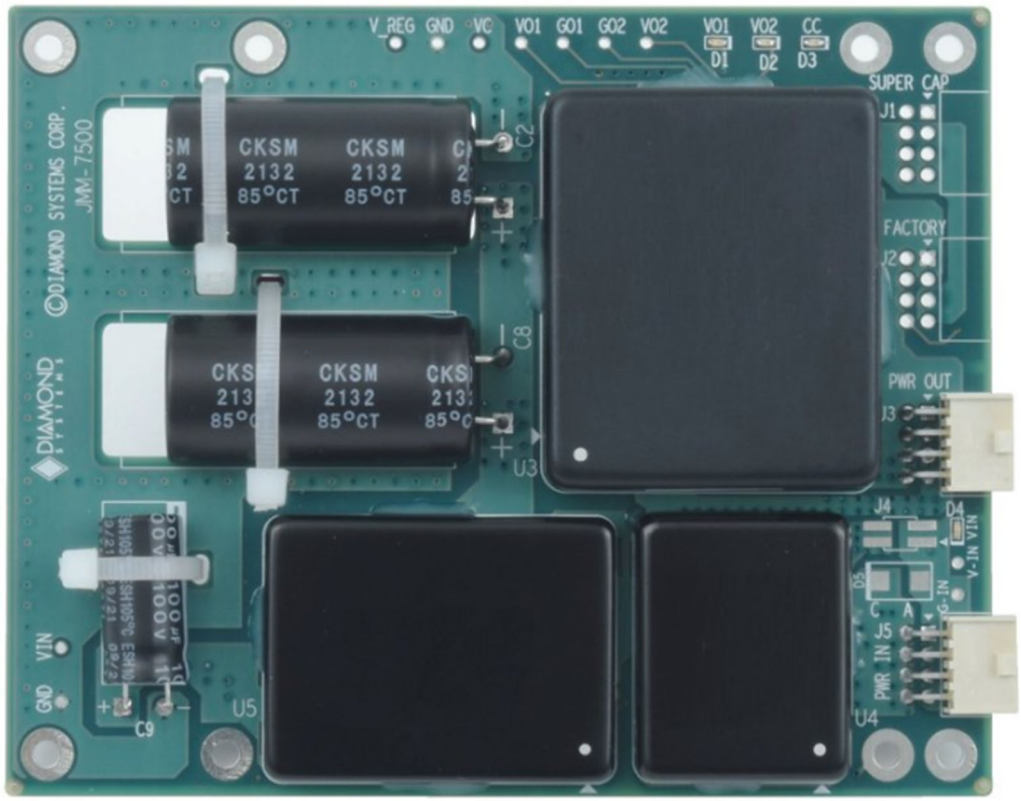
# Jupiter-MM-7500

**80-Watt power supplies for rugged computer systems**

**User Manual 1.0**




| Revision | Date | Comment |
|---|---|---|
| 1.0 | 07/23/2024 | Initial Release |

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# 1. IMPORTANT SAFE HANDLING INFORMATION

## WARNING!

### ESD-Sensitive Electronic Equipment

Observe ESD-safe handling procedures when working with this product.

Always use this product in a properly grounded work area and wear appropriate ESD-preventive clothing and/or accessories.

Always store this product in ESD-protective packaging when not in use.

## ***Safe Handling Precautions***

The board contains a high density connector with many connections to sensitive electronic components. This creates many opportunities for accidental damage during handling, installation and connection to other equipment. The list here describes common causes of failure found on boards returned to Diamond Systems for repair. This information is provided as a source of advice to help you prevent damaging your Diamond (or any vendor's) boards.

**ESD damage** – This type of damage is usually almost impossible to detect, because there is no visual sign of failure or damage. The symptom is that the board eventually simply stops working, because some component becomes defective. Usually the failure can be identified and the chip can be replaced. To prevent ESD damage, always follow proper ESD-prevention practices when handling computer boards.

**Damage during handling or storage** – On some boards we have noticed physical damage from mishandling. A common observation is that a screwdriver slipped while installing the board, causing a gouge in the PCB surface and cutting signal traces or damaging components.

Another common observation is damaged board corners, indicating the board was dropped. This may or may not cause damage to the circuitry, depending on what is near the corner. Most of our boards are designed with at least 25 mils clearance between the board edge and any component pad, and ground / power planes are at least 20 mils from the edge to avoid possible shorting from this type of damage. However these design rules are not sufficient to prevent damage in all situations.

A third cause of failure is when a metal screwdriver tip slips, or a screw drops onto the board while it is powered on, causing a short between a power pin and a signal pin on a component. This can cause overvoltage / power supply problems described below. To avoid this type of failure, only perform assembly operations when the system is powered off.

