## FEATURES

- RoHS Compliant
- Efficiency up to 80%
- 1500VDC I/O Isolation
- Single and Dual Outputs
- MTBF > 2,000,000 Hours
- Internal SMT Construction
- UL94V-0 Packing Material
- Operating Temperature: -25°C to +75°C

## DESCRIPTION

The MSLU series power modules are 1W DC/DC converters in a miniature “gull-wing” SMT package. These converters operate over input voltage ranges of 4.5~5.5VDC, 10.8~13.2VDC, and 21.6~26.4VDC. This series also has single and dual output voltages of 3.3, 5, 9, 12, 15, ±5, ±12, and ±15VDC. These converters’ impressive efficiencies enable them to deliver their fully rated output power from –25°C to +75°C without a heatsink or forced-air cooling. These converters are useful for a variety of applications including distributed power systems, data communication equipment, telecommunication equipment, and industrial robot systems.

## SPECIFICATIONS: *MSLU Series*

All specifications are based on 25°C, Nominal Input Voltage, and Maximum Output Current unless otherwise noted.
We reserve the right to change specifications based on technological advances.

| SPECIFICATION | TEST CONDITIONS | Min | Nom | Max | Unit |
|---|---|---|---|---|---|
| **INPUT ($V_{in}$)** | | | | | |
| Input Voltage Range | 5V nominal input models | 4.5 | 5 | 5.5 | VDC |
| | 12V nominal input models | 10.8 | 12 | 13.2 | |
| | 24V nominal input models | 21.6 | 24 | 26.4 | |
| Reverse Polarity Input Current | All models | | | 0.3 | A |
| Input Surge Voltage (1000ms) | 5V nominal input models | -0.7 | | 9 | VDC |
| | 12V nominal input models | -0.7 | | 18 | |
| | 24V nominal input models | -0.7 | | 30 | |
| Input Filter | All models | Internal Capacitor | | | |
| **OUTPUT ($V_o$)** | | | | | |
| Output Voltage | | See Model Selection Table | | | |
| Output Voltage Balance | Dual Output, Balanced Loads | | ±0.1 | ±1.0 | % |
| Load Regulation | Io = 20% to 100% | See Model Selection Table | | | |
| Line Regulation | For Vin Change of 10% | | ±1.2 | ±1.5 | % |
| Output Power | | | | 1 | W |
| Output Current | | See Model Selection Table | | | |
| Ripple & Noise (20MHz) | | | 60 | 120 | $mV_{pk-pk}$ |
| Ripple & Noise (20MHz) | Over Line, Over Load, and Over Temperature | | | 150 | $mV_{pk-pk}$ |
| Ripple & Noise (20MHz) | | | | 15 | mVrms |
| **PROTECTION** | | | | | |
| Short Circuit Protection | | 0.5 seconds max. | | | |
| Input Fuse Recommendation | 5V nominal input models | 500mA slow-blow type | | | |
| | 12V nominal input models | 200mA slow-blow type | | | |
| | 24V nominal input models | 100mA slow-blow type | | | |
| **GENERAL** | | | | | |
| Efficiency | | See Model Selection Table | | | |
| Switching Frequency | | 50 | 100 | 140 | KHz |
| Isolation Voltage Rated *(See Note 6)* | 60 seconds | 1500 | | | VDC |
| Isolation Voltage Test | Flash Test for 1 second | 1650 | | | VDC |
| Isolation Resistance | 500VDC | 1 | | | GΩ |
| Isolation Capacitance | 100KHz, 1V | | 40 | 100 | pF |
| Internal Power Dissipation | | | | 450 | mW |
| Max. Capacitive Load | | See Model Selection Table | | | |
| Moisture Sensitivity Level (MSL) Temperature | IPC/JEDEC J-STD-20 | Level 2 | | | |
| **ENVIRONMENTAL** | | | | | |
| Operating Temperature (Ambient) | Ambient | -25 | | +75 | °C |
| Operating Temperature (Case) | Case | -25 | | +90 | °C |
| Storage Temperature | | -25 | | +125 | °C |
| Lead Temperature | 1.5mm from case for 10 seconds | | | 260 | °C |
| Humidity | | | | 95 | % |
| Cooling | | Free air convection | | | |
| Temperature Coefficient | | | ±0.01 | ±0.02 | %/°C |
| MTBF | MIL-HDBK-217F @ 25°C, Ground Benign | 2,000,000 hours | | | |
| **PHYSICAL** | | | | | |
| Weight | Single Output Models | 0.06oz (1.7g) | | | |
| | Dual Output Models | 0.07oz (2.0g) | | | |
| Dimensions (L x W x H) | Single Output Models | 0.54 x 0.31 x 0.26 inches (13.7 x 8.0 x 6.7 mm) | | | |
| | Dual Output Models | 0.64 x 0.31 x 0.26 inches (16.24 x 8.0 x 6.7 mm) | | | |
| Case Material | | Non-conductive black plastic | | | |
| Flammability | | UL94V-0 | | | |

