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/inch^3 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
- Digital 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

E131881

Model Number: MEP-600A24J BRA
Unit Weight: 0.435 kg (0.959 lb)
Dimensions (W × L × 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 P: Open frame	Max Wattage in Product Series 600: 600 W	Family Code	Output Voltage (Single Output) 24 – 24V	Family Code J: JST connector	Blank	Delta Standard, No conformal coating with remote on off

All parameters are specified at 25°C ambient unless otherwise noted.
www.DeltaPSU.com (December 2024, Rev. 00.2)

Medical / Industrial AC-DC Power Supply

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

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 ± 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)	± 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 µF 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 µF ceramic capacitor & 10 µF electrolytic capacitor.
PSU need to burn in > 5 minutes.

Medical / Industrial AC-DC Power Supply

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

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 μF ceramic capacitor & 10 μF 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

Medical / Industrial AC-DC Power Supply

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

Power De-rating Curve (Convection)

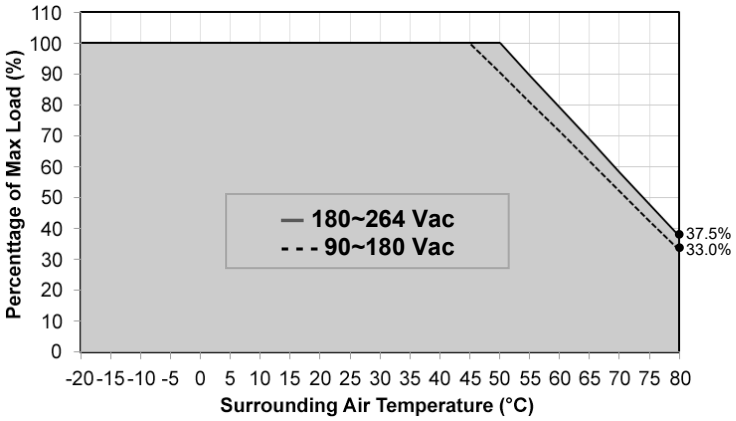


Figure 1. Power De-rating in Convection Cooling
> 45°C de-rate power by 2.08% / °C (90~180 Vac)
> 50°C de-rate power by 1.91% / °C (180~264 Vac)

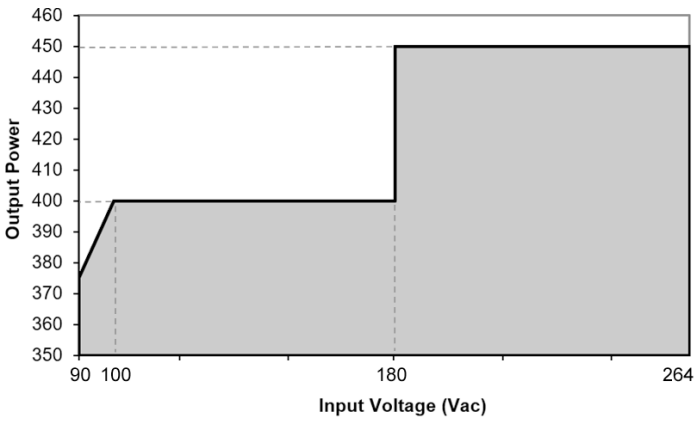


Figure 2. Power De-rating for AC Input Voltage in Convection Cooling
< 100 Vac de-rate power by 2.5 W / V (375 W @ 90 Vac)

Power De-rating Curve (Forced Air 10.873 CFM)

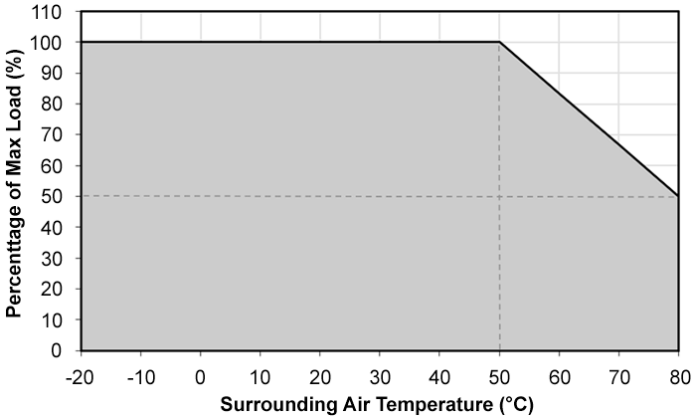


Figure 3. Power De-rating in Force Air Cooling
> 50°C de-rate power by 1.67% / °C