Sometimes boards are stored in racks with slots that grip the edge of the board. This is a common practice for board manufacturers. However our boards are generally very dense, and if the board has components very close to the board edge, they can be damaged or even knocked off the board when the board tilts back in the rack. Diamond recommends that all our boards be stored only in individual ESD-safe packaging. If multiple boards are stored together, they should be contained in bins with dividers between boards. Do not pile boards on top of each other or cram too many boards into a small location. This can cause damage to connector pins or fragile components.

**Power supply wired backwards** – Our power supplies and boards are not designed to withstand a reverse power supply connection. This will destroy each IC that is connected to the power supply (i.e. almost all ICs). In this case the board will most likely will be unrepairable and must be replaced. A chip destroyed by reverse power or by excessive power will often have a visible hole on the top or show some deformation on the top surface due to vaporization inside the package. **Check twice before applying power!**

**Overvoltage on analog input** – If a voltage applied to an analog input exceeds the design specification of the board, the input multiplexor and/or parts behind it can be damaged. Most of our boards will withstand an erroneous connection of up to ±36V on the analog inputs, even when the board is powered off, but not all boards, and not in all conditions.

**Overvoltage on analog output** – If an analog output is accidentally connected to another output signal or a power supply voltage, the output can be damaged. On most of our boards, a short circuit to ground on an analog output will not cause trouble.

**Overvoltage on digital I/O line** – If a Digital I/O is connected to a voltage above the maximum specified voltage, the digital circuitry can be damaged. On most of our boards the acceptable range of voltages connected to digital I/O signals is 0-5V, and they can withstand about 0.5V beyond that (-0.5 to 5.5V) before being damaged. However logic signals at 12V and even 24V are common, and if one of these is connected to a 5V logic chip, the chip will be damaged, and the damage could even extend past that chip to others in the circuit.

# 2. INTRODUCTION

The JMM-7500 series offers 80 watts of DC power for rugged computer systems. It contains features needed to ensure rugged and reliable operation, including input-to-output power isolation and MIL-STD-461/704/1275 compliance. JMM-7500 uses isolated DC/DC converter module MGDD80 from Gaia. The module is compliant with DO160 and MIL-STD-704 standards. The board has LHUG150N input bus conditioner along with FGDS-12A-100V EMI filter makes it compliant to MIL-STD-704A/D/E/F, MIL-STD-1275A/B/C/D/E. MIL-STD-461D/E/F/G military standards.

## 2.1 Available Models

The Jupiter-MM-7500 power supply family is available with the following standard configurations of output power, output voltages, form factor and thermal solution:

| Model | EMI Filter | Pre-regulator | Output Voltage (V) | Output Current (A) | Output Power (W) |
|---|---|---|---|---|---|
| JMM-7512-IF | Yes | Yes | 12V Isolated | 6.66A | 80W |
| JMM-7515-IF | Yes | Yes | 15V Isolated | 5.33A | 80W |
| JMM-7515-F | Yes | Yes | 15V Non-isolated | 5.33A | 80W |
| JMM-7505-IF | Yes | Yes | 5V Isolated | 16A | 80W |

Several configurations are standard; others can be offered with minimum order quantities. In addition, backup timing option can be varied.

Contact Diamond Systems for more information.

# 3. FEATURE DESCRIPTION

## 3.1 Key Features

- Wide input range: 9-60V for isolated supply and 9-36V for non-isolated.
- 80W isolated output power. 5V, 12V, 15V, and 24VDC output options.
- Conduction cooling mounting plate with integrated thermal pads for efficient heat dissipation.
- Modules include input filter (MIL-STD-461), pre-regulator (MIL-STD-704/1275), and power converter.
- MIL-STD-1275A/B/C/D/E compliance and DO-160 rev C, D, E, F, and G compliance.
- Rugged design and heavy components are fixed in place with epoxy and/or cable ties to withstand shock and vibration.
- Input and output connectors are rated for high current and are positive latching.
- The 50% thicker PCB supports the heavier components and helps to withstand shock and vibration.
- -40 to +85oC temperature operation (total output power may be derated at high temperatures).

## 3.2 Cooling

All significant heat generating components are mounted on the top side of the board and are thermally connected to the thermal solution with thermal pads.

**Heat spreader:** A heat spreader on the top side may be used for cooling. The heat spreader needs to be attached to the baseplate of the MGDD-80-N-X and LHUG-150-N to support the full power output at 85ºC.

