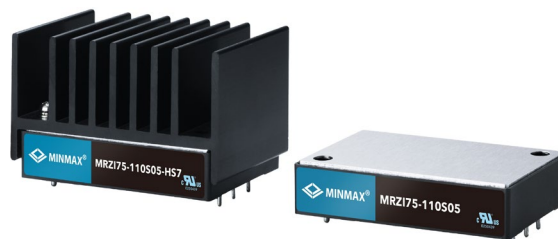


FEATURES

- ▶ Industrial Standard Quarter Brick Package
- ▶ Ultra-wide Input Range 36-160VDC
- ▶ Excellent Efficiency up to 91%
- ▶ I/O Isolation 2000VAC with Reinforced Insulation
- ▶ Operating Baseplate Temp. Range -40°C to +105°C
- ▶ Passed Temperature Cycle Test (TCT) more than 500 Cycles
- ▶ No Min. Load Requirement
- ▶ Under-voltage, Overload/Voltage/Temp. and Short Circuit Protection
- ▶ Remote On/Off Control, Output Voltage Trim, Output Sense
- ▶ Vibration and Shock/Bump Test EN 61373 Approved
- ▶ Cooling, Dry & Damp Heat Test IEC/EN 60068-2-1, 2, 30 Approved
- ▶ Railway EMC Standard EN 50121-3-2 Approved
- ▶ Railway Certified EN 50155 (IEC60571) Approved
- ▶ Fire Protection Test EN 45545-2 Approved
- ▶ UL/cUL/IEC/EN 62368-1 Safety Approval & CE Marking (Pending)

NEW


PRODUCT OVERVIEW

The MINMAX MRZI75 series is a new generation of high-performance 75W isolated DC-DC converters in a quarter-brick package, specifically designed for railway applications. It features a wide input range of 36-160 VDC and offers stable output voltage options of 5, 12, 15, 24, and 54 VDC (suitable for PoE applications), providing a range of choices for various railway needs.

With its advanced circuit topology, the MRZI75 series delivers an impressive efficiency of up to 91%, enabling baseplate temperatures to reach up to 105°C. The series also provides high I/O isolation of up to 2000VAC with reinforced insulation, designed to endure harsh environmental conditions.

Key features include protection against under-voltage, overload, over-voltage, over-temperature, and short circuits. It also supports remote On/Off control (with both positive and negative logic), output voltage trimming, and output sensing for precise power regulation. Notably, the MRZI75 series has passed the Temperature Cycle Test (TCT) with over 500 cycles, ensuring enhanced reliability in extreme operating conditions.

The MRZI75 series is certified to the railway standard EN 50155 and the EMC standard EN 50121-3-2, meeting stringent safety and environmental requirements for railway use. Additionally, it complies with the EN 45545-2 fire protection standard, ensuring safety during railway and railroad vehicle operations.

This series is ideal for a variety of railway applications, such as traction control systems, onboard lighting, communication systems, surveillance equipment, and HVAC systems, providing reliable power conversion in demanding environments.

Model Selection Guide

| Model Number | Input Voltage (Range) VDC | Output Voltage VDC | Output Current Max. A | Input Current | | Over Voltage Protection VDC | Max. capacitive Load μF | Efficiency (typ.) @Max. Load % |
|---------------|------------------------------|-----------------------|-----------------------------|------------------------|----------------------|--------------------------------|----------------------------|--------------------------------------|
| | | | | @Max. Load mA(typ.) | @No Load mA(typ.) | | | |
| MRZI75-110S05 | 110 (36 ~ 160) | 5 | 15 | 766 | 43 | 6.2 | 30000 | 89 |
| MRZI75-110S12 | | 12 | 6.25 | 749 | 43 | 15 | 5200 | 91 |
| MRZI75-110S15 | | 15 | 5 | 749 | 43 | 18 | 3300 | 91 |
| MRZI75-110S24 | | 24 | 3.125 | 758 | 43 | 30 | 1200 | 90 |
| MRZI75-110S54 | | 54 | 1.39 | 767 | 43 | 66 | 330 | 89 |

