

MI1500RW Series

Compact, 1 x 1 Inch 15W, 2:1 Input Range DC/DC Converters



Key Features:

- 15W Output Power
- 2:1 Input Voltage Range
- EN 60950 Approved
- Compact 1 x 1 Inch Case
- 1,500 VDC Isolation
- 21 Standard Models
- Efficiency to 91%
- Wide Temp Operation
- 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		Min.	Typ.	Max.	Units
Parameter	Conditions				
Input Start Voltage	12 VDC Input			9.0	VDC
	24 VDC Input			18.0	
	48 VDC Input			36.0	
Undervoltage Shutdown	12 VDC Input		7.5		VDC
	24 VDC Input		16		
	48 VDC Input		34		
Input Filter	LC Filter				
Start-Up Time	See Note 2			30	mS
Output		Min.	Typ.	Max.	Units
Parameter	Conditions				
Output Voltage Accuracy	Dual Output, Balanced Loads			±1.0	%
Output Voltage Balance				±2.0	%
Line Regulation, VIN = Min to Max	Single Output			±0.2	%
	Dual Output			±0.5	
	3.3 & 5 Vout			±0.5	
Load Regulation, Min Load to Full Load	12, 15 & 24 Vout			±0.2	%
	Dual Output			±1.0	
	3.3 & 5.0 Vout			75	
Ripple & Noise, See Note 3	12, 15 & Dual Output			100	mV P - P
	24 Vout			150	
Transient Recovery Time, See Note 4	25% Load Step Change		300		µSec
Transient Response Deviation			±3.0	±5.0	
Temperature Coefficient				±0.02	%/°C
Output Power Protection	See Note 5		150		%
Output Short Circuit, See Note 6	Continuous (Autorecovery)				
General		Min.	Typ.	Max.	Units
Parameter	Conditions				
Isolation Voltage	60 Seconds	1,500			VDC
	1 Second	1,800			
Isolation Resistance	500 VDC	1,000			MΩ
Isolation Capacitance	100 kHz, 1V			1,500	pF
Switching Frequency			330		kHz
EMI Characteristics		Standard	Criteria	Level	
Conducted Emissions	EN 55032			Class A	
ESD	EN 61000-4-2	A		±8 kV Air, ±6 kV Contact	
RS	EN 61000-4-3	A		10V/m	
EFT, See Note 7	EN 61000-4-4	A		±2 kV	
Surge, See Note 7	EN 61000-4-5	A		±1 kV	
CS	EN 61000-4-6	A		10 Vrms	
PFMF	EN 61000-4-8	A		3A/m	
Environmental		Min.	Typ.	Max.	Units
Parameter	Conditions				
Operating Temperature Range	See Pages 3 & 4	-40	+25	+80	°C
	Case			+105	
Storage Temperature Range		-50		+125	°C
Cooling	Free Air Convection				
Humidity	RH, Non-condensing			95	%
Physical					
Case Size	See Mechanical Diagrams (Page 5)				
