

MR50-xxSRW Series

Compact, 50W Wide Input Railway DC/DC Converter



Key Features:

- 50W Output Power
- Meets EN 50155
- EN 60950 Approved
- EN 50121-3-2 Compliant
- Wide Input Range
- 3,000 VAC rms Isolation
- Reinforced Insulation
- 92% Efficiency
- Meets EN 61373
- Remote On/Off



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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 | 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 | V _{IN} = Min to Max | | | ±0.2 | % | |
| Load Regulation | I _{OUT} = 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 | | %I _{OUT} | |
| Output Short Circuit | Continuous (Hiccup Mode) | | | | | |

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

| Physical | | | | | | |
|---------------|------------|--|------|------|-------|--|
| Parameter | Conditions | Min. | Typ. | Max. | Units | |
| Case Size | | 2.28 x 1.45 x 0.78 Inches (57.90 x 36.8 x 20.00 mm) | | | | |
| Case Material | | Black Anodized Aluminum Case with Aluminum Plate/Heat Sink | | | | |
| Weight | | 2.6 Oz (74.0g) | | | | |

| 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 | V _{CTRL} = 5V | | 0.5 | | mA | |
| Control Input Current, OFF | V _{CTRL} = 0V | | -0.5 | | mA | |
| Control Common | Referenced to -V _{IN} (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) | 77 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 | |

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| 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 | 72 | 43 - 101 | 771 | 50 | 5.0 | 10.00 | 35 | 6.2 | 17,000 | 90 | 2,100 |
| MR50-72S12RW | 72 | 43 - 101 | 755 | 45 | 12.0 | 4.17 | 35 | 15 | 2,950 | 92 | 2,100 |
| MR50-72S15RW | 72 | 43 - 101 | 754 | 45 | 15.0 | 3.33 | 35 | 18 | 1,900 | 92 | 2,100 |
| MR50-72S24RW | 72 | 43 - 101 | 762 | 50 | 24.0 | 2.08 | 35 | 27 | 740 | 91 | 2,100 |
| MR50-110S05RW | 110 | 66 - 160 | 505 | 40 | 5.0 | 10.00 | 35 | 6.2 | 17,000 | 90 | 1,500 |
| MR50-110S12RW | 110 | 66 - 160 | 500 | 35 | 12.0 | 4.17 | 35 | 15 | 2,950 | 91 | 1,500 |
| MR50-110S15RW | 110 | 66 - 160 | 494 | 35 | 15.0 | 3.33 | 35 | 18 | 1,900 | 92 | 1,500 |
| MR50-110S24RW | 110 | 66 - 160 | 499 | 40 | 24.0 | 2.08 | 35 | 27 | 740 | 91 | 1,500 |

Notes:

- 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.
- Transient recovery is measured to within a 1% error band for a load step change of 75% to 100%.
- Output overload protection is provided by a "hiccup" mode circuit
- 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.

- Exceeding absolute maximum ratings may damage the module. These are not continuous operating ratings.
- Operation at no-load will not damage these units, but they may not meet all specifications.
- 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).
- 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.

EMC Specifications

| Parameter | Standard | Level |
|---------------------|------------|---|
| Radiated Emissions | See Note 1 | EN 50121 Class A |
| Conducted Emissions | See Note 1 | EN 55011 Class A |
| ESD | | EN 61000-4-2 Criteria A; ±8 kV Air, ±6 kV Contact |
| RS | | EN 61000-4-3 Criteria A; 10V/m |
| EFT | See Note 2 | EN 61000-4-4 Criteria A; ±2 kV |
| Surge | See Note 2 | EN 61000-4-5 Criteria A; ±1 kV |
| CS | | EN 61000-4-6 Criteria A; 10 V/m |

