

FEATURES

- ▶ Industrial Standard SIP-7 Package
- ▶ Unregulated Output Voltage
- ▶ I/O Isolation 3000VDC
- ▶ Operating Ambient Temp. Range -40°C to +90°C
- ▶ Short Circuit Protection
- ▶ UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval & CE Marking


PRODUCT OVERVIEW

The MINMAX MAPU01H series is a new range of isolated 1W DC-DC converter modules in SIP-7 package which feature a high I/O isolation voltage rated for 3000VDC and there are 32 models available for 3.3, 5, 12 or 24VDC input. Advanced circuit topology provides continuous overload, short circuit protection and a high efficiency up to 84% which allows operating ambient temperatures range of -40°C to +85°C without power derating. These converters offer a cost-effective solution for all applications where a high I/O isolation and fault condition protection are required.

Model Selection Guide

| Model Number | Input Voltage (Range) VDC | Output Voltage VDC | Output Current | | Input Current | | Load Regulation % (max.) | Max. capacitive Load μF | Efficiency (typ.) |
|-----------------|------------------------------|-----------------------|----------------|---------|------------------------|----------------------|-----------------------------|----------------------------|-------------------|
| | | | Max. mA | Min. mA | @Max. Load mA(typ.) | @No Load mA(typ.) | | | @Max. Load % |
| MAPU01-033S033H | 3.3 (2.97 ~ 3.63) | 3.3 | 300 | 6 | 390 | 45 | 15 | 220 | 77 |
| MAPU01-033S05H | | 5 | 200 | 4 | 394 | | 12 | | 77 |
| MAPU01-033S09H | | 9 | 110 | 2.2 | 385 | | 12 | | 78 |
| MAPU01-033S12H | | 12 | 84 | 1.68 | 382 | | 10 | | 80 |
| MAPU01-033S15H | | 15 | 68 | 1.36 | 391 | | 10 | 79 | |
| MAPU01-033D05H | | ±5 | ±100 | ±2 | 394 | | 11 | 77 | |
| MAPU01-033D12H | | ±12 | ±42 | ±0.84 | 387 | | 9 | 100# | 79 |
| MAPU01-033D15H | | ±15 | ±34 | ±0.68 | 391 | | 9 | 79 | |
| MAPU01-05S033H | 5 (4.5 ~ 5.5) | 3.3 | 300 | 6 | 261 | 30 | 12 | 220 | 76 |
| MAPU01-05S05H | | 5 | 200 | 4 | 256 | | 10 | | 78 |
| MAPU01-05S09H | | 9 | 110 | 2.2 | 247 | | 8 | | 81 |
| MAPU01-05S12H | | 12 | 84 | 1.68 | 246 | | 8 | | 82 |
| MAPU01-05S15H | | 15 | 68 | 1.36 | 246 | | 8 | 83 | |
| MAPU01-05D05H | | ±5 | ±100 | ±2 | 247 | | 10 | 81 | |
| MAPU01-05D12H | | ±12 | ±42 | ±0.84 | 249 | | 8 | 100# | 81 |
| MAPU01-05D15H | | ±15 | ±34 | ±0.68 | 252 | | 9 | 81 | |
| MAPU01-12S033H | 12 (10.8 ~ 13.2) | 3.3 | 300 | 6 | 104 | 17 | 10 | 220 | 79 |
| MAPU01-12S05H | | 5 | 200 | 4 | 104 | | 8 | | 80 |
| MAPU01-12S09H | | 9 | 110 | 2.2 | 101 | | 7 | | 82 |
| MAPU01-12S12H | | 12 | 84 | 1.68 | 99 | | 7 | | 84 |
| MAPU01-12S15H | | 15 | 68 | 1.36 | 102 | | 7 | 83 | |
| MAPU01-12D05H | | ±5 | ±100 | ±2 | 103 | | 7 | 81 | |
| MAPU01-12D12H | | ±12 | ±42 | ±0.84 | 102 | | 6 | 100# | 82 |
| MAPU01-12D15H | | ±15 | ±34 | ±0.68 | 104 | | 6 | 82 | |
| MAPU01-24S033H | 24 (21.6 ~ 26.4) | 3.3 | 300 | 6 | 54 | 10 | 10 | 220 | 76 |
| MAPU01-24S05H | | 5 | 200 | 4 | 51 | | 8 | | 81 |
| MAPU01-24S09H | | 9 | 110 | 2.2 | 52 | | 8 | | 79 |
| MAPU01-24S12H | | 12 | 84 | 1.68 | 51 | | 8 | | 82 |
| MAPU01-24S15H | | 15 | 68 | 1.36 | 52 | | 9 | 82 | |
| MAPU01-24D05H | | ±5 | ±100 | ±2 | 52 | | 8 | 80 | |
| MAPU01-24D12H | | ±12 | ±42 | ±0.84 | 52 | | 8 | 100# | 81 |
| MAPU01-24D15H | | ±15 | ±34 | ±0.68 | 53 | | 8 | 80 | |

