

MB1500ERW

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



Key Features:

- 15W Output Power
- EN 60950 Approved
- 2:1 Input Voltage Range
- 1,500 VDC Isolation
- Efficiency to 90%
- Compact 1 x 2 Inch Case
- -40°C to +85°C Operation
- Industry Standard Pin-Out
- Chassis & DIN Rail Mount



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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			18.0	VDC
	48 VDC Input			36.0	
Input Under Voltage Protection	24 VDC Input	14.0	16.5		VDC
	48 VDC Input	26.0	30.0		
Reflected Ripple Current			30.0		mA
Start-Up Time	See Note 1		10		mS
Input Filter	π (Pi) Filter				

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	100	mV P - P
Transient Recovery Time, See Note 3			300	500	μS
Transient Response Deviation	3.3V Outputs		±5.0	±8.0	%
	All Other Outputs		±3.0	±5.0	
Over Voltage Protection		110		160	%V _{OUT}
Output Power Protection		110		190	%I _{OUT}
Temperature Coefficient				±0.03	%/°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	See Note 5		1,050		pF
Switching Frequency			270		kHz

Environmental

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

Physical

Case Size	See Mechanical Diagrams (Starting Page 4)
Case Material	Aluminum Alloy With Non-Conductive Base (UL94-V0)
Weight	See Mechanical Diagrams (Starting Page 4)

Remote On/Off

Parameter	Conditions	Min.	Typ.	Max.	Units
Unit On	See Note 6	2.5		12.0	VDC
Unit Off	See Note 6	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
Safety Standards, See Note 7	UL/cUL 60950-1 recognition (UL certificate)				
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			50.0	VDC
	48 VDC Input			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 Selection Guide

Model Number	Input				Output			Efficiency (% Typ)	Capacitive Load (µF, Max)	Certification	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)				
	Nominal	Range	Full-Load	No-Load							
MB1524S-05ERW	24	18.0 - 36.0	702	30	5.0	3,000	0.0	89	4,700	UL/CE	1,500
MB1524S-12ERW	24	18.0 - 36.0	702	5	12.0	1,250	0.0	89	1,000	UL/CE	1,500
MB1524S-15ERW	24	18.0 - 36.0	702	5	15.0	1,000	0.0	89	820	UL/CE	1,500
MB1524S-24ERW	24	18.0 - 36.0	694	5	24.0	625	0.0	90	270	UL/CE	1,500
MB1548S-03ERW	48	36.0 - 75.0	331	20	3.3	4,000	0.0	83	4,700	CE	700
MB1548S-05ERW	48	36.0 - 75.0	355	20	5.0	3,000	0.0	88	4,700	UL/CE	700
MB1548S-12ERW	48	36.0 - 75.0	355	5	12.0	1,250	0.0	88	1,000	UL/CE	700
MB1548S-15ERW	48	36.0 - 75.0	351	5	15.0	1,000	0.0	89	820	UL/CE	700
MB1548S-24ERW	48	36.0 - 75.0	351	5	24.0	625	0.0	89	270	UL/CE	700

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

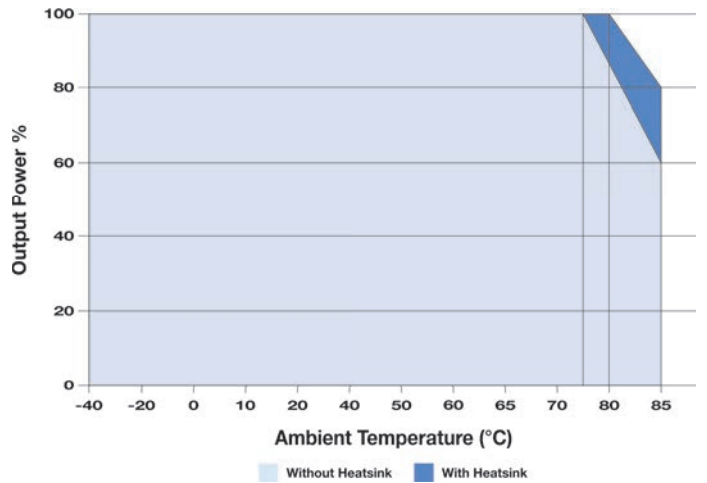
For the A2S adapter board option, add the suffix "-A2S" to the model number (i.e. **MB1548S-05ERW-A2S** or **MB1548S-05ERW-A2S-H**)

