

PMS Panel Mount Power Supply

PMS 2,500 W series / PMS-□V2K5W1BTD

PMS

Highlights & Features



- Universal AC input voltage
- Up to 2,500 Watt in 10.67" x 5" x 1.59" package ^{*1}
- Peak power supported^{*2}
- Full power up to 50°C ambient
- Option for constant current
- 5 V / 2 A standby output
- Active current sharing
- Conformal coating
- Class B Conducted and Radiated EMI
- Remote On/Off and Power Good Signal
- Support Ver 1.3 PMBus
- Intelligent fan speed control
- Optional USB/RS232/RS485 adapter for communication
- Compliance to SEMI F47 @ 200Vac

Safety Standards



CB Certified for worldwide use

Model Number: PMS-□V2K5W1BT□
Unit Weight: 1.95 kg (4.3 lb)
Dimensions (L x W x H): 271 x 127.0 x 40.5 mm^{*1}
 (10.67 x 5 x 1.59 inch)

General Description

PMS Series 2,500 W power supply offers the nominal output voltage of 12 V/24 V/48 V across a wide operating temperature range from -20°C to +70°C and obtains shock and vibration certification IEC 60068-2. The product design with 1U low profile and comes with a universal AC input voltage ranging from 85 Vac to 264 Vac. The PMS series is made for installation in limited spaces. Its built-in active PFC circuit provides high power factor values and conforms to harmonic current emission standards IEC/EN 61000-3-2, Class A.

Model Information

PMS Panel Mount Power Supply

Model Number	Input Voltage Range	Rated Output Voltage	Rated Output Current
PMS-12V2K5W1BTD	85 Vac ~ 264 Vac	12 Vdc	208.3 A
PMS-24V2K5W1BTD		24 Vdc	104.2 A
PMS-48V2K5W1BTD		48 Vdc	52.1 A

Model Numbering

PM	S –	□V	2K5W	1	B	T	D
Panel Mount	Product Type S – SMART Series	Output Voltage 12 – 12 V 24 – 24 V 48 – 48 V	Output Power	Single Phase	Family Code: B	Connector Type M – Terminal with Grille	D – Remote On/Off (default on) & Constant Current Mode Protection

^{*1} Exclude Busbar terminal

^{*2} 24/48V only

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Specifications

Model Number	PMS-12V2K5W1BTD	PMS-24V2K5W1BTD	PMS-48V2K5W1BTD
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Input Ratings / Characteristics

Nominal Input Voltage	100-240 Vac		
Input Voltage Range	85-264 Vac		
Nominal Input Frequency	50-60 Hz		
Input Frequency Range	47-63 Hz		
Input Current (max)	16 A		
Input Surge Voltage (max)	300 Vac for 100 ms		
Full Load Efficiency @ 230Vac* ²	90% typ.	91.6% typ.	93% typ.
No Load Power Consumption	0.75 W typ. @ remote off status		
Max Inrush Current (Cold Start)	40 A @ 264 Vac, cold start		
Power Factor at 100% Load	0.95 @ 115 V / 50 Hz, 230 V / 50 Hz		
Leakage Current	< 0.3 mA @ 240Vac		

*2 Exclude fan power

Output Ratings / Characteristics*³

Nominal Output Voltage	12 Vdc	24 Vdc	48 Vdc
Total Regulation	± 3%	± 3%	± 3%
Output Voltage Adjustment Range (CV mode)	12-14 Vdc	24-28 Vdc	48-56 Vdc
Output Current (CV mode)	0-208.3 A	0-104.2 A	0-52.1 A
Constant Current (CV mode)	208.3 A (Voltage range 12-14 V)	62.5-118A (Voltage range 20.4-28 V)	51-59 A (Voltage range 39.4-56 V)
Current Trimming Range (CC mode)	104 A ~ 178.4 A (Voltage range 12-14 V with 2,500 W max)	62.5 A ~ 108 A (Voltage range 23-28 V with 2,500 W max)	26 A ~ 52.1 A (Voltage range 45-56 V with 2,500 W max)
Output Power	2,500 W @ 180-264 Vac; 1,500 W @ 110Vac-132 Vac; 1,350 W @ 90-100 Vac; 1,000 W @ 85 Vac		
Peak Power (max)	12V: N/A 24 V: 3,200 W peak for 3 sec, @ 180~264 Vac 48 V: 3,200 W peak for 3 sec, @ 180~264 Vac		
Line Regulation	± 0.5% typ.		
Load Regulation	± 1% typ.		
PARD* ⁴ (20MHz)	< 1% Vrated pk-pk @ rated load		
Rise Time	< 50 ms		
Start-up Time	2,000 ms with AC turn on		
Hold-up Time	16 ms @ 2000 W load, with 230 Vac input		
Dynamic Response (Slew Rate: 2.5 A/μS, 50% duty cycle @ 5 Hz & 10 KHz)	± 5% @ 115 & 230 Vac input with 0-50% or 50-100% load change ± 10% @ 115 & 230 Vac input with 5-100% load change		
Start-up with Capacitive Loads	12,000 uF		
Nominal Standby Voltage Output* ⁵	5 V		
Nominal Standby Current Output	2 A		
Total Regulation of Standby Output	± 3%		
Ripple & Noise of Standby Output	100 mV max		

*3 For power de-rating from > 50°C to 70°C, see power de-rating on page 8.

