

# MSLU400 Series

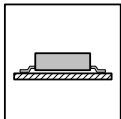
2W, Miniature SMD, Single & Dual Output DC/DC Converters



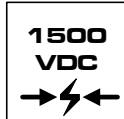
## Key Features



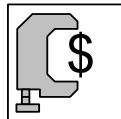
- Efficiency up to 80%
- 1500VDC Isolation
- MTBF > 2,000,000 Hours
- Low Cost
- Input 5, 12 and 24VDC
- Output 3.3, 5, 12,  $\pm 5$ ,  $\pm 12$  and  $\pm 15$ VDC
- Temperature Performance  $-25^{\circ}\text{C}$  to  $+75^{\circ}\text{C}$
- Lead Frame Technology
- UL 94V-0 Package Material
- Internal SMD Construction



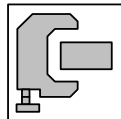
SMD



I/O Isolation



Low Cost



Low Profile

Minmax's MSLU400 2W DC/DC's are in "gull-wing" SMT package, weigh a mere 2.2 grams. The series consists of 18 models with input voltages of 5V, 12V and 24VDC which offers standard output voltages of 3.3V, 5V, 12V,  $\pm 5$ V,  $\pm 12$ V and  $\pm 15$ VDC for the choice.

Their impressive guaranteed efficiencies enable all models to deliver their fully rated output power from  $-25^{\circ}\text{C}$  to  $+75^{\circ}\text{C}$  without heat sinking or forced-air cooling.

The MSLU400 series are excellent selections for a variety of applications including data communication equipments, distributed power systems, telecommunication equipments and industrial robot systems.

The MSLU400 units are available in tape and reel package.

## Absolute Maximum Ratings

Parameter	Min.	Max.	Unit	
Input Surge Voltage (1000 mS)	5VDC Input Models	-0.7	9	VDC
	12VDC Input Models	-0.7	18	VDC
	24VDC Input Models	-0.7	30	VDC
Lead Temperature (1.5mm from case for 10 Sec.)	---	300	$^{\circ}\text{C}$	
Internal Power Dissipation	---	650	mW	

Exceeding the absolute maximum ratings of the unit could cause damage. These are not continuous operating ratings.

Leadfree Reflow Solder Process as per IPC/JEDEC J-STD-020C peak temp. 245C/10 sec.

## Environmental Specifications

Parameter	Conditions	Min.	Max.	Unit
Operating Temperature	Ambient	-25	+75	$^{\circ}\text{C}$
Operating Temperature	Case	-25	+90	$^{\circ}\text{C}$
Storage Temperature		-25	+125	$^{\circ}\text{C}$
Humidity		---	95	%
Cooling	Free-Air Convection			

## Model Selection Guide

Model Number	Input Voltage	Output Voltage	Output Current		Input Current		Load Regulation	Efficiency
			Max.	Min.	@Max. Load	@No Load		
	VDC	VDC	mA	mA	mA (Typ.)	mA (Typ.)	% (Max.)	% (Typ.)
MSLU401	5 (4.5 ~ 5.5)	3.3	500	10	471	60	11	70
MSLU402		5	400	8	548		11	73
MSLU404		12	165	3	514		11	77
MSLU406		±5	±200	±4	541		10	74
MSLU408		±12	±83	±1.5	524		7	76
MSLU409		±15	±66	±1	521		7	76
MSLU411	12 (10.8 ~ 13.2)	3.3	500	10	191	30	8	72
MSLU412		5	400	8	222		8	75
MSLU414		12	165	3	209		5	79
MSLU418		±12	±83	±1.5	208		5	80
MSLU419		±15	±66	±1	206		5	80
MSLU421	24 (21.6 ~ 26.4)	3.3	500	10	96	15	8	72
MSLU422		5	400	8	111		8	75
MSLU424		12	165	3	105		5	79
MSLU428		±12	±83	±1.5	105		5	79
MSLU429		±15	±66	±1	104		5	79

