

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
- Efficiency to 90%
- Meets EN 55032
- Compact 1 x 2 Inch Case
- -40°C to +80°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	
Reflected Ripple Current			40.0		mA
Start-Up Time	See Note 1		10		mS
Input Filter	π (Pi) Filter				
Output					
Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy	5% - 100% IOUT		±1.0	±3.0	%
	0% - 5% IOUT		±1.0	±5.0	
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		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	%VOUT
Output Power Protection		110		190	%IOUT
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	100 kHz/0.1V		2,000		pF
Switching Frequency			300		kHz
Environmental					
Parameter	Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range	Ambient	-40	+25	+80	°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	3.5		12.0	VDC
Unit Off	See Note 5	0		1.2	VDC
Off Idle Current			5.0	8.0	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			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 Number	Input				Output			Efficiency (% 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	970	40	3.3	6,000	0.0	85	10,000	2,000
MB3024S-05ERW	24	18.0 - 36.0	1,420	40	5.0	6,000	0.0	88	10,000	3,000
MB3024S-09ERW	24	18.0 - 36.0	1,420	40	9.0	3,333	0.0	88	4,700	3,000
MB3024S-12ERW	24	18.0 - 36.0	1,388	40	12.0	2,500	0.0	90	2,700	3,000
MB3024S-15ERW	24	18.0 - 36.0	1,388	40	15.0	2,000	0.0	90	1,680	3,000
MB3024S-24ERW	24	18.0 - 36.0	1,388	40	24.0	1,250	0.0	90	680	3,000
MB3048S-03ERW	48	36.0 - 75.0	479	80	3.3	6,000	0.0	86	10,000	1,000
MB3048S-05ERW	48	36.0 - 75.0	710	80	5.0	6,000	0.0	88	10,000	1,500
MB3048S-12ERW	48	36.0 - 75.0	710	80	12.0	2,500	0.0	88	2,700	1,500
MB3048S-15ERW	48	36.0 - 75.0	702	80	15.0	2,000	0.0	89	1,680	1,500
MB3048S-24ERW	48	36.0 - 75.0	702	80	24.0	1,250	0.0	89	680	1,500

Notes:

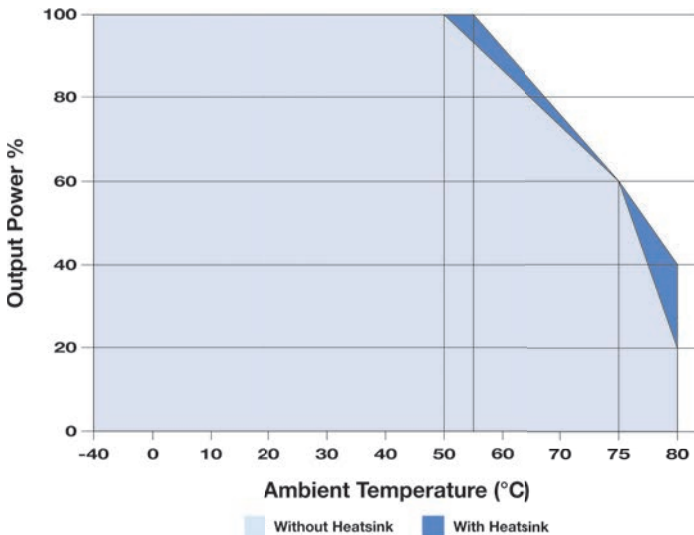
1. Start up time is measured at nominal input and with a constant resistive load.
2. When measuring output ripple, it is recommended that an external ceramic capacitor (approx 1 µF to 10 µF) be placed from the +Vout to the -Vout pins.
3. Transient recovery is measured to within a 1% error band for a load step change of 25%.
4. Short circuit protection is provided by a "hiccup mode" circuit.
5. The control input (pin 6) is referenced to the -Vin (pin 2) input. If it is grounded, the unit will shut off.
6. 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. **MB3024S-05ERW-H**)