For the A4S adapter board option, add the suffix "-A4S" to the model number (i.e. **MB1548S-24ERW-A4S** or **MB1548S-24ERW-A4S-H**)

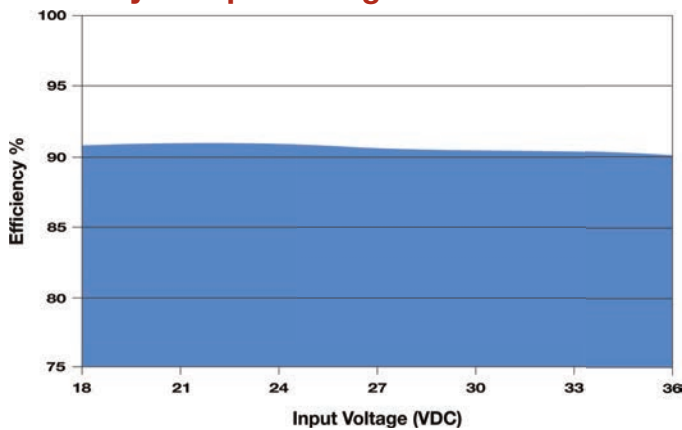
Notes:

1. Start up time is measured at nominal input and with a constant resistive load.
2. When measuring output ripple, it is recommended that an external ceramic capacitor (approx 1 µF to 10 µF) be placed from the +V_{OUT} to the -V_{OUT} pins.
3. Transient recovery is measured to within a 1% error band for a load step change of 25%.
4. Short circuit protection is provided by a "hiccup mode" circuit.
5. Isolation capacitance for 24 VDC output models is 2,050 pF. Isolation capacitance is measured from input to output at 100 kHz/0.1V.
6. The control input (pin 6) is referenced to the -V_{IN} (pin 2) input. If it is grounded, the unit will shut off.
7. See the Model Selection Guide above to see which models have been certified by external testing agencies.
8. 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.

