MINMAX®

MSCWI02 Series

Electric Characteristic Note

# MSCWI02 Series EC Note

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

## Features


- **Very Compact SMD Package**
- **Ultra-wide 4:1 Input Voltage Range**
- **Fully Regulated Output Voltage**
- **I/O Isolation 1500VDC**
- **Operating Ambient Temp. Range -40℃ to +80℃**
- **No Min. Load Requirement**
- **Under-voltage, Overload and Short Circuit Protection**
- **Remote On/Off Control**
- **EMI Emission EN55032 Class A Approved**
- **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 62368-1(60950-1) Safety Approval & CE Marking**

## Applications

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

## Product Overview

The MINMAX MSCWI02 series is a range of isolated 2W DC-DC converter modules-features ultra-wide input voltage ranges and fully regulated output voltage. The product come in a SMD package with very small footprint occupying only 0.3 $in^2$ (0.2 $cm^2$) of PCB space. The converters are qualified to withstand lead free reflow processes according to IPC J-STD-020D.1 standard. High efficiency allows operating temperatures range of -40℃ to 80℃. Further features include under-voltage protection, overload protection, short circuit protection, no min. load requirement and remote ON/OFF. These DC-DC converters offer the best solution for many space critical applications in battery-powered equipment, instrumentation, distributed power architectures in communication and industrial electronics.

## Table of contents

## Model Selection Guide

| Model Number | Input Voltage (Range) | Output Voltage | Output Current | Input Current | | Max. capacitive Load | Efficiency (typ.) |
|---|---|---|---|---|---|---|---|
| | | | Max. | @Max. Load | @No Load | | @Max. Load |
| | VDC | VDC | mA | mA(typ.) | mA(typ.) | µF | % |
| **MSCWI02-05S05** | 5 (4.5 ~ 12) | 5 | 400 | 500 | 40 | 1680 | 80 |
| **MSCWI02-05S12** | | 12 | 167 | 477 | | 820 | 84 |
| **MSCWI02-05S15** | | 15 | 134 | 484 | | 680 | 83 |
| **MSCWI02-05S24** | | 24 | 83 | 474 | | 390 | 84 |
| **MSCWI02-05D12** | | ±12 | ±83 | 480 | | 470# | 83 |
| **MSCWI02-05D15** | | ±15 | ±67 | 490 | | 330# | 82 |
| **MSCWI02-24S05** | 24 (9 ~ 36) | 5 | 400 | 104 | 20 | 1680 | 80 |
| **MSCWI02-24S12** | | 12 | 167 | 99 | | 820 | 84 |
| **MSCWI02-24S15** | | 15 | 134 | 99 | | 680 | 85 |
| **MSCWI02-24S24** | | 24 | 83 | 98 | | 390 | 85 |
| **MSCWI02-24D12** | | ±12 | ±83 | 100 | | 470# | 83 |
| **MSCWI02-24D15** | | ±15 | ±67 | 101 | | 330# | 83 |
| **MSCWI02-48S05** | 48 (18 ~ 75) | 5 | 400 | 53 | 10 | 1680 | 78 |
| **MSCWI02-48S12** | | 12 | 167 | 51 | | 820 | 82 |
| **MSCWI02-48S15** | | 15 | 134 | 51 | | 680 | 83 |
| **MSCWI02-48S24** | | 24 | 83 | 49 | | 390 | 84 |
| **MSCWI02-48D12** | | ±12 | ±83 | 51 | | 470# | 82 |
| **MSCWI02-48D15** | | ±15 | ±67 | 51 | | 330# | 82 |

# For each output

## Input Specifications

| Parameter | Conditions / Model | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Input Surge Voltage (1 sec. max.) | 5V Input Models | -0.7 | --- | 15 | VDC |
| | 24V Input Models | -0.7 | --- | 50 | |
| | 48V Input Models | -0.7 | --- | 100 | |
| Start-Up Threshold Voltage | 5V Input Models | --- | --- | 4.5 | |
| | 24V Input Models | --- | --- | 9 | |
| | 48V Input Models | --- | --- | 18 | |
| Start-Up Time (Power On) | Nominal Vin and Constant Resistive Load | --- | --- | 30 | ms |
| Short Circuit Input Power | All Models | --- | --- | 1500 | mW |
| Input Filter | | Internal Pi Type | | | |

## Remote On/Off Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Converter On | Under 0.6 VDC or Open Circuit | | | | |
| Converter Off | 4.7 to 15 VDC | | | | |
| Standby Input Current | Nominal Vin | --- | --- | 3 | mA |

## Output Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Output Voltage Setting Accuracy | | --- | --- | ±1.0 | %Vnom. |
| Output Voltage Balance | Dual Output, Balanced Loads | --- | --- | ±2.0 | % |
| Line Regulation | Vin=Min. to Max. @Full Load | --- | --- | ±0.5 | % |
| Load Regulation | Io=0% to 100% | --- | --- | ±1.0 | % |
| Load Cross Regulation (Dual Output) | Asymmetrical Load 25/100% Full Load | --- | --- | ±5.0 | % |
| Minimum Load | No minimum Load Requirement | | | | |
| Ripple & Noise | 0-20 MHz Bandwidth | --- | --- | 50 | $mV_{P-P}$ |
| Transient Recovery Time | 25% Load Step Change | --- | 250 | --- | µsec |
| Transient Response Deviation | | --- | ±3 | ±5 | % |
| Temperature Coefficient | | --- | --- | ±0.02 | %/°C |
| Over Load Protection | Foldback | --- | 160 | --- | % |
| Short Circuit Protection | Continuous, Automatic Recovery | | | | |

## General Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| I/O Isolation Voltage | 60 Seconds | 1500 | --- | --- | VDC |
| | 1 Second | 1800 | --- | --- | VDC |
| I/O Isolation Resistance | 500 VDC | 1000 | --- | --- | MΩ |
| I/O Isolation Capacitance | 100kHz, 1V | --- | 500 | --- | pF |
| Switching Frequency | | 100 | --- | --- | kHz |
| MTBF(calculated) | MIL-HDBK-217F@25°C, Ground Benign | 6,432,000 | --- | --- | Hours |
| Moisture Sensitivity Level (MSL) | IPC/JEDEC J-STD-020D.1 | Level 2 | | | |
| Safety Approvals | UL/cUL 60950-1 recognition(UL certificate), IEC/EN 60950-1(CB-report) | | | | |
| | UL/cUL 62368-1 recognition(UL certificate), IEC/EN 62368-1(CB-report) | | | | |

## EMC Specifications

| Parameter | Standards & Level | | | Performance |
|---|---|---|---|---|
| EMI | Conduction | EN 55032 | Without external components | Class A |
| | Radiation | | | |
| $EMS_{(4)}$ | EN 55035 | | | |
| | ESD | EN 61000-4-2 Air ± 8kV, Contact ± 6kV | | A |
| | Radiated immunity | EN 61000-4-3 10V/m | | A |
| | Fast transient | EN 61000-4-4 ±2kV | | A |
| | Surge | EN 61000-4-5 ±1kV | | A |
| | Conducted immunity | EN 61000-4-6 10Vrms | | A |
| | PFMF | EN 61000-4-8 3A/m | | A |

## Environmental Specifications

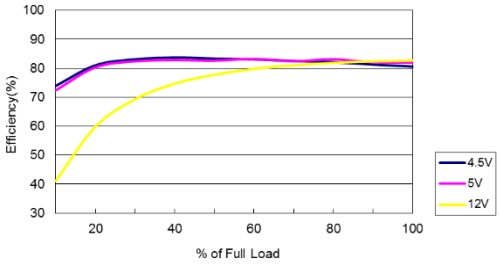
| Parameter | Min. | Max. | Unit |
|---|---|---|---|
| Operating Ambient Temperature Range (See Power Derating Curve) | -40 | +80 | °C |
| Case Temperature | --- | +95 | °C |
| Storage Temperature | -55 | +125 | °C |
| Humidity (non condensing) | --- | 95 | % rel. H |
| Lead-free Reflow Solder Process | IPC/JEDEC J-STD-020D.1 | | |

## Notes

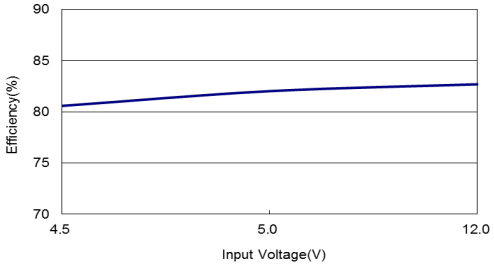
1 Specifications typical at Ta=+25°C, resistive load, nominal input voltage, rated output current unless otherwise noted.
2 We recommend to protect the converter by a slow blow fuse in the input supply line.
3 Other input and output voltage may be available, please contact MINMAX.
4 The external components might be required to meet EMS standard for some of test items. Please contact MINMAX for the solution in detail.
5 Specifications are subject to change without notice.

## Characteristic Curves

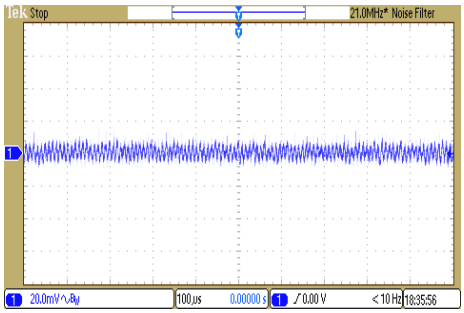
All test conditions are at 25℃ The figures are identical for MSCWI02-05S05