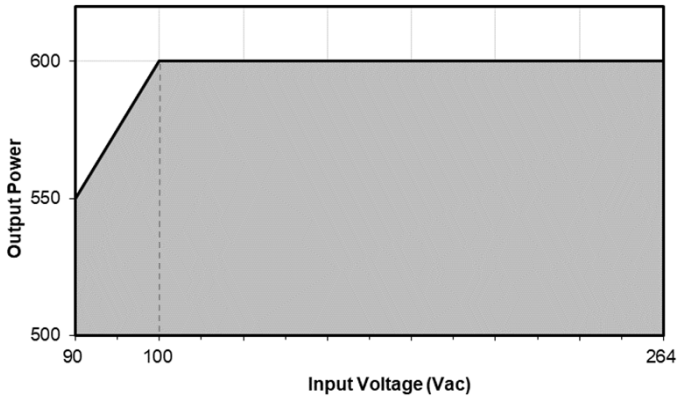


Figure 4. Power De-rating for AC Input Voltage in Force Air Cooling
< 100 Vac de-rate power by 5 W / V (550 W @ 90 Vac)

All parameters are specified at 25°C ambient unless otherwise noted.

Medical / Industrial AC-DC Power Supply
600 W 3” x 5” GaN Based Technology / MEP-600A24J BRA

Thermal Fixture Setup with Fan P/N: DELTA AFB0512HHD

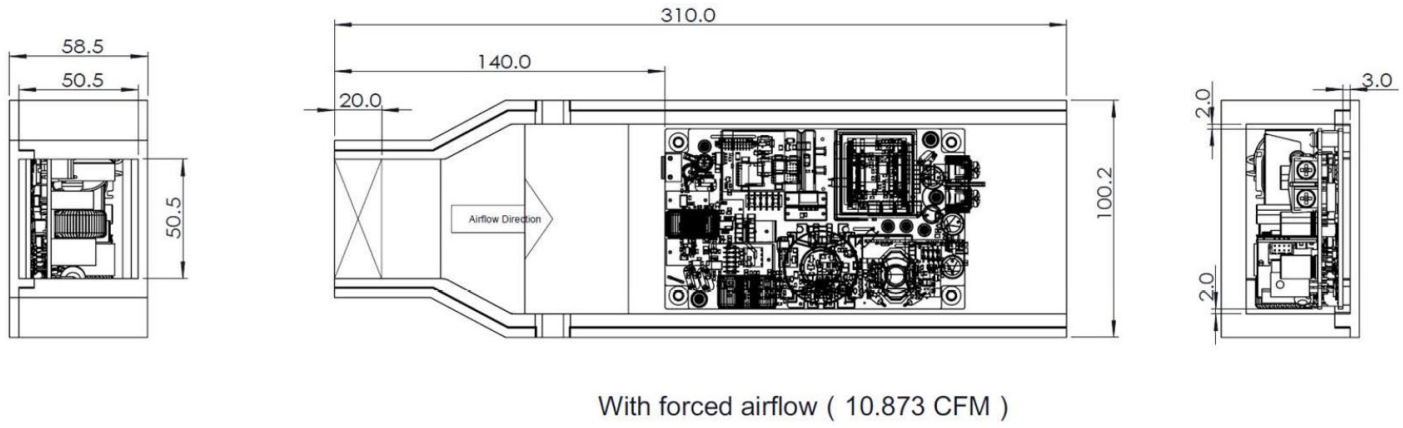


Figure 5. Test Setup in Force Air Cooling

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

Medical / Industrial AC-DC Power Supply

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

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) Input to/Ground (1XMOPP) Output to/Ground (1XMOPP)	4000 Vac 1768 Vac 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°

