MINMAX®

MBU100 Series
Electric Characteristic Note

MBU100 Series EC Note

DC-DC CONVERTER 1W, SIP-Package

Features

- **Industrial Standard SIP-4 Package**
- **Unregulated Output Voltage**
- **I/O Isolation 1000 VDC**
- **Operating Ambient Temp. Range -40℃ to +85℃**

Applications

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

Product Overview

The MINMAX MBU100 series is a range of 1W DC-DC converters in a miniature SIP Package featuring I/O isolation of 1000VDC. A high efficiency allows an operating temperature range of -40℃ to +85℃. These converters offer an economical solution for many space critical applications where a voltage has to be isolated i.e for noise reduction, ground loop elimination, digital interfaces or for board level power distribution.

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Model Selection Guide

Model Number	Input Voltage (Range)	Output Voltage	Output Current	Input Current		Load Regulation	Max. capacitive Load	Efficiency (typ.)
			Max.	@Max. Load	@No Load			@Max. Load
	VDC	VDC	mA	mA(typ.)	mA(typ.)	% (max.)	μF	%
MBU135	3.3 (2.97 ~ 3.63)	3.3	260	351	35	14	33	74
MBU131		5	200	394		14		77
MBU105	5 (4.5 ~ 5.5)	3.3	260	238	30	11	33	72
MBU101		5	200	290		11		69
MBU102		9	110	260		8		76
MBU103		12	84	262		7		77
MBU104		15	67	258		6		78
MBU111	12 (10.8 ~ 13.2)	5	200	117	13	9	33	71
MBU112		9	110	107		5		77
MBU113		12	84	106		5		79
MBU114		15	67	105		4		80
MBU121	24 (21.6 ~ 26.4)	5	200	60	7	8	33	70
MBU122		9	110	54		5		76
MBU123		12	84	53		4		79
MBU124		15	67	53		4		79

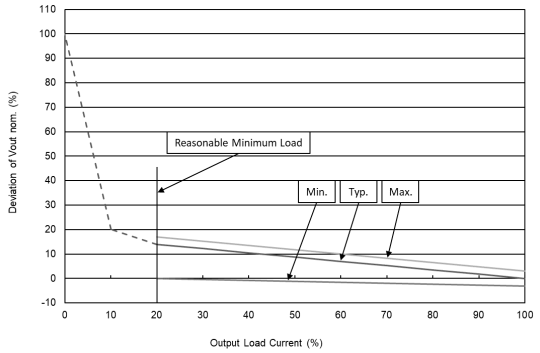
Input Specifications

Parameter	Model	Min.	Typ.	Max.	Unit
Input Voltage Range	3.3V Input Models	2.97	3.3	3.63	VDC
	5V Input Models	4.5	5	5.5	
	12V Input Models	10.8	12	13.2	
	24V Input Models	21.6	24	26.4	
Input Surge Voltage (1 sec. max.)	3.3V Input Models	-0.7	---	6	
	5V Input Models	-0.7	---	9	
	12V Input Models	-0.7	---	18	
	24V Input Models	-0.7	---	30	
Input Filter	All Models	Internal Capacitor			

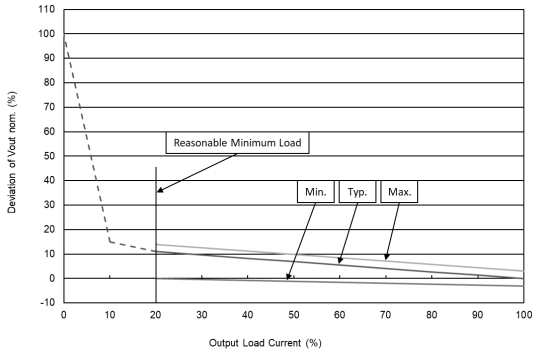
Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy		---	±1.0	±3.0	%Vnom.
Line Regulation	For Vin Change of 1%	---	±1.2	±1.5	%
Load Regulation	Io=20% to 100%	See Model Selection Guide (Operation at lower load will not damage the converter, but it may not meet all specifications)			
Ripple & Noise	0-20 MHz Bandwidth	---	100	150	mV_{P-P}
Temperature Coefficient		---	±0.01	±0.02	%/℃
Short Circuit Protection	0.5 Second Max., Automatic Recovery				

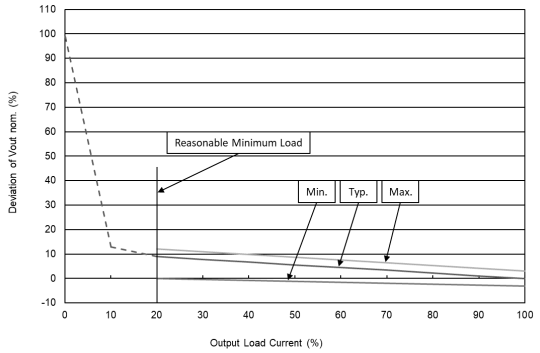
Output Voltage Tolerance



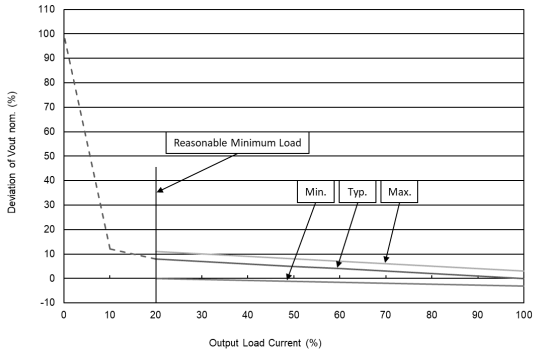
MBU135 & MBU131 Output Voltage VS Output Load Current



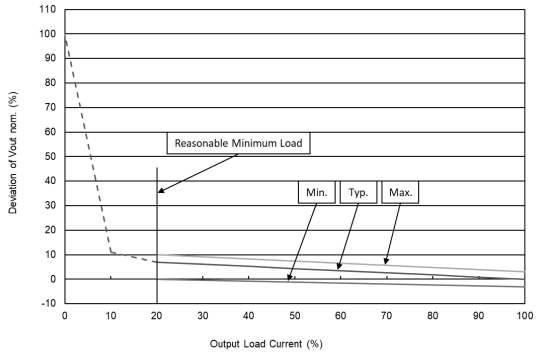
MBU105 & MBU101 Output Voltage VS Output Load Current



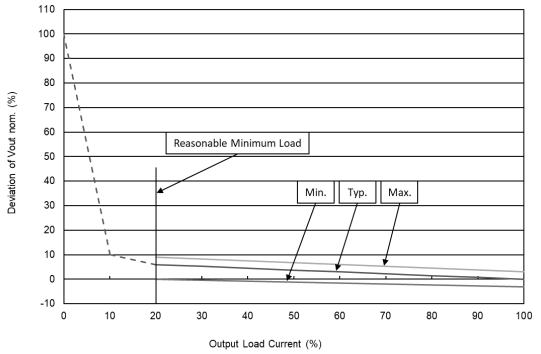
MBU111 Output Voltage VS Output Load Current



