MR50SRW

50W,Quarter Brick Wide Input Railway DC/DC Converter

Key Features:

- 50W Output Power
- Meets EN 50155
- 3,000 VAC rms Isolation
- Reinforced Insulation
- 43-101V & 66-160V Inputs
- UL 62368 Approved
- EN 50121-3-2 Compliant
- Standard ¼ Brick Package
- Meets EN 45545
- Meets EN 60068
- Under Voltage Protection
- Over Voltage Protection
- 92% Efficiency
- Meets EN 61373
- Remote On/Off
- Optional Heat Sink

MicroPower Direct
46 Eastman Street
Unit 1
Easton, MA 02375
USA

T: (781) 344-8226
F: (781) 344-8481
E: sales@micropowerdirect.com
W: www.micropowerdirect.com

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	72 VDC Input	43.0	72.0	101.0	VDC
	110 VDC Input	66.0	110.0	160.0	
Input Start Voltage	72 VDC Input			43.0	VDC
	110 VDC Input			66.0	
Under Voltage Shutdown	72 VDC Input		40.0		VDC
	110 VDC Input		63.0		
Input Filter	PI (π) Filter				

Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy				±1.0	%
Line Regulation	VIN = Min to Max			±0.2	%
Load Regulation	IOUT = 0% to 100%			±0.3	%
Ripple & Noise (20 MHz)	See Note 1		100		mV Pk-Pk
Transient Response Time, See Note 2	25% Load Change		250		µS
Temperature Coefficient				±0.02	%/°C
Output Over Load Protection	See Note 3		150		%IOUT
Output Short Circuit	Continuous (Hiccup Mode)				

General

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage, Reinforced Insulation	Input/Output, 60 Sec	3,000			VAC rms
	Input/Output to Case	1,500			VDC
Isolation Resistance	500 VDC	1,000			MΩ
Isolation Capacitance	100 kHz/1V			3,000	pF
Switching Frequency			320		kHz

Environmental

Parameter	Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range	Ambient, See Note 4	-40	+25	+75	°C
Thermal Impedance, Without Heat Sink	Natural Convection	7.5			°C/W
	100 LFM	6.1			
	200 LFM	5.3			
	400 LFM	3.9			
Thermal Impedance, With Heat Sink	Natural Convection	6.8			°C/W
	100 LFM	4.1			
	200 LFM	3.3			
	400 LFM	2.2			
Operating Temperature Range	Base Plate	-40		+105	°C
Thermal Shutdown	Base Plate		+110		°C
Cooling	See Derating Curves (Starting Page 3)				
Humidity	RH, Non-condensing			95	%

Physical

Case Size & Weight	See Mechanical Diagram (Page 7)
Case Material	Black Anodized Aluminum Case with Aluminum Plate/Heat Sink

Remote On/Off

Parameter	Conditions	Min.	Typ.	Max.	Units
Unit On	3.5 VDC - 12.0 VDC or Open Circuit				
Unit Off	0 VDC - 1.2 VDC or Short Circuit				
Control Input Current, ON	VCTRL = 5V		0.5		mA
Control Input Current, OFF	VCTRL = 0V		-0.5		mA
Control Common	Referenced to -VIN (Pin 3)				
Standby Input Current			2.5		mA

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	314.9			kHrs

Absolute Maximum Ratings, See Note 5

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage Surge (100 mS)	72 VDC Input	-0.7		165.0	VDC
	110 VDC Input	-0.7		250.0	
Lead Temperature	1.5 mm From Case for 10 Sec			260	°C

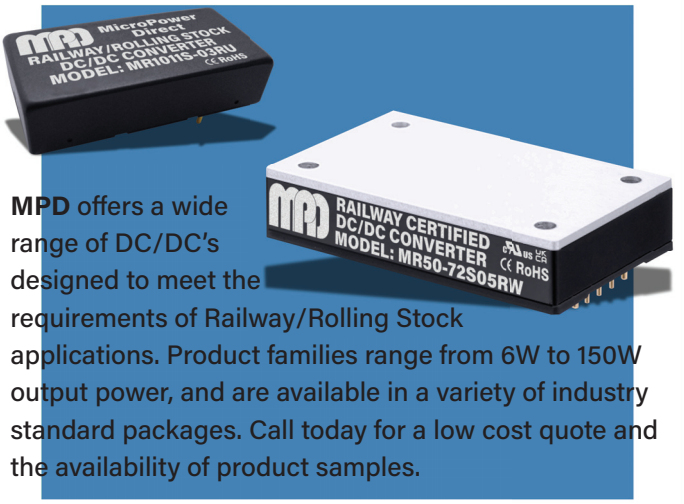
Model Selection Guide

Model Number	Input				Output		Reflected Ripple Current (mA Typ)	Over Voltage Protection (VDC)	Capacitive Load (µF, Max)	Efficiency (%, Typ)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (A)					
	Nominal	Range	Full-Load	No-Load							
MR50-72S05RW(-H)	72	43 - 101	771	50	5.0	10.00	35	6.2	17,000	90	2,100
MR50-72S12RW(-H)	72	43 - 101	755	45	12.0	4.17	35	15	2,950	92	2,100
MR50-72S15RW(-H)	72	43 - 101	754	45	15.0	3.33	35	18	1,900	92	2,100
MR50-72S24RW(-H)	72	43 - 101	762	50	24.0	2.08	35	30	740	91	2,100
MR50-110S05RW(-H)	110	66 - 160	505	40	5.0	10.00	35	6.2	17,000	90	1,500
MR50-110S12RW(-H)	110	66 - 160	500	35	12.0	4.17	35	15	2,950	91	1,500
MR50-110S15RW(-H)	110	66 - 160	494	35	15.0	3.33	35	18	1,900	92	1,500
MR50-110S24RW(-H)	110	66 - 160	499	40	24.0	2.08	35	30	740	91	1,500

Notes:

1. Output noise is measured with a 10 µF tantalum capacitor and a 1.0 µF ceramic capacitor connected in parallel across the output. Ripple & noise is 150 mV typical for 24 VDC output models.
2. Transient recovery is measured to within a 1% error band for a load step change of 75% to 100%.
3. Output overload protection is provided by a "hiccup" mode circuit
4. The ambient temperature range is the maximum possible for a converter with a heatsink mounted. Natural convection is 20 LFM, not "still air". See the power derating curves on page 3 for the operating temperature limits for specific models.
5. Exceeding absolute maximum ratings may damage the module. These are not continuous operating ratings.
6. Operation at no-load will not damage these units, but they may not meet all specifications.
7. If the remote sense outputs are not used, the +Sense (pin 7) should be connected to +Vout (pin 8) and the -Sense (pin 5) should be connected to -Vout (pin 4).
8. It is recommended that a fuse be used on the input of a power supply for protection. For the correct rating, see the model selection table above.