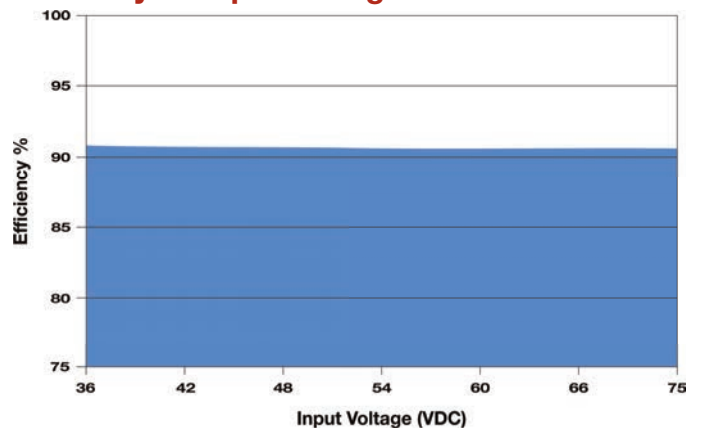
Derating Curve



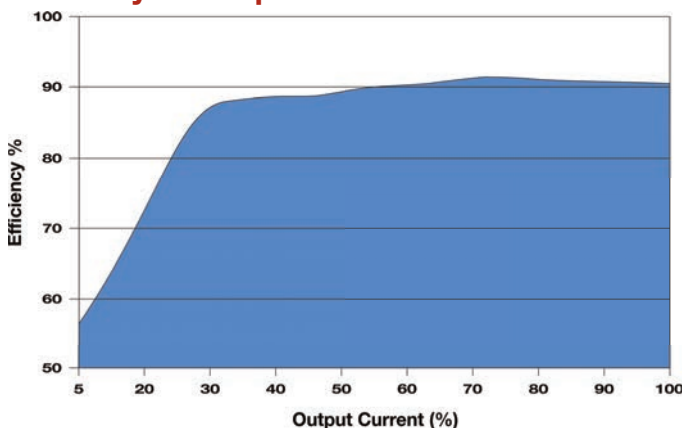
Efficiency vs Input Voltage: 24 V_{IN}



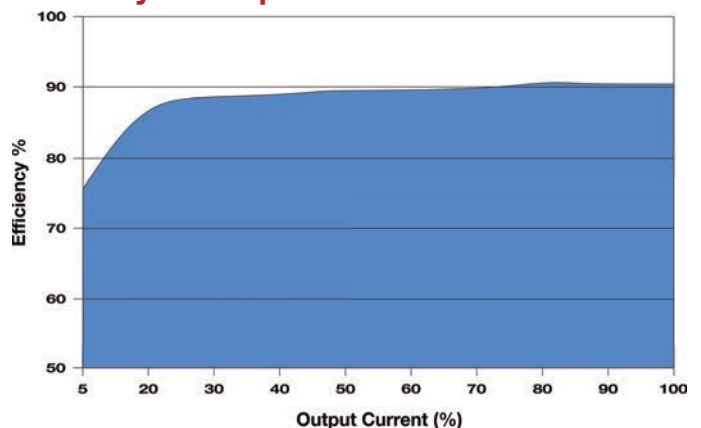
Efficiency vs Input Voltage: 48 V_{IN}



Efficiency vs Output Load: 24 V_{IN}



Efficiency vs Output Load: 48 V_{IN}



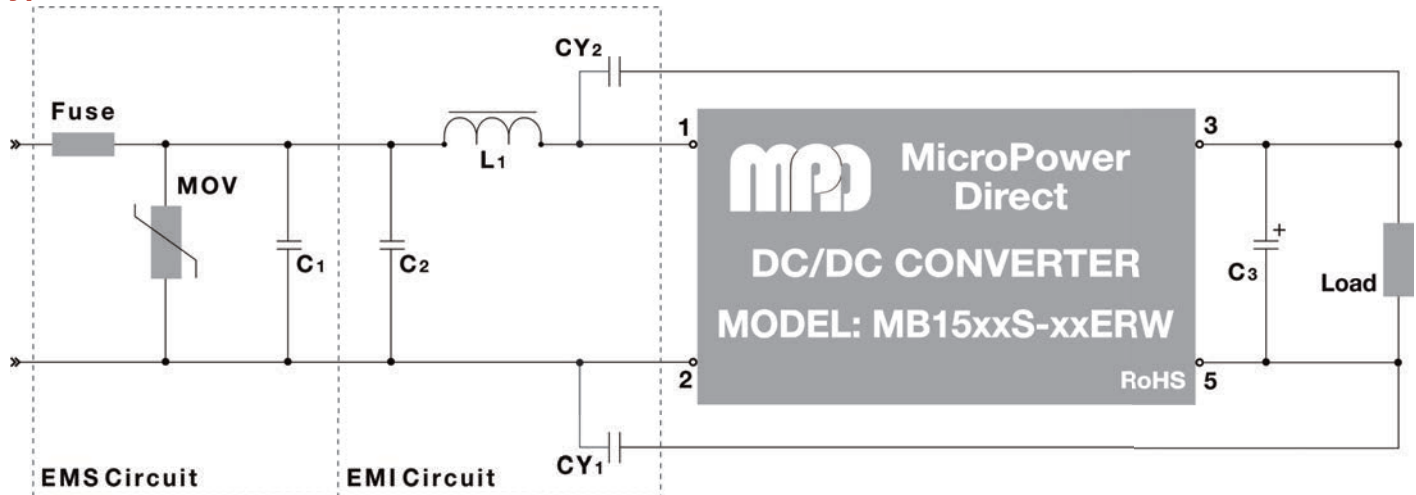
EMI Characteristics

Parameter	Models	Standard	Criteria	Level
Radiated Emissions (See Note 1)	3.3V Output	CISPR 32/EN 55032		Class B (See Typical Connection below)
	All Other Models			Class A (without external components)
Conducted Emissions (See Note 1)	3.3V Output	CISPR 32/EN 55032		Class B (See Typical Connection below)
	All Other Models			Class A (without external components)
ESD		EN 61000-4-2	B	±4 kV Contact
RS		EN 61000-4-3	A	10V/m
EFT	See Note 2	EN 61000-4-4	B	±2 kV
Surge	See Note 3	EN 61000-4-5	B	±2 kV
CS		EN 61000-4-6	A	3 Vrms
Voltage Dips		EN 61000-4-29	B	0% - 70%

Notes:

- If the application does not require that emissions meet international standards, simply adding capacitors to the input and output circuits may be sufficient to reduce ripple & noise. See the Simple Connection diagram and note 5 below.
- To meet the requirements of EN 61000-4-4, external components are needed. The Typical Connection diagram below shows an external input filter that would typically achieve this. Contact the factory for more information.
- To meet the requirements of EN 61000-4-5, external components are needed. This can be done as shown in the Typical Connection diagram below. Contact the factory for more information.