MBU102 & MBU121 Output Voltage VS Output Load Current

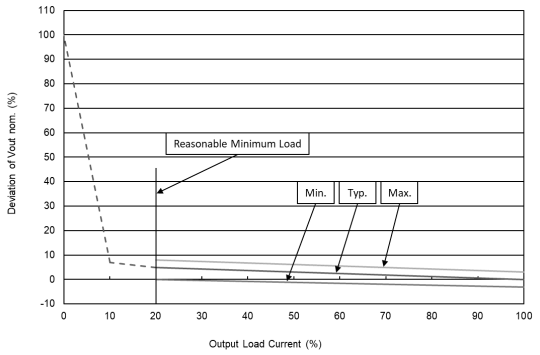


MBU103 Output Voltage VS Output Load Current

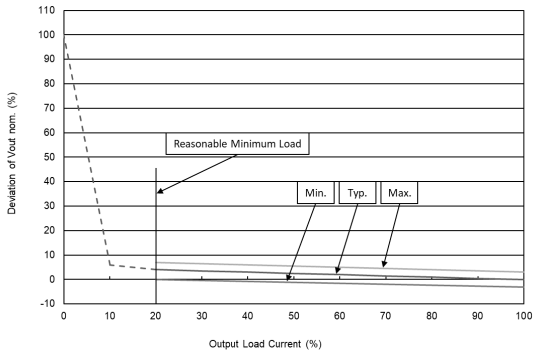


MBU104 Output Voltage VS Output Load Current

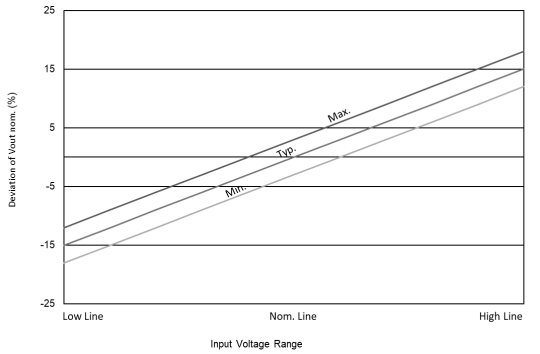
Output Voltage Tolerance



MBU112, MBU113, MBU122 Output Voltage VS Output Load Current



MBU114, MBU123, MBU124 Output Voltage VS Output Load Current



Output Voltage VS Input Voltage Range

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds	1000	---	---	VDC
	1 Seconds	1200	---	---	VDC
I/O Isolation Resistance	500 VDC	1000	---	---	MΩ
I/O Isolation Capacitance	100kHz, 1V	---	60	100	pF
Switching Frequency		50	90	110	kHz
MTBF (calculated)	MIL-HDBK-217F@25℃, Ground Benign		2,000,000		Hours

Environmental Specifications

Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+85	℃
Case Temperature	---	+105	℃
Storage Temperature Range	-50	+125	℃
Humidity (non condensing)	---	95	% rel. H
Lead Temperature (1.5mm from case for 10Sec.)	---	260	℃

Notes

1 Specifications typical at Ta=+25℃, resistive load, nominal input voltage and rated output current unless otherwise noted.

2 These power converters require a minimum output loading to maintain specified regulation, operation under no-load conditions will not damage these modules; however they may not meet all specifications listed.

3 We recommend to protect the converter by a slow blow fuse in the input supply line.

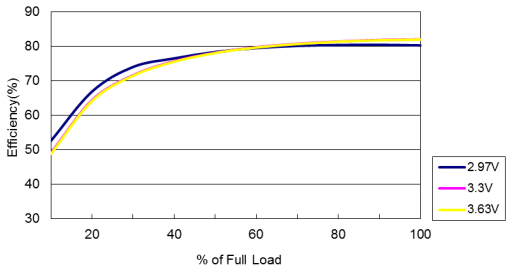
4 Other input and output voltage may be available, please contact MINMAX.

5 Specifications are subject to change without notice.

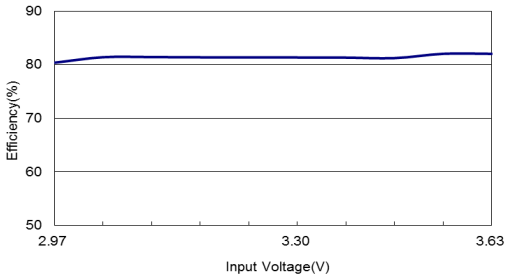
6 The repeated high voltage isolation testing of the converter can degrade isolation capability, to a lesser or greater degree depending on materials, construction, environment and reflow solder process. Any material is susceptible to eventual chemical degradation when subject to very high applied voltages thus implying that the number of tests should be strictly limited. We therefore strongly advise against repeated high voltage isolation testing, but if it is absolutely required, that the voltage be reduced by 20% from specified test voltage. Furthermore, the high voltage isolation capability after reflow solder process should be evaluated as it is applied on system.

Characteristic Curves

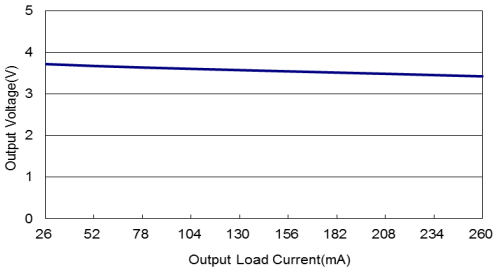
All test conditions are at 25°C The figures are identical for MBU135



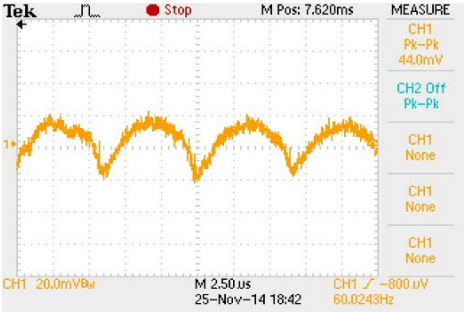
Efficiency Versus Output Current



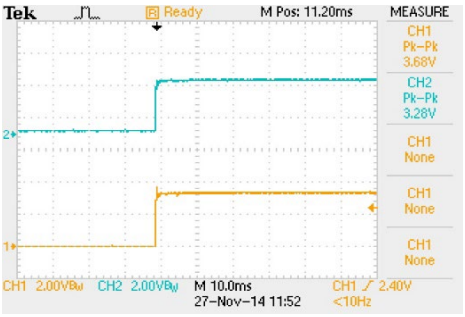
Efficiency Versus Input Voltage
Full Load



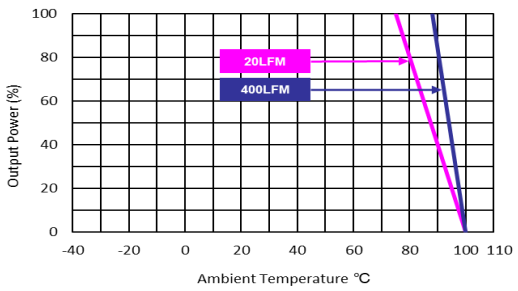
Output Voltage Versus Output Current



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



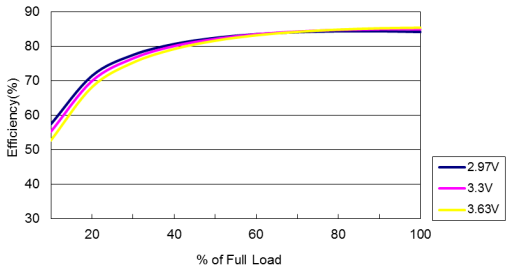
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



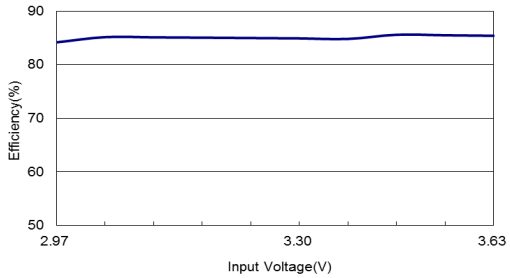
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

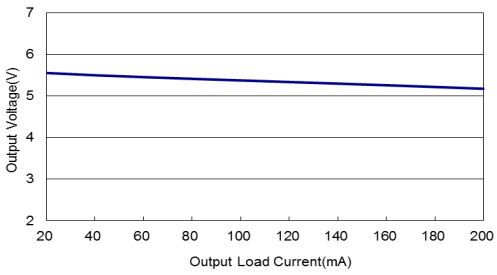
All test conditions are at 25°C The figures are identical for MBU131



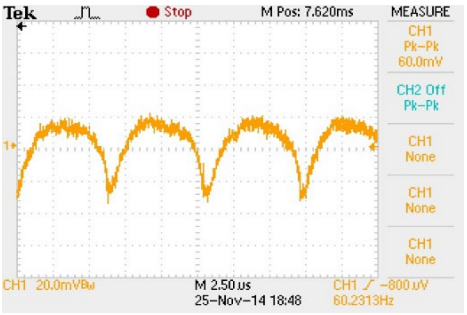
Efficiency Versus Output Current



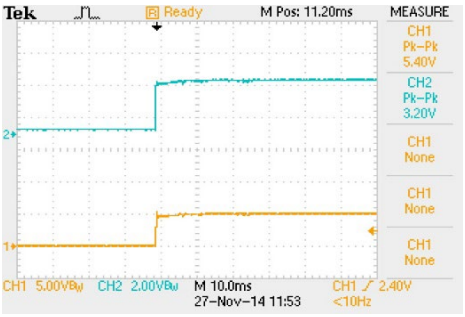
Efficiency Versus Input Voltage
Full Load