Input Specifications

| Parameter | Min. | Typ. | Max. | Unit |
|-----------------------------------|--------------------|------|------|------|
| Input Surge Voltage (1000ms. max) | -0.7 | --- | 200 | VDC |
| Start-up Threshold Voltage | --- | --- | 36 | |
| Under Voltage Shutdown | --- | 32 | --- | |
| Input Filter | Internal Capacitor | | | |

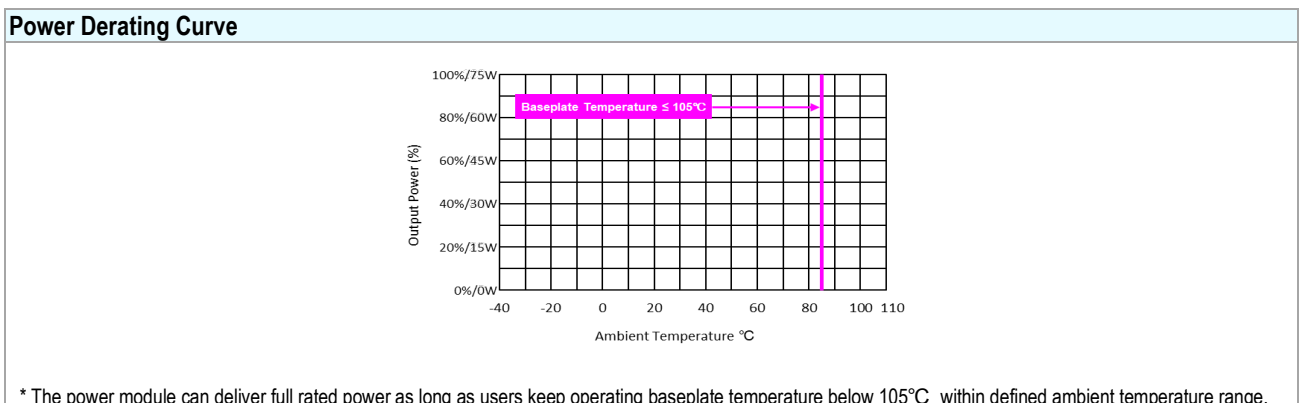
| Output Specifications | | | | | | | |
|---------------------------------|--------------------|---|----------------------------------|--------------|------|-------|-------------------|
| Parameter | | Conditions | | Min. | Typ. | Max. | Unit |
| Output Voltage Setting Accuracy | | | | --- | --- | ±1.0 | % |
| Line Regulation | | Vin=Min. to Max. @ Full Load | | --- | --- | ±0.2 | % |
| Load Regulation | | Min. Load to Full Load | | --- | --- | ±0.3 | % |
| Min.Load | | No minimum Load Requirement | | | | | |
| Ripple & Noise | 0-20 MHz Bandwidth | 5V, 12V, 15V Output | Measured with a 22uF/25V POS-CAP | --- | --- | 100 | mV _{P-P} |
| | | 24V Output | Measured with a 33uF/35V POLYMER | --- | --- | 150 | mV _{P-P} |
| | | 54V Output | Measured with a 1uF/100V MLCC | --- | --- | 300 | mV _{P-P} |
| Start Up Time (Power On) | | | | --- | --- | 70 | ms |
| Transient Recovery Time | | 25% Load Step Change (2) | | --- | 250 | --- | μs |
| Transient Response Deviation | | | | --- | ±3 | ±5 | % |
| Temperature Coefficient | | | | --- | --- | ±0.02 | %/°C |
| Trim Up / Down Range (8) | | % of Nominal Output Voltage | | Other Models | | ±10 | % |
| | | | | 54V Output | | --- | --- |
| Over Load Protection | | Current Limitation at 150% typ. of Iout max., Hiccup | | | | | |
| Short Circuit Protection | | Continuous, Automatic Recovery (Hiccup Mode 0.3Hz typ.) | | | | | |

