



MINMAX[®]

MBSU03 Series

Electric Characteristic Note

MBSU03 Series EC Note

DC-DC CONVERTER 3W, SIP Package

Features

- ▶ Industrial Standard SIP-4 Package
- ▶ Unregulated Output Voltage
- ▶ I/O Isolation 1500VDC
- ▶ Operating Ambient Temp. Range -40°C to +90°C
- ▶ Short Circuit Protection



Applications

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

Product Overview

The MINMAX MBSU03 series is a new range of isolated 3W DC-DC converter modules in SIP-4 package size. There are 9 models available for 5,12 or 24VDC input. Advanced circuit topology provides continuous short circuit protection and a high efficiency up to 86 which allows operating ambient temperatures range of -40°C to +90°C. These converters offer a better solution for all applications where space critical, wide operating temp. range and fault condition protection are required.

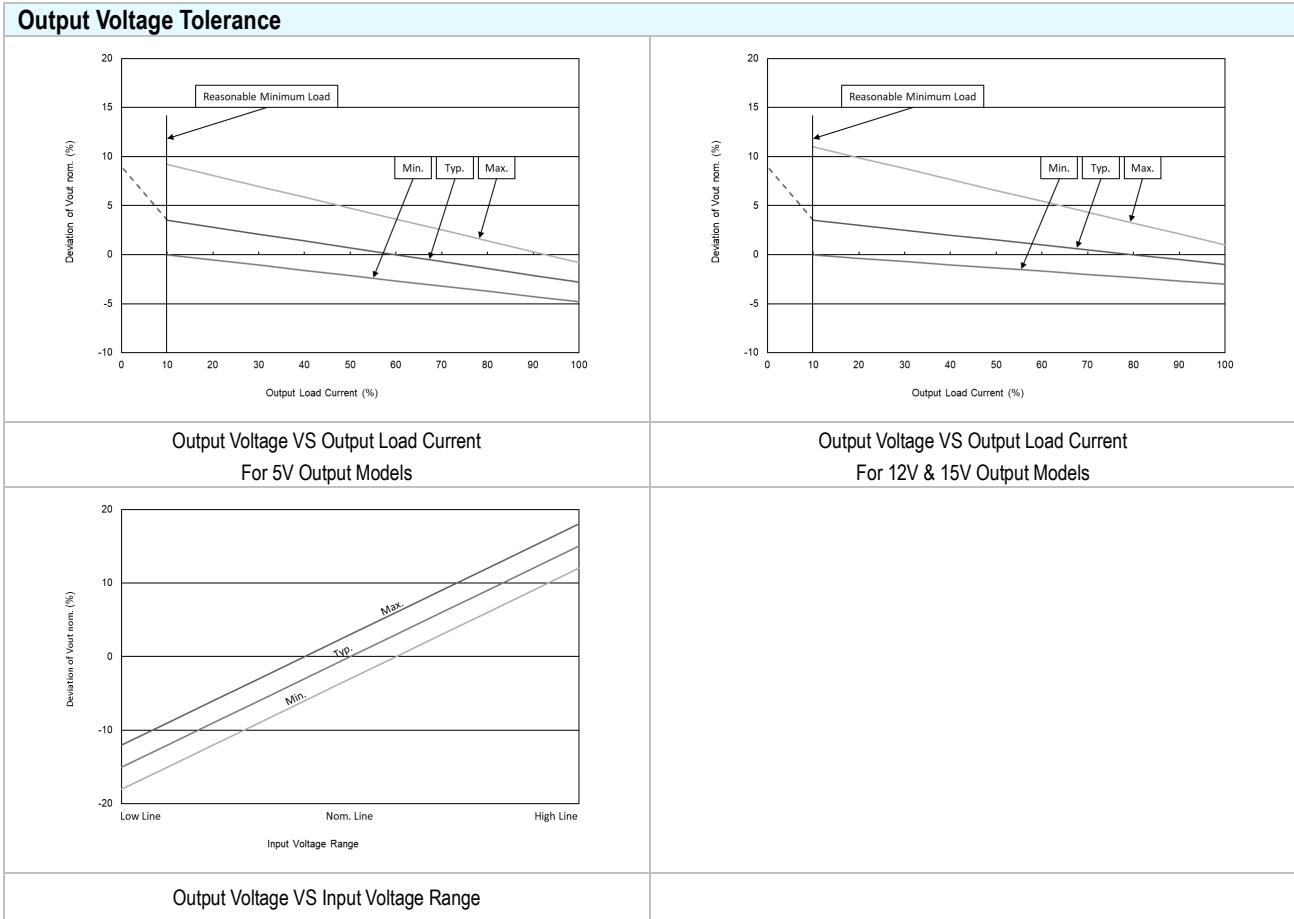
Table of contents

| | | | |
|------------------------------------|----|--------------------------------------|-----|
| Model Selection Guide | P2 | Characteristic Curves | P5 |
| Input Specifications..... | P2 | Package Specifications | P14 |
| Output Specifications..... | P2 | Recommended Pad Layout..... | P14 |
| Output Voltage Tolerance | P3 | Packaging Information for Tube | P15 |
| Isolation, Safety Standards..... | P3 | Wave Soldering Considerations | P15 |
| General Specifications..... | P3 | Hand Welding Parameter | P15 |
| EMC Specifications..... | P3 | Part Number Structure | P16 |
| Environmental Specifications | P4 | MTBF and Reliability | P16 |