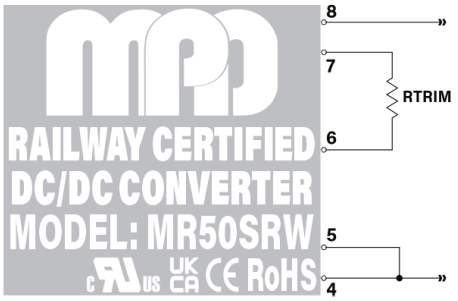
For heatsink option, add "-H" to model number (i.e. MR50-72S12RW-H)



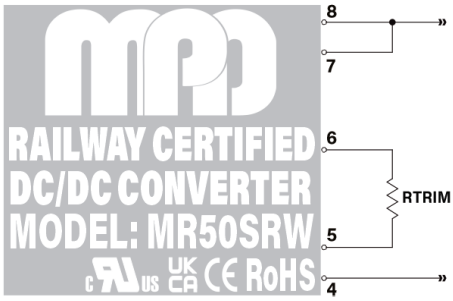
MPD offers a wide range of DC/DC's designed to meet the requirements of Railway/Rolling Stock applications. Product families range from 6W to 150W output power, and are available in a variety of industry standard packages. Call today for a low cost quote and the availability of product samples.

Output Voltage Adjustment

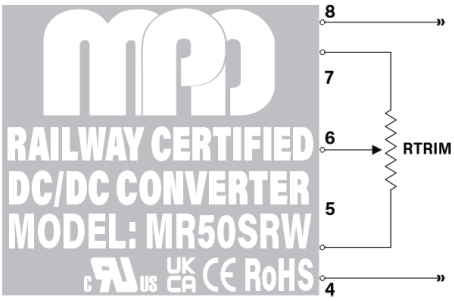
Trim Down



Trim Up



Trim Up/Down



A simple external circuit may be used to adjust the converter output. The range of adjustment is ±10%.

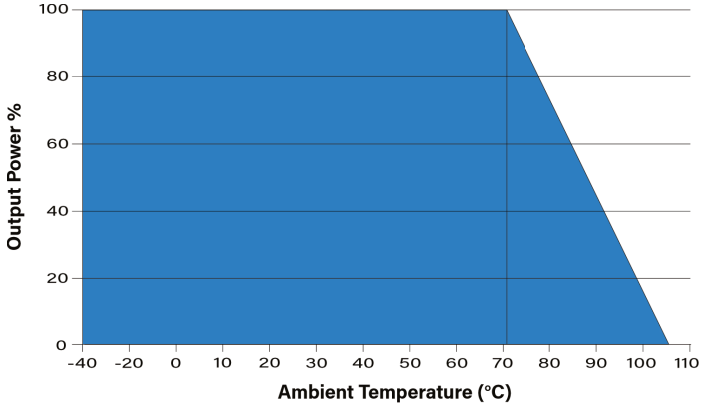
To adjust the output down, connect a 5%, 3W resistor from the plus sense pin (7) to the Vout trim pin (6). To adjust the output up, connect a 5%, 3W resistor from the minus sense pin (5) to the Vout trim pin. For up/down trimming, connect a 10 kV potentiometer from the plus to the minus sense pins. Connect the wiper arm to the Vout trim pin.

See the table below for trim resistor values.

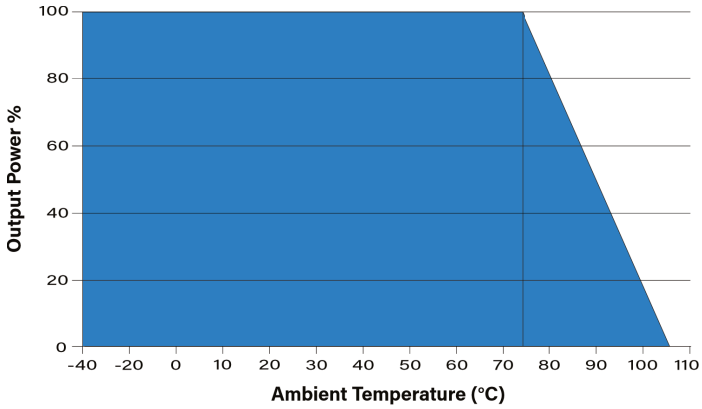
	MR50-XXS05		MR50-XXS12		MR50-XXS15		MR50-XXS24	
Trim Range %	Trim Down (kΩ)	Trim Up (kΩ)	Trim Down (kΩ)	Trim Up (kΩ)	Trim Down (kΩ)	Trim Up (kΩ)	Trim Down (kΩ)	Trim Up (kΩ)
1	138.88	106.87	413.55	351.00	530.73	422.77	598.66	487.14
2	62.41	47.76	184.55	157.50	238.61	189.89	267.78	218.02
3	36.92	28.06	108.22	93.00	141.24	112.26	157.49	128.31
4	24.18	18.21	70.05	60.75	92.56	73.44	102.34	83.46
5	16.53	12.30	47.15	41.40	63.35	50.15	69.25	56.55
6	11.44	8.36	31.88	28.50	43.87	34.63	47.19	38.61
7	7.79	5.55	20.98	19.29	29.96	23.54	31.44	25.79
8	5.06	3.44	12.80	12.37	19.53	15.22	19.62	16.18
9	2.94	1.79	6.44	7.00	11.41	8.75	10.43	8.70
10	1.24	0.48	1.35	2.70	4.92	3.58	3.08	2.72

Power Derating Curves

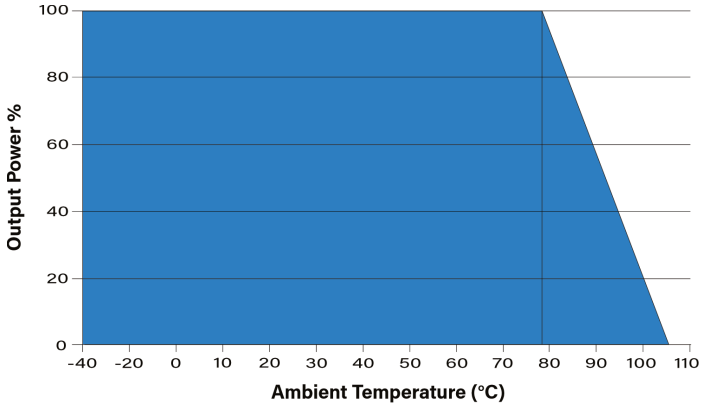
MR50-72S12RW, **72S15RW** & **110S15RW** - 20 LFM without Heatsink



