

FEATURES

- ▶ Industrial SMD Package
- ▶ Unregulated Output Voltage
- ▶ I/O Isolation 1500 VDC
- ▶ Operating Ambient Temp. Range -40°C to +92.5°C
- ▶ Cleaning-washable Process Available (option)
- ▶ Qualified for Lead-free Reflow Solder Process
According to IPC/JEDEC J-STD-020D.1
- ▶ Tape & Reel Package Available


PRODUCT OVERVIEW

The MINMAX MSLU400 series is a range of 2W DC-DC converters in a SMD- Package featuring I/O isolation of 1500VDC. The very small footprint makes this product the ideal solution for many applications where a voltage has to be isolated i.e for noise reduction, ground loop elimination, in digital interfaces or where a converted voltage is required.

An excellent efficiency allows an operating temperature range of -40°C to +85°C. With a new package design these, converters are fully qualified for the higher temperature profile used in lead-free reflow solder processes. For automated SMD production lines, the product can be supplied in tape & reel package.

Model Selection Guide

Model Number	Input Voltage (Range) VDC	Output Voltage VDC	Output Current Max. mA	Input Current		Load Regulation % (max.)	Max. capacitive Load µF	Efficiency (typ.)
				@Max. Load	@No Load			@Max. Load
				mA(typ.)	mA(typ.)			%
MSLU401	5 (4.5 ~ 5.5)	3.3	500	471	60	11	47	70
MSLU402		5	400	548		11	47	73
MSLU404		12	165	514		11	10	77
MSLU406		±5	±200	541		10	10#	74
MSLU408		±12	±83	524		7	4.7#	76
MSLU409		±15	±66	521		7	4.7#	76
MSLU411	12 (10.8 ~ 13.2)	3.3	500	191	30	8	47	72
MSLU412		5	400	222		8	47	75
MSLU414		12	165	209		5	10	79
MSLU418		±12	±83	208		5	4.7#	80
MSLU419		±15	±66	206		5	4.7#	80
MSLU421	24 (21.6 ~ 26.4)	3.3	500	96	15	8	47	72
MSLU422		5	400	111		8	47	75
MSLU424		12	165	105		5	10	79
MSLU428		±12	±83	105		5	4.7#	79
MSLU429		±15	±66	104		5	4.7#	79

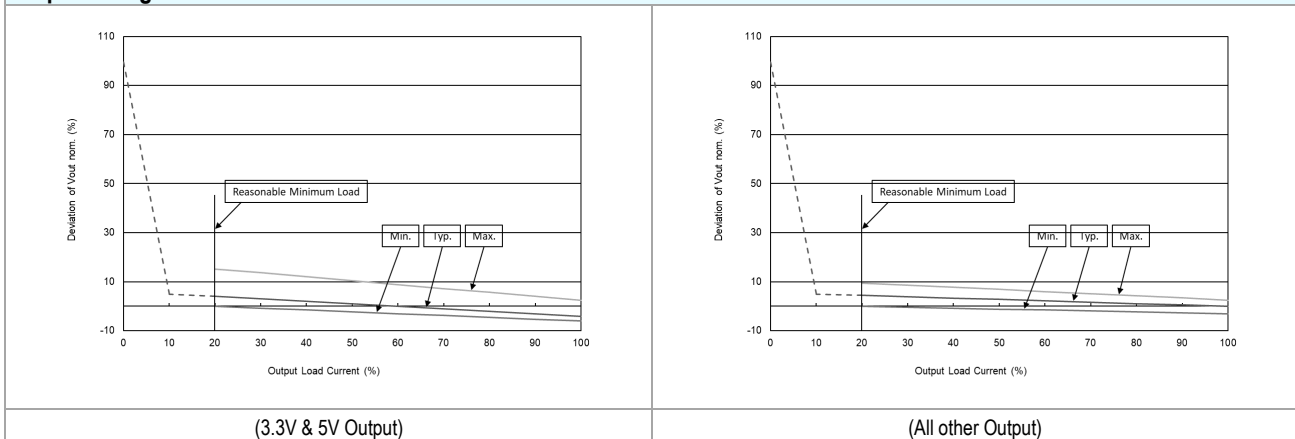
For each output

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	VDC
	12V Input Models	-0.7	---	18	
	24V Input Models	-0.7	---	30	
Input Filter	All Models	Internal Capacitor			