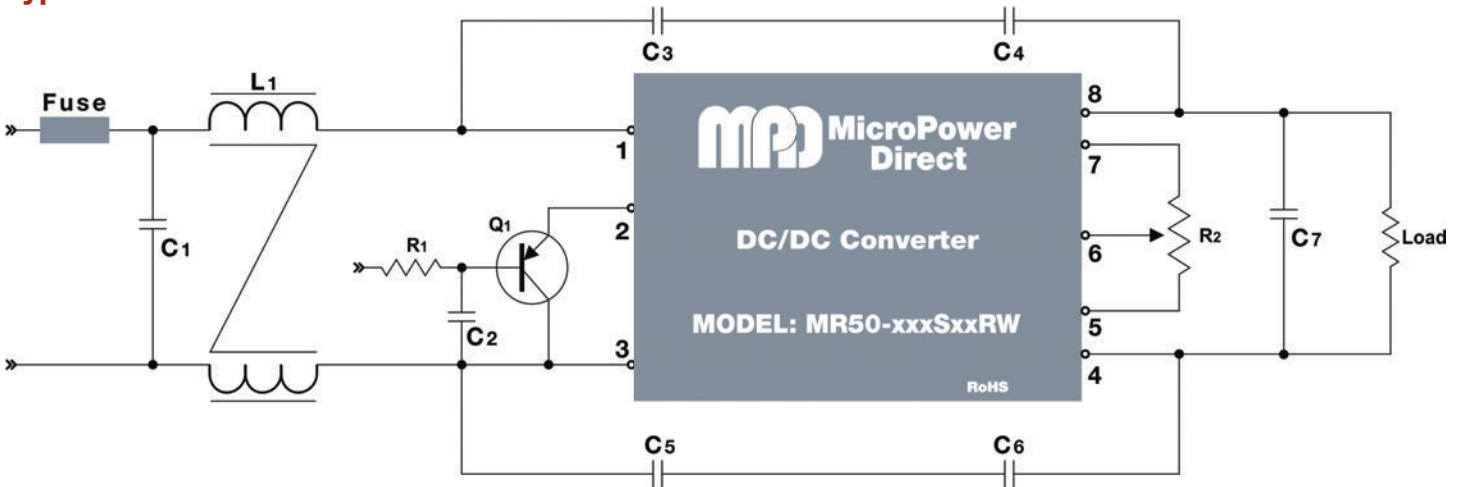
Notes:

- 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.
- 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 |
|-------------------|---------------|
| Vibration & Shock | EN 61373 |
| Cooling Test | EN 60068-2-1 |
| Dry Heat | EN 60068-2-2 |
| Damp Heat | EN 60068-2-30 |

Typical Connection



For applications that require meeting EMC/EMI standards, the diagram above illustrates a typical connection of the MR50-xxxSxxRW series. The units do not require external components to operate as specified. Some notes on this diagram (starting with the input circuit) are:

- It is recommended that an external slow blow fuse be used. The recommended fuse rating is shown in the table at right.
- To meet EN 55011 Class A & EN 50121-3-2, an external input filter is required. In the diagram this filter consists of C1 and L1. The recommended component values are shown in the table at right.
- To meet EN 61000-4-4 and EN 61000-4-5, a capacitor should be connected across the input pins. In the connection diagram above, the value of C1 should be changed to 470 µF/200V.

4. Recommended values for components are:

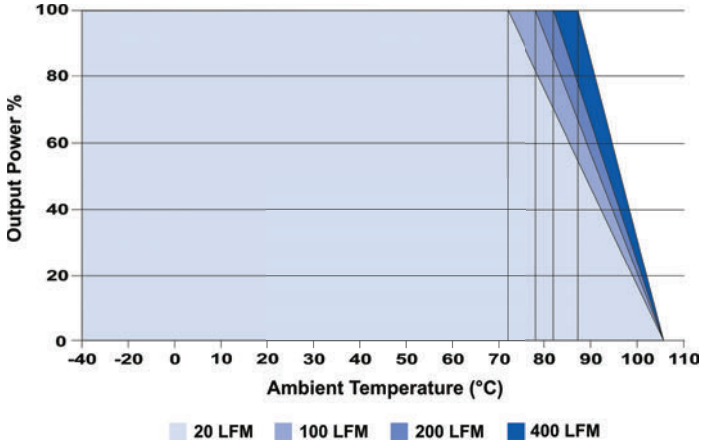
| Component | 72 VIN | 110 VIN |
|-----------|---------------|---------------|
| Fuse | 2,100 mA | 1,500 mA |
| C1 | 68 µF/200V | 68 µF/200V |
| L1 | 450 µH | 450 µH |
| C3 | 2,200 pF/3 kV | 2,200 pF/3 kV |
| C4 | 2,200 pF/3 kV | 2,200 pF/3 kV |
| C5 | 2,200 pF/3 kV | 2,200 pF/3 kV |
| C6 | 2,200 pF/3 kV | 2,200 pF/3 kV |
| C7 | 4.7 µF | 4.7 µF |