* Min. Output Current for Lower Load Regulation

For each output

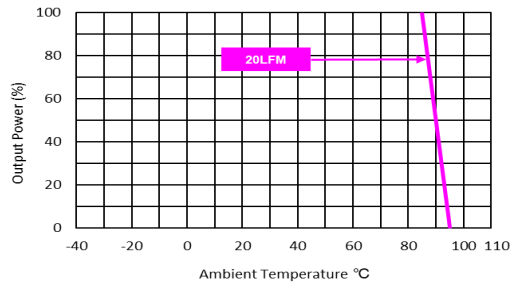
| Input Specifications | | | | | |
|-----------------------------------|-------------------|--------------------|------|------|------|
| Parameter | Model | Min. | Typ. | Max. | Unit |
| Input Voltage Range | 3.3V Input Models | 2.97 | 3.3 | 3.63 | VDC |
| | 5V Input Models | 4.5 | 5 | 5.5 | |
| | 12V Input Models | 10.8 | 12 | 13.2 | |
| | 24V Input Models | 21.6 | 24 | 26.4 | |
| Input Surge Voltage (1 sec. max.) | 3.3V Input Models | -0.7 | --- | 6 | |
| | 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 | % |
| 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=10% to 100% | See Model Selection Guide | | | |
| Ripple & Noise | 0-20 MHz Bandwidth | --- | 65 | 100 | mV _{P-P} |
| Temperature Coefficient | | --- | ±0.01 | ±0.02 | %/°C |
| Short Circuit Protection | Continuous, Automatic Recovery | | | | |

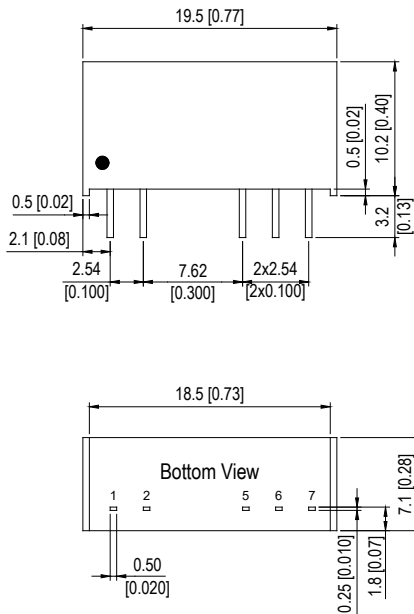
| General Specifications | | | | | |
|---------------------------|---|-----------|------|------|-------|
| Parameter | Conditions | Min. | Typ. | Max. | Unit |
| I/O Isolation Voltage | 60 Seconds | 3000 | --- | --- | VDC |
| I/O Isolation Resistance | 500 VDC | 10 | --- | --- | GΩ |
| I/O Isolation Capacitance | 100kHz, 1V | --- | 20 | --- | pF |
| Switching Frequency | | 40 | 75 | 110 | kHz |
| MTBF (calculated) | MIL-HDBK-217F@25°C, Ground Benign | 3,711,000 | --- | --- | Hours |
| Safety Approvals | UL/cUL 60950-1 recognition(UL 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 | With external components | Class A _(S) |
| | Radiation | | | |
| EMS | EN 55024 | | | |
| | ESD | EN 61000-4-2 Air ± 8kV , Contact ± 6kV | | A |
| | Radiated immunity | EN 61000-4-3 10V/m | | A |
| | Fast transient ⁽⁶⁾ | EN 61000-4-4 ±2kV | | A |
| | Surge ⁽⁶⁾ | 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 | +90 | °C | |
| Case Temperature | --- | +95 | °C | |
| Storage Temperature Range | -50 | +125 | °C | |
| Humidity (non condensing) | --- | 95 | % rel. H | |
| Lead Temperature (1.5mm from case for 10Sec.) | --- | 260 | °C | |

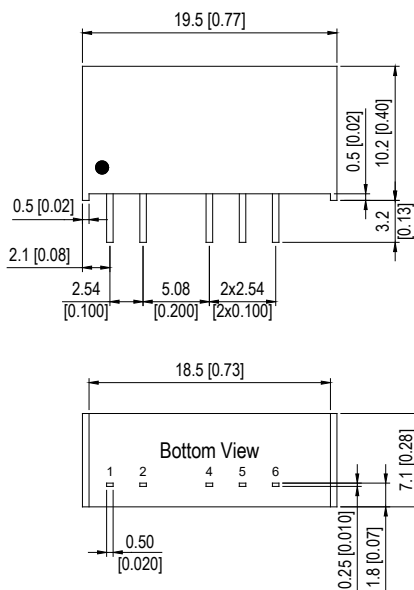
Power Derating Curve**Notes**

- 1 Specifications typical at $T_a=+25^{\circ}\text{C}$, 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 MINMAX.
- 5 To meet EN 55032 Class A an external filter, please contact MINMAX.
- 6 To meet EN 61000-4-4 & EN 61000-4-5 an external filter requested, please contact MINMAX.
- 7 Specifications are subject to change without notice.
- 8 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 |

