

Medical / Industrial AC-DC Power Supply

600 W 3" x 5" GaN Based Technology / MEP-600A24J BRA

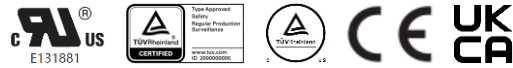
MEP-600A



Highlights & Features

- GaN based technology
- 3" x 5" x 1.5" package with base
- Up to 26.67 W/inch³ power density
- Up to 600 W output with fan cooling
- Up to 450 W output with natural convection cooling
- 5V / 2A standby output
- Built-in remote on off & current sharing function
- Remote sense voltage compensation
- Analog voltage trimming
- Up to 80 °C operating temperature
- Up to 500KHrs MTBF
- 2 x MOPP isolation
- Suited for Type BF medical products
- Class B conducted and radiated EMI
- Medical, IT and household appliances safety approvals

Safety Certifications



Model Number: MEP-600A24J BRA
Unit Weight: 0.435 kg (0.959 lb)
Dimensions (W x L x H): 76.2 x 127.0 x 39.0 mm
 (3.0 x 5.0 x 1.5 inch)

General Description

The GaN based technology MEP-600A offers high power density in a 3" x 5" footprint. It supports up to 600 W output power in a wide operating temperature ranging from -20°C to +80°C. With 5V/2A standby power and electric shock protection complying with 2 x MOPP, the MEP-600A offers reliable power supply for type BF medical equipment. The MEP-600A is certified with medical, IT and home appliance safety approvals, including UL/ TUV/ CE and CB certification, as well as EMC approvals to EN 55032 Class B. It is applicable to type BF medical products, IT equipment and household appliances.

Model Information

| Model Number | Input Voltage | Main Output Voltage | Main Output Current | Standby Output Voltage | Standby Output Current |
|-----------------|---------------|---------------------|---------------------|------------------------|------------------------|
| MEP-600A24J BRA | 90-264 Vac | 24 Vdc | 25 A | 5 Vdc | 2 A |

Model Numbering

| | | | | | | CC Code |
|--------------------------------|-------------------------------|-------------|--|---------------------------------|----------|---|
| MEP – | 600 | A | □ | J | □ | BRA |
| ME: Delta Medical Power Supply | Max Wattage in Product Series | Family Code | Output Voltage (Single Output) 24 – 24V | Family Code J: JST connector | Blank | Delta Standard, No conformal coating with remote on off |
| P: Open frame | 600: 600 W | | | | | |

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Specifications

Input Ratings / Characteristics

| Model Number | | MEP-600A24J BRA |
|-----------------------------|-----------|--|
| Nominal Input Voltage | | 100-240 Vac |
| Input Voltage Range | | 90-264 Vac |
| Nominal Input Frequency | | 50-60 Hz |
| Input Frequency Range | | 47-63 Hz |
| Input Current | | 5.8 A typ. @ 115 Vac, 2.9 A typ. @ 230 Vac |
| Efficiency at 100% load | @ 115 Vac | 93.6% typ. |
| | @ 230 Vac | 95.3% typ. |
| No Load Power Consumption | | 1.1 W typ. @ 264 Vac |
| Inrush Current (Cold Start) | | 40 A typ. @ 264 Vac |
| Power Factor at 100% Load | | > 0.95 @ 115 Vac > 0.93 @ 230 Vac |
| Earth leakage current (max) | | 0.3 mA @ NC, 1.0 mA @ SFC* ¹ |
| Touch current (max) | | 0.1 mA @ NC, 0.5 mA @ SFC* ¹ |

