

MA01 Series

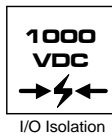
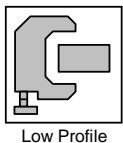
1W, Miniature SIP, Single & Dual Output DC/DC Converters



Key Features



- Efficiency up to 88.5%
- Improved Regulation Performance
- Low Ripple & Noise
- 1000VDC Isolation
- MTBF > 2,000,000 Hours
- Input 5, 12 and 24VDC
- Output 5,9,12,15,±5,±9,±12 and ±15VDC
- Temperature Performance -40°C to +85°C
- UL 94V-0 Package Material
- Internal SMD Construction
- Industry Standard Pinout



Minmax's new launched MA01 series comprises 24 different models with improved regulation performance, low ripple & noise at 30mVp-p and high efficiency up to 88.5%. This series operates input voltages of 5V, 12V and 24V and is available in output voltages of 5V, 9V, 12V, 15V, ±5V, ±9V, ±12V and ±15VDC.

Standard footprint targets data communication equipments, mobile battery driven equipments, distributed power systems, telecommunication equipments, mixed analog/digital subsystems, process/machine control equipments, computer peripheral systems and industrial robot systems.

Absolute Maximum Ratings

Parameter		Min.	Max.	Unit
Input Surge Voltage (1000 mS)	5VDC Input Models	-0.7	9	VDC
	12VDC Input Models	-0.7	18	VDC
	24VDC Input Models	-0.7	30	VDC
Lead Temperature (1.5mm from case for 10 Sec.)		---	260	°C
Internal Power Dissipation		---	450	mW

Exceeding the absolute maximum ratings of the unit could cause damage. These are not continuous operating ratings.

Environmental Specifications

Parameter	Conditions	Min.	Max.	Unit
Operating Temperature	Ambient	-40	+85	°C
Operating Temperature	Case	-40	+90	°C
Storage Temperature		-50	+125	°C
Humidity		---	95	%
Cooling	Free-Air Convection			

Model Selection Guide

Model Number	Input Voltage	Output Voltage	Output Current		Input Current		Load Regulation	Reflected Ripple Current	Efficiency
			Max.	Min.	@Max. Load	@No Load			@Max. Load
	VDC	VDC	mA	mA	mA (Typ.)	mA (Typ.)	% (Max.)	mA (Typ.)	% (Typ.)
MA01-05S05	5 (4.5 ~ 5.5)	5	200	4	238	30	6.5	7	84
MA01-05S09		9	110	2	228		5		87
MA01-05S12		12	84	1.5	232		5.2		87
MA01-05S15		15	67	1	230		5		87.5
MA01-05D05		±5	±100	±2	237		5.2		84.5
MA01-05D09		±9	±56	±1	234		4.2		86
MA01-05D12		±12	±42	±0.8	233		4.6		86.5
MA01-05D15		±15	±34	±0.7	236		4.5		86.5
MA01-12S05	12 (10.8 ~ 13.2)	5	200	4	99	12	5	4	84
MA01-12S09		9	110	2	95		3.4		86.5
MA01-12S12		12	84	1.5	95		3.4		88.5
MA01-12S15		15	67	1	95		2.7		88
MA01-12D05		±5	±100	±2	99		3.9		84.5
MA01-12D09		±9	±56	±1	98		2.8		86
MA01-12D12		±12	±42	±0.8	95		2.9		88.5
MA01-12D15		±15	±34	±0.7	94		2.6		87.5
MA01-24S05	24 (21.6 ~ 26.4)	5	200	4	50	11	3.7	8	84
MA01-24S09		9	110	2	48		2.5		86.5
MA01-24S12		12	84	1.5	48		2.4		87.5
MA01-24S15		15	67	1	48		2.3		87.5
MA01-24D05		±5	±100	±2	50		3.7		83.5
MA01-24D09		±9	±56	±1	49		2.5		86
MA01-24D12		±12	±42	±0.8	48		2.4		87
MA01-24D15		±15	±34	±0.7	49		2.3		87

