

# MB5000RU Series

## Compact, 1 x 2 Inch 50W, 4:1 Input Range DC/DC Converters



### Key Features:

- 50W Output Power
- 4:1 Input Voltage Range
- 1,500 VDC Isolation
- Very High Efficiency
- Compact 1 x 2 Inch Case
- Ten Standard Models
- Remote ON/OFF Control
- Industry Standard Pin-Out



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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 Start Voltage	24 VDC Input			9.0	VDC	
	48 VDC Input			18.0		
Input Shutdown Voltage	24 VDC Input		7.5		VDC	
	48 VDC Input		16.0			
Start-Up Time, See Note 1	Nominal V <sub>IN</sub> , Constant Resistive Load			30	mS	
Input Filter	LC Filter					

Output						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Output Voltage Accuracy				±1.0	%	
Line Regulation	V <sub>IN</sub> = Min to Max			±0.5	%	
Load Regulation, See Note 2				±0.5	%	
Ripple & Noise, See Note 3	3.3 & 5.0 V <sub>OUT</sub> Models		100		mV P - P	
	12, 15 & 24 V <sub>OUT</sub> Models		150			
Transient Recovery Time, See Note 4	25% Load Step Change		250		µSec	
Transient Response Deviation			±3.0	±5.0	%	
Temperature Coefficient				±0.02	%/°C	
Output Power Protection	Hiccup Mode		150		%	
Over Temperature Protection	Shutdown Temperature		+110		°C	
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			2,200	pF	
Switching Frequency			285		kHz	

Environmental						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Operating Temperature Range, Ambient Without Heatsink	3.3 V <sub>OUT</sub> Models			+61	°C	
	12, & 15 V <sub>OUT</sub> Models	-40	+25	+53		
	5.0 & 24 V <sub>OUT</sub> Models			+46		
Operating Temperature Range, Ambient With Heatsink	3.3 V <sub>OUT</sub> Models			+69	°C	
	12, & 15 V <sub>OUT</sub> Models	-40	+25	+62		
	5.0 & 24 V <sub>OUT</sub> Models			+57		
Operating Temperature Range	Case			+105	°C	
Storage Temperature Range		-50		+125	°C	
Cooling	Free Air Convection					
Humidity	RH, Non-condensing			95	%	

Physical						
Parameter	Conditions					
Case Size	2.0 x 1.0 x 0.43 Inches (50.8 x 25.4 x 11.0 mm)					
Case Material	Metal with Non-Conductive Base					
Weight	1.20 Oz (34g)					

Reliability Specifications						
Parameter	Conditions	Min.	Typ.	Max.	Units	
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	233.5			kHours	

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			260.0	°C	

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

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Model Number	Input				Reflected Ripple Current (mA, Typ)	Output			Over Voltage Protection (VDC)	Efficiency (% Typ)	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								
MB5024S-03RU	24	9.0 - 36.0	1,528	80	40	3.3	10,000	0.0	3.9	90	26,000	10.0
MB5024S-05RU	24	9.0 - 36.0	2,290	60	40	5.0	10,000	0.0	6.2	91	17,000	10.0
MB5024S-12RU	24	9.0 - 36.0	2,267	80	40	12.0	4,170	0.0	15.0	92	3,000	10.0
MB5024S-15RU	24	9.0 - 36.0	2,263	80	40	15.0	3,330	0.0	18.0	92	2,000	10.0
MB5024S-24RU	24	9.0 - 36.0	2,286	80	40	24.0	2,080	0.0	30.0	91	750	10.0
MB5048S-03RU	48	18.0 - 75.0	764	40	30	3.3	10,000	0.0	3.9	90	26,000	5.0
MB5048S-05RU	48	18.0 - 75.0	1,145	30	30	5.0	10,000	0.0	6.2	91	17,000	5.0
MB5048S-12RU	48	18.0 - 75.0	1,134	60	30	12.0	4,170	0.0	15.0	92	3,000	5.0
MB5048S-15RU	48	18.0 - 75.0	1,134	60	30	15.0	3,330	0.0	18.0	92	2,000	5.0
MB5048S-24RU	48	18.0 - 75.0	1,143	50	30	24.0	2,080	0.0	30.0	91	750	5.0

