

**FEATURES**

- ▶ Industrial Standard DIP-24 Package
- ▶ Ultra-wide 4:1 Input Voltage Range
- ▶ Fully Regulated Output Voltage
- ▶ High Efficiency up to 87%
- ▶ I/O Isolation 1500 VDC
- ▶ Operating Temp. Range -40°C to +85°C
- ▶ No Min. Load Requirement
- ▶ Overload and Short Circuit Protection
- ▶ Remote On/Off Control
- ▶ Shielded Metal Case with Insulated Baseplate
- ▶ Conducted EMI EN55022 Class A Approved
- ▶ UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval


**PRODUCT OVERVIEW**

The MINMAX MIWI10 series is a range of cost-optimized 10W DC-DC converter modules with ultra-wide 4:1 input ranges and fixed tightly regulated output voltages. The converters come in a shielded metal package in the standard DIP-24 format. By state-of-the-art circuit topology a high efficiency could be achieved allowing allowing an operating temperature up to +70°C at full load. Further features include remote ON/OFF, under-voltage, overload and short circuit protection and internal EMI-filter meeting EN55022 Class A. These converters modules will find a wide range of applications like battery operated instrumentation, distributed power architectures in Communication equipment and in industrial electronics.

**Model Selection Guide**

| Model Number  | Input Voltage (Range)<br>VDC | Output Voltage<br>VDC | Output Current<br>Max.<br>mA | Input Current          |                      | Reflected Ripple Current<br>mA(typ.) | Max. capacitive Load<br>µF | Efficiency (typ.)<br>@Max. Load<br>% |
|---------------|------------------------------|-----------------------|------------------------------|------------------------|----------------------|--------------------------------------|----------------------------|--------------------------------------|
|               |                              |                       |                              | @Max. Load<br>mA(typ.) | @No Load<br>mA(typ.) |                                      |                            |                                      |
| MIWI10-24S033 | 24<br>(9 ~ 36)               | 3.3                   | 2700                         | 432                    | 30                   | 40                                   | 1000                       | 86                                   |
| MIWI10-24S05  |                              | 5                     | 2000                         | 490                    |                      |                                      |                            | 85                                   |
| MIWI10-24S051 |                              | 5.1                   | 2000                         | 500                    |                      |                                      |                            | 85                                   |
| MIWI10-24S12  |                              | 12                    | 833                          | 479                    |                      |                                      |                            | 87                                   |
| MIWI10-24S15  |                              | 15                    | 666                          | 478                    |                      |                                      |                            | 87                                   |
| MIWI10-24S24  |                              | 24                    | 416                          | 478                    |                      |                                      |                            | 87                                   |
| MIWI10-24D12  |                              | ±12                   | ±416                         | 478                    |                      |                                      |                            | 87                                   |
| MIWI10-24D15  |                              | ±15                   | ±333                         | 478                    |                      |                                      |                            | 87                                   |
| MIWI10-48S033 | 48<br>(18 ~ 75)              | 3.3                   | 2700                         | 216                    | 20                   | 30                                   | 1000                       | 86                                   |
| MIWI10-48S05  |                              | 5                     | 2000                         | 245                    |                      |                                      |                            | 85                                   |
| MIWI10-48S051 |                              | 5.1                   | 2000                         | 250                    |                      |                                      |                            | 85                                   |
| MIWI10-48S12  |                              | 12                    | 833                          | 239                    |                      |                                      |                            | 87                                   |
| MIWI10-48S15  |                              | 15                    | 666                          | 236                    |                      |                                      |                            | 87                                   |
| MIWI10-48S24  |                              | 24                    | 416                          | 244                    |                      |                                      |                            | 87                                   |
| MIWI10-48D12  |                              | ±12                   | ±416                         | 244                    |                      |                                      |                            | 87                                   |
| MIWI10-48D15  |                              | ±15                   | ±333                         | 244                    |                      |                                      |                            | 87                                   |

# For each output

| Input Specifications              |                  |                  |      |      |      |
|-----------------------------------|------------------|------------------|------|------|------|
| Parameter                         | Model            | Min.             | Typ. | Max. | Unit |
| Input Surge Voltage (1 sec. max.) | 24V Input Models | -0.7             | ---  | 50   | VDC  |
|                                   | 48V Input Models | -0.7             | ---  | 100  |      |
| Start-Up Threshold Voltage        | 24V Input Models | 7                | 8    | 9    |      |
|                                   | 48V Input Models | 14               | 16   | 18   |      |
| Under Voltage Shutdown            | 24V Input Models | ---              | ---  | 8.5  |      |
|                                   | 48V Input Models | ---              | ---  | 17   |      |
| 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 1 and Pin 2) |      |      |      |      |
| Control Input Current (on)  | Vctrl = 5V                                | ---  | ---  | 500  | μA   |
| Control Input Current (off) | Vctrl = 0V                                | ---  | ---  | -500 | μA   |
| Control Common              | Referenced to Negative Input              |      |      |      |      |
| Standby Input Current       | Nominal Vin                               | ---  | ---  | 10   | mA   |

