

MB2000ERW



Low Cost, 1 x 2 Inch 20W, 2:1 Input Range DC/DC Converters

Key Features:

- 20W 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 +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		
Reflected Ripple Current			30		mA	
Input Filter	π (Pi) Filter					
Start-Up Time	See Note 2		10		mS	
Output						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Output Voltage Accuracy	0% - 100% I _{OUT}		±1.0	±3.0	%	
Output Trim Range			±10		%	
Line Regulation, V _{IN} = Min to Max	Positive Output		±0.2	±0.5	%	
	Negative Output		±0.5	±1.0		
Load Regulation, I _{OUT} = 5% to 100%	Positive Output		±0.5	±1.0	%	
	Negative Output		±0.5	±1.5		
Cross Regulation	See Note 3			±5.0	%	
Ripple & Noise (20 MHz)	See Note 4		50	100	mV P - P	
Transient Recovery Time, See Note 5			300	500	μS	
Transient Response Deviation	3.3, 5.0 & ±5.0 Output Models		±5.0	±8.0	%	
	All Other Models		±3.0	±5.0		
Temperature Coefficient				±0.03	%/°C	
Over Voltage Protection		110		160	%	
Output Power Protection		110		190	%	
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			MΩ	
Isolation Capacitance, 100 kHz, 0.1V	Model MB2024S-24ERW		2,050		pF	
	All Other Models		1,050			
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 7	3.5		12.0	VDC	
Unit Off	See Note 7	0		1.2	VDC	
Off Idle Current			4.0	7.0	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						
MB2024S-03ERW	24	18.0 - 36.0	799	40	3.3	5,000	0.0	86	10,000	2,000
MB2024S-05ERW	24	18.0 - 36.0	925	40	5.0	4,000	0.0	90	10,000	2,000
MB2024S-09ERW	24	18.0 - 36.0	936	6	9.0	2,222	0.0	89	4,700	2,000
MB2024S-12ERW	24	18.0 - 36.0	936	6	12.0	1,667	0.0	89	1,600	2,000
MB2024S-15ERW	24	18.0 - 36.0	925	6	15.0	1,333	0.0	90	1,000	2,000
MB2024S-24ERW	24	18.0 - 36.0	925	6	24.0	834	0.0	90	500	2,000
MB2024D-05ERW	24	18.0 - 36.0	969	40	±5.0	±2,000	±0.0	86	4,800	2,000
MB2024D-09ERW	24	18.0 - 36.0	947	6	±9.0	±1,111	±0.0	88	1,000	2,000
MB2024D-12ERW	24	18.0 - 36.0	947	6	±12.0	±834	±0.0	88	800	2,000
MB2024D-15ERW	24	18.0 - 36.0	947	6	±15.0	±667	±0.0	88	625	2,000
MB2024D-24ERW	24	18.0 - 36.0	947	6	±24.0	±417	±0.0	88	500	2,000
MB2048S-03ERW	48	36.0 - 75.0	400	20	3.3	5,000	0.0	86	10,000	1,000
MB2048S-05ERW	48	36.0 - 75.0	463	20	5.0	4,000	0.0	90	10,000	1,000
MB2048S-09ERW	48	36.0 - 75.0	468	5	9.0	2,222	0.0	89	4,700	1,000
MB2048S-12ERW	48	36.0 - 75.0	468	5	12.0	1,667	0.0	89	1,600	1,000
MB2048S-15ERW	48	36.0 - 75.0	463	5	15.0	1,333	0.0	90	1,000	1,000
MB2048S-24ERW	48	36.0 - 75.0	463	5	24.0	834	0.0	90	500	1,000
MB2048D-05ERW	48	36.0 - 75.0	484	20	±5.0	±2,000	±0.0	86	4,800	1,000
MB2048D-12ERW	48	36.0 - 75.0	473	5	±12.0	±834	±0.0	88	800	1,000
MB2048D-24ERW	48	36.0 - 75.0	473	5	±15.0	±667	±0.0	88	625	1,000

Notes:

