

**FEATURES**

- ▶ Industrial Standard SIP-7 Package
- ▶ I/O Isolation 3000VAC with Reinforced Insulation, rated for 300Vrms Working Voltage
- ▶ Operating Ambient Temp. Range -25°C to +85°C
- ▶ Medical EMC Standard with 4<sup>th</sup> Edition of EMI EN 55011 and EMS EN 60601-1-2 Approved
- ▶ Medical Safety with 1xMOPP & 2xMOOP per 3<sup>rd</sup> Edition of IEC/EN 60601-1 & ANSI/AAMI ES60601-1 Approved
- ▶ UL/cUL/IEC/EN 60950-1 Safety Approval & CE Marking


**PRODUCT OVERVIEW**

The MINMAX MAU400 series is a range of 1W DC-DC converter modules providing a high I/O isolation voltage of 3000VAC with reinforced insulation, which rated for 300Vrms working voltage in a small SIP-package. There are 12 models available for 5VDC or 12VDC input voltage and single or dual output voltage.

This product offers an economical solution for many applications in industrial controls and Instrumentation, consumer electronics and everywhere where a certified supplementary or reinforced insulation system is required to comply with relative safety standards.

**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        |
|              |                       |                | mA             | mA   | mA(typ.)      | mA(typ.) |                 |                      | %                 |
| MAU401       | 5<br>(4.5 ~ 5.5)      | 5              | 200            | 4    | 303           | 55       | 10              | 680                  | 66                |
| MAU402       |                       | 12             | 80             | 2    | 291           |          | 8               |                      | 66                |
| MAU403       |                       | 15             | 65             | 1    | 295           |          | 8               |                      | 66                |
| MAU404       |                       | ±5             | ±100           | ±2   | 303           |          | 10              | 220#                 | 66                |
| MAU405       |                       | ±12            | ±40            | ±1   | 267           |          | 8               |                      | 72                |
| MAU406       |                       | ±15            | ±35            | ±1   | 287           |          | 8               |                      | 73                |
| MAU411       | 12<br>(10.8 ~ 13.2)   | 5              | 200            | 4    | 126           | 30       | 10              | 680                  | 66                |
| MAU412       |                       | 12             | 80             | 2    | 121           |          | 8               |                      | 66                |
| MAU413       |                       | 15             | 65             | 1    | 123           |          | 8               |                      | 66                |
| MAU414       |                       | ±5             | ±100           | ±2   | 126           |          | 10              | 220#                 | 66                |
| MAU415       |                       | ±12            | ±40            | ±1   | 108           |          | 8               |                      | 74                |
| MAU416       |                       | ±15            | ±35            | ±1   | 117           |          | 8               |                      | 75                |

# 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 |      |
| Input Surge Voltage (1 sec. max.) | 5V Input Models  | -0.7             | ---  | 9    |      |
|                                   | 12V Input Models | -0.7             | ---  | 29   |      |
| Input Filter                      | All Models       | Internal LC Type |      |      |      |

**Output Specifications**

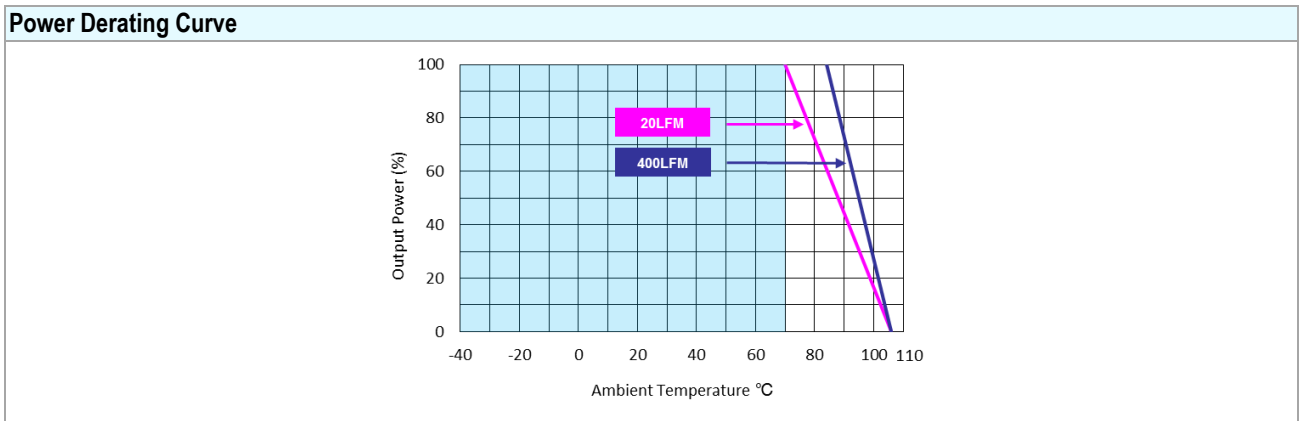
| Parameter                       | Conditions                          | Min.                      | Typ.  | Max.  | Unit              |
|---------------------------------|-------------------------------------|---------------------------|-------|-------|-------------------|
| Output Voltage Setting 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                  | 0-20MHz Bandwith                    | ---                       | ---   | 150   | mV <sub>P-P</sub> |
| Temperature Coefficient         |                                     | ---                       | ±0.01 | ±0.02 | %/°C              |
| Short Circuit Protection        | 0.5 Second Max., Automatic Recovery |                           |       |       |                   |

