MINMAX®

# MSLU300 Series
# Electric Characteristic Note

# MSLU300 Series EC Note

**DC-DC CONVERTER 1W,** High Isolation, SMD Package

## Features


- **Industrial SMD Package**
- **Unregulated Output Voltage**
- **I/O Isolation 3000 VDC**
- **Operating Ambient Temp. Range -40℃ to +90℃**
- **Cleaning-washable Process Available(option)**
- **Qualified for Lead-free Reflow Solder Process According to IPC/JEDEC J-STD-020D.1**
- **Tape & Reel Package Available**

## Applications

- Distributed power architectures
- Workstations
- Computer equipment
- Communications equipment

## Product Overview

The MINMAX MSLU300 series is a range of 1W DC-DC converters in a SMD- Package featuring high I/O isolation of 3000VDC. 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.

## Table of contents

## 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 | % |
| **MSLU301** | 5 (4.5 ~ 5.5) | 3.3 | 260 | 238 | 30 | 10 | 33 | 72 |
| **MSLU302** | | 5 | 200 | 267 | | 10 | 33 | 75 |
| **MSLU304** | | 12 | 84 | 255 | | 7 | 4.7 | 79 |
| **MSLU305** | | 15 | 67 | 251 | | 7 | 4.7 | 80 |
| **MSLU306** | | ±5 | ±100 | 267 | | 10 | 10# | 75 |
| **MSLU308** | | ±12 | ±42 | 255 | | 7 | 2.2# | 79 |
| **MSLU309** | | ±15 | ±34 | 255 | | 7 | 2.2# | 80 |
| **MSLU311** | 12 (10.8 ~ 13.2) | 3.3 | 260 | 98 | 15 | 10 | 33 | 73 |
| **MSLU312** | | 5 | 200 | 110 | | 8 | 33 | 76 |
| **MSLU314** | | 12 | 84 | 105 | | 5 | 4.7 | 80 |
| **MSLU315** | | 15 | 67 | 103 | | 5 | 4.7 | 81 |
| **MSLU316** | | ±5 | ±100 | 110 | | 8 | 10# | 76 |
| **MSLU318** | | ±12 | ±42 | 105 | | 5 | 2.2# | 80 |
| **MSLU319** | | ±15 | ±34 | 106 | | 5 | 2.2# | 80 |
| **MSLU321** | 24 (21.6 ~ 26.4) | 3.3 | 260 | 51 | 8 | 10 | 33 | 70 |
| **MSLU322** | | 5 | 200 | 57 | | 8 | 33 | 73 |
| **MSLU324** | | 12 | 84 | 53 | | 5 | 4.7 | 79 |
| **MSLU325** | | 15 | 67 | 53 | | 5 | 4.7 | 79 |
| **MSLU326** | | ±5 | ±100 | 57 | | 8 | 10# | 73 |
| **MSLU328** | | ±12 | ±42 | 53 | | 5 | 2.2# | 79 |
| **MSLU329** | | ±15 | ±34 | 54 | | 5 | 2.2# | 79 |

# For each output

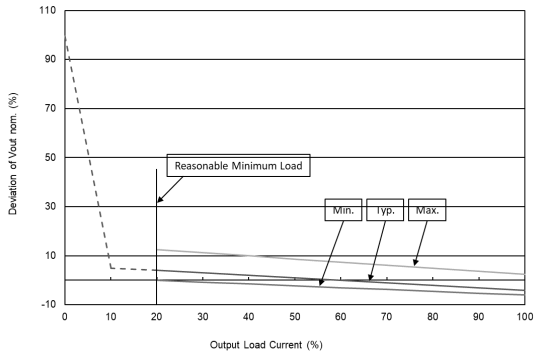
## Input Specifications

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

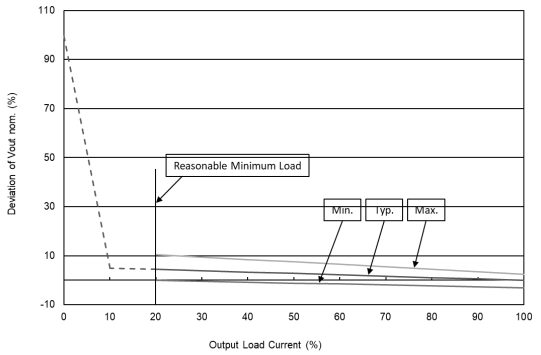
## Output Specifications

| 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 | 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 | --- | --- | 100 | $mV_{P-P}$ |
| Temperature Coefficient | | --- | ±0.01 | ±0.02 | %/°C |
| Short Circuit Protection | 0.5 Second Max., Automatic Recovery | | | | |

## Output Voltage Tolerance




(3.3V & 5V Output)




(All other Output)

## 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 | --- | 60 | 100 | pF |
| Switching Frequency | | 50 | 100 | 150 | kHz |
| MTBF (calculated) | MIL-HDBK-217F@25℃, 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 | +90 | ℃ |
| 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 | | |

## 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 fast blow fuse in the input supply line.

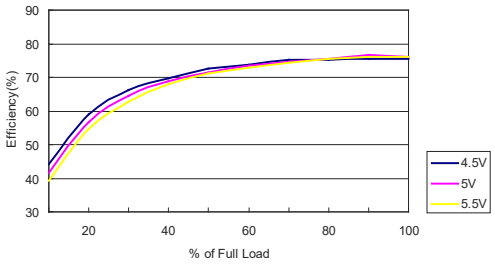
4 Other input and output voltage may be available, please contact MINMAX.

5 Specifications are subject to change without notice.

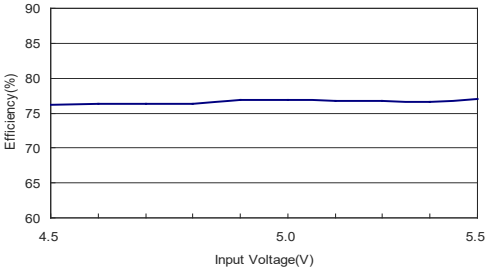
6 The repeated high voltage isolation testing of the converter can degrade isolation capability, to a lesser or greater degree depending on materials, construction, environment and reflow solder process. Any material is susceptible to eventual chemical degradation when subject to very high applied voltages 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.

## Characteristic Curves

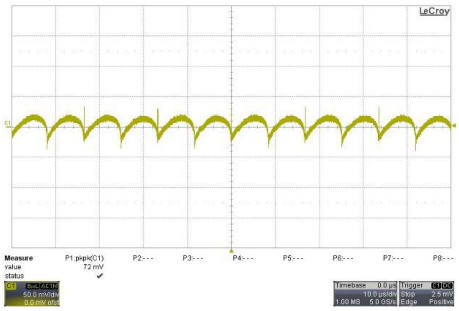
All test conditions are at 25℃ The figures are identical for MSLU301



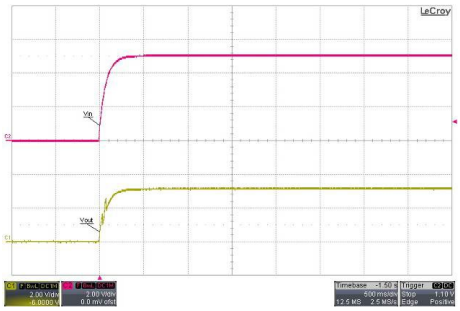

Efficiency Versus Output Current



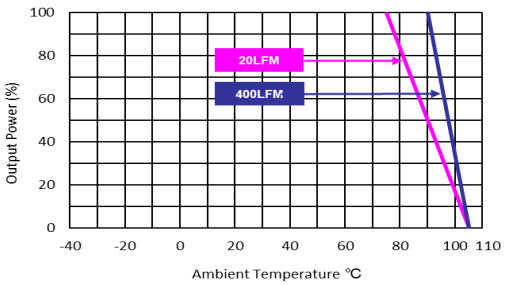

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



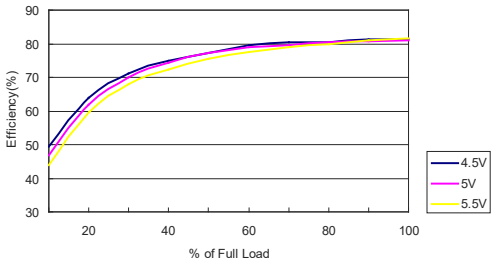
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



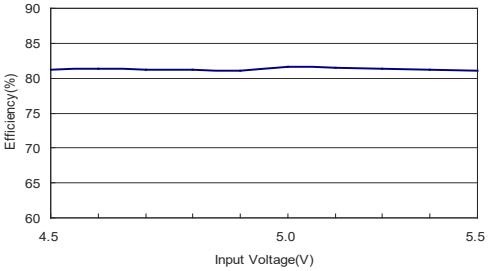

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

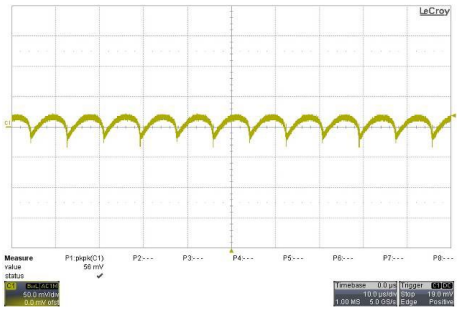
All test conditions are at 25℃ The figures are identical for MSLU302