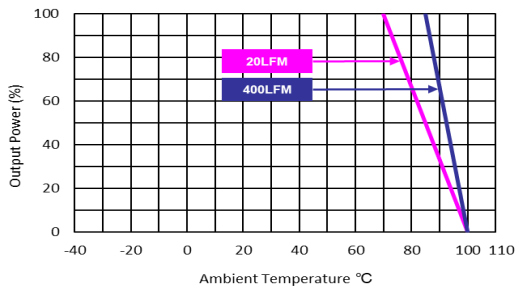
Output Voltage Versus Output Current



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



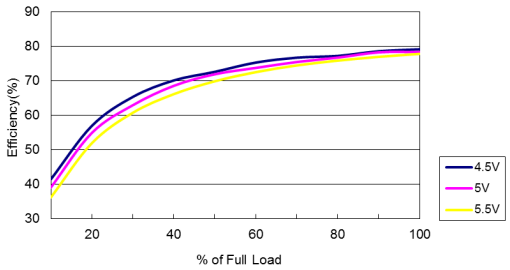
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



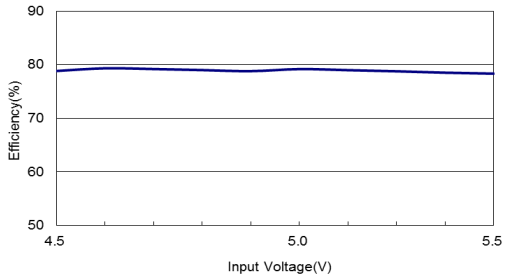
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

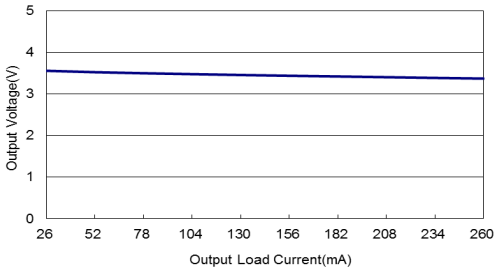
All test conditions are at 25°C The figures are identical for MBU105



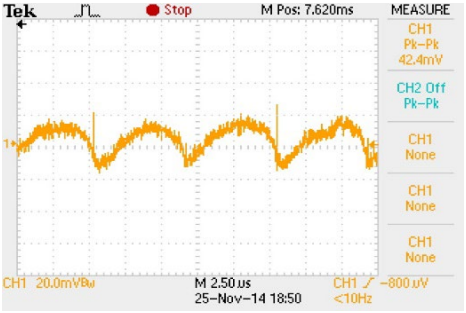
Efficiency Versus Output Current



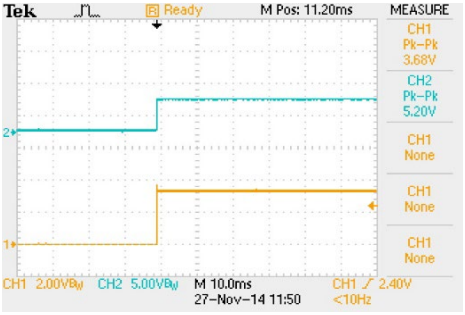
Efficiency Versus Input Voltage
Full Load



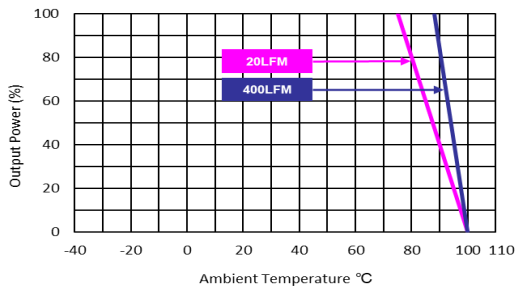
Output Voltage Versus Output Current



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



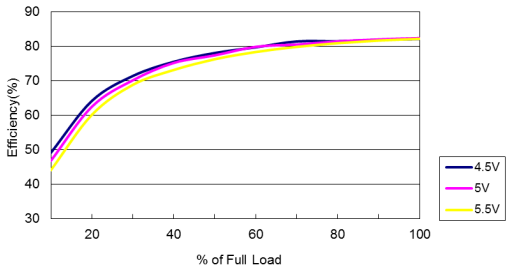
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



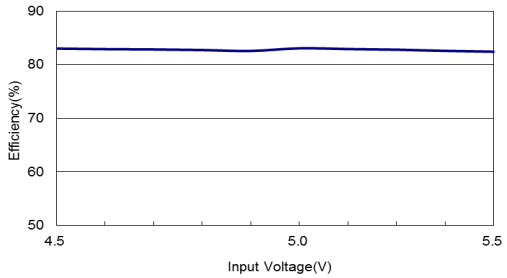
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

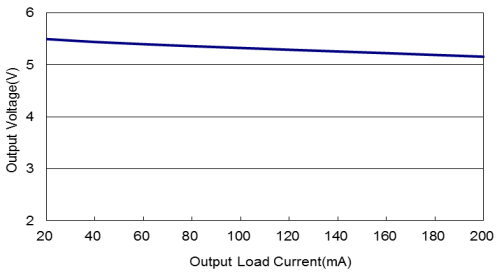
All test conditions are at 25°C The figures are identical for MBU101



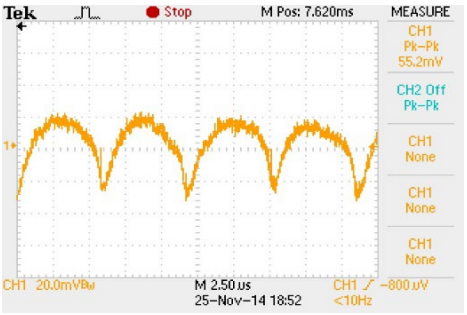
Efficiency Versus Output Current



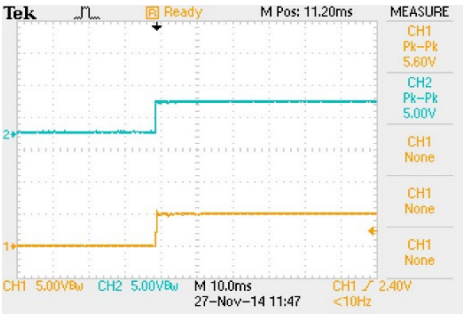
Efficiency Versus Input Voltage
Full Load



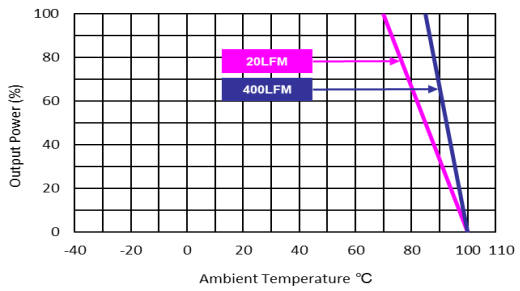
Output Voltage Versus Output Current



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



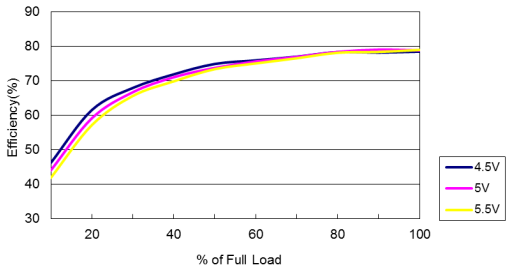
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



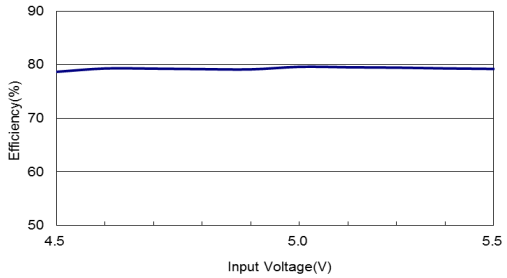
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

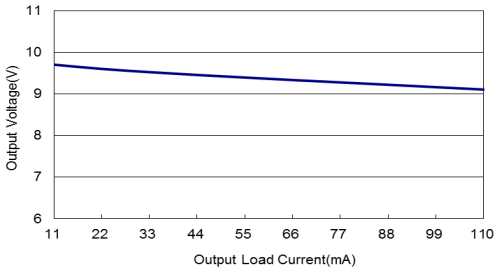
All test conditions are at 25°C The figures are identical for MBU102



