

# MB1500ERW

## Low Cost, 1 x 2 Inch 15W, 2:1 Input Range DC/DC Converters



### Key Features:

- 15W Output Power
- 2:1 Input Voltage Range
- 1,500 VDC Isolation
- Single & Dual Outputs
- Efficiency to 90%
- Compact 1 x 2 Inch Case
- -40°C to +85°C Operation
- Industry Standard Pin-Out
- Low Cost

RoHS



MicroPower Direct



### 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	12 VDC Input	9.0	12.0	18.0	VDC
	24 VDC Input	18.0	24.0	36.0	
	48 VDC Input	36.0	48.0	75.0	
Input Start Voltage	12 VDC Input			9.0	VDC
	24 VDC Input			17.8	
	48 VDC Input			35.8	
Input Filter	$\pi$ (PI) Filter				
Start-Up Time	See Note 2		10		mS

#### Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy			±1.0	±3.0	%
Output Voltage Balance	Dual Outputs, Balanced Loads		±0.5	±1.0	
Output Trim Range			±10		%
Line Regulation	$V_{IN} = \text{Min to Max}$		±0.2	±0.5	%
Load Regulation	$I_{OUT} = 10\% \text{ to } 100\%$		±0.5	±1.0	%
Cross Regulation	See Note 3			±5.0	%
Ripple & Noise (20 MHz)	See Note 4		70	100	mV P - P
Transient Recovery Time, See Note 5	25% Load Step Change		300	500	$\mu\text{S}$
Transient Response Deviation			±3.0	±5.0	%
Output Power Protection			150		%
Temperature Coefficient			±0.02		%/°C
Output Short Circuit, See Note 6	Continuous (Autorecovery)				

#### General

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage	60 Seconds	1,500			VDC
Isolation Resistance	500 VDC	1,000			M $\Omega$
Isolation Capacitance	See Note 7		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	0.99 Oz (28g)				

#### Remote On/Off

Parameter	Conditions	Min.	Typ.	Max.	Units
Unit On	See Note 8	2.5		12.0	VDC
Unit Off	See Note 8	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)	12 VDC Input	-0.7		25.0	VDC
	24 VDC Input	-0.7		50.0	
	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.

