

# POWER MATE TECHNOLOGY

## MAD40 SERIES

2 X 3 Inch AC-DC POWER SUPPLIES

UNIVERSAL INPUT RANGE  
UP TO 40 WATTS



### FEATURES

- LOW STANDBY POWER CONSUMPTION UNDER 0.11 WATT
- WIDE INPUT VOLTAGE RANGE 85 TO 264VAC, 47 TO 63HZ
- BUILT-IN CLASS B EMI FILTER
- OUTPUT VOLTAGE ADJUSTABLE (SINGLE OUTPUT ONLY)
- 4000VAC INPUT TO OUTPUT 2MOPP INSULATION
- PROTECTION TYPE CLASS I AND CLASS II
- LOW LEAKAGE CURRENT UNDER 75µA
- OPERATING ALTITUDE 5000M
- 5 YEAR WARRANTY
- SAFETY MEETS ANSI/AAMI ES60601-1, EN60601-1 AND IEC60601-1 3<sup>rd</sup> EDITION
- CE MARKED
- COMPLIANT TO RoHS II & REACH

### APPLICATIONS

- MEDICAL EQUIPMENT
- WIRELESS NETWORK
- TELECOM/DATACOM
- INDUSTRY CONTROL SYSTEM
- MEASUREMENT EQUIPMENT
- SEMICONDUCTOR EQUIPMENT

|                      |     |     |     |                         |
|----------------------|-----|-----|-----|-------------------------|
| 4000VAC<br>ISOLATION | OCP | SCP | OVP | LOW<br>STANDBY<br>POWER |
|----------------------|-----|-----|-----|-------------------------|

### TECHNICAL SPECIFICATION

All specifications are typical at 230VAC input, full load and 25°C otherwise noted

| Model Number | Input Range | Output Voltage | Output Current @ Convection cooled 73°C Ta | Max. Output Power | Input Power @ No Load | Efficiency |
|--------------|-------------|----------------|--|-------------------|-----------------------|------------|
|              | VAC         | VDC            | A  | W                 | W                     | %          |
| MAD40US05    | 85 ~ 264    | 5              | 8  | 40                | 0.11                  | 90.0       |
| MAD40US7P5   | 85 ~ 264    | 7.5            | 5.34                                       | 40                | 0.11                  | 90.0       |
| MAD40US09    | 85 ~ 264    | 9              | 4.45                                       | 40                | 0.11                  | 91.0       |
| MAD40US12    | 85 ~ 264    | 12             | 3.34                                       | 40                | 0.11                  | 92.0       |
| MAD40US121   | 85 ~ 264    | 12             | 3.34                                       | 40                | 0.11                  | 90.0       |
| MAD40US15    | 85 ~ 264    | 15             | 2.67                                       | 40                | 0.11                  | 92.0       |
| MAD40US151   | 85 ~ 264    | 15             | 2.67                                       | 40                | 0.11                  | 90.5       |
| MAD40US24    | 85 ~ 264    | 24             | 1.67                                       | 40                | 0.11                  | 92.0       |
| MAD40US28    | 85 ~ 264    | 28             | 1.43                                       | 40                | 0.11                  | 91.0       |
| MAD40US36    | 85 ~ 264    | 36             | 1.12                                       | 40                | 0.11                  | 92.0       |
| MAD40US48    | 85 ~ 264    | 48             | 0.84                                       | 40                | 0.13                  | 93.0       |
| MAD40US53    | 85 ~ 264    | 53             | 0.77                                       | 40                | 0.13                  | 92.5       |

