

FEATURES

- ▶ Industrial Standard DIP-24 Package
- ▶ Fully Regulated Output Voltage
- ▶ I/O Isolation 3000VAC with Reinforced Insulation, rated for 300Vrms Working Voltage
- ▶ Low Leakage Current < 2μA
- ▶ Operating Ambient Temp. Range -40°C to +75°C
- ▶ No Min. Load Requirement
- ▶ Short Circuit Protection
- ▶ Conducted EMI EN 55011/22 Class A & FCC Level A Approved
- ▶ Medical EMC Standard with 4th Edition of EMI EN 55011 and EMS EN 60601-1-2 Approved
- ▶ Medical Safety with 1xMOPP & 2xMOOP per 3rd 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 MIDR03M series is a new range of high isolation DC-DC converter modules with a reinforced insulation system. The I/O isolation voltage is specified for 3000VAC with reinforced insulation, which rated for 300Vrms working voltage. The product comes in a small DIP-24 package. There are 15 models available for 5V, 12V and 24V input voltage and single or dual output voltage. The MIDR03M DC-DC converters offer a cost effective solution for applications in industrial controls, medical instrumentation and also in consumer electronics requesting a certified supplementary or reinforced insulation system to comply with industrial or latest medical safety standards.

Model Selection Guide

| Model Number | Input Voltage VDC | Output Voltage VDC | Output Current Max. mA | Input Current | | Max. capacitive Load μF | Efficiency (typ.) |
|---------------|----------------------|-----------------------|------------------------------|------------------------|----------------------|----------------------------|-------------------|
| | | | | @Max. Load mA(typ.) | @No Load mA(typ.) | | @Max. Load % |
| | | | | | | | |
| MIDR03-05S05M | 5 (4.5 ~ 5.5) | 5 | 600 | 1000 | 130 | 470 | 60 |
| MIDR03-05S12M | | 12 | 250 | 960 | | | 62 |
| MIDR03-05S15M | | 15 | 200 | 960 | | | 62 |
| MIDR03-05D12M | | ±12 | ±125 | 1000 | | | 60 |
| MIDR03-05D15M | | ±15 | ±100 | 1000 | | | 60 |
| MIDR03-12S05M | 12 (10.8 ~ 13.2) | 5 | 600 | 420 | 60 | 470 | 60 |
| MIDR03-12S12M | | 12 | 250 | 400 | | | 62 |
| MIDR03-12S15M | | 15 | 200 | 400 | | | 62 |
| MIDR03-12D12M | | ±12 | ±125 | 420 | | | 60 |
| MIDR03-12D15M | | ±15 | ±100 | 420 | | | 60 |
| MIDR03-24S05M | 24 (21.6 ~ 26.4) | 5 | 600 | 210 | 40 | 470 | 60 |
| MIDR03-24S12M | | 12 | 250 | 195 | | | 64 |
| MIDR03-24S15M | | 15 | 200 | 195 | | | 64 |
| MIDR03-24D12M | | ±12 | ±125 | 210 | | | 60 |
| MIDR03-24D15M | | ±15 | ±100 | 210 | | | 60 |

For each output

Input Specifications

| Parameter | Model | Min. | Max. | Unit |
|-----------------------------------|------------------|---|------|------|
| Input Voltage Range | 5V Input Models | 4.5 | 5.5 | VDC |
| | 12V Input Models | 10.8 | 13.2 | |
| | 24V Input Models | 21.6 | 26.4 | |
| Input Surge Voltage (1 sec. max.) | 5V Input Models | -0.7 | 7.5 | |
| | 12V Input Models | -0.7 | 15 | |
| | 24V Input Models | -0.7 | 30 | |
| Short Circuit Input Power | | --- | 2500 | mW |
| Input Filter | All Models | Internal LC Type | | |
| Conducted EMI | | Compliance to EN 55011/22, class A and FCC part 15, class A | | |