*4 PARD is measured with an AC coupling mode, and in parallel to end terminal with 0.1μF ceramic capacitor & 47μF electrolytic capacitor. PSU need to burn in > 5 minutes when AMB ≤ 0°C

*5 5V standby output is always on when AC is present

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Model Number	PMS-12V2K5W1BTD	PMS-24V2K5W1BTD	PMS-48V2K5W1BTD
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Mechanical

Case Chassis	SGCC
Case Cover	SGCC
Dimensions (L x W x H)	271 x 127.0 x 40.5 mm (10.67 x 5 x 1.59 inch)* ⁶
Unit Weight	1.95 kg (4.3 lb)
Cooling System	Force Cooling
Terminal	M3.5 x 3 Pins, CN1 / AC Input M6 x 2 Pins, CN101 / DC Output

*⁶ Exclude Busbar terminal

Environment

Surrounding Air Temperature	Operating	-20°C to +70°C
	Storage	-40°C to +85°C
Power De-rating	Temperature	> 50°C de-rate power by 2.5% / °C
	Input	132-180 Vac, de-rate power by 0.83% / Vac from 2,500 W to 1,500 W @ 132 Vac 100-110 Vac, de-rate power by 0.6% / Vac from 1,500 W to 1,350 W @ 100 Vac 85-90 Vac, de-rate power by 2.8% / Vac from 1,350 W to 1,000 W @ 85 Vac
Operating Humidity		5-95% RH (Non-Condensing)
Operating Altitude		0 to 5,000 Meters (0 to 16,400 ft)
Shock Test	Non-Operating	IEC 60068-2-27, Half Sine Wave: 50 G for duration of 11 ms; 3 times per direction
Vibration	Operating	IEC 60068-2-6, Sine Wave: 5 Hz to 500 Hz @ 2G; 10 Min per cycle, 60min for X, Y, Z direction
Pollution Degree		3
Acoustic Noise* ⁷	Tolerance: ±2dB	< 45dB @ 80% load @ 25°C

*⁷ Acoustic Noise test set up according to ISO-7779

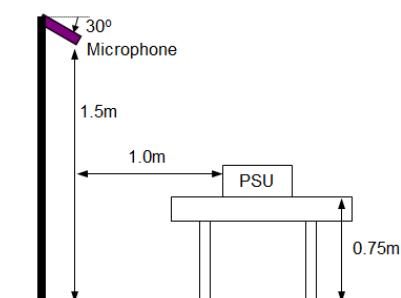


Fig 1. Acoustic Noise Testing Set Up

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Protections

Overvoltage	Main output 145% max of rated normal voltage, Latch Mode Standby 125% max of rated voltage, Latch Mode
Overload / Overcurrent	Main output 130% max of rated load current, Hiccup Mode, Non-Latching (Auto-Recovery) Standby 3.2A max with Hiccup Mode (Non-Latching, Auto-Recovery)
Over Temperature	Auto-Recovery
Short Circuit	Hiccup Mode to Main output / Standby (Non-Latching, Auto-Recovery when the fault is removed)
Protection Against Shock	Class I with PE*8 connection

*8 PE: Protection Earth

Reliability Data

MTBF	500K hrs based on Telcordia SR-332 (@ 230 Vac, 100% Load, 35°C)
Expected Cap Life Time	5 years, (@ 230 Vac, 100% load @ 25°C)

Safety Standards / Directives

Safety Entry Low Voltage	SELV
Electrical Safety	TUV Bauart EN 62368-1 UL/cUL UL 62368-1, and CAN/CSA C22.2 No. 62368-1 CB scheme IEC 62368-1 CQC GB 4943.1
CE	In conformance with EMC Directive 2014/30/EU and Low Voltage Directive 2014/35/EU
UKCA	In conformance with Electromagnetic Compatibility Regulations 2016 and Electrical Equipment (Safety) Regulations 2016
Galvanic Isolation	Input to Output 4.0 KVac Input to Ground 2.0 KVac Output to Ground 1.5 KVac

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EMC

Emissions (CE & RE)		EN 55032, KS C 9832, Comply to FCC Title 47: Class B
Electrostatic Discharge	IEC 61000-4-2	Level 4 Criteria A ¹⁾ Air Discharge: 15 kV Contact Discharge: 8 kV
Radiated Field	IEC 61000-4-3	Criteria A ¹⁾ 80MHz-2700MHz, 10V/m AM modulation Level 2 Criteria A ¹⁾⁵⁾ 385MHz-5785MHz, 28V/m Pulse mode and other modulation
Electrical Fast Transient / Burst	IEC 61000-4-4	Level 3 Criteria A ¹⁾ 2kV
Surge	IEC 61000-4-5	Level 3 Criteria A ¹⁾⁵⁾ Common Mode ³⁾ : 2kV Differential Mode ⁴⁾ : 1kV
Conducted	IEC 61000-4-6	Level 2 Criteria A ¹⁾⁵⁾ 150kHz-80MHz, 3Vrms, 6Vrms at ISM bands and Amateur radio bands
Power Frequency Magnetic Fields	IEC 61000-4-8	Criteria A ¹⁾⁵⁾ Magnetic field strength 30A/m
Voltage Dips and Interruptions	IEC 61000-4-11	30% 10ms Criteria A ¹⁾ 60% 100ms Criteria B ²⁾ 100% 5000ms Criteria B ²⁾
Harmonic Current Emission	IEC/EN 61000-3-2	Meet Class A limit
Voltage Fluctuation and Flicker		EN 61000-3-3
Voltage Sag Immunity SEMI F47 – 0706		80% of 200 Vac, 160 Vac, 1000 ms, Criteria A ¹⁾ 70% of 200 Vac, 140 Vac, 500 ms, Criteria A ¹⁾ @ 1,900W & Criteria B ²⁾ @ 2,500W 50% of 200 Vac, 100 Vac, 200 ms, Criteria A ¹⁾ @ 1,900W & Criteria B ²⁾ @ 2,500W

1) Criteria A: Normal performance within the specification limits

2) Criteria B: Output out of regulation, or shuts down during test. Automatically restored to normal operation after test.

