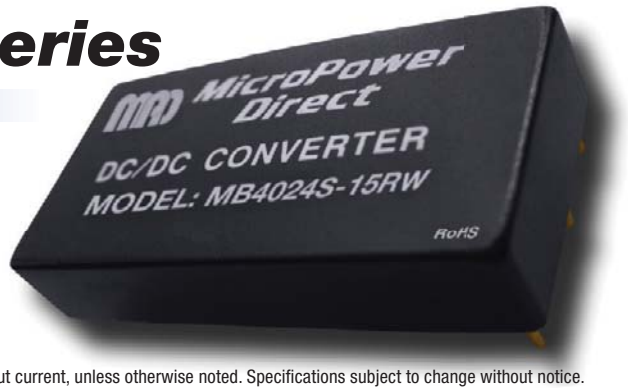
MB4000RW Series

Compact, 1 x 2 Inch 40W, 2:1 Input Range DC/DC Converters



Key Features:

- 40W Output Power
- 2:1 Input Voltage Range
- 1,500 VDC Isolation
- Single & Dual Outputs
- Efficiency to 91%
- Compact 1 x 2 Inch Case
- Wide Temp 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 Start Voltage	12 VDC Input			9.0	VDC
	24 VDC Input			18.0	
	48 VDC Input			36.0	
Input Shutdown Voltage	12 VDC Input		8.3		VDC
	24 VDC Input		16.5		
	48 VDC Input		33.0		
Input Filter	LC Filter				
Start-Up Time	See Note 1		30		mS

Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy				±1.0	%
Output Voltage Balance	Dual Output , Balanced Loads			±2.0	%
Line Regulation	V_{IN} = Min to Max			±0.5	%
Load Regulation, Min Load to Full Load	Single Output Models			±0.5	%
	Dual Output Models			±1.0	
Cross Regulation	See Note 2			±5.0	%
Ripple & Noise, See Note 3	3.3 & 5.0 Vout Models		100		mV P - P
	12, 15 & 24 Vout Models		150		mV P - P
	Dual Output Models		150		mV P - P
Transient Recovery Time, See Note 4	25% Load Step Change		250		µSec
Transient Response Deviation			±3.0	±5.0	%
Temperature Coefficient				±0.02	%/°C
Over Temperature Protection	Shutdown Temperature		110		°C
Output Power Protection			150		%
Output Short Circuit, See Note 5	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, 1V			1,500	pF
Switching Frequency	See Note 6		320		kHz

Environmental

Parameter	Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range, Ambient Without Heatsink	MB40xxS-03RW	-40	+25	+66	°C
	MB40xxS-05RW, -12RW, -15RW, -24RW			+46	
	MB40xxD-xxRW			+40	
Operating Temperature Range, Ambient With Heatsink	MB40xxS-03RW	-40	+25	+73	°C
	MB40xxS-05RW, -12RW, -15RW, -24RW			+57	
	MB40xxD-xxRW			+52	
Operating Temperature Range	Case			+105	°C
Storage Temperature Range		-50		+125	°C
Cooling	Free Air Convection				
Humidity	RH, Non-condensing			95	%

Physical

Case Size, See Note On Page 4	2.0 x 1.0 x 0.40 Inches (50.8 x 25.4 x 10.2 mm)
Case Material	Metal with Non-Conductive Base
Weight	1.06 Oz (30g)

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	328			kHours

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			260.0	°C

Caution: Exceeding Absolute Maximum Ratings may damage the module. These are not continuous operating ratings.