*1 NC: normal condition, SFC: single fault condition

Output Ratings / Characteristics*²

| Model Number | | MEP-600A24J BRA |
|--|--|--|
| Nominal Output Voltage | | 24 Vdc |
| Factory Set Point Tolerance | | 24 Vdc \pm 1% |
| Output Voltage Adjustment Range | | 24.0-28.0 Vdc |
| Output Current | | 25.0 A |
| Output Power (max) | | 600 W |
| Line Regulation (max) | | 0.5% |
| Load Regulation (max) | | 2% |
| PARD* ³ (20 MHz) | | 240 mVpp typ. (100% load) |
| Start-up Time | | 900 ms typ. @ 90 Vac & 264 Vac |
| Hold-up Time | | 19 ms typ. @ 115 Vac & 230 Vac (100% load) |
| Rise Time | | 11 ms typ. @ 90 Vac & 264Vac |
| Dynamic Response (Overshoot & Undershoot O/P Voltage) | | \pm 5% @ with 5-100% load change, (50% duty @ 10 Hz & 10 KHz, 0.5 A/us slew rate) |
| Start-up with Capacitive loads | | 6,000 μ F Max |
| Remote Sense | | Up to 500 mV compensation for voltage drop across external wire connections to load. Short and reverse connection protected. |

*² For power de-rating from > 50°C to 80°C, see power de-rating on page 4

*³ PARD is measured with an AC coupling mode, and in parallel to end terminal with 0.47 μ F ceramic capacitor & 10 μ F electrolytic capacitor. PSU need to burn in > 5 minutes.

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Output Ratings / Characteristics

| Model Number | MEP-600A24J BRA |
|--|-----------------|
| Nominal Output Voltage of Standby Output | 5 Vdc |
| Nominal Output Current of Standby Output | 2A |
| Total Regulation of Standby output | ± 3% |
| PARD (20 MHz) of Standby output*4 | 100 mVpp typ. |

*4 PARD is measured with an AC coupling mode, and in parallel to end terminal with 0.47 μ F ceramic capacitor & 10 μ F electrolytic capacitor. PSU need to burn in > 5 minutes.

Mechanical

| | | |
|--------------------------------|---|--------------------------------------|
| Package | Open Frame | |
| Dimensions (W x L x H) | 76.2 x 127.0 x 39.0 mm (3.0 x 5.0 x 1.5 inch) | |
| Unit Weight | 0.435 kg (0.959 lb) | |
| Cooling System | Convection / Force air | |
| Terminal | Input | JST: B2P3-VH(LF)(SN) or equivalent |
| | Output | M4 x 0.7 |
| | Control | JST: S8B-PHDSS(LF)(SN) or equivalent |
| Noise (15cm from power supply) | Sound Pressure Level (SPL) < 40 dBA | |

Environment

| | | |
|-----------------------------|---|----------------|
| Surrounding Air Temperature | Operating | -20°C to +80°C |
| | Storage | -40°C to +85°C |
| Temperature Power De-rating | > 50°C de-rate power by 1.67% / °C Note: see power de-rating curves below | |
| Line Power De-rating | < 100Vac de-rate power by 0.83% / Vac Note: see power de-rating curves below | |
| Operating Humidity | 5-95% RH (Non-Condensing) | |
| Operating Altitude | Up to 5,000 meters (up to 16,400 feet or 106-54 kPa) | |
| Shock Test (Non-Operating) | 50 G, 11 ms, 3 shocks for each direction | |
| Vibration (Non-Operating) | 5-500 Hz, 2.09 Grms, 20 minutes for each three axis | |
| Over Voltage Category | II | |
| Pollution Degree | 3 | |

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Power De-rating Curve (Convection)

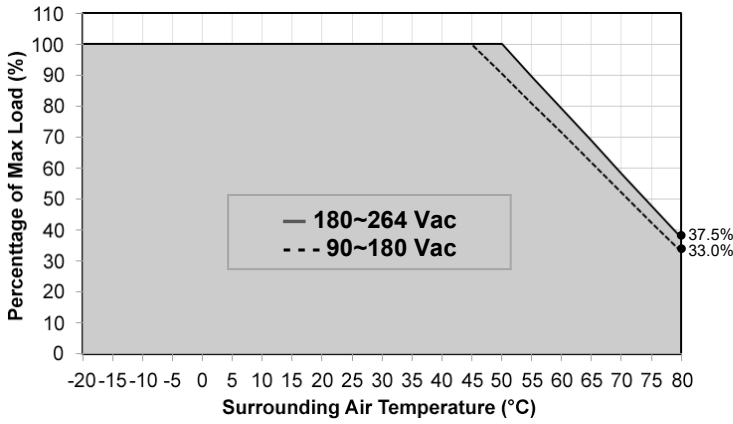


Figure 1. Power De-rating in Convection Cooling
 > 45°C de-rate power by 2.08% / °C (90~180 Vac)
 > 50°C de-rate power by 1.91% / °C (180~264 Vac)

