

MB3000ERW

Low Cost, 1 x 2 Inch 30W, 2:1 Input Range DC/DC Converters



Key Features:

- 30W Output Power
- 2:1 Input Voltage Range
- 1,500 VDC Isolation
- 11 Single Output Models
- Efficiency to 89%
- Compact 1 x 2 Inch Case
- -40°C to +85°C Operation
- Industry Standard Pin-Out
- Low Cost

RoHS



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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 Voltage Range | 24 VDC Input | 18.0 | 24.0 | 36.0 | VDC |
| | 48 VDC Input | 36.0 | 48.0 | 75.0 | |
| Input Start Voltage | 24 VDC Input | | 17.8 | 18.0 | VDC |
| | 48 VDC Input | | 35.8 | 36.0 | |
| Input Filter | π (Pi) Filter | | | | |
| Start-Up Time | See Note 1 | | 10 | | mS |

Output

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|-------------------------------------|--------------------------------|------|-------|------|----------|
| Output Voltage Accuracy | | | ±1.0 | ±3.0 | % |
| Output Trim Range | | | ±10 | | % |
| Line Regulation | V _{IN} = Min to Max | | ±0.2 | ±0.5 | % |
| Load Regulation | I _{OUT} = 10% to 100% | | ±0.5 | ±1.0 | % |
| Ripple & Noise (20 MHz) | See Note 2 | | 50 | 120 | mV P - P |
| Transient Recovery Time, See Note 3 | 25% Load Step Change | | 300 | 500 | μS |
| Transient Response Deviation | | | ±3.0 | ±5.0 | % |
| Output Power Protection | | 120 | 130 | 150 | % |
| Temperature Coefficient | | | ±0.02 | | %/°C |
| Output Short Circuit, See Note 4 | Continuous (Autorecovery) | | | | |

General

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|-----------------------|--------------|-------|-------|------|-------|
| Isolation Voltage | 60 Seconds | 1,500 | | | VDC |
| Isolation Resistance | 500 VDC | 1,000 | | | MΩ |
| Isolation Capacitance | 100 kHz/0.1V | | 1,000 | | pF |
| Switching Frequency | | | 300 | | kHz |

Environmental

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|-----------------------------|---------------------|------|------|------|-------|
| Operating Temperature Range | Ambient | -40 | +25 | +85 | °C |
| Operating Temperature Range | Case | | | +105 | °C |
| Storage Temperature Range | | -55 | | +125 | °C |
| Cooling | Free Air Convection | | | | |
| Humidity | RH, Non-condensing | | | 95 | % |

Physical

| | | | | | |
|---------------|---|--|--|--|--|
| Case Size | See Mechanical Diagram (Page 4) | | | | |
| Case Material | Aluminum Alloy With Non-Conductive Base (UL94-V0) | | | | |
| Weight | 0.78 Oz (22g) | | | | |

Remote On/Off

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|------------------|------------|------|------|------|-------|
| Unit On | See Note 5 | 3.0 | | 40.0 | VDC |
| Unit Off | See Note 5 | 0 | | 1.2 | VDC |
| Off Idle Current | | | 1.0 | | mA |

Reliability Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|-----------|---|------|------|------|--------|
| MTBF | MIL HDBK 217F, 25°C, Gnd Benign | 1.0 | | | MHours |
| Vibration | 10 - 55 Hz, 10G, 30 Min, on X, Y & Z Axis | | | | |

Absolute Maximum Ratings

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|-----------------------------|-----------------------------|------|------|-------|-------|
| Input Voltage Surge (1 Sec) | 24 VDC Input | -0.7 | | 50.0 | VDC |
| | 48 VDC Input | -0.7 | | 100.0 | |
| Lead Temperature | 1.5 mm From Case for 10 Sec | | | 300 | °C |

