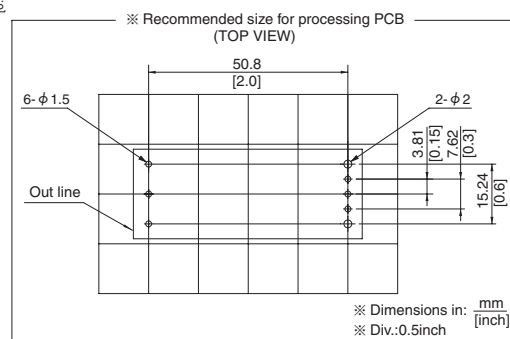
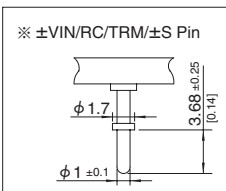
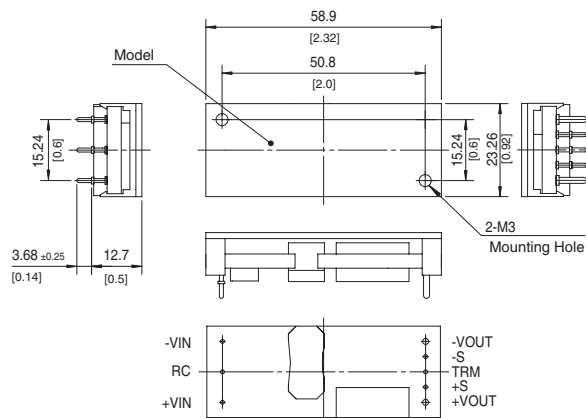
1. DIP



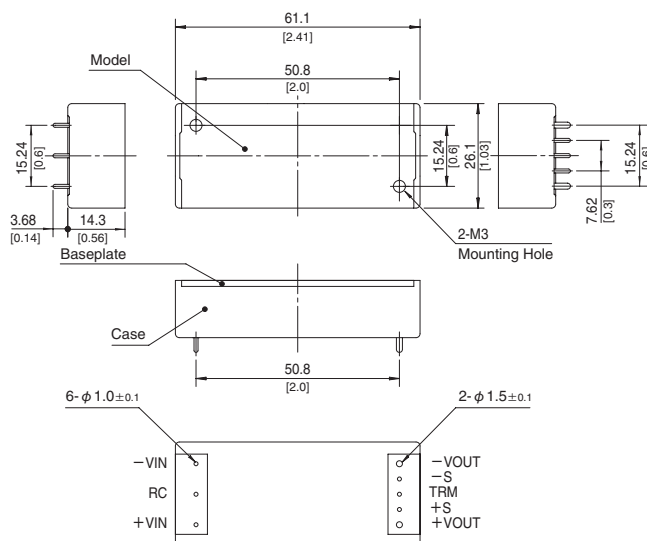
※ Tolerance: ±0.5 [±0.02]
 ※ Dimensions in mm, []=inches



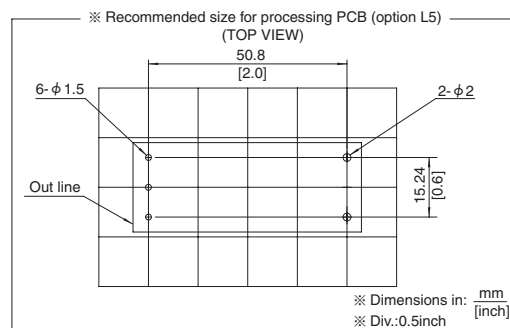
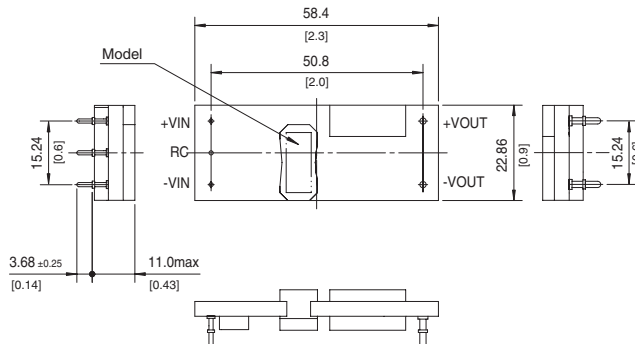
2. BasePlate (optionB)



3. Baseplate and case (option BC)



4. 5pins type (option L5)

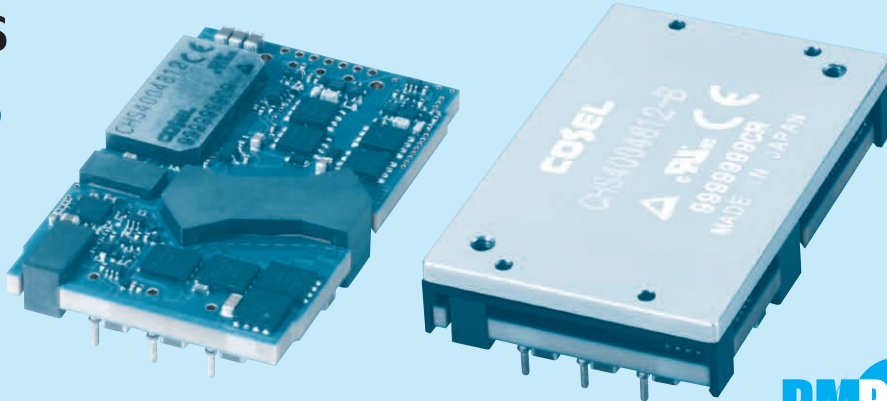


* Please contact us about external view of the PMBus interface (option I).

CHS400

CH S 400 48 12 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output power
- ④ Input voltage
48:DC36 - 76V
- ⑤ Output voltage
10:10V
12:12V
12H:12V(High efficiency type)
- ⑥ Optional
R :with Remote ON/OFF
Positive logic control
U :Shut down in protection
circuit working
B :BasePlate option with
Mounting hole M3
P :Parallel operation (5Pins
:without +S,-S and TRM)
L2:Pin length 5.3mm
L5:5pins type (+S,-S,TRM
less)
I :with the PMBus interface
(Only CHS4004812)

MODEL	CHS4004810	CHS4004812	CHS4004812H
MAX OUTPUT WATTAGE[W]	400.0	396.0	396.0
DC OUTPUT	10V 40A	12V 33A	12V 33A

SPECIFICATIONS

	MODEL	CHS4004810	CHS4004812	CHS4004812H
INPUT	VOLTAGE[V]	DC36 - 76		
	CURRENT[A]	8.82typ	8.68typ	8.64typ
	EFFICIENCY[%]	94.5typ	95typ	95.5typ
OUTPUT	VOLTAGE[V]	10	12	12
	CURRENT[A]	40	33	33
	LINE REGULATION[mV]	±10max	±12max	±12max
	LOAD REGULATION[mV]	±10max	±12max	±12max
	RIPPLE	[mVrms]	60max	60max
		[mVp-p]	160max	180max
	RIPPLE NOISE[mVp-p]	180max	200max	200max
	TEMPERATURE REGULATION[mV]	200max	240max	240max
	DRIFT[mV]	30max	40max	40max
	START-UP TIME[ms]	50max (DCIN 48V, I _o =100%)		
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external resistor (N/A : parallel operation)		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating (Auto restart)		
	OVERVOLTAGE PROTECTION	115% - 135% (Auto restart)		
	REMOTE SENSING	Provided (N/A : parallel operation)		
	REMOTE ON/OFF	Provided (Negative Logic L : ON, H : OFF)		
ISOLATION	INPUT-OUTPUT	DC2,250V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)		
	INPUT-BASEPLATE	DC2,250V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)		
	OUTPUT-BASEPLATE	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)		
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85℃, 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 5,000m (16,000 feet) max		
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max		
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis		
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950		
OTHERS	CASE SIZE/WEIGHT	58.4×9.5×36.8mm [2.3×0.37×1.45 inches] (W×H×D) / 60g max		
	COOLING METHOD	58.9×12.7×37.3mm [2.32×0.5×1.47 inches] (W×H×D) / 90g max		
		Convection / Forced air / Conduction		

*1 At rated input (DC48V) and rated load. Ta=25℃, 2m/s.

*2 Ripple and ripple noise is measured by using measuring board with ceramic capacitor 22 μF.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

*4 Refer to the instruction manual for input voltage derating.

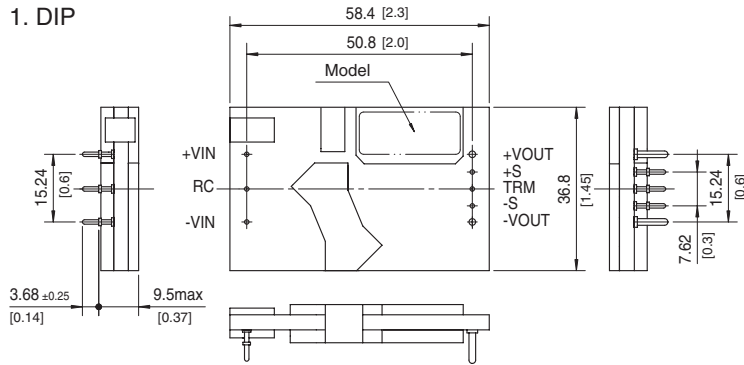
*5 BasePlate Option.

*6 Parallel operation Option is not included.

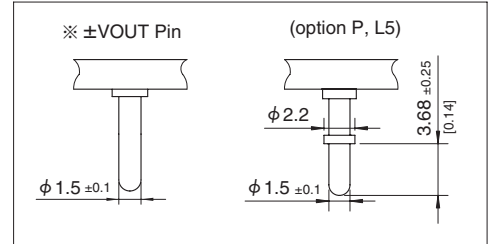
*7 At input voltage DC36-76V(CHS4004810, CHS4004812), DC40-76V(CHS4004812H).

External view

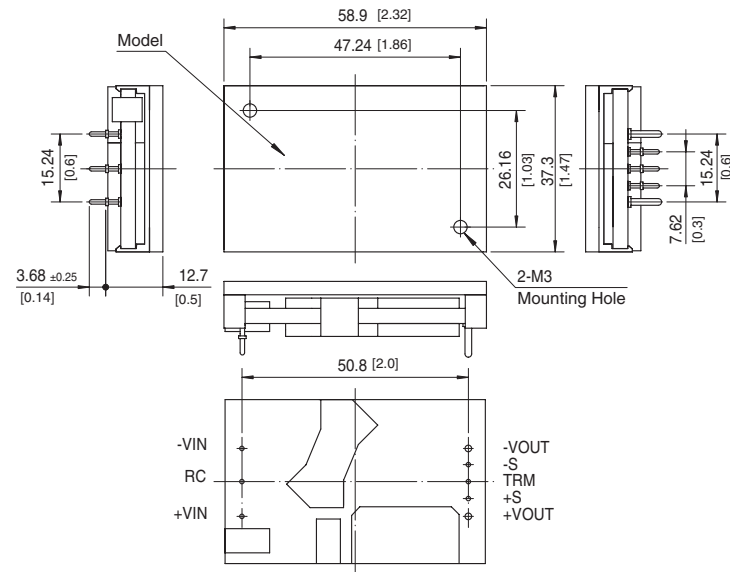
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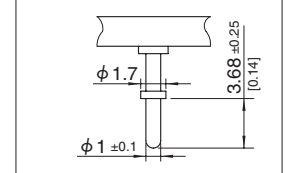
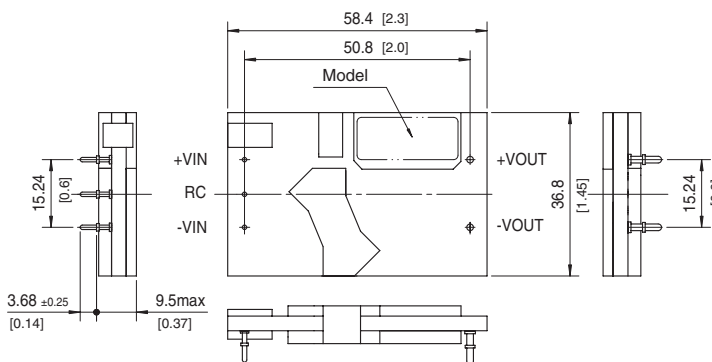
※ Tolerance: ± 0.5 [± 0.02]
 ※ Dimensions in mm, []=inches



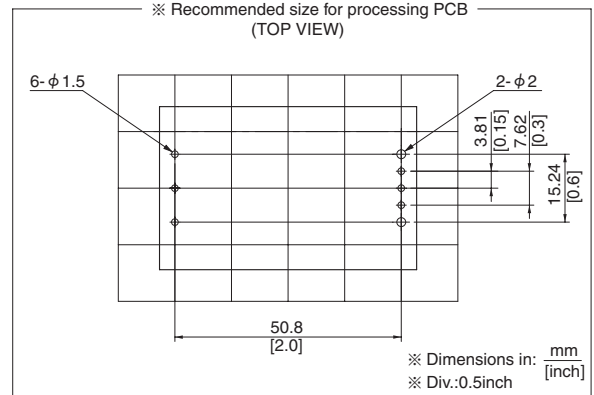
2. BasePlate (optionB)



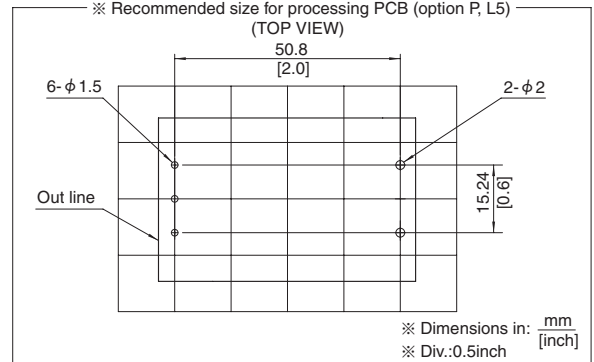
※ \pm VIN/RC/TRM/ \pm S Pin

3. Parallel operation (option P)
5pins type (option L5)

※ Recommended size for processing PCB
 (TOP VIEW)



※ Recommended size for processing PCB (option P, L5)
 (TOP VIEW)

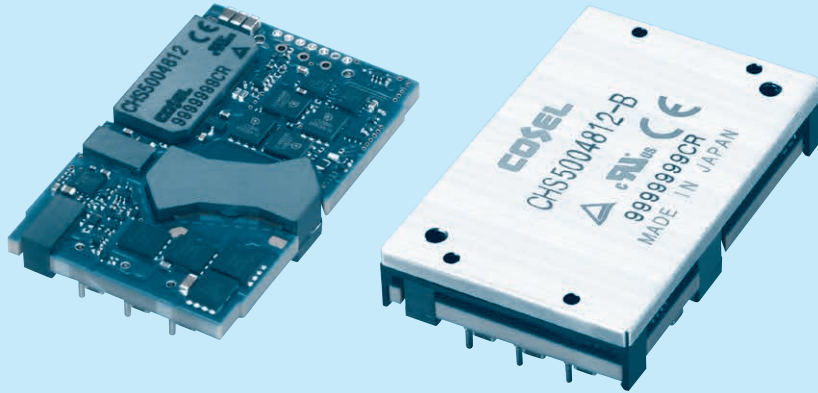
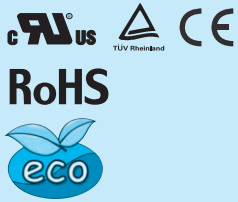


*Please contact us about external view of the PMBus interface (option I).

CHS500

CH S 500 48 12 - ☐

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output power
- ④ Input voltage
48:DC36 - 76V
- ⑤ Output voltage
12:12V
- ⑥ Optional
 - R :with Remote ON/OFF
Positive logic control
 - U :Shut down in protection
circuit working
 - B :BasePlate option with
Mounting hole M3
 - P :Parallel operation (5Pins
:without +S,-S and TRM)
 - L2:Pin length 5.3mm
 - L5:5pins type (+S,-S,TRM
less)

MODEL	CHS5004812
MAX OUTPUT WATTAGE[W]	504.0
DC OUTPUT	12V 42A

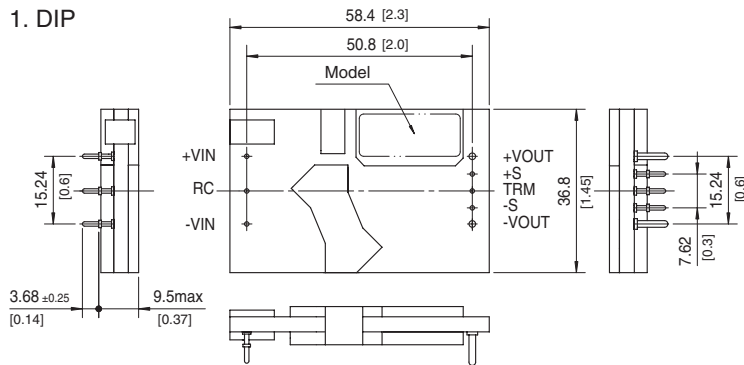
SPECIFICATIONS

	MODEL	CHS5004812
INPUT	VOLTAGE[V]	DC36 - 76
	CURRENT[A]	*1 11.06typ
	EFFICIENCY[%]	*1 95typ
OUTPUT	VOLTAGE[V]	12
	CURRENT[A]	42
	LINE REGULATION[mV]	±12max
	LOAD REGULATION[mV]	*6 ±12max
	RIPPLE	[mVrms] *2 60max
		[mVp-p] *2 180max
	RIPPLE NOISE[mVp-p]	*2 200max
	TEMPERATURE REGULATION[mV]	240max
	DRIFT[mV]	*3 40max
	START-UP TIME[ms]	50max (DCIN 48V, Io=100%)
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating (Auto restart)
	OVERVOLTAGE PROTECTION	115% - 135% (Auto restart)
	REMOTE SENSING	Provided (N/A : parallel operation)
	REMOTE ON/OFF	Provided (Negative Logic L : ON, H :OFF)
ISOLATION	INPUT-OUTPUT	DC2,250V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)
	INPUT-BASEPLATE	*5 DC2,250V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)
	OUTPUT-BASEPLATE	*5 AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85℃, 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 5,000m (16,000 feet) max
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950
OTHERS	CASE SIZE/WEIGHT	58.4×9.5×36.8mm [2.3×0.37×1.45 inches] / 60g max
	COOLING METHOD	58.9×12.7×37.3mm [2.32×0.5×1.47 inches] (W×H×D) / 90g max *5 Convection / Forced air / Conduction

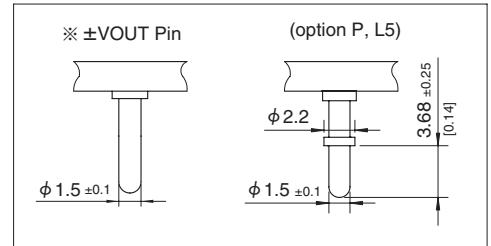
- *1 At rated input (DC48V) and rated load. Ta=25℃, 2m/s.
- *2 Ripple and ripple noise is measured by using measuring board with ceramic capacitor 22 μF.
- *3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.
- *4 Refer to the instruction manual for input voltage derating.
- *5 BasePlate Option.
- *6 Parallel operation Option is not included.

External view

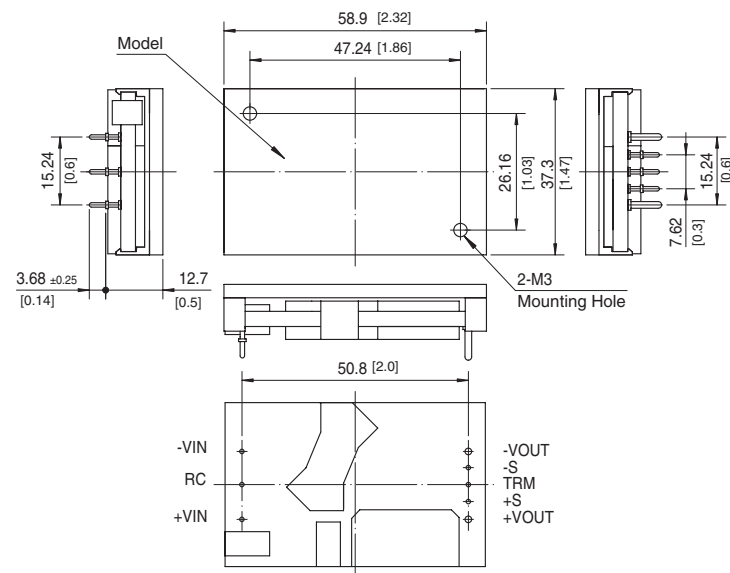
1. DIP



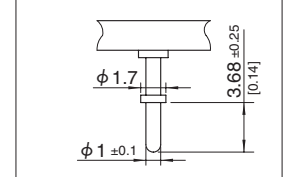
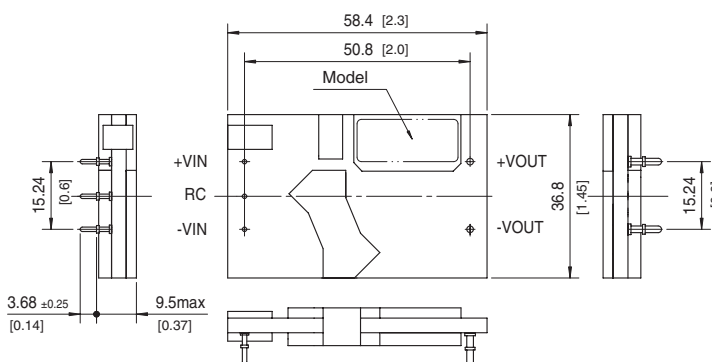
※ Tolerance: ±0.5 [±0.02]
※ Dimensions in mm, []=inches



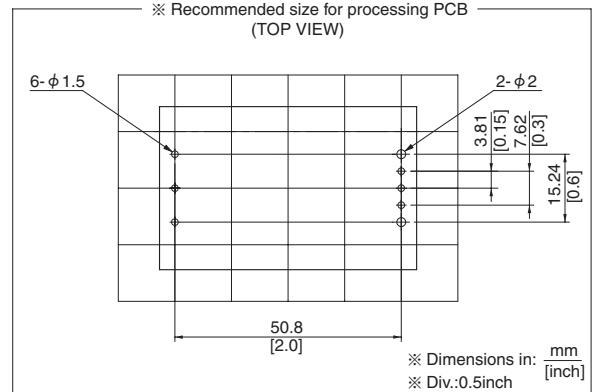
2. BasePlate (optionB)



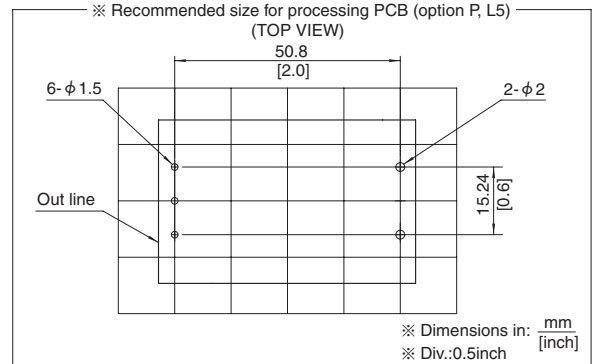
※ ±VIN/RC/TRM/±S Pin

3. Parallel operation (option P)
5pins type (option L5)

※ Recommended size for processing PCB (TOP VIEW)



※ Recommended size for processing PCB (option P, L5) (TOP VIEW)



CHS

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Redundancy operation availability	
						Material	Single sided	Double sided	Series operation	Redundancy operation
CHS60	Foward converter	440	* 1	–	–	glass fabric base, epoxy resin		Multilayer	Yes	* 2
CHS80	Half-bridge converter	250	* 1	–	–	glass fabric base, epoxy resin		Multilayer	Yes	* 2
CHS120	Half-bridge converter	200	* 1	–	–	glass fabric base, epoxy resin		Multilayer	Yes	* 2
CHS200	Full-bridge converter	150	* 1	–	–	glass fabric base, epoxy resin		Multilayer	Yes	* 2
CHS300	Full-bridge converter	170	* 1	–	–	glass fabric base, epoxy resin		Multilayer	Yes	* 2
CHS400	Full-bridge converter	150	* 1	–	–	glass fabric base, epoxy resin		Multilayer	Yes	* 2
CHS500	Full-bridge converter	150	* 1	–	–	glass fabric base, epoxy resin		Multilayer	Yes	* 2

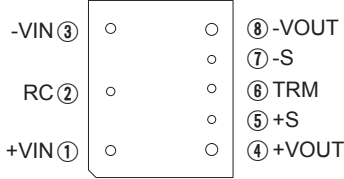
* 1 Refer to Specification.

* 2 Refer to Instruction Manual.

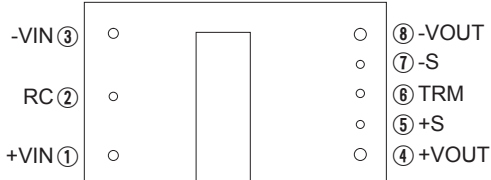
1	Pin Connection	CHS-22
2	Connection for Standard Use	CHS-22
3	Wiring Input/Output Pin	CHS-23
3.1	Wiring input pin	CHS-23
3.2	Wiring output pin	CHS-23
4	Function	CHS-24
4.1	Overcurrent protection	CHS-24
4.2	Overvoltage protection	CHS-24
4.3	Thermal protection	CHS-24
4.4	Remote ON/OFF	CHS-24
4.5	Remote sensing	CHS-24
4.6	Adjustable voltage range	CHS-25
4.7	Isolation	CHS-26
4.8	PMBus interface	CHS-26
5	Series and Parallel Operation	CHS-26
5.1	Series operation	CHS-26
5.2	Parallel operation	CHS-26
5.3	Redundancy operation	CHS-27
6	Implementation · Mounting Method	CHS-27
6.1	Mounting method	CHS-27
6.2	Automatic Mounting (CHS series:option S)	CHS-28
6.3	Soldering	CHS-28
6.4	Stress onto the pins	CHS-28
6.5	Cleaning	CHS-29
6.6	Storage method (CHS series:option S)	CHS-29
6.7	Stress to the product	CHS-29
7	Safety Considerations	CHS-29
8	Derating	CHS-29
8.1	CHS Derating	CHS-29
9	SMD type(optionS) package information	CHS-34

1 Pin Connection

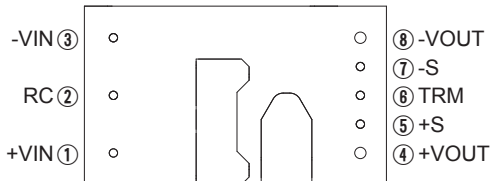
●CHS60



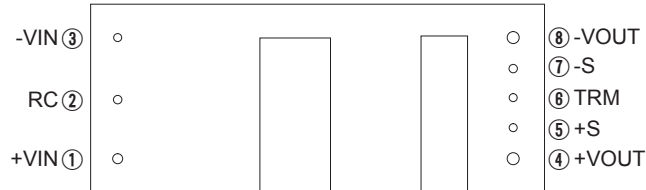
●CHS80



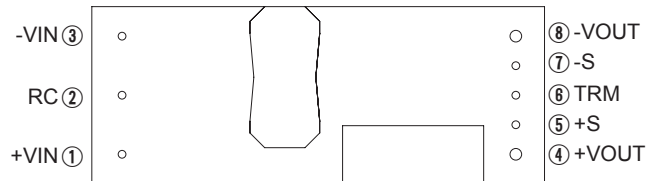
●CHS120



●CHS200



●CHS300



●CHS400/CHS500

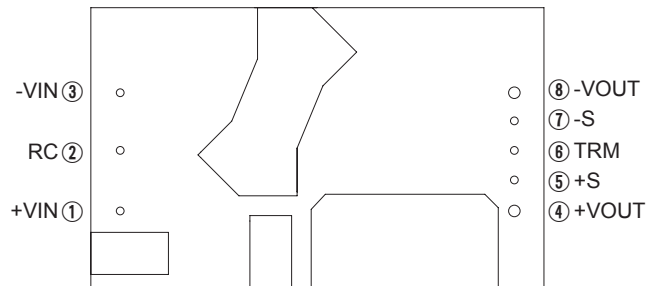


Fig.1.1 Pin Connection (bottom view)

Table 1.1 Pin Connection and function

No.	Pin Connection	Function
①	+VIN	+DC input
②	RC	Remote ON/OFF
③	-VIN	-DC input
④	+VOUT	+DC output
⑤	+S	+Remote sensing
⑥	TRM	Adjustment of output voltage
⑦	-S	-Remote sensing
⑧	-VOUT	-DC output

No.	Pin Connection	Reference
①	+VIN	3.1 "Wiring input pin "
②	RC	4.4 "Remote ON/OFF "
③	-VIN	3.1 "Wiring input pin "
④	+VOUT	3.2 "Wiring output pin "
⑤	+S	4.5 "Remote sensing "
⑥	TRM	4.6 "Adjustable voltage range "
⑦	-S	4.5 "Remote sensing "
⑧	-VOUT	3.2 "Wiring output pin "

2 Connection for Standard Use

■ In order to use the power supply, it is necessary to wire as shown in Fig.2.1.

Reference : 3 "Wiring Input/Output Pin"
8 "Derating"

■ Short the following pins to turn on the power supply.

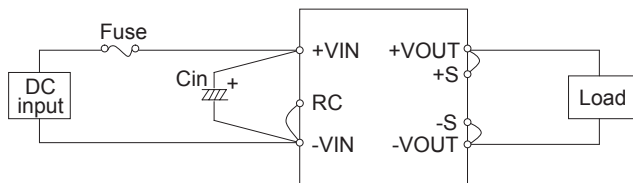
-VIN↔RC, +VOUT↔+S, -VOUT↔-S

Reference : 4.4 "Remote ON/OFF"
4.5 "Remote sensing"

■ The CHS series handle only the DC input.

Avoid applying AC input directly.

It will damage the power supply.



Cin : External capacitor on the input side

Fig.2.1 Connection for standard use

Table 2.1 Recommended External capacitor on the input side

Model	CHS30024			
Cin	660 μ F or more			
Model	CHS6048	CHS8048	CHS12048	CHS20048
Cin	66 μ F or more	33 μ F or more	47 μ F or more	100 μ F or more
Model	CHS30048/CHS40048/CHS50048			
Cin	200 μ F or more			

3 Wiring Input/Output Pin

3.1 Wiring input pin

(1) External fuse

- Fuse is not built-in on input side. In order to protect the unit, install the normal-blow type fuse on input side.
- When the input voltage from a front end unit is supplied to multiple units, install the normal-blow type fuse in each unit.

Table 3.1 Recommended fuse (Normal-blow type)

Model	CHS30024		
Rated current	20A		
Model	CHS6048	CHS8048	CHS12048
Rated current	5A	7A	10A
Model	CHS20048/CHS30048	CHS40048	CHS50048
Rated current	15A	20A	30A

(2) External capacitor on the input side

- Install an external capacitor Cin, between +VIN and -VIN input pins for low line-noise and for stable operation of the power supply.

Capacitance Refer to Table 2.1
Ta = -20 to +85°C Electrolytic or Ceramic capacitor
Ta = -40 to +85°C Ceramic capacitor

- Cin is within 50mm for pins. Make sure that ripple current of Cin is less than its rating.

(3) Recommendation for noise-filter

- Install an external input filter as shown in Fig.3.1 in order to reduce conducted noise. Cin is shown in Table 2.1.

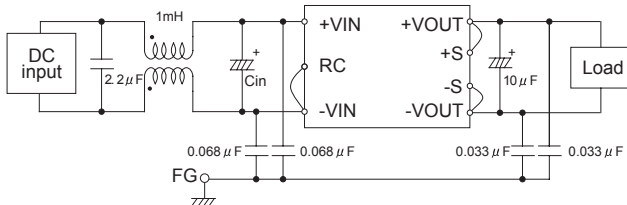


Fig.3.1 Recommended external input filter

(4) Reverse input voltage protection

- Avoid the reverse polarity input voltage. It will damage the power supply.

It is possible to protect the unit from the reverse input voltage by installing an external diode as shown in Fig.3.2.

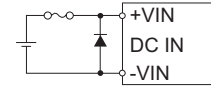


Fig.3.2 Reverse input voltage protection

3.2 Wiring output pin

- When the CHS series supplies the pulse current for the pulse load, please install a capacitor Co between +VOUT and -VOUT pins. Recommended capacitance of Co is shown in Table 3.2, 3.3.
- If output current decreases rapidly, output voltage rises transiently and the overvoltage protection circuit may operate. In this case, please install a capacitor Co.
- Select a high frequency type capacitor. Output ripple and startup waveform may be influenced by ESR-ESL of the capacitor and the wiring impedance.
- Make sure that ripple current of Co is than its rating.

Table 3.2 Recommended capacitance Co (CHS60, CHS80, CHS120)

No.	Output voltage	CHS60	CHS80	CHS120
1	3.3V	0 - 20,000 μ F	0 - 20,000 μ F	0 - 20,000 μ F
2	5V	0 - 10,000 μ F	0 - 10,000 μ F	0 - 10,000 μ F
3	12V	0 - 2,200 μ F	0 - 1,000 μ F	0 - 2,200 μ F

Table 3.3 Recommended capacitance Co (CHS200, CHS300, CHS400, CHS500)

No.	Output voltage	CHS200	CHS300	CHS400/CHS500
1	3.3V	0 - 40,000 μ F	—	—
2	5V	0 - 20,000 μ F	0 - 20,000 μ F	—
3	10V	—	0 - 2,200 μ F	0 - 4,000 μ F
4	12V	0 - 2,200 μ F	0 - 2,200 μ F	0 - 4,000 μ F
5	15V	—	0 - 2,200 μ F	—

- Ripple and Ripple Noise are measured, as shown in the Fig.3.3. Cin is shown in Table 2.1.

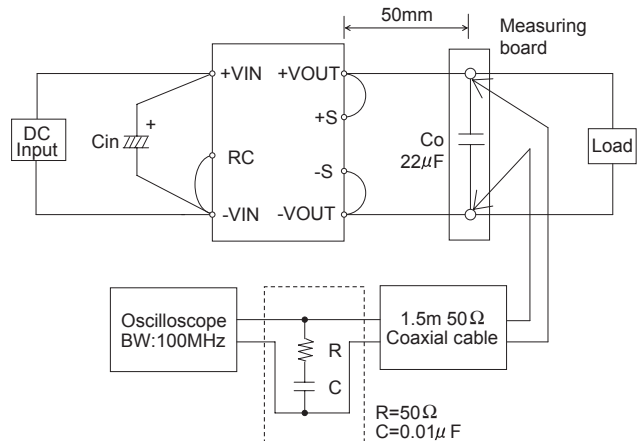


Fig.3.3 Measuring method of Ripple and Ripple Noise

4 Function

4.1 Overcurrent protection

■Over Current Protection (OCP) is built-in and works at 105% of the rated current or higher. However, use in an overcurrent situation must be avoided whenever possible.

The output voltage of the power module will recover automatically when the fault causing overcurrent is corrected.

When the output voltage drops after OCP works, the power module enters a "hiccup mode" where it repeatedly turns on and off at a certain frequency.

4.2 Overvoltage protection

■The overvoltage protection circuit is built-in. The DC input will be shut down if overvoltage protection is in operation.

The output voltage of the power module will recover automatically when the fault causing over voltage is corrected.

Remarks :

Please note that devices inside the power supply might fail when voltage more than rated output voltage is applied to output pin of the power supply. This could happen when the customer tests the overvoltage performance of the unit.

4.3 Thermal protection

■When the power supply temperature is kept above 120°C, the thermal protection will be activated and simultaneously shut down the output.

The output voltage of the power supply will recover automatically when the unit is cool down.

●-U

■Option "-U" means output is shut down when the abovementioned protection circuit is activated.

If this happens, protection circuit can be inactivated by cycling the DC input power off for at least 1 second or toggling Remote ON/OFF signal.

4.4 Remote ON/OFF

■Remote ON/OFF circuit is built-in on the input side (RC).

The ground pin of input side remote ON/OFF circuit is "-VIN" pin.

Table 4.1.1 Specification of Remote ON/OFF(CHS80,CHS200)

	ON/OFF logic	Between RC and -VIN	Output voltage
Standard	Negative	L level(0 - 0.8V) or short	ON
		H level(2.0 - 7.0V) or open	OFF
Optional -R	Positive	L level(0 - 0.8V) or short	OFF
		H level(2.0 - 7.0V) or open	ON

When RC is "Low" level, fan out current is 0.1mA typ. When Vcc is applied, use $2.0 \leq V_{cc} \leq 7.0V$.

Table 4.1.2 Specification of Remote ON/OFF(CHS60,CHS120,CHS300,CHS400,CHS500)

	ON/OFF logic	Between RC and -VIN	Output voltage
Standard	Negative	L level(0 - 0.8V) or short	ON
		H level(4.0 - 7.0V) or open	OFF
Optional -R	Positive	L level(0 - 0.8V) or short	OFF
		H level(4.0 - 7.0V) or open	ON

When RC is "Low" level, fan out current is 0.1mA typ. When Vcc is applied, use $4.0 \leq V_{cc} \leq 7.0V$.

■When remote ON/OFF function is not used, please short between RC and -VIN (-R: open between RC and -VIN).

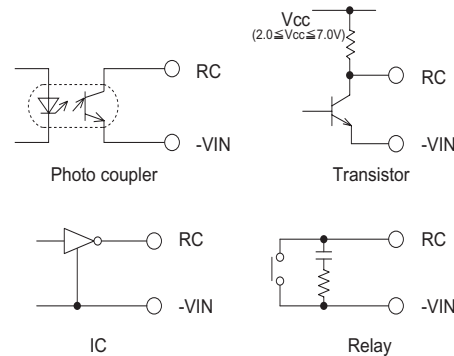


Fig.4.1 RC connection example

4.5 Remote sensing

(1) When the remote sensing function is not in use

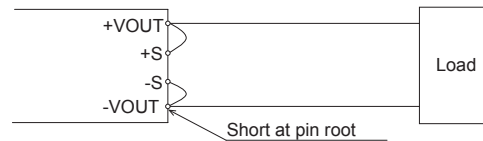


Fig.4.2 Connection when the remote sensing is not in use

■When the remote sensing function is not in use, it is necessary to confirm that pins are shorted between +S & +VOUT and between -S & -VOUT.

■Wire between +S & +VOUT and between -S & -VOUT as short as possible.

Loop wiring should be avoided.

This power supply might become unstable by the noise coming from poor wiring.

(2)When the remote sensing function is in use

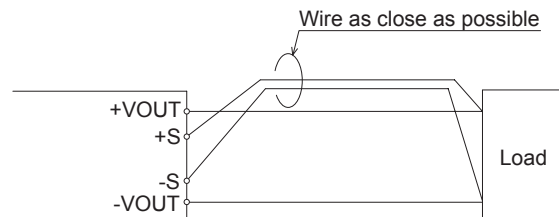


Fig.4.3 Connection when the remote sensing is in use

■Twisted-pair wire or shield wire should be used for sensing wire.

■Thick wire should be used for wiring between the power supply and a load.

Line drop should be less than 0.3V.

Voltage between +VOUT and -VOUT should remain within the output voltage adjustment range.

■ If the sensing patterns are short, heavy-current is drawn and the pattern may be damaged.

The pattern disconnection can be prevented by installing the protection parts as close as possible to a load.

■ Output voltage might become unstable because of impedance of wiring and load condition when length of wire exceeds 40cm.

4.6 Adjustable voltage range

(1) To adjust output voltage

■ Output voltage is adjustable by the external potentiometer.

■ When the output voltage adjustment is used, note that the over voltage protection circuit operates when the output voltage is set too high.

■ If the output voltage drops under the output voltage adjustment range, the Low voltage protection operates.

■ By connecting the external potentiometer (VR1) and resistors (R1, R2), output voltage becomes adjustable, as shown in Fig.4.4. Recommended external parts are shown in Table 4.2.

■ The wiring to the potentiometer should be as short as possible.

The temperature coefficient could become worse, depending on the type of a resistor and potentiometer. Following parts are recommended for the power supply.

Resistor.....Metal film type, coefficient of less than $\pm 100\text{ppm}/^\circ\text{C}$

Potentiometer.....Cermet type, coefficient of less than $\pm 300\text{ppm}/^\circ\text{C}$

■ When the output voltage adjustment is not used, open the TRM pin respectively.

■ The change speed of the TRM voltage should be less than 0.15V/ms, when changing output voltage to less than 90% of the rated.

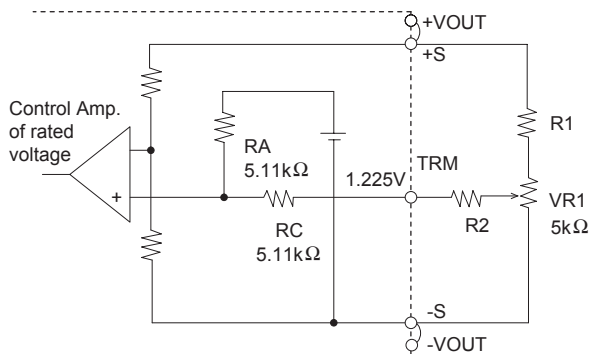


Fig.4.4 Output voltage control circuit

Table 4.2 Recommended value of external potentiometer & resistor

No.	VOUT	Output adjustable range					
		VOUT $\pm 5\%$			VOUT $\pm 10\%$		
		R1	R2	VR1	R1	R2	VR1
1	3.3V	2.2k Ω	68k Ω	5k Ω	2.2k Ω	33k Ω	5k Ω
2	5V	4.7k Ω	68k Ω		5.6k Ω	33k Ω	
3	10V	15k Ω	68k Ω		15k Ω	33k Ω	
4	12V	18k Ω	68k Ω		18k Ω	33k Ω	
5	15V	22k Ω	68k Ω		22k Ω	33k Ω	

(2) To decrease output voltage

■ By connecting the external resistor (RD), output voltage becomes adjustable to decrease.

The external resistor (RD) is calculated by the following equation.

$$RD = \frac{5.11}{\Delta} - 10.22 \text{ [k}\Omega\text{]}$$

$$\Delta = \frac{V_{OR} - V_{OD}}{V_{OR}}$$

V_{OR} : Rated output voltage [V]

V_{OD} : Output voltage needed to set up [V]

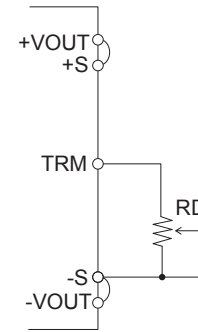


Fig.4.5 Connection to decrease output voltage

(3) To increase output voltage

■ By connecting the external resistor (RU), output voltage becomes adjustable to increase.

The external resistor (RU) is calculated by the following equation.

$$RU = \frac{5.11 \times V_{OR} \times (1 + \Delta)}{1.225 \times \Delta} - \frac{5.11}{\Delta} - 10.22 \text{ [k}\Omega\text{]}$$

$$\Delta = \frac{V_{OU} - V_{OR}}{V_{OR}}$$

V_{OR} : Rated output voltage [V]

V_{OU} : Output voltage needed to set up [V]

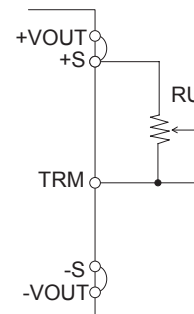
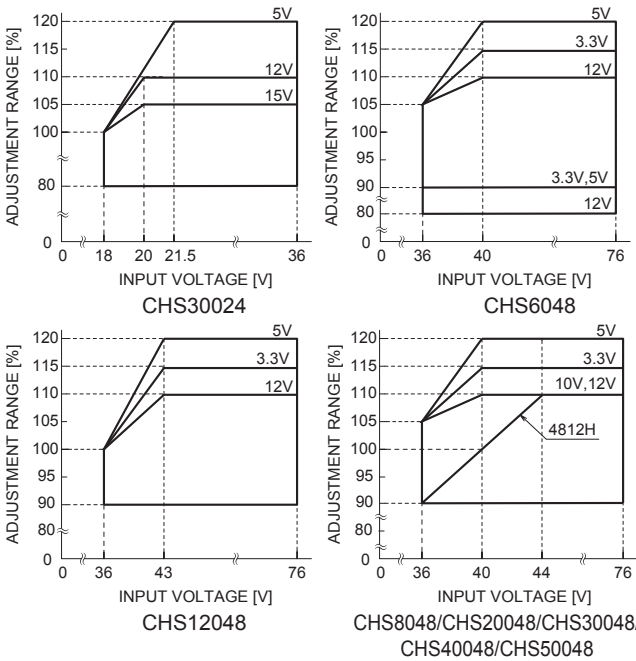


Fig.4.6 Connection to increase output voltage

(4) Input voltage derating

■ When input voltage is 18-21.5V DC or 36-44VDC, the output voltage adjustment range becomes as shown in Fig.4.7.



4.7 Isolation

■ For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage to start (shut down). Avoid using Hi-Pot tester with timer because it may generate voltage a few times higher than the applied voltage at ON/OFF of a timer.

4.8 PMBus interface

●-I (CHS300/CHS400)

■ This option is equipped with a digital PMBus interface.
Please contact us about for details.

5 Series and Parallel Operation

5.1 Series operation

■ Series operation is available by connecting the outputs of two or more power supplies, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

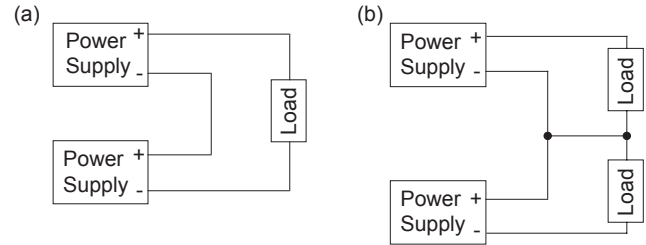


Fig.5.1 Examples of series operation

5.2 Parallel operation

●-P (CHS400/CHS500)

■ This option is for parallel operation.

■ Sensing and adjustment of the output voltage are not possible at the time of the use with this option.

■ As variance of output current drew from each power supply is maximum 10%, the total output current must not exceed the value determined by the following equation.

(Output current in parallel operation)

$$= (\text{the rated current per unit}) \times (\text{number of unit}) \times 0.9$$

When the number of units in parallel operation increases, input current increase at the same time. Adequate wiring design for input circuitry is required, such as circuit pattern, wiring and current capacity for equipment.

■ Total number of units should be no more than 3 pieces.

■ Thick wire should be used for wiring between the power supply and load, and line drop should be less than 0.3V.

■ Connect each input pin for the lowest possible impedance.

■ When the number of the units in parallel operation increases, input current increases. Adequate wiring design for input circuitry such as circuit pattern, wiring and current for equipment is required.

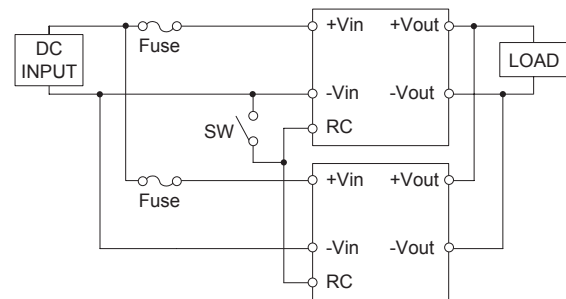


Fig.5.2 Examples of parallel operation

5.3 Redundancy operation

- Parallel operation is not possible.
- Redundancy operation is available by wiring as shown below.

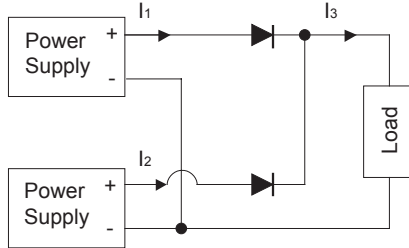


Fig.5.3 Redundancy operation

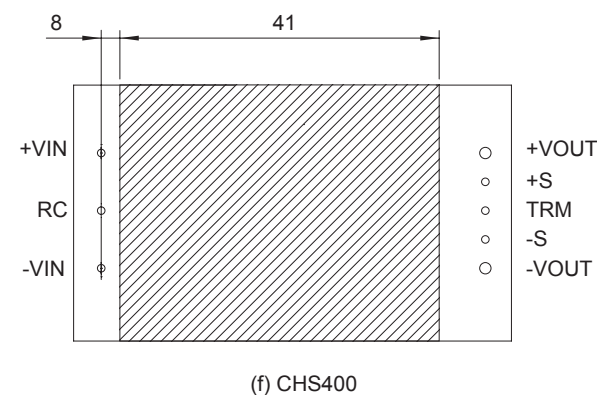
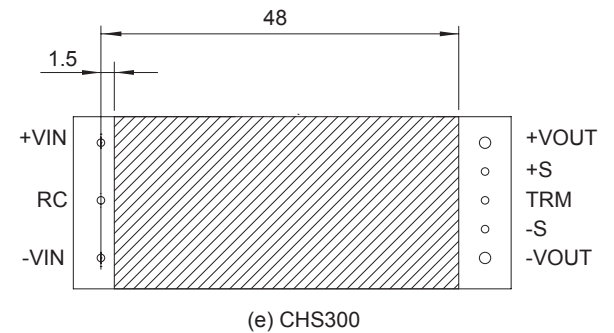
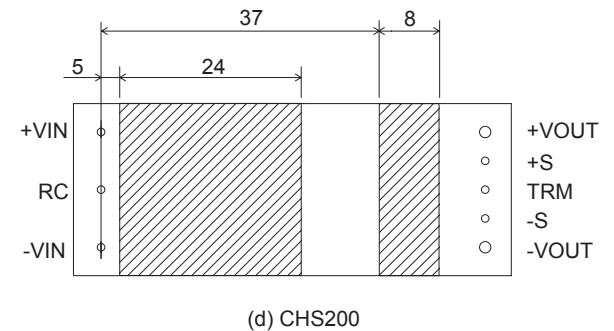
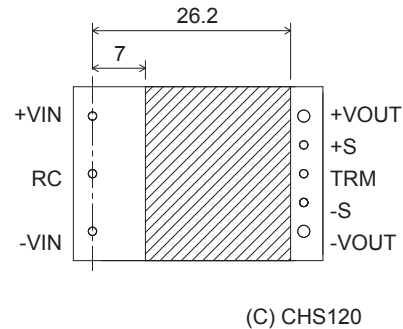
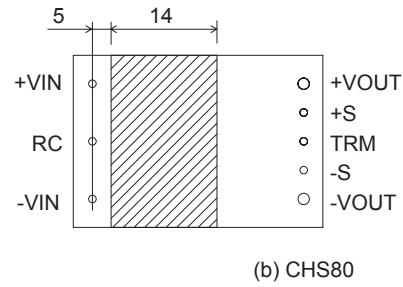
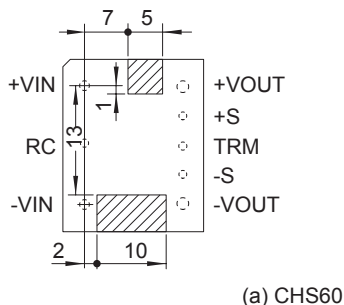
- Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .
- Please make sure that the value of I_3 does not exceed the rated current of the power supply.

$$I_3 \leq \text{the rated current value}$$

6 Implementation · Mounting Method

6.1 Mounting method

- The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. The temperature around each power supply should not exceed the temperature range shown in derating curve.
- Avoid placing the DC input line pattern layout underneath the unit. It will increase the line conducted noise. Make sure to leave an ample distance between the line pattern layout and the unit. Also avoid placing the DC output line pattern underneath the unit because it may increase the output noise. Lay out the pattern away from the unit.
- Avoid placing the signal line pattern layout underneath the unit because the power supply might become unstable. Lay out the pattern away from the unit.
- Avoid placing pattern layout in hatched area shown in Fig.6.1 to insulate between pattern and power supply.



Dimensions in mm

Fig.6.1 Prohibition area of pattern layout (top view)

6.2 Automatic Mounting (CHS series:option S)

■To mount CHS series automatically, use the inductor area near the output pin as an adsorption point. Please see the External View for details of the adsorption point.

If the bottom dead point of a suction nozzle is too low when mounting excessive force is applied to the inductor, it could cause damage. Please mount carefully.

6.3 Soldering

(1)Flow Soldering :260℃ 15 seconds or less

(2)Soldering Iron :maximum 450℃ 5 seconds or less

(3)Reflow Soldering (option “-S”)

■Fig.6.2 shows conditions for the reflow soldering for option “-S” of CHS series. Please make sure that the temperatures of pin terminals +VIN and -VOUT shown in Fig.6.2 do not exceed the temperatures shown in Fig.6.3.

■If time or temperature of the reflow soldering goes beyond the conditions, reliability of internal components may be compromised. Please use the unit under the recommended reflow conditions.

CHS

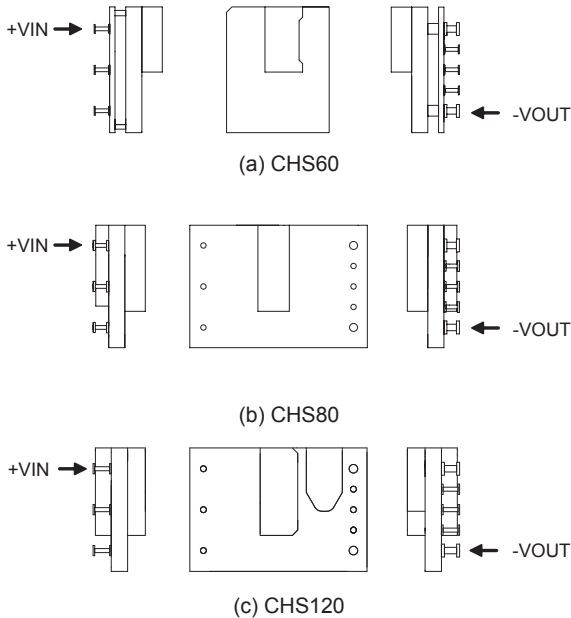
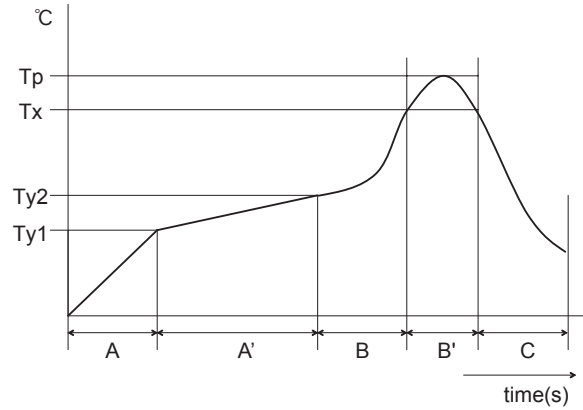


Fig.6.2 Temperature Measuring Points when Setting Reflow Soldering Conditions



A	1.0 - 5.0℃/s
A'	Ty1:160±10℃ Ty2:180±10℃ Ty1 - Ty2:120s max
B	1.0 - 5.0℃/s
B'	Tp:Max245℃ 10s max Tx:220℃ or more:70s max
C	1.0 - 5.0℃/s

Fig.6.3 Recommend Reflow Soldering Conditions

Notes to use option “-S”

■Solder iron or other similar methods are not recommended soldering method for option “-S” because it may not be able to retain connection reliability between the PCB and the Pins. Solder reflow is the acceptable mounting system for the option.

■Option “-S” is not reusable product after soldered on any application PCB.

6.4 Stress to the pins

■When too much stress is applied to the pins of the power supply, the internal connection may be weakened.

As shown in Fig.6.4, avoid applying stress of more than 19.6N (2kgf) to the pins horizontally and more than 39.2N (4kgf) vertically.

■The pins are soldered on PWB internally. Therefore, do not pull or bend them with strong force.

■Fix the unit on PCB (using silicone rubber or fixing fittings) to reduce the stress to the pins.

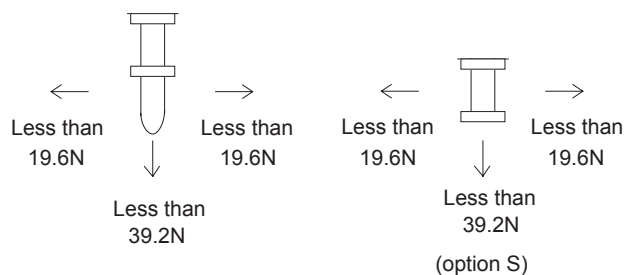


Fig.6.4 Stress to the pins

6.5 Cleaning

- When cleaning is necessary, clean under the following conditions.
 - Method : Varnishing, ultrasonic wave and vapor
 - Cleaning agents : IPA (Solvent type)
 - Total time : 2 minutes or less
- Do not apply pressure to the lead and name plate with a brush or scratch it during the cleaning.
- After cleaning, dry them enough.

6.6 Storage method (CHS series:option S)

- To stock unpacked products in your inventory, it is recommended to keep them under controlled condition, 5-30°C, 60%RH and use them within a year.
- 24-hour baking is recommended at 125°C, if unpacked products were kept under uncontrolled condition, which is 30°C, 60%RH or higher.
 - Original trays are not heat-resistant. Please move them to heat-resistant trays in preparation to bake.
 - To check moisture condition in the pack. Silica gel packet has some moisture condition indicator particles.
 - Indicated blue means good. Pink means alarm to bake it.
- Notification. The tray will be deformed and the power supply might be damaged, if the vacuum pressure is too much to reseal.

6.7 Stress to the product

- CHS series transformer core and choke coil core are attached by glue.
 - There is a possibility that the core will be removed and power supply will be damaged when they receive stress by the fall or some kind of stress.

7 Safety Considerations

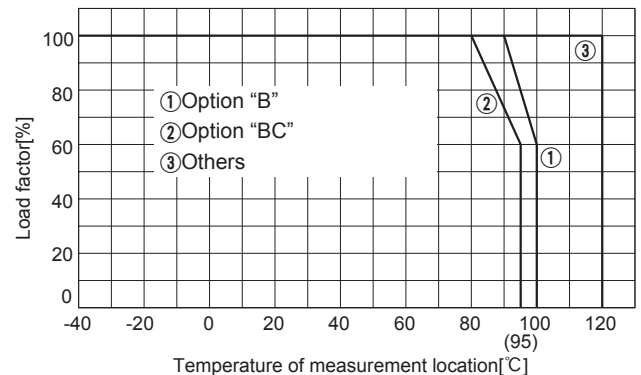
- To apply for safety standard approval using this power supply, the following conditions must be met.
- This unit must be used as a component of the end-use equipment.
- The equipment must contain basic insulation between input and output. If double or reinforced insulation is required, it has to be provided by the end-use equipment in accordance with the final build-in condition.
- Safety approved fuse must be externally installed on input side.

8 Derating

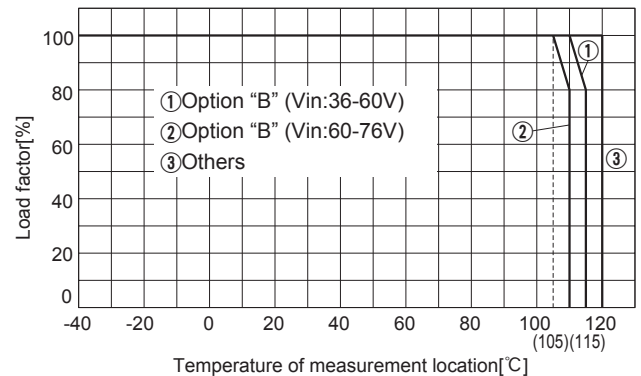
- It is necessary to note thermal fatigue life by power cycle.
 - Please reduce the temperature fluctuation range as much as possible when the up and down of temperature are frequently generated.

8.1 CHS Derating

- Use with the convection cooling or the forced air cooling.
 - Make sure the temperatures at temperature measurement locations shown from Fig.8.2.1 to Fig.8.2.10 below are on or under the derating curve in Fig.8.1.
 - Ambient temperature must be kept at 85°C or under.

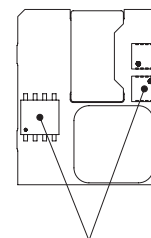


(a) CHS60, CHS80, CHS200, CHS300, CHS400, CHS500



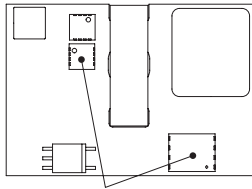
(b) CHS120

Fig.8.1 Derating curve



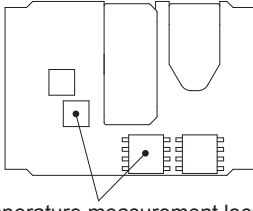
Temperature measurement location

Fig.8.2.1 Temperature measurement location (CHS60)



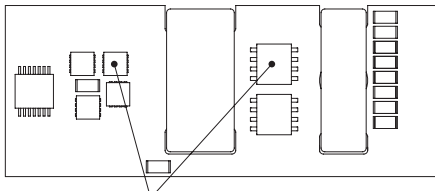
Temperature measurement location

Fig.8.2.2 Temperature measurement location (CHS80)



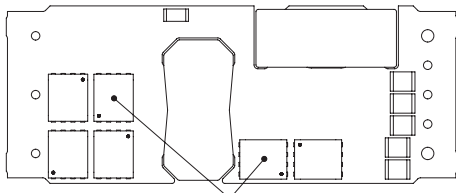
Temperature measurement location

Fig.8.2.3 Temperature measurement location (CHS120)



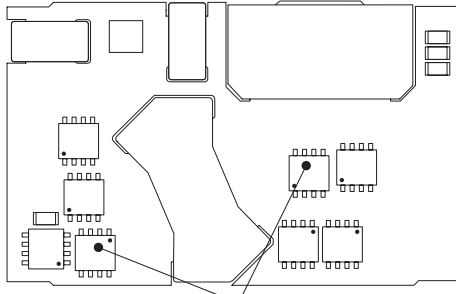
Temperature measurement location

Fig.8.2.4 Temperature measurement location (CHS200)



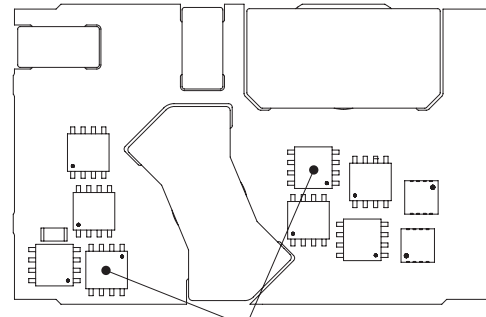
Temperature measurement location

Fig.8.2.5 Temperature measurement location (CHS300)



Temperature measurement location

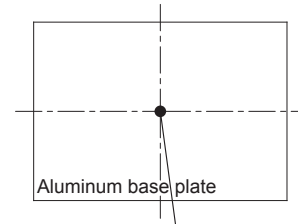
Fig.8.2.6 Temperature measurement location (CHS400)



Temperature measurement location

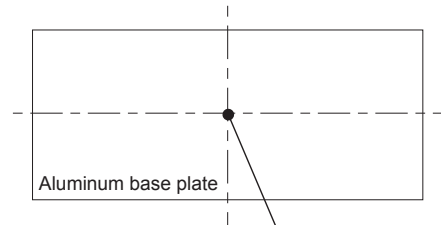
Fig.8.2.7 Temperature measurement location (CHS500)

■ For option "B" which is used with the convection cooling, forced air cooling or conduction cooling, use the temperature measurement location as shown in Fig.8.2.8 to Fig.8.2.10.



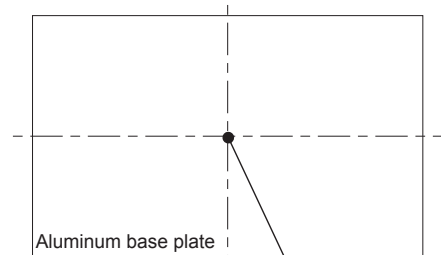
Measurement point

Fig.8.2.8 Measurement point (CHS120 option "B")



Measurement point

Fig.8.2.9 Measurement point (CHS200/CHS300 option "B" and "BC")



Measurement point

Fig.8.2.10 Measurement point (CHS400/CHS500 option "B")

■ Shown the thermal curve with measuring as shown in Fig.8.3.
Verify final design by actual temperature measurement.
Use the temperature measurement location as shown in Fig.8.2.1 to Fig.8.2.7 at 120°C or less.

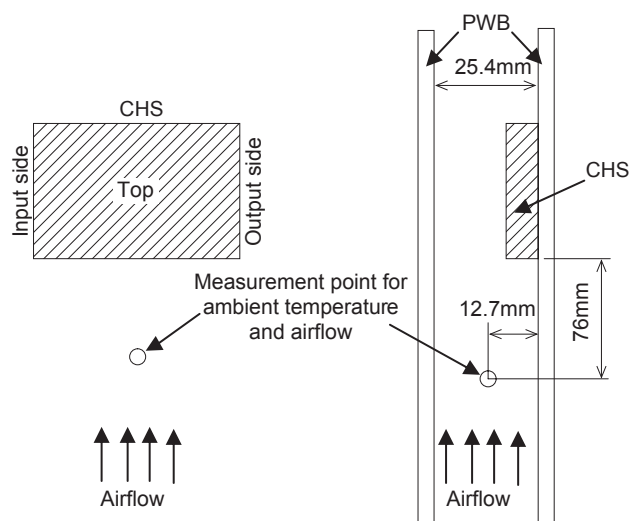


Fig.8.3 Measuring method

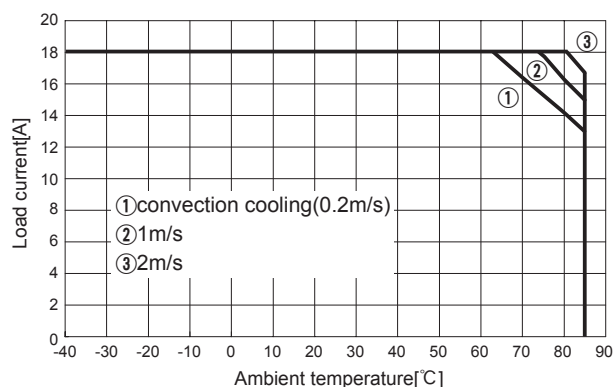


Fig.8.4 Load current vs. ambient temperature(CHS60483R3 Vin=48V)

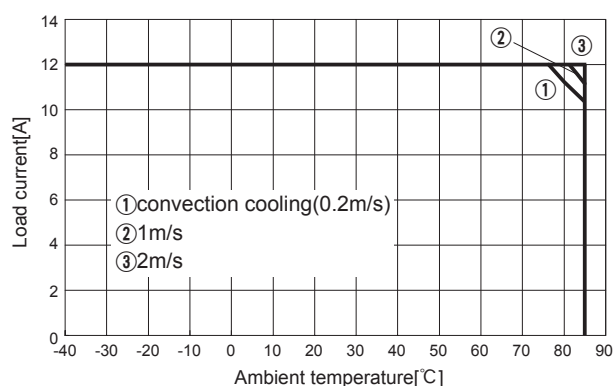


Fig.8.5 Load current vs. ambient temperature(CHS604805 Vin=48V)

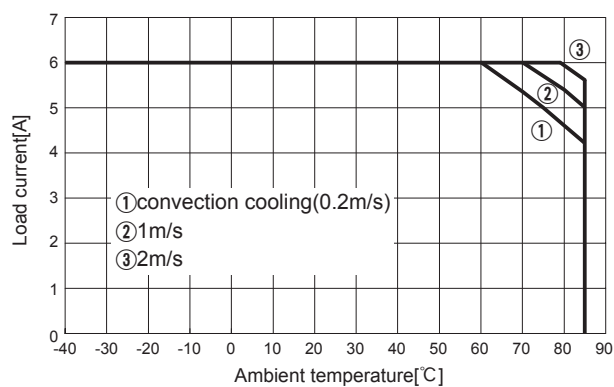


Fig.8.6 Load current vs. ambient temperature(CHS604812 Vin=48V)

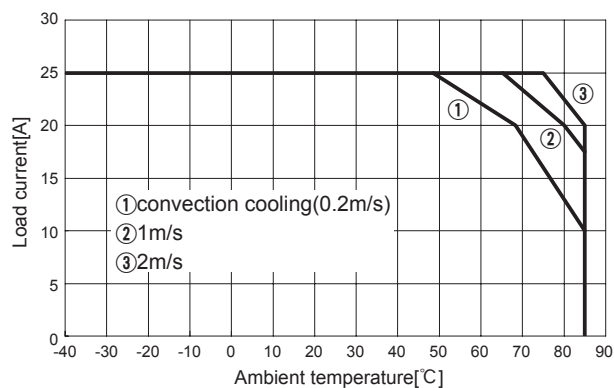


Fig.8.7 Load current vs. ambient temperature(CHS80483R3 Vin=48V)

CHS

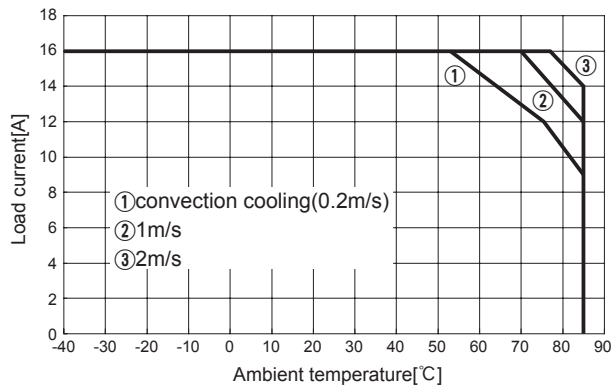


Fig.8.8 Load current vs. ambient temperature(CHS804805 Vin=48V)

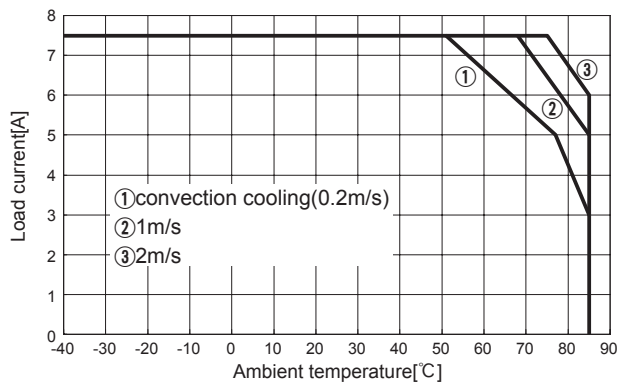


Fig.8.9 Load current vs. ambient temperature(CHS804812 Vin=48V)

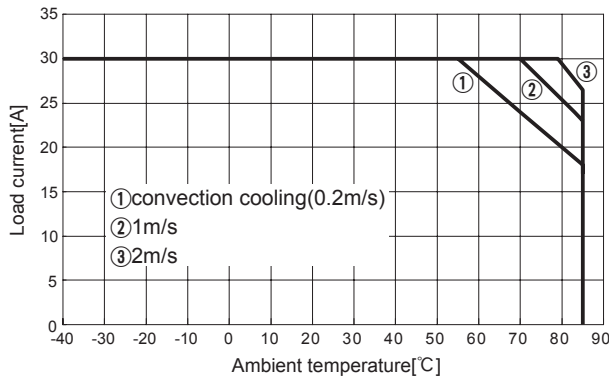


Fig.8.10 Load current vs. ambient temperature(CHS120483R3 Vin=48V)

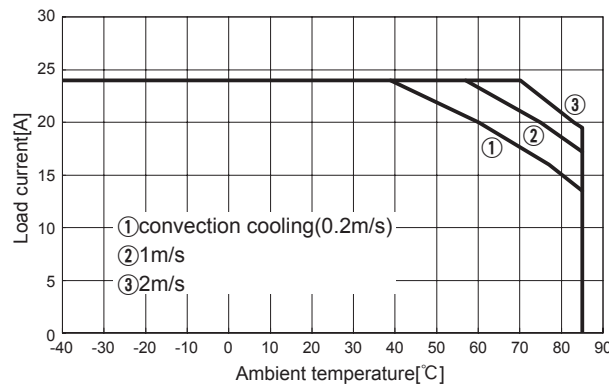


Fig.8.11 Load current vs. ambient temperature(CHS1204805 Vin=48V)

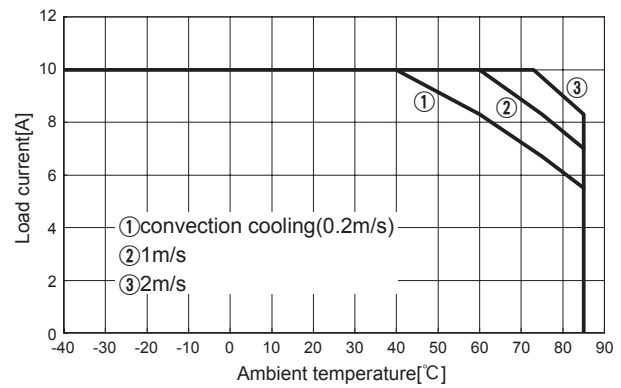


Fig.8.12 Load current vs. ambient temperature(CHS1204812 Vin=48V)

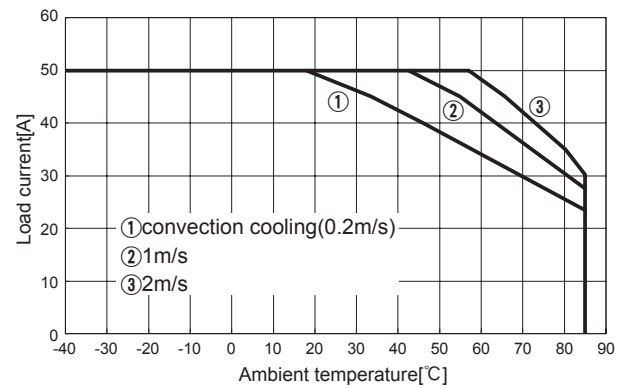


Fig.8.13 Load current vs. ambient temperature(CHS200483R3 Vin=48V)

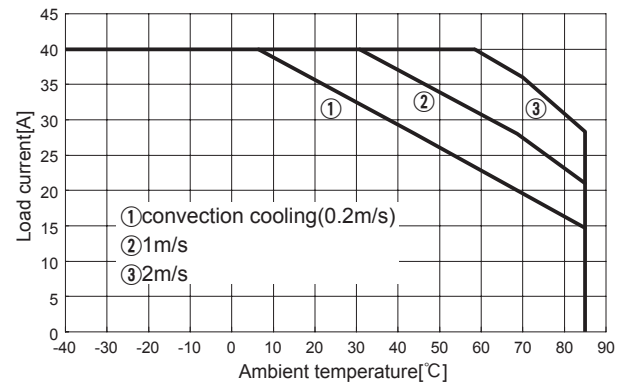


Fig.8.14 Load current vs. ambient temperature(CHS2004805 Vin=48V)

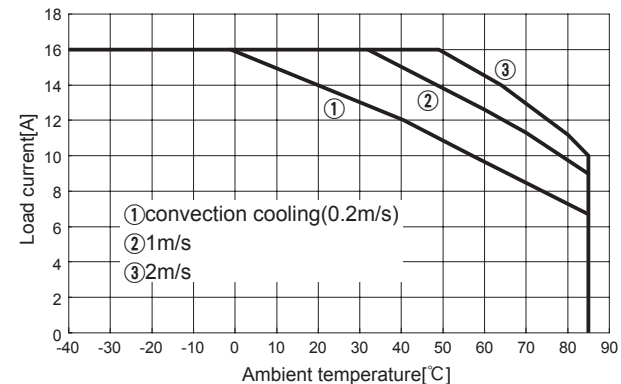


Fig.8.15 Load current vs. ambient temperature(CHS2004812 Vin=48V)

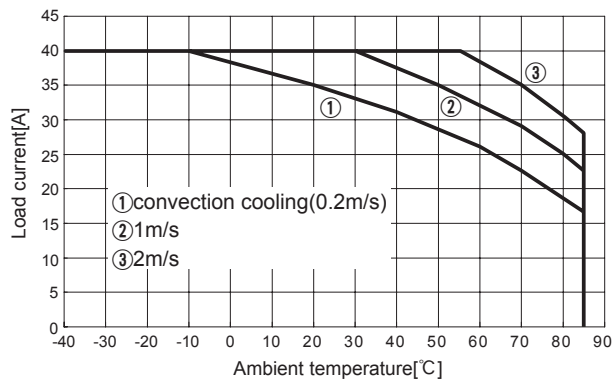


Fig.8.16 Load current vs. ambient temperature(CHS3002405 Vin=24V)

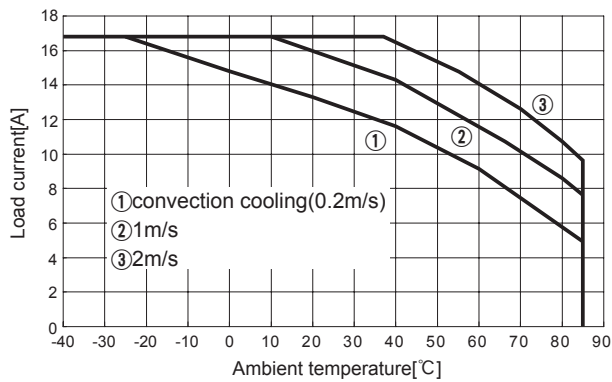


Fig.8.17 Load current vs. ambient temperature(CHS3002412 Vin=24V)

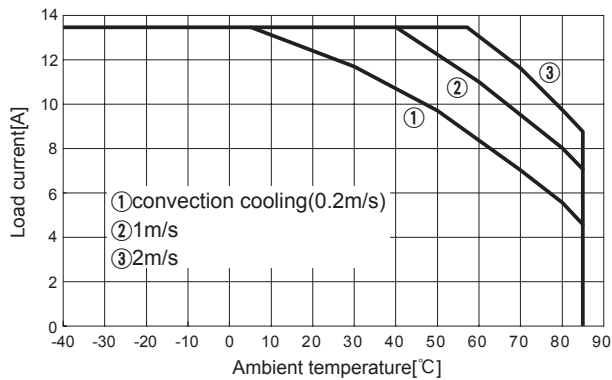


Fig.8.18 Load current vs. ambient temperature(CHS3002415 Vin=24V)

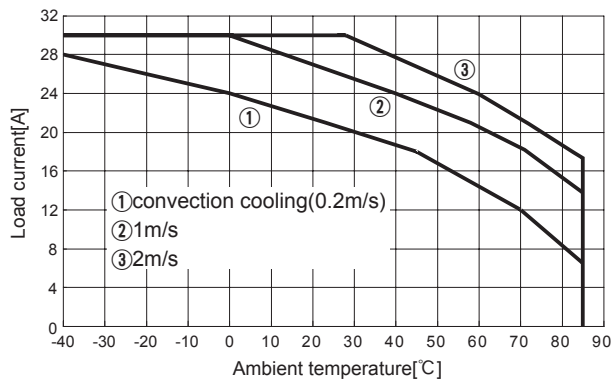


Fig.8.19 Load current vs. ambient temperature(CHS3004810 Vin=48V)

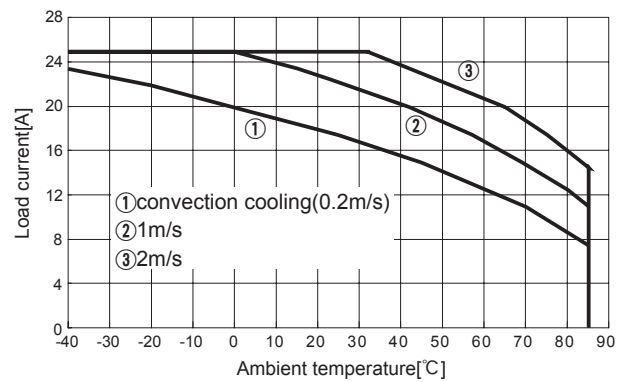


Fig.8.20 Load current vs. ambient temperature(CHS3004812 Vin=48V)

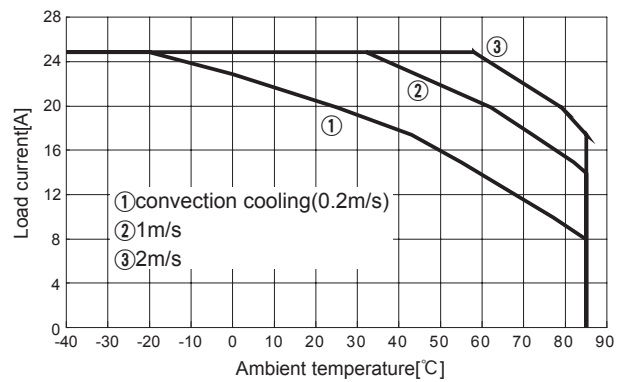


Fig.8.21 Load current vs. ambient temperature(CHS3004812H Vin=48V)

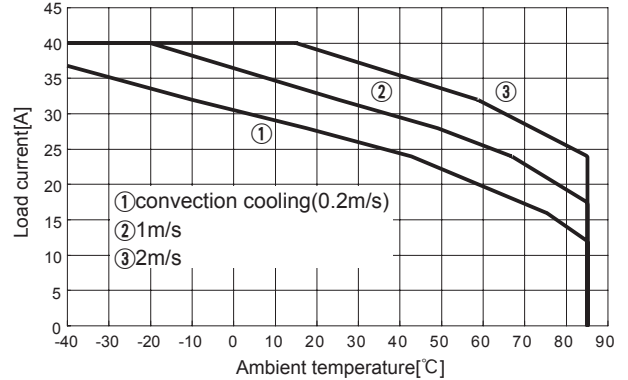


Fig.8.22 Load current vs. ambient temperature(CHS4004810 Vin=48V)

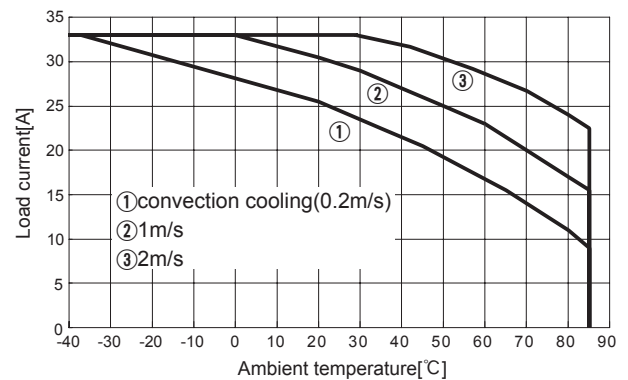


Fig.8.23 Load current vs. ambient temperature(CHS4004812 Vin=48V)

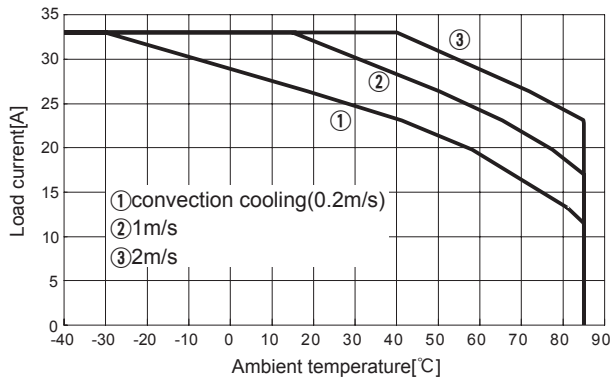


Fig.8.24 Load current vs. ambient temperature(CHS4004812H Vin=48V)

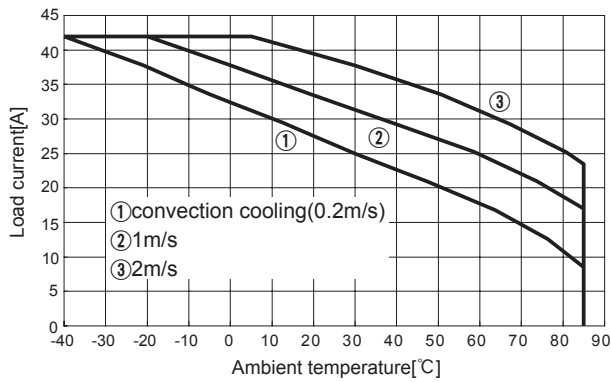


Fig.8.25 Load current vs. ambient temperature(CHS5004812 Vin=48V)

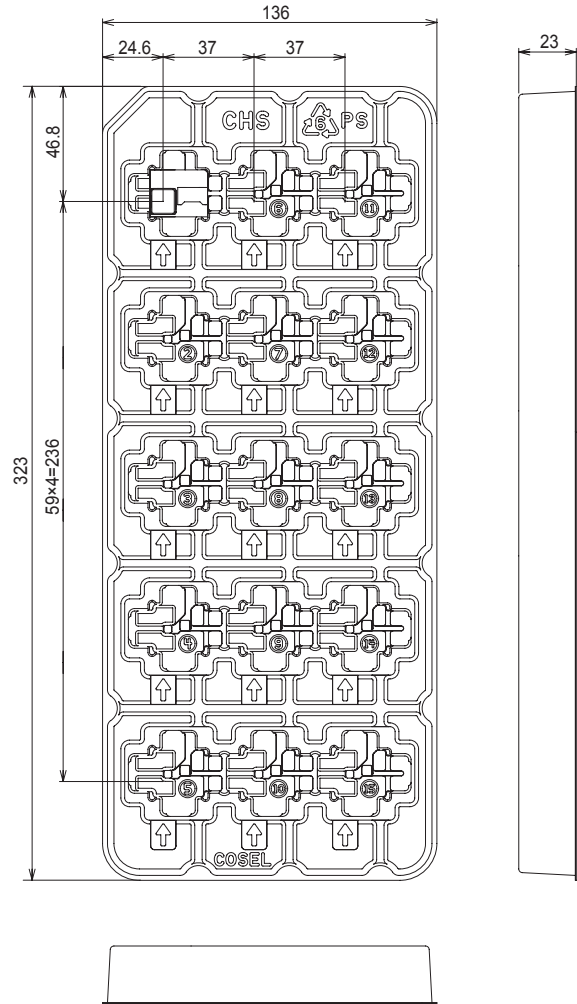
9 SMD type(option S) package information

■ These are packed in a tray (Fig.9.1 to Fig.9.3).

Please order "CHS60□□-S", "CHS80□□-S", "CHS120□□-S" for tray type packaging.

Capacity of the tray is 15max.

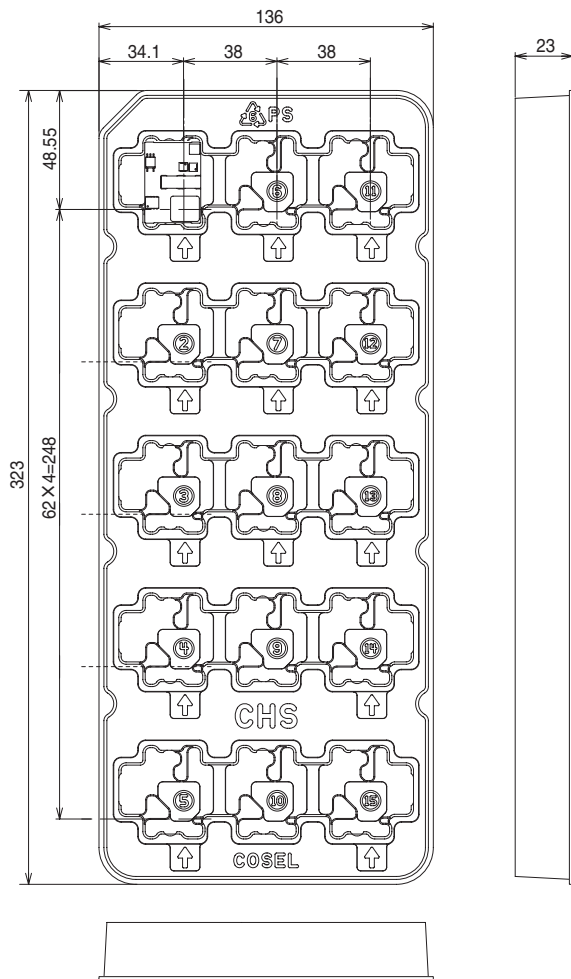
In case of fractions, the units are stored in numerical order.



Dimensions in mm

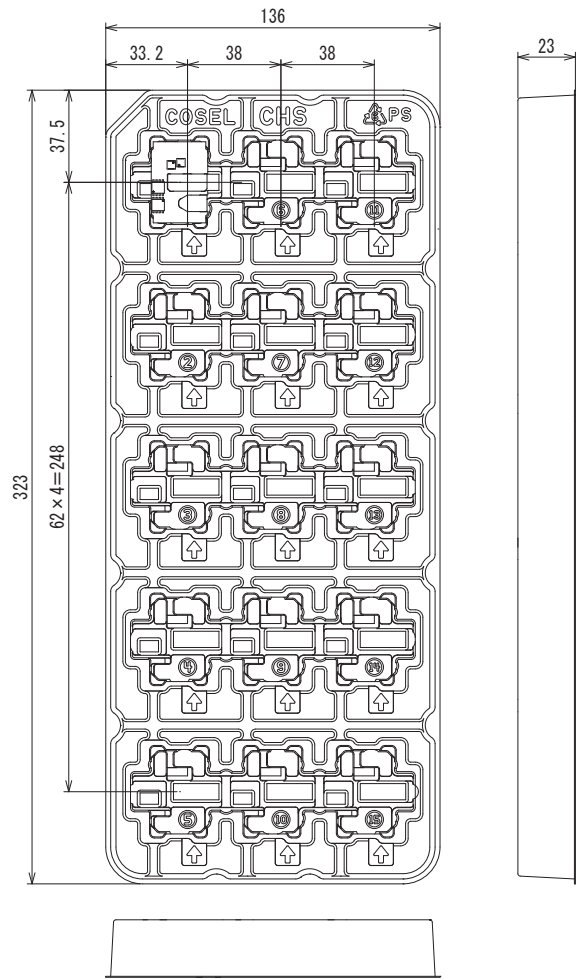
Material : Conductive PS

Fig.9.1 Delivery package information (CHS60)



Dimensions in mm
Material : Conductive PS

Fig.9.2 Delivery package information (CHS80)



Dimensions in mm
Material : Conductive PS

Fig.9.3 Delivery package information (CHS120)



Low Profile



Isolated

Safety
Approvals

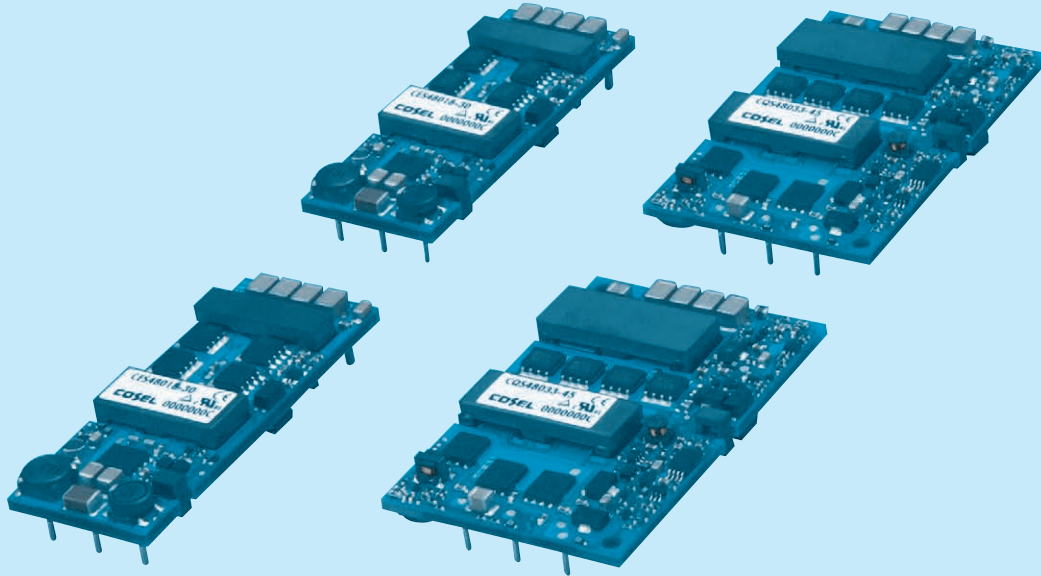
OCP



OVP

Remote
ON/OFF

CES/CQS-series



CE/CQ

Feature

Compact DC - DC Converter, "BRICK SIZE" which has been standard size for Telecommunication Market
 High efficiency
 High density
 High reliability : not built-in aluminum and tantalum electrolytic capacitor
 Built-in overcurrent, overvoltage and thermal protection circuits
 Built-in remote ON/OFF

CE marking

Low Voltage Directive

Safety agency approvals

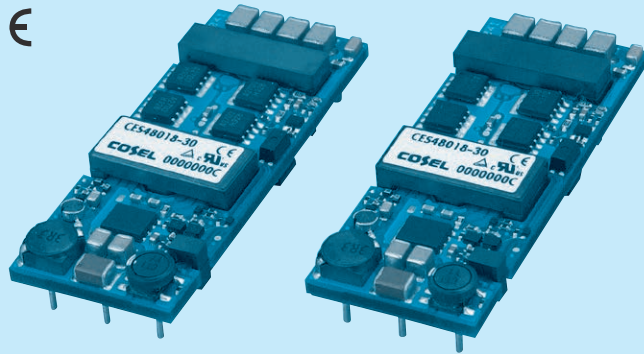
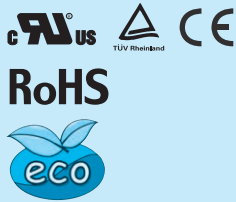
UL60950-1, C-UL recognized, TÜV approved

5-year warranty

CES

CE S 48 018 -30 -

① ② ③ ④ ⑤ ⑥



- ① Series name
② Single output
③ Input voltage
24:DC18 - 36V
48:DC36 - 76V
④ Output voltage
015:1.5V
018:1.8V
025:2.5V
033:3.3V
050:5V
060:6V
120:12V
150:15V
⑤ Output current
⑥ Optional
S : SMD
R : with Remote ON/OFF
Positive logic control
V : Output voltage setting $\pm 1\%$
N : Auto restart from thermal protection

MODEL	CES24033-25	CES24050-16	CES24120-6	CES24150-4
MAX OUTPUT WATTAGE[W]	82.5	80.0	72.0	60.0
DC OUTPUT	3.3V 25A	5V 16A	12V 6A	15V 4A

SPECIFICATIONS

	MODEL	CES24033-25	CES24050-16	CES24120-6	CES24150-4
INPUT	VOLTAGE[V]	DC18 - 36			DC20 - 33
	CURRENT[A]	3.78typ	3.67typ	3.30typ	2.75typ
	EFFICIENCY[%]	91typ	91typ	91typ	91typ
	START-UP VOLTAGE[V]	DC16 - 18			DC18 - 20
	HYSTERESIS VOLTAGE[V]	DC1 min			
OUTPUT	VOLTAGE[V]	3.3	5	12	15
	CURRENT[A]	25	16	6	4
	LINE REGULATION[mV]	$\pm 5\text{max}$	$\pm 5\text{max}$	$\pm 12\text{max}$	$\pm 15\text{max}$
	LOAD REGULATION[mV]	$\pm 5\text{max}$	$\pm 5\text{max}$	$\pm 12\text{max}$	$\pm 15\text{max}$
	RIPPLE	[mVrms] *2	20max	40max	40max
		[mVp-p] *2	60max	120max	120max
	RIPPLE NOISE[mVp-p]	100max	120max	150max	150max
	TEMPERATURE REGULATION[mV]	66max	100max	240max	300max
	DRIFT[mV]	16max	20max	40max	50max
	START-UP TIME[ms]	200max (DCIN 24V, Io=100%)			
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE *4	Fixed (TRM pin open), adjustable by external resistor -15% / +15%			
	OUTPUT VOLTAGE SETTING	$\pm 1.6\%$			
	OVERCURRENT PROTECTION	Works over 105% of rating, low voltage protection (shut down) function is built-in.			
	OVERVOLTAGE PROTECTION	125% - 135%	125% - 135%	117% - 127%	
	REMOTE SENSING	Provided			
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)			

	Standard type							High wattage type		
MODEL	CES48015-30	CES48018-30	CES48025-25	CES48033-25	CES48050-16	CES48120-6	CES48150-4	CES48033-30	CES48050-20	CES48060-17
MAX OUTPUT WATTAGE[W]	45.0	54.0	62.5	82.5	80.0	72.0	60.0	99.0	100.0	102.0
DC OUTPUT	1.5V 30A	1.8V 30A	2.5V 25A	3.3V 25A	5V 16A	12V 6A	15V 4A	3.3V 30A	5V 20A	6V 17A

SPECIFICATIONS

	MODEL	CES48015-30	CES48018-30	CES48025-25	CES48033-25	CES48050-16	CES48120-6	CES48150-4	CES48033-30	CES48050-20	CES48060-17
INPUT	VOLTAGE[V]	DC36 - 76						DC40 - 60	DC36 - 76		
	CURRENT[A]	1.1typ	1.3typ	1.45typ	1.89typ	1.84typ	1.65typ	1.37typ	2.29typ	2.32typ	2.36typ
	EFFICIENCY[%]	86typ	87typ	90typ	91typ	91typ	91typ	91typ	90typ	90typ	92typ
	START-UP VOLTAGE[V]	DC32 - 36						DC36 - 40	DC32 - 36		
	HYSTERESIS VOLTAGE[V]	DC2 min									
OUTPUT	VOLTAGE[V]	1.5	1.8	2.5	3.3	5	12	15	3.3	5	6
	CURRENT[A]	30	30	25	25	16	6	4	30	20	17
	LINE REGULATION[mV]	$\pm 5\text{max}$	$\pm 5\text{max}$	$\pm 5\text{max}$	$\pm 5\text{max}$	$\pm 5\text{max}$	$\pm 12\text{max}$	$\pm 15\text{max}$	$\pm 5\text{max}$	$\pm 5\text{max}$	$\pm 5\text{max}$
	LOAD REGULATION[mV]	$\pm 5\text{max}$	$\pm 5\text{max}$	$\pm 5\text{max}$	$\pm 5\text{max}$	$\pm 5\text{max}$	$\pm 12\text{max}$	$\pm 15\text{max}$	$\pm 5\text{max}$	$\pm 5\text{max}$	$\pm 5\text{max}$
	RIPPLE	[mVrms] *2	20max	20max	20max	25max	40max	40max	20max	25max	25max
		[mVp-p] *2	60max	60max	60max	80max	120max	120max	60max	100max	100max
	RIPPLE NOISE[mVp-p]	100max	100max	100max	100max	120max	150max	150max	100max	150max	150max
	TEMPERATURE REGULATION[mV]	66max	66max	66max	66max	100max	240max	300max	66max	100max	100max
	DRIFT[mV]	16max	16max	16max	16max	20max	40max	50max	16max	20max	20max
	START-UP TIME[ms]	200max (DCIN 48V, Io=100%)									
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open), adjustable by external resistor -20% / +10%									
	OUTPUT VOLTAGE SETTING	$\pm 1.6\%$									
	OVERCURRENT PROTECTION	Works over 105% of rating, low voltage protection (shut down) function is built-in.									
	OVERVOLTAGE PROTECTION	117% - 127%		125% - 135%	117% - 127%				125% - 135%	117% - 127%	
	REMOTE SENSING	Provided									
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)									

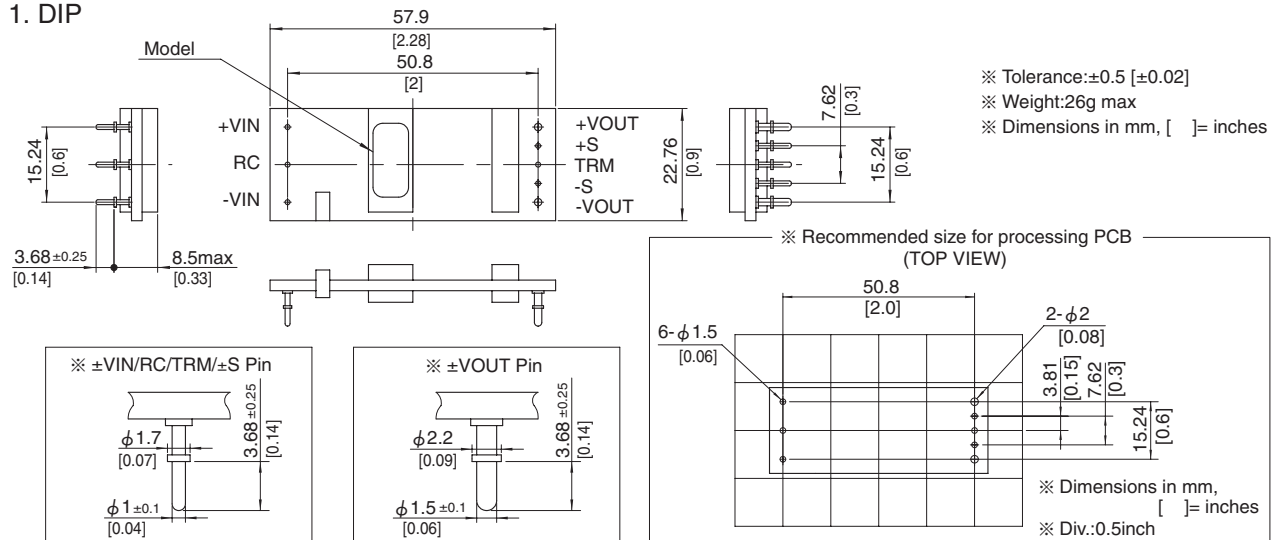
GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	DC1,500V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max (Option S: Refer to the instruction Manual)
	VIBRATION	10 - 55Hz, 49.0m/s 2 (5G), 3minutes period, 60minutes each along X, Y and Z axis
SAFETY	IMPACT	196.1m/s 2 (20G), 11ms, once each along X, Y and Z axis
OTHERS	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1
	CASE SIZE/WEIGHT	57.9 \times 8.5 \times 22.76mm [2.28 \times 0.33 \times 0.9 inches] (W \times H \times D) / 26g max
	COOLING METHOD	Convection / Forced air

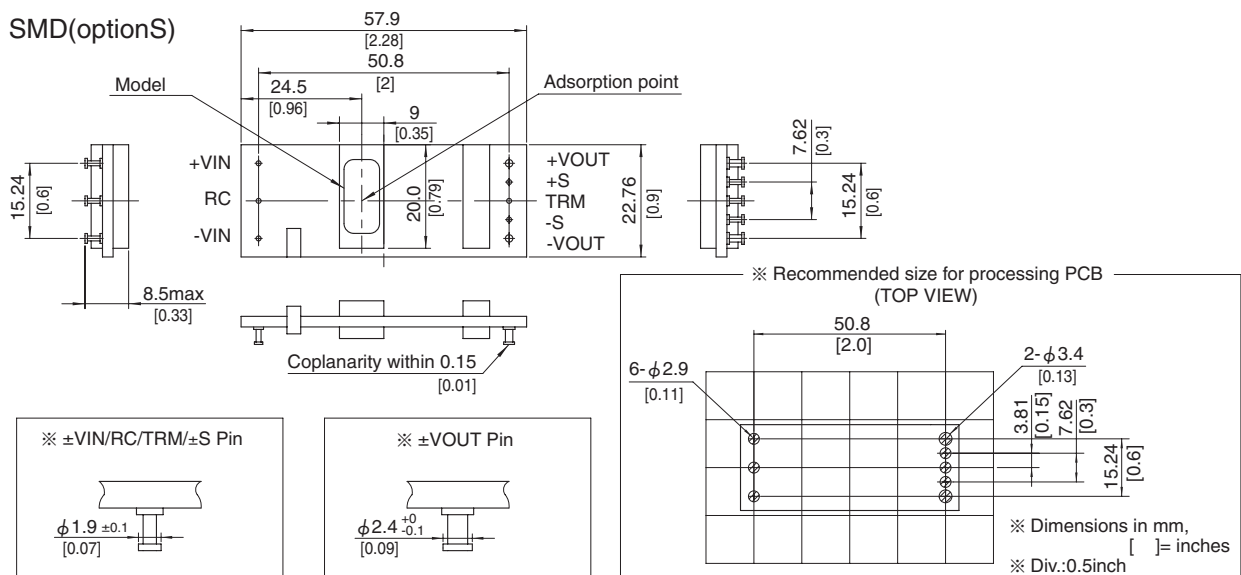
- *1 At rated input(DC24V, DC48V) and rated load and 25 $^{\circ}$ C, 2m/s.
- *2 Ripple and ripple noise is measured by using measuring board with ceramic capacitor 22 μ F. Refer to the Instruction Manual.
- *3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25 $^{\circ}$ C, with the input voltage held constant at the rated input/output.
- *4 Refer to the instruction manual for input voltage derating.

External view

1. DIP



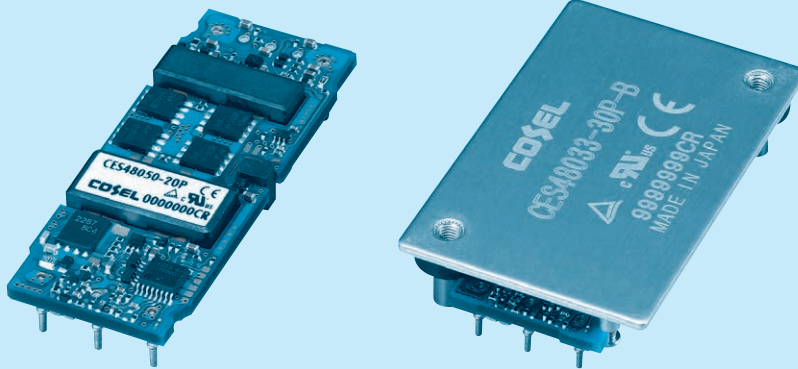
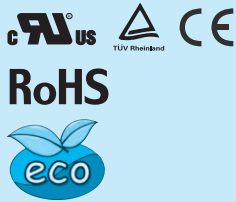
2. SMD(optionS)



CES Type-P

CE **S** **48** **033** **-30** **P** **-** ☐

① ② ③ ④ ⑤ ⑥ ⑦



- ① Series name
 ② Single output
 ③ Input voltage
 48:DC36 - 76V
 ④ Output voltage
 033:3.3V
 050:5.0V
 120:12V
 ⑤ Output current
 ⑥ Type
 P :Conduction Cooling
 ⑦ Optional
 R :with Remote ON/OFF
 Positive logic control
 N :Auto restart from thermal
 protection
 B :BasePlate option
 (Mounting hole M3)
 BT :BasePlate option
 (Mounting hole ϕ 3.4 thru)

* The size of the Base plate option is 1/4Brick size(57.9 X 36.8mm).

MODEL	CES48033-30P	CES48050-20P	CES48120-7P
MAX OUTPUT WATTAGE[W]	99.0	100.0	84.0
DC OUTPUT	3.3V 30A	5.0V 20A	12V 7A

SPECIFICATIONS

	MODEL	CES48033-30P	CES48050-20P	CES48120-7P
INPUT	VOLTAGE[V]	DC36 - 76		
	CURRENT[A]	2.29typ	2.32typ	1.93typ
	EFFICIENCY[%]	90typ	90typ	91typ
	START-UP VOLTAGE[V]	DC32 - 36		
	HYSTERESIS VOLTAGE[V]	DC2 min		
OUTPUT	VOLTAGE[V]	3.3	5	12
	CURRENT[A]	30	20	7
	LINE REGULATION[mV]	± 5 max		
	LOAD REGULATION[mV]	± 5 max		
	RIPPLE	[mVrms] *2	20max	40max
		[mVp-p] *2	60max	120max
	RIPPLE NOISE[mVp-p]	100max	120max	150max
	TEMPERATURE REGULATION[mV]	66max	100max	240max
	DRIFT[mV]	16max	20max	40max
	START-UP TIME[ms]	200max (DCIN 48V, I _o =100%)		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating, low voltage protection (shut down) function is built-in		
	OVERVOLTAGE PROTECTION	120% - 140%	125% - 145%	115% - 135%
	REMOTE SENSING	Provided		
	REMOTE ON/OFF	Provided (Negative logic L:ON, H:OFF)		
ISOLATION	INPUT-OUTPUT	DC1,500V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15°C)		
	INPUT-BASEPLATE	DC1,500V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15°C)		
	OUTPUT-BASEPLATE	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (20 \pm 15°C)		
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-40 to +85°C, 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max		
	STORAGE TEMP.,HUMID.AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max		
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis		
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1		
OTHERS	CASE SIZE/WEIGHT	57.9 x 8.5 x 22.76mm [2.28 x 0.33 x 0.9 inches] (W x H x D) / 26g max		
	COOLING METHOD	57.9 x 12.7 x 36.8mm [2.28 x 0.5 x 1.45 inches] (W x H x D) / 50g max *5		

*1 At rated input(DC48V) and rated load. Ta=25°C, 2m/s.

*2 Ripple and ripple noise is measured by using measuring board with ceramic capacitor 22 μ F.

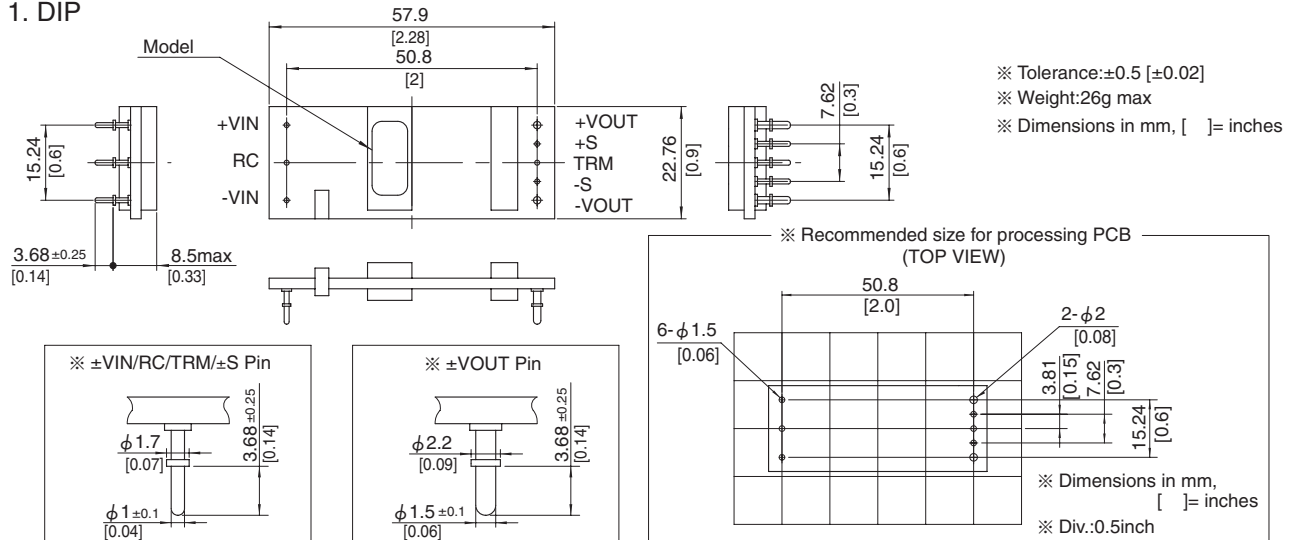
*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*4 DC40V or more input voltage is required to trim the output voltage up more than rated output +10%.

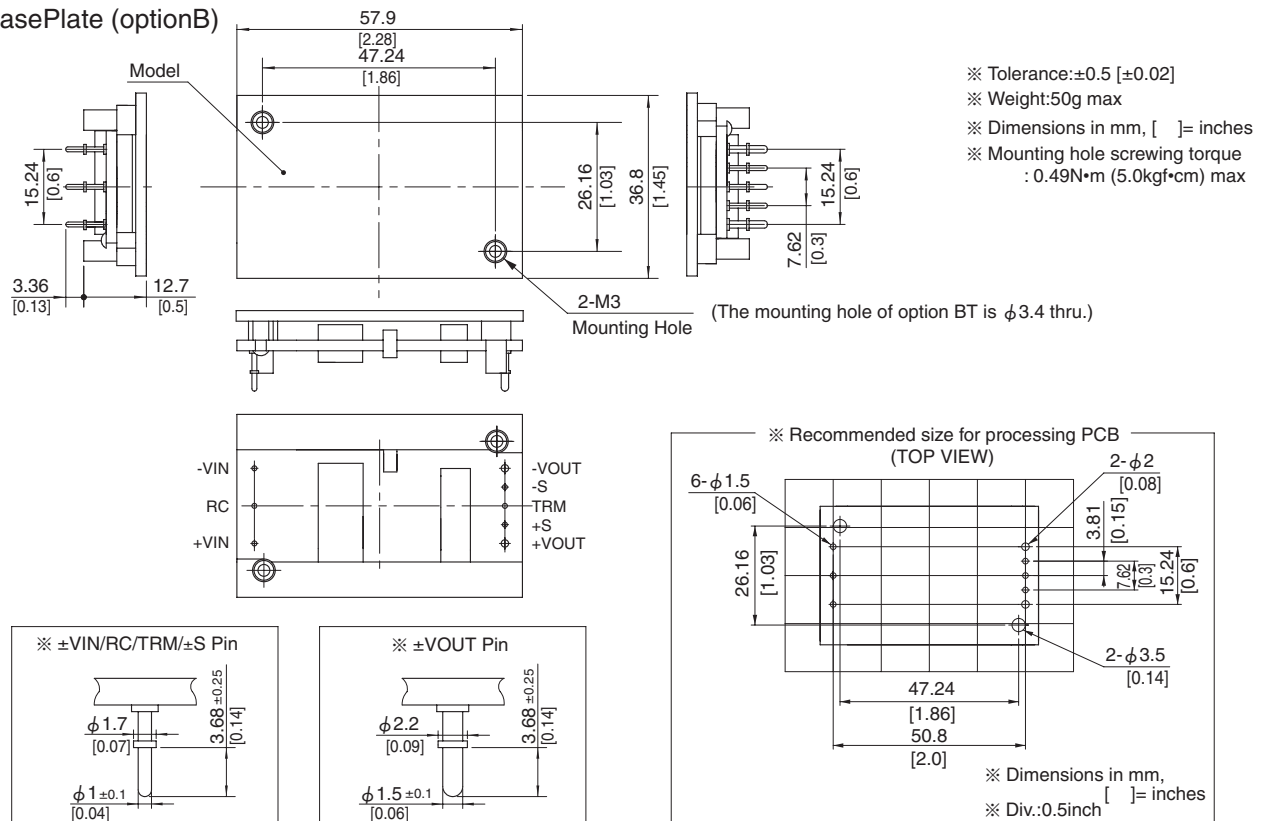
*5 BasePlate Option.

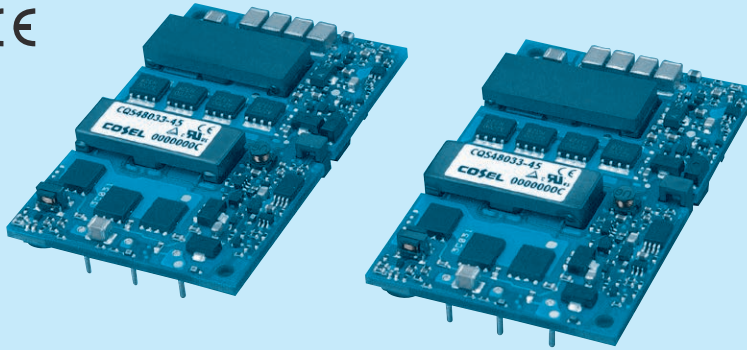
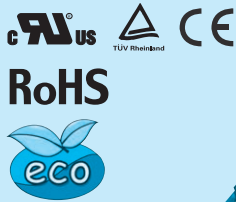
External view

1. DIP



2. BasePlate (optionB)





- ① Series name
 ② Single output
 ③ Input voltage
 24:DC18 - 36V
 48:DC36 - 76V
 ④ Output voltage
 015:1.5V
 018:1.8V
 025:2.5V
 033:3.3V
 050:5V
 120:12V
 150:15V
 ⑤ Output current
 ⑧ Optional
 R :with Remote ON/OFF
 Positive logic control
 V :Output voltage setting $\pm 1\%$
 N :Auto restart from thermal protection

MODEL	CQS24033-40	CQS24050-28	CQS24120-12	CQS24150-8
MAX OUTPUT WATTAGE[W]	132.0	140.0	144.0	120.0
DC OUTPUT	3.3V 40A	5V 28A	12V 12A	15V 8A

SPECIFICATIONS

	MODEL	CQS24033-40	CQS24050-28	CQS24120-12	CQS24150-8
INPUT	VOLTAGE[V]	DC18 - 36			DC20 - 33
	CURRENT[A]	6.05typ	6.45typ	6.59typ	5.44typ
	EFFICIENCY[%]	91typ	91typ	92typ	92typ
	START-UP VOLTAGE[V]	DC16 - 18			DC18 - 20
	HYSTERESIS VOLTAGE[V]	DC1 min			
OUTPUT	VOLTAGE[V]	3.3	5	12	15
	CURRENT[A]	40	28	12	8
	LINE REGULATION[mV]	$\pm 5\text{max}$	$\pm 5\text{max}$	$\pm 12\text{max}$	$\pm 15\text{max}$
	LOAD REGULATION[mV]	$\pm 5\text{max}$	$\pm 5\text{max}$	$\pm 12\text{max}$	$\pm 15\text{max}$
	RIPPLE	[mVrms]	20max	25max	40max
		[mVp-p]	60max	80max	120max
	RIPPLE NOISE[mVp-p]	100max	120max	150max	150max
	TEMPERATURE REGULATION[mV]	66max	100max	240max	300max
	DRIFT[mV]	16max	20max	40max	50max
	START-UP TIME[ms]	200max (DCIN 24V, $I_o=100\%$)			
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open), adjustable by external resistor			
		-15% / +15%	-20% / +20%	-20% / +10%	-20% / +5%
	OUTPUT VOLTAGE SETTING	$\pm 1.6\%$			
	OVERCURRENT PROTECTION	Works over 105% of rating, low voltage protection (shut down) function is built-in.			
	OVERVOLTAGE PROTECTION	125% - 135%	125% - 135%	117% - 127%	
PROTECTION CIRCUIT AND OTHERS	REMOTE SENSING	Provided			
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)			

MODEL	CQS48015-50	CQS48018-50	CQS48025-45	CQS48033-45	CQS48050-28	CQS48120-14	CQS48150-8
MAX OUTPUT WATTAGE[W]	75.0	90.0	112.5	148.5	140.0	168.0	120.0
DC OUTPUT	1.5V 50A	1.8V 50A	2.5V 45A	3.3V 45A	5V 28A	12V 14A	15V 8A

SPECIFICATIONS

	MODEL	CQS48015-50	CQS48018-50	CQS48025-45	CQS48033-45	CQS48050-28	CQS48120-14	CQS48150-8	
INPUT	VOLTAGE[V]	DC36 - 76						DC40 - 60	
	CURRENT[A]	*1 1.80typ	2.13typ	2.58typ	3.36typ	3.17typ	3.80typ	2.72typ	
	EFFICIENCY[%]	*1 87typ	88typ	91typ	92typ	92typ	92typ	92typ	
	START-UP VOLTAGE[V]	DC32 - 36						DC36 - 40	
	HYSTERESIS VOLTAGE[V]	DC2 min							
OUTPUT	VOLTAGE[V]	1.5	1.8	2.5	3.3	5	12	15	
	CURRENT[A]	50	50	45	45	28	14	8	
	LINE REGULATION[mV]	±5max	±5max	±5max	±5max	±5max	±12max	±15max	
	LOAD REGULATION[mV]	±5max	±5max	±5max	±5max	±5max	±12max	±15max	
	RIPPLE	[mVrms]	*2 20max	20max	20max	20max	25max	40max	40max
		[mVp-p]	*2 60max	60max	60max	60max	80max	120max	120max
	RIPPLE NOISE[mVp-p]	*2 100max	100max	100max	100max	120max	150max	150max	
	TEMPERATURE REGULATION[mV]	66max	66max	66max	66max	100max	240max	300max	
	DRIFT[mV]	*3 16max	16max	16max	16max	20max	40max	50max	
	START-UP TIME[ms]	200max (DCIN 48V, Io=100%)							
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open), adjustable by external resistor							
		-20% / +10%			-15% / +15%	-20% / +10%		-20% / +5%	
	OUTPUT VOLTAGE SETTING	±1.6%							
	OVERCURRENT PROTECTION	Works over 105% of rating, low voltage protection (shut down) function is built-in.							
PROTECTION CIRCUIT AND OTHERS	OVERVOLTAGE PROTECTION	117% - 127%			125% - 135%	117% - 127%			
	REMOTE SENSING	Provided							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	DC1,500V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 49.0m/s 2 (5G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	196.1m/s 2 (20G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1
OTHERS	CASE SIZE/WEIGHT	57.9 \times 8.5 \times 36.8mm [2.28 \times 0.33 \times 1.45 inches] (W \times H \times D) / 40g max
	COOLING METHOD	Convection / Forced air

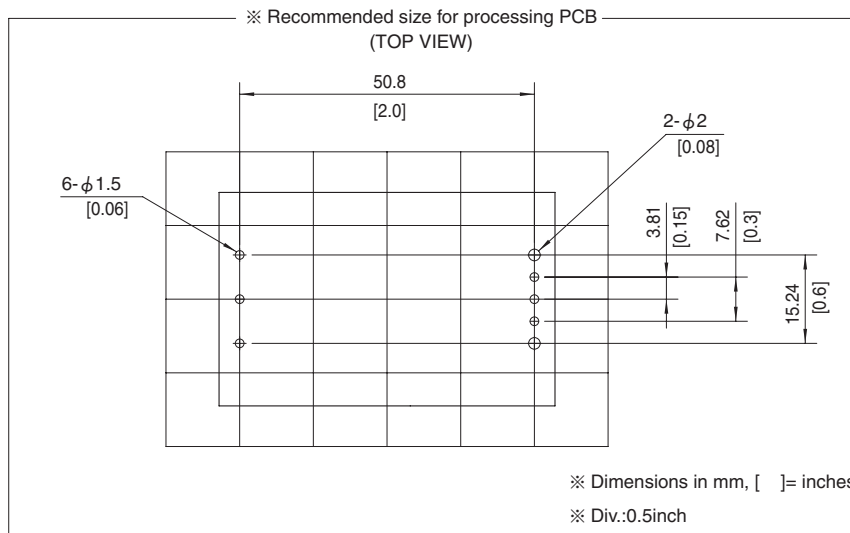
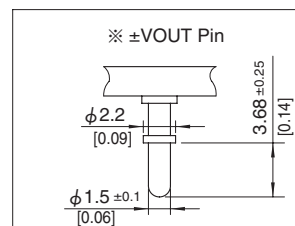
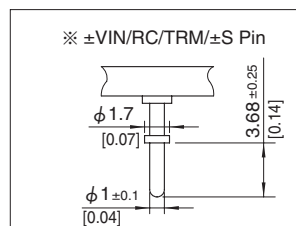
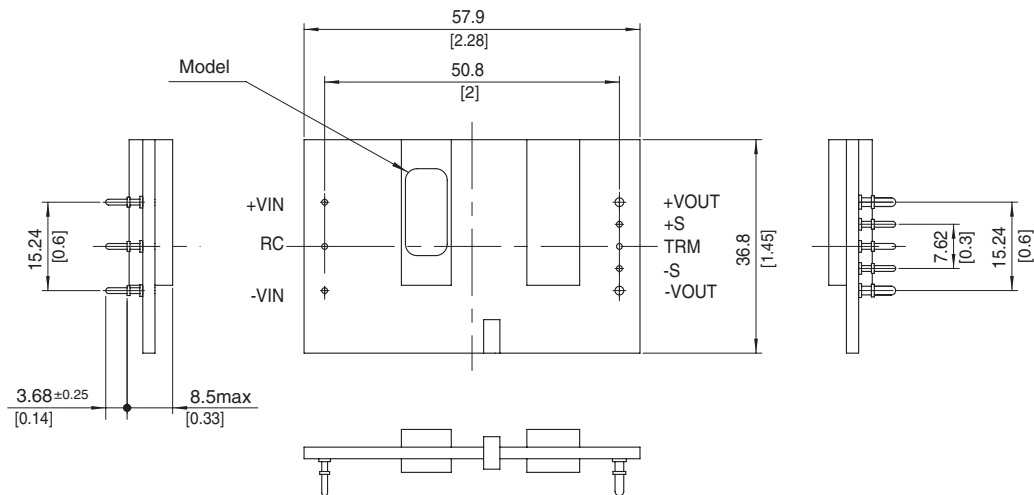
*1 At rated input(DC24V,DC48V) and rated load and 25 $^{\circ}$ C, 2m/s.

*2 Ripple and ripple noise is measured by using measuring board with ceramic capacitor 22 μ F. Refer to the Instruction Manual.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25 $^{\circ}$ C, with the input voltage held constant at the rated input/output.

*4 Refer to the instruction manual for input voltage derating.

External view



※ Tolerance:±0.5 [±0.02]

※ Weight:40g max

※ Dimensions in mm, [] = inches

Basic characteristics data

Model	Circuit method	Switching frequency [KHz]	Input current	Rated input fuse	Inrush current protection circuit	PCB/Pattern			Series/Redundancy operation availability	
						Material	Single sided	Double sided	Series operation	Redundancy operation
CES	Forward converter	420	*1	-	-	glass fabric base, epoxy resin		Multilayer	Yes	*2
CES (type-P)	Forward converter	400	*1	-	-	glass fabric base, epoxy resin		Multilayer	Yes	*2
CQS	Forward converter	420	*1	-	-	glass fabric base, epoxy resin		Multilayer	Yes	*2

*1 Refer to Specification.

*2 Refer to Instruction Manual.

CES · CQS

1 Pin Connection CE/CQ-10**2** Connection for Standard Use CE/CQ-10**3** Wiring Input/Output Pin CE/CQ-10

- 3.1 Wiring input pin CE/CQ-10
- 3.2 Wiring output pin CE/CQ-11

4 Function CE/CQ-12

- 4.1 Overcurrent protection and Low voltage protection CE/CQ-12
- 4.2 Overvoltage protection CE/CQ-12
- 4.3 Thermal protection CE/CQ-12
- 4.4 Remote ON/OFF CE/CQ-12
- 4.5 Remote sensing CE/CQ-12
- 4.6 Adjustable voltage range CE/CQ-13
- 4.7 Isolation CE/CQ-14

CE/CQ

5 Series and Parallel Operation CE/CQ-14

- 5.1 Series operation CE/CQ-14
- 5.2 Redundancy operation CE/CQ-14

6 Implementation · Mounting Method CE/CQ-15

- 6.1 Mounting method CE/CQ-15
- 6.2 Automatic Mounting (CES series:option S) CE/CQ-15
- 6.3 Soldering CE/CQ-15
- 6.4 Stress onto the pins CE/CQ-16
- 6.5 Cleaning CE/CQ-16
- 6.6 Storage method (CES series:option S) CE/CQ-16
- 6.7 Stress to the product CE/CQ-16

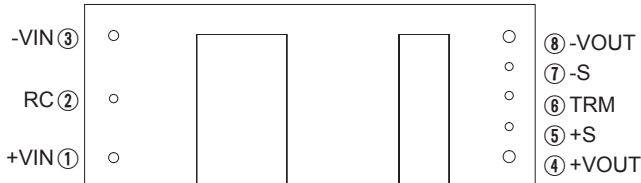
7 Safety Considerations CE/CQ-16**8** Derating CE/CQ-16

- 8.1 CES Derating CE/CQ-16
- 8.2 CQS Derating CE/CQ-20

9 SMD type(optionS) package information CE/CQ-22

1 Pin Connection

●CES Series



●CQS Series

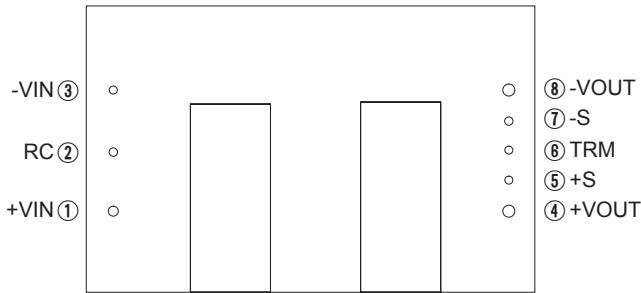


Fig.1.1 Pin Connection (bottom view)

Table 1.1 Pin Connection and function

No.	Pin Connection	Function
①	+VIN	+DC input
②	RC	Remote ON/OFF
③	-VIN	-DC input
④	+VOUT	+DC output
⑤	+S	+Remote sensing
⑥	TRM	Adjustment of output voltage
⑦	-S	-Remote sensing
⑧	-VOUT	-DC output

No.	Pin Connection	Reference
①	+VIN	3.1 "Wiring input pin "
②	RC	4.4 "Remote ON/OFF "
③	-VIN	3.1 "Wiring input pin "
④	+VOUT	3.2 "Wiring output pin "
⑤	+S	4.5 "Remote sensing "
⑥	TRM	4.6 "Adjustable voltage range "
⑦	-S	4.5 "Remote sensing "
⑧	-VOUT	3.2 "Wiring output pin "

2 Connection for Standard Use

■ In order to use the power supply, it is necessary to wire as shown in Fig.2.1.

Reference : 3 "Wiring Input/Output Pin"
8 "Derating"

■ Short the following pins to turn on the power supply.

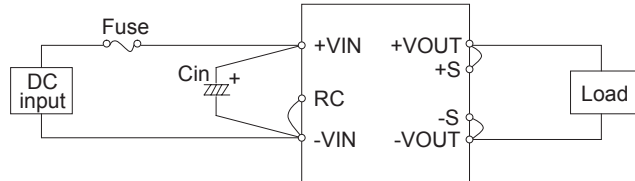
-VIN↔RC, +VOUT↔+S, -VOUT↔-S

Reference : 4.4 "Remote ON/OFF"
4.5 "Remote sensing"

■ The CES series and the CQS series handle only the DC input.

Avoid applying AC input directly.

It will damage the power supply.



Cin : External capacitor on the input side

Fig.2.1 Connection for standard use

Table 2.1 Recommended External capacitor on the input side

Model	CES24/CQS24	
Cin	220μF or more	
Model	CES48/CQS48	CES48033-30, CES48050-20, CES48060-17, CES48033-30P, CES48050-20P, CES48120-7P
Cin	33μF or more	47μF or more

3 Wiring Input/Output Pin

3.1 Wiring input pin

(1) External fuse

■ Fuse is not built-in on input side. In order to protect the unit, install the normal-blow type fuse on input side.

■ When the input voltage from a front end unit is supplied to multiple units, install the normal-blow type fuse in each unit.

Table 3.1 Recommended fuse (Normal-blow type)

Model	CES24	CQS24	CES48	CQS48
Rated current	10A	15A	6.3A	10A

4 Function

4.1 Overcurrent protection and Low voltage protection

■ Overcurrent protection is built-in and comes into effect at over 105% of the rated current.

Overcurrent protection prevents the unit from short circuit and overcurrent condition.

■ The DC output will be shut down, when the output voltage drops under the output voltage adjustment range (low voltage protection).

In this case, recovery from low voltage protection is accomplished by cycling the DC input power off for at least 1 second(★), or toggling Remote ON/OFF signal.

★ The recovery time varies depending on input voltage and input capacity.

4.2 Overvoltage protection

■ The overvoltage protection circuit is built-in. The DC input should be shut down if overvoltage protection is in operation.

In this case, recovery from overvoltage protection is accomplished by cycling the DC input power off for at least 1 second(★), or toggling Remote ON/OFF signal.

★ The recovery time varies depending on input voltage and input capacity.

Remarks :

Please note that devices inside the power supply might fail when voltage more than rated output voltage is applied to output pin of the power supply. This could happen when the customer tests the overvoltage performance of the unit.

4.3 Thermal protection

■ When the power supply temperature is kept above 120°C, the thermal protection will be activated and simultaneously shut down the output.

In this case, the unit should be cool down, and then recovery from thermal protection is accomplished by cycling the DC input power off for at least 1 second, or toggling Remote ON/OFF signal.

●-N

■ Option "-N" means auto restart from thermal protection.

4.4 Remote ON/OFF

■ Remote ON/OFF circuit is built-in on input side (RC).

The ground pin of input side remote ON/OFF circuit is "-VIN" pin.

Table 4.1.1 Specification of Remote ON/OFF

	ON/OFF logic	Between RC and -VIN	Output voltage
Standard	Negative	L level(0 - 0.8V) or short	ON
		H level(2.0 - 7.0V) or open	OFF
Optional -R	Positive	L level(0 - 0.8V) or short	OFF
		H level(2.0 - 7.0V) or open	ON

When RC is "Low" level, fan out current is 0.1mA typ. When Vcc is applied, use $2.0 \leq V_{cc} \leq 7.0V$.

Table 4.1.2 Specification of Remote ON/OFF (type-P)

	ON/OFF logic	Between RC and -VIN	Output voltage
Standard	Negative	L level(0 - 0.8V) or short	ON
		H level(4.0 - 7.0V) or open	OFF
Optional -R	Positive	L level(0 - 0.8V) or short	OFF
		H level(4.0 - 7.0V) or open	ON

When RC is "Low" level, fan out current is 0.1mA typ. When Vcc is applied, use $4.0 \leq V_{cc} \leq 7.0V$.

■ When remote ON/OFF function is not used, please short between RC and -VIN(-R: open between RC and -VIN).

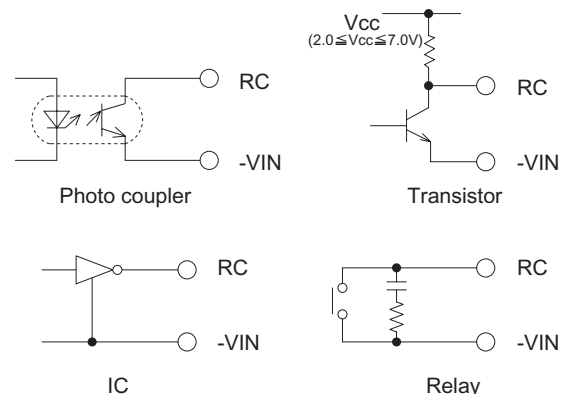


Fig.4.1 RC connection example

4.5 Remote sensing

(1) When the remote sensing function is not in use

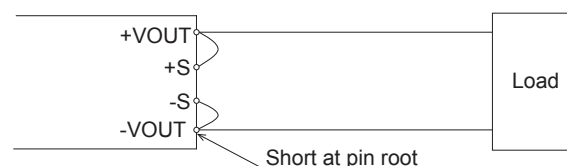


Fig.4.2 Connection when the remote sensing is not in use

CES · CQS

■When the remote sensing function is not in use, it is necessary to confirm that pins are shorted between +S & +VOUT and between -S & -VOUT.

■Wire between +S & +VOUT and between -S & -VOUT as short as possible.

Loop wiring should be avoided.

This power supply might become unstable by the noise coming from poor wiring.

(2)When the remote sensing function is in use

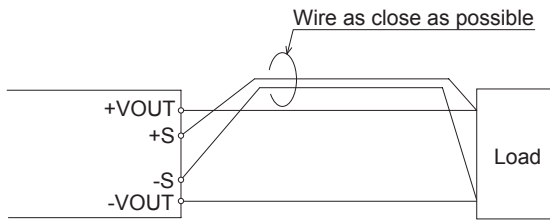


Fig.4.3 Connection when the remote sensing is in use

■Twisted-pair wire or shield wire should be used for sensing wire.

■Thick wire should be used for wiring between the power supply and a load.

Line drop should be less than 0.3V.

Voltage between +VOUT and -VOUT should remain within the output voltage adjustment range.

■If the sensing patterns are short, heavy-current is drawn and the pattern may be damaged.

The pattern disconnection can be prevented by installing the protection parts as close as a load.

■Output voltage might become unstable because of impedance of wiring and load condition when length of wire is exceeding 40cm.

4.6 Adjustable voltage range

(1) Output voltage adjusting

■Output voltage is adjustable by the external potentiometer.

■When the output voltage adjustment is used, note that the over voltage protection circuit operates when the output voltage sets too high.

■If the output voltage drops under the output voltage adjustment range, note that the Low voltage protection operates.

■By connecting the external potentiometer (VR1)and resistors (R1,R2),output voltage becomes adjustable, as shown in Fig.4.4, recommended external parts are shown in Table 4.2.

■The wiring to the potentiometer should be as short as possible.

The temperature coefficient becomes worse, depending on the type of a resistor and potentiometer. Following parts are recommended for the power supply.

Resistor······Metal film type, coefficient of less than $\pm 100\text{ppm}/^\circ\text{C}$

Potentiometer·····Cermet type, coefficient of less than $\pm 300\text{ppm}/^\circ\text{C}$

■When the output voltage adjustment is not used, open the TRM pin respectively.

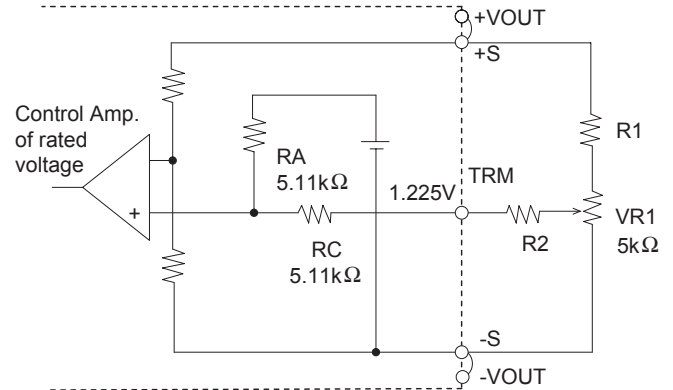


Fig.4.4 Output voltage control circuit

Table 4.2 Recommended value of external potentiometer & resistor

No.	VOUT	Output adjustable range					
		VOUT $\pm 5\%$			VOUT $\pm 10\%$		
		R1	R2	VR1	R1	R2	VR1
1	1.5V	0	10k Ω	5k Ω	0	4.3k Ω	5k Ω
2	1.8V	0	39k Ω		0	18k Ω	
3	2.5V	330 Ω	68k Ω		560 Ω	33k Ω	
4	3.3V	2.2k Ω	68k Ω		2.2k Ω	33k Ω	
5	5V	4.7k Ω	68k Ω		5.6k Ω	33k Ω	
6	6V	5.6k Ω	68k Ω		6.8k Ω	33k Ω	
7	12V	18k Ω	68k Ω		18k Ω	33k Ω	
8	15V	22k Ω	68k Ω		22k Ω	33k Ω	

(2) Output voltage decreasing

■By connecting the external resistor(RD), output voltage becomes adjustable to decrease.

The external resistor(RD) is calculated the following equation.

$$RD = \frac{5.11}{\Delta} - 10.22 \text{ [k}\Omega\text{]}$$

$$\Delta = \frac{V_{OR} - V_{OD}}{V_{OR}}$$

V_{OR} : Rated output voltage [V]

V_{OD} : Output voltage needed to set up [V]

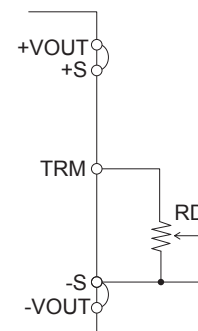


Fig.4.5 Connection for output voltage decreasing

CES · CQS

(3) Output voltage increasing

■ By connecting the external resistor (RU), output voltage becomes adjustable to increase.

The external resistor (RU) is calculated the following equation.

$$RU = \frac{5.11 \times V_{OR} \times (1 + \Delta)}{1.225 \times \Delta} - \frac{5.11}{\Delta} - 10.22 \text{ [k}\Omega\text{]}$$

$$\Delta = \frac{V_{OU} - V_{OR}}{V_{OR}}$$

V_{OR} : Rated output voltage [V]

V_{OU} : Output voltage needed to set up [V]

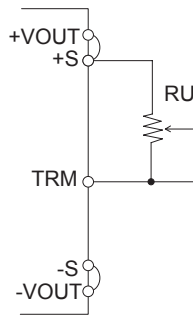


Fig.4.6 Connection for output voltage increasing

CE/CQ

(4) Input voltage derating

■ CES24□-□ and CQS24□-□ require DC20V or more input to trim the output voltage up more than rated.

■ CES48050-20P require DC40V or more input to trim the output voltage up more than 5.5V.

4.7 Isolation

■ For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for a start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

5 Series and Parallel Operation

5.1 Series operation

■ Series operation is available by connecting the outputs of two or more power supplies, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

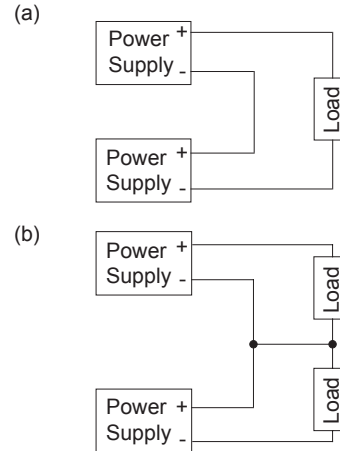


Fig.5.1 Examples of series operation

5.2 Redundancy operation

■ Parallel operation is not possible.

■ Redundancy operation is available by wiring as shown below.

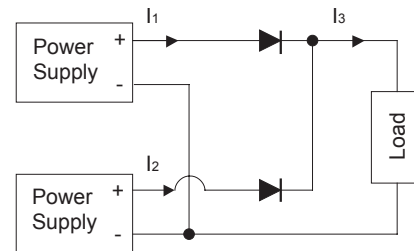


Fig.5.2 Redundancy operation

■ Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .

Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

6 Implementation · Mounting Method

6.1 Mounting method

- The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. The temperature around each power supply should not exceed the temperature range shown in derating curve.
- Avoid placing the DC input line pattern layout underneath the unit, it will increase the line conducted noise. Make sure to leave an ample distance between the line pattern layout and the unit. Also avoid placing the DC output line pattern underneath the unit because it may increase the output noise. Lay out the pattern away from the unit.
- Avoid placing the signal line pattern layout underneath the unit, this power supply might become unstable. Lay out the pattern away from the unit.
- Avoid placing pattern layout in hatched area in Fig.6.1 to insulate between pattern and power supply.

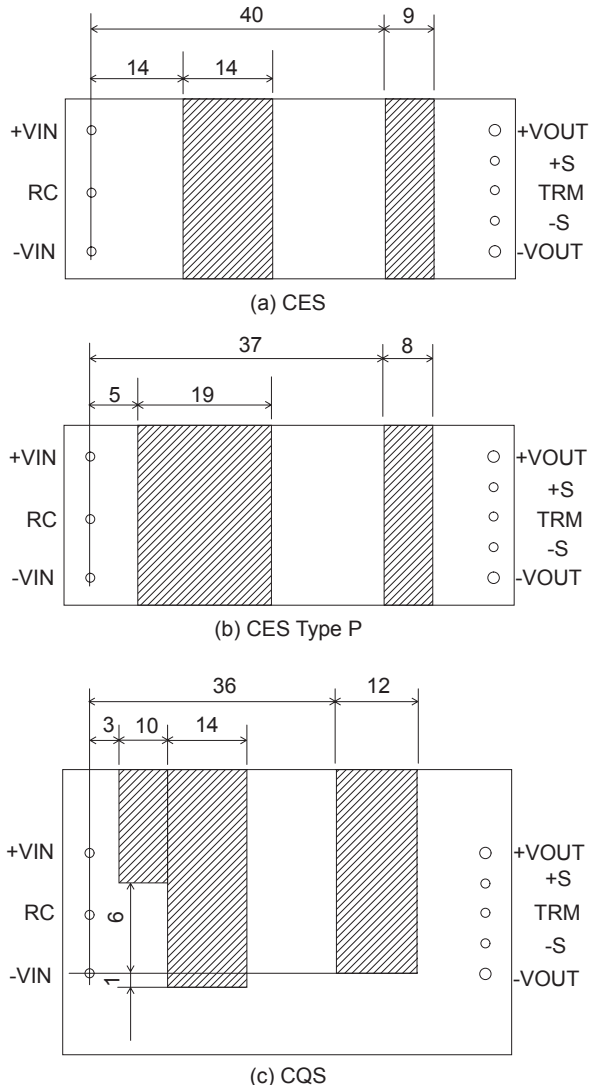


Fig.6.1 Prohibition area of pattern lay out (top view)

6.2 Automatic Mounting (CES series:option S)

- To mount CES series automatically, use the transformer area near the center of the PCB as a adsorption point. Please see the External View for details of the adsorption point.
- If the bottom dead point of a suction nozzle is too low when mounting excessive force is applied to the transformer, which could cause damage. Please mount carefully.

6.3 Soldering

(1) Flow Soldering : 260°C 15 seconds or less

(2) Soldering Iron : maximum 450°C 5 seconds or less

(3) Reflow Soldering (option "-S")

- Fig.6.2 shows conditions for the reflow soldering for option "-S" of CES series. Please make sure that the temperatures of pin terminals +VIN and -VOUT shown in Fig.6.2 do not exceed the temperatures shown in Fig.6.3.

- If time or temperature of the reflow soldering goes beyond the conditions, reliability of internal components may be compromised. Please use the unit under the recommended reflow conditions.

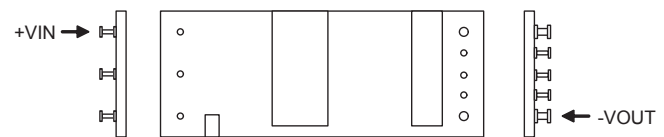
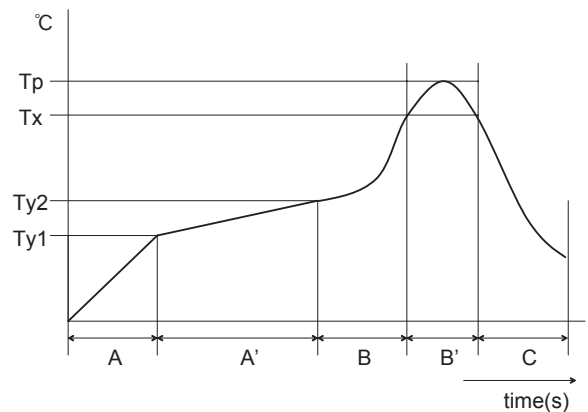


Fig.6.2 Temperature Measuring Points when Setting Reflow Soldering Conditions



A	1.0 - 5.0°C/s
A'	Ty1: 160±10°C Ty2: 180±10°C Ty1 - Ty2: 120s max
B	1.0 - 5.0°C/s
B'	Tp: Max245°C 10s max Tx: 220°C or more: 70s max
C	1.0 - 5.0°C/s

Fig.6.3 Recommend Reflow Soldering Conditions

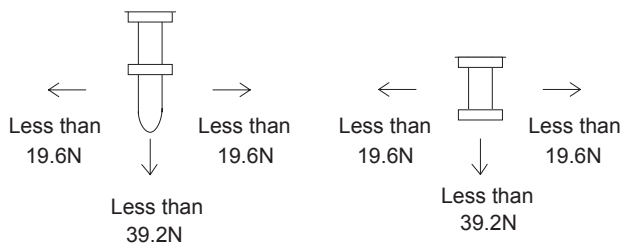
CES · CQS

Notes to use option “-S”

- Solder iron or similar is not recommended soldering method for option “-S”. The reason is to retain connection reliability between the PCB and the Pins. Solder reflow is the acceptable mounting system for the option.
- Option “-S” is not reusable product after soldered on any application PCB.

6.4 Stress onto the pins

- When too much stress is applied to the pins of the power supply, the internal connection may be weakened.
As shown in Fig.6.4, avoid applying stress of more than 19.6N (2kgf) on the pins horizontally and more than 39.2N (4kgf) vertically.
- The pins are soldered on PWB internally, therefore, do not pull or bend them with abnormal forces.
- Fix the unit on PCB (using silicone rubber or fixing fittings) to reduce the stress onto the pins.



(option S)

Fig.6.4 Stress onto the pins

6.5 Cleaning

- When cleaning is necessary, follow the under mentioned condition.
 Method : Varnishing, ultrasonic wave and vapor
 Cleaning agents : IPA (Solvent type)
 Total time : 2 minutes or less
- Do not apply pressure to the lead and name plate with a brush or scratch it during the cleaning.
- After cleaning, dry them enough.

6.6 Storage method (CES series:option S)

- To stock unpacked products in your inventory, it is recommended to be kept under controlled condition, 5-30°C, 60%RH and be used within a year.
- 24-hours-baking is recommended at 125°C if unpacked products was kept under uncontrol condition, in which 30°C, 60%RH or higher.
Original tray is not heat-resistant, please move them to heat-resistant tray preparing to bake them.
To check moisture condition in the pack, silica gel packet has some moisture condition indicator particle.
Indicated blue means good. Pink means alarm to bake it.
- Notification. The tray will be deformed and the power supply might be damaged, if the vacuum pressure is too much to reseal.

6.7 Stress to the product

- CES/CQS series transformer core and choke coil core are attached by glue.
There is a possibility that the core will be removed and power supply will be damaged when it took stress by the fall or some kind of stress.

7 Safety Considerations

- To apply for safety standard approval using this power supply, the following conditions must be met.
 - This unit must be used as a component of the end-use equipment.
 - The equipment contain basic insulation between input and output.
If double or reinforced insulation is required, it has to be provided by the end-use equipment according the final build in condition.
 - Safety approved fuse must be externally installed on input side.

8 Derating

- It is necessary to note thermal fatigue life by power cycle.
Please reduce the temperature fluctuation range as much as possible when the up and down of temperature are frequently generated.

8.1 CES Derating

- Use with the convection cooling or the forced air cooling.
Use the temperature measurement location as shown in Fig.8.2.1 to Fig.8.2.3 below the regulated temperature. Refer to Fig.8.1 for derating curve.
Ambient temperature must keep below 85°C.

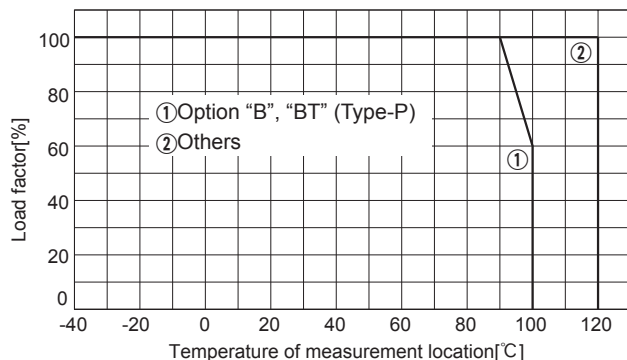
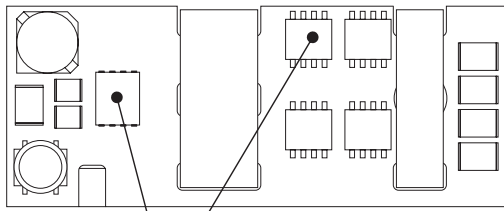
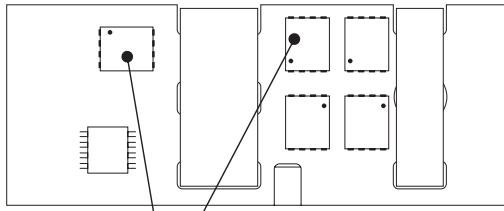


Fig.8.1 Derating curve



Temperature measurement location
Fig.8.2.1 Temperature measurement location



Temperature measurement location
Fig.8.2.2 Temperature measurement location (CES Type P)

■Option “B” and “BT”(Type-P) used with the convection cooling or the forced air cooling or the conduction cooling.
Use the temperature measurement location as shown in Fig.8.2.3.

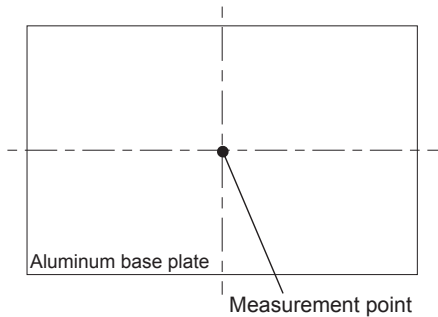


Fig.8.2.3 Measurement point (CES Type P option “B”, “BT”)

■Shown the thermal curve with measuring as shown in Fig.8.3.
Verify final design by actual temperature measurement.
Use the temperature measurement location as shown in Fig.8.2.1 to fig.8.2.3 at 120°C or less.

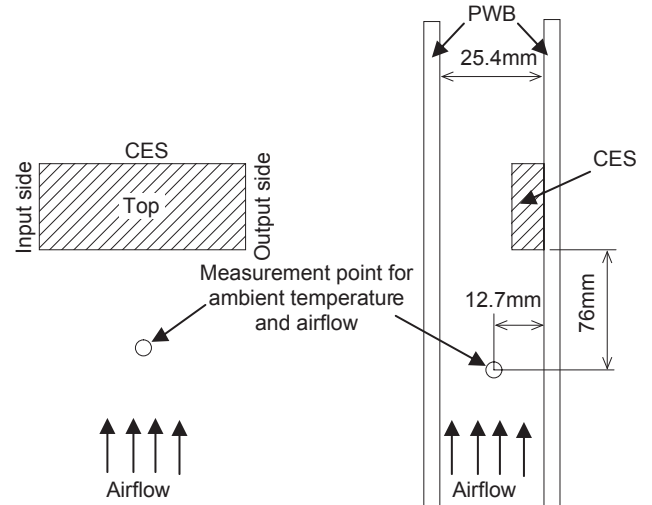


Fig.8.3 Measuring method

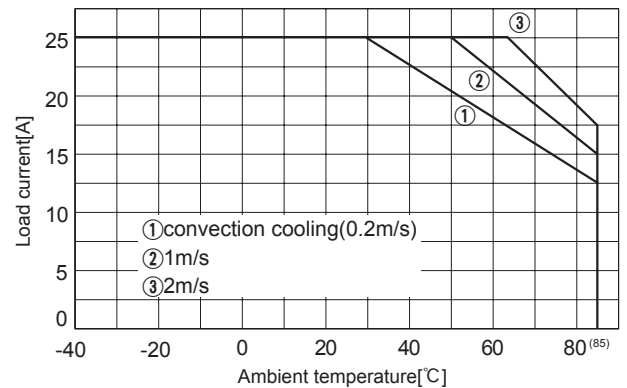


Fig.8.4 Load current vs. ambient temperature (CES24033-25 Vin=24V)

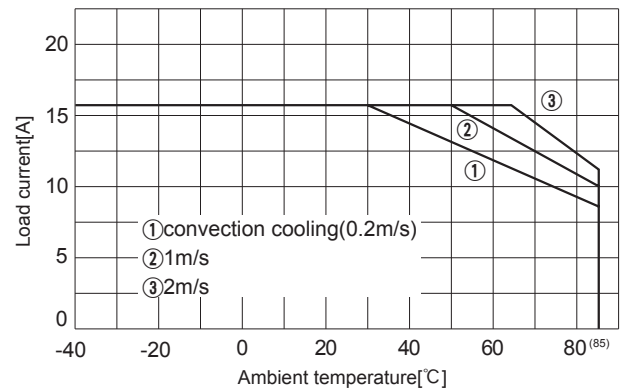


Fig.8.5 Load current vs. ambient temperature (CES24050-16 Vin=24V)

CES · CQS

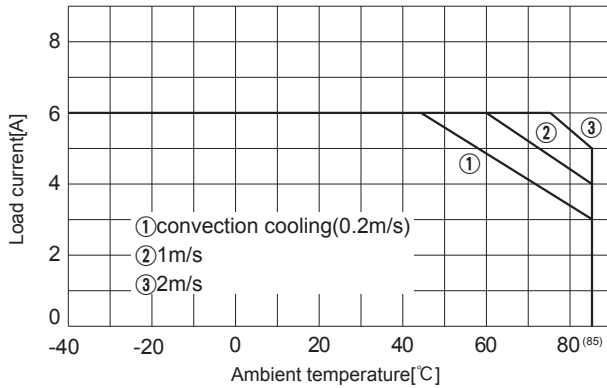


Fig.8.6 Load current vs. ambient temperature (CES24120-6 Vin=24V)

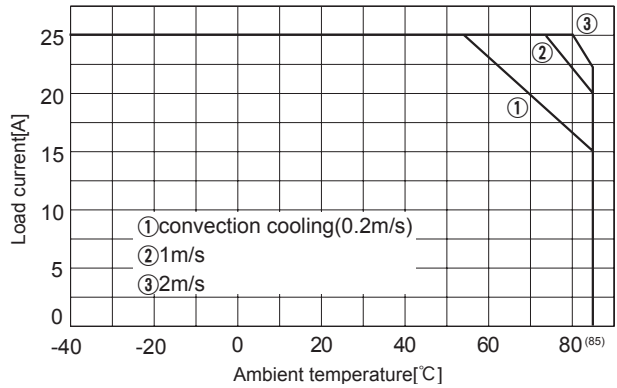


Fig.8.10 Load current vs. ambient temperature (CES48025-25 Vin=48V)

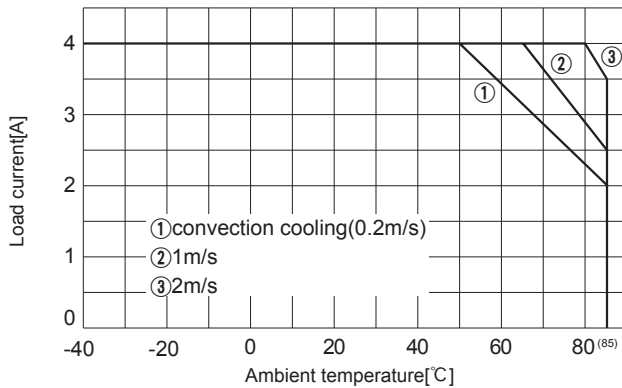


Fig.8.7 Load current vs. ambient temperature (CES24150-4 Vin=24V)

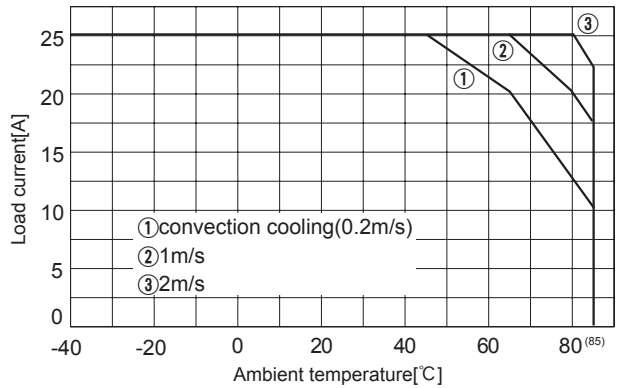


Fig.8.11 Load current vs. ambient temperature (CES48033-25 Vin=48V)

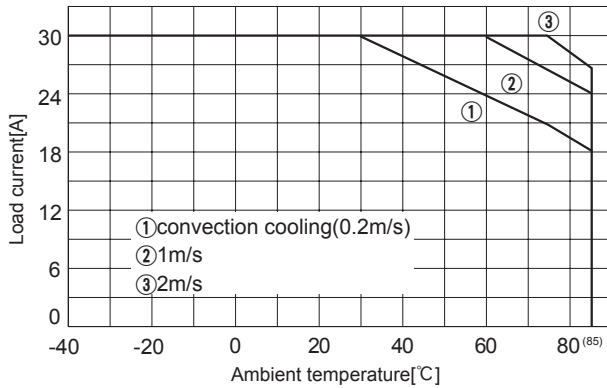


Fig.8.8 Load current vs. ambient temperature (CES48015-30 Vin=48V)

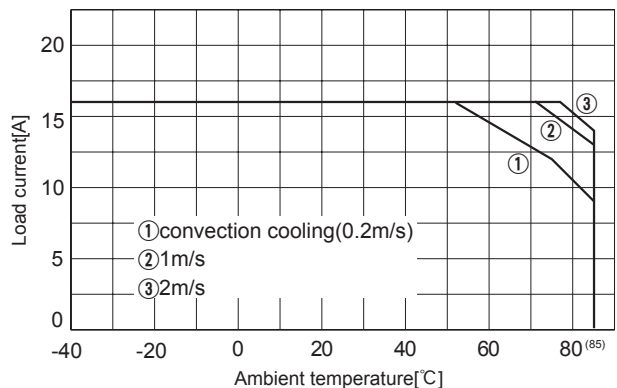


Fig.8.12 Load current vs. ambient temperature (CES48050-16 Vin=48V)

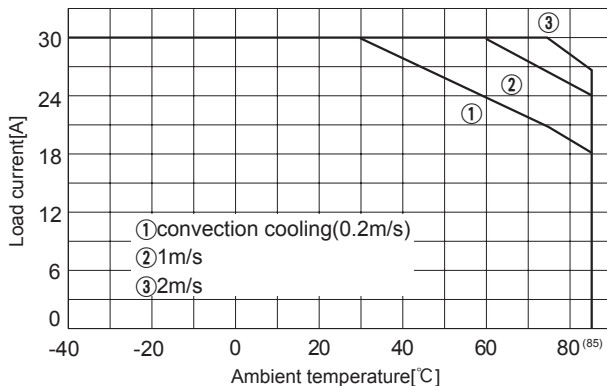


Fig.8.9 Load current vs. ambient temperature (CES48018-30 Vin=48V)

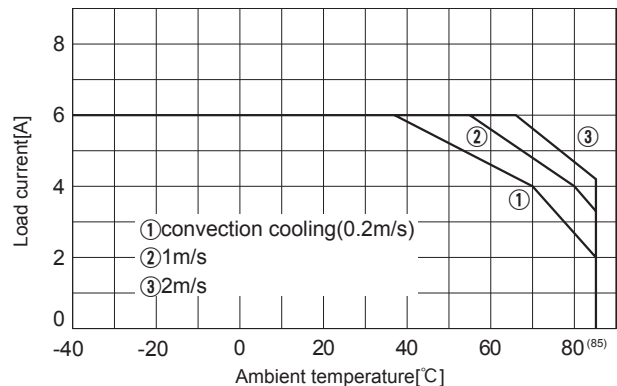


Fig.8.13 Load current vs. ambient temperature (CES48120-6 Vin=48V)

CES · CQS

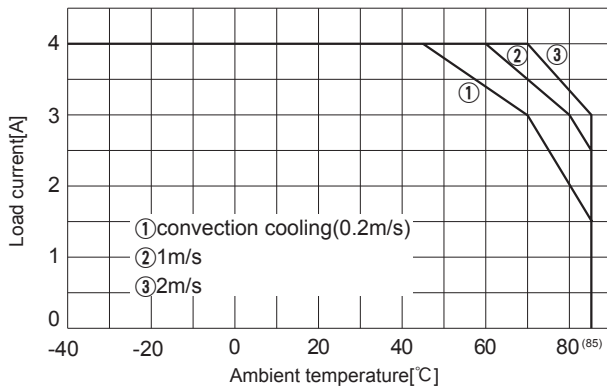


Fig.8.14 Load current vs. ambient temperature (CES48150-4 Vin=48V)

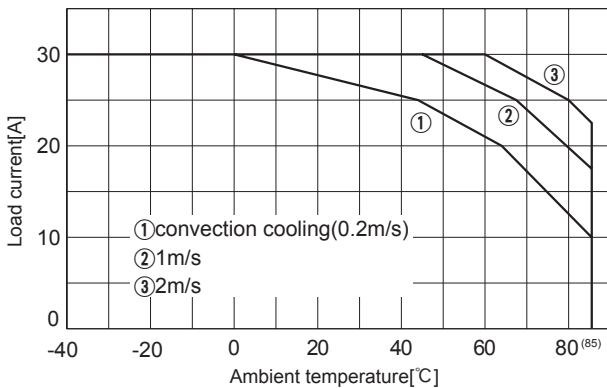


Fig.8.15 Load current vs. ambient temperature (CES48033-30 Vin=48V)

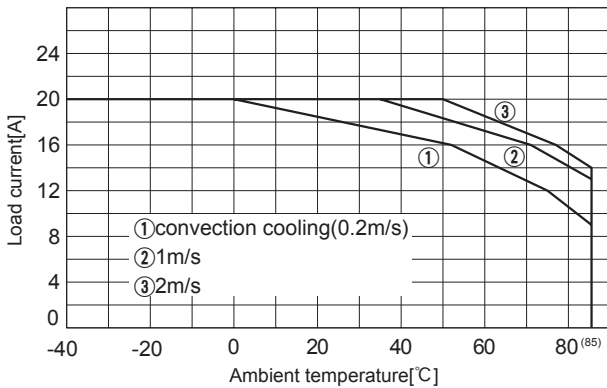


Fig.8.16 Load current vs. ambient temperature (CES48050-20 Vin=48V)

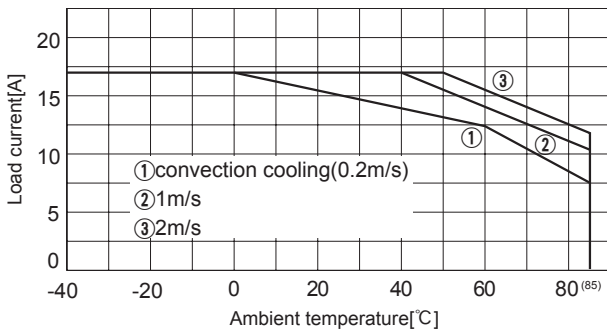


Fig.8.17 Load current vs. ambient temperature (CES48060-17 Vin=48V)

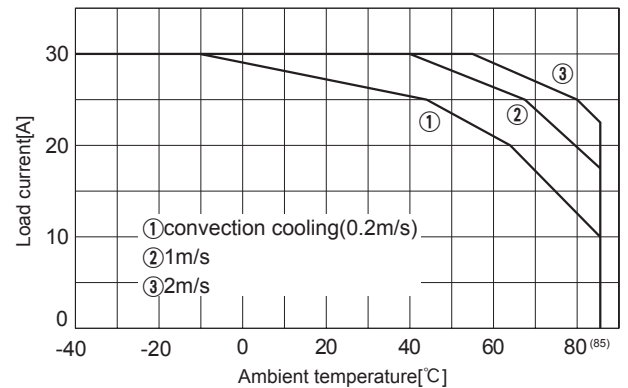


Fig.8.18 Load current vs. ambient temperature (CES48033-30P Vin=48V)

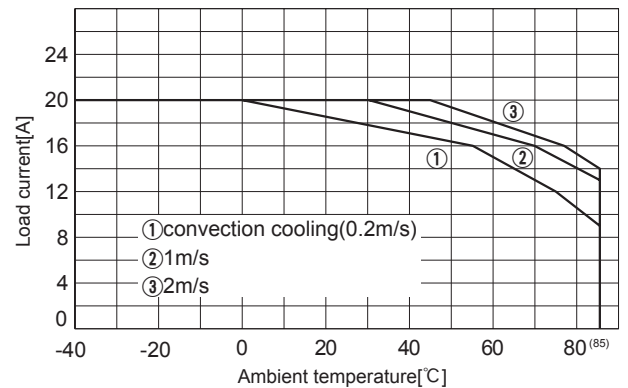


Fig.8.19 Load current vs. ambient temperature (CES48050-20P Vin=48V)

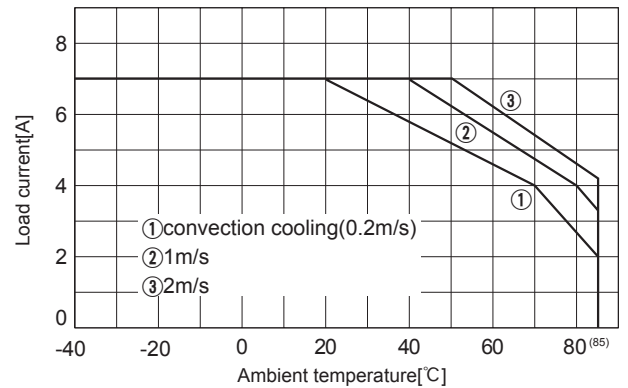


Fig.8.20 Load current vs. ambient temperature (CES48120-7P Vin=48V)

★For other thermal curves, please consult with us.

CES · CQS

8.2 CQS Derating

■ Use with the convection cooling or the forced air cooling.

Use the temperature measurement location as shown in Fig.8.21 at 120°C or less.

Ambient temperature must keep below 85°C.

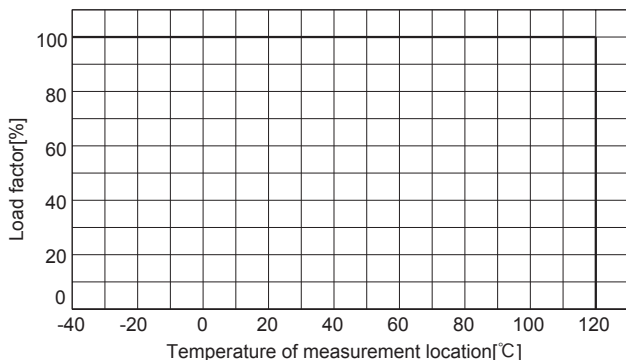
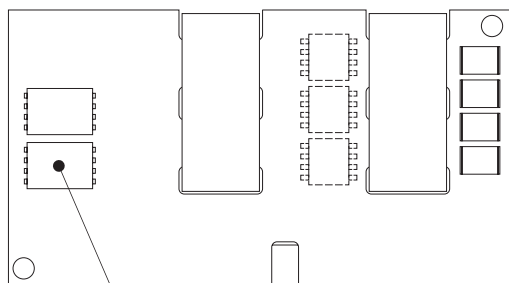
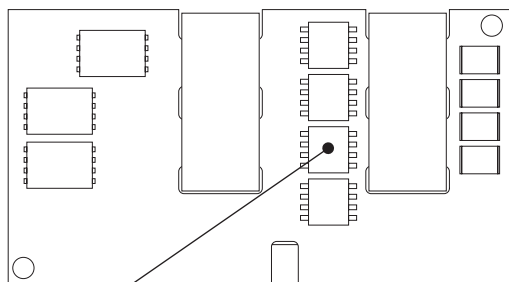


Fig.8.21 Derating curve



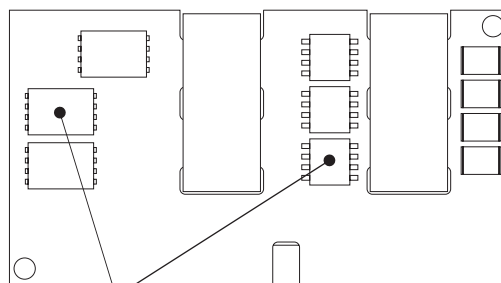
Temperature measurement

Fig.8.22 CQS24□□-□, Temperature measurement location



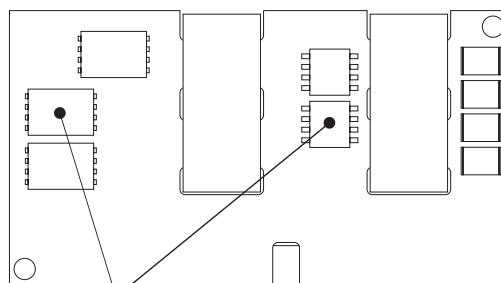
Temperature measurement

Fig.8.23 CQS48015-50, CQS48018-50, CQS48025-45, CQS48033-45, Temperature measurement location



Temperature measurement

Fig.8.24 CQS48050-28, Temperature measurement location



Temperature measurement

Fig.8.25 CQS48120-14, CQS48150-8

Temperature measurement location

■ Shown the thermal curve with measuring as shown in Fig.8.26.

Verify final design by actual temperature measurement.

Use the temperature measurement location as shown in Fig.8.22 to Fig.8.25 at 120°C or less.

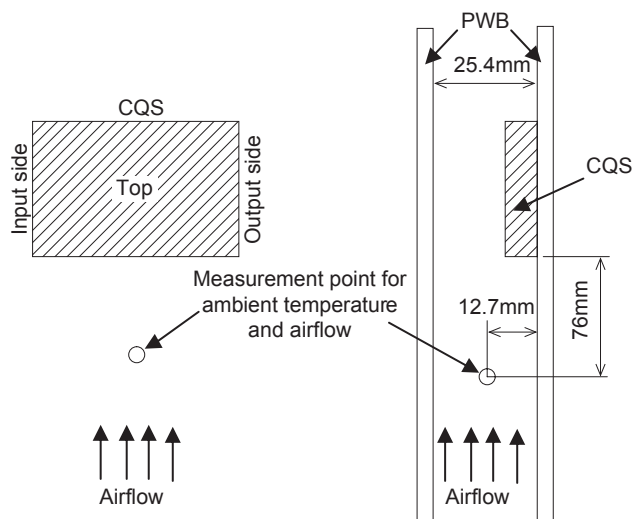


Fig.8.26 Measuring method

CES · CQS

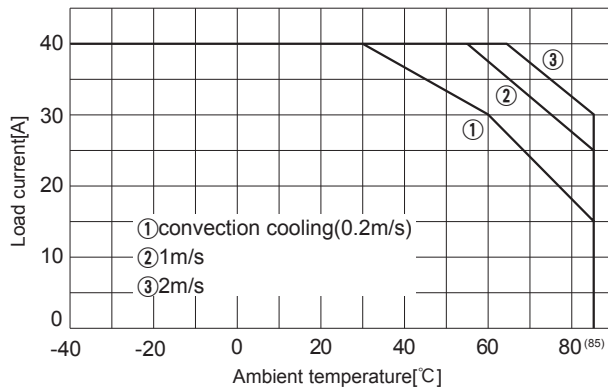


Fig.8.27 Load current vs. ambient temperature(CQS24033-40 Vin=24V)

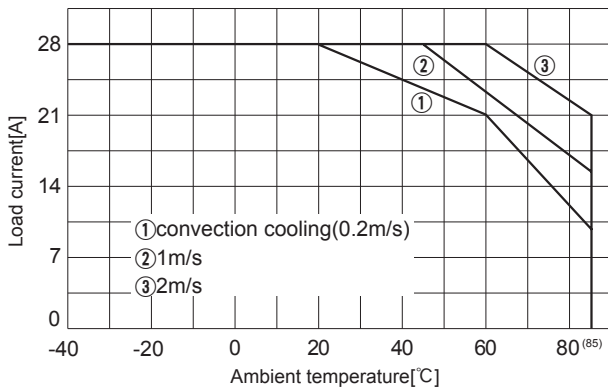


Fig.8.28 Load current vs. ambient temperature(CQS24050-28 Vin=24V)

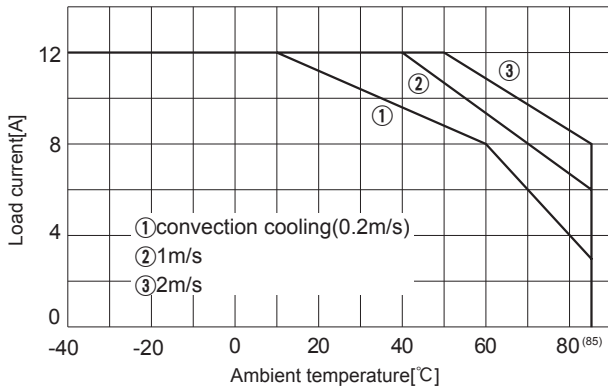


Fig.8.29 Load current vs. ambient temperature(CQS24120-12 Vin=24V)

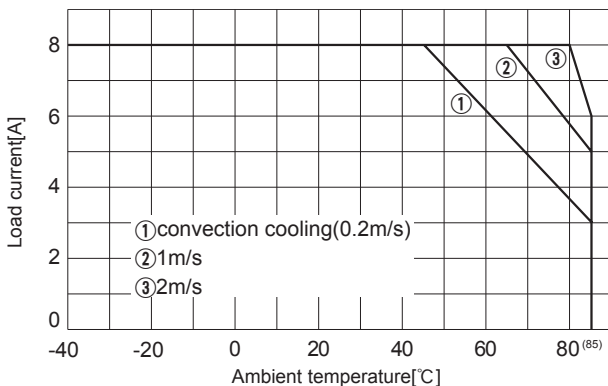


Fig.8.30 Load current vs. ambient temperature(CQS24150-8 Vin=24V)

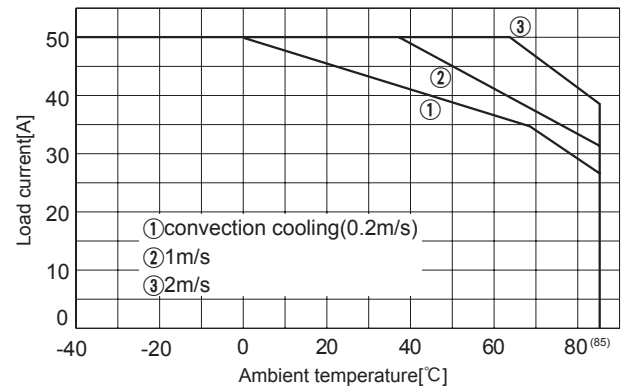


Fig.8.31 Load current vs. ambient temperature(CQS48015-50 Vin=48V)

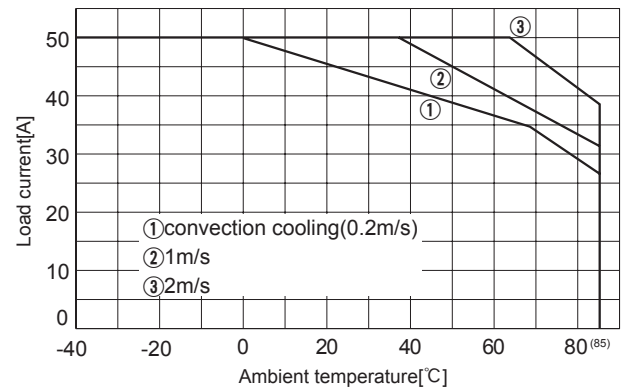


Fig.8.32 Load current vs. ambient temperature(CQS48018-50 Vin=48V)

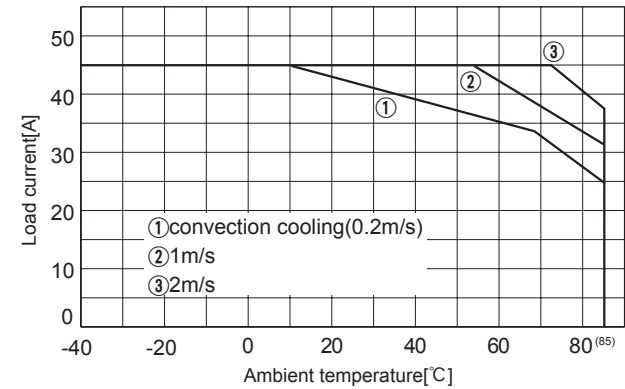


Fig.8.33 Load current vs. ambient temperature(CQS48025-45 Vin=48V)

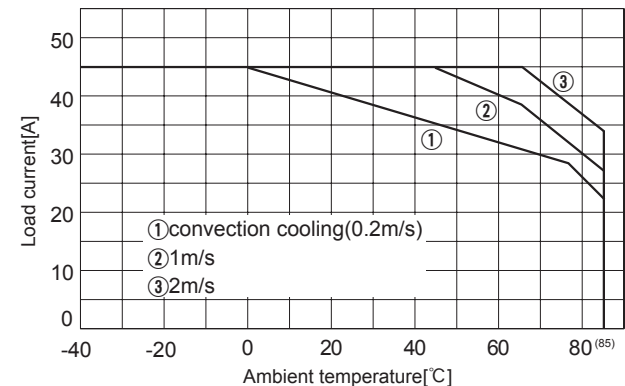


Fig.8.34 Load current vs. ambient temperature(CQS48033-45 Vin=48V)

CES · CQS

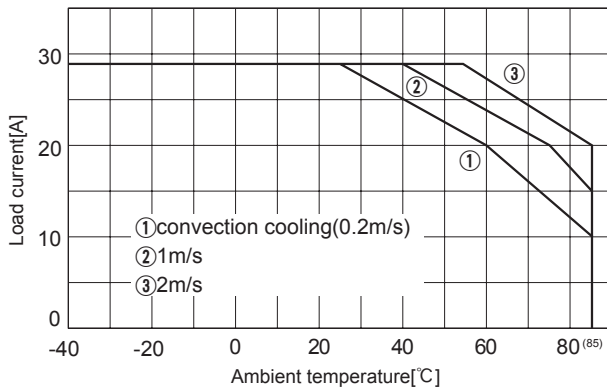


Fig.8.35 Load current vs. ambient temperature(CQS48050-28 Vin=48V)

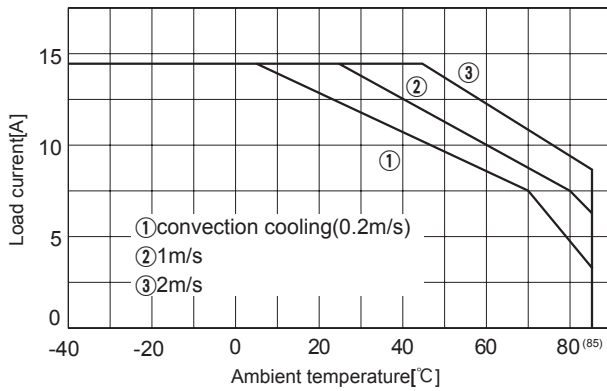


Fig.8.36 Load current vs. ambient temperature(CQS48120-14 Vin=48V)

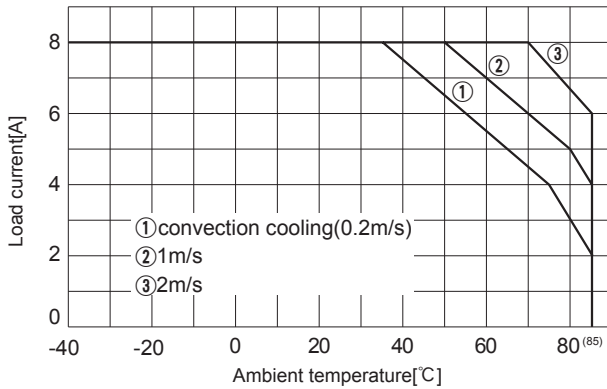


Fig.8.37 Load current vs. ambient temperature(CQS48150-8 Vin=48V)

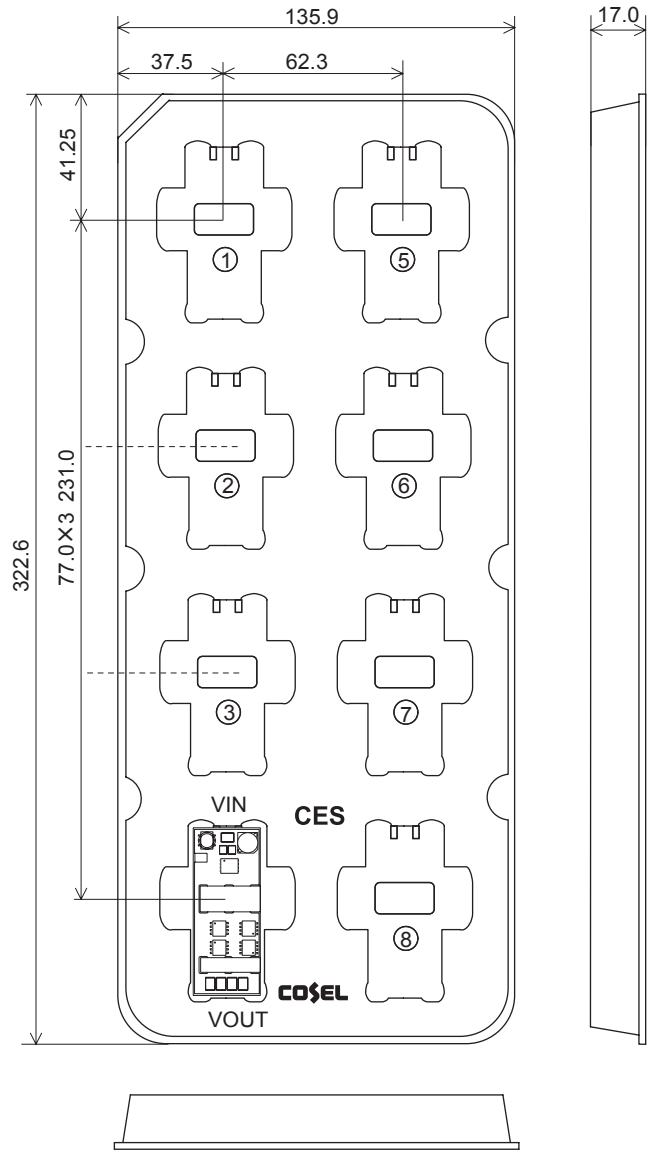
9 SMD type(option S) package information

■ These are packed in a tray (Fig.1.1)

Please order "CES□□-□-S" for tray type packaging.

Capacity of the tray is 8 max.

In case of fractions, the units are stored in numerical order.



Dimensions in mm

Material : Conductive PS

Fig.9.1. Delivery package information



Low Profile



Isolated

Safety
Approvals

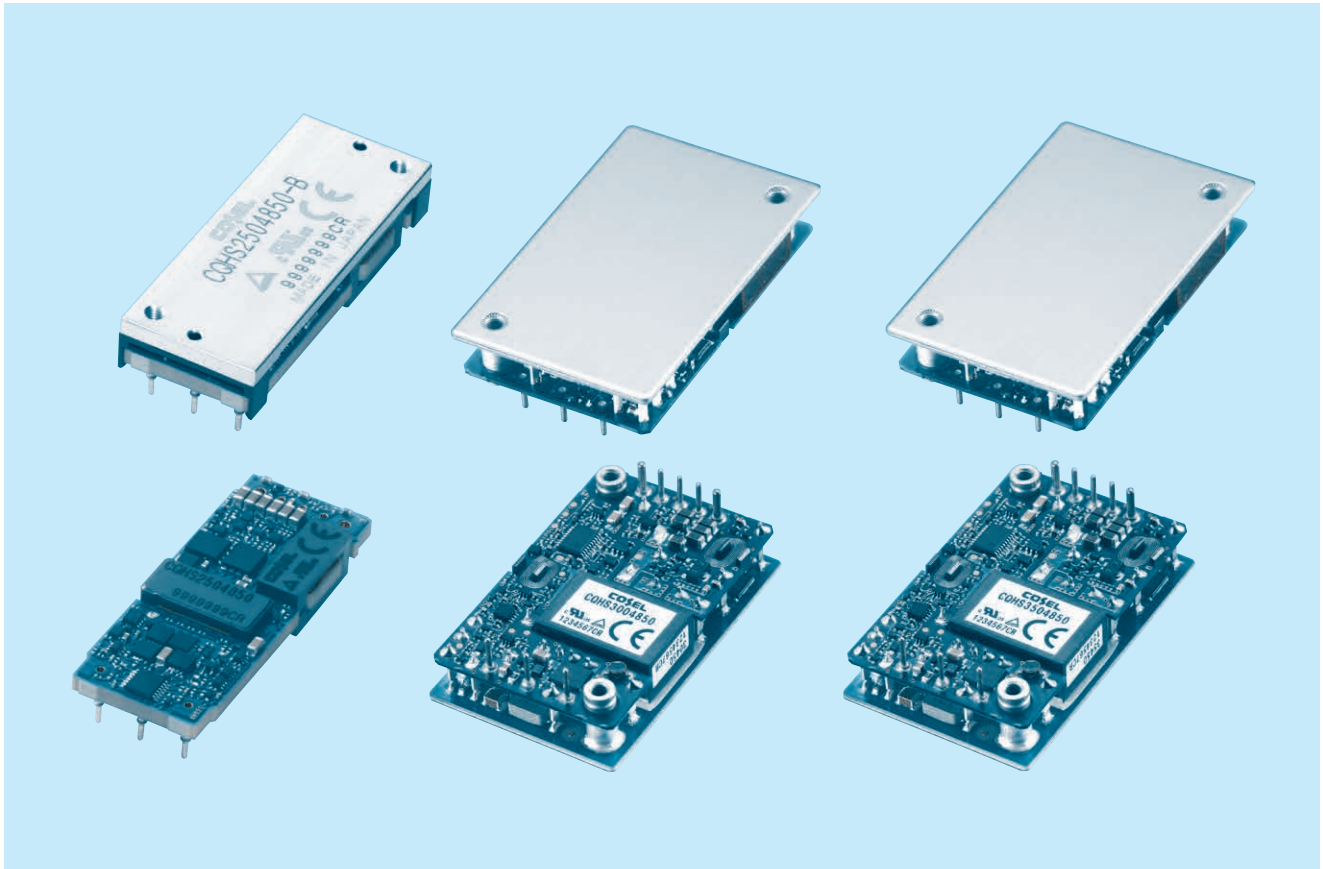
OCP



OVP

Remote
ON/OFF

CQHS-series



CQHS

Feature

Compact DC-DC Converter, "BRICK SIZE" which has been standard size for Telecommunication Market
 High efficiency (synchronous rectifier circuit)
 High density
 High reliability : not built-in aluminum and tantalum electrolytic capacitor
 Built-in overcurrent, overvoltage and thermal protection circuits
 Built-in remote ON/OFF
 Mounting hole (M3 tapped)

CE marking

Low Voltage Directive

Safety agency approvals

UL60950-1, C-UL, EN60950-1

5-year warranty

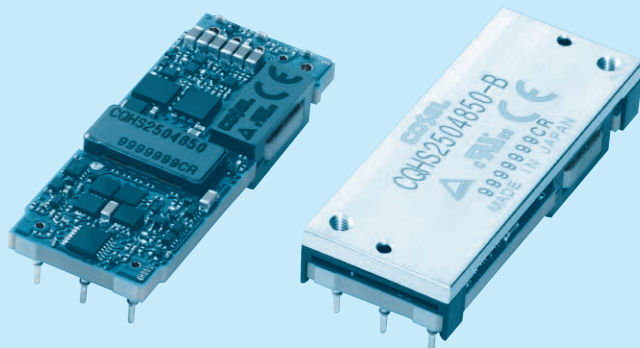
Optional parts

Heat sink (refer to page of optional parts : CQHS300/CQHS350)

CQHS250

CQH S 250 48 50 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
48:DC36 - 76V
- ⑤ Output voltage
- ⑥ Optional
- R :with Remote ON/OFF
Positive logic control
- N :Auto restart in protection
circuit working
- B :Base plate option with
Mounting hole M3
- L2:Pin length 5.3mm

MODEL	CQHS2504832	CQHS2504850
MAX OUTPUT WATTAGE[W]	252.8	250
DC OUTPUT	32V 7.9A	50V 5.0A

SPECIFICATIONS

	MODEL	CQHS2504832	CQHS2504850
INPUT	VOLTAGE[V]	DC36 - 76	
	CURRENT[A]	5.60typ	5.54typ
	EFFICIENCY[%]	94typ	94typ
	START-UP VOLTAGE[V]	DC32 - 36	
	HYSTERESIS VOLTAGE[V]	DC2 min	
OUTPUT	VOLTAGE[V]	32	50
	CURRENT[A]	7.9	5.0
	LINE REGULATION[mV]	64max	100max
	LOAD REGULATION[mV]	64max	100max
	RIPPLE[mVp-p]	-20 to +85°C Vin=36-60V *2	255max
		-20 to +85°C Vin=60-76V *2	320max
		-40 to -20°C *2	320max
	RIPPLE NOISE[mVp-p]	-20 to +85°C *2	320max
		-40 to -20°C *2	410max
	TEMPERATURE REGULATION[mV]	-40 to +85°C	640max
	DRIFT[mV]	*3	120max
	START-UP TIME[ms]	200max (DCIN 48V, Io=100%)	
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external resistor	
		26.88 - 35.20	45.0 - 55.0
	OUTPUT VOLTAGE SETTING[V]*1	31.68 - 32.32	49.50 - 50.50
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating, low voltage protection (shut down) function is built-in.	
	OVERVOLTAGE PROTECTION[V]	36.80 - 44.80	56.50 - 67.50
	REMOTE SENSING	Provided	
	REMOTE ON/OFF	Provided (Negative Logic L : ON, H :OFF)	
ISOLATION	INPUT-OUTPUT	DC1,500V or AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)	
	INPUT-BASE PLATE	*5	DC1,500V or AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)
	OUTPUT-BASE PLATE	*5	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15°C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max	
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max	
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis	
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis	
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1	
OTHERS	CASE SIZE/WEIGHT	57.9×10.5×22.76mm [2.28×0.41×0.9 inches] (W×H×D) / 30g max	
		58.4×12.7×23.26mm [2.3×0.5×0.92 inches] (W×H×D) / 45g max *5	
	COOLING METHOD	Convection / Forced air / Conduction	

*1 At rated input(DC48V), rated load. Ta= 25°C, 2m/s.

*2 Ripple and ripple noise is measured by using measuring board. Refer to the manual.

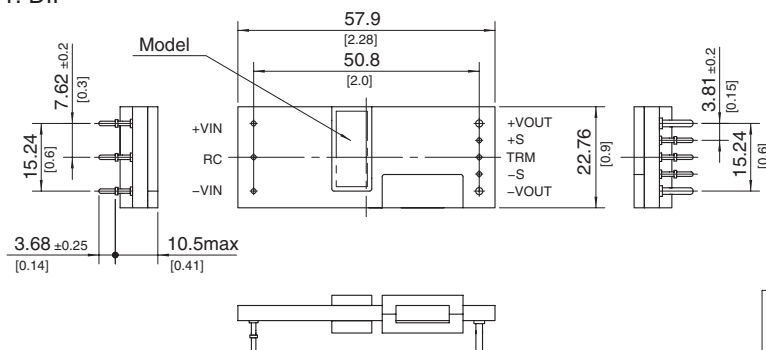
*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*4 When the input voltage is in the range of DC36-40V, output voltage is limited. Refer to the manual.

*5 Base Plate Option.

External view

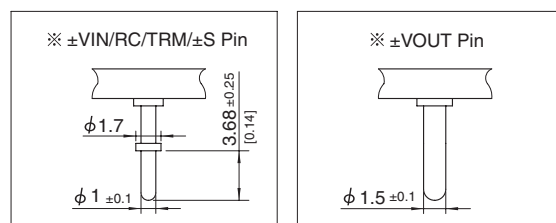
1. DIP



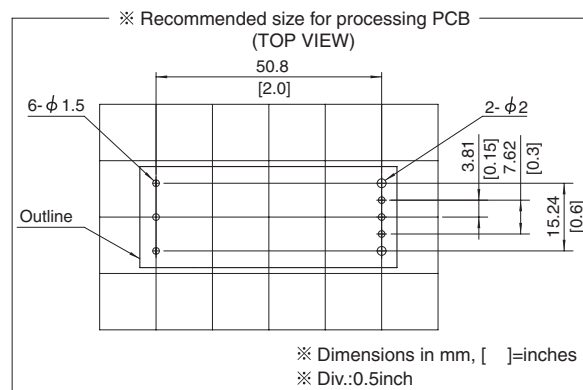
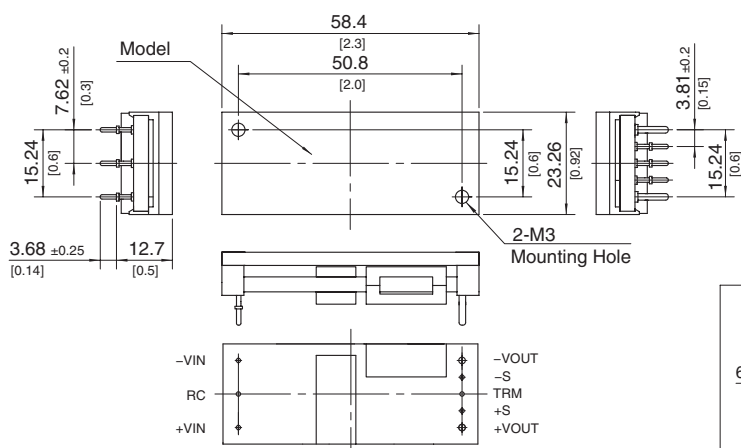
※ Tolerance : ± 0.5 [± 0.02]

※ Weight : 30g max(DIP)
45g max(Base Plate)

※ Dimensions in mm, []=inches



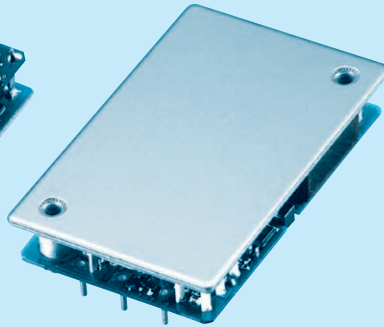
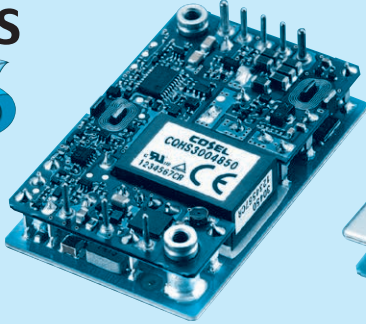
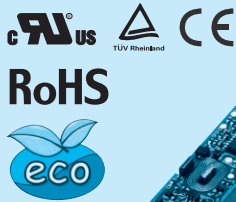
2. Base Plate (option B)



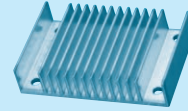
CQHS300

CQH S 300 48 50 - ☐

① ② ③ ④ ⑤ ⑥



* Providing heat sink as option



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
48:DC36 - 76V
- ⑤ Output voltage
- ⑥ Optional
- R : with Remote ON/OFF
Positive logic control
- T : with Mounting hole
φ 3.4 thru

MODEL	CQHS3004832	CQHS3004850
MAX OUTPUT WATTAGE[W]	300.8	300
DC OUTPUT	32V 9.4A	50V 6A

SPECIFICATIONS

	MODEL	CQHS3004832	CQHS3004850
INPUT	VOLTAGE[V]	DC36 - 76	
	CURRENT[A]	6.67typ	6.65typ
	EFFICIENCY[%]	94typ	94typ
	START-UP VOLTAGE[V]	DC32 - 36	
	HYSTERESIS VOLTAGE[V]	DC2 min	
OUTPUT	VOLTAGE[V]	32	50
	CURRENT[A]	9.4	6.0
	LINE REGULATION[mV]	64max	100max
	LOAD REGULATION[mV]	64max	100max
	RIPPLE[mVp-p]	-20 to +100°C *2	255max
		-40 to -20°C Vin=36-60V *2	320max
		-40 to -20°C Vin=60-76V *2	400max
	RIPPLE NOISE[mVp-p]	-20 to +100°C *2	320max
		-40 to -20°C *2	410max
	TEMPERATURE REGULATION[mV]	0 to +65°C	320max
		-40 to +100°C	640max
	DRIFT[mV]	*3	120max
	START-UP TIME[ms]	200max (DCIN 48V, Io=100%)	
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external resistor 27.2 - 35.2	
	OUTPUT VOLTAGE SETTING[V]*1	31.68 - 32.32	45.0 - 55.0
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating, low voltage protection (shut down) function is built-in.	
	OVERVOLTAGE PROTECTION[V]	36.80 - 44.80	56.50 - 67.50
	REMOTE SENSING	Provided	
	REMOTE ON/OFF	Provided (Negative Logic L : ON, H :OFF)	
ISOLATION	INPUT-OUTPUT	DC1,500V or AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)	
	INPUT-BASE PLATE	DC1,500V or AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)	
	OUTPUT-BASE PLATE	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15°C)	
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100°C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max	
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max	
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis	
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis	
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1	
OTHERS	CASE SIZE/WEIGHT	57.9×12.7×36.8mm [2.28×0.5×1.45 inches] (W×H×D) / 75g max	
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)	

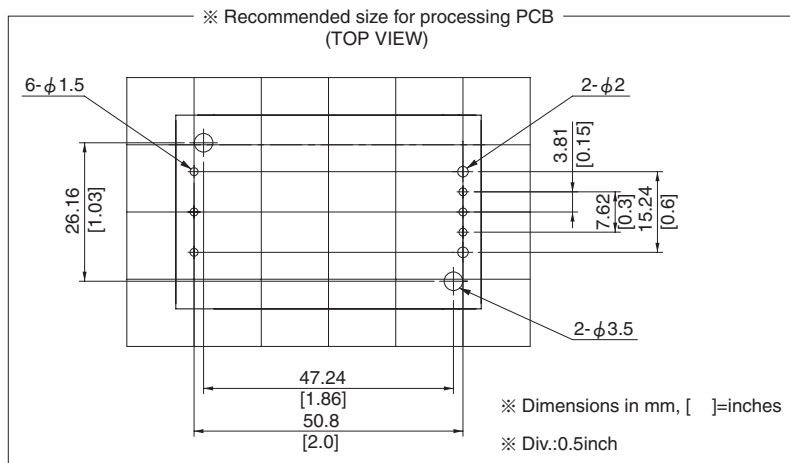
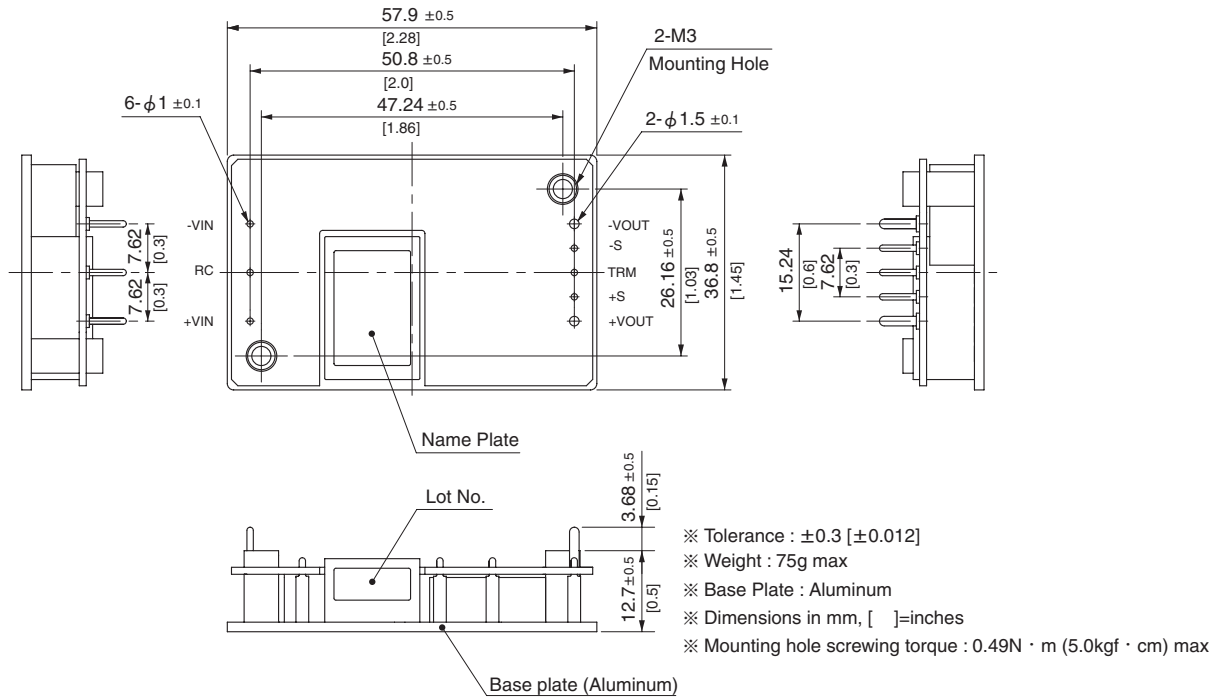
*1 At rated input(DC48V), rated load, and aluminum base plate temperature 25°C.

*2 Ripple and ripple noise is measured by using measuring board with recommended capacitor Co & the film capacitor 0.1 μF.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*4 When the input voltage is in the range of DC36-40V, output voltage is limited. Refer to the manual.

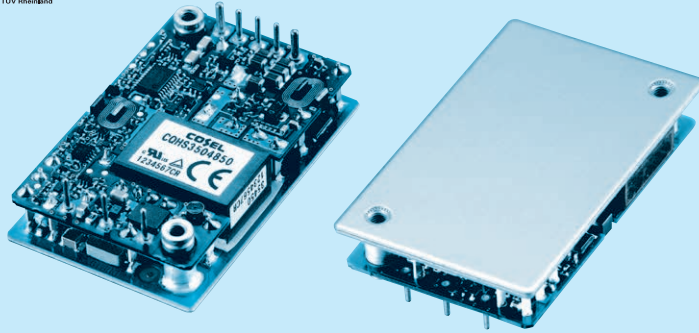
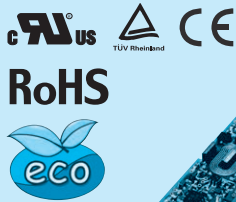
External view



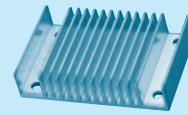
CQHS350

CQH S 350 48 50 - ☐

① ② ③ ④ ⑤ ⑥



* Providing heat sink as option



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
48:DC36 - 65V
- ⑤ Output voltage
- ⑥ Optional
- R :with Remote ON/OFF
Positive logic control
- T :with Mounting hole
φ 3.4 thru

MODEL	CQHS3504832	CQHS3504850
MAX OUTPUT WATTAGE[W]	352	350
DC OUTPUT	32V 11A	50V 7A

SPECIFICATIONS

	MODEL	CQHS3504832	CQHS3504850
INPUT	VOLTAGE[V]	DC36 - 65	
	CURRENT[A]	7.8typ	7.76typ
	EFFICIENCY[%]	94typ	94typ
	START-UP VOLTAGE[V]	DC32 - 36	
	HYSTERESIS VOLTAGE[V]	DC2 min	
OUTPUT	VOLTAGE[V]	32	50
	CURRENT[A]	11.0 *5	7.0
	LINE REGULATION[mV]	64max	100max
	LOAD REGULATION[mV]	64max	100max
	RIPPLE[mVp-p]	-20 to +100℃ *2	255max
		-40 to -20℃ Vin=36-60V	320max
		-40 to -20℃ Vin=60-65V	400max
	RIPPLE NOISE[mVp-p]	-20 to +100℃ *2	320max
		-40 to -20℃ *2	410max
	TEMPERATURE REGULATION[mV]	0 to +65℃	320max
		-40 to +100℃	640max
	DRIFT[mV]	*3	120max
	START-UP TIME[ms]	200max (DCIN 48V, Io=100%)	
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external resistor 26.88 - 35.20	
	OUTPUT VOLTAGE SETTING[V]*1	31.68 - 32.32	45.0 - 55.0
	OVERCURRENT PROTECTION	Works over 105% of rating, low voltage protection (shut down) function is built-in.	
	OVERVOLTAGE PROTECTION[V]	36.80 - 44.80	56.50 - 67.50
	REMOTE SENSING	Provided	
ISOLATION	REMOTE ON/OFF	Provided (Negative Logic L : ON, H :OFF)	
	INPUT-OUTPUT	DC1,500V or AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)	
	INPUT-BASE PLATE	DC1,500V or AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)	
ENVIRONMENT	OUTPUT-BASE PLATE	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)	
	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100℃ (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max	
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max	
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis	
SAFETY	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis	
	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1	
OTHERS	CASE SIZE/WEIGHT	57.9×12.7×36.8mm [2.28×0.5×1.45 inches] (W×H×D) / 75g max	
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)	

*1 At rated input(DC48V), rated load, and aluminum base plate temperature 25℃.

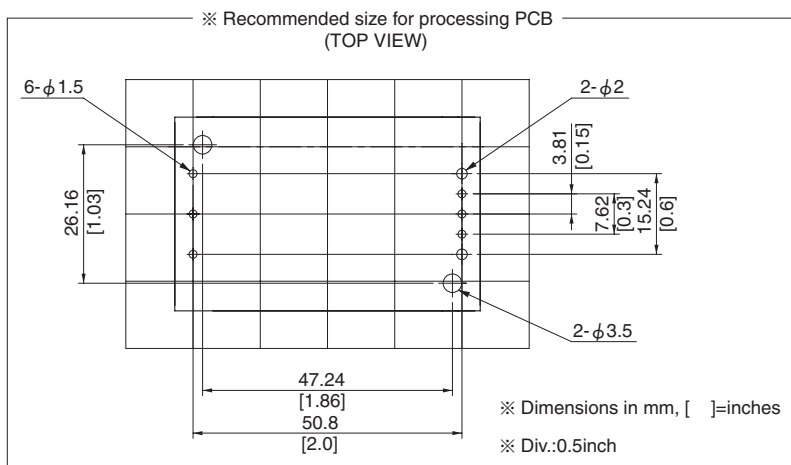
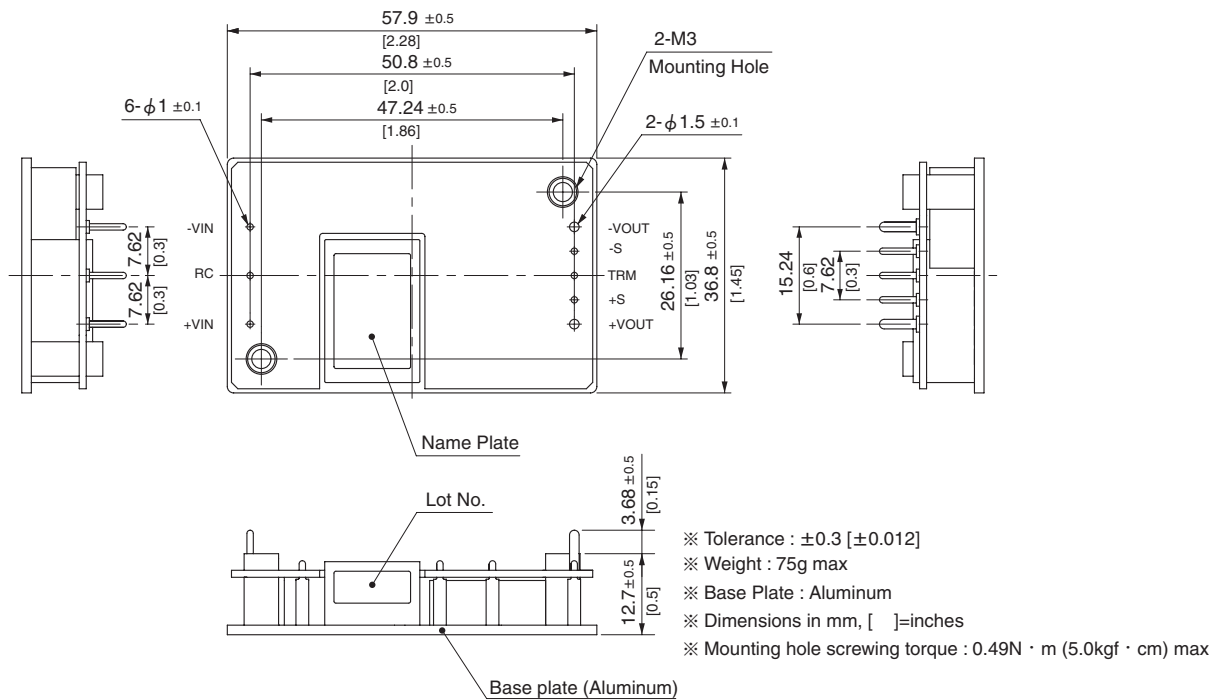
*2 Ripple and ripple noise is measured by using measuring board with recommended capacitor Co & the film capacitor 0.1μF.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

*4 When the input voltage is in the range of DC36-40V, output voltage is limited. Refer to the manual.

*5 Rated current is increased adjusting output voltage to lower than rated output voltage. Refer to the manual.

External view



Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Redundancy operation availability	
						Material	Single sided	Double sided	Series operation	Redundancy operation
CQHS250	Full-bridge converter	140	*1	-	-	glass fabric base, epoxy resin		Multilayer	Yes	*2
CQHS300	Forward converter	250	*1	-	-	Aluminum	Yes		Yes	*2
CQHS350	Forward converter	250	*1	-	-	Aluminum	Yes		Yes	*2

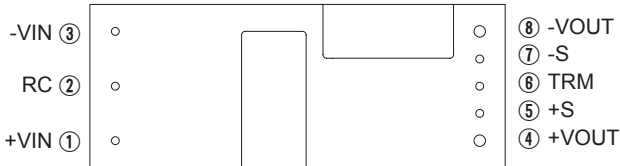
*1 Refer to Specification.

*2 Refer to Instruction Manual.

1	Pin Configuration	CQHS-10
2	Connection for Standard Use	CQHS-10
3	Wiring Input/Output Pin	CQHS-11
3.1	Wiring input pin	CQHS-11
3.2	Wiring output pin	CQHS-11
4	Function	CQHS-12
4.1	Overcurrent protection and Low voltage protection	CQHS-12
4.2	Overvoltage protection	CQHS-12
4.3	Thermal protection	CQHS-12
4.4	Remote ON/OFF	CQHS-13
4.5	Remote sensing	CQHS-13
4.6	Adjustable voltage range	CQHS-14
4.7	Withstanding Voltage / Isolation Voltage	CQHS-14
5	Series and Parallel Operation	CQHS-15
5.1	Series operation	CQHS-15
5.2	Redundancy operation	CQHS-15
6	Implementation · Mounting Method	CQHS-15
6.1	Mounting method	CQHS-15
6.2	Stress onto the pins	CQHS-16
6.3	Cleaning	CQHS-16
6.4	Soldering temperature	CQHS-16
6.5	Derating	CQHS-16
6.6	Heat sink (CQHS300/CQHS350 Optional parts)	CQHS-17
7	Safety Considerations	CQHS-18

1 Pin Configuration

● CQHS250



● CQHS300/CQHS350

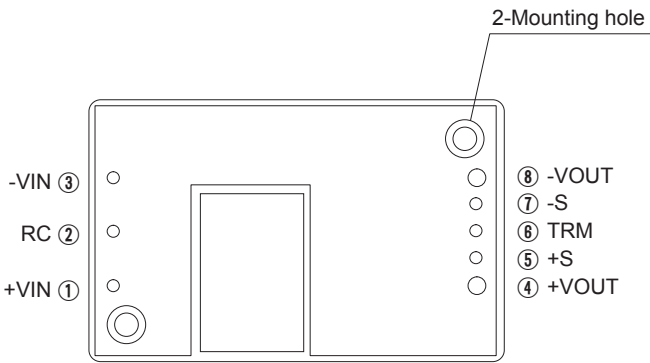


Fig.1.1 Pin configuration (bottom view)

Table 1.1 Pin Assignment

No.	Pin Name	Function
①	+VIN	+DC input
②	RC	Remote ON/OFF
③	-VIN	-DC input
④	+VOUT	+DC output
⑤	+S	+Remote sensing
⑥	TRM	Adjustment of output voltage
⑦	-S	-Remote sensing
⑧	-VOUT	-DC output
—	Mounting hole	Mounting hole

No.	Pin Name	Reference
①	+VIN	3.1 "Wiring input pin "
②	RC	4.4 "Remote ON/OFF "
③	-VIN	3.1 "Wiring input pin "
④	+VOUT	3.2 "Wiring output pin "
⑤	+S	4.5 "Remote sensing "
⑥	TRM	4.6 "Adjustable voltage range "
⑦	-S	4.5 "Remote sensing "
⑧	-VOUT	3.2 "Wiring output pin "
—	Mounting hole	6.1 "Mounting method "

2 Connection for Standard Use

■ The power module needs input and output connection as shown in Fig.2.1 or Fig.2.2.

Reference: 3 "Wiring Input/Output Pin"
6.5 "Derating"

■ Short the following pins to turn on the power supply.

-VIN↔RC, +VOUT↔+S, -VOUT↔-S

Reference: 4.4 "Remote ON/OFF"
4.5 "Remote sensing"

■ Only DC voltage can be applied to CQHS Series. Applying AC voltage will damage the power module.

● CQHS250

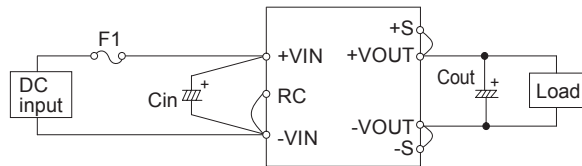


Fig.2.1 Connection for Standard Use (CQHS250)

● CQHS300/CQHS350

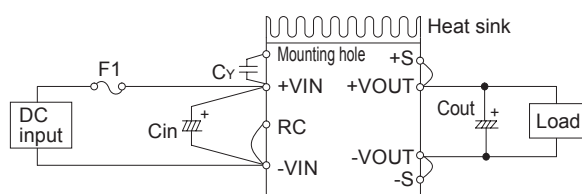


Fig.2.2 Connection for Standard Use (CQHS300/CQHS350)

Table 2.1 External components

No.	Symbol	Component	Reference
1	F1	Input fuse	3.1(1) "External fuse"
2	C _v	Primary decoupling capacitor	3.1(2) "Noise Filter/Decoupling Capacitor"
3	C _{in}	External capacitor on the input side	3.1(3) "External capacitor on the Input"
4	C _{out}	External capacitor on the output side	3.2 "Wiring output pin"
5	—	Heat sink	6.5 "Derating"

3 Wiring Input/Output Pin

3.1 Wiring input pin

(1) External fuse

- The input circuit of CQHS Series does not come with a built-in fuse. In order to protect the power module, a normal-blow fuse should be installed to +VIN.
- When multiple modules get input voltage from a single front-end power supply, a normal-blow fuse must be installed to each module.

Table 3.1 Recommended fuses (Normal-blow type)

Model	CQHS25048	CQHS30048	CQHS35048
Rated current	15A	20A	20A

(2) Noise Filter/Decoupling Capacitor

- An appropriate filter must be used if conformance to the conducted noise regulation is required or if surge voltage may be applied to the unit. Please consult us for more details.

● CQHS300/CQHS350

- A decoupling capacitor C_Y must be used to reduce the line noise on the input line and stabilize the power module operation (Fig. 2.2). Note that resonance and inductance from the input line filter may cause the power module to become unstable.
- Install a decoupling capacitor C_Y of at least 4700 pF as close to the input pins as possible (within 50mm of the pins).
- If the total capacitance of the decoupling capacitor exceeds 15000 pF, the specified isolation voltage between input and output may not be satisfied. In this case, either reduce the capacitance of the decoupling capacitor at the input or install a decoupling capacitor to the output.

(3) External capacitor on the Input

- An external capacitor C_{in} must be installed between +VIN and -VIN to reduce line noise and stabilize the power module operation (Fig. 2.1 and Fig.2.2).

Capacitance	CQHS250/300/350 : at least $68\mu F \times 2$
CQHS250	
Ta=-20 to +85°C	Electrolytic or Ceramic capacitor
Ta=-40 to +85°C	Ceramic capacitor
CQHS300/CQHS350	
Tc=-20 to +100°C	Electrolytic or Ceramic capacitor
Tc=-40 to +100°C	Ceramic capacitor

- The capacitor must be installed less than 50mm of the power module. As ripple current will flow through this capacitor, pay attention to the ripple current rating of the capacitor.
- If the power module is to be turned ON/OFF directly with a switch, inductance from the input line will induce a surge voltage several times that of the input voltage and it may damage the power module. Make sure that the surge is absorbed, for example, by connecting an electrolytic capacitor between the input pins.

(4) Input Voltage Range/Input Current Range

- Keep the input voltage ripple within the specification below. Output ripple voltage will increase as these values increase.

[Ripple voltage CQHS250/300/350 : less than 4Vp-p]

- Make sure that the peak input voltage stays within the specified input voltage range of the power module.
- Choose a front end power supply that can supply enough current I_p (Fig. 3.2) for starting up the power module.

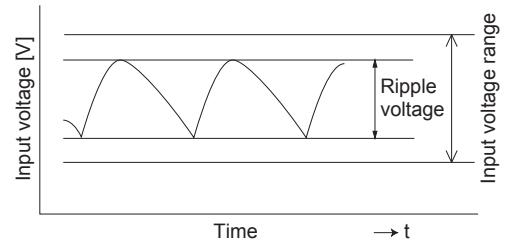


Fig.3.1 Input Voltage Ripple

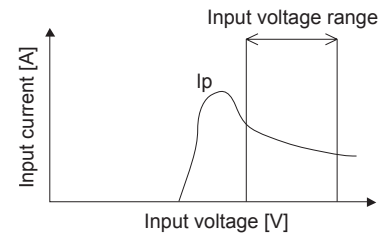


Fig.3.2 Input Current Characteristics

(5) Reverse Input Voltage Protection

- Avoid applying reversed-polarity voltage to the power module as it will damage the power module. To protect the power module from reversed polarity voltage, installing an external diode as shown in Fig. 3.3 is recommended.

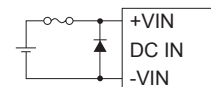


Fig.3.3 Reverse Input Voltage Protection

3.2 Wiring output pin

- Install an external capacitor C_{out} between +VOUT and -VOUT to increase stability of output (Fig. 2.1 and Fig.2.2). Recommended capacitance of C_{out} is shown in Table 3.2 and Table 3.3.

- Choose a high frequency type electrolytic capacitor for C_{out} . Output ripple and rise time will be influenced by the capacitor's ESR and ESL and the wiring impedance.

- As ripple current will flow through capacitor C_{out} , pay attention to the ripple current rating of the capacitor.

- Install capacitor C_{out} as close to the power module as possible (within 50mm).

This is useful for reducing radiated noise and increasing stability of the power module operation.

- When the capacitance of external output capacitor C_{out} is high, it may unstabilize the operation of power supply, so please refer to Table 3.2 and Table 3.3 for the value of the external capacitor C_{out} .

Table 3.2 Capacitance Values for External Output Capacitor Cout [μ F]
(CQHS250)

Output voltage(V)	Recommended capacitance			Maximum capacitance
	Ambient temperature			
	Ta=-40~-20℃	Ta=-20~0℃	Ta=0~+85℃	
32	470	470	220	2200
50	330	100	100	1000

Table 3.3 Capacitance Values for External Output Capacitor Cout [μ F]
(CQHS300/CQHS350)

Output voltage(V)	Recommended capacitance			Maximum capacitance
	Base plate temperature			
	Tc=-40~20℃	Tc=-20~0℃	Tc=0~+100℃	
32	470×2	470×2	470	3300
50	330×2	330	330	2200

■ The specified ripple and ripple noise are measured by the method introduced in Fig. 3.4 and Fig.3.5.

● CQHS250

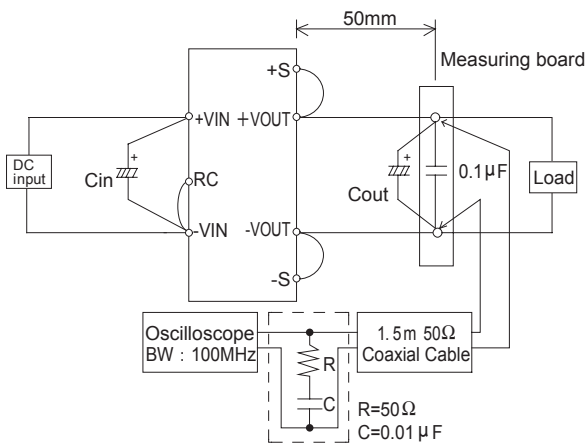


Fig.3.4 Method of Measuring Output Ripple and Ripple Noise
(CQHS250)

● CQHS300/CQHS350

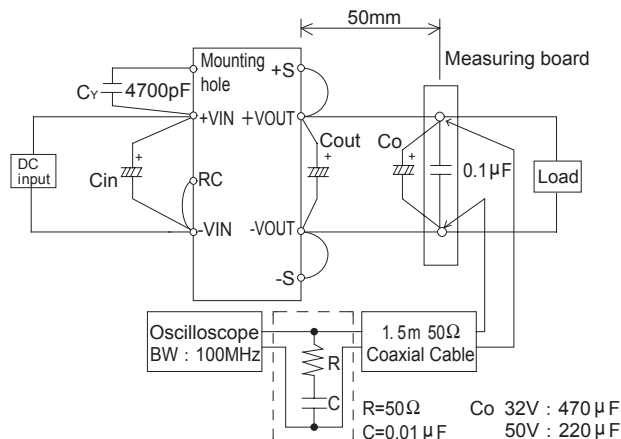


Fig.3.5 Method of Measuring Output Ripple and Ripple Noise
(CQHS300/CQHS350)

4 Function

4.1 Overcurrent protection and Low voltage protection

- Overcurrent protection is built-in and comes into effect at over 105% of the rated current.
Overcurrent protection prevents the unit from short circuit and overcurrent condition.
- The DC output will be shut down, when the output voltage drops under the output voltage adjustment range (low voltage protection).
- Recovery from the protection is accomplished by applying 5VDC or less input for at least 1 second, or toggling remote ON / OFF signal for at least 1 second.

4.2 Overvoltage protection

- The overvoltage protection circuit is built-in. The DC input should be shut down if overvoltage protection is in operation.
- Recovery from the protection is accomplished by applying 5VDC or less input for at least 1 second, or toggling remote ON / OFF signal for at least 1 second.

Remarks :

Please note that devices inside the power supply might fail when voltage more than rated output voltage is applied to output pin of the power supply. This could happen when the customer tests the overvoltage performance of the unit.

4.3 Thermal protection

- Over Temperature Protection (OTP) is built in. If the temperature of PCB exceed 120°C (CQHS250) or the base plate temperature exceed 100°C (CQHS300/CQHS350). OTP will work, causing the output voltage to drop.
- Recovery from the protection is accomplished by applying 5VDC or less input for at least 1 second, or toggling remote ON / OFF signal for at least 1 second, after the unit should be cool down.

● -N (CQHS250)

- Option "-N" means the output voltage of the power module will be recovered automatically when the fault condition (such as OCP, OVP or OTP) is corrected.

4.4 Remote ON/OFF

■ The remote ON/OFF function is incorporated in the input circuit and operated with RC and -VIN. If positive logic control is required, order the power module with “-R” option.

Table 4.1 Remote ON/OFF Specifications (CQHS250)

	ON/OFF logic	Between RC and -VIN	Output voltage
Standard	Negative	L level(0 - 1.0V) or short	ON
		H level(4.0 - 7.0V) or open	OFF
Optional -R	Positive	L level(0 - 1.0V) or short	OFF
		H level(4.0 - 7.0V) or open	ON

■ When RC is at low level, a current of 0.1mA typ will flow out.
When Vcc is used, keep it within the following rage:
 $4 \leq VCC \leq 7V$.
When remote ON/OFF is not used, short RC and -VIN.

Table 4.2 Remote ON/OFF Specifications (CQHS300/CQHS350)

	ON/OFF logic	Between RC and -VIN	Output voltage
Standard	Negative	L level(0 - 1.2V) or short	ON
		H level(3.5 - 7.0V) or open	OFF
Optional -R	Positive	L level(0 - 1.2V) or short	OFF
		H level(3.5 - 7.0V) or open	ON

■ When RC is at low level, a current of 0.5mA typ will flow out.
When Vcc is used, keep it within the following rage:
 $3.5 \leq VCC \leq 7V$.
When remote ON/OFF is not used, short RC and -VIN.

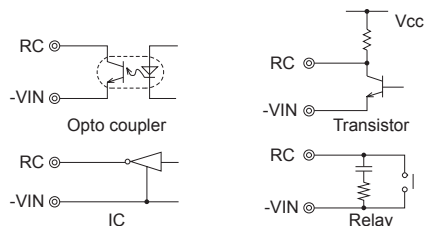


Fig. 4.1 RC Connection Example

4.5 Remote sensing

(1) When Remote Sensing is Not Used

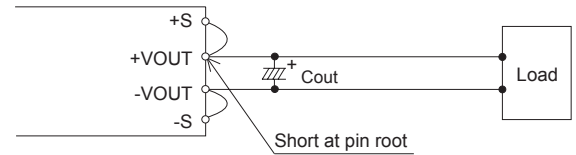


Fig. 4.2 When Remote Sensing is Not Used

■ When remote sensing is not used, make sure +VOUT and +S are shorted, and that -VOUT and -S are shorted as well.
■ Keep the patterns between +S and +VOUT and between -S and -VOUT as short as possible. Avoid a looping pattern. If noise enters the loop, the operation of the power module will become unstable.

(2) When Remote Sensing is Used

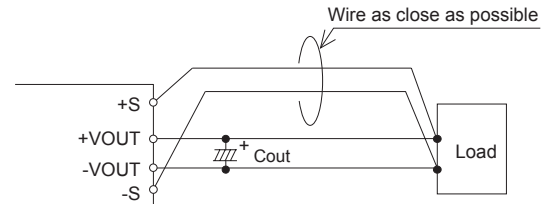


Fig. 4.3 When Remote Sensing is Used

■ Using remote sensing with long wires may cause output voltage to become unstable. Consult us if long sensing wiring is necessary.
■ Sensing patterns or wires should be as short as possible. If wires are used, use either twisted-pair or shielded wires.
■ Use wide PCB patterns or thick wires between the power module and the load. Line drop should be kept less than 0.3V. Make sure output voltage from the power module stays within the specified range.
■ If the sensing patterns are shorted by mistake, a large current may flow and damage the pattern. This can be prevented by installing fuses or resistors close to the load.
As wiring or load impedance may generate oscillation or large fluctuations in output voltage, make sure enough evaluation is given in advance.

4.6 Adjustable voltage range

(1) Output voltage adjusting

■Output voltage is adjustable by the external potentiometer.

■When the output voltage adjustment is used, note that the over voltage protection circuit operates when the output voltage sets too high.

■If the output voltage drops under the output voltage adjustment range, note that the Low voltage protection operates.

■By connecting the external potentiometer (VR1) and resistors (R1, R2), output voltage becomes adjustable, as shown in Fig. 4.4, recommended external parts are shown in Table 4.2.

■The wiring to the potentiometer should be as short as possible.

The temperature coefficient becomes worse, depending on the type of a resistor and potentiometer. Following parts are recommended for the power supply.

Resistor.....Metal film type, coefficient of less than ±100ppm/°C

Potentiometer....Cermet type, coefficient of less than ±300ppm/°C

■When the output voltage adjustment is not used, open the TRM pin respectively.

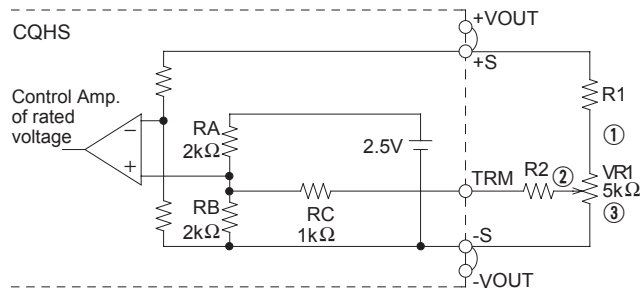


Fig. 4.4 Output voltage control circuit

Table 4.2 Recommended Values of External Resistors

No.	VOUT	Adjustable range			
		VOUT±5%		VOUT±10%	
		R1	R2	R1	R2
1	32V	51kΩ	11kΩ	51kΩ	6.2kΩ
2	50V	82kΩ		82kΩ	

(2) Output voltage decreasing

■By connecting the external resistor (RD), output voltage becomes adjustable to decrease.

The external resistor (RD) is calculated the following equation.

$$RD = \left(\frac{100\%}{\Delta\%} - 2 \right) [k\Omega]$$

$$\Delta\% = \frac{V_{OR} - V_{OD}}{V_{OR}} \times 100$$

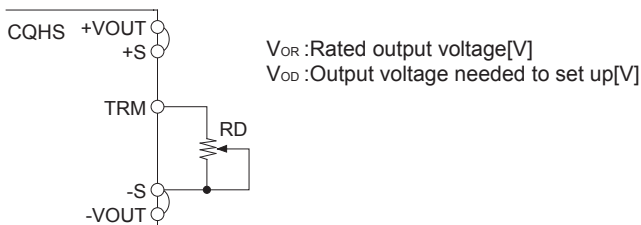


Fig. 4.5 Connection for output voltage decreasing

(3) Output voltage increasing

■By connecting the external resistor (RU), output voltage becomes adjustable to increase.

The external resistor (RU) is calculated the following equation.

$$RU = \left(\frac{V_{OR} \times (100\% + \Delta\%)}{1.225 \times \Delta\%} - \frac{(100\% + 2 \times \Delta\%)}{\Delta\%} \right) [k\Omega]$$

$$\Delta\% = \frac{V_{OU} - V_{OR}}{V_{OR}} \times 100$$

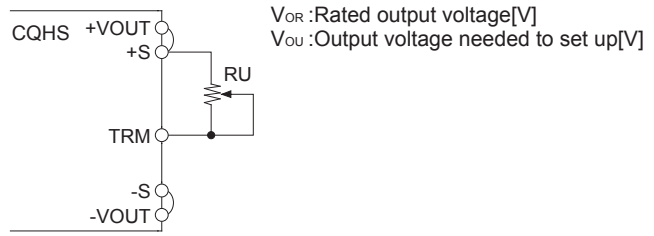


Fig. 4.6 Connection for output voltage increasing

(4) Input voltage derating

■When the input voltage is 36 - 40VDC, the output voltage adjustment range becomes as shown in Fig. 4.7.

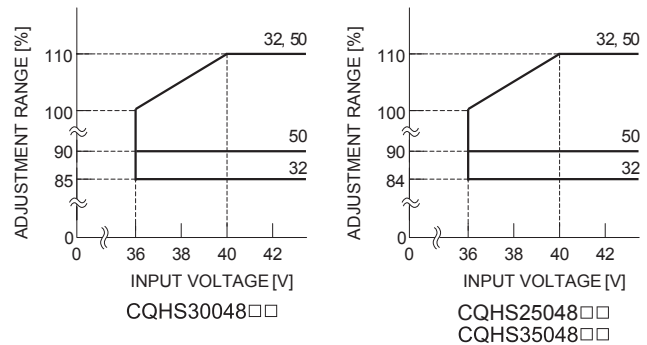


Fig. 4.7 Output voltage adjustment range

(5) Output current derating (CQHS3504832)

■When the output voltage adjust less than rated output voltage, the output current range becomes increasing as shown in Fig. 4.8.

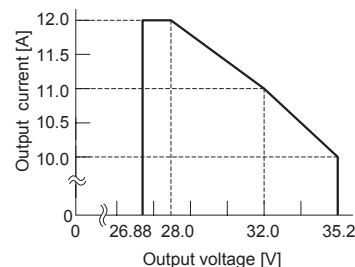


Fig. 4.8 Output Current derating curve (CQHS3504832)

4.7 Withstanding Voltage / Isolation Voltage

■When testing the withstanding voltage, make sure the voltage is increased gradually. When turning off, reduce the voltage gradually by using the dial of the hi-pot tester. Do not use a voltage tester with a timer as it may generate voltage several times as large as the applied voltage.

5 Series and Parallel Operation

5.1 Series operation

■ Series operation is available by connecting the outputs of two or more power supplies, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

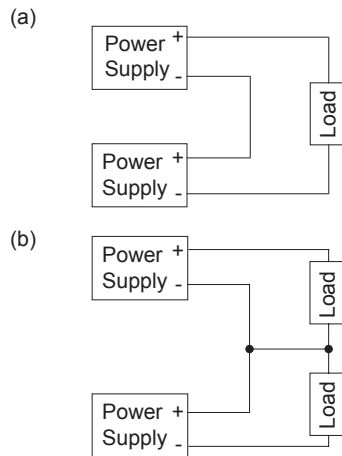


Fig. 5.1 Examples of series operation

5.2 Redundancy operation

■ Parallel operation is not possible.
■ Redundancy operation is available by wiring as shown below.

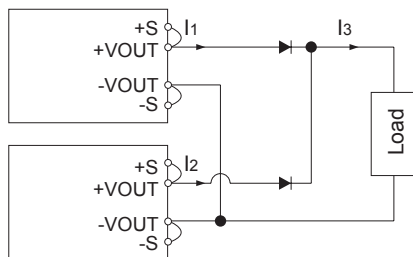


Fig. 5.2 Example of Redundancy Operation

■ Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .
Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

6 Implementation · Mounting Method

6.1 Mounting method

■ When multiple power modules are used side by side, position them with sufficient spaces to allow adequate air ventilation so that the temperature of each power module will remain within the temperature range shown in the derating curves.

■ Do not pass the DC input pattern underneath the power module as this will increase conducted noise. Place the DC input pattern away from the power module.

Do not pass the DC output pattern underneath the power module as this will increase output noise. Place the DC output pattern away from the power module.

■ High frequency noise is radiated from the power module. When mounting the power module on a PCB, leave a copper pattern on the PCB to let it act as a shield and connect this pattern to the mounting hole.

● CQHS250

■ Avoid placing pattern layout in hatched area shown in Fig.6.1 to insulate between pattern and power supply.

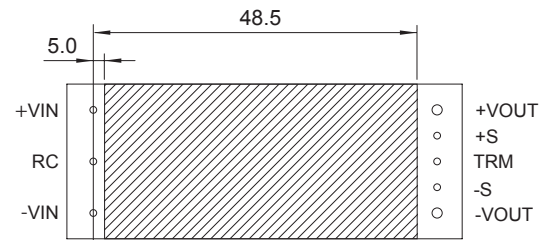


Fig. 6.1 Prohibition area of pattern layout (top view)

● CQHS300/CQHS350

■ Soldering CQHS series with printed board must be done under the flat condition by using the mounting hole and fixing with the screw.

If CQHS series is inclined and it's mounted, the insulation of the internal components and printed board might not be kept.

■ When a heat sink cannot be fixed on the base plate side, order the power module with "-T" option. A heat sink can be mounted by affixing a M3 tap on the heat sink.

Please make sure a mounting hole will be connected to a grounding capacitor C_Y .

Table 6.1 Mounting Hole Configuration

Mounting hole	
Standard	M3 tapped
Optional : -T	ϕ 3.4 thru

6.2 Stress onto the pins

- Applying excessive stress to the input or output pins of the power module may damage internal connections. Avoid applying stress in excess of that shown in Fig. 6.2 and Fig.6.3.
- Input and output pins are soldered onto the internal PCB. Do not bend or pull the leads with excessive force.

● CQHS300/CQHS350

- As unexpected stress may be applied to the pins, set the diameter of the PCB mounting hole at 3.5mm.
- As unexpected stress may be applied to the pins from vibration or shock, fix the power module by using the mounting holes with screws to reduce stress.
- Fix the power module to the PCB with the screws before soldering the input and output pins to prevent the PCB pattern being damaged.

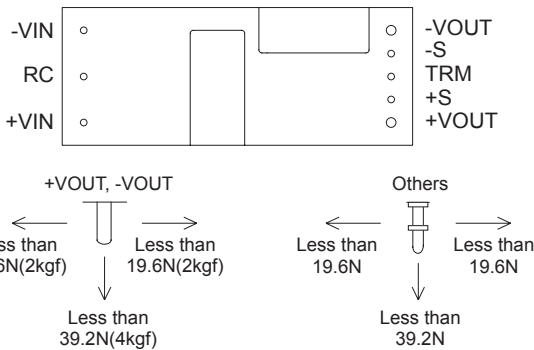


Fig. 6.2 Stress onto Pins (CQHS250)

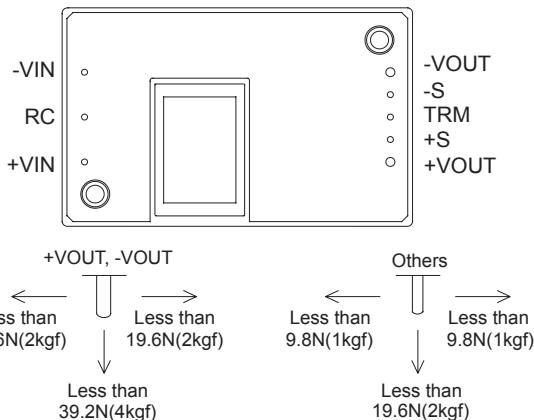


Fig. 6.3 Stress onto Pins (CQHS300/CQHS350)

6.3 Cleaning

- Clean the soldered side of the power module with a brush. Prevent liquid from getting into the power module. Do not clean by soaking the power module into liquid.
- Do not allow solvent to come in contact with product labels in cases as this may cause deletion of the letters printed on the product labels.
- After cleaning, dry the power modules well.

6.4 Soldering temperature

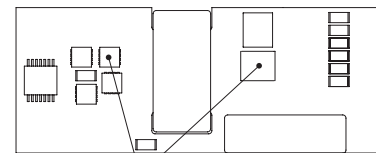
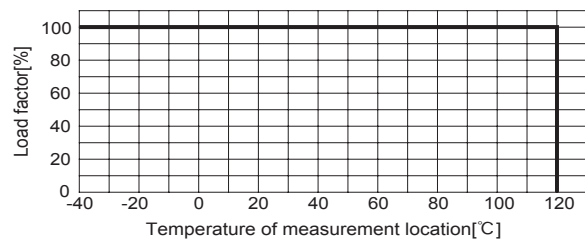
- Flow soldering : 260°C for up to 15 seconds.
- Soldering iron (26W) : 450°C for up to 5 seconds.

6.5 Derating

- It is necessary to note the thermal fatigue life by power cycle. Please reduce the temperature fluctuation range as much as possible when the up and down of the temperature are frequently generated. Contact us for more information on cooling methods.

● CQHS250

- Use with the convection cooling or the forced air cooling. Make sure the temperatures at temperature measurement locations shown from Fig.6.4 below are on or under the derating curve in Fig.6.4. Ambient temperature must be kept at 85°C or under.

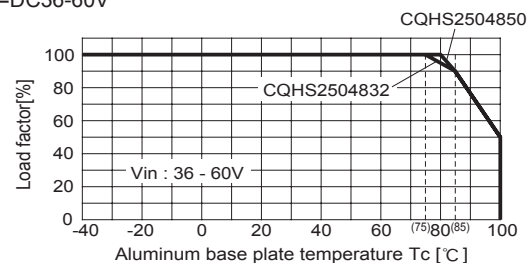


Temperature of measurement location

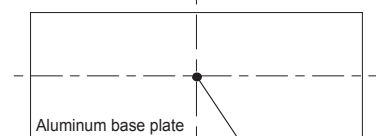
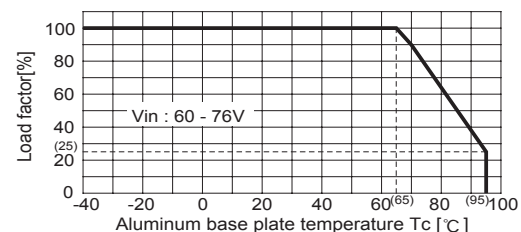
Fig. 6.4 Derating curve (CQHS250)

- For option "B" which is used with the convection cooling, forced air cooling or conduction cooling, use the temperature measurement location as shown in Fig.6.5.

①Vin=DC36-60V



②Vin=DC60-76V



Tc : Measuring point

Fig. 6.5 Derating curve (CQHS250 option "B")

● CQHS300/CQHS350

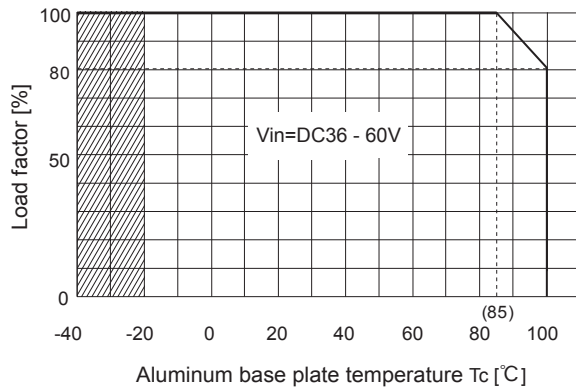
■ Use the power modules with conduction cooling (e.g. heat dissipation from the aluminum base plate to the attached heat sink).

Fig. 6.6 shows the derating curves with respect to the aluminum base plate temperature. Note that operation within the hatched areas will cause a significant level of ripple and ripple noise. Contact us for more information on cooling methods.

■ Please measure the temperature on the aluminum base plate edge side when you cannot measure the temperature of the center part of the aluminum base plate.

In this case, please take 5deg temperature margin from the derating characteristic of Fig. 6.6.

① Vin=DC36-60V



② CQHS300 : Vin=DC60 - 76V CQHS350 : Vin=DC60 - 65V

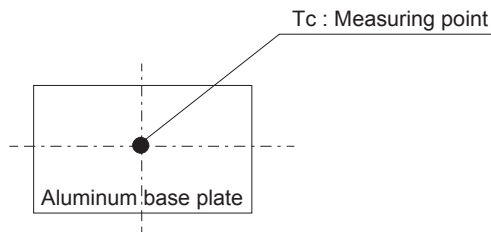
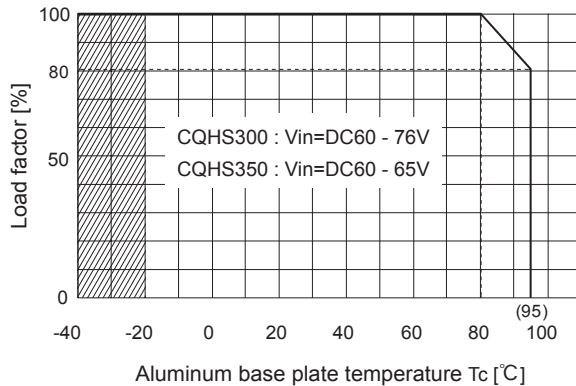


Fig. 6.6 Derating curve (CQHS300/CQHS350)

6.6 Heat sink

(CQHS300/CQHS350 Optional parts)

■ CQHS300/CQHS350 works with conduction cooling and needs heat dissipation using heat sinks. Optional heat sinks are available for CQHS Series. Refer to Table 6.2 for details on the thermal resistance of heat sinks.

Table 6.2 Types of Heat Sinks Available

No.	Model	Size[mm]			Thermal resistance[°C/W]		Style
		H	W	D	Convection (0.1m/s)	Forced Air	
1	F-QB-F1	12.7	58.4	37.6	14.0	Refer Fig.6.8	Horizontal
2	F-QB-F2	12.7	58.7	37.3			Vertical
3	F-QB-F3	25.4	58.4	37.6	7.5		Horizontal
4	F-QB-F4	25.4	58.7	37.3			Vertical
5	F-QB-F5	38.1	58.4	37.6	5.0		Horizontal
6	F-QB-F6	38.1	58.7	37.3			Vertical

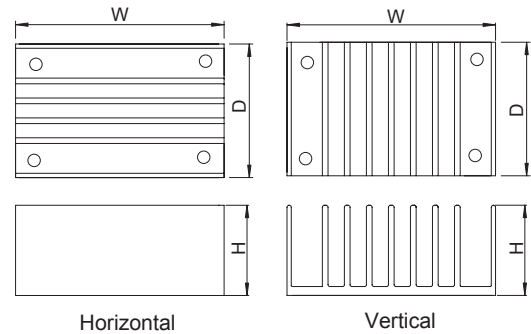


Fig.6.7 Heat Sink Types

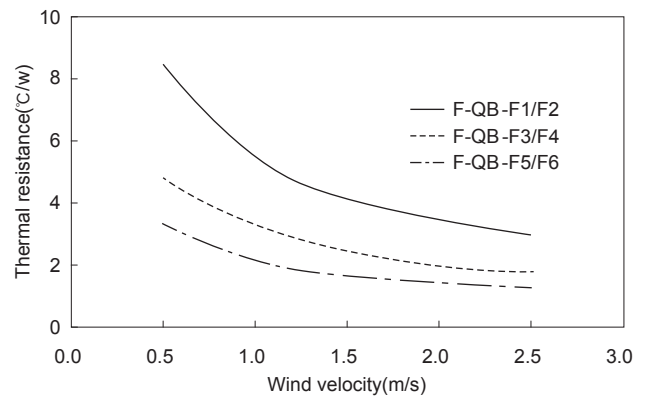


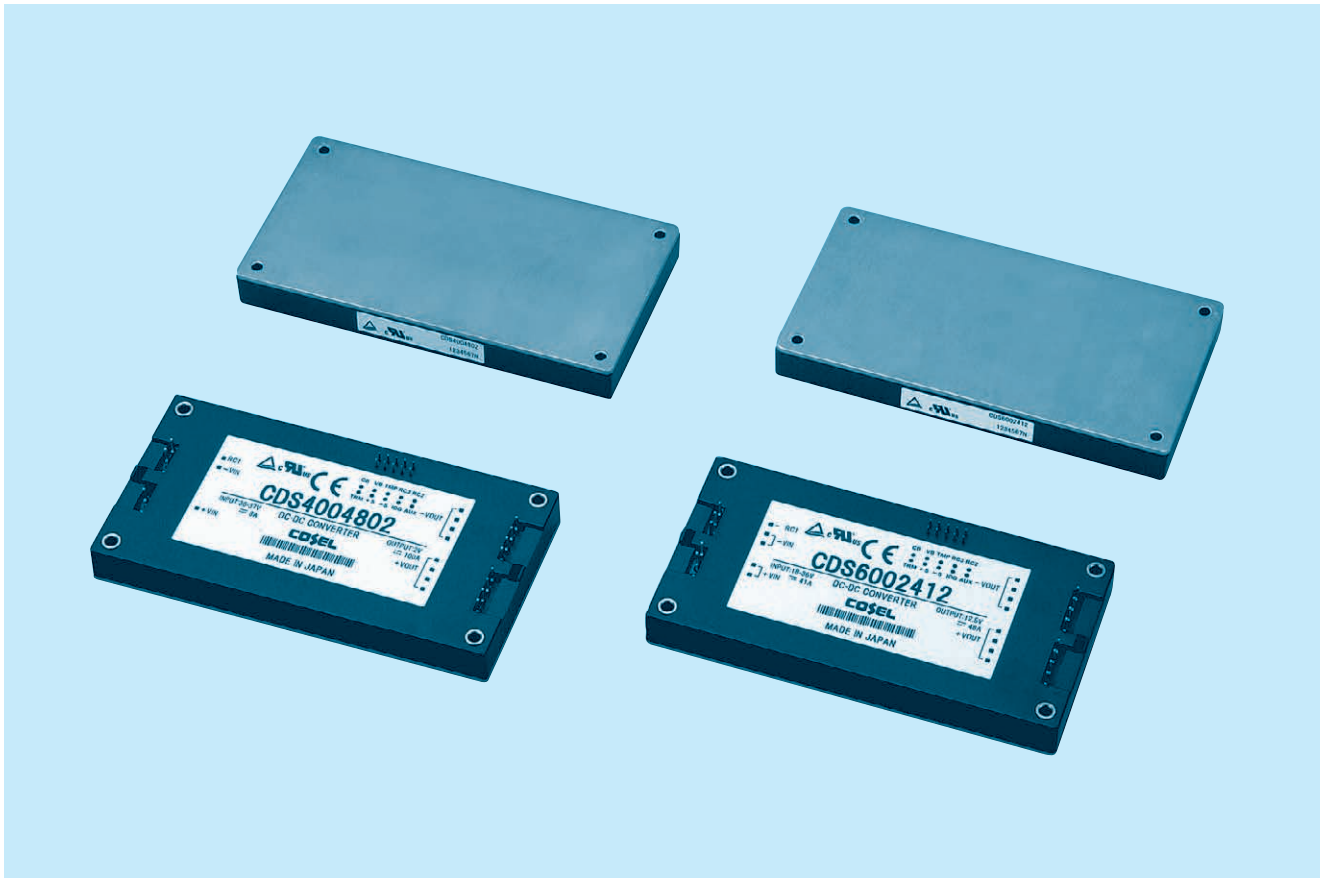
Fig.6.8 Thermal Resistance of Heat Sink(Forced Air)

7 Safety Considerations

- To apply for safety standard approvals with the power module, the following conditions must be met. Consult us for more details.
 - The power modules must be used as a component power supply in end-use equipment.
 - Neither basic isolation nor double/reinforced isolation is provided across input, output and the base plate of the power module. If the power module is to be used with input voltage of more than 60VDC and needs basic or double/reinforced isolation, the required isolation must be provided in the construction of the final product.
 - Use external fuses that comply with safety standards at the input.



CDS-series



CDS

Feature

- Ideal for distributed power systems
- Thin and small size
- Built-in overcurrent, overvoltage and thermal protection circuits
- Built-in Remote ON/OFF (on both side of input and output)
- Inverter operating monitoring (IOG)
- Mounting hole ($\phi 3.4$ thru)

CE marking

- Low Voltage Directive

Safety agency approvals

- UL60950-1, C-UL, EN60950-1

5-year warranty

CDS40048

CD S 400 48 12 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
 ② Single output
 ③ Output wattage
 ④ Input voltage
 48:DC36 - 76V
 ⑤ Output voltage
 ⑥ Optional
 M:with Mounting hole
 M3 tapped

MODEL	CDS4004802	CDS4004803	CDS4004805	CDS4004807	CDS4004812	CDS4004815	CDS4004824	CDS4004828
MAX OUTPUT WATTAGE[W]	200	330	400	405	500	510	504	504
DC OUTPUT	2V 100A	3.3V 100A	5V 80A	7.5V 54A	12.5V 40A	15V 34A	24V 21A	28V 18A

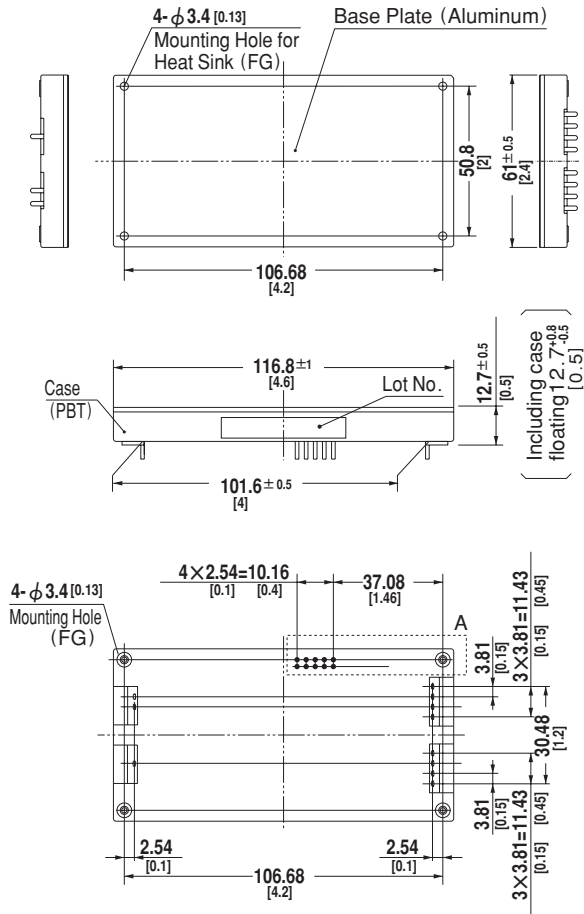
SPECIFICATIONS

	MODEL	CDS4004802	CDS4004803	CDS4004805	CDS4004807	CDS4004812	CDS4004815	CDS4004824	CDS4004828
INPUT	VOLTAGE[V]	DC36 - 76							
	CURRENT[A]	*1 6typ	9typ	10typ	10typ	12typ	12typ	12typ	12typ
	EFFICIENCY[%]	DCIN 48V, I _o =100% 73typ DCIN 48V, I _o =50% 75typ	80typ 82typ	84typ 86typ	87typ 88typ	89typ 91typ	89typ 90typ	89typ 90typ	89typ 90typ
OUTPUT	VOLTAGE[V]	2	3.3	5	7.5	12.5	15	24	28
	CURRENT[A]	100	100	80	54	40	34	21	18
	LINE REGULATION[mV]	10max	16max	20max	30max	40max	60max	95max	95max
	LOAD REGULATION[mV]	20max	30max	40max	60max	100max	150max	190max	190max
	RIPPLE[mVp-p]	0 to +85°C *2 80max -20 - 0°C *2 140max	80max 140max	80max 140max	100max 150max	120max 160max	120max 160max	120max 160max	120max 160max
	RIPPLE NOISE[mVp-p]	0 to +85°C *2 100max -20 - 0°C *2 150max	100max 150max	100max 150max	140max 160max	150max 180max	150max 180max	150max 180max	150max 180max
	TEMPERATURE REGULATION[mV]	0 to +65°C 25max -20 to +85°C 40max	35max 60max	50max 85max	75max 130max	120max 200max	180max 310max	280max 480max	280max 480max
	DRIFT[mV]	*3 10max	16max	20max	30max	40max	60max	90max	90max
	START-UP TIME[ms]	200max (DCIN 48V, I _o =100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), 60 - 110% adjustable by external VR or external voltage							
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE SETTING[V]	1.95 - 2.10	3.25 - 3.45	4.90 - 5.20	7.25 - 7.85	12.00 - 13.00	14.40 - 15.60	23.04 - 24.96	26.88 - 29.12
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	OVERVOLTAGE PROTECTION[V]	2.80 - 4.50	4.00 - 5.50	5.75 - 7.00	8.60 - 10.50	14.35 - 17.50	17.25 - 21.00	27.60 - 33.60	33.00 - 39.20
	REMOTE SENSING	Provided							
ISOLATION	REMOTE ON/OFF	Provided (On both side of input and output)							
	INPUT-OUTPUT	DC1500V 1minute, DC500V 50MΩ min (20±15°C)							
	INPUT-FG	DC1500V 1minute, DC500V 50MΩ min (20±15°C)							
	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15°C)							
ENVIRONMENT	OUTPUT-RC2,RC3	AC100V 1minute, Cutoff current = 100mA, DC100V 10MΩ min (20±15°C)							
	OPERATING TEMP.HUMID.AND ALTITUDE *6	-20 to +85°C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max							
	STORAGE TEMP.HUMID.AND ALTITUDE	-40 to +85°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G) 3minutes period, 60minutes each along X, Y and Z axis							
SAFETY	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis							
	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1							
OTHERS	CASE SIZE/WEIGHT	61 × 12.7 × 116.8mm [2.4 × 0.5 × 4.6 inches] (W × H × D) / 180g max							
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)							

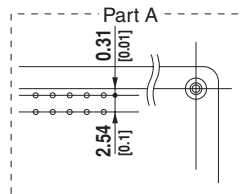
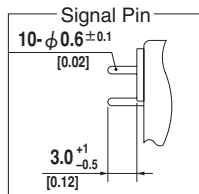
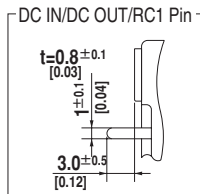
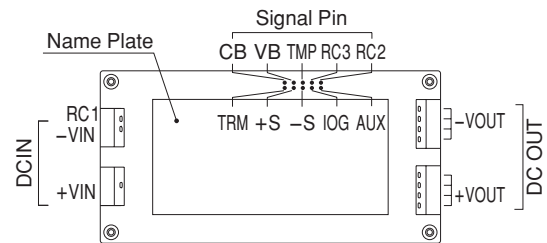
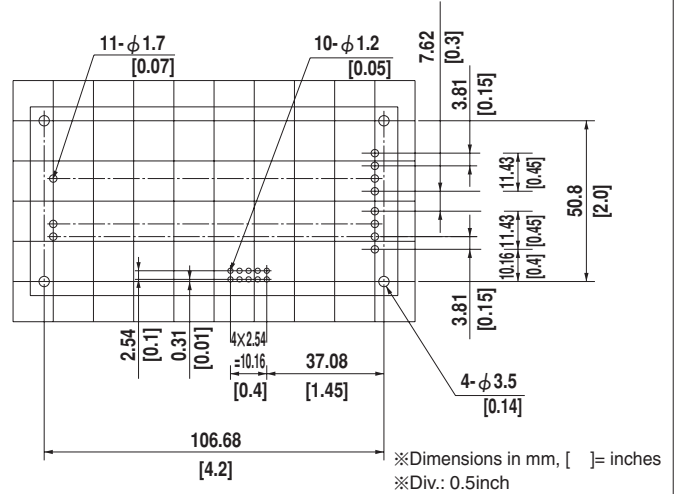
*1 At rated input(DC48V) and rated load.
 *2 Ripple and ripple noise is measured by using measuring board with recommended capacitor Co & the film capacitor 0.1 μF.
 Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN:RM101).
 *3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*4 When using with in the range of 1-1.2V, please consult with us.
 *5 CDS4004828 : Output voltage adjustment range is 60 - 114.3%.
 *6 Please consult us in regard to use from -40°C.

External view



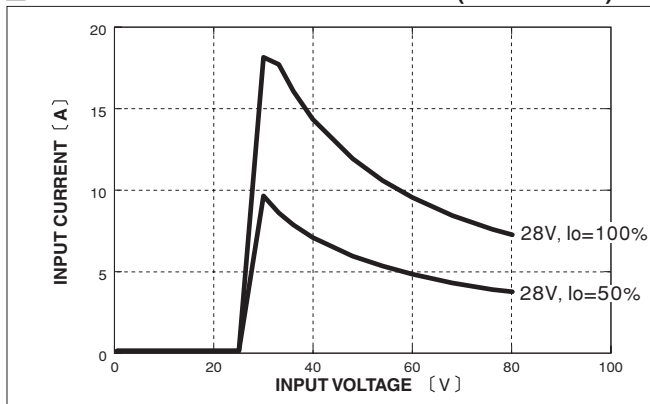
※Recommending size for processing PCB
(TOP VIEW)



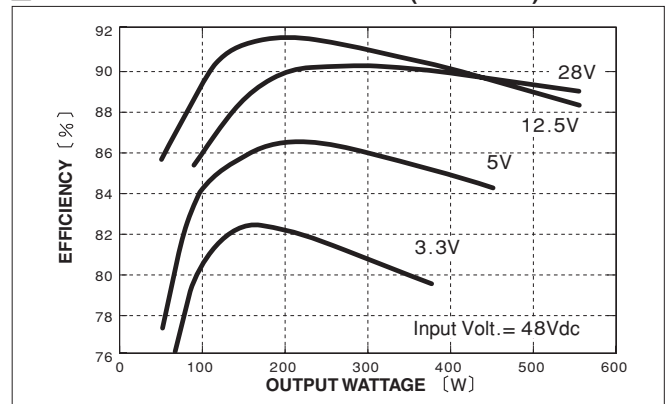
※Weight: 180g max
 ※Tolerance: ± 0.3 [± 0.012]
 ※Base Plate: Aluminum
 ※Dimensions in mm, [] = inches
 ※Mounting hole screwing torque: 0.49N·m
 (5.0kgf·cm) max

Performance data

INPUT CURRENT CHARACTERISTICS (CDS4004828)



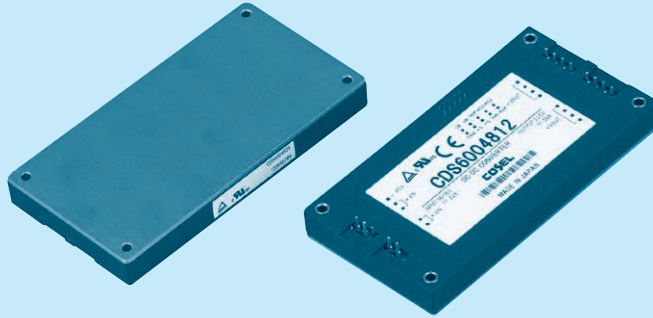
EFFICIENCY CHARACTERISTICS (CDS40048)



CDS500/600

CD S 600 48 12 ☐ - ☐

① ② ③ ④ ⑤ ⑥ ⑦



- ① Series name
 ② Single output
 ③ Output wattage
 ④ Input voltage
 24:DC18 - 36V
 48:DC36 - 76V
 ⑤ Output voltage
 ⑥ H: High Efficiency
 (24VIN Model only)
 ⑦ Optional
 M: with Mounting hole
 M3 tapped

MODEL	CDS5002428H	CDS6002412	CDS6002412H	CDS6002428	CDS6002428H	CDS6004812	CDS6004828
MAX OUTPUT WATTAGE[W]	504	600	600	616	616	700	700
DC OUTPUT	28V 18A	12.5V 48A	12.5V 48A	28V 22A	28V 22A	12.5V 56A	28V 25A

SPECIFICATIONS

	MODEL	CDS5002428H	CDS6002412	CDS6002412H	CDS6002428	CDS6002428H	CDS6004812	CDS6004828	
INPUT	VOLTAGE[V]	DC18 - 36		DC20.5 - 36	DC18 - 36	DC19 - 36	DC36 - 76		
	CURRENT[A]	24typ	30typ	29typ	30typ	29typ	17typ	17typ	
	EFFICIENCY[%]	lo=100%	89typ(DCIN 24V)	83typ(DCIN 24V)	87typ(DCIN 24V)	86typ(DCIN 24V)	89typ(DCIN 24V)	89typ(DCIN 48V)	89typ(DCIN 48V)
		lo=50%	90typ(DCIN 24V)	87typ(DCIN 24V)	90typ(DCIN 24V)	87typ(DCIN 24V)	90typ(DCIN 24V)	91typ(DCIN 48V)	90typ(DCIN 48V)
OUTPUT	VOLTAGE[V]	28	12.5	12.5	28	28	12.5	28	
	CURRENT[A]	18	48	48	22	22	56	25	
	LINE REGULATION[mV]	95max	40max	40max	95max	95max	40max	95max	
	LOAD REGULATION[mV]	190max	100max	100max	190max	190max	100max	190max	
	RIPPLE[mVp-p]	0 to +85℃ *2	120max	120max	120max	120max	120max	120max	120max
		-20 - 0℃ *2	160max	160max	160max	160max	160max	160max	160max
	RIPPLE NOISE[mVp-p]	0 to +85℃ *2	150max	150max	150max	150max	150max	150max	150max
		-20 - 0℃ *2	180max	180max	180max	180max	180max	180max	180max
	TEMPERATURE REGULATION[mV]	0 to +65℃	280max	120max	120max	280max	280max	120max	280max
		-20 to +85℃	480max	200max	200max	480max	480max	200max	480max
	DRIFT[mV]	90max	40max	40max	90max	90max	40max	90max	
	START-UP TIME[ms]	200max (DCIN 24V, Io=100%)						200max (DCIN 48V, Io=100%)	
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), 80 - 110% adjustable by external VR or external voltage							
OUTPUT VOLTAGE SETTING[V]	22.40 - 32.00 *4 *5	10.00 - 13.75	10.00 - 13.75 *5	22.40 - 30.80	22.40 - 32.00 *4 *5	10.00 - 13.75	22.40 - 32.00 *4		
OUTPUT VOLTAGE SETTING[V]	27.72 - 28.28 *6	12.00 - 13.00	12.00 - 13.00	26.88 - 29.12	26.88 - 29.12	12.00 - 13.00	26.88 - 29.12		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	OVERVOLTAGE PROTECTION[V]	33.00 - 39.20	14.35 - 17.50			33.00 - 39.20	14.35 - 17.50	33.00 - 39.20	
	REMOTE SENSING	Provided							
	REMOTE ON/OFF	Provided (On both side of input and output)							
ISOLATION	INPUT-OUTPUT	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)							
	INPUT-FG	AC500V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)							
	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)							
	OUTPUT-RC2.RC3	AC100V 1minute, Cutoff current = 100mA, DC100V 10MΩ min (20±15℃)							
ENVIRONMENT	OPERATING TEMP.HUMID.AND ALTITUDE *7	-20 to +85℃ (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max							
	STORAGE TEMP.HUMID.AND ALTITUDE	-40 to +85℃, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G) 3minutes period, 60minutes each along X, Y and Z axis							
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis							
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1							
OTHERS	CASE SIZE/WEIGHT	61 × 12.7 × 116.8mm [2.4 × 0.5 × 4.6 inches] (W × H × D) / 200g max							
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)							

*1 At rated input(DC24,DC48V) and rated load.

*2 Ripple and ripple noise is measured by using measuring board with recommended capacitor Co & the film capacitor 0.1 μF.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN:RM101).

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

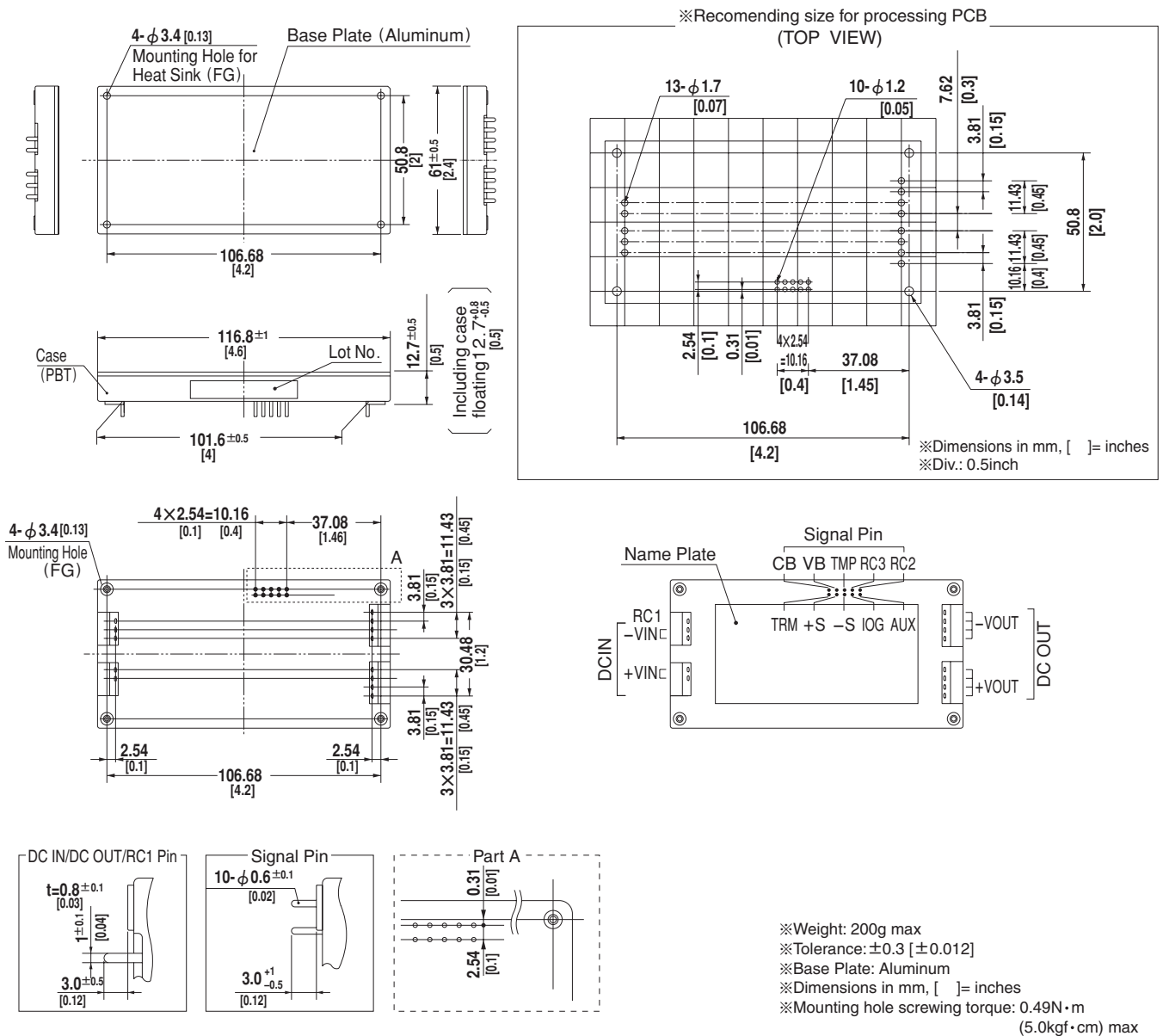
*4 CDS5002428H,CDS6002428H,CDS6004828:Output voltage adjustment range is 80 - 114.3%.

*5 CDS5002428H,CDS6002412H,CDS6002428H:When the output voltage adjustment range is 101% or more,the input voltage range is limited(Refer to Instruction Manual).

*6 Aluminum baseplate temperature Tc=25°C

*7 Please consult us in regard to use from -40°C.

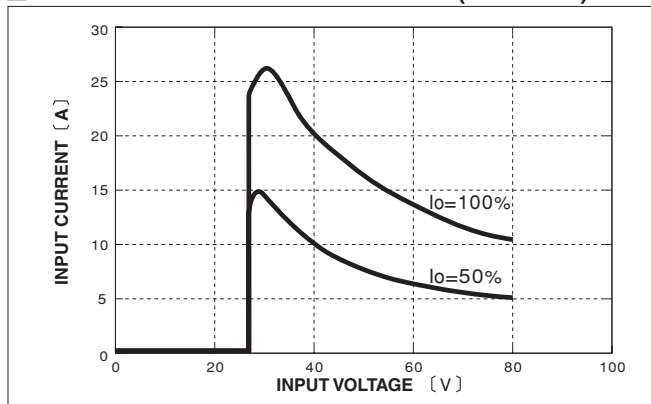
External view



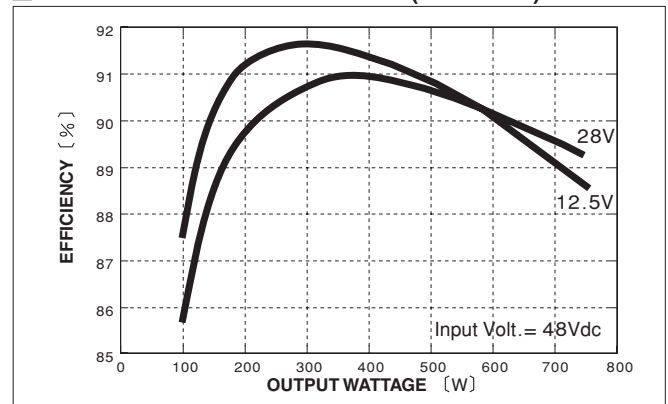
CDS

Performance data

INPUT CURRENT CHARACTERISTICS (CDS60048)



EFFICIENCY CHARACTERISTICS (CDS60048)



Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
CDS4004802	Forward converter	360	6 *1	-	-	Aluminum	Yes		Yes	Yes
CDS4004803	Forward converter	360	9 *1	-	-	Aluminum	Yes		Yes	Yes
CDS4004805	Forward converter	360	10 *1	-	-	Aluminum	Yes		Yes	Yes
CDS4004807	Forward converter	360	10 *1	-	-	Aluminum	Yes		Yes	Yes
CDS4004812	Forward converter	360	12 *1	-	-	Aluminum	Yes		Yes	Yes
CDS4004815	Forward converter	360	12 *1	-	-	Aluminum	Yes		Yes	Yes
CDS4004824	Forward converter	360	12 *1	-	-	Aluminum	Yes		Yes	Yes
CDS4004828	Forward converter	360	12 *1	-	-	Aluminum	Yes		Yes	Yes
CDS5002428H	Forward converter	360	24 *2	-	-	Aluminum	Yes		Yes	Yes
CDS6002412	Forward converter	360	30 *2	-	-	Aluminum	Yes		Yes	Yes
CDS6002412H	Forward converter	360	29 *2	-	-	Aluminum	Yes		Yes	Yes
CDS6002428	Forward converter	360	30 *2	-	-	Aluminum	Yes		Yes	Yes
CDS6002428H	Forward converter	360	29 *2	-	-	Aluminum	Yes		Yes	Yes
CDS6004812	Forward converter	360	17 *1	-	-	Aluminum	Yes		Yes	Yes
CDS6004828	Forward converter	360	17 *1	-	-	Aluminum	Yes		Yes	Yes

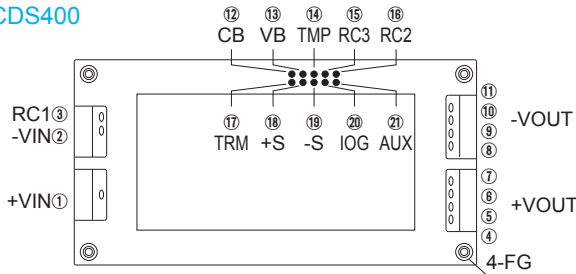
*1 The value of input current is at DCIN48V and rated load.

*2 The value of input current is at DCIN24V and rated load.

1	Pin Connection	CDS-8
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1 Pin Connection

●CDS400



●CDS500/600

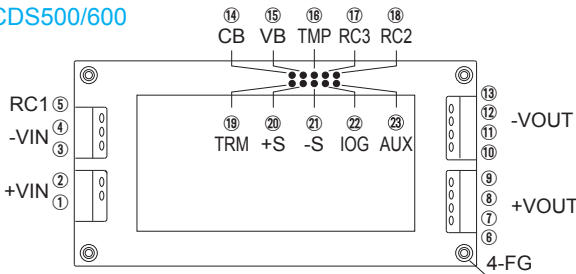


Fig.1.1 Pin Connection(bottom view)

●CDS400 Table 1.1 Pin Connection and function

No.	Pin Connection	Function
①	+VIN	+DC input
②	-VIN	-DC input
③	RC1	Remote ON/OFF(Input side)
④ ⑤ ⑥ ⑦	+VOUT	+DC output
⑧ ⑨ ⑩ ⑪	-VOUT	-DC output
⑫	CB	Current balance
⑬	VB	Voltage balance
⑭	TMP	Thermal detection signal
⑮	RC3	Remote ON/OFF(output side)
⑯	RC2	
⑰	TRM	Adjustment of output voltage
⑱	+S	+Remote sensing
⑲	-S	-Remote sensing
⑳	IOG	Inverter operation monitor
㉑	AUX	Auxiliary power supply
—	FG	Mounting hole(FG)

No.	Pin Connection	Reference
①	+VIN	3.1 "Wiring input pin"
②	-VIN	
③	RC1	4.5 "Remote ON/OFF"
④ ⑤ ⑥ ⑦	+VOUT	3.2 "Wiring output pin"
⑧ ⑨ ⑩ ⑪	-VOUT	
⑫	CB	5.2 "Parallel operation/Master-slave operation"
⑬	VB	
⑭	TMP	4.3 "Thermal detection/Thermal protection"
⑮	RC3	4.5 "Remote ON/OFF"
⑯	RC2	
⑰	TRM	4.7 "Adjustable voltage range"
⑱	+S	4.6 "Remote sensing"
⑲	-S	
⑳	IOG	4.4 "Inverter operation monitor"
㉑	AUX	4.5 "Remote ON/OFF"
—	FG	3.1 "Wiring input pin"

●CDS500/600 Table 1.2 Pin Connection and function

No.	Pin Connection	Function
① ②	+VIN	+DC input
③ ④	-VIN	-DC input
⑤	RC1	Remote ON/OFF(Input side)
⑥ ⑦ ⑧ ⑨	+VOUT	+DC output
⑩ ⑪ ⑫ ⑬	-VOUT	-DC output
⑭	CB	Current balance
⑮	VB	Voltage balance
⑯	TMP	Thermal detection signal
⑰	RC3	Remote ON/OFF(output side)
⑱	RC2	
⑲	TRM	Adjustment of output voltage
㉑	+S	+Remote sensing
㉒	-S	-Remote sensing
㉓	IOG	Inverter operation monitor
㉔	AUX	Auxiliary power supply
—	FG	Mounting hole(FG)

No.	Pin Connection	Reference
① ②	+VIN	3.1 "Wiring input pin"
③ ④	-VIN	
⑤	RC1	4.5 "Remote ON/OFF"
⑥ ⑦ ⑧ ⑨	+VOUT	3.2 "Wiring output pin"
⑩ ⑪ ⑫ ⑬	-VOUT	
⑭	CB	5.2 "Parallel operation/Master-slave operation"
⑮	VB	
⑯	TMP	4.3 "Thermal detection/Thermal protection"
⑰	RC3	4.5 "Remote ON/OFF"
⑱	RC2	
⑲	TRM	4.7 "Adjustable voltage range"
㉑	+S	4.6 "Remote sensing"
㉒	-S	
㉓	IOG	4.4 "Inverter operation monitor"
㉔	AUX	4.5 "Remote ON/OFF"
—	FG	3.1 "Wiring input pin"

2 Connection for Standard Use

■In order to use the power supply, it is necessary to wire as shown in Fig.2.1.

〔Reference: 3 "Wiring Input/Output Pin"〕
6.5 "Derating"〕

■Short the following pins to turn on the power supply.

-VIN↔RC1, +VOUT↔+S, -VOUT↔-S

〔Reference: 4.5 "Remote ON/OFF"〕
4.6 "Remote sensing"〕

■The CDS Series handles only the DC input.

Avoid applying AC input directly.

It will damage the power supply.

■Operate with the conduction cooling(e.g. heat radiation from the aluminum base plate to the attached heat sink).

〔Reference: 6.5 "Derating"〕

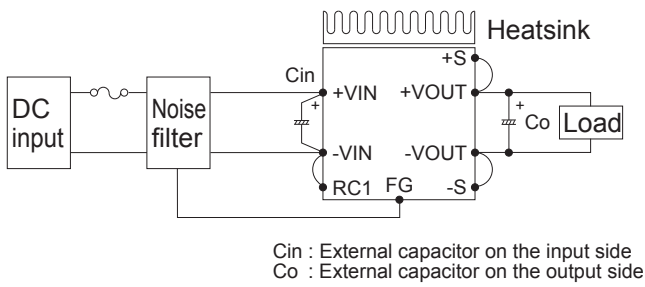


Fig.2.1 Connection for standard use

3 Wiring Input/Output Pin

3.1 Wiring input pin

(1) External fuse

- Fuse is not built-in on input side. In order to protect the unit, install the normal blow type fuse on input side.
- When the input voltage from a front end unit is supplied to multiple units, install a regular type fuse in each unit.

Table 3.1 Recommended fuse(Normal-blow type, maximum value)

Model	CDS40048	CDS50024/CDS60024	CDS60048
Rated current	30A	75A	30A

(2) Noise filter/Decoupling capacitor

- Install an external noise filter for low line-noise and for stable operation of the power supply.
- Install a correspondence filter, if a noise standard meeting is required or if the surge voltage may be applied to the unit.

(3) External capacitor on the input side

- Install an external capacitor Cin between +VIN and -VIN input pins for low line-noise and for stable operation of the power supply.

CDS40048: more than 100 μ F
CDS50024/CDS60024: more than 1000 μ F
CDS60048: more than 470 μ F
- When the line impedance is high or the input voltage rise quickly at start-up(less than 10 μ s), install a capacitor Cin between +VIN and -VIN input pins(within 50mm from pins).

(4) Input voltage range/Input current range

- Input voltage ripple should be less than 2Vp-p.
- Make sure that the voltage fluctuation, including the ripple voltage, will not exceed the input voltage range.
- Use a front end unit with enough power, considering the start-up current Ip of this unit.

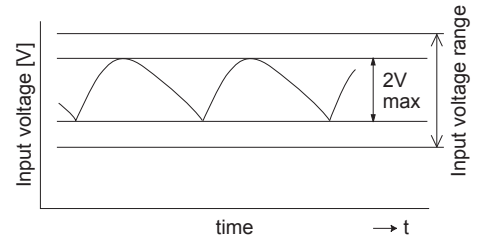


Fig.3.1 Input voltage ripple

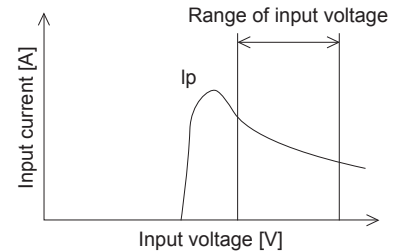


Fig.3.2 Input current characteristics

(5) Operation with AC input

- The CDS series handles only for the DC input.
A front end unit(AC/DC converter) is required when the CDS series is operated with AC input.

(6) Reverse input voltage protection

- Avoid the reverse polarity input voltage. It will break the power supply. It is possible to protect the unit from the reverse input voltage by installing an external diode.

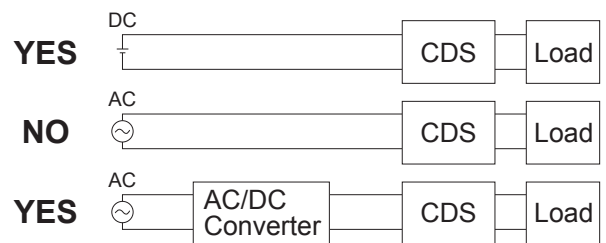


Fig.3.3 Use with AC input

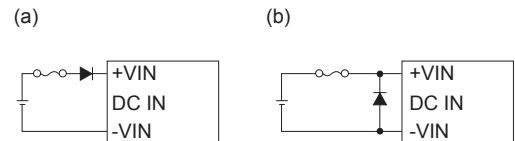


Fig.3.4 Reverse input voltage protection

3.2 Wiring output pin

- Install an external capacitor Co between +VOUT and -VOUT pins for stable operation of the power supply.

Recommended capacitance of Co is shown in Table 3.2.

Table 3.2 Recommended capacitance Co [μ F]

Model	Capacitance
CDS4004802	6800
CDS4004803	6800
CDS4004805	4700
CDS4004807	4700
CDS4004812	470
CDS4004815	330
CDS4004824	220
CDS4004828	220
CDS5002428H	470
CDS6002412	1000
CDS6002412H	1000
CDS6002428	470
CDS6002428H	470
CDS6004812	1000
CDS6004828	470

- Select the high frequency type capacitor. Output ripple and start-up waveform may be influenced by ESR · ESL of the capacitor and the wiring impedance.
- Install a capacitor Co near the output pins(within 100mm from the pins).

CDS

4 Function

4.1 Overcurrent protection

- Overcurrent protection is built-in and comes into effect at over 105% of the rated current.

