



MINMAX[®]

MAPU01H Series

Electric Characteristic Note

MAPU01H Series EC Note

DC-DC CONVERTER 1W, SIP-Package, High Isolation

Features

- ▶ Industrial Standard SIP-7 Package
- ▶ Unregulated Output Voltage
- ▶ I/O Isolation 3000VDC
- ▶ Operating Ambient Temp. Range -40°C to +90°C
- ▶ Short Circuit Protection
- ▶ 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 MAPU01H series is a new range of isolated 1W DC-DC converter modules in SIP-7 package which feature a high I/O isolation voltage rated for 3000VDC and there are 32 models available for 3.3, 5, 12 or 24VDC input. Advanced circuit topology provides continuous overload, short circuit protection and a high efficiency up to 84% which allows operating ambient temperatures range of -40°C to +85°C without power derating. These converters offer a cost-effective solution for all applications where a high I/O isolation and fault condition protection are required.

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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.	Min.	@Max. Load	@No Load			@Max. Load
		VDC	mA	mA	mA(typ.)	mA(typ.)		μF	%
MAPU01-033S033H	3.3 (2.97 ~ 3.63)	3.3	300	6	390	45	15	220	77
MAPU01-033S05H		5	200	4	394		12		77
MAPU01-033S09H		9	110	2.2	385		12		78
MAPU01-033S12H		12	84	1.68	382		10		80
MAPU01-033S15H		15	68	1.36	391		10	100#	79
MAPU01-033D05H		±5	±100	±2	394		11		77
MAPU01-033D12H		±12	±42	±0.84	387		9		79
MAPU01-033D15H		±15	±34	±0.68	391		9		79
MAPU01-05S033H	5 (4.5 ~ 5.5)	3.3	300	6	261	30	12	220	76
MAPU01-05S05H		5	200	4	256		10		78
MAPU01-05S09H		9	110	2.2	247		8		81
MAPU01-05S12H		12	84	1.68	246		8		82
MAPU01-05S15H		15	68	1.36	246		8	100#	83
MAPU01-05D05H		±5	±100	±2	247		10		81
MAPU01-05D12H		±12	±42	±0.84	249		8		81
MAPU01-05D15H		±15	±34	±0.68	252		9		81
MAPU01-12S033H	12 (10.8 ~ 13.2)	3.3	300	6	104	17	10	220	79
MAPU01-12S05H		5	200	4	104		8		80
MAPU01-12S09H		9	110	2.2	101		7		82
MAPU01-12S12H		12	84	1.68	99		7		84
MAPU01-12S15H		15	68	1.36	102		7	100#	83
MAPU01-12D05H		±5	±100	±2	103		7		81
MAPU01-12D12H		±12	±42	±0.84	102		6		82
MAPU01-12D15H		±15	±34	±0.68	104		6		82
MAPU01-24S033H	24 (21.6 ~ 26.4)	3.3	300	6	54	10	10	220	76
MAPU01-24S05H		5	200	4	51		8		81
MAPU01-24S09H		9	110	2.2	52		8		79
MAPU01-24S12H		12	84	1.68	51		8		82
MAPU01-24S15H		15	68	1.36	52		9	100#	82
MAPU01-24D05H		±5	±100	±2	52		8		80
MAPU01-24D12H		±12	±42	±0.84	52		8		81
MAPU01-24D15H		±15	±34	±0.68	53		8		80

* Min. Output Current for Lower Load Regulation

For each output

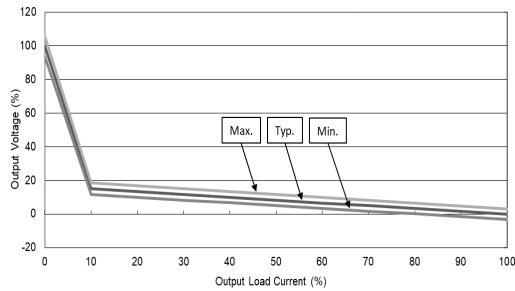
Input Specifications

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			

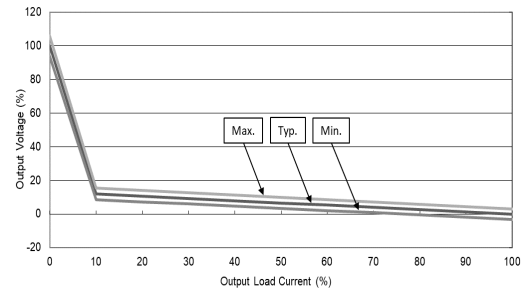
Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy		---	± 1.0	± 3.0	%
Output Voltage Balance	Dual Output, Balanced Loads	---	± 0.1	± 1.0	%
Line Regulation	For V_{in} Change of 1%	---	± 1.2	± 1.5	%
Load Regulation	$I_o = 10\%$ to 100%	See Model Selection Guide			
Ripple & Noise	0-20 MHz Bandwidth	---	65	100	mV _{p-p}
Temperature Coefficient		---	± 0.01	± 0.02	%/°C
Short Circuit Protection	Continuous, Automatic Recovery				