3) Criteria C: Output out of regulation, shuts down during test (Need to recycle AC power cord to normal operation after test)

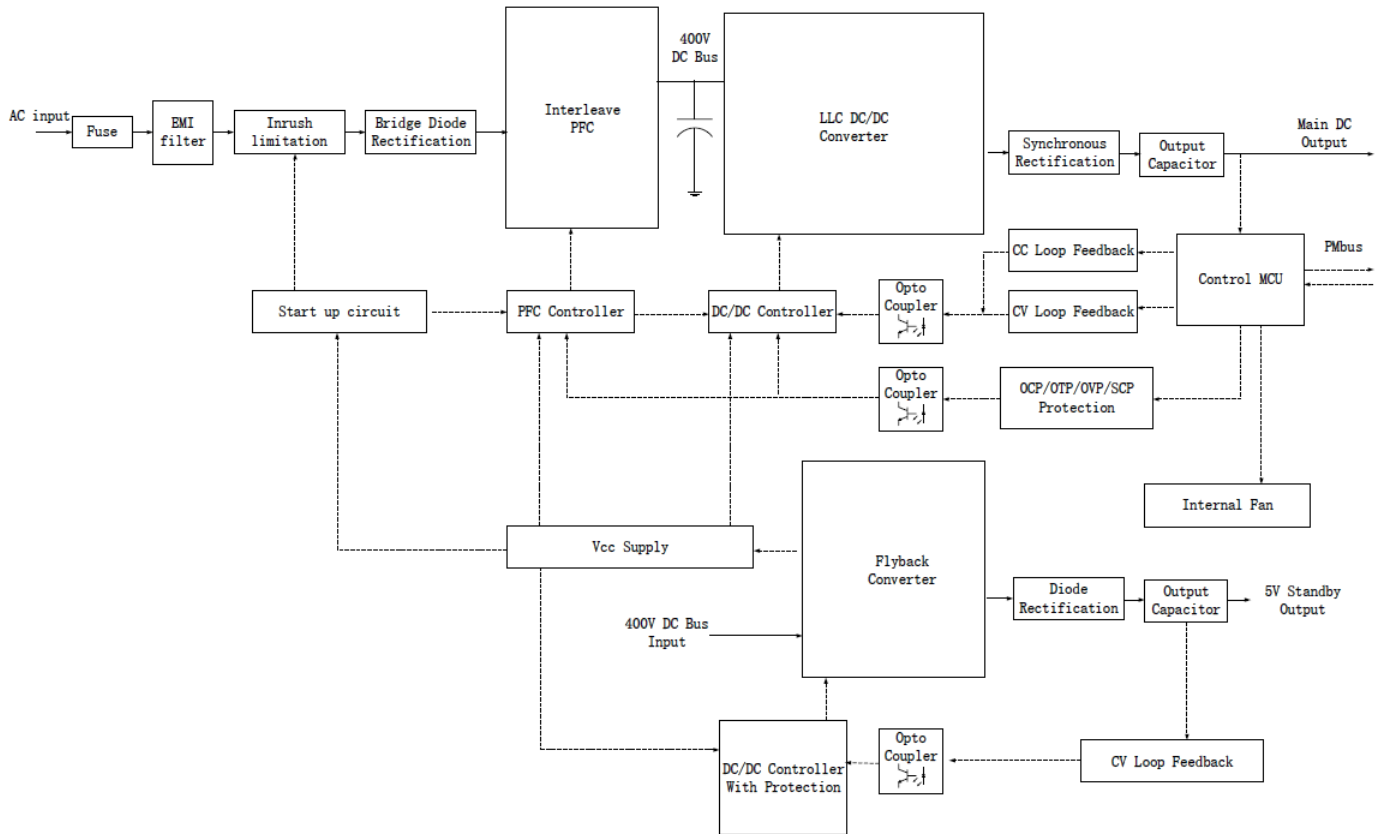
4) Asymmetrical: Common mode (Line to earth)

5) Symmetrical: Differential mode (Line to line)

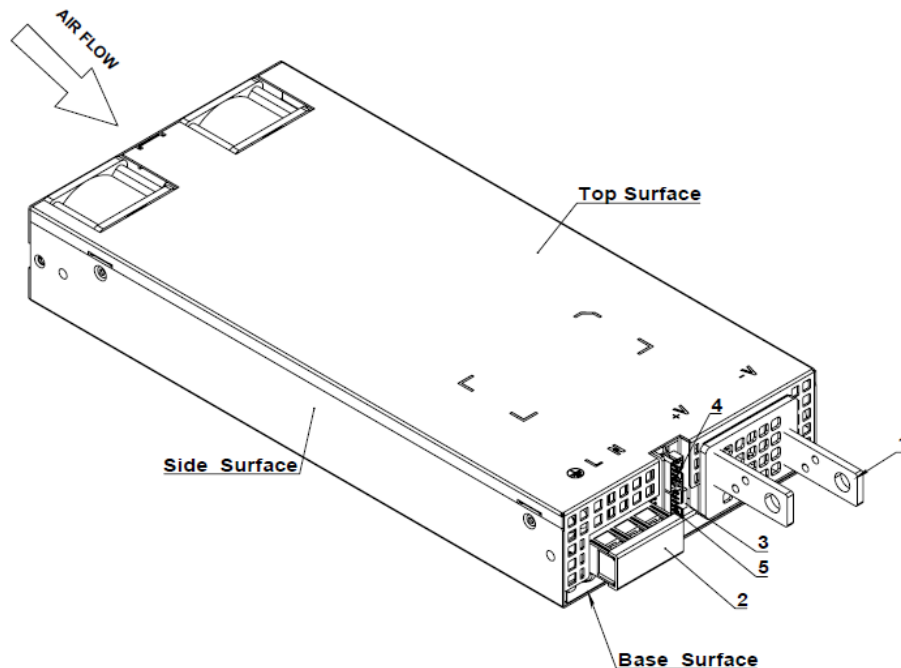
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Block Diagram