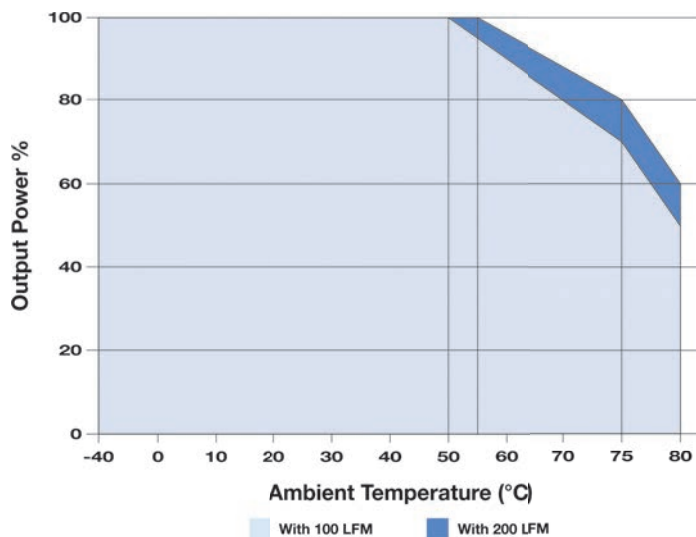
1. The specified maximum capacitive load is for each output.
2. Start up time is measured at nominal input and with a constant resistive load.
3. Cross regulation is measured with the main output set at 50% load. The second output is varied from 10% to 100% load.
4. When measuring output ripple, it is recommended that an external ceramic capacitor (approx 10 µF) be placed from the +Vout to the -Vout pins.
5. Transient recovery is measured to within a 1% error band for a load step change of 25%.
6. Short circuit protection is provided by a "hiccup mode" circuit.
7. The control input (pin 6) is referenced to the -Vin (pin 2) input. If it is grounded, the unit will shut off.
9. Operation at no-load will not damage the unit, but they may not meet all specifications.
10. These units should not be operated over +85°C. Exceeding +85°C may damage the unit.
11. 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. **MB2024S-05ERW-H**)

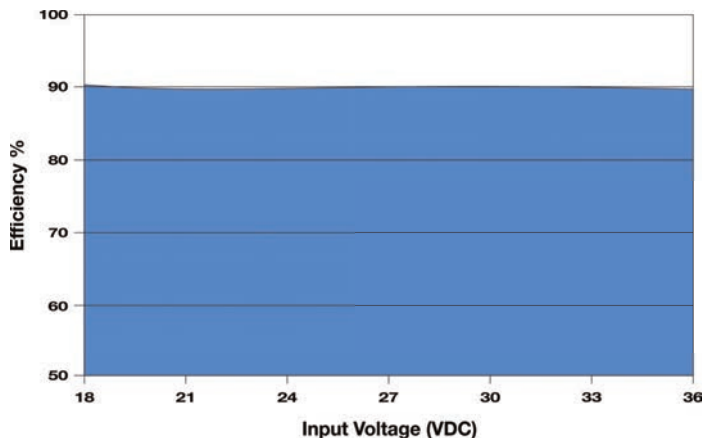
For the A2S adapter board option, add the suffix "-A2S" to the model number (i.e. **MB2048S-05ERW-A2S** or **MB2048S-05ERW-A2S-H**)

For the A4S adapter board option, add the suffix "-A4S" to the model number (i.e. **MB2048S-24ERW-A4S** or **MB2048S-24ERW-A4S-H**)

