MINMAX®

# MSDW1000 Series
# Electric Characteristic Note

# MSDW1000 Series EC Note

**DC-DC CONVERTER 2W,** SMD Package

## Features


- **Industrial SMD Package**
- **Wide 2:1 Input Voltage Range**
- **Fully Regulated Output Voltage**
- **I/O Isolation 1500 VDC**
- **Operating Ambient Temp. Range -40℃ to +85℃**
- **Under-voltage and Short Circuit Protection**
- **Cleaning-washable Process Available(option)**
- **Qualified for Lead-free Reflow Solder Process According to**
- **IPC/JEDEC J-STD-020D.1**
- **Tape & Reel Package Available**
- **UL/cUL/IEC/EN 60950-1 Safety Approval**

## Applications

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

## Product Overview

The MINMAX MSDW1000 series is a range of isolated 2W DC-DC converter modules featuring fully regulated output voltages and wide 2:1 input voltage ranges. The products come in a compact SMD package with a small footprint and low package height of just 8.0 mm (0.31 inch). All models are qualified for lead free reflow solder processes according IPC J-STD-020D.1 standard. An excellent efficiency allows an operating temperature range of -40℃ to +85℃. The compact dimensions of these DC-DC converters make them an ideal solution for many space critical applications in battery-powered equipment and instrumentation.

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## Model Selection Guide

| Model Number | Input Voltage (Range) | Output Voltage | Output Current | | Input Current | | Reflected Ripple Current | Max. capacitive Load | Efficiency (typ.) |
|---|---|---|---|---|---|---|---|---|---|
| | | | Max. | Min. | @Max. Load | @No Load | | | @Max. Load |
| | VDC | VDC | mA | mA | mA(typ.) | mA(typ.) | mA(typ.) | μF | % |
| **MSDW1011** | 5 (4.5 ~ 9) | 3.3 | 500 | 125 | 471 | 40 | 100 | 2200 | 70 |
| **MSDW1012** | | 5 | 400 | 100 | 548 | | | 1000 | 73 |
| **MSDW1013** | | 12 | 167 | 42 | 534 | | | 170 | 75 |
| **MSDW1014** | | 15 | 134 | 33 | 582 | | | 110 | 73 |
| **MSDW1015** | | ±5 | ±200 | ±50 | 667 | | | 470# | 64 |
| **MSDW1016** | | ±12 | ±83 | ±21 | 615 | | | 100# | 69 |
| **MSDW1017** | | ±15 | ±67 | ±17 | 598 | | | 47# | 71 |
| **MSDW1021** | 12 (9 ~ 18) | 3.3 | 500 | 125 | 184 | 20 | 25 | 2200 | 73 |
| **MSDW1022** | | 5 | 400 | 100 | 217 | | | 1000 | 77 |
| **MSDW1023** | | 12 | 167 | 42 | 209 | | | 170 | 80 |
| **MSDW1024** | | 15 | 134 | 33 | 220 | | | 110 | 80 |
| **MSDW1025** | | ±5 | ±200 | ±50 | 242 | | | 470# | 73 |
| **MSDW1026** | | ±12 | ±83 | ±21 | 224 | | | 100# | 78 |
| **MSDW1027** | | ±15 | ±67 | ±17 | 226 | | | 47# | 78 |
| **MSDW1031** | 24 (18 ~ 36) | 3.3 | 500 | 125 | 96 | 10 | 15 | 2200 | 72 |
| **MSDW1032** | | 5 | 400 | 100 | 109 | | | 1000 | 77 |
| **MSDW1033** | | 12 | 167 | 42 | 109 | | | 170 | 80 |
| **MSDW1034** | | 15 | 134 | 33 | 108 | | | 110 | 81 |
| **MSDW1035** | | ±5 | ±200 | ±50 | 119 | | | 470# | 74 |
| **MSDW1036** | | ±12 | ±83 | ±21 | 112 | | | 100# | 78 |
| **MSDW1037** | | ±15 | ±67 | ±17 | 110 | | | 47# | 80 |
| **MSDW1041** | 48 (36 ~ 75) | 3.3 | 500 | 125 | 49 | 8 | 10 | 2200 | 71 |
| **MSDW1042** | | 5 | 400 | 100 | 57 | | | 1000 | 73 |
| **MSDW1043** | | 12 | 167 | 42 | 53 | | | 170 | 79 |
| **MSDW1044** | | 15 | 134 | 33 | 55 | | | 110 | 79 |
| **MSDW1045** | | ±5 | ±200 | ±50 | 62 | | | 470# | 71 |
| **MSDW1046** | | ±12 | ±83 | ±21 | 57 | | | 100# | 77 |
| **MSDW1047** | | ±15 | ±67 | ±17 | 57 | | | 47# | 77 |

# For each output

## Input Specifications

| Parameter | Model | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Input Surge Voltage (1 sec. max.) | 5V Input Models | -0.7 | --- | 11 | VDC |
| | 12V Input Models | -0.7 | --- | 25 | |
| | 24V Input Models | -0.7 | --- | 50 | |
| | 48V Input Models | -0.7 | --- | 100 | |
| Start-Up Threshold Voltage | 5V Input Models | 3.5 | 4 | 4.5 | |
| | 12V Input Models | 4.5 | 7 | 9 | |
| | 24V Input Models | 8 | 12 | 18 | |
| | 48V Input Models | 16 | 24 | 36 | |
| Under Voltage Shutdown | 5V Input Models | --- | 3.5 | 4 | |
| | 12V Input Models | --- | 6.5 | 8.5 | |
| | 24V Input Models | --- | 11 | 17 | |
| | 48V Input Models | --- | 22 | 34 | |
| Short Circuit Input Power | All Models | --- | --- | 1500 | mW |
| Internal Power Dissipation | | --- | --- | 1800 | mW |
| Input Filter | | Internal Pi Type | | | |
| Conducted EMI | | Compliance to EN 55022, class A | | | |

## Output Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Output Voltage Setting Accuracy | | --- | --- | ±2.0 | %Vom. |
| Output Voltage Balance | Dual Output, Balanced Loads | --- | ±1.0 | ±2.0 | % |
| Line Regulation | Vin=Min. to Max. | --- | ±0.3 | ±0.5 | % |
| Load Regulation | Io=25% to 100% | --- | ±0.5 | ±0.75 | % |
| Ripple & Noise | 0-20 MHz Bandwidth | --- | --- | 50 | $mV_{P-P}$ |
| Transient Recovery Time | 25% Load Step Change | --- | 100 | 300 | µsec |
| Transient Response Deviation | | --- | ±3 | ±5 | % |
| Temperature Coefficient | | --- | ±0.01 | ±0.02 | %/℃ |
| Short Circuit Protection | Continuous, Automatic Recovery | | | | |

## General Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| I/O Isolation Voltage | 60 Seconds | 1500 | --- | --- | VDC |
| | 1 Seconds | 1800 | --- | --- | VDC |
| I/O Isolation Resistance | 500 VDC | 1000 | --- | --- | MΩ |
| I/O Isolation Capacitance | 100kHz, 1V | --- | 250 | 420 | pF |
| Switching Frequency | | --- | 300 | --- | kHz |
| MTBF (calculated) | MIL-HDBK-217F@25℃, Ground Benign | 1,000,000 | | | Hours |
| Safety Approvals | UL/cUL 60950-1 recognition(CSA certificate), IEC/EN 60950-1(CB-scheme) | | | | |
| Moisture Sensitivity Level (MSL) | IPC/JEDEC J-STD-020D.1 | Level 2 | | | |

## Environmental Specifications

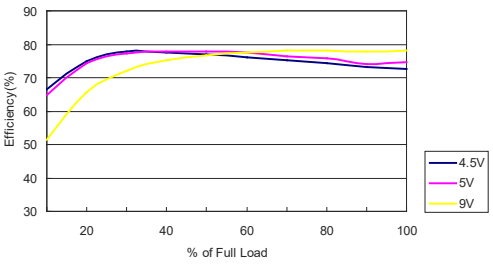
| Parameter | Min. | Max. | Unit |
|---|---|---|---|
| Operating Ambient Temperature Range (See Power Derating Curve) | -40 | +85 | ℃ |
| Case Temperature | --- | +90 | ℃ |
| Storage Temperature Range | -50 | +125 | ℃ |
| Humidity (non condensing) | --- | 95 | % rel. H |
| Lead-free Reflow Solder Process | IPC/JEDEC J-STD-020D.1 | | |

## Notes

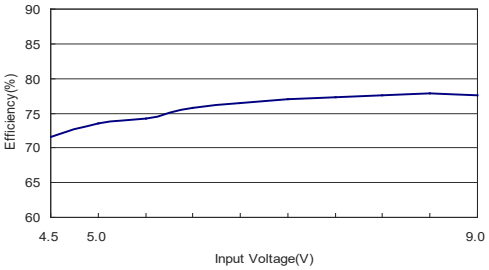
1. Specifications typical at Ta=+25℃, resistive load, nominal input voltage and rated output current unless otherwise noted.
2. Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%.
3. These power converters require a minimum output loading to maintain specified regulation, operation under no-load conditions will not damage these modules; however they may not meet all specifications listed.
4. We recommend to protect the converter by a slow blow fuse in the input supply line.
5. Other input and output voltage may be available, please contact MINMAX.
6. Specifications are subject to change without notice.
7. 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

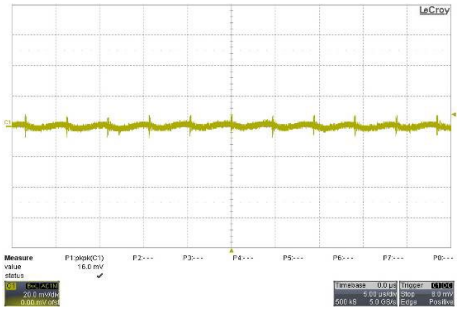
All test conditions are at 25℃ The figures are identical for MSDW1011



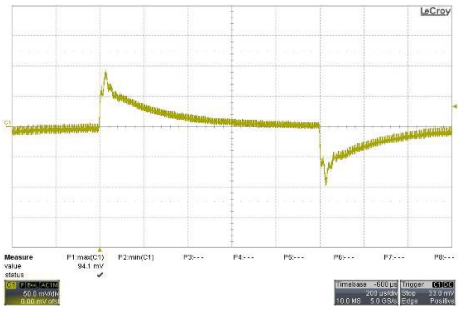

Efficiency Versus Output Current



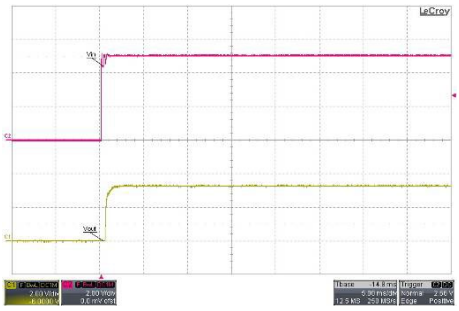

Efficiency Versus Input Voltage
Full Load



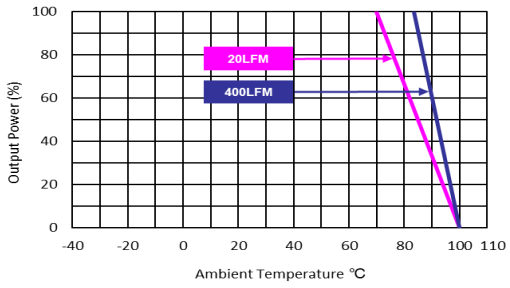
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



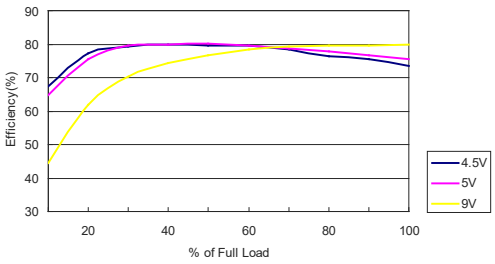
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



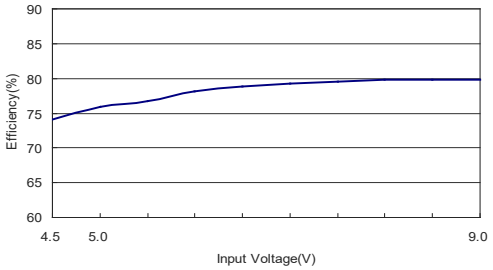

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

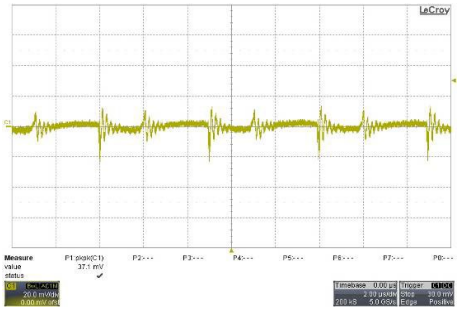
All test conditions are at 25℃ The figures are identical for MSDW1012