Capacitive Load

Models by Vout	5V	9V	12V	15V	±5V #	±9V #	±12V #	±15V #	Unit
Maximum Capacitive Load	220	220	220	220	100	100	100	100	µF

For each output

Input Fuse Selection Guide

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

Input Specifications

Parameter	Model	Min.	Typ.	Max.	Unit
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
Input Filter		Internal Capacitor			

Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Balance	Dual Output, Balanced Loads	---	±0.1	±1.0	%
Line Regulation	For Vin Change of 1%	---	±1.05	±1.2	%
Load Regulation	Io=20% to 100%	See Model Selection Guide			%
Ripple & Noise (20MHz)		---	30	60	mV P-P
Temperature Coefficient		---	±0.01	±0.02	%/°C
Output Short Circuit	0.5 Second Max.				

General Specifications

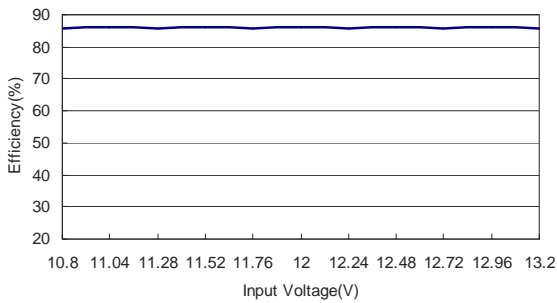
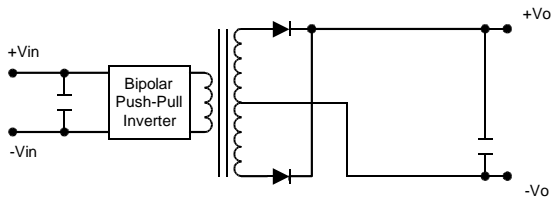
Parameter	Conditions	Min.	Typ.	Max.	Unit
Isolation Voltage Rated	60 Seconds	1000	---	---	VDC
Isolation Voltage Test	Flash Tested for 1 Second	1100	---	---	VDC
Isolation Resistance	500VDC	1000	---	---	MΩ
Isolation Capacitance	100KHz, 1V	40	60	120	pF
Switching Frequency		50	100	120	KHz
MTBF	MIL-HDBK-217F @ 25°C, Ground Benign	2000	---	---	K Hours

Notes:

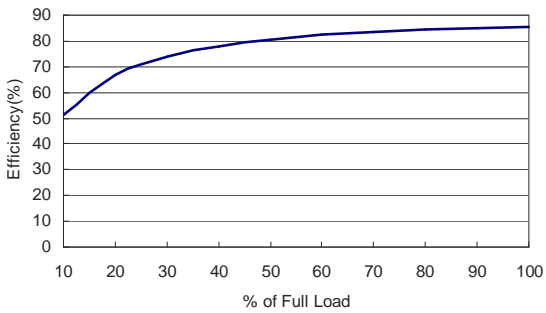
1. Specifications typical at Ta=+25°C, resistive load, nominal input voltage, rated output current unless otherwise noted.
2. Ripple & Noise measurement bandwidth is 0–20 MHz.
3. These power converters require a minimum output loading to maintain specified regulation.
4. Operation under no-load conditions will not damage these modules; however, they may not meet all specifications listed.
5. All DC/DC converters should be externally fused at the front end for protection.
6. Other input and output voltage may be available, please contact factory.
7. Specifications subject to change without notice.