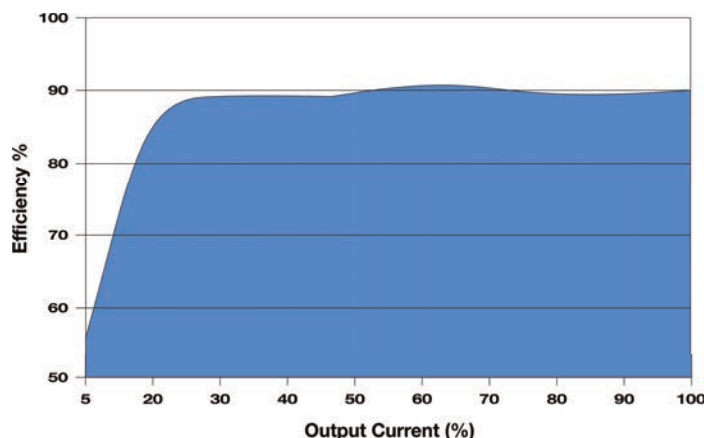
Derating Curve



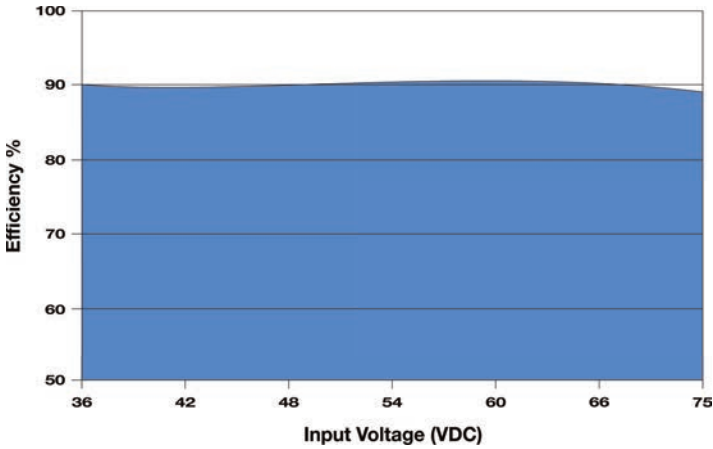
Efficiency vs Input Voltage: 24 VIN



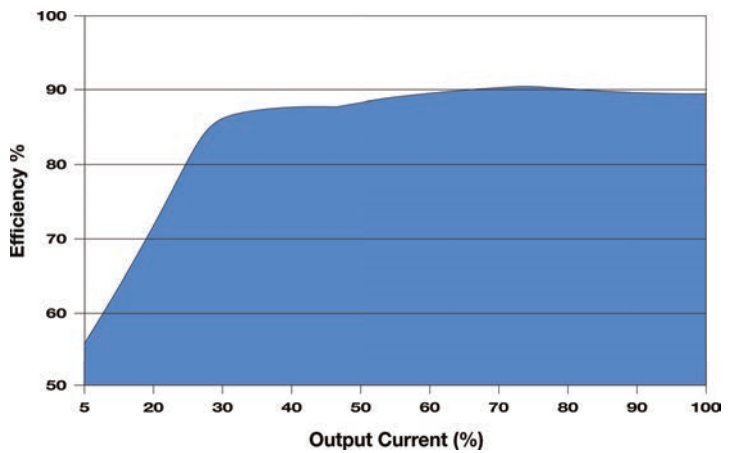
Efficiency vs Output Load: 24 VIN



Efficiency vs Input Voltage: 48 VIN



Efficiency vs Output Load: 48 VIN



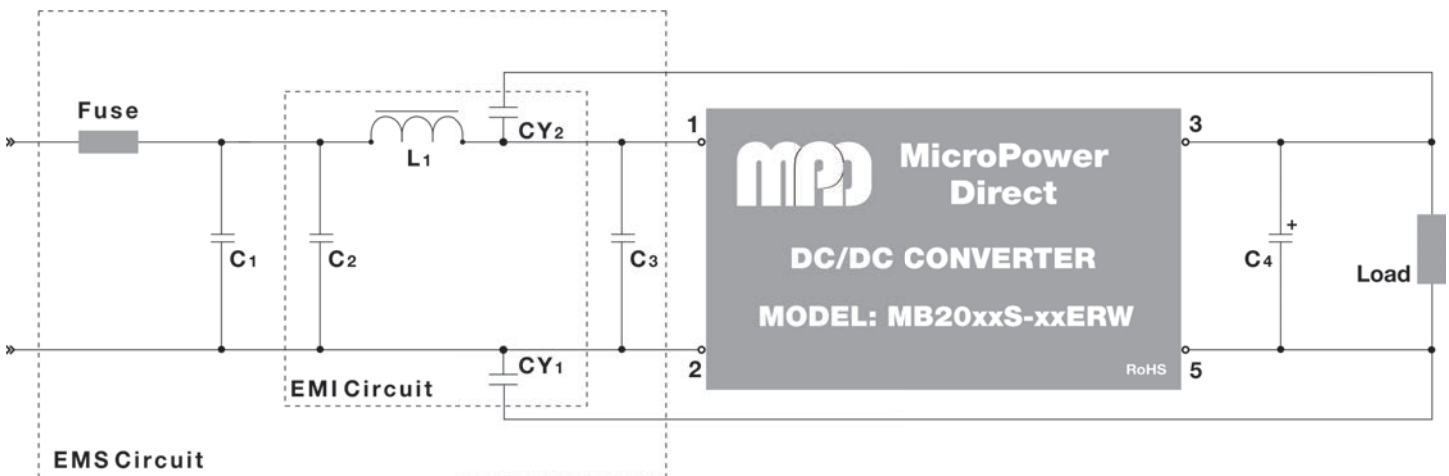
EMI Characteristics

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
Voltage Dips		EN 61000-4-29	B	0% - 70%

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 MB2000xERW 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. 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.

3. Recommended values for components are:

Component	24 VIN	48 VIN
C1	680 µF/50V	680 µF/100V
