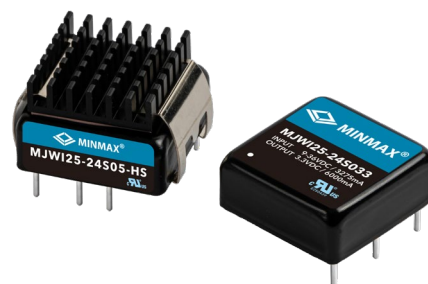


FEATURES

- ▶ Smallest Encapsulated 25W Converter
- ▶ Ultra-compact 1" X 1" Package
- ▶ Ultra-wide 4:1 Input Voltage Range
- ▶ Fully Regulated Output Voltage
- ▶ Excellent Efficiency up to 90%
- ▶ I/O Isolation 1500 VDC
- ▶ Operating Ambient Temp. Range -40°C to +80°C
- ▶ No Min. Load Requirement
- ▶ Overload/Voltage and Short Circuit Protection
- ▶ Remote On/Off Control, Output Voltage Trim
- ▶ Shielded Metal Case with Insulated Baseplate
- ▶ UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval & CE Marking


PRODUCT OVERVIEW

The MINMAX MJWI25 series is the latest range of a new generation of high performance DC-DC converter modules with very high power density. The product offers fully 25W in a shielded metal package with dimensions of just 1.0"x1.0"x0.4". All models provide ultra-wide 4:1 input range and tightly regulated output voltage. State-of-the-art circuit topology provides a very high efficiency up to 90% which allows an operating temperature range of -40°C to +80°C. These converters are qualified for demanding applications in battery operated equipment, instrumentation, data communication, industrial and many other space critical applications.

Model Selection Guide

| Model Number | Input Voltage (Range) VDC | Output Voltage VDC | Output Current Max. mA | Input Current | | Reflected Ripple Current mA (typ.) | Over Voltage Protection VDC | Max. capacitive Load μF | Efficiency (typ.) @Max. Load % |
|---------------|------------------------------|-----------------------|------------------------------|------------------------|----------------------|---------------------------------------|--------------------------------|----------------------------|--------------------------------------|
| | | | | @Max. Load mA(typ.) | @No Load mA(typ.) | | | | |
| | | | | | | | | | |
| MJWI25-24S033 | 24 (9 ~ 36) | 3.3 | 6000 | 950 | 85 | 50 | 3.9 | 10300 | 87 |
| MJWI25-24S05 | | 5 | 5000 | 1170 | 85 | | 6.2 | 6800 | 89 |
| MJWI25-24S12 | | 12 | 2090 | 1175 | 85 | | 15 | 1200 | 89 |
| MJWI25-24S15 | | 15 | 1670 | 1160 | 85 | | 18 | 750 | 90 |
| MJWI25-24D12 | | ±12 | ±1040 | 1170 | 85 | | ±15 | 680# | 89 |
| MJWI25-24D15 | | ±15 | ±840 | 1180 | 85 | | ±18 | 380# | 89 |
| MJWI25-48S033 | 48 (18 ~ 75) | 3.3 | 6000 | 470 | 45 | 30 | 3.9 | 10300 | 88 |
| MJWI25-48S05 | | 5 | 5000 | 580 | 45 | | 6.2 | 6800 | 90 |
| MJWI25-48S12 | | 12 | 2090 | 580 | 45 | | 15 | 1200 | 90 |
| MJWI25-48S15 | | 15 | 1670 | 580 | 45 | | 18 | 750 | 90 |
| MJWI25-48D12 | | ±12 | ±1040 | 585 | 45 | | ±15 | 680# | 89 |
| MJWI25-48D15 | | ±15 | ±840 | 590 | 45 | | ±18 | 380# | 89 |

For each output

Input Specifications

| Parameter | Conditions / Model | Min. | Typ. | Max. | Unit |
|----------------------------------|--------------------|---|------|------|------|
| Input Surge Voltage (100ms max.) | 24V Input Models | -0.7 | --- | 50 | VDC |
| | 48V Input Models | -0.7 | --- | 100 | |
| Start-Up Threshold Voltage | 24V Input Models | --- | --- | 9 | |
| | 48V Input Models | --- | --- | 18 | |
| Start Up Time | Power Up | --- | --- | 30 | ms |
| | Remote On/Off | Nominal Vin and Constant Resistive Load | | 30 | ms |
| Input Filter | All Models | Internal LC Type | | | |