### PART NUMBER STRUCTURE

| M           | A                         | D              | 40               | U                   | S               | 12                   | □                  |
|-------------|---------------------------|----------------|------------------|---------------------|-----------------|----------------------|--------------------|
| Application | Package Code              | Dimension Code | Output Power (W) | Input Voltage (VAC) | Output Quantity | Output Voltage (VDC) | Protection Type    |
| Medical     | A: Open type              |                |                  | U: Universal        | S: Single       | 05: 5                | No suffix: CLASS I |
| Application | U: U chassis type         |                |                  | 85 ~ 264            |                 | 7P5: 7.5             | B: CLASS II        |
|             | E: Enclosed type          |                |                  |                     |                 | 09: 9                |                    |
|             | D: Din rail (E type only) |                |                  |                     |                 | 12: 12               |                    |
|             |                           |                |                  |                     |                 | 15: 15               |                    |
|             |                           |                |                  |                     |                 | 24: 24               |                    |
|             |                           |                |                  |                     |                 | 28: 28               |                    |
|             |                           |                |                  |                     |                 | 36: 36               |                    |
|             |                           |                |                  |                     |                 | 48: 48               |                    |
|             |                           |                |                  |                     |                 | 53: 53               |                    |

| INPUT SPECIFICATIONS          |                                   |                          |      |      |               |       |
|-------------------------------|-----------------------------------|--------------------------|------|------|---------------|-------|
| Parameter                     | Conditions                        |                          | Min. | Typ. | Max.          | Unit  |
| Operating input voltage range | AC input                          |                          | 85   |      | 264           | VAC   |
|                               | DC input                          |                          | 120  |      | 370           | VDC   |
| Input frequency               | AC input                          |                          | 47   |      | 63            | Hz    |
| Input current                 | 100VAC and Full Load              |                          |      |      | 1.0           | A     |
| No load input power           | 240VAC and Full Load              |                          |      |      | 0.5           |       |
|                               | 230VAC                            | 48Vout, 53Vout<br>Others |      |      | 0.13<br>0.11  | Watts |
| Leakage current               | 264VAC                            |                          |      |      | 75            | µA    |
| Start up time                 |                                   |                          |      |      | 1000          | ms    |
| Rise time                     |                                   |                          |      | 20   |               | ms    |
| Hold up time                  | 115VAC and Full Load              |                          |      | 25   |               | ms    |
| Input inrush current          | 230VAC                            |                          |      |      | 60            | A     |
| Input protection              | Internal fuse in line and neutral |                          |      |      | T3.15A/250VAC |       |

| OUTPUT SPECIFICATIONS        |  |   |                        |      |       |                                |
|------------------------------|--|---|------------------------|------|-------|--------------------------------|
| Parameter                    | Conditions   |   | Min.                   | Typ. | Max.  | Unit                           |
| Output power                 |  |   |                        |      | 40    | Watts                          |
| Initial set voltage accuracy | 230VAC and Full Load   |   | -1.0                   |      | +1.0  | %                              |
| Line regulation              | Low Line to High Line at Full Load                           |   | -0.2                   |      | +0.2  | %                              |
| Load regulation              | No Load to Full Load   | 5Vout                                   | -0.7                   |      | +0.7  | %                              |
|                              |  | Others                                  | -0.5                   |      | +0.5  |                                |
|                              | 10% Load to 90% Load   | 5Vout                                   | -0.6                   |      | +0.6  | %                              |
|                              |  | Others                                  | -0.4                   |      | +0.4  |                                |
| Voltage adjustability        | Single output  | 53Vout                                  | -20                    |      | +10   | %                              |
|                              |  | Others                                  | -10                    |      | +10   |                                |
| Minimum load                 |  |   |                        | 0    |       | %                              |
| Ripple and noise             | Measured by 20MHz bandwidth<br>With a 10µF/25V 1206 X7R MLCC | 5Vout, 7.5Vout, 9Vout<br>12Vout, 15Vout |                        | 75   |       | mVp-p                          |
|                              |  | With a 1µF/50V 1206 X7R MLCC            | 24Vout, 28Vout, 36Vout |      | 75    | mVp-p                          |
|                              |  | With a 0.1µF/100V 1206 X7R MLCC         | 48Vout, 53Vout         |      | 150   | mVp-p                          |
| Temperature coefficient      |  |   | -0.02                  |      | +0.02 | %/°C                           |
| Transient response           | Load step form 50 ~ 75% change at 2.5A/µs                    | Peak deviation<br>Recovery time         |                        | 600  | 3     | %Vout<br>µs                    |
| Over voltage protection      | % of Vout(nom); Latch mode                                   |   | 125                    |      | 140   | %                              |
| Over load protection         | % of Iout rated; Hiccup mode                                 |   |                        | 145  |       | %                              |
| Short circuit protection     |  |   |                        |      |       | Continuous, automatic recovery |