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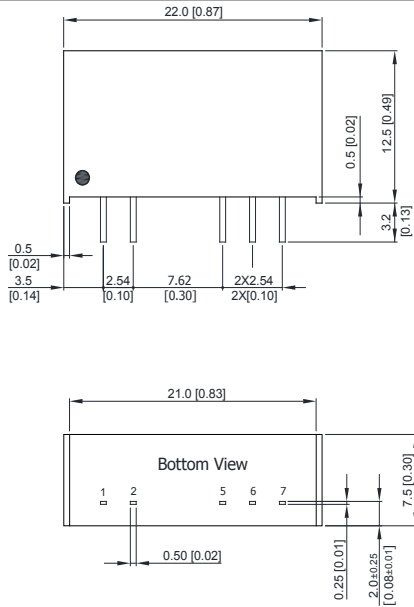
| Isolation, Safety Standards |   |      |      |      |        |
|-----------------------------|---|------|------|------|--------|
| Parameter                   | Conditions  | Min. | Typ. | Max. | Unit   |
| I/O Isolation Voltage       | 60 Seconds<br>Reinforced insulation, rated for 300Vrms working voltage  | 3000 | ---  | ---  | VACrms |
| I/O Isolation Resistance    | 500 VDC   | 10   | ---  | ---  | GΩ     |
| I/O Isolation Capacitance   | 100KHz, 1V  | ---  | 15   | 20   | pF     |
| Safety Standards            | UL/cUL 60950-1, CSA C22.2 No. 60950-1   |      |      |      |        |
|                             | ANSI/AAMI ES 60601-1, CAN/CSA-C22.2 No. 60601-1   |      |      |      |        |
|                             | IEC/EN 60950-1, IEC/EN 60601-1 3 <sup>rd</sup> Edition 1xMOPP & 2xMOOP  |      |      |      |        |
| Safety Approvals            | UL/cUL 60950-1 recognition (UL certificate), IEC/EN 60950-1 (CB-report)   |      |      |      |        |
|                             | ANSI/AAMI ES 60601-1 1xMOPP & 2xMOOP recognition (UL certificate), IEC/EN 60601-1 3 <sup>rd</sup> Edition (CB-report) |      |      |      |        |

| General Specifications |                                   |           |      |      |       |
|------------------------|-----------------------------------|-----------|------|------|-------|
| Parameter              | Conditions                        | Min.      | Typ. | Max. | Unit  |
| Switching Frequency    |                                   | 50        | 80   | 100  | KHz   |
| MTBF (calculated)      | MIL-HDBK-217F@25°C, Ground Benign | 2,000,000 | ---  | ---  | Hours |

| Environmental Specifications                                      |      |      |          |
|---|------|------|----------|
| Parameter   | Min. | Max. | Unit     |
| Operating Ambient Temperature Range<br>(See Power Derating Curve) | -25  | +85  | °C       |
| Case Temperature  | ---  | +90  | °C       |
| Storage Temperature Range   | -50  | +125 | °C       |
| Humidity (non condensing)   | ---  | 95   | % rel. H |
| Lead Temperature (1.5mm from case for 10Sec.)                     | ---  | 260  | °C       |



| 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 factory.   |
| 5     | 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       |

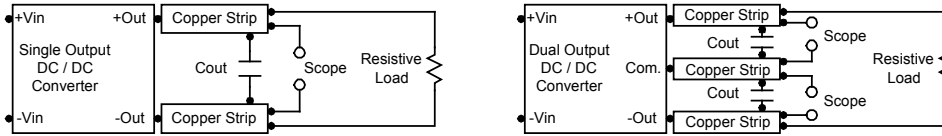
- ▶ All dimensions in mm (inches)
- ▶ Tolerance: X.X±0.5 (X.XX±0.02)  
X.XX±0.13 (X.XXX±0.005)
- ▶ Pins ±0.05 (±0.002)

**Physical Characteristics**

|               |   |
|---------------|---|
| Case Size     | : 22.0x7.5x12.5mm (0.87x0.30x0.49 inches)                       |
| Case Material | : Non-Conductive Black Plastic (flammability to UL 94V-0 rated) |
| Pin Material  | : Alloy 42  |
| Weight        | : 3.9g  |

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

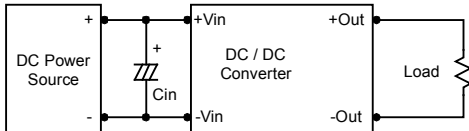
Use a  $C_{out}$  0.33 $\mu$ F ceramic capacitor. Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20 MHz. Position the load between 50 mm and 75 mm from the DC-DC Converter.


**Technical Notes**
**Maximum Capacitive Load**

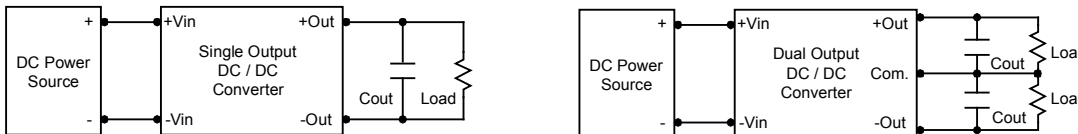
The MAU400 series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. For optimum performance we recommend 220 $\mu$ F maximum capacitive load for dual outputs and 680 $\mu$ 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.


**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 1.5 $\mu$ 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.