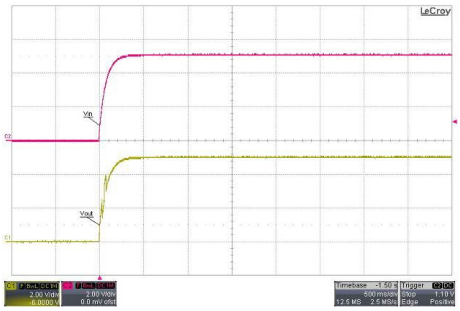

Efficiency Versus Output Current



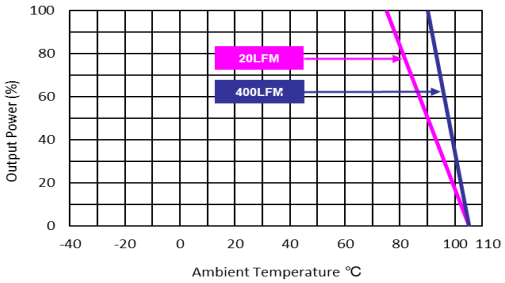

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



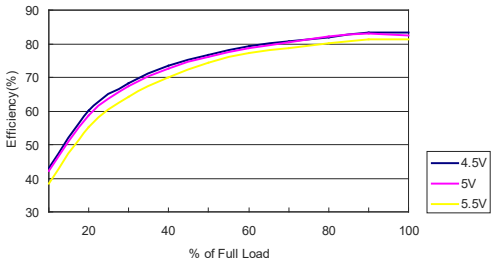
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



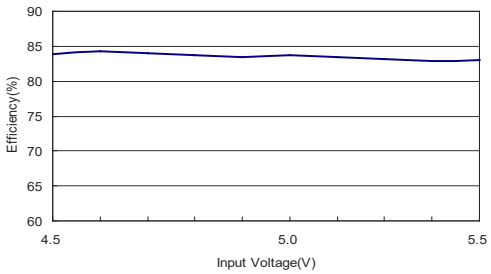

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

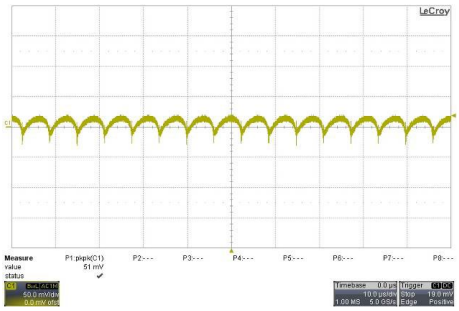
All test conditions are at 25℃ The figures are identical for MSLU304



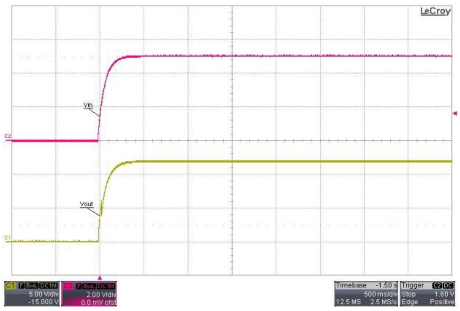

Efficiency Versus Output Current



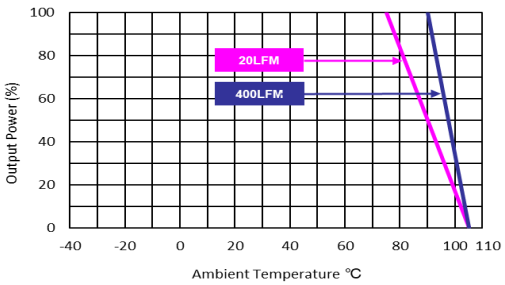

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



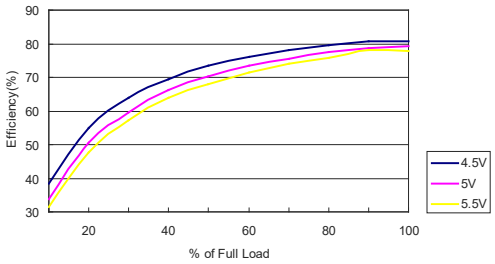
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



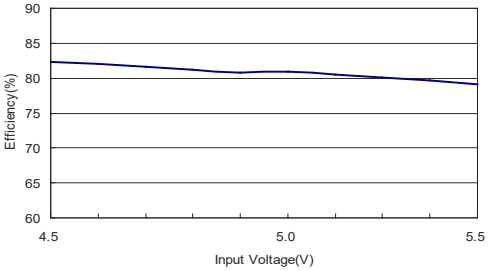

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

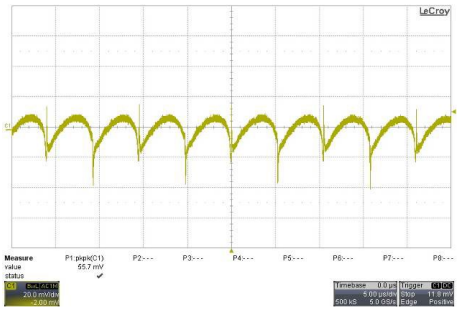
All test conditions are at 25℃ The figures are identical for MSLU305



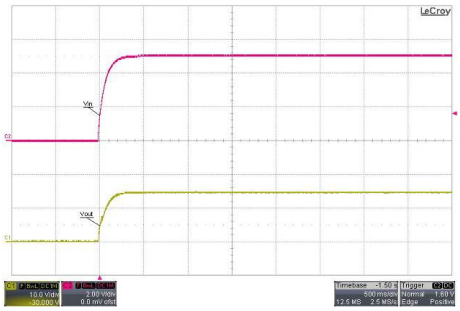

Efficiency Versus Output Current



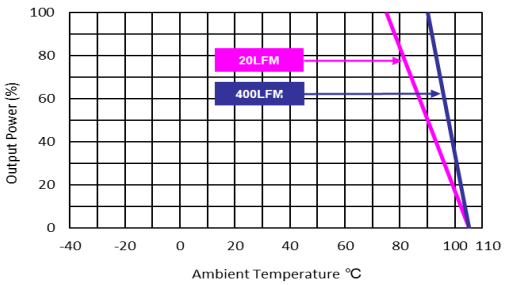

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



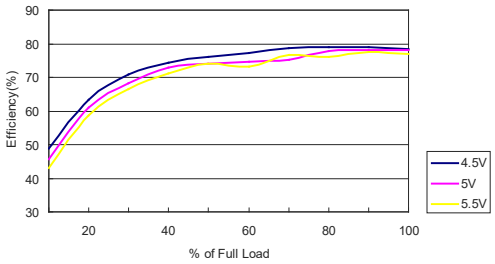
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



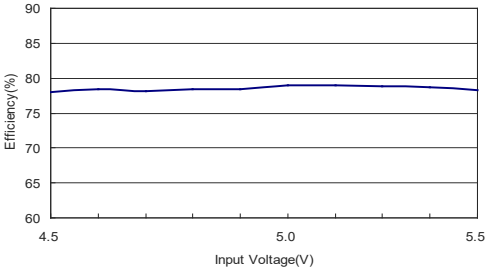

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

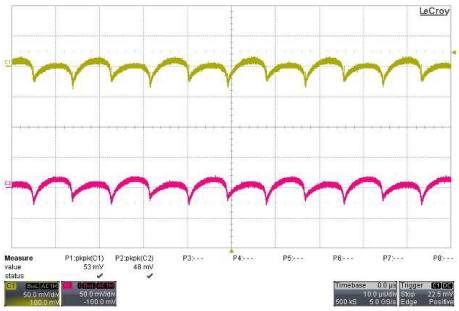
All test conditions are at 25℃ The figures are identical for MSLU306



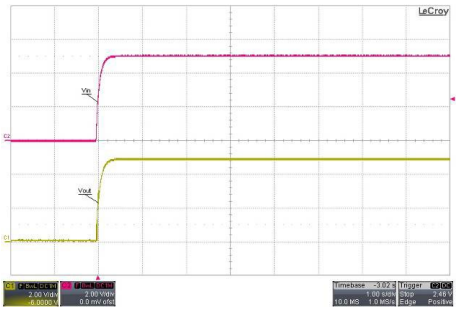

Efficiency Versus Output Current



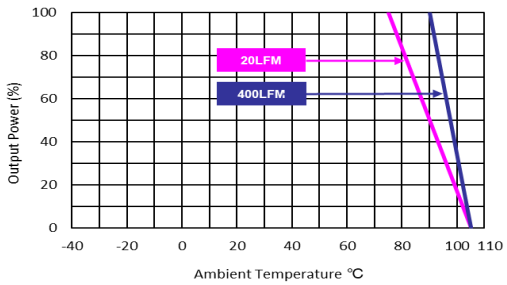

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



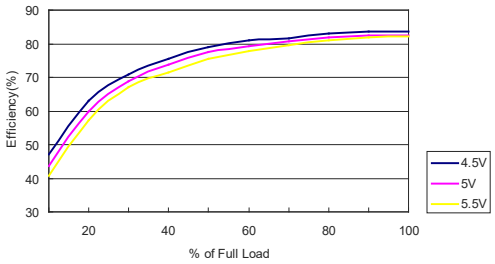
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