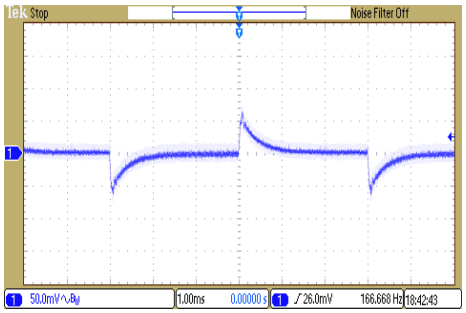

Efficiency Versus Output Current



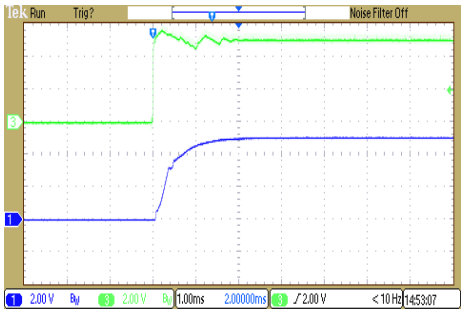

Efficiency Versus Input Voltage
Full Load



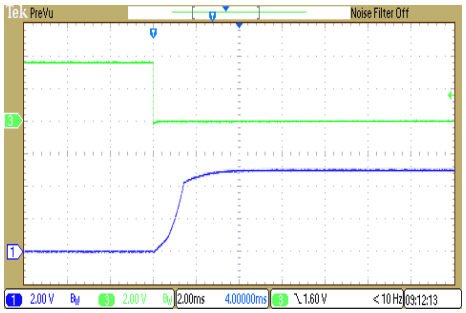

Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



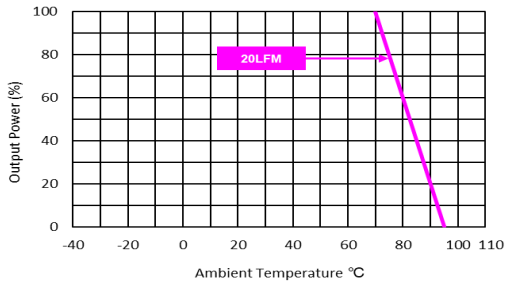

Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$




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



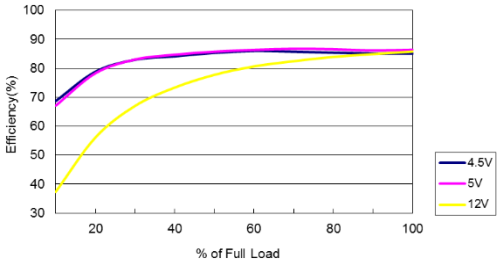

ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



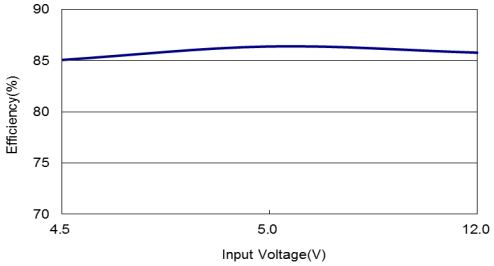

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

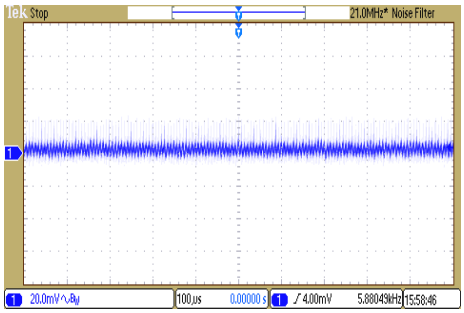
All test conditions are at 25℃ The figures are identical for MSCWI02-05S12



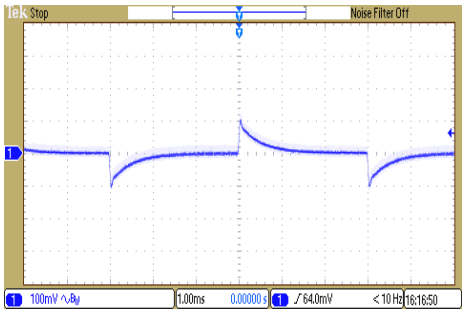

Efficiency Versus Output Current



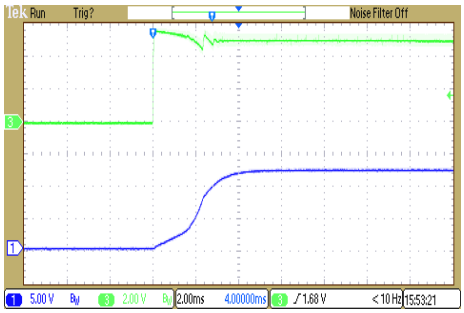

Efficiency Versus Input Voltage
Full Load



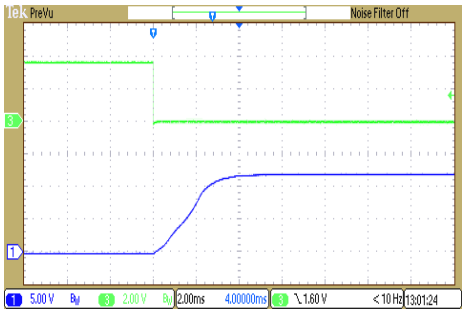

Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



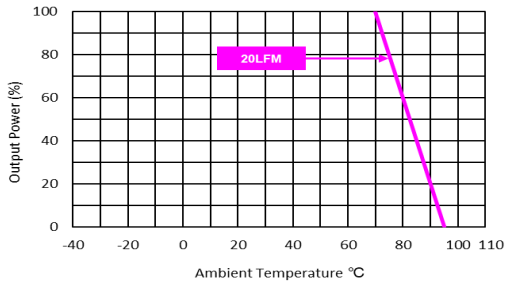

Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$




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



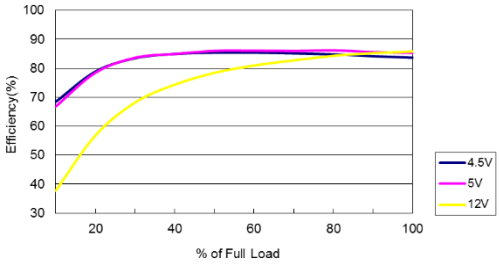

ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



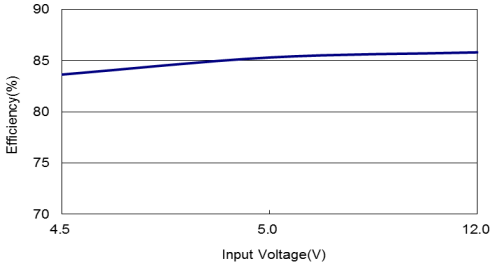

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

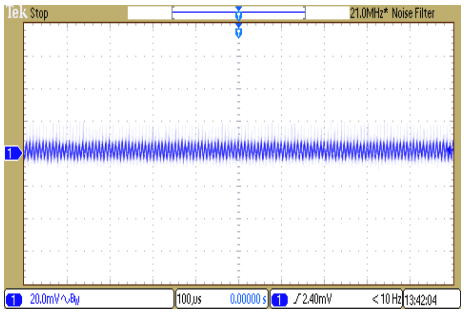
All test conditions are at 25℃ The figures are identical for MSCWI02-05S15



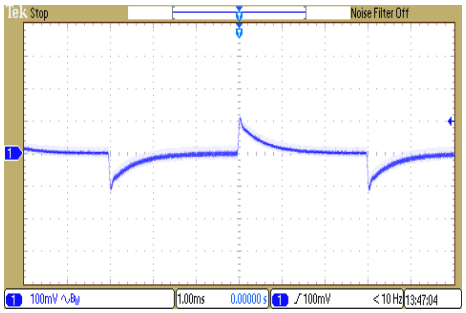

Efficiency Versus Output Current



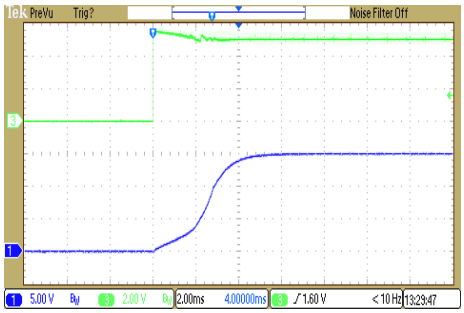

Efficiency Versus Input Voltage
Full Load



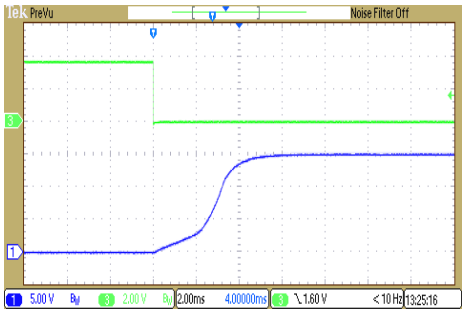

Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



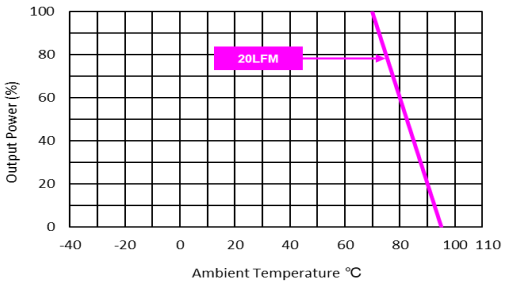

Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$




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



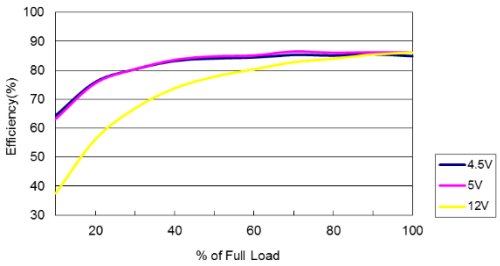

ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



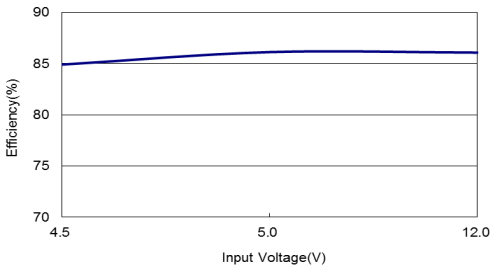

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

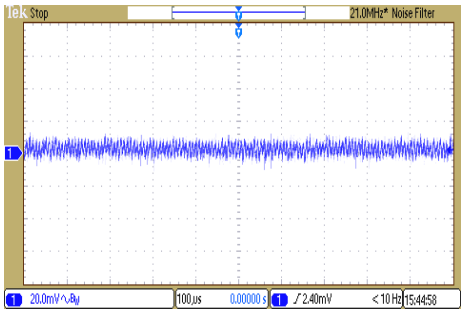
All test conditions are at 25℃ The figures are identical for MSCWI02-05S24



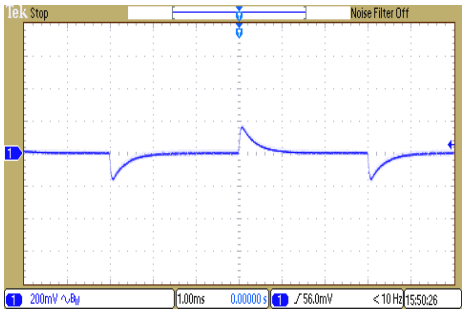

Efficiency Versus Output Current



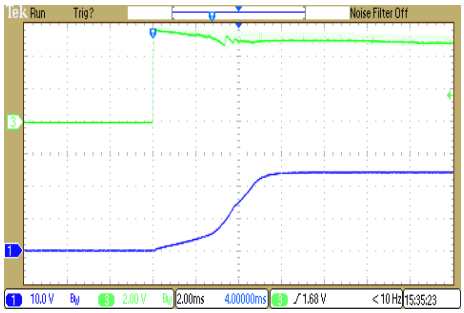

Efficiency Versus Input Voltage
Full Load



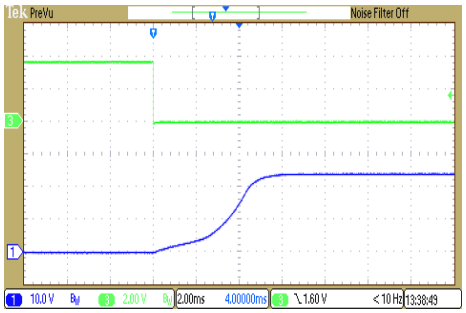
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