Device Descriptions



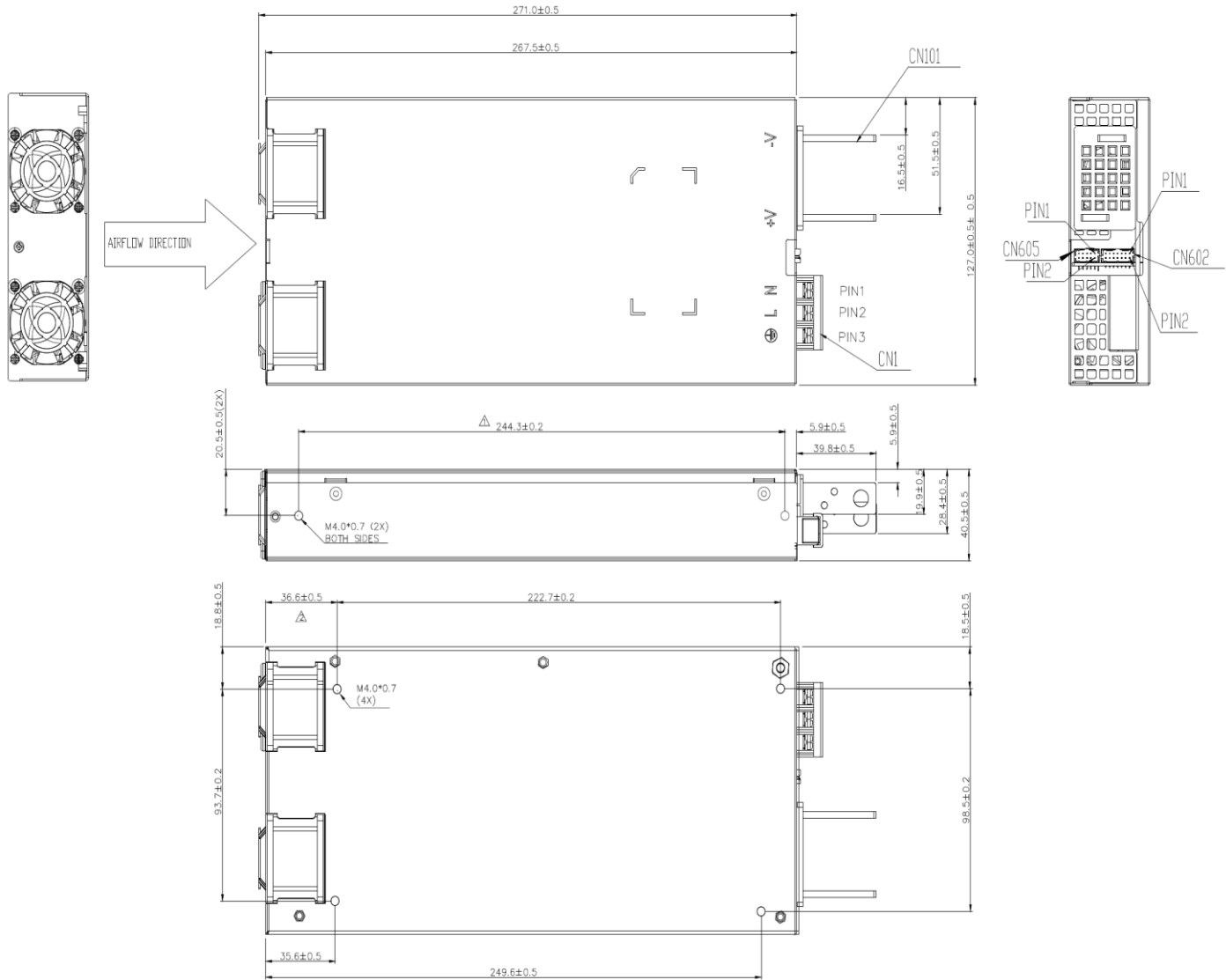
- 1) Output terminal block connector
- 2) Input terminal block connector
- 3) DC voltage adjustment potentiometer
- 4) Communications Connector
- 5) Global Control Signals

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Dimensions

L x W x H: 271 x 127.0 x 40.5 mm (10.67 x 5 x 1.59 inch)



Notes:

1. Base plate mounting, M4 thread holes, maximum penetration 3.0mm (0.118 inch) from outside face of chassis, maximum torque 9-10 kgf.cm (7.82-8.69 lbf.in).
2. Side mounting, M4 thread holes, maximum penetration 3.0mm (0.118inch) from outside face of chassis, maximum torque 9-10 kgf.cm (7.82-8.69 lbf.in).
3. CN101, M6 screw in two positions, maximum torque 32kgf.cm (27.81 inch.lbs). M3 screw in two positions, maximum torque 4-5 kgf.cm (3.48-4.35 inch.lbs)
4. CN1, M3.5 screw in three positions, maximum torque 6-7kgf.cm (5.21-6.08 inch.lbs).
5. VR: clockwise is to increase the output voltage, anti-clockwise is to reduce the output voltage in voltage mode, and to change current in current mode.
6. All dimensions are in millimeters and inches

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Connector Definition and Pin Assignment

Input Connector CN1(ANYTEK: YK50A)	
Pin 1	Earth
Pin 2	Line
Pin 3	Neutral
Output Connector CN101	
V+	Output
V-	Output Return
Control Connector CN605(Molex:87833-1051) Mating With Molex:51110-1051 Terminal:0503948052	
Pin 1	5V bus for I2C
Pin 2	DC RTN of 5V bus for I2C
Pin 3	Serial data signal (SDA)
Pin 4	Serial clock signal (SCL)
Pin 5	NC
Pin 6	NC
Pin 7	Address bit 0 (A0)
Pin 8	Address bit 1 (A1)
Pin 9	Address bit 2 (A2)
Pin 10	NC
Control Connector CN602(Molex:87833-7420) Mating With Molex:51110-1451 Terminal:0503948052	
Pin 1	Remote On Off/Inhibit +
Pin 2	Remote On Off/Inhibit -
Pin 3	Power Good-
Pin 4	Power Good+
Pin 5	NC
Pin 6	NC
Pin 7	5V Standby +
Pin 8	5V Standby +
Pin 9	5V Standby Return
Pin 10	5V Standby Return
Pin 11	Remote Sense +
Pin 12	Remote Sense -
Pin 13	Current Share
Pin 14	CC/CV mode switch

