

**FEATURES**

- ▶ Industrial Standard SIP-7 Package
- ▶ I/O Isolation 3000VDC
- ▶ Operating Ambient Temp. Range -40°C to +90°C
- ▶ Short Circuit Protection

**NEW**

**PRODUCT OVERVIEW**

The MINMAX MAPU02H series is a new range of 2Watt isolated DC-DC power module with 24 models available for 3.3/5/9/12/15/±5/±12/±15 output in a SIP-7 encapsulated package size. Key performance featuring a high I/O isolation voltage rated for 3000VDC, continuous output short circuit protection, wide operating ambient temp. range by -40°C to +90°C assure reliable operation for critical applications in harsh environments. The MAPU02H series which offer a solution for the applications where higher I/O isolation, fault condition protection, fully encapsulated package and wide operating ambient temp. range are required.

**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.	Min.	@Max. Load	@No Load			@Max. Load
			mA	mA	mA(typ.)	mA(typ.)			%
MAPU02-05S033H	5 (4.5 ~ 5.5)	3.3	500	10	446	50	12	440	74
MAPU02-05S05H		5	400	8	513		10		78
MAPU02-05S09H		9	222	4.4	506		8		79
MAPU02-05S12H		12	168	3.36	498		8		81
MAPU02-05S15H		15	132	2.64	495		8	80	
MAPU02-05D05H		±5	±200	±4	519		10	77	
MAPU02-05D12H		±12	±84	±1.68	510		8	200#	79
MAPU02-05D15H		±15	±66	±1.32	508		8	78	
MAPU02-12S033H	12 (10.8 ~ 13.2)	3.3	500	10	181	30	12	440	76
MAPU02-12S05H		5	400	8	214		10		78
MAPU02-12S09H		9	222	4.4	208		8		80
MAPU02-12S12H		12	168	3.36	205		8		82
MAPU02-12S15H		15	132	2.64	204		8	81	
MAPU02-12D05H		±5	±200	±4	214		10	78	
MAPU02-12D12H		±12	±84	±1.68	207		8	200#	81
MAPU02-12D15H		±15	±66	±1.32	204		8	81	
MAPU02-24S033H	24 (21.6 ~ 26.4)	3.3	500	10	90	15	12	440	76
MAPU02-24S05H		5	400	8	107		10		78
MAPU02-24S09H		9	222	4.4	105		8		79
MAPU02-24S12H		12	168	3.36	104		8		81
MAPU02-24S15H		15	132	2.64	104		8	79	
MAPU02-24D05H		±5	±200	±4	110		10	76	
MAPU02-24D12H		±12	±84	±1.68	105		8	200#	80
MAPU02-24D15H		±15	±66	±1.32	104		8	79	

\*Min. Output Current for Lower Load Regulation

# 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	
	24V Input Models	21.6	24	26.4	
Input Surge Voltage (1 sec. max.)	5V Input Models	-0.7	---	9	
	12V Input Models	-0.7	---	18	
	24V Input Models	-0.7	---	30	
Input Filter	All Models	Internal Capacitor			

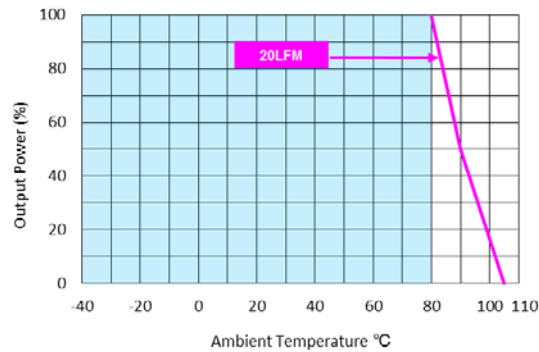
Output Specifications					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy		---	±1.0	±5.0	%
Output Voltage Balance	Dual Output, Balanced Loads	---	±0.1	±1.0	%
Line Regulation	For Vin Change of 1%	---	±1.2	±1.5	%
Load Regulation	Io=10% to 100%	See Model Selection Guide			
Ripple & Noise	0-20 MHz Bandwidth	---	65	100	mV <sub>P-P</sub>
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	60 Seconds	3000	---	---	VDC
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100kHz, 1V	---	20	---	pF
Switching Frequency		40	60	100	kHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	1,608,765	---	---	Hours