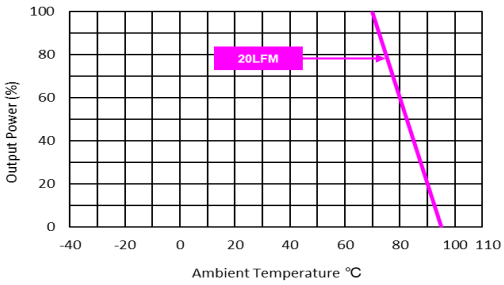
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



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



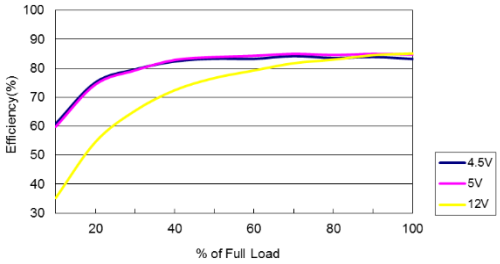
ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



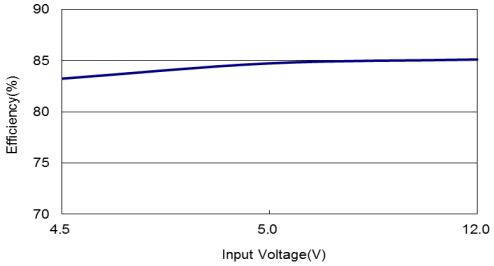

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

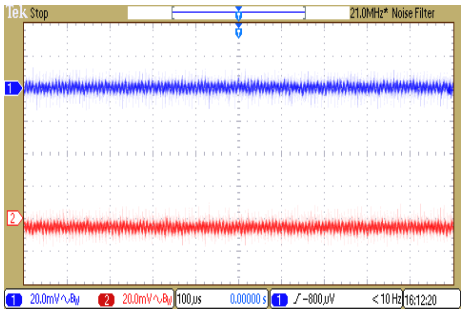
All test conditions are at 25℃ The figures are identical for MSCWI02-05D12



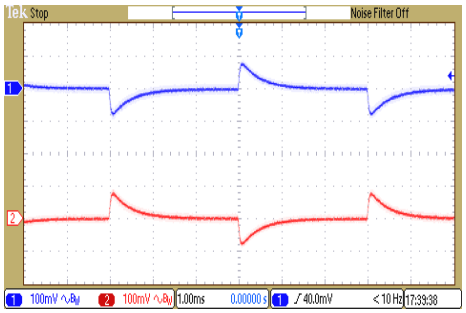

Efficiency Versus Output Current



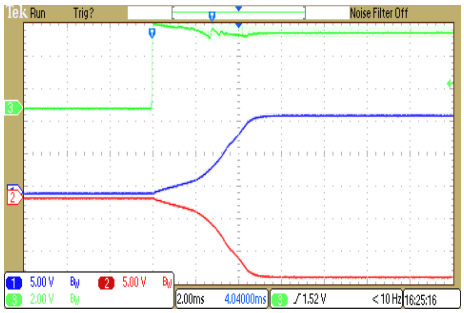

Efficiency Versus Input Voltage
Full Load



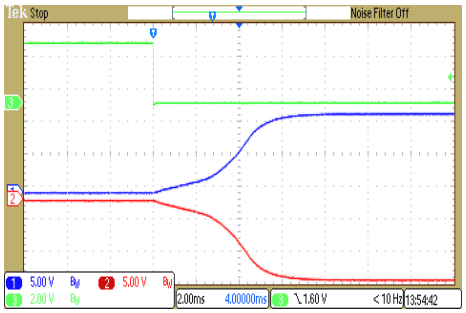
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



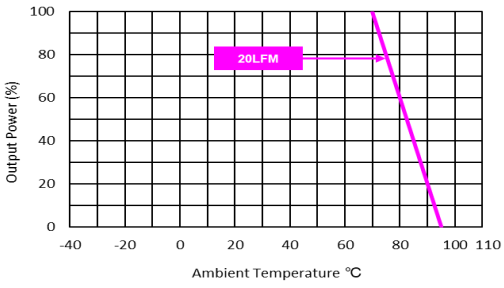
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



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



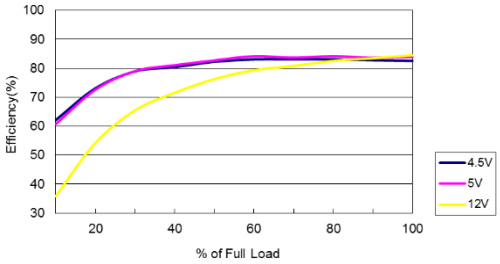
ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



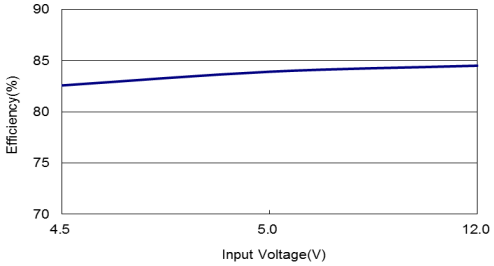

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

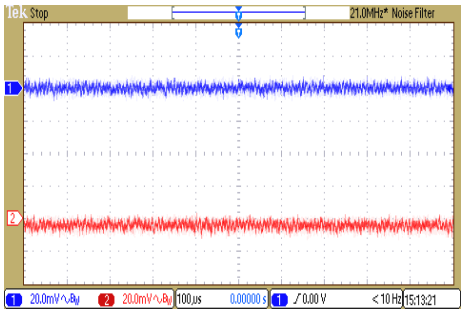
All test conditions are at 25℃ The figures are identical for MSCWI02-05D15



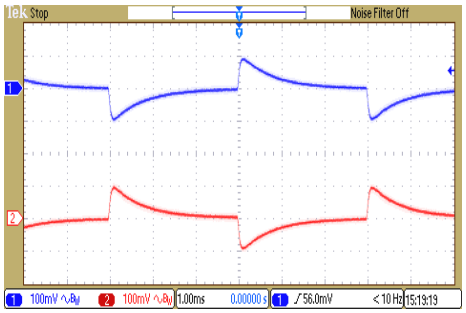

Efficiency Versus Output Current



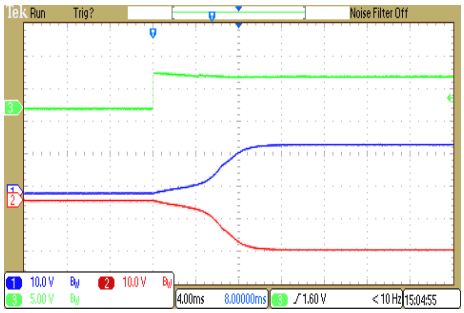

Efficiency Versus Input Voltage
Full Load



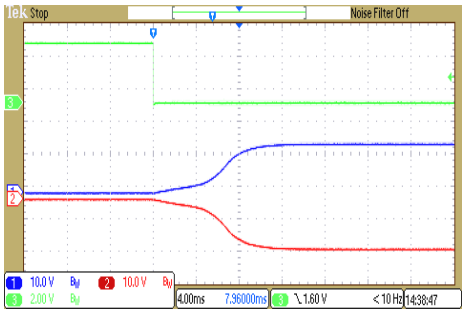
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



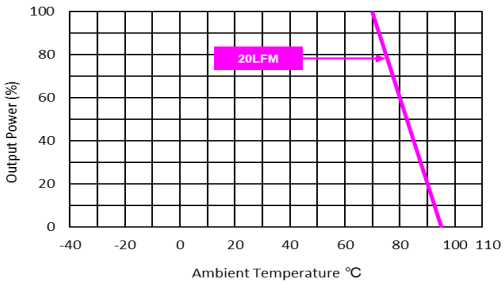
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



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



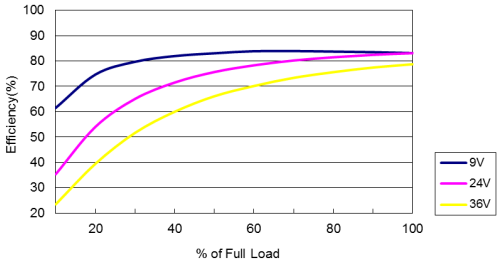
ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



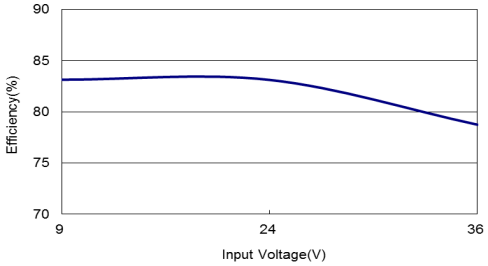

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

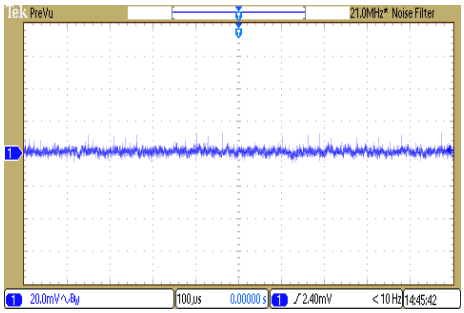
All test conditions are at 25℃ The figures are identical for MSCWI02-24S05



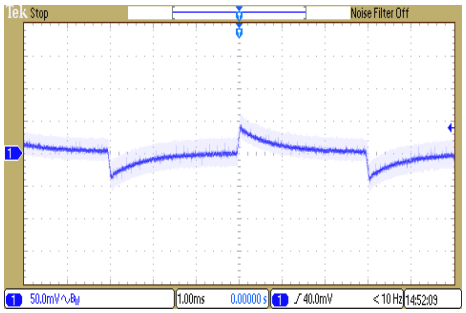

Efficiency Versus Output Current



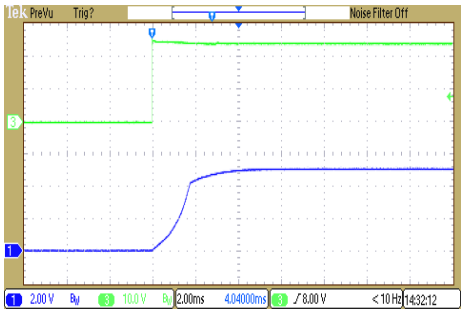

Efficiency Versus Input Voltage
Full Load



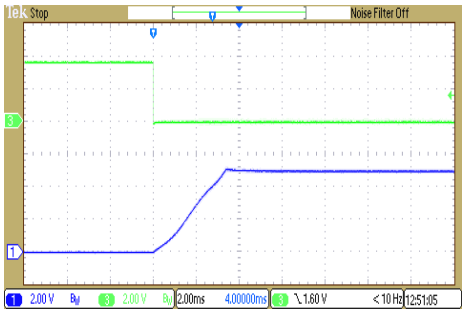

Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



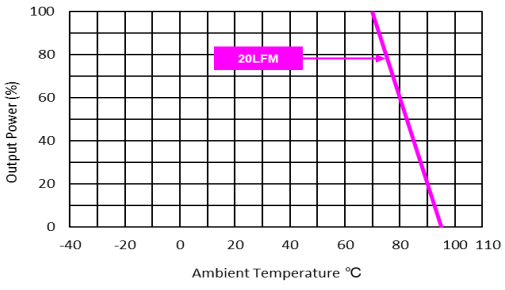

Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$




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



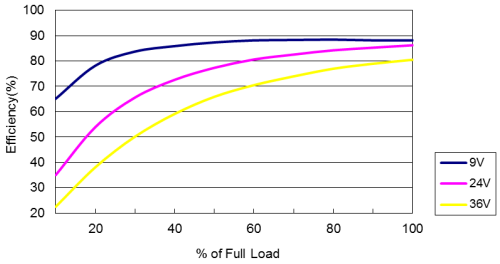

ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



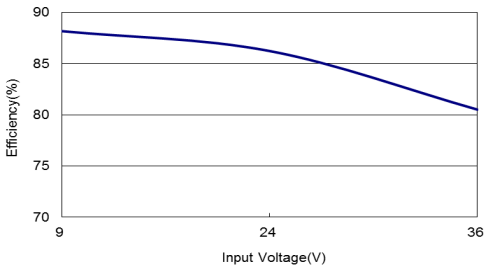

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

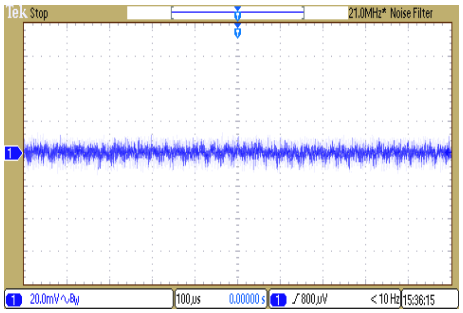
All test conditions are at 25℃ The figures are identical for MSCWI02-24S12



