

FEATURES

- ▶ Standard SIP-7 Package
- ▶ Semi-regulated Output Voltage
- ▶ High 3000VDC I/O-isolation
- ▶ High Efficiency to 88%
- ▶ Operating Temp. Range -40°C to $+85^{\circ}\text{C}$
- ▶ CSA/IEC/EN 60950-1 Safety Approval
- ▶ Industry Standard Pinout
- ▶ 3 Years Product Warranty



PRODUCT OVERVIEW

The MINMAX MA01H series is a new range of isolated 1W DC/DC converter modules in a small SIP-package. There are 24 models available with 5V, 12V or 24VDC input. These products provide have a typical load regulation of 3.5% to 5.5% depending on model.

The MA01H DC/DC converters are a compromise between a more expensive fully regulated converter and a non-regulated converter. They offer the designer a new solution for many cost critical applications where the output voltage variation has to be kept in a certain limit under all load conditions.

Model Selection Guide

Model Number	Input Voltage (Range) VDC	Output Voltage VDC	Output Current		Input Current		Load Regulation % (max.)	Reflected Ripple mA(typ.)	Max. capacitive Load μF	Efficiency (typ.) %
			Max.	Min.	@Max. Load mA(typ.)	@No Load mA(typ.)				
			mA	mA	mA	mA				@Max. Load
MA01-05S05H	5 (4.5 ~ 5.5)	5	200	4	238	30	6.2	11	220	84
MA01-05S09H		9	110	2	229		5.5			86.5
MA01-05S12H		12	84	1.5	231		5.5			87
MA01-05S15H		15	67	1	230		5			87.5
MA01-12S05H	12 (10.8 ~ 13.2)	5	200	4	99	12	5	5	220	84
MA01-12S09H		9	110	2	96		3.3			86
MA01-12S12H		12	84	1.5	95		3.6			88
MA01-12S15H		15	67	1	95		2.9			88
MA01-24S05H	24 (21.6 ~ 26.4)	5	200	4	50	11	5	4.7	220	84
MA01-24S09H		9	110	2	48		3.5			86.5
MA01-24S12H		12	84	1.5	48		3.5			87.5
MA01-24S15H		15	67	1	48		3			87.5

Input Specifications

Parameter	Model	Min.	Typ.	Max.	Unit
Input Surge Voltage (1 sec. max.)	5V Input Models	-0.7	---	9	VDC
	12V Input Models	-0.7	---	18	
	24V Input Models	-0.7	---	30	
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	
Reverse Polarity Input Current	All Models	---	---	0.3	A
Internal Filter Type	All Models	Internal Capacitor			
Internal Power Dissipation	All Models	---	---	450	mW

Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Line Regulation	For V_{in} Change of 1%	---	± 1.05	± 1.2	%
Load Regulation	$I_o = 20\%$ to 100%	See Model Selection Guide			
Ripple & Noise (20MHz)		---	30	60	mV _{P-P}
Temperature Coefficient		---	± 0.01	± 0.02	%/ $^{\circ}\text{C}$
Short Circuit Protection	0.5 Second Max.				

General Specifications

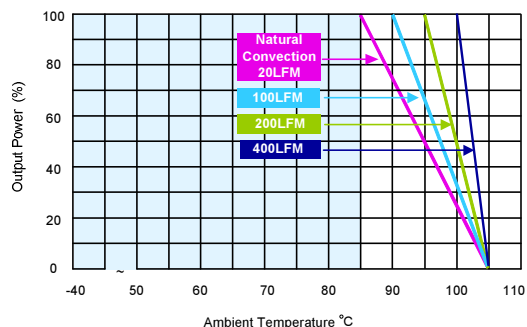
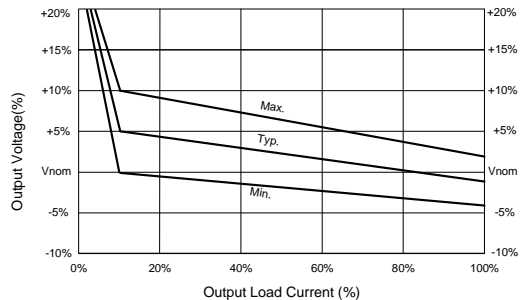
Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage (rated)	60 Seconds	3000	---	---	VDC
I/O Isolation Test Voltage	Flash tested for 1 Second	3300	---	---	V _{PK}
I/O Isolation Resistance	1000 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100KHz, 1V	30	60	120	pF
Switching Frequency		50	100	120	KHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	2,000,000	---	---	Hours
Safety Approvals	CSA 60950-1 recognition, IEC/EN 60950-1 (CB-scheme)				