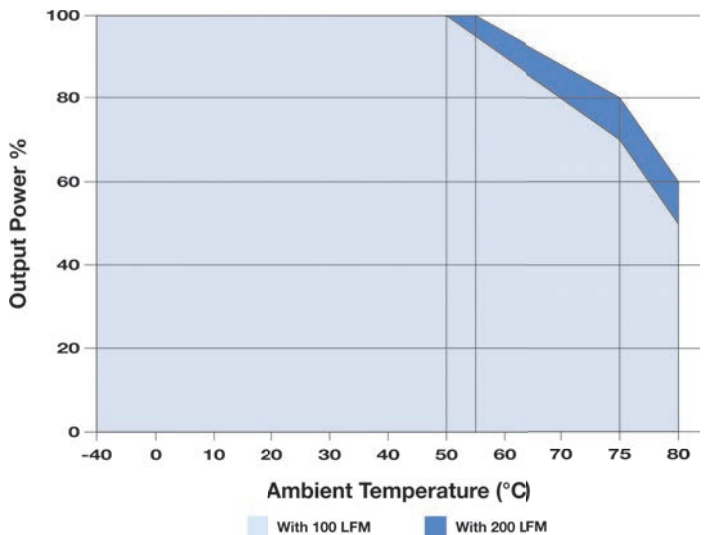
For the A2S adapter board option, add the suffix "-A2S" to the model number (i.e. **MB3048S-05ERW-A2S** or **MB3048S-05ERW-A2S-H**)

For the A4S adapter board option, add the suffix "-A4S" to the model number (i.e. **MB3048S-24ERW-A4S** or **MB3048S-24ERW-A4S-H**)