For heatsink option, add suffix "H" to model number (i.e. MB5024S-03RU-H)

Notes:

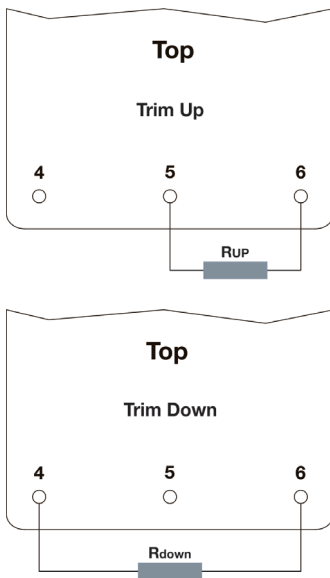
1. Start up time is measured at nominal input and with a constant resistive load.
2. Load regulation is specified for a load change of minimum load to full load.
3. When measuring output ripple, it is recommended that an external 1 µF capacitor and 10 µF capacitor be connected in parallel from the +V<sub>OUT</sub> to the -V<sub>OUT</sub> pins.
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. Operation at no-load will not damage the unit.
7. 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.

Remote On/Off

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:

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

External Trim



An external resistor 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 V<sub>out</sub> trim pin (6). To adjust the output DOWN, connect a 5%, 3W resistor between the plus output pin (4) and the V<sub>out</sub> trim pin (6).

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

MB50xxS-03RU

Trim Down											
V <sub>out</sub>	V <sub>o</sub> x 0.99	V <sub>o</sub> x 0.98	V <sub>o</sub> x 0.97	V <sub>o</sub> x 0.96	V <sub>o</sub> x 0.95	V <sub>o</sub> x 0.94	V <sub>o</sub> x 0.93	V <sub>o</sub> x 0.92	V <sub>o</sub> x 0.91	V <sub>o</sub> x 0.90	Volts
R <sub>DOWN</sub>	72.61	32.55	19.20	12.52	8.51	5.84	3.94	2.51	1.39	0.50	kΩ

Trim Up											
V <sub>out</sub>	V <sub>o</sub> x 1.01	V <sub>o</sub> x 1.02	V <sub>o</sub> x 1.03	V <sub>o</sub> x 1.04	V <sub>o</sub> x 1.05	V <sub>o</sub> x 1.06	V <sub>o</sub> x 1.07	V <sub>o</sub> x 1.08	V <sub>o</sub> x 1.09	V <sub>o</sub> x 1.10	Volts
R <sub>UP</sub>	60.84	27.40	16.25	10.68	7.34	5.11	3.51	2.32	1.39	0.65	kΩ

MB50xxS-05RU

Trim Down											
V <sub>out</sub>	V <sub>o</sub> x 0.99	V <sub>o</sub> x 0.98	V <sub>o</sub> x 0.97	V <sub>o</sub> x 0.96	V <sub>o</sub> x 0.95	V <sub>o</sub> x 0.94	V <sub>o</sub> x 0.93	V <sub>o</sub> x 0.92	V <sub>o</sub> x 0.91	V <sub>o</sub> x 0.90	Volts
R <sub>DOWN</sub>	138.88	62.41	36.92	24.18	16.53	11.44	7.79	5.06	2.94	1.24	kΩ

Trim Up											
V <sub>out</sub>	V <sub>o</sub> x 1.01	V <sub>o</sub> x 1.02	V <sub>o</sub> x 1.03	V <sub>o</sub> x 1.04	V <sub>o</sub> x 1.05	V <sub>o</sub> x 1.06	V <sub>o</sub> x 1.07	V <sub>o</sub> x 1.08	V <sub>o</sub> x 1.09	V <sub>o</sub> x 1.10	Volts
R <sub>UP</sub>	106.87	47.76	28.06	18.21	12.30	8.36	5.55	3.44	1.79	0.48	kΩ

MB50xxS-12RU

Trim Down											
V <sub>out</sub>	V <sub>o</sub> x 0.99	V <sub>o</sub> x 0.98	V <sub>o</sub> x 0.97	V <sub>o</sub> x 0.96	V <sub>o</sub> x 0.95	V <sub>o</sub> x 0.94	V <sub>o</sub> x 0.93	V <sub>o</sub> x 0.92	V <sub>o</sub> x 0.91	V <sub>o</sub> x 0.90	Volts
R <sub>DOWN</sub>	413.55	184.55	108.22	70.05	47.15	31.88	20.98	12.80	6.44	1.35	kΩ