| Model Selection Guide | | | | | | | |
|-----------------------|-----------------------|----------------|----------------|---------------|----------|----------------------|-------------------|
| Model Number | Input Voltage (Range) | Output Voltage | Output Current | Input Current | | Max. capacitive Load | Efficiency (typ.) |
| | | | | @Max. Load | @No Load | | @Max. Load |
| | VDC | VDC | mA | mA(typ.) | mA(typ.) | μF | % |
| MBSU03-05S05 | 5 (4.5 ~ 5.5) | 5 | 600 | 759 | 85 | 2200 | 79 |
| MBSU03-05S12 | | 12 | 250 | 723 | | 1000 | 83 |
| MBSU03-05S15 | | 15 | 200 | 714 | | 820 | 84 |
| MBSU03-12S05 | 12 (10.8 ~ 13.2) | 5 | 600 | 309 | 45 | 2000 | 81 |
| MBSU03-12S12 | | 12 | 250 | 294 | | 1000 | 85 |
| MBSU03-12S15 | | 15 | 200 | 294 | | 820 | 85 |
| MBSU03-24S05 | 24 (21.6 ~ 26.4) | 5 | 600 | 152 | 18 | 2000 | 82 |
| MBSU03-24S12 | | 12 | 250 | 145 | | 1000 | 86 |
| MBSU03-24S15 | | 15 | 200 | 145 | | 820 | 86 |

| Input Specifications | | | | | | |
|-------------------------------------|------------------|--------------------|------|------|------|--|
| Parameter | Model | Min. | Typ. | Max. | Unit | |
| Input Voltage Range | 5V Input Models | 4.5 | 5 | 5.5 | VDC | |
| | 12V Input Models | 10.8 | 12 | 13.2 | | |
| | 24V Input Models | 21.6 | 24 | 26.4 | | |
| Input Surge Voltage (1000 ms. max.) | 5V Input Models | -0.7 | --- | 9 | | |
| | 12V Input Models | -0.7 | --- | 18 | | |
| | 24V Input Models | -0.7 | --- | 30 | | |
| Input Filter | All Models | Internal Capacitor | | | | |

| Output Specifications | | | | | | | |
|--------------------------|--------------------------------|--|-------|-------|-------------------|--|--|
| Parameter | Conditions | Min. | Typ. | Max. | Unit | | |
| Line Regulation | For Vin Change of 1% | --- | ±1.2 | ±1.5 | % | | |
| Load Regulation | Io=10% to 100% | See Model Selection Guide (Operation at lower load will not damage the converter, but it may not meet all specifications) | | | | | |
| Ripple & Noise | 0-20 MHz Bandwidth | --- | 100 | --- | mV _{P-P} | | |
| Temperature Coefficient | | --- | ±0.01 | ±0.02 | %/°C | | |
| Short Circuit Protection | Continuous, Automatic Recovery | | | | | | |



Isolation, Safety Standards

| 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 | --- | 120 | 160 | pF |

General Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---------------------|-----------------------------------|-----------|------|------|-------|
| Switching Frequency | | --- | 60 | --- | kHz |
| MTBF (calculated) | MIL-HDBK-217F@25°C, Ground Benign | 4,963,645 | --- | --- | Hours |

EMC Specifications

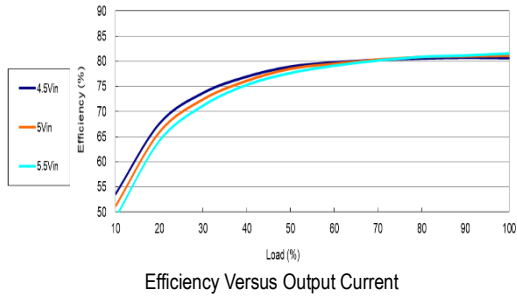
| Parameter | Standards & Level | | | Performance |
|--------------------|--------------------|------------------------|------------------------------|-------------|
| EMI ₍₅₎ | Conduction | EN 55032 | With external components | Class A |
| | Radiation | | | |
| EMS ₍₅₎ | EN 55035 | | | |
| | ESD | Direct discharge | Indirect discharge HCP & VCP | |
| | | EN 61000-4-2 Air ± 8kV | Contact ± 6kV | |
| | 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 30A/m | | A | |

| Environmental Specifications | | | | |
|--|--------------------------|------|------|----------|
| Parameter | Model | Min. | Max. | Unit |
| Operating Ambient Temperature Range Nominal Vin, Load 100% Inom. (for Power Derating see relative Derating Curves) | 5Vo Output Models | -40 | +75 | °C |
| | 12Vo, 15Vo Output Models | | +80 | |
| Case Temperature | | --- | 105 | °C |
| Storage Temperature Range | | -50 | +125 | °C |
| Humidity (non condensing) | | --- | 95 | % rel. H |
| Lead Temperature (1.5mm from case for 10Sec.) | | --- | 260 | °C |