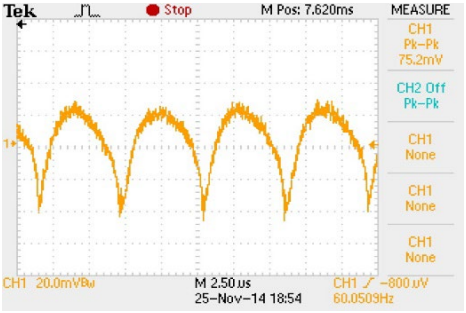
Efficiency Versus Output Current



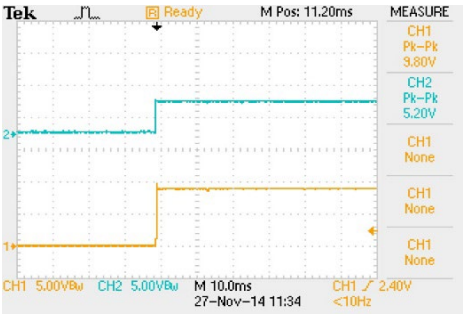
Efficiency Versus Input Voltage
Full Load



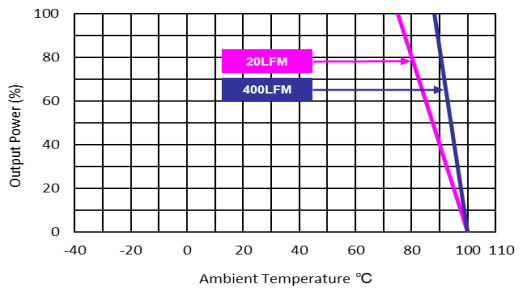
Output Voltage Versus Output Current



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



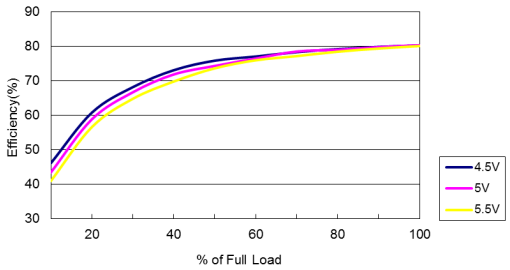
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



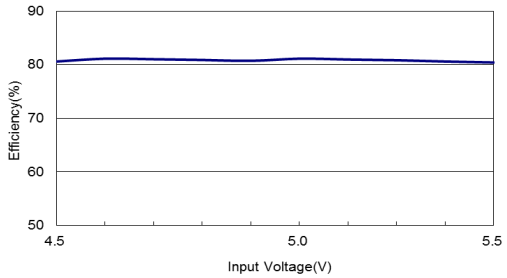
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

All test conditions are at 25°C The figures are identical for MBU103

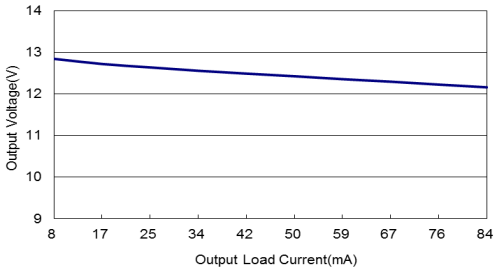


Efficiency Versus Output Current

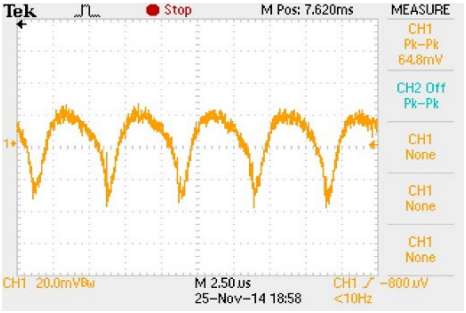


Efficiency Versus Input Voltage

Full Load

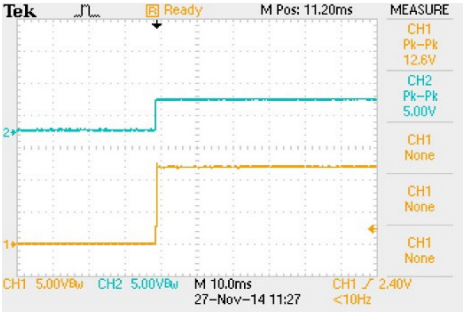


Output Voltage Versus Output Current



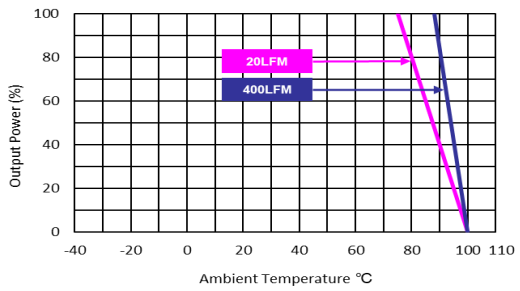
Typical Output Ripple and Noise

V_{in}=$V_{in\ nom}$; Full Load



Typical Input Start-Up and Output Rise Characteristic

V_{in}=$V_{in\ nom}$; Full Load

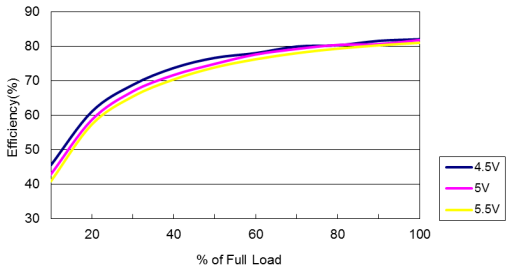


Derating Output Current Versus Ambient Temperature and Airflow

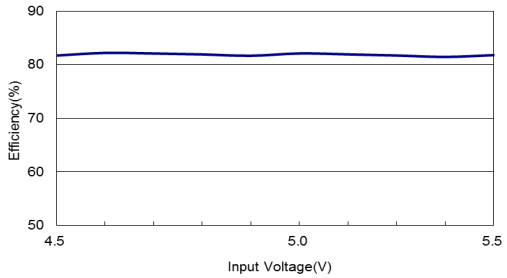
V_{in}=$V_{in\ nom}$

Characteristic Curves

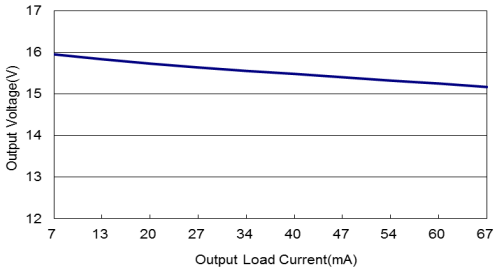
All test conditions are at 25°C The figures are identical for MBU104



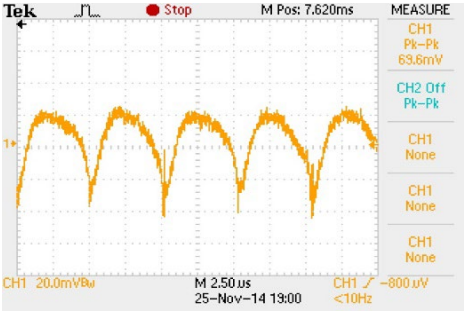
Efficiency Versus Output Current



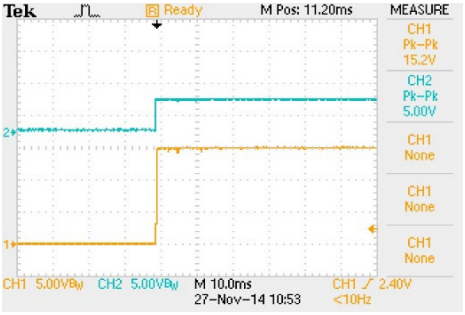
Efficiency Versus Input Voltage
Full Load



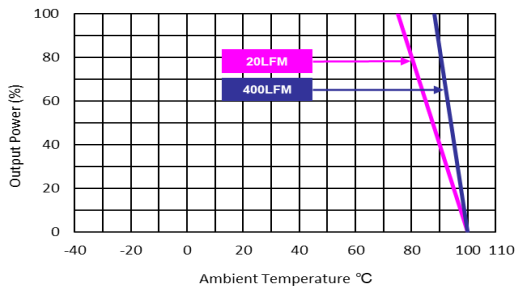
Output Voltage Versus Output Current



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



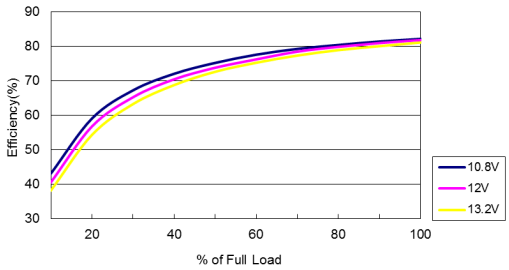
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