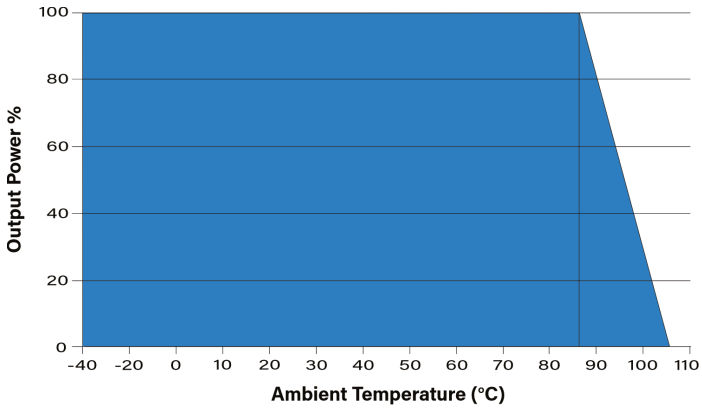
MR50-72S12RW, **72S15RW** & **110S15RW** - 20 LFM with Heatsink



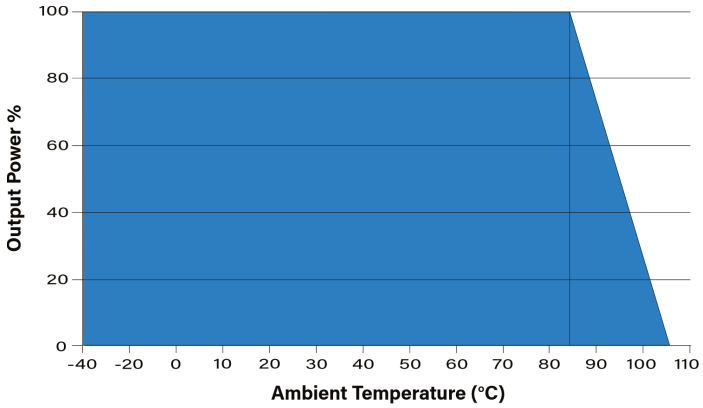
MR50-72S12RW, **72S15RW** & **110S15RW** - 100 LFM without Heatsink



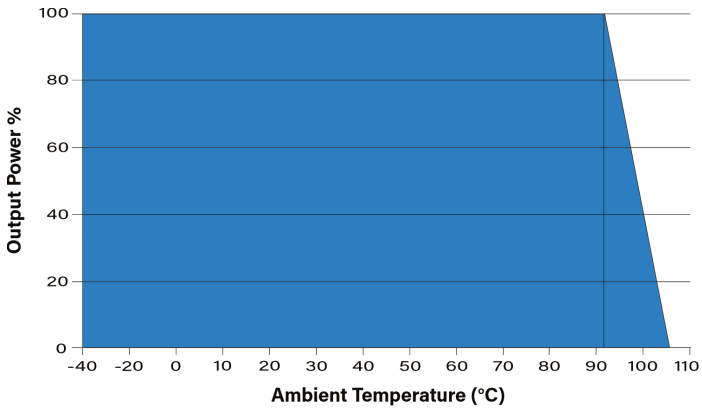
MR50-72S12RW, **72S15RW** & **110S15RW** - 100 LFM with Heatsink



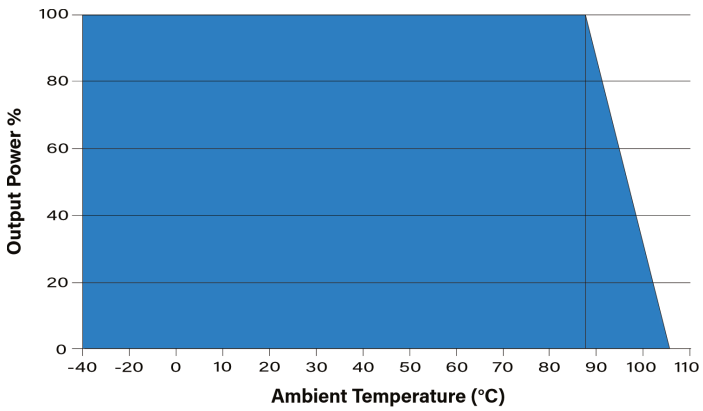
MR50-72S12RW, **72S15RW** & **110S15RW** - 200 LFM without Heatsink



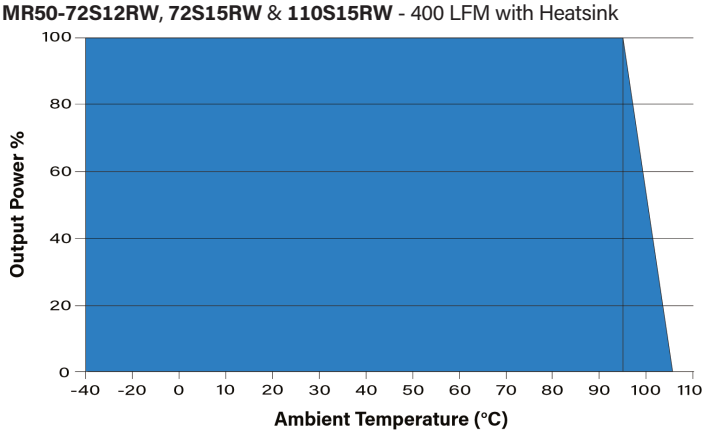
MR50-72S12RW, **72S15RW** & **110S15RW** - 200 LFM with Heatsink



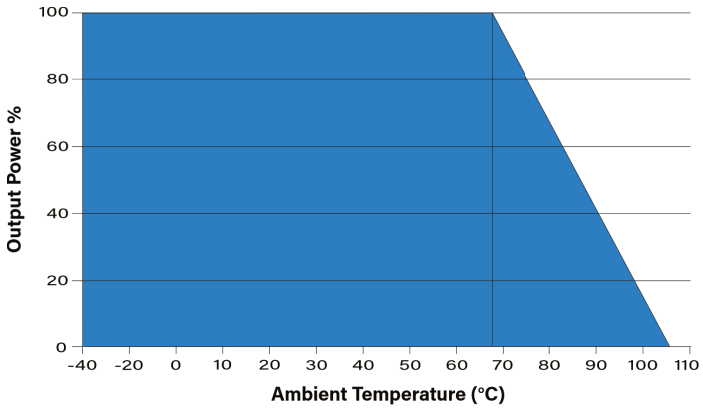
MR50-72S12RW, **72S15RW** & **110S15RW** - 400 LFM without Heatsink