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Model Selection Guide

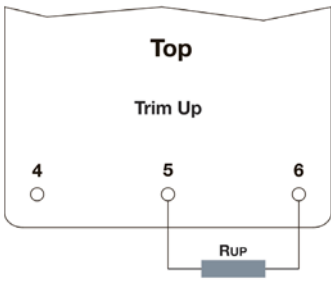
Model Number	Input				Output			Efficiency (%, Typ)	Over Voltage Protection (VDC)	Capacitive Load (µF Max)	Fuse Rating Slow-Blow (A)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)				
	Nominal	Range	Full-Load	No-Load							
MB4012S-03RW	12	9.0 - 18.0	2,470	120	3.3	8,000	0	89	3.9	21,000	8.0
MB4012S-05RW	12	9.0 - 18.0	3,750	160	5.0	8,000	0	89	6.2	13,600	8.0
MB4012S-12RW	12	9.0 - 18.0	3,750	160	12.0	3,330	0	89	15.0	2,400	8.0
MB4012S-15RW	12	9.0 - 18.0	3,700	150	15.0	2,670	0	90	18.0	1,500	8.0
MB4012S-24RW	12	9.0 - 18.0	3,670	160	24.0	1,670	0	91	30.0	600	8.0
MB4012D-12RW	12	9.0 - 18.0	3,790	70	±12.0	±1,670	±145	88	±15.0	±1,200	8.0
MB4012D-15RW	12	9.0 - 18.0	3,790	60	±15.0	±1,330	±110	88	±18.0	±750	8.0
MB4024S-03RW	24	18.0 - 36.0	1,220	75	3.3	8,000	0	90	3.9	21,000	4.0
MB4024S-05RW	24	18.0 - 36.0	1,830	80	5.0	8,000	0	91	6.2	13,600	4.0
MB4024S-12RW	24	18.0 - 36.0	1,830	85	12.0	3,330	0	91	15.0	2,400	4.0
MB4024S-15RW	24	18.0 - 36.0	1,830	75	15.0	2,670	0	91	18.0	1,500	4.0
MB4024S-24RW	24	18.0 - 36.0	1,835	85	24.0	1,670	0	91	30.0	600	4.0
MB4024D-12RW	24	18.0 - 36.0	1,870	50	±12.0	±1,670	±145	89	±15.0	±1,200	4.0
MB4024D-15RW	24	18.0 - 36.0	1,870	45	±15.0	±1,330	±110	89	±18.0	±750	4.0
MB4048S-03RW	48	36.0 - 75.0	610	40	3.3	8,000	0	90	3.9	21,000	2.0
MB4048S-05RW	48	36.0 - 75.0	920	50	5.0	8,000	0	91	6.2	13,600	2.0
MB4048S-12RW	48	36.0 - 75.0	910	50	12.0	3,330	0	92	15.0	2,400	2.0
MB4048S-15RW	48	36.0 - 75.0	910	50	15.0	2,670	0	92	18.0	1,500	2.0
MB4048S-24RW	48	36.0 - 75.0	918	50	24.0	1,670	0	91	30.0	600	2.0
MB4048D-12RW	48	36.0 - 75.0	940	65	±12.0	±1,670	±145	89	±15.0	±1,200	2.0
MB4048D-15RW	48	36.0 - 75.0	940	65	±15.0	±1,330	±110	89	±18.0	±750	2.0

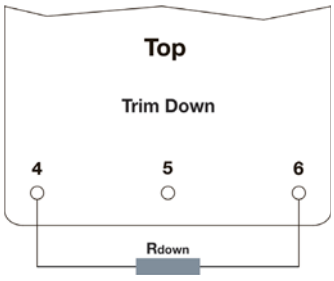
Notes:

1. Start up time is measured at nominal input and with a constant resistive load.
2. Cross regulation is measured with the output being tested at 100% load. The second output is varied from 25% to 100% load.
3. When measuring output ripple, it is recommended that an external 1 µF capacitor and 10 µF capacitor be connected in parallel from the +Vout to the -Vout pins for single output units and from each output to common for dual output units.
4. Transient recovery is measured to within a 1% error band for a load step change of 25%.
5. Short circuit protection is provided by a "hiccup mode" circuit.
6. The switching frequency for 24 VDC output models is 285 kHz.
7. Operation at no-load will not damage these units. However, they may not meet all specifications if operated below the specified minimum load.
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 heatsink option, add suffix "H" to model number (i.e. **MB4012S-05RW-H**)

External Trim





On single output units, an external resister may be added to adjust the converter output.

