

**FEATURES**

- ▶ Industrial SMD Package
- ▶ Unregulated Output Voltage
- ▶ I/O Isolation 3000 VDC
- ▶ Operating Ambient Temp. Range -40°C to +85°C
- ▶ Overload and Short Circuit Protection
- ▶ Cleaning-washable Process Available(option)
- ▶ Qualified for Lead-free Reflow Solder Process  
According to IPC/JEDEC J-STD-020D.1
- ▶ Tape & Reel Package Available
- ▶ UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval & CE Marking


**PRODUCT OVERVIEW**

The MINMAX MSPU01H series is a range of isolated 1W DC-DC converter modules in SMD package which feature a high I/O isolation voltage rated for 3000VDC and there are 21 models available for 3.3, 5 or 12VDC input. Advanced circuit topology provides continuous overload, short circuit protection and a high efficiency up to 84% which allows operating ambient temperatures range of -40°C to +75°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			@Max. Load
			mA	mA	mA(typ.)	mA(typ.)			%
MSPU01-033S033H	3.3 (2.97 ~ 3.63)	3.3	300	6	390	45	15	220	77
MSPU01-033S05H		5	200	4	384		12		79
MSPU01-033S12H		12	84	1.68	377		10		81
MSPU01-033S15H		15	67	1.34	381		9	80	
MSPU01-033D05H		±5	±100	±2	384		12	100#	79
MSPU01-033D12H		±12	±42	±0.84	377		9		81
MSPU01-033D15H		±15	±33	±0.66	375		9		80
MSPU01-05S033H	5 (4.5 ~ 5.5)	3.3	300	6	251	30	12	220	79
MSPU01-05S05H		5	200	4	244		11		82
MSPU01-05S12H		12	84	1.68	240		7		84
MSPU01-05S15H		15	67	1.34	236		7	85	
MSPU01-05D05H		±5	±100	±2	244		11	100#	82
MSPU01-05D12H		±12	±42	±0.84	240		7		84
MSPU01-05D15H		±15	±33	±0.66	236		7		84
MSPU01-12S033H	12 (10.8 ~ 13.2)	3.3	300	6	106	17	9	220	78
MSPU01-12S05H		5	200	4	103		8		81
MSPU01-12S12H		12	84	1.68	101		6		83
MSPU01-12S15H		15	67	1.34	101		6	83	
MSPU01-12D05H		±5	±100	±2	102		7	100#	82
MSPU01-12D12H		±12	±42	±0.84	101		6		83
MSPU01-12D15H		±15	±33	±0.66	99		6		83

\* Min. Output Current for Lower Load Regulation

# For each output

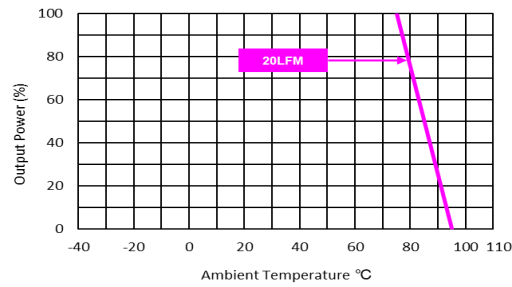
Input Specifications					
Parameter	Model	Min.	Typ.	Max.	Unit
Input Voltage Range	3.3V Input Models	2.97	3.3	3.63	VDC
	5V Input Models	4.5	5	5.5	
	12V Input Models	10.8	12	13.2	
Input Surge Voltage (1 sec. max.)	3.3V Input Models	-0.7	---	6	
	5V Input Models	-0.7	---	9	
	12V Input Models	-0.7	---	18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

Output Specifications					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy		---	---	±3.0	%Vnom.
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
Over Load Protection	Normal Vin at 25°C	---	160	---	%
Short Circuit Protection		Continuous, Automatic Recovery			

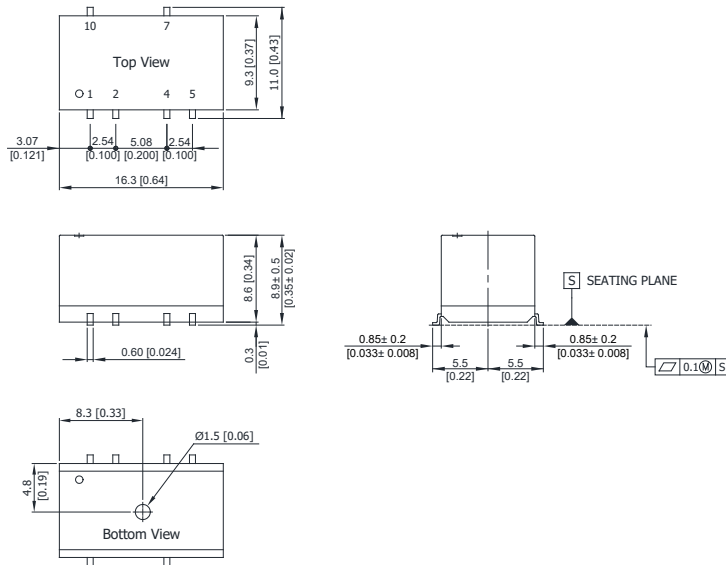
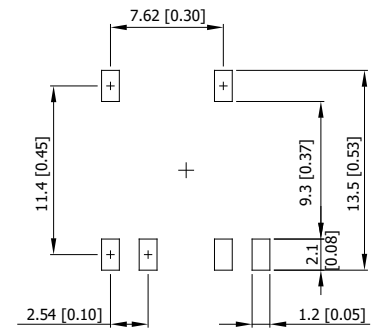
General Specifications					
Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds	3000	---	---	VDC
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100kHz, 1V	---	20	---	pF
Switching Frequency		50	80	110	kHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	3,657,000	---	---	Hours
Moisture Sensitivity Level (MSL)	IPC/JEDEC J-STD-020D.1	Level 2			
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)				