Case Material	Metal with Non-Conductive Base				
Weight	Without Heatsink			0.58 Oz (16.5g)	
	With Heatsink			0.65 Oz (18.5g)	
Reliability Specifications		Min.	Typ.	Max.	Units
Parameter	Conditions				
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	1.49			MHours
Absolute Maximum Ratings		Min.	Typ.	Max.	Units
Parameter	Conditions				
Input Voltage Surge (100 mS)	12 VDC Input			25.0	VDC
	24 VDC Input			50.0	
	48 VDC Input			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				Output			Efficiency (% Typ)	Over Voltage Protection (VDC)	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							
MI1512S-03RW(-H)	12	9.0 - 18.0	1,087	10	3.3	3,400	0.0	86	3.9	5,800	3,000
MI1512S-05RW(-H)	12	9.0 - 18.0	1,404	10	5.0	3,000	0.0	89	6.2	5,100	3,000
MI1512S-12RW(-H)	12	9.0 - 18.0	1,404	10	12.0	1,250	0.0	89	15.0	870	3,000
MI1512S-15RW(-H)	12	9.0 - 18.0	1,404	10	15.0	1,000	0.0	89	18.0	560	3,000
MI1512S-24RW(-H)	12	9.0 - 18.0	1,389	10	24.0	625	0.0	90	30.0	220	3,000
MI1512D-12RW(-H)	12	9.0 - 18.0	1,404	15	±12.0	±625	0.0	89	±15.0	440	3,000
MI1512D-15RW(-H)	12	9.0 - 18.0	1,389	15	±15.0	±500	0.0	90	±18.0	280	3,000
MI1524S-03RW(-H)	24	18.0 - 36.0	544	8	3.3	3,400	0.0	86	3.9	5,800	2,000
MI1524S-05RW(-H)	24	18.0 - 36.0	710	8	5.0	3,000	0.0	88	6.2	5,100	2,000
MI1524S-12RW(-H)	24	18.0 - 36.0	694	8	12.0	1,250	0.0	90	15.0	870	2,000
MI1524S-15RW(-H)	24	18.0 - 36.0	694	8	15.0	1,000	0.0	90	18.0	560	2,000
MI1524S-24RW(-H)	24	18.0 - 36.0	687	8	24.0	625	0.0	91	30.0	220	2,000
MI1524D-12RW(-H)	24	18.0 - 36.0	694	10	±12.0	±625	0.0	90	±15.0	440	2,000
MI1524D-15RW(-H)	24	18.0 - 36.0	694	10	±15.0	±500	0.0	90	±18.0	280	2,000
MI1548S-03RW(-H)	48	36.0 - 75.0	269	8	3.3	3,400	0.0	87	3.9	5,800	1,000
MI1548S-05RW(-H)	48	36.0 - 75.0	355	8	5.0	3,000	0.0	88	6.2	5,100	1,000
MI1548S-12RW(-H)	48	36.0 - 75.0	347	8	12.0	1,250	0.0	90	15.0	870	1,000
MI1548S-15RW(-H)	48	36.0 - 75.0	347	8	15.0	1,000	0.0	90	18.0	560	1,000
MI1548S-24RW(-H)	48	36.0 - 75.0	343	8	24.0	625	0.0	91	30.0	220	1,000
MI1548D-12RW(-H)	48	36.0 - 75.0	351	10	±12.0	±625	0.0	89	±15.0	440	1,000
MI1548D-15RW(-H)	48	36.0 - 75.0	347	10	±15.0	±500	0.0	90	±18.0	280	1,000