Trim Up											
V <sub>out</sub>	V <sub>o</sub> x 1.01	V <sub>o</sub> x 1.02	V <sub>o</sub> x 1.03	V <sub>o</sub> x 1.04	V <sub>o</sub> x 1.05	V <sub>o</sub> x 1.06	V <sub>o</sub> x 1.07	V <sub>o</sub> x 1.08	V <sub>o</sub> x 1.09	V <sub>o</sub> x 1.10	Volts
R <sub>UP</sub>	351.00	157.50	93.00	60.75	41.40	28.50	19.29	12.37	7.00	2.70	kΩ

MB50xxS-15RU

Trim Down											
V <sub>out</sub>	V <sub>o</sub> x 0.99	V <sub>o</sub> x 0.98	V <sub>o</sub> x 0.97	V <sub>o</sub> x 0.96	V <sub>o</sub> x 0.95	V <sub>o</sub> x 0.94	V <sub>o</sub> x 0.93	V <sub>o</sub> x 0.92	V <sub>o</sub> x 0.91	V <sub>o</sub> x 0.90	Volts
R <sub>DOWN</sub>	530.73	238.61	141.24	92.56	63.35	43.87	29.96	19.53	11.41	4.92	kΩ

Trim Up											
V <sub>out</sub>	V <sub>o</sub> x 1.01	V <sub>o</sub> x 1.02	V <sub>o</sub> x 1.03	V <sub>o</sub> x 1.04	V <sub>o</sub> x 1.05	V <sub>o</sub> x 1.06	V <sub>o</sub> x 1.07	V <sub>o</sub> x 1.08	V <sub>o</sub> x 1.09	V <sub>o</sub> x 1.10	Volts
R <sub>UP</sub>	422.77	189.89	112.26	73.44	50.15	34.63	23.54	15.22	8.75	3.58	kΩ