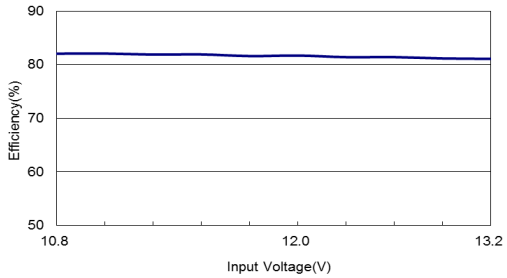
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

All test conditions are at 25°C The figures are identical for MBU111

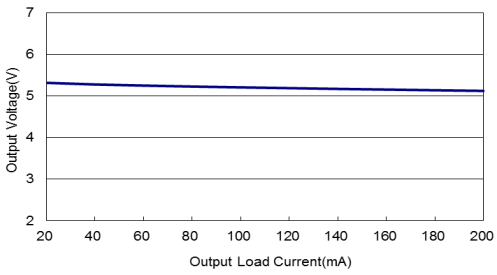


Efficiency Versus Output Current

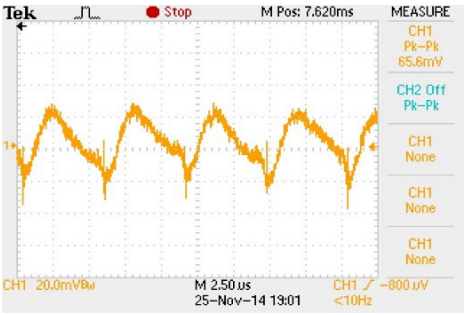


Efficiency Versus Input Voltage

Full Load

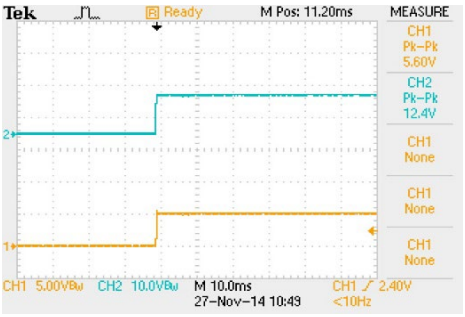


Output Voltage Versus Output Current



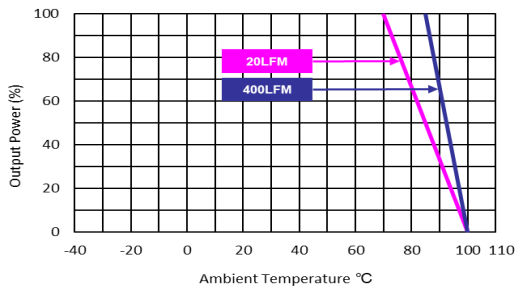
Typical Output Ripple and Noise

V_{in}=$V_{in\ nom}$; Full Load



Typical Input Start-Up and Output Rise Characteristic

V_{in}=$V_{in\ nom}$; Full Load

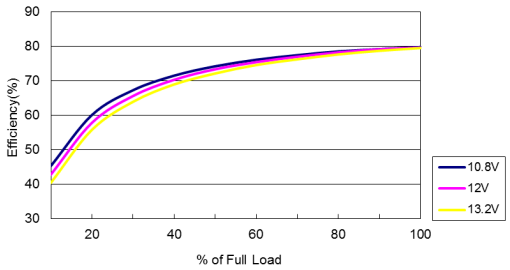


Derating Output Current Versus Ambient Temperature and Airflow

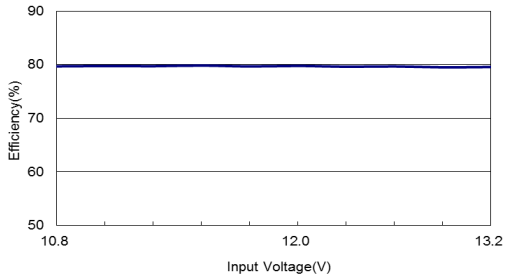
V_{in}=$V_{in\ nom}$

Characteristic Curves

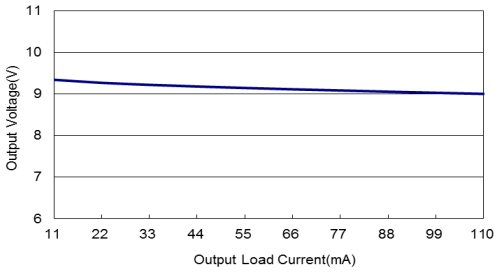
All test conditions are at 25°C The figures are identical for MBU112



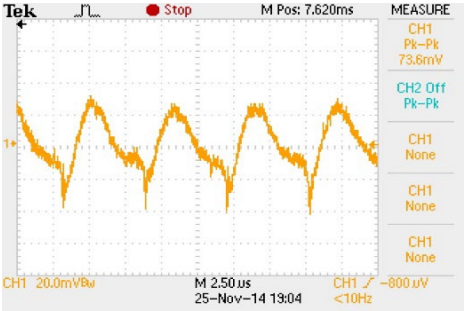
Efficiency Versus Output Current



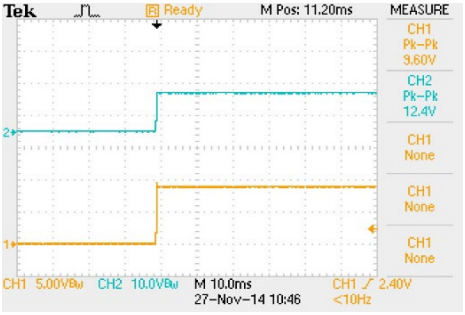
Efficiency Versus Input Voltage
Full Load



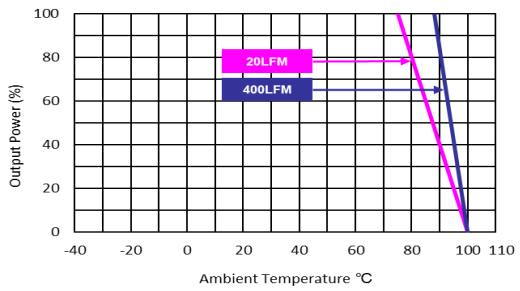
Output Voltage Versus Output Current



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



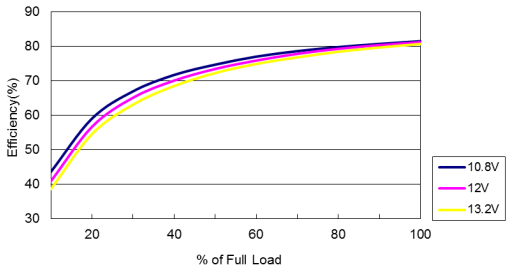
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



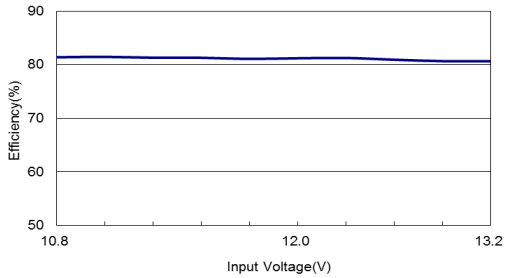
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

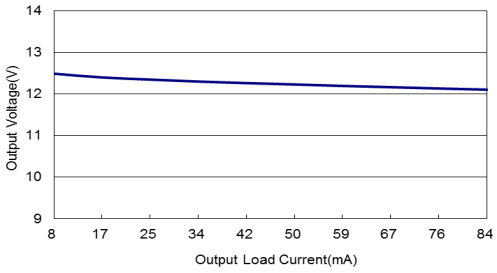
All test conditions are at 25°C The figures are identical for MBU113