To adjust the output UP, connect a 5%, 3W resistor between the minus output pin (5) and the Vout trim pin (6). To adjust the output DOWN, connect a 5%, 3W resistor between the plus output pin (4) and the Vout trim pin (6).

The trim table at right gives suggested resistor values for this adjustment.

MB40xxS-03RW

Trim Down											
Vout	Vo x 0.99	Vo x 0.98	Vo x 0.97	Vo x 0.96	Vo x 0.95	Vo x 0.94	Vo x 0.93	Vo x 0.92	Vo x 0.91	Vo x 0.90	Volts
RDOWN	72.61	32.55	19.20	12.52	8.51	5.84	3.94	2.51	1.39	0.50	kΩ

Trim Up											
Vout	Vo x 1.01	Vo x 1.02	Vo x 1.03	Vo x 1.04	Vo x 1.05	Vo x 1.06	Vo x 1.07	Vo x 1.08	Vo x 1.09	Vo x 1.10	Volts
RUP	60.84	27.40	16.25	10.68	7.34	5.11	3.51	2.32	1.39	0.65	kΩ

MB40xxS-05RW

Trim Down											
Vout	Vo x 0.99	Vo x 0.98	Vo x 0.97	Vo x 0.96	Vo x 0.95	Vo x 0.94	Vo x 0.93	Vo x 0.92	Vo x 0.91	Vo x 0.90	Volts
RDOWN	138.88	62.41	36.92	24.18	16.53	11.44	7.79	5.06	2.94	1.24	kΩ

Trim Up											
Vout	Vo x 1.01	Vo x 1.02	Vo x 1.03	Vo x 1.04	Vo x 1.05	Vo x 1.06	Vo x 1.07	Vo x 1.08	Vo x 1.09	Vo x 1.10	Volts
RUP	106.87	47.76	28.06	18.21	12.30	8.36	5.55	3.44	1.79	0.48	kΩ

MB40xxS-12RW

Trim Down											
Vout	Vo x 0.99	Vo x 0.98	Vo x 0.97	Vo x 0.96	Vo x 0.95	Vo x 0.94	Vo x 0.93	Vo x 0.92	Vo x 0.91	Vo x 0.90	Volts
RDOWN	413.55	184.55	108.22	70.05	47.15	31.88	20.98	12.80	6.44	1.35	kΩ

Trim Up											
Vout	Vo x 1.01	Vo x 1.02	Vo x 1.03	Vo x 1.04	Vo x 1.05	Vo x 1.06	Vo x 1.07	Vo x 1.08	Vo x 1.09	Vo x 1.10	Volts
RUP	351.00	157.50	93.00	60.75	41.40	28.50	19.29	12.37	7.00	2.70	kΩ

MB40xxS-15RW

Trim Down											
Vout	Vo x 0.99	Vo x 0.98	Vo x 0.97	Vo x 0.96	Vo x 0.95	Vo x 0.94	Vo x 0.93	Vo x 0.92	Vo x 0.91	Vo x 0.90	Volts
RDOWN	530.73	238.61	141.24	92.56	63.35	43.87	29.96	19.53	11.41	4.92	kΩ

Trim Up											
Vout	Vo x 1.01	Vo x 1.02	Vo x 1.03	Vo x 1.04	Vo x 1.05	Vo x 1.06	Vo x 1.07	Vo x 1.08	Vo x 1.09	Vo x 1.10	Volts
RUP	422.77	189.89	112.26	73.44	50.15	34.63	23.54	15.22	8.75	3.58	kΩ