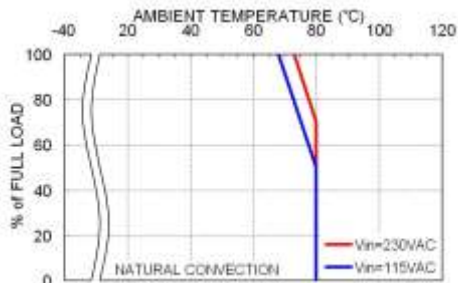
| GENERAL SPECIFICATIONS |                             |   |              |           |  |                             |
|------------------------|-----------------------------|---|--------------|-----------|--|-----------------------------|
| Parameter              | Conditions                  |   | Min.         | Typ.      | Max.   | Unit                        |
| Isolation voltage      | 1 minute (2MOPP insulation) | Input to Output<br>Input (Output) to F.G. | 4000<br>2500 |           |  | VAC                         |
| Isolation resistance   | 500VDC                      |   | 0.1          |           |  | GΩ                          |
| Switching frequency    | 230VAC                      | 5Vout<br>Others                           |              | 70<br>120 |  | kHz                         |
| Safety meets           |                             |   |              |           | ANSI/AAMI ES60601-1<br>EN60601-1<br>IEC60601-1 |                             |
| Weight                 |                             | MAD                                       |              |           |  | 114g (4.02oz)               |
|                        |                             | MUD                                       |              |           |  | 154g (5.43oz)               |
|                        |                             | MED                                       |              |           |  | 169g (5.96oz)               |
|                        |                             | MDD                                       |              |           |  | 190g (6.70oz)               |
| MTBF                   | MIL-HDBK-217F, Full load    |   |              |           |  | 3.010 x 10 <sup>6</sup> hrs |

| ENVIRONMENTAL SPECIFICATIONS  |                    |               |      |      |      |              |
|-------------------------------|--------------------|---------------|------|------|------|--------------|
| Parameter                     | Conditions         |               | Min. | Typ. | Max. | Unit         |
| Operating ambient temperature | Natural convection | With derating | -40  |      | +85  | °C           |
| Storage temperature range     |                    |               | -40  |      | +85  | °C           |
| Operating altitude            |                    |               |      |      | 5000 | m            |
| Shock                         |                    |               |      |      |      | IEC68-2-27   |
| Vibration                     |                    |               |      |      |      | IEC68-2-6    |
| Relative humidity             | Non-condensing     |               |      |      |      | 5% to 95% RH |