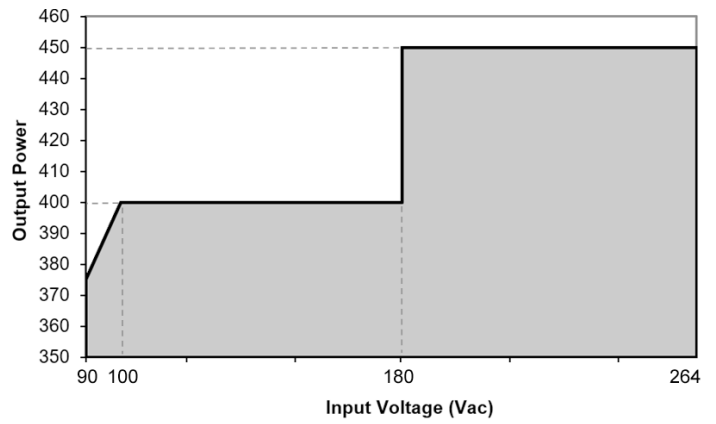


Figure 2. Power De-rating for AC Input Voltage in Convection Cooling
 < 100 Vac de-rate power by 2.5 W / V (375 W @ 90 Vac)

Power De-rating Curve (Forced Air 10.873 CFM)

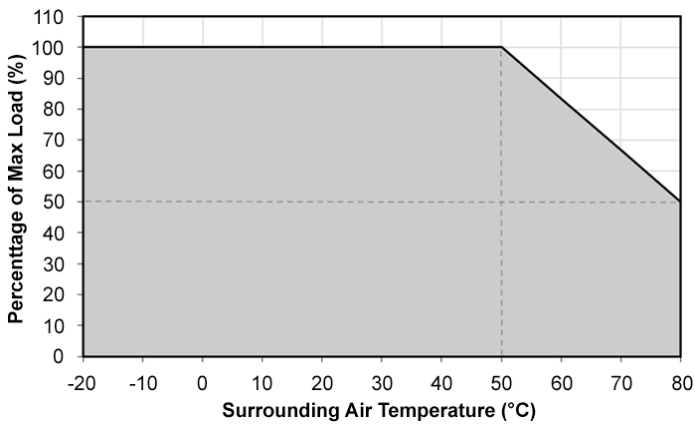


Figure 3. Power De-rating in Force Air Cooling
 > 50°C de-rate power by 1.67% / °C

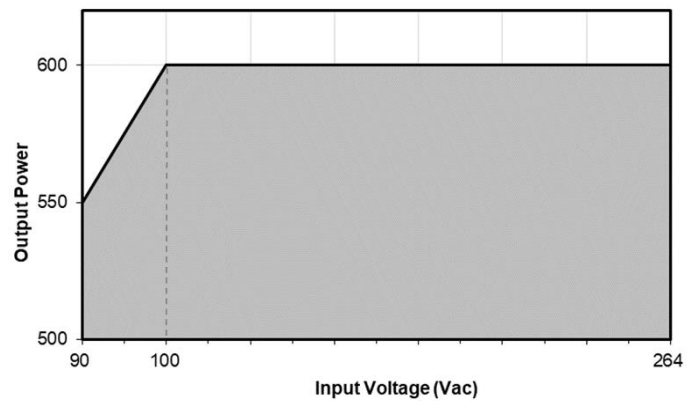
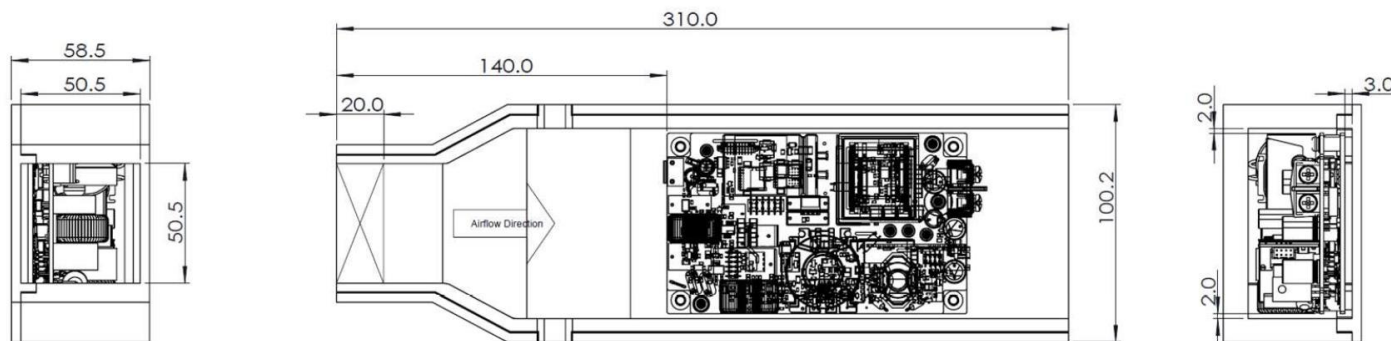