- The circuit consisting of R1, Q1 and C2 illustrates a simple open collector connection for the remote on/off control. The resistor (R1) limits the current on the control line and the capacitor (C2) bypasses noise spikes, helping to prevent phantom triggering of the control. If the control pin is not being used, it should be left open.
- The resistor R2 is connected as an output adjust. The output adjustment capability is explained further on page 3.
- 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.
- The output filtering capacitor (C7) is a low ESR (<1Ω) electrolytic capacitor. Care must be taken in choosing this capacitor not to exceed the capacitive load specification for the unit.

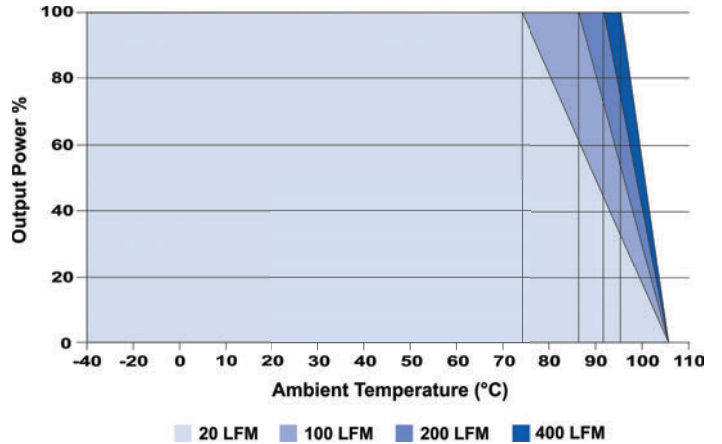


Derating Curves

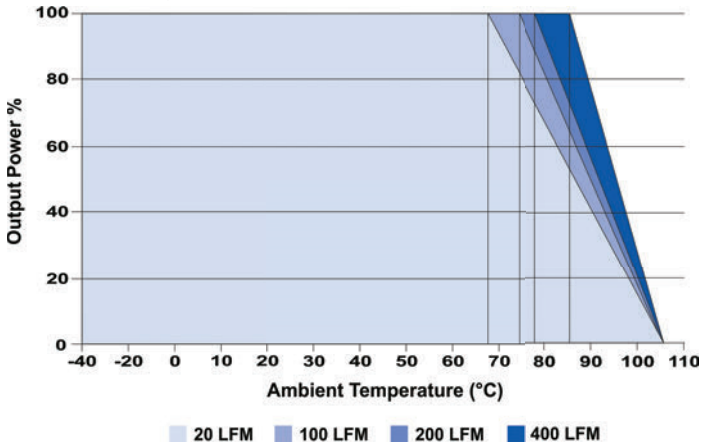
MR50-72S12RW, MR50-72S15RW & MR50-110S15RW without Heatsink



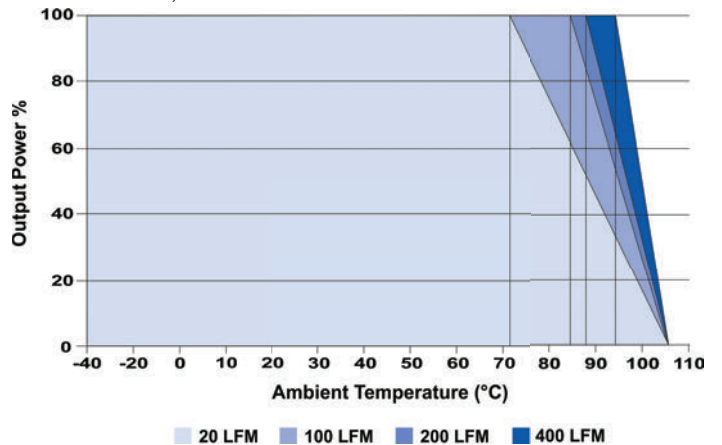
MR50-72S12RW, MR50-72S15RW & MR50-110S15RW with Heatsink