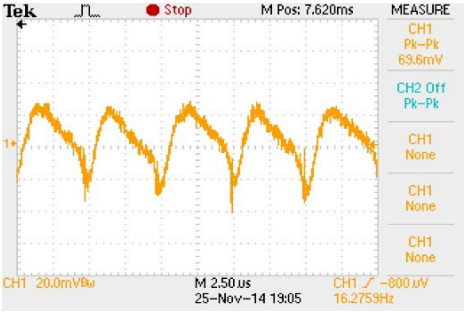
Efficiency Versus Output Current



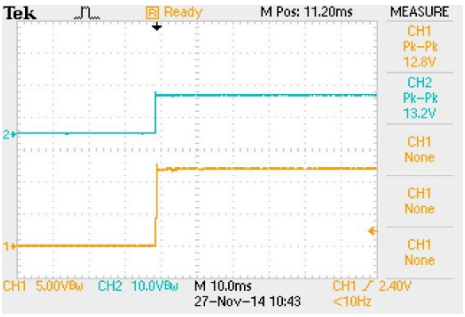
Efficiency Versus Input Voltage
Full Load



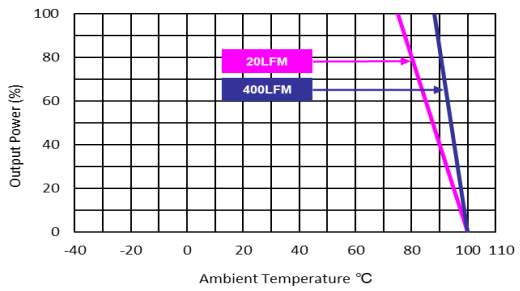
Output Voltage Versus Output Current



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



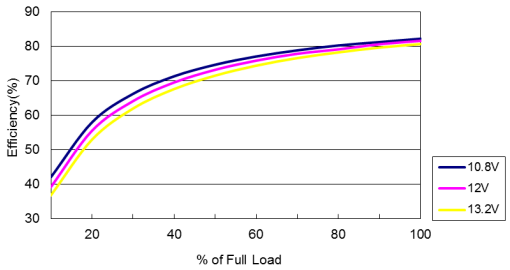
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



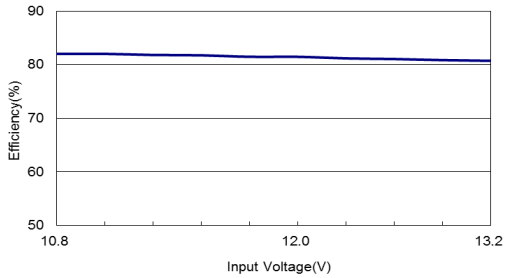
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

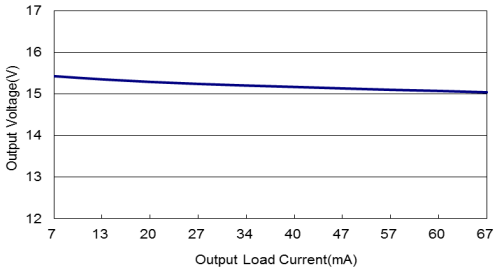
All test conditions are at 25°C The figures are identical for MBU114



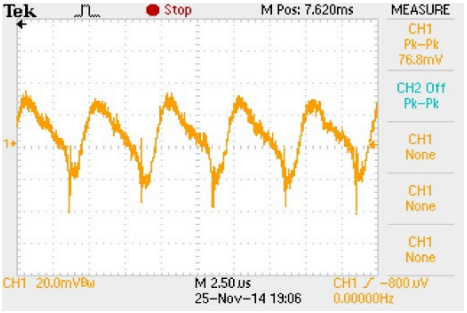
Efficiency Versus Output Current



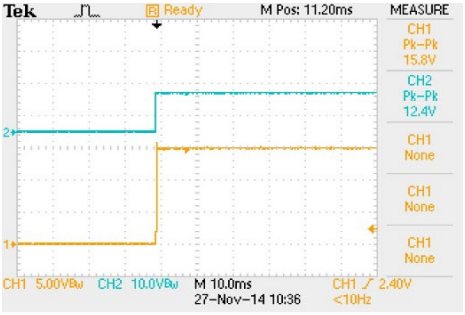
Efficiency Versus Input Voltage
Full Load



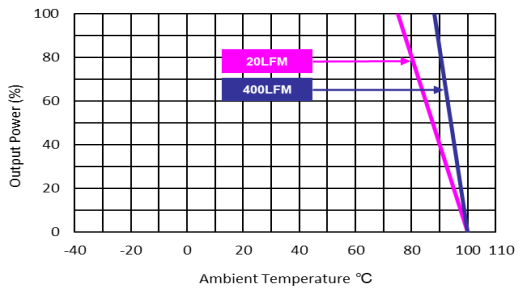
Output Voltage Versus Output Current



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



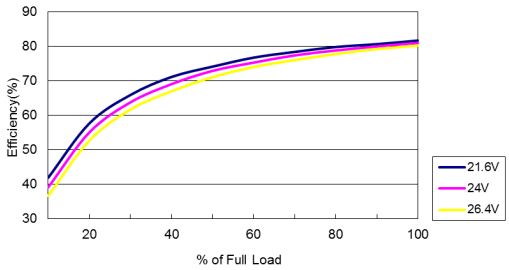
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



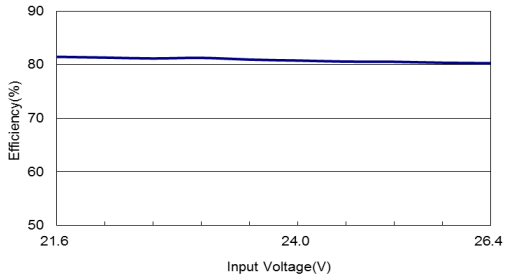
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

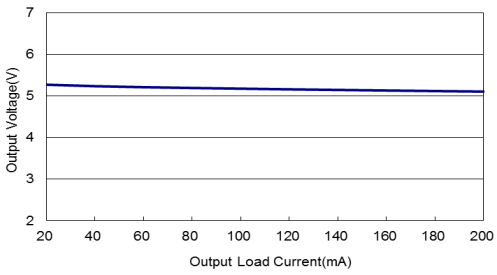
All test conditions are at 25°C The figures are identical for MBU121



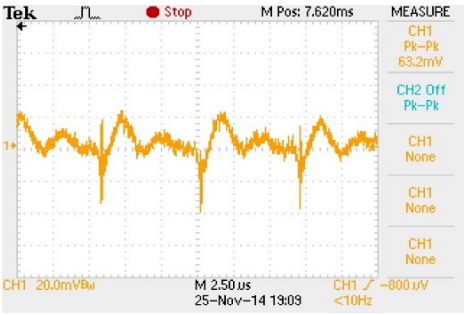
Efficiency Versus Output Current



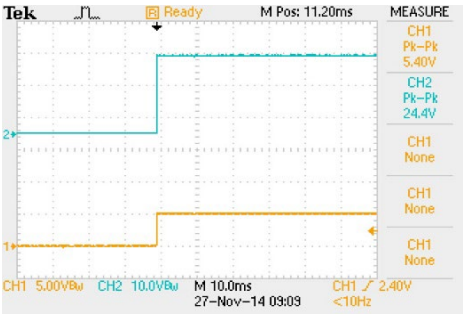
Efficiency Versus Input Voltage
Full Load



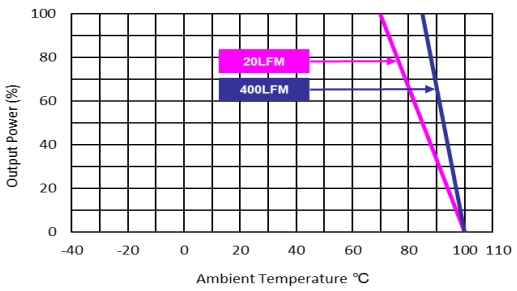
Output Voltage Versus Output Current



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



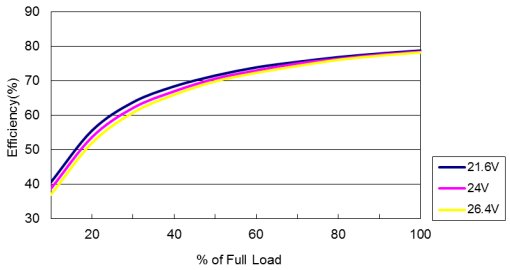
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