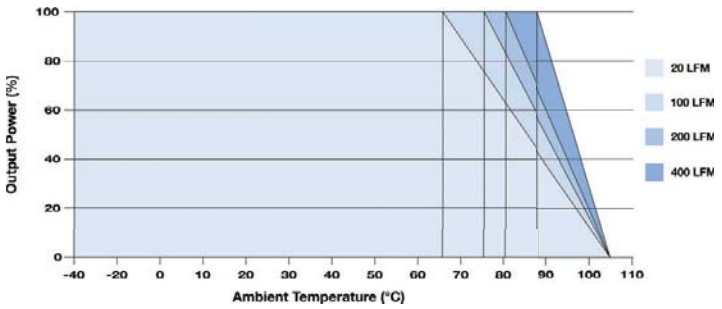
MB40xxS-24RW

Trim Down											
Vout	Vo x 0.99	Vo x 0.98	Vo x 0.97	Vo x 0.96	Vo x 0.95	Vo x 0.94	Vo x 0.93	Vo x 0.92	Vo x 0.91	Vo x 0.90	Volts
RDOWN	333.39	148.80	87.26	56.50	38.04	25.73	16.94	10.35	5.22	1.12	kΩ

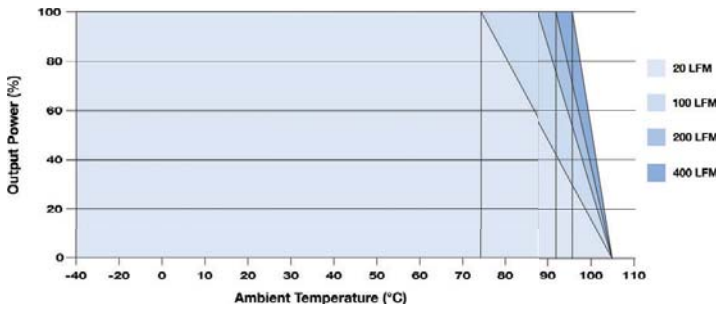
Trim Up											
Vout	Vo x 1.01	Vo x 1.02	Vo x 1.03	Vo x 1.04	Vo x 1.05	Vo x 1.06	Vo x 1.07	Vo x 1.08	Vo x 1.09	Vo x 1.10	Volts
RUP	243.70	108.50	63.43	40.90	27.38	18.37	11.93	7.10	3.34	0.34	kΩ