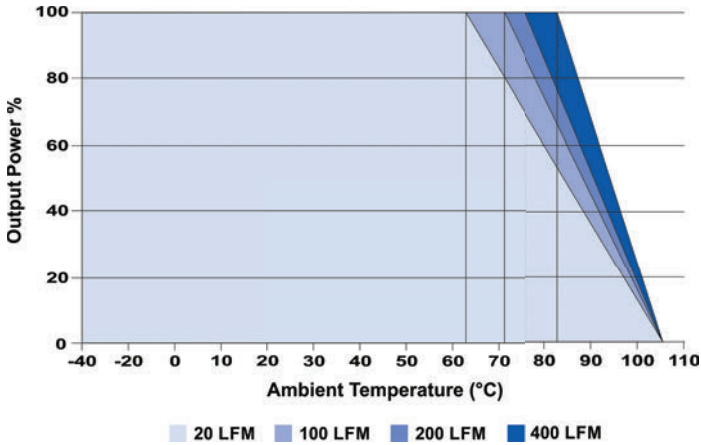
MR50-72S24RW, MR50-110S12RW & MR50-110S24RW without Heatsink



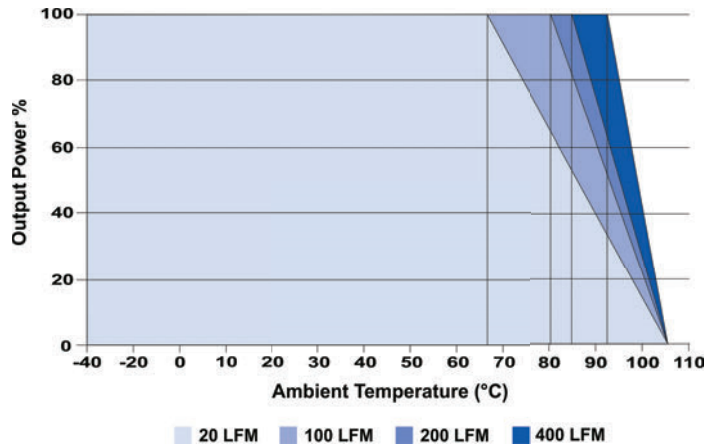
MR50-72S24RW, MR50-110S12RW & MR50-110S24RW with Heatsink



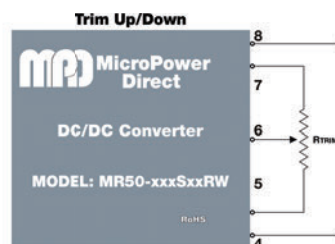
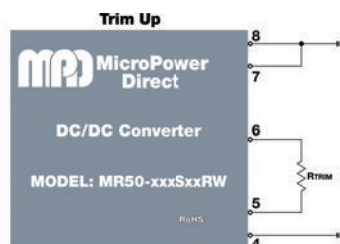
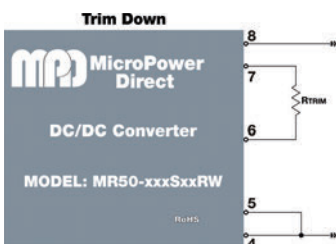
MR50-72S05RW & MR50-110S05RW without Heatsink