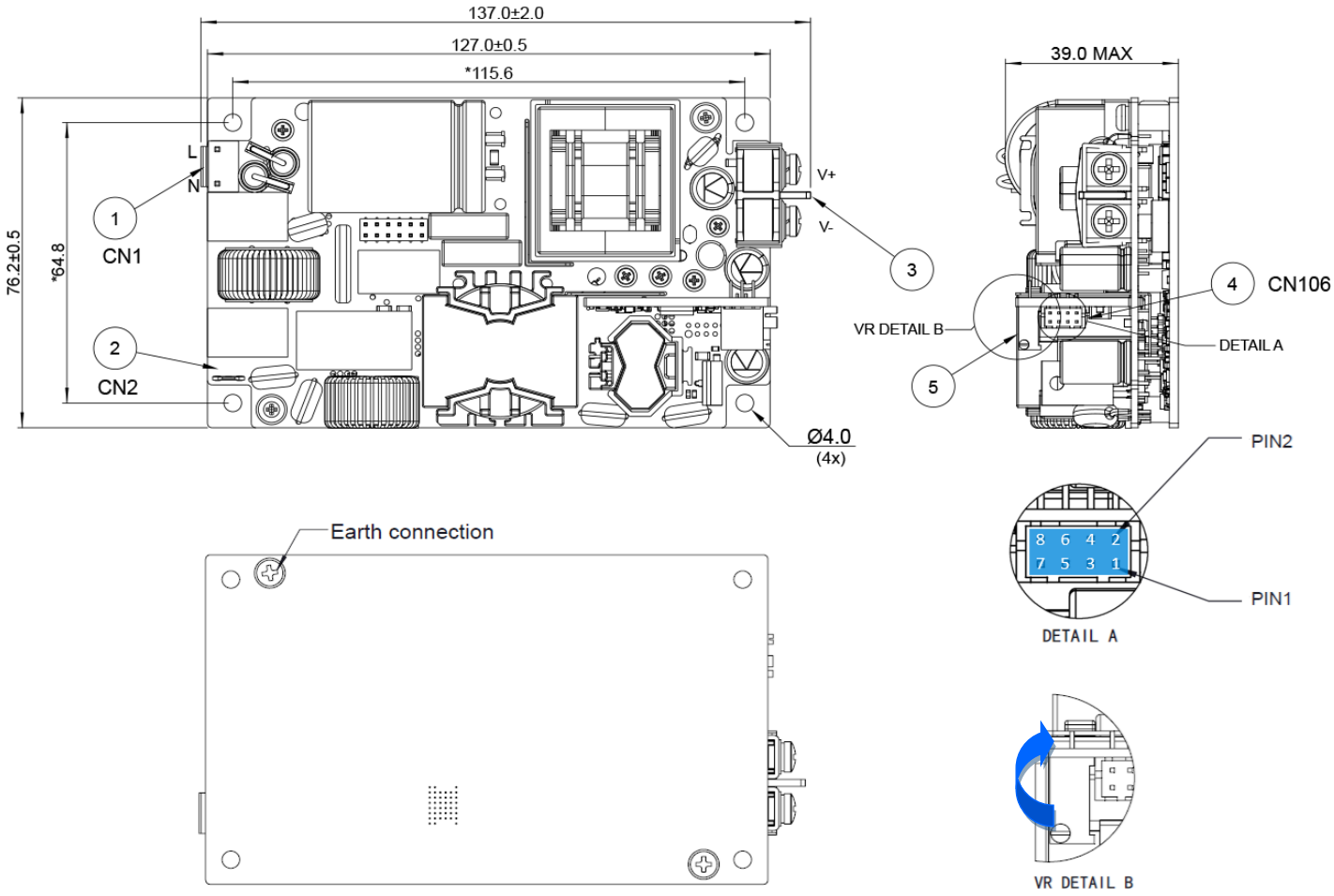
1) Criteria A: Normal performance within the specification limits
2) Criteria B: Output out of regulation, or shuts down during test. Automatically restored to normal operation after test.
3) Asymmetrical: Common mode (Line to earth)
4) Symmetrical: Differential mode (Line to line)

Medical / Industrial AC-DC Power Supply

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

Dimensions

W x L x H: 76.2 x 127.0 x 39 mm (3 x 5 × 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.

