

PJT Open Frame Power Supply

27V/5.55A, 12V/0.5A Standby / PJT-27V150WBNA

PJT

Highlights & Features

- Universal AC input voltage
- Standard industrial footprint of 3" x 5"
- Built-in active PFC with up to 89.5% efficiency
- Power Boost 6.48A (175W) at 27V for 5 seconds
- Conforms to harmonic current IEC/EN 61000-3-2, Class A
- Convection cooled 150Watt operating temperature range from -10°C to +50°C
- Built-in standby output 12V/0.5A
- High MTBF > 700,000 hrs as per Telcordia SR-332

Safety Standards



CB Certified for worldwide use

Model Number: PJT-27V150WBNA
Unit Weight: 0.37 kg (0.82 lb)
Dimensions (L x W x D): 127 x 76.2 x 36.5 mm
 (5.00 x 3.00 x 1.44 inch)

General Description

The PJT-27V150WBNA comes with both a + 27V nominal main output, and a standby +12 volt 0.5 amp output. The open frame power supply is designed with small standard industrial 3" x 5" footprint. The highly efficient convection cooled design with optimum thermal management for high power efficiency. The product can operate from -10°C to +70°C across the entire input voltage range of 85 to 264Vac and features built-in Power Boost of 6.48A (175W) for 5 seconds. The built-in active PFC product has major international safety standard according to IEC/EN/UL 60950-1, and is certified for EMI standards according to EN 55022, EN55032, and FCC Title 47 Class B.

Model Information

PJT Open Frame Power Supply

Model Number	Input Voltage Range	Rated Output Voltage	Rated Output Current
PJT-27V150WBNA	85-264Vac	V1: 27Vdc, V _{SB} : 12Vdc	V1: 5.55A, V _{SB} : 0.5A

Model Numbering

PJ	T –	27V	150W	B	N	A
Open Frame	Product Type T – ITE Application Series	Output Voltage	Output Power	Package Type B – Open Frame	N – No Remote ON/OFF	A – JST connector

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Specifications

Input Ratings / Characteristics

Nominal Input Voltage	100-240Vac	
Input Voltage Range*	85-264Vac	
Nominal Input Frequency	50-60Hz	
Input Frequency Range	47-63Hz	
Input Current	< 1.80A @ 115Vac, < 0.9A @ 230Vac	
Efficiency at 100% Load	> 88.5% @ 115Vac, > 89.5% @ 230Vac	
Max Power Dissipation	No Load	< 0.4W @ 115Vac, < 0.6W @ 230Vac
	100% Load	< 17W @ 115Vac, < 19W @ 230Vac
Max Inrush Current (Cold Start)	< 50A @ 115Vac, < 100A @ 230Vac	
Power Factor at 100% Load	> 0.99 @ 115Vac, > 0.93 @ 230Vac	
Leakage Current	< 0.25mA @ 264Vac	

*For power de-rating at 85-90Vac, see power de-rating on page 3.

Output Ratings / Characteristics**

Nominal Output Voltage		V1: 27Vdc	V _{SB} : 12Vdc	
Factory Set Point Tolerance	No potentiometer	V1: ± 2%	V _{SB} : ± 2%	
Output Current	Nom.	V1: 5.55A	V _{SB} : 0.5A	Continuously operating
		V1: 6.48A	V _{SB} : NA	Power Boost for 5 seconds
Output Power	Nom.	V1: 150W	V _{SB} : 6W	Continuously operating
		V1: 175W	V _{SB} : NA	Power Boost for 5 seconds
Line Regulation		< 0.5% (@ 90-264Vac input, 100% load)		
Load Regulation		< 1.0% (@ 90-264Vac input, 0-100% load)		
PARD*** (20MHz)		V1: < 150mVpp	V _{SB} : < 75mVpp	20MHz, warm up for 10mins
Rise Time		< 100ms @ 115Vac & 230Vac (100% load)		
Start-up Time		< 1500ms @ 115Vac & 230Vac (100% load)		
Hold-up Time		> 40ms @ 115Vac & 230Vac (100% load)		
Dynamic Response (Overshoot & Undershoot O/P Voltage)		± 5% @ 85-264Vac input, 0-100% load (Slew Rate: 0.1A/μS, 50% duty cycle @ 5Hz to 1KHz)		
Start-up with Capacitive Loads		V1: 3,000uF Max V _{SB} : NA		

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

***PARD is measured with an AC coupling mode, 5cm wires, and in parallel with 0.1μF ceramic capacitor & 47μF electrolytic capacitor.