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Engineering Data

Output Load De-rating VS Surrounding Air Temperature

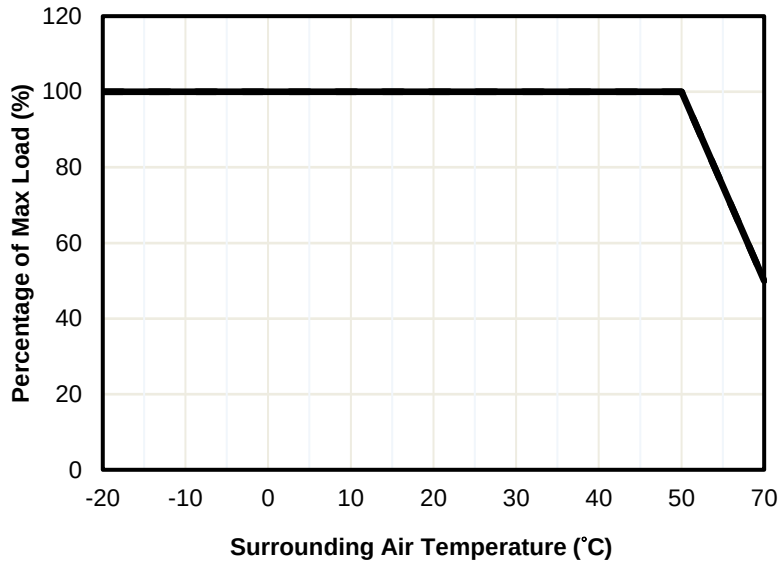


Fig. 2 De-rating for Horizontal Mounting Orientation
> 50°C de-rate power by 2.5% / °C

Note

1. Power supply components may degrade, or be damaged, when the power supply is continuously used outside the shaded region, refer to the graph shown in Fig. 2 & Fig. 3.
2. The PSU will be bouncing and start up time will not exceed 5s when ambient temperature at -20°C.
3. If the output capacity is not reduced when the surrounding air temperature >50°C, the device will run into Over Temperature Protection. When activated, power supply will latch off, until the surrounding air temperature is lowered or the load is reduced as far as necessary to keep the device in working condition, and require removal/re-application of input AC voltage in order to restart.
4. In order for the device to function in the manner intended, it is also necessary to keep a safety distance as recommended in the safety instructions while the device is in operation.
5. Depending on the surrounding air temperature and output load delivered by the power supply, the device can be very hot!

Output Load De-rating VS Input Voltage

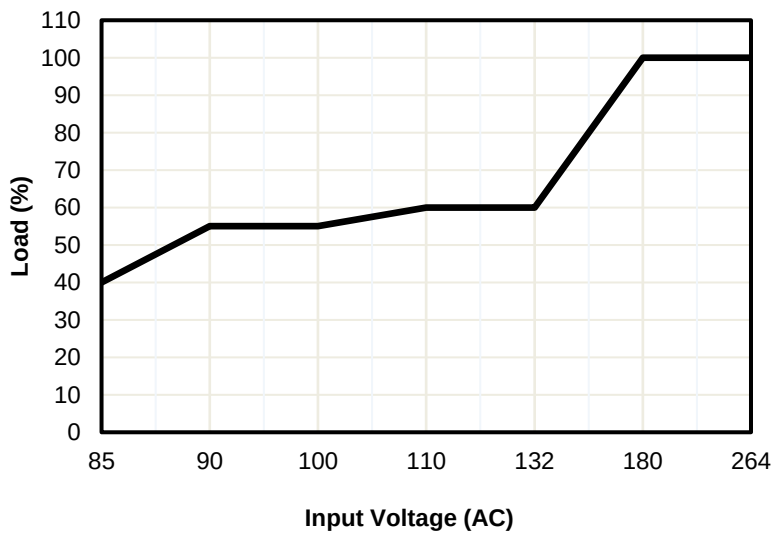


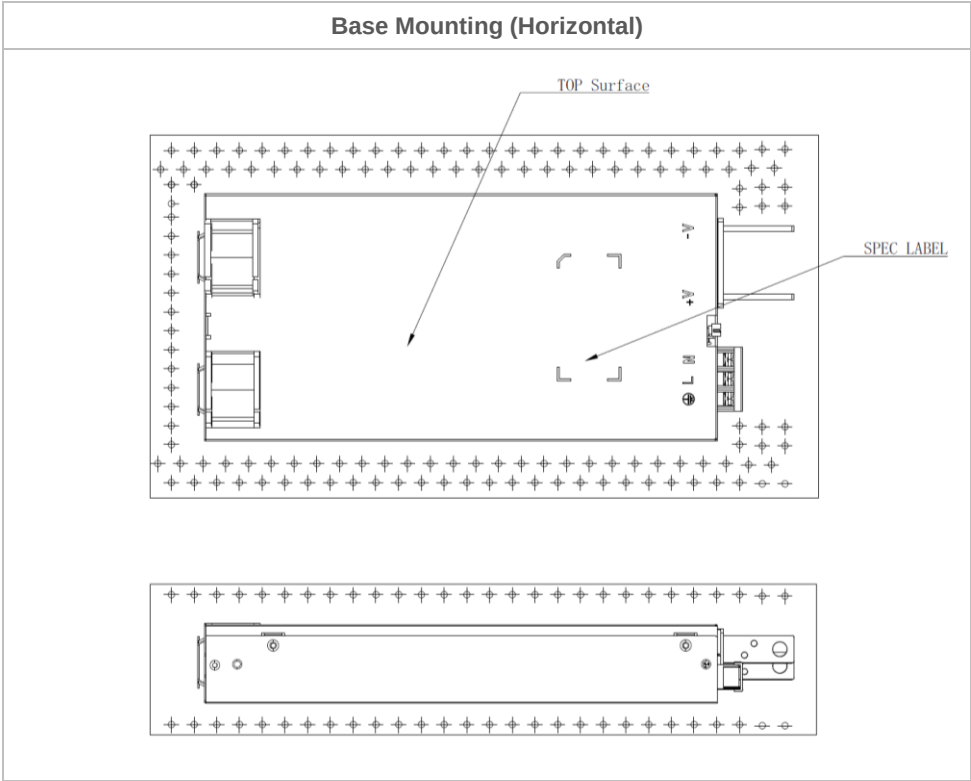
Fig. 3 De-rating for AC Input Voltage
< 180 Vac de-rate power by 0.8% / Vac from 100% to 60 % load
< 110 Vac, de-rate power by 0.6%/ Vac from 60% to 54% load.
< 90 Vac, de-rate power by 2.8%/Vac from 54% to 40% load.