Overcurrent protection prevents the unit from short circuit and overcurrent condition. The unit automatically recovers when the fault condition is cleared.

- When the output voltage drops at overcurrent, the average output current is reduced by intermittent operation of power supply.

4.2 Overvoltage protection

- The overvoltage protection circuit is built-in. The DC input should be shut down if overvoltage protection is in operation. The minimum interval of DC recycling for recovery is for 2 to 3 minutes (*) or input terminal voltage is decreased less than 1V.

★ The recovery time varies depending on input voltage and input capacity.

Remarks:

Please note that devices inside the power supply might fail when voltage more than rated output voltage is applied to output terminal of the power supply. This could happen when the customer tests the overvoltage performance of the unit.

4.3 Thermal detection/Thermal protection

- Thermal detection(TMP) and protection circuit are built-in.
- When overheat is detected, thermal detection signal(TMP) turns "L" from "H".

TMP circuit is designed as shown in Fig.4.1, and specification is shown as in Table 4.1.

- When overheating continues after detecting the TMP signal, the output will be shut down by the thermal protection circuit.

When this function comes into effect, input voltage should be shut off, and eliminate all possible causes of overheat condition and lower the temperature of the unit to the normal level.

4.4 Inverter operation monitor

- By using the inverter operation monitor(IOG), malfunction of the inverter can be monitored.

When inverter operation is in following mode ①, ② or ③, IOG signal turns "H" from "L" within 1 second.

IOG circuit is designed as shown in Fig.4.1 and specification is shown in Table 4.1.

- ① Malfunction of inverter.
- ② The output voltage drops by 60% or less of the rated voltage.
- ③ When output wattage is decreased radically to less than 10% of rated wattage.

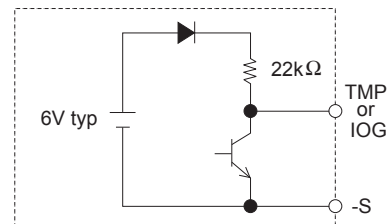


Fig.4.1 TMP, IOG circuit

Table 4.1 Specification of TMP, IOG

No.	Item	TMP	IOG
1	Function	Normal operation "H"	Normal operation "L"
		Overheat detection "L"	Malfunction of inverter "H"
2	Base pin	-S	
3	Level voltage "L"	0.5Vmax at 5mA	
4	Level voltage "H"	5V typ	
5	Maximum sink current	10mA max	
6	Maximum applicable voltage	35V max	

4.5 Remote ON/OFF

■ Remote ON/OFF circuit is built-in on both side of input(RC1) and output(RC2 · RC3).

Output can be controlled by either circuit.

(1) Input side remote ON/OFF(RC1)

■ The ground pin of input side remote ON/OFF circuit is "-VIN" pin.

Between RC1 and -VIN: Output voltage is ON at "Low" level or short circuit(0 - 1.0V).

Between RC1 and -VIN: Output voltage is OFF at "High" level or open circuit(3.5 - 7.0V).

When RC1 is "Low" level, fan out current is 0.3mA typ. When Vcc is applied, use $3.5 \leq V_{cc} \leq 7V$.

When remote ON/OFF function is not used, please short between RC1 and -VIN.

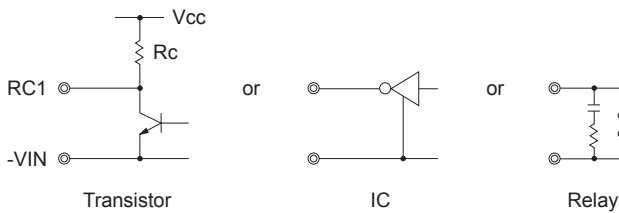


Fig.4.2 RC1 connection example

(2) Output side remote ON/OFF(RC2 · RC3)

Table 4.2 Specification of output side remote ON/OFF(RC2 · RC3)

No.	Item	RC2 · RC3		
1	Wiring method	Fig.4.3 (a)	Fig.4.3 (b)	Fig.4.3 (c)
2	Function	Power ON "H"	Power ON "H"	Power ON "L"
3	Base pin	RC2	-S	-S and RC2
4	Power ON	Open (0.1mA max)		Short (0.5V max)
5	Power OFF	Short (3mA min)		Open (0.1mA max)

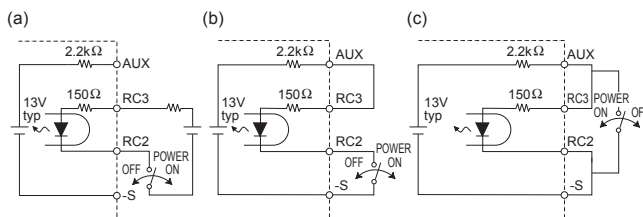


Fig.4.3 RC2 · RC3 connection example

■ When output side remote ON/OFF function is used, please short between RC1 and -VIN.

■ Do not connect RC2 and RC3 with anywhere if remote ON/OFF is not used.

■ Make sure that sink current of output side remote ON/OFF circuit should be less than 12mA.

(3) Auxiliary power supply for remote ON/OFF(AUX)

■ AUX is built in for operating the output side remote ON/OFF(RC2 · RC3).

If AUX is not used for RC2 · RC3, AUX can be used for IOG or TMP signal output by opto coupler.

■ Short protection resistance(2.2kΩ) is built in.

Output voltage decreases as the output current increases.

(AUX voltage at open circuit: 16V max)

4.6 Remote sensing

(1) When the remote sensing function is not in use

■ When the remote sensing function is not in use, it is necessary to confirm that pins are shorted between +S & +VOUT and between -S & -VOUT.

■ Wire between +S & +VOUT and between -S & -VOUT as short as possible.

Loop wiring should be avoided.

This power supply might become unstable by the noise coming from poor wiring.

(2) When the remote sensing function is in use

■ Twisted-pair wire or shield wire should be used for sensing wire.

■ Thick wire should be used for wiring between the power supply and a load.

Line drop should be less than 0.5V.

Voltage between +VOUT and -VOUT should remain within the output voltage adjustment range.

■ If the sensing patterns are short, heavy-current is drawn and the pattern may be damaged.

The pattern disconnection can be prevented by installing the protection parts as close as a load.

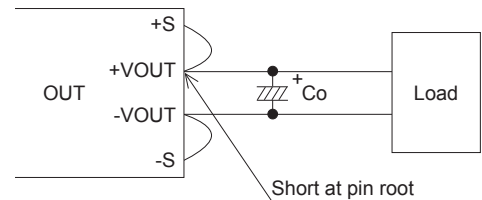


Fig.4.4 Connection when the remote sensing is not in use

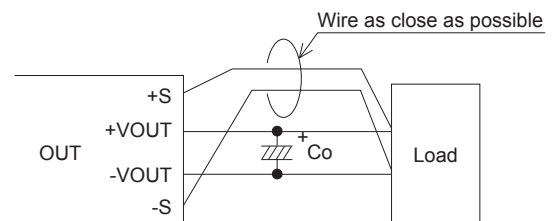


Fig.4.5 Connection when the remote sensing is in use

4.7 Adjustable voltage range

■ Output voltage is adjustable by the external potentiometer or by applied voltage externally.

CDS5002428H, CDS6002412H, CDS6002428H : When the output voltage adjustment range is 101% or more, the input voltage range is limited (Fig.4.6).

■ When the output voltage is raised, decrease the output current so as not to exceed the maximum output wattage.

■ When the output voltage adjustment is used, note that the overvoltage protection circuit operates when the output voltage sets too high.

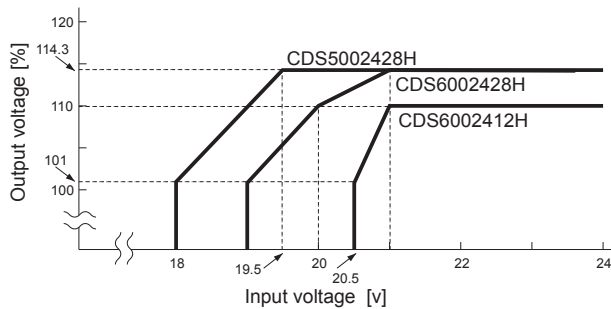


Fig.4.6 Input voltage derating curve

(1) Adjusting method by external resistor

■ By connecting the external potentiometer (VR1) and resistors (R1, R2), output voltage becomes adjustable, as shown in Fig.4.6, recommended external parts are shown in Table 4.3.

■ The wiring to the potentiometer should be as short as possible.

The temperature coefficient becomes worse, depending on the type of a resistor and potentiometer. Following parts are recommended for the power supply.

Resistor Metal film type, coefficient of less than $\pm 100\text{ppm}/^\circ\text{C}$

Potentiometer .. Cermet type, coefficient of less than $\pm 300\text{ppm}/^\circ\text{C}$

■ When the output voltage adjustment is not used, open the TRM pin and VB pin respectively.

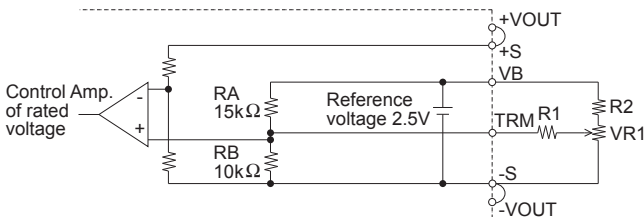


Fig.4.7 Output voltage control circuit

Table 4.3 Recommended value of external potentiometer & resistor

No.	Adjustable range [%]	Number of unit	External parts value [Ω]		
			VR1	R1	R2
1	± 5	Single	5k	75k	1k
2		2sets		36k	
3		3sets		24k	
4	± 10	Single	5k	36k	910
5		2sets		18k	
6		3sets		12k	

(2) Adjusting method by applying external voltage

■ By applying the voltage externally at TRM, output voltage become adjustable.

■ Output voltage is calculated by the following equation.

(Output voltage)

$$= (\text{Applied voltage externally}) \times (\text{Rated output voltage})$$

4.8 Isolation

■ For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for a start(shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

■ Be sure to apply DC voltage when Hi-pot test is performed to the part which is specified as DC voltage. And also set the current limit of Hi-pot tester at 10mA. Don't apply AC voltage, otherwise this may damage the power supply.

(CDS40048 series : INPUT-OUTPUT, INPUT-FG)

5 Series and Parallel Operation

5.1 Series operation

■ Series operation is available by connecting the outputs of two or more power supplies, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

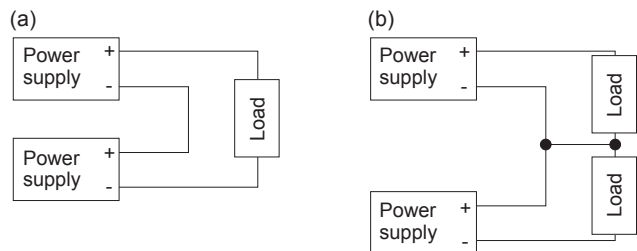


Fig.5.1 Examples of series operation

5.2 Parallel operation/Master-slave operation

■ Parallel operation is available by connecting the units as shown in Fig.5.2.

■ As variance of output current drew from each power supply is maximum 10%, the total output current must not exceed the value determined by the following equation.

(Output current in parallel operation)

$$= (\text{the rated current per unit}) \times (\text{number of unit}) \times 0.9$$

When the number of units in parallel operation increases, input current increase at the same time. Adequate wiring design for input circuitry is required, such as circuit pattern, wiring and current capacity for equipment.

In parallel operation, the maximum operative number of units is 11.

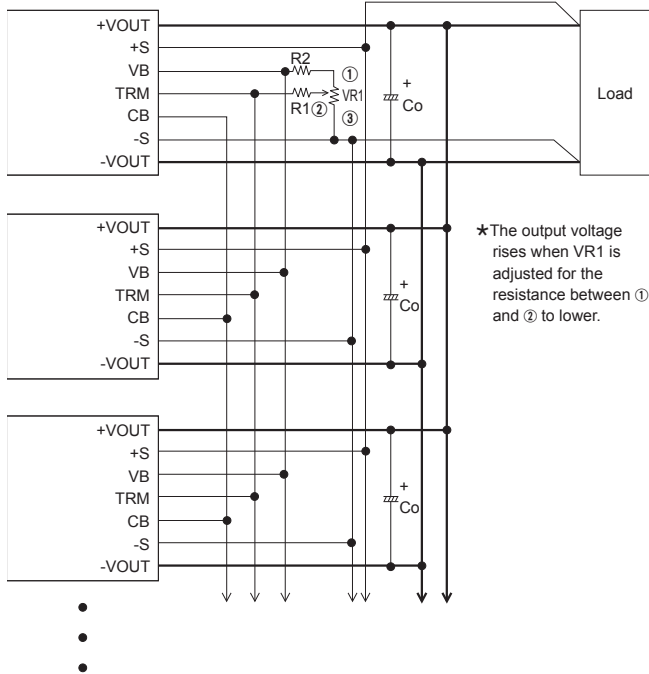


Fig.5.2 Examples of parallel operation

- When output voltage adjustment is not in use. TRM wiring, R1, R2 and VR are not necessary.
- Thick wire should be used for wiring between the power supply and load, and line drop should be less than 0.3V.
- When the output-line impedance is high, the power supply is become unstable.
Use same length and thickness(width) wire(pattern) for the current balance improvement.
- Connect each input pin for the lowest possible impedance.
- When the number of the units in parallel operation increases, input current increases. Adequate wiring design for input circuitry such as circuit pattern, wiring and current for equipment is required.
- Connect the sensing line and the power line by one point after connecting each power supply's sensing pins(+S, -S). In multiple operation, sensing wires should be connected between each units for the muster connection to a load.
- Output current should be 10% or more of the total of the rated output current in parallel operation.
If less than 10%, the IOG signal might become unstable, and output voltage slightly increasing(max5%).

- IOG signal might be unstable for one second when the units are turned on in parallel operation.
- A sound may occur from power supply at parallel operating.

5.3 N+1 redundant operation

- It is possible to set N+1 redundant operation for improving reliability of power supply system.
- Purpose of redundant operation is to ensure stable operation in the event of single power supply failure.
Since extra power supply is reserved for the failure condition, so total power of redundant operation is equal to N-1.

6 Implementation · Mounting Method

6.1 Mounting method

- The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Aluminum base plate temperature around each power supply should not exceed the temperature range shown in derating curve.
- Avoid placing the DC input line pattern lay out underneath the unit, it will increase the line conducted noise. Make sure to leave an ample distance between the line pattern lay out and the unit. Also avoid placing the DC output line pattern underneath the unit because it may increase the output noise. Lay out the pattern away from the unit.
- High-frequency noise radiates directly from the unit to the atmosphere. Therefore, design the shield pattern on the printed circuit board and connect its one to FG.
The shield pattern prevents noise radiation.
- The maximum current is 25A per input pin and output pin.

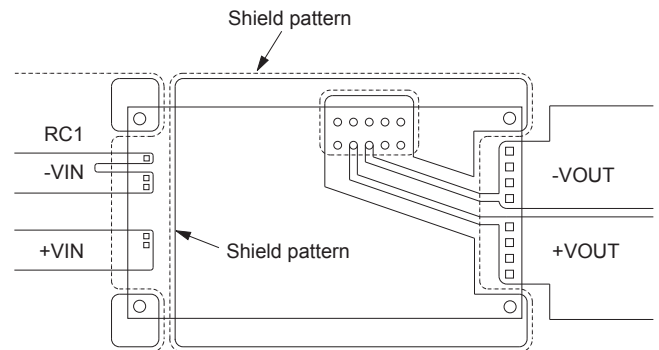


Fig.6.1 Shield pattern lay out(bottom view)

■Option"-M" is available, as shown in Table 6.1.

Table 6.1 Mounting hole

	Mounting hole
Standard	$\phi 3.4$ thru
Optional : -M	M3 tapped

6.2 Stress onto the pins

■When too much stress is applied to the pins of the power supply, the internal connection may be weakened.

As shown in Fig.6.2 avoid applying stress of more than 29.4N(3kgf) on the input pins/output pins(A part) and more than 9.8N(1kgf) to the signal pins(B part).

■The pins are soldered on PCB internally, therefore, do not pull or bend them with abnormal forces.

■Mounting hole diameter of PCB should be 3.5mm to reduce the stress onto the pins.

■Fix the unit on PCB(fixing fittings) by screws to reduce the stress onto the pins. Be sure to mount the unit first, then solder the unit.

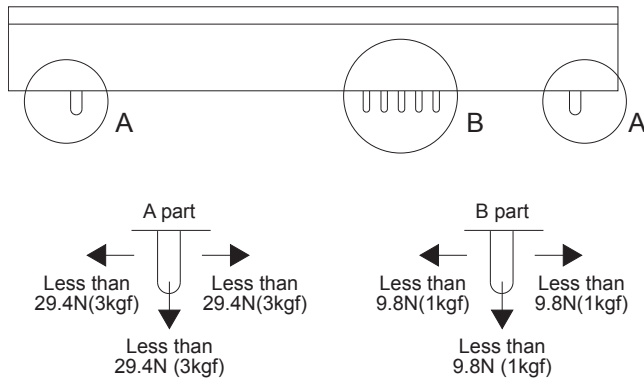


Fig.6.2 Stress onto the pins

6.3 Cleaning

■Clean the product with a brush. Prevent liquid from getting into the product.

Do not soak the product into liquid.

■Do not stick solvent to a name plate or a resin case.

(If solvent sticks to a name plate or a resin case, it will cause to change the color of the case or to fade letters on name plate away.)

■After cleaning, dry them enough.

6.4 Soldering

■Flow soldering :260°C less than 15 seconds.

■Soldering iron

DC IN/DC OUT/RC1 :450°C less than 5 seconds.

Signal pins :350°C less than 3 seconds(less than 20w).

6.5 Derating

■Use with the conduction cooling(e.g. heat radiation by conduction from the aluminum base plate to the attached heat sink).

Fig.6.3 shows the derating curve based on the aluminum base plate temperature. In the hatched area, the specification of Ripple and Ripple Noise is different from other areas.

■It is necessary to note thermal fatigue life by power cycle.

Please reduce the temperature fluctuation range as much as possible when the up and down of temperature are frequently generated.

Contact for more information on cooling methods.

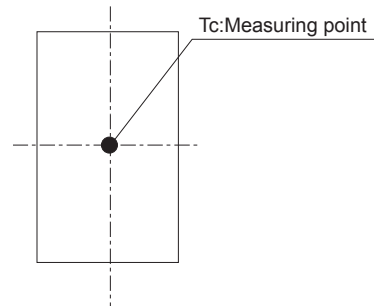
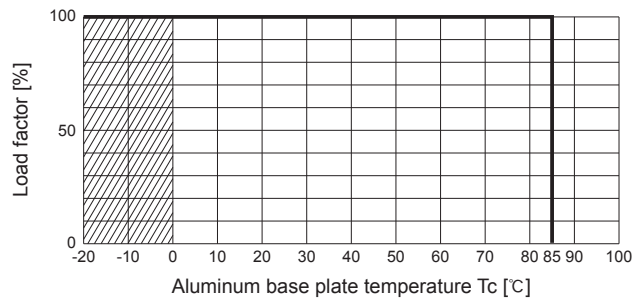


Fig.6.3 Derating curve

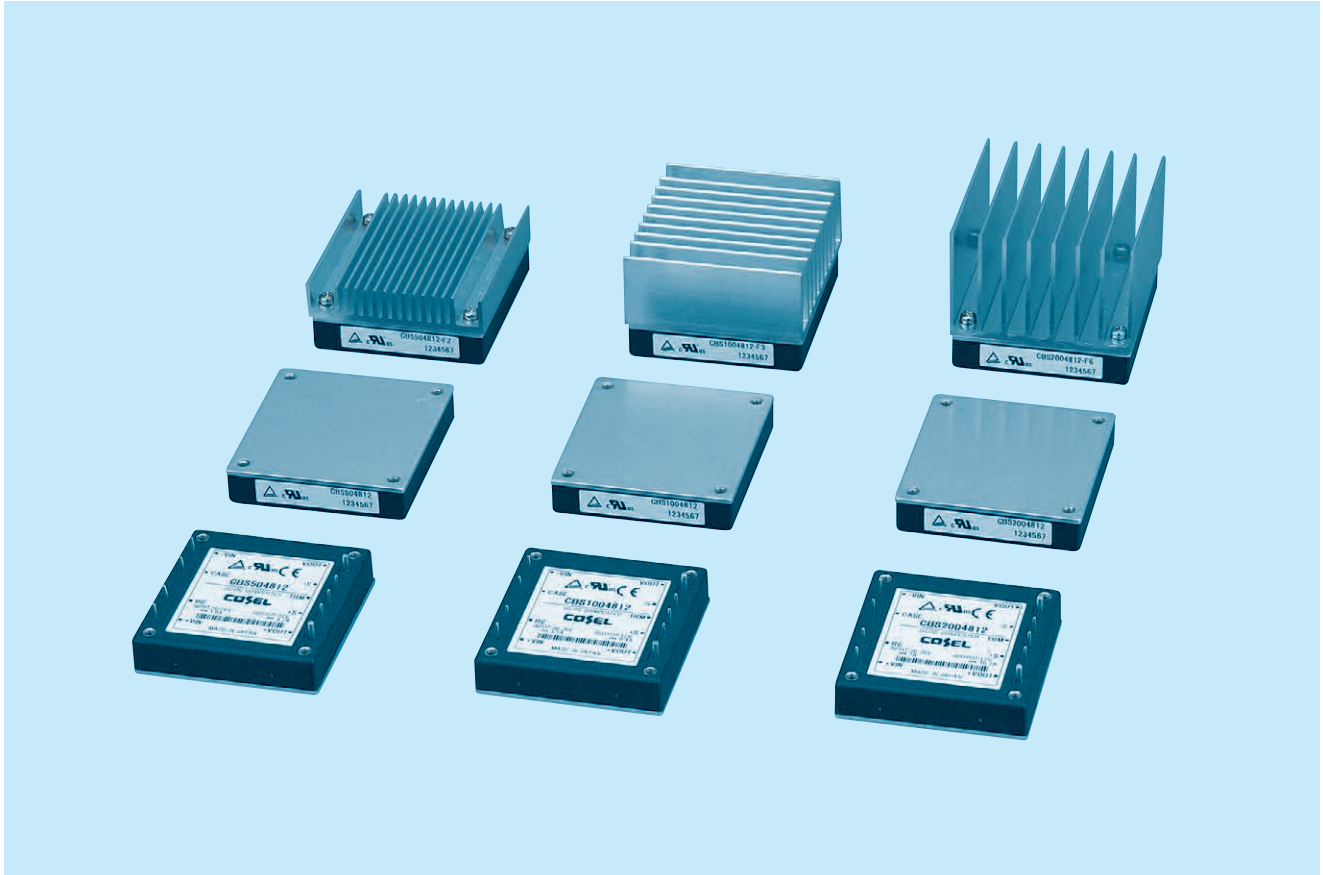
7 Safety Considerations

■To apply for safety standard approval using this power supply, the following conditions must be met.

- This unit must be used as a component of the end-use equipment.
- The equipment does neither contain any basic nor double/reinforced insulation between input and output, and base plate.
If the input voltage is greater than 60VDC, this has to be provided by the end-use equipment according to the final build in condition.
- Safety approved fuse must be externally installed on input side.



CBS-series



CBS

Feature

Compact DC-DC Converter, "HALF BRICK" which has been standard size for Telecommunication Market
 High efficiency
 High density
 High reliability : not built-in aluminum and tantalum electrolytic capacitor
 Built-in overcurrent, overvoltage and thermal protection circuits
 Built-in remote ON/OFF
 Mounting hole (M3 tapped)

CE marking

Low Voltage Directive

Safety agency approvals

UL60950-1, C-UL recognized, TÜV approved

5-year warranty

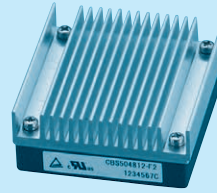
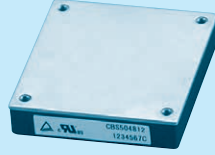
Optional parts

Optional parts	Model	Remarks
Heat sink	CBS50, CBS100, CBS200	Refer to page of optional parts

CBS50

CB S 50 48 12 -

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
24:DC18 - 36V
48:DC36 - 76V
- ⑤ Output voltage
- ⑥ Optional
R :with Remote ON/OFF
Positive logic control
T :with Mounting hole
φ3.4 thru
□:with Addition of a
Heat sink

MODEL	CBS50241R8	CBS50242R5	CBS502403	CBS502405	CBS502412	CBS502415	CBS502424	CBS502428
MAX OUTPUT WATTAGE[W]	21.06	29.25	38.6	50.0	50.4	51.0	50.4	50.4
DC OUTPUT	1.8V 11.7A	2.5V 11.7A	3.3V 11.7A	5V 10A	12V 4.2A	15V 3.4A	24V 2.1A	28V 1.8A

SPECIFICATIONS

	MODEL	CBS50241R8	CBS50242R5	CBS502403	CBS502405	CBS502412	CBS502415	CBS502424	CBS502428
INPUT	VOLTAGE[V]	DC18 - 36							
	CURRENT[A]	1.24typ	1.58typ	2.04typ	2.48typ	2.39typ	2.44typ	2.41typ	2.41typ
	EFFICIENCY[%]	71typ	77typ	79typ	84typ	88typ	87typ	87typ	87typ
OUTPUT	VOLTAGE[V]	1.8	2.5	3.3	5	12	15	24	28
	CURRENT[A]	11.7	11.7	11.7	10	4.2	3.4	2.1	1.8
	LINE REGULATION[mV]	10max	10max	10max	10max	24max	30max	48max	56max
	LOAD REGULATION[mV]	10max	10max	10max	10max	24max	30max	48max	56max
	RIPPLE[mVp-p]	-20 to +100℃	80max	80max	80max	80max	120max	120max	120max
		-40 to -20℃	120max	120max	120max	120max	150max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +100℃	120max	120max	120max	120max	150max	150max	150max
		-40 to -20℃	200max	200max	200max	200max	200max	250max	250max
	TEMPERATURE REGULATION[mV]	0 to +65℃	35max	35max	35max	50max	120max	150max	240max
		-40 to +100℃	66max	66max	66max	100max	240max	300max	480max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV]	16max	16max	16max	20max	40max	60max	90max	90max
	START-UP TIME[ms]	200max (DCIN 24V, I _o =100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external resistor							
	OUTPUT VOLTAGE SETTING[V]	1.77 - 1.88	2.46 - 2.61	3.25 - 3.45	4.90 - 5.20	11.74 - 12.46	14.55 - 15.45	23.28 - 24.72	27.16 - 28.84
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	OVERVOLTAGE PROTECTION[V]	2.16 - 2.88	3.00 - 4.00	4.00 - 5.50	5.75 - 7.00	13.80 - 16.80	17.25 - 21.00	27.60 - 33.60	32.20 - 39.20
	REMOTE SENSING	Provided							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

MODEL	CBS50481R8	CBS50482R5	CBS504803	CBS504805	CBS504812	CBS504815	CBS504824	CBS504828
MAX OUTPUT WATTAGE[W]	21.06	29.25	38.6	50.0	50.4	51.0	50.4	50.4
DC OUTPUT	1.8V 11.7A	2.5V 11.7A	3.3V 11.7A	5V 10A	12V 4.2A	15V 3.4A	24V 2.1A	28V 1.8A

SPECIFICATIONS

	MODEL	CBS50481R8	CBS50482R5	CBS504803	CBS504805	CBS504812	CBS504815	CBS504824	CBS504828
INPUT	VOLTAGE[V]	DC36 - 76							
	CURRENT[A]	0.62typ	0.79typ	1.01typ	1.23typ	1.18typ	1.21typ	1.19typ	1.19typ
	EFFICIENCY[%]	71typ	77typ	80typ	85typ	89typ	88typ	88typ	88typ
OUTPUT	VOLTAGE[V]	1.8	2.5	3.3	5	12	15	24	28
	CURRENT[A]	11.7	11.7	11.7	10	4.2	3.4	2.1	1.8
	LINE REGULATION[mV]	10max	10max	10max	10max	24max	30max	48max	56max
	LOAD REGULATION[mV]	10max	10max	10max	10max	24max	30max	48max	56max
	RIPPLE[mVp-p]	-20 to +100℃	80max	80max	80max	80max	120max	120max	120max
		-40 to -20℃	120max	120max	120max	120max	150max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +100℃	120max	120max	120max	120max	150max	150max	150max
		-40 to -20℃	200max	200max	200max	200max	200max	250max	250max
	TEMPERATURE REGULATION[mV]	0 to +65℃	35max	35max	35max	50max	120max	150max	240max
		-40 to +100℃	66max	66max	66max	100max	240max	300max	480max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV]	16max	16max	16max	20max	40max	60max	90max	90max
	START-UP TIME[ms]	200max (DCIN 48V, I _o =100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external resistor							
	OUTPUT VOLTAGE SETTING[V]	1.77 - 1.88	2.46 - 2.61	3.25 - 3.45	4.90 - 5.20	11.74 - 12.46	14.55 - 15.45	23.28 - 24.72	27.16 - 28.84
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	OVERVOLTAGE PROTECTION[V]	2.16 - 2.88	3.00 - 4.00	4.00 - 5.50	5.75 - 7.00	13.80 - 16.80	17.25 - 21.00	27.60 - 33.60	32.20 - 39.20
	REMOTE SENSING	Provided							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	DC1,500V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min(20 \pm 15 $^{\circ}$ C)
	INPUT-CASE PIN, BASE PLATE	DC1,500V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min(20 \pm 15 $^{\circ}$ C)
	OUTPUT-CASE PIN, BASE PLATE	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 49.0m/s 2 (5G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	196.1m/s 2 (20G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	57.9 \times 12.7 \times 61.0mm [2.28 \times 0.5 \times 2.4 inches](W \times H \times D) / 83g max
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)

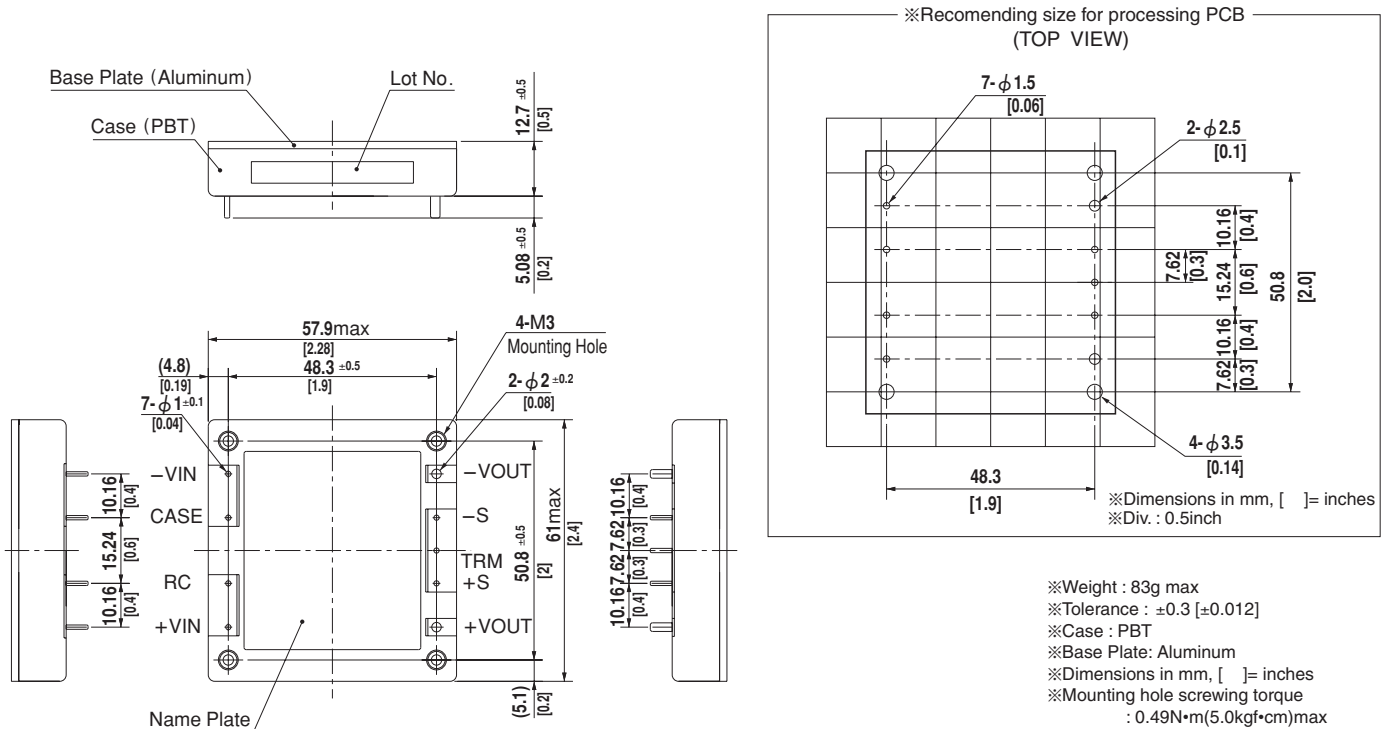
*1 At rated input(DC24V,DC48V) and rated load.

*2 Ripple and ripple noise is measured by using measuring board with recommended capacitor Co & the film capacitor 0.1 μ F.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN:RM101).

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25 $^{\circ}$ C, with the input voltage held constant at the rated input/output.

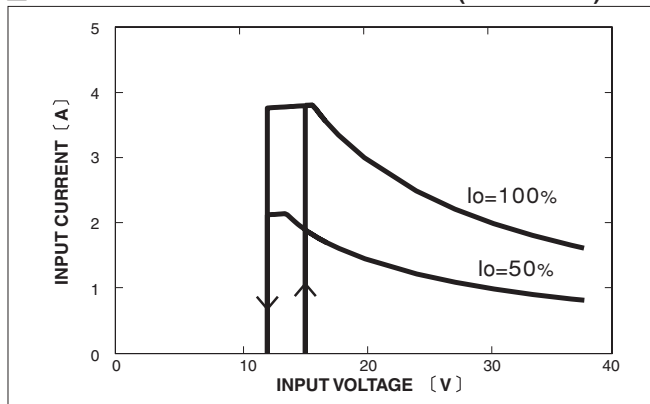
*4 When the input voltage is in the range of DC18 - 20V, DC36 - 40V, output voltage adjustment range is 60 - 105% (except for 1R8/2R5).

External view

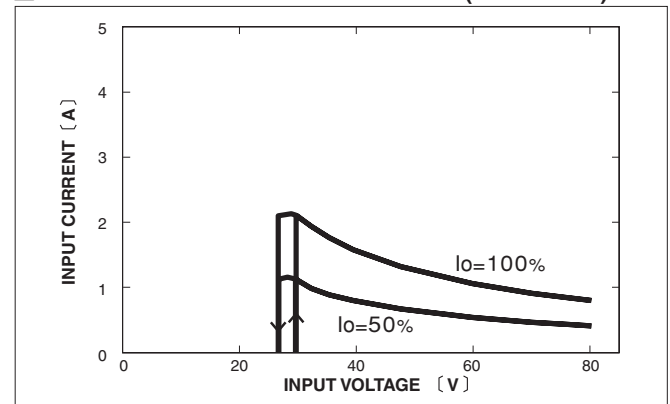


Performance data

INPUT CURRENT CHARACTERISTICS (CBS502428)



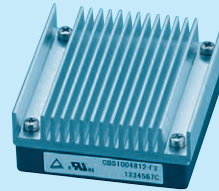
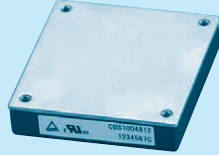
INPUT CURRENT CHARACTERISTICS (CBS504828)



CBS100

CB S 100 48 12 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
24:DC18 - 36V
48:DC36 - 76V
- ⑤ Output voltage
12V 6.7A
- ⑥ Optional
R :with Remote ON/OFF
Positive logic control
T :with Mounting hole
φ 3.4 thru
□ :with Addition of a
Heat sink

MODEL	CBS100241R8	CBS100242R5	CBS1002403	CBS1002405	CBS1002412	CBS1002415	CBS1002424	CBS1002428
MAX OUTPUT WATTAGE[W]	42.12	58.50	77.2	100.0	100.8	100.5	100.8	100.8
DC OUTPUT	1.8V 23.4A	2.5V 23.4A	3.3V 23.4A	5V 20A	12V 8.4A	15V 6.7A	24V 4.2A	28V 3.6A

SPECIFICATIONS

	MODEL	CBS100241R8	CBS100242R5	CBS1002403	CBS1002405	CBS1002412	CBS1002415	CBS1002424	CBS1002428
INPUT	VOLTAGE[V]	DC18 - 36							
	CURRENT[A]	2.47typ	3.17typ	4.07typ	5.02typ	4.77typ	4.81typ	4.83typ	4.83typ
	EFFICIENCY[%]	71typ	77typ	79typ	83typ	88typ	87typ	87typ	87typ
OUTPUT	VOLTAGE[V]	1.8	2.5	3.3	5	12	15	24	28
	CURRENT[A]	23.4	23.4	23.4	20	8.4	6.7	4.2	3.6
	LINE REGULATION[mV]	10max	10max	10max	10max	24max	30max	48max	56max
	LOAD REGULATION[mV]	10max	10max	10max	10max	24max	30max	48max	56max
	RIPPLE[mVp-p]	-20 to +100℃ ±2 -40 to -20℃ ±2	80max 120max	80max 120max	80max 120max	120max 150max	120max 150max	120max 150max	120max 150max
	RIPPLE NOISE[mVp-p]	-20 to +100℃ ±2 -40 to -20℃ ±2	120max 200max	120max 200max	120max 200max	150max 200max	150max 200max	150max 250max	150max 250max
	TEMPERATURE REGULATION[mV]	0 to +65℃ -40 to +100℃	35max 66max	35max 66max	35max 100max	50max 240max	150max 300max	240max 480max	280max 560max
	DRIFT[mV]	16max	16max	16max	20max	40max	60max	90max	90max
	START-UP TIME[ms]	200max (DCIN 24V, I _o =100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external resistor							
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE SETTING[V]	1.77 - 1.88	2.46 - 2.61	3.25 - 3.45	4.90 - 5.20	11.74 - 12.46	14.55 - 15.45	23.28 - 24.72	27.16 - 28.84
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	OVERVOLTAGE PROTECTION[V]	2.16 - 2.88	3.00 - 4.00	4.00 - 5.50	5.75 - 7.00	13.80 - 16.80	17.25 - 21.00	27.60 - 33.60	32.20 - 39.20
	REMOTE SENSING	Provided							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

MODEL	CBS100481R8	CBS100482R5	CBS1004803	CBS1004805	CBS1004812	CBS1004815	CBS1004824	CBS1004828
MAX OUTPUT WATTAGE[W]	42.12	58.50	77.2	100.0	100.8	100.5	100.8	100.8
DC OUTPUT	1.8V 23.4A	2.5V 23.4A	3.3V 23.4A	5V 20A	12V 8.4A	15V 6.7A	24V 4.2A	28V 3.6A

SPECIFICATIONS

	MODEL	CBS100481R8	CBS100482R5	CBS1004803	CBS1004805	CBS1004812	CBS1004815	CBS1004824	CBS1004828
INPUT	VOLTAGE[V]	DC36 - 76							
	CURRENT[A]	1.24typ	1.58typ	2.01typ	2.48typ	2.36typ	2.38typ	2.39typ	2.39typ
	EFFICIENCY[%]	71typ	77typ	80typ	84typ	89typ	88typ	88typ	88typ
OUTPUT	VOLTAGE[V]	1.8	2.5	3.3	5	12	15	24	28
	CURRENT[A]	23.4	23.4	23.4	20	8.4	6.7	4.2	3.6
	LINE REGULATION[mV]	10max	10max	10max	10max	24max	30max	48max	56max
	LOAD REGULATION[mV]	10max	10max	10max	10max	24max	30max	48max	56max
	RIPPLE[mVp-p]	-20 to +100℃ ±2 -40 to -20℃ ±2	80max 120max	80max 120max	80max 120max	120max 150max	120max 150max	120max 150max	120max 150max
	RIPPLE NOISE[mVp-p]	-20 to +100℃ ±2 -40 to -20℃ ±2	120max 200max	120max 200max	120max 200max	150max 200max	150max 200max	150max 250max	150max 250max
	TEMPERATURE REGULATION[mV]	0 to +65℃ -40 to +100℃	35max 66max	35max 66max	50max 100max	120max 240max	150max 300max	240max 480max	280max 560max
	DRIFT[mV]	16max	16max	16max	20max	40max	60max	90max	90max
	START-UP TIME[ms]	200max (DCIN 48V, I _o =100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external resistor							
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE SETTING[V]	1.77 - 1.88	2.46 - 2.61	3.25 - 3.45	4.90 - 5.20	11.74 - 12.46	14.55 - 15.45	23.28 - 24.72	27.16 - 28.84
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	OVERVOLTAGE PROTECTION[V]	2.16 - 2.88	3.00 - 4.00	4.00 - 5.50	5.75 - 7.00	13.80 - 16.80	17.25 - 21.00	27.60 - 33.60	32.20 - 39.20
	REMOTE SENSING	Provided							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	DC1,500V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min(20 \pm 15 $^{\circ}$ C)
	INPUT-CASE PIN, BASE PLATE	DC1,500V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min(20 \pm 15 $^{\circ}$ C)
	OUTPUT-CASE PIN, BASE PLATE	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 49.0m/s 2 (5G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	196.1m/s 2 (20G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	57.9 \times 12.7 \times 61.0mm [2.28 \times 0.5 \times 2.4 inches] (W \times H \times D) / 83g max
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)

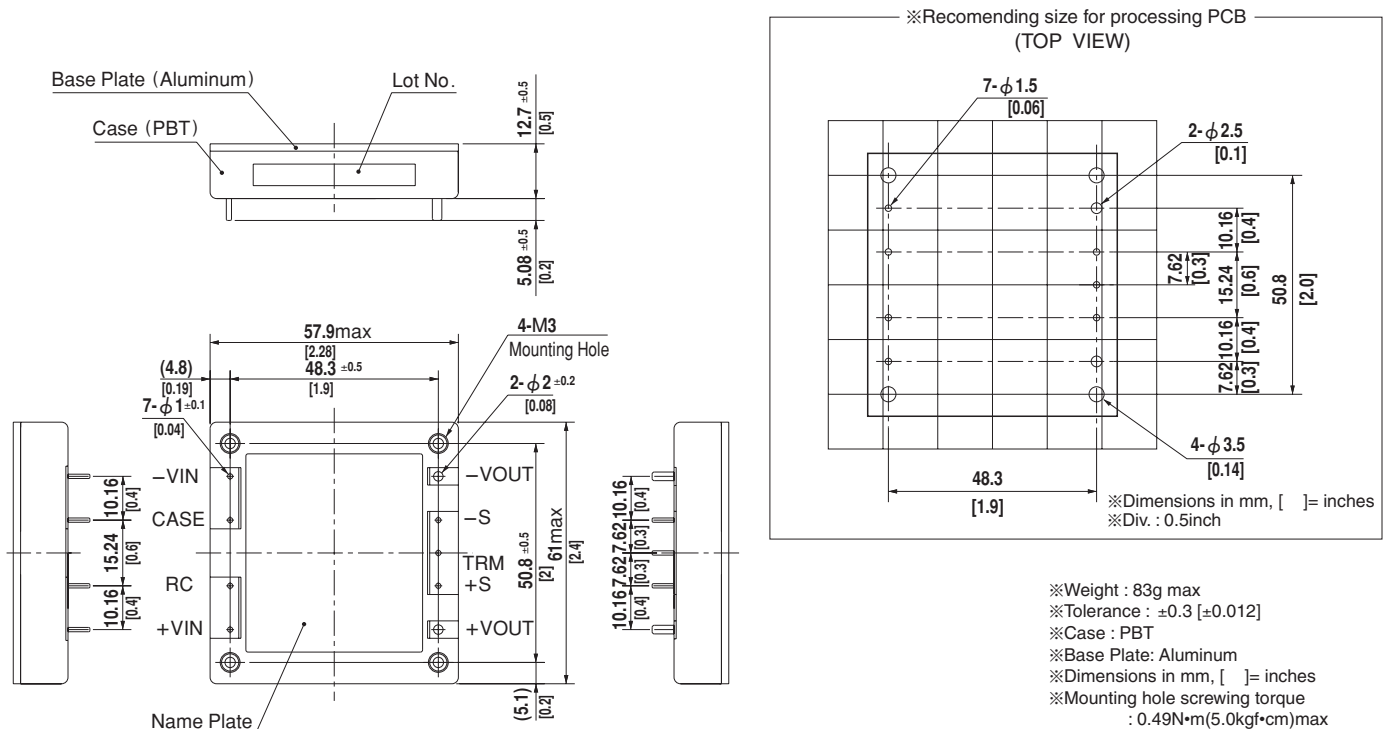
*1 At rated input(DC24V,DC48V) and rated load.

*2 Ripple and ripple noise is measured by using measuring board with recommended capacitor Co & the film capacitor 0.1 μ F.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN:RM101).

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25 $^{\circ}$ C, with the input voltage held constant at the rated input/output.

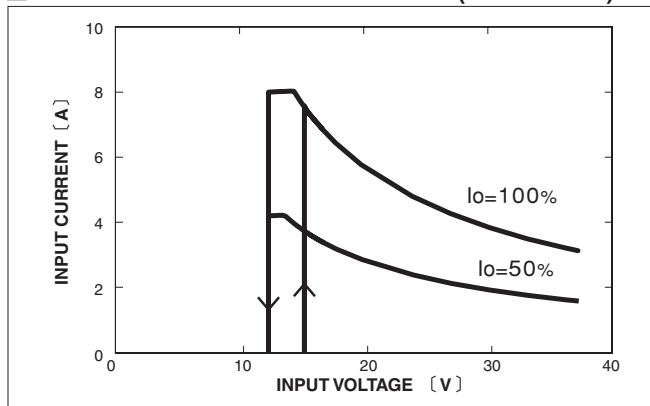
*4 When the input voltage is in the range of DC18 - 20V, DC36 - 40V output voltage adjustment range is 60 - 105% (except for 1R8/2R5).

External view

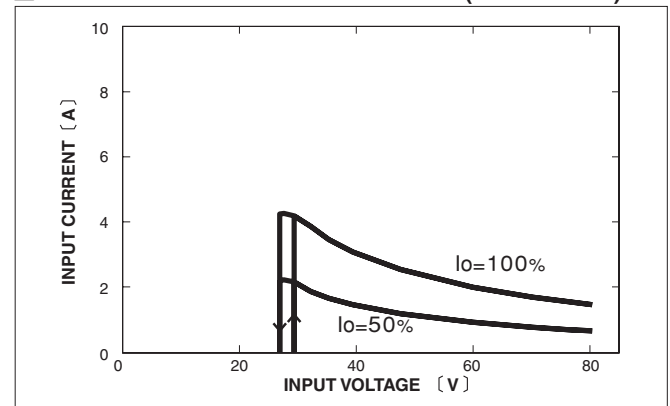


Performance data

INPUT CURRENT CHARACTERISTICS (CBS1002428)



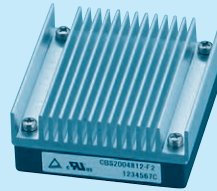
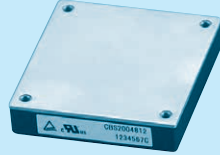
INPUT CURRENT CHARACTERISTICS (CBS1004828)



CBS200

CB S 200 48 12 - ☐

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
- 24:DC18 - 36V
- 48:DC36 - 76V
- ⑤ Output voltage
- ⑥ Optional
- R : with Remote ON/OFF
- Positive logic control
- T : with Mounting hole
- φ3.4 thru
- ☐ : with Addition of a Heat sink

MODEL	CBS200241R8	CBS200242R5	CBS2002403	CBS2002405	CBS2002412	CBS2002415	CBS2002424	CBS2002428
MAX OUTPUT WATTAGE[W]	63.00	87.50	115.5	150.0	200.4	201.0	201.6	201.6
DC OUTPUT	1.8V 35A	2.5V 35A	3.3V 35A	5V 30A	12V 16.7A	15V 13.4A	24V 8.4A	28V 7.2A

SPECIFICATIONS

	MODEL	CBS200241R8	CBS200242R5	CBS2002403	CBS2002405	CBS2002412	CBS2002415	CBS2002424	CBS2002428
INPUT	VOLTAGE[V]	DC18 - 36							
	CURRENT[A]	3.75typ	4.80typ	6.09typ	7.62typ	9.60typ	9.63typ	9.66typ	9.66typ
	EFFICIENCY[%]	70typ	76typ	79typ	82typ	87typ	87typ	87typ	87typ
OUTPUT	VOLTAGE[V]	1.8	2.5	3.3	5	12	15	24	28
	CURRENT[A]	35	35	35	30	16.7	13.4	8.4	7.2
	LINE REGULATION[mV]	10max	10max	10max	10max	24max	30max	48max	56max
	LOAD REGULATION[mV]	10max	10max	10max	10max	24max	30max	48max	56max
	RIPPLE[mVp-p]	-20 to +100°C	80max	80max	80max	80max	120max	120max	120max
		-40 to -20°C	120max	120max	120max	120max	150max	150max	150max
	RIPPLE NOISE[mVp-p]	-20 to +100°C	120max	120max	120max	120max	150max	150max	150max
		-40 to -20°C	200max	200max	200max	200max	200max	250max	250max
	TEMPERATURE REGULATION[mV]	0 to +65°C	35max	35max	35max	50max	120max	150max	240max
		-40 to +100°C	66max	66max	66max	100max	240max	300max	480max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV]	16max	16max	16max	20max	40max	60max	90max	90max
	START-UP TIME[ms]	200max (DCIN 24V, I _o =100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external resistor							
	OUTPUT VOLTAGE SETTING[V]	1.77 - 1.88	2.46 - 2.61	3.25 - 3.45	4.90 - 5.20	11.74 - 12.46	14.55 - 15.45	23.28 - 24.72	27.16 - 28.84
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	OVERVOLTAGE PROTECTION[V]	2.16 - 2.88	3.00 - 4.00	4.00 - 5.50	5.75 - 7.00	13.80 - 16.80	17.25 - 21.00	27.60 - 33.60	32.20 - 39.20
	REMOTE SENSING	Provided							
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)							

MODEL	CBS200481R8	CBS200482R5	CBS2004803	CBS2004805	CBS2004812	CBS2004815	CBS2004824	CBS2004828	CBS2004848
MAX OUTPUT WATTAGE[W]	63.00	87.50	115.5	150.0	200.4	201.0	201.6	201.6	201.6
DC OUTPUT	1.8V 35A	2.5V 35A	3.3V 35A	5V 30A	12V 16.7A	15V 13.4A	24V 8.4A	28V 7.2A	48V 4.2A

SPECIFICATIONS

	MODEL	CBS200481R8	CBS200482R5	CBS2004803	CBS2004805	CBS2004812	CBS2004815	CBS2004824	CBS2004828	CBS2004848
INPUT	VOLTAGE[V]	DC36 - 76								
	CURRENT[A]	1.88typ	2.40typ	3.01typ	3.77typ	4.74typ	4.76typ	4.77typ	4.77typ	4.77typ
	EFFICIENCY[%]	70typ	76typ	80typ	83typ	88typ	88typ	88typ	88typ	88typ
OUTPUT	VOLTAGE[V]	1.8	2.5	3.3	5	12	15	24	28	48
	CURRENT[A]	35	35	35	30	16.7	13.4	8.4	7.2	4.2
	LINE REGULATION[mV]	10max	10max	10max	10max	24max	30max	48max	56max	96max
	LOAD REGULATION[mV]	10max	10max	10max	10max	24max	30max	48max	56max	96max
	RIPPLE[mVp-p]	-20 to +100°C	80max	80max	80max	80max	120max	120max	120max	200max
		-40 to -20°C	120max	120max	120max	120max	150max	150max	150max	250max
	RIPPLE NOISE[mVp-p]	-20 to +100°C	120max	120max	120max	120max	150max	150max	150max	250max
		-40 to -20°C	200max	200max	200max	200max	200max	250max	250max	400max
	TEMPERATURE REGULATION[mV]	0 to +65°C	35max	35max	35max	50max	120max	150max	240max	480max
		-40 to +100°C	66max	66max	66max	100max	240max	300max	480max	960max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV]	16max	16max	16max	20max	40max	60max	90max	90max	180max
	START-UP TIME[ms]	200max (DCIN 48V, I _o =100%)								
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external resistor								
	OUTPUT VOLTAGE SETTING[V]	1.77 - 1.88	2.46 - 2.61	3.25 - 3.45	4.90 - 5.20	11.74 - 12.46	14.55 - 15.45	23.28 - 24.72	27.16 - 28.84	46.56 - 49.44
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically								
	OVERVOLTAGE PROTECTION[V]	2.16 - 2.88	3.00 - 4.00	4.00 - 5.50	5.75 - 7.00	13.80 - 16.80	17.25 - 21.00	27.60 - 33.60	32.20 - 39.20	55.20 - 67.20
	REMOTE SENSING	Provided								
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)								

GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT	DC1,500V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min(20 \pm 15 $^{\circ}$ C)
	INPUT-CASE PIN, BASE PLATE	DC1,500V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min(20 \pm 15 $^{\circ}$ C)
	OUTPUT-CASE PIN, BASE PLATE	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (20 \pm 15 $^{\circ}$ C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max
	VIBRATION	10 - 55Hz, 49.0m/s 2 (5G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	196.1m/s 2 (20G), 11ms, once each along X, Y and Z axis
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1
OTHERS	CASE SIZE/WEIGHT	57.9 \times 12.7 \times 61.0mm [2.28 \times 0.5 \times 2.4 inches] (W \times H \times D) / 83g max
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)

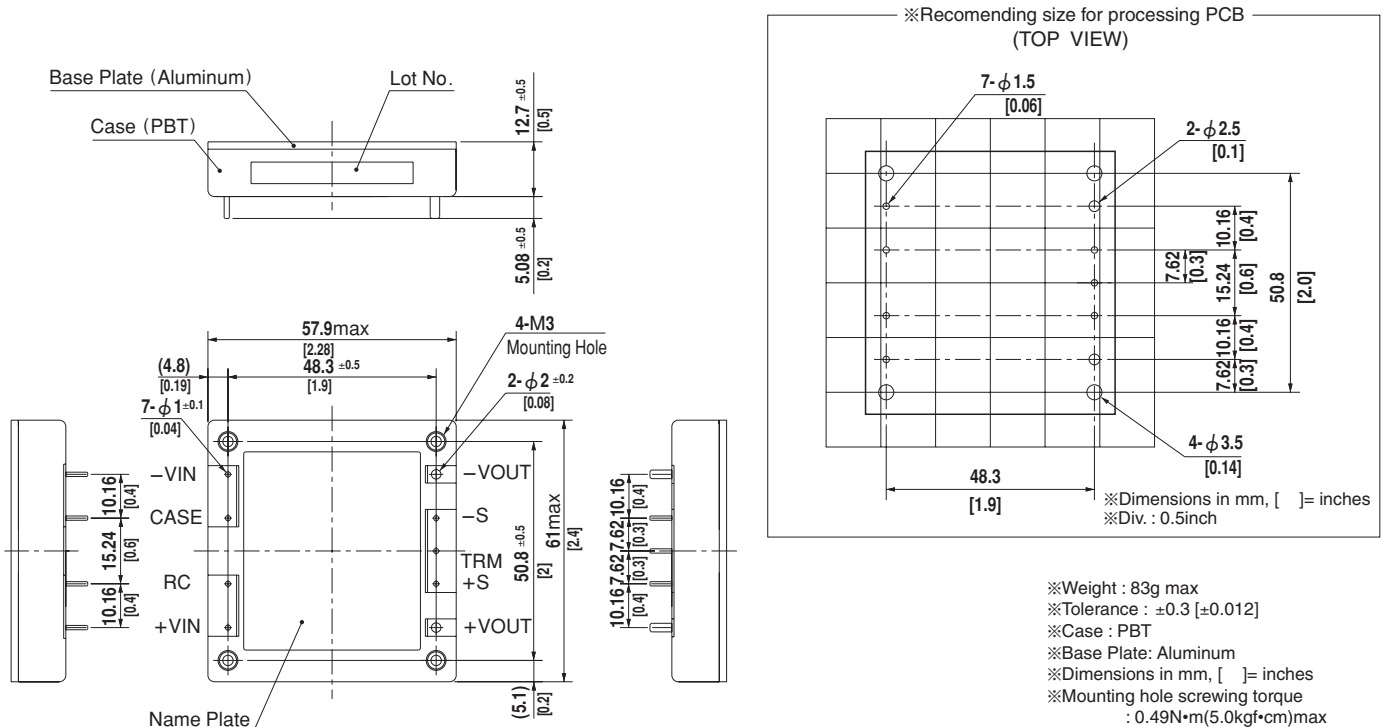
*1 At rated input(DC24V,DC48V) and rated load.

*2 Ripple and ripple noise is measured by using measuring board with recommended capacitor Co & the film capacitor 0.1 μ F.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN:RM101).

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25 $^{\circ}$ C, with the input voltage held constant at the rated input/output.

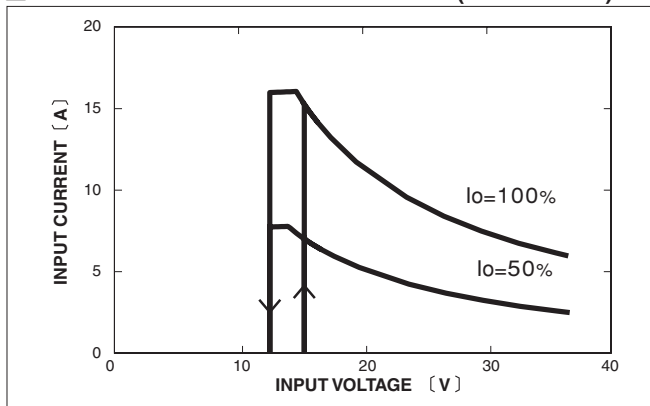
*4 When the input voltage is in the range of DC18 - 20V, DC36 - 40V, output voltage adjustment range is 60 - 105% (except for 1R8/2R5/4R).

External view

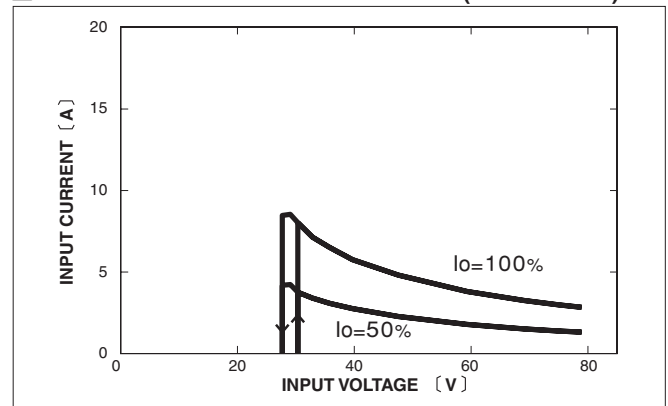


Performance data

INPUT CURRENT CHARACTERISTICS (CBS2002428)



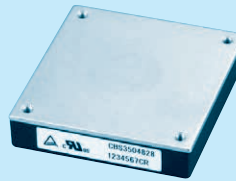
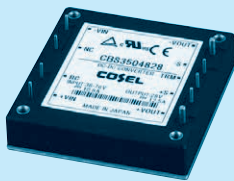
INPUT CURRENT CHARACTERISTICS (CBS2004828)



CBS350

CB S 350 48 12 -

① ② ③ ④ ⑤ ⑥



- ① Series name
② Single output
③ Output wattage
④ Input voltage
⑤ Output voltage
⑥ Optional
R : with Remote ON/OFF
Positive logic control
T : with Mounting hole
φ 3.4 thru

MODEL	CBS3502412	CBS3502424	CBS3502428	CBS3502432	CBS3502448	CBS3504812	CBS3504824	CBS3504828	CBS3504832	CBS3504848
MAX OUTPUT WATTAGE[W]	300	348	350	352	302	348	348	350	352	350
DC OUTPUT	12V 25A	24V 14.5A	28V 12.5A	32V 11A	48V 6.3A	12V 29A	24V 14.5A	28V 12.5A	32V 11A	48V 7.3A

SPECIFICATIONS

	MODEL	CBS3502412	CBS3502424	CBS3502428	CBS3502432	CBS3502448	CBS3504812	CBS3504824	CBS3504828	CBS3504832	CBS3504848	
INPUT	VOLTAGE[V]	DC20 - 36					DC36 - 76					DC36 - 60
	CURRENT[A]	*1 14.5typ	16.7typ	16.4typ	16.5typ	14.0typ	8.33typ	8.15typ	8.10typ	8.15typ	8.15typ	
	EFFICIENCY[%]	*1 86typ	87typ	89typ	89typ	90typ	87typ	89typ	90typ	90typ	91typ	
OUTPUT	VOLTAGE[V]	12	24	28	32	48	12	24	28	32	48	
	CURRENT[A]	25	14.5	12.5	11	6.3	29	14.5	12.5	11	7.3	
	LINE REGULATION[mV]	24max	48max	56max	64max	96max	24max	48max	56max	64max	96max	
	LOAD REGULATION[mV]	24max	48max	56max	64max	96max	24max	48max	56max	64max	96max	
	RIPPLE[mVp-p]	-20 to +100℃ *2	120max	150max	180max	180max	300max	120max	150max	180max	180max	300max
		-40 to -20℃ *2	150max	180max	220max	220max	360max	150max	180max	220max	220max	360max
		0 to 15%Load *2	240max	300max	360max	360max	600max	240max	300max	360max	360max	600max
	RIPPLE NOISE[mVp-p]	-20 to +100℃ *2	150max	180max	220max	220max	360max	150max	180max	220max	220max	360max
		-40 to -20℃ *2	200max	250max	280max	280max	500max	200max	250max	280max	280max	500max
		0 to 15%Load *2	300max	360max	440max	440max	720max	300max	360max	440max	440max	720max
	TEMPERATURE REGULATION[mV]	0 to +65℃	120max	240max	280max	320max	480max	120max	240max	280max	320max	480max
		-40 to +100℃	240max	480max	560max	640max	960max	240max	480max	560max	640max	960max
	DRIFT[mV]	*3 40max	90max	90max	120max	180max	40max	90max	90max	120max	180max	
	START-UP TIME[ms]	200max (DCIN 24V, Io=100%)						200max (DCIN 48V, Io=100%)				
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external resistor										
		7.2 - 13.2	14.4 - 26.4	16.8 - 30.8	25.6 - 35.2	38.4 - 52.8	7.2 - 13.2	14.4 - 26.4	16.8 - 30.8	25.6 - 35.2	38.4 - 55.2	
OUTPUT VOLTAGE SETTING[V]	*1 11.88 - 12.12	23.76 - 24.24	27.72 - 28.28	31.68 - 32.32	47.52 - 48.48	11.88 - 12.12	23.76 - 24.24	27.72 - 28.28	31.68 - 32.32	47.52 - 48.48		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically										
	OVERVOLTAGE PROTECTION[V]	13.80 - 16.80	27.60 - 33.60	32.20 - 39.20	36.80 - 44.80	57.50 - 63.00	13.80 - 16.80	27.60 - 33.60	32.20 - 39.20	36.80 - 44.80	57.50 - 63.00	
	REMOTE SENSING	Provided										
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)										
ISOLATION	INPUT-OUTPUT	DC1,500V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min(20±15℃)										
	INPUT-BASE PLATE	DC1,500V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min(20±15℃)										
	OUTPUT-BASE PLATE	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)										
ENVIRONMENT	OPERATING TEMP.HUMID.AND ALTITUDE	-40 to +100℃ (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max										
	STORAGE TEMP.HUMID.AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max										
	VIBRATION	10 - 55Hz, 49.0m/s² (5G), 3minutes period, 60minutes each along X, Y and Z axis										
	IMPACT	196.1m/s² (20G), 11ms, once each along X, Y and Z axis										
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1										
OTHERS	CASE SIZE/WEIGHT	57.9×12.7×61.0mm [2.28×0.5×2.4 inches] (W×H×D) / 83g max										
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)										

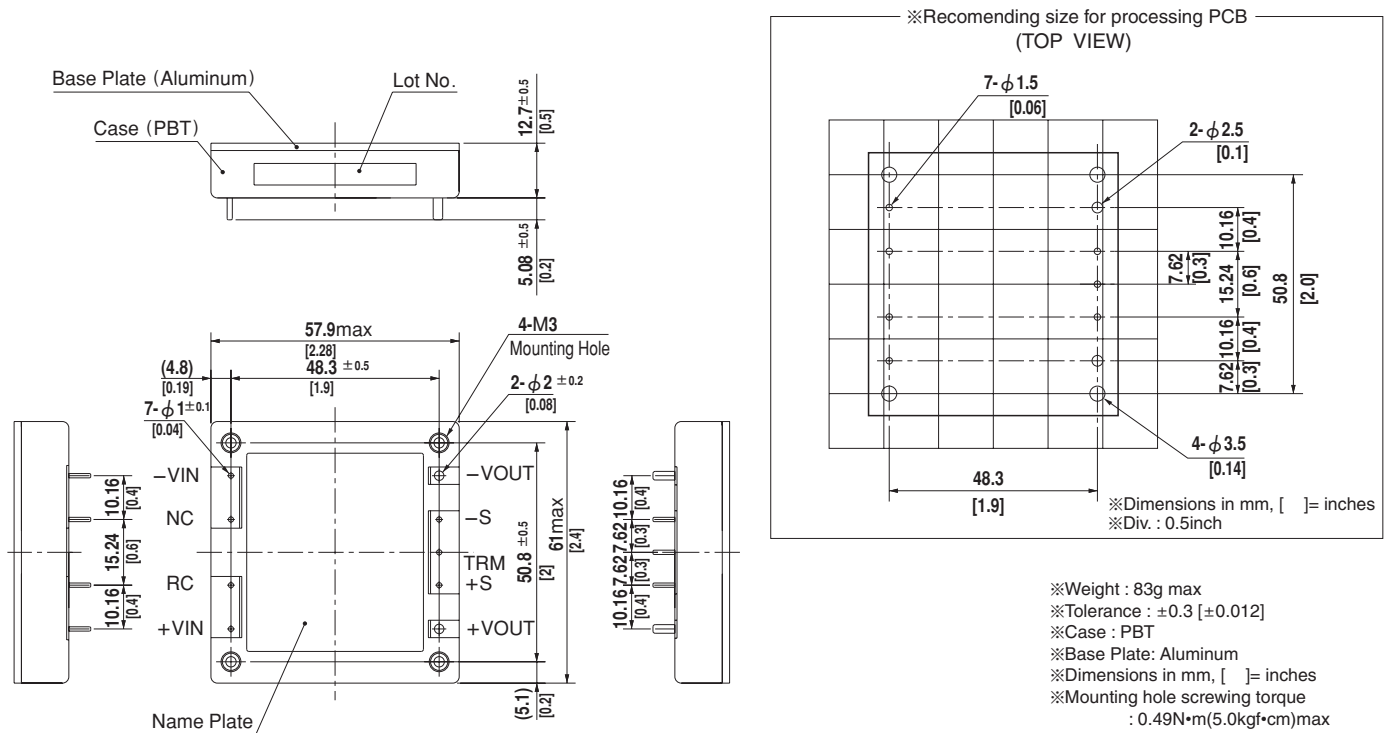
*1 At rated input(DC24V,DC48V), rated load, and aluminum base plate temperature 25℃.

*2 Ripple and ripple noise is measured by using measuring board with recommended capacitor Co & the film capacitor 0.1 μF. Refer to the manual.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

*4 When the input voltage is in the range of DC20 - 22V, DC36 - 40V, output voltage is limited. Refer to the manual.

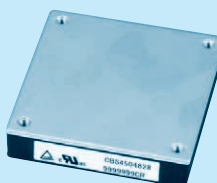
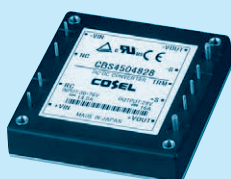
External view



CBS450

CB S 450 48 28 -

① ② ③ ④ ⑤ ⑥



- ① Series name
② Single output
③ Output wattage
④ Input voltage
⑤ Output voltage
⑥ Optional
R : with Remote ON/OFF
Positive logic control
T : with Mounting hole
φ 3.4 thru

MODEL	CBS4504824	CBS4504828	CBS4504832
MAX OUTPUT WATTAGE[W]	456	448	400
DC OUTPUT	24V 19A	28V 16A	32V 12.5A

SPECIFICATIONS

	MODEL	CBS4504824	CBS4504828	CBS4504832
INPUT	VOLTAGE[V]	DC38 - 60	DC36 - 76	DC36 - 76
	CURRENT[A]	*1 10.6typ	10.5typ	9.3typ
	EFFICIENCY[%]	*1 90typ	91typ	91typ
OUTPUT	VOLTAGE[V]	24	28	32
	CURRENT[A]	19	16	12.5
	LINE REGULATION[mV]	48max	56max	64max
	LOAD REGULATION[mV]	48max	56max	64max
	RIPPLE[mVp-p]	-20 to +100°C *2 180max	210max	210max
		-40 to -20°C *2 220max	260max	260max
		0 to 15%Load *2 360max	430max	430max
	RIPPLE NOISE[mVp-p]	-20 to +100°C *2 220max	260max	260max
		-40 to -20°C *2 280max	330max	330max
		0 to 15%Load *2 440max	520max	520max
	TEMPERATURE REGULATION[mV]	0 to +65°C 240max	280max	280max
		-40 to +100°C 480max	560max	560max
	DRIFT[mV]	*3 90max	90max	120max
PROTECTION CIRCUIT AND OTHERS	START-UP TIME[ms]	200max (DCIN 48V, Io=100%)		
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V] *4	Fixed (TRM pin open), adjustable by external resistor		
		19.2 - 26.0	16.8 - 32.2	25.6 - 35.2
	OUTPUT VOLTAGE SETTING[V] *1	23.52 - 24.48	27.44 - 28.56	31.36 - 32.64
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically		
ISOLATION	OVERVOLTAGE PROTECTION[V]	27.60 - 33.60	32.20 - 39.20	36.80 - 44.80
	REMOTE SENSING	Provided		
	REMOTE ON/OFF	Provided (Negative logic L : ON, H : OFF)		
ENVIRONMENT	INPUT-OUTPUT	DC1,500V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min(20±15°C)		
	INPUT-BASE PLATE	DC1,500V or AC1,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min(20±15°C)		
	OUTPUT-BASE PLATE	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15°C)		
SAFETY	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100°C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max		
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max		
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis		
OTHERS	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis		
	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1		
OTHERS	CASE SIZE/WEIGHT	57.9×12.7×61.0mm [2.28×0.5×2.4 inches] (W×H×D) / 83g max		
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)		

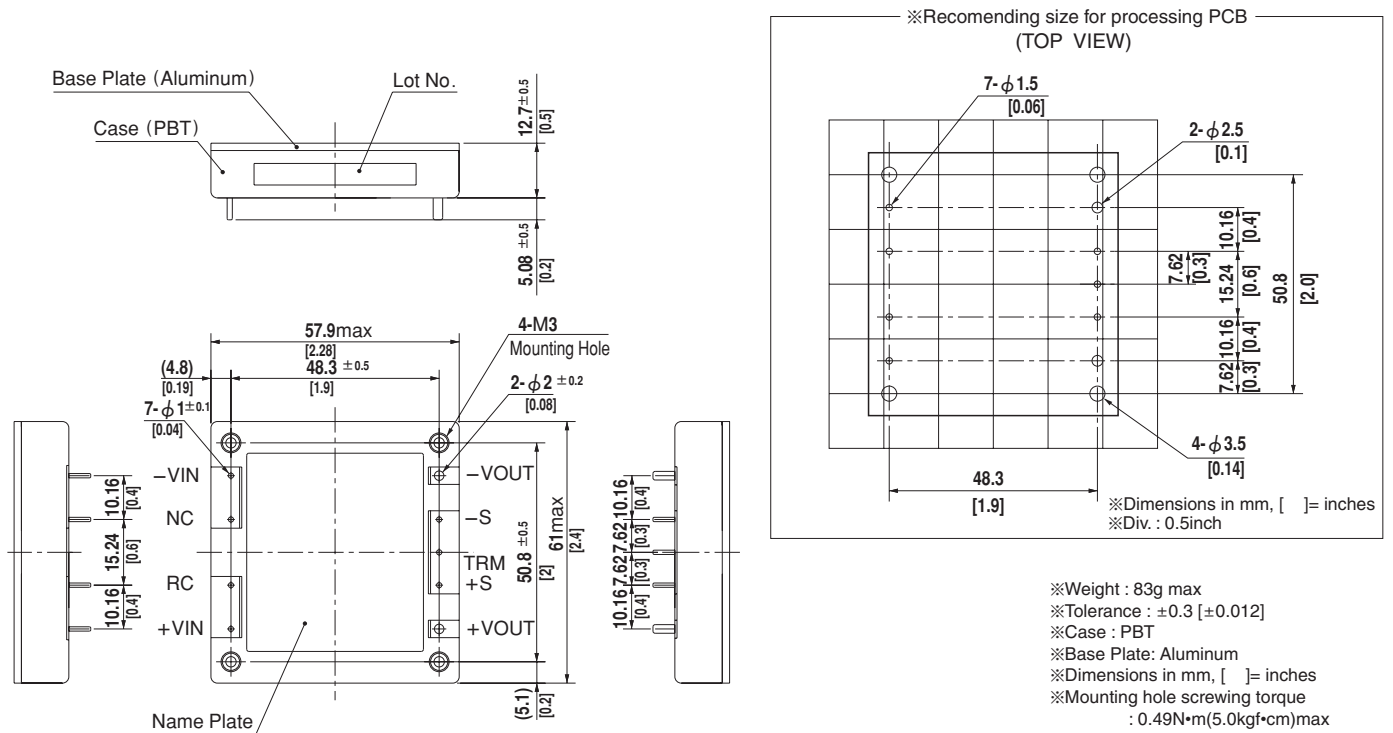
*1 At rated input(DC48V), rated load, and aluminum base plate temperature 25°C.

*2 Ripple and ripple noise is measured by using measuring board with recommended capacitor Co & the film capacitor 0.1 μF. Refer to the manual.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*4 Refer to the manual for the input range.

External view



Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Redundancy operation availability	
						Material	Single sided	Double sided	Series operation	Redundancy operation
CBS50	Forward converter	310	Refer to table No.1	-	-	Aluminum	Yes		Yes	*1
CBS100	Forward converter	370		-	-	Aluminum	Yes		Yes	*1
CBS200	Forward converter	370		-	-	Aluminum	Yes		Yes	*1
CBS350	Forward converter	370		-	-	Aluminum	Yes		Yes	*1
CBS450	Forward converter	370		-	-	Aluminum	Yes		Yes	*1

*1 Refer to Instruction Manual.

Table1. The value of input current (at rated input voltage and rated load)

[A]

Model	Output Voltage									
	1.8V	2.5V	3.3V	5V	12V	15V	24V	28V	32V	48V
CBS5024	1.2	1.6	2.0	2.5	2.4	2.4	2.4	2.4	-	-
CBS5048	0.6	0.8	1.0	1.3	1.2	1.2	1.2	1.2	-	-
CBS10024	2.5	3.2	4.1	5.0	4.8	4.8	4.8	4.8	-	-
CBS10048	1.2	1.6	2.0	2.5	2.4	2.4	2.4	2.4	-	-
CBS20024	3.8	4.8	6.1	7.6	9.6	9.6	9.7	9.7	-	-
CBS20048	1.9	2.4	3.0	3.8	4.8	4.8	4.8	4.8	-	4.8
CBS35024	-	-	-	-	15	-	17	17	17	14
CBS35048	-	-	-	-	8.4	-	8.2	8.1	8.2	8.2
CBS45048	-	-	-	-	-	-	10.6	10.5	9.3	-

1	Pin Configuration	CBS-14
2	Connection for Standard Use	CBS-14
3	Wiring Input/Output Pin	CBS-14
3.1	Wiring input pin	CBS-14
3.2	Wiring output pin	CBS-15
4	Function	CBS-16
4.1	Overcurrent protection	CBS-16
4.2	Overvoltage protection	CBS-16
4.3	Thermal protection	CBS-16
4.4	Remote ON/OFF	CBS-16
4.5	Remote sensing	CBS-16
4.6	Adjustable voltage range	CBS-17
4.7	Withstanding Voltage / Isolation Voltage	CBS-18
5	Series and Parallel Operation	CBS-18
5.1	Series operation	CBS-18
5.2	Redundancy operation	CBS-18
6	Implementation · Mounting Method	CBS-18
6.1	Mounting method	CBS-18
6.2	Stress onto the pins	CBS-18
6.3	Cleaning	CBS-19
6.4	Soldering temperature	CBS-19
6.5	Derating	CBS-19
6.6	Heat sink(Optional parts)	CBS-19
6.7	Addition of a Heat sink(Optional:F□)	CBS-20
7	Safety Considerations	CBS-21

1 Pin Configuration

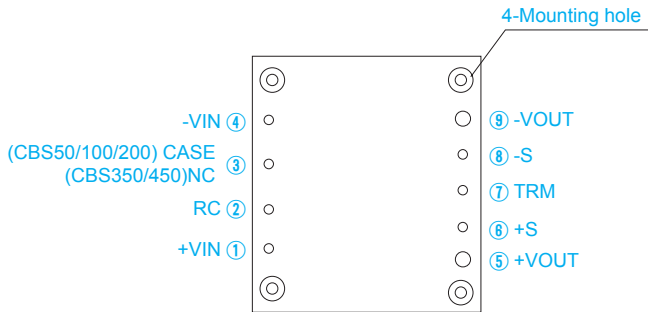


Fig.1.1 Pin Configuration (bottom view)

Table 1.1 Pin Assignment

No.	Pin Name	Function
①	+VIN	+DC input
②	RC	Remote ON/OFF
③	NC	No connection (CBS350/450)
③	CASE	Wiring base plate (CBS50/100/200)
④	-VIN	-DC input
⑤	+VOUT	+DC output
⑥	+S	+Remote sensing
⑦	TRM	Adjustment of output voltage
⑧	-S	-Remote sensing
⑨	-VOUT	-DC output
—	Mounting hole	Mounting hole

No.	Pin Name	Reference
①	+VIN	3.1 "Wiring input pin"
②	RC	4.4 "Remote ON/OFF"
③	NC	—
③	CASE	3.1 "Wiring input pin"
④	-VIN	3.2 "Wiring output pin"
⑤	+VOUT	3.2 "Wiring output pin"
⑥	+S	4.5 "Remote sensing"
⑦	TRM	4.6 "Adjustable voltage range"
⑧	-S	4.5 "Remote sensing"
⑨	-VOUT	3.2 "Wiring output pin"
—	Mounting hole	6.1 "Mounting method"

2 Connection for Standard Use

■ The power module needs input and output connections as shown in Fig. 2.1.

{ Reference: 3 "Wiring Input/Output Pin"
6.5 "Derating" }

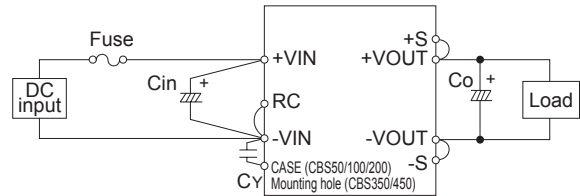
■ Short the following pins to turn on the power module.

-VIN ↔ RC, +VOUT ↔ +S, and -VOUT ↔ -S

{ Reference: 4.4 "Remote ON/OFF"
4.5 "Remote sensing" }

■ Only DC voltage can be applied to CBS Series. Applying AC voltage will damage the power module.

■ The power module is designed for conduction cooling. Make sure that heat sinks, fans, etc. are used for heat dissipation. Refer to 6.5 "Derating"



Cin : External capacitor on the input side
Co : External capacitor on the output side
CY : Primary decoupling capacitor

Fig.2.1 Connection for Standard Use

3 Wiring Input/Output Pin

3.1 Wiring input pin

(1) External fuse

■ The input circuit of CBS Series does not come with a built-in fuse. In order to protect the power module, a normal-blow fuse should be installed to +VIN.

■ When multiple modules get input voltage from a single front-end power supply, a normal-blow fuse must be installed to each module.

Table 3.1 Recommended Fuses (Normal-Blow Type)

Model	CBS5024	CBS10024	CBS20024		CBS35024
			1R8/2R5/03/05	12/15/24/28	
Rated current	6A	12A	20A	25A	30A
Model	CBS5048	CBS10048	CBS20048		CBS35048
			1R8/2R5/03/05	12/15/24/28/48	
Rated current	3A	6A	10A	12A	20A

(2) Noise Filter/Grounding Capacitor

■ A grounding capacitor CY must be used to reduce the line noise on the input line and stabilize the power module operation (Fig. 2.1). Note that resonance and inductance from the input line filter may cause the power module to become unstable.

■ An appropriate filter must be used if conformance to the conducted noise regulation is required or if surge voltage may be applied to the unit. Please consult us for more details.

■ Install a grounding capacitor CY of at least 4700 pF as close to the input pins as possible (within 50mm of the pins).

■ If the total capacitance of the grounding capacitor exceeds 15000 pF, the specified isolation voltage between input and output may not be satisfied. In this case, either reduce the capacitance of the grounding capacitor at the input or install a grounding capacitor to the output.

There is no maximum limit to capacitance C_Y when the power module is used with an isolation voltage of less than 500VAC (1 min.) between input and output.

(3) External Capacitor on the Input

■ An external capacitor C_{in} must be installed between +VIN and -VIN to reduce line noise and stabilize the power module operation (Fig. 2.1).

Capacitance	CBS50/100/20024: at least 68 μ F CBS35024: at least 220 μ F \times 2 CBS50/100/20048: at least 33 μ F CBS35048: at least 68 μ F \times 2 CBS45048: at least 68 μ F \times 2
$T_c = -20$ to $+100^\circ\text{C}$	Electrolytic or Ceramic capacitor
$T_c = -40$ to $+100^\circ\text{C}$	Ceramic capacitor

■ The capacitor must be installed less than 50mm of the power module. As ripple current will flow through this capacitor, pay attention to the ripple current rating of the capacitor.

■ If the power module is to be turned ON/OFF directly with a switch, inductance from the input line will induce a surge voltage several times that of the input voltage and it may damage the power module. Make sure that the surge is absorbed, for example, by connecting an electrolytic capacitor between the input pins.

(4) Input Voltage Range/Input Current Range

■ Keep the input voltage ripple within the specifications below. Output ripple voltage will increase as these values increase.

Ripple voltage	CBS50/100/200/35024: less than 2Vp-p CBS50/100/200/35048: less than 4Vp-p CBS45048: less than 4Vp-p
----------------	---

■ Make sure that the peak input voltage stays within the specified input voltage range of the power module.

■ Choose a front end power supply that can supply enough current I_p (Fig. 3.2) for starting up the power module.

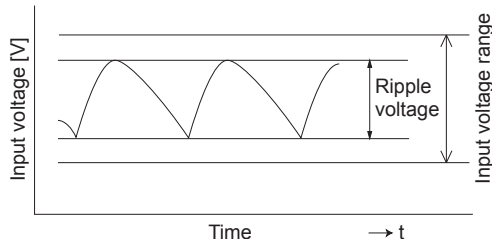


Fig.3.1 Input Voltage Ripple

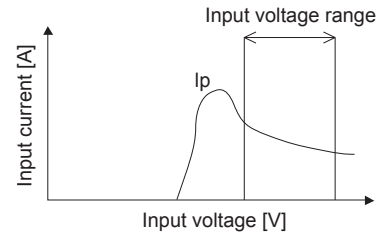


Fig.3.2 Input Current Characteristics

(5) Reverse Input Voltage Protection

■ Avoid applying reversed-polarity voltage to the power module as it will damage the power module. To protect the power module from reversed polarity voltage, installing an external diode as shown in Fig. 3.3 is recommended.

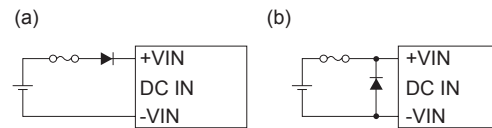


Fig.3.3 Reverse Input Voltage Protection

3.2 Wiring output pin

■ Install an external capacitor C_o between +VOUT and -VOUT to increase stability of output (Fig. 2.1).

Recommended capacitance of C_o is shown in Table 3.2.

■ Choose a high frequency type electrolytic capacitor for C_o . Output ripple and rise time will be influenced by the capacitor's ESR and ESL and the wiring impedance.

■ As ripple current will flow through capacitor C_o , pay attention to the ripple current rating of the capacitor.

■ Install capacitor C_o as close to the power module as possible (within 50mm).

This is useful for reducing radiated noise and increasing stability of the power module operation.

Table 3.2 Recommended Capacitance for External Output Capacitor C_o (μ F)

Base plate temperature : $T_c = -20$ to $+100^\circ\text{C}$							
VOUT	1.8V/2.5V/3.3V/5V	12V	15V	24V	28V	32V	48V
CBS50	2200	470		220		—	—
CBS100	2200	470		220		—	—
CBS200	2200	1000		470		—	330
CBS350	—	470	—		220		
CBS450	—				220		—
Base plate temperature : $T_c = -40$ to $+100^\circ\text{C}$							
VOUT	1.8V/2.5V/3.3V/5V	12V	15V	24V	28V	32V	48V
CBS50	2200 \times 2	470 \times 2		220 \times 2		—	—
CBS100	2200 \times 2	470 \times 2		220 \times 2		—	—
CBS200	2200 \times 2	1000 \times 2		470 \times 2		—	330 \times 3
CBS350	—	470 \times 3	—		220 \times 3		
CBS450	—				220 \times 3		—

■The specified ripple and ripple noise are measured by the method introduced in Fig. 3.4.

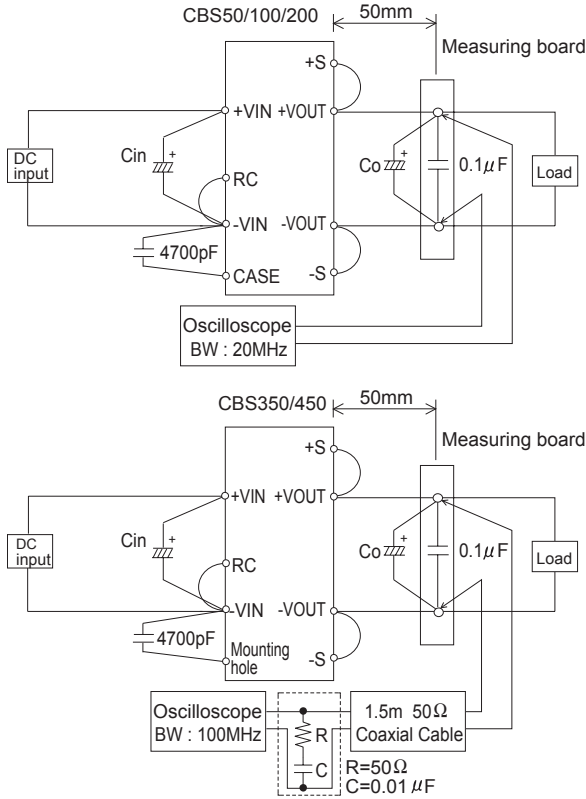


Fig.3.4 Method of Measuring Output Ripple and Ripple Noise

4 Function

4.1 Overcurrent protection

■Over Current Protection (OCP) is built in and works at 105% of the rated current or higher. However, use in an over current situation must be avoided whenever possible. The output voltage of the power module will recover automatically if the fault causing over current is corrected.

When the output voltage drops after OCP works, the power module enters a "hiccup mode" where it repeatedly turns on and off at a certain frequency.

4.2 Overvoltage protection

■Over Voltage Protection (OVP) is built in. When OVP works, output voltage can be recovered by shutting down DC input for at least one second or by turning off the remote control switch for one second without shutting down the DC input. The recovery time varies according to input voltage and input capacitance.

Remarks:

Note that devices inside the power module may fail when a voltage greater than the rated output voltage is applied from an external power supply to the output terminal of the power module. This could happen in in-coming inspections that include OVP function test or when voltage is applied from the load circuit. OVP can be tested by using the TRM terminal. Consult us for details.

4.3 Thermal protection

■Over Temperature Protection (OTP) is built in. If the base plate temperature exceeds 100°C, OTP will work, causing the output voltage to drop. Output voltage can be recovered by shutting down DC input for at least one second or by turning RC off for one second without shutting down the DC input.

4.4 Remote ON/OFF

■The remote ON/OFF function is incorporated in the input circuit and operated with RC and -VIN. If positive logic control is required, order the power module with "-R" option.

Table 4.1 Remote ON/OFF Specifications

	ON/OFF logic	Between RC and -VIN	Output voltage
Standard	Negative	L level(0 - 1.2V) or short	ON
		H level(3.5 - 7.0V) or open	OFF
Optional -R	Positive	L level(0 - 1.2V) or short	OFF
		H level(3.5 - 7.0V) or open	ON

■When RC is at low level, a current of 0.5mA typ will flow out.

When Vcc is used, keep it within the following rage:

$$3.5 \leq VCC \leq 7V.$$

When remote ON/OFF is not used, short RC and -VIN.

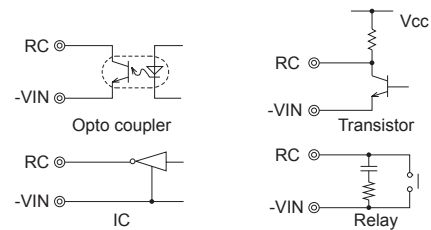


Fig.4.1 RC Connection Example

4.5 Remote sensing

(1) When Remote Sensing is Not Used

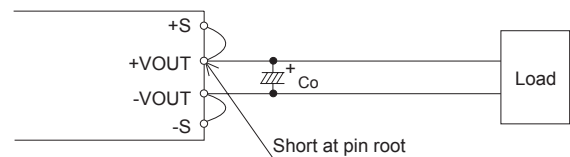


Fig.4.2 When Remote Sensing is Not Used

- When remote sensing is not used, make sure +VOUT and +S are shorted, and that -VOUT and -S are shorted as well.
- Keep the patterns between +S and +VOUT and between -S and -VOUT as short as possible. Avoid a looping pattern. If noise enters the loop, the operation of the power module will become unstable.

(2) When Remote Sensing is Used

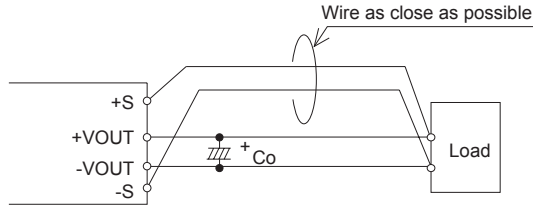


Fig.4.3 When Remote Sensing is Used

- Using remote sensing with long wires may cause output voltage to become unstable. Consult us if long sensing wiring is necessary.
 - Sensing patterns or wires should be as short as possible. If wires are used, use either twisted-pair or shielded wires.
 - Use wide PCB patterns or thick wires between the power module and the load. Line drop should be kept less than 0.3V. Make sure output voltage from the power module stays within the specified range.
 - If the sensing patterns are shorted by mistake, a large current may flow and damage the pattern. This can be prevented by installing fuses or resistors close to the load.
- As wiring or load impedance may generate oscillation or large fluctuations in output voltage, make sure enough evaluation is given in advance.

4.6 Adjustable voltage range

- Output voltage can be adjusted by connecting an external potentiometer (VR1) and resistors (R1 and R2) as shown in Fig. 4.5. Output voltage will increase if the resistance between ① and ② is reduced by turning the potentiometer clockwise. Recommended values for external components are shown in Table 4.2. Consult us if the power module is used in a different configuration.
 - Output voltage between +VOUT and -VOUT can be adjusted by connecting external resistors to TRM.
- However, when the input voltage is 18 - 20VDC with CBS50/100/20024 or 36 - 40VDC with CBS50/100/20048, the output voltage adjustment range is 60 - 105% of the rated output voltage except for 1.8/2.5/48V output models.
- When input voltage is 20 - 22VDC with CBS35024 models or 36 - 40VDC with CBS35048 models, the output voltage adjustment range becomes as shown in Fig. 4.4-1.

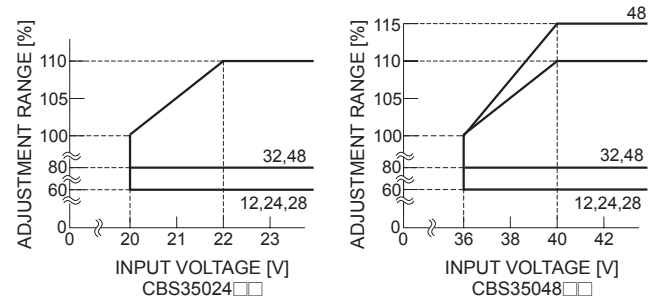


Fig.4.4-1 CBS350 Output Voltage Adjustment Range

The output adjustment range for CBS450 is shown in Fig. 4.4-2.

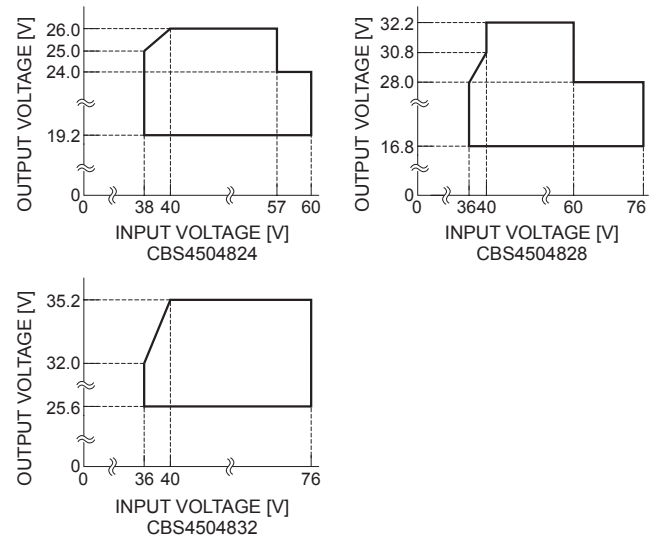


Fig.4.4-2 CBS450 Output Voltage Adjustment Range

- The wiring to the potentiometer should be as short as possible. As the ambient temperature fluctuation characteristics deteriorates depending on the types of resistors and potentiometers used, please use resistors and potentiometers of the following specifications:
 - Resistors..... Metal film type, coefficient less than $\pm 100\text{ppm}/^\circ\text{C}$
 - Potentiometers ... Cermet type, coefficient less than $\pm 300\text{ppm}/^\circ\text{C}$
- When output voltage adjustment is not required, open TRM.
- Note that, when adjusting output voltage, setting output voltage too high may cause OVP to work.

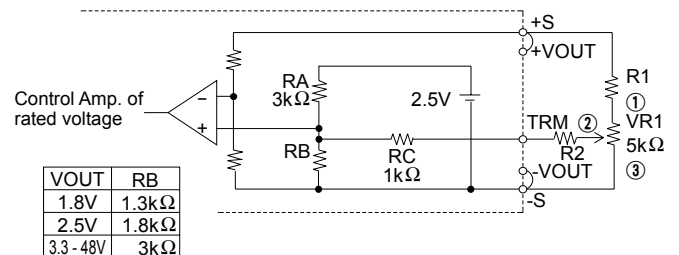


Fig.4.5 Connecting External Parts

Table 4.2 Recommended Values of External Resistors

No.	VOUT	Adjustable range			
		VOUT±5%		VOUT±10%	
		R1	R2	R1	R2
1	1.8V	1.8kΩ	6.2kΩ	1.6kΩ	3.6kΩ
2	2.5V	2.7kΩ	7.5kΩ	2.4kΩ	4.7kΩ
3	3.3V	2.4kΩ	11kΩ	2.4kΩ	6.8kΩ
4	5V	5.6kΩ		5.6kΩ	
5	12V	18kΩ		18kΩ	
6	15V	24kΩ		24kΩ	
7	24V	43kΩ		39kΩ	
8	28V	51kΩ		47kΩ	
9	32V	56kΩ		56kΩ	
10	48V	82kΩ		82kΩ	

4.7 Withstanding Voltage / Isolation Voltage

■When testing the withstanding voltage, make sure the voltage is increased gradually. When turning off, reduce the voltage gradually by using the dial of the hi-pot tester. Do not use a voltage tester with a timer as it may generate voltage several times as large as the applied voltage.

5 Series and Parallel Operation

5.1 Series operation

■Multiple CBS units can be used in series. Keep the output current less than the smallest specified rated current of the modules connected in series. Make sure the current flow into the power module will not exceed the rated current.

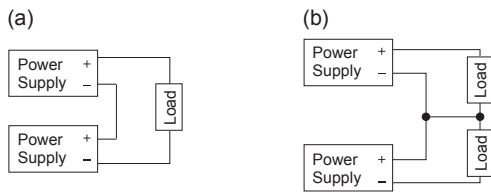


Fig.5.1 Examples of Series Operation

5.2 Redundancy operation

■Parallel operation is not possible.
■Redundancy operation is available by wiring as shown below.

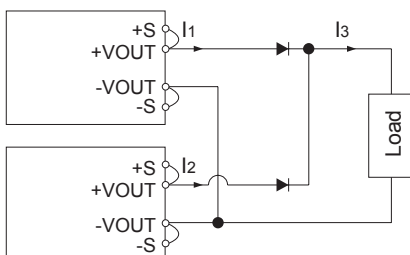


Fig.5.2 Example of Redundancy Operation

■Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .

Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

6 Implementation · Mounting Method

6.1 Mounting method

■When multiple power modules are used side by side, position them with sufficient spaces to allow adequate air ventilation so that the aluminum base plate temperature of each power module will remain within the temperature range shown in the derating curves (Fig. 6.2).

■Do not pass the DC input pattern underneath the power module as this will increase conducted noise. Place the DC input pattern away from the power module.

Do not pass the DC output pattern underneath the power module as this will increase output noise. Place the DC output pattern away from the power module.

■High frequency noise is radiated from the power module. When mounting the power module on a PCB, leave a copper pattern on the PCB to let it act as a shield and connect this pattern to the CASE pin (CBS50/100/200) or the mounting hole.

■When a heat sink cannot be fixed on the base plate side, order the power module with "-T" option. A heat sink can be mounted by affixing a M3 tap on the heat sink. In case of CBS350/450, make sure a mounting hole will be connected to a grounding capacitor C_Y .

Table 6.1 Mounting Hole Configuration

	Mounting hole
Standard	M3 tapped
Optional : -T	φ 3.4 thru

6.2 Stress onto the pins

■Applying excessive stress to the input or output pins of the power module may damage internal connections. Avoid applying stress in excess of that shown in Fig. 6.1.

■Input and output pins are soldered onto the internal PCB. Do not bend or pull the leads with excessive force.

■As unexpected stress may be applied to the pins, set the diameter of the PCB mounting hole at 3.5mm.

■As unexpected stress may be applied to the pins from vibration or shock, fix the power module by using the mounting holes with screws to reduce stress.

■Fix the power module to the PCB with the screws before soldering the input and output pins to prevent the PCB pattern being damaged.

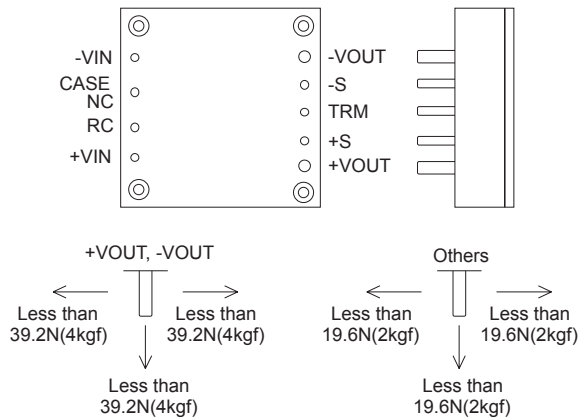


Fig.6.1 Stress onto Pins

6.3 Cleaning

- Clean the soldered side of the power module with a brush. Prevent liquid from getting into the power module. Do not clean by soaking the power module into liquid.
- Do not allow solvent to come in contact with product labels or resin cases as this may change the color of the resin case or cause deletion of the letters printed on the product label.
- After cleaning, dry the power modules well.

6.4 Soldering temperature

- Flow soldering: 260°C for up to 15 seconds.
- Soldering iron (26W): 450°C for up to 5 seconds.

6.5 Derating

- Use the power modules with conduction cooling (e.g. heat dissipation from the aluminum base plate to the attached heat sink). Fig. 6.2 shows the derating curves with respect to the aluminum base plate temperature. Note that operation within the hatched areas will cause a significant level of ripple and ripple noise. Contact us for more information on cooling methods.
- It is necessary to note thermal fatigue life by power cycle. Please reduce the temperature fluctuation range as much as possible when the up and down of temperature are frequently generated. Contact for more information on cooling methods.

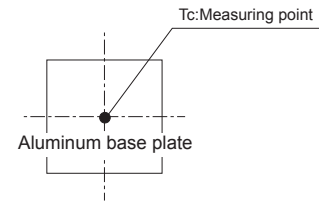
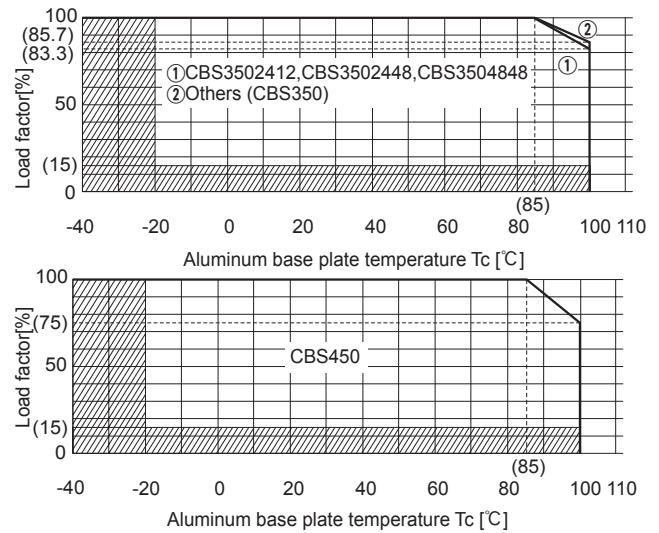
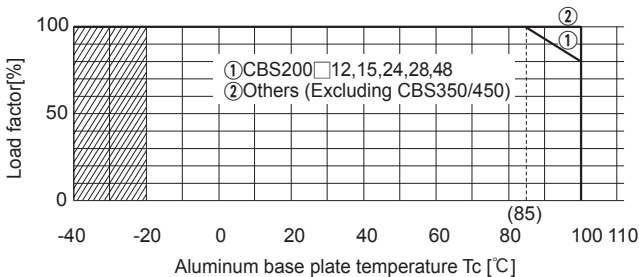


Fig.6.2 Derating Curve

6.6 Heat sink(Optional parts)

- The power module works with conduction cooling and needs heat dissipation using heat sinks. Optional heat sinks are available for CBS Series. Refer to Table 6.2 for details on the thermal resistance of heat sinks.

Table 6.2 Types of Heat Sinks Available

No.	Model	Size[mm]			Thermal resistance[°C/W]		Style
		H	W	D	Convection (0.1m/s)	Forced Air	
1	F-CBS-F1	12.7	57.9	61.5	7.5	Refer Fig.6.4	Horizontal
2	F-CBS-F2	12.7	58.4	61.0			Vertical
3	F-CBS-F3	25.4	57.9	61.5			4.6
4	F-CBS-F4	25.4	58.4	61.0	Vertical		
5	F-CBS-F5	38.1	57.9	61.5	3.0		Horizontal
6	F-CBS-F6	38.1	58.4	61.0			Vertical

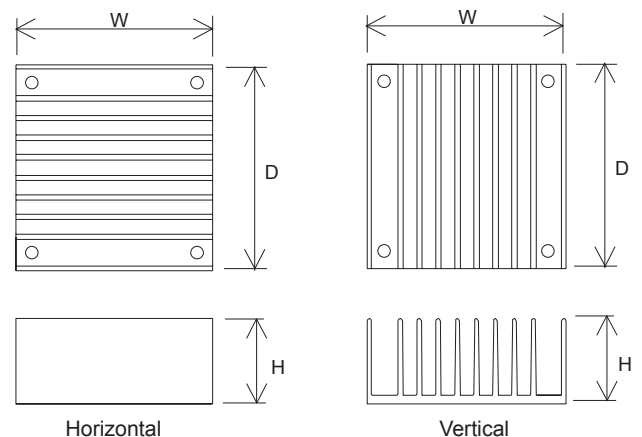


Fig.6.3 Heat Sink Types

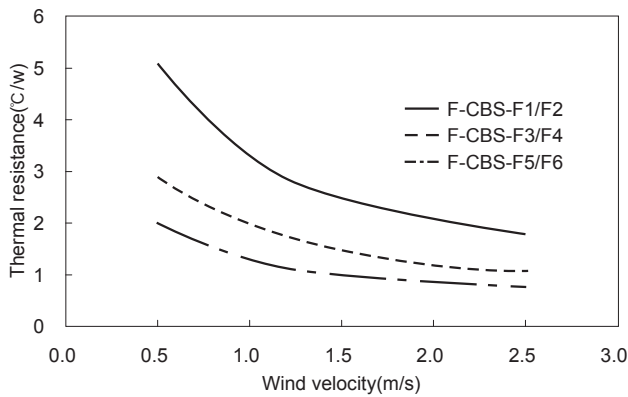


Fig.6.4 Thermal Resistance of Heat Sink(Forced Air)

6.7 Addition of a Heat sink(Optional:F□)

■Heat sink pre-attached models are also available.
(Except CBS350/450)

Table 6.3 Types of Heat Sink Pre-Attached Models Available

Option	Size[mm]			Weight [g]	Style	Heat sink type name
	H	W	D			
F1	26.5	58.7	62.5	150 or less	Horizontal	F-CBS-F1
F2	26.5	59.5	62.0		Vertical	F-CBS-F2
F3	39.2	58.7	62.5	170 or less	Horizontal	F-CBS-F3
F4	39.2	59.5	62.0		Vertical	F-CBS-F4
F5	52.0	58.7	62.5	185 or less	Horizontal	F-CBS-F5
F6	52.0	59.5	62.0		Vertical	F-CBS-F6

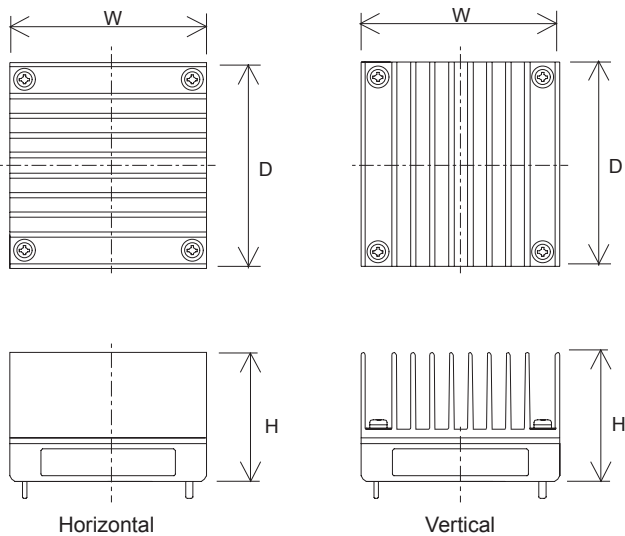


Fig.6.5 Dimensions of Heat Sink Pre-Attached Models

■Derating curve characteristics with respect to aluminum base plate temperature are shown in Fig. 6.6. Measure the temperature of the base plate in a location away from direct airflow (A). Note that operation within the hatched areas will cause a significant level of ripple and ripple noise.

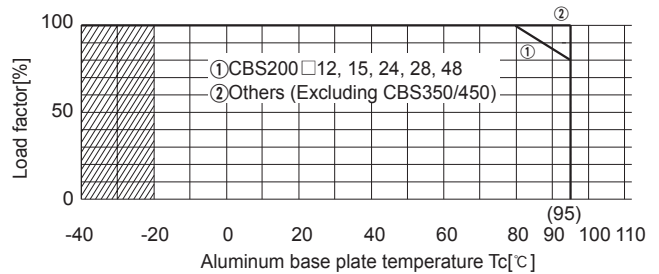


Fig.6.6 Derating Curve Characteristics

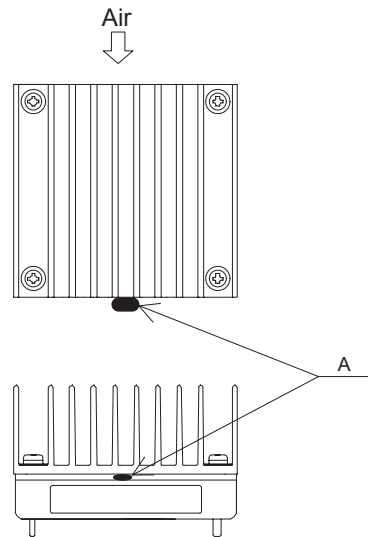


Fig.6.7 Measuring Point

■Make sure that PCB mounting screws do not touch the heat sink mounting screws.

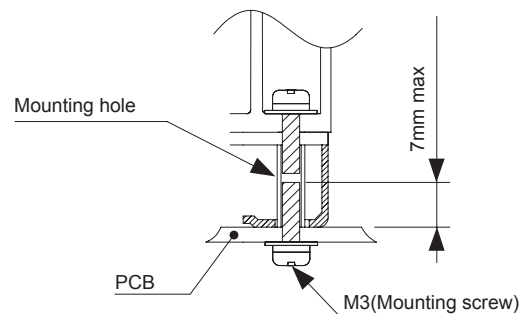


Fig.6.8 PCB Mounting Screw Dimensions

7 Safety Considerations

- To apply for safety standard approvals with the power module, the following conditions must be met. Consult us for more details.
 - The power modules must be used as a component power supply in end-use equipment.
 - Neither basic isolation nor double/reinforced isolation is provided across input, output and the base plate of the power module. If the power module is to be used with input voltage of more than 60VDC and needs basic or double/reinforced isolation, the required isolation must be provided in the construction of the final product.
 - Use external fuses that comply with safety standards at the input.



Low Profile



Isolated


Safety
Approvals

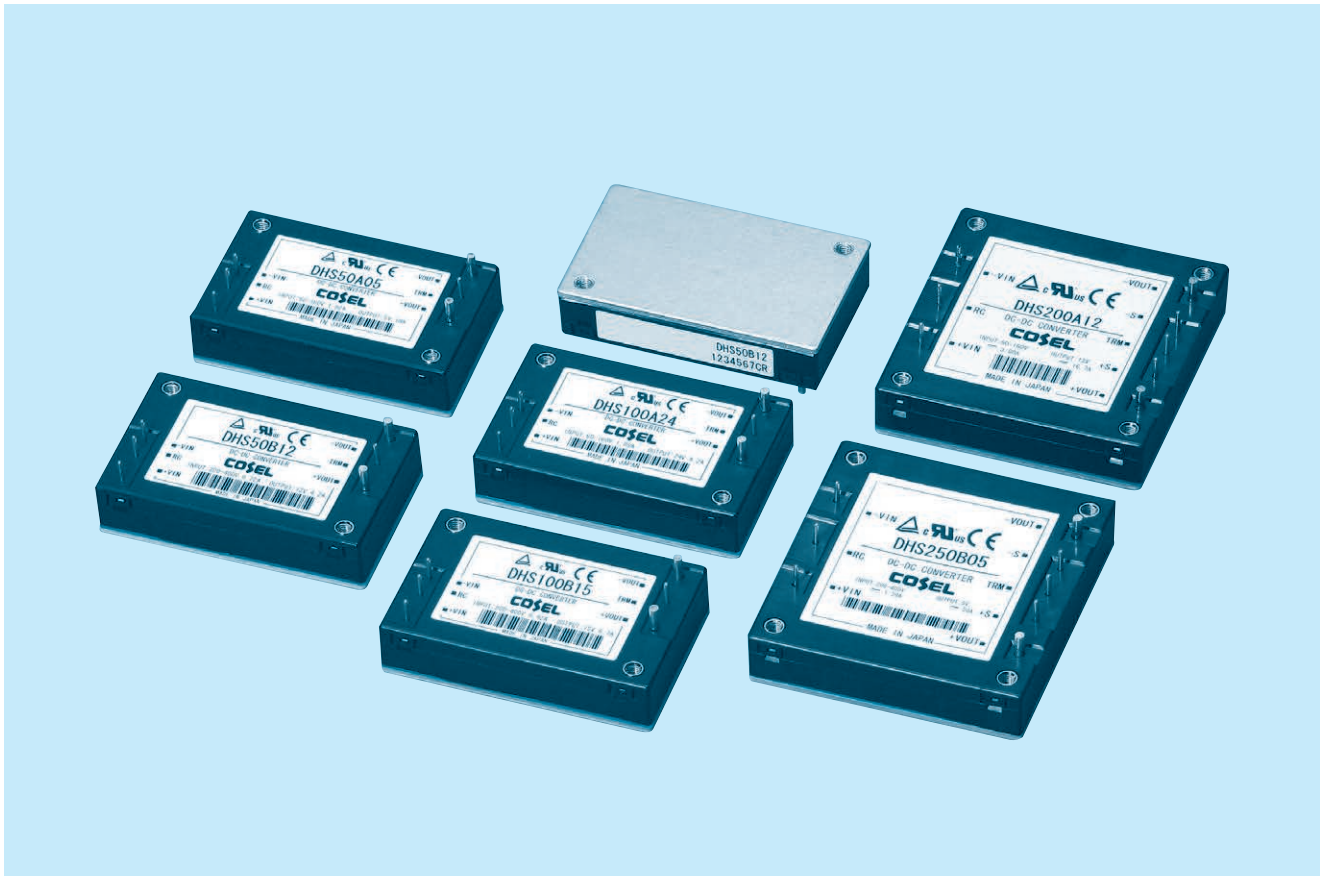

OCP



OVP


Remote
ON/OFF

DHS-series



DHS

Feature

- Ideal for distributed power systems
- Thin and small size
- Built-in overcurrent, overvoltage and thermal protection circuits
- Built-in remote ON/OFF
- Mounting hole (M3 tapped)

CE marking

Low Voltage Directive

Safety agency approvals

UL60950-1, C-UL, EN60950-1

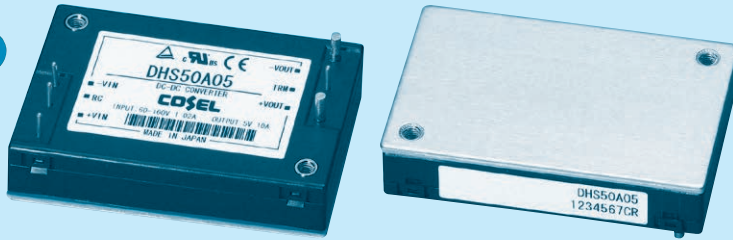
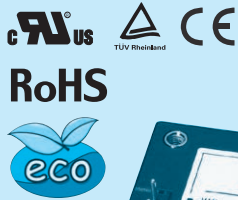
5-year warranty

Optional parts

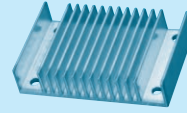
Heat sink (refer to page of option parts)

DHS50A**DH S 50 A 05 -□**

① ② ③ ④ ⑤ ⑥



*Providing heat sink
as option



- ① Series name
② Single output
③ Output wattage
④ A : DC60-160V
⑤ Output voltage
⑥ Optional
T : with Mounting hole
(ϕ 3.4 thru)

MODEL	DHS50A05	DHS50A12	DHS50A15	DHS50A24
MAX OUTPUT WATTAGE[W]	50.0	50.4	51.0	50.4
DC OUTPUT	5V 10A	12V 4.2A	15V 3.4A	24V 2.1A

SPECIFICATIONS

	MODEL	DHS50A05	DHS50A12	DHS50A15	DHS50A24
INPUT	VOLTAGE[V]	DC60 - 160			
	CURRENT[A]	0.55A	0.55A	0.55A	0.55A
	EFFICIENCY[%]	84.0typ	86.0typ	86.0typ	86.0typ
OUTPUT	VOLTAGE[V]	5	12	15	24
	CURRENT[A]	10	4.2	3.4	2.1
	LINE REGULATION[mV]	10max	24max	30max	48max
	LOAD REGULATION[mV]	10max	24max	30max	48max
	RIPPLE[mVp-p]	0 to +100℃ *2	80max	120max	120max
		-40 to 0℃ *2	120max	150max	150max
		0 to 15% Load *2	160max	240max	240max
	RIPPLE NOISE[mVp-p]	0 to +100℃ *2	120max	150max	150max
		-40 to 0℃ *2	200max	200max	250max
		0 to 15% Load *2	240max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +65℃	50max	120max	150max
		-40 to +100℃	100max	240max	480max
	DRIFT[mV]	20max	40max	60max	90max
	START-UP TIME[ms]	200max (DCIN 110V, Io=100%)			
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external VR or external voltage			
		4.50 - 6.00	10.80 - 13.20	13.50 - 16.50	21.60 - 26.40
	OUTPUT VOLTAGE SETTING[V]	4.97 - 5.13	11.91 - 12.29	14.76 - 15.24	23.62 - 24.38
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically			
	OVERVOLTAGE PROTECTION[V]	6.30 - 7.60	13.90 - 17.55	17.25 - 21.75	27.60 - 34.80
ISOLATION	REMOTE SENSING	nothing			
	REMOTE ON/OFF	Provided (Negative Logic L : ON, H : OFF)			
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15℃)			
ENVIRONMENT	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15℃)			
	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (20 \pm 15℃)			
	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100℃ (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max			
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max			
SAFETY	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis Complies with IEC61373 Category 1 Class B			
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis Complies with IEC61373 Category 1 Class B			
OTHERS	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1			
OTHERS	CASE SIZE/WEIGHT	58.4×12.7×37.3mm [2.3×0.5×1.47 inches] (W×H×D) / 60g max			
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)			

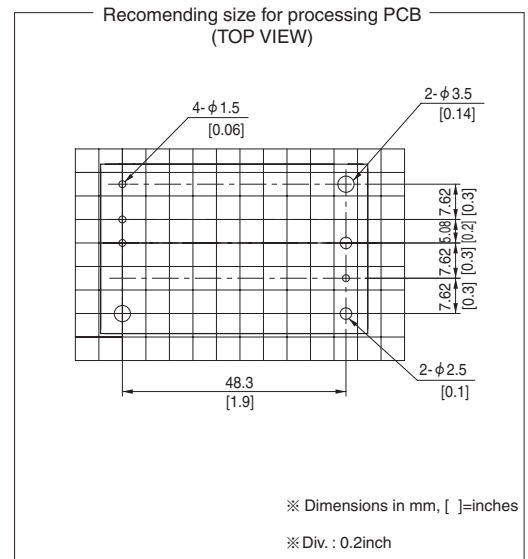
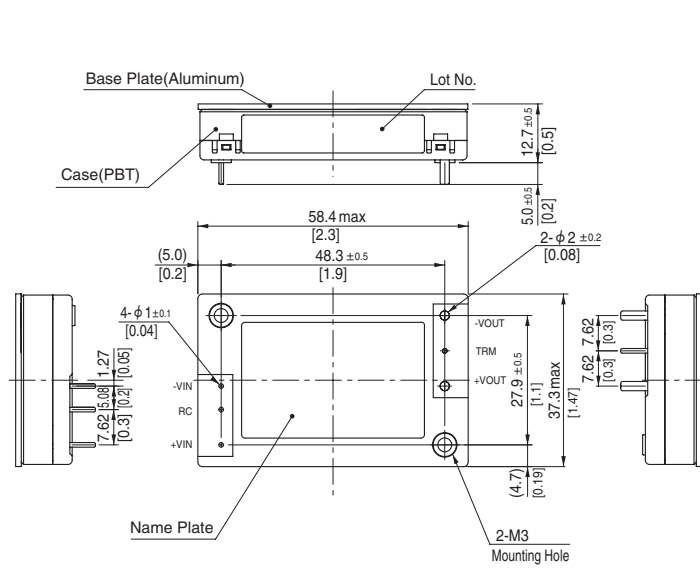
*1 At rated input(DC110V) and rated load.

*2 Ripple and ripple noise is measured by using measuring board. Refer to the manual

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

*4 Refer to the manual for input range.

External view

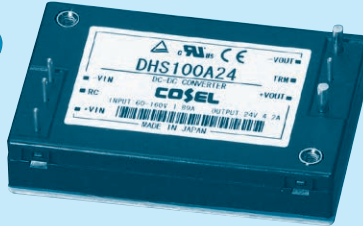
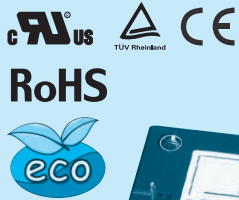


- ※ Tolerance : ±0.3 [±0.012]
- ※ Weight : 60g max
- ※ Dimensions in mm, []=inches
- ※ Mounting hole screwing torque : 0.49N · m (5.0kgf · cm) max

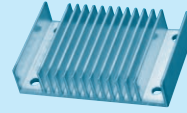
DHS100A

DH S 100 A 05 -□

① ② ③ ④ ⑤ ⑥



*Providing heat sink
as option



- ① Series name
② Single output
③ Output wattage
④ A : DC60-160V
⑤ Output voltage
⑥ Optional
T : with Mounting hole
(ϕ 3.4 thru)

MODEL	DHS100A05	DHS100A12	DHS100A15	DHS100A24
MAX OUTPUT WATTAGE[W]	100.0	100.8	100.5	100.8
DC OUTPUT	5V 20A	12V 8.4A	15V 6.7A	24V 4.2A

SPECIFICATIONS

	MODEL	DHS100A05	DHS100A12	DHS100A15	DHS100A24
INPUT	VOLTAGE[V]	DC60 - 160			
	CURRENT[A]	1.1A	1.1A	1.1A	1.1A
	EFFICIENCY[%]	85.0typ	88.0typ	88.0typ	88.0typ
OUTPUT	VOLTAGE[V]	5	12	15	24
	CURRENT[A]	20	8.4	6.7	4.2
	LINE REGULATION[mV]	10max	24max	30max	48max
	LOAD REGULATION[mV]	10max	24max	30max	48max
	RIPPLE[mVp-p]	0 to +100°C *2	80max	120max	120max
		-40 to 0°C *2	120max	150max	150max
		0 to 15% Load *2	160max	240max	240max
	RIPPLE NOISE[mVp-p]	0 to +100°C *2	120max	150max	150max
		-40 to 0°C *2	200max	200max	250max
		0 to 15% Load *2	240max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +65°C	50max	120max	150max
		-40 to +100°C	100max	240max	480max
	DRIFT[mV]	20max	40max	60max	90max
	START-UP TIME[ms]	200max (DCIN 110V, Io=100%)			
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external VR or external voltage			
		4.50 - 6.00	10.80 - 13.20	13.50 - 16.50	21.60 - 26.40
	OUTPUT VOLTAGE SETTING[V]	4.97 - 5.13	11.91 - 12.29	14.76 - 15.24	23.62 - 24.38
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically			
	OVERVOLTAGE PROTECTION[V]	6.30 - 7.60	13.90 - 17.55	17.25 - 21.75	27.60 - 34.80
ISOLATION	REMOTE SENSING	nothing			
	REMOTE ON/OFF	Provided (Negative Logic L : ON, H : OFF)			
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15°C)			
ENVIRONMENT	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15°C)			
	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (20 \pm 15°C)			
	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100°C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max			
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max			
SAFETY	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis Complies with IEC61373 Category 1 Class B			
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis Complies with IEC61373 Category 1 Class B			
OTHERS	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1			
OTHERS	CASE SIZE/WEIGHT	58.4 X 12.7 X 37.3mm [2.3 X 0.5 X 1.47 inches] (W X H X D) / 60g max			
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)			

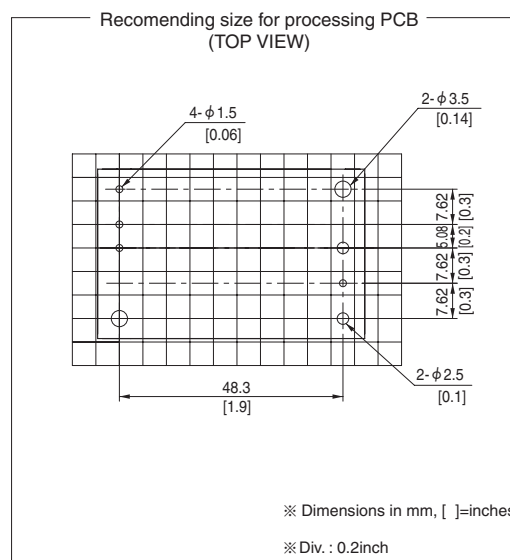
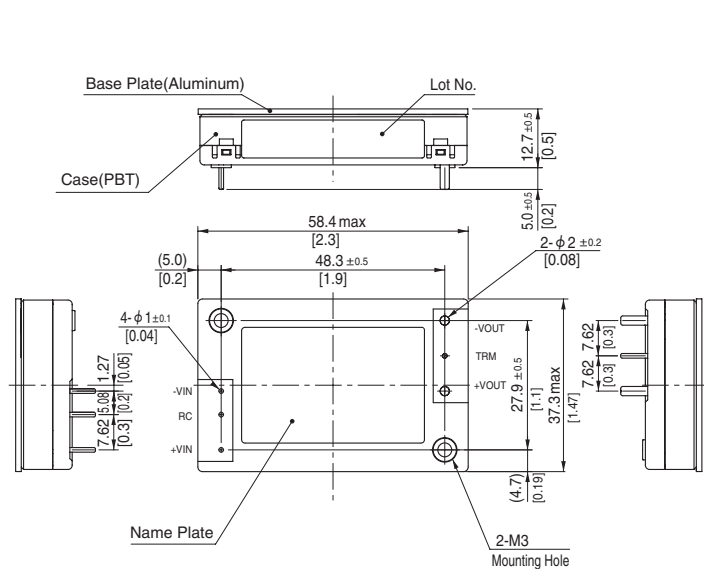
*1 At rated input(DC110V) and rated load.

*2 Ripple and ripple noise is measured by using measuring board. Refer to the manual.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*4 Refer to the manual for input range.

External view

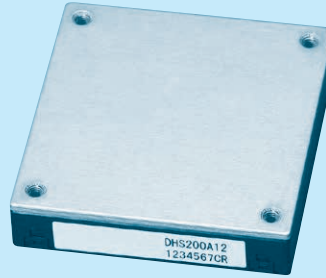
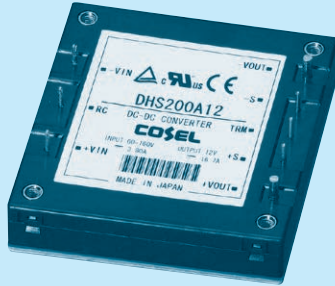


- ※ Tolerance : ±0.3 [±0.012]
- ※ Weight : 60g max
- ※ Dimensions in mm, []=inches
- ※ Mounting hole screwing torque : 0.49N · m (5.0kgf · cm) max

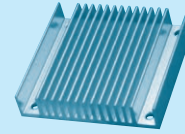
DHS200A

DH S 200 A 05 -□

① ② ③ ④ ⑤ ⑥



*Providing heat sink as option



- ① Series name
- ② Single output
- ③ Output wattage
- ④ A : DC60-160V
- ⑤ Output voltage
- ⑥ Optional
- T : with Mounting hole (φ 3.4 thru)

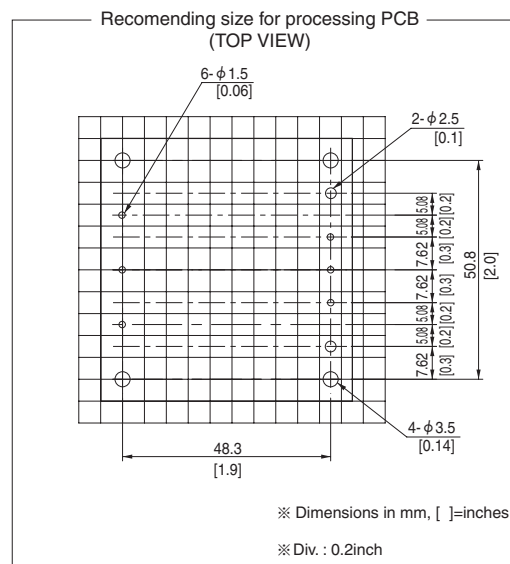
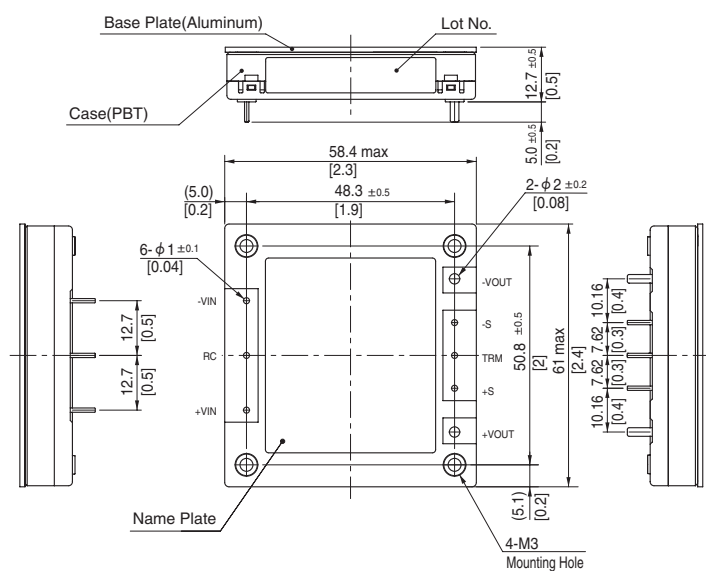
MODEL	DHS200A05	DHS200A12	DHS200A15	DHS200A24
MAX OUTPUT WATTAGE[W]	200.0	200.4	201.0	201.6
DC OUTPUT	5V 40A	12V 16.7A	15V 13.4A	24V 8.4A

SPECIFICATIONS

	MODEL	DHS200A05	DHS200A12	DHS200A15	DHS200A24
INPUT	VOLTAGE[V]	DC60 - 160			
	CURRENT[A]	2.1A	2.1A	2.1A	2.1A
	EFFICIENCY[%]	87.0typ	88.0typ	88.0typ	88.0typ
OUTPUT	VOLTAGE[V]	5	12	15	24
	CURRENT[A]	40	16.7	13.4	8.4
	LINE REGULATION[mV]	10max	24max	30max	48max
	LOAD REGULATION[mV]	10max	24max	30max	48max
	RIPPLE[mVp-p]	0 to +100℃*2	80max	120max	120max
		-40 to 0℃*2	120max	150max	150max
		0 to 15% Load*2	160max	240max	240max
	RIPPLE NOISE[mVp-p]	0 to +100℃*2	120max	150max	150max
		-40 to 0℃*2	200max	200max	250max
		0 to 15% Load*2	240max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +65℃	50max	120max	150max
		-40 to +100℃	100max	240max	480max
	DRIFT[mV]	20max	40max	60max	90max
	START-UP TIME[ms]	200max (DCIN 110V, Io=100%)			
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external VR or external voltage			
		3.00 - 6.00	7.20 - 13.20	9.00 - 16.50	14.40 - 26.40
	OUTPUT VOLTAGE SETTING[V]	4.97 - 5.13	11.91 - 12.29	14.76 - 15.24	23.62 - 24.38
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically			
	OVERVOLTAGE PROTECTION[V]	6.30 - 7.30	13.90 - 16.35	17.25 - 20.25	27.60 - 32.40
ISOLATION	REMOTE SENSING	Provided			
	REMOTE ON/OFF	Provided (Negative Logic L : ON, H : OFF)			
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)			
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)			
ENVIRONMENT	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)			
	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100℃ (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max			
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max			
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis Complies with IEC61373 Category 1 Class B			
SAFETY	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis Complies with IEC61373 Category 1 Class B			
	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1			
OTHERS	CASE SIZE/WEIGHT	58.4×12.7×61mm [2.3×0.5×2.4 inches] (W×H×D) / 100g max			
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)			

- *1 At rated input(DC110V) and rated load.
- *2 Ripple and ripple noise is measured by using measuring board. Refer to the manual.
- *3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.
- *4 Refer to the manual for input range.

External view



※ Tolerance : ± 0.3 [± 0.012]

※ Weight : 100g max

※ Dimensions in mm, []=inches

※ Mounting hole screwing torque : 0.49N · m (5.0kgf · cm) max

DHS50B

DH S 50 B 05 -□

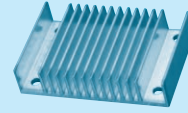
① ② ③ ④ ⑤ ⑥



RoHS



*Providing heat sink as option



- ① Series name
- ② Single output
- ③ Output wattage
- ④ B : DC200-400V
- ⑤ Output voltage
- ⑥ Optional
- T : with Mounting hole (φ 3.4 thru)

MODEL	DHS50B03	DHS50B05	DHS50B12	DHS50B15	DHS50B24	DHS50B28
MAX OUTPUT WATTAGE[W]	33.0	50.0	50.4	51.0	50.4	50.4
DC OUTPUT	3.3V 10A	5V 10A	12V 4.2A	15V 3.4A	24V 2.1A	28V 1.8A

SPECIFICATIONS

	MODEL	DHS50B03	DHS50B05	DHS50B12	DHS50B15	DHS50B24	DHS50B28
INPUT	VOLTAGE[V]	DC200 - 400					
	CURRENT[A]	*1 0.15A	0.22A	0.22A	0.22A	0.22A	0.22A
	EFFICIENCY[%]	*1 77.0typ	80.0typ	83.0typ	83.0typ	83.0typ	82.0typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	24	28
	CURRENT[A]	10	10	4.2	3.4	2.1	1.8
	LINE REGULATION[mV]	10max	10max	24max	30max	48max	56max
	LOAD REGULATION[mV]	10max	10max	24max	30max	48max	56max
	RIPPLE[mVp-p]	0 to +100℃ *2	80max	80max	120max	120max	120max
		-40 to 0℃ *2	120max	120max	150max	150max	150max
		0 to 15% Load *2	160max	160max	240max	240max	240max
	RIPPLE NOISE[mVp-p]	0 to +100℃ *2	120max	120max	150max	150max	150max
		-40 to 0℃ *2	200max	200max	200max	250max	250max
		0 to 15% Load *2	240max	240max	300max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +65℃	35max	50max	120max	150max	240max
		-40 to +100℃	66max	100max	240max	480max	560max
	DRIFT[mV]	*3 16max	20max	40max	60max	90max	90max
	START-UP TIME[ms]	200max (DCIN 280V, Io=100%)					
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external VR or external voltage					
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically					
	OVERVOLTAGE PROTECTION[V]	4.20 - 5.70	6.30 - 7.60	13.90 - 17.55	17.25 - 21.75	27.60 - 34.80	32.20 - 40.60
	REMOTE SENSING	None					
	REMOTE ON/OFF	Provided (Negative Logic L : ON, H : OFF)					
ISOLATION	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)					
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)					
	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)					
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100℃ (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max					
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max					
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis					
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis					
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1					
OTHERS	CASE SIZE/WEIGHT	58.4×12.7×37.3mm [2.3×0.5×1.47 inches] (W×H×D) / 60g max					
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)					

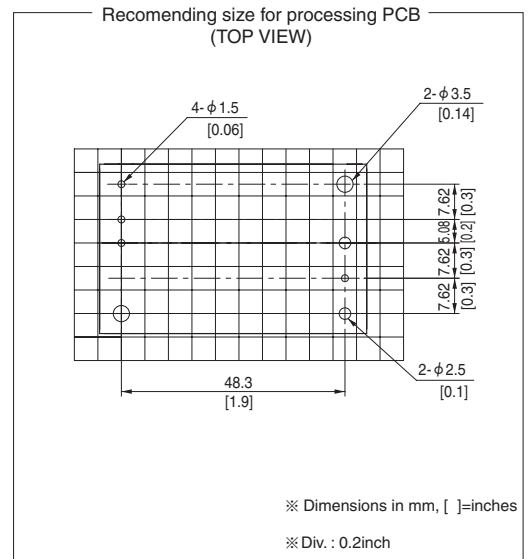
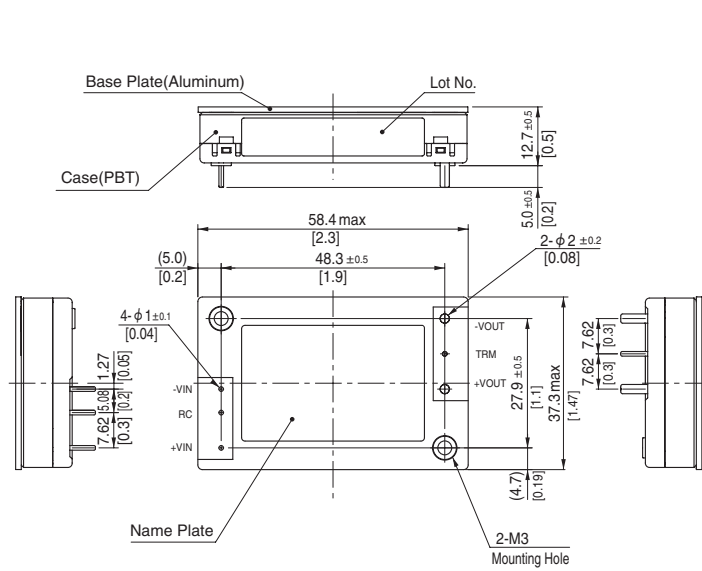
*1 At rated input(DC280V) and rated load.

*2 Ripple and ripple noise is measured by using measuring board. Refer to the manual

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

*4 Refer to the manual for input range.

External view



※ Tolerance : ±0.3 [±0.012]

※ Weight : 60g max

※ Dimensions in mm, []=inches

※ Mounting hole screwing torque : 0.49N · m (5.0kgf · cm) max

DHS100B

DH S 100 B 05 -□

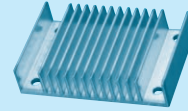
① ② ③ ④ ⑤ ⑥



RoHS



*Providing heat sink as option



- ① Series name
- ② Single output
- ③ Output wattage
- ④ B : DC200-400V
- ⑤ Output voltage
- ⑥ Optional
- T : with Mounting hole (φ 3.4 thru)

MODEL	DHS100B03	DHS100B05	DHS100B12	DHS100B15	DHS100B24	DHS100B28
MAX OUTPUT WATTAGE[W]	66.0	100.0	100.8	100.5	100.8	100.8
DC OUTPUT	3.3V 20A	5V 20A	12V 8.4A	15V 6.7A	24V 4.2A	28V 3.6A

SPECIFICATIONS

	MODEL	DHS100B03	DHS100B05	DHS100B12	DHS100B15	DHS100B24	DHS100B28
INPUT	VOLTAGE[V]	DC200 - 400					
	CURRENT[A]	*1 0.30A	0.44A	0.42A	0.42A	0.42A	0.42A
	EFFICIENCY[%]	*1 79.0typ	82.0typ	85.0typ	86.0typ	86.0typ	86.0typ
OUTPUT	VOLTAGE[V]	3.3	5	12	15	24	28
	CURRENT[A]	20	20	8.4	6.7	4.2	3.6
	LINE REGULATION[mV]	10max	10max	24max	30max	48max	56max
	LOAD REGULATION[mV]	10max	10max	24max	30max	48max	56max
	RIPPLE[mVp-p]	0 to +100℃ *2	80max	80max	120max	120max	120max
		-40 to 0℃ *2	120max	120max	150max	150max	150max
		0 to 15% Load *2	160max	160max	240max	240max	240max
	RIPPLE NOISE[mVp-p]	0 to +100℃ *2	120max	120max	150max	150max	150max
		-40 to 0℃ *2	200max	200max	200max	250max	250max
		0 to 15% Load *2	240max	240max	300max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +65℃	35max	50max	120max	150max	240max
		-40 to +100℃	66max	100max	240max	480max	560max
	DRIFT[mV]	*3 16max	20max	40max	60max	90max	90max
	START-UP TIME[ms]	200max (DCIN 280V, Io=100%)					
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external VR or external voltage					
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically					
	OVERVOLTAGE PROTECTION[V]	4.20 - 5.70	6.30 - 7.60	13.90 - 17.55	17.25 - 21.75	27.60 - 34.80	32.20 - 40.60
	REMOTE SENSING	None					
	REMOTE ON/OFF	Provided (Negative Logic L : ON, H : OFF)					
ISOLATION	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)					
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)					
	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)					
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100℃ (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max					
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max					
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis					
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis					
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1					
OTHERS	CASE SIZE/WEIGHT	58.4×12.7×37.3mm [2.3×0.5×1.47 inches] (W×H×D) / 60g max					
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)					

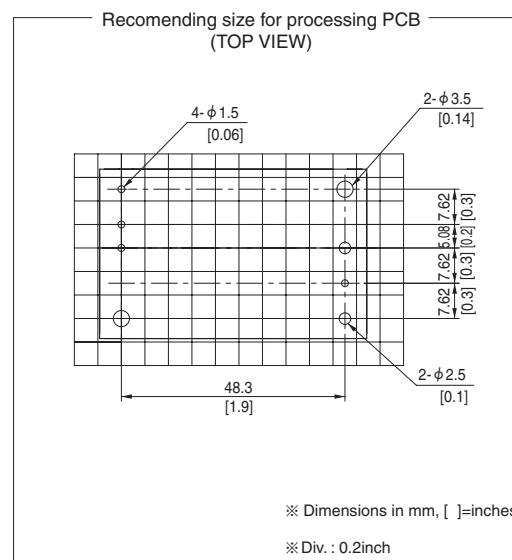
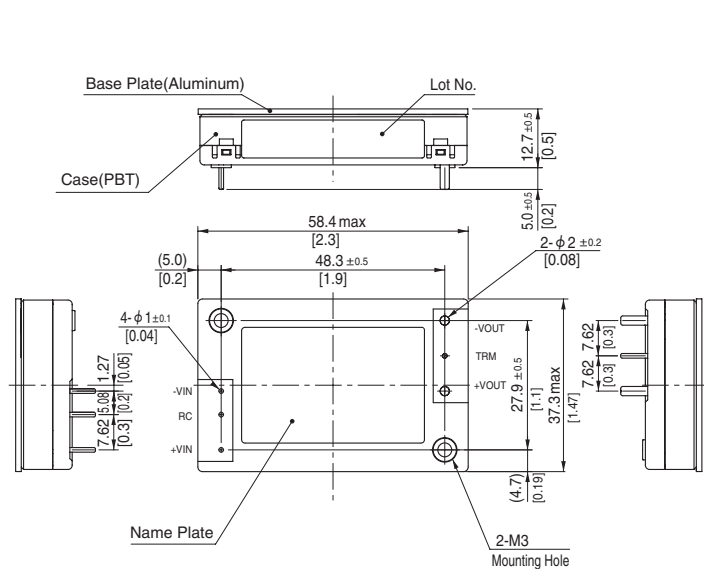
*1 At rated input(DC280V) and rated load.

*2 Ripple and ripple noise is measured by using measuring board. Refer to the manual.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

*4 Refer to the manual for input range.

External view

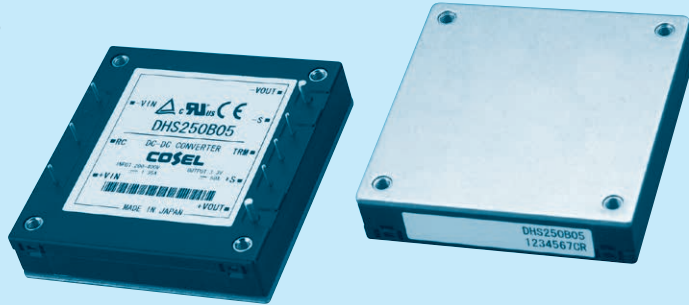


- ※ Tolerance : ±0.3 [±0.012]
- ※ Weight : 60g max
- ※ Dimensions in mm, []=inches
- ※ Mounting hole screwing torque : 0.49N · m (5.0kgf · cm) max

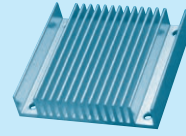
DHS250B

DH S 250 B 05 -□

① ② ③ ④ ⑤ ⑥



*Providing heat sink
as option



- ① Series name
- ② Single output
- ③ Output wattage
- ④ B : DC200-400V
- ⑤ Output voltage
- ⑥ Optional
T : with Mounting hole
(ϕ 3.4 thru)

MODEL	DHS250B03	DHS250B05	DHS250B07	DHS250B12	DHS250B15	DHS250B24	DHS250B28	DHS250B48
MAX OUTPUT WATTAGE[W]	165.0	250.0	247.5	252.0	247.5	252.0	252.0	249.6
DC OUTPUT	3.3V 50A	5V 50A	7.5V 33A	12V 21A	15V 16.5A	24V 10.5A	28V 9.0A	48V 5.2A

SPECIFICATIONS

	MODEL	DHS250B03	DHS250B05	DHS250B07	DHS250B12	DHS250B15	DHS250B24	DHS250B28	DHS250B48
INPUT	VOLTAGE[V]	DC200 - 400							
	CURRENT[A]	*1 0.67A	1.0A	1.0A	1.0A	1.0A	1.0A	1.0A	1.0A
	EFFICIENCY[%]	*1 88.0typ	90.0typ	88.0typ	88.0typ	88.0typ	88.0typ	88.0typ	89.0typ
OUTPUT	VOLTAGE[V]	3.3	5	7.5	12	15	24	28	48
	CURRENT[A]	50	50	33	21	16.5	10.5	9.0	5.2
	LINE REGULATION[mV]	10max	10max	20max	24max	30max	48max	56max	96max
	LOAD REGULATION[mV]	10max	10max	20max	24max	30max	48max	56max	96max
	RIPPLE[mVp-p]	0 to +100℃ *2	80max	80max	100max	120max	120max	120max	200max
		-40 to 0℃ *2	120max	120max	130max	150max	150max	150max	250max
		0 to 15% Load *2	160max	160max	200max	240max	240max	240max	400max
	RIPPLE NOISE[mVp-p]	0 to +100℃ *2	120max	120max	130max	150max	150max	150max	250max
		-40 to 0℃ *2	200max	200max	200max	200max	250max	250max	400max
		0 to 15% Load *2	240max	240max	260max	300max	300max	300max	500max
	TEMPERATURE REGULATION[mV]	0 to +65℃	35max	50max	70max	120max	150max	240max	280max
		-40 to +100℃	66max	100max	140max	240max	300max	480max	960max
	DRIFT[mV]	*3 16max	20max	30max	40max	60max	90max	90max	180max
	START-UP TIME[ms]	200max (DCIN 280V, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external VR or external voltage							
	OUTPUT VOLTAGE SETTING[V]	3.30 - 3.40	4.97 - 5.13	7.43 - 7.67	11.91 - 12.29	14.76 - 15.24	23.62 - 24.38	27.56 - 28.44	47.24 - 48.76
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	OVERVOLTAGE PROTECTION[V]	4.20 - 4.85	6.30 - 7.30	8.70 - 10.20	13.90 - 16.35	17.25 - 20.25	27.60 - 32.40	32.20 - 37.80	55.20 - 64.80
	REMOTE SENSING	Provided							
	REMOTE ON/OFF	Provided (Negative Logic L : ON, H : OFF)							
ISOLATION	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15℃)							
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15℃)							
	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (20 \pm 15℃)							
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100℃ (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max							
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max							
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis							
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis							
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1							
OTHERS	CASE SIZE/WEIGHT	58.4 X 12.7 X 61mm [2.3 X 0.5 X 2.4 inches] (W X H X D) / 100g max							
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)							

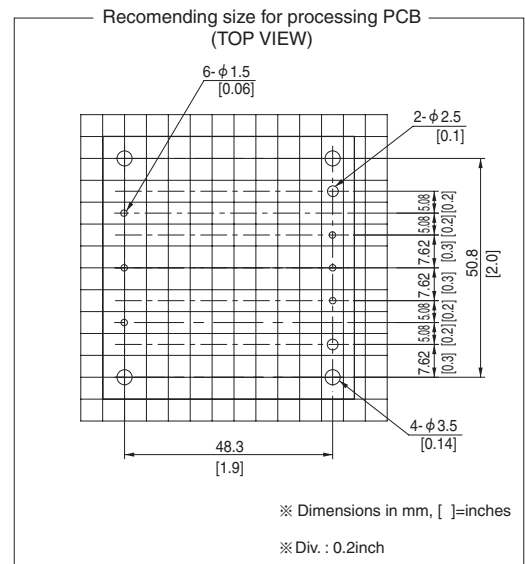
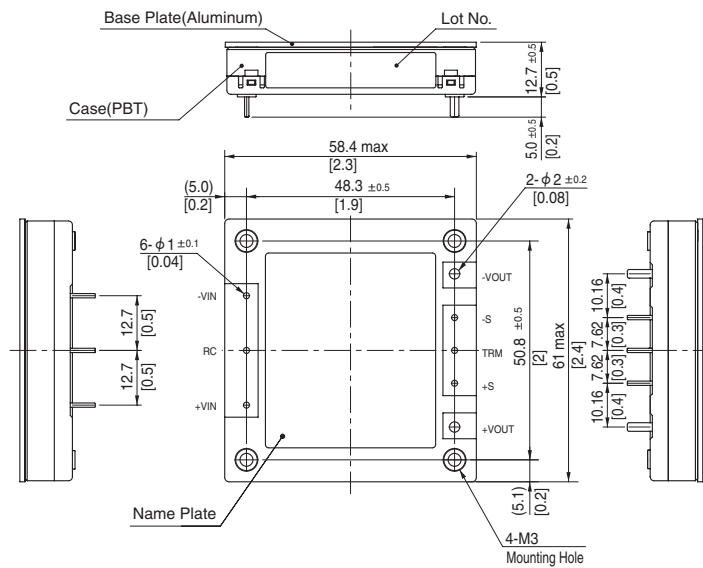
*1 At rated input(DC280V) and rated load.

*2 Ripple and ripple noise is measured by using measuring board. Refer to the manual.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

*4 Refer to the manual for input range.

External view



- ※ Tolerance : ± 0.3 [± 0.012]
- ※ Weight : 100g max
- ※ Dimensions in mm, []=inches
- ※ Mounting hole screwing torque : $0.49\text{N} \cdot \text{m}$ (5.0kgf · cm) max

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	PCB/Pattern			Series/Parallel operation availability	
					Material	Single sided	Double sided	Series operation	Parallel operation
DHS50A DHS50B	Forward converter	470	*1	-	Aluminum	Yes		Yes	*2
DHS100A DHS100B	Forward converter	470	*1	-	Aluminum	Yes		Yes	*2
DHS200A DHS250B	Forward converter	360	*1	-	Aluminum	Yes		Yes	*2

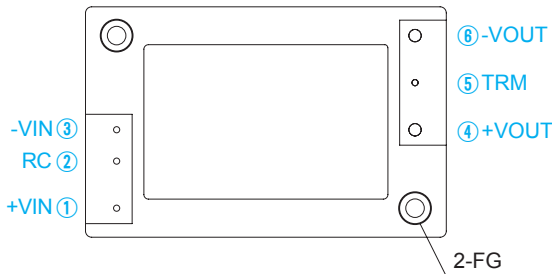
*1 Refer to Specification.

*2 Refer to Instruction Manual.

1	Pin Connection	DHS-16
2	Connection for Standard Use	DHS-16
3	Wiring Input/Output Pin	DHS-16
3.1	Wiring input pin	DHS-16
3.2	Wiring output pin	DHS-17
4	Function	DHS-18
4.1	Overcurrent protection	DHS-18
4.2	Overvoltage protection	DHS-18
4.3	Thermal protection	DHS-18
4.4	Remote ON/OFF	DHS-18
4.5	Remote sensing	DHS-18
4.6	Adjustable voltage range	DHS-19
4.7	Withstanding Voltage / Isolation Voltage	DHS-20
5	Series and Parallel Operation	DHS-20
5.1	Series operation	DHS-20
5.2	Redundancy operation	DHS-20
6	Implementation · Mounting Method	DHS-20
6.1	Mounting method	DHS-20
6.2	Stress onto the pins	DHS-21
6.3	Cleaning	DHS-21
6.4	Soldering temperature	DHS-21
6.5	Derating	DHS-21
6.6	Heat sink(Optional parts)	DHS-22
7	Lifetime expectancy depends on stress by temperature difference	DHS-23

1 Pin Connection

●DHS50/100



●DHS200/250

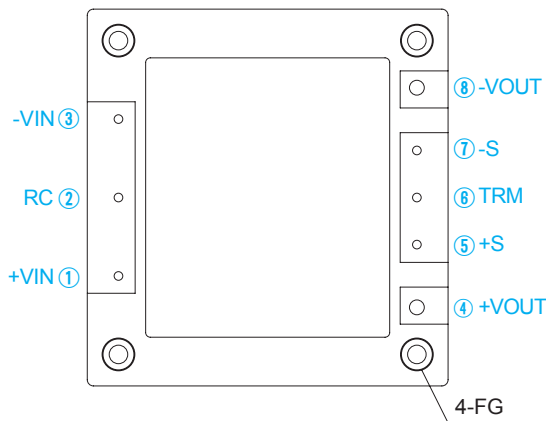


Fig.1.1 Pin Connection (bottom view)

Table 1.1 Pin Connection and function

No.	Pin Connection	Function
DHS50/100 DHS200/250		
①	+VIN	+DC input
②	RC	Remote ON/OFF
③	-VIN	-DC input
④	+VOUT	+DC output
—	⑤ +S	+Remote sensing
⑤	⑥ TRM	Adjustment of output voltage
—	⑦ -S	-Remote sensing
⑥	⑧ -VOUT	-DC output
—	—	Mounting hole

No.	Pin Connection	Reference
DHS50/100 DHS200/250		
①	+VIN	3.1 Wiring input pin
②	RC	4.4 Remote ON/OFF
③	-VIN	3.1 Wiring input pin
④	+VOUT	3.2 Wiring output pin
—	⑤ +S	4.5 Remote sensing
⑤	⑥ TRM	4.6 Adjustable voltage range
—	⑦ -S	4.5 Remote sensing
⑥	⑧ -VOUT	3.2 Wiring output pin
—	—	6.1 "Mounting hole"

2 Connection for Standard Use

■ In order to use the power supply, it is necessary to wire as shown in Fig.2.1 and external components in table2.1.

■ Short the following pins to turn on the power module.

-VIN↔RC, +VOUT↔+S, and -VOUT↔S (DHS200/250)

[Reference: 4.4 "Remote ON/OFF"
4.5 "Remote sensing"]

■ The DHS Series handles only the DC input.

Avoid applying AC input directly.

It will damage the power supply.

■ Operate with the conduction cooling(e.g. heat radiation from the aluminum base plate to the attached heat sink).

[Reference: 6.5 "Derating"]

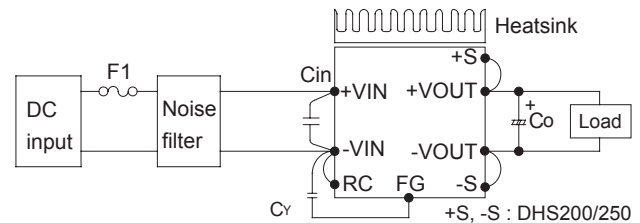


Fig.2.1 Connection for Standard Use

Table 2.1 External components

No.	Symbol	component	Reference
1	F1	Input fuse	3.1 (1) "External fuse"
2	Cy	Primary decoupling capacitor	3.1 (2) "Noise filter/Decoupling capacitor"
3	—	Noise filter	
4	Cin	External capacitor on the input side	3.1 (3) "External capacitor on the input side"
5	Co	External capacitor on the output side	3.2 "Wiring output pin"
6	—	Heatsink	6.5 "Derating"

3 Wiring Input/Output Pin

3.1 Wiring input pin

(1) External fuse

■ Fuse is not built-in on input side. In order to protect the unit, install the normal blow type fuse on input side.

■ When the input voltage from a front end unit is supplied to multiple units, install the normal blow type fuse in each unit.

Table 3.1 Recommended fuses (Normal-blow type)

Model	DHS50A/DHS100A	DHS200A
Rated current	3.15A	5A
Model	DHS50B/DHS100B	DHS250B
Rated current	1.6A	3.15A

(2) Noise filter/Decoupling capacitor

- Install an external noise filter and a decoupling capacitor C_V for low line-noise and for stable operation of the power supply.
- Install a correspondence filter, if a noise standard meeting is required or if the surge voltage may be applied to the unit.
- Install a primary decoupling capacitor C_V , with more than 470pF, near the input pins(within 50mm from the pins).
- When the total capacitance of the primary decoupling capacitor is more than 8800pF, the nominal value in the specification may not be met by the Hi-Pot test between input and output. In this case, it is that a capacitor should be installed between output and FG.

(3) External capacitor on the Input side.

- Install an external capacitor C_{in} between +VIN and -VIN input pins for low line-noise and for stable operation of the power supply.

DHS50A/100A	: more than 22 μ F *
DHS200A	: more than 47 μ F *
DHS50B/100B/250B	: more than 0.1 μ F

*When the line inductance is high or ambient temperature is lower than -20°C, please increase C_{in} value more than the value indicated above.

- When the line impedance is high or the input voltage rise quickly at start-up(less than 10 μ s), install a capacitor C_{in} between +VIN and -VIN input pins(within 50mm from pins).

DHS50B/100B	: more than 10 μ F
DHS250B	: more than 22 μ F

(4) Input voltage range/Input current range

- The specification of input ripple voltage is shown as below.

Ripple voltage	DHS50A/100A/200A : less than 10Vp-p
	DHS50B/100B/250B : less than 20Vp-p

- Make sure that the voltage fluctuation, including the ripple voltage, will not exceed the input voltage range.

- Use a front end unit with enough power, considering the start-up current I_p of this unit.

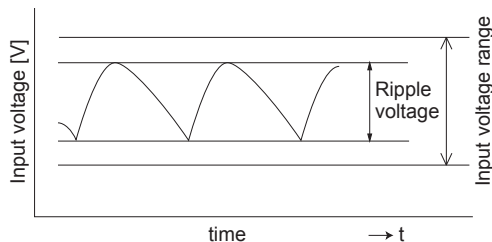


Fig.3.1 Input voltage ripple

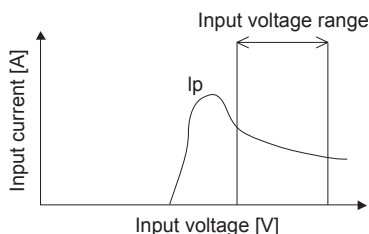


Fig.3.2 Input current characteristics

(5) Operation with AC input

- The DHS series handles only for the DC input.

A front end unit(AC/DC unit) is required when the DHS series is operated with AC input.

(6) Reverse input voltage protection

- Avoid the reverse polarity input voltage. It will break the power supply.

It is possible to protect the unit from the reverse input voltage by installing an external diode.

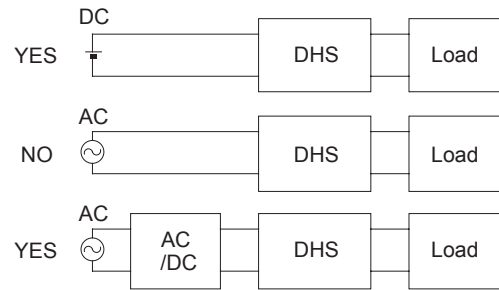


Fig.3.3 Use with AC input

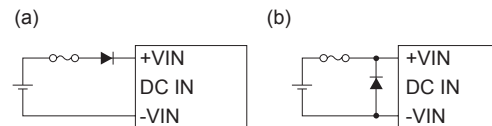


Fig.3.4 Reverse input voltage protection

3.2 Wiring output pin

- Install an external capacitor C_o between +VOUT and -VOUT pins for stable operation of the power supply.

Recommended capacitance of C_o is shown in Table 3.2.

- Select the high frequency type capacitor. Output ripple and start-up waveform may be influenced by ESR ESL of the capacitor and the wiring impedance.

- Install a capacitor C_o near the output pins(within 50mm from the pins).

Table 3.2 Recommended capacitance C_o [μ F]

Model	Temperature of Base plate			
	Tbp=0~+100 °C		Tbp=-40~+100 °C	
Output voltage (V)	DHS50/100	DHS200/250	DHS50/100	DHS200/250
3.3	2200	2200	2200 × 3	2200 × 3
5	2200	2200	2200 × 3	2200 × 3
7.5	-	2200	-	2200 × 3
12	470	1000	470 × 3	1000 × 3
15	470	1000	470 × 3	1000 × 3
24	220	470	220 × 3	470 × 3
28	220	470	220 × 3	470 × 3
48	-	330	-	330 × 3

- The specified ripple and ripple noise are measured by the method introduced in Fig. 3.5.

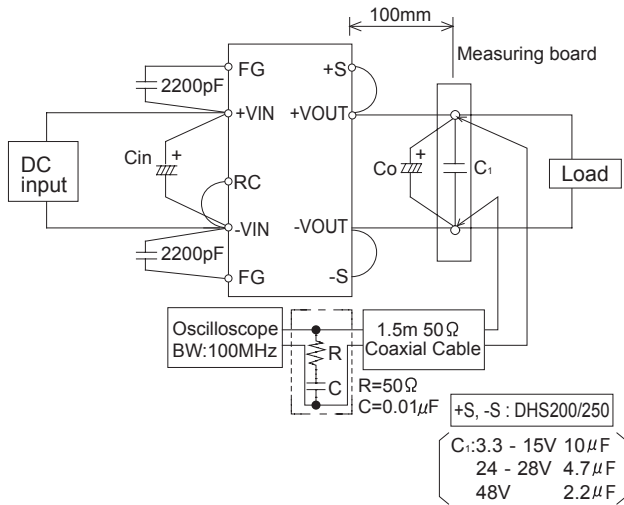


Fig.3.5 Method of Measuring Output Ripple and Ripple Noise

4 Function

4.1 Overcurrent protection

Over Current Protection (OCP) is built in and works at 105% of the rated current or higher. However, use in an over current situation must be avoided whenever possible. The output voltage of the power module will recover automatically if the fault causing over current is corrected.

When the output voltage drops after OCP works, the power module enters a "hiccup mode" where it repeatedly turns on and off at a certain frequency.

4.2 Overvoltage protection

Over Voltage Protection (OVP) is built in. When OVP works, output voltage can be recovered by shutting down DC input for at least one second or by turning off the remote control switch for one second without shutting down the DC input. The recovery time varies according to input voltage and input capacitance.

Remarks:

Note that devices inside the power module may fail when a voltage greater than the rated output voltage is applied from an external power supply to the output terminal of the power module. This could happen in in-coming inspections that include OVP function test or when voltage is applied from the load circuit. OVP can be tested by using the TRM terminal. Consult us for details.

4.3 Thermal protection

Over Temperature Protection (OTP) is built in. If the base plate temperature exceeds 100°C, OTP will work, causing the output voltage to drop. Output voltage can be recovered by shutting down DC input for at least one second or by turning RC off for one second without shutting down the DC input.

4.4 Remote ON/OFF

The remote ON/OFF function is incorporated in the input circuit and operated with RC and -VIN.

Table 4.1 Remote ON/OFF Specifications

ON/OFF logic	Between RC and -VIN	Output voltage
Negative	L level(0 - 1.2V) or short	ON
	H level(3.5 - 7.0V) or open	OFF

When RC is at low level, a current of 0.5mA typ will flow out.

When Vcc is used, keep it within the following rage:

$$3.5 \leq VCC \leq 7V.$$

When remote ON/OFF is not used, short RC and -VIN.

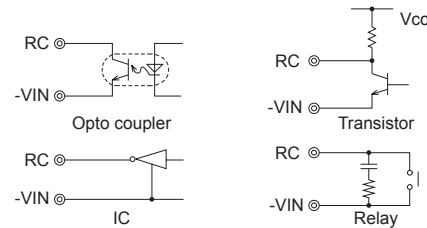


Fig. 4.1 RC Connection Example

●DHS200, DHS250

4.5 Remote sensing

(1) When Remote Sensing is Not Used

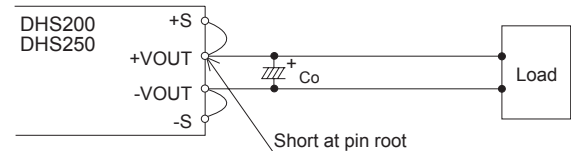


Fig. 4.2 When Remote Sensing is Not Used (DHS200/250)

When remote sensing is not used, make sure +VOUT and +S are shorted, and that -VOUT and -S are shorted as well.

Keep the patterns between +S and +VOUT and between -S and -VOUT as short as possible. Avoid a looping pattern. If noise enters the loop, the operation of the power module will become unstable.

(2) When Remote Sensing is Used

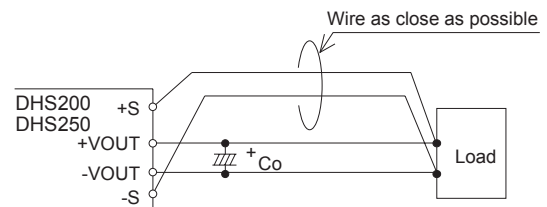


Fig. 4.3 When Remote Sensing is Used (DHS200/250)

Using remote sensing with long wires may cause output voltage to become unstable. Consult us if long sensing wiring is necessary.

Sensing patterns or wires should be as short as possible. If wires are used, use either twisted-pair or shielded wires.

■ Use wide PCB patterns or thick wires between the power module and the load. Line drop should be kept less than 0.3V. Make sure output voltage from the power module stays within the specified range.

■ If the sensing patterns are shorted by mistake, a large current may flow and damage the pattern. This can be prevented by installing fuses or resistors close to the load.

As wiring or load impedance may generate oscillation or large fluctuations in output voltage, make sure enough evaluation is given in advance.

4.6 Adjustable voltage range

■ Output voltage between +VOUT and -VOUT can be adjusted by connecting external resistors to TRM.

■ When the output voltage adjustment is not used, open the TRM pin respectively.

■ When the output voltage adjustment is used, note that the over-voltage protection circuit operates when the output voltage sets too high.

■ The wiring to the potentiometer should be as short as possible.

As the ambient temperature fluctuation characteristics deteriorates depending on the types of resistors and potentiometers used, please use resistors and potentiometers of the following specifications:

Resistors..... Metal film type, coefficient less than $\pm 100\text{ppm}/^\circ\text{C}$

Potentiometers ... Cermet type, coefficient less than $\pm 300\text{ppm}/^\circ\text{C}$

■ When the input voltage is 60 - 66VDC or 200 - 250VDC, the output voltage adjustment range becomes as shown in fig. 4.4.

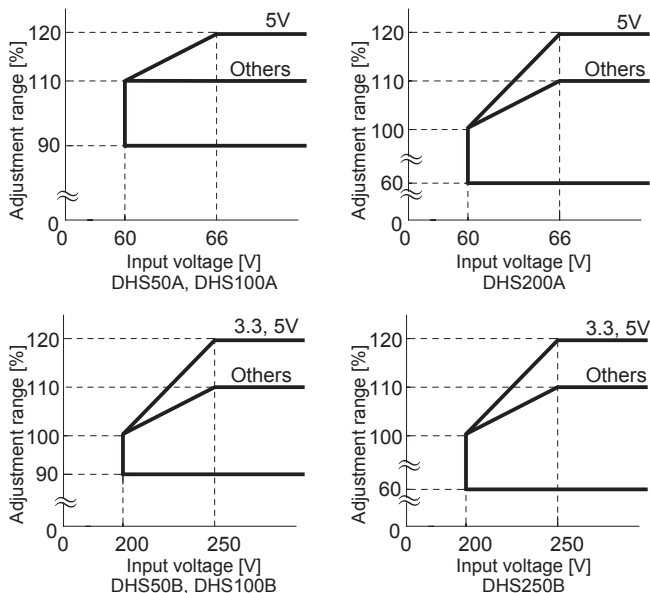


Fig. 4.4 Output Voltage Adjustment Range

● DHS50, DHS100

■ To increase the output voltage, turn the potentiometer clockwise and connect in such a way that the resistance value between ② and ③ becomes small.

To decrease the output voltage, turn the potentiometer counter-clockwise.

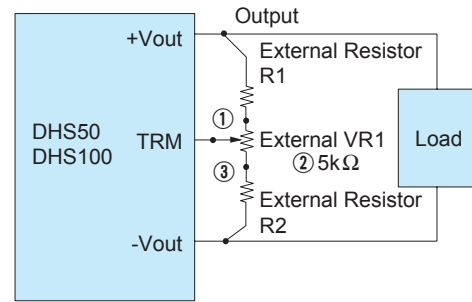


Fig. 4.5 Connecting External Devices (DHS50, DHS100)

Table 4.2 Recommended Values of External Resistors (DHS50, DHS100)

No.	Output Voltage	Adjustable Range			
		VOUT $\pm 5\%$		VOUT $\pm 10\%$	
		R1	R2	R1	R2
1	3.3V	5.1k Ω	3.3k Ω	3.3k Ω	2.2k Ω
2	5V	12k Ω		8.2k Ω	
3	12V	15k Ω		10k Ω	
4	15V	22k Ω		15k Ω	
5	24V	39k Ω		27k Ω	
6	28V	47k Ω		33k Ω	

● DHS200, DHS250

(1) Output voltage adjusting

■ Output voltage can be adjusted by connecting an external potentiometer (VR1) and resistors (R1 and R2) as shown in Fig. 4.6.

Output voltage will increase if the resistance between ① and ② is reduced by turning the potentiometer clockwise.

Recommended values for external components are shown in Table 4.3.

Consult us if the power module is used in a different configuration.

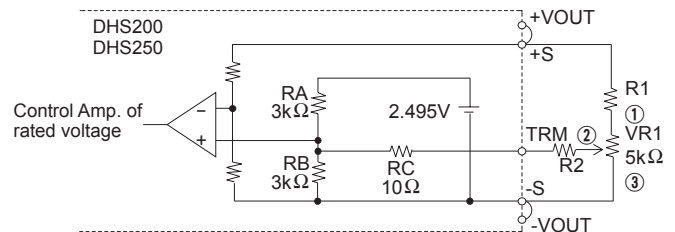


Fig. 4.6 Connecting External Parts (DHS250)

Table 4.3 Recommended Values of External Resistors (DHS250)

No.	Output Voltage	Adjustable Range			
		VOUT $\pm 5\%$		VOUT $\pm 10\%$	
		R1	R2	R1	R2
1	3.3V	2.4k Ω	12k Ω	2.4k Ω	8.2k Ω
2	5V	5.6k Ω		5.6k Ω	
3	7.5V	10k Ω		10k Ω	
4	12V	18k Ω		18k Ω	
5	15V	24k Ω		24k Ω	
6	24V	43k Ω		43k Ω	
7	28V	47k Ω		47k Ω	
8	48V	91k Ω		91k Ω	

(2) Output voltage decreasing

■ By connecting the external resistor (RD), output voltage becomes adjustable to decrease.

The external resistor (RD) is calculated the following equation.

$$RD = \frac{1.51 \times \frac{V_{OD}}{V_{OR}} - 0.01}{1.0 - \frac{V_{OD}}{V_{OR}}} \text{ [k}\Omega\text{]}$$

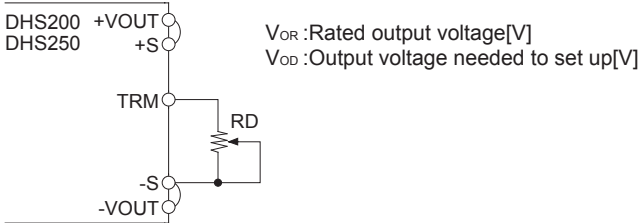


Fig. 4.7 Connection for output voltage decreasing (DHS200/250)

(3) Output voltage increasing

■ By connecting the external resistor (RU), output voltage becomes adjustable to increase.

The external resistor (RU) is calculated the following equation.

$$RU = \frac{\left[3.0 \times \frac{V_{OR}}{V_{ref}} - 1.51 \right] \times \frac{V_{OU}}{V_{OR}} + 0.01}{\frac{V_{OU}}{V_{OR}} - 1.0}$$

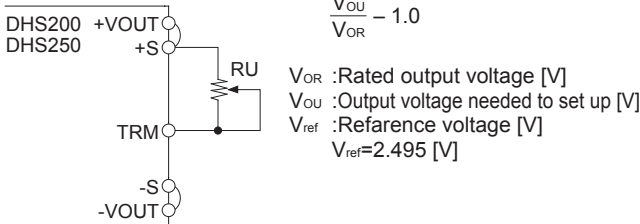


Fig. 4.8 Connection for output voltage increasing (DHS200/250)

4.7 Withstanding Voltage / Isolation Voltage

■ When testing the withstanding voltage, make sure the voltage is increased gradually. When turning off, reduce the voltage gradually by using the dial of the hi-pot tester. Do not use a voltage tester with a timer as it may generate voltage several times as large as the applied voltage.

5 Series and Parallel Operation

5.1 Series operation

■ Series operation is available by connecting the outputs of two or more power supplies, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

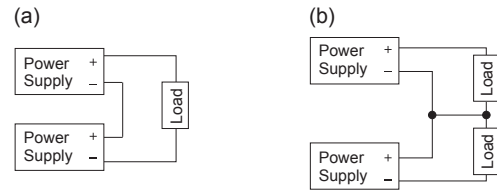


Fig. 5.1 Examples of series operation

5.2 Redundancy operation

■ Parallel operation is not possible.

■ Redundancy operation is available by wiring as shown below.

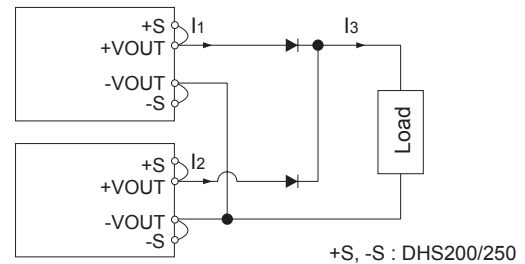


Fig. 5.2 Example of Redundancy Operation

■ Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .

Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

6 Implementation · Mounting Method

6.1 Mounting method

■ The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Aluminum base plate temperature around each power supply should not exceed the temperature range shown in derating curve.

■ Avoid placing the DC input line pattern lay out underneath the unit, it will increase the line conducted noise. Make sure to leave an ample distance between the line pattern lay out and the unit. Also avoid placing the DC output line pattern underneath the unit because it may increase the output noise. Lay out the pattern away from the unit.

■ High-frequency noise radiates directly from the unit to the atmosphere. Therefore, design the shield pattern on the printed circuit board and connect its one to FG.

The shield pattern prevents noise radiation.

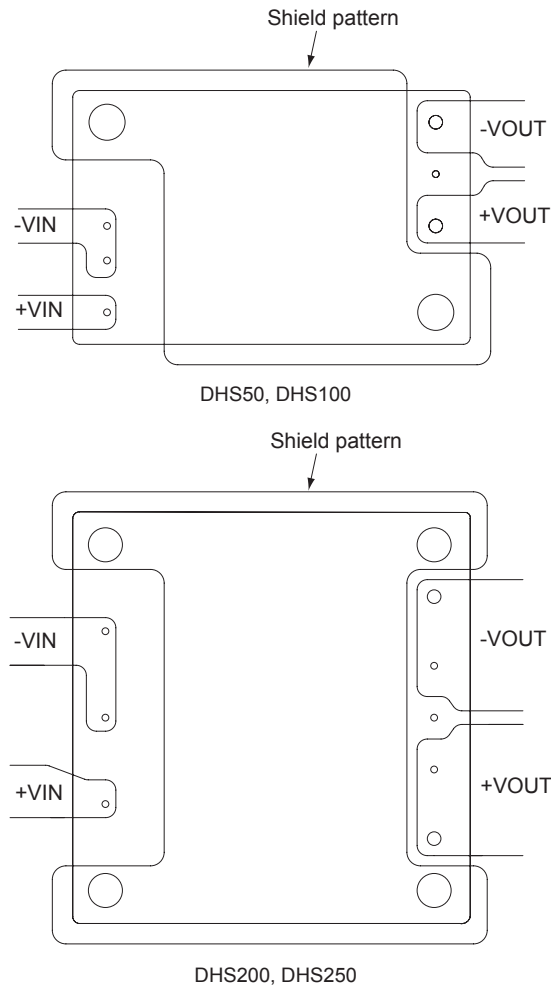


Fig. 6.1 Shield pattern lay out (bottom view)

6.2 Stress onto the pins

- Applying excessive stress to the input or output pins of the power module may damage internal connections. Avoid applying stress in excess of that shown in Fig. 6.1.
- Input and output pins are soldered onto the internal PCB. Do not bend or pull the leads with excessive force.
- As unexpected stress may be applied to the pins, set the diameter of the PCB mounting hole at 3.5mm.
- As unexpected stress may be applied to the pins from vibration or shock, fix the power module by using the mounting holes with screws to reduce stress.
- Fix the power module to the PCB with the screws before soldering the input and output pins to prevent the PCB pattern being damaged.

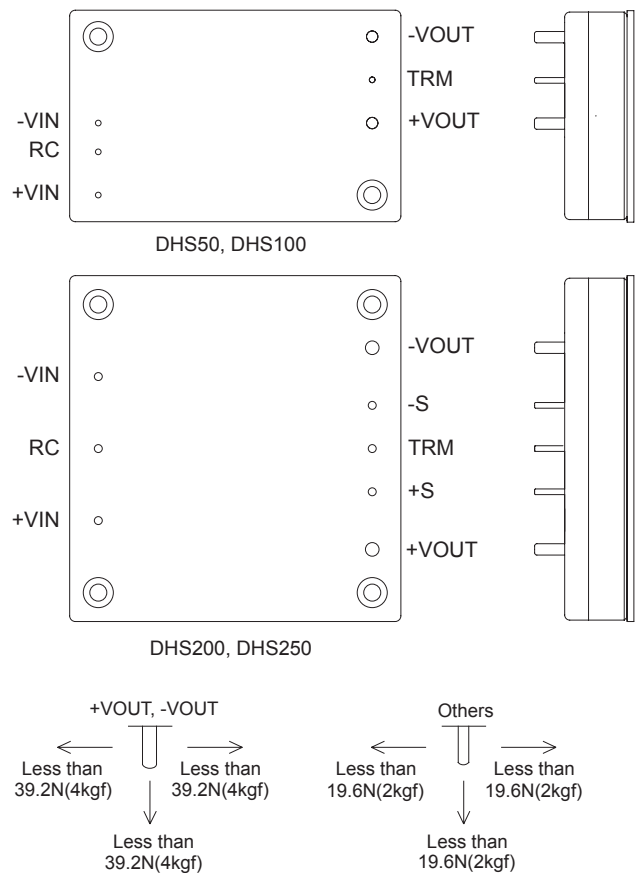


Fig. 6.2 Stress onto Pins

6.3 Cleaning

- Clean the soldered side of the power module with a brush. Prevent liquid from getting into the power module. Do not clean by soaking the power module into liquid.
- Do not allow solvent to come in contact with product labels or resin cases as this may change the color of the resin case or cause deletion of the letters printed on the product label.
- After cleaning, dry the power modules well.

6.4 Soldering temperature

- Flow soldering: 260°C for up to 15 seconds.
- Soldering iron (26W): 450°C for up to 5 seconds.

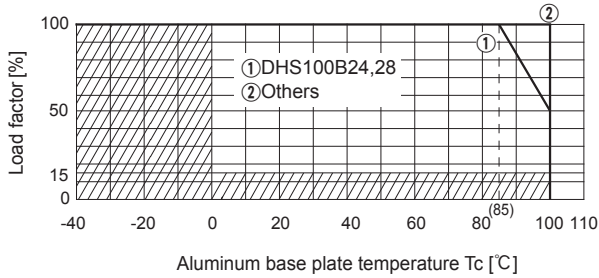
6.5 Derating

- Use the power modules with conduction cooling (e.g. heat dissipation from the aluminum base plate to the attached heat sink). Fig. 6.3 shows the derating curves with respect to the aluminum base plate temperature. Note that operation within the hatched areas will cause a significant level of ripple and ripple noise.
- Please measure the temperature on the aluminum base plate edge side when you cannot measure the temperature of the center part of the aluminum base plate. In this case, please take 5deg temperature margin from the derating characteristic of Figure 6.3.

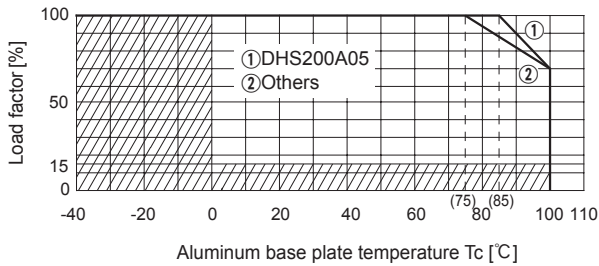
■ It is necessary to note the thermal fatigue life by power cycle.
Please reduce the temperature fluctuation range as much as possible when the up and down of the temperature are frequently generated.

Contact us for more information on cooling methods.

●DHS50, DHS100



●DHS200



●DHS250

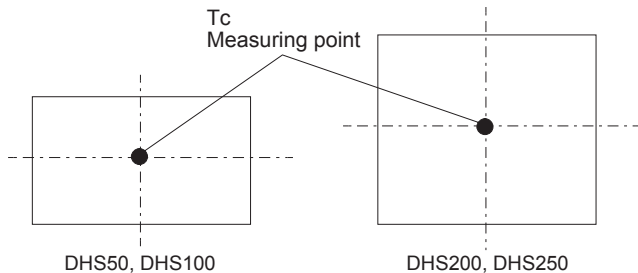
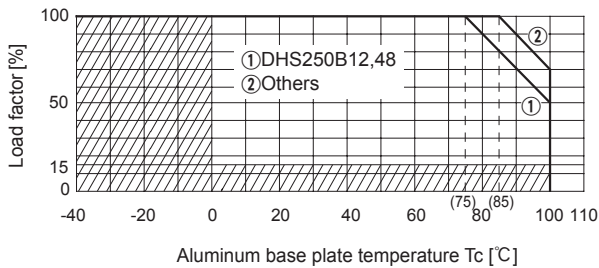


Fig.6.3 Derating Curve

6.6 Heat sink(Optional parts)

●DHS50, DHS100

■ The power module works with conduction cooling and needs heat dissipation using heat sinks. Optional heat sinks are available for DHS Series. Refer to Table 6.1 and Table 6.2 for details on the thermal resistance of heat sinks.

Table 6.1 Types of Heat Sinks Available

No.	Model	Size[mm]			Thermal resistance[°C/W]		Style
		H	W	D	Convection (0.1m/s)	Forced Air	
1	F-QB-F1	12.7	58.4	37.6	14.0	Refer Fig.6.5	Horizontal
2	F-QB-F2	12.7	58.7	37.3			Vertical
3	F-QB-F3	25.4	58.4	37.6	7.5		Horizontal
4	F-QB-F4	25.4	58.7	37.3			Vertical
5	F-QB-F5	38.1	58.4	37.6	5.0		Horizontal
6	F-QB-F6	38.1	58.7	37.3			Vertical

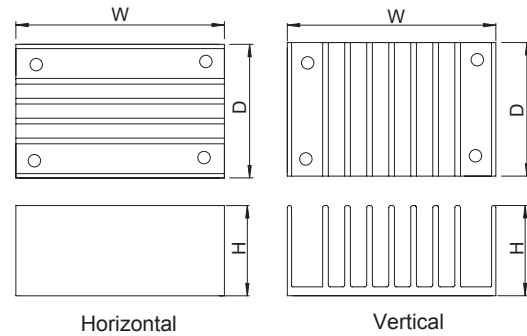


Fig.6.4 Heat Sink Types

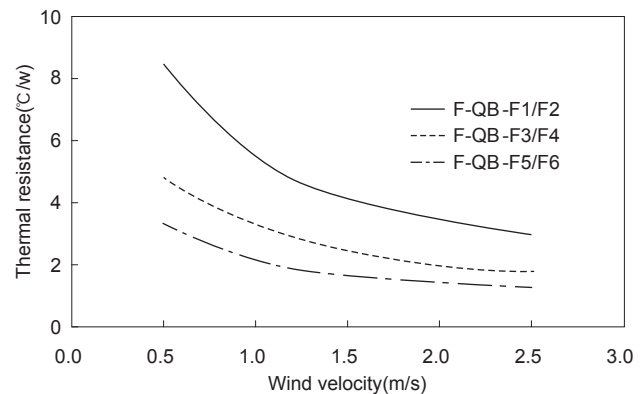


Fig.6.5 Thermal Resistance of Heat Sink(Forced Air)

●DHS200, DHS250

Table 6.2 Types of Heat Sinks Available

No.	Model	Size[mm]			Thermal resistance[°C/W]		Style
		H	W	D	Convection (0.1m/s)	Forced Air	
1	F-CBS-F1	12.7	57.9	61.5	7.5	Refer Fig.6.7	Horizontal
2	F-CBS-F2	12.7	58.4	61.0			Vertical
3	F-CBS-F3	25.4	57.9	61.5	4.6		Horizontal
4	F-CBS-F4	25.4	58.4	61.0			Vertical
5	F-CBS-F5	38.1	57.9	61.5	3.0		Horizontal
6	F-CBS-F6	38.1	58.4	61.0			Vertical

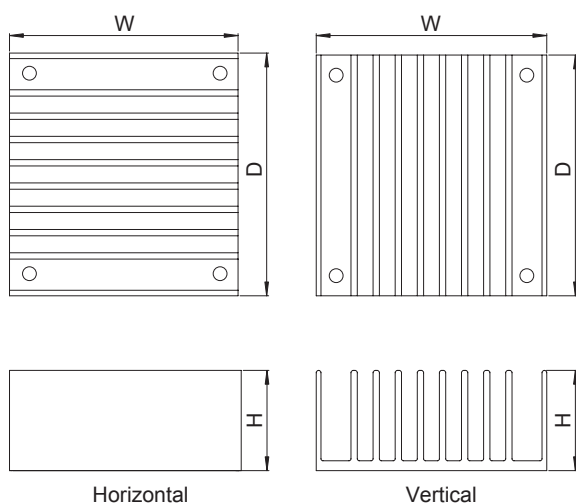


Fig. 6.6 Heat Sink Types

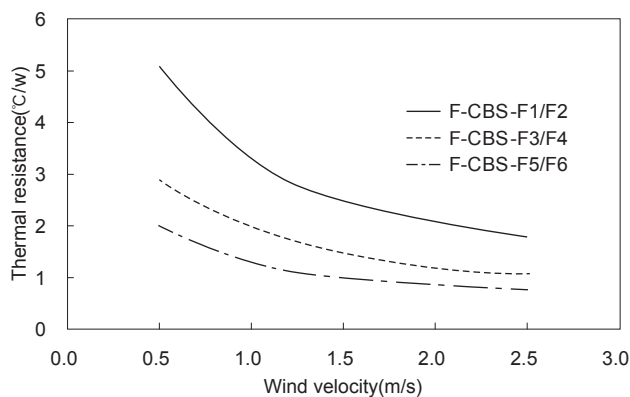


Fig.6.7 Thermal Resistance of Heat Sink(Forced Air)

7 Lifetime expectancy depends on stress by temperature difference

■Regarding lifetime expectancy design of solder joint, following contents must be considered.

It must be careful that the soldering joint is stressed by temperature rise and down which is occurred by self-heating and ambient temperature change.

The stress is accelerated by thermal-cycling, therefore the temperature difference should be minimized as much as possible if temperature rise and down is occurred frequently.

■Product lifetime expectancy depends on the aluminum base plate central temperature difference (ΔT_c) and number of cycling in a day is shown in Fig.7.1.

If the aluminum base plate center part temperature changes frequently by changing output load factor etc., the above the lifetime expectancy design should be applied as well.

Please contact us for details.

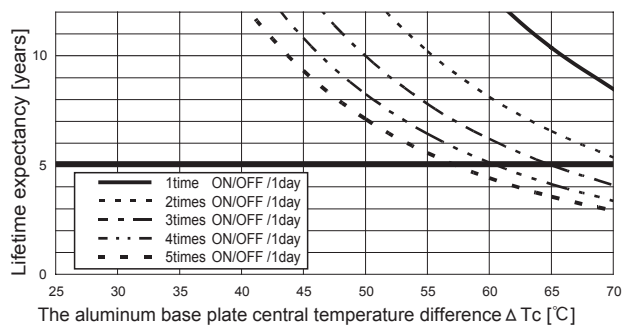


Fig7.1 Lifetime expectancy against rise/fall temperature difference



DBS-series



DBS

Feature

- Ideal for distributed power systems
- Thin and small size
- Built-in overcurrent, overvoltage and thermal protection circuits
- Built-in remote ON/OFF (on both side of input and output)
- Inverter operating monitoring (IOG)
- Mounting hole (M3 tapped)
- The beat noise is decreased by installing of the crystal oscillator (DBS700)

CE marking

- Low Voltage Directive

Safety agency approvals

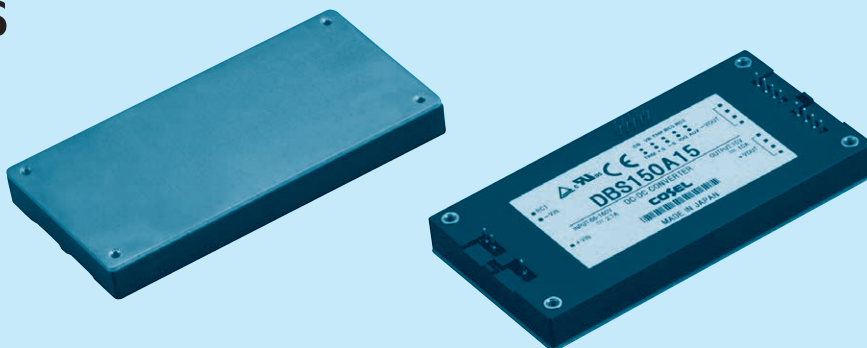
- UL, C-UL recognized, TÜV approved

5-year warranty

DBS100A/DBS150A

DB S 150 A 15

① ② ③ ④ ⑤



- ① Series name
 ② Single output
 ③ Output wattage
 ④ Input voltage
 A :DC110V input
 ⑤ Output voltage

MODEL	DBS100A05	DBS100A13R8	DBS150A12	DBS150A15	DBS150A24
MAX OUTPUT WATTAGE[W]	100	100.7	150	150	151
DC OUTPUT	5V 20A	13.8V 7.3A	12V 12.5A	15V 10A	24V 6.3A

SPECIFICATIONS

	MODEL	DBS100A05	DBS100A13R8	DBS150A12	DBS150A15	DBS150A24
INPUT	VOLTAGE[V]	DC45 - 160		DC66 - 160		
	CURRENT[A]	*1 1.11typ	1.10typ	1.57typ	1.59typ	1.58typ
	EFFICIENCY[%]	*1 82typ	83typ	87typ	86typ	87typ
OUTPUT	VOLTAGE[V]	5	13.8	12	15	24
	CURRENT[A]	20	7.3	12.5	10	6.3
	LINE REGULATION[mV]	20max	60max	40max	60max	95max
	LOAD REGULATION[mV]	40max	150max	100max	150max	190max
	RIPPLE[mVp-p]	0 to +85℃ *2 80max	120max	120max	120max	120max
		-20 - 0℃ *2 140max	160max	160max	160max	160max
	RIPPLE NOISE[mVp-p]	0 to +85℃ *2 100max	150max	150max	150max	150max
		-20 - 0℃ *2 150max	180max	180max	180max	180max
	TEMPERATURE REGULATION[mV]	0 to +65℃ 50max	180max	120max	180max	280max
		-20 to +85℃ 85max	310max	200max	310max	480max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV]	*3 20max	60max	40max	60max	90max
	START-UP TIME[ms]	200max (DCIN 110V, I _o =100%)				
	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open), 60 - 110% adjustable by external VR or external voltage				
	OUTPUT VOLTAGE SETTING[V]	4.90 - 5.20	13.25 - 14.35	11.60 - 12.60	14.40 - 15.60	23.04 - 24.96
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically				
	OVERVOLTAGE PROTECTION	5.75 - 7.00V	15.87 - 19.32V	13.80 - 16.80V	17.25 - 21.00V	27.60 - 33.60V
	REMOTE SENSING	Provided				
ISOLATION	REMOTE ON/OFF	Provided (On both side of input and output)				
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)				
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)				
	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)				
ENVIRONMENT	OUTPUT-RC2.RC3	AC100V 1minute, Cutoff current = 100mA, DC100V 10MΩ min (20±15℃)				
	OPERATING TEMP., HUMID. AND ALTITUDE *4	-20 to +85℃ (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max				
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +85℃, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max				
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis				
SAFETY	IMPACT	196.1m/s ² (20G), 11ms once each along X, Y and Z axis				
	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1				
OTHERS	CASE SIZE/WEIGHT	61 × 12.7 × 116.8mm [2.4 × 0.5 × 4.6 inches] (W × H × D) / 150g max				
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)				

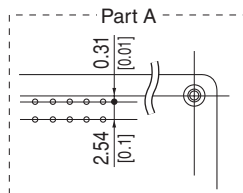
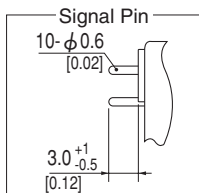
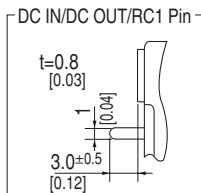
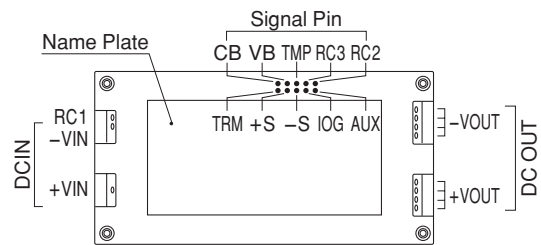
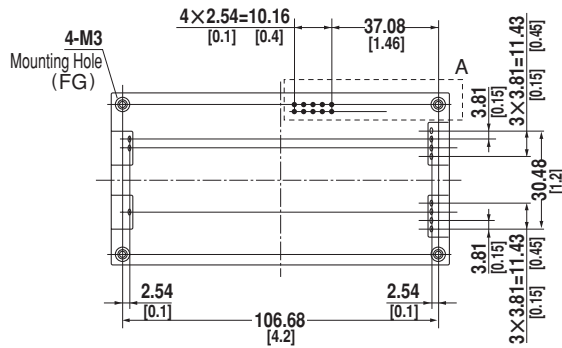
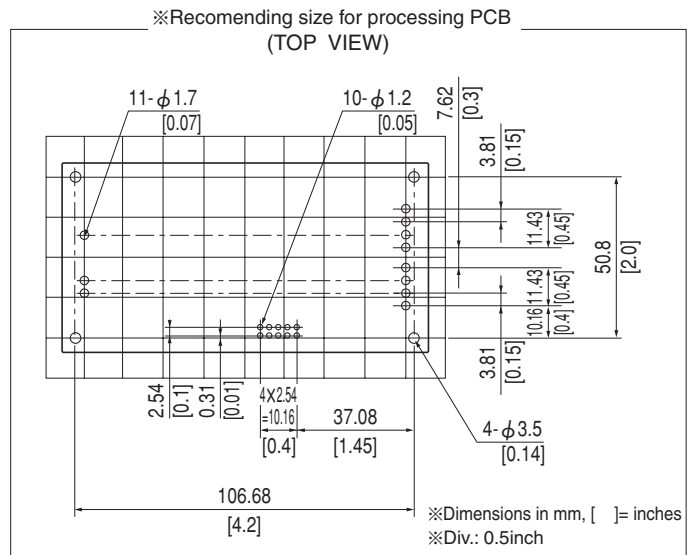
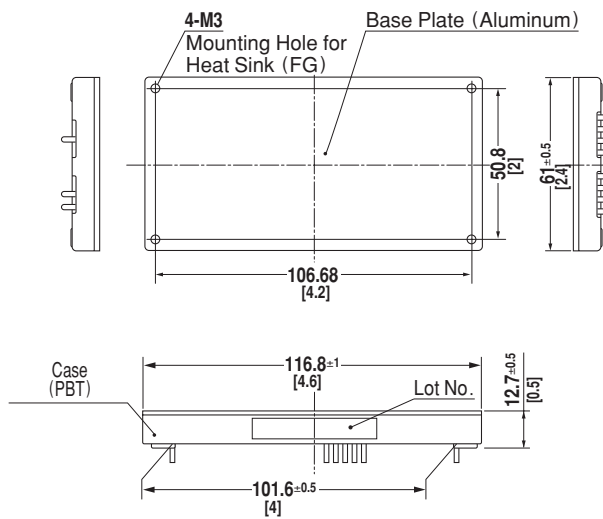
*1 At rated input(DC110V) and rated load.

*2 Ripple and ripple noise is measured by using measuring board with the recommended capacitor Co & the film capacitor 0.1 μF.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN:RM101). Refer to the manual.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

*4 Please consult us in regard to use from -40℃.

External view

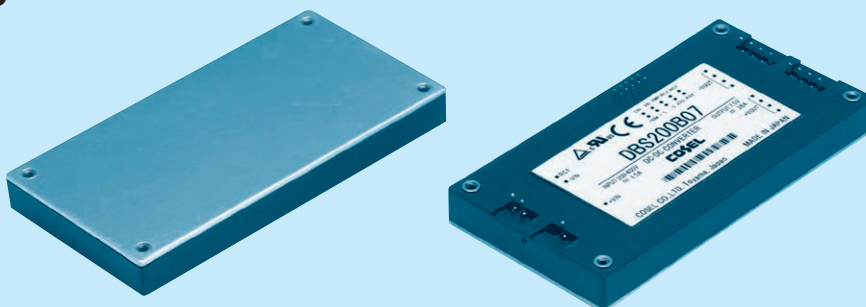


- ※Weight: 150g max
- ※Tolerance: ± 0.3 [± 0.012]
- ※Base Plate: Aluminum
- ※Dimensions in mm, [] = inches
- ※Mounting hole screwing torque: 0.49N·m(5.0kgf·cm)

DBS200B

DB S 200 B 03

① ② ③ ④ ⑤


RoHS


- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
- ⑤ Output voltage

MODEL	DBS200B03	DBS200B05	DBS200B07	DBS200B12
MAX OUTPUT WATTAGE[W]	165	200	210	240
DC OUTPUT	3.3V 50A	5V 40A	7.5V 28A	12V 20A

SPECIFICATIONS

	MODEL	DBS200B03	DBS200B05	DBS200B07	DBS200B12
INPUT	VOLTAGE[V]	DC200 - 400			
	CURRENT[A]	*1 0.75typ	0.86typ	0.87typ	0.99typ
	EFFICIENCY[%]	*1 79typ	83typ	86typ	87typ
OUTPUT	VOLTAGE[V]	3.3	5	7.5	12
	CURRENT[A]	50	40	28	20
	LINE REGULATION[mV]	16max	20max	30max	40max
	LOAD REGULATION[mV]	30max	40max	60max	100max
	RIPPLE[mVp-p]	0 to +85℃ *2 80max	80max	100max	120max
		-20 - 0℃ *2 140max	140max	150max	160max
	RIPPLE NOISE[mVp-p]	0 to +85℃ *2 100max	100max	140max	150max
		-20 - 0℃ *2 150max	150max	160max	180max
	TEMPERATURE REGULATION[mV]	0 to +65℃ 35max	50max	75max	120max
		-20 to +85℃ 60max	85max	130max	200max
	DRIFT[mV]	*3 16max	20max	30max	40max
	START-UP TIME[ms]	200max (DCIN 280V, Io=100%)			
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open), 60 - 110% adjustable by external VR or external voltage			
	OUTPUT VOLTAGE SETTING[V]	3.25 - 3.45	4.90 - 5.20	7.25 - 7.85	11.60 - 12.60
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically			
	OVERVOLTAGE PROTECTION	4.00 - 5.50V	5.75 - 7.00V	8.60 - 10.50V	13.80 - 16.80V
	REMOTE SENSING	Provided			
ISOLATION	REMOTE ON/OFF	Provided (On both side of input and output)			
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)			
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)			
	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)			
ENVIRONMENT	OUTPUT-RC2.RC3	AC100V 1minute, Cutoff current = 100mA, DC100V 10MΩ min (20±15℃)			
	OPERATING TEMP., HUMID. AND ALTITUDE *4	-20 to +85℃ (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max			
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +85℃, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max			
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis			
SAFETY	IMPACT	196.1m/s ² (20G), 11ms once each along X, Y and Z axis			
	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1, EN50178 Complies with DEN-AN and IEC60950-1			
OTHERS	CASE SIZE/WEIGHT	61 × 12.7 × 116.8mm [2.4 × 0.5 × 4.6 inches] (W × H × D) / 150g max			
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)			

*1 At rated input(DC280V) and rated load.

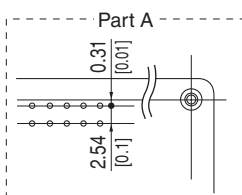
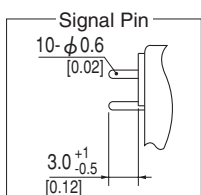
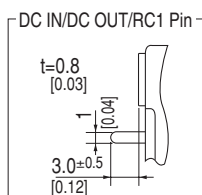
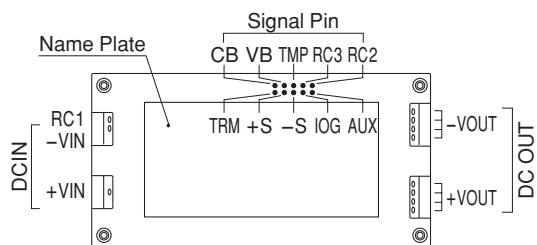
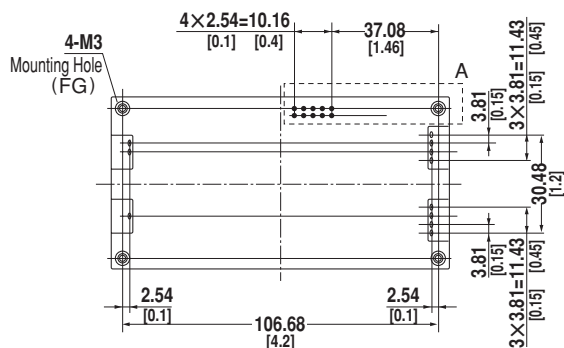
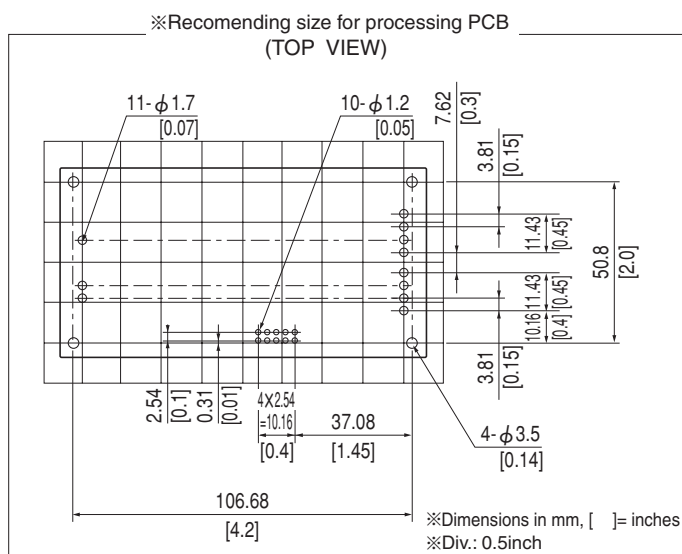
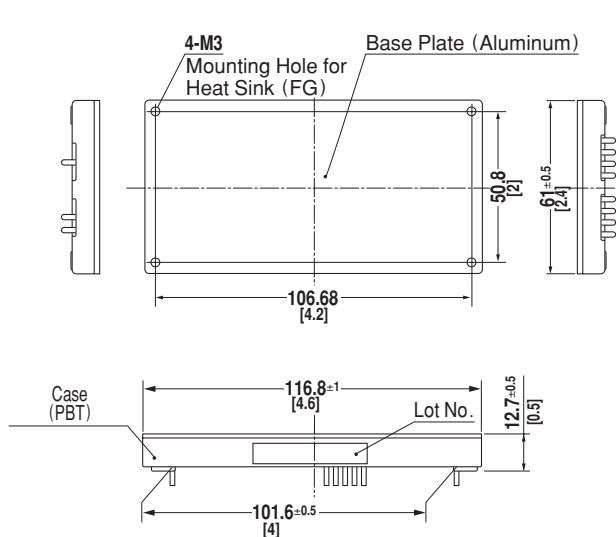
*2 Ripple and ripple noise is measured by using measuring board with the recommended capacitor Co & the film capacitor 0.1μF.

Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN:RM101). Refer to the manual.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

*4 Please consult us in regard to use from -40℃.

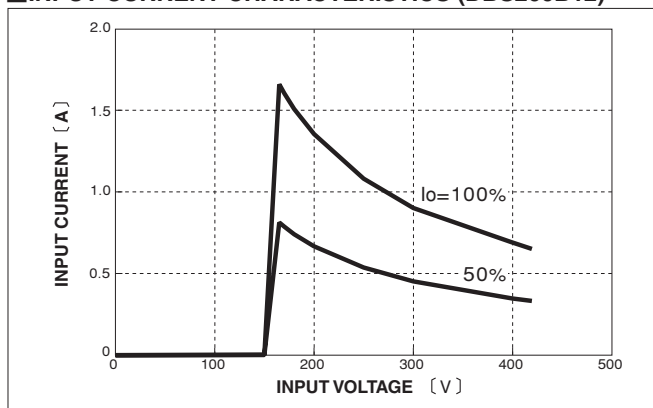
External view



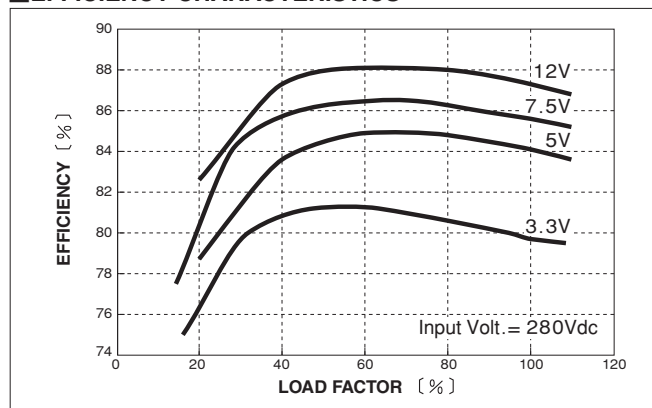
※Weight: 150g max
 ※Tolerance: ± 0.3 [± 0.012]
 ※Base Plate: Aluminum
 ※Dimensions in mm, []= inches
 ※Mounting hole screwing torque: 0.49N·m(5.0kgf·cm)

Performance data

■ INPUT CURRENT CHARACTERISTICS (DBS200B12)



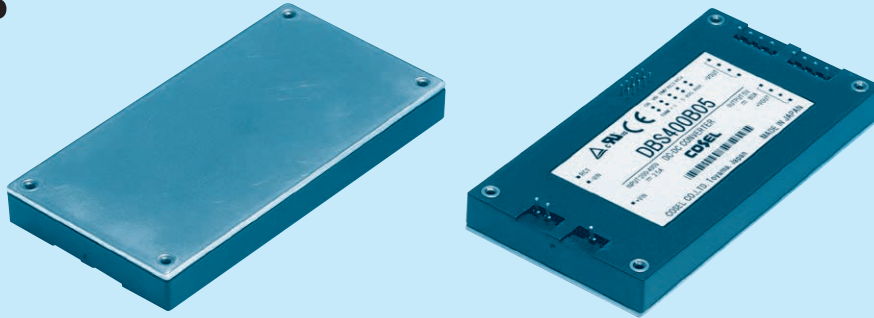
■ EFFICIENCY CHARACTERISTICS



DBS400B

DB S 400 B 03

① ② ③ ④ ⑤



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
B : DC200 - 400V
- ⑤ Output voltage

MODEL	DBS400B03	DBS400B05	DBS400B07	DBS400B12	DBS400B15	DBS400B18	DBS400B24	DBS400B28
MAX OUTPUT WATTAGE[W]	264	400	405	408	405	396	408	406
DC OUTPUT	3.3V 80A	5V 80A	7.5V 54A	12V 34A	15V 27A	18V 22A	24V 17A	28V 14.5A

SPECIFICATIONS

	MODEL	DBS400B03	DBS400B05	DBS400B07	DBS400B12	DBS400B15	DBS400B18	DBS400B24	DBS400B28
INPUT	VOLTAGE[V]	DC200 - 400							
	CURRENT[A]	*1 1.19typ	1.72typ	1.68typ	1.67typ	1.66typ	1.61typ	1.67typ	1.63typ
	EFFICIENCY[%]	*1 79typ	83typ	86typ	87typ	87typ	89typ	87typ	88typ
OUTPUT	VOLTAGE[V]	3.3	5	7.5	12	15	18	24	28
	CURRENT[A]	80	80	54	34	27	22	17	14.5
	LINE REGULATION[mV]	16max	20max	30max	40max	60max	60max	95max	95max
	LOAD REGULATION[mV]	30max	40max	60max	100max	150max	150max	190max	190max
	RIPPLE[mVp-p]	0 to +85°C *2	80max	80max	100max	120max	120max	120max	120max
		-20 - 0°C *2	140max	140max	150max	160max	160max	160max	160max
	RIPPLE NOISE[mVp-p]	0 to +85°C *2	100max	100max	140max	150max	150max	150max	150max
		-20 - 0°C *2	150max	150max	160max	180max	180max	180max	180max
	TEMPERATURE REGULATION[mV]	0 to +65°C	35max	50max	75max	120max	180max	180max	280max
		-20 to +85°C	60max	85max	130max	200max	310max	310max	480max
	DRIFT[mV]	*3	16max	20max	30max	40max	60max	60max	90max
	START-UP TIME[ms]	200max (DCIN 280V, Io=100%)							
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE	Fixed (TRM pin open), 60 - 110% adjustable by external VR or external voltage							
	OUTPUT VOLTAGE SETTING[V]	3.25 - 3.45	4.90 - 5.20	7.25 - 7.85	11.60 - 12.60	14.40 - 15.60	17.28 - 18.72	23.04 - 24.96	26.88 - 29.12
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	OVERVOLTAGE PROTECTION	4.00 - 5.50V	5.75 - 7.00V	8.60 - 10.50V	13.80 - 16.80V	17.25 - 21.00V	20.70 - 25.20V	27.60 - 33.60V	32.20 - 39.20V
	REMOTE SENSING	Provided							
ISOLATION	REMOTE ON/OFF	Provided (On both side of input and output)							
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15°C)							
	OUTPUT-RC2.RC3	AC100V 1minute, Cutoff current = 100mA, DC100V 10MΩ min (20±15°C)							
ENVIRONMENT	OPERATING TEMP.HUMID.AND ALTITUDE *4	-20 to +85°C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max							
	STORAGE TEMP.HUMID.AND ALTITUDE	-40 to +85°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max							
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis							
	IMPACT	196.1m/s ² (20G), 11ms once each along X, Y and Z axis							
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1, EN50178 Complies with DEN-AN and IEC60950-1							
OTHERS	CASE SIZE/WEIGHT	61 × 12.7 × 116.8mm [2.4 × 0.5 × 4.6 inches] (W×H×D) / 180g max							
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)							

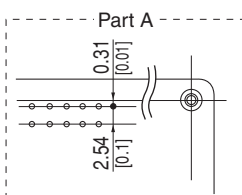
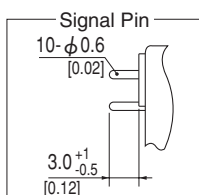
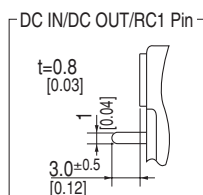
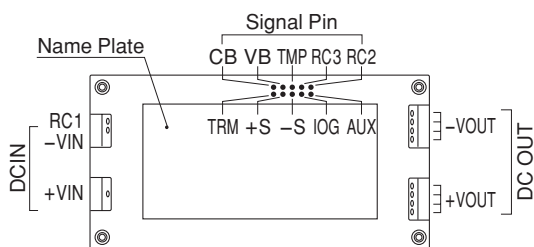
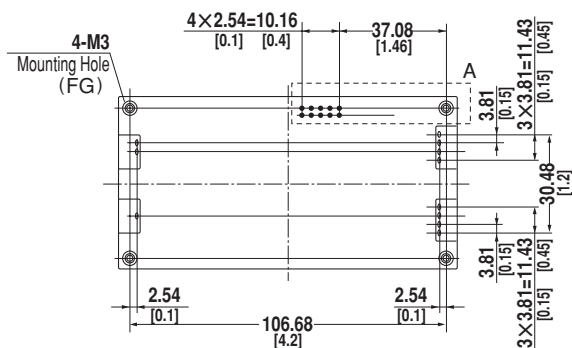
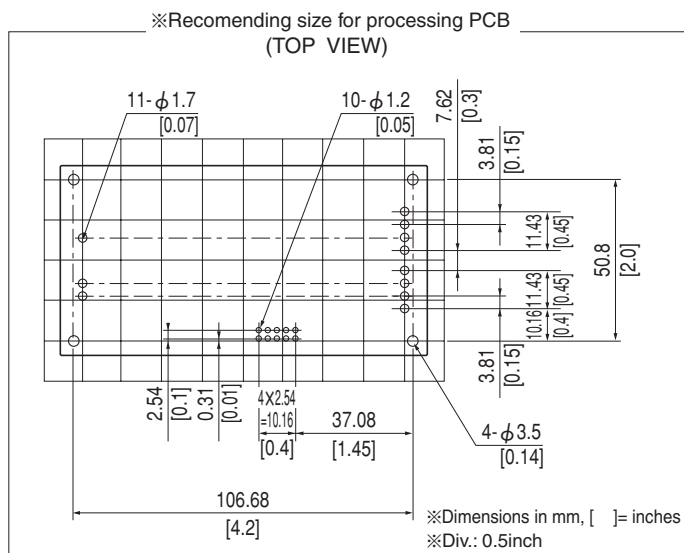
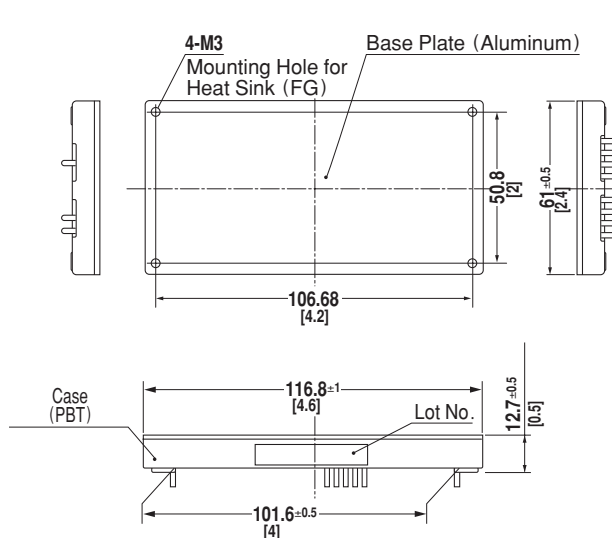
*1 At rated input(DC280V) and rated load.

*2 Ripple and ripple noise is measured by using measuring board with the recommended capacitor Co & the film capacitor 0.1μF.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN:RM101). Refer to the manual.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*4 Please consult us in regard to use from -40°C.

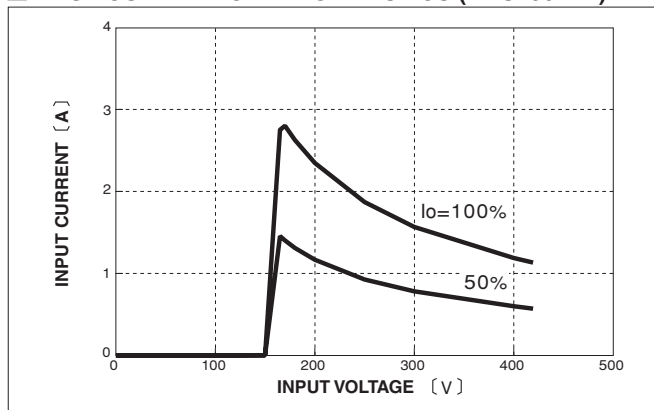
External view



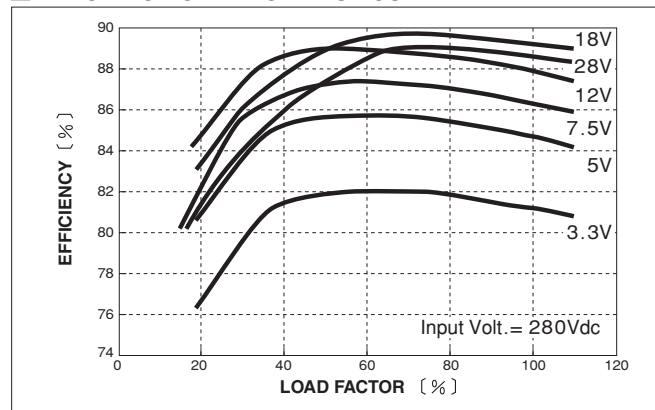
- ※Weight: 180g max
- ※Tolerance: ± 0.3 [± 0.012]
- ※Base Plate: Aluminum
- ※Dimensions in mm, []= inches
- ※Mounting hole screwing torque: $0.49\text{N} \cdot \text{m}$ (5.0kgf · cm)

Performance data

■ INPUT CURRENT CHARACTERISTICS (DBS400B12)



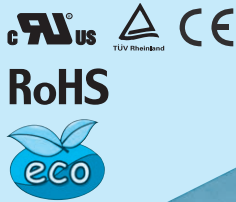
■ EFFICIENCY CHARACTERISTICS



DBS700B

DB S 700 B 28 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Input voltage
B : DC200 - 400V
- ⑤ Output voltage
- ⑥ Optional
T : with Mounting hole
(φ 3.4 thru)

MODEL	DBS700B12	DBS700B24	DBS700B28	DBS700B36	DBS700B48
MAX OUTPUT WATTAGE[W]	696	696	700	702	696
DC OUTPUT	12V 58A	24V 29A	28V 25A	36V 19.5A	48V 14.5A

SPECIFICATIONS

	MODEL	DBS700B12	DBS700B24	DBS700B28	DBS700B36	DBS700B48
INPUT	VOLTAGE[V]	DC200 - 400				
	CURRENT[A]	*1 2.76typ	2.76typ	2.76typ	2.76typ	2.73typ
	EFFICIENCY[%]	*1 90.0typ	90.0typ	90.5typ	90.0typ	91.0typ
OUTPUT	VOLTAGE[V]	12	24	28	36	48
	CURRENT[A]	58	29	25	19.5	14.5
	LINE REGULATION[mV]	40max	95max	95max	95max	120max
	LOAD REGULATION[mV]	100max	190max	190max	200max	240max
	RIPPLE[mVp-p]	0 to +100°C *2 120max	120max	120max	150max	200max
		-40 to 0°C *2 160max	160max	160max	200max	250max
	RIPPLE NOISE[mVp-p]	0 to +100°C *2 150max	150max	150max	200max	250max
		-40 to 0°C *2 180max	180max	180max	240max	400max
	TEMPERATURE REGULATION[mV]	0 to +65°C 120max	280max	280max	360max	480max
		-40 to +100°C 200max	480max	480max	680max	960max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV]	*3 40max	90max	90max	120max	180max
	START-UP TIME[ms]	200max (DCIN 280V, Io=100%)				
	OUTPUT VOLTAGE ADJUSTMENT RANGE *4	Fixed (TRM pin open), 60 - 110% adjustable by external VR or external voltage				
	OUTPUT VOLTAGE SETTING[V]	11.64 - 12.36	23.28 - 24.72	27.16 - 28.84	34.92 - 37.08	46.56 - 49.44
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically				
ISOLATION	OVERVOLTAGE PROTECTION	14.40 - 16.80V	27.60 - 33.60V	32.20 - 39.20V	41.40 - 50.40V	55.20 - 63.00V
	REMOTE SENSING	Provided				
	REMOTE ON/OFF	Provided (On both side of input and output)				
ENVIRONMENT	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)				
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)				
	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15°C)				
	OUTPUT-RC2,RC3	AC100V 1minute, Cutoff current = 100mA, DC100V 10MΩ min (20±15°C)				
SAFETY	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100°C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max				
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max				
	VIBRATION	10 - 55Hz, 49.0m/s ² , 3minutes period, 60minutes each along X, Y and Z axis				
	IMPACT	196.1m/s ² , 11ms once each along X, Y and Z axis				
OTHERS	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1, EN50178				
	CASE SIZE/WEIGHT	61 × 12.7 × 116.8mm [2.4 × 0.5 × 4.6 inches] (W × H × D) / 180g max				
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)				

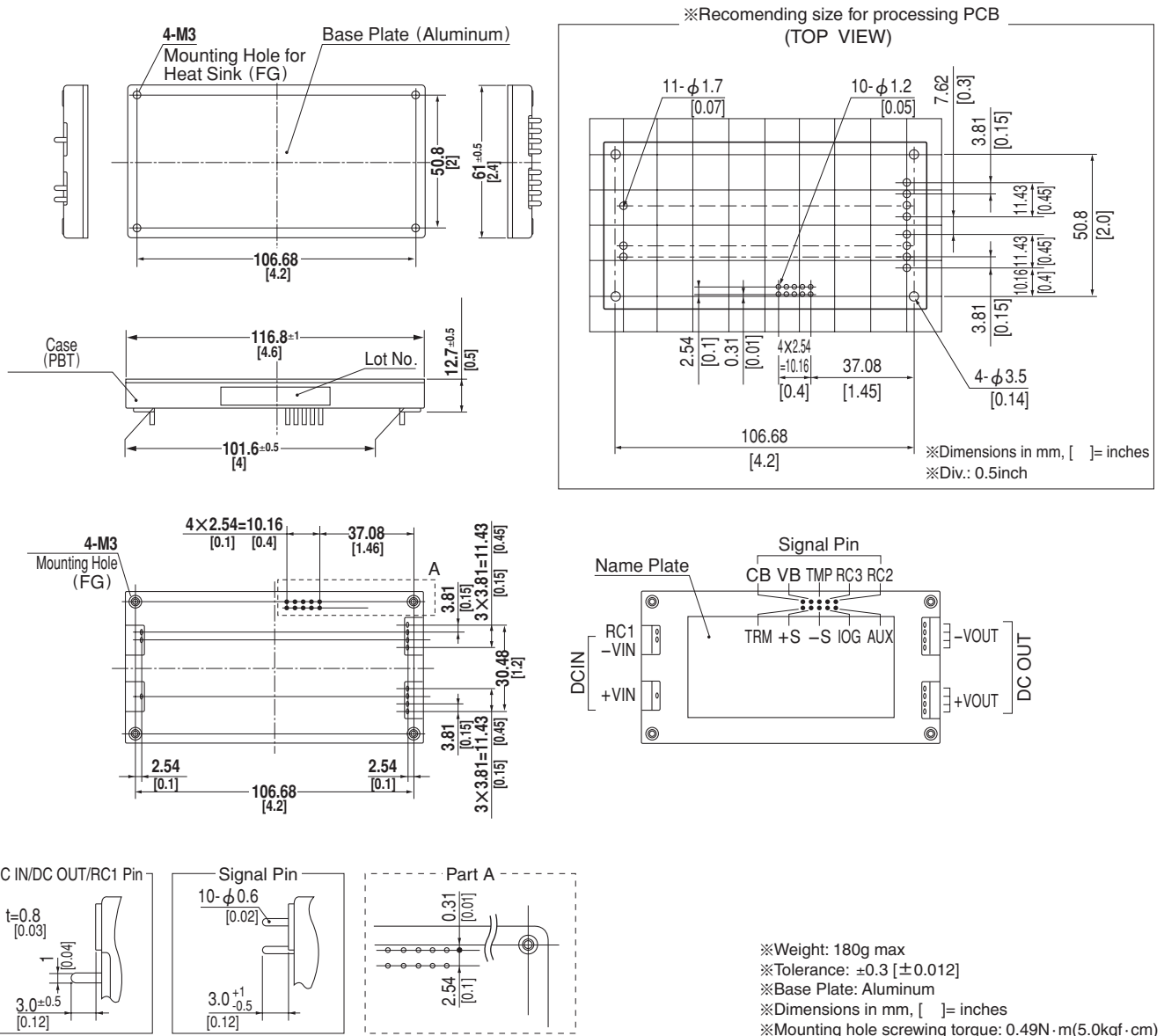
*1 At rated input(DC280V) and rated load.

*2 Ripple and ripple noise is measured by using measuring board with the recommended capacitor Co & the film capacitor 0.1μF. Refer to the manual.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

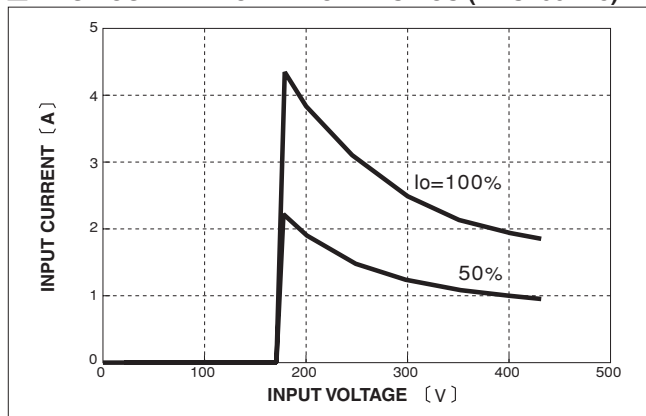
*4 Refer to the manual for the input range.

External view

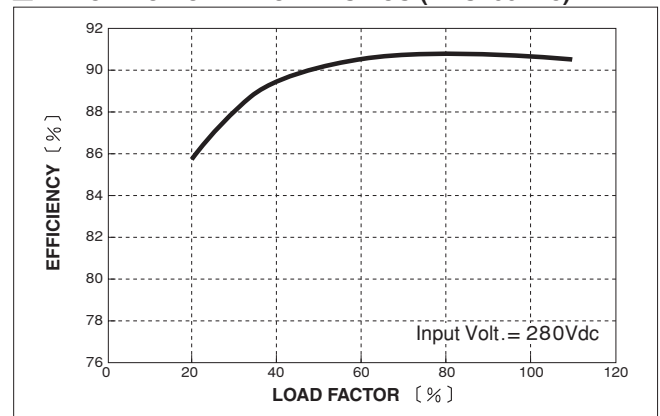


Performance data

INPUT CURRENT CHARACTERISTICS (DBS700B28)



EFFICIENCY CHARACTERISTICS (DBS700B28)



Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
DBS100A	Forward converter	370	1.10 *1	-	-	Aluminum	Yes		Yes	Yes
DBS150A	Forward converter	370	1.59 *1	-	-	Aluminum	Yes		Yes	Yes
DBS200B	Forward converter	370	0.99 *1	-	-	Aluminum	Yes		Yes	Yes
DBS400B	Forward converter	370	1.72 *1	-	-	Aluminum	Yes		Yes	Yes
DBS700B	Forward converter	381	2.76 *1	-	-	Aluminum	Yes		Yes	Yes

*1 The value of input current is at rated input and rated load.

1 Pin Connection DBS-12**2 Connection for Standard Use DBS-12****3 Wiring Input/Output Pin DBS-12**

- 3.1 Wiring input pin DBS-12
- 3.2 Wiring output pin DBS-13

4 Function DBS-14

- 4.1 Overcurrent protection DBS-14
- 4.2 Overvoltage protection DBS-14
- 4.3 Thermal detection/Thermal protection DBS-14
- 4.4 Inverter operation monitor DBS-14
- 4.5 Remote ON/OFF DBS-15
- 4.6 Remote sensing DBS-15
- 4.7 Adjustable voltage range DBS-16
- 4.8 Isolation DBS-16

5 Series and Parallel Operation DBS-17

- 5.1 Series operation DBS-17
- 5.2 Parallel operation/Master-slave operation DBS-17
- 5.3 N+1 redundant operation DBS-17

6 Implementation · Mounting Method DBS-18

- 6.1 Mounting method DBS-18
- 6.2 Stress onto the pins DBS-18
- 6.3 Cleaning DBS-18
- 6.4 Soldering DBS-18
- 6.5 Derating DBS-18

DBS

1 Pin Connection

Table 1.1 Pin Connection and function

NO.	Pin Connection	Function
①	+VIN	+DC input
②	-VIN	-DC input
③	RC1	Remote ON/OFF(Input side)
④ ⑤ ⑥ ⑦	+VOUT	+DC output
⑧ ⑨ ⑩ ⑪	-VOUT	-DC output
⑫	CB	Current balance
⑬	VB	Voltage balance
⑭	TMP	Thermal detection signal
⑮	RC3	Remote ON/OFF(output side)
⑯	RC2	
⑰	TRM	Adjustment of output voltage
⑱	+S	+Remote sensing
⑲	-S	-Remote sensing
⑳	I OG	Inverter operation monitor
㉑	AUX	Auxiliary power supply
—	FG	Mounting hole(FG)

No.	Pin Connection	Reference
①	+VIN	3.1 "Wiring input pin"
②	-VIN	
③	RC1	4.5 "Remote ON/OFF"
④ ⑤ ⑥ ⑦	+VOUT	3.2 "Wiring output pin"
⑧ ⑨ ⑩ ⑪	-VOUT	
⑫	CB	5.2 "Parallel operation/Master-slave operation"
⑬	VB	5.2 "Parallel operation/Master-slave operation"
⑭	TMP	4.3 "Thermal detection/Thermal protection"
⑮	RC3	4.5 "Remote ON/OFF"
⑯	RC2	4.7 "Adjustable voltage range"
⑰	TRM	4.7 "Adjustable voltage range"
⑱	+S	4.6 "Remote sensing"
⑲	-S	4.6 "Remote sensing"
⑳	I OG	4.4 "Inverter operation monitor"
㉑	AUX	4.5 "Remote ON/OFF"
—	FG	3.1 "Wiring input pin"

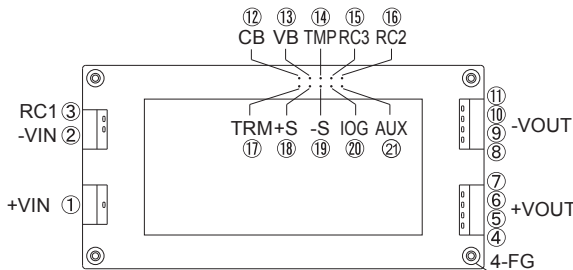


Fig.1.1 Pin connection(bottom view)

2 Connection for Standard Use

■ In order to use the power supply, it is necessary to wire as shown in Fig.2.1 and external components in table2.1.

■ Short the following pins to turn on the power supply.

-VIN↔RC1, +VOUT↔+S, -VOUT↔-S

〔Reference: 4.5 "Remote ON/OFF"
4.6 "Remote sensing"〕

■ The DBS Series handles only the DC input.

Avoid applying AC input directly.

It will damage the power supply.

■ Operate with the conduction cooling(e.g. heat radiation from the aluminum base plate to the attached heat sink).

〔Reference: 6.5 "Derating"〕

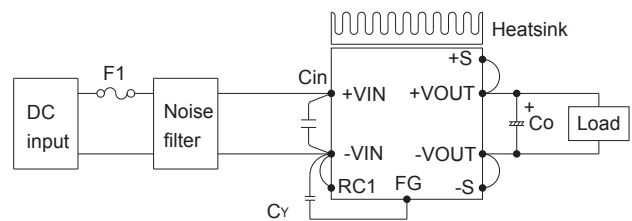


Fig.2.1 Connection for standard use

Table 2.1 External components

No.	Symbol	component	Reference
1	F1	Input fuse	3.1 (1) "External fuse"
2	Cv	Primary decoupling capacitor	3.1 (2) "Noise filter/Decoupling capacitor"
3	—	Noise filter	
4	Cin	External capacitor on the input side	3.1 (3) "External capacitor on the input side"
5	Co	External capacitor on the output side	3.2 "Wiring output pin"
6	—	Heatsink	6.5 "Derating"

3 Wiring Input/Output Pin

3.1 Wiring input pin

(1) External fuse

■ Fuse is not built-in on input side. In order to protect the unit, install the normal blow type fuse on input side.

■ When the input voltage from a front end unit is supplied to multiple units, install the normal blow type fuse in each unit.

Table 3.1 Recommended fuse(Normal-blow type)

Model	DBS100A / 150A	DBS200B	DBS400B	DBS700B
Rated current	5A	3A	5A	10A

(2) Noise filter/Decoupling capacitor

- Install an external noise filter and a decoupling capacitor C_V for low line-noise and for stable operation of the power supply.
- Install a correspondence filter, if a noise standard meeting is required or if the surge voltage may be applied to the unit.
- Install a primary decoupling capacitor C_V , with more than 470pF, near the input pins(within 50mm from the pins).
- When the total capacitance of the primary decoupling capacitor is more than 8800pF, the nominal value in the specification may not be met by the Hi-Pot test between input and output.
In this case, it is that a capacitor should be installed between output and FG.

(3) External capacitor on the input side

- Install an external capacitor C_{in} between +VIN and -VIN input pins for low line-noise and for stable operation of the power supply.

DBS100A / 150A:more than 47 μ F
DBS200B:more than 0.1 μ F
DBS400B / 700B:more than 0.33 μ F

- When the line impedance is high or the input voltage rise quickly at start-up(less than 10 μ s), install a capacitor C_{in} between +VIN and -VIN input pins(within 50mm from pins).

DBS200B:more than 22 μ F
DBS400B / 700B:more than 47 μ F

(4) Input voltage rang/Input current range

- The specification of input ripple voltage is shown as below.

Ripple voltage DBS100A / 150A:less than 10Vp-p
DBS200B / 400B / 700B:less than 20Vp-p
- Make sure that the voltage fluctuation, including the ripple voltage, will not exceed the input voltage range.
- Use a front end unit with enough power, considering the start-up current I_p of this unit.

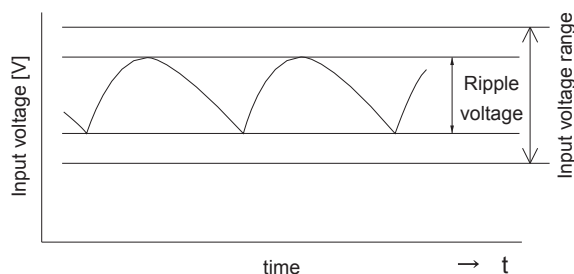


Fig.3.1 Input voltage ripple

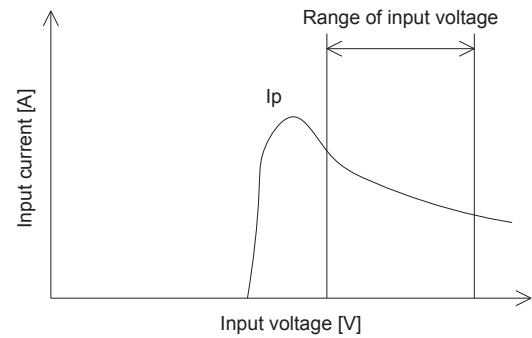


Fig.3.2 Input current characteristics

(5) Operation with AC input

- The DBS series handles only for the DC input.
A front end unit(AC/DC unit) is required when the DBS series is operated with AC input.

(6) Reverse input voltage protection

- Avoid the reverse polarity input voltage. It will break the power supply.
It is possible to protect the unit from the reverse input voltage by installing an external diode.

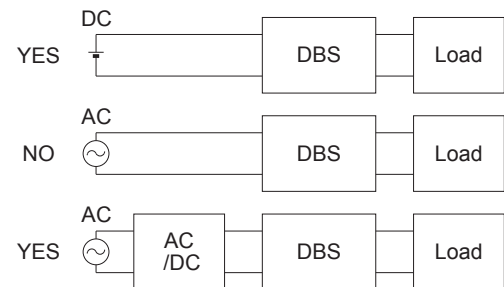


Fig.3.3 Use with AC input

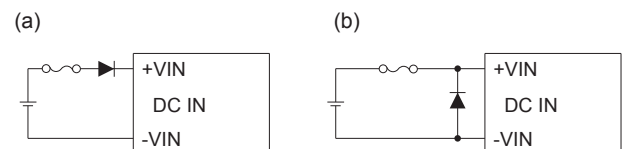


Fig.3.4 Reverse input voltage protection

3.2 Wiring output pin

- Install an external capacitor C_o between +VOUT and -VOUT pins for stable operation of the power supply.
Recommended capacitance of C_o is shown in Table 3.2.
- Select the high frequency type capacitor. Output ripple and start-up waveform may be influenced by ESR · ESL of the capacitor and the wiring impedance.
- Install a capacitor C_o near the output pins(within 100mm from the pins).

Table 3.2 Recommended capacitance Co [μF]

Model Output voltage (V)	DBS100A DBS150A	DBS200B	DBS400B	DBS700B
3.3	—	2200	6800	—
5	2200	2200	4700	—
7.5	—	2200	4700	—
12	1000	1000	2200	2200★
13.8	1000	—	—	—
15	1000	—	2200	—
18	—	—	2200	—
24	470	—	820	2200★
28	—	—	820	2200★
36	—	—	—	2200★
48	—	—	—	1000★

★ When using power supply at -20°C or less, the recommended capacitance becomes 3 times.

■ The specified ripple and ripple noise are measured by the method introduced in Fig.3.5.

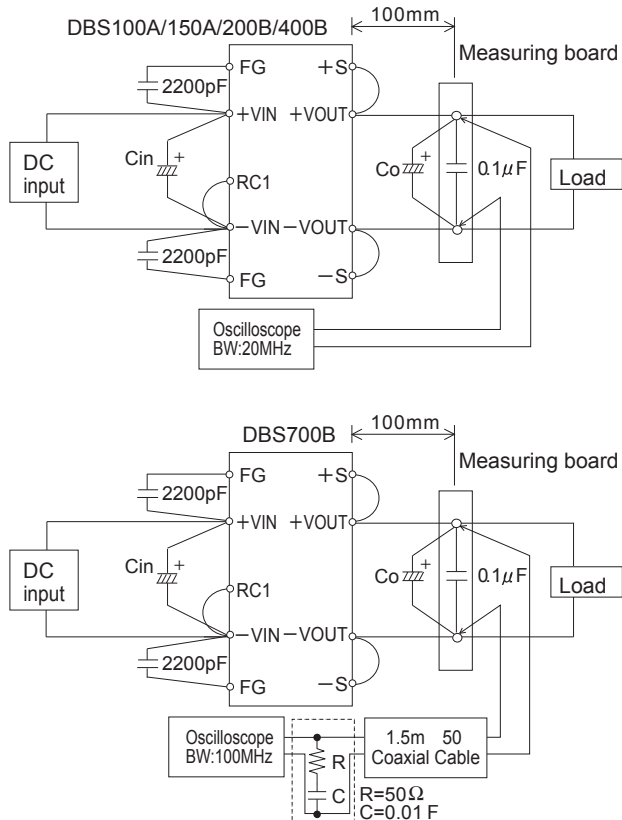


Fig.3.5 Method of Measuring Output Ripple and Ripple Noise

4 Function

4.1 Overcurrent protection

■ Overcurrent protection is built-in and comes into effect at over 105% of the rated current.

Overcurrent protection prevents the unit from short circuit and overcurrent condition. The unit automatically recovers when the fault condition is cleared.

■ When the output voltage drops at overcurrent, the average output current is reduced by intermittent operation of power supply.

4.2 Overvoltage protection

■ The overvoltage protection circuit is built-in. The DC input should be shut down if overvoltage protection is in operation. The minimum interval of DC recycling for recovery is for 2 to 3 minutes(★).

★ The recovery time varies depending on input voltage and input capacity.

Remarks:

Please note that devices inside the power supply might fail when voltage more than rated output voltage is applied to output terminal of the power supply. This could happen when the customer tests the overvoltage performance of the unit.

4.3 Thermal detection/Thermal protection

■ Thermal detection(TMP) and protection circuit are built-in.

■ When overheat is detected, thermal detection signal(TMP) turns "L" from "H".

TMP circuit is designed as shown in Fig.4.1, and specification is shown as in Table 4.1.

■ When overheating continues after detecting the TMP signal, the output will be shut down by the thermal protection circuit.

When this function comes into effect, input voltage should be shut off, and eliminate all possible causes of overheat condition and lower the temperature of the unit to the normal level.

4.4 Inverter operation monitor

■ By using the inverter operation monitor(IOG), malfunction of the inverter can be monitored.

When inverter operation is in following mode ① or ②, IOG signal turns "H" from "L" within 1 second.

IOG circuit is designed as shown in Fig.4.1 and specification is shown in Table 4.1.

① Malfunction of inverter.

② The output voltage drops by 60% or less of the rated voltage.

③ When output wattage is decreased radically to less than 10% of rated wattage.

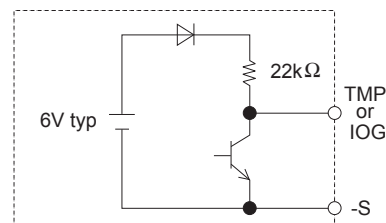


Fig.4.1 TMP, IOG circuit

Table 4.1 Specification of TMP, IOG

No.	Item	TMP	IOG
1	Function	Normal operation "H"	Normal operation "L"
		Overheat detection "L"	Malfunction of inverter "H"
2	Base pin	-S	
3	Level voltage "L"	0.5Vmax at 5mA	
4	Level voltage "H"	5V typ	
5	Maximum sink current	10mA max	
6	Maximum applicable voltage	35V max	

4.5 Remote ON/OFF

■ Remote ON/OFF circuit is built-in on both side of input(RC1) and output(RC2 · RC3).

Output can be controlled by either circuit.

(1) Input side remote ON/OFF(RC1)

■ The ground pin of input side remote ON/OFF circuit is "-VIN" pin.

Between RC1 and -VIN: Output voltage is ON at "Low" level or short circuit(0 - 1.0V).

Between RC1 and -VIN: Output voltage is OFF at "High" level or open circuit(3.5 - 7.0V).

When RC1 is "Low" level, fan out current is 0.3mA typ. When Vcc is applied, use $3.5 \leq V_{cc} \leq 7V$.

When remote ON/OFF function is not used, please short between RC1 and -VIN.

■ When the DPF · DPG series(Power factor & harmonic corrector module) is used as a front end unit, connect between RC1 pin and ENA pin on DPF · DPG for the start-up time of the DBS200B/400B/700B control. Please contact us for details.

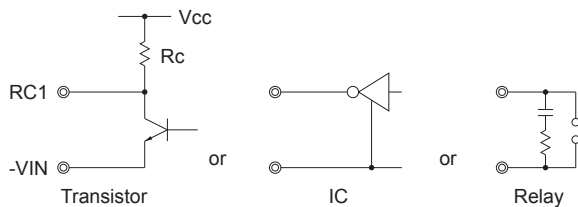


Fig.4.2 RC1 connection example

(2) Output side remote ON/OFF(RC2 · RC3)

Table 4.2 Specification of output side remote ON/OFF(RC2 · RC3)

No.	Item	RC2 · RC3		
1	Wiring method	Fig.4.3 (a)	Fig.4.3 (b)	Fig.4.3 (c)
2	Function	Power ON "H"	Power ON "H"	Power ON "L"
3	Base pin	RC2	-S	-S and RC2
4	Power ON	Open (0.1mA max)	Short (0.5V max)	
5	Power OFF	Short (3mA min)	Open (0.1mA max)	

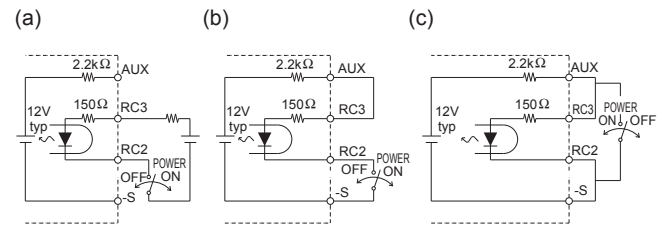


Fig.4.3 RC2 · RC3 connection example

■ Make sure that sink current of output side remote ON/OFF circuit should be less than 12mA.

(3) Auxiliary power supply for remote ON/OFF(AUX)

■ AUX is built in for operating the output side remote ON/OFF (RC2 · RC3).

If AUX is not used for RC2 · RC3, AUX can be used for IOG or TMP signal output by opto coupler.

■ Short protection resistance(2.2kΩ) is built in.

Output voltage decreases as the output current increases.

(AUX voltage at open circuit: 15V max)

4.6 Remote sensing

(1) When the remote sensing function is not in use

■ When the remote sensing function is not in use, it is necessary to confirm that pins are shorted between +S & +VOUT and between -S & -VOUT.

■ Wire between +S & +VOUT and between -S & -VOUT as short as possible.

Loop wiring should be avoided.

This power supply might become unstable by the noise coming from poor wiring.

(2) When the remote sensing function is in use

■ Twisted-pair wire or shield wire should be used for sensing wire.

■ Thick wire should be used for wiring between the power supply and a load.

Line drop should be less than 0.5V.

Voltage between +VOUT and -VOUT should remain within the output voltage adjustment range.

■ If the sensing patterns are short, heavy-current is drawn and the pattern may be damaged.

The pattern disconnection can be prevented by installing the protection parts as close as a load.

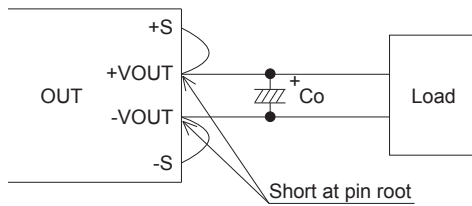


Fig.4.4 Connection when the remote sensing is not in use

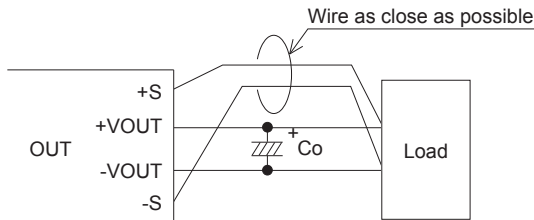


Fig.4.5 Connection when the remote sensing is in use

4.7 Adjustable voltage range

■ Output voltage is adjustable by the external potentiometer or by applied voltage externally.

The adjustable range is 60 - 110% of the rated output voltage.

■ When the output voltage adjustment is used, note that the over-voltage protection circuit operates when the output voltage sets too high.

(1) Adjusting method by external resistor

■ By connecting the external potentiometer (VR1) and resistors (R1, R2), output voltage becomes adjustable, as shown in Fig.4.6, recommended external parts are shown in Table 4.3.

■ The wiring to the potentiometer should be as short as possible. The temperature coefficient becomes worse, depending on the type of a resistor and potentiometer. Following parts are recommended for the power supply.

Resistor Metal film type, coefficient of less than $\pm 100\text{ppm}/^\circ\text{C}$

Potentiometer .. Cermet type, coefficient of less than $\pm 300\text{ppm}/^\circ\text{C}$

■ When the output voltage adjustment is not used, open the TRM pin and VB pin respectively.

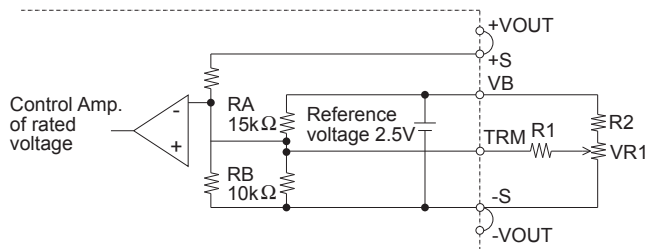


Fig.4.6 Output voltage control circuit

Table 4.3 Recommended value of external potentiometer & resistor

No.	Adjustable range [%]	Number of unit	External parts value [Ω]		
			VR1	R1	R2
1	± 5	Single	5k	75k	1k
2		2sets		36k	
3		3sets		24k	
4	± 10	Single	5k	36k	910
5		2sets		18k	
6		3sets		12k	

(2) Adjusting method by applying external voltage

■ By applying the voltage externally at TRM, output voltage become adjustable.

■ Output voltage is calculated by the following equation.

(Output voltage)

$$= (\text{Applied voltage externally}) \times (\text{Rated output voltage})$$

■ The output adjustment range for DBS700B is shown in Fig.4.7.

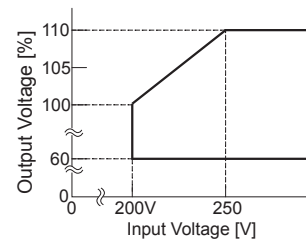


Fig.4.7 DBS700B Output Voltage Adjustment Range

4.8 Isolation

■ For a receiving inspection, such as Hi-Pot test, gradually increase(decrease) the voltage for a start(shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

5 Series and Parallel Operation

5.1 Series operation

■ Series operation is available by connecting the outputs of two or more power supplies, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

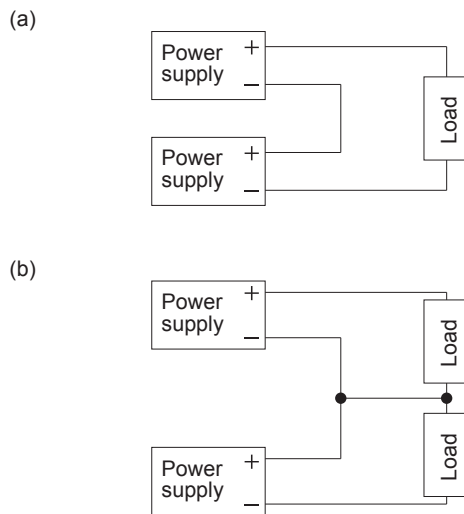


Fig.5.1 Examples of series operation

5.2 Parallel operation/Master-slave operation

■ Parallel operation is available by connecting the units as shown in Fig.5.2.

■ As variance of output current drew from each power supply is maximum 10%, the total output current must not exceed the value determined by the following equation.

$$\begin{aligned} & \text{(Output current in parallel operation)} \\ & = (\text{the rated current per unit}) \times (\text{number of unit}) \times 0.9 \end{aligned}$$

When the number of units in parallel operation increases, input current increase at the same time. Adequate wiring design for input circuitry is required, such as circuit pattern, wiring and current capacity for equipment.

In parallel operation, the maximum operative number of units is 11.

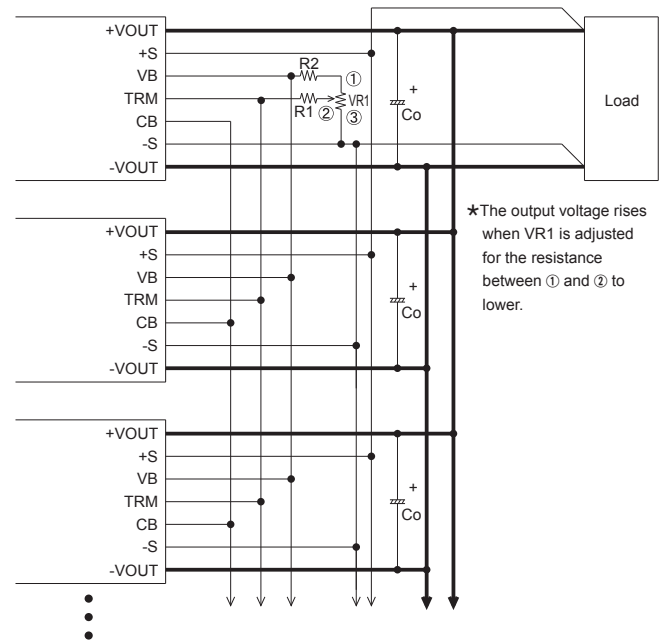


Fig.5.2 Examples of parallel operation

■ When output voltage adjustment is not in use. TRM wiring, R1, R2 and VR are not necessary.

■ Thick wire should be used for wiring between the power supply and load, and line drop should be less than 0.3V.

■ When the output-line impedance is high, the power supply is become unstable.

Use same length and thickness(width) wire(pattern) for the current balance improvement.

■ Connect each input pin for the lowest possible impedance.

■ When the number of the units in parallel operation increases, input current increases. Adequate wiring design for input circuitry such as circuit pattern, wiring and current for equipment is required.

■ Connect the sensing line and the power line by one point after connecting each power supply's sensing pins(+S, -S). In multiple operation, sensing wires should be connected between each units for the master connection to a load.

■ Output current should be 10% or more of the total of the rated output current in parallel operation. If less than 10%, the IOG signal might become unstable, and output voltage slightly increasing (max5%).

■ IOG signal might be unstable for one second when the units are turned on in parallel operation.

5.3 N+1 redundant operation

■ It is possible to set N+1 redundant operation for improving reliability of power supply system.

■ Purpose of redundant operation is to ensure stable operation in the event of single power supply failure.

Since extra power supply is reserved for the failure condition, so total power of redundant operation is equal to N-1.

6 Implementation · Mounting Method

6.1 Mounting method

- The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Aluminum base plate temperature around each power supply should not exceed the temperature range shown in derating curve.
- Avoid placing the DC input line pattern lay out underneath the unit, it will increase the line conducted noise. Make sure to leave an ample distance between the line pattern lay out and the unit. Also avoid placing the DC output line pattern underneath the unit because it may increase the output noise. Lay out the pattern away from the unit.
- High-frequency noise radiates directly from the unit to the atmosphere. Therefore, design the shield pattern on the printed circuit board and connect its one to FG.
The shield pattern prevents noise radiation.

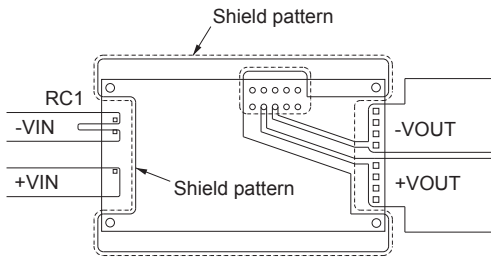


Fig.6.1 Shield pattern lay out(bottom view)

6.2 Stress onto the pins

- When too much stress is applied to the pins of the power supply, the internal connection may be weakened.
As shown in Fig.6.2 avoid applying stress of more than 29.4N(3kgf) on the input pins/output pins(A part) and more than 9.8N(1kgf) to the signal pins(B part).
- The pins are soldered on PCB internally, therefore, do not pull or bend them with abnormal forces.
- Mounting hole diameter of PCB should be 3.5mm to reduce the stress onto the pins.
- Fix the unit on PCB(fixing fittings) by screws to reduce the stress onto the pins. Be sure to mount the unit first, then solder the unit.

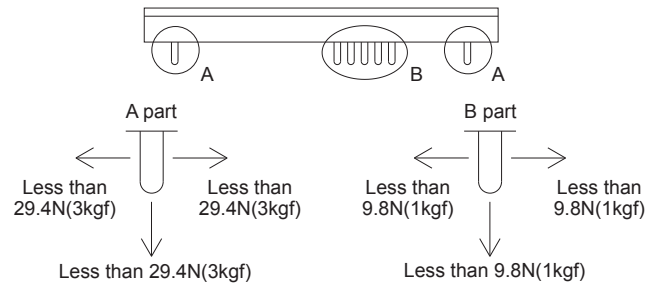


Fig.6.2 Stress onto the pins

6.3 Cleaning

- Clean the product with a brush. Prevent liquid from getting into the product.
Do not soak the product into liquid.
- Do not stick solvent to a name plate or a resin case.
(If solvent sticks to a name plate or a resin case, it will cause to change the color of the case or to fade letters on name plate away.)
- After cleaning, dry them enough.

6.4 Soldering

- Flow soldering : 260°C less than 15 seconds.
- Soldering iron
DC IN/DC OUT/RC1 : 450°C less than 5 seconds.
Signal pins : 350°C less than 3 seconds(less than 20w).

6.5 Derating

- Use with the conduction cooling(e.g. heat radiation by conduction from the aluminum base plate to the attached heat sink).
Fig.6.3 shows the derating curve based on the aluminum base plate temperature. In the hatched area, the specification of ripple and ripple noise is different from other areas.
- It is necessary to note thermal fatigue life by power cycle.
Please reduce the temperature fluctuation range as much as possible when the up and down of temperature are frequently generated.

Contact for more information on cooling methods.

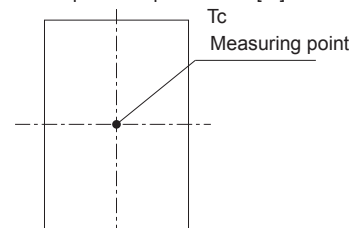
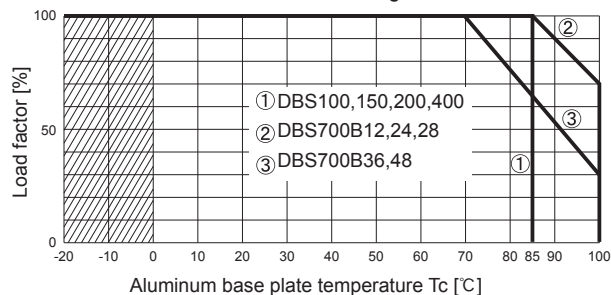
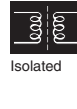
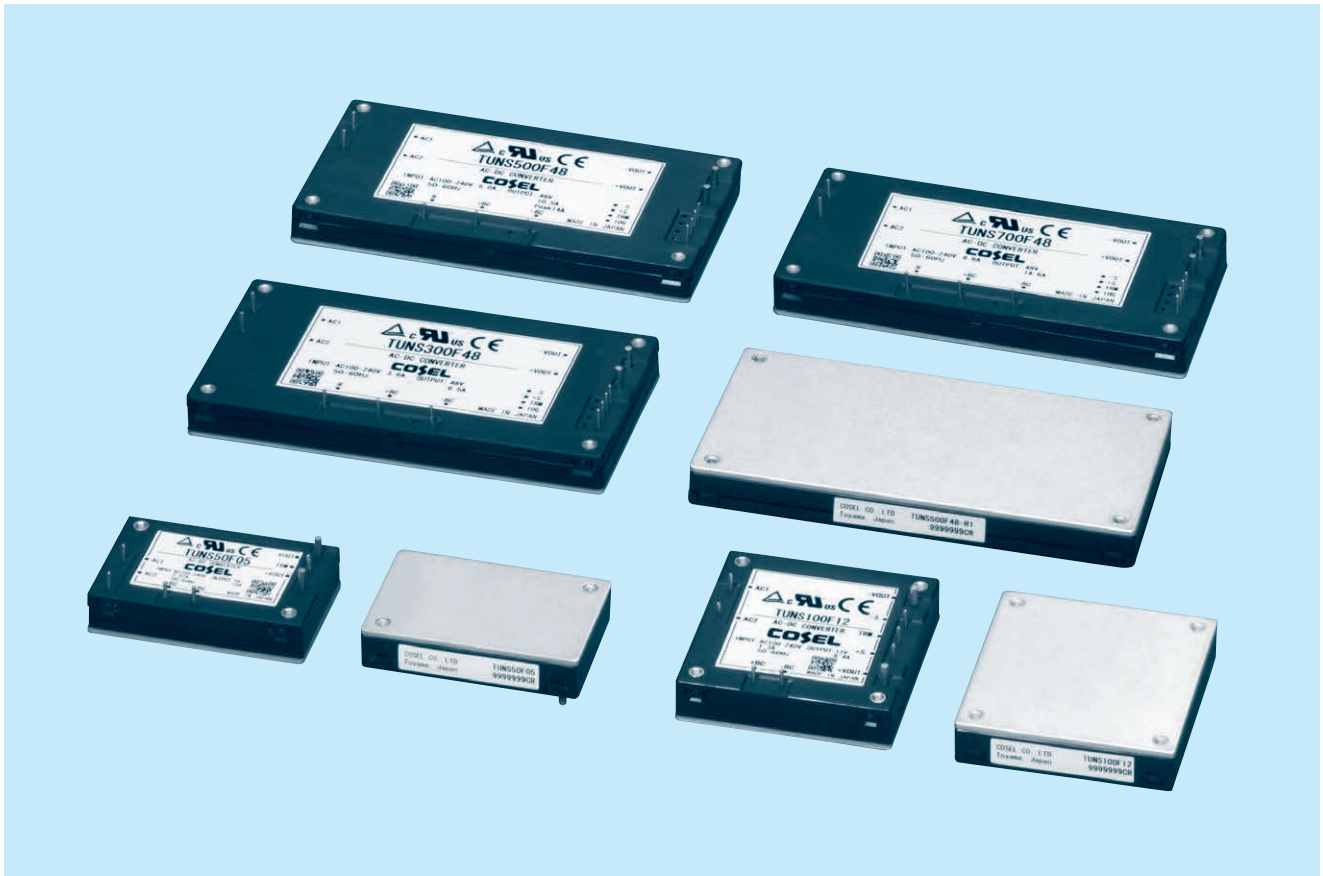


Fig.6.3 Derating curve



TUNS-series



TUNS

Feature

- AC-DC Power Module Type Converter
- Harmonic attenuator (Complies with IEC61000-3-2 class A)
- Thin and small size
- Built-in overcurrent, overvoltage and thermal protection circuits
- Mounting hole (M3 tapped)
- Peak current (TUNS500F)

CE marking

- Low voltage directive

Safety Approval

- UL60950-1, C-UL, EN60950-1

5-year warranty

Optional parts

- Heat sink (Refer to page of option parts : TUNS50F/TUNS100F)

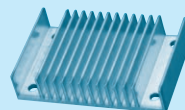
TUNS50F

TUN S 50 F 05 -□

① ② ③ ④ ⑤ ⑥



*Providing heat sink as option



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal Input
- ⑤ Output voltage
- ⑥ Optional
- T : with Mounting hole (φ 3.4 thru)

*Avoid short circuit between +BC and -BC. It may cause the failure of inside components.

*Keep TRM open, if output voltage adjustment is not necessary.

MODEL	TUNS50F05	TUNS50F12	TUNS50F24
MAX OUTPUT WATTAGE[W]	50.0	50.4	50.4
DC OUTPUT	5V 10A	12V 4.2A	24V 2.1A

SPECIFICATIONS

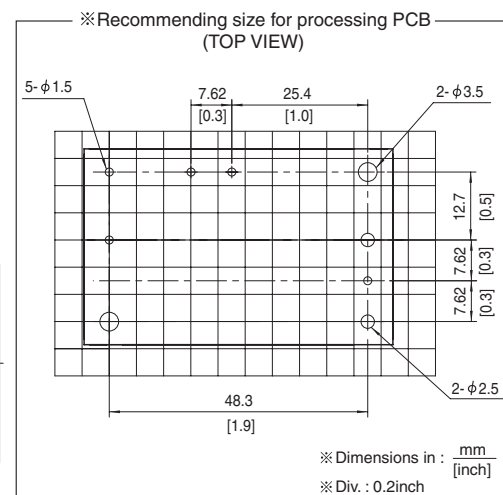
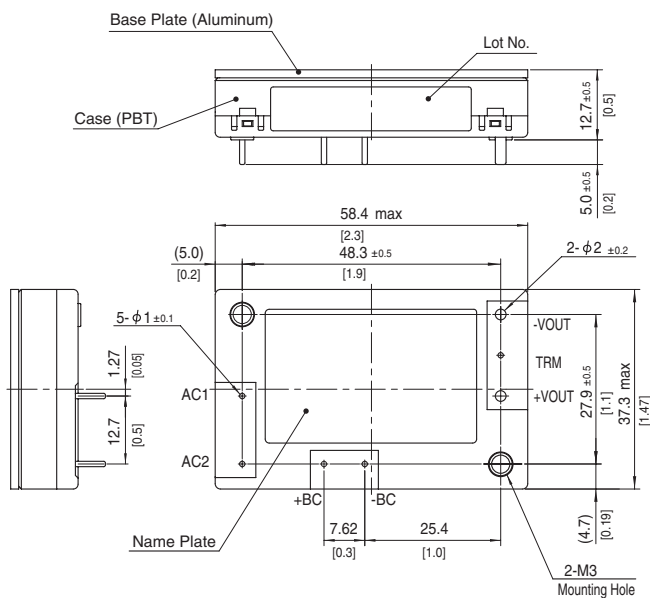
	MODEL	TUNS50F05	TUNS50F12	TUNS50F24
INPUT	VOLTAGE[V]	AC85 - 264 1 φ (Please refer to the instruction manual, 6.5 Derating)		
	CURRENT[A]	ACIN 100V	0.67typ (Io=100%)	
		ACIN 200V	0.35typ (Io=100%)	
	FREQUENCY[Hz]	50/60 (47 - 63)		
	EFFICIENCY[%]	ACIN 100V	79typ	83typ
		ACIN 200V	81typ	84typ
	POWER FACTOR (Io=100%)	ACIN 100V	0.95typ	84typ
		ACIN 200V	0.90typ	86typ
OUTPUT	INRUSH CURRENT	Limited by external components (Thermistor)		
	LEAKAGE CURRENT[ma]	0.75max (ACIN 240V 60Hz, Io=100%, According to IEC60950-1)		
	VOLTAGE[V]	5	12	24
	CURRENT[A]	10	4.2	2.1
	LINE REGULATION[mV]	10max	24max	48max
	LOAD REGULATION[mV]	10max	24max	48max
	RIPPLE[mVp-p]	0 to +100°C *1	80max	120max
		-40 to 0°C *1	120max	150max
		0 to 15% Load *1	200max	380max
	RIPPLE NOISE[mVp-p]	0 to +100°C *1	120max	150max
		-40 to 0°C *1	200max	250max
		0 to 15% Load *1	280max	460max
	TEMPERATURE REGULATION[mV]	0 to +65°C	50max	120max
		-40 to +100°C	100max	240max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV]	*2	20max	40max
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external resistor or external signal		
		4.50 - 6.00	10.80 - 13.20	21.60 - 26.40
	OUTPUT VOLTAGE SETTING[V]	4.97 - 5.13	11.91 - 12.29	23.62 - 24.38
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically		
	OVERVOLTAGE PROTECTION[V]	6.30 - 7.00	13.90 - 16.35	27.60 - 32.40
	REMOTE SENSING	Not provided		
ISOLATION	REMOTE ON/OFF	Not provided		
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)		
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)		
ENVIRONMENT	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15°C)		
	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100°C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max		
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max		
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis		
	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178		
OTHERS	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *3		
	CASE SIZE/WEIGHT	58.4 × 12.7 × 37.3mm [2.3 × 0.5 × 1.47 inches] (W × H × D) / 80g max		
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)		

*1 Refer to instruction manual for measuring method of electric characteristics.

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*3 Please contact us about another class.

External view

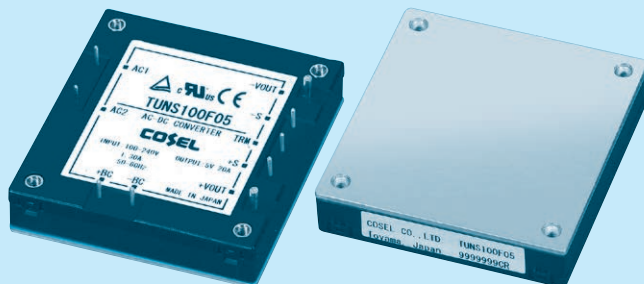


- ※ Tolerance : ±0.3 [±0.012]
- ※ Weight : 80g max
- ※ Dimensions in mm, []=inches
- ※ Mounting hole screwing torque : 0.49N · m (5.0kgf · cm) max

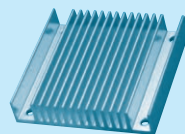
TUNS100F

TUN S 100 F 05 -□

① ② ③ ④ ⑤ ⑥



*Providing heat sink
as option



- ① Series name
② Single output
③ Output wattage
④ Universal Input
⑤ Output voltage
⑥ Optional
T : with Mounting hole
(ϕ 3.4 thru)

*Avoid short circuit between +BC and -BC. It may cause the failure of inside components.

*Keep TRM open, if output voltage adjustment is not necessary.

*If remote sensing is not necessary, connect between +Vout & +S and between -Vout & -S.

MODEL	TUNS100F05	TUNS100F12	TUNS100F24
MAX OUTPUT WATTAGE[W]	100.0	100.8	100.8
DC OUTPUT	5V 20A	12V 8.4A	24V 4.2A

SPECIFICATIONS

	MODEL	TUNS100F05	TUNS100F12	TUNS100F24
INPUT	VOLTAGE[V]		AC85 - 264 1 ϕ (Please refer to the instruction manual, 6.5 Derating)	
	CURRENT[A]	ACIN 100V	1.3typ (Io=100%)	
		ACIN 200V	0.7typ (Io=100%)	
	FREQUENCY[Hz]		50/60 (47 - 63)	
	EFFICIENCY[%]	ACIN 100V	82typ	83typ
		ACIN 200V	85typ	86typ
	POWER FACTOR (Io=100%)	ACIN 100V	0.95typ	
		ACIN 200V	0.90typ	
INRUSH CURRENT		Limited by external components (Thermistor)		
LEAKAGE CURRENT[mA]		0.75max (ACIN 240V 60Hz, Io=100%, According to IEC60950-1)		
OUTPUT	VOLTAGE[V]		12	24
	CURRENT[A]		8.4	4.2
	LINE REGULATION[mV]		24max	48max
	LOAD REGULATION[mV]		24max	48max
	RIPPLE[mVp-p]	0 to +100°C *1	80max	120max
		-40 to 0°C *1	120max	150max
		0 to 15% Load *1	160max	240max
	RIPPLE NOISE[mVp-p]	0 to +100°C *1	120max	150max
		-40 to 0°C *1	200max	250max
		0 to 15% Load *1	240max	300max
	TEMPERATURE REGULATION[mV]	0 to +65°C	50max	120max
		-40 to +100°C	100max	240max
	DRIFT[mV]	*2	20max	40max
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		Fixed (TRM pin open), adjustable by external resistor or external signal		
		4.50 - 6.00	10.80 - 13.20	
OUTPUT VOLTAGE SETTING[V]		4.97 - 5.13	11.91 - 12.29	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically		
	OVERVOLTAGE PROTECTION[V]	6.30 - 7.00	13.90 - 16.35	
	REMOTE SENSING	Provided		
	REMOTE ON/OFF	Not provided		
ISOLATION	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15°C)		
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15°C)		
	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (20 \pm 15°C)		
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100°C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max		
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max		
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178		
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *3		
OTHERS	CASE SIZE/WEIGHT	58.4 X 12.7 X 61.0mm [2.3 X 0.5 X 2.4 inches] (W X H X D) / 120g max		
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)		

*1 Refer to instruction manual for measuring method of electric characteristics.

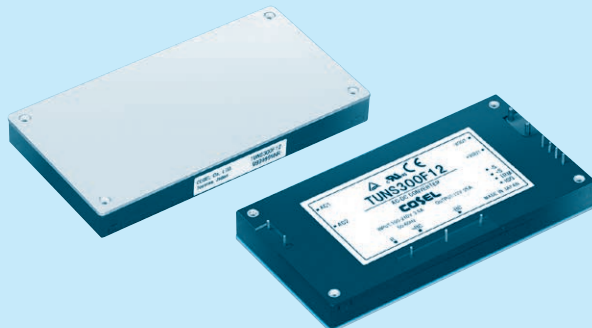
*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*3 Please contact us about another class.

TUNS300F

TUN S 300 F 48 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal Input
- ⑤ Output voltage
- ⑥ Optional
 - T : with Mounting hole (φ 3.4 thru)
 - Y1: Output voltage adjustment range ±20% (Only 48V)
 - R1: with Remote ON/OFF
 - R2: with Remote ON/OFF (Low standby power)

* Avoid short circuit between +BC/R and -BC. It may cause the failure of inside components.

* Keep TRM open, if output voltage adjustment is not necessary.

* If remote sensing is not necessary, connect between +Vout & +S and between -Vout & -S.

MODEL	TUNS300F12	TUNS300F28	TUNS300F48
MAX OUTPUT WATTAGE[W]	300	308	312
DC OUTPUT	12V 25A	28V 11A	48V 6.5A

SPECIFICATIONS

	MODEL		TUNS300F12	TUNS300F28	TUNS300F48
INPUT	VOLTAGE[V]		AC85 - 264 1 φ		
	CURRENT[A]	ACIN 100V	3.6typ (Io=100%)		
		ACIN 200V	1.8typ (Io=100%)		
	FREQUENCY[Hz]		50/60 (47 - 63)		
	EFFICIENCY[%]	ACIN 100V	84typ	87typ	
		ACIN 200V	86typ	89typ	
	POWER FACTOR (Io=100%)	ACIN 100V	0.96typ		
		ACIN 200V	0.93typ		
INRUSH CURRENT		Limited by external resistance			
LEAKAGE CURRENT[ma]		0.75max (ACIN 240V 60Hz, Io=100%, According to IEC60950-1)			
OUTPUT	VOLTAGE[V]		12	28	48
	CURRENT[A]		25	11	6.5
	LINE REGULATION[mV]		24max	56max	96max
	LOAD REGULATION[mV]		24max	56max	96max
	RIPPLE[mVp-p]	0 to +100℃ *1	120max	180max	250max
		-40 to 0℃ *1	150max	200max	300max
	RIPPLE NOISE[mVp-p]	0 to +100℃ *1	150max	200max	300max
		-40 to 0℃ *1	200max	300max	450max
	TEMPERATURE REGULATION[mV]	0 to +65℃	120max	280max	480max
		-40 to +100℃	240max	560max	960max
	DRIFT[mV] *2		40max	90max	180max
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		Fixed (TRM pin open), adjustable by external resistor or external signal		
			9.60 - 14.40	22.40 - 33.60	38.40 - 52.80 (-Y1 Option : 38.4 - 57.6)
OUTPUT VOLTAGE SETTING[V]		11.91 - 12.29	27.56 - 28.44	47.24 - 48.76	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically		
	OVERVOLTAGE PROTECTION[V]		15.00 - 16.80	35.00 - 39.20	55.20 - 64.80 (-Y1 Option : 60.0 - 67.2)
	REMOTE SENSING		Provided		
	REMOTE ON/OFF		Optional (External power supply is required)		
ISOLATION	INPUT-OUTPUT · RC *4	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)			
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)			
	OUTPUT · RC-FG *4	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)			
	OUTPUT-RC *4	AC100V 1minute, Cutoff current = 100mA, DC100V 10MΩ min (20±15℃)			
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE		-40 to +100℃ (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max		
	STORAGE TEMP., HUMID. AND ALTITUDE		-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max		
	VIBRATION		10 - 55Hz, 49.0m/s² (5G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT		196.1m/s² (20G), 11ms, once each along X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1		
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 (Class A) *3		
OTHERS	CASE SIZE/WEIGHT		117.3 X 12.7 X 61.5mm [4.62 X 0.5 X 2.42 inches] (W X H X D) / 190g max		
	COOLING METHOD		Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)		

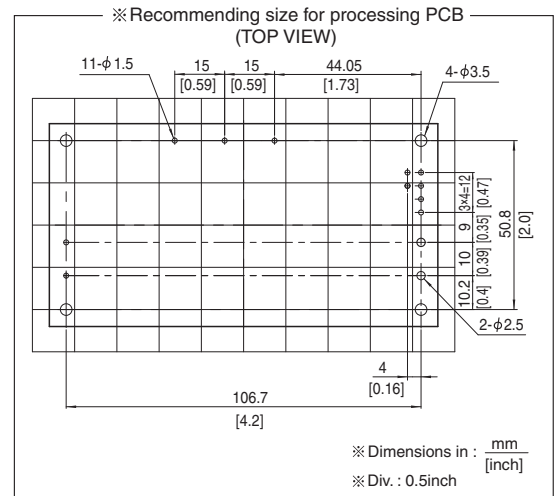
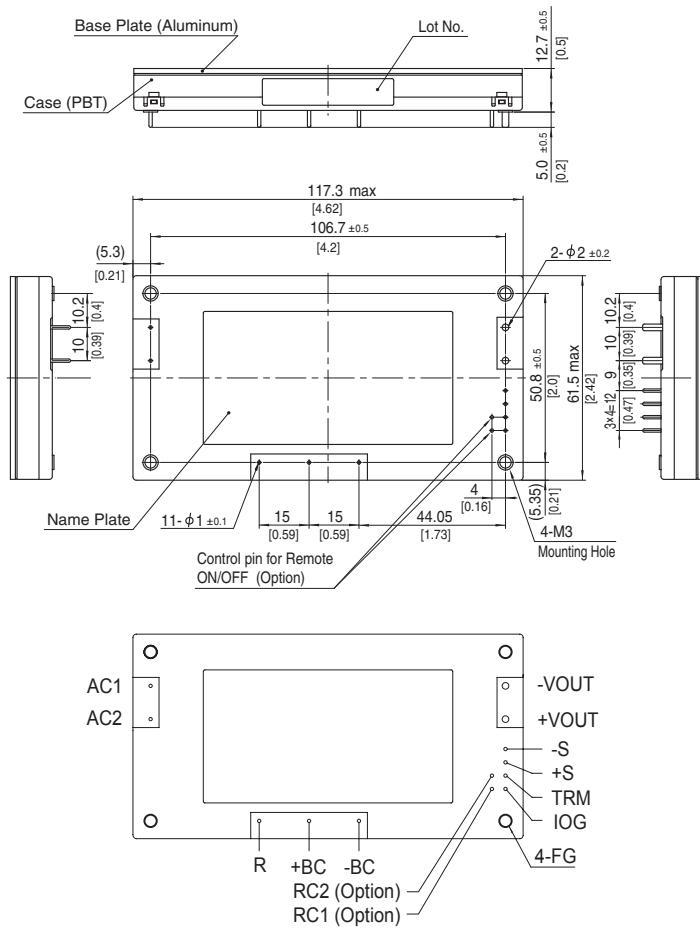
*1 Refer to instruction manual for measuring method of electric characteristics.

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*3 Please contact us about another class.

*4 "RC" is applicable when remote control (optional) is added.

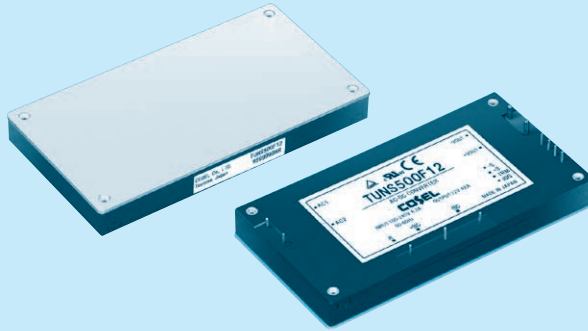
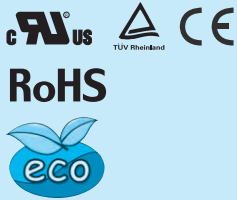
External view



- ※ Tolerance : $\pm 0.3 [\pm 0.012]$
- ※ Weight : 190g max
- ※ Dimensions in mm, []=inches
- ※ Mounting hole screwing torque : $0.49\text{N} \cdot \text{m} (5.0\text{kgf} \cdot \text{cm})$ max

TUNS500F

TUN S 500 F 48 -□



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal Input
- ⑤ Output voltage
- ⑥ Optional
- T : with Mounting hole (φ 3.4 thru)
- Y1: Output voltage adjustment range ±20% (Only 48V)
- R1: with Remote ON/OFF
- R2: with Remote ON/OFF (Low standby power)

* Avoid short circuit between +BC/R and -BC. It may cause the failure of inside components.
 * Keep TRM open, if output voltage adjustment is not necessary.
 * If remote sensing is not necessary, connect between +Vout & +S and between -Vout & -S.

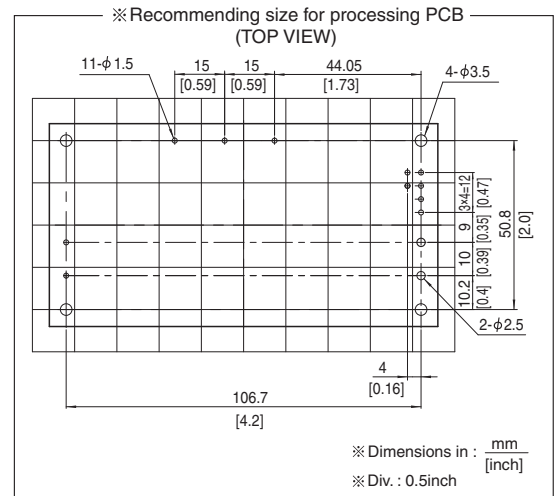
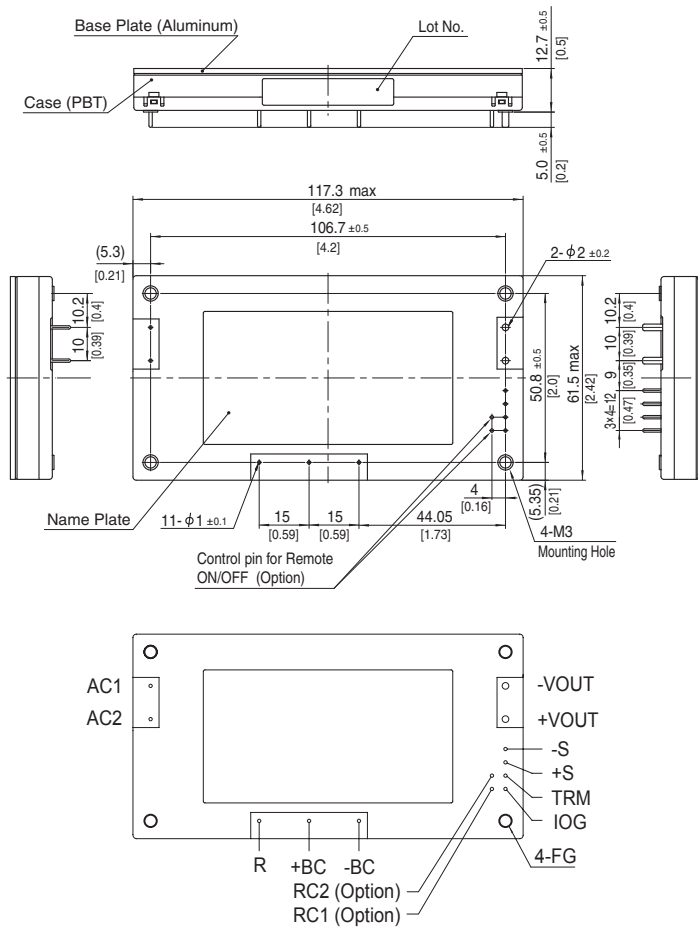
MODEL	TUNS500F12	TUNS500F28	TUNS500F48
MAX OUTPUT WATTAGE[W]	504	504	504
DC OUTPUT	12V 42A (Peak 55A)	28V 18A (Peak 24A)	48V 10.5A (Peak 14A)

SPECIFICATIONS

	MODEL		TUNS500F12	TUNS500F28	TUNS500F48
INPUT	VOLTAGE[V]		AC85 - 264 1 φ		
	CURRENT[A]	ACIN 100V	6.0typ (Io=100%)		
		ACIN 200V	3.0typ (Io=100%)		
	FREQUENCY[Hz]		50/60 (47 - 63)		
	EFFICIENCY[%]	ACIN 100V	84typ	87typ	88typ
		ACIN 200V	86typ	90typ	90.5typ
	POWER FACTOR (Io=100%)	ACIN 100V	0.96typ		
		ACIN 200V	0.93typ		
INRUSH CURRENT		Limited by external resistance			
LEAKAGE CURRENT[ma]		0.75max (ACIN 240V 60Hz, Io=100%, According to IEC60950-1)			
OUTPUT	VOLTAGE[V]		12	28	48
	CURRENT[A] *3		42 (Peak 55)	18 (Peak 24)	10.5 (Peak 14)
	LINE REGULATION[mV]		24max	56max	96max
	LOAD REGULATION[mV]		24max	56max	96max
	RIPPLE[mVp-p]	0 to +100℃ *1	120max	180max	250max
		-40 to 0℃ *1	150max	200max	300max
	RIPPLE NOISE[mVp-p]	0 to +100℃ *1	150max	200max	300max
		-40 to 0℃ *1	200max	300max	450max
	TEMPERATURE REGULATION[mV]	0 to +65℃	120max	280max	480max
		-40 to +100℃	240max	560max	960max
	DRIFT[mV] *2		40max	90max	180max
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		Fixed (TRM pin open), adjustable by external resistor or external signal		
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE SETTING[V]		11.91 - 12.29	27.56 - 28.44	47.24 - 48.76
	OVERCURRENT PROTECTION		Works over 101% of peak current and recovers automatically		
	OVERVOLTAGE PROTECTION[V]		15.00 - 16.80	35.00 - 39.20	55.20 - 64.80 (-Y1 Option : 38.4 - 57.6)
	REMOTE SENSING		Provided		
	REMOTE ON/OFF		Optional (External power supply is required)		
ISOLATION	INPUT-OUTPUT · RC *5		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)		
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)		
	OUTPUT · RC-FG *5		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)		
	OUTPUT-RC *5		AC100V 1minute, Cutoff current = 100mA, DC100V 10MΩ min (20±15℃)		
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE		-40 to +100℃ (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max		
	STORAGE TEMP.,HUMID.AND ALTITUDE		-40 to +100℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max		
	VIBRATION		10 - 55Hz, 49.0m/s² (5G), 3minutes period, 60minutes each along X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	IMPACT		196.1m/s² (20G), 11ms, once each along X, Y and Z axis		
	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1		
OTHERS	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 (Class A) *4		
	CASE SIZE/WEIGHT		117.3×12.7×61.5mm [4.62×0.5×2.42 inches] (W×H×D) / 190g max		
	COOLING METHOD		Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)		

- *1 Refer to instruction manual for measuring method of electric characteristics.
- *2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
- *3 () means peak current. Avoid operating with peak current continuously. It may cause failure of the components inside the product. There are limitation of available condition of the peak current, such as peak time, duty etc. (Refer to the instruction manual in detail.)
- *4 Please contact us about another class.
- *5 "RC" is applicable when remote control (optional) is added.