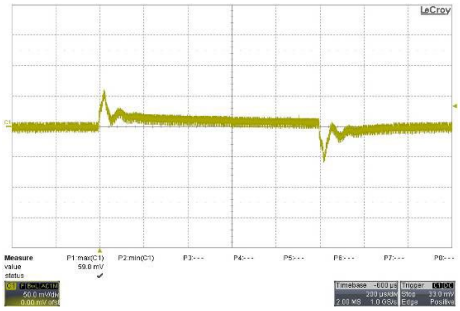

Efficiency Versus Output Current



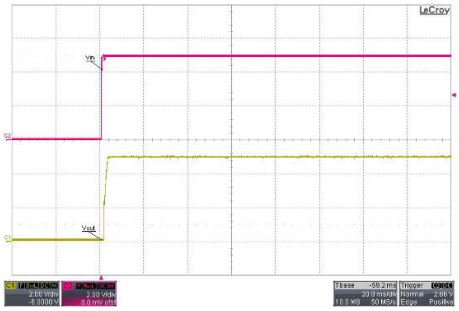

Efficiency Versus Input Voltage
Full Load



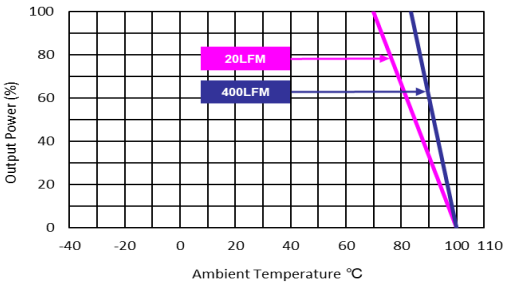
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



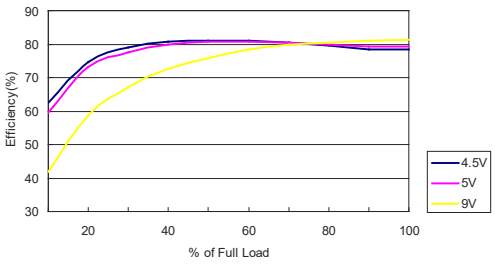
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



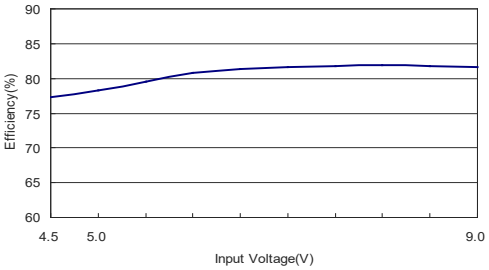

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

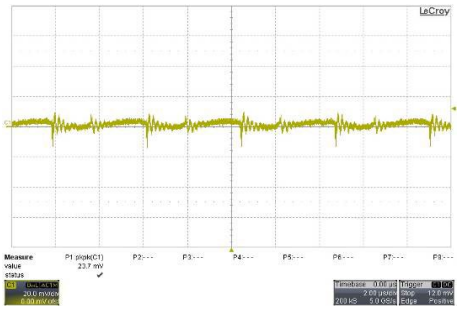
All test conditions are at 25℃ The figures are identical for MSDW1013



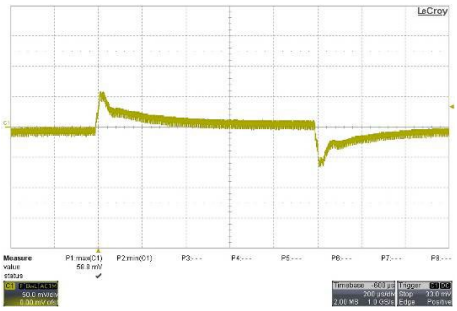

Efficiency Versus Output Current



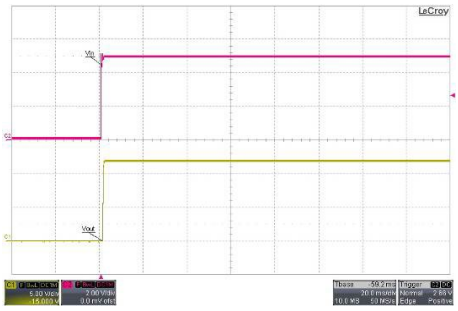

Efficiency Versus Input Voltage
Full Load



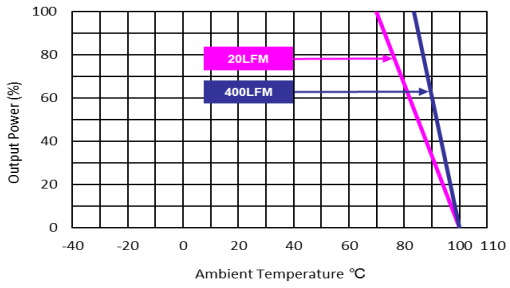
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



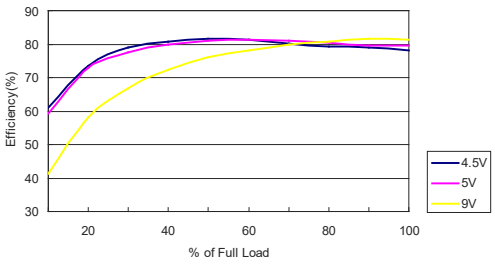
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$ ; Full Load



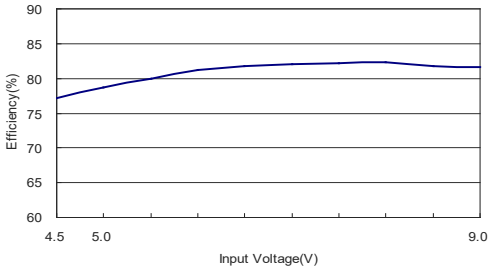

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

## Characteristic Curves

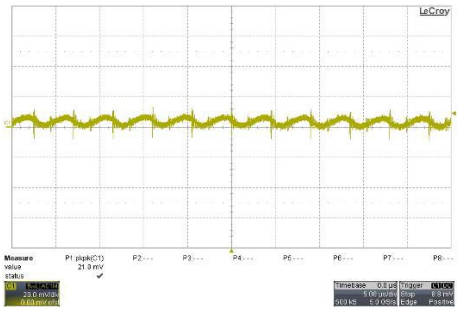
All test conditions are at 25°C  The figures are identical for MSDW1014



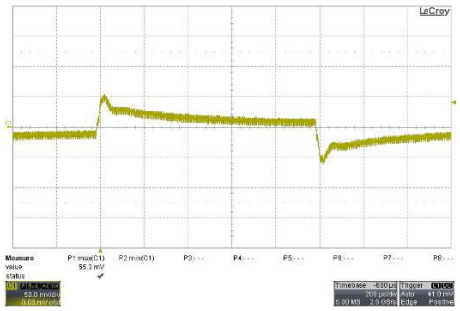

Efficiency Versus Output Current



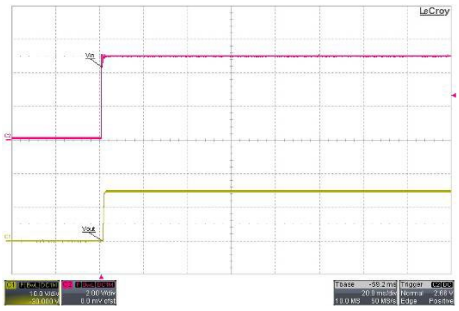

Efficiency Versus Input Voltage
Full Load



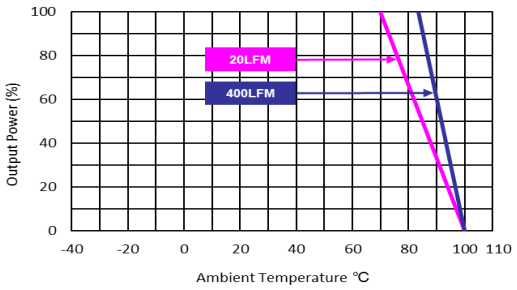
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



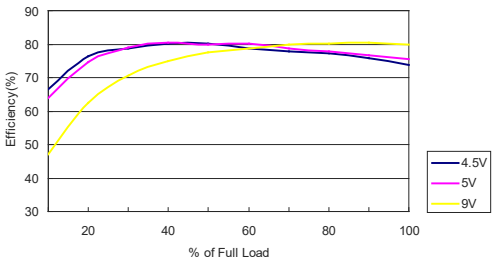
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



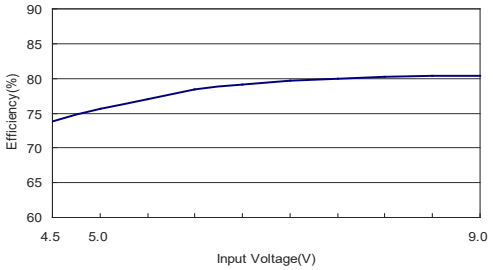

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

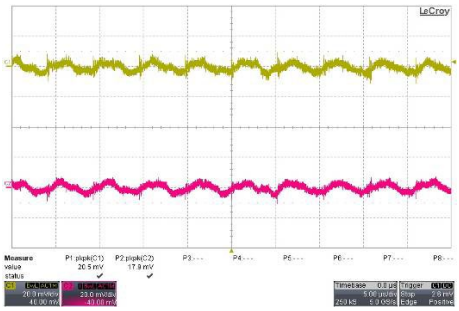
All test conditions are at 25°C  The figures are identical for MSDW1015



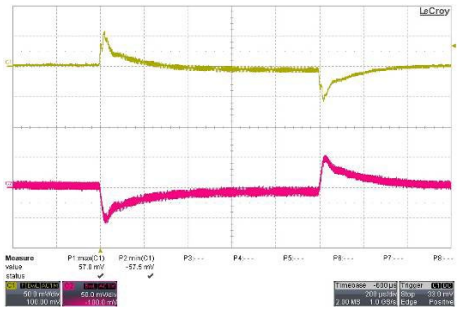

Efficiency Versus Output Current



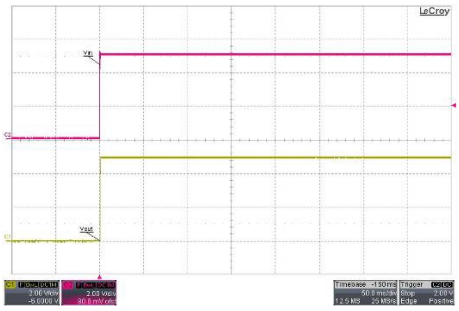

Efficiency Versus Input Voltage
Full Load



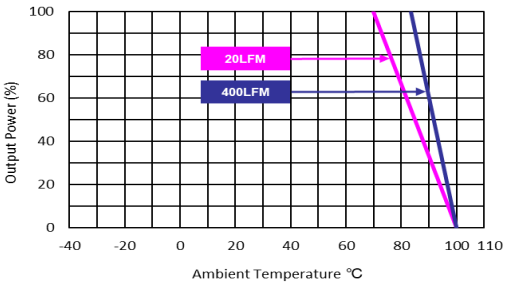
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



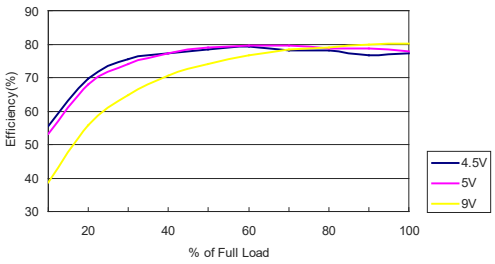
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$ ; Full Load



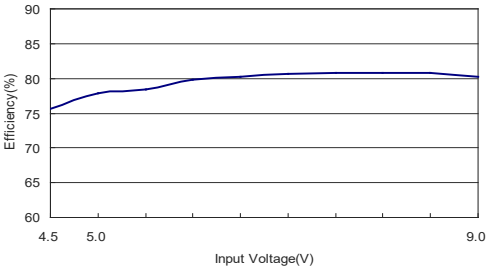

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

## Characteristic Curves

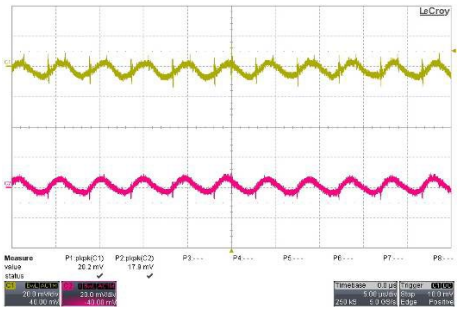
All test conditions are at 25°C  The figures are identical for MSDW1016



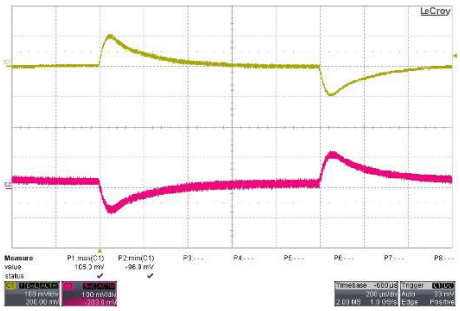

Efficiency Versus Output Current




Efficiency Versus Input Voltage
Full Load

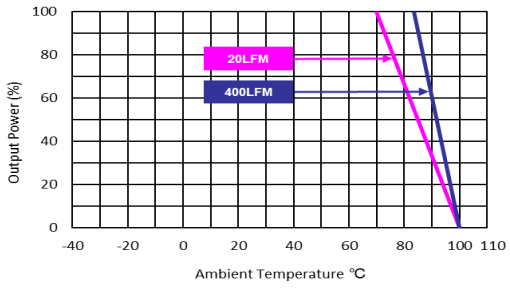


Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$

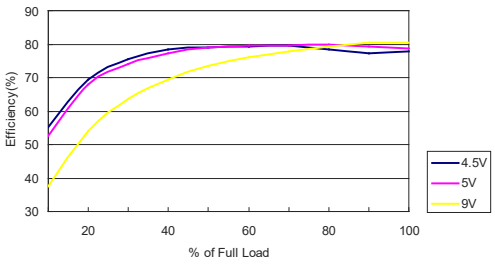
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$ ; Full Load