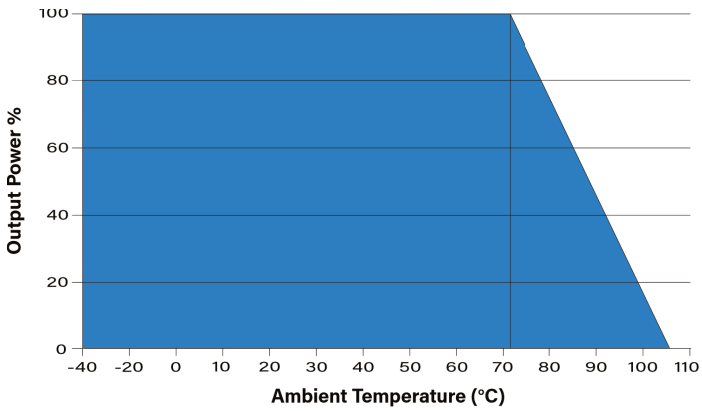
MR50-72S12RW, **72S15RW** & **110S15RW** - 400 LFM with Heatsink



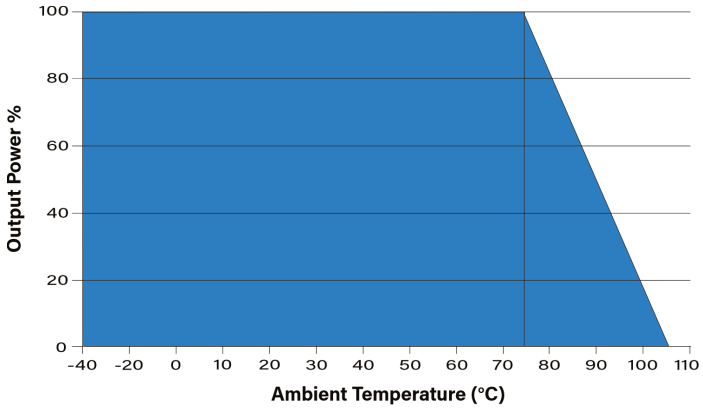
MR50-72S24RW, 110S12RW & **110S24RW** - 20 LFM without Heatsink



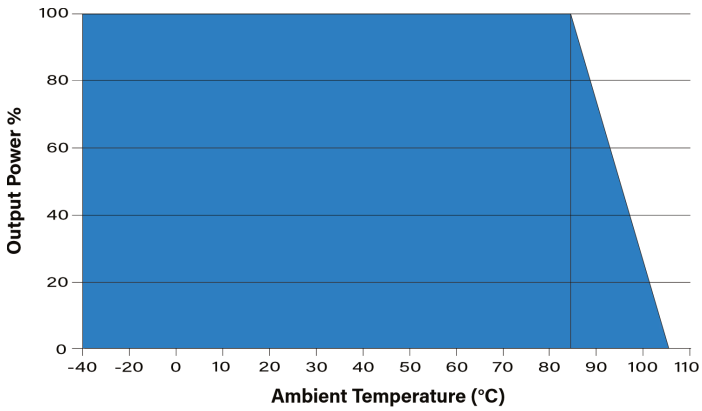
MR50-72S24RW, 110S12RW & **110S24RW** - 20 LFM with Heatsink



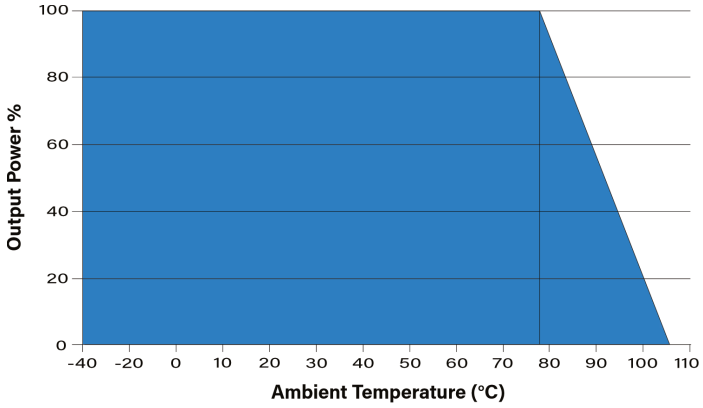
MR50-72S24RW, 110S12RW & **110S24RW** - 100 LFM without Heatsink



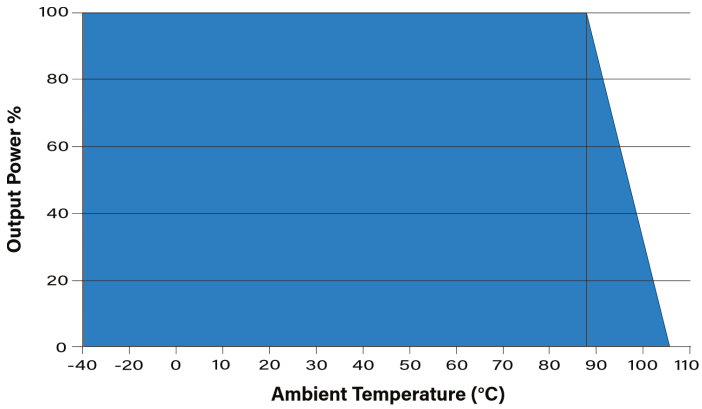
MR50-72S24RW, 110S12RW & **110S24RW** - 100 LFM with Heatsink



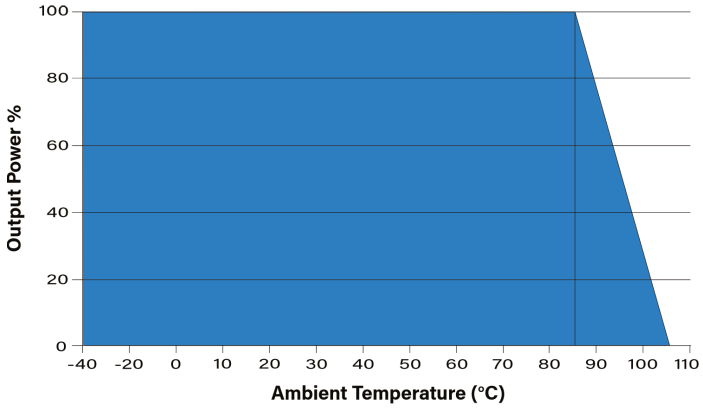
MR50-72S24RW, 110S12RW & **110S24RW** - 200 LFM without Heatsink