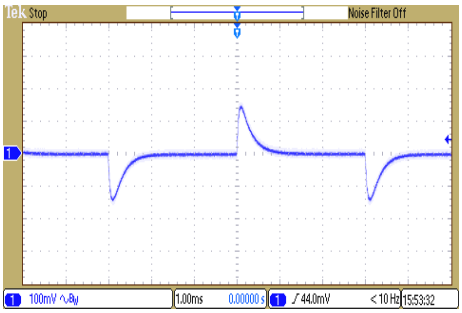

Efficiency Versus Output Current



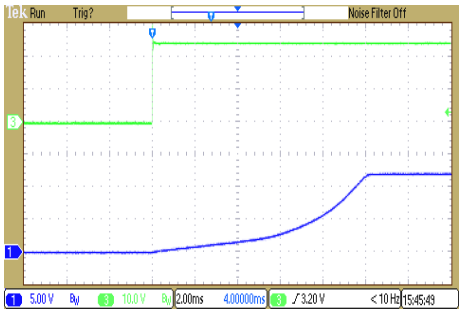

Efficiency Versus Input Voltage
Full Load



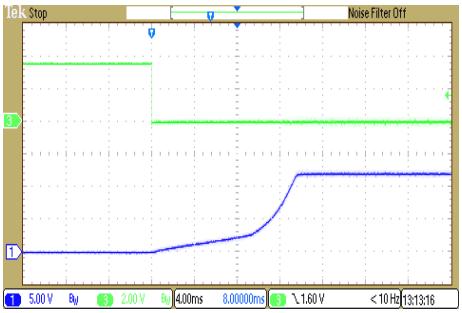
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



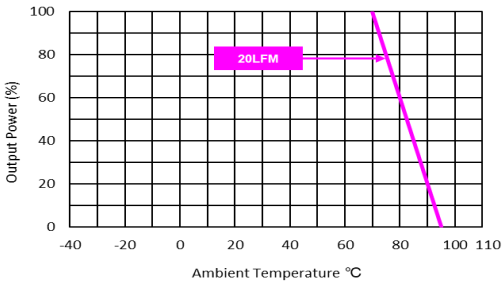
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



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



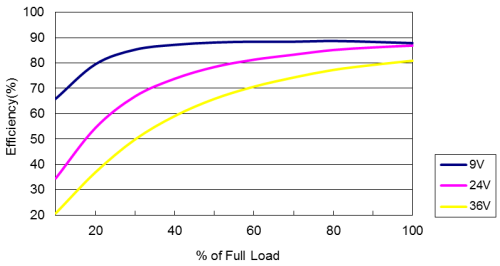
ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



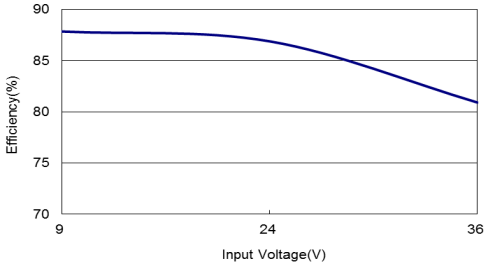

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

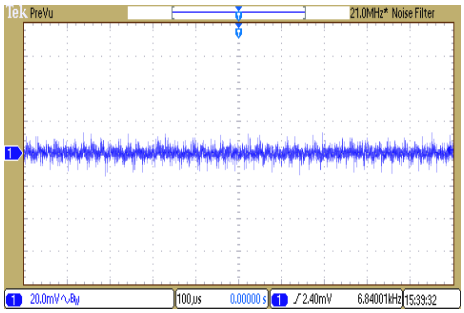
All test conditions are at 25℃ The figures are identical for MSCWI02-24S15



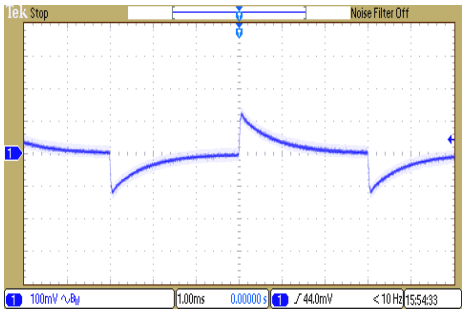

Efficiency Versus Output Current



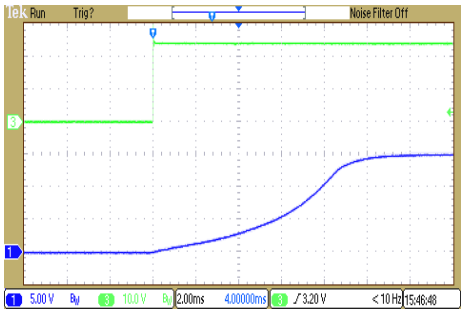

Efficiency Versus Input Voltage
Full Load



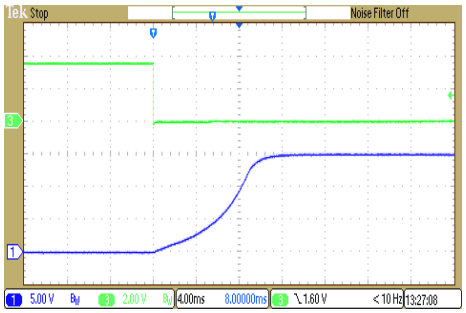

Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



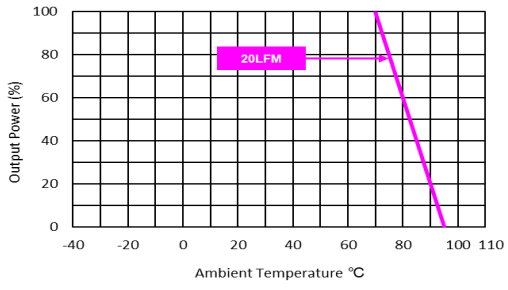

Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$




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



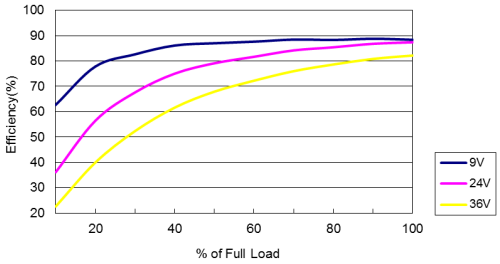

ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



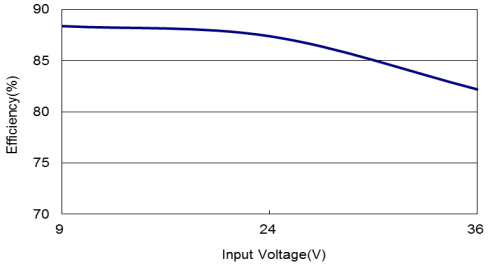

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

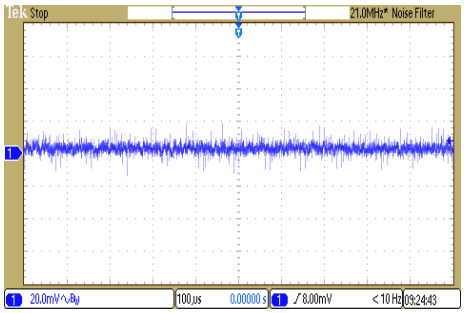
All test conditions are at 25℃ The figures are identical for MSCWI02-24S24



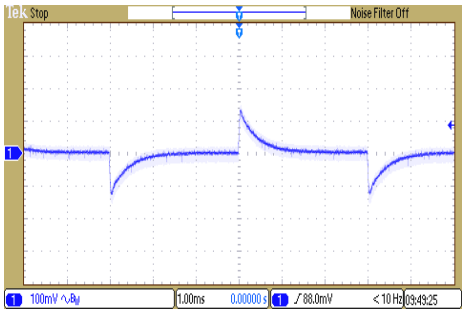

Efficiency Versus Output Current



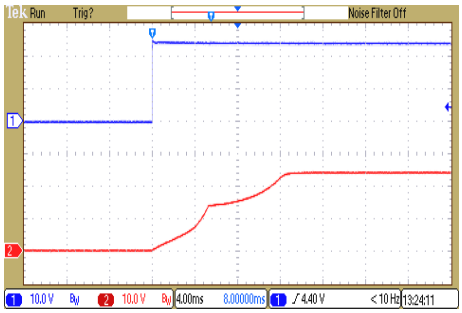

Efficiency Versus Input Voltage
Full Load



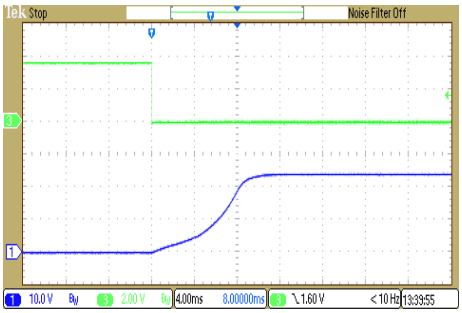
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



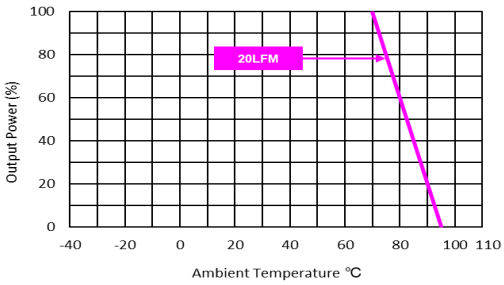
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