## MODEL SELECTION TABLES

| SINGLE OUTPUT MODELS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Model Number | Input Voltage | Output Voltage | Output Current[1] | | Input Current | | Max. Load Regulation | Efficiency[2] | Maximum Capacitive Load |
| | | | Min | Max | No Load | Max Load | | | |
| MSLU5S33-300 | 5 VDC (4.5 ~ 5.5 VDC) | 3.3 VDC | 6mA | 300mA | 30mA | 271mA | 10% | 73% | 33µF |
| MSLU5S05-200 | | 5 VDC | 4mA | 200mA | | 256mA | 10% | 78% | 33µF |
| MSLU5S09-110 | | 9 VDC | 2mA | 110mA | | 254mA | 10% | 78% | 33µF |
| MSLU5S12-84 | | 12 VDC | 1.5mA | 84mA | | 259mA | 8% | 78% | 33µF |
| MSLU5S15-67 | | 15 VDC | 1mA | 67mA | | 254mA | 7% | 79% | 33µF |
| MSLU12S33-300 | 12 VDC (10.8 ~ 13.2 VDC) | 3.3 VDC | 6mA | 300mA | 15mA | 112mA | 8% | 74% | 33µF |
| MSLU12S05-200 | | 5 VDC | 4mA | 200mA | | 109mA | 8% | 76% | 33µF |
| MSLU12S09-110 | | 9 VDC | 2mA | 110mA | | 106mA | 8% | 78% | 33µF |
| MSLU12S12-84 | | 12 VDC | 1.5mA | 84mA | | 106mA | 5% | 79% | 33µF |
| MSLU12S15-67 | | 15 VDC | 1mA | 67mA | | 105mA | 5% | 80% | 33µF |
| MSLU24S33-300 | 24 VDC (21.6 ~ 26.4 VDC) | 3.3 VDC | 6mA | 300mA | 8mA | 58mA | 8% | 72% | 33µF |
| MSLU24S05-200 | | 5 VDC | 4mA | 200mA | | 54mA | 8% | 78% | 33µF |
| MSLU24S09-110 | | 9 VDC | 2mA | 110mA | | 54mA | 8% | 77% | 33µF |
| MSLU24S12-84 | | 12 VDC | 1.5mA | 84mA | | 55mA | 5% | 77% | 33µF |
| MSLU24S15-67 | | 15 VDC | 1mA | 67mA | | 53mA | 5% | 79% | 33µF |

| DUAL OUTPUT MODELS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Model Number | Input Voltage | Output Voltage | Output Current[1] | | Input Current | | Max. Load Regulation | Efficiency[2] | Maximum Capacitive Load |
| | | | Min | Max | No Load | Max Load | | | |
| MSLU5D05-100 | 5 VDC (4.5 ~ 5.5 VDC) | ±5 VDC | ±2mA | ±100mA | 30mA | 270mA | 10% | 74% | 33µF |
| MSLU5D12-42 | | ±12 VDC | ±0.8mA | ±42mA | | 259mA | 8% | 78% | 33µF |
| MSLU5D15-33 | | ±15 VDC | ±0.7mA | ±33mA | | 254mA | 7% | 78% | 33µF |
| MSLU12D05-100 | 12 VDC (10.8 ~ 13.2 VDC) | ±5 VDC | ±2mA | ±100mA | 15mA | 113mA | 8% | 74% | 33µF |
| MSLU12D12-42 | | ±12 VDC | ±0.8mA | ±42mA | | 108mA | 5% | 78% | 33µF |
| MSLU12D15-33 | | ±15 VDC | ±0.7mA | ±33mA | | 104mA | 5% | 79% | 33µF |
| MSLU24D05-100 | 24 VDC (21.6 ~ 26.4 VDC) | ±5 VDC | ±2mA | ±100mA | 9mA | 57mA | 8% | 73% | 33µF |
| MSLU24D12-42 | | ±12 VDC | ±0.8mA | ±42mA | | 54mA | 5% | 78% | 33µF |
| MSLU24D15-33 | | ±15 VDC | ±0.7mA | ±33mA | | 53mA | 5% | 78% | 33µF |