Figure 4. Power De-rating for AC Input Voltage in Force Air Cooling
 < 100 Vac de-rate power by 5 W / V (550 W @ 90 Vac)

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Thermal Fixture Setup with Fan P/N: DELTA AFB0512HHD



With forced airflow (10.873 CFM)

Figure 5. Test Setup in Force Air Cooling

Notes:

- Fan source and box dimensions could be changed or modified to meet air speed: 2.01m/s
- Airflow: 10.873CFM (just for reference, air speed should meet 2.01m/s)
- Used fan voltage: 9.0V (just for reference, the voltage should be adjusted for every fan to meet air speed: 0.086m/s)
- Unit: mm

Protections

| | |
|--------------------------|--|
| Overvoltage | Main output 110-150% of rated normal voltage, Latch mode |
| Over load / Over current | Main output 105-130% of rated current, Hiccup Mode |
| Over Temperature | Latch Mode |
| Short Circuit | Hiccup Mode (Non-Latching, Auto-Recovery) |
| Protection Against Shock | Class I |

Reliability Data

| | |
|--|-------------------------------------|
| MTBF at 115 Vac, 100% load, 35 °C convection air | 500K hrs based on Telecordia SR-332 |
| Operating life at 115 Vac, 100% load, 25 °C convection air | 3 years |



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Safety Standards / Directives

| | |
|--------------------|---|
| Medical Safety | IEC60601-1 CB report TUV EN60601-1 ANSI/AAMI ES 60601-1+CAN/CSA-C22.2 No.60601-1 |
| ITE Safety | IEC62368-1 CB report TUV EN 62368-1 UL 62368-1 and CAN/CSA C22.2 No. 62368-1 |
| Home Appliance | IEC60335-1 CB report IEC61558-1 /-2-16 CB report |
| CE | In conformance with EMC Directive 2014/30/EU and Low Voltage Directive 2014/35/EU EN 60601-1: 2006 + A1: 2013 + A12: 2014 & EN 60601-1-2: 2015 |
| UKCA | In conformance with Electromagnetic Compatibility Regulations 2016 and Medical Devices Regulations 2002 (UK MDR 2002) |
| Galvanic Isolation | Input to/Output (2XMOPP) 4000 Vac Input to/Ground (1XMOPP) 1768 Vac Output to/Ground (1XMOPP) 1768 Vac (Type BF application rated) |