| General Specifications | | | | | | | |
|---------------------------|----------------|--|--|---------|------|------|-------|
| Parameter | | Conditions | | Min. | Typ. | Max. | Unit |
| I/O Isolation Voltage | | Reinforced Insulation, Rated For 60 Seconds | | 2000 | --- | --- | VAC |
| Isolation Voltage | Input to case | Rated For 60 Seconds | | 1680 | --- | --- | VAC |
| | Output to case | | | 500 | --- | --- | VAC |
| I/O Isolation Resistance | | 500 VDC | | 1000 | --- | --- | MΩ |
| I/O Isolation Capacitance | | 100kHz, 1V | | --- | --- | 2200 | pF |
| Switching Frequency | | 5V Output | | --- | 185 | --- | kHz |
| | | Other Models | | --- | 214 | --- | kHz |
| MTBF(calculated) | | MIL-HDBK-217F@25°C Full Load, Ground Benign | | 642,314 | --- | --- | Hours |
| Safety Standards | | EN 50155, IEC 60571 | | | | | |
| | | UL/cUL 62368-1 recognition(UL certificate), IEC/EN 62368-1 | | | | | |

| Remote On/Off Control | | | | | | | |
|---------------------------|-----------------------|------------------------------|--|------|------|------|------|
| Parameter | | Conditions | | Min. | Typ. | Max. | Unit |
| Positive logic (Standard) | Converter On | 3.5V ~ 12V or Open Circuit | | | | | |
| | Converter Off | 0V ~ 1.2V or Short Circuit | | | | | |
| Negative logic (Option) | Converter On | 0V ~ 1.2V or Short Circuit | | | | | |
| | Converter Off | 3.5V ~ 12V or Open Circuit | | | | | |
| Positive logic | Control Input Current | Vctrl = 5.0V | | --- | 0.5 | --- | mA |
| | | Vctrl = 0V | | --- | -0.5 | --- | mA |
| Negative logic | Control Input Current | Vctrl = 0V | | --- | -0.5 | --- | mA |
| | | Vctrl = 5.0V | | --- | 0.5 | --- | mA |
| Control Common | | Referenced to Negative Input | | | | | |
| Standby Input Current | | Nominal Vin | | --- | 3 | --- | mA |

| EMC Specifications | | | |
|--------------------|---|---------------------------------------|---|
| Parameter | Standards & Level | | Performance |
| General | Compliance with EN 50121-3-2 Railway Applications | | |
| EMI ₍₅₎ | Conduction | EN 55032/11 | With external components |
| | Radiation | | |
| EMS ₍₅₎ | EN 55024, EN 55035 | | |
| | ESD | Direct discharge | Indirect discharge HCP & VCP Contact ± 6kV |
| | | EN 61000-4-2 air ± 8kV, Contact ± 6kV | |
| | Radiated immunity | EN 61000-4-3 10V/m | |
| | Fast transient | EN 61000-4-4 ±2kV | |
| | Surge | EN 61000-4-5 ±2kV | |
| | Conducted immunity | EN 61000-4-6 10Vrms | |
| PFMF | EN 61000-4-8 30A/m for Continuous | | |

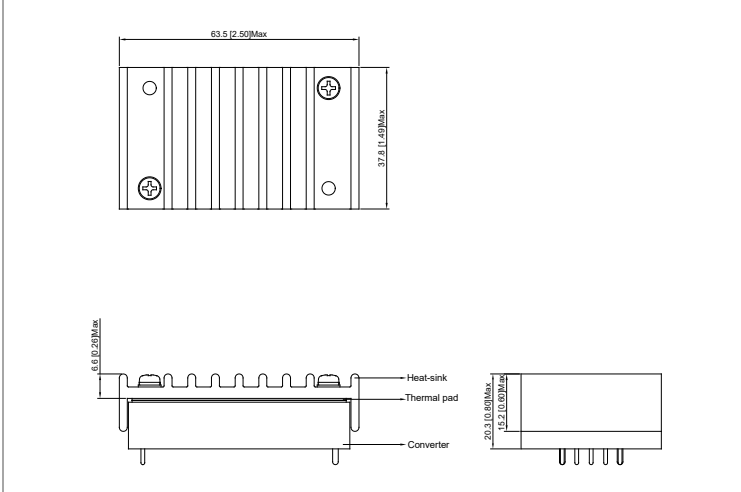
| Environmental Specifications | | | | | | |
|---|--------------------------------|------|------|------|----------|--|
| Parameter | Model | Min. | Typ. | Max. | Unit | |
| Baseplate Temperature Range | | -40 | --- | +105 | °C | |
| Over Temperature Protection (Baseplate) | | --- | +110 | --- | °C | |
| Storage Temperature Range | | -50 | --- | +125 | °C | |
| Cooling Test | Compliance to IEC/EN60068-2-1 | | | | | |
| Dry Heat | Compliance to IEC/EN60068-2-2 | | | | | |
| Damp Heat | Compliance to IEC/EN60068-2-30 | | | | | |
| Vibration and Shock/Bump | Compliance to IEC/EN 61373 | | | | | |
| Operating Humidity (non condensing) | | | 5 | 95 | % rel. H | |
| Lead Temperature (1.5mm from case for 10Sec.) | | | --- | 260 | °C | |



