FEATURES

- **Industrial Standard SMD Package**
- **Unregulated Output Voltage**
- **I/O Isolation 4000VAC with Reinforced Insulation, rated for 300Vrms Working Voltage**
- **Low I/O Leakage Current < 2μA**
- **Operating Ambient Temp. Range -25℃ to +80℃**
- **Cleaning-washable Process Available(option)**
- **Qualified for Lead-free Reflow Solder Process According to**
- **IPC/JEDEC J-STD-020D.1**
- **Tape & Reel Package Available**
- **Medical EMC Standard with 4th Edition of EMI EN 55011 and EMS EN 60601-1-2 Approved**
- **Medical Safety with 1xMOPP & 2xMOOP per 3.2 Edition of IEC/EN 60601-1 & ANSI/AAMI ES60601-1 Approved**
- **Risk Management Report Acquisition according to ISO 14971**
- **UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval & CE Marking**

PRODUCT OVERVIEW

Introducing the MINMAX MSHU100 series - 2W DC-DC converter modules delivering an exceptionally high I/O isolation voltage of 4000VAC with reinforced insulation, rated for a stable 300Vrms working voltage. Housed in a compact SMD package, this product offers 15 models with 5V, 12V, or 24VDC input options, and choices for single or dual output voltages.

The MSHU100 DC-DC converters present an economical solution for a wide range of applications in instrumentation, industrial controls, medical equipment, and wherever a certified supplementary or reinforced insulation system is necessary to comply with prescribed safety standards.

The MSHU100 series is approved to IEC/EN/ES 60601-1 3.2 Edition for 1xMOPP & 2xMOOP and comes with an ISO 14971 Medical Device risk management file, ensuring not only adherence to high-performance standards but also compliance with strict safety benchmarks.

Model Selection Guide

Model Number	Input Voltage (Range)	Output Voltage	Output Current	Input Current		Load Regulation	Max. capacitive Load	Efficiency (typ.)
			Max.	@Max. Load	@No Load			@Max. Load
	VDC	VDC	mA	mA(typ.)	mA(typ.)	% (max.)	μF	%
MSHU102	5 (4.5 ~ 5.5)	5	400	606	90	12	330	66
MSHU104		12	165	600		10		66
MSHU105		15	133	605		10		66
MSHU108		±12	±83	553		10	100#	72
MSHU109		±15	±66	542		10		73
MSHU112	12 (10.8 ~ 13.2)	5	400	253	40	12	330	66
MSHU114		12	165	250		10		66
MSHU115		15	133	252		10		66
MSHU118		±12	±83	224		10	100#	74
MSHU119		±15	±66	220		10		75
MSHU122	24 (21.6 ~ 26.4)	5	400	126	30	12	330	66
MSHU124		12	165	125		10		66
MSHU125		15	133	126		10		66
MSHU128		±12	±83	112		10	100#	74
MSHU129		±15	±66	110		10		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	
	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		---	±2.0	±4.0	%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=20% to 100%	See Model Selection Guide (Operation at lower load will not damage the converter, but it may not meet all specifications)			
Ripple & Noise	0-20 MHz Bandwidth	---	---	150	mV_{P-P}
Temperature Coefficient		---	±0.01	±0.02	%/℃
Short Circuit Protection	0.5 Second Max., Automatic Recovery				

Isolation, Safety Standards

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds Reinforced insulation, rated for 300Vrms working voltage	4000	---	---	VAC
I/O Isolation Test Voltage	Flash tested for 1 Second	6000	---	---	V_{PK}
Leakage Current	240VAC, 60Hz	---	---	2	μA
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100kHz, 1V	---	15	20	pF
Safety Standards	UL/cUL 62368-1, 60950-1, CSA C22.2 No. 60950-1				
	ANSI/AAMI ES60601-1, CAN/CSA-C22.2 No. 60601-1				
	IEC/EN 62368-1, 60950-1, IEC/EN 60601-1 3.2 Edition 1xMOPP & 2xMOOP				
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)				
	ANSI/AAMI ES60601-1 1xMOPP & 2xMOOP recognition(UL certificate), IEC/EN 60601-1 3.2 Edition(CB-report)				

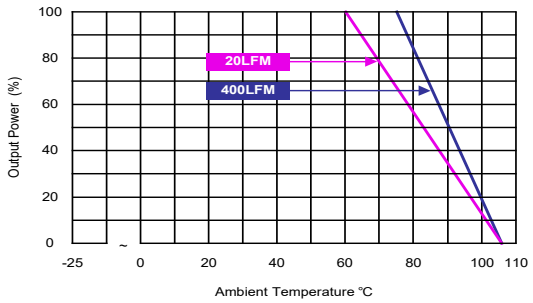
General Specifications

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
Moisture Sensitivity Level (MSL)	IPC/JEDEC J-STD-020D.1	Level 2			

Environmental Specifications

Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-25	+80	℃
Case Temperature	---	+105	℃
Storage Temperature Range	-50	+125	℃
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 Ta=+25℃, 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.