Notes:

- The specified maximum capacitive load is for each output.
- Start up time is measured at nominal input and with a constant resistive load.
- When measuring output ripple, it is recommended that an external 1 μF ceramic capacitor be connected in parallel from the +Vout to the -Vout pin for single output units; or from each output to common for dual output units.
- Transient recovery is measured to within a 1% error band for a load step change of 25%.
- Over Power protection is provided by a "hiccup mode" current limiting circuit.
- Short circuit protection is provided by a "hiccup mode" circuit.
- To meet the requirements of EN 61000-4-4 and EN 61000-4-5, an external capacitor must be placed across the input to the unit. The recommended values are 470 μF/100V for 12 VIN, 3.3 & 5 Vout models and 220 μF/100V for all other models.
- On dual output models, the cross regulation for asymmetrical loads (25%/100%) is ±5% max.
- The output over voltage protection circuit is independent of the primary regulation loop. It provides redundant protection against any possible overvoltage.
- Operation at no-load will not damage these units.
- 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.

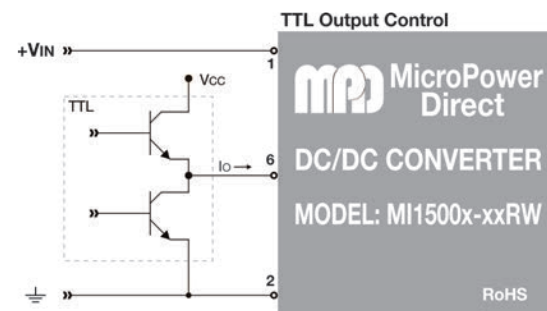
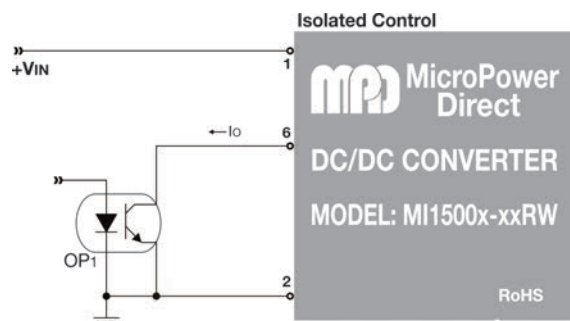
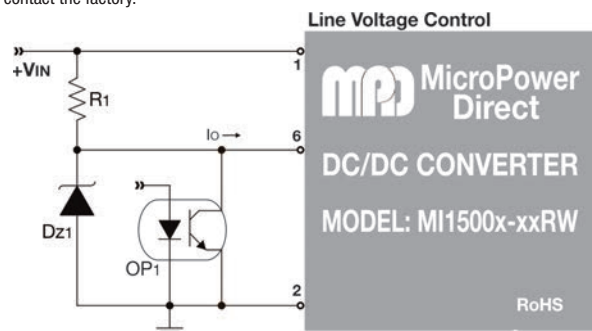
For heatsink option, add suffix "H" to model number (i.e. **MI1512S-05RW-H**)

Remote On/Off

All models of the MI1500RW series can be turned on/off remotely by applying by applying a positive logic signal to pin 6. The specifications for the ON/OFF function are given in the table below.

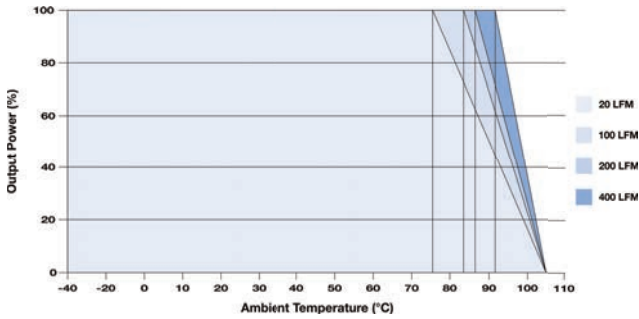
Parameter	Min	Typ	Max	Units
Supply On	3.5		12.0	VDC
Supply Off	0.0		1.2	VDC
Standby Input Current		3.0		mA
Control Common	Referenced to Negative Input (pin 2)			
Control Input Current (ON)			0.5	mA
Control Input Current (OFF)			-0.5	mA

The maximum sink current at the control pin (pin 6) during a logic low is -500 μA. The maximum allowable leakage current of a switch connected to the control pin during a logic high is 10 mA. The switch used can be an open collector transistor, FET or optocoupler. Three possible connections are illustrated in the diagrams below and at right. For more information, please contact the factory.

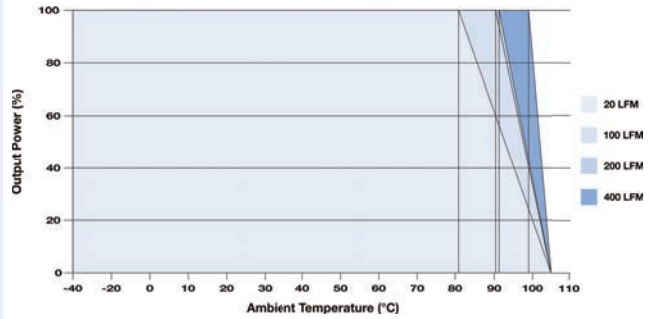


Derating Curves

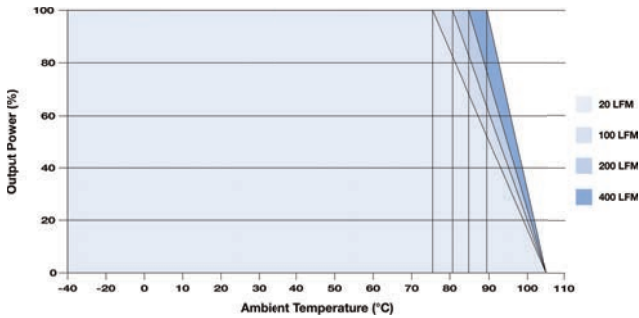
MI1524S-24RW, MI1548S-24RW Without Heatsink