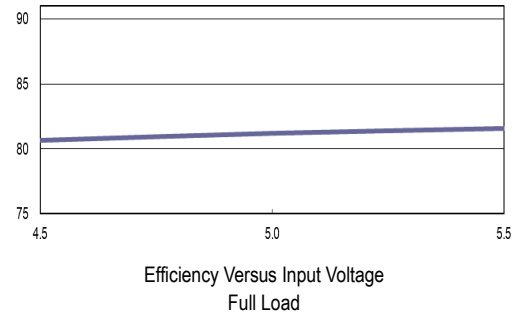
| Notes | |
|-------|---|
| 1 | Specifications typical at Ta=+25°C, resistive load, nominal input voltage and rated output current unless otherwise noted. |
| 2 | These power converters require a minimum output loading to maintain specified regulation, operation under no-load conditions will not damage these modules; however they may not meet all specifications listed. |
| 3 | We recommend to protect the converter by a slow blow fuse in the input supply line. |
| 4 | Other input and output voltage may be available, please contact MINMAX. |
| 5 | The external components might be required to meet EMI/EMS standard for some of test items. Please contact MINMAX for the solution in detail. |
| 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

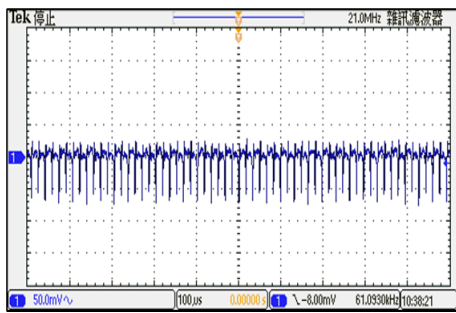
All test conditions are at 25°C The figures are identical for MBSU03-05S05



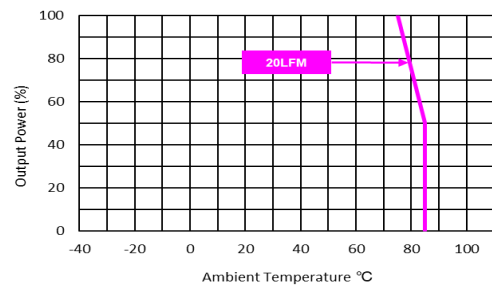
Efficiency Versus Output Current



Efficiency Versus Input Voltage Full Load



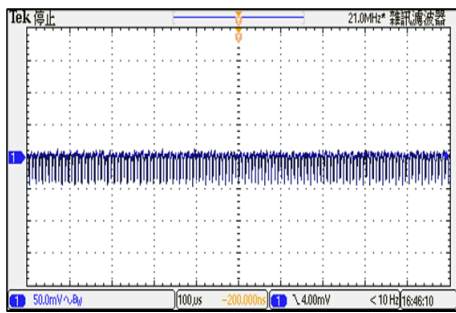
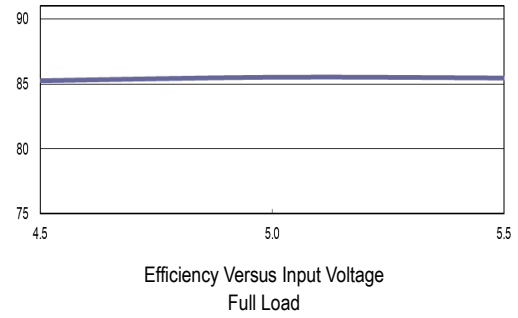
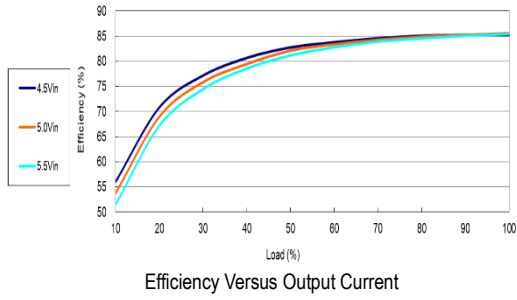
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



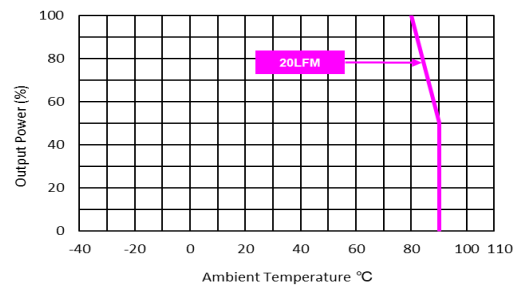
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