Remote On/Off Control

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

Output Specifications

| Parameter | Conditions / Model | Min. | Typ. | Max. | Unit | |
|-----------------------------------|---|------------------------|------|-------|--------|-------------------|
| Output Voltage Setting Accuracy | | --- | --- | ±1.0 | %Vnom. | |
| Output Voltage Balance | Dual Output, Balanced Loads | --- | --- | ±2.0 | % | |
| Line Regulation | Vin=Min. to Max. @Full Load | --- | --- | ±0.2 | % | |
| Load Regulation | Io=0% to 100% | Single Output | --- | --- | ±0.2 | % |
| | | Dual Output | --- | --- | ±1.0 | % |
| Cross Regulation (Dual) | Asymmetrical load 25% / 100% FL | --- | --- | ±5.0 | % | |
| Minimum Load | No minimum Load Requirement | | | | | |
| Ripple & Noise | 0-20 MHz Bandwidth | 3.3V & 5V Models | --- | --- | 100 | mV _{p-p} |
| | | 12V, 15V & Dual Models | --- | --- | 150 | mV _{p-p} |
| Transient Recovery Time | 25% Load Step Change | --- | 250 | --- | μsec | |
| Transient Response Deviation | | --- | ±3 | ±5 | % | |
| Temperature Coefficient | | --- | --- | ±0.02 | %/°C | |
| Trim Up / Down Range (See Page 6) | % of Nominal Output Voltage | --- | --- | ±10 | % | |
| Over Load Protection | Hiccup | --- | 150 | --- | % | |
| Short Circuit Protection | Continuous, Automatic Recovery (Hiccup Mode 0.6Hz typ.) | | | | | |

General Specifications

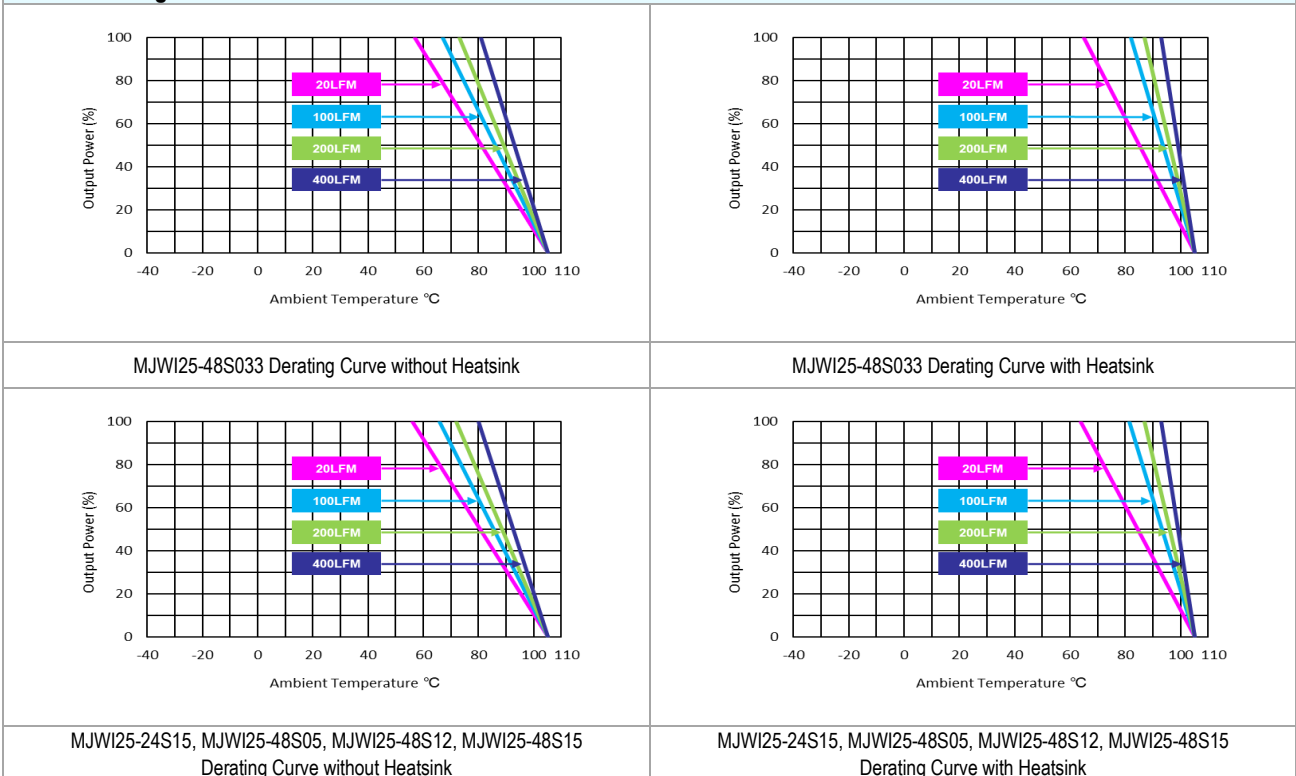
| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---------------------------|--|---------|------|------|-------|
| I/O Isolation Voltage | 60 Seconds | 1500 | --- | --- | VDC |
| | 1 Second | 1800 | --- | --- | VDC |
| I/O Isolation Resistance | 500 VDC | 1000 | --- | --- | MΩ |
| I/O Isolation Capacitance | 100kHz, 1V | --- | --- | 2000 | pF |
| Switching Frequency | | --- | 285 | --- | kHz |
| MTBF(calculated) | MIL-HDBK-217F@25°C, Ground Benign | 444,000 | | | Hours |
| Safety Approvals | UL/cUL 60950-1 recognition(CSA certificate), IEC/EN 60950-1(CB-report) | | | | |
| | UL/cUL 62368-1 recognition(UL certificate), IEC/EN 62368-1(CB-report) | | | | |