EMC

| | |
|-----------------------------------|--|
| Emissions (CE & RE) | EN55032 Class B, AS/NZS CISPR32 Class B |
| Harmonic Current Emissions | IEC 61000-3-2 Meet Class A limit |
| Immunity to | |
| Voltage Flicker | IEC 61000-3-3 |
| 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⁾ 80 MHz-2700 MHz, 10 V/m AM modulation |
| Electrical Fast Transient / Burst | IEC 61000-4-4 Level 3 Criteria A ¹⁾ : 2 kV |
| Surge | IEC 61000-4-5 Level 3 Criteria A ¹⁾ Common Mode ³⁾ : 2 kV Differential Mode ⁴⁾ : 1 kV |
| Conducted | IEC 61000-4-6 Level 2 Criteria A ¹⁾ 150 kHz-80 MHz, 3 Vrms, 6 Vrms at ISM bands and Amateur radio bands |
| Power Frequency Magnetic Fields | IEC 61000-4-8 Criteria A ¹⁾ Magnetic field strength 30 A/m |
| Voltage Dips | IEC 61000-4-11 30% 10ms Criteria A 60% 100ms Criteria B 100% 5000ms Criteria B |
| Voltage Dips ⁵⁾ | IEC 60601-1-2 Criteria A ²⁾ 0% U _T , 0.5 cycle (10 ms), (0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°, 360°) Criteria B ²⁾ 0% U _T , 1 cycle (20 ms), 0° Criteria B ²⁾ 70% U _T , 25 cycle (500 ms), 0° Criteria B ²⁾ 0% U _T , 250 cycle (5000 ms), 0° |

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) Asymmetrical: Common mode (Line to earth)

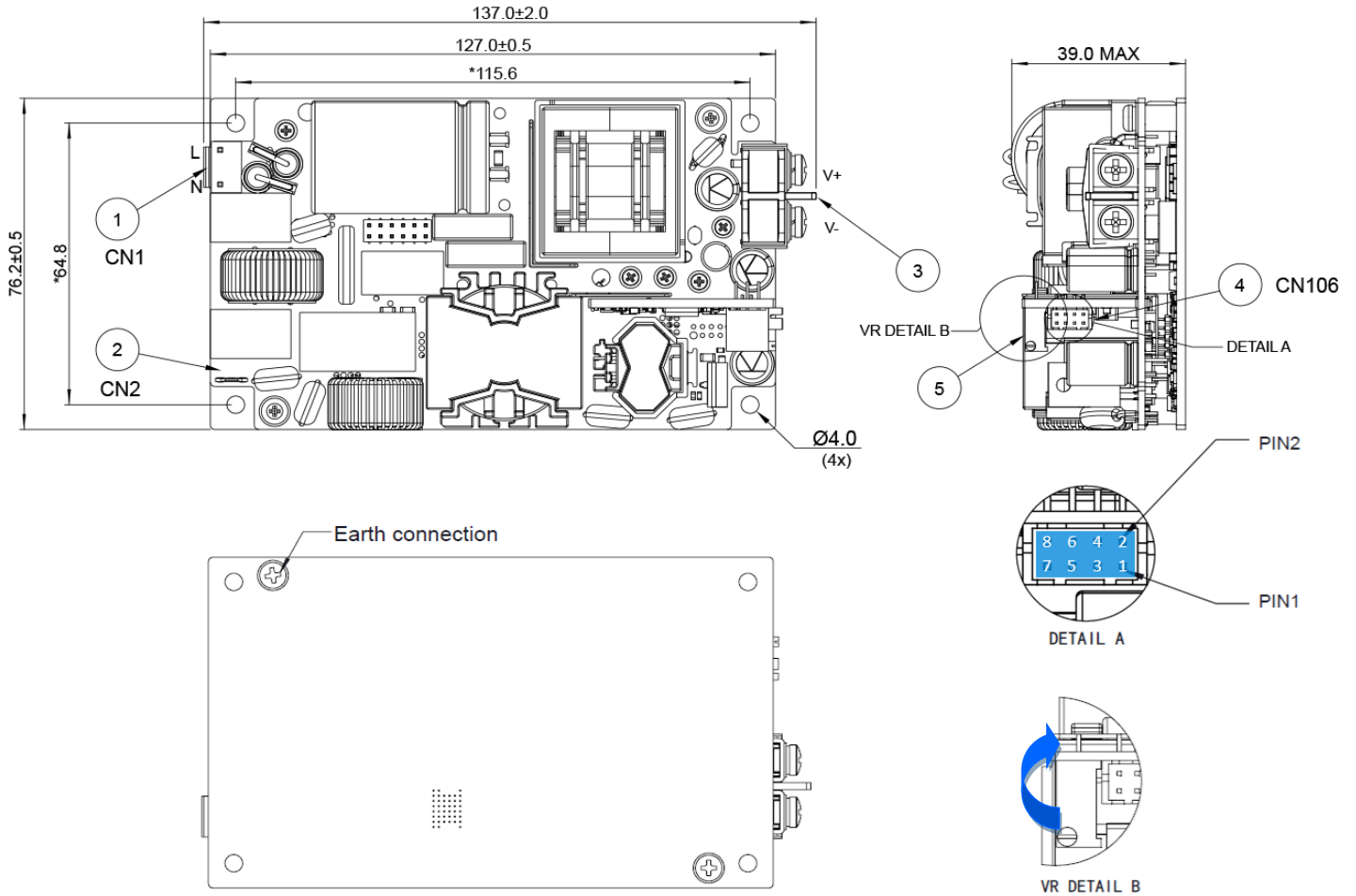
4) Symmetrical: Differential mode (Line to line)