All test conditions are at 25°C The figures are identical for MBSU03-05S12



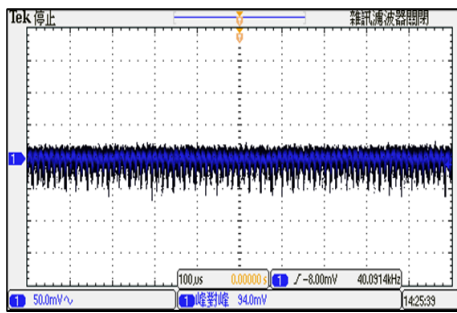
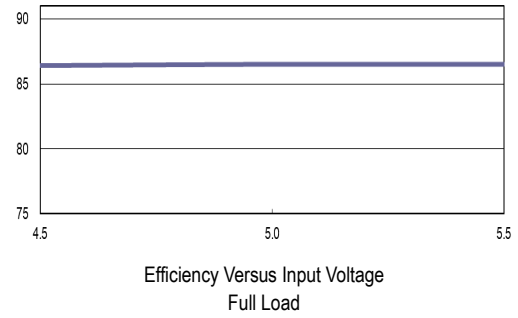
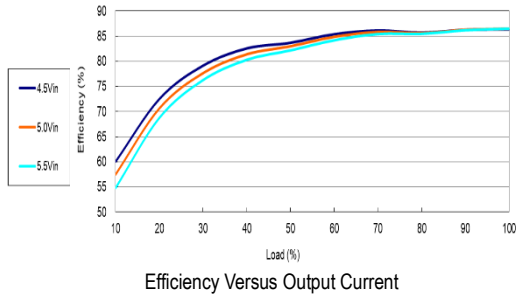
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



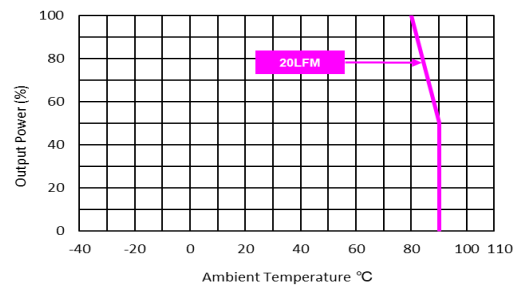
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

All test conditions are at 25°C The figures are identical for MBSU03-05S15



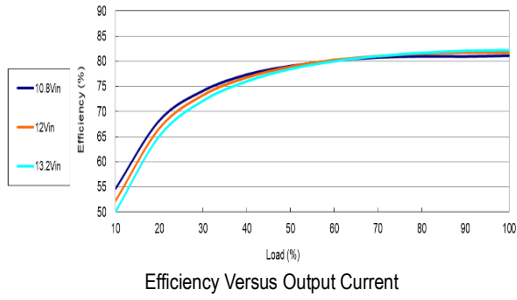
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



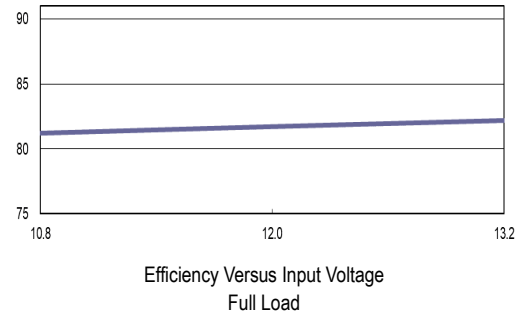
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

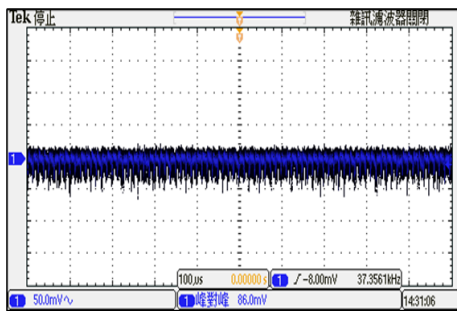
All test conditions are at 25°C The figures are identical for MBSU03-12S05



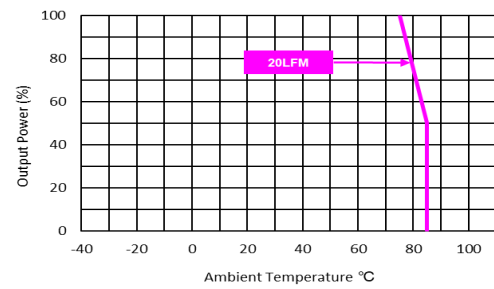
Efficiency Versus Output Current



Efficiency Versus Input Voltage Full Load



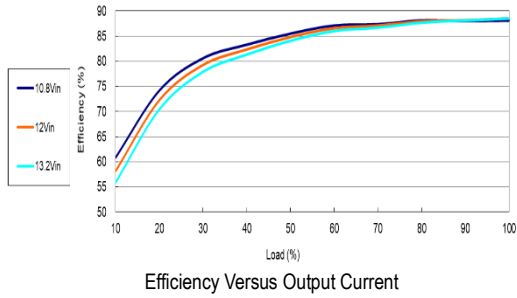
Typical Output Ripple and Noise
 $V_{in} = V_{in\ nom}$; Full Load