Output Specifications

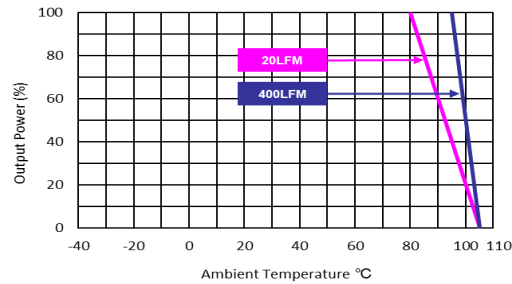
Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Balance	Dual Output, Balanced Loads	---	±0.1	±1.0	%
Line Regulation	For Vin Change of 1%	---	±1.2	±1.5	%
Load Regulation	I _o =20% to 100%	See Model Selection Guide (Operation at lower load will not damage the converter, but it may not meet all specifications)			
Ripple & Noise	0-20 MHz Bandwidth	---	---	120	mV _{P-P}
Temperature Coefficient		---	±0.01	±0.02	%/°C
Short Circuit Protection	0.5 Second Max., Automatic Recovery				

Output Voltage Tolerance

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds	1500	---	---	VDC
	1 Second	1800	---	---	VDC
I/O Isolation Resistance	500 VDC	1000	---	---	MΩ
I/O Isolation Capacitance	100kHz, 1V	---	60	100	pF
Switching Frequency		50	100	120	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

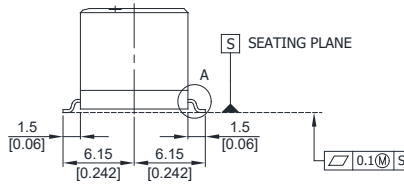
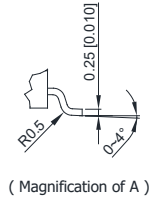
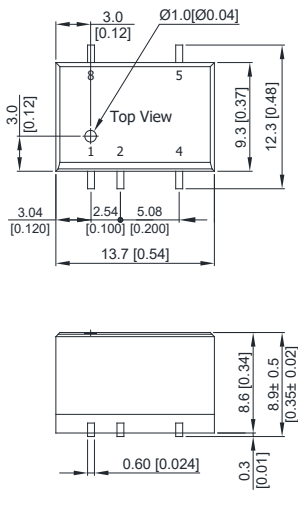
Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+92.5	°C
Case Temperature	---	+105	°C
Storage Temperature Range	-50	+125	°C
Humidity (non condensing)	---	95	% rel. H
Lead-free Reflow Solder Process	IPC/JEDEC J-STD-020D.1		

Power Derating Curve

Notes

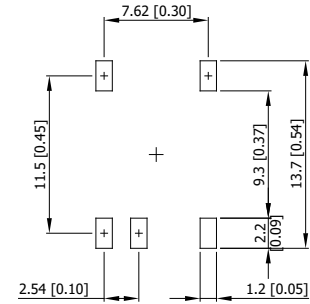
- 1 Specifications typical at $T_a=+25^{\circ}\text{C}$, resistive load, nominal input voltage and rated output current unless otherwise noted.
- 2 These power converters require a minimum output loading to maintain specified regulation, operation under no-load conditions will not damage these modules; 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 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 (Single Output)