Typical Connection



For applications that require meeting EMC standards, the diagram above illustrates a typical connection of the **MB1500xERW** series. The units do not require external components to operate as specified. Some notes on this diagram (starting with the input circuit) are:

- An external fuse should be used in all power module applications. The recommended fuse is shown in the model chart on page 2.
- To protect against a surge, an external MOV is recommended on the input. A suggested value is given in the table at right.
- All input/output filtering capacitors should have a low equivalent impedance. Any output capacitors used should be high frequency, low resistance electrolytic capacitors. Care must be taken in choosing this capacitor not to exceed the capacitive load specification for the unit. Voltage derating of all capacitors should be 60% or greater.

4. Recommended values for components are:

Component	24 V _{IN}	48 V _{IN}
MOV	S20K30	S14K60
C1	330 μF/50V	330 μF/100V
C2	1 μF/50V	4.7 μF/100V
L1	4.7 μH	4.7 μH
CY1	1 nF/2 kV	1 nF/2 kV
CY2	1 nF/2 kV	1 nF/2 kV
C3	See chart under note 5	

- In many applications simply adding input/output capacitors will enhance the input surge protection and reduce output ripple sufficiently. Suggested capacitor values are:

Output Voltage	C _{IN}	C _{OUT}
3.3 V _{OUT}	100 μF	470 μF
5.0 V _{OUT}		
12 V _{OUT}		220 μF
15 V _{OUT}		
24 V _{OUT}		

External Trim

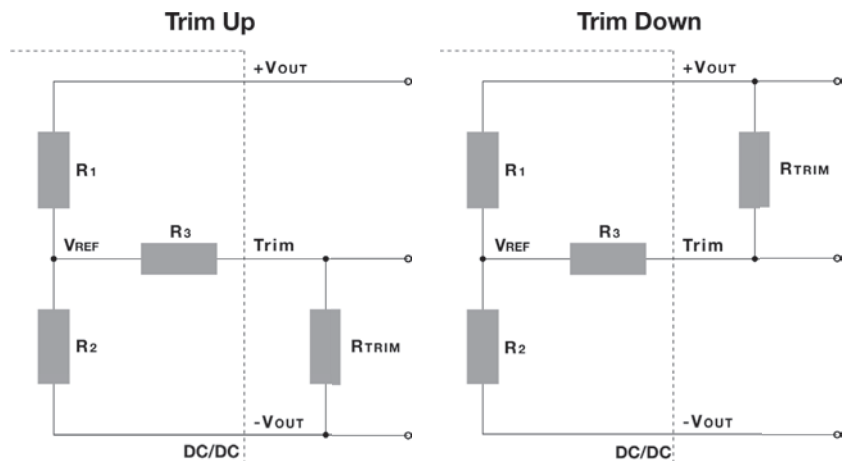
An external resistor can be used to adjust the converter output up/down by about 10%. The connection is shown in the diagram at right. The required resistor value is calculated by the formulas:

$$\text{Trim Up} = R_{\text{TRIM}} = \frac{A \times R_2}{R_2 - A} - R_3 \quad \text{Where } A = \frac{V_{\text{REF}}}{V_{\text{OUT}} - V_{\text{REF}}} \times R_1$$

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

Where R_{TRIM} = The value of the external trim resistor
 A = A is defined as shown above