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

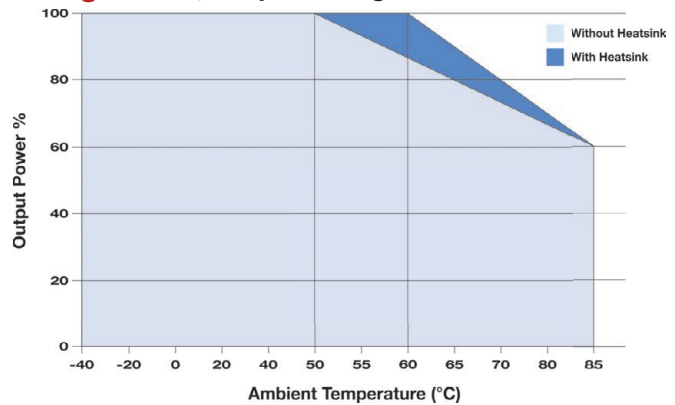
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| Model Number | Input | | | | Output | | | Efficiency (% Typ) | Over Voltage Protection (VDC Typ) | Capacitive Load (µF Max) | Fuse Rating Slow-Blow (mA) |
|---------------|---------------|-------------|--------------|---------|---------------|-------------------|-------------------|--------------------|-----------------------------------|--------------------------|----------------------------|
| | Voltage (VDC) | | Current (mA) | | Voltage (VDC) | Current (mA, Max) | Current (mA, Min) | | | | |
| | Nominal | Range | Full-Load | No-Load | | | | | | | |
| MB3024S-03ERW | 24 | 18.0 - 36.0 | 960 | 120 | 3.3 | 6,000 | 600 | 87 | 3.96 | 6,800 | 2,000 |
| MB3024S-05ERW | 24 | 18.0 - 36.0 | 1,460 | 120 | 5.0 | 6,000 | 600 | 88 | 6.00 | 6,800 | 3,000 |
| MB3024S-09ERW | 24 | 18.0 - 36.0 | 1,440 | 20 | 9.0 | 3,333 | 333 | 88 | 10.8 | 680 | 3,000 |
| MB3024S-12ERW | 24 | 18.0 - 36.0 | 1,440 | 20 | 12.0 | 2,500 | 250 | 88 | 15.0 | 680 | 3,000 |
| MB3024S-15ERW | 24 | 18.0 - 36.0 | 1,440 | 20 | 15.0 | 2,000 | 200 | 89 | 18.0 | 680 | 3,000 |
| MB3024S-24ERW | 24 | 18.0 - 36.0 | 1,440 | 20 | 24.0 | 1,250 | 125 | 89 | 28.0 | 470 | 3,000 |
| MB3048S-03ERW | 48 | 36.0 - 75.0 | 500 | 80 | 3.3 | 6,000 | 600 | 87 | 3.96 | 6,800 | 1,000 |
| MB3048S-05ERW | 48 | 36.0 - 75.0 | 730 | 80 | 5.0 | 6,000 | 600 | 88 | 6.00 | 6,800 | 1,500 |
| MB3048S-12ERW | 48 | 36.0 - 75.0 | 720 | 20 | 12.0 | 2,500 | 250 | 89 | 15.0 | 680 | 1,500 |
| MB3048S-15ERW | 48 | 36.0 - 75.0 | 720 | 20 | 15.0 | 2,000 | 200 | 89 | 18.0 | 680 | 1,500 |
| MB3048S-24ERW | 48 | 36.0 - 75.0 | 720 | 20 | 24.0 | 1,250 | 125 | 88 | 28.0 | 470 | 1,500 |

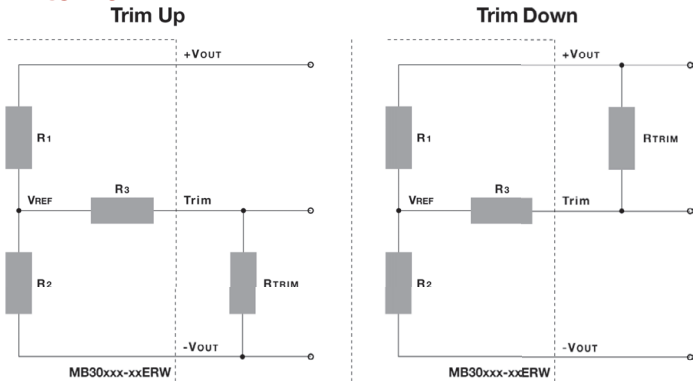
Notes:

- Start up time is measured at nominal input and with a constant resistive load.
- When measuring output ripple, it is recommended that an external ceramic capacitor (approx 1 µF to 10 µF) be placed from the +Vout to the -Vout pins.
- Transient recovery is measured to within a 1% error band for a load step change of 25%.
- Short circuit protection is provided by a "hiccup mode" circuit.
- If the on/off pin is left open, the unit operates. If it is grounded, the unit will shut off.
- These units should not be operated with a load under 10% of full load. Operation at no-load will not damage the unit, but they may not meet all specifications.
- These units should not be operated over +85°C. Exceeding +85°C may damage the unit.
- It is recommended that a fuse be used on the input of a power supply for protection. See the Model Selection table above for the correct rating.

Derating Curve, Output Voltage ≤5V



External Trim



External Trim Notes:

On single output units, an external resistor can be used to adjust the converter output up/down by about 10%. The connection is shown in the diagram at left. The required resistor value is calculated by the formulas:

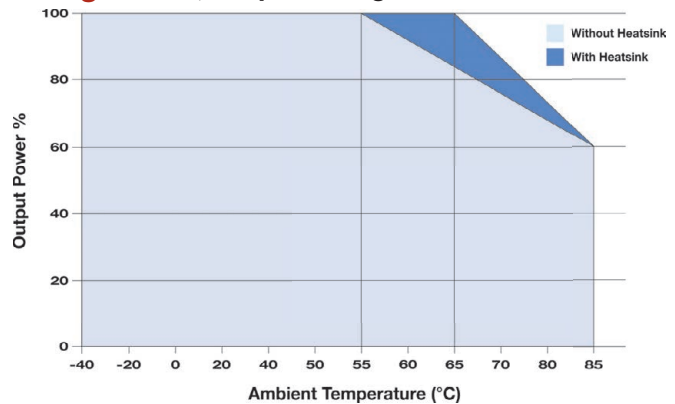
$$\text{Trim UP} = R_{\text{TRIM}} = \frac{A \cdot R_2}{R_2 - A} - R_3 \quad \text{Where } A = \frac{V_{\text{REF}}}{V_{\text{TRIM}} - V_{\text{REF}}} \cdot R_1$$

$$\text{Trim Down} = R_{\text{TRIM}} = \frac{A \cdot R_1}{R_1 - A} - R_3 \quad \text{Where } A = \frac{V_{\text{TRIM}} - V_{\text{REF}}}{V_{\text{REF}}}$$

Where RTRIM = The value of the external trim resistor
 VTRIM = The amount of voltage adjustment required

The value of R1, R2, R3 and VREF are given in the table below.

Derating Curve, Output Voltage >5V



Output Trim Resistor Values

| Parameter | Output Voltage (VDC) | | | | | |
|-----------|----------------------|-------|-------|--------|--------|--------|
| | 3.3 | 5.0 | 9.0 | 12 | 15 | 24 |
| R1 (kΩ) | 4.801 | 2.883 | 7.500 | 10.971 | 14.497 | 24.872 |
| R2 (kΩ) | 2.863 | 2.864 | 2.864 | 2.864 | 2.864 | 2.864 |
| R3 (kΩ) | 15.00 | 10.00 | 15.00 | 17.80 | 17.80 | 20.00 |
| VREF (V) | 1.24 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 |



