MB1500MRWRI4

EN 60601 Approved
Compact, 2:1 Input, 15W
DC/DC Converters

Key Features:
• EN 60601 3rd Ed. Approved
• 15W Output Power
• 4.2 kVrms Isolation
• Reinforced Insulation
• 2 x MOPP per EN 60601-1 3rd Edition & ANSI/AAMI ES 60601-1
• 5 µA Max Leakage Current
• Wide 2:1 Input Range
• Compact 1 x 2 In Case
• Single & Dual Outputs
• 1.42 MH MTBF

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Electrical Specifications
Specifications typical @ +25°C, nominal input voltage & rated output current, unless otherwise noted. Specifications subject to change without notice.

Input
Parameter | Conditions | Min. | Typ. | Max. | Units
---|---|---|---|---|---
Input Start Voltage | 12 VDC Input | 9.0 | 18.0 | VDC
 | 24 VDC Input | 12.0 | 18.0 | VDC
 | 48 VDC Input | 12.0 | 36.0 | VDC
Under Voltage Shutdown | 12 VDC Input | 7.5 | | VDC
 | 24 VDC Input | 15.0 | | VDC
 | 48 VDC Input | 33.0 | | VDC
Input Filter | π (Pi) Filter | | | |
Start Up Time | Nominal Vin, Constant, Resistive Load | 30 | | mS

Output
Parameter | Conditions | Min. | Typ. | Max. | Units
---|---|---|---|---|---
Output Voltage Accuracy | | ±1.0 | | %
Output Voltage Balance | Dual Output, Balanced Loads | ±2.0 | | %
Line Regulation | Vin = Min to Max | ±0.5 | | %
Load Regulation, IOUT = 0% to 100% | Single Output | ±0.5 | | %
 | Dual Output | ±1.0 | | %
Ripple & Noise (20 MHz), See Note 2 | 12V Output | 100 | | mV P-P
 | 15V, ±12V, ±15V Output | 150 | | mV P-P
 | 24V Output | 300 | | µSec
Output Power Protection | Hiccup Circuit | 50 | | %
Transient Recovery Time, See Note 3 | 25% Load Step Change | 300 | | µSec
Transient Response Deviation | | ±3.0 | | %
Temperature Coefficient | | ±0.02 | | %/°C
Output Short Circuit | Continuous (Autorecovery)

General
Parameter | Conditions | Min. | Typ. | Max. | Units
---|---|---|---|---|---
Isolation Voltage, Rated | 60 Seconds | 4,200 | | Vrms
Reinforced Insulation Working Voltage | | 300 | | Vrms
Leakage Current | 240 VAC, 60 Hz | 5 | | µA
Isolation Resistance | 500 VDC | 10 | | GΩ
Isolation Capacitance | 100 kHz, 1V | 80 | | pF
Switching Frequency | | 285 | | kHz

Environmental
Parameter | Conditions | Min. | Typ. | Max. | Units
---|---|---|---|---|---
Operating Temperature Range | See Table on Page 3
Cooling | Free Air Convection
Humidity | RH, Non-condensing | 95 | | %
Altitude | | 4,000 | | m

Physical
Case Size | See Mechanical Diagram (Page 4)
Case Material | Non-Conductive Black Plastic (UL94-V0)
Weight | 1.06 Oz (30g)

Reliability Specifications
Parameter | Conditions | Min. | Typ. | Max. | Units
---|---|---|---|---|---
MTBF | MIL HDBK 217F, 25°C, Gnd Benign | 1.42 | | MHours
 | IEC/EN 60601-1, EN 60601-1 3rd Edition, 2xMOPP
Safety Standards | ANSI/AAMI ES 60601-1 2xMOPP Recognition, (UL Certificate)
 | ANSI/AAMI ES 60601-1, CAN/CSA-C22.2 No.60601-1

Absolute Maximum Ratings
Parameter | Conditions | Min. | Typ. | Max. | Units
---|---|---|---|---|---
Input Voltage Surge (0.1 Sec) | 12 VDC Input | 25.0 | | VDC
 | 24 VDC Input | 50.0 | | VDC
 | 48 VDC Input | 100.0 | | VDC
Lead Temperature | | 1.5 mm From Case For 10 Sec | 260 | | °C

Caution: Exceeding Absolute Maximum Ratings may damage the module. These are not continuous operating ratings.
## Model Selection Guide