## Capacitive Load

Models by Vout	3.3V	5V	12V	±5V #	±12V #	±15V #	Unit
Maximum Capacitive Load	47	47	10	10	4.7	4.7	uF

# For each output

## Input Fuse Selection Guide

5V Input Models	12V Input Models	24V Input Models
1000mA Slow – Blow Type	500mA Slow – Blow Type	200mA Slow – Blow Type

## 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	
Reverse Polarity Input Current	All Models	---	---	0.3	A
Input Filter		Internal Capacitor			

# MSLU400 Series

## Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Balance	Dual Output, Balanced Loads	---	$\pm 0.1$	$\pm 1.0$	%
Line Regulation	For $V_{in}$ Change of 1%	---	$\pm 1.2$	$\pm 1.5$	%
Load Regulation	$I_o=20\%$ to 100%	See Model Selection Guide			%
Ripple & Noise (20MHz)		---	100	120	mV P-P
Ripple & Noise (20MHz)	Over Line, Load & Temp.	---	---	200	mV P-P
Ripple & Noise (20MHz)		---	---	15	mV rms
Temperature Coefficient		---	$\pm 0.01$	$\pm 0.02$	%/°C
Output Short Circuit	0.5 Second Max.				

## General Specifications

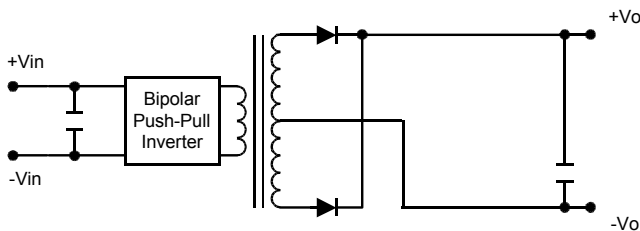
Parameter	Conditions	Min.	Typ.	Max.	Unit
Isolation Voltage Rated	60 Seconds	1500	---	---	VDC
Isolation Voltage Test	Flash Tested for 1 Second	1650	---	---	VDC
Isolation Resistance	500VDC	10	---	---	GΩ
Isolation Capacitance	100KHz, 1V	---	60	100	pF
Switching Frequency		50	100	120	KHz
MTBF	MIL-HDBK-217F @ 25°C, Ground Benign	2000	---	---	K Hours

### Notes :

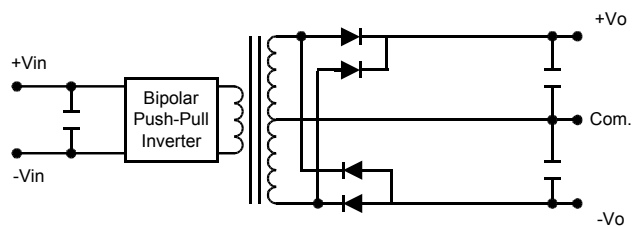
1. Specifications typical at  $T_a=+25^\circ\text{C}$ , resistive load, nominal input voltage, rated output current unless otherwise noted.
2. Ripple & Noise measurement bandwidth is 0-20 MHz.
3. These power converters require a minimum output loading to maintain specified regulation.
4. Operation under no-load conditions will not damage these modules; however, they may not meet all specifications listed.
5. All DC/DC converters should be externally fused on the front end for protection.
6. Other input and output voltage may be available, please contact factory.
7. Specifications subject to change without notice.
8. It is not recommended to use water-washing process on SMT units.