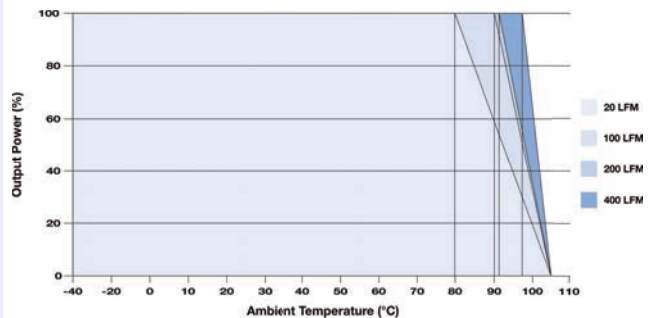
MI1524S-24RW, MI1548S-24RW With Heatsink



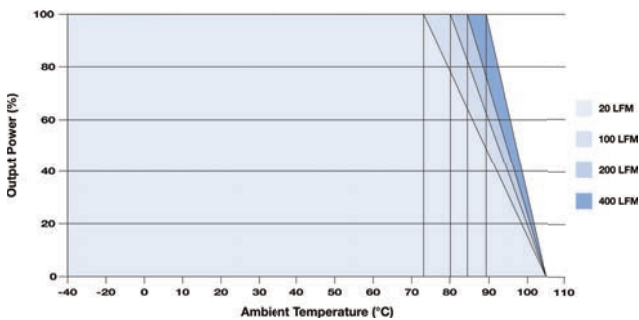
MI1524S-12RW/-15RW, MI1548S-12RW/-15RW, 1512D-15RW, 1524D-12RW/-15RW, MI1512S-24RW, 1548D-15RW, 1512D-15RW Without Heatsink



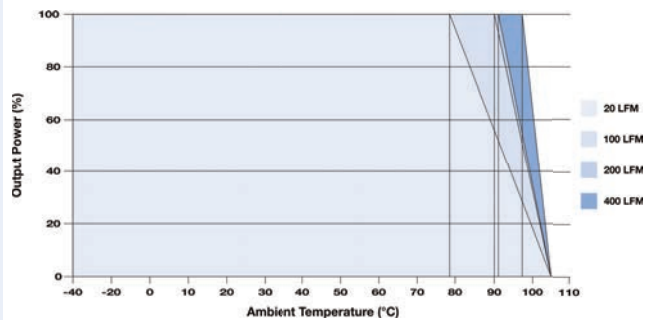
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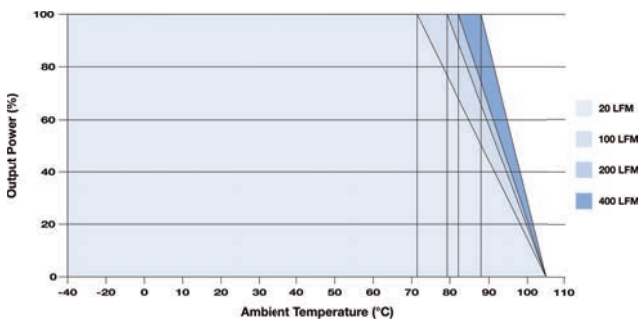
MI1548S-03RW Without Heatsink