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Input Voltage (VDC)</th>
<th>Current (mA)</th>
<th>Reflected Ripple Current (mA, Typ)</th>
<th>Output Voltage (VDC)</th>
<th>Current (mA, Max)</th>
<th>Current (mA, Min)</th>
<th>Efficiency (%, Typ)</th>
<th>Capacitive Load (µF Max)</th>
<th>Fuse Rating Slow-Blow (mA)</th>
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<td>9.0 - 18.0</td>
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<td>36.0 - 75.0</td>
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<td>±15.0</td>
<td>±500</td>
<td>0.0</td>
<td>88</td>
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</tbody>
</table>

Notes:
1. The specified maximum capacitive load is for each output.
2. When measuring output ripple, it is recommended that an external 4.7 µF ceramic capacitor be placed from the +VOUT pin to the -VOUT pin for single output units and from each output to common for dual output units.
3. Transient recovery is measured to within a 1% error band for a load step change of 75% to 100%.
4. Dual output units may be connected to provide a 24 VDC or 30 VDC output. To do this, connect the load across the positive (+VOUT) and negative (-VOUT) outputs and float the output common.
5. The converter should be connected to a low ac-impedance source. An input source with a highly inductive impedance may affect the stability of the converter. In applications where the converter output loading is high and input power is supplied over long lines, it may be necessary to use a capacitor on the input to insure start-up. In this case, it is recommended that a low ESR (ESR <1.0Ω at 100 kHz) capacitor be mounted close to the converter. For 12V input units a 10.0 µF is recommended, for 24V a 4.7 µF and for 48V units a 2.2 µF.
6. It is recommended that a fuse be used on the input of a power supply for protection. See the table above for the correct rating.

## Typical Connection

These converters are specified for operation without external components. However, in some applications the addition of input/output capacitors, as shown in the typical connection diagram above, will enhance stability and reduce output ripple. This simple connection includes a low ESR (<1.0 Ω at 100 kHz) capacitor connected across the input (C1). It is recommended that a 10.0 µF be used for 12V input models, a 4.7 µF for 24V and a 2.2 µF for 48V input units. To improve the output ripple performance, a 3.3 µF capacitor is connected across the output. For dual output units, a 3.3 µF capacitor should be connected from each output to common.

To meet the specified EN 61000-4-4 and EN 61000-4-5 limits, an external capacitor must be connected across the input pins of the module (C1). A 330 µF/100V capacitor is recommended. This capacitor should be mounted as close to the module as possible.
### Temperature Derating Curves

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Model Number</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
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<td>+25</td>
<td>+73</td>
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<td>°C</td>
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</table>

![Temperature Derating Curves](image1.png)

![Temperature Derating Curves](image2.png)

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Mechanical Dimensions

Pin Connections

<table>
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<th>Pin</th>
<th>Single</th>
<th>Dual</th>
<th>Pin</th>
<th>Single</th>
<th>Dual</th>
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<td>+VIN</td>
<td></td>
<td>4</td>
<td>No Pin</td>
<td>Comm.</td>
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<tr>
<td>2</td>
<td>-VIN</td>
<td>-VIN</td>
<td>5</td>
<td>-VOUT</td>
<td>-VOUT</td>
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<tr>
<td>3</td>
<td>+VOUT</td>
<td>+VOUT</td>
<td></td>
<td></td>
<td></td>
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</table>

Mechanical Notes:
- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.01 (±0.25)

Related Products

Medical Approved DC/DC’s

MA600MRWR15 Series
- 6W Output Power
- 5 kVAC Isolation
- Reinforced Insulation
- Meets 2xMOPP
- 2 μA Leakage Current Max
- Wide 2:1 Input Range
- Compact DIP Case
- Single & Dual Outputs
- 1.0 MH MTBF
- EN 60601 Approved

MB2000MRWR14 Series
- 20W Output Power
- 4.2 kVAC Isolation
- Reinforced Insulation
- Meets 1xMOPP & 2xMOOP
- 5 μA Leakage Current Max
- Wide 2:1 Input Range
- Compact 1 x 2 In Case
- Single & Dual Outputs
- 1.08 MH MTBF
- EN 60601 Approved

ML200MRRI4 Series
- 2W Output Power
- 4 kVAC Isolation
- Reinforced Insulation
- Meets 1xMOPP & 2xMOOP
- 2 μA Leakage Current Max
- Compact SMT Case
- Available on Tape/Reel
- 2.0 MH MTBF
- EN 60601 Approved

Thousands of standard power products ranging from 0.5W to 500W are available from MPD in a wide variety of packages and pin-outs. This includes many more families with EN 60601 medical approval.

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