Block Diagram

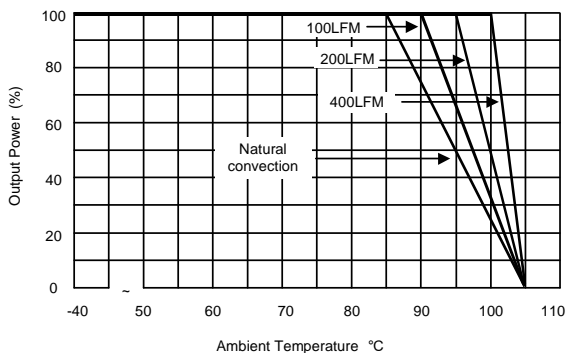
Single Output



Efficiency vs Input Voltage (MA01-12S05)

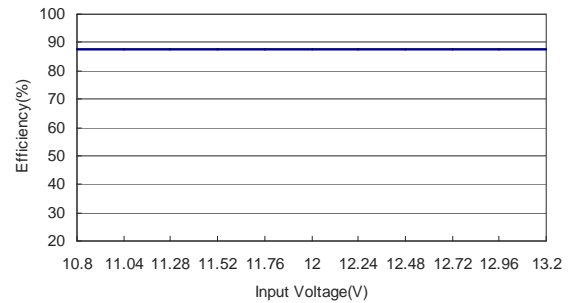
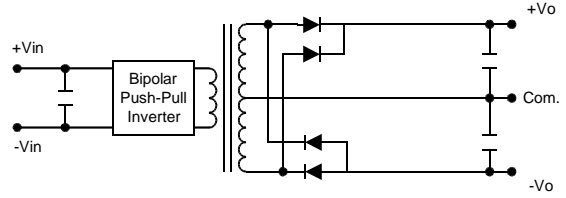


Efficiency vs Output Load (MA01-12S05)

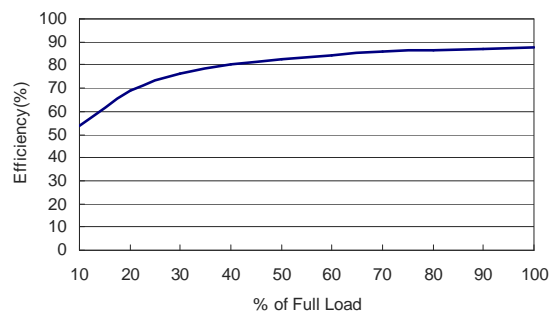


Derating Curve

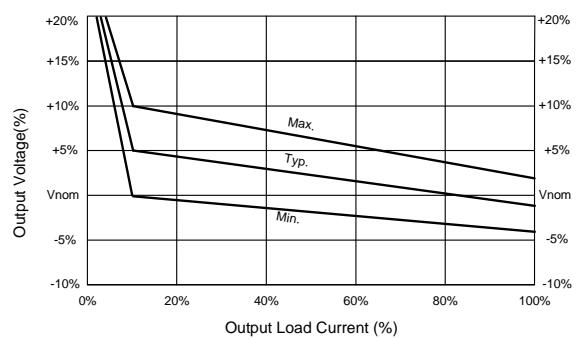
Dual Output



Efficiency vs Input Voltage (MA01-12D05)



Efficiency vs Output Load (MA01-12D05)



Tolerance Envelopes Graph

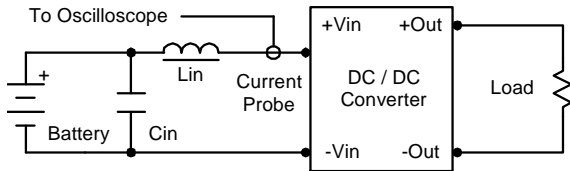
Test Configurations

Input Reflected-Ripple Current Test Setup

Input reflected-ripple current is measured with an inductor L_{in} (10uH) and C_{in} (1uF, ESR < 1.0Ω at 100 KHz) to simulate source impedance.

Capacitor C_{in} , offsets possible battery impedance.

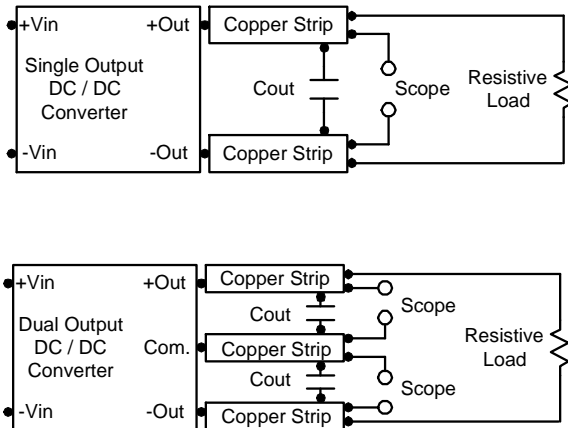
Current ripple is measured at the input terminals of the module, measurement bandwidth is 0–500 KHz.