Derating Curves

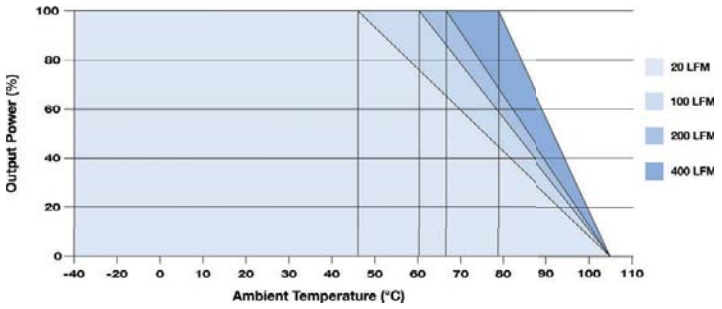
MB40xxS-03RW Without Heatsink



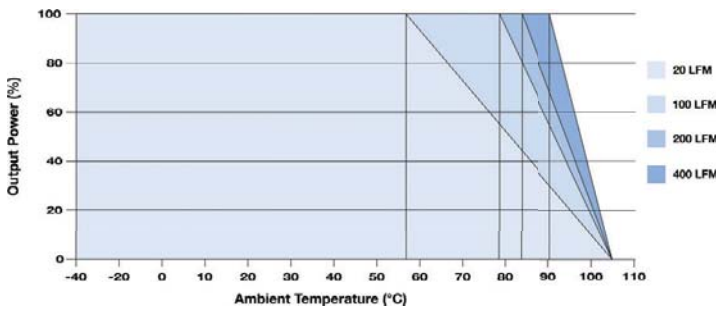
MB40xxS-03RW With Heatsink



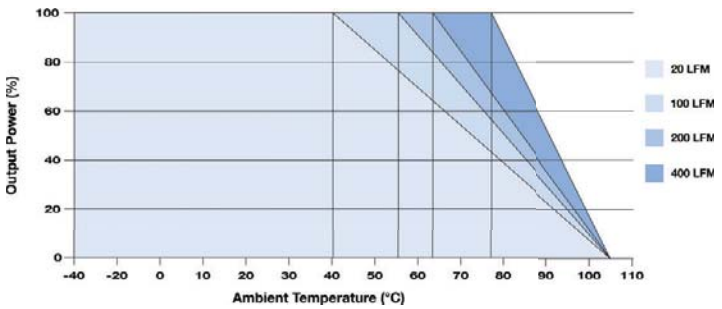
MB40xxS-05RW, -12RW, -15RW, -24RW Without Heatsink



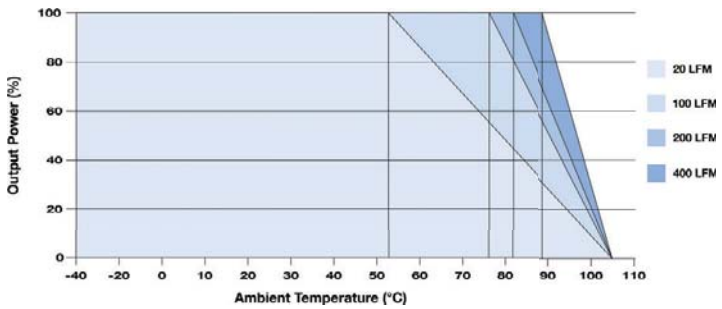
MB40xxS-05RW, -12RW, -15RW, -24RW With Heatsink



MB40xxD-12RW, MB40xxD-15RW Without Heatsink



MB40xxD-12RW, MB40xxD-15RW With Heatsink

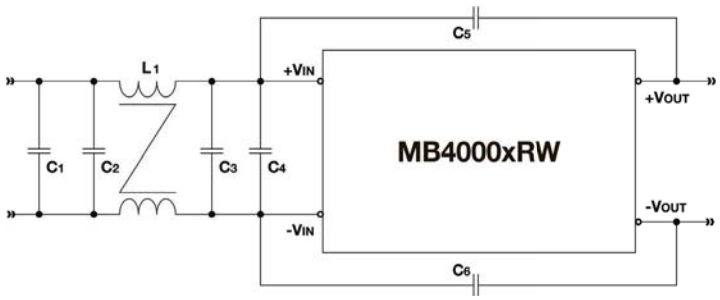


EMC Specifications

Parameter	Standard	
Radiated Emissions	EN 55022	Class A
Conducted Emissions	EN 55022	Class A
ESD	EN 61000-4-2	Criteria B; ±8 kV Air, ±6 kV Contact
RS	EN 61000-4-3	Criteria A; 10V/m
EFT, See Notes	EN 61000-4-4	Criteria A; ±2 kV
Surge, See Notes	EN 61000-4-5	Criteria B; ±1 kV
CS	EN 61000-4-6	Criteria A; 10 V/m

Notes:
All units should meet EN 55022 (CE/RE) class A/B with the simple external circuit shown at right. To meet the requirements of EN 61000-4-4 and EN 61000-4-5, the value of C_1 should be changed to 330 μF/200V. Contact the factory for more information.