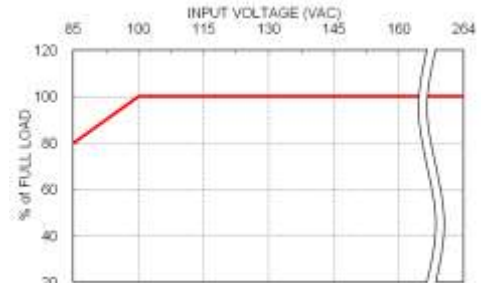
## EMC SPECIFICATIONS

| Parameter                      | Conditions                       |                                     |                  | Level             |
|--------------------------------|----------------------------------|-------------------------------------|------------------|-------------------|
| EMI                            | EN55011, EN55022 and FCC Part 18 |                                     |                  | Conducted Class B |
|                                |                                  |                                     |                  | Radiated Class B  |
| Harmonic currents              | EN61000-3-2                      | Full Load                           |                  | Class A           |
| Voltage flicker                | EN61000-3-3                      |                                     |                  |                   |
| ESD                            | EN61000-4-2                      | Air $\pm 8kV$ and Contact $\pm 6kV$ |                  | Perf. Criteria A  |
| Radiated immunity              | EN61000-4-3                      | 20 V/m                              |                  | Perf. Criteria A  |
| Fast transient                 | EN61000-4-4                      | $\pm 2kV$                           |                  | Perf. Criteria A  |
| Surge                          | EN61000-4-5                      | DM $\pm 1kV$ and CM $\pm 2kV$       |                  | Perf. Criteria A  |
| Conducted immunity             | EN61000-4-6                      | 20 Vr.m.s                           |                  | Perf. Criteria A  |
| Power frequency magnetic field | EN61000-4-8                      | 10 A/m                              |                  | Perf. Criteria A  |
| Dip and interruptions          | EN60601-1-2<br>EN61000-4-11      | 230VAC 50Hz                         | 30% 500mS        | Perf. Criteria A  |
|                                |                                  |                                     | 60% 100mS        | Perf. Criteria A  |
|                                |                                  |                                     | >95% 10mS        | Perf. Criteria A  |
|                                |                                  |                                     | >95% 5000mS      | Perf. Criteria B  |
|                                | 100VAC 50Hz                      | 30% 500mS                           | Perf. Criteria A |                   |
|                                |                                  | 60% 100mS                           | Perf. Criteria B |                   |
|                                |                                  | >95% 10mS                           | Perf. Criteria A |                   |
|                                |                                  | >95% 5000mS                         | Perf. Criteria B |                   |

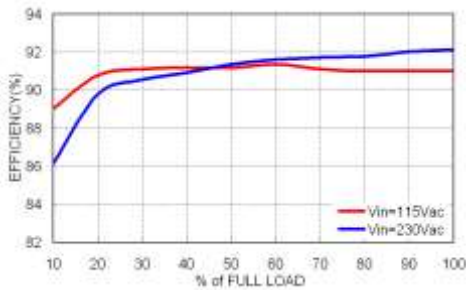
## CHARACTERISTIC CURVE



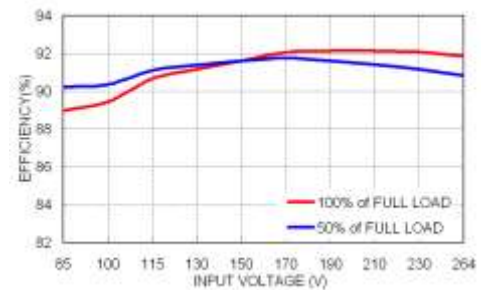
Derating Curve vs. Ambient Temperature  
MAD40US24



Derating Curve vs. Input Voltage



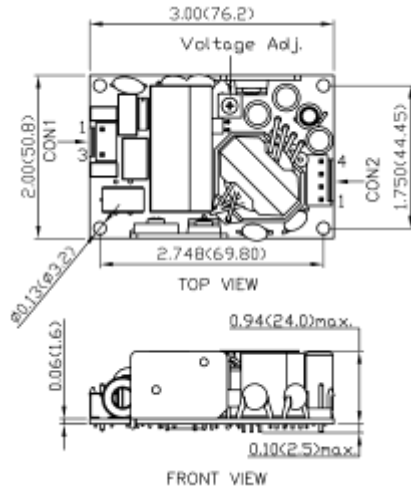
Efficiency vs. Output Load  
MAD40US24



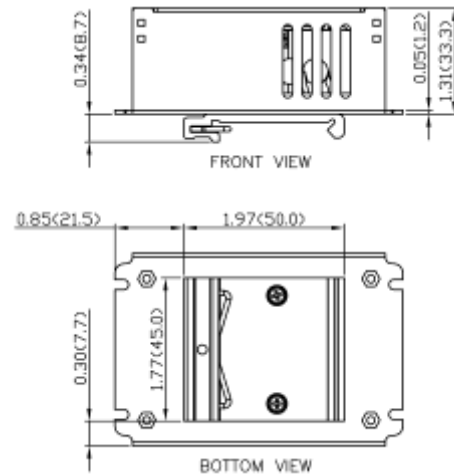
Efficiency vs. Input Voltage  
MAD40US24