C2	1 µF/50V	1 µF/100V
L1	4.7 µH	4.7 µH
C3	330 µF/50V	330 µF/100V
CY1	1 nF/2 kV	1 nF/2 kV
CY2	1 nF/2 kV	1 nF/2 kV
C4	See chart under note 4	

4. 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	CIN	COU
3.3/5.0 VOUT	100 µF	470 µF
9.0/12/15 VOUT		220 µF
24 VOUT		100 µF
±5.0 VOUT		220 µF
±9.0/±12/±15 VOUT		100 µF
±24 VOUT		100 µF

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:

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

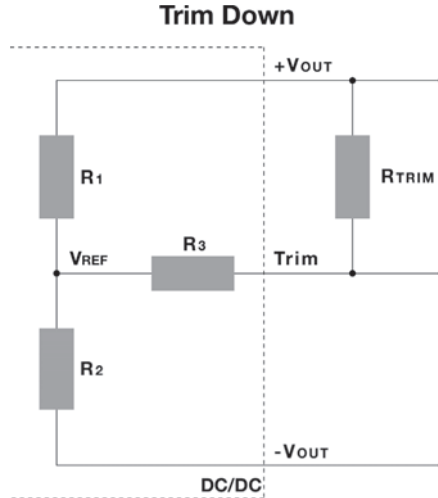
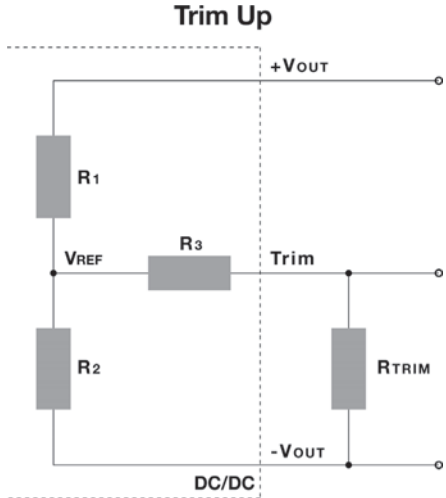
$$\text{Trim Down} = R_{\text{TRIM}} = \frac{A \times R_1}{R_1 - A} - R_3 \quad \text{Where } A = \frac{V_{\text{OUT}} - V_{\text{REF}}}{V_{\text{REF}}} \times R_2$$