Output Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---------------------------------|--------------------------------|------|-------|-------|-------------------|
| Output Voltage Setting Accuracy | | --- | --- | ±4.0 | %Vnom. |
| Output Voltage Balance | Dual Output, Balanced Loads | --- | ±2.0 | ±4.0 | % |
| Line Regulation | Vin=Min. to Max. @Full Load | --- | ±0.3 | ±0.5 | % |
| Load Regulation | Io=10% to 100% | --- | ±0.5 | ±1.0 | % |
| Minimum Load | No minimum Load Requirement | | | | |
| Ripple & Noise | 0-20 MHz Bandwidth | --- | --- | 50 | mV _{p-p} |
| Temperature Coefficient | | --- | ±0.01 | ±0.02 | %/°C |
| Short Circuit Protection | Continuous, Automatic Recovery | | | | |

Isolation, Safety Standards

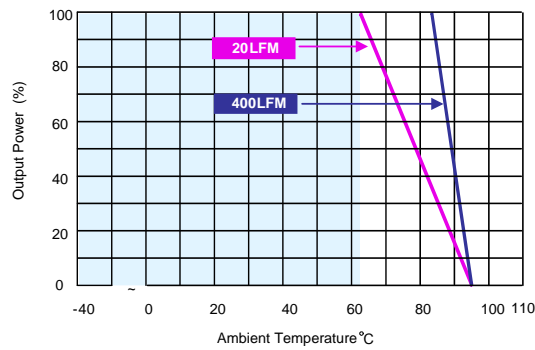
| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---------------------------|--|------|------|------|--------|
| I/O Isolation Voltage | 60 Seconds Reinforced insulation, rated for 300Vrms working voltage | 3000 | --- | --- | VACrms |
| Leakage Current | 240VAC, 60Hz | --- | --- | 2 | μA |
| I/O Isolation Resistance | 500 VDC | 10 | --- | --- | GΩ |
| I/O Isolation Capacitance | 100kHz, 1V | --- | 20 | --- | pF |
| Safety Standards | UL/cUL 60950-1, CSA C22.2 No. 60950-1 | | | | |
| | ANSI/AAMI ES60601-1, CAN/CSA-C22.2 No. 60601-1 | | | | |
| | IEC/EN 60950-1, IEC/EN 60601-1 3 rd Edition 1xMOPP & 2xMOOP | | | | |
| Safety Approvals | UL/cUL 60950-1 recognition (UL certificate), IEC/EN 60950-1 (CB-report) | | | | |
| | ANSI/AAMI ES60601-1 1xMOPP & 2xMOOP recognition (UL certificate), IEC/EN 60601-1 3 rd Edition (CB-report) | | | | |

General Specifications

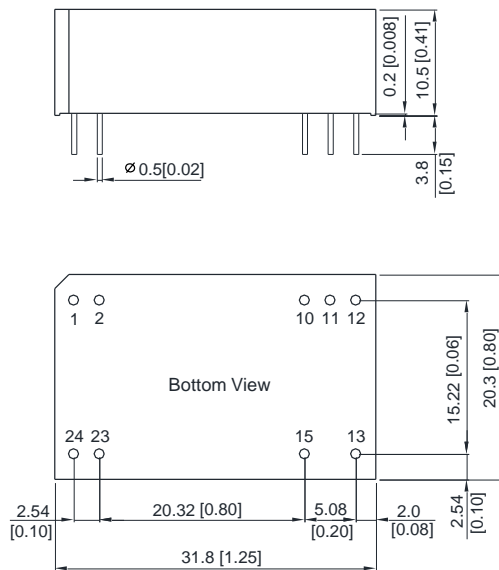
| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---------------------|-----------------------------------|-----------|------|------|-------|
| Switching Frequency | | 25 | 60 | --- | kHz |
| MTBF(calculated) | MIL-HDBK-217F@25°C, Ground Benign | 1,000,000 | --- | --- | Hours |

Environmental Specifications

| Parameter | Min. | Max. | Unit |
|--|------|------|----------|
| Operating Ambient Temperature Range (See Power Derating Curve) | -40 | +75 | °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 Ta=+25°C, resistive load, nominal input voltage and rated output current unless otherwise noted.
- 2 We recommend to protect the converter by a slow blow fuse in the input supply line.
- 3 Other input and output voltage may be available, please contact factory.
- 4 Specifications are subject to change without notice.