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Mechanical

Dimensions (L x W x D)	127.6 x 76.2 x 36.5 mm (5.00 x 3.00 x 1.44 inch)	
Unit Weight	0.37 kg (0.82 lb)	
Cooling System	Convection	
Power Supply Header	Input (CN1)	B3P5-VH (LF)(SN)
	Output (CN2)	B4P-VH (LF)(SN)
	Standby (CN3)	B2B-XH-A (LF)(SN)
Wire	Input (CN1)	AWG 22-18
	Output (CN2)	AWG 22-18
	Standby (CN3)	AWG 28-22
Noise (1 Meter from power supply)	Sound Pressure Level (SPL) < 30dBA	

Environment

Surrounding Air Temperature	Operating	-10°C to +70°C
	Storage	-40°C to +85°C
Power De-rating	Temperature	> 50°C de-rate power by 2.5% / °C
	Input Voltage	< 90Vac de-rate power by 2.0% / °C
Operating Humidity	5 to 95% RH (Non-Condensing)	
Operating Altitude	0 to 5,000 Meters (16,400 ft.)	
Shock Test (Non-Operating)	IEC 60068-2-27, Half Sine 50G for a duration of 11ms, 3 times per direction, 9 times in total	
Vibration (Operating)	IEC 60068-2-6, 10Hz to 150Hz @ 25m/S ² (2.5G peak); displacement of 0.35mm; 90 min per axis for all X, Y, Z direction	
Over Voltage Category	II	
Pollution Degree	2	

Protections

Overvoltage	V1	< 36V, SELV Output, Latch Mode
	V _{SB}	< 19V, SELV Output, Hiccup Mode, Non-Latching (Auto-Recovery)
Overload / Overcurrent	Hiccup Mode, Non-Latching (Auto-Recovery) <ul style="list-style-type: none"> V1: Range of 7.5-8.8A, when V_{SB} is operating at rated output current. Protects only V1 and V_{SB} continues operate V_{SB}: Range of 0.6-1.1A, when V1 is operating at rated output current. Protects only V_{SB} and V1 continues operate 	
Over Temperature	< 75°C Surrounding Air Temperature @ 100% load, Only V1 shuts down in Latch Mode, V _{SB} continuous to operate	
Short Circuit	Hiccup Mode, Non-Latching (Auto-Recovery when the fault is removed) <ul style="list-style-type: none"> V1: short circuit, V_{SB}: still continuously operating V1: still continuously operating, V_{SB}: short circuit 	
Internal Fuse	T3.15AH	
Protection Against Shock	Class I with PE* connection	

*PE: Primary Earth

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Reliability Data

MTBF	> 700,000 hrs. as per Telcordia SR-332 I/P: 115Vac, O/P: 100% load, Ta: 25°C
Expected Cap Life Time	10 years (115Vac & 230Vac, 50% load @ 40°C)

Safety Standards / Directives

Safety Entry Low Voltage		SELV (EN 60950-1)
Electrical Safety	TUV Bauart	EN 60950-1
	UL/cUL recognized	UL 60950-1 and CSA C22.2 No. 60950-1 (File No. E191395)
	CB scheme	IEC 60950-1
CE		In conformance with EMC Directive 2014/30/EU and Low Voltage Directive 2014/35/EU
Material and Parts		RoHS Directive 2011/65/EU Compliant
Galvanic Isolation	Input to Output	3.0KVac
	Input to FG	1.5KVac
	Output to FG*	0.5KVac

* Please refer to Note at page 6.

EMC

Emissions (CE & RE)		CISPR 22, CISPR 32, EN 55022, EN 55032, FCC Title 47: Class B	
Immunity		EN 55024	
Electrostatic Discharge	IEC 61000-4-2	Level 3 Criteria A ¹⁾ Air Discharge: 8kV Contact Discharge: 6kV	
Radiated Field	IEC 61000-4-3	Level 2 Criteria A ¹⁾ 80MHz-1GHz, 3V/M with 1kHz tone / 80% 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⁾ Common Mode ³⁾ : 2kV Differential Mode ⁴⁾ : 1kV	
Conducted	IEC 61000-4-6	Level 2 Criteria A ¹⁾ 3V with 80% AM	
Power Frequency Magnetic Fields	IEC 61000-4-8	Criteria A ¹⁾ 1A/Meter	
Voltage Dips and Interruptions	IEC 61000-4-11	70% of 100Vac, 500ms 5% of 100Vac, 10ms 5% of 100Vac, 5000ms 70% of 240Vac, 500ms 5% of 240Vac, 10ms 5% of 240Vac, 5000ms	Criteria A ¹⁾ Criteria A ¹⁾ Criteria B ²⁾ Criteria A ¹⁾ Criteria A ¹⁾ Criteria B ²⁾
Low Energy Pulse Test (Ring Wave)	IEC 61000-4-12	Level 3 Criteria A ¹⁾ Common Mode ³⁾ : 2kV Differential Mode ⁴⁾ : 1kV	
Harmonic Current Emission		IEC/EN 61000-3-2, Class A	
Voltage Fluctuation and Flicker		IEC/EN 61000-3-3	