External view



- ※ Dimensions in : $\frac{\text{mm}}{\text{inch}}$
- ※ Div. : 0.5inch
- ※ Tolerance : $\pm 0.3 [\pm 0.012]$
- ※ Weight : 190g max
- ※ Dimensions in mm, []=inches
- ※ Mounting hole screwing torque : $0.49\text{N} \cdot \text{m}$ (5.0kgf · cm) max

TUNS700F

TUN S 700 F 48 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal Input
- ⑤ Output voltage
- ⑥ Optional
 - T : with Mounting hole (φ 3.4 thru)
 - Y1: Output voltage adjustment range ±20% (Only 48V)
 - R1: with Remote ON/OFF
 - R2: with Remote ON/OFF (Low standby power)
 - P : Parallel operation (Output voltage variable, Remote sensing disabled)

* Avoid short circuit between +BC/R and -BC. It may cause the failure of inside components.

* Keep TRM open, if output voltage adjustment is not necessary.

* If remote sensing is not necessary, connect between +Vout & +S and between -Vout & -S.

MODEL	TUNS700F12	TUNS700F28	TUNS700F48
MAX OUTPUT WATTAGE[W]	700.8	700.0	700.8
DC OUTPUT	12V 58.4A	28V 25A	48V 14.6A

SPECIFICATIONS

	MODEL		TUNS700F12	TUNS700F28	TUNS700F48
INPUT	VOLTAGE[V]		AC85 - 264 1 φ		
	CURRENT[A]	ACIN 100V	8.6typ (Io=100%)		
		ACIN 200V	4.1typ (Io=100%)		
	FREQUENCY[Hz]		50/60 (47 - 63)		
	EFFICIENCY[%]	ACIN 100V	83typ	86typ	87typ
		ACIN 200V	86typ	89typ	90typ
	POWER FACTOR (Io=100%)	ACIN 100V	0.96typ		
		ACIN 200V	0.93typ		
INRUSH CURRENT		Limited by external resistance			
LEAKAGE CURRENT[mA]		0.75max (ACIN 240V 60Hz, Io=100%, According to IEC60950-1)			
OUTPUT	VOLTAGE[V]		12	28	48
	CURRENT[A]		58.4	25	14.6
	LINE REGULATION[mV]		24max	56max	96max
	LOAD REGULATION[mV]		24max	56max	96max
	RIPPLE[mVp-p]	0 to +100℃ *1	120max	180max	250max
		-40 to 0℃ *1	150max	200max	300max
	RIPPLE NOISE[mVp-p]	0 to +100℃ *1	150max	200max	300max
		-40 to 0℃ *1	200max	300max	450max
	TEMPERATURE REGULATION[mV]	0 to +65℃	120max	280max	480max
		-40 to +100℃	240max	560max	960max
	DRIFT[mV]		*2 40max	90max	180max
	OUTPUT VOLTAGE ADJUSTMENT		Fixed (TRM pin open), adjustable by external resistor or external signal		
PROTECTION CIRCUIT AND OTHERS	RANGE[V]		9.60 - 14.40	22.40 - 33.60	38.40 - 52.80 (-Y1 Option : 38.4 - 57.6)
	OUTPUT VOLTAGE SETTING[V]		11.91 - 12.29	27.56 - 28.44	47.24 - 48.76
	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically		
	OVERVOLTAGE PROTECTION[V]		15.00 - 16.80	35.00 - 39.20	55.20 - 64.80 (-Y1 Option : 60.0 - 67.2)
REMOTE SENSING		Provided			
REMOTE ON/OFF		Optional (External power supply is required)			

MODEL	TUNS700F12-P	TUNS700F28-P	TUNS700F48-P
MAX OUTPUT WATTAGE[W]	700.8	700.0	700.8
DC OUTPUT	12V 58.4A	28V 25A	48V 14.6A

SPECIFICATIONS

	MODEL		TUNS700F12-P	TUNS700F28-P	TUNS700F48-P
INPUT	VOLTAGE[V]		AC85 - 264 1ϕ		
	CURRENT[A]	ACIN 100V	8.6typ (Io=100%)		
		ACIN 200V	4.1typ (Io=100%)		
	FREQUENCY[Hz]		50/60 (47 - 63)		
	EFFICIENCY[%]	ACIN 100V	83typ	86typ	87typ
		ACIN 200V	86typ	89typ	90typ
	POWER FACTOR (Io=100%)	ACIN 100V	0.96typ		
		ACIN 200V	0.93typ		
INRUSH CURRENT		Limited by external resistance			
LEAKAGE CURRENT[ma]		0.75max (ACIN 240V 60Hz, Io=100%, According to IEC60950-1)			
OUTPUT	VOLTAGE[V]		12	28	48
	CURRENT[A]		58.4	25	14.6
	VOLTAGE ACCURACY[%]		+5, -3	+5, -3	+5, -3
	RIPPLE[mVp-p]	0 to +100℃ *1	240max	360max	600max
		-40 to 0℃ *1	300max	400max	700max
		0 to +30% Load *1	360max	540max	900max
	RIPPLE NOISE[mVp-p]	0 to +100℃ *1	300max	400max	700max
		-40 to 0℃ *1	400max	600max	1000max
		0 to +30% Load *1	450max	600max	1000max
	PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically	
OVERVOLTAGE PROTECTION[V]		15.00 - 16.80	35.00 - 39.20	55.20 - 64.80	
REMOTE ON/OFF		Optional (External power supply is required)			

GENERAL SPECIFICATIONS

ISOLATION	INPUT-OUTPUT · RC	*4 AC3,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15°C)
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (20 \pm 15°C)
	OUTPUT · RC-FG	*4 AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (20 \pm 15°C)
	OUTPUT-RC	*4 AC100V 1minute, Cutoff current = 100mA, DC100V 10M Ω min (20 \pm 15°C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100°C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *3
OTHERS	CASE SIZE/WEIGHT	117.3 \times 12.7 \times 61.5mm [4.62 \times 0.5 \times 2.42 inches] (W \times H \times D) / 190g max
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)

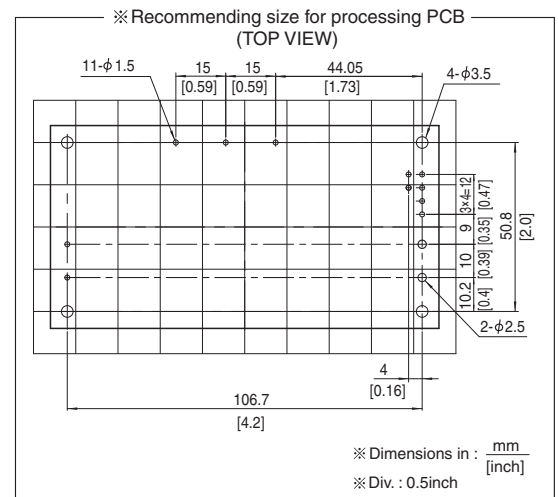
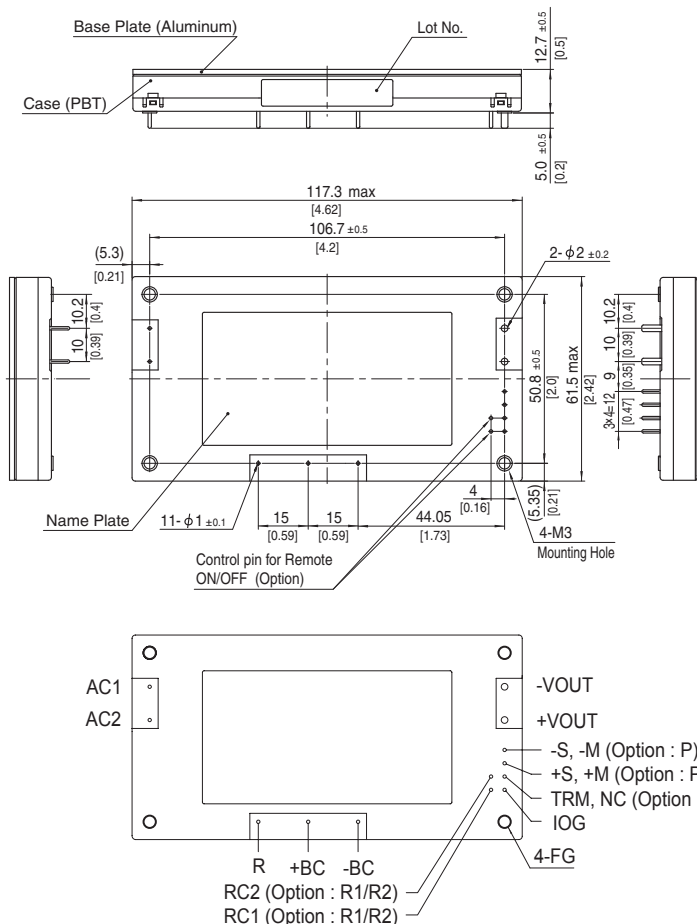
*1 Refer to instruction manual for measuring method of electric characteristics.

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*3 Please contact us about another class.

*4 "RC" is applicable when remote control (optional) is added.

External view



※ Tolerance : ± 0.3 [± 0.012]

※ Weight : 190g max

※ Dimensions in mm, [] = inches

※ Mounting hole screwing torque : 0.49N · m (5.0kgf · cm) max

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A] *1	Inrush current protection circuit	PCB/Pattern			Series/Parallel operation availability	
					Material	Single sided	Double sided	Series operation	Parallel operation
TUNS50F	Active filter	80-600	0.67	Thermistor	Aluminum	Yes		Yes	*2
	Flyback converter	100-300							
TUNS100F	Active filter	80-600	1.3	Thermistor	Aluminum	Yes		Yes	*2
	Forward converter	300							
TUNS300F	Active filter	100	3.6	SCR	Aluminum	Yes		Yes	*2
	Half-bridge converter	400							
TUNS500F	Active filter	100	6.0	SCR	Aluminum	Yes		Yes	*2
	Half-bridge converter	400							
TUNS700F	Active filter	100	8.6	SCR	Aluminum	Yes		Yes	*2
	Half-bridge converter	400							

*1 The value of input current is at ACIN 100V and rated load.

*2 Refer to instruction manual.

TUNS50F, TUNS100F**1 Pin Connection** TUNS-14**2 Connection for Standard Use** TUNS-14**3 Wiring Input/Output Pin** TUNS-15

- 3.1 Wiring input pin TUNS-15
- 3.2 Wiring output pin TUNS-15
- 3.3 Wiring +BC/-BC pins TUNS-15

4 Function TUNS-16

- 4.1 Input voltage range TUNS-16
- 4.2 Overcurrent protection TUNS-16
- 4.3 Overvoltage protection TUNS-16
- 4.4 Thermal protection TUNS-16
- 4.5 Remote sensing TUNS-16
- 4.6 Adjustable voltage range TUNS-17
- 4.7 Withstanding Voltage/Isolation Voltage -- TUNS-17

5 Series and Parallel Operation TUNS-17

- 5.1 Series operation TUNS-17
- 5.2 Parallel operation TUNS-17

6 Implementation · Mounting Method TUNS-18

- 6.1 Mounting method TUNS-18
- 6.2 Stress to the pins TUNS-18
- 6.3 Cleaning TUNS-18
- 6.4 Soldering temperature TUNS-18
- 6.5 Derating TUNS-18
- 6.6 Heat sink (Optional parts) TUNS-19

7 Lifetime expectancy depends on stress by temperature difference TUNS-20**TUNS300F, TUNS500F, TUNS700F****1 Pin Connection** TUNS-21**2 Connection for Standard Use** TUNS-21**3 Wiring Input/Output Pin** TUNS-22

- 3.1 Wiring input pin TUNS-22
- 3.2 Wiring output pin TUNS-22
- 3.3 Wiring +BC/-BC pins TUNS-22

4 Function TUNS-23

- 4.1 Input voltage range TUNS-23
- 4.2 Overcurrent protection TUNS-23
- 4.3 Peak current protection TUNS-23
- 4.4 Overvoltage protection TUNS-23
- 4.5 Thermal protection TUNS-23
- 4.6 Remote ON/OFF TUNS-23
- 4.7 Remote sensing TUNS-24
- 4.8 Adjustable voltage range TUNS-24
- 4.9 Inverter operation monitor (IOG) TUNS-25
- 4.10 Withstanding Voltage/Isolation Voltage -- TUNS-25

5 Series and Parallel Operation TUNS-25

- 5.1 Series operation TUNS-25
- 5.2 Parallel operation TUNS-25
- 5.3 N+1 redundant operation TUNS-26

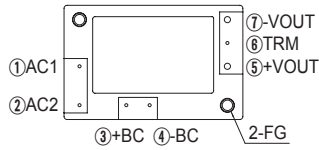
6 Implementation · Mounting Method TUNS-26

- 6.1 Mounting method TUNS-26
- 6.2 Stress to the pins TUNS-26
- 6.3 Cleaning TUNS-26
- 6.4 Soldering temperature TUNS-26
- 6.5 Derating TUNS-26

7 Peak current TUNS-27**8 Lifetime expectancy depends on stress by temperature difference** TUNS-28**TUNS**

1 Pin Connection

●TUNS50F



●TUNS100F

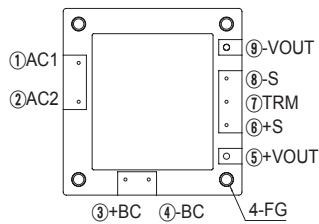


Fig.1.1 Pin connection (bottom view)

Table 1.1 Pin connection and function

No.		Pin Connection	Function
TUNS50F	TUNS100F		
①	①	AC1	AC input
②	②	AC2	
③	③	+BC	+BC output
④	④	-BC	-BC output
⑤	⑤	+VOUT	+DC output
⑦	⑦	-VOUT	-DC output
-	⑧	-S	Remote sensing (-)
-	⑨	+S	Remote sensing (+)
⑩	⑩	TRM	Adjustment of output voltage
-	-	FG	Mounting hole (FG)

2 Connection for Standard Use

■To use TUNS series, connection shown in Fig.2.1 and external components are required.

■This product uses conduction cooling method (e.g. heat radiation from the aluminum base plate to the attached heat sink).
Reference: 6.5 "Derating"

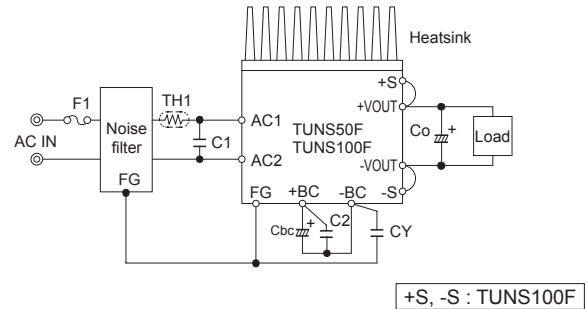


Fig.2.1 Connection for standard use

Table 2.1 External components

No.	Symbol	Components	Reference
1	F1	Input fuse	3.1 "Wiring input pin (1)"
2	C1	Input Capacitor	3.1 "Wiring input pin (2)"
3	-	Noise Filter	3.1 "Wiring input pin (3)"
4	CY	Y capacitor	
5	TH1	Inrush current protection thermistor	3.1 "Wiring input pin (4)"
6	Co	Output capacitor	3.2 "Wiring output pin (1)"
7	Cbc	Smoothing Capacitor for boost voltage	3.3 "Wiring +BC/-BC pins (1)"
8	C2	Capacitor for boost voltage	3.3 "Wiring +BC/-BC pins (2)"
9	-	Heatsink	6.6 "Heat sink"

3 Wiring Input/Output Pin

3.1 Wiring input pin

(1) F1 : External fuse

■ Fuse is not built-in on input side. In order to protect the unit, install the slow-blow type fuse on input side (as shown in Table 3.1).

Table 3.1 Recommended fuse (Slow-blow type)

Model	TUNS50F	TUNS100F
Rated current	2A	3.15A

(2) C1 : External Capacitor for input side

- Install a film capacitor as input capacitor C1 of which the capacitance and ripple current capability are above the values shown in Table 3.2.
- Use a safety approved capacitor with 250V ac rated voltage.
- If C1 is not connected, it may cause the failure of the power supply or external components.

Table 3.2 Input Capacitor C1

No.	Model	Voltage	Capacitance	Rated ripple current
1	TUNS50F	AC250V	1 μ F or more	3A or more
2	TUNS100F		1 μ F or more	3A or more

(3) CY : Noise filter/Decoupling capacitor

- The product doesn't have noise filter internally. Please connect external noise filter and primary decoupling capacitor CY for low line noise and stable operation of the power supply.
- The operation of the power supply may be unstable due to the resonance of the filter or inductance.
- Install a correspondence filter, if it is required to meet a noise standard or if the surge voltage may be applied to the unit.
- Install a primary decoupling capacitor CY, with more than 470pF, near the input pins (within 50mm from the pins).
- When the total capacitance of the primary decoupling capacitor is more than 8800pF, the nominal value in the specification may not be met by the Hi-Pot test between input and output. A capacitor should be installed between output and FG.

(4) TH1 : Inrush current limiting thermistor

- It has a possibility that internal components fail by inrush current, so please use power thermistor or inrush current limiting circuit to keep input current below 60A.
- If you use power thermistor and turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that a power supply cools down before being turned on. And appropriate intervals should be set even if inrush current limiting circuit except power thermistor is used.

- The output voltage may become unstable at low temperature due to the ESR of power thermistor. In this case, increase the capacitance of Cbc more than recommended value or connect same capacitors in parallel. Please evaluate before use.

3.2 Wiring output pin

(1) Co : Output capacitor

- Install an external capacitor Co between +VOUT and -VOUT pins for stable operation of the power supply (Fig.2.1). Recommended capacitance of Co is shown in Table 3.3.
- Select the high frequency type capacitor. Output ripple and start-up waveform may be influenced by ESR-ESL of the capacitor and the wiring impedance.
- Install a capacitor Co near the output pins (within 50mm from the pins).
- When the power supply is used under 0°C ambient temperature, output ripple voltage increases. In this case, connect 3 capacitors Co in parallel connection.

Table 3.3 Recommended capacitance Co[μ F]

Model	Temperature of base plate			
	Tc=0 to +100°C		Tc=-40 to +100°C	
Output voltage (V)	TUNS50F	TUNS100F	TUNS50F	TUNS100F
5	2200	2200	2200×3	2200×3
12	470	470	470×3	470×3
24	220	220	220×3	220×3

The specified ripple and ripple noise are measured by the method introduced in Fig.3.1.

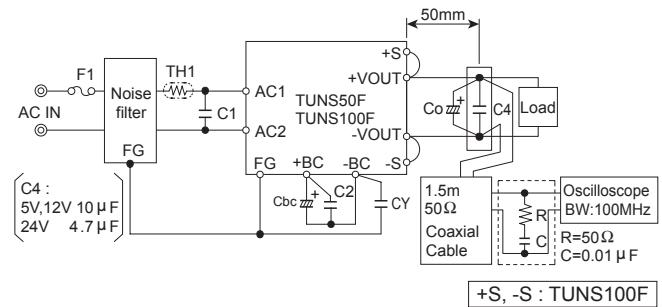


Fig.3.1 Method of Measuring Output Ripple and Ripple Noise

3.3 Wiring +BC/-BC pins

(1) Cbc : Smoothing capacitor for boost voltage

- In order to smooth boost voltage, connect Cbc between +BC and -BC. Recommended capacitance of Cbc is shown in Table3.4.
- Note that +BC and -BC terminals have high voltage (DC385V typ).
- Keep the capacitance within the allowable external capacitance.
- Select a capacitor of which the boost voltage ripple voltage does not exceed 30Vp-p.
- When the power supply is operated under -20°C, it may make the boost voltage unstable due to the characteristic of equivalent series resistor. Please choose the capacitor which has more than recommended capacitance.

Table 3.4 Recommended capacitance Cbc

No.	Model	Voltage	Cbc	Allowable capacitance range
1	TUNS50F	DC420V	82 μ F	47 to 150 μ F
2	TUNS100F	or more	120 μ F	68 to 220 μ F

(2) C2 : Capacitor for boost voltage

- Install external capacitors C2 with capacitance shown in table 3.5.
- If capacitors C2 are not installed, it may cause the failure of the power supply or external components.

Table 3.5 Recommended capacitance C2

No.	Model	Voltage	Capacitance	Rated ripple current
1	TUNS50F	DC450V	0.47 μ F or more	1A or more
2	TUNS100F		0.47 μ F or more	1A or more

4 Function

4.1 Input voltage range

- The input voltage range is from 85 VAC to 264 VAC.
- In cases that conform with safety standard, input voltage range is AC100-AC240V(50/60Hz).
- Be aware that use of voltages other than those listed above may result in the unit not operating according to specifications, or may cause damage. Avoid square waveform input voltage, commonly used in UPS units and inverters.

4.2 Overcurrent protection

- Overcurrent protection is built-in and comes into effect at over 105% of the rated current.
Overcurrent protection prevents the unit from short circuit and overcurrent condition. The unit automatically recovers when the fault condition is cleared.
- When the output voltage drops at overcurrent, the average output current is reduced by intermittent operation of power supply.

4.3 Overvoltage protection

- Overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait more than 3 minutes and turn on the AC input again to recover the output voltage. Recovery time varies depending on such factors as input voltage value at the time of the operation.

Remarks:

Please note that devices inside the power supply might fail when voltage of more than rated output voltage is applied to output terminal of the power supply. This could happen when the customer tests the overvoltage performance of the unit.
To check the function of overvoltage protection, adjust the output voltage by changing TRM voltage. Please contact us for details.

4.4 Thermal protection

- When the power supply temperature is kept above 100°C, the thermal protection will be activated and simultaneously shut down the output.
When the thermal protection is activated, shut off the input voltage and eliminate all the overheating conditions. To recover the output voltage, keep enough time to cool down the power supply before turning on the input voltage again.

4.5 Remote sensing

●TUNS50F

- Remote sensing is not built-in.

●TUNS100F

- Remote sensing is built-in.

(1) When the remote sensing function is not in use

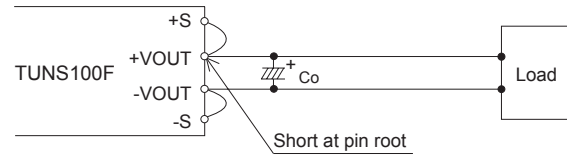


Fig. 4.1 Connection when the remote sensing is not in use

- When the remote sensing function is not in use, it is necessary to confirm that pins are shorted between +S & +VOUT and between -S & -VOUT.
- Wire between +S & +VOUT and between -S & -VOUT as short as possible.
Loop wiring should be avoided.
This power supply might become unstable by the noise coming from poor wiring.

(2) When the remote sensing function is in use

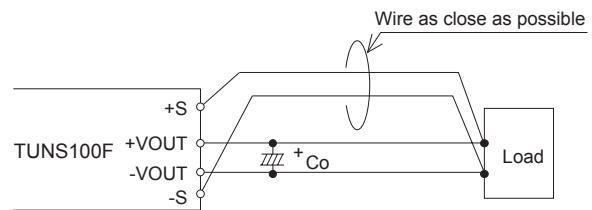


Fig. 4.2 Connection when the remote sensing is in use

- Twisted-pair wire or shield wire should be used for sensing wire.
- Thick wire should be used for wiring between the power supply and a load.
Line drop should be less than 0.5V.
Voltage between +VOUT and -VOUT should remain within the output voltage adjustment range.
- If the sensing patterns are short, heavy-current is drawn and the pattern may be damaged.
The pattern disconnection can be prevented by installing the protection parts as close as a load.

■As wiring or load impedance may generate oscillation or large fluctuations in output voltage, make sure enough evaluation is given advance.

4.6 Adjustable voltage range

■Output voltage between +VOUT and -VOUT can be adjusted by connecting external resistors to TRM.

■When the output voltage adjustment is not used, open the TRM pin respectively.

■When the output voltage adjustment is used, note that the over-voltage protection circuit operates when output voltage is set too high.

■The wiring to the potentiometer should be as short as possible.

As the ambient temperature fluctuation characteristics deteriorate depending on the types of resistors and potentiometers, please use resistors and potentiometers of the following specifications:

Resistors..... Metal film type, coefficient less than $\pm 100\text{ppm}/^\circ\text{C}$

Potentiometers ... Cermet type, coefficient less than $\pm 300\text{ppm}/^\circ\text{C}$

■Output voltage can be adjusted by connecting an external potentiometer (VR1) and resistors (R1 and R2) as shown in Fig. 4.3.

Output voltage will increase if the resistance between ② and ③ is reduced by turning the potentiometer.

Recommended values for external components are shown in Table 4.1.

Consult us if the power module is used in a different configuration.

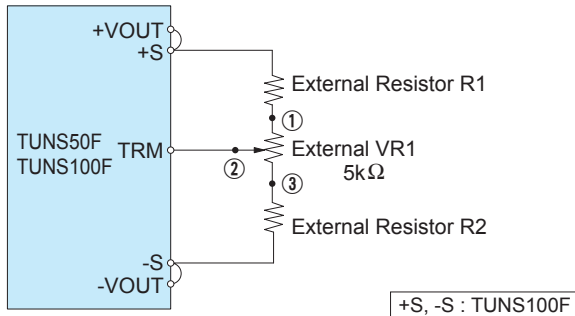


Fig. 4.3 Connecting External Devices (TUNS50F/TUNS100F)

Table 4.1 Recommended Values of External Resistors (TUNS50F, TUNS100F)

No.	Output Voltage	Adjustable Range			
		VOUT $\pm 5\%$		VOUT $\pm 10\%$	
		R1	R2	R1	R2
1	5V	10k Ω	2.7k Ω	4.7k Ω	1k Ω
2	12V	12k Ω	2.2k Ω	5.6k Ω	560 Ω
3	24V	27k Ω	1.8k Ω	15k Ω	470 Ω

4.7 Withstanding Voltage / Isolation Voltage

■When testing the withstanding voltage, make sure the voltage is increased gradually. When turning off, reduce the voltage gradually by using the dial of the hi-pot tester. Do not use a voltage tester with a timer as it may generate voltage several times as large as the applied voltage.

5 Series and Parallel Operation

5.1 Series operation

■Series operation is available by connecting the outputs of two or more power supplies as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

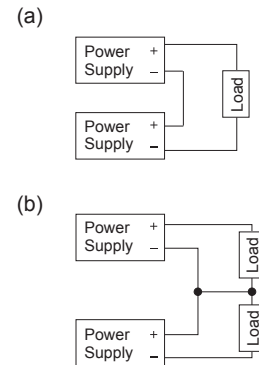


Fig. 5.1 Examples of series operation

5.2 Parallel operation

■Parallel operation is not possible.

■Redundancy operation is available by wiring as shown below.

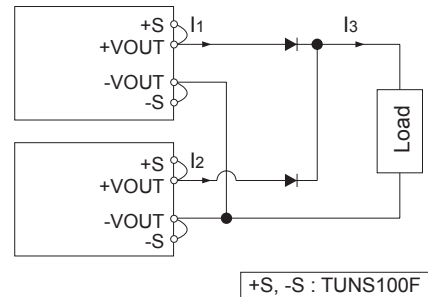


Fig. 5.2 Example of Redundancy Operation

■Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .

Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

6 Implementation · Mounting Method

6.1 Mounting method

- The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Aluminum base plate temperature of each power supply should not exceed the temperature range shown in derating curve.
- Avoid placing the AC input line pattern layout underneath the unit. It will increase the line conducted noise. Make sure to leave an ample distance between the line pattern layout and the unit. Also avoid placing the DC output line pattern underneath the unit because it may increase the output noise. Lay out the pattern away from the unit.
- Avoid placing the signal line pattern layout underneath the unit because the power supply might become unstable. Lay out the pattern away from the unit.
- High-frequency noise radiates directly from the unit to the atmosphere. Therefore, design the shield pattern on the printed circuit board and connect it to FG. The shield pattern prevents noise radiation.
- When a heat sink cannot be fixed on the base plate side, order the power module with "-T" option. A heat sink can be mounted by affixing a M3 tap on the heat sink. Please make sure a mounting hole will be connected to a grounding capacitor C_V .

Table 6.1 Mounting Hole Configuration

	Mounting hole
Standard	M3 tapped
Optional : -T	φ 3.4 thru

6.2 Stress to the pins

- When too much stress is applied to the pins may damage internal connections. Avoid applying stress in excess of that shown in Fig. 6.1.
- The pins are soldered onto the internal PCB. Therefore, Do not bend or pull the leads with excessive force.
- Mounting hole diameter of PCB should be 3.5mm to reduce the stress to the pins.
- Fix the unit on PCB (fixing fittings) by screws to reduce the stress to the pins. Be sure to mount the unit first, then solder the unit.

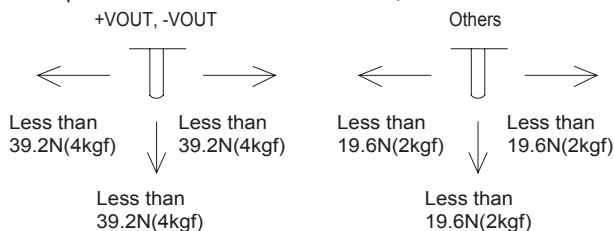


Fig. 6.1 Stress to the pins

6.3 Cleaning

- Clean the product with a brush. Prevent liquid from getting into the product. Do not soak the product into liquid.
- Do not stick solvent to a name plate or a resin case. (If solvent sticks to a name plate or a resin case, it will cause to change the color of the case or to fade letters on name plate away.)
- After cleaning, dry them enough.

6.4 Soldering temperature

- Flow soldering: 260°C for up to 15 seconds.
- Soldering iron (26W): 450°C for up to 5 seconds.

6.5 Derating

(1) Input voltage derating curve

Input voltage derating curve is shown in Fig.6.2.

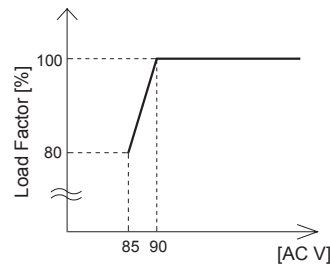


Fig. 6.2 Input voltage derating curve

(2) Output voltage derating curve

- Use the power modules with conduction cooling (e.g. heat dissipation from the aluminum base plate to the attached heat sink). Fig. 6.3 shows the derating curves with respect to the aluminum base plate temperature. Note that operation within the hatched areas will cause a significant level of ripple and ripple noise.
- Please measure the temperature on the aluminum base plate edge side when you cannot measure the temperature of the center part of the aluminum base plate. In this case, please take 5deg temperature margin from the derating characteristics shown in Fig.6.3. Please reduce the temperature fluctuation range as much as possible when the up and down of the temperature are frequently generated. Contact us for more information on cooling methods.

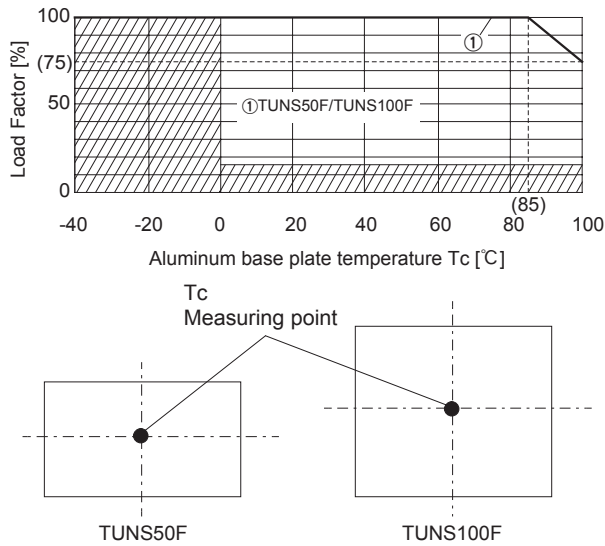


Fig.6.3 Derating curve

6.6 Heat sink (Optional parts)

■ The power module works with conduction cooling and needs heat dissipation using heat sinks. Optional heat sinks are available for TUNS50F/TUNS100F Series. Refer to Table 6.1 and Table 6.2 for details on the thermal resistance of heat sinks.

●TUNS50F

Table 6.1 Types of Heat Sinks Available

No.	Model	Size[mm]			Thermal resistance[°C/W]		Style
		H	W	D	Convection (0.1m/s)	Forced Air	
1	F-QB-F1	12.7	58.4	37.6	14.0	Refer Fig.6.5	Horizontal
2	F-QB-F2	12.7	58.7	37.3			Vertical
3	F-QB-F3	25.4	58.4	37.6	7.5		Horizontal
4	F-QB-F4	25.4	58.7	37.3			Vertical
5	F-QB-F5	38.1	58.4	37.6	5.0		Horizontal
6	F-QB-F6	38.1	58.7	37.3			Vertical

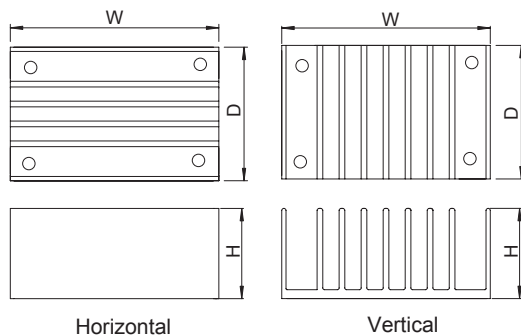


Fig.6.4 Heat Sink Types

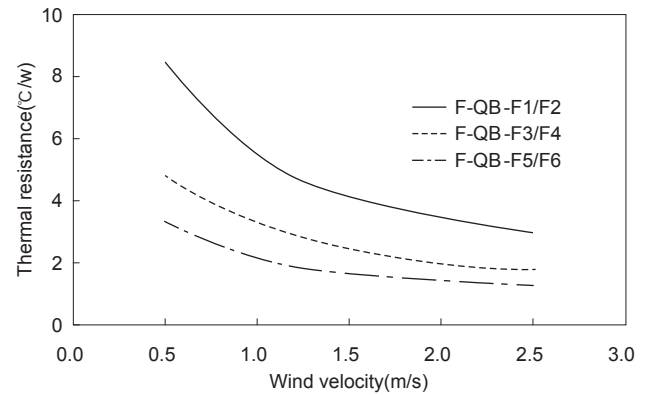


Fig.6.5 Thermal Resistance of Heat Sink(Forced Air)

●TUNS100F

Table 6.2 Types of Heat Sinks Available

No.	Model	Size[mm]			Thermal resistance[°C/W]		Style
		H	W	D	Convection (0.1m/s)	Forced Air	
1	F-CBS-F1	12.7	57.9	61.5	7.5	Refer Fig.6.7	Horizontal
2	F-CBS-F2	12.7	58.4	61.0			Vertical
3	F-CBS-F3	25.4	57.9	61.5	4.6		Horizontal
4	F-CBS-F4	25.4	58.4	61.0			Vertical
5	F-CBS-F5	38.1	57.9	61.5	3.0		Horizontal
6	F-CBS-F6	38.1	58.4	61.0			Vertical

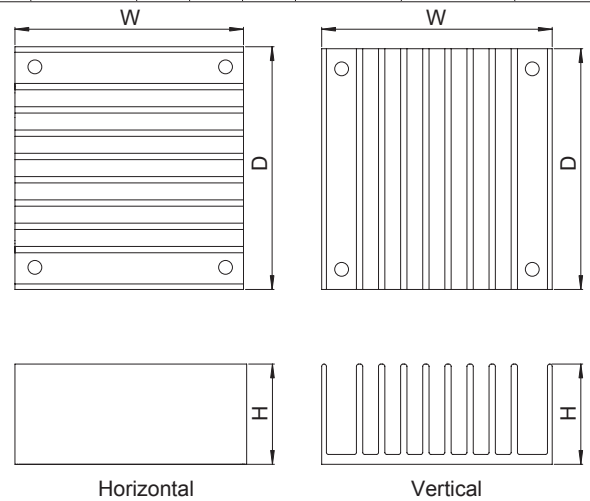


Fig. 6.6 Heat Sink Types

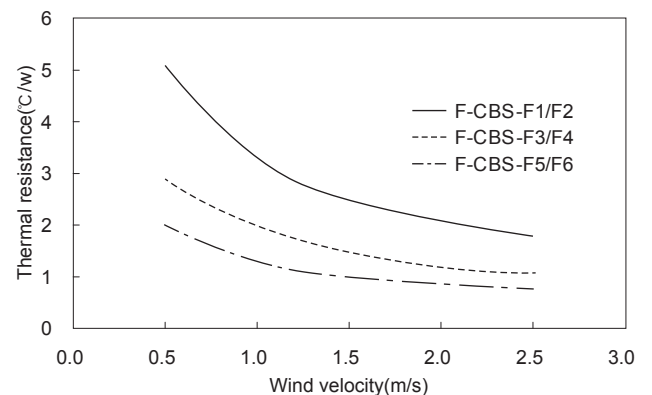


Fig.6.7 Thermal Resistance of Heat Sink(Forced Air)

7 Lifetime expectancy depends on stress by temperature difference

■ Regarding lifetime expectancy design of solder joint, following contents must be considered.

It must be careful that the soldering joint is stressed by temperature rise and down which is occurred by self-heating and ambient temperature change.

The stress is accelerated by thermal-cycling, therefore the temperature difference should be minimized as much as possible if temperature rise and down is occurred frequently.

■ Product lifetime expectancy depends on the aluminum base plate central temperature difference (ΔT_c) and number of cycling in a day is shown in Fig.7.1.

If the aluminum base plate center part temperature changes frequently by changing output load factor etc., the above the lifetime expectancy design should be applied as well.

Please contact us for details.

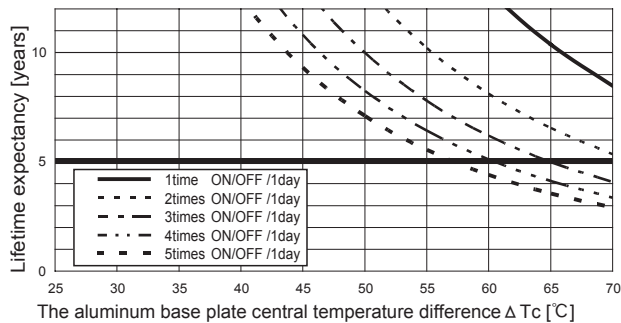


Fig.7.1 Lifetime expectancy against rise/fall temperature difference

Application manuals available at our website.

Recommended external components are also introduced for your reference.

1 Pin Connection

●TUNS300F/TUNS500F/TUNS700F

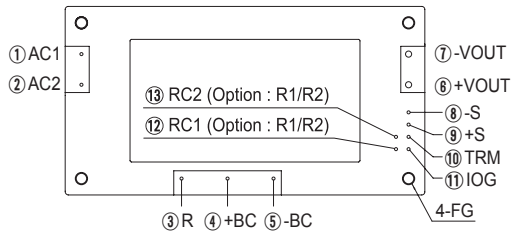


Fig.1.1 Pin connection (bottom view)

Table 1.1 Pin connection and function

No.	Pin Connection	Function
①	AC1	AC input
②	AC2	
③	R	External resistor for inrush current protection
④	+BC	+BC output
⑤	-BC	-BC output
⑥	+VOUT	+DC output
⑦	-VOUT	-DC output
⑧	-S	Remote sensing (-)
⑨	+S	Remote sensing (+)
⑩	TRM	Adjustment of output voltage
⑪	IOG	Inverter operation monitor
⑫	RC1	Remote ON/OFF (Option)
⑬	RC2	
-	FG	Mounting hole (FG)

●TUNS700F□□-P (OPTION)

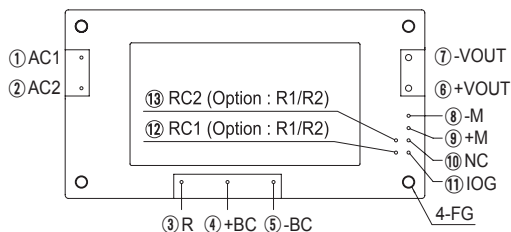


Fig.1.2 Pin connection (bottom view)

Table 1.2 Pin connection and function

No.	Pin Connection	Function
⑧	-M	Output voltage monitor terminal
⑨	+M	
⑩	NC	No connection

Other than the above are the same as standard products.
Please refer to Table 1.1.

2 Connection for Standard Use

■To use TUNS series, connection shown in Fig.2.1 and external components are required.

■This product uses conduction cooling method (e.g. heat radiation from the aluminum base plate to the attached heat sink).
Reference: 6.5 "Derating"

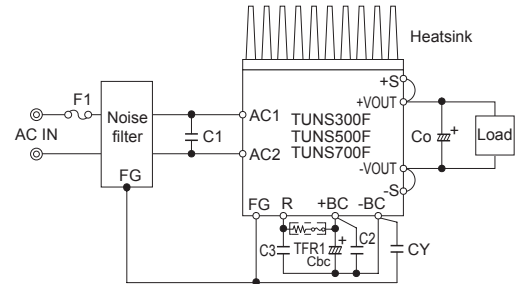


Fig.2.1 Connection for standard use

Table 2.1 External components

No.	Symbol	Components	Reference
1	F1	Input fuse	3.1 "Wiring input pin (1)"
2	C1	Input Capacitor	3.1 "Wiring input pin (2)"
3	-	Noise Filter	3.1 "Wiring input pin (3)"
4	CY	Y capacitor	3.1 "Wiring input pin (3)"
5	Co	Output capacitor	3.2 "Wiring output pin (1)"
6	Cbc	Smoothing Capacitor for boost voltage	3.3 "+BC/-BC pins (1)"
7	C2,C3	Capacitor for boost voltage	3.3 "+BC/-BC pins (2)"
8	TFR1	Inrush current protection resistor	3.3 "+BC/-BC pins (3)"
9	-	Heatsink	-

3 Wiring Input/Output Pin

3.1 Wiring input pin

(1) F1 : External fuse

■ Fuse is not built-in on input side. In order to protect the unit, install the slow-blow type fuse on input side (as shown in Table 3.1).

Table 3.1 Recommended fuse (Slow-blow type)

Model	TUNS300F	TUNS500F/TUNS700F
Rated current	10A	15A

(2) C1 : External Capacitor for input side

■ Install a film capacitor as input capacitor C1 of which the capacitance and ripple current capability are above the values shown in Table 3.2.

■ Use a safety approved capacitor with 250V ac rated voltage.

■ If C1 is not connected, it may cause the failure of the power supply or external components.

Table 3.2 Input Capacitor C1

No.	Model	Voltage	Capacitance	Rated ripple current
1	TUNS300F	AC250V	2 μ F or more	5A or more
2	TUNS500F		2 μ F or more	5A or more
3	TUNS700F		3 μ F or more	5A or more

(3) CY : Noise filter/Decoupling capacitor

■ The product doesn't have noise filter internally.

Please connect external noise filter and primary decoupling capacitor CY for low line noise and stable operation of the power supply.

■ The operation of the power supply may be unstable due to the resonance of the filter or inductance.

■ Install a correspondence filter, if it is required to meet a noise standard or if the surge voltage may be applied to the unit.

■ Install a primary decoupling capacitor CY, with more than 470pF, near the input pins (within 50mm from the pins).

■ When the total capacitance of the primary decoupling capacitor is more than 8800pF, the nominal value in the specification may not be met by the Hi-Pot test between input and output. A capacitor should be installed between output and FG.

3.2 Wiring output pin

(1) Co : Output capacitor

■ Install an external capacitor Co between +VOUT and -VOUT pins for stable operation of the power supply (Fig.2.1).

Recommended capacitance of Co is shown in Table 3.3.

■ Select the high frequency type capacitor. Output ripple and start-up waveform may be influenced by ESR-ESL of the capacitor and the wiring impedance.

■ Install a capacitor Co near the output pins (within 50mm from the pins).

■ When the power supply is used under 0°C ambient temperature, output ripple voltage increases. In this case, connect 3 capacitors Co in parallel connection.

Table 3.3 Recommended capacitance Co[μ F]

Model	Temperature of base plate	
	Tc=0 to +100°C	Tc=-40 to +100°C
Output voltage (V)	TUNS300F/TUNS500F TUNS700F	TUNS300F/TUNS500F TUNS700F
12	2200	2200×3
28	1000	1000×3
48	470	470×3

The specified ripple and ripple noise are measured by the method introduced in Fig.3.1.

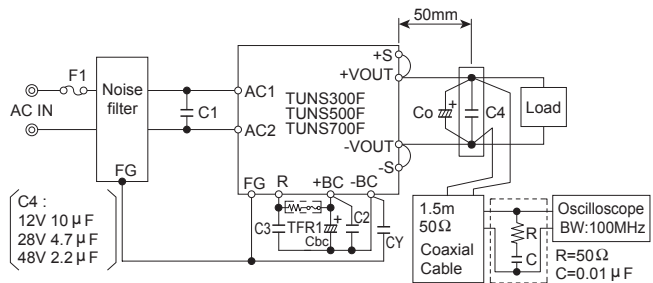


Fig.3.1 Method of Measuring Output Ripple and Ripple Noise

3.3 Wiring +BC/-BC pins

(1) Cbc : Smoothing capacitor for boost voltage

■ In order to smooth boost voltage, connect Cbc between +BC and -BC. Recommended capacitance of Cbc is shown in Table3.4.

■ Note that +BC and -BC terminals have high voltage (DC380V typ).

■ Keep the capacitance within the allowable external capacitance.

■ Select a capacitor of which the boost voltage ripple voltage does not exceed 30Vp-p.

■ When the power supply is operated under -20°C, it may make the boost voltage unstable due to the characteristic of equivalent series resistor. Please choose the capacitor which has more than recommended capacitance.

Table 3.4 Recommended capacitance Cbc

No.	Model	Voltage	Cbc	Allowable capacitance range
1	TUNS300F	DC420V or more	470 μ F	390 to 2200 μ F
2	TUNS500F		390 μ F × 2	390 to 2200 μ F
3	TUNS700F		390 μ F × 2	470 to 2200 μ F

(2) C2, C3 : Capacitor for boost voltage

■ Install external capacitors C2, C3 with capacitance shown in table 3.5.

■ If capacitors C2, C3 are not installed, it may cause the failure of the power supply or external components.

Table 3.5 Recommended capacitance C2 and C3

No.	Model	Voltage	Capacitance	Rated ripple current
1	TUNS300F	DC450V	1 μ F or more	3A or more
2	TUNS500F		1 μ F or more	3A or more
3	TUNS700F		1 μ F or more	3A or more

(3) TFR1 : Inrush current limiting resistor 4.7ohm - 22ohm

■Connect a resistor between R pin and +BC pin for inrush current protection. The surge capacity is required for TFR1, please contact component mfg. Wirewound resistor with thermal cut-offs type is required.

4 Function

4.1 Input voltage range

- The input voltage range is from 85 VAC to 264 VAC.
- In cases that conform with safety standard, input voltage range is AC100-AC240V(50/60Hz).
- Be aware that use of voltages other than those listed above may result in the unit not operating according to specifications, or may cause damage. Avoid square waveform input voltage, commonly used in UPS units and inverters.

4.2 Overcurrent protection

●TUNS300F/TUNS700F

- Overcurrent protection is built-in and comes into effect at over 105% of the rated current.
- Overcurrent protection prevents the unit from short circuit and overcurrent condition. The unit automatically recovers when the fault condition is cleared.
- When the output voltage drops at overcurrent, the average output current is reduced by intermittent operation of power supply.

●TUNS500F

- Overcurrent protection is built-in and comes into effect at over 101% of the peak current.
- Overcurrent protection prevents the unit from short circuit and overcurrent condition. The unit automatically recovers when the fault condition is cleared.
- When the output voltage drops at overcurrent, the average output current is reduced by intermittent operation of power supply.

4.3 Peak current protection

●TUNS500F

- Peak current protection is built-in. When the power supply is operated at over peak load based on section 7 (Peak current), this function comes into effect and reduce the output.
- A few seconds later, a unit automatically recovers. But if the overcurrent condition has not been released, the output will reduced again (intermittent operation mode).

4.4 Overvoltage protection

- Overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait more than 3 minutes and turn on the AC input again to recover the output voltage. Recovery time varies depending on such factors as input voltage value at the time of the operation.

Remarks:

Please note that devices inside the power supply might fail when voltage of more than rated output voltage is applied to output terminal of the power supply. This could happen when the customer tests the overvoltage performance of the unit.

4.5 Thermal protection

- When it exceeds the Derating (Section 6.5), the thermal protection will be activated and simultaneously shut down the output.
- When the thermal protection is activated, shut off the input voltage and eliminate all the overheating conditions. To recover the output voltage, keep enough time to cool down the power supply before turning on the input voltage again.

4.6 Remote ON/OFF

●-R1

- Remote ON/OFF is possible by applying a voltage between RC1 and RC2 pin. External DC power source is necessary to operate remote control.
- External current limiting resistor Rrc is necessary.
- When power supply shut off by over voltage protection or overheating protection, it can be recovered by toggling Remote ON/OFF signal.

Table .4.1 Remote ON/OFF connection specification

No.	ITEM	RC1, RC2
1	Function	Output is OFF in "L"
2	Base pin	RC2
3	Output ON	SW OPEN (0.5V max, 0.1mA max)
4	Output OFF	SW SHORT (5mA typ, 3mA min)

- Sink current of RC1 must be kept up to 12mA.

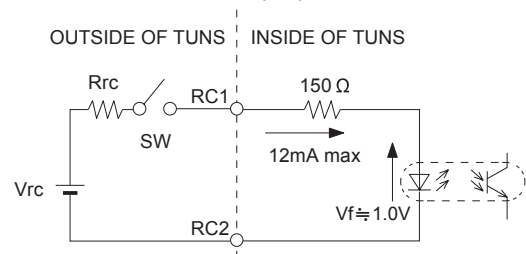


Fig .4.1 RC Connection Example

- *Please be careful not to connect RC1 and RC2 opposite. It may cause a failure of power supply.
- Remote ON/OFF circuit (RC1, RC2) is isolated from the input and output and FG.

●-R2

- "-R2" can reduce standby power than "-R1".
- The usage is same as option "-R1". Please refer to option "-R1"
- Standby power
0.5Wtyp (AC100V), 1.2Wtyp (AC200V)

4.7 Remote sensing

■ Remote sensing is built-in.

(1) When the remote sensing function is not in use

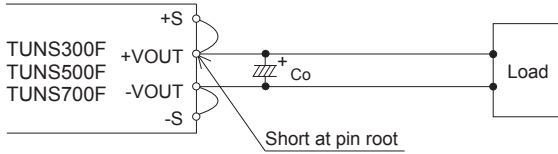


Fig. 4.2 Connection when the remote sensing is not in use

■ When the remote sensing function is not in use, it is necessary to confirm that pins are shorted between +S & +VOUT and between -S & -VOUT.

■ Wire between +S & +VOUT and between -S & -VOUT as short as possible.

Loop wiring should be avoided.

This power supply might become unstable by the noise coming from poor wiring.

(2) When the remote sensing function is in use

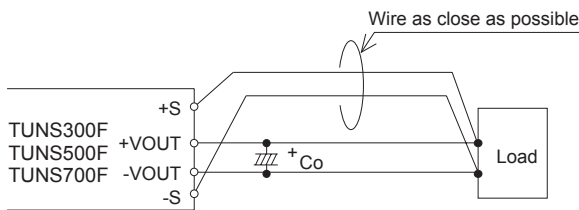


Fig. 4.3 Connection when the remote sensing is in use

■ Twisted-pair wire or shield wire should be used for sensing wire.

■ Thick wire should be used for wiring between the power supply and a load.

Line drop should be less than 0.5V.

Voltage between +VOUT and -VOUT should remain within the output voltage adjustment range.

■ If the sensing patterns are short, heavy-current is drawn and the pattern may be damaged.

The pattern disconnection can be prevented by installing the protection parts as close as a load.

■ As wiring or load impedance may generate oscillation or large fluctuations in output voltage, make sure enough evaluation is given advance.

4.8 Adjustable voltage range

■ Output voltage between +VOUT and -VOUT can be adjusted by connecting external resistors to TRM.

■ When the output voltage adjustment is not used, open the TRM pin respectively.

■ When the output voltage adjustment is used, note that the overvoltage protection circuit operates when output voltage is set too high.

■ The wiring to the potentiometer should be as short as possible.

As the ambient temperature fluctuation characteristics deteriorate depending on the types of resistors and potentiometers, please use resistors and potentiometers of the following specifications:

Resistors..... Metal film type, coefficient less than $\pm 100\text{ppm}/^\circ\text{C}$

Potentiometers... Cermet type, coefficient less than $\pm 300\text{ppm}/^\circ\text{C}$

■ Output voltage can be adjusted by connecting an external potentiometer (VR1) and resistors (R1 and R2) as shown in Fig. 4.4.

Output voltage will increase if the resistance between ② and ③ is reduced by turning the potentiometer.

Recommended values for external components are shown in Table 4.2.

Consult us if the power module is used in a different configuration.

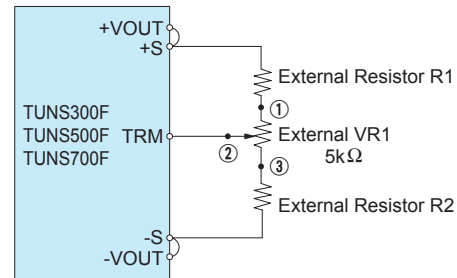


Fig. 4.4 Connecting External Devices (TUNS300F/TUNS500F/TUNS700F)

Table 4.2 Recommended Values of External Resistors (TUNS300F/TUNS500F/TUNS700F)

No.	Output Voltage	Adjustable Range			
		VOUT $\pm 5\%$		VOUT $\pm 10\%$	
		R1	R2	R1	R2
1	12V	12k Ω	2.2k Ω	6.8k Ω	1.0k Ω
2	28V	39k Ω		27k Ω	
3	48V	68k Ω		47k Ω	

●-Y1

■ Adjustable voltage range of 48V output is changed to $\pm 20\%$.

* Adjustable voltage range of standard type except 48V output is $\pm 20\%$.

■ Safety standard, is considered as Non-SELV output.

4.9 Inverter operation monitor (IOG)

■By using the inverter operation monitor (IOG), condition of the inverter can be monitored.

The following ① or ② conditions make the IOG signal turns "H" from "L" within 1 second.

- ① Malfunction of inverter
- ② Output voltage is rapidly dropped by adjusting output voltage

Specification of IOG is shown in Table 4.3.

Table 4.3 Specification of IOG

No.	Item	IOG
1	Function	Normal operation "L"
		Malfunction of inverter "H"
2	Base pin	-S
3	Level voltage "L"	0.5V max at 10mA
4	Level voltage "H"	Open corrector
5	Maximum sink current	10mA max
6	Maximum applied voltage	35V max

4.10 Withstanding Voltage / Isolation Voltage

■When testing the withstanding voltage, make sure the voltage is increased gradually. When turning off, reduce the voltage gradually by using the dial of the hi-pot tester. Do not use a voltage tester with a timer as it may generate voltage several times as large as the applied voltage.

5 Series and Parallel Operation

5.1 Series operation

■Series operation is available by connecting the outputs of two or more power supplies as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

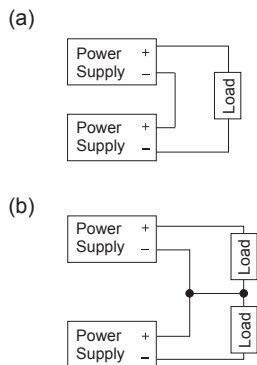


Fig. 5.1 Examples of series operation

5.2 Parallel operation

■Parallel operation is not possible.

● -P (TUNS700F)

■This option is for parallel operation.

■Sensing and adjustment of the output voltage are not possible at the time of the use with this option.

■As variance of output current drew from each power supply is maximum 10%, the total output current must not exceed the value determined by the following equation.

(Output current in parallel operation)

$$= (\text{the rated current per unit}) \times (\text{number of unit}) \times 0.9$$

Total number of units should be no more than 5 pieces.

■To improve the load sharing of each unit, please use the same length from each unit to the load.

■Connect each input pin for the lowest possible impedance.

When the number of the units in parallel operation increases, input current increases. Adequate wiring design for input circuitry such as circuit pattern, wiring and current for equipment is required.

■If temperatures of aluminum base plates are different in the power supply for parallel operation, values of output current will change greatly.

Design radiation to equalize plate temperatures by attaching the same heatsinks.

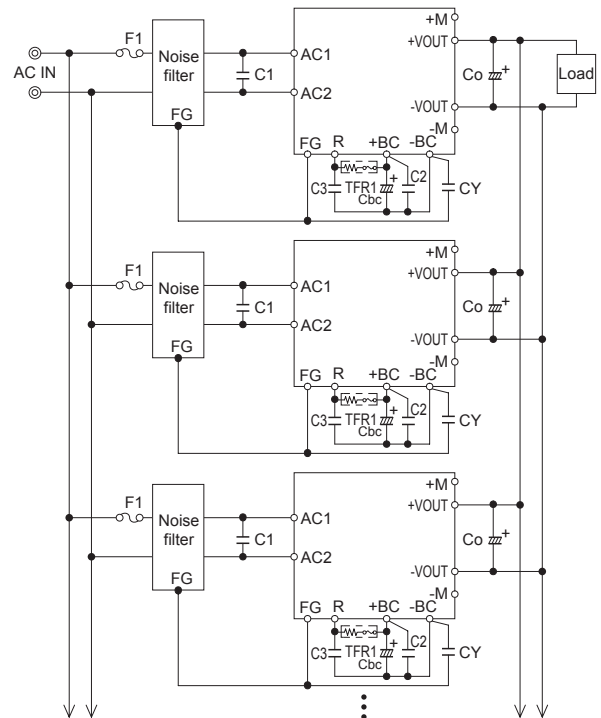


Fig. 5.2 Parallel operation

■Please refer to the application manuals for details of -P type. Application manual is on our web site.

5.3 N+1 redundant operation

■Redundancy operation is available by wiring as shown below.

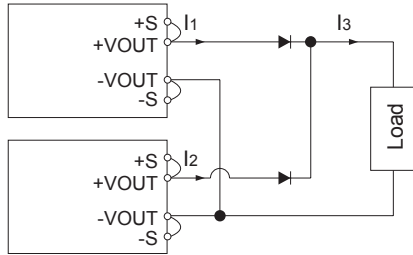


Fig. 5.3 Example of Redundancy Operation

■Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .
Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

6 Implementation · Mounting Method

6.1 Mounting method

- The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Aluminum base plate temperature of each power supply should not exceed the temperature range shown in derating curve.
- Avoid placing the AC input line pattern layout underneath the unit. It will increase the line conducted noise. Make sure to leave an ample distance between the line pattern layout and the unit. Also avoid placing the DC output line pattern underneath the unit because it may increase the output noise. Lay out the pattern away from the unit.
- Avoid placing the signal line pattern layout underneath the unit because the power supply might become unstable. Lay out the pattern away from the unit.
- High-frequency noise radiates directly from the unit to the atmosphere. Therefore, design the shield pattern on the printed circuit board and connect it to FG.
The shield pattern prevents noise radiation.
- When a heat sink cannot be fixed on the base plate side, order the power module with "-T" option. A heat sink can be mounted by affixing a M3 tap on the heat sink.
Please make sure a mounting hole will be connected to a grounding capacitor C_V .

Table 6.1 Mounting Hole Configuration

	Mounting hole
Standard	M3 tapped
Optional : -T	φ 3.4 thru

6.2 Stress to the pins

- When too much stress is applied to the pins may damage internal connections. Avoid applying stress in excess of that shown in Fig. 6.1.
- The pins are soldered onto the internal PCB.
Therefore, Do not bend or pull the leads with excessive force.
- Mounting hole diameter of PCB should be 3.5mm to reduce the stress to the pins.
- Fix the unit on PCB (fixing fittings) by screws to reduce the stress to the pins. Be sure to mount the unit first, then solder the unit.

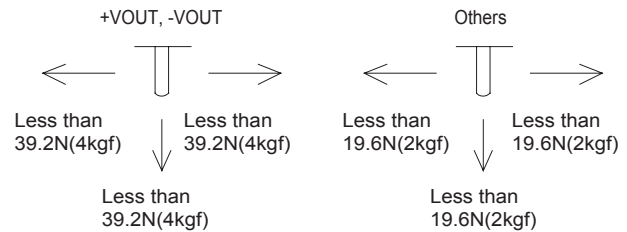


Fig. 6.1 Stress to the pins

6.3 Cleaning

- Clean the product with a brush. Prevent liquid from getting into the product.
Do not soak the product into liquid.
- Do not stick solvent to a name plate or a resin case.
(If solvent sticks to a name plate or a resin case, it will cause to change the color of the case or to fade letters on name plate away.)
- After cleaning, dry them enough.

6.4 Soldering temperature

- Flow soldering: 260°C for up to 15 seconds.
- Soldering iron (26W): 450°C for up to 5 seconds.

6.5 Derating

(1) Input voltage derating curve

●TUNS700F

■Input voltage derating curve is shown in Fig.6.2.

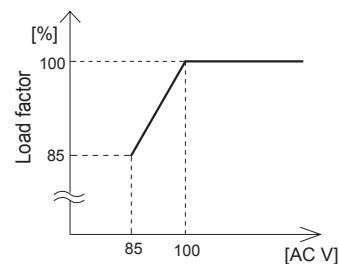


Fig. 6.2 Input voltage derating curve

(2) Output voltage derating curve

■ Use the power modules with conduction cooling (e.g. heat dissipation from the aluminum base plate to the attached heat sink).

Fig.6.3 shows the derating curves with respect to the aluminum base plate temperature. Note that operation within the hatched areas will cause a significant level of ripple and ripple noise.

■ Please measure the temperature on the aluminum base plate edge side when you cannot measure the temperature of the center part of the aluminum base plate.

In this case, please take 5deg temperature margin from the derating characteristics shown in Fig.6.3.

■ In case of forced air cooling, please measure the temperature on the leeward side of aluminum base plate edge.

Especially, in case of using small heat sink, the temperature difference between the center and the edge side of the baseplate becomes large.

In this case, 5deg temperature margin is not required.

■ Please reduce the temperature fluctuation range as much as possible when the up and down of the temperature are frequently generated.

Contact us for more information on cooling methods.

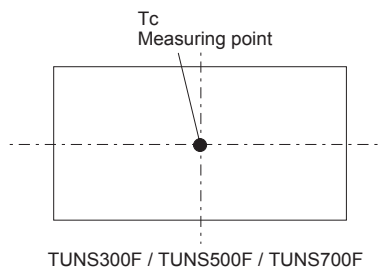
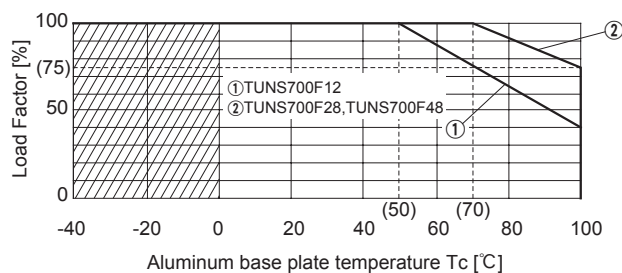
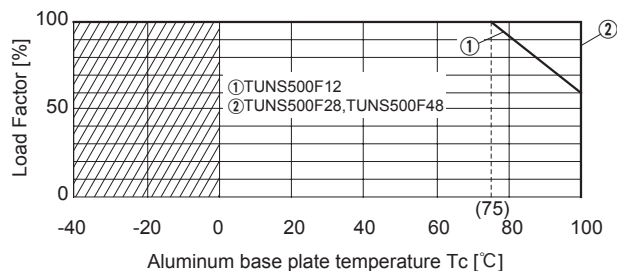
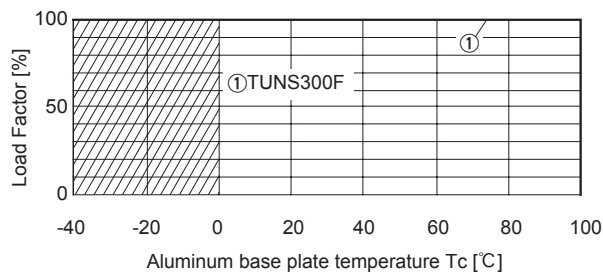


Fig.6.3 Derating curve

7 Peak current

●TUNS500F

■ The unit can generate the peak current under the following conditions.

- $t_1 \leq 10[\text{sec}]$
- $I_p \leq \text{Rated peak current}$
- $I_{ave} \leq \text{Rated current}$
- $\text{Duty} = t_1 / (t_1 + t_2) \times 100[\%] \leq 35\%$

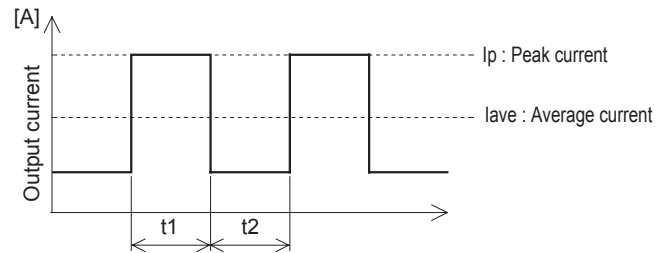


Fig. 7.1 Peak current

■ When aluminum baseplate temperature T_c is higher than 95°C , I_{ave} must be less than 95% of rated current. (TUNS500F28 and TUNS500F48)

8 Lifetime expectancy depends on stress by temperature difference

■ Regarding lifetime expectancy design of solder joint, following contents must be considered.

It must be careful that the soldering joint is stressed by temperature rise and down which is occurred by self-heating and ambient temperature change.

The stress is accelerated by thermal-cycling, therefore the temperature difference should be minimized as much as possible if temperature rise and down is occurred frequently.

■ Product lifetime expectancy depends on the aluminum base plate central temperature difference (ΔT_c) and number of cycling in a day is shown in Fig.8.1.

If the aluminum base plate center part temperature changes frequently by changing output load factor etc., the above the lifetime expectancy design should be applied as well.

Please contact us for details.

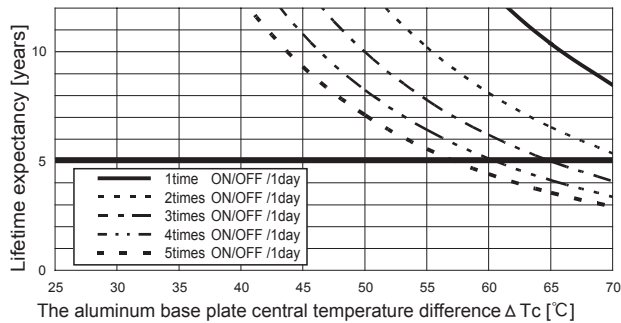
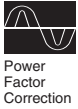


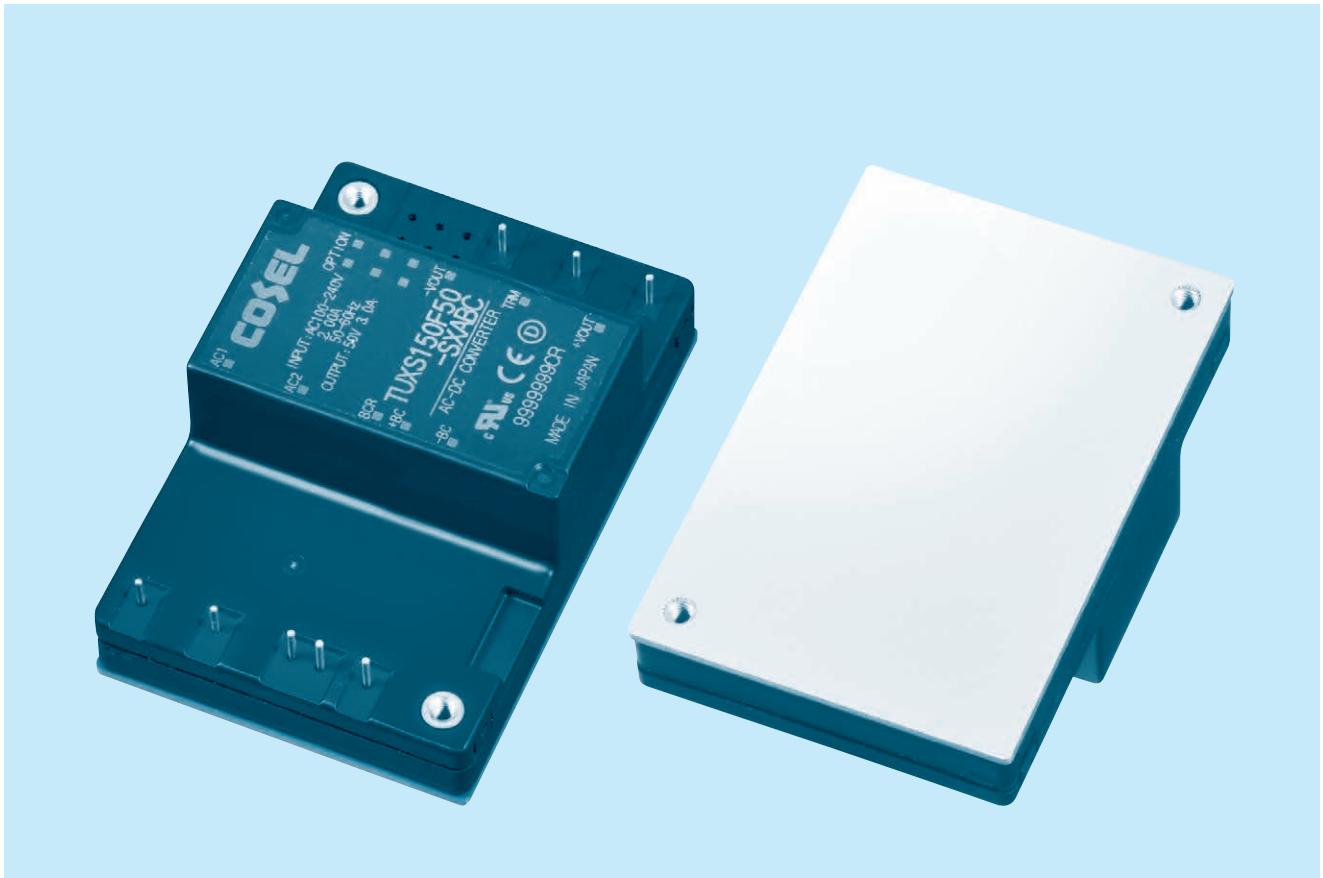
Fig.8.1 Lifetime expectancy against rise/fall temperature difference

Application manuals available at our website.

Recommended external components are also introduced for your reference.



TUXS-series



TUXS

Feature

- AC-DC Power Module Type Converter
- Harmonic attenuator (Complies with IEC61000-3-2 class A)
- Small size
- Built-in overcurrent, overvoltage and thermal protection circuits
- Mounting hole (M3 tapped)
- High efficiency 94%

CE marking

- Low voltage directive

Safety Approval

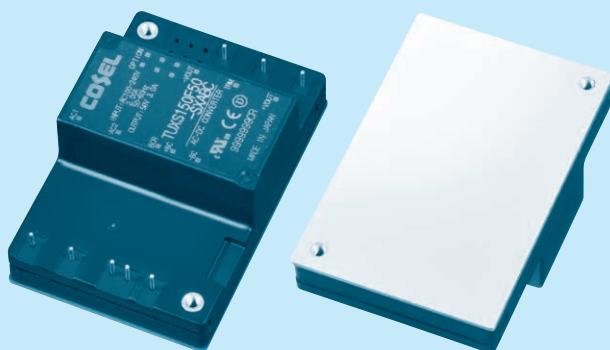
- UL60950-1, C-UL, EN60950-1

5-year warranty

TUXS150F

TUX S 150 F 50 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal Input
- ⑤ Output voltage
- ⑥ Optional
 - T : with Mounting hole (φ 3.4 thru)
 - N : Auto restart in protection circuit working

* Avoid short circuit between +BC and -BC. It may cause the failure of inside components.

* Keep TRM open, if output voltage adjustment is not necessary.

MODEL	TUXS150F50
MAX OUTPUT WATTAGE[W]	150.0
DC OUTPUT	50V 3A

SPECIFICATIONS

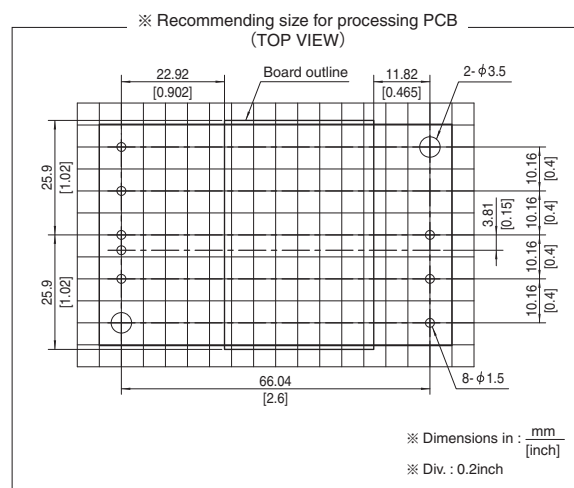
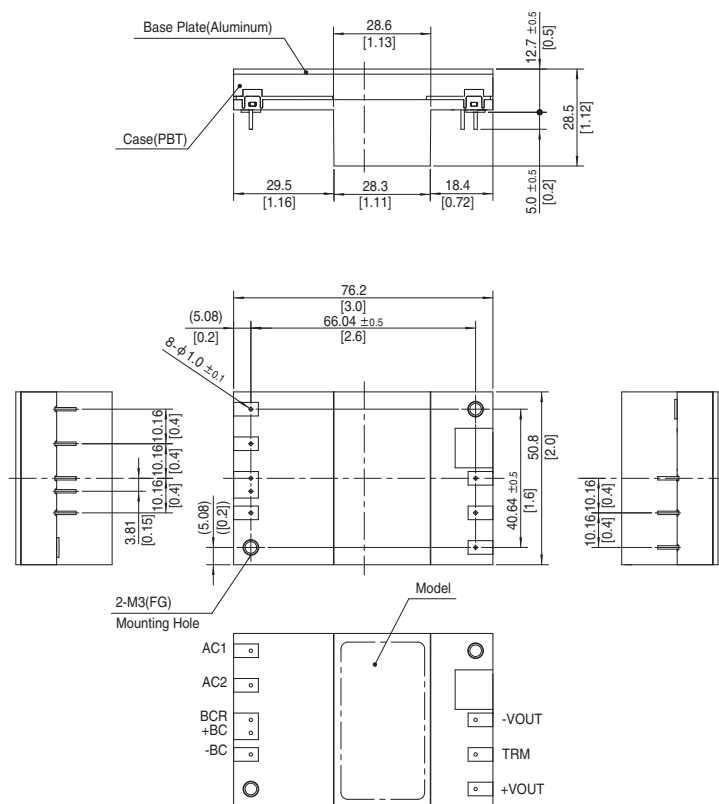
INPUT	MODEL	TUXS150F50
	VOLTAGE[V]	AC85 - 264 1 φ
	CURRENT[A]	ACIN 100V 1.70typ (Io=100%)
		ACIN 200V 0.80typ (Io=100%)
	FREQUENCY[Hz]	50/60 (45 - 66)
	EFFICIENCY[%]	ACIN 100V 93typ
		ACIN 200V 94typ
	POWER FACTOR (Io=100%)	ACIN 100V 0.96typ
		ACIN 200V 0.93typ
	INRUSH CURRENT	Limited by external components (Thermistor)
OUTPUT	LEAKAGE CURRENT[ma]	0.75max (ACIN 240V 60Hz, Io=100%, According to IEC60950-1)
	VOLTAGE[V]	50
	CURRENT[A]	3
	LINE REGULATION[mV]	100max
	LOAD REGULATION[mV]	100max
	RIPPLE[mVp-p]	-20 to +100°C *1 200max
		-40 to -20°C *1 300max
	RIPPLE NOISE[mVp-p]	-20 to +100°C *1 200max
		-40 to -20°C *1 300max
	TEMPERATURE REGULATION[mV]	0 to +100°C 500max
		-40 to +100°C 1000max
	DRIFT[mV]	*2 200max
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	Fixed (TRM pin open), adjustable by external resistor or external signal
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically
	OVERVOLTAGE PROTECTION[V]	57.5 - 67.5
	REMOTE SENSING	Not provided
	REMOTE ON/OFF	Not provided
ISOLATION	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)
	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15°C)
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100°C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 4,000m (13,000 feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max
	VIBRATION	10 - 55Hz, 49.0m/s² (5G), 3minutes period, 60minutes each along X, Y and Z axis
	IMPACT	196.1m/s² (20G), 11ms, once each along X, Y and Z axis
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *3
OTHERS	CASE SIZE/WEIGHT	76.2×28.5×50.8mm [3.0×1.12×2.0 inches] (W×H×D) / 150g max
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)

*1 Refer to instruction manual for measuring method of electric characteristics.

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*3 Please contact us about another class.

External view



- ※ Tolerance : ±0.3 [±0.012]
- ※ Weight : 150g max
- ※ Dimensions in mm, []=inches
- ※ Mounting hole screwing torque : 0.49N/m (5.0kgf/cm) max

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A] *1	Inrush current protection circuit	PCB/Pattern			Series/Parallel operation availability	
					Material	Single sided	Double sided	Series operation	Parallel operation
TUXS150F	Active filter	80-600	1.70	Thermistor	Aluminum	Yes		Yes	*2
	LLC resonant converter	100-300							

*1 The value of input current is at ACIN 100V and rated load.

*2 Refer to instruction manual.

TUXS150F

1 Pin Connection TUXS-6

2 Connection for Standard Use TUXS-6

3 Wiring Input/Output Pin TUXS-7

- 3.1 Wiring input pin TUXS-7
- 3.2 Wiring output pin TUXS-7
- 3.3 Wiring +BC/-BC pins TUXS-7

4 Function TUXS-8

- 4.1 Input voltage range TUXS-8
- 4.2 Overcurrent protection TUXS-8
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- 4.5 Remote sensing TUXS-8
- 4.6 Adjustable voltage range TUXS-8
- 4.7 Withstanding Voltage / Isolation Voltage TUXS-9

5 Series and Parallel Operation TUXS-9

- 5.1 Series operation TUXS-9
- 5.2 Parallel operation TUXS-9

TUXS

6 Implementation · Mounting Method TUXS-10

- 6.1 Mounting method TUXS-10
- 6.2 Stress to the pins TUXS-10
- 6.3 Cleaning TUXS-10
- 6.4 Soldering temperature TUXS-10
- 6.5 Derating TUXS-10

7 Lifetime expectancy depends on stress by temperature difference TUXS-11

1 Pin Connection

● TUXS150F

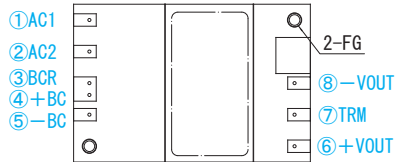


Fig. 1.1 Pin connection (bottom view)

Table 1.1 Pin connection and function

No.	Pin Connection	Function
①	AC1	AC input
②	AC2	
③	BCR	+BC output
④	+BC	+BC output
⑤	-BC	-BC output
⑥	+VOUT	+DC output
⑦	TRM	Adjustment of output voltage
⑧	-VOUT	-DC output
-	FG	Mounting hole (FG)

2 Connection for Standard Use

■ To use TUXS series, connection shown in Fig.2.1 and external components are required.

■ This product uses conduction cooling method (e.g. heat radiation from the aluminum base plate to the attached heat sink).

Reference: 6.5 "Derating"

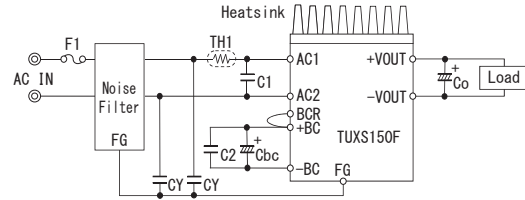


Fig.2.1 Connection for standard use

Table 2.1 External components

No.	Symbol	Components	Reference
1	F1	Input fuse	3.1 "Wiring input pin (1)"
2	C1	Input Capacitor	3.1 "Wiring input pin (2)"
3	-	Noise Filter	3.1 "Wiring input pin (3)"
4	CY	Y capacitor	
5	TH1	Inrush current protection thermistor	3.1 "Wiring input pin (4)"
6	Co	Output capacitor	3.2 "Wiring output pin (1)"
7	Cbc	Smoothing Capacitor for boost voltage	3.3 "Wiring +BC/-BC pins (1)"
8	C2	Capacitor for boost voltage	3.3 "Wiring +BC/-BC pins (2)"

3 Wiring Input/Output Pin

3.1 Wiring input pin

(1) F1 : External fuse

■ Fuse is not built-in on input side. In order to protect the unit, install the slow-blow type fuse on input side (as shown in Table 3.1).

Table 3.1 Recommended fuse (Slow-blow type)

No.	Model	Rated current
1	TUXS150F	5A

(2) C1 : External Capacitor for input side

- Install a film capacitor as input capacitor C1 of which the capacitance and ripple current capability are above the values shown in Table 3.2.
- Use a safety approved capacitor with 250V ac rated voltage.
- If C1 is not connected, it may cause the failure of the power supply or external components.

Table 3.2 Input Capacitor C1

No.	Model	Voltage	Capacitance	Rated ripple current
1	TUXS150F	AC250V	1 μ F or more	1A or more

(3) CY : Noise filter/Decoupling capacitor

- The product doesn't have noise filter internally. Please connect external noise filter and primary decoupling capacitor CY for low line noise and stable operation of the power supply.
- The operation of the power supply may be unstable due to the resonance of the filter or inductance.
- Install a correspondence filter, if it is required to meet a noise standard or if the surge voltage may be applied to the unit.
- When the total capacitance of the primary decoupling capacitor is more than 8800pF, the nominal value in the specification may not be met by the Hi-Pot test between input and output. A capacitor should be installed between output and FG.

(4) TH1 : Inrush current limiting thermistor

- It has a possibility that internal components fail by inrush current, so please use power thermistor or inrush current limiting circuit to keep input current below 60A.
- If you use power thermistor and turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that a power supply cools down before being turned on. And appropriate intervals should be set even if inrush current limiting circuit except power thermistor is used.

- The output voltage may become unstable at low temperature due to the ESR of power thermistor. In this case, increase the capacitance of Cbc more than recommended value or connect same capacitors in parallel. Please evaluate before use.

3.2 Wiring output pin

(1) Co : Output capacitor

- Install an external capacitor Co between +VOUT and -VOUT pins for stable operation of the power supply (Fig.2.1). Recommended capacitance of Co is shown in Table 3.3.
- Select the high frequency type capacitor. Output ripple and start-up waveform may be influenced by ESR-ESL of the capacitor and the wiring impedance.
- Install a capacitor Co near the output pins (within 50mm from the pins).
- When the power supply is used under 0°C ambient temperature, output ripple voltage increases. In this case, connect 3 capacitors Co in parallel connection.

Table 3.3 Recommended capacitance Co[μ F]

Model	Temperature of base plate		Maximum capacitance
	Tc=0 to +100°C	Tc=-40 to +100°C	
TUXS150F50	220	220 \times 3	2200

The specified ripple and ripple noise are measured by the method introduced in Fig.3.1.

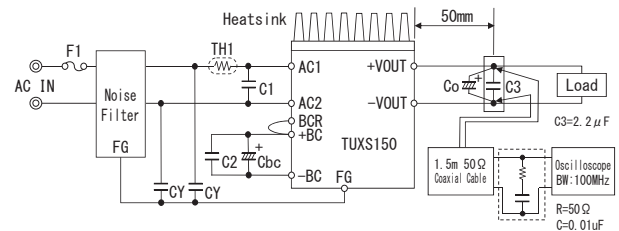


Fig.3.1 Method of Measuring Output Ripple and Ripple Noise

3.3 Wiring +BC/-BC pins

(1) Cbc : Smoothing capacitor for boost voltage

- In order to smooth boost voltage, connect Cbc between +BC and -BC. Recommended capacitance of Cbc is shown in Table 3.4.
- Note that +BC and -BC terminals have high voltage (DC385V typ).
- Keep the capacitance within the allowable external capacitance.
- Select a capacitor of which the boost voltage ripple voltage does not exceed 30Vp-p.
- When the power supply is operated under -20°C, it may make the boost voltage unstable due to the characteristic of equivalent series resistor. Please choose the capacitor which has more than recommended capacitance.
- Wire between BCR and +BC as short as possible in width.

Table 3.4 Recommended capacitance Cbc

No.	Model	Voltage	Cbc	Allowable capacitance range
1	TUXS150F	DC420V or more	150μF	100 to 500μF

(2) C2 : Capacitor for boost voltage

- Install external capacitors C2 with capacitance shown in table 3.5.
- If capacitors C2 are not installed, it may cause the failure of the power supply or external components.

Table 3.5 Recommended capacitance C2

No.	Model	Voltage	Capacitance	Rated ripple current
1	TUXS150F	DC450V	0.47μF or more	1A or more

4 Function

4.1 Input voltage range

- The input voltage range is from 85 VAC to 264 VAC.
- In cases that conform with safety standard, input voltage range is AC100-AC240V(50/60Hz).
- Be aware that use of voltages other than those listed above may result in the unit not operating according to specifications, or may cause damage. Avoid square waveform input voltage, commonly used in UPS units and inverters.

4.2 Overcurrent protection

- Overcurrent protection is built-in and comes into effect at over 105% of the rated current. Overcurrent protection prevents the unit from short circuit and overcurrent condition. The unit automatically recovers when the fault condition is cleared.
- When the output voltage drops at overcurrent, the average output current is reduced by intermittent operation of power supply.

4.3 Overvoltage protection

- Overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait more than 3 minutes and turn on the AC input again to recover the output voltage. Recovery time varies depending on such factors as input voltage value at the time of the operation.

Remarks:

Please note that devices inside the power supply might fail when voltage of more than rated output voltage is applied to output terminal of the power supply. This could happen when the customer tests the overvoltage performance of the unit. To check the function of overvoltage protection, adjust the output voltage by changing TRM voltage. Please contact us for details.

4.4 Thermal protection

- When the power supply temperature is kept above 100°C, the thermal protection will be activated and simultaneously shut down the output. When the thermal protection is activated, shut off the input voltage and eliminate all the overheating conditions. To recover the output voltage, keep enough time to cool down the power supply before turning on the input voltage again.

● -N

- Option "-N" means the output voltage of the power module will be recovered automatically when the fault condition (such as OVP or OTP) is corrected.

4.5 Remote sensing

- Remote sensing is not built-in.

4.6 Adjustable voltage range

(1) Output voltage adjusting

- Output voltage is adjustable by the external potentiometer.
- When the output voltage adjustment is used, note that the over voltage protection circuit operates when the output voltage sets too high.
- If the output voltage drops under the output voltage adjustment range, note that the Low voltage protection operates.
- By connecting the external potentiometer (VR1) and resistors (R1,R2), output voltage becomes adjustable, as shown in Fig.4.1, recommended external parts are shown in Table 4.1.
- The wiring to the potentiometer should be as short as possible. The temperature coefficient becomes worse, depending on the type of a resistor and potentiometer. Following parts are recommended for the power supply.
Resistor.....Metal film type, coefficient of less than ±100ppm/°C
Potentiometer.....Cermet type, coefficient of less than ±300ppm/°C
- When the output voltage adjustment is not used, open the TRM pin respectively.

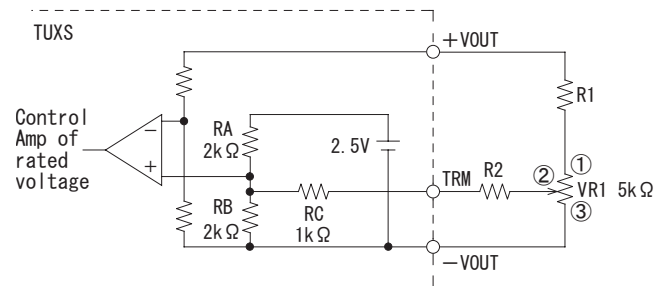


Fig. 4.1 Output voltage control circuit

Table 4.1 Recommended Values of External Resistors

No.	VOUT	Adjustable range			
		VOUT±5%		VOUT±10%	
		R1	R2	R1	R2
1	50V	82kΩ	11kΩ	82kΩ	6.2kΩ

(2) Output voltage decreasing

■By connecting the external resistor(RD), output voltage becomes adjustable to decrease.

The external resistor(RD) is calculated the following equation.

$$RD = \left[\frac{100\%}{\Delta\%} - 2 \right] [k\Omega]$$

$$\Delta\% = \frac{V_{OR} - V_{OD}}{V_{OR}} \times 100$$

V_{OR} : Rated output voltage[V]

V_{OD} : Output voltage needed to set up[V]

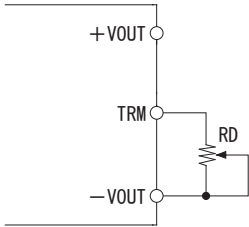


Fig. 4.2 Connection for output voltage decreasing

(3) Output voltage increasing

■By connecting the external resistor (RU), output voltage becomes adjustable to increase.

The external resistor (RU) is calculated the following equation.

$$RU = \left[\frac{V_{OR} \times (100\% + \Delta\%)}{1.225 \times \Delta\%} - \frac{(100\% + 2 \times \Delta\%)}{\Delta\%} \right] [k\Omega]$$

$$\Delta\% = \frac{V_{OU} - V_{OR}}{V_{OR}} \times 100$$

V_{OR} : Rated output voltage[V]

V_{OU} : Output voltage needed to set up[V]

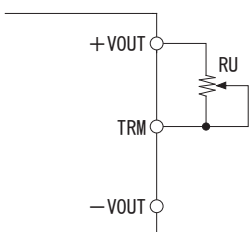


Fig. 4.3 Connection for output voltage increasing

4.7 Withstanding Voltage / Isolation Voltage

■When testing the withstanding voltage, make sure the voltage is increased gradually. When turning off, reduce the voltage gradually by using the dial of the hi-pot tester. Do not use a voltage tester with a timer as it may generate voltage several times as large as the applied voltage.

5 Series and Parallel Operation

5.1 Series operation

■Series operation is available by connecting the outputs of two or more power supplies as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

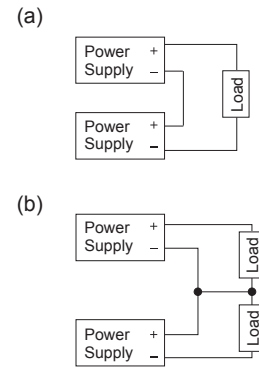


Fig. 5.1 Examples of series operation

5.2 Parallel operation

■Parallel operation is not possible.

■Redundancy operation is available by wiring as shown below.

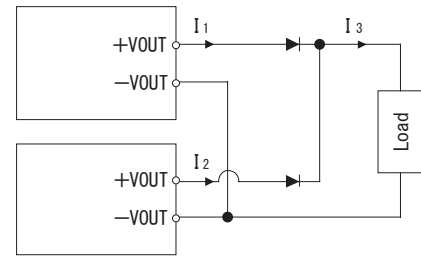


Fig. 5.2 Example of Redundancy Operation

■Even a slight difference in output voltage can affect the balance between the values of I₁ and I₂.

Please make sure that the value of I₃ does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

6 Implementation · Mounting Method

6.1 Mounting method

- The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Aluminum base plate temperature of each power supply should not exceed the temperature range shown in derating curve.
- Avoid placing the AC input line pattern layout underneath the unit. It will increase the line conducted noise. Make sure to leave an ample distance between the line pattern layout and the unit. Also avoid placing the DC output line pattern underneath the unit because it may increase the output noise. Lay out the pattern away from the unit.
- Avoid placing the signal line pattern layout underneath the unit because the power supply might become unstable. Lay out the pattern away from the unit.
- High-frequency noise radiates directly from the unit to the atmosphere. Therefore, design the shield pattern on the printed circuit board and connect it to FG. The shield pattern prevents noise radiation.
- When a heat sink cannot be fixed on the base plate side, order the power module with "-T" option. A heat sink can be mounted by affixing a M3 tap on the heat sink. Please make sure a mounting hole will be connected to a grounding capacitor C_V .

Table 6.1 Mounting Hole Configuration

	Mounting hole
Standard	M3 tapped
Optional : -T	ϕ 3.4 thru

6.2 Stress to the pins

- When too much stress is applied to the pins may damage internal connections. Avoid applying stress in excess of that shown in Fig. 6.1.
- The pins are soldered onto the internal PCB. Therefore, Do not bend or pull the leads with excessive force.
- Mounting hole diameter of PCB should be 3.5mm to reduce the stress to the pins.
- Fix the unit on PCB (fixing fittings) by screws to reduce the stress to the pins. Be sure to mount the unit first, then solder the unit.

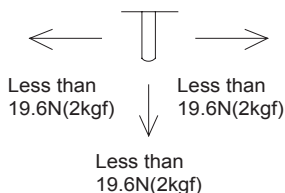


Fig. 6.1 Stress to the pins

6.3 Cleaning

- Clean the product with a brush. Prevent liquid from getting into the product.
Do not soak the product into liquid.
- Do not stick solvent to a name plate or a resin case.
(If solvent sticks to a name plate or a resin case, it will cause to change the color of the case or to fade letters on name plate away.)
- After cleaning, dry them enough.

6.4 Soldering temperature

- Flow soldering: 260°C for up to 15 seconds.
- Soldering iron (26W): 450°C for up to 5 seconds.

6.5 Derating

(1) Output voltage derating curve

- Use the power modules with conduction cooling (e.g. heat dissipation from the aluminum base plate to the attached heat sink).
Fig. 6.3 shows the derating curves with respect to the aluminum base plate temperature. Note that operation within the hatched areas will cause a significant level of ripple and ripple noise.
- Please measure the temperature on the aluminum base plate edge side when you cannot measure the temperature of the center part of the aluminum base plate.
In this case, please take 5deg temperature margin from the derating characteristics shown in Fig.6.3.
Please reduce the temperature fluctuation range as much as possible when the up and down of the temperature are frequently generated.
Contact us for more information on cooling methods.

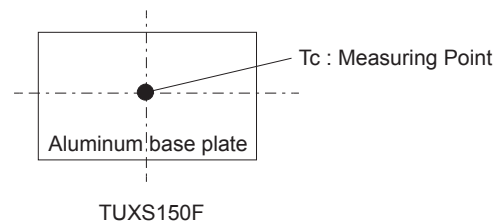
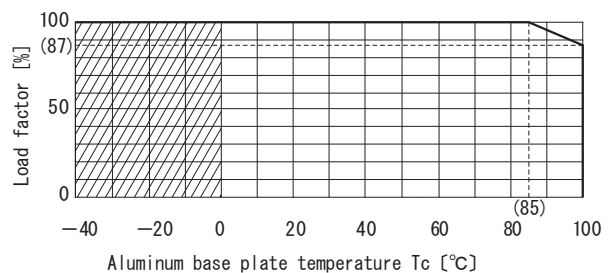


Fig.6.2 Derating curve

7 Lifetime expectancy depends on stress by temperature difference

■ Regarding lifetime expectancy design of solder joint, following contents must be considered.

It must be careful that the soldering joint is stressed by temperature rise and down which is occurred by self-heating and ambient temperature change.

The stress is accelerated by thermal-cycling, therefore the temperature difference should be minimized as much as possible if temperature rise and down is occurred frequently.

■ Product lifetime expectancy depends on the aluminum base plate central temperature difference (ΔT_c) and number of cycling in a day is shown in Fig.7.1.

If the aluminum base plate center part temperature changes frequently by changing output load factor etc., the above the lifetime expectancy design should be applied as well.

Please contact us for details.

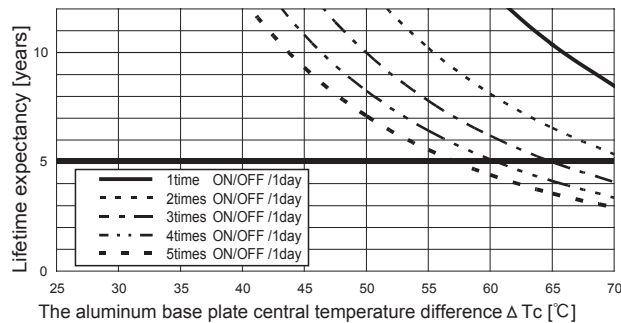


Fig.7.1 Lifetime expectancy against rise/fall temperature difference

Application manuals available at our website.

Recommended external components are also introduced for your reference.



DPG-series



■ Power factor correction module

■ Feature

Harmonic attenuator (Complies with IEC61000-3-2)
 High efficiency 93% (AC100V), 96% (AC200V)
 Universal input voltage (AC85 - 264V)
 Built-in inrush current protection
 Built-in overvoltage and thermal protection circuits
 Enable signal (ENA)
 Auxiliary power supply for external signal (AUX)
 Ideal for distributed power systems

■ 5-year warranty

■ CE marking

Low Voltage Directive

■ Safety agency approvals

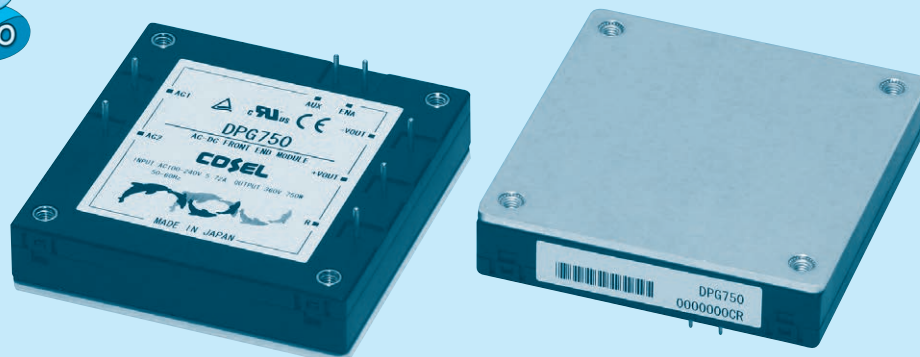
UL, C-UL recognized, TÜV approved

DPG

DPG

DPG 750

① ②



① Series name
② Output power
500 : 500W (ACIN 200V)
750 : 750W (ACIN 200V)

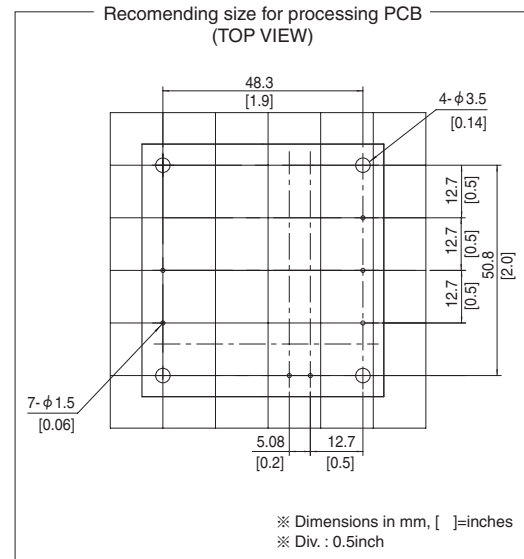
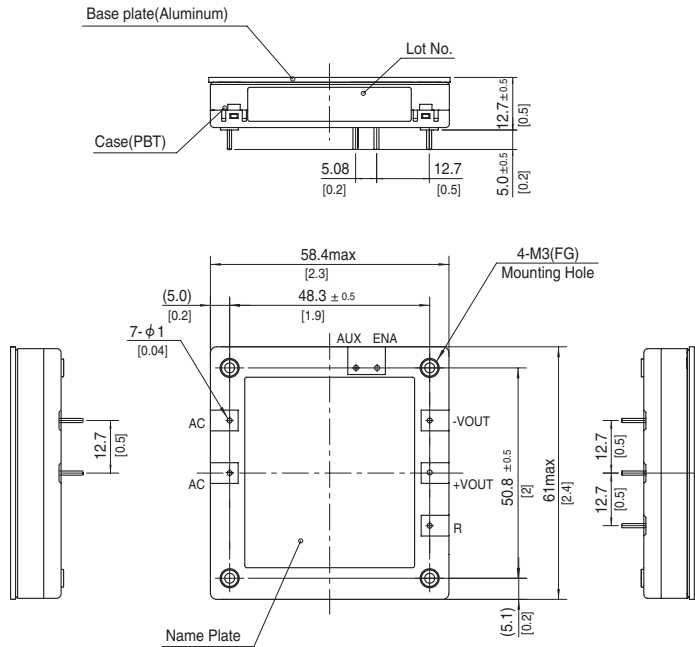
MODEL	DPG500	DPG750
AC INPUT[V]	AC85 - 264	AC170 - 264
MAX OUTPUT WATTAGE[W]	300	500
DC OUTPUT VOLTAGE[V]	360	360

SPECIFICATIONS

	MODEL	DPG500	DPG750
INPUT	VOLTAGE[V]	AC85 - 264 1 φ	AC170 - 264 1 φ
	POWER FACTOR CORRECTION RANGE[V]	AC85 - 264 1 φ	AC85 - 264 1 φ
	CURRENT[A]	3.47typ (ACIN 100V)	5.72typ (ACIN 100V)
	FREQUENCY[Hz]	50/60 (47 - 63) Hz	4.24typ (ACIN 200V)
	INRUSH CURRENT[A]	Limited by external resistance	93typ (ACIN 100V)
	EFFICIENCY[%]	92typ (ACIN 100V)	96typ (ACIN 200V)
	POWER FACTOR	0.96typ (ACIN 100V)	0.93typ (ACIN 200V)
	LEAKAGE CURRENT[mA]	0.75 max (60Hz, According to IEC60950 and DEN-AN)	0.96typ (ACIN 100V)
OUTPUT	WATTAGE[W]	300	500
	VOLTAGE[V]	360	750
	VOLTAGE ACCURACY	±2%	
PROTECTION CIRCUIT AND OTHERS	OVERVOLTAGE PROTECTION[V]	DC400 - 450V The power factor corrector function stops	
	ENA	Enable signal, Open-drain output, Maximum sink current 10mA, Maximum allowance voltage 35V	
	OTHERS	Parallel operation impossible, Thermal protection	
ISOLATION	INPUT-OUTPUT	Non isolated	
	INPUT, OUTPUT-FG	AC2,800V 1minute Cutoff current = 10mA, DC500V, 50MΩ min (20±15°C)	
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-40 to +100°C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE)	3,000m (10,000feet) max
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +100°C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max	
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis	
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis	
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1, EN50178 Complies with DEN-AN and IEC60950-1	
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2	
OTHERS	CASE SIZE/WEIGHT	58.4×12.7×61mm [2.3×0.5×2.4 inches] (W×H×D) / 100g max	
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)	

- *1 Refer to Input voltage derating.
*2 When the input voltage is more than 240V, the output voltage becomes the value proportional to the input voltage.
*3 The value included the output setting and the line regulation, the load regulation and the temperature regulation. However, the input voltage is less than 240V.
*4 Refer to the instruction Manual.
*5 The thermal protection stops the power factor corrector function and the ENA signal.
*6 Please contact us about class C.

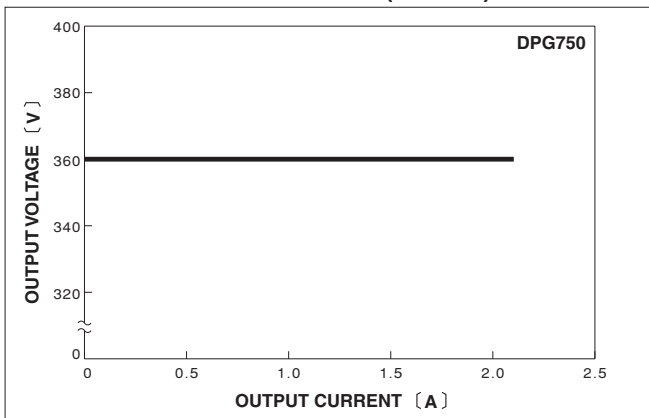
External view



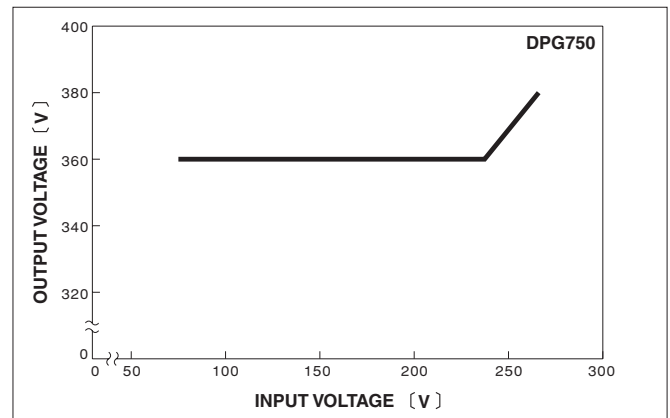
- ※ Tolerance : ± 0.3 [± 0.012]
- ※ Weight : 100g max
- ※ Dimensions in mm, []=inches
- ※ Mounting hole screwing torque : $0.49\text{N} \cdot \text{m}$ (5.0kgf · cm) max

Performance data

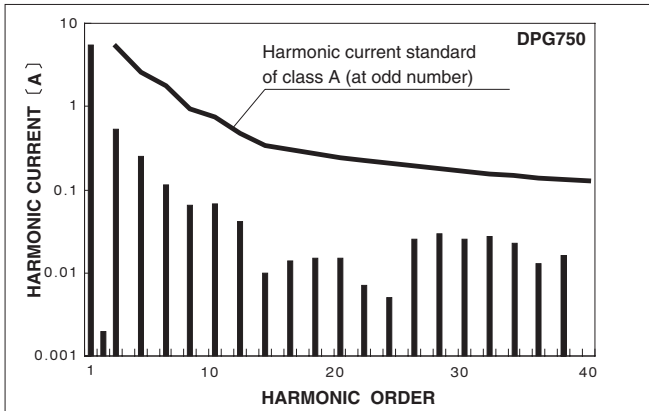
■ STATIC CHARACTERISTICS (AC230V)



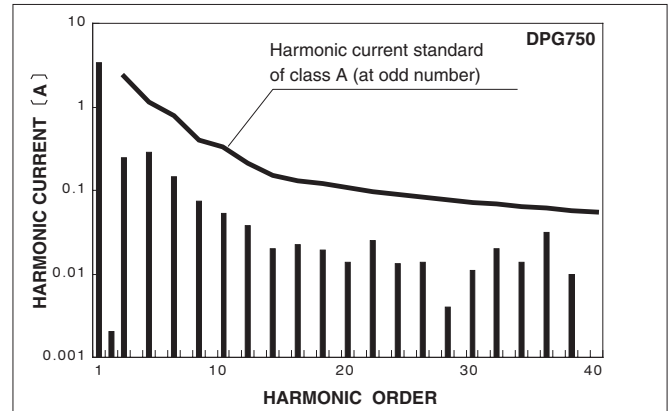
■ OUTPUT VOLTAGE FOR INPUT



■ HARMONIC CURRENT (AC100V)



■ HARMONIC CURRENT (AC230V)



Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
				Material	Single sided	Double sided	Series operation	Parallel operation
DPG500	Active filter	130	SCR	Aluminum	Yes		No	No
DPG750	Active filter	130	SCR	Aluminum	Yes		No	No

1 Pin Connection DPG-6**2** Input Voltage Derating DPG-6**3** Standard Connection Method DPG-6

- 3.1 Standard connection method DPG-6
- 3.2 External components DPG-6
- 3.3 Wiring input pin DPG-7
- 3.4 Connection of loaded circuit DPG-7
- 3.5 Heatsink DPG-7

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- 4.1 Overcurrent protection DPG-7
- 4.2 Overvoltage protection DPG-7
- 4.3 Thermal protection DPG-7
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- 5.1 Series operation DPG-8
- 5.2 Parallel operation DPG-8

6 Implementation · Mounting Method DPG-8

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- 6.2 Stress onto the pins DPG-8
- 6.3 Cleaning DPG-8
- 6.4 Soldering DPG-8
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DPG

1 Pin Connection

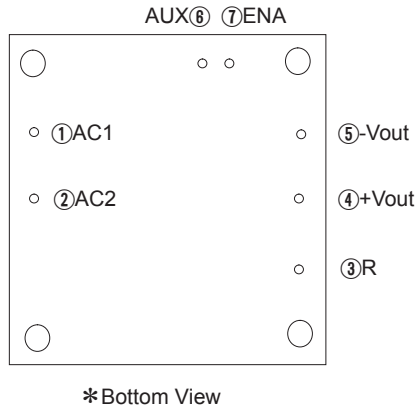


Table 1.1 Pin Connection and function

No.	Pin Connection	Function
①	AC1	AC Input
②	AC2	
③	R	External resistor for inrush current protection
④	+VOUT	+DC output
⑤	-VOUT	-DC output
⑥	AUX	Auxiliary power supply for external signal
⑦	ENA	Enable signal

2 Input Voltage Derating

DPG

Fig.2.1 and 2.2 shows rated output for each input voltage section. Maximum output should be within this range.

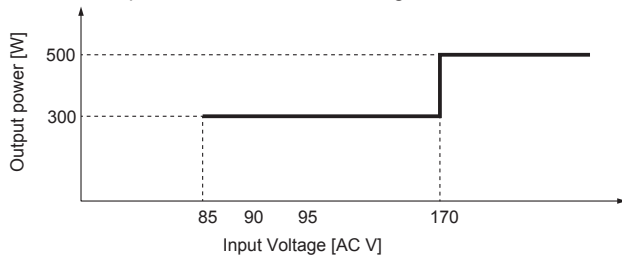


Fig.2.1 Input voltage derating curve (DPG500)

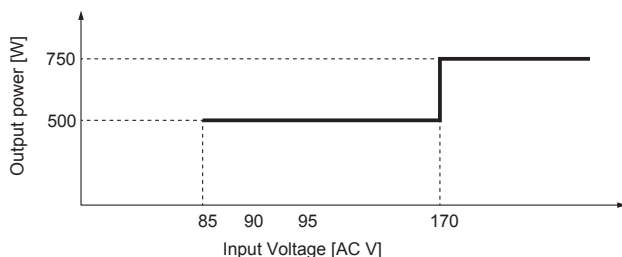


Fig.2.2 Input voltage derating curve (DPG750)

3 Standard Connection Method

3.1 Standard connection method

To use DPG Series, connection shown in Fig.3.1 and outside attached components are required. Through this connection, DC output voltage can be obtained from AC input voltage. AC input voltage and DC output voltage are not insulated.

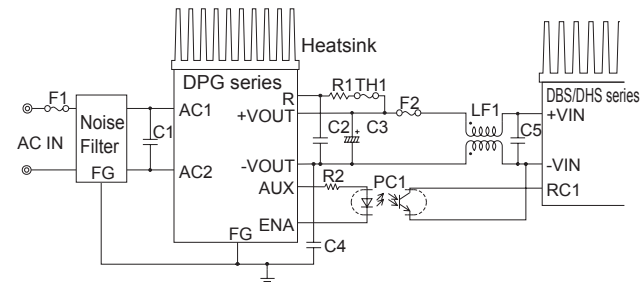


Fig.3.1 Standard connection method

Table 3.1 External components

No.	Symbol	Component	Required characteristics
①	F1	Input fuse	15A or less Slow-blow type
②	F2	Output fuse	10A or less Normal-blow type
③	C1	Input capacitor	2 μ F or more, Rated ripple current : 5A or more, Film capacitor, Safety approved type
④	C2	Output capacitor	1 μ F or more, Rated ripple current : 4A or more, Film capacitor
⑤	C3	Holdup capacitor	220 - 2200 μ F Aluminum electrolytic capacitor
⑥	C4	Y-capacitor	2200pF Safety approved type
⑦	R1	Inrush current protection resistor	4.7 - 22 Ω Wirewound Resistor with Thermal Cut-Offs

3.2 External components

- F1** Input fuse : 15A or less
Fuse is not built-in at input side. In order to secure the safety, use the slow-blow type fuse F1 (15A or less).
- F2** Output fuse : 10A or less
Since over current protection is not built-in, use the normal-blow type fuse F2 (10A or less) at output side to secure the safety.
- C1** Input capacitor : 2 μ F or more
Install an external capacitor C1 (2 μ F or more) to keep stable operation and to avoid failure. Use AC250V rated voltage with safety approved and over 5A rated ripple current.

- C2** Output capacitor : 1 μ F or more
Install an external capacitor C2 (1 μ F or more) as close as possible to the output pins to keep stable operation and to avoid failure. Use DC400V or higher rated voltage and over 4A rated ripple current capacitor.
If the ambient temperature is below -20°C, Holdup capacitors ESR increases remarkably.
Cr must connect 4 μ F or more.
- C3** Holdup capacitor : 220-2200 μ F
Since holdup capacitor is not built-in, install electrolytic capacitor C3 (220 - 2200 μ F) close to the output pins. The rated ripple current of C3 and the holdup time for module should be considered. The capacitor value should be within 220 to 2200 μ F to avoid failure.
If the ambient temperature is below -20°C, Holdup capacitors ESR increases remarkably.
Therefore, be sure to verify characteristics by actual evaluation.
- C4** Y-capacitor : 2200pF
Install an external capacitor C4 (2200pF) to keep stable operation. Use AC250V rated voltage with safety approved capacitor.
- R1** Inrush current protection resistor : 4.7 - 22 Ω
Connect a resistor between R pin and +Vout pin for inrush current protection. The surge capacity is required for R1, please contact component mfg. Wirewound resistor with thermal cut-offs type is required.

3.3 Wiring input pin

- A noise filter is not built in this power supply. Connect an external noise filter to reduce the conducted noise to the power supply line.
- A fuse to protect input is not built in. To assure safety, install a slow-blow fuse of 15A maximum to the input circuit F1.

3.4 Connection of loaded circuit

- For connecting the DBS/DHS series, see Fig.3.1.
For details of F2, LF1 and C5, refer to the instruction manual for the DBS/DHS series.
LF1 may not be required, depending on the noise standard or the design of the printed circuit board. In this case, ENA and RC1 can be directly connected, without having PC1.
- Control load current so that it may flow only when the terminal ENA is at "L". At "H" when inrush current protection circuit is not released, excessive current may be applied to the circuit.
- For connection of loads except the series DBS/DHS, please contact Cosel development department.

3.5 Heatsink

- The power supply adopts the conduction cooling system. Attach a heatsink to the aluminum base plate to cool the power supply for use.
Refer to 6.5 Derating.

4 Function

4.1 Overcurrent protection

- The overcurrent protection circuit is not built-in.

4.2 Overvoltage protection

- The overvoltage protection circuit is built-in. The AC input should be shut down if overvoltage protection is in operation.
When this function operates, the power factor corrector function does not operate, and output voltage becomes the full-wave rectified AC input voltage.

Remarks:

Please note that the unit's internal components may be damaged if excessive voltage (over rated voltage) is applied to output terminal of power supply. This could happen when the customer tests the overvoltage performance of the unit.

4.3 Thermal protection

- Thermal protection circuit is built-in and it operates about 115°C.
If this function comes into effect, shut down the output, eliminate all possible causes of overheating, and drop the temperature to normal level. To prevent the unit from overheating, avoid using the unit in a dusty, poorly ventilated environment.
When this function operates, the power factor corrector function does not operate, and output voltage becomes the full-wave rectified AC input voltage and ENA output changes into "H".

4.4 Auxiliary power supply circuit for external signal (AUX)

- Shortprotection resistance (2.2k Ω) is built in.
Output voltage decreases as the output current increases.
- Never let a short circuit occur between the AUX pin and other pins. It may damage the unit.

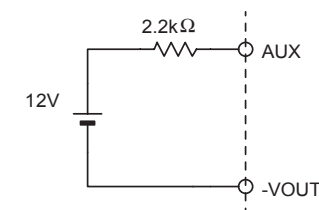


Fig.4.1 AUX circuit

4.5 Enable signal (ENA)

- Use ENA to control starting of the loaded power supply.
- When inrush current protection circuit is released, ENA outputs "LOW".
- If load current flows without releasing of the circuit, the resistor may be burnt.

Table 4.1 Specification of TMP, IOG

No.	Item	ENA
1	Function	Outout passible "L"
		Outout prohibited "H"
2	Base pin	-VOUT
3	Level voltage "L"	0.6V max at 10mA
4	Level voltage "H"	Open drain
5	Maximum sink current	10mA max
6	Maximum applied voltage	35V max

4.6 Isolation

- For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for a start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

5 Series and Parallel Operation

5.1 Series operation

- As input and output are not insulated, series operation is impossible

DPG

5.2 Parallel operation

- Parallel operation is not possible.

6 Implementation · Mounting Method

6.1 Mounting method

- The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Aluminum base plate temperature around each power supply should not exceed the temperature range shown in derating curve.

- Avoid placing the AC input line pattern lay out underneath the unit, it will increase the line conducted noise. Make sure to leave an ample distance between the line pattern lay out and the unit. Also avoid placing the DC output line pattern of DC-DC converter underneath the unit because it may increase the output noise. Lay out the pattern away from the unit.
- High-frequency noise radiates directly from the unit to the atmosphere. Therefore, design the shield pattern on the printed circuit board and connect its one to FG.
The shield pattern prevents noise radiation.

6.2 Stress onto the pins

- When too much stress is applied to the pins of the power supply, the internal connection may be weakened. As shown in Fig.6.1 avoid applying stress of more than 19.6N (2kgf) on the pins.
- The pins are soldered on PCB internally, therefore, do not pull or bend them with abnormal forces.
- Fix the unit on PCB(fixing fittings) to reduce the stress onto the pins.

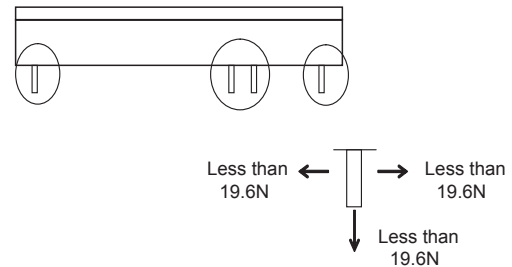


Fig.6.1 Stress onto the pins

6.3 Cleaning

- Clean the product with a brush. Prevent liquid from getting into the product.
Do not soak the product into liquid.
- Do not stick solvent to a name plate or a resin case.
(If solvent sticks to a name plate or a resin case, it will cause to change the color of the case or to fade letters on name plate away.)
- After cleaning, dry them enough.

6.4 Soldering

- Flow soldering: 260°C less than 15 seconds.
- Soldering iron : 450°C less than 5 seconds.

6.5 Derating

■ Use with the conduction cooling (e.g. heat radiation by conduction from the aluminum base plate to the attached heat sink).

Fig.6.2 shows the derating curve based on the aluminum base plate temperature. In the hatched area, the specification of Ripple and Ripple Noise is different from other areas.

■ Please measure the temperature on the aluminum base plate edge side when you cannot measure the temperature of the center part of the aluminum base plate.

In this case, please take 5deg temperature margin from the derating characteristic of Fig 6.2.

■ It is necessary to note the thermal fatigue life by power cycle. Please reduce the temperature fluctuation range as much as possible when the up and down of the temperature are frequently generated.

Contact us for more information on cooling methods.

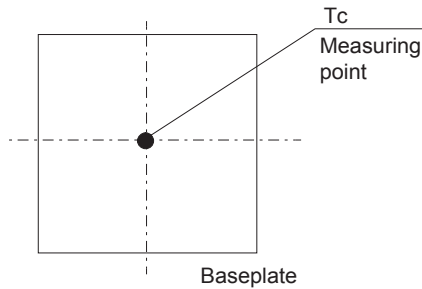
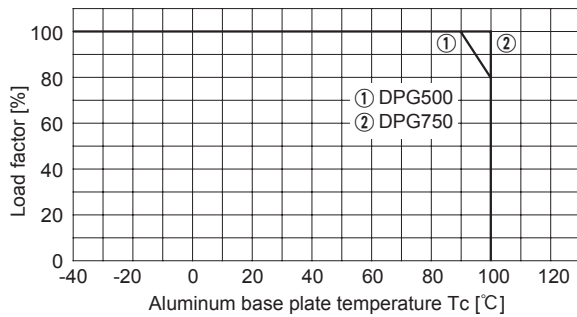
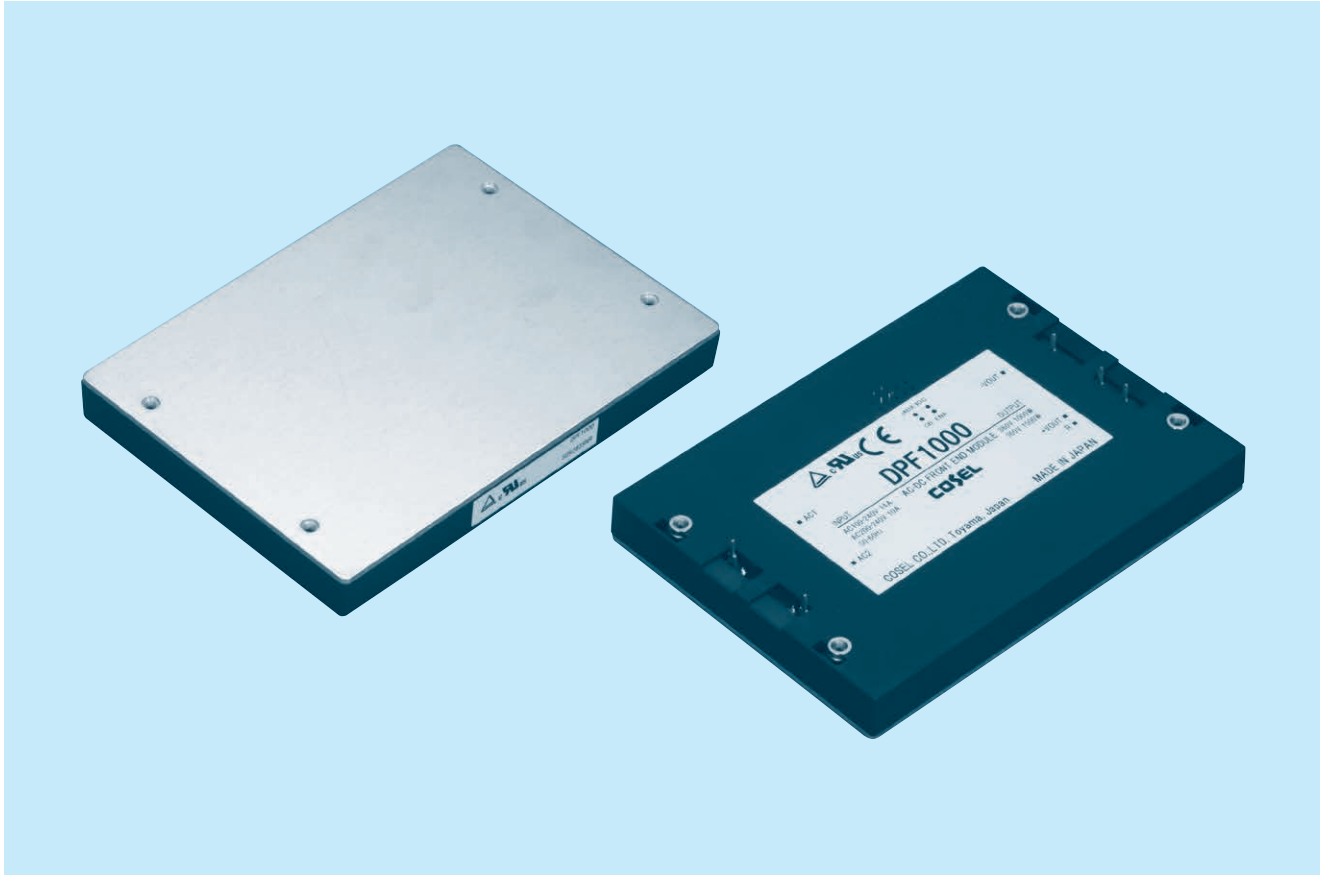


Fig.6.2 Derating curve



DPF-series



■ Power factor correction module

■ Feature

Harmonic attenuator (Complies with IEC61000-3-2)
 High efficiency 90% (AC100V), 95% (AC200V)
 Universal input voltage (AC85 - 264V)
 Built-in inrush current protection
 Parallel operation is possible (Built-in current balancing function)
 Built-in overvoltage and thermal protection circuits
 Inverter operation monitoring (IOG)
 Enable signal (ENA)
 Auxiliary power supply for external signal (AUX)
 Ideal for distributed power systems

■ 5-year warranty

■ CE marking

Low Voltage Directive

■ Safety agency approvals

UL, C-UL recognized, TÜV approved

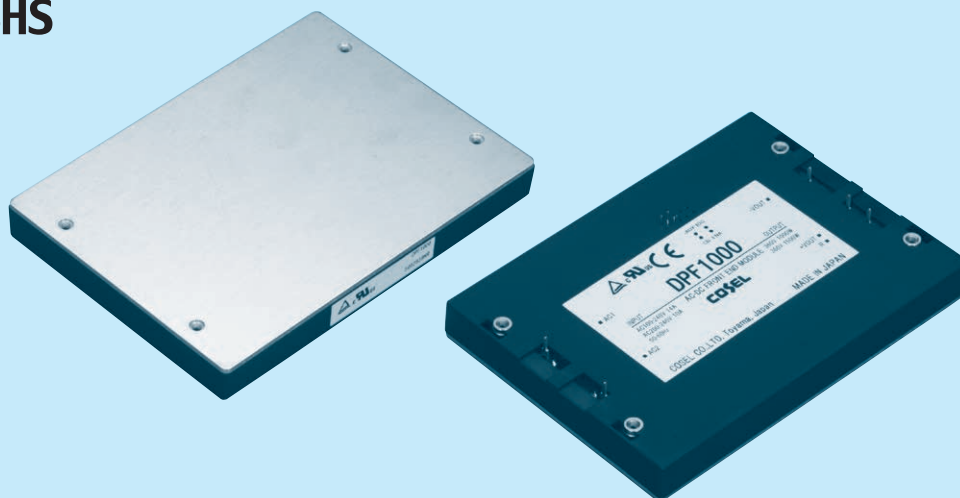
DPF

DPF1000

DPF 1000

①

②

① Series name
② Output wattage


MODEL	DPF1000	
AC INPUT[V]	AC85 - 264	AC170 - 264
MAX OUTPUT WATTAGE[W]	1,000	1,500
DC OUTPUT VOLTAGE[V]	DC360	

SPECIFICATIONS

	MODEL	DPF1000	
INPUT	VOLTAGE[V]	AC85 - 264 1 ϕ	AC170 - 264 1 ϕ
	POWER FACTOR CORRECTION RANGE[V]	AC85 - 255 1 ϕ	
	CURRENT[A]	11.5typ (ACIN 100V)	8.5typ (ACIN 200V)
	FREQUENCY[Hz]	50/60 (47 - 63)	
	INRUSH CURRENT[A]	Limited by external resistance	
	EFFICIENCY[%]	90typ (ACIN 100V)	95typ (ACIN 200V)
	POWER FACTOR	0.98typ (ACIN 100V)	0.95typ (ACIN 200V)
	LEAKAGE CURRENT[ma]	0.75max (60Hz, According to IEC60950 and DEN-AN)	
OUTPUT	WATTAGE[W] *1	1,000	1,500
	VOLTAGE[V] *2	DC360	
	VOLTAGE ACCURACY[V] *3	± 20	
PROTECTION CIRCUIT AND OTHERS	OVERVOLTAGE PROTECTION[V]	DC400 - 450 The power factor corrector function stops	
	IOG	Inverter operation monitoring, Open-collector output, Maximum sink current 10mA, Maximum allowance voltage 35V	
	ENA	Enable signal, Open-collector output, Maximum sink current 10mA, Maximum allowance voltage 35V	
	AUX	Auxiliary power supply for external signal, Output voltage:6.5 - 8.5V maximum, Output current:10mA	
ISOLATION	OTHERS	Parallel operation possible (Current balancing function), N+1 redundant operation possible, Thermal protection	
	INPUT-OUTPUT	Non isolated	
ENVIRONMENT	INPUT, OUTPUT-FG	AC3,000V 1minute Cutoff current = 10mA, DC500V, 50M Ω min (20 \pm 15 $^{\circ}$ C)	
	OPERATING TEMP., HUMID. AND ALTITUDE *4	-20 to +85 $^{\circ}$ C (Aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max	
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +85 $^{\circ}$ C, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max	
	VIBRATION	10 - 55Hz, 49.0m/s ² (5G), 3minutes period, 60minutes each along X, Y and Z axis	
SAFETY	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis	
	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1, EN50178 Complies with DEN-AN and IEC60950-1	
OTHERS	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 *5	
	CASE SIZE/WEIGHT	118.6 \times 12.7 \times 85mm [4.67 \times 0.5 \times 3.35 inches] (W \times H \times D) /200g max	
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)	

*1 Refer to Input voltage derating.

*2 When the input voltage is more than 255V, the power factor corrector function stops, and the output voltage becomes rectified AC input voltage.

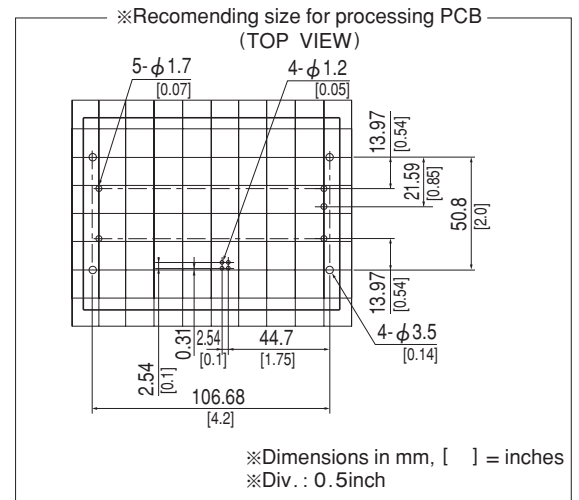
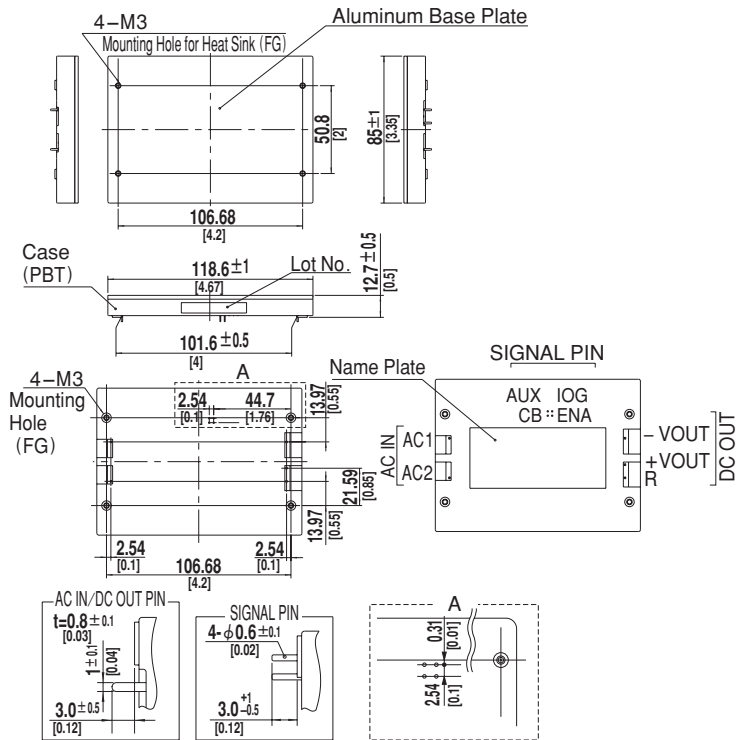
*3 The value included the output setting and the line regulation, the load regulation and the temperature regulation.
However, the input voltage is in the power factor correction range.

*4 Please consult us in regard to use from -40 $^{\circ}$ C.

*5 Please contact us about class C.

* External components are required. Refer to standard connection method.

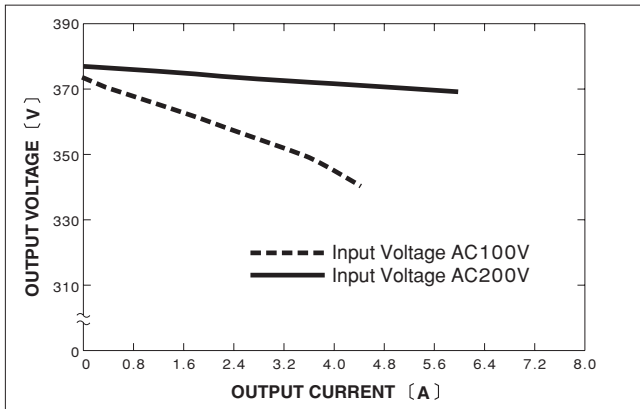
External view



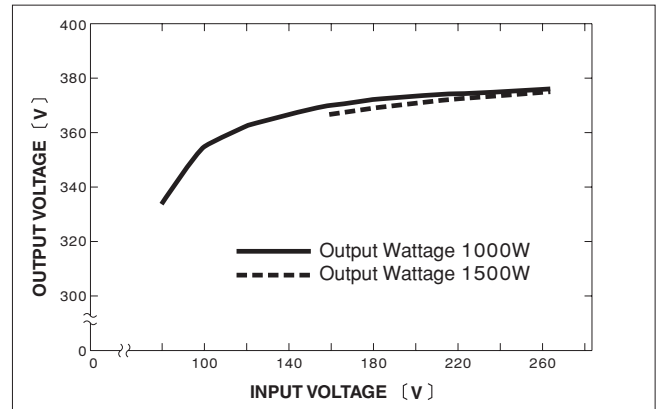
- ※Weight: 200g max
- ※Tolerance: ± 0.3 [± 0.012]
- ※Dimensions in mm, [] = inches
- ※Base Plate: Aluminum
- ※Mounting torque
 - Mounting hole screwing torque 0.4N·m (5.0kgf·cm) max

Performance data

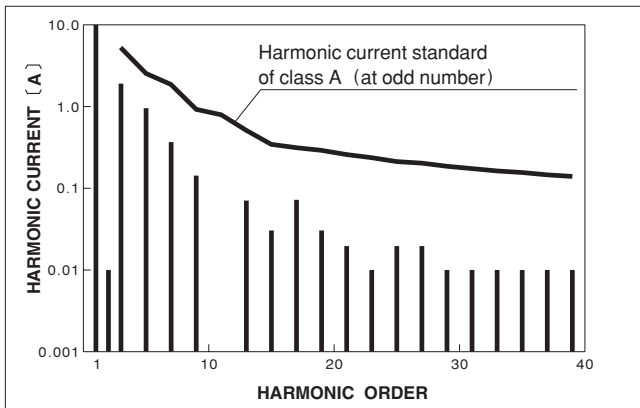
■ STATIC CHARACTERISTICS



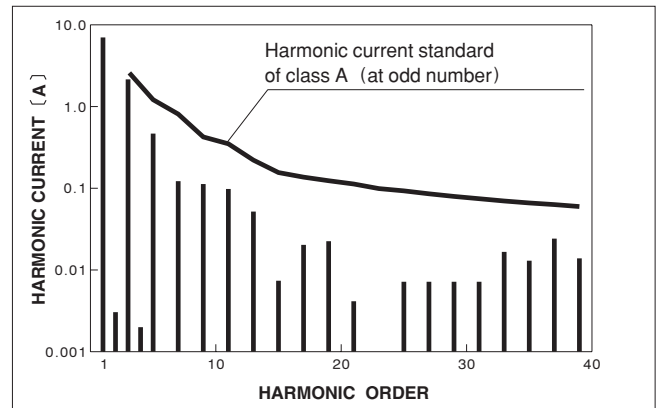
■ OUTPUT VOLTAGE FOR INPUT



■ HARMONIC CURRENT (AC100V)



■ HARMONIC CURRENT (AC230V)



Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
DPF1000	Active filter	130	11.5 *1	-	SCR	Aluminum	Yes		No	Yes
			8.5 *2							

*1 The value of input current is at ACIN 100V and 1000W load.

*2 The value of input current is at ACIN 200V and 1500W load.

1 Pin Connection DPF-6

2 Input Voltage Derating DPF-6

3 Standard Connection Method DPF-6

- 3.1 Standard connection method DPF-6
- 3.2 External components DPF-6
- 3.3 Wiring input pin DPF-7
- 3.4 Connection of loaded circuit DPF-7
- 3.5 Heatsink DPF-7

4 Function DPF-7

- 4.1 Overcurrent protection DPF-7
- 4.2 Overvoltage protection DPF-7
- 4.3 Thermal protection DPF-7
- 4.4 Auxiliary power supply circuit for external signal(AUX) DPF-7
- 4.5 Inverter operation monitor(IOG) DPF-8
- 4.6 Enable signal(ENA) DPF-8
- 4.7 Isolation DPF-8

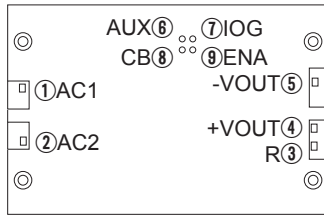
5 Series and Parallel Operation DPF-8

- 5.1 Series operation DPF-8
- 5.2 Parallel operation DPF-8
- 5.3 N+1 redundant operation DPF-9

6 Implementation · Mounting Method DPF-9

- 6.1 Mounting method DPF-9
- 6.2 Stress onto the pins DPF-9
- 6.3 Cleaning DPF-9
- 6.4 Soldering DPF-9
- 6.5 Derating DPF-10

1 Pin Connection



★ Bottom View

Table 1.1 Pin connection and function

No.	Pin connection	Function
①	AC1	AC Input
②	AC2	
③	R	External resistor for inrush current protection
④	+VOUT	+DC Output
⑤	-VOUT	-DC Output
⑥	AUX	Auxiliary power supply for external signal
⑦	IOG	Inverter operation monitor
⑧	CB	Current balance
⑨	ENA	Enable signal

No.	Reference
①	3.3 "Wiring input pin"
②	
③	3.2 "External components"
④	
⑤	3.4 "Connection of loaded circuit"
⑥	4.4 "Auxiliary power supply for external signal"
⑦	4.5 "Inverter operation monitor"
⑧	5.2 "Parallel operation"
⑨	4.6 "Enable signal"

2 Input Voltage Derating

■ Fig.2.1 shows rated output for each input voltage section.
Maximum output should be within this range.

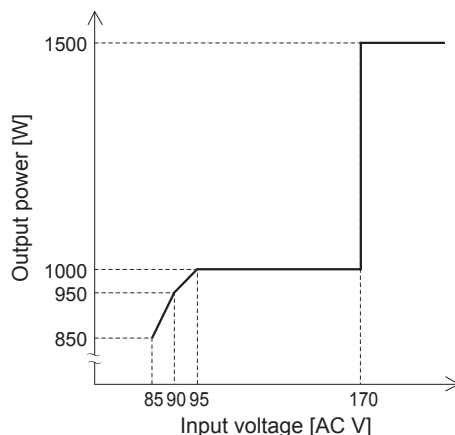


Fig.2.1 Input voltage derating curve

3 Standard Connection Method

3.1 Standard connection method

■ To use DPF1000, connection shown in Fig.3.1 and outside attached components are required. Through this connection, DC output voltage can be obtained from AC input voltage.
AC input voltage and DC output voltage are not insulated.

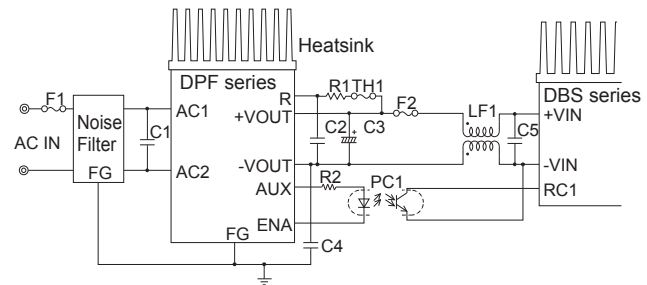


Fig.3.1 Standard connection method

Table 3.1 External components

No.	Symbol	Component	Required characteristics
①	F1	Input fuse	20A or less Slow-blow type
②	F2	Output fuse	10A or less Normal-blow type
③	C1	Input capacitor	2μF or more, Rated ripple current : 9A or more, Film capacitor, Safety approved type
④	C2	Output capacitor	1μF or more, Rated ripple current : 8A or more, Film capacitor
⑤	C3	Holdup capacitor	220 - 2200μF Aluminum electrolytic capacitor
⑧	C4	Y-capacitor	2200pF Safety approved type
⑦	R1	Inrush current protection resistor	4.7 - 10Ω Wirewound Resistor with Thermal Cut-Offs

3.2 External components

F1 Input fuse : 20A or less

Fuse is not built-in at input side. In order to secure the safety, use the slow-blow type fuse F1 (20A or less).

F2 Output fuse : 10A or less

Since over current protection is not built-in, use the normal-blow type fuse F2 (10A or less) at output side to secure the safety.

C1 Input capacitor : 2μF or more

Install an external capacitor C1 (2μF or more) to keep stable operation and to avoid failure. Use AC250V rated voltage with safety approved and over 9A rated ripple current.

- C2** Output capacitor : 1 μ F or more
Install an external capacitor C2 (1 μ F or more) as close as possible to the output pins to keep stable operation and to avoid failure. Use DC400V or higher rated voltage and over 8A rated ripple current capacitor.
- C3** Holdup capacitor : 220-2200 μ F
Since holdup capacitor is not built-in, install electrolytic capacitor C3 (220 - 2200 μ F) close to the output pins. The rated ripple current of C3 and the holdup time for module should be considered. The capacitor value should be within 220 to 2200 μ F to avoid failure.
- C4** Y-capacitor : 2200pF
Install an external capacitor C4 (2200pF) to keep stable operation. Use AC250V rated voltage with safety approved capacitor.
- R1** Inrush current protection resistor : 4.7 - 10 Ω
Connect a resistor between R pin and +Vout pin for inrush current protection. The surge capacity is required for R1, please contact component mfg. Wirewound resistor with thermal cut-offs type is required.

3.3 Wiring input pin

- A noise filter is not built in this power supply. Connect an external noise filter to reduce the conducted noise to the power supply line.
- A fuse to protect input is not built in. To assure safety, install a slow-blow fuse of 20A maximum to the input circuit F1.

3.4 Connection of loaded circuit

- For connecting the DBS/DHS series, see Fig.3.1.
For details of F2, LF1 and C5, refer to the instruction manual for the DBS/DHS series.
LF1 may not be required, depending on the noise standard or the design of the printed circuit board. In this case, ENA and RC1 can be directly connected, without having PC1.
- Control load current so that it may flow only when the terminal ENA is at "L". At "H" when inrush current protection circuit is not released, excessive current may be applied to the circuit.
- For connection of loads except the series DBS/DHS, please contact Cosel development department.

3.5 Heatsink

- The power supply adopts the conduction cooling system. Attach a heatsink to the aluminum base plate to cool the power supply for use. Refer to 6.5 Derating.

4 Function

4.1 Overcurrent protection

- The overcurrent protection circuit is not built-in.

4.2 Overvoltage protection

- The overvoltage protection circuit is built-in. The AC input should be shut down if overvoltage protection is in operation. The minimum interval of AC recycling for recovery is a few minutes which output voltage drops below 20V.

When this function operates, the power factor corrector function does not operate, and output voltage becomes the full-wave rectified AC input voltage.

Remarks:

Please note that the unit's internal components may be damaged if excessive voltage(over rated voltage) is applied to output terminal of power supply. This could happen when the customer tests the overvoltage performance of the unit.

4.3 Thermal protection

- Thermal protection circuit is built-in and it operates at 100 \pm 15 $^{\circ}$ C.
If this function comes into effect, shut down the output, eliminate all possible causes of overheating, and drop the temperature to normal level. To prevent the unit from overheating, avoid using the unit in a dusty, poorly ventilated environment.
When this function operates, the power factor corrector function does not operate, and output voltage becomes the full-wave rectified AC input voltage.

4.4 Auxiliary power supply circuit for external signal(AUX)

- The AUX pin can be used as the power source with the open collector output(output voltage DC 6.5 - 8.5V, maximum output current 10mA) for IOG and ENA.
- When used with AUX pin of additional units of this model for parallel connection, make sure to install a diode and that the maximum output current must be below 10mA.
- Never let a short circuit occur between the AUX pin and other pins. It may damage the unit.

DPF

4.5 Inverter operation monitor(IOG)

■Use IOG to monitor operation of the inverter.

When unit operation stopped due to overvoltage protection, thermal protection or the event of a failure in the power supply, IOG signal state changes to "H" from "L" within 1 second. And output voltage becomes an equal value to the full-wave rectified AC input voltage.

If IOG signal status keeps "H", there is a possibility that unit and/or external circuit is damaged. In case like this, please check the unit and/or external circuit conditions in your system.

■IOG can be used for monitoring failures such as redundant operation.

■IOG may become unstable in case of start-up or sudden change of load current. Set the timer with delay of more than 5 seconds.

■During parallel operation, unstable condition may occur when load current becomes lower than 10% of rated value.

4.6 Enable signal (ENA)

■Use ENA to control starting of the loaded power supply.

■When inrush current protection circuit is released, ENA outputs "LOW".

■If load current flows without releasing of the circuit, the resistor may be burnt.

Table 4.1 Specification of TMP, IOG

No.	Item	IOG	ENA
1	Function	Normal operation "L"	Output possible "L"
		Malfunction of inverter "H"	Output prohibited "H"
2	Base pin	-VOUT	
3	Level voltage "L"	0.6V max at 10mA	
4	Level voltage "H"	Open collector	
5	Maximum sink current	10mA max	
6	Maximum applied voltage	35V max	

4.7 Isolation

■For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for a start(shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

5 Series and Parallel Operation

5.1 Series operation

■As input and output are not insulated, series operation is impossible.

5.2 Parallel operation

■Parallel operation is available by connecting the units as shown in Fig.5.1.

■As variance of output current drew from each power supply is maximum 10%, the total output current must not exceed the value determined by the following equation.

$$\begin{aligned} & \text{(Output current in parallel operation)} \\ & = (\text{the rated current per unit}) \times (\text{number of unit}) \times 0.9 \end{aligned}$$

In parallel operation, the maximum operative number of units is 5.

■When the output-line impedance is high, the power supply is become unstable. Use same length and thickness(width) wire(pattern) for the current balance improvement.

■Connect each input pin for the lowest possible impedance.

When the number of the units in parallel operation increases, input current increases. Adequate wiring design for input circuitry such as circuit pattern, wiring and current for equipment is required.

■If temperatures of aluminum base plates are different in the power supply for parallel operation, values of output current will change greatly.

Design radiation to equalize plate temperatures by attaching the same heatsinks.

■Output diode Di is not required if capacity of output smoothing capacitor for parallel connection is below 2,500μF.

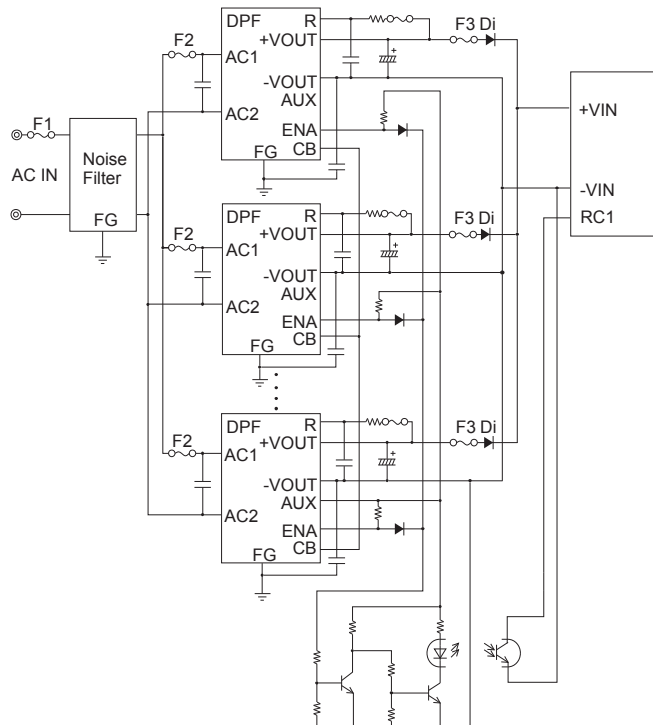


Fig.5.1 Parallel operation

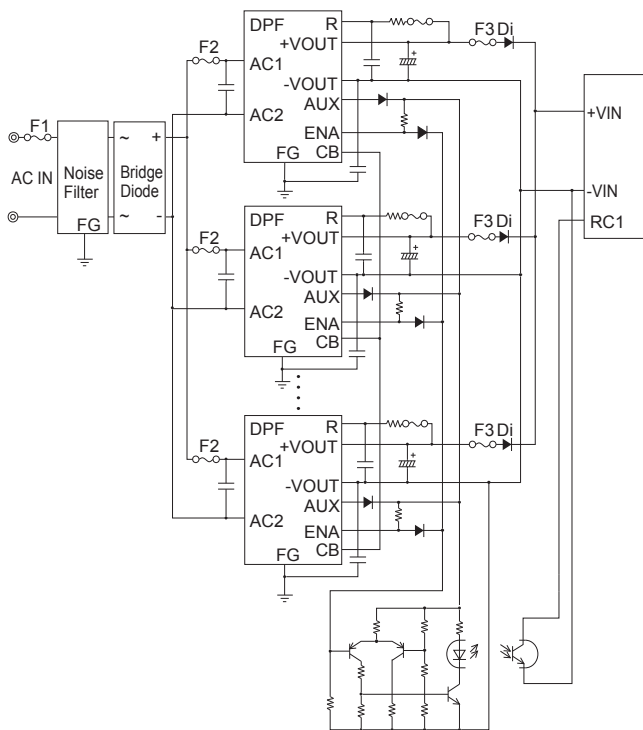


Fig.5.2 N+1 redundant operation

5.3 N+1 redundant operation

■It is possible to set N+1 redundant operation for improving reliability of power supply system.

Connect as shown in Fig.5.2.

■Purpose of redundant operation is to ensure stable operation in the event of single power supply failure.

Since extra power supply is reserved for the failure condition, so total power of redundant operation is equal to N.

6 Implementation · Mounting Method

6.1 Mounting method

■The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Aluminum base plate temperature around each power supply should not exceed the temperature range shown in derating curve.

■Avoid placing the AC input line pattern lay out underneath the unit, it will increase the line conducted noise. Make sure to leave an ample distance between the line pattern lay out and the unit. Also avoid placing the DC output line pattern of DC-DC converter underneath the unit because it may increase the output noise. Lay out the pattern away from the unit.

■High-frequency noise radiates directly from the unit to the atmosphere. Therefore, design the shield pattern on the printed circuit board and connect its one to FG.

The shield pattern prevents noise radiation.

6.2 Stress onto the pins

■When too much stress is applied to the pins of the power supply, the internal connection may be weakened. As shown in Fig.6.1 avoid applying stress of more than 29.4N(3kgf) on the input pins/output pins(A part) and more than 9.8N(1kgf) to the signal pins(B part).

■The pins are soldered on PCB internally, therefore, do not pull or bend them with abnormal forces.

■Fix the unit on PCB(fixing fittings) to reduce the stress onto the pins.

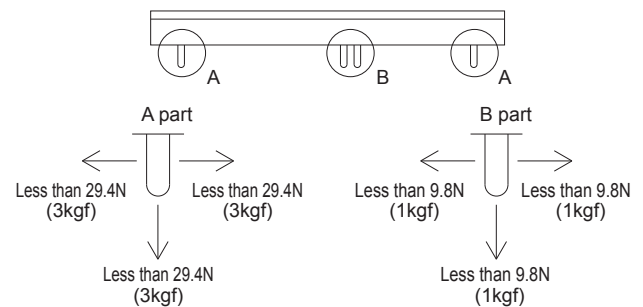


Fig.6.1 Stress onto the pins

6.3 Cleaning

■Clean the product with a brush. Prevent liquid from getting into the product.

Do not soak the product into liquid.

■Do not stick solvent to a name plate or a resin case.

(If solvent sticks to a name plate or a resin case, it will cause to change the color of the case or to fade letters on name plate away.)

■After cleaning, dry them enough.

6.4 Soldering

■Flow soldering : 260°C less than 15 seconds.

■Soldering iron

AC IN/DC OUT/R pins : 450°C less than 5 seconds.

Signal pins : 350°C less than 3 seconds(less than 20W).

6.5 Derating

■ Use with the conduction cooling (e.g. heat radiation by conduction from the aluminum base plate to the attached heat sink).

Fig.6.2 shows the derating curve based on the aluminum base plate temperature. In the hatched area, the specification of Ripple and Ripple Noise is different from other areas.

■ It is necessary to note thermal fatigue life by power cycle.

Please reduce the temperature fluctuation range as much as possible when the up and down of temperature are frequently generated.

Contact for more information on cooling methods.

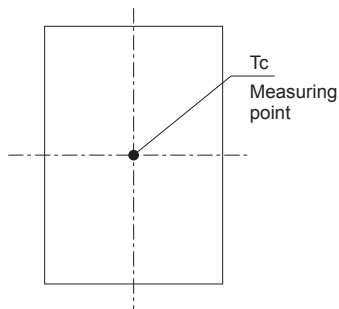
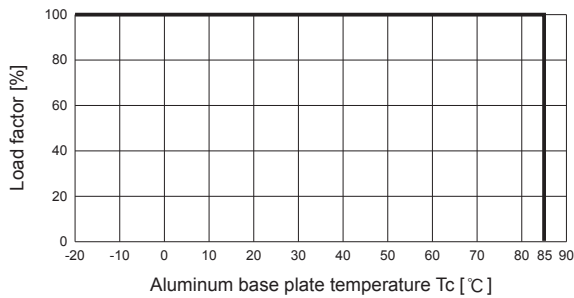
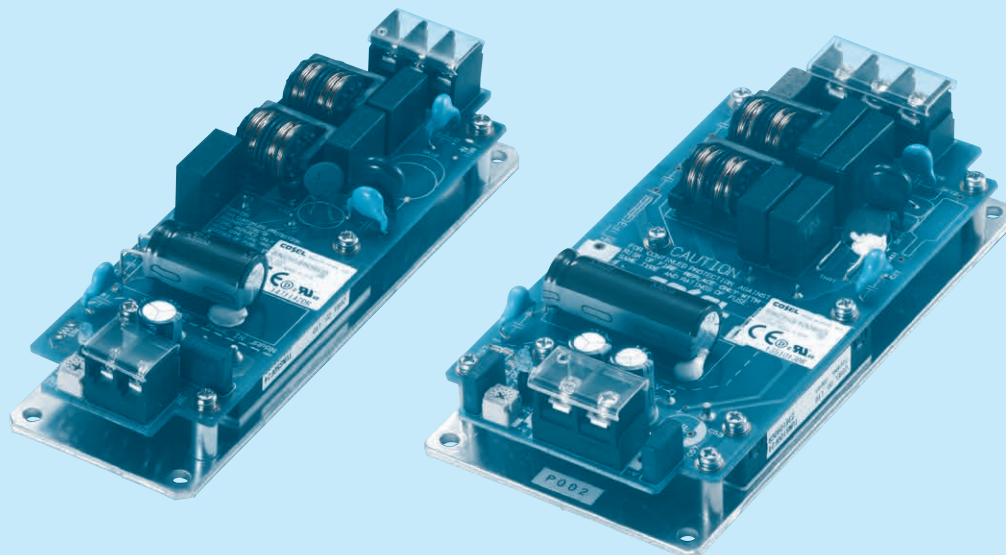


Fig.6.2 Derating curve



SNTU-series



Feature

AC-DC converter, SNTUNS50/100F series includes TUNS50/100F series.
 Universal input(AC85-264V)
 Power factor correction
 Harmonic attenuator (Complies with IEC61000-3-2)
 Built-in Inrush current , overcurrent, overvoltage and thermal protection

Safety agency approvals

UL60950-1, C-UL, EN60950-1, EN50178
 Complies with DEN-AN

3-year warranty

CE marking

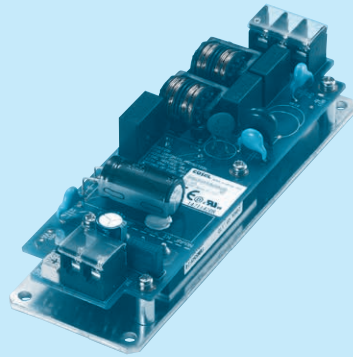
Low voltage directive

SNTU

SNTUNS50

SNTUN S 50 F 05 -□

① ② ③ ④ ⑤ ⑥



Recommended EMI/EMC Filter
NAC-04-472



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* The EMI/EMC Filter is recommended
to connect with several devices.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal Input
- ⑤ Output voltage
- ⑥ Optional
C : with Coating
J : Connector type

MODEL	SNTUNS50F05	SNTUNS50F12	SNTUNS50F24
MAX OUTPUT WATTAGE[W]	50.0	50.4	50.4
DC OUTPUT	5V 10A	12V 4.2A	24V 2.1A

SPECIFICATIONS

	MODEL		SNTUNS50F05	SNTUNS50F12	SNTUNS50F24
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Please refer to the instruction manual 1.1 and 3.2)		
	CURRENT[A]	ACIN 100V	0.67typ (Io=100%)		
		ACIN 200V	0.37typ (Io=100%)		
	FREQUENCY[Hz]		50/60 (47 - 63)		
	EFFICIENCY[%]	ACIN 100V	76typ	80typ	81typ
		ACIN 200V	78typ	83typ	84typ
	POWER FACTOR (Io=100%)	ACIN 100V	0.95typ		
		ACIN 200V	0.90typ		
	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25℃)		
ACIN 200V		30typ (Io=100%) (At cold start) (Ta=25℃)			
LEAKAGE CURRENT[mA]		0.4/0.75 (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)			
OUTPUT	VOLTAGE[V]		5	12	24
	CURRENT[A]		10	4.2	2.1
	LINE REGULATION[mV]		10max	24max	48max
	LOAD REGULATION[mV]		150max	100max	100max
	RIPPLE[mVp-p]	0 to +95℃ *1	80max	120max	120max
		-20 to 0℃ *1	140max	160max	160max
		0 to 15% Load *1	200max	280max	380max
	RIPPLE NOISE[mVp-p]	0 to +95℃ *1	120max	150max	150max
		-20 to 0℃ *1	200max	200max	250max
		0 to 15% Load *1	280max	360max	460max
	TEMPERATURE REGULATION[mV]	0 to +65℃	50max	120max	240max
		-20 to +95℃	100max	240max	480max
	DRIFT[mV] *2		20max	40max	90max
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		4.50 - 5.50	10.80 - 13.20	21.60 - 26.40
	OUTPUT VOLTAGE SETTING[V]		5.00 - 5.15	12.00 - 12.48	24.00 - 24.96
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically		
	OVERVOLTAGE PROTECTION[V]		6.30 - 7.00	13.90 - 16.35	27.60 - 32.40
	REMOTE SENSING		Not provided		
	REMOTE ON/OFF		Not provided		
ISOLATION	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)		
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)		
	OUTPUT-FG		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)		
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE		-20 to +95℃ (On aluminum base plate), 20 - 95%RH (Non condensing) *4		
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +95℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max		
	VIBRATION		10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT		196.1m/s² (20G), 11ms, once each along X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN		
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR-B, EN55011-B, EN55022-B		
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 (Class A) *3		
OTHERS	CASE SIZE/WEIGHT		50 X 36 X 150mm [1.97 X 1.42 X 5.91 inches] (W X H X D) / 230g max		

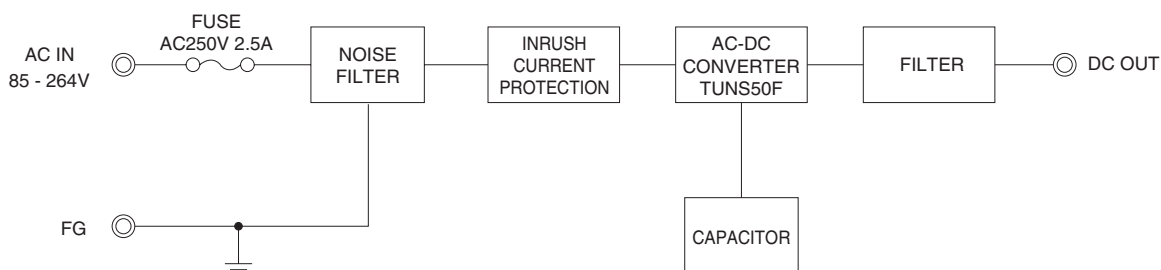
*1 Refer to Instruction manual for measuring method of an electrical property.

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

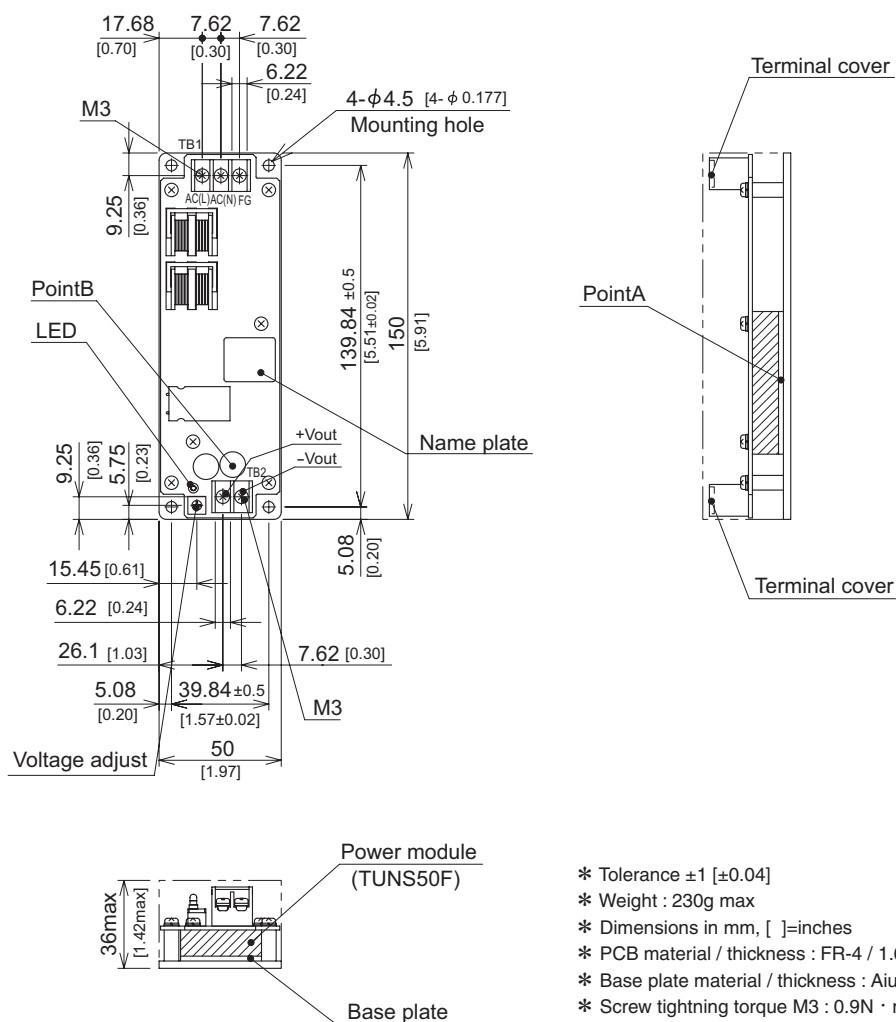
*3 Please contact us about another class.

*4 Refer to Instruction manual 3.2 and 3.3.

Block diagram



External view

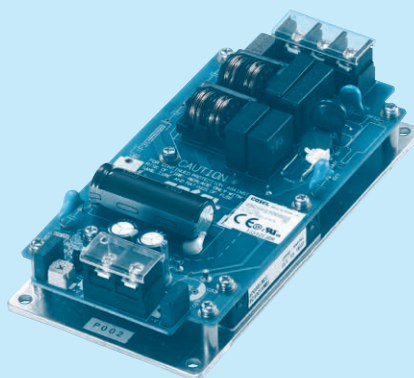


- * Tolerance ± 1 [± 0.04]
- * Weight : 230g max
- * Dimensions in mm, []=inches
- * PCB material / thickness : FR-4 / 1.6mm [0.06]
- * Base plate material / thickness : Aluminum / 3.0mm [0.12]
- * Screw tightening torque M3 : 0.9N · m (9.2kgf · cm) max
- * Please connect safety ground to the base plate in $\phi 4.5$ [$\phi 0.177$] hole.

SNTUNS100

SNTUN S 100 F 05 -□

① ② ③ ④ ⑤ ⑥

Recommended EMI/EMC Filter
NAC-04-472

High voltage pulse noise type : NAP series
Low leakage current type : NAM series

* The EMI/EMC Filter is recommended
to connect with several devices.

- ① Series name
② Single output
③ Output wattage
④ Universal Input
⑤ Output voltage
⑥ Optional
C : with Coating
J : Connector type

MODEL	SNTUNS100F05	SNTUNS100F12	SNTUNS100F24
MAX OUTPUT WATTAGE[W]	100.0	100.8	100.8
DC OUTPUT	5V 20A	12V 8.4A	24V 4.2A

SPECIFICATIONS

	MODEL	SNTUNS100F05	SNTUNS100F12	SNTUNS100F24	
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Please refer to the instruction manua 1.1 and 3.2)		
	CURRENT[A]	ACIN 100V	1.3typ (Io=100%)		
		ACIN 200V	0.7typ (Io=100%)		
	FREQUENCY[Hz]		50/60 (47 - 63)		
	EFFICIENCY[%]	ACIN 100V	79typ	81typ	82typ
		ACIN 200V	82typ	83typ	84typ
	POWER FACTOR (Io=100%)	ACIN 100V	0.95typ		
		ACIN 200V	0.90typ		
INRUSH CURRENT[A]	ACIN 100V	20yp (Io=100%) (At cold start) (Ta=25℃)			
	ACIN 200V	40typ (Io=100%) (At cold start) (Ta=25℃)			
LEAKAGE CURRENT[mA]		0.4/0.75 (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)			
OUTPUT	VOLTAGE[V]		5	12	24
	CURRENT[A]		20	8.4	4.2
	LINE REGULATION[mV]		10max	24max	48max
	LOAD REGULATION[mV]		150max	100max	100max
	RIPPLE[mVp-p]	0 to +95℃ *1	80max	120max	120max
		-20 to 0℃ *1	140max	160max	160max
		0 to 15% Load*1	160max	240max	240max
	RIPPLE NOISE[mVp-p]	0 to +95℃ *1	120max	150max	150max
		-20 to 0℃ *1	200max	200max	250max
		0 to 15% Load*1	240max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +65℃	50max	120max	240max
		-20 to +95℃	100max	240max	480max
	DRIFT[mV] *2		20max	40max	90max
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		4.50 - 5.50	10.80 - 13.20	21.60 - 26.40	
OUTPUT VOLTAGE SETTING[V]		5.00 - 5.15	12.00 - 12.48	24.00 - 24.96	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically		
	OVERVOLTAGE PROTECTION[V]		6.30 - 7.00	13.90 - 16.35	27.60 - 32.40
	REMOTE SENSING		Optional (Option:K)	—	—
	REMOTE ON/OFF		Not provided		
ISOLATION	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)		
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)		
	OUTPUT-FG		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)		
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE		-20 to +95℃ (On aluminum base plate), 20 - 95%RH (Non condensing) *4		
	STORAGE TEMP.,HUMID.AND ALTITUDE		-20 to +95℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max		
	VIBRATION		10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT		196.1m/s² (20G), 11ms, once each along X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178 Complies with DEN-AN		
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR-B, EN55011-B, EN55022-B		
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 (Class A) *3		
OTHERS	CASE SIZE/WEIGHT		74×37×150mm [2.91×1.46×5.91 inches] (W×H×D) / 340g max		

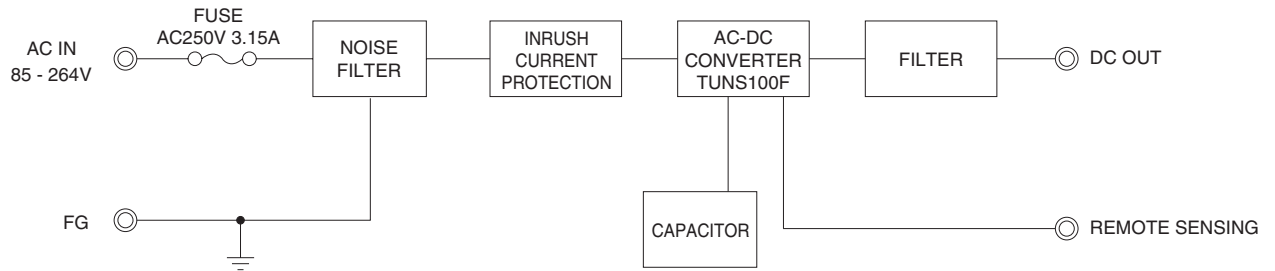
*1 Refer to Instruction manual for measuring method of an electrical property.

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

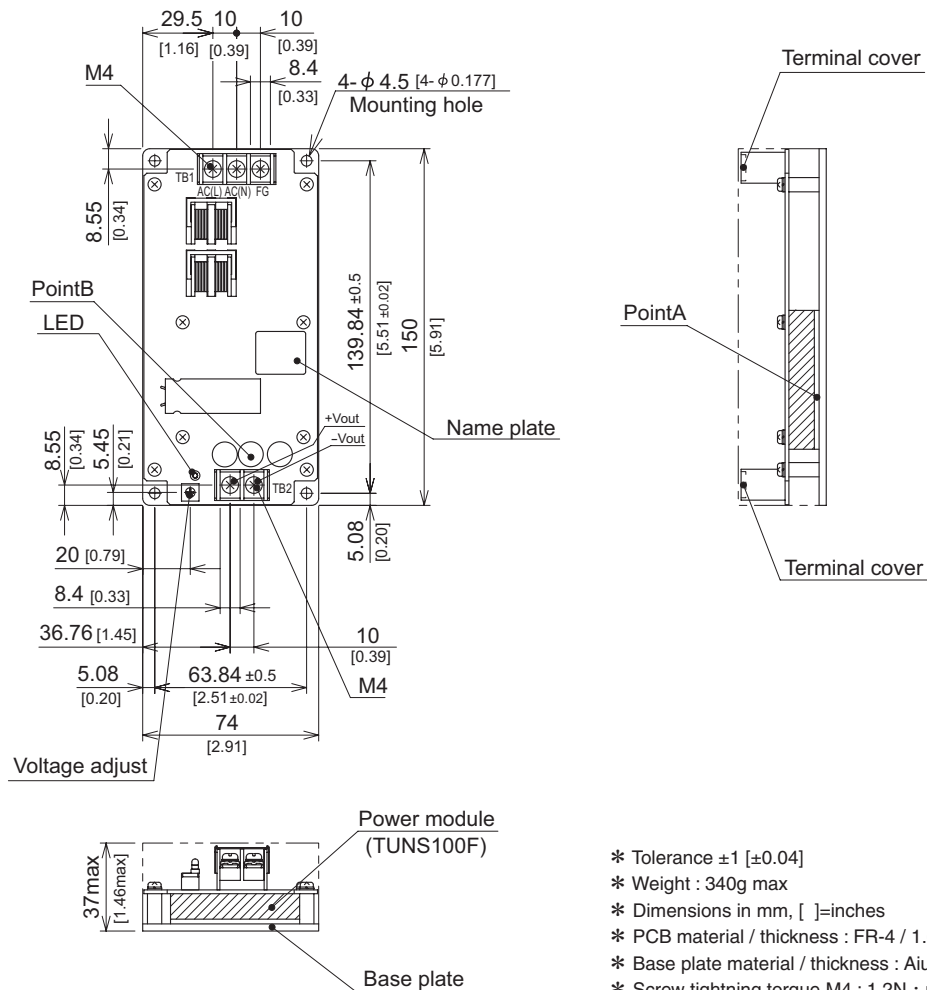
*3 Please contact us about another class.

*4 Refer to Instruction manual 3.2 and 3.3.

Block diagram



External view



- * Tolerance ± 1 [± 0.04]
- * Weight : 340g max
- * Dimensions in mm, []=inches
- * PCB material / thickness : FR-4 / 1.6mm [0.06]
- * Base plate material / thickness : Aiuminum / 3.0mm [0.12]
- * Screw tightning torque M4 : 1.2N · m (12.2kgf · cm) max
- * Please connect safety ground to the base plate in $\phi 4.5$ [$\phi 0.177$] hole.

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A] *1	Inrush current protection circuit	PCB/Pattern			Series/Parallel operation availability	
					Material	Single sided	Double sided	Series operation	Parallel operation
SNTUNS50F	Active filter	80-600	0.67	Thermistor	FR-4		Yes	Yes	*2
	Flyback converter	100-300							
SNTUNS100F	Active filter	80-600	1.3	Thermistor	FR-4		Yes	Yes	*2
	Forward converter	300							

*1 The value of input current is at ACIN 100V and rated load.

*2 Refer to instruction manual.

1 Function SNTU-8

1.1	Input voltage range	SNTU-8
1.2	Inrush current limiting	SNTU-8
1.3	Overcurrent protection	SNTU-8
1.4	Overvoltage protection	SNTU-8
1.5	Thermal protection	SNTU-8
1.6	Output voltage adjustment range	SNTU-8
1.7	Output ripple and ripple noise	SNTU-8
1.8	Isolation	SNTU-8

2 Series Operation and Parallel Operation SNTU-9

2.1	Series Operation	SNTU-9
2.2	Parallel Operation	SNTU-9

3 Assembling and Installation Method SNTU-9

3.1	Installation method	SNTU-9
3.2	Input voltage derating curve	SNTU-9
3.3	Output derating curve	SNTU-10

4 Options SNTU-10

4.1	Outline of Options	SNTU-10
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1 Function

1.1 Input voltage range

- Input voltage range of the power supplies is from AC85V to AC264V (please see SPECIFICATIONS for details).
- To comply with safety standards, input voltage range is AC100-AC240V (50/60Hz).
- If input value doesn't fall within above range, a unit may not operate in accordance with specifications and/or start hunting or fail. If you need to apply a square waveform input voltage, which is commonly used in UPS and inverters, please contact us.
- When the input voltage changes suddenly, the output voltage accuracy might exceed the specification. Please contact us.

1.2 Inrush current limiting

- An inrush current limiting circuit is built-in.
- If you need to use a switch on the input side, please select one that can withstand an input inrush current.
- Thermistor is used in the inrush current limiting circuit. When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that a power supply cools down before being turned on.

1.3 Overcurrent protection

- An overcurrent protection circuit is built-in and activated at 105% of the rated current .
A unit automatically recovers when a fault condition is removed. Please do not use a unit in short circuit and/or under an overcurrent condition.
- Intermittent Operation Mode
Intermittent operation for overcurrent protection is included in a part of series. When the overcurrent protection circuit is activated and the output voltage drops to a certain extent, the output becomes intermittent so that the average current will also decrease.

1.4 Overvoltage protection

- The overvoltage protection circuit is built-in. The overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait more than 3 minutes and turn on the AC input again to recover the output voltage. Recovery time varies depending on such factors as input voltage value at the time of the operation.

Remarks :

Please avoid applying a voltage exceeding the rated voltage to an output terminal. Doing so may cause a power supply to malfunction or fail. If you cannot avoid doing so, for example, if you need to operate a motor, etc., please install an external diode on the output terminal to protect the unit.

1.5 Thermal protection

- When the power supply temperature is kept above 100C, the thermal protection will be activated and simultaneously shut down the output.
When the thermal protection is activated, shut off the input voltage and eliminate all the overheating conditions. To recover the output voltage, keep enough time to cool down the power supply before turning on the input voltage again.

1.6 Output voltage adjustment range

- To increase an output voltage, turn a built-in potentiometer clockwise.
To decrease the output voltage, turn it counterclockwise.

1.7 Output ripple and ripple noise

- Output ripple noise may be influenced by measurement environment, measuring method fig 1.1 is recommended.

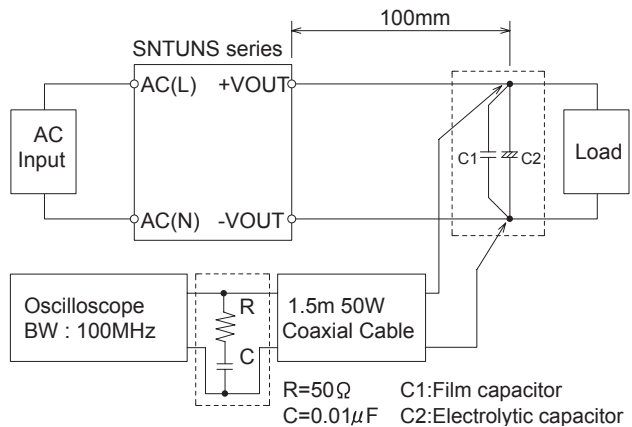


Fig.1.1 Measuring method of Ripple and Ripple Noise

1.8 Isolation

- When you run a Hi-Pot test as receiving inspection, gradually increase the voltage to start. When you shut down, decrease the voltage gradually by using a dial. Please avoid a Hi-Pot tester with a timer because, when the timer is turned ON or OFF, it may generate a voltage a few times higher than the applied voltage.

2 Series Operation and Parallel Operation

2.1 Series Operation

■You can use a power supply in series operation. The output current in series operation should be lower than the rated current of a power supply with the lowest rated current among the power supplies that are serially connected. Please make sure that no current exceeding the rated current flows into a power supply.

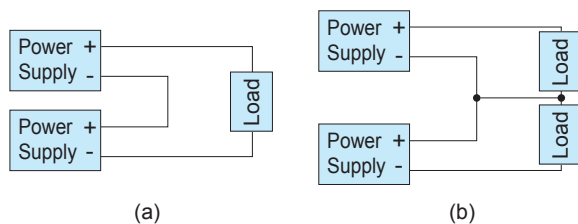


Fig.2.1 Examples of connecting in series operation

2.2 Parallel Operation

■There is no current balance function.

When operating in parallel, such as diode-OR, please use on the output voltage was adjusted enough to balance the current. Exceeds the rated output current, the output is shut down.

■Redundancy operation is available by wiring as shown below.

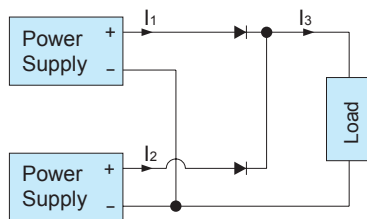


Fig.2.2 Example of connecting in redundancy operation

■Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .

Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{rated current value}$$

3 Assembling and Installation Method

3.1 Installation method

■The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. The temperature around each power supply should not exceed the temperature range shown in derating curve.

■In case of metal chassis, keep the distance between $d1$ for to insulate between lead of component and metal chassis. If it is less than $d1$ insert the insulation sheet between power supply and metal chassis.

■Avoid placing the AC input line cable underneath the unit. It will increase the line conducted noise. Make sure to leave an ample distance between the cable pattern layout and the unit. Also avoid placing the DC output line cable underneath the unit because it may increase the output noise. Lay out the cable away from the unit.

■Avoid placing the signal line pattern layout underneath the unit because the power supply might become unstable. Lay out the pattern away from the unit.

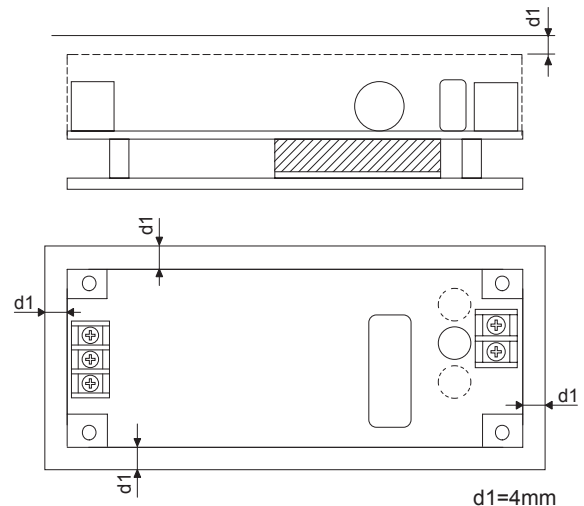


Fig.3.1 Mounting method

3.2 Input voltage derating curve

■Input voltage derating curve is shown in Fig.3.2.

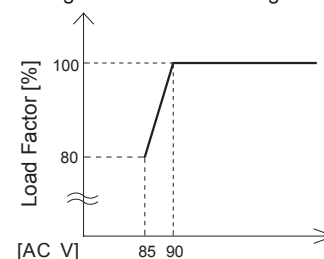


Fig.3.2 Derating curve depending on input voltage

3.3 Output derating curve

- Use with the conduction cooling (e.g. heat radiation by conduction from the aluminum base plate to the attached heat sink).
Fig.3.3, shows the derating curve based on the aluminum base plate temperature. In the hatched area, the specification of Ripple and Ripple Noise is different from other areas.
- Please measure the temperature on the aluminum base plate edge side (Point A).
- Please consider the ventilation to keep the temperature on the PCB (Point B) less than the temperature of Fig.3.4.
Contact us for more information on cooling methods.

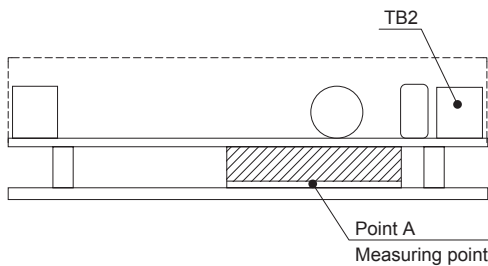
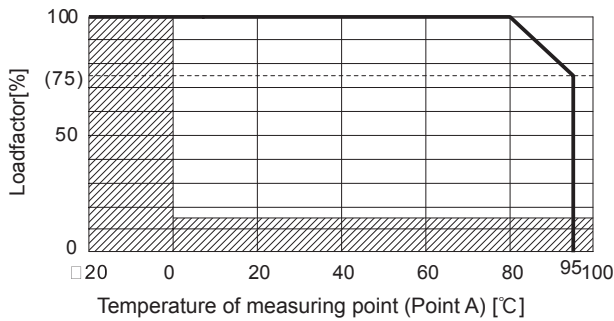


Fig.3.3 Derating curve (Point A)

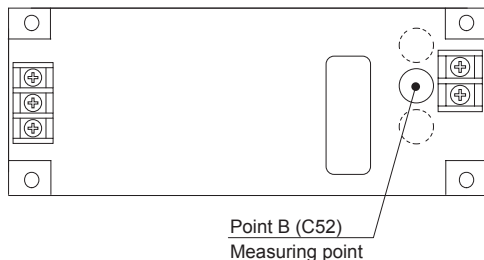
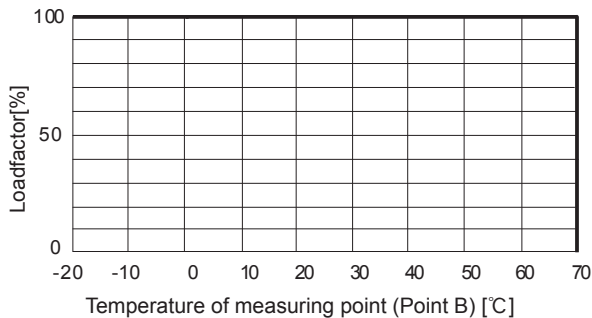


Fig.3.4 Derating curve (Point B)

4 Options

4.1 Outline of Options

- * Please inquire us for details of specifications and delivery timing.
- * You can combine multiple options. Some options, however, cannot be combined with other options. Please contact us for details.

● -C

- Option -C units have coated internal PCB for better moisture resistance.

● -J

- Option -J units have J.S.T connectors instead of a terminal block.
- Dedicated harnesses are available for your purchase. Please see Optional Parts for details.
- Please contact us for details about appearance.
- Please do not apply more than 5A per 1 pin.

(1) Matching J.S.T Connectors and Terminals for SNTUNS50F

I/O Connector		Matching Connector	Terminal
CN1	B3P5-VH	VHR-5N	Chain : SVH-21T-P1.1
			Loose : BVH-21T-P1.1
CN2	B4P-VH	VHR-4N	Chain : SVH-21T-P1.1
			Loose : BVH-21T-P1.1

(Mfr : J.S.T.)

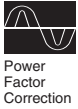
(2) Matching J.S.T Connectors and Terminals for SNTUNS100F

I/O Connector		Matching Connector	Terminal
CN1	B3P5-VH	VHR-5N	Chain : SVH-21T-P1.1
			Loose : BVH-21T-P1.1
CN2	B8P-VH	VHR-8N	Chain : SVH-21T-P1.1
			Loose : BVH-21T-P1.1

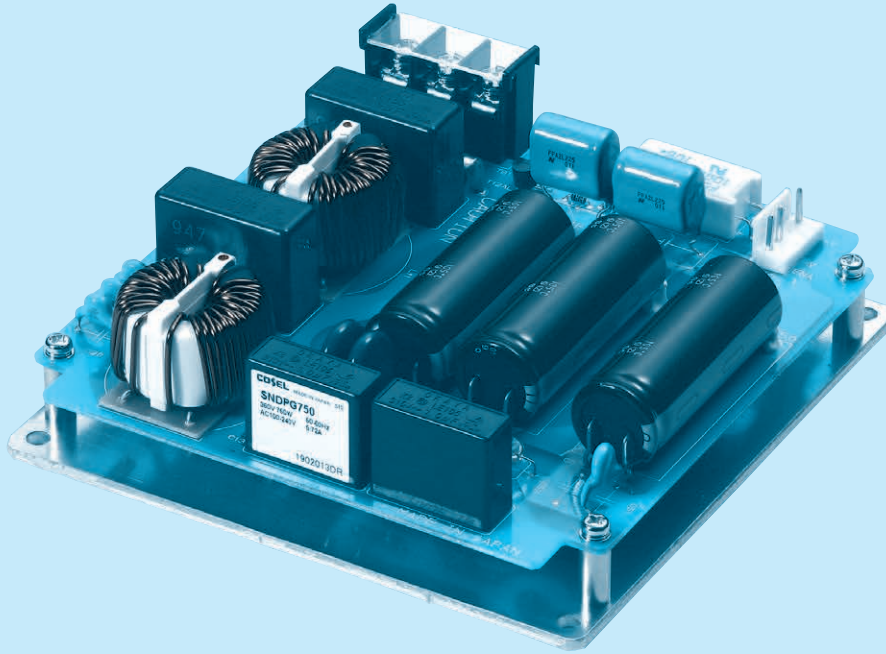
(Mfr : J.S.T.)

● -K (SNTUNS100F05 only)

- Option -K units have a remote sensing function. Please note that this option is not available for all models.
- Please contact us for details.



SNDPG-series



■ Power factor correction module

Compact AC - DC converter, SNDPG series includes DPG series
Conduction cooling (e.g. heat radiation from the aluminum
base plate to the attached heat sink)
AC-DC Converter can be constituted in combination with
SNDHS series and SNDBS series

■ 3-year warranty

■ CE marking

Low Voltage Directive

SNDPG

■ Features

High efficiency 93% (AC100V), 96% (AC200V)
Harmonic attenuator (Complies with IEC61000-3-2)
Universal input voltage (AC85 - 264V)
Built-in inrush current protection
Enable signal (ENA)

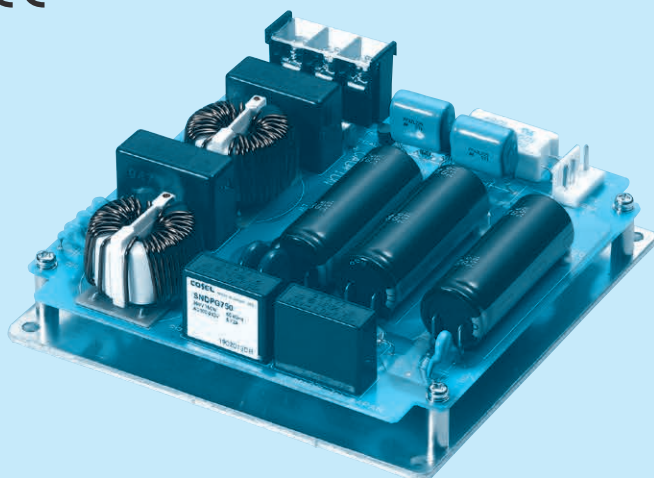
■ Safety agency approvals

UL60950-1, C-UL and EN60950-1
Complies with DEN-AN

SNDPG750

SNDPG 750 - ☐

① ② ③



- ① Series name
 ② Output power
 750 : 750W (ACIN 200V)
 ③ Optional
 C : with Coating
 R : with Remote ON/OFF
 (Enable signal)

Please refer to Instruction manual 7.

* Please note that the unit's internal components is damaged if the output is short-circuit.

MODEL	SNDPG750	
AC INPUT[V]	AC85 - 264	AC170 - 264
MAX OUTPUT WATTAGE[W]	*1 500	750
DC OUTPUT VOLTAGE[V]	*2 360	

SPECIFICATIONS

	MODEL	SNDPG750	
INPUT	VOLTAGE[V]	AC85 - 264 1 ϕ	AC170 - 264 1 ϕ
	POWER FACTOR CORRECTION RANGE[V]	AC85 - 264 1 ϕ	
	CURRENT[A]	5.72typ (ACIN 100V)	4.24typ (ACIN 200V)
	FREQUENCY[Hz]	50/60 (47 - 63)	
	INRUSH CURRENT[A]	20/20 typ (Io=100%) (Primary inrush current / Secondary inrush current) (More than 10 sec. to re-start)	
	*3 AC200V	40/20 typ (Io=100%) (Primary inrush current / Secondary inrush current) (More than 10 sec. to re-start)	
	EFFICIENCY[%]	93typ (ACIN 100V)	96typ (ACIN 200V)
	POWER FACTOR	0.96typ (ACIN 100V)	0.93typ (ACIN 200V)
OUTPUT	LEAKAGE CURRENT[mA]	0.75 max (60Hz, According to IEC60950-1 and DEN-AN)	
	WATTAGE[W]	500	750
	VOLTAGE[V]	*2 360	
	VOLTAGE ACCURACY	*4 $\pm 2\%$	
PROTECTION CIRCUIT AND OTHERS	OVERVOLTAGE PROTECTION[V]	DC400 - 450V The power factor corrector function stops	
	ENA	*5 Enable signal, Open-correcter output	
	OTHERS	*6 Parallel operation impossible , Thermal protection	
ISOLATION	INPUT-OUTPUT, RC	*9 Non isolated	
	INPUT, OUTPUT, RC-FG	*9 AC2,800V 1minute Cutoff current = 10mA, DC500V, 50M Ω min (20 $\pm 15^{\circ}\text{C}$)	
	OUTPUT-RC	*9 AC100V 1minute Cutoff current = 25mA, DC100V, 10M Ω min (20 $\pm 15^{\circ}\text{C}$)	
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	*8 -20 to +95 $^{\circ}\text{C}$ (Aluminum base plate of the power module), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE) 3,000m (10,000feet) max	
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +95 $^{\circ}\text{C}$, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max	
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis	
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis	
SAFETY	SAFETY AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1, Complies with DEN-AN	
	CONDUCTED NOISE	Complies with FCC-A, VCCI-A, CISPR22-A, EN55011-A, EN55022-A	
	HARMONIC ATTENUATOR	*7 Complies with IEC61000-3-2	
OTHERS	CASE SIZE/WEIGHT	125 X 44.5 X 127mm [4.92 X 1.75 X 5.0inches] (W X H X D) / 600g max	
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)	

*1 Refer to the instruction manual 2.

*2 When the input voltage is more than 240V, the output voltage becomes the value proportional to the input voltage.

*3 The value is primary surge. The current of input surge to a built-in noise filter (0.2ms or less) is excluded.

*4 The value included the output setting and the line regulation, the load regulation and the temperature regulation.
However, the input voltage is less than 240V.

*5 Refer to the instruction manual 4.4.

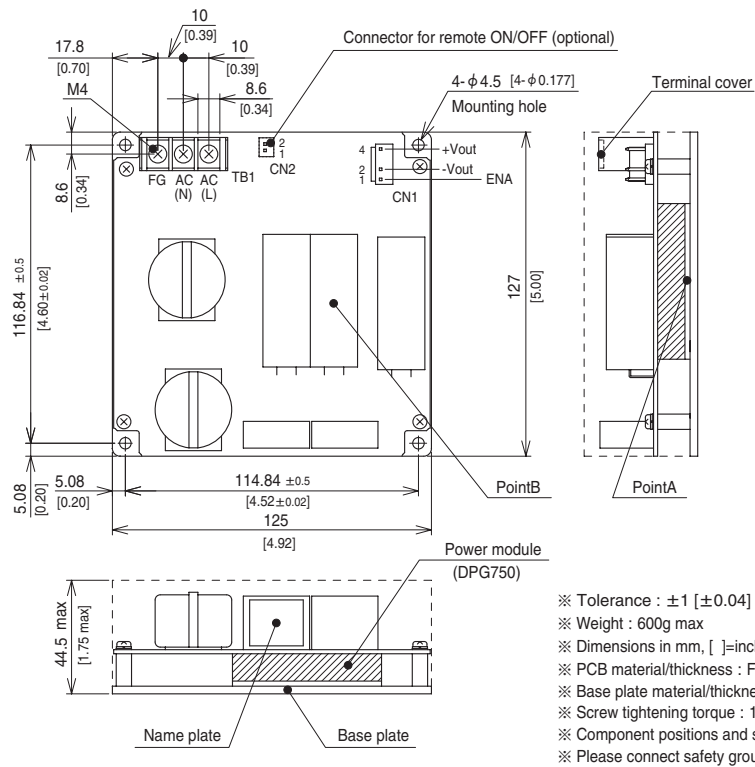
*6 The thermal protection stops the power factor corrector function and the ENA signal.

*7 Please contact us about class C.

*8 Refer to the instruction manual 6.2.

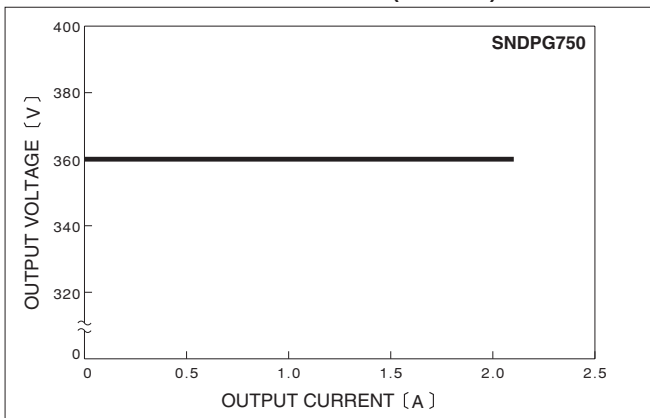
*9 Applicable when remote control (optional) is added.

External view

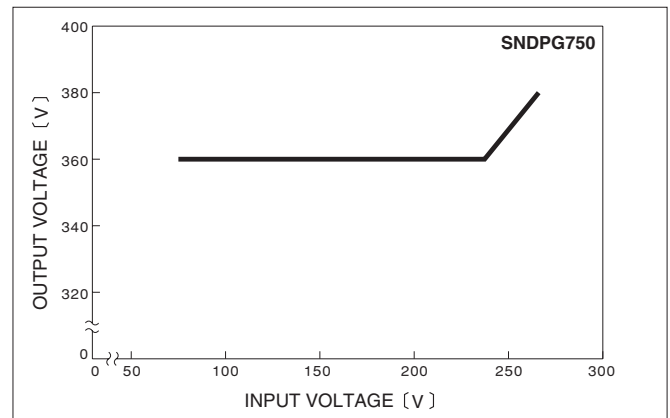


Performance data

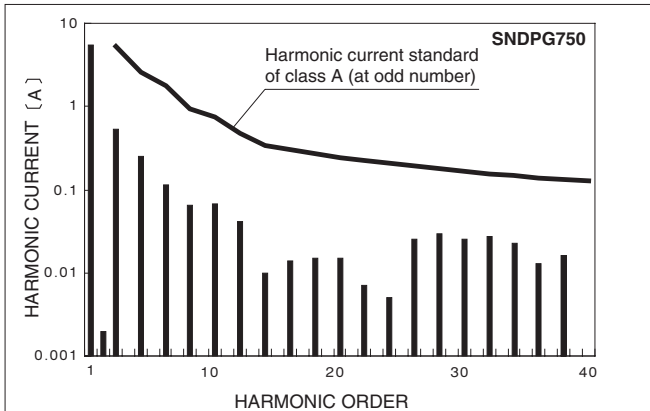
■ STATIC CHARACTERISTICS (AC230V)



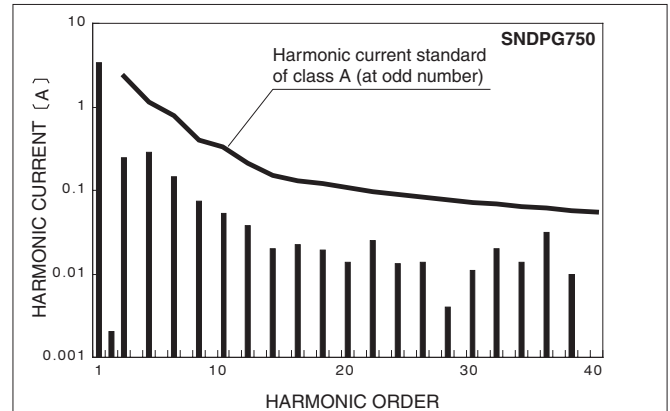
■ OUTPUT VOLTAGE FOR INPUT



■ HARMONIC CURRENT (AC100V)



■ HARMONIC CURRENT (AC230V)



Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
					Material	Single sided	Double sided	Series operation	Parallel operation
SNDPG750	Active filter	130	250V 12A	SCR	FR-4		Yes	No	No

1 Terminal Connection SNDPG-6**2** Input Voltage Derating SNDPG-6**3** Standard Connection Method SNDPG-6

- 3.1 Standard connection method SNDPG-6
- 3.2 Connection of loaded circuit SNDPG-6
- 3.3 Heatsink SNDPG-6

4 Function SNDPG-7

- 4.1 Overcurrent protection SNDPG-7
- 4.2 Overvoltage protection SNDPG-7
- 4.3 Thermal protection SNDPG-7
- 4.4 Enable signal (ENA) SNDPG-7
- 4.5 Isolation SNDPG-7

5 Series and Parallel Operation SNDPG-7

- 5.1 Series operation SNDPG-7
- 5.2 Parallel operation SNDPG-7

6 Implementation · Mounting Method SNDPG-7

- 6.1 Mounting method SNDPG-7
- 6.2 Derating SNDPG-8

7 Optional and Others SNDPG-9

- 7.1 Outline of option SNDPG-9

1 Terminal Connection

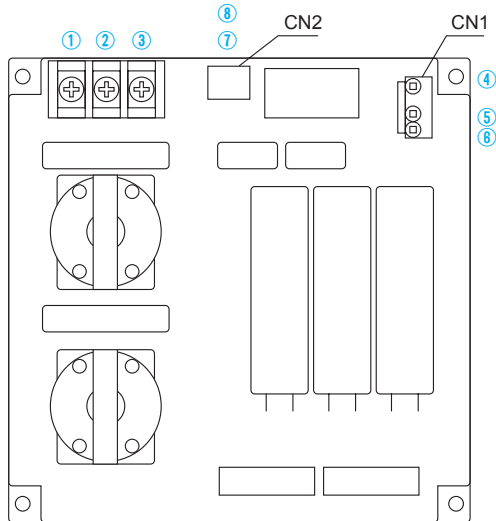


Fig. 1.1 Terminal connection (top view)

Table 1.1 Terminal connection and functions

No.	Terminal connection	Function
①	FG	FG
②	AC(N)	AC Input
③	AC(L)	
④	+VOUT	+DC output
⑤	-VOUT	-DC output
⑥	ENA	Enable signal
⑦	+RC	Remote ON/OFF (+RC) Optional
⑧	-RC	Remote ON/OFF (-RC) Optional

Table 1.2 Pin configuration and functions of CN1

Pin No.	Function
1	ENA : Enable signal
2	-V : -DC OUTPUT (-VOUT)
3	NC : No connection
4	+V : +DC OUTPUT (+VOUT)

Table 1.3 Pin configuration and functions of CN2 (optional)

Pin No.	Function
1	+RC : Remote ON/OFF (+RC)
2	-RC : Remote ON/OFF (-RC)

Table 1.4 Mating connectors and terminals of CN1 and CN2

Connector	Mating connector	Terminal	Mfr.
CN1	B3P4-VH	VHR-4N	J.S.T.
		Chain:SVH-21T-P1.1	
		Loose:BVH-21T-P1.1	
CN2	B2B-XH-AM	XHP-2	
		Chain: SXH-001T-P0.6	
		Loose: BXH-001T-P0.6	

2 Input Voltage Derating

■ Fig.2.1 shows rated output for each input voltage section.

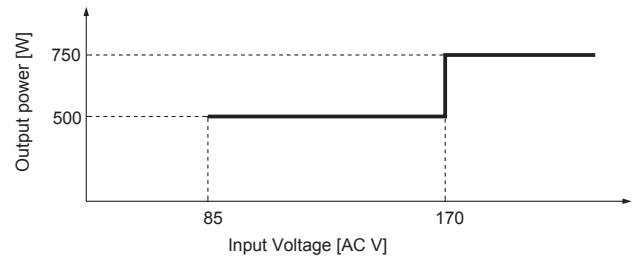


Fig.2.1 Input voltage derating curve (SNDPG750)

3 Standard Connection Method

3.1 Standard connection method

■ To use SNDPG Series, connection shown in Fig.3.1. Through this connection, DC output voltage can be obtained from AC input voltage. AC input voltage and DC output voltage are not insulated.

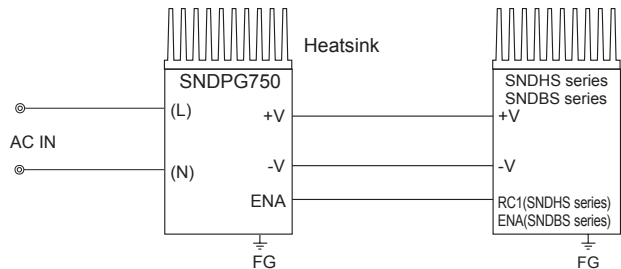


Fig.3.1 Standard connection method

■ Confirm each specification and instruction manual about the SNDHS/ SNDBS series.

3.2 Connection of loaded circuit

■ For connecting the SNDHS series (SNDHS50B / 100B / 250B) and SNDBS series, see Fig.3.1.

■ Control load current so that it may flow only when the terminal ENA is at "H". At "L" when inrush current protection circuit is not released, excessive current may be applied to the circuit.

■ For connection of loads except the SNDHS series and SNDBS series, please contact us.

3.3 Heatsink

■ The power supply adopts the conduction cooling system.

Attach a heatsink to the aluminum base plate to cool the power supply for use.

Refer to 6.2 Derating.

4 Function

4.1 Overcurrent protection

■The overcurrent protection circuit is not built-in.

4.2 Overvoltage protection

■The overvoltage protection circuit is built-in. The AC input should be shut down if overvoltage protection is in operation. When this function operates, the power factor corrector function does not operate, and output voltage becomes the full-wave rectified AC input voltage.

Remarks:

Please note that the unit's internal components may be damaged if excessive voltage (over rated voltage) is applied to output terminal of power supply. This could happen when the customer tests the overvoltage performance of the unit.

4.3 Thermal protection

■Thermal protection circuit is built-in and it operates about 115°C. If this function comes into effect, shut down the output, eliminate all possible causes of overheating, and drop the temperature to normal level. To prevent the unit from overheating, avoid using the unit in a dusty, poorly ventilated environment. When this function operates, the power factor corrector function does not operate, and output voltage becomes the full-wave rectified AC input voltage and ENA output changes into "L".

4.4 Enable signal (ENA)

- Use ENA to control starting of the loaded power supply.
- When inrush current protection circuit is released, ENA outputs "High".
- If load current flows without releasing of the circuit, the resistor may be burnt.

Table 4.1 Specification of ENA

No.	Item	ENA
1	Function	Output possible "H"
		Output prohibited "L"
2	Base pin	-VOUT
3	Level voltage "H"	10V typ (at no load)
4	Level voltage "L"	0V typ

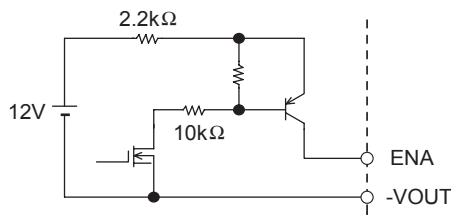


Fig.4.1 Internal circuit of ENA

4.5 Isolation

■For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for a start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

5 Series and Parallel Operation

5.1 Series operation

■As input and output are not insulated, series operation is impossible.

5.2 Parallel operation

■Parallel operation is not possible.

6 Implementation · Mounting Method

6.1 Mounting method

- The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Aluminum base plate temperature (Point A) around each power supply should not exceed the temperature range shown in derating curve.
- In case of metal chassis, keep the distance between d1 for to insulate between lead of component and metal chassis. If it is less than d1, insert the insulation sheet between power supply and metal chassis.

SNDPG

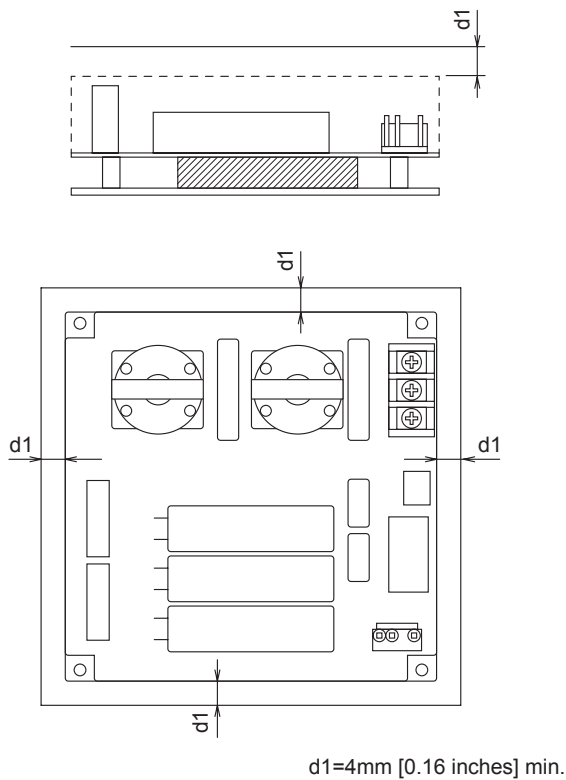


Fig.6.1 Mounting method

6.2 Derating

- Use with the conduction cooling (e.g. heat radiation by conduction from the aluminum base plate to the attached heat sink).
Fig.6.2 shows the derating curve based on the aluminum base plate temperature.
- Please measure the temperature on the aluminum base plate edge side (Point A).
Please consider the ventilation to keep the component temperature on the PCB (Point B) less than the temperature of Fig.6.3.
- It is necessary to note the thermal fatigue life by power cycle.
Please reduce the temperature fluctuation range as much as possible when the up and down of the temperature are frequently generated.
Contact us for more information on cooling methods.

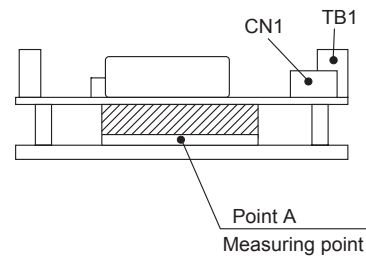
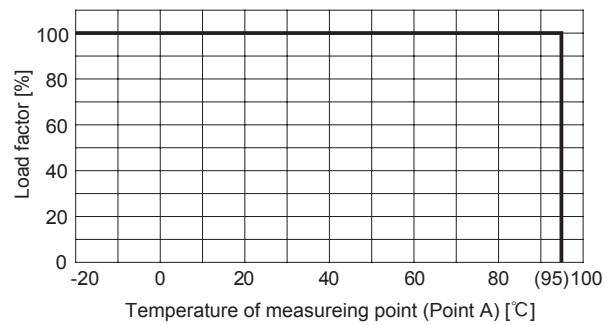


Fig.6.2 Derating curve (Point A)

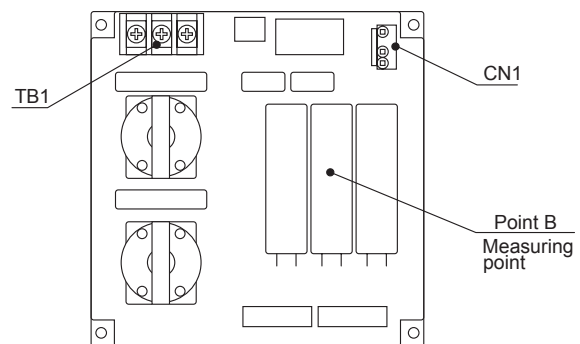
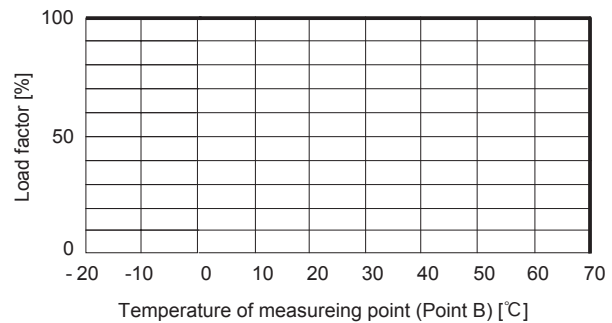


Fig.6.3 Derating curve (Point B)

7 Optional and Others

7.1 Outline of option

● -C

- Option -C units have coated internal PCB for better moisture resistance.

● -R

- You can control enable signal (ENA) ON/OFF remotely in Option -R units. To do so, connect an external DC power supply and apply a voltage to a remote ON/OFF connector, which is available as option.

Built-in Resistor Ri [Ω]	Voltage between +RC and -RC [V]		Input Current [mA]
	ENA ON	ENA OFF	
1200	3.5 - 12	0 - 0.5	10max

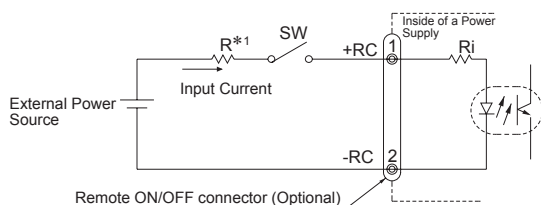


Fig.7.1 Example of using a remote ON/OFF circuit

- Dedicated harnesses are available for your purchase. Please see Optional Parts for details.

*1 If the output of an external power supply is within the range of 3.5 - 12V, you do not need a current limiting resistor R. If the output exceeds 12V, however, please connect the current limiting resistor R.

To calculate a current limiting resistance value, please use the following equation.

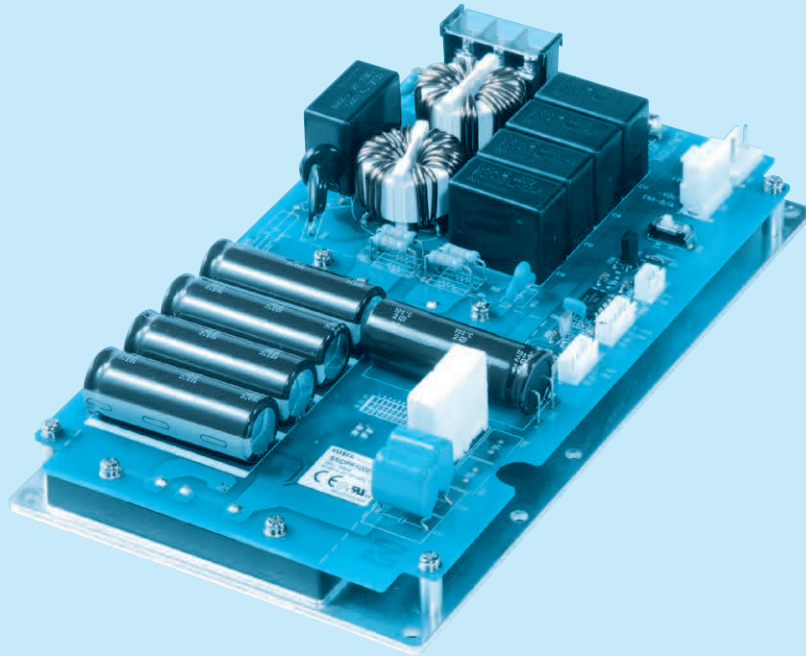
$$R[\Omega] = \frac{V_{CC} - (1.1 + R_i \times 0.005)}{0.005}$$

*Please wire carefully. If you wire wrongly, the internal components of a unit may be damaged.

■ Remote ON/OFF circuits (+RC and -RC) are isolated from input, output and FG.



SNDPF-series



Feature

Compact AC-DC converter, SNDPF series includes DPF series
Conduction cooling is possible by the combination with SNDBS and SNDHS series

Harmonic attenuator (Complies with IEC61000-3-2)
High efficiency 90% (AC100V) 95% (AC200V)
Universal input voltage (AC85-264V)
Built-in inrush current protection
Parallel operation is possible (Built-in current balancing function)
Built-in overvoltage and thermal protection circuits
Inverter operating monitoring (IOG)
Enable signal (ENA)

Safety agency approvals

UL60950-1, C-UL, EN60950-1
Complies with EN50178 and DENAN

CE marking

Low Voltage Directive

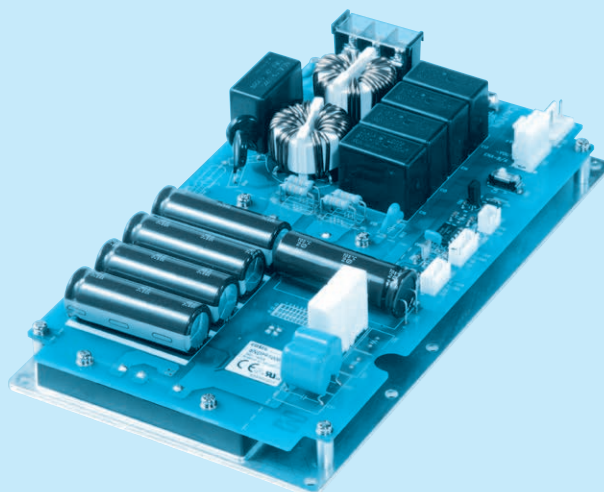
3-year warranty

SNDPF

SNDPF1000

SNDPF 1000

① ②



① Series name
② Output wattage
1000 : 1000W (AC 100V)
1500 : 1500W (AC 200V)

* For connection of loads except the series SNDHS/SNDBS, please contact Cosel development department.

MODEL	SNDPF1000	
AC INPUT[V]	AC85 - 264	AC170 - 264
MAX OUTPUT WATTAGE[W]	*1 1000	1500
DC OUTPUT VOLTAGE[V]	*2 360	

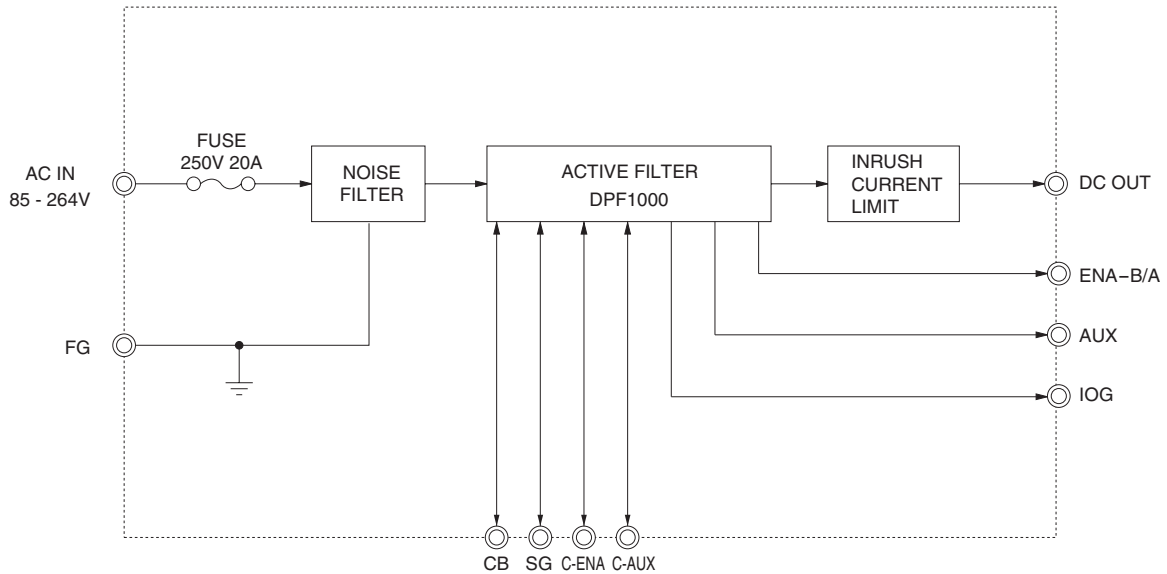
SPECIFICATIONS

	MODEL	SNDPF1000	
INPUT	VOLTAGE[V]	AC85 - 264 1 ϕ	AC170 - 264 1 ϕ
	POWER FACTOR CORRECTION RANGE[V]	AC85 - 255 1 ϕ	
	CURRENT[A]	11.5typ (ACIN 100V)	8.5typ (ACIN 200V)
	FREQUENCY[Hz]	50/60 (47 - 63)	
	INRUSH CURRENT[A]	20/20 typ (Io=100%) (Primary inrush current / Secondary inrush current) (More than 10 sec. to re-start)	
	*3 AC200V	40/20 typ (Io=100%) (Primary inrush current / Secondary inrush current) (More than 10 sec. to re-start)	
	EFFICIENCY[%]	90typ (ACIN 100V, Io=100%)	95typ (ACIN 200V, Io=100%)
	POWER FACTOR	0.98typ (ACIN 100V, Io=100%)	0.95typ (ACIN 200V, Io=100%)
OUTPUT	LEAKAGE CURRENT[ma]	0.75 max (ACIN 240V 60Hz, Io=100%, According to IEC60950-1, DENAN)	
	WATTAGE[W]	1000	1500
	VOLTAGE[V]	*2 360	
	VOLTAGE ACCURACY	*4 $\pm 20\%$	
PROTECTION CIRCUIT AND OTHERS	OVERVOLTAGE PROTECTION[V]	DC400-450V The power factor correction function stops	
	IOG	Inverter operation monitoring, Open-collector output, Maximum sink current 10mA, Maximum allowance voltage 35V	
	ENA	*5 Enable signal, Open-collector output, Maximum sink current 10mA, Maximum allowance voltage 35V	
	AUX	Auxiliary power supply for external signal Refer to Instruction Manual (4.6 AUX)	
	OTHERS	*6 Parallel operation possible (Current balancing function), Thermal protection	
ISOLATION	INPUT-OUTPUT	Non isolated	
	INPUT, OUTPUT-FG	AC3,000V 1minute Cutoff current = 10mA, DC500V, 50M Ω min (20 $\pm 15^{\circ}\text{C}$)	
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-20 to +80 $^{\circ}\text{C}$ (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE) 3,000m (10,000feet) max	
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +100 $^{\circ}\text{C}$, 20 - 95%RH (Non condensing), 9,000m (30,000feet) max	
	VIBRATION	10 - 55Hz, 19.6m/s 2 (2G), 3minutes period, 60minutes each along X, Y and Z axis	
	IMPACT	196.1m/s 2 (20G), 11ms, once each along X, Y and Z axis	
SAFETY	SAFETY AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1, Complies with DEN-AN	
	CONDUCTED NOISE	Complies with FCC-A, VCCI-A, CISPR22-A, EN55011-A, EN55022-A	
	HARMONIC ATTENUATOR	*7 Complies with IEC61000-3-2 (Class A) (1000W output power exceeds the electrolytic capacitor is required for external)	
OTHERS	CASE SIZE/WEIGHT	127 X 44.5 X 222mm [5.0 X 1.75 X 8.75inches] (W X H X D) / 920g max	
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)	

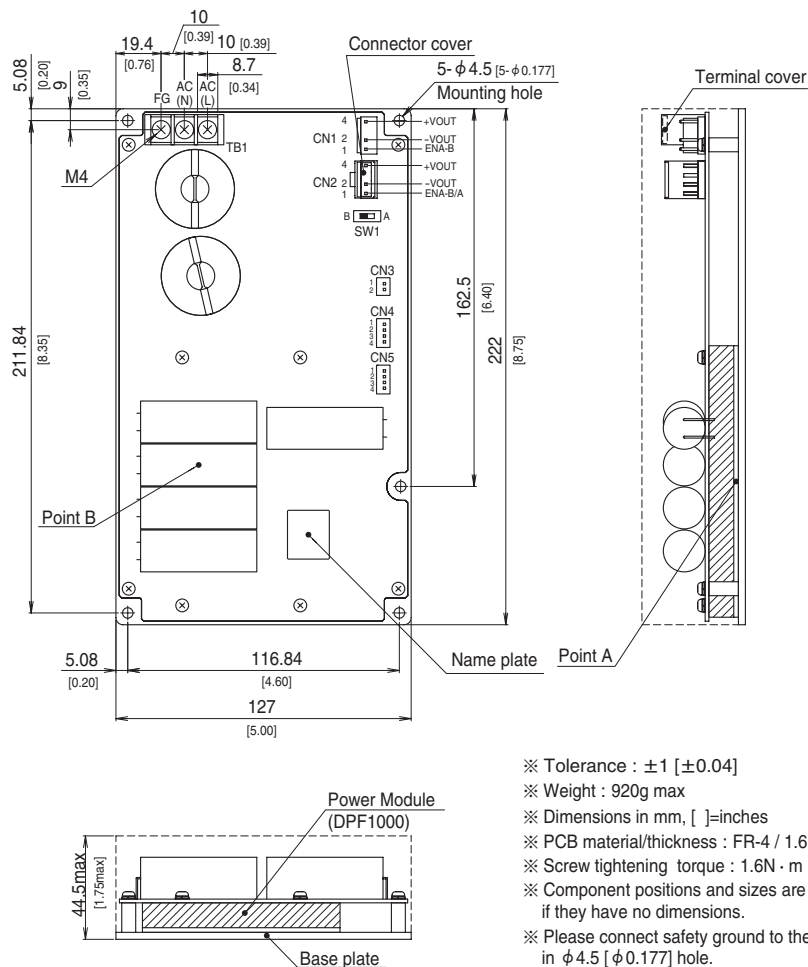
*1 Refer to input voltage derating.
*2 When the input voltage is more than 255V, the power factor correction function stops, and the output voltage becomes rectified AC input voltage.
*3 The current of input surge to a built-in EMI/EMC filter (0.2ms or less) is excluded.
*4 The value included the output setting and the line regulation, the load regulation and the temperature regulation.
However, the input voltage is in the power factor correction range.

*5 Refer to manual.
*6 The power factor correction function and ENA stop when thermal protection function works.
*7 Please contact us about Harmonic attenuator class C.

Block diagram



External view



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 920g max
- ※ Dimensions in mm, []=inches
- ※ PCB material/thickness : FR-4 / 1.6mm [0.06]
- ※ Screw tightening torque : 1.6N · m (16.9kgf · cm) max
- ※ Component positions and sizes are for your reference if they have no dimensions.
- ※ Please connect safety ground to the base plate in φ4.5 [φ0.177] hole.
- ※ The following parts are attached at shipping from factory
CN2 : Housing for protection
- ※ Keep drawing current per pin below 7A for CN1/CN2.

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection circuit	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
SNDPF1000	Active filter	130	11.5 *1	250V 20A	SCR	FR-4		Yes	No	Yes *3
			8.5 *2							

*1 The value of input current is at AC100V and 1000W load.

*2 The value of input current is at AC200V and 1500W load.

*3 Refer to Instruction Manual 5 Series and Parallel Operation.

1 Terminal Connection SNDPF-6

2 Input Voltage Derating SNDPF-6

3 Standard Connection Method SNDPF-6

- 3.1 Standard connection method SNDPF-6
- 3.2 Connection of loaded circuit SNDPF-7
- 3.3 Heatsink SNDPF-7

4 Function SNDPF-7

- 4.1 Overcurrent protection SNDPF-7
- 4.2 Overvoltage protection SNDPF-7
- 4.3 Thermal protection SNDPF-7
- 4.4 Enable signal (ENA) SNDPF-7
- 4.5 Inverter operation monitor (IOG) SNDPF-8
- 4.6 Auxiliary power supply circuit for external signal (AUX) SNDPF-8
- 4.7 Isolation SNDPF-8

5 Series and Parallel Operation SNDPF-8

- 5.1 Series operation SNDPF-8
- 5.2 Parallel operation SNDPF-8
- 5.3 Synchronized start up of Several power supplies SNDPF-9

6 Implementation · Mounting Method SNDPF-9

- 6.1 Mounting method SNDPF-9
- 6.2 Derating SNDPF-9

SNDPF

1 Terminal Connection

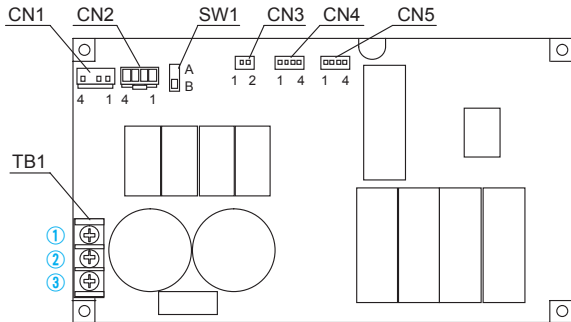


Fig.1.1 Terminal Connection

Table 1.1 Terminal connection and functions

No	Terminal connection	Function
①	AC(L)	AC Input
②	AC(N)	
③	FG	

Table 1.2 Terminal connection and functions of CN1

Pin No.	Function
1	ENA-B : Enable signal for SNDBS
2	-VOUT : -DC output
3	NC : No connection
4	+VOUT : +DC output

Table 1.3 Terminal connection and functions of CN2

Pin No.	Function
1	ENA-B/A : Enable signal for SNDHS
2	-VOUT : -DC output
3	NC : No connection
4	+VOUT : +DC output

Housing for protection is attached on CN2 at shipping from factory

Table 1.4 Terminal connection and functions CN3

Pin No.	Function
1	IOG : Inverter operation monitor
2	AUX : Auxiliary power supply for external signal

Table 1.5 Terminal connection and functions of CN4 and CN5

Pin No.	Function
1	C-AUX : Auxiliary power supply for external signal for synchronized start up
2	C-ENA : Enable signal for synchronized start up
3	SG : Signal ground
4	CB : Current balance

Common signs among CN4 and CN5 represent the same potential.

Table 1.6 Mating connectors and terminals of CN1,CN2,CN3,CN4 and CN5

Connector	Mating connector	Terminal	Mfr.
CN1 CN2	B3P4-VH-B	VHR-4N	Reel :SVH-21T-P1.1 Loose:BVH-21T-P1.1
CN3	B2B-XH-AM	XHP-2	Reel :SXH-001T-P0.6 Loose:BXH-001T-P0.6
CN4 CN5	B4B-XH-AM	XHP-4	Reel :SXH-001T-P0.6 Loose:BXH-001T-P0.6

J.S.T.

2 Input Voltage Derating

■ Fig.2.1 shows rated output for each input voltage section.
Maximum output should be within this range.

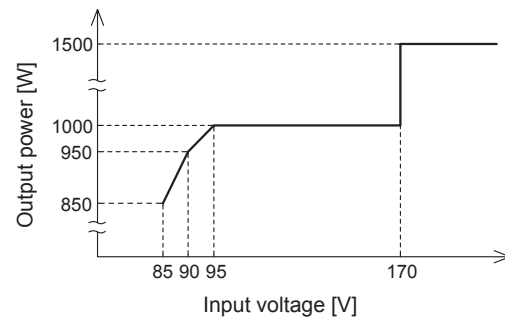


Fig.2.1 Input voltage derating curve

3 Standard Connection Method

3.1 Standard connection method

■ To use SNDPF1000, connection shown in Fig.3.1 and outside attached components are required. Through this connection, DC output voltage can be obtained from AC input voltage.
AC input voltage and DC output voltage are not insulated.

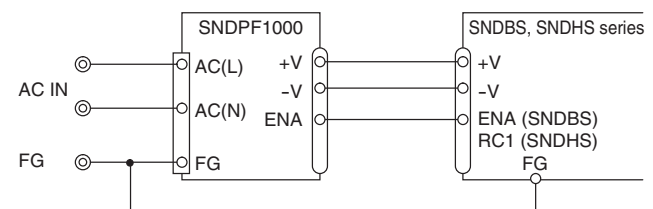


Fig.3.1 Standard connection method

3.2 Connection of loaded circuit

- Control load current so that it may flow only when the terminal ENA is at "H".
- For connecting the SNDBS/SNDHS series, see Fig.3.1.
- For connection of loads except the SNDBS/SNDHS series, please contact Cosel development department.

3.3 Heatsink

- The power supply adopts the conduction cooling system. Attach a heatsink to the aluminum base plate to cool the power supply for use.
- Refer to 6.2 Derating.

4 Function

4.1 Overcurrent protection

- The overcurrent protection circuit is not built-in.
- In order to secure the safety, use the fuse at output side for connection of loads except the SNDBS/SNDHS series.

4.2 Overvoltage protection

- The overvoltage protection circuit is built-in. The AC input should be shut down if overvoltage protection is in operation. When this function operates, the power factor corrector function does not operate, and output voltage becomes the full-wave rectified AC input voltage.
- The minimum interval of AC recycling for recovery is a few minutes which output voltage drops below 20V.

Remarks:

Please note that the unit's internal components may be damaged if excessive voltage (over rated voltage) is applied to output terminal of power supply. This could happen when the customer tests the overvoltage performance of the unit.

4.3 Thermal protection

- Thermal protection circuit is built-in.
- If this function comes into effect, shut down the output, eliminate all possible causes of overheating, and drop the temperature to normal level.
- To prevent the unit from overheating, avoid using the unit in a dusty, poorly ventilated environment.
- When this function operates, the power factor corrector function does not operate, and output voltage becomes the full-wave rectified AC input voltage and ENA output changes into "L".
 - When this function operates, the power factor corrector function does not operate, and output voltage becomes the full-wave rectified AC input voltage.

4.4 Enable signal (ENA)

- Use ENA to control starting of the loaded power supply.
 - When inrush current protection circuit is released, ENA outputs "H". If load current flows without releasing of the circuit, the resistor may be damaged.
 - Setting of ENA has two kinds of SNDHS use (ENA-A) and the SNDBS use (ENA-B).
- The setting of ENA-A is possible only in CN2.
- Please connect the ENA-A terminal to RC1 terminal of the SNDHS series.

Table 4.1 Specification of ENA

No.	Item	ENA-A	ENA-B
1	Load of SNDPF1000	SNDHS series	SNDBS series
2	Signal pin	ENA-B/A at CN2	ENA-B at CN1 ENA-B/A at CN2
3	Base pin	-VOUT	
4	Setting of SW1	A	B
5	Function	Output possible "H" Output prohibited "L"	
6	Level voltage "H"	5.5V typ at 1mA	7.5V typ at 1mA
7	Level voltage "L"	Open collector	

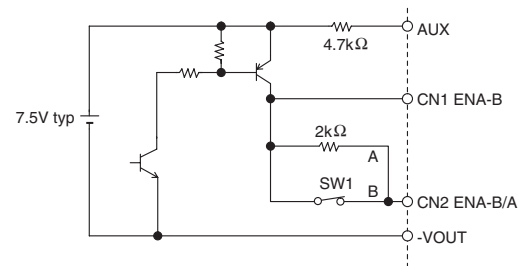
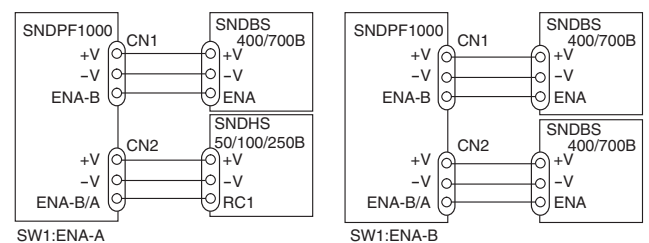


Fig.4.1 Internal circuit of ENA



(a) Example of connection to ENA using SNDHS

(b) Example of connection to ENA using SNDBS

Fig.4.2 Example of connection to ENA

4.5 Inverter operation monitor (IOG)

■ Use IOG to monitor operation of the inverter.

When unit operation stopped due to overvoltage protection, thermal protection or the event of a failure in the power supply, IOG-signal state changes to "H" from "L" within 1 second.

And output voltage becomes an equal value to the full-wave rectified AC input voltage.

If IOG signal status keeps "H", there is a possibility that unit and/or external circuit is damaged. In case like this, please check the unit and/or external circuit conditions in your system.

IOG can be used for monitoring failures such as redundant operation.

■ IOG may become unstable in case of start-up or sudden change of load current. Set the timer with delay of more than 5 seconds.

■ During parallel operation, unstable condition may occur when load current becomes lower than 10% of rated value.

Table 4.2 Specification of IOG

No.	Item	IOG
1	Function	L Normal operation
		H Malfunction of inverter
2	Output level	L 0.6Vmax at 10mA 10mA max
		H Open collector 35V max
3	Base pin	-VOUT

4.6 Auxiliary power supply circuit for external signal (AUX)

■ The AUX pin can be used as the power source with the open collector output for IOG .

■ Shortprotection resistance (4.7kΩ) is built in.

Output voltage decreases as the output current increases.

4.7 Isolation

■ For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for a start(shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

5 Series and Parallel Operation

5.1 Series operation

■ As input and output are not insulated, series operation is impossible.

5.2 Parallel operation

■ Parallel operation is available by connecting the units as shown in Fig.5.1.

Synchronization output current balance, ENA signal is performed.

■ As variance of output current drew from each power supply is maximum 10%, the total output current must not exceed the value determined by the following equation.

$$\left(\begin{array}{c} \text{Output current in} \\ \text{parallel operation} \end{array} \right) = \left(\begin{array}{c} \text{the rated current} \\ \text{per unit} \end{array} \right) \times (\text{number of unit}) \times 0.9$$

In parallel operation, the maximum operative number of units is 5.

■ When the output-line impedance is high, the power supply is become unstable. Use same length and thickness (width) wire (pattern) for the current balance improvement.

■ Connect each input pin for the lowest possible impedance.

When the number of the units in parallel operation increases, input current increases.

Adequate wiring design for input circuitry such as circuit pattern, wiring and current for equipment is required.

If temperatures of aluminum base plates are different in the power supply for parallel operation, values of output current will change greatly.

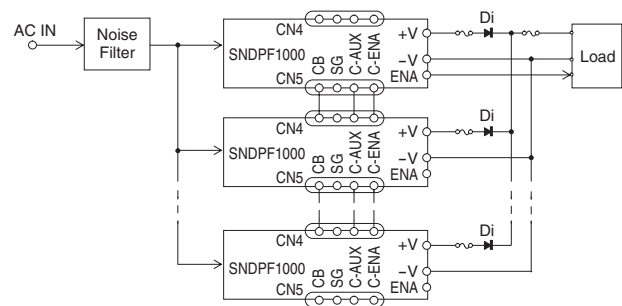
Design radiation to equalize plate temperatures by attaching the same heatsinks.

■ Fuse, each diode to the output terminal of each power supply in order to ensure safety Please connect.

The output side diode if the following three parallel units are omitted Can be.

■ Input voltage of the power supply to operate in parallel, please supply the same strain.

■ Keep drawing current per pin below 7A for CN1/CN2.



* Common signs among CN4 and CN5 represent the same potential.
* Please connect each CB, C-AUX and C-ENA.

Fig.5.1 Parallel operation

5.3 Synchronized start up of Several power supplies

- Make a connection in Figure 5.2, ENA signal to be synchronized, even if you do not parallel operation is possible.
When all SNDPF1000 connected becomes able to work, ENA signal turns into H.
- When one of the SNDPF1000 connected is prohibited, ENA signal turns into L.
- For parallel operation and shall not, eliminating the output side diode, a fuse.

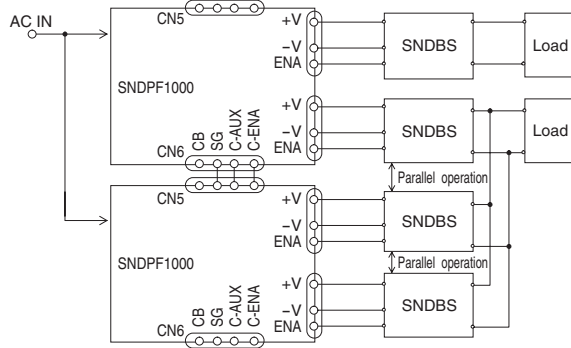


Fig.5.2 Synchronized start up connection Example

6 Implementation · Mounting Method

6.1 Mounting method

- The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Aluminum base plate temperature around each power supply should not exceed the temperature range shown in derating curve.
- In case of metal chassis, keep the distance between d1 for to insulate between lead of component and metal chassis. If it is less than d1, insert the insulation sheet between power supply and metal chassis.

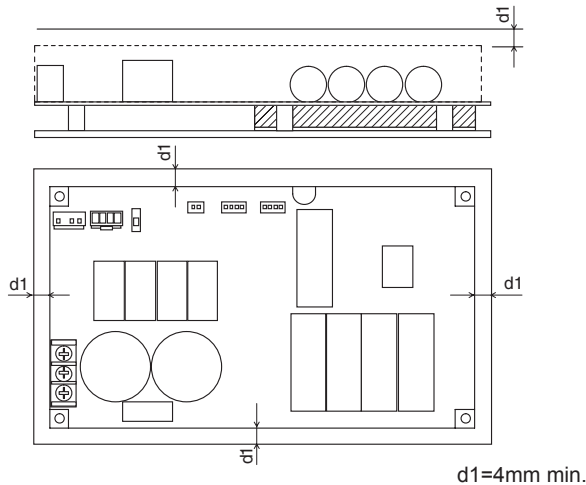


Fig.6.1 Mounting method

6.2 Derating

- Use with the conduction cooling (e.g. heat radiation by conduction from the aluminum plate to the attached heat sink).
Fig.6.2 shows the derating curve based on the aluminum base plate temperature.
- Please measure the temperature on the aluminum base plate edge side (Point A).
Please consider the ventilation to keep the component temperature on the PCB (Point B) less than the temperature of Fig.6.3.
- It is necessary to note the thermal fatigue life by power cycle.
Please reduce the temperature fluctuation range as much as possible when the up and down of the temperature are frequently generated.
- Contact us for more information on cooling methods.

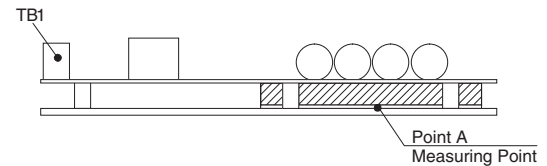
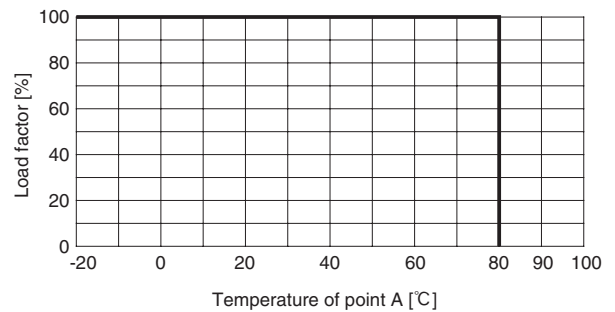


Fig.6.2 Derating curve of point A

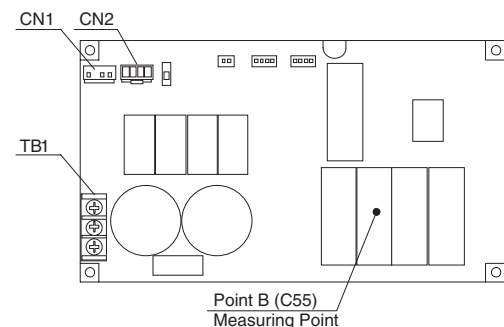
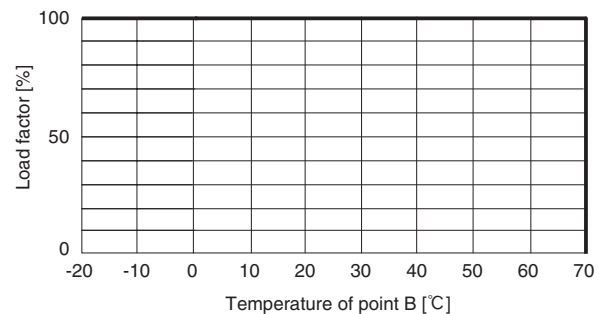


Fig.6.3 Derating curve of point B



Isolated



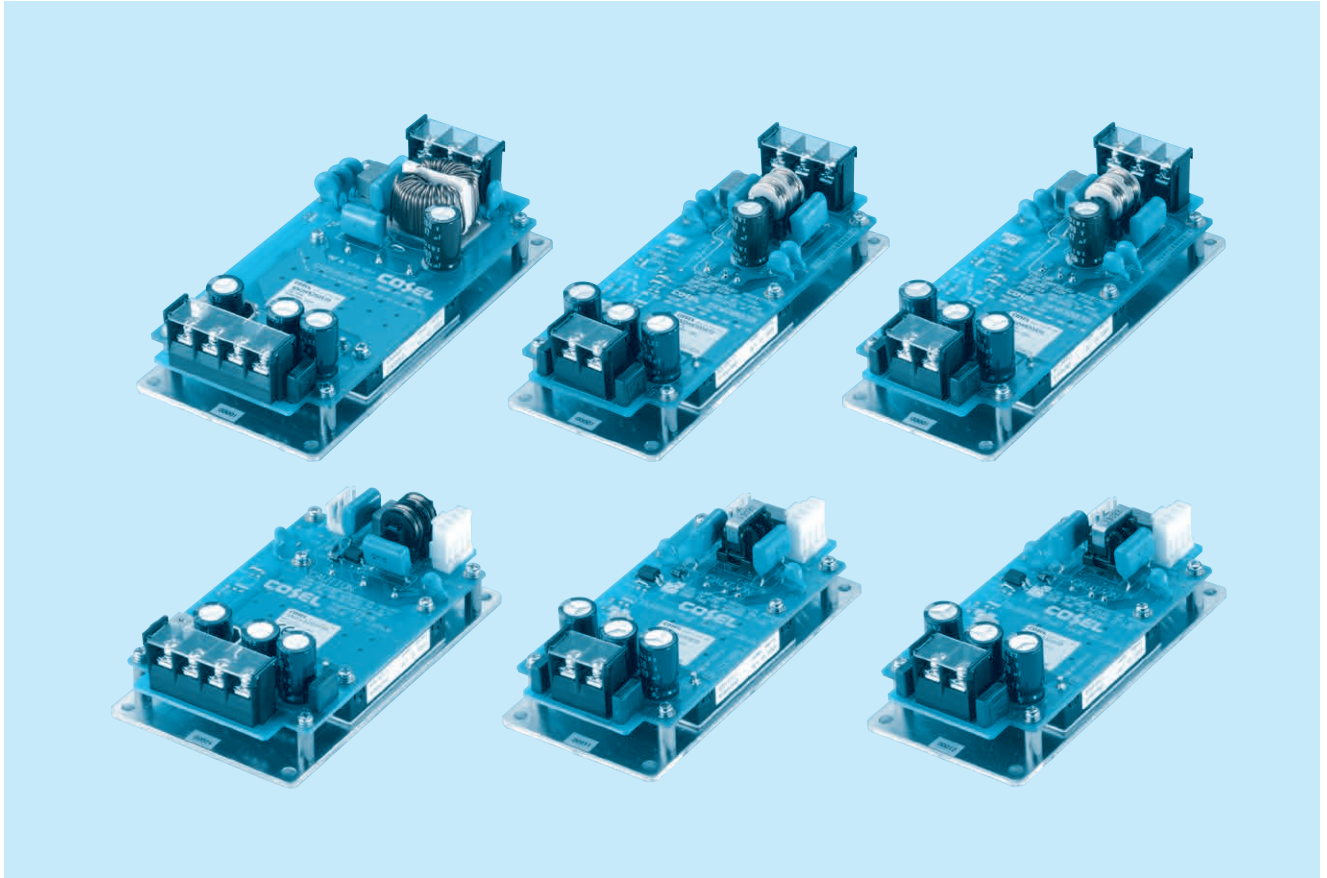
OCP



OVP

Remote
ON/OFF

SNDHS-series



■ Features

Compact DC-DC Converter, SNDHS series includes DHS series

High efficiency

Built-in overcurrent, overvoltage and thermal protection circuits

Built-in remote ON/OFF (secondary is an optional)

Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)

AC-DC Converter can be constituted in combination with SNDPG series (only SNDHS50B/SNDHS100B/SNDHS250B)

SNDHS

■ Safety agency approvals

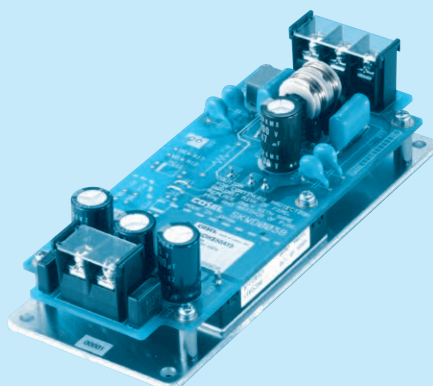
UL60950-1, C-UL and EN60950-1

■ 3-year warranty

SNDHS50A

SNDH S 50 A 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
② Single output
③ Output wattage
④ A : DC60-160V
⑤ Output voltage
⑥ Optional
C : with Coating
R : with Remote ON/OFF

Please refer to Instruction manual 7.

MODEL	SNDHS50A05	SNDHS50A12	SNDHS50A15	SNDHS50A24
MAX OUTPUT WATTAGE[W]	50.0	50.4	51.0	50.4
DC OUTPUT	5V 10A	12V 4.2A	15V 3.4A	24V 2.1A

SPECIFICATIONS

	MODEL	SNDHS50A05	SNDHS50A12	SNDHS50A15	SNDHS50A24	
INPUT	VOLTAGE[V]	DC60 - 160				
	CURRENT[A]	*1 0.55typ	0.55typ	0.55typ	0.55typ	
	EFFICIENCY[%]	*1 83.0typ	85.0typ	85.0typ	85.0typ	
OUTPUT	VOLTAGE[V]	5	12	15	24	
	CURRENT[A]	10	4.2	3.4	2.1	
	LINE REGULATION[mV]	10max	24max	30max	48max	
	LOAD REGULATION[mV]	150max	100max	100max	100max	
	RIPPLE[mVp-p]	0 to +95℃ *2	80max	120max	120max	120max
		-20 to 0℃ *2	120max	150max	150max	150max
		0 to 15% Load *2	160max	240max	240max	240max
	RIPPLE NOISE[mVp-p]	0 to +95℃ *2	160max	200max	200max	200max
		-20 to 0℃ *2	250max	280max	280max	280max
		0 to 15% Load *2	300max	300max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	120max	150max	240max
		-20 to +95℃	100max	240max	300max	480max
	DRIFT[mV]	*3	20max	40max	60max	90max
START-UP TIME[ms]	200max (DCIN 110V, Io=100%)					
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	*4	4.50 - 5.50	10.80 - 13.20	13.50 - 16.50	21.60 - 26.40	
OUTPUT VOLTAGE SETTING[V]		5.00 - 5.15	12.00 - 12.48	15.00 - 15.60	24.00 - 24.96	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically				
	OVERVOLTAGE PROTECTION[V]	6.30 - 7.60	13.90 - 17.55	17.25 - 21.75	27.60 - 34.80	
	REMOTE SENSING	None				
	REMOTE ON/OFF (RC)	Optional (Required external power source)				
ISOLATION	INPUT-OUTPUT, RC	*5	AC3,000V 1minute, Cutoff current = 15mA, DC500V 50MΩ min (20±15℃)			
	INPUT-FG		AC2,000V 1minute, Cutoff current = 15mA, DC500V 50MΩ min (20±15℃)			
	OUTPUT, RC-FG	*5	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)			
	OUTPUT-RC	*5	AC100V 1minute, Cutoff current = 25mA, DC100V 10MΩ min (20±15℃)			
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	*6	-20 to +95℃ (Aluminum base plate of the power module), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max			
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +95℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max			
	VIBRATION		10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis			
	IMPACT		196.1m/s² (20G), 11ms, once each along X, Y and Z axis			
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1				
	CONDUCTED NOISE (at only DC input)	Complies with FCC-A, VCCI-A, CISPR22-A, EN55011-A, EN55022-A				
OTHERS	CASE SIZE/WEIGHT	61.5×44.5×150mm [2.42×1.75×5.91 inches] (W×H×D) / 270g max				
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)				

*1 At rated input(DC110V) and rated load.

*2 Ripple and ripple noise is measured by using measuring board with capacitor of 22 μF at 150mm [5.91 inches] from output terminal.
Refer to the instruction manual 3.2.

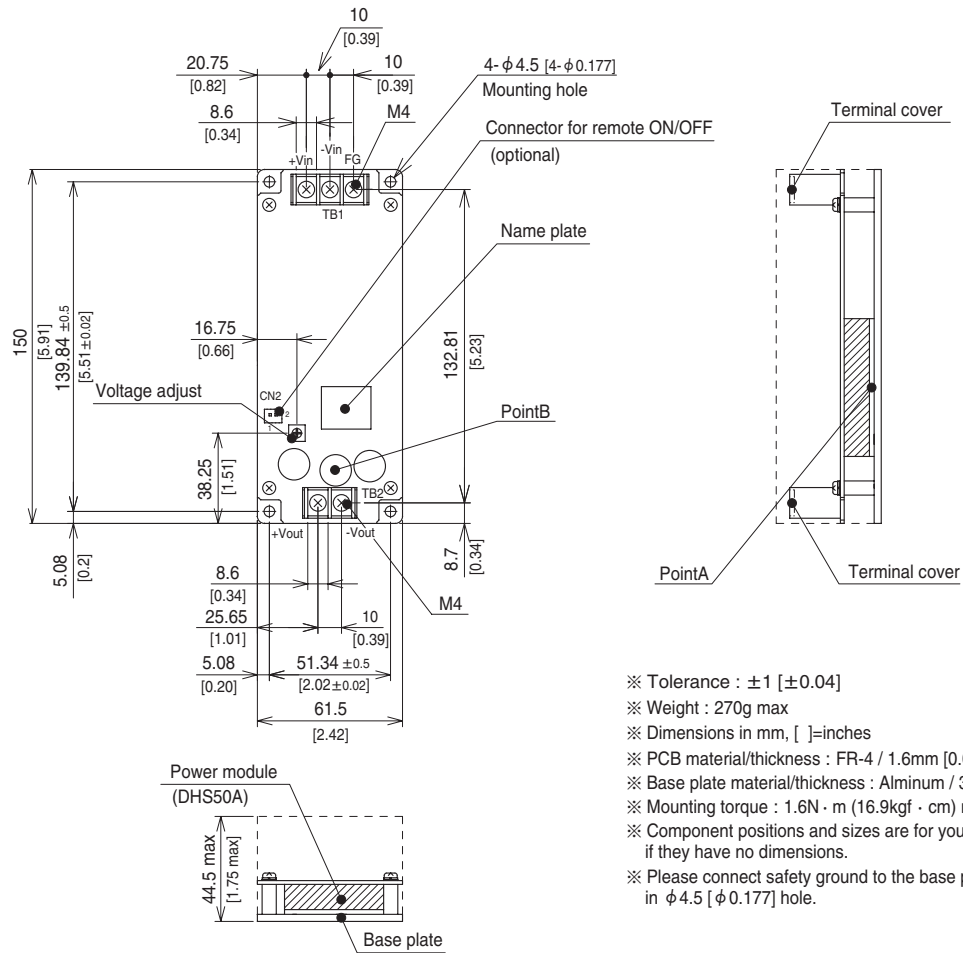
*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*4 Refer to the instruction manual 4.6.

*5 Applicable when remote control (optional) is added.

*6 Refer to the instruction manual 6.2.

External view

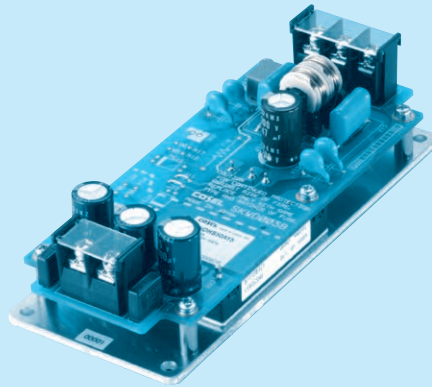


- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 270g max
- ※ Dimensions in mm, []=inches
- ※ PCB material/thickness : FR-4 / 1.6mm [0.06]
- ※ Base plate material/thickness : Aluminum / 3.0mm[0.12]
- ※ Mounting torque : 1.6N · m (16.9kgf · cm) max
- ※ Component positions and sizes are for your reference if they have no dimensions.
- ※ Please connect safety ground to the base plate in $\phi 4.5$ [$\phi 0.177$] hole.

SNDHS100A

SNDH S 100 A 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
 ② Single output
 ③ Output wattage
 ④ A : DC60-160V
 ⑤ Output voltage
 ⑥ Optional
 C : with Coating
 R : with Remote ON/OFF

Please refer to Instruction manual 7.

MODEL	SNDHS100A05	SNDHS100A12	SNDHS100A15	SNDHS100A24
MAX OUTPUT WATTAGE[W]	100.0	100.8	100.5	100.8
DC OUTPUT	5V 20A	12V 8.4A	15V 6.7A	24V 4.2A

SPECIFICATIONS

	MODEL	SNDHS100A05	SNDHS100A12	SNDHS100A15	SNDHS100A24	
INPUT	VOLTAGE[V]	DC60 - 160				
	CURRENT[A]	1.1typ	1.1typ	1.1typ	1.1typ	
	EFFICIENCY[%]	84.0typ	87.0typ	87.0typ	87.0typ	
OUTPUT	VOLTAGE[V]	5	12	15	24	
	CURRENT[A]	20	8.4	6.7	4.2	
	LINE REGULATION[mV]	10max	24max	30max	48max	
	LOAD REGULATION[mV]	150max	100max	100max	100max	
	RIPPLE[mVp-p]	0 to +95℃	80max	120max	120max	120max
		-20 to 0℃	120max	150max	150max	150max
		0 to 15% Load	160max	240max	240max	240max
	RIPPLE NOISE[mVp-p]	0 to +95℃	160max	200max	200max	200max
		-20 to 0℃	250max	280max	280max	280max
		0 to 15% Load	300max	300max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	120max	150max	240max
		-20 to +95℃	100max	240max	300max	480max
	DRIFT[mV]		20max	40max	60max	90max
START-UP TIME[ms]	200max (DCIN 110V, Io=100%)					
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	4.50 - 5.50	10.80 - 13.20	13.50 - 16.50	21.60 - 26.40		
OUTPUT VOLTAGE SETTING[V]	5.00 - 5.15	12.00 - 12.48	15.00 - 15.60	24.00 - 24.96		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically				
	OVERVOLTAGE PROTECTION[V]	6.30 - 7.60	13.90 - 17.55	17.25 - 21.75	27.60 - 34.80	
	REMOTE SENSING	None				
	REMOTE ON/OFF (RC)	Optional (Required external power source)				
ISOLATION	INPUT-OUTPUT, RC	AC3,000V 1minute, Cutoff current = 15mA, DC500V 50MΩ min (20±15℃)				
	INPUT-FG	AC2,000V 1minute, Cutoff current = 15mA, DC500V 50MΩ min (20±15℃)				
	OUTPUT, RC-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)				
	OUTPUT-RC	AC100V 1minute, Cutoff current = 25mA, DC100V 10MΩ min (20±15℃)				
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-20 to +95℃ (Aluminum base plate of the power module), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max				
	STORAGE TEMP.,HUMID.AND ALTITUDE	-20 to +95℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max				
	VIBRATION	10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis				
	IMPACT	196.1m/s² (20G), 11ms, once each along X, Y and Z axis				
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1				
	CONDUCTED NOISE (at only DC input)	Complies with FCC-A, VCCI-A, CISPR22-A, EN55011-A, EN55022-A				
OTHERS	CASE SIZE/WEIGHT	61.5×44.5×150mm [2.42×1.75×5.91 inches] (W×H×D) / 270g max				
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)				

*1 At rated input(DC110V) and rated load.

*2 Ripple and ripple noise is measured by using measuring board with capacitor of 22 μF at 150mm [5.91 inches] from output terminal.
 Refer to the instruction manual 3.2.

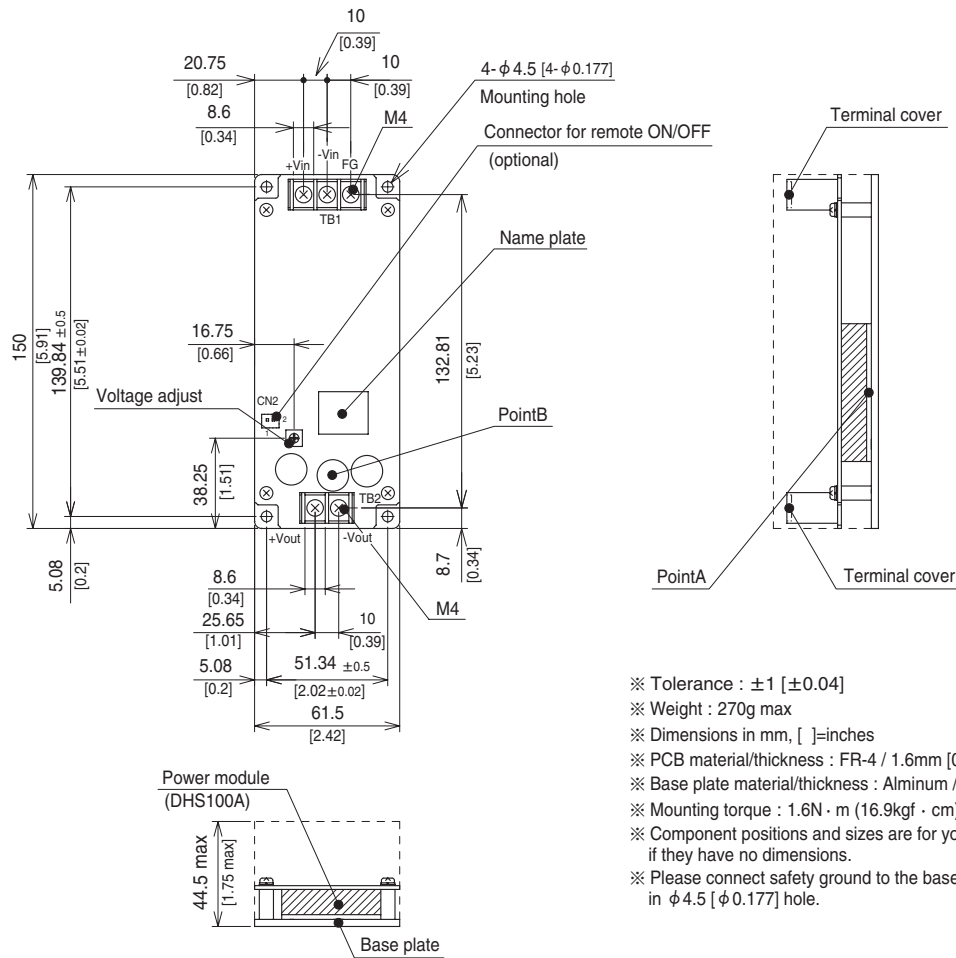
*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*4 Refer to the instruction manual 4.6.

*5 Applicable when remote control (optional) is added.

*6 Refer to the instruction manual 6.2.

External view



- ※ Tolerance : ±1 [±0.04]
- ※ Weight : 270g max
- ※ Dimensions in mm, []=inches
- ※ PCB material/thickness : FR-4 / 1.6mm [0.06]
- ※ Base plate material/thickness : Alminum / 3.0mm[0.12]
- ※ Mounting torque : 1.6N · m (16.9kgf · cm) max
- ※ Component positions and sizes are for your reference if they have no dimensions.
- ※ Please connect safety ground to the base plate in φ 4.5 [φ 0.177] hole.

SNDHS200A

SNDH S 200 A 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
 ② Single output
 ③ Output wattage
 ④ A : DC60-160V
 ⑤ Output voltage
 ⑥ Optional
 C : with Coating
 R : with Remote ON/OFF

Please refer to Instruction manual 7.

MODEL	SNDHS200A05	SNDHS200A12	SNDHS200A15	SNDHS200A24
MAX OUTPUT WATTAGE[W]	200.0	200.4	201.0	201.6
DC OUTPUT	5V 40A	12V 16.7A	15V 13.4A	24V 8.4A

SPECIFICATIONS

	MODEL	SNDHS200A05	SNDHS200A12	SNDHS200A15	SNDHS200A24
INPUT	VOLTAGE[V]	DC60 - 160			
	CURRENT[A]	*1 2.1typ	2.1typ	2.1typ	2.1typ
	EFFICIENCY[%]	*1 87.0typ	87.0typ	87.0typ	87.0typ
OUTPUT	VOLTAGE[V]	5	12	15	24
	CURRENT[A]	40	16.7	13.4	8.4
	LINE REGULATION[mV]	10max	24max	30max	48max
	LOAD REGULATION[mV]	150max	100max	100max	100max
	RIPPLE[mVp-p]	0 to +95°C *2 80max	120max	120max	120max
		-20 to 0°C *2 120max	150max	150max	150max
		0 to 15% Load *2 160max	240max	240max	240max
	RIPPLE NOISE[mVp-p]	0 to +95°C *2 160max	200max	200max	200max
		-20 to 0°C *2 250max	280max	280max	280max
		0 to 15% Load *2 300max	300max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +50°C 50max	120max	150max	240max
		-20 to +95°C 100max	240max	300max	480max
	DRIFT[mV]	*3 20max	40max	60max	90max
PROTECTION CIRCUIT AND OTHERS	START-UP TIME[ms]	200max (DCIN 110V, Io=100%)			
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	*4 4.50 - 5.50	10.80 - 13.20	13.50 - 16.50	21.60 - 26.40
	OUTPUT VOLTAGE SETTING[V]	5.00 - 5.15	12.00 - 12.48	15.00 - 15.60	24.00 - 24.96
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically			
	OVERVOLTAGE PROTECTION[V]	6.30 - 7.60	13.90 - 16.35	17.25 - 20.25	27.60 - 32.40
	REMOTE SENSING	Provided			
ISOLATION	REMOTE ON/OFF (RC)	Optional (Required external power source)			
	INPUT-OUTPUT, RC	*5 AC3,000V 1minute, Cutoff current = 15mA, DC500V 50MΩ min (20±15°C)			
	INPUT-FG	AC2,000V 1minute, Cutoff current = 15mA, DC500V 50MΩ min (20±15°C)			
	OUTPUT, RC-FG	*5 AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15°C)			
ENVIRONMENT	OUTPUT-RC	*5 AC100V 1minute, Cutoff current = 25mA, DC100V 10MΩ min (20±15°C)			
	OPERATING TEMP., HUMID. AND ALTITUDE	*6 -20 to +95°C (Aluminum base plate of the power module), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max			
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +95°C, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max			
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis			
SAFETY	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis			
	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1			
OTHERS	CONDUCTED NOISE (at only DC input)	Complies with FCC-A, VCCI-A, CISPR22-A, EN55011-A, EN55022-A			
	CASE SIZE/WEIGHT	74.2×44.5×150mm [2.92×1.75×5.91 inches](W×H×D) / 390g max			
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)			

*1 At rated input(DC110V) and rated load.

*2 Ripple and ripple noise is measured by using measuring board with capacitor of 22 μF at 150mm [5.91 inches] from output terminal. Refer to the instruction manual 3.2.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*4 Refer to the instruction manual 4.6.

*5 Applicable when remote control (optional) is added.

*6 Refer to the instruction manual 6.2.

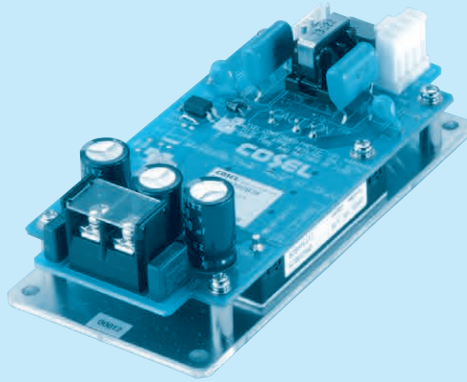
[illegible]

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 390g max
- ※ Dimensions in mm, []=inches
- ※ PCB material/thickness : FR-4 / 1.6mm [0.06]
- ※ Base plate material/thickness : Aluminum / 3.0mm[0.12]
- ※ Mounting torque : 1.6N · m (16.9kgf · cm) max
- ※ Component positions and sizes are for your reference if they have no dimensions.
- ※ Please connect safety ground to the base plate in $\phi 4.5$ [$\phi 0.177$] hole.

SNDHS50B

SNDH S 50 B 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ B : DC200-400V
- ⑤ Output voltage
- ⑥ Optional
- C : with Coating
- R : with a function not to need external power source

MODEL	SNDHS50B03	SNDHS50B05	SNDHS50B12	SNDHS50B15	SNDHS50B24	SNDHS50B28
MAX OUTPUT WATTAGE[W]	33.0	50.0	50.4	51.0	50.4	50.4
DC OUTPUT	3.3V 10A	5V 10A	12V 4.2A	15V 3.4A	24V 2.1A	28V 1.8A

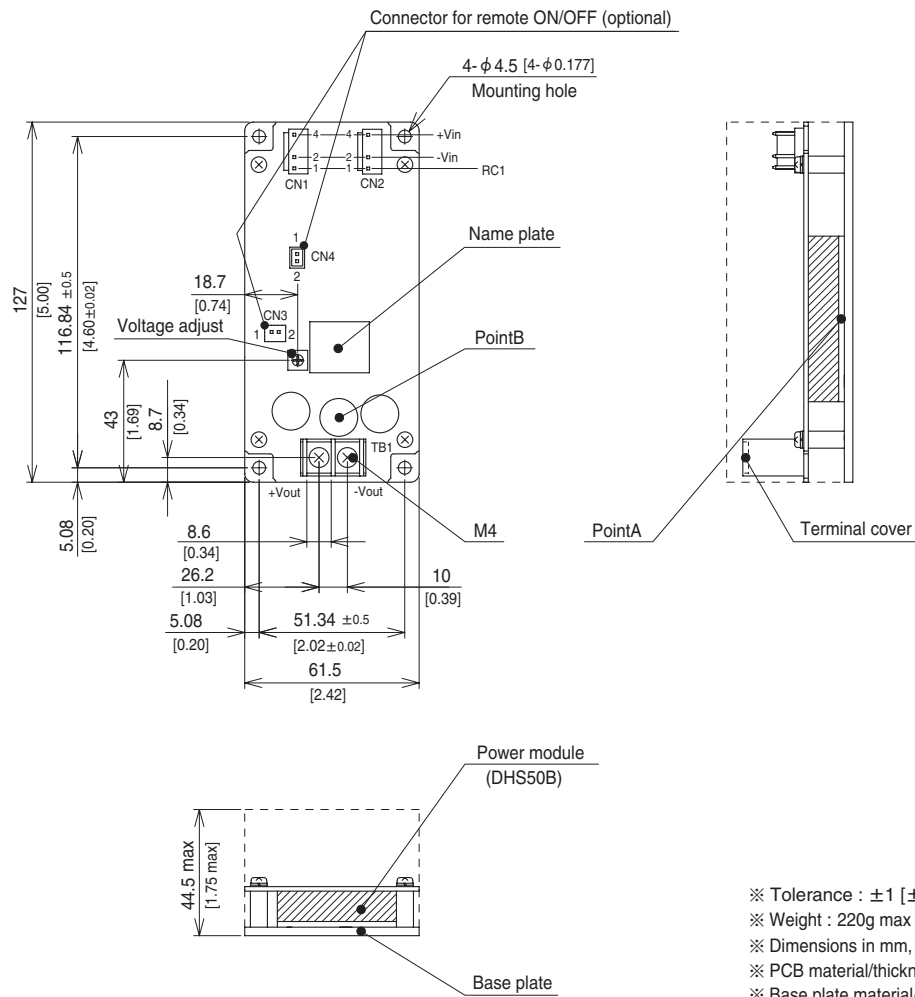
SPECIFICATIONS

	MODEL	SNDHS50B03	SNDHS50B05	SNDHS50B12	SNDHS50B15	SNDHS50B24	SNDHS50B28	
INPUT	VOLTAGE[V]	DC200 - 400 (Prepare another power supply to the RC1 terminal *5)						
	CURRENT[A] *1	0.15typ	0.22typ	0.22typ	0.22typ	0.22typ	0.22typ	
	EFFICIENCY[%] *1	76.0typ	79.0typ	82.0typ	82.0typ	82.0typ	82.0typ	
OUTPUT	VOLTAGE[V]	3.3	5	12	15	24	28	
	CURRENT[A]	10	10	4.2	3.4	2.1	1.8	
	LINE REGULATION[mV]	10max	10max	24max	30max	48max	56max	
	LOAD REGULATION[mV]	150max	150max	100max	100max	100max	100max	
	RIPPLE[mVp-p]	0 to +95℃ *2	80max	80max	120max	120max	120max	120max
		-20 to 0℃ *2	120max	120max	150max	150max	150max	150max
		0 to 15% Load *2	160max	160max	240max	240max	240max	240max
	RIPPLE NOISE[mVp-p]	0 to +95℃ *2	160max	160max	200max	200max	200max	200max
		-20 to 0℃ *2	250max	250max	280max	280max	280max	280max
		0 to 15% Load *2	300max	300max	300max	300max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +50℃	35max	50max	120max	150max	240max	280max
		-20 to +95℃	66max	100max	240max	300max	480max	560max
	DRIFT[mV] *3	16max	20max	40max	60max	90max	90max	
	START-UP TIME[ms]	200max (DCIN 280V, Io=100%)						
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V] *4	2.97 - 3.63	4.50 - 5.50	10.80 - 13.20	13.50 - 16.50	21.60 - 26.40	25.20 - 30.80	
OUTPUT VOLTAGE SETTING[V]	3.30 - 3.40	5.00 - 5.15	12.00 - 12.48	15.00 - 15.60	24.00 - 24.96	28.00 - 29.12		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically						
	OVERVOLTAGE PROTECTION[V]	4.20 - 5.70	6.30 - 7.60	13.90 - 17.55	17.25 - 21.75	27.60 - 34.80	32.20 - 40.60	
	REMOTE SENSING	None						
	REMOTE ON/OFF (RC1) *6	Provided (Logic H : ON, L :OFF) Required external power source						
ISOLATION	INPUT-OUTPUT, RC2 *8	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)						
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)						
	OUTPUT, RC2-FG *8	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)						
	OUTPUT-RC2 *8	AC100V 1minute, Cutoff current = 25mA, DC100V 10MΩ min (20±15℃)						
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE *7	-20 to +95℃ (Aluminum base plate of the power module), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max						
	STORAGE TEMP.,HUMID.AND ALTITUDE	-20 to +95℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max						
	VIBRATION	10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis						
	IMPACT	196.1m/s² (20G), 11ms, once each along X, Y and Z axis						
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1						
OTHERS	CASE SIZE/WEIGHT	61.5×44.5×127mm [2.42×1.75×5.0 inches] (W×H×D) / 220g max						
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)						

- *1 At rated input(DC280V) and rated load.
- *2 Ripple and ripple noise is measured by using measuring board with capacitor of 22 μF at 150mm [5.91 inches] from output terminal.
Refer to the instruction manual 3.2.
- *3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
- *4 Refer to the instruction manual 4.6.
- *5 Refer to the instruction manual 2, 4.4

- *6 Refer to the instruction manual 4.4
- *7 Refer to the instruction manual 6.2
- *8 "RC2" is applicable to an option not to need external power source.

External view

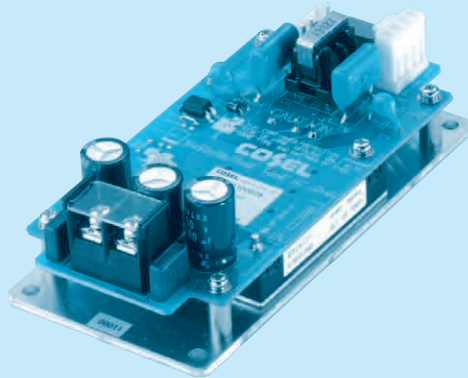


- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 220g max
- ※ Dimensions in mm, []=inches
- ※ PCB material/thickness : FR-4 / 1.6mm [0.06]
- ※ Base plate material/thickness : Aluminum / 3.0mm [0.12]
- ※ Screw tightening torque : 1.6N · m (16.9kgf · cm) max
- ※ Component positions and sizes are for your reference if they have no dimensions.
- ※ Please connect safety ground to the base plate in $\phi 4.5$ [$\phi 0.177$] hole.

SNDHS100B

SNDH S 100 B 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
② Single output
③ Output wattage
④ B : DC200-400V
⑤ Output voltage
⑥ Optional
C : with Coating
R : with a function not to need external power source

MODEL	SNDHS100B03	SNDHS100B05	SNDHS100B12	SNDHS100B15	SNDHS100B24	SNDHS100B28
MAX OUTPUT WATTAGE[W]	66.0	100.0	100.8	100.5	100.8	100.8
DC OUTPUT	3.3V 20A	5V 20A	12V 8.4A	15V 6.7A	24V 4.2A	28V 3.6A

SPECIFICATIONS

	MODEL	SNDHS100B03	SNDHS100B05	SNDHS100B12	SNDHS100B15	SNDHS100B24	SNDHS100B28	
INPUT	VOLTAGE[V]	DC200 - 400 (Prepare another power supply to the RC1 terminal *5)						
	CURRENT[A] *1	0.30typ	0.44typ	0.42typ	0.42typ	0.42typ	0.42typ	
	EFFICIENCY[%] *1	78.0typ	81.0typ	84.0typ	85.0typ	85.0typ	85.0typ	
OUTPUT	VOLTAGE[V]	3.3	5	12	15	24	28	
	CURRENT[A]	20	20	8.4	6.7	4.2	3.6	
	LINE REGULATION[mV]	10max	10max	24max	30max	48max	56max	
	LOAD REGULATION[mV]	150max	150max	100max	100max	100max	100max	
	RIPPLE[mVp-p]	0 to +95℃ *2	80max	80max	120max	120max	120max	120max
		-20 to 0℃ *2	120max	120max	150max	150max	150max	150max
		0 to 15% Load *2	160max	160max	240max	240max	240max	240max
	RIPPLE NOISE[mVp-p]	0 to +95℃ *2	160max	160max	200max	200max	200max	200max
		-20 to 0℃ *2	250max	250max	280max	280max	280max	280max
		0 to 15% Load *2	300max	300max	300max	300max	300max	300max
	TEMPERATURE REGULATION[mV]	0 to +50℃	35max	50max	120max	150max	240max	280max
		-20 to +95℃	66max	100max	240max	300max	480max	560max
	DRIFT[mV] *3	16max	20max	40max	60max	90max	90max	
	START-UP TIME[ms]	200max (DCIN 280V, Io=100%)						
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V] *4	2.97 - 3.63	4.50 - 5.50	10.80 - 13.20	13.50 - 16.50	21.60 - 26.40	25.20 - 30.80	
OUTPUT VOLTAGE SETTING[V]	3.30 - 3.40	5.00 - 5.15	12.00 - 12.48	15.00 - 15.60	24.00 - 24.96	28.00 - 29.12		
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically						
	OVERVOLTAGE PROTECTION[V]	4.20 - 5.70	6.30 - 7.60	13.90 - 17.55	17.25 - 21.75	27.60 - 34.80	32.20 - 40.60	
	REMOTE SENSING	None						
	REMOTE ON/OFF (RC1) *6	Provided (Logic H : ON, L :OFF) Required external power source						
ISOLATION	INPUT-OUTPUT, RC2 *8	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)						
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15℃)						
	OUTPUT, RC2-FG *8	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15℃)						
	OUTPUT-RC2 *8	AC100V 1minute, Cutoff current = 25mA, DC100V 10MΩ min (20±15℃)						
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE *7	-20 to +95℃ (Aluminum base plate of the power module), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max						
	STORAGE TEMP.,HUMID.AND ALTITUDE	-20 to +95℃, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max						
	VIBRATION	10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis						
	IMPACT	196.1m/s² (20G), 11ms, once each along X, Y and Z axis						
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1						
OTHERS	CASE SIZE/WEIGHT	61.5×44.5×127mm [2.42×1.75×5.0 inches] (W×H×D) / 220g max						
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)						

*1 At rated input(DC280V) and rated load.

*2 Ripple and ripple noise is measured by using measuring board with capacitor of 22μF at 150mm [5.91 inches] from output terminal.
Refer to the instruction manual 3.2.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*4 Refer to the instruction manual 4.6.

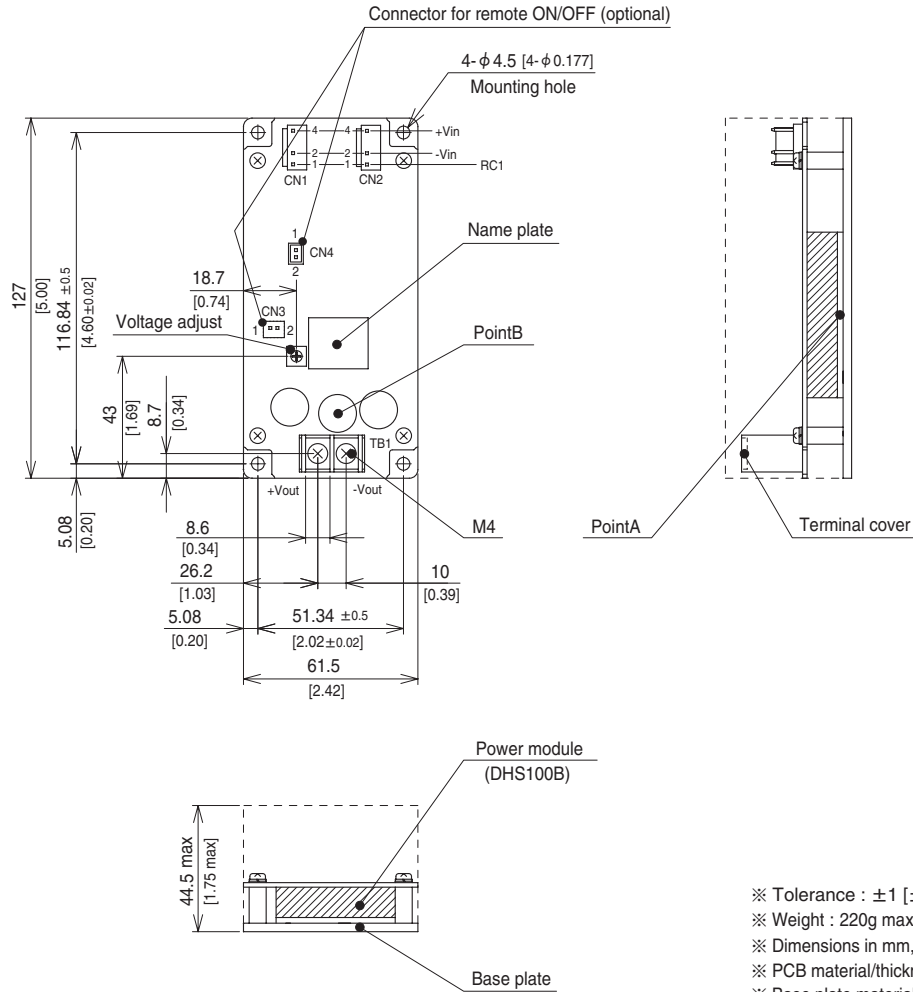
*5 Refer to the instruction manual 2, 4.4

*6 Refer to the instruction manual 4.4

*7 Refer to the instruction manual 6.2

*8 "RC2" is applicable to an option not to need external power source.

External view

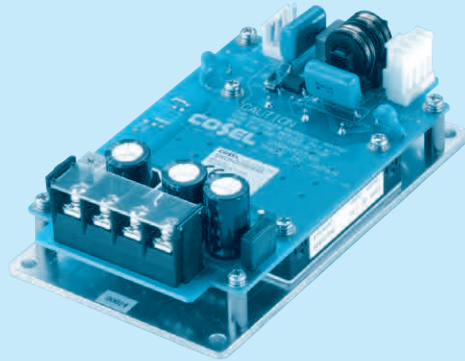


- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 220g max
- ※ Dimensions in mm, []=inches
- ※ PCB material/thickness : FR-4 / 1.6mm [0.06]
- ※ Base plate material/thickness : Alminum / 3.0mm[0.12]
- ※ Screw tightening torque : 1.6N · m (16.9kgf · cm) max
- ※ Component positions and sizes are for your reference if they have no dimensions.
- ※ Please connect safety ground to the base plate in ϕ 4.5 [ϕ 0.177] hole.