| Output Specifications           |   |      |       |       |                   |
|---------------------------------|---|------|-------|-------|-------------------|
| Parameter                       | Conditions  | Min. | Typ.  | Max.  | Unit              |
| Output Voltage Setting Accuracy |   | ---  | ±1.0  | ±2.0  | %Vnom.            |
| Output Voltage Balance          | Dual Output, Balanced Loads                             | ---  | ±1.0  | ±2.0  | %                 |
| Line Regulation                 | Vin=Min. to Max. @Full Load                             | ---  | ±0.5  | ±1.0  | %                 |
| Load Regulation                 | Io=0% to 100%   | ---  | ±0.5  | ±1.2  | %                 |
| Minimum Load                    | No minimum Load Requirement                             |      |       |       |                   |
| Ripple & Noise                  | 0-20 MHz Bandwidth                                      | ---  | ---   | 100   | mV <sub>P-P</sub> |
| Transient Recovery Time         | 25% Load Step Change                                    | ---  | 300   | 600   | μsec              |
| Transient Response Deviation    |   | ---  | ±3    | ±5    | %                 |
| Temperature Coefficient         |   | ---  | ±0.01 | ±0.02 | %/°C              |
| Over Load Protection            | Hiccup  | ---  | 150   | ---   | %                 |
| Short Circuit Protection        | Continuous, Automatic Recovery (Hiccup Mode 0.7Hz typ.) |      |       |       |                   |

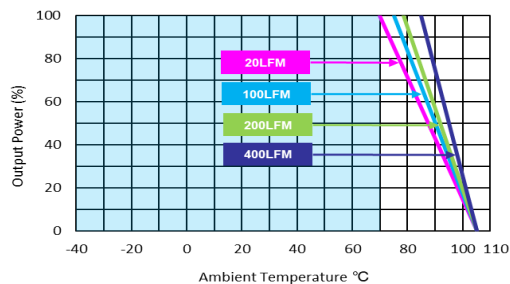
| General Specifications    |  |           |      |      |       |
|---------------------------|--|-----------|------|------|-------|
| Parameter                 | Conditions   | Min.      | Typ. | Max. | Unit  |
| I/O Isolation Voltage     | 60 Seconds   | 1500      | ---  | ---  | VDC   |
|                           | 1 Second   | 1800      | ---  | ---  | VDC   |
| I/O Isolation Resistance  | 500 VDC  | 1000      | ---  | ---  | MΩ    |
| I/O Isolation Capacitance | 100kHz, 1V   | ---       | 1000 | 1500 | pF    |
| Switching Frequency       |  | ---       | 330  | ---  | kHz   |
| MTBF (calculated)         | MIL-HDBK-217F@25°C, Ground Benign                                      | 1,000,000 |      |      | 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**

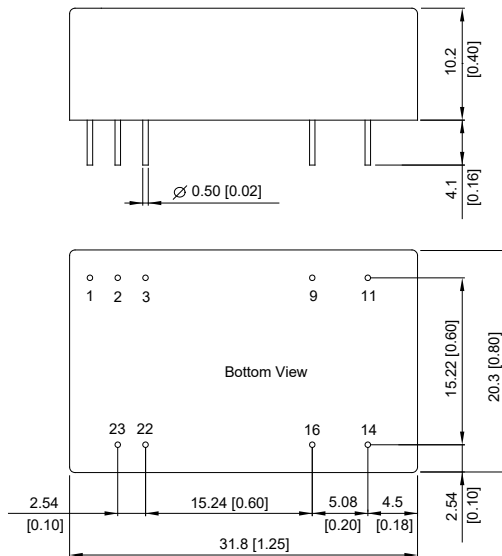
| Parameter | Standards & Level  |   | Performance                 |
|-----------|--------------------|---|-----------------------------|
| EMI       | Conduction         | EN55022                                       | Without external components |
|           | Radiation          |   | With external components    |
| EMS       | EN55024            |   |                             |
|           | ESD                | EN61000-4-2 Air $\pm$ 8kV , Contact $\pm$ 6kV | A                           |
|           | Radiated immunity  | EN61000-4-3 10V/m                             | A                           |
|           | Fast transient (s) | EN61000-4-4 $\pm$ 2kV                         | A                           |
|           | Surge (s)          | EN61000-4-5 $\pm$ 1kV                         | A                           |
|           | Conducted immunity | EN61000-4-6 10Vrms                            | A                           |

