FEATURES

- **Industrial Standard SIP-7 Package**
- **Ultra-high I/O Isolation 5200VDC**
- **Common Mode Transient Immunity : 15kV/μs**
- **Qualified for IGBT and High Isolation Applications**
- **Operating Ambient Temp. Range -40℃ to +90℃**
- **UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval**

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UL 62368-1 CSA 60950-1 CB Scheme

HIGH ISOLATION CONFLICT FREE Minerals Policy REACH COMPLIANT 3 YEAR WARRANTY RoHS Compliant

PRODUCT OVERVIEW

The MINMAX MA01-HI series is a range of isolated 1W DC-DC converter modules in SIP-package which feature a very high I/O-isolation voltage rated for 5200V. A very high common mode transient immunity qualifies these product for IGBT applications. There are 40 Models available for 5, 12, 15 or 24VDC input. These converters offer an economical solution for all applications where a very high I/O –isolation is required.

Model Selection Guide

Model Number	Input Voltage (Range)	Output Voltage	Output Current		Input Current		Load Regulation	Max. capacitive Load	Efficiency (typ.)
			Max.	Min.	@Max. Load	@No Load			@Max. Load
	VDC	VDC	mA	mA	mA(typ.)	mA(typ.)	% (max.)	μF	%
MA01-05S033HI	5 ±10%	3.3	303	6	286	35	20	1000	70
MA01-05S05HI		5	200	4	286		15	470	70
MA01-05S09HI		9	111	2	266		10	470	75
MA01-05S12HI		12	84	1.7	261		10	220	77
MA01-05S15HI		15	66	1.3	254		10	220	78
MA01-05D05HI		±5	±100	±2	282		15	220#	71
MA01-05D09HI		±9	±56	±1.1	269		10	220#	75
MA01-05D12HI		±12	±42	±0.8	262		10	100#	77
MA01-05D15HI		±15	±33	±0.7	254		10	100#	78
MA01-05A1509HI		15	+33	+0.7	260		10	100	76
		-9	-55	-1.1				220	
MA01-12S033HI	12 ±10%	3.3	303	6	117	17	20	1000	71
MA01-12S05HI		5	200	4	117		15	470	71
MA01-12S09HI		9	111	2	110		10	470	76
MA01-12S12HI		12	84	1.7	108		10	220	78
MA01-12S15HI		15	66	1.3	104		10	220	79
MA01-12D05HI		±5	±100	±2	116		15	220#	72
MA01-12D09HI		±9	±56	±1.1	111		10	220#	76
MA01-12D12HI		±12	±42	±0.8	108		10	100#	78
MA01-12D15HI		±15	±33	±0.7	104		10	100#	79
MA01-12A1509HI		15	+33	+0.7	107		10	100	77
		-9	-55	-1.1				220	
MA01-15S033HI	15 ±10%	3.3	303	6	95	16	20	1000	70
MA01-15S05HI		5	200	4	95		15	470	70
MA01-15S09HI		9	111	2	89		10	470	75
MA01-15S12HI		12	84	1.7	90		10	220	75
MA01-15S15HI		15	66	1.3	84		10	220	79
MA01-15D05HI		±5	±100	±2	94		15	220#	71
MA01-15D09HI		±9	±56	±1.1	90		10	220#	75
MA01-15D12HI		±12	±42	±0.8	86		10	100#	78
MA01-15D15HI		±15	±33	±0.7	84		10	100#	79
MA01-15A1509HI		15	+33	+0.7	87		10	100	76
		-9	-55	-1.1				220	
MA01-24S033HI	24 ±10%	3.3	303	6	60	12	20	1000	70
MA01-24S05HI		5	200	4	60		15	470	70
MA01-24S09HI		9	111	2	56		10	470	75
MA01-24S12HI		12	84	1.7	53		10	220	78
MA01-24S15HI		15	66	1.3	52		10	220	80
MA01-24D05HI		±5	±100	±2	59		15	220#	71
MA01-24D09HI		±9	±56	±1.1	56		10	220#	75
MA01-24D12HI		±12	±42	±0.8	55		10	100#	77
MA01-24D15HI		±15	±33	±0.7	53		10	100#	78
MA01-24A1509HI		15	+33	+0.7	55		10	100	75
		-9	-55	-1.1				220	

For each output

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	
	15V Input Models	-0.7	---	20	
	24V Input Models	-0.7	---	30	
Input Voltage Range	5V Input Models	4.5	5	5.5	
	12V Input Models	10.8	12	13.2	
	15V Input Models	13.5	15	16.5	
	24V Input Models	21.6	24	26.4	
Input Filter	All Models	Internal Capacitor			

Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy		---	---	±5.0	%Vnom.
Output Voltage Balance	Dual Output, Balanced Loads	---	±0.1	±1.0	%
Line Regulation	For Vin Change of 1%	---	±1.2	---	%
Load Regulation	Io=20% to 100%	See Model Selection Guide			
Ripple & Noise	0-20MHz Bandwidth	---	---	100	mV P-P
Temperature Coefficient		---	±0.01	±0.02	%/°C
Short Circuit Protection	Continuous, Automatic Recovery				