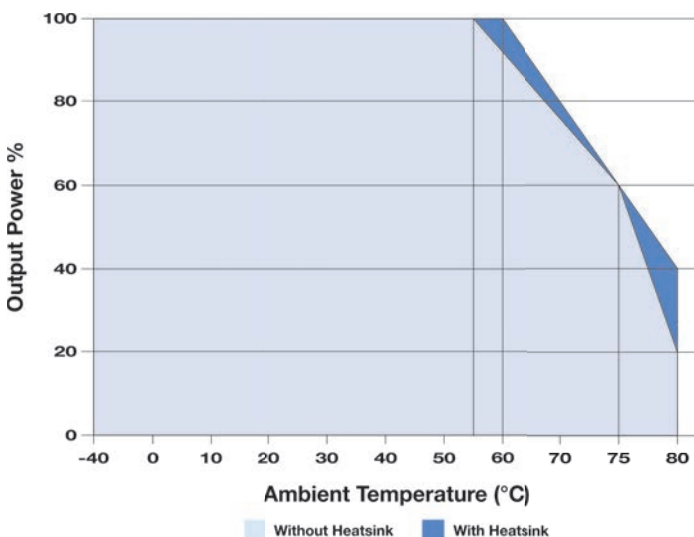
Derating Curve: 3.3V & 5V Models



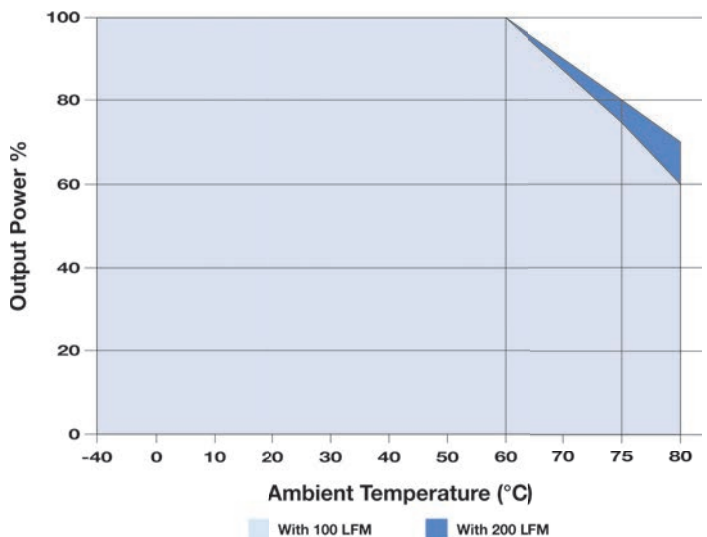
Derating Curve: 3.3V & 5V Models



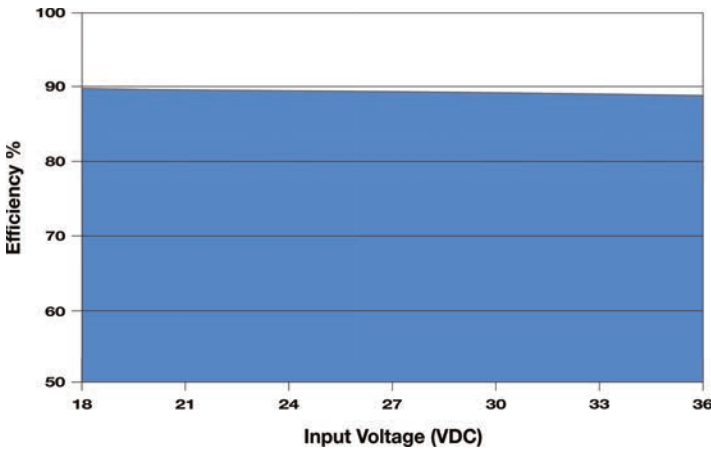
Derating Curve: All Other Models



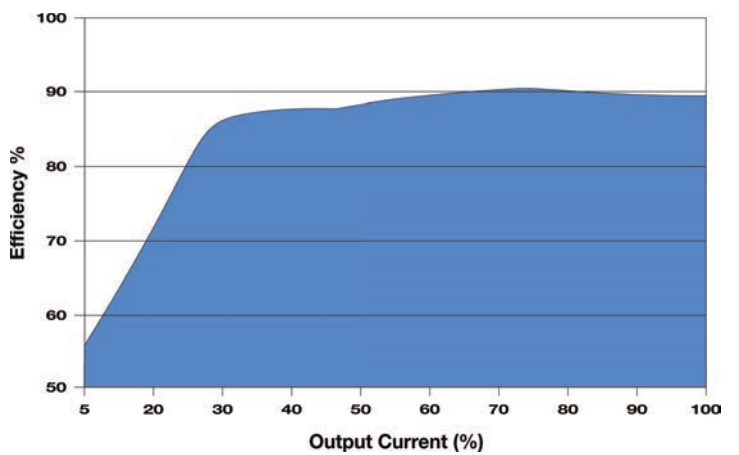
Derating Curve: All Other Models



Efficiency vs Input Voltage: 24 V_{IN}



Efficiency vs Output Load: 24 V_{IN}



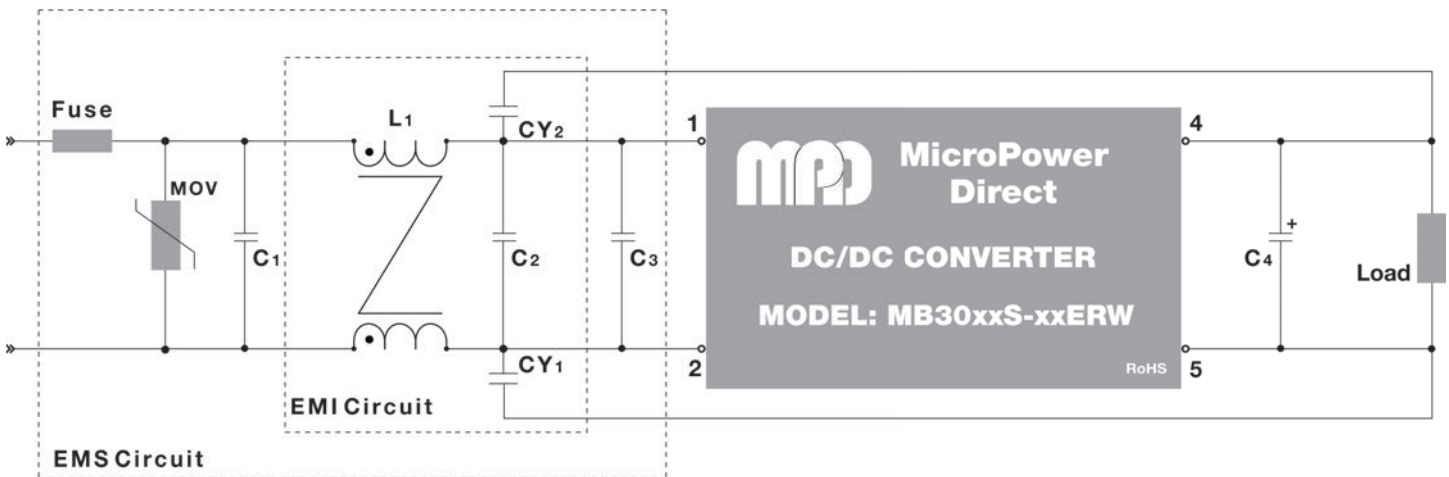
EMI Characteristics

Parameter	Standard	Criteria	Level	
Radiated Emissions (See Note 1)	CISPR 32/EN 55032		Class A (without external components)	
			Class B (See Typical Connection below)	
Conducted Emissions (See Note 1)	CISPR 32/EN 55032		Class A (without external components)	
			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. 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.
2. 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.
3. 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 MB3000xERW series. The units do not require external components to operate as specified. Some notes on this diagram (starting with the input circuit) are:

1. An external fuse should be used in all power module applications. The recommended fuse is shown in the model chart on page 2.
2. To protect against a surge, an external MOV is recommended on the input. A suggested value is given in the table at right.
3. 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
C ₁	680 μF/50V	330 μF/100V
L ₁	1 mH	1 mH
C ₂	4.7 μF/50V	2.2 μF/100V
C ₃	330 μF/50V	330 μF/100V
CY ₁	1 nF/2 kV	1 nF/2 kV
CY ₂	1 nF/2 kV	1 nF/2 kV
C ₄	See chart under note 5	

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	220 μF
5.0 V _{OUT}		
9.0 V _{OUT}		
12 V _{OUT}		
15 V _{OUT}	100 μF	100 μF
24 V _{OUT}		

External Trim

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 diagrams below. The required resistor value is calculated by the formulas:

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

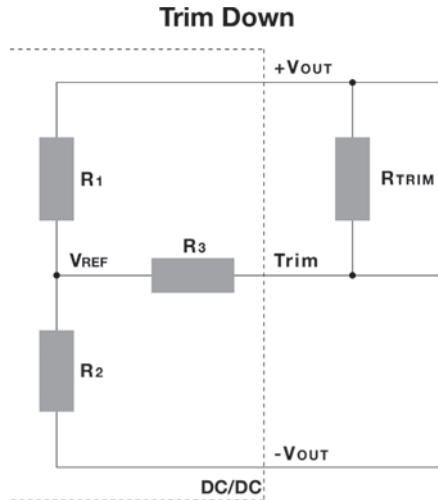
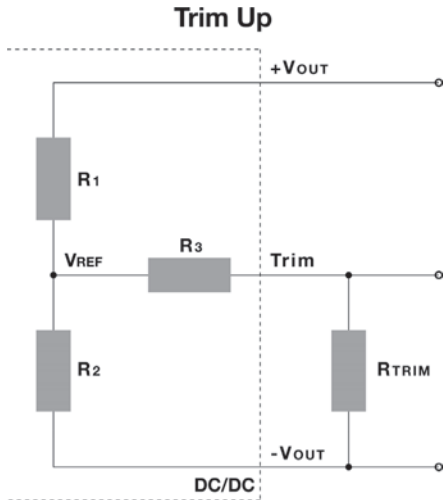
$$\text{Trim Down} = R_{\text{TRIM}} = \frac{A \times R_1}{R_1 - A} - R_3 \quad \text{Where } A = \frac{V_{\text{OUT}} - V_{\text{REF}}}{V_{\text{REF}}} \times R_2$$