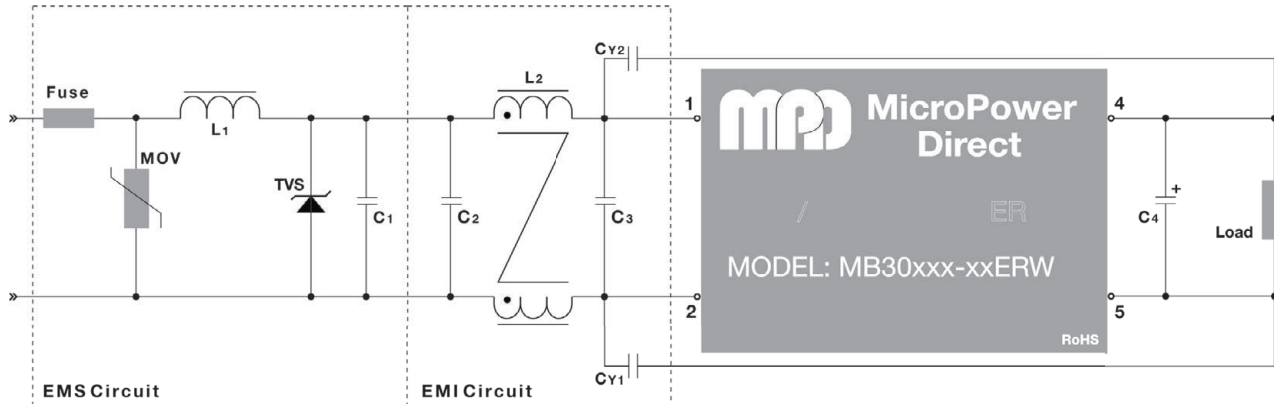
EMC Specifications

| Parameter | Standard | | |
|---------------------|------------|---------------|---------------------------|
| Radiated Emissions | See Note 1 | EN 55022 | Class A |
| Conducted Emissions | See Note 1 | EN 55022 | Class A |
| ESD | | EN 61000-4-2 | Criteria B; ±4 kV Contact |
| RS | | EN 61000-4-3 | Criteria A; 10V/m |
| EFT | See Note 2 | EN 61000-4-4 | Criteria B; ±2 kV |
| Surge | See Note 3 | EN 61000-4-5 | Criteria B; ±2 kV |
| CS | | EN 61000-4-6 | Criteria A; 3 Vrms |
| Voltage Dips | | EN 61000-4-29 | Criteria B; 0% - 70% |

Notes:

- All units are rated for EN 55022 (CE/RE) class A without external components. They will meet class B with the addition of the **MDCFM-xxW** (or a similar discrete filter circuit). Contact the factory for more information.
- To meet the requirements of EN 61000-4-4 (±2 kV), external components are needed. This can be done discretely, or with the addition of the **MDCFM-xxW**. Contact the factory for more information.
- To meet the requirements of EN 61000-4-5 (±2 kV), external components are needed. This can be done discretely, or with the addition of the **MDCFM-xxW**. Contact the factory for more information.

Typical Connection



The diagram above illustrates a typical connection of the **MB3000ERW** series for applications that require meeting EMC standards. The units do not require external components to operate as specified. Some notes on this diagram (starting with the input circuit) are:

- It is recommended that an external fuse be used. The recommended fuse is shown in the model chart on page 2.
- An external MOV is recommended on the input to protect the unit in the event of a surge. A recommended value is given in the table at right.
- An external TVS is recommended on the input to protect the unit in the event of a voltage spike. A recommended value is given in the table at right.
- The output filtering capacitor (C4) is a high frequency, low resistance electrolytic capacitor. Care must be taken in choosing this capacitor not to exceed the capacitive load specification for the unit. Voltage derating of capacitors should be 80% or above.

5. Recommended values for components are:

| Component | 24 V _{IN} | 48 V _{IN} |
|-----------|--------------------|--------------------|
| MOV | S14K35 | S14K60 |
| L1 | 56 μH | 56 μH |
| TVS | SMCJ48A | SMCJ90A |
| C1 | 330 μF/50V | 330 μF/100V |
| C2, C3 | 4.7 μF/50V | 2.2 μF/100V |
| L2 | 1.0 mH | 1.0 mH |
| Cy1, Cy2 | 1nF/2 kV | 1nF/2 kV |
| C0 | 400 μF/200V | 400 μF/200V |