1) Criteria A: Normal performance within the specification limits

2) Criteria B: Temporary degradation or loss of function which is self-recoverable

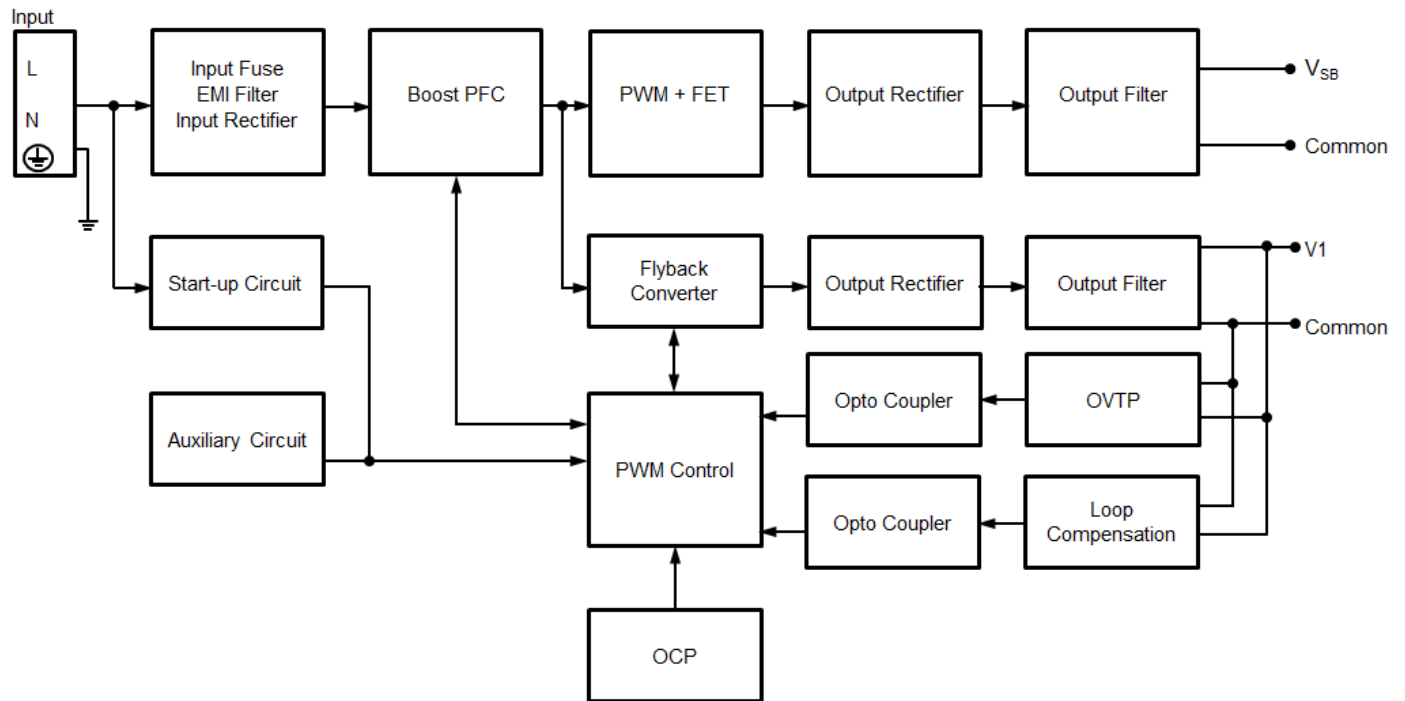
3) Asymmetrical: Common mode (Line to earth)

4) Symmetrical: Differential mode (Line to line)