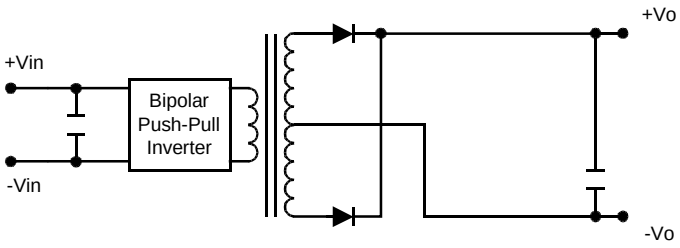
***Due to advances in technology, specifications subject to change without notice.***

## NOTES

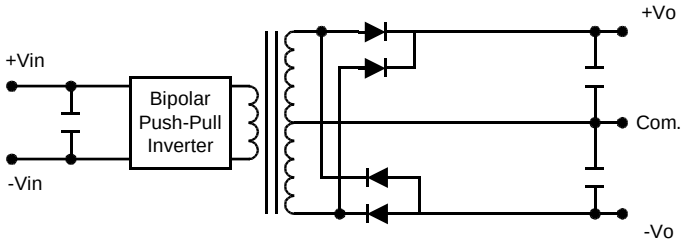
1. The MSLU series requires a minimum output loading to maintain specified regulations. Operation under no-load conditions will not damage these devices; however they may not meet all listed specifications.
2. Efficiency: typical value measured at max load.
3. All DC/DC converters should be externally fused at the front end for protection.
4. Other input and output voltages may be available, please contact factory.
5. It is not recommended to use water-washing processes on surface mount units.
6. For 3000VDC I/O isolation voltage see the MSLUH series.

