

**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 +80°C
- ▶ No Min. Load Requirement
- ▶ Short Circuit Protection
- ▶ Designed-in Conducted EMI meets EN55022 Class A & FCC Level A
- ▶ Medical EMC Standard meets 4<sup>th</sup> Edition of EMI EN55011 and EMS EN60601-1-2
- ▶ Medical Safety meets 1xMOPP & 2xMOOP per 3<sup>rd</sup> Edition of IEC/EN 60601-1 & ANSI/AAMI ES60601-1
- ▶ 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 3000VACrms. 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	Input Current		Max. capacitive Load μF	Efficiency (typ.)
			Max. mA	@Max. Load mA(typ.)	@No Load mA(typ.)		@Max. Load %
MIDR03-05S05M	5 ±10%	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%	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 ±10%	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**

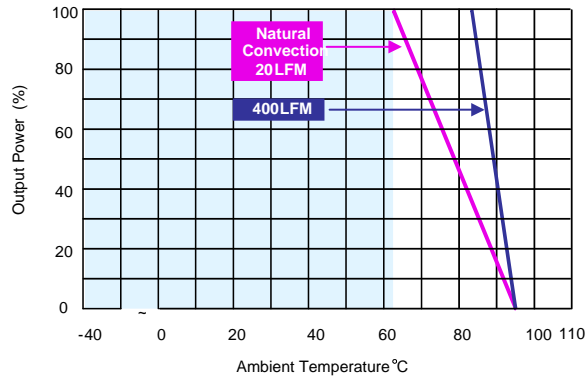
Parameter	Model	Min.	Max.	Unit
Input Voltage Range	5V Input Models	4.5	5.5	VDC
	12V Input Models	10.8	13.2	
	24V Input Models	21.6	26.4	
Input Surge Voltage (1 sec. max.)	5V Input Models	-0.7	7.5	VDC
	12V Input Models	-0.7	15	
	24V Input Models	-0.7	30	
Short Circuit Input Power	All Models	---	2500	mW
Input Filter		Internal LC Type		
Conducted EMI		Compliance to EN 55022, 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 <sub>P-P</sub>
Temperature Coefficient		---	±0.01	±0.02	%/°C
Short Circuit Protection	Continuous, Automatic Recovery				

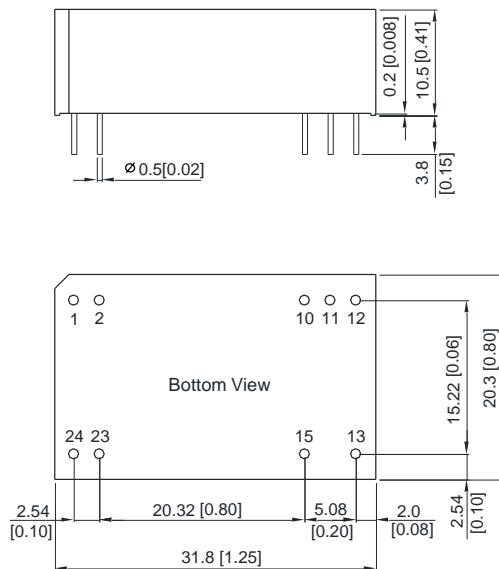
Isolation, Safety Standards					
Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds Reinforced insulation, rated for 300Vrms working voltage	3000	---	---	VACrms
Leakage Current	240VAC, 60Hz	---	---	2	µA
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100KHz, 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 <sup>rd</sup> 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 <sup>rd</sup> 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	Conditions	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	Natural Convection	-40	+75	°C
Case Temperature		---	+95	°C
Storage Temperature Range		-50	+125	°C
Humidity (non condensing)		---	95	% rel. H
Cooling	Natural Convection			
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 That "natural convection" is about 20LFM but is not equal to still air (0 LFM).
- 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
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  $\varnothing 0.5 \pm 0.05 (0.02 \pm 0.002)$

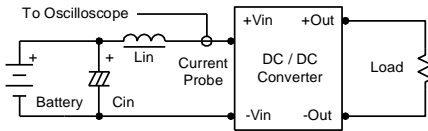
**Physical Characteristics**

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

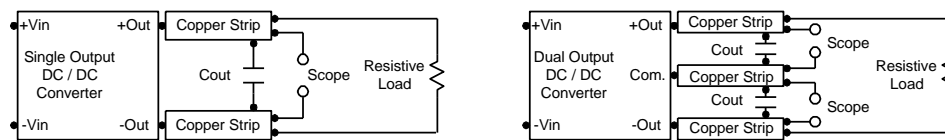
Input reflected-ripple current is measured with an inductor  $L_{in}$  (4.7 $\mu$ H) and  $C_{in}$  (220 $\mu$ F, ESR < 1.0 $\Omega$  at 100 KHz) to simulate source impedance. Capacitor  $C_{in}$ , offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement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



#### 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

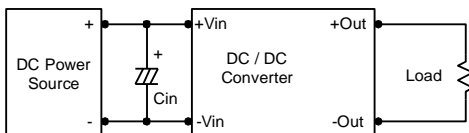
The MIDR03M series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. For optimum performance we recommend 220 $\mu$ F maximum capacitive load for dual outputs and 470 $\mu$ 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 4.7 $\mu$ F for the 5V input devices and a 2.2 $\mu$ 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 $\mu$ 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.