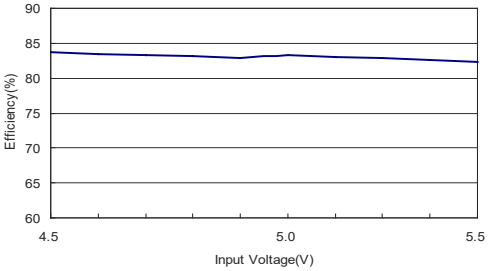

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

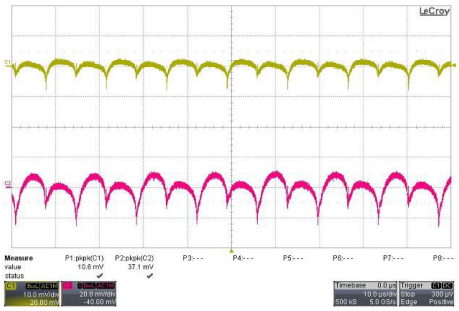
All test conditions are at 25℃ The figures are identical for MSLU308



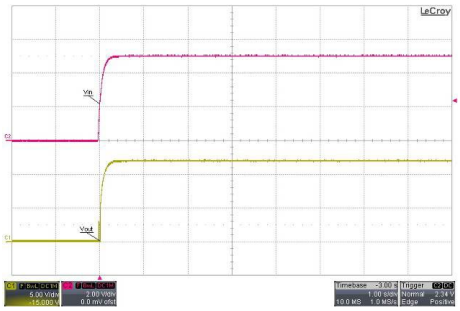

Efficiency Versus Output Current



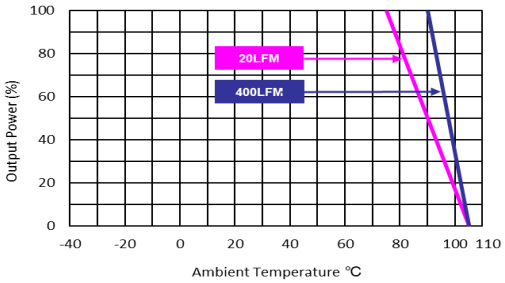

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



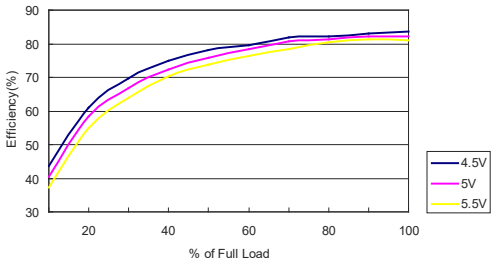
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



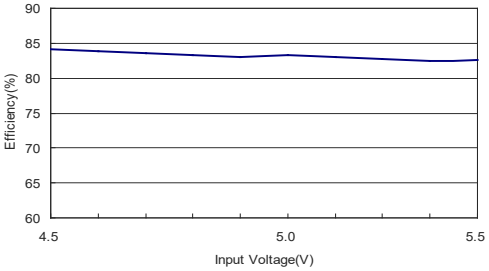

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

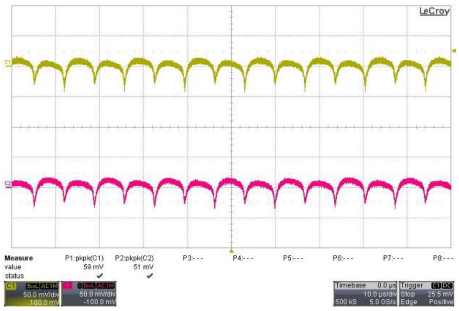
All test conditions are at 25℃ The figures are identical for MSLU309



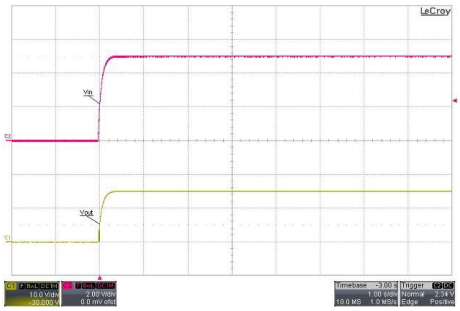

Efficiency Versus Output Current



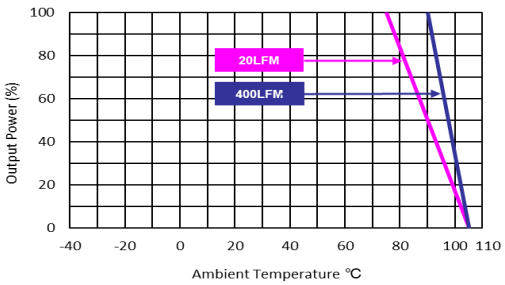

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



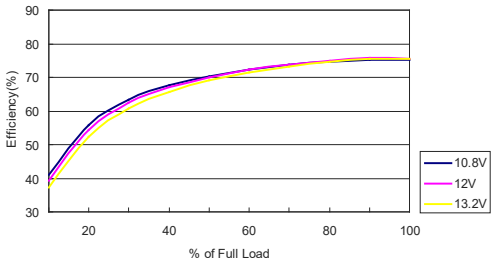
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



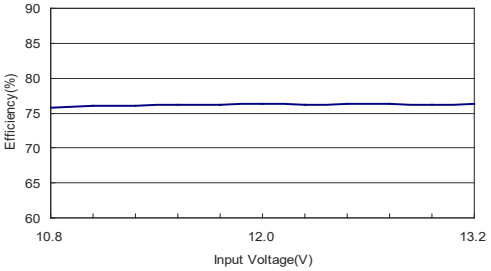

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

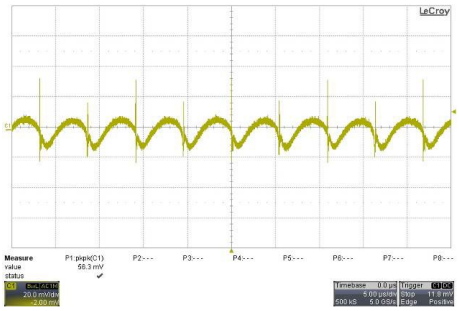
All test conditions are at 25℃ The figures are identical for MSLU311



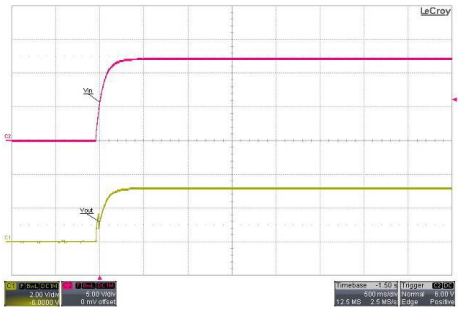

Efficiency Versus Output Current



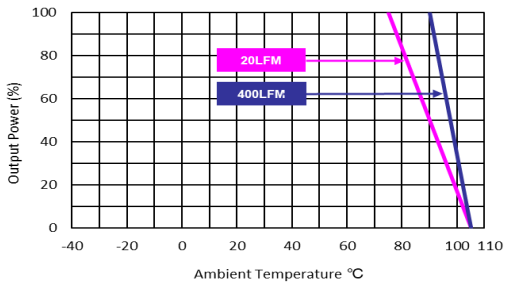

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



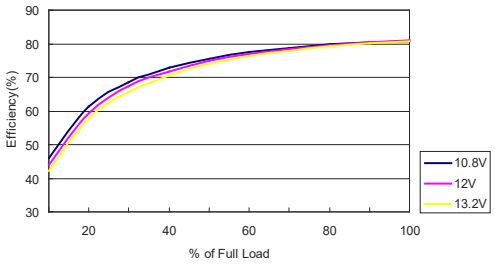
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



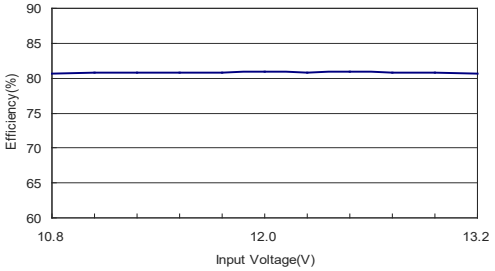

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

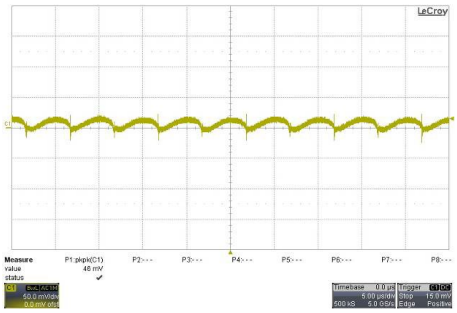
All test conditions are at 25°C  The figures are identical for MSLU312