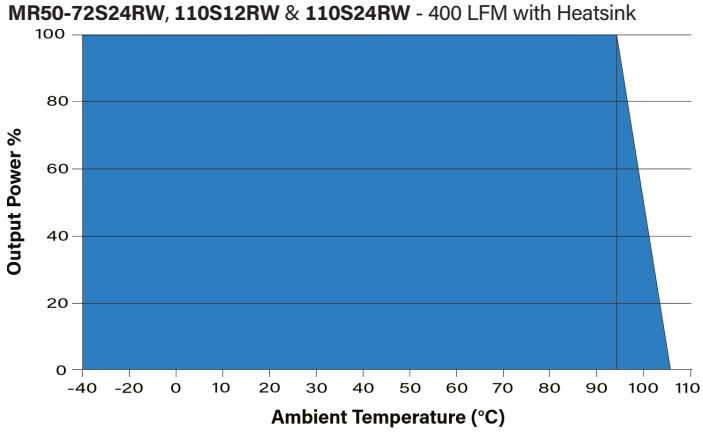
MR50-72S24RW, 110S12RW & **110S24RW** - 200 LFM with Heatsink



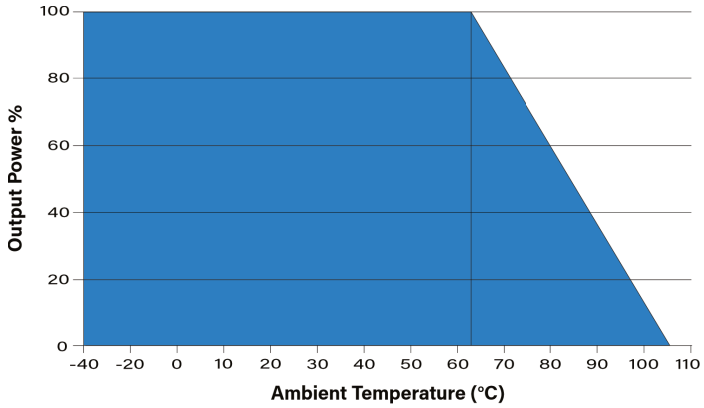
MR50-72S24RW, 110S12RW & **110S24RW** - 400 LFM without Heatsink



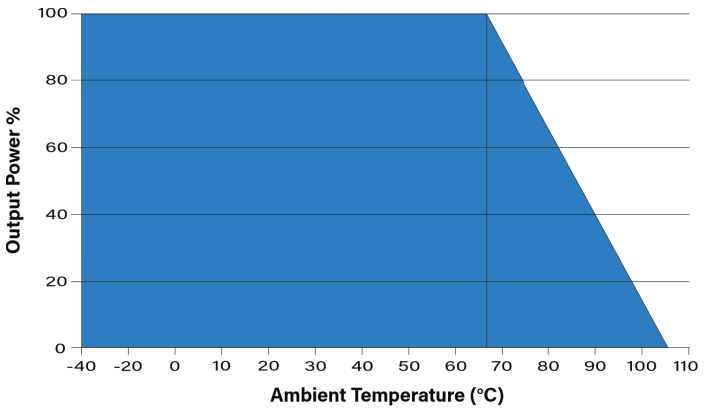
MR50-72S24RW, 110S12RW & **110S24RW** - 400 LFM with Heatsink



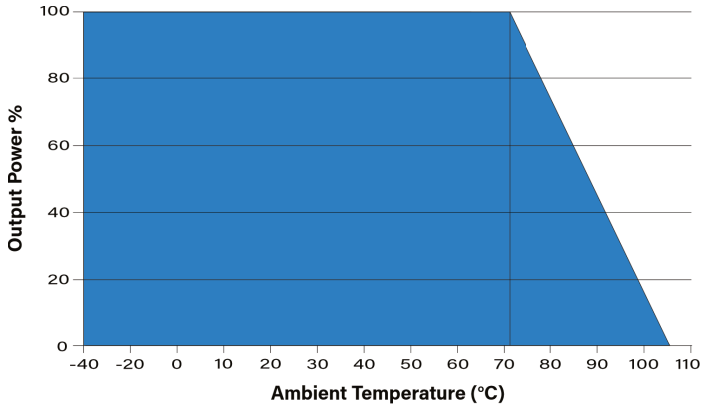
MR50-72S05RW & 110S05RW - 20 LFM without Heatsink



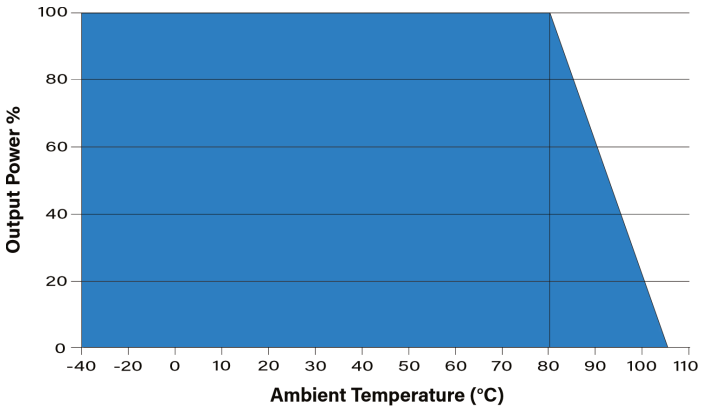
MR50-72S05RW & 110S05RW - 20 LFM with Heatsink



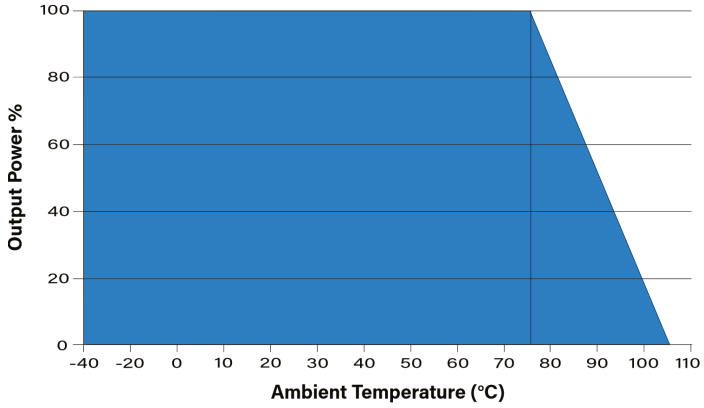
MR50-72S05RW & 110S05RW - 100 LFM without Heatsink