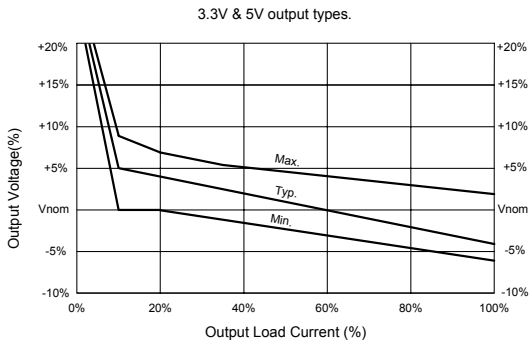
## Block Diagram

### Single Output

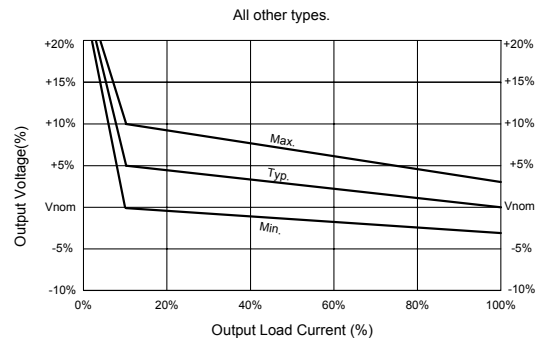


### Dual Output





**Tolerance Envelopes Graph (3.3V & 5V Output)**



**Tolerance Envelopes Graph (All other Output)**

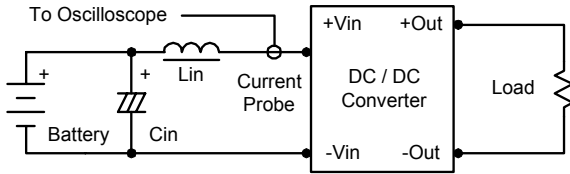
## Test Configurations

### Input Reflected-Ripple Current Test Setup

Input reflected-ripple current is measured with an inductor  $L_{in}$  (4.7uH) and  $C_{in}$  (220uF, ESR < 1.0Ω at 100 KHz) to simulate source impedance.

Capacitor  $C_{in}$ , offsets possible battery impedance.

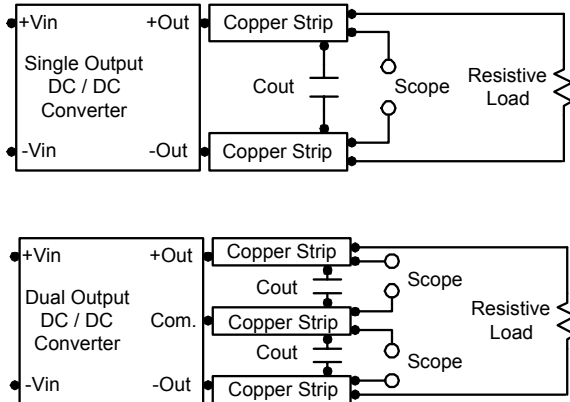
Current ripple is measured at the input terminals of the module, measurement bandwidth is 0–500 KHz.



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

Use a  $C_{out}$  0.33uF 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.



## Design & Feature Considerations

### 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.

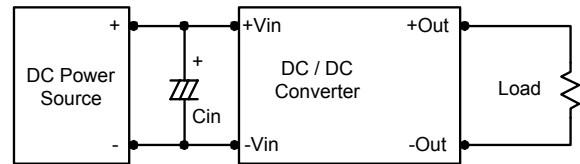
### Input Source Impedance

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.

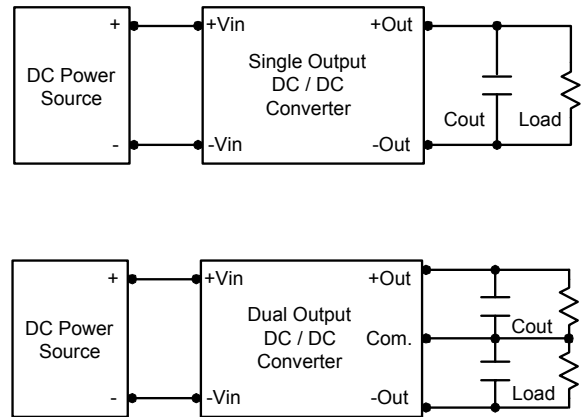
Capacitor mounted close to the power module helps ensure stability of the unit, it is recommended to use a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 KHz) capacitor of a 2.2uF for the 5V input devices, a 1.0uF for the 12V input devices and a 0.47uF for the 24V devices.

