MB5000ERW

Low Cost, 1 x 2 Inch 50W, 2:1 Input Range DC/DC Converters

Key Features:

- 50W Output Power
- 2:1 Input Voltage Range
- 1,500 VDC Isolation
- Efficiency to 93%
- Meets EN 55032
- Compact 1 x 2 Inch Case
- -40°C to +85°C Operation
- Industry Standard Pin-Out
- Chassis & DIN Rail Mount

RoHS

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	
Under Voltage Shutdown	24 VDC Input	15.0			VDC
	48 VDC Input	31.0			
Input Over Voltage Shutdown	24 VDC Input			41.0	VDC
	48 VDC Input			83.0	
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	VIN = Min to Max		±0.2	±0.5	%
Load Regulation	IOUT = 5% to 100%		±0.5	±1.0	%
Ripple & Noise (20 MHz), See Note 2	3.3 & 5 VDC Output Models		100	250	mV P - P
	MB5048S-24ERW		200	350	
	All Other Models		200	300	
Transient Recovery Time, See Note 3	25% Load Step Change		300	500	μS
Transient Response Deviation			±3.0	±5.0	%
Output Power Protection		120		160	%
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		2,000		pF
Switching Frequency			300		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 5	3.0		12.0	VDC
Unit Off	See Note 5	0		1.2	VDC
Off Idle Current			6.0		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 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							
MB5024S-03ERW	24	18.0 - 36.0	1,511	42	3.3	10,000	500	91	3.90	27,000	3,000
MB5024S-05ERW	24	18.0 - 36.0	2,240	59	5.0	10,000	500	91	6.20	18,900	5,000
MB5024S-12ERW	24	18.0 - 36.0	2,240	85	12.0	4,167	208	93	15.0	3,700	5,000
MB5024S-15ERW	24	18.0 - 36.0	2,240	90	15.0	3,333	167	93	18.0	2,000	5,000
MB5024S-24ERW	24	18.0 - 36.0	2,289	45	24.0	2,083	104	91	30.0	1,000	5,000
MB5048S-03ERW	48	36.0 - 75.0	756	30	3.3	10,000	500	91	3.90	27,000	1,500
MB5048S-05ERW	48	36.0 - 75.0	1,120	50	5.0	10,000	500	91	6.20	18,900	2,500
MB5048S-12ERW	48	36.0 - 75.0	1,120	34	12.0	4,167	208	93	15.0	3,700	2,500
MB5048S-15ERW	48	36.0 - 75.0	1,120	50	15.0	3,333	167	93	18.0	2,000	2,500
MB5048S-24ERW	48	36.0 - 75.0	1,132	30	24.0	2,083	104	92	30.0	1,000	2,500

Notes:

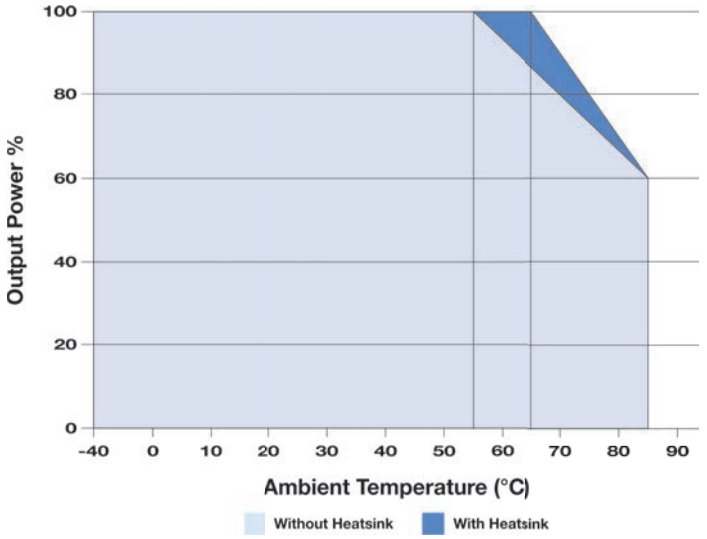
1. Start up time is measured at nominal input and with a constant resistive load.
2. When measuring output ripple, it is recommended that an external ceramic capacitor (approx 1 µF to 10 µF) be placed from the +Vout to the -Vout pins.
3. Transient recovery is measured to within a 1% error band for a load step change of 25%. The recovery time for 24V output models is 500 µS typical, 1,000 µS maximum.
4. Short circuit protection is provided by a "hiccup mode" circuit.
5. The voltage at the Remote On/Off pin (Pin 6) is referenced to the -Vin input (Pin 2). If the on/off pin is left open, the unit operates. If it is grounded, the unit will shut off.
6. 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.
7. These units should not be operated over +85°C. Exceeding +85°C may damage the unit.
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.

