

**FEATURES**

- ▶ Industrial Standard SIP-7 Package
- ▶ I/O Isolation 3000VDC
- ▶ Operating Ambient Temp. Range -40°C to +90°C
- ▶ Overload and Short Circuit Protection
- ▶ UL/cUL/IEC/EN 62368-1 (60950-1) Safety Approval & CE Marking


**PRODUCT OVERVIEW**

The MINMAX MAPU01H series is a new range of isolated 1W DC/DC converter modules in SIP-7 package which feature a high I/O isolation voltage rated for 3000VDC and there are 32 models available for 3.3, 5, 12 or 24VDC input.

Advanced circuit topology provides continuous overload, short circuit protection and a high efficiency up to 82% which allows operating ambient temperatures range of -40°C to +85°C without power derating.

These converters offer a cost-effective solution for all applications where a high I/O isolation and fault condition protection 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			
			mA	mA	mA(typ.)	mA(typ.)			
MAPU01-033S033H	3.3 (2.97 ~ 3.63)	3.3	300	6	390	45	15	220	77
MAPU01-033S05H		5	200	4	394		12		77
MAPU01-033S09H		9	110	2.2	385		12		78
MAPU01-033S12H		12	84	1.68	382		10		80
MAPU01-033S15H		15	67	1.34	386		10	79	
MAPU01-033D05H		±5	±100	±2	394		11	100#	77
MAPU01-033D12H		±12	±42	±0.84	387		9		79
MAPU01-033D15H		±15	±33	±0.66	380		9		79
MAPU01-05S033H	3.3	300	6	261	12	30	76		
MAPU01-05S05H	5	200	4	256	10		78		
MAPU01-05S09H	9	110	2.2	247	8		220	81	
MAPU01-05S12H	12	84	1.68	246	8			82	
MAPU01-05S15H	15	67	1.34	241	8			83	
MAPU01-05D05H	±5	±100	±2	247	10			100#	81
MAPU01-05D12H	±12	±42	±0.84	249	8		81		
MAPU01-05D15H	±15	±33	±0.66	244	9		81		
MAPU01-12S033H	3.3	300	6	104	10	17	79		
MAPU01-12S05H	5	200	4	104	8		220	80	
MAPU01-12S09H	9	110	2.2	101	7			82	
MAPU01-12S12H	12	84	1.68	99	7			84	
MAPU01-12S15H	15	67	1.34	100	7			83	
MAPU01-12D05H	±5	±100	±2	103	7		100#	81	
MAPU01-12D12H	±12	±42	±0.84	102	6			82	
MAPU01-12D15H	±15	±33	±0.66	102	6			82	
MAPU01-24S033H	3.3	300	6	54	10	10		220	76
MAPU01-24S05H	5	200	4	51		8	81		
MAPU01-24S09H	9	110	2.2	52		8	79		
MAPU01-24S12H	12	84	1.68	51		8	82		
MAPU01-24S15H	15	67	1.34	51		9	82		
MAPU01-24D05H	±5	±100	±2	52		8	100#	80	
MAPU01-24D12H	±12	±42	±0.84	52		8		81	
MAPU01-24D15H	±15	±33	±0.66	52		8		80	

# For each output

Input Specifications					
Parameter	Model	Min.	Typ.	Max.	Unit
Input Voltage Range	3.3V Input Models	2.97	3.3	3.63	VDC
	5V Input Models	4.5	5	5.5	
	12V Input Models	10.8	12	13.2	
	24V Input Models	21.6	24	26.4	
Input Surge Voltage (1 sec. max.)	3.3V Input Models	-0.7	---	6	
	5V Input Models	-0.7	---	9	
	12V Input Models	-0.7	---	18	
	24V Input Models	-0.7	---	30	
Input Filter	All Models	Internal Capacitor			

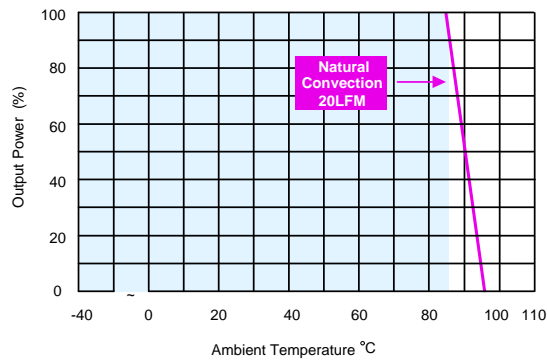
Output Specifications					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy		---	±1.0	±3.0	%
Output Voltage Balance	Dual Output, Balanced Loads	---	±0.1	±1.0	%
Line Regulation	For Vin Change of 1%	---	±1.2	±1.5	%
Load Regulation	Io=10% to 100%	See Model Selection Guide			
Ripple & 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	75	110	kHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	3,711,000	---	---	Hours
Safety Approvals	UL/cUL 60950-1 recognition (UL certificate), IEC/EN 60950-1 (CB-report)				
	UL/cUL 62368-1 recognition (UL certificate), IEC/EN 62368-1 (CB-report)				

Environmental Specifications					
Parameter	Conditions	Min.	Max.	Unit	
Operating Ambient Temperature Range (See Power Derating Curve)	Natural Convection	-40	+90	°C	
Case Temperature		---	+95	°C	
Storage Temperature Range		-50	+125	°C	
Humidity (non condensing)		---	95	% rel. H	
Cooling	Natural Convection				
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