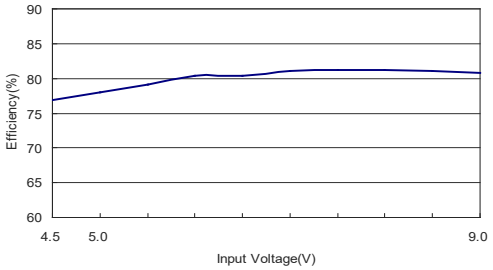

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

## Characteristic Curves

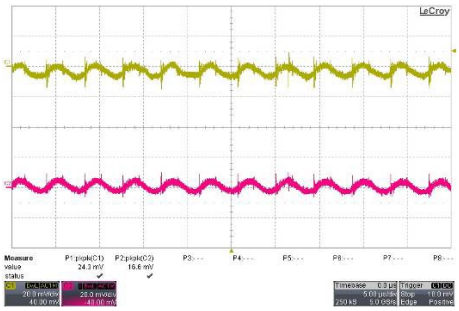
All test conditions are at 25℃ The figures are identical for MSDW1017



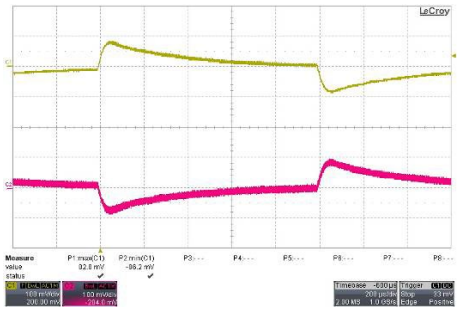

Efficiency Versus Output Current



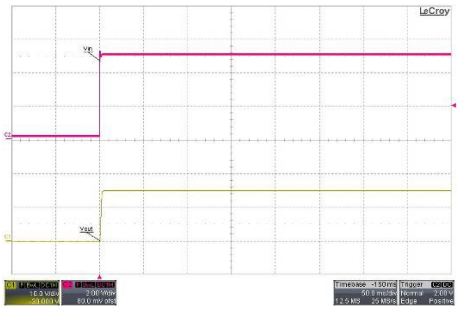

Efficiency Versus Input Voltage
Full Load



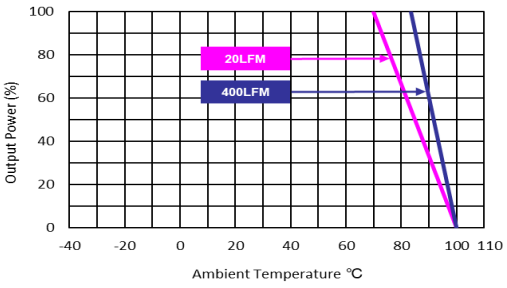
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



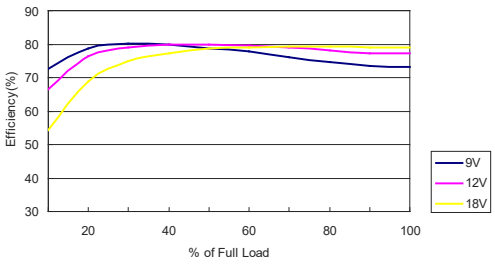
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



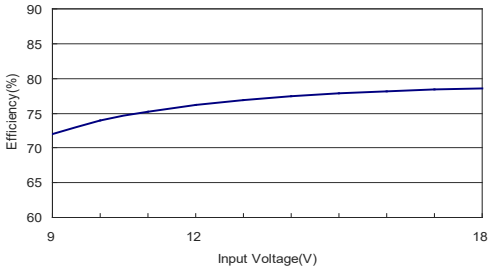

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

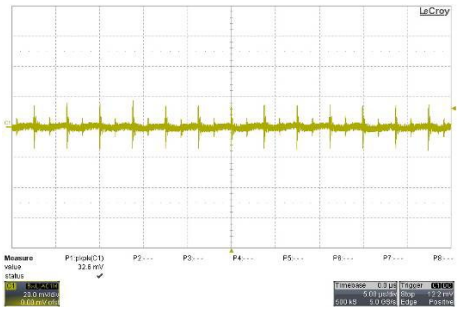
All test conditions are at 25℃ The figures are identical for MSDW1021



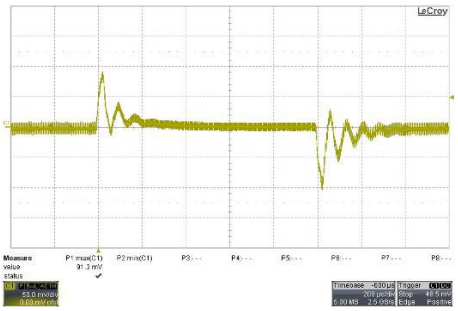

Efficiency Versus Output Current



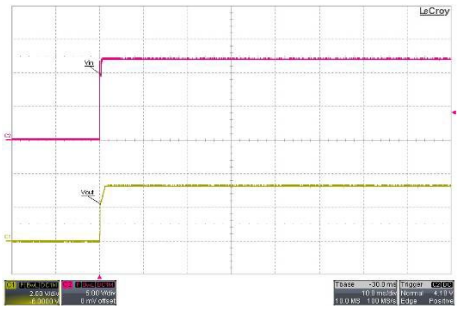

Efficiency Versus Input Voltage
Full Load



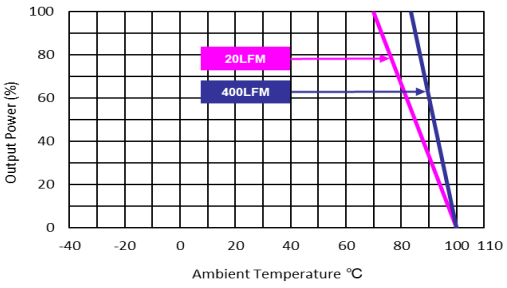
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



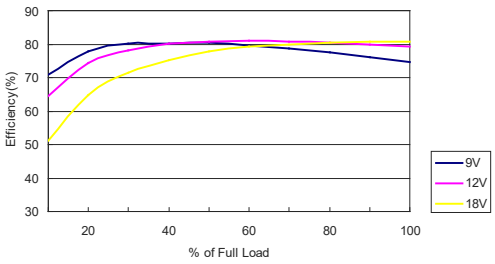
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$ ; Full Load



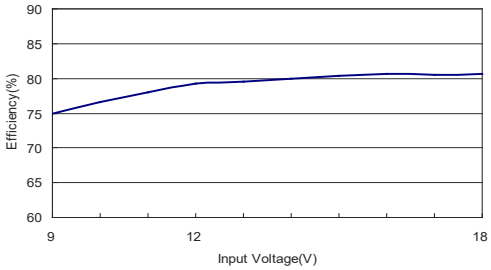

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

## Characteristic Curves

All test conditions are at 25℃ The figures are identical for MSDW1022

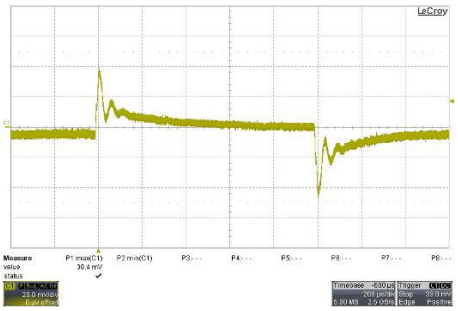



Efficiency Versus Output Current

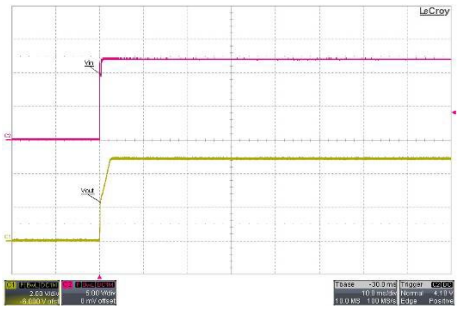



Efficiency Versus Input Voltage
Full Load

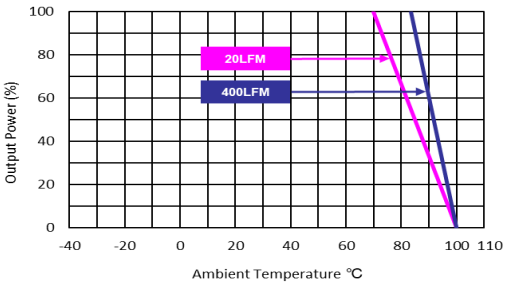
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



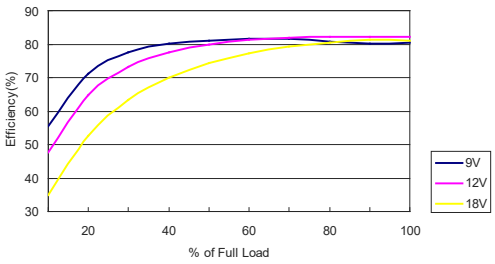
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$ ; Full Load



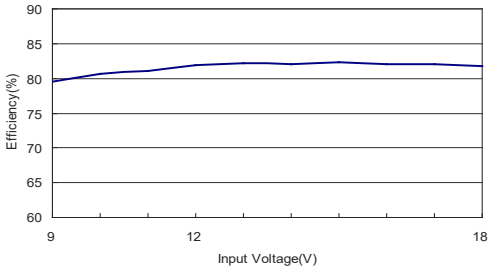

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

## Characteristic Curves

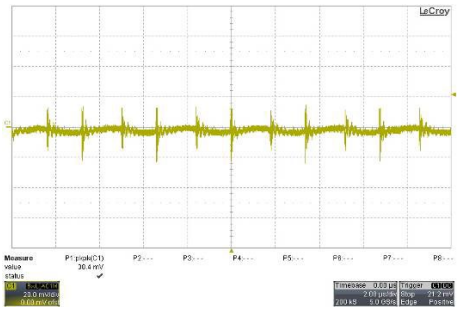
All test conditions are at 25°C  The figures are identical for MSDW1023



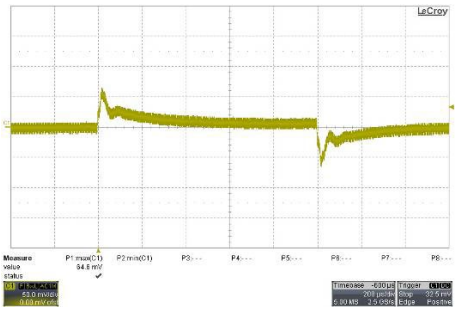

Efficiency Versus Output Current



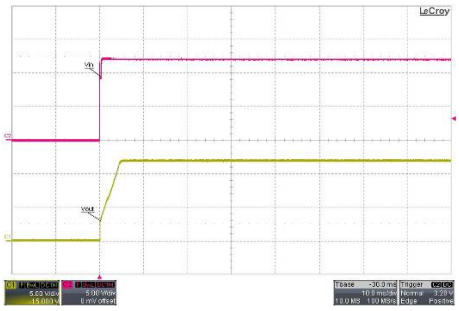

Efficiency Versus Input Voltage
Full Load



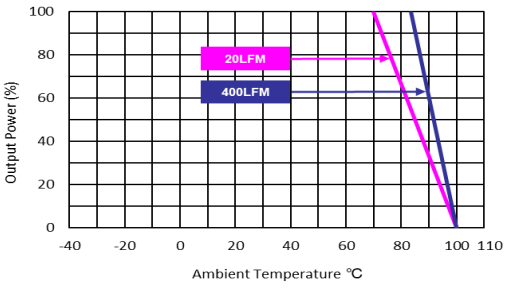
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



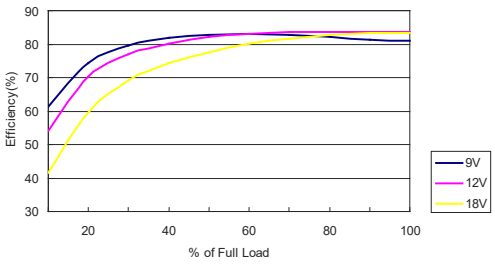
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$ ; Full Load



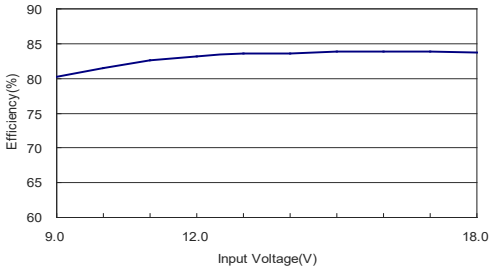

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

## Characteristic Curves

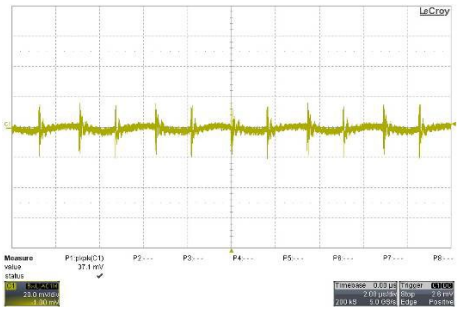
All test conditions are at 25℃ The figures are identical for MSDW1024