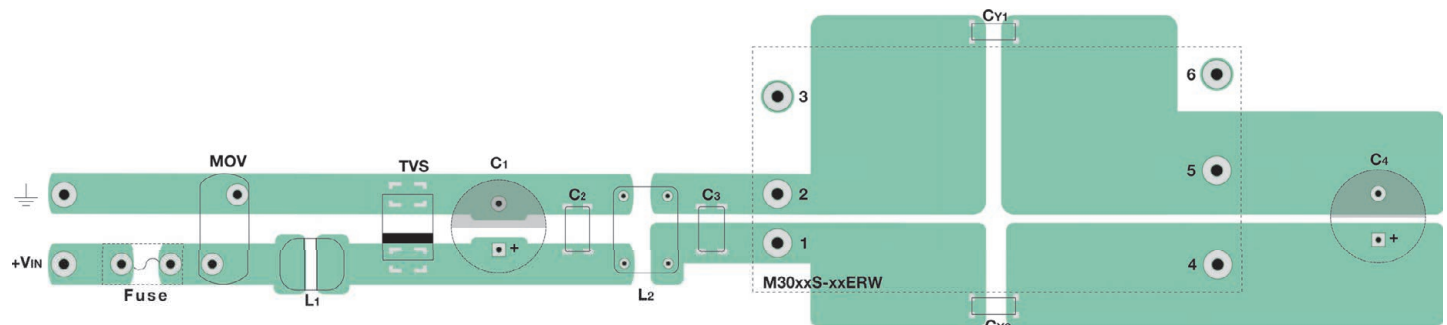
6. Input noise and surge suppression modules are available for a number of **MPD** DC/DC power supplies. A connection for one of these modules is illustrated in the typical board layout shown at

the bottom of this page For pricing or full technical information, please contact the factory.

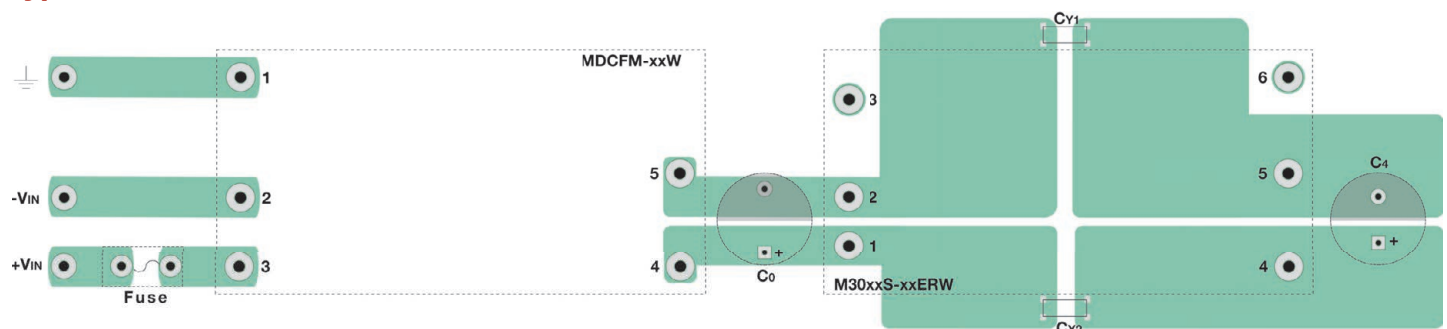
- In many applications simply adding input/output capacitors will enhance the input surge protection and reduce output ripple sufficiently. The input capacitor C1 and output capacitor C4 shown in the typical connection diagram above (& board layout drawing below) illustrate their connection. Recommended capacitor values are given in the table.

| V _{in} (VDC) | Input Capacitor | V _{out} (VDC) | Output Capacitor |
|-----------------------|-----------------|------------------------|------------------|
| 24 | 100 μF | 3.3 | 220 μF |
| | | 5.0 | 220 μF |
| 48 | 100 μF | 9.0 | 100 μF |
| | | 12 | 100 μF |
| | | 15 | 100 μF |
| 24 | | 47 μF | |

