

FEATURES

- ▶ Industrial Standard SMD Package
- ▶ Unregulated Output Voltage
- ▶ I/O Isolation 4000VAC with Reinforced Insulation, rated for 250Vrms Working Voltage
- ▶ Low I/O Leakage Current < 2μA
- ▶ Operating Ambient Temp. Range -40°C to 95°C
- ▶ Cleaning-washable Process Available (option)
- ▶ Qualified for Lead-free Reflow Solder Process According to IPC/JEDEC J-STD-020D.1
- ▶ Tape & Reel Package Available
- ▶ Short Circuit Protection
- ▶ Medical EMC Standard with 4th Edition of EMI EN 55011 and EMS EN 60601-1-2 Approved
- ▶ Medical Safety with 2xMOPP per 3rd Edition of IEC/EN 60601-1 & ANSI/AAMI ES60601-1 Approved with CE Marking

NEW

PRODUCT OVERVIEW

The MINMAX MSCU01M series is a new range of medical approved 1W isolated DC-DC converter within enclosed SMD-14 package which specifically design for medical applications. There are 15 models available for input voltage of 5, 12, 24VDC and 5, 12, 15, ±12, ±15VDC output. The I/O isolation is specified for 4000VAC with reinforced insulation, which rated for 250Vrms working voltage. Further features include short circuit protection, low I/O leakage current 2μA max. and operating ambient temp. range by -40°C to 95°C without derating. MSCU01M series conform to 4th edition medical EMC standard, medical safety with 2xMOPP (Means Of Patient Protection) per 3rd edition of IEC/EN 60601-1 & ANSI/AAMI ES60601-1 approved.

The MSCU01M series offer a superior solution for demanding applications in medical instrument requesting a certified supplementary and reinforced insulation system to comply with latest medical safety approval for 2xMOPP requirement.

Model Selection Guide

| Model Number | Input Voltage (Range) | Output Voltage | Output Current | | Input Current | | Max. capacitive Load | Efficiency (typ.) |
|---------------|-----------------------|----------------|----------------|-------|---------------|----------|----------------------|-------------------|
| | | | Max. | Min. | @Max. Load | @No Load | | |
| | VDC | VDC | mA | mA | mA(typ.) | mA(typ.) | μF | % |
| MSCU01-05S05M | 5 (4.5 ~ 5.5) | 5 | 200 | 4 | 263 | 50 | 220 | 76 |
| MSCU01-05S12M | | 12 | 84 | 1.68 | 252 | | | 80 |
| MSCU01-05S15M | | 15 | 68 | 1.36 | 246 | | | 83 |
| MSCU01-05D12M | | ±12 | ±42 | ±0.84 | 252 | | 100# | 80 |
| MSCU01-05D15M | | ±15 | ±33 | ±0.66 | 236 | | | 84 |
| MSCU01-12S05M | 12 (10.8 ~ 13.2) | 5 | 200 | 4 | 110 | 35 | 220 | 76 |
| MSCU01-12S12M | | 12 | 84 | 1.68 | 106 | | | 79 |
| MSCU01-12S15M | | 15 | 68 | 1.36 | 106 | | | 80 |
| MSCU01-12D12M | | ±12 | ±42 | ±0.84 | 106 | | 100# | 79 |
| MSCU01-12D15M | | ±15 | ±33 | ±0.66 | 103 | | | 80 |
| MSCU01-24S05M | 24 (21.6 ~ 26.4) | 5 | 200 | 4 | 55 | 20 | 220 | 76 |
| MSCU01-24S12M | | 12 | 84 | 1.68 | 53 | | | 80 |
| MSCU01-24S15M | | 15 | 68 | 1.36 | 53 | | | 80 |
| MSCU01-24D12M | | ±12 | ±42 | ±0.84 | 53 | | 100# | 80 |
| MSCU01-24D15M | | ±15 | ±33 | ±0.66 | 52 | | | 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=10% to 100% | --- | --- | ±10 | % |
| Ripple & Noise | 0-20 MHz Bandwidth | --- | --- | 100 | mV _{p-p} |
| Temperature Coefficient | | --- | ±0.01 | ±0.02 | %/°C |
| Short Circuit Protection | Continuous, Automatic Recovery | | | | |