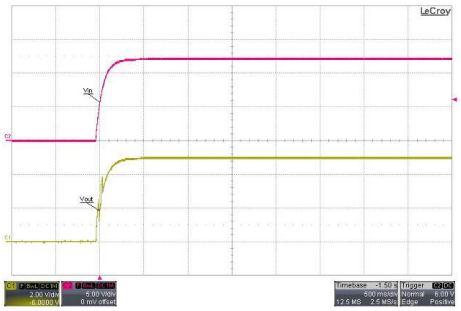

Efficiency Versus Output Current



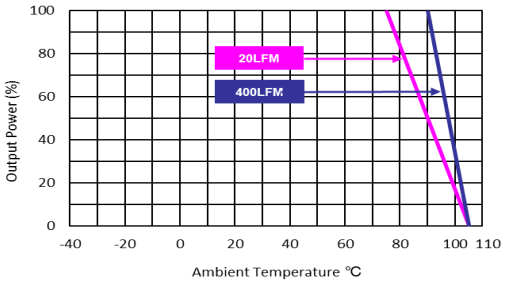

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



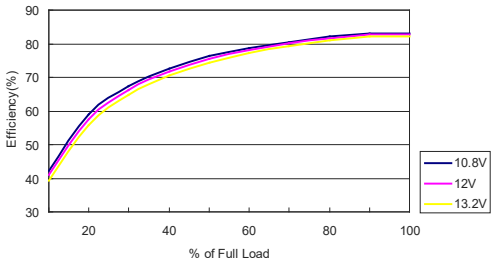
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



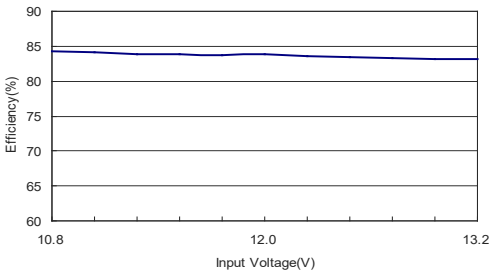

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

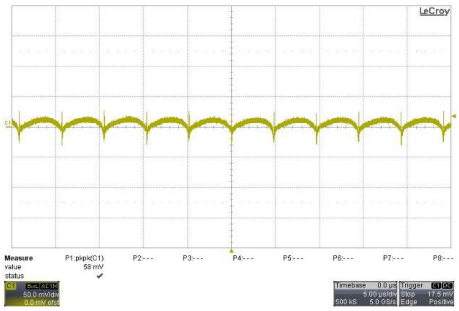
All test conditions are at 25℃ The figures are identical for MSLU314



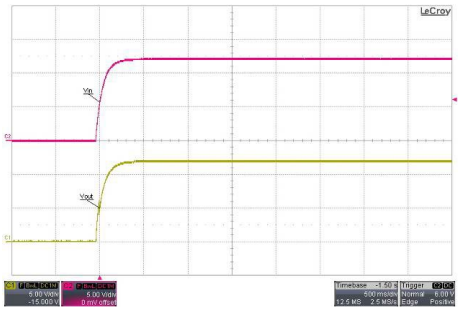

Efficiency Versus Output Current



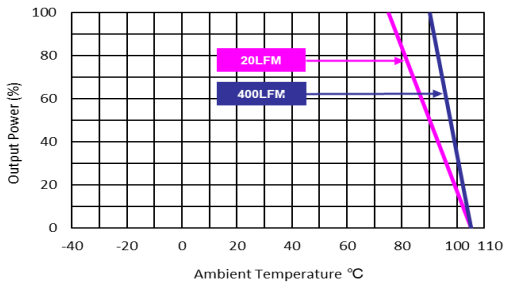

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



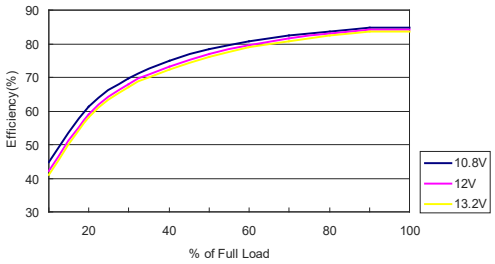
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



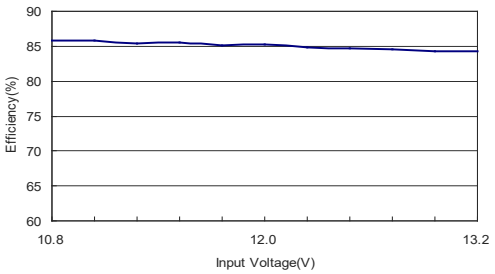

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

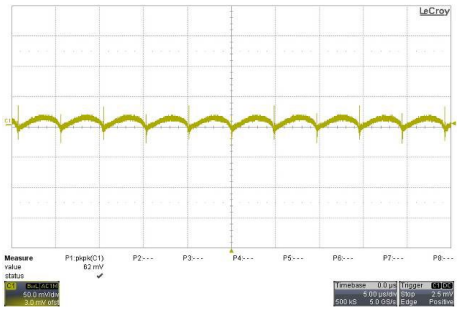
All test conditions are at 25°C  The figures are identical for MSLU315



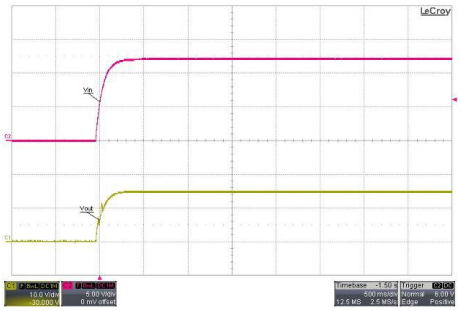

Efficiency Versus Output Current



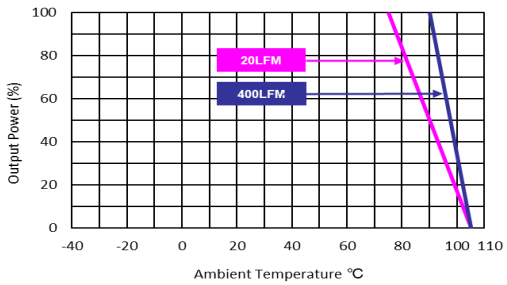

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



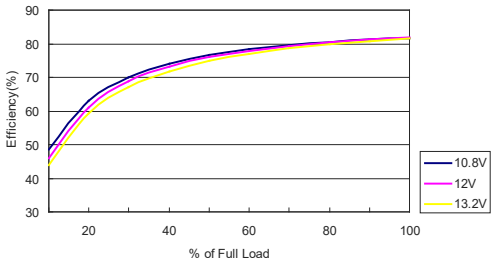
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



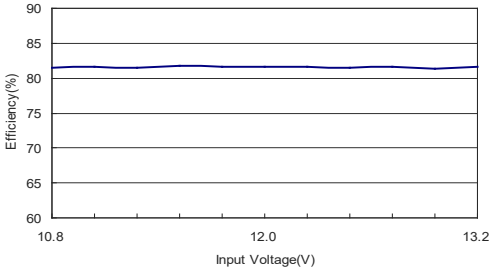

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

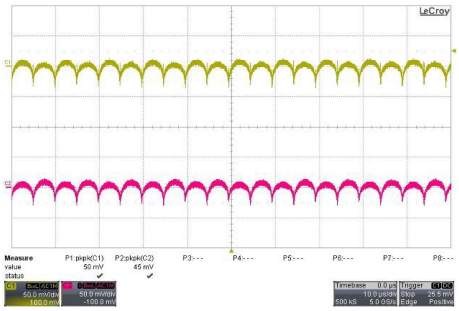
All test conditions are at 25℃ The figures are identical for MSLU316



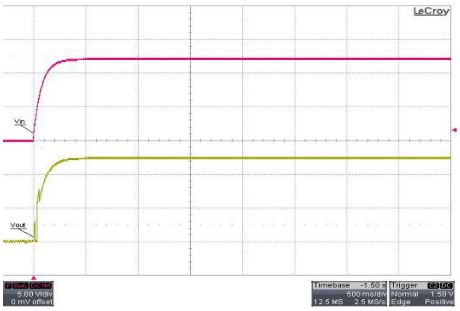

Efficiency Versus Output Current



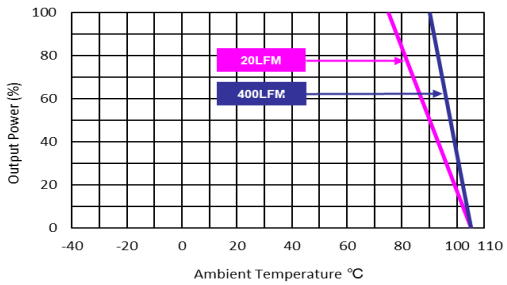

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



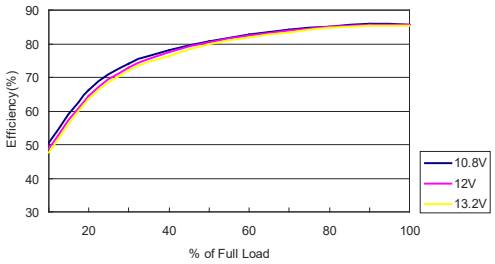
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