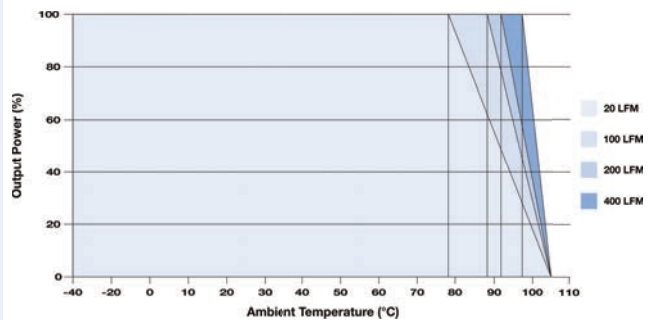
MI1548S-03RW With Heatsink



MI1512S-03RW, MI1524S-03RW Without Heatsink



MI1512S-03RW, MI1524S-03RW With Heatsink



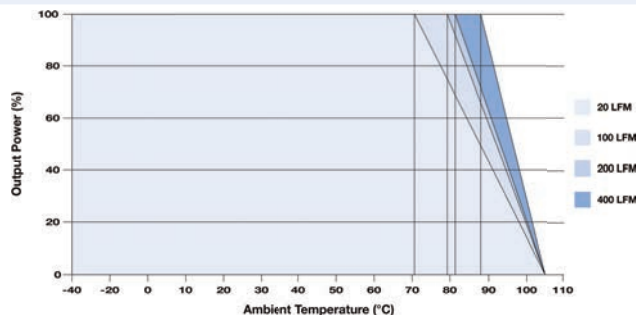
Thermal Impedance

Air Flow	Without Heatsink	With Heatsink	Units
Natural Convection	18.2	15.3	°C/W
100 LFM	13.9	8.8	°C/W
200 LFM	12.1	6.8	°C/W
400 LFM	9.1	4.6	°C/W

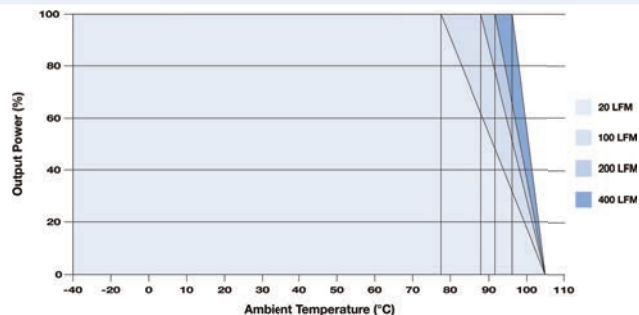
Note: Natural Convection equals 20 LFM

Efficiency Vs Output Load Curves

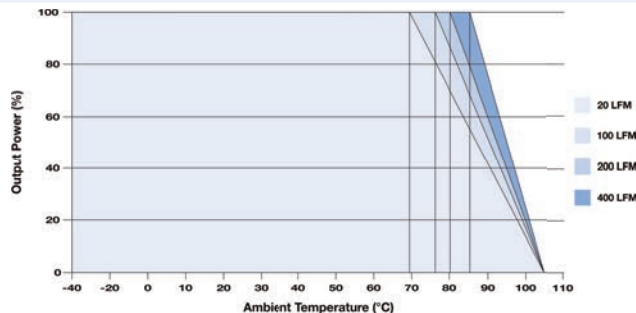
MI1512S-05RW/12RW/15RW, MI1512D-12RW,
MI1548S-12RW Without Heatsink



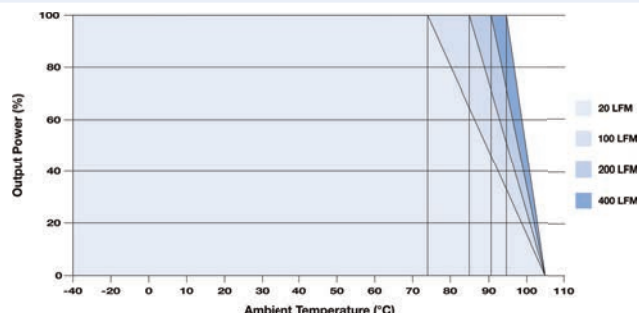
MI1512S-05RW/12RW/15RW, MI1512D-12RW,
MI1548S-12RW With Heatsink



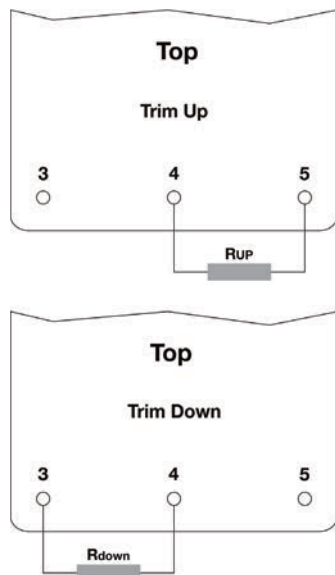
MI1524S-05RW, MI1548S-05RW Without Heatsink