For the heatsink option, add the suffix "-H" to the model number (i.e. **MB5024S-05ERW-H**)

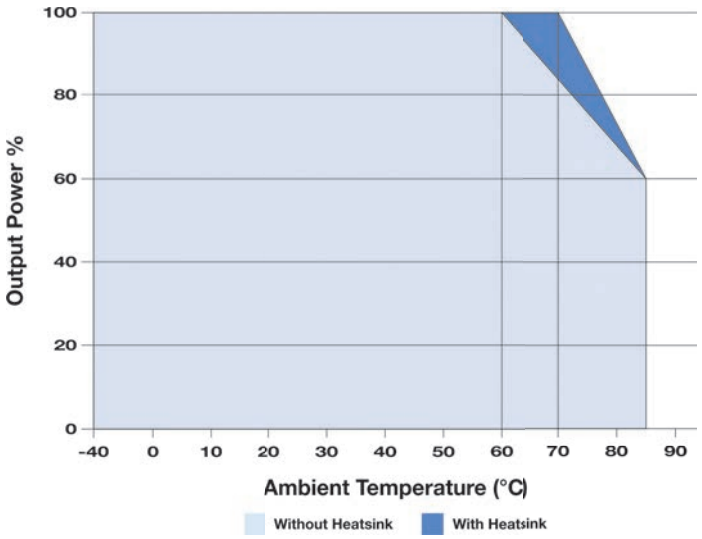
For the A2S adapter board option, add the suffix "-A2S" to the model number (i.e. **MB5048S-05ERW-A2S** or **MB5048S-05ERW-A2S-H**)

For the A4S adapter board option, add the suffix "-A4S" to the model number (i.e. **MB5048S-24ERW-A4S** or **MB5048S-24ERW-A4S-H**)