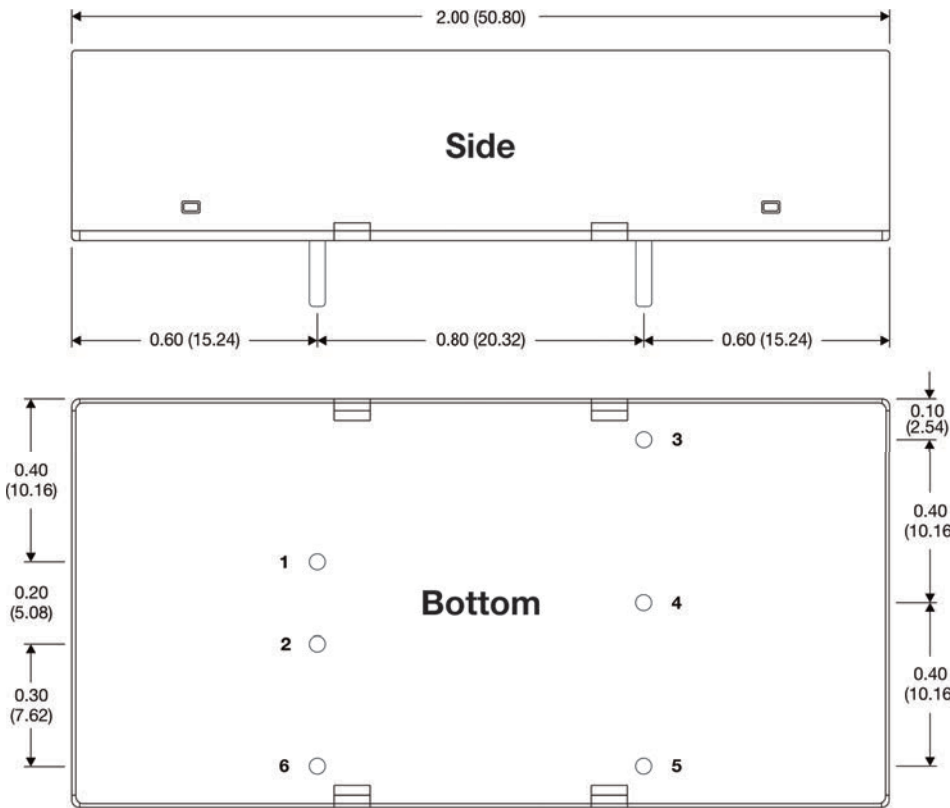
The values of R_1 , R_2 , R_3 and V_{REF} are given in the table below.



Output Trim Resistor Values

Resistor	Output Voltage (VDC)				
	3.3	5.0	12	15	24
R1 (kΩ)	4.801	2.883	11.000	14.494	24.872
R2 (kΩ)	2.870	2.870	2.870	2.870	2.870
R3 (kΩ)	12.40	10.00	15.00	15.00	17.80
VREF (V)	1.24	2.50	2.50	2.50	2.50

Mechanical Dimensions



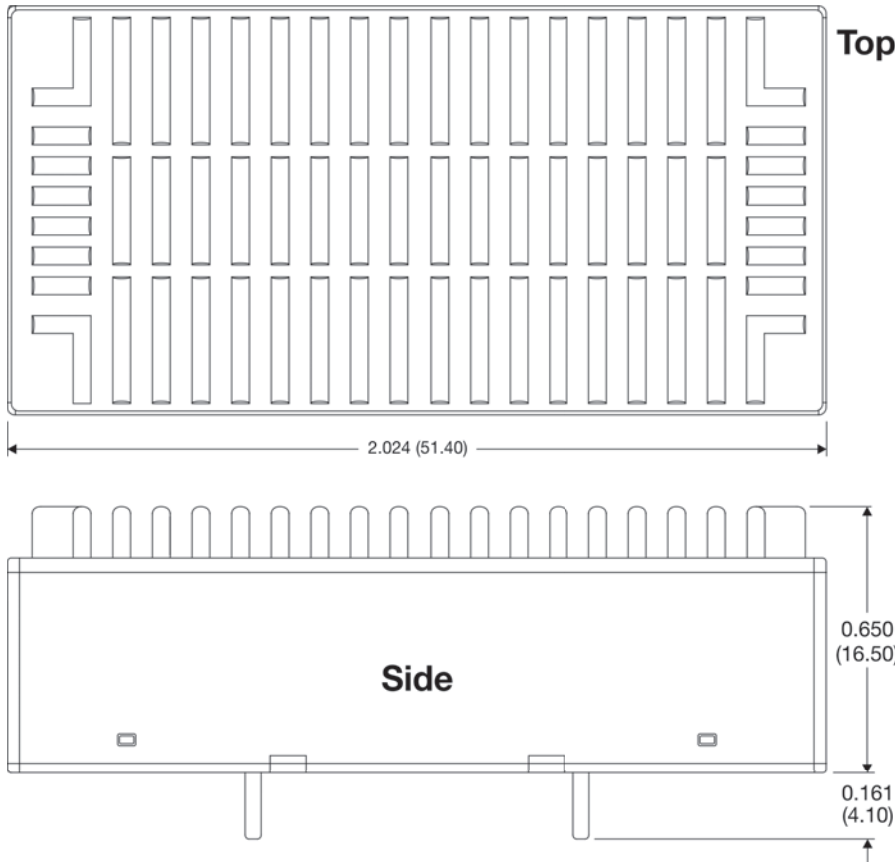
Pin Connections

Pin	Function
1	+VIN
2	-VIN
3	+VOUT
4	Trim
5	-VOUT
6	Remote On/Off

Notes:

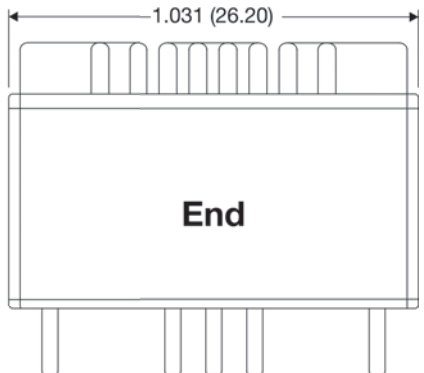
- All dimensions are typical in inches (mm)
- Tolerance x.xx = ± 0.02 (± 0.50)
- Weight (Typ) = 0.92 Oz (26g)

Mechanical Dimensions: With Optional Heatsink



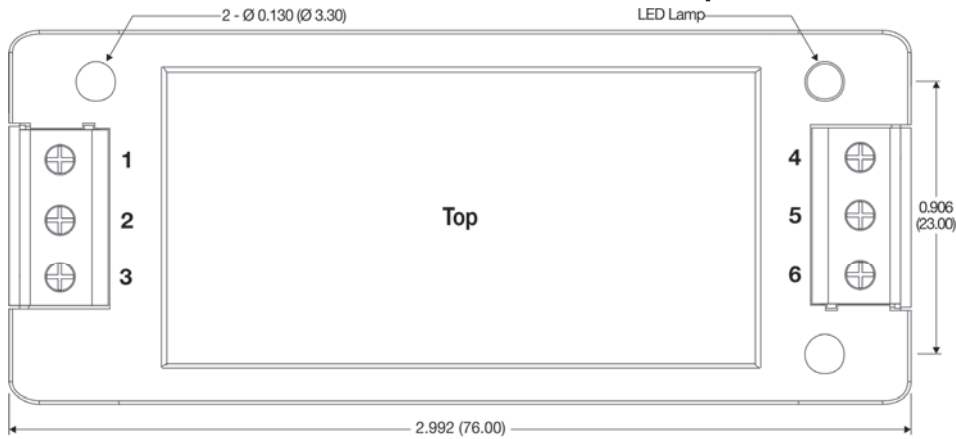
Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ± 0.02 (± 0.50)
- Weight (Typ) = 1.20 Oz (34g)



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

Mechanical Dimensions: A2 Chassis Mount Adapter



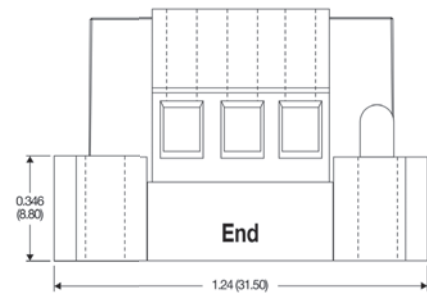
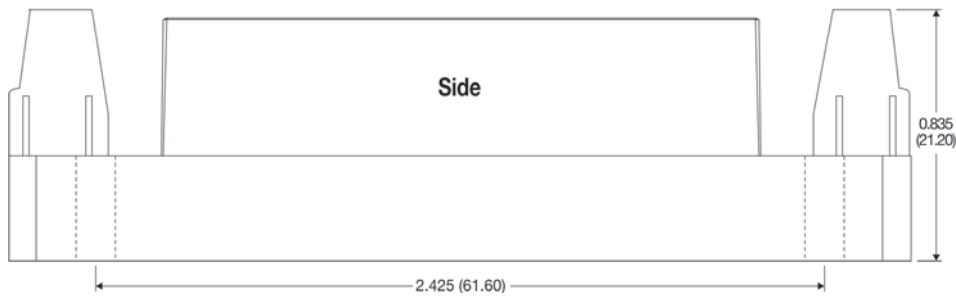
Pin Connections

