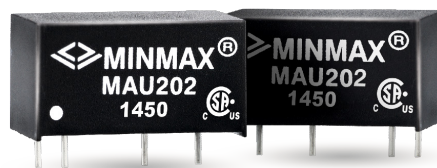


## FEATURES

- ▶ Industrial Standard SIP-7 Package
- ▶ Unregulated Output Voltage
- ▶ I/O Isolation 3000 VDC
- ▶ Operating Ambient Temp. Range -40°C to +90°C
- ▶ UL/cUL/IEC/EN 60950-1 Safety Approval



## PRODUCT OVERVIEW

The MINMAX MAU200 series is a range of 1W DC-DC converters in a small SIP Package featuring high I/O isolation of 3000VDC. An excellent efficiency allows an operating temperature range of -40°C to +90°C. These converters offer an economical solution for many applications where a voltage has to be isolated i.e for noise reduction, ground loop elimination, digital interfaces or for board level power distribution where a higher I/O-isolation is required.

### Model Selection Guide

| Model Number | Input Voltage (Range) | Output Voltage | Output Current |      | Input Current |          | Load Regulation | Max. capacitive Load | Efficiency (typ.) |
|--------------|-----------------------|----------------|----------------|------|---------------|----------|-----------------|----------------------|-------------------|
|              |                       |                | Max.           | Min. | @Max. Load    | @No Load |                 |                      | @Max. Load        |
|              | VDC                   | VDC            | mA             | mA   | mA(typ.)      | mA(typ.) | % (max.)        | μF                   | %                 |
| MAU201       | 5<br>(4.5 ~ 5.5)      | 3.3            | 260            | 5    | 235           | 30       | 10              | 220                  | 73                |
| MAU202       |                       | 5              | 200            | 4    | 281           |          | 10              |                      | 71                |
| MAU203       |                       | 9              | 110            | 2    | 260           |          | 8               |                      | 76                |
| MAU204       |                       | 12             | 84             | 1.5  | 258           |          | 7               |                      | 78                |
| MAU205       |                       | 15             | 67             | 1    | 258           |          | 7               |                      | 78                |
| MAU206       |                       | ±5             | ±100           | ±2   | 278           |          | 10              | 100#                 | 72                |
| MAU207       |                       | ±9             | ±56            | ±1   | 262           |          | 8               |                      | 77                |
| MAU208       |                       | ±12            | ±42            | ±0.8 | 258           |          | 7               |                      | 78                |
| MAU209       |                       | ±15            | ±34            | ±0.7 | 258           |          | 7               |                      | 79                |
| MAU211       | 12<br>(10.8 ~ 13.2)   | 3.3            | 260            | 5    | 96            | 12       | 8               | 220                  | 74                |
| MAU212       |                       | 5              | 200            | 4    | 114           |          | 8               |                      | 73                |
| MAU213       |                       | 9              | 110            | 2    | 106           |          | 5               |                      | 78                |
| MAU214       |                       | 12             | 84             | 1.5  | 105           |          | 5               |                      | 80                |
| MAU215       |                       | 15             | 67             | 1    | 104           |          | 5               |                      | 80                |
| MAU216       |                       | ±5             | ±100           | ±2   | 113           |          | 8               | 100#                 | 74                |
| MAU217       |                       | ±9             | ±56            | ±1   | 106           |          | 5               |                      | 79                |
| MAU218       |                       | ±12            | ±42            | ±0.8 | 104           |          | 5               |                      | 81                |
| MAU219       |                       | ±15            | ±34            | ±0.7 | 105           |          | 5               |                      | 81                |
| MAU221       | 24<br>(21.6 ~ 26.4)   | 3.3            | 260            | 5    | 49            | 7        | 8               | 220                  | 73                |
| MAU222       |                       | 5              | 200            | 4    | 59            |          | 8               |                      | 71                |
| MAU223       |                       | 9              | 110            | 2    | 54            |          | 5               |                      | 76                |
| MAU224       |                       | 12             | 84             | 1.5  | 54            |          | 5               |                      | 78                |
| MAU225       |                       | 15             | 67             | 1    | 53            |          | 5               |                      | 79                |
| MAU226       |                       | ±5             | ±100           | ±2   | 58            |          | 8               | 100#                 | 72                |
| MAU227       |                       | ±9             | ±56            | ±1   | 55            |          | 5               |                      | 76                |
| MAU228       |                       | ±12            | ±42            | ±0.8 | 53            |          | 5               |                      | 79                |
| MAU229       |                       | ±15            | ±34            | ±0.7 | 53            |          | 5               |                      | 80                |