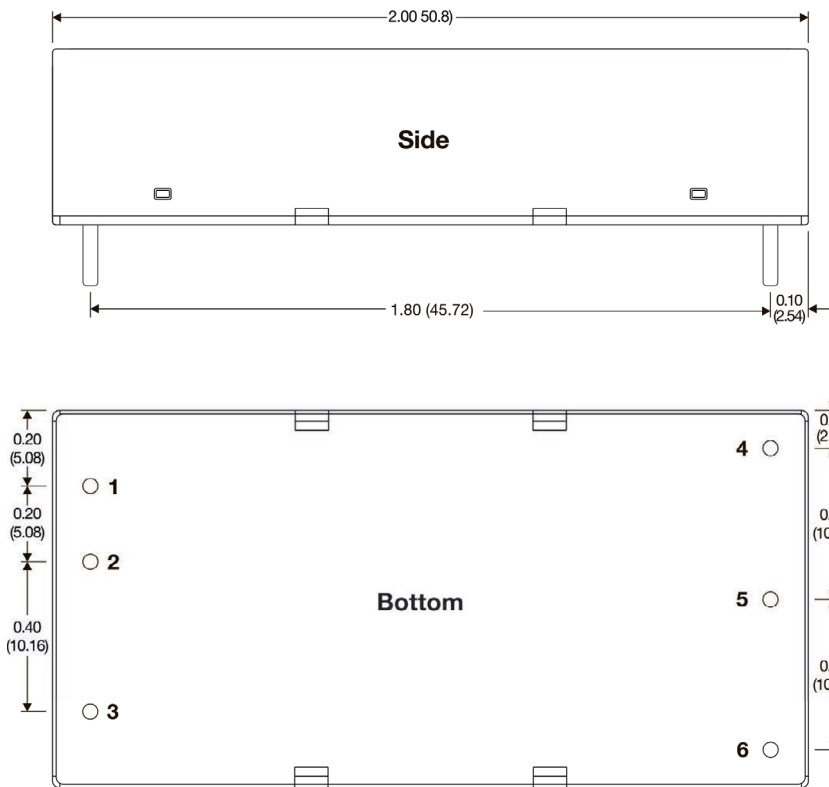
Typical Board Layout: With External Filter/Surge Components



Typical Connection: With External Filter Module Unit



Mechanical Dimensions



Pin Connections

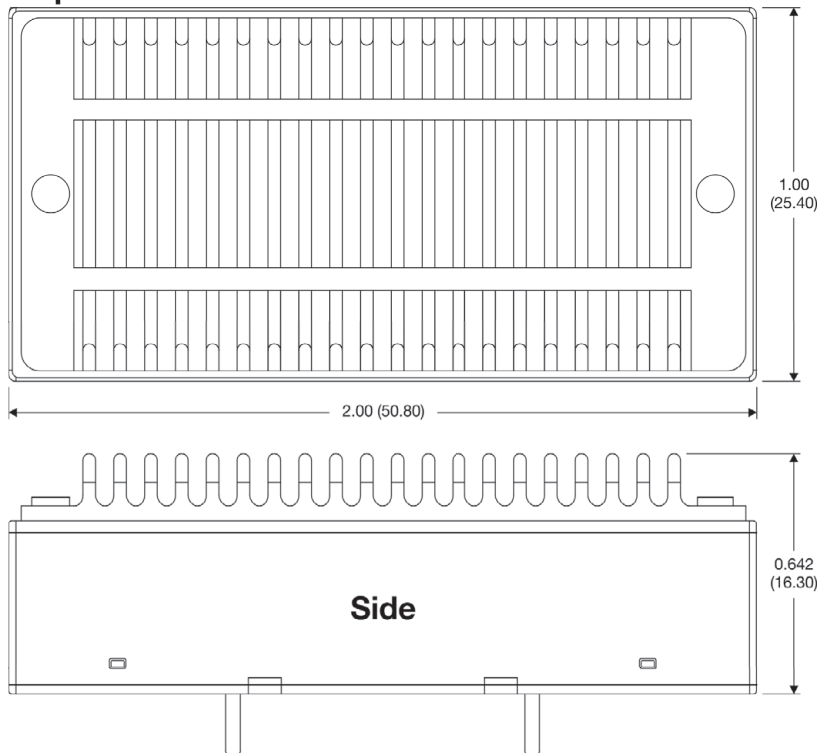
| Pin | Function |
|-----|---------------|
| 1 | +Vin |
| 2 | -Vin |
| 3 | Remote On/Off |
| 4 | +Vout |
| 5 | -Vout |
| 6 | Trim |

Adapter Plate



All models of the **MB3000x-xxERW** series are available mounted on an adapter plate similar to the one pictured at left. The adapter plate makes it easier to mount the unit to a chassis or to a standard DIN rail. Please contact the factory for more information.

Mechanical Dimensions: With Optional Heatsink Top



For the heatsink option, add suffix "H" to the model number (i.e. **MB3024S-05ERW-H**)

Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.50)