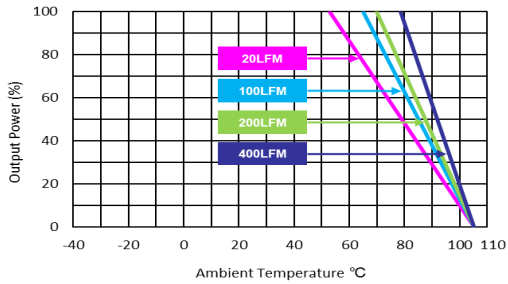
EMC Specifications

| Parameter | Standards & Level | | | Performance |
|--------------------|--------------------|---------------------------------------|--------------------------|-------------|
| EMI _(e) | Conduction | EN 55032 | With external components | Class A |
| | Radiation | | | |
| EMS _(e) | EN 55024 | | | |
| | ESD | EN 61000-4-2 Air ± 8kV, Contact ± 6kV | | A |
| | Radiated immunity | EN 61000-4-3 10V/m | | A |
| | Fast transient | EN 61000-4-4 ±2kV | | A |
| | Surge | EN 61000-4-5 ±1kV | | A |
| | Conducted immunity | EN 61000-4-6 10Vrms | | A |

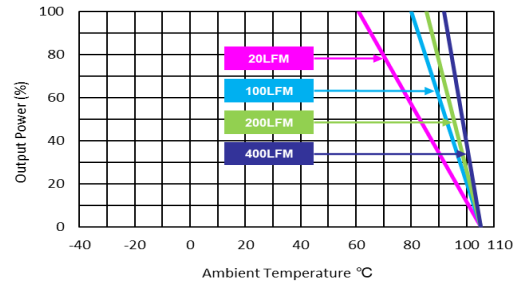
Environmental Specifications

| Parameter | Conditions/Model | Min. | Max. | | Unit |
|--|--|------|------------------|---------------|----------|
| | | | without Heatsink | with Heatsink | |
| Operating Ambient Temperature Range Nominal Vin, Load 100% Inom. (for Power Derating see relative Derating Curves) | MJWI25-48S033 | -40 | 57 | 65 | °C |
| | MJWI25-24S15, MJWI25-48S05 MJWI25-48S12, MJWI25-48S15 | | 56 | 64 | |
| | MJWI25-24S033 | | 53 | 61 | |
| | MJWI25-24S05, MJWI25-24S12 MJWI25-24D12, MJWI25-24D15 MJWI25-48D12, MJWI25-48D15 | | 50 | 59 | |
| | | | | | |
| Thermal Impedance | 20LFM Convection without Heatsink | 17.6 | --- | --- | °C/W |
| | 20LFM Convection with Heatsink | 14.8 | --- | --- | °C/W |
| | 100LFM Convection without Heatsink | 13.6 | --- | --- | °C/W |
| | 100LFM Convection with Heatsink | 8.5 | --- | --- | °C/W |
| | 200LFM Convection without Heatsink | 11.8 | --- | --- | °C/W |
| | 200LFM Convection with Heatsink | 6.5 | --- | --- | °C/W |
| | 400LFM Convection without Heatsink | 8.8 | --- | --- | °C/W |
| | 400LFM Convection with Heatsink | 4.3 | --- | --- | °C/W |
| Case Temperature | | --- | +105 | --- | °C |
| Storage Temperature Range | | -50 | +125 | --- | °C |
| Humidity (non condensing) | | --- | 95 | --- | % rel. H |
| RFI | Six-Sided shielded, Metal Case | | | | |
| Lead Temperature (1.5mm from case for 10Sec.) | | --- | 260 | --- | °C |