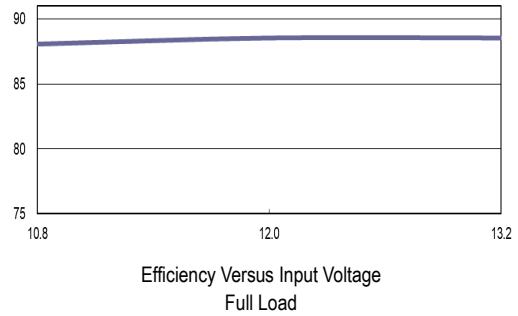
Derating Output Power Versus Ambient Temperature
 $V_{in} = V_{in\ nom}$

Characteristic Curves

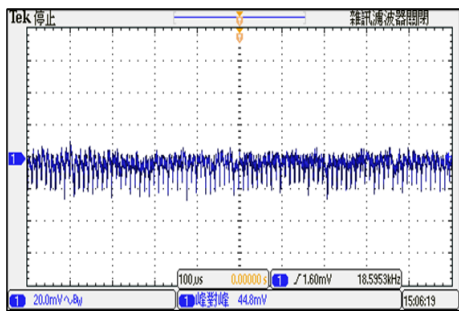
All test conditions are at 25°C The figures are identical for MBSU03-12S12



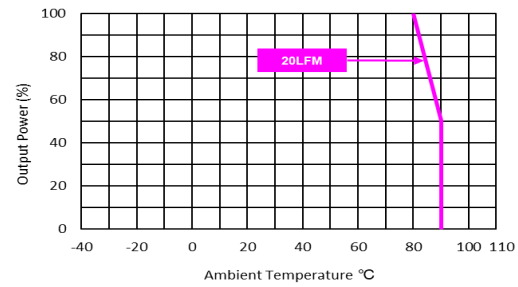
Efficiency Versus Output Current



Efficiency Versus Input Voltage Full Load



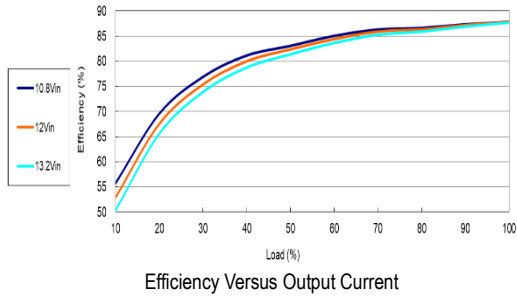
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



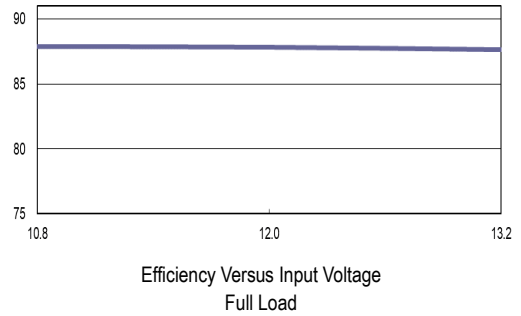
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

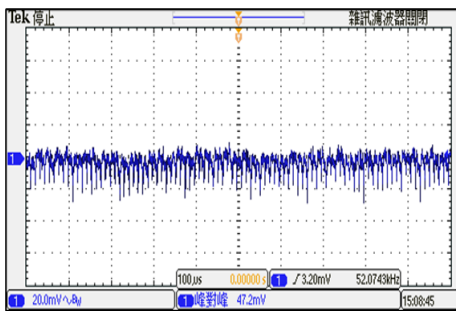
All test conditions are at 25°C The figures are identical for MBSU03-12S15



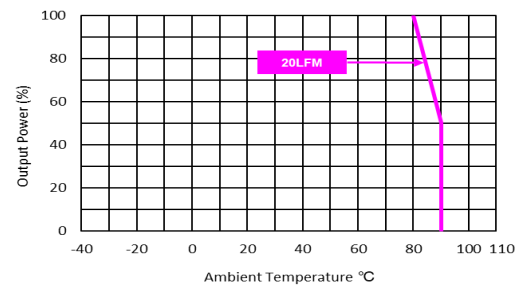
Efficiency Versus Output Current



Efficiency Versus Input Voltage Full Load



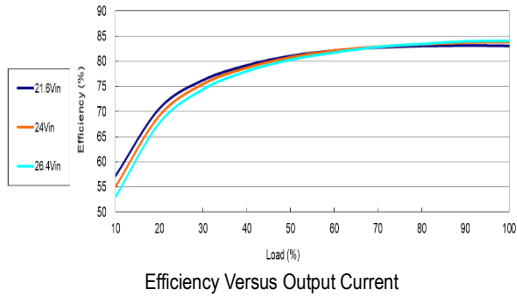
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