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

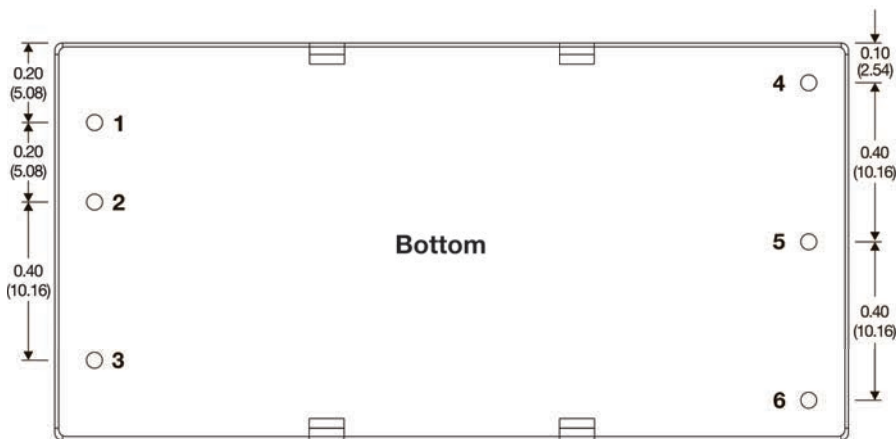
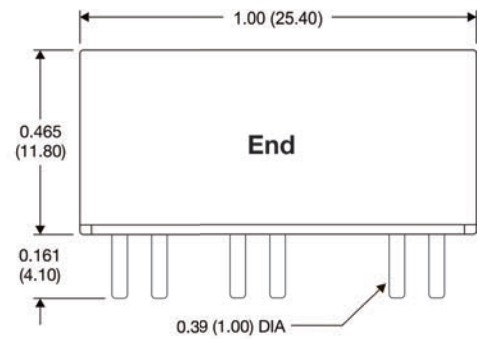
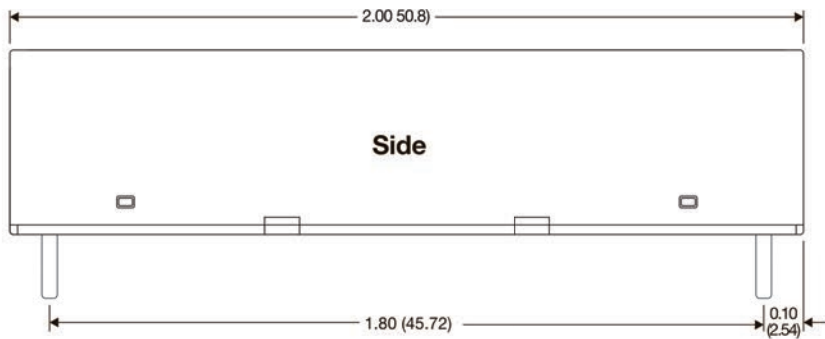
The values of R_1 , R_2 , R_3 and V_{REF} are given in the table at right.

Output Trim Resistor Values

Output Voltage	Resistor Value			
	R1 (kΩ)	R2 (kΩ)	R3 (kΩ)	VREF (V)
3.3 VDC	4.801	2.870	12.400	1.24
5.0 VDC	2.883	2.870	10.000	2.50
9.0 VDC	7.500	2.870	15.000	2.50
12 VDC	11.000	2.870	15.000	2.50
15 VDC	14.494	2.870	15.000	2.50
24 VDC	24.872	2.870	17.800	2.50



Mechanical Dimensions



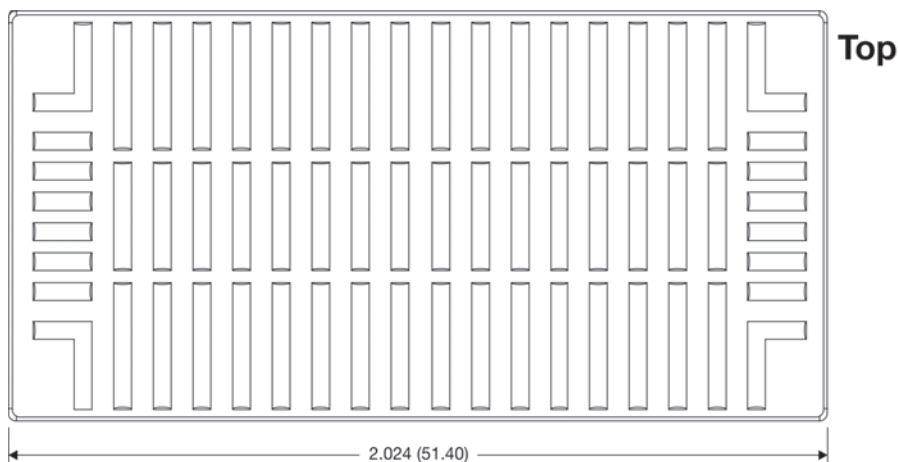
Pin Connections

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)