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



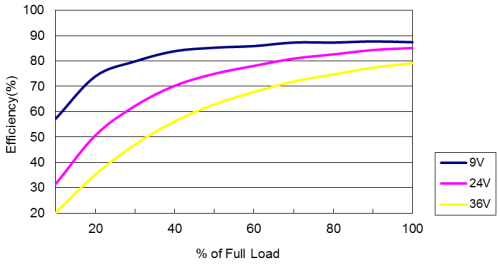
ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



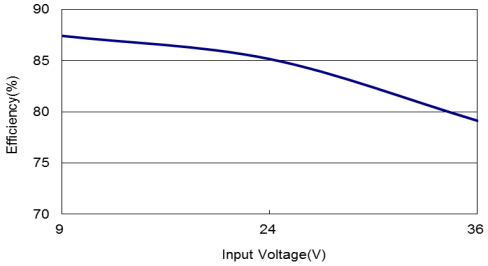

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

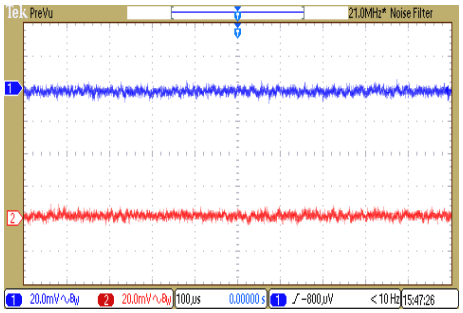
All test conditions are at 25℃ The figures are identical for MSCWI02-24D12



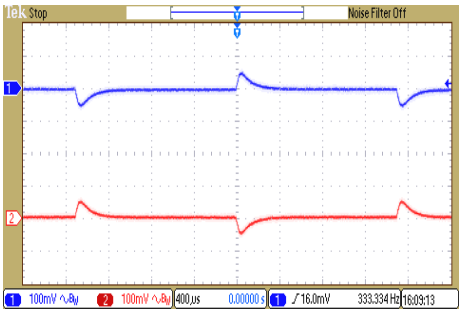

Efficiency Versus Output Current



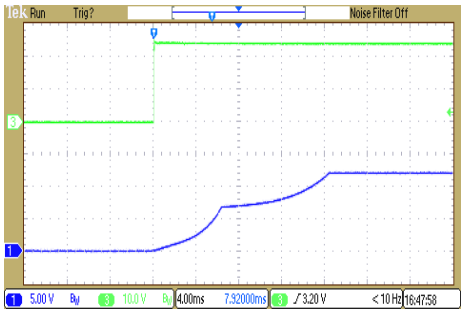

Efficiency Versus Input Voltage
Full Load



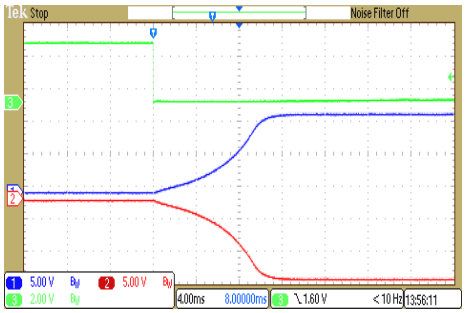
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



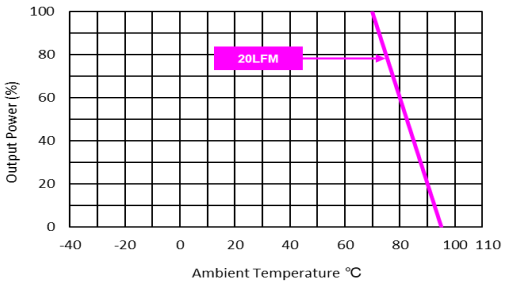
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



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



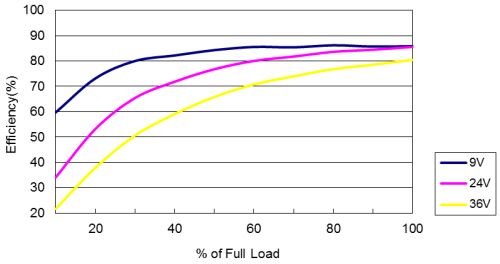
ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



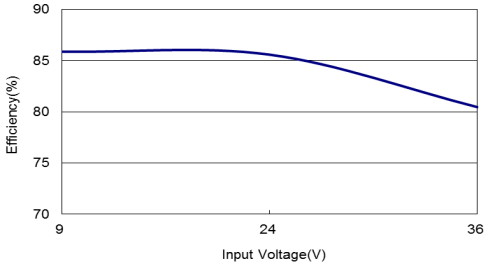

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

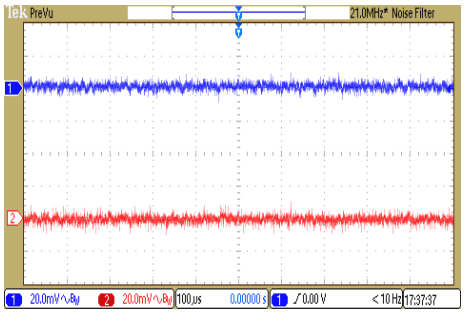
All test conditions are at 25℃ The figures are identical for MSCWI02-24D15



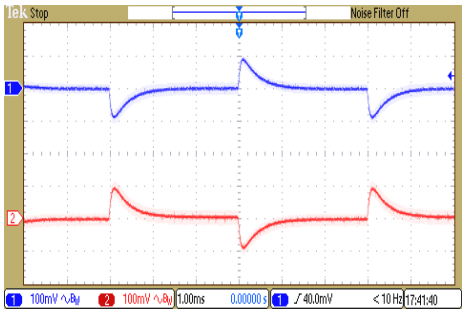

Efficiency Versus Output Current



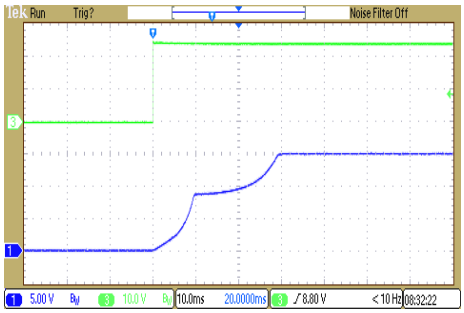

Efficiency Versus Input Voltage
Full Load



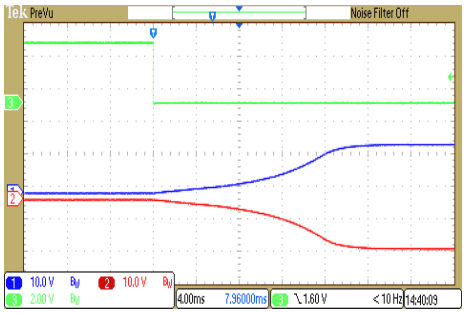

Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



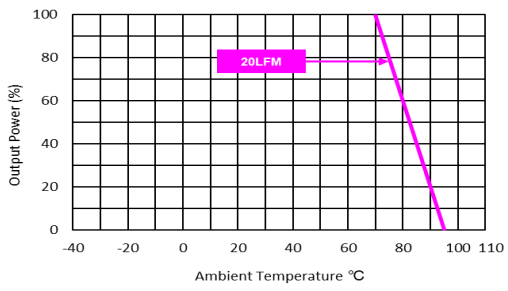

Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$




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



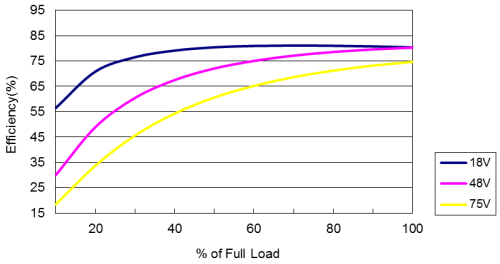

ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



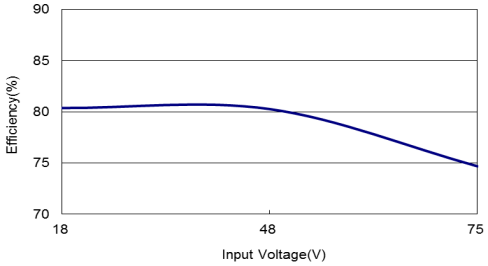

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

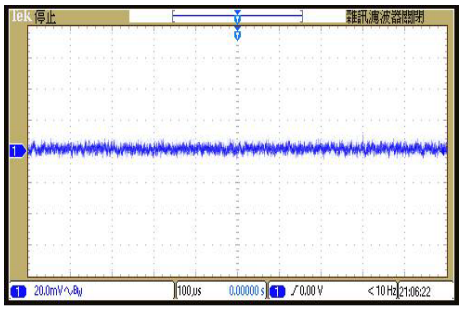
All test conditions are at 25℃ The figures are identical for MSCWI02-48S05



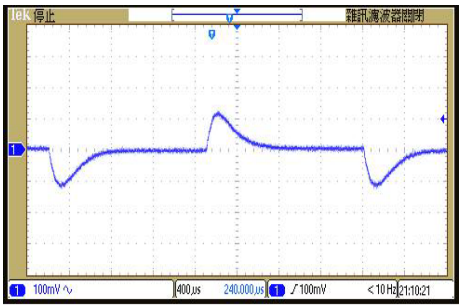

Efficiency Versus Output Current



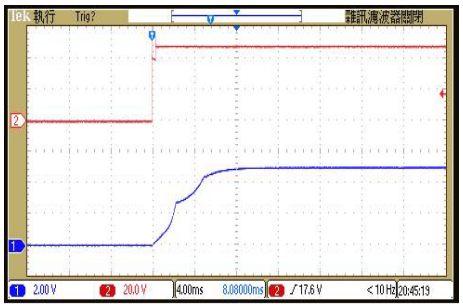

Efficiency Versus Input Voltage
Full Load



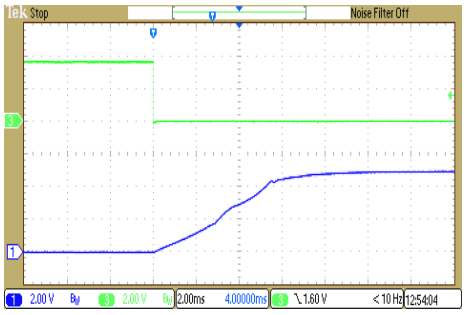
Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



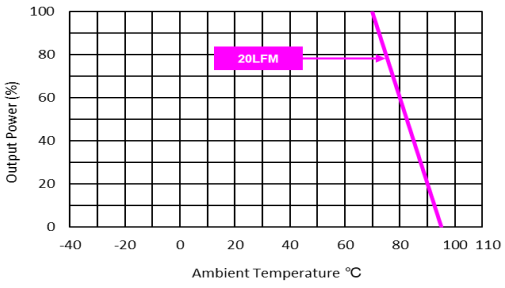
Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$



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



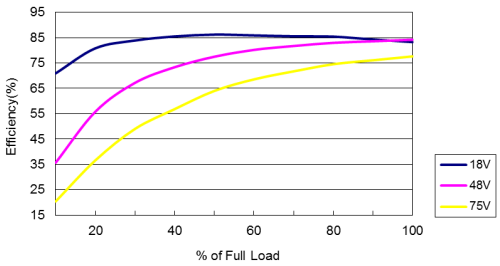
ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