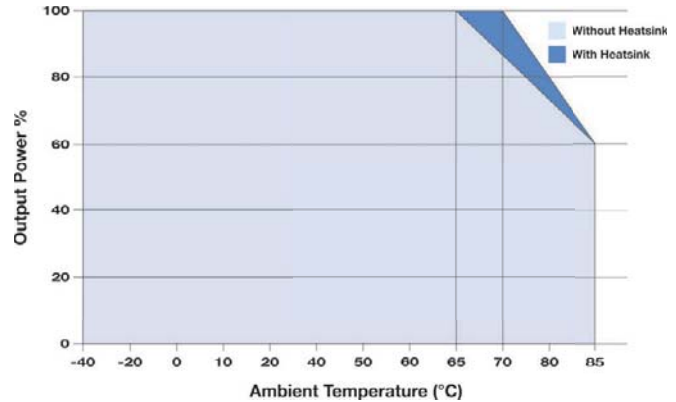
# Model Selection Guide

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							
MB1512S-03ERW	12	9.0 - 18.0	1,465	65	3.3	4,000	200	87	3.9	10,500	3,000
MB1512S-05ERW	12	9.0 - 18.0	1,405	60	5.0	3,000	150	89	6.2	4,020	3,000
MB1512S-12ERW	12	9.0 - 18.0	1,405	25	12.0	1,250	63	89	15.0	1,035	3,000
MB1512S-15ERW	12	9.0 - 18.0	1,405	25	15.0	1,000	50	89	18.0	705	3,000
MB1512S-24ERW	12	9.0 - 18.0	1,389	30	24.0	625	32	90	30.0	250	3,000
MB1512D-05ERW	12	9.0 - 18.0	1,453	30	±5.0	±1,500	±75	86	±6.2	1,020	3,000
MB1512D-12ERW	12	9.0 - 18.0	1,420	25	±12.0	±625	±32	88	±15.0	495	3,000
MB1512D-15ERW	12	9.0 - 18.0	1,420	25	±15.0	±500	±25	88	±18.0	165	3,000
MB1512D-24ERW	12	9.0 - 18.0	1,420	20	±24.0	±313	±16	88	±30.0	200	3,000
MB1524S-03ERW	24	18.0 - 36.0	625	35	3.3	4,000	200	88	3.9	10,500	1,500
MB1524S-05ERW	24	18.0 - 36.0	695	35	5.0	3,000	150	90	6.2	4,020	1,500
MB1524S-12ERW	24	18.0 - 36.0	703	20	12.0	1,250	63	89	15.0	1,035	1,500
MB1524S-15ERW	24	18.0 - 36.0	695	20	15.0	1,000	50	90	18.0	705	1,500
MB1524S-24ERW	24	18.0 - 36.0	695	25	24.0	625	32	90	30.0	250	1,500
MB1524D-05ERW	24	18.0 - 36.0	727	25	±5.0	±1,500	±75	86	±6.2	1,020	1,500
MB1524D-12ERW	24	18.0 - 36.0	710	20	±12.0	±625	±32	88	±15.0	495	1,500
MB1524D-15ERW	24	18.0 - 36.0	710	20	±15.0	±500	±25	88	±18.0	165	1,500
MB1524D-24ERW	24	18.0 - 36.0	710	20	±24.0	±313	±16	88	±30.0	200	1,500
MB1548S-03ERW	48	36.0 - 75.0	316	35	3.3	4,000	200	87	3.9	10,500	1,000
MB1548S-05ERW	48	36.0 - 75.0	360	35	5.0	3,000	150	87	6.2	4,020	1,000
MB1548S-12ERW	48	36.0 - 75.0	352	25	12.0	1,250	63	89	15.0	1,035	1,000
MB1548S-15ERW	48	36.0 - 75.0	348	15	15.0	1,000	50	90	18.0	705	1,000
MB1548S-24ERW	48	36.0 - 75.0	352	15	24.0	625	32	89	30.0	250	1,000
MB1548D-05ERW	48	36.0 - 75.0	363	20	±5.0	±1,500	±75	86	±6.2	1,020	1,000
MB1548D-12ERW	48	36.0 - 75.0	355	15	±12.0	±625	±32	88	±15.0	495	1,000
MB1548D-15ERW	48	36.0 - 75.0	355	15	±15.0	±500	±25	88	±18.0	165	1,000
MB1548D-24ERW	48	36.0 - 75.0	355	15	±24.0	±313	±16	88	±30.0	200	1,000

**Notes:**

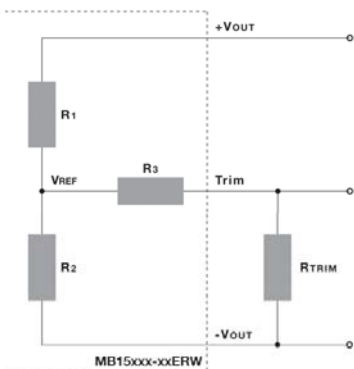
- The specified maximum capacitive load is for each output.
- Start up time is measured at nominal input and with a constant resistive load.
- Cross regulation is measured with the main output set at 50% load. The second output is varied from 10% to 100% load.
- When measuring output ripple, it is recommended 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.
- Isolation capacitance for 24 VDC output models is 2,000 pF. Isolation capacitance is measured from input to output at 100 kHz/0.1V.
- The control input (pin 6) is referenced to the -VIN (pin 2) input. 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

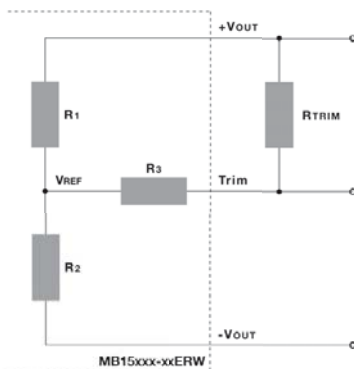


## External Trim

### Trim Up



### Trim Down



**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:

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

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

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.