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Block Diagram

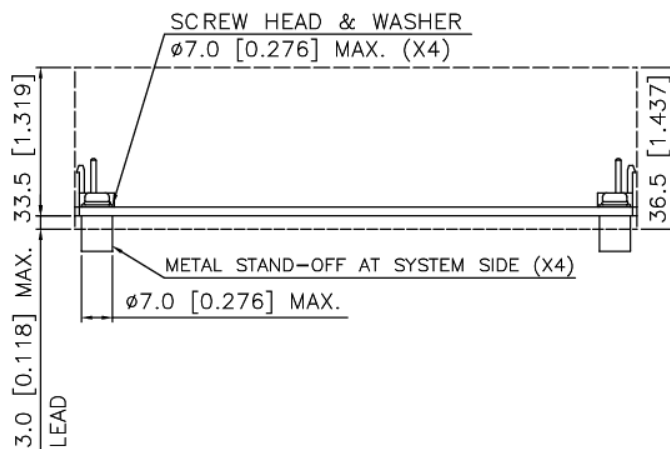
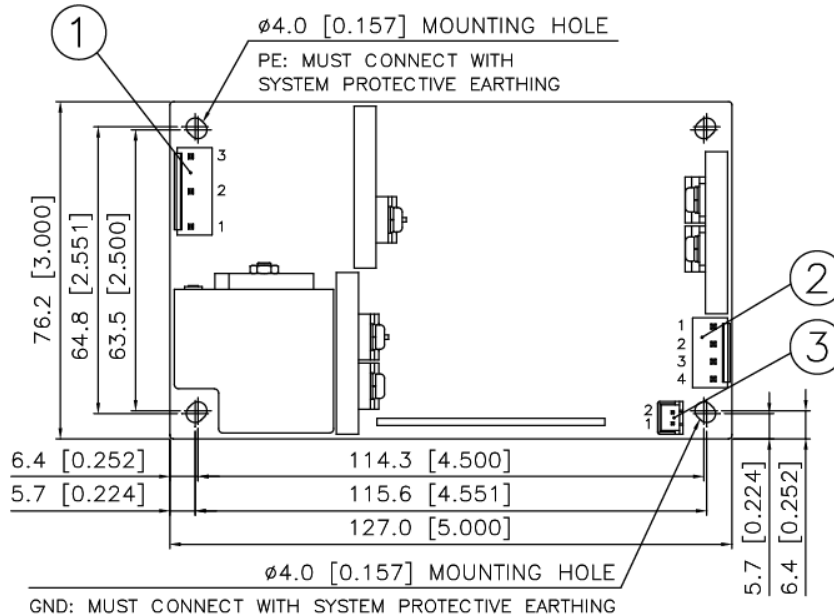


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Dimensions

L x W x D: 127 x 76.2 x 36.5 mm [5.00 x 3.00 x 1.44 inch]



Item	Device Description
1	Input Connector (CN1) Pin 1: Line Pin 2: Neutral Pin 3: FG
2	Output Connector (CN2) Pin 1 to 2: V1(-) Pin 3 to 4: V1(+)
3	Output Connector (CN3) Pin 1: V _{SB} (+) Pin 2: V _{SB} (-)

Note: For optimum EMI performance, the two mounting holes as described above need to be connected together to the system's protective earthing (PE). Protective bonding conductor from the end product protective earth terminal can be tied to the input FG. Under this mounting condition, there is no galvanic isolation between Output to FG.

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Engineering Data

Output Load De-rating VS Surrounding Air Temperature

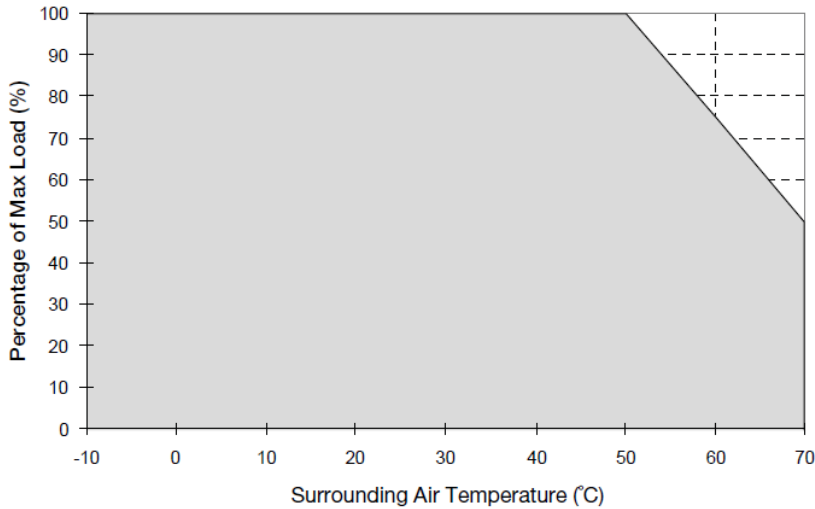
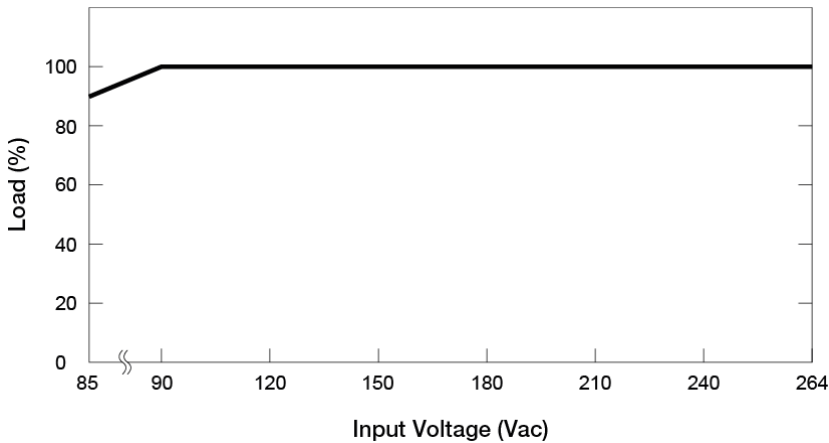