Peak-to-Peak Output Noise Measurement Test

Use a C_{out} 0.33uF 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.



Design & Feature Considerations

Maximum Capacitive Load

The MA01 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 100uF maximum capacitive load for dual outputs and 220uF capacitive load for single outputs.

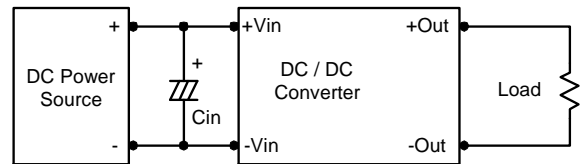
The maximum capacitance can be found in the data sheet.

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.

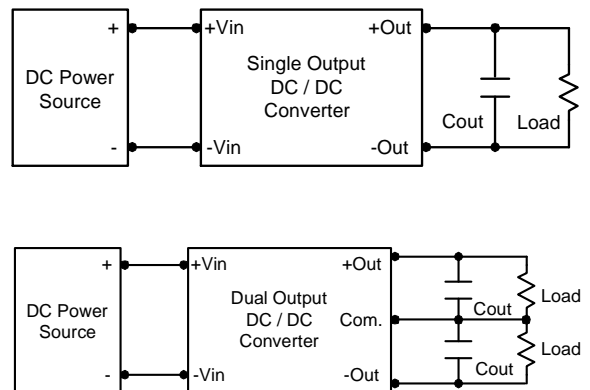
Capacitor mounted close to the power module helps ensure stability of the unit, it is recommended to use a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 KHz) capacitor of a 2.2uF for the 5V input devices, a 1.0uF for the 12V input devices and a 0.47uF for the 24V devices.



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.

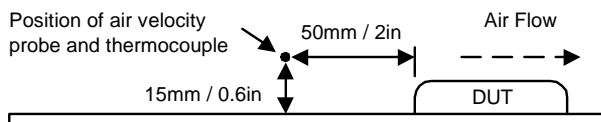
To reduce output ripple, it is recommended to use 1.0uF capacitors at the output.



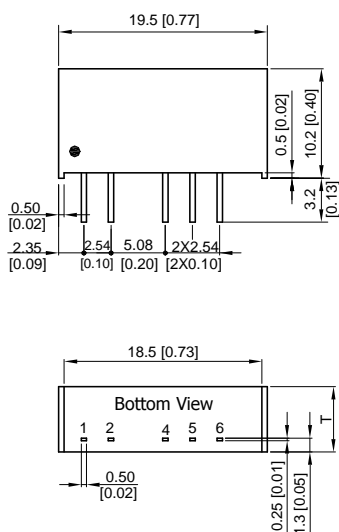
Thermal Considerations

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 90°C.

The derating curves are determined from measurements obtained in an experimental apparatus.



Mechanical Dimensions



T=6.1 [0.24] for 5V & 12V Input Models
 T=7.1 [0.28] for 24V Input Models

Tolerance	Millimeters	Inches
	X.X±0.25	X.XX±0.01
	X.XX±0.13	X.XXX±0.005
Pin	±0.05	±0.002

Physical Characteristics

Case Size (5V & 12V Input) : 19.5×6.1×10.2 mm
 : 0.77×0.24×0.40 inches

Case Size (24V Input) : 19.5×7.1×10.2 mm
 : 0.77×0.28×0.40 inches

Case Material : Non-Conductive Black Plastic

Weight : 2.2g (5 & 12V Input)
 : 2.6g (24V Input)

Pin Connections

Pin	Single Output	Dual Output
1	+Vin	+Vin
2	-Vin	-Vin
4	-Vout	-Vout
5	No Pin	Common
6	+Vout	+Vout