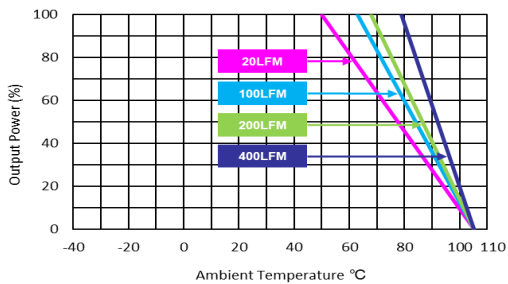
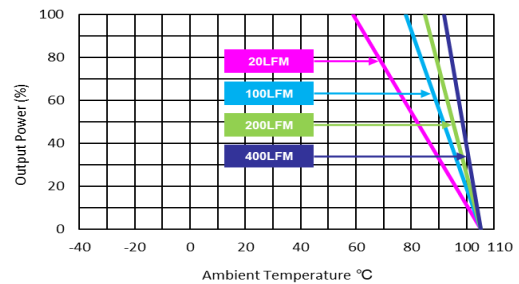
Power Derating Curve


Power Derating Curve


MJWI25-24S033 Derating Curve without Heatsink



MJWI25-24S033 Derating Curve with Heatsink

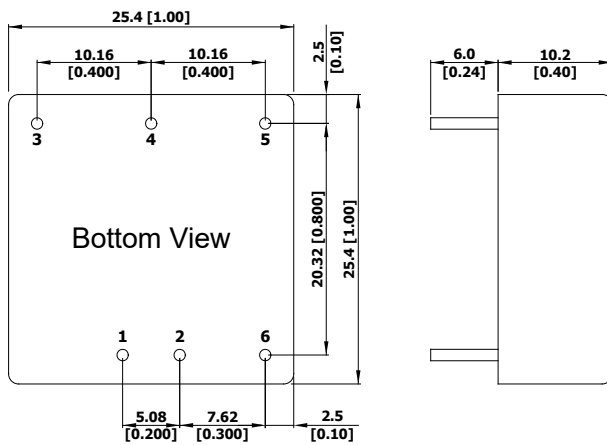

 MJWI25-24S05, MJWI25-24S12, MJWI25-24D12
 MJWI25-24D15, MJWI25-48D12, MJWI25-48D15
 Derating Curve without Heatsink

 MJWI25-24S05, MJWI25-24S12, MJWI25-24D12
 MJWI25-24D15, MJWI25-48D12, MJWI25-48D15
 Derating Curve with Heatsink

Notes

- 1 Specifications typical at $T_a = +25^\circ\text{C}$, resistive load, nominal input voltage, 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 Ripple & Noise measurement with a $1\mu\text{F}/25\text{V}$ MLCC and a $10\mu\text{F}/50\text{V}$ Tantalum Capacitor.
- 4 We recommend to protect the converter by a slow blow fuse in the input supply line.
- 5 Other input and output voltage may be available, please contact MINMAX.
- 6 The external components might be required to meet EMI/EMS standard for some of test items. Please contact MINMAX for the solution in detail.
- 7 Specifications are subject to change without notice.
- 8 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 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