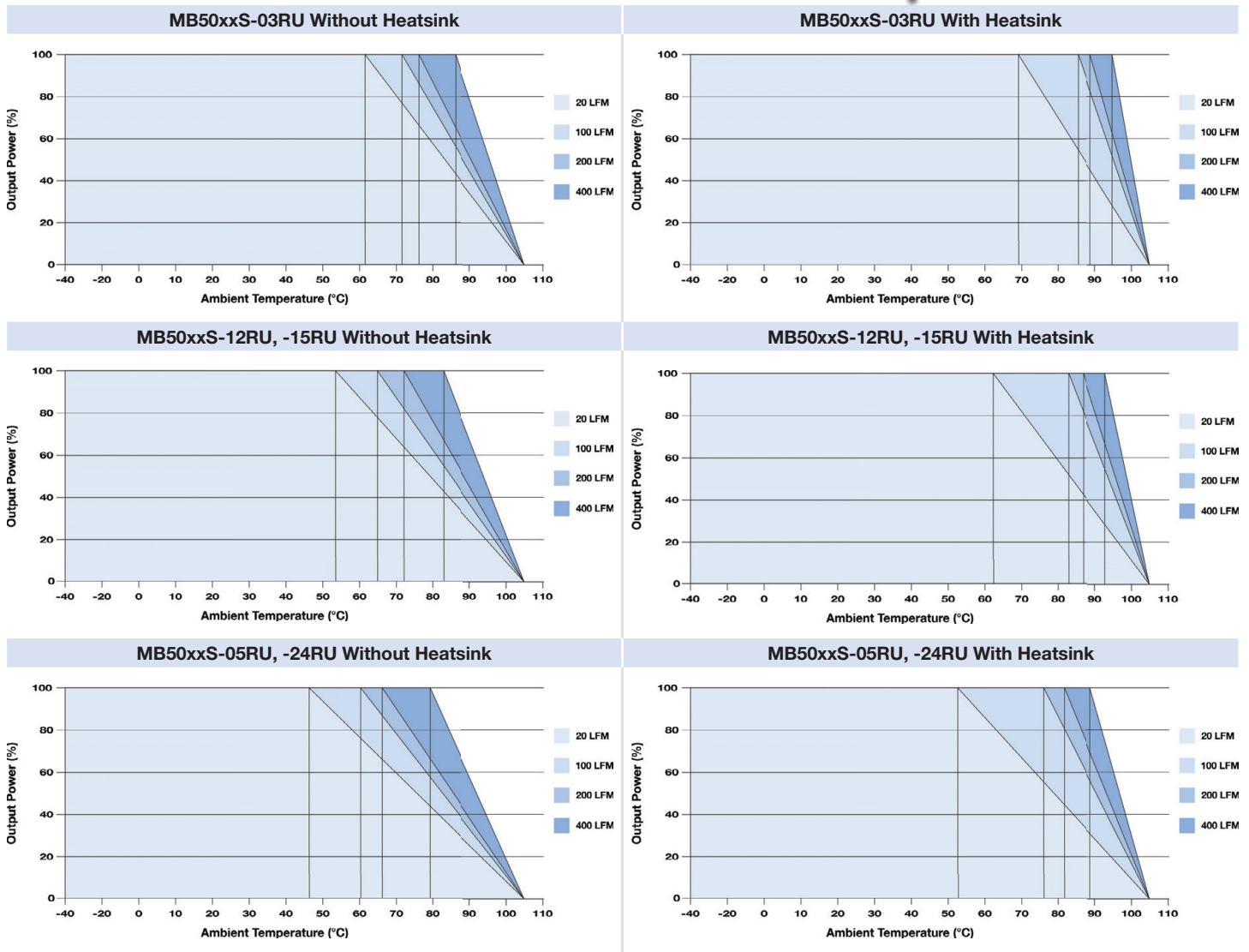
MB50xxS-24RU

Trim Down											
V <sub>out</sub>	V <sub>o</sub> x 0.99	V <sub>o</sub> x 0.98	V <sub>o</sub> x 0.97	V <sub>o</sub> x 0.96	V <sub>o</sub> x 0.95	V <sub>o</sub> x 0.94	V <sub>o</sub> x 0.93	V <sub>o</sub> x 0.92	V <sub>o</sub> x 0.91	V <sub>o</sub> x 0.90	Volts
R <sub>DOWN</sub>	333.39	148.80	87.26	56.50	38.04	25.73	16.94	10.35	5.22	1.12	kΩ

Trim Up											
V <sub>out</sub>	V <sub>o</sub> x 1.01	V <sub>o</sub> x 1.02	V <sub>o</sub> x 1.03	V <sub>o</sub> x 1.04	V <sub>o</sub> x 1.05	V <sub>o</sub> x 1.06	V <sub>o</sub> x 1.07	V <sub>o</sub> x 1.08	V <sub>o</sub> x 1.09	V <sub>o</sub> x 1.10	Volts
R <sub>UP</sub>	243.70	108.50	63.43	40.90	27.38	18.37	11.93	7.10	3.34	0.34	kΩ



## Derating Curves



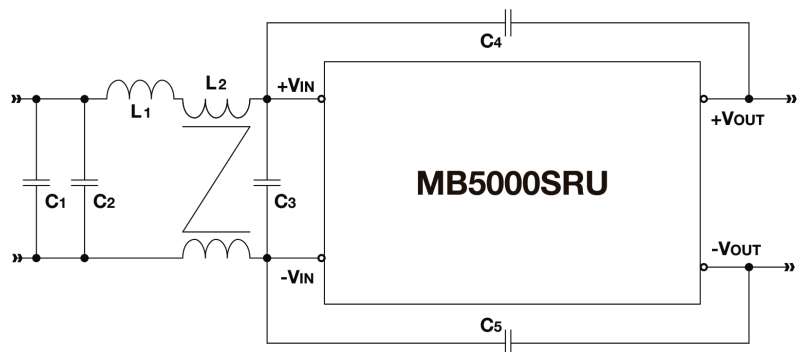
## EMC Specifications

Parameter	Standard	
Radiated Emissions	EN 55022	Class A/B
Conducted Emissions	EN 55022	Class A/B
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 A; ±1 kV
CS	EN 61000-4-6	Criteria A; 10 V/m