Input Fuse

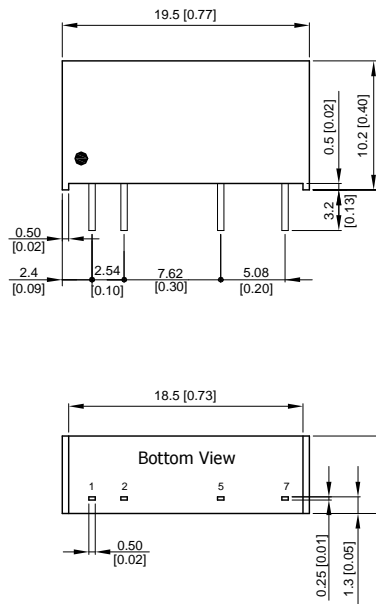
5V Input Models	12V Input Models	24V Input Models
500mA Slow-Blow Type	200mA Slow-Blow Type	100mA Slow-Blow Type

Environmental Specifications

Parameter	Conditions	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	Natural Convection	-40	+85	°C
Case Temperature		---	+95	°C
Storage Temperature Range		-50	+125	°C
Humidity (non condensing)		---	95	% rel. H
Cooling	Free-Air convection			
Lead Temperature (1.5mm from case for 10Sec.)		---	260	°C

Power Derating Curve

Output Voltage Tolerance

Notes

- Specifications typical at Ta=+25°C, resistive load, nominal input voltage and rated output current unless otherwise noted.
- Ripple & Noise measurement bandwidth is 0-20MHz.
- 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.
- All DC/DC converters should be externally fused at the front end for protection.
- Other input and output voltage may be available, please contact factory.
- That "natural convection" is about 20LFM but is not equal to still air (0 LFM).
- Specifications are subject to change without notice.

Package Specifications
Mechanical Dimensions

Pin Connections

Pin	Function
1	+Vin
2	-Vin
5	-Vout
7	+Vout

T=6.1[0.24] for 5V & 12V Input Models

T=7.1[0.28] for 24V Input Models

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

Physical Characteristics

Case Size (5&12V Input) : 19.5x6.1x10.2mm (0.77x0.24x0.40 inches)

Case Size (24V Input) : 19.5x7.1x10.2mm (0.77x0.28x0.40 inches)

Case Material : Non-Conductive Black Plastic (flammability to UL 94V-0 rated)

Pin Material : Alloy 42

Weight (5&12V Input) : 2.2g

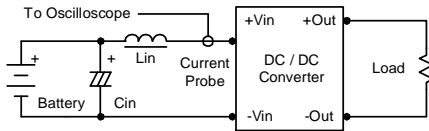
Weight (24V Input) : 2.6g

Test Setup

Input Reflected-Ripple Current Test Setup

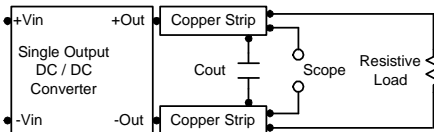
Input reflected-ripple current is measured with an inductor L_{in} (10 μ H) and C_{in} (1 μ F, ESR < 1.0 Ω at 100 KHz) to simulate source impedance. Capacitor C_{in} offsets possible battery impedance.

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 μ 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

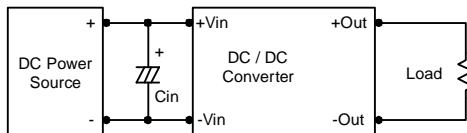
The MA01H series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. For optimum performance we recommend 220 μ F maximum capacitive load for devices.

The maximum capacitance can be found in the data sheet.

Input Source Impedance

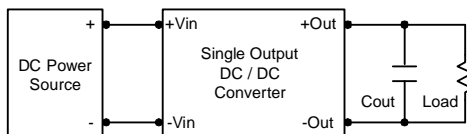
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.

Capacitor mounted close to the power module helps ensure stability of the unit, it is commended 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 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 1.0 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 95°C. The derating curves are determined from measurements obtained in a test setup.