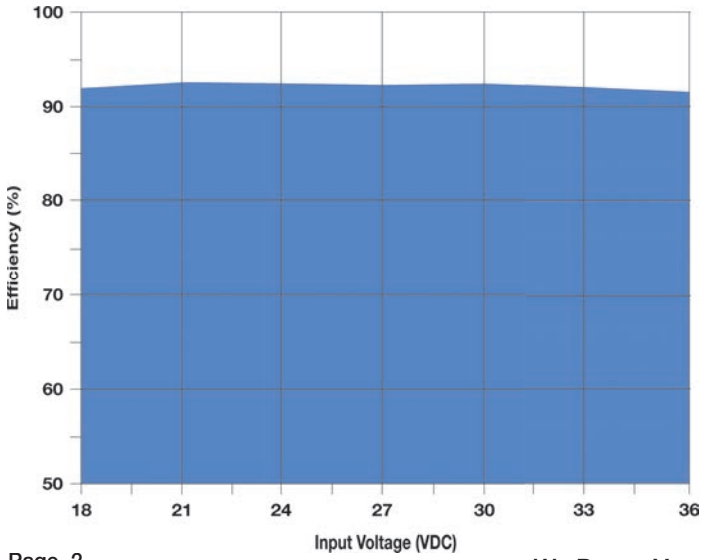
Derating Curve, Output Voltage ≤5V



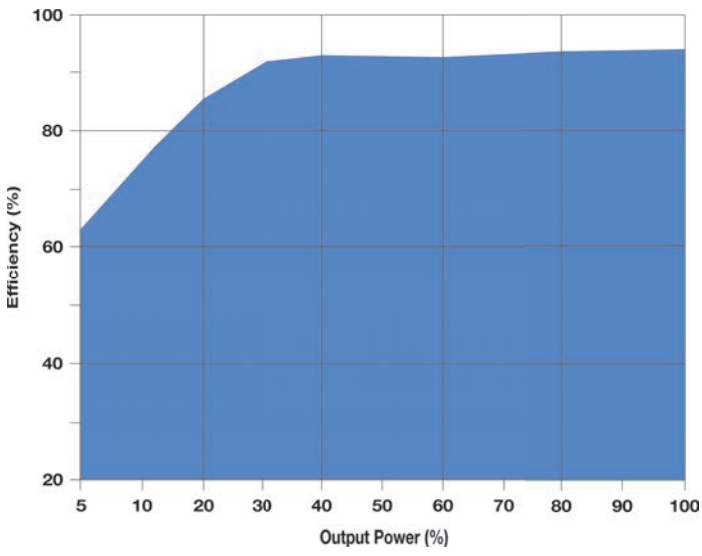
Derating Curve, Output Voltage >5V



Efficiency vs Input Voltage: 24 Vin



Efficiency vs Output Load: 24 Vin

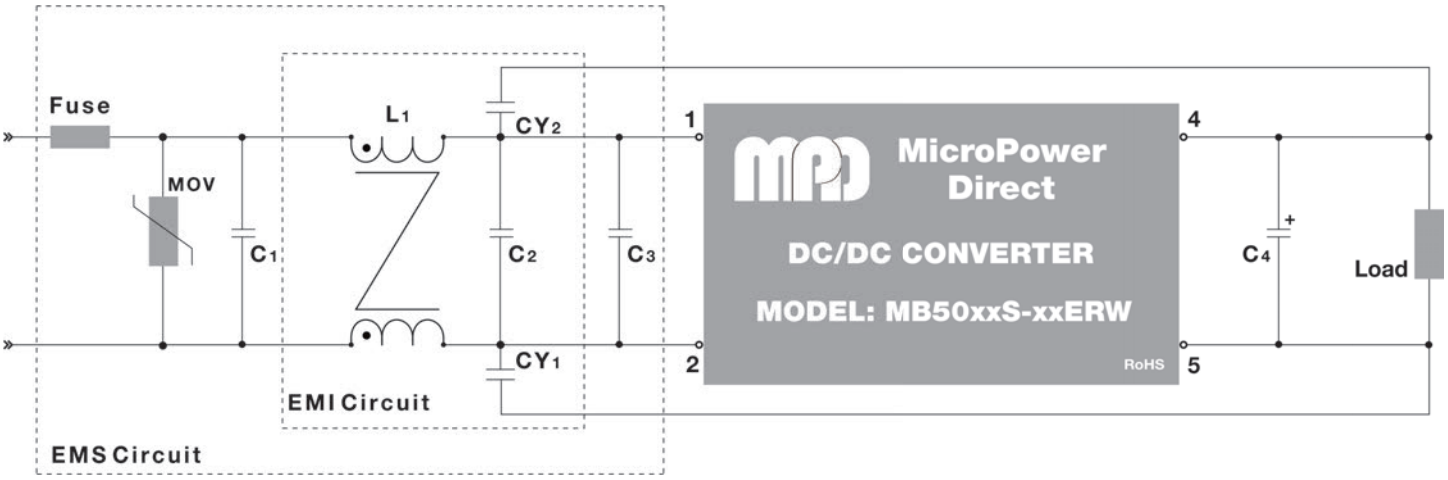


EMI Characteristics

Parameter	Standard		Criteria	Level
Radiated Emissions (See Note 1)	CISPR 32/EN 55032			Class B (See Typical Connection below)
Conducted Emissions (See Note 1)	CISPR 32/EN 55032			Class B (See Typical Connection below)
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

Notes:
1. With the addition of external components as shown in the typical connection diagram below. Contact the factory for more information.
2. To meet the requirements of EN 61000-4-4 (±2 kV), external components are needed. This can be done discretely, as shown in the typical connection diagram below. Contact the factory for more information.
3. To meet the requirements of EN 61000-4-5 (±2 kV), external components are needed. This can be done discretely, as shown in the typical connection diagram below. Contact the factory for more information.

