FEATURES

- **Smallest Encapsulated 3W Converter**
- **Ultra-compact DIP-8 Package**
- **Wide 2:1 Input Voltage Range**
- **Fully Regulated Output Voltage**
- **I/O Isolation 1500 VDC**
- **Operating Ambient Temp. Range -40℃ to +80℃**
- **No Min. Load Requirement**
- **Under-voltage, Overload and Short Circuit Protection**
- **UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval & CE Marking**

PRODUCT OVERVIEW

The MINMAX MFW03 series is the latest generation of high performance DC-DC converter modules setting a new standard concerning power density. The product offers a full 3W isolated DC-DC converter within an encapsulated DIP-8 package which occupies only 0.3 in^2 of PCB space. There are 28 models available for 5, 12, 24, 48VDC input with wide 2:1 input voltage range. Further features include under-voltage protection, overload protection, short circuit protection and no min. load requirement as well. An high efficiency allows operating temperatures range of -40°C to +80°C.
These DC-DC converters offer an economical solution for many cost critical applications in battery-powered equipment, instrumentation, distributed power architectures in communication, industrial electronics, energy facilities and many other critical applications where PCB space is limited.

Model Selection Guide

Model Number	Input Voltage (Range)	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	%
MFW03-05S033	5 (4.5 ~ 10)	3.3	600	501	45	100	79
MFW03-05S05		5	600	741			81
MFW03-05S12		12	250	706			85
MFW03-05S15		15	200	706			85
MFW03-05D05		±5	±300	732		100#	82
MFW03-05D12		±12	±125	714			84
MFW03-05D15		±15	±100	706			85
MFW03-12S033	12 (9 ~ 18)	3.3	600	206	27	100	80
MFW03-12S05		5	600	301			83
MFW03-12S12		12	250	287			87
MFW03-12S15		15	200	287			87
MFW03-12D05		±5	±300	298		100#	84
MFW03-12D12		±12	±125	291			86
MFW03-12D15		±15	±100	287			87
MFW03-24S033	24 (18 ~ 36)	3.3	600	103	16	100	80
MFW03-24S05		5	600	151			83
MFW03-24S12		12	250	144			87
MFW03-24S15		15	200	144			87
MFW03-24D05		±5	±300	149		100#	84
MFW03-24D12		±12	±125	145			86
MFW03-24D15		±15	±100	144			87
MFW03-48S033	48 (36 ~ 75)	3.3	600	52	10	100	79
MFW03-48S05		5	600	76			82
MFW03-48S12		12	250	73			86
MFW03-48S15		15	200	73			86
MFW03-48D05		±5	±300	76		100#	82
MFW03-48D12		±12	±125	74			85
MFW03-48D15		±15	±100	74			85

For each output

Input Specifications

Parameter	Conditions / Model	Min.	Typ.	Max.	Unit
Input Surge Voltage (1 sec. max.)	5V Input Models	-0.7	---	12	VDC
	12V Input Models	-0.7	---	25	
	24V Input Models	-0.7	---	50	
	48V Input Models	-0.7	---	100	
Start-Up Threshold Voltage	5V Input Models	---	---	4.5	
	12V Input Models	---	---	9	
	24V Input Models	---	---	18	
	48V Input Models	---	---	36	
Short Circuit Input Power	All Models	---	---	0.5	W
Input Filter		Internal Capacitor			

Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy		---	---	±1.5	%Vnom.
Output Voltage Balance	Dual Output, Balanced Loads	---	---	±2.0	%
Line Regulation	Vin=Min. to Max. @Full Load	---	---	±0.2	%
Load Regulation	Io=0% to 100%	---	---	±1.0	%
Minimum Load	No minimum Load Requirement				
Cross Regulation (Dual)	Asymmetrical load 25% / 100% FL	---	---	±5.0	%
Ripple & Noise	0-20 MHz Bandwidth	---	70	---	mV P-P
Transient Recovery Time	25% Load Step Change	---	250	500	µsec
Transient Response Deviation		---	±3	±5	%
Temperature Coefficient		---	±0.01	±0.02	%/°C
Over Load Protection	Foldback	---	170	---	%
Short Circuit Protection	Continuous, Automatic Recovery				