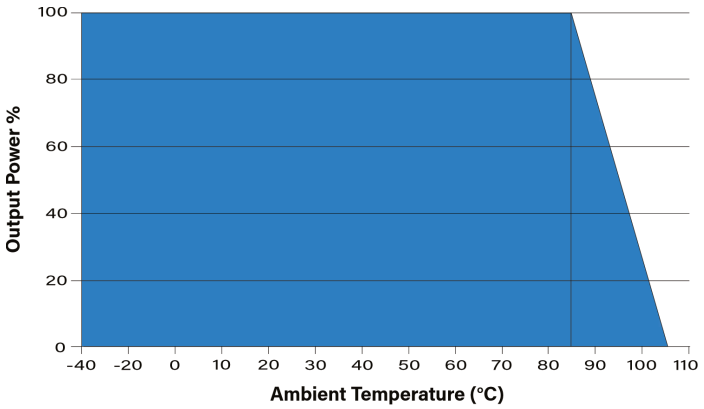
MR50-72S05RW & 110S05RW - 100 LFM with Heatsink



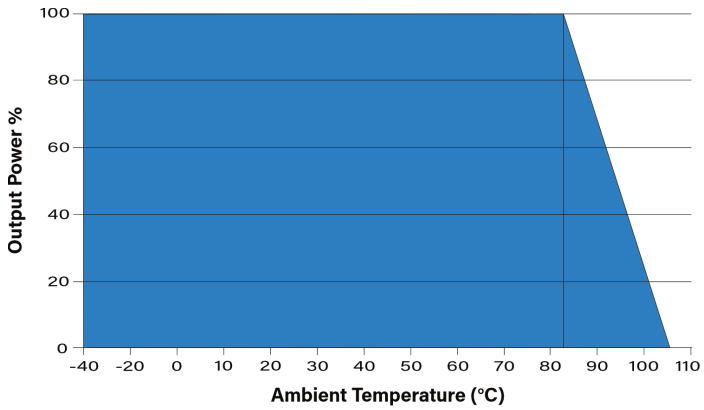
MR50-72S05RW & 110S05RW - 200 LFM without Heatsink



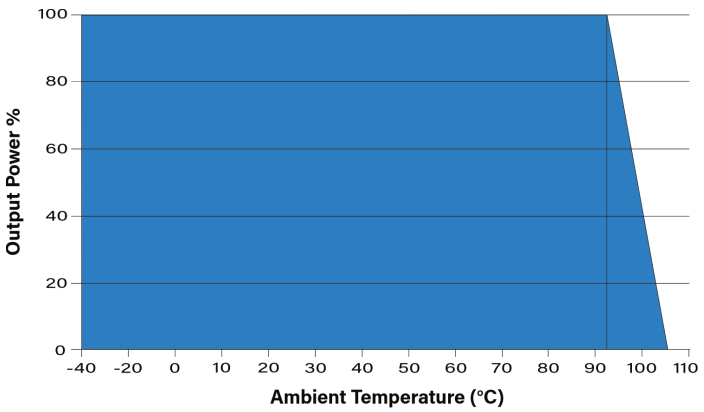
MR50-72S05RW & 110S05RW - 200 LFM with Heatsink



MR50-72S05RW & 110S05RW - 400 LFM without Heatsink



MR50-72S05RW & 110S05RW - 400 LFM with Heatsink



EMC Specifications

Parameter	Standard		Criteria	Level
Radiated Emissions	See Note 1	EN 55032/11		Class A
Conducted Emissions	See Note 1	EN 55032/11		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 2	EN 61000-4-4	A	±2 kV
Surge	See Note 2	EN 61000-4-5	A	±2 kV
CS		EN 61000-4-6	A	10 V/rms
PFMF		EN 61000-4-8	A	100 A/m (1,000 A/m For 1s)

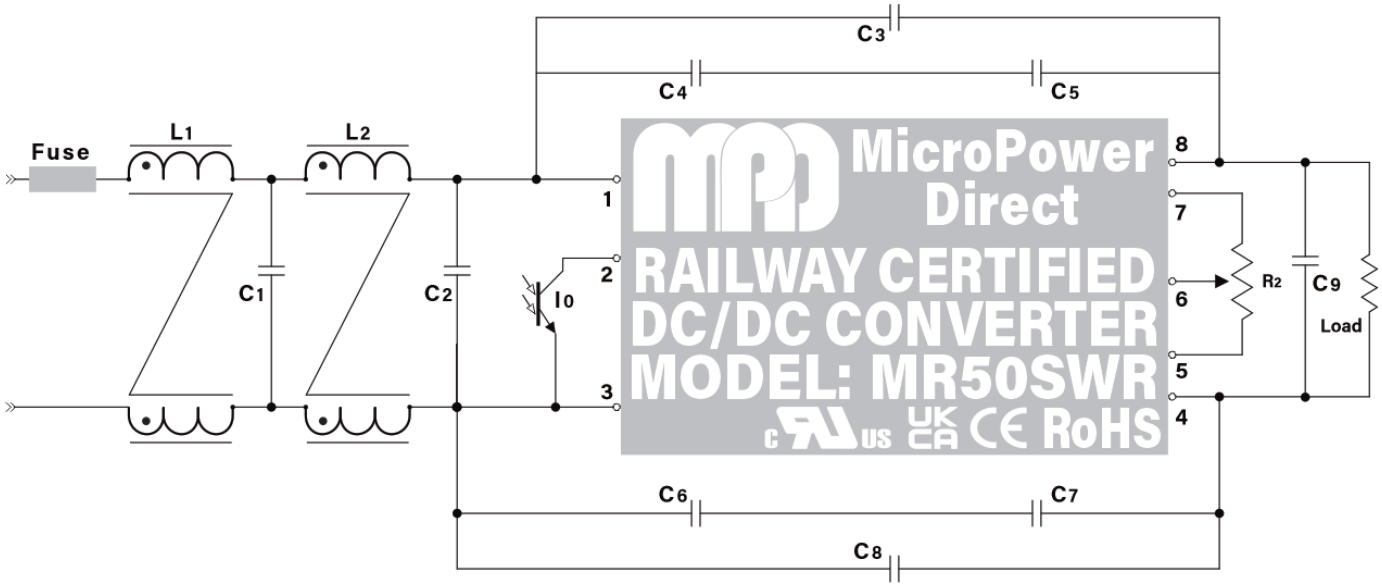
Notes:
1. To meet EN 55011 Class A, and EN 50121-3-2, an external input filter is required. See the connection diagram below for a typical circuit.
2. To meet EN 61000-4-4 and EN 61000-4-5, a capacitor should be connected across the input pins. See the connection diagram below for a typical example.