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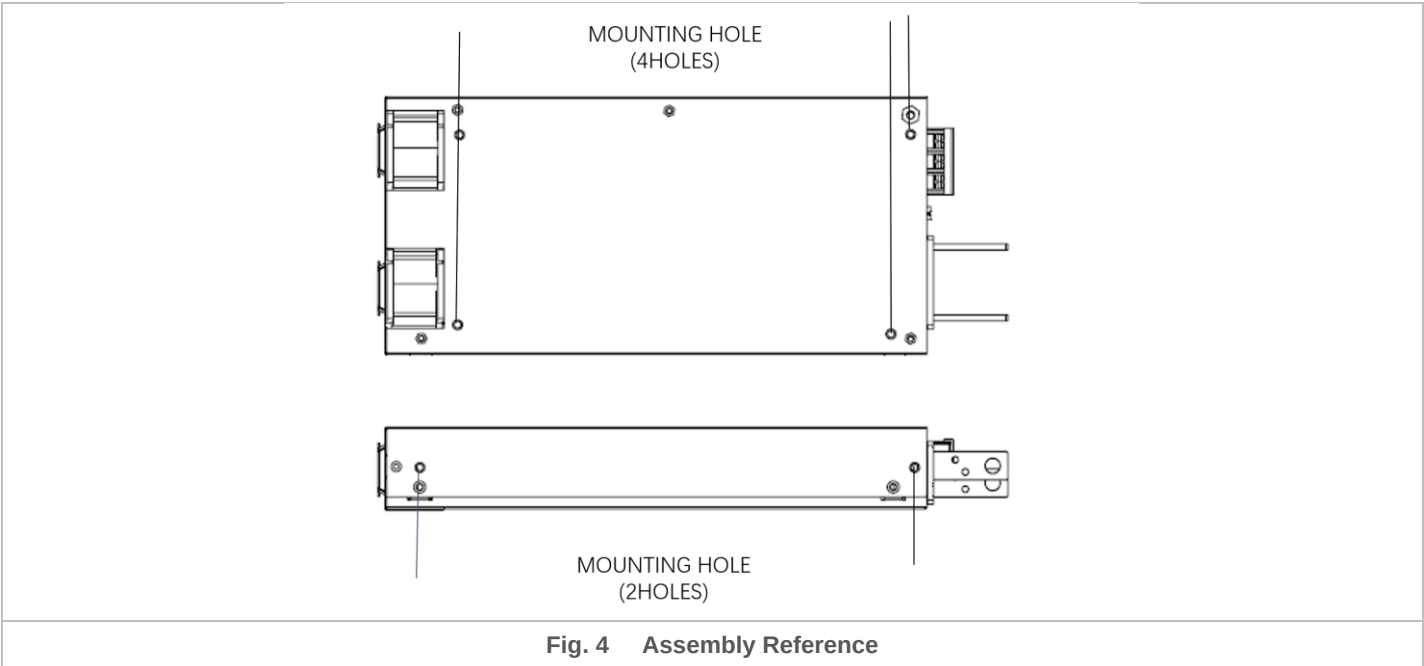
Assembly & Installation

- Ⓐ Base Mounting: Fig. 3 shows the mounting hole locations for power supply assembly onto a metal mounting surface.
- Ⓑ This surface belongs to customer's end system or panel where the power supply is mounted.
- Ⓒ Connector



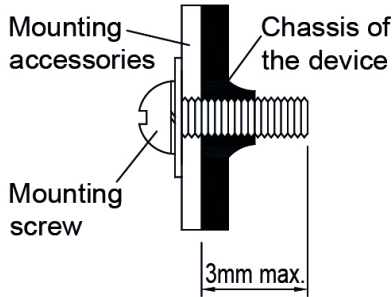
* If the device has to be mounted in any other orientation, please leave a message via the [Contact Us](#) form.

Installation of Mounting Accessories



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- Only use M4 screw ≤ 3 mm (0.12 inch) through the base mounting holes. This is to keep a safe distance between the screw and internal components.
- Recommended mounting tightening torque: 10 kgf.cm (7.82-8.69 inch.lbs).

Fig. 5 Mounting Screw

Safety Instructions

- If user's mounting orientation is not according to the recommended mounting orientations, please consult Delta for further information.
- To ensure sufficient convection cooling, always maintain a safety distance of ≥ 50 mm (1.97 inch) from all ventilated surfaces while the device is in operation.
- The device is not recommended to be placed on low thermal conductive surface. For example, plastics.
- The enclosure of the device can become very hot depending on the ambient temperature and load of the power supply. Do not touch the device while it is in operation or immediately after power is turned OFF. Risk of burning!
- Do not touch the terminals while power is being supplied. Risk of electric shock.
- Prevent any foreign metal, particles or conductors from entering the device through the openings during installation. It may cause: Electric shock; Safety Hazard; Fire; Product failure
- The power supply must be mounted by metal screws onto a grounded metal surface. It is highly recommended that the Earth terminal on the connector be connected to the grounded surface.

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Functions

Start-up Time

The time required for the output voltage to reach 90% of its final steady state value, after the input voltage is applied.

Rise Time

The time required for the output voltage to change from 10% to 90% of its final steady state value.

Hold-up Time

Time between the collapse of the AC input voltage, and the output falling to 90% of its steady state value.

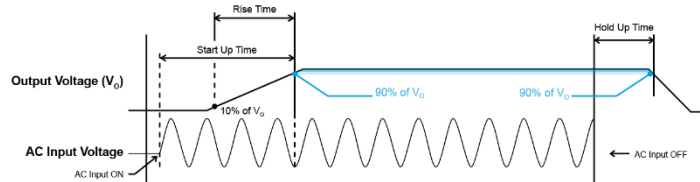


Fig. 6 Time Sequence

Dynamic Response (Main Output)

The power supply output voltage will remain within $\pm 5\%$ of its steady state value, when subjected to a dynamic load 50 to 100% of its rated current.