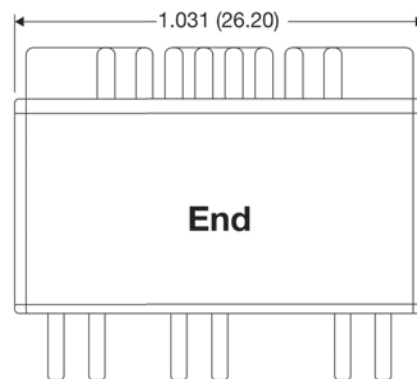
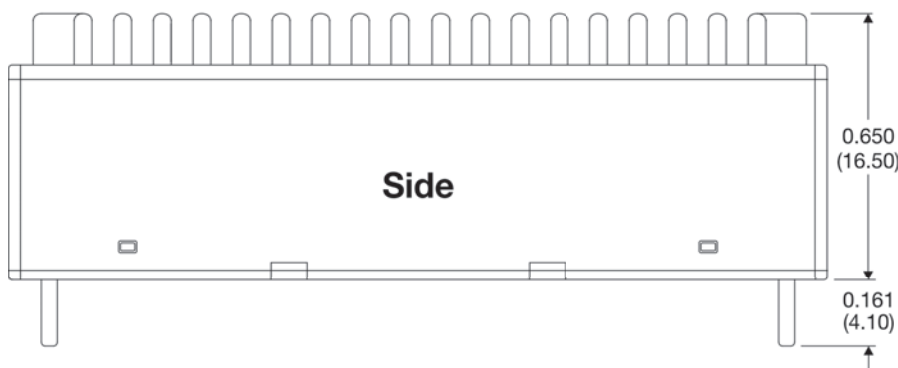
Mechanical Dimensions: With Optional Heatsink



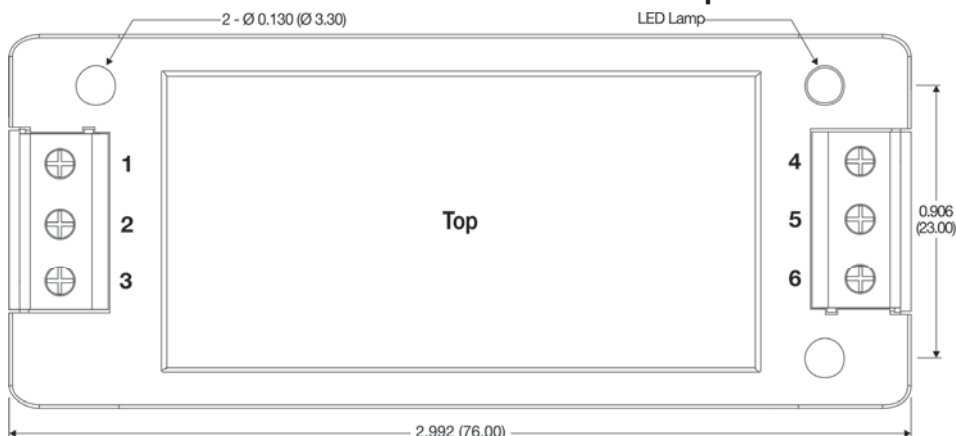
For the heatsink option, add the suffix "-H" to the model number (i.e. **MB3024S-05ERW-H**)

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

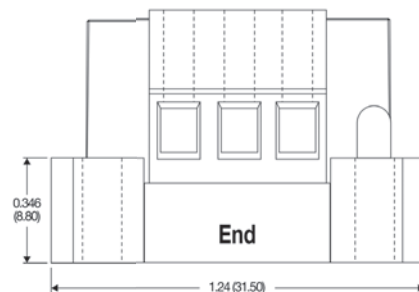
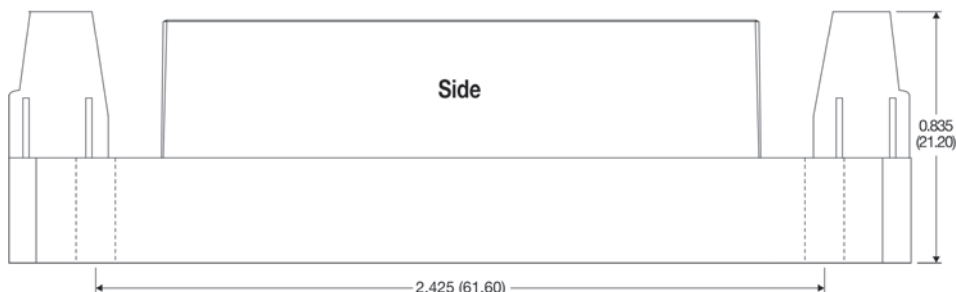