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



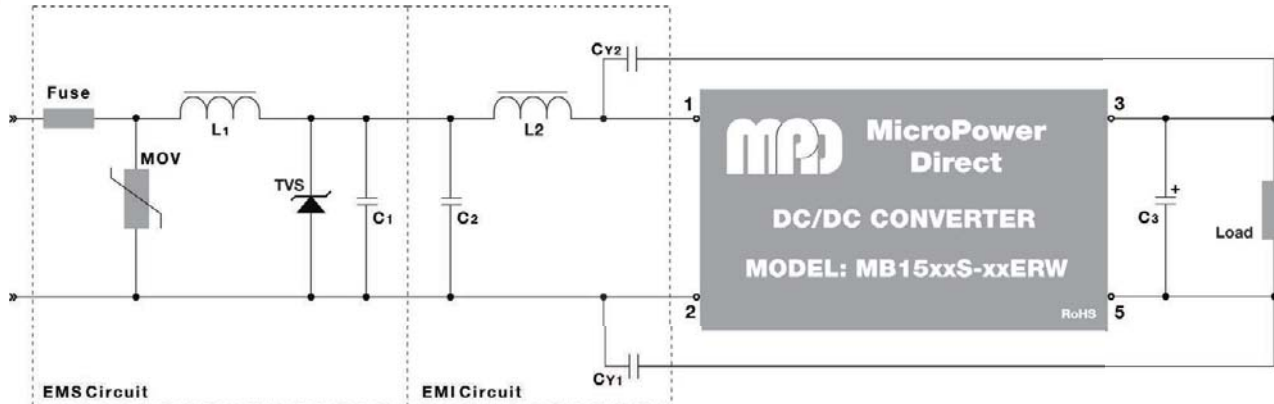
## EMC Specifications

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 **MB1500ERW** 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 (C<sub>3</sub>) 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. The board layout illustration below shows a connection for dual output units. Voltage derating of capacitors should be 80% or above.

5. Recommended values for components are:

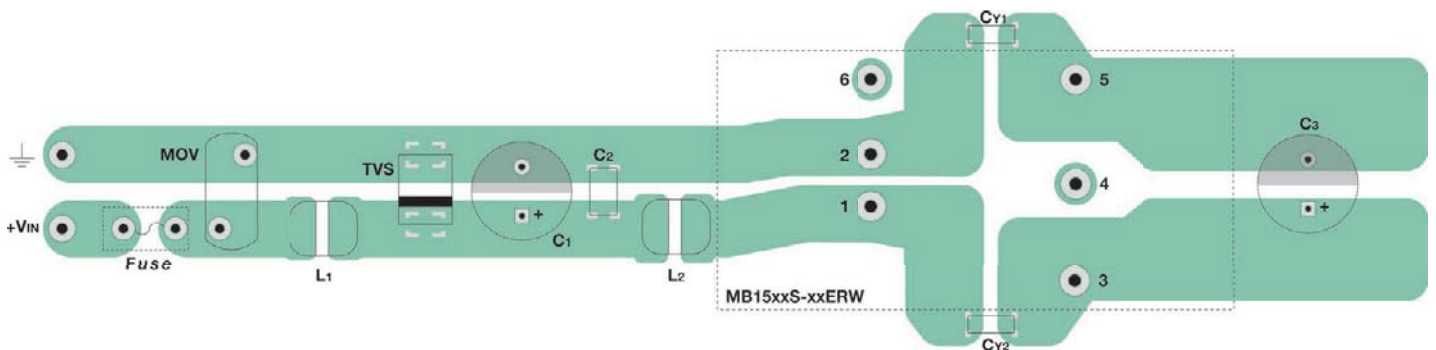
Component	12 V <sub>IN</sub>	24 V <sub>IN</sub>	48 V <sub>IN</sub>
MOV	---	S14K35	S14K60
L <sub>1</sub>	---	56 µH	56 µH
TVS	SMCJ28A	SMCJ48A	SMCJ90A
C <sub>1</sub>	680 µF/25V	330 µF/50V	330 µF/100V
C <sub>2</sub>	1.0 µF/50V	1.0 µF/50V	1.0 µF/100V
L <sub>2</sub>	4.7 µH	4.7 µH	4.7 µH
C <sub>Y1</sub> , C <sub>Y2</sub>	1,000 pF/2 kV	1,000 pF/2 kV	1,000 pF/2 kV

- Input noise and surge suppression modules are available for a number of **MPD** DC/DC power supplies. For pricing or full technical information, please contact the factory.