■ 50 to 100% Load

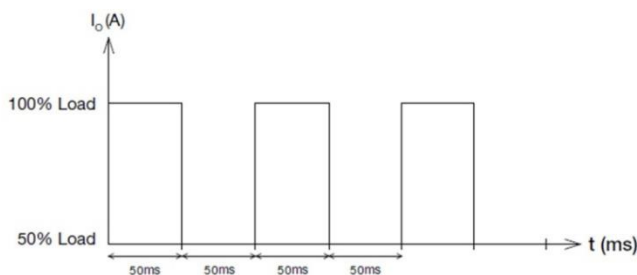


Fig. 7 Dynamic Load

Inrush Current

Inrush current is the input current that occurs when the input voltage is first applied. For AC input voltages, the maximum peak value of inrush current will occur during the first half cycle of the applied AC voltage. This peak value decreases exponentially during subsequent cycles of AC voltage.

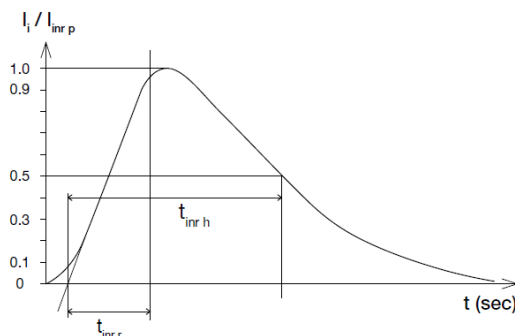


Fig. 8 Inrush Current

Overvoltage Protection

The power supply's overvoltage circuit will be activated when its internal feedback circuit fails. The output voltage shall not exceed its specifications defined on Page 3 under "Protections". Power supply will latch off, and require removal/re-application of input AC voltage in order to restart.

Overload & Over current Protections

The power supply's Overload (OLP) and Overcurrent (OCP) Protections will be activated when output current exceeds 130% of I_o (Max load). In such occurrence, the V_o will start to droop and once the power supply has reached its maximum power limit, the protection is activated and the power supply will go into "Hiccup mode" (Auto-Recovery). The power supply will recover once the fault condition of the OLP and OCP is removed and I_o is back within the specifications.

Please be noted the output current might be clamped in constant current mode and in this case, the protection will be triggered by output under voltage (85% for 12V/24V and 82% for 48V).

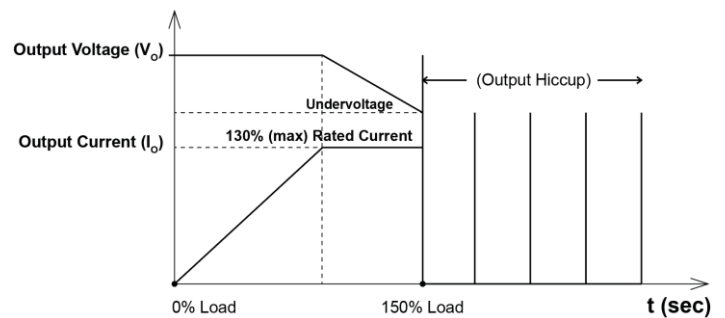


Fig. 9 Hiccup at OLP/OCP

Short Circuit Protection

Output OLP/OCP function also provides protection against short circuits. When a short circuit is applied, the output current will operate in "Hiccup mode", The power supply will return to normal operation after the short circuit is removed.

Over Temperature Protection

As mentioned above, the power supply also has Over Temperature Protection (OTP). This is activated when the overload condition persists for an extended duration and the output current is below the overload trigger point but $>100\%$ load. In the event of a higher operating temperature condition at 100% load, the power supply will run into OTP when the surrounding air temperature is higher than the operating temperature. When activated, the output voltage will go into recovery mode until the surrounding air temperature drops to its normal operating temperature.

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Power Good

Power Good+/- pin is an isolated open collector transistor (80V/50mA rating). A resistor (suggested value 10Kohm, 1/8W) can be added between Power Good- pin and DC RTN, Power Good+ pin can be connected to 5V standby (or, other available pull-up voltage that is no greater than the transistor rating). Value of resistor may have to be adjusted, depending on voltage used, and other end-use conditions of the Power Good+ pin connection to the product. When AC input is on, Power Good Signal (Shown in below figure) generated will be high. When AC input is off, Power Good Signal generated will be low. There will be a minimum of 5 milliseconds (at 2,000W load @ 230Vac) between the time the Power Good Signal goes to low level, and the time when the output reaches 90% of its rated value.

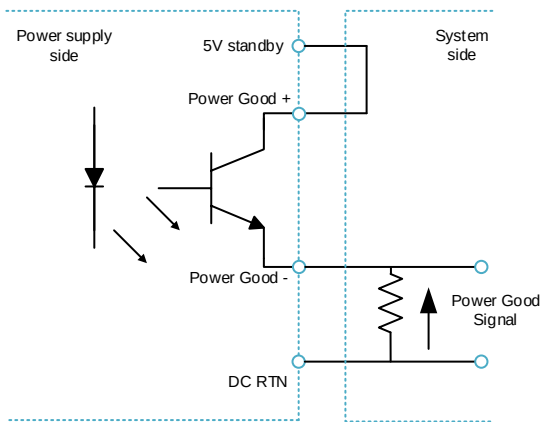


Fig. 10 Power Good Connection

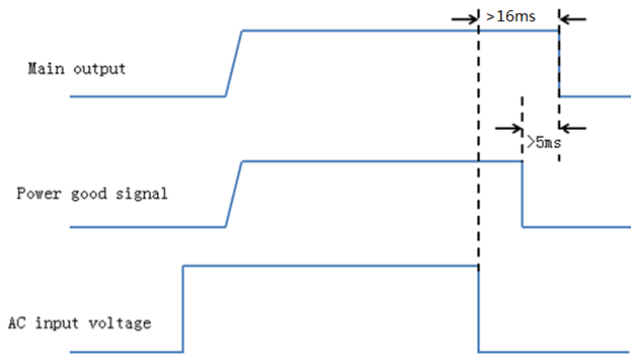


Fig. 11 Power Good Time Sequence

Remote On_Off/Inhibit

Remote ON_OFF/INHIBIT uses an isolated diode located within the power supply. This signal can be used to enable or disable only the main output. When the main output is disabled, the +5V Standby output will continue to operate. System can use a switch to conduct through this diode (suggested pull up resistor to 5V standby with 500~1Kohm resistor) to disable the main out.

