POWER MATE TECHNOLOGY CO., LTD.

P-DUKE

# MAD100 SERIES

## 2 X 3 Inch AC-DC POWER SUPPLIES

**UNIVERSAL INPUT RANGE**
**UP TO 100Watts**

## FEATURES

- LOW STANDBY POWER CONSUMPTION UNDER 0.3 WATT
- WIDE INPUT VOLTAGE RANGE 85 TO 264VAC, 47 TO 63HZ
- ACTIVE POWER FACTOR CORRECTION
- BUILT-IN EMI FILTER
- OUTPUT VOLTAGE ADJUSTABLE
- OPEN FRAME DIMENSIONS 2.00 X 3.00 X 1.16 INCH
- 4000VAC INPUT TO OUTPUT 2MOPP INSULATION
- PROTECTION TYPE CLASS I AND CLASS II
- LOW LEAKAGE CURRENT UNDER 75μA
- OPERATING ALTITUDE 5000M
- 5 YEAR WARRANTY
- ANSI/AAMI ES60601-1, EN60601-1, & IEC60601-1 3rd EDITION SAFETY APPROVALS
- CE MARKED
- COMPLIANT TO RoHS II & REACH

## APPLICATIONS

- MEDICAL EQUIPMENT

| 4000VAC ISOLATION | OCP | SCP | OVP | LOW STANDBY POWER |
|---|---|---|---|---|

## TECHNICAL SPECIFICATION

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

| Model Number | Input Range | Output Voltage | Output Current @ Natural convection 50℃ Ta | Input Power @ No Load | Efficiency |
|---|---|---|---|---|---|
| | VAC | VDC | A | W | % |
| MAD100US12 | 85 ~ 264 | 12 | 8.34 | 0.3 | 91 |
| MAD100US15 | 85 ~ 264 | 15 | 6.67 | 0.3 | 92 |
| MAD100US24 | 85 ~ 264 | 24 | 4.17 | 0.3 | 92 |
| MAD100US28 | 85 ~ 264 | 28 | 3.58 | 0.3 | 92 |
| MAD100US36 | 85 ~ 264 | 36 | 2.78 | 0.3 | 91 |
| MAD100US48 | 85 ~ 264 | 48 | 2.09 | 0.3 | 91 |

## PART NUMBER STRUCTURE

| M | A | D | 100 | U | S | 12 | □ |
|---|---|---|---|---|---|---|---|
| **Application** | **Package Code** | **Dimension Code** | **Output Power (W)** | **Input Voltage (VAC)** | **Output Quantity** | **Output Voltage (VDC)** | **Protection Type** |
| **Medical Application** | **A:** Open type<br>**U:** U chassis type<br>**E:** Enclosed type<br>**D:** Din rail (E type only) | | | **U:**Universal 85 ~ 264VAC | **S:**Single | **12:** 12V<br>**15:** 15V<br>**24:** 24V<br>**28:** 28V<br>**36:** 36V<br>**48:** 48V | **No suffix:** CLASS I<br>**B:** CLASS II |

## INPUT SPECIFICATIONS

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Operating input voltage range | AC input<br>DC input | 85<br>120 | | 264<br>370 | VAC<br>VDC |
| Input frequency | AC input | 47 | | 63 | Hz |
| Input current | 115VAC and Full Load<br>230VAC and Full Load | | | 1.15<br>0.55 | A |
| No load input power | 230VAC | | | 0.3 | Watts |
| Leakage current | 264VAC | | | 75 | μA |
| Power Factor | | 0.95 | | | |
| Start up time | | | | 1000 | ms |
| Rise time | | | 20 | | ms |
| Hold up time | 115VAC and Full Load | 16 | | | 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 | Open frame | | | | 100 | 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<br>10% Load to 90% Load | | -0.5<br>-0.4 | | +0.5<br>+0.4 | % |
| Voltage adjustability | | | -10 | | +10 | % |
| Minimum load | | | | 0 | | % |
| Ripple and noise | Measured by 20MHz bandwidth<br>With a 10μF/25V 1206 X7R MLCC<br>With a 10μF/25V 1206 X7R MLCC<br>With a 1μF/50V 1206 X7R MLCC<br>With a 1μF/50V 1206 X7R MLCC<br>With a 1μF/50V 1206 X7R MLCC<br>With a 0.1μF/100V 1206 X7R MLCC | <br>12Vout<br>15Vout<br>24Vout<br>28Vout<br>36Vout<br>48Vout | | <br>120<br>150<br>160<br>180<br>190<br>340 | | mVp-p |
| Temperature coefficient | | | -0.02 | | +0.02 | %/℃ |
| Transient response | Load step form 50 ~ 75% change at 2.5A/μs | Peak deviation<br>Recovery time | | <br>500 | 3 | % Vout<br>μs |
| Over voltage protection | % of Vout(nom); Latch mode | | 115 | | 135 | % |
| Over load protection | % of Iout rated; Hiccup mode | | 115 | | 150 | % |
| Short circuit protection | | | | Continuous, automatics 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>1500 | | | VAC |
| Isolation resistance | 500VDC | | 0.1 | | | GΩ |
| Switching frequency | | | | 60 | | kHz |
| Safety approvals | | | | | | ANSI/AAMI ES60601-1<br>EN60601-1<br>IEC60601-1 |
| Weight | | MAD<br>MUD<br>MED<br>MDD | | | | 156g (5.50oz)<br>194g (6.84oz)<br>210g (7.41oz)<br>232g (8.18oz) |
| MTBF | MIL-HDBK-217F Ta=25℃, Full load | | | | | $7.903 \times 10^5$ hrs |