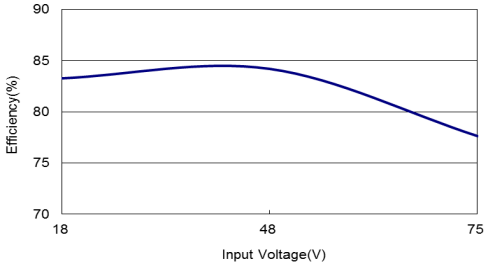

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

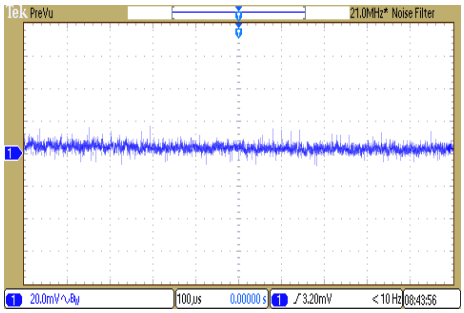
All test conditions are at 25℃ The figures are identical for MSCWI02-48S12



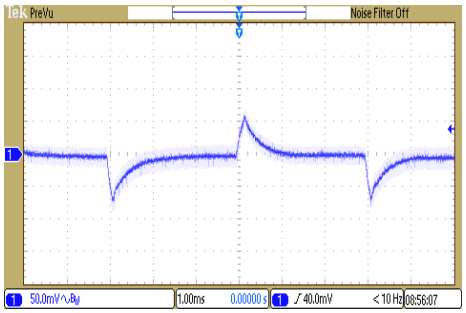

Efficiency Versus Output Current



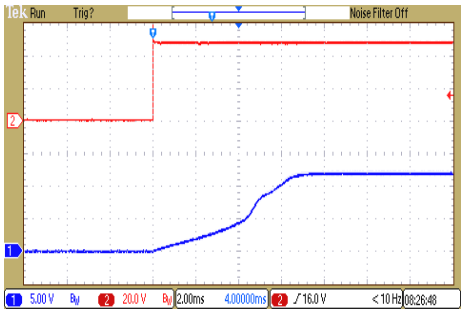

Efficiency Versus Input Voltage
Full Load



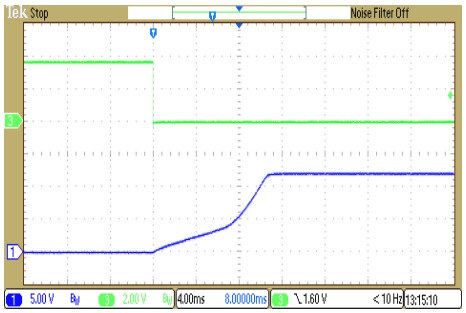

Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$ ; Full Load



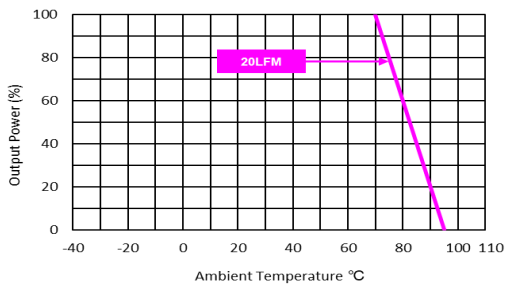

Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$




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



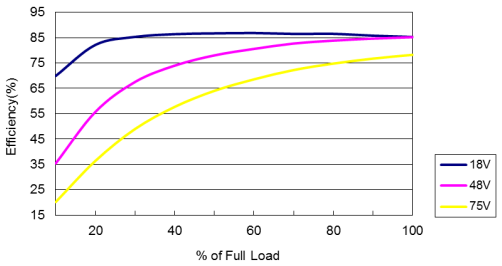

ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$ ; Full Load



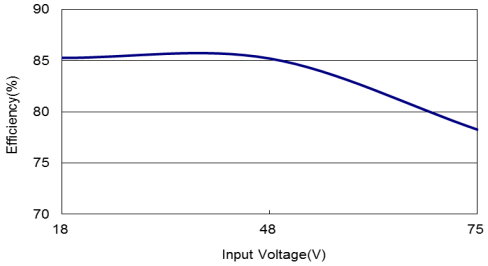

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

## Characteristic Curves

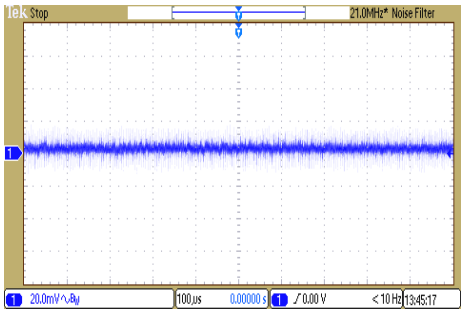
All test conditions are at 25℃ The figures are identical for MSCWI02-48S15



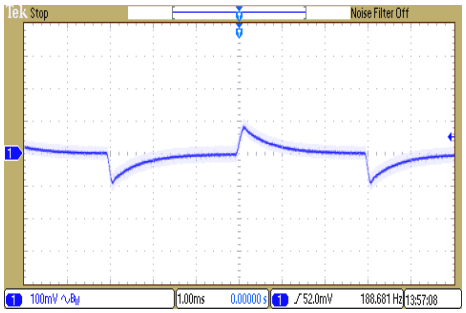

Efficiency Versus Output Current



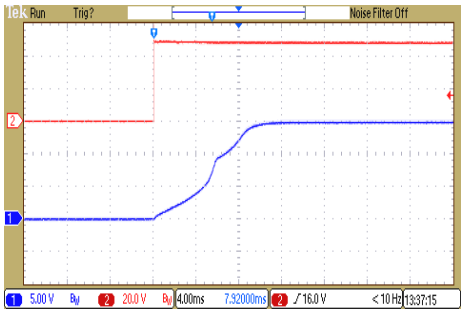

Efficiency Versus Input Voltage
Full Load



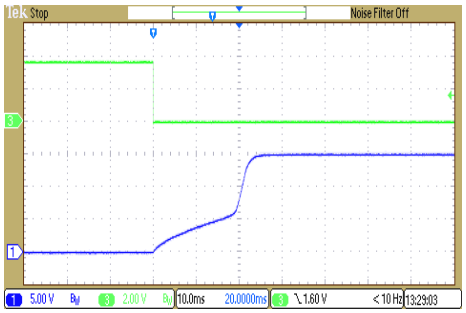

Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$ ; Full Load



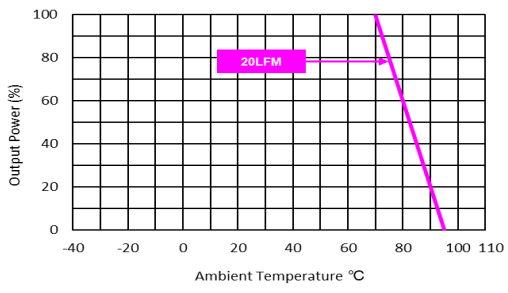

Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}=V_{in\ nom}$




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



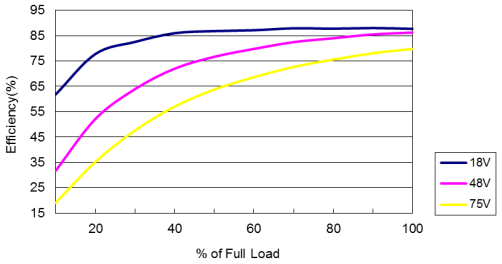

ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}=V_{in\ nom}$ ; Full Load



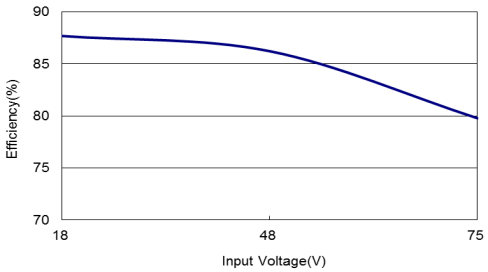

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}=V_{in\ nom}$

## Characteristic Curves

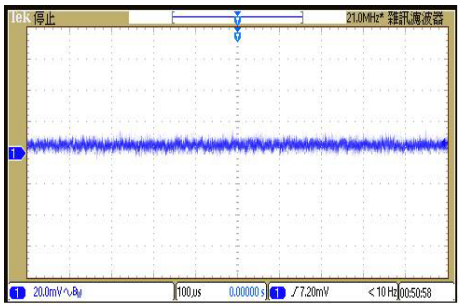
All test conditions are at 25℃ The figures are identical for MSCWI02-48S24



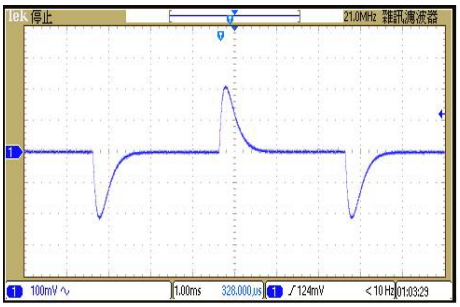

Efficiency Versus Output Current



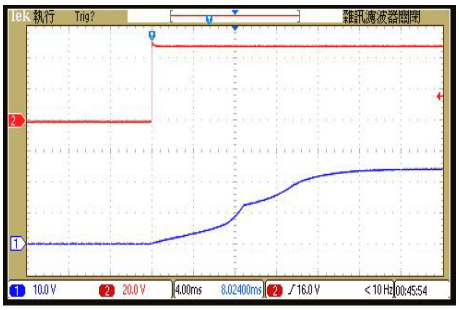

Efficiency Versus Input Voltage
Full Load



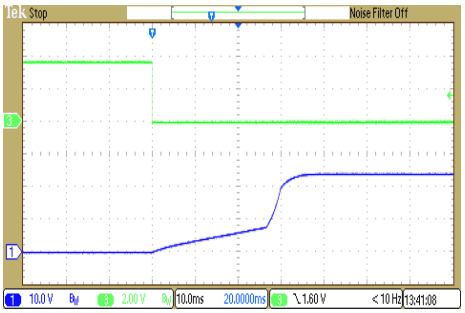

Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



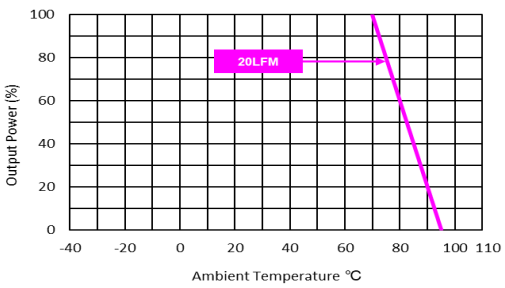

Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$




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



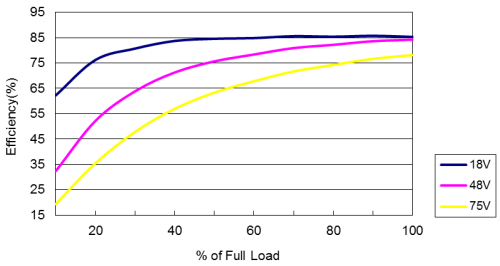

ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



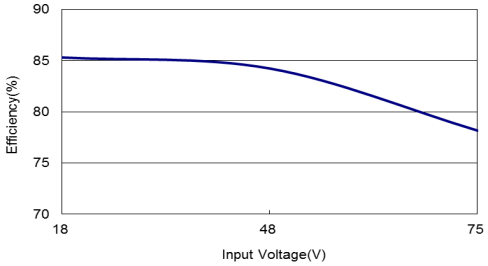

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

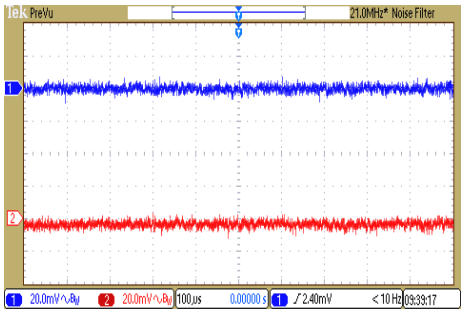
All test conditions are at 25℃ The figures are identical for MSCWI02-48D12