## 3.3 LED Indicators

Green LEDs are provided for indicating input and output power supply is on. The LEDs are located along the connector edge of the PCB.

All LEDs are calibrated to have equal brightness at the nominal output voltage for their designated power supply.

# 4. FUNCTIONAL BLOCK DIAGRAM

Figure 1 shows the block diagram for the Jupiter-MM-7500 family. Both low-cost and full-featured models are shown.

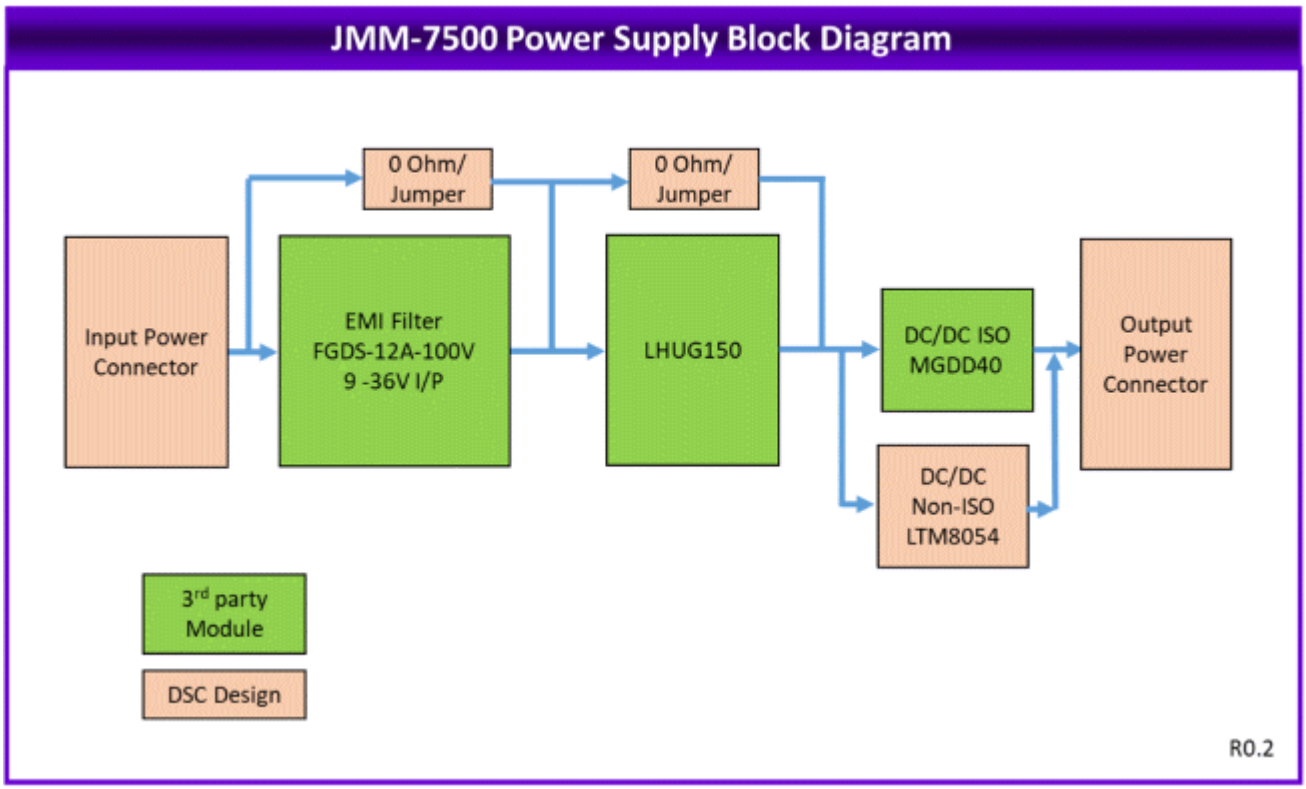



**Figure 1 JMM-7500 Block Diagram**

# 5. MECHANICAL BOARD DRAWING

JMM-7500 supports to the PC/104 and PC/104-Plus form factor mounting holes. The board can be mounted on top of a PC/104 board. Sample mechanical drawings of these form factors are shown below.

