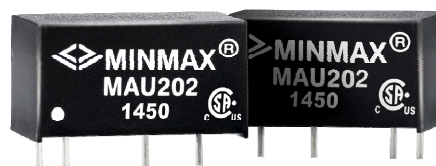


## FEATURES

- ▶ SIP Package with Industry Standard Pinout
- ▶ Package Dimension:
  - 19.5 x 10.2 x 6.1 mm (0.77"x 0.4"x 0.24") 5V&12V Models
  - 19.5 x 10.2 x 7.1 mm (0.77"x 0.4"x 0.28") 24V Models
- ▶ Single and Dual Output Models
- ▶ I/O-Isolation 3000 VDC
- ▶ Operating Temp. Range -40°C to +85°C
- ▶ UL/cUL/IEC/EN 60950-1 Safety Approval
- ▶ 3 Years Product Warranty



## 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 +85°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                |

# 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    | VDC  |
|                                   | 12V Input Models | -0.7               | ---  | 18   |      |
|                                   | 24V Input Models | -0.7               | ---  | 30   |      |
| Reverse Polarity Input Current    | All Models       | ---                | ---  | 0.3  | A    |
| Internal Filter Type              |                  | Internal Capacitor |      |      |      |
| Internal Power Dissipation        |                  | ---                | ---  | 450  | mW   |

**Output Specifications**

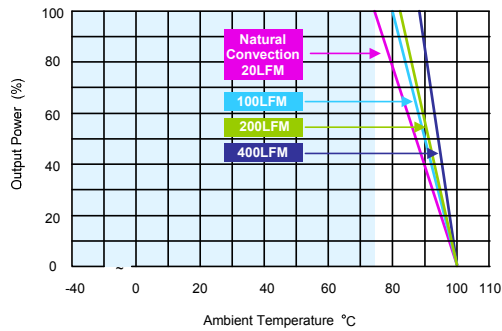
| Parameter                | Conditions                  | Min.                      | Typ.  | Max.  | Unit              |
|--------------------------|-----------------------------|---------------------------|-------|-------|-------------------|
| Output Voltage Accuracy  |                             | ---                       | ±1.0  | ±3.0  | %                 |
| 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.           |       |       |                   |

**General Specifications**

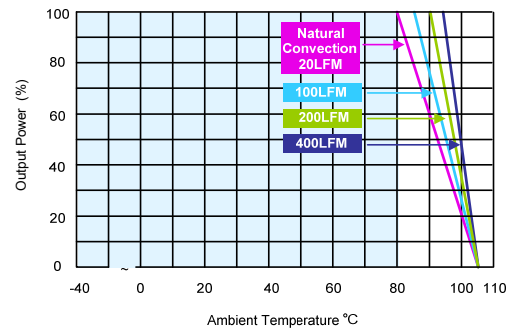
| Parameter                 | Conditions                                                              | Min.      | Typ. | Max. | Unit  |
|---------------------------|-------------------------------------------------------------------------|-----------|------|------|-------|
| I/O Isolation Voltage     | 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                                                      | Conditions          | Min. | Max. | Unit     |
|----------------------------------------------------------------|---------------------|------|------|----------|
| Operating Ambient Temperature Range (See Power Derating Curve) | Natural Convection  | -40  | +85  | °C       |
| Case Temperature                                               |                     | ---  | +90  | °C       |
| Storage Temperature Range                                      |                     | -50  | +125 | °C       |
| Humidity (non condensing)                                      |                     | ---  | 95   | % rel. H |
| Cooling                                                        | Free-Air convection |      |      |          |
| Lead Temperature (1.5mm from case for 10Sec.)                  |                     | ---  | 260  | °C       |

**Power Derating Curve**


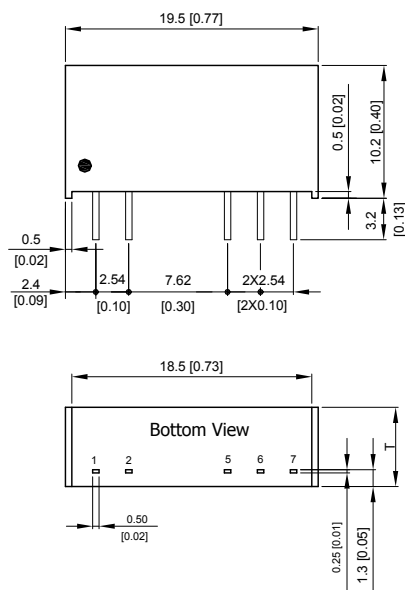
(3.3V, 5V &amp; ±5V)



(all other output)

**Notes**

- 1 Specifications typical at  $T_a=+25^{\circ}\text{C}$ , 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 factory.
- 5 That "natural convection" is about 20LFM but is not equal to still air (0 LFM).
- 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        |
| 5   | -Vout         | -Vout       |
| 6   | No Pin        | Common      |
| 7   | +Vout         | +Vout       |

T: 6.1mm(0.24 inch) for 5V&amp;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  $\pm 0.05$ ( $\pm 0.002$ )

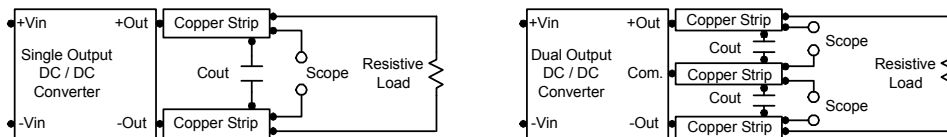
**Physical Characteristics**

|                          |                                                                 |
|--------------------------|-----------------------------------------------------------------|
| 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

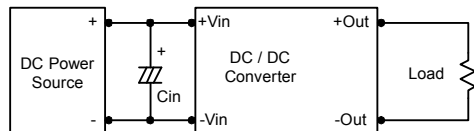
### Maximum Capacitive Load

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

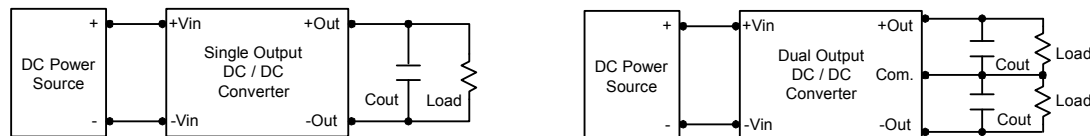
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.

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 90°C. The derating curves are determined from measurements obtained in a test setup.