MI1524S-05RW, MI1548S-05RW With Heatsink



External Trim



MI15xxS-03RW

Trim Down

Vout	$V_o \times 0.99$	$V_o \times 0.98$	$V_o \times 0.97$	$V_o \times 0.96$	$V_o \times 0.95$	$V_o \times 0.94$	$V_o \times 0.93$	$V_o \times 0.92$	$V_o \times 0.91$	$V_o \times 0.90$	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	$V_o \times 1.01$	$V_o \times 1.02$	$V_o \times 1.03$	$V_o \times 1.04$	$V_o \times 1.05$	$V_o \times 1.06$	$V_o \times 1.07$	$V_o \times 1.08$	$V_o \times 1.09$	$V_o \times 1.10$	Volts
RUP	60.84	27.40	16.25	10.68	7.34	5.11	3.51	2.32	1.39	0.65	kΩ

MI15xxS-05RW

Trim Down

Vout	$V_o \times 0.99$	$V_o \times 0.98$	$V_o \times 0.97$	$V_o \times 0.96$	$V_o \times 0.95$	$V_o \times 0.94$	$V_o \times 0.93$	$V_o \times 0.92$	$V_o \times 0.91$	$V_o \times 0.90$	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	$V_o \times 1.01$	$V_o \times 1.02$	$V_o \times 1.03$	$V_o \times 1.04$	$V_o \times 1.05$	$V_o \times 1.06$	$V_o \times 1.07$	$V_o \times 1.08$	$V_o \times 1.09$	$V_o \times 1.10$	Volts
RUP	106.87	47.76	28.06	18.21	12.30	8.36	5.55	3.44	1.79	0.48	kΩ

MI15xxS-12RW

Trim Down

Vout	$V_o \times 0.99$	$V_o \times 0.98$	$V_o \times 0.97$	$V_o \times 0.96$	$V_o \times 0.95$	$V_o \times 0.94$	$V_o \times 0.93$	$V_o \times 0.92$	$V_o \times 0.91$	$V_o \times 0.90$	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	$V_o \times 1.01$	$V_o \times 1.02$	$V_o \times 1.03$	$V_o \times 1.04$	$V_o \times 1.05$	$V_o \times 1.06$	$V_o \times 1.07$	$V_o \times 1.08$	$V_o \times 1.09$	$V_o \times 1.10$	Volts
RUP	351.00	157.50	93.00	60.75	41.40	28.50	19.29	12.37	7.00	2.70	kΩ

MB15xxS-15RW

Trim Down

Vout	$V_o \times 0.99$	$V_o \times 0.98$	$V_o \times 0.97$	$V_o \times 0.96$	$V_o \times 0.95$	$V_o \times 0.94$	$V_o \times 0.93$	$V_o \times 0.92$	$V_o \times 0.91$	$V_o \times 0.90$	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	$V_o \times 1.01$	$V_o \times 1.02$	$V_o \times 1.03$	$V_o \times 1.04$	$V_o \times 1.05$	$V_o \times 1.06$	$V_o \times 1.07$	$V_o \times 1.08$	$V_o \times 1.09$	$V_o \times 1.10$	Volts
RUP	422.77	189.89	112.26	73.44	50.15	34.63	23.54	15.22	8.75	3.58	kΩ