MR50-72S05RW & MR50-110S05RW with Heatsink



Output Voltage Adjustment

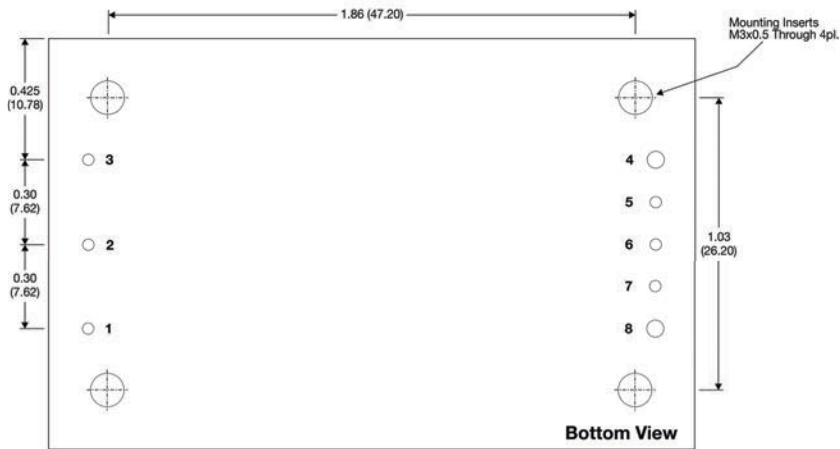
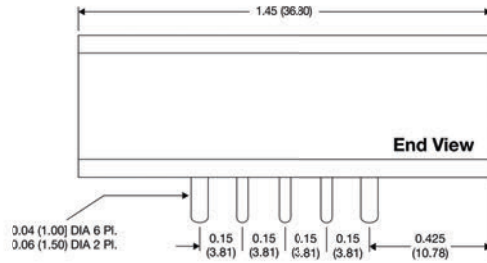
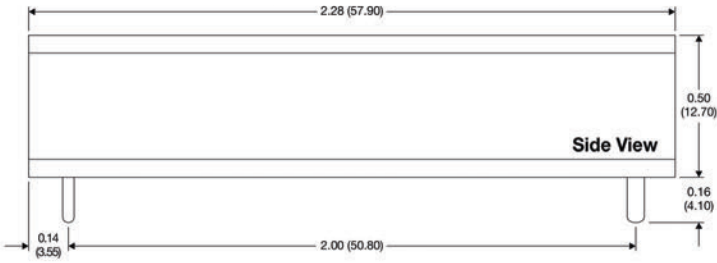


A simple external circuit may be used to adjust the converter output. The range of adjustment is $\pm 10\%$.

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 k Ω potentiometer from the plus to the minus sense pins. Connect the wiper arm to the Vout trim pin.

For a table of trim resistor values, contact the factory.

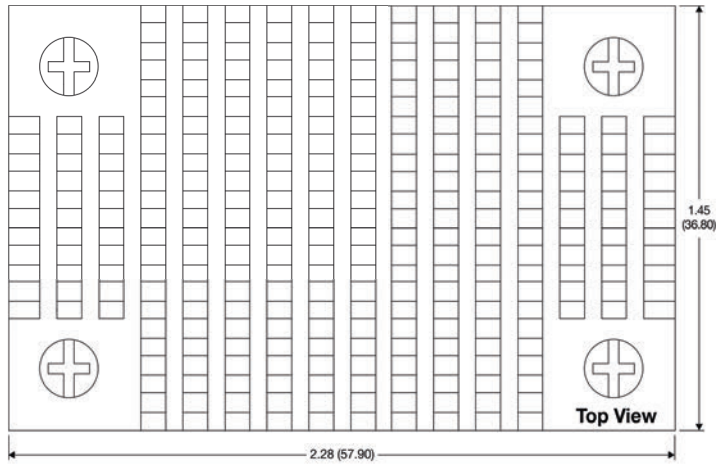
Mechanical Dimensions



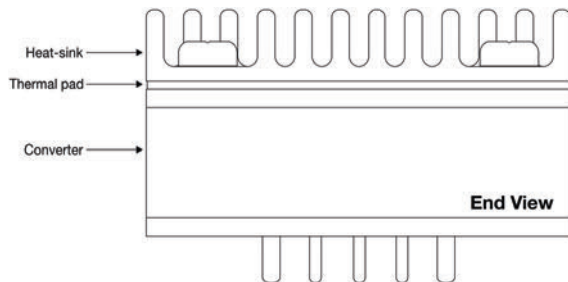
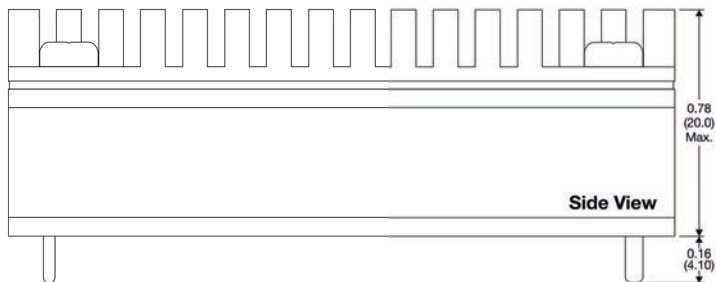
Pin Connections

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

Mechanical Dimensions - With Optional Heatsink



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



Mechanical Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.02 (±0.50)



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