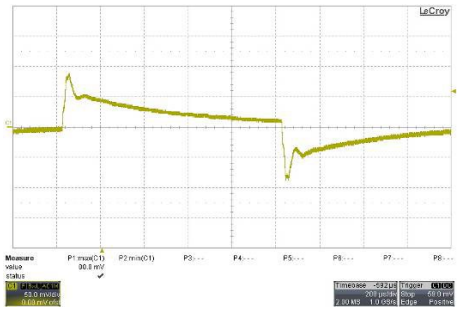

Efficiency Versus Output Current



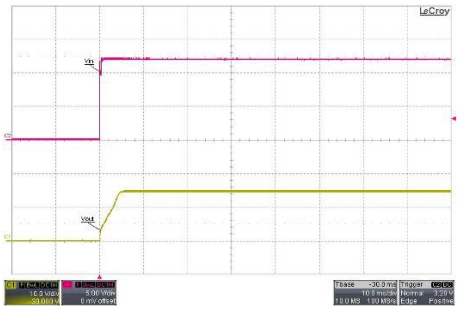

Efficiency Versus Input Voltage
Full Load



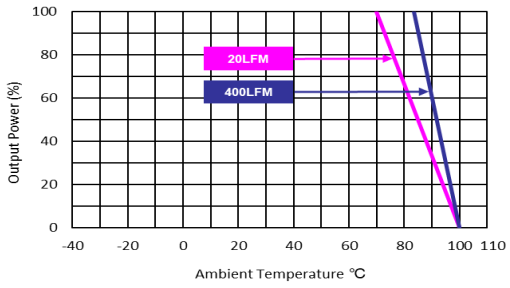
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



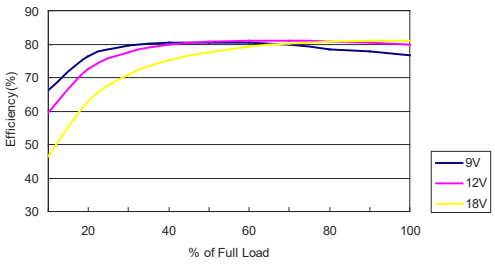
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



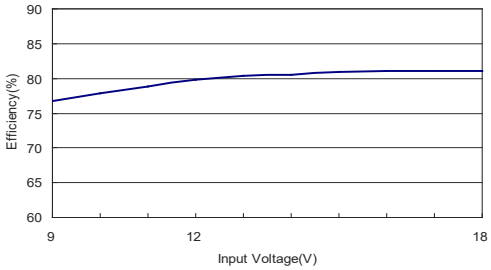

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

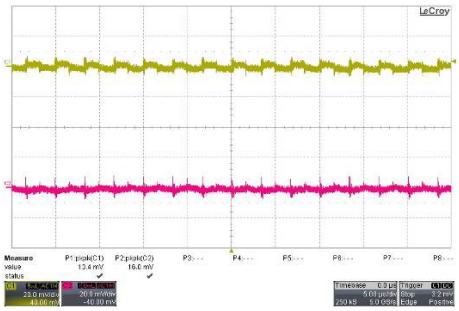
All test conditions are at 25℃ The figures are identical for MSDW1025



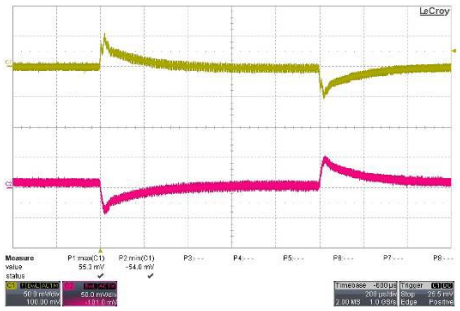

Efficiency Versus Output Current



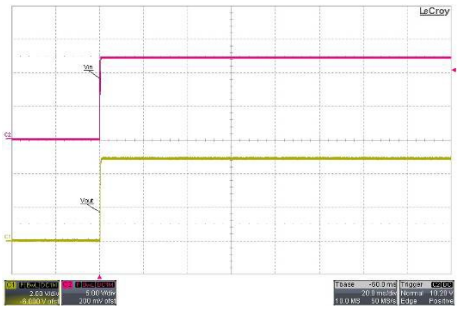

Efficiency Versus Input Voltage
Full Load



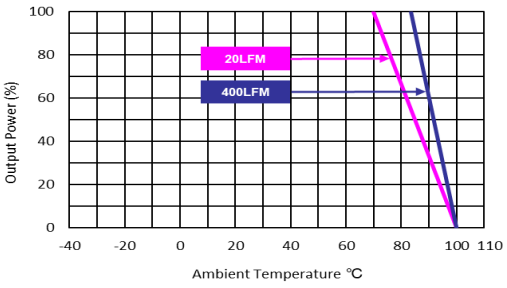
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



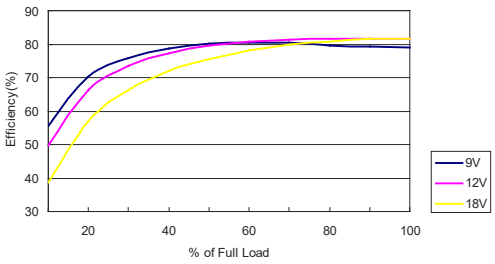
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$ ; Full Load



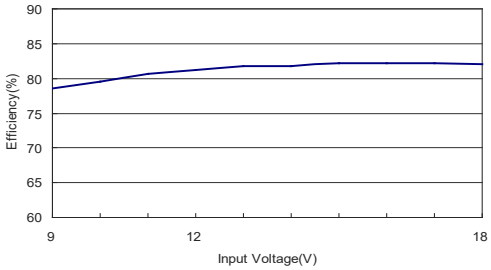

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

## Characteristic Curves

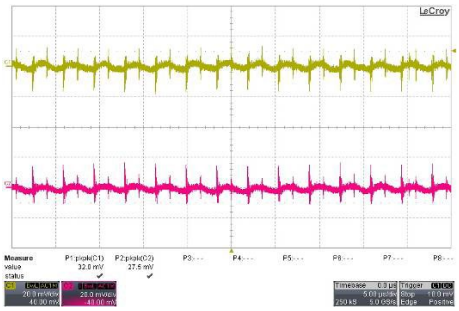
All test conditions are at 25℃ The figures are identical for MSDW1026



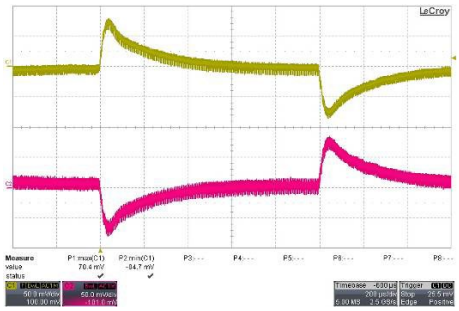

Efficiency Versus Output Current



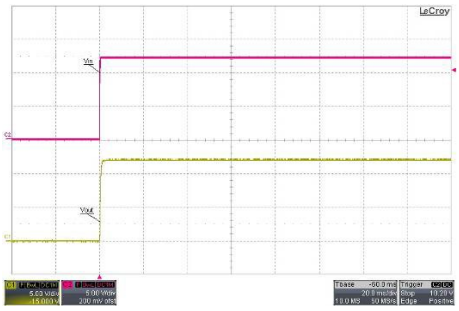

Efficiency Versus Input Voltage
Full Load



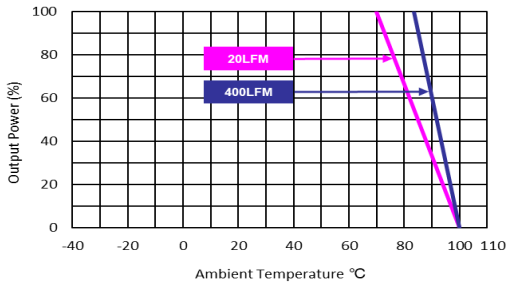
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



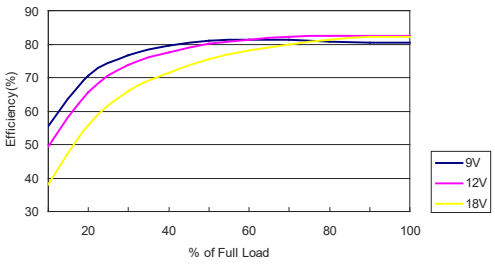
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$ ; Full Load



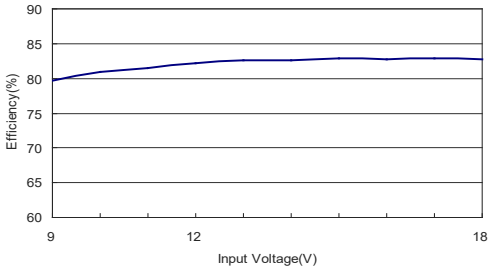

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

## Characteristic Curves

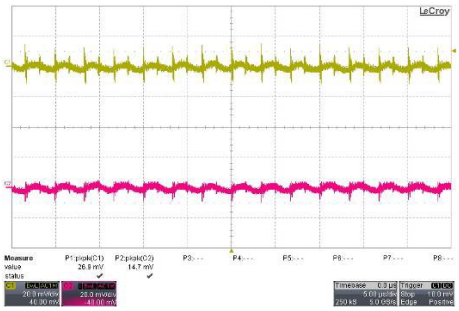
All test conditions are at 25℃ The figures are identical for MSDW1027



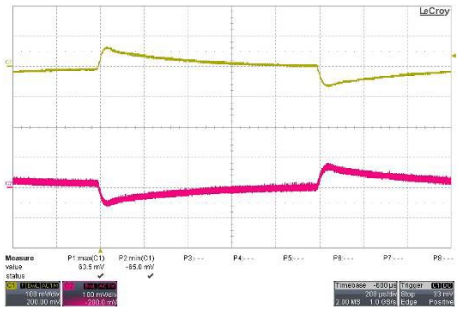

Efficiency Versus Output Current



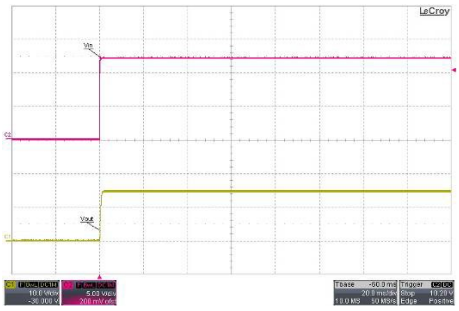

Efficiency Versus Input Voltage
Full Load



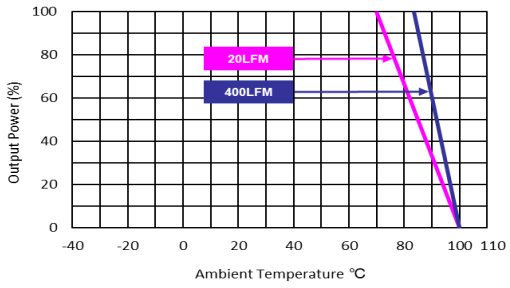
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



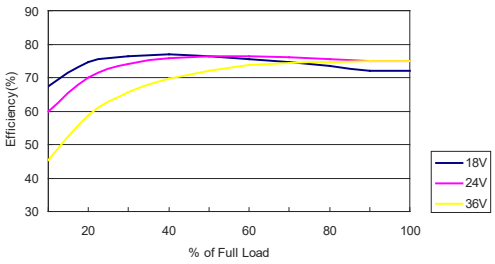
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



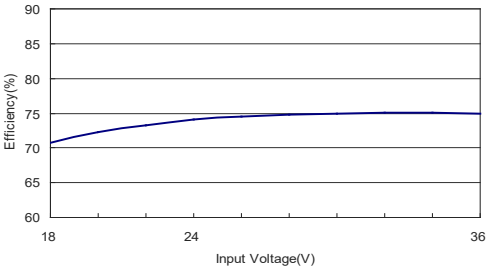

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

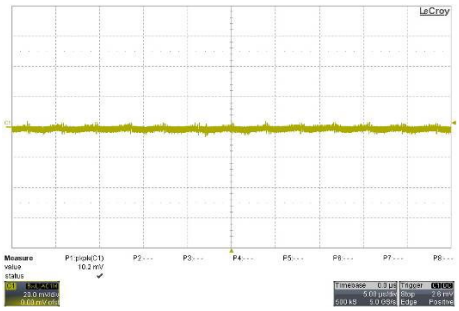
All test conditions are at 25℃ The figures are identical for MSDW1031



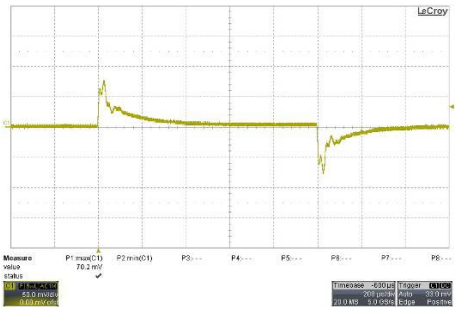

Efficiency Versus Output Current



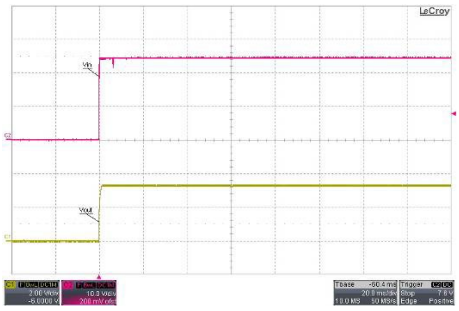

Efficiency Versus Input Voltage
Full Load



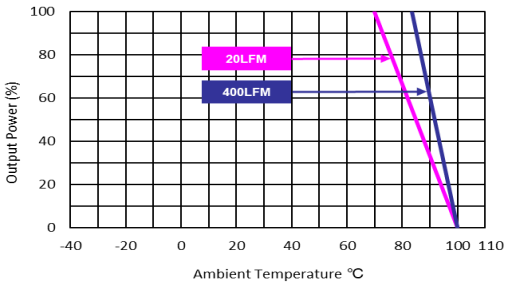
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