SNDHS250B

SNDH S 250 B 05 -□

① ② ③ ④ ⑤ ⑥



- ① Series name
- ② Single output
- ③ Output wattage
- ④ B : DC200-400V
- ⑤ Output voltage
- ⑥ Optional
- C : with Coating
- R : with a function not to need external power source

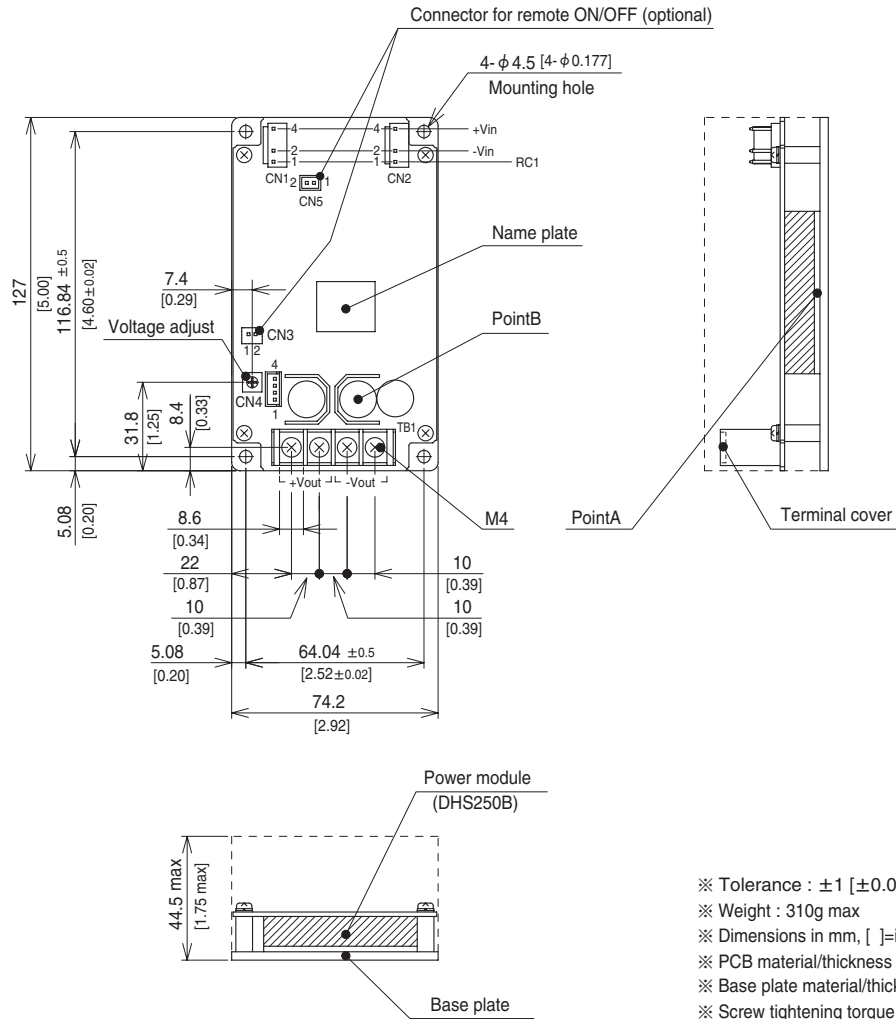
MODEL	SNDHS250B03	SNDHS250B05	SNDHS250B07	SNDHS250B12	SNDHS250B15	SNDHS250B24	SNDHS250B28	SNDHS250B48
MAX OUTPUT WATTAGE[W]	165.0	250.0	247.5	252.0	247.5	252.0	252.0	249.6
DC OUTPUT	3.3V 50A	5V 50A	7.5V 33A	12V 21A	15V 16.5A	24V 10.5A	28V 9.0A	48V 5.2A

SPECIFICATIONS

	MODEL	SNDHS250B03	SNDHS250B05	SNDHS250B07	SNDHS250B12	SNDHS250B15	SNDHS250B24	SNDHS250B28	SNDHS250B48	
INPUT	VOLTAGE[V]	DC200 - 400 (Prepare another power supply to the RC1 terminal *5)								
	CURRENT[A]	*1 0.67typ	1.0typ	1.0typ	1.0typ	1.0typ	1.0typ	1.0typ	1.0typ	
	EFFICIENCY[%]	*1 86.0typ	88.0typ	86.0typ	86.0typ	86.0typ	86.0typ	86.0typ	87.0typ	
OUTPUT	VOLTAGE[V]	3.3	5	7.5	12	15	24	28	48	
	CURRENT[A]	50	50	33	21	16.5	10.5	9.0	5.2	
	LINE REGULATION[mV]	10max	10max	20max	24max	30max	48max	56max	96max	
	LOAD REGULATION[mV]	150max	150max	150max	100max	100max	100max	100max	100max	
	RIPPLE[mVp-p]	0 to +95°C *2	80max	80max	100max	120max	120max	120max	200max	
		-20 to 0°C *2	120max	120max	130max	150max	150max	150max	250max	
		0 to 15% Load *2	160max	160max	200max	240max	240max	240max	400max	
	RIPPLE NOISE[mVp-p]	0 to +95°C *2	160max	160max	200max	200max	200max	200max	250max	
		-20 to 0°C *2	250max	250max	280max	280max	280max	280max	400max	
		0 to 15% Load *2	300max	300max	300max	300max	300max	300max	500max	
	TEMPERATURE REGULATION[mV]	0 to +50°C	35max	50max	70max	120max	150max	240max	280max	480max
		-20 to +95°C	66max	100max	140max	240max	300max	480max	560max	960max
	DRIFT[mV]	*3	16max	20max	30max	40max	60max	90max	90max	180max
	START-UP TIME[ms]		200max (DCIN 280V, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	*4	2.97 - 3.63	4.50 - 5.50	6.75 - 8.25	10.80 - 13.20	13.50 - 16.50	21.60 - 26.40	25.20 - 30.80	43.20 - 52.80
OUTPUT VOLTAGE SETTING[V]		3.30 - 3.40	5.00 - 5.15	7.50 - 7.80	12.00 - 12.48	15.00 - 15.60	24.00 - 24.96	28.00 - 29.12	48.00 - 49.92	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically								
	OVERVOLTAGE PROTECTION[V]	4.20 - 4.85	6.30 - 7.30	8.70 - 10.20	13.90 - 16.35	17.25 - 20.25	27.60 - 32.40	32.20 - 37.80	55.20 - 64.80	
	REMOTE SENSING	Provided								
	REMOTE ON/OFF (RC1)	*6	Provided (Logic H : ON, L :OFF) Required external power source							
ISOLATION	INPUT-OUTPUT, RC2	*8	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	OUTPUT, RC2-FG	*8	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15°C)							
	OUTPUT-RC2	*8	AC100V 1minute, Cutoff current = 25mA, DC100V 10MΩ min (20±15°C)							
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	*7	-20 to +95°C (Aluminum base plate of the power module), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max							
	STORAGE TEMP.,HUMID.AND ALTITUDE		-20 to +95°C , 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max							
	VIBRATION		10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis							
	IMPACT		196.1m/s ² (20G), 11ms, once each along X, Y and Z axis							
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1								
OTHERS	CASE SIZE/WEIGHT	74.2 X 44.5 X 127mm [2.92 X 1.75 X 5.0 inches](W X H X D) / 310g max								
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)								

- *1 At rated input(DC280V) and rated load.
- *2 Ripple and ripple noise is measured by using measuring board with capacitor of 22μF at 150mm [5.91 inches] from output terminal.
Refer to the instruction manual 3.2.
- *3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
- *4 Refer to the instruction manual 4.6.
- *5 Refer to the instruction manual 2, 4.4
- *6 Refer to the instruction manual 4.4
- *7 Refer to the instruction manual 6.2
- *8 "RC2" is applicable to an option not to need external power source.

External view



- ※ Tolerance : ±1 [±0.04]
- ※ Weight : 310g max
- ※ Dimensions in mm, []=inches
- ※ PCB material/thickness : FR-4 / 1.6mm [0.06]
- ※ Base plate material/thickness : Aluminum / 3.0mm[0.12]
- ※ Screw tightening torque : 1.6N·m (16.9kgf·cm) max
- ※ Component positions and sizes are for your reference if they have no dimensions.
- ※ Please connect safety ground to the base plate in φ4.5 [φ0.177] hole.

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection circuit	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
SNDHS50A	Forward converter	470	*1	400V 3.15A	–	FR-4		Yes	Yes	*2
SNDHS50B	Forward converter	470	*1	400V 1.6A	–	FR-4		Yes	Yes	*2
SNDHS100A	Forward converter	470	*1	400V 3.15A	–	FR-4		Yes	Yes	*2
SNDHS100B	Forward converter	470	*1	400V 1.6A	–	FR-4		Yes	Yes	*2
SNDHS200A	Forward converter	360	*1	400V 5.0A	–	FR-4		Yes	Yes	*2
SNDHS250B	Forward converter	360	*1	400V 3.15A	–	FR-4		Yes	Yes	*2

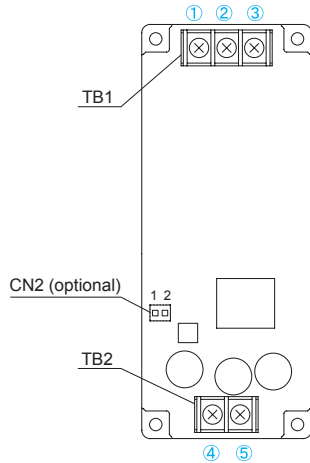
*1 Refer to Specification.

*2 Refer to Instruction Manual.

1	Terminal Connection	SNDHS-16
2	Connection for Standard Use	SNDHS-17
3	Wiring Input/Output Terminal	SNDHS-18
3.1	Wiring input terminal	SNDHS-18
3.2	Wiring output terminal	SNDHS-18
4	Function	SNDHS-19
4.1	Overcurrent protection	SNDHS-19
4.2	Overvoltage protection	SNDHS-19
4.3	Thermal protection	SNDHS-19
4.4	Remote ON/OFF	SNDHS-19
4.5	Remote sensing	SNDHS-19
4.6	Output voltage adjusting	SNDHS-20
4.7	Withstanding voltage / Isolation voltage	SNDHS-20
5	Series and Parallel Operation	SNDHS-20
5.1	Series operation	SNDHS-20
5.2	Redundancy operation	SNDHS-20
6	Implementation · Mounting Method	SNDHS-21
6.1	Mounting method	SNDHS-21
6.2	Derating	SNDHS-21
7	Option and Others	SNDHS-22
7.1	Outline of option	SNDHS-22

1 Terminal Connection

●SNDHS50A/100A



●SNDHS200A

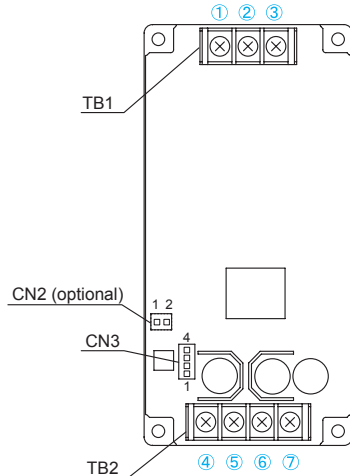


Fig.1.1 Terminal connection (top view)

Table 1.1 Terminal connection and function

No.		Terminal connection	Function
SNDHS 50A/100A	SNDHS 200A		
①	①	+VIN	+DC input
②	②	-VIN	-DC input
③	③	FG	Frame Ground
④	④ ⑤	+VOUT	+DC output
⑤	⑥ ⑦	-VOUT	-DC output

Pin configuration and functions of CN2 (Optional)

Pin No.	Function
1	+RC : +Remote ON/OFF
2	-RC : -Remote ON/OFF

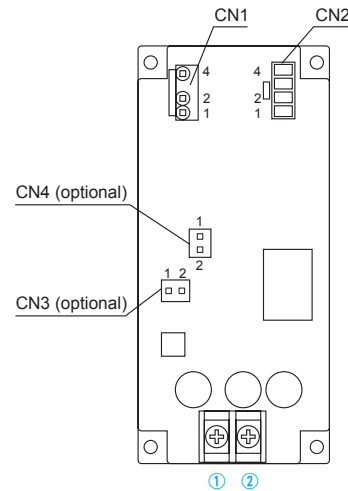
Pin configuration and functions of CN3

Pin No.	Function
1	-M : -Self sensing terminal. (Do not wire for external connection.)
2	-S : -Remote sensing
3	+S : +Remote sensing
4	+M : +Self sensing terminal. (Do not wire for external connection.)

Mating connectors and terminals on CN2, CN3

Connector	Mating connector	Terminal	Mfr.
CN2	B2B-XH-AM	XHP-2	J.S.T.
		Chain : SXH-001T-P0.6	
		Loose : BXH-001T-P0.6	
CN3	B4B-XH-AM	XHP-4	
		Chain : SXH-001T-P0.6	
		Loose : BXH-001T-P0.6	

●SNDHS50B/100B



●SNDHS250B

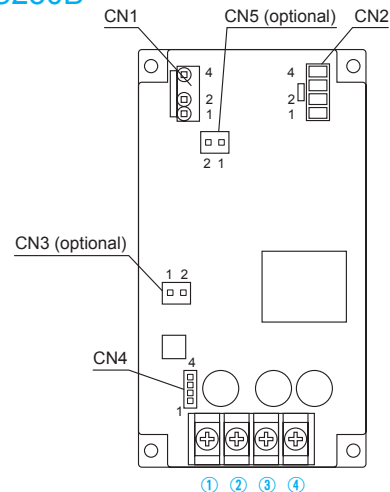


Fig.1.2 Terminal connection (top view)

Table 1.2 Terminal connection and function

No.		Terminal connection	Function
SNDHS 50B/100B	SNDHS 250B		
①	① ②	+VOUT	+DC output
②	③ ④	-VOUT	-DC output

Pin configuration and functions of CN1 and CN2

Pin No.	Function
1	RC1 : Remote ON/OFF
2	-VIN : -Input Voltage
3	NC : No connection
4	+VIN : +Input Voltage

CN1 and CN2 are connected internally.

Pin configuration and functions of CN3:Optional

Pin No.	Function
1	+RC2 : +Remote ON/OFF
2	-RC2 : -Remote ON/OFF

Pin configuration and functions of CN4:Optional(SNDHS50B/100B)

Pin No.	Function
1	+RC3 : +Remote ON/OFF
2	-RC3 : -Remote ON/OFF

Pin configuration and functions of CN4(SNDHS250B)

Pin No.	Function
1	-M : -Self sensing terminal. (Do not wire for external connection.)
2	-S : -Remote sensing
3	+S : +Remote sensing
4	+M : +Self sensing terminal. (Do not wire for external connection.)

Pin configuration and functions of CN5:Optional(SNDHS250B)

Pin No.	Function
1	+RC3 : +Remote ON/OFF
2	-RC3 : -Remote ON/OFF

Mating connectors and terminals on CN1, CN2, CN3, CN4 and CN5

SNDHS 50B/100B	SNDHS 250B	Connector	Mating connector	Terminal	Mfr.
CN1	CN1	B3P4-VH	VHR-4N	Chain : SVH-21T-P1.1 Loose : BVH-21T-P1.1	J.S.T.
CN2	CN2				
CN3	CN3	B2B-XH-AM	XHP-2	Chain : SXH-001T-P0.6 Loose : BXH-001T-P0.6	
CN4	CN5				
-	CN4	B4B-XH-AM	XHP-4	Chain : SXH-001T-P0.6 Loose : BXH-001T-P0.6	

2 Connection for Standard Use

■ In order to use the power supply, it is necessary to wire as shown in Fig.2.1, Fig.2.2.

●SNDHS50A/100A/200A

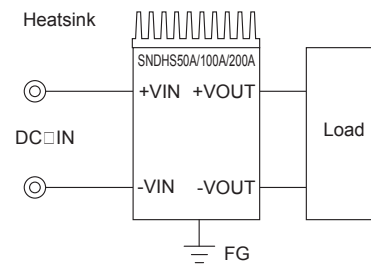


Fig.2.1 Connection for standard use

●SNDHS50B/100B/250B

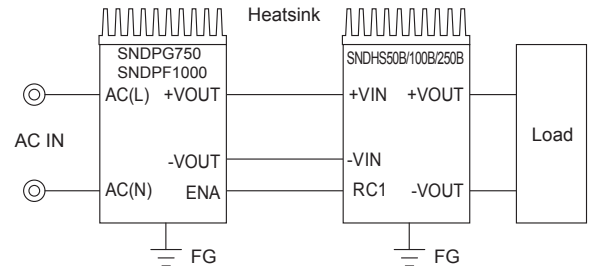


Fig.2.2 Connection 1 for standard use

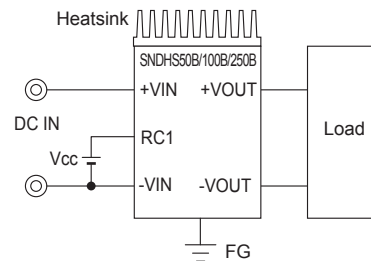


Fig.2.3 Connection 2 for standard use

■ The SNDHS Series handles only the DC input.

Avoid applying AC input directly.

It will damage the power supply.

■ Operate with the conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink).

[Reference: 6.2 "Derating"]

■ This power supply must be prepared another power supply to the RC1 terminal (as shown in Fig.2.3).

[Reference: 4.4 "Remote ON/OFF"]

■ If you need except SNDPG750/SNDPF1000 for the input of SNDHS50B/100B/250B, please contact us.

* Confirm each specification and instruction manual about the SNDPG/SNDPF series.

3 Wiring Input/Output Terminal

3.1 Wiring input terminal

(1) External capacitor on the Input side

■When it turns on an input with a switch directly, one several times the surge voltage of input voltage occurs by the inductance ingredient of an input line, and there is a possibility that a power supply may break down.

Please install a capacitor between +VIN and -VIN input terminals and absorb surge.

[SNDHS50B/100B : more than 10 μ F]
[SNDHS250B : more than 22 μ F]

■When the line impedance is high or the input voltage rise quickly at start-up (less than 10 μ s), install a capacitor between +VIN and -VIN input terminals.

(2) Input voltage range/Input current range

■The specification of input ripple voltage is shown as below.

[Ripple voltage SNDHS50A/100A/200A : less than 10Vp-p]
[SNDHS50B/100B/250B : less than 20Vp-p]

■Make sure that the voltage fluctuation, including the ripple voltage, will not exceed the input voltage range.

■Use a front end unit with enough power, considering the start-up current I_p of this unit.

(3) Operation with AC input

■The SNDHS series handles only for the DC input.

A front end unit(AC/DC unit) is required when the SNDHS series is operated with AC input.

(4) Reverse input voltage protection

■Avoid the reverse polarity input voltage. It will break the power supply.

It is possible to protect the unit from the reverse input voltage by installing an external diode.

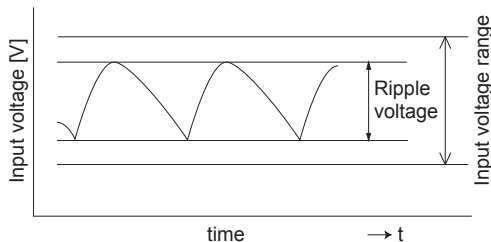


Fig.3.1 Input voltage ripple

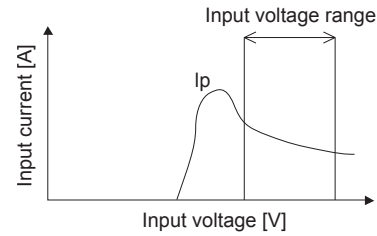


Fig.3.2 Input current characteristics

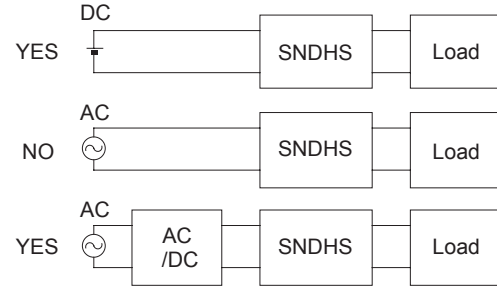


Fig.3.3 Use with AC input

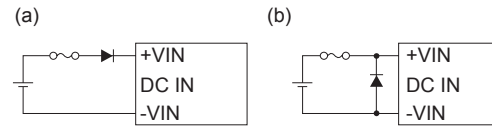
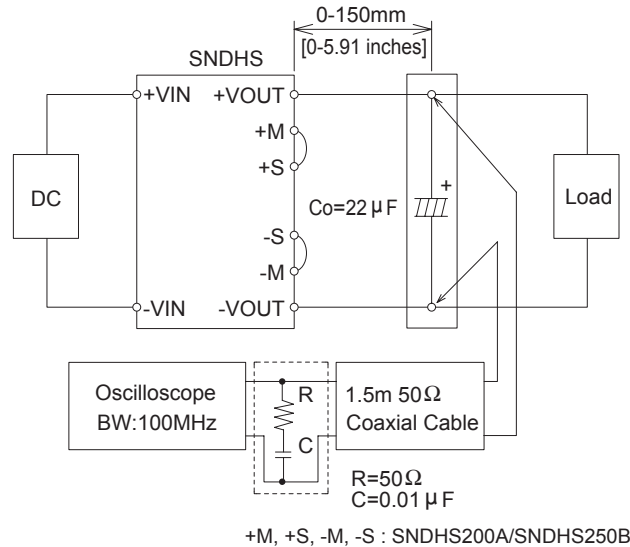


Fig.3.4 Reverse input voltage protection

3.2 Wiring output terminal

■The specified ripple and ripple noise are measured by the method introduced in Fig. 3.5.



+M, +S, -M, -S : SNDHS200A/SNDHS250B

Fig.3.5 Method of measuring output ripple and ripple noise

4 Function

4.1 Overcurrent protection

■Over Current Protection (OCP) is built in and works at 105% of the rated current or higher. However, use in an over current situation must be avoided whenever possible. The output voltage of the power module will recover automatically if the fault causing over current is corrected.

When the output voltage drops after OCP works, the power module enters a "hiccup mode" where it repeatedly turns on and off at a certain frequency.

4.2 Overvoltage protection

■Over Voltage Protection (OVP) is built in. When OVP works, output voltage can be recovered by shutting down DC input for at least one second or by turning off the remote control switch (secondary is an optional) for one second without shutting down the DC input. The recovery time varies according to input voltage and input capacitance.

Remarks:

Note that devices inside the power module may fail when a voltage greater than the rated output voltage is applied from an external power supply to the output terminal of the power module. This could happen in in-coming inspections that include OVP function test or when voltage is applied from the load circuit. OVP can be tested by using the TRM terminal. Consult us for details.

4.3 Thermal protection

■Over Temperature Protection (OTP) is built in. If the base plate temperature exceeds 100°C, OTP will work, causing the output voltage to drop. Output voltage can be recovered by shutting down DC input for at least one second or by turning off the remote control switch (secondary is an optional) for one second without shutting down the DC input.

4.4 Remote ON/OFF

■Please contact us about remote control of an optional.

●SNDHS50B/100B/250B

■This power supply must be prepared another power supply to the RC1 terminal.

■The remote ON/OFF function is incorporated in the input circuit and operated with RC1 and -VIN.

Table 4.1 Remote ON/OFF specifications

Between RC1 and -VIN (Vcc)	Output Voltage
L level (0 - 1.2V) or Open	OFF
H level (3.5 - 12V)	ON

■When RC1 is at High level, a current of 13mA max will sink in.

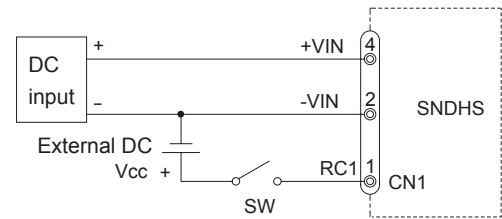


Fig. 4.1 RC1 connection example

■Avoid the reverse polarity input voltage. It will break the power supply.

4.5 Remote sensing

●SNDHS250A/SNDHS250B

(1) When Remote Sensing is Not Used

■When the power supplies are shipped from a factory, they come with a dedicated short pieces being mounted on CN3 (SNDHS200A), CN4 (SNDHS250B).

If you do not use the remote sensing function, you can use the power supplies as they are.

(2) When Remote Sensing is Used

■When remote sensing is used, please remove the short pieces of CN3, CN4.

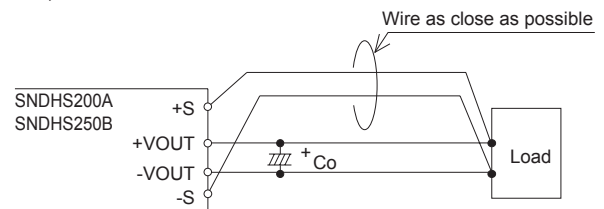


Fig. 4.2 When remote sensing is used ((SNDHS200A/SNDHS250B))

■Using remote sensing with long wires may cause output voltage to become unstable. Consult us if long sensing wiring is necessary.

■Sensing patterns or wires should be as short as possible. If wires are used, use either twisted-pair or shielded wires.

■Use wide PCB patterns or thick wires between the power supply and the load. Line drop should be kept less than 0.3V. Make sure output voltage from the power supply stays within the specified range.

■If the sensing patterns are shorted by mistake, a large current may flow and damage the pattern. This can be prevented by installing fuses or resistors close to the load.

As wiring or load impedance may generate oscillation or large fluctuations in output voltage, make sure enough evaluation is given in advance.

4.6 Output voltage adjusting

■ Output voltage can be adjusted by internal potentiometer.

To increase an output voltage, turn a built-in potentiometer clockwise.

To decrease the output voltage, turn it counterclockwise.

■ When the input voltage is 60-66VDC or 200-250VDC, the output voltage adjustment range becomes as shown in Fig.4.3.

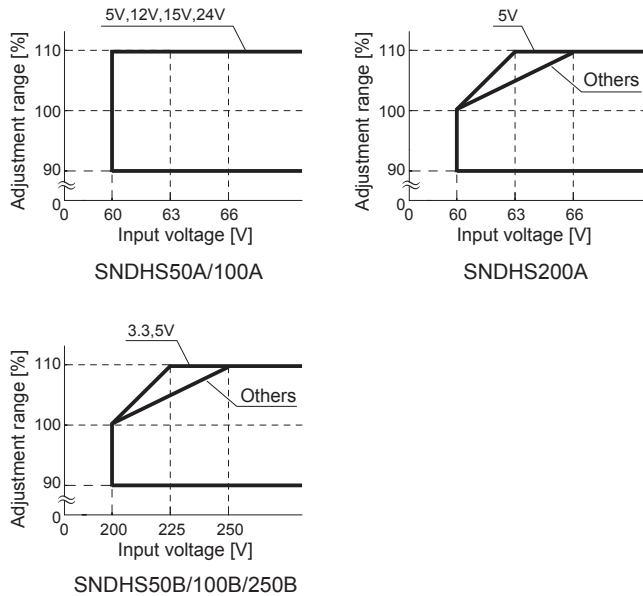


Fig. 4.3 Output voltage adjustment range

4.7 Withstanding voltage / Isolation voltage

■ When testing the withstanding voltage, make sure the voltage is increased gradually. When turning off, reduce the voltage gradually by using the dial of the hi-pot tester. Do not use a voltage tester with a timer as it may generate voltage several times as large as the applied voltage.

5 Series and Parallel Operation

5.1 Series operation

■ Series operation is available by connecting the outputs of two or more power supplies, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

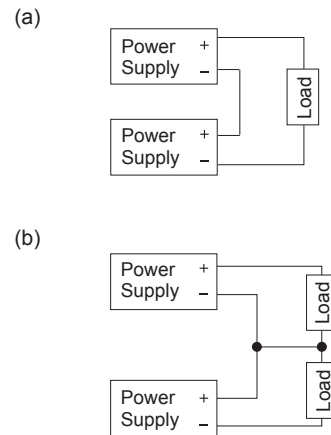


Fig. 5.1 Examples of series operation

5.2 Redundancy operation

■ Parallel operation is not possible.

■ Redundancy operation is available by wiring as shown below.

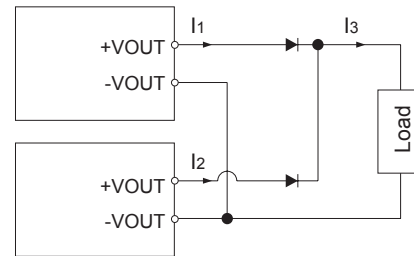


Fig. 5.2 Example of redundancy operation

■ Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .

Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

6 Implementation · Mounting Method

6.1 Mounting method

- The unit can be mounted in any direction. When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Aluminum base plate temperature (Point A) around each power supply should not exceed the temperature range shown in derating curve (Fig.6.2, Fig.6.4).
- In case of metal chassis, keep the distance between d1 for to insulate between lead of component and metal chassis, use the spacer of 4mm[0.16 inches] or more between d1. If it is less than d1, insert the insulation sheet between power supply and metal chassis.

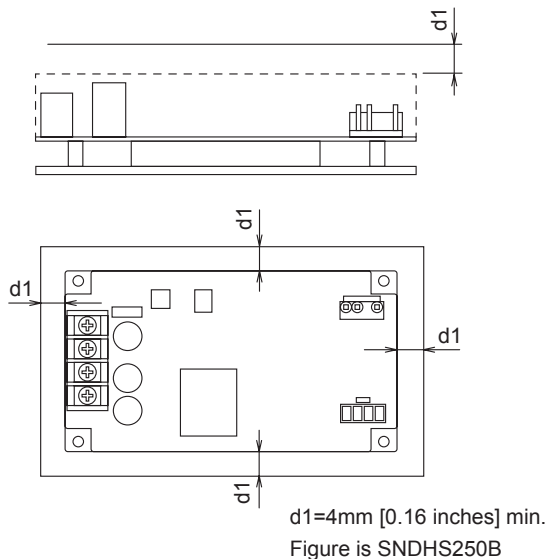


Fig.6.1 Mounting method

6.2 Derating

- Use with the conduction cooling (e.g. heat radiation by conduction from the aluminum base plate to the attached heat sink). Fig.6.2, Fig.6.4 shows the derating curve based on the aluminum base plate temperature. In the hatched area, the specification of Ripple and Ripple Noise is different from other areas.
- Please measure the temperature on the aluminum base plate edge side (Point A).
- Please consider the ventilation to keep the temperature on the PCB (Point B) less than the temperature of Fig.6.3., Fig.6.5.
- It is necessary to note the thermal fatigue life by power cycle. Please reduce the temperature fluctuation range as much as possible when the up and down of the temperature are frequently generated. Contact us for more information on cooling methods.

●SNDHS50A/100A/200A

Specifications for ripple and ripple noise changes in the shaded area.

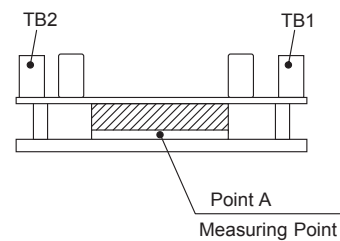
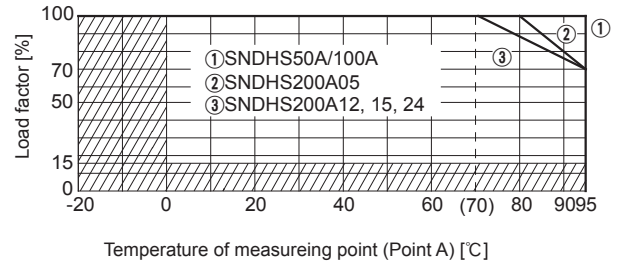


Fig.6.2 Derating curve (Point A)

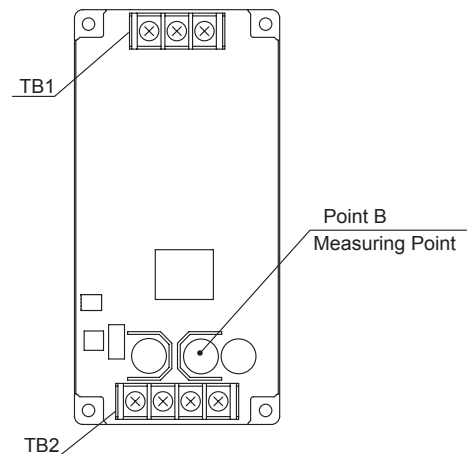
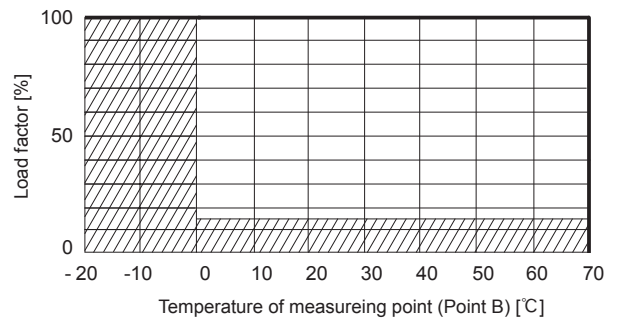


Figure is SNDHS200A

Fig.6.3 Derating curve (Point B)

●SNDHS50B/100B/250B

Specifications for ripple and ripple noise changes in the shaded area.

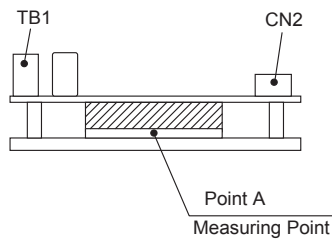
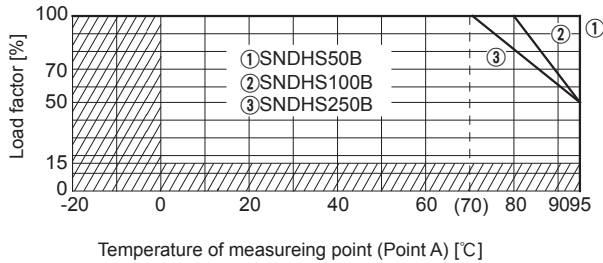


Fig.6.4 Derating curve (Point A)

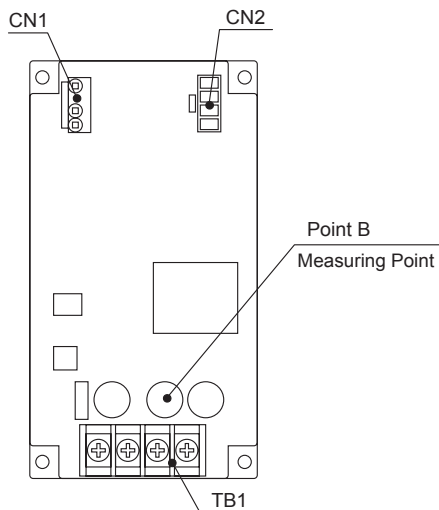
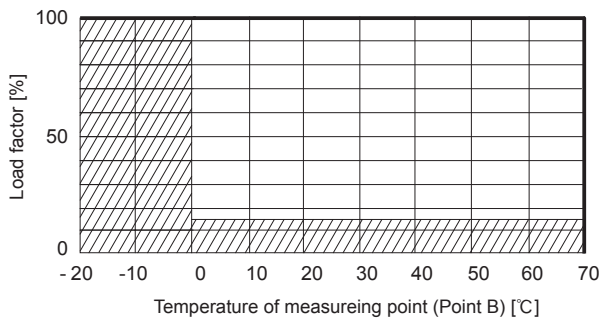


Figure is SNDHS250B

Fig.6.5 Derating curve (Point B)

7 Option and Others

7.1 Outline of option

● -C

- Option -C units have coated internal PCB for better moisture resistance.

● -R (SNDHS50A, SNDHA100A, SNDHS200A)

- You can control output ON/OFF remotely in Option -R units. To do so, connect an external DC power supply and apply a voltage to a remote ON/OFF connector, which is available as option.

Model Name	Built-in Resistor Ri [Ω]	Voltage between +RC and -RC [V]		Input Current [mA]
		ENA ON	ENA OFF	
SNDHS50A, SNDHS100A, SNDHS200A	1200	3.5 - 12	0 - 0.5	10max

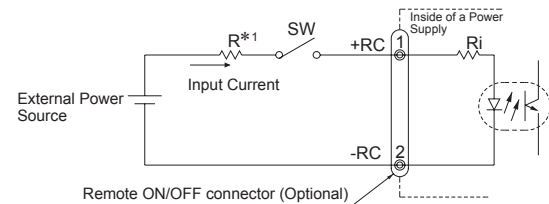


Fig.7.1 Example of using a remote ON/OFF circuit

- Dedicated harnesses are available for your purchase. Please see Optional Parts for details.

*1 If the output of an external power supply is within the range of 3.5 - 12V, you do not need a current limiting resistor R. If the output exceeds 12V, however, please connect the current limiting resistor R.

To calculate a current limiting resistance value, please use the following equation.

$$R[\Omega] = \frac{V_{CC} - (1.1 + R_i \times 0.005)}{0.005}$$

*Please wire carefully. If you wire wrongly, the internal components of a unit may be damaged.

■ Remote ON/OFF circuits (+RC and -RC) are isolated from input, output and FG.

● -R (SNDHS50B, SNDHA100B, SNDHS250B)

- The output can be turned on without external power source.
- When short circuit piece is not mounted on RC3, various remote control is available.

Case 1: When short circuit piece is mounted on RC3, the output can be turned on by applying input voltage (external power source to the remote control circuit is unnecessary). When the power supplies are shipped from a factory, they come with a dedicated short circuit piece mounted on RC3.

Case 2: When short circuit piece is mounted on RC3, the output (ON/OFF) can be controlled by making open/short RC3.

Case 3: When short circuit piece is not mounted on RC3, the output (ON/OFF) can be controlled by external power source to remote control circuit RC1 and RC2.

CASE	RC3 SHORT CIRCUIT PIECE	RC3	RC1 DC VOLTAGE	RC2 DC VOLTAGE	OUTPUT	OUTSIDE OF POWER SUPPLY	INSIDE OF POWER SUPPLY
1	mounted	Short	—	—	ON		
2	not mounted	Short	1.2[V] or less	0.5[V] or less	ON		
		Open			OFF		
3	not mounted	Open	3.5 ~ 12[V]	3.5 ~ 12[V] 0.5[V] or less	ON OFF		

Fig.7.2 Example of using a remote ON/OFF circuit.

- Dedicated harnesses are available for your purchase. Please see Optional Parts for details.

*1 If the output of an external power supply is within the range of 3.5 - 12V, you do not need a current limiting resistor R1, R2. If the output exceeds 12V, however, please connect the current limiting resistor R1, R2.

To calculate a current limiting resistance value, please use the following equation.

$$R1, R2[\Omega] = \frac{V_{cc} - (1.1 + R_{i1}, R_{i2} \times 0.005)}{0.005}$$

* Please wire carefully. If you wire wrongly, the internal components of a unit may be damaged.

■ Remote ON/OFF circuits (+RC2 and -RC2 only) are isolated from input, output and FG.



Isolated



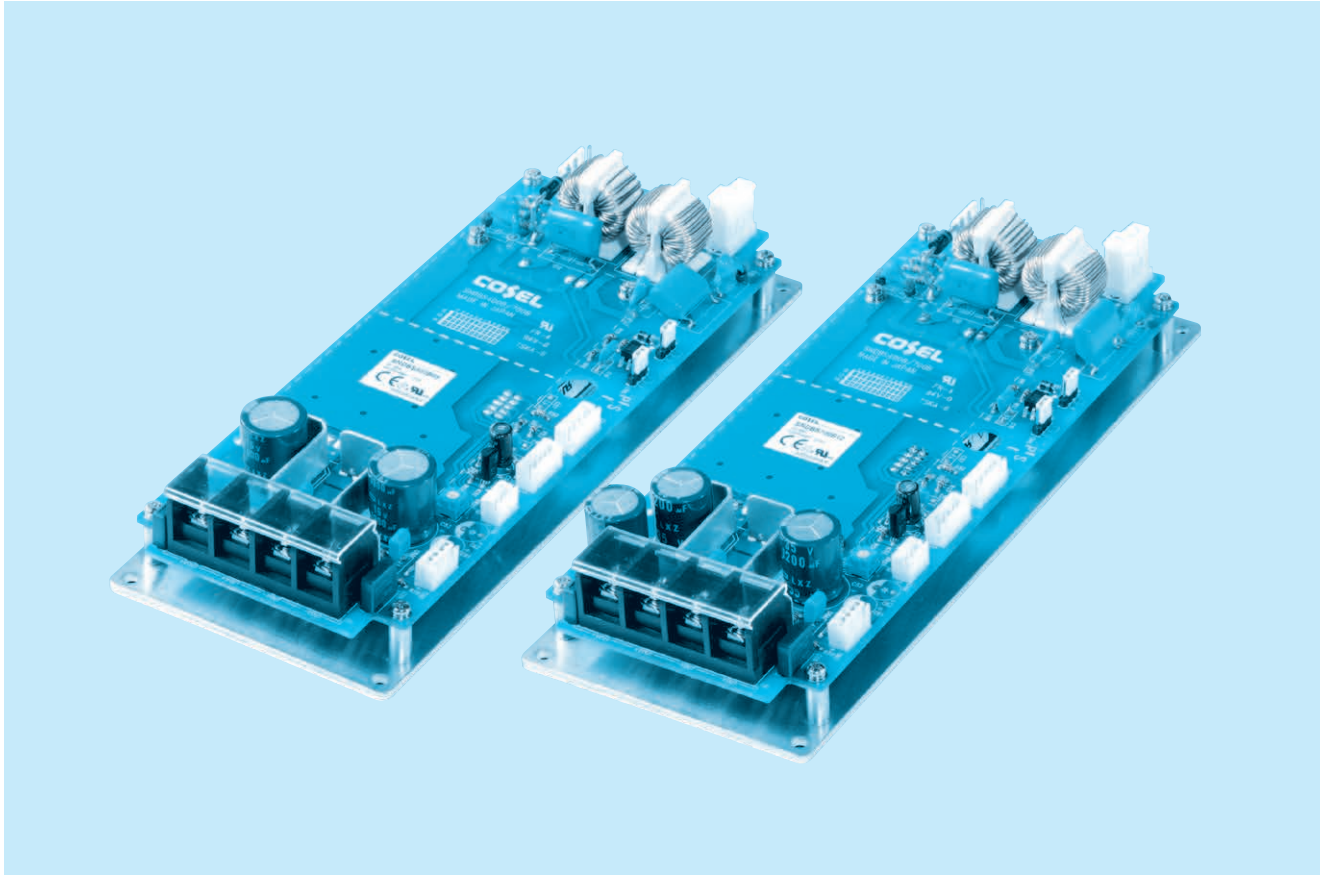
OCP



OVP

Remote
ON/OFFSafety
ApprovalsParallel
Operation

SNDBS-series



Feature

Compact DC-DC converter, SNDBS series includes DBS series
 Conduction cooling is possible by the combination with SNDPF and SNDPG series
 Built-in overcurrent, overvoltage and thermal protection circuits
 Built-in remote ON/OFF
 Inverter operating monitoring (IOG)
 Parallel operation

Safety agency approvals

UL60950-1, C-UL, EN60950-1
 Complies with EN50178

CE marking

Low Voltage Directive

3-year warranty

SNDBS

SNDBS400B

SNDB S 400 B 03

① ② ③ ④ ⑤



- ① Series name
② Single output
③ Output wattage
④ B : DC200-400V
⑤ Output voltage

* Please set short-pieces with 2-3 pins of CN8, when you do not use ENA. Refer to the manual.

MODEL	SNDBS400B03	SNDBS400B05	SNDBS400B07	SNDBS400B12	SNDBS400B15	SNDBS400B18	SNDBS400B24	SNDBS400B28
MAX OUTPUT WATTAGE[W]	264	400	405	408	405	396	408	406
DC OUTPUT	3.3V 80A	5V 80A	7.5V 54A	12V 34A	15V 27A	18V 22A	24V 17A	28V 14.5A

SPECIFICATIONS

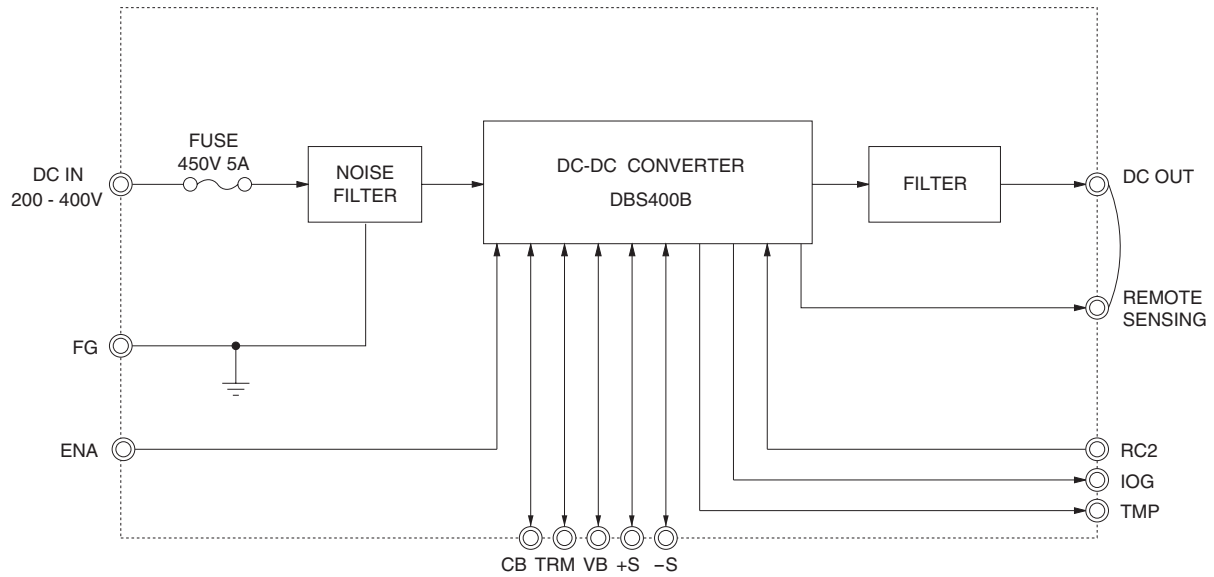
	MODEL	SNDBS400B03	SNDBS400B05	SNDBS400B07	SNDBS400B12	SNDBS400B15	SNDBS400B18	SNDBS400B24	SNDBS400B28
INPUT	VOLTAGE[V]	DC200 - 400							
	CURRENT[A]	*1 1.19typ	1.72typ	1.68typ	1.67typ	1.66typ	1.61typ	1.67typ	1.63typ
	EFFICIENCY[%]	*1 79typ	83typ	86typ	87typ	87typ	89typ	87typ	88typ
OUTPUT	VOLTAGE[V]	3.3	5	7.5	12	15	18	24	28
	CURRENT[A]	80	80	54	34	27	22	17	14.5
	LINE REGULATION[mV]	16max	20max	30max	40max	60max	60max	95max	95max
	LOAD REGULATION[mV]	150max	150max	150max	150max	150max	150max	190max	190max
	RIPPLE[mVp-p]	0 to +80°C *2	80max	80max	100max	120max	120max	120max	120max
		-20 to 0°C *2	140max	140max	150max	160max	160max	160max	160max
	RIPPLE NOISE[mVp-p]	0 to +80°C *2	160max	160max	200max	200max	200max	200max	200max
		-20 to 0°C *2	250max	250max	280max	280max	280max	280max	280max
	TEMPERATURE REGULATION[mV]	0 to +65°C	35max	50max	75max	120max	180max	180max	280max
		-20 to +80°C	60max	85max	130max	200max	310max	310max	480max
	DRIFT[mV]	*3 16max	20max	30max	40max	60max	60max	90max	90max
PROTECTION CIRCUIT AND OTHERS	START-UP TIME[ms]	200max (DCIN 280V, Io=100%)							
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	2.97 - 3.63	4.50 - 5.50	6.75 - 8.25	10.80 - 13.20	13.50 - 16.50	16.20 - 19.80	21.60 - 26.40	25.20 - 30.80
	OUTPUT VOLTAGE SETTING[V]	3.25 - 3.45	4.90 - 5.20	7.25 - 7.85	11.60 - 12.60	14.40 - 15.60	17.28 - 18.72	23.04 - 24.96	26.88 - 29.12
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically							
	OVERVOLTAGE PROTECTION[V]	4.00 - 5.50	5.75 - 7.00	8.60 - 10.50	13.80 - 16.80	17.25 - 21.00	20.70 - 25.20	27.60 - 33.60	32.20 - 39.20
	REMOTE SENSING	Provided							
ISOLATION	REMOTE ON/OFF	Provided (Input side : ENA, Output side : RC2)							
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)							
ENVIRONMENT	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15°C)							
	OPERATING TEMP., HUMID. AND ALTITUDE	-20 to +80°C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max							
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +85°C, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max							
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis							
SAFETY	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis							
	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1							
OTHERS	CASE SIZE/WEIGHT	89×44.5×222mm [3.51×1.75×8.75 inches](W×H×D) / 570g max							
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)							

*1 At rated input (DC280V) and rated load.

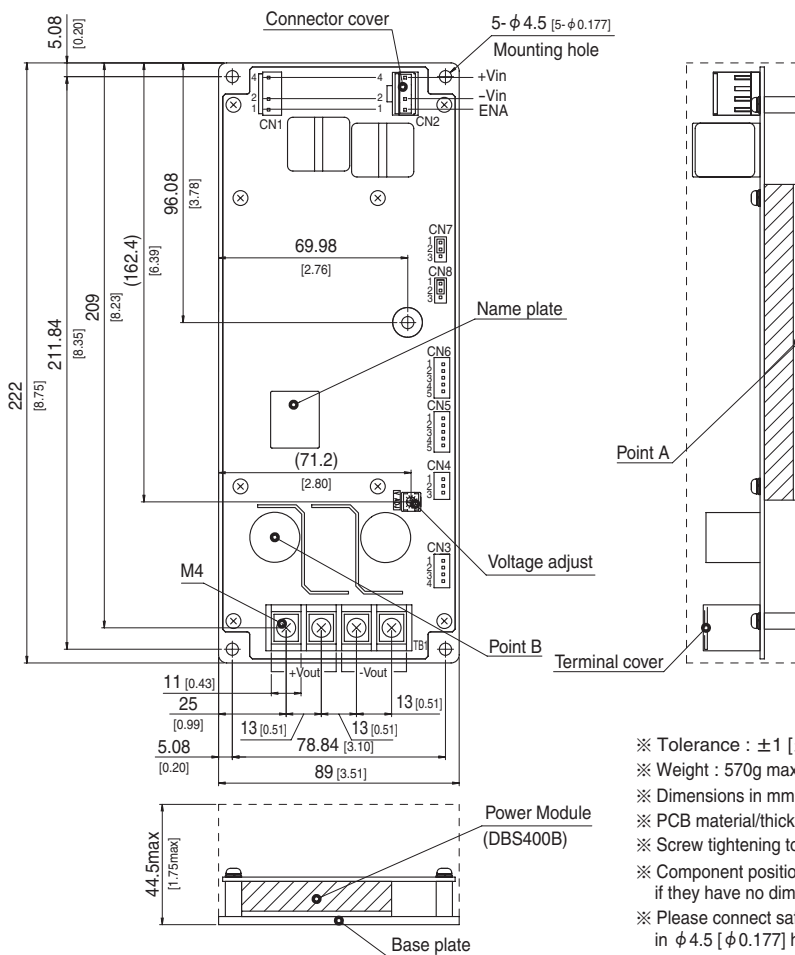
*2 Refer to Instruction manual for the measuring method of an electrical property.

*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input / output.

Block diagram



External view

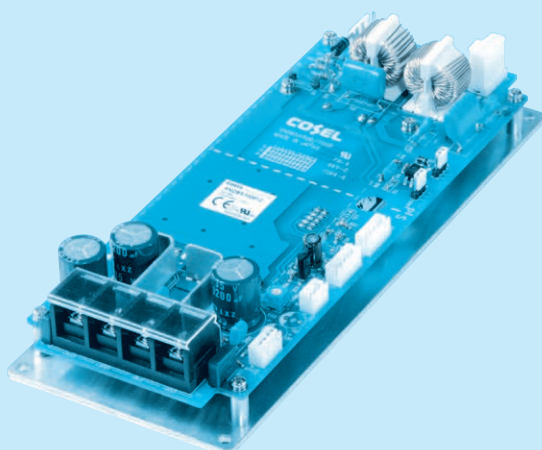


- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 570g max
- ※ Dimensions in mm, []=inches
- ※ PCB material/thickness : FR-4 / 1.6mm [0.06]
- ※ Screw tightening torque : 1.6N · m (16.9kgf · cm)max
- ※ Component positions and sizes are for your reference if they have no dimensions.
- ※ Please connect safety ground to the base plate in $\phi 4.5$ [$\phi 0.177$] hole.
- ※ The following parts are attached at shipping from factory
- CN2 : Housing for protection
- CN3 : Short-pieces for without remote sensing
- CN7, CN8 : Short-piece for setting
- ※ Keep drawing current per pin below 7A for CN1/CN2.

SNDBS700B

SNDB S 700 B 28

① ② ③ ④ ⑤



- ① Series name
② Single output
③ Output wattage
④ B : DC200-400V
⑤ Output voltage

* Please set short-pieces with 2-3 pins of CN8, when you do not use ENA. Refer to the manual.

MODEL	SNDBS700B12	SNDBS700B24	SNDBS700B28	SNDBS700B36	SNDBS700B48
MAX OUTPUT WATTAGE[W]	696	696	700	702	696
DC OUTPUT	12V 58A	24V 29A	28V 25A	36V 19.5A	48V 14.5A

SPECIFICATIONS

	MODEL	SNDBS700B12	SNDBS700B24	SNDBS700B28	SNDBS700B36	SNDBS700B48
INPUT	VOLTAGE[V]	DC200 - 400				
	CURRENT[A]	*1 2.76typ	2.76typ	2.76typ	2.76typ	2.73typ
	EFFICIENCY[%]	*1 90.0typ	90.0typ	90.5typ	90.0typ	91.0typ
OUTPUT	VOLTAGE[V]	12	24	28	36	48
	CURRENT[A]	58	29	25	19.5	14.5
	LINE REGULATION[mV]	40max	95max	95max	95max	120max
	LOAD REGULATION[mV]	150max	190max	190max	200max	240max
	RIPPLE[mVp-p]	0 to +95°C *2 120max	120max	120max	150max	200max
		-20 to 0°C *2 160max	160max	160max	200max	250max
	RIPPLE NOISE[mVp-p]	0 to +95°C *2 200max	200max	200max	200max	250max
		-20 to 0°C *2 280max	280max	280max	280max	400max
	TEMPERATURE REGULATION[mV]	0 to +65°C 120max	280max	280max	360max	480max
		-20 to +95°C 200max	480max	480max	680max	960max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV]	*3 40max	90max	90max	120max	180max
	START-UP TIME[ms]	200max (DCIN 280V, Io=100%)				
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V] *4	10.80 - 13.20	21.60 - 26.40	25.20 - 30.80	32.40 - 39.60	43.20 - 52.80
	OUTPUT VOLTAGE SETTING[V] *1	11.64 - 12.36	23.28 - 24.72	27.16 - 28.84	34.92 - 37.08	46.56 - 49.44
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically				
	OVERVOLTAGE PROTECTION[V]	13.80 - 16.80	27.60 - 33.60	32.20 - 39.20	41.40 - 50.40	55.20 - 63.00
ISOLATION	REMOTE SENSING	Provided				
	REMOTE ON/OFF	Provided (On both side of input output)				
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)				
ENVIRONMENT	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (20±15°C)				
	OUTPUT-FG	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (20±15°C)				
	OPERATING TEMP., HUMID. AND ALTITUDE	-20 to +95°C (On aluminum base plate), 20 - 95%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000 feet) max				
SAFETY	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +95°C, 20 - 95%RH (Non condensing), 9,000m (30,000 feet) max				
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis				
	IMPACT	196.1m/s ² (20G), 11ms, once each along X, Y and Z axis				
OTHERS	AGENCY APPROVALS	UL60950-1, C-UL, EN60950-1				
OTHERS	CASE SIZE/WEIGHT	89×44.5×222mm [3.51×1.75×8.75 inches] (W×H×D) / 570g max				
	COOLING METHOD	Conduction cooling (e.g. heat radiation from the aluminum base plate to the attached heat sink)				

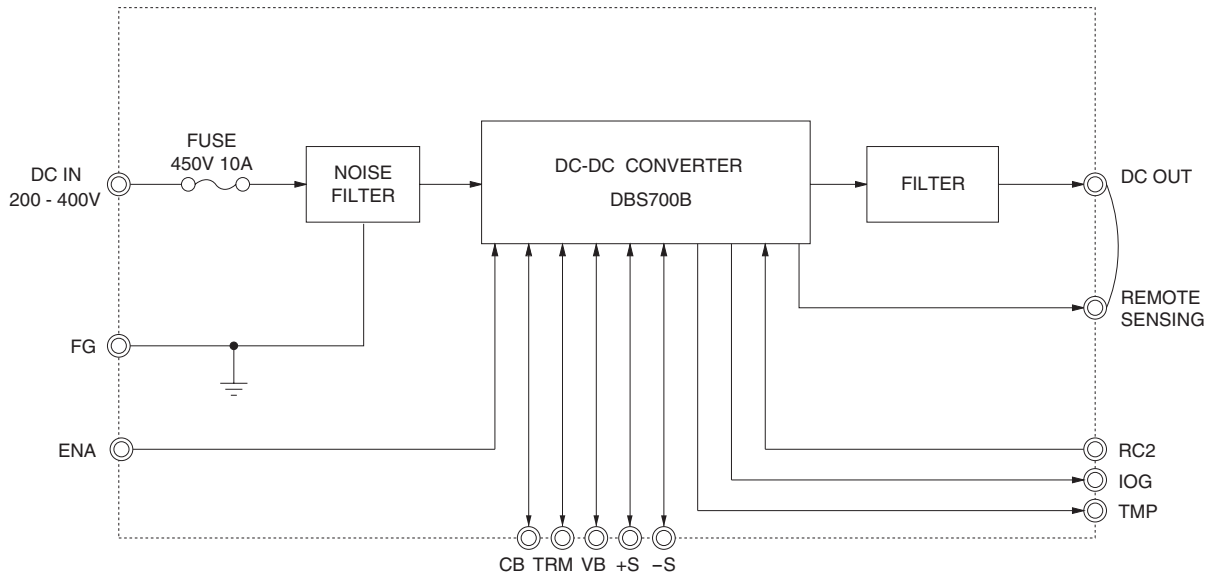
*1 At rated input (DC280V) and rated load.

*2 Refer to Instruction manual for the measuring method of an electrical property.

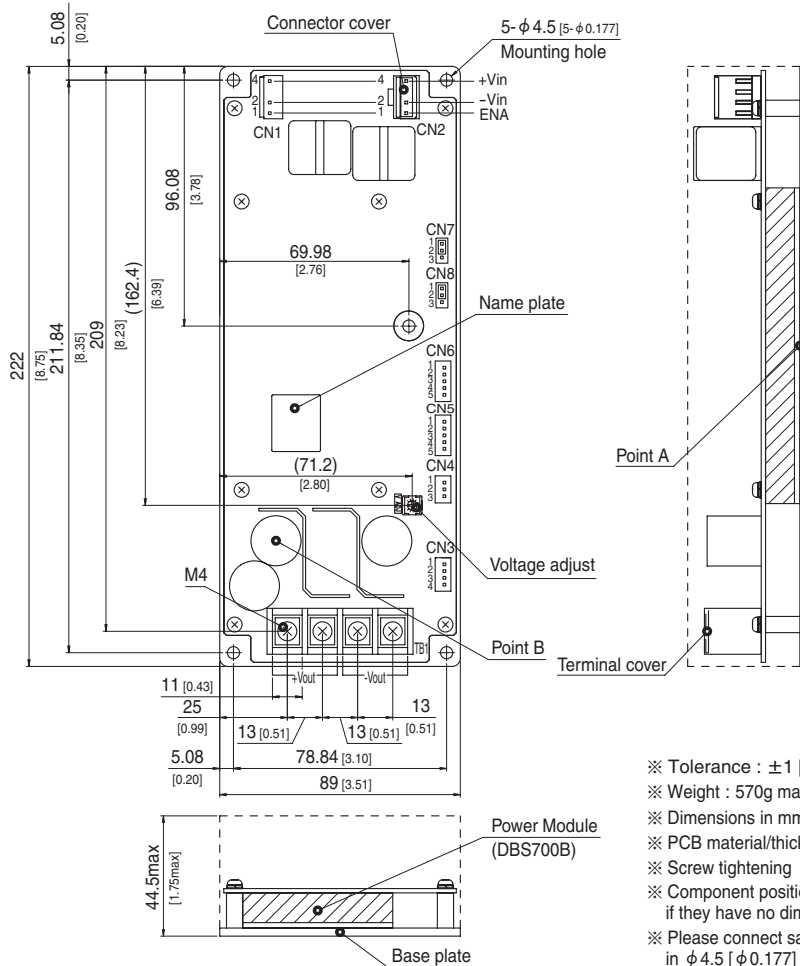
*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input / output.

*4 Refer to the manual for the input range.

Block diagram



External view



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 570g max
- ※ Dimensions in mm, []=inches
- ※ PCB material/thickness : FR-4 / 1.6mm [0.06]
- ※ Screw tightening torque : 1.6N · m (16.9kgf · cm) max
- ※ Component positions and sizes are for your reference if they have no dimensions.
- ※ Please connect safety ground to the base plate in $\phi 4.5$ [$\phi 0.177$] hole.
- ※ The following parts are attached at shipping from factory
 - CN2 : Housing for protection
 - CN3 : Short-pieces for without remote sensing
 - CN7, CN8 : Short-piece for setting
- ※ Keep drawing current per pin below 7A for CN1/CN2.

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection circuit	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
SNDBS400B	Forward converter	370	1.72 *1	450V 5A	–	FR-4		Yes	Yes	Yes *2
SNDBS700B	Forward converter	381	2.76 *1	450V 10A	–	FR-4		Yes	Yes	Yes *2

*1 Refer to specification.

*2 Refer to Instruction Manual.

1 Terminal Connection SNDBS-8**2** Connection for Standard Use SNDBS-8**3** Wiring Input / Output Terminal SNDBS-9

- 3.1 Wiring input terminal SNDBS-9
- 3.2 Wiring output terminal SNDBS-9

4 Function SNDBS-10

- 4.1 Overcurrent protection SNDBS-10
- 4.2 Overvoltage protection SNDBS-10
- 4.3 Thermal detection / Thermal protection SNDBS-10
- 4.4 Inverter operation monitor (IOG) SNDBS-10
- 4.5 Enable signal (ENA) SNDBS-10
- 4.6 Remote ON / OFF (RC2) SNDBS-11
- 4.7 Remote sensing SNDBS-11
- 4.8 Output voltage adjusting SNDBS-11
- 4.9 Isolation SNDBS-11

5 Series and Parallel operation SNDBS-12

- 5.1 Series operation SNDBS-12
- 5.2 Parallel operation / Master-slave operation SNDBS-12
- 5.3 N+1 Redundancy operation SNDBS-12

6 Implementation · Mounting Method SNDBS-13

- 6.1 Mounting method SNDBS-13
- 6.2 Derating SNDBS-13

1 Terminal Connection

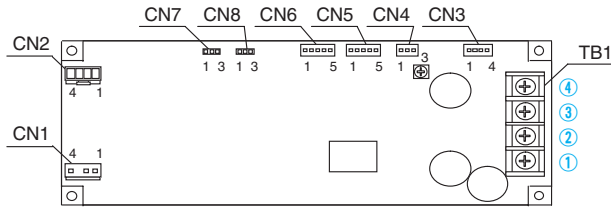


Table 1.1 Terminal connection and functions

No	Terminal connection	Function
①②	+VOUT	+DC output
③④	-VOUT	-DC output

Table 1.2 Configuration and functions of CN1 and CN2

Pin No.	Function
1	ENA-B : Enable signal
2	-VIN : -DC input
3	NC : No connection
4	+VIN : +DC input

Housing for protection is attached on CN2 at shipping from factory

Table 1.3 Configuration and functions of CN3

Pin No.	Function
1	+M : +Self sensing terminal. (Do not wire for external connection.)
2	+S : +Remote sensing
3	-S : -Remote sensing
4	-M : -Self sensing terminal. (Do not wire for external connection.)

Short-pieces for without remote sensing is attached on CN3 at shipping from factory

Table 1.4 Terminal connection and functions CN4

Pin No.	Function
1	RC2 : Remote ON/OFF
2	TEMP : Thermal detection / Thermal protection
3	IOG : Inverter operation monitor

Table 1.5 Terminal connection and functions of CN5 and CN6

Pin No.	Function
1	+S : +Remote sensing
2	-S : -Remote sensing
3	TRM : Adjustment of output voltage
4	VB : Voltage balance
5	CB : Current balance

Common signs among CN4 and CN5 represent the same potential.

Table 1.6 Terminal connection and functions of CN7

Pin No.	Function
1	Setting of
2	ENA

Short-piece for setting is attached on CN7 at shipping from factory

Table 1.7 Terminal connection and functions of CN8

Pin No.	Function
1	Setting of ENA
2	effective

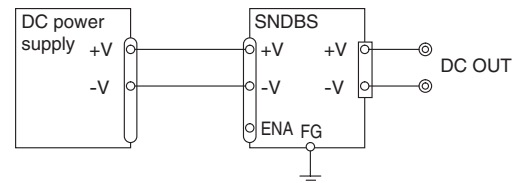
Short-piece for setting is attached on CN8 at shipping from factory

Table 1.8 Mating connectors and terminals of CN1,CN2,CN3,CN4,CN5 and CN6

Connector	Mating connector	Terminal	Mfr.
CN1 CN2	B3P4-VH-B	VHR-4N	Reel :SVH-21T-P1.1 Loose:BVH-21T-P1.1
CN3	B4B-XH-AM	XHP-4	Reel :SXH-001T-P0.6 Loose:BXH-001T-P0.6
CN4	B3B-XH-AM	XHP-3	Reel :SXH-001T-P0.6 Loose:BXH-001T-P0.6
CN5 CN6	B5B-XH-AM	XHP-5	Reel :SXH-001T-P0.6 Loose:BXH-001T-P0.6

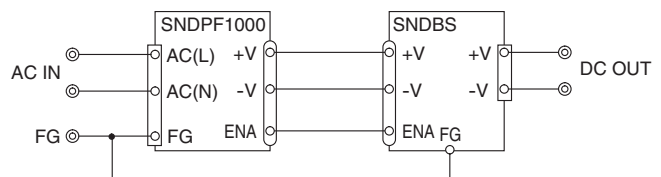
2 Connection for Standard Use

■ In order to use the power supply, it is necessary Fig.2.1.



* Set short-piece to 2 and 3 on CN8

(a) Connection for DC input



*Set short-piece to 1 and 2 on CN7 for using with SNDPF1000

*Set short-piece to 2 and 3 on CN7 for using with SNDPG750

*Refer to 4.5 Enable (ENA)

(b) Connection for AC input

Fig.2.1 Connection for Standard Use

■ The SNDBS Series handles only the DC input.

Avoid applying AC input directly.

It will damage the power supply.

- Between the same terminal name, CN2 CN1 are power supply are connected internally. Be used in multiple units can be cascaded. Keep drawing current per pin below 7A for CN1/CN2.
- Operate with the conduction cooling(e.g. heat radiation from the aluminum base plate to the attached heat sink).
Reference: 6.2 "Derating"
- Please contact us If you need except SNDPG750/SNDPF1000 for the input .

3 Wiring Input / Output Terminal

3.1 Wiring input terminal

(1) External capacitor on the Input side

- When it turns on an input with a switch directly, one several times the surge voltage of input voltage occurs by the inductance ingredient of an input line, and there is a possibility that a power supply may break down.

Please install a capacitor between +VIN and -VIN input terminals and absorb surge.

Capacitor : 47 μ F or more

- When the line impedance is high or the input voltage rise quickly at start-up (less than 10 μ s), install a capacitor between +VIN and -VIN input terminals.
- Install a correspondence filter, if a noise standard meeting is required or if the surge voltage may be applied to the unit.
Please contact us in details.

(2) Input voltage rang/Input current range

- The specification of input ripple voltage is 40Vp-p.
- Make sure that the voltage fluctuation, including the ripple voltage, will not exceed the input voltage range.
- Use a front end unit with enough power, considering the start-up current I_p of this unit.

(3) Operation with AC input

- The SNDBS series handles only for the DC input.
A front end unit(AC/DC unit) is required when the SNDBS series is operated with AC input.

(4) Reverse input voltage protection

- Avoid the reverse polarity input voltage. It will break the power supply.
It is possible to protect the unit from the reverse input voltage by installing an external diode.

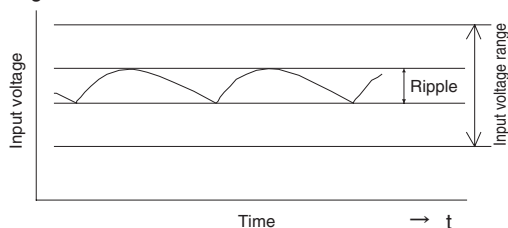


Fig.3.1 Ripple of input voltage

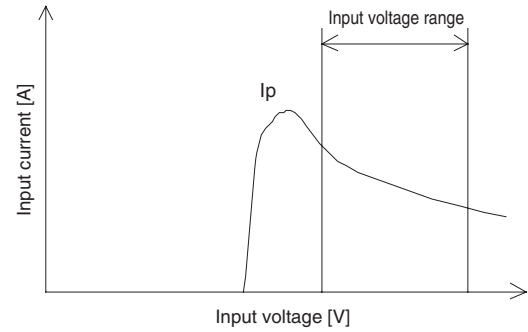


Fig.3.2 Input current characteristics

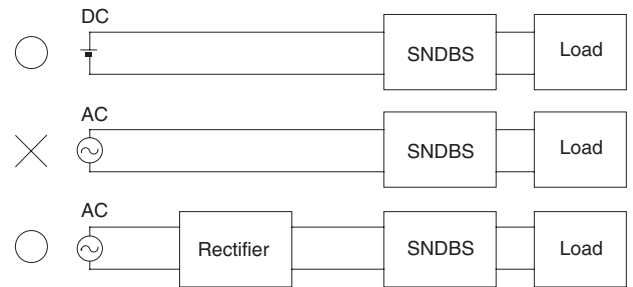


Fig.3.3 Use wit AC input

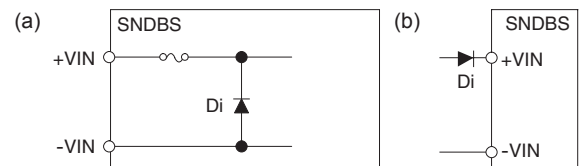


Fig.3.4 Reverse input voltage protection

3.2 Wiring output terminal

- The specified ripple and ripple noise are measured by the method introduced in Fig.3.5.

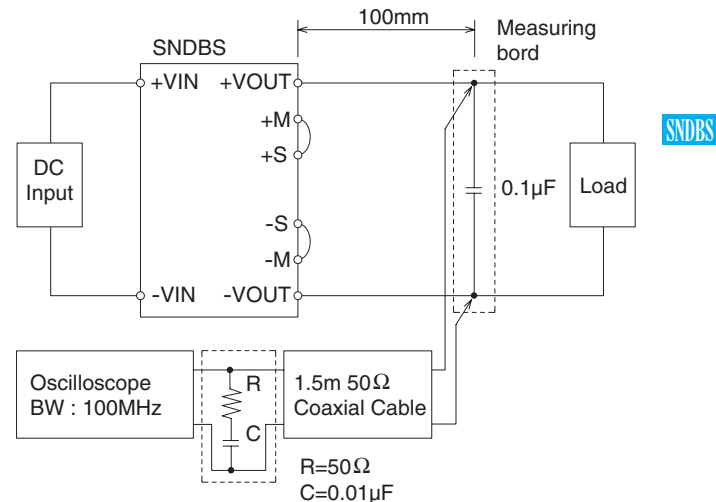


Fig.5.1 Method of Measuring Output Ripple and Ripple Noise

4 Function

4.1 Overcurrent protection

■ Overcurrent protection is built-in and comes into effect at over 105% of the rated current.

Overcurrent protection prevents the unit from short circuit and overcurrent condition. The unit automatically recovers when the fault condition is cleared.

■ When the output voltage drops at overcurrent, the average output current is reduced by intermittent operation of power supply

4.2 Overvoltage protection

■ The overvoltage protection circuit is built-in. The DC input should be shut down if overvoltage protection is in operation. The minimum interval of DC recycling for recovery is for 2 to 3 minutes(*).

*The recovery time varies depending on input voltage and input capacity.

Remarks:

Please note that devices inside the power supply might fail when voltage more than rated output voltage is applied to output terminal of the power supply. This could happen when the customer tests the overvoltage performance of the unit.

4.3 Thermal detection / Thermal protection

■ Thermal detection (TMP) and protection circuit are built-in.

■ When overheat is detected, thermal detection signal (TMP) turns "L" from "H". TMP circuit is designed as shown in Fig.4.1, and specification is shown as in Table 4.1.

■ When overheating continues after detecting the TMP signal, the output will be shut down by the thermal protection circuit. When this function comes into effect, input voltage should be shut off, and eliminate all possible causes of overheat condition and lower the temperature of the unit to the normal level.

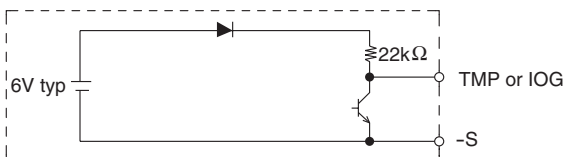


Fig.4.1 TMP, IOG circuit

Table 4.1 Specification of TMP, IOG

No.	Item	TMP	IOG
1	Function	Normal operation "H" Overheat detection "L"	Normal operation "L" Malfunction of inverter "H"
2	Base pin	-S	
3	Level voltage "L"	0.5Vmax at 5mA	
4	Level voltage "H"	5V typ	
5	Maximum sink current	10mA max	
6	Maximum applicable voltage	35V max	

4.4 Inverter operation monitor (IOG)

■ By using the inverter operation monitor(IOG), malfunction of the inverter can be monitored.

When inverter operation is in following mode or , IOG signal turns "H" from "L" within 1 second.

IOG circuit is designed as shown in Fig.4.1 and specification is shown in Table 4.1.

①Malfunction of inverter.

②The output voltage drops by 60% or less of the rated voltage.

③When output wattage is decreased radically to less than 10% of rated wattage.

4.5 Enable signal (ENA)

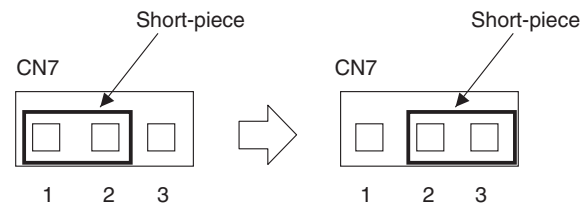
■ When I connect SNDPF or SNDPG to input of SNDBS, you can operate it to start, a stop of SNDPF by connecting ENA.

In this case, please set the short-piece of CN8 on 1 pin and 2 pins to prevent the trouble of the power supply.

■ When the power supplies are shipped from a factory, they come with a dedicated short-piece being mounted on CN7.

If you use SNDPF1000 , you can use the power supplies as they are.

If you use SNDPG750 , you must set short-piece to pin2 and 3 on CN7.

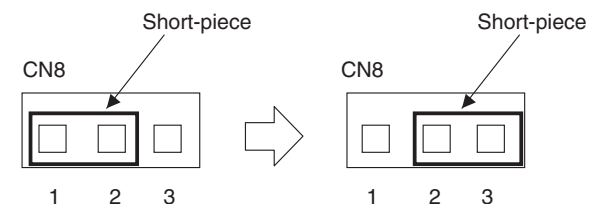


ENA terminal Enable
(at shipping from factory)

ENA terminal Disable

Fig.4.2 Setting of ENA

■ If you do not use ENA , remove the short-piece to pin 2 and 3 at CN8 shown in Fig.4.3.



The ENA terminal is effective
(Initial setting)

The ENA terminal is invalid

Fig.4.3 Setting of ENA

4.6 Remote ON / OFF (RC2)

■ You can operate the remote ON/OFF function by sending signals to CN4.

Please see Table 4.2 for specifications.

■ Remote ON/OFF circuits (RC2) is not isolated from output.

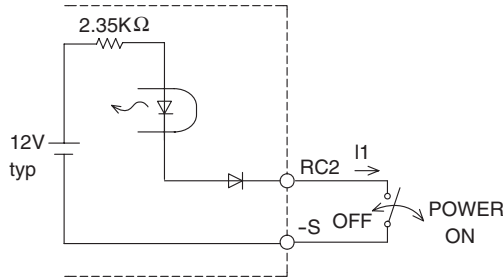


Fig.4.3 Remote ON/OFF (RC2)

Table 4.2 Specification of output side remote ON/OFF (RC2)

No.	Item	RC2
1	Power ON	Open (0.1mA max)
2	Power OFF	Short (3mA min)
3	Base pin	-S

4.7 Remote sensing

(1) When the remote sensing function is not in use

■ If you do not use the remote sensing function, you can short out between +S and +M and between -S and -M on CN3.

When the power supplies are shipped from a factory, they come with a dedicated harness being mounted on CN3.

If you do not use the remote sensing function, you can use the power supplies as they are.

(2) When the remote sensing function is in use

■ Please see Fig.4.2 if you use the remote sensing function.

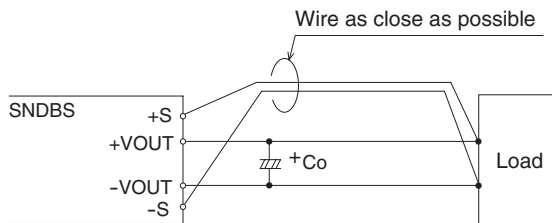


Fig.4.2 Connection when the remote sensing is in use

■ Wire carefully. When a connection of a load line becomes loose(due to such factors as loose screw), the load current flows to the sensing line and internal circuits of the power supply may be damaged.

■ Use a sufficiently thick wire to connect between the power supply and the load and keep the line drop at 0.3V or below.

■ Use a twisted pair wire or a shielded wire as the sensing line.

■ Do not draw the output current from +M, -M, +S or -S.

■ When the remote sensing function is used, the output voltage of the power supply may show an oscillating waveform or the output voltage may dramatically fluctuate because of an impedance of wiring and load conditions.

4.8 Output voltage adjusting

(1) Adjusting method by installed potentiometer

■ Output voltage is adjustable by the internal potentiometer or by applied voltage externally.

The adjustable range is 90 - 110% of the rated output voltage.

To increase an output voltage, turn a built-in potentiometer clockwise.

To decrease the output voltage, turn it counterclockwise

■ The output adjustment range for DBS700B is shown in Fig.4.4.

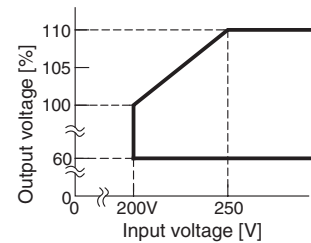


Fig.4.4 SNDBS700B Output Voltage Adjustment Range

(2) Adjusting method by applying external voltage

■ By applying the voltage externally at TRM, output voltage become adjustable.

Output voltage is calculated by the following equation.

$$\text{Output voltage [V]} = \frac{\text{Applied voltage externally [V]}}{1 [\text{V}]} \times \text{Rated output voltage [V]} \quad \textcircled{1}$$

■ If the output voltage decreases to almost 0V, output ripple may become large.

■ When the output voltage adjustment is used, note that the over-voltage protection circuit operates when the output voltage sets too high.

4.9 Isolation

■ For a receiving inspection, such as Hi-Pot test, gradually increase(decrease) the voltage for a start(shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

5 Series and Parallel Operation

5.1 Series operation

■ Series operation is available by connecting the outputs of two or more power supplies, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

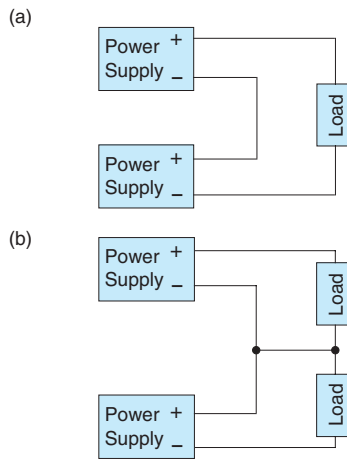


Fig.5.1 Serial operation

5.2 Parallel operation/Master-slave operation

■ Parallel operation is available by connecting the units as shown in Fig.5.2.

■ You can adjust the output voltage in parallel operation by adjusting a potentiometer of just one power supply. To do so, select one power supply as the master unit and turn the potentiometers of the other (slave) power supplies clockwise to the end.

Once you have done this, you can adjust the output voltage by turning the potentiometer of the master unit.

■ You cannot parallel power supplies with different output voltage or electrical power.

■ As variance of output current from each power supply is maximum 10%, the total output current must not exceed the value determined by the following equation.

$$\left(\begin{array}{c} \text{Output current in} \\ \text{parallel operation} \end{array} \right) = \left(\begin{array}{c} \text{the rated current} \\ \text{per unit} \end{array} \right) \times (\text{number of unit}) \times 0.9$$

In parallel operation, the maximum operative number of units is 5.

■ When the number of the units in parallel operation increases, input current increases. Adequate wiring design for input circuitry such as circuit pattern, wiring and current for equipment is required.

Connect the sensing line and the power line by one point after connecting each power supply's sensing pins(+S, -S). In multiple operation, sensing wires should be connected between each units for the master connection to a load.

■ Connect the sensing line and the power line by one point after connecting each power supply's sensing pins(+S, -S).

In multiple operation, sensing wires should be connected between each units for the master connection to a load.

■ Output current should be 10% or more of the total of the rated output current in parallel operation. If less than 10%, the IOG signal might become unstable, and output voltage slightly increasing (max5%).

■ IOG signal might be unstable for one second when the units are turned on in parallel operation.

■ Please be connected diode to the +VOUT side to avoid malfunctions and damage.

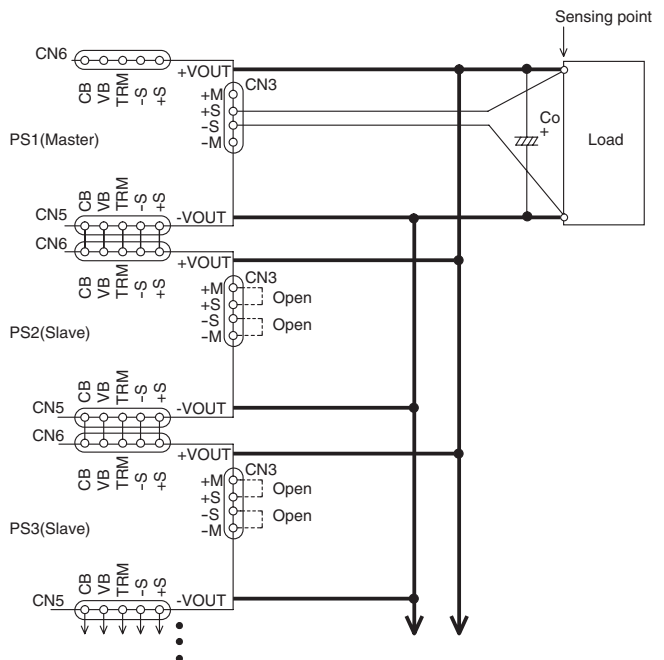


Fig.5.2 Examples of parallel operation

5.3 N+1 Redundancy operation

■ It is possible to set N+1 redundant operation for improving reliability of power supply system.

Purpose of redundant operation is to ensure stable operation in the event of single power supply failure.

Since extra power supply is reserved for the failure condition, so total power of redundant operation is equal to N-1.

■ Please contact us about N+1 redundant operation in details.

6 Implementation · Mounting Method

6.1 Mounting method

- When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Aluminum base plate temperature around each power supply should not exceed the temperature range shown in derating curve.
- In case of metal chassis, keep the distance between d1 for to insulate between lead of component and metal chassis, use the spacer of 4mm[0.16 inches] or more between d1. If it is less than d1, insert the insulation sheet between power supply and metal chassis.
- Avoid placing the DC input line wires underneath the unit, it will increase the line conducted noise.
Make sure to leave an ample distance between the line pattern lay out and the unit.
Also avoid placing the DC output line wires underneath the unit because it may increase the output noise. Lay out the pattern away from the unit.

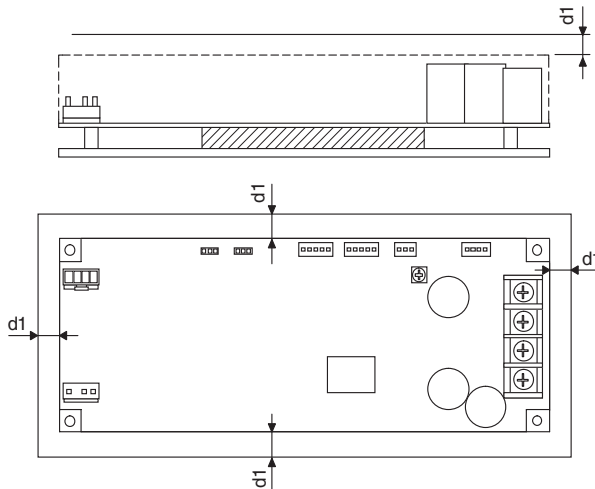


Fig.6.1 Mounting method

6.2 Derating

- Use with the conduction cooling(e.g. heat radiation by conduction from the aluminum base plate to the attached heat sink).
Fig.6.2 shows the derating curve based on the aluminum base plate temperature.
- Please measure the temperature on the aluminum base plate edge side (Point A).
- Please consider the ventilation to keep the temperature on the PCB (Point B) less than the temperature of Fig.6.3., Fig.6.5.
- It is necessary to note the thermal fatigue life by power cycle.
Please reduce the temperature fluctuation range as much as possible when the up and down of the temperature are frequently generated.
Contact us for more information on cooling methods.

- In the hatched area, the specification of ripple and ripple noise is different from other areas

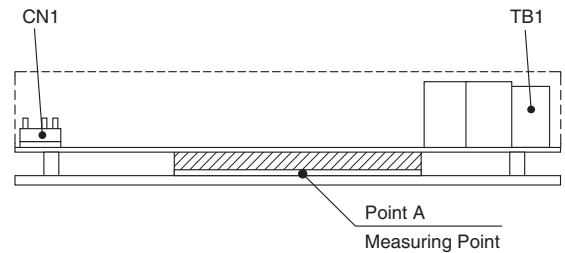
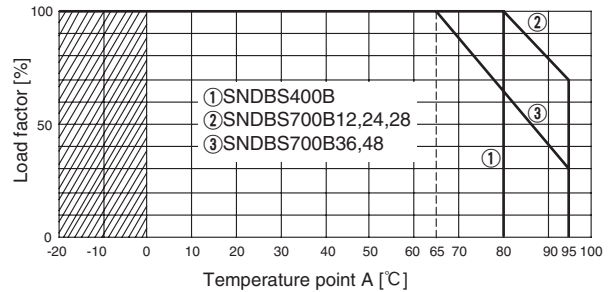


Fig. 6.2 Derating curve (Point A)

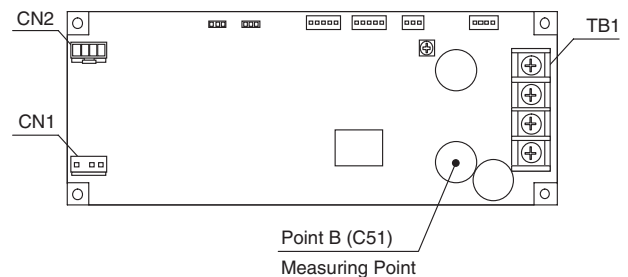
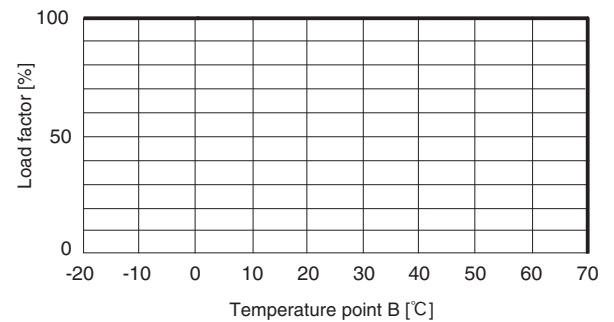
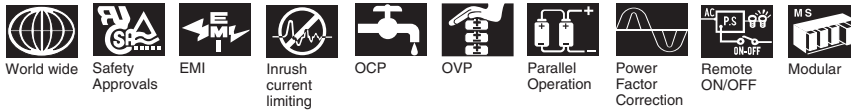
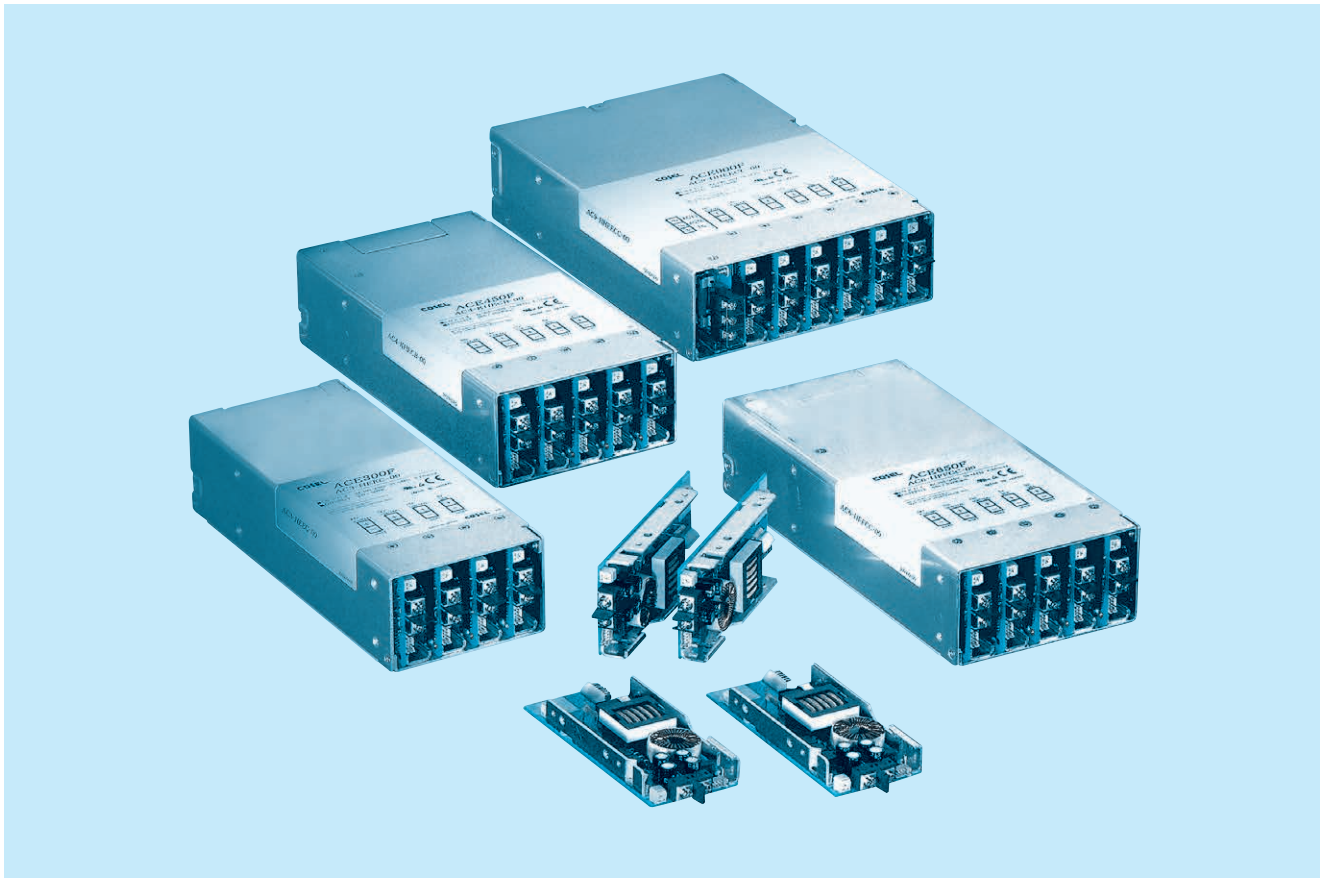


Fig. 6.3 Derating curve (Point A)



ACE-series



Feature

Flexible modular system architecture provides various output configuration
 Harmonic attenuator (Complies with IEC61000-3-2)
 Universal input (AC85 - 264V)
 Remote ON/OFF control, alarm

Safety agency approvals

UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178
 Complies with DEN-AN
 UL60601-1, C-UL (CSA601.1), EN60601-1 approvals (optional)

EMI

Complies with FCC-B, CISPR22-B,
 EN55022-B, VCCI-B

3-year warranty

CE marking

Low Voltage Directive

EMS Compliance : EN61204-3, EN61000-6-2

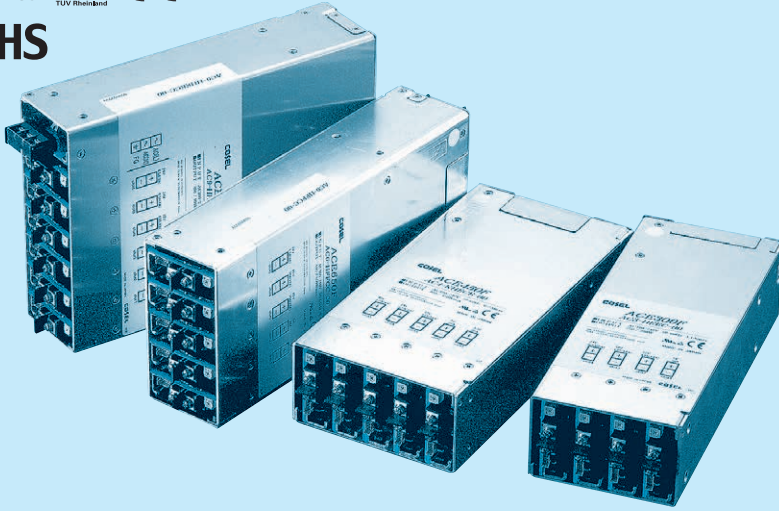
EN61000-4-2
 EN61000-4-3
 EN61000-4-4
 EN61000-4-5
 EN61000-4-6
 EN61000-4-8
 EN61000-4-11

ACE

ACE series

AC - - -

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

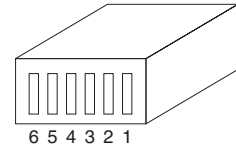


Example recommended EMI/EMC filter
 ACE300F NAC-06-472
 ACE450F NAC-10-472
 ACE650F NAC-20-472
 ACE900F NAC-20-472



High voltage pulse noise type : NAP series
 Low leakage current type : NAM series
 * A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Abbreviation type name of ACE series
- ② Abbreviation power of ACE series
 3 : ACE300F
 4 : ACE450F
 6 : ACE650F
 9 : ACE900F
- ③ Slot 6 Output module
- ④ Slot 5 Output module
- ⑤ Slot 4 Output module
- ⑥ Slot 3 Output module
- ⑦ Slot 2 Output module
- ⑧ Slot 1 Output module
- ⑨ Parallel code
- ⑩ Option (series code) *8
 Refer to instruction manual 5.1
 Safety : UL60601-1, EN60601-1
 Refer to instruction manual 7. for details.



Slot

* The number of slot is different depending on the model.

* Empty slot is code:0

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

SPECIFICATIONS

	MODEL	ACE300F	ACE450F	ACE650F	ACE900F
INPUT	VOLTAGE[V]	AC85 - 264 1 φ / DC120 - 350 (option=-U AC70 or DC100 - refer to instruction manual 5)			
	FREQUENCY[Hz]	47 - 63			
	CURRENT[A]	AC100V *1	3.7typ	5.7typ	8.0typ
		AC200V *1	2.0typ	3.1typ	4.2typ
	POWER FACTOR	AC100V *1	0.99typ		
		AC200V *1	0.95typ		
	INRUSH CURRENT [A]	AC100V *2	15 / 30typ *7		15 / 50typ *7
		AC200V *2	30 / 30typ *7		30 / 50typ *7
	EFFICIENCY[%]	AC100V *1	74typ	75typ	77typ
		AC200V *1	78typ	80typ	80typ
OUTPUT	LEAKAGE CURRENT[mA]	AC100V *3	0.5max		
		AC230V *3	0.95max		
	NUMBER OF SLOT	4	5	5	6
	TOTAL OUTPUT[W]	AC90 - 150V *4	250	400	600
		AC170 - 264V *4	300	450	650
	START-UP TIME[ms]	500max (ACIN100V, Io=100%)			
	HOLD-UP TIME[ms] *1	20typ (ACIN100V, Io=100%)			
	AUXILIARY POWER (AUX)	12V 0.1A (Only for Remote ON/OFF) (option=-J 5V0.1A)			
	ALARM (PR)	FAN alarm, LINE alarm			
	INPUT-OUTPUT, RC, AUX	AC3.000V 1minute, Cutoff current=10mA, DC500V 50MΩ min (At Room Temperature)			
ISOLATION	INPUT-FG	AC2,000V 1minute, Cutoff current=10mA, DC500V 50MΩ min (At Room Temperature)			
	OUTPUT, RC, AUX(PR)-FG *5	AC500V 1minute, Cutoff current=100mA, DC500V 50MΩ min (At Room Temperature)			
	OPERATING TEMP., HUMID. AND ALTITUDE *4	-20 to +70°C, 20 - 90%RH (Non condensing) 3,000m (10,000feet) max			
ENVIRONMENT	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing) 9,000m (30,000feet) max			
	VIBRATION	19.6m/s ² (2G) , 10 - 55Hz, 3minutes period, 60minutes each along X, Y and Z axis			
	IMPACT	196.1m/s ² (20G) , 11ms, once each X, Y and Z axis			
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178, Complies with DEN-AN (At only AC input)			
		UL60601-1, EN60601-1 (At only AC input) (Refer to instruction manual 7)			
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR22-B and EN55022-B			
OTHERS	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 *9			
	CASE SIZE *6	103X63.5X254mm (W×H×D) [4.06×2.5×10 inches]	127X63.5X254mm (W×H×D) [5×2.5×10 inches]	127X63.5X279mm (W×H×D) [5×2.5×10.98 inches]	177.5X63.5X254mm (W×H×D) [6.99×2.5×10 inches]
	WEIGHT[kg]	1.7max	2.2max	2.4max	3.0max
	COOLING METHOD	Forced cooling (built-in)			

*1 In case of modular power supply, the value changes by composing and load factor of installed output modules. The values in specifications mean each the model are composed of voluntary modules that are 5V (code : C), 12V (code : E), 24V (code : H) and the output power is total

output wattage under the prescribed conditions.
 *2 More than 3sec. to restart. Io=100%
 *3 Complies with IEC60950 and DEN-AN 60Hz and 100% load.
 *4 Refer to instruction manual 4.2 Derating in detail.
 *5 Each output module, RC and AUX are isolated.

*6 Case size contains neither the terminal blocks, screw nor.
 *7 Primary inrush current / Secondary inrush current.
 *8 Please contact us about safety approvals for the model with option.
 *9 Please contact us about class C.
 * A sound may occur from power supply at pulse loading.

Output module specifications

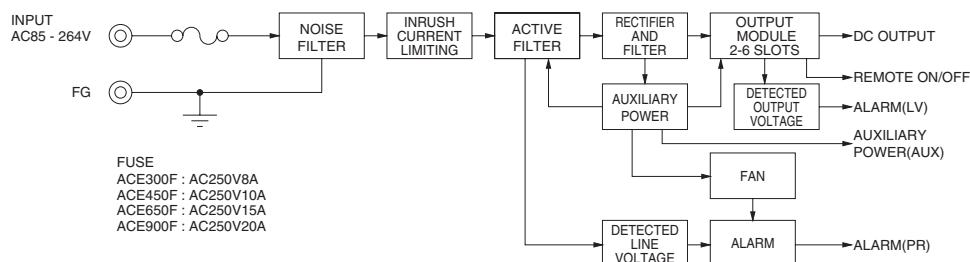
		150W suitable single output										50W suitable single output					75W dual output						
ITEM	CODE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	Y*7	W*7	Z*7	9*7			
Number of slots used		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
VOLTAGE[V]		+2	+3.3	+5	+7.5	+12	+15	+18	+24	+34	+48	+3.3	+5	+12	+15	+24	±5	±12	±15	±24			
MINIMUM CURRENT[A]		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
CURRENT1[A]		26	26	26	18	13	10	8.5	6.5	4.5	3.2	10	10	5	4	2.5	3	3.2	2.5	1.6			
CURRENT2[A]		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7	4.2	3.5	2.5			
PEAK CURRENT[A]		*1	—	—	—	14	12	10	8	5.5	4	—	—	—	—	—	—	5	4	—			
LINE REGULATION[mV]max		20	20	20	36	48	60	72	96	120	192	20	20	48	60	96	20	48	60	60			
LOAD REGULATION1[mV]max*5		40	40	40	100	100	120	120	150	180	300	40	40	100	120	150	250	600	600	600			
LOAD REGULATION2[mV]max*6		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	500	750	750	750			
RIPPLE [mVp-p]max	0 to +50℃ *2	80	80	80	120	120	120	120	120	120	150	80	80	120	120	120	80	120	120	120			
	-20 to 0℃ *2	140	140	140	160	160	160	160	160	160	300	140	140	160	160	160	140	160	160	160			
RIPPLE NOISE [mVp-p]max	0 to +50℃ *2	120	120	120	150	150	150	150	150	150	350	120	120	150	150	150	120	150	150	150			
	-20 to 0℃ *2	160	160	160	180	180	180	180	180	180	400	160	160	180	180	180	160	180	180	180			
TEMPERATURE COEFFICIENT[mV]max		0 to +50℃	50	50	50	90	120	150	180	240	300	480	50	50	120	150	240	50	120	150	150		
DRIFT[mV]max		*3	20	20	20	36	48	60	72	96	120	192	20	20	48	60	96	20	48	60	60		
OUTPUT VOLTAGE SETTING[V]		2.00-2.20	3.25-3.45	4.99-5.30	7.20-7.80	11.5-12.5	14.4-15.6	17.3-18.7	23.0-25.0	33.0-35.0	46.0-50.0	3.25-3.45	4.99-5.30	11.5-12.5	14.4-15.6	23.0-25.0	4.99-5.30	11.5-12.5	14.4-15.6	23.0-25.0			
OUTPUT VOLTAGE ADJUSTMENT RANGE[V] *4		1.60-2.60	2.60-3.60	4.00-5.50	6.00-8.20	9.00-13.2	13.2-16.5	16.5-19.2	19.2-26.4	27.2-37.4	38.4-52.8	2.60-3.60	4.00-5.50	9.00-13.2	13.2-16.5	19.2-26.4	4.99-6.00	9.60-13.2	13.2-16.5	19.2-26.4			
OVERCURRENT PROTECTION[A]		Works over 105%min of rated current or 101%min of peak current. Automatic recovery.																					
OVERVOLTAGE PROTECTION[V]		3.00-4.80	4.00-5.25	Works at 115 - 140% of rated voltage										4.00-5.25	Works at 115 - 140% of rated voltage					6.90-8.40	13.8-16.8	17.25-21.0	27.6-33.6
FUNCTION		Remotesensing, remote ON/OFF, alarm (LV)										Remote ON/OFF, alarm (LV)											

		300W suitable single output										100W insulation dual output						150W dual output		★
ITEM	CODE	2A	2B	2C	2D	2E	2F	2G	2H	2J	2K	S *8		T *8		U *8		Q *7	V *7	I
Number of slots used		2	2	2	2	2	2	2	2	2	2	1		1		1		1	1	1
VOLTAGE[V]		+2	+3.3	+5	+7.5	+12	+15	+18	+24	+34	+48	V1:±5	V2:±5	V1:±5	V2:±12	V1:±5	V2:±24	±12	±15	Input module Refer to instruction manual 6 Input.
MINIMUM CURRENT[A]		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
CURRENT1[A]		60	60	60	40	25	20	17	14	10	7	10	5	10	4.2	10	2.1	6.4	5.5	
CURRENT2[A]		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8	7	
PEAK CURRENT[A]		*1	—	—	—	34	27	23	20	14	10	—	—	—	—	—	—	10	8	
LINE REGULATION[mV]max		20	20	20	36	48	60	72	96	120	192	20	20	20	48	20	96	48	60	
LOAD REGULATION1[mV]max*5		40	40	40	100	100	120	120	150	180	300	40	40	40	100	40	150	600	600	
LOAD REGULATION2[mV]max*6		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	750	750	
RIPPLE [mVp-p]max	0 to +50℃ *2	80	80	80	120	120	120	120	120	120	150	80	80	80	120	80	120	140	140	
	-20 to 0℃ *2	140	140	140	160	160	160	160	160	160	300	140	140	140	160	140	160	200	200	
RIPPLE NOISE [mVp-p]max	0 to +50℃ *2	120	120	120	150	150	150	150	150	150	350	120	120	120	150	120	150	230	230	
	-20 to 0℃ *2	160	160	160	180	180	180	180	180	180	400	160	160	160	180	160	180	350	350	
TEMPERATURE COEFFICIENT[mV]max		50	50	50	90	120	150	180	240	300	480	50	50	50	120	50	240	120	150	
DRIFT[mV]max		*3	20	20	20	36	48	60	72	96	120	20	20	20	48	20	96	48	60	
OUTPUT VOLTAGE SETTING[V]		2.00-2.20	3.25-3.45	4.99-5.30	7.20-7.80	11.5-12.5	14.4-15.6	17.3-18.7	23.0-25.0	33.0-35.0	46.0-50.0	4.99-5.30	4.99-5.30	4.99-5.30	11.5-12.5	4.99-5.30	23.0-25.0	11.5-12.5	14.4-15.6	
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		1.60-2.60	2.60-3.60	4.00-5.50	6.00-8.20	9.00-13.2	13.2-16.5	16.5-19.2	19.2-26.4	27.2-37.4	38.4-52.8	4.99-5.50	3.00-5.50	4.99-5.50	7.50-13.2	4.99-5.50	15.0-26.4	9.60-13.2	13.2-16.5	
OVERCURRENT PROTECTION[A]		Works over 105%min of rated current or 101%min of peak current. Automatic recovery.																		
OVERVOLTAGE PROTECTION[V]		3.00-4.80	4.00-5.25	Works at 115 - 140% of rated voltage																
FUNCTION		Remotesensing, remote ON/OFF, alarm (LV)										Remote ON/OFF						Same as W,Z		—

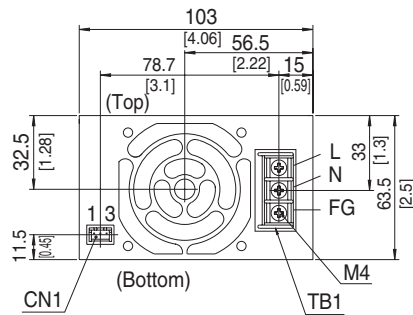
- ^{*1} Operating condition of peak current : Peak current is less than 10sec., duty is less than 35% and average current is less than rated current. (rated current2 at Module W, Z, 9, Q and V)
- ^{*2} Measured by 20MHz oscilloscope or Ripple-Noise Meter (Equivalent to KEISOKU-GIKEN : RM101). Ripple and Ripple Noise is measured by using measuring board with capacitor of 22 μF within 150mm from output terminal.
- ^{*3} Drift is changed in DC output for an eight hour period after half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
- ^{*4} When the output voltage of module A is used less than 2.0V, keep minimum output current 2.6A.
- ^{*5} It is a value from 0 to rated output current1. The current on non-measurement side is fixed.
- ^{*6} It is a value from 0 to rated output current2. The current on non-measurement side is fixed.
- ^{*7} The sum of +power and -power must be less than output power(Y:50W, W:76.8W, Z:75W, 9:76.8W, Q:153.6W, V:165W).

- ^{*8} Ratings of V2 can draw up to 50% of rated current at the time of 0A in load of V1. (Only module S,T,U. refer to instruction manual 4.2 for details.)
- ★ Each output of module Y,Z, 9, Q and V is a ground common type (not isolated), each output of module S,T and U is isolated.
- ★ For ACE300F,450F and 650F, input and output terminals can be set at the same side if Input module (code:I) is installed instead of the most left module.
- ★ Modules which can correspond to medical electrical equipment (UL2601-1, EN60601-1) are all modules except module S, T and U. Refer to instruction manual 7. for details.

Block diagram



ACE300F external view



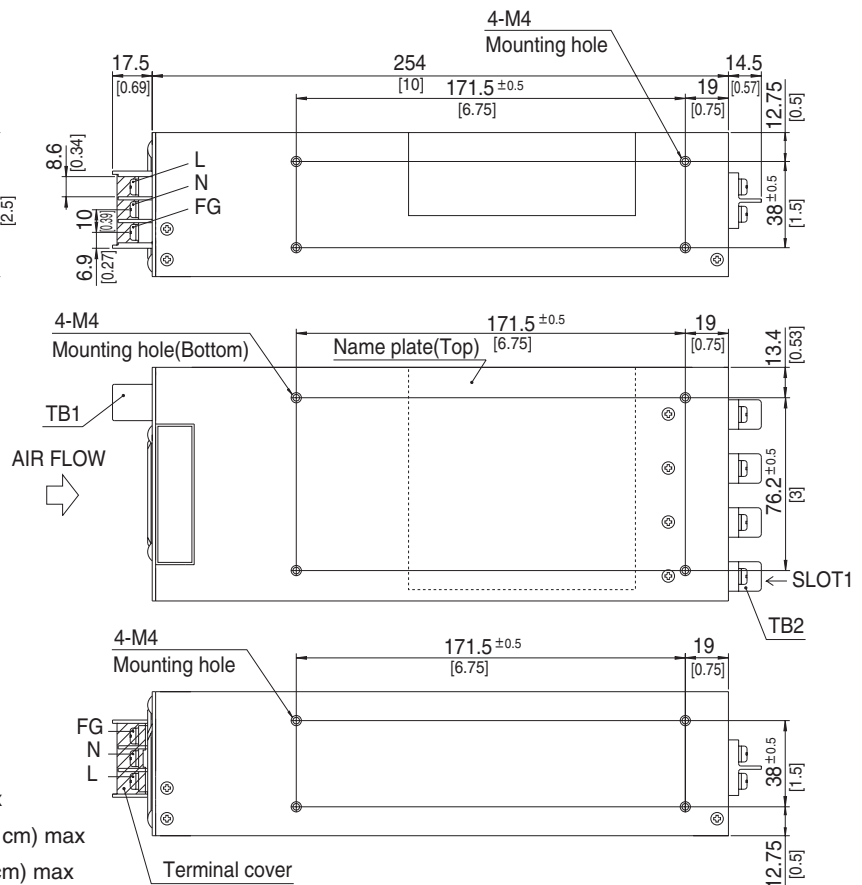
Pin connection and function of CN1

Pin No.	Function
1	G : Auxiliary power ground
2	PR : PR alarm
3	AUX : Auxiliary power (only remote ON/OFF)

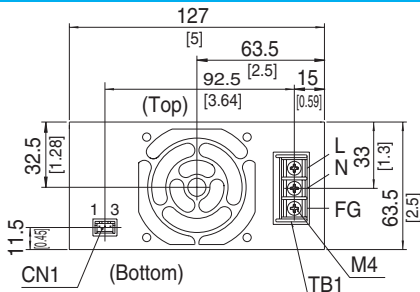
Mating connector and terminal of CN1

Connector	Mating connector	Terminal	Mfr.
CN1	S3B-XH-A	XHP-3	J.S.T.
		Reel : SXH-001T-P0.6	
		Bulk : BXH-001T-P0.6	

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 1.7kg max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminium
- ※ Dimensions in mm, []=inches
- ※ Mounting torque : $1.2\text{N} \cdot \text{m}$ (12.8kgf \cdot cm) max
- ※ Screw tightening torque M4 : $1.6\text{N} \cdot \text{m}$ (16.9kgf \cdot cm) max
- ※ M3 : $0.8\text{N} \cdot \text{m}$ (8.5kgf \cdot cm) max



ACE450F external view



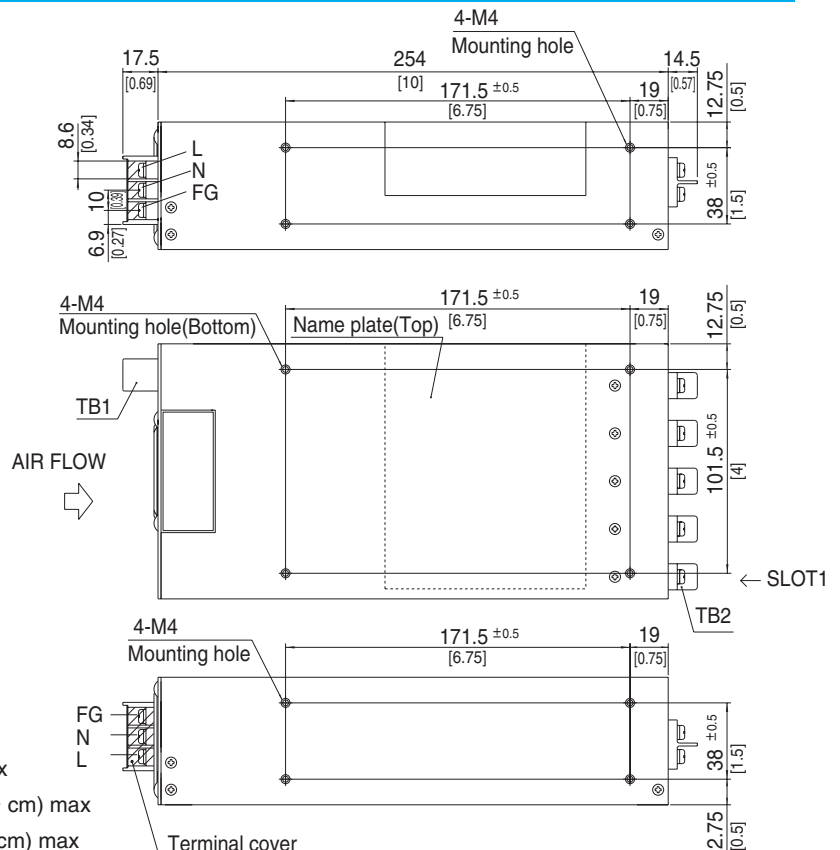
Pin connection and function of CN1

Pin No.	Function
1	G : Auxiliary power ground
2	PR : PR alarm
3	AUX : Auxiliary power (only remote ON/OFF)

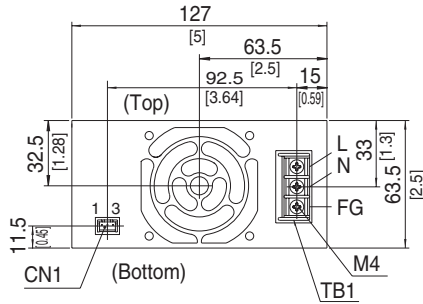
Mating connector and terminal of CN1

Connector	Mating connector	Terminal	Mfr.
CN1	S3B-XH-A	XHP-3	J.S.T.
		Reel : SXH-001T-P0.6	
		Bulk : BXH-001T-P0.6	

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 2.2kg max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminium
- ※ Dimensions in mm, []=inches
- ※ Mounting torque : $1.2\text{N} \cdot \text{m}$ (12.8kgf \cdot cm) max
- ※ Screw tightening torque M4 : $1.6\text{N} \cdot \text{m}$ (16.9kgf \cdot cm) max
- ※ M3 : $0.8\text{N} \cdot \text{m}$ (8.5kgf \cdot cm) max



ACE650F external view



Pin connection and function of CN1

Pin No.	Function
1	G : Auxiliary power ground
2	PR : PR alarm
3	AUX : Auxiliary power (only remote ON/OFF)

Mating connector and terminal of CN1

Connector	Mating connector	Terminal	Mfr.
CN1	S3B-XH-A	XHP-3	Reel : SXH-001T-P0.6 Bulk : BXH-001T-P0.6
			J.S.T.

※ Tolerance : ± 1 [± 0.04]

※ Weight : 2.4kg max

※ PCB Material/thickness : FR-4 / 1.6mm [0.06]

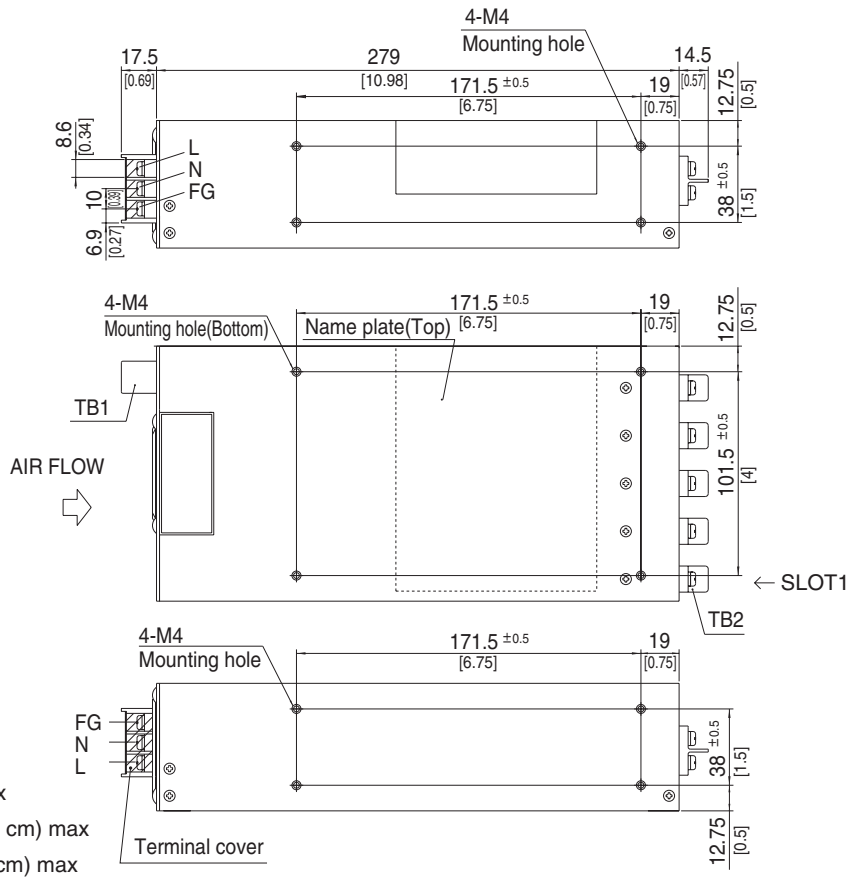
※ Chassis material : Aluminium

※ Dimensions in mm, []=inches

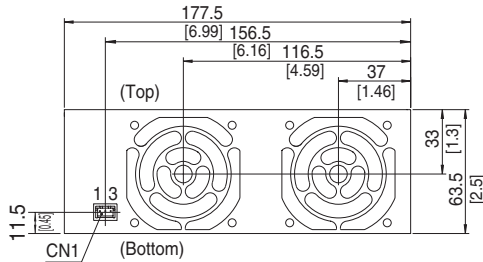
※ Mounting torque : 1.2N · m (12.8kgf · cm) max

※ Screw tightening torque M4 : 1.6N · m (16.9kgf · cm) max

M3 : 0.8N · m (8.5kgf · cm) max



ACE900F external view



Pin connection and function of CN1

Pin No.	Function
1	G : Auxiliary power ground
2	PR : PR alarm
3	AUX : Auxiliary power (only remote ON/OFF)

Mating connector and terminal of CN1

Connector	Mating connector	Terminal	Mfr.
CN1	S3B-XH-A	XHP-3	Reel : SXH-001T-P0.6 Bulk : BXH-001T-P0.6
			J.S.T.

※ Tolerance : ± 1 [± 0.04]

※ Weight : 3kg max

※ PCB Material/thickness : FR-4 / 1.6mm [0.06]

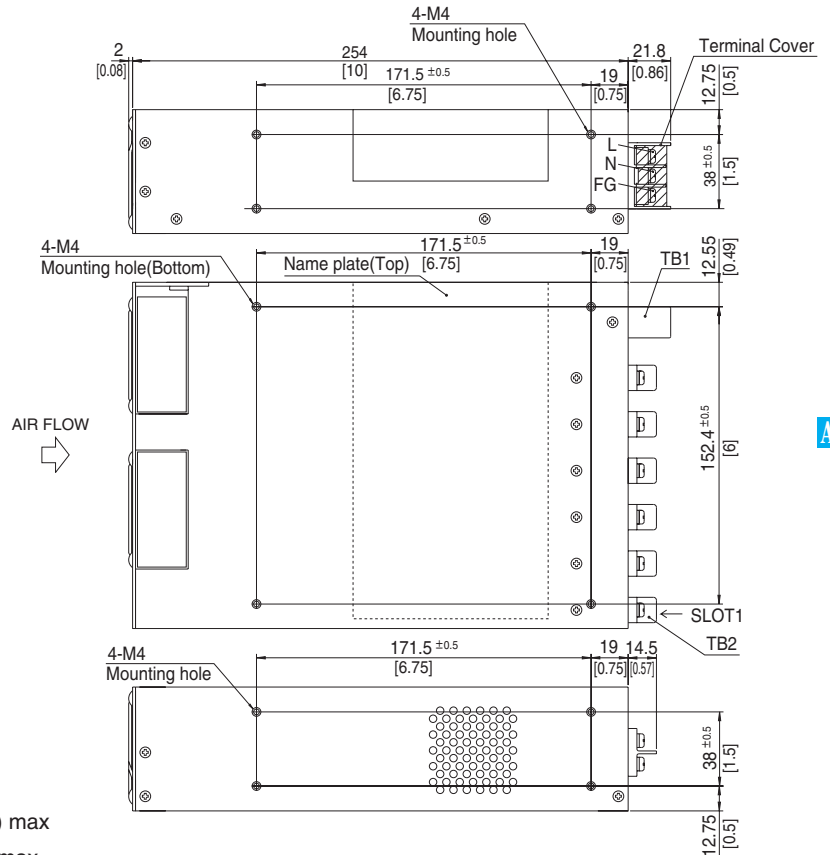
※ Chassis material : Aluminium

※ Dimensions in mm, []=inches

※ Mounting torque : 1.2N · m (12.8kgf · cm) max

※ Screw tightening torque M4 : 1.6N · m (16.9kgf · cm) max

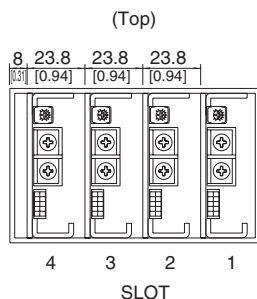
M3 : 0.8N · m (8.5kgf · cm) max



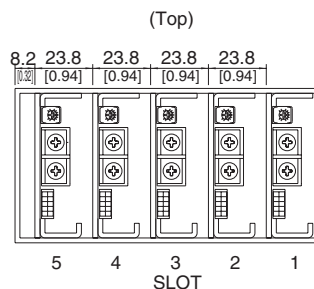
Output module and connector pin assign

1. Output side view

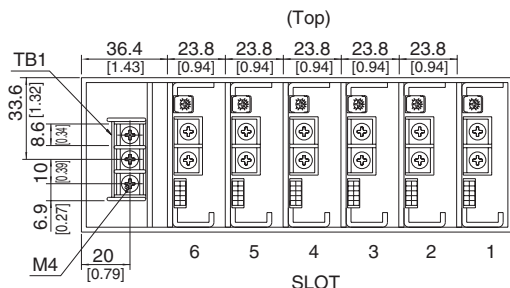
ACE300F Output side view



ACE450F/650F Output side view



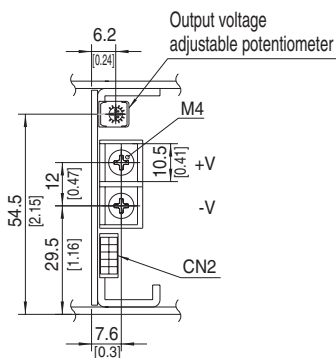
ACE900F Output side view



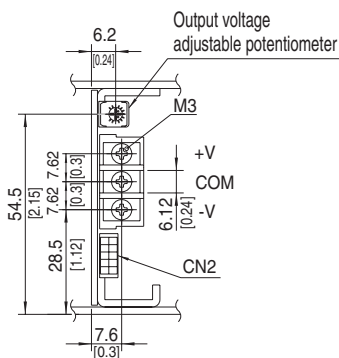
※Tolerance : ± 1 [± 0.04]

※Dimensions in mm, [] = inches

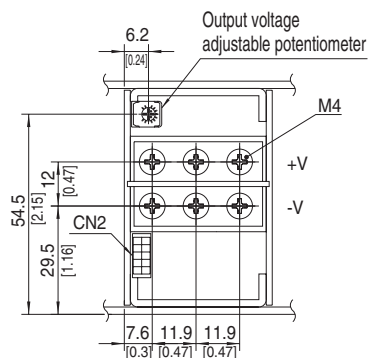
2. Output module side view and connector pin assign



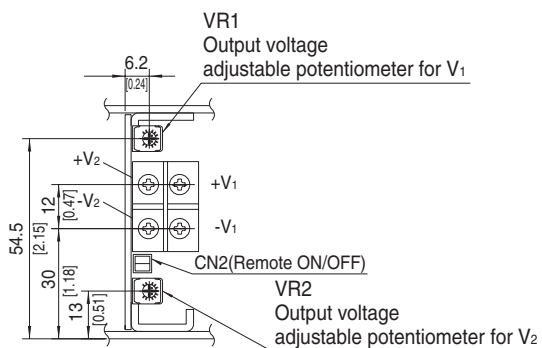
Module : A-K, L, M, N, P, R



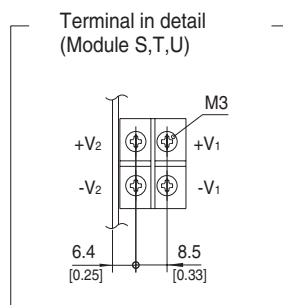
Module : Y, W, Z, 9, Q, V



Module : 2A-2K



Module : S, T, U



※Tolerance : ± 1 [± 0.04]

※Dimensions in mm, [] = inches

Output module and connector pin assign

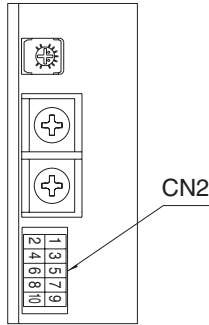
●CN2 connector pin assign except module S,T,U

Mating connector and terminal of CN2 in Output Module

Connector	Mating connector	Terminal	Mfr.
CN2	S10B-PHDSS	PHDR-10VS	J.S.T.
		Chain : SPHD-002T-P0.5 Loose : BPHD-001T-P0.5 BPHD-002T-P0.5 *1	

※ The housing for the remote sensing unused is mounted on CN2 of each output module(applying module : A - K,2A - 2K).

*1 Please consult J.S.T for a non-standard crimping tool.



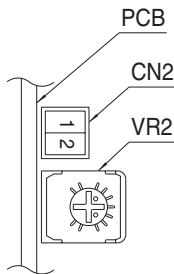
Pin connection and function of CN2 in Output Module

Pin No.	Function	
	Applying module : A - K,2A - 2K	Applying module : L,M,N,P,R,Y,W,Z,9,Q,V
1	RC+ : Remote ON/OFF +	RC+ : Remote ON/OFF +
2	RC- : Remote ON/OFF -	RC- : Remote ON/OFF -
3	N/C : N.C.	N/C : N.C.
4	N/C : N.C.	N/C : N.C.
5	LV+ : LV alarm	LV+ : LV alarm
6	LV- : LV alarm ground	LV- : LV alarm ground
7	+M : Self sensing terminal. (Do not wire for external connection.)	N/C : N.C.
8	+S : + Remote sensing	N/C : N.C.
9	-M : Self sensing terminal. (Do not wire for external connection.)	N/C : N.C.
10	-S : - Remote sensing	N/C : N.C.

●CN2 connector pin assign of module S,T,U

Mating connector and terminal of CN2 in Output Module

Connector	Mating connector	Terminal	Mfr.
CN2	S2B-PH-K-S	PHR-2	J.S.T.
		Chain:SPH-002T-P0.5S Loose:BPH-002T-P0.5S	



Pin connection and function of CN2 in Output Module

Pin No.	Function
1	Remote ON/OFF +
2	Remote ON/OFF -

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
Input module of ACE300F	Active filter	80	3.7*1	250V 8A	SCR	FR-4		Yes	No	No
Input module of ACE450F	Active filter	80	5.7*2	250V 10A	SCR	FR-4		Yes	No	No
Input module of ACE650F	Active filter	80	8.0*3	250V 15A	SCR	FR-4		Yes	No	No
Input module of ACE900F	Active filter	80	11*4	250V 20A	SCR	FR-4		Yes	No	No
Output module A-K	Forward converter	120	–	–	–	FR-4		Yes	Yes*5	Yes*7
Output module 2A-2K	Forward converter	120	–	–	–	FR-4		Yes	Yes*5	Yes*7
Output module L,M,N,P,R	Forward converter	120	–	–	–	FR-4		Yes	Yes*5	No
Output module Y,W,Z,9,Q,V	Forward converter	120	–	–	–	FR-4		Yes	Yes*6	No
Output module S,T,U	Forward converter	120	–	–	–	FR-4		Yes	Yes*6	No

*1 Input current is based on Model AC3-HHEC-00 outputs 250W at AC100V.

*2 Input current is based on Model AC4-HHECC-00 outputs 400W at AC100V.

*3 Input current is based on Model AC6-HHECC-00 outputs 600W at AC100V.

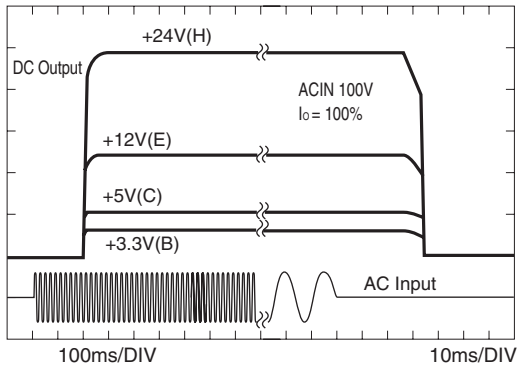
*4 Input current is based on Model AC9-HHECC-00 outputs 800W at AC100V.

*5 Series operation is possible with the same output modules.

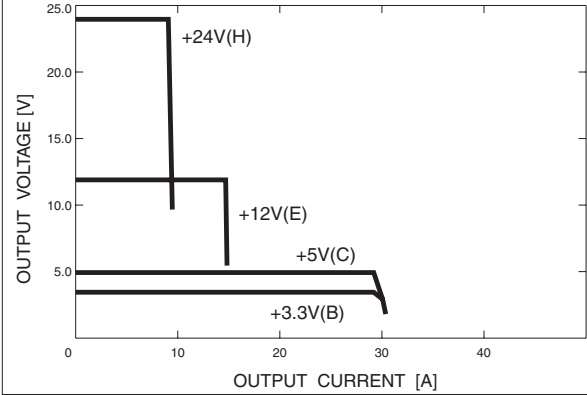
*6 Series operation is possible, but series bar cannot be set by the series code.

*7 Parallel operation is possible with the same output voltage module.

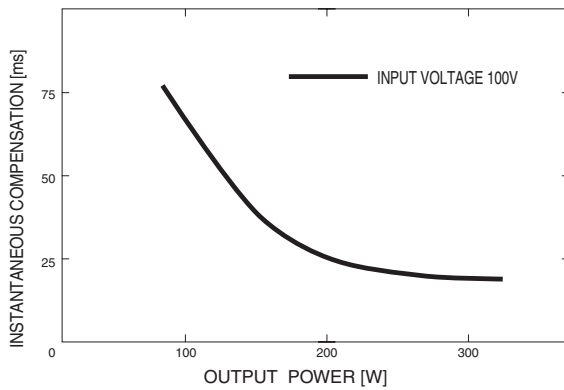
● RISE TIME & FALL TIME



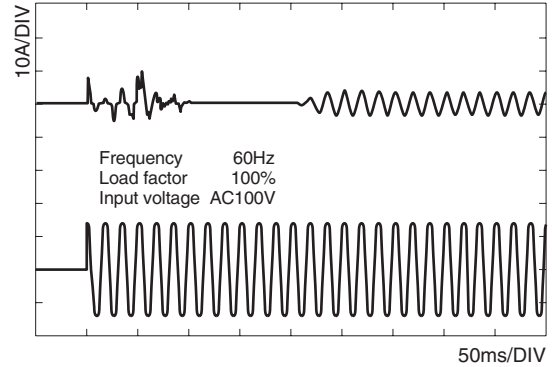
● OVER CURRENT CHARACTERISTICS



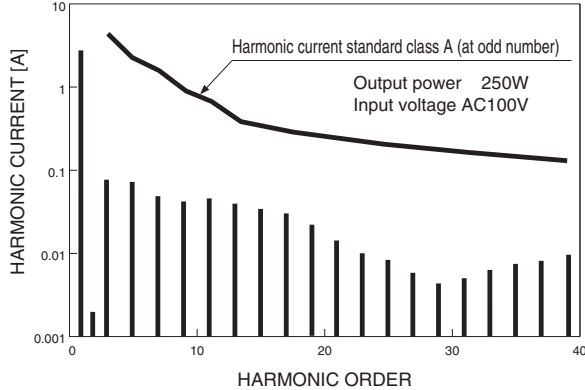
● INSTANTANEOUS INTERRUPTION COMPENSATION (AC3-HEEC-00)



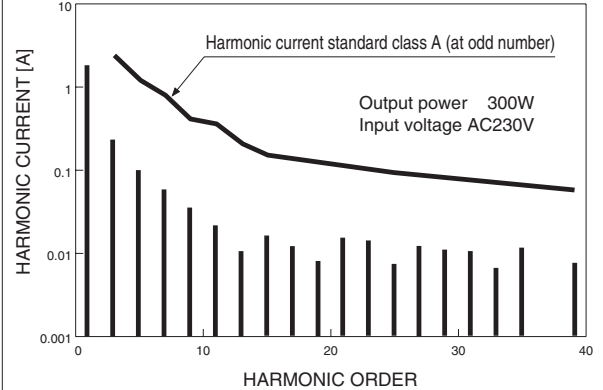
● INRUSH CURRENT (AC3-HEEC-00)



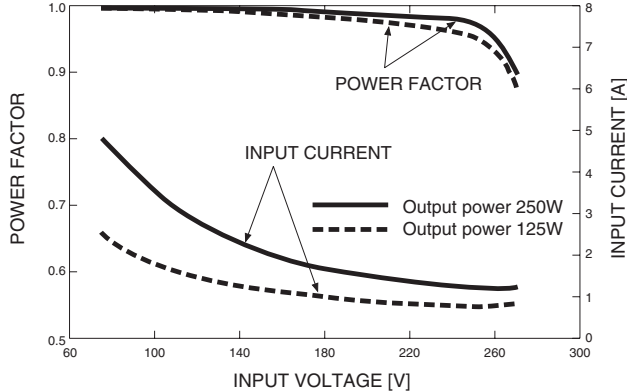
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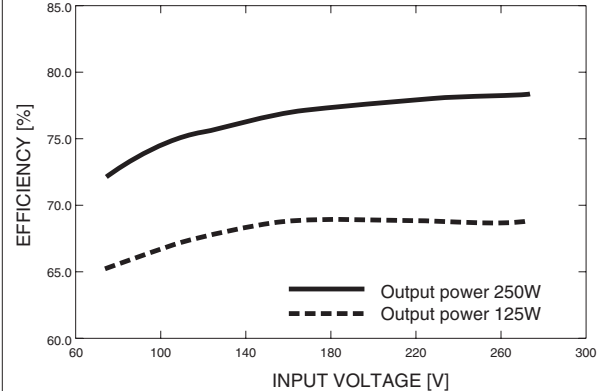
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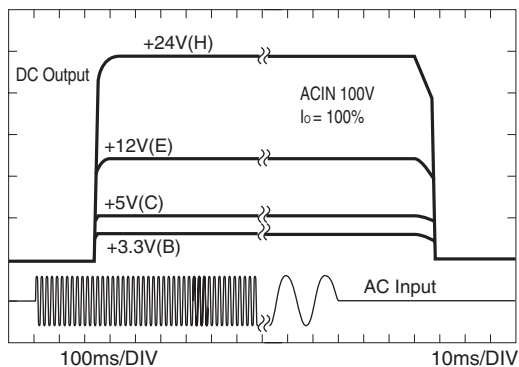
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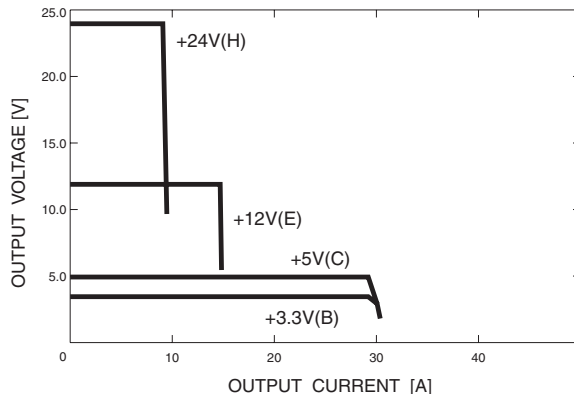
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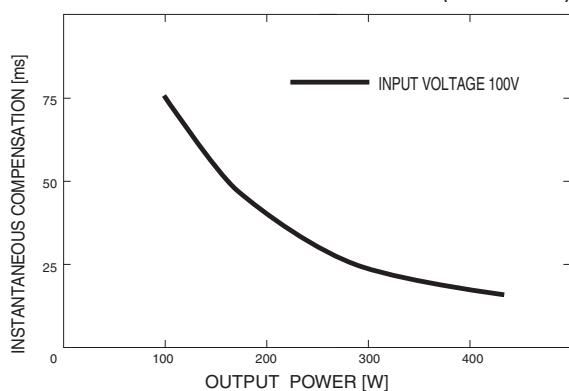
● RISE TIME & FALL TIME



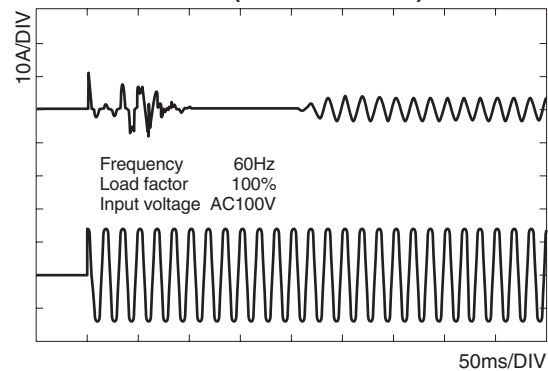
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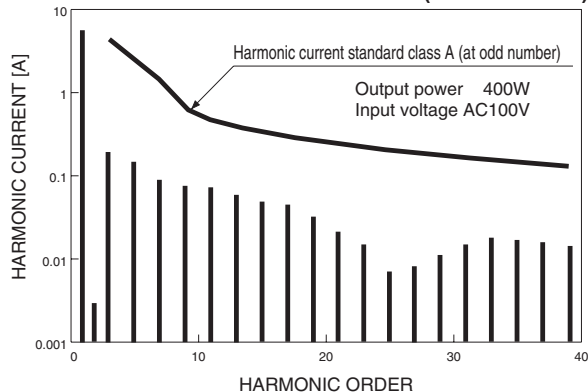
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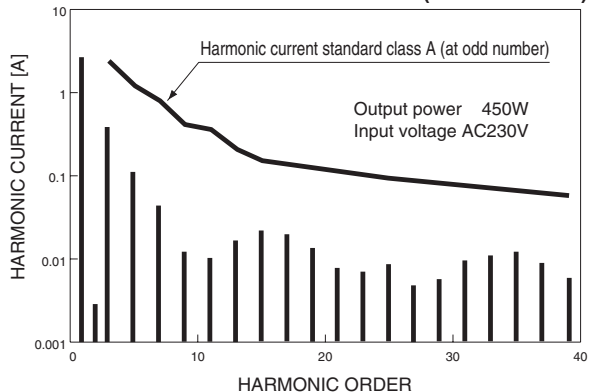
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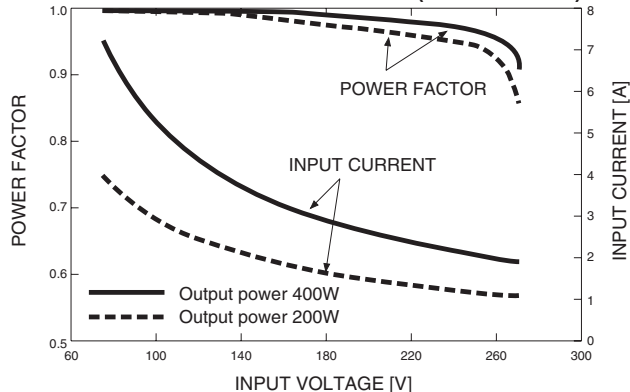
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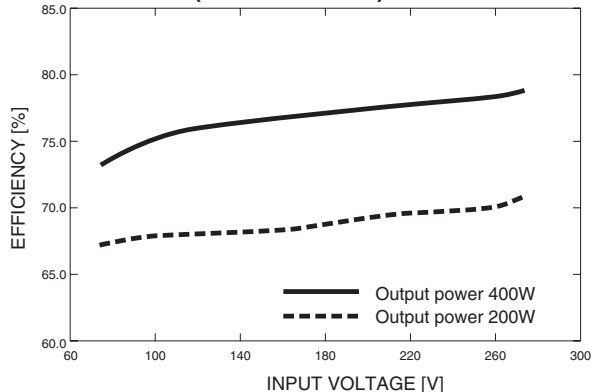
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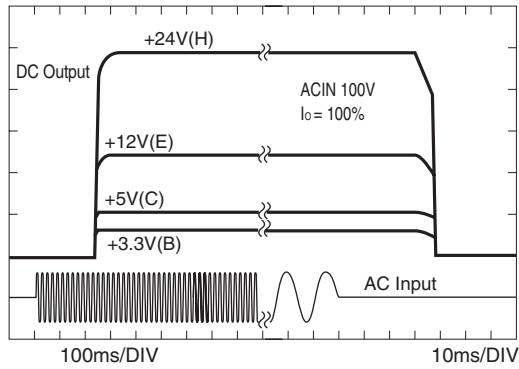
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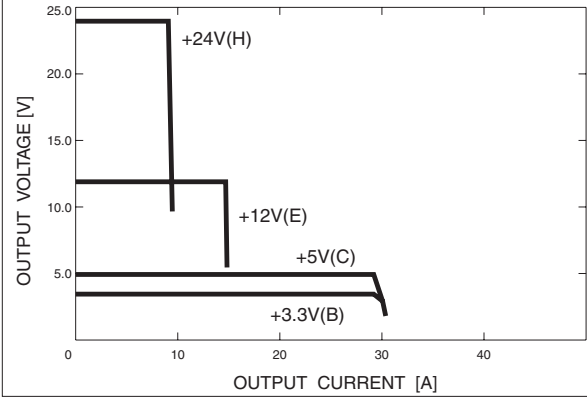
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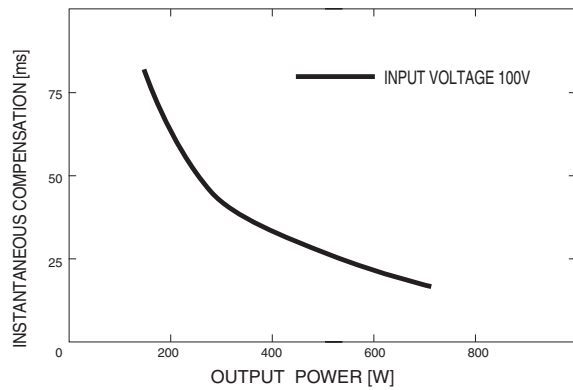
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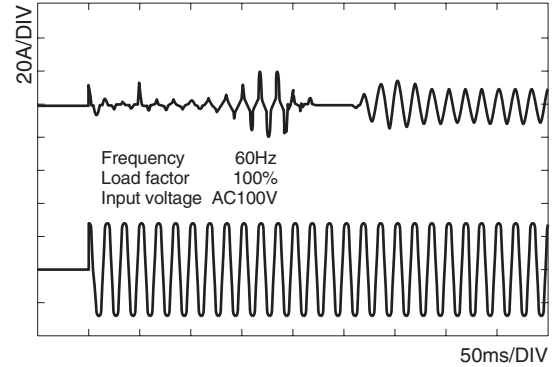
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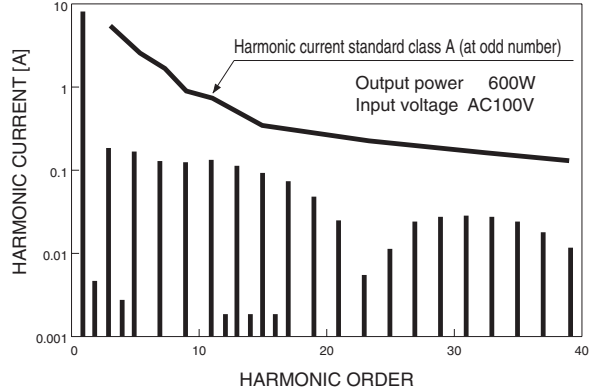
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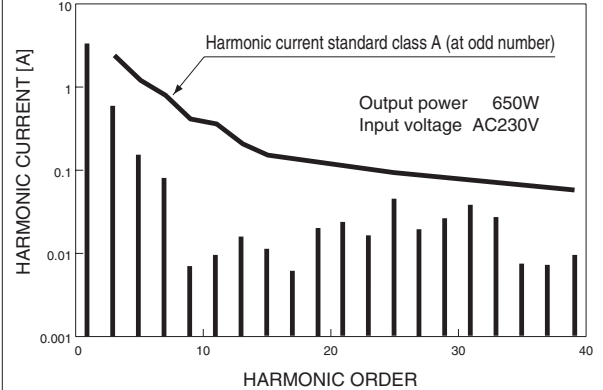
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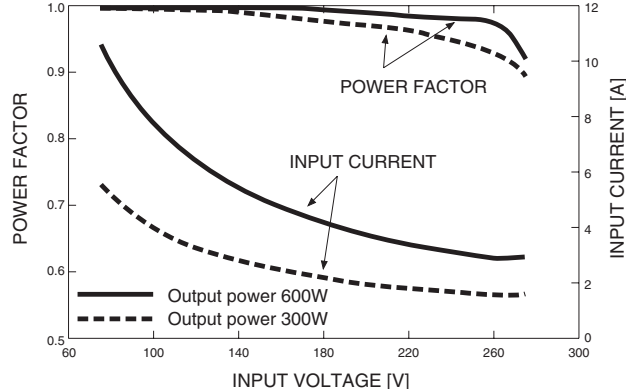
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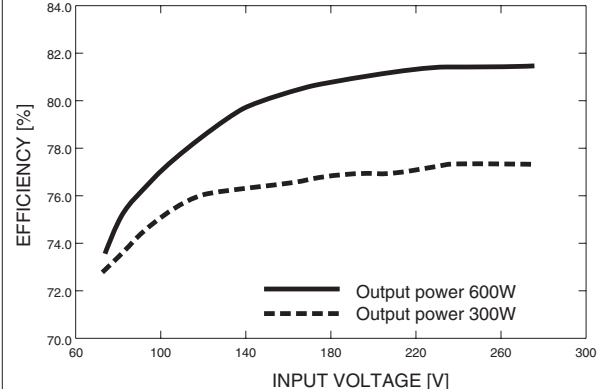
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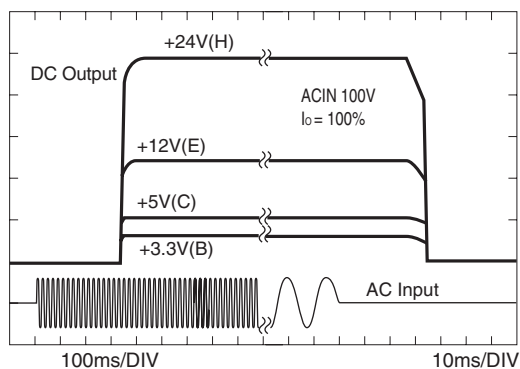
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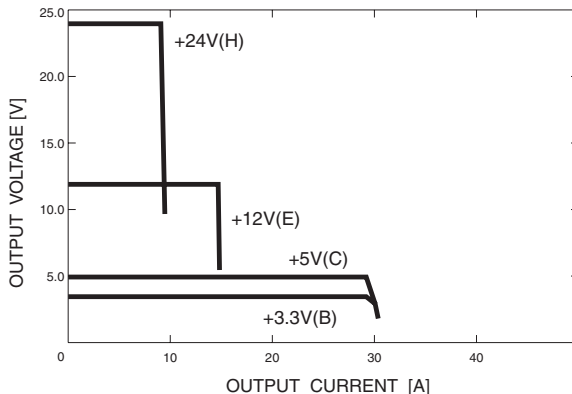
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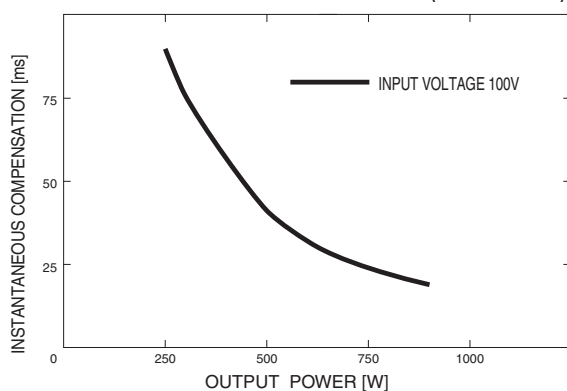
● RISE TIME & FALL TIME



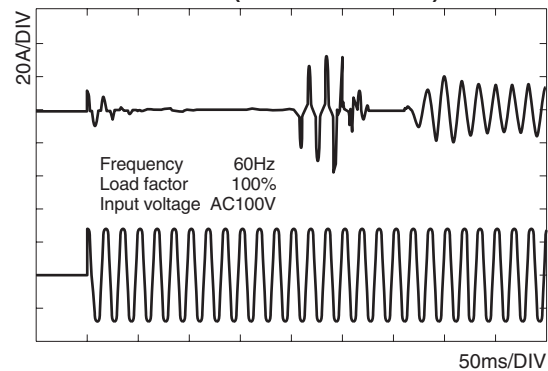
● OVER CURRENT CHARACTERISTICS



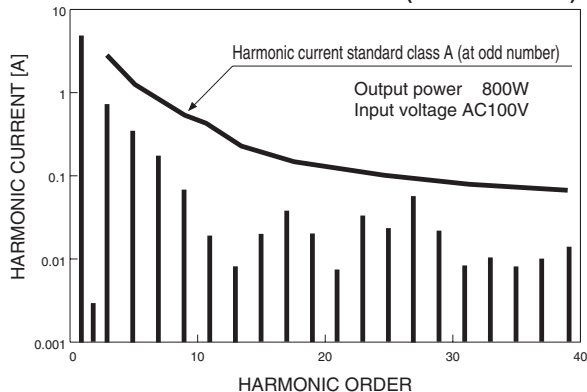
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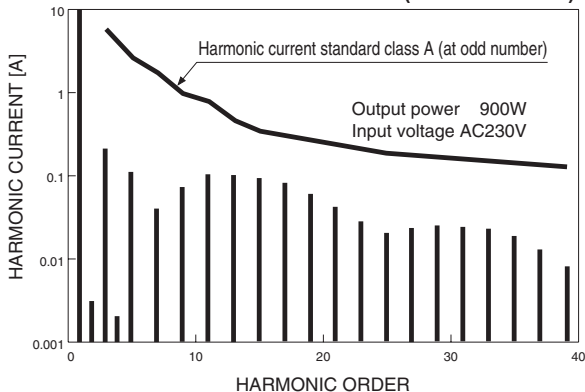
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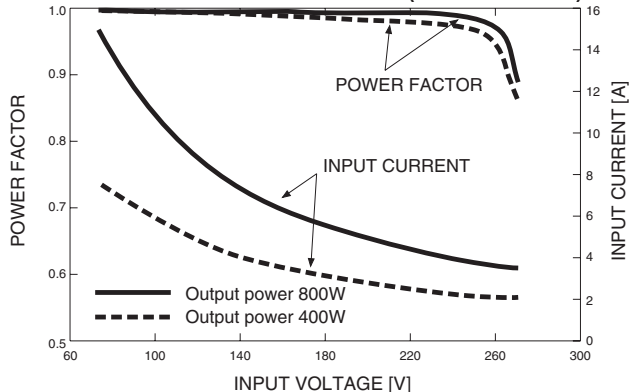
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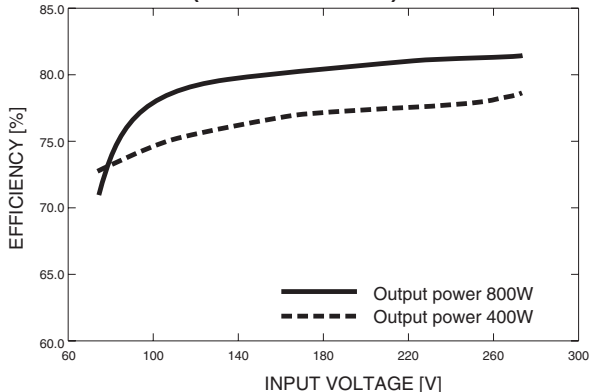
● INPUT HARMONIC CURRENT AC230V (AC9-HHECC-00)



● POWER FACTOR & INPUT CURRENT (AC9-HHECC-00)



● EFFICIENCY (AC9-HHECC-00)



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1 Ordering information

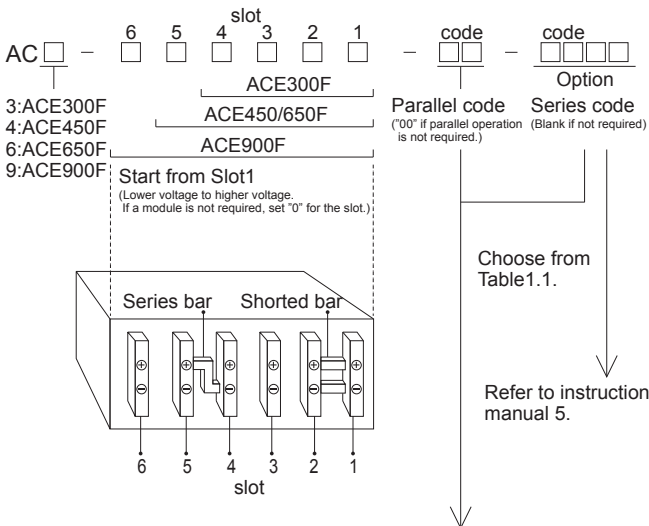
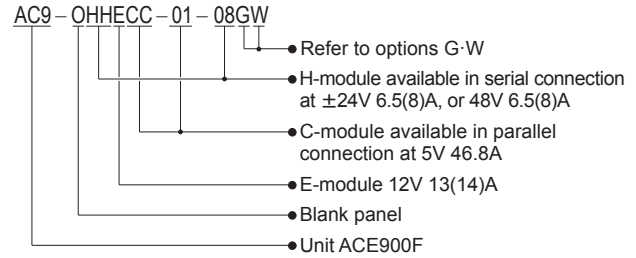


Table 1.1 Parallel / Series code

	code	slot6	slot5	slot4	slot3	slot2	slot1
ACE300F	00						
	01					●	●
	02				●	●	●
	03				●	●	●
	04			●	●		
	05			●	●	●	●
	06			●	●	●	●
	07			●	●	●	●
ACE450/650F	08		●	●			
	09		●	●		●	●
	0A		●	●	●	●	●
	0B		●	●	●	●	●
	0C		●	●	●		
	0D		●	●	●	●	●
	0E		●	●	●	●	●
	0F		●	●	●	●	●
ACE900F	10	●	●				
	11	●	●			●	●
	12	●	●		●	●	●
	13	●	●		●	●	●
	14	●	●	●	●		
	15	●	●	●	●	●	●
	16	●	●	●	●	●	●
	17	●	●	●	●	●	●
	18	●	●	●			
	19	●	●	●		●	●
	1A	●	●	●	●	●	●
	1B	●	●	●	●	●	●
	1C	●	●	●	●		
	1D	●	●	●	●	●	●
	1E	●	●	●	●	●	●
	1F	●	●	●	●	●	●

● : Output terminal
— : Connection

PART NUMBERING EXAMPLE (1)



PART NUMBERING EXAMPLE (2)

If the parallel operating module C (5V, 46.8A) in example (1) is changed to module 2C(5V, 60A), the part number would change to AC9-0HHE2C-00-08GW.

PART NUMBERING EXAMPLE (3)

Parallel and series operation of 2A-2K both use codes as in Table 1.1.

For example, if connecting two modules 2E [12V, 25(34)A] in series, and using these as 24V, 25(34)A, the part number would change to AC9-002E2E-00-02.

Naming rules

- Confirm the output voltage and current, and select the code for output modules to be installed in slots 1-6 from the output module specifications. Use an "O" to designate slots where no output module will be installed.
- If the supply will be operated in parallel or in series, refer to Table 1.1 for the proper placement of the bus bar(s) between the output modules, and the appropriate code designation(s).
 - ★ Refer to section 2 for notes on settings for series and parallel operation.
- A minimum of two slots must be filled.
- List of modules which may be used for series or parallel operation.

Parallel setting	possible	A-K, 2A-2K
	impossible	L, M, N, P, R, S, T, U, Y, W, Z, 9, Q, V
Series setting	possible	A-K, 2A-2K, L, M, N, P, R
	impossible	S, T, U, Y, W, Z, 9, Q, V

■ Series operation can provide a higher maximum output voltage, depending on the modules used. In addition, series operation provides a dynamic load response superior to that of parallel operation during abrupt changes in load. Therefore, we recommend operation in series for dynamic loads in order to increase power.

2 Series operation and Parallel operation in Modular power supply

2.1 Series operation

■ Series operation is possible only between identical output modules. If series operation is specified in the part number, the supply will be shipped with a series bar installed. However, series operation is possible with modules S, T, U, Y, W, Z, 9, Q, and V, but series bar cannot be specified.

■ The output current in series operation is the same as that of the individual modules that are connected.

■ Please consider the following items when configuring your supply for series operation:

- ① Connect only the same type of modules in series.
- ② A total rated voltage of up to 48V can be set up for series operation.
- ③ Modules in the same power supply can be set up for series or parallel operation, but not both.

Please consult with us for usage other than in accordance with the above conditions.

2.2 Parallel operation (applying module : A-K, 2A-2K)

■ Parallel operation is possible using modules with identical output voltage. If parallel operation is specified in the part number, the supply will be internally configured accordingly, and shipped with the appropriate bus bar in place. Parallel operation cannot be set up once the unit has been shipped.

■ Output current in parallel operation.

Current ratings for output modules connected in parallel are derated by 10%.

Ex.: AC4-HHECB-08

- Parallel code 08 means slots 4 and 5 are connected in parallel.
- The output module for slots 4 and 5 is "H". Therefore, the current is as shown below:

$$\text{Current} = (6.5\text{A} + 6.5\text{A}) \times 0.9 = 11.7\text{A}$$

■ Please consider the following when configuring your supply for parallel operation.

- ① Please consult us as regarding usage methods for remote sensing.

② Peak loads cannot be obtained.

③ In case that output voltage adjustment is required for modules connected in parallel, the modules aforementioned must be adjusted. If precision adjustment is required, remove the bus bar between modules, adjust the output voltage, and reinstall the bus bar. The output voltage difference will appear as load regulation. To reduce the regulation, adjust the output voltage as same as possible. Adjust the output voltage so that each voltage get same value to reduce the regulation.

④ In case that output current changes rapidly such as pulse load, the output voltage fluctuation (dynamic load regulation) value may increase. Therefore, please consult us in advance if the unit will be used for such a application.

■ At startup, modules connected in series or in parallel, may show stepped input and output voltage waveforms. This is due to a delay in the rise time.

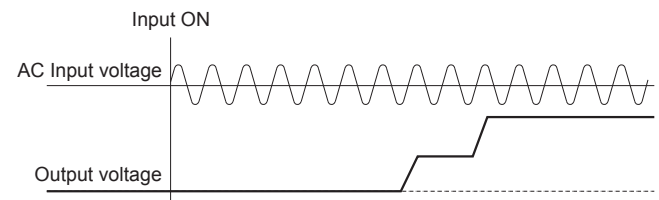


Fig. 2.1 Start-up waveform for series and parallel operation

3 Function

3.1 Input voltage range

■ The input voltage range is from 85 VAC to 264 VAC, or 120 VDC to 350 VDC.

■ In cases that conform with safety standard, input voltage range is AC100-AC240V(50/60Hz).

■ Be aware that use of voltages other than those listed above may result in the unit not operating according to specifications, or may cause damage. Avoid square waveform input voltage, commonly used in UPS units and inverters.

3.2 Inrush current limiting

■ Inrush current limiting is built-in.

■ If a switch is being used for input, ensure that it is rated to handle the input inrush current. When turning the power OFF and then ON again within a short period of time, the inrush current limiting may be disabled, therefore, ensure sufficient time elapses before restarting.

■ Inrush current limiting uses a thyristor, therefore primary inrush current and secondary inrush current are generated. If power is turned ON and OFF repeatedly, failure may result. Please allow enough time between power ON and OFF.

3.3 Overcurrent protection

■ Overcurrent protection is built in (activated at 105% of the rated current, or for operation with peak current, at 101% of the peak current); however avoid short circuits or overcurrent. The unit automatically recovers when the cause of the short or overcurrent is cleared.

■ When the output voltage drops as a result of the overcurrent circuit being activated, the average output current is reduced by intermittent operation of the power supply (intermittent overcurrent mode).

■ Auxiliary power (AUX)

Output that supplies power to the RC terminal of output modules. AUX power is designed to be used for control of the remote ON/OFF function.

■ Peak current protection (applicable modules: 2E-2K)

Peak current protection is built in (refer to Output module specifications ※1 for peak current usage methods).

Peak current protection operates independently for each output module. Its activation will not halt the entire power supply. Shut off input AC voltage, wait for at least 2-3 minutes, and recycle to recover output voltage(★).

★ The recovery time varies depending on input voltages and load status during operation.

3.4 Thermal protection

■ Thermal protection is built in. If either of the following takes place, the thermal protection may be activated, shutting off the output:

- ① The current or temperature is continuously in excess of the derating curve.
- ② The fan has stopped or the airflow from the fan is reduced by an obstruction.

If the thermal protection is activated, shut off input voltage, remove the cause of the overheating, wait for the unit to cool down, and recycle to recover output voltage.

3.5 Overvoltage protection

■ Overvoltage protection operates independently for each output module. Its activation will not halt the entire power supply.

Overvoltage protection is built in. When the overvoltage protection is activated, shut off input, wait for at least 1-2 minutes, and recycle to recover output voltage.

The recovery time varies depending on input voltage, etc.

- When testing the power supply for overvoltage performance or applying voltage from the load circuit, please note that components inside the power supply might fail if the voltage applied exceeds the rated output voltage.

3.6 Output voltage adjustment

■ Output voltage can be adjusted by turning the internal potentiometer.

■ Refer to specifications for adjustment ranges. Please consult with us regarding operation outside the specified ranges.

★ For modules Y, W, Z, 9, and Q, turning the internal potentiometer clockwise increases the positive voltage and decreases the negative voltage simultaneously.

3.7 Remote sensing

(applying module : A-K, 2A-2K)

■ Each output module incorporates remote sensing functions.

■ If remote sensing is not used, then please short +S and +M, and -S and -M at the CN2 output module.

Fig. 3.1 shows wiring for when remote sensing is not used.

The unit is shipped with harnesses for when remote sensing is not used.

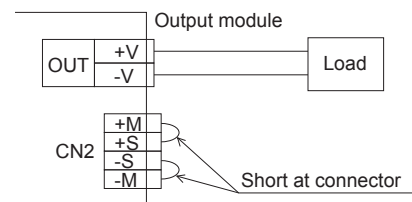


Fig. 3.1 When the remote sensing function is not used

■ Wiring method with remote sensing is shown in Fig.3.2.

■ Please consider the following when using remote sensing:

- ① Be sure connections are made properly. If the load wire is not connected correctly, a load current may flow through the sensing wire, which could damage circuitry inside the power supply.
- ② Wire of an appropriate type and gauge should be used to connect the power supply to the load. Line drop should be less than 0.3V.
- ③ When using the remote sensing function, oscillation in the power supply output voltage, or significant variations in output voltages can be generated by wiring or load impedance.

The following are ways to remedy instability in output voltage.

- Remove remote sensing from the negative side, and short -S and -M at the CN2 on each output module.
- If oscillation occurs, connect C₀, C₁, and R1.

Please consult us for details.

■ Ensure that current is not drawn from the CN2 +M or -M terminals.

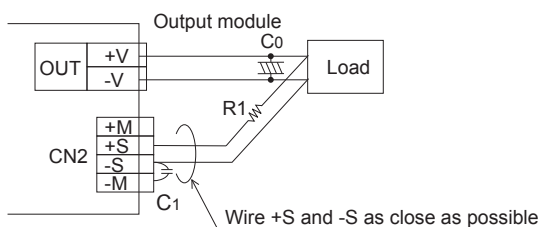


Fig. 3.2 When the remote sensing function is used

3.8 Remote ON/OFF

■ Each output module incorporates remote ON/OFF functions. Output voltage ON/OFF can be controlled by applying a voltage to CN2 at each output module.

■ Dedicated auxiliary power (AUX) for remote ON/OFF.

Auxiliary power (AUX) is built-in for control of remote ON/OFF.

Auxiliary power (AUX) is isolated from input, output, and FG.

Remote ON/OFF connection methods with AUX are shown in Fig. 3.3.

■ Remote ON/OFF control logic.

① The output stops when voltage (4.5 - 12.5V) is applied to RC+.

★ Reverse logic option (-R) also available. Refer to section 5. Option.

② The built-in fan does not stop even if the output is turned OFF using remote ON/OFF.

③ If the output has been turned OFF using remote ON/OFF, the LV alarm signal will be generated (except modules, S, T, and U).

④ This function operates on each output module independently.

■ Remote ON/OFF circuits operate independently on each output module; therefore it is possible to use remote ON/OFF on individual output modules. Please be aware that this cannot turn off all outputs together. If turning off all output modules together is a requirement, we recommend use of the remote ON/OFF circuits in series or parallel.

■ The remote ON/OFF circuit (RC+, RC-) is isolated from input, output, and FG.

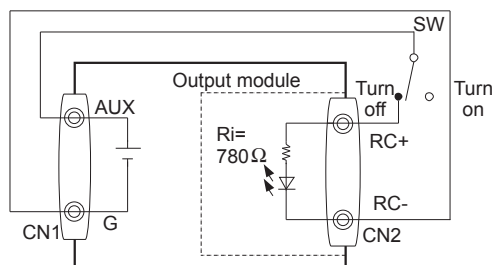


Fig. 3.3 Example of use with remote ON/OFF

Table 3.1 Remote ON/OFF specifications

Connection method		Fig 3.3 Remote SW
SW Logic	Turn on	SW open (0-0.5V between RC+ and RC-)
	Turn off	SW close (12V between RC+ and RC-)
Bases terminal		CN2 RC-

3.9 Isolation

■ When performing incoming inspections, ensure that the applied voltage is increased gradually. Additionally, when turning off power to the unit, use a dial to gradually reduce the voltage. Do not use a voltage tester in conjunction with a timer. Doing so may generate voltage several times higher than the applied voltage.

3.10 Alarm

■ The following two types of alarm function are built in.

Refer to Table 3.2 for details.

① PR: abnormal input voltage, fan alarm

② LV: abnormal output module voltage (except modules S, T, and U).

Table 3.2 Explanation of alarms

	Alarm	Output of alarm
PR	When input voltage is abnormal (low input voltage) or the fan stops, the alarm signal is generated from CN1.	Open collector method Good : Low (0-0.8V, 1-20mA) Fail :35V max
LV	When rated output voltage decreases or stops, the alarm signal is generated from CN2. Note : ① In the event of overcurrent output (intermittent current), operation of the alarm will become inconsistent. ② The LV alarm is not isolated from output. Therefore, make sure all connections are correct when the power supply is used to supply negative voltage or is operated in series. (Refer to Fig. 3.5).	Open collector method Good : Low (0-0.8V, 1-20mA) Fail :35V max

Please consult us details.

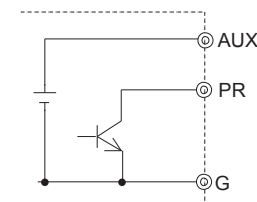


Fig. 3.4 PR internal circuit

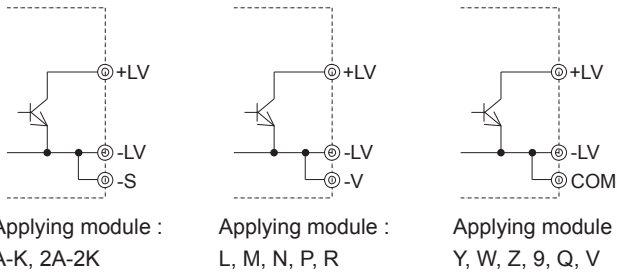


Fig. 3.5 LV internal circuit

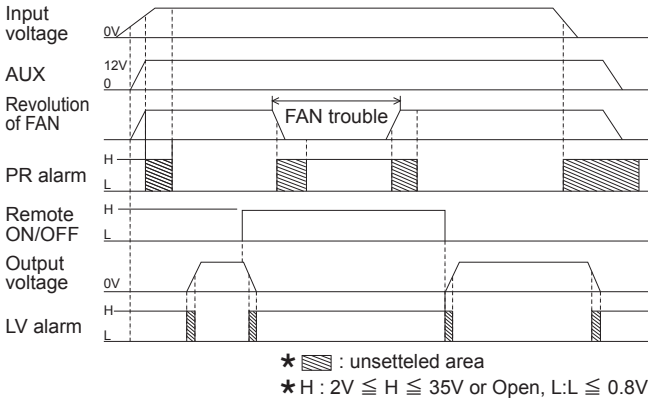


Fig. 3.6 Sequences for alarm types

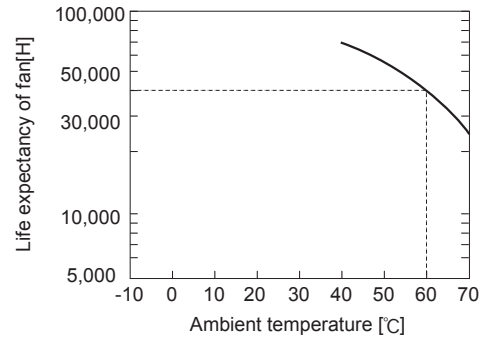


Fig. 4.2 Life expectancy of fan(R(t)=90%)

■When mounting the power supply with screws, it is recommended that this be done as shown in Fig. 4.3. If other methods are used, be sure the weight of the power supply is taken into account.

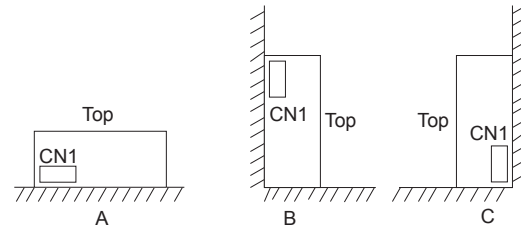


Fig. 4.3 Installation method 1

■Avoid installation method 2 as shown in Fig. 4.4, which can cause stress on the mounting holes.

■Maximum length of mounting screws is 6mm (Refer to Fig. 4.5).

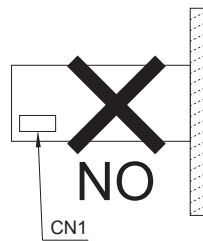


Fig. 4.4 Installation method 2

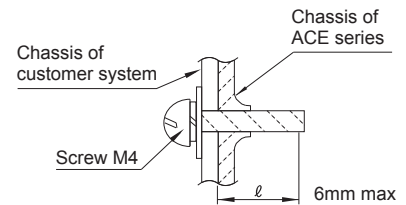


Fig. 4.5 Mounting screw

4 Assembling and installation method

4.1 Installation method

■Fans for forced air cooling are built in.

Ensure that the inlet (rear) and outlet (output terminal) vents are not blocked, to prevent disruption of the airflow.

★Option with reversed airflow (-F) is also available.



Fig. 4.1 Air flow

■If the unit is used in a dusty environment, an air filter should be used so the cooling efficiency of the fan is not reduced.

■If the fan stops, the thermal protection may be activated, shutting down the output. Life expectancy of the fan varies depending on usage conditions; therefore regular inspections of the fan are required for increased reliability. Should the fan become non-operational over the course of time, it can be replaced. Refer to the optional parts section of this catalog.

4.2 Derating

■The ACE series comprises power supplies consisting of a combination of output modules. Make sure each output module is used within specifications, and that the total output power of all modules is equal to, or less than the rated total output power.

■The derating curve for the ambient temperature (inlet temperature for cooling) of output modules is shown in Fig. 4.6.

■Operation within the hatched area will result in different ripple and ripple noise specifications.

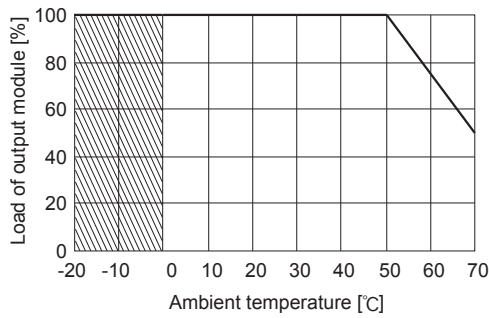


Fig. 4.6 Derating curve for ambient temperature

■ The derating curve with respect to input voltage is shown in Figs. 4.7 to 4.10.

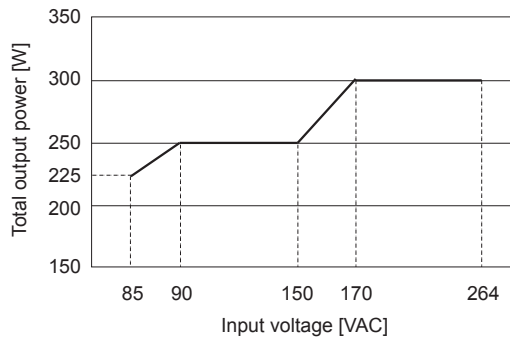


Fig. 4.7 Derating curve for input voltage (ACE300F)

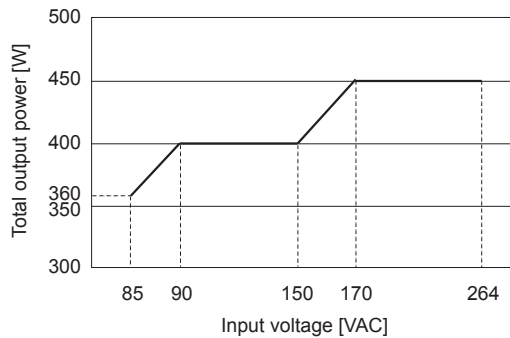


Fig. 4.8 Derating curve for input voltage (ACE450F)

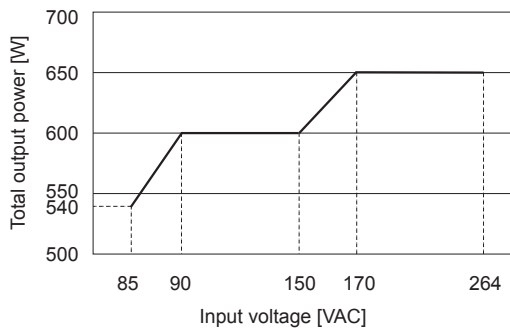


Fig. 4.9 Derating curve for input voltage (ACE650F)

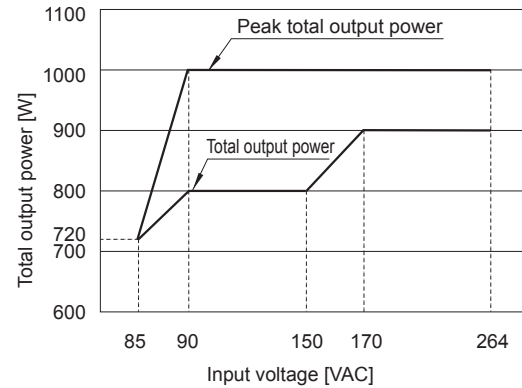
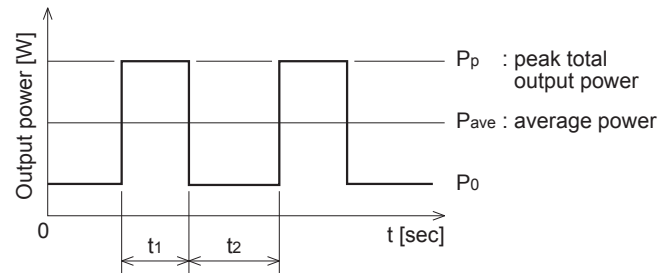


Fig. 4.10 Derating curve for input voltage (ACE900F)

■ The ACE900F can output peak power under the following conditions.



$$t_1 \leq 1[\text{sec}], P_{\text{ave}} = \frac{P_p t_1 + P_0 t_2}{t_1 + t_2} \leq \text{total output power}, \frac{t_1}{t_1 + t_2} \leq 0.3$$

Fig. 4.11 Peak output power (ACE900F only)

■ Definition of load factor

$$A_0 = \frac{(\text{Sum of each module power})}{(\text{Total output power})} \times 100$$

$$= \frac{\sum_{k=1}^6 (I_{k1} \times V_{k1} + I_{k2} \times V_{k2})}{(\text{Total output power})} \times 100$$

Note : Only the number with a small occupation slot number is calculated in 2A-2K.

$$A_{11}, A_{21}, A_{31}, A_{41}, A_{51}, A_{61} : A_{k1} = I_{k1} / I_{0k1} \times 100$$

$$A_{12}, A_{22}, A_{32}, A_{42}, A_{52}, A_{62} : A_{k2} = I_{k2} / I_{0k2} \times 100$$

I_{k1} , V_{k1} , I_{0k1} : output current (★1), voltage, and rated current (★2) for modules S, T, and U (excepting V2).

I_{k2} , V_{k2} , I_{0k2} : output current, voltage, and rated current for V2 in modules S, T, and U.

Total output power : Dependent upon input voltage
(Refer to Figs.4.7-4.10)

★1 The output current for module codes Y, W, Z, 9, Q, and V is the sum of + and - output currents.

★2 Rated output for modules is as below.

· Excepting module codes Y, W, Z, 9, Q, and V

: Refer to output module specifications

· Module codes Y, W, Z, 9, Q, and V

: 10A(Y), 6.4A(W), 5A(Z), 3.2A(9)

12.8A(Q), 11A(V)

(Sum of +current and -current)

Load [%]=maximum value of A_0 to A_{52}

■ Load regulation in modules Y, W, Z, 9, Q, and V

Ensure that the sum of + and - output is less than total output as follows: Y: 50W, W: 76.8W, Z: 75W, 9: 76.8W, Q: 153.6W, and V: 165W.

The relationship between current and load regulation is shown in the following example(Refer to Fig. 4.12).

<Example for module W>

- (1) Rated current 1 : 3.2A --- When drawing current within the range of +3.2A and -3.2A (total 6.4A), the specifications of load regulation are as in "Load regulation 1".
- (2) Rated current 2 : 4.2A --- When drawing current within the range +4.2A and -2.2A (or +2.2A and -4.2A, total 6.4A) the specifications of load regulation are as in "Load regulation 2".
- (3) Peak current : 5A ----- Loads of +5 A and -1.4 A (or +1.4 A and -5A, total 6.4A) are possible. However, refer to Output Module Specifications ★1 when drawing 4.2-5A.

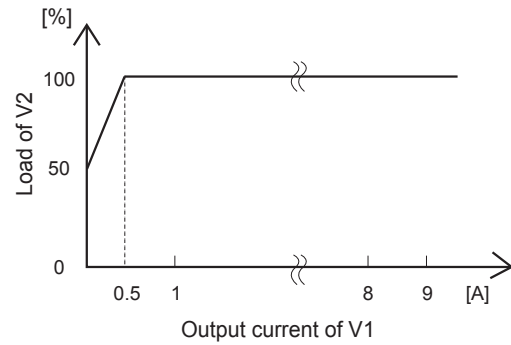
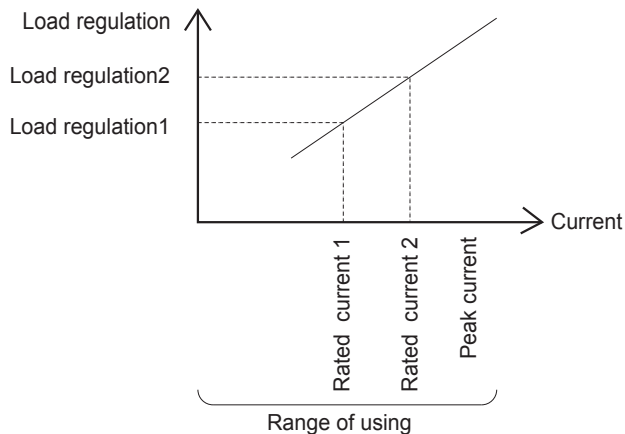


Fig. 4.13 Minimum output current of V1

■ Usage example

[Example1] Method to confirm that AC4-LWHEC-00 can be used under the following conditions.

Input voltage : 100 VAC
 Ambient temperature : 50℃
 Output module : slot1 : 5V 15A
 slot2 : 12V 7A
 slot3 : 24V 6A
 slot4 : +12V 4A, -12V 1A
 slot5 : 3.3V 10A

Calculating A_{11} ~ A_{51}

$$\begin{aligned}
 A_0 &= \frac{(\text{Sum of each module power})}{(\text{Total output power})} \times 100 \\
 &= \frac{\sum_{k=1}^6 (I_{k1} \times V_{k1} + I_{k2} \times V_{k2})}{(\text{Total output power})} \times 100 \\
 &= 396/400 \times 100 = 99\% \\
 A_{11} &= I_{11}/I_{011} \times 100 = 15/26 \times 100 = 58\% \\
 A_{21} &= I_{21}/I_{021} \times 100 = 7/13 \times 100 = 54\% \\
 A_{31} &= I_{31}/I_{031} \times 100 = 6/6.5 \times 100 = 92\% \\
 A_{41} &= I_{41}/I_{041} \times 100 = 5/6.4 \times 100 = 78\% \\
 A_{51} &= I_{51}/I_{051} \times 100 = 10/10 \times 100 = 100\%
 \end{aligned}$$

Accordingly, because the derating curve (Fig. 4.6) indicates that up to 100% of the maximum load can be used up to 50℃ and the largest value amongst A_0 , A_{11} , A_{21} , A_{31} , A_{41} , and A_{51} is 100%, this assures that these input and output conditions are acceptable.

■ Minimum output current of modules S, T, and U.

The allowable load of V2 dependent upon the output current of V1 changes as follows.

ACE Fig. 4.12 The relationship between rated current and load regulation

[Example2] Method to confirm that AC9-2HCSWP-00 can be used under the following conditions.

Input voltage : 100 VAC
 Ambient temperature : 50°C
 Output module : slot1 : 15V 3A
 slot2 : +12V 3.2A, -12V 2.3A
 slot3 : 5V 8A, 5V 4A
 slot4 : 5V 25A
 slot5 : 24V 13A

Calculating A_{11} - A_{51}

$$A_0 = \frac{\text{Sum of each module power}}{\text{Total output power}} \times 100$$

$$= \frac{\sum_{k=1}^6 (I_{k1} \times V_{k1} + I_{k2} \times V_{k2})}{\text{Total output power}} \times 100$$

$$= 608/800 \times 100 = 76\%$$

$$A_{11} = I_{11}/I_{011} \times 100 = 3/4 \times 100 = 75\%$$

$$A_{21} = I_{21}/I_{021} \times 100 = 5.5/6.4 \times 100 = 86\%$$

$$A_{31} = I_{31}/I_{031} \times 100 = 8/10 \times 100 = 80\%$$

$$A_{32} = I_{32}/I_{032} \times 100 = 4/5 \times 100 = 80\%$$

$$A_{41} = I_{41}/I_{041} \times 100 = 25/26 \times 100 = 96\%$$

$$A_{51} = I_{51}/I_{051} \times 100 = 13/14 \times 100 = 93\%$$

Accordingly, because the derating curve (Fig. 4.6) indicates that up to 100% of the maximum load can be used up to 50°C and the largest value amongst A_0 , A_{11} , A_{21} , A_{31} , A_{32} , A_{41} , and A_{51} is 96%, this assures that these input and output conditions are acceptable.

5 Option

5.1 Option outline

- Please contact us in advance as regards detailed specifications and delivery.
- Please refer to "1. Ordering information" for ordering methods.
- While some combinations of options are possible, others are not. Please contact us for details.

●-E, -G

- Reduced leakage current type.
- Differences from standard products are shown Table 5.1.

Table 5.1 Reduced leakage current

	-E	-G
Leakage current (230 VAC)	0.5mA max	0.15mA max
Conducted Noise	Class A	Not available
Ripple Noise	1.5 times standard	2.0 times standard

●-F

- Specification with reversed air exhaust
- Differences from standard products are shown in Fig.5.1 and Fig.5.2.
- Please contact us for details about life expectancy of fan.



Fig. 5.1 Air flow(-F)

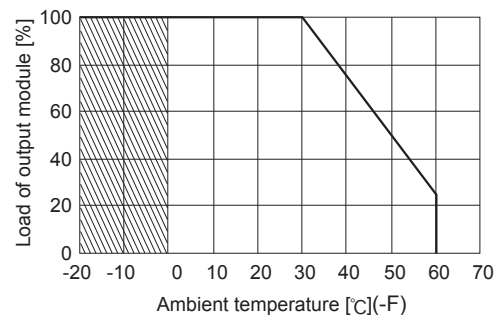


Fig. 5.2 Derating curve characteristics resulting from ambient temperature (-F)

- ★ The derating curve of output modules based on input voltage is also different for the ACE900F.

●-C

- Option -C units have coated internal PCB for better moisture resistance.

●-J

- Option -J units, the AUX output is 5V, 0.1A typ.

●-N(External specifications may vary; please contact us for details)

- In the event that cooling can be provided by the user's fan, the built-in fan may be eliminated (Refer to Fig.5.3).
- If applying for agency approval, it is necessary to measure the temperature of the transformer.
- Please contact us for details on cooling methods.

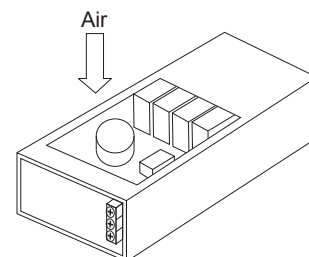


Fig. 5.3 Dwg. of -N specification

●-K

- Specification with lower speed fan for reduced noise.
- The difference from standard is shown Fig.5.4.

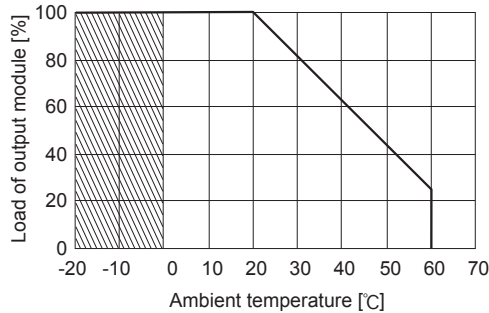


Fig. 5.4 Derating curve based on ambient temperature (-K)

●-R

- Specification with reversed logic for remote ON/OFF operation.
- If -R is specified, then even if input voltage is applied to the module, it will not function as long as voltage is not applied to the RC terminal.

Turn on : 12[V] between RC+ and RC-
 Turn off : 0-0.5[V] between RC+ and RC-

- -R specification applies to all installed output modules.
- A harness is required for connecting to CN2 when using these specifications.
- Please use H-SN-16 to H-SN-18, etc.
- When the customer is to provide a harness, please note the remote sensing wiring (refer to section 3.7, "Remote Sensing").
- Please consult us if specifications that mix normal logic and reverse logic are required.

●-T(External specifications may vary; please contact us for details)

- Specification that adds a filter to prevent the entry of foreign bodies.
- The difference from standard products is shown in Fig.5.5.
- Combinations with -F and -K are not possible.
- Dust can result in clogging and reduced cooling; therefore it is required that the unit is used in a dust-free environment, or that it is periodically cleaned.

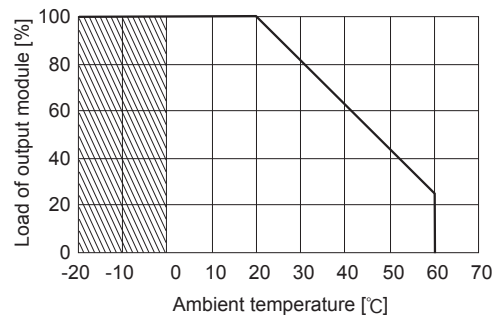


Fig. 5.5 Derating curve for operational ambient temperature (-T)

●-U

- Specifications for support of instantaneous voltage dips (low input voltage support).

- Use condition

Input	70 VAC(100 VDC)
Duty	1s/30s
Output	ACE300F 200W
	ACE450F 360W
	ACE650F 540W
	ACE900F 720W

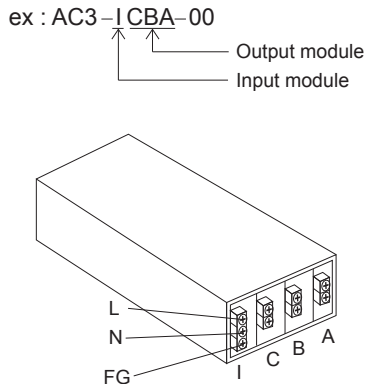
- ★Avoid continuous use for more than 1 second under the conditions mentioned above, as such use can lead to damage to the power supply.

●-W(External specifications may vary; please contact us for details)

- Specification with terminal covers attached to output modules.
- If -W is specified, a terminal cover is attached to all installed output modules.

6 Input module

Input terminals for the ACE300F, 450F, and 650F are upon the fan mount surface, however these can be situated on the output side. This places the input module (I) in the far left slot of each module, instead of the output module. External dimensions will change. Consult us for details.



★With module I specified, conducted noise is class A.

7 Medical electrical equipment

Specifications supporting medical electrical equipment. Types and specifications, etc. are below. Please contact us for details.

7.1 Type

AC□ - □ □ □ □ □ - □□ - H

When units that support use as medical electrical equipment and other options are combined, the end of the type name is as follows.

AC□ - □ □ □ □ □ - □□ - H○△

★ ○, △ : other options

Refer to instruction manual 5. for Option.

Example of use in conjunction with option -K model (reduced fan speed).

AC□ - □ □ □ □ □ - □□ - HK

★Options that cannot be used in conjunction with this are as follows:

C : coating

E : low leakage current

★Option -H is a low leakage current specification product.

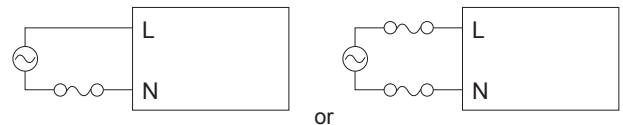
Refer to section 7.2 for details.

7.2 Specification

- Safety : UL60601-1 (CSA601.1), EN60601-1
- Isolation : 4,000 VAC input-output, RC, AUX 1min.
cutoff current 10mA
- leakage current : 0.3mA max (100 VAC), 0.5mA max (230 VAC)
★0.1mA max. is also possible.
- conducted noise : complies with FCC-A, VCCI-A, CISPR22-A, EN55022-A
- Supported modules
All modules except S, T, and U modules with "output module specification." Please note that there is no support for modules S, T, and U.
- Ripple noise
Ripple noise is 1.5 times that of standard models.

7.3 Others

- If applying for medical equipment agency approval, use fuses or breakers that comply with applicable safety regulations on input terminals.



FUSE ACE300F 250 VAC8A ACE450F 250 VAC10A
ACE650F 250 VAC15A ACE900F 250 VAC20A

Fig. 7.1 Connecting FUSE

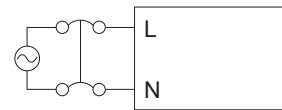
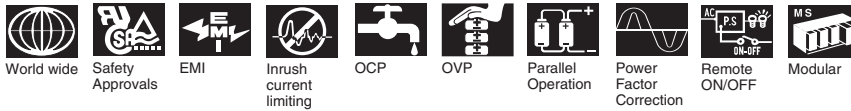
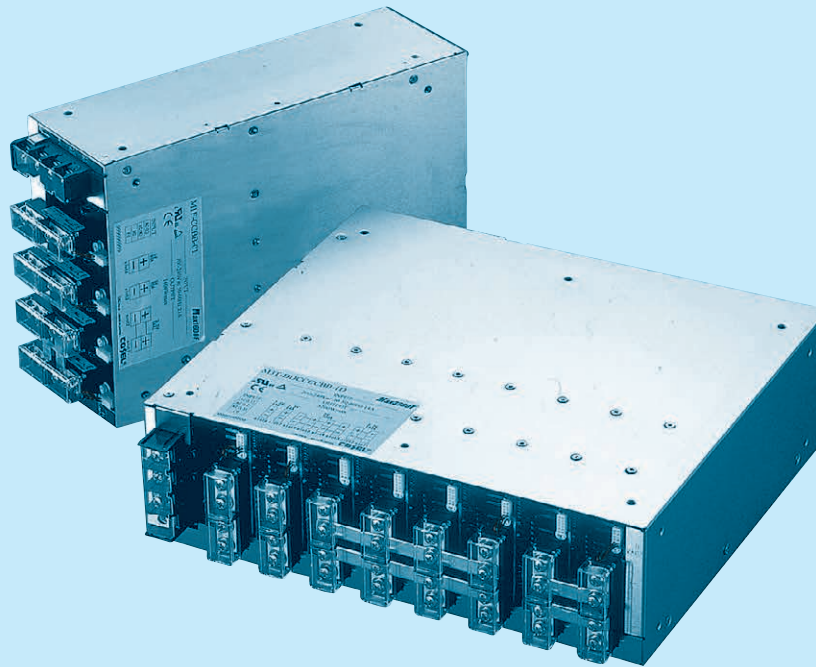


Fig. 7.2 Connecting circuit breaker



MAX-series



Feature

Flexible modular system architecture provides various output configurations.

Harmonic attenuator (Complies with IEC61000-3-2) : MAX1600F

Universal input voltage

High power factor

Various functions

Remote ON/OFF control, alarm, parallel operation

Safety agency approvals

UL60950-1, C-UL (CSA60950-1), EN60950-1

Complies with DEN-AN

EMI

Complies with FCC-B, CISPR22-B, EN55022-B and VCCI-B : MAX1600F

Complies with FCC-A, CISPR22-A, EN55011-A and VCCI-A : MAX1600T / MAX3200T

3-year warranty

Optional parts

Optional parts	Usage
Harness	Remote ON/OFF control, remote sensing, alarm
Bus bar	Wiring for output terminal

CE marking

Low Voltage Directive

EMC Compliance : EN61204-3, EN61000-6-2

EN61000-3-2 (MAX1600F)

EN61000-4-2

EN61000-4-3

EN61000-4-4

EN61000-4-5

EN61000-4-6

EN61000-4-8

EN61000-4-11

MAX series

Ordering information

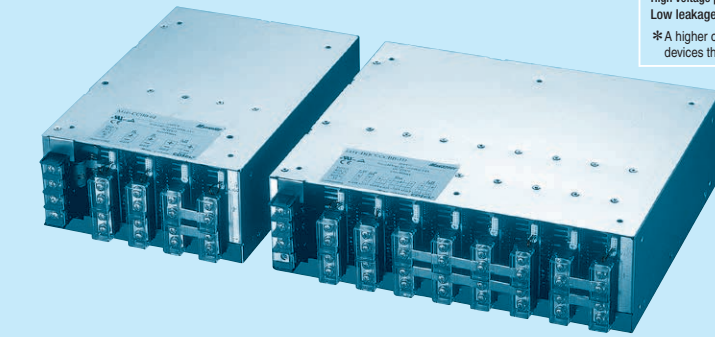
M1 ☐ -

①

☐ ☐ ☐ ☐ - ☐ ☐ - ☐ ☐
⑥ ⑦ ⑧ ⑨ ⑩ ⑪

M3T ☐ -

①

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ - ☐ ☐ - ☐ ☐
② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪


Example recommended EMI/EMC filter
MAX1600F NAC-30-472



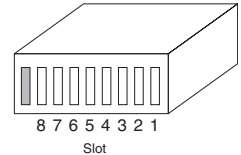
High voltage pulse noise type : NAP series
Low leakage current type : NAM series

*A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

MAX1600T TAC-10-683
MAX3200T TAC-20-683



- ① Abbreviation type name of MAX series
M1F : MAX1600F
M1T : MAX1600T
M3T : MAX3200T
② Slot 8 Output module
③ Slot 7 Output module
④ Slot 6 Output module
⑤ Slot 5 Output module
⑥ Slot 4 Output module
⑦ Slot 3 Output module
⑧ Slot 2 Output module
⑨ Slot 1 Output module
⑩ Parallel code
⑪ Series and option code *7
Refer to instruction manual



* The number of slot is different depending on the model.

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

SPECIFICATIONS

	MODEL	MAX1600F (M1F)	MAX1600T (M1T)	MAX3200T (M3T)
INPUT	VOLTAGE[V]	AC85 - 264 1 ϕ / DC120 - 350	AC170 - 264 3 ϕ	AC170 - 264 3 ϕ
	FREQUENCY[Hz]	47 - 63	47 - 63	47 - 63
	CURRENT[A]	AC100V *1 19typ	-	-
	POWER FACTOR	AC200V *2 10typ	6.5typ	13typ
		AC100V *1 0.99typ	-	-
		AC200V *2 0.95typ	0.95typ	0.95typ
	INRUSH CURRENT [A]	AC100V 20/40typ (Primary inrush current/Secondary inrush current)	-	-
		AC200V 40/40typ (Primary inrush current/Secondary inrush current)	40typ	40typ
OUTPUT	EFFICIENCY[%]	AC100V *1 78typ	-	-
		AC200V *2 82typ	85typ	85typ
	LEAKAGE CURRENT [mA] *3	1.5max	2max	2max
	NUMBER OF SLOT *4	4	4	8
	TOTAL MAXIMUM POWER[W]	AC90 - 150V *5 1500	-	-
		AC170 - 264V *5 1600	1600	3200
	START-UP TIME [ms]	AC100V *1 700typ	-	-
		AC200V *2 500typ	500typ	500typ
FUNCTION	HOLD-UP TIME[ms] *1	20typ	20typ	20typ
	ALARM	FAN ALARM	FAN AND OPEN PHASE ALARM	FAN AND OPEN PHASE ALARM
ISOLATION	INPUT-OUTPUT, RC	AC3,000V 1minute, Cutoff current=25mA, DC500V 50M Ω min (At Room Temperature) (Cutoff current = 100mA : MAX3200T)		
	INPUT-FG	AC2,000V 1minute, Cutoff current=25mA, DC500V 50M Ω min (At Room Temperature)		
	OUTPUT, RC-FG	AC500V 1minute, Cutoff current=100mA, DC500V 50M Ω min (At Room Temperature)		
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE *5	-20 to +65°C, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max		
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing) 9,000m (30,000feet) max		
	VIBRATION	19.6m/s ² , 10 - 55Hz, 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT	196.1m/s ² , 11ms, once each X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178, Complies with DEN-AN (At only AC input)		
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR22-B and EN55022-B		
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 *8	-	-
OTHERS	CASE SIZE *6	200×97×300mm (W×H×D) [7.87×3.82×11.81 inches]	200×97×300mm (W×H×D) [7.87×3.82×11.81 inches]	340×97×300mm (W×H×D) [13.39×3.82×11.81 inches]
	WEIGHT	7kg max	7kg max	14kg max
	COOLING METHOD	Forced cooling (built-in)		

*1 It is a value when M1F-HFEC-00 (MAX1600F : 5V80A, 12V34A, 15V27A, 24V17A) outputs 1500W.
The value changes by composing the output modules.

*2 It is a value when M1F-HFEC-00 (MAX1600F : 5V80A, 12V34A, 15V27A, 24V17A) outputs 1600W or
M1T-HFEC-00 (MAX1600T : 5V80A, 12V34A, 15V27A, 24V17A) outputs 1600W or
M3T-HHFFEECC-00 (MAX3200T : 5V80A×2, 12V34A×2, 15V27A×2, 24V17A×2) outputs 3200W.
The value changes by composing the output modules.

*3 Complies with IEC60950 at AC240V 60Hz.

*4 Each output module is insulated.

*5 Refer to derating.

*6 Case size contains neither the terminal blocks (cover) nor the screw.

*7 Please contact us about safety approvals for the model with option.

*8 Please contact us about class C.

Output module specifications

ITEM	CODE	A	B	C	D	E	F	G	H	I	O
Number of slots used		1	1	1	1	1	1	1	1	1	1
VOLTAGE[V]		2	3.3	5	7.5	12	15	18	24	28	BLANK PANEL
CURRENT[A]		80	80	80	54	34	27	22	17	14.5	
LINE REGULATION[mV]max		20	20	20	30	48	60	72	96	112	
LOAD REGULATION[mV]max		40	40	40	60	100	120	150	150	180	
RIPPLE [mV]max	0 to +50°C *1	80	80	80	120	120	120	120	120	120	
	-20 to 0°C *1	140	140	140	160	160	160	160	160	160	
RIPPLE NOISE [mV]max	0 to +50°C *1	120	120	120	150	150	150	150	150	150	
	-20 to 0°C *1	160	160	160	180	180	180	180	180	180	
TEMPERATURE COEFFICIENT[mV]max	0 to +50°C	40	40	50	75	120	150	180	240	280	
	-10 to +50°C	60	60	75	120	180	225	270	360	420	
DRIFT[mV]max	*2	12	12	20	30	48	60	72	96	112	
OUTPUT VOLTAGE SETTING[V]		2.00 - 2.06	3.30 - 3.40	5.00 - 5.15	7.50 - 7.80	12.00 - 12.48	15.00 - 15.60	18.00 - 18.72	24.00 - 24.96	28.00 - 29.12	
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		1.98 - 2.20	2.64 - 3.63	4.00 - 5.50	6.00 - 8.25	9.60 - 13.20	12.00 - 16.50	14.40 - 19.80	19.20 - 26.40	22.40 - 30.80	
OVERCURRENT PROTECTION		Works over 105% of rated current automatic recovery									
OVERVOLTAGE PROTECTION[V]		4.00 - 5.50	4.00 - 5.50	5.75 - 7.00	8.63 - 10.50	13.80 - 16.80	17.25 - 21.00	20.70 - 25.20	27.60 - 33.60	32.20 - 39.20	
OUTPUT CURRENT IN PARALLEL[A] *3	TWO MODULES IN PARALLEL	144	144	144	97	61	49	40	31	26	-
	THREE MODULES IN PARALLEL	216	216	216	146	92	73	60	46	40	-
	FOUR MODULES IN PARALLEL	300	300	300	195	125	100	80	63	54	-
	FIVE MODULES IN PARALLEL	360	360	360	243	153	122	100	77	66	-
	SIX MODULES IN PARALLEL	444	444	444	292	196	149	120	92	80	-
	SEVEN MODULES IN PARALLEL	516	516	516	341	217	173	140	107	94	-
	EIGHT MODULES IN PARALLEL	600	600	600	390	250	200	160	127	108	-

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN : RM101).

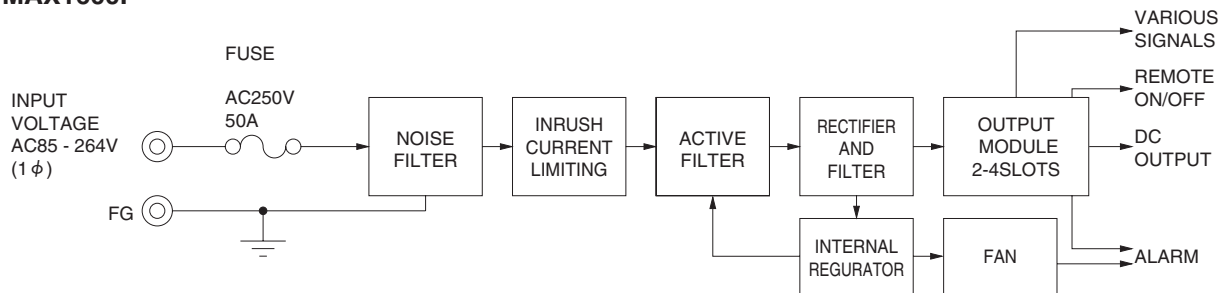
Ripple and Ripple Noise is measured by using measuring board with capacitor of 470 μ F between 20mm to 100mm from the output terminal.

*2 Drift is change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

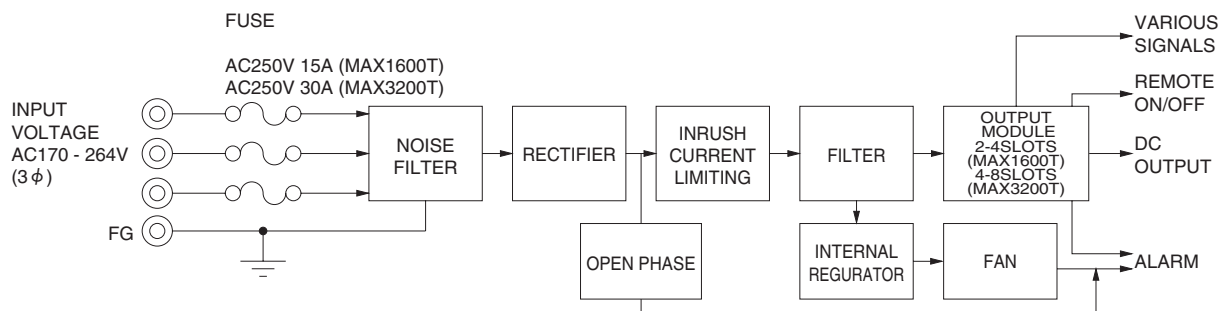
*3 Modular in parallel are built to order and are not possible for the user to assemble them.

Block diagram

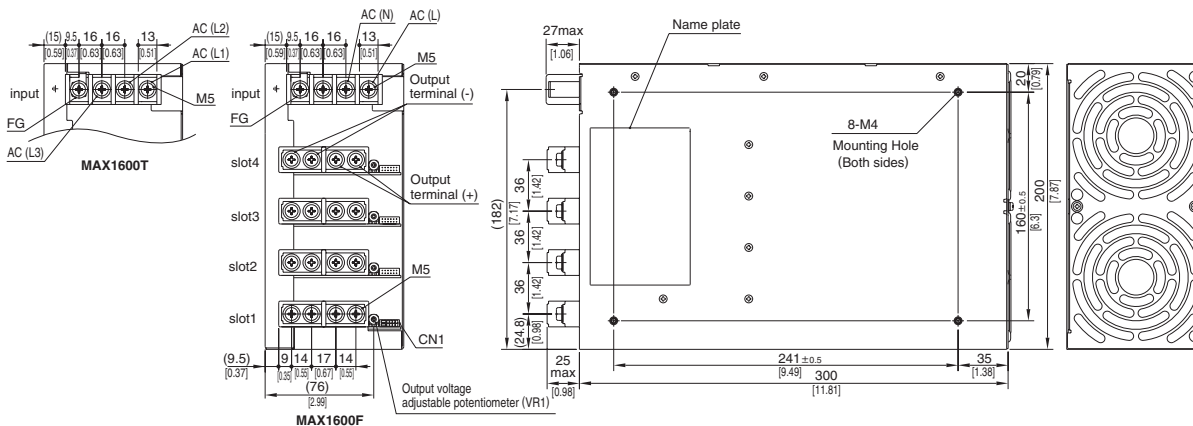
● MAX1600F



● MAX1600T / MAX3200T

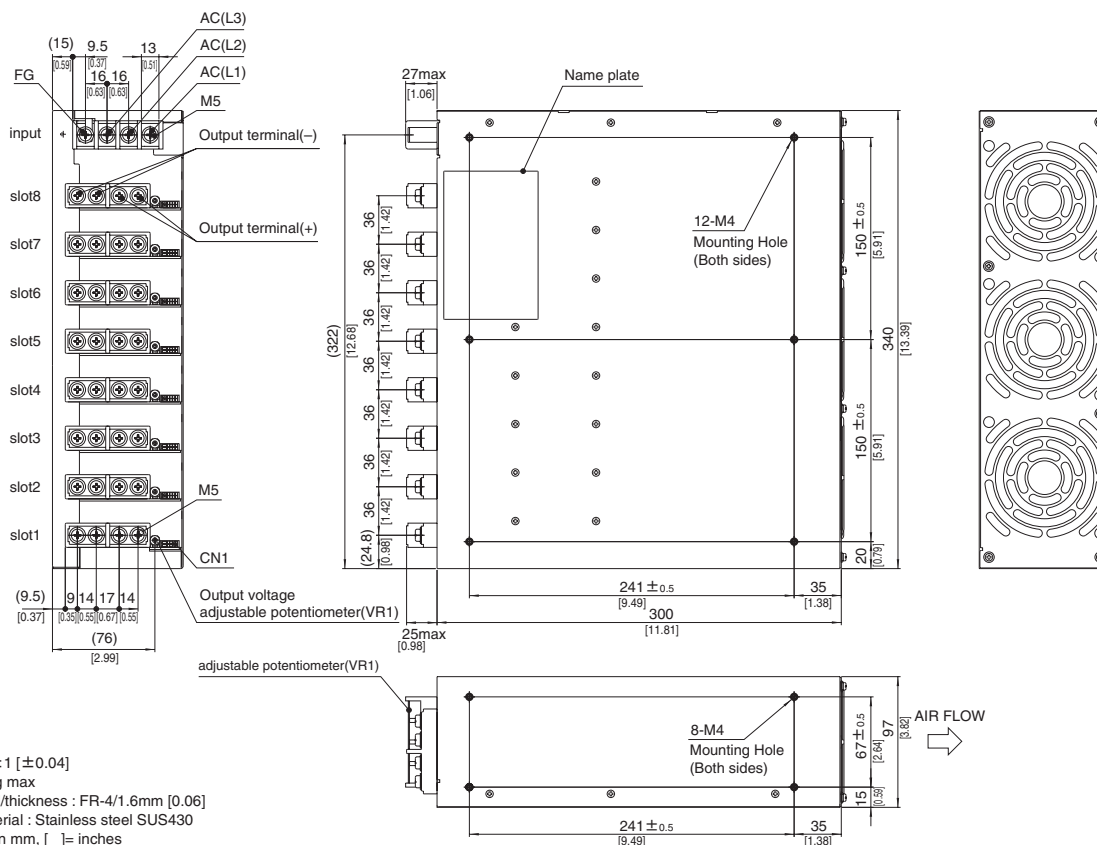


MAX1600F / MAX1600T external view



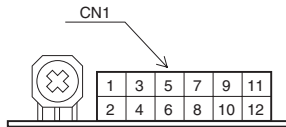
- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 7kg max
- ※ PCB Material/thickness : FR-4/1.6mm [0.06]
- ※ Chassis material : Stainless steel SUS430
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque : $1.5\text{N} \cdot \text{m}$ (16kgf · cm) max
- ※ Keep drawing current per terminal below 80A of output terminal.
- ※ The housing for the remote sensing unused is mounted on CN1 of each output module.
However, when the output module is connected in parallel, the housing is mounted on only master output module.
- ※ Output terminal covers are appended.

MAX3200T external view



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 14kg max
- ※ PCB Material/thickness : FR-4/1.6mm [0.06]
- ※ Chassis material : Stainless steel SUS430
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque : $1.5\text{N} \cdot \text{m}$ (16kgf · cm) max
- ※ Keep drawing current per terminal below 80A of output terminal.
- ※ The housing for the remote sensing unused is mounted on CN1 of each output module.
However, when the output module is connected in parallel, the housing is mounted on only master output module.
- ※ Output terminal covers are appended.

Function connector (CN1) pinassign



Mating connector and terminal of output module CN1

	Connector	Mating connector	Terminal	Mfr.
CN1	S12B-PHDSS	PHDR-12VS	Chain : SPHD-002T-P0.5	J.S.T
			Loose : BPHD-001T-P0.5 : BPHD-002T-P0.5*1	

* 1 Ratchet Hand is nothing

Pin connection and function of output module CN1

Pin No.	Function
1	+M : +Output voltage monitoring
2	-M : -Output voltage monitoring
3	+S : +Remote sensing
4	-S : -Remote sensing, Signal ground
5	TRM : Adjustment of output Voltage
6	-S : -Remote sensing, Signal ground
7	RC2 : Remote ON/OFF
8	-S : -Remote sensing, Signal ground
9	RC3 : Remote ON/OFF
10	ALM : Fan alarm (and open phase alarm)*
11	IOG : Inverter operation monitor
12	TMP : Thermal detection signal

* MAX1600T / MAX3200T

Basic Characteristics Data

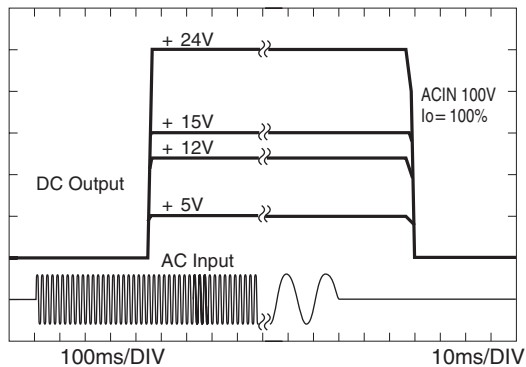
Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
Input module of MAX1600F	Active filter	65	19 *1	250V 50A	SCR	FR-4		Yes	–	–
Input module of MAX1600T	Rectifier and filter	–	6.5 *2	250V 15A	SCR	FR-4		Yes	–	–
Input module of MAX3200T	Rectifier and filter	–	13 *3	250V 30A	SCR	FR-4		Yes	–	–
Output module	Forward converter	370	–	–	–	FR-4		Yes	Yes	Yes

*1 Input current is based on Modul M1F-HFEC-00 (MAX1600F : 5V80A, 12V34A, 15V27A, 24V17A) outputs 1500W at AC100V.

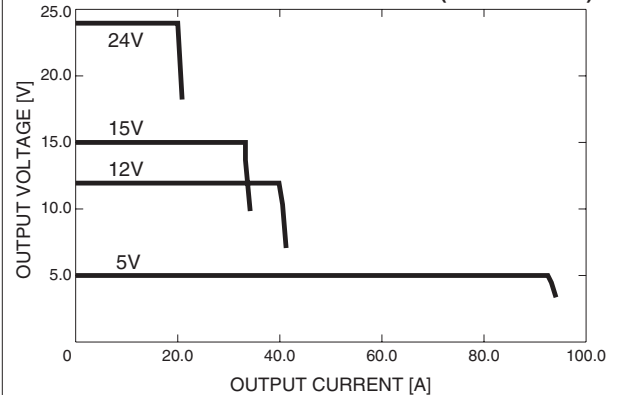
*2 M1T-HFEC-00 (MAX1600T : 5V80A, 12V34A, 15V27A, 24V17A) outputs 1600W at AC200V.

*3 M3T-HHFFEECC-00 (MAX3200T : 5V80A × 2, 12V34A × 2, 15V27A × 2, 24V17A × 2) outputs 3200W at AC200V.
The value changes by composing the output modules.

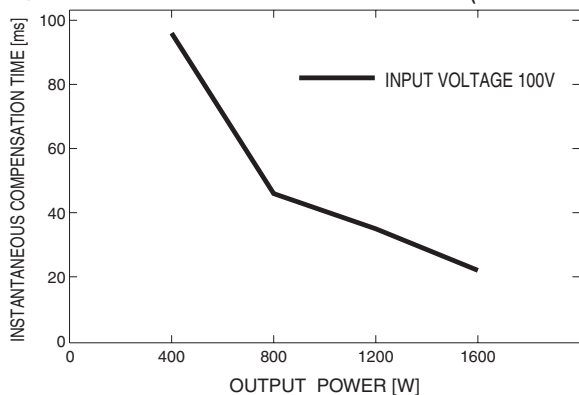
● RISE TIME & FALL TIME (M1F-HFEC-00)



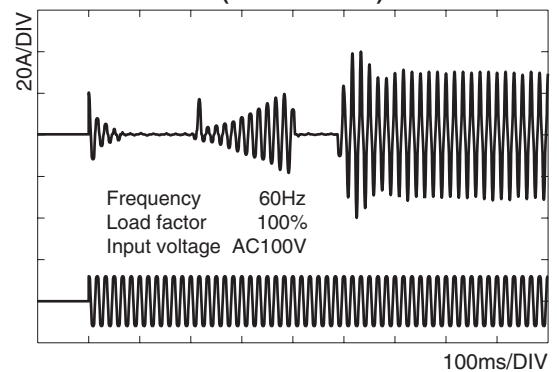
● OVER CURRENT CHARACTERISTICS (M1F-HFEC-00)



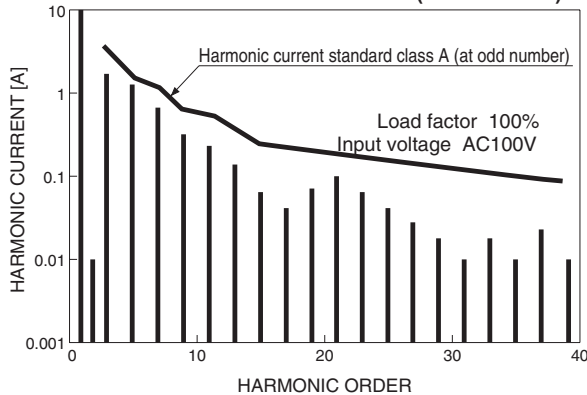
● INSTANTANEOUS INTERRUPTION COMPENSATION (M1F-CCCC-00)



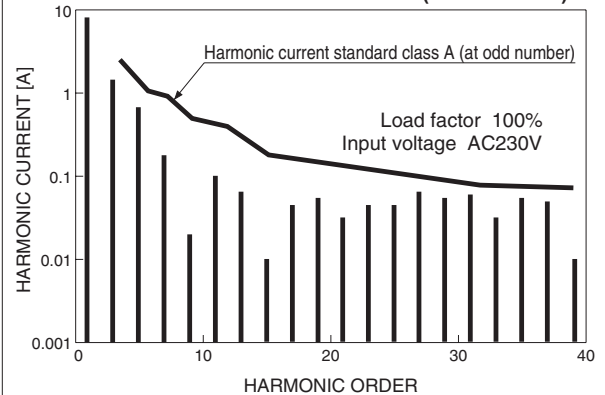
● INRUSH CURRENT (M1F-HFEC-00)



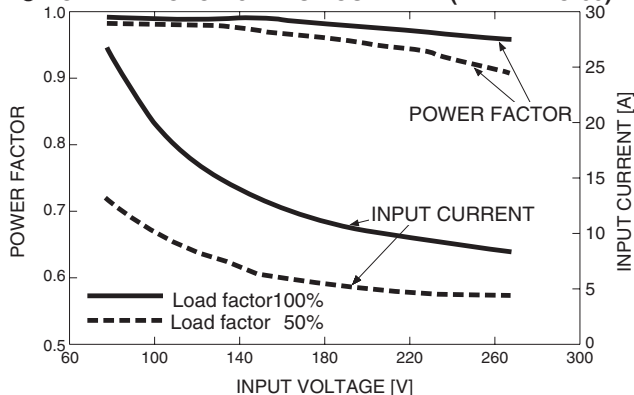
● INPUT HARMONIC CURRENT AC100V (M1F-HFEC-00)



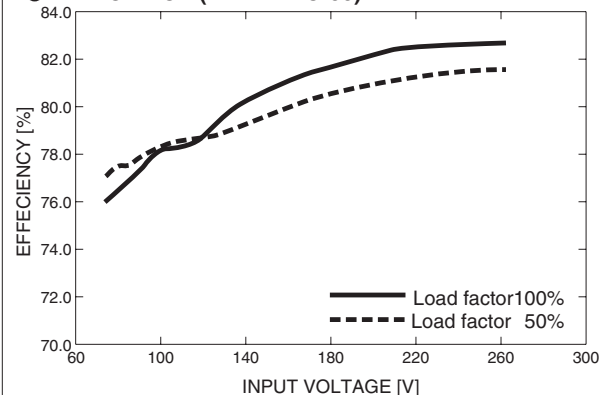
● INPUT HARMONIC CURRENT AC230V (M1F-HFEC-00)



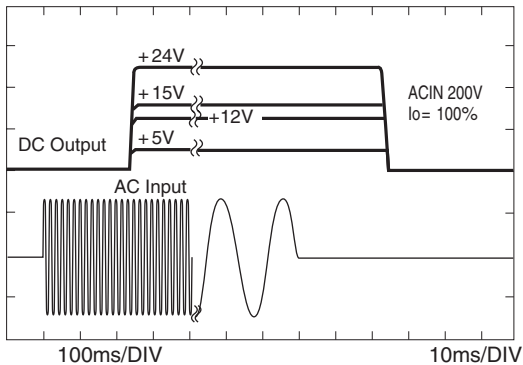
● POWER FACTOR & INPUT CURRENT (M1F-HFEC-00)



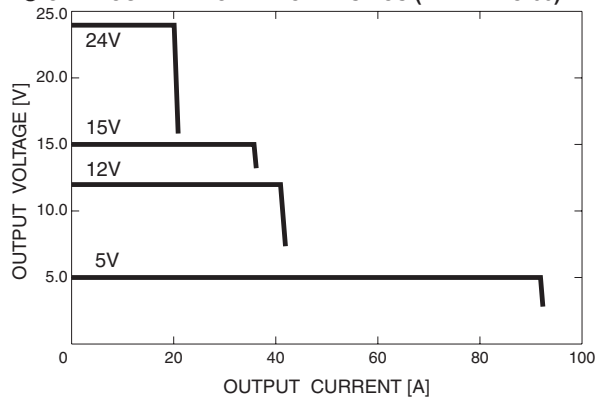
● EFFICIENCY (M1F-HFEC-00)



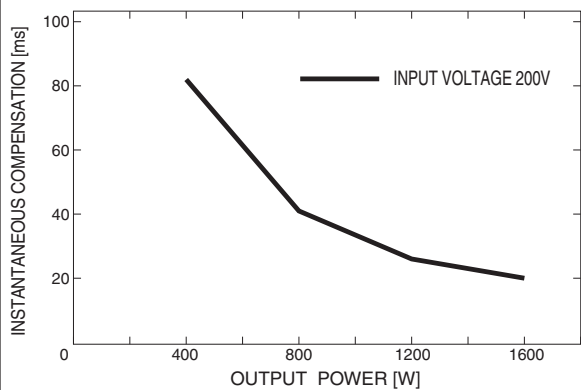
● RISE TIME & FALL TIME (M1T-HFEC-00)



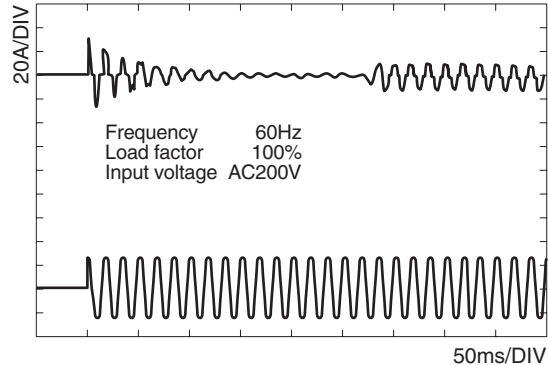
● OVER CURRENT CHARACTERISTICS (M1T-HFEC-00)



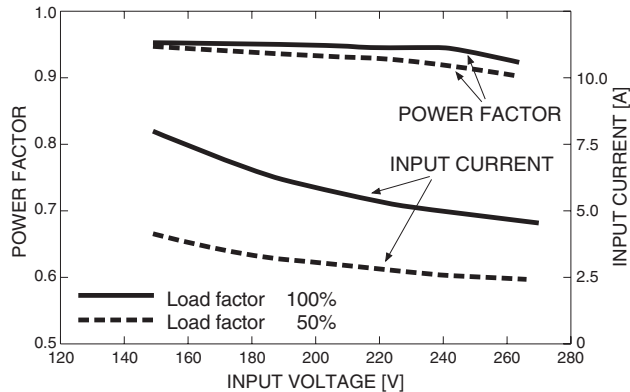
● INSTANTANEOUS INTERRUPTION COMPENSATION (M1T-CCCC-00)



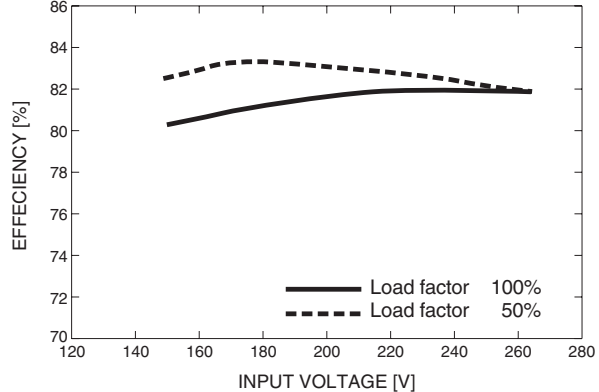
● INRUSH CURRENT (M1T-CCCC-00)



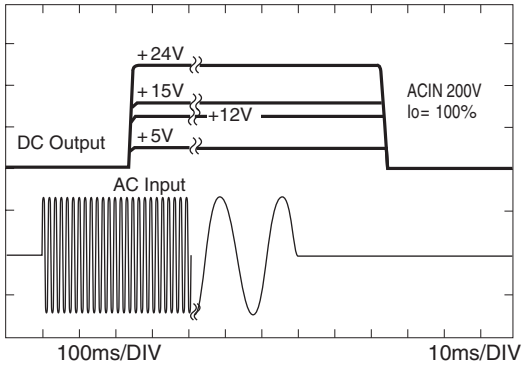
● POWER FACTOR & INPUT CURRENT (M1T-CCCC-00)



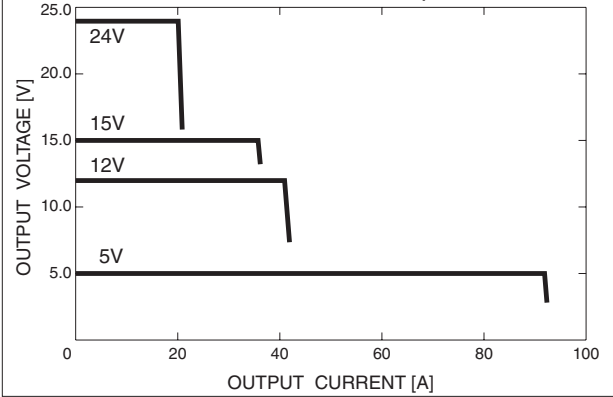
● EFFECIENCY (M1T-CCCC-00)



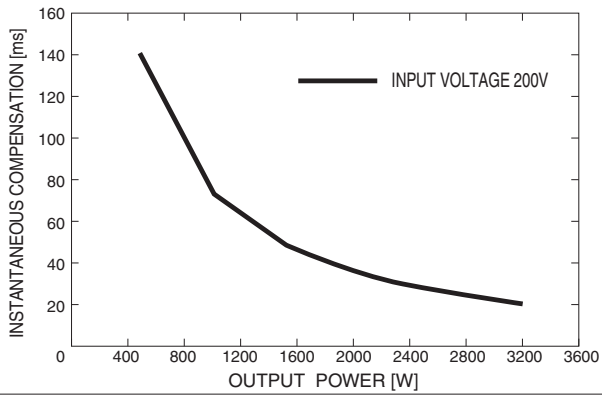
● RISE TIME & FALL TIME (M3T-HHFFEECC-00)



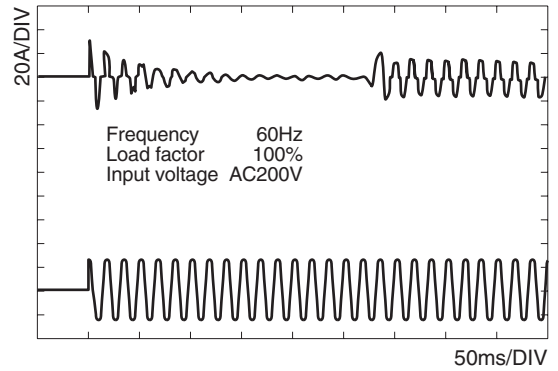
● OVER CURRENT CHARACTERISTICS (M3T-HHFFEECC-00)



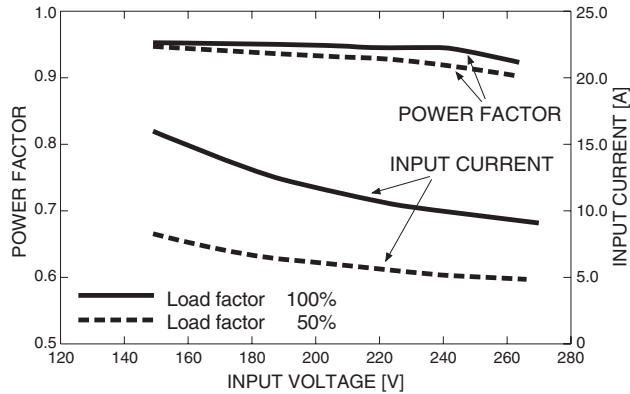
● INSTANTANEOUS INTERRUPTION COMPENSATION (M3T-CCCCCCCC-00)



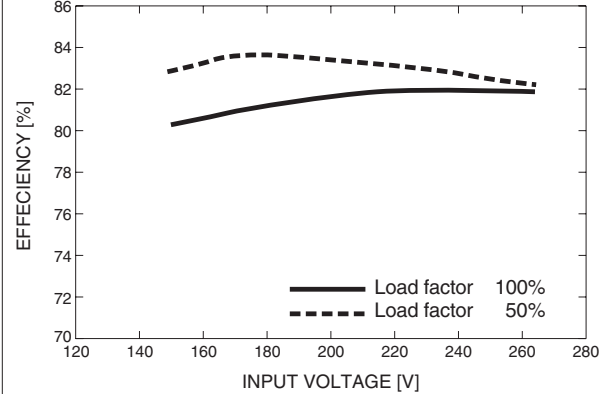
● INRUSH CURRENT (M3T-CCCCCCCC-00)



● POWER FACTOR & INPUT CURRENT (M3T-CCCCCCCC-00)



● EFFECIENCY (M3T-CCCCCCCC-00)



1	Ordering information	MAX-12
2	Function	MAX-13
2.1	Input voltage range	MAX-13
2.2	Inrush current limiting	MAX-13
2.3	Overcurrent protection	MAX-13
2.4	Overvoltage protection	MAX-13
2.5	Thermal protection	MAX-13
2.6	External output voltage adjustment	MAX-14
2.7	Remote ON/OFF	MAX-14
2.8	Remote sensing	MAX-14
2.9	Isolation	MAX-15
2.10	Alarm	MAX-15
3	Series operation and Parallel operation	MAX-15
3.1	Series operation	MAX-15
3.2	Parallel operation/Master-slave operation	MAX-16
4	Assembling and installation method	MAX-16
4.1	Installation method	MAX-16
4.2	Derating	MAX-17

1 Ordering information

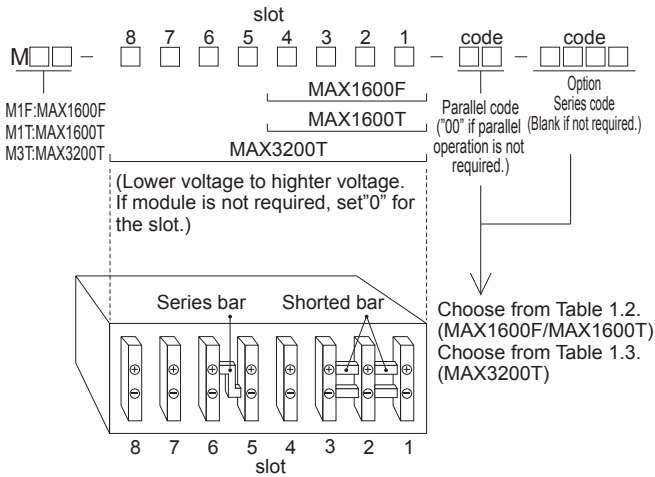


Table 1.1 Output module code

Code	A	B	C	D	E	F	G	H	I	O
Output voltage [V]	2	3.3	5	7.5	12	15	18	24	28	Blank panel
Output current [A]	80	80	80	54	34	27	22	17	14.5	
Output power [W]	160	264	400	405	408	405	396	408	406	

Table 1.2 Parallel / Series code

Code	slot4	slot3	slot2	slot1
00	●	●	●	●
01	●	●	—	●
02	●	●	●	●
03	●	●	—	●
04	●	—	●	●
05	●	●	—	●
06	●	●	●	●
07	●	●	—	●

● : Output terminal
— : Connection

Table 1.3 Parallel / Series code

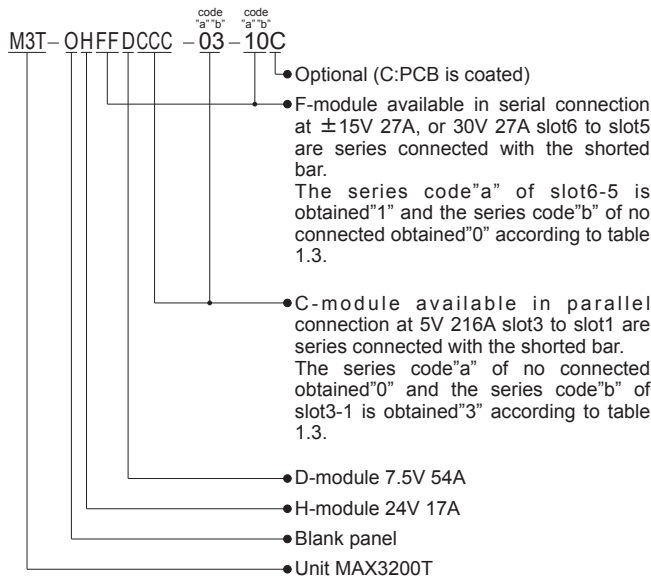
Code "a"	slot8	slot7	slot6	slot5	slot4	slot3	slot2	slot1	Code "b"
0	●	●	●	●	●	●	●	●	0
1	●	●	—	●	●	●	—	●	1
2	●	—	●	●	●	—	●	●	2
3	●	●	—	●	●	—	●	●	3
4	—	●	●	●	—	●	●	●	4
5	●	—	●	●	—	●	—	●	5
6	●	●	—	●	—	●	●	●	6
7	●	●	●	—	●	—	●	●	7
	—	—	—	—	—	—	—	—	8
	—	—	—	—	—	—	—	—	9
	—	—	—	—	—	—	—	—	A
	—	—	—	—	—	—	—	—	B
	—	—	—	—	—	—	—	—	C
	—	—	—	—	—	—	—	—	D
	—	—	—	—	—	—	—	—	E
	—	—	—	—	—	—	—	—	F

● : Output terminal
— : Connection

Configuration rules

- (1) After the output voltage and the output current are confirmed, the code of the output module installed in the slot1-8 is selected from Table 1.1.
Put the blank panel(code 0) in when modules are not installes in the slots.
- (2) When output module is operated in parallel and series, the parallel code can be selected from Table 1.2 and Table 1.3 depending on whether or not the bus bar between the output modules exists.
- (3) Do not put the blank panel in the slot1 because fan alarm and open phase alarm* (ALM signal) is output from CN1 of the slot1.
*MAX1600T/MAX3200T
- (4) Do not put the blank panel in between the output modules connected in parallel.
- (5) Install more than two output modules in the slot.
(MAX1600F/MAX1600T)
Install more than four output modules in the slot. (MAX3200T)
- (6) Modules with low output voltage should be installed out of the slot1 in order.

●Example of naming



- The total output current in parallel is shown output module specifications.

2 Function

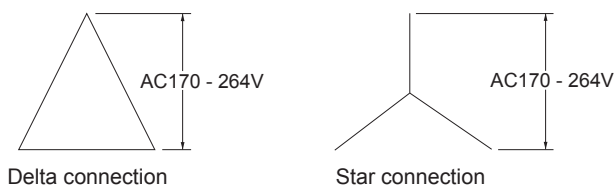
2.1 Input voltage range

●MAX1600F

- The range is from AC85V to AC264V or from DC120V to DC350V.
- In cases that conform with safety standard, input voltage range is AC100-AC240V(50/60Hz).
- If the wrong input is applied, the unit will not operate properly and/or may be damaged. Avoid the followings to cause failure of the unit to apply square waveform input voltage, which is commonly used in UPS and inverters.

●MAX1600T/MAX3200T

- The input voltage range is AC170-264V(three-phase). Units are not influenced by the phase sequence. The voltage line of the three-phase is connected, and the earthing conductor cannot be used for the three-phase four line type.



- In cases that conform with safety standard, input voltage range is AC200-AC240V(50/60Hz).

- If the wrong input or single phase input is applied, the unit will not operate properly and/or may be damaged. Avoid the followings to cause failure of the unit to apply square waveform input voltage, which is commonly used in UPS and inverters.

2.2 Inrush current limiting

- Inrush current limiting is built-in.
- If a switch on the input side is installed, it has to be the one handling the input inrush current.
- The thyristor technique is used for protection from inrush current. When power is turned ON/OFF repeatedly within a short period of time, it is necessary to have enough time between power ON and OFF to operate circuit for inrush current. When the switch of the input is turned on, the primary inrush current and secondary inrush current are generated.

2.3 Overcurrent protection

- Overcurrent protection is built-in and comes into effect at 105% of the rated current. Overcurrent protection prevents the unit from short circuit and overcurrent condition. The unit automatically recovers when the fault condition is cleared.
- If the output voltage drops more than 50% of the rated voltage in an overcurrent protection mode, the average current will also be reduced by the intermittent operation.

2.4 Overvoltage protection

- Overvoltage protection circuit is built-in and comes into effect 115 - 140% of the rated voltage(except 3.3V output voltage type : it operates at 4.0 - 5.5V). The AC input should be shut down if overvoltage protection is operation. The minimum interval of AC recycling for recovery is more than 3 minutes. The recovery time varies depending on input voltage.

2.5 Thermal protection

- Thermal protection circuit is built-in and avoid the followings to shut down at operating thermal protection.
 - When the current and the temperature which deviates from the derating characteristic are consecutive.
 - The case FAN stops or the case the wind out of FAN is interrupted and the amount of the wind decreases.
 After the input voltage is intercepted and the inside of the power supply cools enough, the return after the overheating protection operates turns on the input of the power supply again.

MAX

2.6 External output voltage adjustment

- By applying the voltage externally or connecting register externally between TRM and -S, output voltage becomes adjustable. Output level is able to be calculated by following equation① ; however, external output voltage should not be less than -0.7V and more than 2.5V.

$$\text{Output voltage} = \frac{\text{The voltage between TRM and -S}}{1 [\text{V}]} \times \text{Rated output voltage} \cdots \text{①}$$

2.7 Remote ON/OFF

- Each output module has remote ON/OFF. ON/OFF of output voltage becomes available. Table 2.1 shows the specification of remote ON/OFF.

Fig.2.1 shows the way to connect remote control(Example), and followings are notes when you use the remote control.

- ①The output stops when the current is down in RC3. The current drowning RC3 is less than 12mA.
- ②Built-in fans do not stop even if the output is turned off with remote ON/OFF circuit.
- ③The IOG signal is output when the output voltage is turned off with remote ON/OFF.
- ④You should be careful of electric potential in series when you wire the remote control circuit,since it is not insulated from the output. Example of a circuit in series is shown in Fig.2.2.

- It is possible turn on and turn off by the remote control of the master module, because RC2 of the output module is connected with RC3 in the power supply in parallel operation. However, please note that currents necessary for the control increase more than the time used with the output module unit because RC2 and RC3 of the output module are connected in parallel.

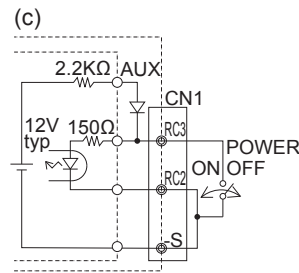
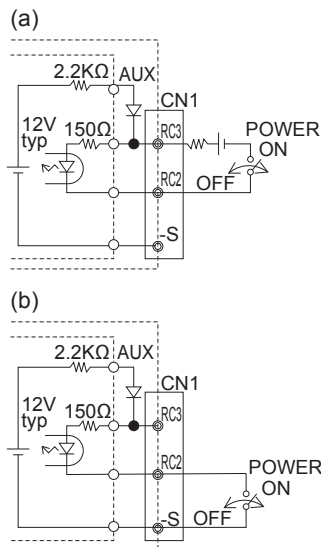


Fig.2.1 Examples of connecting remote ON/OFF of output module

Table 2.1 Specification of remote ON/OFF

Connection method		Fig.2.10(a)	Fig.2.10(b)	Fig.2.10(c)
SW Logic	Output on	SW open (0.1mA max)	SW open (0.1mA max)	SW close (0.5V max)
	Output off	SW close (3mA min)	SW close (3mA min)	SW open (0.1mA max)
pin		-	-S	-S

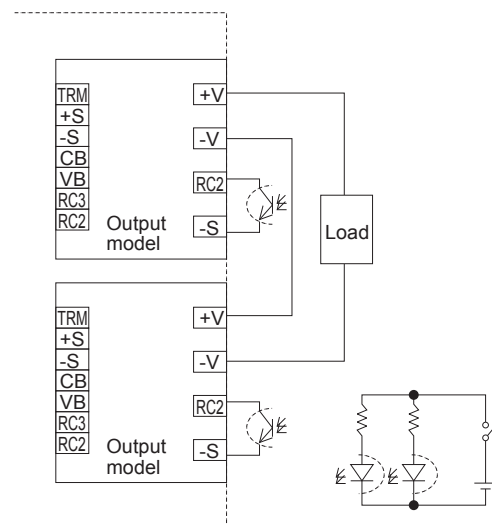


Fig.2.2 Example of remote control circuit in series operation

2.8 Remote sensing

- Remote sensing circuit is built-in each output module.
- Wiring method without using remote sensing is shown in Fig.2.3. When you do not use the remote sensing, connect between +S and +M and between -S and -M with CN1 of each output module. When the power supply is shipped out of a factory, a special harness is mounted on CN1 of the output module.

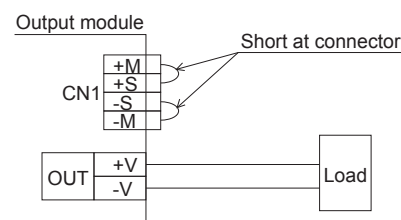


Fig.2.3 When not using remote sensing function

■ Wiring method with remote sensing is shown in Fig.2.4.

■ Notes, when you use the remote sensing, are shown as follows.

① Note connecting wires enough because the load current flows to sensing line and an internal circuit of power supply is damaged occasionally, when defective contact of the screw such as loosening happens in the load line.

② Conform the line drop should be at 0.3V or less using a thick wire from the power supply to the load.

③ When remote sensing function is used, output voltage might become unstable because of a impedance of wiring and load condition. And the power supply should be evaluated enough. Following are examples to improve it.

· -S sensing wire is removed and terminals between -M and -S are shorted.

· C_0 and R1 are connected as above figure.

Please ask details to us.

■ When using remote sensing in parallel, you use remote sensing out of a module that should be a master module and other output module in parallel should be open between $\pm S$ and $\pm M$.

■ Do not take out the output current of $\pm M$ at CN1.

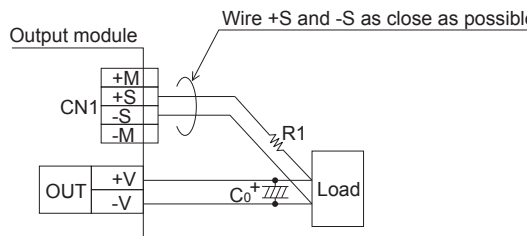


Fig.2.4 When using remote sensing function

2.9 Isolation

■ For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for start(shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

If the unit is tested on the isolation between input & output and output & FG must be shorted all output.

2.10 Alarm

■ Table 2.2 shows the alarm function built-in the power supply.

Table 2.2 Explanation of alarms

Alarm		Output of alarm
ALM	When the fan stops or the power supply breaks down (or one of three phase is open)*, the alarm from CN1 of the output module of slot1.	Open collector method Good : Low(0.5Vmax at 5mA) Bad : High or open 35V 10mA max
TMP	When the thermal protection circuit of the output module operates immediately or before, the alarm outputs.	Good : High(5V typ) Bad : Low(0.5Vmax at 5mA) 35V 10mA max
IOG	When the switching operation in the output module stops.	Good : Low(0.5Vmax at 5mA) Bad : High(5V typ) 35V 10mA max

★MAX1600T / MAX3200T

■ Notes, you should be careful of electric potential in series when you wire the alarm circuit, since it is not isolated from the output.

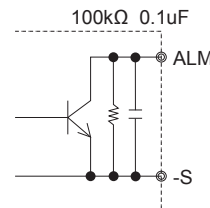


Fig.2.5 Internal circuit of ALM

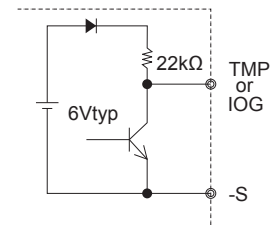


Fig.2.6 Internal circuit of TMP and IOG

3 Series operation and Parallel operation

3.1 Series operation

■ Series operation is possible between the output modules in the same power supply as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

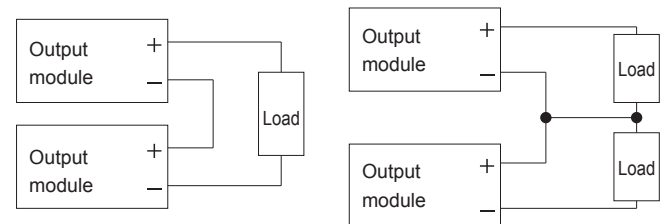


Fig.3.1 Connection method in series

■ Output current in series connection is the same as the specification of the connected module.

■ Please notice and set the following items.

- ① Choosing same modules in series setting in principle.
 - ② The rating voltage of the total in series setting can set less than 48V.
 - ③ It is impossible to use series setting with parallel setting.
- Please consult us excluding the above-mentioned.

3.2 Parallel operation/Master-slave operation

- Parallel operation is possible between the output modules in the same power supply. (Already set up at the time of shipping out. Impossible for user to set up.)

The output terminal of the module (set up for parallel operation) should be connected with a shorted bar.

Do not apply input voltage after you remove the shorted bar because it can be damaged. The connection in parallel is shown in Fig.3.2.

- Notes of parallel operation are shown as follows.

① At 10% load factor or less

- IOG may turn to be "H"
- Output voltage may slightly rise, max.5%.

② AC IN & Remote ON

- IOG signal becomes irregular for 1 second when input voltage is applied or remote ON/OFF is turned ON.

- Method to set up output voltage when output module is connected in parallel.

You need to decide an output module out of modules for parallel operation and turn the volume of other output modules fully right. You need to turn the volume in the master module and set up the output voltage. When the unit is shipped from the factory, we establish the output voltage as a master power supply whose slot number is smallest.

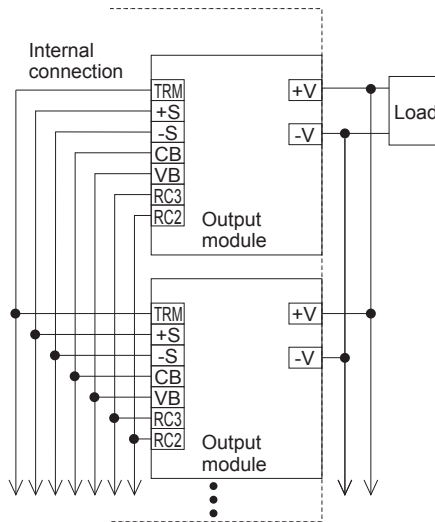


Fig.3.2 Connection method in parallel

- In series and parallel operation, output voltage increases like stairs due to a delay of the rise time output voltage at turn on.

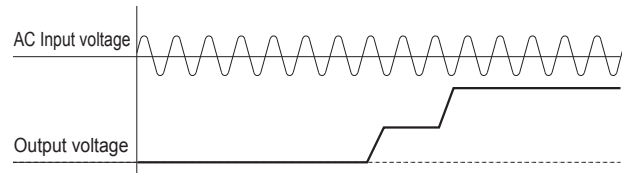


Fig.3.3 Start-up waveform in series and/or parallel operation

4 Assembling and installation method

4.1 Installation method

- Fans for forced cooling are built-in.

Do not block the ventilation at suction side (terminal block side) and its opposite side.

- Regular exchange is necessary for the fan, because the life expectancy ($R(t)=90\%$) of the fan depending on the use condition is shown in Fig.4.1.

Install the air filter so that the effect of cooling by the fan does not decrease when the power supply is used in a dusty place.

Fan unit for maintenance can be ordered. Refer to optional parts.

- Fix firmly, considering weight, though it can be used by the installation method shown in Fig.4.2B and C.

The screw should be inserted up to 8mm max from outside of the power supply to keep a distance between inside parts and an isolation.

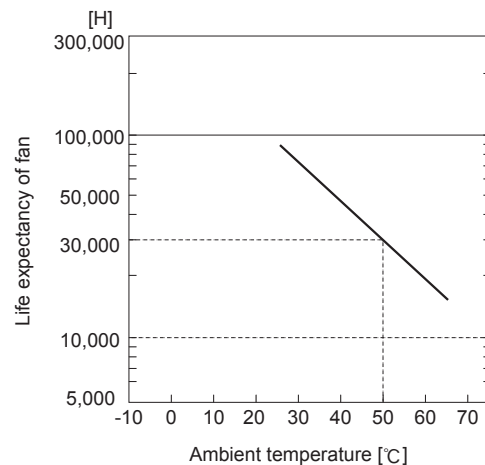


Fig.4.1 Life expectancy of fan ($R(t)=90\%$)

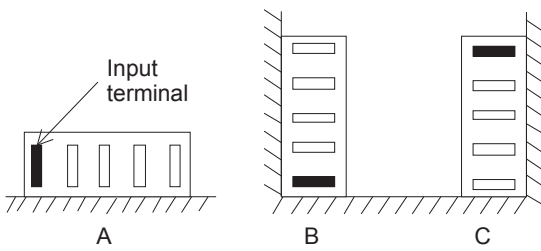


Fig.4.2 Installation method

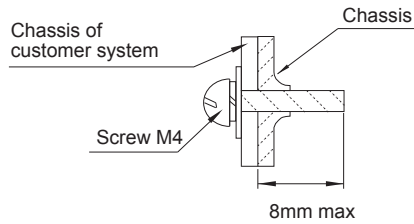


Fig.4.3 Mounting screw

4.2 Derating

●MAX1600F

- Derating curve of output module depending on ambient temperature and derating curve depending on input voltage are shown in Fig.4.4 and Fig.4.5.
- In the hatched area, the specifications of Ripple and Ripple Noise are different from other, refer to specifications of output module.

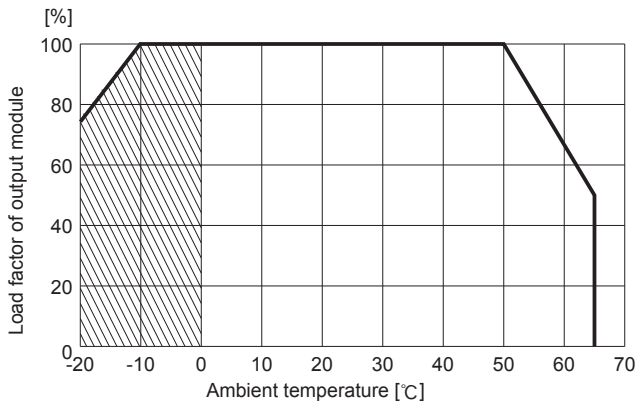


Fig.4.4 Derating curve of output module depend on ambient temperature

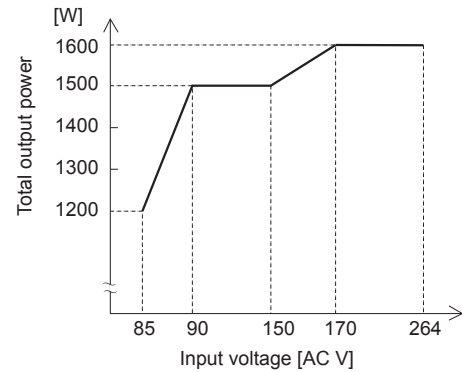


Fig.4.5 Derating curve depend on input voltage

●MAX1600T/MAX3200T

- Derating curve of output module depending on ambient temperature is shown in Fig.4.6.
- In the hatched area, the specifications of Ripple and Ripple Noise are different from other, refer to specifications of output module.

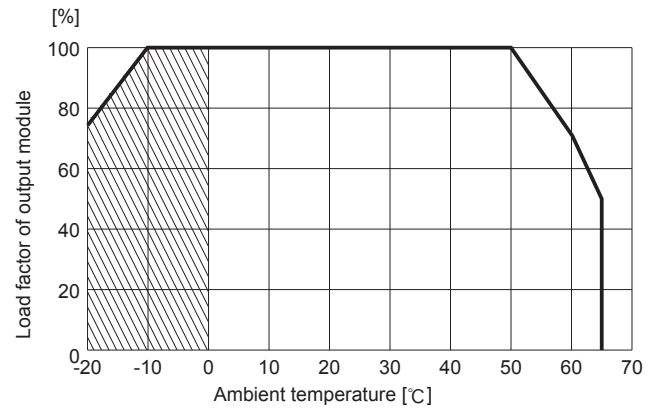


Fig.4.6 Derating curve of output module depend on ambient temperature



KH-series



Feature

For DIN (35mm) rail products
Wide operating ambient temperature range
I/O terminal has 2 types, Euro Style and Barrier Blocks Style
Built in overcurrent protection, overvoltage protection circuits

- KHEA30F/60F/90F, KHNA30F/60F/90F
Low power consumption at no load
- KHEA120F/240F/480F, KHNA120F/240F/480F
Built in remote ON/OFF
Built in signal output for confirming output voltage
Complies with SEMI F-47

Safety agency approvals

UL60950-1, UL508, C-UL (CSA60950-1), EN60950-1, EN50178,
ANSI/ISA12.12.01
Complies with DEN-AN

5-year warranty (refer to Instruction Manual)

CE marking

Low Voltage Directive

EMI

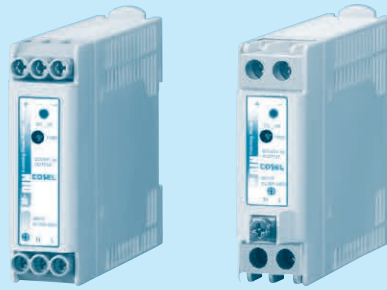
Complies with FCC-B, CISPR22-B, EN55011-B, EN55022-B, VCCI-B

EMS Compliance : EN61204-3, EN61000-6-2

EN61000-4-2
EN61000-4-3
EN61000-4-4
EN61000-4-5
EN61000-4-6
EN61000-4-8
EN61000-4-11

KHEA/KHNA30F

KH ☐ A 30 F - ☐ - ☐
 ① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-04-472-D



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
KHE : Euro style I/O terminals
KHN : Barrier blocks style I/O terminals
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Option
C : with Coating

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	KHEA/KHNA30F-5	KHEA/KHNA30F-12	KHEA/KHNA30F-24
MAX OUTPUT WATTAGE[W]	25	27.6	31.2
DC OUTPUT	5V 5A	12V 2.3A	24V 1.3A

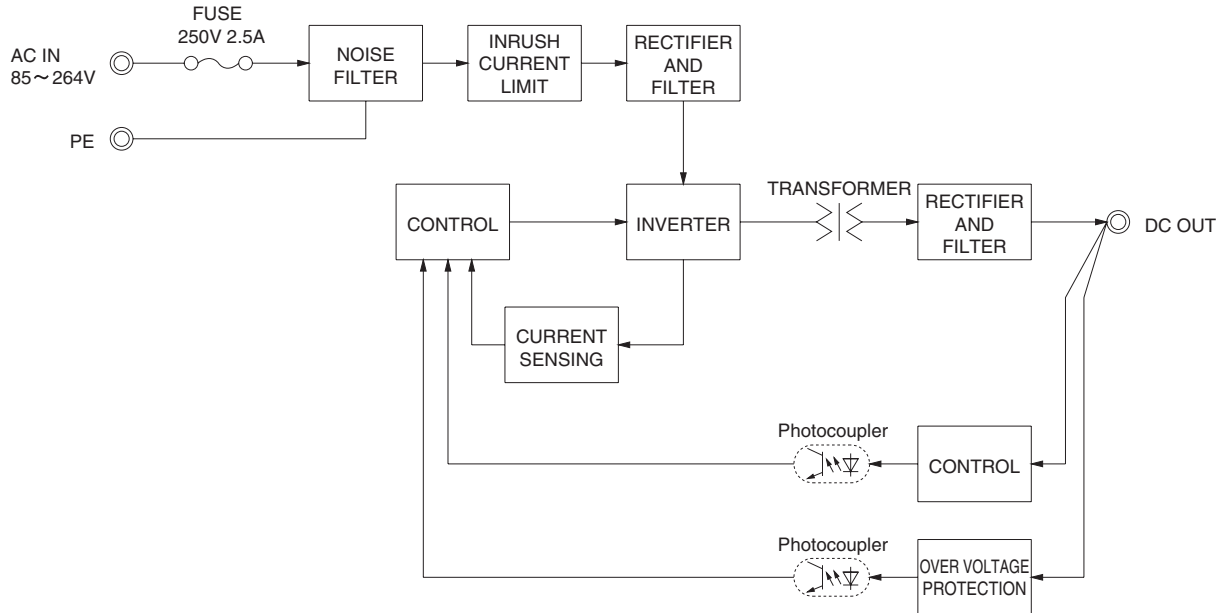
SPECIFICATIONS

	MODEL		KHEA/KHNA30F-5	KHEA/KHNA30F-12	KHEA/KHNA30F-24
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Output derating is required) or DC120 - 370		
	CURRENT[A]	ACIN 115V ACIN 230V	0.45typ 0.30typ	0.50typ 0.30typ	0.55typ 0.35typ
	FREQUENCY[Hz]		50 / 60 (45 - 440) or DC		
	EFFICIENCY[%]	ACIN 115V ACIN 230V	84.0typ 85.5typ	87.0typ 88.5typ	88.5typ 89.5typ
	INRUSH CURRENT[A]	ACIN 115V *1 ACIN 230V	18typ (Io=100%) (at cold start Ta=25℃) 35typ (Io=100%) (at cold start Ta=25℃)		
	LEAKAGE CURRENT[ma]		0.45 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)		
	OUTPUT	VOLTAGE[V]		5	12
CURRENT[A]		5.0	2.3	1.3	
PEAK CURRENT[A]		-	-	-	
LINE REGULATION[mV] *2		20max	48max	96max	
LOAD REGULATION[mV] *2		80max	100max	150max	
RIPPLE[mVp-p] *3		0 to +70℃	150max	150max	150max
		-20 - 0℃	300max	300max	300max
		Io=0 - 30%	300max *4	300max *4	300max *4
RIPPLE NOISE[mVp-p] *3		0 to +70℃	180max	180max	180max
		-20 - 0℃	360max	360max	360max
		Io=0 - 30%	360max *4	360max *4	360max *4
TEMPERATURE REGULATION[mV]		0 to +70℃	50max	120max	240max
		-20 to +70℃	60max	150max	290max
DRIFT[mV] *5		20max	48max	96max	
START-UP TIME[ms]		200typ (ACIN 115V, Io=100%)			
HOLD-UP TIME[ms]		20typ (ACIN 115V, Io=100%)			
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		4.50 to 5.50	10.80 to 13.20	22.50 to 28.50	
OUTPUT VOLTAGE SETTING[V]		5.00 to 5.15	12.00 to 12.48	24.00 to 24.96	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically *10		
	OVERVOLTAGE PROTECTION[V]		6.30 to 7.60	13.80 to 16.80	30.00 to 36.00
	DC_OK LAMP		LED (Green)		
ISOLATION	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)		
	INPUT-PE		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)		
	OUTPUT-PE		AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)		
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE		-20 to +70℃ (Required to Derating), 20 - 90%RH (Non condensing)		
	STORAGE TEMP., HUMID. AND ALTITUDE		-30 to +85℃, 20 - 90%RH (Non condensing)		
	VIBRATION *8		10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60 minutes along Z axis (Non operating, mounted on DIN Rail)		
	IMPACT		196.1m/s² (20G), 11ms, once each X, Y and Z axis (Packing state)		
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS (At only AC input)		UL60950-1, C-UL(CSA60950-1), UL508 (NEC Class2 per UL1310), ANSI/ISA12.12.01, EN60950-1, EN50178 Complies with DEN-AN		
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B		
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 (Class A) *6 (Not built-in to active filter) *9		
OTHERS	CASE SIZE *7		22.5×75×90mm (W×H×D) [0.89×2.95×3.54 inches]		
	WEIGHT		165g max		
	COOLING METHOD		Convection		

*1 The value is primary surge. The current of input surge to a built-in EMI/EMC Filter(0.2ms or less) is excluded.
 *2 Please contact us about dynamic load and input response.
 *3 This is the value that measured on measuring board with capacitor of 22μF and 0.1μF at 150mm from output terminal.
 Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103). Please refer to the instruction manual 2.7.
 *4 In case of operating under 0°C ambient temperature, the value is two times of specification at 0 to 30% load factor.
 *5 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*6 Please contact us about another class.
 *7 Case size contains neither the umbo.
 *8 Only as standard mounting orientation (A). Refer to the instruction manual 5.1.
 If install other than standard mounting orientation (A), please fix the power supply for withstand the vibration and impact.
 *9 When two or more units are operating it may not comply with the IEC61000-3-2.
 *10 If the overcurrent protection circuit operates continuously, the output voltage shut down. Refer to the instruction manual 2.3.
 * To meet the specifications. Do not operate over-loaded condition.
 * A sound may occur from power supply at light or peak loading.

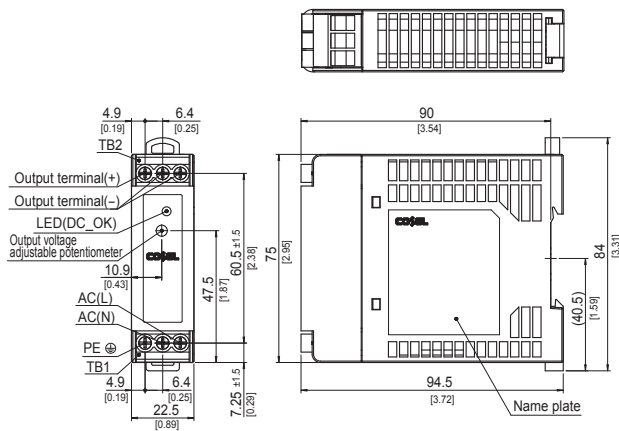
Block diagram



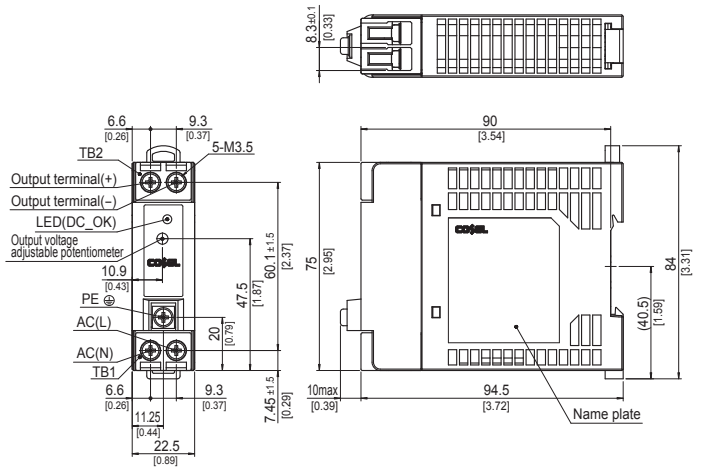
External view

<KHEA30F(Euro Style I/O Terminals)>

<KHNA30F(Barrier Blocks Style I/O Terminals)>



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 165g max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis · Case material : PBT
- ※ Din rail attachment material : PC/ABS
- ※ Dimensions in mm, [] = inches
- ※ Screw tightening torque : 1N · m max



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 165g max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis · Case material : PBT
- ※ Din rail attachment material : PC/ABS
- ※ Dimensions in mm, [] = inches
- ※ Screw tightening torque : 1N · m max

KHEA/KHNA60F

KH ☐ A 60 F - ☐ - ☐

① ② ③ ④ ⑤ ⑥

Example recommended EMI/EMC filter
NAC-04-472-D

High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
KHE : Euro style I/O terminals
KHN : Barrier blocks style I/O terminals
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Option
C : with Coating

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	KHEA/KHNA60F-12	KHEA/KHNA60F-24
MAX OUTPUT WATTAGE[W]	54	60
DC OUTPUT	12V 4.5A	24V 2.5A

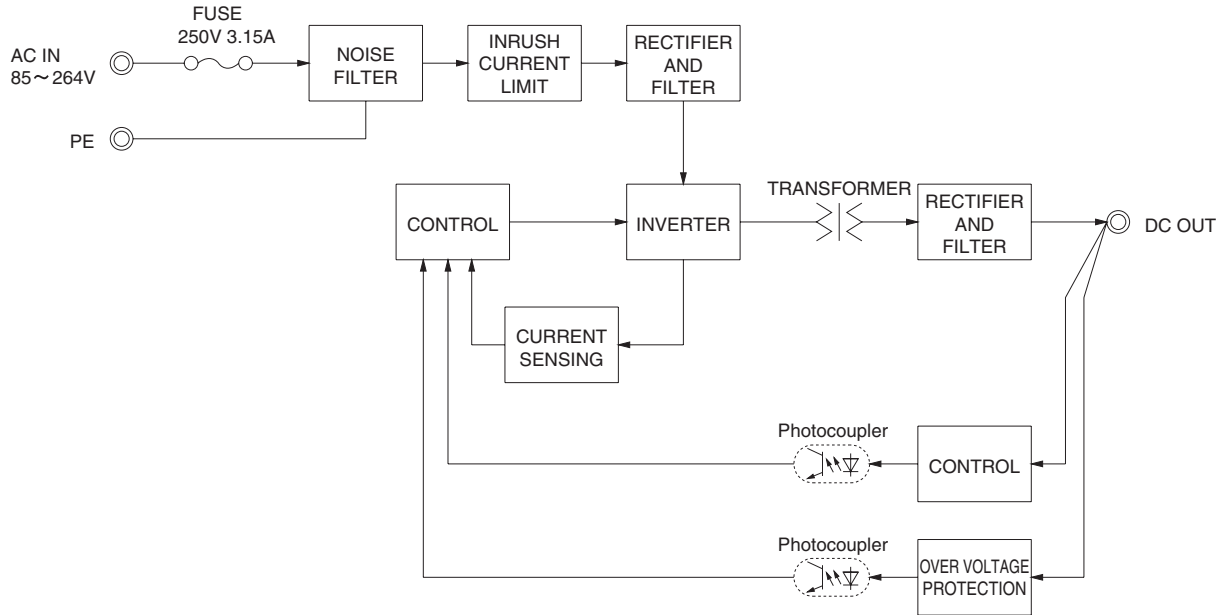
SPECIFICATIONS

	MODEL	KHEA/KHNA60F-12	KHEA/KHNA60F-24
INPUT	VOLTAGE[V]	AC85 - 264 1 φ (Output derating is required) or DC120 - 370	
	CURRENT[A]	ACIN 115V 1.00typ ACIN 230V 0.60typ	1.10typ 0.70typ
	FREQUENCY[Hz]	50 / 60 (45 - 440) or DC	
	EFFICIENCY[%]	ACIN 115V 87.0typ ACIN 230V 88.0typ	89.0typ 91.0typ
	INRUSH CURRENT[A]	ACIN 115V 18typ (I _o =100%) (at cold start Ta=25°C) *1 ACIN 230V 35typ (I _o =100%) (at cold start Ta=25°C)	
	LEAKAGE CURRENT[ma]	0.45 / 0.75max (ACIN 100V / 240V 60Hz, I _o =100%, According to IEC60950-1 and DEN-AN)	
OUTPUT	VOLTAGE[V]	12	24
	CURRENT[A]	4.5	2.5
	PEAK CURRENT[A]	-	-
	LINE REGULATION[mV] *2	48max	96max
	LOAD REGULATION[mV] *2	100max	150max
	RIPPLE[mVp-p] *3	0 to +70°C 200max -20 - 0°C 300max I _o =0 - 30% 300max *4	200max 300max 300max *4
	RIPPLE NOISE[mVp-p] *3	0 to +70°C 260max -20 - 0°C 360max I _o =0 - 30% 360max *4	260max 360max 360max *4
	TEMPERATURE REGULATION[mV]	0 to +70°C 120max -20 to +70°C 150max	240max 290max
	DRIFT[mV] *5	48max	96max
	START-UP TIME[ms]	200typ (ACIN 115V, I _o =100%)	
	HOLD-UP TIME[ms]	20typ (ACIN 115V, I _o =100%)	
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	10.80 to 13.20	22.50 to 28.50
	OUTPUT VOLTAGE SETTING[V]	12.00 to 12.48	24.00 to 24.96
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically *10	
	OVERVOLTAGE PROTECTION[V]	13.80 to 16.80	30.00 to 36.00
	DC_OK LAMP	LED (Green)	
ISOLATION	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)	
	INPUT-PE	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)	
	OUTPUT-PE	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)	
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-20 to +70°C (Required to Derating), 20 - 90%RH (Non condensing)	
	STORAGE TEMP., HUMID. AND ALTITUDE	-30 to +85°C, 20 - 90%RH (Non condensing)	
	VIBRATION *8	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60 minutes along Z axis (Non operating, mounted on DIN Rail)	
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis (Packing state)	
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL(CSA60950-1), UL508 (NEC Class2 per UL1310), ANSI/ISA12.12.01, EN60950-1, EN50178 Complies with DEN-AN	
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B	
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *6 (Not built-in to active filter) *9	
	CASE SIZE *7	32×90×90mm (W×H×D) [1.26×3.54×3.54 inches]	
OTHERS	WEIGHT	270g max	
	COOLING METHOD	Convection	

*1 The value is primary surge. The current of input surge to a built-in EMI/EMC Filter(0.2ms or less) is excluded.
*2 Please contact us about dynamic load and input response.
*3 This is the value that measured on measuring board with capacitor of 22μF and 0.1μF at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103). Please refer to the instruction manual 2.7.
Ripple and ripple noise spec is change at I_o=0 to 30% by burst operation.
*4 In case of operating under 0°C ambient temperature, the value is two times of specification at 0 to 30% load factor.
*5 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*6 Please contact us about another class.
*7 Case size contains neither the umbo.
*8 Only as standard mounting orientation (A). Refer to the instruction manual 5.1.
If install other than standard mounting orientation (A), please fix the power supply for withstand the vibration and impact.
*9 When two or more units are operating it may not comply with the IEC61000-3-2.
*10 If the overcurrent protection circuit operates continuously, the output voltage shut down. Refer to the instruction manual 2.3.
To meet the specifications. Do not operate over-loaded condition.
* A sound may occur from power supply at light or peak loading.

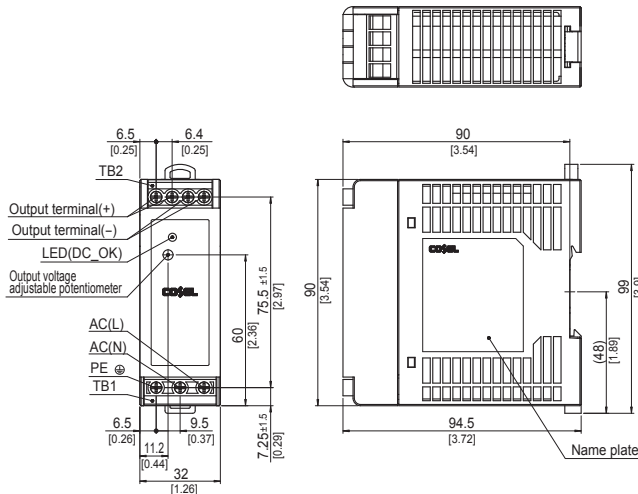
Block diagram



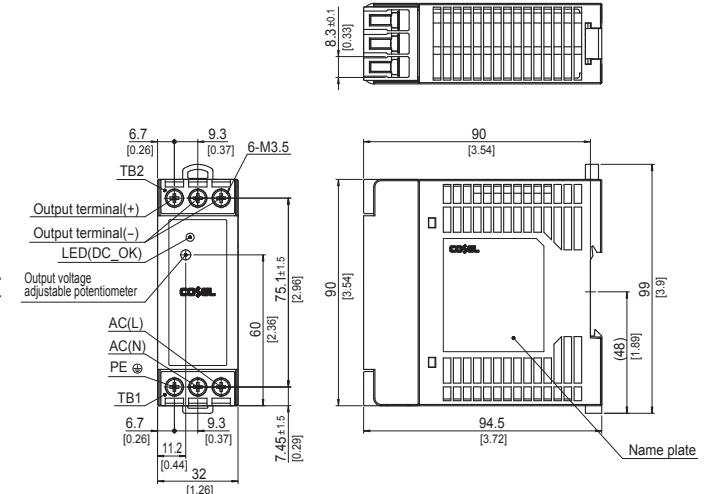
External view

<KHEA60F(Euro Style I/O Terminals)>

<KHNA60F(Barrier Blocks Style I/O Terminals)>



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 270g max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis · Case material : PBT
- ※ Din rail attachment material : PC/ABS
- ※ Dimensions in mm, [] = inches
- ※ Screw tightening torque : 1N · m max



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 270g max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis · Case material : PBT
- ※ Din rail attachment material : PC/ABS
- ※ Dimensions in mm, [] = inches
- ※ Screw tightening torque : 1N · m max

KHEA/KHNA90F

KH ☐ A 90 F - ☐ - ☐

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-04-472-D



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
KHE : Euro style I/O terminals
KHN : Barrier blocks style
I/O terminals
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Option
C : with Coating
E : NEC Class2 (24V)

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	KHEA/KHNA90F-12	KHEA/KHNA90F-24
MAX OUTPUT WATTAGE[W]	81.6	91.2
DC OUTPUT	12V 6.8A	24V 3.8A

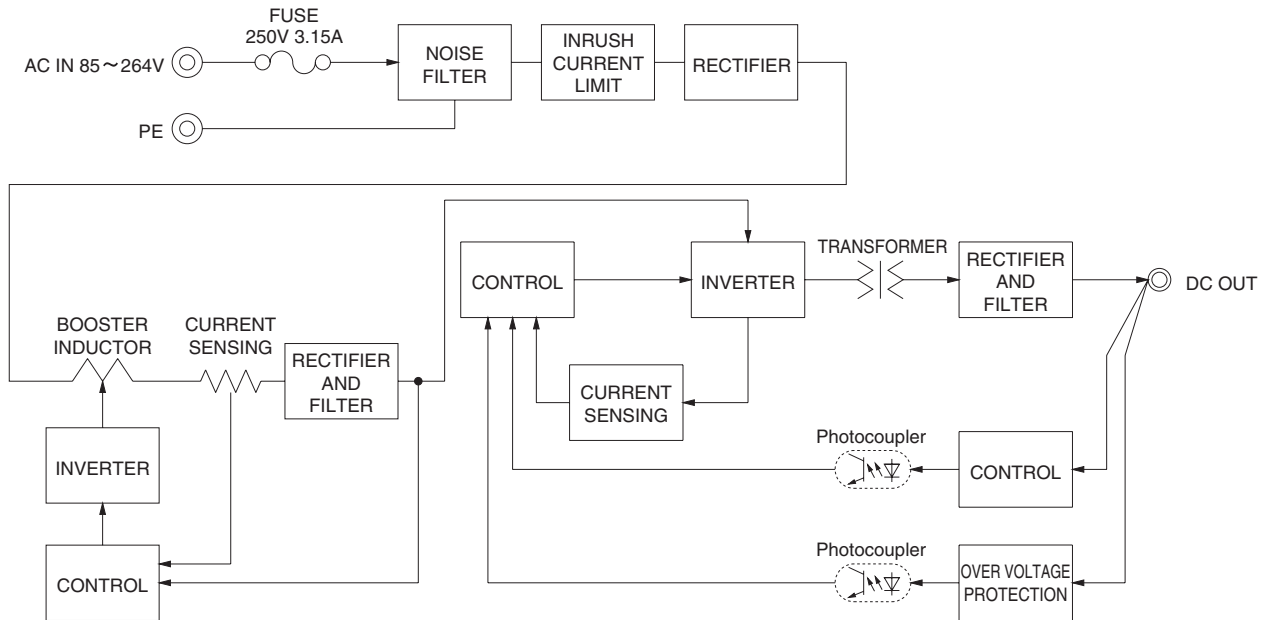
SPECIFICATIONS

	MODEL	KHEA/KHNA90F-12	KHEA/KHNA90F-24
INPUT	VOLTAGE[V]	AC85 - 264 1 φ (Output derating is required) or DC88-250 *10	
	CURRENT[A]	ACIN 115V	0.85typ
		ACIN 230V	0.45typ
	FREQUENCY[Hz]	50 / 60 (45 - 66) or DC	
	EFFICIENCY[%]	ACIN 115V	87.0typ
		ACIN 230V	88.0typ
	POWER FACTOR (Io=100%)	ACIN 115V	0.98typ
		ACIN 230V	0.86typ
	INRUSH CURRENT[A]	ACIN 115V	18typ (Io=100%) (at cold start Ta=25℃)
		*1 ACIN 230V	35typ (Io=100%) (at cold start Ta=25℃)
	LEAKAGE CURRENT[ma]	0.45 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)	
OUTPUT	VOLTAGE[V]	12	24
	CURRENT[A]	6.8	3.8
	PEAK CURRENT[A]	-	-
	LINE REGULATION[mV] *2	48max	96max
	LOAD REGULATION[mV] *2	100max	150max
	RIPPLE[mVp-p] *3	0 to +70℃	200max
		-20 - 0℃	300max
		Io=0 - 30%	300max *4
	RIPPLE NOISE[mVp-p] *3	0 to +70℃	260max
		-20 - 0℃	360max
		Io=0 - 30%	360max *4
	TEMPERATURE REGULATION[mV]	0 to +70℃	120max
		-20 to +70℃	150max
	DRIFT[mV] *5	48max	96max
PROTECTION CIRCUIT AND OTHERS	START-UP TIME[ms]	500typ (ACIN 115V, Io=100%)	
	HOLD-UP TIME[ms]	20typ (ACIN 115V, Io=100%)	
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	10.80 to 13.20	22.50 to 28.50 (Fixed for option -E)
	OUTPUT VOLTAGE SETTING[V]	12.00 to 12.48	24.00 to 24.96 (24.00 to 24.50 for option -E)
	OVERCURRENT PROTECTION	Works over 105% of rating (101% for option -E), recovers automatically *9	
ISOLATION	OVERVOLTAGE PROTECTION[V]	13.80 to 16.80	30.00 to 36.00 (26.40 to 33.60 for option -E)
	DC_OK LAMP	LED (Green)	
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)	
ENVIRONMENT	INPUT-PE	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)	
	OUTPUT-PE	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)	
	OPERATING TEMP., HUMID. AND ALTITUDE	-20 to +70℃ (Required to Derating), 20 - 90%RH (Non condensing)	
	STORAGE TEMP., HUMID. AND ALTITUDE	-30 to +85℃, 20 - 90%RH (Non condensing)	
SAFETY AND NOISE REGULATIONS	VIBRATION *8	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60 minutes along Z axis (Non operating, mounted on DIN Rail)	
	IMPACT	196.1m/s ² (20G), 11ms, X, Y and Z axis (Packing state)	
OTHERS	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL(CSA60950-1), EN60950-1, EN50178, UL508, NEC Class2 (24V output only option -E), ANSI/ISA12.12.01 Complies with DEN-AN	
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B	
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *6	
	CASE SIZE *7	50×90×90mm (W×H×D) [1.97×3.54×3.54 inches]	
	WEIGHT	405g max	
	COOLING METHOD	Convection	

*1 The value is primary surge. The current of input surge to a built-in EMI/EMC Filter(0.2ms or less) is excluded.
*2 Please contact us about dynamic load and input response.
*3 This is the value that measured on measuring board with capacitor of 22μF and 0.1μF at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103). Please refer to the instruction manual 2.7.
*4 In case of operating under 0℃ ambient temperature, the value is two times of specification at 0 to 30% load factor.
*5 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.

*6 Please contact us about another class.
*7 Case size contains neither the umbo.
*8 Only as standard mounting orientation (A). Refer to the instruction manual 5.1.
If install other than standard mounting orientation (A), please fix the power supply for withstand the vibration and impact.
*9 If the overcurrent protection circuit operates continuously, the output voltage shut down. Refer to the instruction manual 2.3.
*10 Under low DC input voltage below DC110V, the temperature derating -1℃/V or the output power derating -1%/V are required.
* To meet the specifications. Do not operate over-loaded condition.
* A sound may occur from power supply at light or peak loading.

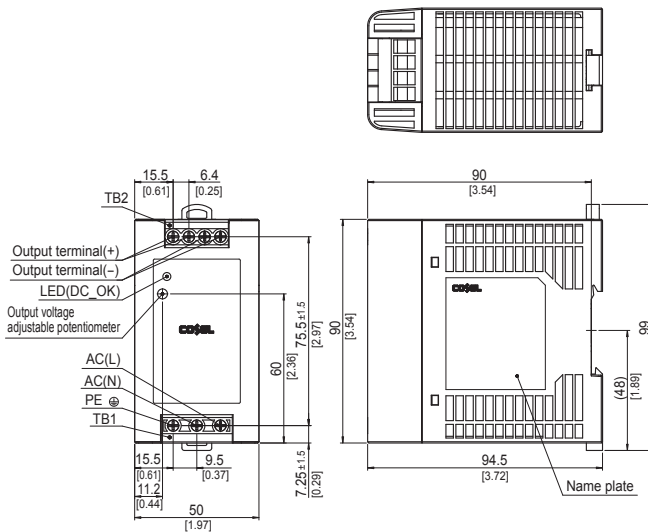
Block diagram



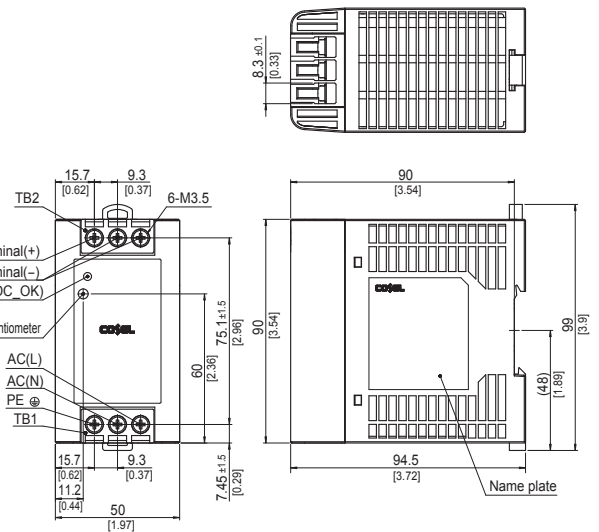
External view

<KHEA90F(Euro Style I/O Terminals)>

<KHNA90F(Barrier Blocks Style I/O Terminals)>



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 405g max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis · Case material : PBT
- ※ Din rail attachment material : PC/ABS
- ※ Dimensions in mm, [] = inches
- ※ Screw tightening torque : 1N · m max



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 405g max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis · Case material : PBT
- ※ Din rail attachment material : PC/ABS
- ※ Dimensions in mm, [] = inches
- ※ Screw tightening torque : 1N · m max

KHEA/KHNA120F

KH ☐ A -120 F -24 - ☐

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-04-472-D



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
KHE : Euro style I/O terminals
KHN : Barrier blocks style I/O terminals
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Option
C : with Coating
N2: Screw mounting

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	KHEA / KHNA120F-24
MAX OUTPUT WATTAGE[W]	120
DC OUTPUT	24V 5A (Peak 7.5A)

SPECIFICATIONS

	MODEL	KHEA / KHNA120F-24
INPUT	VOLTAGE[V]	AC85 - 264 1 ϕ or DC88 - 370 *10
	CURRENT[A]	ACIN 115V 1.2typ
		ACIN 230V 0.6typ
	FREQUENCY[Hz]	50 / 60 (45 - 66) or DC
	EFFICIENCY[%]	ACIN 115V 90typ
		ACIN 230V 92typ
	POWER FACTOR	ACIN 115V 0.98typ
		ACIN 230V 0.93typ
	INRUSH CURRENT[A]	ACIN 115V 15typ (at cold start Ta=25°C)
		*1 ACIN 230V 30typ (at cold start Ta=25°C)
	LEAKAGE CURRENT[ma]	0.45 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)
OUTPUT	VOLTAGE[V]	24
	CURRENT[A]	5
	PEAK CURRENT[A]	*2 7.5
	LINE REGULATION[mV]	*3 96max
	LOAD REGULATION[mV]	*3 150max *4
	RIPPLE[mVp-p]	0 to +70°C 120max
		*5 -25 - 0°C 240max
		I _o =0 - 30% 240max *4
		0 to +70°C 150max
	RIPPLE NOISE[mVp-p]	*5 -25 - 0°C 300max
		I _o =0 - 30% 300max *4
	TEMPERATURE REGULATION[mV]	0 to +70°C 240max *4
		-25 to +70°C 360max *4
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV]	*6 96max
	START-UP TIME[ms]	750max (ACIN 115V, I _o =100%)
	HOLD-UP TIME[ms]	20typ (ACIN 115V, I _o =100%)
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	22.5 to 28.5
	OUTPUT VOLTAGE SETTING[V]	24.0 \pm 1.0%
	OVERCURRENT PROTECTION	Works over 101% of peak current and recovers automatically
	OVERVOLTAGE PROTECTION[V]	30.0 to 36.0
ISOLATION	DC_OK LAMP	LED (Green)
	ALARM LAMP	LED (Red)
	DC_OK CONTACT	Relay contact 30VDC 1A max, 30VAC 0.5A max (resistive load) (Only KHEA)
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)
ENVIRONMENT	INPUT-PE	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)
	OUTPUT-PE	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (At Room Temperature)
	OUTPUT-RC, DC_OK	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (At Room Temperature)
	OPERATING TEMP., HUMID. AND ALTITUDE	-25 to +70°C (Required to Derating), 20 - 90%RH (Non condensing)
SAFETY AND NOISE REGULATIONS	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 - 90%RH (Non condensing)
	VIBRATION	*9 10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60 minutes along Z axis (Non operating, mounted on DIN Rail)
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis (Packing state)
	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178, UL508, ANSI / ISA12.12.01, GL Complies with DEN-AN
OTHERS	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *7
	CASE SIZE	*8 37 \times 124 \times 117mm (W \times H \times D) [1.46 \times 4.88 \times 4.61 inches]
	WEIGHT	580g max
	COOLING METHOD	Convection

*1 The value is primary surge. The current of input surge to a built-in EMI/EMC Filter (0.2ms or less) is excluded.