Fig. 1 De-rating for All Recommended Mounting Orientation in Fig. 2
 > 50°C de-rate power by 2.5% / °C

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. 1.
2. 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.
3. In order for the device to function in the manner intended, it is also necessary to keep a safety distance of $\geq 8\text{mm}$ (0.16 inch) at all sides from other components and equipment.
4. Depending on the surrounding air temperature and output load delivered by the power supply, the device can be very hot!
5. If the device has to be mounted in any other orientation, please contact info@deltapsu.com for more details.

Output Load De-rating VS Input Voltage



- No output power de-rating for the input voltage from 90Vac to 264Vac

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Assembly & Installation

Any excessive twisting or bending may damage the device's PCB. Please handle the device with care.

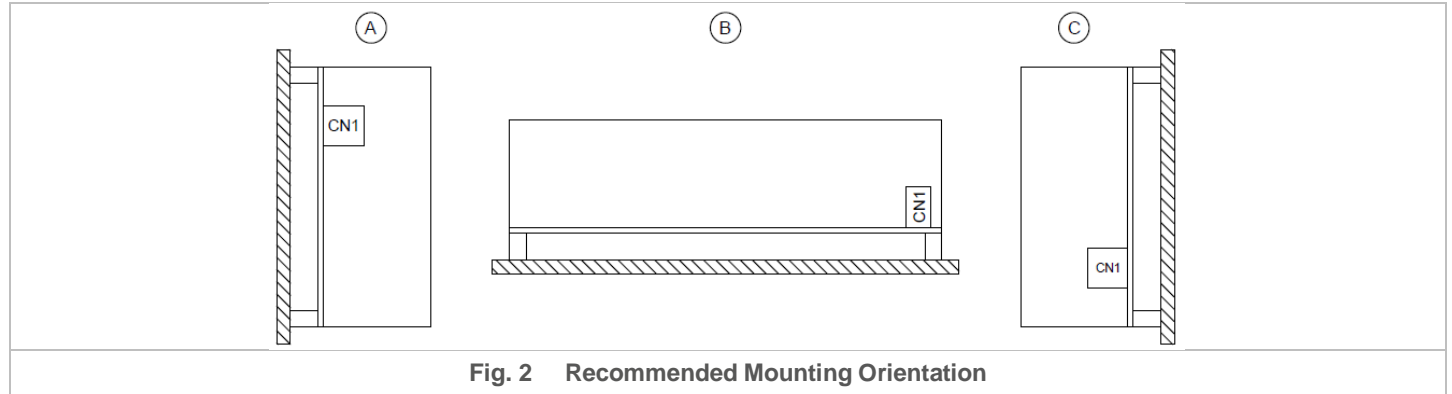


Fig. 2 Recommended Mounting Orientation

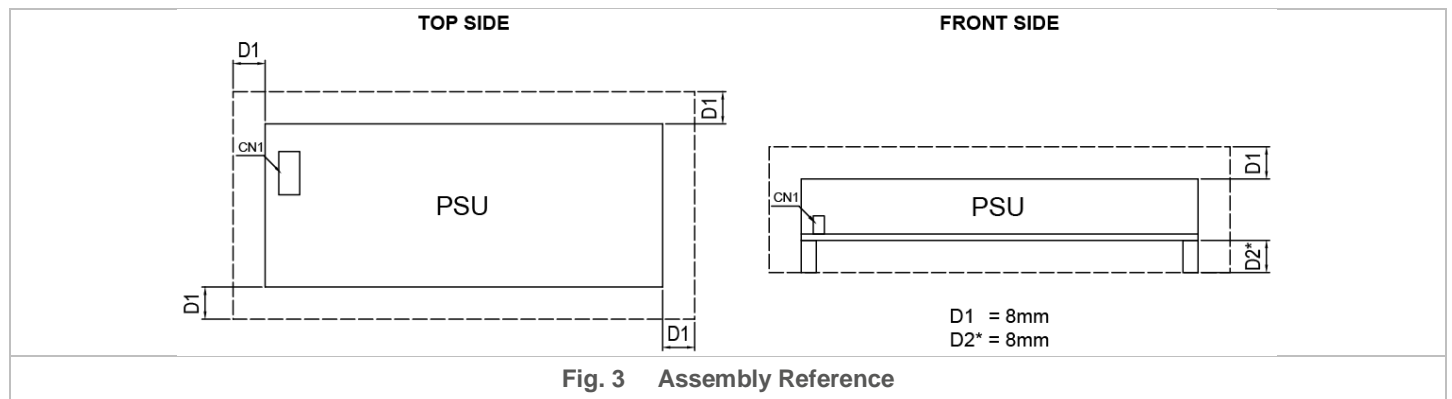


Fig. 3 Assembly Reference

Please refer to Table 1 for the recommended Mating Connector, Terminal and AWG wire size.

Table 1		Power Supply Header	Mating Connector	Terminal	AWG
Input (JST)		B3P5-VH(LF)(SN)	VHR-5N	SVH-21T-P1.1	22-18
Output (JST)	V1	B4P-VH(LF)(SN)	VHR-4N		
Output (JST)	V _{SB}	B2B-XH-A(LF)(SN)	XHP-2	SXH-001T-P0.6	28-22

Safety Instructions