Package Specifications
Mechanical Dimensions

Pin Connections

| Pin | Single Output | Dual Output |
|-----|---------------|-------------|
| 1 | +Vin | +Vin |
| 2 | +Vin | +Vin |
| 10 | No Pin | Common |
| 11 | No Pin | Common |
| 12 | -Vout | No Pin |
| 13 | +Vout | -Vout |
| 15 | No Pin | +Vout |
| 23 | -Vin | -Vin |
| 24 | -Vin | -Vin |

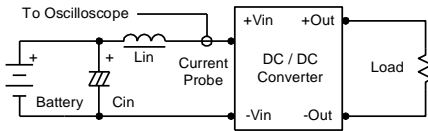
- ▶ All dimensions in mm (inches)
- ▶ Tolerance: X.X±0.25 (X.XX±0.01)
X.XX±0.13 (X.XXX±0.005)
- ▶ Pin diameter $\varnothing 0.5 \pm 0.05$ (0.02±0.002)

Physical Characteristics

| | |
|---------------|---|
| Case Size | : 31.8x20.3x10.5 mm (1.25x0.80x0.41 inches) |
| Case Material | : Non-Conductive Black Plastic (flammability to UL 94V-0 rated) |
| Pin Material | : Copper Alloy with Gold Plate Over Nickel Subplate |
| Weight | : 12.4g |

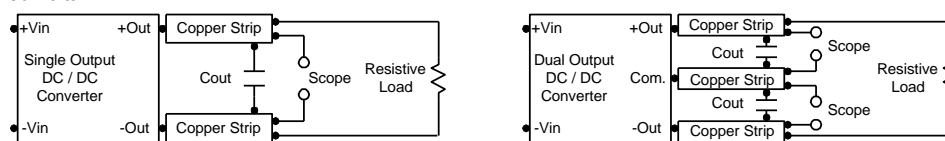
Test Setup
Input Reflected-Ripple Current Test Setup

Input reflected-ripple current is measured with an inductor L_{in} ($4.7\mu\text{H}$) and C_{in} ($220\mu\text{F}$, $\text{ESR} < 1.0\Omega$ at 100 KHz) to simulate source impedance. Capacitor C_{in} , offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is $0\text{-}500\text{ KHz}$.


Peak-to-Peak Output Noise Measurement Test

Use a C_{out} $0.33\mu\text{F}$ ceramic capacitor.

Scope measurement should be made by using a BNC socket, measurement bandwidth is $0\text{-}20\text{ MHz}$. Position the load between 50 mm and 75 mm from the DC-DC Converter.


Technical Notes
Maximum Capacitive Load

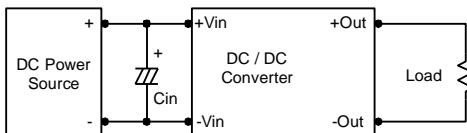
The MIDR03M series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. For optimum performance we recommend $220\mu\text{F}$ maximum capacitive load for dual outputs and $470\mu\text{F}$ capacitive load for single outputs. The maximum capacitance can be found in the data sheet.

Input Source Impedance

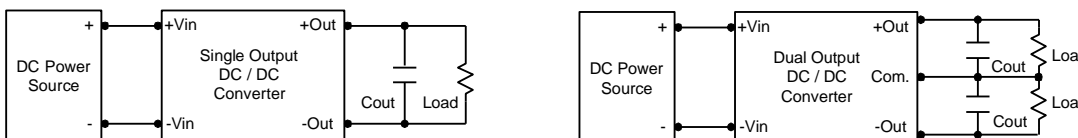
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module.

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 ($\text{ESR} < 1.0\Omega$ at 100 KHz) capacitor of a $4.7\mu\text{F}$ for the 5V input devices and a $2.2\mu\text{F}$ for the 12V and 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 $1.5\mu\text{F}$ 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 95°C . The derating curves are determined from measurements obtained in a test setup.