Typical Connection



The diagram above illustrates a typical connection of the **MB5000ERW** 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:

1. It is recommended that an external fuse be used. The recommended fuse is shown in the model chart on page 2.
2. The output filtering capacitor (C_4) 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.
3. Recommended values for components are:

Component	24 V_{IN}	48 V_{IN}
MOV	S20K30	S14K60
C_1	680 µF/50V	330 µF/100V
L_1	2.2 mH	2.2 mH
C_2	330 µF/50V	330 µF/100V
C_3	4.7 µF/50V	2.2 µF/100V
C_{Y1}, C_{Y2}	3.3 nF/2 kV	3.3 nF/2 kV
C_4	See Note 4	

4. In many applications simply adding input/output capacitors will enhance the input surge protection and reduce output ripple sufficiently. The input capacitor C_1 and output capacitor C_4 shown in the typical connection diagram above (& board layout drawing below) illustrate their connection. Recommended capacitor values are given in the table.

Vin (VDC)	Input Capacitor	Vout (VDC)	Output Capacitor
24	100 µF	3.3	470 µF
		5.0	470 µF
48		12	100 µF
		15	100 µF
		24	47 µF

External Trim

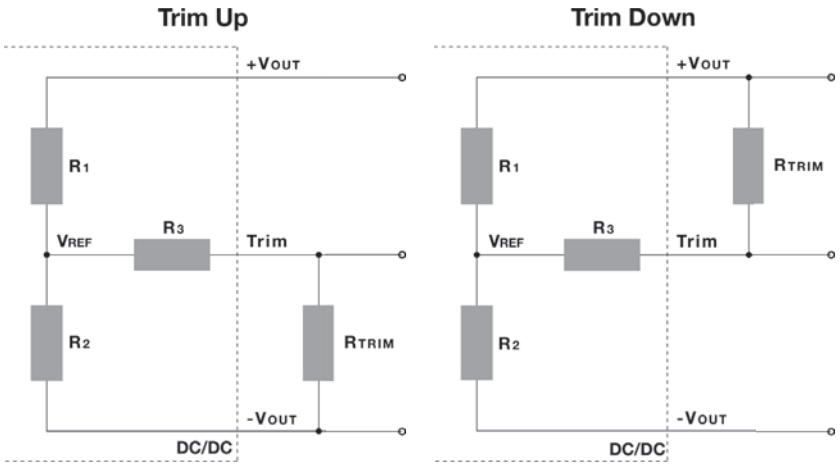
An external resistor can be used to adjust the converter output up/down by about 10%. The connection is shown in the diagram at right. The required resistor value is calculated by the formulas:

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

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

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

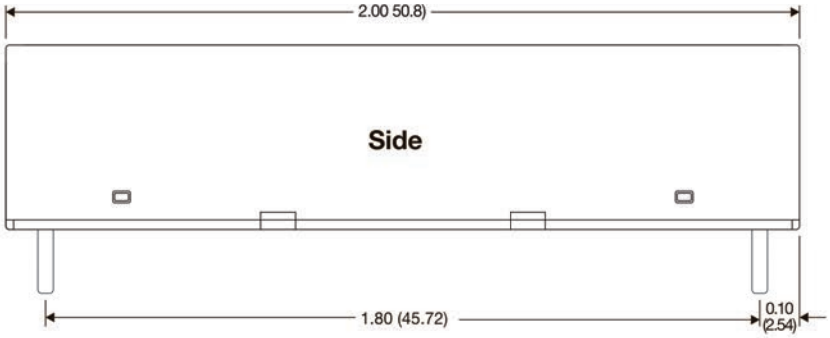
The values of R_1, R_2, R_3 and V_{REF} are given in the table below.