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

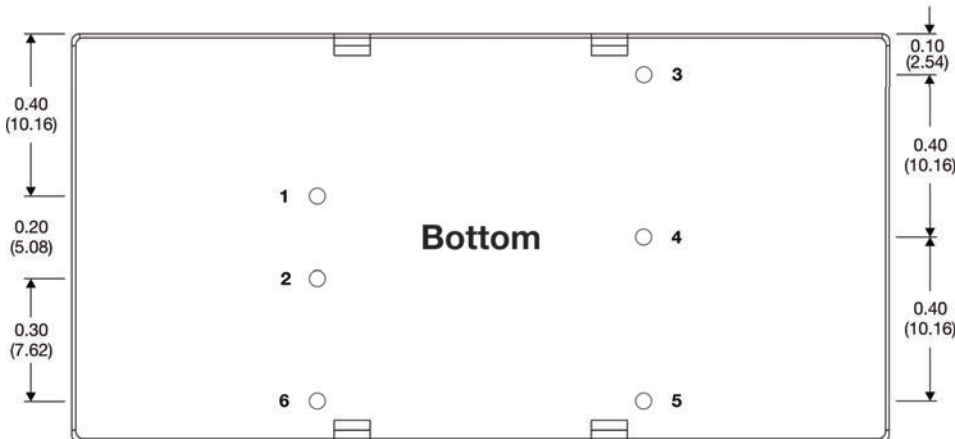
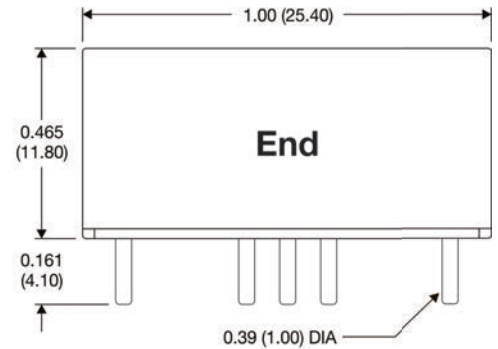
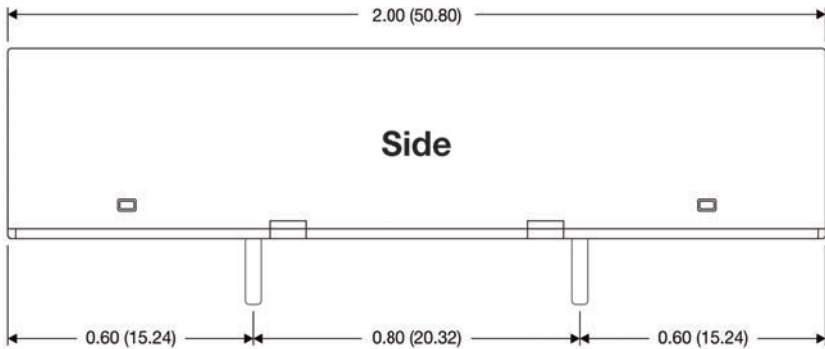
The values of R_1 , R_2 , R_3 and V_{REF} are given in the table at right.

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



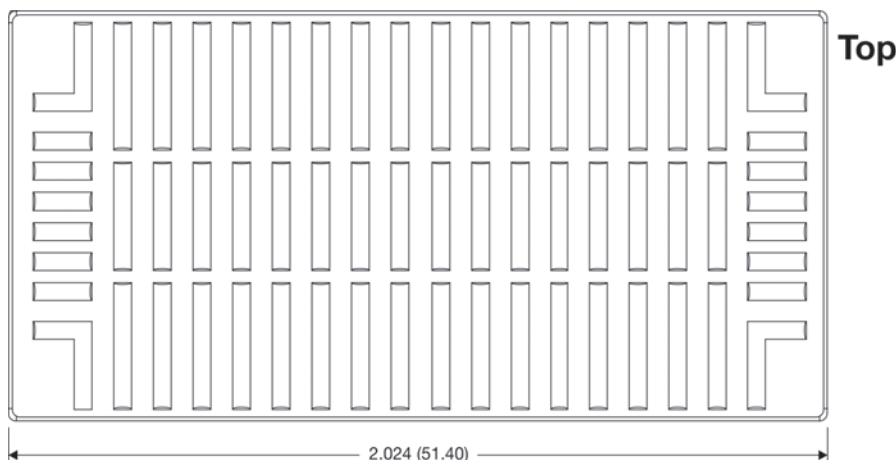
Pin Connections

Pin	Single	Dual
1	+VIN	+VIN
2	-VIN	-VIN
3	+VOUT	+VOUT
4	Trim	Common
5	-VOUT	-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)