Environmental Specifications				
Parameter	Min.	Max.	Unit	
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+90	°C	
Case Temperature	---	+105	°C	
Storage Temperature Range	-50	+125	°C	
Humidity (non condensing)	---	95	% rel. H	
Lead Temperature (1.5mm from case for 10Sec.)	---	260	°C	

EMC Specifications			
Parameter	Standards & Level		Performance
EMI	Conduction	EN 55032, FCC part 15	Class A <sup>(5)</sup>
	EN 55024		
EMS	ESD	EN 61000-4-2 Air ± 8kV, Contact ± 6kV	A
	Radiated immunity	EN 61000-4-3 10V/m	A
	Fast transient <sup>(6)</sup>	EN 61000-4-4 ±2kV	A
	Surge <sup>(6)</sup>	EN 61000-4-5 ±1kV	A
	Conducted immunity	EN 61000-4-6 10Vrms	A
	PFMF	EN 61000-4-8 3A/m	A

## Power Derating Curve

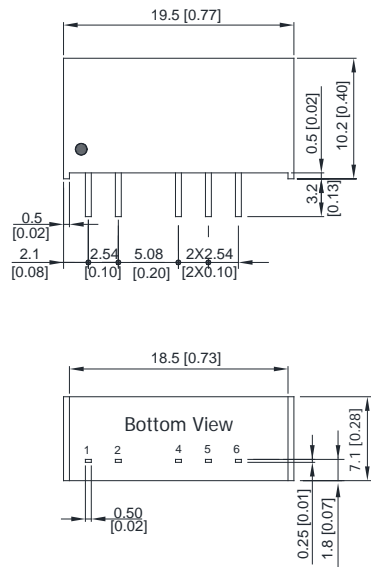


## Notes

- 1 Specifications typical at  $T_a=+25^{\circ}\text{C}$ , 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 To meet EN 55032 Class A an external filter, please contact MINMAX.
- 6 To meet EN 61000-4-4 & EN 61000-4-5 an external capacitor across the input pins is required, please contact MINMAX.
- 7 Specifications are subject to change without notice.

**Package Specifications**

Mechanical Dimensions



Pin Connections

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

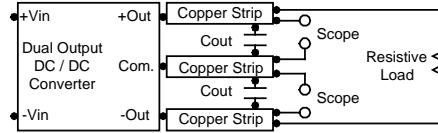
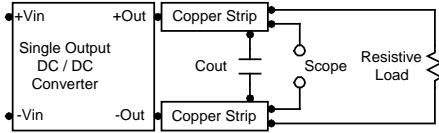
**Physical Characteristics**

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	:	Tinned Copper
Weight	:	3.1g

## Test Setup

### Peak-to-Peak Output Noise Measurement Test

Cout uses a 0.47 $\mu$ 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.



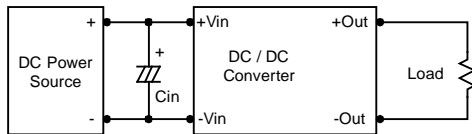
## Technical Notes

### 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.

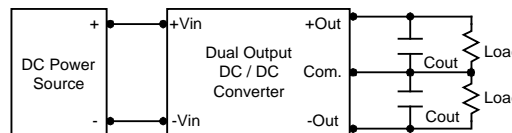
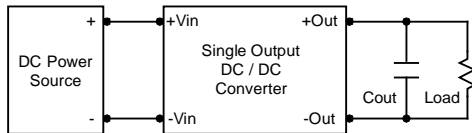
### Input Source Impedance

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 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 all the 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 3.3 $\mu$ F capacitors at the output.



### Maximum Capacitive Load

The MAPU02H 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.

### 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 $^{\circ}$ C.

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