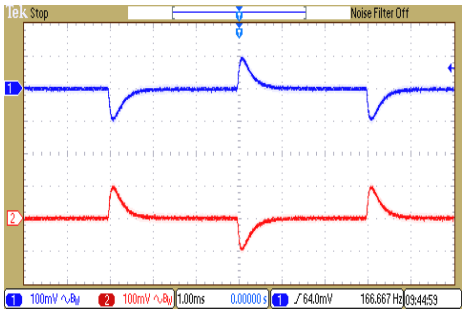

Efficiency Versus Output Current



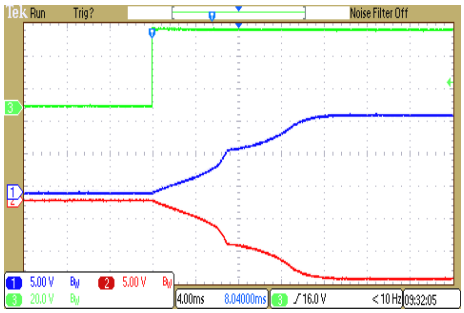

Efficiency Versus Input Voltage
Full Load



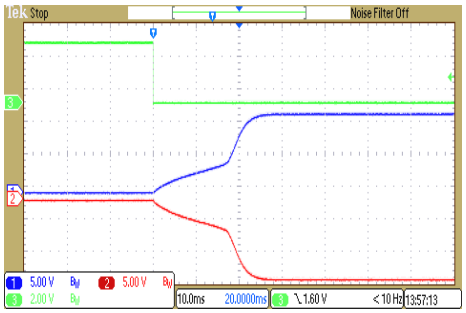

Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



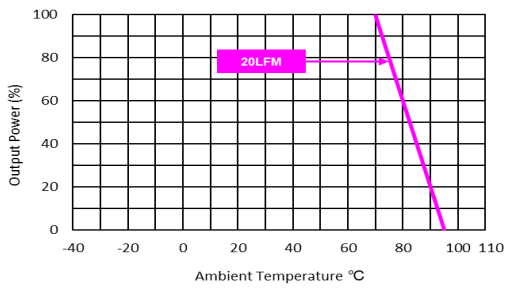

Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$




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



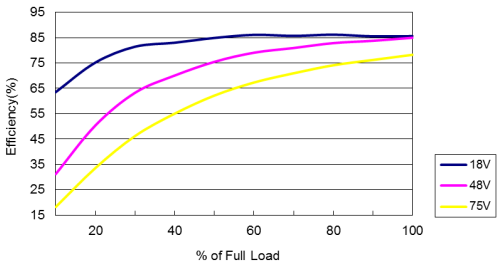

ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



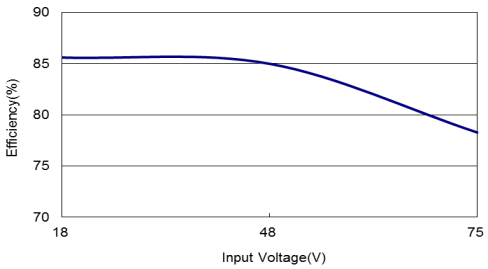

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Characteristic Curves

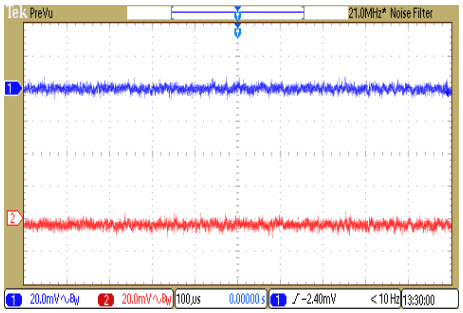
All test conditions are at 25℃ The figures are identical for MSCWI02-48D15



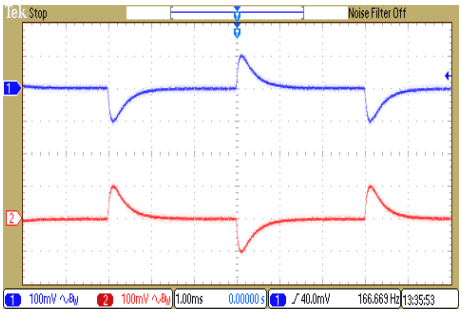

Efficiency Versus Output Current



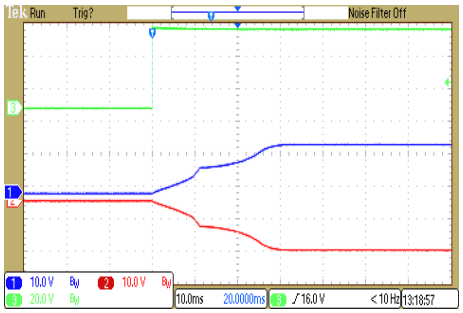

Efficiency Versus Input Voltage
Full Load



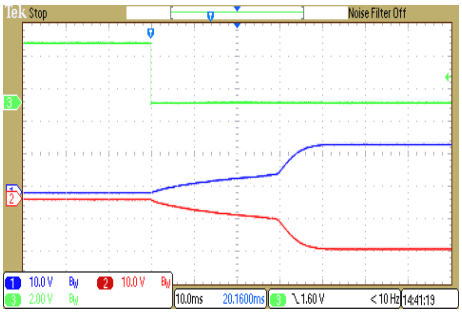

Typical Output Ripple and Noise
$V_{in}$=$V_{in\ nom}$ ; Full Load



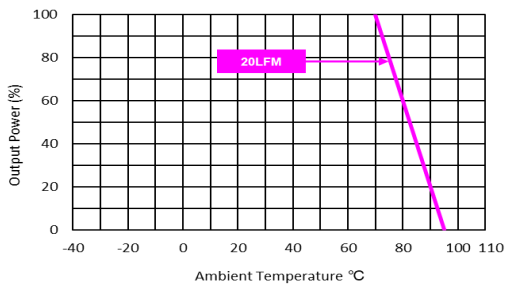

Transient Response to Dynamic Load Change
from 100% to 75% of Full Load ; $V_{in}$=$V_{in\ nom}$




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



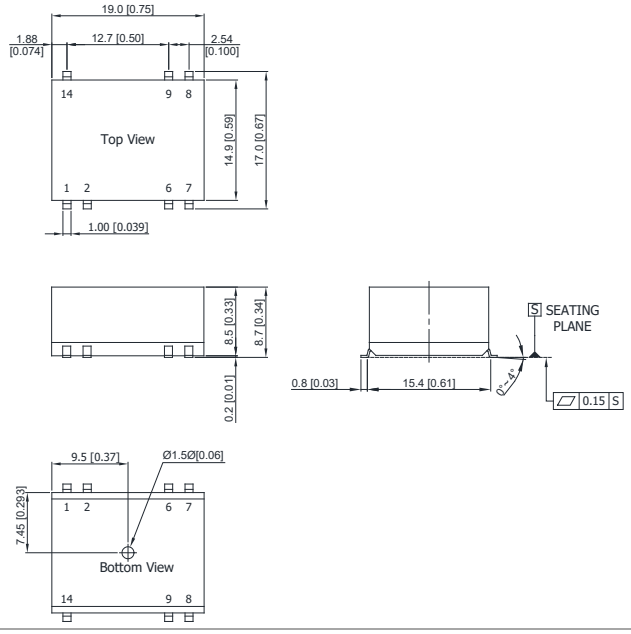

ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in}$=$V_{in\ nom}$ ; Full Load



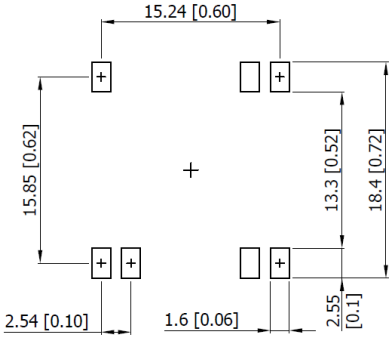

Derating Output Current Versus Ambient Temperature and Airflow
$V_{in}$=$V_{in\ nom}$

## Package Specifications

### Mechanical Dimensions




### Connecting Pin Patterns




- All dimensions in mm (inches)
- Tolerance: X.X±0.5 (X.XX±0.02)
  X.XX±0.25 (X.XXX±0.01)
- Pins ±0.05(±0.002)

### Pin Connections

| Pin | Single Output | Dual Output |
|---|---|---|
| 1 | -Vin | -Vin |
| 2 | Remote On/Off | Remote On/Off |
| 6 | NC | Common |
| 7 | NC | -Vout |
| 8 | +Vout | +Vout |
| 9 | -Vout | Common |
| 14 | +Vin | +Vin |

NC: No Connection

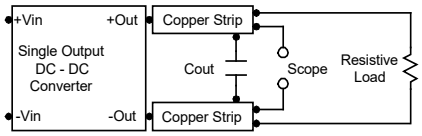
### Physical Characteristics

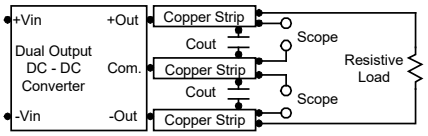
| | | |
|---|---|---|
| Case Size | : | 19.0x14.9x8.5mm (0.75x0.59x0.33 inches) |
| Case Material | : | Plastic resin (flammability to UL 94V-0 rated) |
| Pin Material | : | Phosphor Bronze |
| Weight | : | 3.5g |

## Test Setup

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

Refer to the output specifications or add 4.7μF capacitor if the output specifications undefine Cout. 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

### Remote On/Off

Only one type of remote ON/OFF control is available for MSCWI02. The module will turn on during the ON/OFF pin open or high impedance between ON/OFF pin and -Vin pin. The module will turn off if the ON/OFF pin is applied with a current of 2~4mA.

### Maximum Capacitive Load

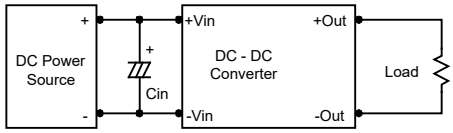
The MSCWI02 series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. The maximum capacitance can be found in the data sheet.