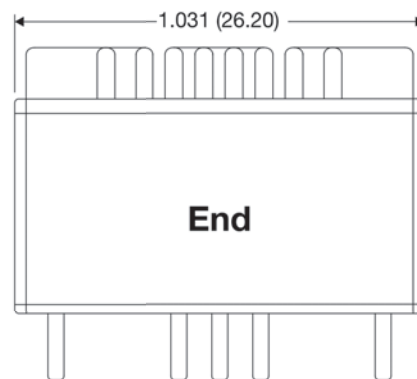
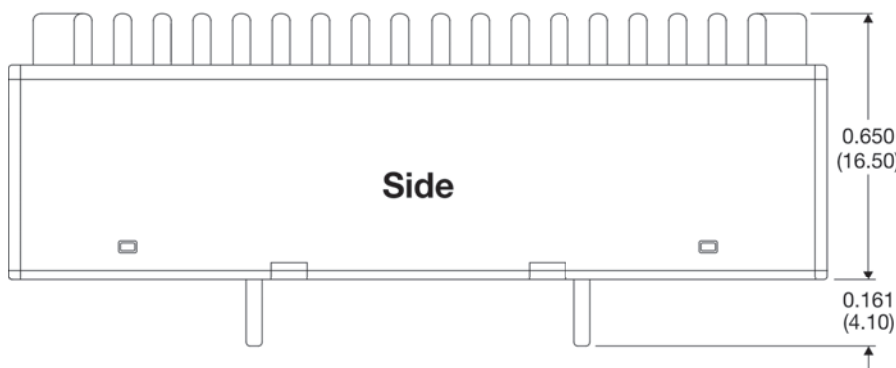
Mechanical Dimensions: With Optional Heatsink



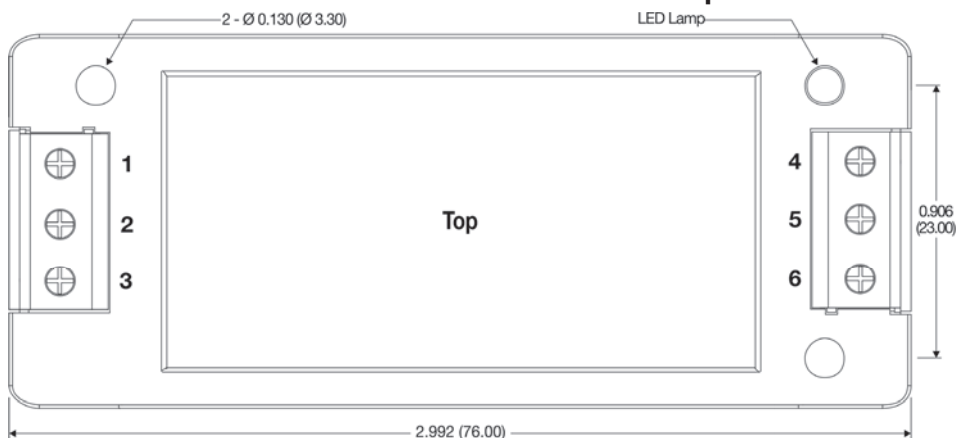
For the heatsink option, add the suffix “-H” to the model number (i.e. **MB2024S-05ERW-H**)

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

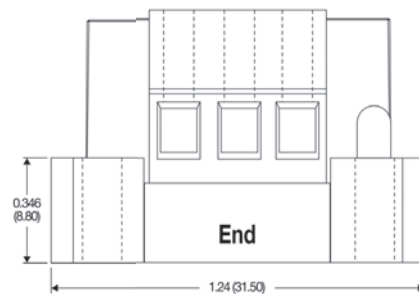
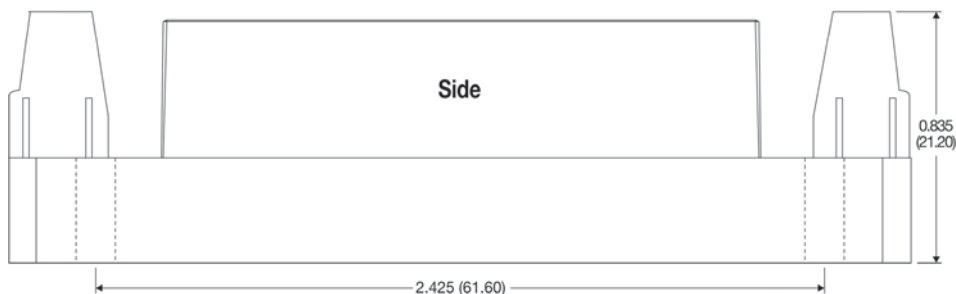