External Component Connection



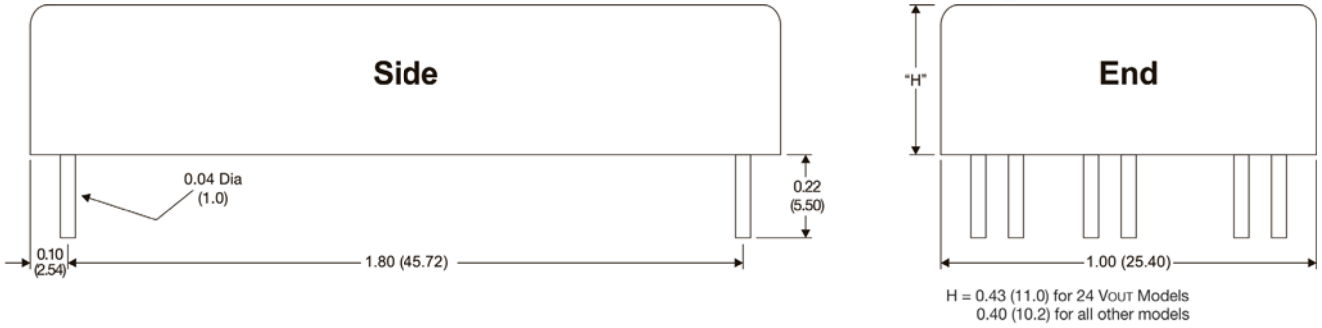
Standard	Model	C_1	C_2	L_1	C_3	C_4	C_5	C_6
EN55022 Class A	**MB4012x-xxRW**	10 µF/25V 1812 MLCC	---	---	---	---	1,000 pF/2kV 1808 MLCC	1,000 pF/2kV 1808 MLCC
	MB4024x-xxRW	4.7 µF/50V 1812 MLCC	---	---	---	---	1,000 pF/2kV 1808 MLCC	1,000 pF/2kV 1808 MLCC
	MB4048x-xxRW	2.2 µF/100V 1812 MLCC	---	---	---	---	1,000 pF/2kV 1808 MLCC	1,000 pF/2kV 1808 MLCC
EN55022 Class B	**MB40xxS-xxRW**	3.3 µF/100V 1210/X7S	3.3 µF/100V 1210/X7S	1 mH	3.3 µF/100V 1210/X7S	3.3 µF/100V 1210/X7S	1,000 pF/2kV 1808 X7R	1,000 pF/2kV 1808 X7R
	MB40xxD-xxRW	3.3 µF/100V 1210/X7S	3.3 µF/100V 1210/X7S	1 mH	3.3 µF/100V 1210/X7S	3.3 µF/100V 1210/X7S	1,000 pF/2kV 1808 X7R	1,000 pF/2kV 1808 X7R

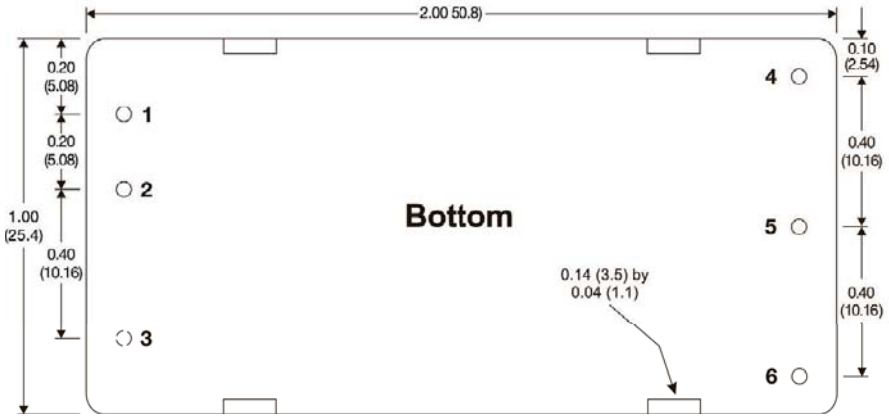
Remote On/Off

Parameter	Min	Typ	Max	Units
Supply On	3.5		12.0	VDC
Supply Off	0.0		1.2	VDC
Standby Input Current		2.5		mA
Control Common	Referenced to Negative Input (pin 2)			
Control Input Current (ON)		0.5		mA
Control Input Current (OFF)		-0.5		mA

Applying a signal to pin 3 will turn the unit ON/OFF. If the pin is left open, the unit operates. If grounded, the unit will shut off. The specifications for the ON/OFF function are given in the table at left.