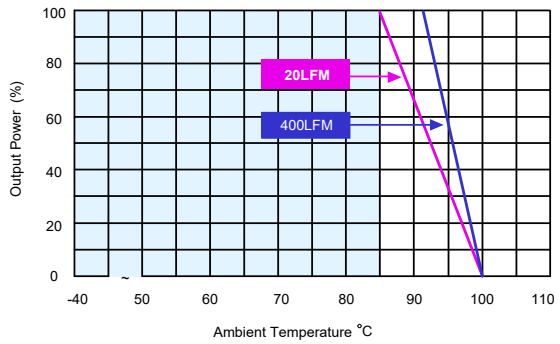
General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	Rated for 60 seconds	5200	---	---	VDC
	Tested for 1 second	5700	---	---	VDC
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100kHz, 1V	---	7	---	pF
Common Mode Transient Immunity		15	---	---	kV/μs
Switching Frequency		---	100	---	kHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	2,000,000			Hours
Safety Approvals	UL/cUL 60950-1 recognition (CSA certificate), IEC/EN 60950-1(CB-report)				
	UL/cUL 62368-1 recognition (UL certificate), IEC/EN 62368-1 (CB-report)				

Environmental Specifications

Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+85	°C
Case Temperature	---	+100	°C
Storage Temperature Range	-55	+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℃, resistive load, nominal input voltage and rated output current unless otherwise noted.

2 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.

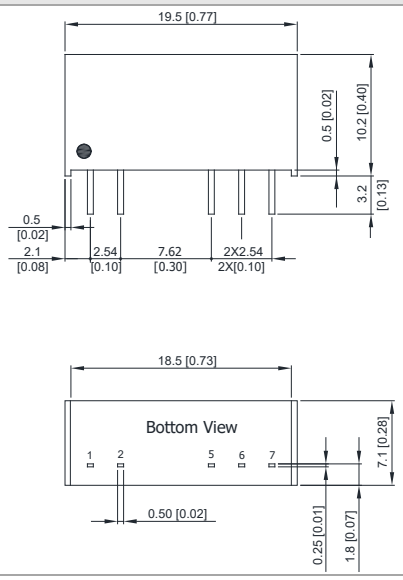
3 We recommend to protect the converter by a slow blow fuse in the input supply line.

4 Other input and output voltage may be available, please contact factory.

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
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)
- Pins ±0.05(±0.002)

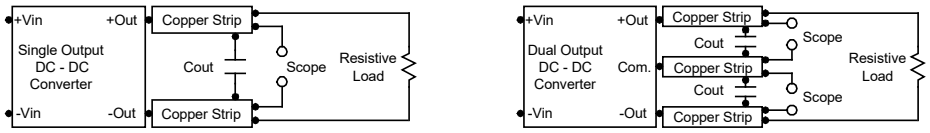
Physical Characteristics

Case Size	:	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	:	2.4g

Test Setup

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.



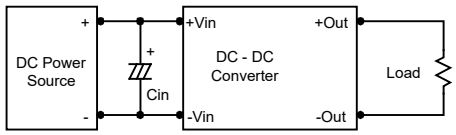
Technical Notes

Maximum Capacitive Load

The MA01-HI 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.

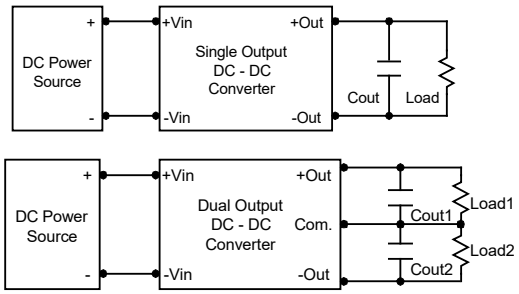
Input Source Impedance

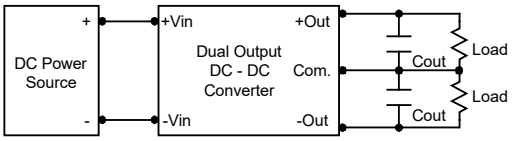
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.
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 2.2μF for the 5V input devices, a 1.0μF for the 12V,15V input devices and a 0.47μF for the 24V devices.



Output Ripple Reduction

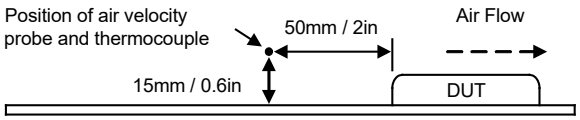
A good quality low ESR capacitor placed as close as practicable across the load will give the best ripple and noise performance. To reduce output ripple, it is recommended to use 1.0μF capacitors at the output.





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 100°C. The derating curves are determined from measurements obtained in a test setup.



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