*2 Refer to 3, instruction manual.

*3 Please contact us about dynamic load and input response.

*4 The output voltage is below 23.5V, the value is equal to three times of the specification.

*5 This is the value that measured on measuring board with capacitor of 22 μ F and 0.1 μ F at 150mm from output terminal.

Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

Please refer to the instruction manual 2.7.

*6 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*7 Please contact us about another class.

*8 Case size contains neither the umbo.

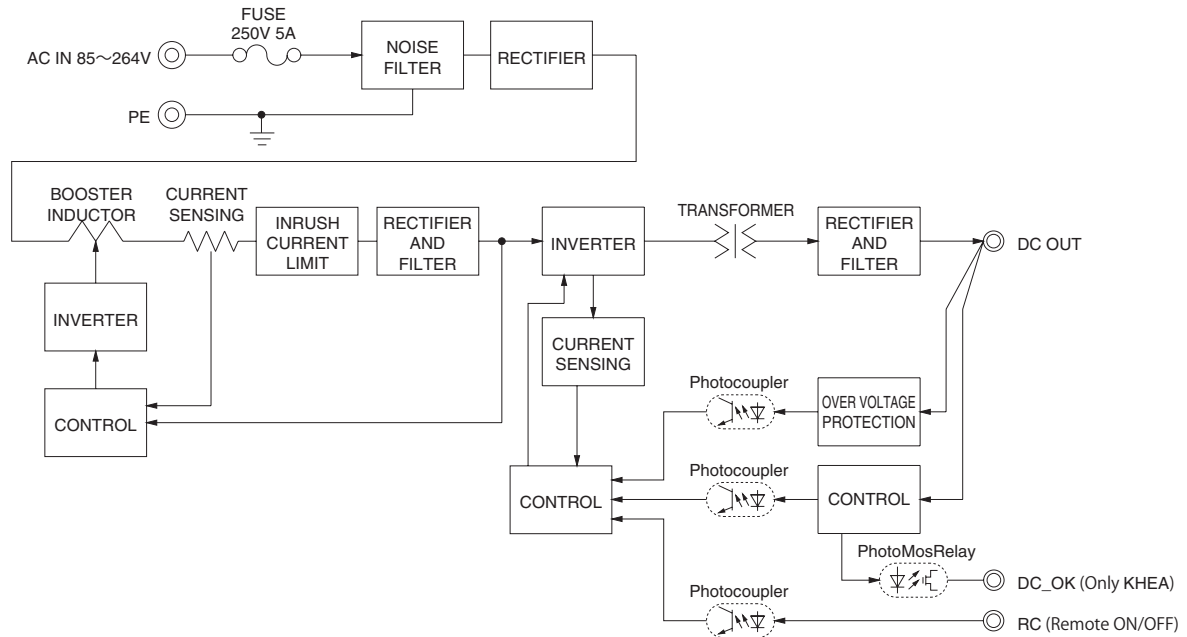
*9 Only as standard mounting orientation (A). Refer to the instruction manual 5.1. If install other than standard mounting orientation (A), please fix the power supply for withstand the vibration and impact.

*10 Under low DC input voltage below DC110V, the temperature derating -1°C/V or the output power derating -1%/V are required.

* To meet the specifications. Do not operate over-loaded condition.

* A sound may occur from power supply at light or peak loading.

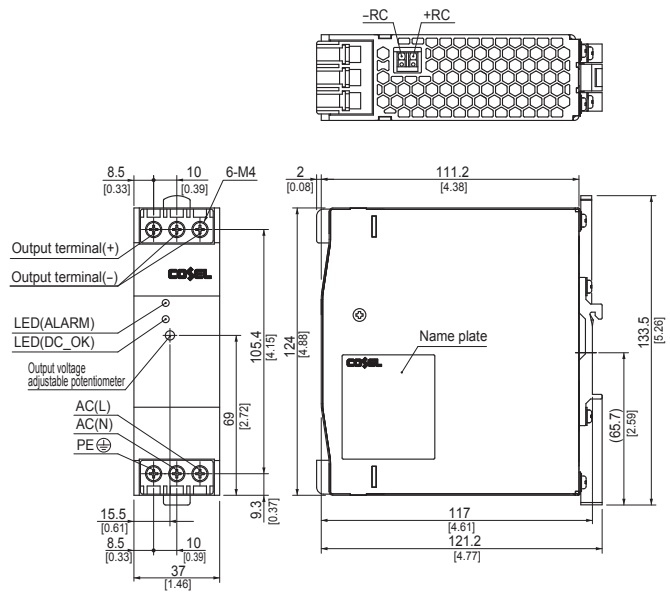
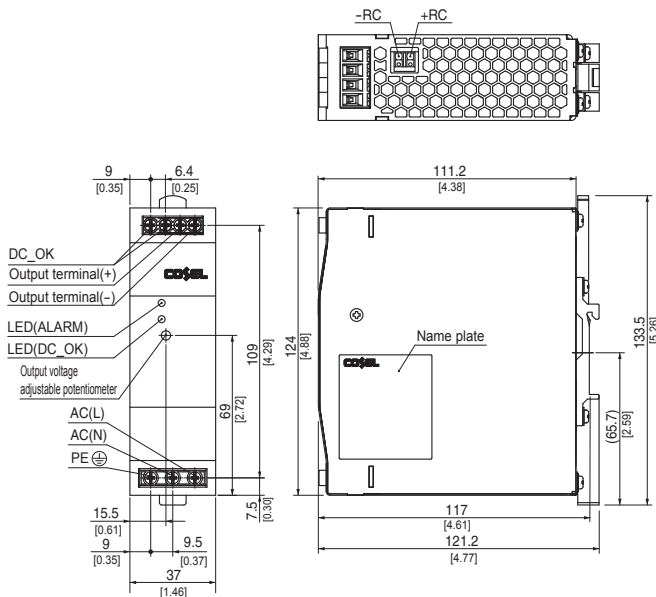
Block diagram



External view

<KHEA120F(Euro Style I/O Terminals)>

<KHNA120F(Barrier Blocks Style I/O Terminals)>



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 580g max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Case material : Stainless steel
- ※ DIN rail attachment material : Aluminum, Nylon
- ※ Dimensions in mm, [] = inches
- ※ Screw tightening torque : 1N · m max

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 580g max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Case material : Stainless steel
- ※ DIN rail attachment material : Aluminum, Nylon
- ※ Dimensions in mm, [] = inches
- ※ Screw tightening torque : 1.6N · m max

KHEA/KHNA240F

KH ☐ A -240 F -24 - ☐

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-06-472-D



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
KHE : Euro style I/O terminals
KHNA : Barrier blocks style
I/O terminals
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Option
C : with Coating
N2 : Screw mounting

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	KHEA / KHNA240F-24
MAX OUTPUT WATTAGE[W]	240
DC OUTPUT	24V 10A (Peak 15A)

SPECIFICATIONS

	MODEL	KHEA / KHNA240F-24
	VOLTAGE[V]	AC85 - 264 1 ϕ or DC88 - 370 *10
INPUT	CURRENT[A]	ACIN 115V 2.3typ ACIN 230V 1.2typ
	FREQUENCY[Hz]	50 / 60 (45 - 66) or DC
	EFFICIENCY[%]	ACIN 115V 92typ ACIN 230V 94typ
	POWER FACTOR	ACIN 115V 0.98typ ACIN 230V 0.93typ
	INRUSH CURRENT[A]	ACIN 115V 20typ (more than 3 sec. to re-start) *1 ACIN 230V 40typ (more than 3 sec. to re-start)
	LEAKAGE CURRENT[ma]	0.45 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)
OUTPUT	VOLTAGE[V]	24
	CURRENT[A]	10
	PEAK CURRENT[A]	*2 15
	LINE REGULATION[mV]	*3 96max
	LOAD REGULATION[mV]	*3 150max *4
	RIPPLE[mVp-p]	0 to +70°C 120max *5 -25 - 0°C 240max Io=0 - 30% 240max *4
	RIPPLE NOISE[mVp-p]	0 to +70°C 150max *5 -25 - 0°C 300max Io=0 - 30% 300max *4
	TEMPERATURE REGULATION[mV]	0 to +70°C 240max *4 -25 to +70°C 360max *4
	DRIFT[mV]	*6 96max
	START-UP TIME[ms]	750max (ACIN 115V, Io=100%)
	HOLD-UP TIME[ms]	20typ (ACIN 115V, Io=100%)
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	22.5 to 28.5
	OUTPUT VOLTAGE SETTING[V]	24.0 \pm 1.0%
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 101% of peak current and recovers automatically
	OVERVOLTAGE PROTECTION[V]	30.0 to 36.0
	DC_OK LAMP	LED (Green)
	ALARM LAMP	LED (Red)
ISOLATION	DC_OK CONTACT	Relay contact 30VDC 1A max, 30VAC 0.5A max (resistive load) (Only KHEA)
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)
	INPUT-PE	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)
	OUTPUT-PE	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (At Room Temperature)
ENVIRONMENT	OUTPUT-RC, DC_OK	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (At Room Temperature)
	OPERATING TEMP., HUMID. AND ALTITUDE	-25 to +70°C (Required to Derating), 20 - 90%RH (Non condensing)
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 - 90%RH (Non condensing)
	VIBRATION	*9 10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60 minutes along Z axis (Non operating, mounted on DIN Rail)
SAFETY AND NOISE REGULATIONS	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis (Packing state)
	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178, UL508, ANSI / ISA12.12.01, GL Complies with DEN-AN
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *7
OTHERS	CASE SIZE	*8 50 \times 124 \times 117mm (W \times H \times D) [1.97 \times 4.88 \times 4.61 inches]
	WEIGHT	900g max
	COOLING METHOD	Convection

*1 The value is primary surge. The current of input surge to a built-in EMI/EMC Filter (0.2ms or less) is excluded.

*2 Refer to 3, instruction manual.

*3 Please contact us about dynamic load and input response.

*4 The output voltage is below 23.5V, the value is equal to three times of the specification.

*5 This is the value that measured on measuring board with capacitor of 22 μ F and 0.1 μ F at 150mm from output terminal.

Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

Please refer to the instruction manual 2.7.

*6 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

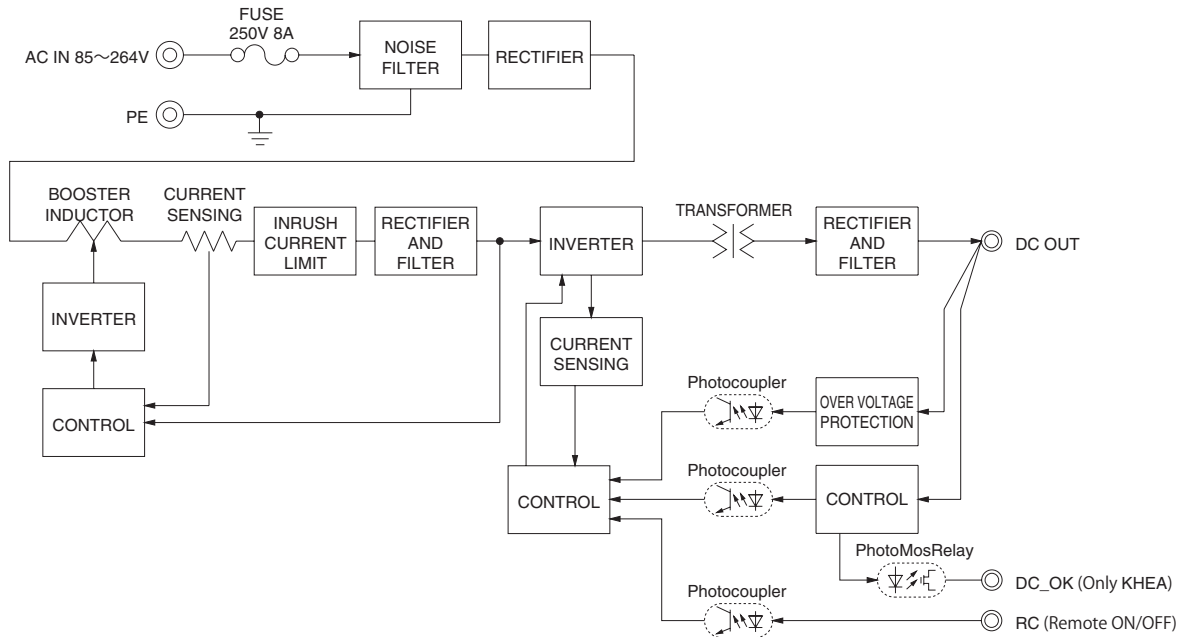
*7 Please contact us about another class.
*8 Case size contains neither the umbro.

*9 Only as standard mounting orientation (A). Refer to the instruction manual 5.1. If install other than standard mounting orientation (A), please fix the power supply for withstand the vibration and impact.

*10 Under low DC input voltage below DC110V, the temperature derating -1°C/V or the output power derating -1%/V are required.

* To meet the specifications. Do not operate over-loaded condition.
* A sound may occur from power supply at light or peak loading.

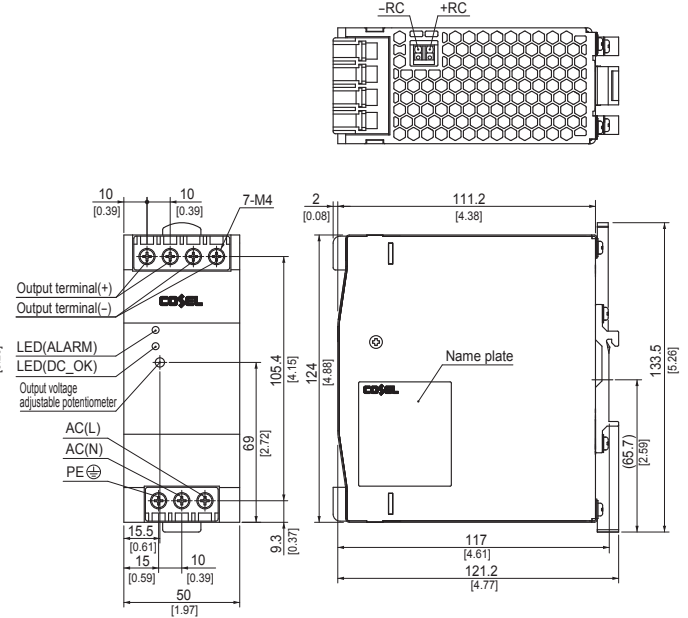
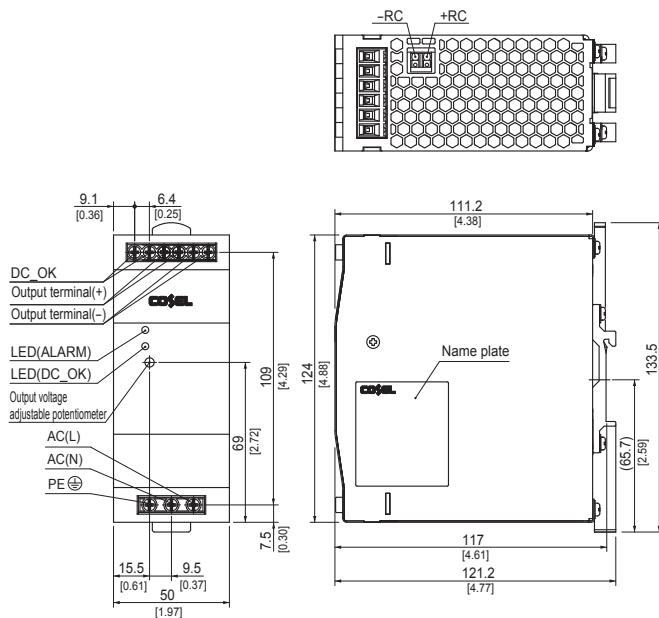
Block diagram



External view

<KHEA240F(Euro Style I/O Terminals)>

<KHNA240F(Barrier Blocks Style I/O Terminals)>



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 900g max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Case material : Stainless steel
- ※ DIN rail attachment material : Aluminum, Nylon
- ※ Dimensions in mm, [] = inches
- ※ Screw tightening torque : 1N · m max

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 900g max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Case material : Stainless steel
- ※ DIN rail attachment material : Aluminum, Nylon
- ※ Dimensions in mm, [] = inches
- ※ Screw tightening torque : 1.6N · m max

KHEA/KHNA480F

KH ☐ A 480 F - ☐ - ☐

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-10-472-D



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
KHE : Euro style I/O terminals
KHN : Barrier blocks style I/O terminals
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Option
C : with Coating
N2: Screw mounting

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	KHEA / KHNA480F-24	KHEA / KHNA480F-48
MAX OUTPUT WATTAGE[W]	480	480
DC OUTPUT	24V 20A (Peak 30A)	48V 10A (Peak 15A)

SPECIFICATIONS

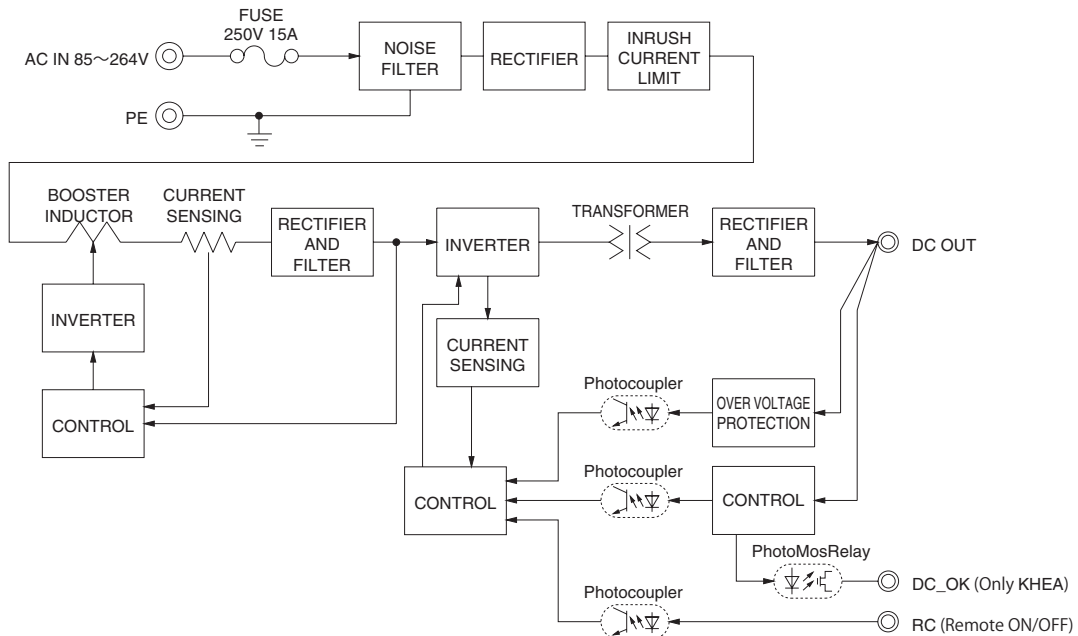
	MODEL	KHEA / KHNA480F-24	KHEA / KHNA480F-48
INPUT	VOLTAGE[V]	AC85 - 264 1 ϕ (Output derating is required) or DC88 - 350 *10	
	CURRENT[A]	ACIN 115V	4.6typ
		ACIN 230V	2.3typ
	FREQUENCY[Hz]	50 / 60 (45 - 66) or DC	
	EFFICIENCY[%]	ACIN 115V	92typ
		ACIN 230V	94typ
	POWER FACTOR	ACIN 115V	0.98typ
		ACIN 230V	0.93typ
	INRUSH CURRENT[A]	ACIN 115V	20typ (more than 3 sec. to re-start)
		*1 ACIN 230V	40typ (more than 3 sec. to re-start)
	LEAKAGE CURRENT[ma]	0.75 / 1.5max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)	
OUTPUT	VOLTAGE[V]	24	48
	CURRENT[A]	20	10
	PEAK CURRENT[A]	*2 30	15
	LINE REGULATION[mV]	*3 96max (Io=30-100%) *9	192max (Io=30-100%) *9
	LOAD REGULATION[mV]	*3 150max (Io=30-100%) *9	300max (Io=30-100%) *9
	RIPPLE[mVp-p]	0 to +70°C	120max
		-25 - 0°C	240max
		Io=0 - 30%	500max
	RIPPLE NOISE[mVp-p]	0 to +70°C	150max
		-25 - 0°C	300max
		Io=0 - 30%	600max
	TEMPERATURE REGULATION[mV]	0 to +70°C	240max
		-25 to +70°C	360max
	DRIFT[mV]	*5 96max	192max
PROTECTION CIRCUIT AND OTHERS	START-UP TIME[ms]	750max (ACIN 115V, Io=100%)	
	HOLD-UP TIME[ms]	20typ (ACIN 115V, Io=100%)	
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	22.5 to 26.4	45.0 to 55.2
	OUTPUT VOLTAGE SETTING[V]	24.0 \pm 1.0%	48.0 \pm 1.0%
	OVERCURRENT PROTECTION	Works over 101% of peak current and recovers automatically	
	OVERVOLTAGE PROTECTION[V]	30.0 to 36.0	57.6 to 67.2
	DC_OK LAMP	LED (Green)	
	ALARM LAMP	LED (Red)	
	DC_OK CONTACT	Relay contact 30VDC 1A max, 30VAC 0.5A max (resistive load) (Only KHEA)	
ISOLATION	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)	
	INPUT-PE	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50M Ω min (At Room Temperature)	
	OUTPUT-PE	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (At Room Temperature)	
	OUTPUT-RC, DC_OK	AC500V 1minute, Cutoff current = 100mA, DC500V 50M Ω min (At Room Temperature)	
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-25 to +70°C (Required to Derating), 20 - 90%RH (Non condensing)	
	STORAGE TEMP., HUMID. AND ALTITUDE	-40 to +85°C, 20 - 90%RH (Non condensing)	
	VIBRATION	*8 10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60 minutes along Z axis (Non operating, mounted on DIN Rail)	
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis (Packing state)	
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS (At only AC input)	UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178, UL508, ANSI / ISA12.12.01, GL (Only 24V) Complies with DEN-AN	
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B	
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *6	
OTHERS	CASE SIZE	*7 70 \times 124 \times 117mm (W \times H \times D) [2.76 \times 4.88 \times 4.61 inches]	
	WEIGHT	1,200g max	
	COOLING METHOD	Convection	

*1 The value is primary surge. The current of input surge to a built-in EMI/EMC Filter (0.2ms or less) is excluded.
*2 Refer to 3, instruction manual.
*3 Please contact us about dynamic load and input response.
*4 This is the value that measured on measuring board with capacitor of 22 μ F and 0.1 μ F at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

*5 Please refer to the instruction manual 2.7.
Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
*6 Please contact us about another class.
*7 Case size contains neither the umbo.
*8 Only as standard mounting orientation (A). Refer to the instruction manual 5.1.
If install other than standard mounting orientation (A), please fix the power

supply for withstand the vibration and impact.
*9 Burst operation at 30% load or less.
*10 Under low DC input voltage below DC110V, the temperature derating -1°C/V or the output power derating -1%/V are required.
* To meet the specifications. Do not operate over-loaded condition.
* A sound may occur from power supply at light or peak loading.

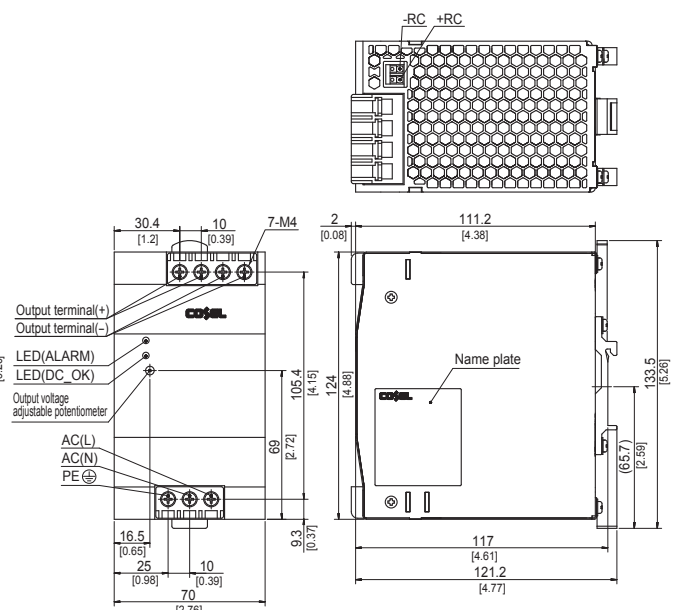
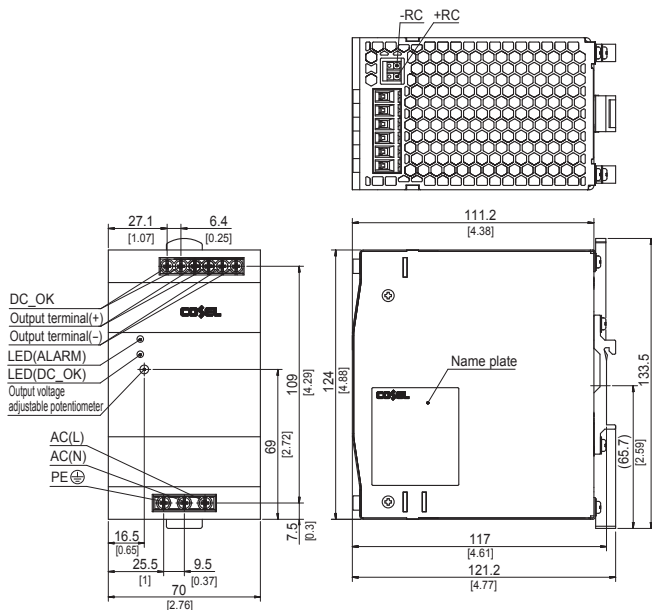
Block diagram



External view

<KHEA480F(Euro Style I/O Terminals)>

<KHNA480F(Barrier Blocks Style I/O Terminals)>



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 1,200g max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Case material : Stainless steel
- ※ DIN rail attachment material : Aluminum, Nylon
- ※ Dimensions in mm, [] = inches
- ※ Screw tightening torque : 1N · m max

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 1,200g max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Case material : Stainless steel
- ※ DIN rail attachment material : Aluminum, Nylon
- ※ Dimensions in mm, [] = inches
- ※ Screw tightening torque : 1.6N · m max

Basic Characteristics Data

Model	Circuit method	Switching frequency *2 [kHz]	Input current [A] *1	Rated input fuse	Inrush current protection circuit	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
KHEA30F KHNA30F	Flyback converter	50 - 200	0.55	250V 2.5A	Thermistor	FR-4		Yes	Yes	No
KHEA60F KHNA60F	Flyback converter	50 - 200	1.10	250V 3.15A	Thermistor	FR-4		Yes	Yes	No
KHEA90F KHNA90F	Active filter Flyback converter	20 - 500 50 - 200	0.95	250V 3.15A	Thermistor	FR-4		Yes	Yes	No
KHEA120F KHNA120F	Active filter LLC resonant converter	60 - 550 45 - 350	1.2	250V 5A	Thermistor	FR-4		Yes	Yes	No
KHEA240F KHNA240F	Active filter LLC resonant converter	60 - 550 45 - 350	2.3	250V 8A	SCR	FR-4		Yes	Yes	No
KHEA480F KHNA480F	Active filter LLC resonant converter	60 - 150 45 - 350	4.6	250V 15A	Relay	FR-4		Yes	Yes	No

*1 The value of input current is at ACIN 115V and 100%.

*2 Burst operation at light loading, frequency is change by use condition.
Please contact us about detail.

1 Terminal Blocks

KH-16

2 Functions

KH-18

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3 Peak Current

KH-20

4 Series/Parallel Operation

KH-20

4.1	Series Operation	KH-20
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5 Assembling and Installation Method

KH-21

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6 Option

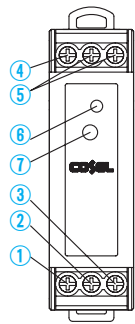
KH-28

6.1	Outline of option	KH-28
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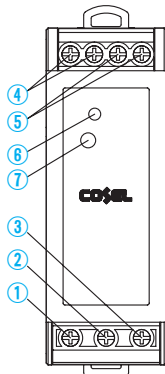
KH

1 Terminal Blocks

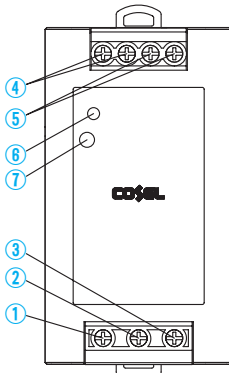
● KHEA30F



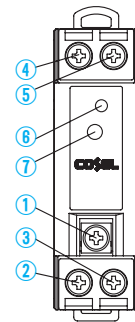
● KHEA60F



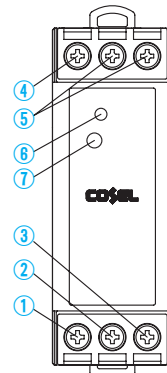
● KHEA90F



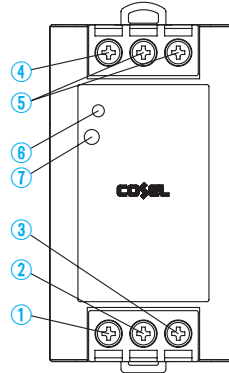
● KHNA30F



● KHNA60F



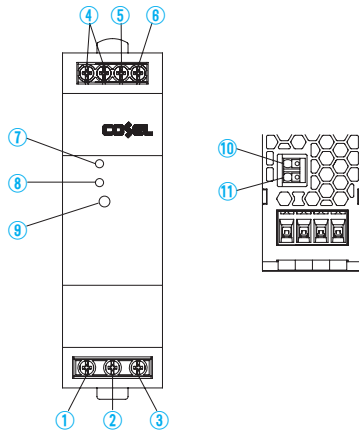
● KHNA90F



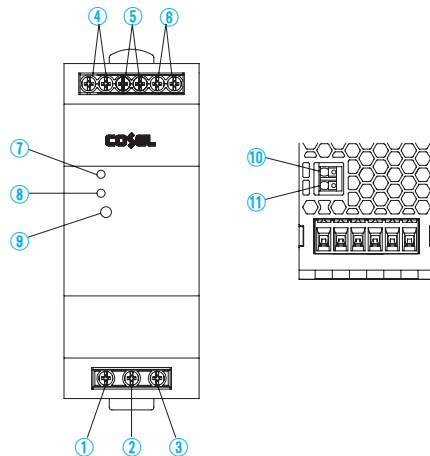
KH

Terminal Number	Terminal Name	Function
①	PE	Protective earth Terminal
②	AC (N)	Input Terminals
③	AC (L)	
④	+VOUT	+Output Terminals
⑤	-VOUT	-Output Terminals
⑥	DC_OK	LED for output voltage confirmation
⑦	TRM	Adjustment of output voltage

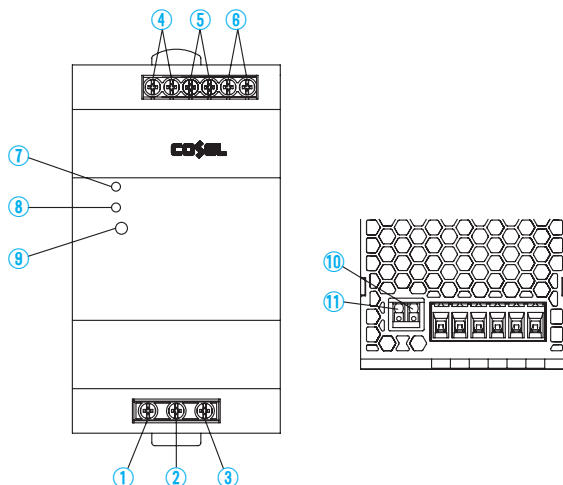
● KHEA120F



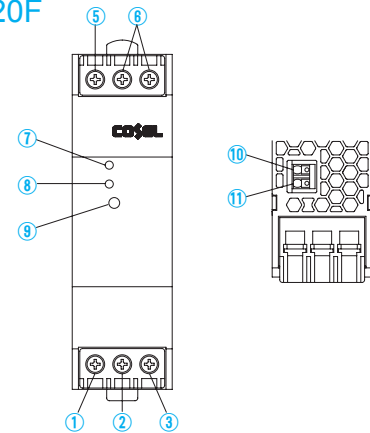
● KHEA240F



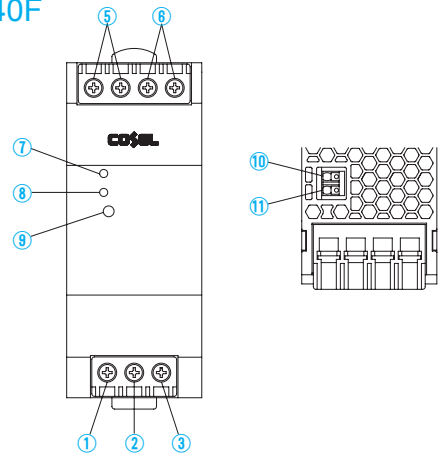
● KHEA480F



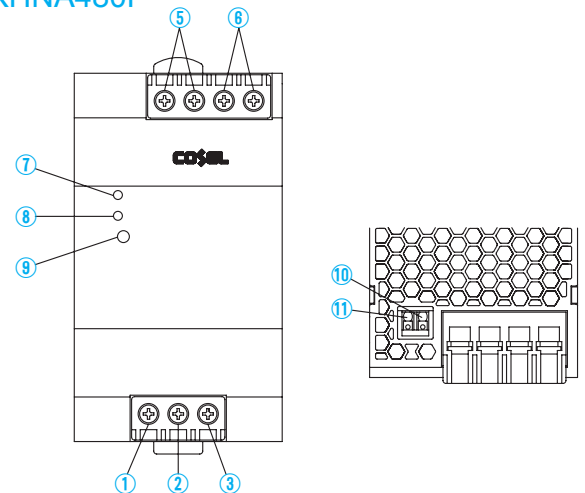
● KHNA120F



● KHNA240F



● KHNA480F



Terminal Number	Terminal Name	Function
①	PE	Protective earth Terminal
②	AC (N)	Input Terminals
③	AC (L)	
④	DC_OK	Output voltage confirmation(relay contact)
⑤	+VOUT	+Output Terminals
⑥	-VOUT	-Output Terminals
⑦	ALARM	LED Alarm for lowered output voltage
⑧	DC_OK	LED for output voltage confirmation
⑨	TRM	Adjustment of output voltage
⑩	+RC	Remote ON/OFF Terminals
⑪	-RC	

KH

2 Functions

2.1 Input Voltage Range

- Input voltage range of the power supplies is from AC85V to AC264V or DC (please see SPECIFICATIONS for details).
- To comply with safety standards, input voltage range is AC100-AC240V (50/60Hz).
- If input value doesn't fall within above range, a unit may not operate in accordance with specifications and/or start hunting or operate protection circuit or fail.
If you need to apply a square waveform input voltage, which is commonly used in UPS and inverters, please contact us.
- When the input voltage changes suddenly, the output voltage accuracy might exceed the specification. Please contact us.

● KHEA30F/60F/90F, KHNA30F/60F/90F

- Operation stop voltage is set at a lower value than of a standard version (derating is needed).
· Use Conditions

	Output
KHEA30F, KHNA30F	10W
KHEA60F, KHNA60F	20W
KHEA90F, KHNA90F	30W
Input AC50V or DC70V	
Duty 1s/30s	

*Please avoid using continuously for more than 1 second under above conditions. Doing so may cause a failure.

2.2 Inrush Current Limiting

- An inrush current limiting circuit is built-in.
- If you need to use a switch on the input side, please select one that can withstand an input inrush current.

● KHEA30F/60F/90F/120F, KHNA30F/60F/90F/120F

- Thermistor is used in the inrush current limiting circuit. When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that a power supply cools down before being turned on.

● KHEA240F/480F, KHNA240F/480F

- Thyristor technique (KHEA/KHNA240F) and power relay technique (KHEA/KHNA480F) is used in the inrush current limiting circuit.
- When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that the inrush current limiting circuit becomes operative.
- When the switch of the input is turned on, the primary inrush current and secondary inrush current will be generated.

2.3 Overcurrent Protection

● KHEA30F/60F/90F, KHNA30F/60F/90F

- An overcurrent protection circuit is built-in and activated at 105% of the rated current. A unit automatically recovers when a fault condition is removed. Please do not use a unit in short circuit and/or under an overcurrent condition.
- Intermittent Operation Mode (except KHEA/KHNA90F)
When the overcurrent protection circuit is activated and the output voltage drops to a certain extent, the output becomes intermittent so that the average current will also decrease.
- Output Voltage Shutdown
If the output voltage drops according to the overcurrent protection circuit operating continuously for about 0.5 second, the output voltage may shut down. To recover the output voltage, remove a condition that is causing an overcurrent, shut down the input voltage, wait more than 3 minutes and turn on the AC input again.

● KHEA120F/240F/480F, KHNA120F/240F/480F

- An overcurrent protection circuit is built-in and activated at 101% of the peak current. A unit automatically recovers when a fault condition is removed. Please do not use a unit in short circuit and/or under an overcurrent condition.
- Intermittent Operation Mode
When the overcurrent protection circuit is activated and the output voltage drops to a certain extent, the output becomes intermittent so that the average current will also decrease.

2.4 Peakcurrent Protection

● KHEA120F/240F/480F, KHNA120F/240F/480F

- Peakcurrent protection is built-in (refer to Instruction Manual 3 for Peak loading).
If this function comes into effect, the output is shut down.
A few seconds later, A unit automatically recovers.
But if the overcurrent condition has not been released, the output will stop again (intermittent Operation Mode).
- *The recovery time varies depending on input voltage and load condition.

2.5 Overvoltage Protection

● KHEA30F/60F/90F, KHNA30F/60F/90F

- An overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait more than 3 minutes and turn on the AC input again to recover the output voltage. Recovery time varies depending on such factors as input voltage value at the time of the operation.

● KHEA120F/240F/480F, KHNA120F/240F/480F

- An overvoltage protection circuit is built-in.
A unit automatically recovers when the fault condition is removed.

Note :

Please avoid applying a voltage exceeding the rated voltage to an output terminal. Doing so may cause a power supply to malfunction or fail. If you cannot avoid doing so, for example, if you need to operate a motor, etc., please install an external diode on the output terminal to protect the unit.

2.6 Thermal Protection

● KHEA120F/240F/480F, KHNA120F/240F/480F

■ A thermal protection circuit is built-in.

The thermal protection circuit may be activated under the following conditions and shut down the output.

- ① When a temperature continue to exceed the values determined by the derating curve.
- ② When a current exceeding the rated current is applied.
- ③ When convection stops.
- ④ When peak load is applied in conditions other than those shown in Section 3.

A unit automatically recovers when the fault condition is removed.

2.7 Output ripple and ripple noise

■ Output ripple noise may be influenced by measurement environment, measuring method fig 2.1 is recommended.

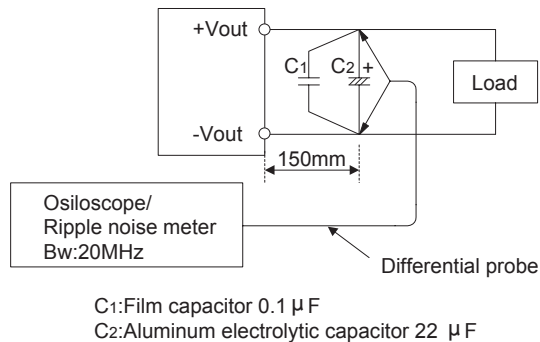


Fig.2.1 Measuring method of Ripple and Noise

2.8 Remote ON/OFF

■ You can reduce the standby power by Remote ON/OFF.

To do so, connect an external DC power supply and apply a voltage to a remote ON/OFF connector.

Table 2.1 Remote ON/OFF Specifications

ON/OFF logic	Between +RC and -RC	Output voltage
Negative	L level (0 to 0.5V) or open	ON
	H level (4.5 to 29.5V)	OFF

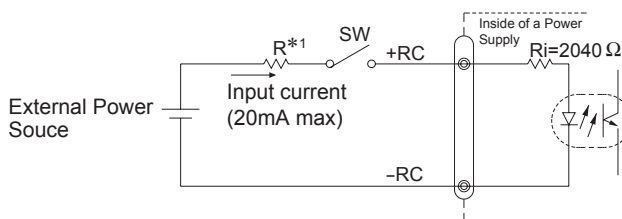


Fig.2.2 Example of use with remote ON/OFF

*1 If the output of an external power supply is within the range of 4.5 - 29.5V, you do not need a current limiting resistor R. If the output exceeds 29.5V, however, please connect the current limiting resistor R.

To calculate a current limiting resistance value, please use the following equation.

$$R [\Omega] = \frac{V_{cc} - (1.1 + R_i \times 0.005)}{0.005}$$

■ Please wire carefully. If you wire wrongly, the internal components of a unit may be damaged.

■ Remote ON/OFF circuits (+RC and -RC) are isolated from input, output and PE.

■ Restart time is 750 ms max .

2.9 Output Voltage Adjustment Range

■ To increase an output voltage, turn a built-in potentiometer clockwise. To decrease the output voltage, turn it counterclockwise.

2.10 Isolation

■ When you run a Hi-Pot test as receiving inspection, gradually increase the voltage to start. When you shut down, decrease the voltage gradually by using a dial. Please avoid a Hi-Pot tester with a timer because, when the timer is turned ON or OFF, it may generate a voltage a few times higher than the applied voltage.

■ When you test a unit for isolation between the output and the DC_OK, short all terminals of DC_OK.

2.11 Signal Output

Functions of LED indicators and signal output (KHEA series)

● KHEA120F/240F/480F, KHNA120F/240F/480F

■ Functions of LED indicators and signal output in the form of relay contact are shown below. Checking the presence/absence of voltage at the output terminal of a power supply is possible.

Table 2.2 Description of the signal output

Signal Output	Normal	Output is decreasing
DC_OK (LED: Green)	ON	OFF
ALARM (LED: Red)	OFF	ON
DC_OK (Relay Contact) *	Short	Open

*DC_OK signal (relay contact) is built in KHEA series. This circuit is insulated from other circuits (input and output circuits).

Caution on signal outputs :

■ The timing of signals might be very depending on models, input and load conditions. Please make sure enough evaluation.

3 Peak Current

● KHEA120F/240F/480F, KHNA120F/240F/480F

■ The units can generate the peak current under the following conditions.

- $t_1 \leq 5\text{sec}$
- $I_p \leq \text{Rated peak current}$
- $I_{ave} \leq \text{Rated current}$

* Please use a maximum of Duty following shown in Table 3.1.

$$\text{Duty} = \frac{t_1}{t_1 + t_2} \times 100 [\%]$$

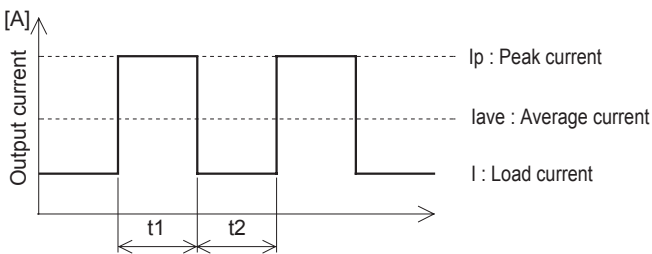


Fig.3.1 Peak current

Table 3.1 Maximum Duty by the mounting orientation

Mounting orientation	Input Voltage	Maximum Duty			
		KHEA120F KHNA120F	KHEA240F KHNA240F	KHEA480F-24 KHNA480F-24	KHEA480F-48 KHNA480F-48
A	AC85 - 170V AC170 - 264V	35%	35%	20%	20%
B	AC85 - 264V			20%	
C	AC85 - 264V			5%	
D	AC85 - 264V			20%	
E	AC85 - 264V			20%	

4 Series/Parallel Operation

4.1 Series Operation

■ You can use a power supply in series operation. The output current in series operation should be lower than the rated current of a power supply with the lowest rated current among the power supplies that are serially connected. Please make sure that no current exceeding the rated current flows into a power supply.

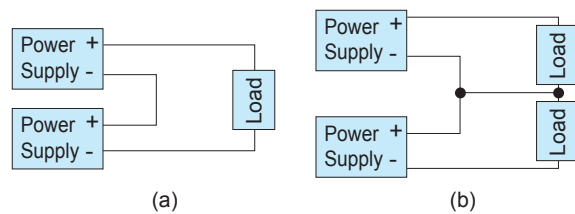


Fig.4.1 Examples of connecting in series operation

4.2 Parallel Operation

■ There is no current balance function.

When operating in parallel, such as diode-OR, please use on the output voltage was adjusted enough to balance the current.

Exceeds the rated output current, the output is shut down.

■ Redundancy operation is available by wiring as shown below.

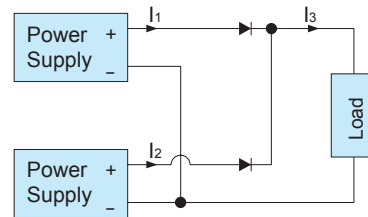


Fig.4.2 Example of connecting in redundancy operation

Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .

Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{rated current value}$$

5 Assembling and Installation Method

5.1 Installation Mounting methods

■About DIN-Rail

Attachment available with DIN EN60715 TH 35 (35×7.5mm) (Top hat shaped DIN rail)

■Below shows mounting orientation.

If install other than standard mounting orientation (A), please fix the power supply for withstand the impact and vibration.

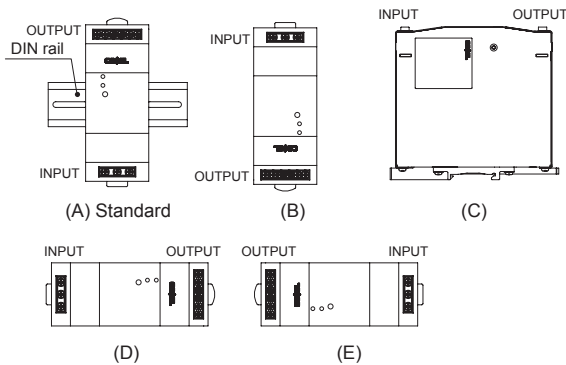


Fig.5.1 Mounting orientation

■When you mount a power supply on a DIN rail, have the area marked A catch one side of the rail and push the unit to the direction of B. To remove the power supply from the rail, either push down the area marked C or insert a tool such as driver to the area marked D and pull the unit apart from the rail. When you couldn't remove the unit easily, push down the area marked C while lightly pushing the unit to the direction of E.

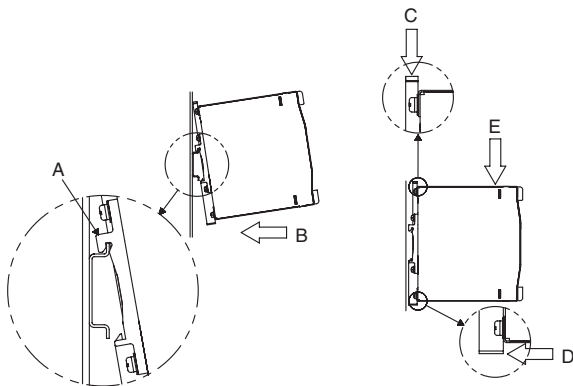


Fig.5.2 Installation method

■Shown below the notes about installation clearance of a unit.

● KHEA30F/60F/90F, KHNA30F/60F/90F

① Installation clearance at above and below the unit.

Please have clearance of at least 25mm above and below the unit to avoid heat accumulation.

② Installation clearance at the side of the unit.

Please have clearance of at least 5mm side the unit to insulating the internal components. However, refer to Table 5.1, if adjacent device of the unit (including power supply) is a heat source.

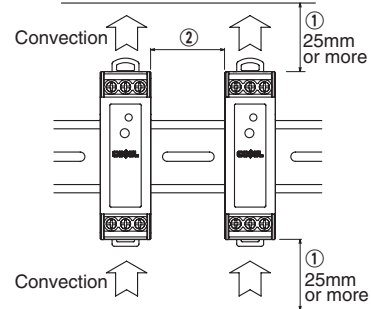


Fig.5.3 Installation clearance

Table 5.1 Installation clearance at the side of the unit.

No.	Model	Adjacent device of the unit	
		Non-heat source	Heat source(*)
1	KHEA30F, KHNA30F	5mm or more	15mm or more
2	KHEA60F, KHNA60F	5mm or more	15mm or more
3	KHEA90F, KHNA90F	5mm or more	15mm or more

*Reference value when same power units are adjacent.

● KHEA120F/240F/480F, KHNA120F/240F/480F

① Installation clearance at above and below the unit.

Please have clearance of at least 25mm above and below the unit to avoid heat accumulation.

② Installation clearance at the side of the unit.

Please have clearance of at least 15mm side the unit to avoid interfering with heat radiation from housing. However, refer to Table 5.2, if adjacent device of the unit (including power supply) is a heat source.

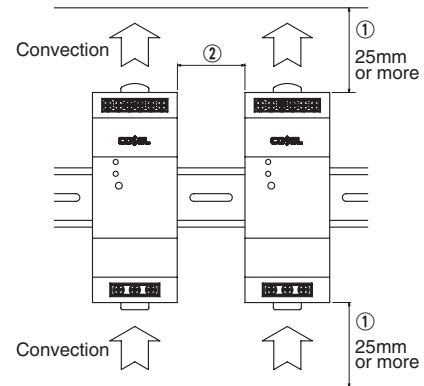


Fig.5.4 Installation clearance

Table 5.2 Installation clearance at the side of the unit.

No.	Model	Adjacent device of the unit	
		Non-heat source	Heat source(*)
1	KHEA120F, KHNA120F	15mm or more	
2	KHEA240F, KHNA240F	15mm or more	
3	KHEA480F, KHNA480F	15mm or more	50mm or more

*Reference value when same power units are adjacent.

5.2 Derating curve depend on input voltage

● KHEA30F/60F/90F, KHNA30F/60F/90F

■ Derating curve depend on input voltage.

Derating curve depend on input voltage is shown in Fig.5.5.

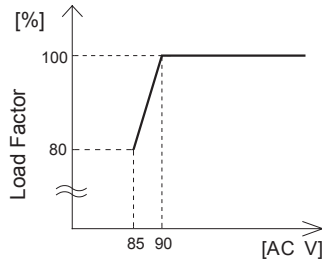


Fig.5.5 Derating curve depend on input voltage

● KHEA480F, KHNA480F

■ Derating curve depend on input voltage.

Derating curve depend on input voltage is shown in Fig.5.6.

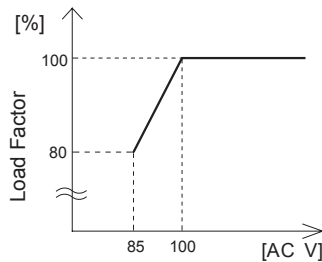


Fig.5.6 Derating curve depend on input voltage

5.3 Derating curve depend on ambient temperature

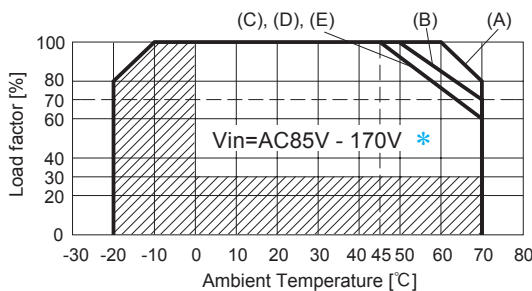
■ The operative ambient temperature as different by input voltage.

Derating curve is shown below.

■ In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

■ Derating Curve (Convection)

● KHEA30F, KHNA30F



* Derating curve depend on input voltage is required.

Fig.5.7 Derating curve depend on ambient temperature

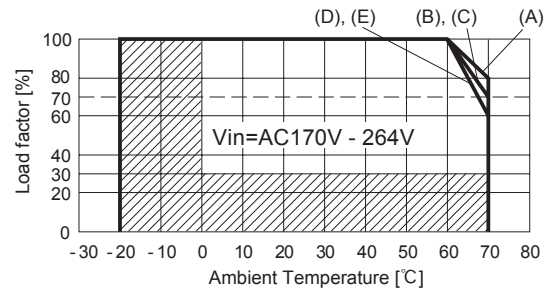
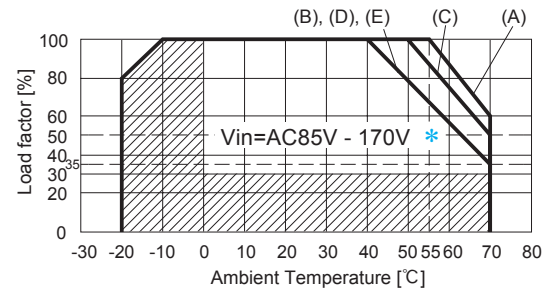


Fig.5.8 Derating curve depend on ambient temperature

● KHEA60F, KHNA60F



* Derating curve depend on input voltage is required.

Fig.5.9 Derating curve depend on ambient temperature

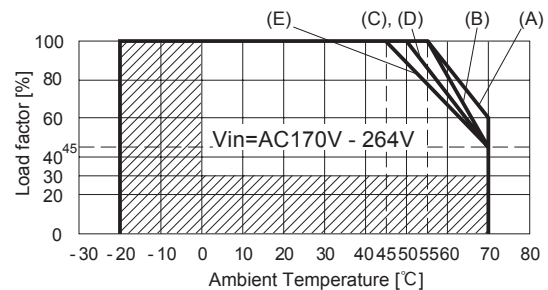
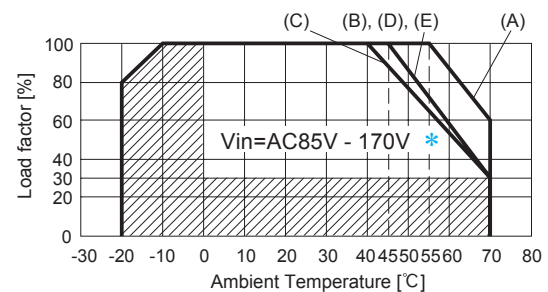


Fig.5.10 Derating curve depend on ambient temperature

● KHEA90F, KHNA90F



* Derating curve depend on input voltage is required.

Fig.5.11 Derating curve depend on ambient temperature

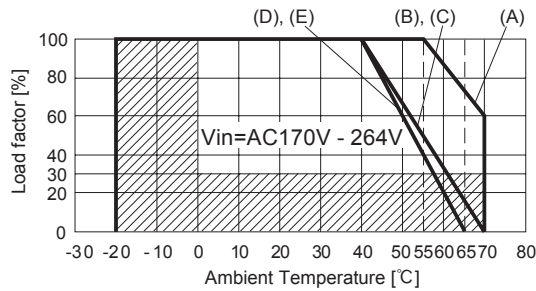


Fig.5.12 Derating curve depend on ambient temperature

● KHEA120F, KHNA120F

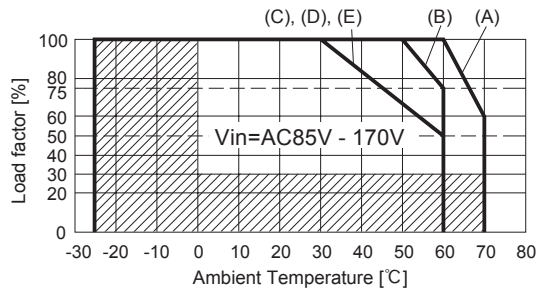


Fig.5.13 Derating curve depend on ambient temperature

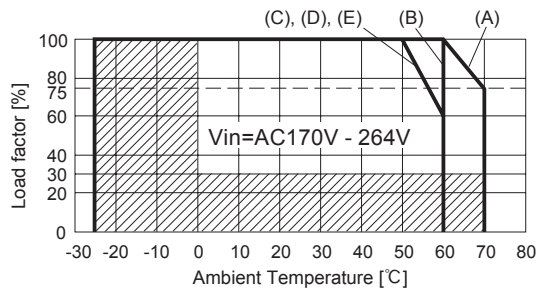


Fig.5.14 Derating curve depend on ambient temperature

● KHEA240F, KHNA240F

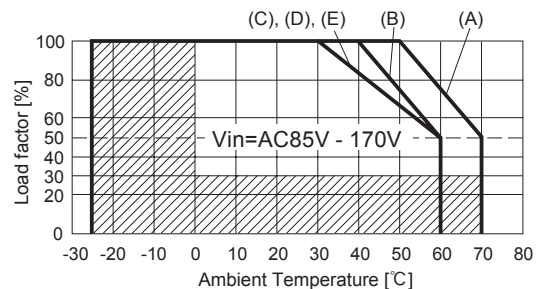


Fig.5.15 Derating curve depend on ambient temperature

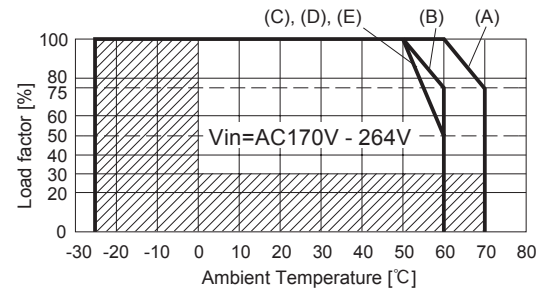
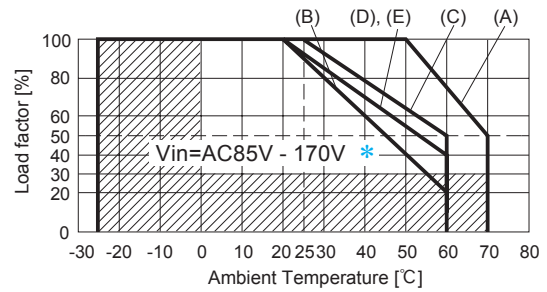


Fig.5.16 Derating curve depend on ambient temperature

● KHEA480F, KHNA480F



* Derating curve depend on input voltage is required.

Fig.5.17 Derating curve depend on ambient temperature

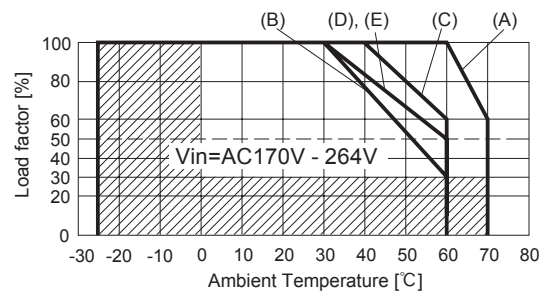


Fig.5.18 Derating curve depend on ambient temperature

■ Ambient temperature indicates the temperature of the inlet of the air.

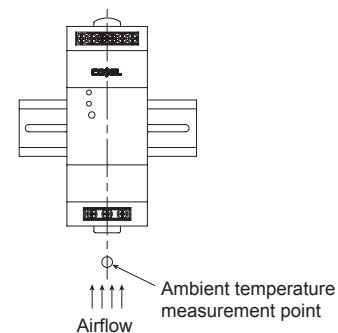


Fig.5.19 Ambient temperature measurement point

● KHEA30F/60F/90F, KHNA30F/60F/90F

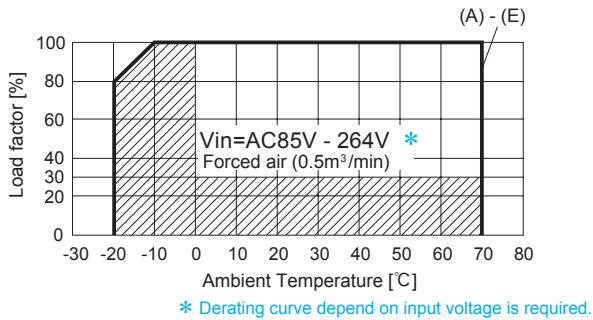


Fig.5.20 Derating curve depend on ambient temperature

■ Temperature of Forced air

Use the temperature measurement point as shown in Fig.5.21 to 5.23. Please use at the temperature dose not exceed the values in Table 5.3. Please also make sure that the ambient temperature does not exceed 70°C.

● KHEA30F, KHNA30F

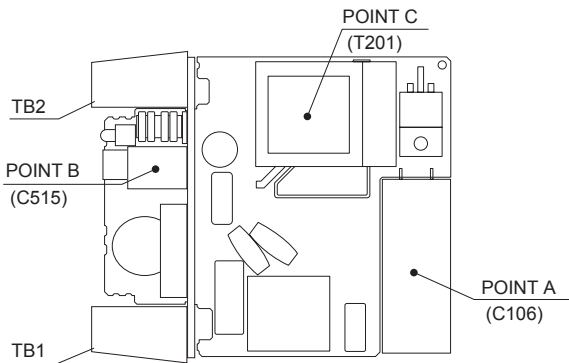


Fig.5.21 Temperature measurement point (Forced air)

● KHEA60F, KHNA60F

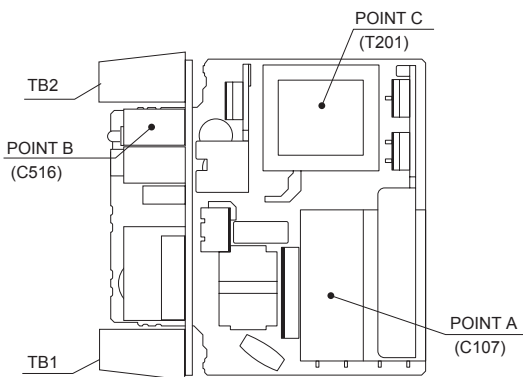
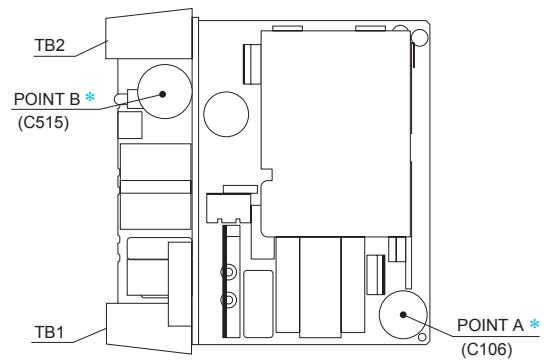


Fig.5.22 Temperature measurement point (Forced air)

● KHEA90F, KHNA90F



* Please be careful of electric shock or earth leakage in case of temperature measurement, because POINT A and POINT B is live potential.

Fig.5.23 Temperature measurement point (Forced air)

Table 5.3 Specified temperature of the measurement point

No.	Model	Temperature measurement point		
		Point A	Point B	Point C
1	KHEA30F, KHNA30F	80°C	80°C	105°C
2	KHEA60F, KHNA60F	80°C	80°C	105°C
3	KHEA90F, KHNA90F	80°C	80°C	

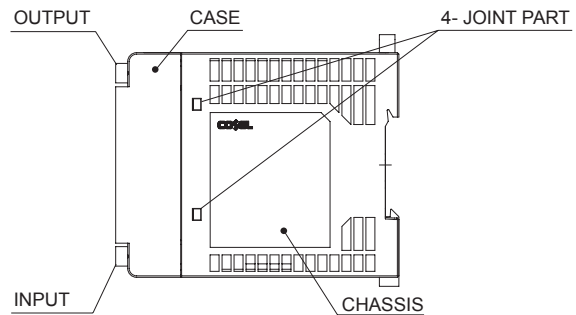


Fig.5.24 Installation removing chassis and case

Thermocouple for temperature checking must be added into temperature measuring point after removing chassis and case. Then assembling chassis and case again, the temperature can be measured.

Chassis and case are fixed in 4 parts which are shown in the figure. Please contact us about detail.

● KHEA120F/240F, KHNA120F/240F

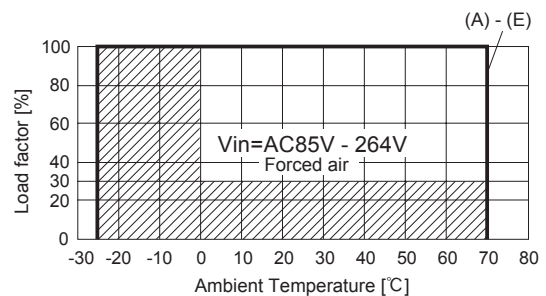


Fig.5.25 Derating curve depend on ambient temperature

● KHEA480F, KHNA480F

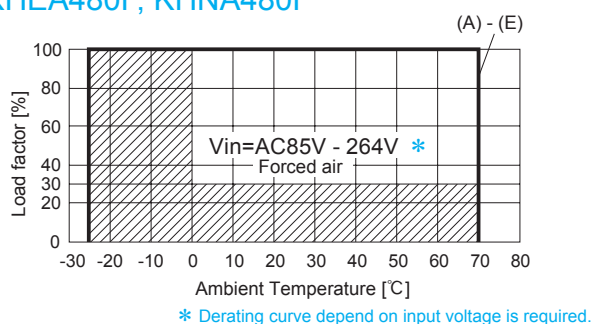


Fig.5.26 Derating curve depend on ambient temperature

■ Temperature of Forced air

Use the temperature measurement point as shown in Fig 5.27.
Please use at the temperature does not exceed the values in Table 5.4.

Please also make sure that the ambient temperature does not exceed 70°C.

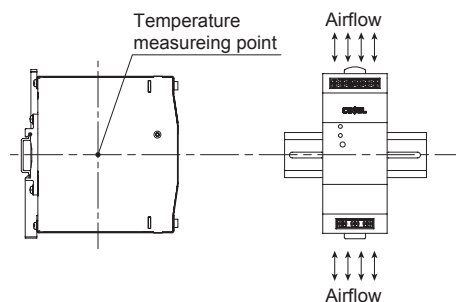


Fig.5.27 Temperature measurement point (Forced air)

Table 5.4 Specified temperature of the measurement point

No.	Model	temperature measurement point
1	KHEA120F, KHNA120F	75°C
2	KHEA240F, KHNA240F	80°C
3	KHEA480F, KHNA480F	85°C

5.4 Expectancy life and warranty

Please note derating curve depend on input voltage is required.

■ Expectancy Life.

Table 5.5 Expectancy Life (KHEA30F, KHNA30F)

Mounting method	Cooling method	Input voltage	Average ambient temperature (year)	Expectancy Life	
				Load factor $Io \leq 75\%$	Load factor $75\% < Io \leq 100\%$
A	Convection	AC85 - 170V	Ta = 50°C or less	10years	7years
			Ta = 60°C	6years	3years
		AC170 - 264V	Ta = 50°C or less	10years	9years
			Ta = 60°C	6years	4years
B	Convection	AC85 - 170V	Ta = 40°C or less	10years	10years
			Ta = 50°C	10years	6years
		AC170 - 264V	Ta = 50°C or less	10years	9years
			Ta = 60°C	6years	4years
C	Convection	AC85 - 170V	Ta = 35°C or less	10years	10years
			Ta = 45°C	10years	7years
		AC170 - 264V	Ta = 50°C or less	10years	6years
			Ta = 60°C	5years	3years
D	Convection	AC85 - 170V	Ta = 35°C or less	10years	10years
			Ta = 45°C	10years	6years
		AC170 - 264V	Ta = 50°C or less	10years	7years
			Ta = 60°C	5years	3years
E	Convection	AC85 - 170V	Ta = 35°C or less	10years	10years
			Ta = 45°C	10years	6years
		AC170 - 264V	Ta = 50°C or less	10years	7years
			Ta = 60°C	5years	3years
A,B,C,D and E	Forced air	AC85 - 264V	Ta = 70°C	5years	3years

Table 5.6 Expectancy Life (KHEA60F, KHNA60F)

Mounting method	Cooling method	Input voltage	Average ambient temperature (year)	Expectancy Life	
				Load factor $Io \leq 75\%$	Load factor $75\% < Io \leq 100\%$
A	Convection	AC85 - 170V	Ta = 45°C or less	10years	5years
			Ta = 55°C	5years	3years
		AC170 - 264V	Ta = 45°C or less	10years	10years
			Ta = 55°C	9years	6years
B	Convection	AC85 - 170V	Ta = 30°C or less	10years	7years
			Ta = 40°C	9years	3years
		AC170 - 264V	Ta = 45°C or less	9years	7years
			Ta = 55°C	5years	3years
C	Convection	AC85 - 170V	Ta = 40°C or less	10years	6years
			Ta = 50°C	7years	3years
		AC170 - 264V	Ta = 40°C or less	10years	10years
			Ta = 50°C	8years	5years
D	Convection	AC85 - 170V	Ta = 30°C or less	10years	5years
			Ta = 40°C	8years	2years
		AC170 - 264V	Ta = 40°C or less	10years	8years
			Ta = 50°C	6years	4years
E	Convection	AC85 - 170V	Ta = 30°C or less	10years	6years
			Ta = 40°C	9years	3years
		AC170 - 264V	Ta = 35°C or less	10years	10years
			Ta = 45°C	10years	7years
A,B,C,D and E	Forced air	AC85 - 264V	Ta = 70°C	5years	3years

Table 5.7 Expectancy Life (KHEA90F, KHNA90F)

Mounting method	Cooling method	Input voltage	Average ambient temperature (year)	Expectancy Life	
				Load factor $Io \leq 75\%$	Load factor $75\% < Io \leq 100\%$
A	Convection	AC85 - 170V	Ta = 45°C or less	10years	8years
			Ta = 55°C	7years	4years
		AC170 - 264V	Ta = 45°C or less	10years	10years
			Ta = 55°C	10years	7years
B	Convection	AC85 - 170V	Ta = 35°C or less	10years	10years
			Ta = 45°C	8years	7years
		AC170 - 264V	Ta = 30°C or less	10years	10years
			Ta = 40°C	10years	10years
C	Convection	AC85 - 170V	Ta = 30°C or less	10years	10years
			Ta = 40°C	10years	8years
		AC170 - 264V	Ta = 30°C or less	10years	10years
			Ta = 40°C	10years	10years
D	Convection	AC85 - 170V	Ta = 35°C or less	10years	8years
			Ta = 45°C	10years	4years
		AC170 - 264V	Ta = 30°C or less	10years	10years
			Ta = 40°C	10years	10years
E	Convection	AC85 - 170V	Ta = 35°C or less	10years	10years
			Ta = 45°C	10years	5years
		AC170 - 264V	Ta = 30°C or less	10years	10years
			Ta = 40°C	10years	10years
A,B,C,D and E	Forced air	AC85 - 264V	Ta = 70°C	5years	3years

Table 5.8 Expectancy Life (KHEA120F, KHNA120F)

Mounting method	Cooling method	Input voltage	Average ambient temperature (year)	Expectancy Life	
				Load factor $Io \leq 75\%$	Load factor $75\% < Io \leq 100\%$
A	Convection	AC85 - 170V	Ta = 50°C or less	10years	8years
			Ta = 60°C	8years	3years
		AC170 - 264V	Ta = 50°C or less	10years	6years
			Ta = 60°C	5years	4years
B	Convection	AC85 - 170V	Ta = 40°C or less	10years	10years
			Ta = 50°C	8years	5years
		AC170 - 264V	Ta = 40°C or less	10years	10years
			Ta = 50°C	8years	5years
C	Convection	AC85 - 170V	Ta = 20°C or less	10years	10years
			Ta = 30°C	10years	10years
		AC170 - 264V	Ta = 40°C or less	10years	10years
			Ta = 50°C	5years	3years
D	Convection	AC85 - 170V	Ta = 20°C or less	10years	10years
			Ta = 30°C	10years	8years
		AC170 - 264V	Ta = 40°C or less	10years	8years
			Ta = 50°C	5years	3years
E	Convection	AC85 - 170V	Ta = 20°C or less	10years	10years
			Ta = 30°C	10years	8years
		AC170 - 264V	Ta = 40°C or less	10years	10years
			Ta = 50°C	5years	3years
A,B,C,D and E	Forced air	AC85 - 264V	Ta = 70°C	5years	3years

Table 5.9 Expectancy Life (KHEA240F, KHNA240F)

Mounting method	Cooling method	Input voltage	Average ambient temperature (year)	Expectancy Life	
				Load factor $Io \leq 75\%$	Load factor $75\% < Io \leq 100\%$
A	Convection	AC85 - 170V	Ta = 40°C or less	10years	6years
			Ta = 50°C	5years	3years
		AC170 - 264V	Ta = 50°C or less	10years	6years
			Ta = 60°C	5years	3years
B	Convection	AC85 - 170V	Ta = 30°C or less	10years	10years
			Ta = 40°C	10years	8years
		AC170 - 264V	Ta = 40°C or less	10years	10years
			Ta = 50°C	10years	6years
C	Convection	AC85 - 170V	Ta = 20°C or less	10years	10years
			Ta = 30°C	10years	8years
		AC170 - 264V	Ta = 40°C or less	10years	8years
			Ta = 50°C	6years	3years
D and E	Convection	AC85 - 170V	Ta = 20°C or less	10years	10years
			Ta = 30°C	10years	5years
		AC170 - 264V	Ta = 40°C or less	10years	6years
			Ta = 50°C	5years	3years
A,B,C,D and E	Forced air	AC85 - 264V	Ta = 70°C	5years	3years

Table 5.10 Expectancy Life (KHEA480F, KHNA480F)

Mounting method	Cooling method	Input voltage	Average ambient temperature (year)	Expectancy Life	
				Load factor $Io \leq 75\%$	Load factor $75\% < Io \leq 100\%$
A	Convection	AC85 - 170V	Ta = 40°C or less	10years	4years
			Ta = 45°C	7years	3years
		AC170 - 264V	Ta = 50°C	5years	2years
			Ta = 55°C	5years	3years
B	Convection	AC85 - 170V	Ta = 10°C or less	10years	10years
			Ta = 20°C	10years	10years
		AC170 - 264V	Ta = 20°C or less	10years	10years
			Ta = 30°C	10years	10years
C	Convection	AC85 - 170V	Ta = 15°C or less	10years	10years
			Ta = 25°C	10years	5years
		AC170 - 264V	Ta = 30°C or less	10years	7years
			Ta = 40°C	8years	3years
D	Convection	AC85 - 170V	Ta = 10°C or less	10years	10years
			Ta = 20°C	10years	5years
		AC170 - 264V	Ta = 20°C or less	10years	10years
			Ta = 30°C	10years	5years
E	Convection	AC85 - 170V	Ta = 10°C or less	10years	7years
			Ta = 20°C	8years	3years
		AC170 - 264V	Ta = 20°C or less	10years	7years
			Ta = 30°C	10years	3years
A,B,C,D and E	Forced air	AC85 - 264V	Ta = 70°C	5years	3years

■ Warranty

Table 5.11 Warranty (KHEA30F, KHNA30F)

Mounting method	Cooling method	Input voltage	Average ambient temperature (year)	Warranty term	
				Load factor $Io \leq 75\%$	Load factor $75\% < Io \leq 100\%$
A	Convection	AC85 - 170V	Ta = 50°C or less	5years	5years
			Ta = 60°C	5years	3years
		AC170 - 264V	Ta = 50°C or less	5years	5years
B	Convection	AC85 - 170V	Ta = 40°C or less	5years	5years
			Ta = 50°C	5years	3years
		AC170 - 264V	Ta = 50°C or less	5years	5years
C	Convection	AC85 - 170V	Ta = 35°C or less	5years	5years
			Ta = 45°C	5years	5years
		AC170 - 264V	Ta = 50°C or less	5years	5years
D and E	Convection	AC85 - 170V	Ta = 35°C or less	5years	5years
			Ta = 45°C	5years	3years
		AC170 - 264V	Ta = 50°C or less	5years	5years
A,B,C,D and E	Forced air	AC85 - 264V	Ta = 60°C	5years	3years
			Ta = 70°C	5years	3years

Table 5.12 Warranty (KHEA60F, KHNA60F)

Mounting method	Cooling method	Input voltage	Average ambient temperature (year)	Warranty term	
				Load factor $Io \leq 75\%$	Load factor $75\% < Io \leq 100\%$
A	Convection	AC85 - 170V	Ta = 45°C or less	5years	3years
			Ta = 55°C	5years	3years
		AC170 - 264V	Ta = 45°C or less	5years	5years
B	Convection	AC85 - 170V	Ta = 30°C or less	5years	5years
			Ta = 40°C	5years	3years
		AC170 - 264V	Ta = 45°C or less	5years	3years
C	Convection	AC85 - 170V	Ta = 30°C or less	5years	3years
			Ta = 40°C	5years	3years
		AC170 - 264V	Ta = 40°C or less	5years	5years
D	Convection	AC85 - 170V	Ta = 30°C or less	5years	3years
			Ta = 40°C	5years	2years
		AC170 - 264V	Ta = 40°C or less	5years	5years
E	Convection	AC85 - 170V	Ta = 30°C or less	5years	3years
			Ta = 40°C	5years	3years
		AC170 - 264V	Ta = 35°C or less	5years	5years
A,B,C,D and E	Forced air	AC85 - 264V	Ta = 45°C	5years	3years
			Ta = 70°C	5years	3years

Table 5.13 Warranty (KHEA90F, KHNA90F)

Mounting method	Cooling method	Input voltage	Average ambient temperature (year)	Warranty term	
				Load factor $Io \leq 75\%$	Load factor $75\% < Io \leq 100\%$
A	Convection	AC85 - 170V	Ta = 45°C or less	5years	5years
			Ta = 55°C	5years	3years
		AC170 - 264V	Ta = 45°C or less	5years	5years
B	Convection	AC85 - 170V	Ta = 35°C or less	5years	5years
			Ta = 45°C	5years	5years
		AC170 - 264V	Ta = 30°C or less	5years	5years
C	Convection	AC85 - 170V	Ta = 30°C or less	5years	5years
			Ta = 40°C	5years	5years
		AC170 - 264V	Ta = 30°C or less	5years	5years
D and E	Convection	AC85 - 170V	Ta = 35°C or less	5years	5years
			Ta = 45°C	5years	3years
		AC170 - 264V	Ta = 30°C or less	5years	5years
A,B,C,D and E	Forced air	AC85 - 264V	Ta = 40°C	5years	5years
			Ta = 70°C	5years	3years

Table 5.14 Warranty (KHEA120F, KHNA120F)

Mounting method	Cooling method	Input voltage	Average ambient temperature (year)	Warranty term	
				Load factor $Io \leq 75\%$	Load factor $75\% < Io \leq 100\%$
A	Convection	AC85 - 170V	Ta = 50°C or less	5years	5years
			Ta = 60°C	5years	3years
		AC170 - 264V	Ta = 50°C or less	5years	5years
B	Convection	AC85 - 170V	Ta = 40°C or less	5years	5years
			Ta = 50°C	5years	5years
		AC170 - 264V	Ta = 40°C or less	5years	5years
C,D and E	Convection	AC85 - 170V	Ta = 20°C or less	5years	5years
			Ta = 30°C	5years	5years
		AC170 - 264V	Ta = 40°C or less	5years	5years
A,B,C,D and E	Forced air	AC85 - 264V	Ta = 50°C	5years	3years
			Ta = 70°C	5years	3years

Table 5.15 Warranty (KHEA240F, KHNA240F)

Mounting method	Cooling method	Input voltage	Average ambient temperature (year)	Warranty term	
				Load factor $Io \leq 75\%$	Load factor $75\% < Io \leq 100\%$
A	Convection	AC85 - 170V	Ta = 40°C or less	5years	5years
			Ta = 50°C	5years	3years
		AC170 - 264V	Ta = 50°C or less	5years	5years
B	Convection	AC85 - 170V	Ta = 60°C	5years	3years
			Ta = 30°C or less	5years	5years
		AC170 - 264V	Ta = 40°C	5years	5years
C,D and E	Convection	AC85 - 170V	Ta = 40°C or less	5years	5years
			Ta = 30°C	5years	5years
		AC170 - 264V	Ta = 40°C or less	5years	5years
A,B,C,D and E	Forced air	AC85 - 264V	Ta = 50°C	5years	3years
			Ta = 70°C	5years	3years

Table 5.16 Warranty (KHEA480F, KHNA480F)

Mounting method	Cooling method	Input voltage	Average ambient temperature (year)	Warranty term	
				Load factor $Io \leq 75\%$	Load factor $75\% < Io \leq 100\%$
A	Convection	AC85 - 170V	Ta = 40°C or less	5years	4years
			Ta = 45°C	5years	3years
		AC170 - 264V	Ta = 50°C	4years	2years
			Ta = 55°C	5years	3years
B	Convection	AC85 - 170V	Ta = 50°C or less	5years	4years
			Ta = 55°C	5years	3years
		AC170 - 264V	Ta = 60°C	4years	2years
			Ta = 65°C	5years	3years
C	Convection	AC85 - 170V	Ta = 10°C or less	5years	5years
			Ta = 20°C	5years	5years
		AC170 - 264V	Ta = 20°C or less	5years	5years
			Ta = 30°C	5years	5years
D	Convection	AC85 - 170V	Ta = 15°C or less	5years	5years
			Ta = 25°C	5years	5years
		AC170 - 264V	Ta = 30°C or less	5years	5years
			Ta = 40°C	5years	3years
E	Convection	AC85 - 170V	Ta = 10°C or less	5years	5years
			Ta = 20°C	5years	3years
		AC170 - 264V	Ta = 20°C or less	5years	5years
			Ta = 30°C	5years	3years
A,B,C,D and E	Forced air	AC85 - 264V	Ta = 70°C	5years	3years

5.5 Applicable Electric Cable

■ Input terminals, Output terminals

● KHEA30F/60F/90F/120F/240F

Table 5.17 Applicable Wire

	Input terminals	Output terminals
Solid wire	Diameter 0.5 mm to 2.6 mm (AWG.24 to AWG.10)	
Stranded wire	0.2mm ² to 5.2mm ² (AWG.24 to AWG.10) Conductor diameter more than 0.18mm	
Sheath strip length	8mm	

● KHEA480F

Table 5.18 Applicable Wire

	Input terminals	Output terminals
Solid wire	Diameter 0.8 mm to 2.6 mm (AWG.20 to AWG.10)	
Stranded wire	0.5mm ² to 5.2mm ² (AWG.20 to AWG.10) Conductor diameter more than 0.18mm	
Sheath strip length	8mm	

■ RC terminals

● KHEA120F/240F/480F, KHNA120F/240F/480F

Table 5.19 Applicable Wire

	RC terminals
Solid wire	Diameter 0.5 mm to 1.3 mm (AWG.24 to AWG.16)
Stranded wire	0.2 mm ² to 1.5 mm ² (AWG.24 to AWG.16)
Sheath strip length	8mm

5.6 Applicable Electric Cable

■ While turning on the electricity, and for a while after turning off, please don't touch the inside of a power supply because there are some hot parts in that.

■ When a mass capacitor is connected with the output terminal (load side), the output might become the stop or an unstable operation. Please contact us for details when you connect the capacitor.

6 Option

6.1 Outline of option

● -C

· Option -C units have coated internal PCB for better moisture resistance.

● -E

(KHEA90F, KHNA90F)

· Option -E units acquires NEC Class2.

● -N2

(KHEA120F/240F/480F, KHNA120F/240F/480F)

· Option -N2 units have attachment with screw mounting instead of DIN rail mounting.

Mounting holes pitch are shown in Table 6.1.

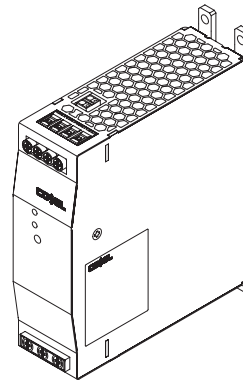


Fig.6.1 Image of option -N2

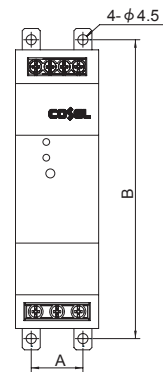


Fig.6.2 Mounting place (screw holes)

Table 6.1 Mounting holes pitch

No.	Model	A	B
1	KHEA120F, KHNA120F	23mm	133mm
2	KHEA240F, KHNA240F	34mm	133mm
3	KHEA480F, KHNA480F	54mm	133mm



KL-series



Feature

For DIN (35mm) rail products
Wide operating ambient temperature range
I/O terminal has 2 types, Euro Style and Barrier Blocks Style
Built in overcurrent protection, overvoltage protection circuits

Safety agency approvals

UL60950-1, UL508, C-UL (CSA60950-1), EN60950-1
Complies with DEN-AN

5-year warranty (refer to Instruction Manual)

CE marking

Low Voltage Directive

EMI

Complies with FCC-B, CISPR22-B, EN55011-B, EN55022-B, VCCI-B

EMS Compliance : EN61204-3, EN61000-6-2

EN61000-4-2
EN61000-4-3
EN61000-4-4
EN61000-4-5
EN61000-4-6
EN61000-4-8
EN61000-4-11

KLEA/KLNA120F

KL ☐ A 120 F - ☐ - ☐

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-04-472-D



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
KLE : Euro Style I/O Terminals
KLN : Barrier Blocks Style I/O Terminals
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Option
C : with Coating
N2: Screw mounting

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	KLEA/KLNA120F-24	KLEA/KLNA120F-48
MAX OUTPUT WATTAGE[W]	120	120
DC OUTPUT	24V 5A	48V 2.5A

SPECIFICATIONS

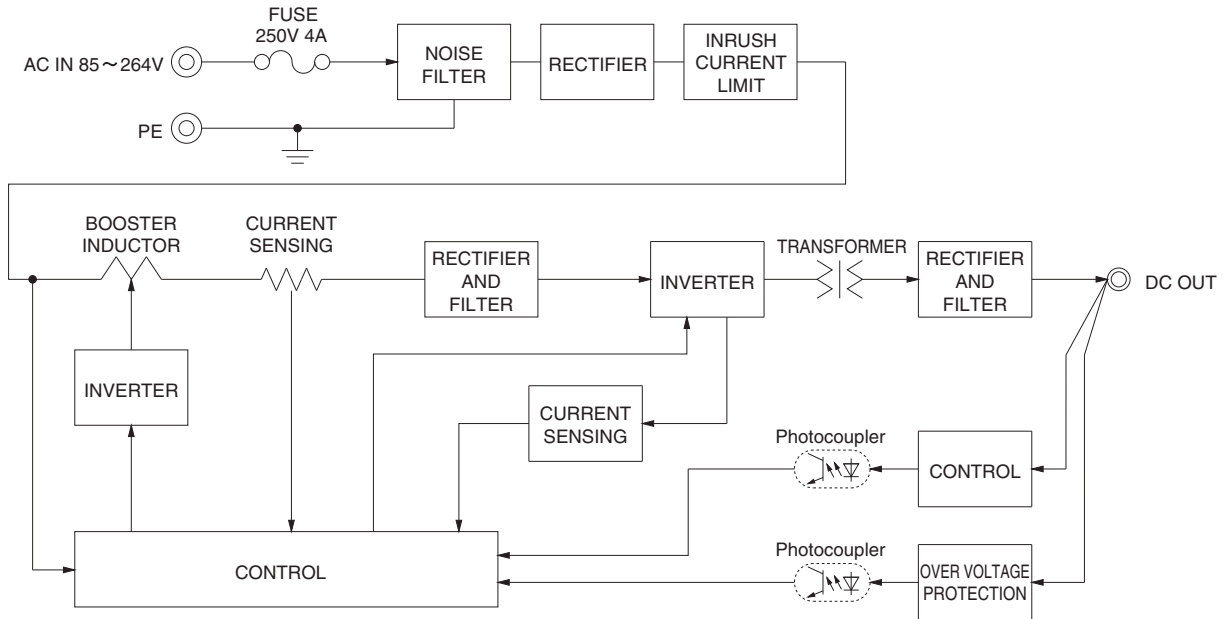
	MODEL	KLEA/KLNA120F-24	KLEA/KLNA120F-48
INPUT	VOLTAGE[V]	AC85 - 264 1 φ (Output derating is required) *9	
	CURRENT[A]	ACIN 115V 1.2typ ACIN 230V 0.6typ	
	FREQUENCY[Hz]	50 / 60 (45 - 66)	
	EFFICIENCY[%]	ACIN 115V 86.5typ ACIN 230V 88.0typ	
	POWER FACTOR	ACIN 115V 0.98typ ACIN 230V 0.90typ	
	INRUSH CURRENT[A]	ACIN 115V 20typ (Io=100%)(at cold start Ta=25°C) ACIN 230V 40typ (Io=100%)(at cold start Ta=25°C)	
	LEAKAGE CURRENT[ma]	0.45 / 0.75max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60950-1 and DEN-AN)	
OUTPUT	VOLTAGE[V]	24	48
	CURRENT[A]	5	2.5
	LINE REGULATION[mV] *2	96max (Io=30-100%) *8	192max (Io=30-100%) *8
	LOAD REGULATION[mV] *2	150max (Io=30-100%) *8	300max (Io=30-100%) *8
	RIPPLE[mVp-p] *3	0 to +70°C 150max	150max
		-20 - 0°C 240max	240max
		Io=0 - 30% 500max	650max
	RIPPLE NOISE[mVp-p] *3	0 to +70°C 180max	180max
		-20 - 0°C 300max	300max
		Io=0 - 30% 500max	650max
	TEMPERATURE REGULATION[mV]	0 to +70°C 240max	480max
		-20 to +70°C 290max	600max
PROTECTION CIRCUIT AND OTHERS	DRIFT[mV] *4	96max	192max
	START-UP TIME[ms]	500typ (ACIN 115V, Io=100%)	
	HOLD-UP TIME[ms]	20typ (ACIN 115V, Io=100%)	
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	21.60 to 26.40	43.20 to 52.80
	OUTPUT VOLTAGE SETTING[V]	24.00 to 24.96	48.00 to 49.92
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically	
	OVERVOLTAGE PROTECTION[V]	27.60 to 33.60	54.00 to 67.20
ISOLATION	DC_OK LAMP	LED (Green)	
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)	
	INPUT-PE	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)	
ENVIRONMENT	OUTPUT-PE	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)	
	OPERATING TEMP., HUMID. AND ALTITUDE	-20 to +70°C (Required to Derating), 20 - 90%RH (Non condensing)	
	STORAGE TEMP., HUMID. AND ALTITUDE	-30 to +85°C, 20 - 90%RH (Non condensing)	
	VIBRATION *7	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60 minutes along Z axis (Non operating, mounted on DIN Rail)	
SAFETY AND NOISE REGULATIONS	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis (Packing state)	
	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1, UL508, Complies with DEN-AN	
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B	
OTHERS	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *5	
	CASE SIZE *6	38×124×117mm (W×H×D) [1.5×4.88×4.61 inches]	
	WEIGHT	580g max	
OTHERS	COOLING METHOD	Convection	

*1 The value is primary surge. The current of input surge to a built-in EMI/EMC Filter (0.2ms or less) is excluded.
*2 Please contact us about dynamic load and input response.
*3 This is the value that measured on measuring board with capacitor of 22 μF and 0.1 μF at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).
Please refer to the instruction manual 2.5.

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
*5 Please contact us about another class.
*6 Case size contains neither the umbo.
*7 Only as standard mounting orientation (A). Refer to the instruction manual 4.1. If install other than standard mounting orientation (A), please fix the power supply for withstand the vibration and impact.

*8 Burst operation at 30% load or less.
*9 Please contact us about DC input voltage.
* To meet the specifications. Do not operate over-loaded condition.
* A sound may occur from power supply at light or peak loading.

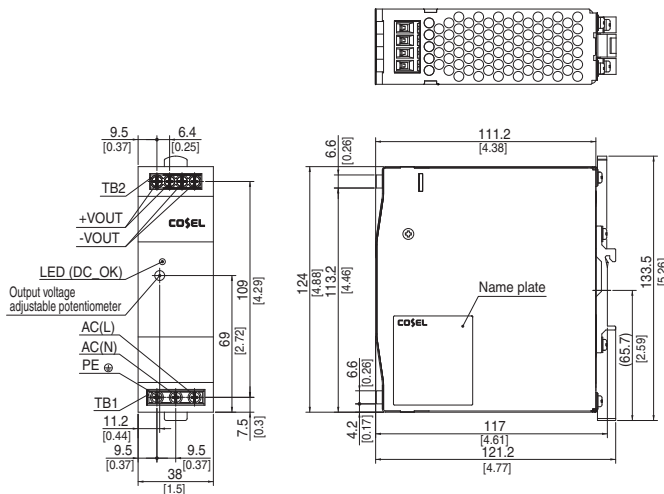
Block diagram



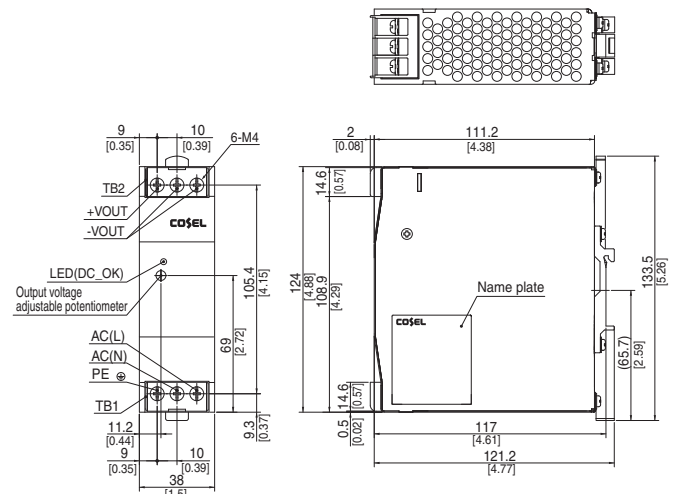
External view

<KLEA120F(Euro Style I/O Terminals)>

<KLNA120F(Barrier Blocks Style I/O Terminals)>



- ※ Tolerance : ± 1.5 [± 0.06]
- ※ Weight : 580g max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Case material : Stainless steel
- ※ Din rail attachment material : Aluminum, Nylon
- ※ Dimensions in mm, [] = inches
- ※ Screw tightening torque : 1N · m max



- ※ Tolerance : ± 1.5 [± 0.06]
- ※ Weight : 580g max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
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- ※ Din rail attachment material : Aluminum, Nylon
- ※ Dimensions in mm, [] = inches
- ※ Screw tightening torque : 1.6N · m max

KLEA/KLNA240F

KL ☐ A 240 F - ☐ - ☐

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
NAC-06-472-D



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
KLE : Euro Style I/O Terminals
KLN : Barrier Blocks Style I/O Terminals
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Option
C : with Coating
N2: Screw mounting

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	KLEA/KLNA240F-24	KLEA/KLNA240F-48
MAX OUTPUT WATTAGE[W]	240	240
DC OUTPUT	24V 10A	48V 5A

SPECIFICATIONS

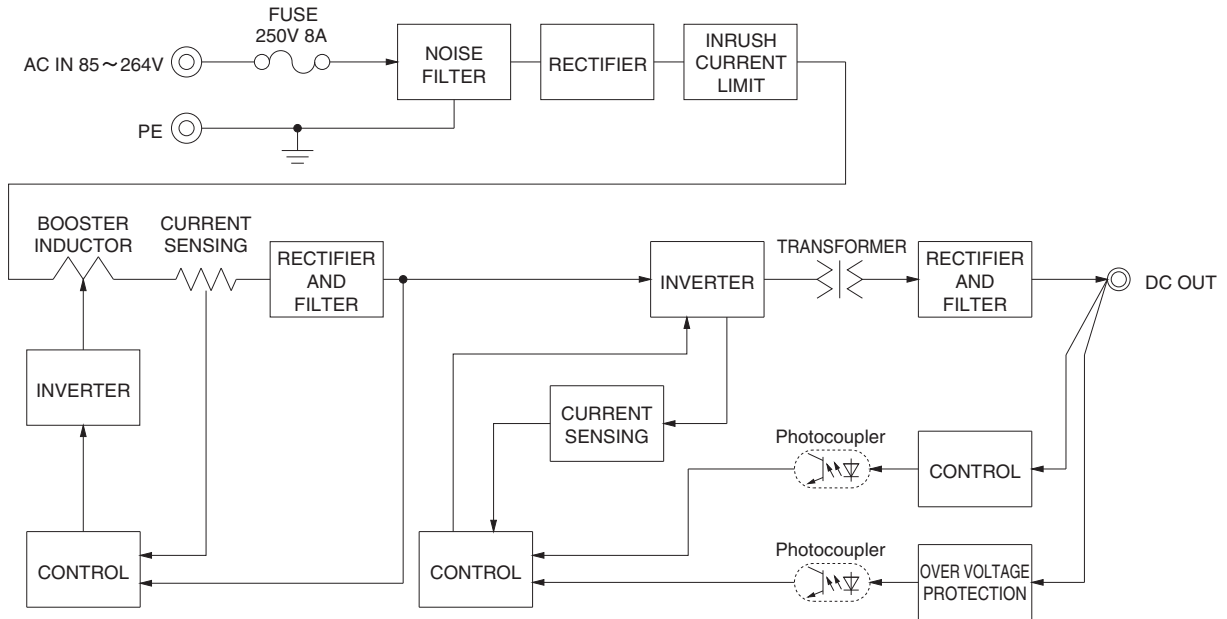
	MODEL	KLEA/KLNA240F-24	KLEA/KLNA240F-48
INPUT	VOLTAGE[V]	AC85 - 264 1 φ (Output derating is required) *8	
	CURRENT[A]	ACIN 115V 2.4typ	
		ACIN 230V 1.3typ	
	FREQUENCY[Hz]	50 / 60 (45 - 66)	
	EFFICIENCY[%]	ACIN 115V 88typ	
		ACIN 230V 90typ	
	POWER FACTOR	ACIN 115V 0.98typ	
		ACIN 230V 0.90typ	
OUTPUT	INRUSH CURRENT[A]	ACIN 115V 20typ (I _o =100%)(at cold start Ta=25°C)	
	*1 ACIN 230V	40typ (I _o =100%)(at cold start Ta=25°C)	
	LEAKAGE CURRENT[ma]	0.45 / 0.75max (ACIN 100V / 240V 60Hz, I _o =100%, According to IEC60950-1 and DEN-AN)	
	VOLTAGE[V]	24	48
	CURRENT[A]	10	5
	LINE REGULATION[mV] *2	96max	192max
	LOAD REGULATION[mV] *2	150max	300max
	RIPPLE[mVp-p] *3	0 to +70°C 150max	150max
		-20 - 0°C 240max	240max
	RIPPLE NOISE[mVp-p] *3	0 to +70°C 180max	180max
PROTECTION CIRCUIT AND OTHERS		-20 - 0°C 300max	300max
	TEMPERATURE REGULATION[mV]	0 to +70°C 240max	480max
		-20 to +70°C 290max	600max
	DRIFT[mV] *4	96max	192max
	START-UP TIME[ms]	500typ (ACIN 115V, I _o =100%)	
	HOLD-UP TIME[ms]	20typ (ACIN 115V, I _o =100%)	
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	21.60 to 26.40	43.20 to 52.80
	OUTPUT VOLTAGE SETTING[V]	24.00 to 24.96	48.00 to 49.92
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically	
	OVERVOLTAGE PROTECTION[V]	27.60 to 33.60	54.00 to 67.20
ISOLATION	DC_OK LAMP	LED (Green)	
	INPUT-OUTPUT	AC3,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)	
	INPUT-PE	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)	
ENVIRONMENT	OUTPUT-PE	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)	
	OPERATING TEMP., HUMID. AND ALTITUDE	-20 to +70°C (Required to Derating), 20 - 90%RH (Non condensing)	
	STORAGE TEMP., HUMID. AND ALTITUDE	-30 to +85°C, 20 - 90%RH (Non condensing)	
	VIBRATION *7	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60 minutes along Z axis (Non operating, mounted on DIN Rail)	
SAFETY AND NOISE REGULATIONS	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis (Packing state)	
	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1), EN60950-1, UL508, Complies with DEN-AN	
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B	
OTHERS	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *5	
	CASE SIZE *6	50×124×117mm (W×H×D) [1.97×4.88×4.61 inches]	
	WEIGHT	750g max	
	COOLING METHOD	Convection	

*1 The value is primary surge. The current of input surge to a built-in EMI/EMC Filter (0.2ms or less) is excluded.
*2 Please contact us about dynamic load and input response.
*3 This is the value that measured on measuring board with capacitor of 22 μF and 0.1 μF at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).
Please refer to the instruction manual 2.5.

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
*5 Please contact us about another class.
*6 Case size contains neither the umbo.
*7 Only as standard mounting orientation (A). Refer to the instruction manual 4.1. If install other than standard mounting orientation (A), please fix the power supply for withstand the vibration and impact.

*8 Please contact us about DC input voltage.
* To meet the specifications. Do not operate over-loaded condition.
* A sound may occur from power supply at light or peak loading.

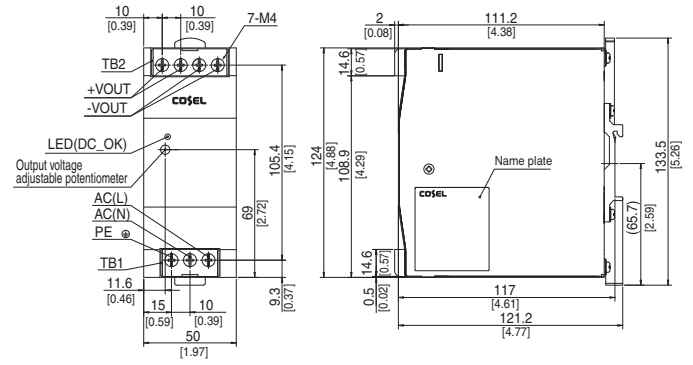
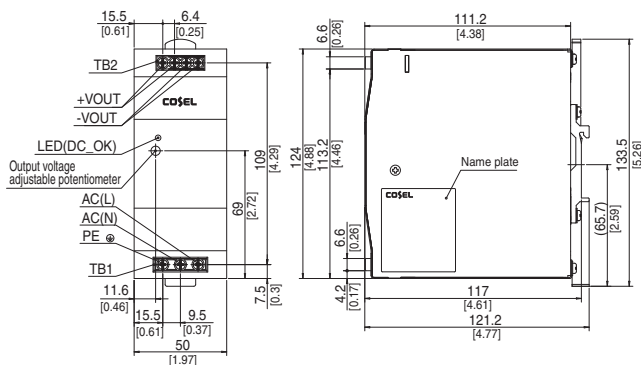
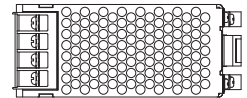
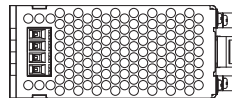
Block diagram



External view

<KLEA240F(Euro Style I/O Terminals)>

<KLNA240F(Barrier Blocks Style I/O Terminals)>



- ※ Tolerance : ± 1.5 [± 0.06]
- ※ Weight : 750g max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Case material : Stainless steel
- ※ Din rail attachment material : Aluminum, Nylon
- ※ Dimensions in mm, [] = inches
- ※ Screw tightening torque : 1N · m max

- ※ Tolerance : ± 1.5 [± 0.06]
- ※ Weight : 750g max
- ※ PCB Material/thickness : FR-4 / 1.6mm [0.06]
- ※ Chassis material : Aluminum
- ※ Case material : Stainless steel
- ※ Din rail attachment material : Aluminum, Nylon
- ※ Dimensions in mm, [] = inches
- ※ Screw tightening torque : 1.6N · m max

KL

Basic Characteristics Data

Model	Circuit method	Switching frequency [KLz]	Input current [A] *1	Rated input fuse	Inrush current protection circuit	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
KLEA120F	Active filter	40 - 160	1.2	250V 4A	Thermistor	FR-4		Yes	Yes	No
KLNA120F	Flyback converter	20 - 150*2								
KLEA240F	Active filter	50 - 70	2.4	250V 8A	Thermistor	FR-4		Yes	Yes	No
KLNA240F	Forward converter	130								

*1 The value of input current is at ACIN 115V and 100%.

*2 Burst operation at light loading, frequency is change by use condition.
Please contact us about detail.

1 Terminal Blocks

KL-8

2 Functions

KL-9

2.1	Input Voltage Range	KL-9
2.2	Inrush Current Limiting	KL-9
2.3	Overcurrent Protection	KL-9
2.4	Overvoltage Protection	KL-9
2.5	Output Ripple and Ripple Noise	KL-9
2.6	Output Voltage Adjustment Range	KL-9
2.7	Isolation	KL-9
2.8	Signal Output	KL-9

3 Series/Parallel Operation

KL-10

3.1	Series Operation	KL-10
3.2	Parallel Operation	KL-10

4 Assembling and Installation Method

KL-10

4.1	Installation Mounting methods	KL-10
4.2	Derating curve depend on input voltage	KL-11
4.3	Derating curve depend on ambient temperature	KL-11
4.4	Expected Life and Warranty	KL-12
4.5	Applicable Electric Cable	KL-13
4.6	Others	KL-13

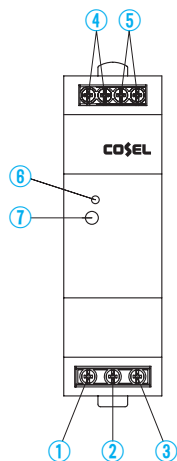
5 Option

KL-13

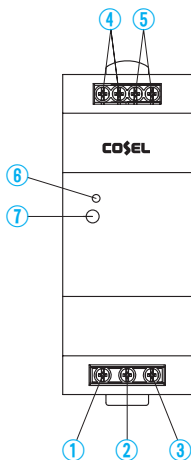
5.1	Outline of option	KL-13
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1 Terminal Blocks

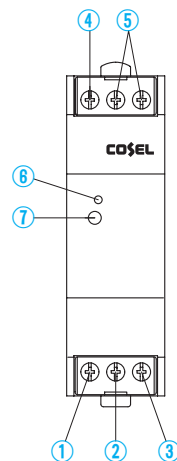
● KLEA120F



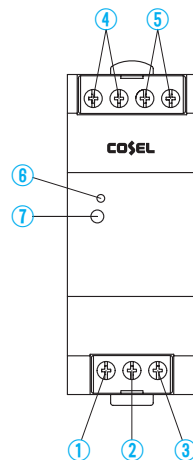
● KLEA240F



● KLNA120F



● KLNA240F



Terminal Number	Terminal Name	Function
①	PE	Protective earth Terminal
②	AC (N)	Input Terminals
③	AC (L)	
④	+VOUT	+Output Terminals
⑤	-VOUT	-Output Terminals
⑥	DC_OK	LED for output voltage confirmation
⑦	TRM	Adjustment of output voltage

2 Functions

2.1 Input Voltage Range

- Input voltage range of the power supplies is from AC85V to AC264V.
- To comply with safety standards, input voltage range is AC100-AC240V (50/60Hz).
- If input value doesn't fall within above range, a unit may not operate in accordance with specifications and/or start hunting or operate protection circuit or fail.
If you need to apply a square waveform input voltage, which is commonly used in UPS and inverters, please contact us.
- When the input voltage changes suddenly, the output voltage accuracy might exceed the specification. Please contact us.
- When the power supply is used with DC voltage input, an external DC fuse is required for protection. Consult us for more details.
- If the input voltage is more than AC250V, power factor correction does not work and the power factor deteriorates. Consult us for more details. (except KLEA240F, KLNA240F)
- Operation stop voltage is set at a lower value than of a standard version (derating is needed).
 - Use Conditions

	Output
KLEA120F, KLNA120F	70W
KLEA240F, KLNA240F	100W
Input AC50V or DC70V	
Duty 1s/30s	

*Please avoid using continuously for more than 1 second under above conditions. Doing so may cause a failure.

2.2 Inrush Current Limiting

- An inrush current limiting circuit is built-in.
- If you need to use a switch on the input side, please select one that can withstand an input inrush current.
- Thermistor is used in the inrush current limiting circuit. When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that a power supply cools down before being turned on.

2.3 Overcurrent Protection

- A overcurrent protection circuit is built-in and activated at 105% of the rated current. A unit automatically recovers when a fault condition is removed. Please do not use a unit in short circuit and/or under an overcurrent condition.
- Intermittent Operation Mode (except KLEA240F, KLNA240F)
When the overcurrent protection circuit is activated and the output voltage drops to a certain extent, the output becomes intermittent so that the average current will also decrease.

2.4 Overvoltage Protection

- An overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait more than 3 minutes and turn on the AC input again to recover the output voltage. Recovery time varies depending on such factors as input voltage value at the time of the operation.

Note :

Please avoid applying a voltage exceeding the rated voltage to an output terminal. Doing so may cause a power supply to malfunction or fail. If you cannot avoid doing so, for example, if you need to operate a motor, etc., please install an external diode on the output terminal to protect the unit.

2.5 Output ripple and ripple noise

- Output ripple noise may be influenced by measurement environment, measuring method fig 2.1 is recommended.

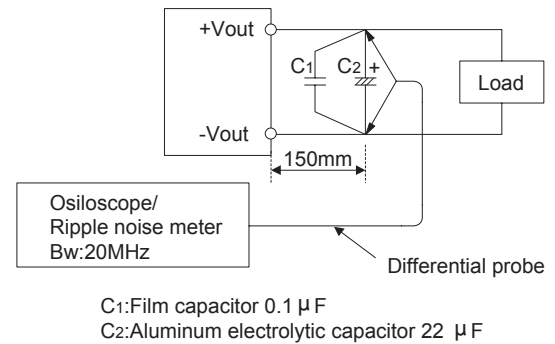


Fig.2.1 Measuring method of Ripple and Ripple Noise

2.6 Output Voltage Adjustment Range

- To increase an output voltage, turn a built-in potentiometer clockwise. To decrease the output voltage, turn it counterclockwise.

2.7 Isolation

- When you run a Hi-Pot test as receiving inspection, gradually increase the voltage to start. When you shut down, decrease the voltage gradually by using a dial. Please avoid a Hi-Pot tester with a timer because, when the timer is turned ON or OFF, it may generate a voltage a few times higher than the applied voltage.

2.8 Signal Output

Functions of LED indicators.

- Functions of LED indicators and signal output in the form of are shown below. Checking the presence/absence of voltage at the output terminal of a power supply is possible.

Table 2.1 Description of the signal output

Signal Output	Normal	Output is decreasing
DC_OK (LED: Green)	ON	OFF

KL

3 Series/Parallel Operation

3.1 Series Operation

■ You can use a power supply in series operation. The output current in series operation should be lower than the rated current of a power supply with the lowest rated current among the power supplies that are serially connected. Please make sure that no current exceeding the rated current flows into a power supply.

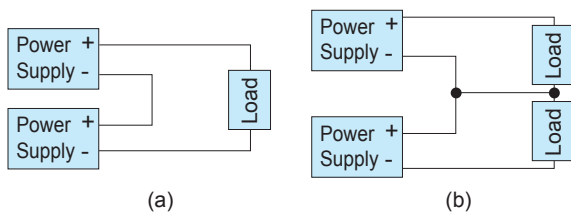


Fig.3.1 Examples of connecting in series operation

3.2 Parallel Operation

■ There is no current balance function.

When operating in parallel, such as diode-OR, please use on the output voltage was adjusted enough to balance the current. Exceeds the rated output current, the output is shut down.

■ Redundancy operation is available by wiring as shown below.

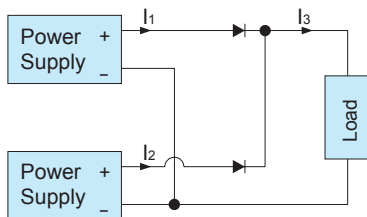


Fig.3.2 Example of connecting in redundancy operation

Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .

Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{rated current value}$$

4 Assembling and Installation Method

4.1 Installation Mounting methods

■ About DIN-Rail

Attachment available with DIN EN60715 TH 35 (35×7.5mm) (Top hat shaped DIN rail)

■ Below shows mounting orientation.

If install other than standard mounting orientation (A), please fix the power supply for withstand the impact and vibration.

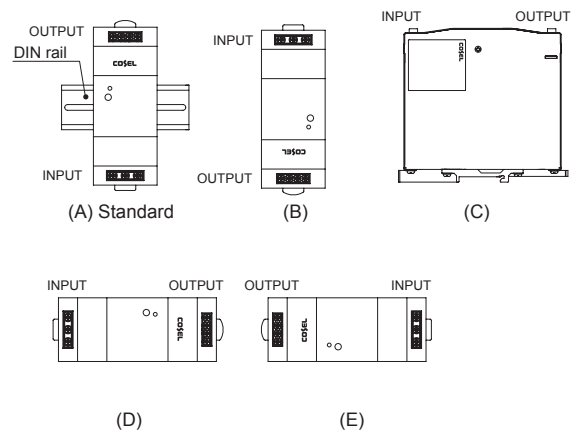


Fig.4.1 Mounting orientation

■ When you mount a power supply on a DIN rail, have the area marked A catch one side of the rail and push the unit to the direction of B. To remove the power supply from the rail, either push down the area marked C or insert a tool such as driver to the area marked D and pull the unit apart from the rail.

When you couldn't remove the unit easily, push down the area marked C while lightly pushing the unit to the direction of E.

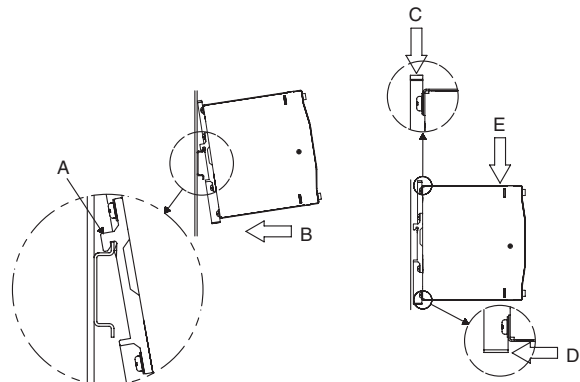


Fig.4.2 Installation method

■ Shown below the notes about installation clearance of a unit.

① Installation clearance at above and below the unit.

Please have clearance of at least 25mm above and below the unit to avoid heat accumulation.

② Installation clearance at the side of the unit.

Please have clearance of at least 15mm side the unit to avoid interfering with heat radiation from housing. However, refer to Table 4.1, if adjacent device of the unit (including power supply) is a heat source.

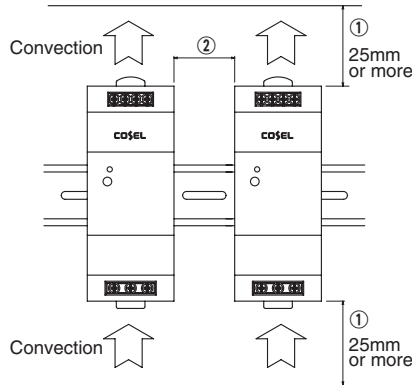


Fig.4.3 Installation clearance

Table 4.1 Installation clearance at the side of the unit.

No.	Model	Adjacent device of the unit	
		Non-heat source	Heat source(*)
1	KLEA120F, KLNA120F	15mm or more	25mm or more
2	KLEA240F, KLNA240F	15mm or more	25mm or more

*Reference value when same power units are adjacent.

4.2 Derating curve depend on input voltage

■ Derating curve depend on input voltage.

Derating curve depend on input voltage is shown in Fig.4.4.

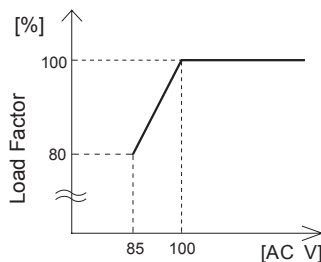


Fig.4.4 Derating curve depend on input voltage

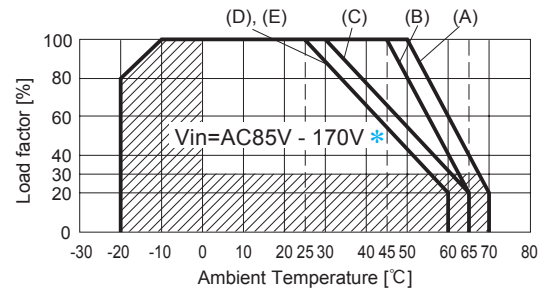
4.3 Derating curve depend on ambient temperature

■ The operative ambient temperature as different by input voltage. Derating curve is shown below.

■ In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

■ Derating Curve (Convection)

● KLEA120F, KLNA120F



* Derating curve depend on input voltage is required.

Fig.4.5 Derating curve depend on ambient temperature

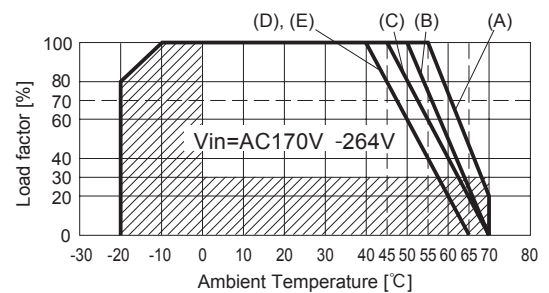
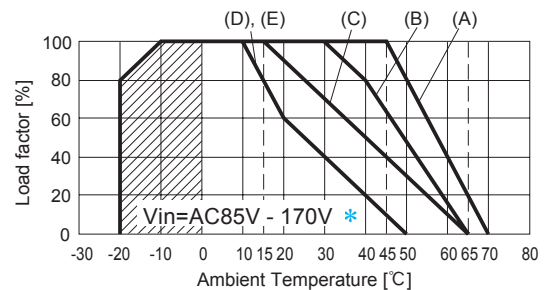


Fig.4.6 Derating curve depend on ambient temperature

● KLEA240F, KLNA240F



* Derating curve depend on input voltage is required.

Fig.4.7 Derating curve depend on ambient temperature

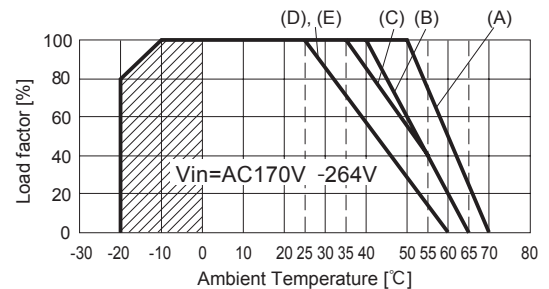


Fig.4.8 Derating curve depend on ambient temperature

■ Ambient temperature indicates the temperature of the inlet of the air.

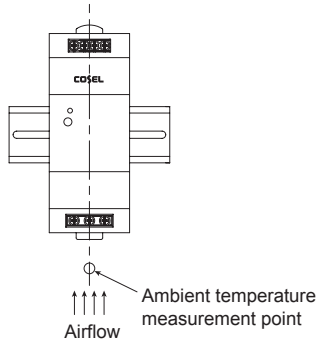


Fig.4.9 Ambient temperature measurement point

● KLEA120F, KLNA120F

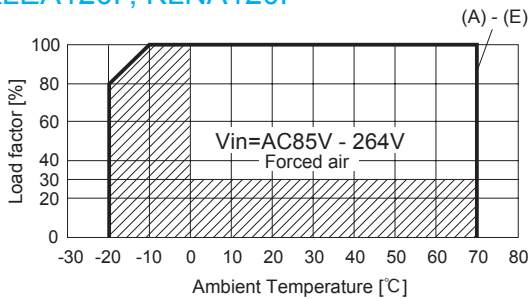


Fig.4.10 Derating curve depend on ambient temperature

● KLEA240F, KLNA240F

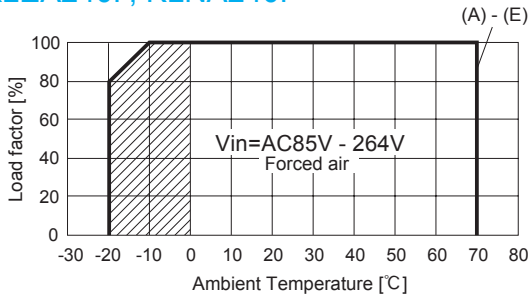


Fig.4.11 Derating curve depend on ambient temperature

■ Temperature of Forced air

Use the temperature measurement point as shown in Fig 4.12.
Please use at the temperature does not exceed the values in Table 4.2.
Please also make sure that the ambient temperature does not exceed 70°C.

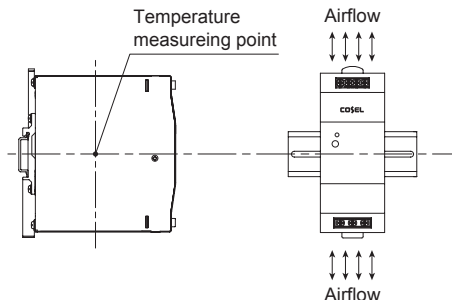


Fig.4.12 Temperature measurement point (Forced air)

Table 4.2 Specified temperature of the measurement point

No.	Model	temperature measurement point
1	KLEA120F, KLNA120F	75°C
2	KLEA240F, KLNA240F	75°C

4.4 Expectancy life and warranty

Please note derating curve depend on input voltage is required.

■ Expectancy Life.

Table 4.3 Expectancy Life (KLEA120F, KLNA120F)

Mounting method	Cooling method	Input voltage	Average ambient temperature (year)	Expectancy Life	
				Load factor $l_o \leq 75\%$	Load factor $75\% < l_o \leq 100\%$
A	Convection	AC85 - 170V	Ta = 40°C or less	10years	6years
			Ta = 50°C	5years	3years
		AC170 - 264V	Ta = 45°C or less	9years	6years
			Ta = 55°C	4years	3years
B	Convection	AC85 - 170V	Ta = 35°C or less	10years	7years
			Ta = 45°C	5years	3years
		AC170 - 264V	Ta = 40°C or less	10years	8years
			Ta = 50°C	5years	4years
C	Convection	AC85 - 170V	Ta = 20°C or less	10years	10years
			Ta = 30°C	10years	7years
		AC170 - 264V	Ta = 35°C or less	10years	7years
			Ta = 45°C	6years	4years
D and E	Convection	AC85 - 170V	Ta = 15°C or less	10years	6years
			Ta = 25°C	7years	3years
		AC170 - 264V	Ta = 30°C or less	10years	5years
			Ta = 40°C	5years	2years
A,B,C,D and E	Forced air	AC85 - 264V	Ta = 70°C	5years	3years

Table 4.4 Expectancy Life (KLEA240F, KLNA240F)

Mounting method	Cooling method	Input voltage	Average ambient temperature (year)	Expectancy Life	
				Load factor $l_o \leq 75\%$	Load factor $75\% < l_o \leq 100\%$
A	Convection	AC85 - 170V	Ta = 35°C or less	8years	5years
			Ta = 45°C	4years	2years
		AC170 - 264V	Ta = 40°C or less	8years	6years
			Ta = 50°C	4years	3years
B	Convection	AC85 - 170V	Ta = 20°C or less	10years	5years
			Ta = 30°C	5years	2years
		AC170 - 264V	Ta = 30°C or less	8years	5years
			Ta = 40°C	4years	2years
C	Convection	AC85 - 170V	Ta = 5°C or less	10years	10years
			Ta = 15°C	10years	6years
		AC170 - 264V	Ta = 25°C or less	10years	7years
			Ta = 35°C	5years	3years
D and E	Convection	AC85 - 170V	Ta = 0°C or less	10years	5years
			Ta = 10°C	5years	2years
		AC170 - 264V	Ta = 15°C or less	9years	5years
			Ta = 25°C	4years	2years
A,B,C,D and E	Forced air	AC85 - 264V	Ta = 70°C	5years	3years

Warranty

Table 4.5 Warranty (KLEA120F, KLNA120F)

Mounting method	Cooling method	Input voltage	Average ambient temperature (year)	Warranty term	
				Load factor $I_o \leq 75\%$	Load factor $75\% < I_o \leq 100\%$
A	Convection	AC85 - 170V	Ta = 40°C or less	5years	5years
			Ta = 50°C	5years	3years
		AC170 - 264V	Ta = 45°C or less	5years	5years
			Ta = 55°C	4years	3years
B	Convection	AC85 - 170V	Ta = 35°C or less	5years	5years
			Ta = 45°C	5years	3years
		AC170 - 264V	Ta = 40°C or less	5years	5years
			Ta = 50°C	5years	4years
C	Convection	AC85 - 170V	Ta = 20°C or less	5years	5years
			Ta = 30°C	5years	5years
		AC170 - 264V	Ta = 35°C or less	5years	5years
			Ta = 45°C	5years	4years
D and E	Convection	AC85 - 170V	Ta = 15°C or less	5years	5years
			Ta = 25°C	5years	3years
		AC170 - 264V	Ta = 30°C or less	5years	5years
			Ta = 40°C	5years	2years
A,B,C,D and E	Forced air	AC85 - 264V	Ta = 70°C	5years	3years

Table 4.6 Warranty (KLEA240F, KLNA240F)

Mounting method	Cooling method	Input voltage	Average ambient temperature (year)	Warranty term	
				Load factor $I_o \leq 75\%$	Load factor $75\% < I_o \leq 100\%$
A	Convection	AC85 - 170V	Ta = 35°C or less	5years	5years
			Ta = 45°C	4years	2years
		AC170 - 264V	Ta = 40°C or less	5years	5years
			Ta = 50°C	4years	3years
B	Convection	AC85 - 170V	Ta = 20°C or less	5years	5years
			Ta = 30°C	5years	2years
		AC170 - 264V	Ta = 30°C or less	5years	5years
			Ta = 40°C	4years	2years
C	Convection	AC85 - 170V	Ta = 5°C or less	5years	5years
			Ta = 15°C	5years	5years
		AC170 - 264V	Ta = 25°C or less	5years	5years
			Ta = 35°C	5years	3years
D and E	Convection	AC85 - 170V	Ta = 0°C or less	5years	5years
			Ta = 10°C	5years	2years
		AC170 - 264V	Ta = 15°C or less	5years	5years
			Ta = 25°C	4years	2years
A,B,C,D and E	Forced air	AC85 - 264V	Ta = 70°C	5years	3years

4.5 Applicable Electric Cable

Input terminals, Output terminals

Table 4.7 Applicable Wire

	Input terminals	Output terminals
Solid wire	Diameter 0.5 mm to 2.6 mm (AWG.24 to AWG.10)	
Stranded wire	0.2mm ² to 5.2mm ² (AWG.24 to AWG.10) Conductor diameter more than 0.18mm	
Sheath strip length	8mm	

4.6 Applicable Electric Cable

While turning on the electricity, and for a while after turning off, please don't touch the inside of a power supply because there are some hot parts in that.

When a mass capacitor is connected with the output terminal (load side), the output might become the stop or an unstable operation. Please contact us for details when you connect the capacitor.

5 Option

5.1 Outline of option

-C

Option -C units have coated internal PCB for better moisture resistance.

-N2

Option -N2 units have attachment with screw mounting instead of DIN rail mounting.
Mounting holes pitch are shown in Table 5.1.

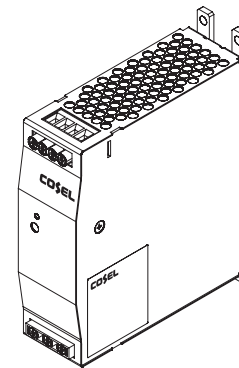


Fig.5.1 Image of option -N2

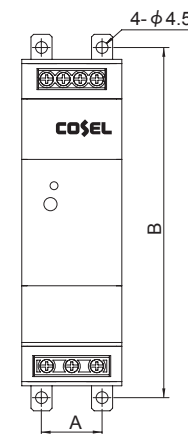


Fig.5.2 Mounting place (screw holes)

Table 5.1 Mounting holes pitch

No.	Model	A	B
1	KLEA120F, KLNA120F	24mm	133mm
2	KLEA240F, KLNA240F	34mm	133mm



KR-series



KRE-20A

KRE-40A

Feature

- Redundancy module
- For DIN (35mm) rail products
- Wide input voltage range
- Wide operating ambient temperature range
- Input voltage balance OK LED
- Input voltage OK LED and relay output

Safety agency approvals

UL60950-1, UL508, C-UL (CSA60950-1), EN60950-1

CE marking

Low Voltage Directive

EMI

Complies with FCC-B, CISPR22-B, EN55011-B, EN55022-B, VCCI-B

EMS Compliance : EN61204-3, EN61000-6-2

EN61000-4-2
EN61000-4-3
EN61000-4-4
EN61000-4-6

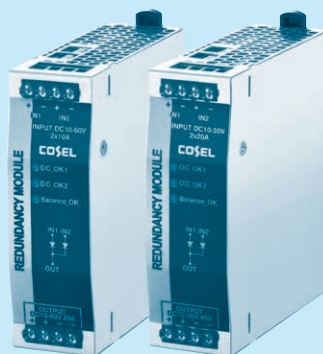
5-year warranty

KRE -20A / -40A

KRE -□□A

①

②



① Series name
KRE : Euro style I/O terminals
② Output current

MODEL	KRE-20A	KRE-40A
DC OUTPUT CURRENT	20	40
DC PEAK OUTPUT CURRENT	30	60

SPECIFICATIONS

	MODEL	KRE-20A	KRE-40A
INPUT	VOLTAGE[V]	DC10 ~ 60	DC10 ~ 30
	CURRENT[A]	10 (×2 Input)	20 (×2 Input)
	PEAK CURRENT[A]	15 (×2 Input)	30 (×2 Input)
	INPUT-OUTPUT POTENTIAL DIFFERENCE[V]	0.6typ (Ta=25°C ,Io=100%)	0.4typ (Ta=25°C ,Io=100%)
OUTPUT	CURRENT[A]	20	40
	PEAK CURRENT[A]	30	60
FUNCTION	DC_OK LAMP	LED (Green)	
	Balance_OK LAMP	LED (Green)	
	DC_OK CONTACT	Relay contact 30VDC 0.5Amax , 30VAC 0.5Amax (resistive load)	
ISOLATION	INPUT-OUTPUT-Chassis	AC1,000V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)	
	INPUT-OUTPUT-DC_OK	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)	
	DC_OK-Chassis	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)	
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	-25 to +70°C (Required to Derating), 20 - 90%RH (Non condensing)	
	STORAGE TEMP., HUMID. AND ALTITUDE	-25 to +85°C, 20 - 90%RH (Non condensing)	
	VIBRATION	10 ~ 55Hz, 19.6m/s ² (2G), 3minutes period, 60 minutes along Z axis (Non operating, mounted on DIN Rail)	
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis (Packing state)	
SAFETY	AGENCY APPROVALS	UL60950-1, C-UL (CSA60950-1) , EN60950-1 , UL508	
	CE MARKING	LVD	
OTHERS	CASE SIZE	38×124×117mm (W×H×D) [1.5X4.88X4.61 inches]	
	WEIGHT	480g max	610gmax
	COOLING METHOD	Convection	

*1 Refer to 3, instruction manual.

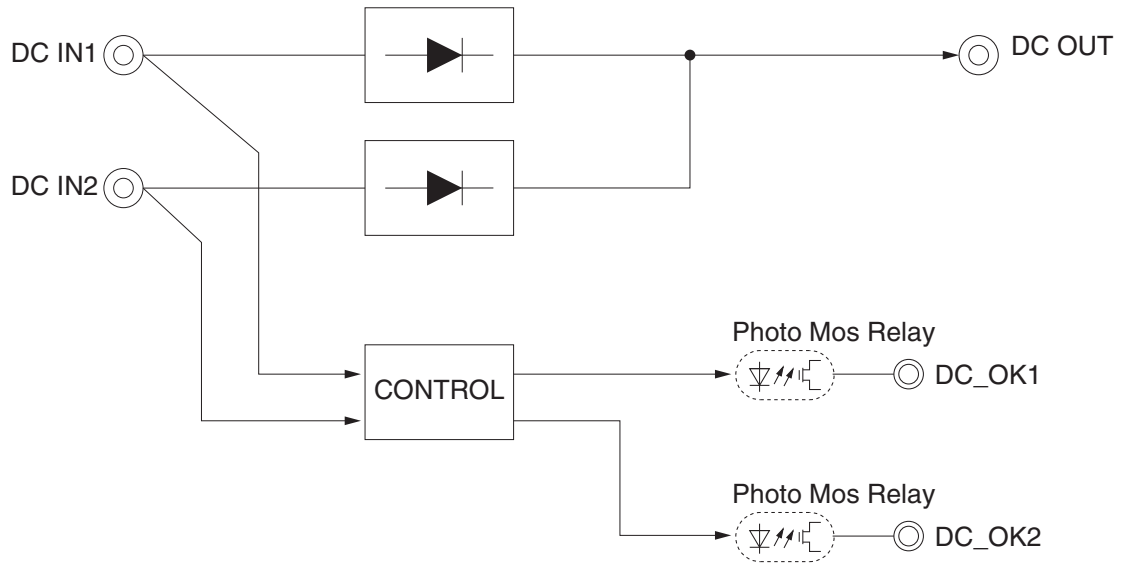
*2 Only as standard mounting orientation (A). Refer to the instruction manual 4.1.

If install other than standard mounting orientation (A), please fix the power supply for withstand the vibration and impact.

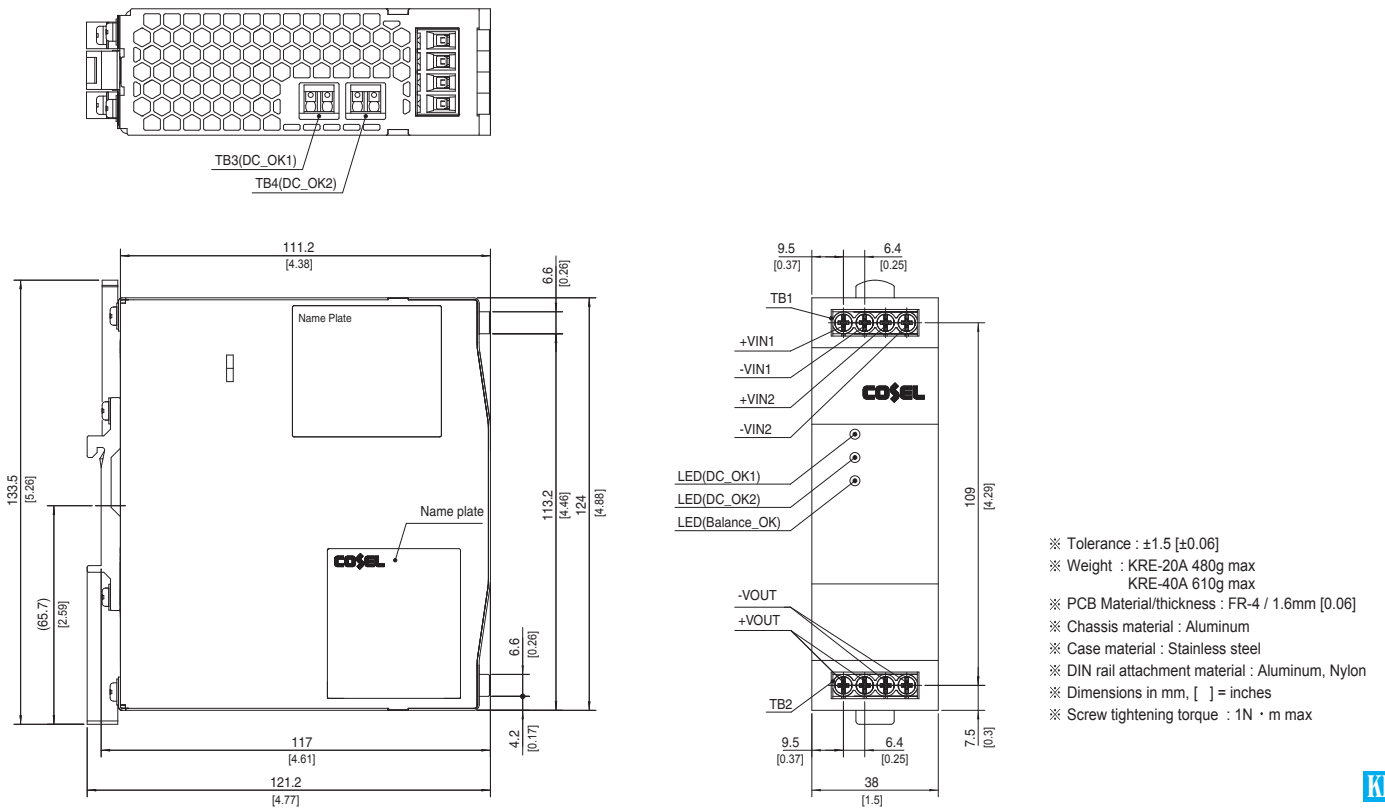
*3 Case size contains neither the umbo.

* To meet the specifications. Do not operate over-loaded condition.

Block diagram



External view



Basic Characteristics Data

Model	Circuit method	PCB/Pattern		
		Material	Single sided	Double sided
KRE-20A	Diode	FR-4		Yes
KRE-40A	Diode	FR-4		Yes

1 Terminal Blocks

KR-6

2 Functions

KR-6

- 2.1 Input Voltage Range KR-6
- 2.2 Isolation KR-6
- 2.3 Signal Output KR-6

3 Peak Current

KR-6

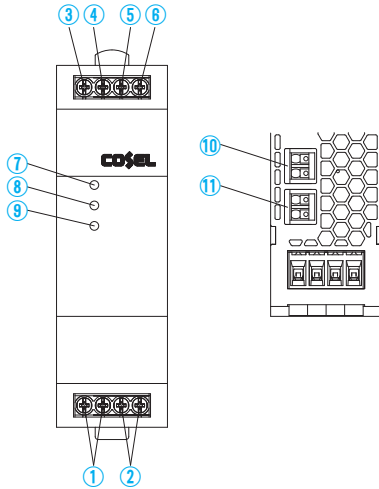
4 Assembling and Installation Method

KR-7

- 4.1 Installation Mounting methods KR-7
- 4.2 Derating curve depend on ambient temperature KR-7
- 4.3 Applicable Electric Cable KR-8
- 4.4 Others KR-8

1 Terminal Blocks

KRE-20A/-40A



Terminal Number	Terminal Name	Function
①	+VOUT	+Output Terminals
②	-VOUT	-Output Terminals
③	+VIN1	+Input Terminals 1
④	-VIN1	-Input Terminals 1
⑤	+VIN2	+Input Terminals 2
⑥	-VIN2	-Input Terminals 2
⑦	DC_OK1	LED for input voltage 1 confirmation
⑧	DC_OK2	LED for input voltage 2 confirmation
⑨	Balance_OK	LED for input voltage balance confirmation
⑩	DC_OK1	Input voltage 1 confirmation (relay contact)
⑪	DC_OK2	Input voltage 2 confirmation (relay contact)

2 Functions

2.1 Input Voltage Range

■ Input voltage range of the module is from DC10V to DC60V(KRE-20A), DC10V to 30V(KRE-40A).

To comply with safety standards, input voltage range is

KRE-20A: [DC10V to DC60V]

KRE-40A: [DC10V to DC30V]

■ If input value doesn't fall within above range, a unit may not operate in accordance with specifications or fail.

2.2 Isolation

■ When you run a Hi-Pot test as receiving inspection, gradually increase the voltage to start. When you shut down, decrease the voltage gradually by using a dial. Please avoid a Hi-Pot tester with a timer because, when the timer is turned ON or OFF, it may generate a voltage a few times higher than the applied voltage.

■ When you test a unit for isolation between the input-output and the DC_OK, or between the DC_OK and the chassis, short all terminals of DC_OK.

2.3 Signal Output

■ LED indicators and signal output in the form of relay contact are signals to check the presence/absence of voltage at the input terminal of a unit.

The timing of signals might be vary depending on input and load conditions. Please make sure enough evaluation.

Table 2.1 Description of the signal output

Signal Output	More than 10V	※1
DC_OK1 (LED: Green)	ON	OFF
DC_OK2 (LED: Green)	ON	OFF
DC_OK1 (Relay Output) ※2	Short	Open
DC_OK2 (Relay Output) ※2	Short	Open

Caution on signal outputs :

■ The timing of signals might be very depending on models, input and load conditions.

※1 In case of that the input terminal voltage is less than 8V or less than approximately 50% of another the input terminal voltage, LED turns off and DC_OK relay opens.

※2 This circuit is insulated from other circuits (input and output).

■ It is possible to check the input voltage difference by using Balance_OK LED indicator in order to make a voltage balance of connected two power supplies.

In case that the input voltage difference is small, LED lights up and the output current of the connected two power supplies tends to be balanced. It expects longer life time than unbalanced condition.

In case that the input voltage difference is not small enough, LED is turned off.

The timing of LED indicator might be vary depending on input and load conditions. Please make sure enough evaluation.

※ Same input cables (length and diameter) from the two power supplies are recommended in order to make a better balance.

3 Peak Current

■ The units can generate the peak current under the following conditions.

• $t_1 \leq 5\text{sec}$

• $I_p \leq \text{Rated peak current}$

• $I_{ave} \leq \text{Rated current}$

• $\text{Duty} \leq 35\%$

• $\text{Duty} = \frac{t_1}{t_1 + t_2} \times 100 [\%]$

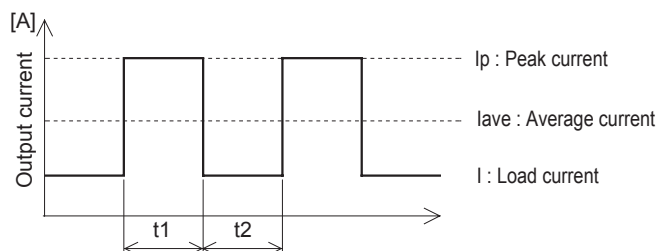


Fig.3.1 Peak current

4 Assembling and Installation Method

4.1 Installation Mounting methods

■About DIN-Rail

Attachment available with DIN EN60715 TH 35 (35×7.5mm) (Top hat shaped DIN rail)

■Below shows mounting orientation.

If install other than standard mounting orientation (A), please fix the power supply for withstand the impact and vibration.

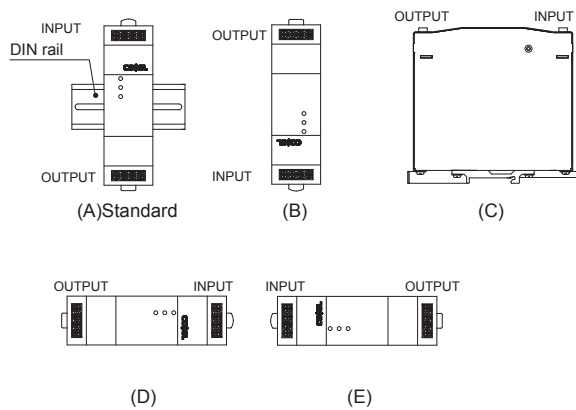


Fig.4.1 Mounting orientation

■When you mount a power supply on a DIN rail, have the area marked A catch one side of the rail and push the unit to the direction of B. To remove the power supply from the rail, either push down the area marked C or insert a tool such as driver to the area marked D and pull the unit apart from the rail.

When you couldn't remove the unit easily, push down the area marked C while lightly pushing the unit to the direction of E.

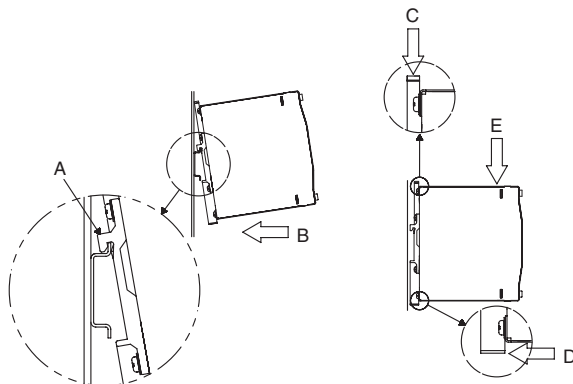


Fig.4.2 Installation method

■Shown below the notes about installation clearance of a unit.

① Installation clearance at above and below the unit.

Please have clearance of at least 25mm above and below the unit to avoid heat accumulation.

② Installation clearance at the side of the unit.

Please have clearance of at least 15mm side the unit to avoid interfering with heat radiation from housing.

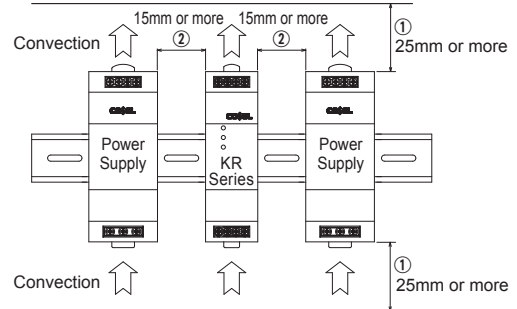


Fig.4.3 Installation clearance

4.2 Derating curve depend on ambient temperature

■The operative ambient temperature as different by input voltage.

Derating curve is shown below.

■Derating Curve (Convection)

●KRE-20A

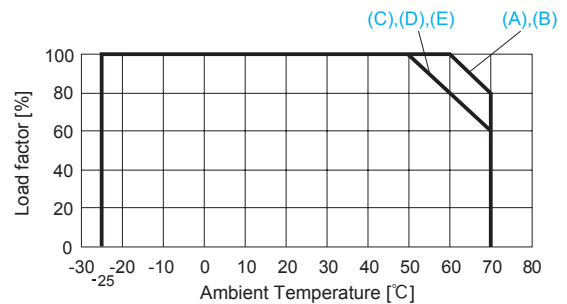


Fig.4.4 Derating curve depend on ambient temperature

●KRE-40A

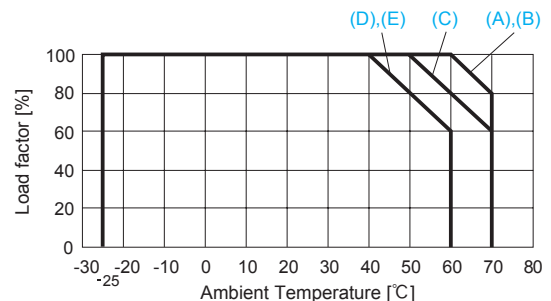


Fig.4.5 Derating curve depend on ambient temperature

※ In KRE-40A, if you use the AWG12 wire, please use at 10deg lower than the derating curve shown on Fig.4.5, since the heat generation of the wire increases.

■ Ambient temperature indicates the temperature of the inlet of the air.

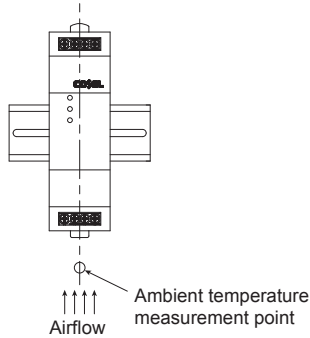


Fig.4.6 Ambient temperature measurement point

■ Temperature of Forced air

※ UL508 (Listing) is excluded.

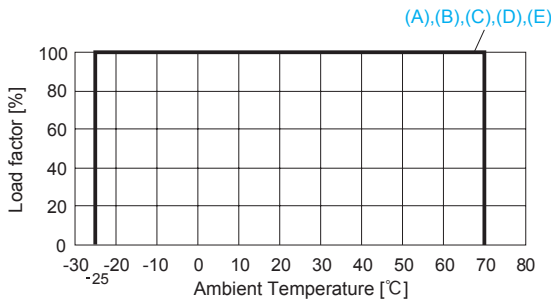


Fig.4.7 Derating curve depend on ambient temperature

■ Temperature of Forced air

Use the temperature measurement point as shown in Fig 4.8.
Please use at the temperature does not exceed 75°C.
Please also make sure that the ambient temperature does not exceed 70°C.

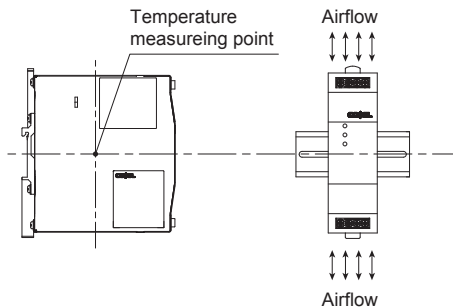


Fig.4.8 Temperature measurement point (Forced air)

4.3 Applicable Electric Cable

■ Input terminals, Output terminals

● KRE-20A, KRE-40A

Table 4.1 Applicable Wire

	Input terminals	Output terminals
Solid wire	Diameter 2.0 mm to 2.6 mm (AWG.12 to AWG.10)	
Stranded wire	3.3mm ² to 5.2mm ² (AWG.12 to AWG.10) Conductor diameter more than 0.18mm	
Sheath strip length	8mm	

※ For safety standard certification, please use wires of the following rated temperature.

UL508 : 75°Cmin

C-UL (CSA) : 105°Cmin

■ DC_OK terminals

Table 4.2 Applicable Wire

	DC_OK terminals
Solid wire	Diameter 0.5 mm to 1.3 mm (AWG.24 to AWG.16)
Stranded wire	0.2mm ² to 1.5mm ² (AWG.24 to AWG.16)
Sheath strip length	8mm

4.4 Others

■ While turning on the electricity, and for a while after turning off, please don't touch the inside of a power supply because there are some hot parts in that.

■ Please avoid applying a voltage exceeding the rated voltage to an output terminal. Doing so may cause a power supply to malfunction or fail. If you cannot avoid doing so, for example, if you need to operate a motor, etc., please install an external diode on the output terminal to protect the unit.



Medical
electric
equipment



Power
Factor
Correction



World wide



Cost
Effective



Rugged
PCB type



Safety
Approvals



EMI



Inrush
current
limiting

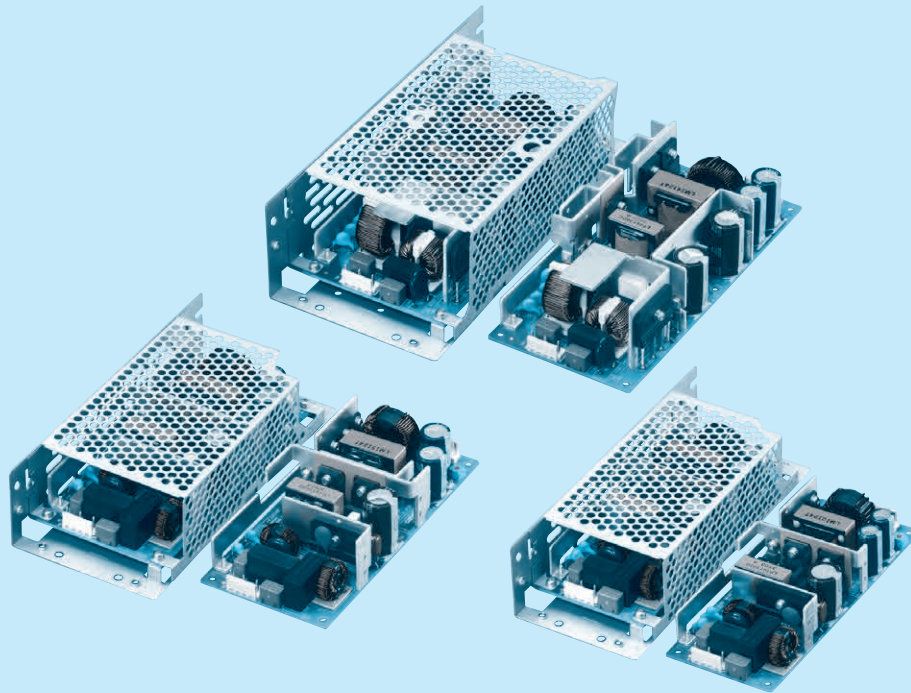


OCP



OVP

LMA-series



Feature

- For medical electric equipment
- Internal dual fuses
- Low leakage current
- High power & peak power (option)
- Small and compact PCB construction
- Built-in inrush current, overcurrent and overvoltage protection circuits
- Harmonic attenuator (Complies with IEC61000-3-2 class A)
- Universal input (AC85-264V)
- Power factor correction

Safety agency approvals

ANSI/AAMI ES60601, EN60601-1 3rd

EMI

Complies with FCC-B, CISPR22-B, EN55011-B, EN55022-B, VCCI-B

5-year warranty

CE marking

EMS Compliance : EN61204-3, EN61000-6-2

EN61000-4-2
EN61000-4-3
EN61000-4-4
EN61000-4-5
EN61000-4-6
EN61000-4-8
EN61000-4-11

LMA100F

LM

A

100

F

-

-

①

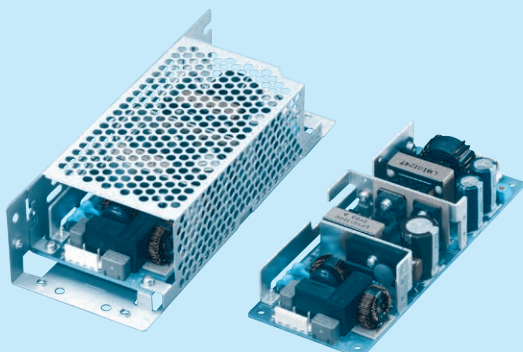
②

③

④

⑤

⑥

Example recommended EMI/EMC filter
NAM-04-101

High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *1
C : with Coating
G : Low leakage current
H : with the function to be acceptable
to output peak current
J1 : VH(J.S.T.)connector type
R : with Remote ON/OFF
R2 : with Remote ON/OFF
S : with Chassis
SN : with Chassis & cover
P : Setting in the overcurrent
protection rating

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.
* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LMA100F-24-Y	LMA100F-24-HY
MAX OUTPUT WATTAGE[W]	103.2	103.2 (206.4) *2
DC OUTPUT	24V 4.3A	24V 4.3A (8.6A) *2

SPECIFICATIONS

	MODEL	LMA100F-24-Y	LMA100F-24-HY
INPUT	VOLTAGE[V]	AC85 - 264 1 φ	
	CURRENT[A]	ACIN 100V	1.4typ (Io=100%)
		ACIN 200V	0.7typ (Io=100%)
	FREQUENCY[Hz]	50 / 60 (47 - 63)	
	EFFICIENCY[%]	ACIN 100V	84.0typ (Io=100%)
		ACIN 200V	86.0typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.99typ (Io=100%)
OUTPUT		ACIN 200V	0.95typ (Io=100%)
	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25°C)
		ACIN 200V	30typ (Io=100%) (At cold start) (Ta=25°C)
	LEAKAGE CURRENT[mA]	0.10 / 0.25max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60601-1)	
	VOLTAGE[V]	24	24
	CURRENT[A]	4.3	4.3 (Peak 8.6) *2
	LINE REGULATION[mV]	*7 96max	96max
	LOAD REGULATION[mV]	*7 150max	150max
	RIPPLE[mVp-p]	0 to +50°C	120max
		-10 - 0°C	160max
	RIPPLE NOISE[mVp-p]*3	0 to +50°C	150max
		-10 - 0°C	180max
	TEMPERATURE REGULATION[mV]	0 to +50°C	240max
		-10 to +50°C	290max
	DRIFT[mV]	*4 96max	96max
	START-UP TIME[ms]	350typ (ACIN 100V, Io=100%)	
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)	
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	19.20 to 27.50	19.20 to 27.50
	OUTPUT VOLTAGE SETTING[V]	24.00 to 24.96	24.00 to 24.96
	OVERCURRENT PROTECTION	Works over 105% of rating (works over 101% of peak current at option -H) and recovers automatically	
	OVERVOLTAGE PROTECTION[V]	27.60 to 33.60	27.60 to 33.60
	OPERATING INDICATION	Not provided	
ISOLATION	REMOTE SENSING	Not provided	
	REMOTE ON/OFF	Option (Required external power source.)	
	INPUT-OUTPUT-RC	*6 AC4,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)	2MOOP
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)	1MOOP
	OUTPUT-RC-FG	*6 AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)	
ENVIRONMENT	OUTPUT-RC	*6 AC100V 1minute, Cutoff current = 25mA, DC100V 10MΩ min (At Room Temperature)	
	OPERATING TEMP., HUMID. AND ALTITUDE *5	-10 to +70°C, 20 - 90%RH (Non condensing), 3,000m (10,000feet) max	
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max	
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis	
SAFETY AND NOISE REGULATIONS	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis	
	AGENCY APPROVALS (AT ONLY AC input)	ANSI/AAMI ES60601-1, EN60601-1 3rd	
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B	
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *8	
OTHERS	CASE SIZE/WEIGHT	62 X 33 X 155mm [2.44 X 1.30 X 6.10 inches] (W X H X D) / 290g max (with chassis & cover : 470g max)	
	COOLING METHOD	Convection *5	

*1 Specification is changed at option, refer to Instruction Manual.

*2 Peak loading for 10sec. And Duty 40% max.

() means peak current. There is a possibility that an internal device is damaged when the specification is exceeded.

*3 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*5 Derating is required.

*6 Applicable when remote control (optional) is added.

*7 Please contact us about dynamic load and input response.

*8 Please contact us about another class.

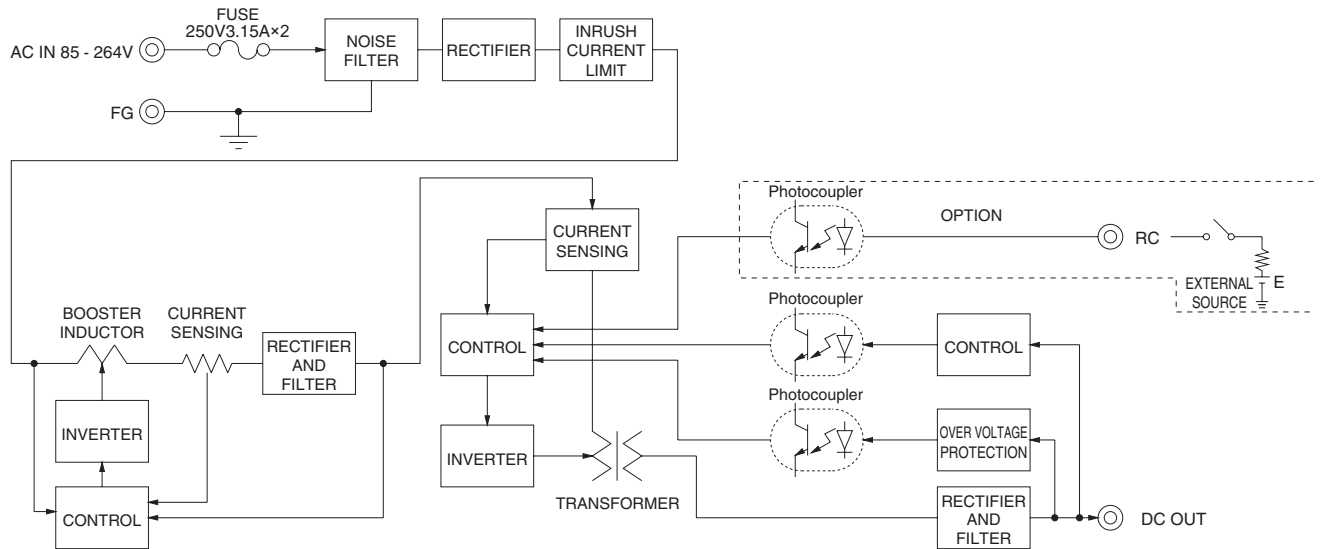
* To meet the specifications. Do not operate over-loaded condition.

* Parallel operation is not possible.

* Derating is required when operated with chassis and cover.

* Sound noise may be generated by power supply in case of pulse load.

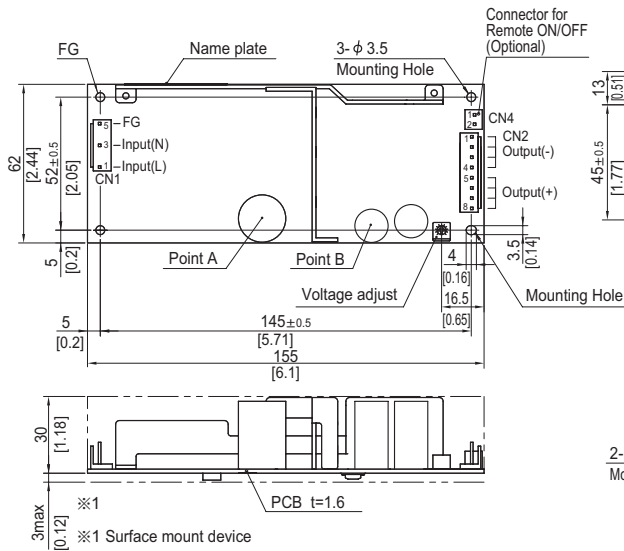
Block diagram



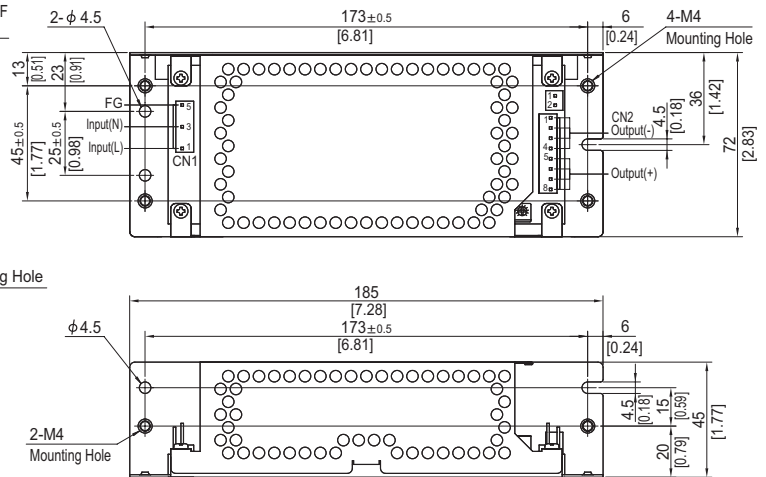
External view

※ External size of option is different from standard model.

Standard type



Chassis and cover type



- ※ 4 Mounting holes are existing.
- ※ The back side of P.C.B. of the power supply is assembled some SMDs.
Be attention not to bump against the attached area by vibration.
- ※ Use the spacer of 8mm length or more regarding insulation.
And do not use press-fitting bush.
- ※ Point A, Point B are thermometry points.

I/O Connector	Mating connector	Terminal	
CN1	1-1123724-3	Chain	1123721-1
		Loose	1318912-1
CN2	1-1123723-8	Chain	1123721-1
		Loose	1318912-1

(Mfr:Tyco Electronics)

- ※ I/O Connector is Mfr. Tyco Electronics
- ※ Option:-J1:VH(J.S.T) connector type.

<PIN CONNECTION>

CN1

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

CN2

Pin No.	Output
1 to 4	-V
5 to 8	+V

- ※ Keep drawing current per pin below 5A for CN2.

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 290g max (with chassis & cover : 470g max)
- ※ PCB material : CEM3
- ※ Optional chassis and cover material : Electric galvanizing steel board.
- ※ Dimensions in mm, [] =inches
- ※ Mounting torque (Mounting hole of chassis) : $1.5N \cdot m$ (16kgf \cdot cm) max

Connector type

CN4 Option (Mfr:J.S.T)

PIN No.	Contents
1	RC(+)
2	RC(-)

Barrier strip type

Model B2B-XH-A
Mating Connector (Terminal)
XHP-2
(BXH-001T-P0.6
or SXH-001T-P0.6)

LMA150F

LM

A

150

F

-

-

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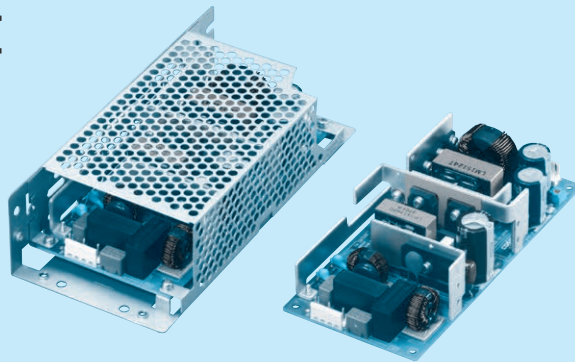
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Example recommended EMI/EMC filter
NAM-04-101

High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *1
C : with Coating
G : Low leakage current
H : with the function to be acceptable
to output peak current
J1 : VH(J.S.T.)connector type
R : with Remote ON/OFF
R2 : with Remote ON/OFF
S : with Chassis
SN : with Chassis & cover
P : Setting in the overcurrent
protection rating

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.
* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LMA150F-24-Y	LMA150F-24-HY
MAX OUTPUT WATTAGE[W]	151.2	151.2 (302.4) *2
DC OUTPUT	24V 6.3A	24V 6.3A (12.6A) *2

SPECIFICATIONS

	MODEL	LMA150F-24-Y	LMA150F-24-HY
INPUT	VOLTAGE[V]	AC85 - 264 1 φ	
	CURRENT[A]	ACIN 100V	2.0typ (Io=100%)
		ACIN 200V	1.0typ (Io=100%)
	FREQUENCY[Hz]	50 / 60 (47 - 63)	
	EFFICIENCY[%]	ACIN 100V	85.0typ (Io=100%)
		ACIN 200V	87.0typ (Io=100%)
	POWER FACTOR	ACIN 100V	0.99typ (Io=100%)
OUTPUT		ACIN 200V	0.95typ (Io=100%)
	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start) (Ta=25°C)
		ACIN 200V	30typ (Io=100%) (At cold start) (Ta=25°C)
	LEAKAGE CURRENT[mA]	0.10 / 0.25max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60601-1)	
	VOLTAGE[V]	24	24
	CURRENT[A]	6.3	6.3 (Peak 12.6) *2
	LINE REGULATION[mV]	*7 96max	96max
	LOAD REGULATION[mV]	*7 150max	150max
	RIPPLE[mVp-p]	0 to +50°C	120max
		-10 - 0°C	160max
	RIPPLE NOISE[mVp-p]*3	0 to +50°C	150max
		-10 - 0°C	180max
	TEMPERATURE REGULATION[mV]	0 to +50°C	240max
		-10 to +50°C	290max
	DRIFT[mV]	*4 96max	96max
	START-UP TIME[ms]	350typ (ACIN 100V, Io=100%)	
	HOLD-UP TIME[ms]	20typ (ACIN 100V, Io=100%)	
PROTECTION CIRCUIT AND OTHERS	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	19.20 to 27.50	19.20 to 27.50
	OUTPUT VOLTAGE SETTING[V]	24.00 to 24.96	24.00 to 24.96
	OVERCURRENT PROTECTION	Works over 105% of rating (works over 101% of peak current at option -H) and recovers automatically	
	OVERVOLTAGE PROTECTION[V]	27.60 to 33.60	27.60 to 33.60
	OPERATING INDICATION	Not provided	
ISOLATION	REMOTE SENSING	Not provided	
	REMOTE ON/OFF	Option (Required external power source.)	
	INPUT-OUTPUT-RC	*6 AC4,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)	2MOOP
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)	1MOOP
	OUTPUT-RC-FG	*6 AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)	
ENVIRONMENT	OUTPUT-RC	*6 AC100V 1minute, Cutoff current = 25mA, DC100V 10MΩ min (At Room Temperature)	
	OPERATING TEMP., HUMID. AND ALTITUDE *5	-10 to +70°C, 20 - 90%RH (Non condensing), 3,000m (10,000feet) max	
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max	
	VIBRATION	10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis	
SAFETY AND NOISE REGULATIONS	IMPACT	196.1m/s² (20G), 11ms, once each X, Y and Z axis	
	AGENCY APPROVALS (AT ONIY AC input)	ANSI/AAMI ES60601-1, EN60601-1 3rd	
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B	
OTHERS	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *8	
	CASE SIZE/WEIGHT	75 X 36.5 X 160mm [2.95 X 1.44 X 6.30 inches] (W X H X D) / 370g max (with chassis & cover : 600g max)	
	COOLING METHOD	Convection *5	

*1 Specification is changed at option, refer to Instruction Manual.

*2 Peak loading for 10sec. And Duty 40% max.

() means peak current. There is a possibility that an internal device is damaged when the specification is exceeded.

*3 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*5 Derating is required.

*6 Applicable when remote control (optional) is added.

*7 Please contact us about dynamic load and input response.

*8 Please contact us about another class.

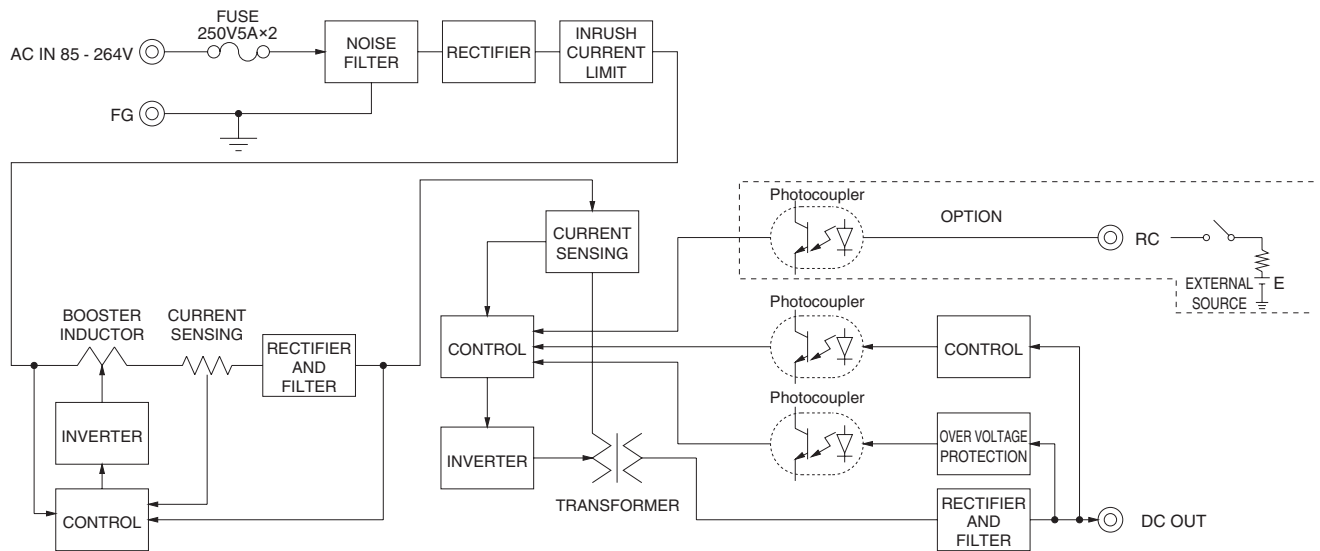
* To meet the specifications. Do not operate over-loaded condition.

* Parallel operation is not possible.

* Derating is required when operated with chassis and cover.

* Sound noise may be generated by power supply in case of pulse load.

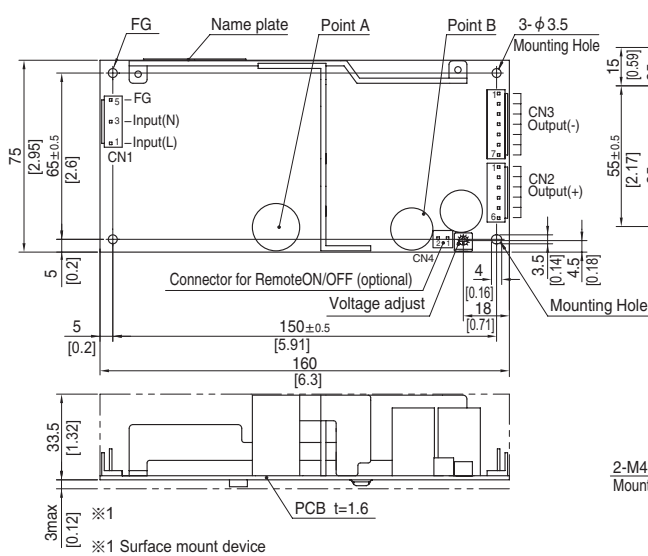
Block diagram



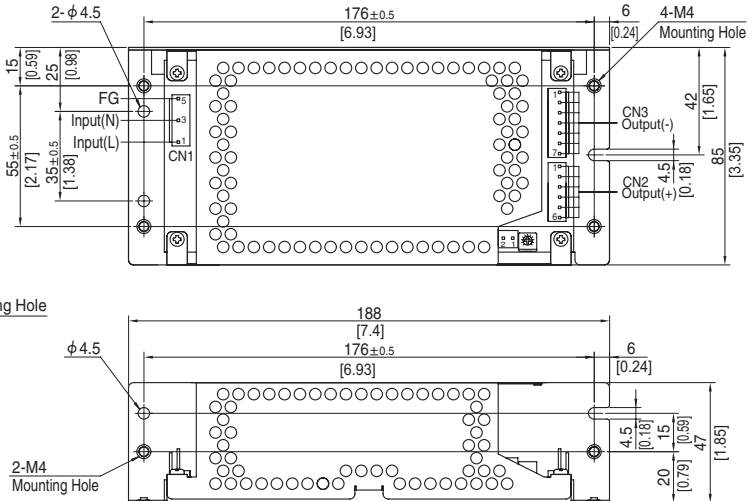
External view

※ External size of option is different from standard model.

Standard type



Chassis and cover type



- ※ 4 Mounting holes are existing.
- ※ The back side of P.C.B. of the power supply is assembled some SMDs.
- Be attention not to bump against the attached area by vibration.
- ※ Use the spacer of 8mm length or more regarding insulation.
- And do not use press-fitting bush.
- ※ Point A, Point B are thermometry points.

I/O Connector	Mating connector	Terminal
CN1	1-1123724-3	1-1123722-5
CN2	1-1123723-6	1-1123722-6
CN3	1-1123723-7	1-1123722-7

(Mfr: Tyco Electronics)

- ※ I/O Connector is Mfr. Tyco Electronics
- ※ Option:-J1:VH(J.S.T) connector type.

<PIN CONNECTION>

CN1	CN2	CN3
Pin No.	Pin No.	Pin No.
1	1 to 6	1 to 7
2		
3	+V	-V
4		
5		
FG		

※ Keep drawing current per pin below 5A for CN2, CN3.

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 370g max (with chassis & cover : 600g max)
- ※ PCB material : CEM3
- ※ Optional chassis and cover material : Electric galvanizing steel board.
- ※ Dimensions in mm, [] = inches
- ※ Mounting torque (Mounting hole of chassis) : 1.5N · m (16kgf · cm) max

Connector type

CN4 Option (Mfr: J.S.T)

PIN No.	Contents
1	RC(+)
2	RC(-)

Barrier strip type

Model B2B-XH-A
Mating Connector (Terminal)
XHP-2
(BXH-001T-P0.6
or SXH-001T-P0.6)

LMA240F

LM

A

240

F

-□

-□

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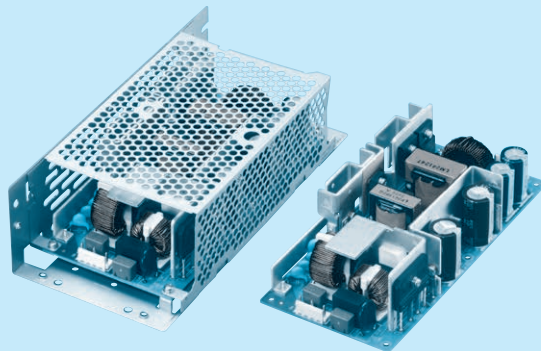
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Example recommended EMI/EMC filter
NAM-06-101



High voltage pulse noise type : NAP series
Low leakage current type : NAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional *1
- C : with Coating
- G : Low leakage current
- H : with the function to be acceptable
to output peak current
- J1 : VH(J.S.T.)connector type
- R : with Remote ON/OFF
- R2 : with Remote ON/OFF
- S : with Chassis
- SN : with Chassis & cover
- P : Setting in the overcurrent
protection rating

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	LMA240F-24-Y	LMA240F-24-HY
MAX OUTPUT WATTAGE[W]	300	300 (480) *2
DC OUTPUT	<div>Convection 24V 10A</div> <div>Forced air 24V 12.5A</div>	<div>24V 10A (20A) *2</div> <div>24V 12.5A (20A) *2</div>

SPECIFICATIONS

	MODEL	LMA240F-24-Y	LMA240F-24-HY
INPUT	VOLTAGE[V]	AC85 - 264 1 φ	
	CURRENT[A]	<div>ACIN 100V 3.9typ (Io=100%)</div> <div>ACIN 200V 1.8typ (Io=100%)</div>	
	FREQUENCY[Hz]	50 / 60 (47 - 63)	
	EFFICIENCY[%]	<div>ACIN 100V 86.0typ (Io=100%)</div> <div>ACIN 200V 88.0typ (Io=100%)</div>	<div>86.0typ (Io=100%)</div> <div>88.0typ (Io=100%)</div>
	POWER FACTOR	<div>ACIN 100V 0.99typ (Io=100%)</div> <div>ACIN 200V 0.95typ (Io=100%)</div>	
	INRUSH CURRENT[A]	<div>ACIN 100V 15 / 30typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 3 sec. to re-start)</div> <div>ACIN 200V 30 / 30typ (Io=100%) (Primary inrush current /Secondary inrush current) (More than 3 sec. to re-start)</div>	
	LEAKAGE CURRENT[ma]	0.15 / 0.40max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60601-1)	
OUTPUT	VOLTAGE[V]	24	24
	CURRENT[A]	<div>Convection 10</div> <div>Forced air 12.5</div>	<div>10 (Peak 20) *2</div> <div>12.5 (Peak 20) *2</div>
	LINE REGULATION[mV]	*7 96max	96max
	LOAD REGULATION[mV]	*7 150max	150max
	RIPPLE[mVp-p]	<div>*3 0 to +50°C 120max</div> <div>-10 - 0°C 160max</div>	<div>120max</div> <div>160max</div>
	RIPPLE NOISE[mVp-p]*3	<div>0 to +50°C 150max</div> <div>-10 - 0°C 180max</div>	<div>150max</div> <div>180max</div>
	TEMPERATURE REGULATION[mV]	<div>0 to +50°C 240max</div> <div>-10 to +50°C 290max</div>	<div>240max</div> <div>290max</div>
	DRIFT[mV]	*4 96max	96max
	START-UP TIME[ms]	350typ (ACIN 100V, Io=100%)	
	HOLD-UP TIME[ms]	*9 20typ (ACIN 100V, Io=100%)	
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	19.20 to 27.50	19.20 to 27.50
	OUTPUT VOLTAGE SETTING[V]	24.00 to 24.96	24.00 to 24.96
	OVERCURRENT PROTECTION	Works over 105% of rating (works over 101% of peak current at option -H) and recovers automatically	
PROTECTION CIRCUIT AND OTHERS	OVERVOLTAGE PROTECTION[V]	27.60 to 33.60	27.60 to 33.60
	OPERATING INDICATION	Not provided	
	REMOTE SENSING	Not provided	
	REMOTE ON/OFF	Option (Required external power source.)	
ISOLATION	INPUT-OUTPUT-RC	*6 AC4,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature) 2MOOP	
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature) 1MOOP	
	OUTPUT-RC-FG	*6 AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)	
	OUTPUT-RC	*6 AC100V 1minute, Cutoff current = 25mA, DC100V 10MΩ min (At Room Temperature)	
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE	*5 -10 to +70°C, 20 - 90%RH (Non condensing), 3,000m (10,000feet) max	
	STORAGE TEMP., HUMID. AND ALTITUDE	-20 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max	
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis	
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis	
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS (AT ONIY AC input)	ANSI/AAMI ES60601-1, EN60601-1 3rd	
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR22-B, EN55011-B, EN55022-B	
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (Class A) *8	
OTHERS	CASE SIZE/WEIGHT	84 X 46 X 180mm [3.31 X 1.81 X 7.09 inches] (W X H X D) / 540g max (with chassis & cover : 860g max)	
	COOLING METHOD	Convection / Forced air *5	

*1 Specification is changed at option, refer to Instruction Manual.

*2 Peak loading for 10sec. And Duty 40% max.

() means peak current. There is a possibility that an internal device is damaged when the specification is exceeded.

*3 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent

to KEISOKU-GIKEN: RM103).

*4 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*5 Derating is required.

*6 Applicable when remote control (optional) is added.

*7 Please contact us about dynamic load and input response.

*8 Please contact us about another class.

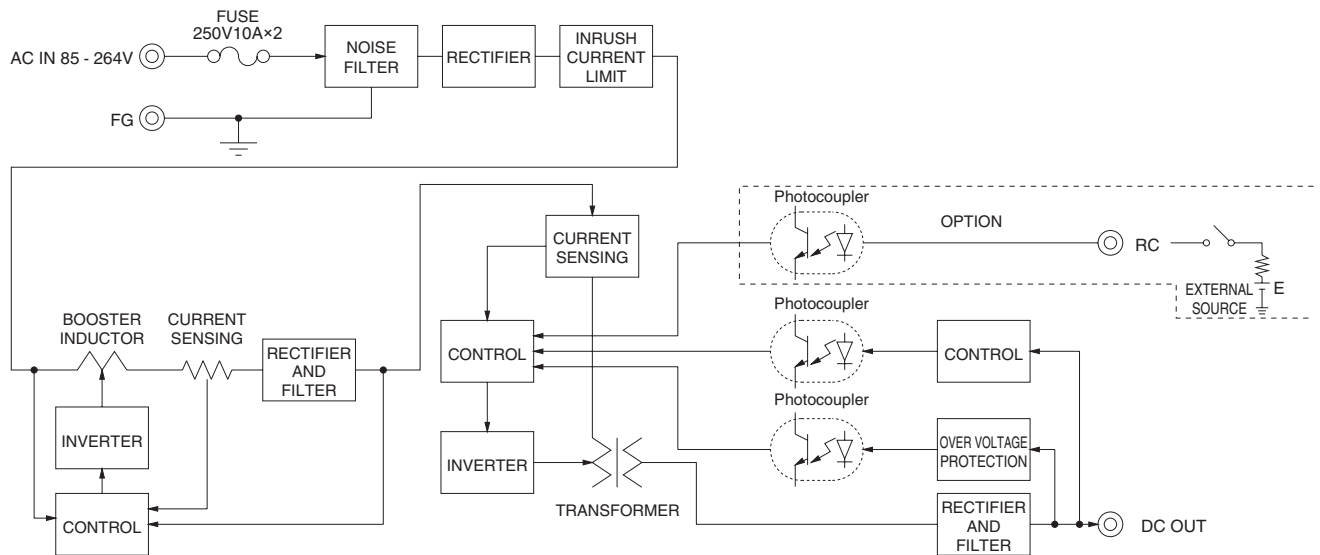
* To meet the specifications. Do not operate over-loaded condition.

* Parallel operation is not possible.

* Derating is required when operated with chassis and cover.

* Sound noise may be generated by power supply in case of pulse load.

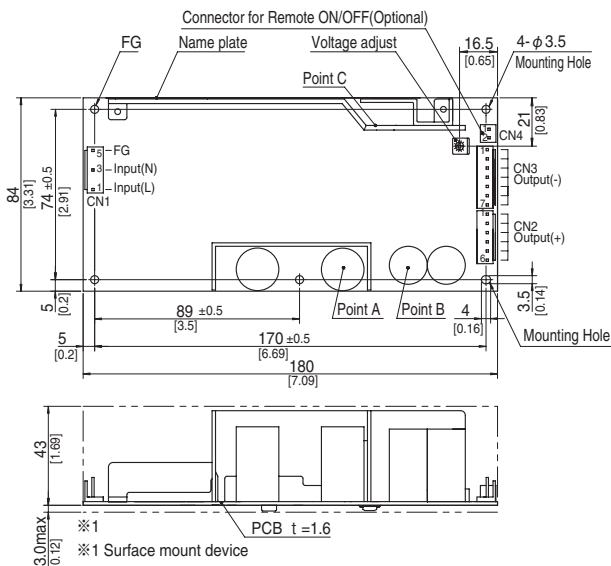
Block diagram



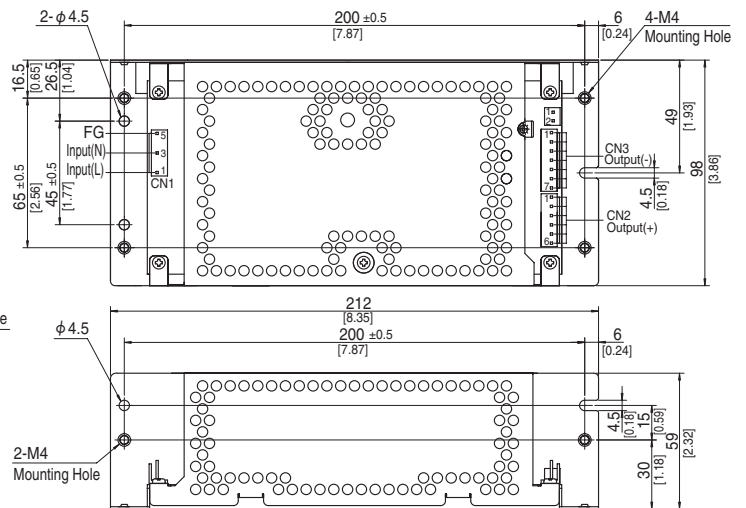
External view

※ External size of option is different from standard model.

Standard type



Chassis and cover type



- ※ 5 Mounting holes are existing.
- ※ The back side of P.C.B. of the power supply is assembled some SMDs.
Be attention not to bump against the attached area by vibration.
- ※ Use the spacer of 8mm length or more regarding insulation.
And do not use press-fitting bush.
- ※ Point A, Point B, Point C are thermometry points.

<PIN CONNECTION>

I/O Connector	Mating connector	Terminal
CN1	1-1123724-3	1123721-1 Chain 1318912-1 Loose
CN2	1-1123723-6	1123721-1 Chain 1318912-1 Loose
CN3	1-1123723-7	1123721-1 Chain 1318912-1 Loose

(Mfr:Tyco Electronics)

- ※ I/O Connector is Mfr. Tyco Electronics
- ※ Option:-J1:VH(J.S.T) connector type.

CN1

Pin No.	Input
1	AC(L)
2	
3	AC(N)
4	
5	FG

CN2

Pin No.	Output
1 to 6	+V

CN3

Pin No.	Output
1 to 7	-V

- ※ Keep drawing current per pin below 5A for CN2,CN3.

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 540g max (with chassis & cover : 860g max)
- ※ PCB material : CEM3
- ※ Optional chassis and cover material : Electric galvanizing steel board.
- ※ Dimensions in mm, [] =inches
- ※ Mounting torque (Mounting hole of chassis) : 1.5N · m (16kgf · cm) max

Connector type

CN4 Option (Mfr:J.S.T)

PIN No.	Contents
1	RC(+)
2	RC(-)

Barrier strip type

Model B2B-XH-A
Mating Connector (Terminal)
XHP-2
(BXH-001T-P0.6
or SXH-001T-P0.6)

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current *1 [A]	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
					Material	Single sided	Double sided	Series operation	Parallel operation
LMA100F	Active filter	60	1.4	Thermistor	CEM-3		Yes	Yes	No
	Forward converter	130							
LMA150F	Active filter	60	2.0	Thermistor	CEM-3		Yes	Yes	No
	Forward converter	130							
LMA240F	Active filter	60	3.9	SCR	CEM-3		Yes	Yes	No
	Forward converter	130							

*1 The value of input current is at ACIN 100V and rated load.

1 Function LMA-10

1.1	Input voltage range	LMA-10
1.2	Inrush current limiting	LMA-10
1.3	Overcurrent protection	LMA-10
1.4	Overvoltage protection	LMA-10
1.5	Thermal protection	LMA-10
1.6	Output voltage adjustment range	LMA-10
1.7	Output ripple and ripple noise	LMA-10
1.8	Isolation	LMA-11
1.9	Reducing standby power	LMA-11

2 Series Operation and Parallel Operation LMA-11

2.1	Series Operation	LMA-11
2.2	Parallel Operation	LMA-11

3 Assembling and Installation Method LMA-11

3.1	Installation method	LMA-11
3.2	Derating	LMA-11
3.3	Mounting screw	LMA-13
3.4	Expectancy life and warranty	LMA-13

4 Ground LMA-14

5 Option and Others LMA-14

5.1	Outline of options	LMA-14
5.2	Others	LMA-15

1 Function

1.1 Input voltage range

- The range is from AC85V to AC264V or DC120V to DC370V (please see SPECIFICATIONS for details).
- In cases that conform with safety standard, input voltage range is AC100-AC240V (50/60Hz).
- If input value doesn't fall within above range, a unit may not operate in accordance with specifications and/or start hunting or fail. If you need to apply a square waveform input voltage, which is commonly used in UPS and inverters, please contact us.
- When the input voltage changes suddenly, the output voltage accuracy might exceed the specification. Please contact us.
- Operation stop voltage is set at a lower value than that of a standard version (derating is needed).

· Use Conditions

Output		*Please avoid using continuously for more than 1 second under above conditions. Doing so may cause a failure.
LMA100F	30W	
LMA150F	50W	
LMA240F	80W	
Input AC50V or DC70V Duty 1s/30s		

1.2 Inrush current limiting

- An inrush current limiting circuit is built-in.
- If you need to use a switch on the input side, please select one that can withstand an input inrush current.

● LMA100F, LMA150F

- Thermistor is used in the inrush current limiting circuit. When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that a power supply cools down before being turned on.

● LMA240F

- Thyristor technique is used in the inrush current limiting circuit. When you turn power ON/OFF repeatedly within a short period of time, please have enough intervals so that the inrush current limiting circuit becomes operative.
- When the switch of the input is turned on, the primary inrush current and secondary inrush current will be generated because the thyristor technique is used for the inrush current limiting circuit.

1.3 Overcurrent protection

- An overcurrent protection circuit is built-in and activated at 105% of the rated current. A unit automatically recovers when a fault condition is removed.
Please do not use a unit in short circuit and/or under an overcurrent condition.
- Please don't use continuously in constant current mode with over current protection (Ex: for Battery charging), which might lead to internal parts damage.
- In case of using in constant current mode, please refer to 5.1, -P option.

1.4 Overvoltage protection

- An overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait more than 3 minutes and turn on the AC input again to recover the output voltage. Recovery time varies depending on such factors as input voltage value at the time of the operation.
- In option -R2, overvoltage protection is removed by toggling ON/OFF signal of remote control.

Remarks :

Please avoid applying a voltage exceeding the rated voltage to an output terminal. Doing so may cause a power supply to malfunction or fail. If you cannot avoid doing so, for example, if you need to operate a motor, etc., please install an external diode on the output terminal to protect the unit.

1.5 Thermal protection

- A thermal protection circuit is built-in.
The thermal protection circuit may be activated under the following conditions and shut down the output.
- ① When a temperature continue to exceed the values determined by the derating curve.
- ② When a current exceeding the rated current is applied.
- ③ When convection stops.

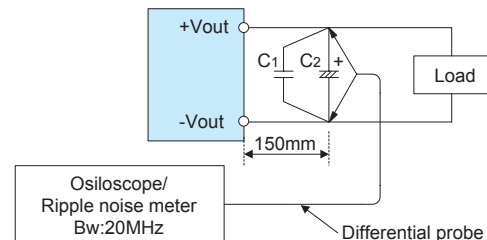
If the thermal protection circuit is activated, shut off the input voltage and eliminate all the overheating conditions. To recover the output voltage, have enough time to cool down the unit before turning on the input voltage again.

1.6 Output voltage adjustment range

- Adjustment of output voltage is possible by using potentiometer.

1.7 Output ripple and ripple noise

- Output ripple noise may be influenced by measurement environment, measuring method fig.1.1 is recommended.



C1 : Film capacitor 0.1µF

C2 : Aluminum electrolytic capacitor 22µF

Fig.1.1 Measuring method of Ripple and Ripple Noise

Remarks :

When GND cable of probe with flux of magnetic force from power supply are crossing, ripple and ripple noise might not measure correctly.

Please note the measuring environment.

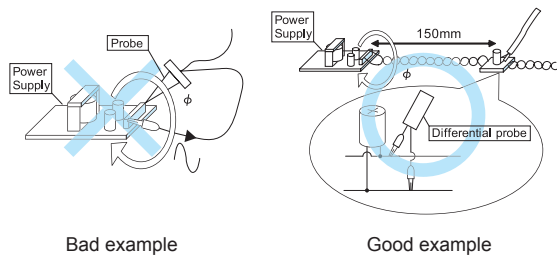


Fig.1.2. Example of measuring output ripple and ripple noise

1.8 Isolation

■For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for the start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

1.9 Reducing standby power

■As for option -R2, reducing standby power is possible by OFF signal of the remote control.
Please refer to instruction manual 6.1.

2 Series Operation and Parallel Operation

2.1 Series Operation

■You can use a power supply in series operation. The output current in series operation should be lower than the rated current of a power supply with the lowest rated current among power supplies that are serially connected. Please make sure that no current exceeding the rated current flows into a power supply.

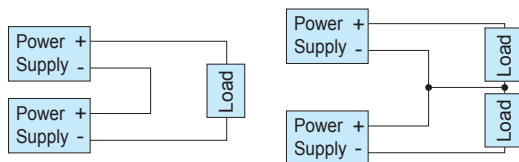


Fig.2.1 Examples of connecting in series operation

2.2 Parallel Operation

■Parallel operation is not possible.
■Redundancy operation is available by wiring as shown below.

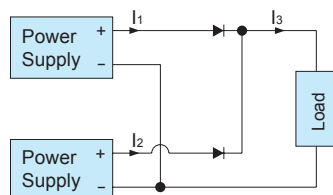


Fig.2.2 Example of redundancy operation

■Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 .
Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

3 Assembling and Installation Method

3.1 Installation method

■This power supply is manufactured by SMD technology.
The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.
■In case of metal chassis, keep the distance between d_1 & d_2 for to insulate between lead of component and metal chassis, use the spacer of 8mm or more between d_1 . If it is less than d_1 & d_2 , insert the insulation sheet between power supply and metal chassis.

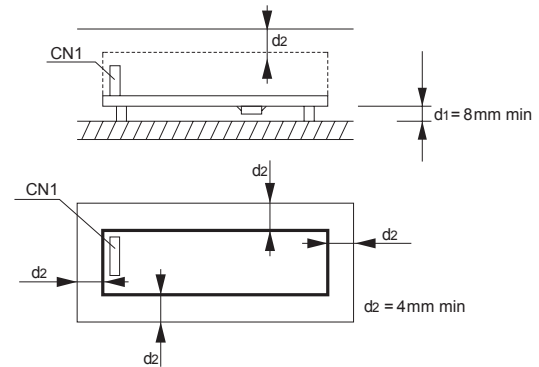


Fig.3.1 Installation method

■There is a possibility that it is not possible to cool enough when the power supply is used by the sealing up space as showing in Figure 3.2.
Please use it after confirming the temperature of point A and point B of Instruction Manual 3.2.

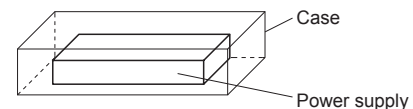


Fig.3.2 Installation example

3.2 Derating

■Environment to use it and Installation environment

When using it, it is necessary to radiate heat by the heat of the power supply.

Table 3.1 - 3.4 shows the relation between the upper limit temperature (Point A and Point B) and load factors.

Please consider the ventilation so that the convection which is enough for the whole power supply is provided.

And temperature of Point A and Point B please become lower than upper limit temperature.

The expectancy life in the upper bound temperature (Point A and Point B) is three years or more.

Please refer to External View for the position of Point A and Point B. In case of with Chassis and Cover, please contact our sales office for getting more information.

Remarks:

*Please be careful of electric shock or earth leakage in case of temperature measurement, because Point A and Point B is live potential.

*Please refer to 3.4 if you want to extend the longevity of the expectancy life.

Table 3.1 Temperatures of Point A, Point B LMA100F-24-Y

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	75%<lo≤100%	87	75
		50%<lo≤75%	86	77
		0%<lo≤50%	89	83
B	Convection	75%<lo≤100%	80	76
		50%<lo≤75%	81	78
		0%<lo≤50%	86	86
C	Convection	75%<lo≤100%	84	85
		50%<lo≤75%	85	86
		0%<lo≤50%	86	88
D	Convection	75%<lo≤100%	79	62
		50%<lo≤75%	83	68
		0%<lo≤50%	86	75
E	Convection	75%<lo≤100%	82	86
		50%<lo≤75%	83	89
		0%<lo≤50%	82	89
F	Convection	75%<lo≤100%	77	66
		50%<lo≤75%	87	80
		0%<lo≤50%	84	78
A,B,C,D,E,F	Forced air	70%<lo≤100%	75	75
		0%<lo≤70%	75	75

Table 3.2 Temperatures of Point A, Point B LMA150F-24-Y

Mounting Method	Cooling Method	Load factor	Max temperature	
			Point A[°C]	Point B[°C]
A	Convection	75%<lo≤100%	82	66
		50%<lo≤75%	89	78
		0%<lo≤50%	89	82
B	Convection	75%<lo≤100%	73	62
		50%<lo≤75%	86	77
		0%<lo≤50%	86	80
C	Convection	75%<lo≤100%	86	74
		50%<lo≤75%	89	80
		0%<lo≤50%	89	84
D	Convection	75%<lo≤100%	76	67
		50%<lo≤75%	76	73
		0%<lo≤50%	79	79
E	Convection	75%<lo≤100%	80	84
		50%<lo≤75%	84	89
		0%<lo≤50%	83	89
F	Convection	75%<lo≤100%	71	60
		50%<lo≤75%	79	72
		0%<lo≤50%	82	78
A,B,C,D,E,F	Forced air	70%<lo≤100%	75	75
		0%<lo≤70%	75	75

Table 3.3 Temperatures of Point A, Point B, Point C LMA240F-24-Y

Mounting Method	Cooling Method	Load factor	Max temperature		
			Point A[°C]	Point B[°C]	Point C[°C]
A	Convection	75%<lo≤100%	74	70	
		50%<lo≤75%	82	78	
		0%<lo≤50%	89	86	
B	Convection	75%<lo≤100%	71	68	
		50%<lo≤75%	83	79	
		0%<lo≤50%	84	81	
C	Convection	75%<lo≤100%	64	61	
		50%<lo≤75%	76	72	
		0%<lo≤50%	76	83	
D	Convection	75%<lo≤100%	59	57	
		50%<lo≤75%	68	68	
		0%<lo≤50%	76	76	
E	Convection	75%<lo≤100%	77	57	
		50%<lo≤75%	83	68	
		0%<lo≤50%	89	73	
F	Convection	75%<lo≤100%	83	69	
		50%<lo≤75%	86	77	
		0%<lo≤50%	89	82	
A,B,C,D,E,F	Forced air	70%<lo≤100%	75	75	85
		0%<lo≤70%	75	75	85

■The operative ambient temperature is different by with / without chassis cover or mounting position. Derating curve is shown below.
Note: In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

● LMA100F

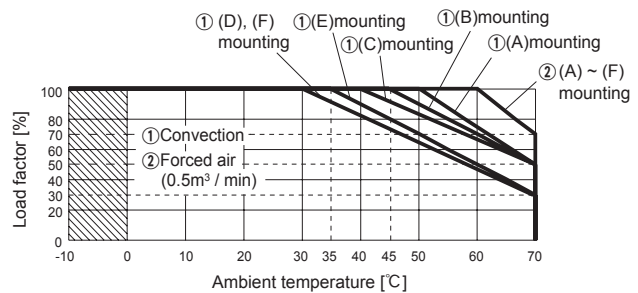


Fig.3.3 Ambient temperature derating curve (refer to Table 3.1)

● LMA150F

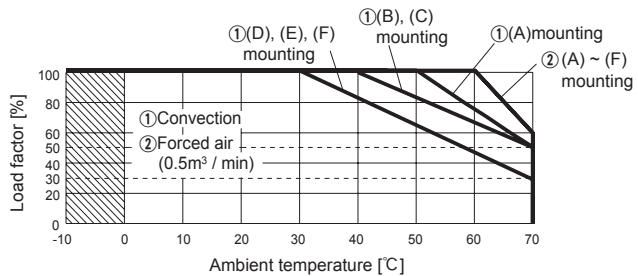


Fig.3.4 Ambient temperature derating curve (refer to Table 3.2)

● LMA240F

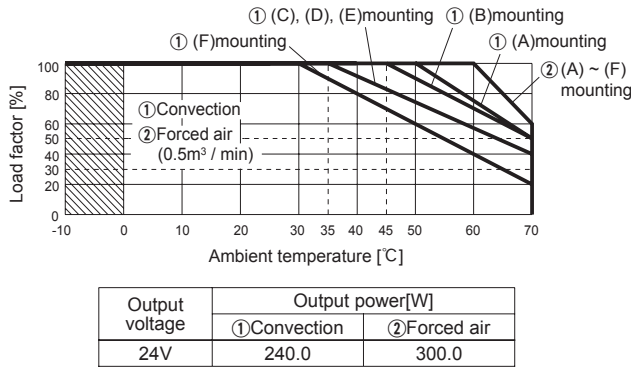


Fig.3.5 Ambient temperature derating curve (refer to Table 3.3)

■ Derating curve depending on input voltage

Derating curve depending on input voltage is shown in Fig.3.6.

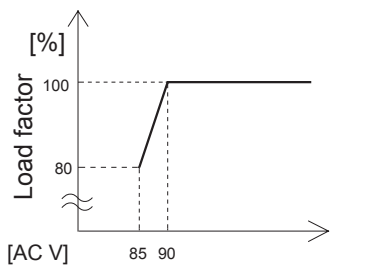


Fig.3.6 Derating curve depending on input voltage

■ Mounting method

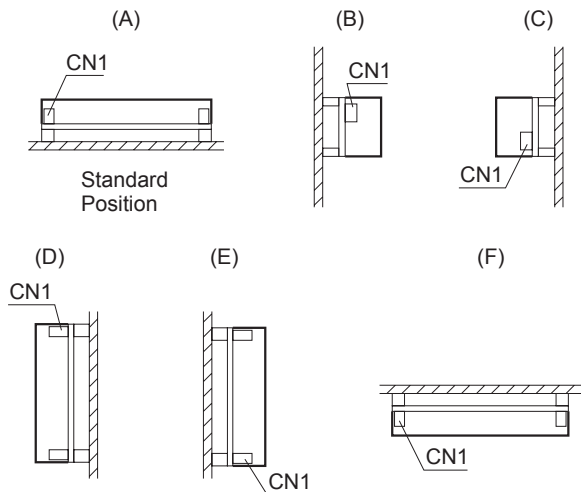


Fig.3.7 Mounting method

■ (F) mounting is not possible when unit is with case cover, but if need to operate unit by (F) positioning with case cover, temperature / load derating is necessary. For more details, please contact our sales or engineering departments.

3.3 Mounting screw

■ The mounting screw should be M3. The hatched area shows the allowance of metal parts for mounting.

■ If metallic fittings are used on the component side of the board, ensure there is no contact with surface mounted components.

■ This product uses SMD technology.

Please avoid the PCB installation method which includes the twisting stress or the bending stress.

* Recommendation to electrically connect FG to metal chassis for reducing noise.

● LMA100F, LMA150F

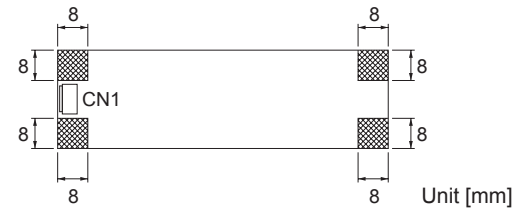


Fig.3.8 Allowance of metal for mounting

● LMA240F

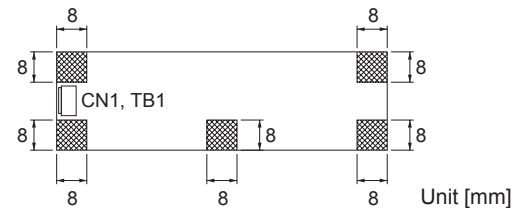


Fig.3.9 Allowance of metal for mounting

3.4 Expectancy life and warranty

■ Expectancy Life.

Table 3.4 Expectancy Life (LMA100F-24-Y)

Mounting Method	Cooling Method	Average ambient temperature (year)	Expectancy Life	
			Io ≤ 75%	75% < Io ≤ 100%
A	Convection	Ta = 40°C or less	6years	6years
		Ta = 50°C	6years	4years
B	Convection	Ta = 45°C	6years	6years
C	Convection	Ta = 30°C or less	6years	6years
		Ta = 40°C	6years	4years
D, F	Convection	Ta = 30°C	6years	6years
E	Convection	Ta = 35°C or less	6years	6years
A,B,C,D,E,F	Forced air	Ta = 60°C	6years	4years

Table 3.5 Expectancy Life (LMA150F-24-Y)

Mounting Method	Cooling Method	Average ambient temperature (year)	Expectancy Life	
			Io ≤ 75%	75% < Io ≤ 100%
A	Convection	Ta = 40°C or less	6years	6years
		Ta = 50°C	6years	4years
B, C	Convection	Ta = 40°C or less	6years	6years
D, E	Convection	Ta = 30°C or less	6years	6years
F	Convection	Ta = 30°C or less	6years	4years
A,B,C,D,E,F	Forced air	Ta = 60°C	6years	4years

Table 3.6 Expectancy Life (LMA240F-□-Y)

Mounting Method	Cooling Method	Average ambient temperature (year)	Expectancy Life	
			$I_o \leq 75\%$	$75\% < I_o \leq 100\%$
A	Convection	Ta = 50°C or less	6years	6years
B	Convection	Ta = 35°C or less	6years	6years
		Ta = 45°C	6years	4years
C, D	Convection	Ta = 35°C or less	6years	6years
E	Convection	Ta = 25°C or less	6years	6years
		Ta = 35°C	6years	4years
F	Convection	Ta = 30°C or less	6years	6years
A,B,C,D,E,F	Forced air	Ta = 60°C	6years	4years

Warranty

Table 3.7 Warranty (LMA100F-24-Y)

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			$I_o \leq 75\%$	$75\% < I_o \leq 100\%$
A	Convection	Ta = 40°C or less	5years	5years
		Ta = 50°C	5years	3years
B	Convection	Ta = 45°C or less	5years	5years
C	Convection	Ta = 30°C or less	5years	5years
		Ta = 40°C	5years	3years
D, F	Convection	Ta = 30°C or less	5years	5years
E	Convection	Ta = 35°C or less	5years	5years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.8 Warranty (LMA150F-24-Y)

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			$I_o \leq 75\%$	$75\% < I_o \leq 100\%$
A	Convection	Ta = 40°C or less	5years	5years
		Ta = 50°C	5years	3years
B, C	Convection	Ta = 40°C or less	5years	5years
D, E	Convection	Ta = 30°C or less	5years	5years
F	Convection	Ta = 30°C or less	5years	3years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

Table 3.9 Warranty (LMA240F-24-Y)

Mounting Method	Cooling Method	Average ambient temperature (year)	Warranty	
			$I_o \leq 75\%$	$75\% < I_o \leq 100\%$
A	Convection	Ta = 50°C or less	5years	5years
B	Convection	Ta = 35°C or less	5years	5years
		Ta = 45°C	5years	3years
C, D	Convection	Ta = 35°C or less	5years	5years
E	Convection	Ta = 25°C or less	5years	5years
		Ta = 35°C	5years	3years
F	Convection	Ta = 30°C or less	5years	5years
A,B,C,D,E,F	Forced air	Ta = 60°C	5years	3years

4 Ground

When installing the power supply with your unit, ensure that the input FG terminal of CN1 or mounting hole FG is connected to safety ground of the unit.

LMA

5 Option and Others

5.1 Outline of options

-C

- Option -C units have coated internal PCB for better moisture resistance.

-G

- Option -G units are low leakage current type.
- Differences from standard versions are summarized in Table 5.1.

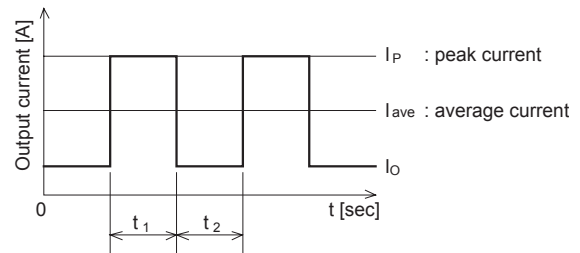
Table 5.1 Low leakage current type

Leakage Current (AC100V 60Hz)	0.05mA max
Conducted Noise	N/A
Output Ripple Noise	Please contact us for details about Ripple Noise

* This is the value that measured on measuring board with capacitor of 22μF at 150mm from output connector.

Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN:RM-103).

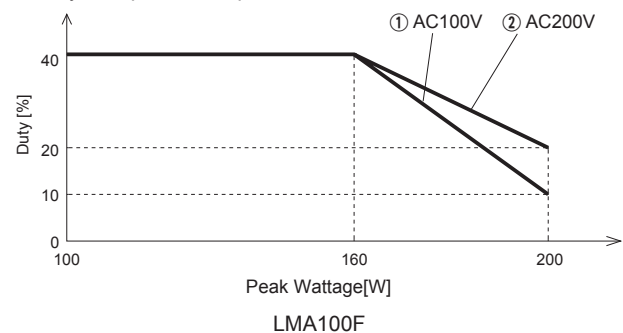
-H



$$t_1 \leq 10 [\text{sec}], I_{\text{ave}} = \frac{I_P t_1 + I_o t_2}{t_1 + t_2} \leq \text{rated current},$$

$$\frac{t_1}{t_1 + t_2} \leq 0.40 \text{ (Refer to below chart)}$$

Duty is depended on peak load, refer to below chart.



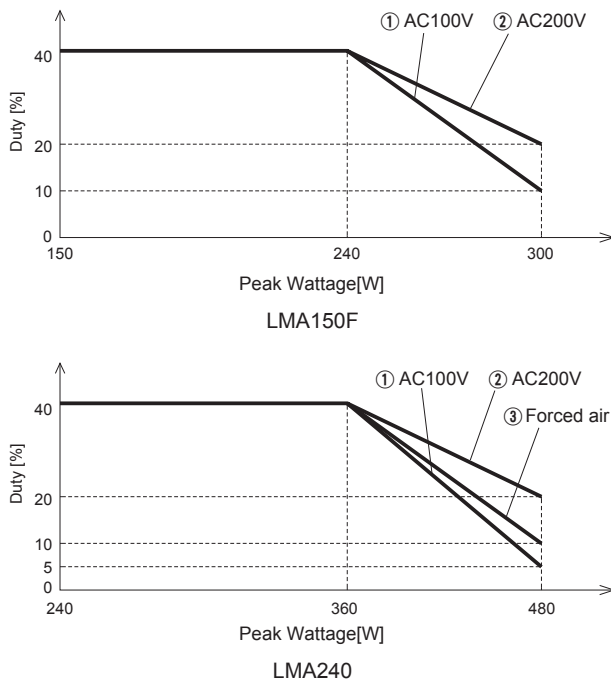


Fig.5.1 Derating of peak loading

● -S · -SN

- -S indicates a type with chassis, and -SN indicates a type with chassis and cover (Refer to external view). Please contact us about the detail of derating curve.

● -R

- You can control output ON/OFF remotely in Option -R units. To do so, connect an external DC power supply and apply a voltage to a remote ON/OFF connector, which is available as option.

Model Name	Built-in Resistor Ri [Ω]	Voltage between RC (+) and RC (-) [V]		Input Current [mA]
		Output ON	Output OFF	
LMA100F, LMA150F LMA240F	780	4.5 - 12.5	0 - 0.5	20max

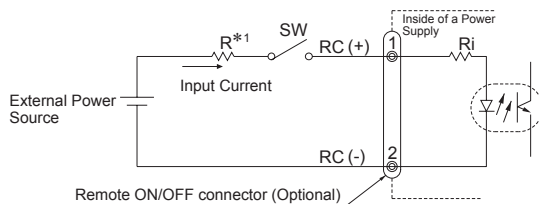


Fig.5.2 Example of using a remote ON/OFF circuit

- Dedicated harnesses are available for your purchase. Please see Optional Parts for details.
- *1 If the output of an external power supply is within the range of 4.5 - 12.5V, you do not need a current limiting resistor R. If the output exceeds 12.5V, however, please connect the current limiting resistor R.

To calculate a current limiting resistance value, please use the following equation.

$$R[\Omega] = \frac{V_{cc} - (1.1 + R_i \times 0.005)}{0.005}$$

* Please wire carefully. If you wire wrongly, the internal components of a unit may be damaged.

■ Remote ON/OFF circuits (RC+ and RC-) are isolated from input, output and FG.

● -R2

- The usage is the same as option -R, please refer to Option -R.
- Reducing standby power is possible by OFF signal of the remote control.
- Start up time by ON signal in remote control is 350ms(typ).
- The latch condition in overvoltage protection is removed by toggling ON/OFF signal of remote control.
- Standby power
LMA100F, LMA150F, LMA240F
0.2Wtyp (AC100V), 0.7Wtyp (AC200V)

● -P

- Constant current mode for battery charging is possible by setting the over current activation point within rated output current.
- Over current activation point varies depending on output voltage setting as shown in Table 5.2.
- Parallel operation is not possible.

Table 5.2 Overcurrent protection *

Model	Output voltage setting [V]	Overcurrent protection [A]
LMA100F-24-PY	$19.2 \leq V_o < 21.6$	2.5 - 4.2
	$21.6 \leq V_o < 26.4$	2.2 - 4.0
	$26.4 \leq V_o < 27.5$	2.1 - 3.8
LMA150F-24-PY	$19.2 \leq V_o < 21.6$	4.3 - 6.2
	$21.6 \leq V_o < 26.4$	4.1 - 6.1
	$26.4 \leq V_o < 27.5$	4.0 - 5.9
LMA240F-24-PY	$19.2 \leq V_o < 21.6$	7.2 - 9.9
	$21.6 \leq V_o < 26.4$	6.9 - 9.7
	$26.4 \leq V_o < 27.5$	6.7 - 9.5

* -P option can not generate rated output current as shown on label.

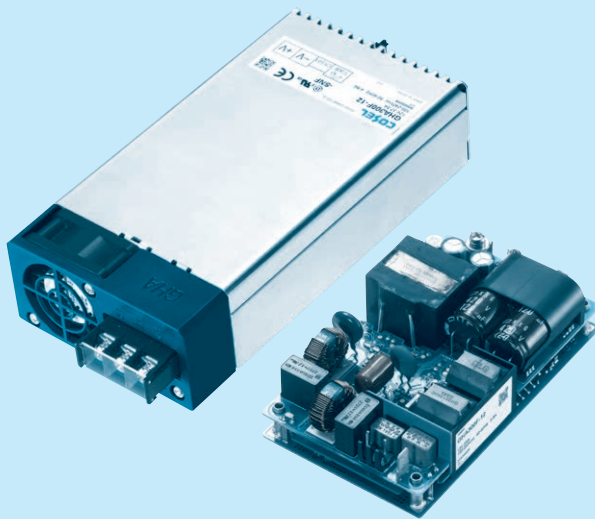
5.2 Others

- This power supply is the rugged PCB type. Do not drop conductive objects in the power supply.
- At light load, there remains high voltage inside the power supply for a few minutes after power OFF. So, at maintenance, take care about electric shock.
- This power supply is manufactured by SMD technology. The stress to PCB like twisting or bending causes the defect of the unit, so handle the unit with care.
 - Tighten all the screws in the screw hole.
 - Install it so that PCB may become parallel to the clamp face.
 - Avoid the impact such as drops.
- While turning on the electricity, and for a while after turning off, please don't touch the inside of a power supply because there are some hot parts in that.
- When a mass capacitor is connected with the output terminal (load side), the output might become the stop or an unstable operation. Please contact us for details when you connect the capacitor.

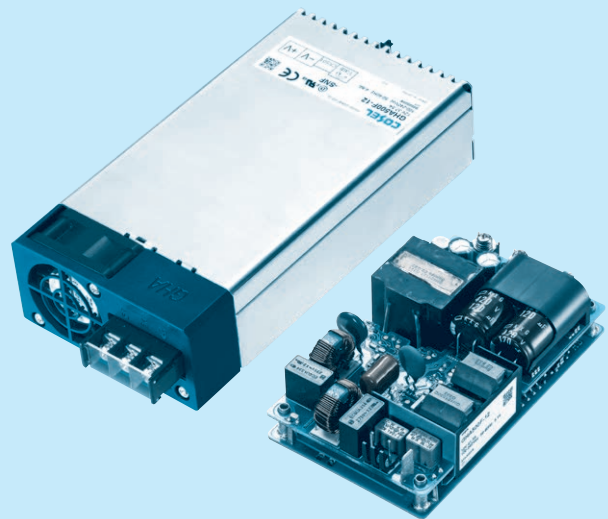


GHA-series

GHA series is an innovative model that offers a wide variety of cooling methods (convection, forced air, and conduction cooling).



GHA300F / GHA300F-SNF



GHA500F / GHA500F-SNF

Feature

- Wattage 500Wmax
- Conduction cooling (GHA500F)
- 3" X 5" standard footprint
- Less than 1U high
- ITE and Medical safety approvals
- Low leakage current
- With Remote (Option)
- With AUX1(5V), AUX2(12V) (Option)
- With FAN (GHA300F-SNF, GHA500F-SNF)

Safety agency approvals

- UL60950-1, ANSI/AAMI ES60601-1
- C-UL (CSA60950-1, CAN/CSA60601-1)
- EN60950-1, EN60601-1 3rd

5-year warranty (Refer to Instruction Manual)

CE marking

Low Voltage Directive

EMI

Complies with FCC-B, CISPR11-B, CISPR22-B, EN55011-B, EN55022-B, VCCI-B

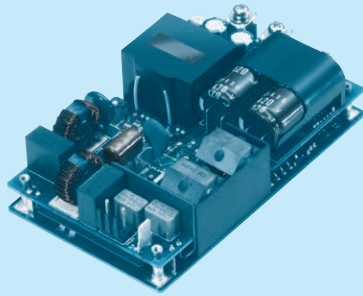
EMS Compliance

- EN61000-4-2
- EN61000-4-3
- EN61000-4-4
- EN61000-4-5
- EN61000-4-6
- EN61000-4-8
- EN61000-4-11

GHA300F

GH A 300 F -□□ -□

① ② ③ ④ ⑤ ⑥



Example recommended EMI/EMC filter
EAC-10-472



High voltage pulse noise type : EAP series
Low leakage current type : EAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *6
T3 : mounting hole M3
J1 : VH(J.S.T.)connector type
R3 : with Subfeatures
(5VAUX,12VAUX,Remote, Power good)

Specification is changed at option, refer to Instruction manual.

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, please handle the unit with care
* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	GHA300F-12	GHA300F-24	GHA300F-48
MAX OUTPUT WATTAGE[W]	300	300	302.4
DC OUTPUT	Forced air at 50°C	12V 25A	24V 12.5A
	Convection at 40°C	12V 8.4A	24V 4.2A
	at 50°C	12V 4.5A	24V 2.2A

SPECIFICATIONS

	MODEL	GHA300F-12	GHA300F-24	GHA300F-48
INPUT	VOLTAGE[V]	AC90 - 264 1 φ (output derating is required at AC90V -115V *3)		
	CURRENT[A]	ACIN 120V	3.3typ	
		ACIN 230V	1.8typ	
	FREQUENCY[Hz]	50 / 60 (47 - 63)		
	EFFICIENCY[%]	ACIN 120V	89typ	90typ
		ACIN 230V	91typ	92typ
	POWER FACTOR (Io=100%)	ACIN 120V	0.95typ	
		ACIN 230V	0.90typ	
OUTPUT	INRUSH CURRENT[A]	ACIN 120V	20typ (Io=100%) (At cold start) (Ta=25°C)	
		ACIN 230V	40typ (Io=100%) (At cold start) (Ta=25°C)	
	LEAKAGE CURRENT[ma]	0.125/0.250max (ACIN 120V/240V 60Hz,Io=100%, According to IEC60601-1)		
	VOLTAGE[V]	12	24	48
	CURRENT[A]	Forced air	25.0	12.5
		Convection	4.5	2.2
	LINE REGULATION[mV] *4	48max	96max	192max
	LOAD REGULATION[mV] *4	100max	150max	240max
	RIPPLE[mVp-p] *1	0 to +50°C	240max	300max
		-20 to 0°C	320max	400max
	RIPPLE NOISE[mVp-p]*1	0 to +50°C	300max	480max
		-20 to 0°C	360max	500max
PROTECTION CIRCUIT AND OTHERS	TEMPERATURE REGULATION[mV]	0 to +50°C	120max	240max
		-20 to +50°C	150max	290max
	DRIFT[mV] *2	48max	96max	192max
	START-UP TIME[ms]	500typ (ACIN 120V, Io=100%)		
	HOLD-UP TIME[ms]	16typ (ACIN 120V, Io=100%)		
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	10.80 to 13.20	21.60 to 26.40	43.20 to 52.80
	OUTPUT VOLTAGE SETTING[V]	12.00 to 12.48	24.00 to 24.96	48.00 to 49.92
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically		
	OVERVOLTAGE PROTECTION[V]	13.80 to 16.80	27.60 to 33.60	55.20 to 67.20
	AUX1 (12V1A)	Optional		
ISOLATION	AUX2 (5V1A)	Optional		
	REMOTE ON/OFF	Optional		
	PowerGood	Optional		
	INPUT-OUTPUT · RC · AUX *7	AC4,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature) 2MOPP		
ENVIRONMENT	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature) 1MOPP		
	OUTPUT · RC · AUX-FG *7	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)		
	OUTPUT-RC · AUX *7	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)		
SAFETY AND NOISE REGULATIONS	OPERATING TEMP., HUMID. AND ALTITUDE	-20 to +70°C, 20 - 90%RH (Non condensing), 3,000m (10,000feet) max *3		
	STORAGE TEMP., HUMID. AND ALTITUDE	-30 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max		
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis		
OTHERS	AGENCY APPROVALS	UL60950-1, ANSI/AAMI ES60601-1, C-UL(CSA60950-1, CAN/CSA60601-1), EN60950-1, EN60601-1 3rd		
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR11-B, CISPR22-B, EN55011-B, EN55022-B		
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (class A) *5		
	CASE SIZE/WEIGHT	76.2×35×127mm [3.0×1.4×5.0 inches] (W×H×D) / 400g max		
	COOLING METHOD	Convection, Forced air (Require external fan)		

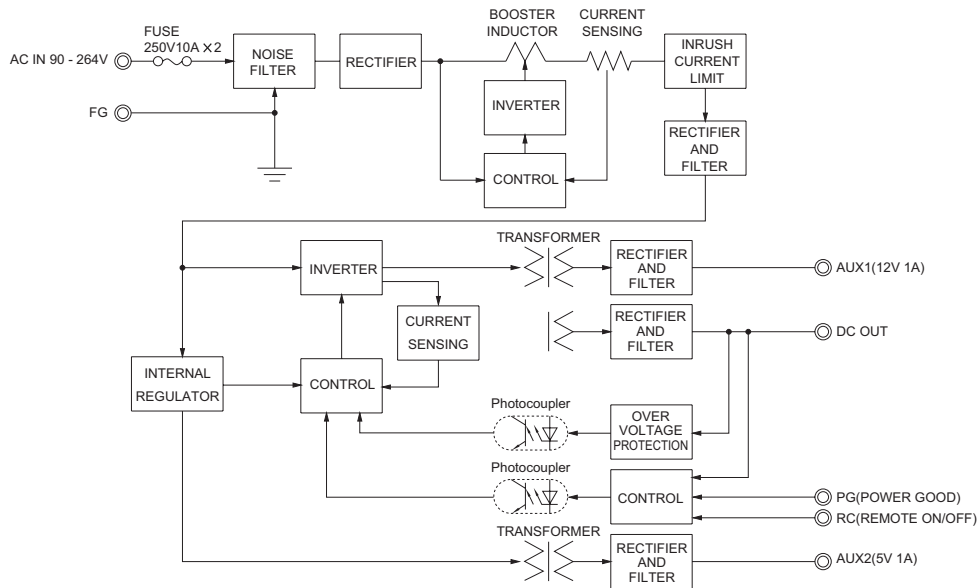
*1 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).
*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
*3 Derating is required.
*4 Please contact us about dynamic load and input response.
*5 Please contact us about another class.

*6 Specification is changed at option, refer to Instruction Manual.
*7 Applicable when AUX and remote control (optional) is added.
* To meet the specifications. Do not operate over-loaded condition.
* Sound noise may be generated by power supply in case of pulse load.
* Parallel operation is not possible.
* Forced air cooling is required to output up to MAX OUTPUT WATTAGE.
* Bottom layer P.C.B has electric potential which is required isolation from FG by clearance or creepage as the safety design issue.

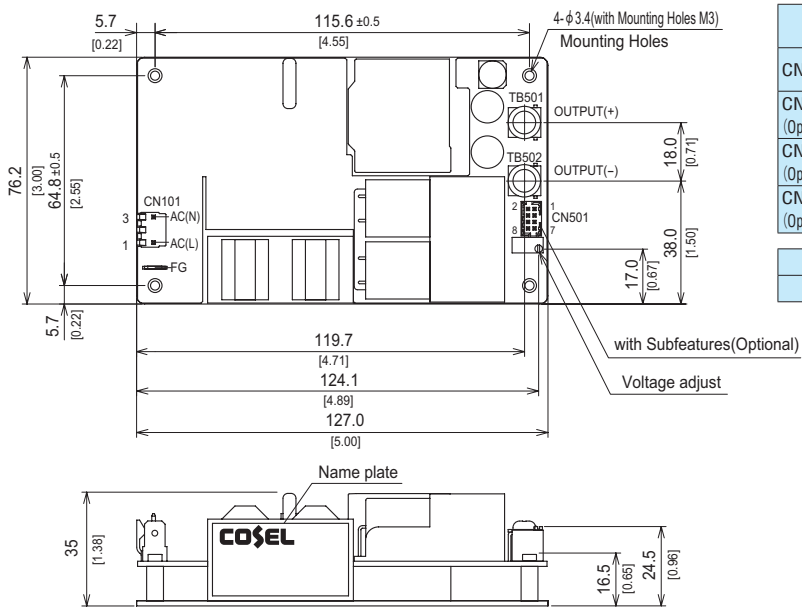
Features

- High Power density: 14.3W/inch³
- High efficiency 92% typ (Input Voltage 230V, Output Voltage 24V)
- 3" × 5" standard footprint
- Fits 1U applications
- Industrial and Medical safety approvals
- Low leakage current
- With Remote On/Off (Optional)
- With AUX1 (5V), AUX2 (12V) (Optional)
- No minimum load is required

Block diagram



External view



- ※ Tolerance ± 1 [± 0.04]
- ※ Weight : 400g max
- ※ There is a total of four attachment holes.
- ※ This power supply requires mounting on metal standoffs 5mm in height. (Insulating sheet is required if you do not use a spacer).
- ※ Dimensions in mm, []=inches
- ※ Screw tightening torque : (TB501, 502) : 1.5N · m max
- ※ Mounting torque : 0.6N · m max
- ※ Avoid contact between TB501 and 502 wiring with mounting parts.
- ※ Option : -J1 : (J.S.T) connector type. Refer to Instruction Manual 5.

I/O Connector	Mating connector	Terminal	Mfr
CN101	A-41671-A03A197-2	09-50-8031	MOLEX
CN501 (Optional)	087831-0820	51110-0851	
CN101 (Optional)	B2P3-VH	VHR-3N	J.S.T.
CN501 (Optional)	B8B-PHDSS	PHDR-08VS	

FG	Mating connector	Terminal	Mfr
-	250 Series	170603-2	Tyco Electronics

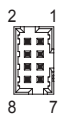
<Pin Assignments>

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Pin No.	Input
1	AC(L)
2	
3	AC(N)

<CN501(Optional)>

Pin No.	Function
1	AUX1 : AUX1 (12V1A)
2	AUX1G: AUX1 (GND)
3	RC : REMOTE ON/OFF
4	RCG : REMOTE ON/OFF (GND)
5	PG : Power good
6	PGG : Power good (GND)
7	AUX2 : AUX2 (5V1A)
8	AUX2G: AUX2 (GND)

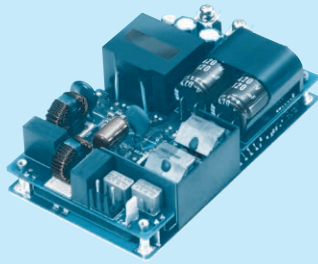


CN501

GHA500F

GH A 500 F -□□ -□

① ② ③ ④ ⑤ ⑥

Example recommended EMI/EMC filter
EAC-10-472

High voltage pulse noise type : EAP series
Low leakage current type : EAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *6
T3 : mounting hole M3
J1 : VH(J.S.T.)connector type
R3 : with Subfeatures
(5VAUX,12VAUX,Remote, Power good)
P : Pallarel Operation
Specification is changed at option, refer to Instruction manual.

This power supply is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, please handle the unit with care
* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	GHA500F-12	GHA500F-15	GHA500F-24	GHA500F-30	GHA500F-48	GHA500F-56
MAX OUTPUT WATTAGE[W]	500.4	501	504	501	504	504
DC OUTPUT	Forced air at 50°C	12V 41.7A	15V 33.4A	24V 21.0A	30V 16.7A	48V 10.5A
	Convection at 40°C	12V 12.5A	15V 10.0A	24V 6.3A	30V 5.0A	48V 3.2A
	at 50°C	12V 9.2A	15V 7.4A	24V 4.6A	30V 3.7A	48V 2.3A
	conduction cooling at 0°C	12V 30.0A	15V 24.0A	24V 15.0A	30V 12.0A	48V 7.5A
	at 50°C	12V 16.7A	15V 13.4A	24V 8.4A	30V 6.7A	48V 4.2A

SPECIFICATIONS

	MODEL	GHA500F-12	GHA500F-15	GHA500F-24	GHA500F-30	GHA500F-48	GHA500F-56
INPUT	VOLTAGE[V]	AC90 - 264 1 φ (output derating is required at AC90V -115V *3)					
	CURRENT[A]	ACIN 120V	5.4typ				
		ACIN 230V	2.9typ				
	FREQUENCY[Hz]	50 / 60 (47 - 63)					
	EFFICIENCY[%]	ACIN 120V	88typ	90typ	90typ	90typ	90typ
		ACIN 230V	90typ	92typ	92typ	92typ	92typ
	POWER FACTOR (Io=100%)	ACIN 120V	0.95typ				
		ACIN 230V	0.90typ				
OUTPUT	INRUSH CURRENT[A]	ACIN 120V	20typ (Io=100%) (At cold start) (Ta=25°C)				
		ACIN 230V	40typ (Io=100%) (At cold start) (Ta=25°C)				
	LEAKAGE CURRENT[ma]	0.125/0.250max (ACIN 120V/240V 60Hz,Io=100%, According to IEC60601-1)					
	VOLTAGE[V]	12	15	24	30	48	56
	CURRENT[A]	Forced air	41.7	33.4	21.0	16.7	10.5
		Convection	9.2	7.4	4.6	3.7	2.3
		conduction cooling	16.7	13.4	8.4	6.7	4.2
	LINE REGULATION[mV] *4	48max	60max	96max	120max	192max	192max
PROTECTION CIRCUIT AND OTHERS	LOAD REGULATION[mV] *4	100max	120max	150max	180max	240max	240max
	RIPPLE[mVp-p] *1	0 to +50°C	240max	240max	240max	300max	300max
		-20 - 0°C	320max	320max	320max	400max	400max
	RIPPLE NOISE[mVp-p] *1	0 to +50°C	300max	300max	300max	480max	480max
		-20 - 0°C	360max	360max	360max	500max	500max
	TEMPERATURE REGULATION[mV]	0 to +50°C	120max	150max	240max	300max	480max
		-20 to +50°C	150max	180max	290max	360max	600max
	DRIFT[mV] *2	48max	60max	96max	120max	192max	192max
ISOLATION	START-UP TIME[ms]	500typ (ACIN 120V, Io=100%)					
	HOLD-UP TIME[ms]	16typ (ACIN 120V, Io=100%)					
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	10.80 to 13.20	13.50 to 16.50	21.60 to 26.40	27.00 to 31.50	43.20 to 52.80	52.00 to 56.00
	OUTPUT VOLTAGE SETTING[V]	12.00 to 12.48	15.00 to 15.30	24.00 to 24.96	30.00 to 31.20	48.00 to 49.92	55.00 to 56.00
	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically					
	OVERVOLTAGE PROTECTION[V]	13.80 to 16.80	17.25 to 21.00	27.60 to 33.60	34.50 to 42.00	55.20 to 67.20	60.00 to 69.00
	AUX1 (12V1A)	Optional					
	AUX2 (5V1A)	Optional					
ENVIRONMENT	REMOTE ON/OFF	Optional					
	PowerGood	Optional					
	INPUT-OUTPUT · RC · AUX *7	AC4,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature) 2MOPP					
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature) 1MOPP					
SAFETY AND NOISE REGULATIONS	OUTPUT · RC · AUX-FG *7	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)					
	OUTPUT-RC · AUX *7	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)					
	OPERATING TEMP., HUMID. AND ALTITUDE	-20 to +80°C, 20 - 90%RH (Non condensing), 3,000m (10,000feet) max					
	STORAGE TEMP., HUMID. AND ALTITUDE	-30 to +80°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max					
OTHERS	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis					
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis					
	AGENCY APPROVALS	UL60950-1, ANSI/AAMI ES60601-1, C-UL(CSA60950-1, CAN/CSA60601-1), EN60950-1, EN60601-1 3rd					
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR11-B, CISPR22-B, EN55011-B, EN55022-B					
CASE SIZE/WEIGHT	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (class A) *5					
	CASE SIZE/WEIGHT	76.2×35×127mm [3.0×1.4×5.0 inches] (W×H×D) / 420g max					
COOLING METHOD	COOLING METHOD	Convection, Forced air (Require external fan), Conduction cooling					

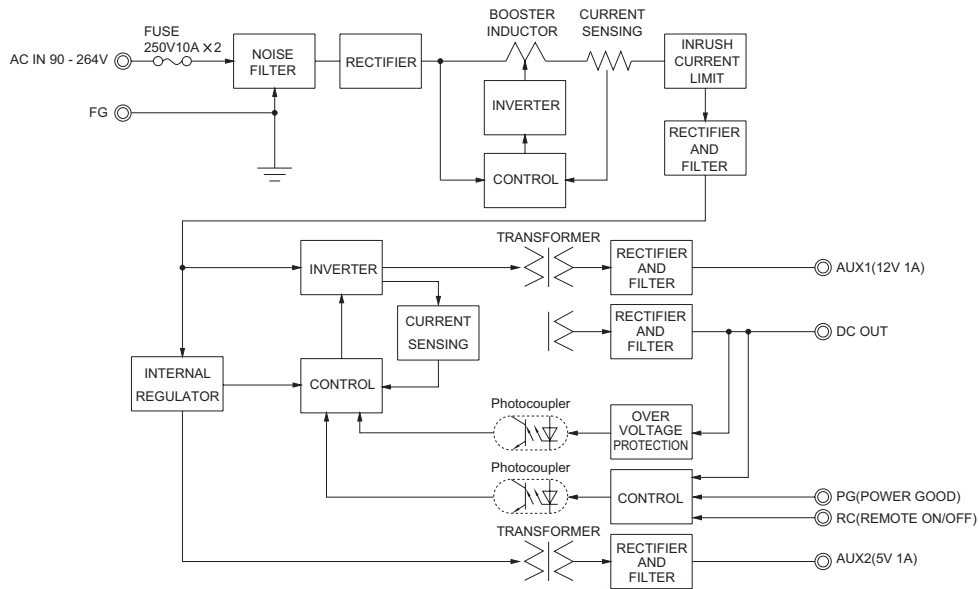
*1 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.
Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).
*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
*3 Derating is required.
*4 Please contact us about dynamic load and input response.
*5 Please contact us about another class.

*6 Specification is changed at option, refer to Instruction Manual.
*7 Applicable when AUX and remote control (optional) is added.
* To meet the specifications. Do not operate over-loaded condition.
* Sound noise may be generated by power supply in case of pulse load.
* Parallel operation is available with -P option. Refer to 5.1 on the instruction manual.
* Forced air cooling is required to output up to MAX OUTPUT WATTAGE.

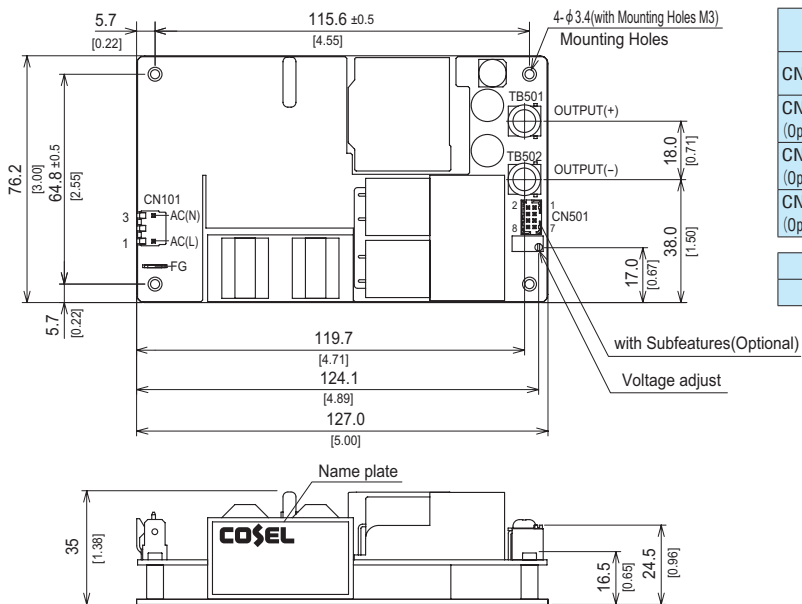
Features

- Wattage 500W max
- High Power density: 24.1W/inch³
- High efficiency 92% typ (Input Voltage 230V, Output Voltage 24V)
- Conduction cooling
- 3" × 5" standard footprint
- Fits 1U applications
- Industrial and Medical safety approvals
- Low leakage current
- With Remote On/Off (Optional)
- With AUX1 (5V), AUX2 (12V) (Optional)
- No minimum load is required

Block diagram



External view



- ※ Tolerance ± 1 [± 0.04]
- ※ Weight : 420g max
- ※ There is a total of four attachment holes.
- ※ Base Plate : Aluminum
- ※ Dimensions in mm, [] = inches
- ※ Screw tightening torque : (TB501, 502) : 1.5N · m max
- ※ Mounting torque : 0.6N · m max
- ※ Avoid contact between TB501 and 502 wiring with mounting parts.
- ※ Option : ~J1 : (J.S.T) connector type. Refer to Instruction Manual 5.

I/O Connector	Mating connector	Terminal	Mfr
CN101	A-41671-A03A197-2	09-50-8031	MOLEX
CN501 (Optional)	087831-0820	51110-0851	
CN101 (Optional)	B2P3-VH	VHR-3N	J.S.T.
CN501 (Optional)	B8B-PHDSS	PHDR-08VS	
FG	Mating connector	Terminal	Mfr
-	250 Series	-	170603-2 Tyco Electronics

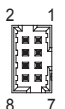
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<CN101>

Pin No.	Input
1	AC(L)
2	
3	AC(N)

<CN501(Optional)>

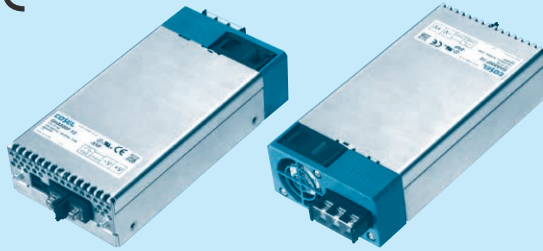
Pin No.	Function
1	AUX1 : AUX1 (12V1A)
2	AUX1G : AUX1 (GND)
3	RC : REMOTE ON/OFF
4	RCG : REMOTE ON/OFF (GND)
5	PG : Power good
6	PGG : Power good (GND)
7	AUX2 : AUX2 (5V1A)
8	AUX2G : AUX2 (GND)



CN501

GHA300F-SNF

GH A 300 F -□□ -SNF□



Example recommended EMI/EMC filter
EAC-10-472



High voltage pulse noise type : EAP series
Low leakage current type : EAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional *6
- J1 : CN501
PH(J.S.T.)connector type

Refer to the instruction manual 5.1.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	GHA300F-12-SNF	GHA300F-24-SNF	GHA300F-48-SNF
MAX OUTPUT WATTAGE[W]	300	300	302.4
DC OUTPUT	Forced air +50°C	12V 25.0A	24V 12.5A
			48V 6.3A

SPECIFICATIONS

	MODEL	GHA300F-12-SNF	GHA300F-24-SNF	GHA300F-48-SNF
INPUT	VOLTAGE[V]	AC90 - 264 1 φ (output derating is required at AC90V -115V *3)		
	CURRENT[A]	ACIN 120V	3.3typ	
		ACIN 230V	1.8typ	
	FREQUENCY[Hz]	50 / 60 (47 - 63)		
	EFFICIENCY[%]	ACIN 120V	88typ	89typ
		ACIN 230V	90typ	91typ
	POWER FACTOR (Io=100%)	ACIN 120V	0.95typ	
		ACIN 230V	0.90typ	
	INRUSH CURRENT[A]	ACIN 120V	20typ (Io=100%) (At cold start) (Ta=25°C)	
		ACIN 230V	40typ (Io=100%) (At cold start) (Ta=25°C)	
	LEAKAGE CURRENT[mA]	0.125/0.250max (ACIN 120V/240V 60Hz,Io=100%, According to IEC60601-1)		
OUTPUT	VOLTAGE[V]	12	24	48
	CURRENT[A]	Forced air	25.0	12.5
	LINE REGULATION[mV] *4	48max	96max	192max
	LOAD REGULATION[mV] *4	100max	150max	240max
	RIPPLE[mVp-p] *1	0 to +50°C	240max	300max
		-20 - 0°C	320max	400max
	RIPPLE NOISE[mVp-p]*1	0 to +50°C	300max	480max
		-20 - 0°C	360max	500max
	TEMPERATURE REGULATION[mV]	0 to +50°C	120max	240max
		-20 to +50°C	150max	290max
	DRIFT[mV] *2	48max	96max	192max
	START-UP TIME[ms]	500typ (ACIN 120V, Io=100%)		
	HOLD-UP TIME[ms]	16typ (ACIN 120V, Io=100%)		
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	10.80 to 13.20	21.60 to 26.40	43.20 to 52.80
	OUTPUT VOLTAGE SETTING[V]	12.00 to 12.48	24.00 to 24.96	48.00 to 49.92
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically *7		
	OVERVOLTAGE PROTECTION[V]	13.80 to 16.80	27.60 to 33.60	55.20 to 67.20
	AUX1	10V 0.5A		
	AUX2	5V 1A		
	REMOTE ON/OFF	Possible, AUX2 is available		
	PowerGood	Open corrector		
ISOLATION	INPUT-OUTPUT · RC · AUX	AC4,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature) 2MOPP		
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature) 1MOPP		
	OUTPUT · RC · AUX-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)		
	OUTPUT-RC · AUX	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)		
ENVIRONMENT	OPERATING TEMP.,HUMID.AND ALTITUDE	-20 to +70°C, 20 - 90%RH (Non condensing), 3,000m (10,000feet) max *3		
	STORAGE TEMP.,HUMID.AND ALTITUDE	-30 to +75°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max		
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis		
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis		
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS	UL60950-1, ANSI/AAMI ES60601-1, C-UL(CSA60950-1, CAN/CSA60601-1), EN60950-1, EN60601-1 3rd		
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR11-B, CISPR22-B, EN55011-B, EN55022-B		
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (class A) *5		
OTHERS	CASE SIZE/WEIGHT	85.2×41×165.3mm [3.35×1.61×6.5 inches] (W×H×D) / 620g max		
	COOLING METHOD	Forced air		

*1 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.

Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).
*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*3 Derating is required.

*4 Please contact us about dynamic load and input response.

*5 Please contact us about another class.

*6 Specification is changed at option, refer to Instruction Manual.

*7 When output current more than rated, output will shut down after 5 seconds or more. Recycle input after 3 minutes to reset the protection.

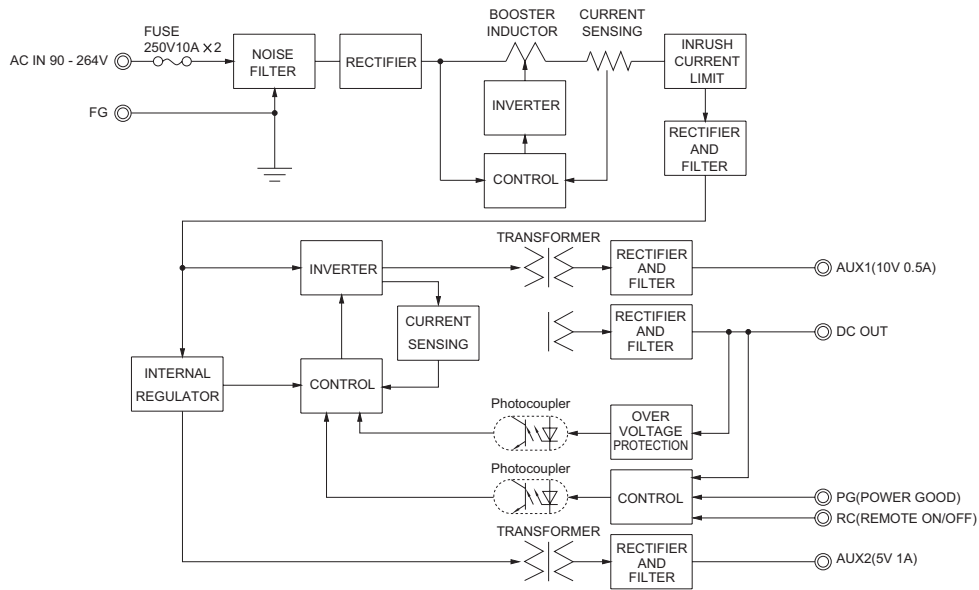
* To meet the specifications. Do not operate over-loaded condition.

* Sound noise may be generated by power supply in case of pulse load.

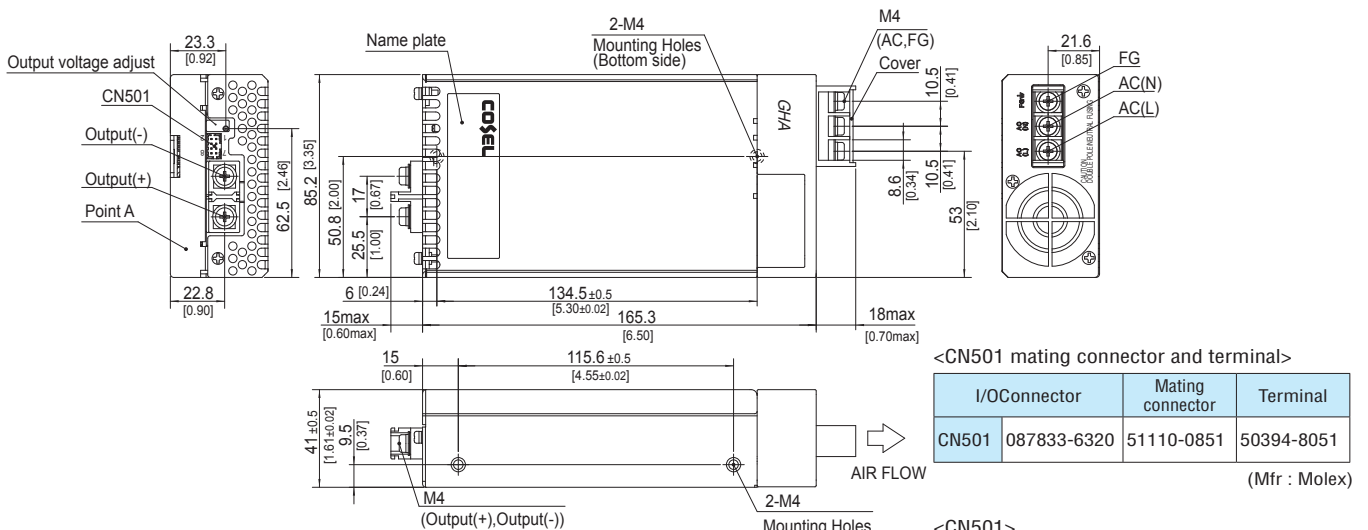
Features

- Full packaged desin united with GHA's features and additional robustness..
- High efficiency 91% typ (Input voltage 230V,Output voltage 24V)
- Optical for 1U applications
- Medical and Industrial safety approvals
- Low leakage current
- Conformal coating
- Single remote ON/OFF control for DC output, AUX1 and Fan.
- Isolated dual AUX (AUX1 10V 0.5A, AUX2 5V 1A)

Block diagram



External view



- ※ Tolerance ± 1 [± 0.04]
- ※ Weight : 620g max
- ※ Upper PCB Material/thickness : FR-4/1.6mm
- ※ Lower PCB Material/thickness : FR-4/1.6mm
- ※ Chassis Material/thickness : Aluminum/1.5mm
- ※ Cover Material/thickness : Aluminum/1.2mm
- ※ Fan cover Material : PBT
- ※ Mounting torque : $1.5\text{N} \cdot \text{m}$ (14.7kgf · cm) max
- ※ Screw tightening torque M4 : $1.6\text{N} \cdot \text{m}$ (16.9kgf · cm) max
- ※ Dimensions in mm, []=inches

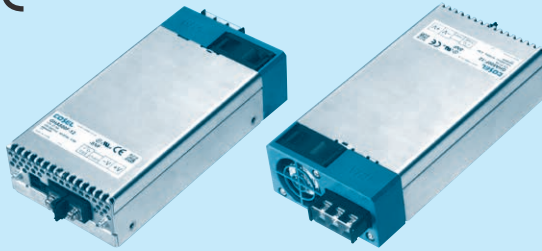


CN501

GHA500F-SNF

GH A 500 F -□□ -SNF□

① ② ③ ④ ⑤ ⑥

Example recommended EMI/EMC filter
EAC-10-472

High voltage pulse noise type : EAP series
Low leakage current type : EAM series
* A higher current rating EMI/EMC filter
may be recommended in view of the
other devices that could be connected
in parallel with the power supply.

- ① Series name
② Single output
③ Output wattage
④ Universal input
⑤ Output voltage
⑥ Optional *6
J1 : CN501
PH(J.S.T.)connector type
P : Pallarell Operation

Refer to the instruction manual
5.1.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	GHA500F-12-SNF	GHA500F-15-SNF	GHA500F-24-SNF	GHA500F-30-SNF	GHA500F-48-SNF	GHA500F-56-SNF
MAX OUTPUT WATTAGE[W]	450	501	504	501	504	504
DC OUTPUT	Forced air +50°C	12V 37.5A	15V 33.4A	24V 21.0A	30V 16.7A	48V 10.5A
		56V 9.0A				

SPECIFICATIONS

	MODEL	GHA500F-12-SNF	GHA500F-15-SNF	GHA500F-24-SNF	GHA500F-30-SNF	GHA500F-48-SNF	GHA500F-56-SNF
INPUT	VOLTAGE[V]	AC90 - 264 1 φ (output derating is required at AC90V -115V *3)					
	CURRENT[A]	ACIN 120V	4.8typ	5.4typ			
		ACIN 230V	2.6typ	2.9typ			
	FREQUENCY[Hz]	50 / 60 (47 - 63)					
	EFFICIENCY[%]	ACIN 120V	87typ	89typ	89typ	89typ	89typ
		ACIN 230V	89typ	91typ	91typ	91typ	91typ
	POWER FACTOR (Io=100%)	ACIN 120V	0.95typ				
		ACIN 230V	0.90typ				
INRUSH CURRENT[A]	ACIN 120V	20typ (Io=100%) (At cold start) (Ta=25°C)					
	ACIN 230V	40typ (Io=100%) (At cold start) (Ta=25°C)					
	LEAKAGE CURRENT[mA]	0.125/0.250max (ACIN 120V/240V 60Hz,Io=100%, According to IEC60601-1)					
OUTPUT	VOLTAGE[V]	12	15	24	30	48	56
	CURRENT[A]	Forced air	37.5	33.4	21.0	16.7	10.5
	LINE REGULATION[mV]	*4	48max	60max	96max	120max	192max
	LOAD REGULATION[mV]	*4	100max	120max	150max	180max	240max
	RIPPLE[mVp-p]	*1	0 to +50°C	240max	240max	240max	300max
			-20 - 0°C	320max	320max	320max	400max
	RIPPLE NOISE[mVp-p]*1		0 to +50°C	300max	300max	300max	300max
			-20 - 0°C	360max	360max	360max	360max
	TEMPERATURE REGULATION[mV]		0 to +50°C	120max	150max	240max	300max
			-20 to +50°C	150max	180max	290max	360max
	DRIFT[mV]	*2	48max	60max	96max	120max	192max
	START-UP TIME[ms]	500typ (ACIN 120V, Io=100%)					
	HOLD-UP TIME[ms]	16typ (ACIN 120V, Io=100%)					
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]	10.80 to 13.20	13.50 to 16.50	21.60 to 26.40	27.00 to 31.50	43.20 to 52.80	52.00 to 56.00
	OUTPUT VOLTAGE SETTING[V]	12.00 to 12.48	15.00 to 15.30	24.00 to 24.96	30.00 to 31.20	48.00 to 49.92	55.00 to 56.00
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION	Works over 105% of rating and recovers automatically *7					
	OVERVOLTAGE PROTECTION[V]	13.80 to 16.80	17.25 to 21.00	27.60 to 33.60	34.50 to 42.00	55.20 to 67.20	60.00 to 69.00
	AUX1	12V 0.5A					
	AUX2	5V 1A					
	REMOTE ON/OFF	Possible, AUX2 is available					
ISOLATION	PowerGood	Open corrector					
	INPUT-OUTPUT · RC · AUX	AC4,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature) 2MOPP					
	INPUT-FG	AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature) 1MOPP					
	OUTPUT · RC · AUX-FG	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)					
ENVIRONMENT	OUTPUT-RC · AUX	AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)					
	OPERATING TEMP,HUMID.AND ALTITUDE	-20 to +70°C, 20 - 90%RH (Non condensing), 3,000m (10,000feet) max *3					
	STORAGE TEMP,HUMID.AND ALTITUDE	-30 to +80°C, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max					
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis					
SAFETY AND NOISE REGULATIONS	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis					
	AGENCY APPROVALS	UL60950-1, ANSI/AAMI ES60601-1, C-UL(CSA60950-1, CAN/CSA60601-1), EN60950-1, EN60601-1 3rd					
	CONDUCTED NOISE	Complies with FCC-B, VCCI-B, CISPR11-B, CISPR22-B, EN55011-B, EN55022-B					
	HARMONIC ATTENUATOR	Complies with IEC61000-3-2 (class A) *5					
OTHERS	CASE SIZE/WEIGHT	85.2×41×165.3mm [3.35×1.61×6.5 inches] (W×H×D) / 660g max					
	COOLING METHOD	Forced air					

*1 This is the value that measured on measuring board with capacitor of 22 μF at 150mm from output terminal.

Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN: RM103).
*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

*3 Derating is required.

*4 Please contact us about dynamic load and input response.

*5 Please contact us about another class.

*6 Specification is changed at option, refer to Instruction Manual.

*7 When output current more than rated, output will shut down after 5 seconds or more.
Recycle input after 3 minutes to reset the protection.

* To meet the specifications. Do not operate over-loaded condition.

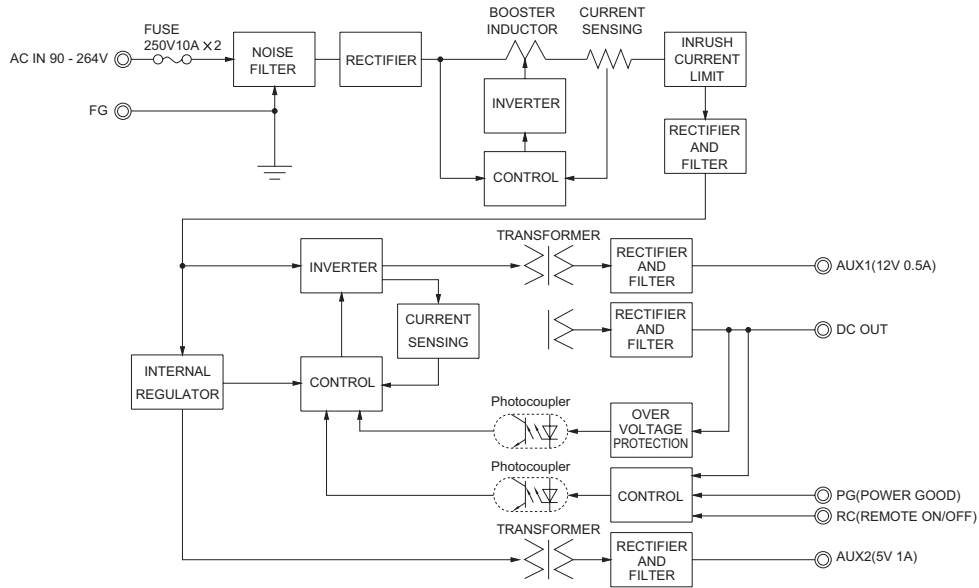
* Sound noise may be generated by power supply in case of pulse load.

* Parallel operation is available with -P option. Refer to 5.1on the instruction manual.

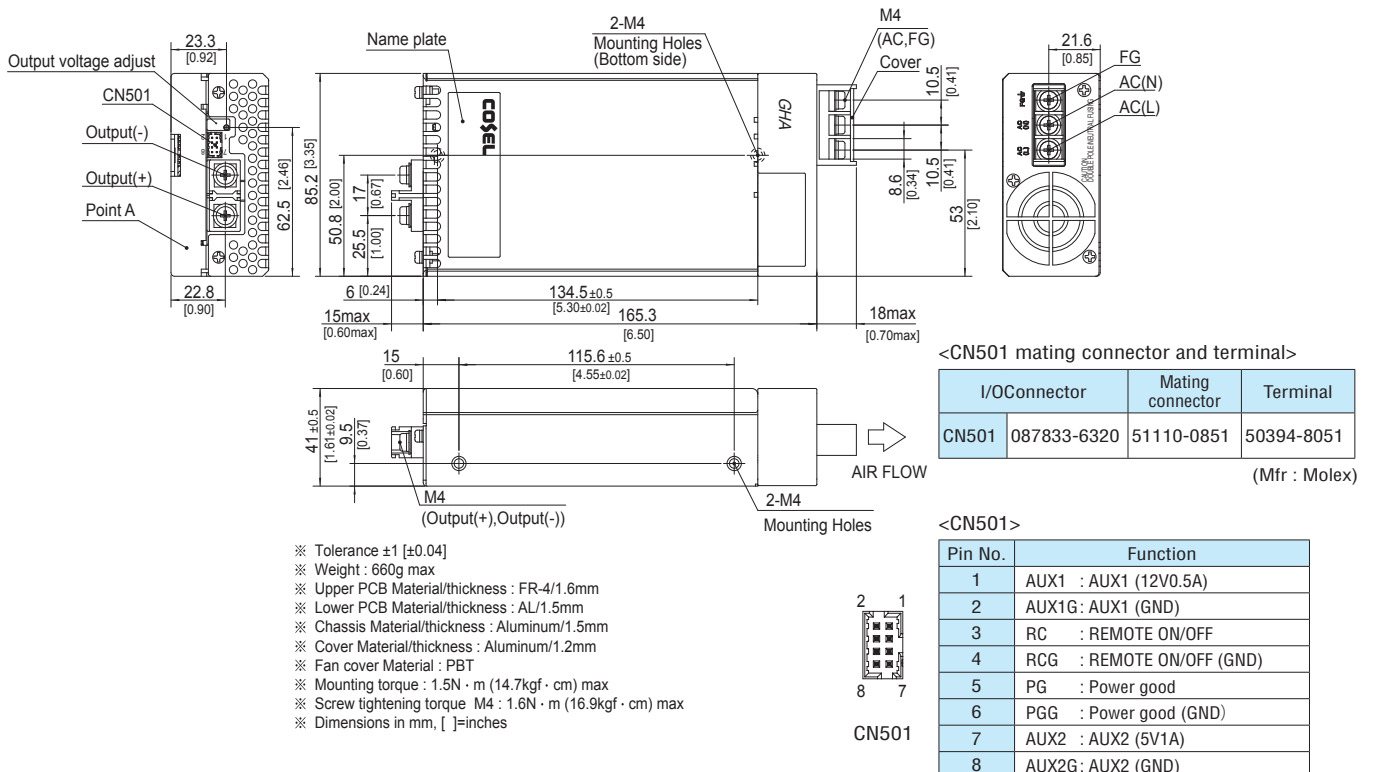
Features

- Full packaged design united with GHA's features, and additional robustness..
- High efficiency 91% typ (Input voltage 230V, Output voltage 24V)
- 50% minimized size compares with previous products.
- Optical for 1U applications
- Medical and Industrial safety approvals
- Low leakage current
- Conformal coating
- Single remote ON/OFF control for DC output, AUX1 and Fan.
- Isolated dual AUX (AUX1 12V 0.5A, AUX2 5V 1A)

Block diagram



External view



Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current *1 [A]	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
					Material	Single sided	Double sided	Series operation	Parallel operation
GHA300F	boost chopper	60 - 220	3.3	Thermistor	FR-4		Yes	Yes	No
	LLC resonant converters	90 - 180							
GHA500F	boost chopper	60 - 220	5.4	Thermistor	Aluminum/FR-4	Yes	Yes	Yes	*2
	LLC resonant converters	90 - 180							
GHA300F-SNF	boost chopper	60 - 220	3.3	Thermistor	FR-4	Yes	Yes	Yes	No
	LLC resonant converters	90 - 180							
GHA500F-SNF	boost chopper	60 - 220	5.4	Thermistor	Aluminum/FR-4	Yes	Yes	Yes	*2
	LLC resonant converters	90 - 180							

*1 The value of input current is at ACIN 120V and rated load.

*2 Parallel operation is available with -P option. Refer to 5.1 on the instruction manual.

1 Function GHA-12

- 1.1 Input voltage range GHA-12
- 1.2 Inrush current limiting GHA-12
- 1.3 Overcurrent protection GHA-12
- 1.4 Overvoltage protection GHA-12
- 1.5 Thermal protection GHA-12
- 1.6 Output voltage adjustment range GHA-12
- 1.7 Output ripple and ripple noise GHA-12
- 1.8 Isolation GHA-13

2 Series Operation and Parallel Operation GHA-13

- 2.1 Series Operation GHA-13
- 2.2 Parallel Operation GHA-13

3 Assembling and Installation Method GHA-13

- 3.1 Heat dissipation (derating) GHA-14
- 3.2 Installation method GHA-15
- 3.3 Mounting screw GHA-16
- 3.4 Expectancy life and warranty GHA-16
- 3.5 External capacitor on the output side GHA-16

4 Ground GHA-16

5 Option and Others GHA-17

- 5.1 Outline of options GHA-17
- 5.2 Medical Isolation Grade GHA-19
- 5.3 Others GHA-19

1 Function

1.1 Input voltage range

- The range is from AC90V to AC264V or DC130V to DC370V (please see SPECIFICATIONS for details).
- In cases that conform with safety standard, input voltage range is AC100-AC240V (50/60Hz).

(a) Recommended Capacity : 6.3A, slow -blow

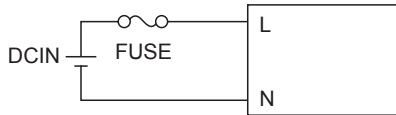


Fig.1.1 Connection method

- If input value doesn't fall within above range, a unit may not operate in accordance with specifications and/or start hunting or fail. If you need to apply a square waveform input voltage, which is commonly used in UPS and inverters, please contact us.
- When the input voltage changes suddenly, the output voltage accuracy might exceed the specification. Please contact us.

1.2 Inrush current limiting

- An inrush current limiting circuit is built-in.
- If you need to use a switch on the input side, please select one that can withstand an input inrush current.
- Thermistor is used in the inrush current limiting circuit. When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that a power supply cools down before being turned on.
- Surge current in the filter unit does not include. (0.2ms or less).

1.3 Overcurrent protection

- An overcurrent protection circuit is built-in and activated at 105% of the rated current. A unit automatically recovers when a fault condition is removed. Please do not use a unit in short circuit and/or under an overcurrent condition.
- Intermittent Operation Mode
Intermittent operation for overcurrent protection is included in a part of series. When the overcurrent protection circuit is activated and the output voltage drops to a certain extent, the output becomes intermittent so that the average current will also decrease.

1.4 Overvoltage protection

- An overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait more than 3 minutes and turn on the AC input again to recover the output voltage. Recovery time varies depending on such factors as input voltage value at the time of the operation.

Remarks :

Please avoid applying a voltage exceeding the rated voltage to an output terminal. Doing so may cause a power supply to malfunction or fail. If you cannot avoid doing so, for example, if you need to operate a motor, etc., please install an external diode on the output terminal to protect the unit.

1.5 Thermal protection

- Over Temperature Protection (OTP) is built in.
- If this function is in operation, turn off power, eliminate all possible causes of overheating, and drop the temperature to normal level. Output voltage recovers after applying input voltage. The recovery time varies depending on input voltage and load condition.
- ① Over rated temperature
- ② Poor ventilation
- ③ Over peak load based on Instruction Manual 4. for Peak loading

Remarks :

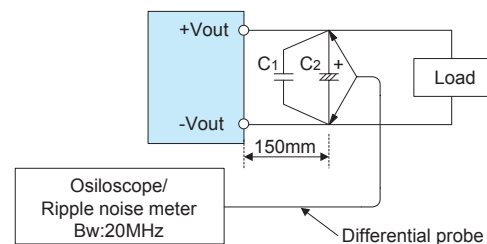
Please comply with recommended mounting method in section 3.1.

1.6 Output voltage adjustment range

- To increase an output voltage, turn a built-in potentiometer clockwise. To decrease the output voltage, turn it counterclockwise

1.7 Output ripple and ripple noise

- Output ripple noise may be influenced by measurement environment, measuring method Fig.1.2 is recommended.



C1 : Film capacitor 0.1μF

C2 : Aluminum electrolytic capacitor 22μF

Fig.1.2 Measuring method of Ripple and Ripple Noise

Remarks :

When GND cable of probe with flux of magnetic force from power supply are crossing, ripple and ripple noise might not measure correctly.

Please note the measuring environment.

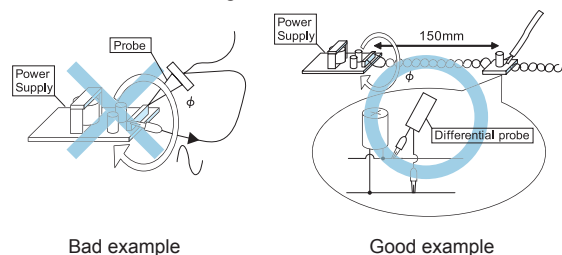


Fig.1.3 Example of measuring output ripple and ripple noise

1.8 Isolation

- For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for the start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.
- When you test a unit for isolation between the input and output, input and the terminal FG or between the output and the terminal FG, short-circuit between the output and the terminals RCG, PGG and AUXG.

2 Series Operation and Parallel Operation

2.1 Series Operation

- Series operation is available by connecting the outputs of two or more power supplies with the same output voltage, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

Remarks :

Please be sure to have enough cooling in case one of the power supply stops due to activation of the protection circuitry.

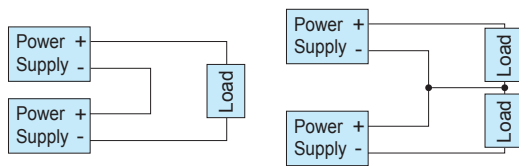


Fig.2.1 Examples of connecting in series operation

2.2 Parallel Operation

■ Parallel operation

Parallel operation is possible with option "-P".

Parallel operation is not available for the standard unit, please refer to the listed options.

■ Redundancy operation

Redundancy operation is available by wiring as shown below.

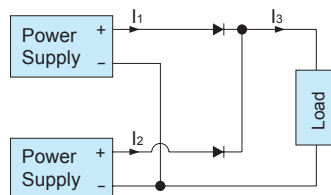


Fig.2.2 Example of redundancy operation

- Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 . Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

Please evaluate carefully and test for any possible failure modes.

- Hot-swap or Hot-plug is not available.

3 Assembling and Installation Method

■ Features of the cooling method

● GHA500F

■ Cooling method

Conduction cooling, forced air and convection cooling are available.

The combination of the cooling method makes mechanical design flexible.

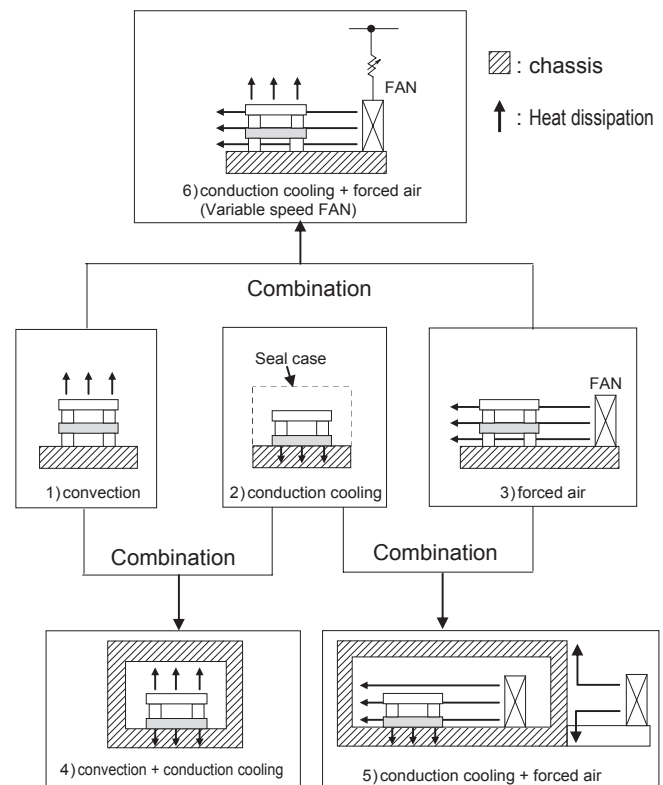


Fig.3.1 Cooling method Combination

In order to determine if the power supply operates according to our specifications, the maximum operating temperature and temperature measuring points are shown in table 3.1., for reference.

● GHA300F

■ Cooling method

Both Forced air and convection cooling are available.

(Fig 3.1 1),3),6)cooling method).

Remarks:

- For proper operation of the power supply, please note the following:

① Heat dissipation (derating): Section 3.1 reference

• The temperature rise and heat dissipation of the converter must be

considered.

- Conditions varies with environment and input voltage.
- Mounting surface will be very hot during the operation ,so please be careful not to touch the surface.

②Insulation distance: Please refer to Section 3.2

- AC voltage exist on the primary side therefore.
- In order to prevent electric shock, or to meet the leakage current requirements of the safety standard, you need to ensure the proper insulation distance.

③Consideration at the Combination with Conduction cooling + Forced air cooling

- GHA500F series can achieve the efficient heat dissipation by combining Conduction cooling and Forced air cooling. However, if the cooling fan stops due to the fan failure or other reason, Over Temperature Protection may not be activated due to the conduction cooling, and then the components temperature which are cooled by forced air (①, ②, ③ and ④ shown in table 3.1) would become high. Please ensure fail safe function of your product, and consult us for more details.

3.1 Heat dissipation (derating)

■Given the potential for variation between one application and another, the real test is to measure the critical components temperature rise when the power supply installed in the end-application.

For reliable and safe operation, please make sure the maximum component temperatures rise given in table 3.1 is not exceeded.

Please refer to Fig.3.4 - 3.9 for derating information based on different cooling methods.

Operating at the maximum temperature rating results in 3-Years life expectancy. The actual life expectancy can be extended by reducing the ambient temperature. Please refer to section 3.4 for more information.

■Test Measuring points

Be aware of the conductive parts during the measurements.
Please contact us for more detail.

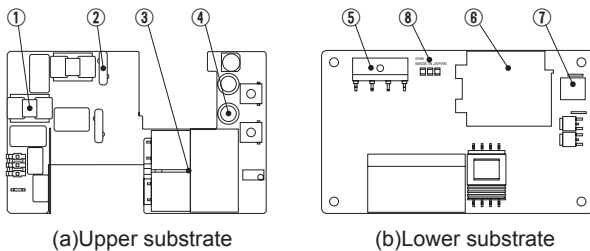


Fig.3.2 Temperature measurement points locations

Table 3.1 Maximum operating temperature

Point	Parts name	Symbol No.	Maximum temperature[°C]		Remarks
			500F	300F	
①	Line Filter	L101	115	115	
②	Varistor	SK101	76	76	
③	Input Capacitor	C106	89	89	
④	Output Capacitor	C506	87	87	
⑤	Rectifier	SS11	120	120	case temperature
⑥	Transformer	T11	110	110	
⑦	Output Choke	L51	115	115	
⑧	Aluminum base plate	-	*	-	

*Operating ambient temperature derating of Conduction cooling (Fig.3.7)

Remarks:

There is a possibility that it is not possible to cool enough when the power supply is used by the sealing up space as showing in Fig.3.3.

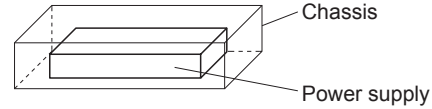


Fig.3.3 Installation example

● GHA500F

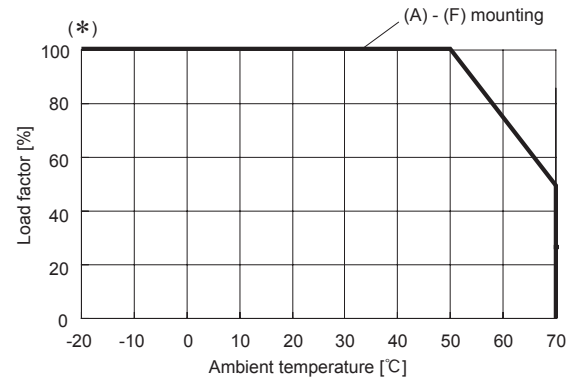


Fig.3.4 Forced air cooling derating curve (Reference value)

*Maximum power with Forced air (Fig.3.5)

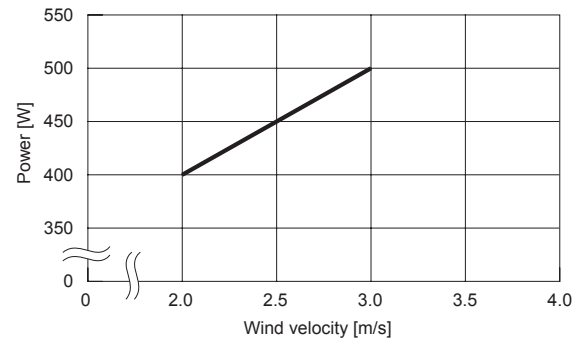


Fig.3.5 The maximum output power by wind speed conditions

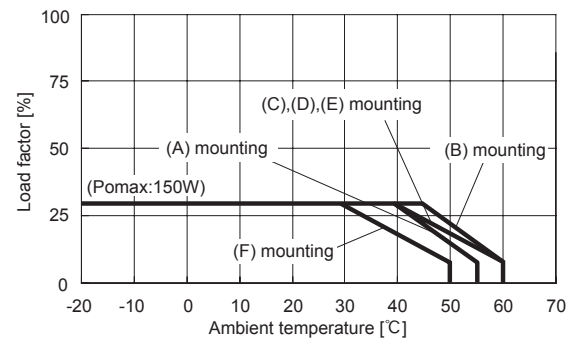


Fig.3.6 Convection cooling derating curve (Reference value)

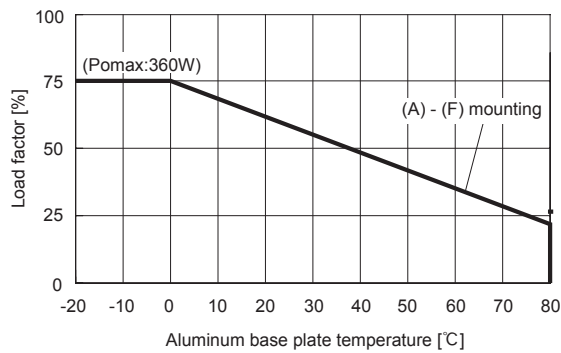


Fig.3.7 Conduction cooling derating curve (Reference value)

● GHA300F

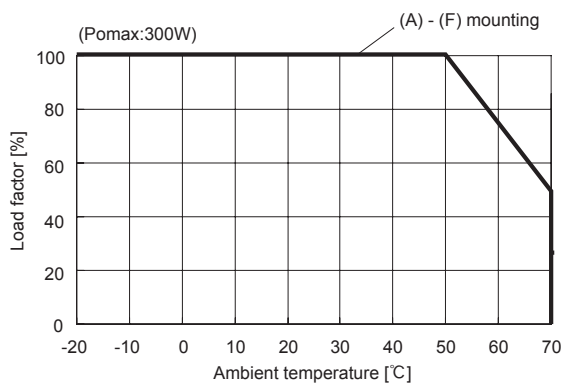


Fig.3.8 Forced air cooling derating curve (Reference value)

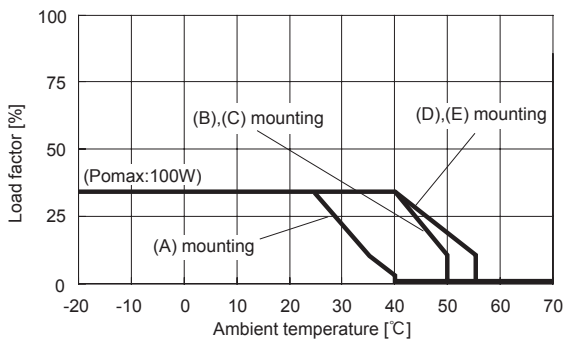


Fig.3.9 Convection cooling derating curve (Reference value)

■ Input voltage derating curve

Derating curve depending on input voltage is Fig.3.10.

For maximum power in each cooling method, please apply.

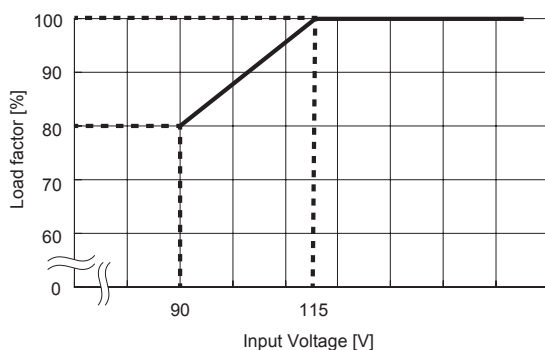


Fig.3.10 Input voltage derating curve

■ Mounting method

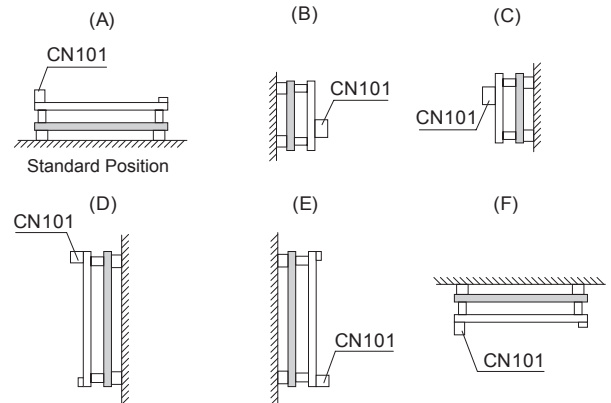


Fig.3.11 Mounting method

3.2 Installation method

■ During use, keep the distance between d_1 & d_2 for to insulate between lead of component and metal chassis, use the spacer of 5mm or more between d_2 . If it is less than d_1 & d_2 , insert the insulation sheet between power supply and metal chassis.

● GHA500F

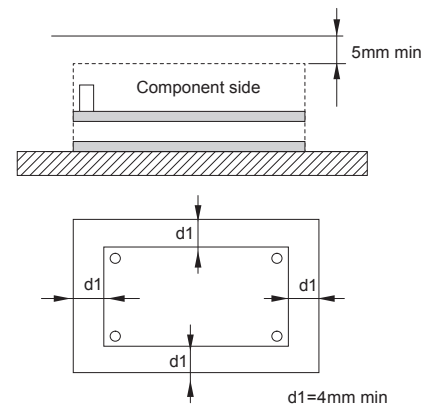


Fig.3.12 Installation method

● GHA300F

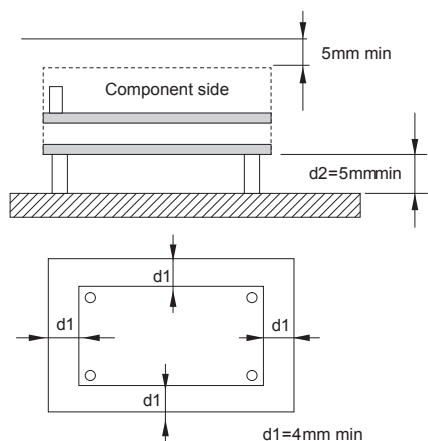


Fig.3.13 Installation method

3.3 Mounting screw

■The mounting screw should be M3. The hatched area shows the allowance of metal parts for mounting.

● GHA300F, GHA500F

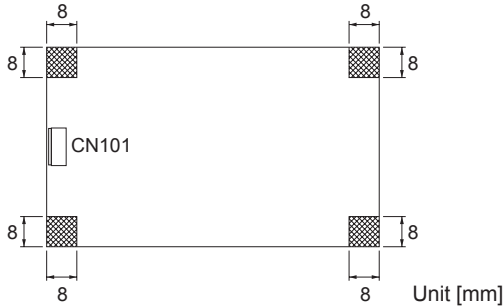


Fig.3.14 Allowance of metal for mounting

■If metallic fittings are used on the component side of the board, ensure there is no contact with surface mounted components.

■This product uses SMD technology.

Please avoid the PCB installation method which includes the twisting stress or the bending stress.

3.4 Expectancy life and warranty

■Expectancy Life.

Table 3.2 Life Expectancy (GHA500F-□)

Cooling Method	Mounting Method	Average ambient temperature (year)	Expectancy Life	
			$Io \leq 75\%$	$75\% < Io \leq 100\%$
Convection	A, C, D	Ta = 35°C or less	10years	6years
		Ta = 40°C	7years	4years
	B	Ta = 45°C	10years	7years
	E	Ta = 30°C or less	10years	7years
		Ta = 35°C	7years	5years
Forced air	A,B,C,D,E,F	Ta = 30°C	10years	7years
		Ta = 40°C or less	Over 10years	Over 10years
		Ta = 50°C	Over 10years	Over 10years

Table 3.3 Life Expectancy (GHA300F-□)

Cooling Method	Mounting Method	Average ambient temperature (year)	Expectancy Life	
			$Io \leq 75\%$	$75\% < Io \leq 100\%$
Convection	A	Ta = 30°C	Over 10years	Over 10years
	B, C	Ta = 45°C	Over 10years	7years
		Ta = 45°C	Over 10years	Over 10years
	E	Ta = 40°C or less	Over 10years	7years
		Ta = 45°C	Over 10years	6years
Forced air	A,B,C,D,E,F	Ta = 40°C or less	Over 10years	Over 10years
		Ta = 50°C	Over 10years	Over 10years

Remarks:

Estimated life expectancy can be calculated by point temperature

③, ④ shown in section 3.1. Please contact us for details.

■Warranty

Table 3.4 Warranty (GHA500F-□)

Cooling Method	Mounting Method	Average ambient temperature (year)	Warranty	
			$Io \leq 75\%$	$75\% < Io \leq 100\%$
Convection	A, C, D	Ta = 35°C or less	5years	5years
		Ta = 40°C	5years	3years
	B	Ta = 45°C	5years	5years
	E	Ta = 30°C or less	5years	5years
		Ta = 35°C	5years	4years
Forced air	A,B,C,D,E,F	Ta = 30°C	5years	5years
		Ta = 40°C or less	5years	4years
		Ta = 50°C	5years	3years

Table 3.5 Warranty (GHA300F-□)

Cooling Method	Mounting Method	Average ambient temperature (year)	Warranty	
			$Io \leq 75\%$	$75\% < Io \leq 100\%$
Convection	A	Ta = 30°C	5years	5years
	B, C	Ta = 45°C	5years	5years
		Ta = 45°C	5years	5years
	E	Ta = 40°C or less	5years	5years
		Ta = 45°C	5years	4years
Forced air	A,B,C,D,E,F	Ta = 40°C or less	5years	4years
		Ta = 50°C	5years	3years

* Warranty with conduction cooling is three years at the highest point of the temperature measurement.