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Dimensions

W x L x H: 76.2 x 127.0 x 39 mm (3 x 5 x 1.5 inch)



Notes:

- All dimensions are in millimeters and inches.
- CN101 / CN102, M4*0.7 screw in two positions, maximum torque 10-12 kgf.cm (8.67~10.41 inch.lbs).
- VR: clockwise is to reduce the output voltage, anti-clockwise is to increase the output voltage.

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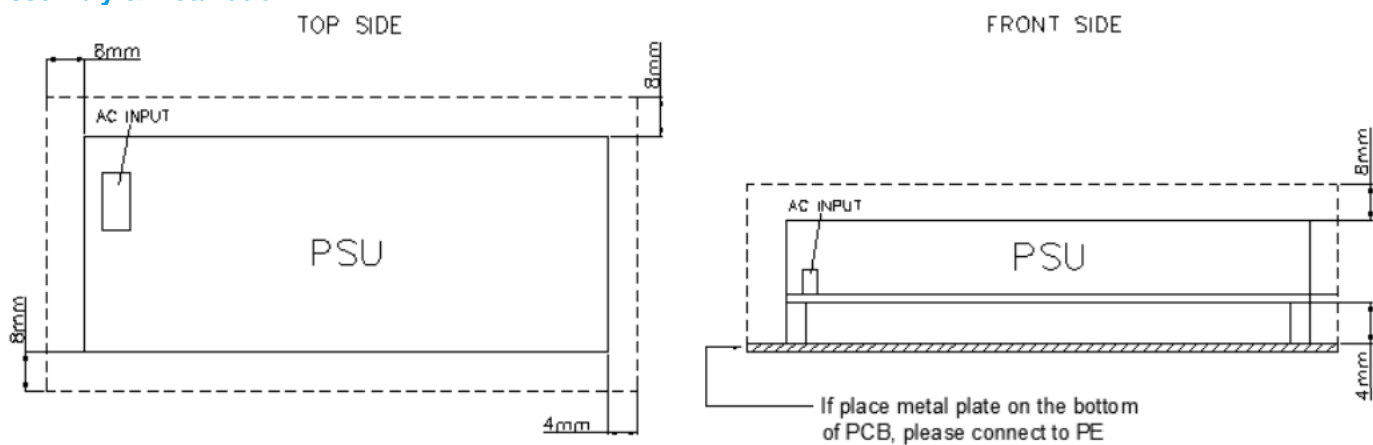
Connector Definition and Pin Assignment:

| Item | Part Name |
|------|--|
| 1 | CN1 Input Terminal – Line & Neutral JST: B2P3-VH(LF)(SN) MATING with JST: VAJR-02VS or EQUIVALENT TERMINAL: SVT-41T-P1.1 |
| 2 | CN2 Input Terminal - Ground Connection KANGYANG: PCR187(0.8) MATING: KST, FDFNYD1-187(8) or EQUIVALENT |
| 3 | CN101, CN102 Output Terminal M4 x 0.7 |
| 4 | CN106 Control Connector JST: S8B-PHDSS(LF)(SN) MATING with JST: PHDR-08VS or EQUIVALENT TERMINAL: SPHD-001T-P0.5 or EQUIVALENT <u>Pin Assignment</u> Pin 1: Remote Sense - Pin 2: Remote On_Off / Inhibit Pin 3: Remote Sense + Pin 4: Current Share Pin 5: Power Good + Pin 6: NC Pin 7: 5V STANDBY + Pin 8: DC RTN |
| 5 | VR |