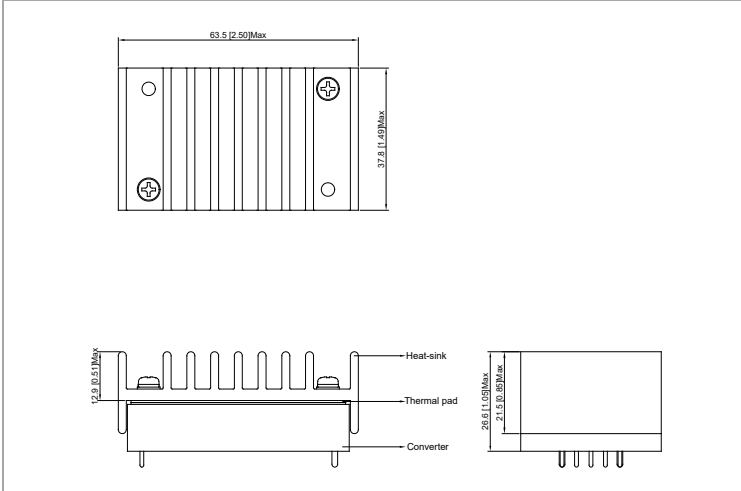
| Notes | |
|-------|---|
| 1 | Specifications typical at Ta=+25°C, resistive load, nominal input voltage and rated output current unless otherwise noted. |
| 2 | Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%. |
| 3 | Other input and output voltage may be available, please contact MINMAX. |
| 4 | It is necessary to parallel a capacitor across the input pins under normal operation. Minimum Capacitance: 150µF/ 250V KXJ. |
| 5 | The external components might be required to meet EMI/EMS standard for some of test items. Please contact MINMAX for the solution in detail. |
| 6 | The hot-swap operation is extremely prohibited. |
| 7 | Over Current Protection (OCP) is built in and works over 130% of the rated current or higher. However, use in an over current situation over 4 seconds must be avoided whenever possible. |
| 8 | Do not exceed maximum power specification when adjusting output voltage. Please see the External Output Trimming table at page 7. |
| 9 | Specifications are subject to change without notice. |
| 10 | The repeated high voltage isolation testing of the converter can degrade isolation capability, to a lesser or greater degree depending on materials, construction, environment and reflow solder process. Any material is susceptible to eventual chemical degradation when subject to very high applied voltages thus implying that the number of tests should be strictly limited. We therefore strongly advise against repeated high voltage isolation testing, but if it is absolutely required, that the voltage be reduced by 20% from specified test voltage. Furthermore, the high voltage isolation capability after reflow solder process should be evaluated as it is applied on system. |