\* Min. Output Current for Lower Load Regulation

# For each output

**Input Specifications**

| Parameter                         | Model            | Min.               | Typ. | Max. | Unit |
|-----------------------------------|------------------|--------------------|------|------|------|
| Input Voltage Range               | 5V Input Models  | 4.5                | 5    | 5.5  | VDC  |
|                                   | 12V Input Models | 10.8               | 12   | 13.2 |      |
|                                   | 24V Input Models | 21.6               | 24   | 26.4 |      |
| Input Surge Voltage (1 sec. max.) | 5V Input Models  | -0.7               | ---  | 9    |      |
|                                   | 12V Input Models | -0.7               | ---  | 18   |      |
|                                   | 24V Input Models | -0.7               | ---  | 30   |      |
| Input Filter                      | All Models       | Internal Capacitor |      |      |      |

**Output Specifications**

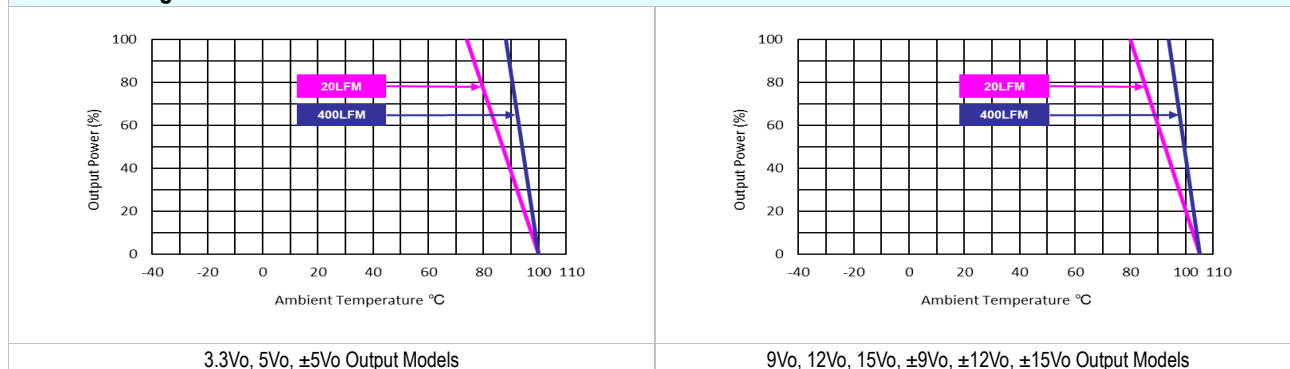
| Parameter                       | Conditions                          | Min.                      | Typ.  | Max.  | Unit              |
|---------------------------------|-------------------------------------|---------------------------|-------|-------|-------------------|
| Output Voltage Setting Accuracy |                                     | ---                       | ±1.0  | ±3.0  | %Vnom.            |
| Output Voltage Balance          | Dual Output, Balanced Loads         | ---                       | ±0.1  | ±1.0  | %                 |
| Line Regulation                 | For Vin Change of 1%                | ---                       | ±1.2  | ±1.5  | %                 |
| Load Regulation                 | Io=20% to 100%                      | See Model Selection Guide |       |       |                   |
| Ripple & Noise                  | 0-20 MHz Bandwidth                  | ---                       | 65    | 100   | mV <sub>P-P</sub> |
| Temperature Coefficient         |                                     | ---                       | ±0.01 | ±0.02 | %/°C              |
| Short Circuit Protection        | 0.5 Second Max., Automatic Recovery |                           |       |       |                   |

**General Specifications**

| General Specifications    |                                                                         |           |      |      |       |  |
|---------------------------|-------------------------------------------------------------------------|-----------|------|------|-------|--|
| Parameter                 | Conditions                                                              | Min.      | Typ. | Max. | Unit  |  |
| I/O Isolation Voltage     | 60 Seconds                                                              | 3000      | ---  | ---  | VDC   |  |
| I/O Isolation Resistance  | 500 VDC                                                                 | 10        | ---  | ---  | GΩ    |  |
| I/O Isolation Capacitance | 100kHz, 1V                                                              | ---       | 60   | 100  | pF    |  |
| Switching Frequency       |                                                                         | 70        | 100  | 120  | kHz   |  |
| MTBF (calculated)         | MIL-HDBK-217F@25°C, Ground Benign                                       | 2,000,000 |      |      | Hours |  |
| Safety Approvals          | UL/cUL 60950-1 recognition (CSA certificate), IEC/EN 60950-1(CB-report) |           |      |      |       |  |