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Assembly & Installation



For safety reasons, please ensure the mounted device is kept safety distance as below at all sides from other components and equipments.

a) For Open Frame Type ≥ 8 mm (0.315 inch) from primary side and ≥ 4 mm (0.16 inch) from secondary side.

Please insert an insulation sheet between the system and product, if the safety distance is less than 4 mm (0.16 inch).

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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.

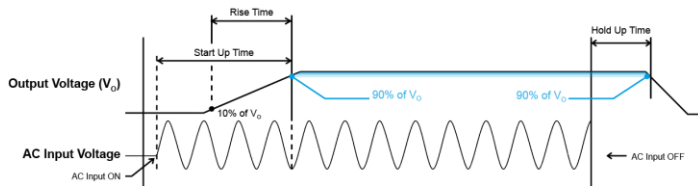


Figure 6. Time Sequence

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 5% to 100% of its rated current.

5% to 100% Load

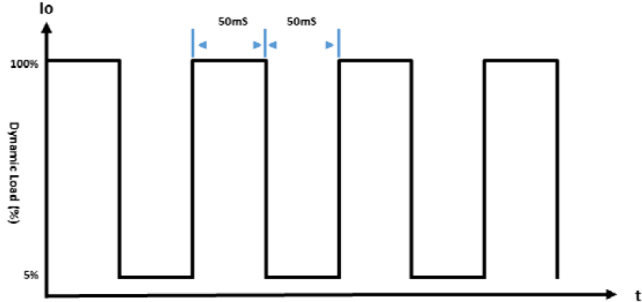


Figure 7-1. Dynamic Load (10 Hz)

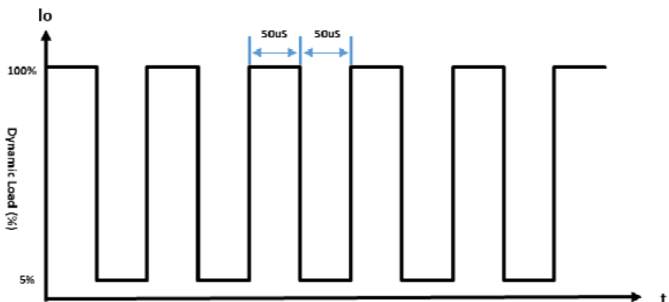


Figure 7-2. Dynamic Load (10K Hz)

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.

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 5 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 Over current (OCP) Protections will be activated before output current under 130% of I_o (Max load). Upon such occurrence, V_o will start to drop. Once the power supply has reached its maximum power limit, the protection will be activated and the power supply will go into "Hiccup mode" (Auto-Recovery). The power supply will recover once the fault condition causing the OLP and OCP is removed and I_o is back within the specified limit.

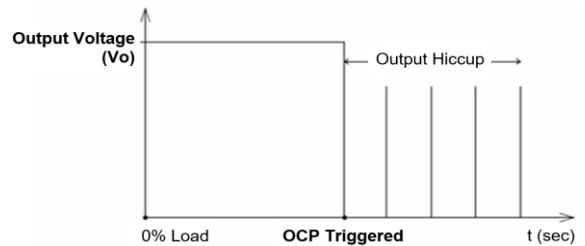


Figure 8. Hiccup at OLP/OCP

Additionally, if the I_{out} is $>100\%$ for a prolonged period of time (depending on the load), the Over Temperature Protection (OTP) may be activated due to high temperature on critical components. The power supply will then go into latch mode.

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 latch mode until the input voltage is removed; then, reapplied, and the surrounding air temperature drops to its normal operating temperature.

