## FEATURES

- ▶ **Industrial Standard 1" x 1" Package**
- ▶ **Wide 2:1 Input Voltage Range**
- ▶ **Fully Regulated Output Voltage**
- ▶ **I/O Isolation 1500VDC**
- ▶ **Operating Ambient Temp. Range -40℃ to +80℃**
- ▶ **Low No Load Power Consumption**
- ▶ **No Min. Load Requirement**
- ▶ **Under-voltage, Overload and Short Circuit Protection**
- ▶ **Remote On/Off Control (option)**
- ▶ **Shielded Metal Case with Insulated Baseplate**
- ▶ **Conducted EMI EN 55032 Class A & FCC Level A Approved**
- ▶ **UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval & CE Marking**


UL 62368-1 CSA 60950-1 CB Scheme

CONFLICT FREE Minerals Policy REACH COMPLIANT 3 YEAR WARRANTY RoHS Compliant

## PRODUCT OVERVIEW

The MINMAX MJW10 series is a new range of cost-optimized 10W isolated DC-DC converter within an encapsulated 1"x1" industrial standard package. There are 24 models available for 12, 24, 48VDC with wide 2:1 input voltage range and tight output voltage regulation. The MJW10 series come in a shielded metal package and conducted EMI EN 55032 class A & FCC level A approved without external components.

By state-of-the-art circuit topology and 89% high efficiency could be achieved allowing an operating temperature of -40℃ to +80℃ as well as low standby power consumption. Further features include remote ON/OFF, under-voltage protection, overload protection, short circuit protection and no min. load requirement as well.

These DC-DC converters offer a superior solution for many space-critical applications in battery-powered equipment, instrumentation, distributed power architectures in communication, industrial electronics, energy facilities and many other critical space applications.

### Model Selection Guide

| Model Number | Input Voltage (Range) | Output Voltage | Output Current | Input Current | | Max. capacitive Load | Efficiency (typ.) |
|---|---|---|---|---|---|---|---|
| | | | Max. | @Max. Load | @No Load | | @Max. Load |
| | VDC | VDC | mA | mA(typ.) | mA(typ.) | μF | % |
| **MJW10-12S033** | 12 (9 ~ 18) | 3.3 | 2500 | 838 | 15 | 4700 | 82 |
| **MJW10-12S05** | | 5 | 2000 | 980 | | 2200 | 85 |
| **MJW10-12S051** | | 5.1 | 2000 | 1000 | | 2200 | 85 |
| **MJW10-12S12** | | 12 | 830 | 954 | | 330 | 87 |
| **MJW10-12S15** | | 15 | 670 | 952 | | 220 | 88 |
| **MJW10-12D05** | | ±5 | ±1000 | 992 | | 1000# | 84 |
| **MJW10-12D12** | | ±12 | ±416 | 956 | | 150# | 87 |
| **MJW10-12D15** | | ±15 | ±333 | 957 | | 100# | 87 |
| **MJW10-24S033** | 24 (18 ~ 36) | 3.3 | 2500 | 414 | 12 | 4700 | 83 |
| **MJW10-24S05** | | 5 | 2000 | 490 | | 2200 | 85 |
| **MJW10-24S051** | | 5.1 | 2000 | 500 | | 2200 | 85 |
| **MJW10-24S12** | | 12 | 830 | 472 | | 330 | 88 |
| **MJW10-24S15** | | 15 | 670 | 471 | | 220 | 89 |
| **MJW10-24D05** | | ±5 | ±1000 | 490 | | 1000# | 85 |
| **MJW10-24D12** | | ±12 | ±416 | 473 | | 150# | 88 |
| **MJW10-24D15** | | ±15 | ±333 | 468 | | 100# | 89 |
| **MJW10-48S033** | 48 (36 ~ 75) | 3.3 | 2500 | 207 | 10 | 4700 | 83 |
| **MJW10-48S05** | | 5 | 2000 | 242 | | 2200 | 86 |
| **MJW10-48S051** | | 5.1 | 2000 | 250 | | 2200 | 85 |
| **MJW10-48S12** | | 12 | 830 | 233 | | 330 | 89 |
| **MJW10-48S15** | | 15 | 670 | 235 | | 220 | 89 |
| **MJW10-48D05** | | ±5 | ±1000 | 242 | | 1000# | 86 |
| **MJW10-48D12** | | ±12 | ±416 | 239 | | 150# | 87 |
| **MJW10-48D15** | | ±15 | ±333 | 237 | | 100# | 88 |