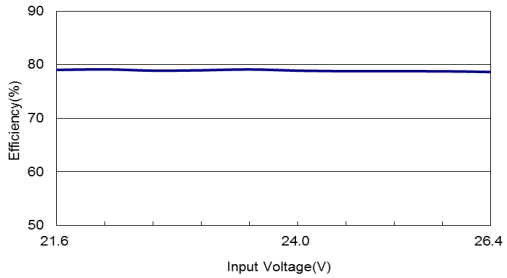
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

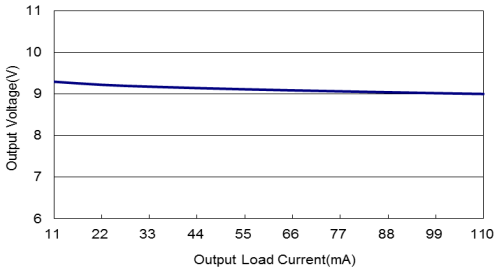
All test conditions are at 25°C The figures are identical for MBU122



Efficiency Versus Output Current

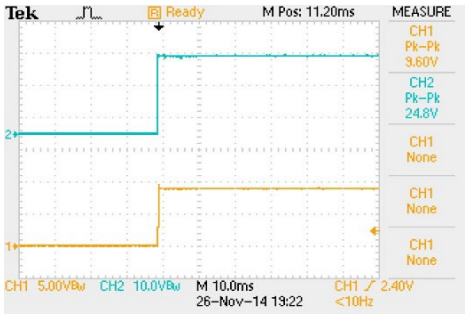


Efficiency Versus Input Voltage
Full Load

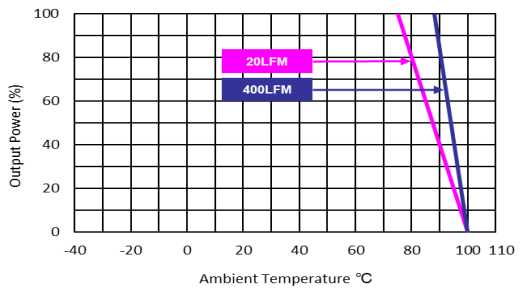


Output Voltage Versus Output Current

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



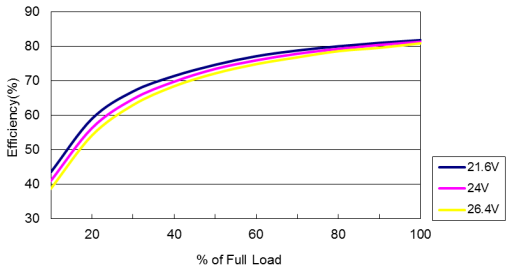
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



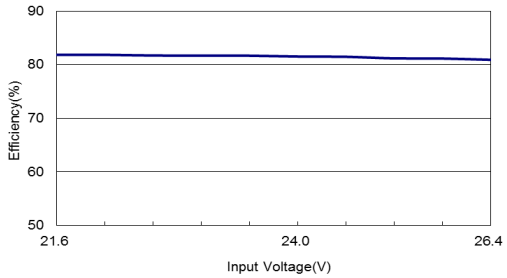
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

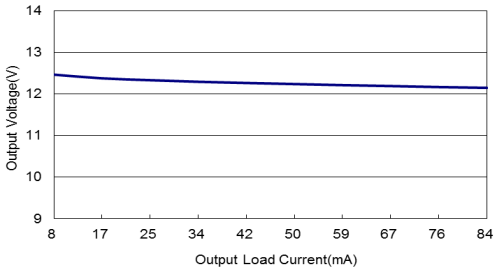
All test conditions are at 25°C The figures are identical for MBU123



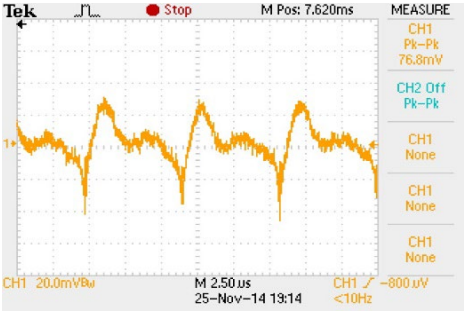
Efficiency Versus Output Current



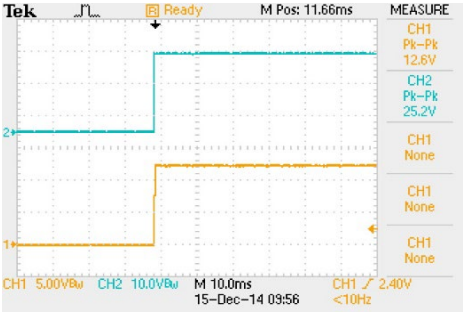
Efficiency Versus Input Voltage
Full Load



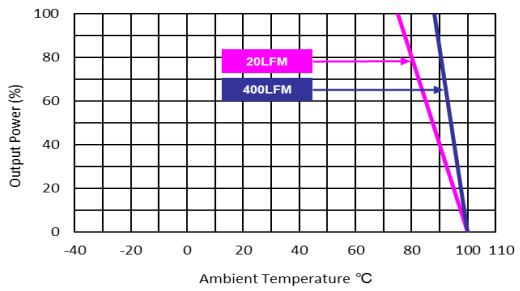
Output Voltage Versus Output Current



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



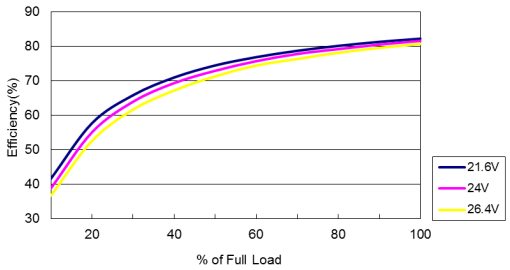
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



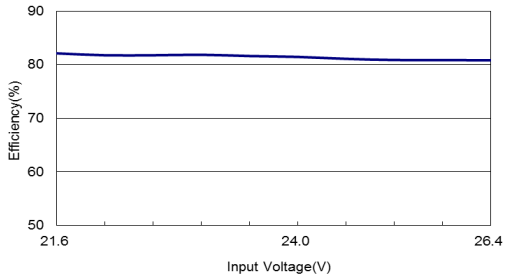
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

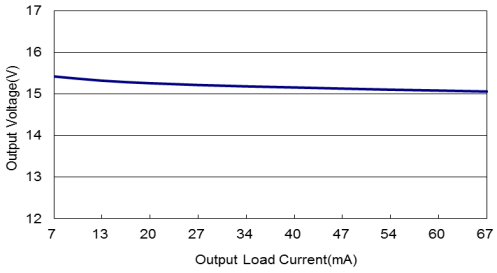
All test conditions are at 25°C The figures are identical for MBU124



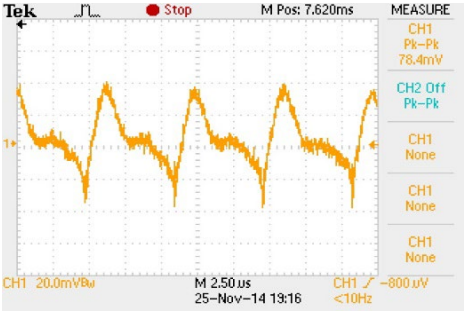
Efficiency Versus Output Current



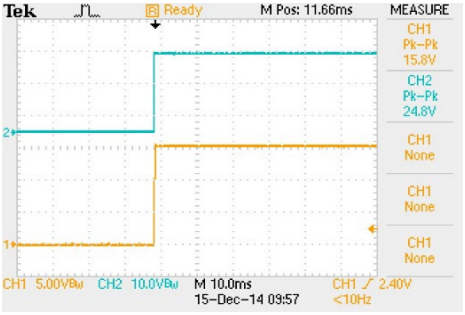
Efficiency Versus Input Voltage
Full Load