Pin Connections

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

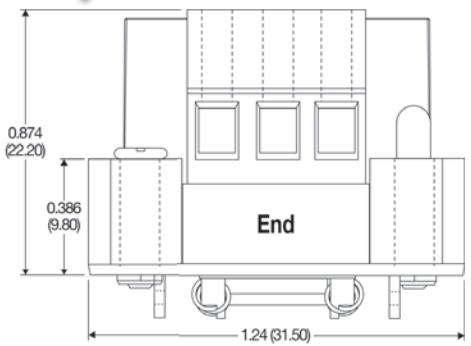
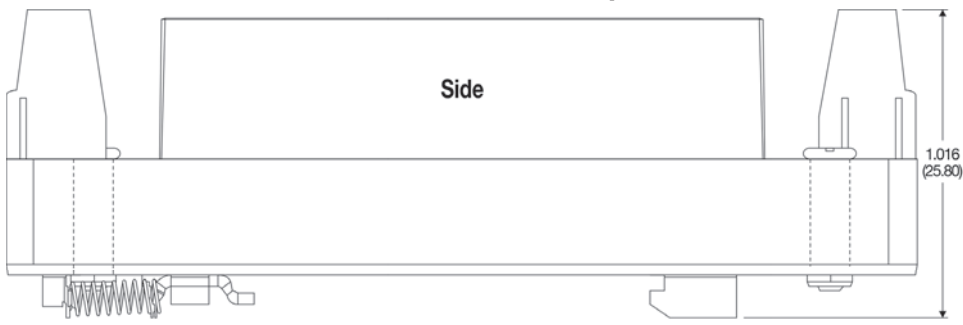
Notes:

- 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. **MB2024S-05ERW-A2**)

Mechanical Dimensions: A4 DIN Rail Adapter



Pin Connections

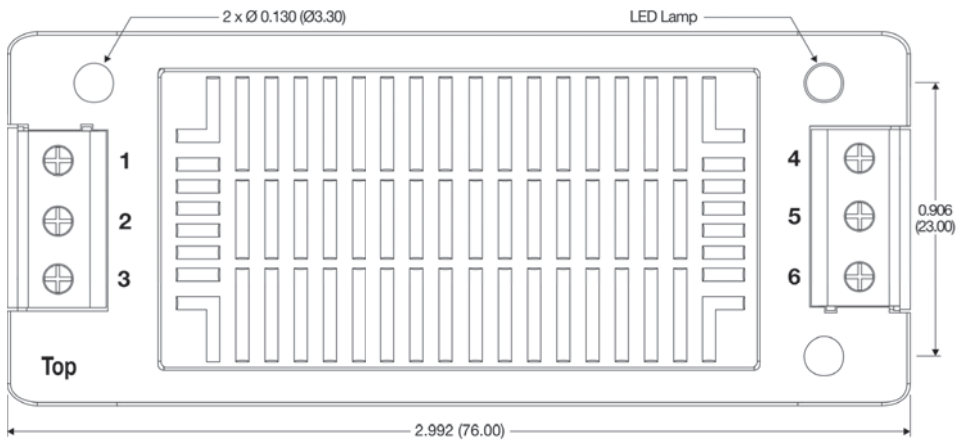
Pin	Single	Dual
1	Remote On/Off	Remote On/Off
2	-VIN	-VIN
3	+VIN	+VIN
4	-VOUT	-VOUT
5	Trim	Common
6	+VOUT	+VOUT

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. **MB2024S-05ERW-A4**)