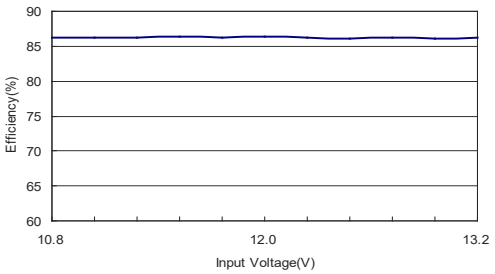

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

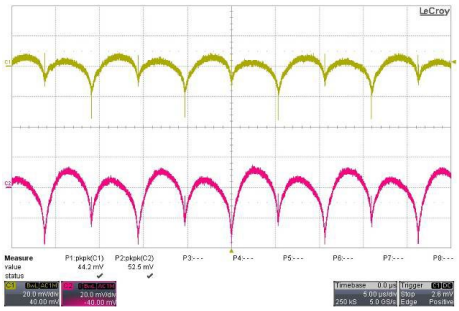
All test conditions are at 25℃ The figures are identical for MSLU318



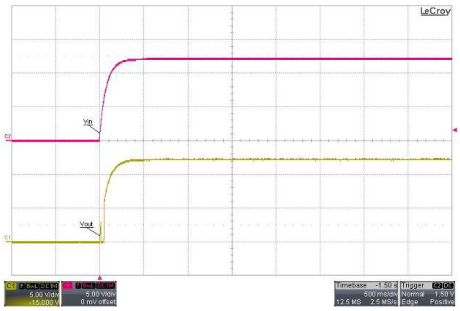

Efficiency Versus Output Current



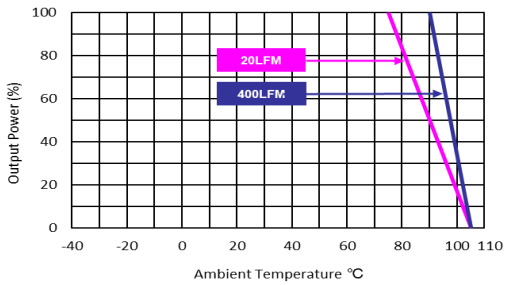

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



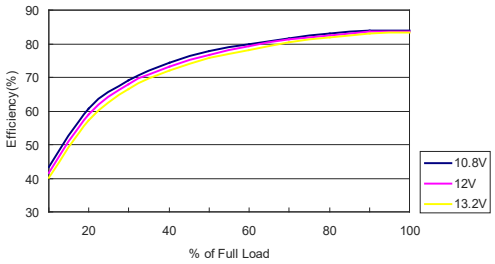
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



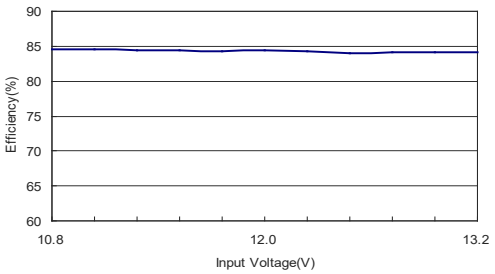

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

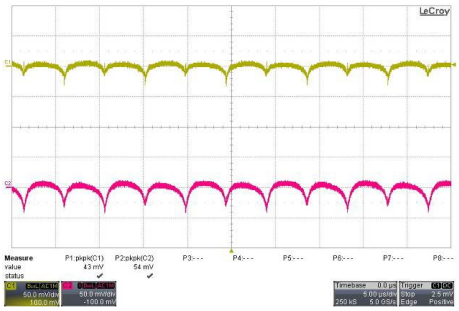
All test conditions are at 25°C  The figures are identical for MSLU319



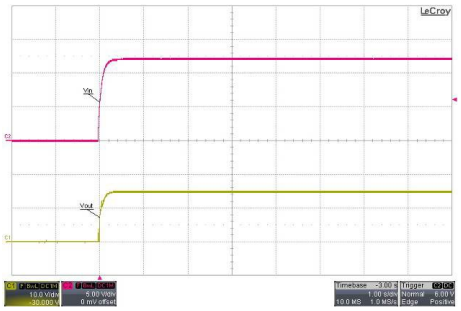

Efficiency Versus Output Current



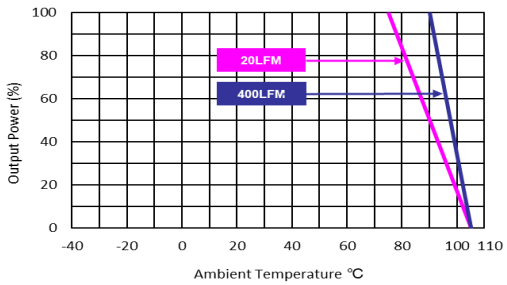

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



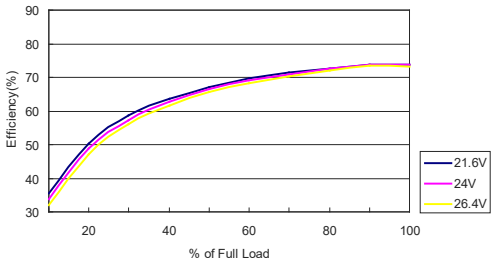
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



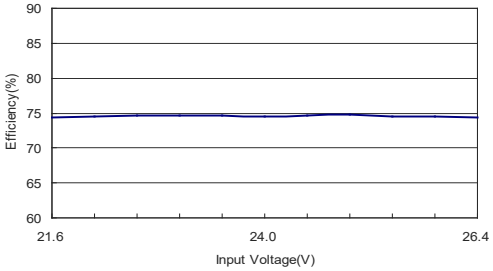

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

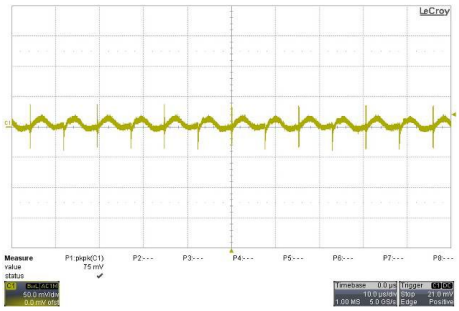
All test conditions are at 25℃ The figures are identical for MSLU321



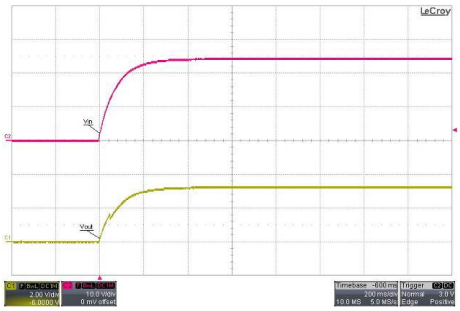

Efficiency Versus Output Current



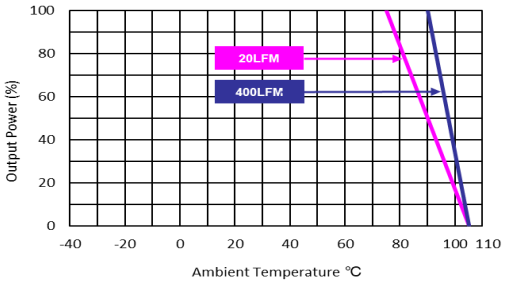

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



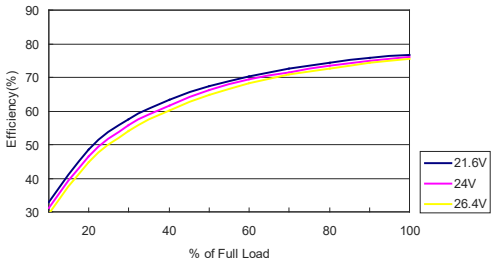
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



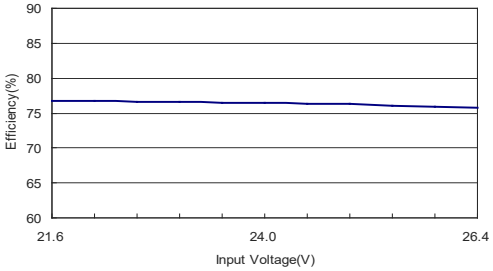

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

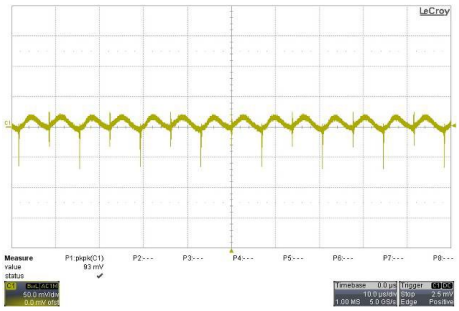
All test conditions are at 25℃ The figures are identical for MSLU322