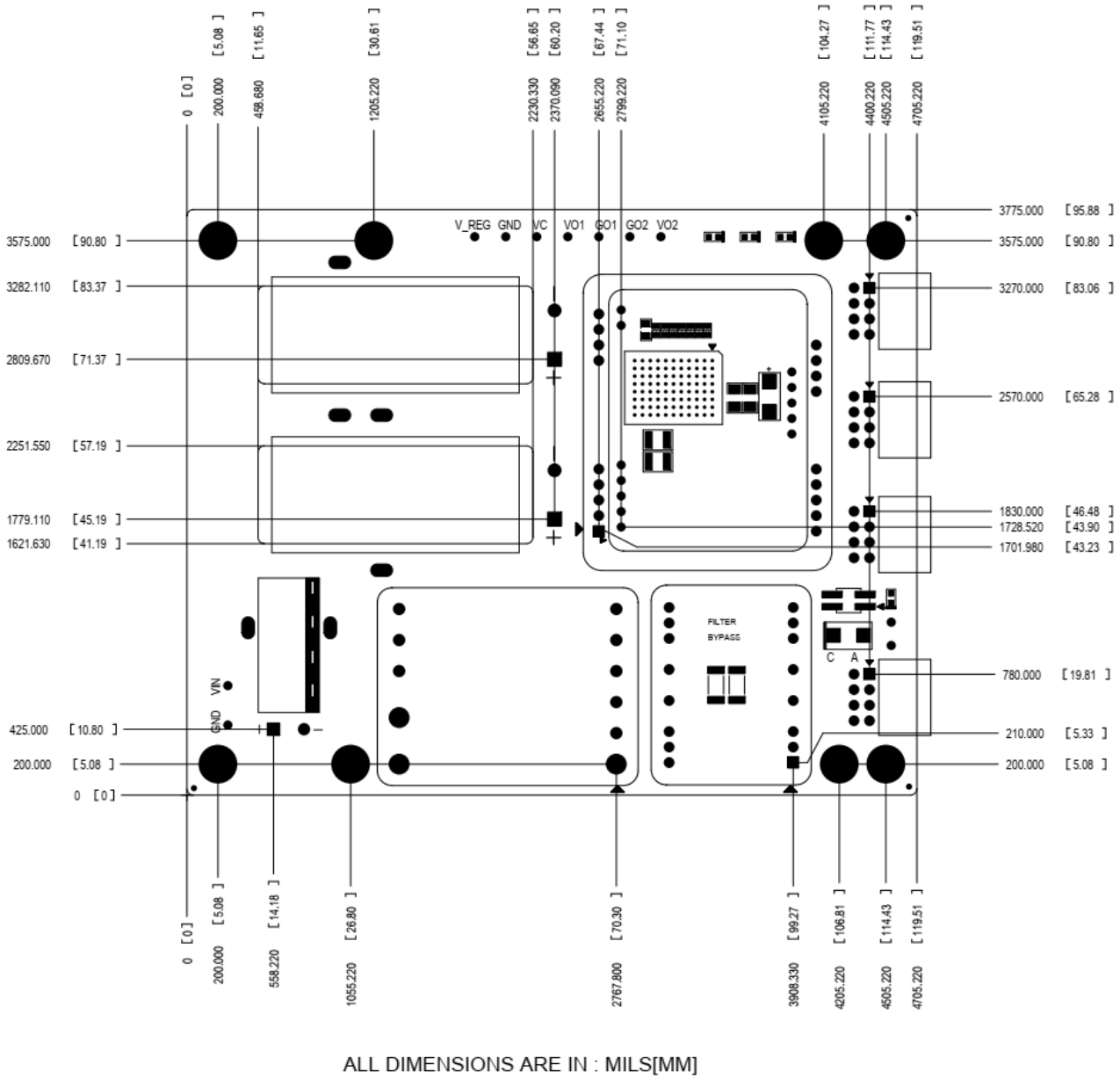



**Figure 2 JMM-7500 Mechanical Drawing**

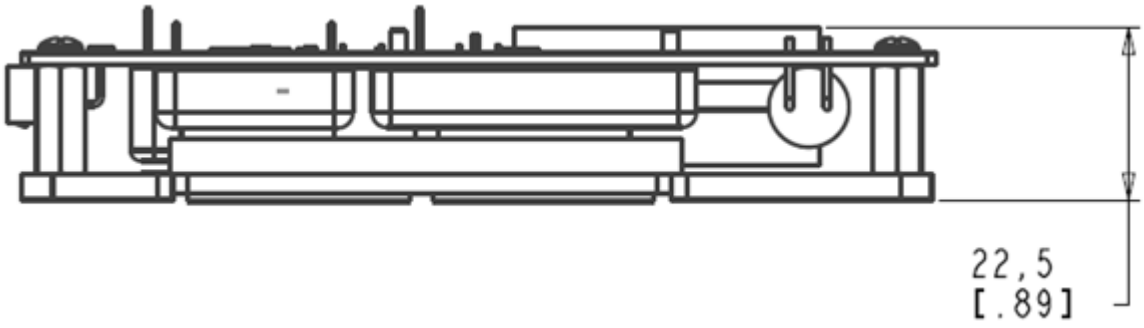



**Figure 3 JMM-7500 with Heat Spreader – Front side**

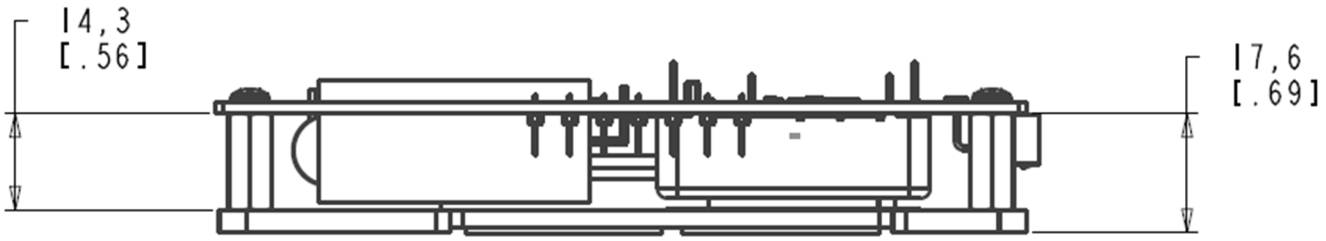



**Figure 4 JMM-7500 with Heat Spreader – Back side**

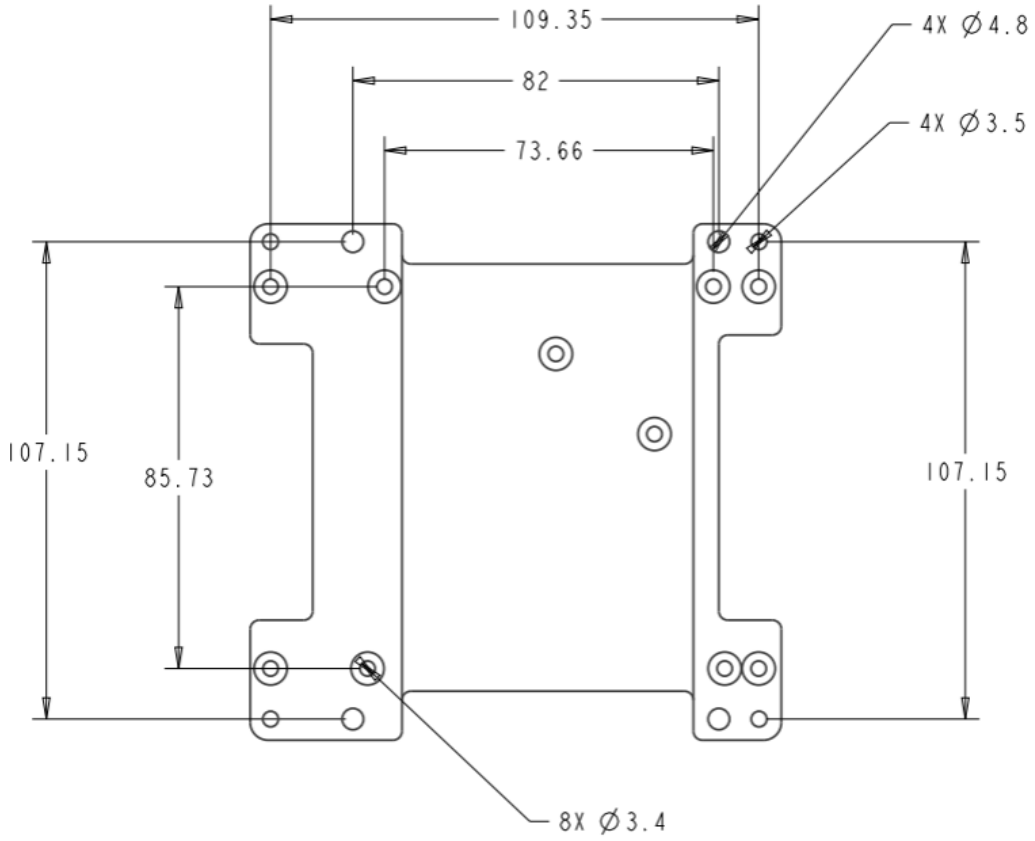



**Figure 5 Heat Spreader Mechanical Drawing**

# 6. POWER SUPPLY OPERATION

## 6.1 EMI Filter

The design supports input EMI filter which also protects from the spikes. FGDS-12A-100V is input EMI filter module from Gaia Converter which can support up to 300W power or up to 12A output current. It can withstand up to 100V transient input voltage during 50ms or up to 80V transient input voltage during 100ms. FGDS module complies with following major standards:

- The US MIL-STD-461 rev D, E and rev F
- The international DO-160 rev C, D, E F and rev G

The internal resistance of capacitor will act as damping resistor.