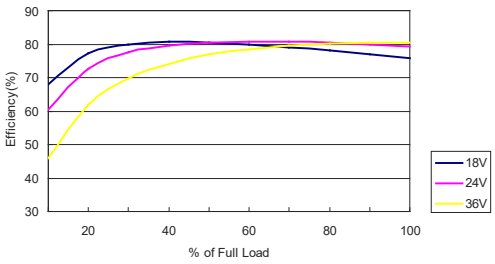
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$ ; Full Load



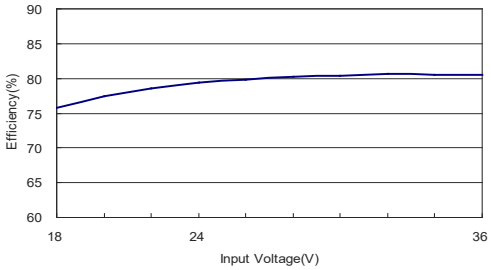

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

## Characteristic Curves

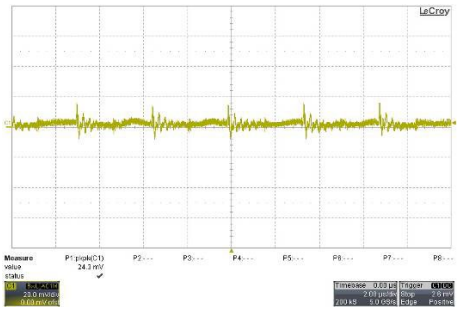
All test conditions are at 25℃ The figures are identical for MSDW1032



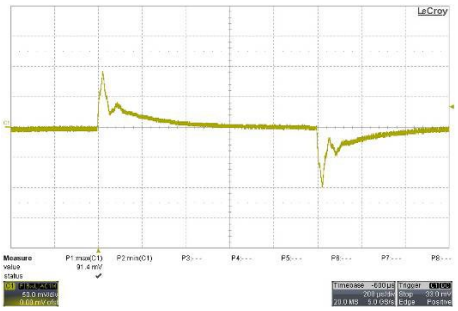

Efficiency Versus Output Current



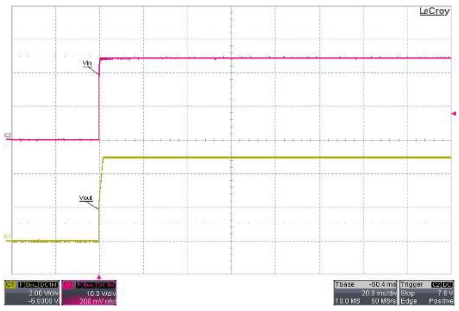

Efficiency Versus Input Voltage
Full Load



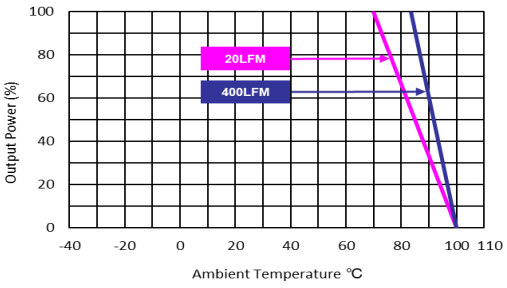
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



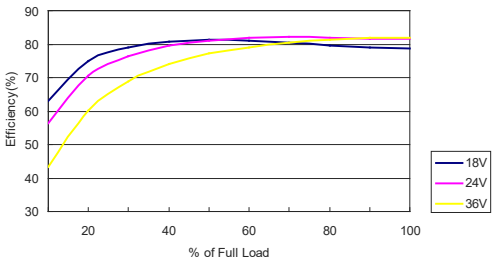
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



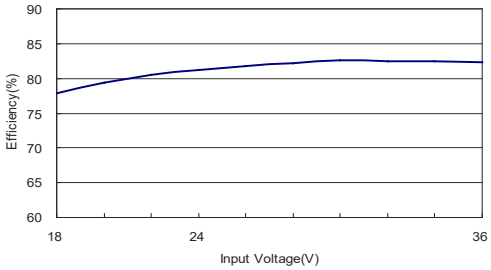

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

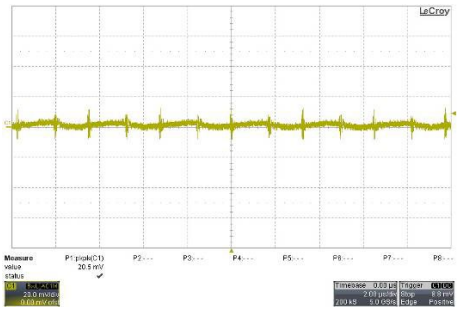
All test conditions are at 25℃ The figures are identical for MSDW1033



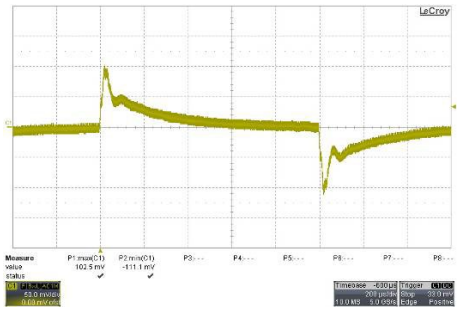

Efficiency Versus Output Current



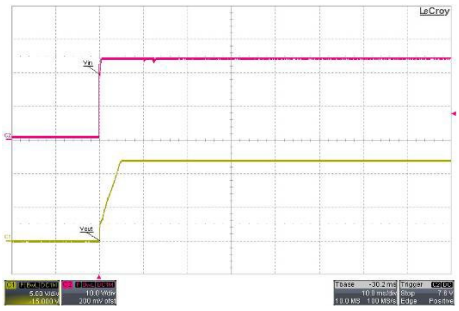

Efficiency Versus Input Voltage
Full Load



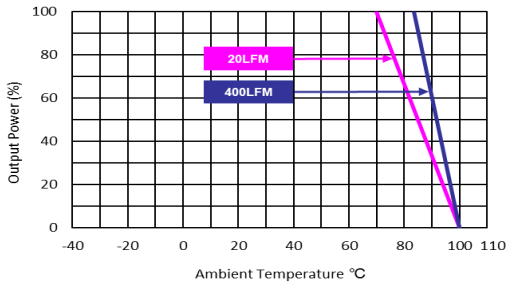
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



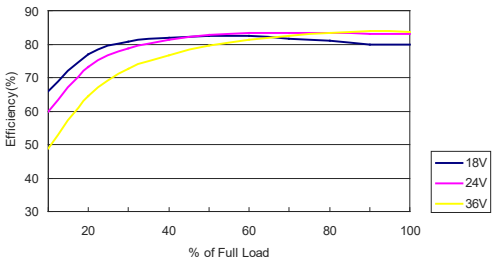
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



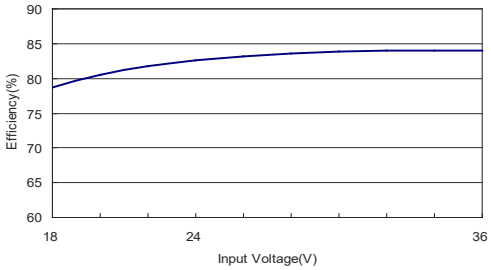

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

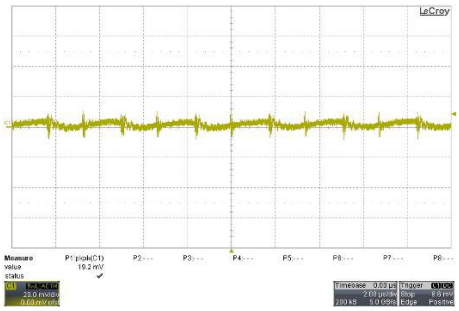
All test conditions are at 25℃ The figures are identical for MSDW1034



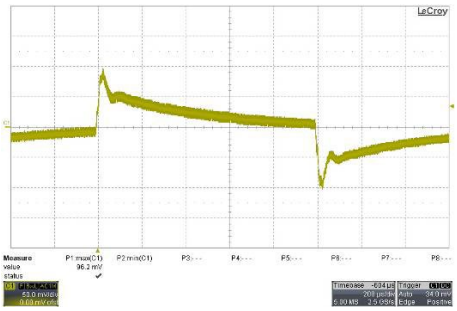

Efficiency Versus Output Current



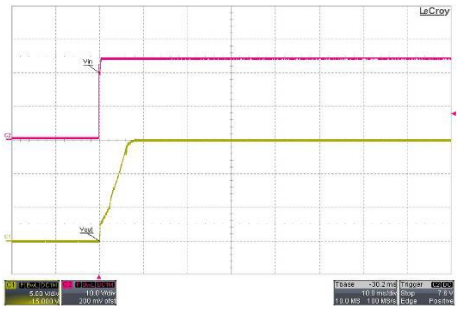

Efficiency Versus Input Voltage
Full Load



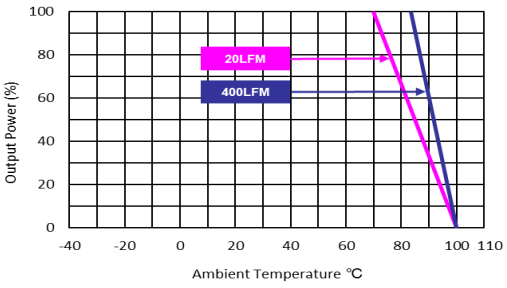
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



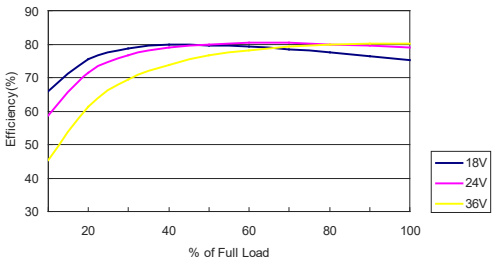
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



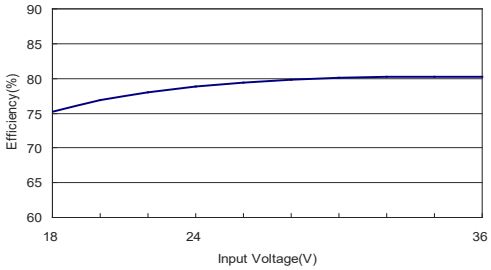

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

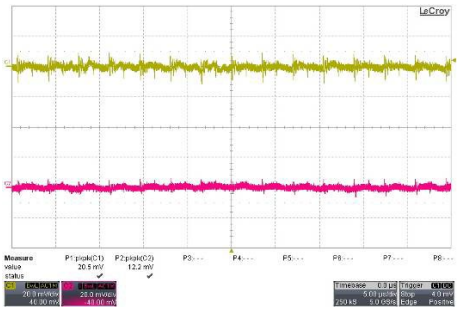
All test conditions are at 25°C  The figures are identical for MSDW1035



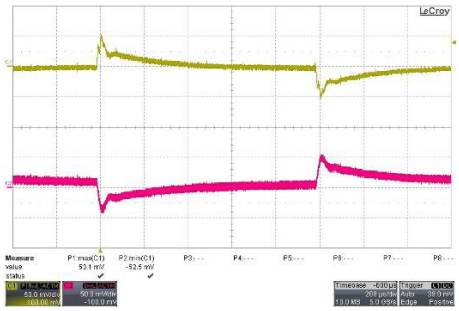

Efficiency Versus Output Current



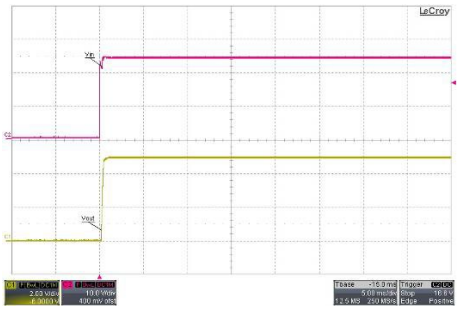

Efficiency Versus Input Voltage
Full Load



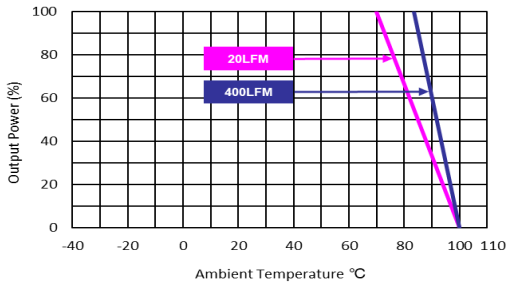
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



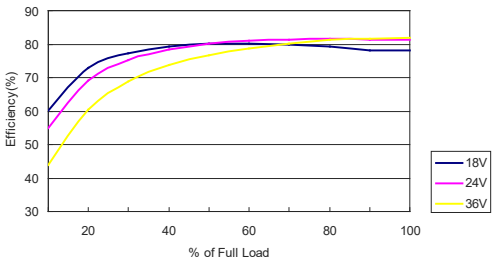
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$ ; Full Load