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds	1500	---	---	VDC
	1 Second	1800	---	---	VDC
I/O Isolation Resistance	500 VDC	1000	---	---	MΩ
I/O Isolation Capacitance	100kHz, 1V	---	100	---	pF
Switching Frequency		100	---	---	kHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	3,450,000	---	---	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)				

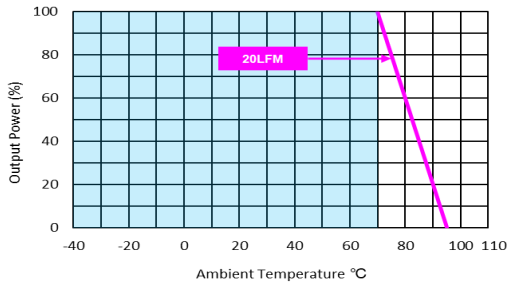
EMC Specifications

Parameter	Standards & Level			Performance
EMI	Conduction	EN 55032	With external components	Class A, B(5)
	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 (4)	EN 61000-4-4 ±2kV		A
	Surge (4)	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	+80	℃
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

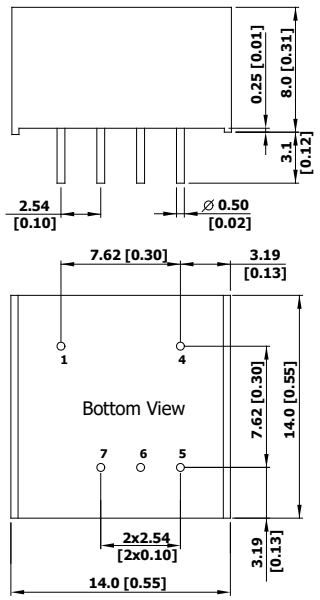


Notes

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. To meet EN 61000-4-4 & EN 61000-4-5 an external capacitor across the input pins is required, please contact MINMAX.
5. To meet EN 55032 Class A,B an external filter, please contact MINMAX.
6. Specifications are subject to change without notice.

Package Specifications

Mechanical Dimensions



Pin Connections

Pin	Single Output	Dual Output
1	-Vin	-Vin
4	+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)
- Pin diameter ⌀ 0.5 ±0.05 (0.02±0.002)

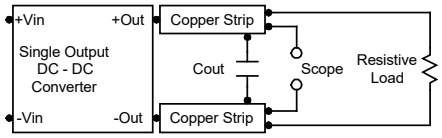
Physical Characteristics

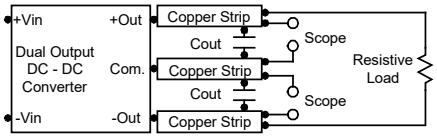
Case Size	:	14.0x14.0x8.0mm (0.55x0.55x0.31 inches)
Case Material	:	Non-Conductive Black Plastic (flammability to UL 94V-0 rated)
Pin Material	:	Phosphor Bronze with Tin Plate Over Nickel Subplate
Weight	:	3.9g

Test Setup

Peak-to-Peak Output Noise Measurement Test

Use a Cout 0.47μF 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

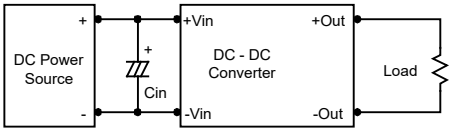
The MFW03 series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. The maximum capacitance can be found in the data sheet.

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.

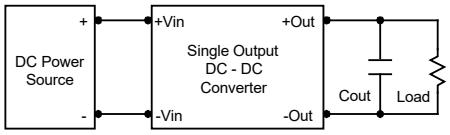
Input Source Impedance

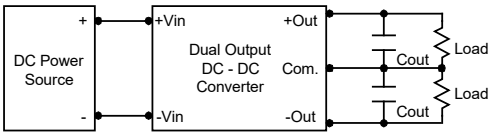
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.
Capacitor mounted close to the power module helps ensure stability of the unit, it is commended to use a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 kHz) capacitor of a 8.2μF for the 5V input device, a 3.3μF for the 12V input devices and a 1.5μF for the 24V and 48V 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 3.3μF 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℃. The derating curves are determined from measurements obtained in a test setup.