| Package Specifications | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|-------------------------|----------|-------------------------|---|------|--------------|---|---------------|--------------|---|------|--------------|---|-------|--------------|---|----------|--------------|---|------|--------------|---|----------|--------------|---|-------|--------------|
| <p>Mechanical Dimensions</p> <p>BOTTOM VIEW</p> <p>Mounting Inserts M3X0.5 Through Zpl.</p> | <p>Pin Connections</p> <table border="1"> <thead> <tr> <th>Pin</th> <th>Function</th> <th>Diameter mm (inches)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>+Vin</td> <td>∅ 1.0 [0.04]</td> </tr> <tr> <td>2</td> <td>Remote On/Off</td> <td>∅ 1.0 [0.04]</td> </tr> <tr> <td>3</td> <td>-Vin</td> <td>∅ 1.0 [0.04]</td> </tr> <tr> <td>4</td> <td>-Vout</td> <td>∅ 1.5 [0.06]</td> </tr> <tr> <td>5</td> <td>* -Sense</td> <td>∅ 1.0 [0.04]</td> </tr> <tr> <td>6</td> <td>Trim</td> <td>∅ 1.0 [0.04]</td> </tr> <tr> <td>7</td> <td>* +Sense</td> <td>∅ 1.0 [0.04]</td> </tr> <tr> <td>8</td> <td>+Vout</td> <td>∅ 1.5 [0.06]</td> </tr> </tbody> </table> <p>* If remote sense not used the +sense should be connected to +output and -sense should be connected to -output Maximum output deviation is 10% inclusive of trim</p> <ul style="list-style-type: none"> ▶ All dimensions in mm (inches) ▶ Tolerance: X.X±0.5 (X.XX±0.02) X.XX±0.25 (X.XXX±0.01) ▶ Pin diameter tolerance: X.X±0.05 (X.XX±0.002) | Pin | Function | Diameter mm (inches) | 1 | +Vin | ∅ 1.0 [0.04] | 2 | Remote On/Off | ∅ 1.0 [0.04] | 3 | -Vin | ∅ 1.0 [0.04] | 4 | -Vout | ∅ 1.5 [0.06] | 5 | * -Sense | ∅ 1.0 [0.04] | 6 | Trim | ∅ 1.0 [0.04] | 7 | * +Sense | ∅ 1.0 [0.04] | 8 | +Vout | ∅ 1.5 [0.06] |
| Pin | Function | Diameter mm (inches) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | +Vin | ∅ 1.0 [0.04] | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Remote On/Off | ∅ 1.0 [0.04] | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | -Vin | ∅ 1.0 [0.04] | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | -Vout | ∅ 1.5 [0.06] | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | * -Sense | ∅ 1.0 [0.04] | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | Trim | ∅ 1.0 [0.04] | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | * +Sense | ∅ 1.0 [0.04] | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | +Vout | ∅ 1.5 [0.06] | | | | | | | | | | | | | | | | | | | | | | | | | | |

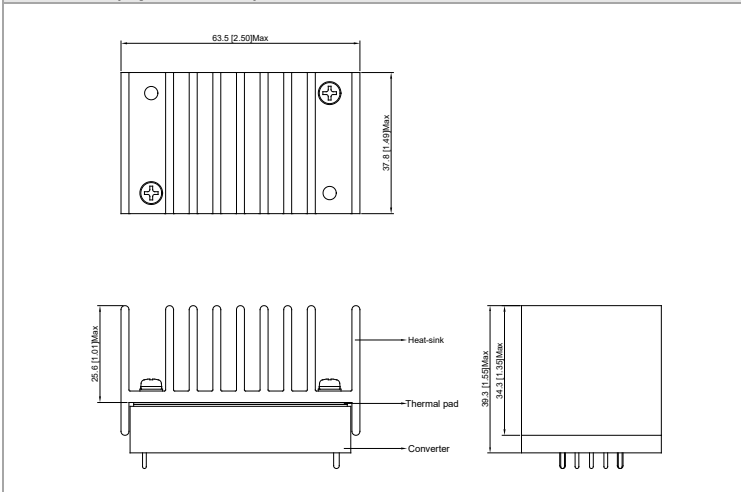
| Physical Characteristics | |
|--------------------------|--|
| Case Size | : 58.4x37.3x12.7 mm (2.30x1.47x0.50 inches) |
| Case Material | : Plastic resin (flammability to UL 94V-0 rated) |
| Top Side Base Material | : Aluminum Plate |
| Pin Material | : Copper |
| Potting Material | : Silicone (UL94-V0) |
| Weight | : 70g |

Heatsink (Option –HS5)

Physical Characteristics

| | | |
|-------------------|---|------------------------|
| Heatsink Material | : | Aluminum |
| Finish | : | Black Anodized Coating |
| Weight | : | 27g |