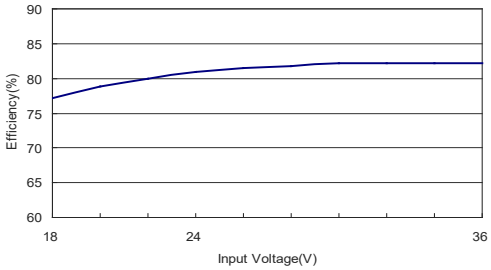

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

## Characteristic Curves

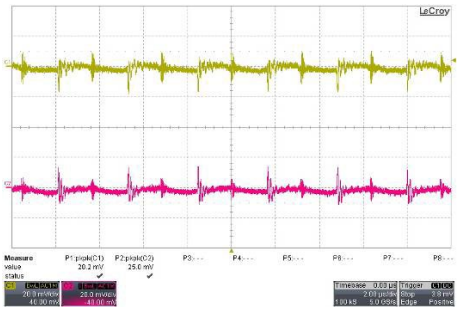
All test conditions are at 25℃ The figures are identical for MSDW1036



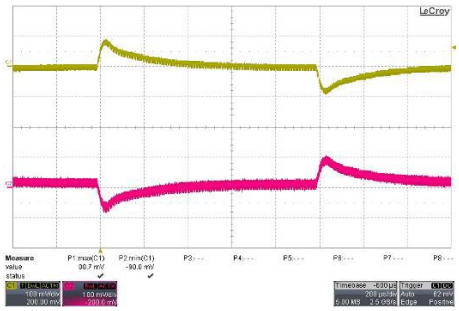

Efficiency Versus Output Current



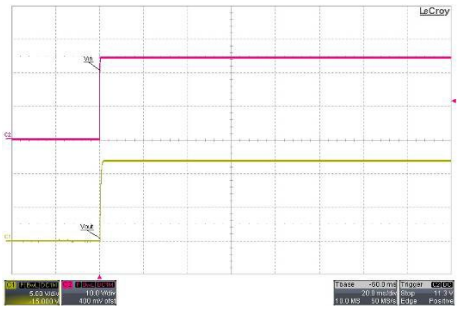

Efficiency Versus Input Voltage
Full Load



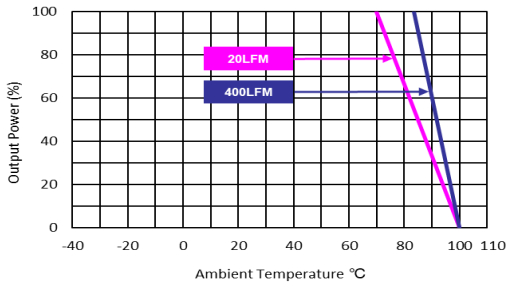
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



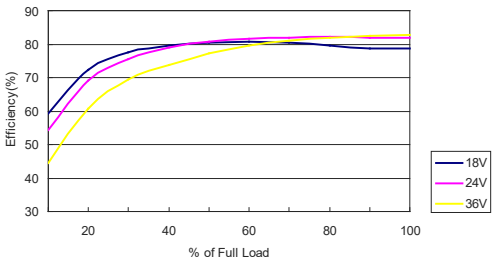
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$ ; Full Load



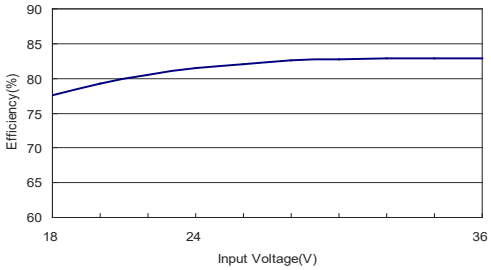

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

## Characteristic Curves

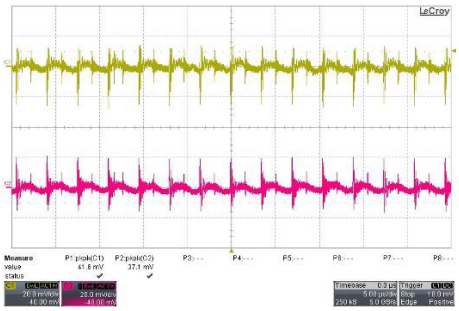
All test conditions are at 25℃ The figures are identical for MSDW1037



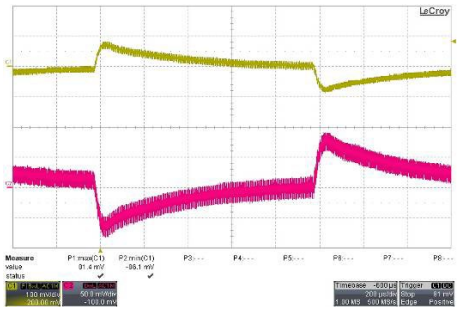

Efficiency Versus Output Current



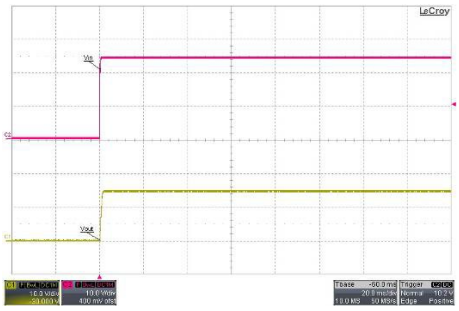

Efficiency Versus Input Voltage
Full Load



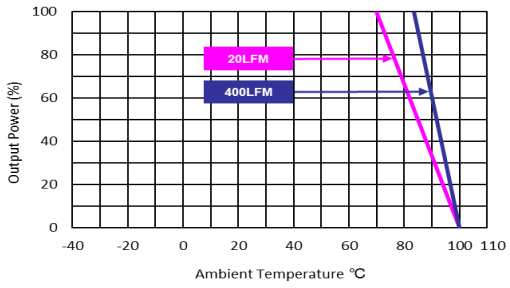
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



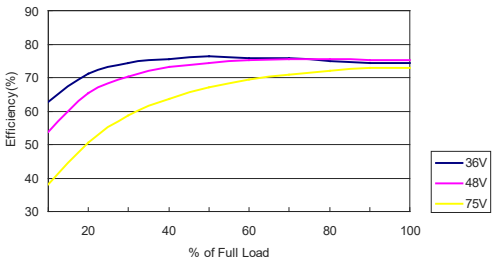
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



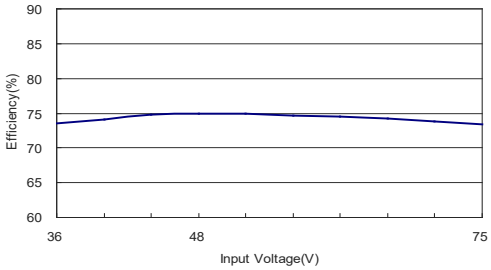

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

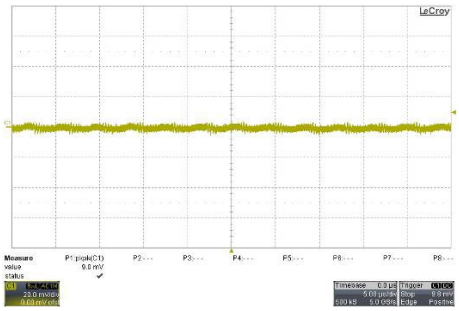
All test conditions are at 25℃ The figures are identical for MSDW1041



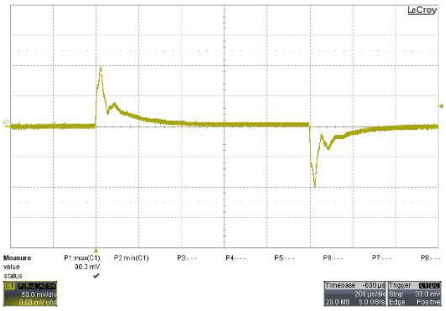

Efficiency Versus Output Current



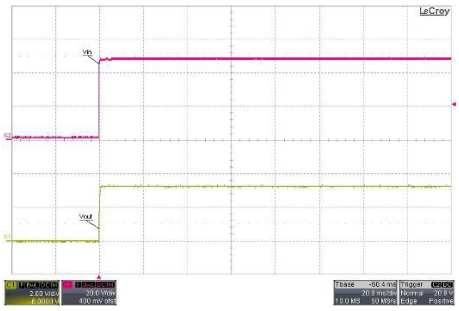

Efficiency Versus Input Voltage
Full Load



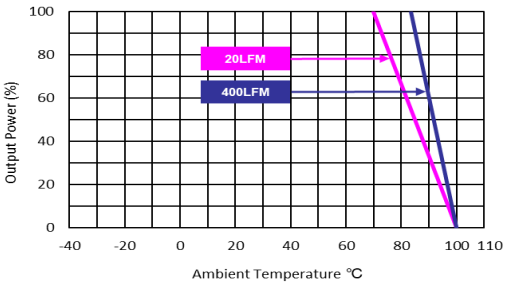
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



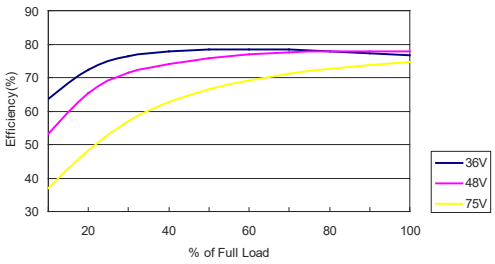
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



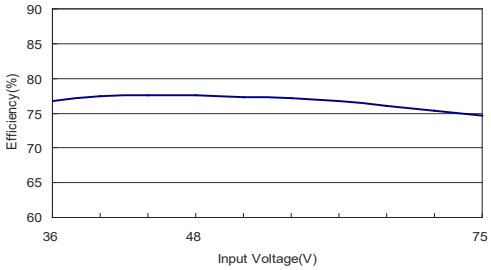

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

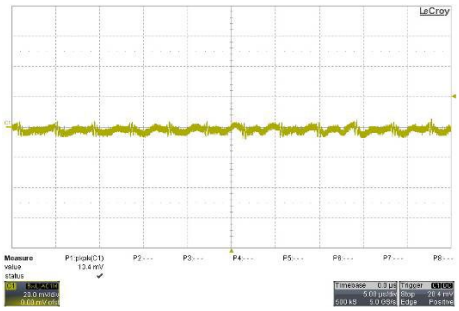
All test conditions are at 25℃ The figures are identical for MSDW1042



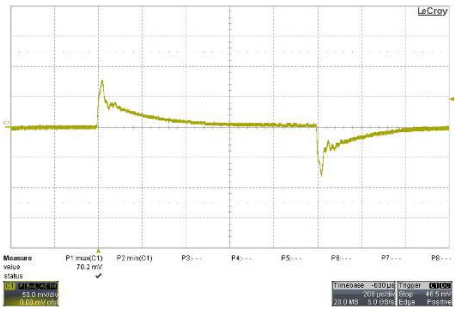

Efficiency Versus Output Current



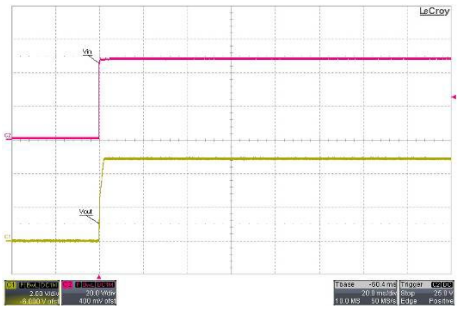

Efficiency Versus Input Voltage
Full Load



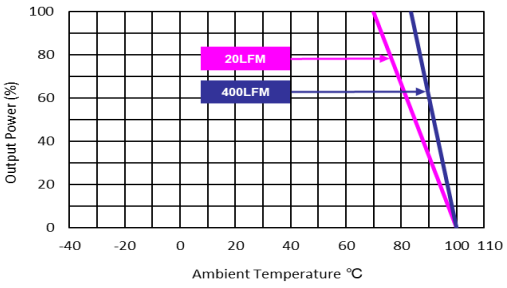
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$



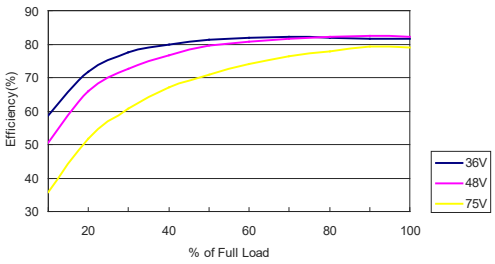
Typical Input Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$ ; Full Load



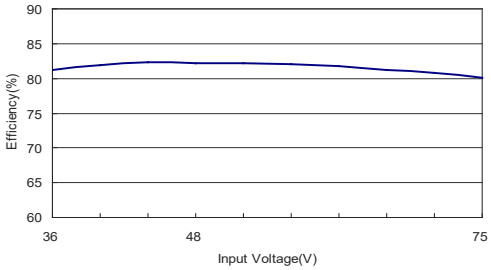

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

## Characteristic Curves

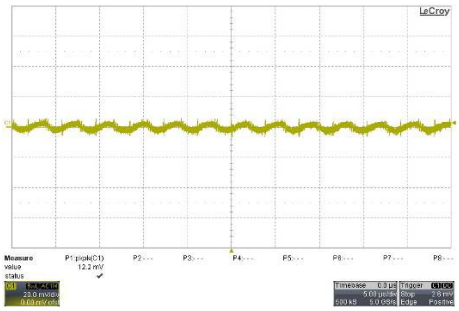
All test conditions are at 25℃ The figures are identical for MSDW1043