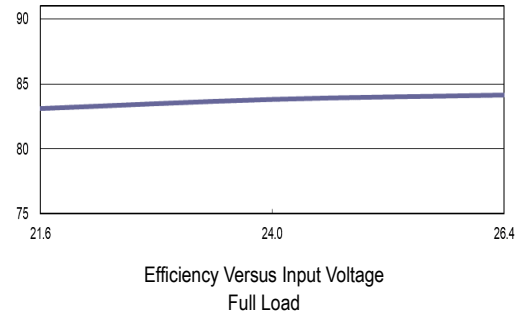
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

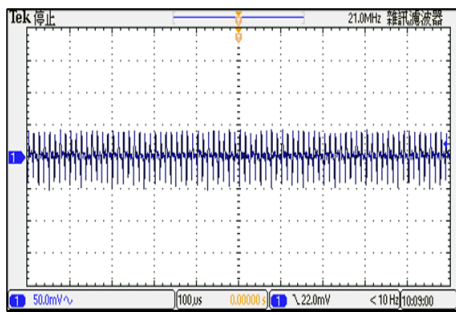
All test conditions are at 25°C The figures are identical for MBSU03-24S05



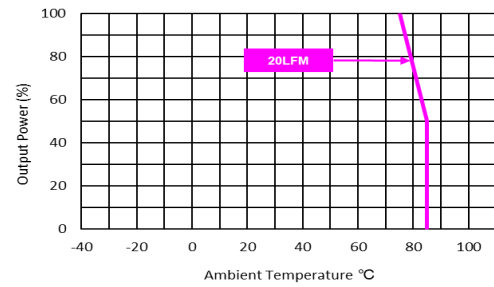
Efficiency Versus Output Current



Efficiency Versus Input Voltage Full Load



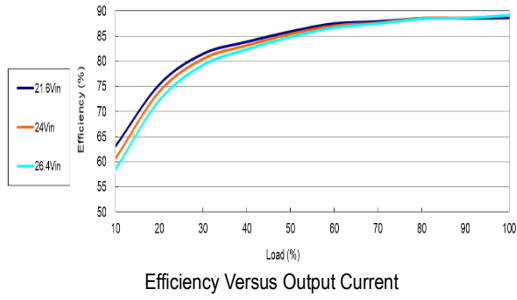
Typical Output Ripple and Noise
 $V_{in} = V_{in\ nom}$; Full Load



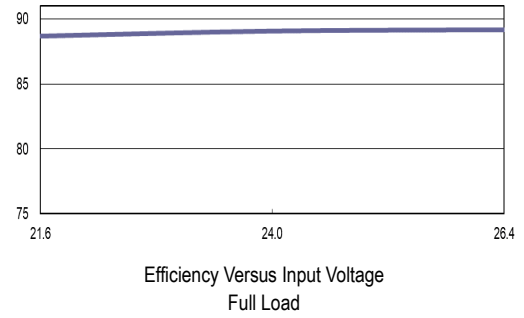
Derating Output Power Versus Ambient Temperature
 $V_{in} = V_{in\ nom}$

Characteristic Curves

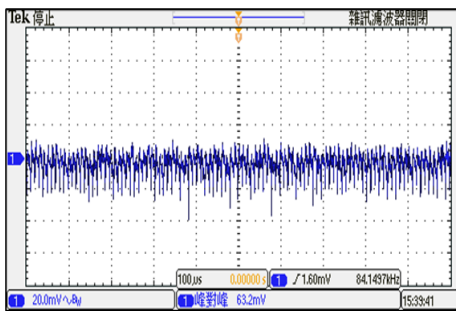
All test conditions are at 25°C The figures are identical for MBSU03-24S12



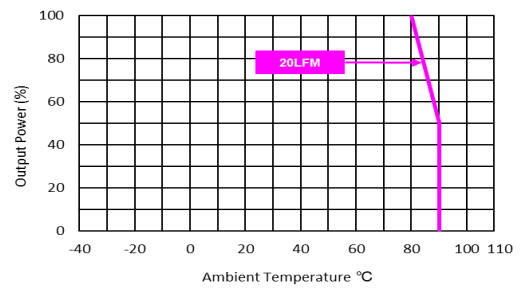
Efficiency Versus Output Current



Efficiency Versus Input Voltage Full Load



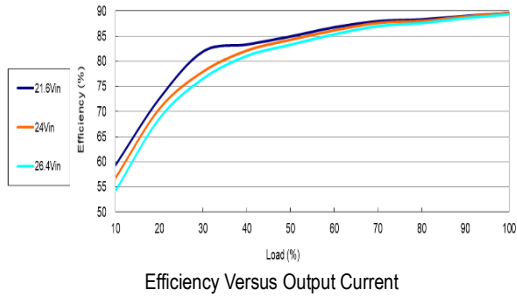
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}; Full\ Load$