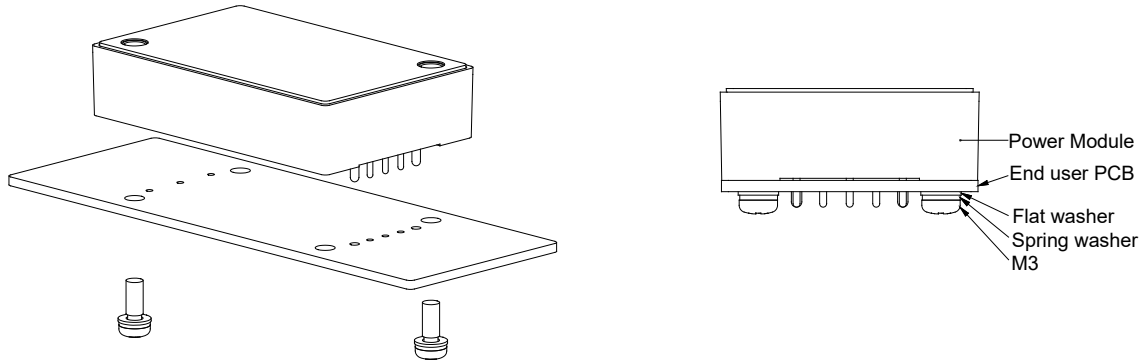
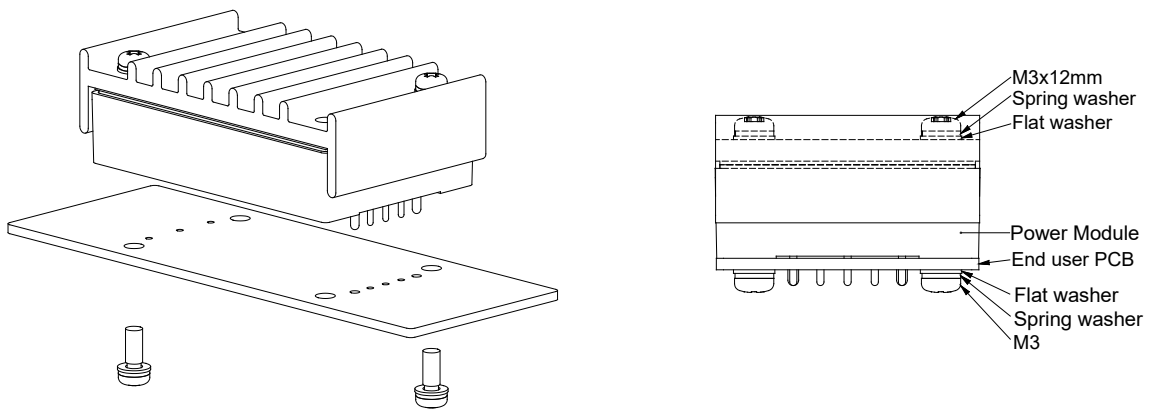
Heatsink (Option –HS6)

Physical Characteristics

| | | |
|-------------------|---|------------------------|
| Heatsink Material | : | Aluminum |
| Finish | : | Black Anodized Coating |
| Weight | : | 38g |

Heatsink (Option –HS7)

Physical Characteristics

| | | |
|-------------------|---|------------------------|
| Heatsink Material | : | Aluminum |
| Finish | : | Black Anodized Coating |
| Weight | : | 63g |

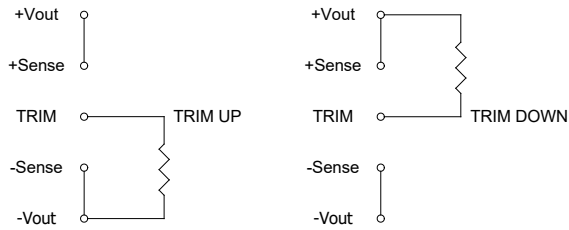
*For more power derating information, please refer to E.C Note.

PCB Installation of End Users
Standard Kit

Heatsink Kit


1. Please evaluate mechanical stress (vibration, shock, bump) during field applications.
2. It has to equip with installation kit if excess the guaranteed specifications, please contact MINMAX for detail information.
3. Applied torque per screw 5 kgf.cm min.

