

## FEATURES

- ▶ Small SIP Package
- ▶ Reinforced Insulation rated for 300VAC Working Voltage
- ▶ I/O-isolation 3000VACrms
- ▶ Industrial & Medical Safety Approval
- ▶ Operating Temp. Range -25°C to +85°C
- ▶ Low Coupling Capacity
- ▶ 3 Years Product Warranty



## PRODUCT OVERVIEW

The MINMAX MAU400 series is a range of 1W DC/DC converter modules providing a high I/O-isolation voltage of 3000VAC in a small SIP-package. There are 12 models available for 5VDC or 12VDC input voltage and single- or dual-output voltage.

This product offers an economical solution for many applications in industrial controls and Instrumentation, consumer electronics and everywhere where a certified supplementary or reinforced insulation system is required to comply with relative safety standards.

### Model Selection Guide

Model Number	Input Voltage (Range) VDC	Output Voltage VDC	Output Current		Input Current		Load Regulation % (max.)	Max. capacitive Load μF	Efficiency (typ.) @Max. Load %
			Max.	Min.	@Max. Load	@No Load			
			mA	mA	mA(typ.)	mA(typ.)			
MAU401	5 (4.5 ~ 5.5)	5	200	4	303	55	10	680	66
MAU402		12	80	2	291		8		66
MAU403		15	65	1	295		8		66
MAU404		±5	±100	±2	303		10	220#	66
MAU405		±12	±40	±1	267		8		72
MAU406		±15	±35	±1	287		8		73
MAU411	12 (10.8 ~ 13.2)	5	200	4	126	30	10	680	66
MAU412		12	80	2	121		8		66
MAU413		15	65	1	123		8		66
MAU414		±5	±100	±2	126		10	220#	66
MAU415		±12	±40	±1	108		8		74
MAU416		±15	±35	±1	117		8		75

# For each output

### 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	
Input Surge Voltage (1 sec. max.)	5V Input Models	-0.7	---	9	VDC
	12V Input Models	-0.7	---	29	
Reverse Polarity Input Current	All Models	---	---	0.3	A
Internal Filter Type		LC Filter			
Internal Power Dissipation		---	---	650	mW

### Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Accuracy		---	±1.0	±3.0	%
Output Voltage Balance	Dual Output, Balanced Loads	---	±0.1	±1.0	%
Line Regulation	For Vin Change of 1%	---	±1.2	±1.5	%
Load Regulation	Io=20% to 100%	See Model Selection Guide			
Ripple & Noise	0-20MHz bandwidth	---	---	150	mV <sub>P-P</sub>
Temperature Coefficient		---	±0.01	±0.02	%/°C
Short Circuit Protection		0.5 Second Max.			

**Isolation, Safety Standards**

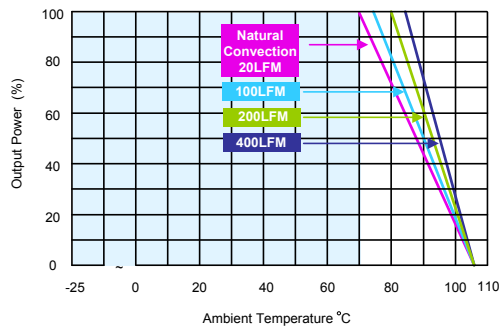
Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage (rated)	60 Seconds	3000	---	---	VACrms
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100KHz, 1V	---	15	20	pF
Safety Standards	cUL/UL 60950-1				
	ANSI/AAMI ES60601-1, CAN/CSA-C22.2 No. 60601-1				
Approvals	IEC/EN 60950-1, IEC/EN 60601-1 3 <sup>rd</sup> Edition 2xMOOP				
	IEC 60950-1 CB Report, cUL/UL 60950-1 certificate				
IEC 60601-1 CB Report, ANSI/AAMI ES60601-1 2xMOOP certificate					

**General Specifications**

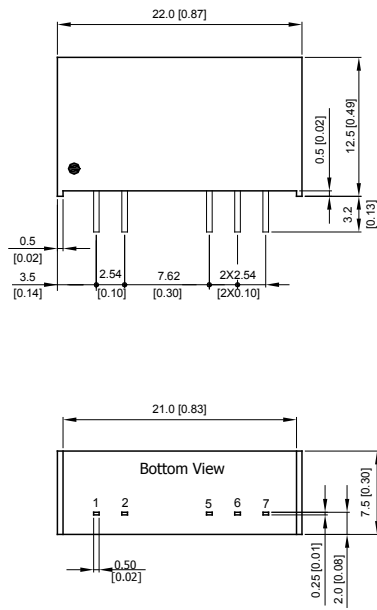
Parameter	Conditions	Min.	Typ.	Max.	Unit
Switching Frequency		50	80	100	KHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	2,000,000			Hours

**Environmental Specifications**

Parameter	Conditions	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	Ambient	-25	+85	°C
Case Temperature		---	+90	°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**

**Notes**

- 1 Specifications typical at Ta=+25°C, 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 That "natural convection" is about 20LFM but is not equal to still air (0 LFM).
- 6 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±0.13 (X.XXX±0.005)
- ▶ Pins ±0.05 (±0.002)

**Physical Characteristics**

Case Size : 22.0x7.5x12.5mm (0.87x0.30x0.49 inches)

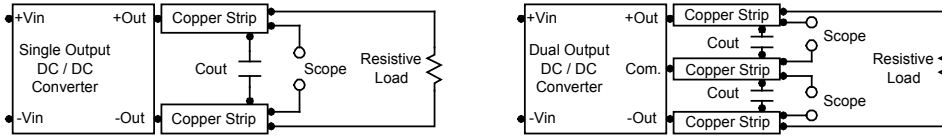
Case Material : Non-Conductive Black Plastic (flammability to UL 94V-0 rated)

Pin Material : Alloy 42

Weight : 3.9g

**Test Setup**
**Peak-to-Peak Output Noise Measurement Test**

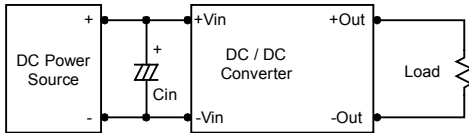
Use a  $C_{out}$  0.33 $\mu$ F ceramic capacitor. Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20 MHz. Position the load between 50 mm and 75 mm from the DC/DC Converter.


**Technical Notes**
**Maximum Capacitive Load**

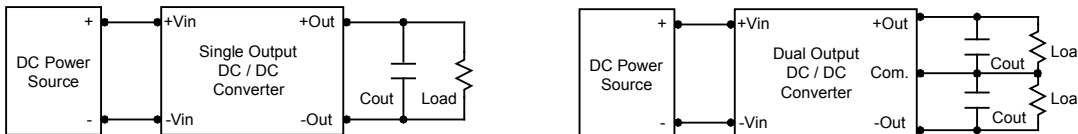
The MAU400 series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. For optimum performance we recommend 220 $\mu$ F maximum capacitive load for dual outputs and 680 $\mu$ F 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 < 1.0  $\Omega$  at 100 KHz) capacitor of a 2.2 $\mu$ F for the 5V input devices, a 1.0 $\mu$ F for the 12V input 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 1.5 $\mu$ 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 90°C. The derating curves are determined from measurements obtained in a test setup.