3.5 External capacitor on the output side

■When the load current changes rapidly, for output stability improvement, we recommend that you connect the capacitor to the output terminal.

Table 3.6 External capacity on the output recommended capacity [μF]

	Output Voltage [V]	Recommended capacity [μF]
GHA300F-12 GHA500F-12	$10.8 \leq Vo \leq 13.2$	2,200 to 22,000
GHA500F-15	$13.5 \leq Vo \leq 16.5$	2,200 to 10,000
GHA300F-24 GHA500F-24	$21.6 \leq Vo \leq 26.4$	3,300 to 8,800
GHA500F-30	$27.0 \leq Vo \leq 31.5$	3,300 to 8,800
GHA300F-48	$43.2 \leq Vo < 51.0$	0 to 1,000
GHA500F-48	$51.0 \leq Vo \leq 52.8$	0 to 120
GHA500F-56	$52.0 \leq Vo \leq 56.0$	0 to 120

Remarks:

When load current changes rapidly, some specifications may not meet the spec.

Please mount power supply after enough evaluation and comply with recommended amount of capacitor. If you exceed the rated amount of capacitor, output for power supply may be stopped or power supply may be unstable.

4 Ground

■In the case of the power installation, please be sure to connect two or more Input FG and mounting hole FG with safety ground of the chassis.

5 Option and Others

5.1 Outline of option

● -J1

■Option -J1 units, the Input connector is VH connectors (Mfr. J.S.T.).

● -R3, -SNF

■The following features are included.

■Dedicated harness. Please refer to the optional parts.

■AUX1 (12V±10%* -R3 : 1.0A, -SNF : 0.5A)

- This power supply is equipped with an auxiliary low power 12V* output AUX1 which is available from CN501.
- AUX has been isolated from other circuit (input, output, FG, RC, PG).
- Do not exceed the current rating, it may causes malfunction or failure of the internal circuitry.

* GHA300F-SNF: 10V±10%

■AUX2 (5V1A)

- Output AUX2 will be generated from CN501. AUX2 (5V±5% 1.0A) can be used to power up remote control or other circuits. AUX has been isolated from other circuit (input, output, FG, RC, PG).
- Do not exceed the current rating , it may causes malfunction or failure of the internal circuitry.
- When the load current changes rapidly, for output stability improvement, we recommend that you connect the capacitor to the output terminal.

Table 5.1 External capacitor on the recommended capacity of AUX2

Output Voltage	recommended capacity [μF]
5V (AUX2)	GHA300/500F 330 ~ 560

■Alarm

- Table 5.2, see Fig. 5.1 the internal structure circuit explaining the operation of the PG alarm.

Table 5.2 Description of the alarm

Alarm output condition	Alarm output
PG	Or lowering of the rated output voltage, output PG, PGG from terminal when you stop. *Output is unstable state when the overcurrent condition
	Open collector method Good : Low(0-0.5V 10mA max) Bad : High or Open(40V 0.5mA max) Tr : 40V 10mA max

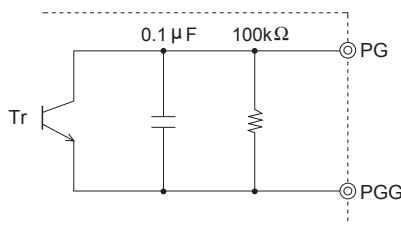


Fig.5.1 Internal circuit of PG

■Remote ON/OFF

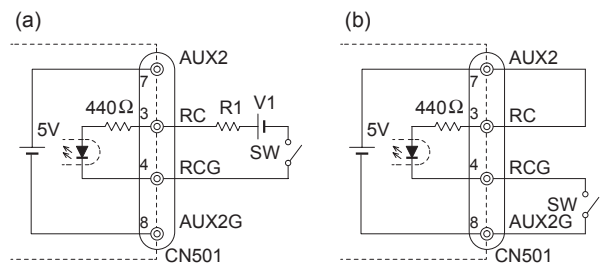
- You can operate the remote ON/OFF function by sending signals to CN501. Please see Table 5.3 for specifications and Fig.5.2 for connecting examples.
- Remote ON/OFF circuits (RC and RCG) are isolated from input, output FG, AUX and PG.
- Please note the followings when using the remote ON/OFF function.

- ① -R3 turns on by drawing current to RC, -SNF turns off by drawing current to RC.
- ② The current flown to RC is a 5mA typ (maximum 30mA).
- ③ If the output voltage is turned off through the remote ON/OFF circuit, 12V* AUX stops.
- ④ If the output voltage is turned off through the remote ON/OFF circuit, PG signals turn to "High".
- ⑤ If voltage or current of a value not listed in Table 5.3 is applied between RC and RCG, the output voltage may not be generated normally.
- ⑥ Please wire carefully. If you wire wrongly, the internal components of a unit may be damaged.

* GHA300F-SNF : 10V

Table 5.3 Specifications of remote ON/OFF

Fig.5.2 RC circuit example		-R3	-SNF
SW Logic	Output on	SW close (3mA min)	SW open (0.1mA max)
	Output off	SW open (0.1mA max)	SW close (3mA min)
Optional harness		H-SN-34 or H-SN-35	



(Example V1 : 5V R1 : 270Ω)

Fig.5.2 RC circuit example

- * If the output of an external power supply is within the range of 4.5 - 12.5V, you do not need a current limiting resistor R1. If the output exceeds 12.5V, however, please connect the current limiting resistor R1.

To calculate a current limiting resistance value, please use the following equation.

$$R1[\Omega] = \frac{V1 - (1.1 + Ri \times 0.005)}{0.005} \quad Ri = 440[\Omega]$$

● -SNF

■ Chassis and a cooling fan are added.

■ Oil and chemical environment may cause of power supply's malfunction or failure. Please avoid operation and storage in such environments.

■ Derating

It should be satisfied that derating curve depending on input voltage in Fig.3.10 and derating curve on ambient temperature in Fig.5.4. As the verification method, temperature of measurement point A should be rated temperature or less in Table 5.4.

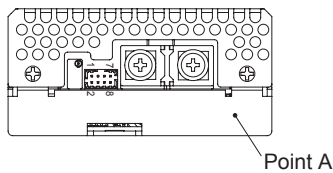


Fig.5.3 Measurement point A

Table 5.4 Rated temperature of measurement point A

Measurement	Ambient temperature	
	50°C	70°C
Point A	65°C or less	78°C or less

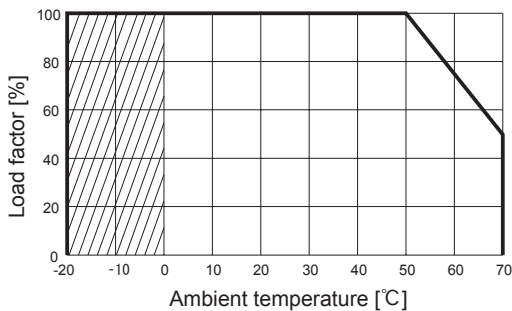


Fig.5.4 Ambient temperature derating curve (Reference)

■ When output current more than rated, output may shut down after 5 seconds or more. Recycle the input after 3 minutes to reset the protection.

■ Maintenance of FAN

FAN life time expectancy ($R(t)=90\%$) in Fig.5.5 is depended on measurement point temperature in Fig.5.6, which exhaust air temperature from FAN at input terminal side.

If load wires are generating heat, intake air temperature may become high. It may influence to FAN exhaust temperature. It is a notice that optical wires have to be selected for the avoidance. When FAN stop or air volume decrease happen, power supply's output will be shut down.

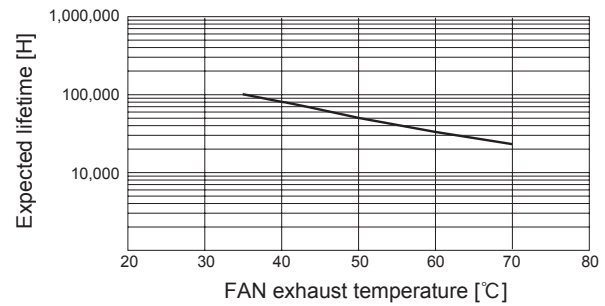


Fig.5.5 Expected life time of FAN

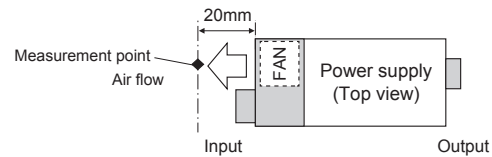


Fig.5.6 Measurement of FAN exhaust temperature

■ Mounting screw

Screw length into power supply should be shorter than 6mm due to keep safety isolation clearance from inside components in Fig.5.7. Please fix power supply surely by screws in consideration of the weight.

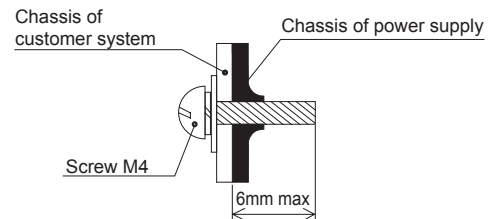
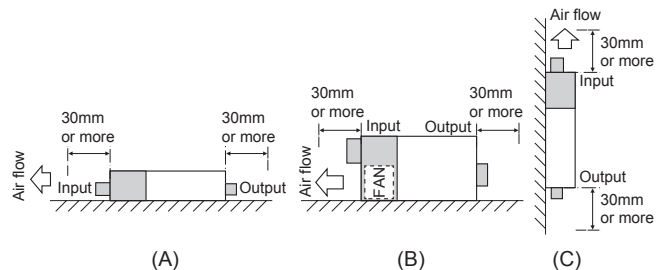


Fig.5.7 Mounting screw

■ A cooling FAN is built-in. Please keep 30mm or more clearance both input and output side to make enough air ventilation. Do not block off cooling FAN's air flow for stable operation.



■ When power supply is used where dust exist, it may cause of FAN failure. It is recommended to install a air filter to the system air ventilation duct.

● -T3

■ M3 threaded mounting hole is available as an option (-T3).

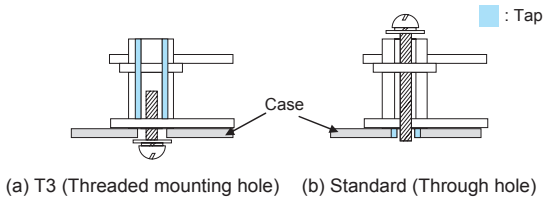


Fig.5.8 Screw mounting image

● -P

■ Parallel operation is available (Recommended two).

■ Output wattage setting is 90% per power supply of MAX OUTPUT WATTAGE.

Remarks:

- The difference of output voltage between power supply for parallel operation should be less 0.1V.
- During parallel operation, higher voltage power supply become the master in system. Depend on voltage difference between master and slave, the master power supply may recover the system's required wattage up to 90% of MAX OUTPUT WATTAGE.
- The master unit should be evaluated for heat dissipation, life expectancy and warranty period according to section 3.1 - 3.4.
- Parallel operation, due to the fluctuation of load, the output voltage may be varied.
- There is a possibility that beat noise occurs due to the difference of the oscillation frequency. Please use after enough evaluation.
- Forced air cooling is required.
- Input voltage ought be AC115V or more.

5.2 Medical Isolation Grade

■ GHA series fit 2MOPP

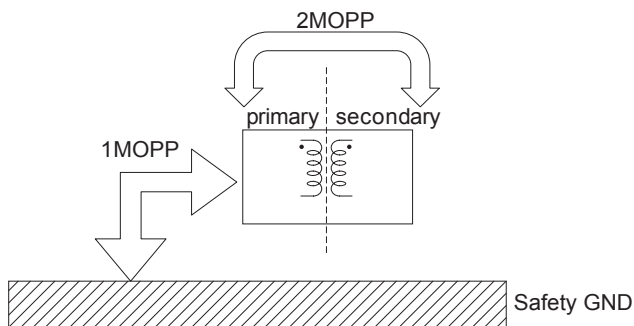


Fig.5.9 Medical Isolation Grade

5.3 Others

■ High voltage exist in the power supply for a few minutes after input voltage is stopped. Please pay attention to this during the maintenance.

■ Notes for mounting

- ① All Mounting holes should be tight and secured.
- ② Power supply should be mounted parallel to the mounting surface.
- ③ Avoid applying mechanical stress or shock to the power supply.

■ When power supply is energized or immediately after power supply stops working, power supply is still very hot, so please handle it with care.



Medical
electric
equipment



Power
Factor
Correction



World wide



Safety
Approvals



EMI



Inrush
current
limiting



OCP

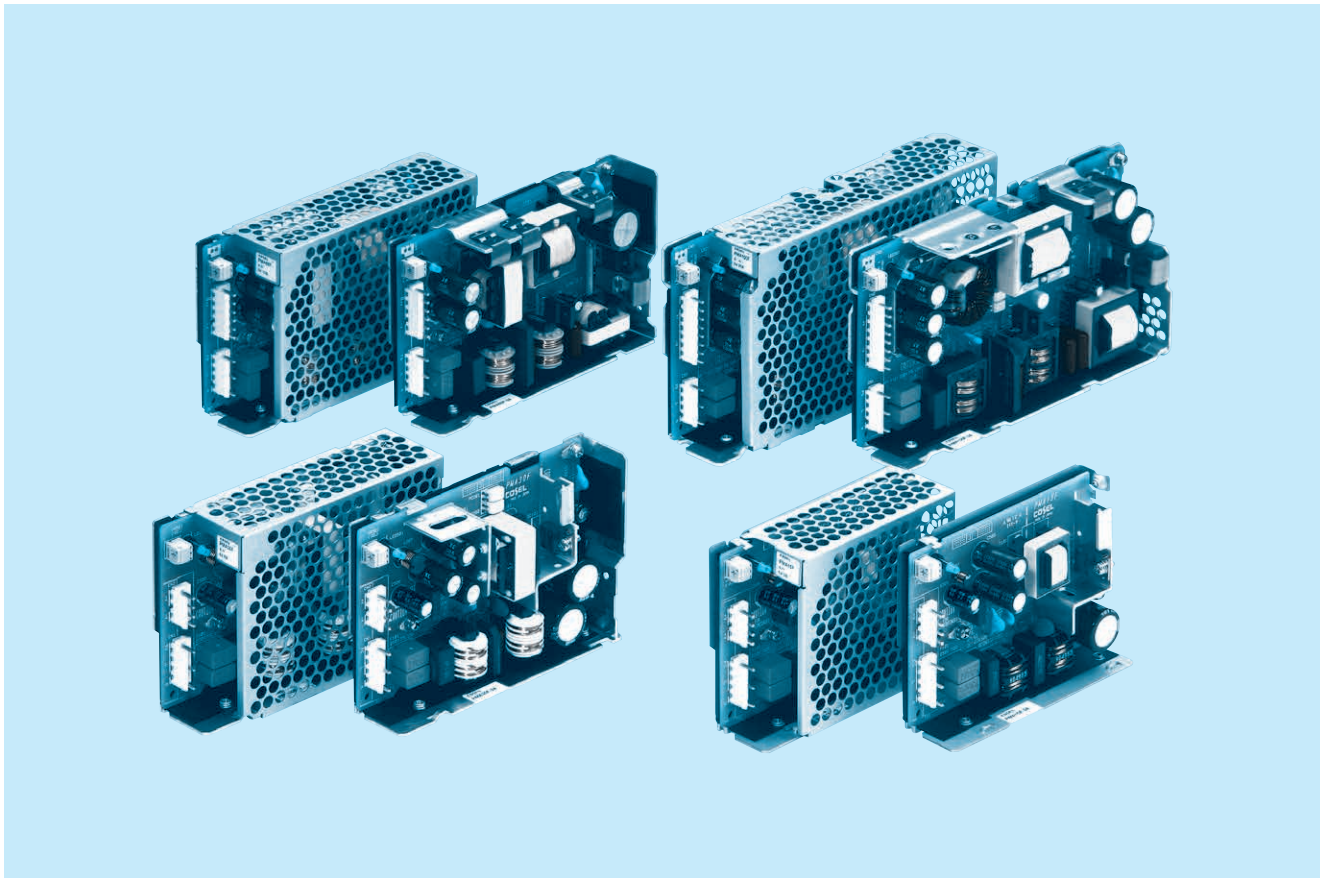


OVP



Remote
ON/OFF

PMA-series



Feature

For medical electric equipment
Internal dual fuses
Harmonic attenuator (Complies with IEC61000-3-2)
Universal input (AC85 - 264V)
Efficiency increased with synchronous rectification technology (PMA60F, PMA100F)
Variety of option

Safety agency approvals

UL60601-1, C-UL (CSA-C22.2 No.601.1), EN60601-1

EMI

FCC-B, CISPR11-B, CISPR22-B, EN55011-B, EN55022-B, VCCI-B

5-year warranty (refer to Instruction Manual)

CE marking

EMS Compliance : EN61204-3, EN61000-6-2

EN61000-4-2
EN61000-4-3
EN61000-4-4
EN61000-4-5 (Common mode Level4, Differential mode Level2)
EN61000-4-6
EN61000-4-8
EN61000-4-11

PMA15F

PM

A

15

F

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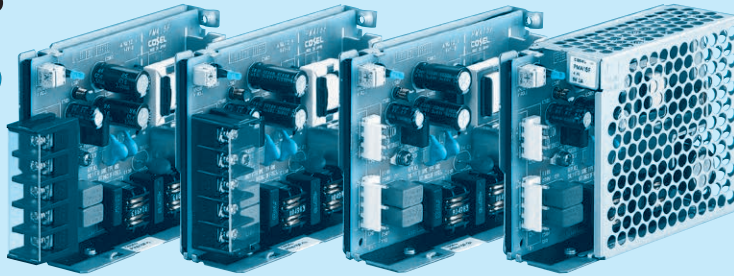
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Horizontal terminal block
(option : -T1)

Vertical terminal block
(option : -T)

Standard type

with Cover
(option : -N)

Example recommended EMI/EMC filter
NAM-04-000



Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional *5
- T : Vertical terminal block
- T1 : Horizontal terminal block
- N : with Cover
- J1 : VH(J.S.T.)connector type

Specification is changed at option, refer to Instruction Manual.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PMA15F-3R3	PMA15F-5	PMA15F-12	PMA15F-15	PMA15F-24
MAX OUTPUT WATTAGE[W]	9.9	15	15.6	15	16.8
DC OUTPUT	3.3V 3A	5V 3A	12V 1.3A	15V 1A	24V 0.7A

SPECIFICATIONS

	MODEL		PMA15F-3R3	PMA15F-5	PMA15F-12	PMA15F-15	PMA15F-24
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Refer to the Instruction Manual 1.1 and 3.2) *3				
	CURRENT[A]	ACIN 100V	0.30typ (Io=100%)	0.40typ (Io=100%)			
		ACIN 200V	0.15typ (Io=100%)	0.20typ (Io=100%)			
	FREQUENCY[Hz]		50 / 60 (47 - 440)				
	EFFICIENCY[%]	ACIN 100V	66typ	70typ	74typ	76typ	76typ
		ACIN 200V	67typ	74typ	78typ	79typ	79typ
	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start)				
ACIN 200V		30typ (Io=100%) (At cold start)					
LEAKAGE CURRENT[mA]		0.05/0.10max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60601-1)					
OUTPUT	VOLTAGE[V]		3.3	5	12	15	24
	CURRENT[A]		3.0	3.0	1.3	1.0	0.7
	LINE REGULATION[mV]		20max	20max	48max	60max	96max
	LOAD REGULATION[mV]		40max	40max	100max	120max	150max
	RIPPLE[mVp-p]	0 to +50℃	80max	80max	120max	120max	120max
		*1 -10 - 0℃	140max	140max	160max	160max	160max
	RIPPLE NOISE[mVp-p]	0 to +50℃	120max	120max	150max	150max	150max
		*1 -10 - 0℃	160max	160max	180max	180max	180max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	50max	120max	150max	240max
		-10 to +50℃	60max	60max	150max	180max	290max
	DRIFT[mV]		*2 20max	20max	48max	60max	96max
	START-UP TIME[ms]		200typ (ACIN 100V, Io=100%) *Start-up time is 700ms typ for less than 1minute of applying input again from turning off the input voltage.				
HOLD-UP TIME[ms]		20typ (ACIN 100V, Io=100%)					
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		2.85 to 3.60	4.50 to 5.50	10.00 to 13.20	13.20 to 18.00	19.20 to 27.00	
OUTPUT VOLTAGE SETTING[V]		3.30 to 3.40	5.00 to 5.15	12.00 to 12.48	15.00 to 15.60	24.00 to 24.96	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically				
	OVERVOLTAGE PROTECTION[V]		4.00 to 5.25	5.75 to 7.00	15.00 to 18.00	20.00 to 25.00	30.00 to 37.00
	OPERATING INDICATION		LED (Green)				
	REMOTE ON/OFF		Not provided				
ISOLATION	INPUT-OUTPUT		AC4,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)				
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)				
	OUTPUT-FG		AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)				
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE		-10 to +70℃, 20 - 90%RH (Non condensing), 3,000m (10,000 feet) max *3				
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000 feet) max				
	VIBRATION		10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis				
	IMPACT		196.1m/s ² (20G), 11ms, once each X, Y and Z axis				
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60601-1, C-UL (CSA-C22.2 No.601.1), EN60601-1				
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR11-B, CISPR22-B, EN55011-B, EN55022-B				
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 (Class A) *6 (Not built-in to active filter *4)				
OTHERS	CASE SIZE/WEIGHT		31 × 78 × 103mm [1.22 × 3.07 × 4.06 inches] (W × H × D) / 230g max (with cover : 265g max)				
	COOLING METHOD		Convection				

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter (equivalent to KEISOKU-GIKEN: RM101).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃.

*3 Derating is required.

*4 When two or more units are used, they may not comply with the harmonic attenuator. Please contact us for details.

*5 Please contact us about safety approvals for the model with option.

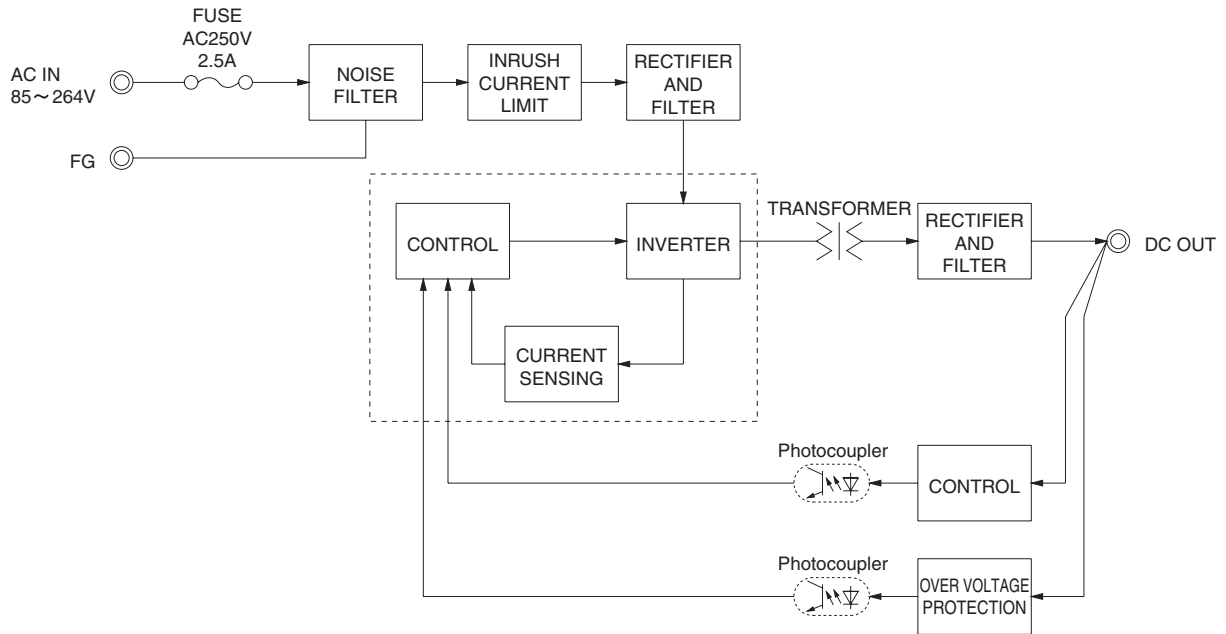
*6 Please contact us about another class.

Parallel operation with other model is not possible.

Derating is required when operated with cover.

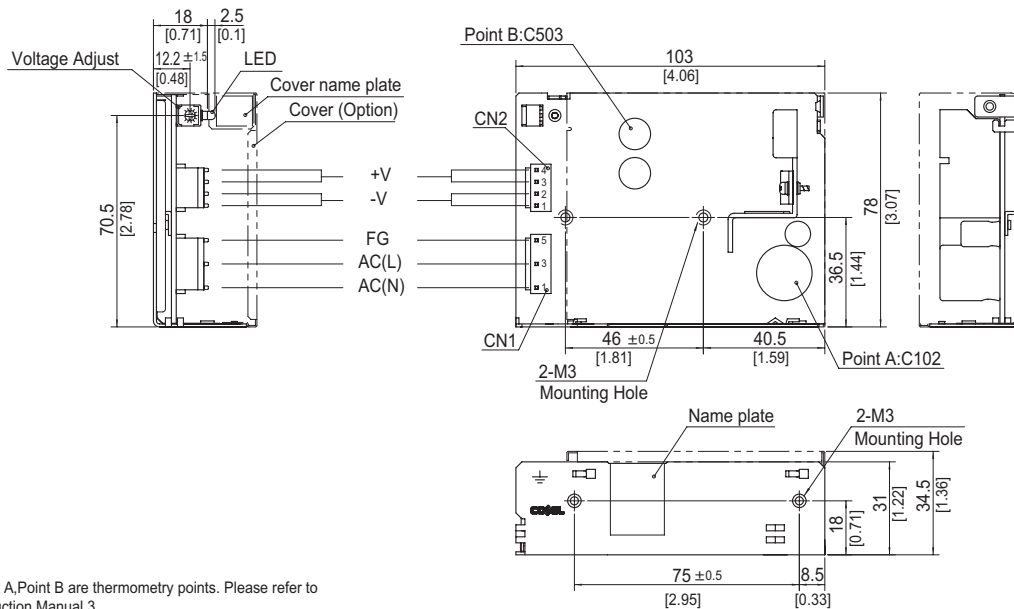
A sound may occur from power supply at peak loading.

Block diagram



External view

※ External size of option T,T1 and N is different from standard model and refer to 4 Option of instruction manual for details.



※ Point A,Point B are thermometry points. Please refer to Instruction Manual 3.

I/O Connector		Mating Connector	Terminal
CN1	1-1123724-3	1-1123722-5	Chain
			Loose
CN2	1-1123723-4	1-1123722-4	Chain
			Loose

(Mfr : Tyco Electronics AMP)

※ I/O Connector is Mfr.Tyco Electronics AMP

※ Option : -J1 : (J.S.T) connector type

-T : Vertical terminal block type

-T1 : Horizontal terminal block type
Refer to Instruction Manual 4.

<PIN CONNECTION>

CN1		CN2	
Pin No.	Input	Pin No.	Output
1	AC(N)	1, 2	-V
2		3, 4	+V
3	AC(L)		
4			
5	FG		

※ Tolerance : ± 1 [± 0.04]

※ Weight : 230g max (with cover : 265g max)

※ PCB Material/thickness : CEM-3 / 1.6mm [0.06inches]

※ Chassis material : Electric galvanizing steel board

※ Keep drawing current per pin below 5A of CN2.

※ Dimensions in mm. []=inches

※ Mounting torque : 0.6N・m (6.3kgf・cm) max

- ※ Mounting torque : 0.6N · m (6.3kgf · cm) max
- ※ Please connect safety ground to the unit in 2-M3 holes.

※ Please connect safety ground to the unit in 2-M3 holes.

PMA30F

PM

A

30

F

-□

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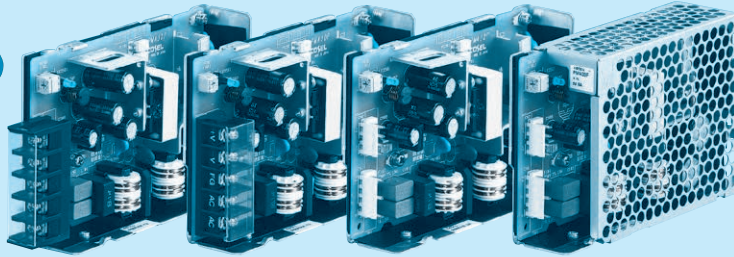
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Horizontal terminal block
(option : -T1)

Vertical terminal block
(option : -T)

Standard type

with Cover
(option : -N)

Example recommended EMI/EMC filter
NAM-04-000



Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional *5
- T : Vertical terminal block
- T1 : Horizontal terminal block
- N : with Cover
- J1 : VH(J.S.T.)connector type

Specification is changed at option, refer to Instruction Manual.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PMA30F-3R3	PMA30F-5	PMA30F-12	PMA30F-15	PMA30F-24
MAX OUTPUT WATTAGE[W]	19.8	30	30	30	31.2
DC OUTPUT	3.3V 6A	5V 6A	12V 2.5A	15V 2A	24V 1.3A

SPECIFICATIONS

	MODEL		PMA30F-3R3	PMA30F-5	PMA30F-12	PMA30F-15	PMA30F-24
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Refer to the Instruction Manual 1.1 and 3.2) *3				
	CURRENT[A]	ACIN 100V	0.50typ (Io=100%)	0.70typ (Io=100%)			
		ACIN 200V	0.30typ (Io=100%)	0.40typ (Io=100%)			
	FREQUENCY[Hz]		50 / 60 (47 - 440)				
	EFFICIENCY[%]	ACIN 100V	67typ	71typ	76typ	77typ	77typ
		ACIN 200V	69typ	74typ	78typ	80typ	80typ
	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start)				
ACIN 200V		30typ (Io=100%) (At cold start)					
LEAKAGE CURRENT[mA]		0.05 / 0.10max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60601-1)					
OUTPUT	VOLTAGE[V]		3.3	5	12	15	24
	CURRENT[A]		6.0	6.0	2.5	2.0	1.3
	LINE REGULATION[mV]		20max	20max	48max	60max	96max
	LOAD REGULATION[mV]		40max	40max	100max	120max	150max
	RIPPLE[mVp-p]	0 to +50℃	80max	80max	120max	120max	120max
		-10 - 0℃	140max	140max	160max	160max	160max
	RIPPLE NOISE[mVp-p]	0 to +50℃	120max	120max	150max	150max	150max
		-10 - 0℃	160max	160max	180max	180max	180max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	50max	120max	150max	240max
		-10 to +50℃	60max	60max	150max	180max	290max
	DRIFT[mV]		20max	20max	48max	60max	96max
	START-UP TIME[ms]		200typ (ACIN 100V, Io=100%) *Start-up time is 700ms typ for less than 1minute of applying input again from turning off the input voltage.				
	HOLD-UP TIME[ms]		20typ (ACIN 100V, Io=100%)				
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		2.85 to 3.60	4.50 to 5.50	10.00 to 13.20	13.20 to 18.00	19.20 to 27.00	
OUTPUT VOLTAGE SETTING[V]		3.30 to 3.40	5.00 to 5.15	12.00 to 12.48	15.00 to 15.60	24.00 to 24.96	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically				
	OVERVOLTAGE PROTECTION[V]		4.00 to 5.25	5.75 to 7.00	15.00 to 18.00	20.00 to 25.00	30.00 to 37.00
	OPERATING INDICATION		LED (Green)				
	REMOTE ON/OFF		Not provided				
ISOLATION	INPUT-OUTPUT		AC4,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)				
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)				
	OUTPUT-FG		AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)				
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE		-10 to +70℃, 20 - 90%RH (Non condensing), 3,000m (10,000feet) max *3				
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max				
	VIBRATION		10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis				
	IMPACT		196.1m/s² (20G), 11ms, once each X, Y and Z axis				
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60601-1, C-UL (CSA-C22.2 No.601.1), EN60601-1				
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR11-B, CISPR22-B, EN55011-B, EN55022-B				
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 (Class A) *6 (Not built-in to active filter *4)				
OTHERS	CASE SIZE/WEIGHT		31 X 82 X 120mm [1.22 X 3.23 X 4.72 inches] (W X H X D) / 240g max (with cover : 280g max)				
	COOLING METHOD		Convection				

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter (equivalent to KEISOKU-GIKEN: RM101).

*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃.

*3 Derating is required.

*4 When two or more units are used, they may not comply with the harmonic attenuator. Please contact us for details.

*5 Please contact us about safety approvals for the model with option.

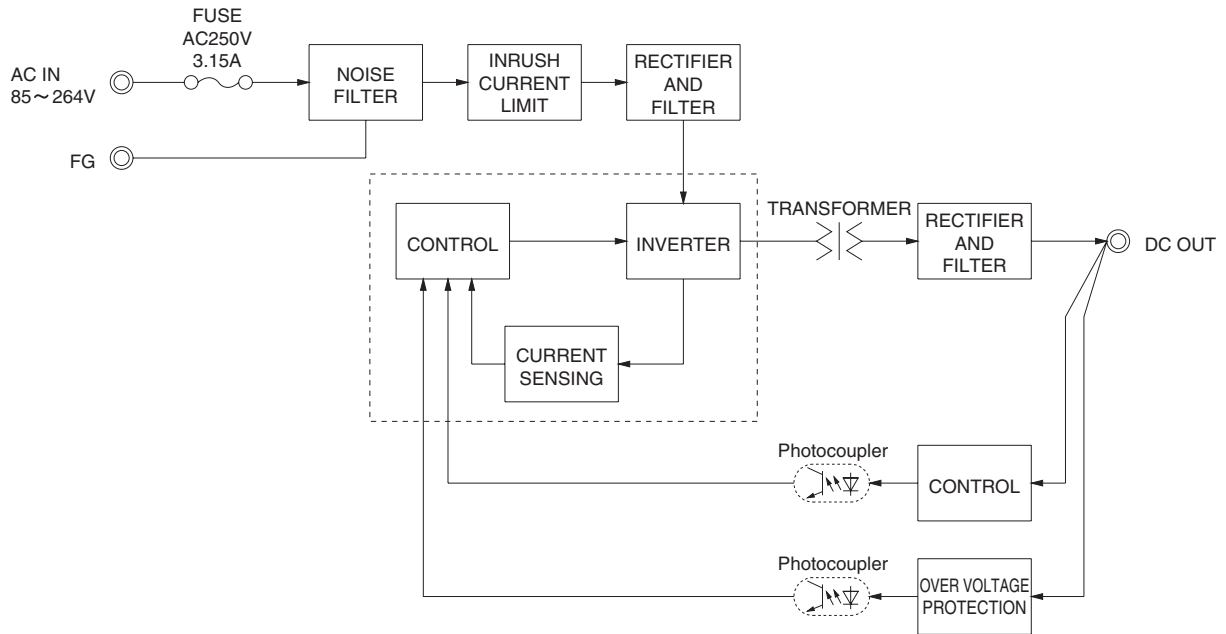
*6 Please contact us about another class.

Parallel operation with other model is not possible.

Derating is required when operated with cover.

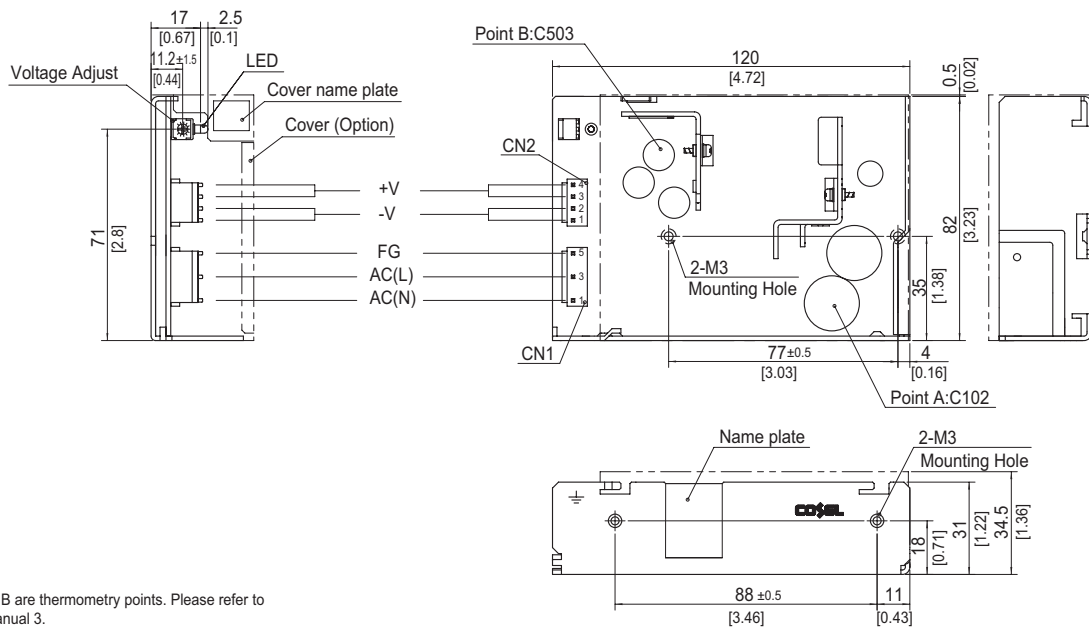
A sound may occur from power supply at peak loading.

Block diagram



External view

※ External size of option T, T1 and N is different from standard model and refer to 4 Option of instruction manual for details.



※ Point A, Point B are thermometry points. Please refer to Instruction Manual 3.

I/O Connector	Mating Connector	Terminal
CN1	1-1123724-3	Chain 1123721-1 Loose 1318912-1
CN2	1-1123723-4	Chain 1123721-1 Loose 1318912-1

(Mfr: Tyco Electronics AMP)

※ I/O Connector is Mfr. Tyco Electronics AMP
 ※ Option : -J1 : (J.S.T) connector type
 -T : Vertical terminal block type
 -T1 : Horizontal terminal block type
 Refer to Instruction Manual 4.

<PIN CONNECTION>

Pin No.	Input	Pin No.	Output
1	AC(N)	1, 2	-V
2			
3	AC(L)	3, 4	+V
4			
5	FG		

※ Tolerance : ± 1 [± 0.04]
 ※ Weight : 240g max (with cover : 280g max)
 ※ PCB Material/thickness : CEM-3 / 1.6mm [0.06inches]
 ※ Chassis material : Aluminum
 ※ Keep drawing current per pin below 5A of CN2.
 ※ Dimensions in mm, []=inches
 ※ Mounting torque : 0.49N · m (5kgf · cm) max
 ※ Please connect safety ground to the unit in 2-M3 holes.

PMA60F

PM

A

60

F

-□

-□

①

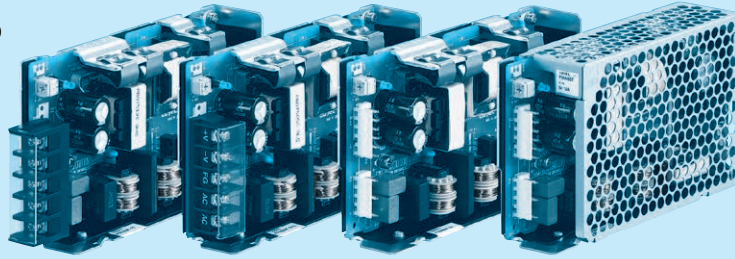
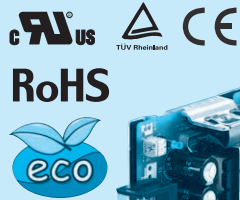
②

③

④

⑤

⑥



Horizontal terminal block
(option : -T1)

Vertical terminal block
(option : -T)

Standard type

with Cover
(option : -N)

Example recommended EMI/EMC filter
NAM-04-000



Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional *5
- T : Vertical terminal block
- T1 : Horizontal terminal block
- N : with Cover
- J1 : VH(J.S.T.)connector type
- R : with Remote ON/OFF

Specification is changed at option, refer to Instruction Manual.

* Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PMA60F-3R3	PMA60F-5	PMA60F-12	PMA60F-15	PMA60F-24
MAX OUTPUT WATTAGE[W]	39.6	60	60	60	60
DC OUTPUT	3.3V 12A	5V 12A	12V 5A	15V 4A	24V 2.5A

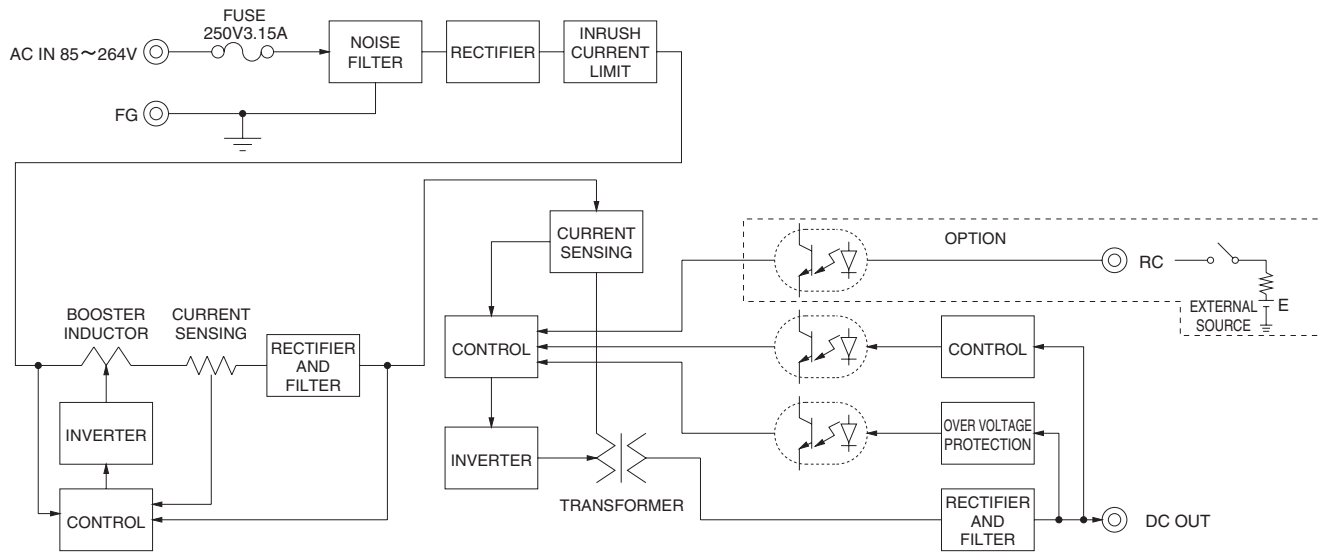
SPECIFICATIONS

	MODEL		PMA60F-3R3	PMA60F-5	PMA60F-12	PMA60F-15	PMA60F-24
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Refer to the Instruction Manual 1.1)				
	CURRENT[A]	ACIN 100V	0.7typ (Io=100%)	0.8typ (Io=100%)			
		ACIN 200V	0.4typ (Io=100%)	0.5typ (Io=100%)			
	FREQUENCY[Hz]		50 / 60 (47 - 63)				
	EFFICIENCY[%]	ACIN 100V	77typ	80typ	80typ	81typ	81typ
		ACIN 200V	78typ	83typ	82typ	83typ	83typ
	POWER FACTOR (Io=100%)	ACIN 100V	0.98typ				
		ACIN 200V	0.85typ	0.90typ			
	INRUSH CURRENT[A]	ACIN 100V	15typ (Io=100%) (At cold start)				
		ACIN 200V	30typ (Io=100%) (At cold start)				
LEAKAGE CURRENT[mA]		0.09 / 0.18max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60601-1)					
OUTPUT	VOLTAGE[V]		3.3	5	12	15	24
	CURRENT[A]		12.0	12.0	5.0	4.0	2.5
	LINE REGULATION[mV]		20max	20max	48max	60max	96max
	LOAD REGULATION[mV]		40max	40max	100max	120max	150max
	RIPPLE[mVp-p]	0 to +50℃	80max	80max	120max	120max	120max
		*1 -10 - 0℃	140max	140max	160max	160max	160max
	RIPPLE NOISE[mVp-p]	0 to +50℃	120max	120max	150max	150max	150max
		*1 -10 - 0℃	160max	160max	180max	180max	180max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	50max	120max	150max	240max
		-10 to +50℃	60max	60max	150max	180max	290max
	DRIFT[mV]		*2 20max	20max	48max	60max	96max
	START-UP TIME[ms]		250typ (ACIN 100V, Io=100%)				
	HOLD-UP TIME[ms]		20typ (ACIN 100V, Io=100%)				
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		2.85 to 3.60	4.50 to 5.50	10.00 to 13.20	13.20 to 18.00	19.20 to 27.00	
OUTPUT VOLTAGE SETTING[V]		3.30 to 3.40	5.00 to 5.15	12.00 to 12.48	15.00 to 15.60	24.00 to 24.96	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically				
	OVERVOLTAGE PROTECTION[V]		4.00 to 5.25	5.75 to 7.00	15.00 to 18.00	20.00 to 25.00	30.00 to 37.00
	OPERATING INDICATION		LED (Green)				
	REMOTE ON/OFF		Optional (Required external power source)				
ISOLATION	INPUT-OUTPUT-RC		*3 AC4,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)				
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)				
	OUTPUT-RC-FG		*3 AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)				
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE		-10 to +70℃, 20 - 90%RH (Non condensing), 3,000m (10,000feet) max *4				
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max				
	VIBRATION		10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis				
	IMPACT		196.1m/s ² (20G), 11ms, once each X, Y and Z axis				
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60601-1, C-UL (CSA-C22.2 No.601.1), EN60601-1				
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR11-B, CISPR22-B, EN55011-B, EN55022-B				
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 *6				
OTHERS	CASE SIZE/WEIGHT		32 X 82 X 135mm [1.26 X 3.23 X 5.31 inches] (W X H X D) / 350g max (with cover : 395g max)				
	COOLING METHOD		Convection				

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter (equivalent to KEISOKU-GIKEN: RM101).
 *2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C.
 *3 Applicable when Remote ON/OFF (optional) is added. RC is insulated with input, output and FG.
 *4 Derating is required.
 *5 Please contact us about safety approvals for the model with option.

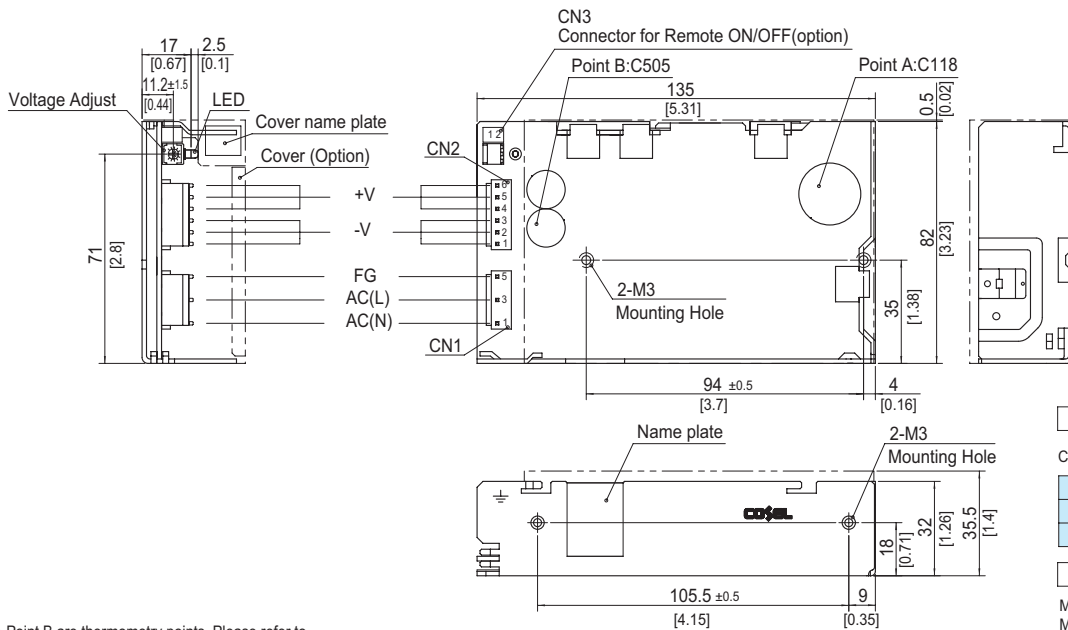
*6 Please contact us about class C.
 * Parallel operation with other model is not possible.
 * Derating is required when operated with cover.
 * A sound may occur from power supply at peak loading.

Block diagram



External view

※ External size of option T, T1, R and N is different from standard model and refer to 4 Option of instruction manual for details.



※ Point A, Point B are thermometry points. Please refer to Instruction Manual 3.

I/O Connector	Mating Connector	Terminal
CN1	1-1123724-3	1-1123722-5
		Chain 1123721-1
		Loose 1318912-1
CN2	1-1123723-6	1-1123722-6
		Chain 1123721-1
		Loose 1318912-1

(Mfr: Tyco Electronics AMP)

※ I/O Connector is Mfr. Tyco Electronics AMP

※ Option: -J1: (J.S.T) connector type

-T: Vertical terminal block type

-T1: Horizontal terminal block type

Refer to Instruction Manual 4.

<PIN CONNECTION>

Pin No.	Input
1	AC(N)
2	
3	AC(L)
4	
5	FG

Pin No.	Output
1 - 3	-V
4 - 6	+V

※ Tolerance: ± 1 [± 0.04]

※ Weight: 350g max (with cover: 395g max)

※ PCB Material/thickness: CEM-3 / 1.6mm [0.06inches]

※ Chassis material: Aluminum

※ Keep drawing current per pin below 5A of CN2.

※ Dimensions in mm, [] = inches

※ Mounting torque: 0.49N · m (5kgf · cm) max

※ Please connect safety ground to the unit in 2-M3 holes.

Connector type

CN3 Option (Mfr: J.S.T)

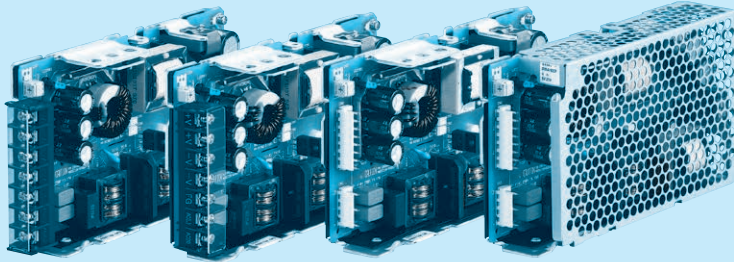
PIN No.	Contents
1	RC(+)
2	RC(-)

Barrier strip type

Model B2B-XH-A
Mating Connector (Terminal)
XHP-2
(BXH-001T-P0.6
or SXH-001T-P0.6)

PMA100F

PM A 100 F - □ - □
① ② ③ ④ ⑤ ⑥



Horizontal terminal block (option : -T1) Vertical terminal block (option : -T) Standard type with Cover (option : -N)

Example recommended EMI/EMC filter
NAM-06-000



Low leakage current type : NAM series
* A higher current rating EMI/EMC filter may be recommended in view of the other devices that could be connected in parallel with the power supply.

- ① Series name
- ② Single output
- ③ Output wattage
- ④ Universal input
- ⑤ Output voltage
- ⑥ Optional *5
- T : Vertical terminal block
- T1: Horizontal terminal block
- N : with Cover
- J1: VH(J.S.T.)connector type
- R : with Remote ON/OFF

Specification is changed at option, refer to Instruction Manual.

*Make sure necessary tests will be carried out on your end equipment with the power supply installed in accordance with any required EMC/EMI regulations.

MODEL	PMA100F-3R3	PMA100F-5	PMA100F-12	PMA100F-24	PMA100F-48
MAX OUTPUT WATTAGE[W]	66	100	102	108	100.8
DC OUTPUT	3.3V 20A	5V 20A	12V 8.5A	24V 4.5A	48V 2.1A

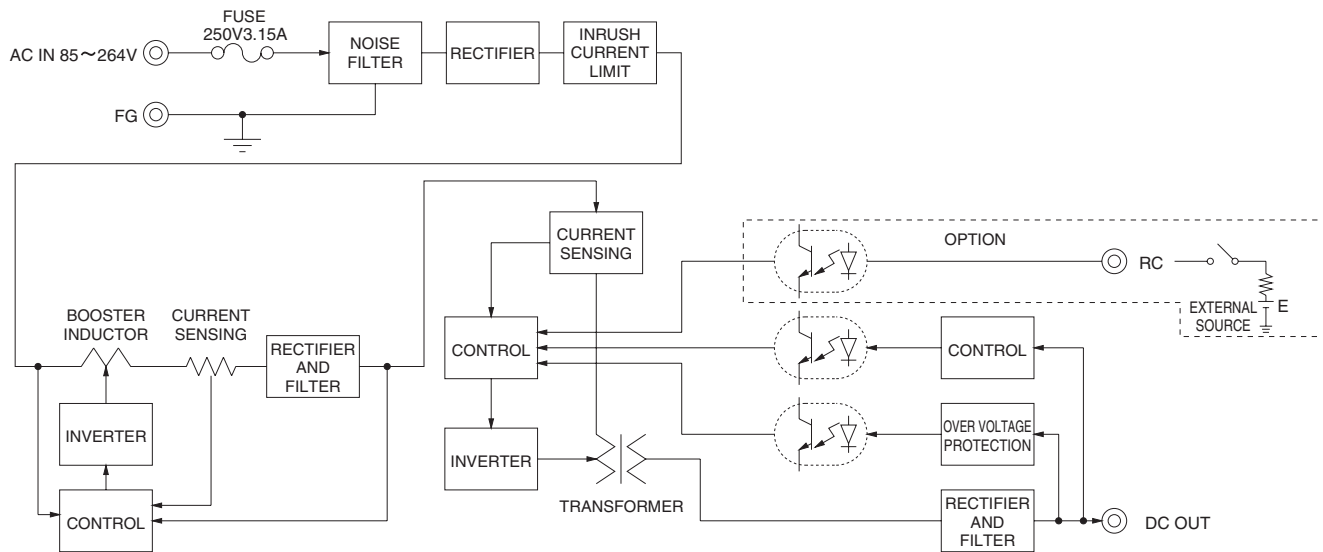
SPECIFICATIONS

	MODEL		PMA100F-3R3	PMA100F-5	PMA100F-12	PMA100F-24	PMA100F-48
INPUT	VOLTAGE[V]		AC85 - 264 1 φ (Refer to the Instruction Manual 1.1)				
	CURRENT[A]	ACIN 100V	0.9typ (Io=100%)	1.3typ (Io=100%)			
		ACIN 200V	0.5typ (Io=100%)	0.7typ (Io=100%)			
	FREQUENCY[Hz]		50 / 60 (47 - 63)				
	EFFICIENCY[%]	ACIN 100V	77typ	81typ	82typ	84typ	84typ
		ACIN 200V	78typ	83typ	83typ	86typ	86typ
	POWER FACTOR (Io=100%)	ACIN 100V	0.98typ				
		ACIN 200V	0.85typ	0.90typ			
	ACIN 100V	20typ (Io=100%) (At cold start)					
	ACIN 200V	40typ (Io=100%) (At cold start)					
LEAKAGE CURRENT[mA]		0.09 / 0.18max (ACIN 100V / 240V 60Hz, Io=100%, According to IEC60601-1)					
OUTPUT	VOLTAGE[V]		3.3	5	12	24	48
	CURRENT[A]		20.0	20.0	8.5	4.5	2.1
	LINE REGULATION[mV]		20max	20max	48max	96max	192max
	LOAD REGULATION[mV]		40max	40max	100max	150max	240max
	RIPPLE[mVp-p]	0 to +50℃	80max	80max	120max	120max	150max
		*1 -10 - 0℃	140max	140max	160max	160max	200max
	RIPPLE NOISE[mVp-p]	0 to +50℃	120max	120max	150max	150max	250max
		*1 -10 - 0℃	160max	160max	180max	180max	300max
	TEMPERATURE REGULATION[mV]	0 to +50℃	50max	50max	120max	240max	480max
		-10 to +50℃	60max	60max	150max	290max	600max
	DRIFT[mV]		*2 20max	20max	48max	96max	192max
	START-UP TIME[ms]		250typ (ACIN 100V, Io=100%)				
	HOLD-UP TIME[ms]		20typ (ACIN 100V, Io=100%)				
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		2.85 to 3.60	4.50 to 5.50	10.00 to 13.20	19.20 to 27.00	39.00 to 53.00	
OUTPUT VOLTAGE SETTING[V]		3.30 to 3.40	5.00 to 5.15	12.00 to 12.48	24.00 to 24.96	48.00 to 49.92	
PROTECTION CIRCUIT AND OTHERS	OVERCURRENT PROTECTION		Works over 105% of rating and recovers automatically				
	OVERVOLTAGE PROTECTION[V]		4.00 to 5.25	5.75 to 7.00	15.00 to 18.00	30.00 to 37.00	58.00 to 65.00
	OPERATING INDICATION		LED (Green)				
	REMOTE ON/OFF		Optional (Required external power source)				
ISOLATION	INPUT-OUTPUT-RC		*3 AC4,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)				
	INPUT-FG		AC2,000V 1minute, Cutoff current = 10mA, DC500V 50MΩ min (At Room Temperature)				
	OUTPUT-RC-FG		*3 AC500V 1minute, Cutoff current = 25mA, DC500V 50MΩ min (At Room Temperature)				
ENVIRONMENT	OPERATING TEMP., HUMID. AND ALTITUDE		-10 to +70℃, 20 - 90%RH (Non condensing), 3,000m (10,000feet) max *4				
	STORAGE TEMP., HUMID. AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing), 9,000m (30,000feet) max				
	VIBRATION		10 - 55Hz, 19.6m/s² (2G), 3minutes period, 60minutes each along X, Y and Z axis				
	IMPACT		196.1m/s² (20G), 11ms, once each X, Y and Z axis				
SAFETY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60601-1, C-UL (CSA-C22.2 No.601.1), EN60601-1				
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR11-B, CISPR22-B, EN55011-B, EN55022-B				
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2 *6				
OTHERS	CASE SIZE/WEIGHT		34 X 93 X 168mm [1.34 X 3.66 X 6.61 inches] (W X H X D) / 560g max (with cover : 625g max)				
	COOLING METHOD		Convection				

*1 Measured by 20MHz oscilloscope or Ripple-Noise meter (equivalent to KEISOKU-GIKEN: RM101).
 *2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25℃.
 *3 Applicable when Remote ON/OFF (optional) is added. RC is insulated with input, output and FG.
 *4 Derating is required.
 *5 Please contact us about safety approvals for the model with option.

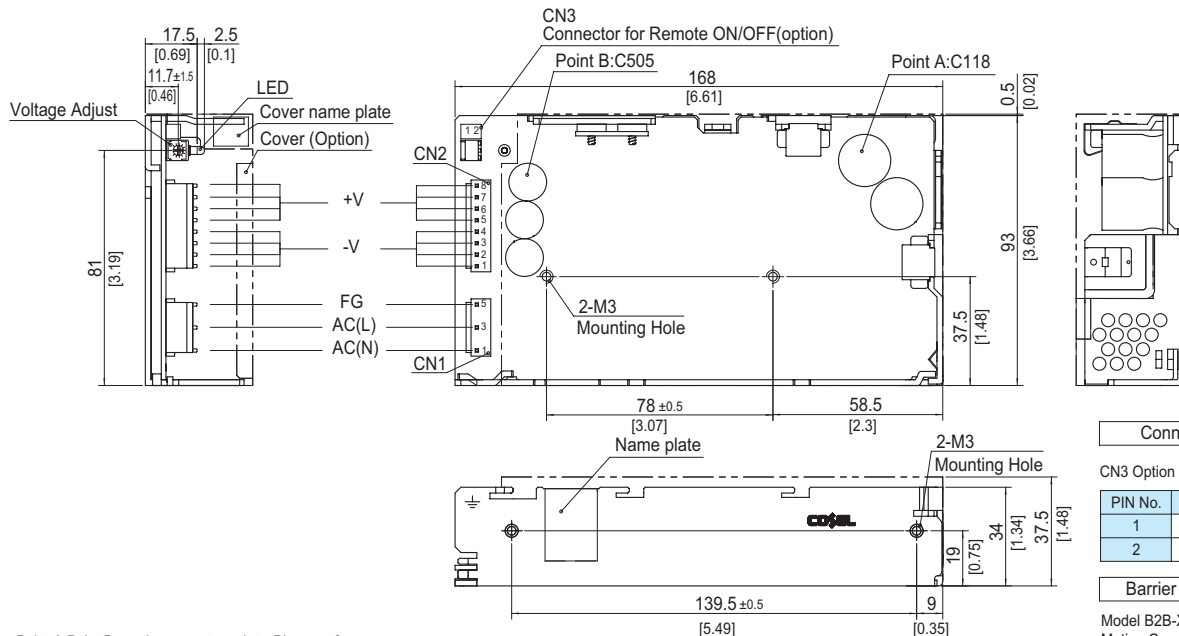
*6 Please contact us about class C.
 * Parallel operation with other model is not possible.
 * Derating is required when operated with cover.
 * A sound may occur from power supply at peak loading.

Block diagram



External view

※ External size of option T, T1, R and N is different from standard model and refer to 4 Option of instruction manual for details.



※ Point A, Point B are thermometry points. Please refer to Instruction Manual 3.

I/O Connector	Mating Connector	Terminal
CN1	1-1123724-3	1-1123722-5
CN2	1-1123723-8	1-1123722-8

(Mfr: Tyco Electronics AMP)

※ I/O Connector is Mfr. Tyco Electronics AMP
 ※ Option: -J1: (J.S.T) connector type
 -T: Vertical terminal block type
 -T1: Horizontal terminal block type
 Refer to Instruction Manual 4.

<PIN CONNECTION>

Pin No.	Input
1	AC(N)
2	
3	AC(L)
4	
5	FG

Pin No.	Output
1 - 4	-V
5 - 8	+V

Connector type

CN3 Option (Mfr: J.S.T)

PIN No.	Contents
1	RC(+)
2	RC(-)

Barrier strip type

Model B2B-XH-A
 Mating Connector (Terminal)
 XHP-2
 (BXH-001T-P0.6
 or SXH-001T-P0.6)

※ Tolerance: ± 1 [± 0.04]
 ※ Weight: 560g max (with cover: 625g max)
 ※ PCB Material/thickness: CEM-3 / 1.6mm [0.06inches]
 ※ Chassis material: Aluminum
 ※ Keep drawing current per pin below 5A of CN2.
 ※ Dimensions in mm, [] = inches
 ※ Mounting torque: 0.49N · m (5kgf · cm) max
 ※ Please connect safety ground to the unit in 2-M3 holes.

Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A] *1	Inrush current protection	PCB/Pattern			Series/Parallel operation availability *2	
					Material	Single sided	Double sided	Series operation	Parallel operation
PMA15F	Flyback converter	100	0.4	Thermistor	CEM-3	Yes		Yes	No
PMA30F	Flyback converter	100	0.7	Thermistor	CEM-3	Yes		Yes	No
PMA60F	Active filter	60 - 550	0.8	Thermistor	CEM-3	Yes		Yes	No
	Forward converter	120							
PMA100F	Active filter	60 - 550	1.3	Thermistor	CEM-3	Yes		Yes	No
	Forward converter	120							

*1 The value of input current is at ACIN 100V and rated load.

*2 Refer to Instruction Manual 2.

1	Function	PMA-12
1.1	Input voltage range	PMA-12
1.2	Inrush current limiting	PMA-12
1.3	Overcurrent protection	PMA-12
1.4	Overvoltage protection	PMA-12
1.5	Output voltage adjustment	PMA-12
1.6	Isolation	PMA-12
1.7	Remote ON/OFF	PMA-12
2	Series Operation and Parallel Operation	PMA-12
3	Assembling and Installation Method	PMA-13
3.1	Installation method	PMA-13
3.2	Derating	PMA-13
3.3	Expectancy life and warranty	PMA-14
4	Option and Others	PMA-15
4.1	Outline of options	PMA-15
4.2	Others	PMA-16

1 Function

1.1 Input voltage range

- Input voltage range of the power supplies is from AC85V to AC264V (please see SPECIFICATIONS for details).
- In cases that conform with safety standard, input voltage range is AC100-AC240V (50/60Hz).
- If input value doesn't fall within above range, a unit may not operate in accordance with specifications and/or start hunting or fail. If you need to apply a square waveform input voltage, which is commonly used in UPS and inverters, please contact us.
- When the input voltage changes suddenly, the output voltage accuracy might exceed the specification. Please contact us.

● PMA15F, PMA30F

- A power factor improvement circuit (active filter) is not built-in. If you use multiple units for a single system, standards for input harmonic current may not be satisfied. Please contact us for details.

1.2 Inrush current limiting

- An inrush current limiting circuit is built-in.
- If you need to use a switch on the input side, please select one that can withstand an input inrush current.
- Thermistor is used in the inrush current limiting circuit. When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that a power supply cools down before being turned on.

1.3 Overcurrent protection

- An overcurrent protection circuit is built-in and activated at 105% of the rated current. A unit automatically recovers when a fault condition is removed. Please do not use a unit in short circuit and/or under an overcurrent condition.
- Intermittent Operation Mode
When the overcurrent protection circuit is activated and the output voltage drops to a certain extent, the output becomes intermittent so that the average current will also decrease.

1.4 Overvoltage protection

- An overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait more than 3 minutes and turn on the AC input again to recover the output voltage. Recovery time varies depending on such factors as input voltage value at the time of the operation.

Remarks :

Please avoid applying a voltage exceeding the rated voltage to an output terminal. Doing so may cause a power supply to malfunction or fail. If you cannot avoid doing so, for example, if you need to operate a motor, etc., please install an external diode on the output terminal to protect the unit.

1.5 Output voltage adjustment

- To increase an output voltage, turn a built-in potentiometer clockwise. To decrease the output voltage, turn it counterclockwise.

1.6 Isolation

- For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for the start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

1.7 Remote ON/OFF

● PMA15F, PMA30F

- These models do not have a remote ON/OFF function.

● PMA60F, PMA100F

- Option -R is available to provide a remote ON/OFF function. Please see "4 Option and Others" for details.

2 Series Operation and Parallel Operation

- You can use a power supply in series operation. The output current in series operation should be lower than the rated current of a power supply with the lowest rated current among power supplies that are serially connected. Please make sure that no current exceeding the rated current flows into a power supply.

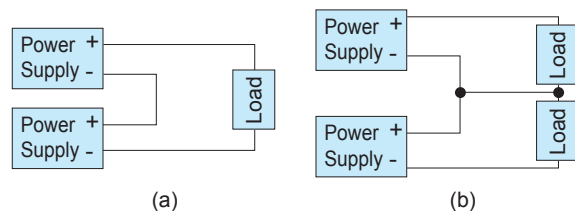


Fig.2.1 Examples of connecting in series operation

- Parallel operation is not possible.
- Redundancy operation is available by wiring as shown below.

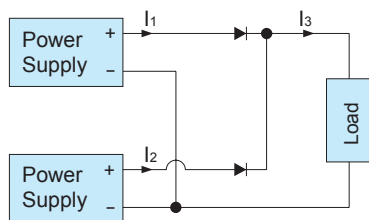


Fig.2.2 Example of redundancy operation

- Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 . Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

3 Assembling and Installation Method

3.1 Installation method

- Do not insert a screw more than 6mm from the outside of a power supply to keep enough insulation distance between the screw and internal components.

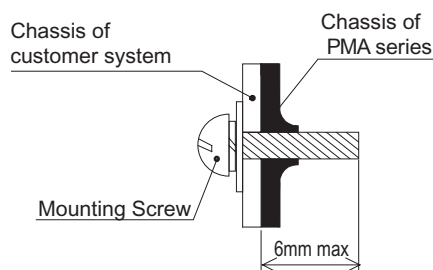
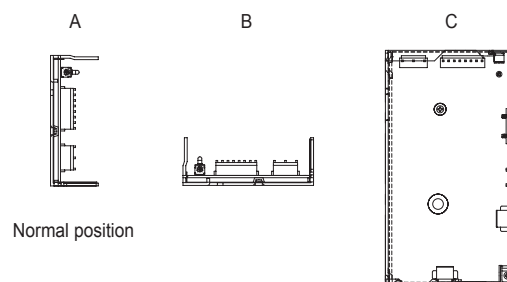


Fig.3.1 Mounting screw

- If you use two or more power supplies side by side, please keep a sufficient distance between them to allow enough air ventilation. Ambient temperature around each power supply should not exceed the temperature range shown in the derating curve.

3.2 Derating

- Mounting Method



Normal position

Fig.3.2 Mounting method

- Environment to use it and Installation environment

When using it, it is necessary to radiate heat by the heat of the power supply.

Table 3.1 - 3.4 shows the relation between the upper limit temperature (Point A and Point B) and load factors.

Please consider the ventilation so that the convection which is enough for the whole power supply is provided.

And temperature of Point A and Point B please become lower than upper limit temperature.

The expectancy life in the upper bound temperature (Point A and Point B) is three years or more.

Please refer to External View for the position of Point A and Point B.

Remarks:

- * Please be careful of electric shock or earth leakage in case of temperature measurement, because Point A and Point B is live potential.

Table 3.1 Temperatures of Point A, Point B PMA15F-□

Mounting Method	Load factor	Max temperature	
		Point A[°C]	Point B[°C]
A	70% < $I_o \leq 100\%$	72	75
	20% < $I_o \leq 70\%$	75	77
	$I_o \leq 20\%$	77	77
B	70% < $I_o \leq 100\%$	62	62
	20% < $I_o \leq 70\%$	64	66
	$I_o \leq 20\%$	66	67
C	70% < $I_o \leq 100\%$	55	62
	20% < $I_o \leq 70\%$	58	64
	$I_o \leq 20\%$	61	63

Table 3.2 Temperatures of Point A, Point B PMA30F-□

Mounting Method	Load factor	Max temperature	
		Point A[°C]	Point B[°C]
A	70% < $I_o \leq 100\%$	77	83
	20% < $I_o \leq 70\%$	79	83
	$I_o \leq 20\%$	80	84
B	70% < $I_o \leq 100\%$	72	74
	20% < $I_o \leq 70\%$	70	74
	$I_o \leq 20\%$	71	74
C	70% < $I_o \leq 100\%$	66	76
	20% < $I_o \leq 70\%$	67	75
	$I_o \leq 20\%$	68	73

Table 3.3 Temperatures of Point A, Point B PMA60F-□

Mounting Method	Load factor	Max temperature	
		Point A[°C]	Point B[°C]
A	70%<lo≤100%	82	76
	20%<lo≤70%	88	81
	lo≤20%	88	83
B	70%<lo≤100%	66	68
	20%<lo≤70%	75	73
	lo≤20%	77	75
C	70%<lo≤100%	64	65
	20%<lo≤70%	71	72
	lo≤20%	73	72

Table 3.4 Temperatures of Point A, Point B PMA100F-□

Mounting Method	Load factor	Max temperature	
		Point A[°C]	Point B[°C]
A	70%<lo≤100%	78	80
	20%<lo≤70%	83	82
	lo≤20%	84	84
B	70%<lo≤100%	64	73
	20%<lo≤70%	70	73
	lo≤20%	73	75
C	70%<lo≤100%	59	76
	20%<lo≤70%	65	76
	lo≤20%	67	74

■The operative ambient temperature is different by with / without case cover or mounting position. Derating curve is shown below.

Note: In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

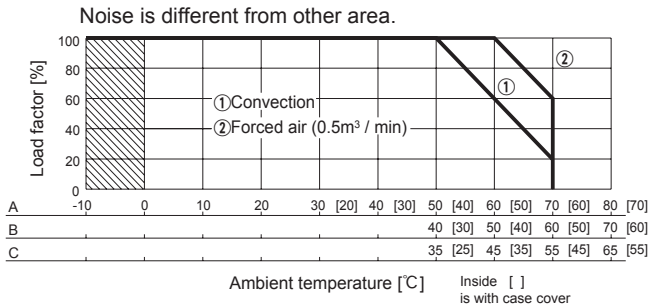
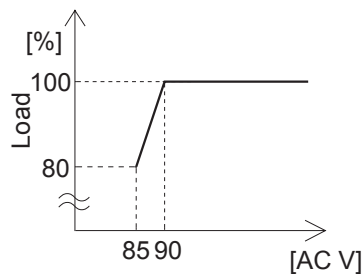


Fig.3.3 Ambient temperature derating curve (refer to Table 3.1-3.4)

● PMA15F, PMA30F

■Input Voltage Derating Curve

Input voltage derating curve is shown in Fig.3.4.



3.3 Expectancy life and warranty

■Expectancy Life.

Please see the following tables for expectancy life.

Table 3.5 Expectancy Life

Mounting Method	Annual Average of Ambient Temperatures	Load Factor	
		50%	100%
A	Ta = 30°C or less	10 years or more	10 years or more
	Ta = 40°C	10 years or more	6 years
	Ta = 50°C	5 years	3 years
B and C	Ta = 20°C or less	10 years or more	10 years or more
	Ta = 30°C	10 years or more	6 years
	Ta = 40°C	5 years	3 years

■Warranty

Table 3.6 Warranty

Mounting Method	Annual Average of Ambient Temperatures	Load Factor	
		50%	100%
A	Ta = 40°C or less	5 years	5 years
	Ta = 50°C	5 years	3 years
B and C	Ta = 30°C or less	5 years	5 years
	Ta = 40°C	5 years	3 years

4 Option and Others

4.1 Outline of options

- *Please inquire us for details of specifications and delivery timing.
- *You can combine multiple options. Some options, however, cannot be combined with other options. Please contact us for details.

● -T

- Option -T units have vertically positioned screws on a terminal block.
- Please contact us for details about appearance.

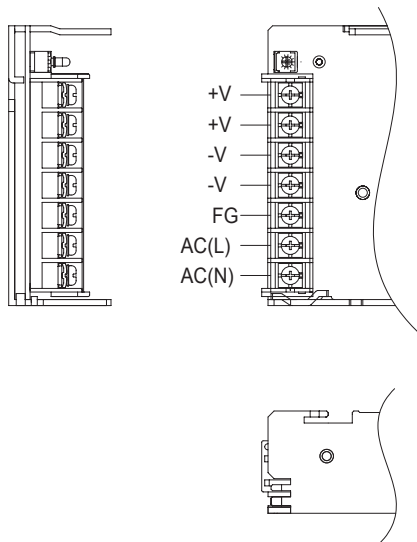


Fig.4.1 Example of option -T (PMA100F)

● -T1

- Option -T1 units have horizontally positioned screws on a terminal block.
- Please contact us for details about appearance.

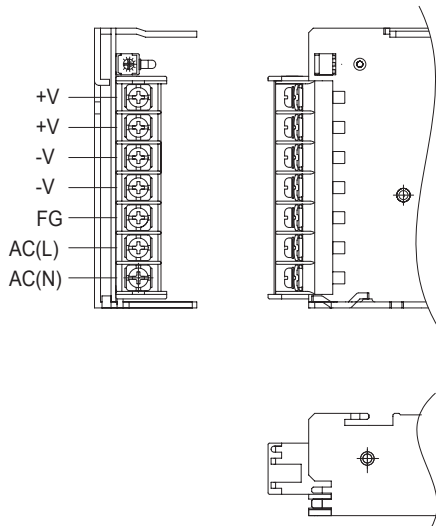


Fig.4.2 Example of option -T1 (PMA100F)

● -N

- Option -N units come with a cover.
- Appearance of Option -N units is different from that of standard units. Please see External View for details.
- Derating curve for Option -N units is different from that for standard units. Please see 3.2 Derating Curve for details.

*Safety agency approvals will be void if the cover is attached after the unit is ex-factoryed.

● -J1

- Option -J1 units, the Input and Output connector is VH connectors (Mfr. J.S.T.).

● -R (PMA60F, PMA100F)

- You can control output ON/OFF remotely in Option -R units. To do so, connect an external DC power supply and apply a voltage to a remote ON/OFF connector, which is available as option.

Model Name	Built-in Resistor Ri [Ω]	Voltage between RC (+) and RC (-) [V]		Input Current [mA]
		Output ON	Output OFF	
PMA60F PMA100F	780	4.5 - 12.5	0 - 0.5	(20max)

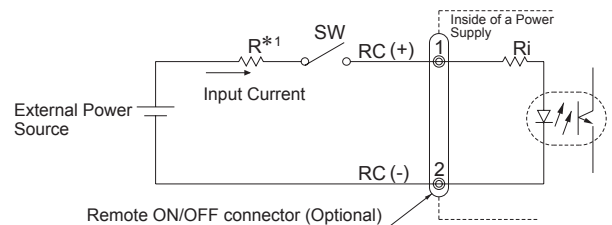


Fig.4.3 Example of using a remote ON/OFF circuit

- Dedicated harnesses are available for your purchase. Please see Optional Parts for details.

*1 If the output of an external power supply is within the range of 4.5 - 12.5V, you do not need a current limiting resistor R. If the output exceeds 12.5V, however, please connect the current limiting resistor R.

To calculate a current limiting resistance value, please use the following equation.

$$R[\Omega] = \frac{V_{CC} - (1.1 + R_i \times 0.005)}{0.005}$$

*Please wire carefully. If you wire wrongly, the internal components of a unit may be damaged.

■ Remote ON/OFF circuits (RC+ and RC-) are isolated from input, output and FG.

4.2 Others

■ While turning on the electricity, and for a while after turning off, please don't touch the inside of a power supply because there are some hot parts in that.

● PMA15F, PMA30F

■ When a mass capacitor is connected with the output terminal (load side), the output might become the stop or an unstable operation. Please contact us for details when you connect the capacitor.



World wide



Safety Approvals



EMI



Inrush current limiting



OCP



OVP



Parallel Operation



Power Factor Correction

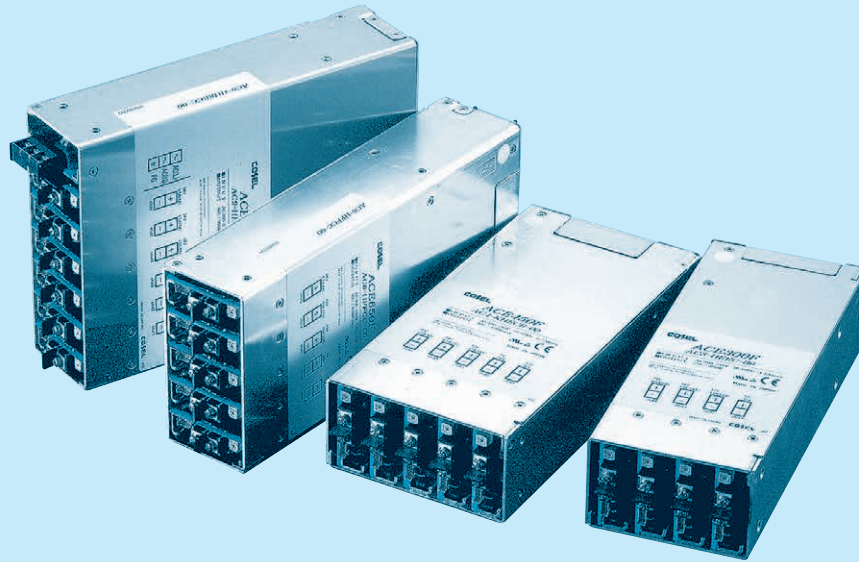


Remote ON/OFF



Modular

ACE-series (-H : Medical)



ACE-H option is a configurable type power supply for medical use.
For more details, please refer to the specifications of ACE series.

Feature

Flexible modular system architecture provides various output configuration
Harmonic attenuator (Complies with IEC61000-3-2)
Universal input (AC85 - 264V)
Remote ON/OFF control, alarm

Safety agency approvals

UL60950-1, C-UL (CSA60950-1), EN60950-1, EN50178
Complies with DEN-AN
UL60601-1, C-UL (CSA601.1), EN60601-1 approvals (optional)

EMI

Complies with FCC-B, CISPR22-B,
EN55022-B, VCCI-B

3-year warranty

CE marking

Low Voltage Directive

EMS Compliance : EN61204-3, EN61000-6-2

EN61000-4-2
EN61000-4-3
EN61000-4-4
EN61000-4-5
EN61000-4-6
EN61000-4-8
EN61000-4-11

Medical electrical equipment

- ACE-H option is a configurable type power supply for medical use. For more details, please refer to the specifications of ACE series.

1 Type

AC □ - □□□□□ - □□ - H

When units that support use as medical electrical equipment and other options are combined, the end of the type name is as follows.

AC □ - □□□□□ - □□ - H ○ △

*○, △ :other options

Refer to instruction manual 5. for Option.

Example of use in conjunction with option -K model (reduced fan speed).

AC □ - □□□□□ - □□ - HK

*Options that cannot be used in conjunction with this are as follows:

C : coating

E : low leakage current

*Option -H is a low leakage current specification product.

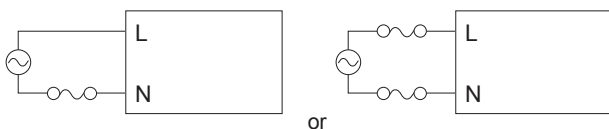
Refer to section 2 for details.

2 Specification

- Safety : UL60601-1 (CSA601.1), EN60601-1
- Isolation : 4,000 VAC input-output, RC, AUX 1min.
cutoff current 10mA
- leakage current : 0.3mA max (100 VAC), 0.5mA max (230 VAC)
*0.1mA max. is also possible.
- conducted noise : complies with FCC-A, VCCI-A, CISPR22-A,
EN55022-A
- Supported modules
All modules except S, T, and U modules with "output module specification."Please note that there is no support for modules S, T, and U.
- Ripple noise
Ripple noise is 1.5 times that of standard models.

3 Others

- If applying for medical equipment agency approval, use fuses or breakers that comply with applicable safety regulations on input terminals.



FUSE ACE300F 250 VAC8A ACE450F 250 VAC10A
ACE650F 250 VAC15A ACE900F 250 VAC20A

Fig.3.1 Connecting FUSE

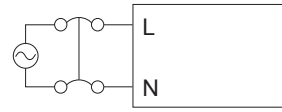
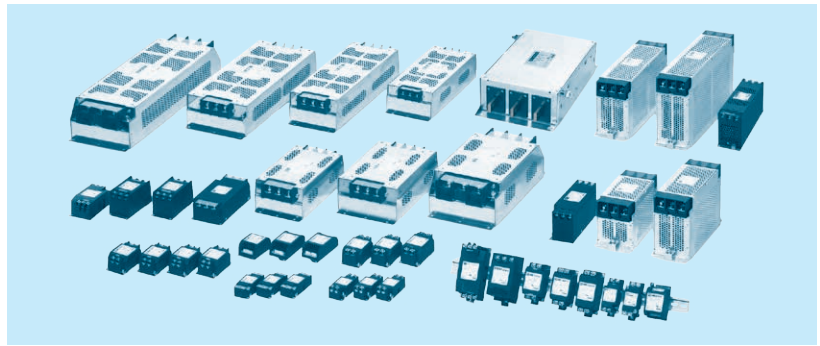


Fig. 3.2 Connecting circuit breaker

EMI/EMC Filter

5-year
Warranty



Contents

■ Single phase type



RoHS

	Rated voltage	Series	Rated current [A]							Leakage current* AC250V 60Hz	Released year	Main feature
			3	4	6	10	16	20	30			
1-stage	AC250V	EAC	●	—	●	●	●	●	●	150μA-1.0mA max	'10	Small, attenuation (150kHz-1MHz), DIN rail installation (Optional)
	AC250V	EAM	●	—	●	●	●	●	●	10μA-100μA max	'10	Small, Low leakage current, DIN rail installation (Optional)
	AC250V	EAP	●	—	●	●	●	●	●	10μA-1.0mA max	'10	Small, High-voltage pulses attenuation, DIN rail installation (Optional)
	AC250V	ESC	●	—	●	●	●	—	—	150μA-1.0mA max	'10	Small, attenuation (150kHz-1MHz), Screwless terminal type, DIN rail installation (Optional)
	AC250V	ESM	●	—	●	●	●	—	—	10μA-100μA max	'10	Small, Low leakage current, Screwless terminal type, DIN rail installation (Optional)
	AC250V	ESP	●	—	●	●	●	—	—	10μA-1.0mA max	'10	Small, High-voltage pulses attenuation, Screwless terminal type, DIN rail installation (Optional)
	AC250V	NAC	—	●	●	●	●	●	●	150μA-1.0mA max	'05	General-purpose High-attenuation (150kHz-1MHz), DIN rail installation (Optional)
	AC250V	NAM	—	●	●	●	●	●	●	10μA-100μA max	'05	Low leakage current, DIN rail installation (Optional)
	AC250V	NAH	—	—	●	●	●	●	●	10μA-1.0mA max	'05	Ultra high-attenuation (10kHz-1MHz), DIN rail installation (Optional)
	AC250V	NAP	—	●	●	●	●	●	●	10μA-1.0mA max	'05	High-voltage pulses high-attenuation, DIN rail installation (Optional)
2-stage	AC250V	NBH	—	—	●	●	●	●	●	10μA-1.0mA max	'07	Ultra high-attenuation and broadband (10kHz-10MHz), DIN rail installation (Optional)
	AC250V	NBC	—	—	●	●	●	●	●	150μA-1.0mA max	'07	High-attenuation (150kHz-1MHz), DIN rail installation (Optional)
	AC250V	NBM	—	—	●	●	●	●	●	10μA-100μA max	'07	Low leakage current, Withstand voltage 4KVAC, DIN rail installation (Optional)

* Selectable leakage current value

■ Three phase type



RoHS

	Rated voltage	Series	Rated current [A]																Leakage current AC250/500V 60Hz	Released year	Main feature
			4	6	10	20	30	40	50	60	80	100	125	150	200	250	300	400	600		
1-stage	AC500V	JAC	—	●	●	●	—	—	—	—	—	—	—	—	—	—	—	—	0.5-2.5/1.0-5.0mA max *	NEW '14	Compact and low profile General-purpose High-attenuation (150kHz-1MHz), Ultra high-attenuation (optional), DIN rail installation (Optional)
	AC500V	TAC	●	●	●	●	—	—	—	—	—	—	—	—	—	—	—	—	2.5/5.0mA max	'05	General-purpose High-attenuation (150kHz-1MHz), DIN rail installation (Optional)
	AC500V	TAH	●	●	●	●	—	—	—	—	—	—	—	—	—	—	—	—	2.5/5.0mA max	'05	Ultra high-attenuation (10kHz-1MHz), DIN rail installation (Optional)
	AC500V	TAC	—	—	—	—	—	●	●	●	●	—	—	—	—	—	—	—	1.0-3.5/2.0-7.0mA max *	'08	General-purpose High-attenuation (150kHz-1MHz), Input voltage range 528VAC max
	AC500V	TAH	—	—	—	—	—	●	●	●	●	—	—	—	—	—	—	—	1.0-3.5/2.0-7.0mA max *	NEW '16	Ultra high-attenuation (10kHz-1MHz), Input voltage range 528VAC max
	AC500V	TAC	—	—	—	—	—	—	—	—	—	—	—	—	●	●	●	—	1.0-3.5/2.0-7.0mA max *	'09	General-purpose High-attenuation (150kHz-1MHz), Input voltage range 528VAC max
	AC500V	FTA	—	—	—	—	—	●	●	●	—	—	—	—	—	—	—	—	1.0-3.5/2.0-7.0mA max * (It excludes it for Europe)	'13	General-purpose High-attenuation (150kHz-1MHz), For Europe high-attenuation, Ultra high-attenuation (Optional) With switch of line to ground capacitor (Optional)
	AC500V	FTA	—	—	—	—	—	—	—	—	●	●	●	—	—	—	—	—	1.0-3.5/2.0-7.0mA max * (It excludes it for Europe)	'11	General-purpose High-attenuation (150kHz-1MHz), For Europe high-attenuation, Ultra high-attenuation (Optional)
2-stage	AC500V	TBC	—	—	—	—	—	—	—	—	—	—	—	—	—	●	●	●	—	'08	High-attenuation (150kHz-1MHz), Input voltage range 528VAC max
	AC500V	TBC	—	—	—	—	—	—	—	—	—	—	—	—	—	●	●	●	—	'09	High-attenuation (150kHz-1MHz), Input voltage range 528VAC max
	AC500V	FTB	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.0-12.0/2.0-24.0mA max * (It excludes it for Europe)	'11	High-attenuation (150kHz-1MHz), Ultra high-attenuation (Optional)
	AC500V	FSB	—	—	●	●	—	—	—	—	—	—	—	—	—	—	—	—	1.0-12.0/2.0-24.0mA max * (It excludes it for Europe)	NEW '16	EMI/EMC Filter for motor drive system. Improve saturation resistance.
multi-stage	AC500V	TSC	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	●	20mA/40mA max (Y-connection)	'13	Ultra high attenuation for star connection with neutral earthing, Input voltage range 528VAC max

* Selectable leakage current value

■ DC type



RoHS

	Rated voltage	Series	Rated current [A]				Line to ground capacitor	Released year	Main feature
			1	3	6	10			
1-stage	DC±50V	SNA	●	●	●	—	Capacitor existence selection	'05	Ripple noise attenuation for switch mode power supplies (±Vin), DIN rail installation (Optional)
	DC50V	SNR	—	—	—	●	Capacitor existence selection	'07	Ripple noise attenuation for switch mode power supplies (+Vin), Peak load, DIN rail installation (Optional)

EMI/EMC Filter Selection Guide

Three phase EMI/EMC Filter

		Rated current		4A	6A	10A	20A	30A
<div> </div>	<div> </div>	RoHS						
		JAC Series						
		1-stage filter						
		Compact and low profile						
		General-purpose						
		Push down type terminal block						
<div> </div>	<div> </div>	TAC Series						
		1-stage filter						
		General-purpose						
		Push down type terminal block						
		Selectable leakage current specification						
		TAC/TAH Series for 30A or less						
<div> </div>	<div> </div>	TAC Series						
		1-stage filter						
		General-purpose						
		Push down type terminal block						
		Selectable leakage current specification						
		TAC/TAH Series for 50A or more						
<div> </div>	<div> </div>	TAH Series						
		1-stage filter						
		General-purpose						
		Push down type terminal block						
		Selectable leakage current specification						
		TAC/TAH Series for 50A or more						
<div> </div>	<div> </div>	TBC Series						
		2-stage filter						
		High-attenuation						
		Push down type terminal block						
		Selectable leakage current specification						
		TAC/TAH Series for 50A or more						
<div> </div>	<div> </div>	FTA Series						
		1-stage filter						
		General-purpose						
		Push down type terminal block						
		Selectable leakage current specification						
		TAC/TAH Series for 50A or more						
<div> </div>	<div> </div>	FTB Series						
		2-stage filter						
		High-attenuation						
		Push down type terminal block						
		Selectable leakage current specification						
		TAC/TAH Series for 50A or more						
<div> </div>	<div> </div>	FSB Series						
		2-stage filter						
		Saturation resistance type						
		Push down type terminal block						
		Selectable leakage current specification						
		TAC/TAH Series for 50A or more						
<div> </div>	<div> </div>	JAC Series						
		1-stage filter						
		General-purpose						
		Push down type terminal block						
		Selectable leakage current specification						
		TAC/TAH Series for 50A or more						
<div> </div>	<div> </div>	TAC Series						
		1-stage filter						
		General-purpose						
		Push down type terminal block						
		Selectable leakage current specification						
		TAC/TAH Series for 50A or more						
<div> </div>	<div> </div>	TAH Series						
		1-stage filter						
		General-purpose						
		Push down type terminal block						
		Selectable leakage current specification						
		TAC/TAH Series for 50A or more						
<div> </div>	<div> </div>	TBC Series						
		2-stage filter						
		High-attenuation						
		Push down type terminal block						
		Selectable leakage current specification						
		TAC/TAH Series for 50A or more						
<div> </div>	<div> </div>	FTA Series						
		1-stage filter						
		General-purpose						
		Push down type terminal block						
		Selectable leakage current specification						
		TAC/TAH Series for 50A or more						
<div> </div>	<div> </div>	FTB Series						
		2-stage filter						
		High-attenuation						
		Push down type terminal block						
		Selectable leakage current specification						
		TAC/TAH Series for 50A or more						
<div> </div>	<div> </div>	FSB Series						
		2-stage filter						
		Saturation resistance type						
		Push down type terminal block						
		Selectable leakage current specification						
		TAC/TAH Series for 50A or more						
<div> </div>	<div> </div>	JAC Series						
		1-stage filter						
		General-purpose						
		Push down type terminal block						
		Selectable leakage current specification						
		TAC/TAH Series for 50A or more						
<div> </div>	<div> </div>	TAC Series						
		1-stage filter						
		General-purpose						
		Push down type terminal block						
		Selectable leakage current specification						
		TAC/TAH Series for 50A or more						
<div> </div>	<div> </div>	TAH Series						
		1-stage filter						
		General-purpose						
		Push down type terminal block						
		Selectable leakage current specification						
		TAC/TAH Series for 50A or more						
<div> </div>	<div> </div>	TBC Series						
		2-stage filter						
		High-attenuation						

40A 50A 60A

80A 100A 125A

150A

200A 250A 300A

400A 600A

TAC Series

50A 60A

**TAC Series**

80A 100A

**TAC Series**

150A

**TAC Series**

200A to 300A



High attenuation for
Low frequency range
(150kHz to 1MHz)

1-stage filter

Option(-U)
Improve differential
mode attenuation
TAC/TAH Series
for 50A or more

TAH Series

50A 60A



NEW

TAH Series

80A 100A



NEW

TAH Series

150A



NEW

Ultra high attenuation broadband
(10kHz to 1MHz)

TBC Series

50A 60A

**TBC Series**

80A 100A

**TBC Series**

150A

**TBC Series**

200A to 300A



Ultra high attenuation for
Low frequency range
(150kHz to 1MHz)

2-stage filter

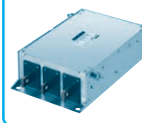
RoHS

TSC Series

multi-stage filter

TSC Series

400A 600A



Ultra high attenuation
for star connection with
neutral earthing

High attenuation for
Low frequency range
(150kHz to 1MHz)

FTA Series

40A 50A 60A

**FTA Series**

80A 100A 125A

**FTA Series**

150A



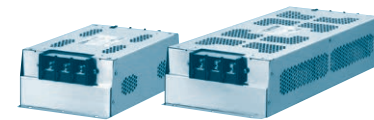
Ultra high attenuation for
Low frequency range
(150kHz to 1MHz)

FTB Series

80A 100A

**FTB Series**

150A



Low-profile

Book type

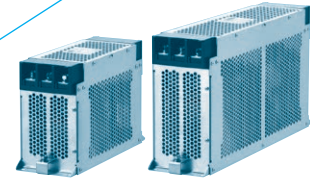
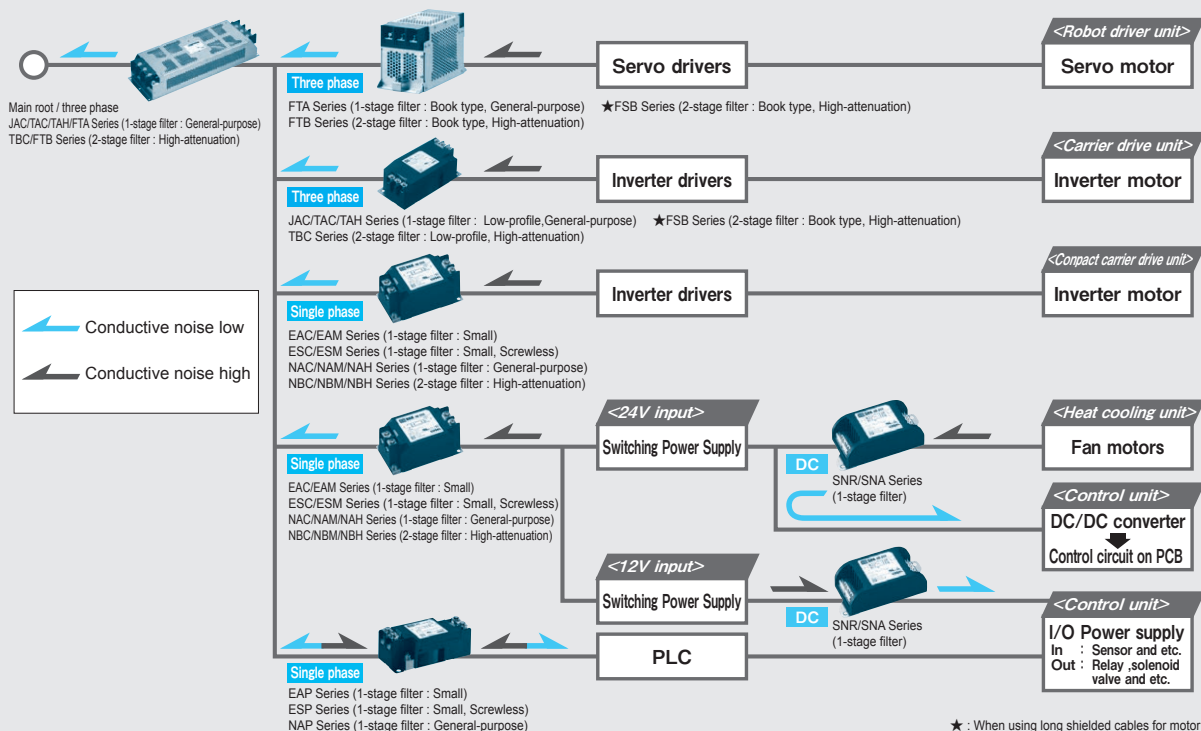


Diagram of Sample application



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- 1 Source Voltages in the World

1 Noise Basics

1 What Is Noise?

Noises refers to unwanted variations or fluctuations in voltage, current, signals, etc.

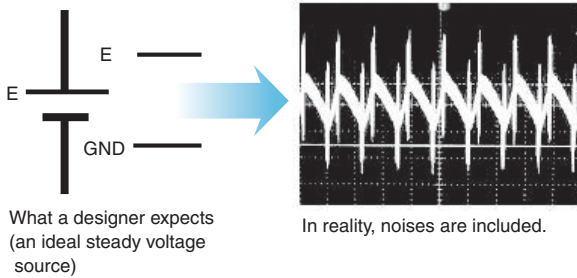


Figure 1.1.1 What Is Noise?

2 Noise Sources

Noise comes in two types: natural noise and manmade noise. While natural noises are generated by a lightning strike or static electricity, manmade noises are generated by familiar devices such as industrial equipment, fluorescent bulbs, or communication equipment.

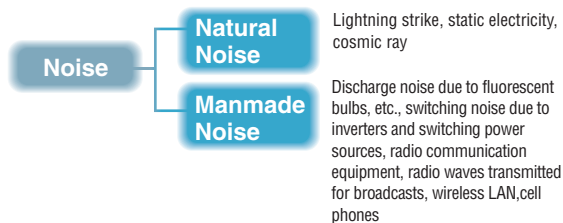


Figure 1.2.1 Noise Sources

Typical devices that generate noise are switching power sources and general-purpose inverters. Such devices include switching elements such as FETs and IGBTs, and are major noise sources due to high-frequency switching of those elements.

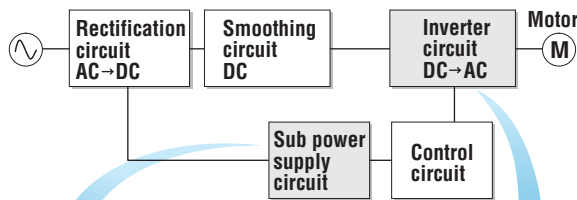


Figure 1.2.2 Inverter block diagram

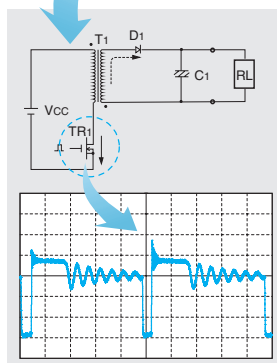


Figure 1.2.3 Sub power supply inverter operation waveform

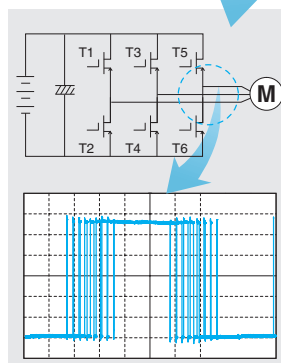


Figure 1.2.4 Inverter PWM output waveform

3 What Is EMC?

EMC stands for electromagnetic compatibility, and refers to the ability of electrical equipment to have both EMI and EMS at once; the former indicates the ability to suppress noise radiated from the equipment itself and the latter means the ability to endure noise from other equipment.

What are EMC compliant products?

The EMC compliant products refer to those that meet standards required by EMI and EMS.

They provide various types of parts that can deal with noise from the viewpoint of EMI and/or EMS.

Our noise filters (hereinafter, "EMI filters") are parts that mainly deal with conducted interference in terms of EMI.

$$\text{EMC} = \text{EMI} + \text{EMS}$$

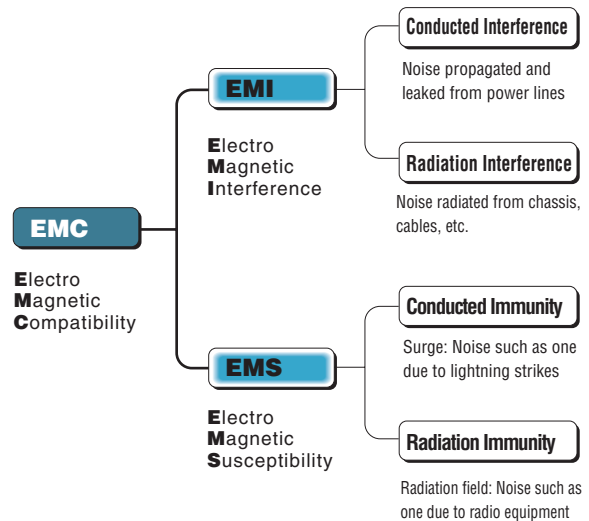


Figure 1.3.1 Concept of EMC

4 Propagation Paths of Noise

a. Conductive noise

Refers to noise that propagates through a power line or PCB tracing.

b. Inductive noise

Refers to noise that is induced due to electromagnetic or electrostatic induction caused by a power line or a signal line of a peripheral device when it is placed near a line or pattern in which noise current flows and propagates through the line.

c. Radiated noise

Noise radiated by an antenna (or a line be having as an antenna) that propagates to other devices through the air.

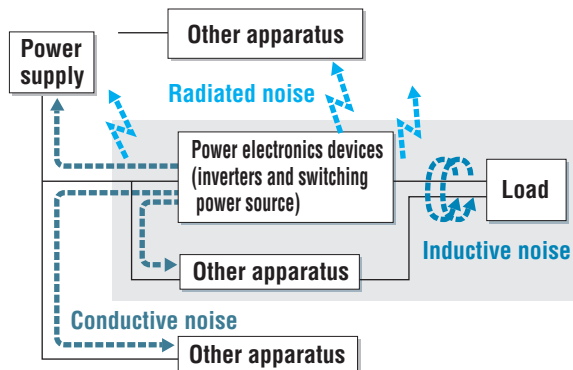


Figure 1.4.1 Propagation Paths of Noise

5 Basics of Noise Reduction

The propagation of noise consists of a noise source, an entity that is affected by the noise, and propagation path that connects both. To reduce noise:

- ◎ Reduce the noise level of a noise source
- ◎ Make it more difficult for noise to propagate
- ◎ Make equipment less vulnerable to noise

In addition to the above, designs must consider standards, quality and cost of noise reduction methods.

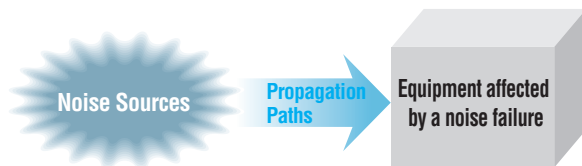


Figure 1.5.1 Overview of Noise Generation and Propagation Path

6 Types of Conductive Noise

Noise is divided into two types based on its generation mode: normal mode noise and common mode noise. Normal mode noise is also called differential mode noise, and refers to noise generated between power lines. Common mode noise refers to noise generated between a power line and ground line.

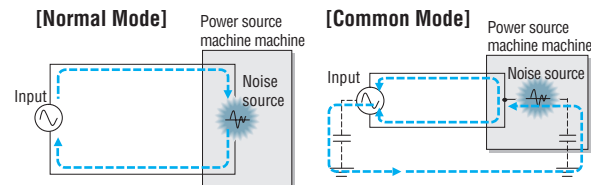
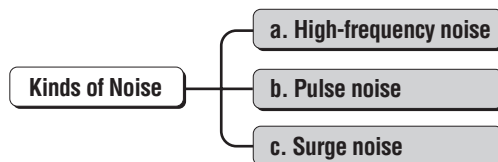


Figure 1.6.1 Noise Generation Paths
(Example in which a noise source is within power equipment)

7 Types of and Countermeasures for Noise



a. High-frequency noise

Also called EMI noise or power supply noise and refers to high-frequency components such as the clock frequency of a computer and switching frequency of power sources. As an antinoise measure, an EMI filter should be installed on the input side. An appropriate filter should be selected based on requirements such as attenuation, mechanical design and cost.

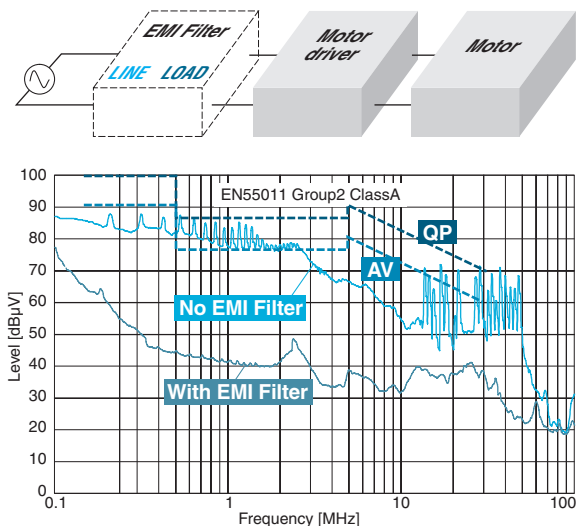


Figure 1.7.1 Example of Noise Reduction by an EMI Filter

1 Noise Basics

Output ripple noise from a switching power source is also a type of high-frequency noise.

Ripple noise can be reduced with a DC filter designed for it.

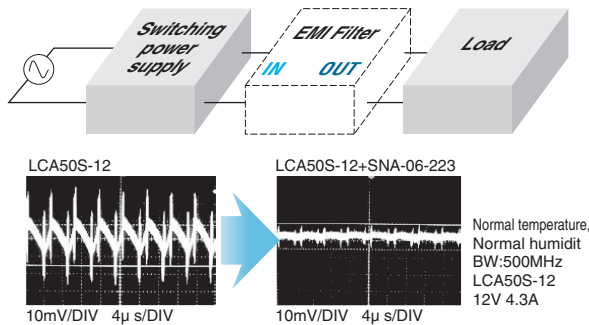


Figure 1.7.2 Example of Effectiveness of Ripple Noise Filter

b. Pulse noise

This noise is generated when a relay or motor is driven. As peak voltage may reach as high as a few thousand volts, generic filters may not be able to sufficiently attenuate noise because its choke coil gets saturated. As an antinoise measure, one could select a filter that uses an amorphous core for its superior pulse attenuation characteristic.

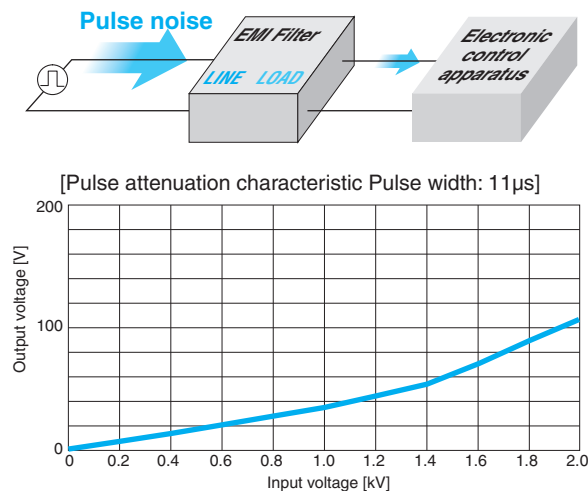


Figure 1.7.3 Example of Pulse Attenuation Characteristic(NAP-16-472)

c. Surge noise

This noise occurs when a natural discharge (such as lightning) affects a power line. As the generated voltage reaches as extremely high as a few kilovolts or more, EMI filters cannot suppress surge noise. As an antinoise measure, one could use a part such as a varistor to control surge voltage between power lines or between a power line and ground. EMI filters can withstand approximately 2 kV between power lines and approximately 4 kV between a power line and ground (these values are not guaranteed).

If surges are a concern, surge countermeasures should be selected and installed to handle the EMI filter's capabilities.

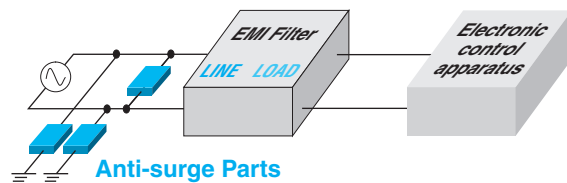


Figure 1.7.4 Proper Installation Location of surge Countermeasures

2 Selection of EMI Filters

1 Rated Voltage

The rated voltage is the maximum line voltage (nominal value) allowable to be used.

As the rated voltages for some parts used within an EMI filter are high in reality, however, voltages higher than the rated voltage of the EMI filter may be used without causing any trouble.

In fact, the rated voltages of filter components are often higher, in which case the filter can handle actual voltages that exceed its ratings.

In the case of some EMI filters, the maximum operation voltages are defined by specifications for them, separately from rated voltages.

Note that using EMI filters at voltages lower than their rated voltages do not pose any problems. For example, an EMI filter with a rated voltage of AC 250 V can be used for power lines of AC 100V.

As for line frequency, EMI filters for AC power supply lines have been basically designed to be used with the commercial frequency (50 Hz/60 Hz).

Higher frequencies such as 400Hz can cause problems such as excessive capacitor heating.

Note that EMI filters for AC power lines can also be used for DC power supply lines.

2 Rated Current

The rated current is the maximum load current (nominal value) that can be continuously carried. If the ambient temperature is high, however, the load current needs to be derated.

Figure 2.2.1 shows an example of a derating characteristic.

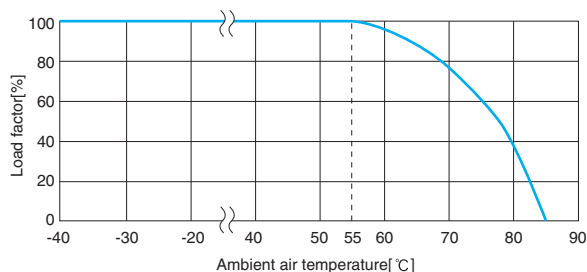


Figure 2.2.1 Derating Curve

This example indicates that when the maximum ambient temperature reaches 75, the EMI filter should be used with a load factor of approximately 60% (approximately 60% of the rated current) or lower.

Current higher than the rated current would be allowed to flow in EMI filters for a short period of time only. Inrush current (Up to 40A or 10 times the rated current, single shots with a length of a few milliseconds) from devices such as a general switching power source does not cause any problems, but relatively long and / or repetitive peak current draws can result in the average current exceeding the filter's rating.

3 Test Voltage (Withstand Voltage)

The test voltage is a voltage value that is applied at the time of withstand voltage test. The withstand voltage test is to verify that the part does not break when applying a high voltage in a short period of time between a terminal (line) and the mounting plate (ground) of an EMI filter.

In the case of EMI filters for AC power lines, the test voltage is generally AC 2000 V or AC 2500 V.

In withstand voltage tests, the high voltage applied between a line and ground, results in abnormally high leakage current flow. When carrying out a withstand voltage test in an acceptance inspection, please set the cutoff current of withstand voltage test equipment to an appropriate value (the cutoff current defined in the specifications for the EMI filter).

For some EMI filters that have ground capacitors with extremely large capacity, DC voltages may be used for test voltages because the leakage current becomes too high when AC voltages are applied.

4 Insulation Resistance (Isolation Resistance)

Insulation resistance is a resistance value when applying a specified DC voltage (normally 500 V) between isolated conductors such as a terminal (line) and the mounting plate (ground), and regarded as one indicator of degree of insulation.

The insulation resistance is found by measuring the very small current that flows in an insulating material such as a resin case and capacitor when DC voltage is applied.

5 Leakage Current

The leakage current is an electric current that flows from the ground terminal of an EMI filter when the filter is connected to an AC power line.

Generally, as one sets the capacitance of a ground capacitor to a higher value, the reduction effect on common mode noise will be heightened and at the same time, the leakage current will increase.

Care must be taken, because large leakage current could cause a circuit breaker to trip or electric shock to occur when the EMI filter is not properly grounded.

Current (I) that flows from each power line to ground is represented with the following expression; it forms the basis of leakage current calculation.

$$I = 2 \pi f C E$$

f : Power frequency
C : Capacitance between line and ground
E : Power supply voltage between line and ground

2 Selection of EMI Filters

6 DC Resistance

DC resistance is a resistance value between the input and output of an EMI filter (the sum of resistance values for both directions).

It is mostly accounted for with the coil resistances but also includes connections between the coils and terminals.

The voltage drop caused by an EMI filter is represented with the following expression:

$$\text{Voltage drop} = \text{DC resistance} \times \text{Load current}$$

Note that specifications for some products define voltage drops when rated current is carried, instead of resistance values.

7 Temperature/Humidity

a. Operating temperature

This is the range of ambient temperatures for which the product's usage is guaranteed.

If an ambient temperature is high, the load current needs to be derated.

b. Operating humidity

This is the range of ambient humidities for which the product's usage is guaranteed.

It assumes no condensation.

c. Storage temperature and humidity

The specified ranges of ambient temperatures and humidities that EMI filters in an unenergized state can be stored without deteriorating performance. No condensation is assumed for the storage humidity.

8 Circuitry

The following represents examples of EMI filter circuit structures.

a. Single-phase 1-stage filter

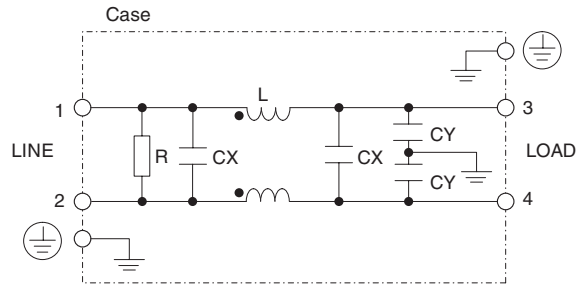


Figure 2.8.1 Circuit Structure Example of a Single-phase 1-stage EMI Filter

This figure shows a standard circuit structure for single-phase EMI filters.

L and CYs reduce the common mode noise; CXs and leakage inductance from L reduce the normal mode noise.

R indicates a discharge resistance for capacitors.

b. Single-phase 2-stage EMI filter

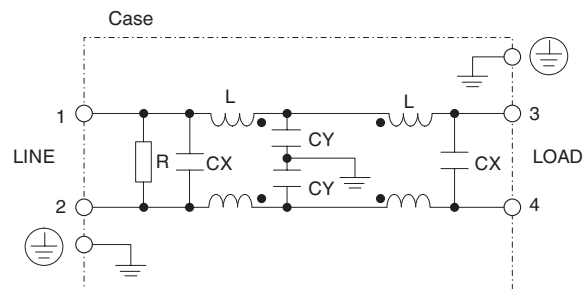


Figure 2.8.2 Circuit Structure Example of a Single-phase 2-stage EMI filter

The above figure represents a circuit structure example of placing choke coils in two stages to improve the attenuation characteristic.

The following graph shows an example comparison of attenuation characteristics for a 1-stage and 2-stage EMI filter.

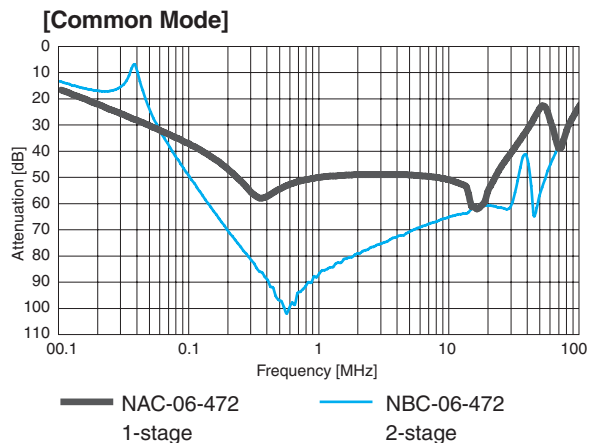


Figure 2.8.3 Example of Comparing Attenuation Characteristics between 1-stage and 2-stage EMI filters.

2 Selection of EMI Filters

9 Safety Standards

a. General description of safety standards

The international standards consist of IEC standards which concern the electrical fields, and ISO standards which concern the non-electrical fields.

IEC

(International Electrotechnical Commission)

Standardization organization for standards related to the electrical fields; its headquarters is located in Switzerland.

It releases technical standards for electricity based on the latest sciences and technologies, and each country develops its own specific safety standards based on the corresponding IEC standards.

CISPR

(Comite International Special des

Perturbations Radioelectriques

=International Special Committee

on Radio Interference)

One of IEC's special committees; it was established with the aim to integrate standards such as allowable values and measurement methods for interfering waves causing radio communication failures, and includes a standardization committee for EMC (Electro Magnetic Compatibility).

European Standard / EN Standard





(Europäische Norm=European Standard)


The EN Standard was created based on the IEC and CISPR standards, and consists of items almost similar to those in both standards.

A unique number is assigned to each standard.

(Example: IEC939 EN60939)

[An example of Certification Authorities in Europe based on EN Standard]

VDE	Germany	
TUV	Germany	
DEMKO	Denmark	
SEMKO	Sweden	

EN Standard: **EN** **55** 

Europe standard sign

Sequence number

Standard classification number

Standard classification number	Reference standards
EN50000 series	General European standards
EN55000 series	CISPR standards
EN60000 series	IEC standards

ENEC



(European Norm Electrical Certification)

The safety approval mark in Europe that enables products to smoothly be delivered among all the EU signatories, EFTA (European Free Trade Area), and East European countries.

Electronic products that are authorized to bear the ENEC mark do not need to be subjected to application procedures among the signatories. It provides a benefit of eliminating the need to obtain approval from each signatory to which they are distributed. The ENEC mark is intended to apply to products such as lighting equipment, transformers, information processing equipment, switches and EMI filters.

★ EU signatories... Germany, UK, Italy, Denmark, and 24 other countries

★ EFTA... Iceland, Norway, Switzerland, and Lichtenstein

★ East European... Ukraine, Estonia, Belorussia, countries Moldova, Latvia, and Lithuania

North America

UL (Underwriters Laboratories Inc.)


A test organization established in 1894 by the Electrical Bureau of the National Board of Fire Underwriters. Since then, it has been performing compliance tests on various electric products.

CSA (Canadian Standard Association)

A non-profit standardization organization established in Canada in 1919. Each state law in Canada requires that electric equipment that needs to be connected to a public power source conforms to the CSA standards.

UL	USA	
CSA	Canada	

As the US and Canada have signed MRA (Mutual Recognition Agreement), mutual approval can be obtained. If UL verifies that a certain electric product conforms to the CSA standard, or to the UL and CAS standards, the product is authorized to bear the following approval marks:

CSA	
UL, CSA	

b. Safety standards for EMI filters

Different products may conform to different safety standards and bear different approval marks (for use in different countries). Check the approved safety standards when considering purchasing them.

IEC939	International standard	IEC
EN60939	EU	EN
UL1283	USA	UL
C22.2 No.8	Canada	CSA

c. CCC approval from China

EMI filters do not fall within the scope of CCC. (as of November 2011)

2 Selection of EMI Filters

10 Attenuation Characteristic (Static Characteristic)

Attenuation characteristic provides a rough indication of noise reduction effect. The graph is derived from plotting an attenuation characteristic when connecting a EMI filter to a specified measurement circuit with frequency on the horizontal axis and with attenuation on the vertical axis.

The measurement methods are shown in Figure 2.10.1 and Figure 2.10.2. The attenuation is given as the ratio of U_{01} to U_{02} , where U_{01} is output when EMI filters are not in the measured circuit and U_{02} is when an EMI filter is in the circuit, and normally expressed with the logarithm of that ratio in [dB].

$$\text{Attenuation} = 20\text{Log}_{10} (U_{01}/U_{02}) [\text{dB}]$$

U_{01} : Generated voltage when a EMI filter is not inserted [V]

U_{02} : Generated voltage when a EMI filter is inserted [V]

*An attenuation of 20 [dB] means that the noise level reduces to 1/10 of the one without an EMI filter. Similarly, 40 [dB] and 60 [dB] mean a 1/100 and 1/1000 reduction of the noise level, respectively.

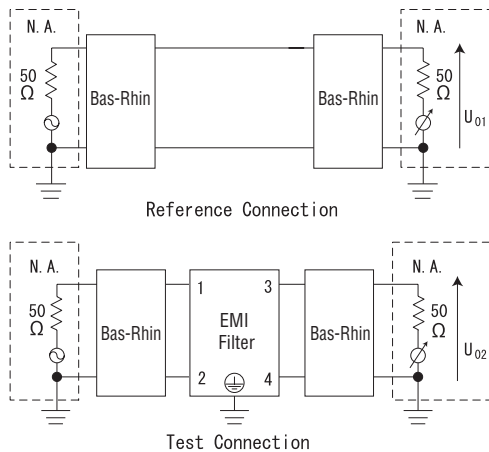


Figure 2.10.1 Attenuation Characteristic Measurement Method (Single-phase Normal Mode)

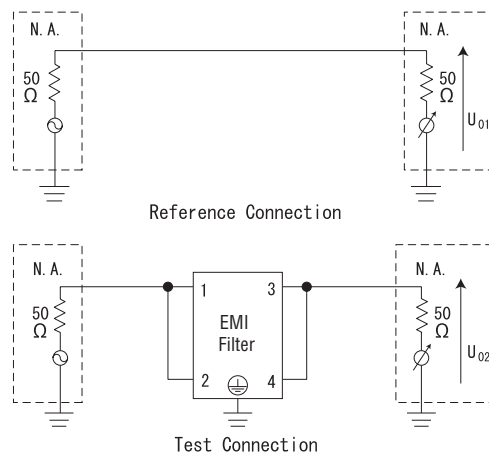


Figure 2.10.2 Attenuation Characteristic Measurement Method (Single-phase Common Mode)

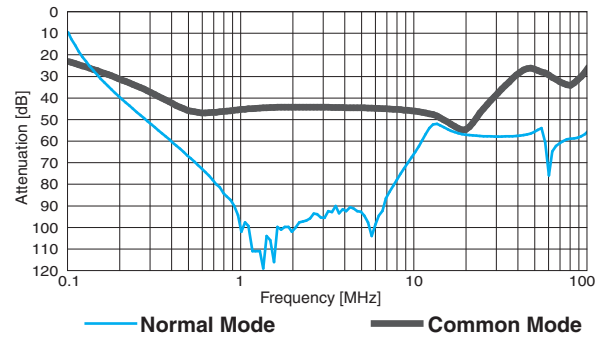


Figure 2.10.3 Example of Attenuation Characteristic (NAC-16-472)

The attenuation characteristic of EMI filters is affected by the input and output impedances of a measured circuit. This attenuation characteristic (static characteristic) is measured under the constant condition of input and output impedances of 50 Ω regardless of measurement frequencies. This enables the attenuation characteristics of different filters to be compared under the same conditions.

However, actual electronic devices have different power line impedances, and impedance itself has its own frequency characteristic and does not take a constant value.

For these reasons, the attenuation characteristics (static characteristics) that are specified in the catalogs for EMI filters do not necessarily coincide with those when they are attached to actual electronic devices.

One must also be careful that when connecting EMI filters in series, the static characteristic of the resultant series is not derived from simply adding the static characteristics [dB] of the individual filters.

11 Pulse Attenuation Characteristic

Figure 2.11.2 represents how much the EMI filter can attenuate pulse common mode noises, which may cause malfunctions of electronic equipment, connected to a power line. Figure 2.11.1 illustrates the measurement method.

When terminating the input and output of the EMI filter with 50 Ω , and applying a specified pulse waveform on the input, pulse voltages appearing on the output are measured and plotted with the horizontal axis representing input pulse voltage and with the vertical axis representing output pulse voltage.

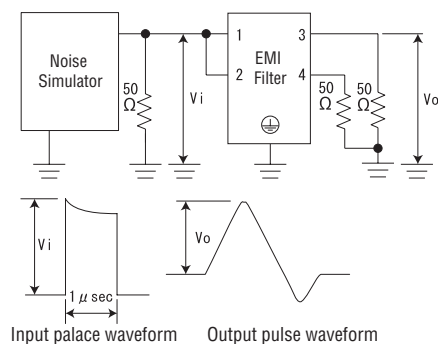


Figure 2.11.1 Measurement Method for Pulse Attenuation Characteristic (Single Phase)

2 Selection of EMI Filters

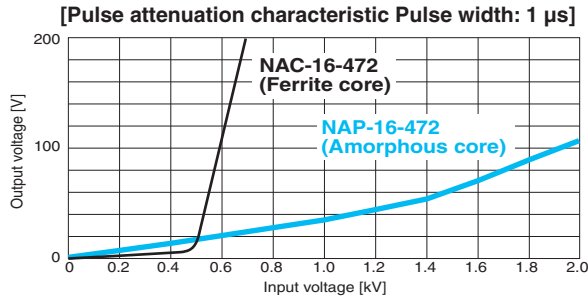


Figure 2.11.2 Example of Comparing Pulse Attenuation Characteristics

Figure 2.11.2 gives an example of comparing pulse attenuation characteristics for an EMI filter using a general ferrite core and one using an amorphous core.

The graph suggests that the amorphous core prevents the voltage of output pulses from increasing quickly in relation to rising input pulse voltage (a good pulse attenuation characteristic).

Beyond a given volt-time product the choke coil of an EMI filter will saturate, resulting in significantly reduced noise suppression. The volt-time product (V·T) that causes the core to reach magnetic saturation is found with the following calculation expression:

$$V \cdot T = \Delta B \cdot N \cdot A_e$$

V : Pulse voltage [V]
T : Pulse width [sec]
 ΔB : Change of core's magnetic flux density = $B_m - B_r$ [T]
 (B_m : Saturation magnetic flux density
 B_r : Residual magnetic flux density)
N : Number of turns in a coil [turns]
A_e: Effective cross section [m²]

According to the expression, an EMI filter using a core that has larger ΔB (for example, an amorphous core) is less vulnerable to magnetic saturation, assuming that the numbers of turns and the sizes of cores are the same.

12 Ground Capacitor Codes

Many EMI filters can support various capacities of ground capacitors by specifying an appropriate code. The selectable ground capacitor codes depend on the types of EMI filters; the following table lists an example of ground capacitor codes and attenuation characteristics.

Table 2.12.1 Example of Ground Capacitor Codes (EAP series)

Code	Leak Current (input 125/250V 60Hz)	Line to ground capacitor (nominal value)
000	5 μ A / 10 μ A max	Not Provided
101	12.5 μ A / 25 μ A max	100pF
221	25 μ A / 50 μ A max	220pF
331	37.5 μ A / 75 μ A max	330pF
471	50 μ A / 100 μ A max	470pF
681	75.5 μ A / 150 μ A max	680pF
102	0.13 mA / 0.25 mA max	1000pF
222	0.25 mA / 0.5 mA max	2200pF
332	0.38 mA / 0.75 mA max	3300pF
472	0.5 mA / 1.0 mA max	4700pF

EAP -10 -472 -☐
Model Name Rated Current Ground Capacitor Codes Option

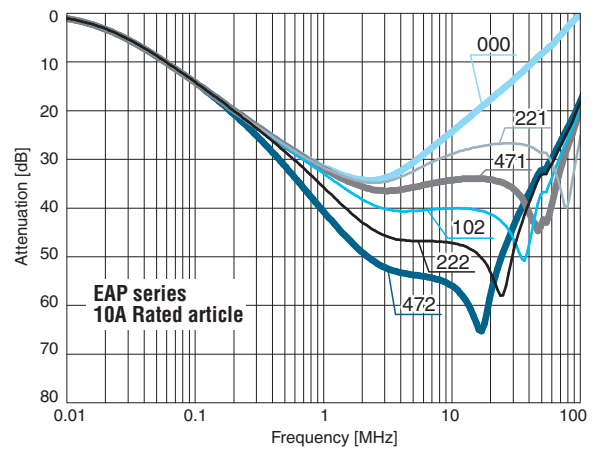


Figure 2.12.1 Example of Ground Capacitor Codes and Common Attenuation Characteristics

Generally, the larger capacity one sets a ground capacitor to, the better the common mode attenuation characteristic. But, the leakage current will also become larger, which means that there is a tradeoff.

The abundant selections of ground capacitor capacities make it possible for one to develop the best balance between attenuation characteristic and leakage current.

13 Options

Our EMI filters can be customized by specifying an option code.

As the types of set options depend on filter products, please refer to our catalog.

The following describes the outline of each option:

a. DIN rail installation type: D

This type of EMI filter can be installed to a DIN rail often used for control consoles, etc.

This option available set for products whose rated current is 30 A or lower (Except FSB series).

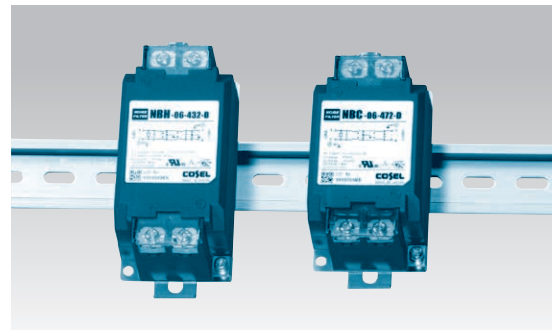


Figure 2.13.1 Examples of DIN Rail Installation Type EMI Filters

Note that as this type of EMI filter may not produce proper noise attenuation with grounding through a DIN rail, one must connect the ground to the protective earth terminal (PE) of the EMI filter. For EMI filters that have two protective earth terminals, it can connect the ground to either one only.

2 Selection of EMI Filters

b. Terminal block type: T

These types of EMI filters use a terminal block as their interface (if the standard product uses a connector).

This option is available for the SNA series (6A rated products) and the SNR series.

[Standard Product]



[Option:T]

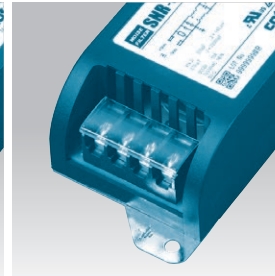


Figure 2.13.2 Comparison between Standard Product and T-option Product

c. High permeability choke coil type

(ultra low-frequency and ultra high attenuation): H

These types of EMI filters the choke coil core with a high permeability core.

These types improve the common mode attenuation characteristic for low frequencies compared to their standard products.

This option is available for the FTA series, FTB series, JAC series and FSB series.

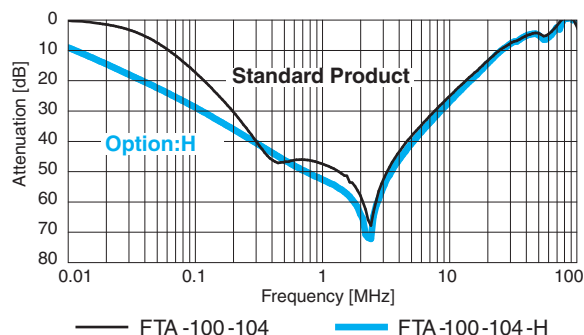


Figure 2.13.3 Example of Comparing Common Mode Attenuation Characteristics between Standard Product and H-option Product

d. Hexagon socket head cap bolt type: S

These types of EMI filters have a hexagon socket head cap (Allen) bolt in their terminal block in instead of the standard bolt (cross recessed (Philips) hexagon head bolt).

Customers can select the desired type of bolt for tools they are using.

This option is available for the FTA series and FTB series.

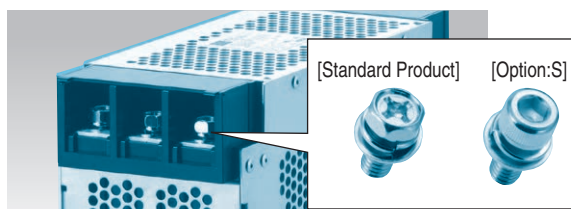


Figure 2.13.4 Comparison between Standard Product and S-option Product

e. With switch of line to ground capacitor type : G

These types of Ultra high attenuation type for EU, With switch of line to ground capacitor.

This option is available for the FTA series.

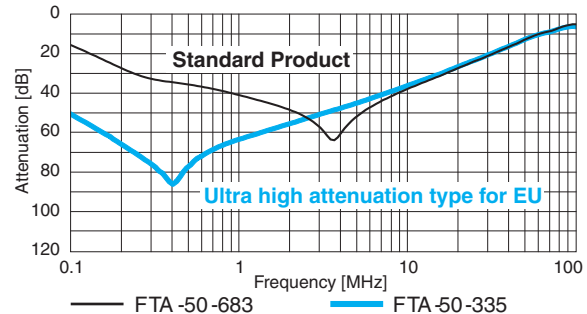


Figure 2.13.5 Example of Comparing Common Mode Attenuation Characteristics between Standard Product and Ultra high attenuation type for EU Product



Figure 2.13.6 With switch of line to ground capacitor type (Customers use when Test Voltage)

f. Improve differential mode attenuation type : U

These types of change the rated voltage 250V.

This option is available for the FTA series, TAC series (50-300A), TAH series (50-150A) and FSB series.

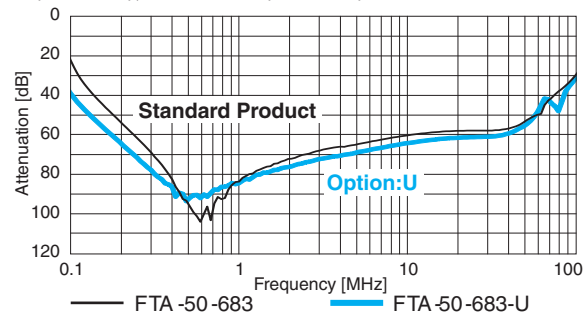


Figure 2.13.7 Example of Comparing differential Mode Attenuation Characteristics between Standard Product and U-option Product

g. Ultra high attenuation type for EU : L

These types of Ultra high attenuation type for EU.

This option is available for the FTB series.

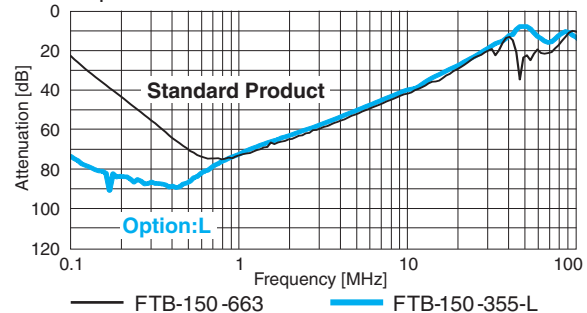


Figure 2.13.8 Example of Comparing Common Mode Attenuation Characteristics between Standard Product and L-option Product

Option code is possible combination.
Please contact us for more information.

3 How to Use EMI Filters

1 Ground Wiring

When wiring an EMI filter with a ground wire, use a wire as thick and short as possible. A long ground wire will deteriorate attenuation of high frequencies due to inductance in the wire.

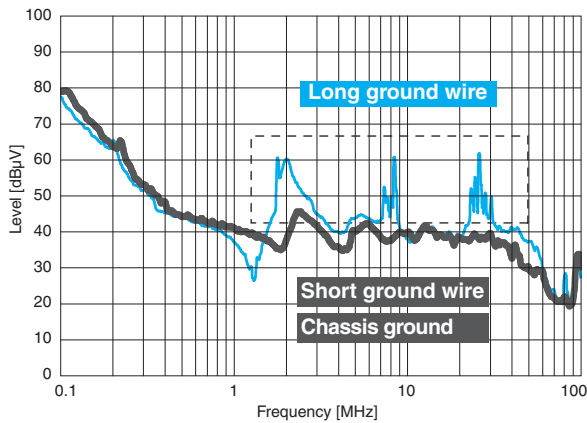


Figure 3.1.1 Example of Ground wiring Effed on Noise

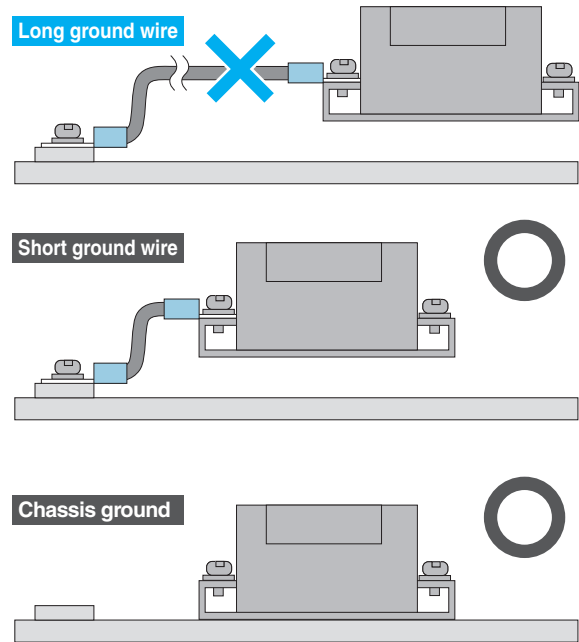


Figure 3.1.2 Proper grounding

If customers connect the metal chassis of their EMI filter, they can obtain an effect similar to a short ground wire.

2 Input and Output Wiring

Separate input wires from output wires. If one binds input and output wires of EMI filters, or lays them close to each other, the filters may lose their proper attenuation effect because the high-frequency noise component may bypass them. Twisting input (and / or output) wires in pairs can reduce noise.

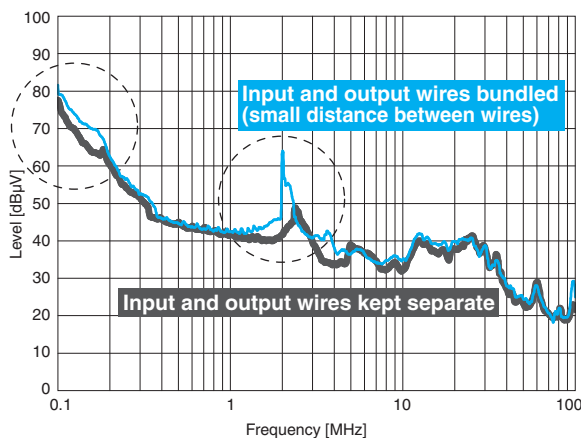


Figure 3.2.1 Example of Effect of wiring on Noise

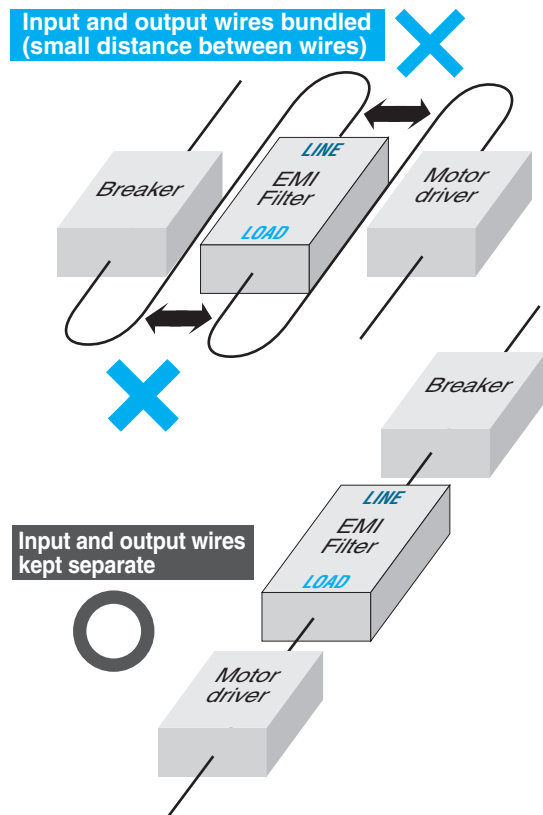


Figure 3.2.2 Input and output wires

4 Noise Reduction

1 Input and Output Impedance and Filter Circuit

The input/output impedances of a noise source and a load will have various optimal filter circuits.

General EMI filters take a configuration of a low pass filter that combines L and C. If the expected attenuation effect can not be obtained, impedances of noise source and load may be the reasons.

Table 4.1.1 Combinations of I/O Impedances and Optimal Filters

	Output impedance (Z_o)	
	High	Low
Input impedance (Z_i)	High	
	Low	

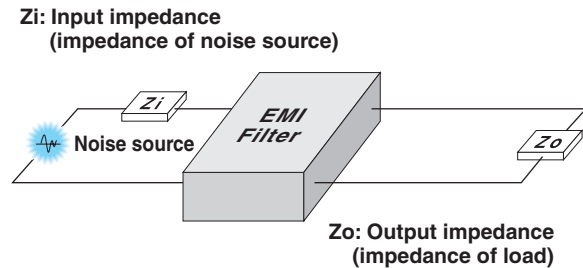


Figure 4.1.1 Input/output Impedances of an EMI Filter Circuit

2 EMI Filter Installation and Orientation

Generally, an EMI filter is placed in a way that the LINE terminal is connected to the input side, but it can also be used in a reverse configuration.

However, it may end up producing a different attenuation effect.

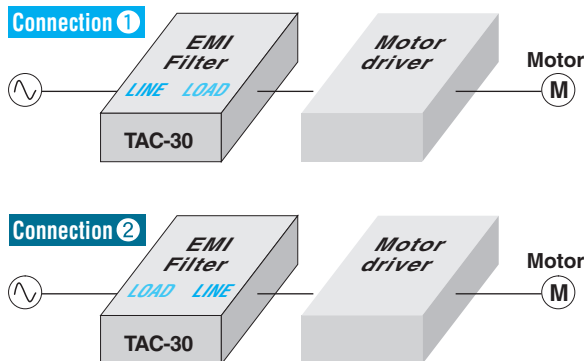


Figure 4.2.1 Direction in which an EMI Filter Is Attached and Connected

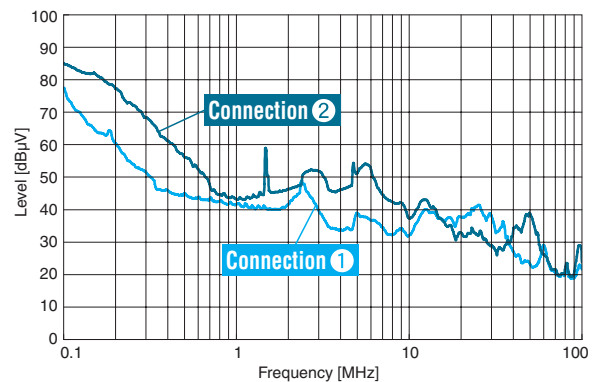


Figure 4.2.2 Example of Effect of Filter Orientation on Noise

If the internal circuit consists of a symmetric EMI filter (one of the NBC series or TBC series), the direction in which the filter is connected will not cause any difference in noise attenuation. But in the case of asymmetric ones, it may cause difference in the attenuation.

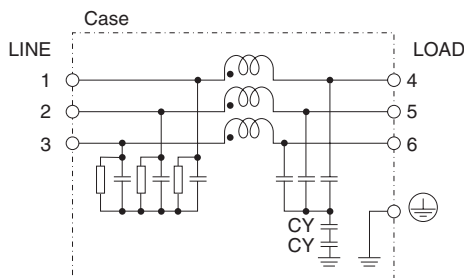


Figure 4.2.3 TAC Series Circuit Diagram (Circuit Is Asymmetric)

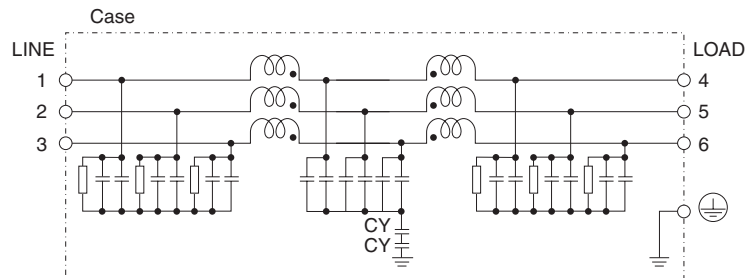


Figure 4.2.4 TBC Series Circuit Diagram (Circuit Is Symmetric)

CY: Line to ground capacitor
: Mounting Plate

3 Combining Multiple EMI Filters

If one EMI filter cannot provide sufficient attenuation, the attenuation effect can be improved by connecting two filters in series. However, one must pay attention to the fact that it will result in combining the leakage current and voltage drop of two EMI filters.

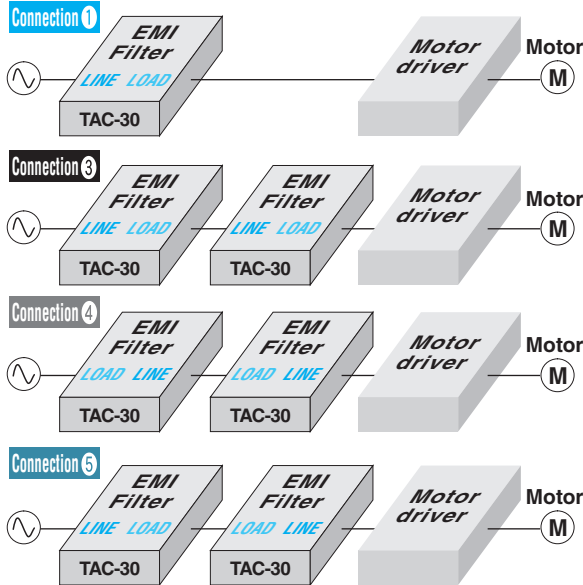


Figure 4.3.1 Example of EMI Filter Connection Directions

When connecting two EMI filters, the direction in which they are connected may also cause difference in the attenuation characteristic. Figure 4.3.3 shows the results of comparing the attenuation characteristics (static characteristics) due to different directions in which two EMI filters are connected.

Figure 4.3.4 shows the actual sample noise characteristics caused by the connection directions.

Unlike the static characteristic data, connection ④ does not improve the attenuation in this case. This phenomenon occurred because the input and output impedances of the EMI filters were different from the conditions of static characteristics.

When trying to optimize the way EMI filters are connected, one must evaluate by checking actual noise levels.

4 External Ferrite Core

If one EMI filter cannot provide sufficient attenuation, the effect can be improved by inserting an external core.

Whether a core is inserted on the LINE side or on the LOAD side of an EMI filter may cause difference in the attenuation characteristic.

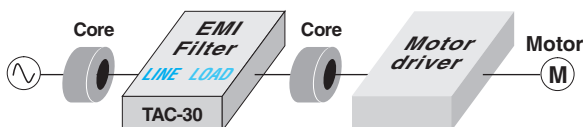


Figure 4.4.1 Example of Placing an External Core

When adding a core on the LINE side, one needs a core that can generate sufficiently large inductance for the choke coil within the EMI filter.

Just inserting on the LINE side a core whose performance is equal to or less than that of the internal choke coil does not contribute to reducing noise.

When inserting it on the LOAD side, it will produce a large attenuation effect because the circuit takes a configuration of a T-type EMI filter circuit.

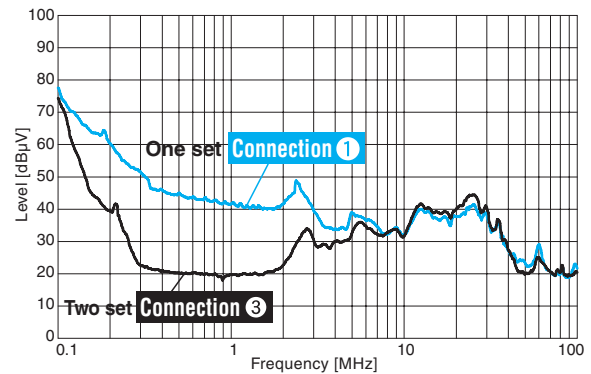


Figure 4.3.2 Example of Effect of Combining Multiple Filters

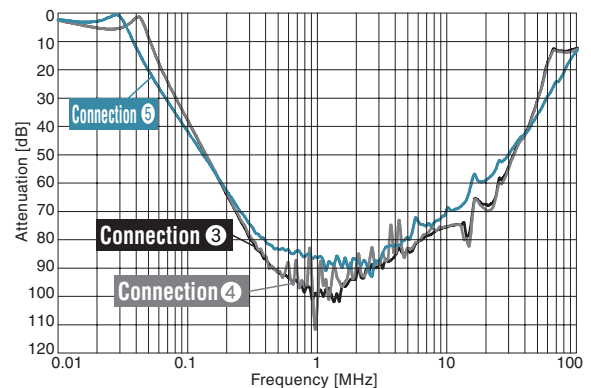


Figure 4.3.3 Comparing Static Characteristics of Different 2-filter configurations

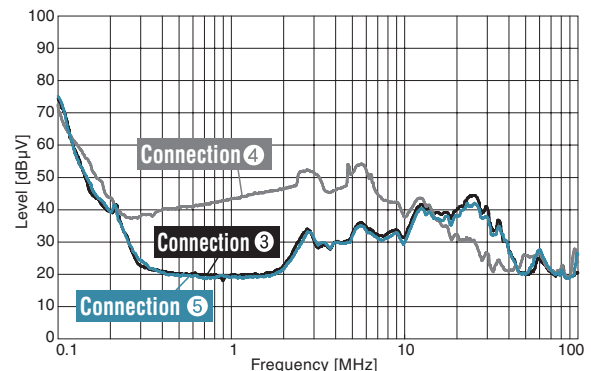


Figure 4.3.4 Comparing Effects of Different 2-filter Configurations

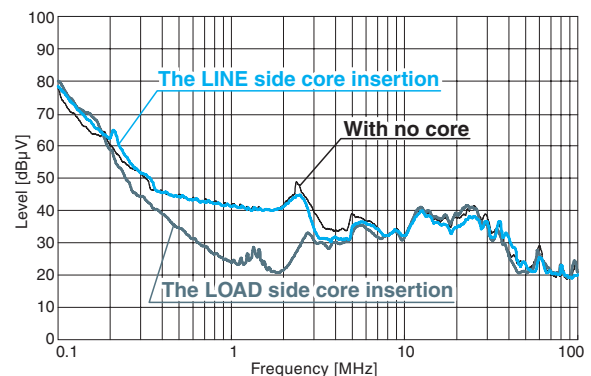


Figure 4.4.2 Example of Effect of Adding an External Ferrite Core

1 CE Marking

For machines and electric products to be sold in the EU area, manufacturers are required to bear a CE mark to prove they are in compliance with safety requirements, quality control, and ecocide prevention. To be allowed to do so, they must meet appropriate EC directives. The following describes the EC directives that are applied to general machinery products:

a. Machinery directive

This directive covers products that are an assembly of parts and have a driving section (with the central focus on industrial equipment).

b. EMC directive

This directive is intended to apply to electric parts which can be sources of radio disturbance or are affected by electromagnetic interference. It requires that two items, emission (EMI) and immunity (EMS), be met.

c. Low voltage directive

This directive is intended to apply to products that operate with a rated voltage in the range of 50 to 1000 V AC or 75 to 1500 V DC.

As there are no appropriate EC directives (including the ones described above) which apply to EMI filters, EMI filter products cannot bear a CE mark.

However, EMI filters can obtain an ENEC mark, which has a similar effect on bypassing application procedures of its signatories.

2 Conducted Emission EN61000-6-4

The voltages of interfering waves propagated through a power cable from equipment to the outside are measured with LISN★ in an open site★ or anechoic chamber★.

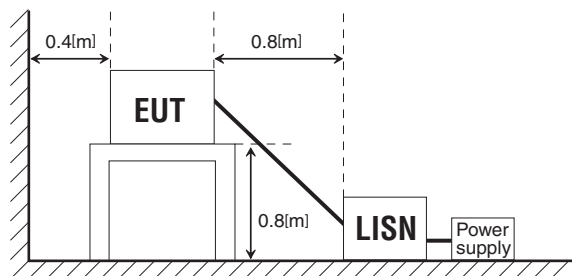


Figure 5.2.1 Example of Conducted Emissions Measurement Configuration

★ : Refer to the description in "Terminology related to EMC Test" in this document.

3 Radiated Emission EN61000-6-4

When operating equipment, the strength of electromagnetic waves is measured in a range of specified frequencies at a location 3 or 10 m away from the equipment

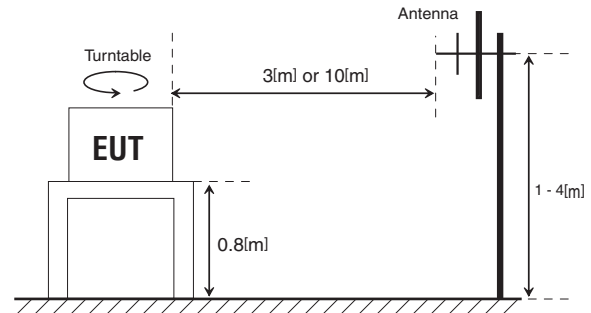


Figure 5.3.1 Example of Radiated Emission Measurement Configuration

4 Power Supply Harmonic Current EN61000-3-2

One analyzes the frequencies of input currents and checks the value of the harmonic current for each order.

5 Electrostatic Discharge EN61000-4-2

This test simulates effects of electrostatic discharge (malfunctions or destruction of semiconductor elements) and includes contact discharge and aerial discharge in its scope.

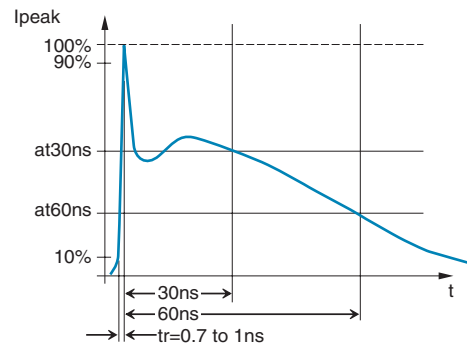


Figure 5.5.1 Discharge current waveform

Table 5.5.1 Application Level

Level	Specified voltage	First peak discharge current ($\pm 10\%$) I_p	Rise time	Current value at 30 ns ($\pm 30\%$)	Current value at 60 ns ($\pm 30\%$)
1	2kV	7.5A	0.7 - 1ns	4A	2A
2	4kV	15A	0.7 - 1ns	8A	4A
3	6kV	22.5A	0.7 - 1ns	12A	6A
4	8kV	30A	0.7 - 1ns	16A	8A

6 Radio frequency electromagnetic field EN61000-4-3

This test checks immunities of equipment to effects of electromagnetic waves.

7 Fast Transient/Burst EN61000-4-4

This test checks immunities to burst waves by from injecting via cable pulses that resemble the results of a discharge.

8 Surge EN61000-4-5

This test checks immunities to surges by applying a specified surge waveform.

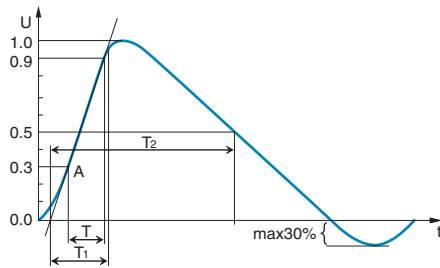


Figure 5.8.1 Example of a Surge Waveform in Voltage

Table 5.8.1 Level

Level	Open circuit test voltage $\pm 10\%$ [kV]
1	0.5
2	1.0
3	2.0
4	4.0
X	special

9 Conducted Radio-frequency Interference EN61000-4-6

This test checks immunities to conducted disturbances when electromagnetic waves pass into equipment through a cable.

10 Power Frequency Magnetic Field EN61000-4-8

This test checks immunities to magnetic fields generated by power frequency currents flowing through an input line or a power wiring.

11 Voltage Dip/Momentary Power Interruption EN61000-4-11

These tests check if equipment functions normally after momentary voltage drop, or power failure that decreases voltage to 0.

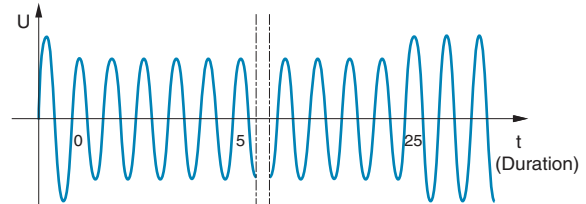


Figure 5.11.1 Example of a Waveform of Voltage Dips

12 Unit of Noise

Noise is represented with 1 μV as its reference in [dB]. It is assumed that 1 μV equals 0 [dB μV]. For example, 1 [V] is represented as follows:

$$20\text{Log}_{10} \frac{1}{1 \times 10^{-6}} = 120 [\text{dB}\mu\text{V}]$$

$$\begin{aligned} 10 [\text{V}] &\Rightarrow 140 [\text{dB}\mu\text{V}] \\ 100 [\text{V}] &\Rightarrow 160 [\text{dB}\mu\text{V}] \\ 1000 [\text{V}] &\Rightarrow 180 [\text{dB}\mu\text{V}] \end{aligned}$$

13 Detection Method

a. Peak detection (PK)

It detects the heights of peaks of an output waveform.

b. Quasi-peak detection (QP)

It detects quasi-peaks through a circuit that has time constants at the time of charge and discharge. Quasi-peak detection value equals an intermediate value between peak and average ones.

This detection has high measurement results when noise has a long duration or occurs frequently.

c. Average detection (AV)

It detects an average of values of an output waveform.

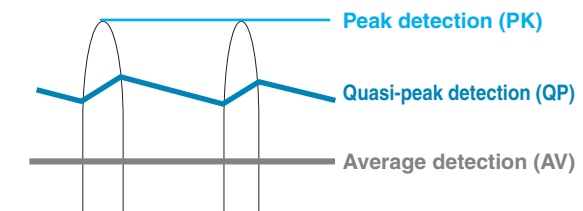


Figure 5.13.1 Relations between Detection Methods and Measurement Levels

14 Conducted and Radiated Emission Limits (Excerpt)

Test item	Standard	EN61000 -6-3	EN61000 -6-4	EN55011			EN55022		EN60601-1-2			EN50370-1	
				Group 1 ★									
	Classification	Common standard	Common standard	Standard for product groups			Standard for product groups		Standard for product groups			Standard for product groups	
	Product	—	—	ISM equipment ★			Information processing equipment (ITE equipment)		ISM equipment (medical equipment)			Machine tool	
	Operating environment	Class B	Class A	Class B	Class A	Class A			—	20 kVA or less	Exceeding 20 kVA	16A or less	Exceeding 16A

Level:Unit [dBμV]

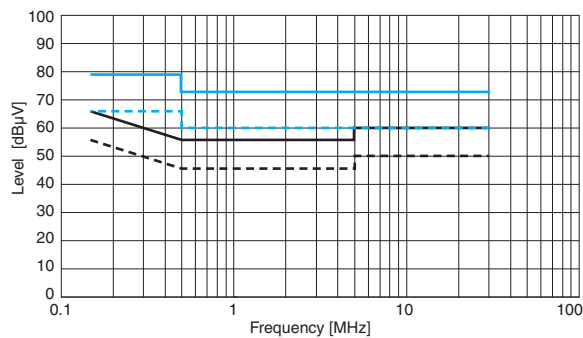
Conducted emission	Limit	QP	0.1 - 50.5MHz	66 - 56	79	66 - 56	79	100	66 - 56	79	66 - 56	79	100	79	100
			0.5 - 5MHz	56	73	56	73	86	56	73	56	73	86	73	86
			5 - 30MHz	60	73	60	73	90 - 73	60	73	60	73	90 - 73	60	90 - 70
		AV	0.15 - 0.5MHz	56 - 46	66	56 - 46	66	90	56 - 46	66	56 - 46	66	90	66	90
			0.5 - 5MHz	46	60	46	60	76	46	60	46	60	76	60	76
			5 - 30MHz	50	60	50	60	80 - 60	50	60	50	60	80 - 60	60	80 - 60

Level:Unit [dBμV/m]

Radiated emission	Limit	10m Law	30 - 230MHz	30	40	30	40	50	30	40	30	40	50	40	50
			230MHz - 1GHz	37	47	37	47	50	37	47	37	47	50	47	50
		30m Law	30 - 230MHz	—	30	—	—	—	—	—	—	—	—	—	—
			230MHz - 1GHz	—	37	—	—	—	—	—	—	—	—	—	—

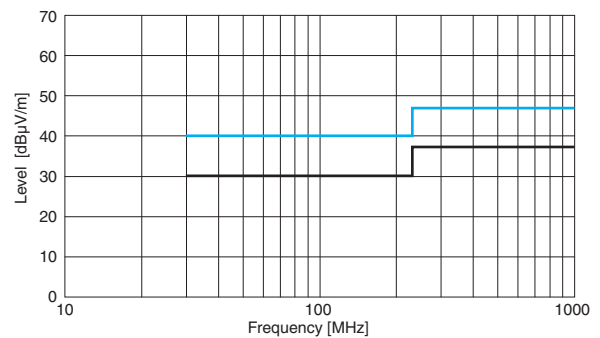
★ : Refer to the description in “Terminology related to EMC Test” in this document.

(As of November 2011)



— EN55011 ClassA QP (Group 1)
 --- EN55011 ClassA AV (Group 1)
 — EN55011 ClassB QP (Group 1)
 --- EN55011 ClassB AV (Group 1)
 (the above is also applied to EN55013, EN55014-1, EN55022, and EN60601-1)

Figure 5.14.1 Conducted Emission Limit Graph



— ClassB
 — ClassA

Figure 5.14.2 Radiated Emission Limit Graph

15 Terminology related to EMC Test

★ EUT

Stands for Equipment Under Test, and refers to equipment that will be tested or provided for a test.

★ Immunity test

Refers to a test to evaluate the durability of EUT against electromagnetic interference.

★ Emission test

Refers to a test to evaluate whether the strength of electromagnetic interference emitted from EUT exceeds a given limit.

★ Open site

Refers to an experimental facility installed outdoors to be used for activities such as EMC measurement.

★ Anechoic chamber

Refers to a facility to be used to create an electromagnetically isolated environment; the interior surfaces of the chamber absorb radio frequency waves.

★ CISPR

One of IEC's special committees; it was established to integrate standards such as those for allowable values and measurement methods for interfering waves causing radio communication failures and includes a standardization committee for EMC (Electro Magnetic Compatibility).

★ Group 1 and Group 2 in EN55011

Group1 : Equipment for laboratories, healthcare, and sciences
(Example: frequency counters, spectrum analyzers, switching power source, and measuring apparatus)

Group2 : Industrial induction heating equipment, induction heating equipment, industrial microwave heating equipment, household microwave ovens, medical equipment, spark erosion equipment, and spot welders.


























★ ISM equipment

Stands for Industrial, Scientific and Medical radio-frequency equipment and refers to radio-frequency equipment for industry, science, and health care.

★ LISN

Stands for Line Impedance Stabilization Network. It refers to equipment that sends noise components to a measurement device while monitoring impedances, looking at the power source from EUT. It is also called AMN (Artificial Mains Network).

1 Source Voltages in the World

	People's Republic of China	Single phase 2 wire 220V	Three phase 4 wire 380V
	Taiwan	Single phase 2 wire 110V, 220V	Three phase 4 wire 380V
	India	Single phase 2 wire 230V, 240V	Three phase 4 wire 400V, 415V
	Indonesia	Single phase 2 wire 220V	Three phase 4 wire 380V
	Japan	Single phase 2 wire 100V, 200V	Three phase 3 wire 200V
	Korea	Single phase 2 wire 110V, 220V	Three phase 3 wire 200V Three phase 4 wire 380V
	Philippines	Single phase 2 wire 220V, 230V, 240V	Three phase 3 wire 480V
	Singapore	Single phase 2 wire 230V	Three phase 4 wire 400V
	Thailand	Single phase 2 wire 220V	Three phase 4 wire 380V
	Malaysia	Single phase 2 wire 240V	Three phase 4 wire 415V
	Egypt	Single phase 2 wire 220V	Three phase 4 wire 380V
	Saudi Arabia	Single phase 2 wire 127V, 220V	Three phase 4 wire 380V
	Australia	Single phase 2 wire 240V	Three phase 4 wire 415V
	New Zealand	Single phase 2 wire 230V, 240V	Three phase 4 wire 400V, 415V
	Austria	Single phase 2 wire 230V	Three phase 4 wire 400V
	France	Single phase 2 wire 230V	Three phase 4 wire 400V
	Germany	Single phase 2 wire 230V	Three phase 4 wire 400V
	UK	Single phase 2 wire 240V	Three phase 4 wire 415V
	Netherlands	Single phase 2 wire 230V	Three phase 4 wire 400V
	Italy	Single phase 2 wire 220V	Three phase 4 wire 380V
	Spain	Single phase 2 wire 127V, 220V	Three phase 4 wire 380V
	Switzerland	Single phase 2 wire 230V	Three phase 4 wire 400V
	Russia (former republics of the Soviet Union)	Single phase 2 wire 127V, 220V	Three phase 4 wire 380V
	USA	Single phase 2 wire 120V, 265V, 277V Single phase 3 wire 115/230V, 120/240V, 240/480V	Three phase 4 wire 208V, 460V, 480V
	Brazil	Single phase 2 wire 127V	Three phase 4 wire 220V

EAC series

EAC -10 -472 -□

① ② ③ ④

- ① Model Name
② Rated Current
③ Line to ground capacitor code: See table 1.1.

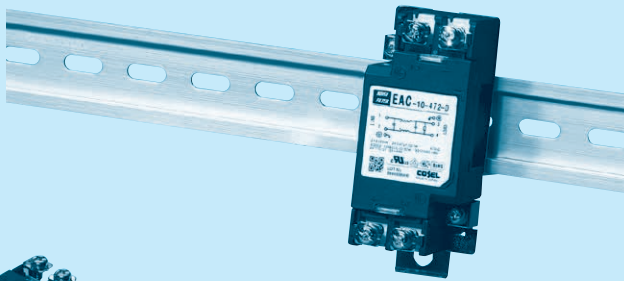
table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 125/250V 60Hz)	Line to ground capacitor (nominal value)
681	75.5 μ A/150 μ A max	680pF
102	0.13mA/0.25mA max	1000pF
222	0.25mA/0.5 mA max	2200pF
332	0.38mA/0.75mA max	3300pF
472	0.5 mA/1.0 mA max	4700pF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

④ Options
D: DIN rail installation type

* The dimensions change when the option is set.
Refer to External view.



The terminal cover is retracted inside the unit

DIN rail installation type is option

Features of EAC series

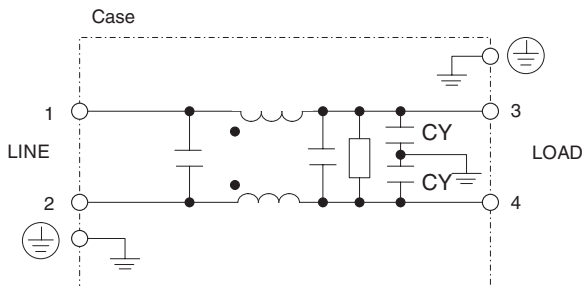
Small, common mode EMI/EMC Filters in 150kHz to 1MHz(1-Stage filter)

- Single Phase 250 VAC
 - Small-size
 - Quick and easy push-down terminal
- Just connect the wires, push-down and tighten the screws with a screwdriver

Specifications

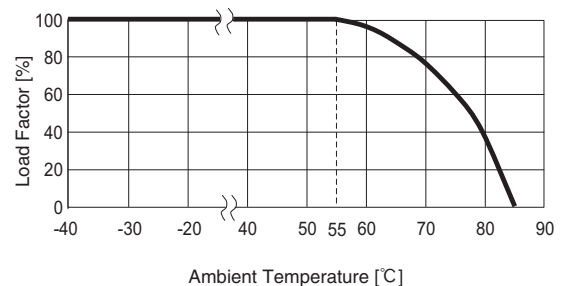
No.	Items	EAC-03-472	EAC-06-472	EAC-10-472	EAC-16-472	EAC-20-472	EAC-30-472
1	Rated Voltage[V]	AC 1 ϕ 250 / DC250					
2	Rated Current[A]	3	6	10	16	20	30
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 20mA), 1minute at room temperature and humidity					
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 500M Ω min at room temperature and humidity					
5	Leakage current 125/250V 60Hz	0.5mA/1.0mA max					
6	DC resistance	180m Ω max	110m Ω max	40m Ω max	20m Ω max	10m Ω max	6m Ω max
7	Safety agency approval temperatures	-25 to +85 $^{\circ}$ C (Refer to Derating Curve)					
8	Operating temperature	-40 to +85 $^{\circ}$ C (Refer to Derating Curve)					
9	Operating humidity	20 to 95%RH (Non condensing)					
10	Storage temperature/humidity	-40 to +85 $^{\circ}$ C/20 to 95%RH (Non condensing)					
11	Vibration	10 to 55Hz, 19.6m/s 2 (2G), 3min. Period, 1hour each X, Y and Z axis					
12	Impact	196.1m/s 2 (20G), 11ms Once each X, Y and Z axis					
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC (At only AC input)					
14	Case size (without projection) /Weight	39X30X85 mm [1.54X1.18X3.35 inches] (WXHxD) /170g max (Option : -D refer to external view)					

Circuit Diagram



CY : Line to ground capacitor \perp : Mounting Plate

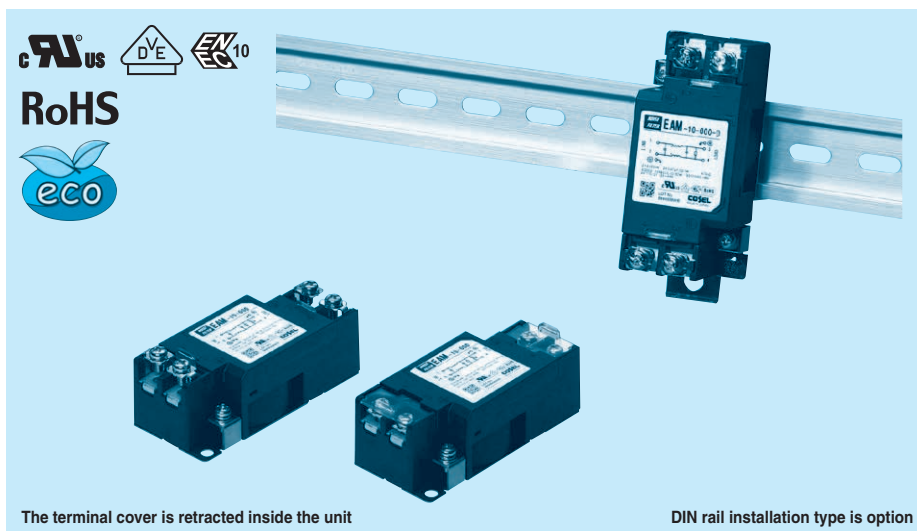
Derating Curve



EAM series

EAM -10 -000 -□

① ② ③ ④



- ① Model Name
- ② Rated Current
- ③ Line to ground capacitor code: See table 1.1.

table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 125/250V 60Hz)	Line to ground capacitor (nominal value)
000	5 μ A / 10 μ A max	Not Provided
101	12.5 μ A / 25 μ A max	100pF
221	25 μ A / 50 μ A max	220pF
331	37.5 μ A / 75 μ A max	330pF
471	50 μ A / 100 μ A max	470pF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

- ④ Options
- D: DIN rail installation type

* The dimensions change when the option is set.
Refer to External view.

Features of EAM series

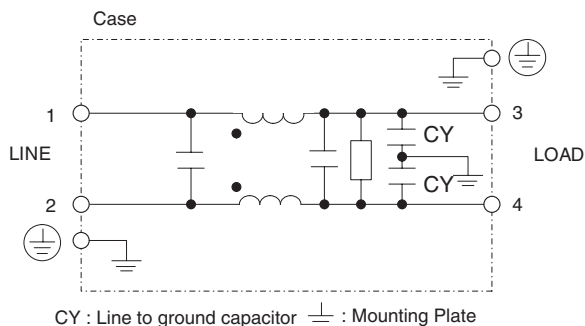
Small, Low leakage current type(1-Stage filter)

- Single Phase 250 VAC
 - Small-size
 - Quick and easy push-down terminal
- Just connect the wires, push-down and tighten the screws with a screwdriver

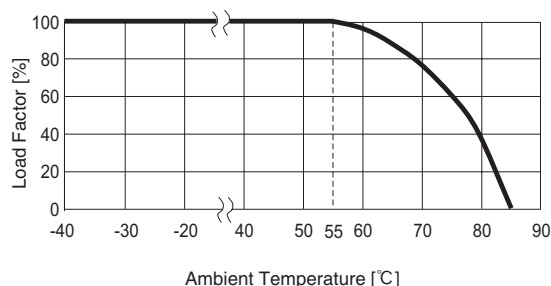
Specifications

No.	Items	EAM-03-000	EAM-06-000	EAM-10-000	EAM-16-000	EAM-20-000	EAM-30-000
1	Rated Voltage[V]	AC 1 ϕ 250 / DC250					
2	Rated Current[A]	3	6	10	16	20	30
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 20mA), 1 minute at room temperature and humidity					
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 500M Ω min at room temperature and humidity					
5	Leakage current 125/250V 60Hz	5 μ A/10 μ A max					
6	DC resistance	180m Ω max	110m Ω max	40m Ω max	20m Ω max	10m Ω max	6m Ω max
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)					
8	Operating temperature	-40 to +85°C (Refer to Derating Curve)					
9	Operating humidity	20 to 95%RH (Non condensing)					
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)					
11	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis					
12	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis					
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC (At only AC input)					
14	Case size (without projection) /Weight	39X30X85 mm [1.54X1.18X3.35 inches] (W X H X D) /170g max (Option : -D refer to external view)					

Circuit Diagram



Derating Curve



EAP series

EAP -10 -472 -□

① ② ③ ④

- ① Model Name
② Rated Current
③ Line to ground capacitor code: See table 1.1.

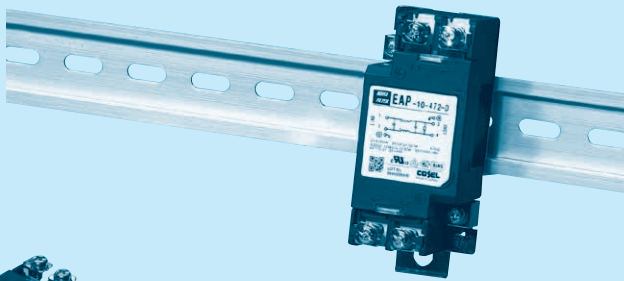
table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 125/250V 60Hz)	Line to ground capacitor (nominal value)
000	5 μ A/ 10 μ A max	Not Provided
101	12.5 μ A/ 25 μ A max	100pF
221	25 μ A/ 50 μ A max	220pF
331	37.5 μ A/ 75 μ A max	330pF
471	50 μ A/100 μ A max	470pF
681	75.5 μ A/150 μ A max	680pF
102	0.13mA/0.25mA max	1000pF
222	0.25mA/0.5 mA max	2200pF
332	0.38mA/0.75mA max	3300pF
472	0.5 mA/1.0 mA max	4700pF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

- ④ Options
D: DIN rail installation type

* The dimensions change when the option is set.
Refer to External view.



The terminal cover is retracted inside the unit

DIN rail installation type is option

Features of EAP series

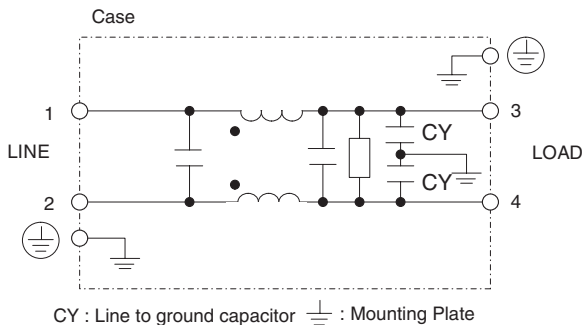
Small, High-voltage pulses common mode EMI/EMC Filters (1-Stage filter)

- Single Phase 250 VAC
 - Small-size
 - Quick and easy push-down terminal
- Just connect the wires, push-down and tighten the screws with a screwdriver

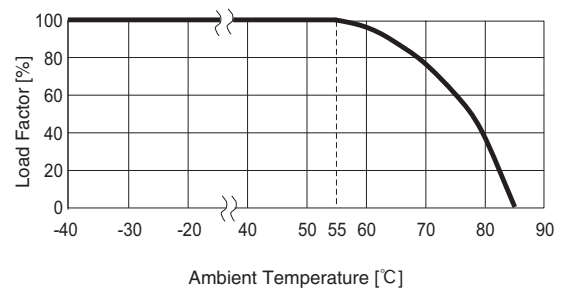
Specifications

No.	Items	EAP-03-472	EAP-06-472	EAP-10-472	EAP-16-472	EAP-20-472	EAP-30-472
1	Rated Voltage[V]	AC 1 ϕ 250 / DC250					
2	Rated Current[A]	3	6	10	16	20	30
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 20mA), 1minute at room temperature and humidity					
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 500M Ω min at room temperature and humidity					
5	Leakage current 125/250V 60Hz	0.5mA/1.0mA max					
6	DC resistance	180m Ω max	110m Ω max	40m Ω max	20m Ω max	10m Ω max	6m Ω max
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)					
8	Operating temperature	-40 to +85°C (Refer to Derating Curve)					
9	Operating humidity	20 to 95%RH (Non condensing)					
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)					
11	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis					
12	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis					
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC (At only AC input)					
14	Case size (without projection) /Weight	39X30X85 mm [1.54X1.18X3.35 inches] (W×H×D) /170g max (Option : -D refer to external view)					

Circuit Diagram



Derating Curve

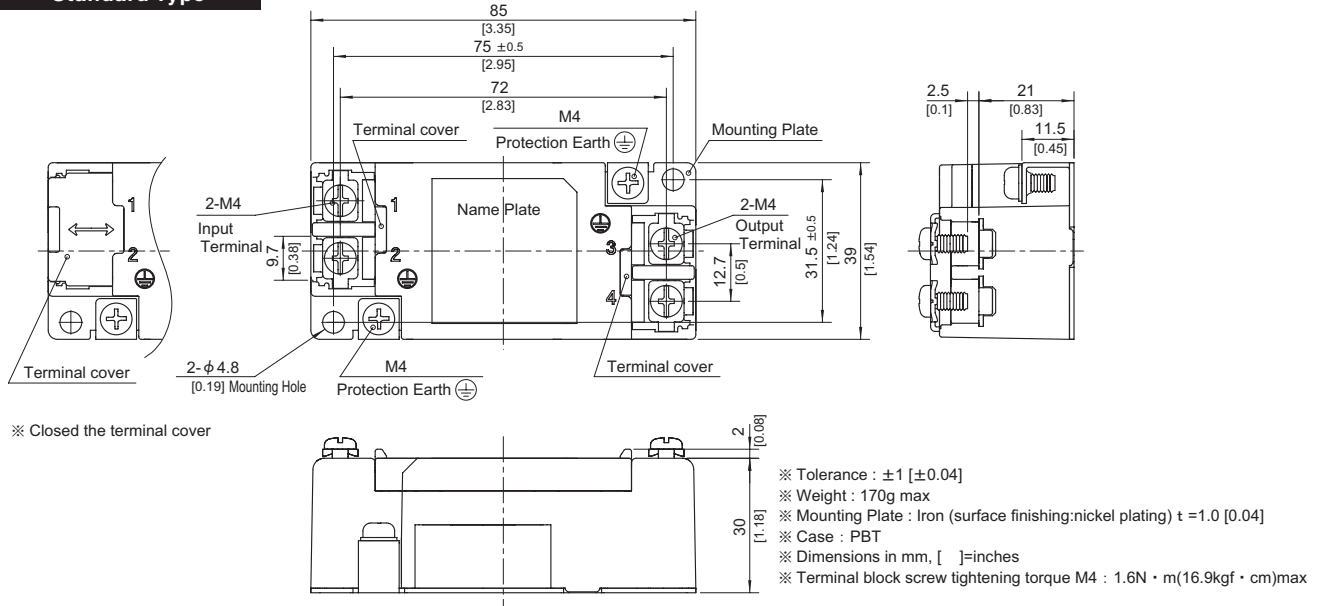


External view

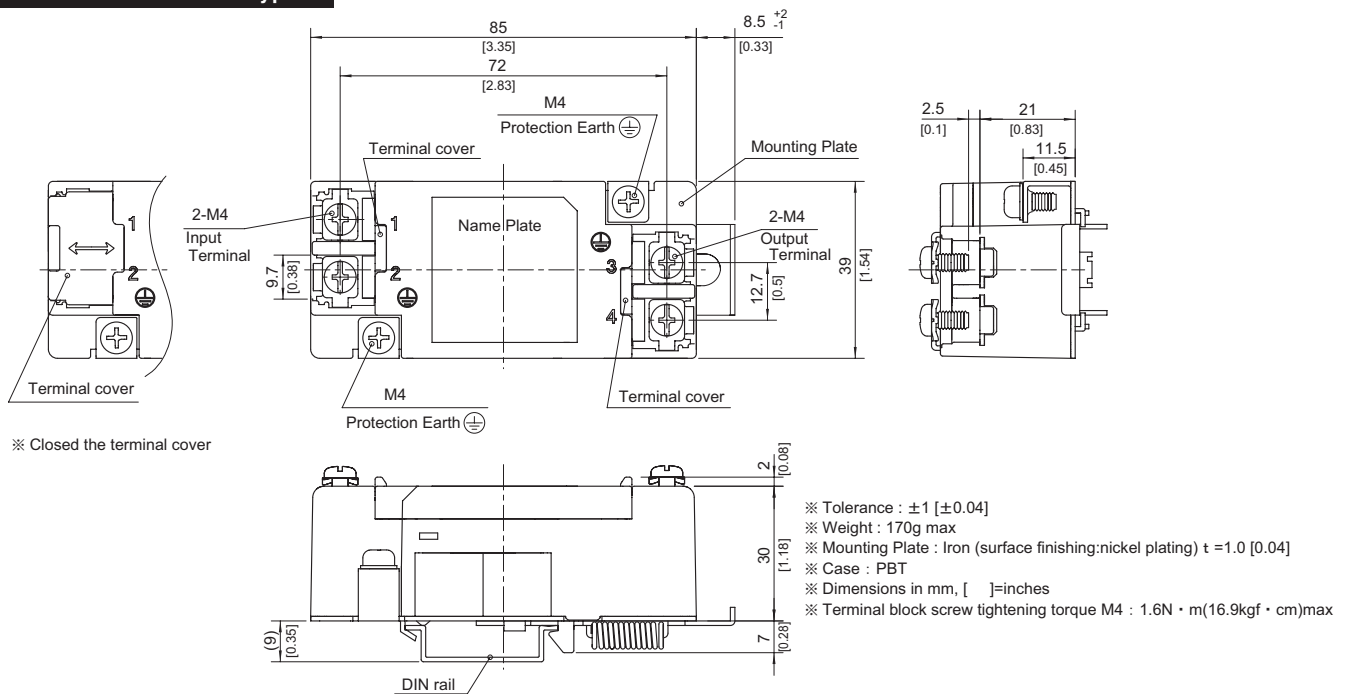
This product is shipped in the following condition, because it is equipped with push-down terminals.

- ① The terminal cover is retracted inside the unit.
- ② The screws for connecting the terminals are held in the up right position.

Standard Type



DIN rail installation Type

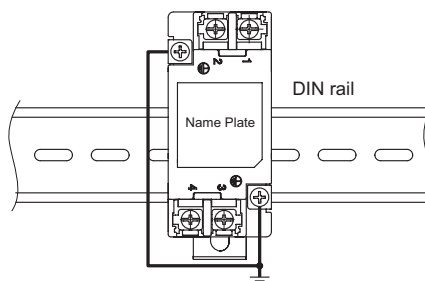


■Note when installing the EMI/EMC Filter on a DIN rail.

When the EMI/EMC Filter is grounded through the DIN rail, the proper noise attenuation may not be achieved.

Be sure to connect the protection earth (PE) of the EMI/EMC Filter body to the earth.

It can connect the ground to either one only.



ESC series

Ordering information

ESC -10 -472 -□

① ② ③ ④

- ① Model Name
② Rated Current
③ Line to ground capacitor code: See table 1.1.

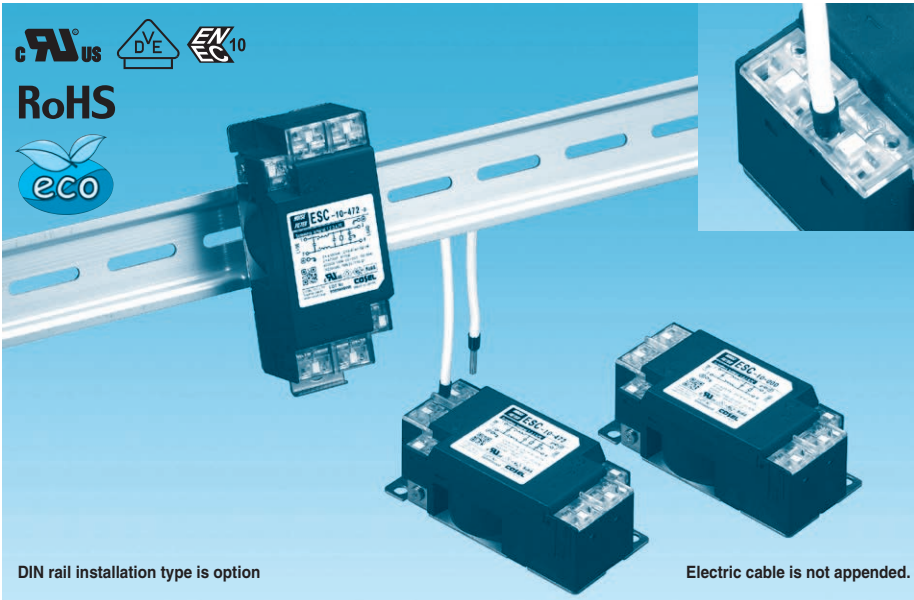
table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 125/250V 60Hz)	Line to ground capacitor (nominal value)
681	75.5 μ A/150 μ A max	680pF
102	0.13mA/0.25mA max	1000pF
222	0.25mA/0.5 mA max	2200pF
332	0.38mA/0.75mA max	3300pF
472	0.5 mA/1.0 mA max	4700pF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

④ Options
D: DIN rail installation type

* The dimensions change when the option is set.
Refer to External view.



Features of ESC series

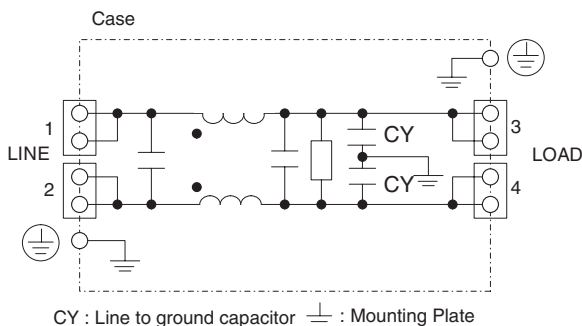
Small, common mode EMI/EMC Filters in 150kHz to 1MHz(1-Stage filter)

- Small EMI/EMC Filters that change input-output terminal and protection earth terminal of EA series into screwless terminal type
- Single Phase 250VAC
- Torque management is unnecessary with screwless

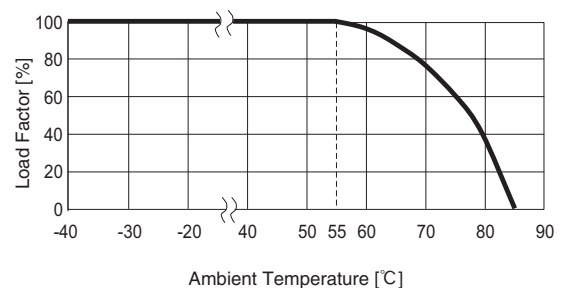
Specifications

No.	Items	ESC-03-472	ESC-06-472	ESC-10-472	ESC-16-472
1	Rated Voltage[V]	AC 1 ϕ 250 / DC250			
2	Rated Current[A]	3	6	10	16
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 20mA), 1minute at room temperature and humidity			
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 500M Ω min at room temperature and humidity			
5	Leakage current 125/250V 60Hz	0.5mA/1.0mA max			
6	DC resistance	180m Ω max	110m Ω max	40m Ω max	20m Ω max
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)			
8	Operating temperature	-40 to +85°C (Refer to Derating Curve)			
9	Operating humidity	20 to 95%RH (Non condensing)			
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)			
11	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis			
12	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis			
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC (At only AC input)			
14	Case size (without projection) /Weight	39 X 30 X 85 mm [1.54 X 1.18 X 3.35 inches] (W X H X D) /170g max (Option : -D refer to external view)			

Circuit Diagram



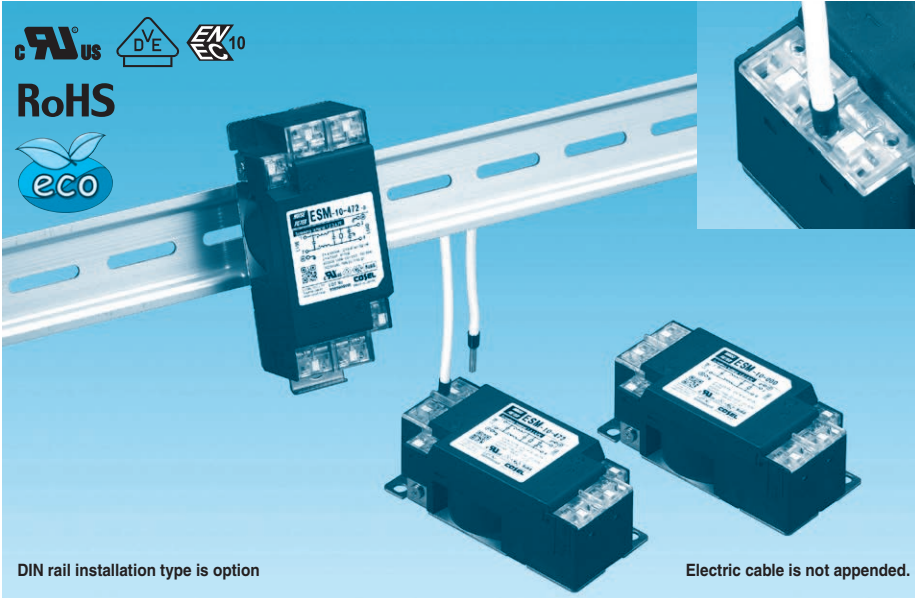
Derating Curve



ESM series

ESM -10 -000 -□

① ② ③ ④



- ① Model Name
- ② Rated Current
- ③ Line to ground capacitor code: See table 1.1.

table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 125/250V 60Hz)	Line to ground capacitor (nominal value)
000	5 μ A / 10 μ A max	Not Provided
101	12.5 μ A / 25 μ A max	100pF
221	25 μ A / 50 μ A max	220pF
331	37.5 μ A / 75 μ A max	330pF
471	50 μ A / 100 μ A max	470pF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

- ④ Options
- D: DIN rail installation type

* The dimensions change when the option is set. Refer to External view.

Features of ESM series

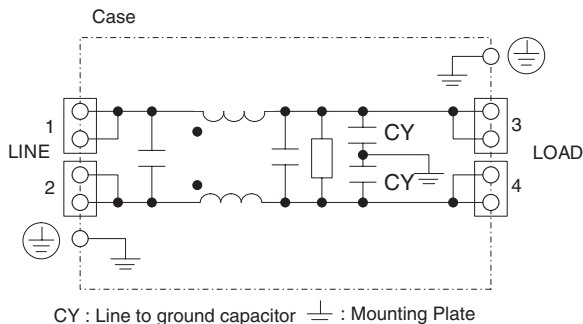
Small, Low leakage current type(1-Stage filter)

- Small EMI/EMC Filters that change input-output terminal and protection earth terminal of EA series into screwless terminal type
- Single Phase 250VAC
- Torque management is unnecessary with screwless

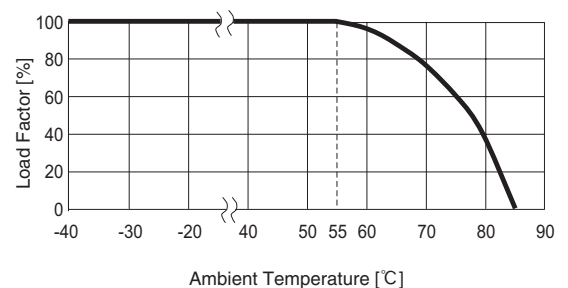
Specifications

No.	Items	ESM-03-000	ESM-06-000	ESM-10-000	ESM-16-000
1	Rated Voltage[V]	AC 1 ϕ 250 / DC250			
2	Rated Current[A]	3	6	10	16
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 20mA), 1minute at room temperature and humidity			
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 500M Ω min at room temperature and humidity			
5	Leakage current 125/250V 60Hz	5 μ A/10 μ A max			
6	DC resistance	180m Ω max	110m Ω max	40m Ω max	20m Ω max
7	Safety agency approval temperatures	-25 to +85 $^{\circ}$ C (Refer to Derating Curve)			
8	Operating temperature	-40 to +85 $^{\circ}$ C (Refer to Derating Curve)			
9	Operating humidity	20 to 95%RH (Non condensing)			
10	Storage temperature/humidity	-40 to +85 $^{\circ}$ C/20 to 95%RH (Non condensing)			
11	Vibration	10 to 55Hz, 19.6m/s 2 (2G), 3min. Period, 1hour each X, Y and Z axis			
12	Impact	196.1m/s 2 (20G), 11ms Once each X, Y and Z axis			
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC (At only AC input)			
14	Case size (without projection) /Weight	39 X 30 X 85 mm [1.54 X 1.18 X 3.35 inches] (W X H X D) /170g max (Option : -D refer to external view)			

Circuit Diagram



Derating Curve



ESP series

ESP -10 -472 -□

① ② ③ ④

- ① Model Name
② Rated Current
③ Line to ground capacitor code: See table 1.1.

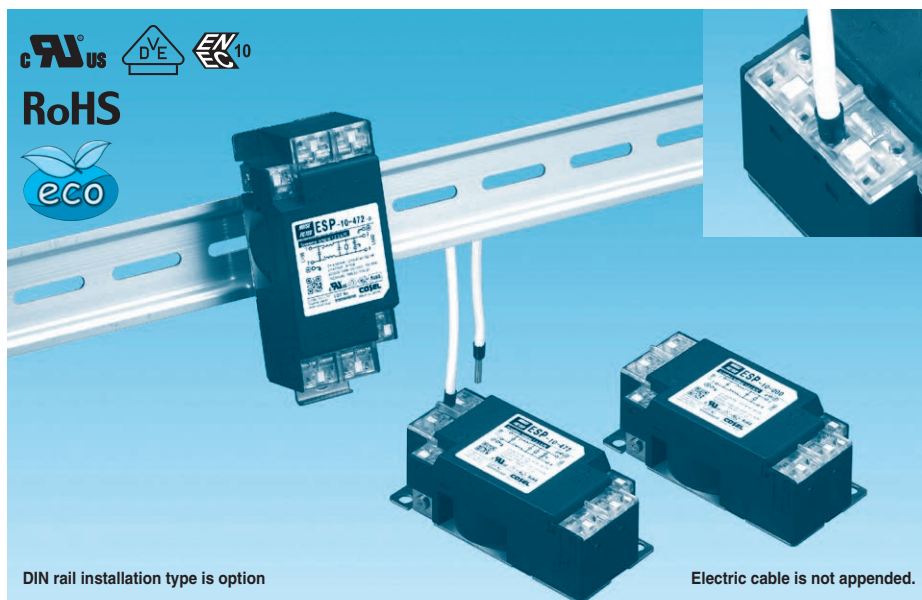
table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 125/250V 60Hz)	Line to ground capacitor (nominal value)
000	5 μ A/ 10 μ A max	Not Provided
101	12.5 μ A/ 25 μ A max	100pF
221	25 μ A/ 50 μ A max	220pF
331	37.5 μ A/ 75 μ A max	330pF
471	50 μ A/100 μ A max	470pF
681	75.5 μ A/150 μ A max	680pF
102	0.13mA/0.25mA max	1000pF
222	0.25mA/0.5 mA max	2200pF
332	0.38mA/0.75mA max	3300pF
472	0.5 mA/1.0 mA max	4700pF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

④ Options
D: DIN rail installation type

* The dimensions change when the option is set. Refer to External view.



DIN rail installation type is option

Electric cable is not appended.

Features of ESP series

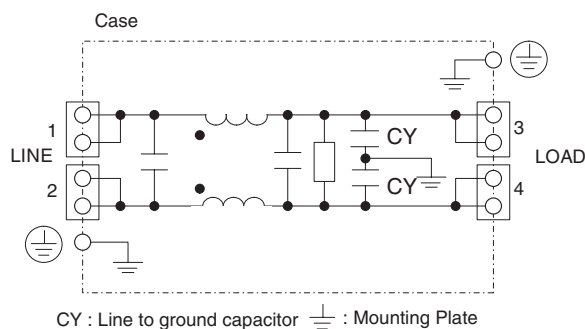
Small, High-voltage pulses common mode EMI/EMC Filters (1-Stage filter)

- Small EMI/EMC Filters that change input-output terminal and protection earth terminal of EA series into screwless terminal type
- Single Phase 250VAC
- Torque management is unnecessary with screwless

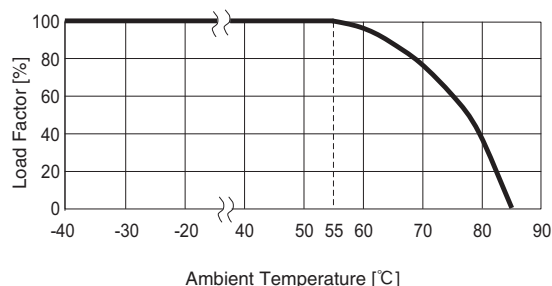
Specifications

No.	Items	ESP-03-472	ESP-06-472	ESP-10-472	ESP-16-472
1	Rated Voltage[V]	AC 1 ϕ 250 / DC250			
2	Rated Current[A]	3	6	10	16
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 20mA), 1minute at room temperature and humidity			
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 500M Ω min at room temperature and humidity			
5	Leakage current 125/250V 60Hz	0.5mA/1.0mA max			
6	DC resistance	180m Ω max	110m Ω max	40m Ω max	20m Ω max
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)			
8	Operating temperature	-40 to +85°C (Refer to Derating Curve)			
9	Operating humidity	20 to 95%RH (Non condensing)			
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)			
11	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis			
12	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis			
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC (At only AC input)			
14	Case size (without projection) /Weight	39X30X85 mm [1.54X1.18X3.35 inches] (W X H X D) /170g max (Option : -D refer to external view)			

Circuit Diagram

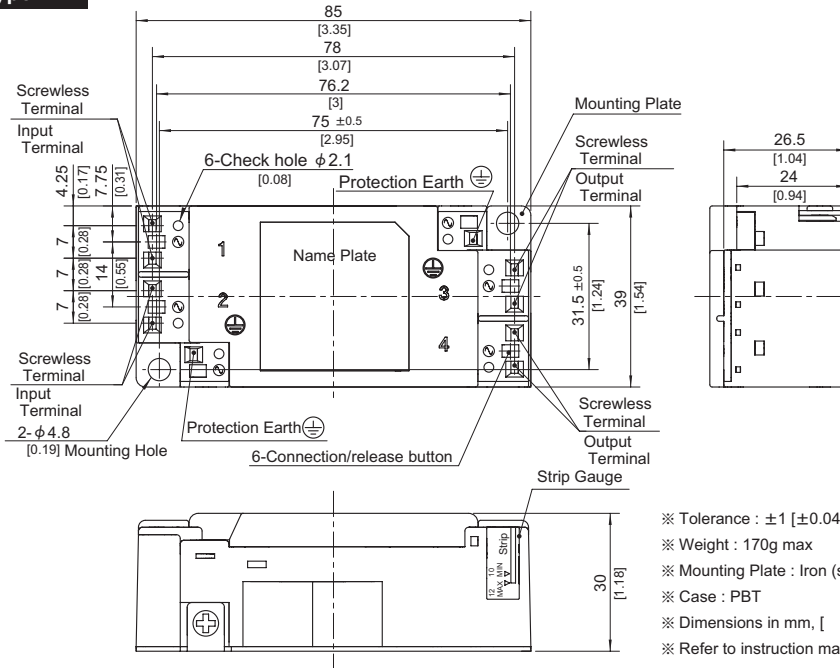


Derating Curve

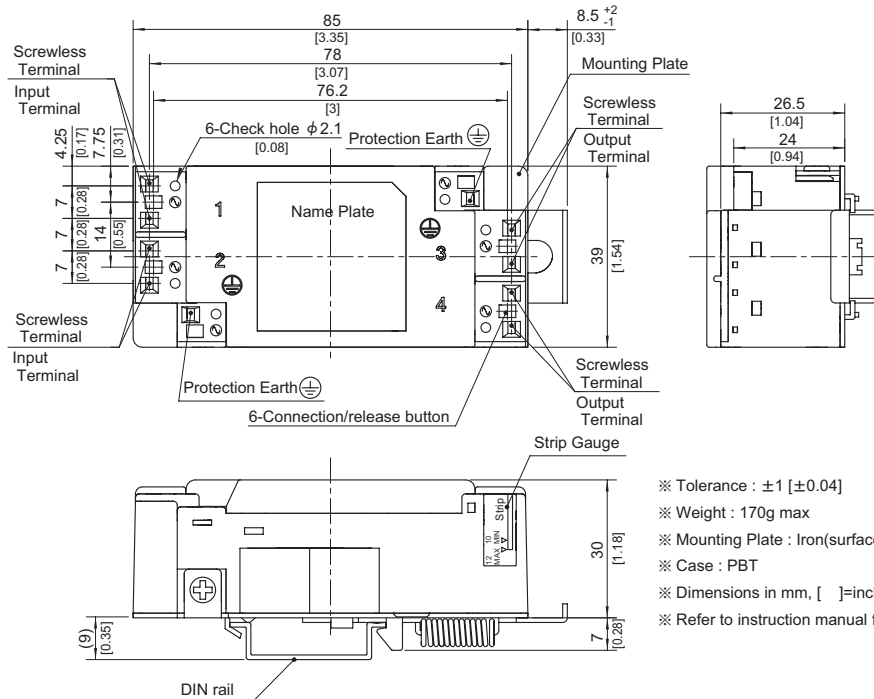


External view

Standard Type



DIN rail installation Type

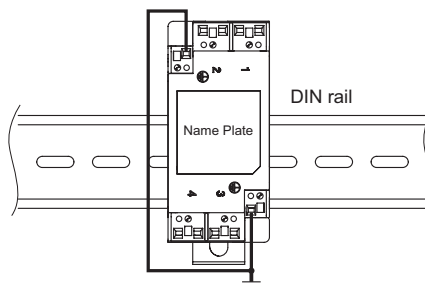


■Note when installing the EMI/EMC Filter on a DIN rail.

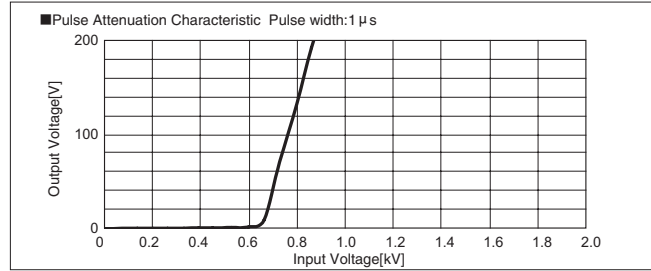
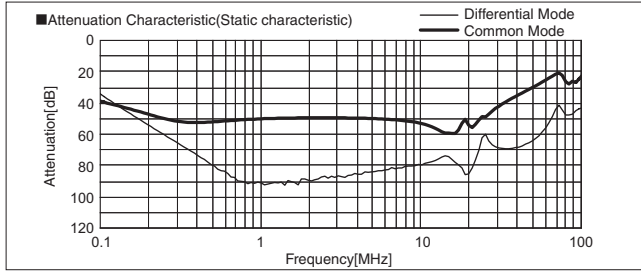
When the EMI/EMC Filter is grounded through the DIN rail, the proper noise attenuation may not be achieved.

Be sure to connect the protection earth (PE) of the EMI/EMC Filter body to the earth.

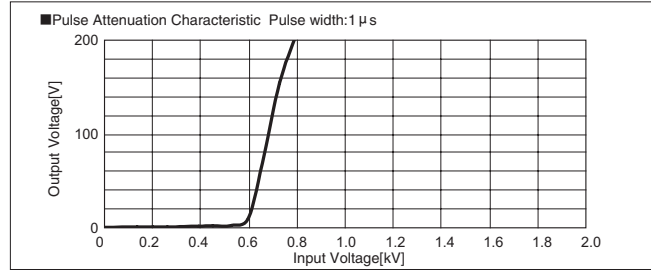
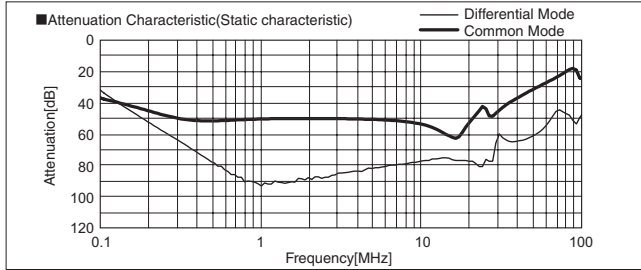
It can connect the ground to either one only.



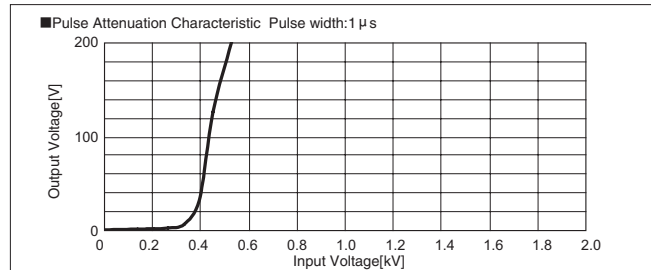
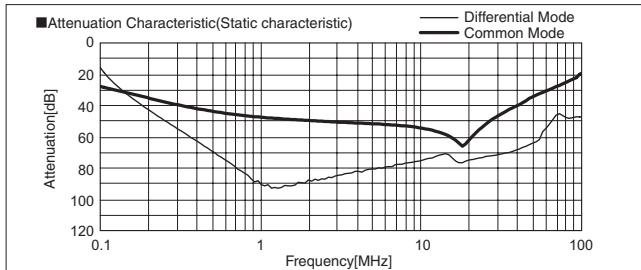
EAC-03-472 / ESC-03-472



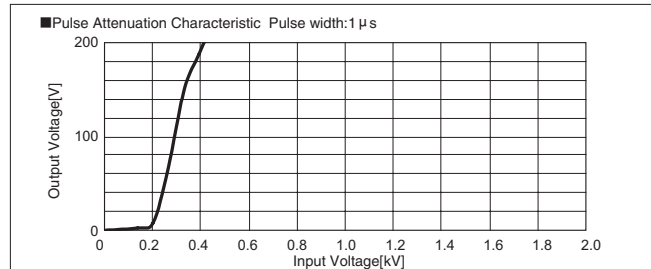
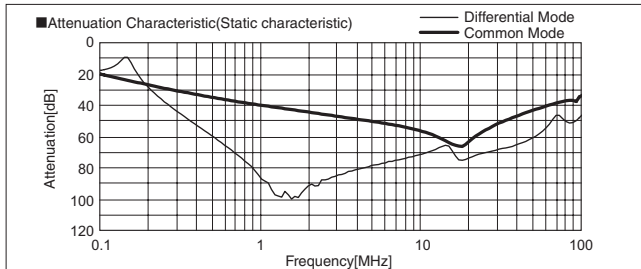
EAC-06-472 / ESC-06-472



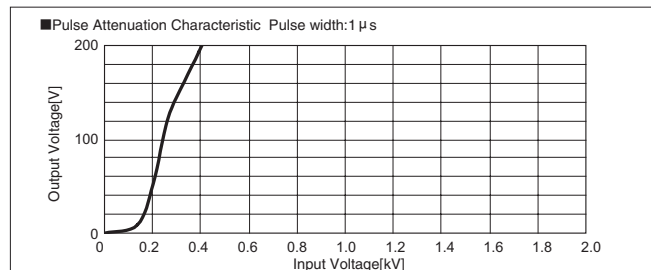
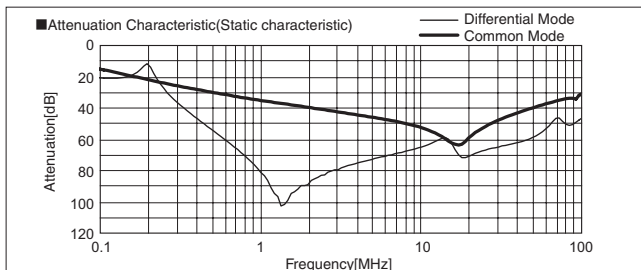
EAC-10-472 / ESC-10-472



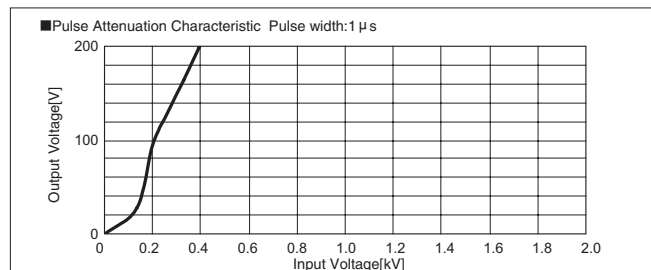
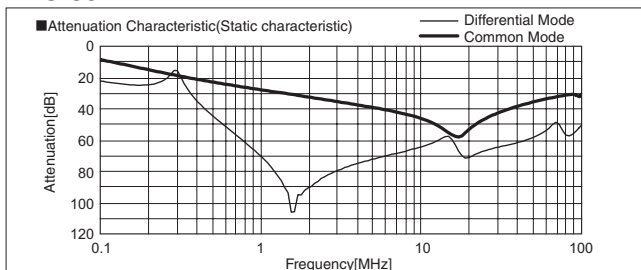
EAC-16-472 / ESC-16-472



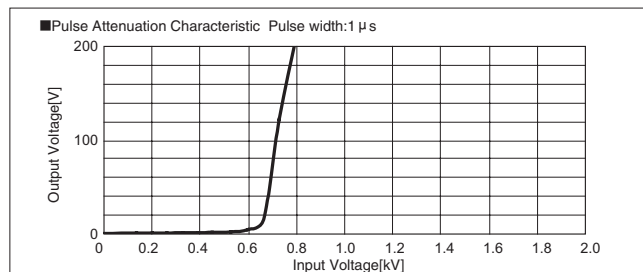
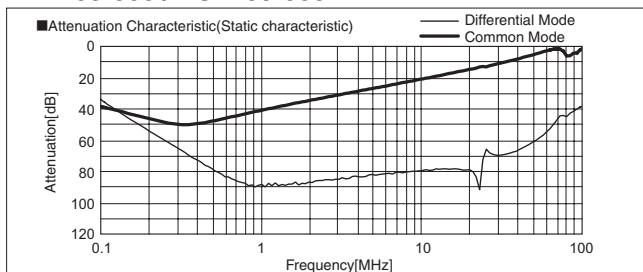
EAC-20-472



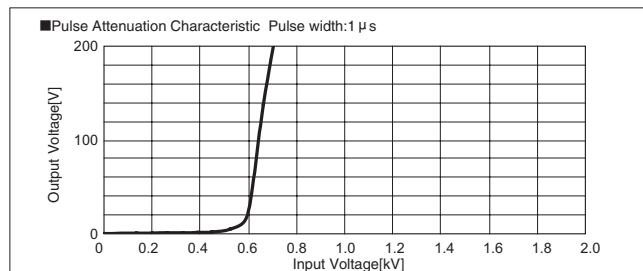
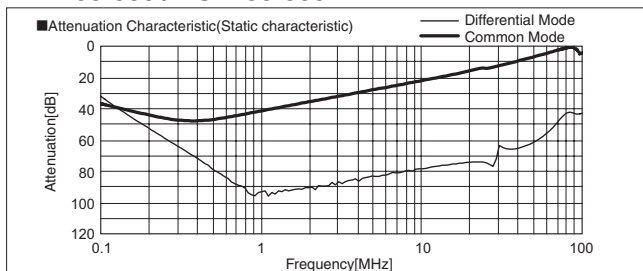
EAC-30-472



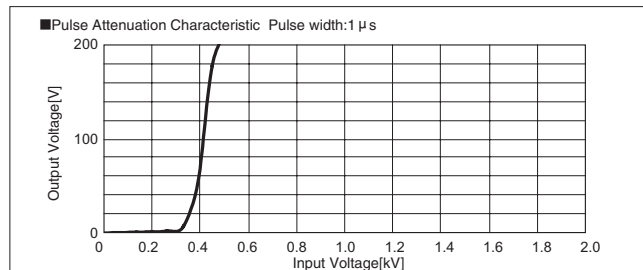
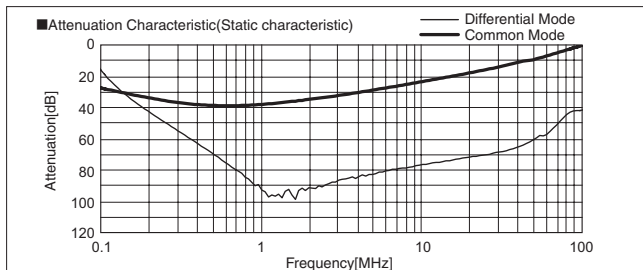
EAM-03-000 / ESM-03-000



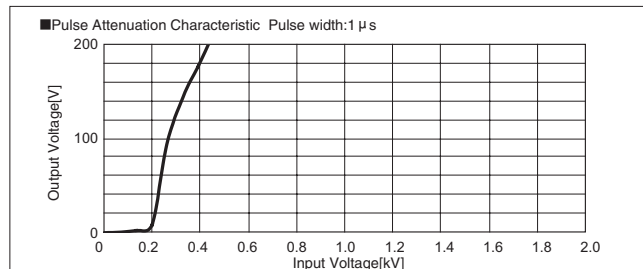
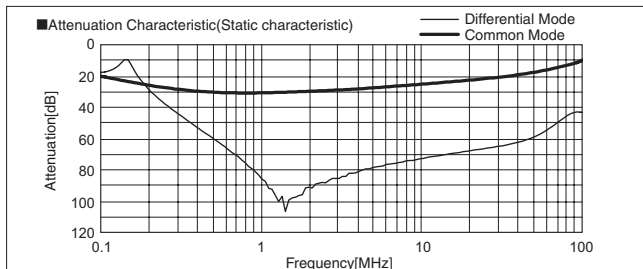
EAM-06-000 / ESM-06-000



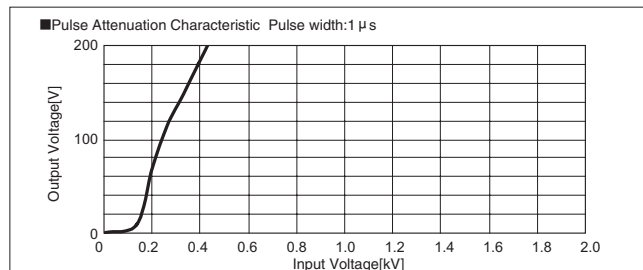
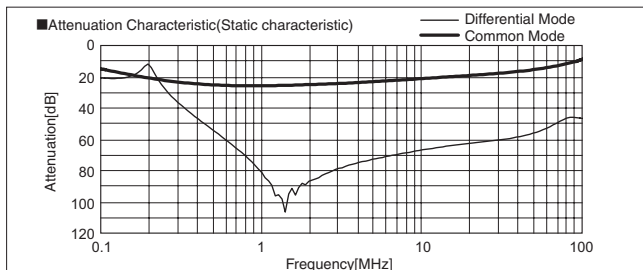
EAM-10-000 / ESM-10-000



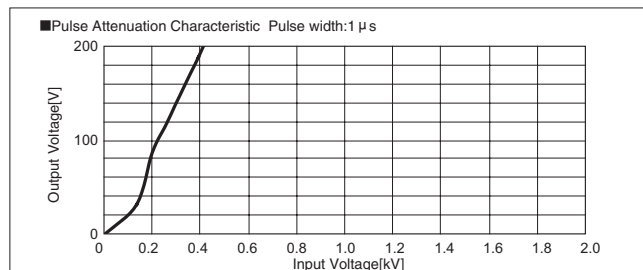
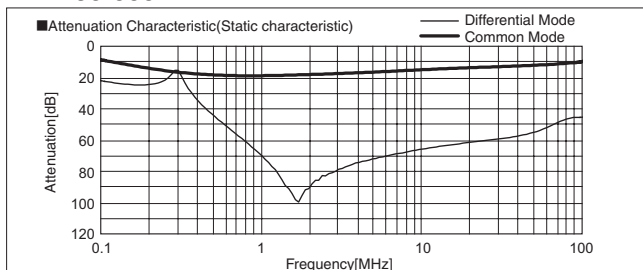
EAM-16-000 / ESM-16-000



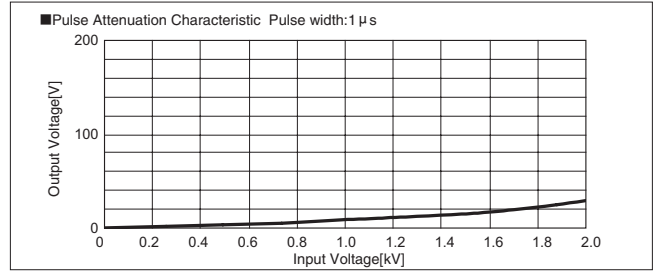
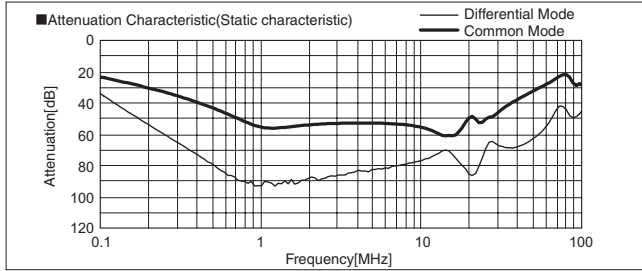
EAM-20-000



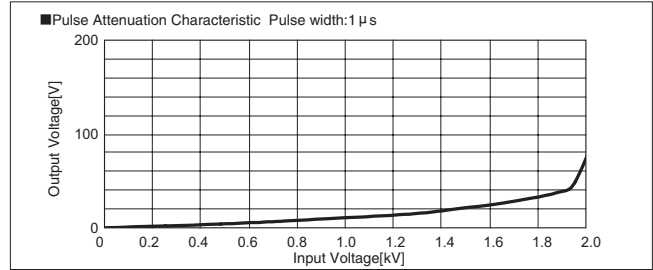
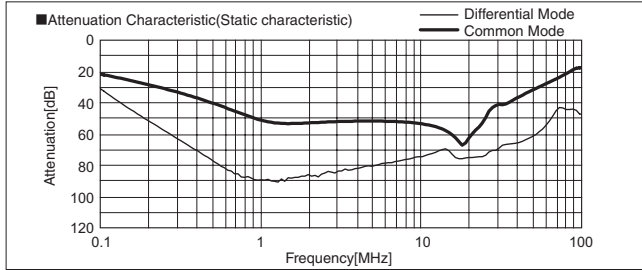
EAM-30-000



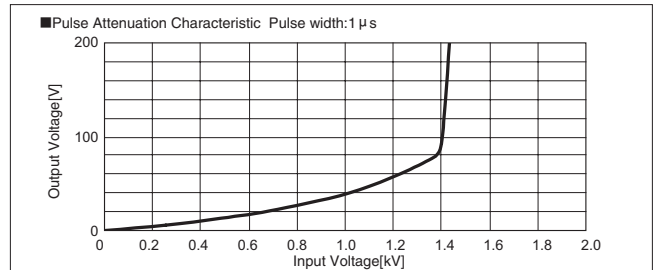
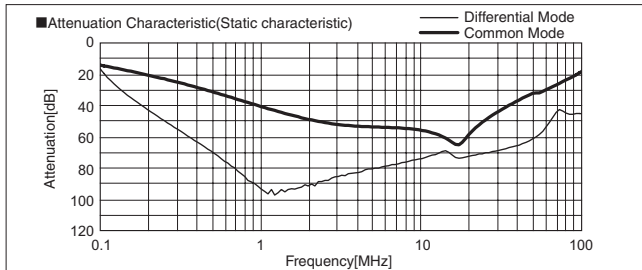
EAP-03-472 / ESP-03-472



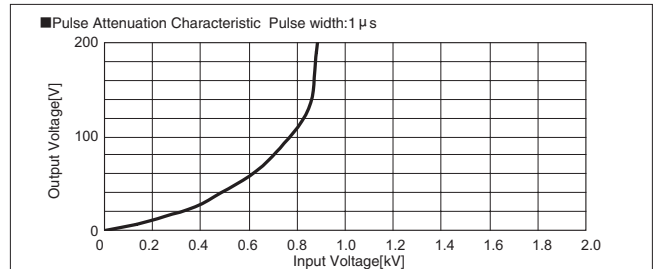
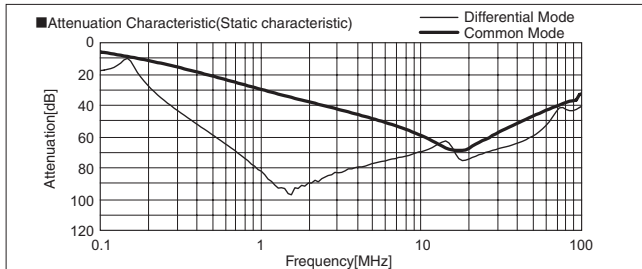
EAP-06-472 / ESP-06-472



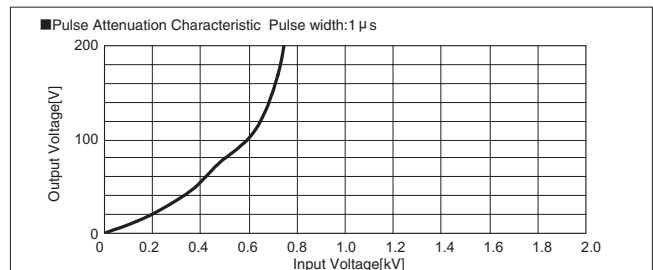
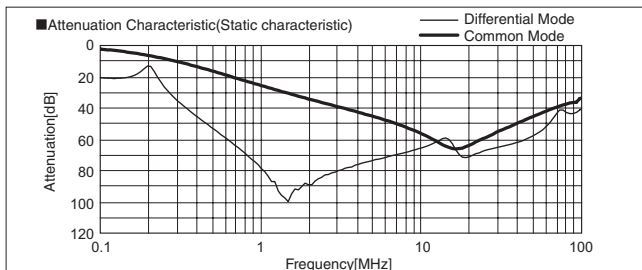
EAP-10-472 / ESP-10-472



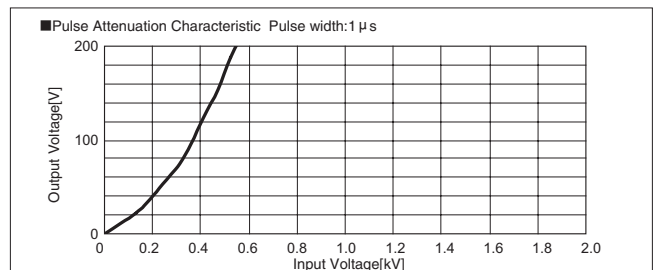
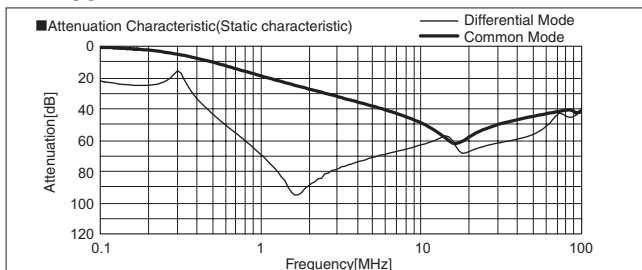
EAP-16-472 / ESP-16-472



EAP-20-472



EAP-30-472



1 Applicable Electric Cable

- Only use the electric cable that exists in the Table1.
- Use the cable that conductor material is copper. Do not use the cable that conductor material is iron or aluminum. Never use the one other than the electric cable.
Ex. Steel wire, Stick made of resin, other wire
- Note that the current rating is different in each electric cable.
- Strip so as not to damage the conductor at stripping sheath.
- Strip specified length of cable sheath (Refer to Table1).
Strip Length can be confirmed with a gauge of the body case. Refer to External view.
- Do not put solder on the conductor. It becomes impossible to connect cable.

Table.1 Applicable Wire

Solid wire	Diameter 0.5mm to 1.2mm (AWG.22 to AWG.16)
Stranded wire	0.3mm ² to 1.25mm ² (AWG.22 to AWG.16) Conductor diameter more than 0.18 mm
Sheath strip length	10mm to 12mm

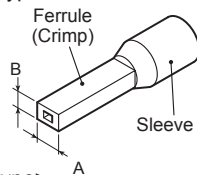
2 Applicable bar-type terminal

- The applicable bar-type terminal (Refer to Table 2) must be used, and after crimp, the size of bar-type terminal must be kept value of Table 3. Use the applicable terminal (Refer to Table 2) and keep the size of terminal, or you will not be able to connect cable. Contact us when the bar-type terminals other than the applicable bar-type terminal (Refer to Table 2) are used.
- Connect cable so as not to conceal the button with the sleeve of the cable when a round terminals other than the applicable terminal are used.

Table.2 Applicable bar-type terminal

Manufacturer	Size	model	Crimp tool
Phoenix Contact	AWG.22	AI0.34-12TQ	CRIMPFOX UD6-4
	AWG.20	AI0.5-10WH AI0.5-12WH	
	AWG.18	AI0.75-10GY AI0.75-12GY AI1-10RD AI1-12RD	
	AWG.16	AI1.5-10BK AI1.5-12BK	
Nichifu	AWG.22-16	TGN TC-1.25-11T	NH11 NH32 NH65
		TGV TC-1.25-11T	

<Square type>



<Round type>

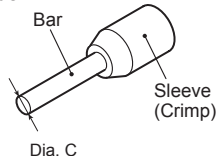
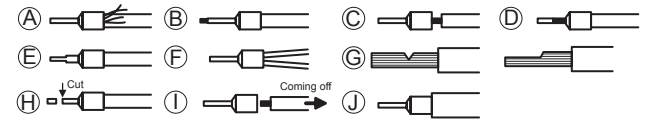


Table.3 Dimension of terminal at crimp
[Dimensions in mm]

Part	Dimension
A	1.1 to 2.6
B	0.8 to 1.6
Dia. C	0.8 to 1.6

3 State of crimped bar-type terminal

● Bad condition



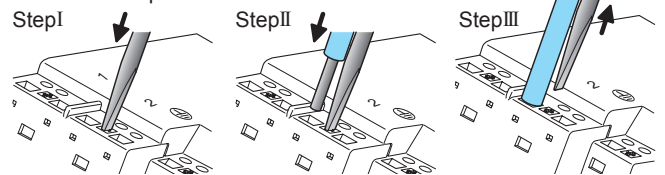
- Ⓐ The wire protrudes from the sleeve.
- Ⓑ The conductor extremely protrudes from the point of the bar-type terminal.
- Ⓒ The electric conductor is not inserted enough and the conductor has been exposed from the terminal.
- Ⓓ The sheath strip length doesn't suffice and the conductor is not enough inserted in the ferrules.
- Ⓔ Crimp is only the point of conductor.
- Ⓕ It crimps two electric cables.
- Ⓖ There is a damage or a disconnection part in the conductor.
- Ⓗ The point of the terminal is cut.
- Ⓘ It comes off the terminal when the cable is pulled.
- Ⓙ The sheath of the cable protrudes from the sleeve.

4 Wiring Terminal Blocks (connecting/releasing)

- One electric cable one insertion hole. When two or more is connected, it causes trouble.
- Do connecting and releasing of the electric cable by using a flat-blade driver while pushing the connection/release button. Moreover, insert the conductor or the bar-type terminal to the end fully.
- When you connect the stranded cable, connect wires after lightly stranding wires.
- Confirm the electric cable is surely connected with the terminal after connecting.
- The check hole can be used for the check of wire connecting and insulation and for the operation monitor etc.

● Connecting : Stranded cable, Solid cable (Diameter 0.5 to 0.9)

- StepI Push the button with a flat-blade driver.
- StepII Insert the cable into the hole while pushing the button.
- StepIII Release the flat-blade driver and cable connection is completion.



● Connecting : Solid wire (except diameter 0.5 to 0.9), bar type terminal

Insert the cable into the insertion hole.

* Insert it while pushing the button when it is not easy to insert it.

● Releasing : Stranded wire, Solid wire, bar type terminal

Pull out the electric cable while pushing the button with flat-blade driver.

* Notice : Two insertion holes are released at the same time by pushing the button once. (Except PE terminal)

- Use the flat-blade driver that meets the size in Table 4.



Table.4 Dimension of flat-blade driver
[Dimensions in mm]

Part	Dimension
D	1.0max
E	3.0max

NAC series

NAC -10 -472 -□

① ② ③ ④

- ① Model Name
② Rated Current
③ Line to ground capacitor code: See table 1.1.

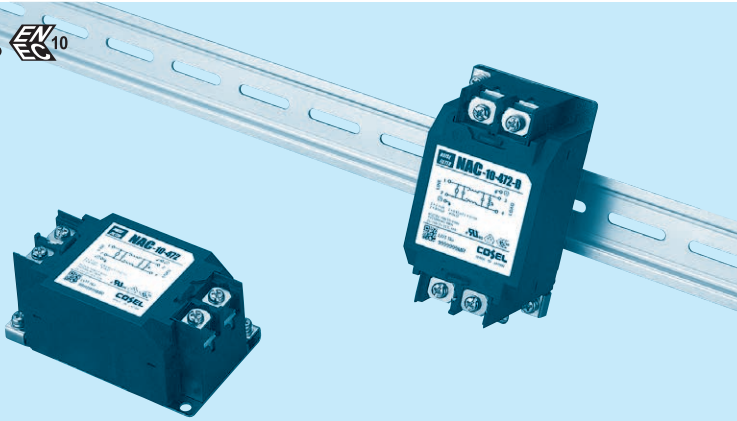
table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 125/250V 60Hz)	Line to ground capacitor (nominal value)
681	75.5 μ A / 150 μ A max	680pF
102	0.13mA / 0.25mA max	1000pF
222	0.25mA / 0.5 mA max	2200pF
332	0.38mA / 0.75mA max	3300pF
472	0.5 mA / 1.0 mA max	4700pF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

④ Options
D: DIN rail installation type

* The dimensions change when the option is set.
Refer to External view.



The terminal cover is retracted inside the unit

DIN rail installation type is option

Features of NAC series

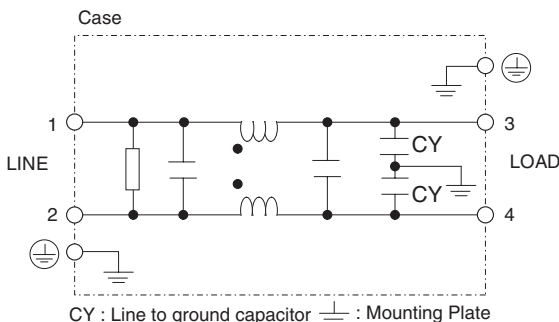
High-attenuation type of common mode noise from 150kHz to 1MHz

- Single Phase 250 VAC
- Push down type terminal block

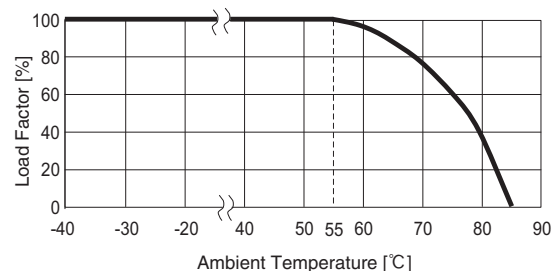
Specifications

No.	Items	NAC-04-472	NAC-06-472	NAC-10-472	NAC-16-472	NAC-20-472	NAC-30-472
1	Rated Voltage[V]	AC 1 ϕ 250 / DC250					
2	Rated Current[A]	4	6	10	16	20	30
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 20mA), 1minute at room temperature and humidity					
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100M Ω min at room temperature and humidity					
5	Leakage current 125/250V 60Hz	0.5mA/1.0mA max					
6	Voltage drop	1.0V max					
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)					
8	Operating temperature	-40 to +85°C (Refer to Derating Curve)					
9	Operating humidity	20 to 95%RH (Non condensing)					
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)					
11	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis					
12	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis					
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC (At only AC input)					
14	Case size (without projection) /Weight	53 X 41 X 92 mm [2.09 X 1.61 X 3.62 inches] (W X H X D) /300g max (Option : -D refer to external view)					

Circuit Diagram



Derating Curve



NAM series

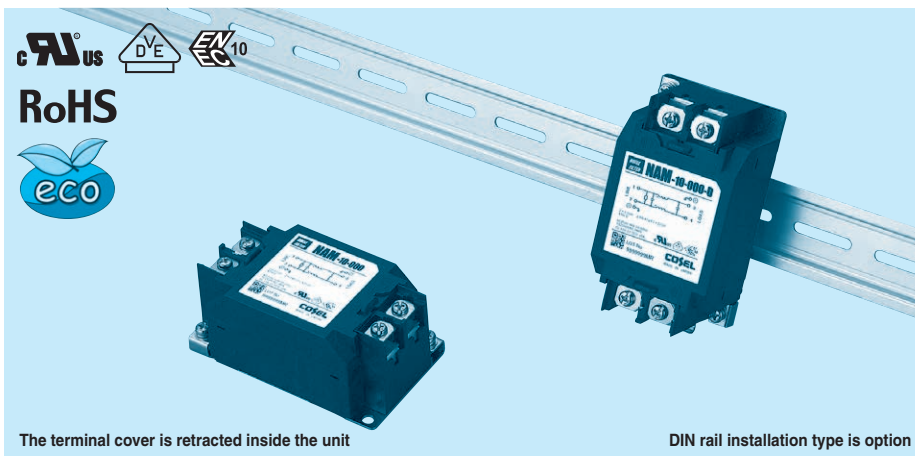
NAM -10 -000 -□

①

②

③

④



① Model Name

② Rated Current

③ Line to ground capacitor code: See table 1.1.

table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 125/250V 60Hz)	Line to ground capacitor (nominal value)
000	5 μ A / 10 μ A max	Not Provided
101	12.5 μ A / 25 μ A max	100pF
221	25 μ A / 50 μ A max	220pF
331	37.5 μ A / 75 μ A max	330pF
471	50 μ A / 100 μ A max	470pF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

④ Options

D: DIN rail installation type

* The dimensions change when the option is set.
Refer to External view.

Features of NAM series

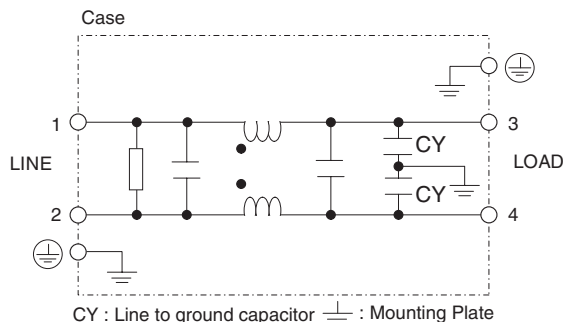
Low leakage current type

- Single Phase 250 VAC
- Push down type terminal block

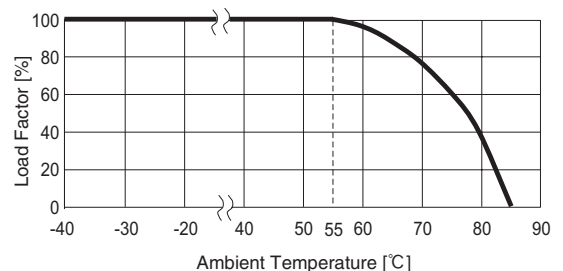
Specifications

No.	Items	NAM-04-000	NAM-06-000	NAM-10-000	NAM-16-000	NAM-20-000	NAM-30-000
1	Rated Voltage[V]	AC 1 ϕ 250 / DC250					
2	Rated Current[A]	4	6	10	16	20	30
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 20mA), 1minute at room temperature and humidity					
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100M Ω min at room temperature and humidity					
5	Leakage current 125/250V 60Hz	5 μ A/10 μ A max					
6	Voltage drop	1.0V max					
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)					
8	Operating temperature	-40 to +85°C (Refer to Derating Curve)					
9	Operating humidity	20 to 95%RH (Non condensing)					
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)					
11	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis					
12	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis					
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC (At only AC input)					
14	Case size (without projection) /Weight	53×41×92 mm [2.09×1.61×3.62 inches] (W×H×D) /300g max (Option : -D refer to external view)					

Circuit Diagram



Derating Curve



NAH series

NAH -10 -472 -□

① ② ③ ④

- ① Model Name
② Rated Current
③ Line to ground capacitor code: See table 1.1.

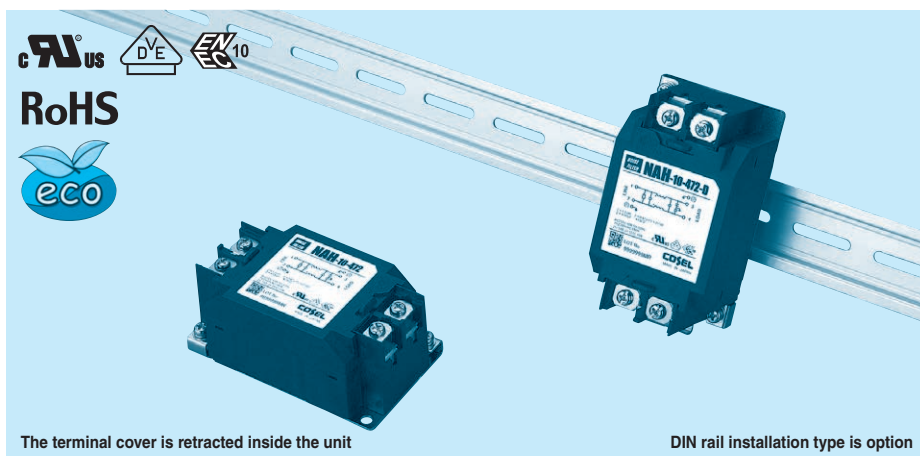
table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 125/250V 60Hz)	Line to ground capacitor (nominal value)
000	5 μ A/ 10 μ A max	Not Provided
101	12.5 μ A/ 25 μ A max	100pF
221	25 μ A/ 50 μ A max	220pF
331	37.5 μ A/ 75 μ A max	330pF
471	50 μ A/ 100 μ A max	470pF
681	75.5 μ A/ 150 μ A max	680pF
102	0.13mA/ 0.25mA max	1000pF
222	0.25mA/ 0.5 mA max	2200pF
332	0.38mA/ 0.75mA max	3300pF
472	0.5 mA/ 1.0 mA max	4700pF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

- ④ Options
D: DIN rail installation type

* The dimensions change when the option is set.
Refer to External view.



The terminal cover is retracted inside the unit

DIN rail installation type is option

Features of NAH series

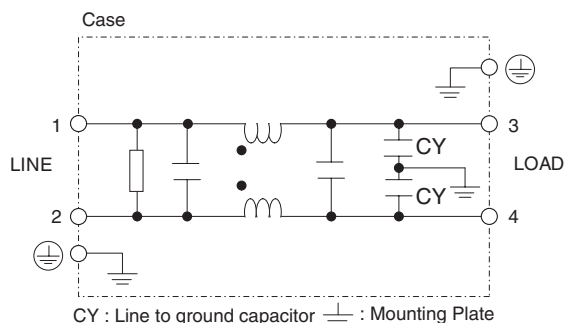
Ultra high-attenuation type of common mode noise from 10kHz to 1MHz

- Single Phase 250 VAC
- Push down type terminal block

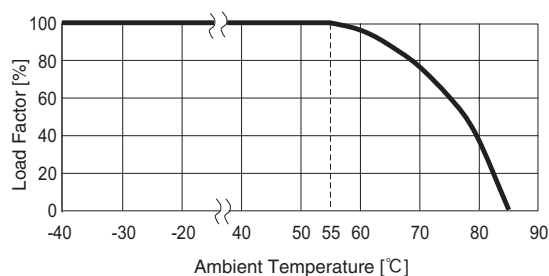
Specifications

No.	Items	NAH-06-472	NAH-10-472	NAH-16-472	NAH-20-472	NAH-30-472
1	Rated Voltage[V]	AC 1 ϕ 250 / DC250				
2	Rated Current[A]	6	10	16	20	30
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 20mA), 1minute at room temperature and humidity				
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100M Ω min at room temperature and humidity				
5	Leakage current 125/250V 60Hz	0.5mA/1.0mA max				
6	Voltage drop	1.0V max				
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)				
8	Operating temperature	-40 to +85°C (Refer to Derating Curve)				
9	Operating humidity	20 to 95%RH (Non condensing)				
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)				
11	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis				
12	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis				
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC (At only AC input)				
14	Case size (without projection) /Weight	53 X 41 X 92 mm [2.09 X 1.61 X 3.62 inches] (W X H X D) /300g max (Option : -D refer to external view)				

Circuit Diagram



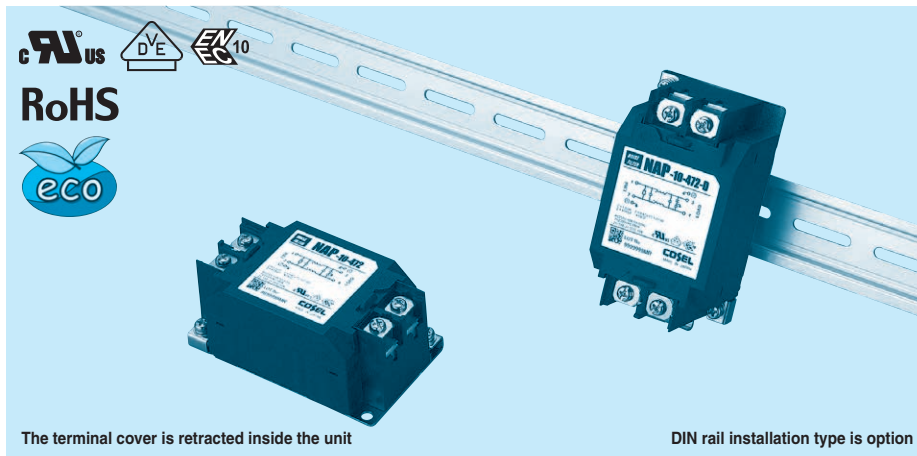
Derating Curve



NAP series

NAP -10 -472 -□

① ② ③ ④



- ① Model Name
 ② Rated Current
 ③ Line to ground capacitor code: See table 1.1.

table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 125/250V 60Hz)	Line to ground capacitor (nominal value)
000	5 μ A/ 10 μ A max	Not Provided
101	12.5 μ A/ 25 μ A max	100pF
221	25 μ A/ 50 μ A max	220pF
331	37.5 μ A/ 75 μ A max	330pF
471	50 μ A/ 100 μ A max	470pF
681	75.5 μ A/ 150 μ A max	680pF
102	0.13mA/ 0.25mA max	1000pF
222	0.25mA/ 0.5 mA max	2200pF
332	0.38mA/ 0.75mA max	3300pF
472	0.5 mA/ 1.0 mA max	4700pF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

- ④ Options
 D: DIN rail installation type

* The dimensions change when the option is set.
 Refer to External view.

Features of NAP series

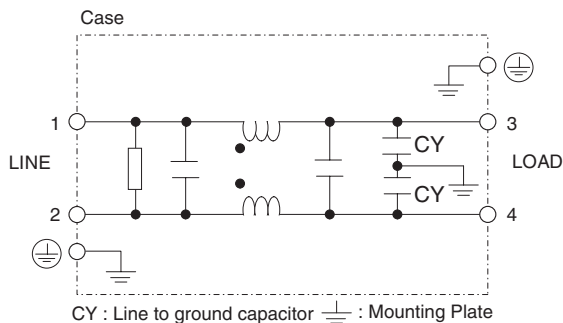
High-voltage pulses high-attenuation type

- Single Phase 250 VAC
- Push down type terminal block

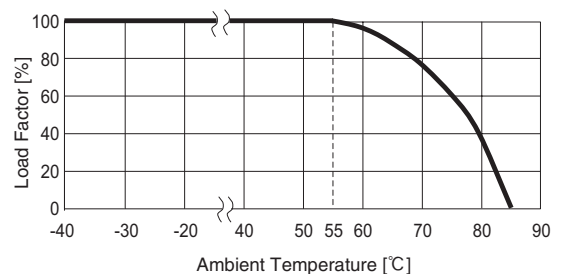
Specifications

No.	Items	NAP-04-472	NAP-06-472	NAP-10-472	NAP-16-472	NAP-20-472	NAP-30-472
1	Rated Voltage[V]	AC 1 ϕ 250 / DC250					
2	Rated Current[A]	4	6	10	16	20	30
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 20mA), 1minute at room temperature and humidity					
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100M Ω min at room temperature and humidity					
5	Leakage current 125/250V 60Hz	0.5mA/1.0mA max					
6	Voltage drop	1.0V max					
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)					
8	Operating temperature	-40 to +85°C (Refer to Derating Curve)					
9	Operating humidity	20 to 95%RH (Non condensing)					
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)					
11	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis					
12	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis					
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC (At only AC input)					
14	Case size (without projection) /Weight	53×41×92 mm [2.09×1.61×3.62 inches] (W×H×D) /300g max (Option : -D refer to external view)					

Circuit Diagram



Derating Curve

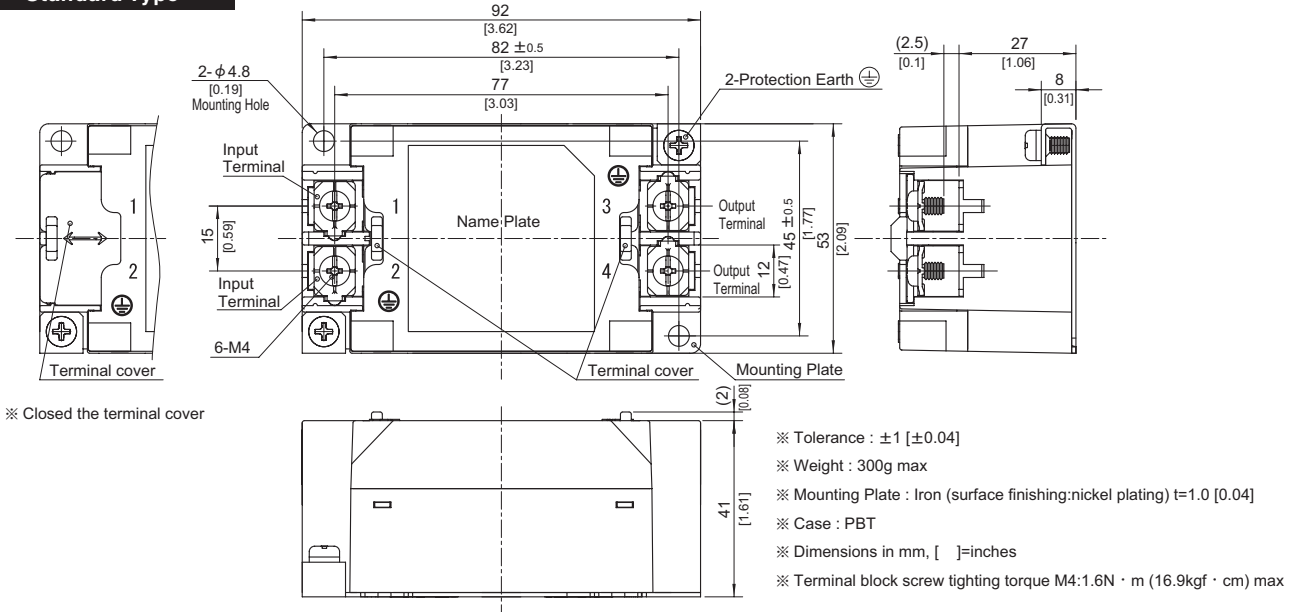


External view

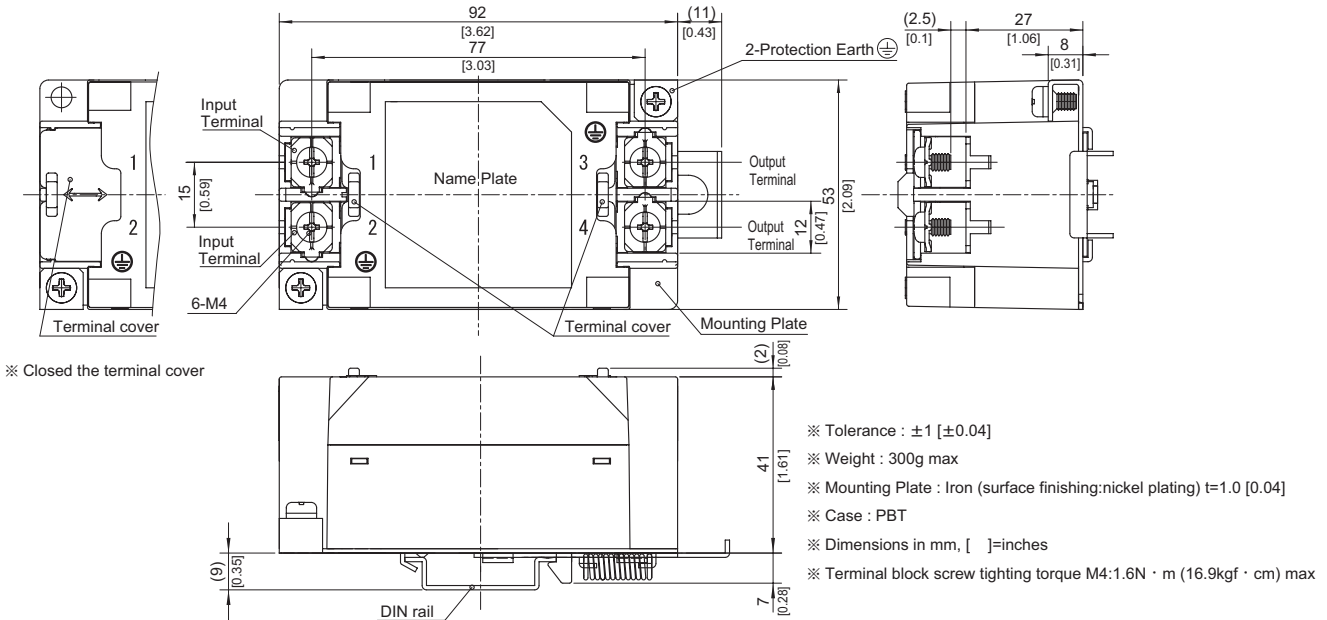
As this product is adopted push-down type terminal block, this appearance is as follows.

- ①The terminal cover is retracted inside the unit.
- ②The screws for connecting the terminals are held in the up right position.

Standard Type



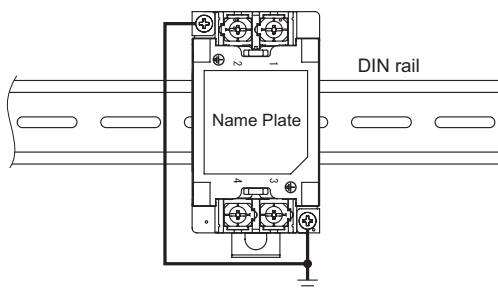
DIN rail installation Type



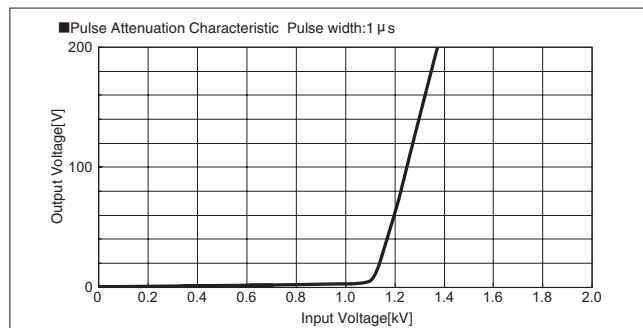
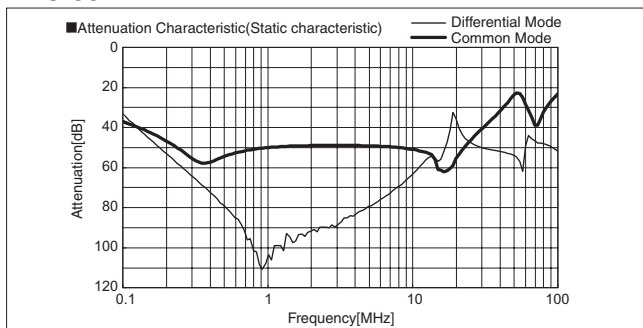
■Note when installing the EMI/EMC Filter on a DIN rail.

When the EMI/EMC Filter is grounded through the DIN rail, the proper noise attenuation may not be achieved.

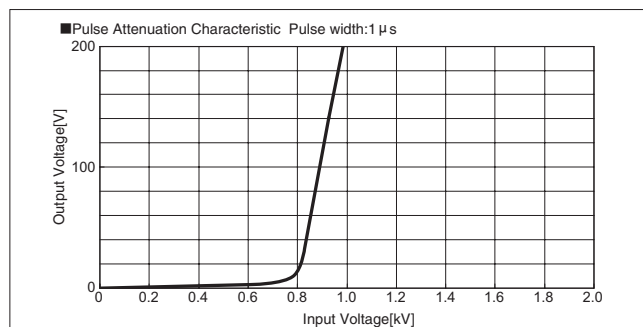
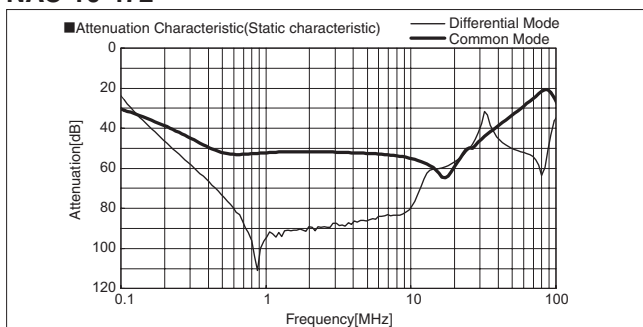
Be sure to connect the protection earth (PE) of the EMI/EMC Filter body to the earth. It can connect the ground to either one only.



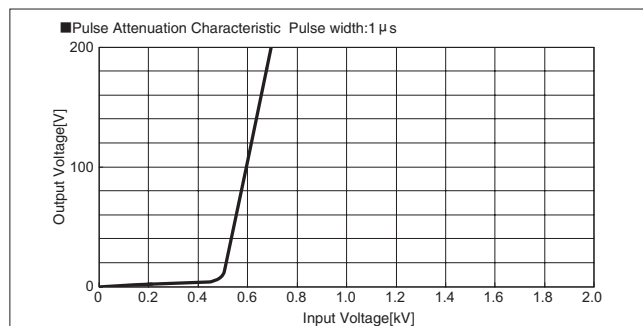
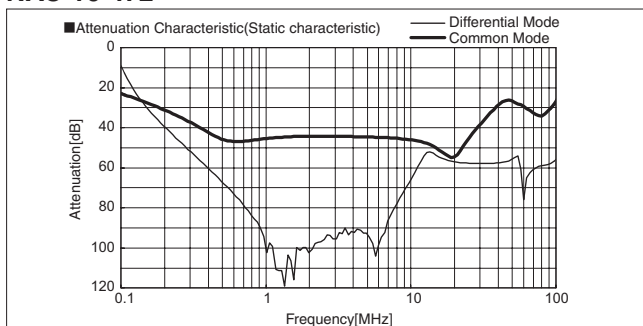
NAC-06-472



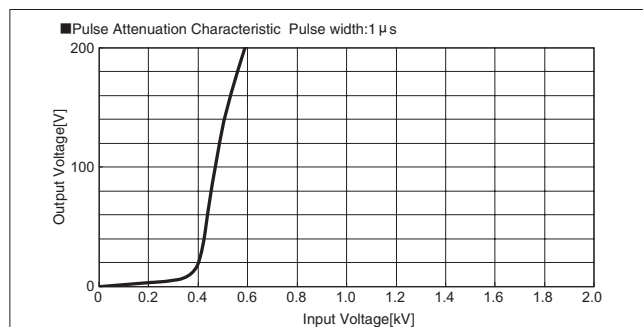
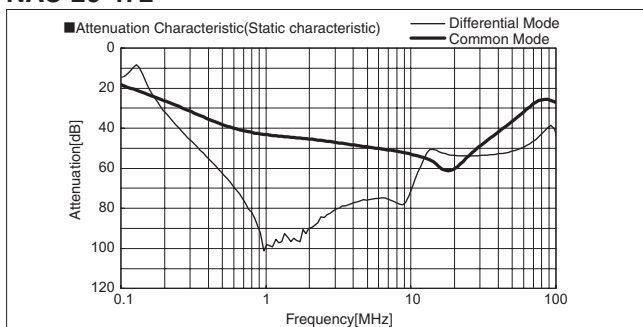
NAC-10-472



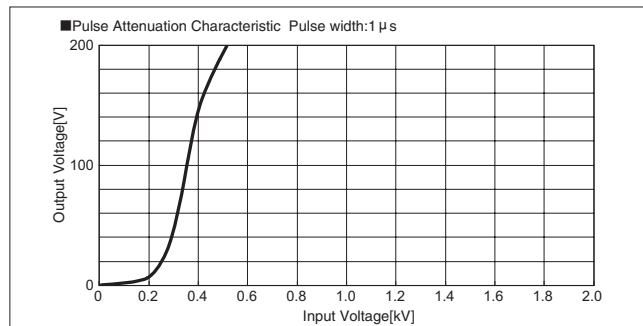
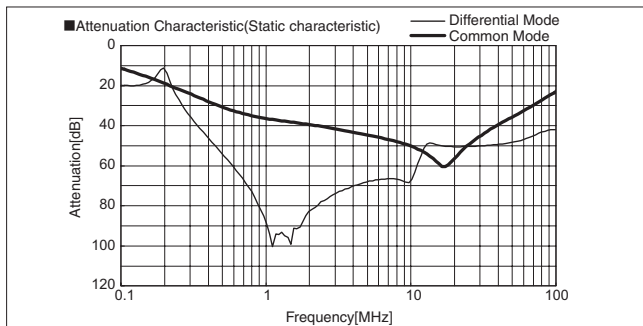
NAC-16-472



NAC-20-472

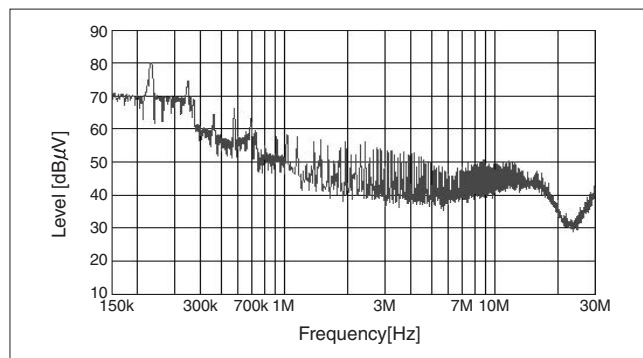


NAC-30-472

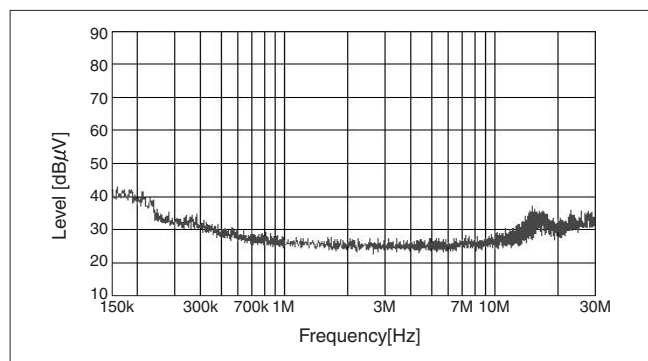


■Characteristic example of conductive noise reduction.

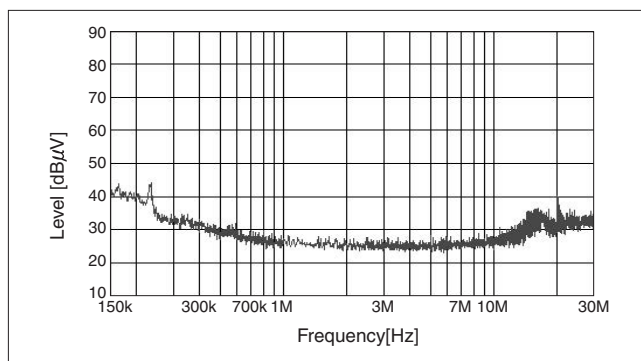
Reference data (PBA150F-5-G : Low leakage current type)



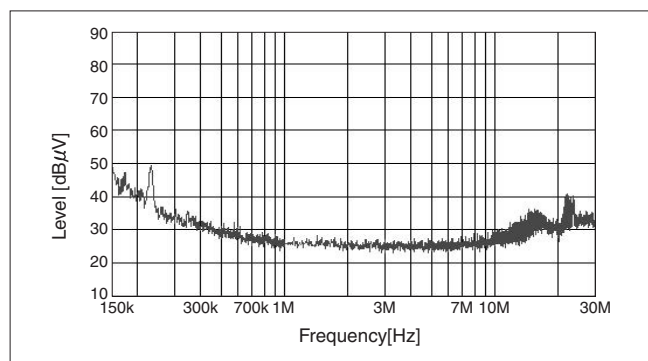
NAC-06-472+PBA150F-5-G



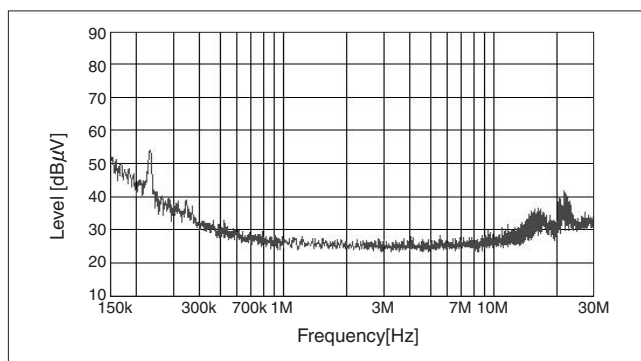
NAC-10-472+PBA150F-5-G



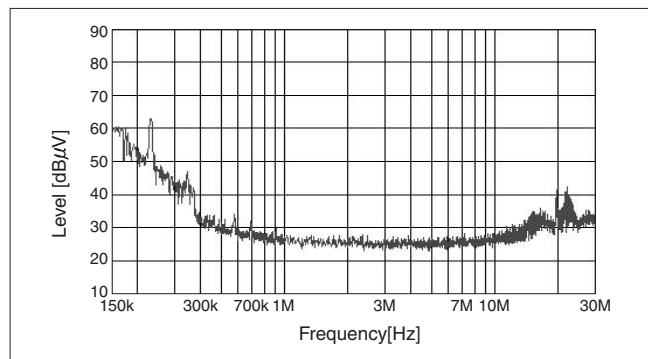
NAC-16-472+PBA150F-5-G



NAC-20-472+PBA150F-5-G

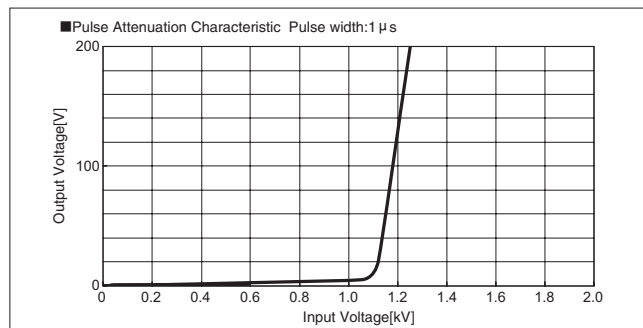
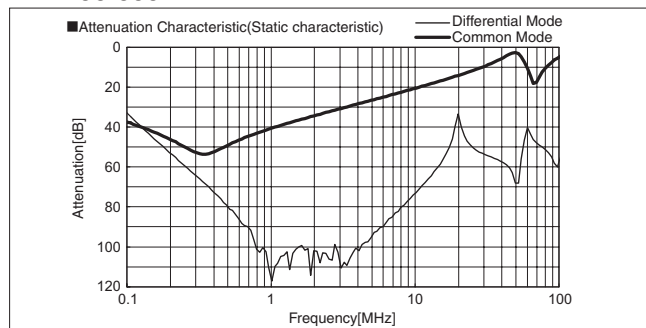


NAC-30-472+PBA150F-5-G

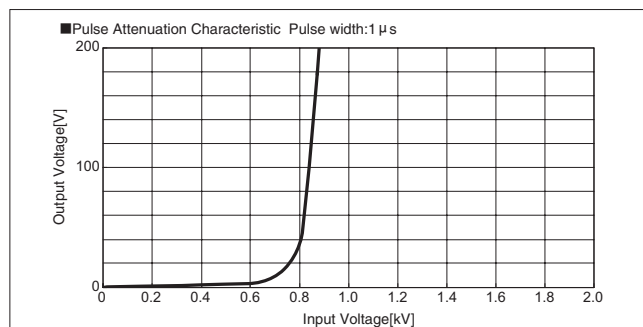
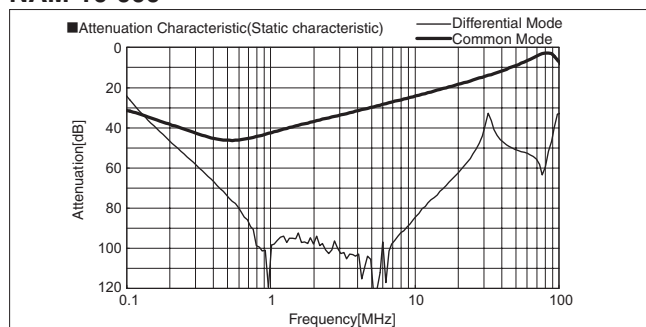


Condition : 230 VAC, $I_o=100\%$

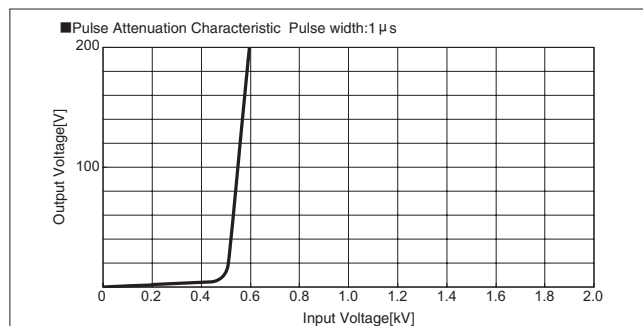
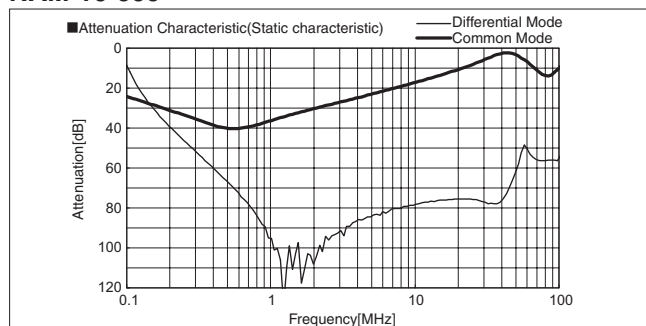
NAM-06-000



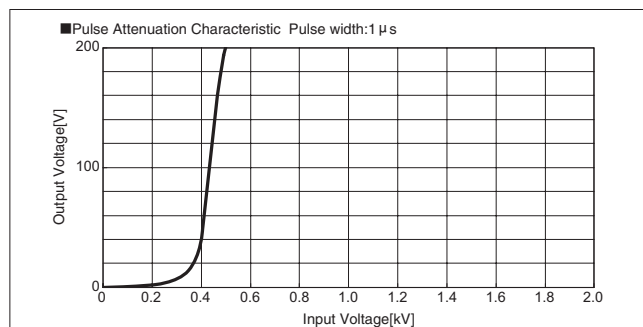
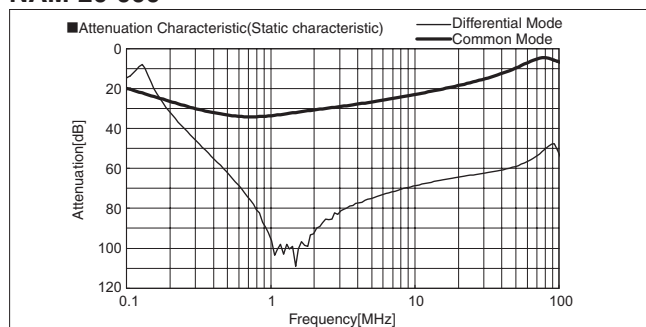
NAM-10-000



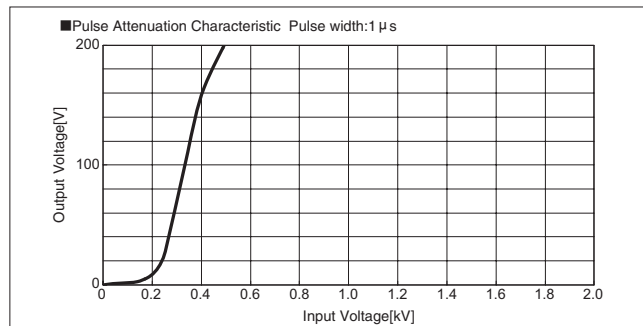
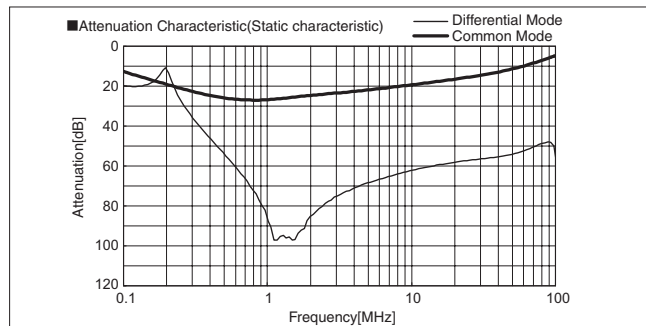
NAM-16-000



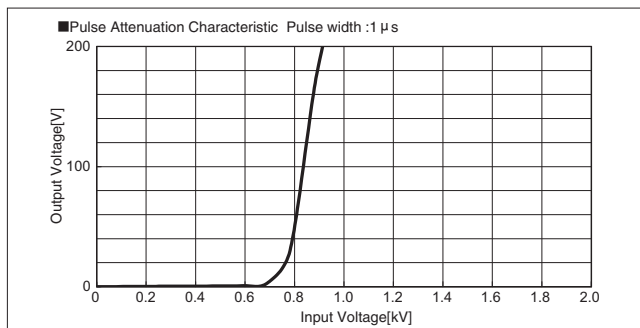
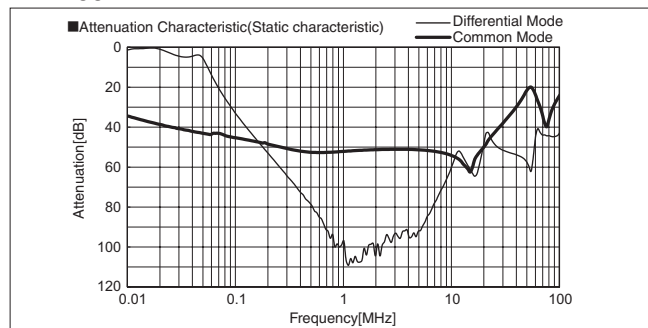
NAM-20-000



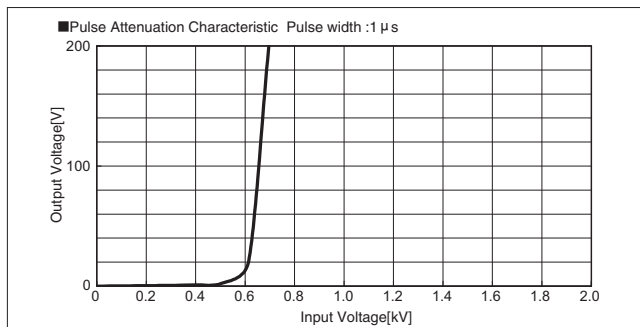
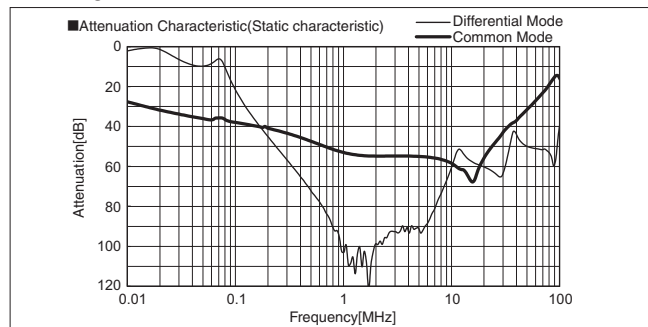
NAM-30-000



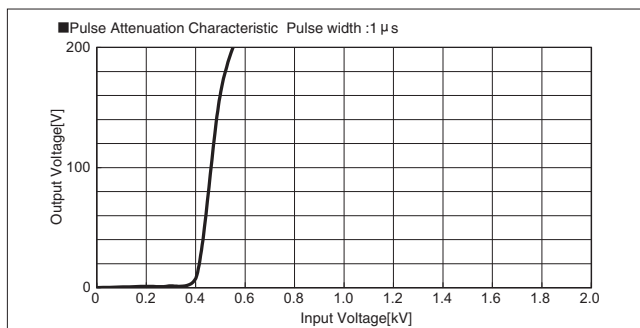
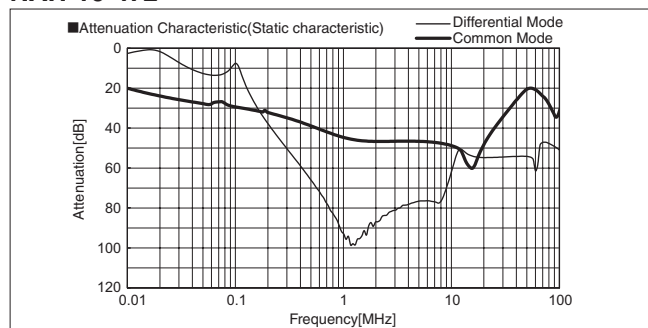
NAH-06-472



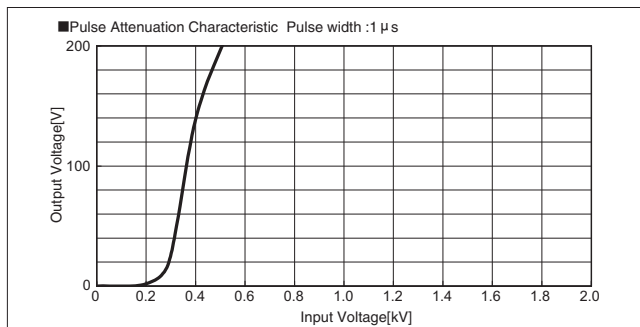
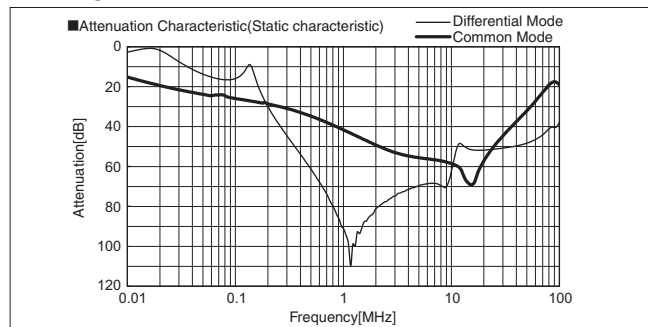
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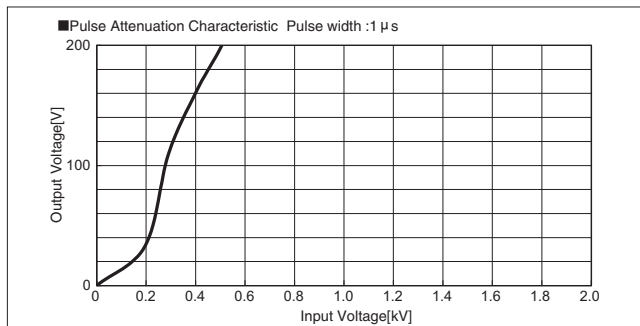
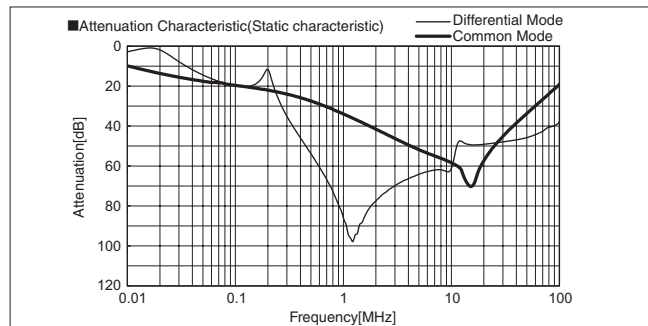
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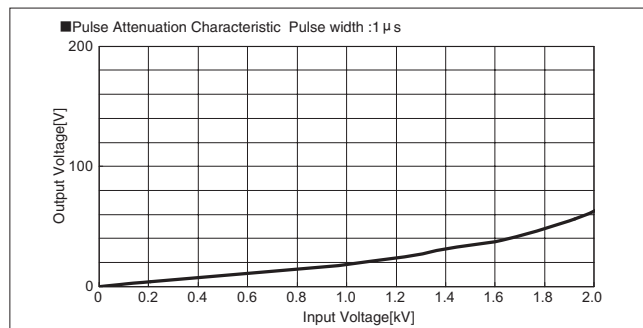
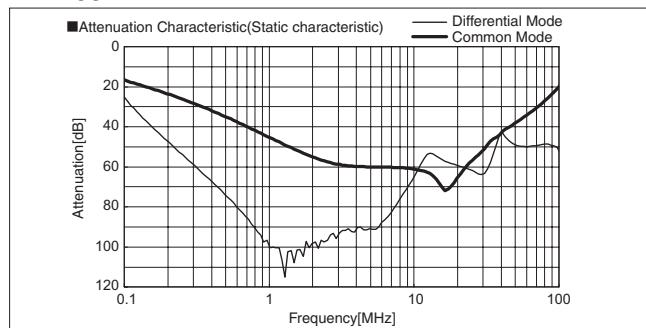
NAH-20-472



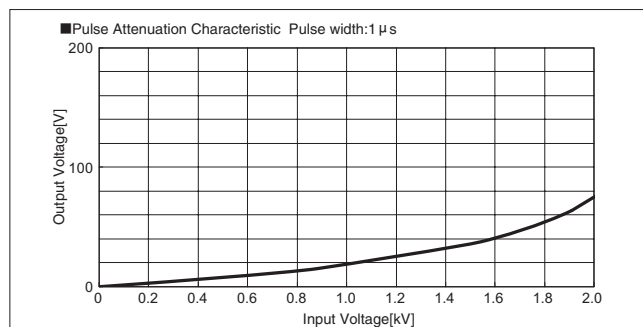
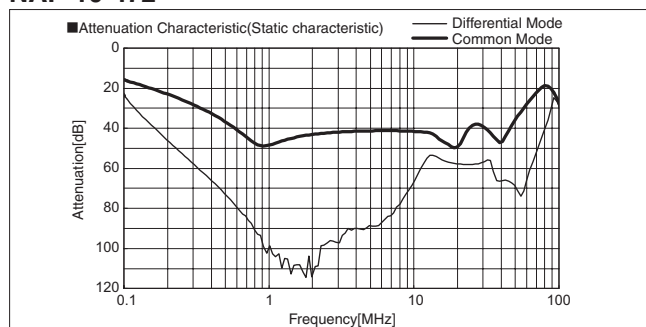
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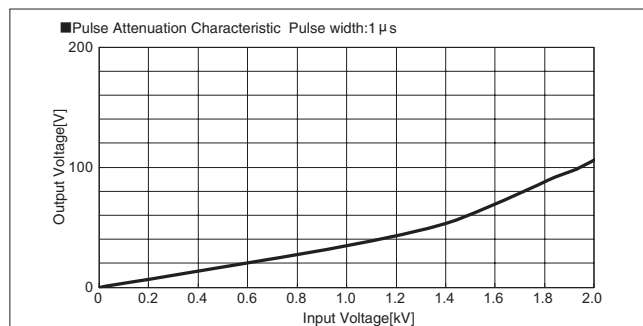
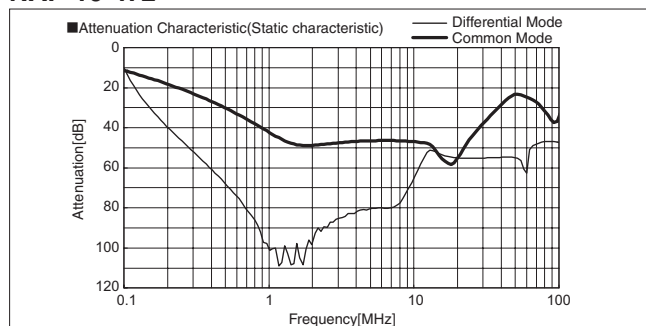
NAP-06-472



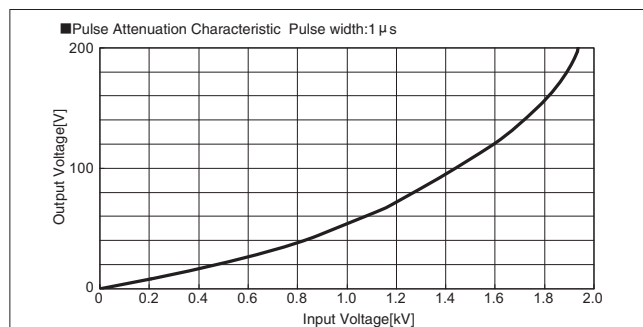
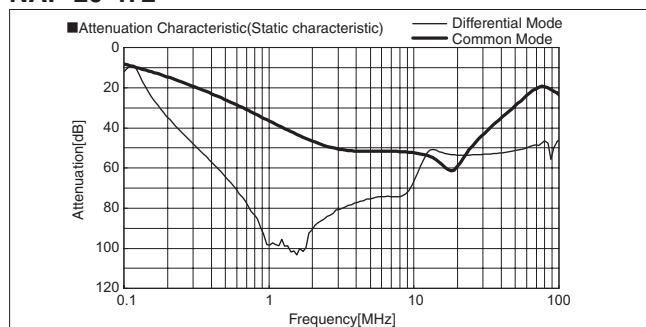
NAP-10-472



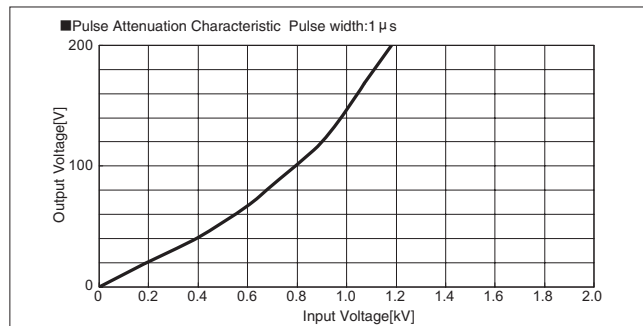
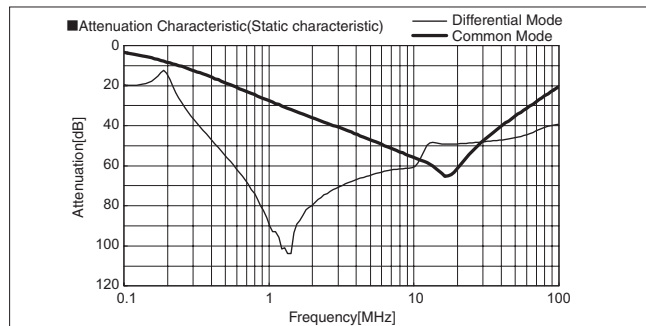
NAP-16-472



NAP-20-472



NAP-30-472



NBH series

NBH -10 -432 -□

- ① Model Name
② Rated Current
③ Line to ground capacitor code: See table 1.1.

table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 125/250V 60Hz)	Line to ground capacitor (nominal value)		Test voltage (Terminal- Mounting Plate)
		CY1	CY2	
000	5 μ A/ 10 μ A max	Not Provided	Not Provided	4,000VAC
101	12.5 μ A/ 25 μ A max	100pF	Not Provided	
221	25 μ A/ 50 μ A max	220pF	Not Provided	
331	37.5 μ A/ 75 μ A max	330pF	Not Provided	
471	50 μ A/100 μ A max	470pF	Not Provided	
681	75.5 μ A/150 μ A max	680pF	Not Provided	2,500VAC
102	0.13mA/0.25mA max	1000pF	Not Provided	
202	0.25mA/0.5 mA max	1000pF	1000pF	
322	0.38mA/0.75mA max	2200pF	1000pF	
432	0.5 mA/1.0 mA max	3300pF	1000pF	

* When the line to ground capacitor code is different, the attenuation characteristic is different.