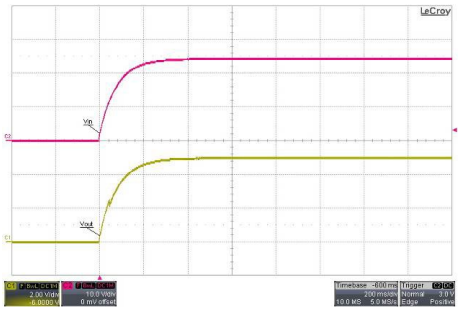

Efficiency Versus Output Current



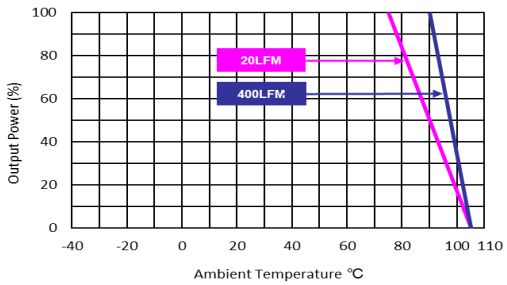

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



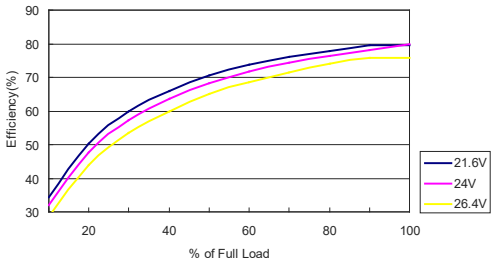
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



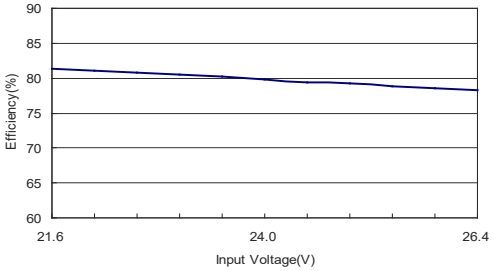

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

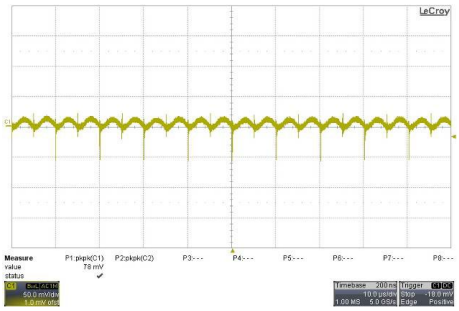
All test conditions are at 25℃ The figures are identical for MSLU324



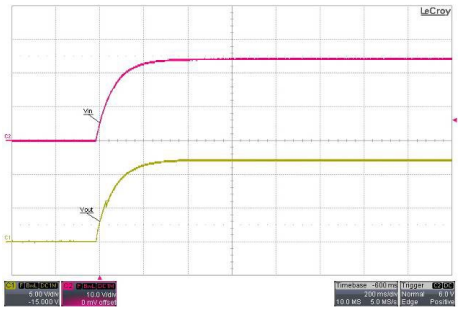

Efficiency Versus Output Current



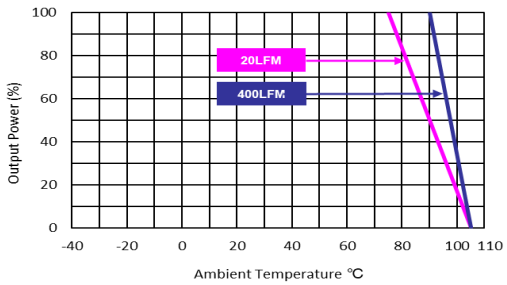

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



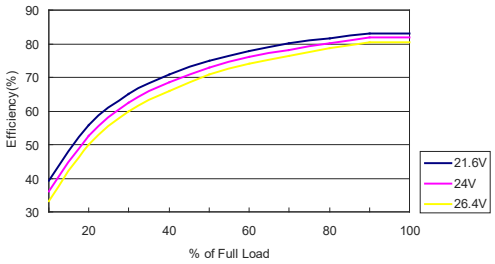
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



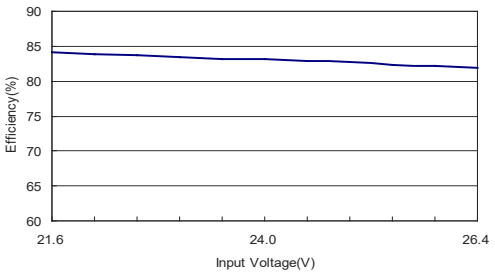

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

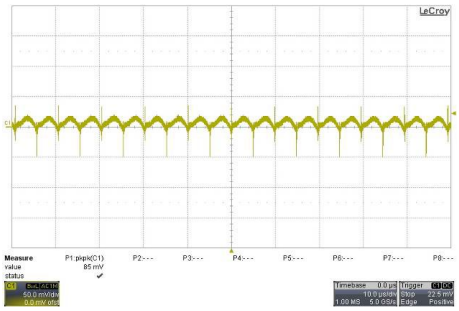
All test conditions are at 25°C  The figures are identical for MSLU325



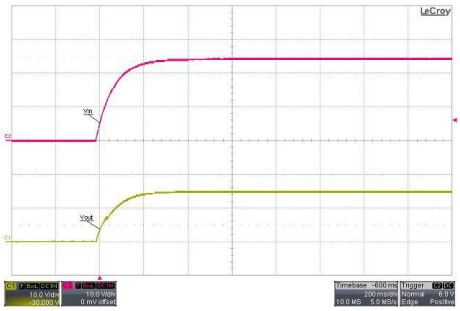

Efficiency Versus Output Current



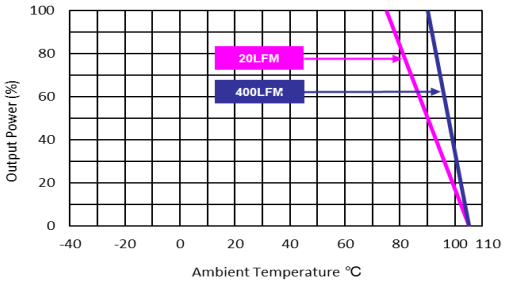

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



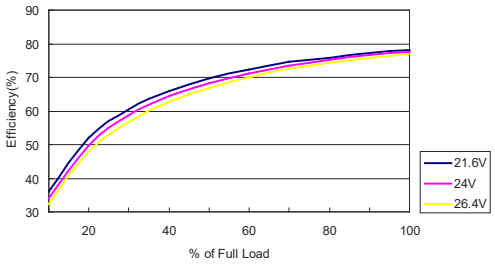
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



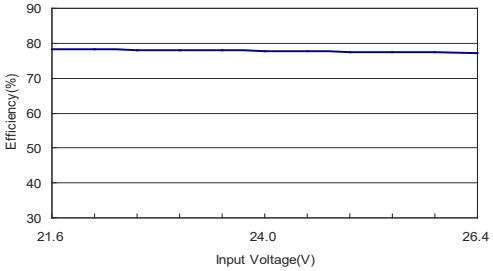

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

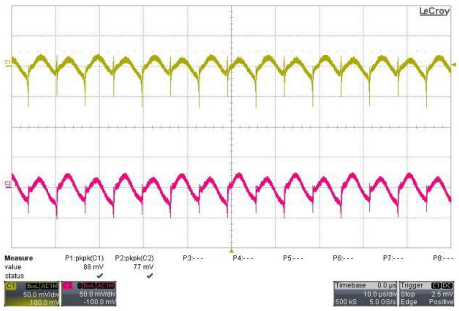
All test conditions are at 25℃ The figures are identical for MSLU326



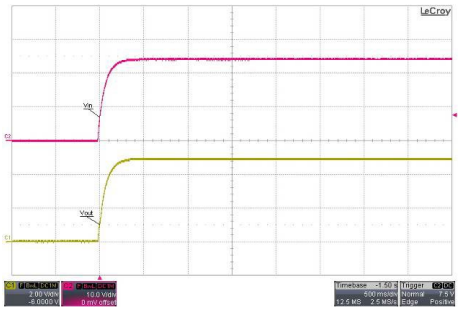

Efficiency Versus Output Current



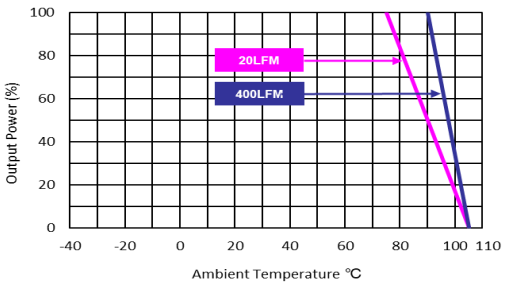

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



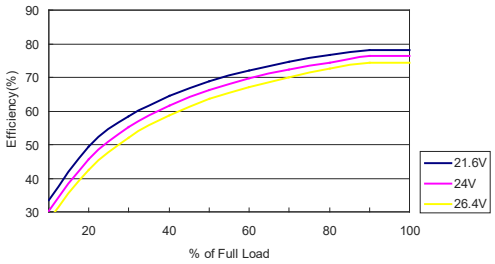
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