Mechanical Dimensions



Pin Connections

| Pin | Single Output | Dual Output | Diameter mm (inches) |
|-----|---------------|---------------|----------------------|
| 1 | +Vin | +Vin | ∅ 1.0 [0.04] |
| 2 | -Vin | -Vin | ∅ 1.0 [0.04] |
| 3 | +Vout | +Vout | ∅ 1.0 [0.04] |
| 4 | Trim | Common | ∅ 1.0 [0.04] |
| 5 | -Vout | -Vout | ∅ 1.0 [0.04] |
| 6 | Remote On/Off | Remote On/Off | ∅ 1.0 [0.04] |

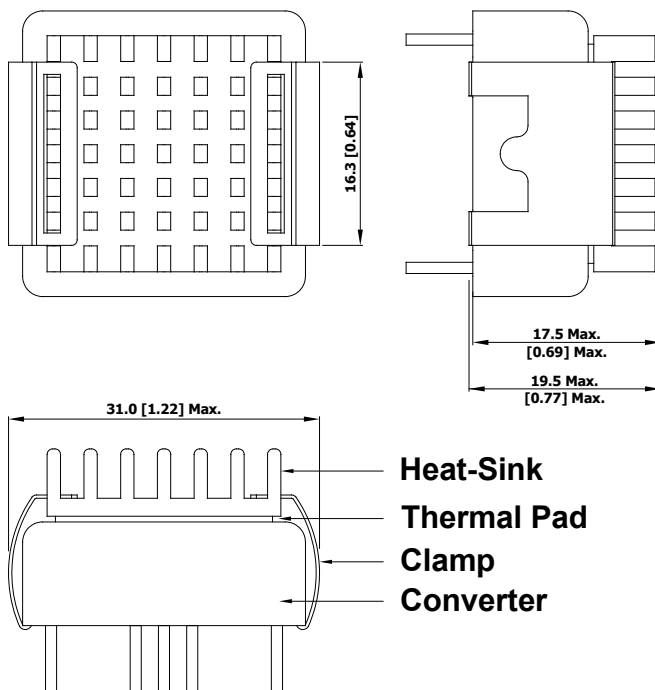
- ▶ All dimensions in mm (inches)
- ▶ Tolerance: X.X±0.5 (X.XX±0.02)
X.XX±0.25 (X.XXX±0.01)
- ▶ Pin diameter tolerance: X.X±0.05 (X.XX±0.002)

Physical Characteristics

| | |
|---------------|--|
| Case Size | : 25.4x25.4x10.2mm (1.0x1.0x0.4 inches) |
| Case Material | : Metal With Non-Conductive Baseplate |
| Base Material | : FR4 PCB (flammability to UL 94V-0 rated) |
| Pin Material | : Copper Alloy |
| Weight | : 16.5g |

Heatsink (Option –HS)

Mechanical Dimensions

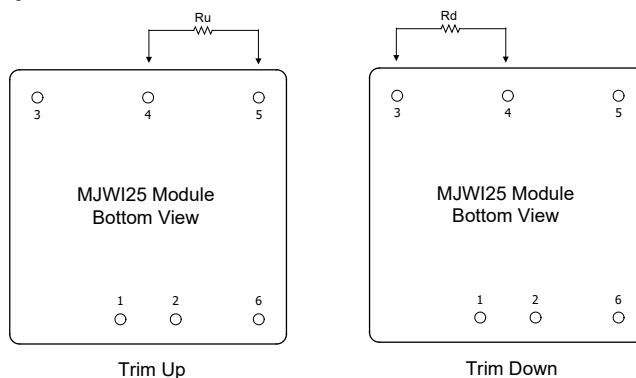


Heatsink Material: Aluminum
 Finish: Anodic treatment (black)
 Weight: 2g

- ▶ The advantages of adding a heatsink are:
 1. To improve heat dissipation and increase the stability and reliability of the DC-DC converters at high operating temperatures.
 2. To increase Operating temperature of the DC-DC converter, please refer to Derating Curve.