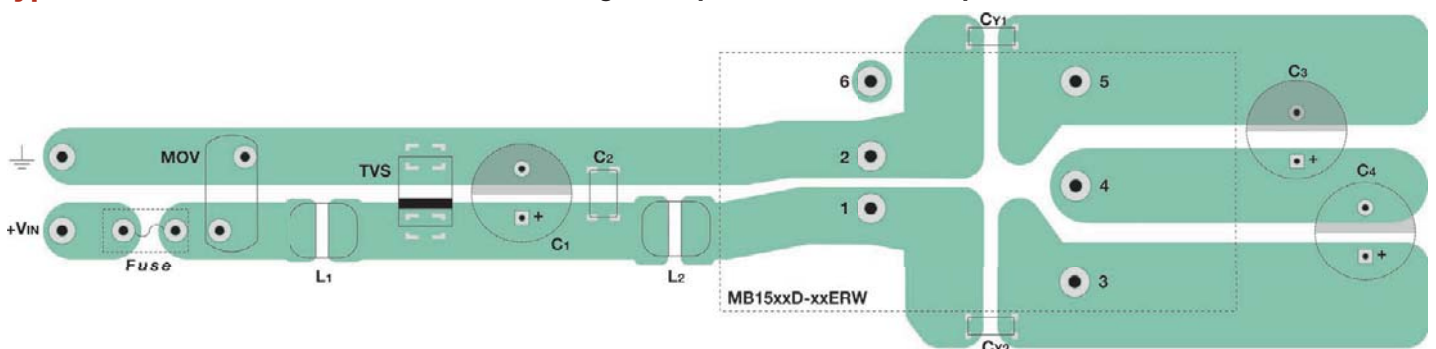
- In many applications simply adding input/output capacitors will enhance the input surge protection and reduce output ripple sufficiently. The input capacitor C<sub>1</sub> and output capacitors C<sub>3</sub> and C<sub>4</sub> shown in the typical connection diagram above (& board layout drawing below), illustrate their connection. Recommended capacitor values are given in the table at right.

V <sub>IN</sub> (VDC)	Input Capacitor	V <sub>OUT</sub> (VDC)	Output Capacitor
12	100 µF	3.3	470 µF
		5	470 µF
24	100 µF	12	220 µF
		15	220 µF
48	100 µF	24	100 µF
		±5	±220 µF
		±12	±100 µF
		±15	±100 µF
±24	±47 µF		

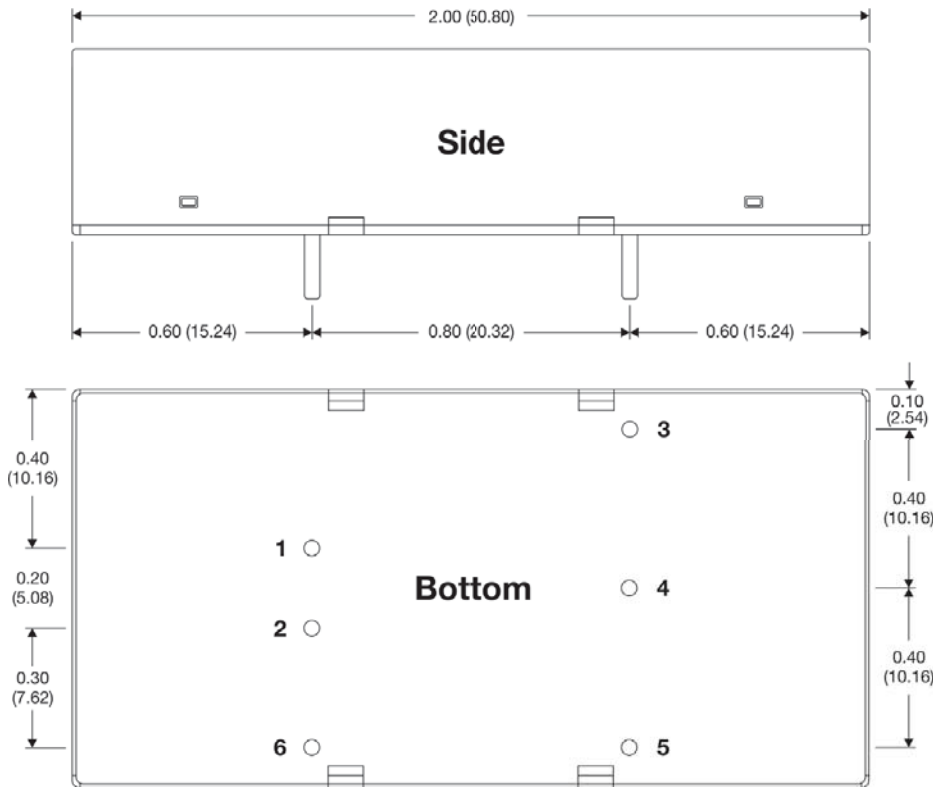
## Typical Board Layout: With External Filter/Surge Components for Single Output Unit