### Notes:

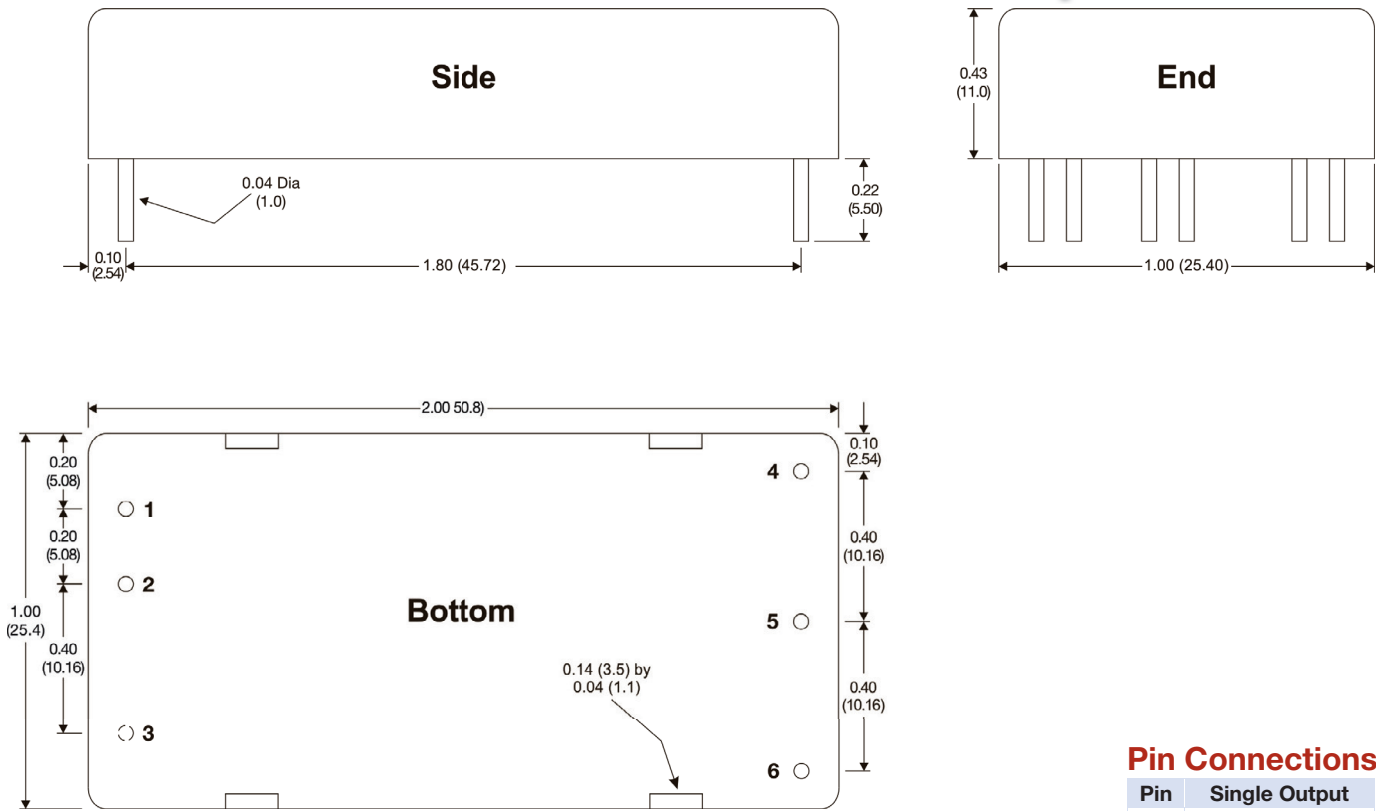
All units should meet EN 55022 (CE/RE) class A/B with the simple external circuit shown at right. To meet the requirements of EN 61000-4-4 and EN 61000-4-5, the value of C<sub>1</sub> should be changed to 220 µF/100V. Contact the factory for more information.