A bypass option is provided for designs that do not require EMI filter.

## 6.2 Pre-Regulator

A pre-regulator is a circuit that performs preliminary voltage regulation before feeding its output to the final regulator. This is used to improve the characteristics of the overall regulation circuitry. Pre-regulator module acts as transient suppressor. LHUG-150-N from Gaia Converter is used as a pre-regulator module. It operates from a 9-60V input range, and it supports up to 150W of power, however JMM-7500 is designed for 80W only. The LHUG-150 complies with the additional input requirements of 24 / 28 Vdc Mil / Aero buses such as: input inrush current limitation, transient input voltage, transparency due to brownout, +/-100 V reverse protection.

## 6.3 Hold up capacitor/Supercapacitor

The Hold-up section of the LHUG-150 features a 17 W constant power charger that allows to charge a Hold-up capacitor with a total control of inrush current.

Currently 2000uF is installed in the board which supports 80mS interruption time for 80W output power. For more interruption time, additional capacitors can be connected to connector J1. Additional capacitance can be calculated using the below formula.

C = (1000 * P * t) / 2072

Where: C = capacitor value in µF (2000uF already installed)

P = Output power in Watts (80W max)

t = interruption time in ms

## 6.4 DC/DC Regulator

Isolated and non-isolated DC/DC regulator modules can be supported in the design. Any one module will be mounted at a time depending upon the power and isolation requirement. DC/DC regulator circuit is designed to provide maximum output voltage of 24V.

**Isolated DC/DC Regulator**: MGDD-80-N series, isolated DC/DC regulator module is used in the design.

MGDD-80-N series from Gaia converter is used as an isolated DC/DC regulator. The series includes dual output voltage choices individually isolated of 2 x 3.3 volts, 2 x 5 volts, 2 x 12 volts, 2 x 15 volts and 2 x 24 volts. It supports input voltage from 9-60V. Up to 80W total power is supported. Depending on the output voltage requirement, appropriate module will be mounted.

The following table lists the various parts available in MGDD-80-N series.