## MECHANICAL DRAWING

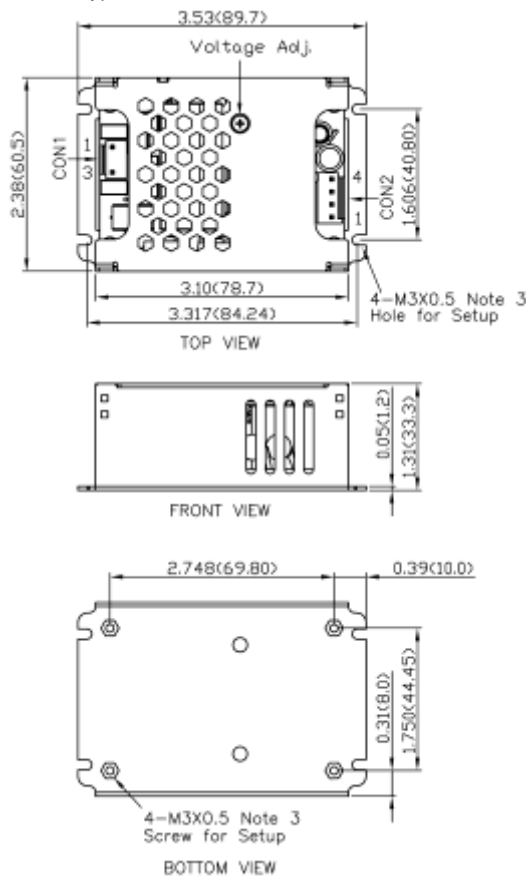
**MAD** Open type



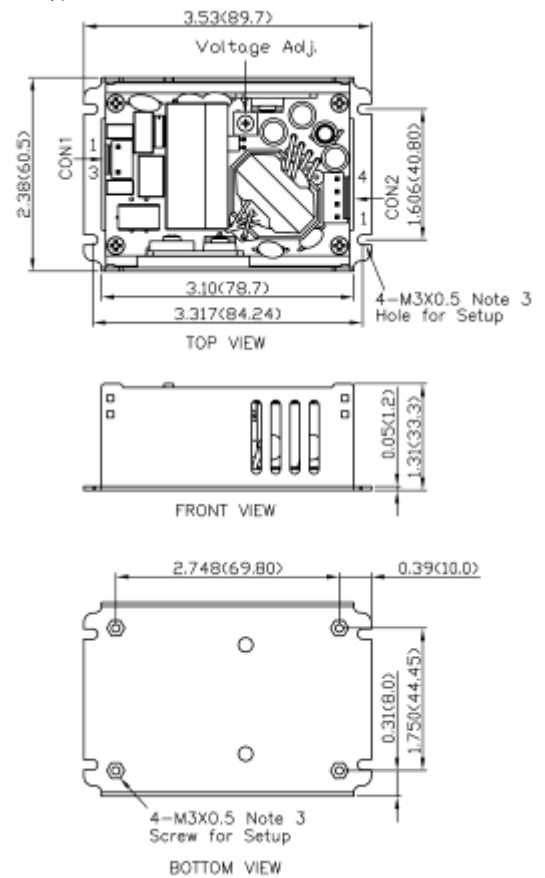
**MDD** Din rail type



**MED** Enclosed type



**MUD** U chassis type



1. All dimensions in inch (mm)
2. Tolerance : x.xx±0.02 (x.x±0.5) x.xxx±0.01 (x.xx±0.25)
3. M3x0.5 screw locked torque MAX 5Kgf.cm/0.49N.m

### CONNECTORS CONNECTIONS

#### CON1 – Input Connector

|       |         |
|-------|---------|
| Pin 1 | Line    |
| Pin 3 | Neutral |

Mates with  
JST housing : **VHR-3N**  
JST crimp terminals : **SVH-21T-P1.1**

Mounting holes marked with ⊕ must be connected to safety earth for CLASS I application

#### CON2 – Output Connector

|         |       |
|---------|-------|
| Pin 1,2 | -Vout |
| Pin 3,4 | +Vout |

Mates with  
JST housing : **VHR-4N**  
JST crimp terminals : **SVH-21T-P1.1**