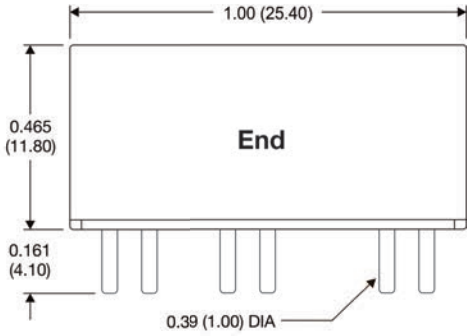


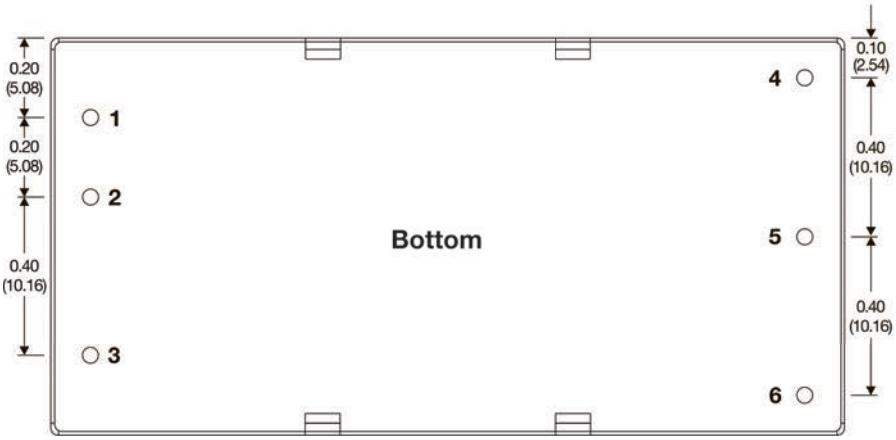
Output Trim Resistor Values

Resistor	Output Voltage (VDC)					
	3.3	5.0	12	15	24 (24V_{IN})	24 (48V_{IN})
R_1 (kΩ)	4.788	2.870	11.00	15.00	20.00	26.00
R_2 (kΩ)	2.870	2.870	2.870	3.000	2.308	3.000
R_3 (kΩ)	12.40	10.00	15.00	17.40	15.00	15.00
V_{REF} (V)	1.24	2.50	2.50	2.50	2.50	2.50

Mechanical Dimensions







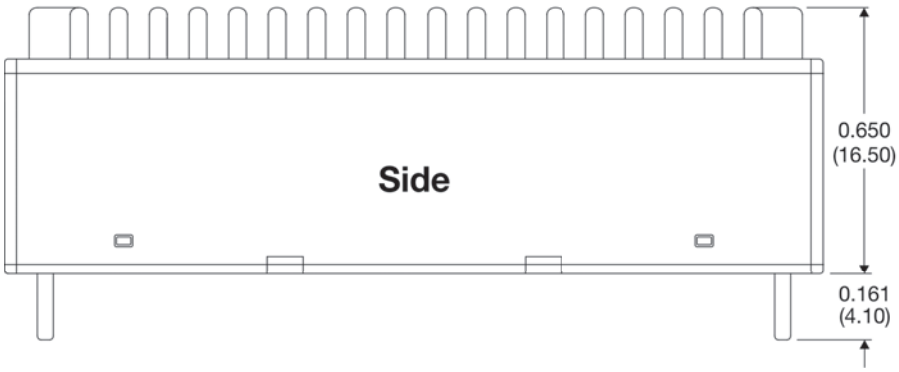
Pin Connections

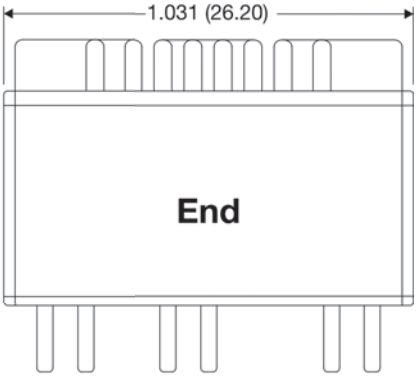
Pin	Function
1	+VIN
2	-VIN
3	Remote On/Off
4	+VOUT
5	-VOUT
6	Trim