# For each output

## Input Specifications

| Parameter | Conditions / Model | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Input Surge Voltage (1 sec. max.) | 12V Input Models | -0.7 | --- | 25 | VDC |
| | 24V Input Models | -0.7 | --- | 50 | |
| | 48V Input Models | -0.7 | --- | 100 | |
| Start-Up Threshold Voltage | 12V Input Models | --- | --- | 9 | |
| | 24V Input Models | --- | --- | 18 | |
| | 48V Input Models | --- | --- | 36 | |
| Under Voltage Shutdown | 12V Input Models | --- | --- | 8.5 | |
| | 24V Input Models | --- | --- | 17 | |
| | 48V Input Models | --- | --- | 34 | |
| Input Filter | All Models | Internal Pi Type | | | |

## Remote On/Off Control

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Converter On | 3.5V ~ 12V or Open Circuit | | | | |
| Converter Off | 0~1.2V or Short Circuit (Pin 2 and Pin 6) | | | | |
| Control Input Current (on) | Vctrl = 5V | --- | --- | 0.5 | mA |
| Control Input Current (off) | Vctrl = 0V | --- | --- | -0.5 | mA |
| Control Common | Referenced to Negative Input | | | | |
| Standby Input Current | Nominal Vin | --- | 5 | --- | mA |

## Output Specifications

| Parameter | Conditions / Model | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage Setting Accuracy | | | --- | --- | ±2.0 | %Vnom. |
| Output Voltage Balance | Dual Output, Balanced Loads | | --- | --- | ±2.0 | % |
| Line Regulation | Vin=Min. to Max. @Full Load | | --- | --- | ±1.0 | % |
| Load Regulation | Io=0% to 100% | Single Output | --- | --- | ±0.5 | % |
| | | 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 | 3.3 & 5V Output | --- | 80 | --- | $mV_{p-p}$ |
| | | Other Output | --- | 100 | --- | $mV_{p-p}$ |
| Transient Recovery Time | 25% Load Step Change | | --- | 300 | --- | µsec |
| Transient Response Deviation | | | --- | ±3 | ±5 | % |
| Temperature Coefficient | | | --- | ±0.01 | ±0.02 | %/°C |
| Over Load Protection | Hiccup | | 110 | 150 | --- | % |
| Short Circuit Protection | Continuous, Automatic Recovery (Hiccup Mode 0.7Hz 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 | | --- | 330 | --- | kHz |
| MTBF(calculated) | MIL-HDBK-217F@25°C, Ground Benign | 2,596,000 | --- | --- | 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) | | | | |

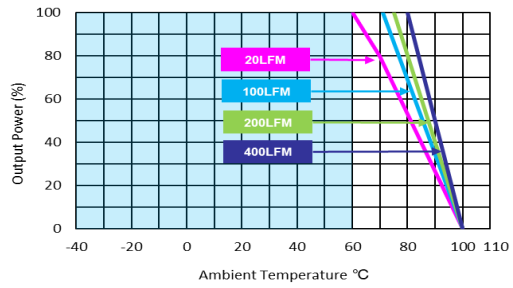
## EMC Specifications

| Parameter | Standards & Level | | Performance |
|---|---|---|---|
| EMI | Conduction | EN 55032, FCC part 15 | Class A |
| EMS | EN 55024 | | |
| | ESD | EN 61000-4-2 Air ± 8kV , Contact ±6kV | A |
| | Radiated immunity | EN 61000-4-3 10V/m | A |
| | Fast transient (5) | EN 61000-4-4 ±2kV | A |
| | Surge (5) | EN 61000-4-5 ±1kV | A |
| | Conducted immunity | EN 61000-4-6 10Vrms | A |
| | PFMF | EN 61000-4-8 3A/m | A |

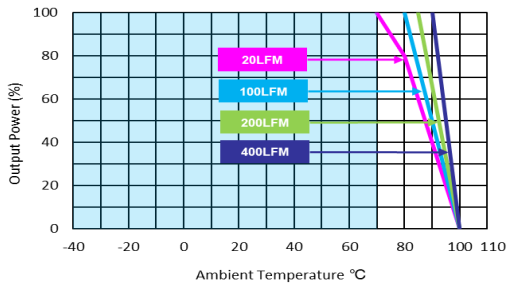
## Environmental Specifications

| Parameter | Min. | Max. | Unit |
|---|---|---|---|
| Operating Ambient Temperature Range (See Power Derating Curve) | -40 | +80 | ℃ |
| Case Temperature | --- | +100 | ℃ |
| Storage Temperature Range | -50 | +125 | ℃ |
| Humidity (non condensing) | --- | 95 | % rel. H |
| RFI | Six-Sided Shielded, Metal Case | | |
| Lead Temperature (1.5mm from case for 10Sec.) | --- | 260 | ℃ |