Mechanical Dimensions



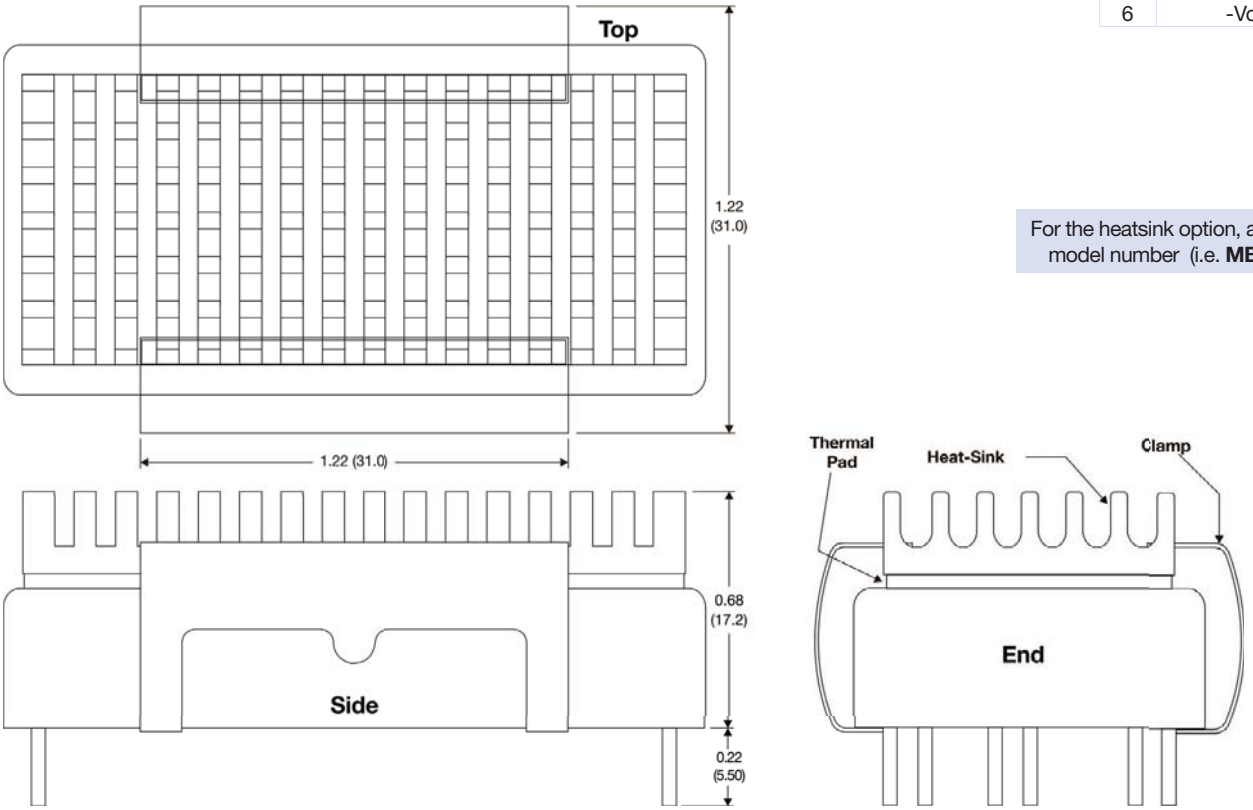


Pin Connections

Pin	Single Output
1	+Vin
2	-Vin
3	Remote On/Off
4	+Vout
5	-Vout
6	Trim

Pin	Dual Output
1	+Vin
2	-Vin
3	Remote On/Off
4	+Vout
5	Common
6	-Vout

Mechanical Dimensions: With Optional Heatsink



For the heatsink option, add suffix "H" to the model number (i.e. **MB4048S-24RW-H**)

Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.50)
- Heatsink is black, anodized aluminum