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



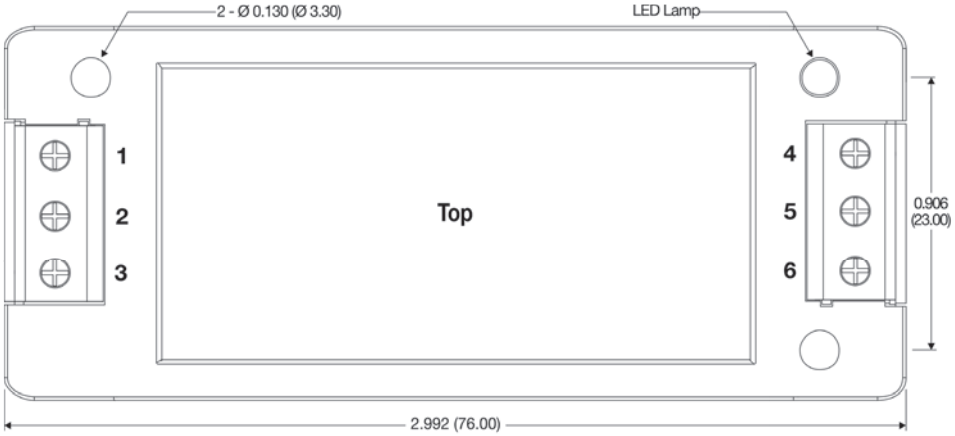


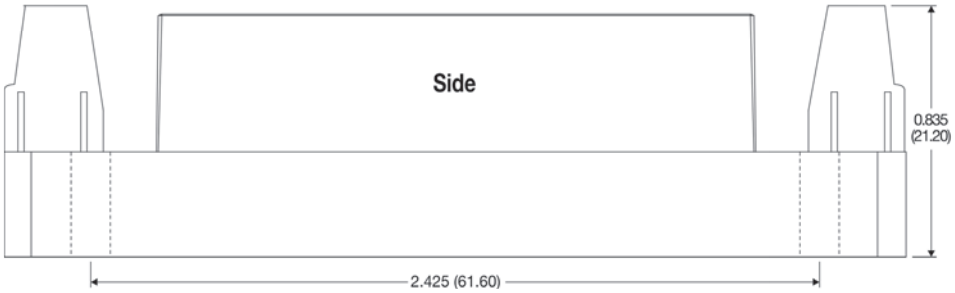
For the heatsink option, add the suffix "-H" to the model number (i.e. **MB5024S-05ERW-H**)

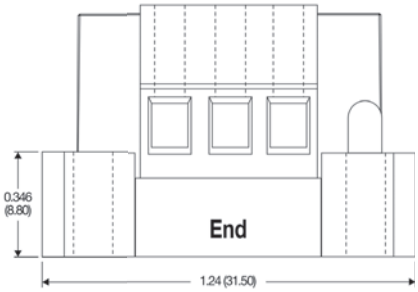
Notes:

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

Mechanical Dimensions: A2 Chassis Mount Adapter







Pin Connections

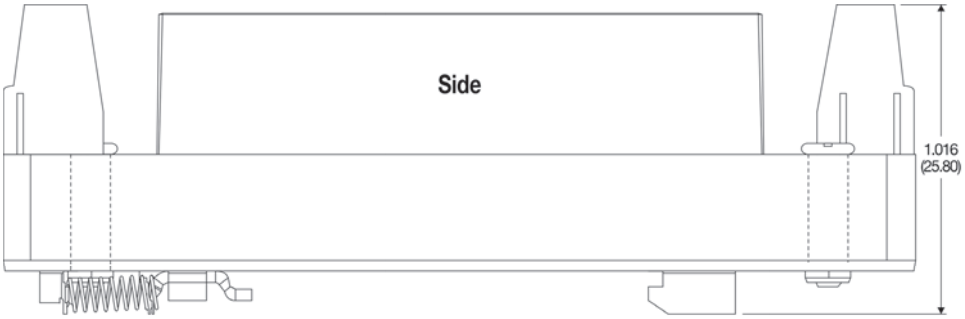
Pin	Function
1	Remote On/Off
2	-VIN
3	+VIN
4	Trim
5	-VOUT
6	+VOUT

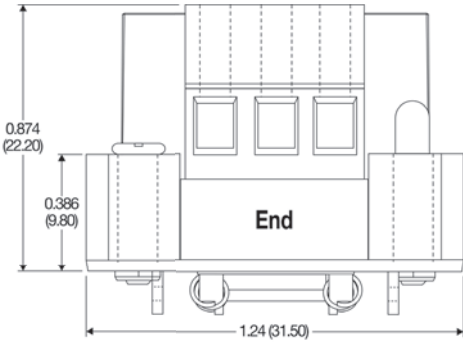
Notes:

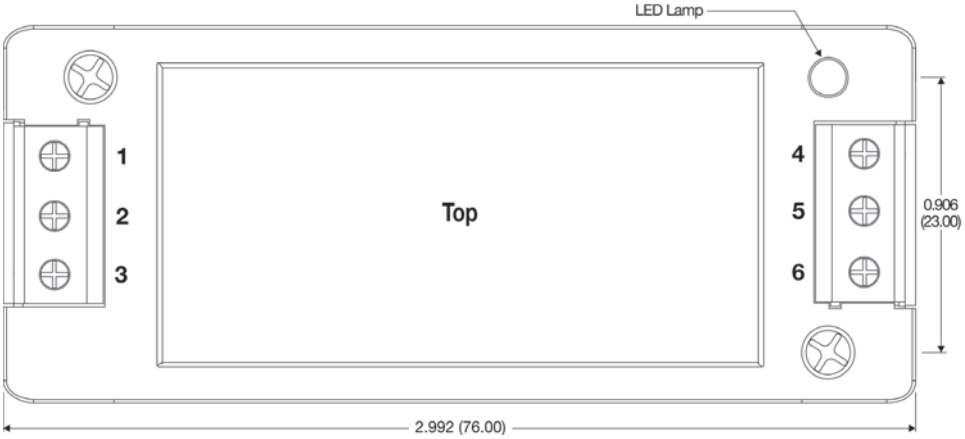
- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.50)
- Weight (Typ) = 1.69 Oz (48g)

For the chassis mount option, add suffix "-A2" to the model number (i.e. **MB5024S-05ERW-A2**)

Mechanical Dimensions: A4 DIN Rail Adapter







Pin Connections

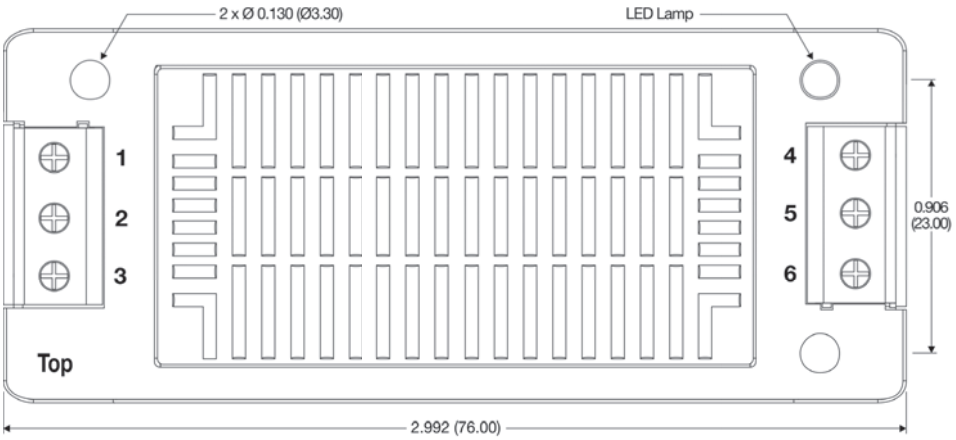
Pin	Function
1	Remote On/Off
2	-VIN
3	+VIN
4	Trim
5	-VOUT
6	+VOUT

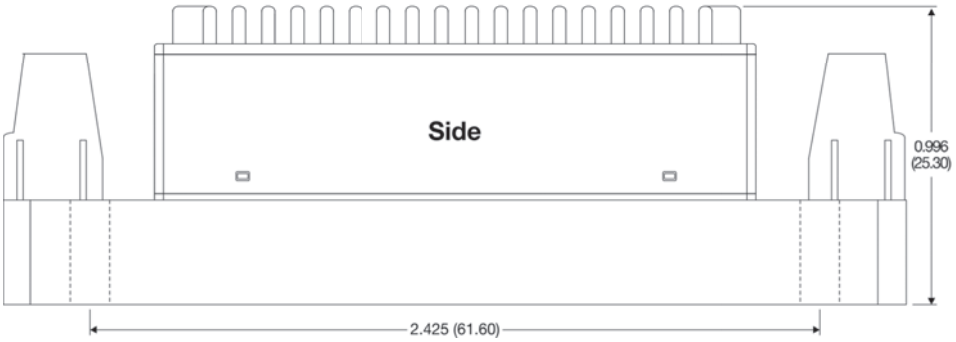
Notes:

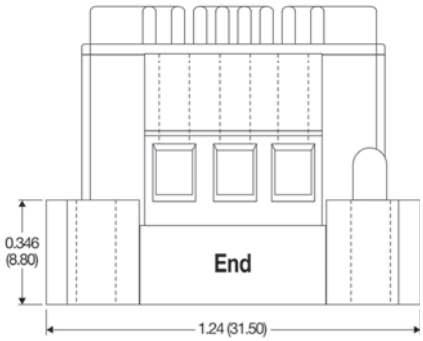
- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.50)
- Weight (Typ) = 2.40 Oz (68g)

For the DIN rail mount option, add the suffix "-A4" to the model number (i.e. **MB5024S-12ERW-A4**)

Mechanical Dimensions: A2 Chassis Mount Adapter with Heatsink







Pin Connections

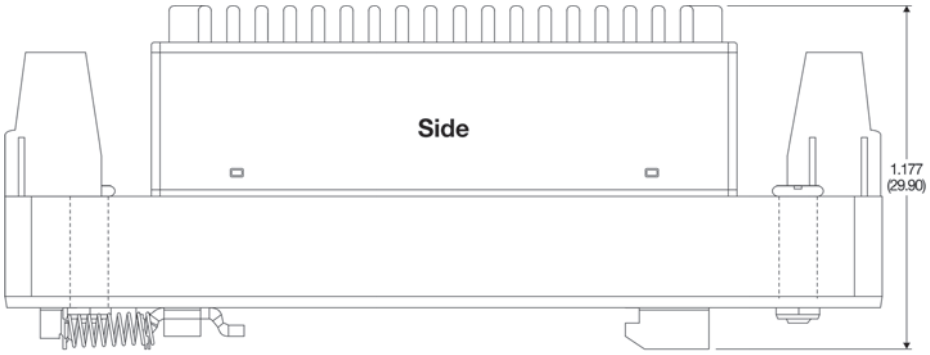
Pin	Function
1	Remote On/Off
2	-VIN
3	+VIN
4	Trim
5	-VOUT
6	+VOUT

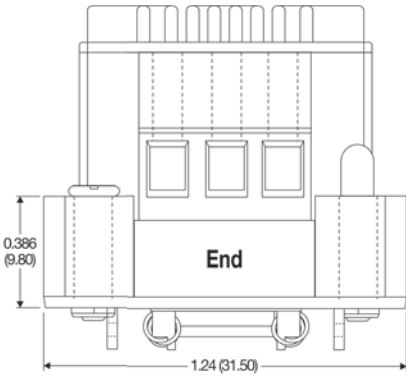
Notes:

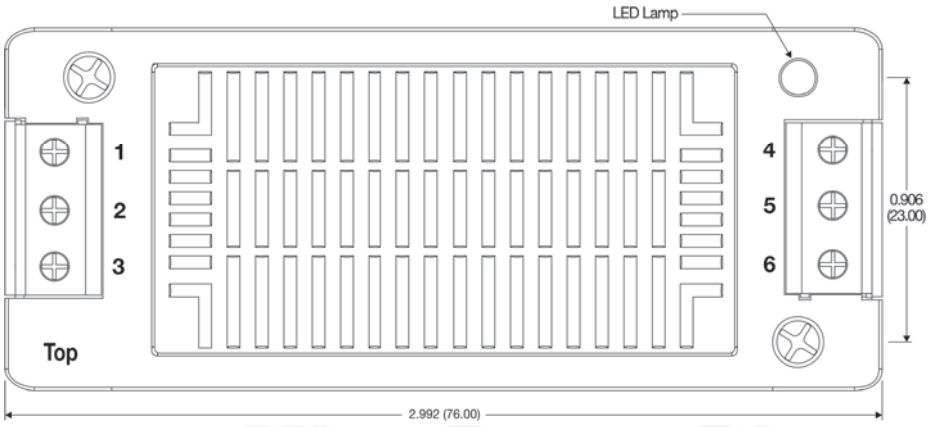
- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.50)
- Weight (Typ) = 1.98 Oz (56g)

For the chassis mount option with heatsink, add the suffix "-A2-H" to the model number (i.e. **MB5048S-12ERW-A2-H**)

Mechanical Dimensions: A4 DIN Rail Adapter with Heatsink







Pin Connections

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

For the DIN rail mount option with heatsink, add the suffix "-A4-H" to the model number (i.e. **MB5048S-12ERW-A4-H**)

Notes:

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

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