- ▶ All dimensions in mm (inches)
- ▶ Tolerance: X.X±0.5 (X.XX±0.02)
X.XX±0.25 (X.XXX±0.01)
- ▶ Pins ±0.05(±0.002)

Package Specifications with "A" Pinning (order code suffix A)
Mechanical Dimensions

Pin Connections

| Pin | Single Output | Dual Output |
|-----|---------------|-------------|
| 1 | +Vin | +Vin |
| 2 | -Vin | -Vin |
| 4 | -Vout | -Vout |
| 5 | No Pin | Common |
| 6 | +Vout | +Vout |

- ▶ All dimensions in mm (inches)
- ▶ Tolerance: X.X±0.5 (X.XX±0.02)
X.XX±0.25 (X.XXX±0.01)
- ▶ Pins ±0.05(±0.002)

Physical Characteristics

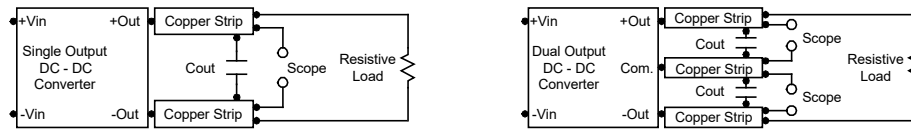
| | | |
|---------------|---|---|
| Case Size | : | 19.5x7.1x10.2mm (0.77x0.28x0.40 inches) |
| Case Material | : | Non-Conductive Black Plastic (flammability to UL 94V-0 rated) |
| Pin Material | : | Alloy 42 |
| Weight | : | 3.1g |

| Order Code Table | |
|------------------|------------------|
| Standard | With "A" Pinning |
| MAPU01-033S033H | MAPU01-033S033HA |
| MAPU01-033S05H | MAPU01-033S05HA |
| MAPU01-033S09H | MAPU01-033S09HA |
| MAPU01-033S12H | MAPU01-033S12HA |
| MAPU01-033S15H | MAPU01-033S15HA |
| MAPU01-033D05H | MAPU01-033D05HA |
| MAPU01-033D12H | MAPU01-033D12HA |
| MAPU01-033D15H | MAPU01-033D15HA |
| MAPU01-05S033H | MAPU01-05S033HA |
| MAPU01-05S05H | MAPU01-05S05HA |
| MAPU01-05S09H | MAPU01-05S09HA |
| MAPU01-05S12H | MAPU01-05S12HA |
| MAPU01-05S15H | MAPU01-05S15HA |
| MAPU01-05D05H | MAPU01-05D05HA |
| MAPU01-05D12H | MAPU01-05D12HA |
| MAPU01-05D15H | MAPU01-05D15HA |
| MAPU01-12S033H | MAPU01-12S033HA |
| MAPU01-12S05H | MAPU01-12S05HA |
| MAPU01-12S09H | MAPU01-12S09HA |
| MAPU01-12S12H | MAPU01-12S12HA |
| MAPU01-12S15H | MAPU01-12S15HA |
| MAPU01-12D05H | MAPU01-12D05HA |
| MAPU01-12D12H | MAPU01-12D12HA |
| MAPU01-12D15H | MAPU01-12D15HA |
| MAPU01-24S033H | MAPU01-24S033HA |
| MAPU01-24S05H | MAPU01-24S05HA |
| MAPU01-24S09H | MAPU01-24S09HA |
| MAPU01-24S12H | MAPU01-24S12HA |
| MAPU01-24S15H | MAPU01-24S15HA |
| MAPU01-24D05H | MAPU01-24D05HA |
| MAPU01-24D12H | MAPU01-24D12HA |
| MAPU01-24D15H | MAPU01-24D15HA |

Test Setup

Peak-to-Peak Output Noise Measurement Test

Cout uses a 0.47 μ 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.



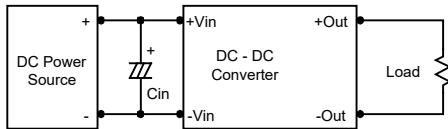
Technical Notes

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.

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 Ω at 100 kHz) capacitor of a 2.2 μ F for all the 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 3.3 μ F capacitors at the output.



Maximum Capacitive Load

The MAPU01H 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. 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 95 $^{\circ}$ C.

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