Environmental Standards

Parameter	Standard
Cooling Test	EN 60068-2-1
Dry Heat	EN 60068-2-2
Damp Heat	EN 60068-2-30

Parameter	Standard
Vibration & Shock	EN 61373
Fire Protection Test	EN 45545-2

EMI Connection



For applications that require meeting EMC/EMI standards, the diagram above illustrates a typical connection of the **MR50SRW** series. The units do not require external components to operate as specified. Some notes on this diagram (starting with the input circuit) are:

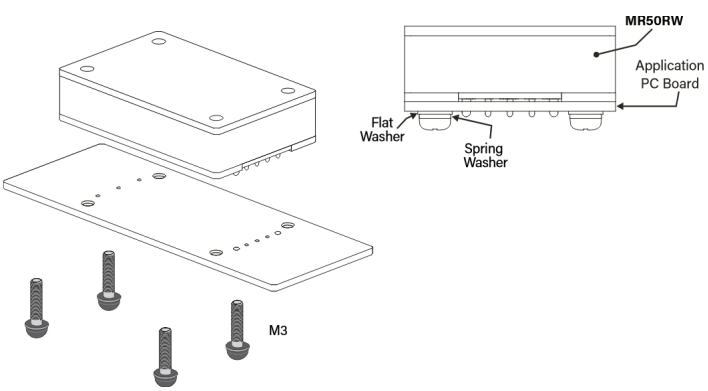
1. It is recommended that an external slow blow fuse be used. The recommended fuse rating is shown in the table at right.
2. To meet EN 55011 Class A & EN 50121-3-2, an external input filter is required. In the diagram this filter consists of C_1, L_1, C_2 and L_2. The recommended component values are shown in the table at right.
3. The resister R_2 is connected as an output adjust. The output adjustment capability is explained further on page 2.

4. Recommended values for components are:

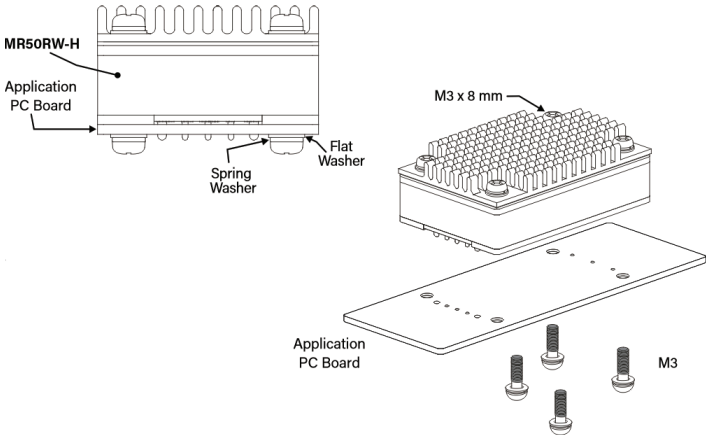
Component	72 V_{IN}	110 V_{IN}
Fuse	2,100 mA	1,500 mA
L_1	7448012501	7448012501
C_1	470 µF/200V KXJ	470 µF/200V KXJ
L_2	7448227005	7448227005
C_2	68 µF/250V Y1	68 µF/250V Y1
C_3 /C_8	4,700 pF/400 VAC Y1 Cap	4,700 pF/400 VAC Y1 Cap
C_4 /C_5 / C_6 / C_7	2,200 pF/400 VAC Y1 Cap	2,200 pF/400 VAC Y1 Cap
C_9	4.7 µF	4.7 µF
R_2	See Page 2	

5. The output sense pins (pin 7 and pin 5) may be used to compensate for the losses incurred over long leads to an output load. If not used for load compensation or output adjustment, the sense pins should be connected directly to the appropriate output pins, pin 7 to pin 8 and pin 5 to pin 4.
6. The output filtering capacitor (C_9) is a low ESR (<1V) electrolytic capacitor. Care must be taken in choosing this capacitor not to exceed the capacitive load specification for the unit.
7. All units have a remote control capability. The EMI connection above uses an Optocoupler to control the level at pin 2. The module is turned on when a logic high is applied to the pin. It is turned off If a logic low is applied. If the feature is not used, pin 2 should be left open.