## BLOCK DIAGRAMS

### Single Output

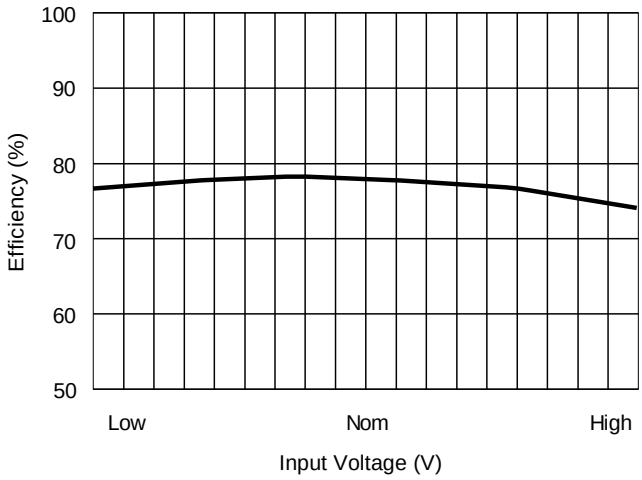



### Dual Output

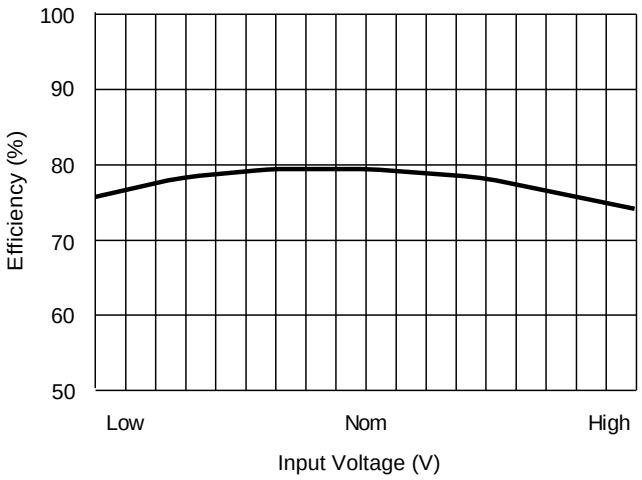



## GRAPHS AND CURVES

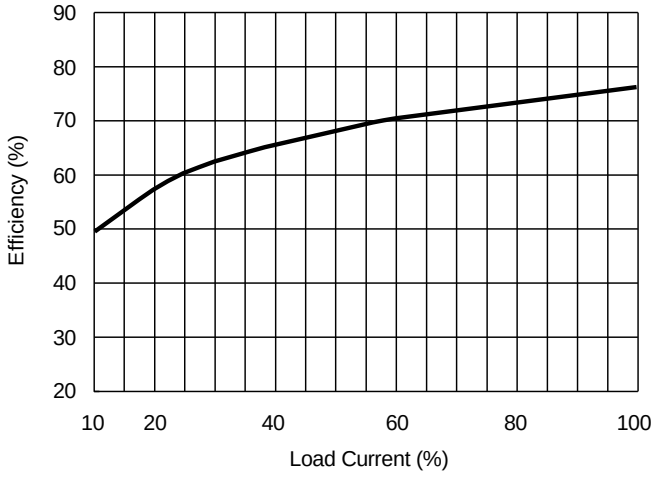
### Efficiency vs Input Voltage (Single Output)



