FEATURES

- ▶ **Industrial Standard DIP-24 Package**
- ▶ **Fully Regulated Output Voltage**
- ▶ **I/O Isolation 3000VAC with Reinforced Insulation, rated for 300Vrms Working Voltage**
- ▶ **Low I/O Leakage Current < 2μA**
- ▶ **Operating Ambient Temp. Range -40℃ to +77.5℃**
- ▶ **No Min. Load Requirement**
- ▶ **Short Circuit Protection**
- ▶ **Conducted EMI EN 55011/22 Class 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**

PRODUCT OVERVIEW

The MINMAX MIDR03M series is a 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	Output Voltage	Output Current	Input Current		Max. capacitive Load	Efficiency (typ.)
			Max.	@Max. Load	@No Load		@Max. Load
	VDC	VDC	mA	mA(typ.)	mA(typ.)	μF	%
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		220 #	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		220 #	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		220 #	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	All Models	---	2500	mW
Input Filter		Internal Pi Type		
Conducted EMI		Compliance to EN 55011/22, 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	%/℃
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	---	---	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				
Safety Approvals	ANSI/AAMI ES60601-1 1xMOPP & 2xMOOP recognition(UL certificate), IEC/EN 60601-1 3rd Edition (CB-report)				
	UL/cUL 62368-1 recognition(UL certificate), IEC/EN 62368-1(CB-report)				

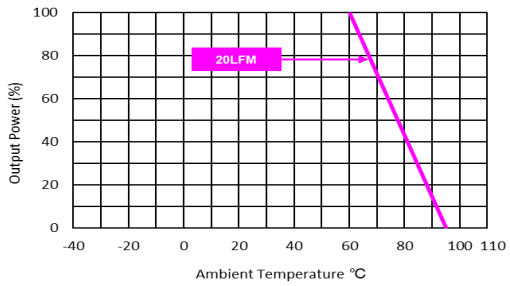
General Specifications

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

Environmental Specifications

Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+77.5	℃
Case Temperature	---	+95	℃
Storage Temperature Range	-50	+125	℃
Humidity (non condensing)	---	95	% rel. H
Lead Temperature (1.5mm from case for 10Sec.)	---	260	℃

Power Derating Curve

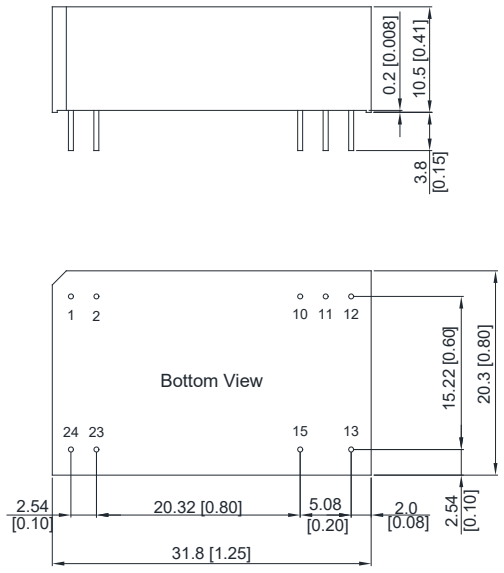


Notes

1 Specifications typical at Ta=+25℃, 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 MINMAX.
4 Specifications are subject to change without notice.

Package Specifications

Mechanical Dimensions



Pin Connections

Pin	Single Output	Dual Output	Diameter mm (inches)
1	+Vin	+Vin	Ø 0.5 [0.02]
2	+Vin	+Vin	Ø 0.5 [0.02]
10	No Pin	Common	Ø 0.5 [0.02]
11	No Pin	Common	Ø 0.5 [0.02]
12	-Vout	No Pin	Ø 0.5 [0.02]
13	+Vout	-Vout	Ø 0.5 [0.02]
15	No Pin	+Vout	Ø 0.5 [0.02]
23	-Vin	-Vin	Ø 0.5 [0.02]
24	-Vin	-Vin	Ø 0.5 [0.02]

▶ All dimensions in mm (inches)
▶ Tolerance: X.X±0.25 (X.XX±0.01)
X.XX±0.13 (X.XXX±0.005)
▶ Pin diameter tolerance: X.X±0.05 (X.XX±0.002)

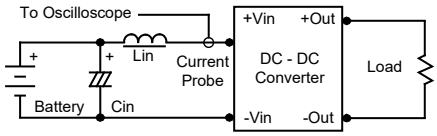
Physical Characteristics

Case Size	:	31.8x20.3x10.5 mm (1.25x0.80x0.41 inches)
Case Material	:	Plastic resin (flammability to UL 94V-0 rated)
Pin Material	:	Copper Alloy
Weight	:	12.4g

Test Setup

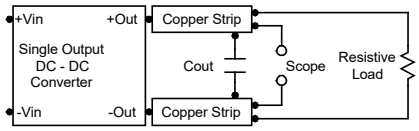
Input Reflected-Ripple Current Test Setup

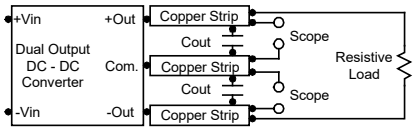
Input reflected-ripple current is measured with a inductor Lin (4.7μH) and Cin (220μF, ESR < 1.0Ω at 100 kHz) to simulate source impedance.
Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 kHz.



Peak-to-Peak Output Noise Measurement Test

Use a Cout 0.33μF 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.





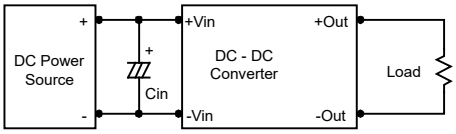
Technical Notes

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 220μF maximum capacitive load for dual outputs and 470μF capacitive load for single outputs. The maximum capacitance can be found in the data sheet.

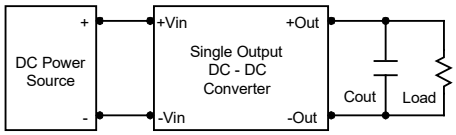
Input Source Impedance

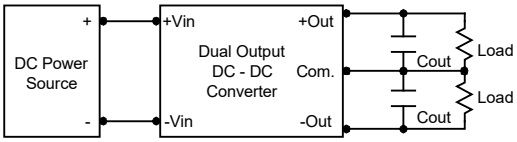
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module.
In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.
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 < 1.0Ω at 100 kHz) capacitor of a 4.7μF for the 5V input devices and a 2.2μF 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 1.5μF 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.