- If the device has to be mounted in any other orientation, please contact info@deltapsu.com for more details.
- The device is not recommended to be placed on surface with low thermal conductivity, such as plastics, for example.
- For safety reasons, please ensure the mounted device is kept at $\geq 8\text{mm}$ (0.31 inch) safety distance at all sides from other components and equipments (Refer Fig. 3). Please insert an insulation sheet between the system and product, if the safety distance is less than 8mm for D2*.
- Note that 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
- Warning: 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 metal surface.

For optimum EMI performance, the two mounting holes as described at Dimension on page 6 need to be connected together to the system's protective earthing (PE). Protective bonding conductor from the end protective earth terminal can be tied to the input FG. Under this mounting condition, there is no galvanic isolation between Output to FG.

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Functions

Start-up Time

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

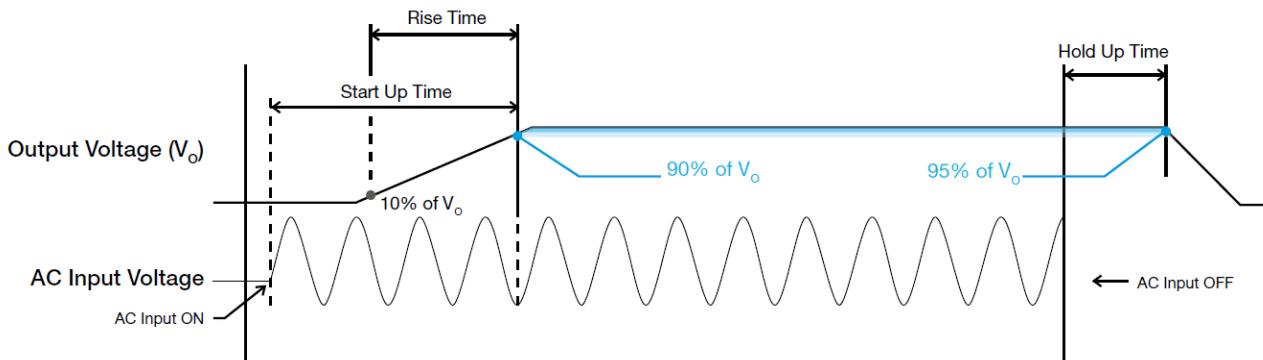
Rise Time

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

Hold-up Time

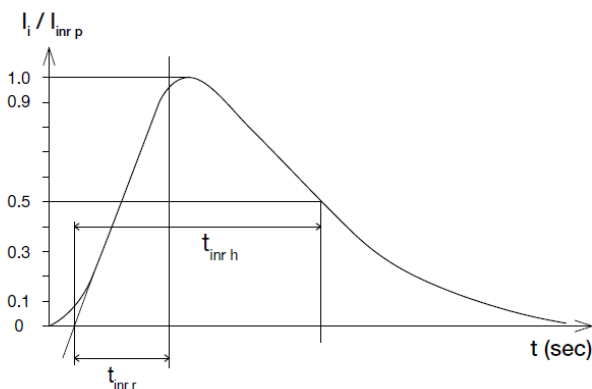
Time between the collapse of the AC input voltage, and the output falling to 95% of its steady state set value.