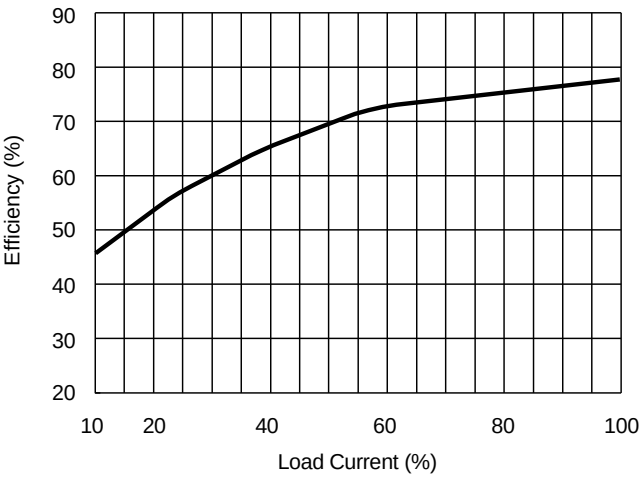

### Efficiency vs Input Voltage (Dual Output)



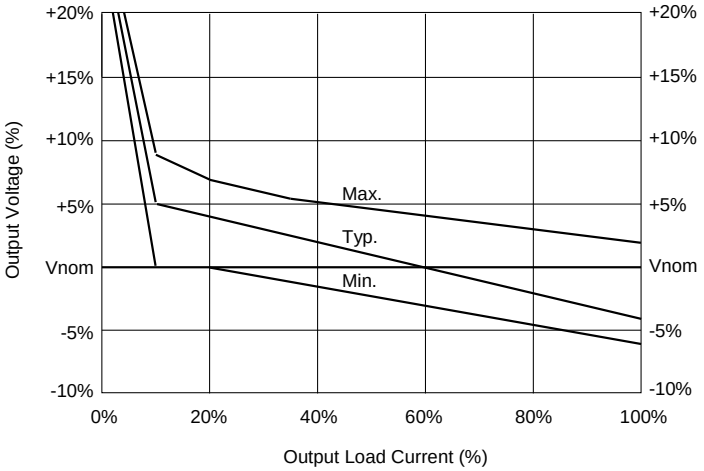

### Efficiency vs Output Load (Single Output)



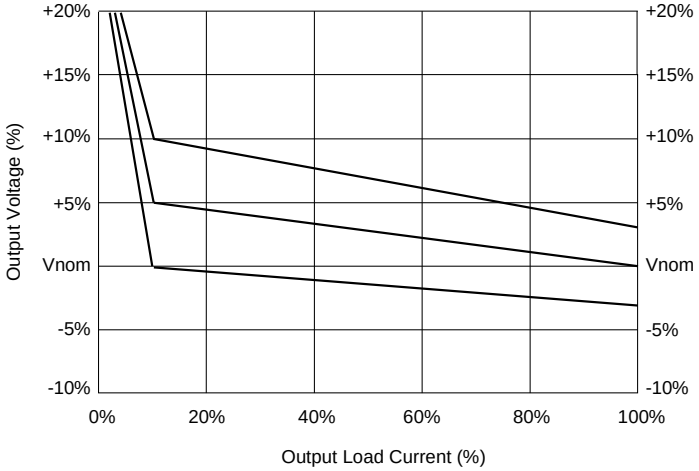

### Efficiency vs Output Load (Dual Output)



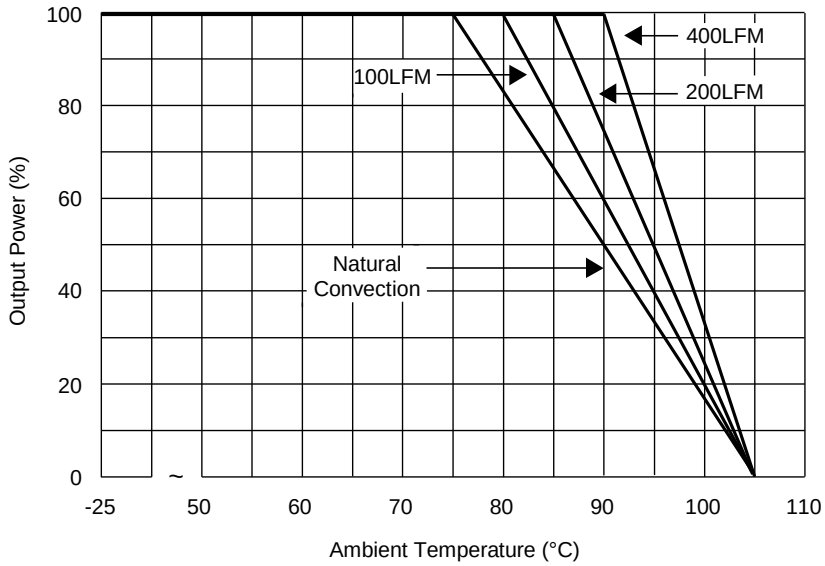
### Tolerance Envelope Graph (3.3V & 5V Outputs)