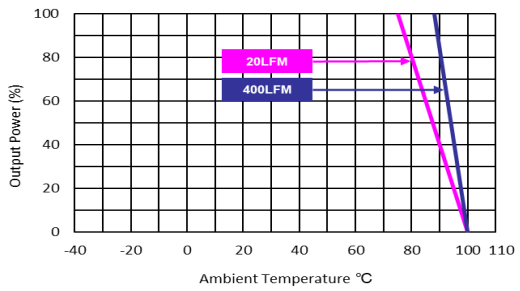
Output Voltage Versus Output Current



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



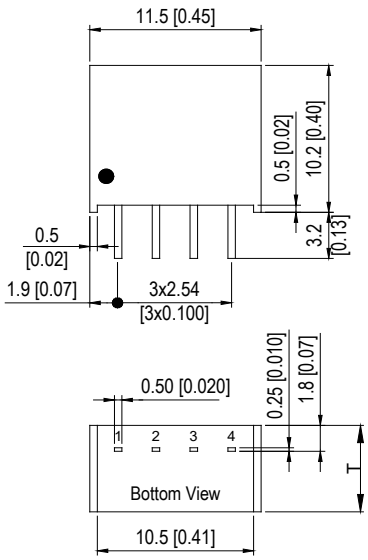
Typical Input Start-Up and Output Rise Characteristic
V_{in}=$V_{in\ nom}$; Full Load



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

Package Specifications

Mechanical Dimensions



Pin Connections

Pin	Function
1	-Vin
2	+Vin
3	-Vout
4	+Vout

T: 6.1mm(0.24 inch) for 3.3V&5V&12V Input Models

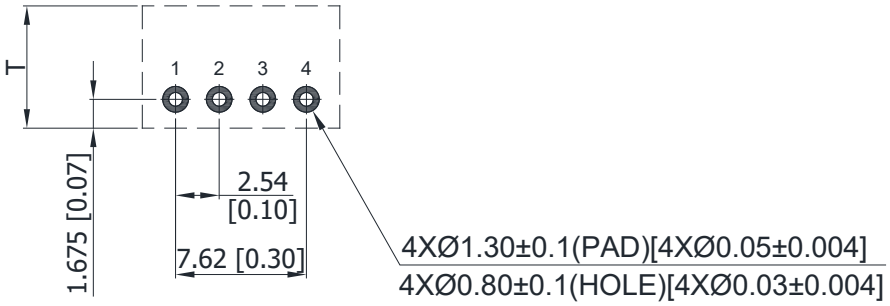
T: 7.1mm(0.28 inch) for 24V Input Models

- 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)

Physical Characteristics

Case Size(3.3V, 5V, 12V Input)	:	11.5x6.1x10.2mm (0.45x0.24x0.40 inches)
Case Size(24V Input)	:	11.5x7.1x10.2mm (0.45x0.28x0.40 inches)
Case Material	:	Plastic resin (flammability to UL 94V-0 rated)
Pin Material	:	Alloy 42
Weight(3.3V, 5V, 12V Input)	:	1.3g
Weight(24V Input)	:	1.7g

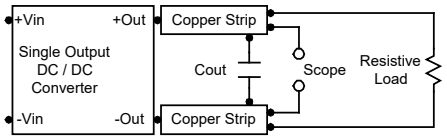
Recommended Pad Layout



Test Setup

Peak-to-Peak Output Noise Measurement Test

Use a Cout 0.33µF ceramic capacitor. Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20 MHz. Position the load between 50 mm and 75 mm from the DC-DC Converter.



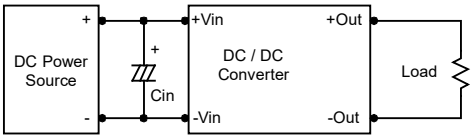
Technical Notes

Maximum Capacitive Load

The MBU100 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. For optimum performance we recommend 33µF maximum capacitive load for devices. The maximum capacitance can be found in the data sheet.

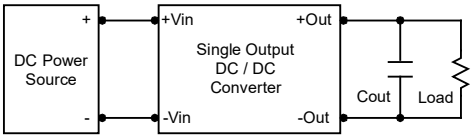
Input Source Impedance

The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.
Capacitor mounted close to the power module helps ensure stability of the unit, it is comended to use a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 kHz) capacitor of a 2.2µF for the 3.3V, 5V input devices, a 1.0µF for the 12V input devices and a 0.47µF for the 24V devices.



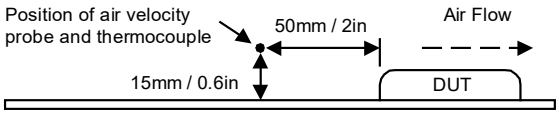
Output Ripple Reduction

A good quality low ESR capacitor placed as close as practicable across the load will give the best ripple and noise performance. To reduce output ripple, it is recommended to use 1µF capacitors at the output.



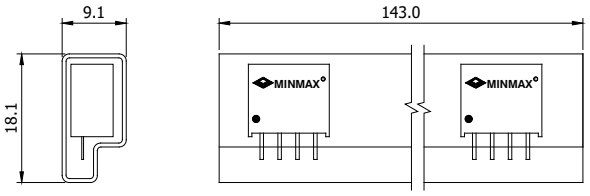
Thermal Considerations

Many conditions affect the thermal performance of the power module, such as orientation, airflow over the module and board spacing. To avoid exceeding the maximum temperature rating of the components inside the power module, the case temperature must be kept below 105°C. The derating curves are determined from measurements obtained in a test setup.

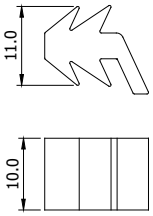


Packaging Information for Tube

Tube



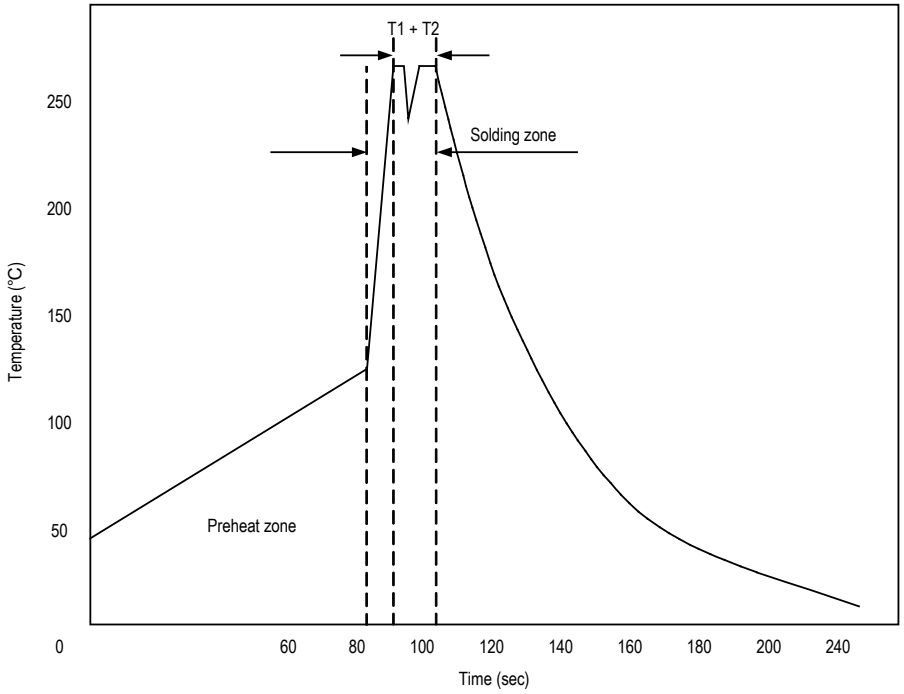
Plug



Unit: mm
10 PCS per TUBE

Wave Soldering Considerations

Lead free wave solder profile



Zone	Reference Parameter
Preheat	Rise temp. speed：3℃/sec max.
zone	Preheat temp.：100~130℃
Actual	Peak temp.：250~260℃
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℃

Part Number Structure

M	B	U	10	1

Package Type
SIP-4

Output Regulation
Unregulated

Input Voltage Range

10:	4.5	~	5.5	VDC
11:	10.8	~	13.2	VDC
12:	21.6	~	26.4	VDC
13:	2.97	~	3.63	VDC

Output Voltage

1:	5	VDC
2:	9	VDC
3:	12	VDC
4:	15	VDC
5:	3.3	VDC

MTBF and Reliability

The MTBF of MBU100 series of DC-DC converters has been calculated using

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

Model	MTBF	Unit
MBU135	6,620,000	Hours
MBU131	6,635,000	
MBU105	6,616,000	
MBU101	6,568,000	
MBU102	5,980,000	
MBU103	4,655,000	
MBU104	3,694,000	
MBU111	4,958,000	
MBU112	4,983,000	
MBU113	4,818,000	
MBU114	3,357,000	
MBU121	4,035,000	
MBU122	4,055,000	
MBU123	3,658,000	
MBU124	2,706,000	