## Power Derating Curve




Derating Curve without Heatsink



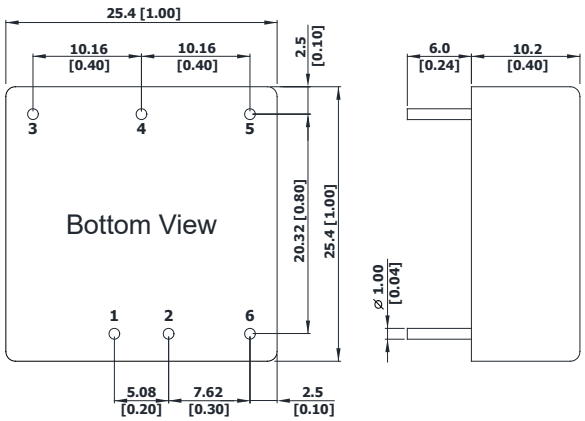

Derating Curve with Heatsink

## Notes

1. Specifications typical at Ta=+25℃, 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. We recommend to protect the converter by a fast blow fuse in the input supply line.
4. Other input and output voltage may be available, please contact factory.
5. To meet EN 61000-4-4 & EN 61000-4-5, an external capacitor across the input pins is required. Suggested capacitor : 330μF/80V
6. Specifications are subject to change without notice.

## Package Specifications

### Mechanical Dimensions




### Pin Connections

| Pin | Single Output | Dual Output |
|---|---|---|
| 1 | +Vin | +Vin |
| 2 | -Vin | -Vin |
| 3 | +Vout | +Vout |
| 4 | No Pin | Common |
| 5 | -Vout | -Vout |
| 6 | Remote On/Off (Optional) | |

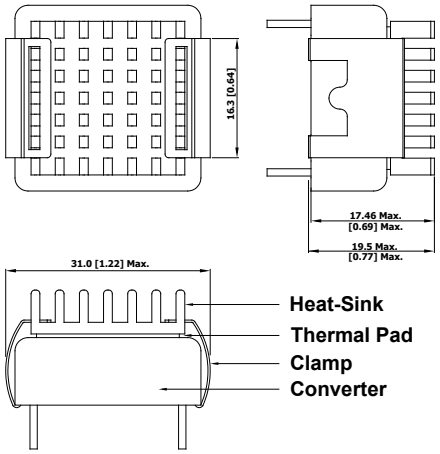
- ▶All dimensions in mm (inches)
- ▶Tolerance: X.X±0.5 (X.XX±0.02)
  X.XX±0.25 ( X.XXX±0.01)
- ▶Pin diameter ∅ 1.0 ±0.05 (0.04±0.002)

## Physical Characteristics

| | | |
|---|---|---|
| Case Size | : | 25.4x25.4x10.2mm (1.0x1.0x0.4 inches) |
| Case Material | : | Aluminium Alloy, Black Anodized Coating |
| Base Material | : | FR4 PCB (flammability to UL 94V-0 rated) |
| Pin Material | : | Tinned Copper |
| Weight | : | 15g |