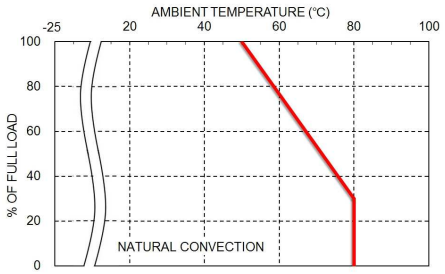
## ENVIRONMENTAL SPECIFICATIONS

| Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Operating ambient temperature | Natural convection | With derating | -25 | | +80 | ℃ |
| Storage temperature range | | | -40 | | +85 | ℃ |
| Operating altitude | | | | | 5000 | m |
| Thermal shock | | | | | | MIL-STD-810F |
| Shock | | | | | | IEC68-2-27 |
| Vibration | | | | | | IEC68-2-6 |
| Relative humidity | Non-condensing | | | | | 5% to 95% RH |

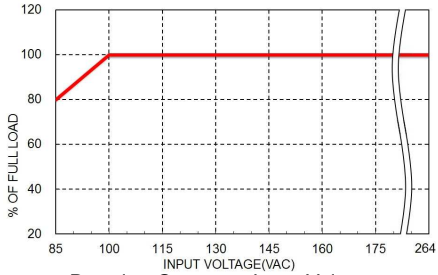
## EMC SPECIFICATIONS

| Parameter | Conditions | | | | Level |
|---|---|---|---|---|---|
| EMI | EN55011, EN55022 and FCC Part 18 | | | | Conducted Class B<br>Radiated Class A |
| Harmonic currents | EN61000-3-2 | Full Load | | | Class A and D |
| Voltage flicker | EN61000-3-3 | | | | |
| ESD | EN61000-4-2 | Air ± 8kV and Contact ± 6kV | | | Perf. Criteria A |
| Radiated immunity | EN61000-4-3 | 20 V/m | | | Perf. Criteria A |
| Fast transient | EN61000-4-4 | ± 2kV | | | Perf. Criteria A |
| Surge | EN61000-4-5 | DM ± 1kV and CM ± 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 | 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 |