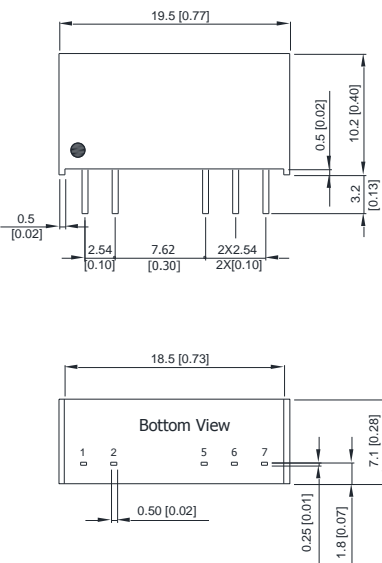
### Power Derating Curve



### Notes

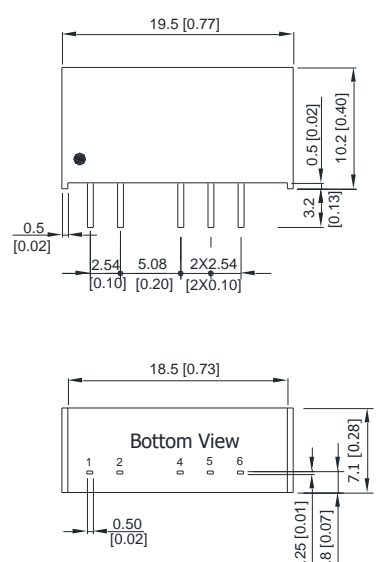
- 1 Specifications typical at  $T_a = +25^\circ\text{C}$ , resistive load, nominal input voltage and rated output current unless otherwise noted.
- 2 These power converters require a minimum output loading to maintain specified regulation, operation under no-load conditions will not damage these modules; 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 EN61000-4-4 & EN61000-4-5 an external components across the input pins is required.  
Suggested capacitor: 033XXX & 05XXX: 100 $\mu\text{F}/25\text{V.KY}/1.5\text{KE}7.5\text{CA}$  (TVS Diode)  
12XXX: 560 $\mu\text{F}/50\text{V.KY}/1.5\text{KE}18\text{CA}$  (TVS Diode)  
24XXX: 820 $\mu\text{F}/50\text{V.KY}$
- 7 That "natural convection" is about 20LFM but is not equal to still air (0 LFM).
- 8 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)

### Package Specifications with "A" Pinning (order code suffix A)

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)
- ▶ Pin diameter ∅ 1.0 ±0.05 (0.04±0.002)

### Physical Characteristics

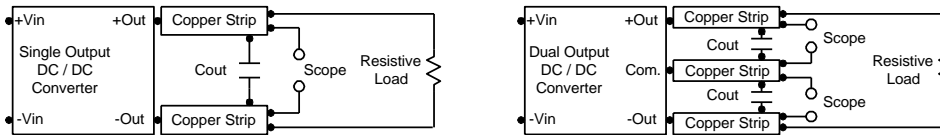
Case Size	:	19.5x7.1x10.2mm (0.77x0.28x0.40 inches)
Case Material	:	Non-Conductive Black Plastic (flammability to UL 94V-0 rated)
Pin Material	:	Tinned Copper
Weight	:	3.1g

Order Code Table	
Standard	With "A" Pinning
MAPU01-033S033H	MAPU01-033S033HA
MAPU01-033S05H	MAPU01-033S05HA
MAPU01-033S09H	MAPU01-033S09HA
MAPU01-033S12H	MAPU01-033S12HA
MAPU01-033S15H	MAPU01-033S15HA
MAPU01-033D05H	MAPU01-033D05HA
MAPU01-033D12H	MAPU01-033D12HA
MAPU01-033D15H	MAPU01-033D15HA
MAPU01-05S033H	MAPU01-05S033HA
MAPU01-05S05H	MAPU01-05S05HA
MAPU01-05S09H	MAPU01-05S09HA
MAPU01-05S12H	MAPU01-05S12HA
MAPU01-05S15H	MAPU01-05S15HA
MAPU01-05D05H	MAPU01-05D05HA
MAPU01-05D12H	MAPU01-05D12HA
MAPU01-05D15H	MAPU01-05D15HA
MAPU01-12S033H	MAPU01-12S033HA
MAPU01-12S05H	MAPU01-12S05HA
MAPU01-12S09H	MAPU01-12S09HA
MAPU01-12S12H	MAPU01-12S12HA
MAPU01-12S15H	MAPU01-12S15HA
MAPU01-12D05H	MAPU01-12D05HA
MAPU01-12D12H	MAPU01-12D12HA
MAPU01-12D15H	MAPU01-12D15HA
MAPU01-24S033H	MAPU01-24S033HA
MAPU01-24S05H	MAPU01-24S05HA
MAPU01-24S09H	MAPU01-24S09HA
MAPU01-24S12H	MAPU01-24S12HA
MAPU01-24S15H	MAPU01-24S15HA
MAPU01-24D05H	MAPU01-24D05HA
MAPU01-24D12H	MAPU01-24D12HA
MAPU01-24D15H	MAPU01-24D15HA

## 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.



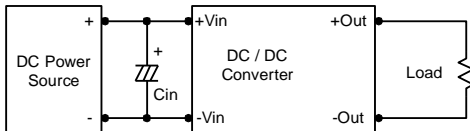
## Technical Notes

### 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.

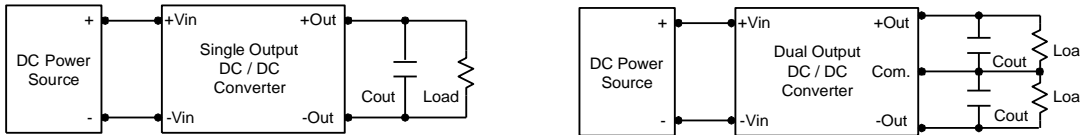
### Input Source Impedance

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 MAPU01H 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°C. The derating curves are determined from measurements obtained in a test setup.