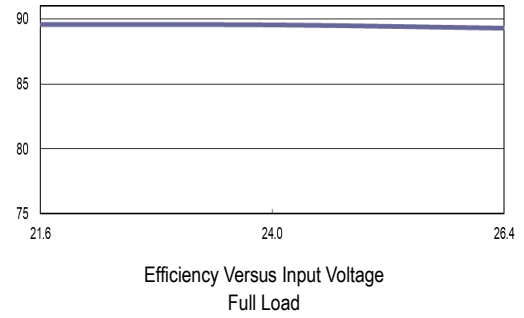
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

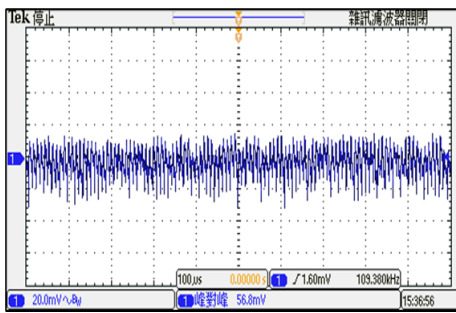
All test conditions are at 25°C The figures are identical for MBSU03-24S15



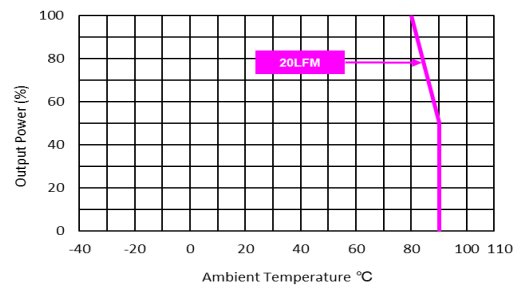
Efficiency Versus Output Current



Efficiency Versus Input Voltage Full Load



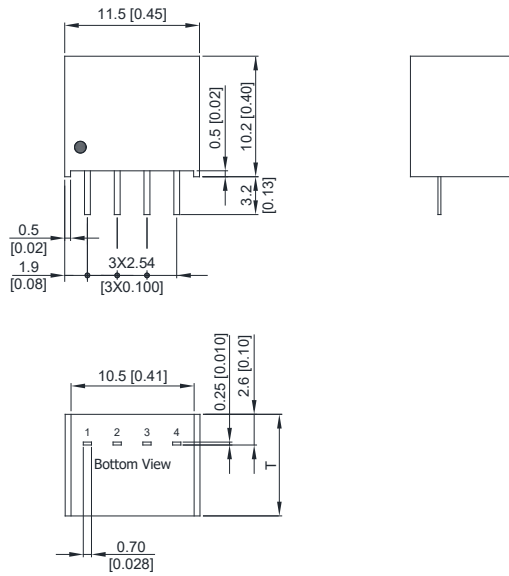
Typical Output Ripple and Noise
V_{in}=V_{in nom}; Full Load



Derating Output Power Versus Ambient Temperature
V_{in}=V_{in nom}

Package Specifications

Mechanical Dimensions



Pin Connections

| Pin | Single Output |
|-----|---------------|
| 1 | -Vin |
| 2 | +Vin |
| 3 | -Vout |
| 4 | +Vout |

T: 8.6mm(0.34 inch) for 5V & 12V Input Models

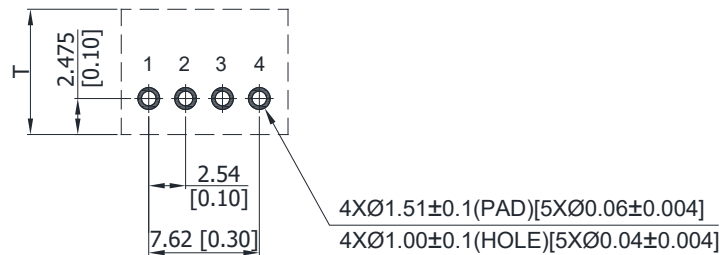
T: 9.6mm(0.38 inch) for 24V Input Models

- ▶ 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)

Physical Characteristics

| | |
|----------------------------|--|
| Case Size (5V & 12V Input) | : 11.5x10.2x8.6mm (0.45x0.40x0.34 inches) |
| Case Size (24V Input) | : 11.5x10.2x9.6mm (0.45x0.40x0.38 inches) |
| Case Material | : Plastic resin (flammability to UL 94V-0 rated) |
| Pin Material | : Phosphor Bronze |
| Weight (5V & 12V Input) | : 3.20g |
| Weight (24V Input) | : 3.40g |