Medical / Industrial AC-DC Power Supply
600 W 3” x 5” GaN Based Technology / MEP-600A24J BRA

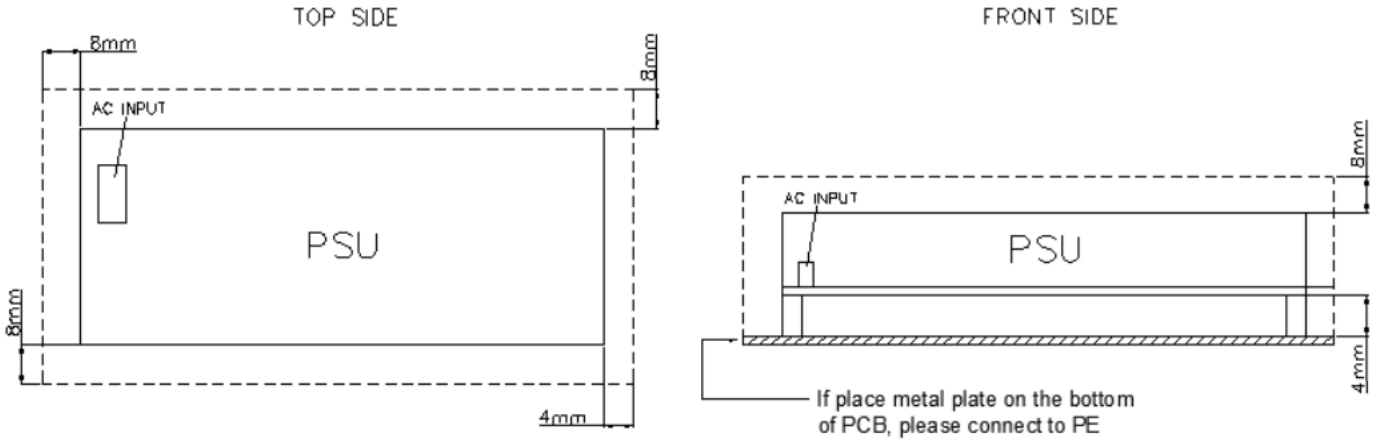
Connector Definition and Pin Assignment:

Item	Part Name
1	**CN1** Input Terminal – Line & Neutral JST: B2P3-VH(LF)(SN) MATING with JST: VAJR-02VS or EQUILVALENT TERMINAL: SVT-41T-P1.1
2	**CN2** Input Terminal - Ground Connection KANGYANG: PCR187(0.8) MATING: KST, FDFNYD1-187(8) or EQUILVALENT
3	**CN101, CN102** Output Terminal M4 x 0.7
4	**CN106** Control Connector JST: S8B-PHDSS(LF)(SN) MATING with JST: PHDR-08VS or EQUILVALENT TERMINAL: SPHD-001T-P0.5 or EQUILVALENT Pin Assignment 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

Medical / Industrial AC-DC Power Supply

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

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).

Medical / Industrial AC-DC Power Supply
600 W 3” x 5” GaN Based Technology / MEP-600A24J BRA

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.

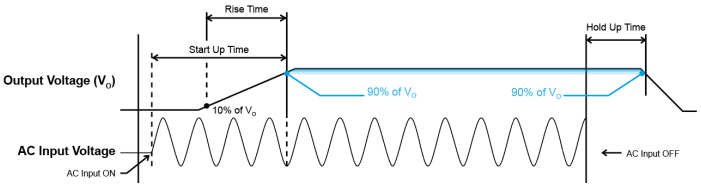


Figure 6. Time Sequence

Dynamic Response (Main Output)

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

■ **5% to 100% Load**

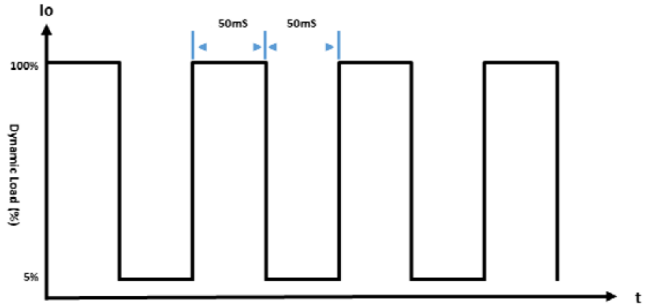


Figure 7-1. Dynamic Load (10 Hz)