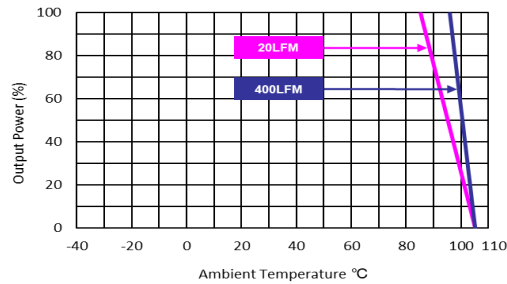
| Isolation, Safety Standards | | | | | |
|-----------------------------|-----------------------------------------------------------------------------------------------------------|------|------|------|------|
| Parameter | Conditions | Min. | Typ. | Max. | Unit |
| I/O Isolation Voltage | 60 Seconds Reinforced insulation, rated for 250Vrms working voltage | 4000 | --- | --- | VAC |
| Leakage Current | 240VAC, 60Hz | --- | --- | 2 | μA |
| I/O Isolation Resistance | 500 VDC | 10 | --- | --- | GΩ |
| I/O Isolation Capacitance | 100kHz, 1V | --- | 20 | --- | pF |
| Safety Standards | ANSI/AAMI ES60601-1, CAN/CSA-C22.2 No. 60601-1 IEC/EN 60601-1 3 rd Edition 2xMOPP | | | | |
| Safety Approvals | ANSI/AAMI ES60601-1 2xMOPP recognition(UL certificate), IEC/EN 60601-1 3 rd Edition(CB-report) | | | | |

| General Specifications | | | | | |
|----------------------------------|-----------------------------------|-----------|------|------|-------|
| Parameter | Conditions | Min. | Typ. | Max. | Unit |
| Switching Frequency | | --- | 55 | --- | kHz |
| MTBF (calculated) | MIL-HDBK-217F@25°C, Ground Benign | 4,771,507 | --- | --- | Hours |
| Moisture Sensitivity Level (MSL) | IPC/JEDEC J-STD-020D.1 | Level 2 | | | |

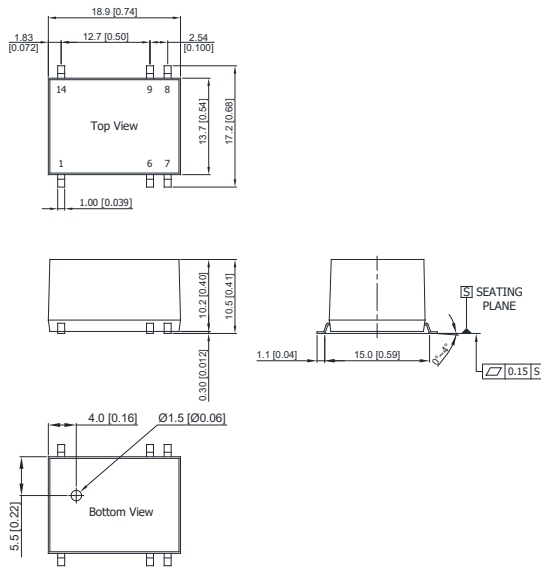
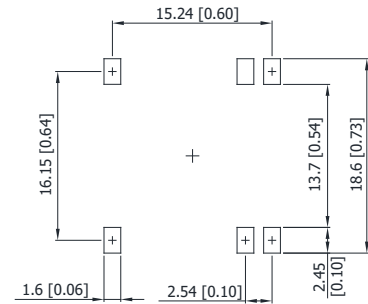
| EMC Specifications | | | |
|--------------------|------------------------------|-----------------------------------------|-----------------------------|
| Parameter | Standards & Level | | Performance |
| EMI | Conduction | EN 55011 | With external components |
| | Radiation | | Without external components |
| EMS | EN 60601-1-2 4 th | | |
| | ESD | EN 61000-4-2 Air ± 15kV . Contact ± 8kV | |
| | Radiated immunity | EN 61000-4-3 10V/m | |
| | Fast transient (6) | EN 61000-4-4 ±2kV | |
| | Surge (6) | EN 61000-4-5 ±1kV | |
| | Conducted immunity | EN 61000-4-6 10Vrms | |
| | PFMF | EN 61000-4-8 30A/m | |