Pin Connections

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

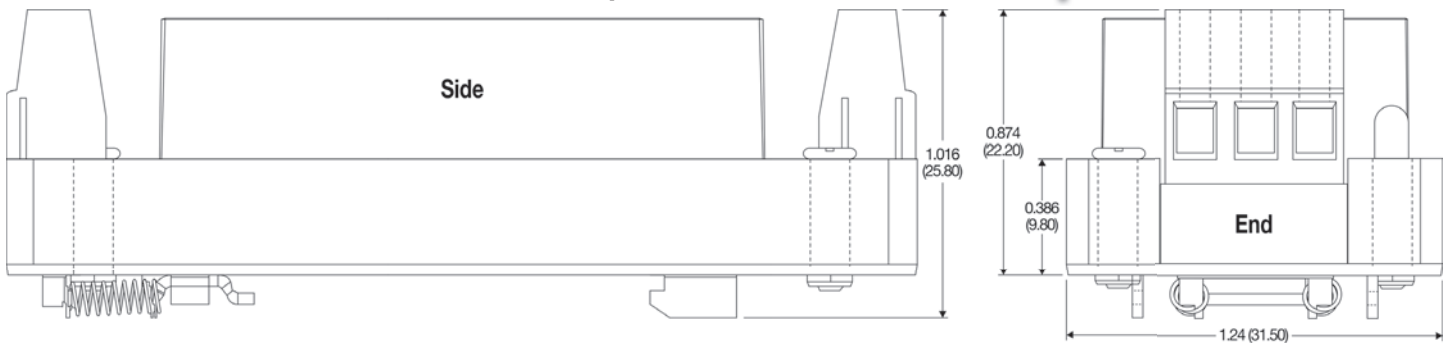
Notes:

- 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 the suffix "-A2" to the model number (i.e. **MB3024S-05ERW-A2**)

Mechanical Dimensions: A4 DIN Rail Adapter



Pin Connections

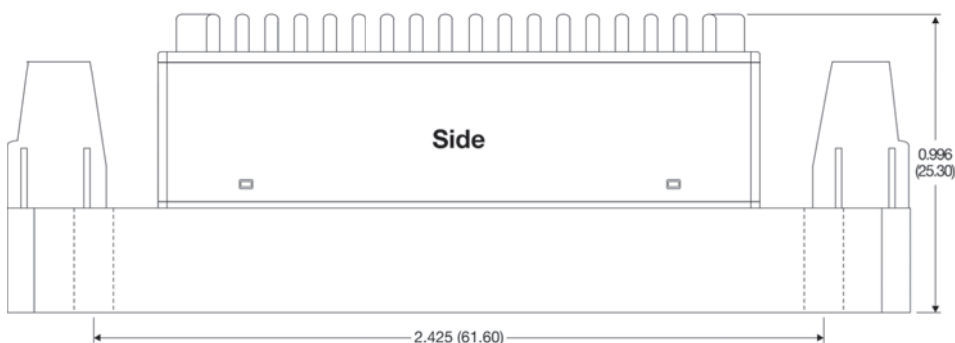
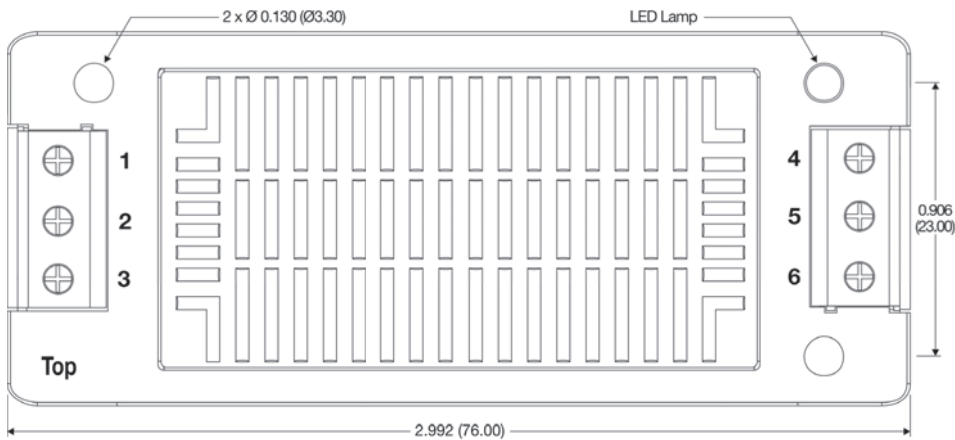
Pin	Function
1	Remote On/Off
2	-VIN
3	+VIN
4	Trim
5	-VOUT
6	+VOUT