Pin	Function
1	Remote On/Off
2	-VIN
3	+VIN
4	-VOUT
5	Trim
6	+VOUT

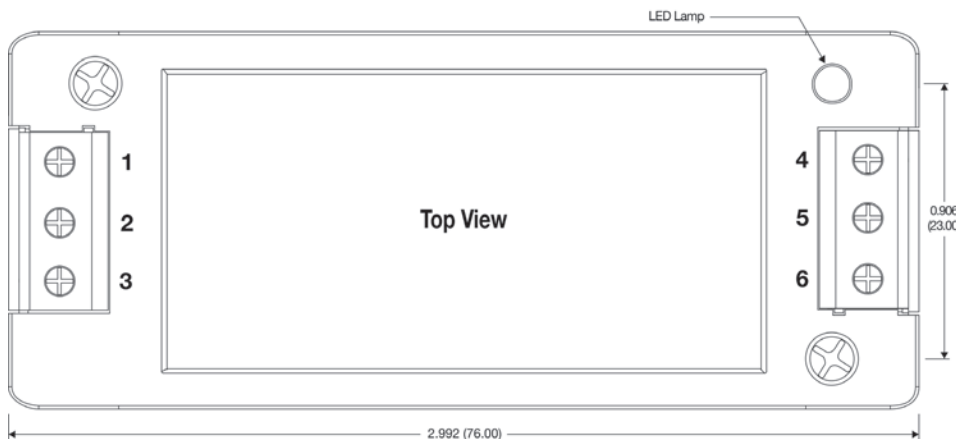
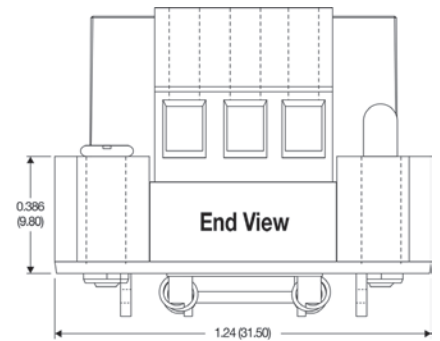
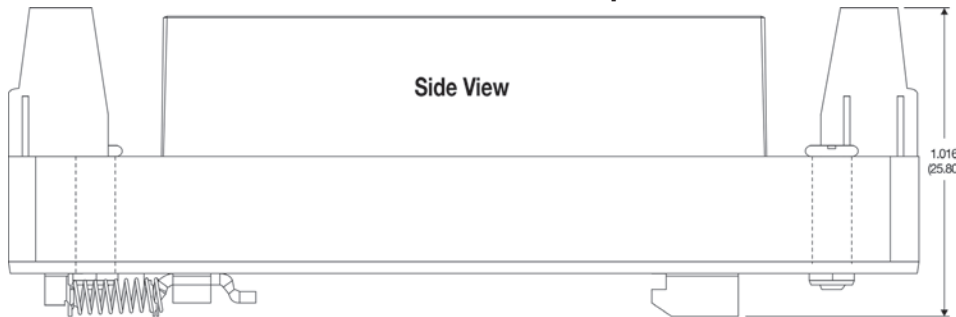
For the chassis mount option, add the suffix “-A2” to the model number (i.e. **MB1524S-05ERW-A2**)

Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.50)
- Weight (Typ) = 1.69 Oz (48g)



Mechanical Dimensions: A4 DIN Rail Adapter



Pin Connections

Pin	Function
1	Remote On/Off
2	-VIN
3	+VIN
4	-VOUT
5	Trim
6	+VOUT

Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.50)
- Weight (Typ) = 2.40 Oz (68g)

For the DIN rail mount option, add the suffix “-A4” to the model number (i.e. **MB15024S-12ERW-A4**)

Mechanical Dimensions: A2 Chassis Mount Adapter with Heatsink



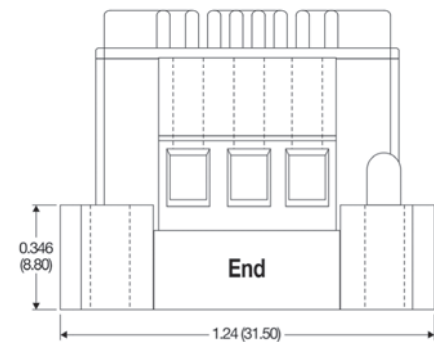
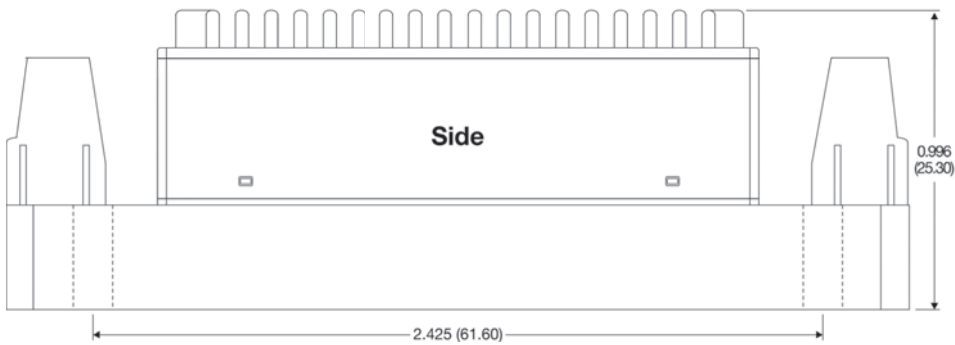
Pin Connections