Environmental Specifications

| Parameter | Min. | Max. | Unit |
|----------------------------------------------------------------|------------------------|------|----------|
| Operating Ambient Temperature Range (See Power Derating Curve) | -40 | +95 | °C |
| Case Temperature | --- | +105 | °C |
| Storage Temperature Range | -50 | +125 | °C |
| Humidity (non condensing) | --- | 95 | % rel. H |
| Lead-free Reflow Solder Process | IPC/JEDEC J-STD-020D.1 | | |

Power Derating Curve

Notes

- Specifications typical at $T_a=+25^{\circ}\text{C}$, resistive load, nominal input voltage and rated output current unless otherwise noted.
- 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.
- We recommend to protect the converter by a slow blow fuse in the input supply line.
- Other input and output voltage may be available, please contact MINMAX.
- To meet EN 55011 Class A an external filter, please contact MINMAX.
- To meet EN 61000-4-4 & EN 61000-4-5 an external capacitor across the input pins is required, please contact MINMAX.
- Specifications are subject to change without notice.
- 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

Connecting Pin Patterns


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

Pin Connections

| Pin | Single Output | Dual Output |
|-----|---------------|-------------|
| 1 | -Vin | -Vin |
| 6 | NC | Common |
| 7 | NC | -Vout |
| 8 | +Vout | +Vout |
| 9 | -Vout | Common |
| 14 | +Vin | +Vin |

Physical Characteristics

| | |
|---------------|--------------------------------------------------|
| Case Size | : 18.9x13.7x10.2 mm (0.74x0.54x0.40 inches) |
| Case Material | : Plastic resin (flammability to UL 94V-0 rated) |
| Pin Material | : Phosphor Bronze |
| Weight | : 4.1g |

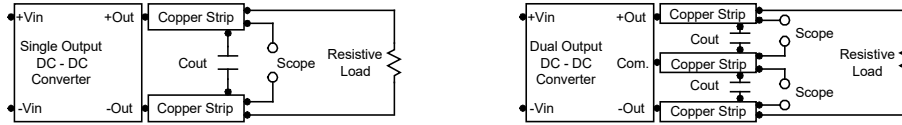
NC: No Connection

Order Code Table

| Standard | For cleaning-washable process |
|---------------|-------------------------------|
| MSCU01-05S05M | MSCU01-05S05M-W |
| MSCU01-05S12M | MSCU01-05S12M-W |
| MSCU01-05S15M | MSCU01-05S15M-W |
| MSCU01-05D12M | MSCU01-05D12M-W |
| MSCU01-05D15M | MSCU01-05D15M-W |
| MSCU01-12S05M | MSCU01-12S05M-W |
| MSCU01-12S12M | MSCU01-12S12M-W |
| MSCU01-12S15M | MSCU01-12S15M-W |
| MSCU01-12D12M | MSCU01-12D12M-W |
| MSCU01-12D15M | MSCU01-12D15M-W |
| MSCU01-24S05M | MSCU01-24S05M-W |
| MSCU01-24S12M | MSCU01-24S12M-W |
| MSCU01-24S15M | MSCU01-24S15M-W |
| MSCU01-24D12M | MSCU01-24D12M-W |
| MSCU01-24D15M | MSCU01-24D15M-W |

Test Setup
Peak-to-Peak Output Noise Measurement Test

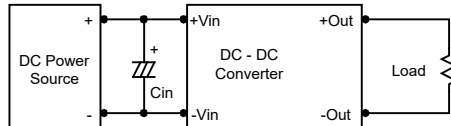
Refer to the output specifications or add 4.7 μ F capacitor if the output specifications undefine Cout.. Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20 MHz. Position the load between 50 mm and 75 mm from the DC-DC Converter.


Technical Notes
Maximum Capacitive Load

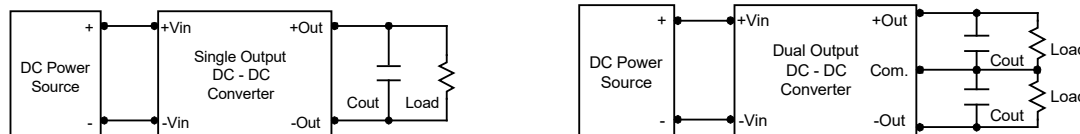
The MSCU01M series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. For optimum performance we recommend 100 μ F maximum capacitive load for dual outputs and 220 μ F capacitive 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 Ω at 100 kHz) capacitor of a 2.2 μ F for the 5V input devices, a 1.0 μ F for the 12V input devices and a 0.47 μ F for the 24V 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 3.3 μ 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.