External Output Trimming

Output can be externally trimmed by using the method shown below

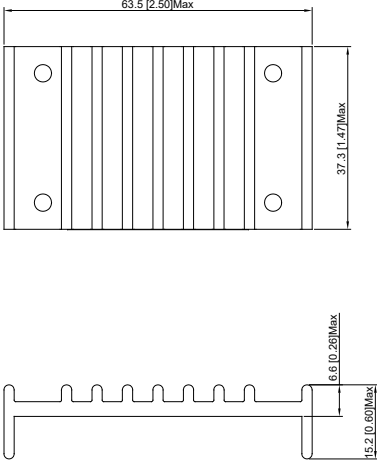
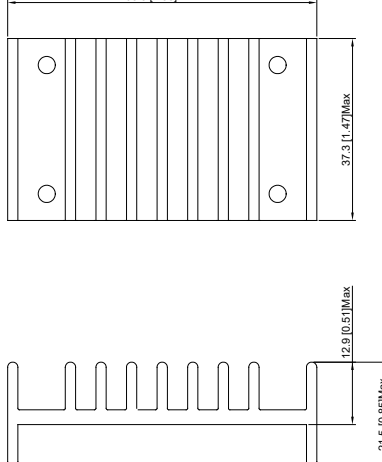
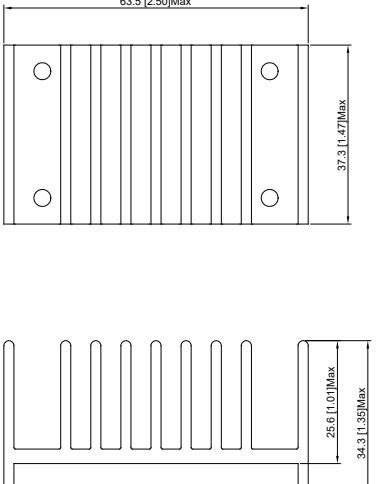


| | MRZI75-110S05 | | MRZI75-110S12 | | MRZI75-110S15 | | MRZI75-110S24 | | MRZI75-110S54 | |
|----------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|
| Trim Range (%) | Trim down (kΩ) | Trim up (kΩ) | Trim down (kΩ) | Trim up (kΩ) | Trim down (kΩ) | Trim up (kΩ) | Trim down (kΩ) | Trim up (kΩ) | Trim down (kΩ) | Trim up (kΩ) |
| 1 | 138.88 | 106.87 | 413.55 | 351.00 | 530.73 | 422.77 | 599.27 | 486.53 | 1,882.57 | 560.73 |
| 2 | 62.41 | 47.76 | 184.55 | 157.50 | 238.61 | 189.89 | 268.09 | 217.71 | 877.94 | 230.36 |
| 3 | 36.92 | 28.06 | 108.22 | 93.00 | 141.24 | 112.26 | 157.69 | 218.11 | 543.06 | 120.24 |
| 4 | 24.18 | 18.21 | 70.05 | 60.75 | 92.56 | 73.44 | 102.49 | 83.31 | 375.62 | 65.18 |
| 5 | 16.53 | 12.30 | 47.15 | 41.40 | 63.35 | 50.15 | 69.37 | 56.43 | 275.15 | 32.15 |
| 6 | 11.44 | 8.36 | 31.88 | 28.50 | 43.87 | 34.63 | 47.3 | 38.5 | 208.18 | --- |
| 7 | 7.79 | 5.55 | 20.98 | 19.29 | 29.96 | 23.54 | 31.52 | 25.7 | 160.34 | --- |
| 8 | 5.06 | 3.44 | 12.80 | 12.37 | 19.53 | 15.22 | 19.7 | 16.1 | 124.46 | --- |
| 9 | 2.94 | 1.79 | 6.44 | 7.00 | 11.41 | 8.75 | 10.5 | 8.64 | 96.55 | --- |
| 10 | 1.24 | 0.48 | 1.35 | 2.70 | 4.92 | 3.58 | 3.14 | 2.66 | 74.23 | --- |
| 11 | --- | --- | --- | --- | --- | --- | --- | --- | 55.96 | --- |
| 12 | --- | --- | --- | --- | --- | --- | --- | --- | 40.74 | --- |
| 13 | --- | --- | --- | --- | --- | --- | --- | --- | 27.86 | --- |
| 14 | --- | --- | --- | --- | --- | --- | --- | --- | 16.82 | --- |
| 15 | --- | --- | --- | --- | --- | --- | --- | --- | 7.25 | --- |