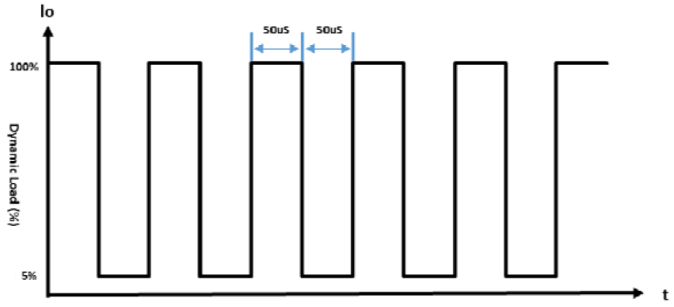


Figure 7-2. Dynamic Load (10K Hz)

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.

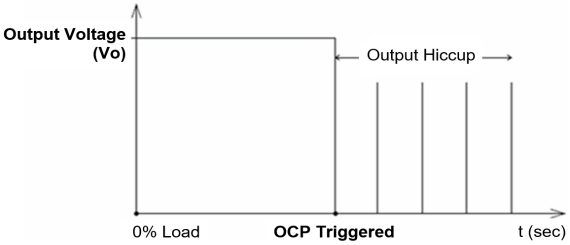


Figure 8. Hiccup at OLP/OCP

Additionally, if the Iout is >100% for a prolong 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.

Medical / Industrial AC-DC Power Supply

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

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.

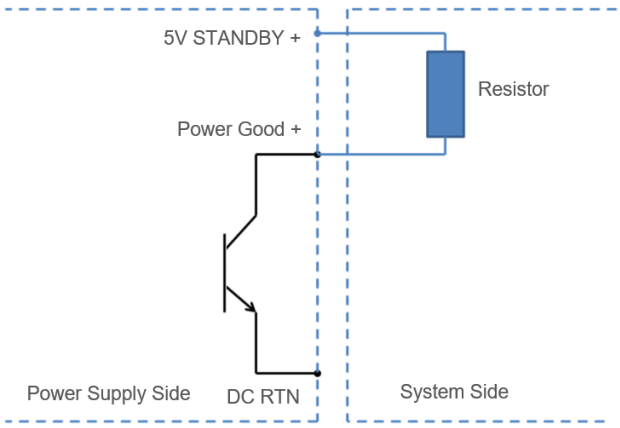


Figure 9. Power Good Connection

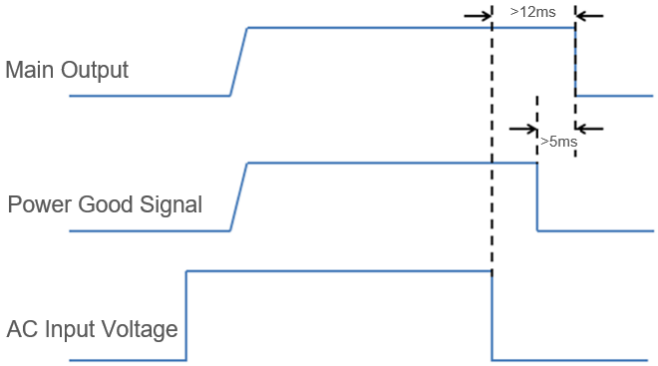


Figure 10. Power Good Time Sequence

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.

Medical / Industrial AC-DC Power Supply

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

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: 2003 and EN ISO 13485:2012 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

E356265

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 www.DeltaPSU.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

Manufacturer

Taiwan
Delta Electronics, Inc.
3 Tungyuan Road, Chungli Industrial Zone, Taoyuan County
32063, Taiwan

Authorized Representatives

The Netherlands
Delta Greentech (Netherlands) B.V.
Zandsteen 15, 2132 MZ Hoofddorp, The Netherlands

United Kingdom
Delta Electronics Europe Limited
1 Redwood Court, Peel Park Campus,
East Kilbride, Glasgow, G74 5PF, United Kingdom