Mechanical Dimensions: A2 Chassis Mount Adapter with Heatsink

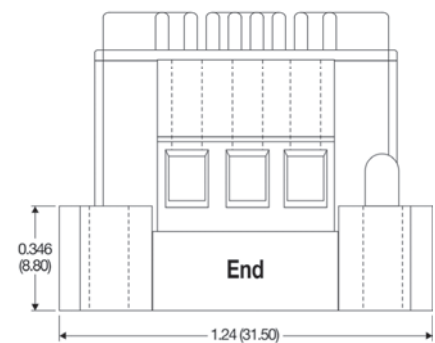
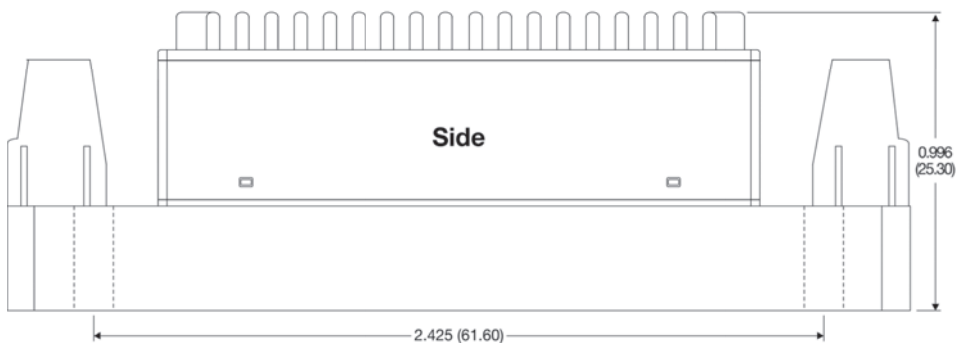


Pin Connections

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

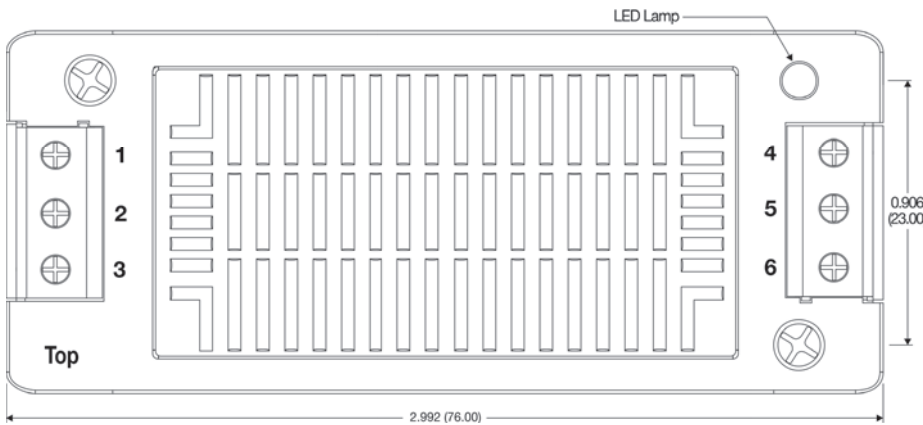
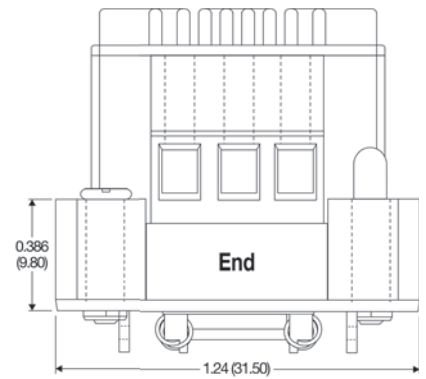
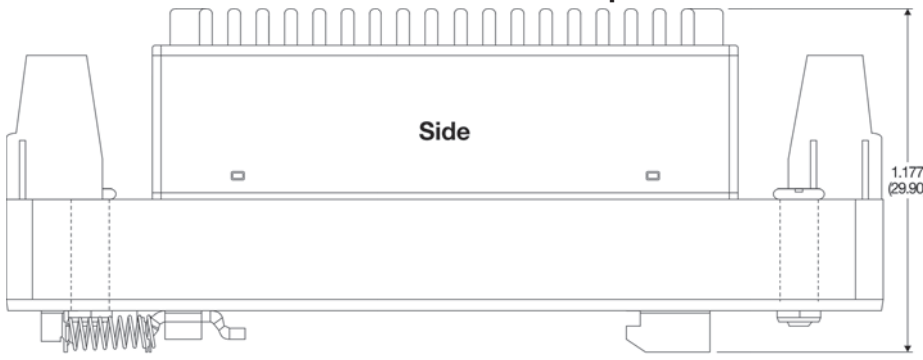
Notes:

- 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. **MB2048S-12ERW-A2-H**)

Mechanical Dimensions: A4 DIN Rail Adapter with Heatsink



Pin Connections

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

For the DIN rail mount option with heatsink, add the suffix "-A4-H" to the model number (i.e. **MB2048S-12ERW-A4-H**)

Notes:

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

Power Products

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