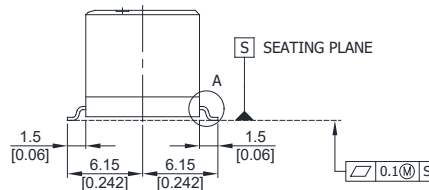
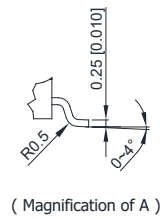
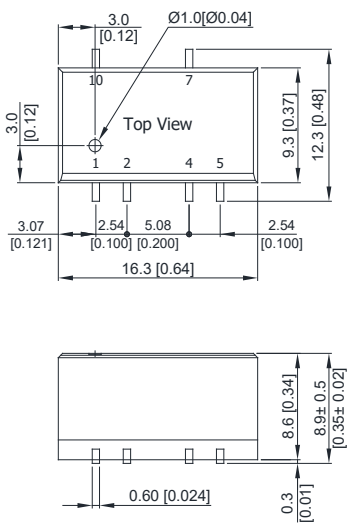


Connecting Pin Patterns

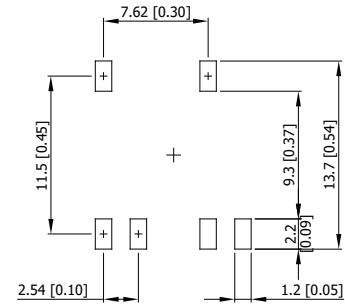


Package Specifications

Mechanical Dimensions (Dual Output)



Connecting Pin Patterns



- ▶ All dimensions in mm (inches)
- ▶ Tolerance: X.X±0.25 (X.XX±0.01)
X.XX±0.13 (X.XXX±0.005)
- ▶ Pins ±0.05(±0.002)

Pin Connections

Pin	Single Output	Dual Output
1	-Vin	-Vin
2	+Vin	+Vin
4	-Vout	Common
5	+Vout	-Vout
7	No Pin	+Vout
8	NA	No Pin
10	No Pin	NA

NA : Not Available for Electrical Connection

Physical Characteristics

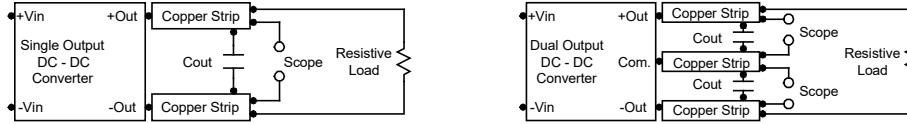
Case Size (Single Output)	: 13.7x9.3x8.6mm (0.54x0.37x0.34 inches)
Case Size (Dual Output)	: 16.3x9.3x8.6mm (0.64x0.37x0.34 inches)
Case Material	: Plastic resin (flammability to UL 94V-0 rated)
Pin Material	: Phosphor Bronze
Weight (Single Output)	: 1.5g
Weight (Dual Output)	: 2.2g

Order Code Table	
Standard	For cleaning-washable process
MSLU401	MSLU401-W
MSLU402	MSLU402-W
MSLU404	MSLU404-W
MSLU406	MSLU406-W
MSLU408	MSLU408-W
MSLU409	MSLU409-W
MSLU411	MSLU411-W
MSLU412	MSLU412-W
MSLU414	MSLU414-W
MSLU418	MSLU418-W
MSLU419	MSLU419-W
MSLU421	MSLU421-W
MSLU422	MSLU422-W
MSLU424	MSLU424-W
MSLU428	MSLU428-W
MSLU429	MSLU429-W

Test Setup

Peak-to-Peak Output Noise Measurement Test

Use a Cout 0.33 μ 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.



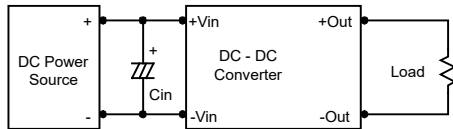
Technical Notes

Maximum Capacitive Load

The MSLU400 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.

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 comended to use a good quality low Equivalent Series Resistance (ESR < 1.0 Ω at 100 kHz) capacitor of a 2.2 μ F for the 5V input devices, a 1.0 μ F for the 12V input devices and a 0.47 μ F for the 24V 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 μ 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 105°C. The derating curves are determined from measurements obtained in a test setup.