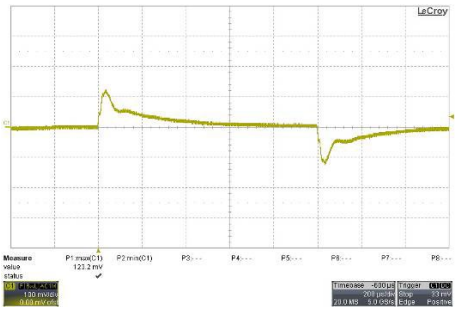

Efficiency Versus Output Current



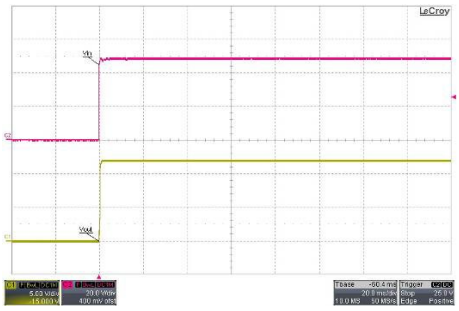

Efficiency Versus Input Voltage
Full Load



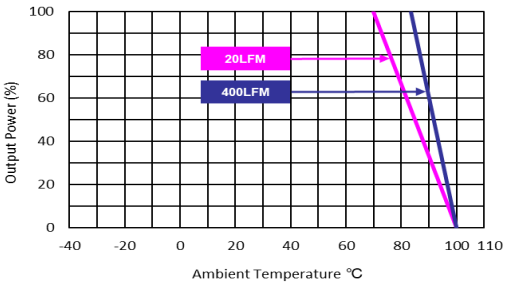
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



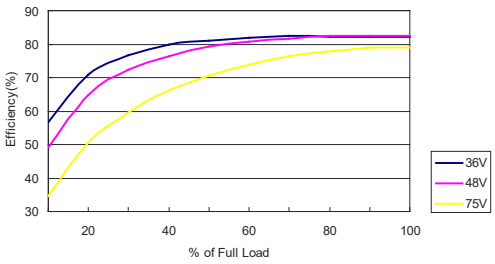
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



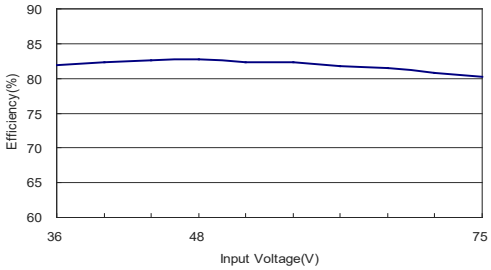

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

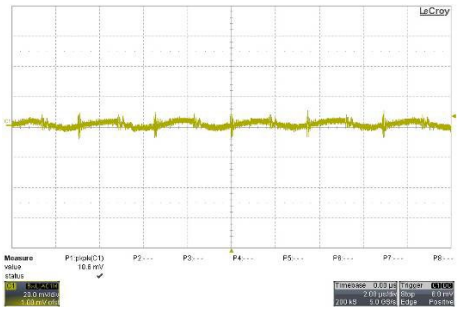
All test conditions are at 25℃ The figures are identical for MSDW1044



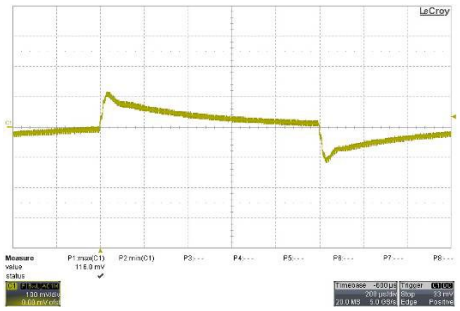

Efficiency Versus Output Current



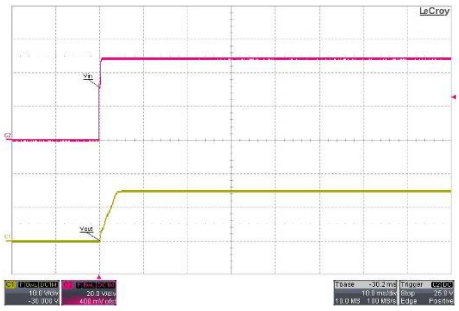

Efficiency Versus Input Voltage
Full Load



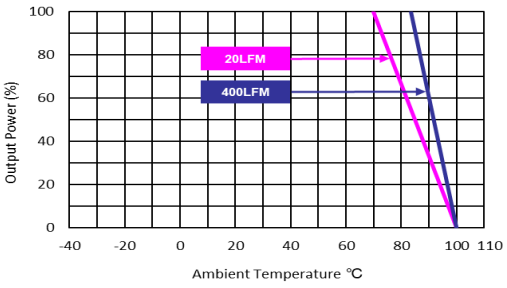
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



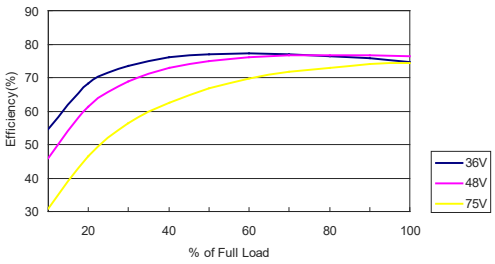
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



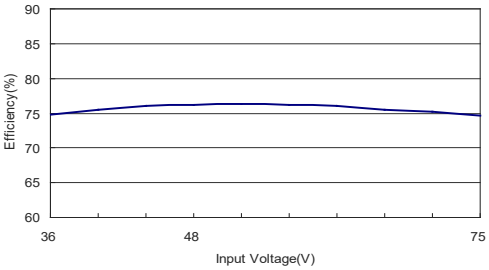

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

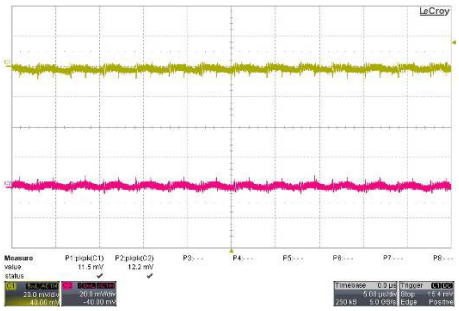
All test conditions are at 25℃ The figures are identical for MSDW1045



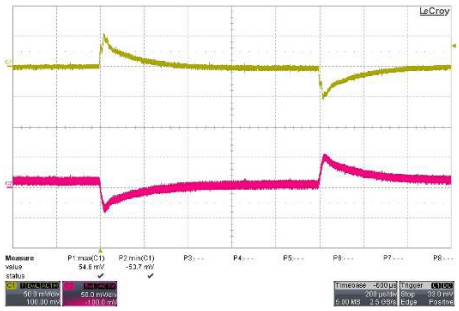

Efficiency Versus Output Current



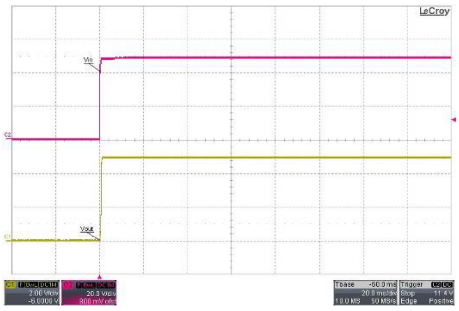

Efficiency Versus Input Voltage
Full Load



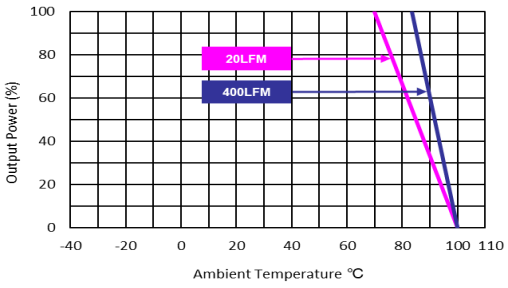
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



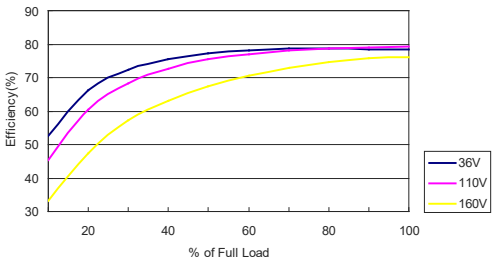
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



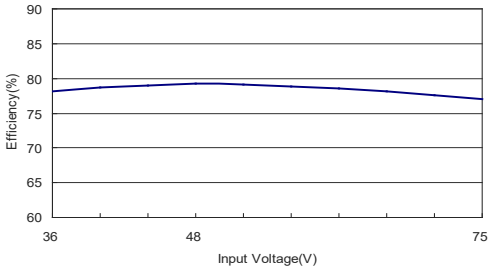

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

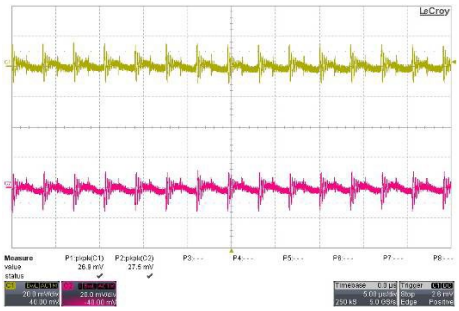
All test conditions are at 25℃ The figures are identical for MSDW1046



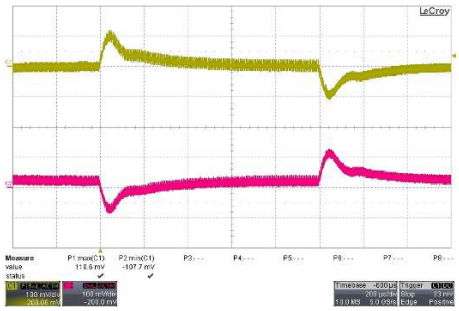

Efficiency Versus Output Current



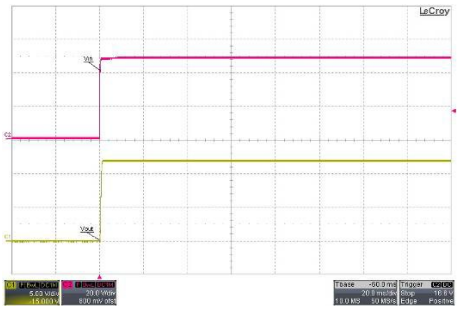

Efficiency Versus Input Voltage
Full Load



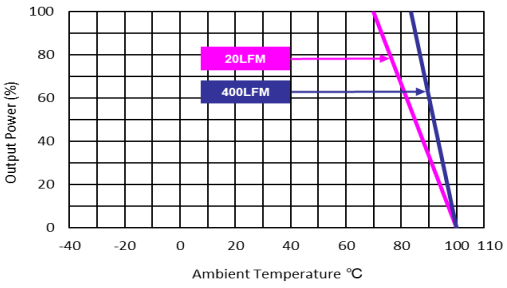
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



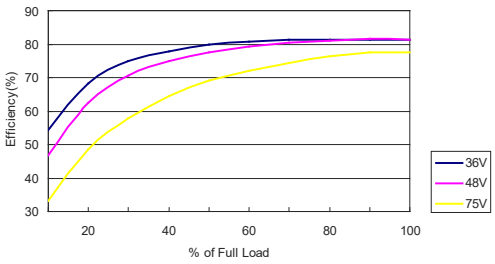
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



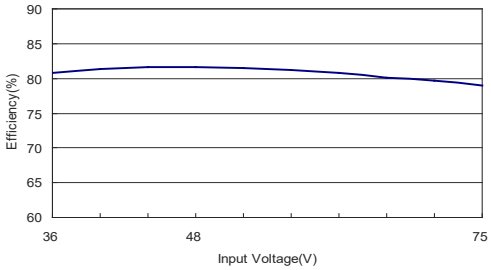

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

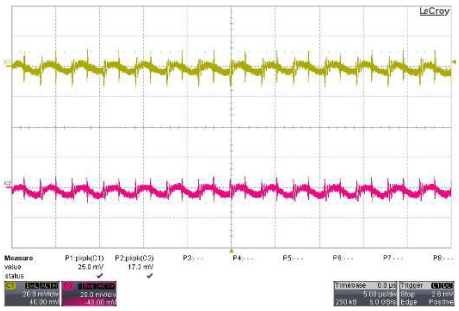
All test conditions are at 25℃ The figures are identical for MSDW1047



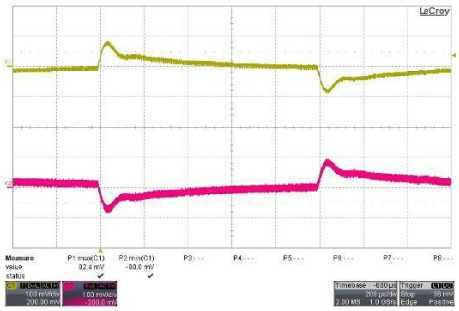

Efficiency Versus Output Current



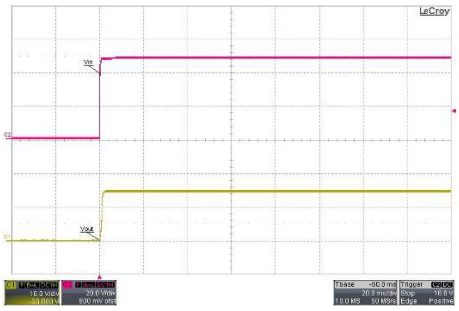

Efficiency Versus Input Voltage
Full Load



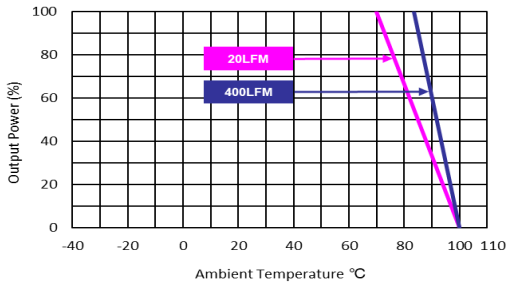
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