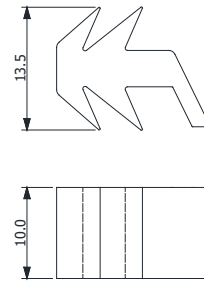
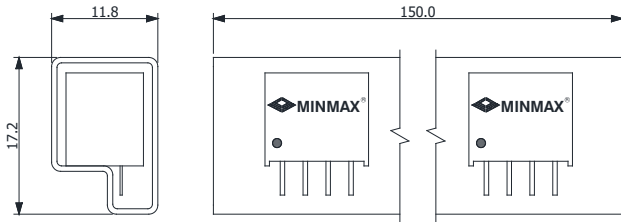
Recommended Pad Layout



Packaging Information for Tube

Tube

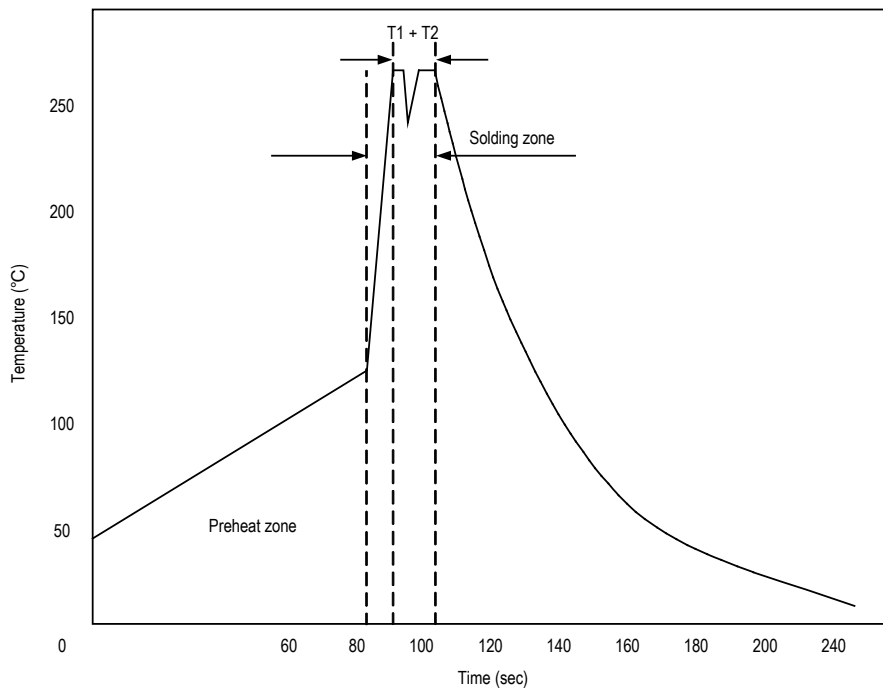
Plug



Unit: mm
10 PCS per TUBE

Wave Soldering Considerations

Lead free wave solder profile



| Zone | Reference Parameter |
|---------|---------------------------------|
| Preheat | Rise temp. speed : 3°C/sec max. |
| zone | Preheat temp. : 100~130°C |
| Actual | Peak temp. : 250~260°C |
| heating | Peak time(T1+T2) : 4~6 sec |

Hand Welding Parameter

Reference Solder: Sn-Ag-Cu : Sn-Cu : Sn-Ag

Hand Welding: Soldering iron : Power 60W

Welding Time: 2~4 sec

Temp.: 380~400°C

| Part Number Structure | | | | | | | |
|-----------------------|-----------------------|--|------------------------|---|---------------------|------------------------------|----------------|
| M | B | SU | 03 | - | 05 | S | 05 |
| | Package Type SIP-4 | Protection Short Circuit Protection | Output Power 3 Watt | | Input Voltage Range | Output Quantity S: Single | Output Voltage |
| | | ±10% Input Range | | | 05: 4.5 ~ 5.5 VDC | | 05: 5 VDC |
| | | Output Regulation Unregulated | | | 12: 10.8 ~ 13.2 VDC | | 12: 12 VDC |
| | | | | | 24: 21.6 ~ 26.4 VDC | | 15: 15 VDC |

| MTBF and Reliability | | |
|---|-----------|-------|
| The MTBF of MBSU03 series of DC-DC converters has been calculated using MIL-HDBK 217F NOTICE2, Operating Temperature 25°C, Ground Benign. | | |
| Model | MTBF | Unit |
| MBSU03-05S05 | 5,061,477 | Hours |
| MBSU03-05S12 | 6,127,439 | |
| MBSU03-05S15 | 5,246,916 | |
| MBSU03-12S05 | 5,436,219 | |
| MBSU03-12S12 | 5,753,000 | |
| MBSU03-12S15 | 4,963,645 | |
| MBSU03-24S05 | 5,634,989 | |
| MBSU03-24S12 | 5,945,517 | |
| MBSU03-24S15 | 5,945,083 | |