MB15xxS-24RW

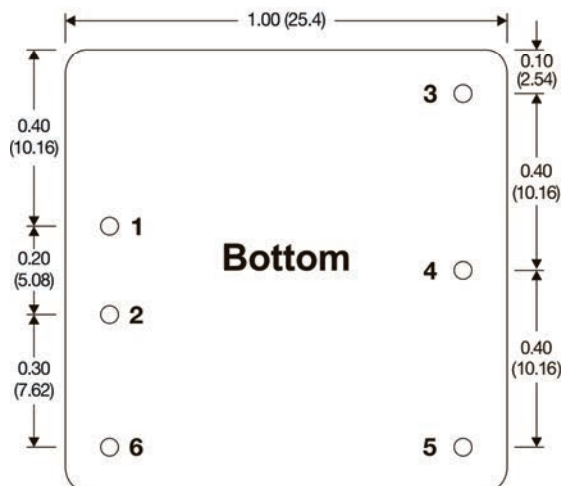
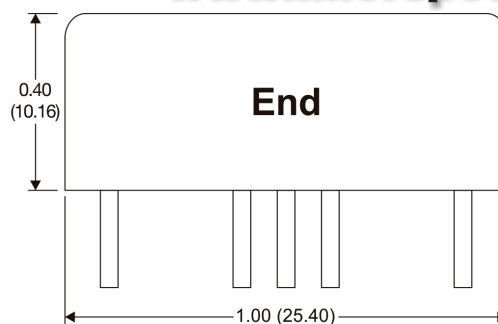
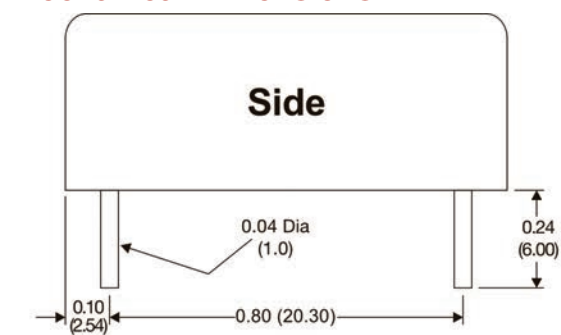
Trim Down

Vout	$V_o \times 0.99$	$V_o \times 0.98$	$V_o \times 0.97$	$V_o \times 0.96$	$V_o \times 0.95$	$V_o \times 0.94$	$V_o \times 0.93$	$V_o \times 0.92$	$V_o \times 0.91$	$V_o \times 0.90$	Volts
RDOWN	598.66	267.78	157.49	102.34	69.25	47.19	31.44	19.62	10.43	3.08	kΩ

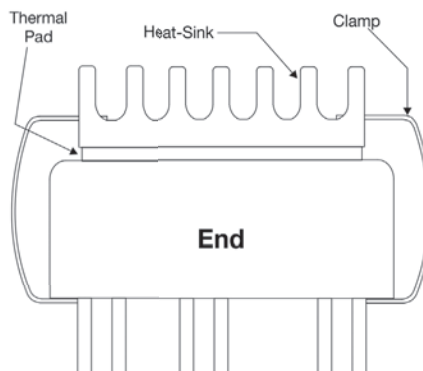
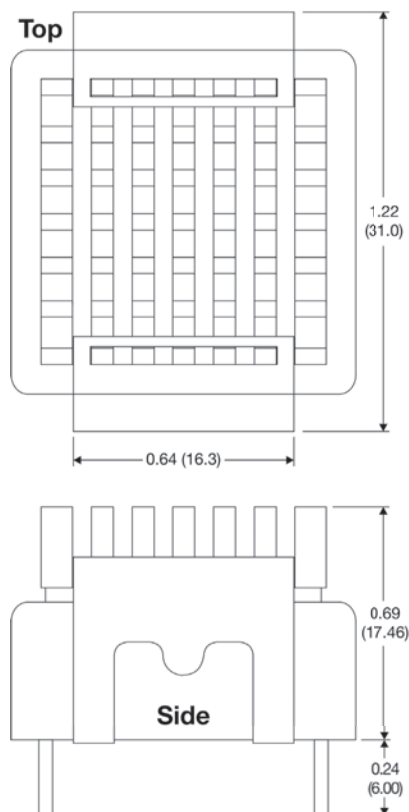
Trim Up

Vout	$V_o \times 1.01$	$V_o \times 1.02$	$V_o \times 1.03$	$V_o \times 1.04$	$V_o \times 1.05$	$V_o \times 1.06$	$V_o \times 1.07$	$V_o \times 1.08$	$V_o \times 1.09$	$V_o \times 1.10$	Volts
RUP	487.14	218.02	128.31	83.46	56.55	38.61	25.79	16.18	8.70	2.72	kΩ

Mechanical Dimensions



Mechanical Dimensions: With Optional Heatsink



Pin Connections

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

For the heatsink option, add suffix "H" to the model number (i.e. **MI1524S-12RW-H**)

Notes:

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