### Overload 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.

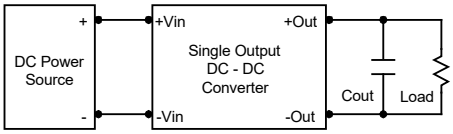
### Input Source Impedance

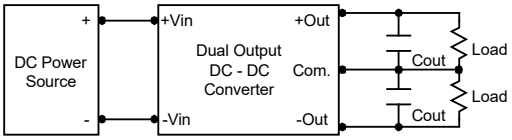
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.
Capacitor mounted close to the power module helps ensure stability of the unit, it is commended to use a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 kHz) capacitor of a 4.7μF for the 5V input devices and a 2.2μF for the 24V and 48V devices.




### Output Ripple Reduction

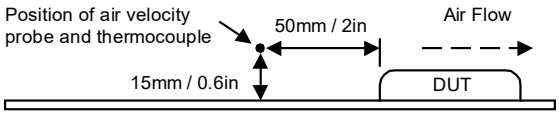
A good quality low ESR capacitor placed as close as practicable across the load will give the best ripple and noise performance. To reduce output ripple, it is recommended to use 3.3μF capacitors at the output.



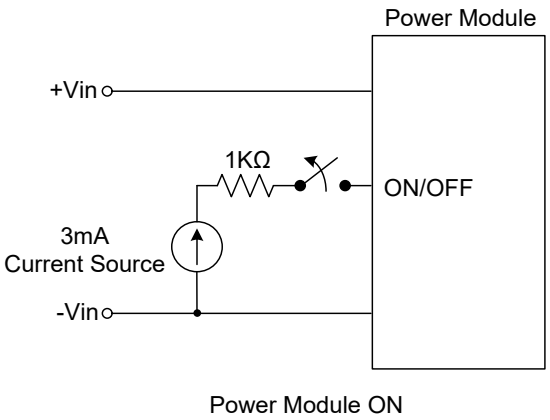

### Thermal Considerations

Many conditions affect the thermal performance of the power module, such as orientation, airflow over the module and board spacing. To avoid exceeding the maximum temperature rating of the components inside the power module, the case temperature must be kept below 95℃. The derating curves are determined from measurements obtained in a test setup.

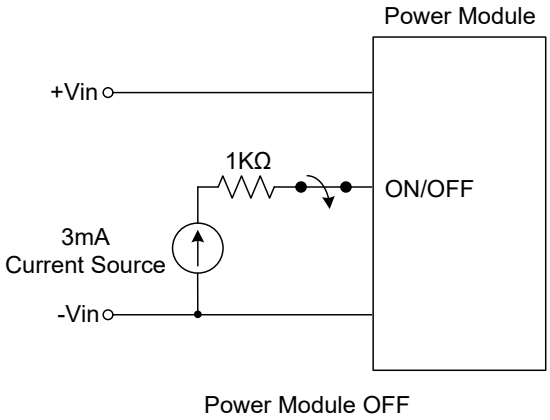


## Remote On/Off Implementation

Only one type of remote ON/OFF control is available for MSCWI02. The module will turn on during the ON/OFF pin open or high impedance between ON/OFF pin and -Vin pin. The module will turn off if the ON/OFF pin is applied with a current of 2~4mA.



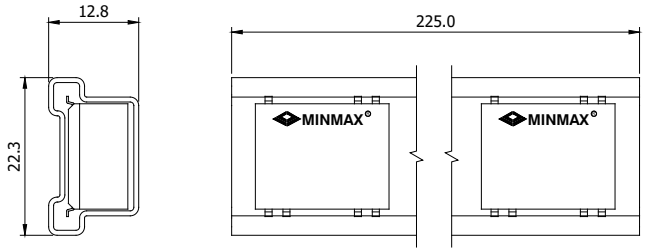

Power Module ON



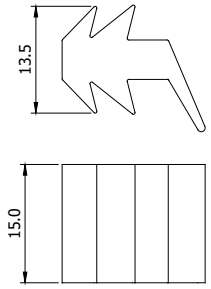

Power Module OFF

## Packaging Information for Tube

Tube



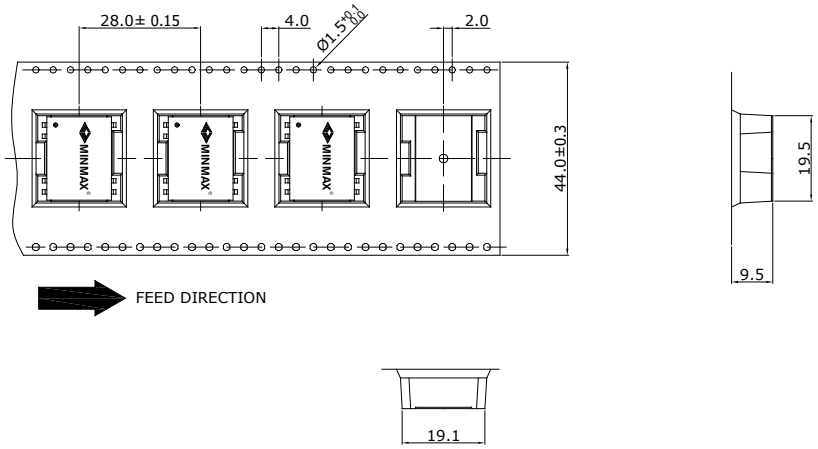

Plug



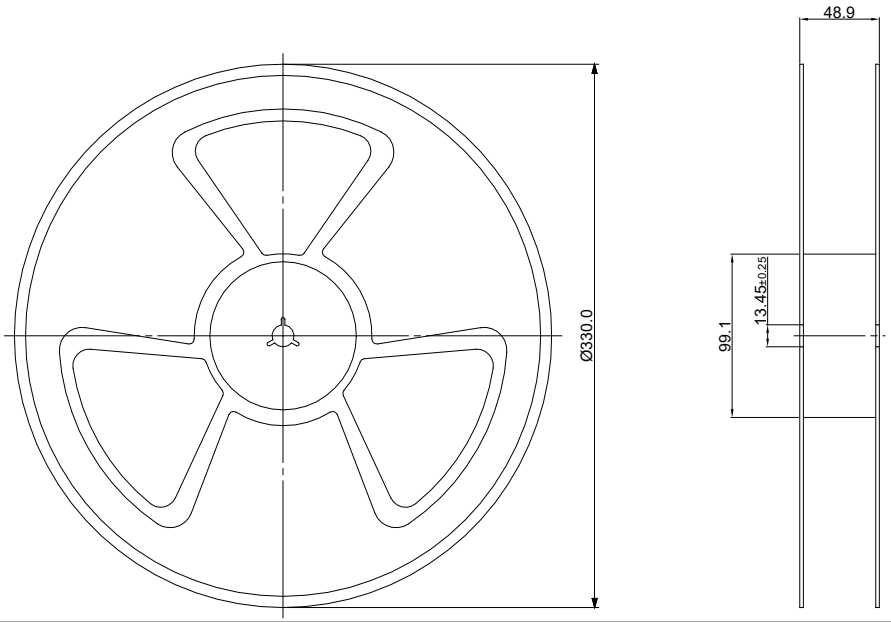

Unit: mm
10 PCS per TUBE

## 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.

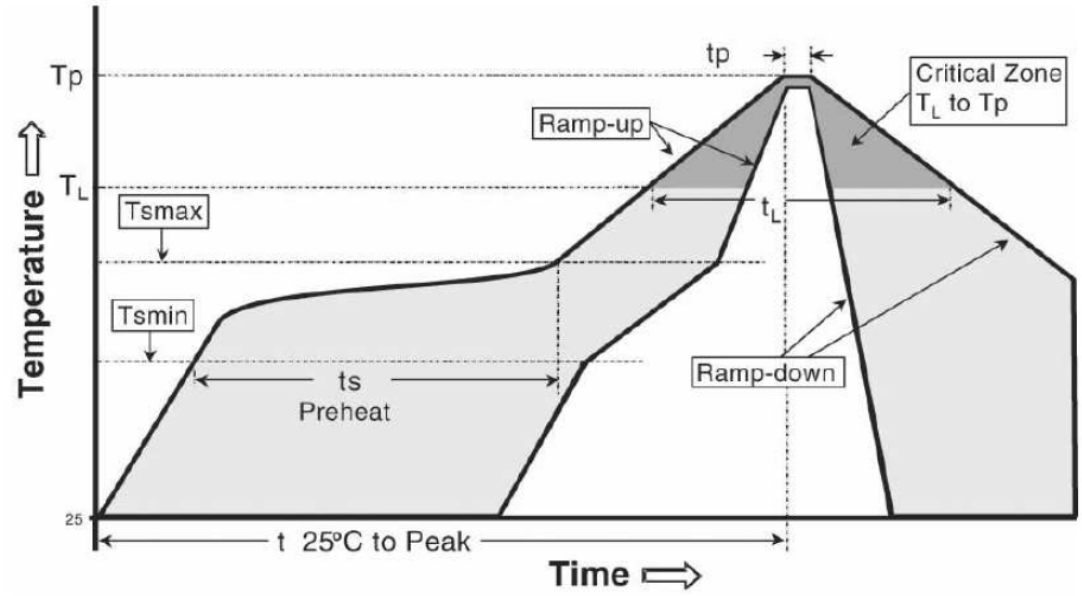



Table 4-1 SnPb Eutectic Process-Classification Temperatures ($T_C$)

| | 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 | SC | WI | 02 | - | 05 | S | 05 |
|---|---|---|---|---|---|---|---|
| | Package Type<br>SMD-14 | Ultra-wide 4:1<br>Input Voltage Range | Output Power<br>2 Watt | | Input Voltage Range<br>05: 4.5 ~ 12 VDC<br>24: 9 ~ 36 VDC<br>48: 18 ~ 75 VDC | Output Quantity<br>S: Single<br>D: Dual | Output Voltage<br>05: 5 VDC<br>12: 12 VDC<br>15: 15 VDC<br>24: 24 VDC |

## MTBF and Reliability

The MTBF of MSCWI02 series of DC-DC converters has been calculated using

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

| Model | MTBF | Unit |
|---|---|---|
| MSCWI02-05S05 | 7,237,000 | Hours |
| MSCWI02-05S12 | 7,369,000 | |
| MSCWI02-05S15 | 7,162,000 | |
| MSCWI02-05S24 | 7,247,000 | |
| MSCWI02-05D12 | 6,783,000 | |
| MSCWI02-05D15 | 6,432,000 | |
| MSCWI02-24S05 | 7,352,000 | |
| MSCWI02-24S12 | 7,549,000 | |
| MSCWI02-24S15 | 7,432,000 | |
| MSCWI02-24S24 | 7,234,000 | |
| MSCWI02-24D12 | 6,966,000 | |
| MSCWI02-24D15 | 6,718,000 | |
| MSCWI02-48S05 | 7,352,000 | |
| MSCWI02-48S12 | 7,256,000 | |
| MSCWI02-48S15 | 7,278,000 | |
| MSCWI02-48S24 | 7,394,000 | |
| MSCWI02-48D12 | 6,904,000 | |
| MSCWI02-48D15 | 6,664,000 | |