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Voltage Adjustment

The power supply provides a potentiometer for user to adjust the output voltage. The output voltage is designed to be able to adjust up to 16.7% of rated voltage, when the output is adjusted below nominal value, the maximum output current is the same as the nominal output, 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).

Power Good

Power Good+ pin is an open collector transistor. A resistor (suggested value 10Kohm, 1/8W) can be added between 5V STANDBY+ pin (or other available pull-up voltage that is no greater than 30V) and the Power Good+ pin (refer to Figure 9 below). Value of pull-up 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+ pin will be high. When AC input is off, Power Good+ pin will be low. There will be a minimum of 5 milliseconds (at 600W load) between the time the power good goes to low level, and the time when the output reaches 90% of its rated full load.

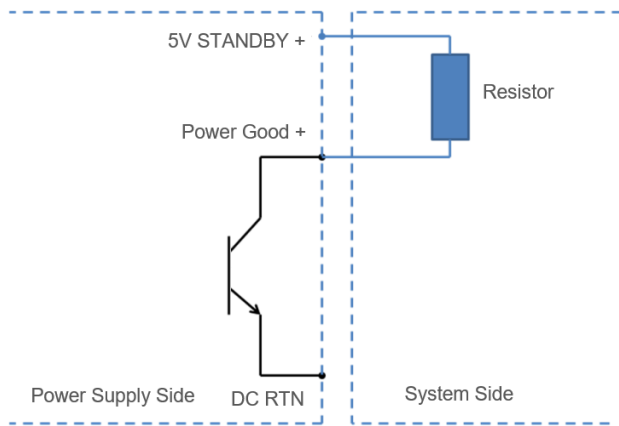


Figure 9. Power Good Connection

Remote On_Off/Inhibit

Remote ON_OFF/INHIBIT can be used to enable or disable only the main output. When the main output is disabled, the 5V STANDBY + will continue to operate. This signal can be pulled down to a low level of 0.3 volts, or floated (no connection to the signal), in order for the main output to be enabled; and pulled up to a value greater than or equal to 3 volts, in order to disable the main output.

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.

Current Sharing

The power supply supports current sharing. Parallel the outputs as well as the current sharing bus to enable this feature. To ensure better current sharing performance, use VR to trim output voltage as close as possible before put two power supplies in parallel.

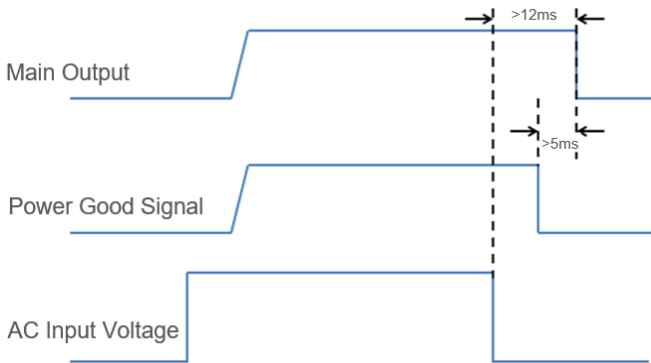


Figure 10. Power Good Time Sequence

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Certificate



All Delta Medical Power products conform to the European directive 2011/65/EU.
RoHS is the abbreviation for "Restriction of the use of certain hazardous substances"



Delta has been certified as meeting the requirement of ISO 13485: 2016 and EN ISO 13485:2016 for the design and manufacture of switching power supply and adaptor for medical device.



In addition to a UL Total Certification Program (TCP) approved client laboratory for IEC60950 and IEC60065. Delta also has participated UL Client Test Data Program (CDTP) for IEC 60601

Attention

Delta provides all information in the datasheets on an "AS IS" basis and does not offer any kind of warranty through the information for using the product. In the event of any discrepancy between the information in the catalog and datasheets, the datasheets shall prevail (please refer to PSU.deltaww.com for the latest datasheets information). Delta shall have no liability of indemnification for any claim or action arising from any error for the provided information in the datasheets. Customer shall take its responsibility for evaluation of using the product before placing an order with Delta.

Delta reserves the right to make changes to the information described in the datasheets without notice.

Manufacturer and Authorized Representatives Information

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