■ Graph illustrating the Start-up Time, Rise Time, and Hold-up Time



Inrush Current

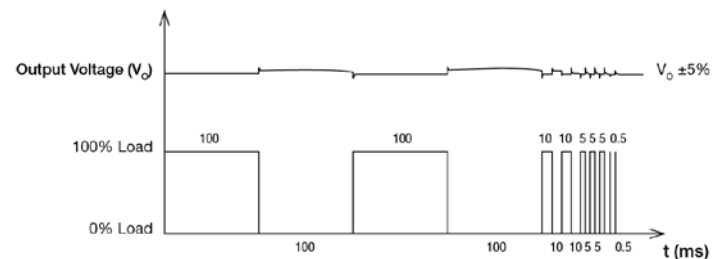
Inrush current is the peak, instantaneous, input current measured and, occurs when the input voltage is first applied. For AC input voltages, the maximum peak value of inrush current will occur during the first half cycle of the applied AC voltage. This peak value decreases exponentially during subsequent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



Dynamic Response

The power supply output voltage will remain within $\pm 5\%$ of its steady state value, when subjected to a dynamic load from 0% to 100% of its rated current.

■ 50% duty cycle / 5Hz to 1KHz

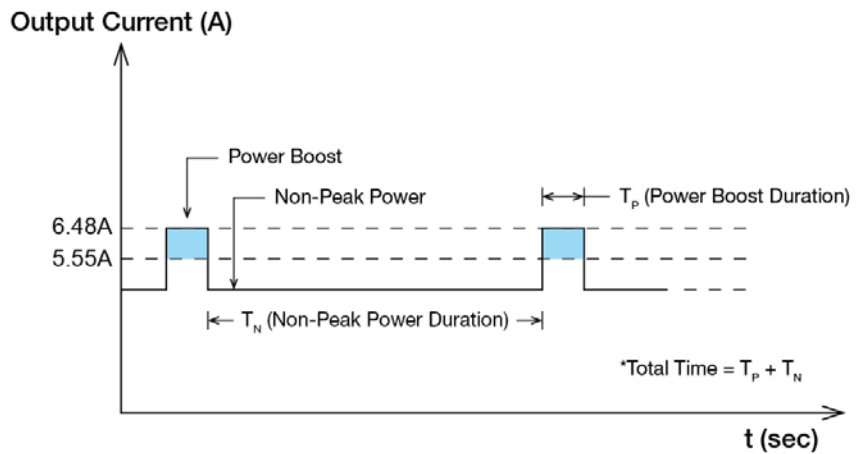


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Power Boost

Power Boost is the reserve power available that allows support of sudden and short spikes of load and eliminates the need for a more expensive higher rated power supply unit. After the output at V1 has reached its steady state set value, the power supply can support surge loads with a higher short-term current of up to 6.48A for a maximum duration of 5 seconds. The Power Boost is also available on a repeated basis with the condition that the average (R.M.S) output power shall not exceed continuous rated power. Refer to duty cycle calculation below.



$$\text{Duty cycle (\%)} = \frac{T_p}{\text{Total Time}}$$

$$\text{Average Output Power } (P_{Avg}) = \frac{(\text{Power Boost} \times T_p) + (\text{Non-Peak Power} \times T_N)}{\text{Total Time}}$$

OR

$$\text{Non-Peak Power} = \frac{(P_{Avg} \times \text{Total Time}) - (\text{Power Boost} \times T_p)}{T_N}$$

■ An example of Power Boost and Average Output Power

Power Boost	Peak Power (W _P)	Power Boost Duration (T _P)	Duty Cycle	Non-Peak Power (W _N)	Non-Peak Power Duration (T _N)	Total Time (T)
6.48A	175	3 sec	10%	91W (3.37A)	26 sec	29 sec
6.48A	175	5 sec	30%	67W (2.48A)	11.5 sec	16.5 sec

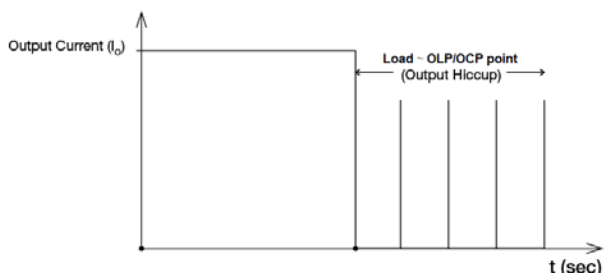
It is not recommended to prolong the duration of Power Boost to be longer than the specified duty cycle calculation, this may cause damage to the PSU.