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. **MB3024S-09ERW-A4**)

Mechanical Dimensions: A2 Chassis Mount Adapter with Heatsink

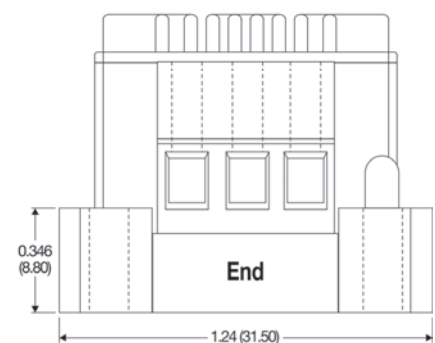


Pin Connections

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

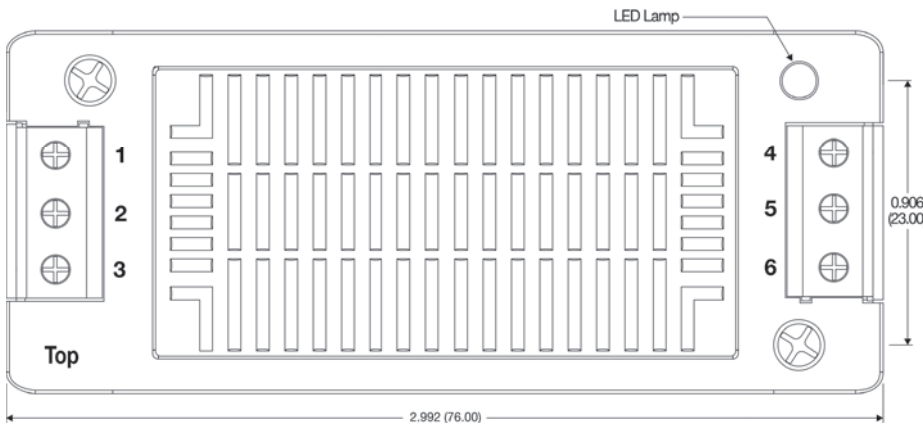
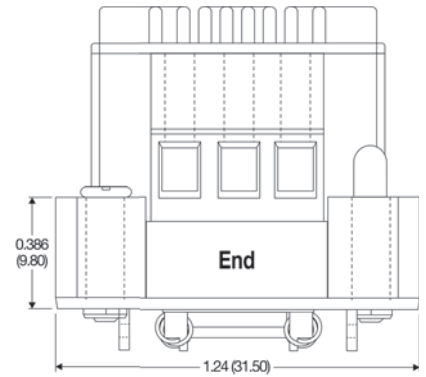
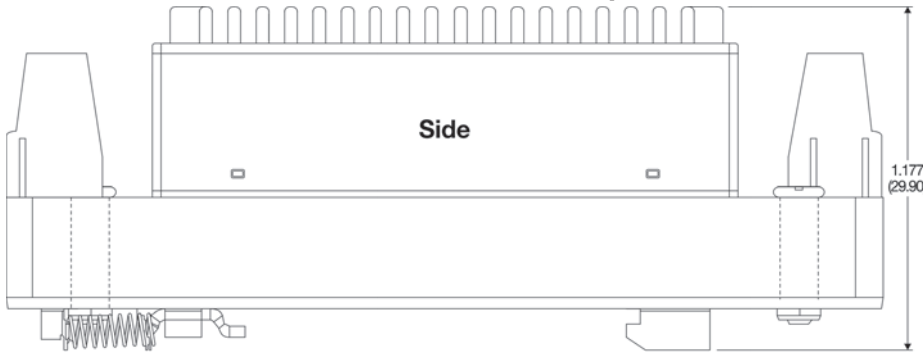
Notes:

- 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. **MB3048S-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. **MB3048S-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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