## 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.

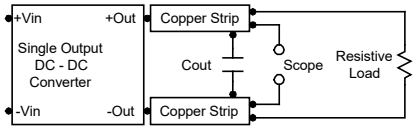
**Order Code Table**

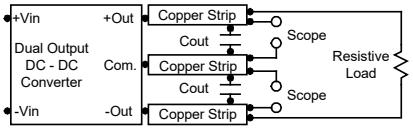
| Standard | With Remote On/Off | With heatsink | With Remote On/Off & heatsink |
|---|---|---|---|
| MJW10-12S033 | MJW10-12S033-RC | MJW10-12S033-HS | MJW10-12S033-RC-HS |
| MJW10-12S05 | MJW10-12S05-RC | MJW10-12S05-HS | MJW10-12S05-RC-HS |
| MJW10-12S051 | MJW10-12S051-RC | MJW10-12S051-HS | MJW10-12S051-RC-HS |
| MJW10-12S12 | MJW10-12S12-RC | MJW10-12S12-HS | MJW10-12S12-RC-HS |
| MJW10-12S15 | MJW10-12S15-RC | MJW10-12S15-HS | MJW10-12S15-RC-HS |
| MJW10-12D05 | MJW10-12D05-RC | MJW10-12D05-HS | MJW10-12D05-RC-HS |
| MJW10-12D12 | MJW10-12D12-RC | MJW10-12D12-HS | MJW10-12D12-RC-HS |
| MJW10-12D15 | MJW10-12D15-RC | MJW10-12D15-HS | MJW10-12D15-RC-HS |
| MJW10-24S033 | MJW10-24S033-RC | MJW10-24S033-HS | MJW10-24S033-RC-HS |
| MJW10-24S05 | MJW10-24S05-RC | MJW10-24S05-HS | MJW10-24S05-RC-HS |
| MJW10-24S051 | MJW10-24S051-RC | MJW10-24S051-HS | MJW10-24S051-RC-HS |
| MJW10-24S12 | MJW10-24S12-RC | MJW10-24S12-HS | MJW10-24S12-RC-HS |
| MJW10-24S15 | MJW10-24S15-RC | MJW10-24S15-HS | MJW10-24S15-RC-HS |
| MJW10-24D05 | MJW10-24D05-RC | MJW10-24D05-HS | MJW10-24D05-RC-HS |
| MJW10-24D12 | MJW10-24D12-RC | MJW10-24D12-HS | MJW10-24D12-RC-HS |
| MJW10-24D15 | MJW10-24D15-RC | MJW10-24D15-HS | MJW10-24D15-RC-HS |
| MJW10-48S033 | MJW10-48S033-RC | MJW10-48S033-HS | MJW10-48S033-RC-HS |
| MJW10-48S05 | MJW10-48S05-RC | MJW10-48S05-HS | MJW10-48S05-RC-HS |
| MJW10-48S051 | MJW10-48S051-RC | MJW10-48S051-HS | MJW10-48S051-RC-HS |
| MJW10-48S12 | MJW10-48S12-RC | MJW10-48S12-HS | MJW10-48S12-RC-HS |
| MJW10-48S15 | MJW10-48S15-RC | MJW10-48S15-HS | MJW10-48S15-RC-HS |
| MJW10-48D05 | MJW10-48D05-RC | MJW10-48D05-HS | MJW10-48D05-RC-HS |
| MJW10-48D12 | MJW10-48D12-RC | MJW10-48D12-HS | MJW10-48D12-RC-HS |
| MJW10-48D15 | MJW10-48D15-RC | MJW10-48D15-HS | MJW10-48D15-RC-HS |

## Test Setup

### Peak-to-Peak Output Noise Measurement Test

Use a Cout 0.47µF ceramic capacitor. 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 6) during a logic low is -500uA.

### Overload Protection

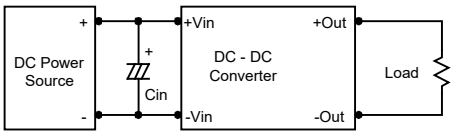
To provide protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure current limiting for an unlimited duration. At the point of current-limit inception, the unit shifts from voltage control to current control. The unit operates normally once the output current is brought back into its specified range.

### 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.

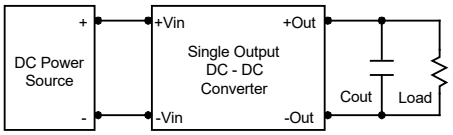
### Input Source Impedance

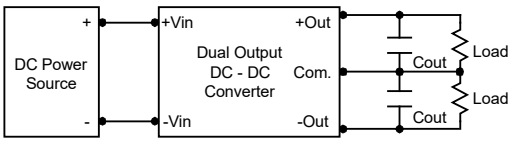
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module.
In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.
By using a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 kHz) capacitor of a 12µF for the 12V, 4.7µF for the 24V input devices and a 2.2µF for the 48V devices, capacitor mounted close to the power module helps ensure stability of the unit.




### 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 3.3µF capacitors at the output.




### Maximum Capacitive Load

The MJW10 series has limitation of maximum connected capacitance on the output. The power module may operate 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 100°C.
The derating curves are determined from measurements obtained in a test setup.