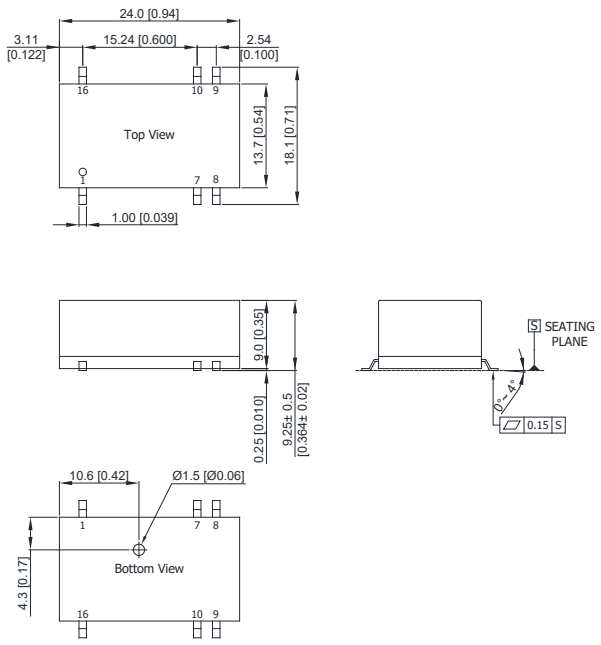
4 Other input and output voltage may be available, please contact MINMAX.

5 Specifications are subject to change without notice.

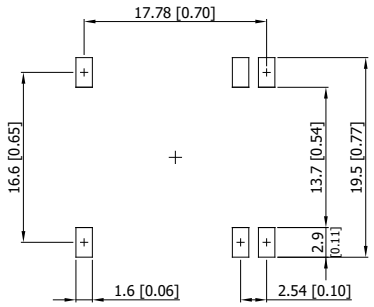
6 The repeated high voltage isolation testing of the converter can degrade isolation capability, to a lesser or greater degree depending on materials, construction, environment and reflow solder process. Any material is susceptible to eventual chemical degradation when subject to very high applied voltages 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
7	NC	NC
8	NC	Common
9	+Vout	+Vout
10	-Vout	-Vout
16	+Vin	+Vin

NC: No Connection

Physical Characteristics

Case Size	:	24.0x13.7x9.0mm (0.94x0.54x0.35 inches)
Case Material	:	Plastic resin (flammability to UL 94V-0 rated)
Pin Material	:	Phosphor Bronze
Weight	:	3.75g

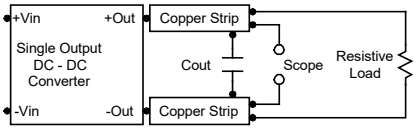
Order Code Table

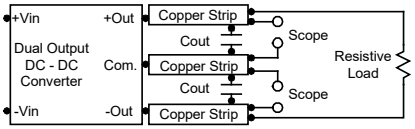
Standard	For cleaning-washable process
MSHU102	MSHU102-W
MSHU104	MSHU104-W
MSHU105	MSHU105-W
MSHU108	MSHU108-W
MSHU109	MSHU109-W
MSHU112	MSHU112-W
MSHU114	MSHU114-W
MSHU115	MSHU115-W
MSHU118	MSHU118-W
MSHU119	MSHU119-W
MSHU122	MSHU122-W
MSHU124	MSHU124-W
MSHU125	MSHU125-W
MSHU128	MSHU128-W
MSHU129	MSHU129-W

Test Setup

Peak-to-Peak Output Noise Measurement Test

Use a Cout 0.47μF 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.





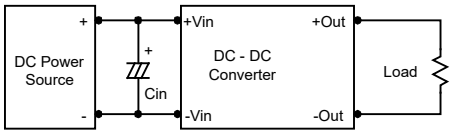
Technical Notes

Maximum Capacitive Load

The MSHU100 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 100μF maximum capacitive load for dual outputs and 330μF capacitive load for single outputs. The maximum capacitance can be found in the data sheet.

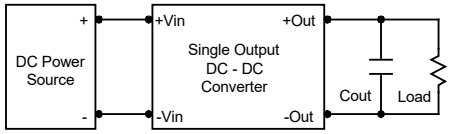
Input Source Impedance

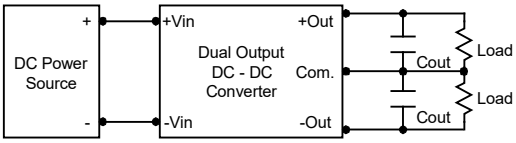
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup. 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 2.2μF for the 5V input devices, a 1.0μF for the 12V input devices and a 0.47μF for the 24V 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 3.3μF 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 105°C. The derating curves are determined from measurements obtained in a test setup.