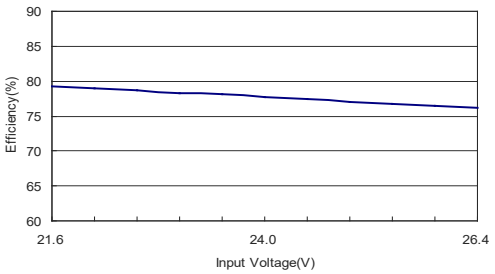

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

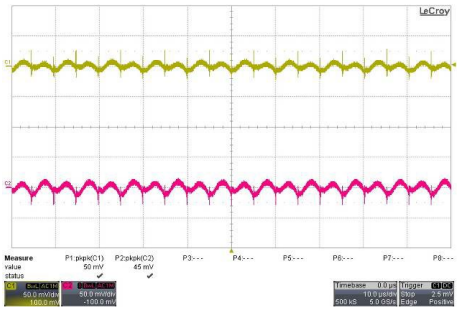
All test conditions are at 25°C  The figures are identical for MSLU328



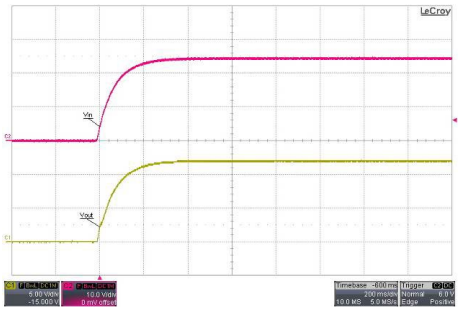

Efficiency Versus Output Current



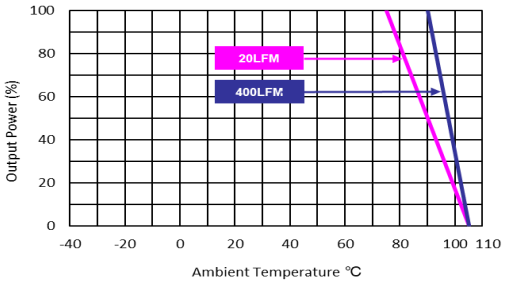

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



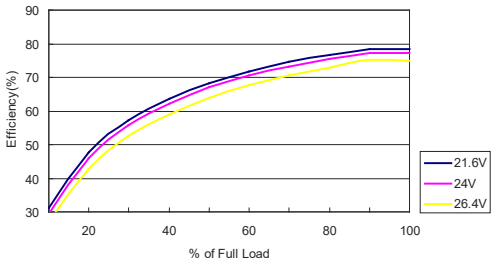
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



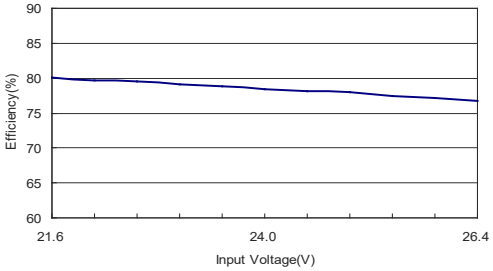

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

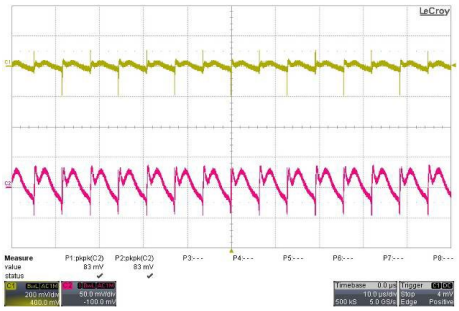
All test conditions are at 25℃ The figures are identical for MSLU329



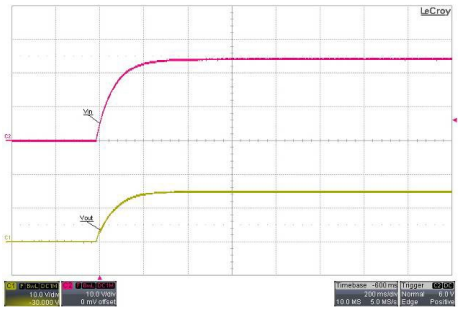

Efficiency Versus Output Current



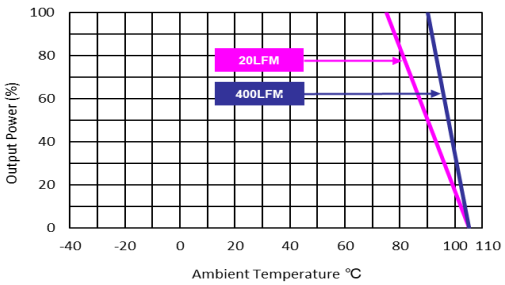

Efficiency Versus Input Voltage
Full Load



Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



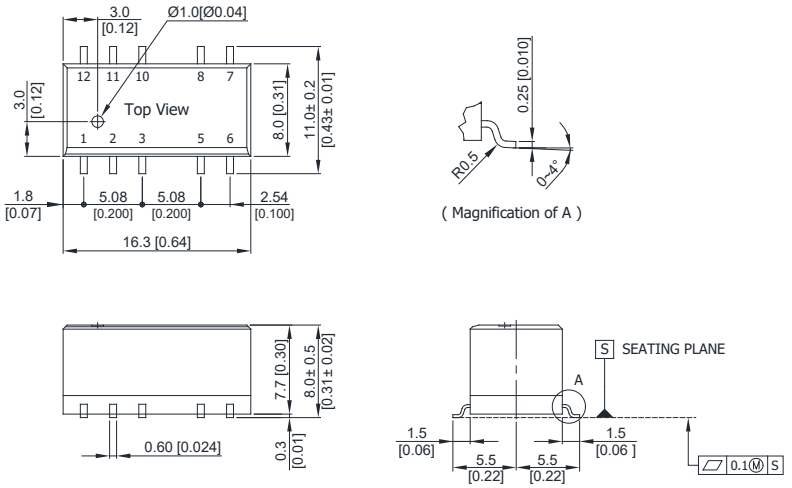
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



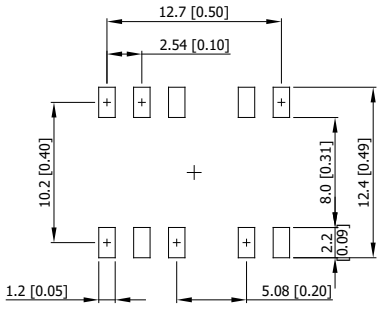

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Package Specifications

### Mechanical Dimensions




### 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 |
| 3 | NA | NA |
| 5 | -Vout | Common |
| 6 | NA | -Vout |
| 7 | NA | NA |
| 8 | +Vout | +Vout |
| 10 | NA | NA |
| 11 | NA | NA |
| 12 | NA | NA |

NA : Not Available for Electrical Connection

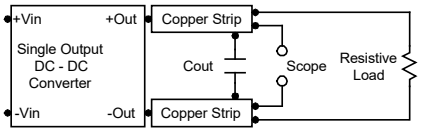
### Physical Characteristics

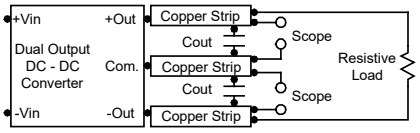
| | | |
|---|---|---|
| Case Size | : | 16.3x8.0x7.7mm (0.64x0.31x0.30 inches) |
| Case Material | : | Plastic resin (flammability to UL 94V-0 rated) |
| Pin Material | : | Phosphor Bronze |
| Weight | : | 2g |

## Test Setup

### 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 0-20 MHz. Position the load between 50 mm and 75 mm from the DC-DC Converter.



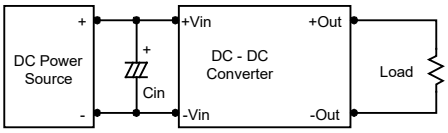

## Technical Notes

### Maximum Capacitive Load

The MSLU300 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.

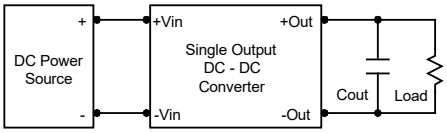
### Input Source Impedance

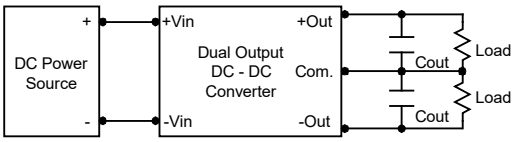
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup. 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 2.2µF for the 5V input devices, a 1.0µF for the 12V input devices and a 0.47µF for the 24V devices.




### Output Ripple Reduction

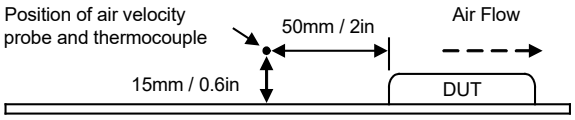
A good quality low ESR capacitor placed as close as practicable across the load will give the best ripple and noise performance. To reduce output ripple, it is recommended to use 1.0µF capacitors at the output.



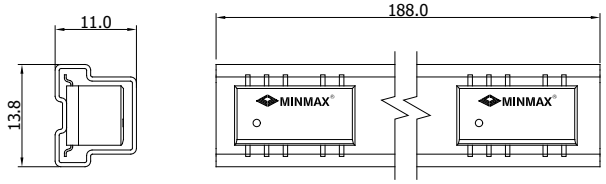

### Thermal Considerations

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.