### 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.

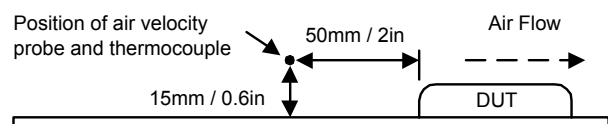
To reduce output ripple, it is recommended to use 1.5uF capacitors at the output.



### 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 90°C.

The derating curves are determined from measurements obtained in an experimental apparatus.

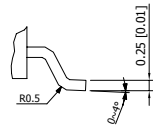
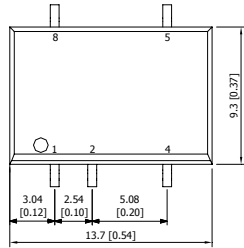


## Mechanical Dimensions

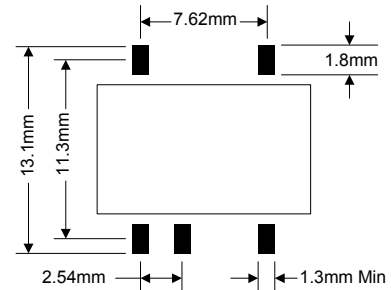
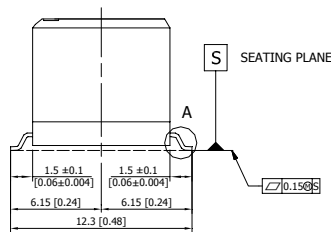
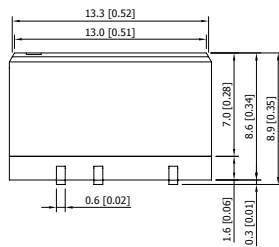
## Connecting Pin Patterns

Top View ( 2.54 mm / 0.1 inch grids )

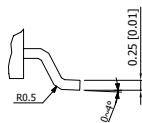
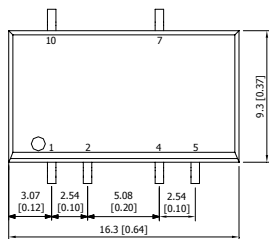
### Single Output



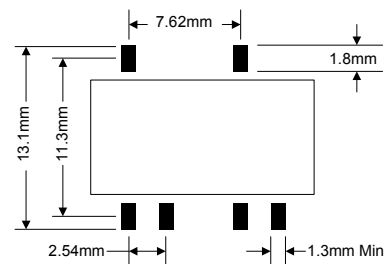
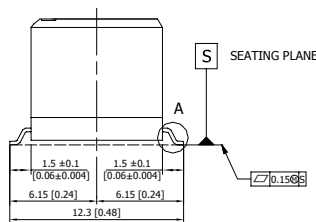
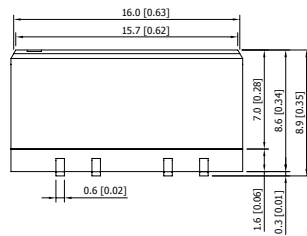
(Magnification of A)



### Dual Output



(Magnification of A)



Tolerance	Millimeters	Inches
	$X.X \pm 0.25$	$X.XX \pm 0.01$
	$X.XX \pm 0.13$	$X.XXX \pm 0.005$
Pin	$\pm 0.05$	$\pm 0.002$

## 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)** : 13.7×9.3×8.7 mm  
0.54×0.37×0.34 inches

**Case Size (Dual Output)** : 16.3×9.3×8.7 mm  
0.64×0.37×0.34 inches

**Case Material** : Non-Conductive Black Plastic

**Weight (Single Output)** : 1.5g

**Weight (Dual Output)** : 2.2g

**Flammability** : UL94V-0