**Environmental Specifications**

| Parameter  | Min. | Max. | Unit     |
|--|------|------|----------|
| Operating Ambient Temperature Range (See Power Derating Curve) | -40  | +85  | °C       |
| Case Temperature   | ---  | +105 | °C       |
| Storage Temperature Range                                      | -50  | +125 | °C       |
| Humidity (non condensing)                                      | ---  | 95   | % rel. H |
| Lead Temperature (1.5mm from case for 10Sec.)                  | ---  | 260  | °C       |

**Power Derating Curve**

**Notes**

- Specifications typical at Ta=+25°C, resistive load, nominal input voltage and rated output current unless otherwise noted.
- Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%.
- We recommend to protect the converter by a fast blow fuse in the input supply line.
- Other input and output voltages may be available, please contact MINMAX.
- To meet EN61000-4-4 & EN61000-4-5 an external capacitor across the input pins is required, please contact MINMAX.
- Specifications are subject to change without notice.

**Package Specifications**
**Mechanical Dimensions**

**Pin Connections**

| Pin | Single Output | Dual Output   |
|-----|---------------|---------------|
| 1   | Remote On/Off | Remote On/Off |
| 2   | -Vin          | -Vin          |
| 3   | -Vin          | -Vin          |
| 9   | No Pin        | Common        |
| 11  | NC            | -Vout         |
| 14  | +Vout         | +Vout         |
| 16  | -Vout         | Common        |
| 22  | +Vin          | +Vin          |
| 23  | +Vin          | +Vin          |

NC: No Connection

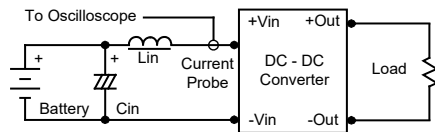
- ▶ All dimensions in mm (inches)
- ▶ Tolerance: X.X±0.5 (X.XX±0.02)  
X.XX±0.25 (X.XXX±0.01)
- ▶ Pin diameter  $\varnothing 0.5 \pm 0.05$  (0.02±0.002)

**Physical Characteristics**

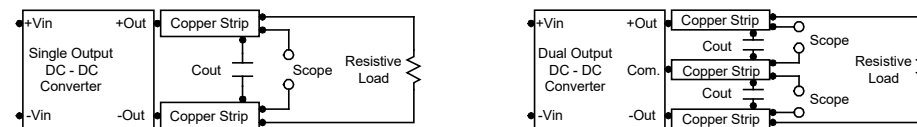
|               |   |
|---------------|---|
| Case Size     | : 31.8x20.3x10.2mm (1.25x0.80x0.40 inches)          |
| Case Material | : Metal with Non-Conductive Baseplate               |
| Pin Material  | : Copper Alloy with Gold Plate Over Nickel Subplate |
| Weight        | : 17.3g   |

**Test Setup**
**Input Reflected-Ripple Current Test Setup**

Input reflected-ripple current is measured with an inductor  $L_{in}$  (4.7 $\mu$ H) and  $C_{in}$  (220 $\mu$ F, 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 0-500 kHz.


**Peak-to-Peak Output Noise Measurement Test**

Use a  $C_{out}$  0.47 $\mu$ F 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 1) during a logic low is -100 $\mu$ A.

**Overload Protection**

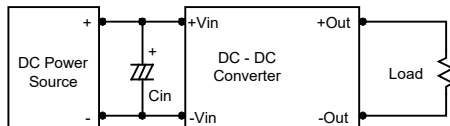
To provide protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure current limiting for an unlimited duration. At the point of current-limit inception, the unit shifts from voltage control to current control. The unit operates normally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

**Overvoltage Protection**

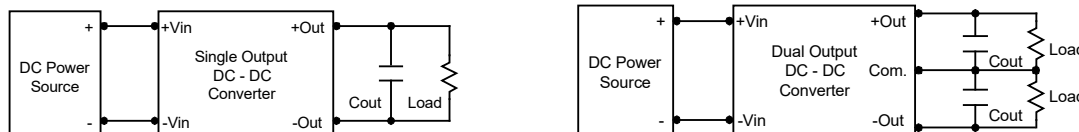
The output overvoltage clamp consists of control circuitry, which is independent of the primary regulation loop, that monitors the voltage on the output terminals. The control loop of the clamp has a higher voltage set point than the primary loop. This provides a redundant voltage control that reduces 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 < 1.0 $\Omega$  at 100 kHz) capacitor of a 4.7 $\mu$ F for the 24V input devices and a 2.2 $\mu$ F 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 3.3 $\mu$ F capacitors at the output.


**Maximum Capacitive Load**

The MIW10 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 105 $^{\circ}$ C. The derating curves are determined from measurements obtained in a test setup.