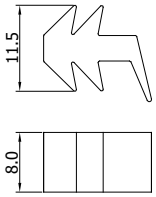


## Packaging Information for Tube

Tube



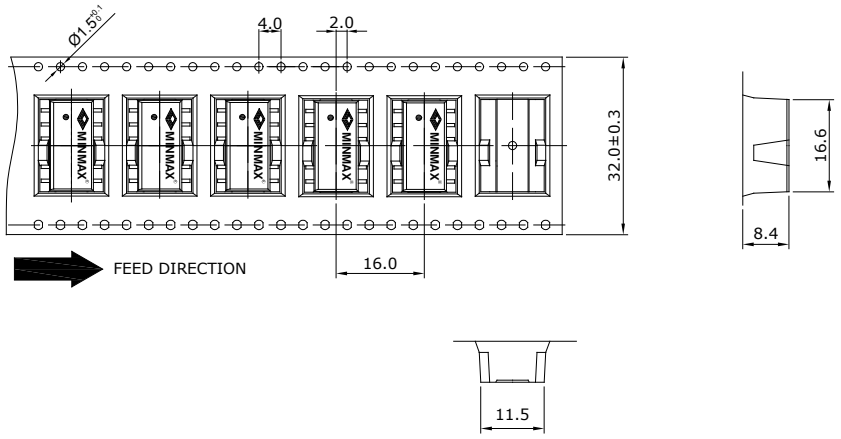

Plug



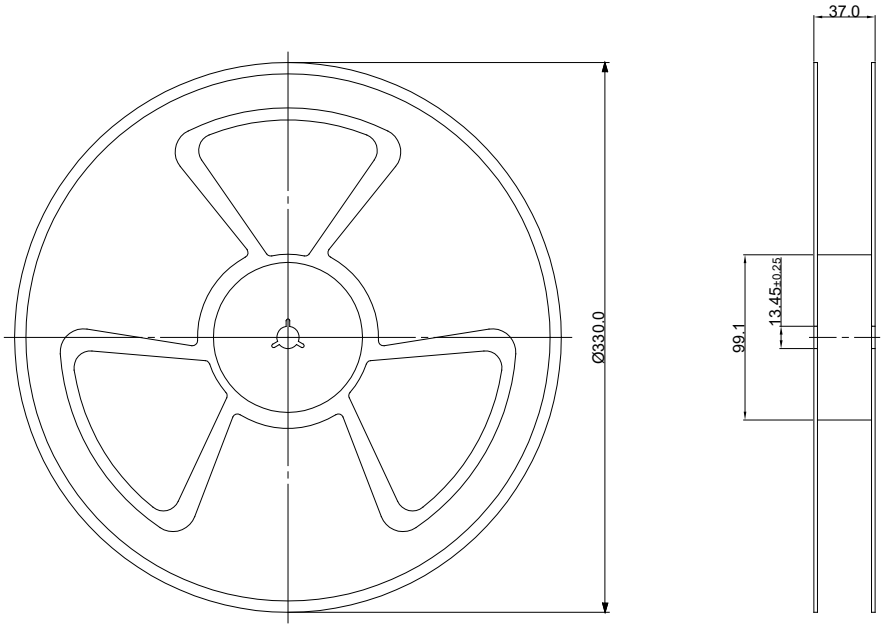

Unit: mm
10 PCS per TUBE

## Packaging Information for Tape & Reel

Tape




Reel




| Packaging Style | Quantity |
|---|---|
| With Heatsink Tube | N/A |
| Tape and Reel to IEC 286-3 Specifications | 450 |

## Soldering and Reflow Considerations

| Profile | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|---|---|---|
| Average ramp-up rate(Ts max. To Tp) | 3°C/second max. | 3°C/second max. |
| Preheat<br>· Temperature Min ($Ts_{min.}$)<br>· Temperature Max ($Ts_{max.}$)<br>· Time ($Ts_{min}$ to $Ts_{max}$) (ts) | <br>100°C<br>150°C<br>60~120 seconds | <br>150°C<br>200°C<br>60~180 seconds |
| Time maintained above:<br>· Temperature ($T_L$)<br>· Time ($t_L$) | <br>183°C<br>60~150 seconds | <br>217°C<br>60~150 seconds |
| Peak Temperature (Tp) | See Table 4-1 | See Table 4-2 |
| Time within 5°C of actual Peak Temperature $(tp)^2$ | 10~30 seconds | 20~40 seconds |
| Ramp-down Rate | 6°C/second max. | 6°C/second max. |
| Time 25°C to Peak Temperature | 6 minutes max. | 8 minutes max. |

Note 1: All temperatures refer to topside of the package, measured on the package body surface.
Note 2: Time within 5°C of actual peak temperature (tp) specified for the reflow profiles is a "supplier" minimum and "user" maximum.

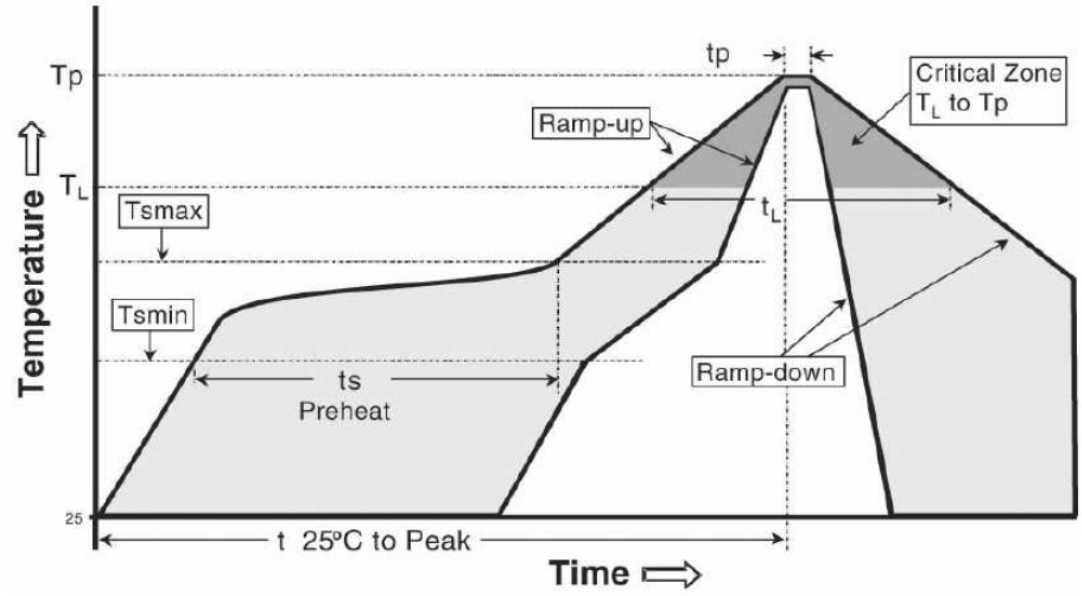



Table 4-1 SnPb Eutectic Process-Classification Temperatures ($T_C$)

| | Volume $mm^3$ | Volume $mm^3$ |
|---|---|---|
| Package Thickness | <350 | ≥350 |
| <2.5mm | 235°C | 220°C |
| ≥2.5mm | 220°C | 220°C |

Table 4-2 Pb-Free Process-Classification Temperatures ($T_C$)

| | Volume $mm^3$ | Volume $mm^3$ | Volume $mm^3$ |
|---|---|---|---|
| Package Thickness | <350 | 350-2000 | >2000 |
| <1.6mm | 260°C | 260°C | 260°C |
| 1.6mm-2.5mm | 260°C | 250°C | 245°C |
| >2.5mm | 250°C | 245°C | 245°C |

## Part Number Structure

| M | SL | U | 30 | 1 |
|---|---|---|---|---|
| | Package Type<br>SMD-12 | Output Regulation<br>Unregulated | Input Voltage Range<br>30: 4.5 ~ 5.5 VDC<br>31: 10.8 ~ 13.2 VDC<br>32: 21.6 ~ 26.4 VDC | Output Voltage<br>1: 3.3 VDC<br>2: 5 VDC<br>4: 12 VDC<br>5: 15 VDC<br>6: ±5 VDC<br>8: ±12 VDC<br>9: ±15 VDC |

## MTBF and Reliability

The MTBF of MSLU300 series of DC-DC converters has been calculated using

MIL-HDBK 217F NOTICE2, Operating Temperature 25°C, Ground Benign.

| Model | MTBF | Unit |
|---|---|---|
| MSLU301 | 4,752,206 | Hours |
| MSLU302 | 4,758,668 | |
| MSLU304 | 4,755,435 | |
| MSLU305 | 4,755,435 | |
| MSLU306 | 4,758,668 | |
| MSLU308 | 4,608,295 | |
| MSLU309 | 4,758,668 | |
| MSLU311 | 4,801,098 | |
| MSLU312 | 4,804,393 | |
| MSLU314 | 4,804,393 | |
| MSLU315 | 4,807,692 | |
| MSLU316 | 4,644,990 | |
| MSLU318 | 4,644,990 | |
| MSLU319 | 4,804,393 | |
| MSLU321 | 4,691,689 | |
| MSLU322 | 4,794,521 | |
| MSLU324 | 4,560,261 | |
| MSLU325 | 4,554,327 | |
| MSLU326 | 4,641,910 | |
| MSLU328 | 4,641,910 | |
| MSLU329 | 4,648,074 | |