- ④ Options
D: DIN rail installation type

* The dimensions change when the option is set.
Refer to External view.

Features of NBH series

Ultra high-attenuation type of common mode noise from 10kHz to 10MHz (2-stage filter)

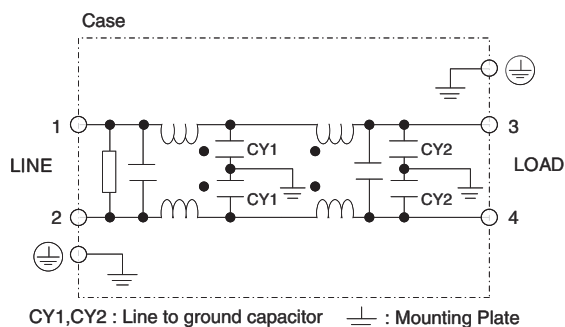
- Single Phase 250 VAC
- Withstand voltage 4,000 VAC
(Line to ground capacitor code -000 to -471)
- Push down type terminal block

Specifications

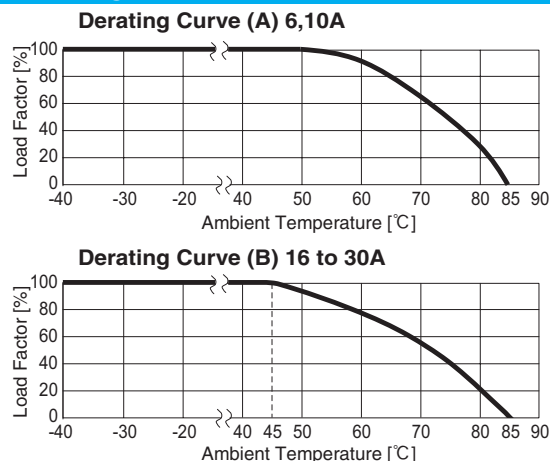
No.	Items	NBH-06-432	NBH-10-432	NBH-16-432	NBH-20-432	NBH-30-432
1	Rated Voltage[V]	AC 1 ϕ 250 / DC250				
2	Rated Current[A]	6	10	16	20	30
3	Test Voltage (Terminal-Mounting Plate) *1	2,500 VAC (Cutoff Current = 20mA), 1minute at room temperature and humidity				
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100M Ω min at room temperature and humidity				
5	Leakage current 125/250V 60Hz	0.5mA/1.0mA max				
6	Voltage drop	1.0V max				
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve A)		-25 to +85°C (Refer to Derating Curve B)		
8	Operating temperature	-40 to +85°C (Refer to Derating Curve A)		-40 to +85°C (Refer to Derating Curve B)		
9	Operating humidity	20 to 95%RH (Non condensing)				
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)				
11	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis				
12	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis				
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC (At only AC input)				
14	Case size (without projection) /Weight	53×43×104 mm [2.09×1.69×4.09 inches] (W×H×D) /320g max (Option : -D refer to external view)				

*1 When the line to ground capacitor code is different, the test voltage characteristic is different. (See table 1.1)

Circuit Diagram



Derating Curve

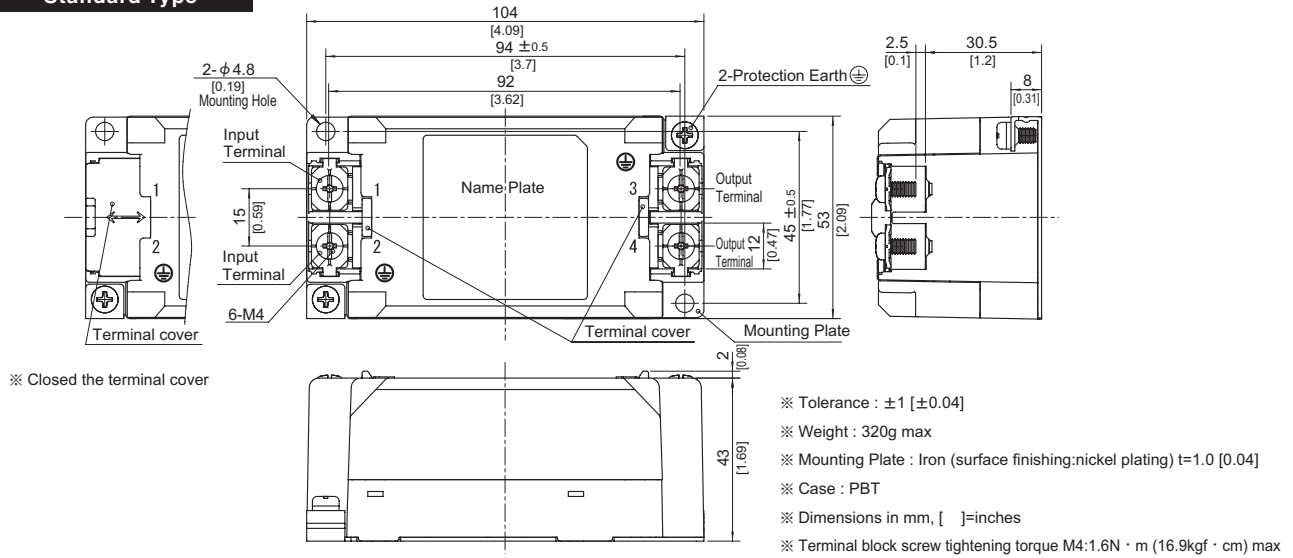


External view

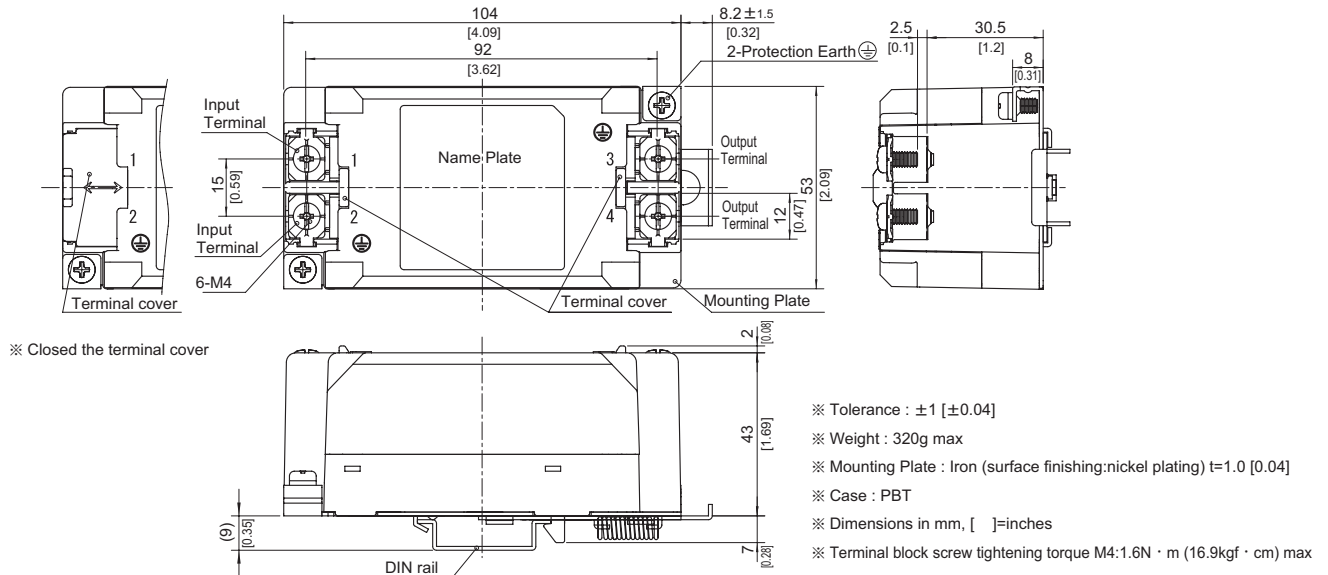
As this product is adopted push-down type terminal block, this appearance is as follows.

- ①The terminal cover is retracted inside the unit.
- ②The screws for connecting the terminals are held in the up right position.

Standard Type



DIN rail installation Type

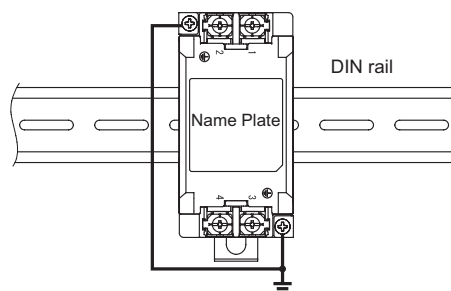


■Note when installing the EMI/EMC Filter on a DIN rail.

When the EMI/EMC Filter is grounded through the DIN rail, the proper noise attenuation may not be achieved.

Be sure to connect the protection earth (PE) of the EMI/EMC Filter body to the earth.
It can connect the ground to either one only.

It can connect the ground to either one only.



NBC series

NBC -10 -472 -□

① ② ③ ④

- ① Model Name
② Rated Current
③ Line to ground capacitor code: See table 1.1.

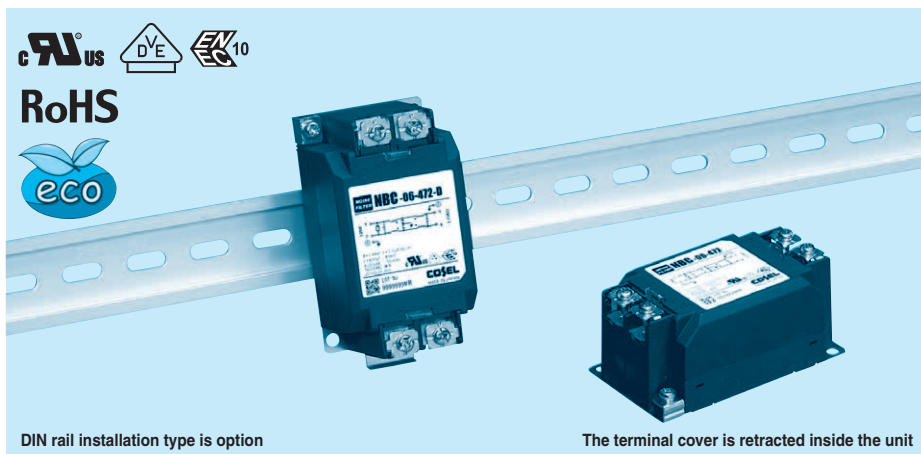
table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 125/250V 60Hz)	Line to ground capacitor (nominal value)
681	75.5 μ A/ 150 μ A max	680pF
102	0.13mA/ 0.25mA max	1000pF
222	0.25mA/ 0.5 mA max	2200pF
332	0.38mA/ 0.75mA max	3300pF
472	0.5 mA/ 1.0 mA max	4700pF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

- ④ Options
D: DIN rail installation type

* The dimensions change when the option is set.
Refer to External view.



DIN rail installation type is option

The terminal cover is retracted inside the unit

Features of NBC series

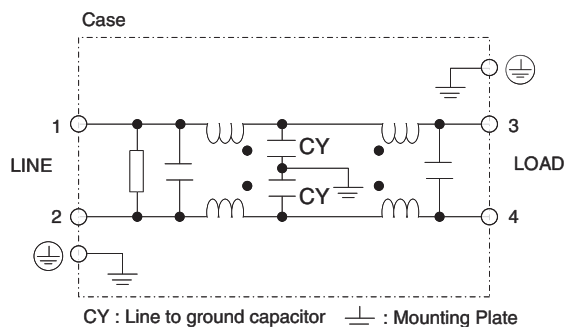
High-attenuation type of common mode noise from 150kHz to 1MHz (2-stage filter)

- Single Phase 250 VAC
- Push down type terminal block

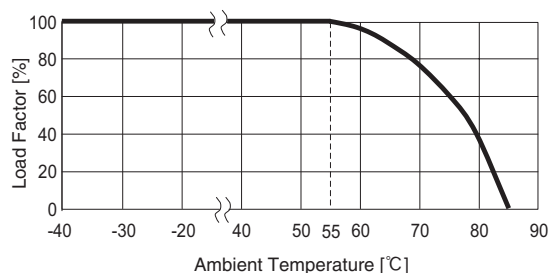
Specifications

No.	Items	NBC-06-472	NBC-10-472	NBC-16-472	NBC-20-472	NBC-30-472
1	Rated Voltage[V]	AC 1 ϕ 250 / DC250				
2	Rated Current[A]	6	10	16	20	30
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 20mA), 1minute at room temperature and humidity				
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100M Ω min at room temperature and humidity				
5	Leakage current 125/250V 60Hz	0.5mA/1.0mA max				
6	Voltage drop	1.0V max				
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)				
8	Operating temperature	-40 to +85°C (Refer to Derating Curve)				
9	Operating humidity	20 to 95%RH (Non condensing)				
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)				
11	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis				
12	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis				
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC (At only AC input)				
14	Case size (without projection) /Weight	53 X 41 X 92 mm [2.09 X 1.61 X 3.62 inches] (W X H X D) /270g max (Option : -D refer to external view)				

Circuit Diagram



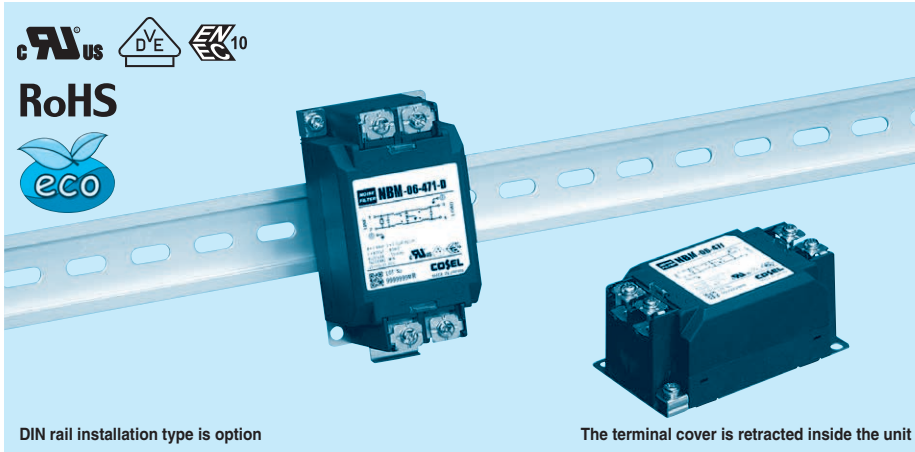
Derating Curve



NBM series

NBM -10 -471 -□

① ② ③ ④



- ① Model Name
- ② Rated Current
- ③ Line to ground capacitor code: See table 1.1.

table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 125/250V 60Hz)	Line to ground capacitor (nominal value)
000	5 μ A / 10 μ A max	Not Provided
101	12.5 μ A / 25 μ A max	100pF
221	25 μ A / 50 μ A max	220pF
331	37.5 μ A / 75 μ A max	330pF
471	50 μ A / 100 μ A max	470pF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

- ④ Options
- D: DIN rail installation type

* The dimensions change when the option is set.
Refer to External view.

Features of NBM series

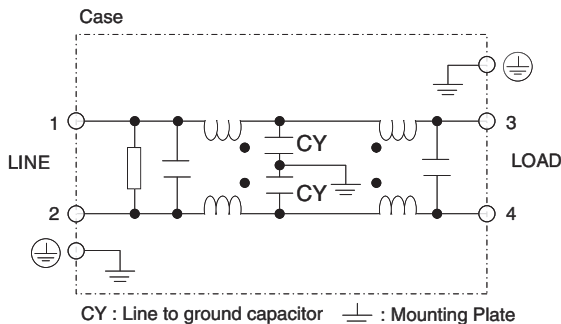
Low leakage current type, Withstand voltage 4,000VAC (2-stage filter)

- Single Phase 250 VAC
- Push down type terminal block

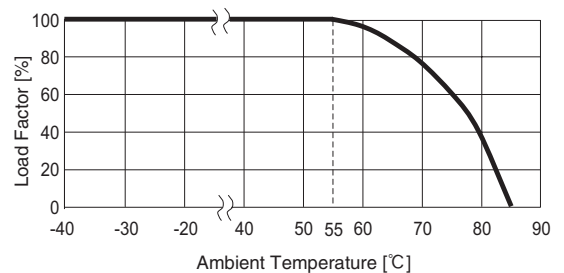
Specifications

No.	Items	NBM-06-471	NBM-10-471	NBM-16-471	NBM-20-471	NBM-30-471
1	Rated Voltage[V]	AC 1 ϕ 250 / DC250				
2	Rated Current[A]	6	10	16	20	30
3	Test Voltage (Terminal-Mounting Plate)	4,000 VAC (Cutoff Current = 20mA), 1minute at room temperature and humidity				
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100M Ω min at room temperature and humidity				
5	Leakage current 125/250V 60Hz	50 μ A/100 μ A max				
6	Voltage drop	1.0V max				
7	Safety agency approval temperatures	-25 to +85 $^{\circ}$ C (Refer to Derating Curve)				
8	Operating temperature	-40 to +85 $^{\circ}$ C (Refer to Derating Curve)				
9	Operating humidity	20 to 95%RH (Non condensing)				
10	Storage temperature/humidity	-40 to +85 $^{\circ}$ C/20 to 95%RH (Non condensing)				
11	Vibration	10 to 55Hz, 19.6m/s 2 (2G), 3min. Period, 1hour each X, Y and Z axis				
12	Impact	196.1m/s 2 (20G), 11ms Once each X, Y and Z axis				
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC (At only AC input)				
14	Case size (without projection) /Weight	53 \times 41 \times 92 mm [2.09 \times 1.61 \times 3.62 inches] (W \times H \times D) /270g max (Option : -D refer to external view)				

Circuit Diagram



Derating Curve

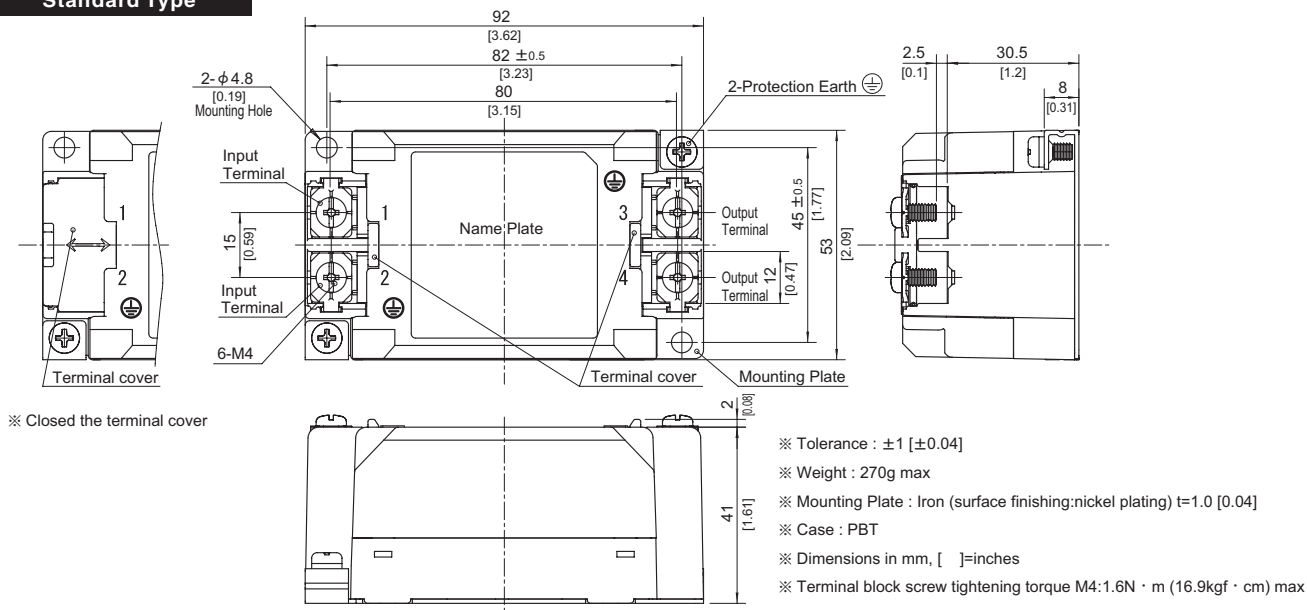


External view

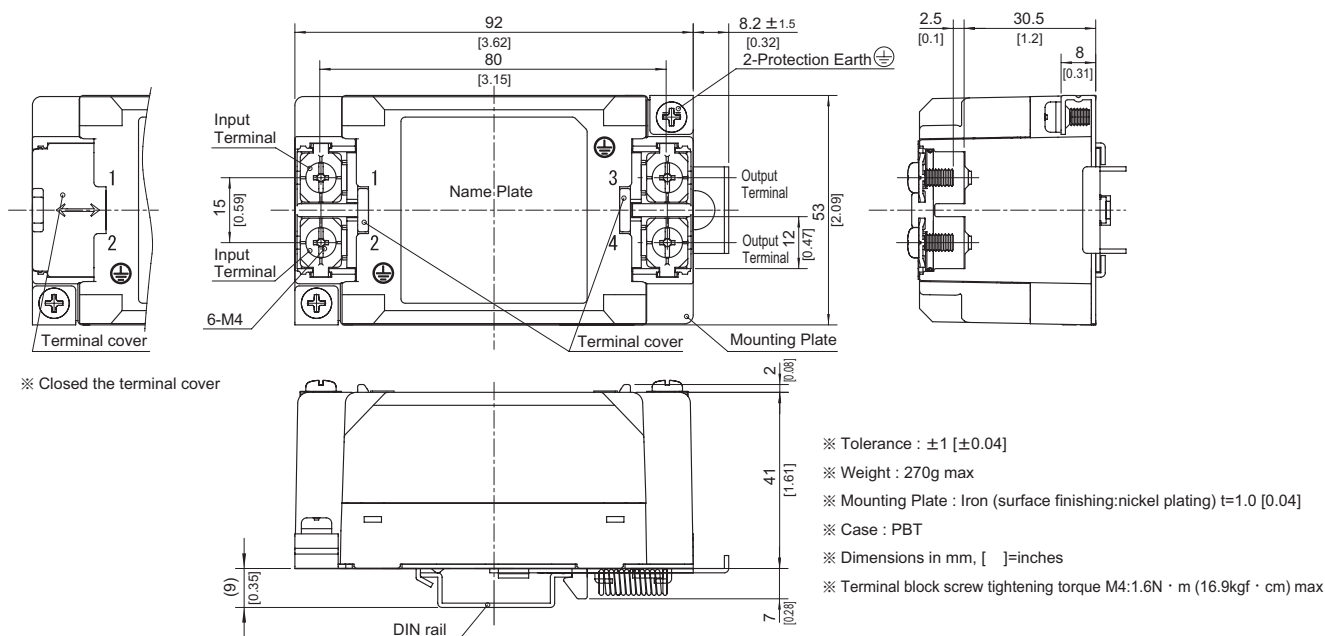
As this product is adopted push-down type terminal block, this appearance is as follows.

- ①The terminal cover is retracted inside the unit.
- ②The screws for connecting the terminals are held in the up right position.

Standard Type



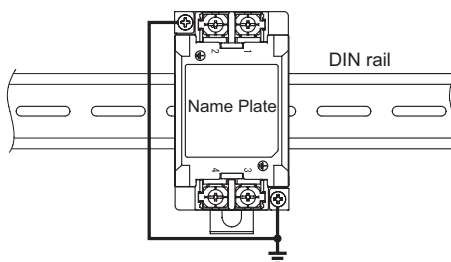
DIN rail installation Type



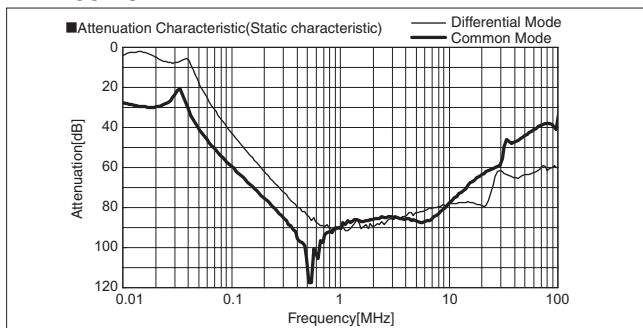
■Note when installing the EMI/EMC Filter on a DIN rail.

When the EMI/EMC Filter is grounded through the DIN rail, the proper noise attenuation may not be achieved.

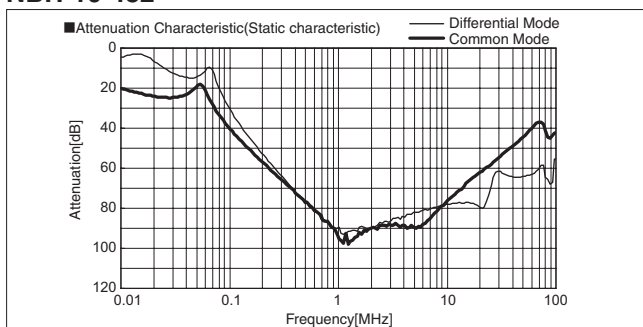
Be sure to connect the protection earth (PE) of the EMI/EMC Filter body to the earth. It can connect the ground to either one only.



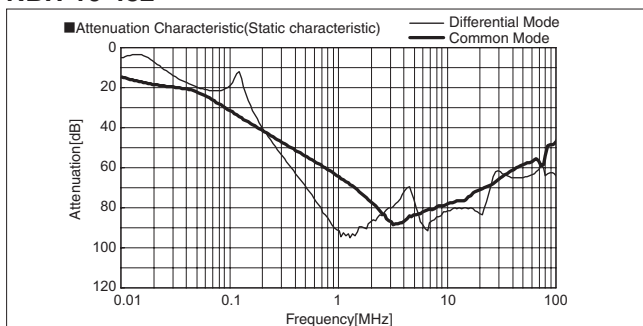
NBH-06-432



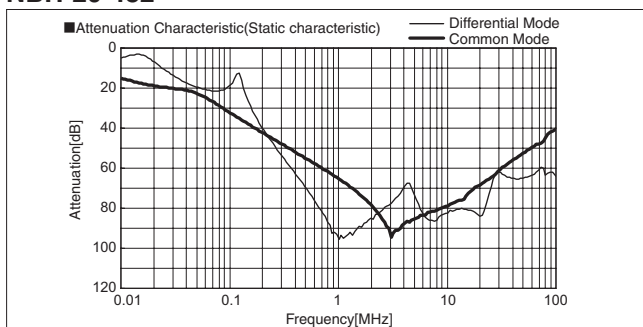
NBH-10-432



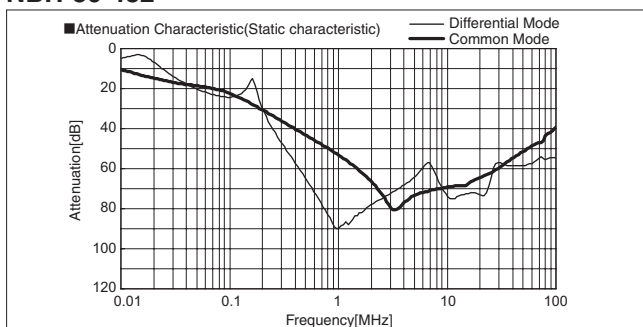
NBH-16-432



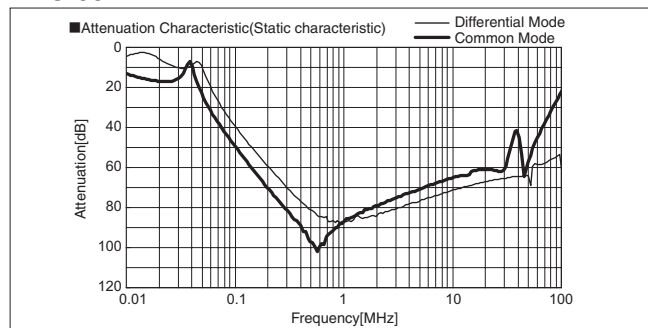
NBH-20-432



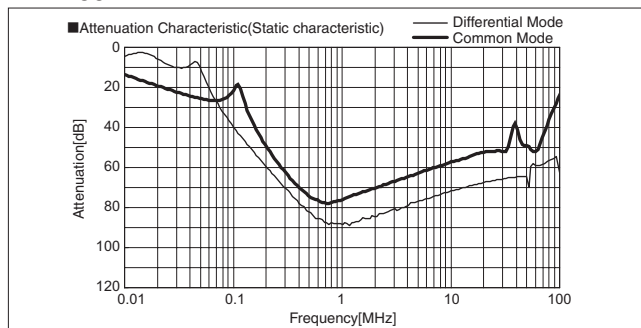
NBH-30-432



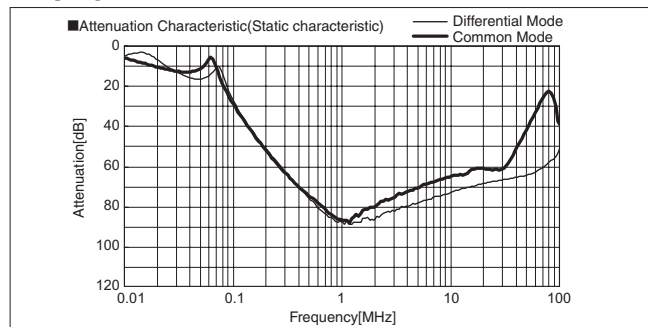
NBC-06-472



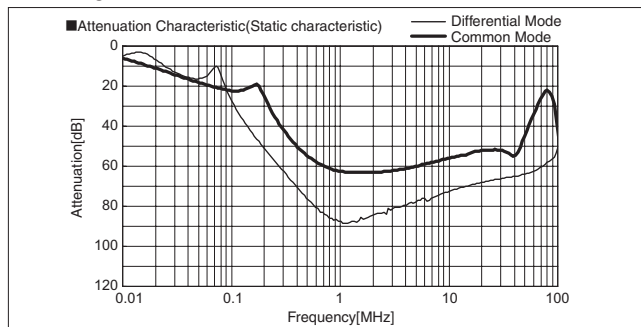
NBM-06-471



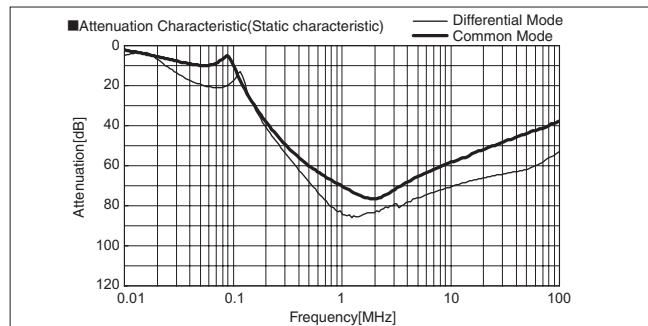
NBC-10-472



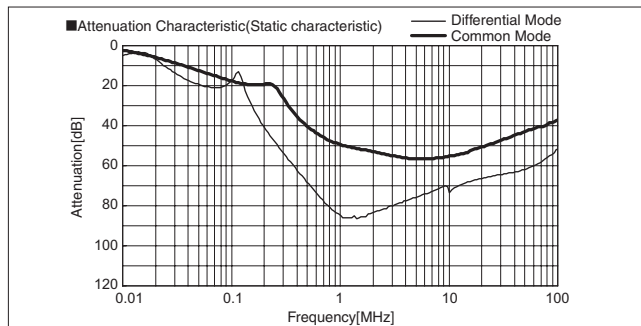
NBM-10-471



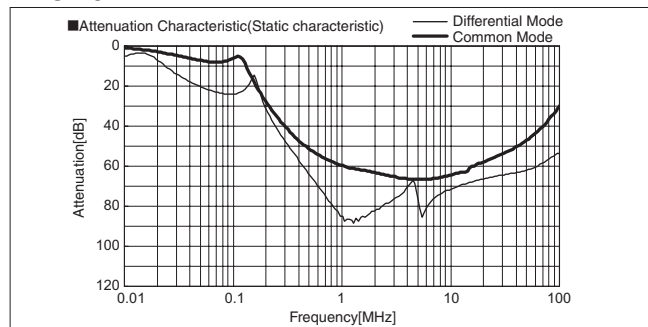
NBC-16-472



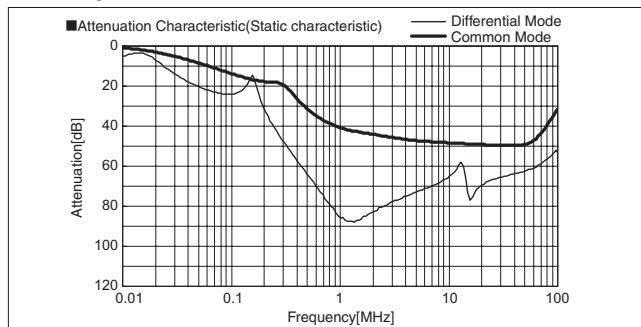
NBM-16-471



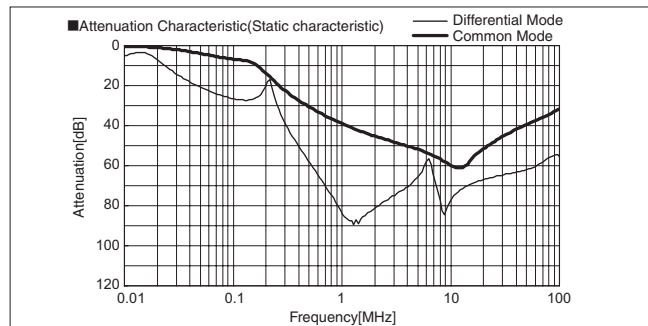
NBC-20-472



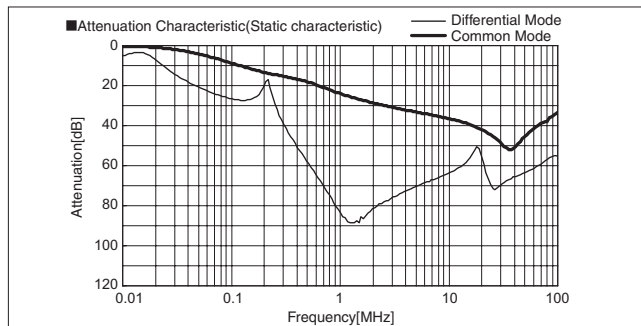
NBM-20-471



NBC-30-472



NBM-30-471



JAC series(6-30A)

JAC -30 -683 -□

① ② ③ ④

① Model Name

② Rated Current

③ Line to ground capacitor code:See table 1.1.

table1.1 Line to ground capacitor code

Code	Leakage Current (Input 250/500V 60Hz)	Line to ground capacitor (nominal value)
103	0.5mA/1.0 mA max	10,000pF
223	1.0mA/2.0 mA max	22,000pF
683	2.5mA/5.0 mA max	68,000pF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

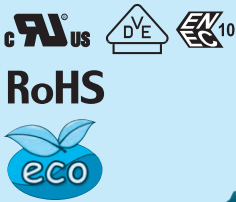
* Please contact us about ultra high attenuation type for EU (Wye type with neutral earth system).

④ Option

D:DIN rail installation type

* The dimensions change when the option is set.
Refer to External view.

H:Ultra high-attenuation type



The terminal cover is retracted inside the unit

DIN rail installation type is option

Features of JAC series

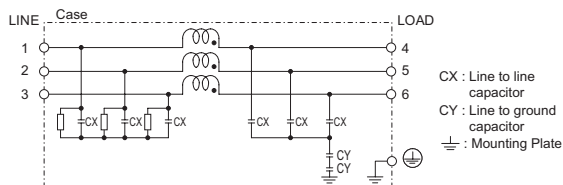
Compact and low profile , common mode EMI/EMC filters in 150kHz to 1MHz(1-stage filter)

- Three Phase 500 VAC
- Push down type terminal block

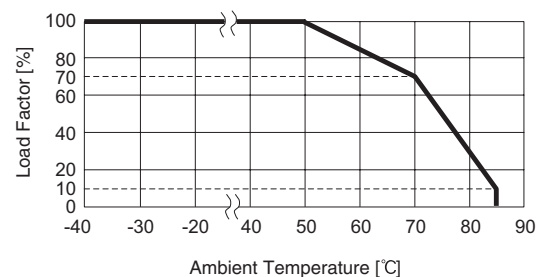
Specifications

No.	Items	JAC-06-683	JAC-10-683	JAC-20-683	JAC-30-683
1	Rated Voltage[V]	AC Three Phase 500 (voltage range:528 max) 50/60Hz			
2	Rated Current[A]	6	10	20	30
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 100mA), 1minute at room temperature and humidity			
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100MΩ min at room temperature and humidity			
5	Leakage current 250/500V 60Hz	2.5mA/5.0mA max			
6	DC resistance	100mΩ max	45mΩ max	15mΩ max	8mΩ max
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)			
8	Operating temperature	-40 to +85°C (Refer to Derating Curve)			
9	Operating humidity	20 to 95%RH (Non condensing)			
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)			
11	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis			
12	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis			
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL) , DIN EN60939 VDE0565 Teil3-1, ENEC			
14	Case size (without projection)	63×44×132 mm (W×H×D) (Option: -D refer to external view) [2.48×1.73×5.20 inches] (W×H×D)			
15	Weight	440g max			

Circuit Diagram



Derating Curve

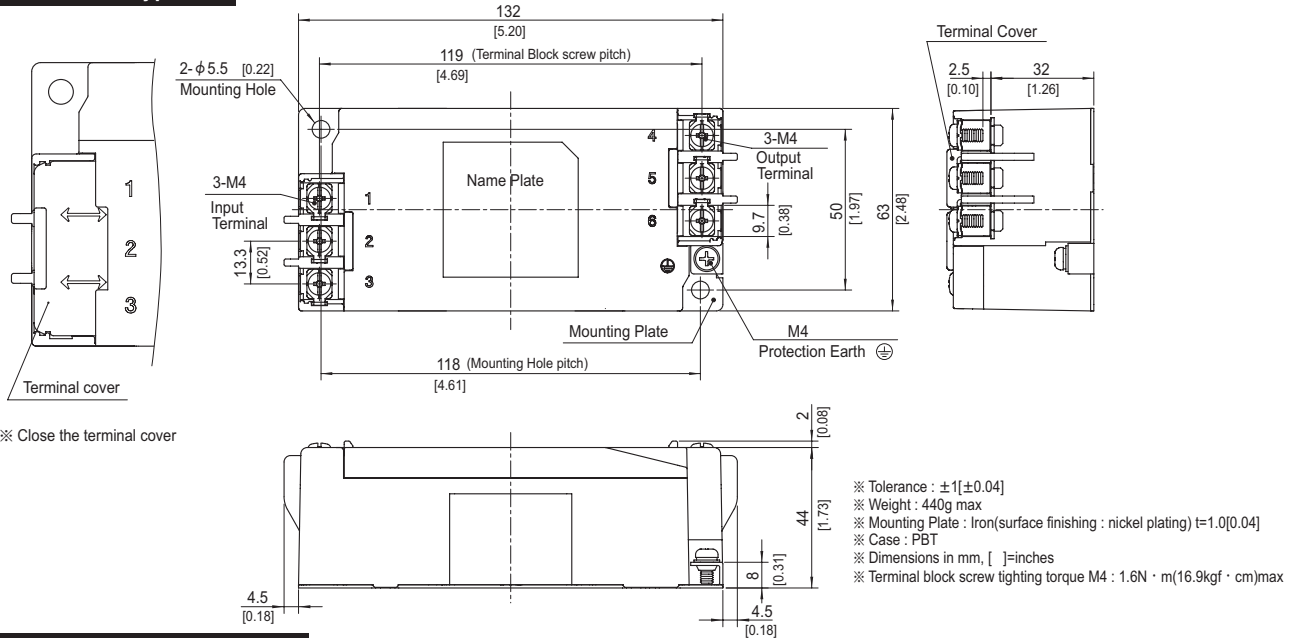


External view

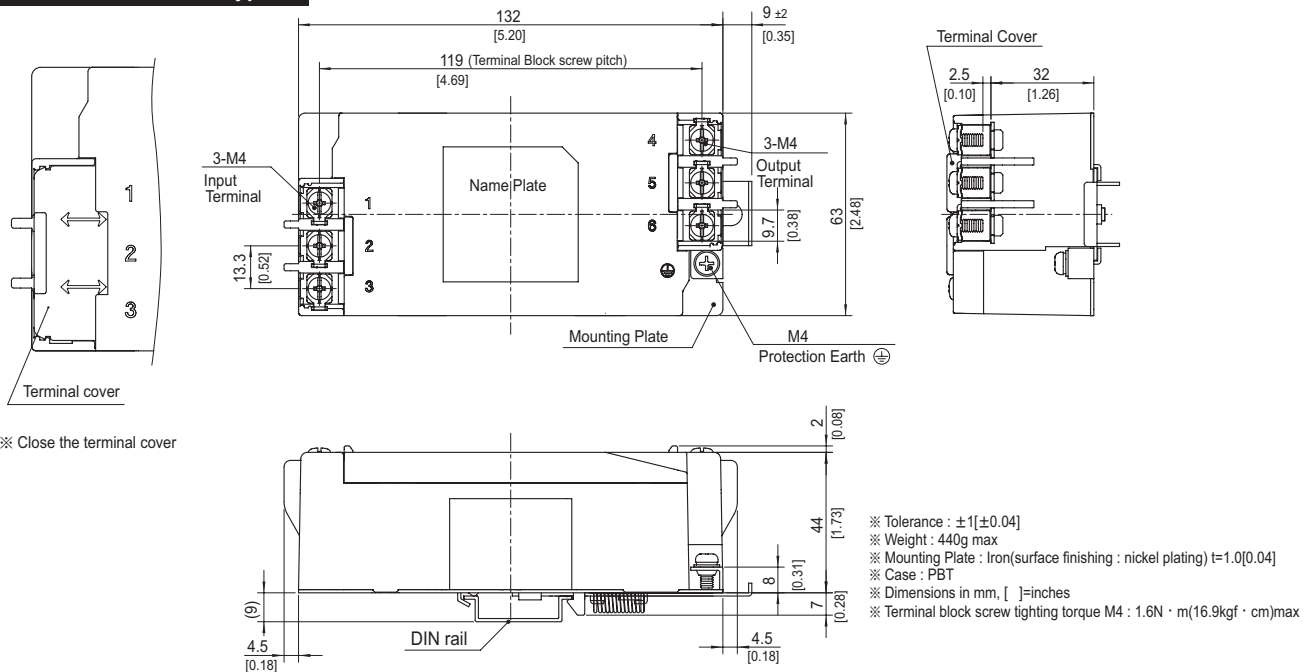
As this product is adopted push-down type terminal block, this appearance is as follows.

- ①The terminal cover is retracted inside the unit.
- ②The screws for connecting the terminals are held in the up right position.

Standard Type



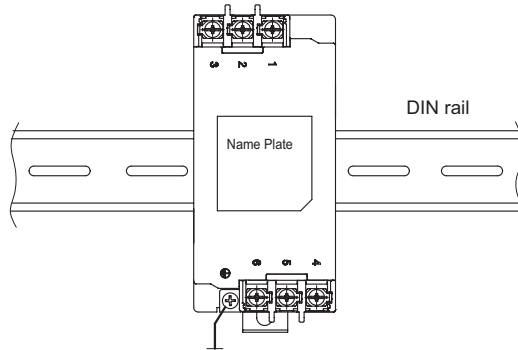
DIN rail installation Type

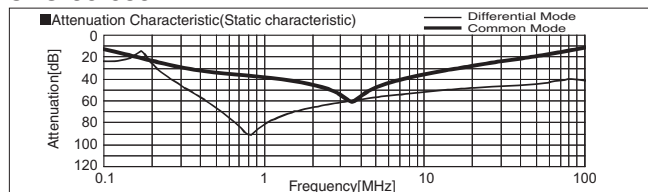
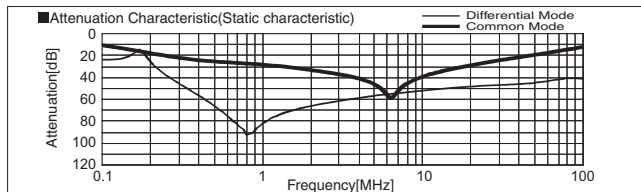
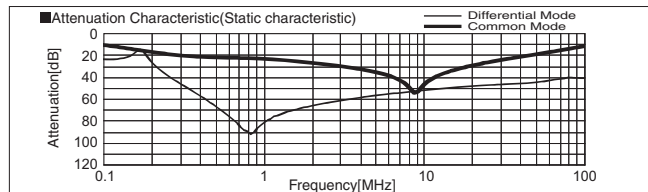
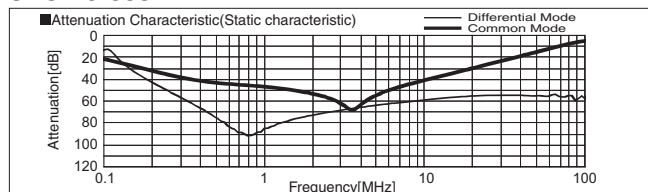
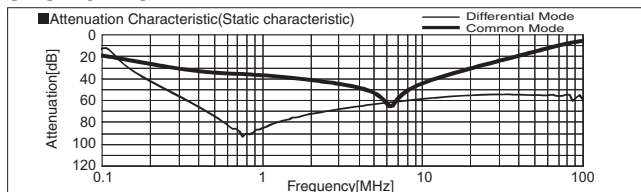
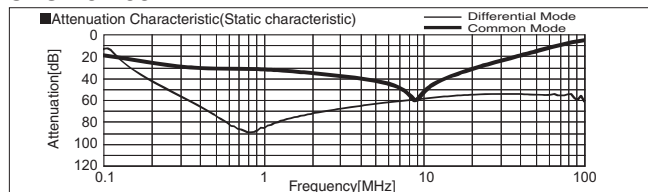
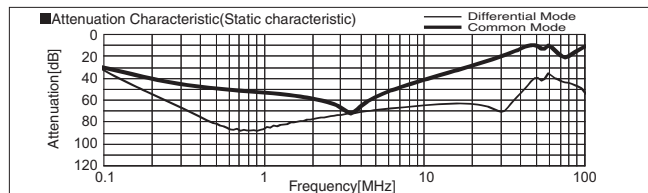
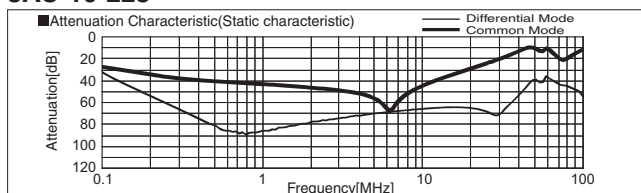
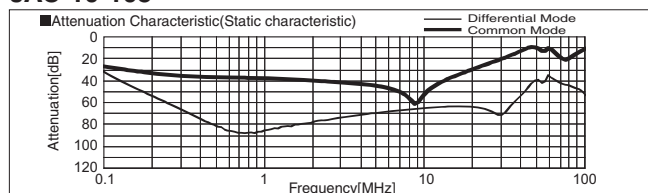
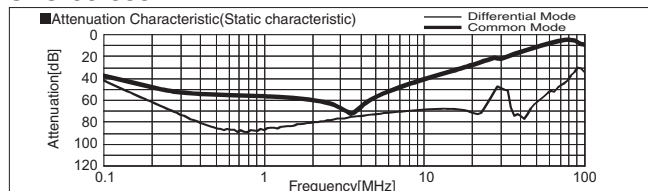
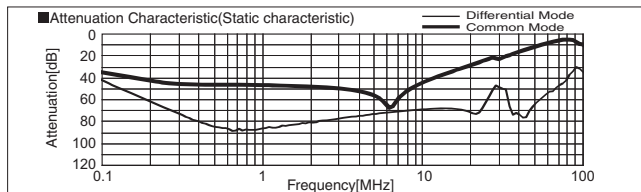
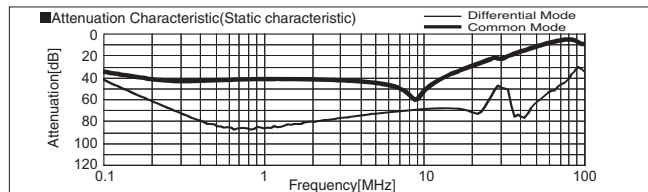


■Note when installing the EMI/ EMC Filter on a DIN rail.

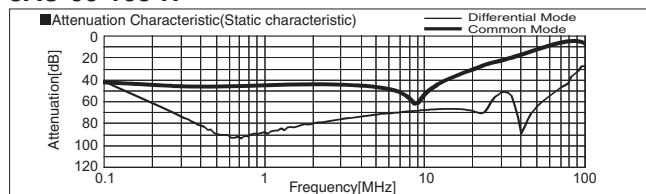
When the EMI/EMC Filter is grounded through the DIN rail, the proper noise attenuation may not be achieved.

Be sure to connect the protection earth (PE) of the EMI/EMC Filter body to the earth.

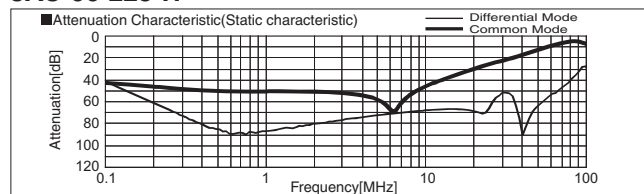




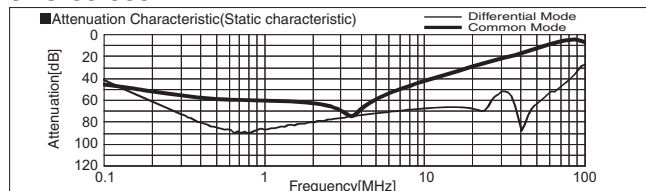
JAC-06-103-H



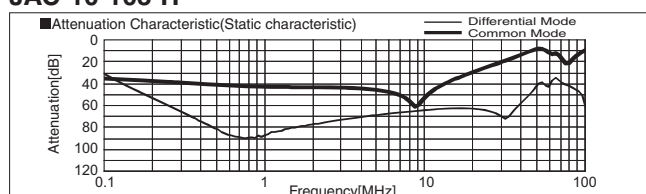
JAC-06-223-H



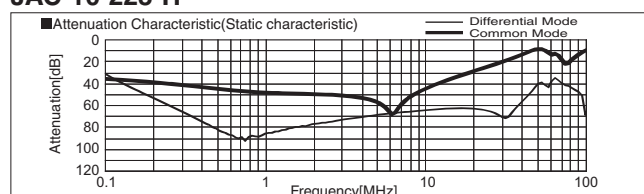
JAC-06-683-H



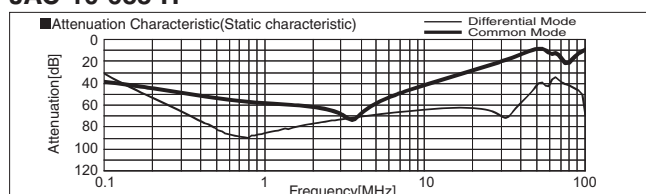
JAC-10-103-H



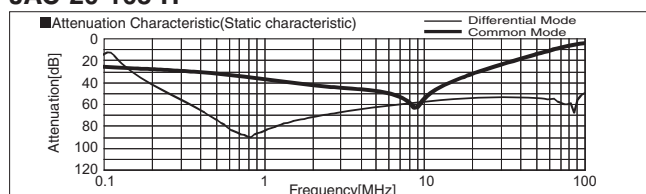
JAC-10-223-H



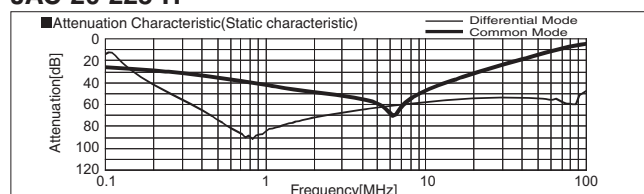
JAC-10-683-H



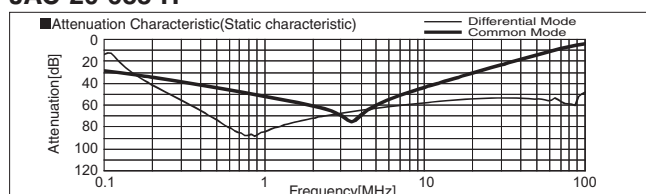
JAC-20-103-H



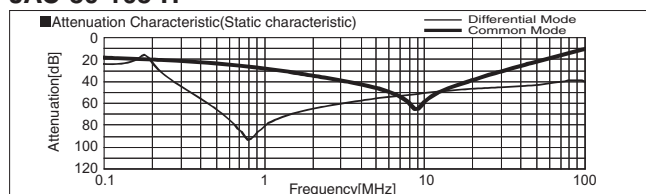
JAC-20-223-H



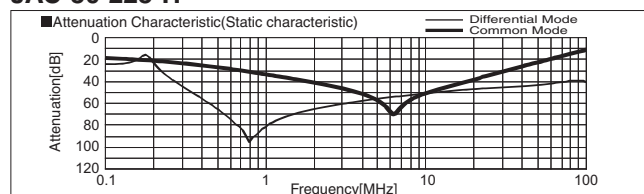
JAC-20-683-H



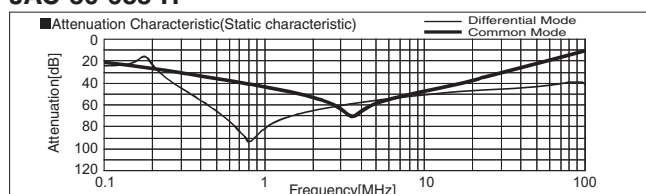
JAC-30-103-H



JAC-30-223-H



JAC-30-683-H



TAC series(4-30A)

TAC -10 -683 -□

①

②

③

④

① Model Name

② Rated Current

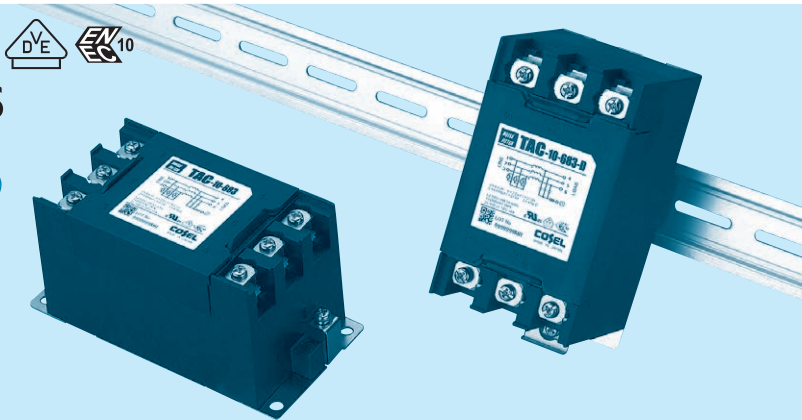
③ Line to ground capacitor code: See table 1.1.

table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 250/500V 60Hz)	Line to ground capacitor (nominal value)
683	2.5mA/5.0mA max	68000pF

④ Options

D: DIN rail installation type

* The dimensions change when the option is set.
Refer to External view.

The terminal cover is retracted inside the unit

DIN rail installation type is option

Features of TAC series

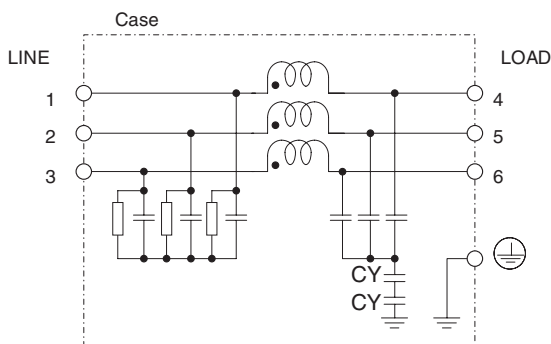
High-attenuation type of common mode noise from 150kHz to 1MHz

- Three Phase 500 VAC
- Push down type terminal block

Specifications

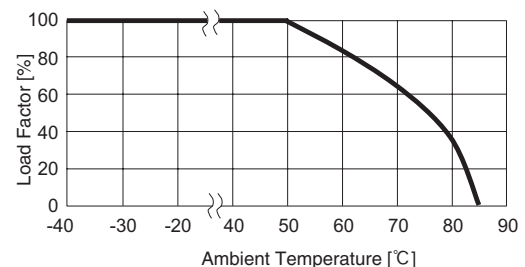
No.	Items	TAC-04-683	TAC-06-683	TAC-10-683	TAC-20-683	TAC-30-683
1	Rated Voltage[V]	AC Three Phase 500 50/60Hz				
2	Rated Current[A]	4	6	10	20	30
3	Test Voltage (Terminal-Mounting Plate)	2,000 VAC (Cutoff Current = 100mA), 1minute at room temperature and humidity				
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100MΩ min at room temperature and humidity				
5	Leakage current 250/500V 60Hz	2.5mA/5.0mA max				
6	Voltage drop	1.5V max		1.0V max		
7	Safety agency approval temperatures	-25 to +85℃ (Refer to Derating Curve)				
8	Operating temperature	-40 to +85℃ (Refer to Derating Curve)				
9	Operating humidity	20 to 95%RH (Non condensing)				
10	Storage temperature/humidity	-40 to +85℃/20 to 95%RH (Non condensing)				
11	Vibration	10 to 55Hz, 19.6m/s²(2G), 3min. Period, 1hour each X, Y and Z axis				
12	Impact	196.1m/s²(20G), 11ms Once each X, Y and Z axis				
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL) , DIN EN60939 VDE0565 Teil3-1, ENEC				
14	Case size (without projection) /Weight	63×64×128 mm [2.48×2.52×5.04 inches] (W×H×D) /620g max (Option : -D refer to external view)				

Circuit Diagram



CY : Line to ground capacitor : Mounting Plate

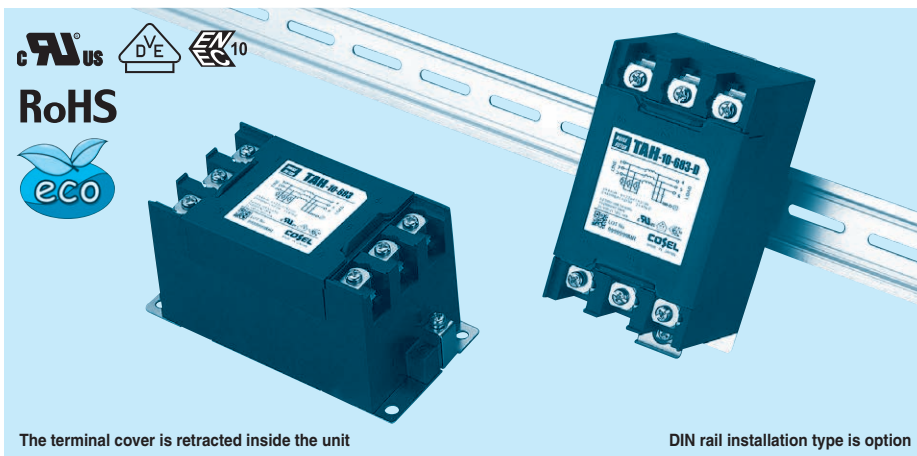
Derating Curve



TAH series(4-30A)

TAH -10 -683 -□

① ② ③ ④



- ① Model Name
 ② Rated Current
 ③ Line to ground capacitor code: See table 1.1.

table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 250/500V 60Hz)	Line to ground capacitor (nominal value)
683	2.5mA/5.0mA max	68000pF

- ④ Options
 D: DIN rail installation type

* The dimensions change when the option is set.
 Refer to External view.

Features of TAH series

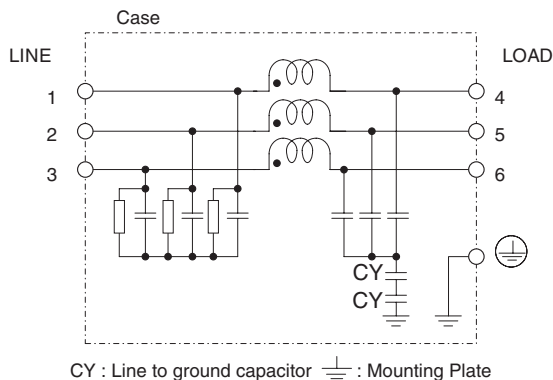
Ultra high-attenuation type of common mode noise from 10kHz to 1MHz

- Three Phase 500 VAC
- Push down type terminal block

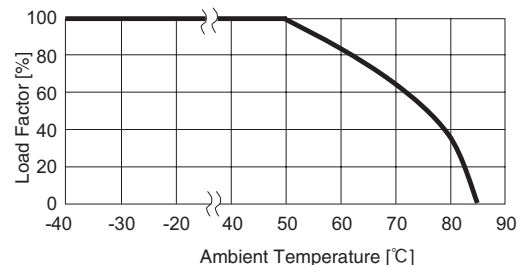
Specifications

No.	Items	TAH-04-683	TAH-06-683	TAH-10-683	TAH-20-683	TAH-30-683
1	Rated Voltage[V]	AC Three Phase 500 50/60Hz				
2	Rated Current[A]	4	6	10	20	30
3	Test Voltage (Terminal-Mounting Plate)	2,000 VAC (Cutoff Current = 100mA), 1minute at room temperature and humidity				
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100MΩ min at room temperature and humidity				
5	Leakage current 250/500V 60Hz	2.5mA/5.0mA max				
6	Voltage drop	1.5V max		1.0V max		
7	Safety agency approval temperatures	-25 to +85℃ (Refer to Derating Curve)				
8	Operating temperature	-40 to +85℃ (Refer to Derating Curve)				
9	Operating humidity	20 to 95%RH (Non condensing)				
10	Storage temperature/humidity	-40 to +85℃/20 to 95%RH (Non condensing)				
11	Vibration	10 to 55Hz, 19.6m/s²(2G), 3min. Period, 1hour each X, Y and Z axis				
12	Impact	196.1m/s²(20G), 11ms Once each X, Y and Z axis				
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL) , DIN EN60939 VDE0565 Teil3-1, ENEC				
14	Case size (without projection) /Weight	63×64×128 mm [2.48×2.52×5.04 inches] (W×H×D) /620g max (Option : -D refer to external view)				

Circuit Diagram



Derating Curve

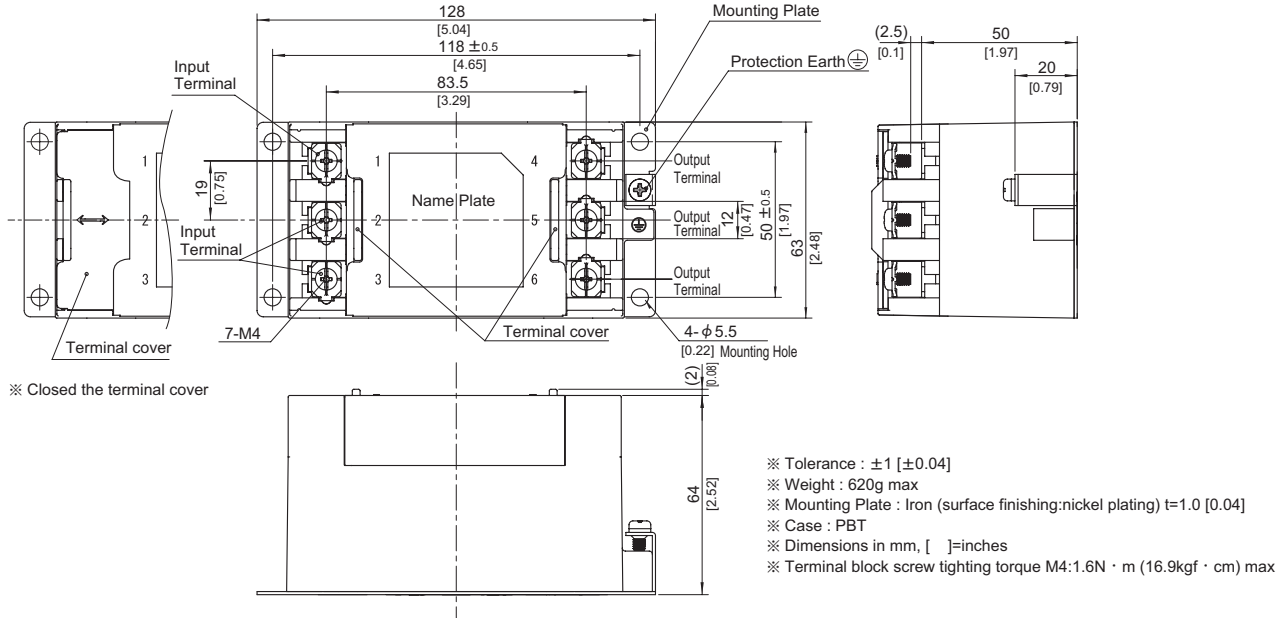


External view

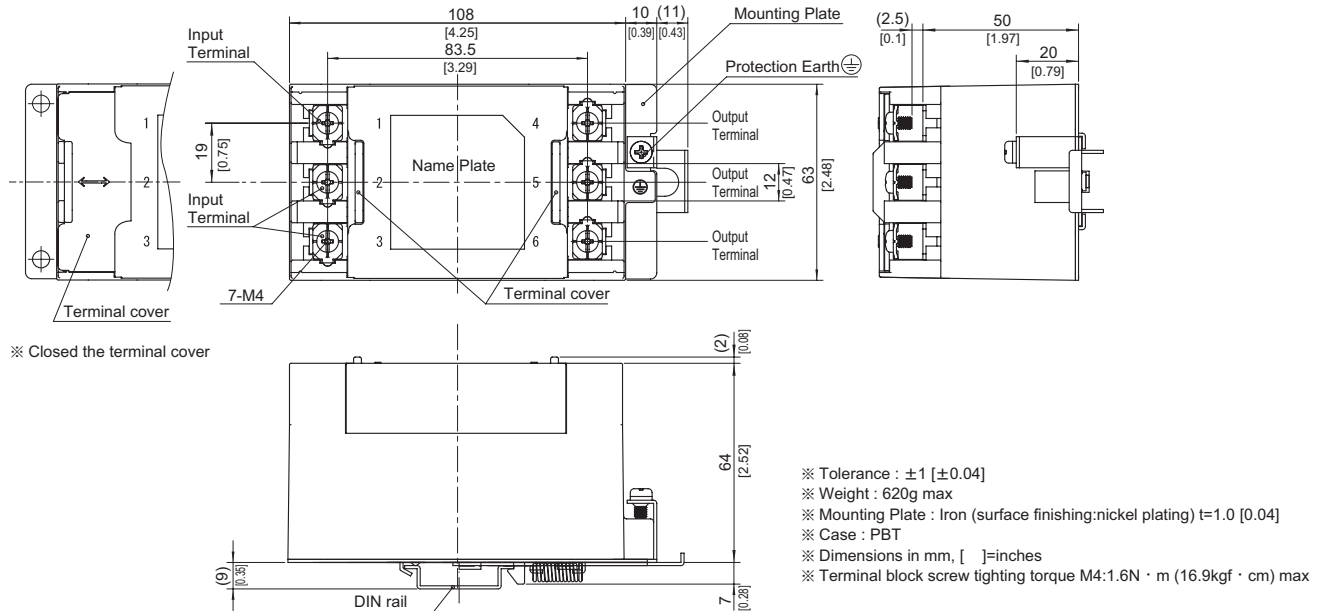
As this product is adopted push-down type terminal block, this appearance is as follows.

- ①The terminal cover is retracted inside the unit.
- ②The screws for connecting the terminals are held in the up right position.

Standard Type



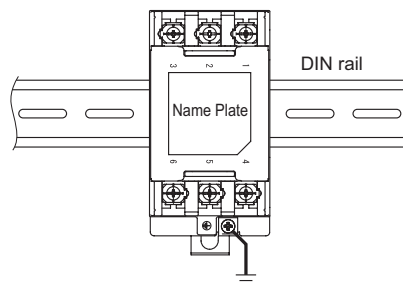
DIN rail installation Type



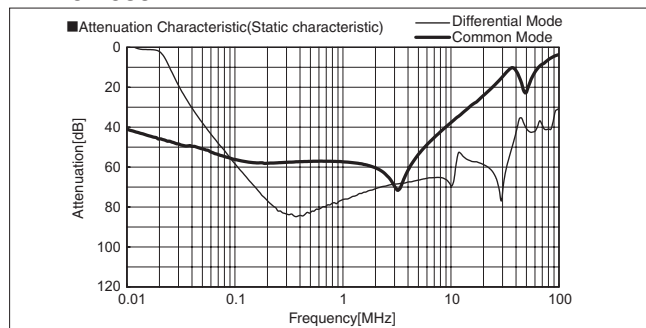
■Note when installing the EMI/EMC Filter on a DIN rail.

When the EMI/EMC Filter is grounded through the DIN rail, the proper noise attenuation may not be achieved.

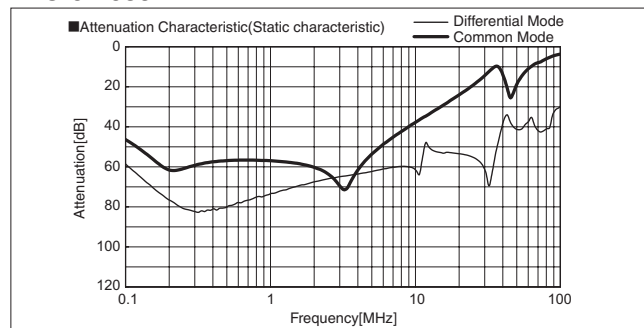
Be sure to connect the protection earth (PE) of the EMI/EMC Filter body to the earth.



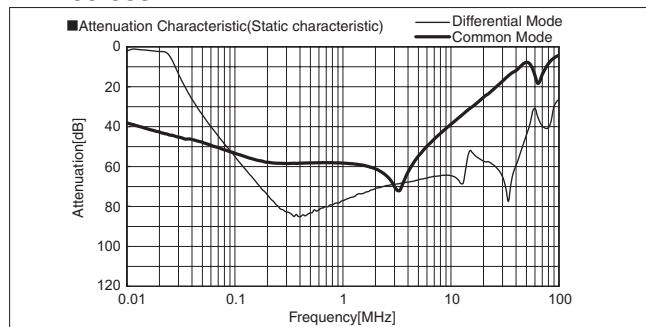
TAH-04-683



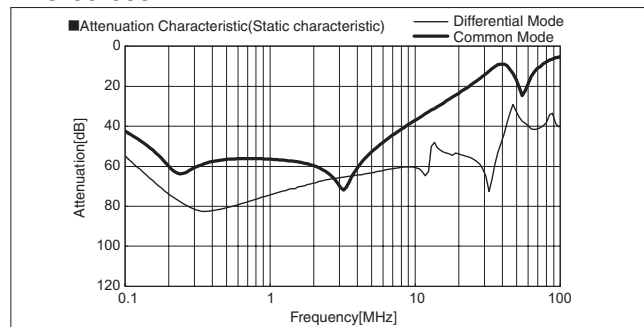
TAC-04-683



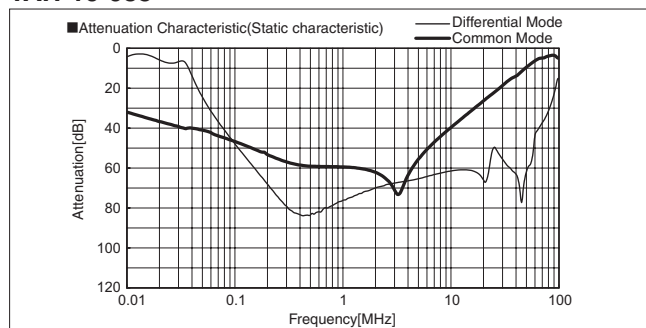
TAH-06-683



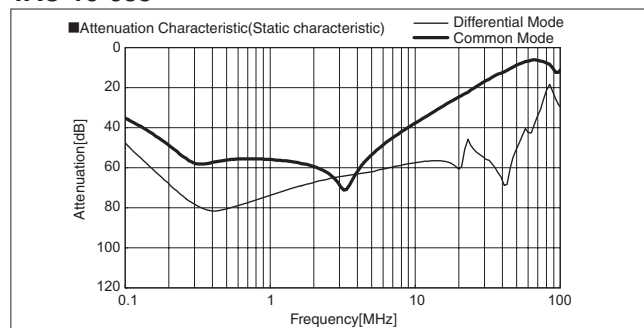
TAC-06-683



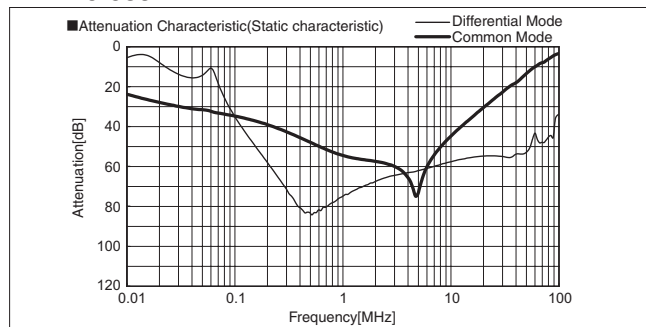
TAH-10-683



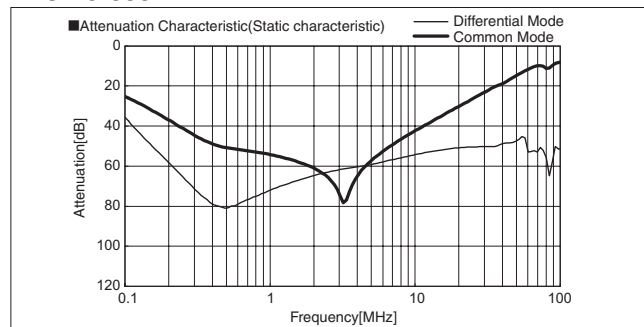
TAC-10-683



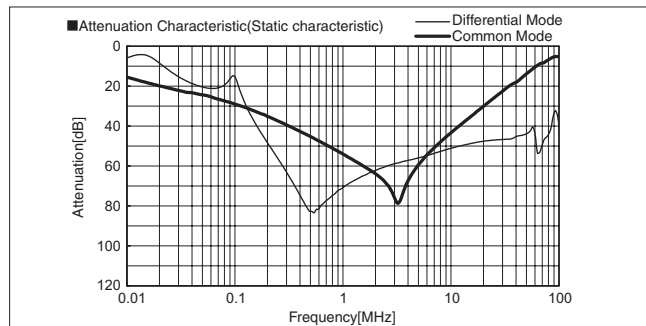
TAH-20-683



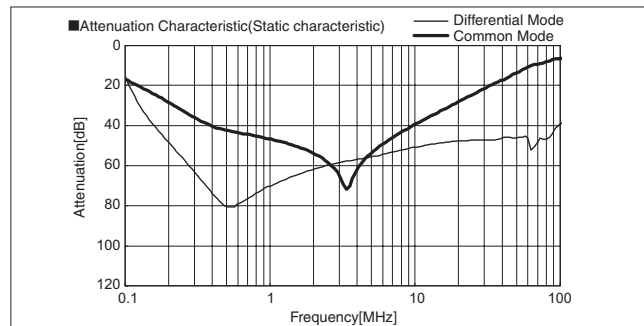
TAC-20-683



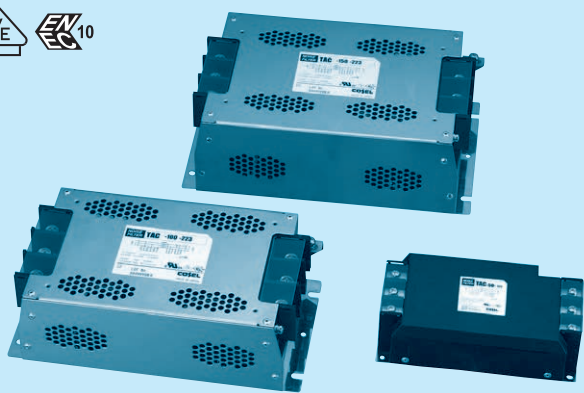
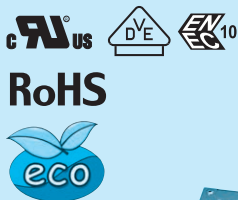
TAH-30-683



TAC-30-683



TAC series(50,60,80,100,150A)



①Model Name
②Rated Current
③Line to ground capacitor code:See table 1.1.

table1.1 Line to ground capacitor code

Code	Leakage Current (Input 250/500V 60Hz)	Line to ground capacitor (nominal value)
103	1.0mA/2.0mA max	10,000pF
223	2.5mA/5.0mA max	22,000pF
333	3.5mA/7.0mA max	33,000pF

*When the line to ground capacitor code is different, the attenuation characteristic is different.

④ Option
U: Improve differential mode attenuation
(Rated voltage 250V)

Features of TAC series

High-attenuation type of common mode noise from 150kHz to 1MHz (1-stage filter)

- Three phase rated voltage 500 VAC (voltage range:528V max)
- Selectable leakage current value

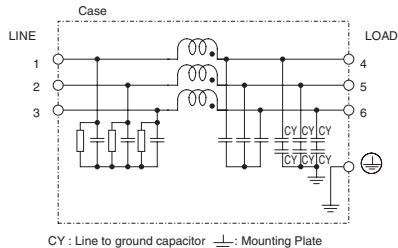
Specifications

No.	Items	TAC-50-223	TAC-60-223	TAC-80-223	TAC-100-223	TAC-150-223
1	Rated Voltage[V]	AC Three Phase 500 (voltage range:528 max) 50/60Hz *1				
2	Rated Current[A]	50	60	80	100	150
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 100mA), 1minute at room temperature and humidity				
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100MΩ min at room temperature and humidity				
5	Leakage current 250/500V 60Hz	2.5mA/5.0mA max				
6	DC resistance	7mΩ max	5mΩ max	5mΩ max	4mΩ max	3mΩ max
7	Safety agency approval temperatures	-25 to +85℃ (Refer to Derating Curve)				
8	Operating temperature	-40 to +85℃ (Refer to Derating Curve)				
9	Operating humidity	20 to 95%RH (Non condensing)				
10	Storage temperature/humidity	-40 to +85℃/20 to 95%RH (Non condensing)				
11	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis				
12	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis				
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL) , DIN EN60939 VDE0565 Teil3-1, ENEC				
14	Case size (without projection)	90×54×179 mm (W×H×D) [3.54×2.13×7.05 inches]		140×85×267 mm (W×H×D) [5.51×3.35×10.51 inches]		170×92×285 mm (W×H×D) [6.69×3.62×11.22 inches]
15	Weight	1.4kg max		3.8kg max		4.8kg max

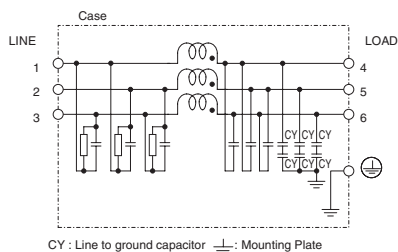
*1 Only "TAC-□□□-□□□-U", Three Phase 250 (275 max)

Circuit Diagram

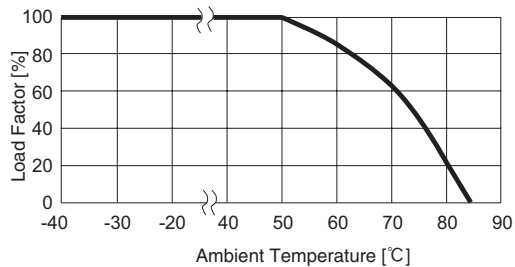
(1) TAC-□□□-□□□



(2) TAC-□□□-□□□-U (Option : U)



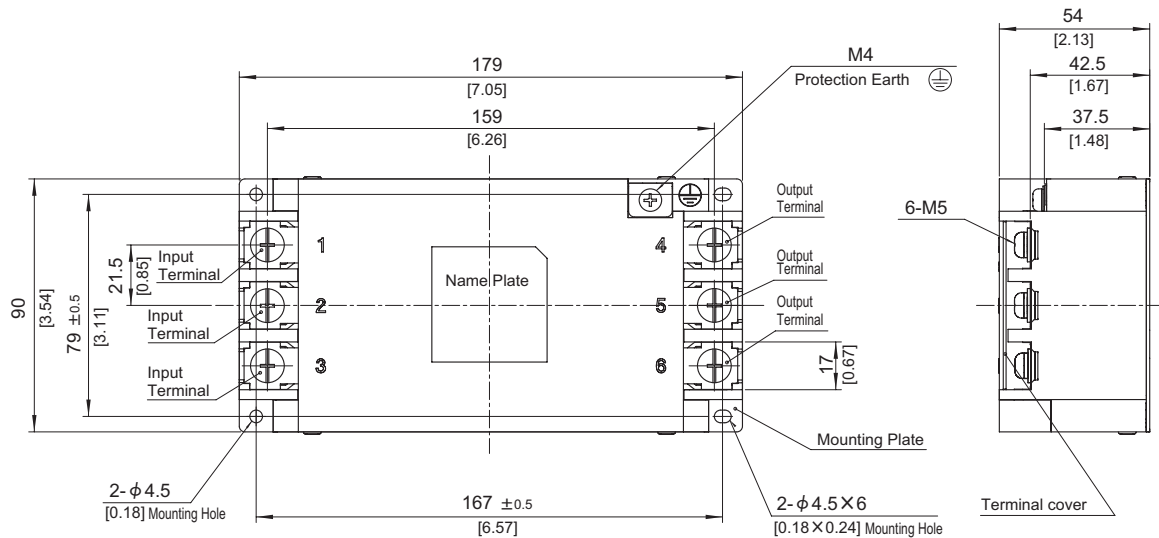
Derating Curve



*Keep free ventilation holes for cooling.

External view

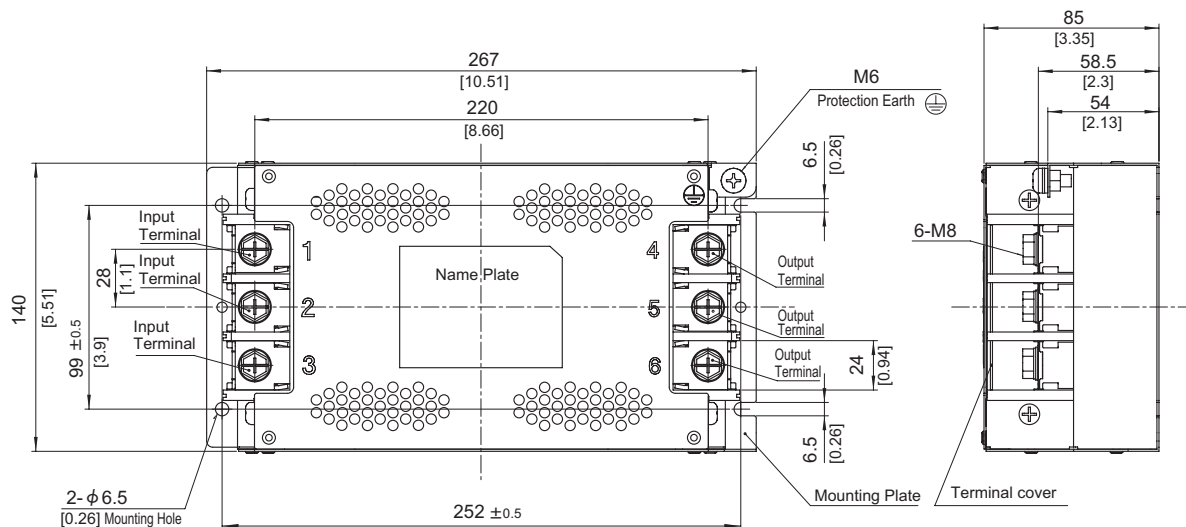
TAC-50-□□□ / TAC-60-□□□
TAH-50-□□□ / TAH-60-□□□



※ Can not be mounted upside-down.
(mounted the top surface)

※ Tolerance : ± 1 [± 0.04]
 ※ Weight : 1.4kg max
 ※ Mounting Plate : Iron (surface finishing:nickel plating) $t=1.2$ [0.05]
 ※ Case : PBT
 ※ Dimensions in mm, []=inches
 ※ Terminal block screw tightening torque M5:3.0N · m (30.7kgf · cm) max
 ※ Protection Earth screw tightening torque M4:1.6N · m (16.9kgf · cm) max

TAC-80-□□□ / TAC-100-□□□
TAH-80-□□□ / TAH-100-□□□

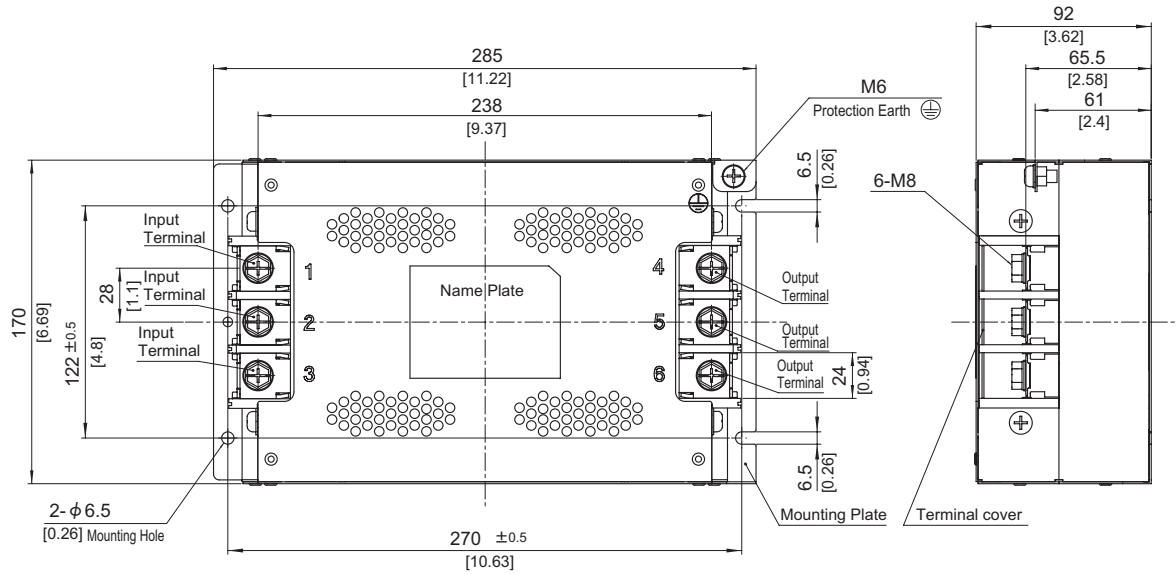


※ Can not be mounted upside-down.
(mounted the top surface)

※ Tolerance : ± 1 [± 0.04]
 ※ Weight : 3.8kg max
 ※ Chassis Material : Stainless steel $t=1.0$ [0.04]
 ※ Dimensions in mm, []=inches
 ※ Terminal block screw tightening torque M8:9.2N · m (93.9kgf · cm) max
 ※ Protection Earth screw tightening torque M6:5.8N · m (59.2kgf · cm) max

External view

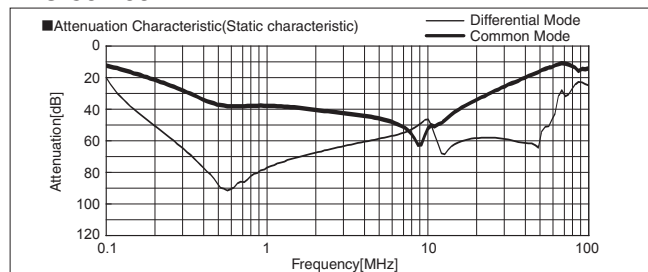
TAC-150-□□□
TAH-150-□□□



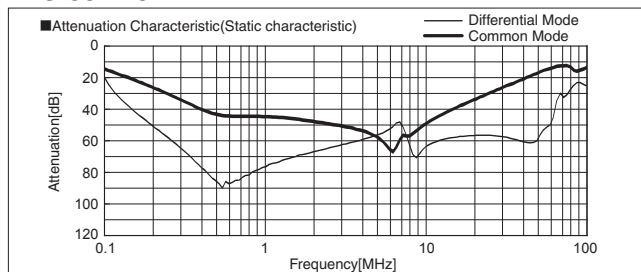
※ Can not be mounted upside-down.
(mounted the top surface)

※ Tolerance : ± 1 [± 0.04]
 ※ Weight : 4.8kg max
 ※ Chassis Material : Stainless steel t=1.0 [0.04]
 ※ Dimensions in mm, []=inches
 ※ Terminal block screw tightening torque M8:9.2N · m (93.9kgf · cm) max
 ※ Protection Earth screw tightening torque M6:5.8N · m (59.2kgf · cm) max

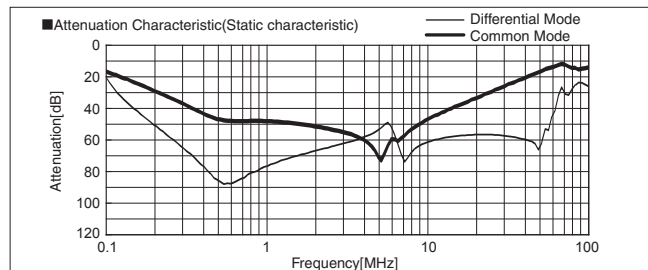
TAC-50-103



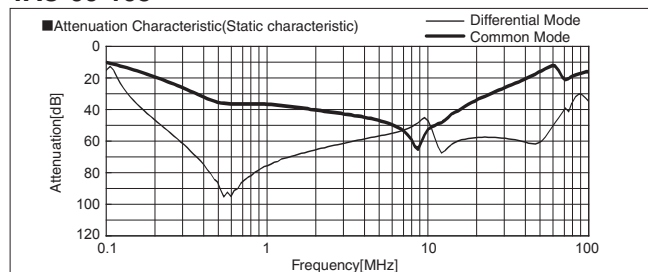
TAC-50-223



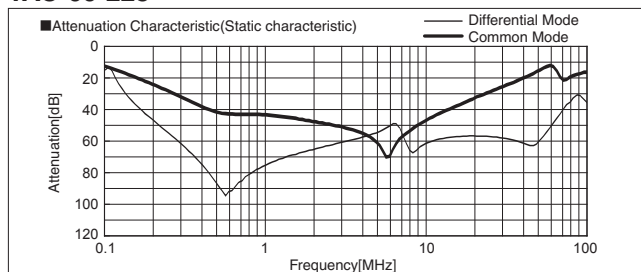
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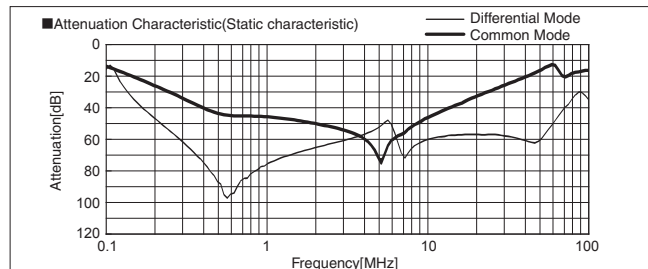
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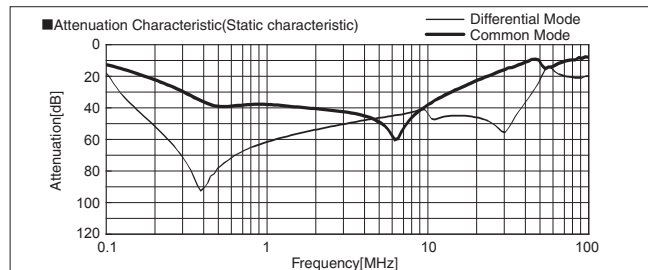
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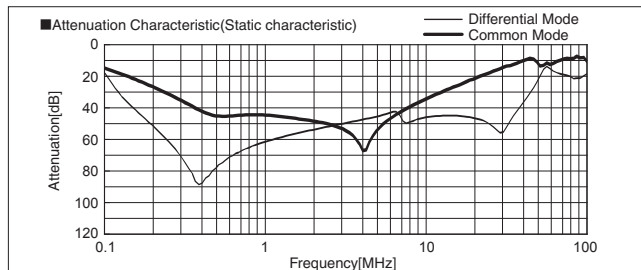
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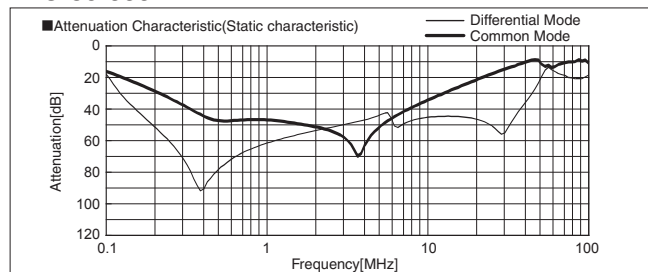
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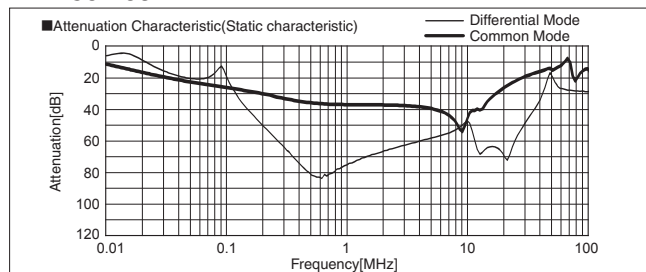
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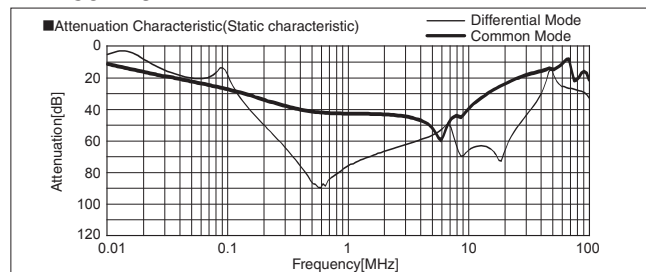
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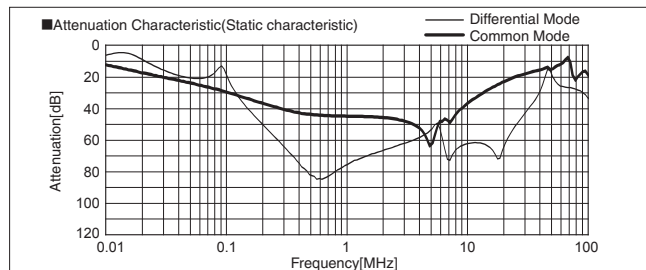
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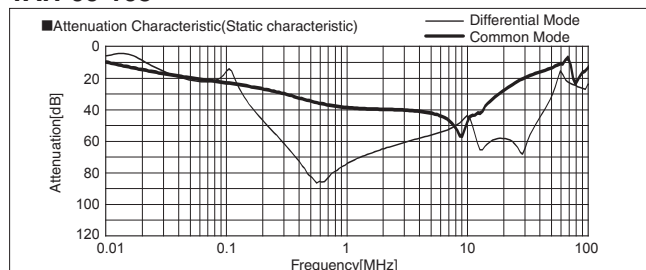
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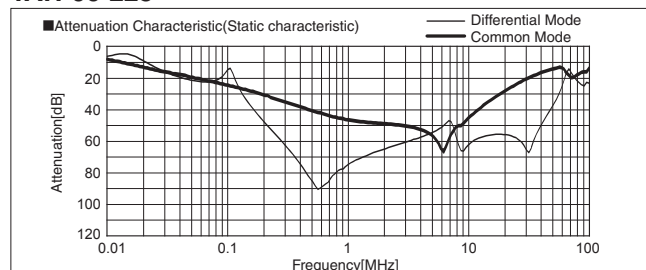
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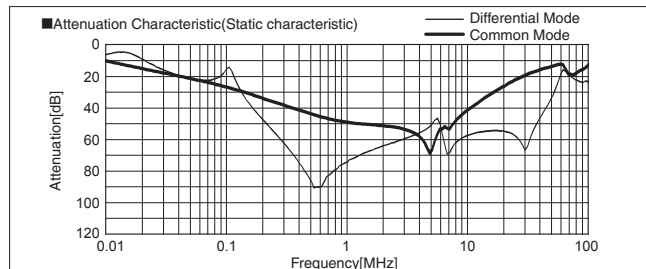
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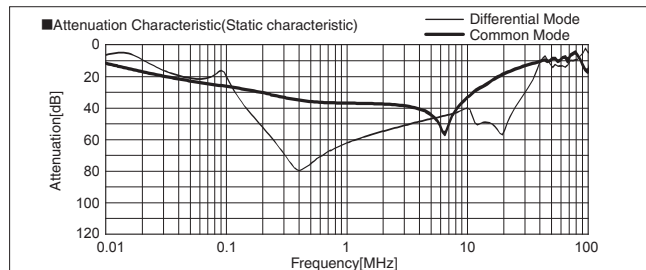
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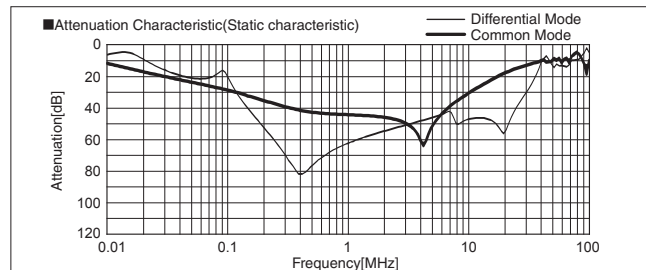
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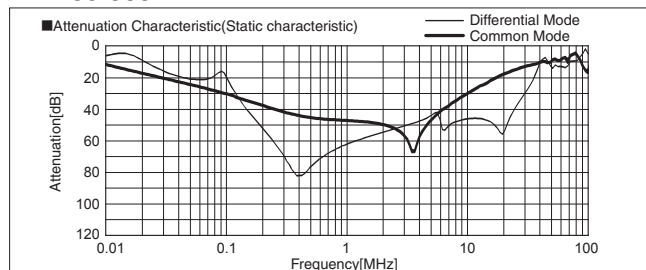
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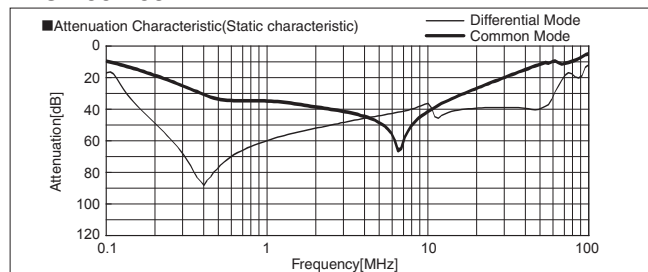
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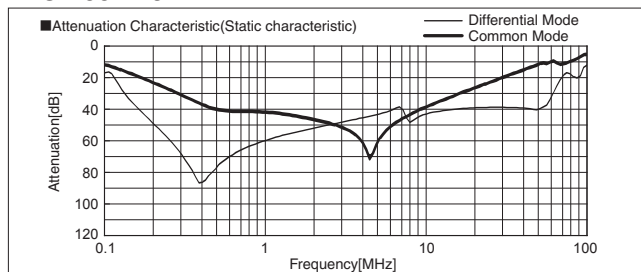
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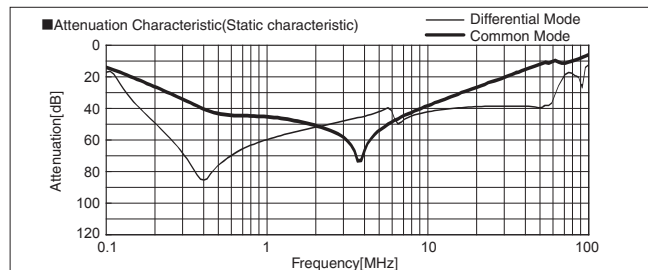
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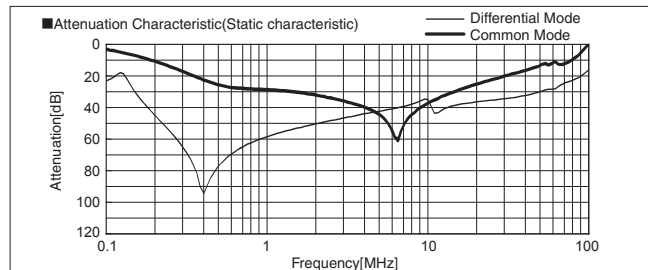
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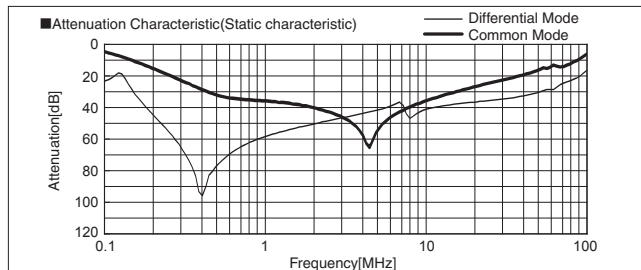
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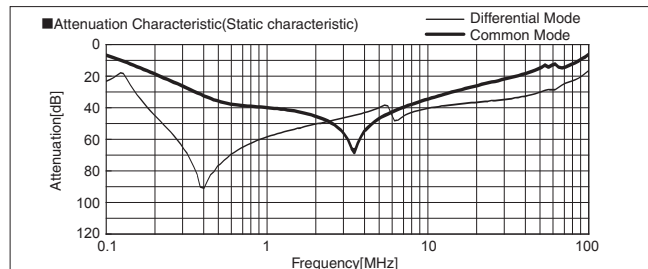
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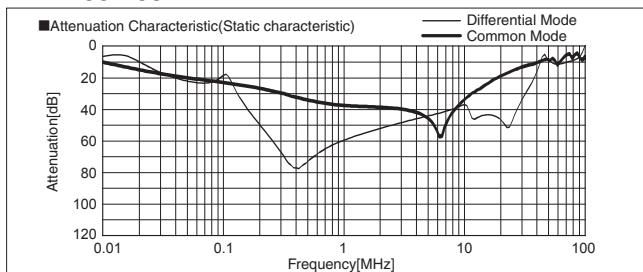
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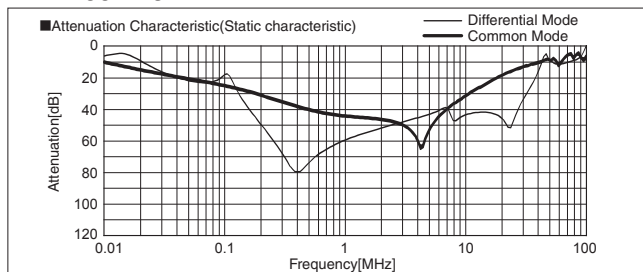
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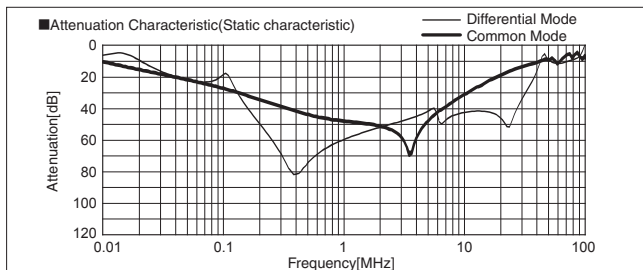
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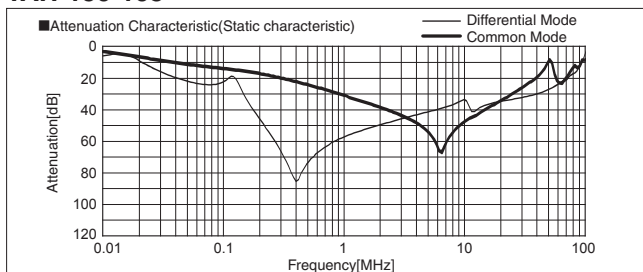
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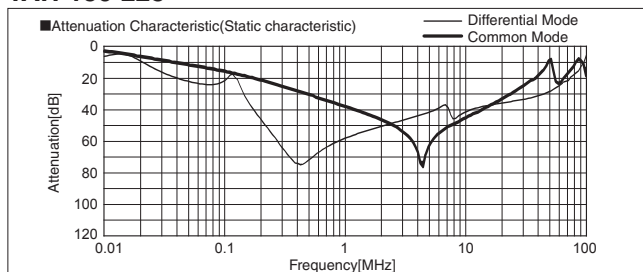
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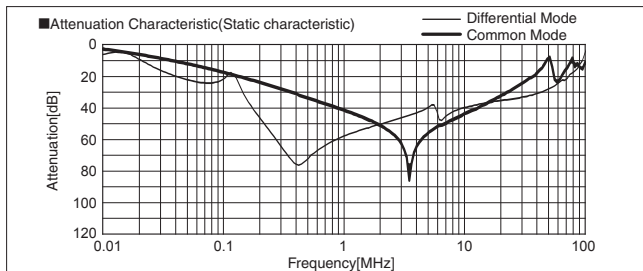
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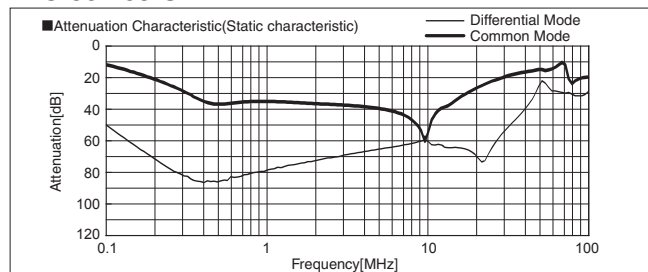
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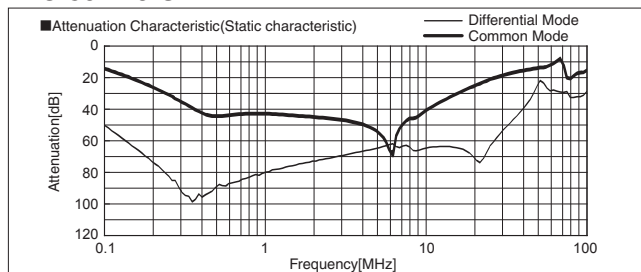
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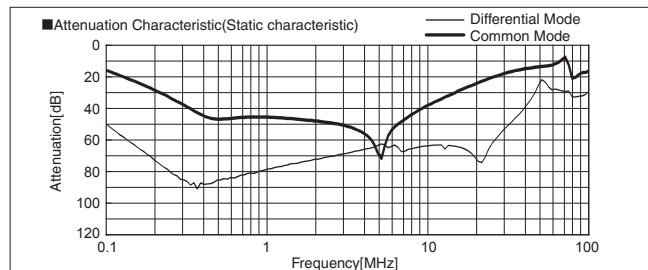
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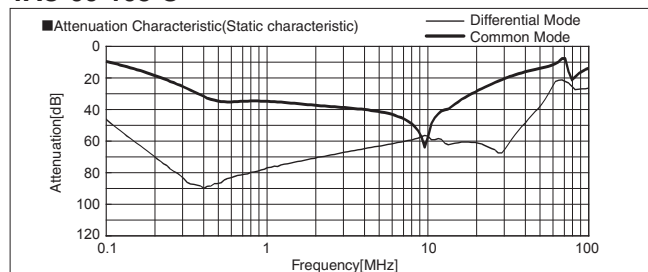
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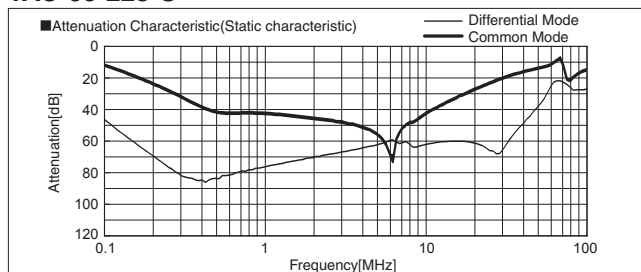
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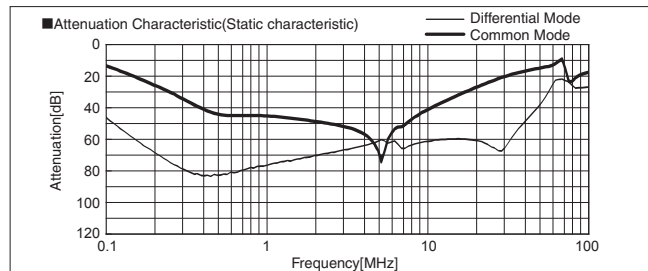
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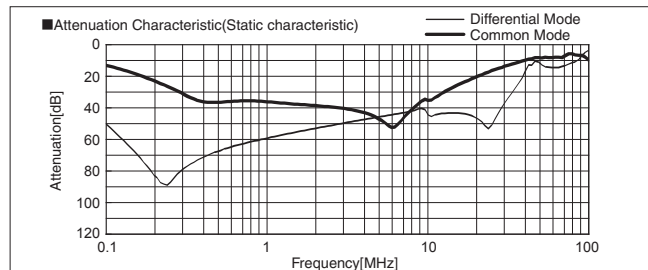
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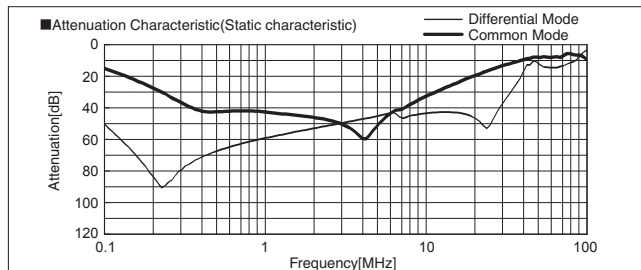
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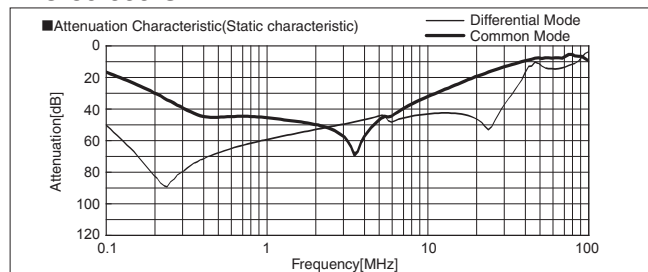
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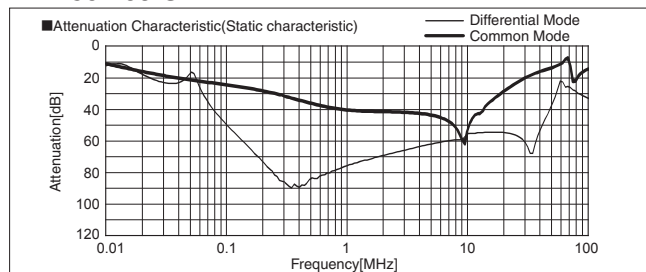
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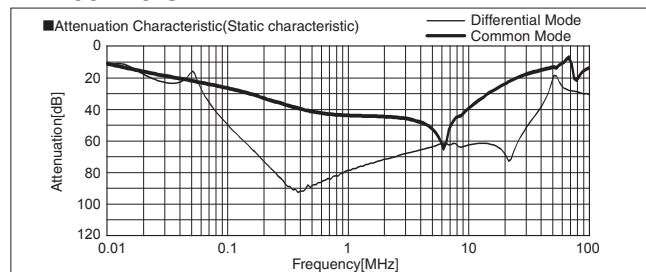
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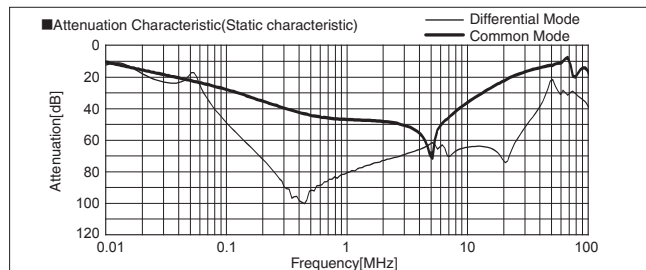
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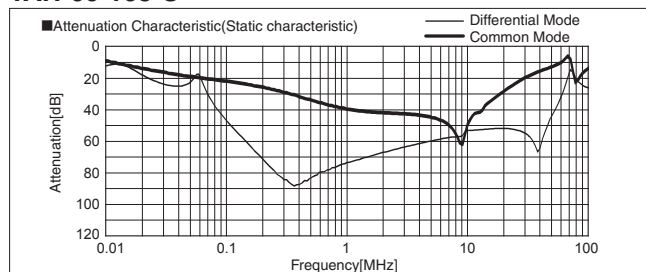
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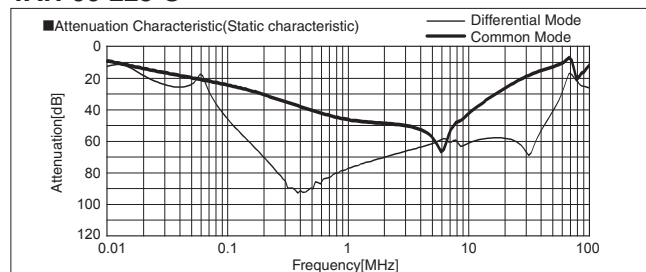
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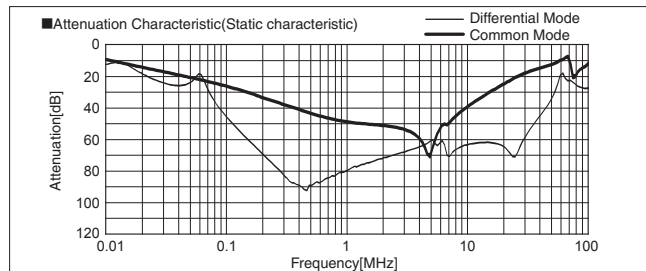
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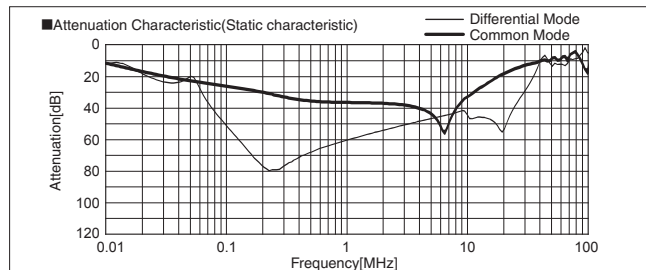
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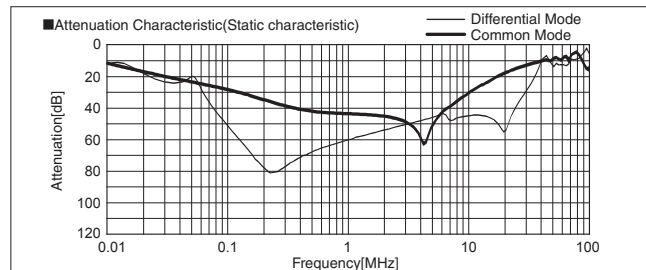
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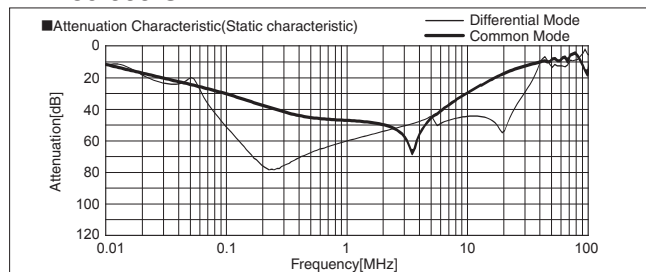
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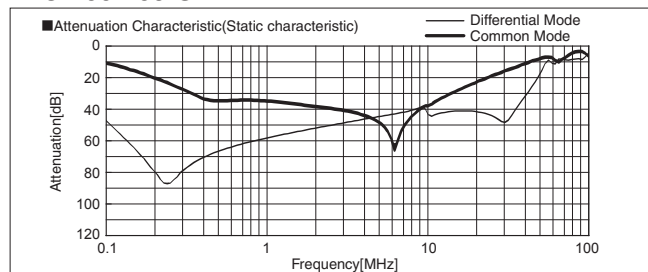
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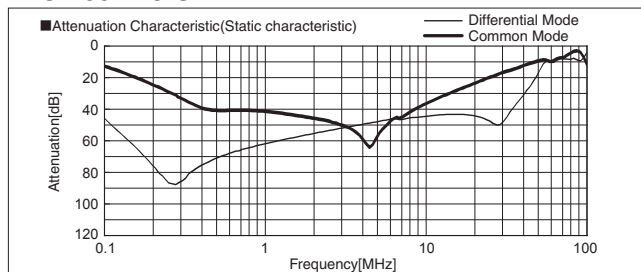
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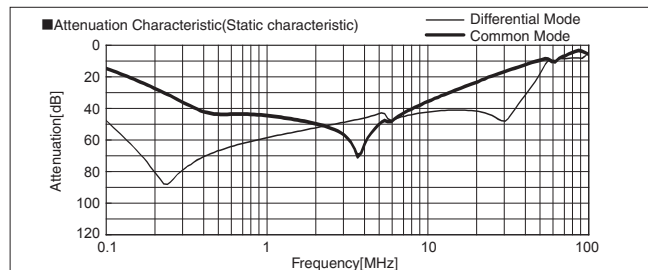
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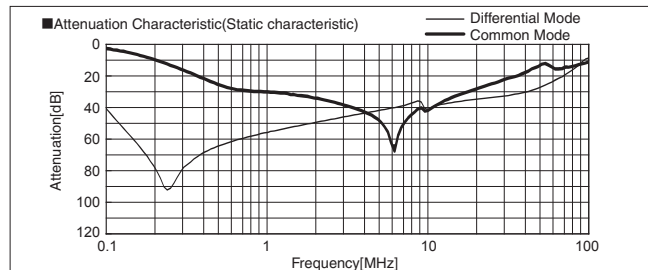
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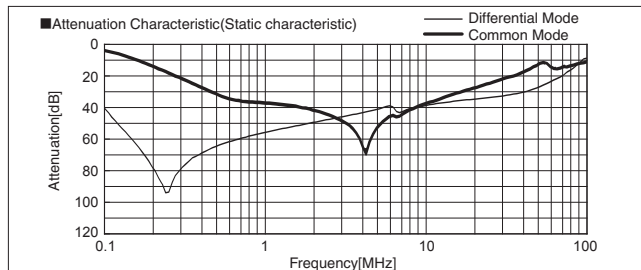
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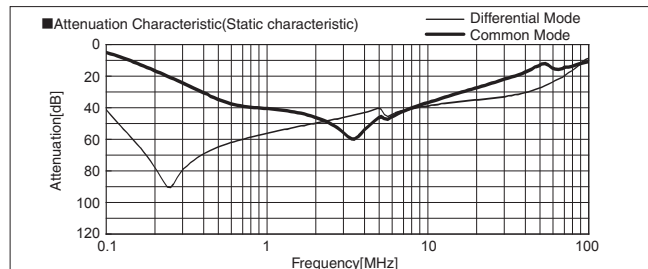
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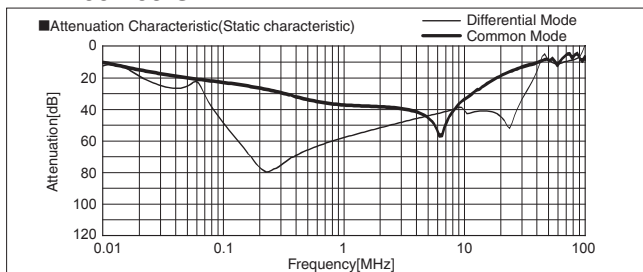
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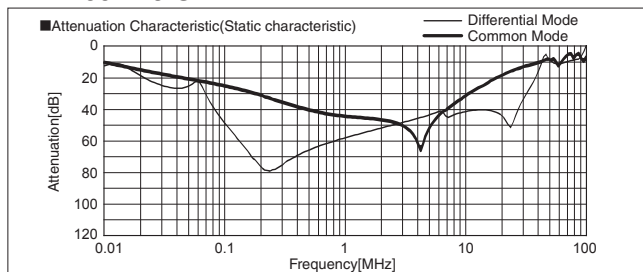
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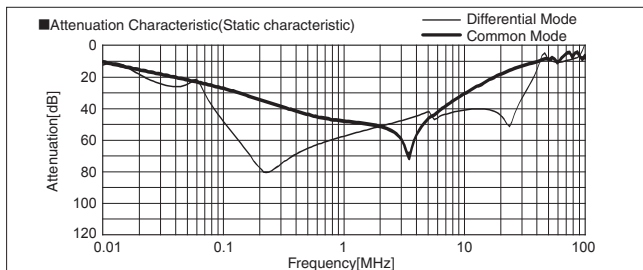
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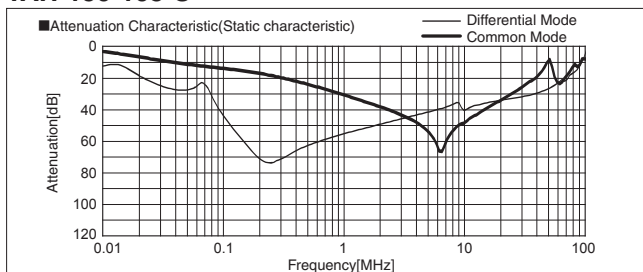
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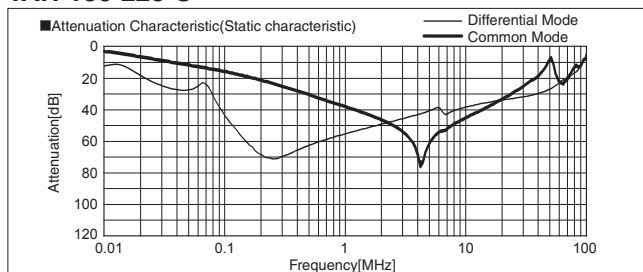
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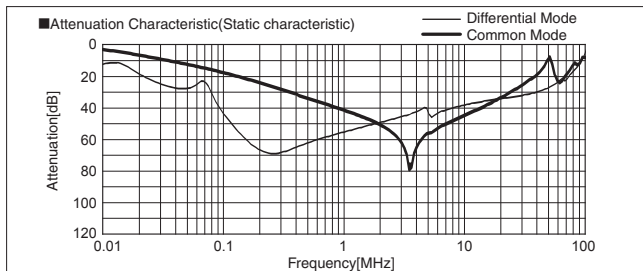
TAH-150-103-U



TAH-150-223-U



TAH-150-333-U



TAC series(200,250,300A)

TAC -200 -223 -□

① ② ③ ④

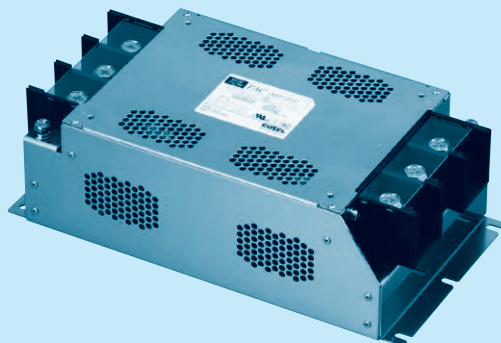
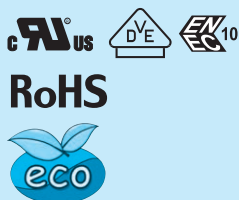
- ① Model Name
② Rated Current
③ Line to ground capacitor code: See table 1.1.

table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 250/500V 60Hz)	Line to ground capacitor (nominal value)
103	1.0mA/2.0mA max	10,000pF
223	2.5mA/5.0mA max	22,000pF
333	3.5mA/7.0mA max	33,000pF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

- ④ Option
U: Improve differential mode attenuation
(Rated voltage 250V)



Features of TAC series

High-attenuation type of common mode noise from 150kHz to 1MHz (1-stage filter)

- Three phase rated voltage 500 VAC (voltage range: 528V max)
- Selectable leakage current value

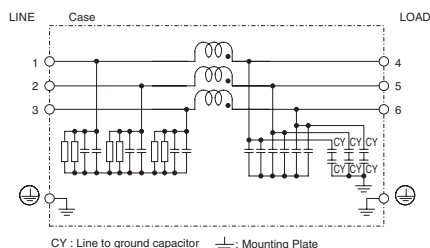
Specifications

No.	Items	TAC-200-223	TAC-250-223	TAC-300-223
1	Rated Voltage[V]	AC Three Phase 500 (voltage range: 528 max) 50/60Hz *1		
2	Rated Current[A]	200	250	300
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 100mA), 1minute at room temperature and humidity		
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100MΩ min at room temperature and humidity		
5	Leakage current 250/500V 60Hz	2.5mA/5.0mA max		
6	DC resistance	2mΩ max	1.5mΩ max	1mΩ max
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)		
8	Operating temperature	-40 to +85°C (Refer to Derating Curve)		
9	Operating humidity	20 to 95%RH (Non condensing)		
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)		
11	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis		
12	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis		
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC		
14	Case size (without projection)	190 X 110 X 360 mm [7.48 X 4.33 X 14.17 inches] (W X H X D)		
15	Weight	8.0kg max		

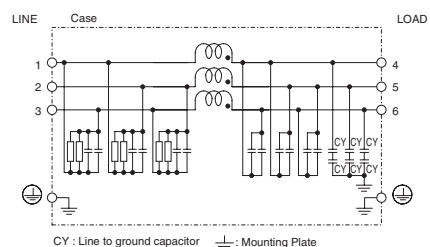
*1 Only "TAC-□□□-□□□-U", Three Phase 250 (275 max)

Circuit Diagram

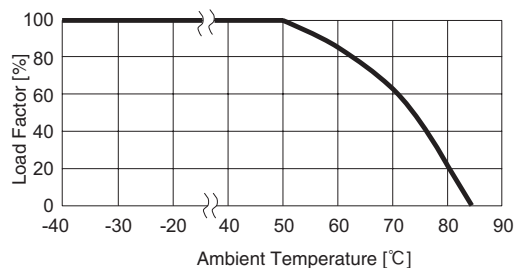
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(2) TAC-□□□-□□□-U (Option : U)

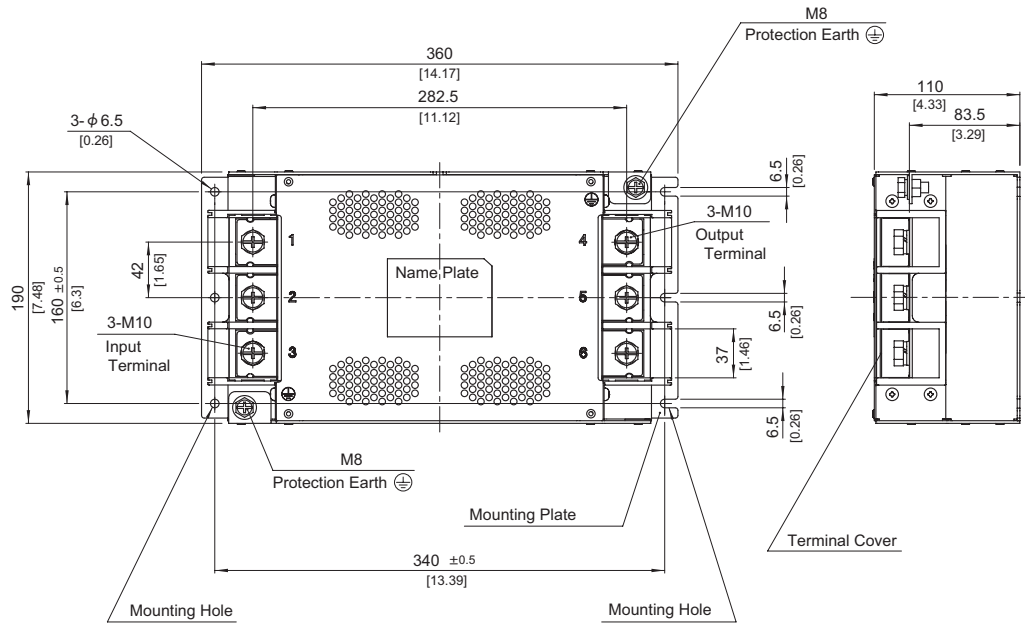


Derating Curve



* Keep free ventilation holes for cooling.

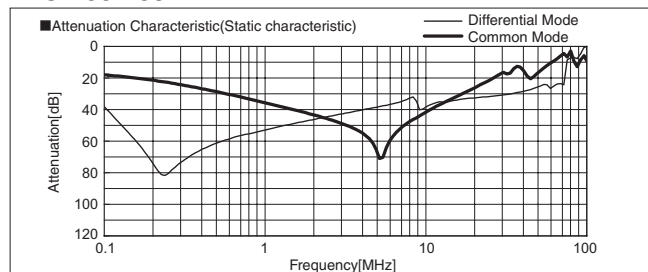
External view



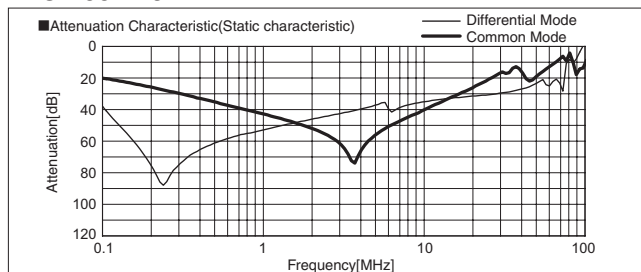
※ Can not be mounted upside-down.
(mounted the top surface)

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 8.0kg max
- ※ Mounting Plate : Stainless steel $t=2.0$ [0.08]
- ※ Dimensions in mm, []=inches
- ※ Terminal block screw tightening torque M10 : $14.2\text{N} \cdot \text{m}$ ($144.9\text{kgf} \cdot \text{cm}$) max
- ※ Protection Earth screw tightening torque M8 : $9.2\text{N} \cdot \text{m}$ ($93.9\text{kgf} \cdot \text{cm}$) max

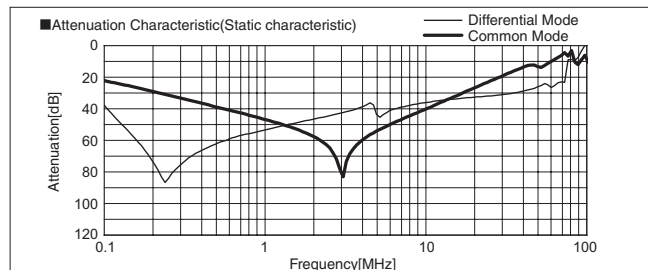
TAC-200-103



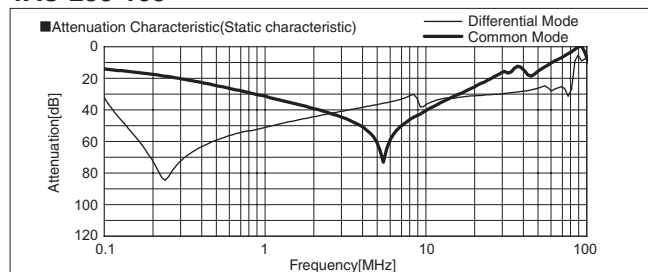
TAC-200-223



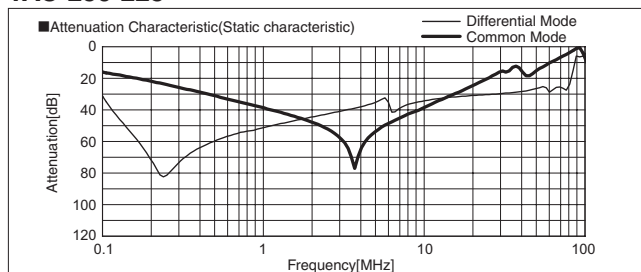
TAC-200-333



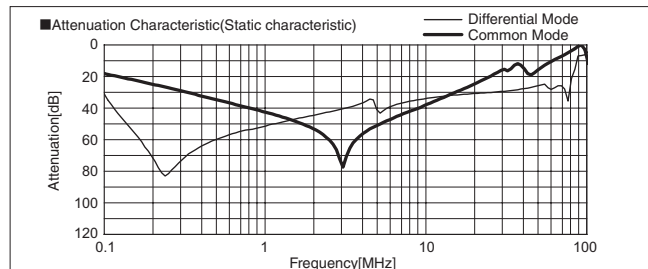
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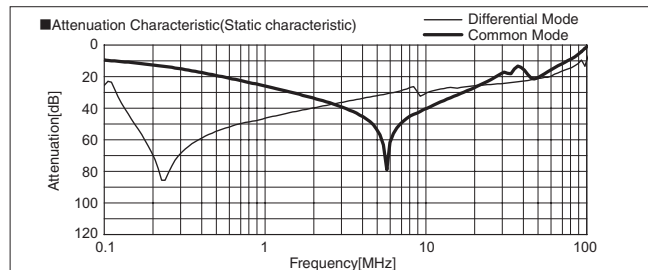
TAC-250-223



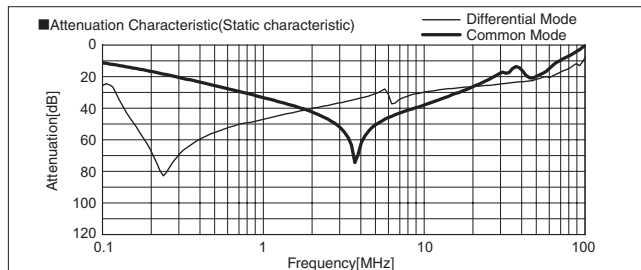
TAC-250-333



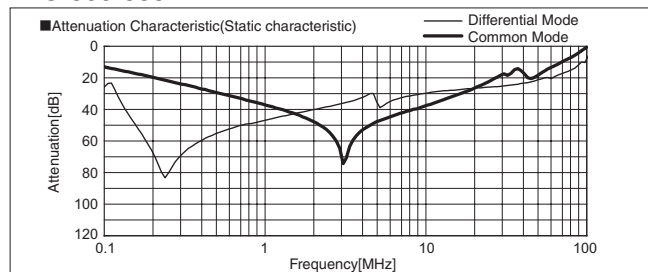
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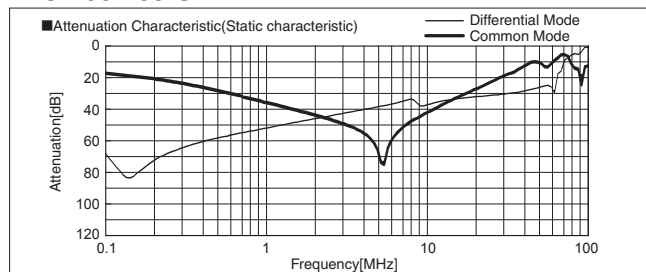
TAC-300-223



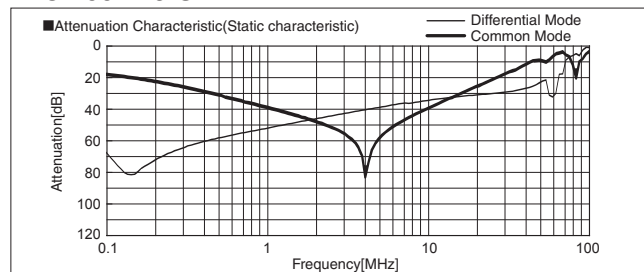
TAC-300-333



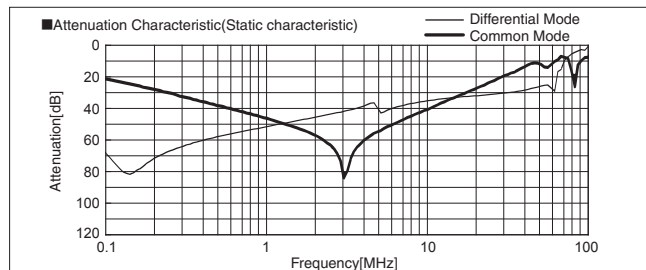
TAC-200-103-U



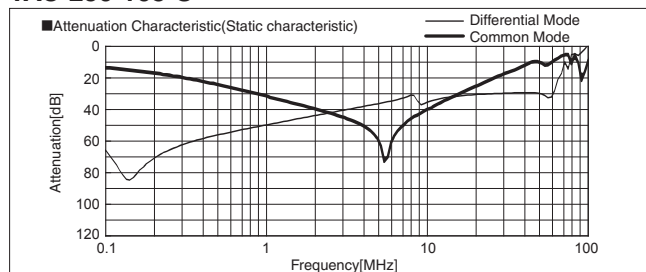
TAC-200-223-U



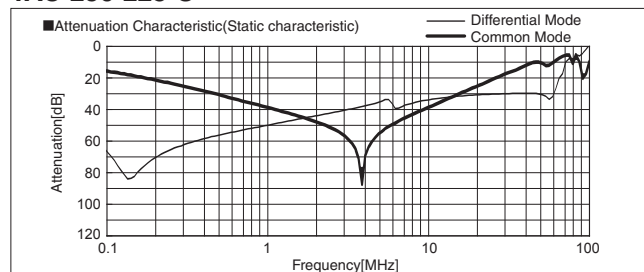
TAC-200-333-U



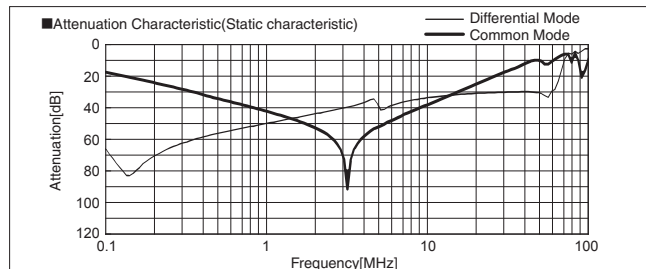
TAC-250-103-U



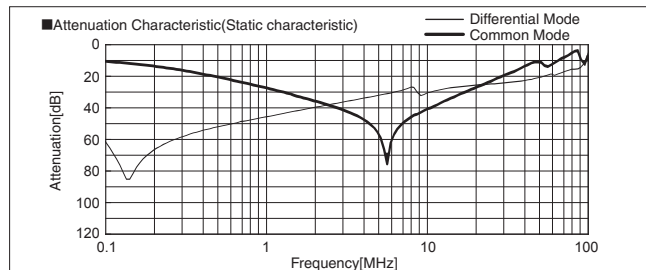
TAC-250-223-U



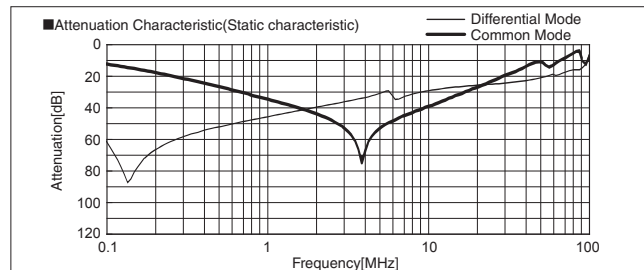
TAC-250-333-U



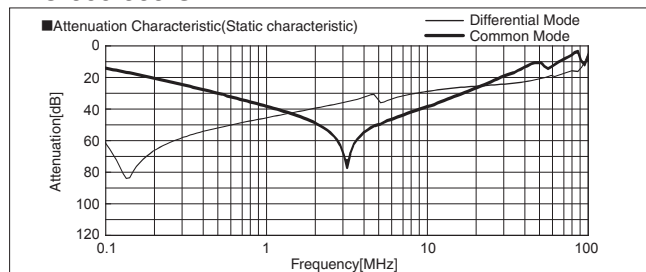
TAC-300-103-U



TAC-300-223-U



TAC-300-333-U



FTA series(40,50,60A)

FTA -50 -683 -□

① ② ③ ④

- ① Model Name
② Rated Current
③ Line to ground capacitor code: See table 1.1.

table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 250/500V 60Hz) (335 only 250/400V 60Hz)	Line to ground capacitor (nominal value)
223	1.0mA/2.0mA max	22,000pF
683	2.5mA/5.0mA max	68,000pF
104	3.5mA/7.0mA max	100,000pF
335	160mA/250mA max	3.3μF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

④ Option

H: Ultra high attenuation type
"335" is not applied.

U: Improve differential mode attenuation
(Rated voltage 250V)

G: With switch of line to ground capacitor
Only "335" is applied.

* Leakage current 160mA/250mA max when the switch state is ON (switched to "1").
10μA/16μA max when the switch state is OFF (switched to "0").

Features of FTA series

Book type (Space-saving type)

- 1-stage filter General-purpose High-attenuation (150kHz - 1MHz)
- Selectable leakage current value, Ultra high attenuation type "335" for EU(Wye type with neutral earth system), With switch of line to ground capacitor "-G"

Specifications

No.	Items	FTA-40-683	FTA-50-683	FTA-60-683
1	Rated Voltage[V]	AC Three Phase 500 (voltage range: 528 max) 50/60Hz *1 *2		
2	Rated Current[A]	40	50	60
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 100mA), 1minute at room temperature and humidity *3		
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100MΩ min at room temperature and humidity *4		
5	Leakage current 250/500V 60Hz	2.5mA/5.0mA max		
6	DC resistance	8.5mΩ max	6mΩ max	4.5mΩ max
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)		
8	Operating temperature	-40 to +85°C (Refer to Derating Curve)		
9	Operating humidity	20 to 95%RH (Non condensing)		
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)		
11	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis		
12	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis		
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC		
14	Case size (without projection)	65×84×153 mm (W×H×D) (Option: -G refer to external view) [2.56×3.31×6.02 inches] (W×H×D)		
15	Weight	1.2kg max		

*1 Only capacitor code "335", Three Phase Δ-connection : 400 (440 max), Wye-connection : 500 (528 max)

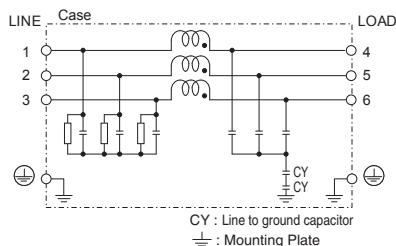
*2 Only "FTA-□□□□□-U", Three Phase 250 (275 max)

*3 Only capacitor code "335", 2,800VDC (Cutoff Current = 10mA), 1minute at room temperature and humidity.

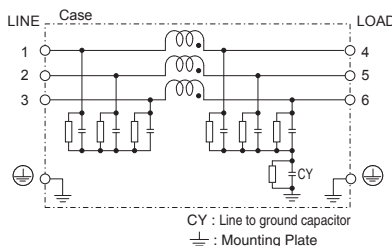
*4 Only capacitor code "335", Isolation resistance specification is deleted.

Circuit Diagram

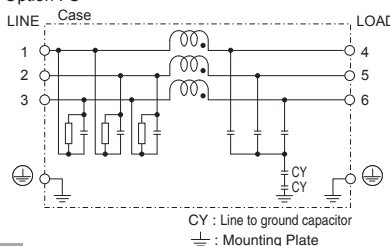
(1) Line to ground capacitor code : 223, 683, 104



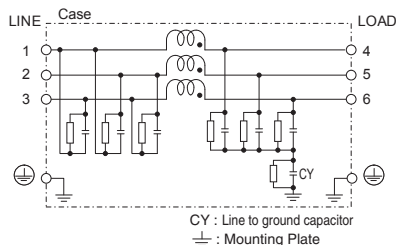
(2) Line to ground capacitor code : 335



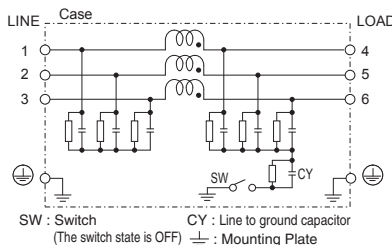
(3) Line to ground capacitor code : 223, 683, 104
Option : U



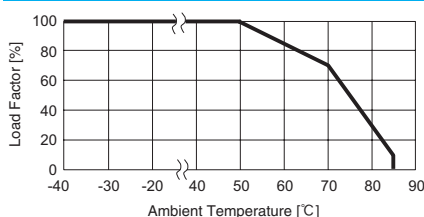
(4) FTA-□□□-335-U



(5) FTA-□□□-335-G

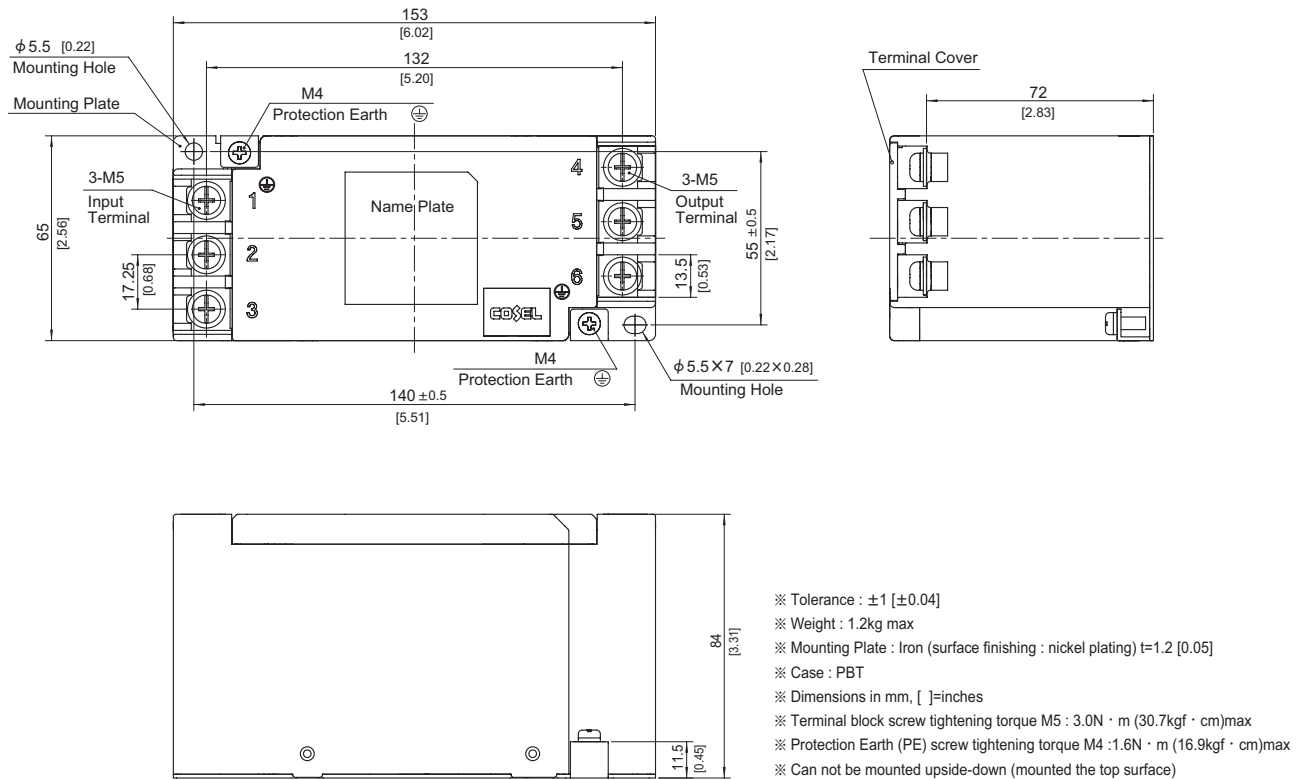


Derating Curve

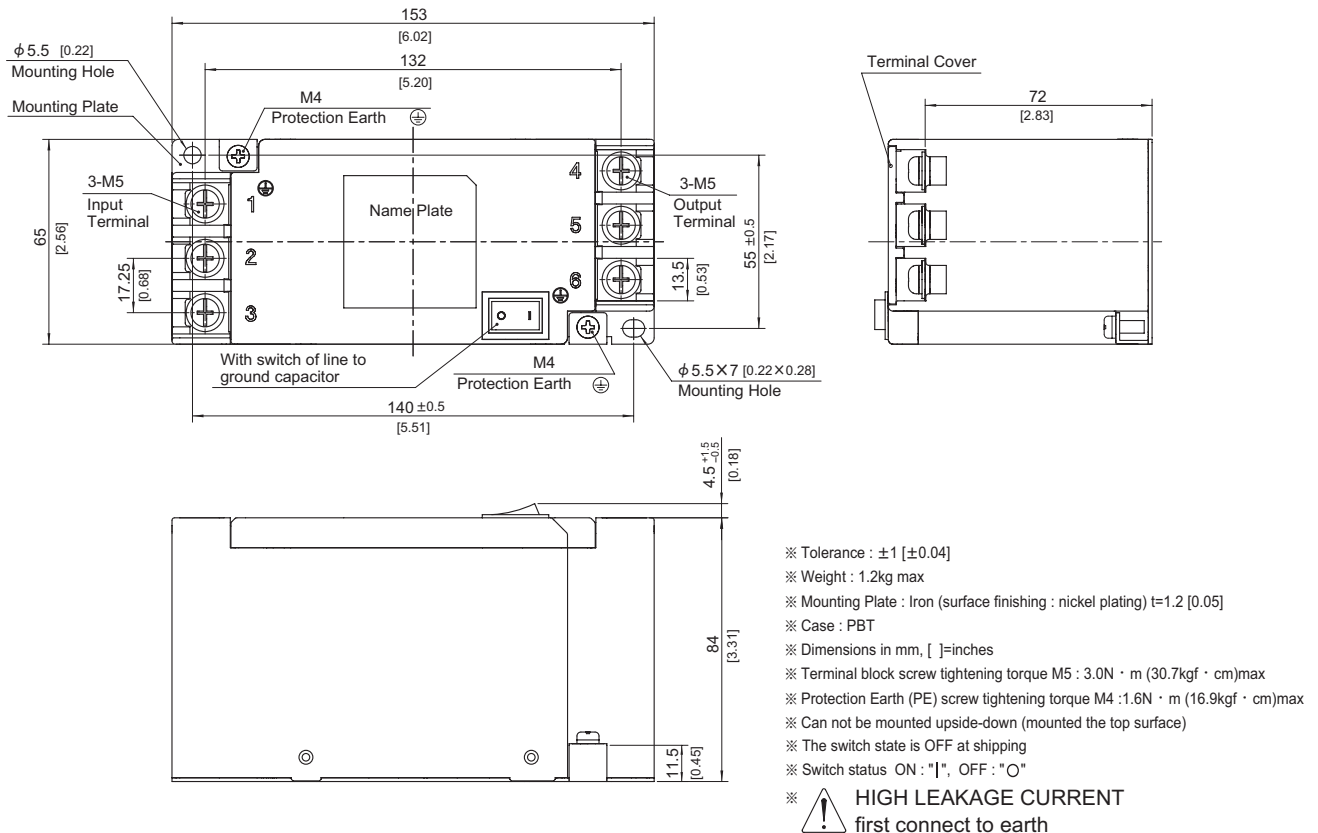


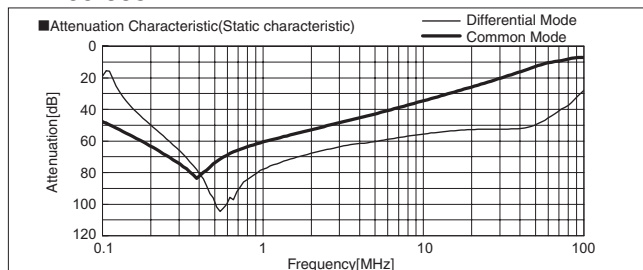
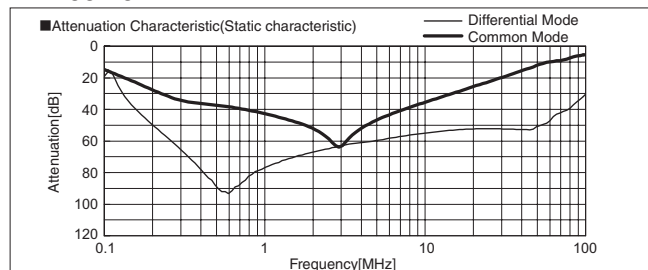
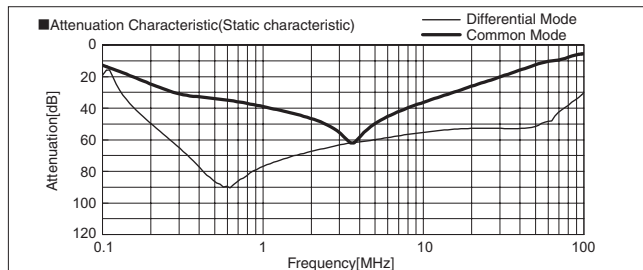
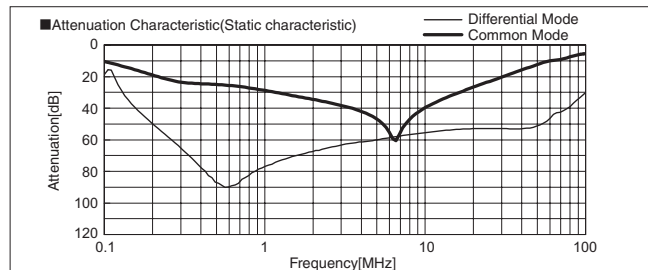
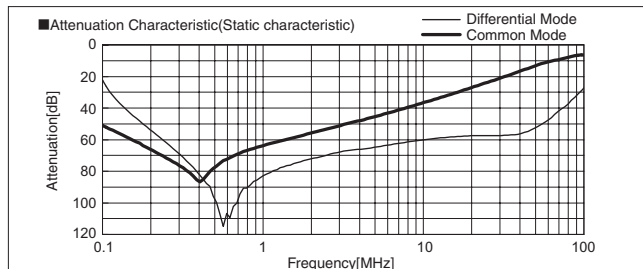
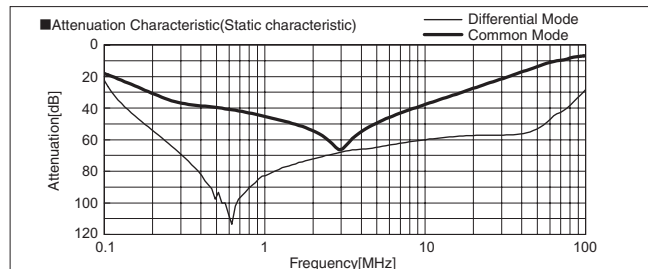
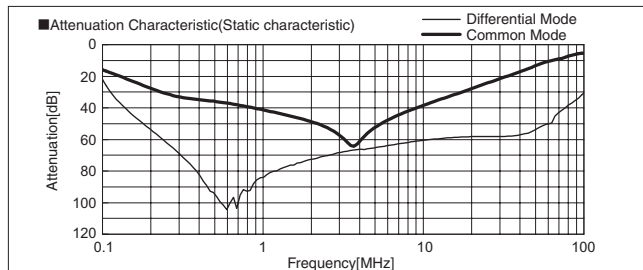
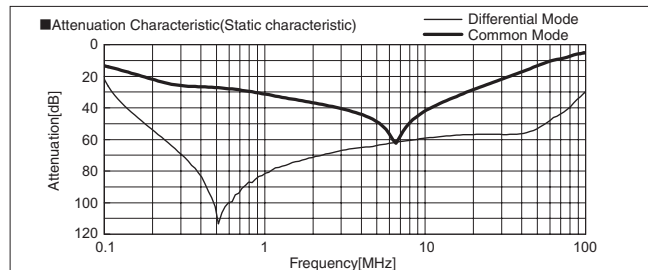
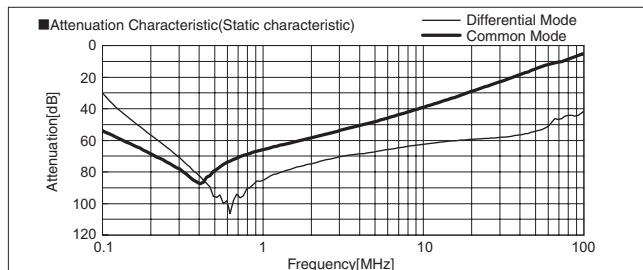
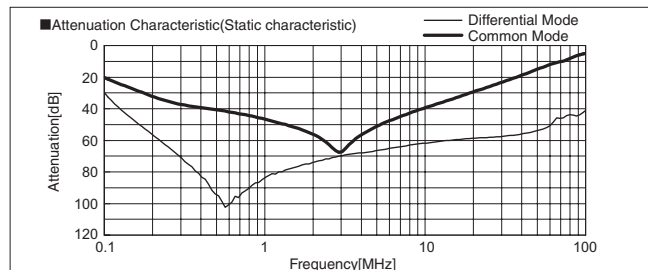
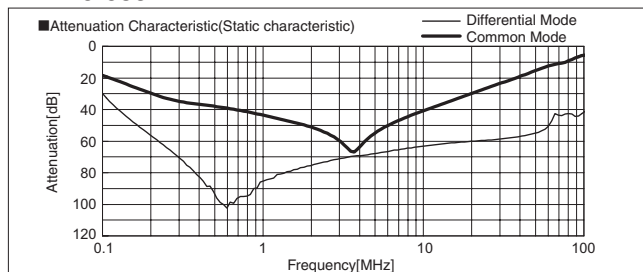
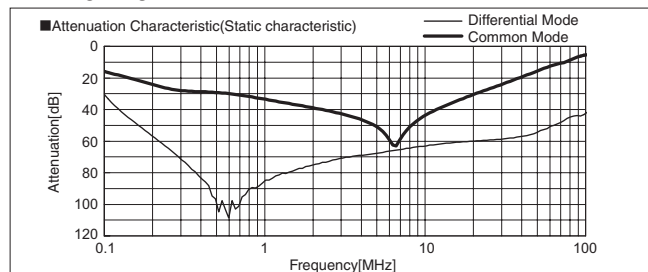
External view

Standard Type

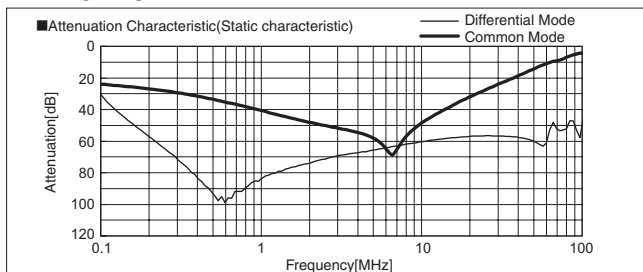


With switch of line to ground capacitor ON/OFF

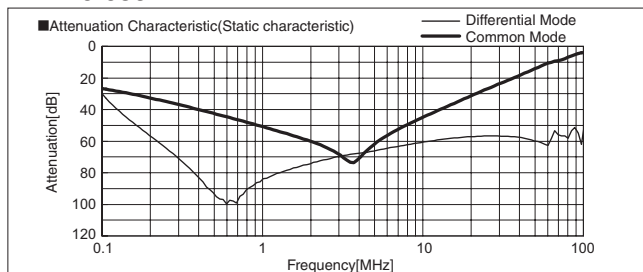




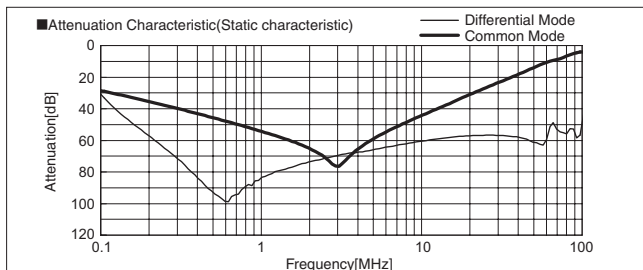
FTA-40-223-H



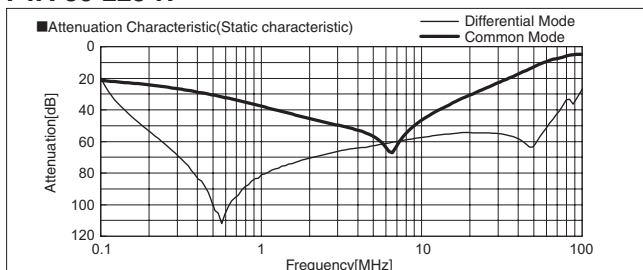
FTA-40-683-H



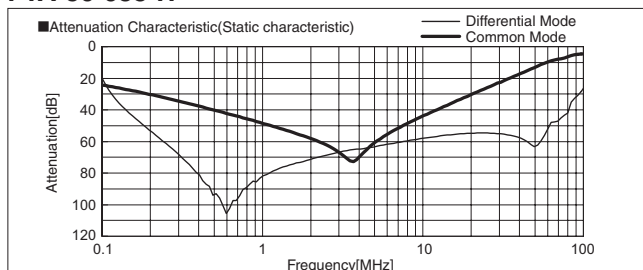
FTA-40-104-H



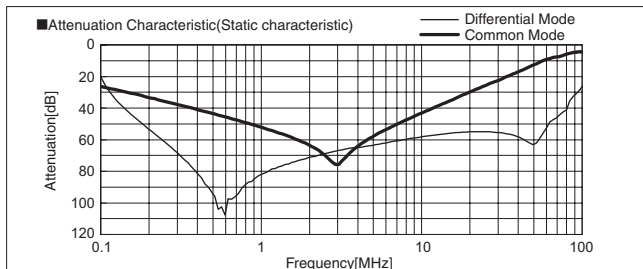
FTA-50-223-H



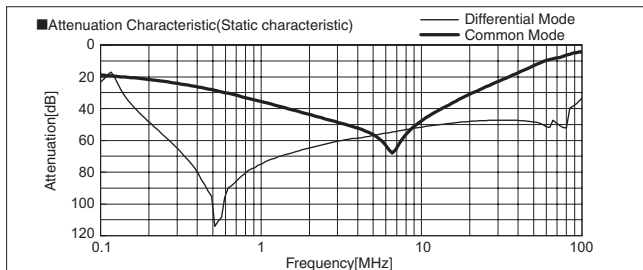
FTA-50-683-H



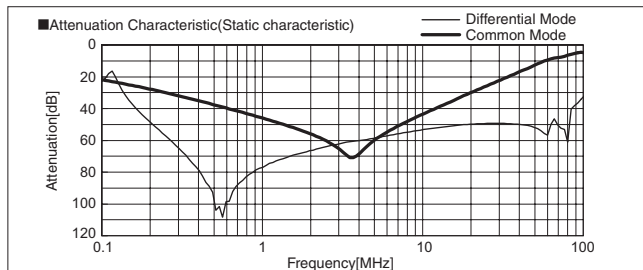
FTA-50-104-H



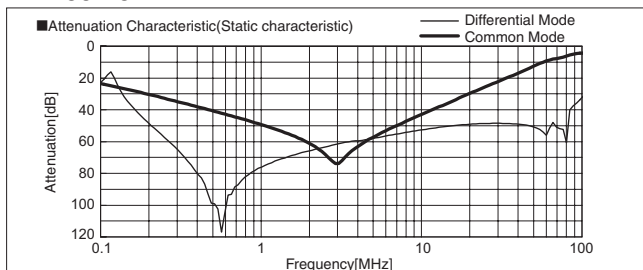
FTA-60-223-H

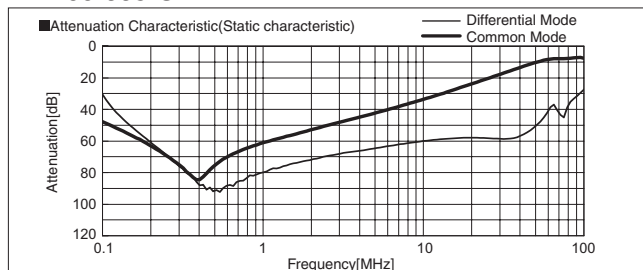
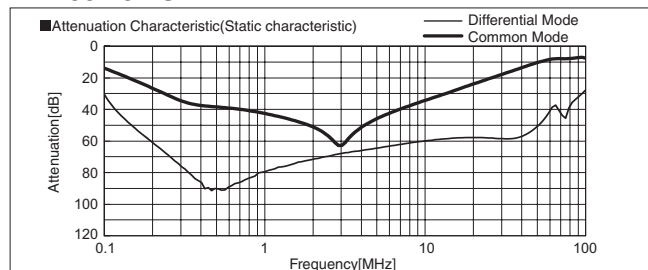
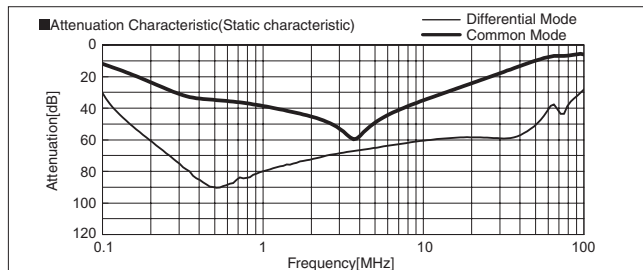
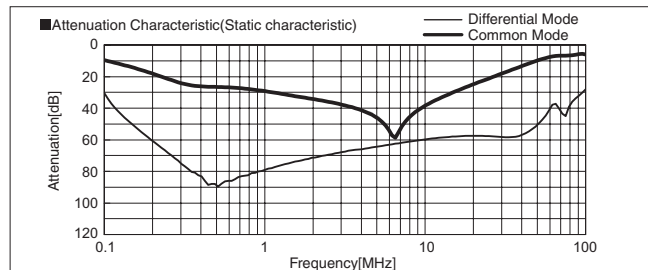
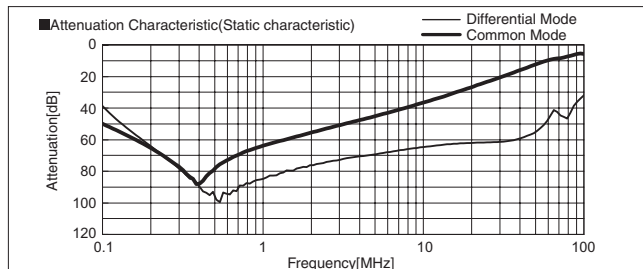
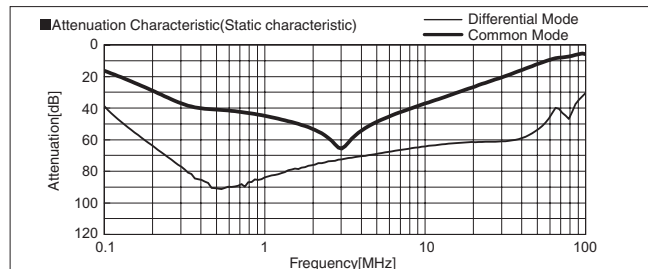
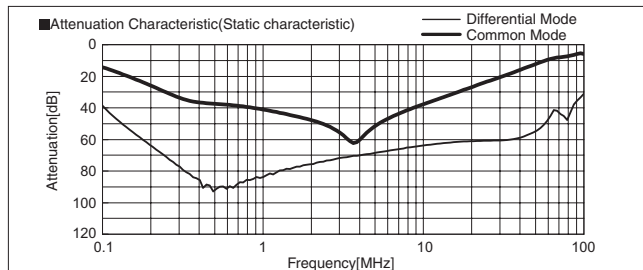
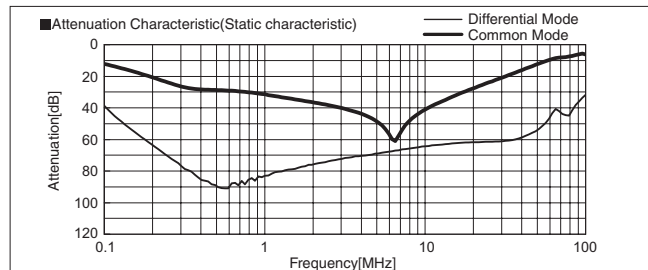
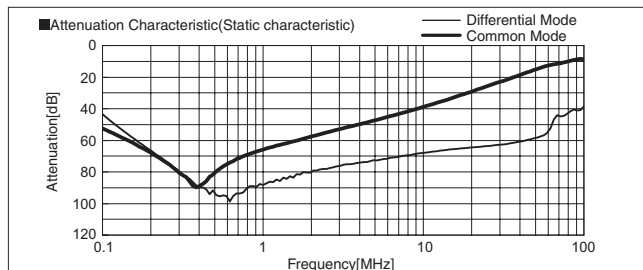
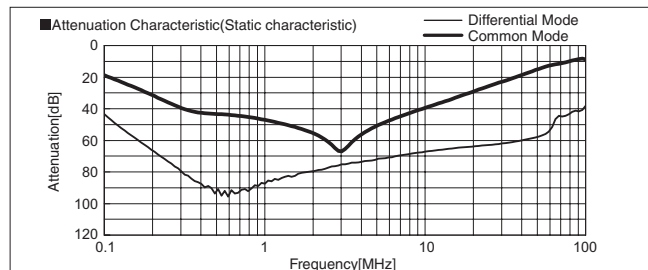
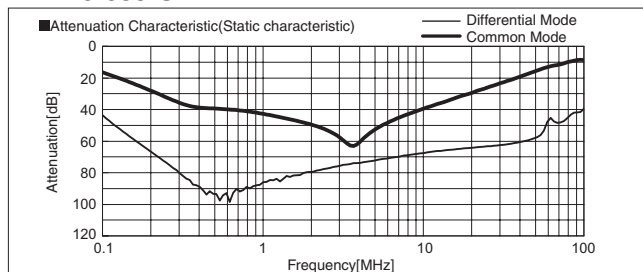
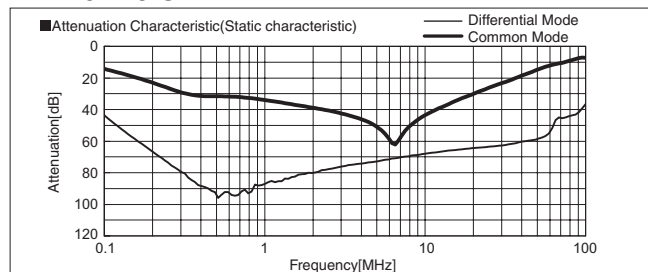


FTA-60-683-H



FTA-60-104-H

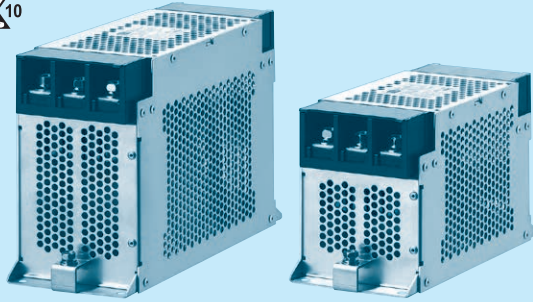




FTA series(80,100,125,150A)

FTA -80 -683 -□

① ② ③ ④



① Model Name

② Rated Current

③ Line to ground capacitor code: See table 1.1.
table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 250/500V 60Hz) (155,335 only 250/400V 60Hz)	Line to ground capacitor (nominal value)
223	1.0mA/2.0mA max	22,000pF
683	2.5mA/5.0mA max	68,000pF
104	3.5mA/7.0mA max	100,000pF
155	160mA/250mA max	1.5μF
335	320mA/500mA max	3.3μF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

④ Option

H: Ultra high attenuation type

"155", "335" is not applied.

S: Hexagon socket head cap screw

(Standard type is Hexagon head screw)

U: Improve differential mode attenuation
(Rated voltage 250V)

G: With switch of line to ground capacitor

Only "155", "335" is applied.

* "155" is Leakage current 160mA/250mA max
when the switch state is ON (switched to "I").
50μA/80μA max when the switch state is OFF
(switched to "O").* "335" is Leakage current 320mA/500mA max
when the switch state is ON (switched to "I").
50μA/80μA max when the switch state is OFF
(switched to "O").

Features of FTA series

Book type (Space-saving type)

- 1-stage filter General-purpose High-attenuation (150kHz - 1MHz)
- Selectable leakage current value, Ultra high attenuation type
"155", "335" for EU
(Wye type with neutral earth system), With switch of line to ground capacitor "-G"

Specifications

No.	Items	FTA-80-683	FTA-100-683	FTA-125-683	FTA-150-683
1	Rated Voltage[V]	AC Three phase 500 (voltage range: 528 max) 50/60Hz *1 *2			
2	Rated Current[A]	80	100	125	150
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 100mA), 1minute at room temperature and humidity *3			
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100MΩ min at room temperature and humidity *4			
5	Leakage current 250/500V 60Hz	2.5mA/5.0mA max			
6	DC resistance	5mΩ max	4mΩ max	3mΩ max	3mΩ max
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)			
8	Operating temperature	-40 to +85°C (Refer to Derating Curve)			
9	Operating humidity	20 to 95%RH (Non condensing)			
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)			
11	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis			
12	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis			
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC			
14	Case size (without projection)	100 X 130 X 210 mm (W X H X D) (Option: -G refer to external view) [3.94 X 5.12 X 8.27 inches]		100 X 170 X 260 mm (W X H X D) (Option: -G refer to external view) [3.94 X 6.69 X 10.24 inches]	
15	Weight	3.1kg max		4.2kg max	

*1 Only capacitor code and option "155", "335", Three Phase Δ-connection: 400 (440 max), Wye-connection: 500 (528 max)

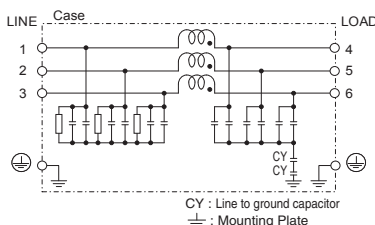
*2 Only option "U", Three Phase 250 (275 max)

*3 Only capacitor code and option "155", "335", 2,800VDC (Cutoff Current = 10mA), 1minute at room temperature and humidity.

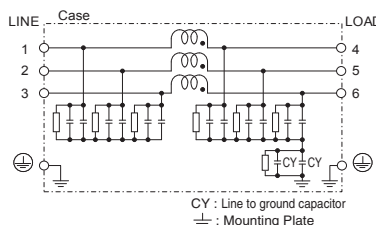
*4 Only capacitor code and option "155", "335", Isolation resistance specification is deleted.

Circuit Diagram

(1) Line to ground capacitor code : 223, 683, 104

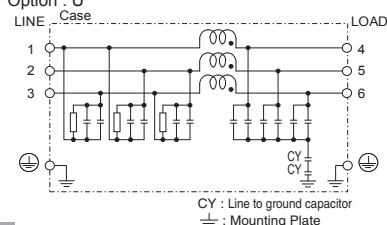


(2) Line to ground capacitor code : 155, 335



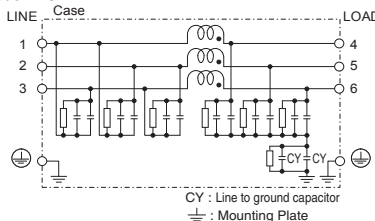
(3) Line to ground capacitor code : 223, 683, 104

Option : U



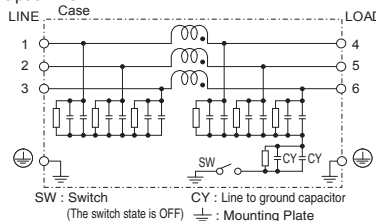
(4) Line to ground capacitor code : 155, 335

Option : U

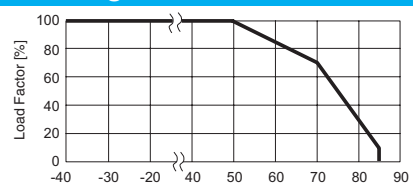


(5) Line to ground capacitor code : 155, 335

Option : G



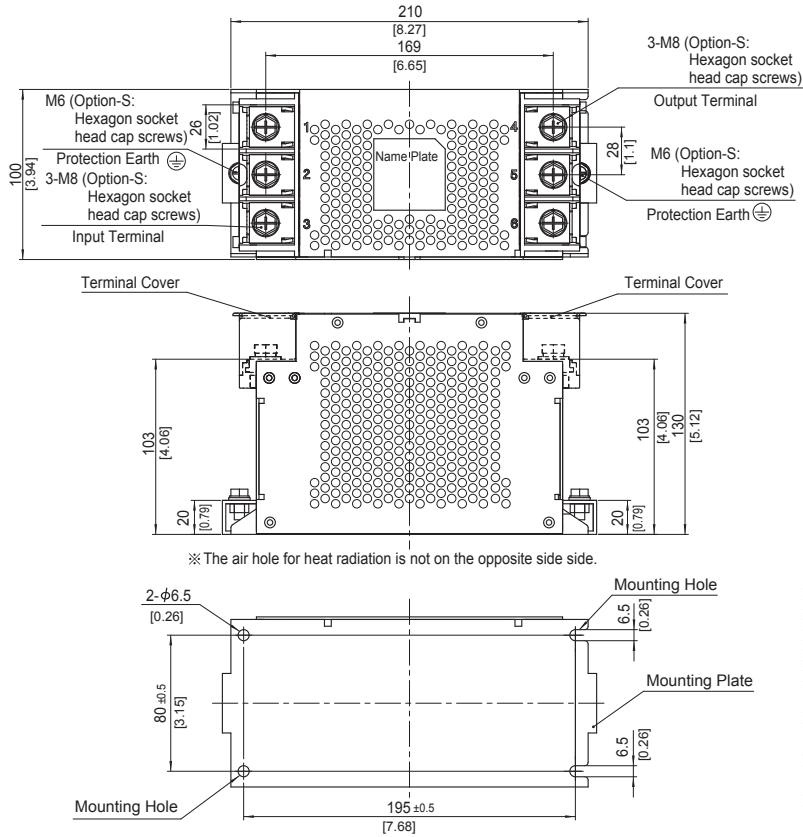
Derating Curve



* Keep free ventilation holes for cooling.

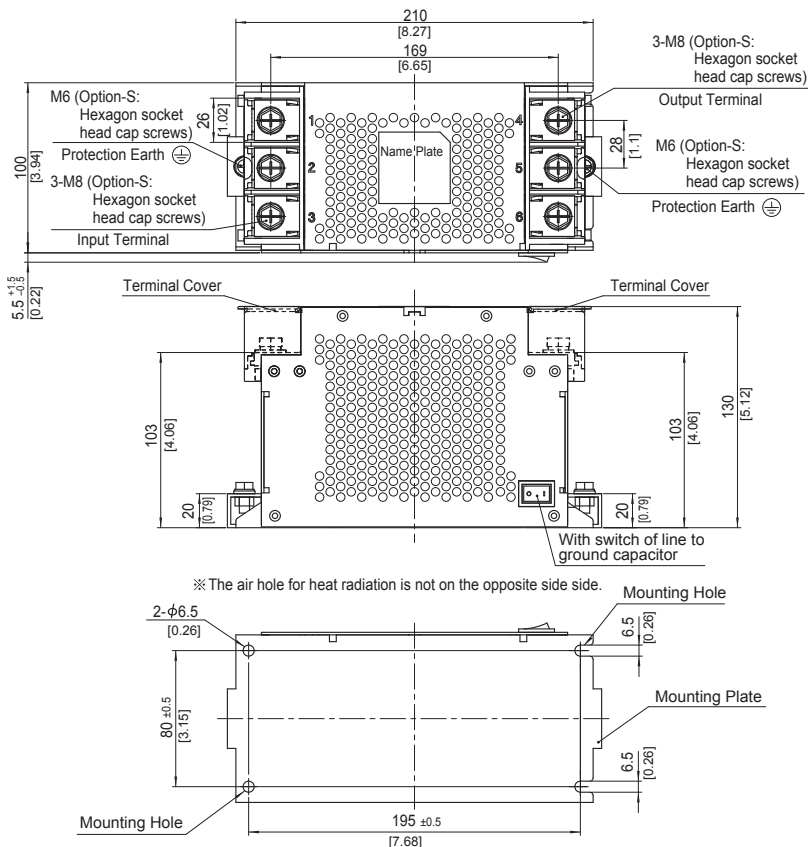
External view

FTA-80 / FTA-100 / FTA-125



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 3.1kg max
- ※ Mounting Plate : Aluminum $t=2.0$ [0.08]
- ※ Dimensions in mm, []=inches
- ※ Terminal block screw tightening torque
M8 : $9.2\text{N} \cdot \text{m}$ (93.9kgf \cdot cm)/max
- ※ Protection Earth (PE) screw tightening torque
M6 : $5.8\text{N} \cdot \text{m}$ (59.2kgf \cdot cm)/max
- ※ Can not be mounted upside-down (mounted the top surface)
- ※ Keep free ventilation holes for cooling

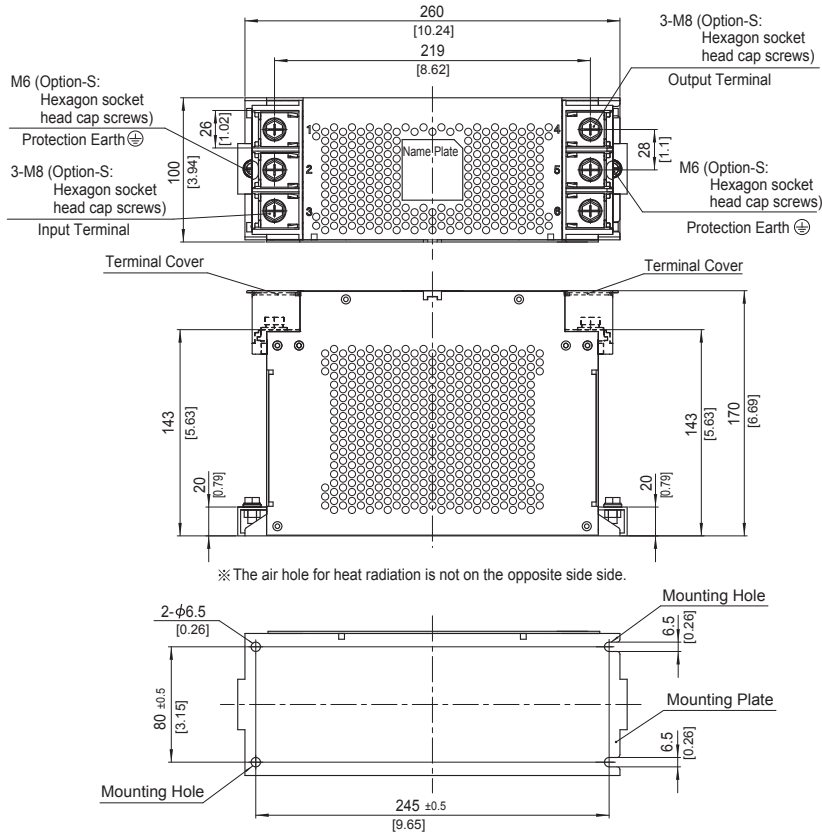
FTA-80 / FTA-100 / FTA-125 with switch of line to ground capacitor ON/OFF



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 3.1kg max
- ※ Mounting Plate : Aluminum $t=2.0$ [0.08]
- ※ Dimensions in mm, []=inches
- ※ Terminal block screw tightening torque
M8 : $9.2\text{N} \cdot \text{m}$ (93.9kgf \cdot cm)/max
- ※ Protection Earth (PE) screw tightening torque
M6 : $5.8\text{N} \cdot \text{m}$ (59.2kgf \cdot cm)/max
- ※ Can not be mounted upside-down (mounted the top surface)
- ※ Keep free ventilation holes for cooling
- ※ The switch state is OFF at shipping
- ※ Switch status ON : "I", OFF : "O"
- ※ HIGH LEAKAGE CURRENT first connect to earth

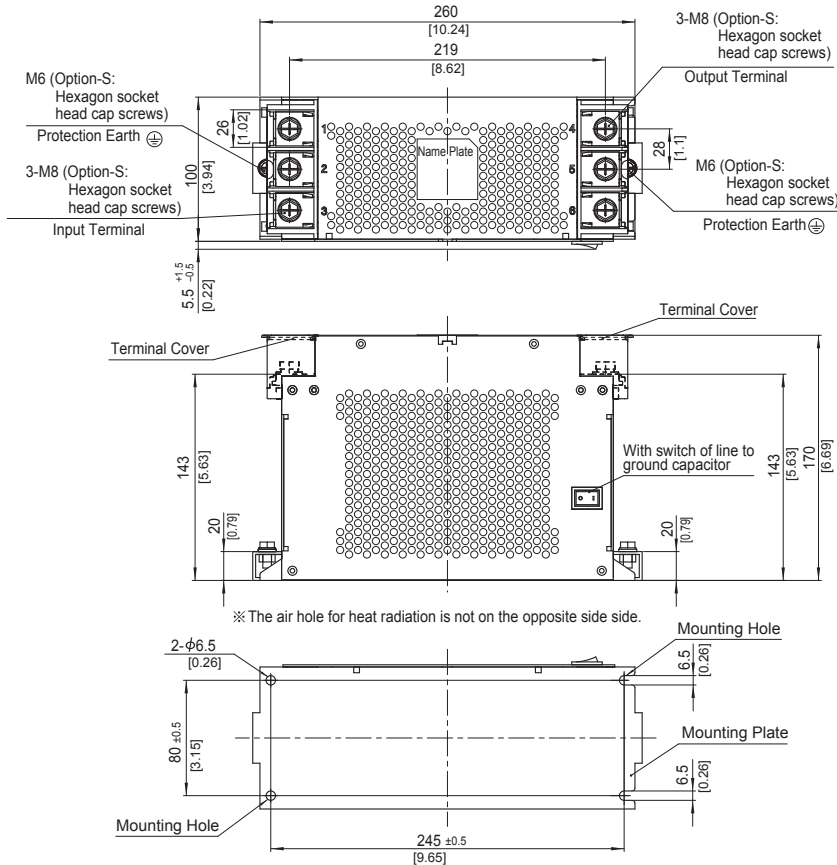
External view

FTA-150

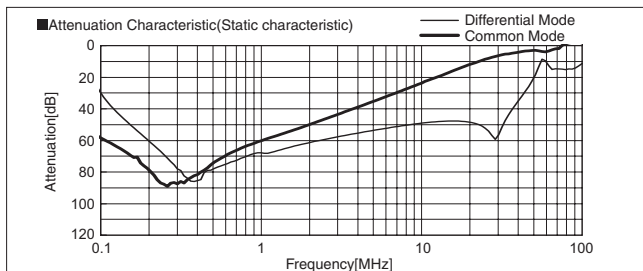
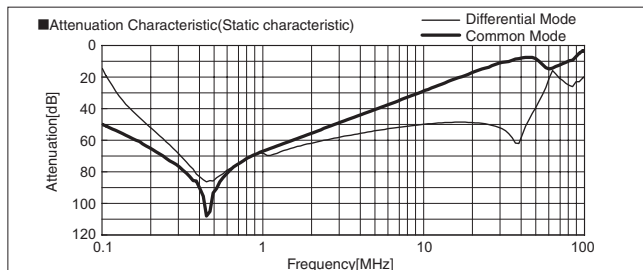
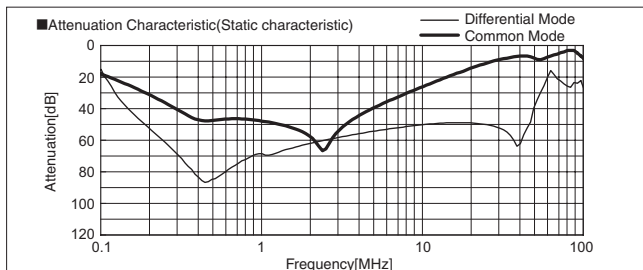
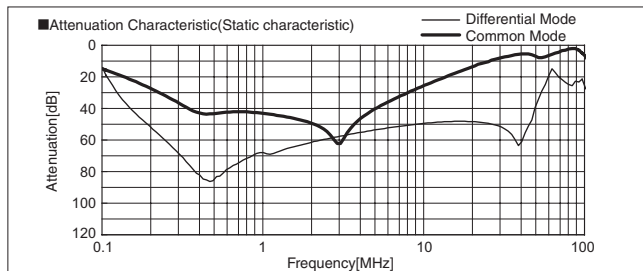
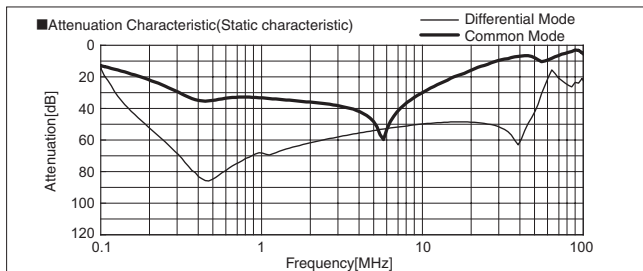
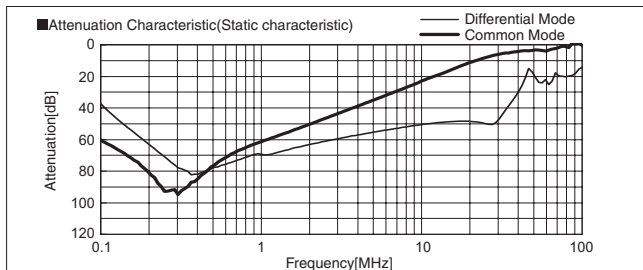
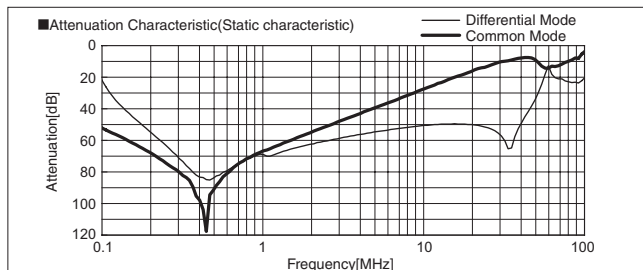
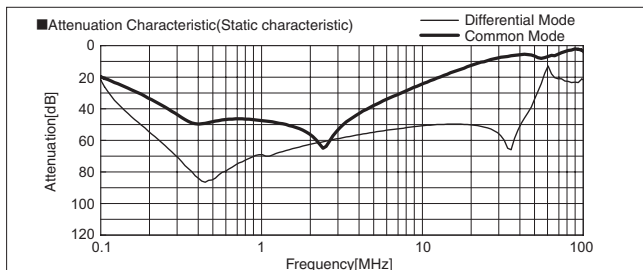
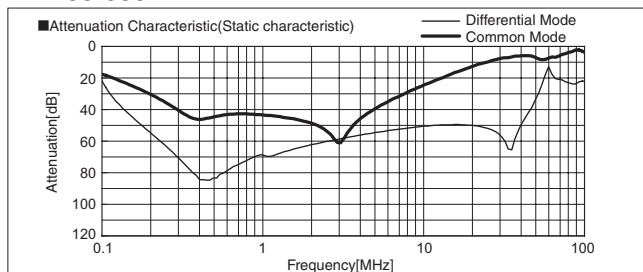
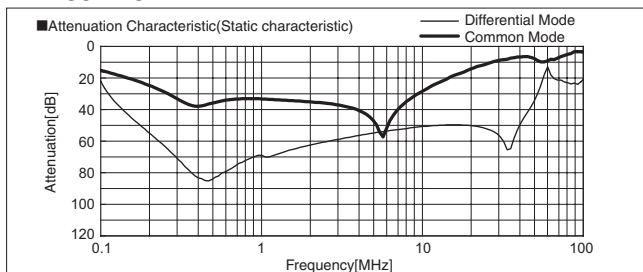


- ※ Tolerance : ±1 [±0.04]
- ※ Weight : 4.2kg max
- ※ Mounting Plate : Aluminum t=2.0 [0.08]
- ※ Dimensions in mm, []=inches
- ※ Terminal block screw tightening torque
M8 : 9.2N · m(93.9kgf · cm)max
- ※ Protection Earth (PE) screw tightening torque
M6 : 5.8N · m(59.2kgf · cm)max
- ※ Can not be mounted upside-down (mounted the top surface)
- ※ Keep free ventilation holes for cooling

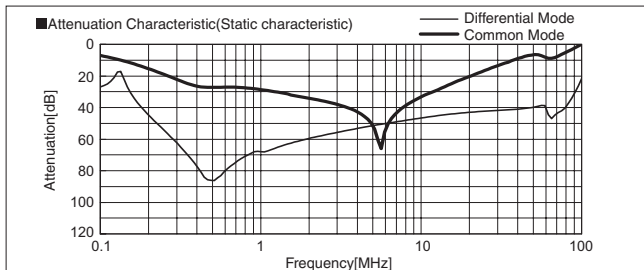
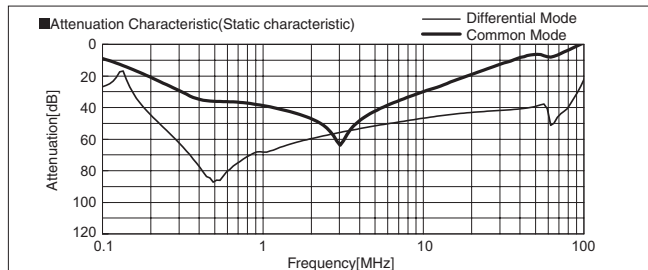
FTA-150 with switch of line to ground capacitor ON/OFF



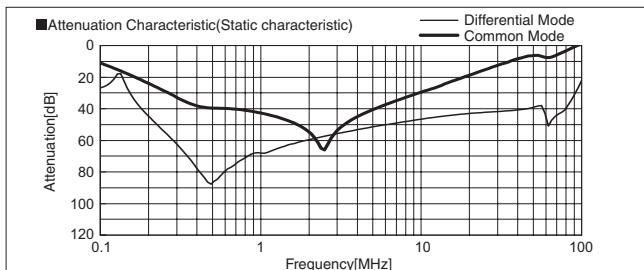
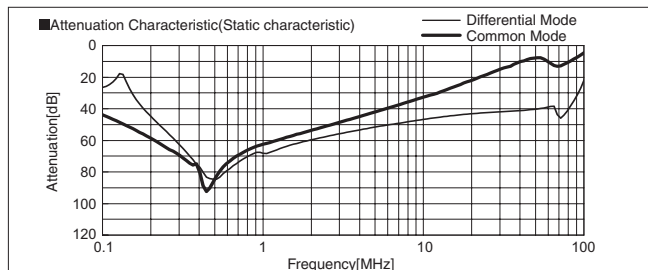
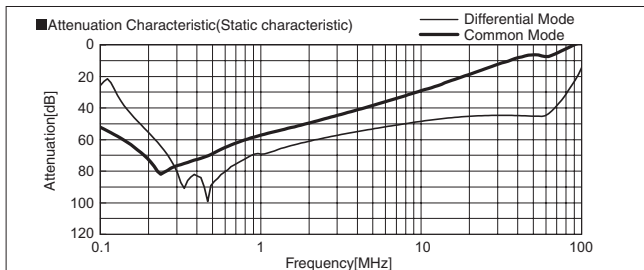
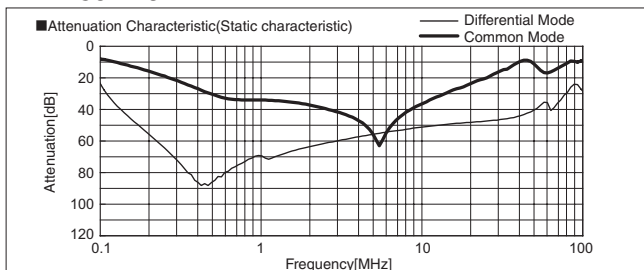
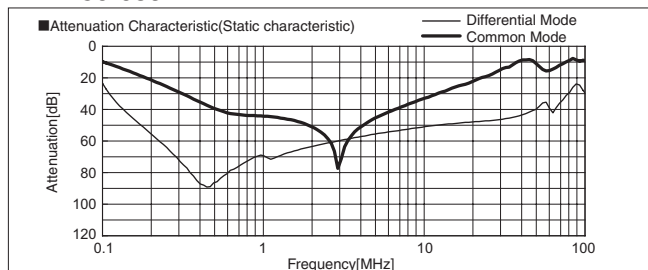
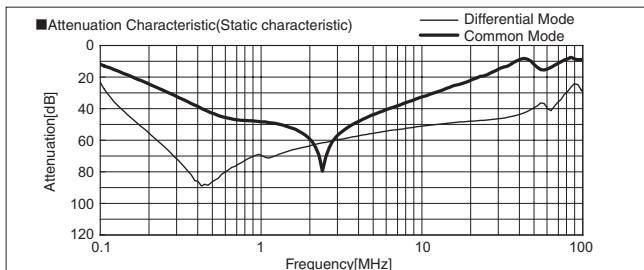
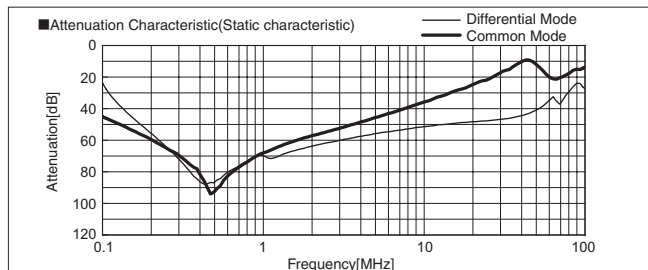
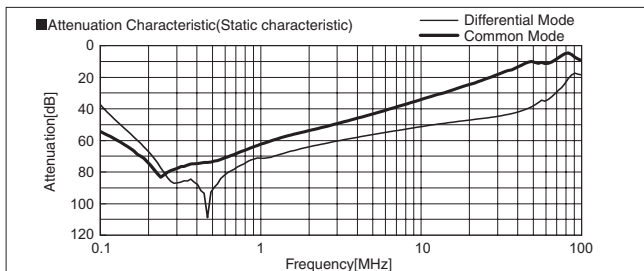
- ※ Tolerance : ±1 [±0.04]
- ※ Weight : 4.2kg max
- ※ Mounting Plate : Aluminum t=2.0 [0.08]
- ※ Dimensions in mm, []=inches
- ※ Terminal block screw tightening torque
M8 : 9.2N · m(93.9kgf · cm)max
- ※ Protection Earth (PE) screw tightening torque
M6 : 5.8N · m(59.2kgf · cm)max
- ※ Can not be mounted upside-down (mounted the top surface)
- ※ Keep free ventilation holes for cooling
- ※ The switch state is OFF at shipping
- ※ Switch status ON : "I", OFF : "O"
- ※ HIGH LEAKAGE CURRENT first connect to earth



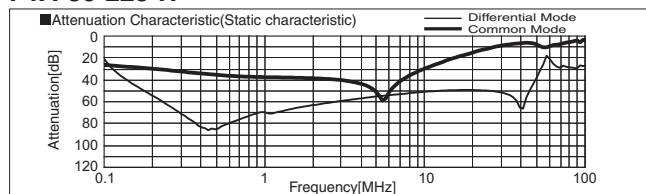
FTA-125-223

**FTA-125-683**

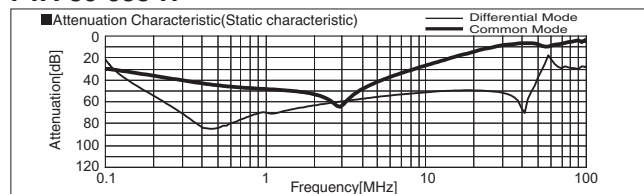
FTA-125-104

**FTA-125-155****FTA-125-335****FTA-150-223****FTA-150-683****FTA-150-104****FTA-150-155****FTA-150-335**

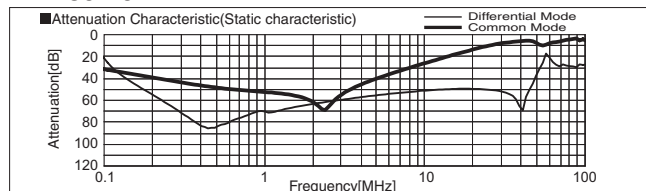
FTA-80-223-H



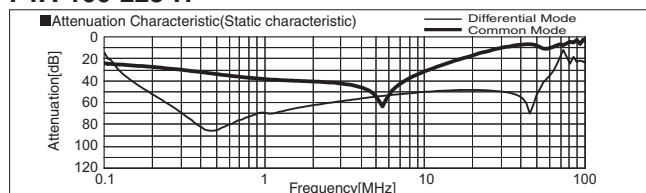
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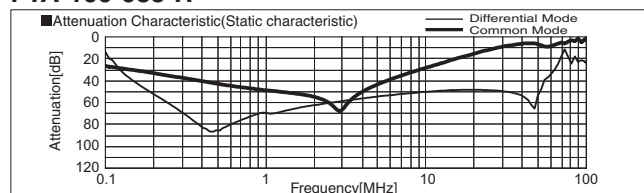
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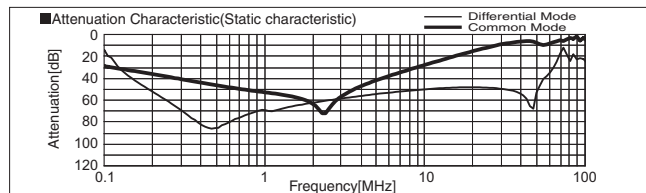
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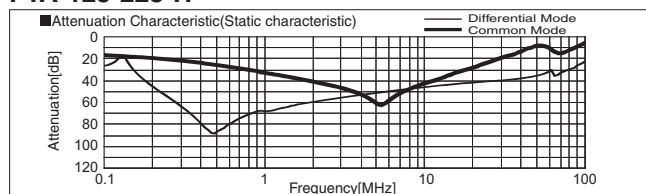
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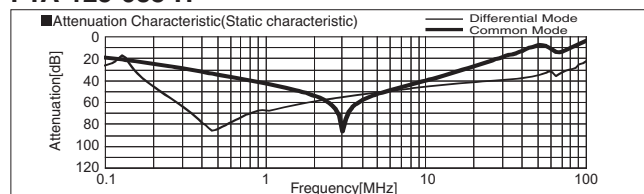
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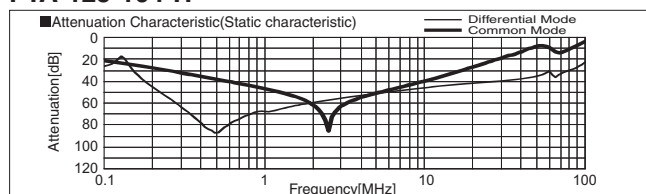
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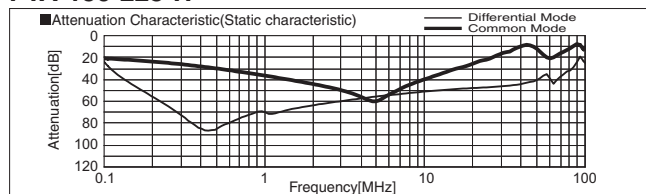
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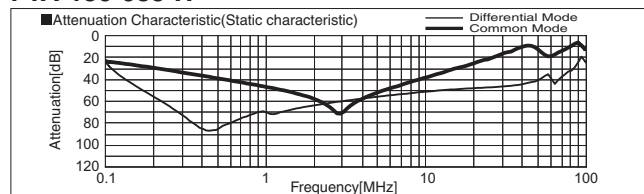
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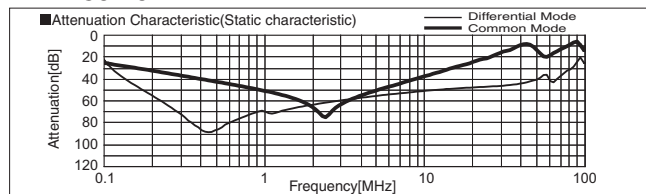
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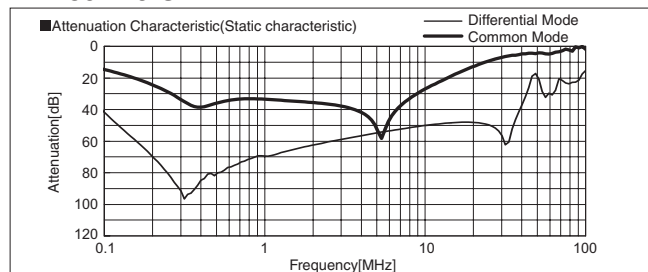
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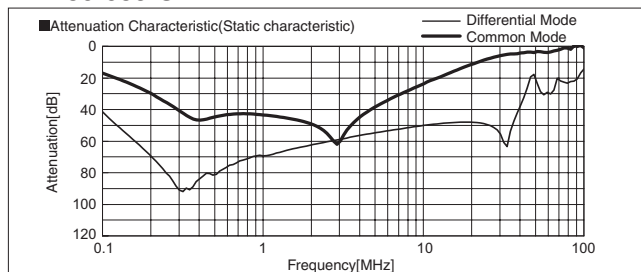
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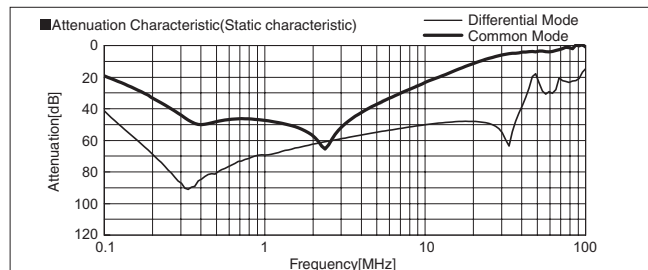
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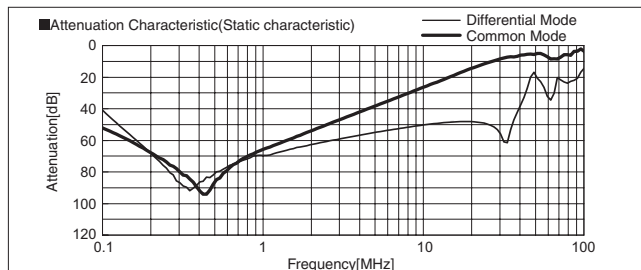
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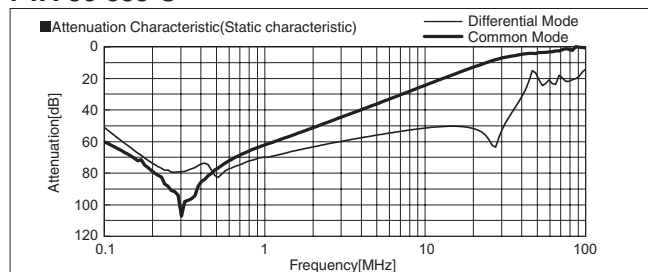
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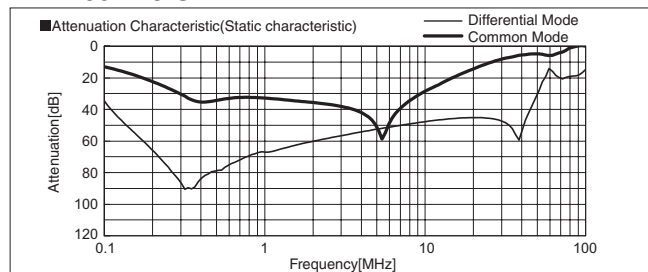
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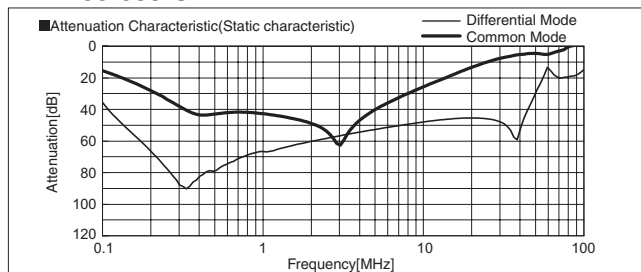
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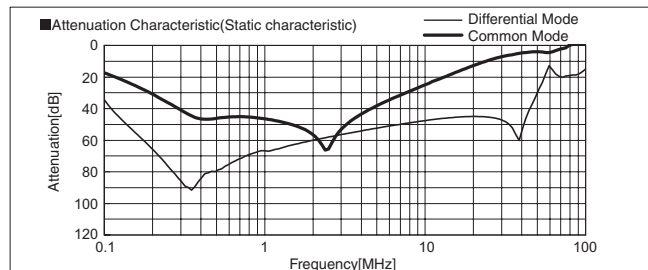
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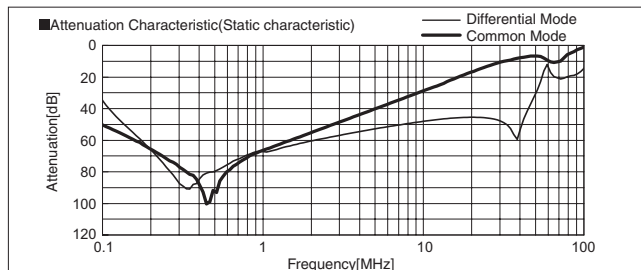
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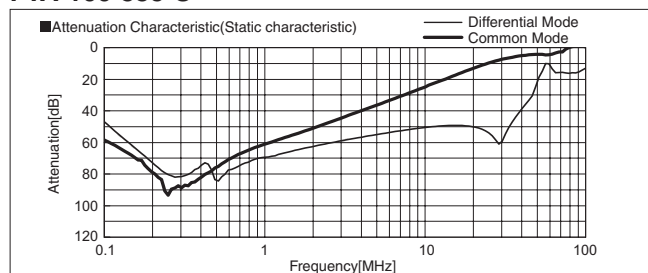
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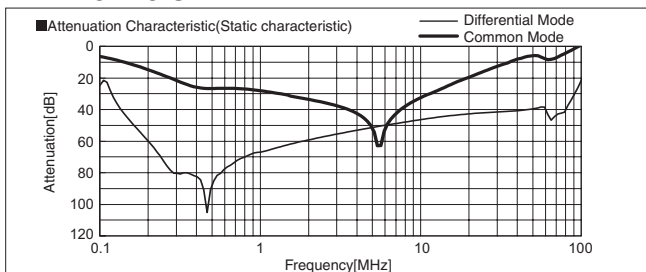
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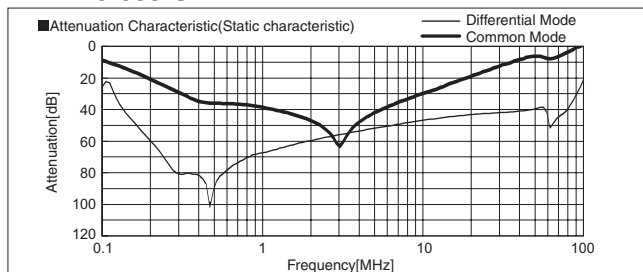
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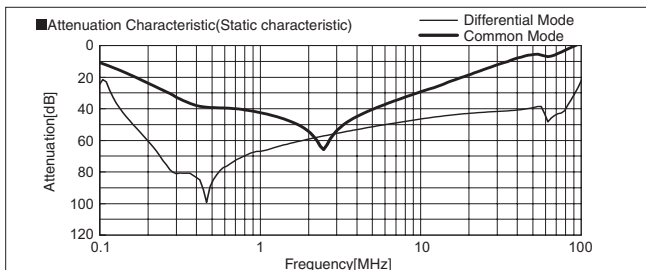
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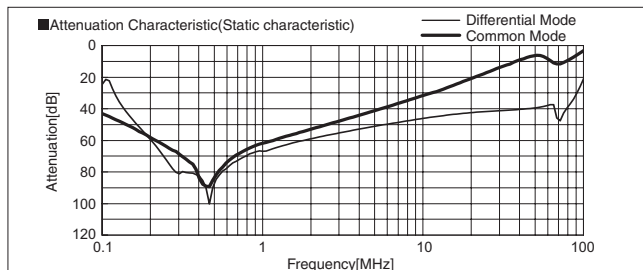
FTA-125-683-U



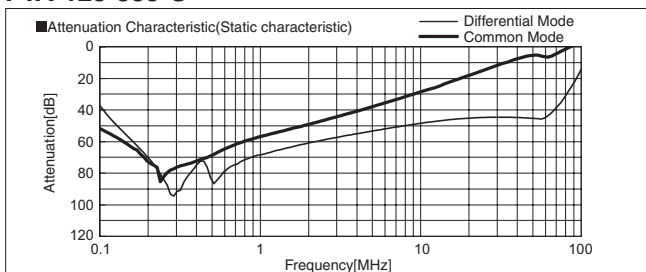
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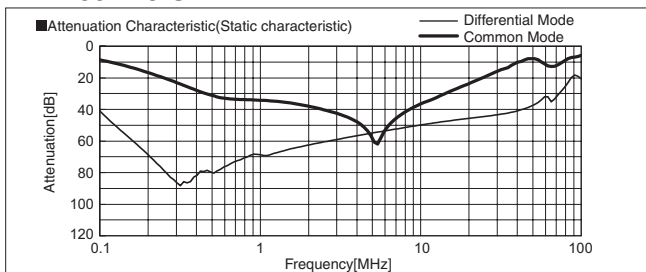
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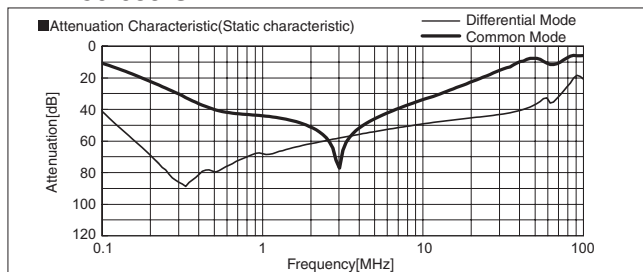
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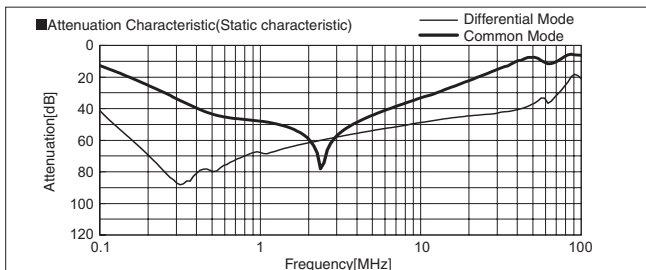
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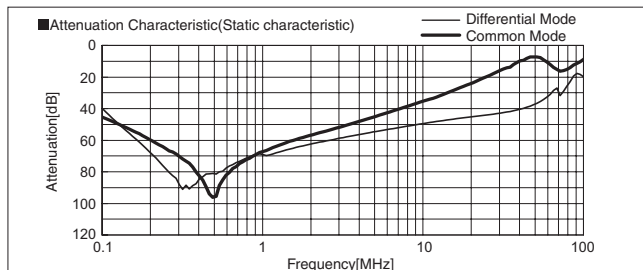
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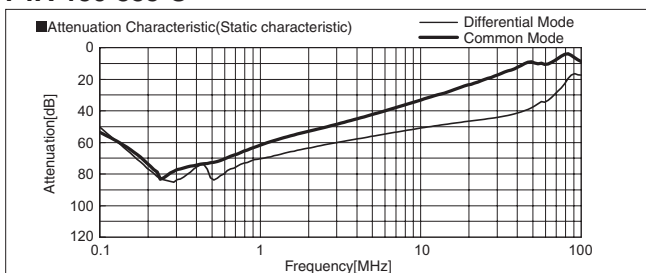
FTA-150-104-U



FTA-150-155-U



FTA-150-335-U



TBC series(50,60,80,100,150A)

TBC -50 -683

①

②

③

① Model Name

② Rated Current

③ Line to ground capacitor code: See table 1.1.

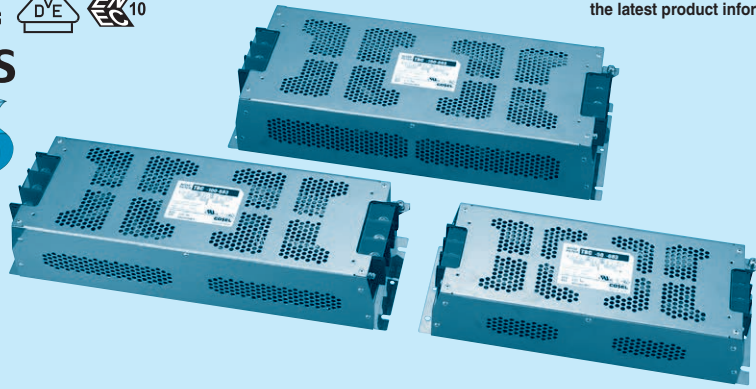
table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 250/500V 60Hz)	Line to ground capacitor (nominal value)
223	1.0mA/2.0mA max	22,000pF
683	2.5mA/5.0mA max	68,000pF
104	3.5mA/7.0mA max	100,000pF

* When the line to ground capacitor code is different, the attenuation characteristic is different.



* Link to www.cosel.co.jp/en for the latest product information.



Features of TBC series

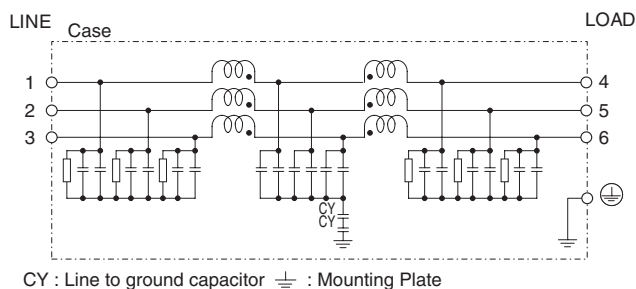
High-attenuation type of common mode noise from 150kHz to 1MHz (2-stage filter)

- Three phase rated voltage 500 VAC (voltage range: 528V max)
- Selectable leakage current value

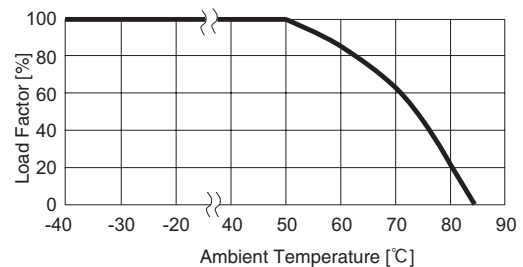
Specifications

No.	Items	TBC-50-683	TBC-60-683	TBC-80-683	TBC-100-683	TBC-150-683
1	Rated Voltage[V]	AC Three Phase 500 (voltage range: 528 max) 50/60Hz				
2	Rated Current[A]	50	60	80	100	150
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 100mA), 1minute at room temperature and humidity				
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100MΩ min at room temperature and humidity				
5	Leakage current 250/500V 60Hz	2.5mA/5.0mA max				
6	DC resistance	14mΩ max	10mΩ max	10mΩ max	8mΩ max	6mΩ max
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)				
8	Operating temperature	-40 to +85°C (Refer to Derating Curve)				
9	Operating humidity	20 to 95%RH (Non condensing)				
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)				
11	Vibration	10 to 55Hz, 19.6m/s² (2G), 3min. Period, 1hour each X, Y and Z axis				
12	Impact	196.1m/s² (20G), 11ms Once each X, Y and Z axis				
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC				
14	Case size (without projection)	140 X 80 X 374 mm (W X H X D)		150 X 92 X 456 mm (W X H X D)		190 X 92 X 482 mm (W X H X D)
		[5.51 X 3.15 X 14.72 inches]		[5.91 X 3.62 X 17.95 inches]		[7.48 X 3.62 X 18.98 inches]
15	Weight	4.3kg max		7.7kg max		9.6kg max

Circuit Diagram



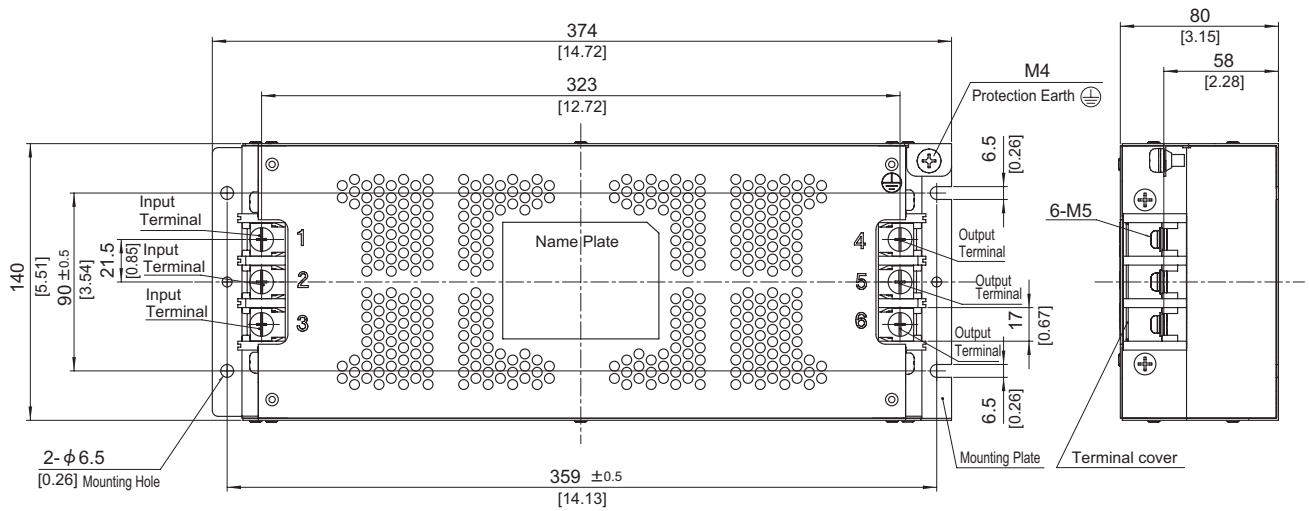
Derating Curve



* Keep free ventilation holes for cooling.

External view

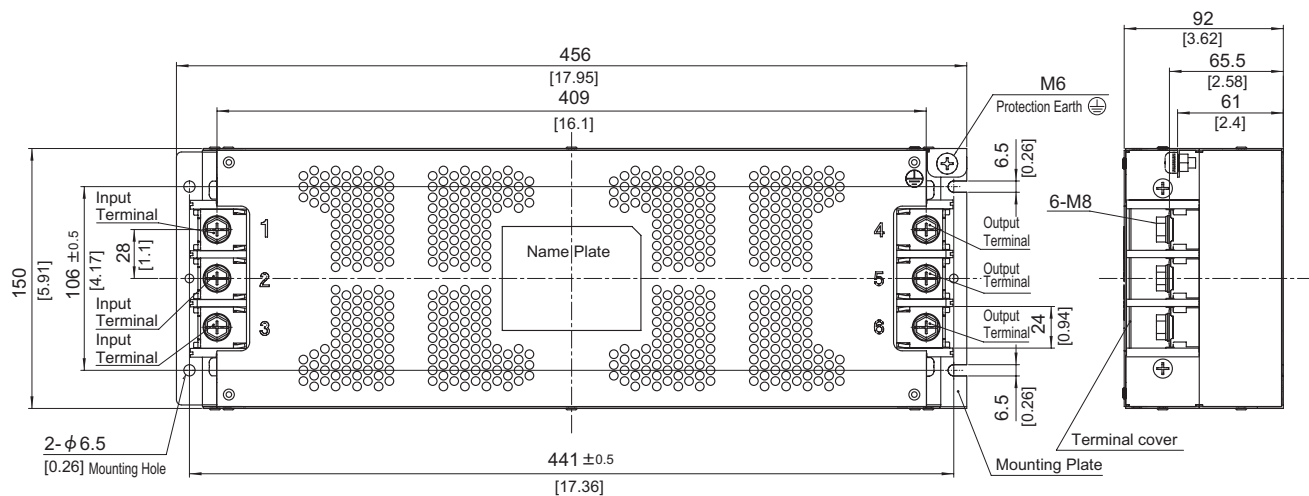
TBC-50-□□□ / TBC-60-□□□



※ Can not be mounted upside-down.
(mounted the top surface)

※ Tolerance : ± 1 [± 0.04]
 ※ Weight : 4.3kg max
 ※ Chassis Material : Stainless steel $t=1.0$ [0.04]
 ※ Dimensions in mm, []=inches
 ※ Terminal block screw tightening torque M5:3.0N · m (30.7kgf · cm) max
 ※ Protection Earth screw tightening torque M4:1.6N · m (16.9kgf · cm) max

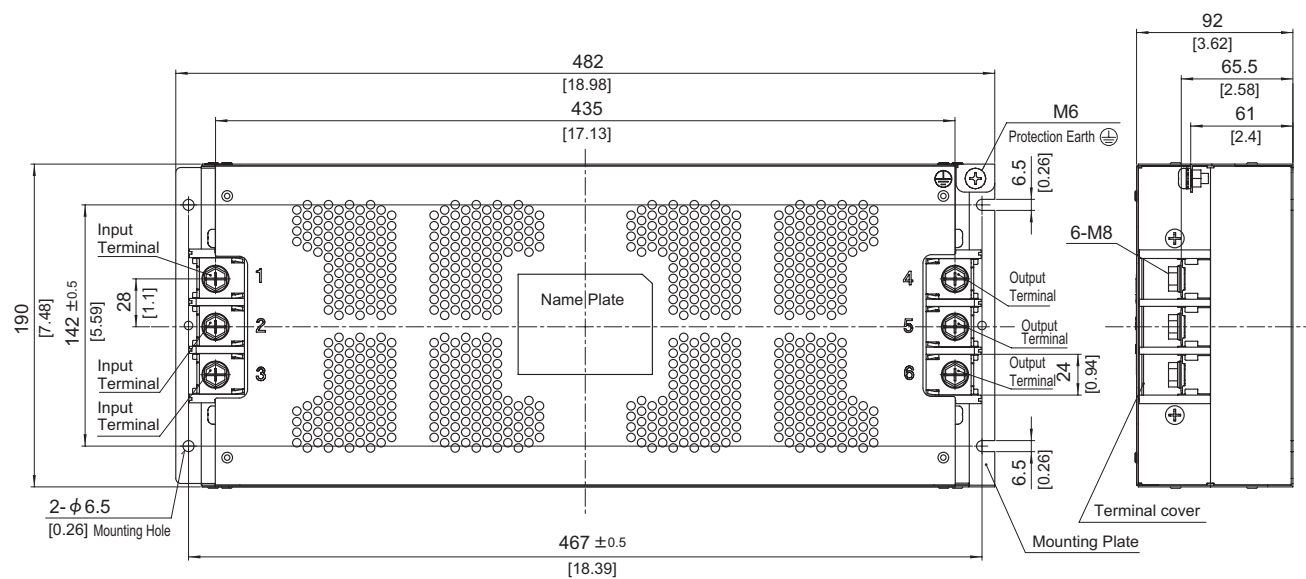
TBC-80-□□□ / TBC-100-□□□



※ Can not be mounted upside-down.
(mounted the top surface)

※ Tolerance : ± 1 [± 0.04]
 ※ Weight : 7.7kg max
 ※ Chassis Material : Stainless steel $t=1.0$ [0.04]
 ※ Dimensions in mm, []=inches
 ※ Terminal block screw tightening torque M8:9.2N · m (93.9kgf · cm) max
 ※ Protection Earth screw tightening torque M6:5.8N · m (59.2kgf · cm) max

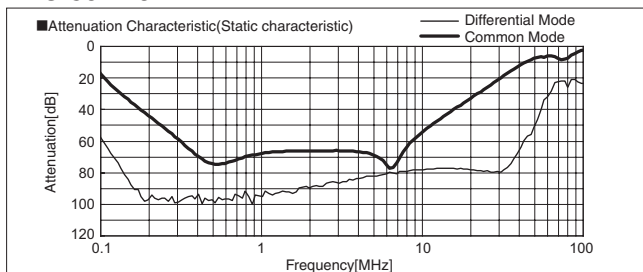
External view

TBC-150-

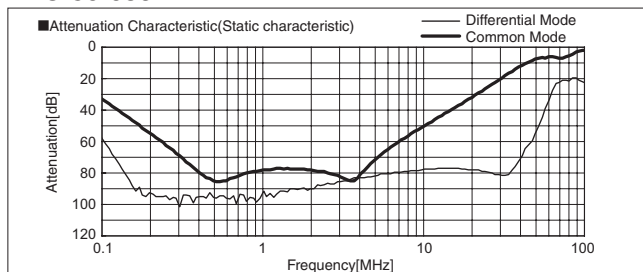
※ Can not be mounted upside-down.
(mounted the top surface)

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 9.6kg max
- ※ Chassis Material : Stainless steel t=1.0 [0.04]
- ※ Dimensions in mm, []=inches
- ※ Terminal block screw tightening torque M8:9.2N · m (93.9kgf · cm) max
- ※ Protection Earth screw tightening torque M6:5.8N · m (59.2kgf · cm) max

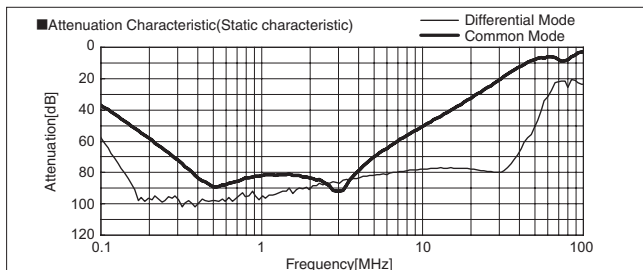
TBC-50-223



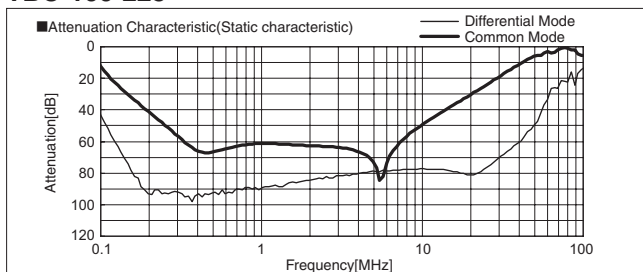
TBC-50-683



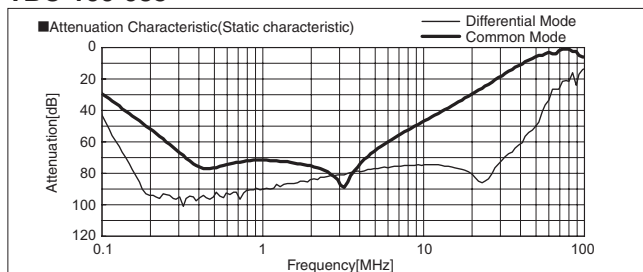
TBC-50-104



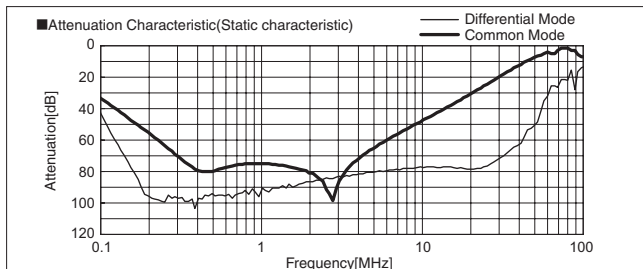
TBC-100-223



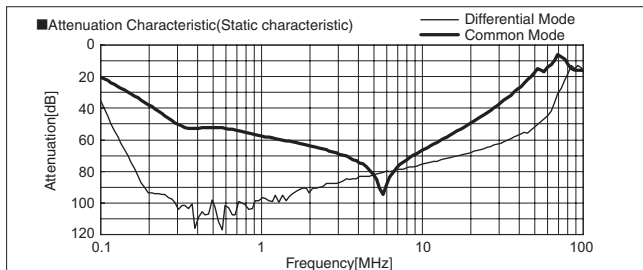
TBC-100-683



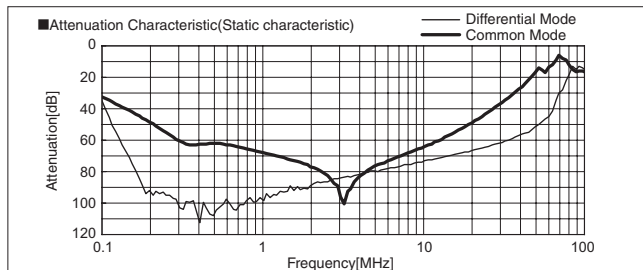
TBC-100-104



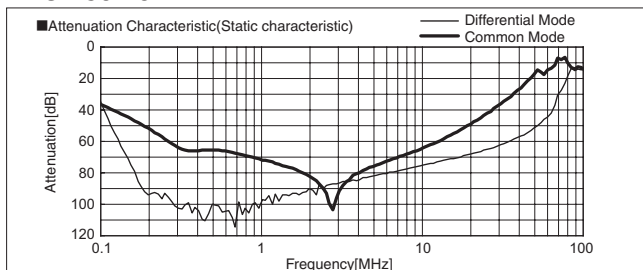
TBC-150-223



TBC-150-683



TBC-150-104



TBC series(200,250,300A)

TBC -200 -683

①

②

③

① Model Name

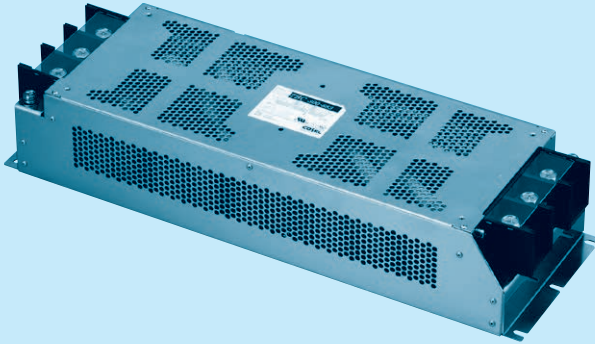
② Rated Current

③ Line to ground capacitor code: See table 1.1.

table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 250/500V 60Hz)	Line to ground capacitor (nominal value)
223	1.0mA/2.0mA max	22,000pF
683	2.5mA/5.0mA max	68,000pF
104	3.5mA/7.0mA max	100,000pF

* When the line to ground capacitor code is different, the attenuation characteristic is different.



Features of TBC series

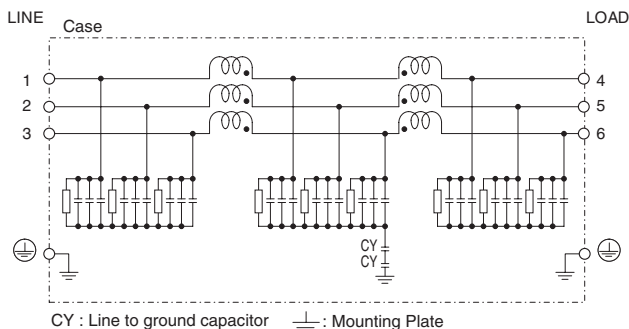
High-attenuation type of common mode noise from 150kHz to 1MHz (2-stage filter)

- Three phase rated voltage 500 VAC (voltage range: 528V max)
- Selectable leakage current value

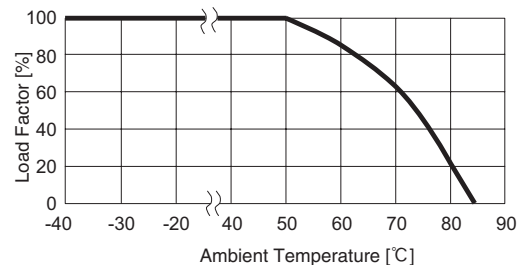
Specifications

No.	Items	TBC-200-683	TBC-250-683	TBC-300-683
1	Rated Voltage[V]	AC Three Phase 500 (voltage range: 528 max) 50/60Hz		
2	Rated Current[A]	200	250	300
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 100mA), 1minute at room temperature and humidity		
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100MΩ min at room temperature and humidity		
5	Leakage current 250/500V 60Hz	2.5mA/5.0mA max		
6	DC resistance	4mΩ max	3mΩ max	2mΩ max
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)		
8	Operating temperature	-40 to +85°C (Refer to Derating Curve)		
9	Operating humidity	20 to 95%RH (Non condensing)		
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)		
11	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis		
12	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis		
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC		
14	Case size (without projection)	190 X 110 X 580 mm [7.48 X 4.33 X 22.83 inches] (W X H X D)		
15	Weight	13.0kg max		

Circuit Diagram

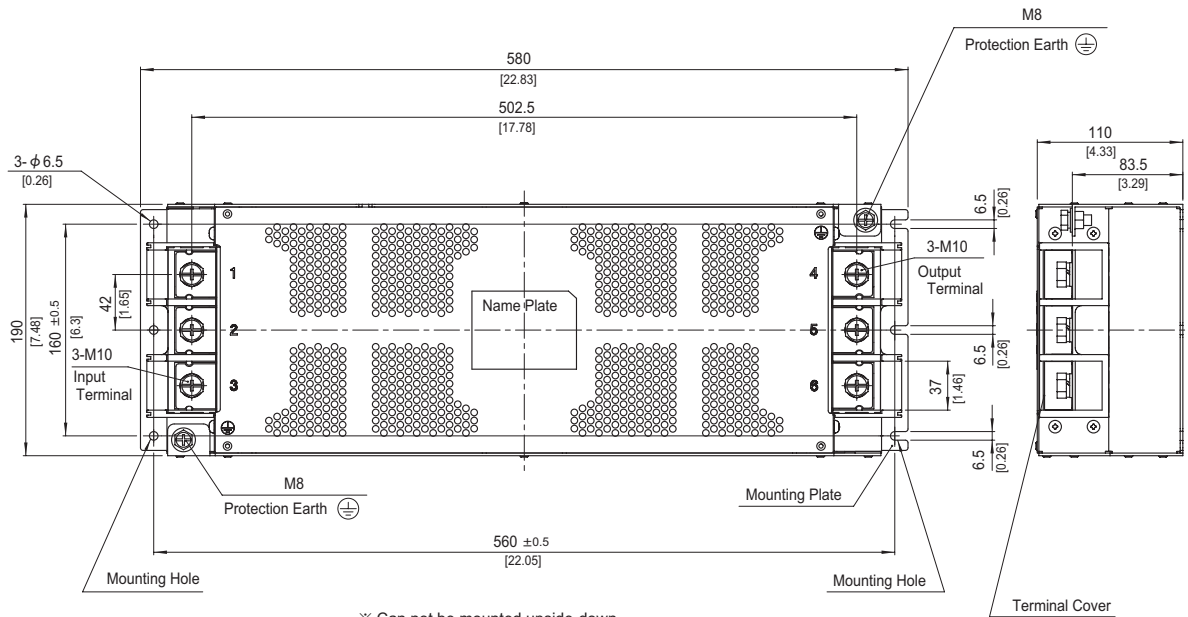


Derating Curve



* Keep free ventilation holes for cooling.

External view



※ Can not be mounted upside-down.
(mounted the top surface)

※ Tolerance : ± 1 [± 0.04]

※ Weight : 13.0kg max

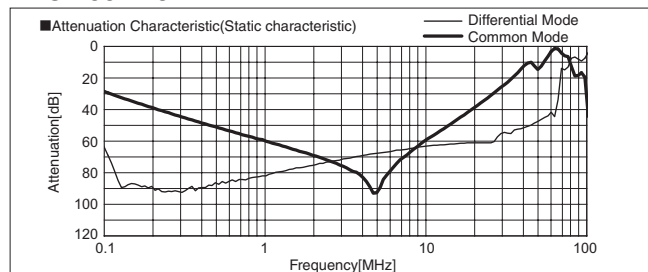
※ Mounting Plate : Stainless steel $t=2.0$ [0.08]

※ Dimensions in mm, []=inches

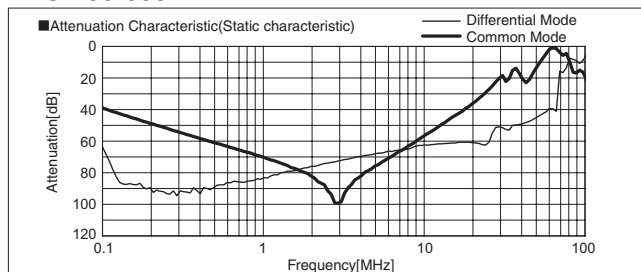
※ Terminal block screw tightening torque M10 : $14.2\text{N} \cdot \text{m}$ (144.9kgf \cdot cm) max

※ Protection Earth screw tightening torque M8 : $9.2\text{N} \cdot \text{m}$ (93.9kgf \cdot cm) max

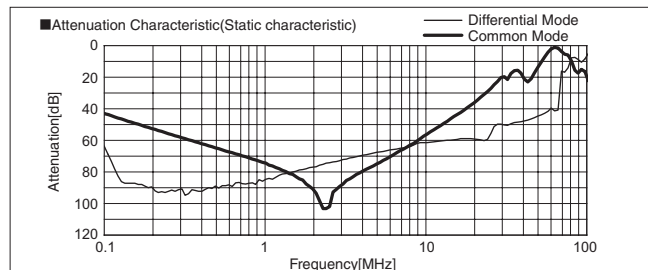
TBC-200-223



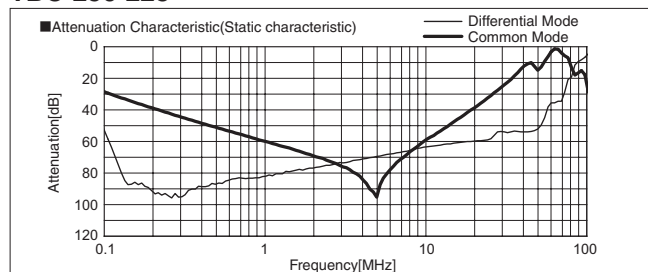
TBC-200-683



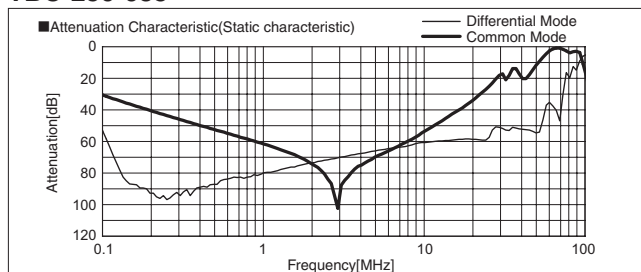
TBC-200-104



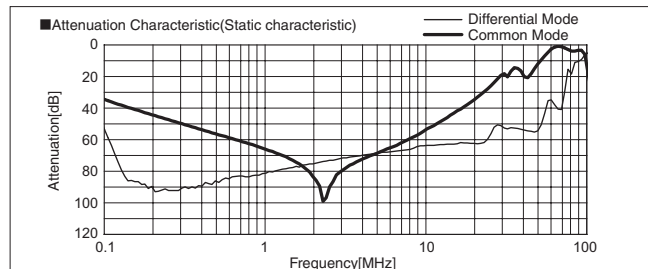
TBC-250-223



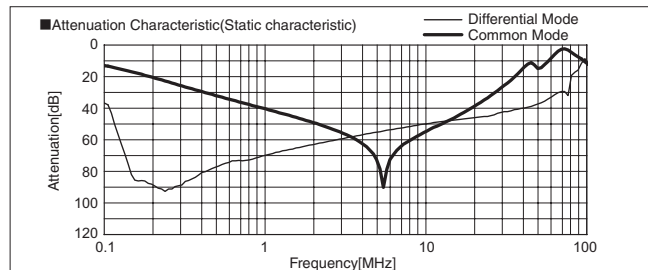
TBC-250-683



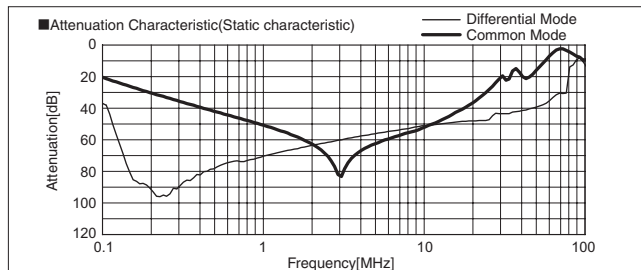
TBC-250-104



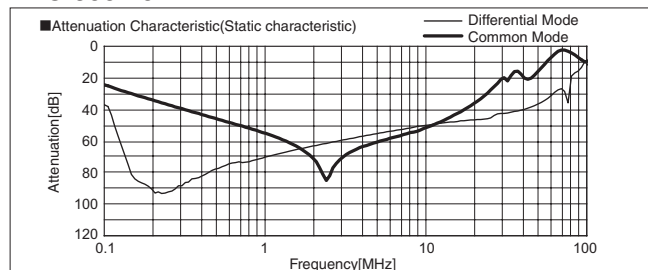
TBC-300-223



TBC-300-683



TBC-300-104



FTB series(80,100,150A)

FTB -80 -663 -□

① ② ③ ④

- ① Model Name
② Rated Current
③ Line to ground capacitor code: See table 1.1.

table 1.1 Line to ground capacitor code

Code	Leakage Current (Input 250/500V 60Hz) (355 only 250/400V 60Hz)	Line to ground capacitor CY1 (nominal value)	Line to ground capacitor CY2 (nominal value)
203	1.0mA/2.0mA max	10,000pF	10,000pF
663	2.5mA/5.0mA max	33,000pF	33,000pF
324	12mA/24mA max	220,000pF	100,000pF
355 *1	330mA/515mA max	220,000pF	3,300,000pF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

* 1 Only "L" type is applied.

- ④ Option
H: Ultra high attenuation type
"355" is not applied
S: Hexagon socket head cap screw
(Standard type is Hexagon head screw)
L: Ultra high attenuation type for EU

Features of FTB series

Book type (Space-saving type)

- 2-stage filter High-attenuation (150kHz - 1MHz)
- Selectable leakage current value, Ultra high attenuation type
"-355-L" for EU (Wye type with neutral earth system)

Specifications

No.	Items	FTB-80-663	FTB-100-663	FTB-150-663
1	Rated Voltage[V]	AC Three Phase 500 (voltage range: 528 max) 50/60Hz *2		
2	Rated Current[A]	80	100	150
3	Test Voltage (Terminal-Mounting Plate)	2,500 VAC (Cutoff Current = 100mA), 1minute at room temperature and humidity *3		
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100MΩ min at room temperature and humidity *4		
5	Leakage current 250/500V 60Hz	2.5mA/5.0mA max		
6	DC resistance	10mΩ max	8mΩ max	6mΩ max
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)		
8	Operating temperature	-40 to +85°C (Refer to Derating Curve)		
9	Operating humidity	20 to 95%RH (Non condensing)		
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)		
11	Vibration	10 to 55Hz, 19.6m/s² (2G), 3min. Period, 1hour each X, Y and Z axis		
12	Impact	196.1m/s² (20G), 11ms Once each X, Y and Z axis		
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil3-1, ENEC		
14	Case size (without projection)	100 X 170 X 350 mm (W X H X D) [3.94 X 6.69 X 13.78 inches]		100 X 210 X 400 mm (W X H X D) [3.94 X 8.27 X 15.75 inches]
15	Weight	5.3kg max		7.8kg max

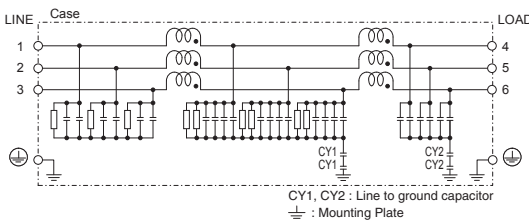
*2 Only capacitor code "355", Three Phase Δ-connection : 400 (440 max), Wye-connection : 500 (528 max)

*3 Only capacitor code "324", "355" 2,800 VDC (Cutoff Current = 10mA), 1minute at room temperature and humidity.

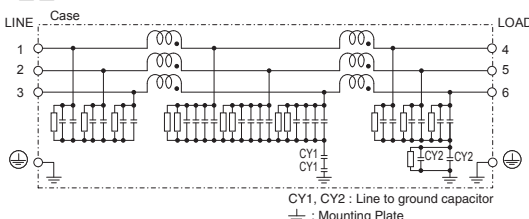
*4 Only capacitor code "355", Isolation resistance specification is deleted.

Circuit Diagram

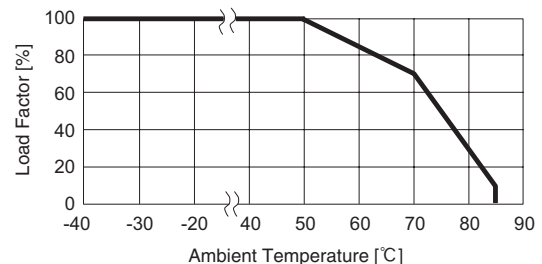
(1) Line to ground capacitor code : 203, 663, 324



(2) FTB-□-355-L



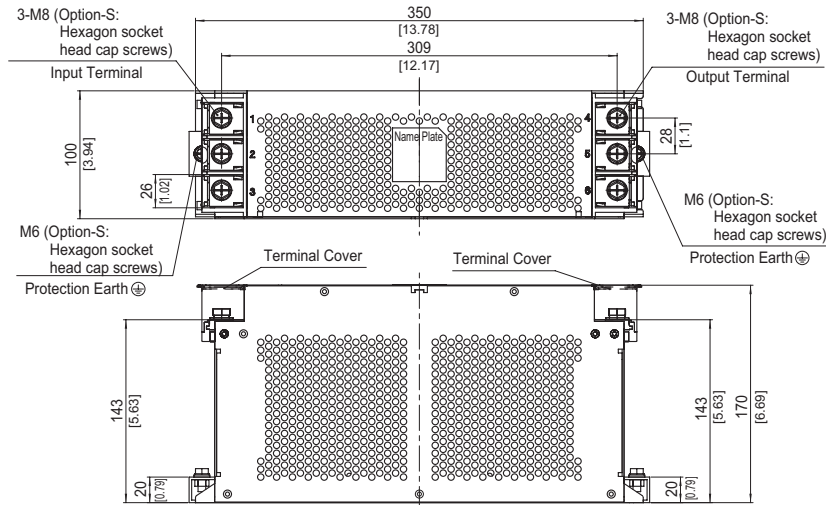
Derating Curve



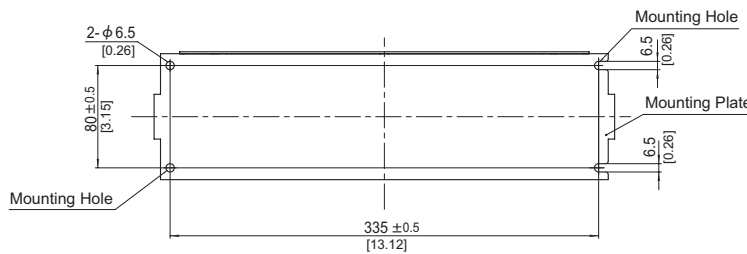
* Keep free ventilation holes for cooling.

External view

FTB-80-□□□ / FTB-100-□□□

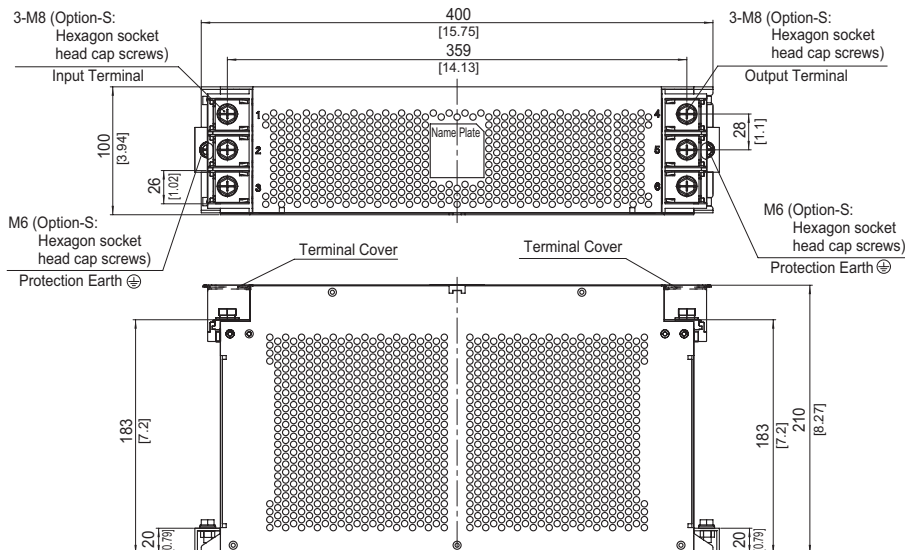


※ The air hole for heat radiation is not on the opposite side side.

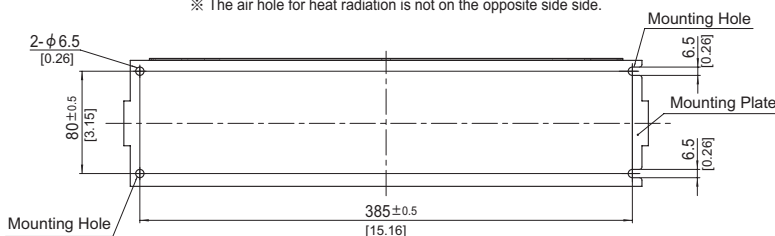


- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 5.3kg max
- ※ Mounting Plate : Aluminum $t = 2.0$ [0.08]
- ※ Dimensions in mm, []=inches
- ※ Terminal block screw tightening torque
M8 : $9.2\text{N} \cdot \text{m}$ (93.9kgf · cm)max
- ※ Protection Earth (PE) screw tightening torque
M6 : $5.8\text{N} \cdot \text{m}$ (59.2kgf · cm)max
- ※ Can not be mounted upside-down (mounted the top surface)
- ※ Keep free ventilation holes for cooling

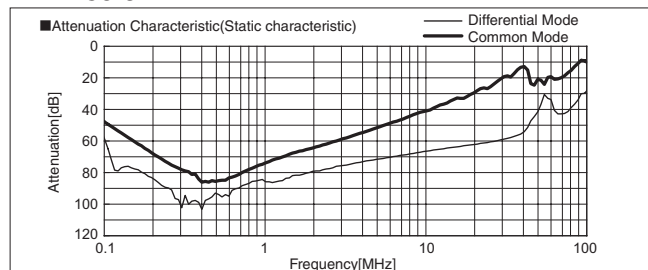
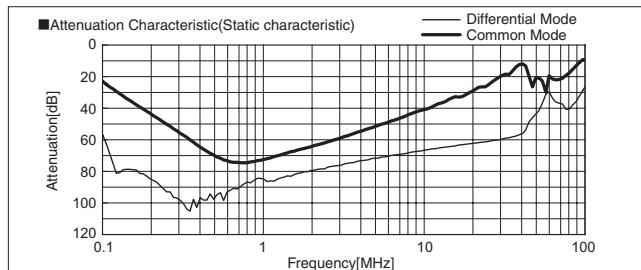
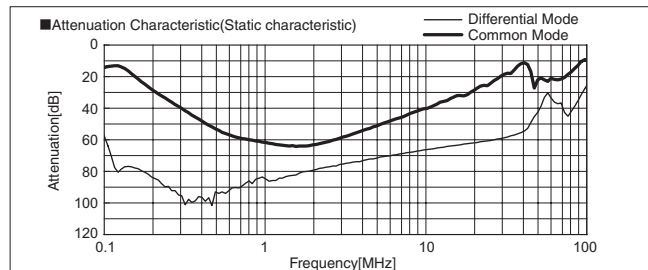
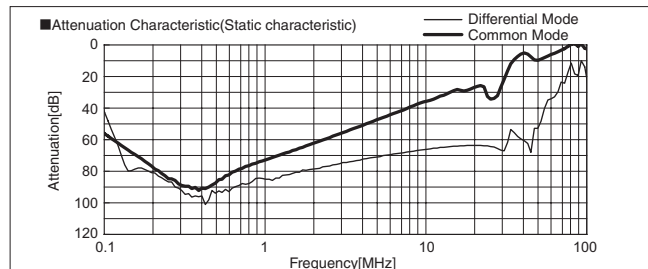
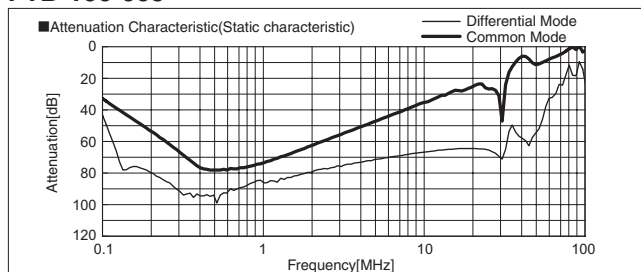
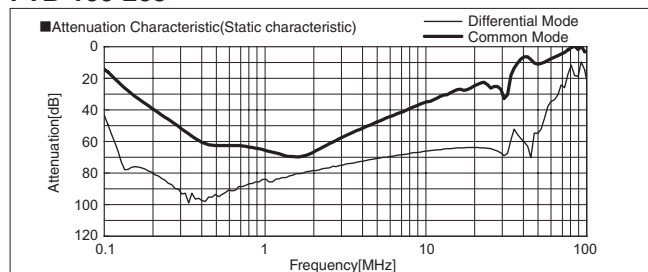
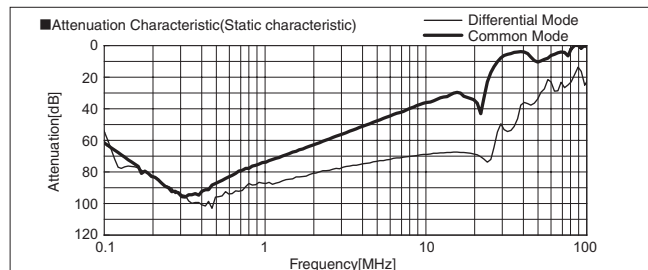
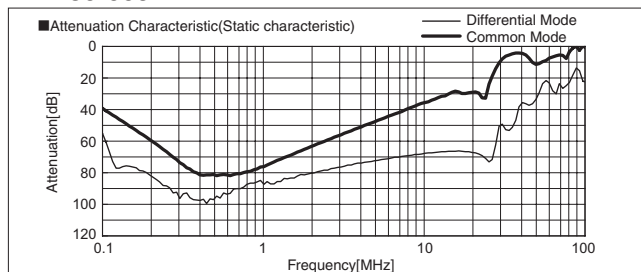
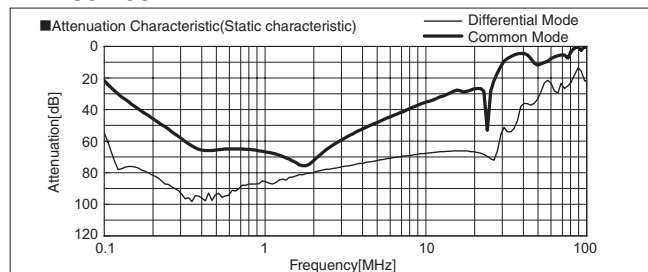
FTB-150-□□□



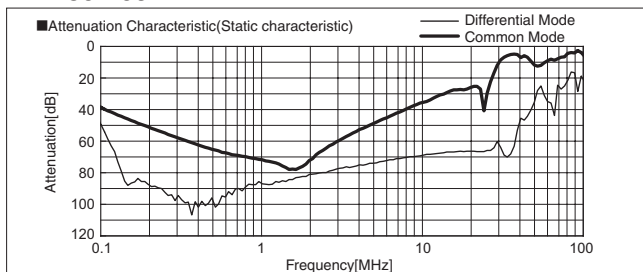
※ The air hole for heat radiation is not on the opposite side side.



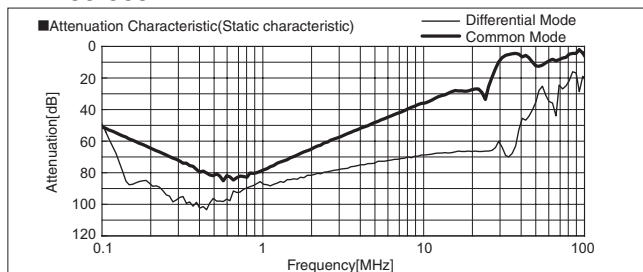
- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 7.8kg max
- ※ Mounting Plate : Aluminum $t = 2.0$ [0.08]
- ※ Dimensions in mm, []=inches
- ※ Terminal block screw tightening torque
M8 : $9.2\text{N} \cdot \text{m}$ (93.9kgf · cm)max
- ※ Protection Earth (PE) screw tightening torque
M6 : $5.8\text{N} \cdot \text{m}$ (59.2kgf · cm)max
- ※ Can not be mounted upside-down (mounted the top surface)
- ※ Keep free ventilation holes for cooling



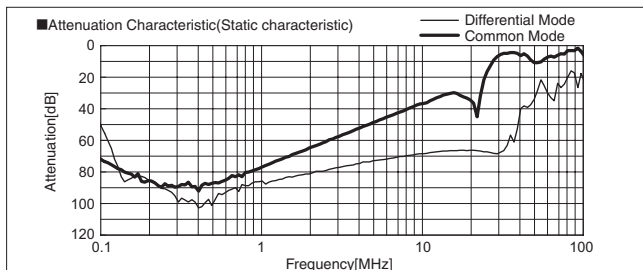
FTB-80-203-H



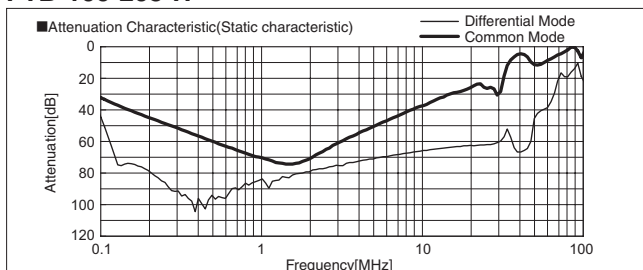
FTB-80-663-H



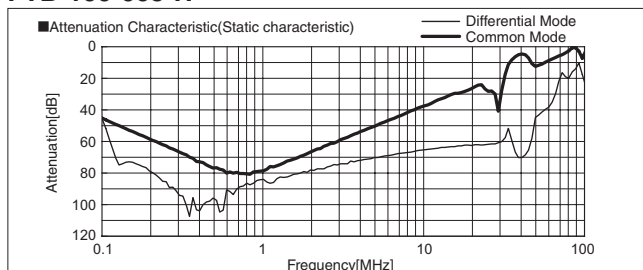
FTB-80-324-H



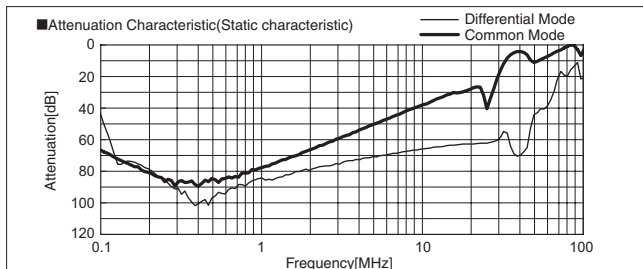
FTB-100-203-H



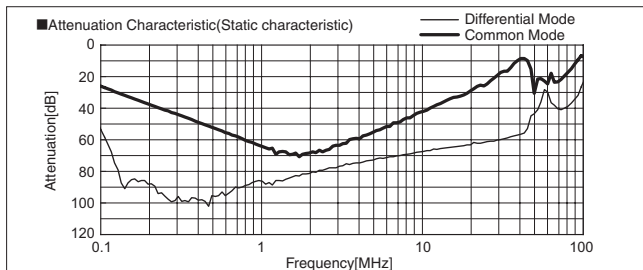
FTB-100-663-H



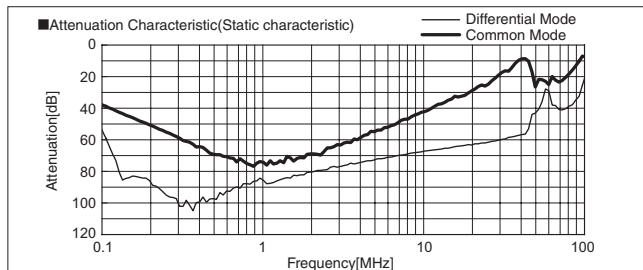
FTB-100-324-H



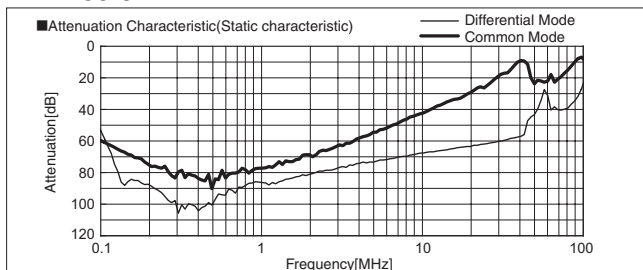
FTB-150-203-H



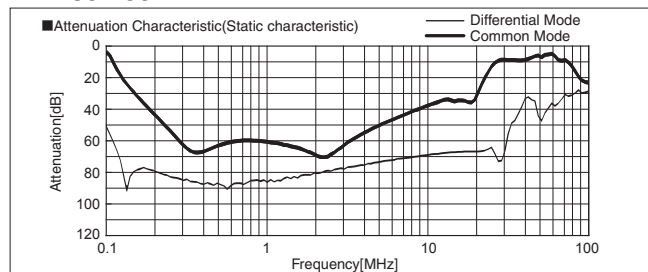
FTB-150-663-H



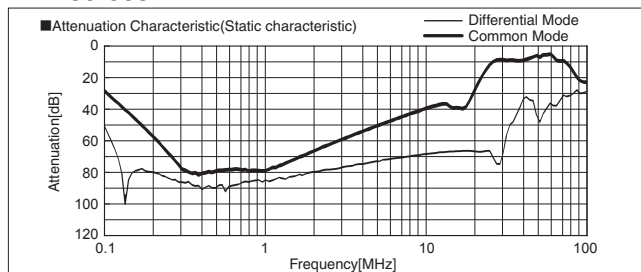
FTB-150-324-H



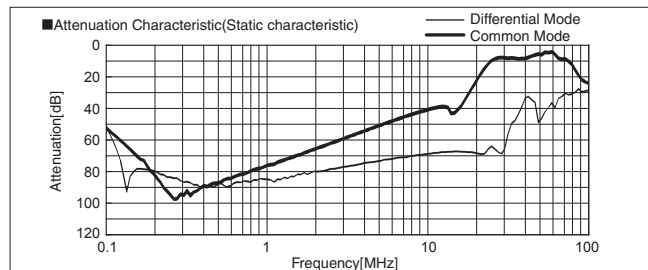
FTB-80-203-L



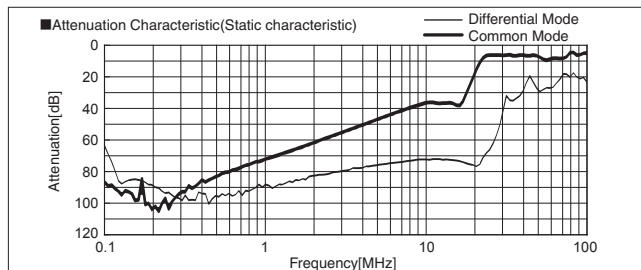
FTB-80-663-L



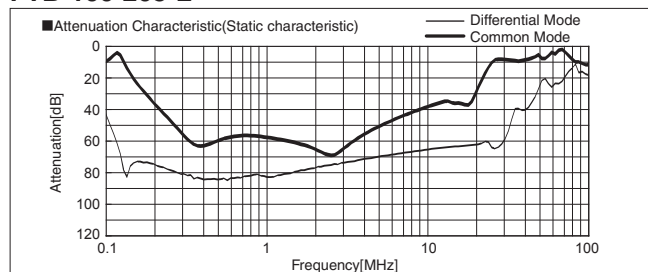
FTB-80-324-L



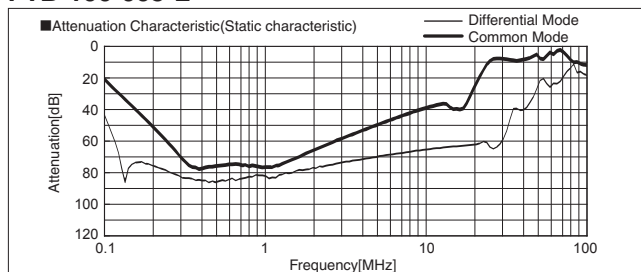
FTB-80-355-L



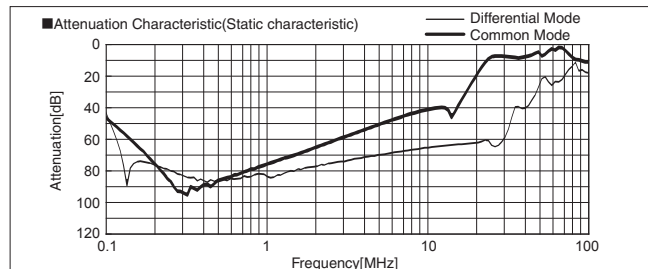
FTB-100-203-L



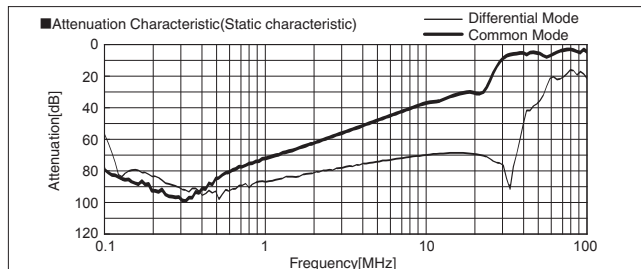
FTB-100-663-L



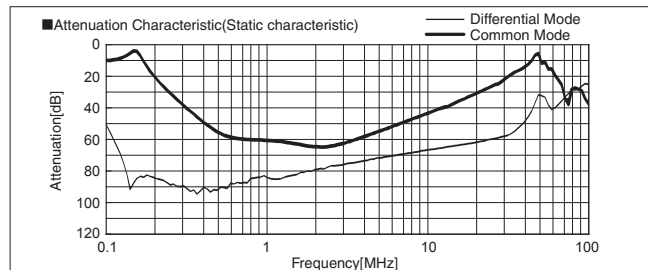
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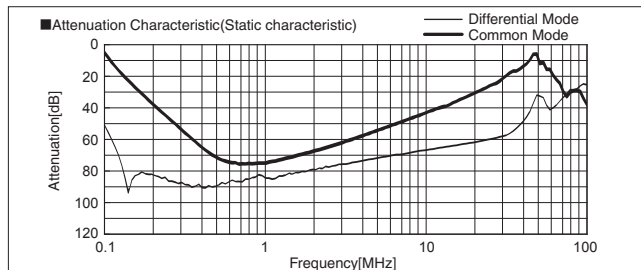
FTB-100-355-L



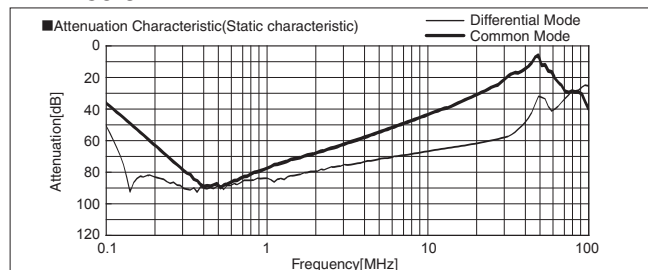
FTB-150-203-L



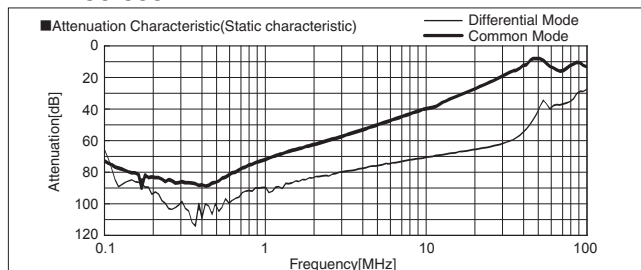
FTB-150-663-L



FTB-150-324-L



FTB-150-355-L



FSB series(10,20,30A)

FSB -30 -324 -□

① ② ③ ④

- ① Model Name
② Rated Current
③ Line to ground capacitor code: See table 1.1.

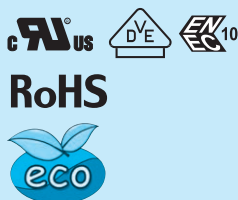
table 1.1 Line to ground capacitor code

Code	Leakage Current *1 Upper row : Δ-connection Lower berth : Wye-connection	Line to ground capacitor CY1 (nominal value)	Line to ground capacitor CY2 (nominal value)
203	1.0mA/2.0mA max 0.1mA/0.2mA max	0.01μF	0.01μF
573 *2	2.5mA max/Not applicable 0.35mA max/Not applicable	0.01μF	0.047μF
693	2.5mA/5.0mA max 0.35mA/0.7mA max	0.022μF	0.047μF
104	3.5mA/7.0mA max 0.5mA/1.0mA max	0.033μF	0.068μF
254 *2	12mA max/Not applicable 1.5mA max/Not applicable	0.033μF	0.22μF
324	12mA/24mA max 1.5mA/3.0mA max	0.1μF	0.22μF
335 *2	160mA max/Not applicable 20mA max/Not applicable	0.033μF	3.3μF
355	180mA/270mA max 25mA/50mA max	0.22μF	3.3μF

* When the line to ground capacitor code is different, the attenuation characteristic is different.

*1 Input 250/500V 60Hz (Only Δ-connection of "355" is 250/400V 60Hz)
*2 Only "U" type is applied.

④ Option
H: Ultra high attenuation type
U: Improve differential mode attenuation (Rated voltage 250V)
Only "573", "254", "335" is applied.



The terminal cover is retracted inside the unit

Features of FSB series

EMI/EMC Filter for motor drive system (AC servo)

- Improve saturation resistance (There is such as performance improvement type "254-HU")
 - Book type (Space-saving type)
 - Quick and easy push-down terminal
- Just connect the wires, push-down and tighten the screws with a screwdriver

Specifications

No.	Items	FSB-10-324	FSB-20-324	FSB-30-324
1	Rated Voltage[V]	AC Three Phase 500 (voltage range: 528 max) 50/60Hz *3 *4		
2	Rated Current[A]	10	20	30
3	Test Voltage (Terminal-Mounting Plate)	2,800 VDC (Cutoff Current = 10mA), 1minute at room temperature and humidity *5		
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 100MΩ min at room temperature and humidity *6		
5	Leakage current 250/500V 60Hz	12mA/24mA max		
6	DC resistance	100mΩ max	38mΩ max	20mΩ max
7	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)		
8	Operating temperature	-40 to +85°C (Refer to Derating Curve)		
9	Operating humidity	20 to 95%RH (Non condensing)		
10	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)		
11	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis		
12	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis		
13	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL), DIN EN60939 VDE0565 Teil 3-1, ENEC		
14	Case size (without projection)	66×100×240 mm (W×H×D) [2.60×3.94×9.45 inches] (W×H×D)		
15	Weight	1.8kg max		

*3 Only capacitor code "355", Three Phase Δ-connection : 400 (440 max), Wye-connection : 500 (528 max)

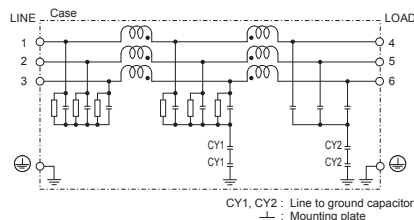
*4 Only "FSB-□□□□□□-U", Three Phase 250 (275 max)

*5 Only capacitor code "203", "573", "693", "104", 2,500VAC (Cutoff Current = 100mA), 1minute at room temperature and humidity.

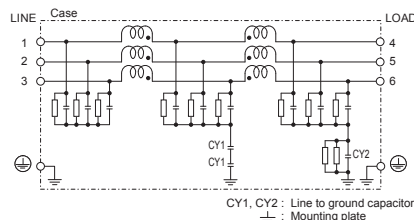
*6 Only capacitor code "335", "355", Isolation resistance specification is deleted.

Circuit Diagram

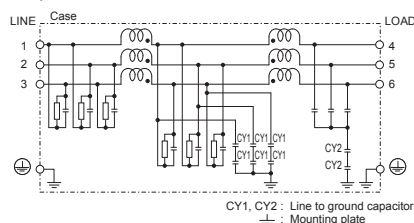
(1) Line to ground capacitor code : 203, 693, 104, 324



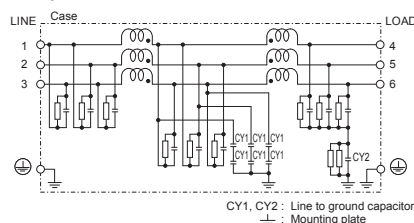
(2) Line to ground capacitor code : 355



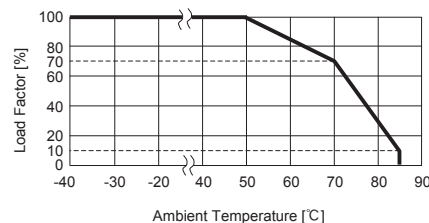
(3) Line to ground capacitor code : 573, 254
Option : U



(4) Line to ground capacitor code : 335
Option : U



Derating Curve

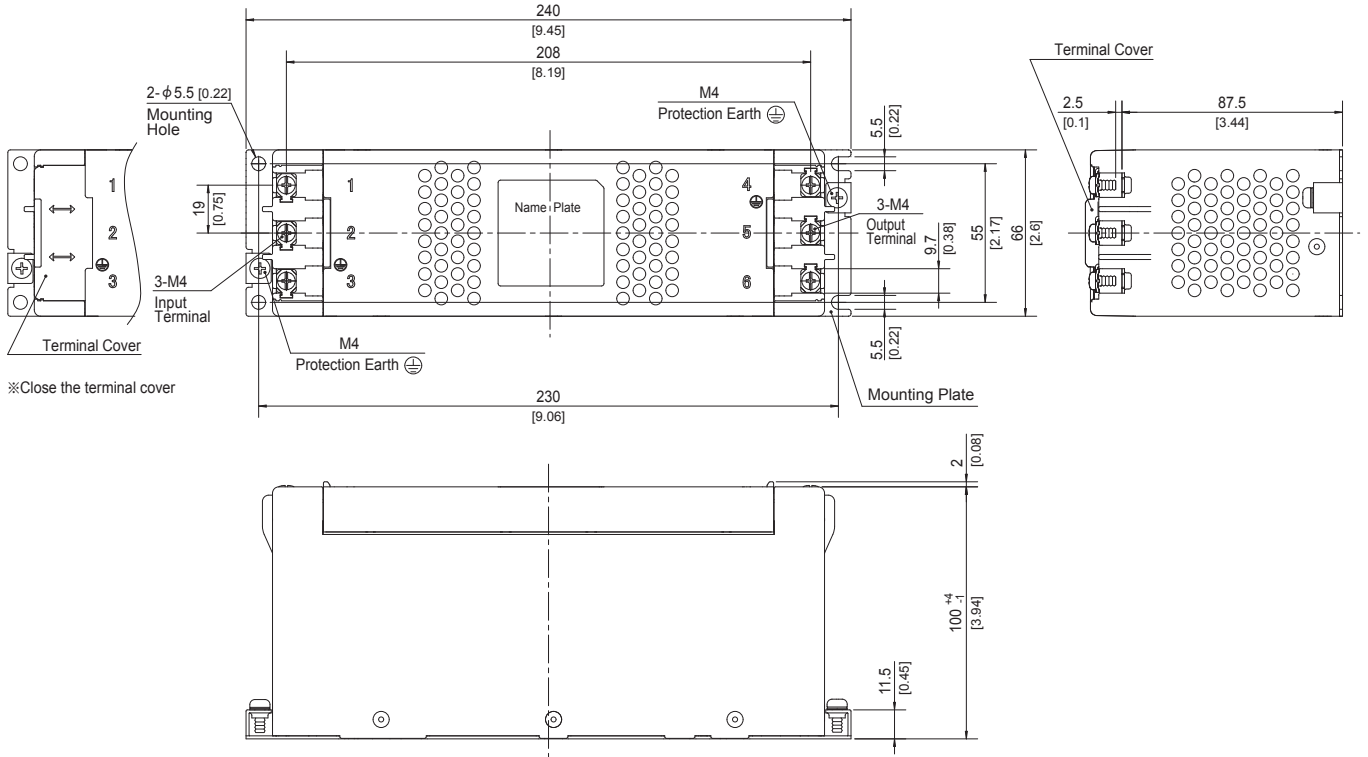


* Keep free ventilation holes for cooling.

External view

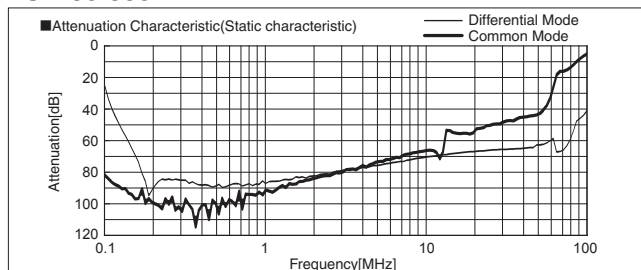
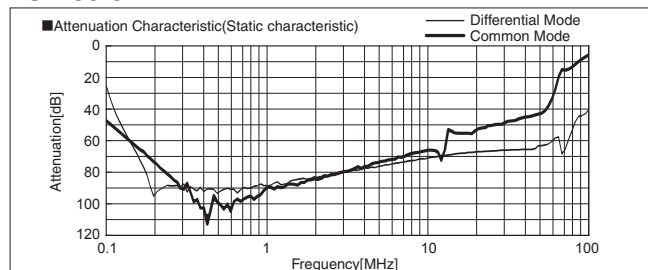
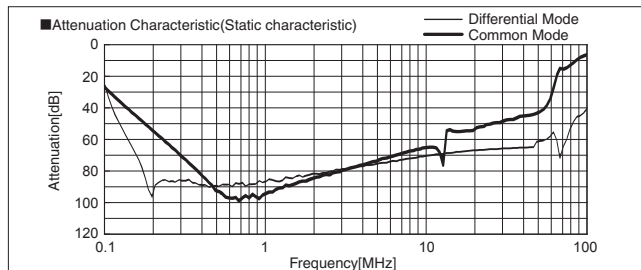
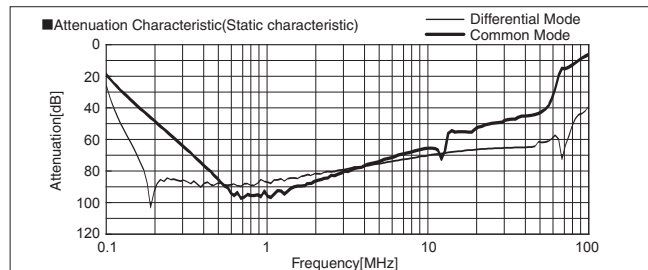
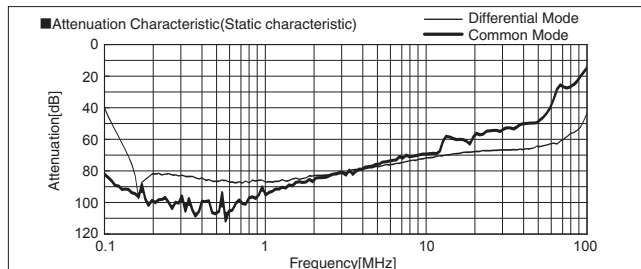
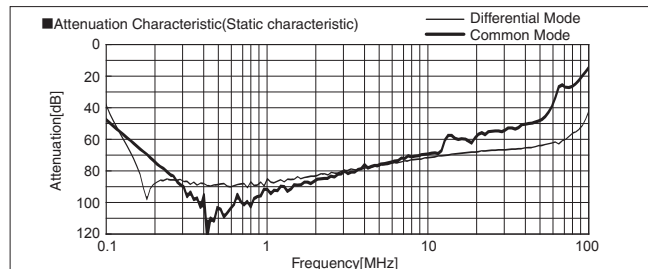
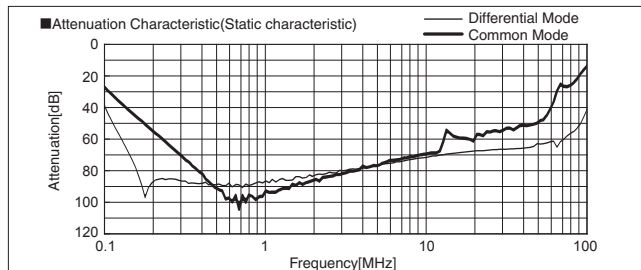
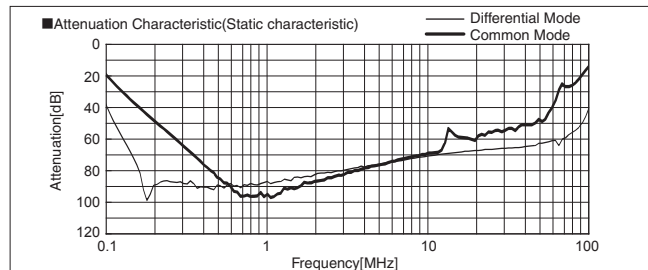
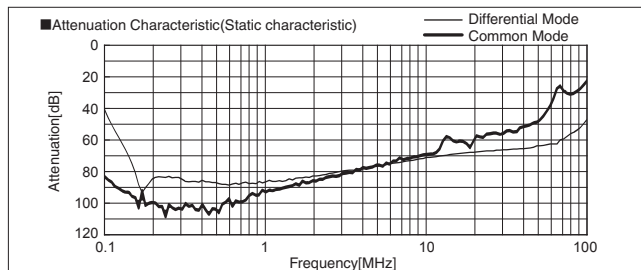
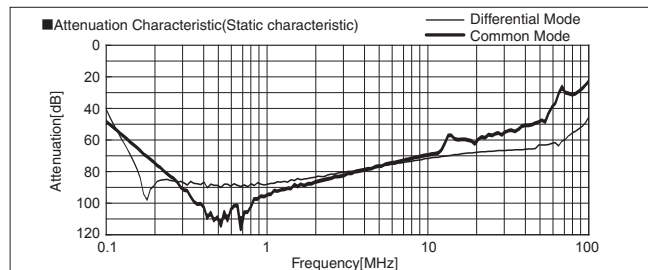
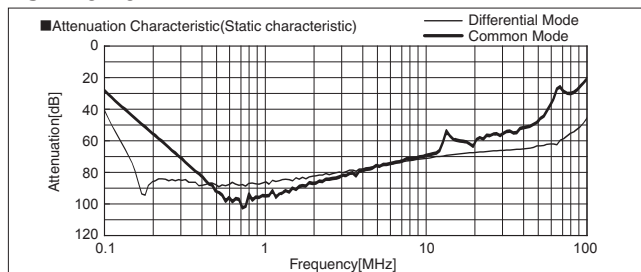
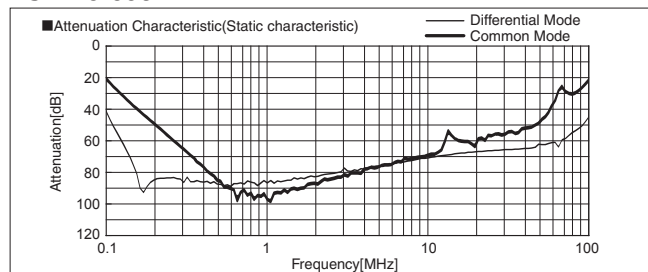
As this product is adopted push-down type terminal block, this appearance is as follows.