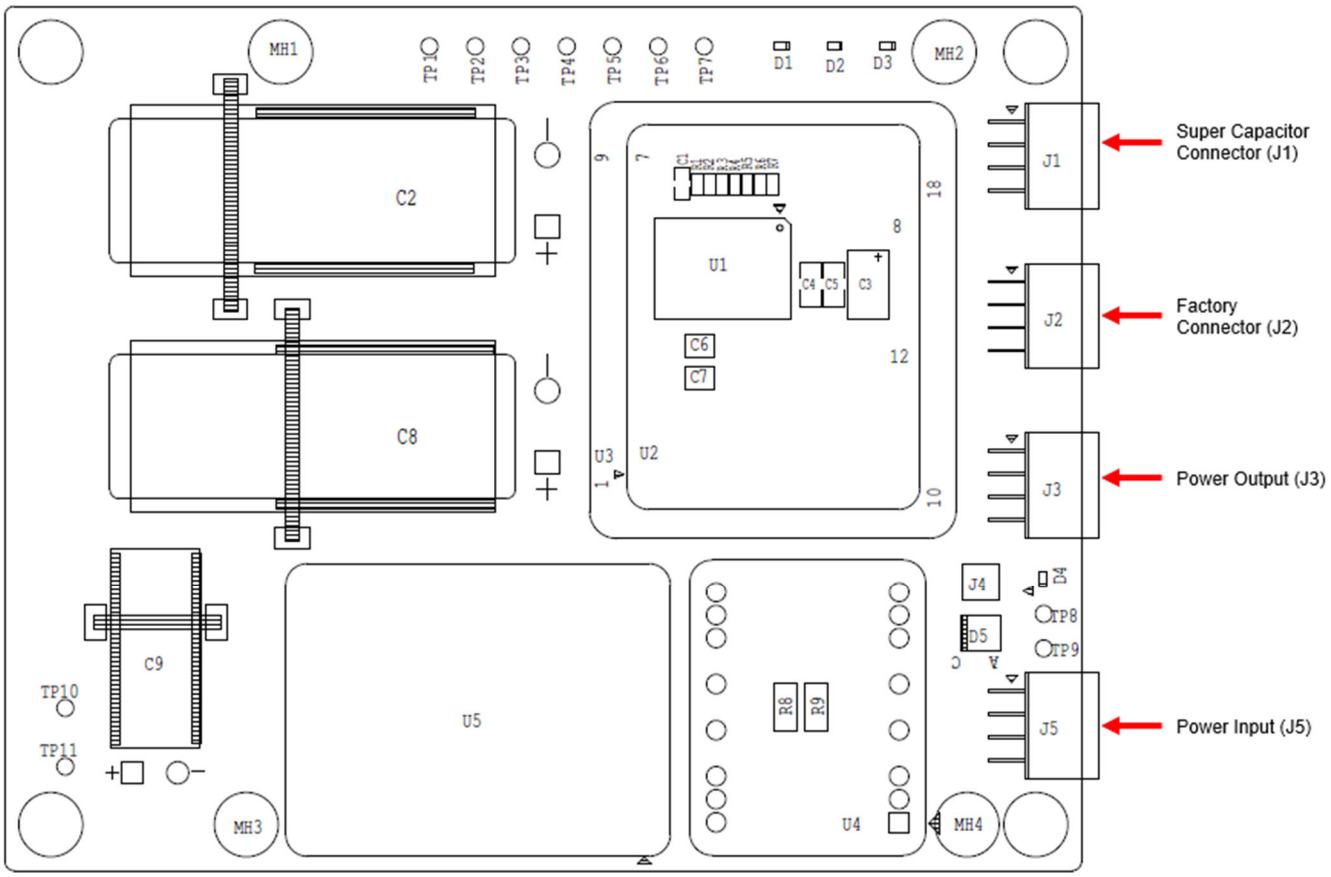
| Input range | Output | Current per Output | Reference | Options |
|---|---|---|---|---|
| 9-60 VDC | 2 x 3.3 VDC | 8 A | MGDD-80-N-B | /T, /S |
| 9-60 VDC | 2 x 5 VDC ** | 8 A | MGDD-80-N-C | /T, /S |
| 9-60 VDC | 2 x 12 VDC ** | 3.4 A | MGDD-80-N-E | /T, /S |
| 9-60 VDC | 2 x 15 VDC ** | 2.7 A | MGDD-80-N-F | /T, /S |
| 9-60 VDC | 2 x 24 VDC ** | 1.7 A | MGDD-80-N-I | /T, /S |
| 9-60 VDC | 5 VDC and 12 VDC | 8A and 3.4A | MGDD-80-N-CE | /T, /S |

** JMM7500 product V_OUT can be changed to 5V/12V/15V/24V by changing the DC/DC converter part. The other two options (2x3.3 VDC, 5VDC and 12VDC) are not available.

These isolated DC/DC regulators output can be further adjusted by using trim resistor connected between TRIM pin and Vo1 or Go1 allows to trim output voltage in the range -20/+10%. Common mode noise capacitance is connected between input and output capacitor for filtering.

**Non isolated DC/DC Regulator**: Option is provided to mount LTM8054 buck boost module from Linear Technology. It supports input voltage from 5-36V. Output voltage ranges from 1.2-36V and it can support up to 5.33A output current at 15V output while operating at 24V input voltage. Output voltage can be varied by changing the feedback resistor values. By default, 15V will be set as output voltage.

# 7. CONNECTOR LOCATION




## 7.1 Connector and Jumper List

| *Connector* | *Description* |
|---|---|
| J1 | Super Capacitor Connector |
| J2 | Factory Connector |
| J3 | Power Output Connector |
| J4 | Jumper Option for Production Test |
| J5 | Power Input Connector |

# 8. CONNECTOR PINOUT AND PIN DESCRIPTION

## 8.1 Power Input (J5)

An 8-position right angle connector is used to provide main input power to the board. This connector is located along the right side of the board.

**Connector: J5**

| | | | |
|---|---|---|---|
| GND | 1 | 5 | V_VIN_CON |
| GND | 2 | 6 | V_VIN_CON |
| GND | 3 | 7 | V_VIN_CON |
| GND | 4 | 8 | V_VIN_CON |

**Connector PN:** IPL1-104-01-L-D-RA-K
**Mating Connector PN:** IPD1-04-D-K

## 8.2 Power Output (J3)

Power output connector is same as input power connector. This connector is located along the right side of the board. Output connector accommodates dual output voltages supported by MGDD-40-NCE Module. For all other modules, V_OUT1 and V_OUT2 will be shorted using 0 Ohm resistor.