EMC Specifications				
Parameter	Standards & Level			Performance
EMI <sub>(5)</sub>	Conduction	EN 55032	With external components	Class A
	Radiation			
EMS <sub>(5)</sub>	EN 55024			
	ESD	EN61000-4-2 Air ± 8kV , Contact ± 6kV		A
	Radiated immunity	EN 61000-4-3 10V/m		A
	Fast transient	EN 61000-4-4 ±2kV		A
	Surge	EN 61000-4-5 ±1kV		A
	Conducted immunity	EN 61000-4-6 10Vrms		A
	PFMF	EN 61000-4-8 3A/m		A

Environmental Specifications				
Parameter	Min.	Max.	Unit	
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+85	°C	
Case Temperature	---	+95	°C	
Storage Temperature Range	-50	+125	°C	
Humidity (non condensing)	---	95	% rel. H	
Lead-free Reflow Solder Process	IPC/JEDEC J-STD-020D.1			

**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 fast blow fuse in the input supply line.
- 4 Other input and output voltage may be available, please contact MINMAX.
- 5 The external components might be required to meet EMI/EMS standard for some of test items. Please contact MINMAX for the solution in detail.
- 6 Specifications are subject to change without notice.
- 7 The repeated high voltage isolation testing of the converter can degrade isolation capability, to a lesser or greater degree depending on materials, construction, environment and reflow solder process. Any material is susceptible to eventual chemical degradation when subject to very high applied voltages thus implying that the number of tests should be strictly limited. We therefore strongly advise against repeated high voltage isolation testing, but if it is absolutely required, that the voltage be reduced by 20% from specified test voltage. Furthermore, the high voltage isolation capability after reflow solder process should be evaluated as it is applied on system.

**Package Specifications**
**Mechanical Dimensions**

**Connecting Pin Patterns**


- ▶ 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)

**Pin Connections**

Pin	Single Output	Dual Output
1	-Vin	-Vin
2	+Vin	+Vin
3	No Pin	No Pin
4	-Vout	Common
5	No Pin	-Vout
6	No Pin	No Pin
7	+Vout	+Vout
8	No Pin	No Pin
9	No Pin	No Pin
10	NC	NC

NC: No Connection

**Physical Characteristics**

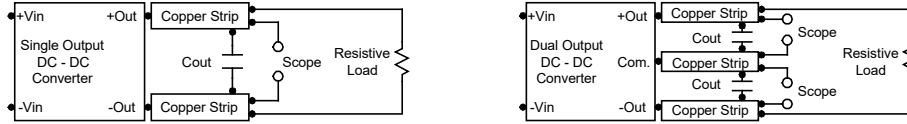
Case Size	: 16.3x9.3x8.6 mm (0.64x0.37x0.34 inches)
Case Material	: Plastic resin (flammability to UL 94V-0 rated)
Pin Material	: Phosphor Bronze
Weight	: 1.9g

Order Code Table	
Standard	For cleaning-washable process
MSPU01-033S033H	MSPU01-033S033H-W
MSPU01-033S05H	MSPU01-033S05H-W
MSPU01-033S12H	MSPU01-033S12H-W
MSPU01-033S15H	MSPU01-033S15H-W
MSPU01-033D05H	MSPU01-033D05H-W
MSPU01-033D12H	MSPU01-033D12H-W
MSPU01-033D15H	MSPU01-033D15H-W
MSPU01-05S033H	MSPU01-05S033H-W
MSPU01-05S05H	MSPU01-05S05H-W
MSPU01-05S12H	MSPU01-05S12H-W
MSPU01-05S15H	MSPU01-05S15H-W
MSPU01-05D05H	MSPU01-05D05H-W
MSPU01-05D12H	MSPU01-05D12H-W
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MSPU01-12S05H	MSPU01-12S05H-W
MSPU01-12S12H	MSPU01-12S12H-W
MSPU01-12S15H	MSPU01-12S15H-W
MSPU01-12D05H	MSPU01-12D05H-W
MSPU01-12D12H	MSPU01-12D12H-W
MSPU01-12D15H	MSPU01-12D15H-W

### 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.



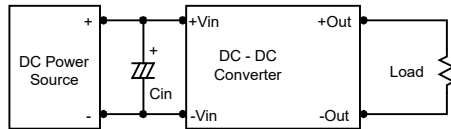
### Technical Notes

#### 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.

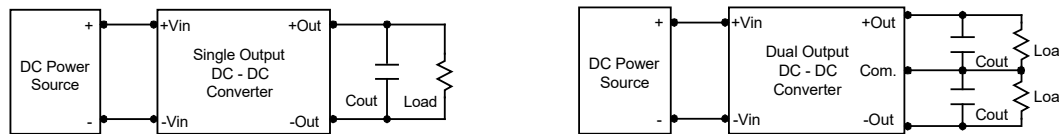
#### Input Source Impedance

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 MSPU01H 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.