## Typical Connection: With External Filter/Surge Components for Dual Output Unit



## Mechanical Dimensions



## Pin Connections

Pin	Single Output	Pin	Dual Output
1	+VIN	1	+VIN
2	-VIN	2	-VIN
3	+VOUT	3	+VOUT
4	Trim	4	Common
5	-VOUT	5	-VOUT
6	Remote On/Off	6	Remote On/Off

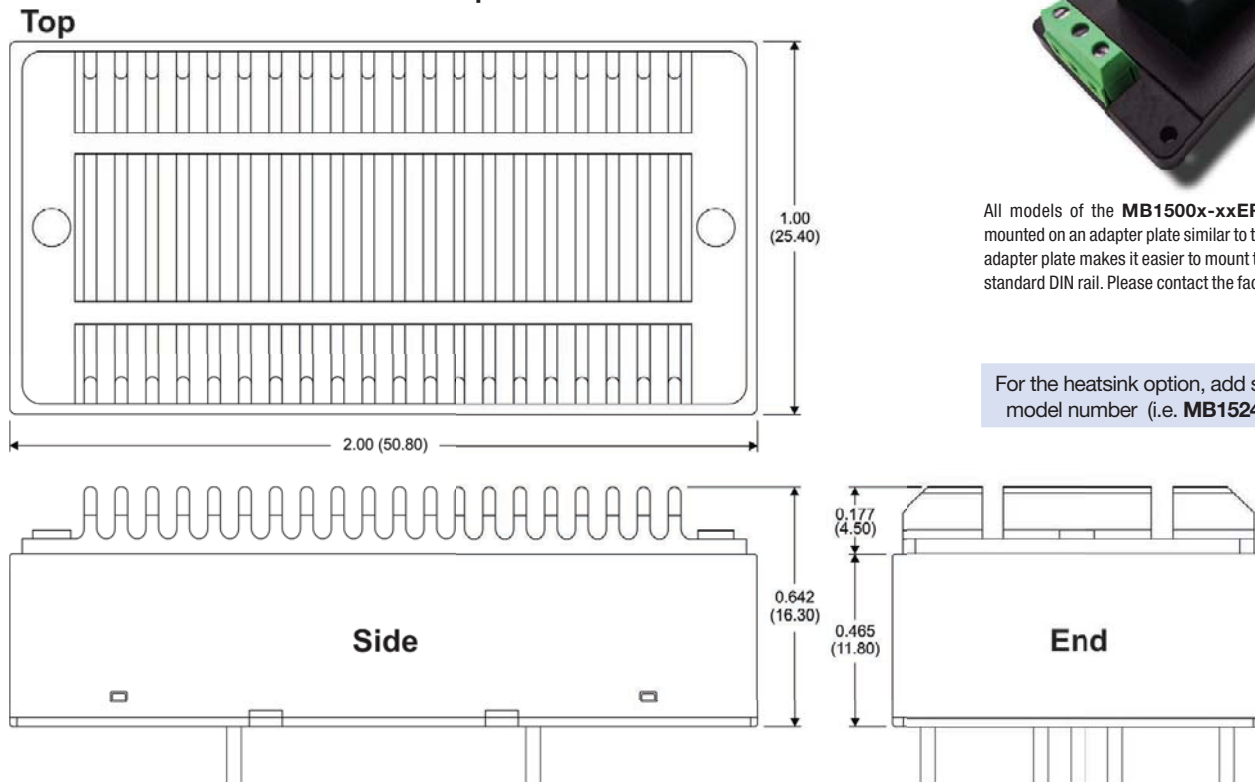
## Adapter Plate



All models of the **MB1500x-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.

For the heatsink option, add suffix "H" to the model number (i.e. **MB1524S-05ERW-H**)

## Mechanical Dimensions: With Optional Heatsink



**MPD** **MicroPower Direct**  
 We Power Your Success - For Less!

### Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.50)
- Pin 1 is marked by a "dot" or indentation on the top of the unit