## External Component Connection



Standard	Model	C <sub>1</sub>	C <sub>2</sub>	L <sub>1</sub>	L <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>
EN55022 Class A	MB5024S-xxRU	10 µF/50V 1210 X7S	---	1.5 µH	---	---	---	1,000 pF/2kV 1206 MLCC
	MB5048S-xxRU	3.3 µF/100V 1210 X7S	---	6.8 µH	---	---	---	1,000 pF/2kV 1206 MLCC
EN55022 Class B	MB5024S-xxRU	3.3 µF/100V 1210 X7S	3.3 µF/100V 1210 X7S	---	1 mH	3.3 µF/100V 1210 X7S	1,200 pF/2kV 1808 X7R	1,200 pF/2kV 1808 X7R
	MB5048S-xxRU	3.3 µF/100V 1210 X7S	3.3 µF/100V 1210 X7S	---	1 mH	3.3 µF/100V 1210 X7S	1,200 pF/2kV 1808 X7R	1,200 pF/2kV 1808 X7R

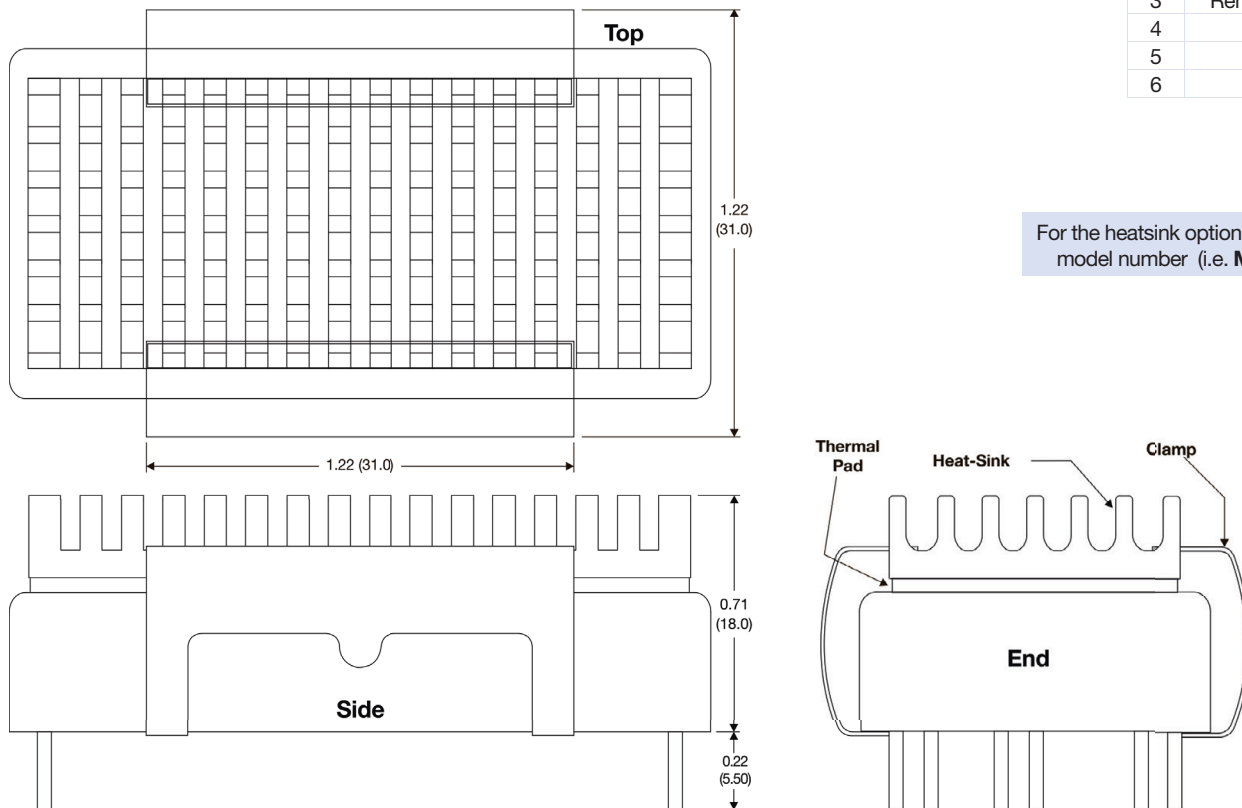
## Mechanical Dimensions



## Pin Connections

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

## Mechanical Dimensions: With Optional Heatsink



For the heatsink option, add suffix "H" to the model number (i.e. **MB5048S-24RU-H**)

## Notes:

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



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