### Tolerance Envelope Graph (All Other Outputs)



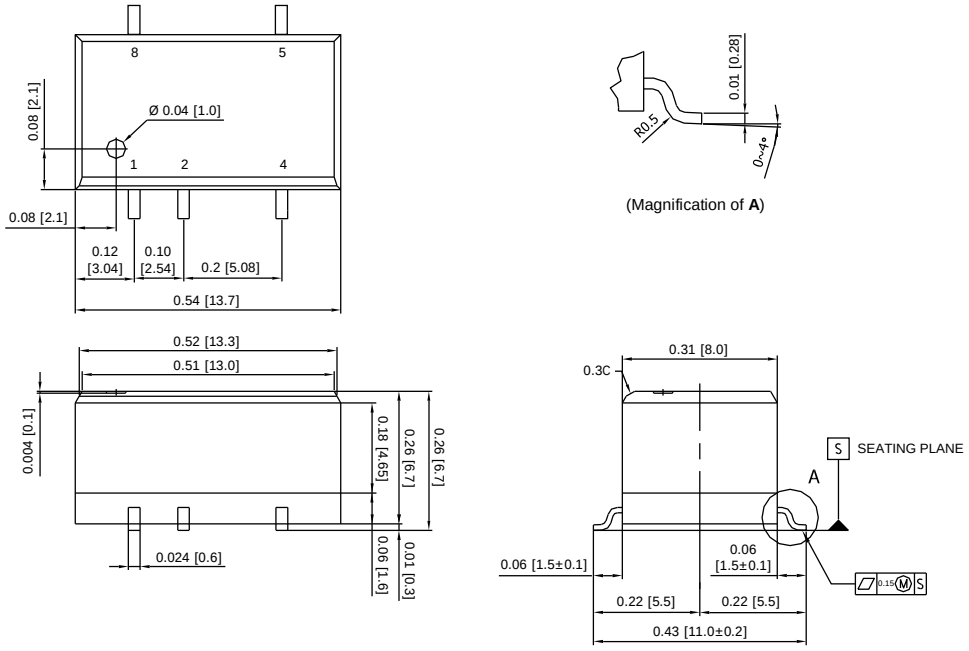

## DERATING CURVE



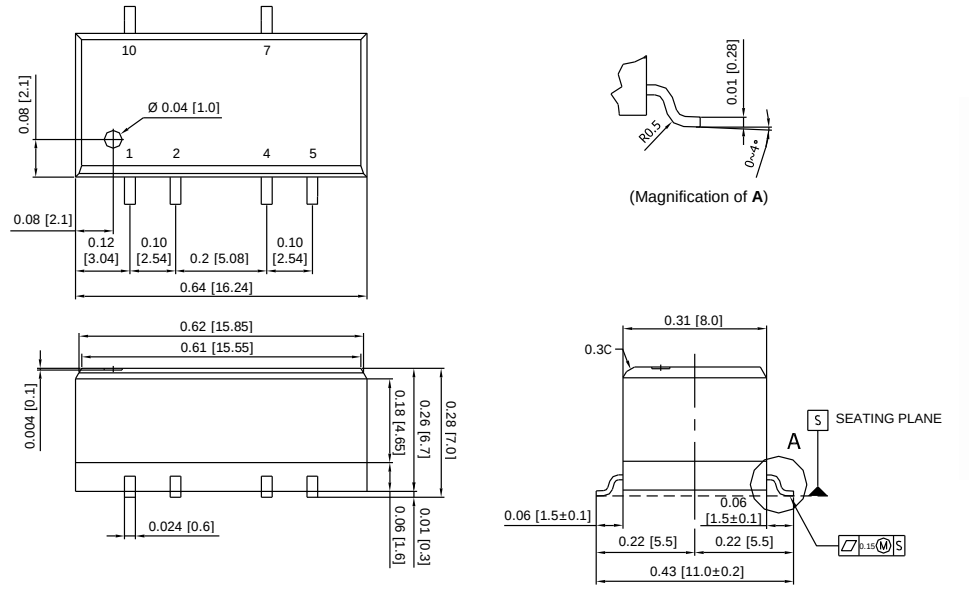
## MECHANICAL DRAWING

Unit: inches [mm]

### Single Output

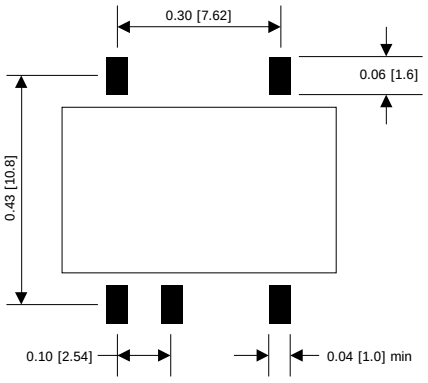



### Dual Output



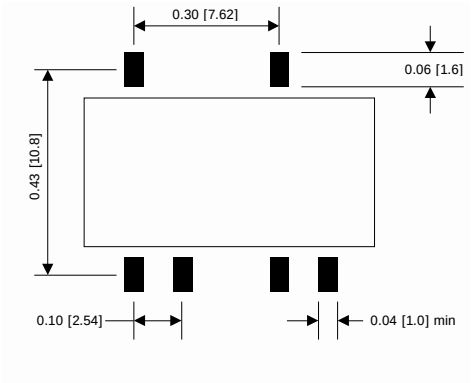

## CONNECTING PIN PATTERNS

### Top View (2.54mm / 0.1 inch grids)




| PIN CONNECTIONS | | |
|---|---|---|
| **Pin** | **Single Output** | **Dual Output** |
| 1 | -Vin | -Vin |
| 2 | +Vin | +Vin |
| 3 | No Pin | No Pin |
| 4 | -Vout | Common |
| 5 | +Vout | -Vout |
| 6 | No Pin | No Pin |
| 7 | No Pin | +Vout |
| 8 | NA | No Pin |
| 9 | | No Pin |
| 10 | | NA |

NA: Not available for electrical connection

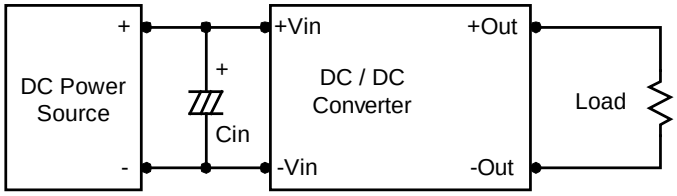



1. Tolerance: X.XX±0.01 [X.X±0.25]
   X.XXX±0.004 [X.XX±0.10]
2. Pin: ±0.002 [±0.05]

## DESIGN & FEATURE CONSIDERATIONS

### 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. A 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 100KHz) capacitor of 2.2µF for the 5V input models, a 1.0µF for the 12V input models, and a 0.47µF for the 24V input models.




### Maximum Capacitive Load

The MSLU series has a limit 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 optimal performance we recommend a maximum load of 33µF.