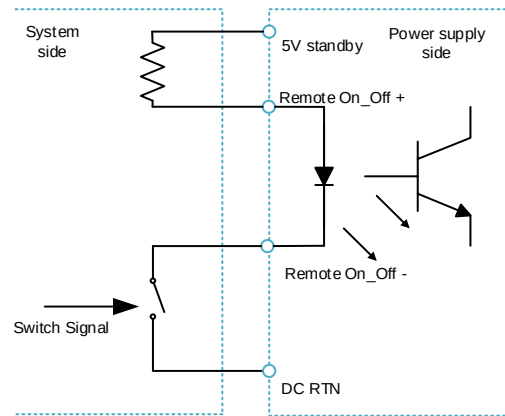


Fig. 12 Remote On_Off Connection

Remote Sense

Remote sense feature can be used to compensate for the extra voltage drop on output wires that are connected from the main output terminals, to the load. With wires connected from the remote sense pins, at the same locations as the wires from the main output, the remote sense function can compensate up to 500mV voltage drop. The power supply will not be damaged if the remote sense pins are shorted, or if a reverse/inverted polarity connection is made to the load.

Voltage/Current Adjustment

The power supply provides a potentiometer for user to adjust the output voltage in CV mode or to adjust the output current in CC mode. The output voltage is designed to be able to adjust above the normal rated voltage, when the output is adjusted above nominal value, the output power cannot exceed the nominal maximum power (the maximum output current will be reduced accordingly).

PMBus

The power supply can communicate with the host product, using PMBus version 1.3 protocols. Multiple functions can be realized, such as monitoring the power supply operation status, and editing the power supply operating set-points. See user instruction for detailed control information.

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Current Sharing

The power supply supports parallel current sharing function. Two power supply main outputs are connected in parallel and connected to the Load. The Current Share port can enable this function (Pin13 of CN602, refer to the power structure diagram and lead Foot definition), up to six power supplies can be connected in parallel.

When the power supply is connected in parallel, adjust the voltage difference between different power supplies to within ± 150 mV, and ensure that the maximum output current does not exceed 80% of the rated current.

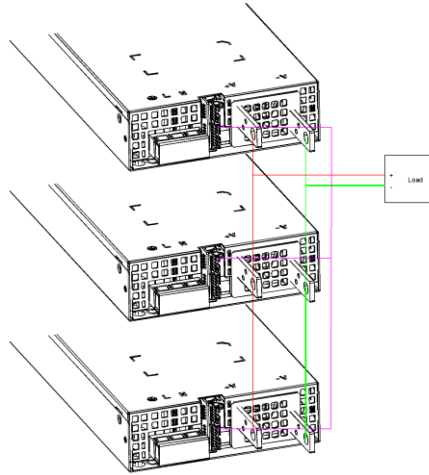


Fig. 13 Parallel Connection

CC/CV mode selection

Pin14 of CN602 can be used to select from constant voltage output mode or constant current output mode, if the pin is left open the output will be default as constant voltage output, if the pin is shorted to ground return, the output will be selected as constant current.

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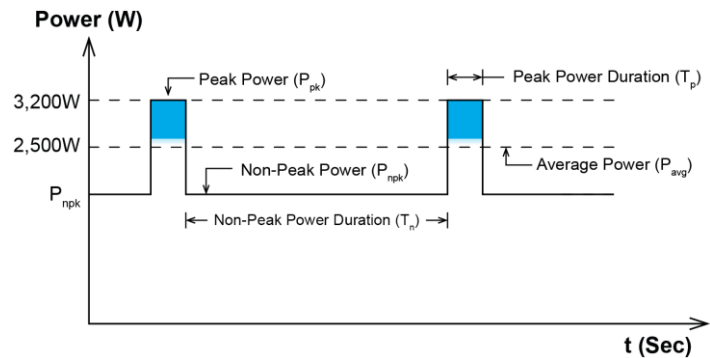
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Peak Power

Peak Power (P_{pk}) is the reserve power available constantly that allows reliable startup to support sudden and short spike of loads with high inrush current typically during turn on to remove the need of more expensive higher rated power supply unit.

After the output has reached its steady state set value, the power supply can support surge loads with a higher short-term power demand up to P_{pk} , for a maximum duration of 3 seconds.

During peak power, limit the average power within 8 seconds to no more than the rated output power (P_{rated}).



$$Duty\ cycle\ (\%) = \frac{T_p}{Total\ Time} \ ; \ (T_p \leq 3\ sec)$$

$$Average\ Output\ Power\ (P_{avg}) = \frac{(P_{pk} \times T_p) + (P_{npk} \times T_n)}{Total\ Time}$$

OR

$$Non-Peak\ Power\ (P_{npk}) = \frac{(P_{avg} \times Total\ Time) - (P_{pk} \times T_p)}{T_n}$$

Peak Power (%)	Peak Power (P_{pk})	Peak Power Duration (T_p)	Duty Cycle	Non-Peak Power (P_{npk})	Non-Peak Power Duration (T_n)	Total Time (T)
128%	3,200W	3 sec	37.5%	2,080W	5 sec	8 sec

Fig. 14 Duty Cycle Calculation



PMS Panel Mount Power Supply

PMS 2,500 W series / PMS-□V2K5W1BTD

Attention

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