External Output Trimming

Output can be externally trimmed by using the method shown below

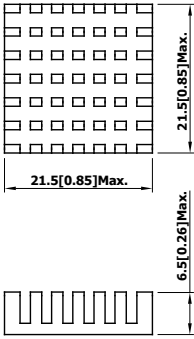


| Trim Range (%) | MJWI25-XXS033 | | MJWI25-XXS05 | | MJWI25-XXS12 | | MJWI25-XXS15 | |
|----------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|
| | Trim down (kΩ) | Trim up (kΩ) | Trim down (kΩ) | Trim up (kΩ) | Trim down (kΩ) | Trim up (kΩ) | Trim down (kΩ) | Trim up (kΩ) |
| 1 | 72.61 | 60.84 | 138.88 | 106.87 | 413.55 | 351.00 | 530.73 | 422.77 |
| 2 | 32.55 | 27.40 | 62.41 | 47.76 | 184.55 | 157.50 | 238.61 | 189.89 |
| 3 | 19.20 | 16.25 | 36.92 | 28.06 | 108.22 | 93.00 | 141.24 | 112.26 |
| 4 | 12.52 | 10.68 | 24.18 | 18.21 | 70.05 | 60.75 | 92.56 | 73.44 |
| 5 | 8.51 | 7.34 | 16.53 | 12.30 | 47.15 | 41.40 | 63.35 | 50.15 |
| 6 | 5.84 | 5.11 | 11.44 | 8.36 | 31.88 | 28.50 | 43.87 | 34.63 |
| 7 | 3.94 | 3.51 | 7.79 | 5.55 | 20.98 | 19.29 | 29.96 | 23.54 |
| 8 | 2.51 | 2.32 | 5.06 | 3.44 | 12.80 | 12.37 | 19.53 | 15.22 |
| 9 | 1.39 | 1.39 | 2.94 | 1.79 | 6.44 | 7.00 | 11.41 | 8.75 |
| 10 | 0.50 | 0.65 | 1.24 | 0.48 | 1.35 | 2.70 | 4.92 | 3.58 |

| Order Code Table | |
|------------------|------------------|
| Standard | With heatsink |
| MJWI25-24S033 | MJWI25-24S033-HS |
| MJWI25-24S05 | MJWI25-24S05-HS |
| MJWI25-24S12 | MJWI25-24S12-HS |
| MJWI25-24S15 | MJWI25-24S15-HS |
| MJWI25-24D12 | MJWI25-24D12-HS |
| MJWI25-24D15 | MJWI25-24D15-HS |
| MJWI25-48S033 | MJWI25-48S033-HS |
| MJWI25-48S05 | MJWI25-48S05-HS |
| MJWI25-48S12 | MJWI25-48S12-HS |
| MJWI25-48S15 | MJWI25-48S15-HS |
| MJWI25-48D12 | MJWI25-48D12-HS |
| MJWI25-48D15 | MJWI25-48D15-HS |

Order Code For Heatsink kit (including: Heatsink x1, Clamp x 2, Thermal Pad x1)

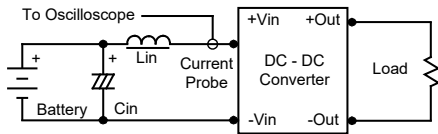
HS-J001



Test Setup

Input Reflected-Ripple Current Test Setup

Input reflected-ripple current is measured with an inductor L_{in} ($4.7\mu\text{H}$) and C_{in} ($220\mu\text{F}$, $\text{ESR} < 1.0\Omega$ at 100 kHz) to simulate source impedance. Capacitor C_{in} , offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is $0\text{-}500\text{ kHz}$.



Peak-to-Peak Output Noise Measurement Test

Use a $1\mu\text{F}$ ceramic capacitor and a $10\mu\text{F}$ tantalum capacitor. Scope measurement should be made by using a BNC socket, measurement bandwidth is $0\text{-}20\text{ MHz}$. 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 $-V_{in}$ 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 6) during a logic low is $-500\mu\text{A}$. The maximum allowable leakage current of a switch connected to the on/off terminal (Pin 6) at logic high (3.5V to 12V) is 10mA .

Overload Protection

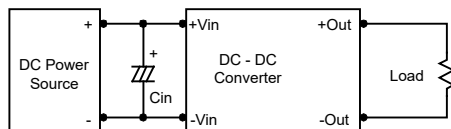
To provide hiccup mode protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure overload for an unlimited duration.

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.

Input Source Impedance

The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup. Capacitor mounted close to the power module helps ensure stability of the unit, it is recommended to use a good quality low Equivalent Series Resistance ($\text{ESR} < 1.0\Omega$ at 100 kHz) capacitor of a $10\mu\text{F}$ for the 24V and 48V devices.



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 $4.7\mu\text{F}$ capacitors at the output.



Maximum Capacitive Load

The MJWI25 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 case temperature must be kept below 105°C . The derating curves are determined from measurements obtained in a test setup.