Pin	Function
1	Remote On/Off
2	-VIN
3	+VIN
4	-VOUT
5	Trim
6	+VOUT

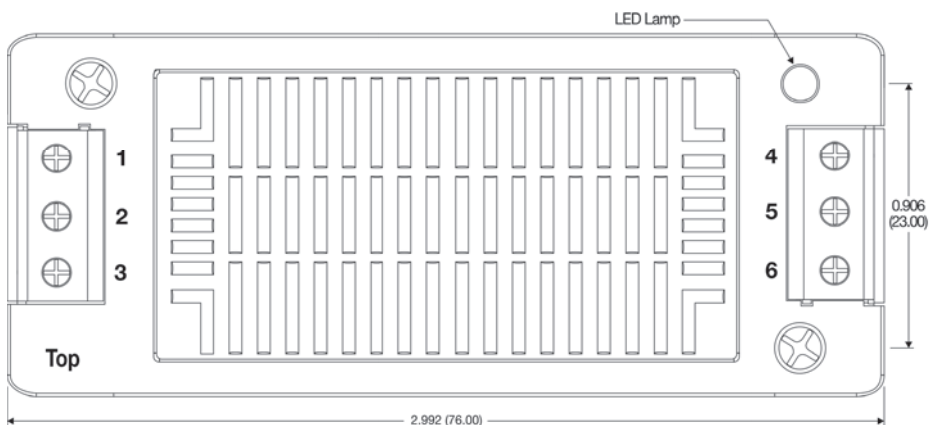
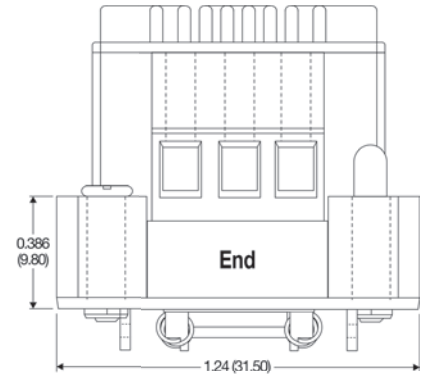
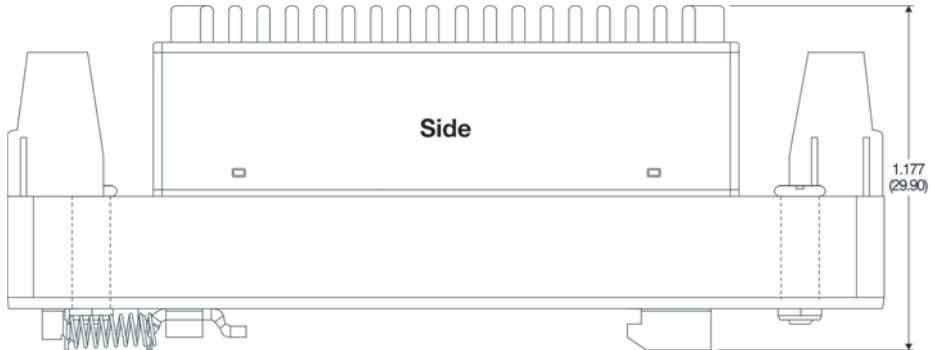
For the chassis mount option with heatsink, add the suffix "-A2-H" to the model number (i.e. MB1548S-12ERW-A2-H)

Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.50)
- Weight (Typ) = 1.98 Oz (56g)



Mechanical Dimensions: A4 DIN Rail Adapter with Heatsink



Pin Connections

Pin	Function
1	Remote On/Off
2	-VIN
3	+VIN
4	-VOUT
5	Trim
6	+VOUT

Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.50)
- Weight (Typ) = 2.68 Oz (76g)

For the DIN rail mount option with heatsink, add the suffix "-A4-H" to the model number (i.e. MB1548S-12ERW-A4-H)