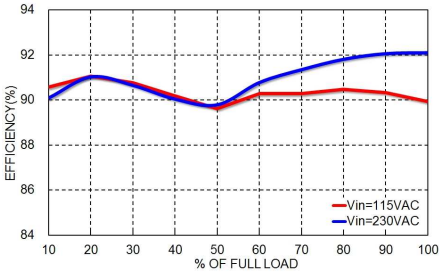
## CHARACTERISTIC CURVE



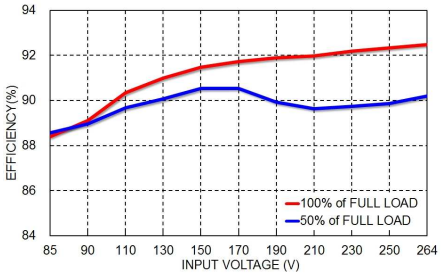

Derating Curve vs. Ambient Temperature
M□D100




Derating Curve vs. Input Voltage
M□D100



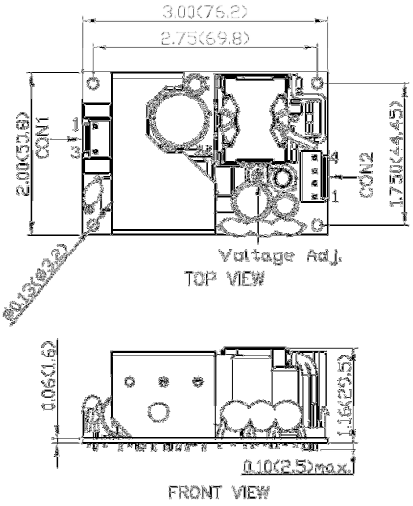

Efficiency vs. Output Load
M□D100US24



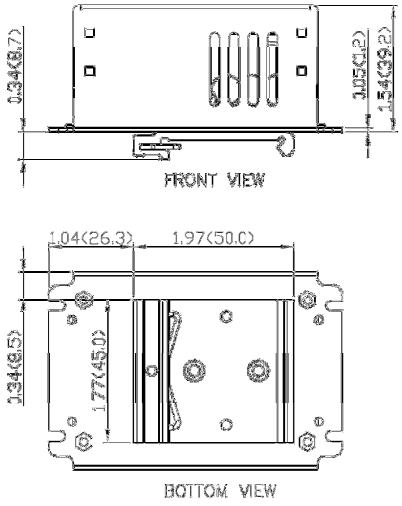

Efficiency vs. Input Voltage
M□D100US24

## MECHANICAL DRAWING

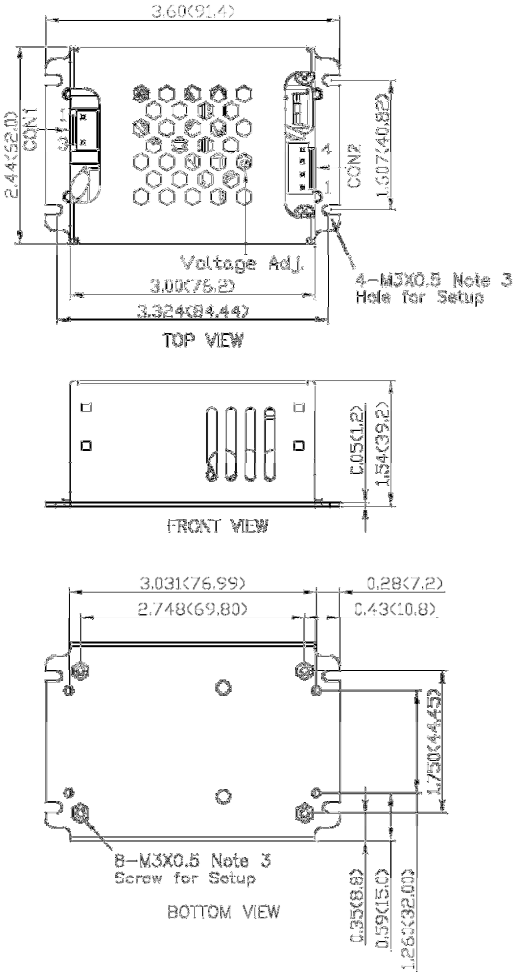
MAD Open type



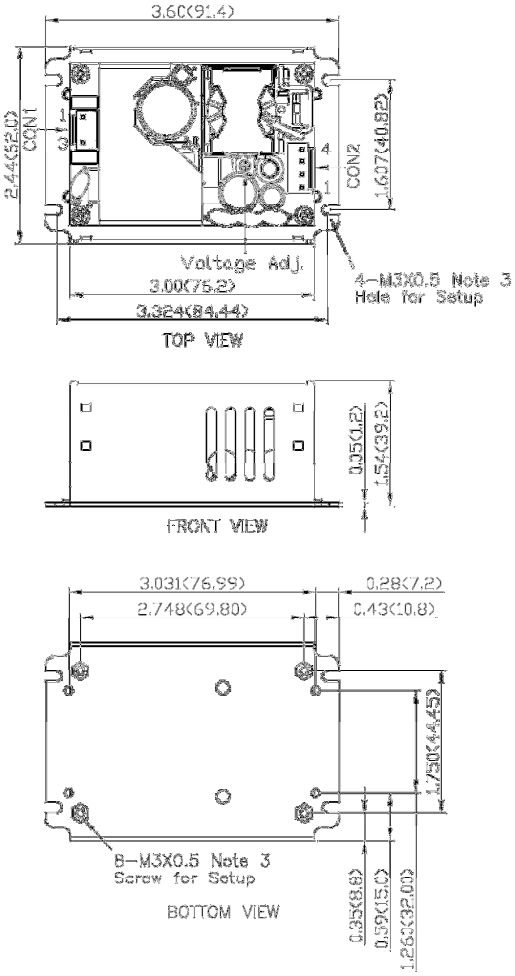

MDD Din rail type




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. M3×0.5 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**