**Environmental Specifications**

| Parameter                                                                                                             | Min. | Max. | Unit     |
|-----------------------------------------------------------------------------------------------------------------------|------|------|----------|
| Operating Ambient Temperature Range Nominal Vin, Load 100% Inom.<br>(for Power Derating see relative Derating Curves) | -40  | +90  | °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       |

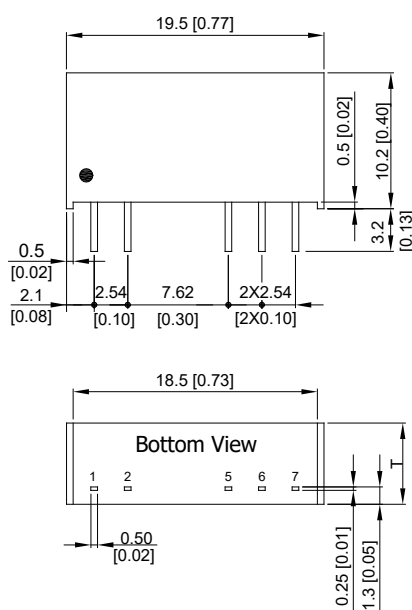
**Power Derating Curve**


## Notes

- 1 Specifications typical at Ta=+25°C, resistive load, nominal input voltage and rated output current unless otherwise noted.
- 2 These power converters require a minimum output loading to maintain specified regulation, operation under no-load conditions will not damage these modules; however they may not meet all specifications listed.
- 3 We recommend to protect the converter by a slow blow fuse in the input supply line.
- 4 Other input and output voltage may be available, please contact MINMAX.
- 5 Specifications are subject to change without notice.
- 6 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 |
|-----|---------------|-------------|
| 1   | +Vin          | +Vin        |
| 2   | -Vin          | -Vin        |
| 5   | -Vout         | -Vout       |
| 6   | No Pin        | Common      |
| 7   | +Vout         | +Vout       |

T: 6.1mm(0.24 inch) for 5V&12V Input Models

T: 7.1mm(0.28 inch) for 24V Input Models

- ▶ All dimensions in mm (inches)
- ▶ Tolerance: X.X $\pm$ 0.25 (X.XX $\pm$ 0.01)  
X.XX $\pm$ 0.13 (X.XXX $\pm$ 0.005)
- ▶ Pins  $\pm$ 0.05( $\pm$ 0.002)

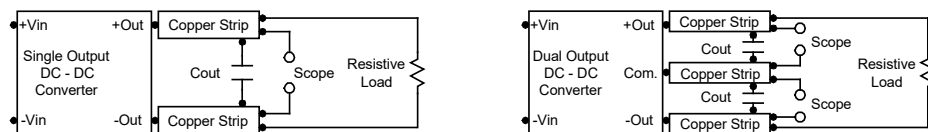
## Physical Characteristics

|                          |                                                                 |
|--------------------------|-----------------------------------------------------------------|
| Case Size (5V&12V Input) | : 19.5x6.1x10.2mm (0.77x0.24x0.40 inches)                       |
| Case Size (24V Input)    | : 19.5x7.1x10.2mm (0.77x0.28x0.40 inches)                       |
| Case Material            | : Non-Conductive Black Plastic (flammability to UL 94V-0 rated) |
| Pin Material             | : Alloy 42                                                      |
| Weight (5V&12V Input)    | : 2.2g                                                          |
| Weight (24V Input)       | : 2.6g                                                          |

## Test Setup

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

Use a  $C_{out}$  0.33 $\mu$ 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.



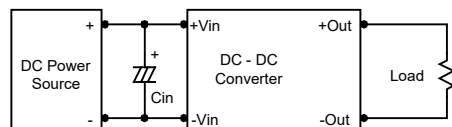
## Technical Notes

### Maximum Capacitive Load

The MAU200 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. For optimum performance we recommend 100 $\mu$ F maximum capacitive load for dual outputs and 220 $\mu$ F capacitive load for single outputs. The maximum capacitance can be found in the data sheet.

### 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 (ESR < 1.0 $\Omega$  at 100 kHz) capacitor of a 2.2 $\mu$ F for the 5V input devices, a 1.0 $\mu$ F for the 12V input devices and a 0.47 $\mu$ F for the 24V 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 1.0 $\mu$ F capacitors at the output.



### 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.