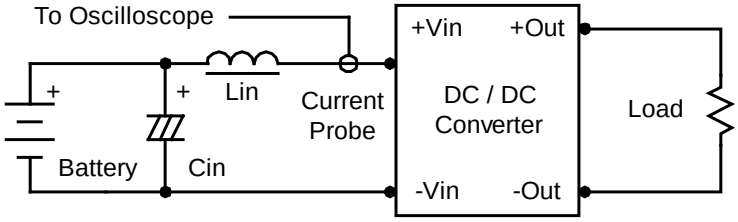
## TEST CONFIGURATIONS

### Input Reflected-Ripple Current Test Setup

Input reflected-ripple current is measured with an inductor Lin (4.7µH) and Cin (220µF, ESR < 1.0Ω at 100KHz) to simulate source impedance.

Capacitor Cin offsets possible battery impedance.

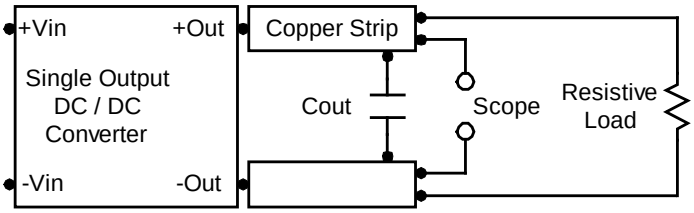
Current ripple is measured at the input terminals of the module. Measurement bandwidth is 0-500 KHz.

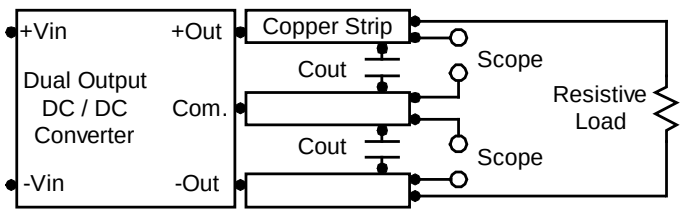



### Peak-to-Peak Output Noise Measurement Test

Use a Cout 0.33µF ceramic capacitor.

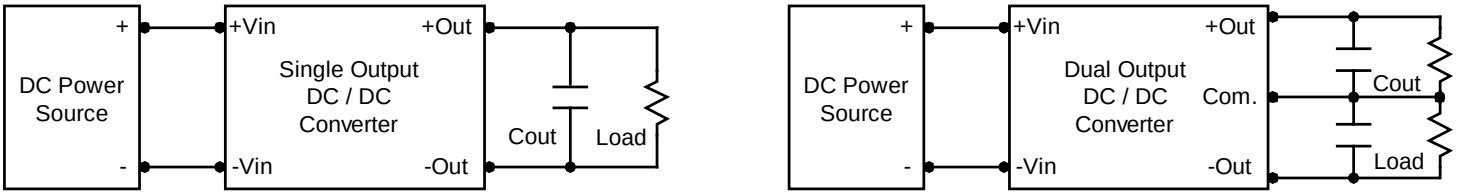
Scope measurement should be made by using a BNC socket; measurement bandwidth is 0 ~ 20MHz. Position the load between 50mm and 75mm from the DC/DC Converter.



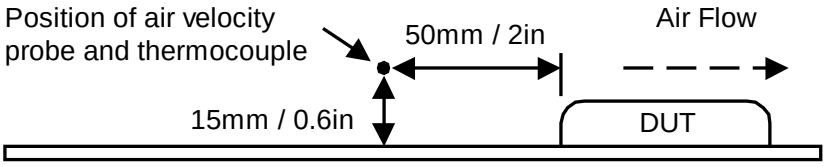
**Output Ripple Reduction**

A good quality low ESR capacitor placed as close as possible 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 90°C. The derating curves are determined from measurements obtained in an experimental apparatus.




## COMPANY INFORMATION

Wall Industries, Inc. has created custom and modified units for over 40 years. Our in-house research and development engineers will provide a solution that exceeds your performance requirements on time and on budget. Our ISO9001-2008 certification is just one example of our commitment to producing a high quality, well-documented product for our customers.

Our past projects demonstrate our commitment to you, our customer. Wall Industries, Inc. has a reputation for working closely with its customers to ensure each solution meets or exceeds form, fit and function requirements. We will continue to provide ongoing support for your project above and beyond the design and production phases. Give us a call today to discuss your future projects.

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