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Overload & Overcurrent Protections (Auto-Recovery)

The power supply's Overload (OLP) and Overcurrent (OCP) Protections will be activated when either output's current exceeds its specification as defined on Page 3 under "Protections". In such occurrence, the V1 or V_{SB} 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. If an OLP or OCP occurs on one of the outputs, the other output will continue to operate in a normal manner.



It is not recommended to prolong the duration of I_O when it is less than OLP/OCP point, but greater than 100%, since such an overload condition may cause damage to the PSU.

Short Circuit Protection (Auto-Recovery)

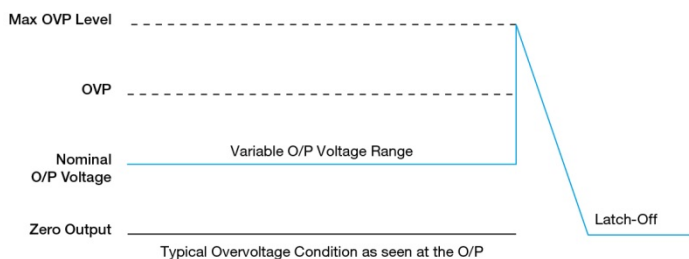
The power supply's output OLP/OCP function also provides protection against short circuits. When a short circuit is applied between either V1 or V_{SB} and DC Return; then; the output current will operate in "Hiccup mode", as shown in the illustration in the OLP/OCP section on this page. The power supply will return to normal operation after the short circuit is removed. When a short circuit is applied to either output, the other output will continue to operate in a normal manner.

Overvoltage Protection

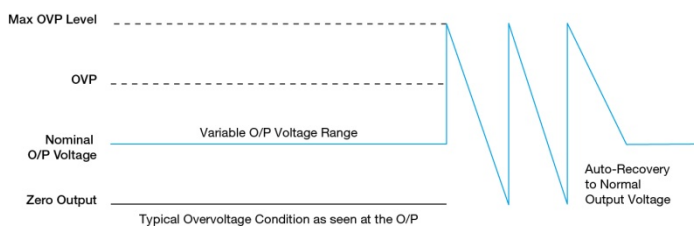
(V1: Latch Mode, V_{SB}: Auto-Recovery)

The power supply's overvoltage protection circuit will be activated when its internal feedback circuit fails. The output voltage shall not exceed its specifications defined on Page 3 under "Protections".

V1: The power supply should be latch, and require removal/re-application of input AC voltage in order to restart.



V_{SB}: The power supply will operate into "Hiccup mode" (Auto-Recovery).



Over Temperature Protection (Latch Mode)

As described in load de-rating section, the power supply also has Over Temperature Protection (OTP). In the event of a higher operating temperature at 100% load; or, when the operating temperature is beyond what is recommended in the de-rating graph, the OTP circuit will be activated. When activated, output V1 will latch off, until the surrounding air temperature drops to its normal operating temperature or the load is reduced as recommended in the de-rating graph. Removal/re-application of input AC voltage will then be required in order to restart output V1. Whenever V1 is latched off due to an over temperature condition, V_{SB} will continue to operate normally.

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Others

Delta RoHS Compliant

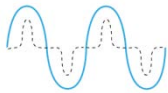


Restriction of the usage of hazardous substances

The European directive 2011/65/EU limits the maximum impurity level of homogeneous materials such as lead, mercury, cadmium, chrome, polybrominated flame retardants PBB and PBDE for the use in electrical and electronic equipment. RoHS is the abbreviation for "Restriction of the use of certain hazardous substances in electrical and electronic equipment".

This product conforms to this standard

PFC – Norm EN 61000-3-2



Line Current Harmonic content

Typically, the input current waveform is not sinusoidal due to the periodical peak charging of the input capacitor. In industrial environment, complying with EN 61000-3-2 is only necessary under special conditions. Complying to this standard can have some technical drawbacks, such as lower efficiency as well as some commercial aspects such as higher purchasing costs. Frequently, the user does not profit from fulfilling this standard, therefore, it is important to know whether it is mandatory to meet this standard for a specific application.