**Connector: J3**

| | | | |
|---|---|---|---|
| GND_OUT2 | 1 | 5 | V_OUT2 |
| GND_OUT2 | 2 | 6 | V_OUT2 |
| GND_OUT1 | 3 | 7 | V_OUT1 |
| GND_OUT1 | 4 | 8 | V_OUT1 |

**Connector PN:** IPL1-104-01-L-D-RA-K
**Mating Connector PN:** IPD1-04-D-K

Note: The supply will be isolated or non-isolated based on the board configuration.

## 8.3 Super Capacitor Connector (J1)

Super capacitor connector on board is provided to connect additional hold up/super capacitor to support additional backup power during interruption. The connector will be same as input and output power connectors. This connector will not be installed by default.

**Connector: J1**

| | | | |
|---|---|---|---|
| VC | 1 | 5 | GND_DIG |
| VC | 2 | 6 | GND_DIG |
| VC | 3 | 7 | GND_DIG |
| VC | 4 | 8 | GND_DIG |

**Connector PN:** IPL1-104-01-L-D-RA-K
**Mating Connector PN:** IPD1-04-D-K

## 8.4 Factory Connector (J2)

Factory connector on board is provided to connect the external MGDD regulator for testing, prior to mounting the same on JMM-7500 board. Connector will be same as input and output power connectors.

**Connector: J2**

| | | | |
|---|---|---|---|
| V_OUT1 | 1 | 5 | GND_OUT1 |
| V_OUT2 | 2 | 6 | GND_OUT2 |
| V_VIN_REG | 3 | 7 | GND_DIG |
| NC | 4 | 8 | ON/OFF |

# 9. INSTALLATION

All JMM-7500 power supplies are load tested prior to shipping. The power supplies ship with all the external connectors required to start using your power supply immediately.

No user configuration is required for any version of JMM-7500. Simply plug in the input power and the supply is operational. To power up your supply:

1. For protection, if you are unfamiliar with the use of this product, do not plug any other boards onto it when powering it up for the first time.
2. Connect a DC source to the Input connector, J5. The supply will operate with input voltages from +9V to +36 VDC for non-isolated power supply, and 9V-60V for isolated power supply.
3. Once the input voltage is in the valid range, verify that the proper power input and output indicator LEDs (D4, D1 and D2) along the edge of the board are illuminated. This verifies your input power connections and the power supply is fully functional. Note that only indicators corresponding to the voltages available on the supply will be lit.
4. Power down the supply. Plug the output power cable to connector J3. Your system is ready to use.

# 10. OUTPUT VOLTAGES AND CURRENTS

JMM-7500 provides output voltages based on the model and options ordered. The outputs appear on the output power connector J3. The table below lists the maximum ratings for each output voltage on each base Jupiter-7500 model.

| Model | EMI Filter MIL-461) | Pre-regulator (704/1275) | Output Voltage (V) | Output Current (A) | Output Power (W) |
|---|---|---|---|---|---|
| JMM-7512-IF | Yes | Yes | 12V Isolated | 6.66A | 80W |
| JMM-7515-IF | Yes | Yes | 15V Isolated | 5.33A | 80W |
| JMM-7515-F | Yes | Yes | 15V Non-isolated | 5.33A | 80W |
| JMM-7505-IF | Yes | Yes | 5V Isolated | 16A | 80W |

# 11. SPECIFICATIONS

| | |
|---|---|
| ***Input*** | |
| Input voltage | 9-60V for isolated supply and 9-36V for non-isolated |
| Input protection | Over / under voltage, over current, surges, transients, reflected noise |
| ***Output*** | |
| Output voltage/current | **Isolated:**<br>Single 12V/6.66A<br>Single 15V/5.33A<br>Single 5V/16A<br>**Non- isolated:**<br>Single 15V/5.33A |
| Output protection | Current limit and short circuit protection |
| Output regulation<br>(Line + load + thermal) | ±2%, Vmin to Vmax, 0 to 100% load on all models. Regulation is measured with both outputs in parallel configuration. |
| Output ripple | 300 mV peak-to-peak maximum for 12V output at full load, $T_A$ = 25°C |
| Efficiency | 92% Typical, at full load, $T_A$ = 25°C |
| ***General*** | |
| Dimensions | PC/104 form factor:<br>3.77" x 4.7" (96mm x 120mm) not including connectors<br>Maximum height .56" (14.3mm) above PCB top surface |
| Operating temperature | -40°C to +85°C (-40°F to +185°F) |
| Operating humidity | 5 to 95% non-condensing |
| Shock | MIL-STD-810H compatible |
| Vibration | MIL-STD-810H compatible |
| Weight | Xx oz (yyy g) heat sink<br>Xx oz (yyy g) heat spreader |
| RoHS | Compliant |