- ①The terminal cover is retracted inside the unit.
- ②The screws for connecting the terminals are held in the up right position.

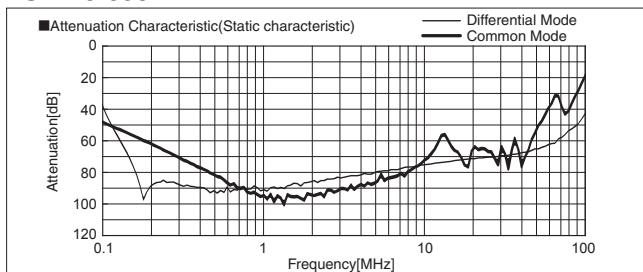


※Close the terminal cover

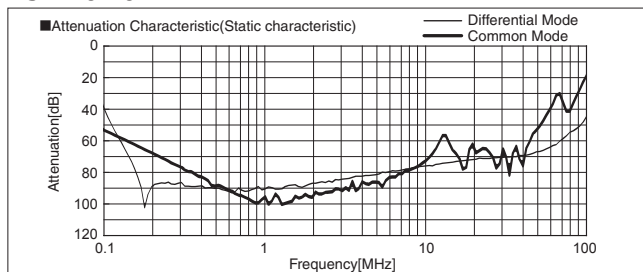
- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 1.8kg max
- ※ Mounting Plate : Hot-dip Galvanized Steel board $t=1.2$ [0.05]
- ※ Case : PBT
- ※ Dimensions in mm, []=inches
- ※ Terminal block screw tightening torque M4 : $1.6N \cdot m$ (16.9kgf·cm)max
- ※ Can not be mounted upside-down (mounted the top surface)
- ※ Keep free ventilation holes for cooling



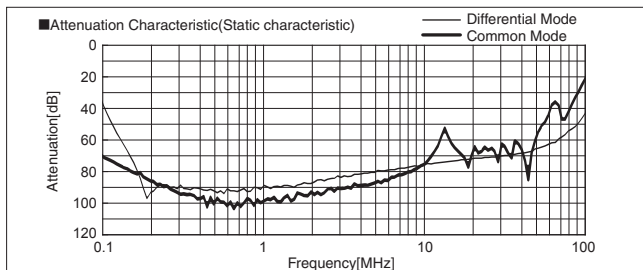
FSB-10-693-H



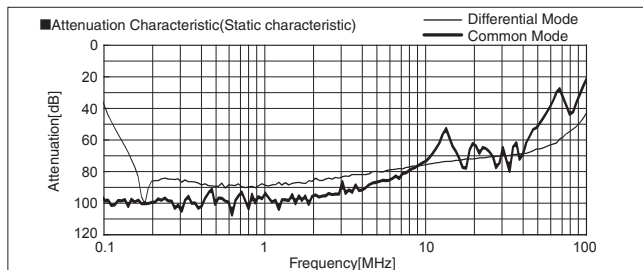
FSB-10-104-H



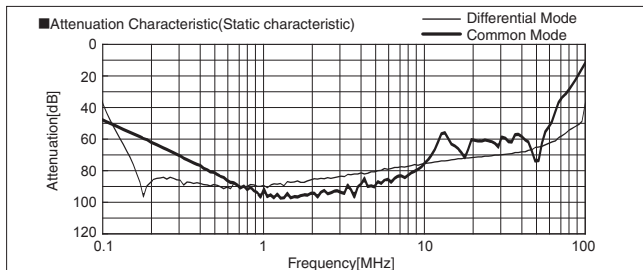
FSB-10-324-H



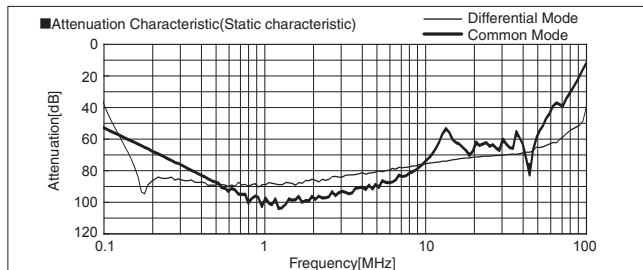
FSB-10-355-H



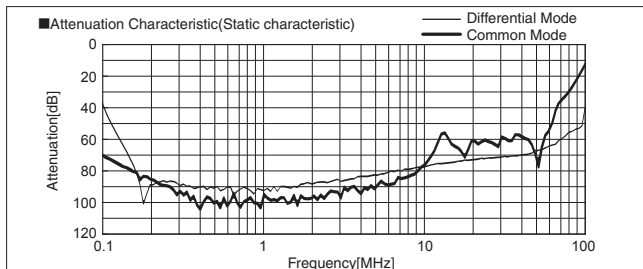
FSB-20-693-H



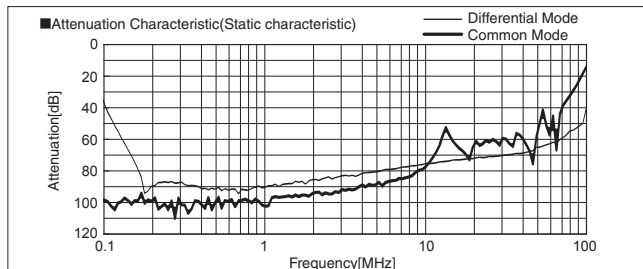
FSB-20-104-H



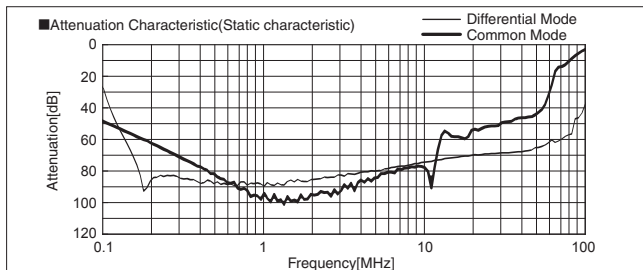
FSB-20-324-H



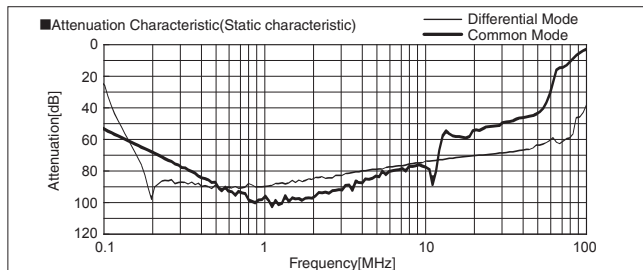
FSB-20-355-H



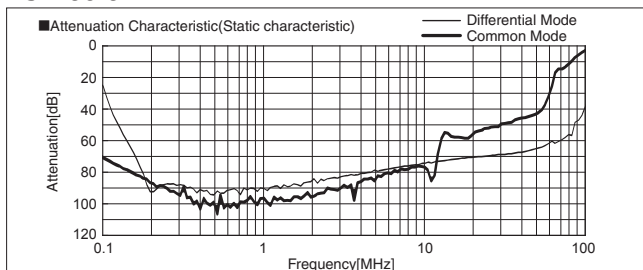
FSB-30-693-H



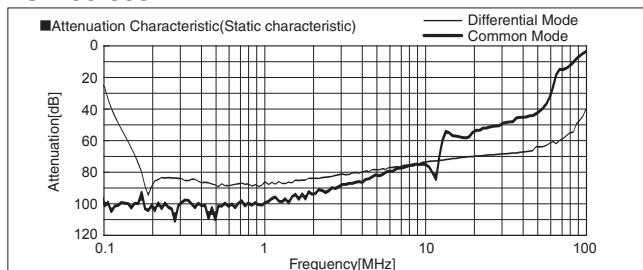
FSB-30-104-H



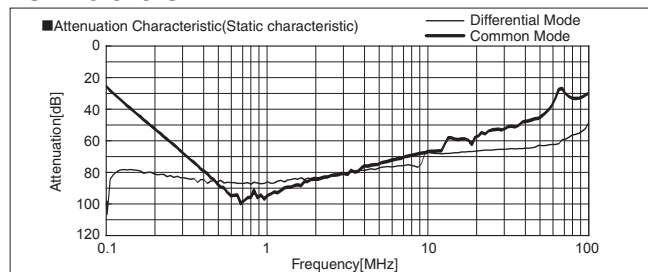
FSB-30-324-H



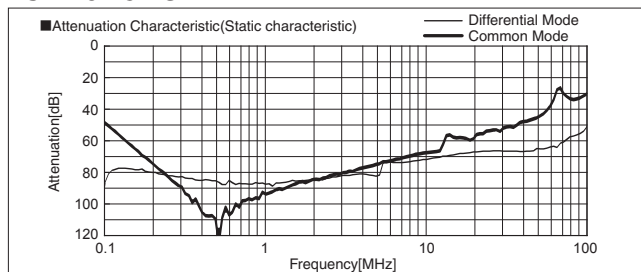
FSB-30-355-H



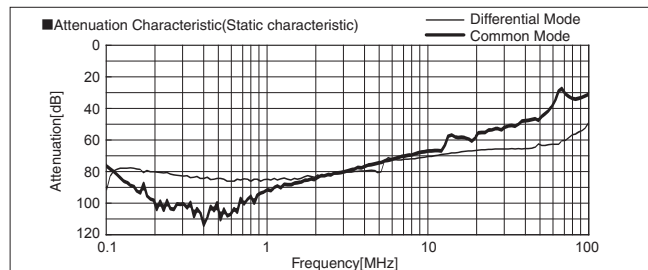
FSB-10-573-U



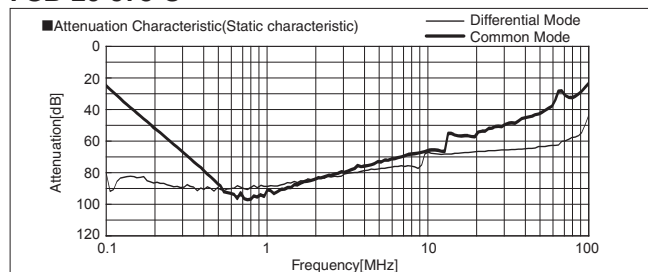
FSB-10-254-U



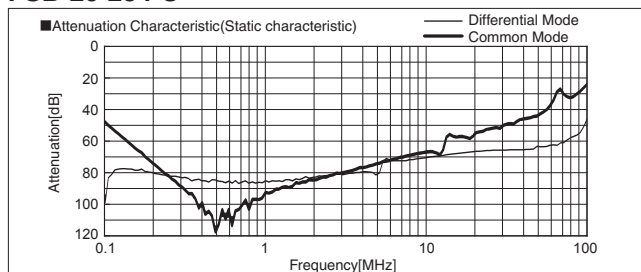
FSB-10-335-U



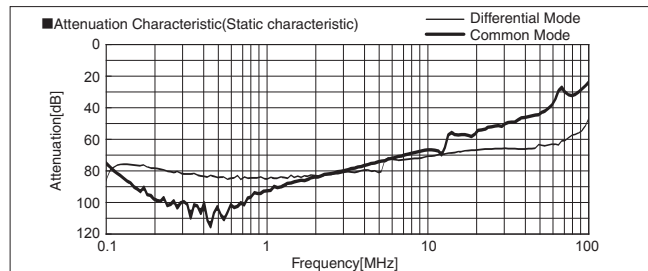
FSB-20-573-U



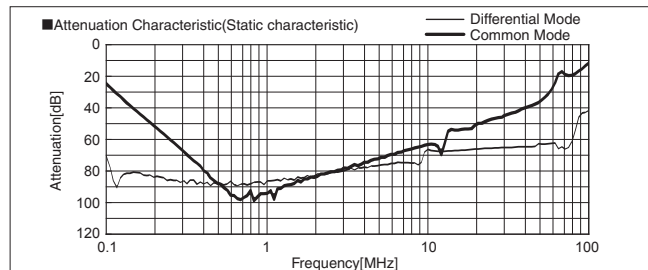
FSB-20-254-U



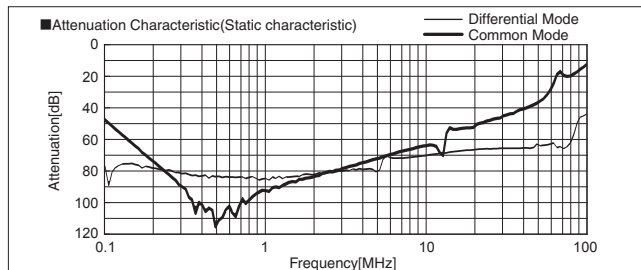
FSB-20-335-U



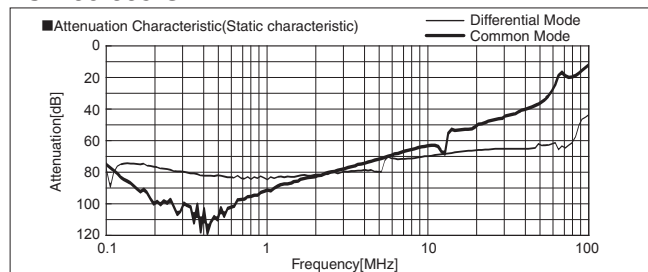
FSB-30-573-U



FSB-30-254-U



FSB-30-335-U



TSC series(400,600A)

TSC -600 -665

①

②

③

① Model Name

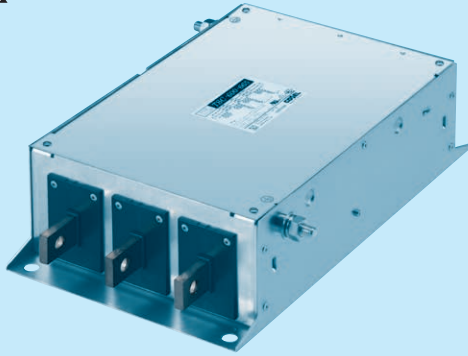
② Rated Current

③ Line to ground capacitor code: See table 1.1

table 1.1 Line to ground capacitor code

Code	Leakage Current (Input Y-connection 250V / 500V 60Hz)	Line to ground capacitor (nominal value)		
		CY1	CY2	CY3
665	20mA/40mA max	2.2μF	2.2μF	2.2μF

* Please contact us about low leakage current type (Change to low grounding capacitor) and further high attenuation type (Change to high permeability choke coil).



Features of TSC series

Ultra high attenuation for star connection with neutral earthing

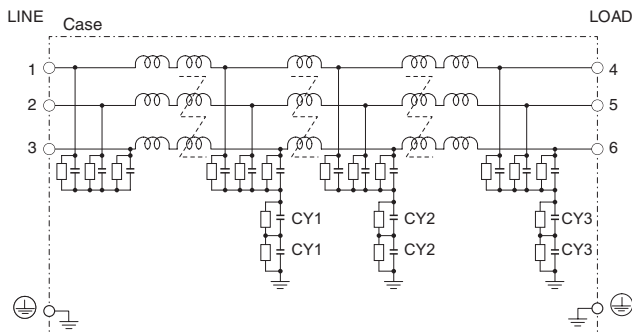
- Input and output terminals : Busbar type
- Ideal for Solar Photovoltaic system , Large Manufacturing facility

Specifications

No.	Items	TSC-400-665	TSC-600-665
1	Rated Voltage[V]	AC Three Phase Y-connection 500 (voltage range:528 max) 50/60Hz *1	
2	Rated Current[A]	400	600
3	Test Voltage (Terminal-Mounting Plate)	3,600 VDC (Cutoff Current = 10mA), 1minute at room temperature and humidity	
4	Leakage current 250/500V 60Hz	20mA/40mA max (Y-connection)	
5	DC resistance	0.27mΩ max	0.2mΩ max
6	Safety agency approval temperatures	-25 to +85°C (Refer to Derating Curve)	
7	Operating temperature	-40 to +85°C (Refer to Derating Curve)	
8	Operating humidity	20 to 95%RH (Non condensing)	
9	Storage temperature/humidity	-40 to +85°C/20 to 95%RH (Non condensing)	
10	Vibration	10 to 55Hz, 9.8m/s ² (1G), 3min. Period, 1hour each X, Y and Z axis	
11	Impact	98.1m/s ² (10G), 11ms Once each X, Y and Z axis	
12	Safety agency approvals	UL1283, CSA C22.2 No.8 (C-UL) , DIN EN60939 VDE0565 Teil3-1, ENEC	
13	Case size (without projection)	210 X 100 X 360 mm [8.27 X 3.94 X 14.17 inches] (W X H X D)	
14	Weight	9.5kg max	10.0kg max

*1 Three Phase Δ-connection:400 (440 max)

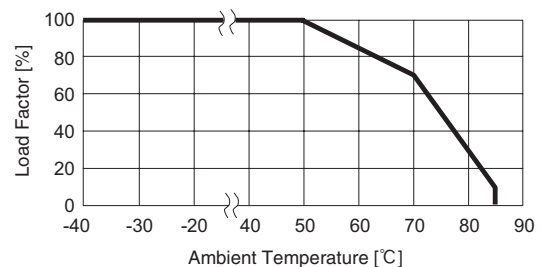
Circuit Diagram



CY1, CY2, CY3 : Line to ground capacitor

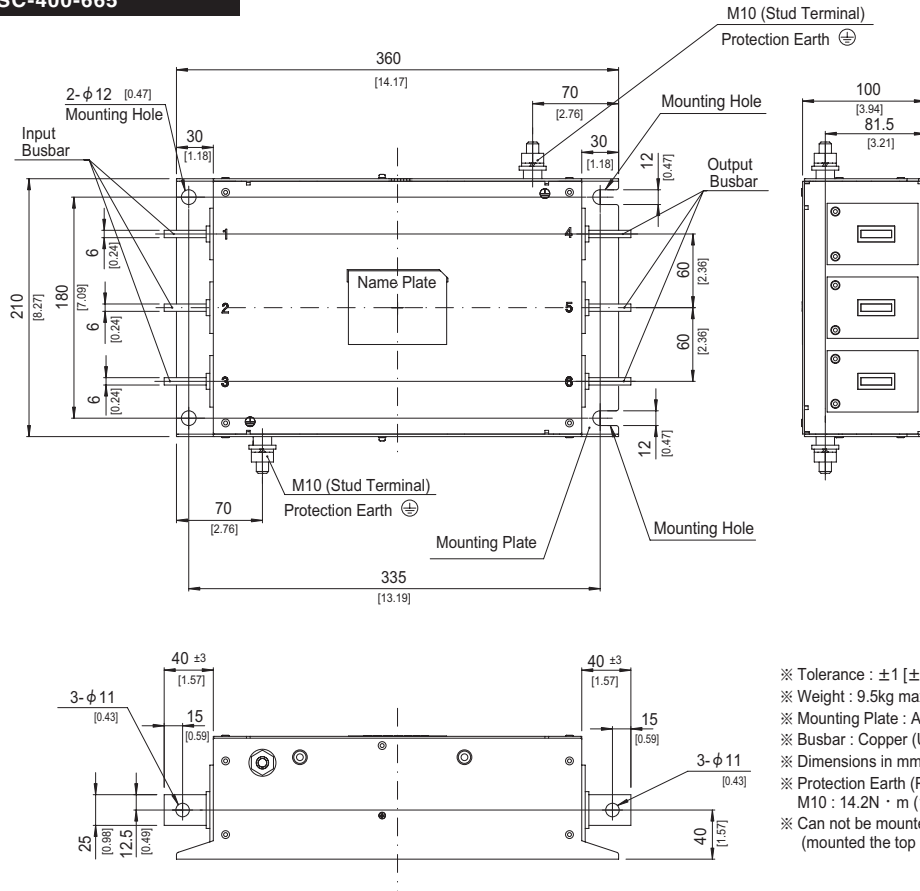
⊥ : Mounting Plate

Derating Curve

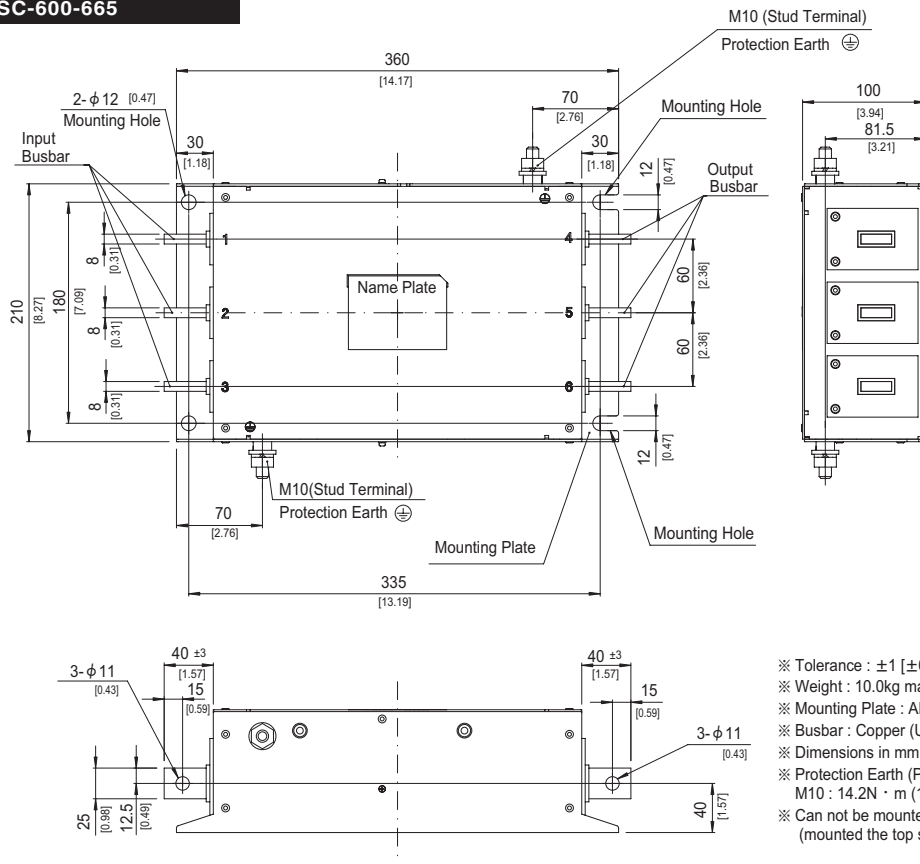


External view

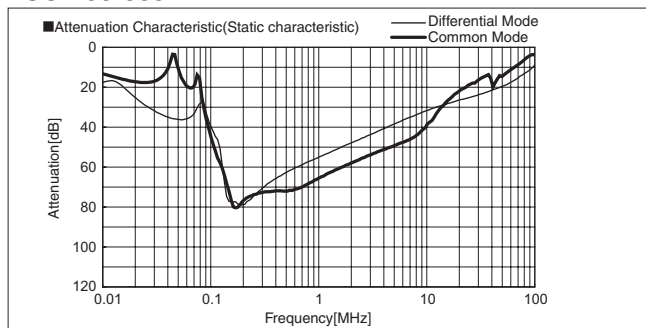
TSC-400-665



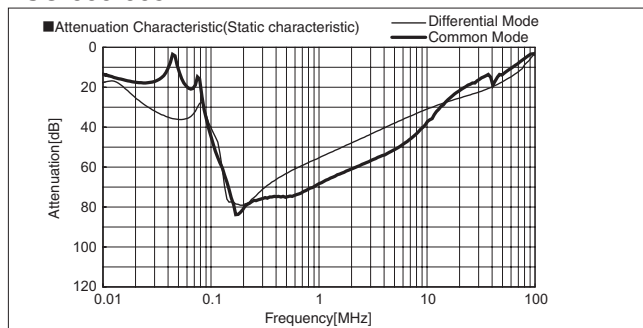
TSC-600-665



TSC-400-665



TSC-600-665



1 Busbar Applicable connect

- When wiring an M10 terminal to the busbar, the external dimension of the crimp terminal is critical in maintaining isolation distance between insulating resin, chassis, and mounting screws. We therefore recommend that you use terminals of the dimensions shown in table 1.1.

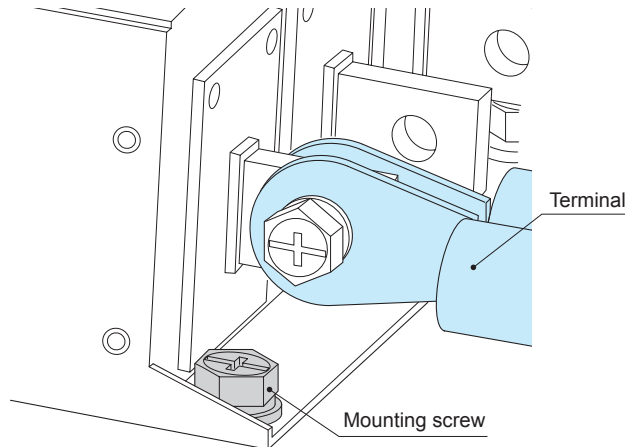


Fig.1.1 Busbar connection

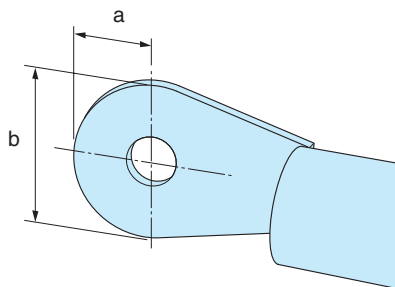


Fig.1.2 Terminals dimension

table.1.1 Selected conditions terminals dimension

Model Name	"a"Allowable dimension	"b"Allowable dimension
TSC series	19.5mm max	38.5mm max

2 Notes on wiring and storage

■ Notes on wiring

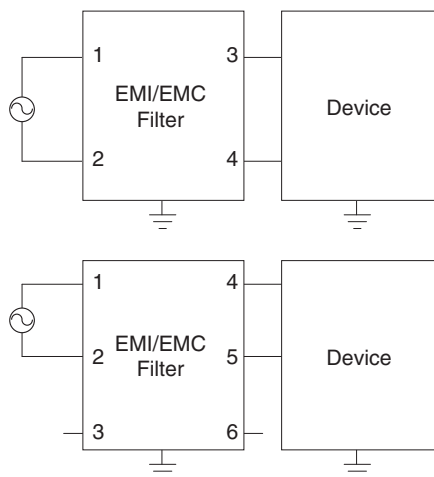
Since the (copper) busbar has not been surface treated, surface oxidation may form a resistive layer between the contacts. We therefore recommend abrasion of all mating surfaces before, and wearing gloves during, all wiring work. Please be careful not to leave fingerprints.

■ Notes on storage

Please avoid storage in environments where copper corrosion is concerned. Storage under a normal temperature and humidity environment is recommended.

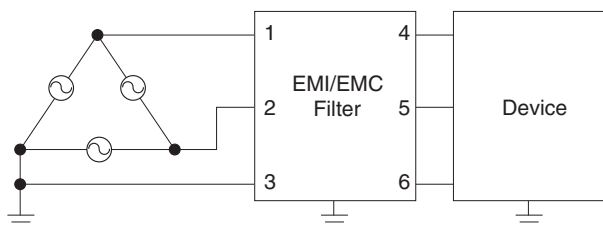
1 Method of connecting EMI/EMC Filter

(1) Single Phase

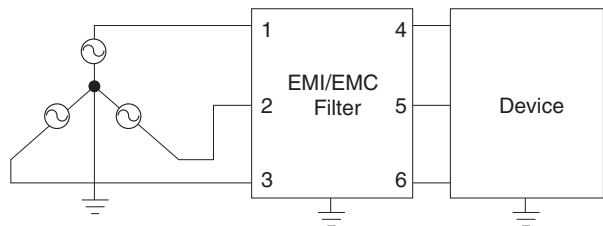


※Three phase EMI/EMC filter is also available as a single phase input type.

(2) Three phase (Delta-connection)



(3) Three phase (Star-connection)



[Reference] Example of calculating input current calculation

Input voltage 400 [V]

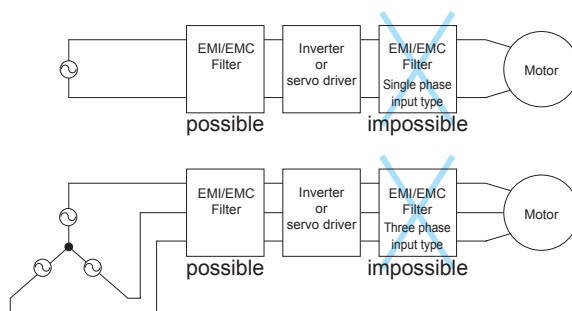
Input capacity of the equipment 4000 [VA]

$$\text{Input current} = \frac{4000 [\text{VA}]}{400 [\text{V}] \times \sqrt{3}} = 5.8 [\text{A}]$$

2 Connection with a general-purpose inverter (servo driver)

The EMI/EMC Filter cannot be used between the inverter (servo driver) and the motor, because the EMI/EMC Filter might cause abnormal heat.

Please connect the EMI/EMC Filter to input side of inverter driver (servo driver).



3 Safety Considerations

- To apply for safety standard approval using this EMI/EMC Filter, the following conditions must be met.
- The unit must be used as a component of an end-use equipment.
- Protection earth terminal (PE) must be connected to safety ground of end-use equipment.

SNA series (1A,3A)

SNA -03 -223 -□

① ② ③ ④

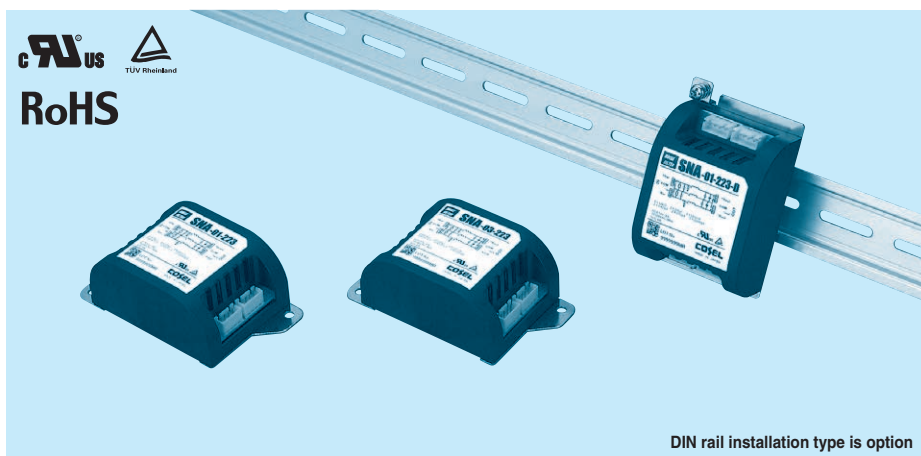
- ① Model Name
② Rated Current
③ Line to ground capacitor code: See table 1.1.

table 1.1 Line to ground capacitor code

Code	Line to ground capacitor (nominal value)
000	Not Provided
223	22000pF

- ④ Options
D: DIN rail installation type

* The dimensions change when the option is set.
Refer to External view.



DIN rail installation type is option

Features of SNA series (1A and 3A)

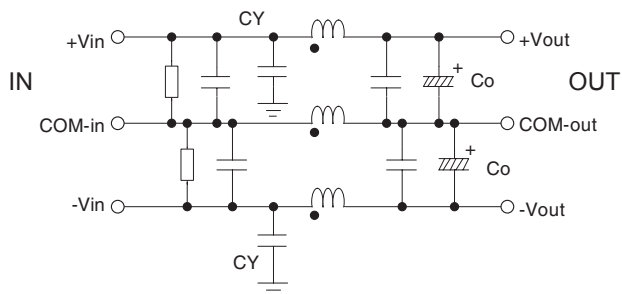
Ripple noise attenuation type for switch mode power supplies(DC)

- ± 50 VDC
- Best filter for switch mode power supplies of analog circuits
(ex. power supply filter for an operational amplifier)

Specifications

No.	Items	SNA-01-223	SNA-03-223
		Interface: Connector	
1	Rated Voltage DC[V]	± 50 (+Vin - COM-in, -Vin - COM-in)	
2	Rated Current DC[A]	1	3
3	Test Voltage (Terminal-Mounting Plate)	500 VAC (Cutoff Current = 100mA), 1 minute at room temperature and humidity	
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 50M Ω min at room temperature and humidity	
5	D.C Resistance[m Ω]	190 max	90 max
6	Operating temperature	-40 to +71°C (Refer to Derating Curve)	
7	Operating humidity	20 to 95%RH (Non condensing)	
8	Storage temperature/humidity	-40 to +75°C/20 to 95%RH (Non condensing)	
9	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis	
10	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis	
11	Safety agency approvals	UL60950-1, C-UL (CSA60950-1), EN60950-1	
12	Case size (without projection) /Weight	52 X 35 X 93 mm [2.05 X 1.38 X 3.66 inches] (W X H X D) /130g max (Option : -D refer to external view)	

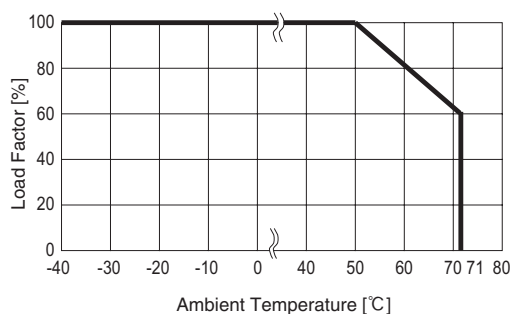
Circuit Diagram



CY : Line to ground capacitor Co : Electrolytic capacitor : Mounting Plate

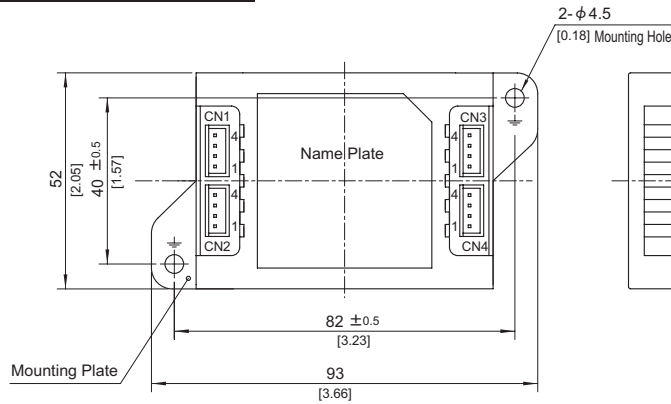
■ Expected life : 10 years

Derating Curve



External view

Standard Type



Pin No.	Function
1,2	COM-in
3,4	+Vin

Pin No.	Function
1,2	-Vin
3,4	COM-in

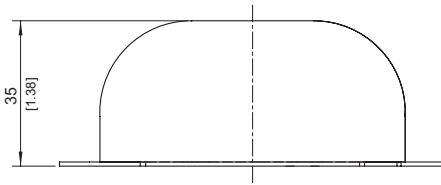
Pin No.	Function
1,2	COM-out
3,4	+Vout

Pin No.	Function
1,2	-Vout
3,4	COM-out

I/O Connector	Mating connector	Terminal
CN1-CN4	B4B-XH-AM	XHP-4
		Reel: SXH-001T-P0.6
		Bulk: BXH-001T-P0.6

(Mfr.: J.S.T.)

Option harness : Refer to Instruction Manual 4

※ Tolerance : ± 1 [± 0.04]

※ Weight : 130g max

※ PCB Material /thickness : CEM3 /1.6mm [0.06 inches]

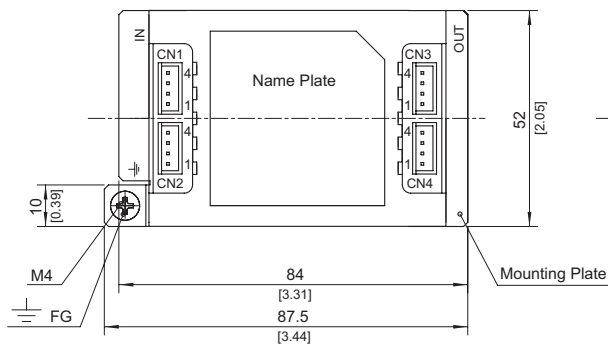
※ Mounting plate : Iron (surface finishing : nickel plating) $t=1.0$ [0.04]

※ Case : PBT

※ Dimensions in mm, []=inches

※ Keeping drawing current per pin below 2A for CN1 to CN4

DIN rail installation Type



Pin No.	Function
1,2	COM-in
3,4	+Vin

Pin No.	Function
1,2	-Vin
3,4	COM-in

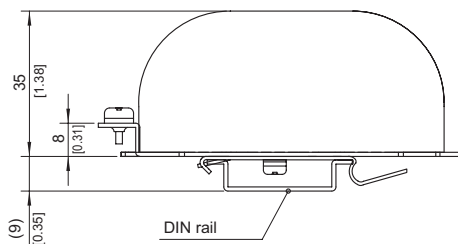
Pin No.	Function
1,2	COM-out
3,4	+Vout

Pin No.	Function
1,2	-Vout
3,4	COM-out

I/O Connector	Mating connector	Terminal
CN1-CN4	B4B-XH-AM	XHP-4
		Reel: SXH-001T-P0.6
		Bulk: BXH-001T-P0.6

(Mfr.: J.S.T.)

Option harness : Refer to Instruction Manual 4

※ Tolerance : ± 1 [± 0.04]

※ Weight : 140g max

※ PCB Material /thickness : CEM3 /1.6mm [0.06 inches]

※ Mounting plate : Iron (surface finishing : nickel plating) $t=1.0$ [0.04]

※ Case : PBT

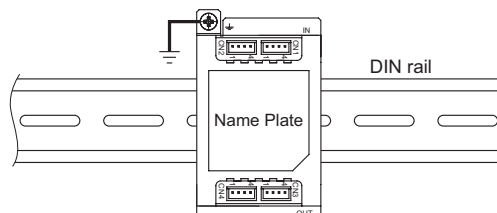
※ Dimensions in mm, []=inches

※ Keeping drawing current per pin below 2A for CN1 to CN4

■Note when installing the EMI/EMC Filter on a DIN rail.

When the EMI/EMC Filter is grounded through the DIN rail, the proper noise attenuation may not be achieved.

Be sure to connect the FG terminal of the EMI/EMC Filter body to the earth.



SNA series (6A)

SNA -06 -223 -□

① ② ③ ④

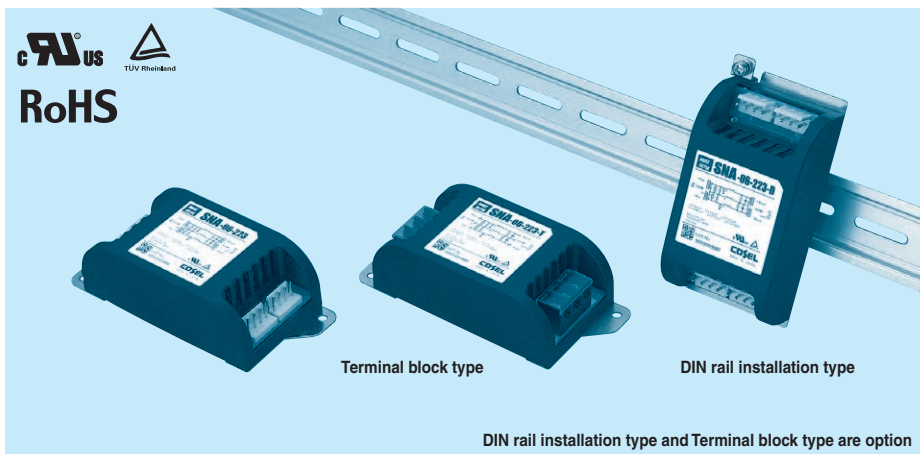
- ① Model Name
② Rated Current
③ Line to ground capacitor code: See table 1.1.

table 1.1 Line to ground capacitor code

Code	Line to ground capacitor (nominal value)
000	Not Provided
223	22000pF

- ④ Options
D : DIN rail installation type
T : Terminal block type
DT : Terminal block and DIN rail type

* The dimensions change when the option is set.
Refer to External view.



Features of SNA series (6A)

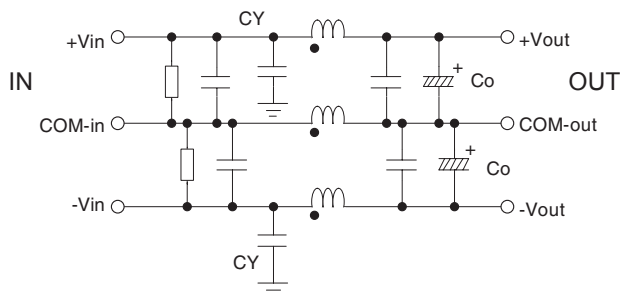
Ripple noise attenuation type for switch mode power supplies(DC)

- ± 50 VDC
- Best filter for switch mode power supplies of analog circuits
(ex. power supply filter for an operational amplifier)

Specifications

No.	Items	SNA-06-223
		Interface: Connector
1	Rated Voltage DC[V]	± 50 (+Vin - COM-in, -Vin - COM-in)
2	Rated Current DC[A]	6
3	Test Voltage (Terminal-Mounting Plate)	500 VAC (Cutoff Current = 100mA), 1minute at room temperature and humidity
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 50M Ω min at room temperature and humidity
5	D.C Resistance[m Ω]	50 max
6	Operating temperature	-40 to +71°C (Refer to Derating Curve)
7	Operating humidity	20 to 95%RH (Non condensing)
8	Storage temperature/humidity	-40 to +75°C/20 to 95%RH (Non condensing)
9	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis
10	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis
11	Safety agency approvals	UL60950-1, C-UL (CSA60950-1), EN60950-1
12	Case size (without projection) /Weight	52 X 35 X 117 mm [2.05 X 1.38 X 4.61 inches] (W X H X D) /150g max (Option : -D, -T, -DT refer to external view)

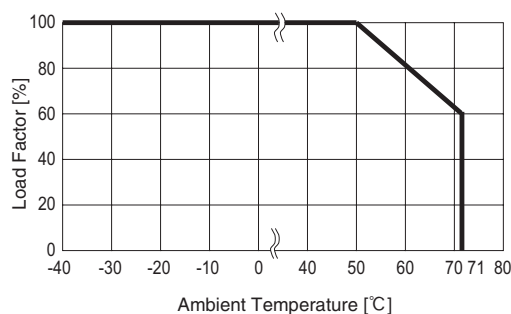
Circuit Diagram



CY : Line to ground capacitor Co : Electrolytic capacitor $\frac{\square}{\square}$: Mounting Plate

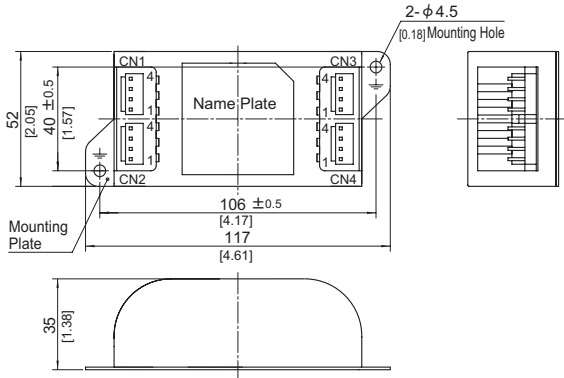
■ Expected life : 10 years

Derating Curve



External view

Standard Type



CN1		CN3	
Pin No.	Function	Pin No.	Function
1,2	COM-in	1,2	COM-out
3,4	+Vin	3,4	+Vout

CN2		CN4	
Pin No.	Function	Pin No.	Function
1,2	-Vin	1,2	-Vout
3,4	COM-in	3,4	COM-out

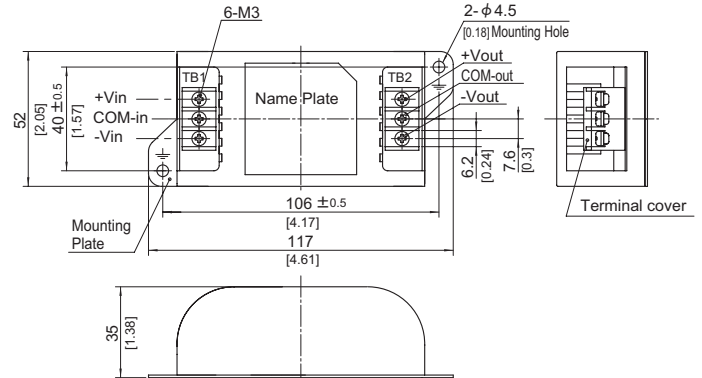
- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 150g max
- ※ PCB Material /thickness : CEM3 /1.6mm [0.06 inches]
- ※ Mounting plate : Iron (surface finishing : nickel plating) $t=1.0$ [0.04]
- ※ Case : PBT
- ※ Dimensions in mm, []=inches
- ※ Keeping drawing current per pin below 5A for CN1 to CN4

I/O Connector	Mating connector	Terminal
CN1-CN4	B4P-VH	VHR-4N
		Reel:SVH-21T-P1.1
		Bulk:BVH-21T-P1.1

(Mfr:J.S.T)

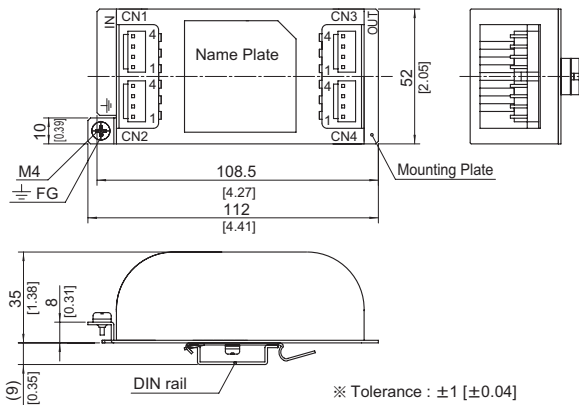
Option harness : Refer to Instruction Manual 4

Terminal block Type



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 160g max
- ※ PCB Material /thickness : CEM3 /1.6mm [0.06 inches]
- ※ Mounting plate : Iron (surface finishing : nickel plating) $t=1.0$ [0.04]
- ※ Case : PBT
- ※ Dimensions in mm, []=inches
- ※ Terminal block screw tightening torque M3:0.8N · m (8.5kgf · cm) max

DIN rail installation Type



CN1		CN3	
Pin No.	Function	Pin No.	Function
1,2	COM-in	1,2	COM-out
3,4	+Vin	3,4	+Vout

CN2		CN4	
Pin No.	Function	Pin No.	Function
1,2	-Vin	1,2	-Vout
3,4	COM-in	3,4	COM-out

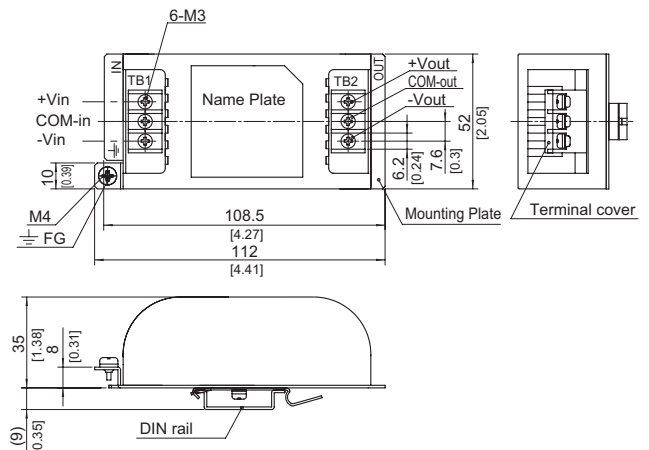
- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 160g max
- ※ PCB Material /thickness : CEM3 / 1.6mm [0.06 inches]
- ※ Mounting plate : Iron (surface finishing : nickel plating) $t=1.0$ [0.04]
- ※ Case : PBT
- ※ Dimensions in mm, []=inches
- ※ Keeping drawing current per pin below 5A for CN1 to CN4

I/O Connector	Mating connector	Terminal
CN1-CN4	B4P-VH	VHR-4N
		Reel:SVH-21T-P1.1
		Bulk:BVH-21T-P1.1

(Mfr:J.S.T)

Option harness : Refer to Instruction Manual 4

Terminal block type+DIN rail installation Type

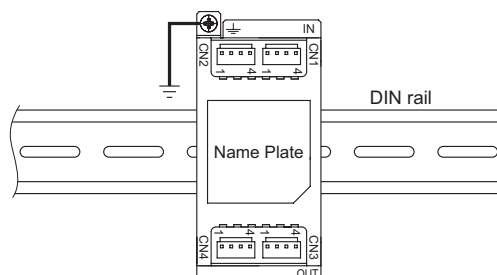


- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 170g max
- ※ PCB Material /thickness : CEM3 /1.6mm [0.06 inches]
- ※ Mounting plate : Iron (surface finishing : nickel plating) $t=1.0$ [0.04]
- ※ Case : PBT
- ※ Dimensions in mm, []=inches
- ※ Terminal block screw tightening torque M3:0.8N · m (8.5kgf · cm) max

Note when installing the EM/EMC Filter on a DIN rail.

When the EM/EMC Filter is grounded through the DIN rail, the proper noise attenuation may not be achieved.

Be sure to connect the FG terminal of the EM/EMC Filter body to the earth.



SNR series (10A)

SNR -10 -223 -□

① ② ③ ④

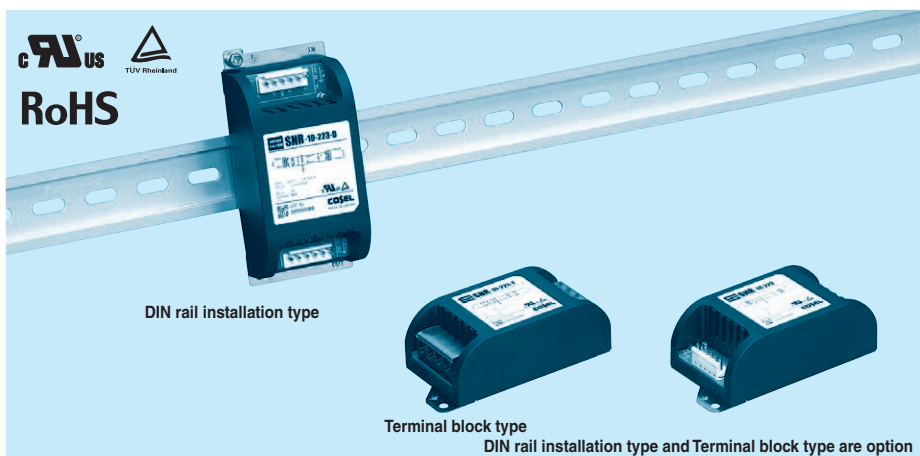
- ① Model Name
② Rated Current
③ Line to ground capacitor code: See table 1.1.

table 1.1 Line to ground capacitor code

Code	Line to ground capacitor (nominal value)
000	Not Provided
223	22000pF

- ④ Options
D : DIN rail installation type
T : Terminal block type
DT : Terminal block and DIN rail type

* The dimensions change when the option is set.
Refer to External view.



Features of SNR series (10A)

Ripple noise attenuation type for switch mode power supplies(DC)

· 50 VDC

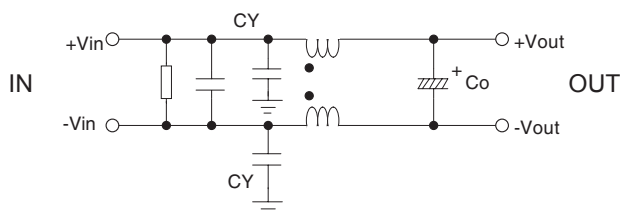
· Best filter for switch mode power supplies of analog circuits

Specifications

No.	Items	SNR-10-223
		Interface: Connector
1	Rated Voltage DC[V]	50
2	Rated Current DC[A]	*1 10 (Peak 20)
3	Test Voltage (Terminal-Mounting Plate)	500 VAC (Cutoff Current = 100mA), 1minute at room temperature and humidity
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 50MΩ min at room temperature and humidity
5	D.C Resistance[mΩ]	20 max
6	Operating temperature	-40 to +71°C (Refer to Derating Curve)
7	Operating humidity	20 to 95%RH (Non condensing)
8	Storage temperature/humidity	-40 to +75°C/20 to 95%RH (Non condensing)
9	Vibration	10 to 55Hz, 19.6m/s ² (2G), 3min. Period, 1hour each X, Y and Z axis
10	Impact	196.1m/s ² (20G), 11ms Once each X, Y and Z axis
11	Safety agency approvals	UL60950-1, C-UL (CSA60950-1), EN60950-1
12	Case size (without projection) /Weight	52 X 35 X 117 mm [2.05 X 1.38 X 4.61 inches] (W X H X D) /140g max (Option : -D, -T, -DT refer to external view)

*1 Peak current for 10 sec. And Duty 35% max, refer to Instruction Manual 5. In detail.

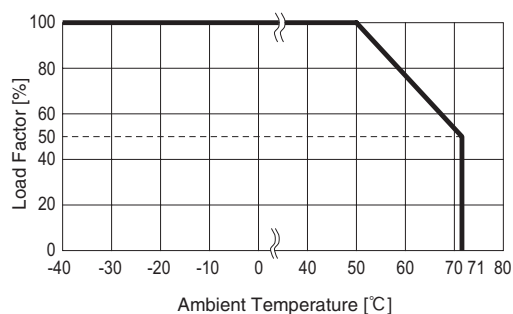
Circuit Diagram



CY : Line to ground capacitor Co : Electrolytic capacitor $\frac{\square}{\square}$: Mounting Plate

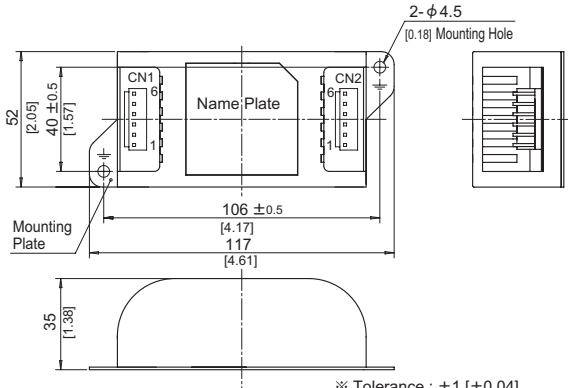
■ Expected life : 10 years

Derating Curve



External view

Standard Type



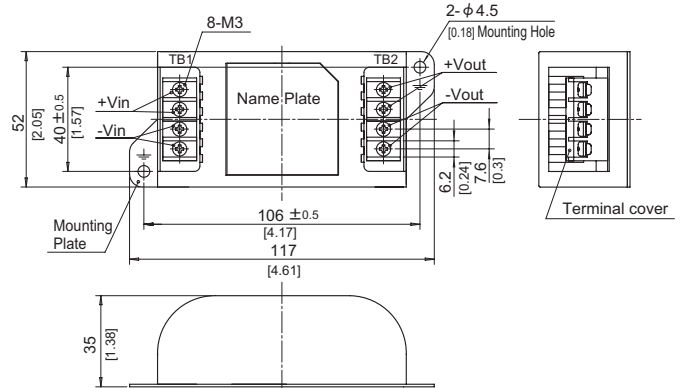
CN1	Pin No.	Function	CN2	Pin No.	Function
	1,2,3	-Vin		1,2,3	-Vout
	4,5,6	+Vin		4,5,6	+Vout

I/O Connector	Mating connector	Terminal
CN1,CN2	B6P-VH	VHR-6N
		Reel:SVH-21T-P1.1
		Bulk:BVH-21T-P1.1

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 140g max
- ※ PCB Material /thickness : CEM3 /1.6mm [0.06 inches]
- ※ Mounting plate : Iron (surface finishing : nickel plating) $t=1.0$ [0.04]
- ※ Case : PBT
- ※ Dimensions in mm, []=inches
- ※ Keeping drawing current per pin below 5A (7A at peak current) for CN1 to CN2

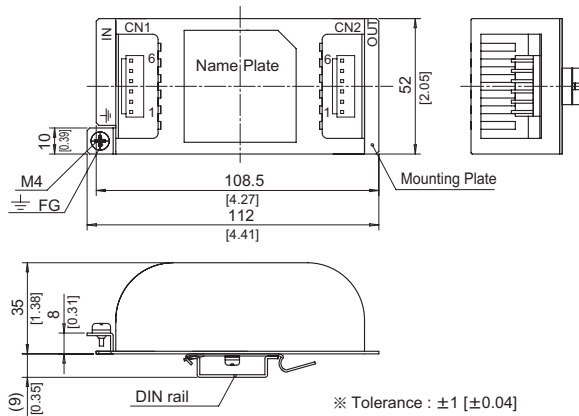
(Mfr:J.S.T)
Option harness : Refer to Instruction Manual 4

Terminal block Type



- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 150g max
- ※ PCB Material /thickness : CEM3 /1.6mm [0.06 inches]
- ※ Mounting plate : Iron (surface finishing : nickel plating) $t=1.0$ [0.04]
- ※ Case : PBT
- ※ Dimensions in mm, []=inches
- ※ Terminal block screw tightening torque $M3:0.8N \cdot m$ (8.5kgf \cdot cm) max
- ※ Keeping drawing current per pin below 8A (10A at peak current) for TB1 to TB2

DIN rail installation Type



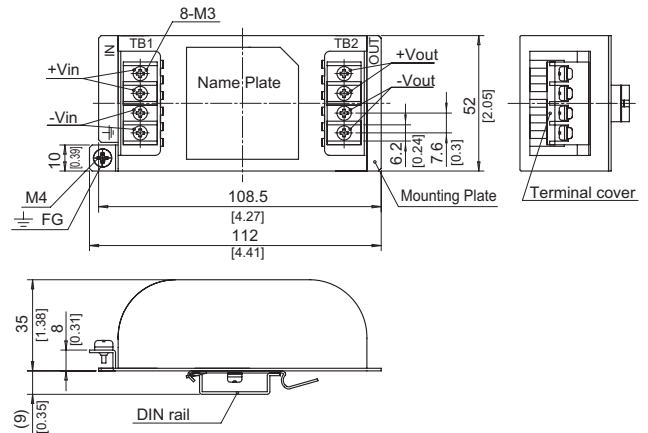
CN1	Pin No.	Function	CN2	Pin No.	Function
	1,2,3	-Vin		1,2,3	-Vout
	4,5,6	+Vin		4,5,6	+Vout

I/O Connector	Mating connector	Terminal
CN1,CN2	B6P-VH	VHR-6N
		Reel:SVH-21T-P1.1
		Bulk:BVH-21T-P1.1

- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 150g max
- ※ PCB Material /thickness : CEM3 /1.6mm [0.06 inches]
- ※ Mounting plate : Iron (surface finishing : nickel plating) $t=1.0$ [0.04]
- ※ Case : PBT
- ※ Dimensions in mm, []=inches
- ※ Keeping drawing current per pin below 5A (7A at peak current) for CN1 to CN2

(Mfr:J.S.T)
Option harness : Refer to Instruction Manual 4

Terminal block type+DIN rail installation Type

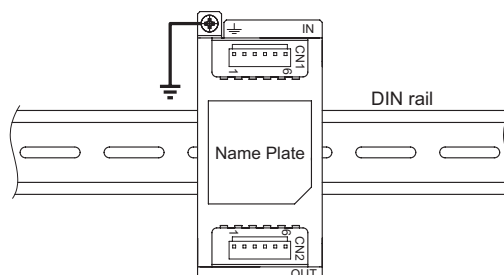


- ※ Tolerance : ± 1 [± 0.04]
- ※ Weight : 160g max
- ※ PCB Material /thickness : CEM3 /1.6mm [0.06 inches]
- ※ Mounting plate : Iron (surface finishing : nickel plating) $t=1.0$ [0.04]
- ※ Case : PBT
- ※ Dimensions in mm, []=inches
- ※ Terminal block screw tightening torque $M3:0.8N \cdot m$ (8.5kgf \cdot cm) max
- ※ Keeping drawing current per pin below 8A (10A at peak current) for TB1 to TB2

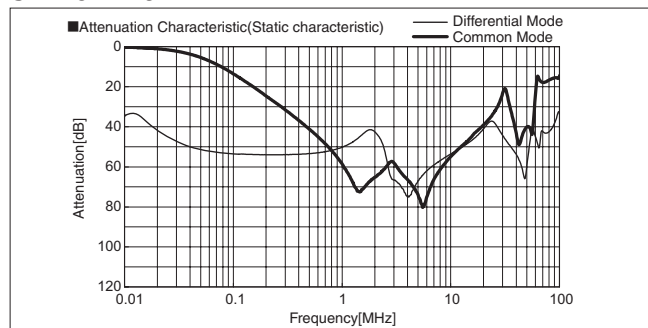
Note when installing the EM/EMC Filter on a DIN rail.

When the EM/EMC Filter is grounded through the DIN rail, the proper noise attenuation may not be achieved.

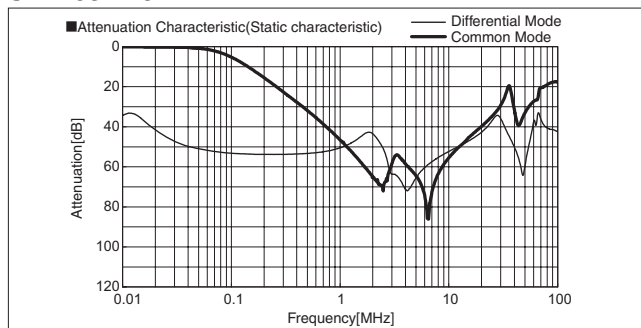
Be sure to connect the FG terminal of the EM/EMC Filter body to the earth.



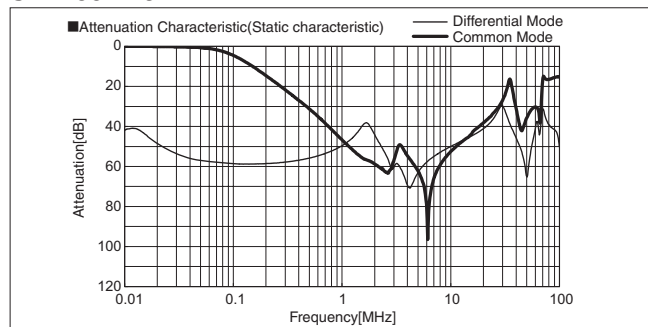
SNA-01-223



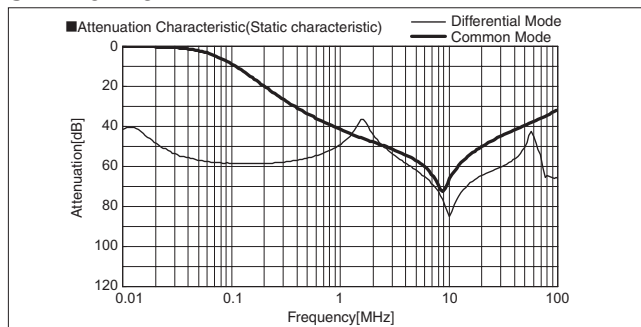
SNA-03-223



SNA-06-223



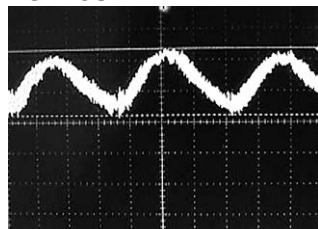
SNR-10-223



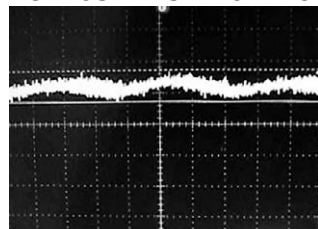
※ This product only reduces ripple noise of the switch mode power supply. It cannot be used effectively to reduce ripple noise at line frequency.

■ Example of attenuation output noise.

LCA10S-12

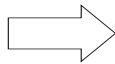
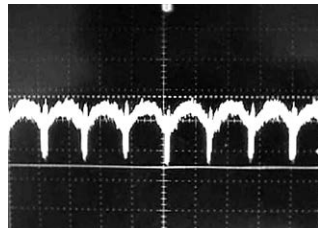


LCA10S-12+SNA-01-223

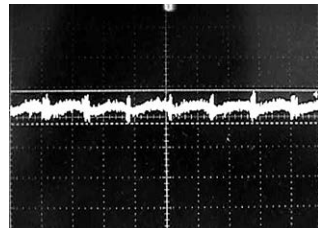


(Room temp, Room Humi)
BW:500MHz
LCA10S-12
12V 0.9A

LCA30S-12

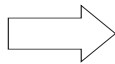
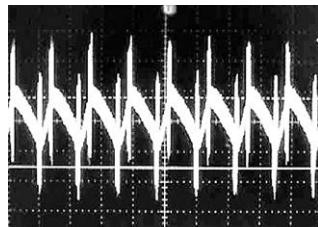


LCA30S-12+SNA-03-223

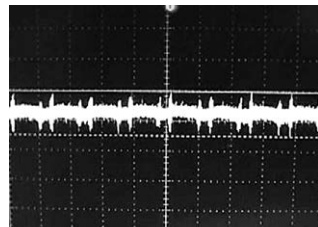


(Room temp, Room Humi)
BW:500MHz
LCA30S-12
12V 2.5A

LCA50S-12

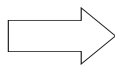
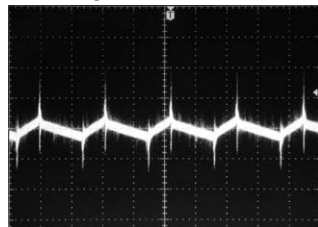


LCA50S-12+SNA-06-223

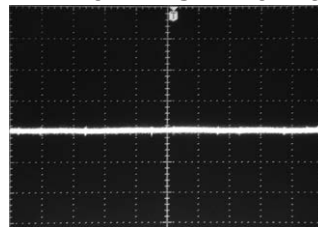


(Room temp, Room Humi)
BW:500MHz
LCA50S-12
12V 4.3A

LEP240F-24



LEP240F-24+SNR-10-223



(Room temp, Room Humi)
BW:500MHz
LEP240F-24
24V 10A

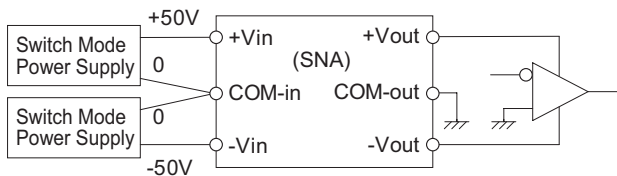
※ Measured by differential probe (KEISOKU-GIKEN:DP-100).

1 Wiring to Input/Output terminals

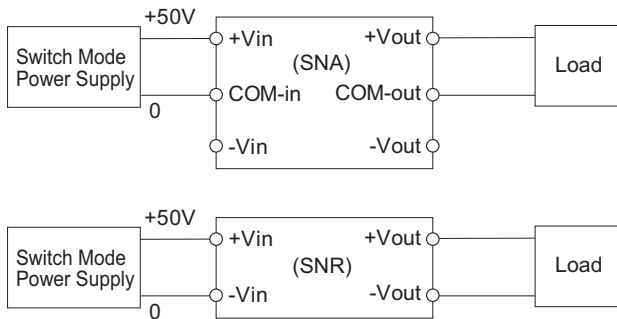
- This filter uses polarized components (electrolytic capacitor), The filter will break if reverse voltage is applied to the input/output terminals. Please exercise caution when wiring.

2 Application examples

- Power supply for an operational amplifier.



- Single output power supply.



3 Safety Considerations

- To apply for safety standard approval using this EMI/EMC Filter, the following conditions must be met.
 - The unit must be used as a component of an end-use equipment.
 - The unit must be used in the secondary circuit that is insulated from the primary circuit through double or reinforced insulation.
 - The mounting plate (FG) must be connected to safety ground of end-use equipment.

4 Optional Parts

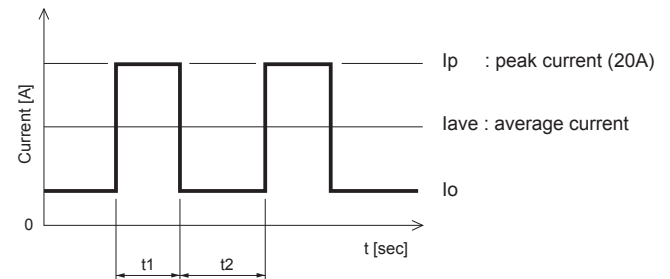
- The harness for Input/Output of EMI/EMC Filter is available.

Model	Harness model
SNA-01	H-OU-8
SNA-03	H-OU-8
SNA-06	H-OU-9
SNR-10	H-OU-18

- ※ The same harness model applies to both input and output.
- ※ Sold in units of 1 piece.

5 Peak current (SNR)

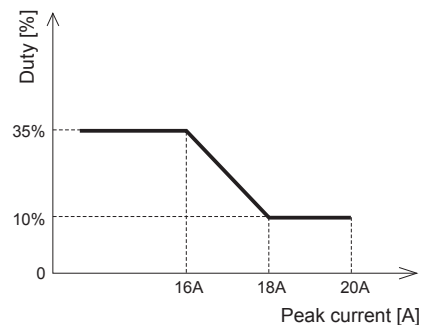
- Peak current is possible to draw as below.



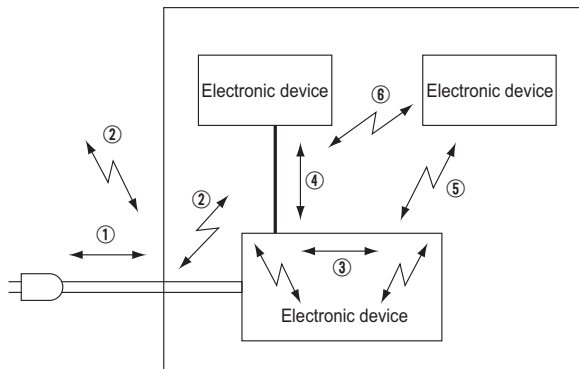
$$t1 \leq 10 [\text{sec}], I_{ave} = \frac{I_p \cdot t1 + I_o \cdot t2}{t1 + t2} \leq \text{rated current}$$

$$\frac{t1}{t1 + t2} \leq \text{Duty}$$

Duty is depended on peak current, refer to below chart.



1 Noise Transmission



Noise transmission between electric power and electronic device

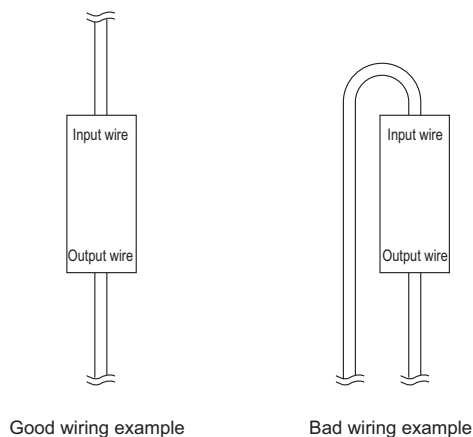
- ① Conducted noise from electric power lines.
- ② Radiated noise which is picked up and generated by the power line as antenna.
- ③ Conducted and radiated noise which is generated in the electronic device.
- ④ Conducted noise which is generated by the signal lines between electronic devices.
- ⑤ Radiated noise emitted an electronic device that interferes with other device.
- ⑥ Radiated noise which is picked up and generated by the signal line as antenna.

2 Application Precautions

The following points should be kept in mind to use the EMI/EMC Filter more effectively.

- Input wire and output wire of the EMI/EMC Filter should be separated.

When the input/output wire are bundled together or wired parallel with each other, high frequency noise is induced so, and the expected effect of noise attenuation cannot be achieved.



- Ground lines should be as short as possible. If it is not, an equivalent inductance appears, and the high frequency attenuation characteristics degrade. When grounding the mounting plate of the EMI/EMC Filter, you should remove the paint to reduce the contact resistance from the equipment case, and then install the EMI/EMC Filter.

3 Method of measuring characteristic data

※ Attenuation = $20\log(U_{01}/U_{02})$ [dB]
 U_{01} : Voltage in state without filters
 U_{02} : Voltage in state which added filters
 ※ N.A. : Network analyzer

(1) Attenuation Characteristic(Static characteristic)

Object product: Single phase input type

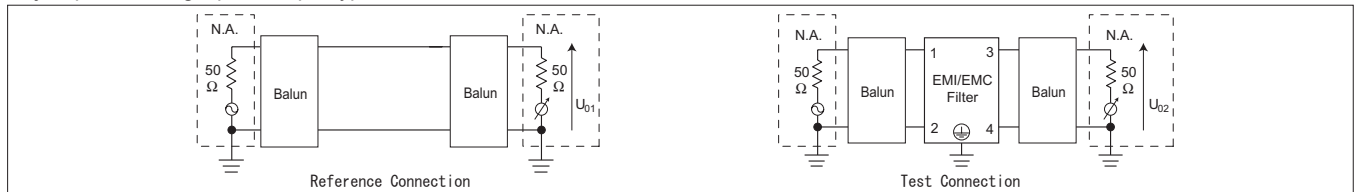


Fig.3.1 Differential mode attenuation measurement diagram

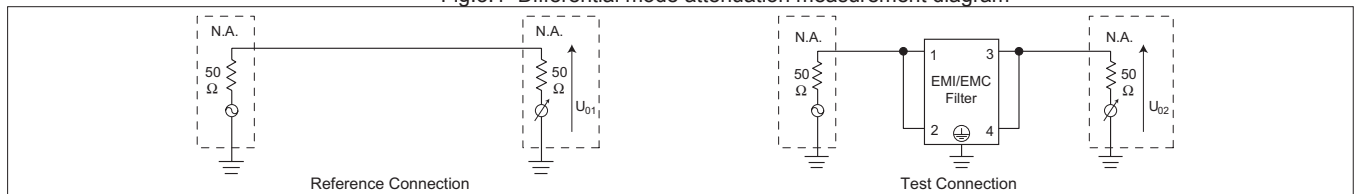


Fig.3.2 Common mode attenuation measurement diagram

Object product: Three phase input type

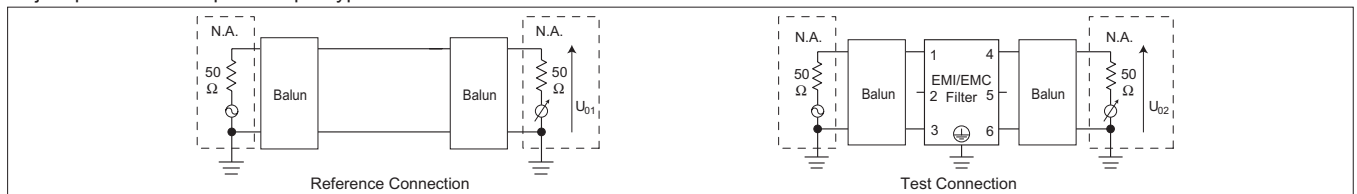


Fig.3.3 Differential mode attenuation measurement diagram

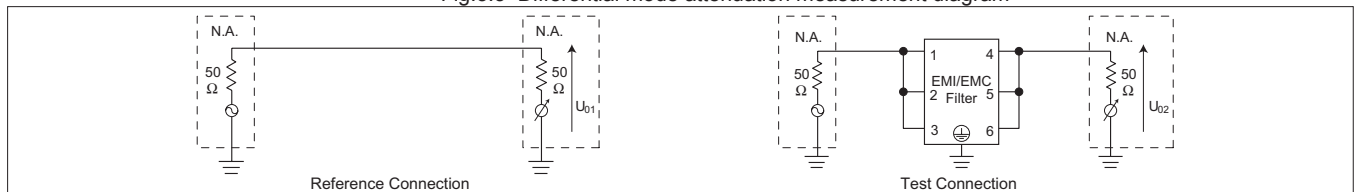


Fig.3.4 Common mode attenuation measurement diagram

Object product: DC input type

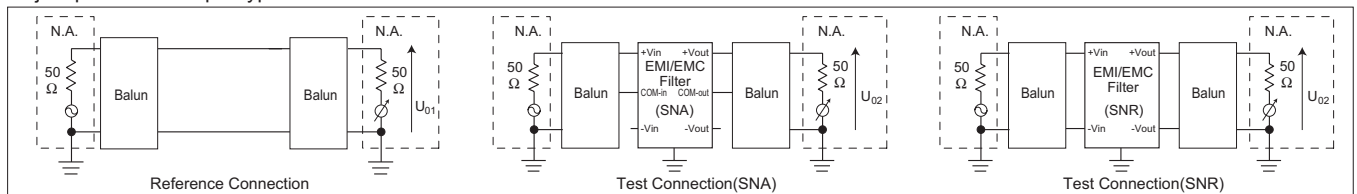


Fig.3.5 Differential mode attenuation measurement diagram

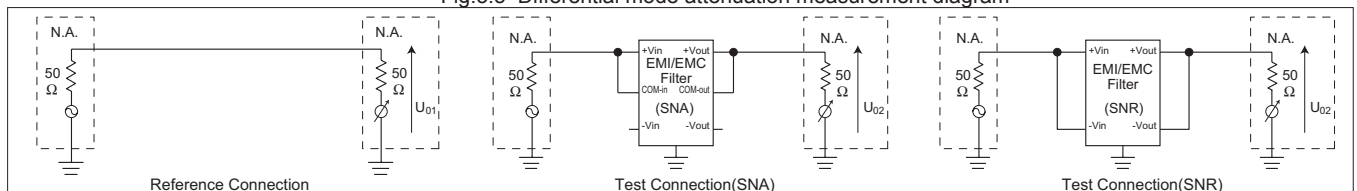


Fig.3.6 Common mode attenuation measurement diagram

(2) Pulse Attenuation Characteristic

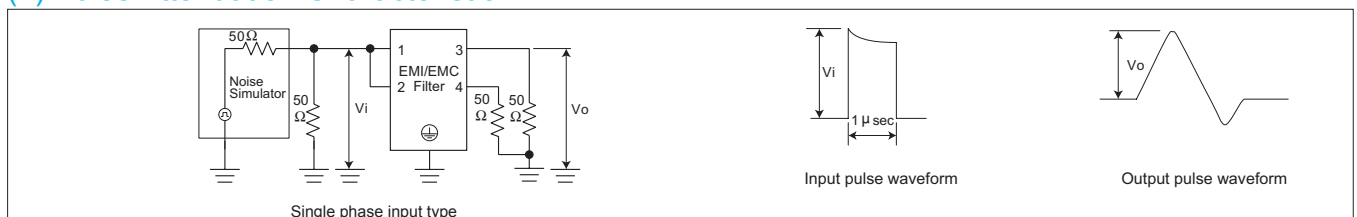


Fig.3.7 Pulse attenuation measurement diagram

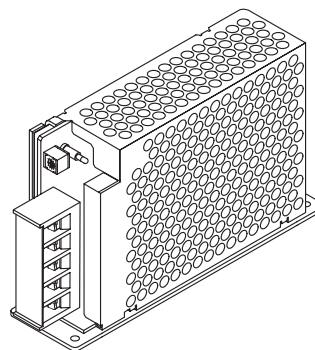
1	Attachment	Option-2
2	Din rail Attachment Plate	Option-15
3	Heat sink	Option-19
4	Harness	Option-22
5	Terminal Attachment	Option-49
6	Fan unit	Option-51
7	Insulated tube	Option-60
8	External Capacitor unit	Option-61

PB · PMA Series Attachment

BASE Attachment

Plate model	Applicable models
F-PBA10-1	PBA10F
F-PBA15-1	PBA15F, PBW15F
F-PBA30-1	PBA30F, PBW30F, PMA15F
F-PBA50-1	PBA50F, PBW50F, PMA30F
F-PBA75-1	PBA75F, PMA60F
F-PBA100-1	PBA100F
F-PBA150-1	PBA150F, PMA100F

Example



< TOP VIEW > (Unit : mm) (Tolerance : ±1)

<p>F-PBA10-1</p> <p>Size</p> <p>★ Material : SECC ★ Thickness : 2.0 ★ Weight : 60g max</p>	<p>F-PBA15-1</p> <p>Size</p> <p>★ Material : SECC ★ Thickness : 2.0 ★ Weight : 70g max</p>
<p>★ M3 Flat screw is requested when mounting. Please check the instruction manual for the size of screw.</p>	
<p>Mounting hole size</p> <p>FRONT←</p>	<p>Mounting hole size</p> <p>FRONT←</p>
<p>F-PBA30-1</p> <p>Size</p> <p>★ Material : SECC ★ Thickness : 2.0 ★ Weight : 85g max</p>	<p>F-PBA50-1</p> <p>Size</p> <p>★ Material : SECC ★ Thickness : 2.0 ★ Weight : 95g max</p>
<p>★ M3 Flat screw is requested when mounting. Please check the instruction manual for the size of screw.</p>	
<p>Mounting hole size</p> <p>FRONT←</p>	<p>Mounting hole size</p> <p>FRONT←</p>

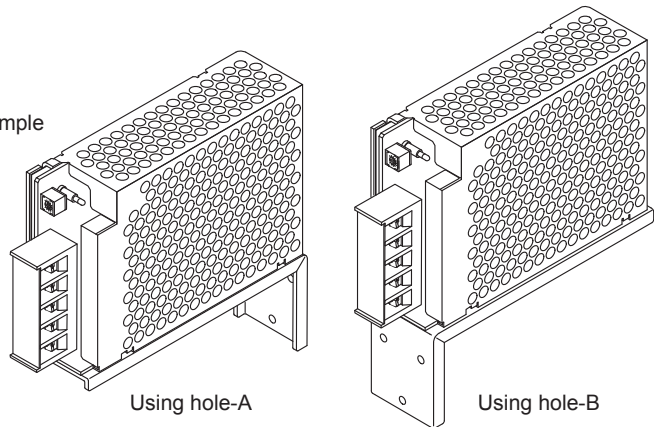
< TOP VIEW > (Unit : mm) (Tolerance : ±1)

<p align="center">F-PBA75-1</p> <p>Size</p> <p> ★ Material : SECC ★ Thickness : 2.0 ★ Weight : 110g max </p>	<p align="center">F-PBA100-1</p> <p>Size</p> <p> ★ Material : SECC ★ Thickness : 2.0 ★ Weight : 110g max </p>
<p align="center"> ★ M3 Flat screw is requested when mounting. Please check the instruction manual for the size of screw. </p>	
<p>Mounting hole size</p> <p>FRONT ←</p>	<p>Mounting hole size</p> <p>FRONT ←</p>
<p align="center">F-PBA150-1</p> <p>Size</p> <p> ★ Material : SECC ★ Thickness : 2.0 ★ Weight : 130g max </p>	
<p align="center"> ★ M3 Flat screw is requested when mounting. Please check the instruction manual for the size of screw. </p>	
<p>Mounting hole size</p> <p>FRONT ←</p>	

FRONT • REVERSE
Attachment

Plate model	Applicable models
F-PBA10-2	PBA10F
F-PBA15-2	PBA15F, PBW15F
F-PBA30-2	PBA30F, PBW30F, PMA15F
F-PBA50-2	PBA50F, PBW50F, PMA30F
F-PBA75-2	PBA75F, PMA60F
F-PBA100-2	PBA100F
F-PBA150-2	PBA150F, PMA100F

Example



Using hole-A

Using hole-B

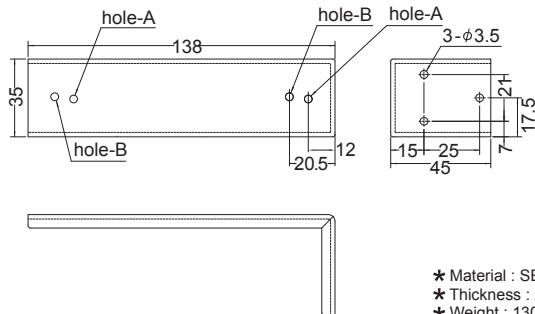
< TOP VIEW > (Unit : mm) (Tolerance : ±1)

F-PBA10-2	F-PBA15-2
<p>Size</p> <p>★ Material : SECC ★ Thickness : 1.6 ★ Weight : 60g max</p>	<p>Size</p> <p>★ Material : SECC ★ Thickness : 1.6 ★ Weight : 70g max</p>
<p>★ M3 screw is requested when mounting. Please check the instruction manual for the size of screw.</p>	
F-PBA30-2	F-PBA50-2
<p>Size</p> <p>★ Material : SECC ★ Thickness : 1.6 ★ Weight : 80g max</p>	<p>Size</p> <p>★ Material : SECC ★ Thickness : 2.0 ★ Weight : 120g max</p>
<p>★ M3 screw is requested when mounting. Please check the instruction manual for the size of screw.</p>	

< TOP VIEW > (Unit : mm) (Tolerance : ±1)

F-PBA75-2

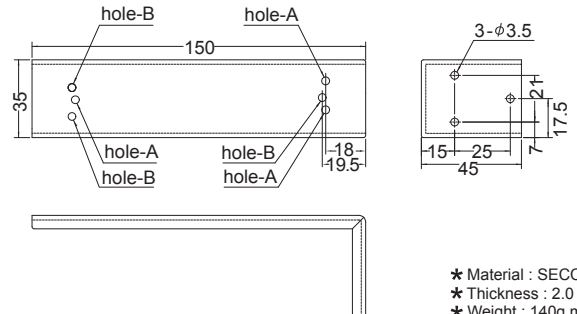
Size



- ★ Material : SECC
- ★ Thickness : 2.0
- ★ Weight : 130g max

F-PBA100-2

Size

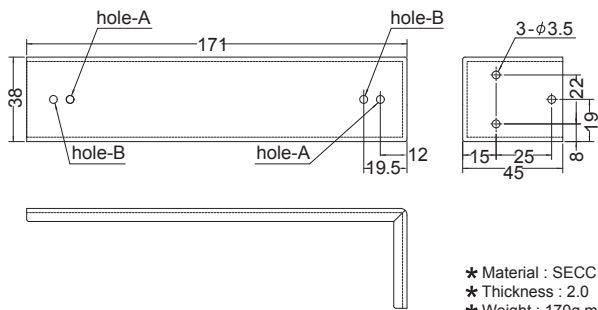


- ★ Material : SECC
- ★ Thickness : 2.0
- ★ Weight : 140g max

★ M3 screw is requested when mounting.
Please check the instruction manual for the size of screw.

F-PBA150-2

Size



- ★ Material : SECC
- ★ Thickness : 2.0
- ★ Weight : 170g max

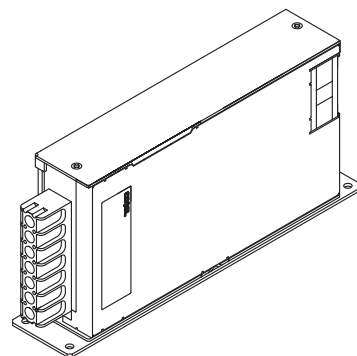
★ M3 screw is requested when mounting.
Please check the instruction manual for the size of screw.

PLA Series Attachment

BASE Attachment

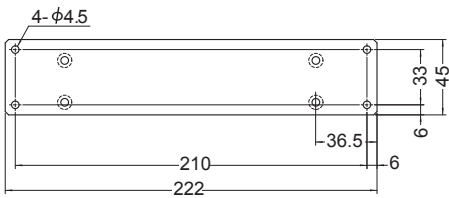
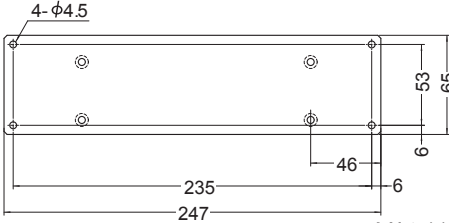
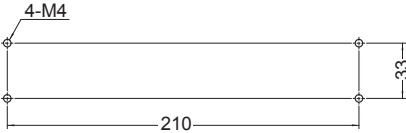
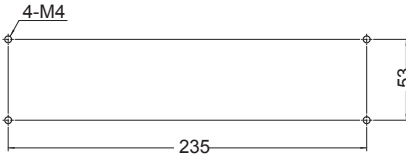
Plate model	Applicable models
F-PLA15-1	PLA15F
F-PLA30-1	PLA30F
F-PLA50-1	PLA50F
F-PLA100-1	PLA100F, PLA150F
F-PLA300-1	PLA300F
F-PLA600-1	PLA600F

Example
(PLA300F)



〈 TOP VIEW 〉 (Unit : mm) (Tolerance : ±1)

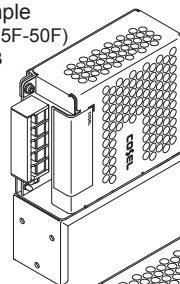
<p>F-PLA15-1</p> <p>Size</p> <p>★ Material : SECC ★ Thickness : 2.0 ★ Weight : 65g max</p>	<p>F-PLA30-1</p> <p>Size</p> <p>★ Material : SECC ★ Thickness : 2.0 ★ Weight : 75g max</p>
<p>★ M3 Flat screw is requested when mounting. Please check the instruction manual for the size of screw.</p>	
<p>Mounting hole size</p> <p>FRONT ←</p>	<p>Mounting hole size</p> <p>FRONT ←</p>
<p>F-PLA50-1</p> <p>Size</p> <p>★ Material : SECC ★ Thickness : 2.0 ★ Weight : 85g max</p>	<p>F-PLA100-1</p> <p>Size</p> <p>★ Material : SEHC ★ Thickness : 2.3 ★ hole-A : PLA100F ★ hole-B : PLA150F ★ Weight : 130g max</p>
<p>★ M3 Flat screw is requested when mounting. Please check the instruction manual for the size of screw.</p>	
<p>Mounting hole size</p> <p>FRONT ←</p>	<p>Mounting hole size</p> <p>FRONT ←</p>

F-PLA300-1	F-PLA600-1
<div>Size</div> <div></div> <div><ul style="list-style-type: none">* Material : SEHC* Thickness : 3.2* Weight : 300g max</div>	<div>Size</div> <div></div> <div><ul style="list-style-type: none">* Material : SEHC* Thickness : 3.2* Weight : 460g max</div>
<div>* M4 Flat screw is requested when mounting. Please check the instruction manual for the size of screw.</div>	
<div>Mounting hole size</div> <div></div> <div>FRONT ←</div>	<div>Mounting hole size</div> <div></div> <div>FRONT ←</div>

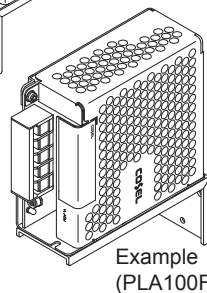
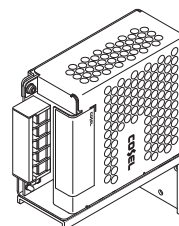
FRONT • REVERSE Attachment

Plate model	Applicable models
F-PLA15-2	PLA15F
F-PLA30-2	PLA30F
F-PLA50-2	PLA50F
F-PLA100-2	PLA100F, PLA150F
F-PLA300-2	PLA300F
F-PLA600-2	PLA600F

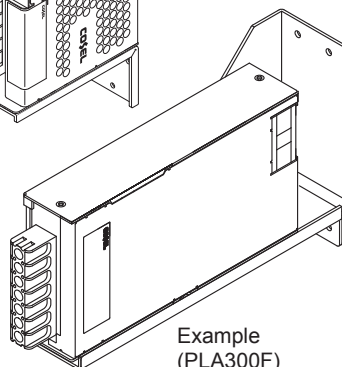
Example
(PLA15F-50F)
hole-B



Example
(PLA15F-50F)
hole-A



Example
(PLA100F)

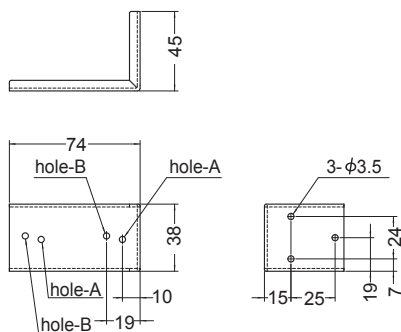


Example
(PLA300F)

(Unit : mm) (Tolerance : ±1)

F-PLA15-2

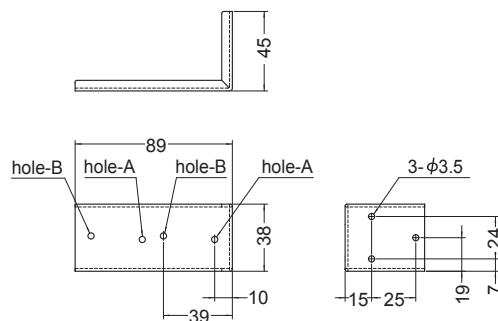
Size



- ★ Material : SECC
- ★ Thickness : 1.6
- ★ Weight : 70g max

F-PLA30-2

Size

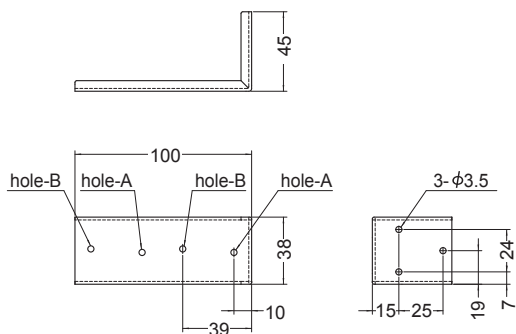


- ★ Material : SECC
- ★ Thickness : 1.6
- ★ Weight : 80g max

★ M3 screw is requested when mounting.
Please check the instruction manual for the size of screw.

F-PLA50-2

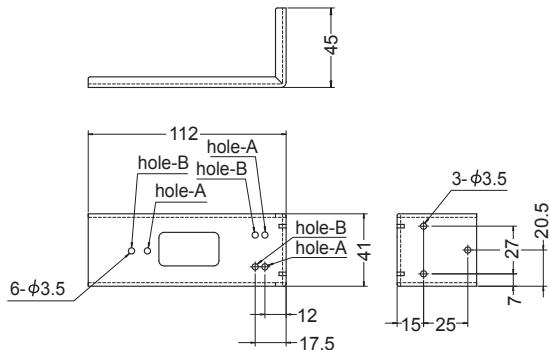
Size



- ★ Material : SECC
- ★ Thickness : 1.6
- ★ Weight : 85g max

F-PLA100-2

Size



- ★ Material : SECC
- ★ Thickness : 2.0
- ★ hole-A : PLA100F
- ★ hole-B : PLA150F
- ★ Weight : 120g max

★ M3 screw is requested when mounting.
Please check the instruction manual for the size of screw.

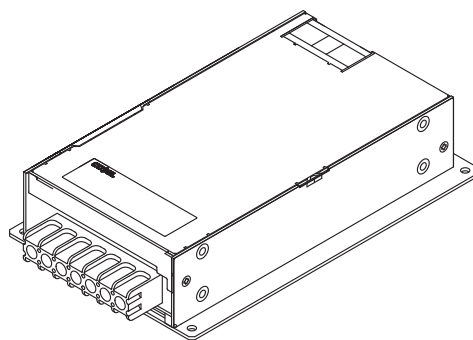
(Unit : mm) (Tolerance : ± 1)

F-PLA300-2	F-PLA600-2
<p>Size</p> <p> * Material : SEHC * Thickness : 2.0 * Weight : 600g max </p>	<p>Size</p> <p> * Material : SEHC * Thickness : 2.0 * Weight : 800g max </p>
<p> * M4 screw is requested when mounting. Please check the instruction manual for the size of screw. </p>	

BASE Attachment

Plate model	Applicable models
F-PLA300-3	PLA300F
F-PLA600-3	PLA600F

Example
(PLA300F)



〈 TOP VIEW 〉 (Unit : mm) (Tolerance : ±1)

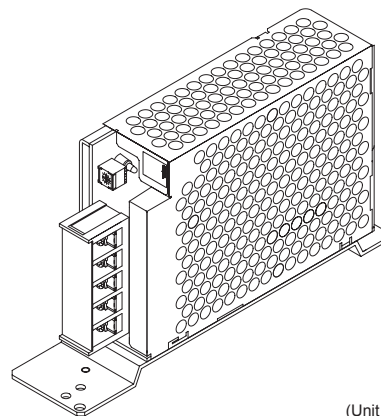
F-PLA300-3		F-PLA600-3	
Size	<p>★ Material : SEHC ★ Thickness : 3.2 ★ Weight : 750g max</p>	Size	<p>★ Material : SEHC ★ Thickness : 3.2 ★ Weight : 950g max</p>
<p>★ M4 Flat screw is requested when mounting. Please check the instruction manual for the size of screw.</p>			
Mounting hole size	<p>FRONT ←</p>	Mounting hole size	<p>FRONT ←</p>

Attachment for Replacement

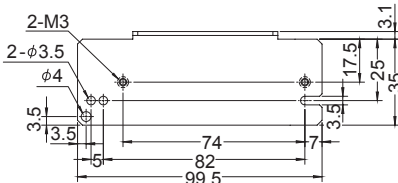
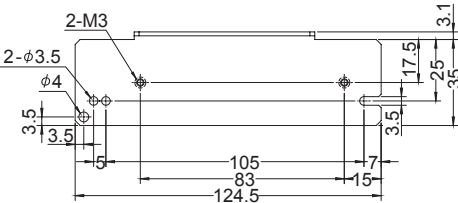
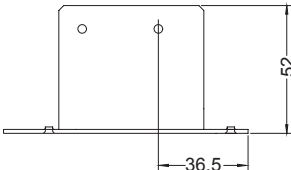
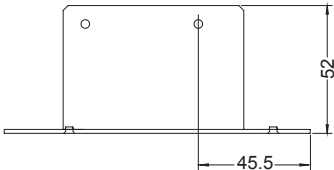
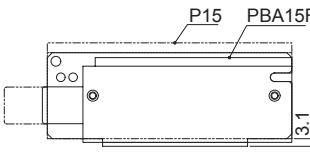
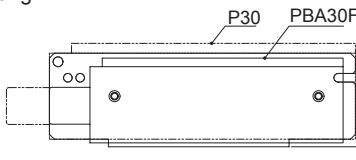
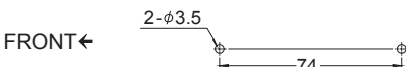

This is an attachment when replacing to PBA series from P・PAA series.

Plate model	Applicable models
F-PPBA15-1	P15 → PBA15F
F-PPBA30-1	P30 → PBA30F
F-PPBA50-1	P50, PAA50F → PBA50F
F-PPBA75-1	PAA75F → PBA75F
F-PPBA100-1	P100, PAA100F → PBA100F
F-PPBA150-1	P150, PAA150F → PBA150F

Example
(PBA50F)



(Unit : mm) (Tolerance : ±1)

F-PPBA15-1		F-PPBA30-1	
Size		Size	
Mounting			
	 <p>(BOTTOM VIEW)</p> <p>★ Material : SECC ★ Thickness : 1.6 ★ Weight : 100g max</p> <p>When change to PBA15F, external size becomes larger.</p>	 <p>(BOTTOM VIEW)</p> <p>★ Material : SECC ★ Thickness : 1.6 ★ Weight : 120g max</p> <p>When change to PBA30F, external size becomes larger.</p>	
★ M3 screw is requested when mounting. Please check the instruction manual for the size of screw.			
Mounting hole size		Mounting hole size	

(Unit : mm) (Tolerance : ± 1)

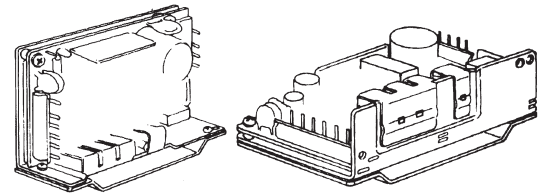
<p>F-PPBA50-1</p> <p>Size</p> <p>Mounting</p> <p>(SIDE VIEW)</p> <ul style="list-style-type: none"> * Material : SECC * Thickness : 1.6 * Weight : 90g max 	<p>F-PPBA75-1</p> <p>Size</p> <p>Mounting</p> <p>(SIDE VIEW)</p> <ul style="list-style-type: none"> * Material : SECC * Thickness : 1.6 * Weight : 120g max
<p>* M3 screw is requested when mounting. Please check the instruction manual for the size of screw.</p>	
<p>Mounting hole size</p> <p>FRONT ←</p>	<p>Mounting hole size</p> <p>FRONT ←</p>
<p>F-PPBA100-1</p> <p>Size</p> <p>Mounting</p> <p>(SIDE VIEW)</p> <ul style="list-style-type: none"> * Material : SECC * Thickness : 1.6 * Weight : 150g max 	<p>F-PPBA150-1</p> <p>Size</p> <p>Mounting</p> <p>(SIDE VIEW)</p> <ul style="list-style-type: none"> * Material : SECC * Thickness : 1.6 * Weight : 200g max
<p>* M3 screw is requested when mounting. Please check the instruction manual for the size of screw.</p>	
<p>Mounting hole size</p> <p>FRONT ←</p>	<p>Mounting hole size</p> <p>FRONT ←</p>

Attachment for Replacement

This is an attachment when replacing to PMC series from KMC · 2KMC series.

Classification	Plate model	Applicable models
Vertical	F-KMC15-1	KMC15 → PMC15
Horizontal	F-KMC15-2	2KMC15 → PMC15
Vertical	F-KMC30-1	KMC30 → PMC30
Horizontal	F-KMC30-2	2KMC30 → PMC30

Example
(PMC15)



Vertical

Horizontal

(Unit : mm) (Tolerance : ±1)

<p>F-KMC15-1</p> <p>Size</p> <p>Mounting</p> <p>(TOP VIEW)</p>	<p>F-KMC15-2</p> <p>Size</p> <p>Mounting</p> <p>(SIDE VIEW)</p>
<p>★ M3 screw is requested when mounting. Please check the instruction manual for the size of screw.</p>	
<p>Mounting hole size</p>	<p>Mounting hole size</p>
<p>F-KMC30-1</p> <p>Size</p> <p>Mounting</p> <p>(SIDE VIEW)</p>	<p>F-KMC30-2</p> <p>Size</p> <p>Mounting</p> <p>(SIDE VIEW)</p>
<p>★ M3 screw is requested when mounting. Please check the instruction manual for the size of screw.</p>	
<p>Mounting hole size</p>	<p>Mounting hole size</p>

ADA Series

Special attachment for installation of ADA Series is prepared.

Installation attachment type	Model
F-ADA-1	ADA Series
F-ADA-2	ADA Series
F-ADA-3	ADA Series
F-ADA-4	ADA Series
F-ADA-5	ADA600F

★Refer to Instruction Manual 2.3 for installation A, B and C.

<p>F-ADA-1</p> <p>★ Material: SPCC t=2.0 ★ Weight : 35g max</p>	<p>F-ADA-2</p> <p>★ Material: SPCC t=2.0 ★ Weight : 45g max</p>	<p>F-ADA-3</p> <p>★ Material: SPCC t=2.0 ★ Weight : 55g max</p>
<p>★ M4 screw is requested when mounting. Please check the instruction manual for the size of screw.</p>		
<p>① It is use in accordance with installation B. ② It is use in accordance with installation A.</p>	<p>① Using hole-A It is use in accordance with installation B. ② Using hole-B It is use in accordance with installation A.</p>	<p>It is possible to comply with installation A because the space is kept by 30mm.</p>
<p>F-ADA-4</p> <p>★ Material: SPCC t=2.0 ★ Weight : 20g max</p>	<p>F-ADA-5</p> <p>★ Material: SPCC t=2.0 ★ Weight : 80g max</p>	
<p>★ M4 screw is requested when mounting. Please check the instruction manual for the size of screw.</p>		
<p>It is use in accordance with installation C. It is possible to comply with installation A or B when the power supply is vertically installed.</p>	<p>It is possible to install from the rear, and to use from the front. (Only ADA600F)</p>	

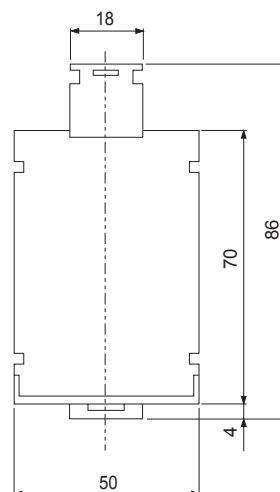
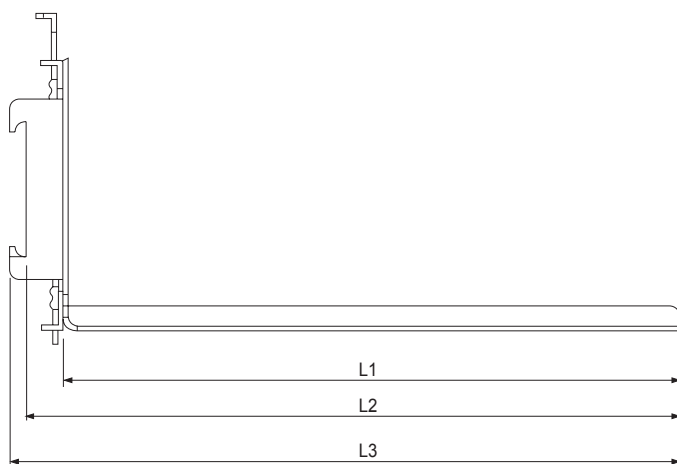
Din rail Attachment Plate

APPLICABLE TO MODEL

Din rail width : 35mm

Plate model	Model	screws for installation	
		Type	Qty
FD-A	RMB30A, RMC30A	M3	2pcs
FD-B	MMC8A RMB15A, RMC15A	M3	2pcs

EXTERNAL VIEW



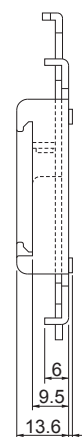
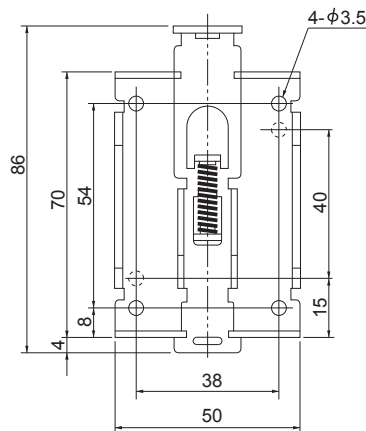
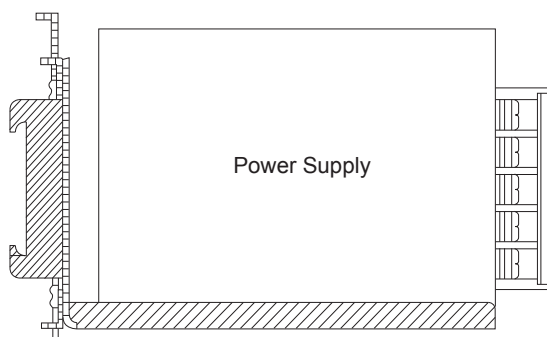
(Unit : mm)

Model	L1	L2	L3
FD-A	165	174.5	178.6
FD-B	115	124.5	128.6

- ★ Material : SPCC
- ★ Thickness : 1.6
- ★ Tolerance : ± 1
- ★ Weight : FD-A 290g max
FD-B 240g max

DIN RAIL ATTACHMENT MODEL : FD-SP

MOUNTING EXAMPLE



- ★ Material : SPCC
- ★ Thickness : 1.6
- ★ Tolerance : ± 1
- ★ Weight : 85g max

■Din rail Attachment Plate(PB Series)

APPLICABLE TO MODEL

Din rail width : 35mm

Plate model	Model	screws for installation	
		Type	Qty
FD-PBA10	PBA10F	M3	2pcs
FD-PBA15	PBA15F, PBW15F		
FD-PBA30	PBA30F, PBW30F		
FD-PBA50	PBA50F, PBW50F, PBA75F		
FD-PBA100	PBA100F	M3	3pcs
	PBA150F	M3	2pcs
FD-PBA300	PBA300F	M4	2pcs

FD-PBA10, FD-PBA15, FD-PBA30 EXTERNAL VIEW

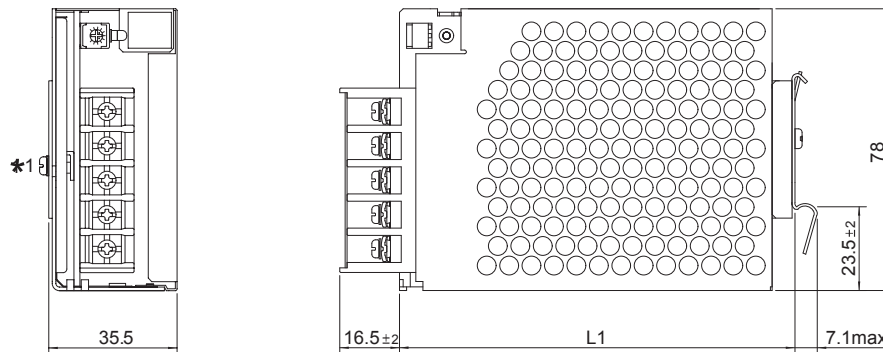


Plate model	Model	L1
FD-PBA10	PBA10F	75.0±2
FD-PBA15	PBA15F, PBW15F	92.0±2
FD-PBA30	PBA30F, PBW30F	110.0±2

- ★ Material : SECC
- ★ Thickness : 1.0
- ★ Tolerance : ±1
- ★ 1 Screws for installation (attached to Plate)
- ★ Weight : FD-PBA10 45g max
FD-PBA15 55g max
FD-PBA30 60g max

FD-PBA50, FD-PBA100 EXTERNAL VIEW

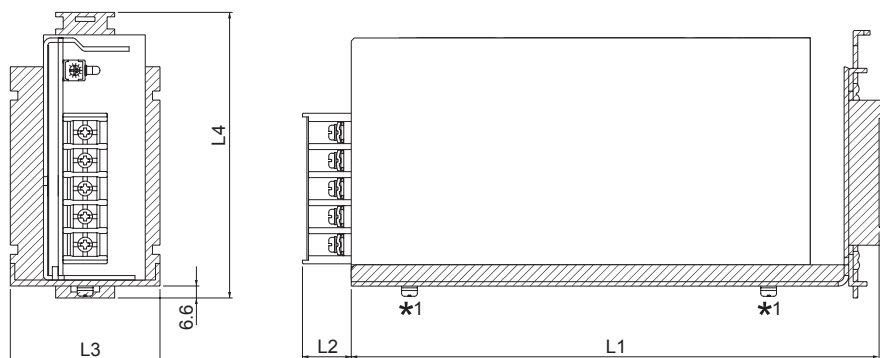


Plate model	Model	L1	L2	L3	L4
FD-PBA50	PBA50F	135	16.5±2	41	102.5
	PBA75F	150			
FD-PBA100	PBA100F	162	13.5±2	42.5	112
	PBA150F	183			

- * Material : SECC
- * Thickness : 1.6
- * Tolerance : ±1
- * 1 Screws for installation (attached to Plate)
- * Weight : FD-PBA50 220g max
- Weight : FD-PBA100 260g max

FD-PBA300 EXTERNAL VIEW

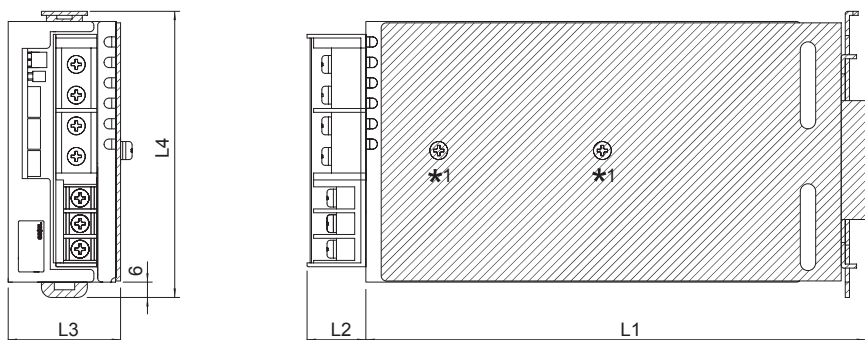


Plate model	Model	L1	L2	L3	L4
FD-PBA300	PBA300F	195.5	25max	44	112

- * Material : SPHC
- * Thickness : 2.0
- * Tolerance : ±1
- * 1 Screws for installation (attached to Plate)
- * Weight : 500g max

Din rail Attachment Plate(PLA Series)

APPLICABLE TO MODEL

Din rail width : 35mm

Plate model	Model	screws for installation	
		Type	Qty
FD-PLA15	PLA15F	M3	2pcs
FD-PLA30	PLA30F		
FD-PLA50	PLA50F		
FD-PLA100	PLA100F		
FD-PLA150	PLA150F		

FD-PLA15, FD-PLA30, FD-PLA50 FD-PLA100, FD-PLA150 EXTERNAL VIEW

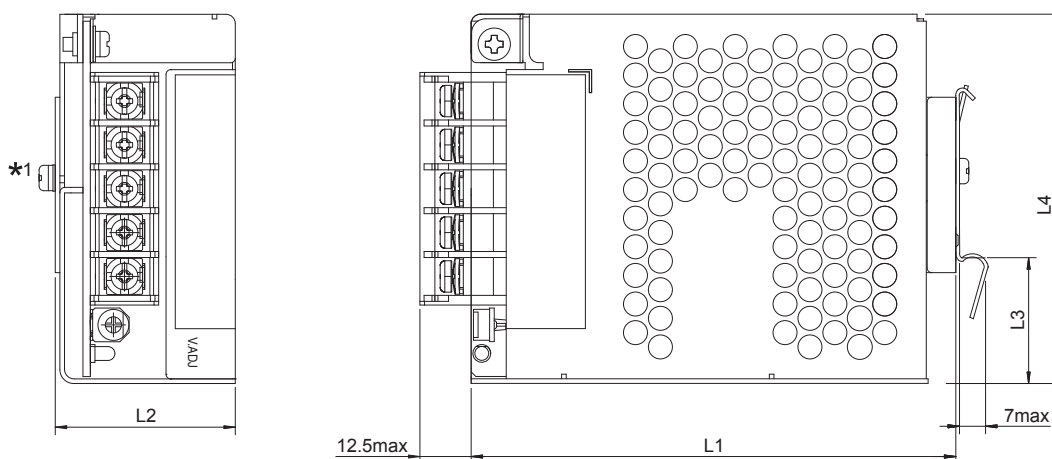


Plate model	Model	L1	L2	L3	L4
FD-PLA15	PLA15F	79±2	39	27.2±2	80
FD-PLA30	PLA30F	94±2	39	27.2±2	80
FD-PLA50	PLA50F	105±2	39	27.2±2	80
FD-PLA100	PLA100F	112.5±2	42	37.2±2	97
FD-PLA150	PLA150F	132.5±2	42.6	37.2±2	97

* Material : SECC

* Thickness FD-PLA15 : 1.0
FD-PLA30 : 1.0
FD-PLA50 : 1.0
FD-PLA100 : 1.0
FD-PLA150 : 1.6

* Tolerance : ±1

* 1 Screws for installation (attached to Plate)

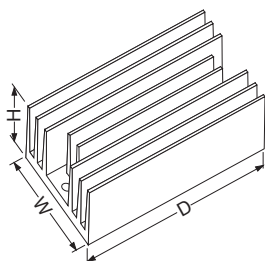
* Weight : FD-PLA15 55g max
FD-PLA30 60g max
FD-PLA50 60g max
FD-PLA100 60g max
FD-PLA150 100g max

Heat sink

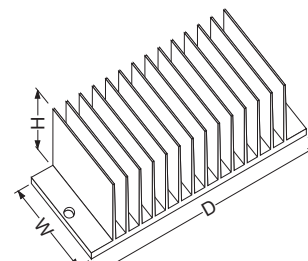
Heat sink is prepared in DAS · DPA series.

Chart: List of Heat sink for DAS · DPA series

No	Model designagion		Size [mm]			Heat resistance [°C/W]		Style	Weight
			H	W	D	Convection	Forced Air		
1	For DAS50	F-DA 50A	12	57.5	114.5	11.3	Refer Fig.1	Vertical	100g max
2		F-DA 50B				9.3		Horizontal	95g max
3		F-DA 50C	30			3.8	Refer Fig.2	Vertical	160g max
4		F-DA 50D				3.6		Horizontal	130g max
5	For DAS100 and DPA500F	F-DA 100A	12	57.5	129.5	10.9	Refer Fig.3	Vertical	120g max
6		F-DA 100B				8.3		Horizontal	110g max
7		F-DA 100C	30			3.6	Refer Fig.4	Vertical	180g max
8		F-DA 100D				3.2		Horizontal	160g max



Vertical type



Horizontal type

F-DA50A, F-DA50B Heat resistance
(Forced air)

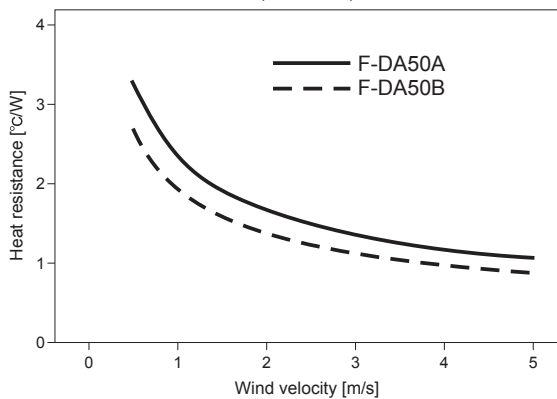


Fig.1 F-DA50A, F-DA50B Heat sink heat resistance

F-DA100A, F-DA100B Heat resistance
(Forced air)

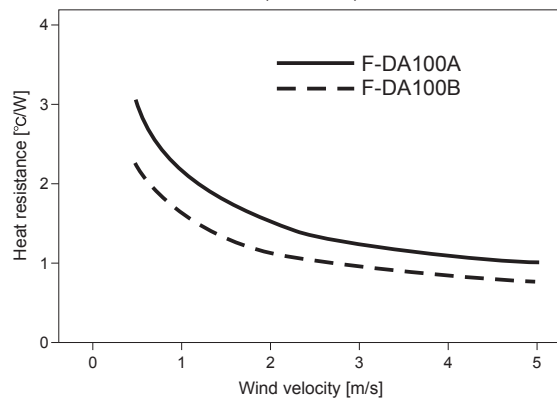


Fig.3 F-DA100A, F-DA100B Heat sink heat resistance

F-DA50C, F-DA50D Heat resistance
(Forced air)

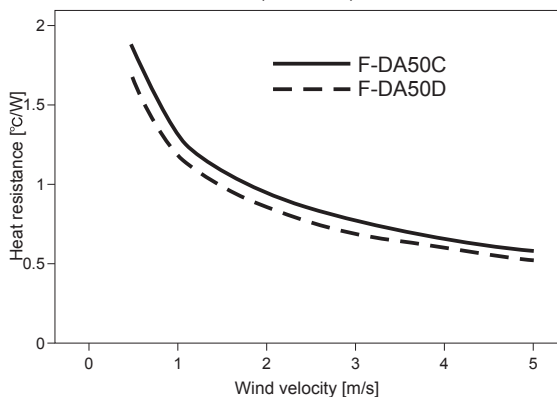


Fig.2 F-DA50C, F-DA50D Heat sink heat resistance

F-DA100C, F-DA100D Heat resistance
(Forced air)

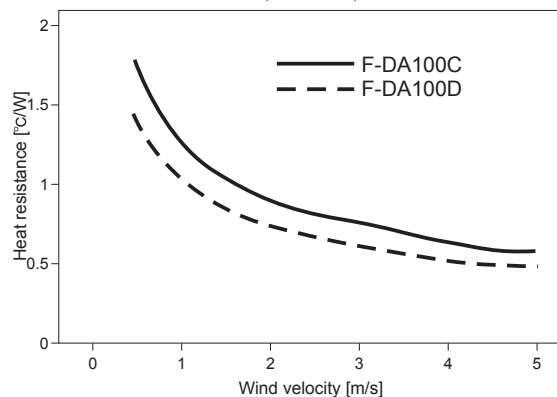


Fig.4 F-DA100C, F-DA100D Heat sink heat resistance

Heat sink

Heat sink is prepared in TUNS50 series, CQHS300 series, CQHS350 series, DHS50 series and DHS100 series.

Chart: List of Heat sink for TUNS50 series, CQHS300 series, CQHS350 series, DHS50 series and DHS100 series

No	Model	Size [mm]			Thermal resistance [°C/W]		Style	Weight
		H	W	D	Convection (0.1m/s)	Forced Air		
1	F-QB-F1	12.7	58.4	37.6	14.0	Refer Fig.7	Horizontal	35g max
2	F-QB-F2	12.7	58.7	37.3			Vertical	40g max
3	F-QB-F3	25.4	58.4	37.6	7.5		Horizontal	50g max
4	F-QB-F4	25.4	58.7	37.3			Vertical	50g max
5	F-QB-F5	38.1	58.4	37.6	5.0		Horizontal	60g max
6	F-QB-F6	38.1	58.7	37.3			Vertical	60g max

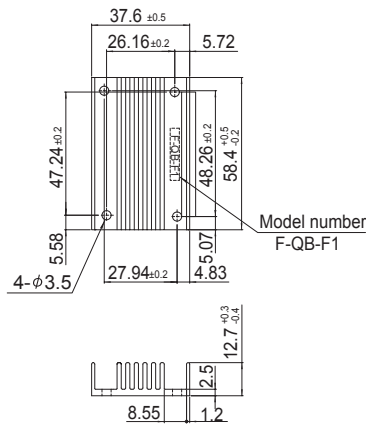


Fig.1 F-QB-F1 external view

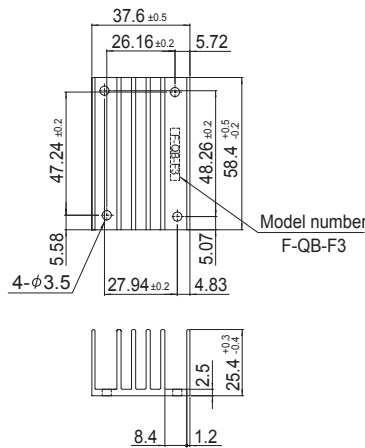


Fig.2 F-QB-F3 external view

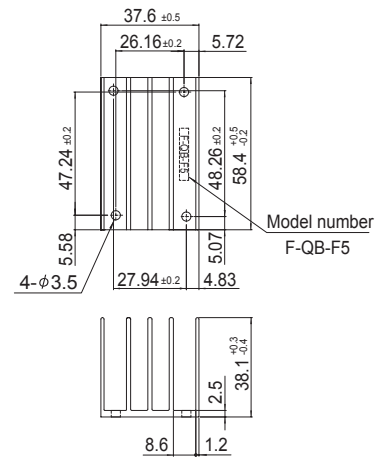


Fig.3 F-QB-F5 external view

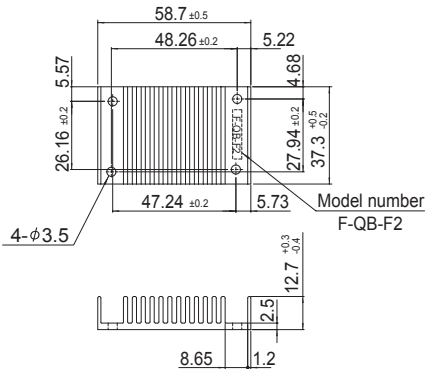


Fig.4 F-QB-F2 external view

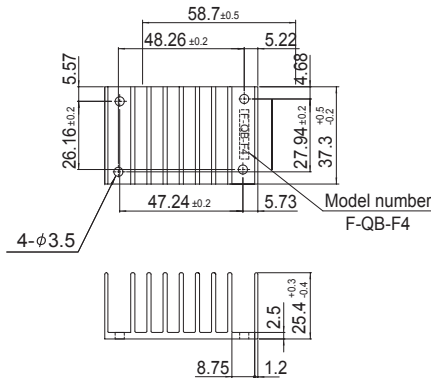


Fig.5 F-QB-F4 external view

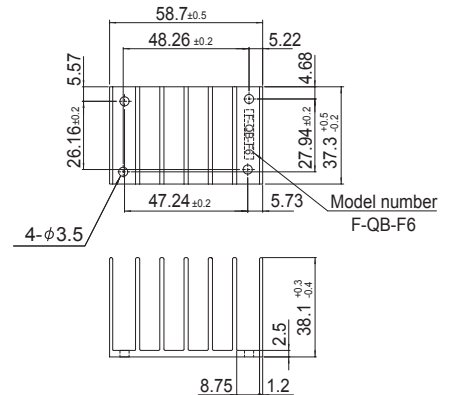


Fig.6 F-QB-F6 external view

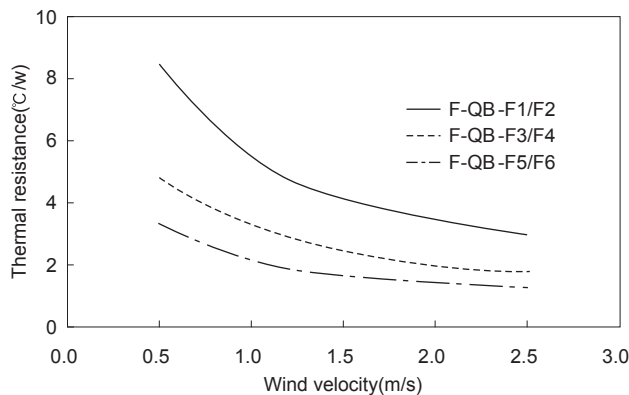


Fig.7 Thermal resistance of heat sink(Forced air)

Heat sink

Heat sink is prepared in TUNS100 series, CBS series, DHS200 series and DHS250 series.

Chart: List of Heat sink for TUNS100 series, CBS series, DHS200 series and DHS250 series

No	Model	Size [mm]			Thermal resistance [°C/W]		Style	Weight
		H	W	D	Convection (0.1m/s)	Forced Air		
1	F-CBS-F1	12.7	57.9	61.5	7.5	Refer Fig.7	Horizontal	70g max
2	F-CBS-F2	12.7	58.4	61.0			Vertical	70g max
3	F-CBS-F3	25.4	57.9	61.5	4.6		Horizontal	95g max
4	F-CBS-F4	25.4	58.4	61.0			Vertical	95g max
5	F-CBS-F5	38.1	57.9	61.5	3.0		Horizontal	120g max
6	F-CBS-F6	38.1	58.4	61.0			Vertical	100g max

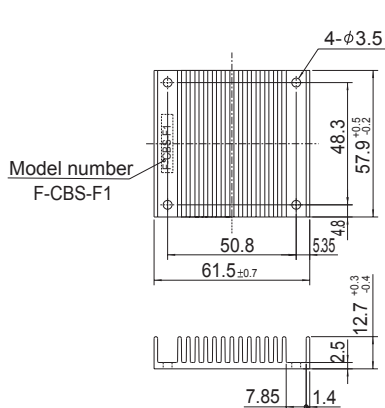


Fig.1 F-CBS-F1 external view

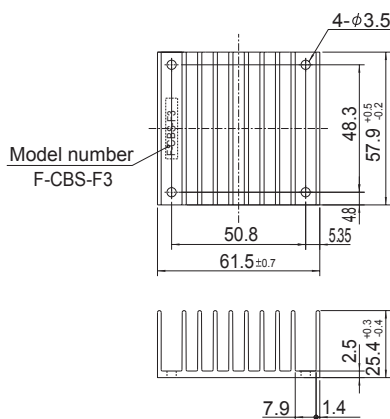


Fig.2 F-CBS-F3 external view

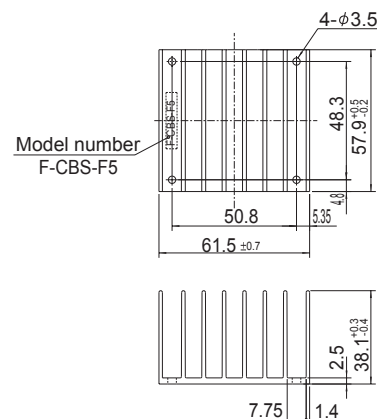


Fig.3 F-CBS-F5 external view

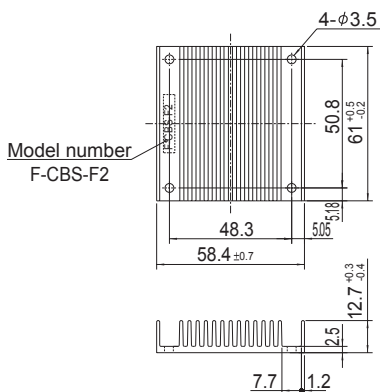


Fig.4 F-CBS-F2 external view

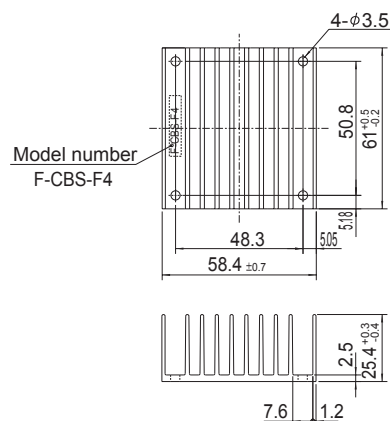


Fig.5 F-CBS-F4 external view

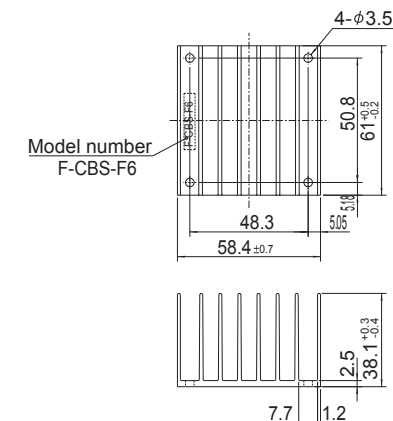


Fig.6 F-CBS-F6 external view

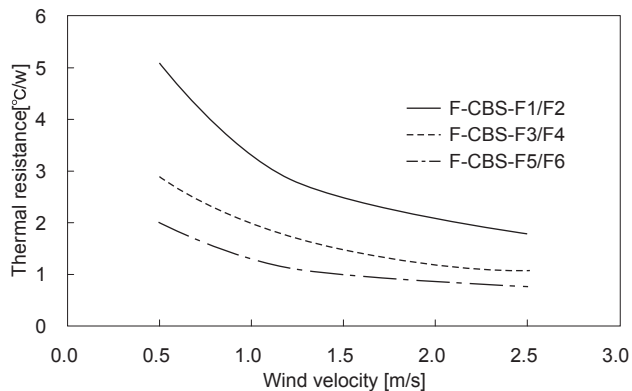


Fig.7 Thermal resistance of heat sink(Forced air)

Harness Mating harness

MMC Series PMC Series

Model	Harness model #	
	Input	Output
MMC8A	H-IN-2 or H-IN-9	H-OU-2
MMC50A	H-IN-1 or H-IN-8	H-OU-4
MMC75B	H-IN-1 or H-IN-8	H-OU-4
MMC100B	H-IN-1 or H-IN-8	H-OU-4

Model	Harness model #	
	Input	Output
PMC15	H-IN-1 or H-IN-8	H-OU-1
PMC30	H-IN-2 or H-IN-9	H-OU-1
PMC50	H-IN-2 or H-IN-9	H-OU-4
PMC75	H-IN-1 or H-IN-8	H-OU-4
PMC100	H-IN-1 or H-IN-8	H-OU-4

<div>●Model number</div> <div>H-IN-1</div> <div>Housing : 10-63-3044 (Molex) Pin : 08-70-1030 or 08-70-1031 (Molex) Weight : 25g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr><tr><td>1</td><td>UL1015</td><td>20</td><td>green</td><td>500</td></tr><tr><td>2</td><td>UL1015</td><td>20</td><td>black</td><td>500</td></tr><tr><td>3</td><td></td><td></td><td></td><td></td></tr><tr><td>4</td><td>UL1015</td><td>20</td><td>white</td><td>500</td></tr></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1015	20	green	500	2	UL1015	20	black	500	3					4	UL1015	20	white	500																														
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4	UL1015	20	white	500																																																					
<div>●Model number</div> <div>H-IN-2</div> <div>Housing : 10-63-3044 (Molex) Pin : 08-70-1030 or 08-70-1031 (Molex) Weight : 25g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr><tr><td>1</td><td>UL1015</td><td>20</td><td>green</td><td>500</td></tr><tr><td>2</td><td>UL1015</td><td>20</td><td>white</td><td>500</td></tr><tr><td>3</td><td></td><td></td><td></td><td></td></tr><tr><td>4</td><td>UL1015</td><td>20</td><td>black</td><td>500</td></tr></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1015	20	green	500	2	UL1015	20	white	500	3					4	UL1015	20	black	500																														
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4	UL1015	20	black	500																																																					
<div>●Model number</div> <div>H-IN-8</div> <div>Housing : 10-63-3044 (Molex) Pin : 08-70-1030 or 08-70-1031 (Molex) Weight : 25g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr><tr><td>1</td><td>UL1015</td><td>20</td><td>green/yellow</td><td>500</td></tr><tr><td>2</td><td>UL1015</td><td>20</td><td>black</td><td>500</td></tr><tr><td>3</td><td></td><td></td><td></td><td></td></tr><tr><td>4</td><td>UL1015</td><td>20</td><td>white</td><td>500</td></tr></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1015	20	green/yellow	500	2	UL1015	20	black	500	3					4	UL1015	20	white	500																														
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<div>●Model number</div> <div>H-IN-9</div> <div>Housing : 10-63-3044 (Molex) Pin : 08-70-1030 or 08-70-1031 (Molex) Weight : 25g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr><tr><td>1</td><td>UL1015</td><td>20</td><td>green/yellow</td><td>500</td></tr><tr><td>2</td><td>UL1015</td><td>20</td><td>white</td><td>500</td></tr><tr><td>3</td><td></td><td></td><td></td><td></td></tr><tr><td>4</td><td>UL1015</td><td>20</td><td>black</td><td>500</td></tr></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1015	20	green/yellow	500	2	UL1015	20	white	500	3					4	UL1015	20	black	500																														
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3																																																									
4	UL1015	20	black	500																																																					
<div>●Model number</div> <div>H-OU-1</div> <div>Housing : 10-63-3064 (Molex) Pin : 08-70-1030 or 08-70-1031 (Molex) Weight : 40g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr><tr><td>1</td><td></td><td></td><td></td><td></td></tr><tr><td>2</td><td>UL1015</td><td>20</td><td>black</td><td>500</td></tr><tr><td>3</td><td>UL1015</td><td>20</td><td>red</td><td>500</td></tr><tr><td>4</td><td>UL1015</td><td>20</td><td>purple</td><td>500</td></tr><tr><td>5</td><td>UL1015</td><td>20</td><td>gray</td><td>500</td></tr><tr><td>6</td><td>UL1015</td><td>20</td><td>orange</td><td>500</td></tr></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1					2	UL1015	20	black	500	3	UL1015	20	red	500	4	UL1015	20	purple	500	5	UL1015	20	gray	500	6	UL1015	20	orange	500																				
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5	UL1015	20	gray	500																																																					
6	UL1015	20	orange	500																																																					
<div>●Model number</div> <div>H-OU-2</div> <div>Housing : 09-50-1053 (Molex) Pin : 08-70-1030 or 08-70-1031 (Molex) Weight : 40g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr><tr><td>1</td><td>UL1015</td><td>20</td><td>red</td><td>500</td></tr><tr><td>2</td><td>UL1015</td><td>20</td><td>black</td><td>500</td></tr><tr><td>3</td><td>UL1015</td><td>20</td><td>orange</td><td>500</td></tr><tr><td>4</td><td>UL1015</td><td>20</td><td>gray</td><td>500</td></tr><tr><td>5</td><td>UL1015</td><td>20</td><td>purple</td><td>500</td></tr></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1015	20	red	500	2	UL1015	20	black	500	3	UL1015	20	orange	500	4	UL1015	20	gray	500	5	UL1015	20	purple	500																									
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4	UL1015	20	gray	500																																																					
5	UL1015	20	purple	500																																																					
<div>●Model number</div> <div>H-OU-4</div> <div>Housing : 09-50-1103 (Molex) Pin : 08-70-1030 or 08-70-1031 (Molex) Weight : 100g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr><tr><td>1</td><td>UL1015</td><td>18</td><td>red</td><td>500</td></tr><tr><td>2</td><td>UL1015</td><td>18</td><td>red</td><td>500</td></tr><tr><td>3</td><td>UL1015</td><td>18</td><td>black</td><td>500</td></tr><tr><td>4</td><td>UL1015</td><td>18</td><td>black</td><td>500</td></tr><tr><td>5</td><td>UL1015</td><td>18</td><td>orange</td><td>500</td></tr><tr><td>6</td><td>UL1015</td><td>18</td><td>orange</td><td>500</td></tr><tr><td>7</td><td>UL1015</td><td>18</td><td>gray</td><td>500</td></tr><tr><td>8</td><td>UL1015</td><td>18</td><td>gray</td><td>500</td></tr><tr><td>9</td><td>UL1015</td><td>18</td><td>purple</td><td>500</td></tr><tr><td>10</td><td>UL1015</td><td>18</td><td>purple</td><td>500</td></tr></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1015	18	red	500	2	UL1015	18	red	500	3	UL1015	18	black	500	4	UL1015	18	black	500	5	UL1015	18	orange	500	6	UL1015	18	orange	500	7	UL1015	18	gray	500	8	UL1015	18	gray	500	9	UL1015	18	purple	500	10	UL1015	18	purple	500
Pin #	Wire	AWG	Color	Length ℓ (mm)																																																					
1	UL1015	18	red	500																																																					
2	UL1015	18	red	500																																																					
3	UL1015	18	black	500																																																					
4	UL1015	18	black	500																																																					
5	UL1015	18	orange	500																																																					
6	UL1015	18	orange	500																																																					
7	UL1015	18	gray	500																																																					
8	UL1015	18	gray	500																																																					
9	UL1015	18	purple	500																																																					
10	UL1015	18	purple	500																																																					

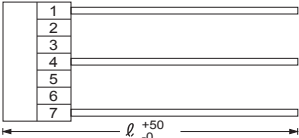
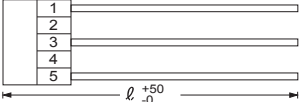
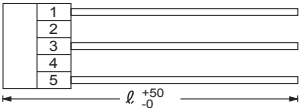
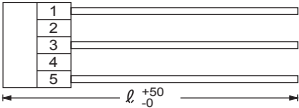
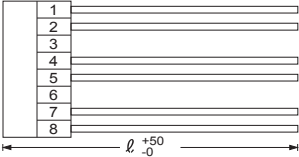
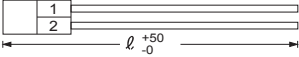
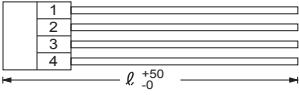
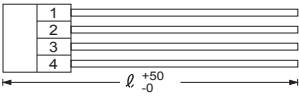
Mating harness

Model	Harness model #	
	Input	Output
LCA10S	H-IN-4	H-OU-7
LCA15S	H-IN-4	H-OU-8
LCA30S	H-IN-5 or H-IN-10	H-OU-9
LCA50S, *LGA50A		H-OU-9
LCA75S, *LGA75A		H-OU-18
LCA100S, *LGA100A		H-OU-10
LCA150S, *LGA150A		H-OU-11
*LGA240A, *LFA300F, *LFP300F	H-IN-14	H-OU-12
SNA-01-03	H-OU-8	H-OU-8
SNA-06	H-OU-9	H-OU-9
SNR-10	H-OU-18	H-OU-18

Model	Harness model #	
	Input	Output
LDA10F	H-IN-5 or H-IN-10	H-OU-8
LDA15F		H-OU-8
LDA30F, *LFA30F		H-OU-9
LDA50F, LEA50F, *LFA50F		H-OU-9
LDA75F, LEA75F, *LFA75F		H-OU-18
LDA100W, LEA100F, *LFP100F, *LFA100F		H-OU-10
*LMA100F, LEP100F, 150F, 240F		H-OU-11
LDA150W, LEA150F, *LFP150F, *LFA150F, *LFA240F, *LFP240F, *LMA150F, *LMA240F		H-OU-12
*LFA10F		H-OU-34
*LFA15F		H-OU-34
*LDA300W		H-OU-22
	H-IN-7	

* Optional : connector type "-J" (LDA300W)
 * Optional : connector type "-J1" (LGA50A, 75A, 100A, 150A, 240A)
 * Optional : connector type "-J1" (LFA10F, 15F, 30F, 50F, 75F, 100F, 150F, 240F, 300F)
 * Optional : connector type "-J1" (LFP100F, 150F, 240F, 300F)
 * Optional : connector type "-J1" (LMA100F, 150F, 240F)

LCA Series
 LGA Series
 LDA Series
 LEA Series
 LEP Series
 LFA Series
 LFP Series
 LMA Series
 SNA Series
 SNR Series

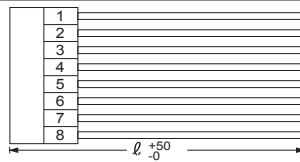
<div>●Model number</div> <div>H-IN-4</div> <div>Housing : XHP-7 (J.S.T.) Pin : SXH-001T-P0.6 (J.S.T.) Weight : 10g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr><tr><td>1</td><td>UL1007</td><td>22</td><td>black</td><td>500</td></tr><tr><td>2, 3</td><td></td><td></td><td></td><td></td></tr><tr><td>4</td><td>UL1007</td><td>22</td><td>white</td><td>500</td></tr><tr><td>5, 6</td><td></td><td></td><td></td><td></td></tr><tr><td>7</td><td>UL1007</td><td>22</td><td>green</td><td>500</td></tr></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1007	22	black	500	2, 3					4	UL1007	22	white	500	5, 6					7	UL1007	22	green	500
Pin #	Wire	AWG	Color	Length ℓ (mm)																												
1	UL1007	22	black	500																												
2, 3																																
4	UL1007	22	white	500																												
5, 6																																
7	UL1007	22	green	500																												
<div>●Model number</div> <div>H-IN-5</div> <div>Housing : VHR-5N (J.S.T.) Pin : SVH-21T-P1.1 (J.S.T.) Weight : 30g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr><tr><td>1</td><td>UL1015</td><td>18</td><td>black</td><td>500</td></tr><tr><td>2</td><td></td><td></td><td></td><td></td></tr><tr><td>3</td><td>UL1015</td><td>18</td><td>white</td><td>500</td></tr><tr><td>4</td><td></td><td></td><td></td><td></td></tr><tr><td>5</td><td>UL1015</td><td>18</td><td>green</td><td>500</td></tr></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1015	18	black	500	2					3	UL1015	18	white	500	4					5	UL1015	18	green	500
Pin #	Wire	AWG	Color	Length ℓ (mm)																												
1	UL1015	18	black	500																												
2																																
3	UL1015	18	white	500																												
4																																
5	UL1015	18	green	500																												
<div>●Model number</div> <div>H-IN-7</div> <div>Housing : 1-178128-5 (Tyco Electronics) Pin : 1-175218-2 or 1-175218-3 (Tyco Electronics) Weight : 35g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr><tr><td>1</td><td>UL1015</td><td>18</td><td>white</td><td>500</td></tr><tr><td>2</td><td></td><td></td><td></td><td></td></tr><tr><td>3</td><td>UL1015</td><td>18</td><td>black</td><td>500</td></tr><tr><td>4</td><td></td><td></td><td></td><td></td></tr><tr><td>5</td><td>UL1015</td><td>18</td><td>green/yellow</td><td>500</td></tr></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1015	18	white	500	2					3	UL1015	18	black	500	4					5	UL1015	18	green/yellow	500
Pin #	Wire	AWG	Color	Length ℓ (mm)																												
1	UL1015	18	white	500																												
2																																
3	UL1015	18	black	500																												
4																																
5	UL1015	18	green/yellow	500																												
<div>●Model number</div> <div>H-IN-10</div> <div>Housing : VHR-5N (J.S.T.) Pin : SVH-21T-P1.1 (J.S.T.) Weight : 30g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr><tr><td>1</td><td>UL1015</td><td>18</td><td>black</td><td>500</td></tr><tr><td>2</td><td></td><td></td><td></td><td></td></tr><tr><td>3</td><td>UL1015</td><td>18</td><td>white</td><td>500</td></tr><tr><td>4</td><td></td><td></td><td></td><td></td></tr><tr><td>5</td><td>UL1015</td><td>18</td><td>green/yellow</td><td>500</td></tr></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1015	18	black	500	2					3	UL1015	18	white	500	4					5	UL1015	18	green/yellow	500
Pin #	Wire	AWG	Color	Length ℓ (mm)																												
1	UL1015	18	black	500																												
2																																
3	UL1015	18	white	500																												
4																																
5	UL1015	18	green/yellow	500																												
<div>●Model number</div> <div>H-IN-14</div> <div>Housing : VHR-8N (J.S.T.) Pin : SVH-21T-P1.1 (J.S.T.) Weight : 60g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr><tr><td>1, 2</td><td>UL1015</td><td>18</td><td>black</td><td>500</td></tr><tr><td>3</td><td></td><td></td><td></td><td></td></tr><tr><td>4, 5</td><td>UL1015</td><td>18</td><td>white</td><td>500</td></tr><tr><td>6</td><td></td><td></td><td></td><td></td></tr><tr><td>7, 8</td><td>UL1015</td><td>18</td><td>green</td><td>500</td></tr></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1, 2	UL1015	18	black	500	3					4, 5	UL1015	18	white	500	6					7, 8	UL1015	18	green	500
Pin #	Wire	AWG	Color	Length ℓ (mm)																												
1, 2	UL1015	18	black	500																												
3																																
4, 5	UL1015	18	white	500																												
6																																
7, 8	UL1015	18	green	500																												
<div>●Model number</div> <div>H-OU-7</div> <div>Housing : XHP-2 (J.S.T.) Pin : SXH-001T-P0.6 (J.S.T.) Weight : 7g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr><tr><td>1</td><td>UL1007</td><td>22</td><td>black</td><td>500</td></tr><tr><td>2</td><td>UL1007</td><td>22</td><td>red</td><td>500</td></tr></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1007	22	black	500	2	UL1007	22	red	500															
Pin #	Wire	AWG	Color	Length ℓ (mm)																												
1	UL1007	22	black	500																												
2	UL1007	22	red	500																												
<div>●Model number</div> <div>H-OU-8</div> <div>Housing : XHP-4 (J.S.T.) Pin : SXH-001T-P0.6 (J.S.T.) Weight : 15g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr><tr><td>1</td><td>UL1007</td><td>22</td><td>black</td><td>500</td></tr><tr><td>2</td><td>UL1007</td><td>22</td><td>black</td><td>500</td></tr><tr><td>3</td><td>UL1007</td><td>22</td><td>red</td><td>500</td></tr><tr><td>4</td><td>UL1007</td><td>22</td><td>red</td><td>500</td></tr></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1007	22	black	500	2	UL1007	22	black	500	3	UL1007	22	red	500	4	UL1007	22	red	500					
Pin #	Wire	AWG	Color	Length ℓ (mm)																												
1	UL1007	22	black	500																												
2	UL1007	22	black	500																												
3	UL1007	22	red	500																												
4	UL1007	22	red	500																												
<div>●Model number</div> <div>H-OU-9</div> <div>Housing : VHR-4N (J.S.T.) Pin : SVH-21T-P1.1 (J.S.T.) Weight : 40g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr><tr><td>1</td><td>UL1015</td><td>18</td><td>black</td><td>500</td></tr><tr><td>2</td><td>UL1015</td><td>18</td><td>black</td><td>500</td></tr><tr><td>3</td><td>UL1015</td><td>18</td><td>red</td><td>500</td></tr><tr><td>4</td><td>UL1015</td><td>18</td><td>red</td><td>500</td></tr></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1015	18	black	500	2	UL1015	18	black	500	3	UL1015	18	red	500	4	UL1015	18	red	500					
Pin #	Wire	AWG	Color	Length ℓ (mm)																												
1	UL1015	18	black	500																												
2	UL1015	18	black	500																												
3	UL1015	18	red	500																												
4	UL1015	18	red	500																												

●Model number

H-OU-10

Housing : VHR-8N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 80g max

●Type



●Wire

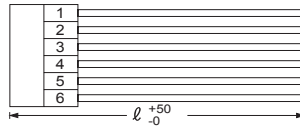
Pin #	Wire	AWG	Color	Length ℓ (mm)
1 - 4	UL1015	18	black	500
5 - 8	UL1015	18	red	500

●Model number

H-OU-11

Housing : VHR-6N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 60g max

●Type



●Wire

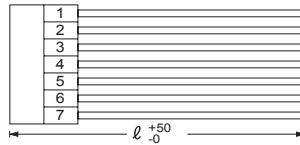
Pin #	Wire	AWG	Color	Length ℓ (mm)
1 - 6	UL1015	18	red	500

●Model number

H-OU-12

Housing : VHR-7N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 70g max

●Type



●Wire

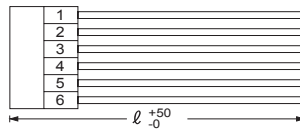
Pin #	Wire	AWG	Color	Length ℓ (mm)
1 - 7	UL1015	18	black	500

●Model number

H-OU-18

Housing : VHR-6N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 60g max

●Type



●Wire

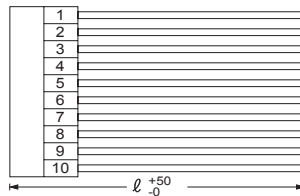
Pin #	Wire	AWG	Color	Length ℓ (mm)
1 - 3	UL1015	18	black	500
4 - 6	UL1015	18	red	500

●Model number

H-OU-22

Housing : 1-178288-8 (Tyco Electronics)
Pin : 1-175218-2 or
1-175218-3 (Tyco Electronics)
Weight : 100g max

●Type



●Wire

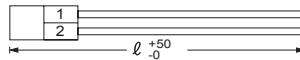
Pin #	Wire	AWG	Color	Length ℓ (mm)
1 - 5	UL1015	18	black	500
6 - 10	UL1015	18	red	500

●Model number

H-OU-34

Housing : VHR-2N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 20g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1015	18	black	500
2	UL1015	18	red	500

Mating harness

LGA Series
LFA Series
LFP Series
LMA Series

Model	Harness model #	
	Input	Output
LFA10F	H-IN-12	H-OU-33
LFA15F		H-OU-33
LFA30F		H-OU-28
LFA50F, LGA50A		H-OU-28
LFA75F, LGA75A		H-OU-29
LFP100F, LFA100F, LGA100A, LMA100F		H-OU-30
LFP150F, LFA150F, LGA150A, LFA240F, LFP240F, LMA150F, LMA240F		H-OU-31 H-OU-32
LGA240A, LFA300F, LFP300F	H-IN-13	H-OU-31 H-OU-32

●Model number

H-IN-12

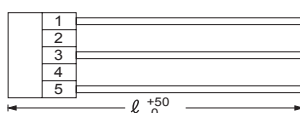
Housing : 1-1123722-5 (Tyco Electronics)

Pin : 1123721-1 or

1318912-1 (Tyco Electronics)

Weight : 30g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1015	18	black	500
2				
3	UL1015	18	white	500
4				
5	UL1015	18	green	500

●Model number

H-IN-13

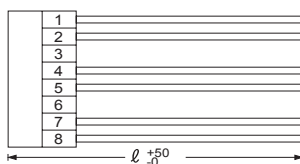
Housing : 1-1123722-8 (Tyco Electronics)

Pin : 1123721-1 or

1318912-1 (Tyco Electronics)

Weight : 55g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1, 2	UL1015	18	black	500
3				
4, 5	UL1015	18	white	500
6				
7, 8	UL1015	18	green	500

●Model number

H-OU-28

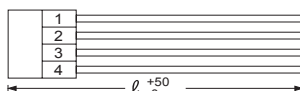
Housing : 1-1123722-4 (Tyco Electronics)

Pin : 1123721-1 or

1318912-1 (Tyco Electronics)

Weight : 40g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1015	18	black	500
2	UL1015	18	black	500
3	UL1015	18	red	500
4	UL1015	18	red	500

●Model number

H-OU-29

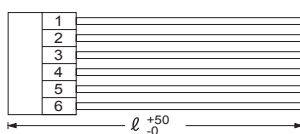
Housing : 1-1123722-6 (Tyco Electronics)

Pin : 1123721-1 or

1318912-1 (Tyco Electronics)

Weight : 60g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1 - 3	UL1015	18	black	500
4 - 6	UL1015	18	red	500

●Model number

H-OU-30

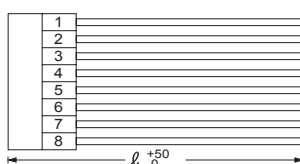
Housing : 1-1123722-8 (Tyco Electronics)

Pin : 1123721-1 or

1318912-1 (Tyco Electronics)

Weight : 75g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1 - 4	UL1015	18	black	500
5 - 8	UL1015	18	red	500

●Model number

H-OU-31

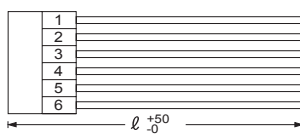
Housing : 1-1123722-6 (Tyco Electronics)

Pin : 1123721-1 or

1318912-1 (Tyco Electronics)

Weight : 60g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1 - 6	UL1015	18	red	500

●Model number

H-OU-32

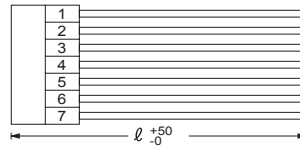
Housing : 1-1123722-7 (Tyco Electronics)

Pin : 1123721-1 or

1318912-1 (Tyco Electronics)

Weight : 70g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1 - 7	UL1015	18	black	500

●Model number

H-OU-33

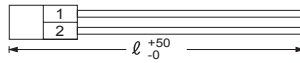
Housing : 1-1123722-2 (Tyco Electronics)

Pin : 1123721-1 or

1318912-1 (Tyco Electronics)

Weight : 20g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1015	18	black	500
2	UL1015	18	red	500

LFP Series

Harness for connecting the external capacitor unit is prepared for LFP240/300F(U1 type).

●Model number

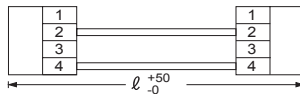
H-IN-23

Housing : VHR-4N(J.S.T.)

Pin : SVH-21T-P1.1(J.S.T.)

Weight : 5g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1				
2	UL1015	20	black	100
3				
4	UL1015	20	red	100

Mating harness

LEB Series
LDC Series
LCC Series

Model	Harness model #		
	Input	Output	Option: -Z □
LEB100F	H-IN-5 or H-IN-10	H-OU-23	H-OU-25
LEB150F		H-OU-23	
LEB225F		H-OU-24	

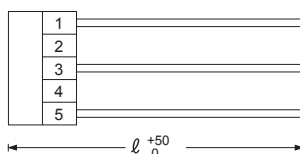
Model	Harness model #	
	Input	Output
LDC15F	H-IN-5 or H-IN-10	H-OU-13
LDC30F・LCC30A		H-OU-14
LDC60F		H-OU-19

●Model number

H-IN-5

Housing : VHR-5N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 30g max

●Type



●Wire

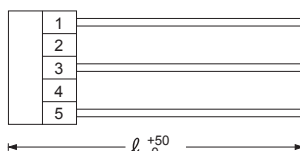
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1015	18	black	500
2				
3	UL1015	18	white	500
4				
5	UL1015	18	green	500

●Model number

H-IN-10

Housing : VHR-5N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 30g max

●Type



●Wire

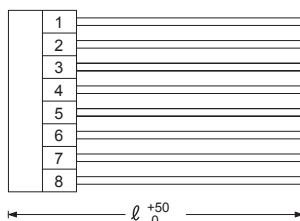
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1015	18	black	500
2				
3	UL1015	18	white	500
4				
5	UL1015	18	green/yellow	500

●Model number

H-OU-13

Housing : XHP-8 (J.S.T.)
Pin : SXH-001T-P0.6 (J.S.T.)
Weight : 25g max

●Type



●Wire

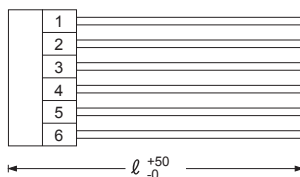
Pin #	Wire	AWG	Color	Length ℓ (mm)
1, 2	UL1007	22	red	500
3, 4	UL1007	22	black	500
5	UL1007	22	orange	500
6, 7	UL1007	22	gray	500
8	UL1007	22	purple	500

●Model number

H-OU-14

Housing : VHR-6N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 60g max

●Type



●Wire

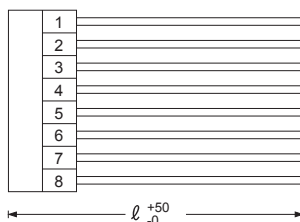
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1015	18	purple	500
2, 3	UL1015	18	gray	500
4	UL1015	18	orange	500
5	UL1015	18	black	500
6	UL1015	18	red	500

●Model number

H-OU-19

Housing : VHR-8N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 80g max

●Type



●Wire

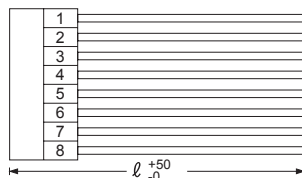
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1015	18	purple	500
2, 3	UL1015	18	gray	500
4	UL1015	18	orange	500
5, 6	UL1015	18	black	500
7, 8	UL1015	18	red	500

●Model number

H-OU-23

Housing : VHR-8N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 80g max

●Type



●Wire

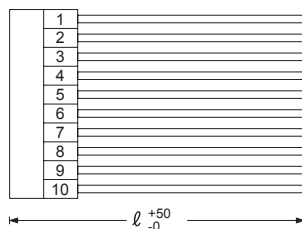
Pin #	Wire	AWG	Color	Length ℓ (mm)
1, 2	UL1015	18	gray	500
3, 4	UL1015	18	orange	500
5, 6	UL1015	18	black	500
7, 8	UL1015	18	red	500

●Model number

H-OU-24

Housing : VHR-10N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 100g max

●Type



●Wire

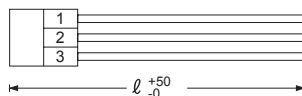
Pin #	Wire	AWG	Color	Length ℓ (mm)
1, 2, 3	UL1015	18	gray	500
4, 5, 6	UL1015	18	orange	500
7, 8	UL1015	18	black	500
9, 10	UL1015	18	red	500

●Model number

H-OU-25

Housing : XHP-3 (J.S.T.)
Pin : SXH-001-P0.6 (J.S.T.)
Weight : 10g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1007	22	orange	500
2	UL1007	22	gray	500
3	UL1007	22	purple	500

Harness for input/output(J type) is prepared in RMB/RMC series.

RMB Series

RMC Series

Mating harness

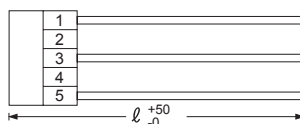
Model	Harness model #	
	Input	Output
RMB15A・30A・50A	H-IN-3	H-OU-16
RMC15A・30A・50A		H-OU-15

●Model number

H-IN-3

Housing : VHR-5N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 20g max

●Type



●Wire

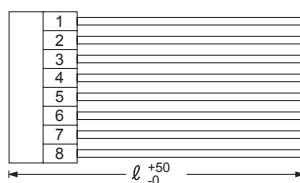
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1015	20	white	500
2				
3	UL1015	20	black	500
4				
5	UL1015	20	green	500

●Model number

H-OU-15

Housing : VHR-8N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 80g max

●Type



●Wire

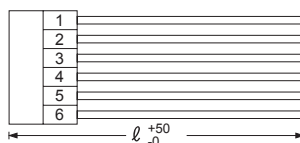
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1015	18	purple	500
2	UL1015	18	gray	500
3	UL1015	18	gray	500
4	UL1015	18	orange	500
5	UL1015	18	black	500
6	UL1015	18	black	500
7	UL1015	18	red	500
8	UL1015	18	red	500

●Model number

H-OU-16

Housing : VHR-6N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 60g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1015	18	gray	500
2	UL1015	18	orange	500
3	UL1015	18	black	500
4	UL1015	18	black	500
5	UL1015	18	red	500
6	UL1015	18	red	500

Harness for remote sensing is prepared in LDA series.

LDA Series

Mating harness

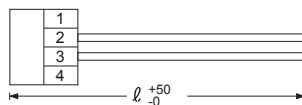
Model	Harness model #	Contents
LDA300W	H-SN-1	For remote sensing

●Model number

H-SN-1

Housing : XHP-4 (J.S.T.)
Pin : SXH-001T-P0.6 (J.S.T.)
Weight : 3g max

●Type



●Wire

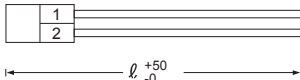
Pin #	Wire	AWG	Color	Length l (mm)
1				
2	UL1061	28	black	500
3	UL1061	28	red	500
4				

Harness for remote ON/OFF(R type) is prepared in LDA, LEA, LEB, LEP, LFA, LFP & LMA series.

LDA Series
LEA Series
LEB Series
LEP Series
LFA Series
LFP Series
LMA Series

Mating harness

Model	Harness model #
LDA50F, LDA75F, LDA100W, LDA150W, LDA300W	H-RC-1
LEA50F, LEA75F, LEA100F, LEA150F, LEP100F, LEP150F, LEP240F	
LEB100F, LEB150F, LEB225F	
LFA100F, LFA150F, LFA240F, LFA300F, LFP100F, LFP150F, LFP240F, LFP300F	
LMA100F, LMA150F, LMA240F	

●Model number	●Type	●Wire															
H-RC-1		<table><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr><tr><td>1</td><td>UL1007</td><td>22</td><td>orange</td><td>500</td></tr><tr><td>2</td><td>UL1007</td><td>22</td><td>blue</td><td>500</td></tr></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1007	22	orange	500	2	UL1007	22	blue	500
Pin #	Wire	AWG	Color	Length ℓ (mm)													
1	UL1007	22	orange	500													
2	UL1007	22	blue	500													
Housing : XHP-2 (J.S.T.) Pin : SXH-001T-P0.6 (J.S.T.) Weight : 7g max																	

Harness to use the function of the output module is prepared in MAX series.

MAX Series

Mating harness

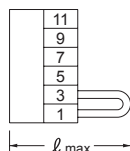
Model	Harness model #	Contents
MAX1600F	H-SN-3	Harness for using no function of the output module. It is appended to standard model.
MAX1600T	H-SN-4	Harness for using all functions of output module.
MAX3200T	H-SN-6	Harness for using all functions except remote sensing of the output module.

●Model number

H-SN-3

Housing : PHDR-12VS (J.S.T.)
Pin : SPHD-002T-P0.5 (J.S.T.)
Weight : 1g max

●Type



●Wire

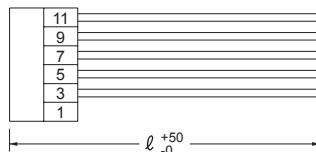
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1061	28	red	30
2	UL1061	28	black	30
3	UL1061	28	red	30
4	UL1061	28	black	30
5	-	-	-	-
6	-	-	-	-
7	-	-	-	-
8	-	-	-	-
9	-	-	-	-
10	-	-	-	-
11	-	-	-	-
12	-	-	-	-

●Model number

H-SN-4

Housing : PHDR-12VS (J.S.T.)
Pin : SPHD-002T-P0.5 (J.S.T.)
Weight : 10g max

●Type



●Wire

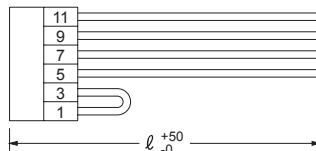
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	-	-	-	-
2	-	-	-	-
3	UL1061	28	red	500
4	UL1061	28	black	500
5	UL1061	28	brown	500
6	UL1061	28	black	500
7	UL1061	28	orange	500
8	UL1061	28	black	500
9	UL1061	28	yellow	500
10	UL1061	28	green	500
11	UL1061	28	blue	500
12	UL1061	28	purple	500

●Model number

H-SN-6

Housing : PHDR-12VS (J.S.T.)
Pin : SPHD-002T-P0.5 (J.S.T.)
Weight : 8g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1061	28	red	30
2	UL1061	28	black	30
3	UL1061	28	red	30
4	UL1061	28	black	30
5	UL1061	28	brown	500
6	UL1061	28	black	500
7	UL1061	28	orange	500
8	UL1061	28	black	500
9	UL1061	28	yellow	500
10	UL1061	28	green	500
11	UL1061	28	blue	500
12	UL1061	28	purple	500

* The even number pin side of the connector is the same wiring as the odd number pin side.

Harness to use the function of the output module is prepared in ACE series.

ACE Series

Mating harness

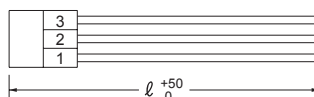
Model	Harness model #	Contents
ACE series	H-SN-14	Harness for using AUX and PR alarm of CN1.
	H-SN-16	Harness for using all function of output modules. (CN2)
	H-SN-17	Harness for using all functions except remote sensing of the output modules. (CN2)
	H-SN-18	Harness for using remote ON/OFF of output module S, T, U.(CN2)

●Model number

H-SN-14

Housing : XHP-3 (J.S.T.)
Pin : SXH-001T-P0.6 (J.S.T.)
Weight : 10g max

●Type



●Wire

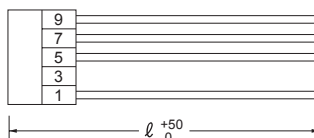
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1007	22	black	500
2	UL1007	22	yellow	500
3	UL1007	22	red	500

●Model number

H-SN-16

Housing : PHDR-10VS (J.S.T.)
Pin : SPHD-002T-P0.5 (J.S.T.)
Weight : 8g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1061	28	yellow	500
2	UL1061	28	orange	500
3	-	-	-	-
4	-	-	-	-
5	UL1061	28	blue	500
6	UL1061	28	black	500
7	UL1061	28	red	500
8	UL1061	28	red	500
9	UL1061	28	black	500
10	UL1061	28	black	500

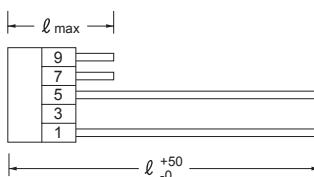
★ The even number pin side of the connector is the same wiring as the odd number pin side.

●Model number

H-SN-17

Housing : PHDR-10VS (J.S.T.)
Pin : SPHD-002T-P0.5 (J.S.T.)
Weight : 5g max

●Type



★ Pin #7 and #8 are shorted with harness and also pin #9 and #10.

●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1061	28	yellow	500
2	UL1061	28	orange	500
3	-	-	-	-
4	-	-	-	-
5	UL1061	28	blue	500
6	UL1061	28	black	500
7	UL1061	28	red	30
8	UL1061	28	red	30
9	UL1061	28	black	30
10	UL1061	28	black	30

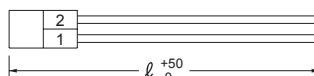
★ The even number pin side of the connector is the same wiring as the odd number pin side.

●Model number

H-SN-18

Housing : PHR-2 (J.S.T.)
Pin : SPH-002T-P0.5S (J.S.T.)
Weight : 4g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1007	26	yellow	500
2	UL1007	26	orange	500

Harness to use the function of ADA Series is prepared.

★ Please see the our company home page or consult us about detailed information.

ADA Series

Mating harness

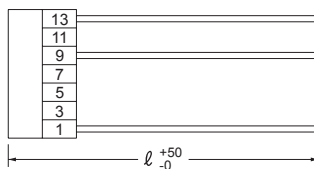
Model	Harness model #	Contents
ADA Series	H-SN-23	:Harness for using option:-W and/or -R when I/O interface is terminal block type (standard).
	H-IN-11	:Input harness when I/O interface is connector type (option:-J).
	H-OU-26	:Output harness when I/O interface is connector type (option:-J).
	H-PA-5	:Harness for parallel operation when I/O interface is connector type (option:-J).
	H-RC-2	:Harness for using option:-R when I/O interface is connector type (option:-J).

●Model number

H-SN-23

Housing : PHDR-14VS(J.S.T)
Pin : SPHD-002T-P0.5(J.S.T)
Weight : 6g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1061	28	red	500
2	UL1061	28	black	500
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-
7	-	-	-	-
8	-	-	-	-
9	UL1061	28	orange	500
10	UL1061	28	blue	500
11	-	-	-	-
12	-	-	-	-
13	UL1061	28	yellow	500
14	UL1061	28	black	500

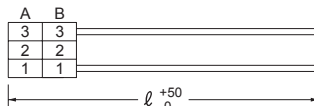
★ Even number pin side of the connector is the same wiring as odd number pin side.

●Model number

H-IN-11

Housing : 1-178129-6(AMP)
Pin : 1-175218-5 equivalent goods(AMP)
Weight : 45g max

●Type



●Wire

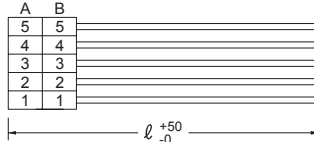
Pin #	Wire	AWG	Color	Length ℓ (mm)
B 1	UL1051	18	white	500
A 1	UL1051	18	white	500
B 2	-	-	-	-
A 2	-	-	-	-
B 3	UL1051	18	black	500
A 3	UL1051	18	black	500

●Model number

H-OU-26

Housing : 178289-5(AMP)
Pin : 1-353717-5 equivalent goods(AMP)
Weight : 105g max

●Type



●Wire

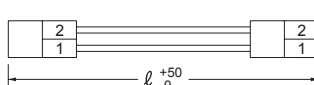
Pin #	Wire	AWG	Color	Length ℓ (mm)
B 1	UL1007	16	red	500
A 1	UL1007	16	red	500
B 2	UL1007	16	red	500
A 2	UL1007	16	red	500
B 3	UL1007	16	red	500
A 3	UL1007	16	black	500
B 4	UL1007	16	black	500
A 4	UL1007	16	black	500
B 5	UL1007	16	black	500
A 5	UL1007	16	black	500

●Model number

H-PA-5

Housing : 171822-2(AMP)
Pin : 170204-2 equivalent goods(AMP)
Weight : 4g max

●Type



●Wire

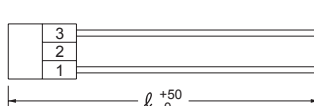
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1007	22	white	200
2	UL1007	22	black	200

●Model number

H-RC-2

Housing : 171822-3(AMP)
Pin : 170204-2 equivalent goods(AMP)
Weight : 7g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1007	22	white	500
2	-	-	-	-
3	UL1007	22	red	500

Harness to use the function is prepared in PB series.

PB Series

Mating harness

Model	Harness model #	Contents
PBA10F, PBA15F, PBW15F, PBA30F, PBW30F, PBA50F, PBW50F, PBA75F, PBA100F, PBA150F ★1	H-IN-1 or H-IN-8	Input harness when I/O interface is connector type (option : -J)
PBA10F, PBA15F, PBA30F, PBA50F	H-OU-20	Output harness when I/O interface is connector type (option : -J)
PBA75F, PBA100F, PBA150F ★1	H-OU-21	Output harness when I/O interface is connector type (option : -J)
PBW15F, PBW30F, PBW50F	H-OU-27	Output harness when I/O interface is connector type (option : -J)
PBA50F, PBW50F, PBA75F, PBA100F, PBA150F	H-RC-1	Harness for using option : -R
PBA100F, PBA150F ★2	H-SN-1	Harness for using option : -K
PBA10F, PBA15F, PBW15F, PBA30F, PBW30F PBA50F, PBW50F, PBA75F, PBA100F, PBA150F	H-SN-18	Harness for using option : -V
PBA300F	H-PA-3	Harness for parallel operation
PBA600F	H-SN-20	Harness for using all functions of CN1 and CN2
PBA1000F	H-SN-21	Harness for using all functions except remote sensing of CN2
PBA1500F	H-SN-22	Harness for using all functions of CN3
PBA1500T	H-SN-24	Harness for using example remote ON/OFF circuit (C)

★1 Available for 12V, 15V, 24V, 36V and 48V output model in PBA100F / 150F.

★2 Available for 3.3V and 5V output model in PBA100F / 150F.

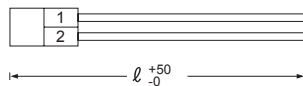
<div>●Model number</div> <div>H-IN-1</div> <div>Housing : 10-63-3044 (Molex) Pin : 08-70-1030 or 08-70-1031 (Molex) Weight : 25g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><thead><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr></thead><tbody><tr><td>1</td><td>UL1015</td><td>20</td><td>green</td><td>500</td></tr><tr><td>2</td><td>UL1015</td><td>20</td><td>black</td><td>500</td></tr><tr><td>3</td><td></td><td></td><td></td><td></td></tr><tr><td>4</td><td>UL1015</td><td>20</td><td>white</td><td>500</td></tr></tbody></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1015	20	green	500	2	UL1015	20	black	500	3					4	UL1015	20	white	500										
Pin #	Wire	AWG	Color	Length ℓ (mm)																																	
1	UL1015	20	green	500																																	
2	UL1015	20	black	500																																	
3																																					
4	UL1015	20	white	500																																	
<div>●Model number</div> <div>H-IN-8</div> <div>Housing : 10-63-3044 (Molex) Pin : 08-70-1030 or 08-70-1031 (Molex) Weight : 25g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><thead><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr></thead><tbody><tr><td>1</td><td>UL1015</td><td>20</td><td>green/yellow</td><td>500</td></tr><tr><td>2</td><td>UL1015</td><td>20</td><td>black</td><td>500</td></tr><tr><td>3</td><td></td><td></td><td></td><td></td></tr><tr><td>4</td><td>UL1015</td><td>20</td><td>white</td><td>500</td></tr></tbody></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1015	20	green/yellow	500	2	UL1015	20	black	500	3					4	UL1015	20	white	500										
Pin #	Wire	AWG	Color	Length ℓ (mm)																																	
1	UL1015	20	green/yellow	500																																	
2	UL1015	20	black	500																																	
3																																					
4	UL1015	20	white	500																																	
<div>●Model number</div> <div>H-OU-20</div> <div>Housing : 09-50-1043 (Molex) Pin : 08-70-1030 or 08-70-1031 (Molex) Weight : 40g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><thead><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr></thead><tbody><tr><td>1</td><td>UL1015</td><td>18</td><td>red</td><td>500</td></tr><tr><td>2</td><td>UL1015</td><td>18</td><td>red</td><td>500</td></tr><tr><td>3</td><td>UL1015</td><td>18</td><td>black</td><td>500</td></tr><tr><td>4</td><td>UL1015</td><td>18</td><td>black</td><td>500</td></tr></tbody></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1015	18	red	500	2	UL1015	18	red	500	3	UL1015	18	black	500	4	UL1015	18	black	500										
Pin #	Wire	AWG	Color	Length ℓ (mm)																																	
1	UL1015	18	red	500																																	
2	UL1015	18	red	500																																	
3	UL1015	18	black	500																																	
4	UL1015	18	black	500																																	
<div>●Model number</div> <div>H-OU-21</div> <div>Housing : 09-50-1063 (Molex) Pin : 08-70-1030 or 08-70-1031 (Molex) Weight : 60g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><thead><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr></thead><tbody><tr><td>1</td><td>UL1015</td><td>18</td><td>red</td><td>500</td></tr><tr><td>2</td><td>UL1015</td><td>18</td><td>red</td><td>500</td></tr><tr><td>3</td><td>UL1015</td><td>18</td><td>red</td><td>500</td></tr><tr><td>4</td><td>UL1015</td><td>18</td><td>black</td><td>500</td></tr><tr><td>5</td><td>UL1015</td><td>18</td><td>black</td><td>500</td></tr><tr><td>6</td><td>UL1015</td><td>18</td><td>black</td><td>500</td></tr></tbody></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1015	18	red	500	2	UL1015	18	red	500	3	UL1015	18	red	500	4	UL1015	18	black	500	5	UL1015	18	black	500	6	UL1015	18	black	500
Pin #	Wire	AWG	Color	Length ℓ (mm)																																	
1	UL1015	18	red	500																																	
2	UL1015	18	red	500																																	
3	UL1015	18	red	500																																	
4	UL1015	18	black	500																																	
5	UL1015	18	black	500																																	
6	UL1015	18	black	500																																	
<div>●Model number</div> <div>H-OU-27</div> <div>Housing : 09-50-1043 (Molex) Pin : 08-70-1030 or 08-70-1031 (Molex) Weight : 40g max</div>	<div>●Type</div> <div></div>	<div>●Wire</div> <table><thead><tr><th>Pin #</th><th>Wire</th><th>AWG</th><th>Color</th><th>Length ℓ (mm)</th></tr></thead><tbody><tr><td>1</td><td>UL1015</td><td>18</td><td>red</td><td>500</td></tr><tr><td>2</td><td>UL1015</td><td>18</td><td>black</td><td>500</td></tr><tr><td>3</td><td>UL1015</td><td>18</td><td>black</td><td>500</td></tr><tr><td>4</td><td>UL1015</td><td>18</td><td>purple</td><td>500</td></tr></tbody></table>	Pin #	Wire	AWG	Color	Length ℓ (mm)	1	UL1015	18	red	500	2	UL1015	18	black	500	3	UL1015	18	black	500	4	UL1015	18	purple	500										
Pin #	Wire	AWG	Color	Length ℓ (mm)																																	
1	UL1015	18	red	500																																	
2	UL1015	18	black	500																																	
3	UL1015	18	black	500																																	
4	UL1015	18	purple	500																																	

●Model number

H-RC-1

Housing : XHP-2 (J.S.T.)
Pin : SXH-001T-P0.6 (J.S.T.)
Weight : 7g max

●Type



●Wire

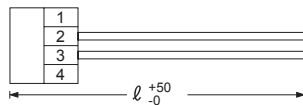
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1007	22	orange	500
2	UL1007	22	blue	500

●Model number

H-SN-1

Housing : XHP-4 (J.S.T.)
Pin : SXH-001T-P0.6 (J.S.T.)
Weight : 3g max

●Type



●Wire

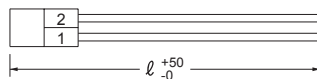
Pin #	Wire	AWG	Color	Length ℓ (mm)
1				
2	UL1061	28	black	500
3	UL1061	28	red	500
4				

●Model number

H-SN-18

Housing : PHR-2 (J.S.T.)
Pin : SPH-002T-P0.5S (J.S.T.)
Weight : 4g max

●Type



●Wire

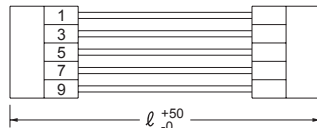
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1007	26	yellow	500
2	UL1007	26	orange	500

●Model number

H-PA-3

Housing : PHDR-10VS(J.S.T.)
Pin : SPHD-002T-P0.5(J.S.T.)
Weight : 5g max

●Type



●Wire

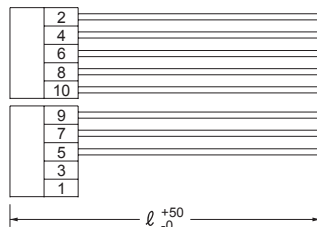
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	-	-	-	-
2	UL1061	28	red	270
3	-	-	-	-
4	UL1061	28	black	270
5	UL1061	28	yellow	270
6	UL1061	28	green	270
7	UL1061	28	blue	270
8	-	-	-	-
9	UL1061	28	orange	270
10	UL1061	28	purple	270

●Model number

H-SN-20

Housing : PHDR-10VS(J.S.T.)
Pin : SPHD-002T-P0.5(J.S.T.)
Weight : 8g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	-	-	-	-
2	UL1061	28	red	500
3	-	-	-	-
4	UL1061	28	black	500
5	UL1061	28	yellow	500
6	UL1061	28	green	500
7	UL1061	28	blue	500
8	UL1061	28	black	500
9	UL1061	28	orange	500
10	UL1061	28	purple	500

●Model number

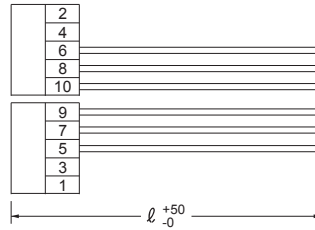
H-SN-21

Housing : PHDR-10VS(J.S.T)

Pin : SPHD-002T-P0.5(J.S.T)

Weight : 6g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	UL1061	28	yellow	500
6	UL1061	28	green	500
7	UL1061	28	blue	500
8	UL1061	28	black	500
9	UL1061	28	orange	500
10	UL1061	28	purple	500

●Model number

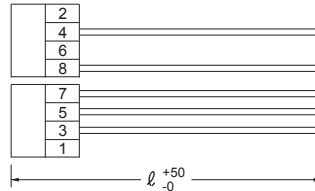
H-SN-22

Housing : PHDR-8VS(J.S.T)

Pin : SPHD-002T-P0.5(J.S.T)

Weight : 5g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	-	-	-	-
2	-	-	-	-
3	UL1061	28	pink	500
4	UL1061	28	brown	500
5	UL1061	28	white	500
6	-	-	-	-
7	UL1061	28	yellow	500
8	UL1061	28	gray	500

●Model number

H-SN-24

CN A :

Housing : PHDR-10VS(J.S.T)

Pin : SPHD-002T-P0.5(J.S.T)

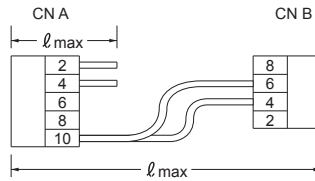
CN B :

Housing : PHDR-08VS(J.S.T)

Pin : SPHD-002T-P0.5(J.S.T)

Weight : 2g max

●Type



●Wire

Pin #		Wire	AWG	Color	Length ℓ (mm)
CN A	1	UL1061	28	red	30
	2	UL1061	28	red	30
	3	UL1061	28	black	30
	4	UL1061	28	black	30
	5	-	-	-	-
	6	-	-	-	-
	7	-	-	-	-
	8	-	-	-	-
	9	UL1061	28	black	70
	10	UL1061	28	black	70
CN B	1	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
	4	UL1061	28	black	70
	5	UL1061	28	black	70
	6	-	-	-	-
	7	-	-	-	-
	8	-	-	-	-

* Pin #1 and #2, Pin #3 and #4 in CN A are connected by harness.

* Pin #9 in CN A and Pin #4 in CN B are connected by harness.

* Pin #10 in CN A and Pin #5 in CN B are connected by harness.

SC Series

Mating harness

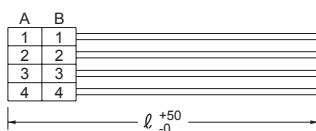
Model	Harness model #	Contents	Connector	
			SCHA	SCDA
SC Series	H-SN-27	Harness for using remote signal ON/OFF function	CN1~CN4	CN1,CN2
	H-SN-28	Harness for using MAS,SLV,CTB,PCONT,COM terminal	CN5,CN6	CN3,CN4
	H-SN-29	Harness for using system ON/OFF function	CN7,CN8	CN5,CN6
	H-SN-30	Harness for using alarm / output voltage monitor terminal	CN9,CN10	CN7,CN8
	H-OU-35	Output harness	Output connector 1~20	Output connector 1~14
	H-PA-7	Harness for using parallel connection (SLAVE unit-SLAVE unit)	CN5,CN6	CN3,CN4
	H-PA-8	Harness for using parallel connection (MASTER unit-SLAVE unit)	CN5,CN6	CN3,CN4

●Model number

H-SN-27

Housing : 1-1318119-4 (Tyco Electronics AMP)
Pin : 1318105-1 or 1318107-1
(Tyco Electronics AMP)
Weight : 100g max

●Type



●Wire

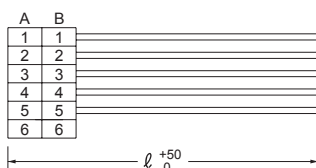
Pin #	Wire	AWG	Color	Length ℓ (mm)
A 1	UL1007	22	brown	2000
B 1	UL1007	22	green	2000
A 2	UL1007	22	red	2000
B 2	UL1007	22	blue	2000
A 3	UL1007	22	orange	2000
B 3	UL1007	22	purple	2000
A 4	UL1007	22	yellow	2000
B 4	UL1007	22	gray	2000

●Model number

H-SN-28

Housing : 1-1318118-6 (Tyco Electronics AMP)
Pin : 1318105-1 or 1318107-1
(Tyco Electronics AMP)
Weight : 65g max

●Type



●Wire

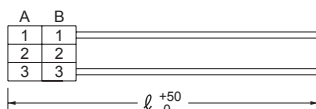
Pin #	Wire	AWG	Color	Length ℓ (mm)
A 1	UL1007	22	brown	2000
B 1	-	-	-	-
A 2	UL1007	22	red	2000
B 2	-	-	-	-
A 3	UL1007	22	orange	2000
B 3	-	-	-	-
A 4	UL1007	22	yellow	2000
B 4	-	-	-	-
A 5	UL1007	22	green	2000
B 5	-	-	-	-
A 6	-	-	-	-
B 6	-	-	-	-

●Model number

H-SN-29

Housing : 1-1318119-3 (Tyco Electronics AMP)
Pin : 1318105-1 or 1318107-1
(Tyco Electronics AMP)
Weight : 25g max

●Type



●Wire

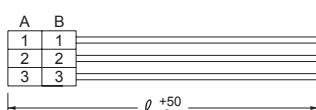
Pin #	Wire	AWG	Color	Length ℓ (mm)
A 1	UL1007	22	brown	2000
B 1	-	-	-	-
A 2	-	-	-	-
B 2	-	-	-	-
A 3	UL1007	22	orange	2000
B 3	-	-	-	-

●Model number

H-SN-30

Housing : 2-1318119-3 (Tyco Electronics AMP)
Pin : 1318105-1 or 1318107-1
(Tyco Electronics AMP)
Weight : 50g max

●Type



●Wire

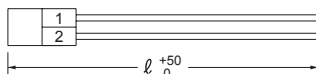
Pin #	Wire	AWG	Color	Length ℓ (mm)
A 1	UL1007	22	brown	2000
B 1	-	-	-	-
A 2	UL1007	22	red	2000
B 2	UL1007	22	green	2000
A 3	UL1007	22	orange	2000
B 3	-	-	-	-

●Model number

H-OU-35

Housing : 1-179958-2 (Tyco Electronics AMP)
Pin : 179956-2 or 316041-2
(Tyco Electronics AMP)
Weight : 6g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1015	10	red	2000
2	UL1015	10	black	2000

●Model number

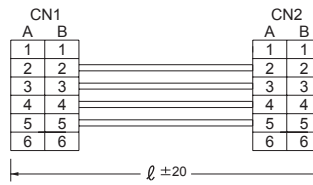
H-PA-7

Housing : 1-1318118-6 (Tyco Electronics AMP)

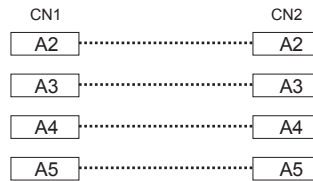
Pin : 1318105-1 or 1318107-1
(Tyco Electronics AMP)

Weight : 20g max

●Type



●Connection



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
CN1	A 1	-	-	-
	B 1	-	-	-
	A 2	UL1007	red	400
	B 2	-	-	-
	A 3	UL1007	orange	400
	B 3	-	-	-
	A 4	UL1007	yellow	400
	B 4	-	-	-
	A 5	UL1007	green	400
	B 5	-	-	-
	A 6	-	-	-
	B 6	-	-	-
CN2	A 1	-	-	-
	B 1	-	-	-
	A 2	UL1007	red	400
	B 2	-	-	-
	A 3	UL1007	orange	400
	B 3	-	-	-
	A 4	UL1007	yellow	400
	B 4	-	-	-
	A 5	UL1007	green	400
	B 5	-	-	-
	A 6	-	-	-
	B 6	-	-	-

●Model number

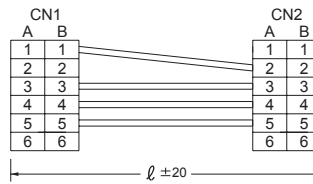
H-PA-8

Housing : 1-1318118-6 (Tyco Electronics AMP)

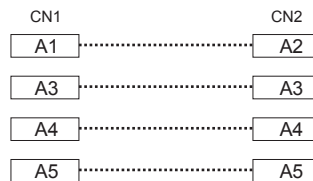
Pin : 1318105-1 or 1318107-1
(Tyco Electronics AMP)

Weight : 20g max

●Type



●Connection



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
CN1	A 1	UL1007	brown	400
	B 1	-	-	-
	A 2	-	-	-
	B 2	-	-	-
	A 3	UL1007	orange	400
	B 3	-	-	-
	A 4	UL1007	yellow	400
	B 4	-	-	-
	A 5	UL1007	green	400
	B 5	-	-	-
	A 6	-	-	-
	B 6	-	-	-
CN2	A 1	-	-	-
	B 1	-	-	-
	A 2	UL1007	brown	400
	B 2	-	-	-
	A 3	UL1007	orange	400
	B 3	-	-	-
	A 4	UL1007	yellow	400
	B 4	-	-	-
	A 5	UL1007	green	400
	B 5	-	-	-
	A 6	-	-	-
	B 6	-	-	-

PMA Series

Mating harness

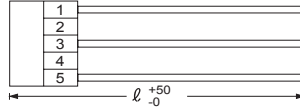
Model	Harness model #	Contents
PMA15F, PMA30F, PMA60F, PMA100F	H-IN -15	Input harness when I/O interface is connector (Mfr:Tyco Electronics AMP) type
PMA15F, PMA30F	H-OU-28	Output harness when I/O interface is connector (Mfr:Tyco Electronics AMP) type
PMA60F	H-OU-29	Output harness when I/O interface is connector (Mfr:Tyco Electronics AMP) type
PMA100F	H-OU-30	Output harness when I/O interface is connector (Mfr:Tyco Electronics AMP) type
PMA15F, PMA30F, PMA60F, PMA100F	H-IN - 3	Input harness when I/O interface is connector (Mfr:J.S.T) type (option:-J)
PMA15F, PMA30F	H-OU- 9	Output harness when I/O interface is connector (Mfr:J.S.T) type (option:-J)
PMA60F	H-OU-18	Output harness when I/O interface is connector (Mfr:J.S.T) type (option:-J)
PMA100F	H-OU-10	Output harness when I/O interface is connector (Mfr:J.S.T) type (option:-J)
PMA60F, PMA100F	H-RC- 1	Harness for using option : -R

●Model number

H-IN-3

Housing : VHR-5N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 20g max

●Type



●Wire

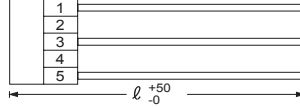
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL 1015	20	white	500
2				
3	UL 1015	20	black	500
4				
5	UL 1015	20	green	500

●Model number

H-IN-15

Housing : 1-1123722-5 (Tyco Electronics AMP)
Pin : 1123721-1 or
1318912-1 (Tyco Electronics AMP)
Weight : 20g max

●Type



●Wire

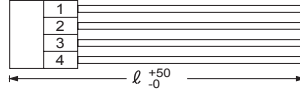
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL 1015	20	white	500
2				
3	UL 1015	20	black	500
4				
5	UL 1015	20	green	500

●Model number

H-OU-9

Housing : VHR-4N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 40g max

●Type



●Wire

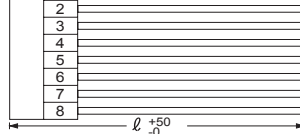
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL 1015	18	black	500
2	UL 1015	18	black	500
3	UL 1015	18	red	500
4	UL 1015	18	red	500

●Model number

H-OU-10

Housing : VHR-8N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 80g max

●Type



●Wire

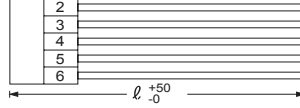
Pin #	Wire	AWG	Color	Length ℓ (mm)
1 - 4	UL 1015	18	black	500
5 - 8	UL 1015	18	red	500

●Model number

H-OU-18

Housing : VHR-6N (J.S.T.)
Pin : SVH-21T-P1.1 (J.S.T.)
Weight : 60g max

●Type



●Wire

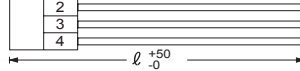
Pin #	Wire	AWG	Color	Length ℓ (mm)
1 - 3	UL 1015	18	black	500
4 - 6	UL 1015	18	red	500

●Model number

H-OU-28

Housing : 1-1123722-4 (Tyco Electronics AMP)
Pin : 1123721-1 or
1318912-1 (Tyco Electronics AMP)
Weight : 40g max

●Type



●Wire

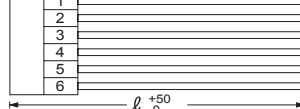
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL 1015	18	black	500
2	UL 1015	18	black	500
3	UL 1015	18	red	500
4	UL 1015	18	red	500

●Model number

H-OU-29

Housing : 1-1123722-6 (Tyco Electronics AMP)
Pin : 1123721-1 or
1318912-1 (Tyco Electronics AMP)
Weight : 60g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1 - 3	UL 1015	18	black	500
4 - 6	UL 1015	18	red	500

●Model number

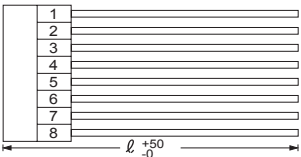
H-OU-30

Housing : 1-1123722-8 (Tyco Electronics AMP)

Pin : 1123721-1 or
1318912-1 (Tyco Electronics AMP)

Weight : 75g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1 - 4	UL1015	18	black	500
5 - 8	UL1015	18	red	500

●Model number

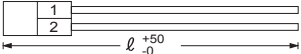
H-RC-1

Housing : XHP-2 (J.S.T.)

Pin : SXH-001T-P0.6 (J.S.T.)

Weight : 7g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1007	22	orange	500
2	UL1007	22	blue	500

Harness to use the function is prepared in PLA series.

PLA Series

The latest information is in our website

Mating harness

Model	Harness model #	Contents
PLA15F, PLA30F, PLA50F, PLA100F, PLA150F	H-IN-22	Input harness when I/O interface is connector type (option : -J)
PLA100F, PLA150F	H-OU-37	Output harness when I/O interface is connector type (option : -J)
PLA15F, PLA30F, PLA50F	H-OU-38	Output harness when I/O interface is connector type (option : -J)
PLA100F, PLA150F	H-RC-1	Harness for using option : -R
PLA300F	H-RC-6	Harness for using option : -R
PLA600F, PLA1000F, PLA1500F	H-PA-9	Harness for parallel operation (option: -W)
	H-SN-32	Harness for using all functions of option -W and -R
	H-SN-33	Harness for using all functions except remote sensing of option -W and -R
	H-RC-5	Harness for using a function of option -R
PLA300F, PLA600F, PLA1000F, PLA1500F	H-SN-18	Harness for using option : -V

* These harnesses are used for product which includes option.

●Model number

H-IN-22

Housing : 1-1123722-5 (Tyco Electronics AMP)

Pin : 1123721-1 or 1318912-1 (Tyco Electronics AMP)

Weight : 30g max

●Type

●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1015	18	green	500
2				
3	UL1015	18	white	500
4				
5	UL1015	18	black	500

●Model number

H-OU-37

Housing : 1-1123722-6 (Tyco Electronics AMP)

Pin : 1123721-1 or 1318912-1 (Tyco Electronics AMP)

Weight : 60g max

●Type

●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1 - 3	UL1015	18	red	500
4 - 6	UL1015	18	black	500

●Model number

H-OU-38

Housing : 1-1123722-4 (Tyco Electronics AMP)

Pin : 1123721-1 or 1318912-1 (Tyco Electronics AMP)

Weight : 40g max

●Type

●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1, 2	UL1015	18	red	500
3, 4	UL1015	18	black	500

●Model number

H-RC-1

Housing : XHP-2 (J.S.T.)

Pin : SXH-001T-P0.6 (J.S.T.)

Weight : 7g max

●Type

●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1007	22	orange	500
2	UL1007	22	blue	500

●Model number

H-RC-6

Housing : XAP-02V-1 (J.S.T.)

Pin : SXA-001T-P0.6(J.S.T.)

Weight : 7g max

●Type

●Wire

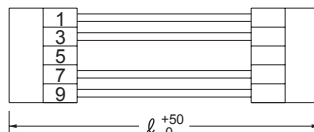
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1007	22	orange	500
2	UL1007	22	blue	500

●Model number

H-PA-9

Housing : PHDR-10VS(J.S.T.)
Pin : SPHD-002T-P0.5(J.S.T.)
Weight : 4g max

●Type



●Wire

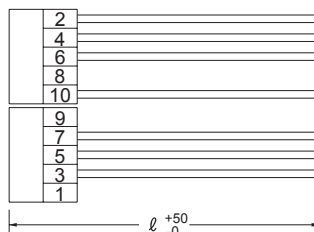
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	-	-	-	-
2	UL1061	28	red	270
3	UL1061	28	orange	270
4	UL1061	28	purple	270
5	-	-	-	-
6	-	-	-	-
7	UL1061	28	green	270
8	-	-	-	-
9	-	-	-	-
10	UL1061	28	black	270

●Model number

H-SN-32

Housing : PHDR-10VS(J.S.T.)
Pin : SPHD-002T-P0.5(J.S.T.)
Weight : 7g max

●Type



●Wire

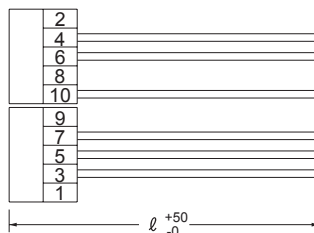
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	-	-	-	-
2	UL1061	28	red	500
3	UL1061	28	orange	500
4	UL1061	28	purple	500
5	UL1061	28	yellow	500
6	UL1061	28	blue	500
7	UL1061	28	green	500
8	-	-	-	-
9	-	-	-	-
10	UL1061	28	black	500

●Model number

H-SN-33

Housing : PHDR-10VS(J.S.T.)
Pin : SPHD-002T-P0.5(J.S.T.)
Weight : 6g max

●Type



●Wire

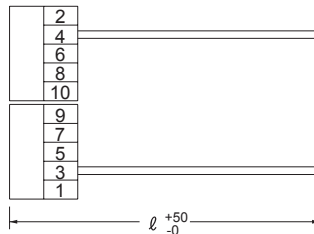
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	-	-	-	-
2	-	-	-	-
3	UL1061	28	orange	500
4	UL1061	28	purple	500
5	UL1061	28	yellow	500
6	UL1061	28	blue	500
7	UL1061	28	green	500
8	-	-	-	-
9	-	-	-	-
10	UL1061	28	black	500

●Model number

H-RC-5

Housing : PHDR-10VS(J.S.T.)
Pin : SPHD-002T-P0.5(J.S.T.)
Weight : 3g max

●Type



●Wire

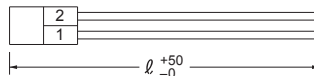
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	-	-	-	-
2	-	-	-	-
3	UL1061	28	orange	500
4	UL1061	28	purple	500
5	-	-	-	-
6	-	-	-	-
7	-	-	-	-
8	-	-	-	-
9	-	-	-	-
10	-	-	-	-

●Model number

H-SN-18

Housing : PHR-2(J.S.T.)
Pin : SPH-002T-P0.5S(J.S.T.)
Weight : 4g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1007	26	yellow	500
2	UL1007	26	orange	500

SNDPG Series SNDPF Series SNDHS Series SNDBS Series

Mating harness

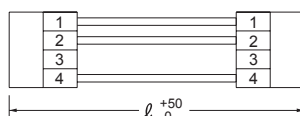
Model	Harness model #	Contents
SNDPG750 SNDPF1000	H-IN-19	Output harness, L=90mm (Type connector for connecting SNDHS, SNDBS)
	H-IN-20	Output harness, L=150mm (Type connector for connecting SNDHS, SNDBS)
	H-IN-21	Output harness
SNDHS50B/100B/250B SNDBS400B/700B	H-IN-19	Input harness, L=90mm (Type connector for connecting SNDPG, SNDPF)
	H-IN-20	Input harness, L=150mm (Type connector for connecting SNDPG, SNDPF)
	H-IN-21	Input harness
SNDPG750	H-RC-1	Harness for using CN2 (RC) ★option:-R
SNDPF1000	H-RC-1	Harness for using CN3 (AUX, I/O)
SNDHS50A/100A	H-RC-1	Harness for using CN2 (RC) ★option:-R
SNDHS200A	H-RC-1	Harness for using CN2 (RC) ★option:-R
	H-SN-45	Harness for using CN3 (Remote sensing)
SNDHS50B/100B	H-RC-1	Harness for using CN3 (RC2), CN4 (RC3) ★option:-R
SNDHS250B	H-RC-1	Harness for using CN3 (RC2), CN5 (RC3) ★option:-R
	H-SN-45	Harness for using CN4 (Remote sensing)
SNDPF1000	H-IN-20	Harness output for parallel connection
	H-PA-10	Harnesses for parallel signal output (CN4 and CN5)
	H-SN-44	Harness for using functions of CN4 and CN5
SNDBS400B/700B	H-SN-45	Harness for using CN3 (Remote sensing)
	H-SN-14	Harness for using functions of CN4
	H-PA-11	Harnesses for parallel signal output (CN5 and CN6)
	H-SN-46	Harness for using functions of CN5 and CN6

●Model number

H-IN-19

Housing : VHR-4N (J.S.T)
Pin : SVH-21T-P1.1 (J.S.T)
Weight : 8g max

●Type



●Wire

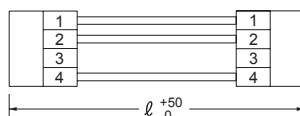
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1015	18	blue	90
2	UL1015	18	black	90
3				
4	UL1015	18	red	90

●Model number

H-IN-20

Housing : VHR-4N (J.S.T)
Pin : SVH-21T-P1.1 (J.S.T)
Weight : 13g max

●Type



●Wire

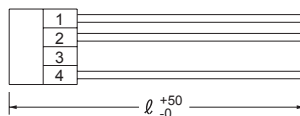
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1015	18	blue	150
2	UL1015	18	black	150
3				
4	UL1015	18	red	150

●Model number

H-IN-21

Housing : VHR-4N (J.S.T)
Pin : SVH-21T-P1.1 (J.S.T)
Weight : 30g max

●Type



●Wire

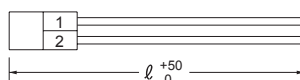
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1015	18	blue	500
2	UL1015	18	black	500
3				
4	UL1015	18	red	500

●Model number

H-RC-1

Housing : XHP-2 (J.S.T)
Pin : SXH-001T-P0.6 (J.S.T)
Weight : 7g max

●Type



●Wire

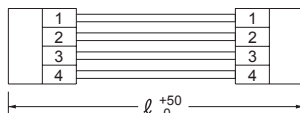
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1007	22	orange	500
2	UL1007	22	blue	500

●Model number

H-PA-10

Housing : XHP-4 (J.S.T)
Pin : SXH-001T-P0.6 (J.S.T)
Weight : 5g max

●Type



●Wire

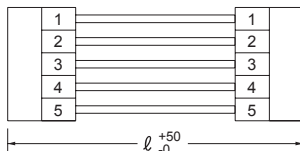
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1007	22	orange	150
2	UL1007	22	yellow	150
3	UL1007	22	black	150
4	UL1007	22	blue	150

●Model number

H-PA-11

Housing : XHP-5 (J.S.T)
Pin : SXH-001T-P0.6 (J.S.T)
Weight : 5g max

●Type



●Wire

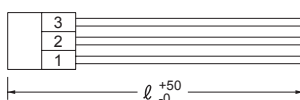
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1007	22	red	100
2	UL1007	22	black	100
3	UL1007	22	yellow	100
4	UL1007	22	blue	100
5	UL1007	22	orange	100

●Model number

H-SN-14

Housing : XHP-3 (J.S.T)
Pin : SXH-001T-P0.6 (J.S.T)
Weight : 10g max

●Type



●Wire

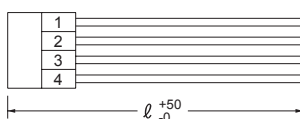
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1007	22	black	500
2	UL1007	22	yellow	500
3	UL1007	22	red	500

●Model number

H-SN-44

Housing : XHP-4 (J.S.T)
Pin : SXH-001T-P0.6 (J.S.T)
Weight : 15g max

●Type



●Wire

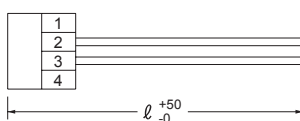
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1007	22	orange	500
2	UL1007	22	yellow	500
3	UL1007	22	black	500
4	UL1007	22	blue	500

●Model number

H-SN-45

Housing : XHP-4 (J.S.T)
Pin : SXH-001T-P0.6 (J.S.T)
Weight : 3g max

●Type



●Wire

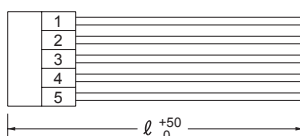
Pin #	Wire	AWG	Color	Length ℓ (mm)
1				
2	UL1061	28	red	500
3	UL1061	28	black	500
4				

●Model number

H-SN-46

Housing : XHP-5 (J.S.T)
Pin : SXH-001T-P0.6 (J.S.T)
Weight : 20g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1007	22	red	500
2	UL1007	22	black	500
3	UL1007	22	yellow	500
4	UL1007	22	blue	500
5	UL1007	22	orange	500

Harness to use the function is prepared in GHA series.

GHA Series

Mating harness

Standard type (Molex connector)

Model	Harness model #	Contents
GHA300F, GHA500F	H-IN-17	Input harness
	H-SN-34	Harness for using all functions.
	H-SN-35	Harness for using AUX(5V) remote control and PG terminal.

-J type (J.S.T. connector)

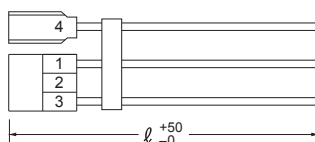
Model	Harness model #	Contents
GHA300F, GHA500F	H-IN-18	Input harness
	H-SN-38	Harness for using all functions.
	H-SN-39	Harness for using AUX(5V) remote control and PG terminal.

●Model number

H-IN-17

Housing : 09-50-8031 (Molex)
Pin (1-3) : 08-50-0105 (Molex)
 : 08-65-0114 (Molex)
(4) : 170603-2 (Tyco Electronics)
Weight : 25g max

●Type



●Wire

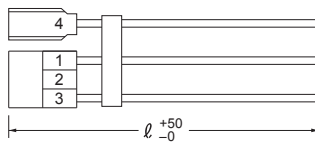
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL3239	18	black	500
2				
3	UL3239	18	white	500
4	UL3239	18	green	500

●Model number

H-IN-18

Housing : VHR-3N (J.S.T.)
Pin (1-3) : SVH-21T-P1.1 (J.S.T.)
(4) : 170603-2 (Tyco Electronics)
Weight : 35g max

●Type



●Wire

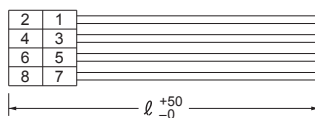
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1015	18	black	500
2				
3	UL1015	18	white	500
4	UL1015	18	green	500

●Model number

H-SN-34

Housing : 51110-0851 (Molex)
Pin : 50394-8051 (Molex)
Weight : 8g max

●Type



●Wire

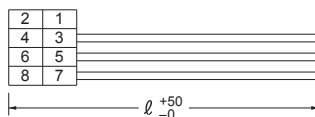
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1061	28	red	500
2	UL1061	28	black	500
3	UL1061	28	blue	500
4	UL1061	28	brown	500
5	UL1061	28	yellow	500
6	UL1061	28	gray	500
7	UL1061	28	orange	500
8	UL1061	28	purple	500

●Model number

H-SN-35

Housing : 51110-0851 (Molex)
Pin : 50394-8051 (Molex)
Weight : 6g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1				
2				
3	UL1061	28	blue	500
4	UL1061	28	brown	500
5	UL1061	28	yellow	500
6	UL1061	28	gray	500
7	UL1061	28	orange	500
8	UL1061	28	purple	500

●Model number

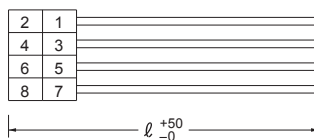
H-SN-38

Housing : PHDR-08VS (J.S.T.)

Pin : SPHD-002T-P0.5 (J.S.T.)

Weight : 8g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1061	28	red	500
2	UL1061	28	black	500
3	UL1061	28	blue	500
4	UL1061	28	brown	500
5	UL1061	28	yellow	500
6	UL1061	28	gray	500
7	UL1061	28	orange	500
8	UL1061	28	purple	500

●Model number

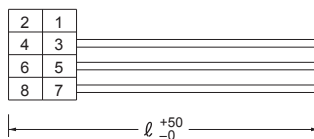
H-SN-39

Housing : PHDR-08VS (J.S.T.)

Pin : SPHD-002T-P0.5 (J.S.T.)

Weight : 6g max

●Type



●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1				
2				
3	UL1061	28	blue	500
4	UL1061	28	brown	500
5	UL1061	28	yellow	500
6	UL1061	28	gray	500
7	UL1061	28	orange	500
8	UL1061	28	purple	500

FETA Series

Mating harness

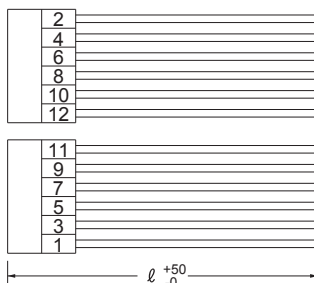
Model	Harness model #	Contents
FE series	H-SN-47	Harness for using all functions of CN1 and CN2
	H-PA-12	Harness for parallel operation
	H-PA-13	Harness for parallel operation and using all other functions of CN1 and CN2

●Model number

H-SN-47

Housing : PUDP-12V-S(J.S.T.)
Pin : SPUD-002T-P0.5(J.S.T.)
Weight : 13g max

●Type



●Wire

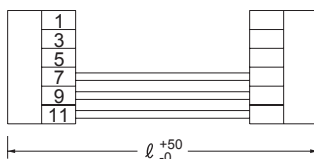
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1061	28	white	500
2	UL1061	28	pink	500
3	UL1061	28	brown	500
4	UL1061	28	yellow	500
5	UL1061	28	gray	500
6	UL1061	28	orange	500
7	UL1061	28	purple	500
8	UL1061	28	red	500
9	UL1061	28	black	500
10	UL1061	28	blue	500
11	UL1061	28	yellow	500
12	UL1061	28	green	500

●Model number

H-PA-12

Housing : PUDP-12V-S(J.S.T.)
Pin : SPUD-002T-P0.5(J.S.T.)
Weight : 5g max

●Type



●Wire

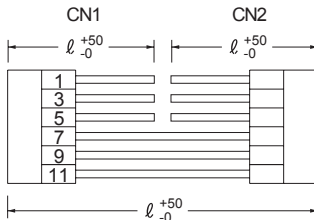
Pin #	Wire	AWG	Color	Length ℓ (mm)
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-
7	UL1061	28	purple	210
8	UL1061	28	red	210
9	UL1061	28	black	210
10	UL1061	28	blue	210
11	UL1061	28	yellow	210
12	UL1061	28	green	210

●Model number

H-PA-13

Housing : PUDP-12V-S(J.S.T.)
Pin : SPUD-002T-P0.5(J.S.T.)
Weight : 16g max

●Type



- * Terminals of Pin #1 - #6 in CN1 and CN2 are opened.
- * Pin #7 - #12 in CN1 are connected to same pins in CN2 by harness.

●Wire

Pin #	Wire	AWG	Color	Length ℓ (mm)
1	UL1061	28	white	500
2	UL1061	28	pink	500
3	UL1061	28	brown	500
4	UL1061	28	yellow	500
5	UL1061	28	gray	500
6	UL1061	28	orange	500
7	UL1061	28	purple	210
8	UL1061	28	red	210
9	UL1061	28	black	210
10	UL1061	28	blue	210
11	UL1061	28	yellow	210
12	UL1061	28	green	210

Terminal Attachment

Terminal attachment to facilitate two or more terminal connections to power supply output is prepared in PBA, MAX and ACE series.

Type	Mating Model	Contents
B-MX-1	PBA600F MAX1600F MAX1600T MAX3200T	Terminal attachment to facilitate terminal connections to power supply output
B-MX-9	MAX1600F MAX1600T MAX3200T	Terminal attachment for series operation as output modules

B-MX-1	B-MX-9
<p>Size</p> <p> ★ Material : Copper ★ Thickness : 2.0 ★ Dimension in mm ★ Weight : 30g max </p>	<p>Size</p> <p> ★ Material : Copper ★ Thickness : 1.5 ★ Dimension in mm ★ Weight : 15g max </p>

- ★ It is necessary to install B-MX-1 on opposite direction to avoid short-circuit between + and - terminal block.
- ★ Please note the direction of the installation to prevent the short-circuit between the outputs when using B-MX-1 and B-MX-9 at the same time.
- ★ The cover of terminal block does not be attached to B-MX-1 with installation screw and solderless terminal occasionally.

Type	Mating Model	Contents
B-ACE-7	ACE series	Terminal attachment to facilitate faston terminal output modules
B-ACE-8	ACE series	Terminal attachment to facilitate wiring
B-ACE-9	ACE series	Terminal attachment for series operation as output modules

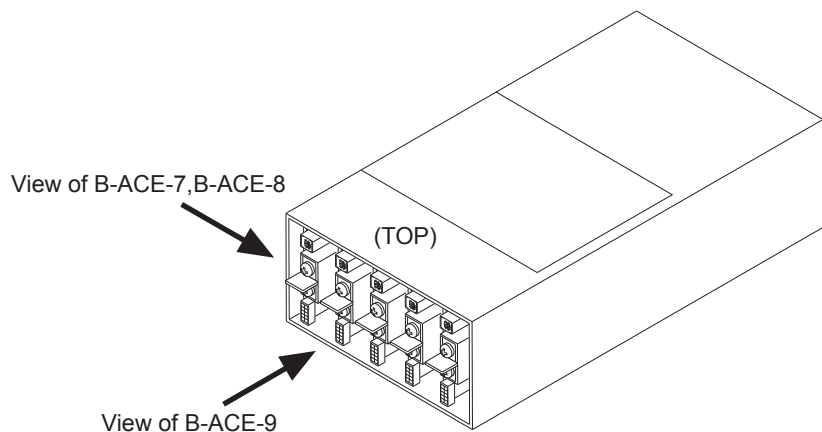
★These attachments cannot be used for module code S, T, U, Y, W, Z, 9, Q, and V.

B-ACE-7	B-ACE-8
<p>Size</p> <p>Installation (TOP)</p> <p>★ Material : Copper ★ Thickness : 0.8 ★ Dimension in mm ★ Weight : 3g max</p>	<p>Size</p> <p>Installation (TOP)</p> <p>★ Material : Brass ★ Thickness : 1.0 ★ Dimension in mm ★ Weight : 3g max</p> <p>★ Material : Brass ★ Thickness : 1.2 ★ Dimension in mm ★ Weight : 5g max</p>

★ B-ACE-7: Recommended faston terminal #250.
Quantity is 1 piece.

★ B-ACE-8: Please be careful with that B-ACE-8 is not stressed in wiring.
Quantity is a couple.

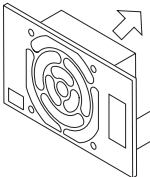
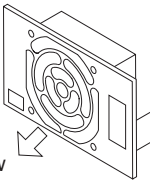
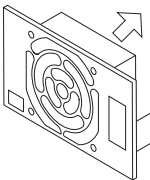
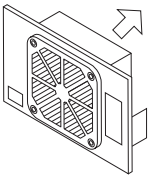
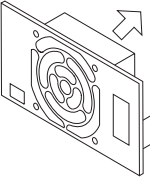
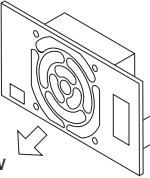
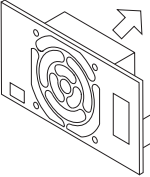
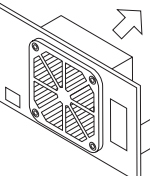
B-ACE-9
<p>Size</p> <p>Installation (TOP)</p> <p>★ Material : Brass ★ Thickness : 1.0 ★ Dimension in mm ★ Weight : 4g max</p>



Fan unit

★ Fan unit is prepared by the option.

ACE Series MAX Series

Fan unit type	Matching model	External	Pin connection								
FAN-AC3 (Standard)	ACE300F <Standard>	 <p>Air flow</p> <p>★ Weight : 75g max</p>	<p>CONNECTOR = XAP-03V-1 (Mfr : J. S. T) TERMINAL = SXA-001T-P0.6 (Mfr : J. S. T)</p> <table><tr><th>Pin No.</th><th>Content</th></tr><tr><td>1</td><td>GND</td></tr><tr><td>2</td><td>FAN ALARM</td></tr><tr><td>3</td><td>POWER</td></tr></table> <p>LENGTH OF HARNESS = 60 ± 10mm</p>	Pin No.	Content	1	GND	2	FAN ALARM	3	POWER
Pin No.	Content										
1	GND										
2	FAN ALARM										
3	POWER										
FAN-AC3-F (Air flow reverse : -F)	ACE300F <Modification : F>	 <p>Air flow</p> <p>★ Weight : 75g max</p>									
FAN-AC3-K (Low speed : -K)	ACE300F <Modification : K>	 <p>Air flow</p> <p>★ Weight : 85g max</p>									
FAN-AC3-T (With filter : -T)	ACE300F <Modification : T>	 <p>Air flow</p> <p>★ Weight : 130g max</p>	<p>CONNECTOR = XAP-03V-1 (Mfr : J. S. T) TERMINAL = SXA-001T-P0.6 (Mfr : J. S. T)</p> <table><tr><th>Pin No.</th><th>Content</th></tr><tr><td>1</td><td>GND</td></tr><tr><td>2</td><td>FAN ALARM</td></tr><tr><td>3</td><td>POWER</td></tr></table> <p>LENGTH OF HARNESS = 55 ± 10mm</p>	Pin No.	Content	1	GND	2	FAN ALARM	3	POWER
Pin No.	Content										
1	GND										
2	FAN ALARM										
3	POWER										
FAN-AC4 (Standard)	ACE450F ACE650F <Standard>	 <p>Air flow</p> <p>★ Weight : 130g max</p>									
FAN-AC4-F (Air flow reverse : -F)	ACE450F ACE650F <Modification : F>	 <p>Air flow</p> <p>★ Weight : 130g max</p>									
FAN-AC4-K (Low speed : -K)	ACE450F ACE650F <Modification : K>	 <p>Air flow</p> <p>★ Weight : 130g max</p>									
FAN-AC4-T (With filter : -T)	ACE450F ACE650F <Modification : T>	 <p>Air flow</p> <p>★ Weight : 180g max</p>									

★ 1 Handle with care and don't add the impact such as falls or throwing to the unit.

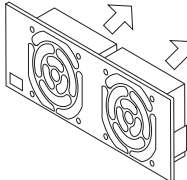
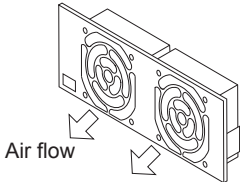
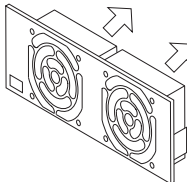
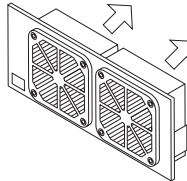
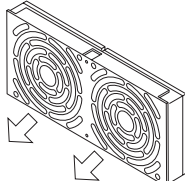
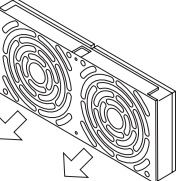
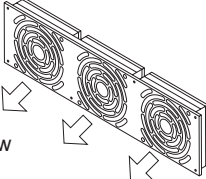
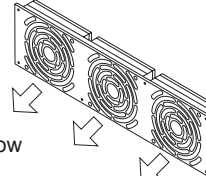
★ 2 Exchange the unit after intercepting the input power.

★ 3 When the unit is exchanged, make sure there are not loosening of the connector and shutting the harness.

Fan unit

★Fan unit is prepared by the option.

ACE Series MAX Series

Fan unit type	Matching model	External	Pin connection								
FAN-AC9 (Standard)	ACE900F <Standard>	 ★Weight : 220g max	<div>CONNECTOR = XAP-03V-1 (Mfr : J. S. T) TERMINAL = SXA-001T-P0.6 (Mfr : J. S. T)</div> <table><tr><th>Pin No.</th><th>Content</th></tr><tr><td>1</td><td>GND</td></tr><tr><td>2</td><td>FAN ALARM</td></tr><tr><td>3</td><td>POWER</td></tr></table> <div>LENGTH OF HARNESS = 55 ± 10mm</div>	Pin No.	Content	1	GND	2	FAN ALARM	3	POWER
Pin No.	Content										
1	GND										
2	FAN ALARM										
3	POWER										
FAN-AC9-F (Air flow reverse : -F)	ACE900F <Modification : F>	 ★Weight : 220g max									
FAN-AC9-K (Low speed : -K)	ACE900F <Modification : K>	 ★Weight : 220g max									
FAN-AC9-T (With filter : -T)	ACE900F <Modification : T>	 ★Weight : 320g max									
FAN-MA1 (Standard)	MAX1600F MAX1600T <Standard>	 ★Weight : 400g max	<div>CONNECTOR = XHP-3 (Mfr : J. S. T) TERMINAL = SXH-001T-P0.6 (Mfr : J. S. T)</div> <table><tr><th>Pin No.</th><th>Content</th></tr><tr><td>1</td><td>POWER</td></tr><tr><td>2</td><td>FAN ALARM</td></tr><tr><td>3</td><td>GND</td></tr></table> <div>LENGTH OF HARNESS = 210 ± 15mm</div>	Pin No.	Content	1	POWER	2	FAN ALARM	3	GND
Pin No.	Content										
1	POWER										
2	FAN ALARM										
3	GND										
FAN-MA1-B (Long life : -B)	MAX1600F MAX1600T <Modification : B>	 ★Weight : 550g max									
FAN-MA3 (Standard)	MAX3200T <Standard>	 ★Weight : 610g max									
FAN-MA3-B (Long life : -B)	MAX3200T <Modification : B>	 ★Weight : 830g max									

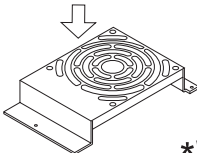
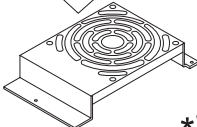
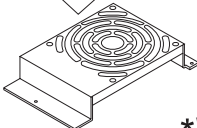
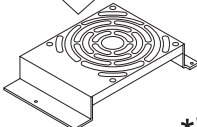
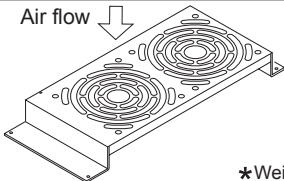
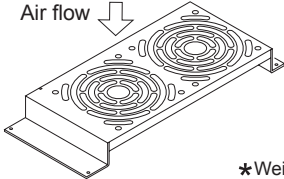
★ 1 Handle with care and don't add the impact such as falls or throwing to the unit.

★ 2 Exchange the unit after intercepting the input power.

★ 3 When the unit is exchanged, make sure there are not loosening of the connector and shutting the harness.

Fan unit

ADA Series

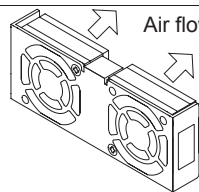
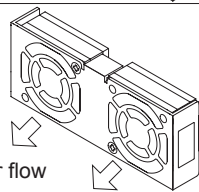
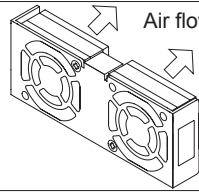
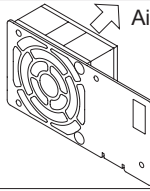
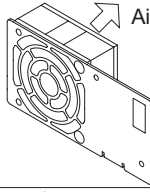
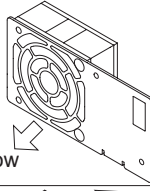
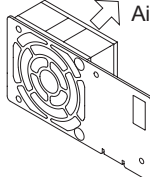
Fan unit type	Matching model	External	Harness								
FAN-AD6-24	ADA600F-24	<div><div>Air flow</div><div></div><div>★Weight : 230g max</div></div>	<table><tr><th colspan="2">Wire</th></tr><tr><th>Color</th><th>Content</th></tr><tr><td>red</td><td>POWER</td></tr><tr><td>black</td><td>GND</td></tr></table>	Wire		Color	Content	red	POWER	black	GND
Wire											
Color	Content										
red	POWER										
black	GND										
FAN-AD6-48	ADA600F-30 ADA600F-36 ADA600F-48	<div><div>Air flow</div><div></div><div>★Weight : 220g max</div></div>	<table><tr><th colspan="2">Wire</th></tr><tr><th>Color</th><th>Content</th></tr><tr><td>red</td><td>POWER</td></tr><tr><td>black</td><td>GND</td></tr></table>	Wire		Color	Content	red	POWER	black	GND
Wire											
Color	Content										
red	POWER										
black	GND										
FAN-AD7-24	ADA750F-24	<div><div>Air flow</div><div></div><div>★Weight : 230g max</div></div>	<table><tr><th colspan="2">Wire</th></tr><tr><th>Color</th><th>Content</th></tr><tr><td>red</td><td>POWER</td></tr><tr><td>black</td><td>GND</td></tr></table>	Wire		Color	Content	red	POWER	black	GND
Wire											
Color	Content										
red	POWER										
black	GND										
FAN-AD7-48	ADA750F-30 ADA750F-36 ADA750F-48	<div><div>Air flow</div><div></div><div>★Weight : 220g max</div></div>	<table><tr><th colspan="2">Wire</th></tr><tr><th>Color</th><th>Content</th></tr><tr><td>red</td><td>POWER</td></tr><tr><td>black</td><td>GND</td></tr></table>	Wire		Color	Content	red	POWER	black	GND
Wire											
Color	Content										
red	POWER										
black	GND										
FAN-AD1-24	ADA1000F-24	<div><div>Air flow</div><div></div><div>★Weight : 450g max</div></div>	<table><tr><th colspan="2">Wire</th></tr><tr><th>Color</th><th>Content</th></tr><tr><td>red</td><td>POWER</td></tr><tr><td>black</td><td>GND</td></tr></table>	Wire		Color	Content	red	POWER	black	GND
Wire											
Color	Content										
red	POWER										
black	GND										
FAN-AD1-48	ADA1000F-30 ADA1000F-36 ADA1000F-48	<div><div>Air flow</div><div></div><div>★Weight : 420g max</div></div>	<table><tr><th colspan="2">Wire</th></tr><tr><th>Color</th><th>Content</th></tr><tr><td>red</td><td>POWER</td></tr><tr><td>black</td><td>GND</td></tr></table>	Wire		Color	Content	red	POWER	black	GND
Wire											
Color	Content										
red	POWER										
black	GND										

- ★ 1 Handle with care and don't add the impact such as falls or throwing to the unit.
- ★ 2 Exchange the unit after intercepting the input power.
- ★ 3 When the unit is exchanged, make sure there are not loosening of terminal screw and shutting the harness.

Fan unit

★ Fan unit is prepared by the option.

PB Series

Fan unit type	Matching model	External	Pin connection								
FAN-PB3 (Standard)	PBA300F <Standard>	 ★ Weight : 90g max	CONNECTOR = PHR-3 (Mfr : J. S. T) TERMINAL = SPH-002T-P0.5S (Mfr : J. S. T) <table><tr><th>Pin No.</th><th>Content</th></tr><tr><td>1</td><td>GND</td></tr><tr><td>2</td><td>FAN ALARM</td></tr><tr><td>3</td><td>POWER</td></tr></table> LENGTH OF HARNESS = 40 ± 5mm	Pin No.	Content	1	GND	2	FAN ALARM	3	POWER
Pin No.	Content										
1	GND										
2	FAN ALARM										
3	POWER										
FAN-PB3-F3 (Air flow reverse : -F3)	PBA300F <Modification : F3>	 ★ Weight : 90g max									
FAN-PB3-F4 (Low speed : -F4)	PBA300F <Modification : F4>	 ★ Weight : 90g max									
FAN-PB6 (Standard)	PBA600F <Standard>	 ★Weight : 120g max	CONNECTOR = XAP-03V-1 (Mfr : J. S. T) TERMINAL = SXA-001T-P0.6 (Mfr : J. S. T) <table><tr><th>Pin No.</th><th>Content</th></tr><tr><td>1</td><td>GND</td></tr><tr><td>2</td><td>FAN ALARM</td></tr><tr><td>3</td><td>POWER</td></tr></table> LENGTH OF HARNESS = 55 ± 7mm	Pin No.	Content	1	GND	2	FAN ALARM	3	POWER
Pin No.	Content										
1	GND										
2	FAN ALARM										
3	POWER										
FAN-PB6-F1 (Long life : -F1)	PBA600F <Modification : F1>	 ★Weight : 150g max									
FAN-PB6-F3 (Air flow reverse : -F3)	PBA600F <Modification : F3>	 ★Weight : 120g max									
FAN-PB6-F4 (Low speed : -F4)	PBA600F <Modification : F4>	 ★Weight : 120g max									

★ 1 Handle with care and don't add the impact such as falls or throwing to the unit.

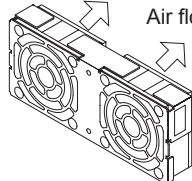
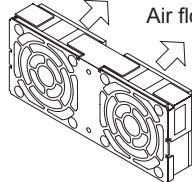
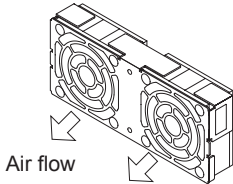
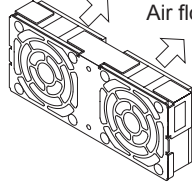
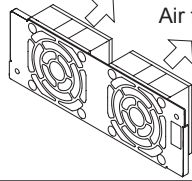
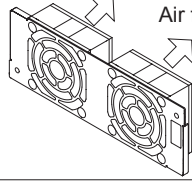
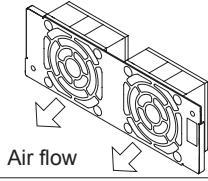
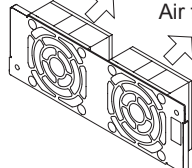
★ 2 Exchange the unit after intercepting the input power.

★ 3 When the unit is exchanged, make sure there are not loosening of the connector and shutting the harness.

Fan unit

★ Fan unit is prepared by the option.

PB Series

Fan unit type	Matching model	External	Pin connection								
FAN-PB10 (Standard)	PBA1000F <Standard>	 ★Weight : 210g max	<div>CONNECTOR = XAP-03V-1 (Mfr : J. S. T) TERMINAL = SXA-001T-P0.6 (Mfr : J. S. T)</div> <table><tr><th>Pin No.</th><th>Content</th></tr><tr><td>1</td><td>GND</td></tr><tr><td>2</td><td>FAN ALARM</td></tr><tr><td>3</td><td>POWER</td></tr></table> <div>LENGTH OF HARNESS = 55 ± 7mm</div>	Pin No.	Content	1	GND	2	FAN ALARM	3	POWER
Pin No.	Content										
1	GND										
2	FAN ALARM										
3	POWER										
FAN-PB10-F1 (Long life : -F1)	PBA1000F <Modification : F1>	 ★Weight : 260g max									
FAN-PB10-F3 (Air flow reverse : -F3)	PBA1000F <Modification : F3>	 ★Weight : 210g max									
FAN-PB10-F4 (Low speed : -F4)	PBA1000F <Modification : F4>	 ★Weight : 200g max									
FAN-PB15 (Standard)	PBA1500F PBA1500T <Standard>	 ★Weight : 210g max									
FAN-PB15-F1 (Long life : -F1)	PBA1500F PBA1500T <Modification : F1>	 ★Weight : 260g max									
FAN-PB15-F3 (Air flow reverse : -F3)	PBA1500F PBA1500T <Modification : F3>	 ★Weight : 210g max									
FAN-PB15-F4 (Low speed : -F4)	PBA1500F PBA1500T <Modification : F4>	 ★Weight : 200g max									

- ★ 1 Handle with care and don't add the impact such as falls or throwing to the unit.
- ★ 2 Exchange the unit after intercepting the input power.
- ★ 3 When the unit is exchanged, make sure there are not loosening of the connector and shutting the harness.

Fan unit

SC Series

★Several kind optional fan unit are prepared for SC series.

This fan unit is used to distribute sufficient air for cooling single SC unit.

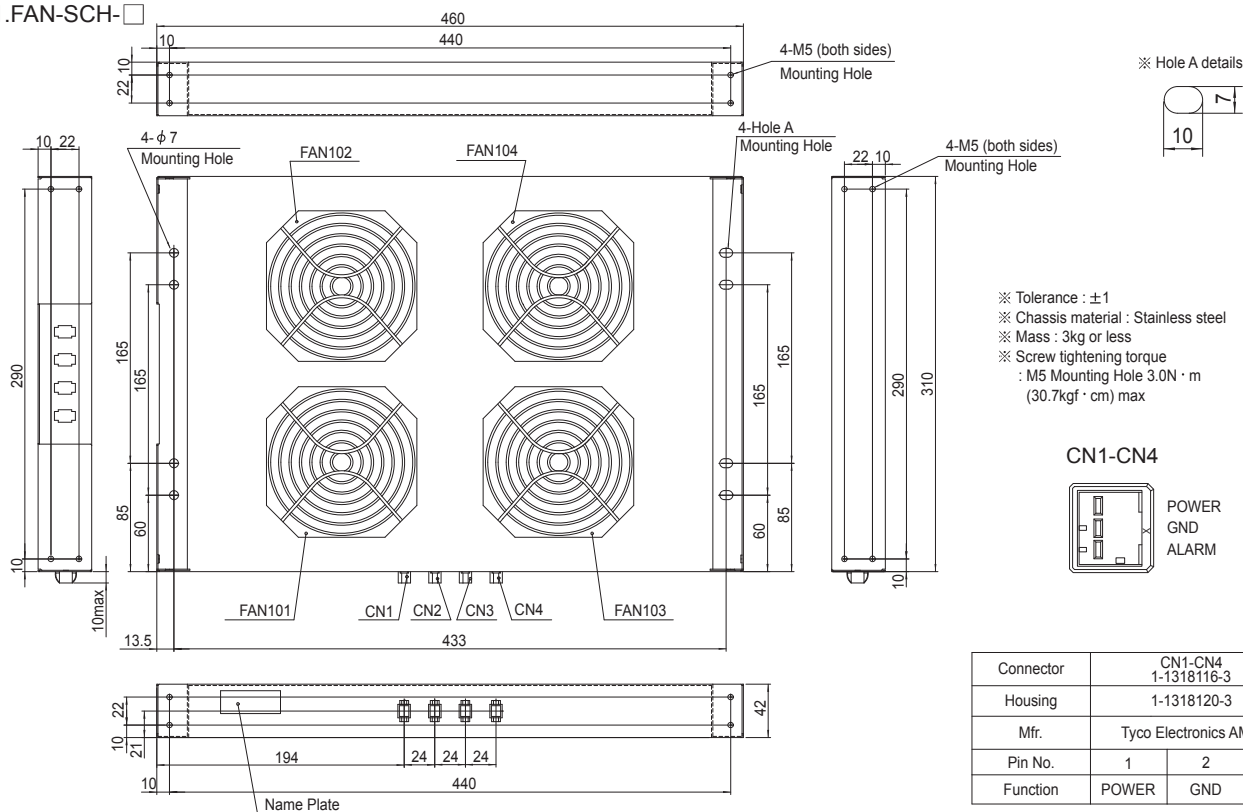
Fan unit type	Matching model	External
FAN-SCH-1	SCHA10000T-48	
FAN-SCH-2	SCHA10000T-48	
FAN-SCD-1	SCDA10000T-48	
FAN-SCD-2	SCDA10000T-48	

★ 1 Fan is delicate component, ageist impact stress such as throwing the unit, or drop the unit, careful handling is required to avoid failure.

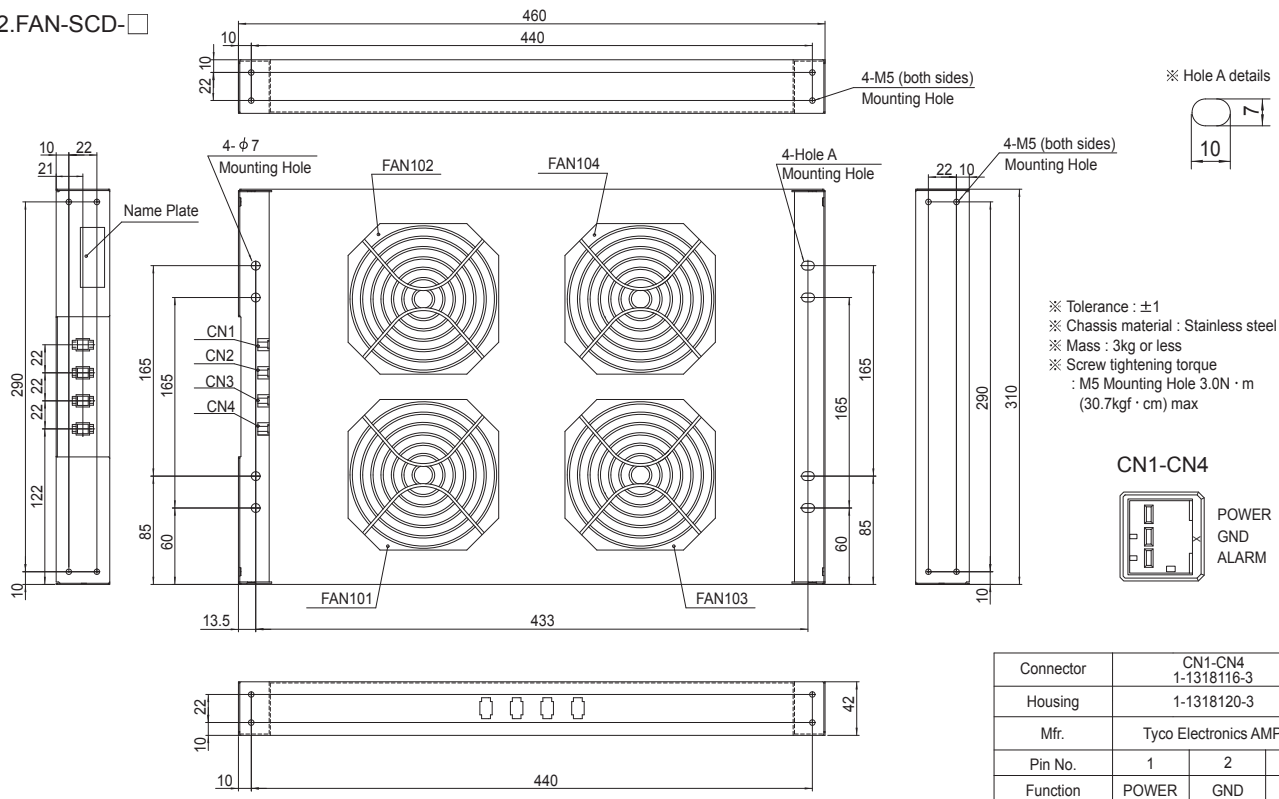
★ 2 Please make sure there is not loose connection and cramping the harness wire between chassis.

1 External view

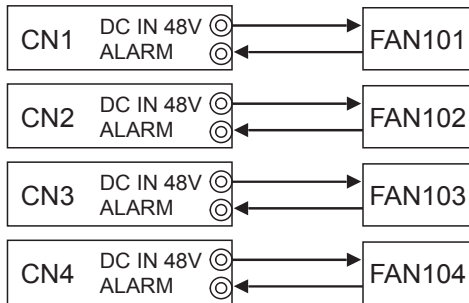
1.FAN-SCH-□



2.FAN-SCD-□



2 Block diagram



3 Specifications

■ Specifications is on Table 3.1.

Table 3.1 Specifications

ITEM	SPECIFICATIONS
INPUT VOLTAGE[V]	DC46.0-50.0 ※
INPUT CURRENT[A]	0.23/Connector (Total 0.92)
OPERATING TENP	0 to +70 °C

※ You may use the output voltage of SC series

4 Fan alarm

■ Individual fan has built-in alarm function detecting the operation. Fan alarm specifications are shown in Table4.1. A connection for example is shown in Fig.4.1.

Table 4.1 Fan sensor specifications

ITEM	SPECIFICATIONS
OUTPUT	open collector output
PULL UP VOLTAGE[V]	60max ※
SINK CURRENT[ma]	5max

※ You can use output voltage of the SC series

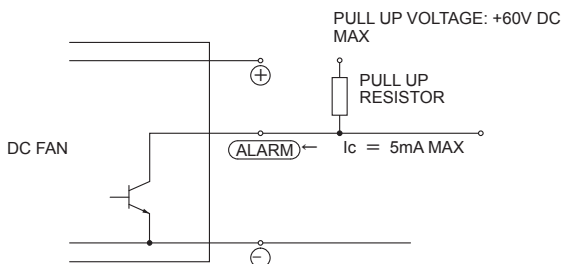


Fig.4.1 Fan alarm connection example

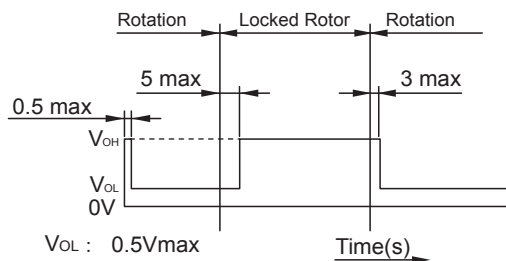


Fig.4.2 Fan alarm output wave form

5 Life time expectancy of the fan unit

■ Life time expectancy of the fan unit (R(t)90%) is shown in Fig.5.1.

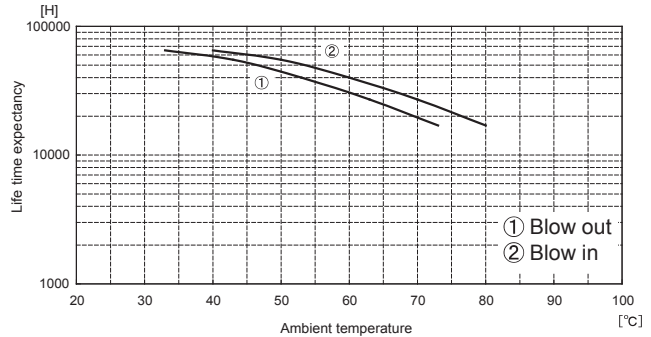
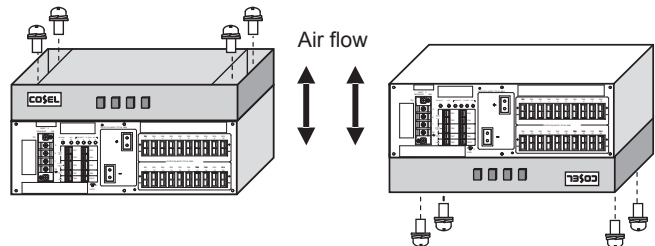


Fig.5.1 Life expectancy of fan unit

6 Installation method

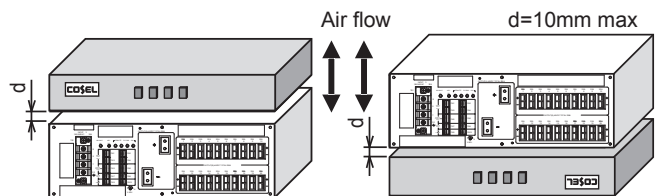
■ The fan unit is screw-mountable either upside or downside of SC unit.

(1) Mounting instruction by using screws to SC series.



(2) Rack-mounting

The fan unit is needed 10mm or less clearance against SC unit chassis.



7 Life time expectancy of SC series

■ Life time expectancy with optional fan unit : 10 years

8 Operating Environment

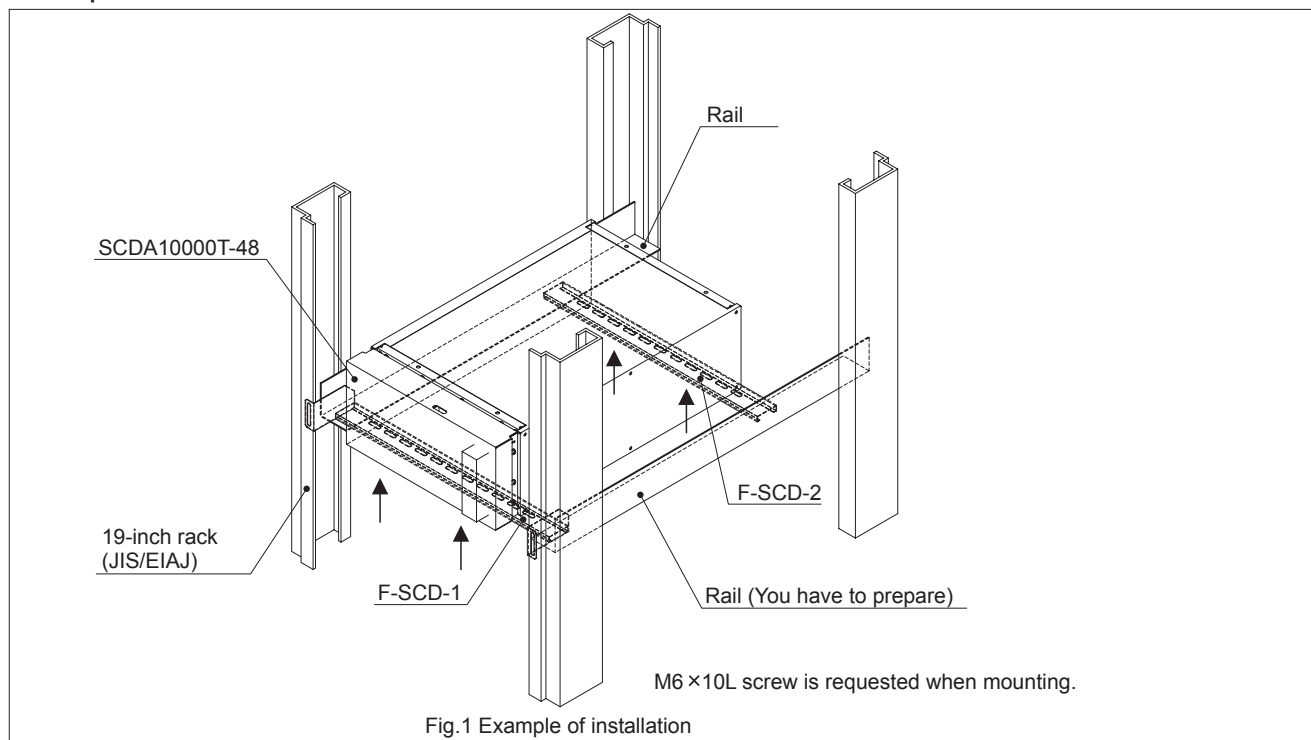
■ Oil and other chemical liquid splashing environment may cause the performance degradation and failure.

SC Series Attachment

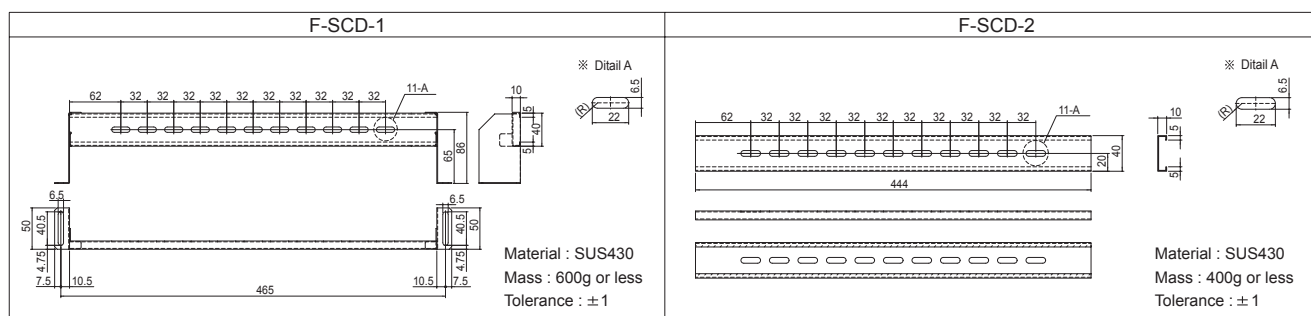
SC Series

Plate model	Applicable to model	Note
F-SCD-1	SCDA10000T-48	For 19-inch rack (bracket type)
F-SCD-2	SCDA10000T-48	For 19-inch rack

Example of installation



External view



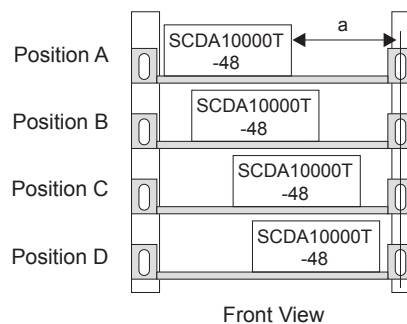
Mounting position

4 mounting position is available.

Mounting position and space distance a are on Table 1.

Table 1 position and space distance (mm)

Position	Distance a
A	115-118
B	83-93
C	51-61
D	19-29



Others

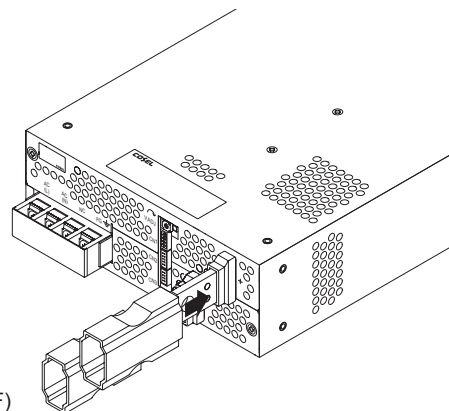
19-inch rails are required for initial preparation.

2 units or more stack is not recommended mounting with F-SCD-1 and F-SCD-2.

■ Insulated tube for PBA1000F, PBA1500F, PBA1500T, PLA1000F & PLA1500F

This is a tube used to insulate an output terminal.

Plate model	Applicable to model
T-PBA1500-1	PBA1000F, PBA1500F, PBA1500T, PLA1000F, PLA1500F
T-PBA1500-2	PBA1000F, PBA1500F, PBA1500T, PLA1000F, PLA1500F



Example(PBA1500F)

(Unit : mm) (Tolerance : ±1)

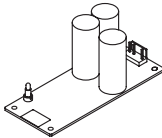
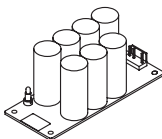
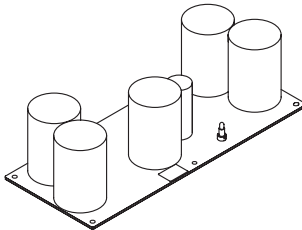
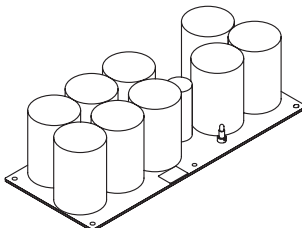
T-PBA1500-1	T-PBA1500-2
<p>★ This is used when insulating the tip portion of an output terminal.</p> <p>★ Material : Silicone rubber Black ★ Weight : 15g max</p>	<p>★ This is used when insulating the root portion of an output terminal.</p> <p>★ Material : Silicone rubber Black ★ Weight : 2g max</p>

★ If this product is attached, a wiring portion can't visible.
Be careful not to forget to attach the screw or the bolt for electric wire connection.

External capacitor unit

LFP Series

By connecting an external capacitor unit to the power supply, it is possible to extend the hold-up time.

External capacitor unit model	Approved power supply	Hold-up time *	Appearance
CR-HUT241-1 (Rated capacitance:240μF)	LFP240F LFP300F <U1 type>	100 ms (Power supply output 180W)	
		55 ms (Power supply output 360W)	
CR-HUT721-1 (Rated capacitance:720μF)		220 ms (Power supply output 180W)	
		110 ms (Power supply output 360W)	
CR-HUT282-2 (Rated capacitance:2,800μF)		650 ms (Power supply output 180W)	
		300 ms (Power supply output 360W)	
CR-HUT502-2 (Rated capacitance:5,040μF)		1,100 ms (Power supply output 180W)	
		500 ms (Power supply output 360W)	

* It is reference data in the case of connecting LFP300F-□-TU1Y.

Hold-up time will vary depending on the environment (power supply, output power, etc).

Please refer to the Instruction Manual of approved power supply for more information.

1 Specification

	ITEM	CR-HUT241-1	CR-HUT721-1	CR-HUT282-2	CR-HUT502-2
ELECTRICAL SPECIFICATIONS	INPUT VOLTAGE[V]	DC420max			
	RATED CAPACITANCE [μF]	240typ	720typ	2,800typ	5,040typ
	CHARGE COMPLETION TIME [s] *1	2yp	5typ	30typ	60typ
	LED LIGHTING VOLTAGE [V] *2	45typ			
	DISCHARGING TIME [s]	30typ	55typ	165typ	285typ
ENVIRONMENT	OPERATING TEMP., HUMID. *3	-10 to +70°C, 20 - 90%RH (Non condensing)			
	STORAGE TEMP., HUMID.	-20 to +75°C, 20 - 90%RH (Non condensing)			
	VIBRATION	10 - 55Hz, 19.6m/s ² (2G), 3minutes period, 60minutes each along X, Y and Z axis			
	IMPACT	196.1m/s ² (20G), 11ms, once each X, Y and Z axis			
AGENCY APPROVALS		Be certified by connecting to the correct power			
OTHERS	SIZE	45×48×110mm [1.77×1.89×4.33 inches] (W×H×D)		85×58×206mm [3.35×2.28×8.11 inches] (W×H×D)	
	WEIGHT	105g max	195g max	525g max	860g max
	COOLING METHOD	Convection			

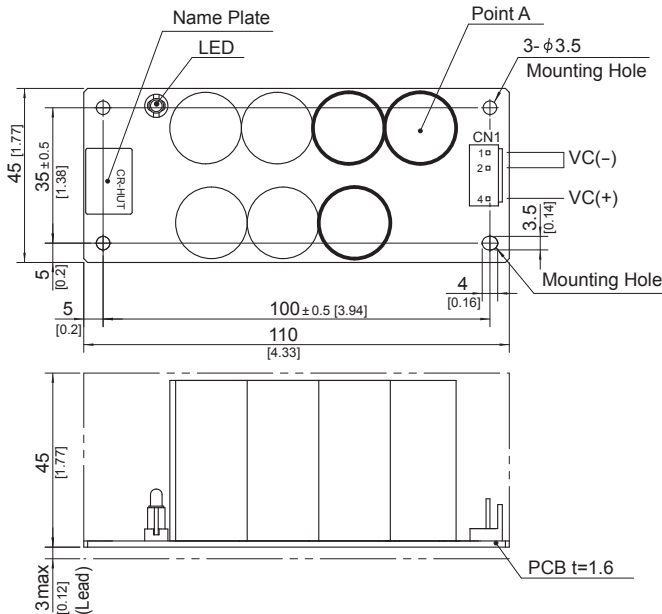
*1 Time to be charged to over 98% of the applied voltage.

*2 Capacitor voltage which LED turns on.

*3 LED turn off time after input voltage shut off from full charged condition.

2 External View

1. CR-HUT□-1



- ※4 Mounting holes are existing.
- ※The back side of P.C.B. of the power supply is assembled some SMDs.
Be attention not to bump against the attached area by vibration.
- ※Use the spacer of 8mm length or more regarding insulation.
And do not use press-fitting bush.
- ※Point A is thermometry points. Please refer to Instruction Manual 3.

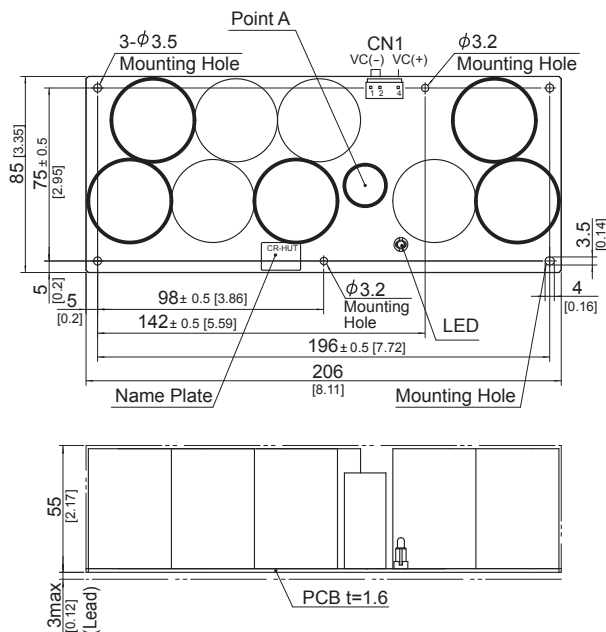
- ※Dimensions in mm, []=inches
- ※Tolerance : ±1 [±0.04]
- ※Weight : 105g max (CR-HUT241-1)
195g max (CR-HUT721-1)
- ※PCB material : CEM3
- ※Thick line represents the capacitor mounted on CR-HUT241-1.
- All capacitors are mounted on CR-HUT721-1.

CN1

Connector	B3P4-VH			
Mating Connector	VHR-4N			
Terminal	Chain : SVH-21T-P1.1			
	Loose : BVH-21T-P1.1			
Manufacturer	J.S.T.			
Pin No.	1	2	3	4
Function	VC(-)	VC(-)		VC(+)

※Pin 3 is removed

2. CR-HUT□-2



- ※4 Mounting holes are existing.
- ※The back side of P.C.B. of the power supply is assembled some SMDs.
Be attention not to bump against the attached area by vibration.
- ※Use the spacer of 8mm length or more regarding insulation.
And do not use press-fitting bush.
- ※Point A is thermometry points. Please refer to Instruction Manual 3.

- ※Dimensions in mm, []=inches
- ※Tolerance : ±1 [±0.04]
- ※Weight : 525g max (CR-HUT282-2)
860g max (CR-HUT502-2)
- ※PCB material : CEM3
- ※Thick line represents the capacitor mounted on CR-HUT282-2.
- All capacitors are mounted on CR-HUT502-2.

CN1

Connector	B3P4-VH			
Mating Connector	VHR-4N			
Terminal	Chain : SVH-21T-P1.1			
	Loose : BVH-21T-P1.1			
Manufacturer	J.S.T.			
Pin No.	1	2	3	4
Function	VC(-)	VC(-)		VC(+)

※Pin 3 is removed

3 Assembling and Installation Method

3.1 Installation method

■ This external capacitor unit is manufactured by SMD technology. The stress to P.C.B like twisting or bending causes the defect of the unit, so handle the unit with care.

■ In case of metal chassis, keep the distance between d_1 & d_2 for to insulate between lead of component and metal chassis, use the spacer of 8mm or more between d_1 . If it is less than d_1 & d_2 , insert the insulation sheet between external capacitor unit and metal chassis.

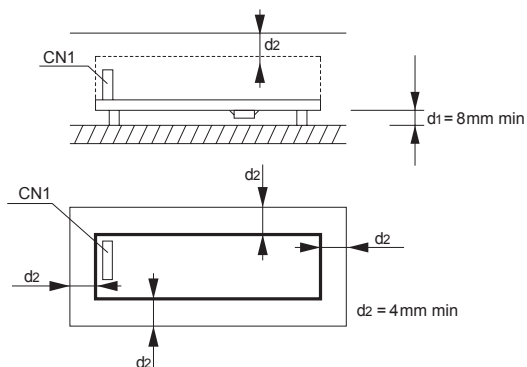


Fig.3.1 Installation method

■ There is a possibility that it is not possible to cool enough when the external capacitor unit is used by the sealing up space as showing in Figure 3.2.

Please use it after confirming the temperature of point A of Instruction Manual 3.2.

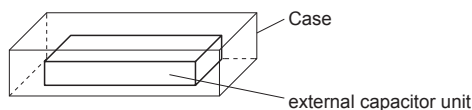


Fig.3.2 Installation example

■ Connection method

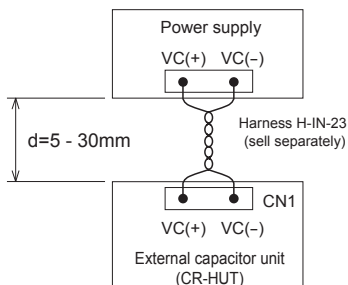


Fig.3.3 Connection method

● Caution

- (1) Distance between the external capacitor unit and power supply unit must be secured more than 5mm.
- (2) It must be 30mm or less, since the noise is generated from the wire which is connecting the external capacitor unit and power supply. And, it is necessary to twist the wire as short as possible.
- (3) It is necessary to use wires which rated voltage is 600V or more.

■ Mounting method

● CR-HUT□-1

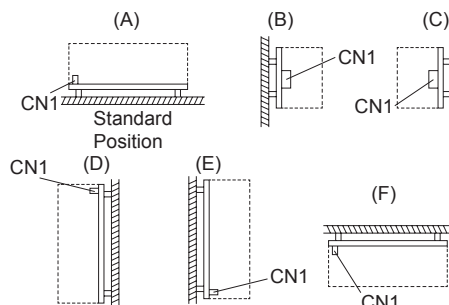


Fig.3.4 CR-HUT□-1 Mounting method

● CR-HUT□-2

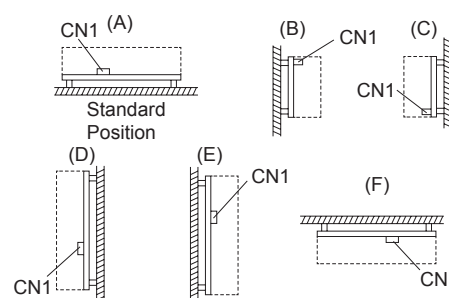


Fig.3.5 CR-HUT□-2 Mounting method

3.2 Environment to use the Unit and Installation environment

■ When using the unit, it is necessary to dissipate heat of the external capacitor unit. Table 3.1 shows the relation between the maximum temperature Point A and Installation environment.

Please consider the ventilation to keep sufficient convection for whole external capacitor unit. And temperature of Point A must be kept under maximum temperature shown table 3.1. The expectancy life at maximum temperature of Point A is three years or more.

Please refer to External View for the position of Point A.

Please contact us for details.

Remarks:

* Please be careful of electric shock or earth leakage in case of temperature measurement, because Point A is live potential.

* Please refer to 3.4 if you want to extend the longevity of the expectancy life.

Table 3.1 Temperatures of Point A

Mounting Method	Cooling Method	Max temperature[°C]
A,B,C,D,E	Convection	86
F	Convection	81
A,B,C,D,E,F	Forced air	75

3.3 Mounting screw

■The mounting screw should be M3. The hatched area shows the allowance of metal parts for mounting.

● CR-HUT□-1

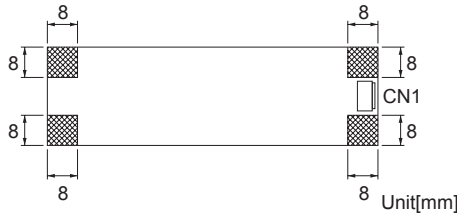


Fig.3.6 CR-HUT□-1 Allowance of metal for mounting

● CR-HUT□-2

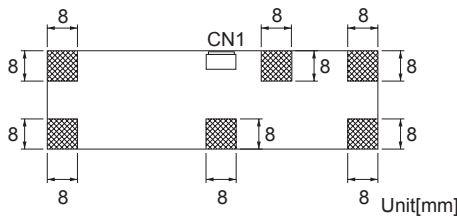


Fig.3.7 CR-HUT□-2 Allowance of metal for mounting

3.4 Expectancy life and warranty

■Expectancy Life.

Mounting Method	Cooling Method	Average ambient temperature (year)	Expectancy Life
A,B,C,D,E,F	Convection	Ta = 60°C or less	10years
		Ta = 70°C	6years

■Warranty

Warranty 5 years.

4 Others

■This external capacitor unit is the rugged PCB type. Do not drop conductive objects in the external capacitor unit.

■Do not touch absolutely during operation.

There is a risk of electric shock.

■High voltage remains inside the external capacitor unit after voltage shut off.

There is a risk of electric shock, do not touch until the LED turns off.

■There is possibility that electric charge is remained inside the capacitor.

Do not short-circuit the CN1 terminals.

■This external capacitor unit is manufactured by SMD technology.

The stress to PCB like twisting or bending causes the defect of the unit, so handle the unit with care.

· Tighten all the screws in the screw hole.

CR-HUT□-1 (4 places)

CR-HUT□-2 (6 places)

CR-HUT-2 may be a mounting method of the following. (Refer Fig.4.1)

Screw should be used to hole A (4 places).

Screw or resin spacer should be used to hole B (2 places).

Recommendation resin spacer: MPS series

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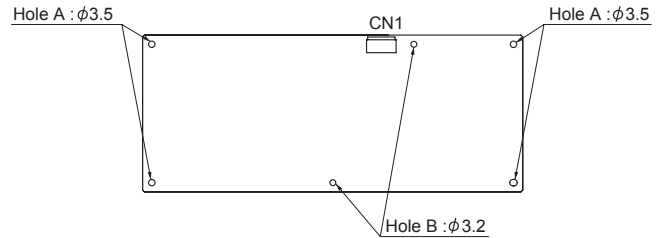


Fig.4.1 CR-HUT□-2 Resin spacer mounting method

· Install the PCB of the external capacitor unit horizontally to the surface of mounting.

· Avoid the impact such as drops.

Modified power supply

Cosel is dedicated to providing support for customers requiring additional features or modifications to catalog products.

The factory will assign a special identification alphabet to modified units. Please feel free to contact us with your requirements.

Following is the list of modified units available:

Ex.1	Model designation : R25-5-J Detail of this modification : The input/output terminal is changed to connector type.
Ex.2	Model designation : R25-12-CN Detail of this modification : PCB is coated and case cover is attached.

■ Alphabets of modified units and it's contents of modification

• ENCLOSED TYPE • OPEN FRAME/ENCLOSED TYPE • MEDICAL TYPE • DIN RAIL TYPE

No.	Alphabets	Contents
1	A	± Power supply that V2(GND) and V3(+) were made common.
2	C	Except a certain device (e.g.potentiometer), PCB is coated.
3	D	Output voltage is set on request within the output voltage adjustable range.
4	F	Fan or Fan unit is additionally included in power supply.
5	G	Decreasing a leakage current by reducing the value of earth capacitor at input filtering circuit.
6	H	By changing the overcurrent operative point, and make it possible to get peak output current.
7	I	Modified as series operation possible those which are not possible to make series operation.
8	J / Jn	Terminal block at input/output is changed to connector type.
9	L	LED for output confirmation is added.
10	M	Silicon rubber is attached to those power supply.
11	N	Case cover is attached to those open frame type power supply.
12	P	Operative overcurrent point is set to 90 - 100% of rated output current.
13	R	Output remote ON/OFF is made possible. The logic of output remote ON/OFF is reversed.
14	SN	Chassis and cover is attached to PCB type.
15	T	Terminal block is changed from horizontal to vertical position against PCB for screwing.
16	V	Twisted wire is led from power supply to attach output voltage setting potentiometer externally.
17	Y	Potentiometer is attached additionally to those which is not available to standard power supply.

• PCB MOUNT TYPE • POWER MODULE TYPE

No.	Alphabets	Contents
1	F	Power supply with the addition of a heat sink.
2	G	Capacitor between Input and Output is removed.
3	L	Input/Output pin are changed.
4	R	The logic of output remote ON/OFF is reversed.
5	S	Case connecting pin is cut.
6	T	Mounting holes are through-hole type.
7	M	Mounting holes are tapping-hole type.

• CONFIGURABLE TYPE

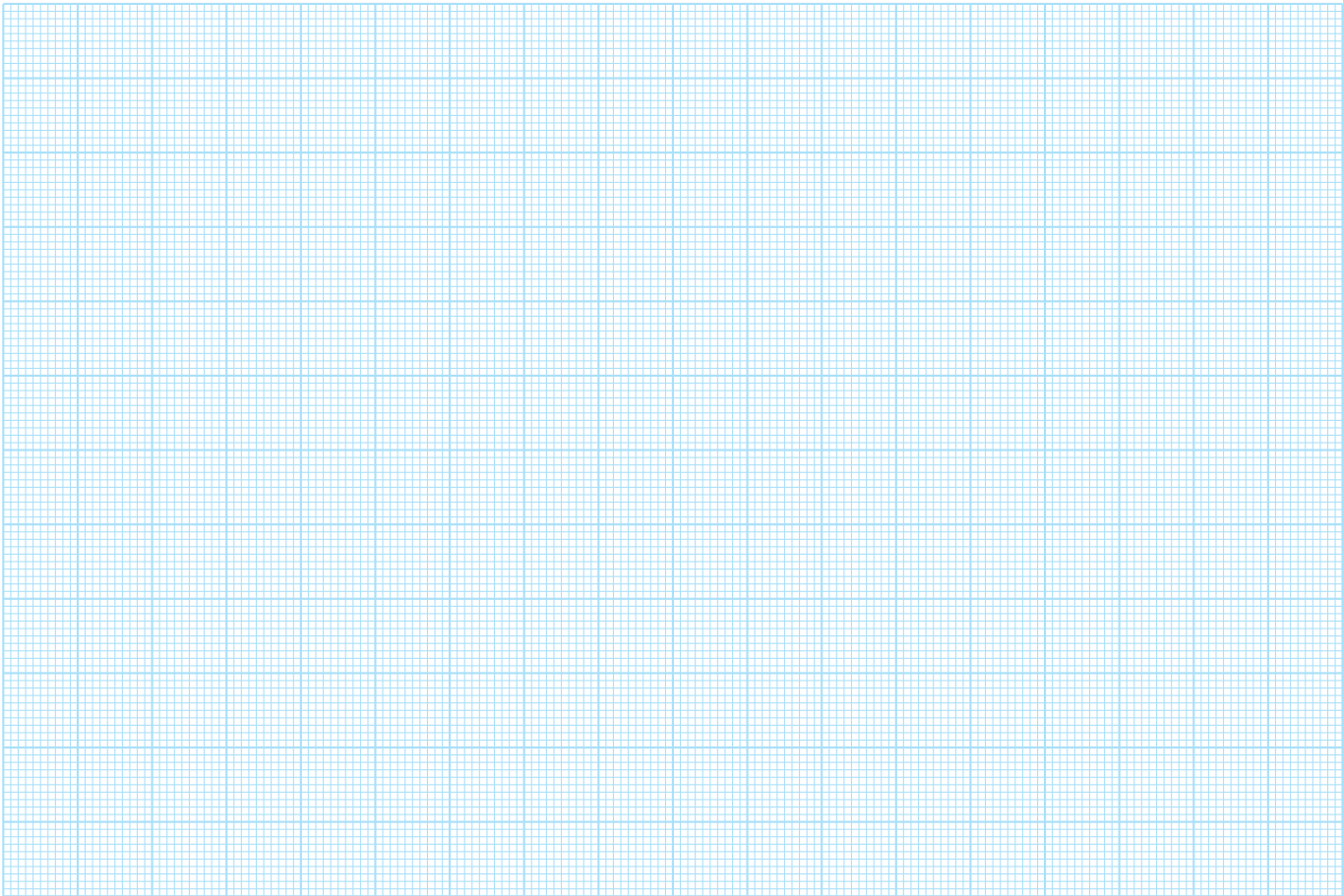
No.	Alphabets	Contents
1	E	Reduce leakage current to the EMI class A level.
2	F	The wind directions reversed.
3	G	Leakage current is reduced.
4	K	Low speed fans are used.
5	N	Built-in fan is not used. The fan set externally is used to cool the unit.
6	R	The logic of remote on/off is reversed.
7	T	A fan filter is attached to fan.
8	U	Operation stop voltage is set at a lower value than the standard version.
9	W	A covers are installed on the terminal block of output modules.

*Some models are not possible for modification mentioned above. Beside the above, we have some other modification. Please feel free to contact us.

MEMO

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

MEMO

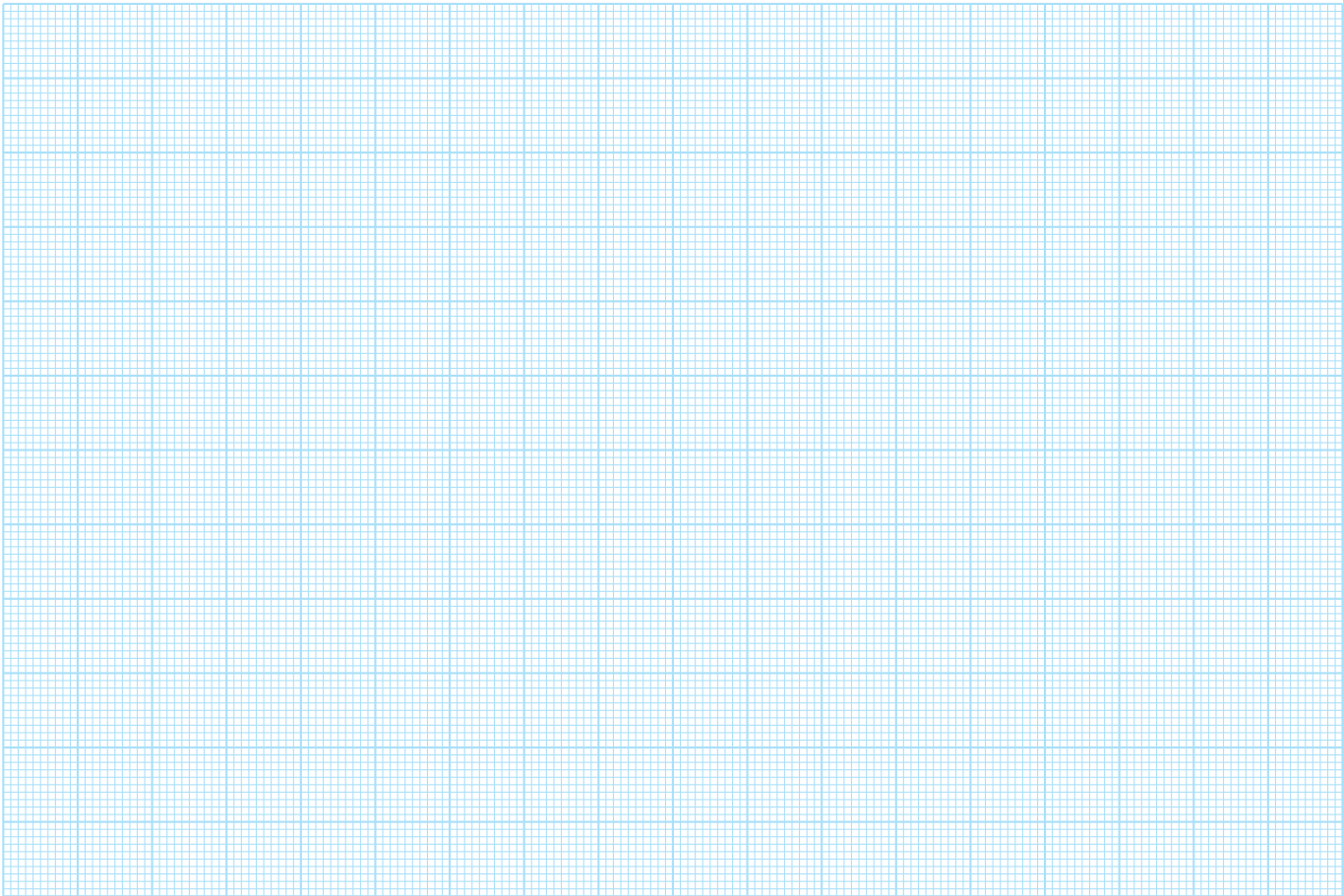


A series of horizontal lines for writing, consisting of 15 evenly spaced lines.

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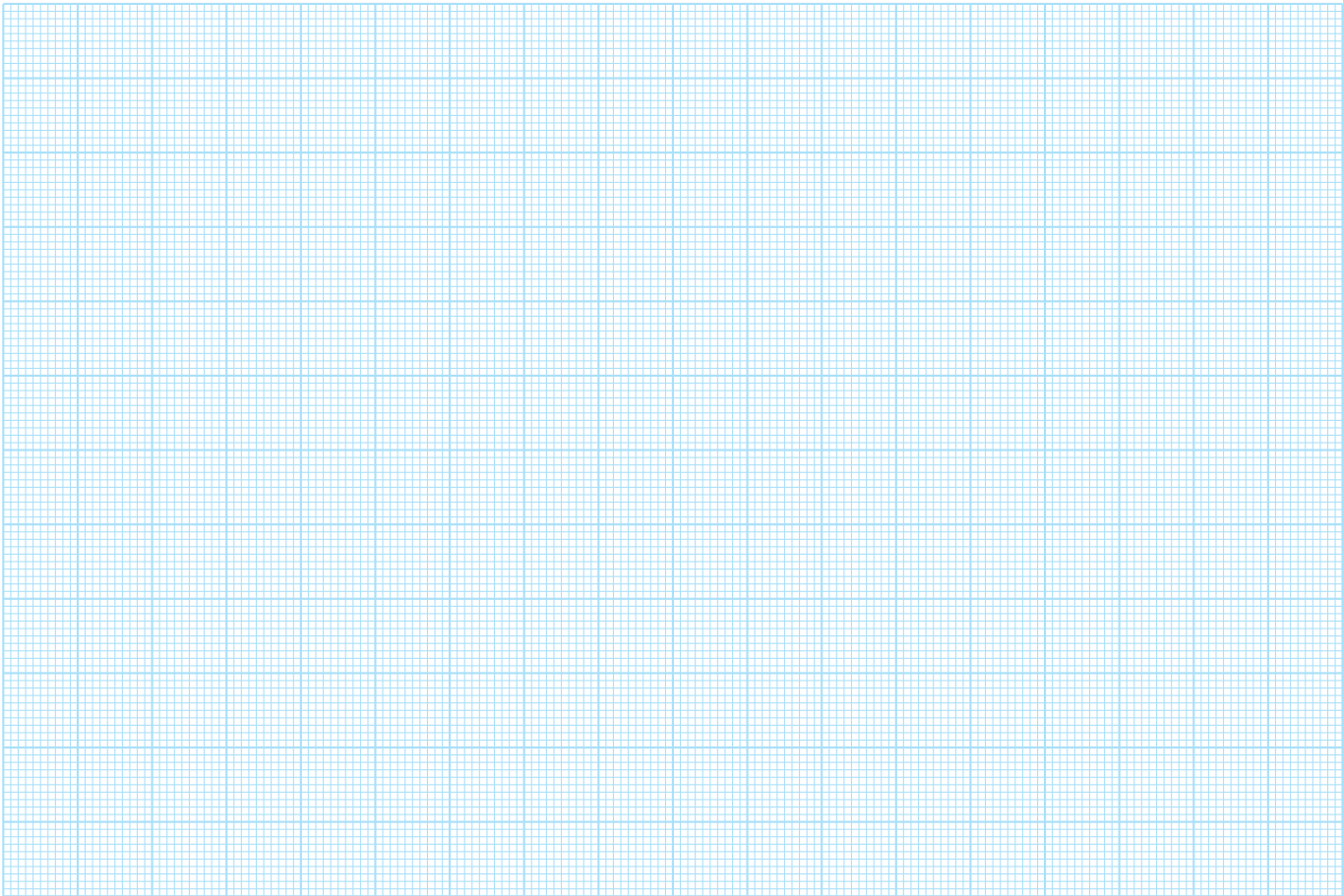


A series of horizontal lines for writing, located below the grid area. There are 15 evenly spaced horizontal lines spanning the width of the page.

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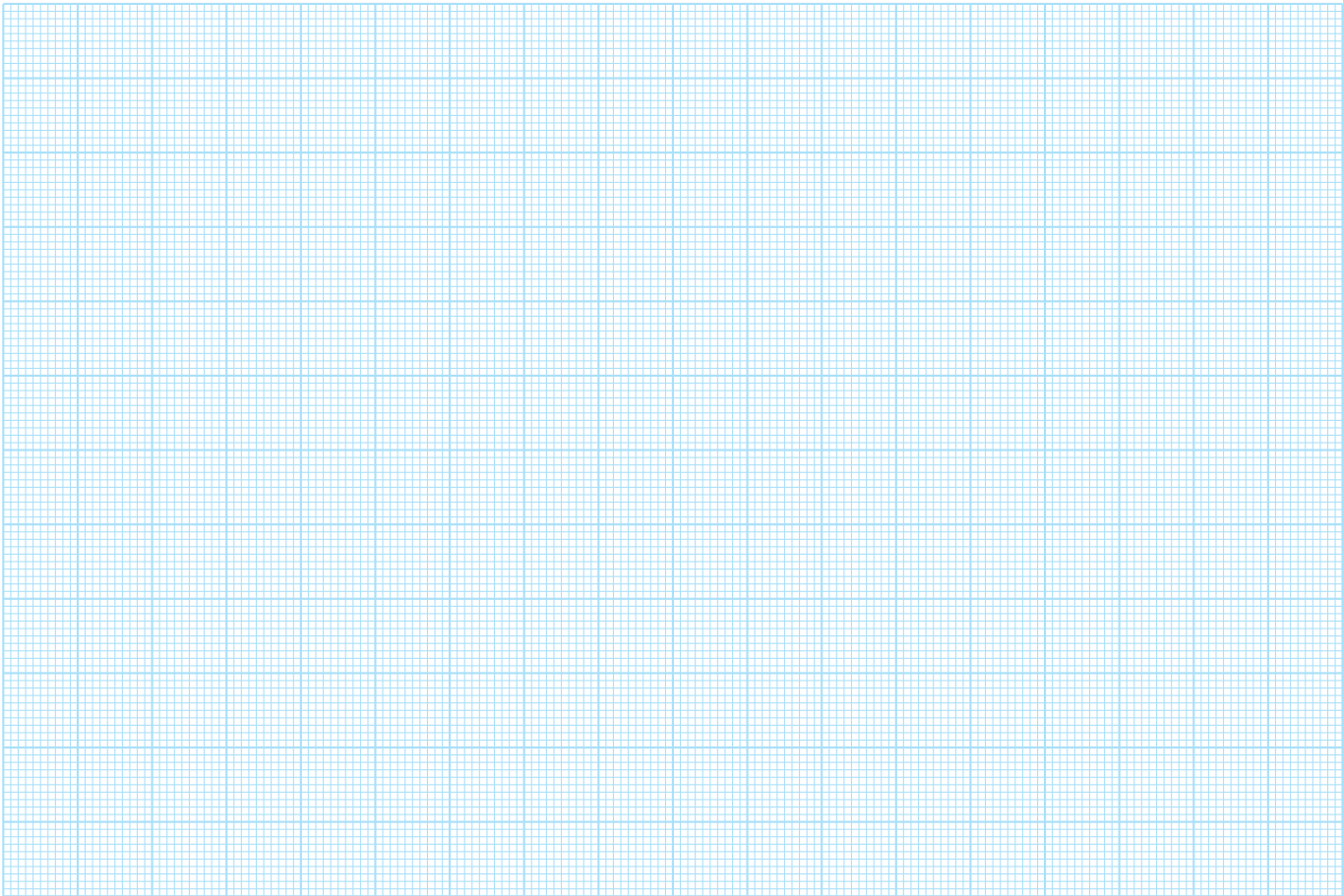


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