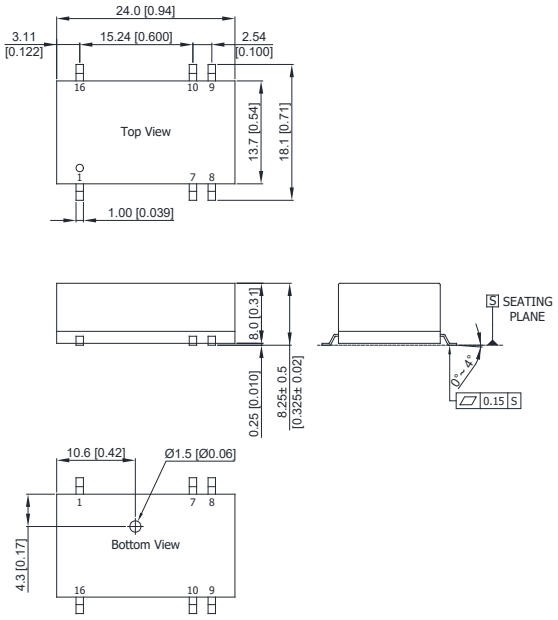
Typical Input Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



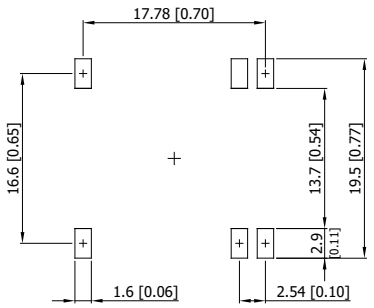

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## 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 |
| 7 | NC | NC |
| 8 | NC | Common |
| 9 | +Vout | +Vout |
| 10 | -Vout | -Vout |
| 16 | +Vin | +Vin |

NC : No Connection

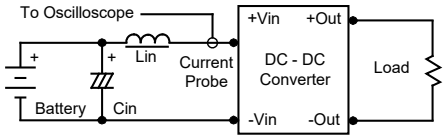
### Physical Characteristics

| | | |
|---|---|---|
| Case Size | : | 24.0x13.7x8.0mm (0.94x0.54x0.31 inches) |
| Case Material | : | Plastic resin (flammability to UL 94V-0 rated) |
| Pin Material | : | Phosphor Bronze |
| Weight | : | 5.1g |

## Test Setup

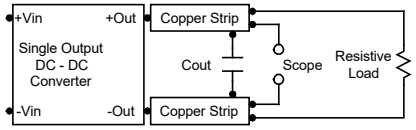
### Input Reflected-Ripple Current Test Setup

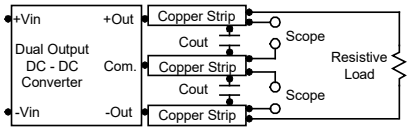
Input reflected-ripple current is measured with a inductor Lin (4.7μH) and Cin (220μF, ESR < 1.0Ω at 100 kHz) to simulate source impedance.
Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 kHz.




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

Use a Cout 0.47μF 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.



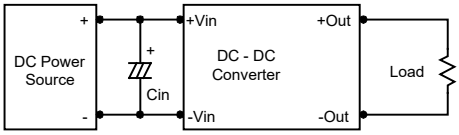

## Technical Notes

### Overcurrent Protection

To provide protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure current limiting for an unlimited duration. At the point of current-limit inception, the unit shifts from voltage control to current control. The unit operates normally once the output current is brought back into its specified range.

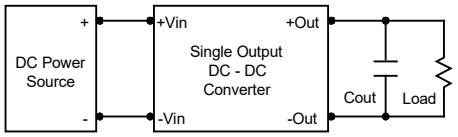
### Input Source Impedance

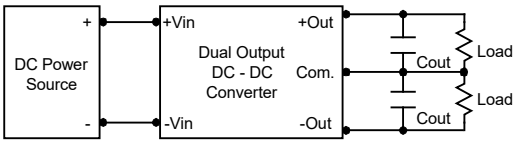
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module.
In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor on the input to insure startup.
By using a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 kHz) capacitor of a 8.2μF for the 5V input devices, a 3.3μF for the 12V input devices and a 1.5μF for the 24V and 48V devices, capacitor mounted close to the power module helps ensure stability of the unit.




### 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.



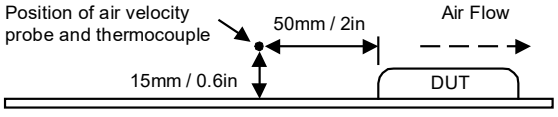




### Maximum Capacitive Load

The MSDW1000 series has limitation of maximum connected capacitance on the output. The power module may operate 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.

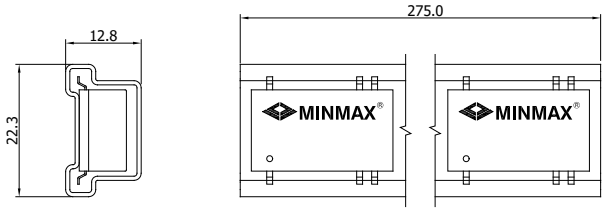
### Thermal Considerations

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 a test setup.

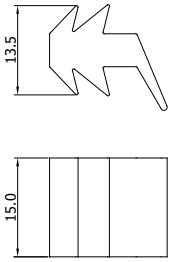


## Packaging Information for Tube

Tube



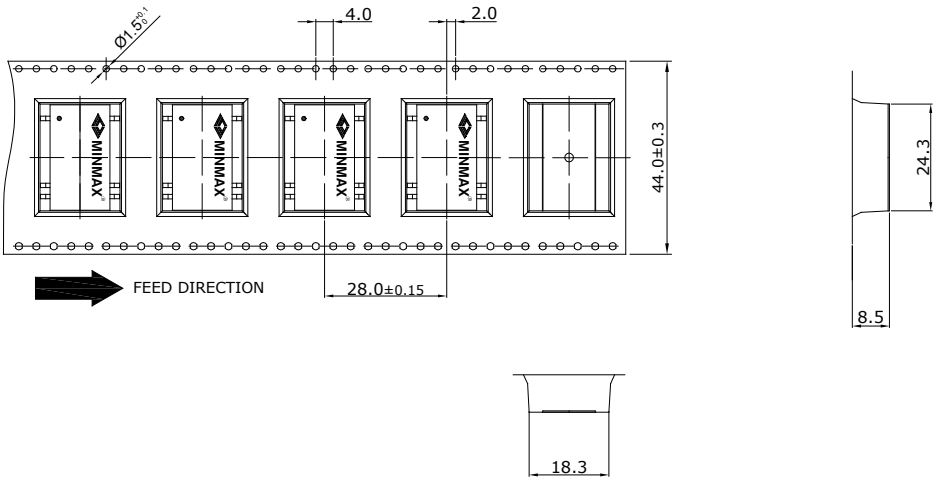

Plug



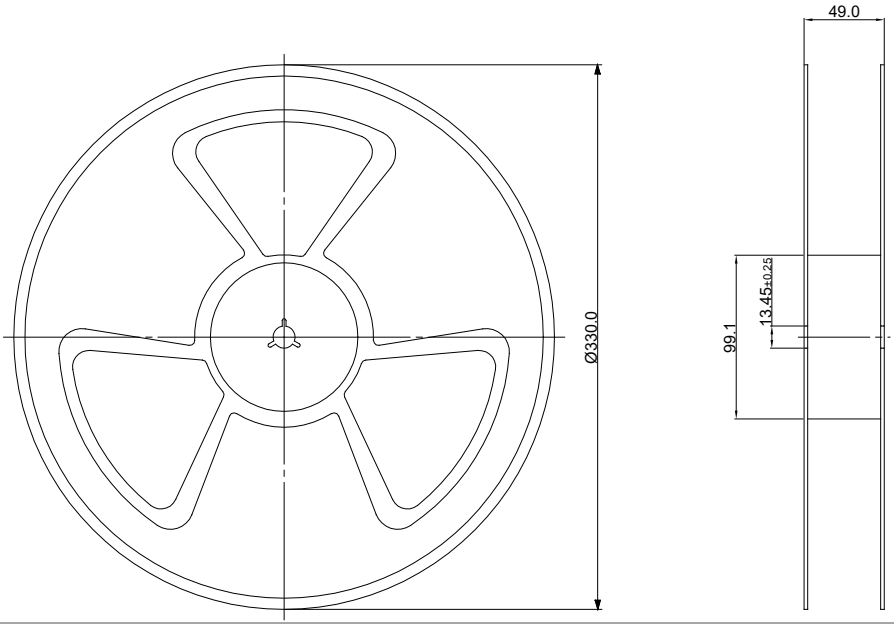

Unit: mm
10 PCS per TUBE

## Packaging Information for Tape & Reel

Tape




Reel




| Packaging Style | Quantity |
|---|---|
| With Heatsink Tube | N/A |
| Tape and Reel to IEC 286-3 Specifications | 250 |

## 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.

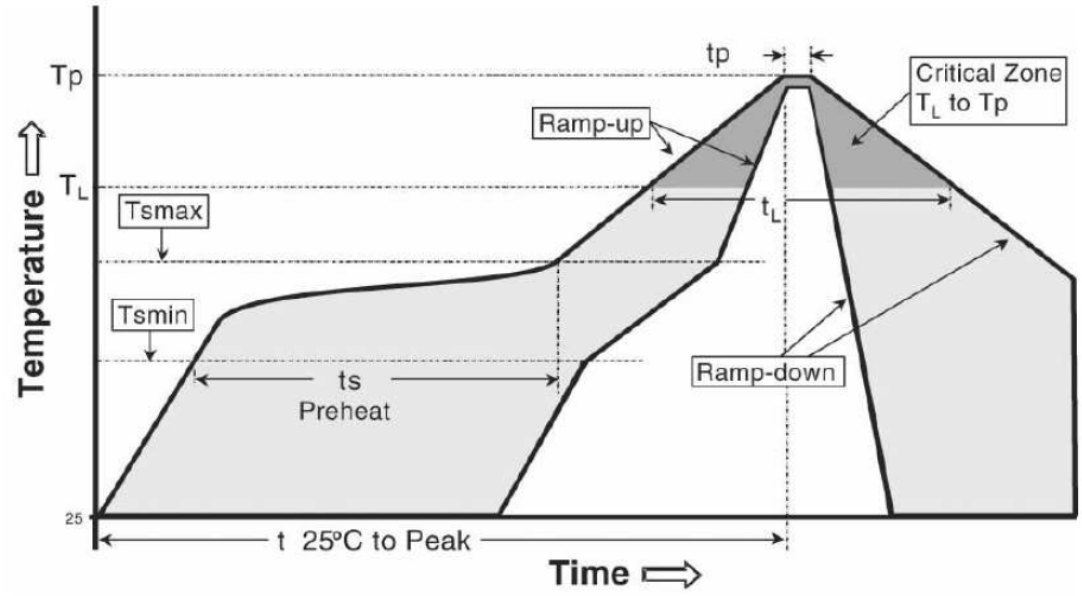



Table 4-1 SnPb Eutectic Process-Classification Temperatures ($T_C$)

| | 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 | SD | W | 101 | 1 |
|---|---|---|---|---|
| | Package Type<br>SMD-16 | Wide 2:1<br>Input Voltage Range | Input Voltage Range<br>101: 4.5 ~ 9 VDC<br>102: 9 ~ 18 VDC<br>103: 18 ~ 36 VDC<br>104: 36 ~ 75 VDC | Output Voltage<br>1: 3.3 VDC<br>2: 5 VDC<br>3: 12 VDC<br>4: 15 VDC<br>5: ±5 VDC<br>6: ±12 VDC<br>7: ±15 VDC |

## MTBF and Reliability

The MTBF of MSDW1000 series of DC-DC converters has been calculated using

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

| Model | MTBF | Unit |
|---|---|---|
| MSDW1011 | 1,360,729 | Hours |
| MSDW1012 | 1,699,813 | |
| MSDW1013 | 1,389,082 | |
| MSDW1014 | 1,389,082 | |
| MSDW1015 | 1,340,123 | |
| MSDW1016 | 1,366,867 | |
| MSDW1017 | 1,366,867 | |
| MSDW1021 | 1,370,238 | |
| MSDW1022 | 1,370,238 | |
| MSDW1023 | 1,403,115 | |
| MSDW1024 | 1,403,115 | |
| MSDW1025 | 1,353,363 | |
| MSDW1026 | 1,380,643 | |
| MSDW1027 | 1,380,643 | |
| MSDW1031 | 1,365,934 | |
| MSDW1032 | 1,365,934 | |
| MSDW1033 | 1,407,856 | |
| MSDW1034 | 1,407,856 | |
| MSDW1035 | 1,347,709 | |
| MSDW1036 | 1,374,759 | |
| MSDW1037 | 1,374,759 | |
| MSDW1041 | 1,367,428 | |
| MSDW1042 | 1,367,428 | |
| MSDW1043 | 1,394,895 | |
| MSDW1044 | 1,394,895 | |
| MSDW1045 | 1,331,381 | |
| MSDW1046 | 1,357,773 | |
| MSDW1047 | 1,357,773 | |