Order Code Table For Converter and Converter With Heatsink

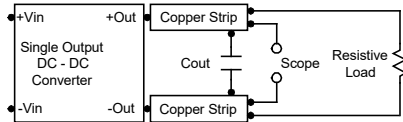
| Standard (Positive logic) | With heatsink (Positive logic) | | |
|---------------------------|--------------------------------|--------------------|--------------------|
| | MRZI75 + HS-QB005 | MRZI75 + HS-QB006 | MRZI75 + HS-QB007 |
| MRZI75-110S05 | MRZI75-110S05-HS5 | MRZI75-110S05-HS6 | MRZI75-110S05-HS7 |
| MRZI75-110S12 | MRZI75-110S12-HS5 | MRZI75-110S12-HS6 | MRZI75-110S12-HS7 |
| MRZI75-110S15 | MRZI75-110S15-HS5 | MRZI75-110S15-HS6 | MRZI75-110S15-HS7 |
| MRZI75-110S24 | MRZI75-110S24-HS5 | MRZI75-110S24-HS6 | MRZI75-110S24-HS7 |
| MRZI75-110S54 | MRZI75-110S54-HS5 | MRZI75-110S54-HS6 | MRZI75-110S54-HS7 |
| Negative logic | With heatsink (Negative logic) | | |
| | MRZI75 + HS-QB005 | MRZI75 + HS-QB006 | MRZI75 + HS-QB007 |
| MRZI75-110S05N | MRZI75-110S05N-HS5 | MRZI75-110S05N-HS6 | MRZI75-110S05N-HS7 |
| MRZI75-110S12N | MRZI75-110S12N-HS5 | MRZI75-110S12N-HS6 | MRZI75-110S12N-HS7 |
| MRZI75-110S15N | MRZI75-110S15N-HS5 | MRZI75-110S15N-HS6 | MRZI75-110S15N-HS7 |
| MRZI75-110S24N | MRZI75-110S24N-HS5 | MRZI75-110S24N-HS6 | MRZI75-110S24N-HS7 |
| MRZI75-110S54N | MRZI75-110S54N-HS5 | MRZI75-110S54N-HS6 | MRZI75-110S54N-HS7 |

Order Code Table For Heatsink kit (including: Heatsink x1, Screw (M3/14mm) x 2, Thermal Pad x1)

| HS-QB005 | HS-QB006 | HS-QB007 |
|--|--|--|
|  |  |  |

Test Setup
Peak-to-Peak Output Noise Measurement Test

Use a 22 μ F polymer capacitor for 5V, 12V, 15V output models and a 33 μ F polymer capacitor for 24V output model and a 1 μ F ceramic capacitor for 54V output model. Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20 MHz. Position the load between 50 mm and 75 mm from the DC-DC Converter.


Technical Notes
Remote On/Off

Positive logic remote on/off turns the module on during a logic high voltage on the remote on/off pin, and off during a logic low. To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal and the -Vin terminal. The switch can be an open collector or equivalent. A logic low is 0V to 1.2V. A logic high is 3.5V to 12V. The maximum sink current at the on/off terminal (Pin 2) during a logic low is -500 μ A.

Negative logic remote on/off turns the module on during a logic low voltage on the remote on/off pin, and off during a logic high. To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal and the -Vin terminal. The switch can be an open collector or equivalent. A logic low is 0V to 1.2V. A logic high is 3.5V to 12V. The maximum source current at the on/off terminal (Pin 2) during a logic high is 500 μ A.

Overload Protection

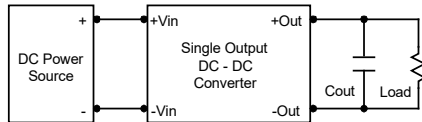
To provide hiccup mode protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure overload for an unlimited duration.

Overvoltage Protection

The output overvoltage clamp consists of control circuitry, which is independent of the primary regulation loop, that monitors the voltage on the output terminals. The control loop of the clamp has a higher voltage set point than the primary loop. This provides a redundant voltage control that reduces the risk of output overvoltage. The OVP level can be found in the output data.

Output Ripple Reduction

A good quality low ESR capacitor placed as close as practicable across the load will give the best ripple and noise performance. To reduce output ripple, it is recommended to use 4.7 μ F capacitors at the output.


Maximum Capacitive Load

The MRZI75 series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. The maximum capacitance can be found in the data sheet.

Thermal Considerations

Many conditions affect the thermal performance of the power module, such as orientation, airflow over the module and board spacing. To avoid exceeding the maximum temperature rating of the components inside the power module, the baseplate temperature must be kept below 105°C. The derating curves are determined from measurements obtained in a test setup.