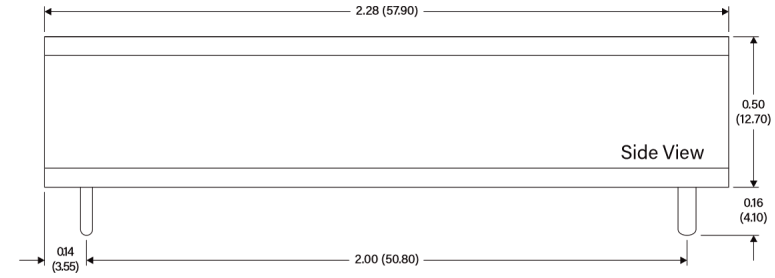
Standard PCB Installation

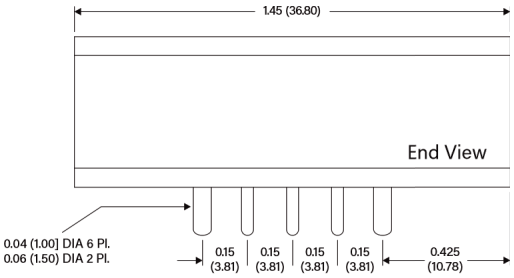


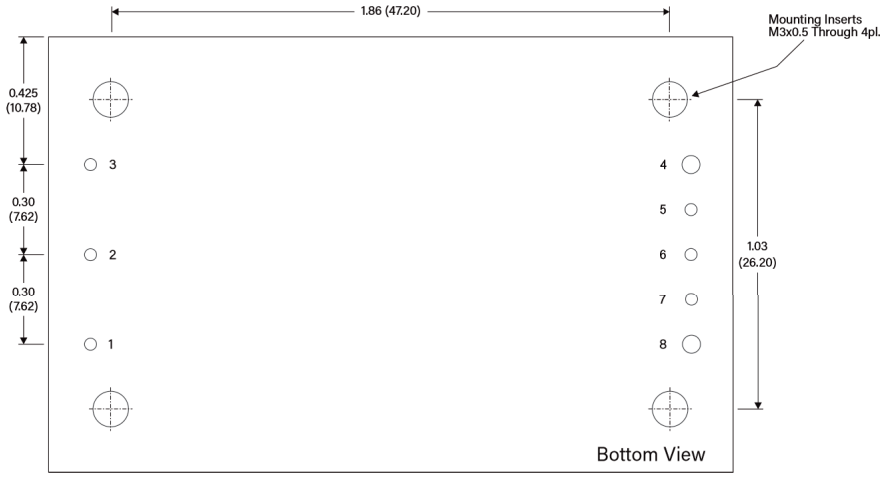
Heat Sink Model PCB Installation



Mechanical Dimensions







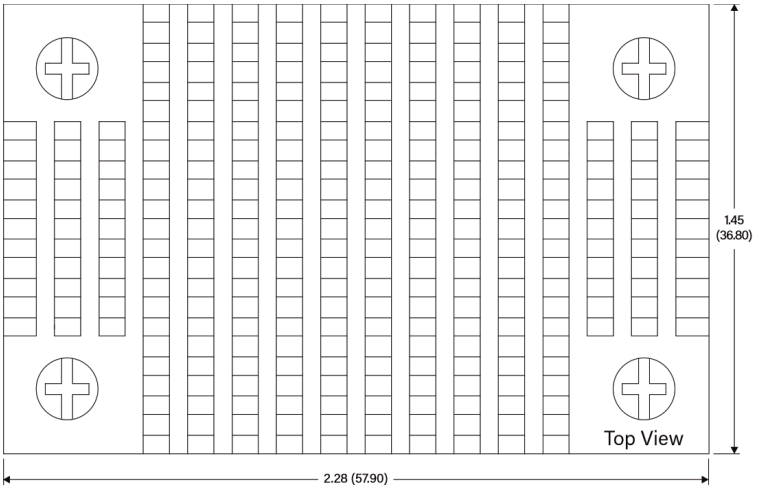
Pin Connections

Pin	Description
1	+VIN
2	Remote On/Off
3	-VIN
4	-VOUT
5	-Sense
6	Trim
7	+Sense
8	+VOUT

Notes:

- All dimensions are typical in inches (mm)
- Tolerance = X.X ±0.5 (x.xx ±0.02)
  X.XX ±0.25 (x.xxx ±0.01)
- Pin Diameter Tolerance = X.X ±0.5 (x.xx ±0.02)
- Weight (Typ) = 2.15 Oz (61g)
- Tightening Torque: Max 0.4 N·m

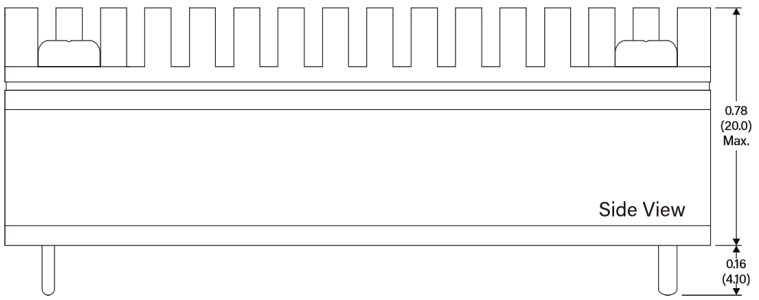
Mechanical Dimensions - With Optional Heatsink

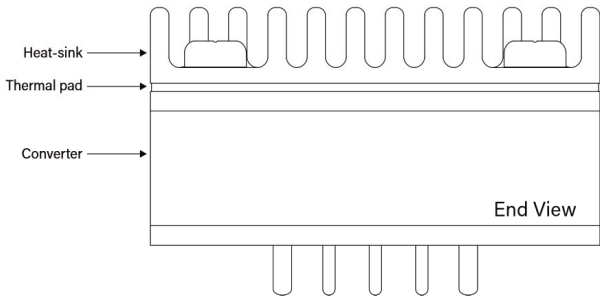


For the heatsink option, add suffix "H" to the model number (i.e. **MR50-110S24RW-H**)

Notes:

- All dimensions are typical in inches (mm)
- Tolerance = X.X ±0.5 (x.xx ±0.02)
  X.XX ±0.25 (x.xxx ±0.01)
- Pin Diameter Tolerance = X.X ±0.5 (x.xx ±0.02)
- Weight (Typ) = 2.60 Oz (74g)
- Tightening Torque: Max 0.4 N·m





MPD: Eastman Street, Unit 1, Easton, MA 02375 • Tel: (781)-344-8226) • Fax: (781)-344-848 • E-Mail: sales@micropowerdirect.com

MPD offers a wide range of high performance RAILWAY power modules.

These include the models below. Call today or go to our website "**MICROPOWERDIRECT.COM**" for more info.

MR0611SRU Series:

Compact, Ultra Wide Input, 6W Railway DC/DC Modules

- 6W Output Power
- Meets EN 62368, EN 50155
- DIN Rail/Chassis Mount Avail.
- Universal 40 - 160 VDC Input
- 2,250 VDC I/O Isolation
- Compact 1 x 1 Inch Size

MR15011SRU Series:

Compact, Ultra Wide Input, 15W, Railway DC/DC Modules

- 15W Output Power
- UL 62368 Approved
- DIN Rail/Chassis Mount Avail.
- Universal 40 - 160 VDC Input
- 2,250 VDC I/O Isolation
- Meets EN 50121, EN 55032

MR4011SRU Series:

Compact, Ultra Wide Input, 40W, Railway DC/DC Modules

- 40W Output Power
- 3kVDC Reinforced Isolation
- DIN Rail/Chassis Mount Avail.
- Universal 40 - 160 VAC Input
- Meets EN 50155
- DIN Rail/Chassis Mount Avail.

MR75SRW Series:

Very Compact, Ultra Wide Input, 75W, AC Power Supplies

- 75W Output Power
- UL 62368 Approved
- Standard 1/4 Brick Case
- Universal 66 - 110 VAC Input
- 3,000 VAC I/O Isolation
- Meets EN 45545, EN 60068

MPD MicroPower Direct
46 Eastman Street, Unit 1, Easton, MA 02375 • TEL: (781) 344-8226 • FAX: (781) 344-8481 • E-Mail: sales@micropowerdirect.com