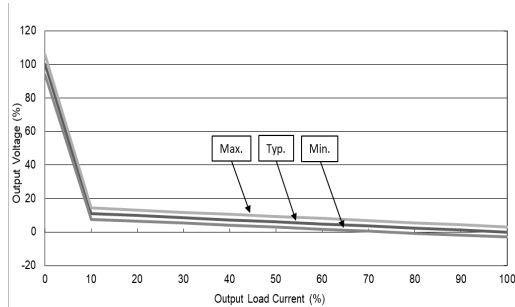
Output Voltage Tolerance



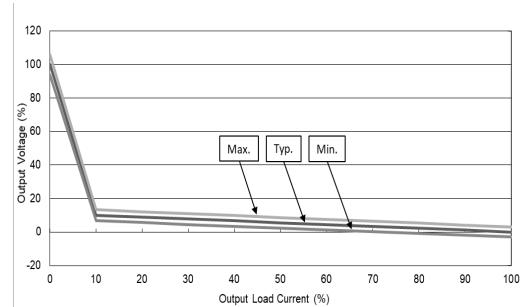
MAPU01-033S033H Output Voltage VS Output Load Current



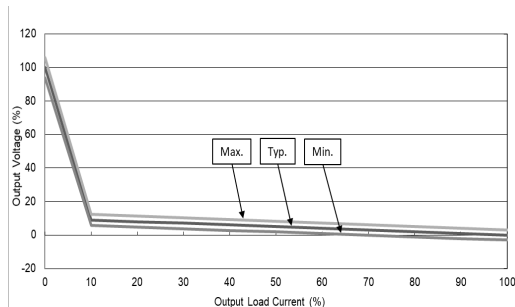
MAPU01-033S05H, MAPU01-033S09H, MAPU01-05S033H
Output Voltage VS Output Load Current



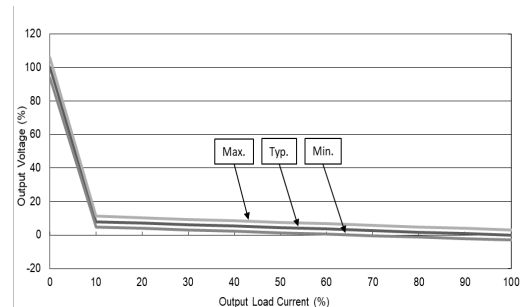
MAPU01-033D05H Output Voltage VS Output Load Current



MAPU01-033S12H, MAPU01-033S15H, MAPU01-05S05H
MAPU01-05D05H, MAPU01-12S033H, MAPU01-24S033H
Output Voltage VS Output Load Current

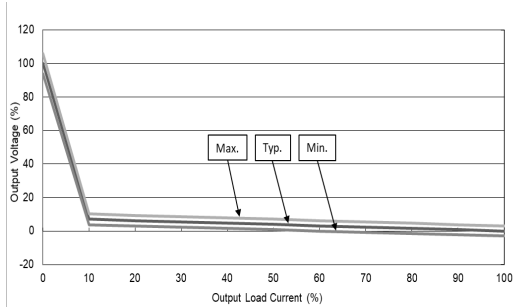


MAPU01-033D12H, MAPU01-033D15H, MAPU01-05D15H, MAPU01-24S15H
Output Voltage VS Output Load Current

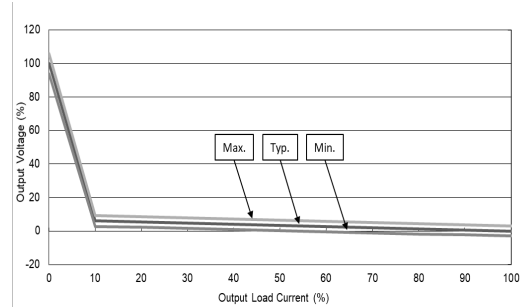


MAPU01-05S09H, MAPU01-05S12H, MAPU01-05S15H, MAPU01-05D12H
MAPU01-12S05H, MAPU01-24S05H, MAPU01-24S09H, MAPU01-24S12H
MAPU01-24D05H, MAPU01-24D12H, MAPU01-24D15H
Output Voltage VS Output Load Current

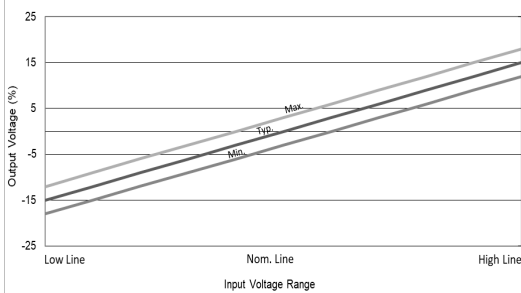
Output Voltage Tolerance



MAPU01-12S09H, MAPU01-12S12H, MAPU01-12S15H, MAPU01-12D05H
Output Voltage VS Output Load Current



MAPU01-12D12H, MAPU01-12D15H
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	3000	---	---	VDC
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100kHz, 1V	---	20	---	pF
Switching Frequency		40	75	110	kHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	3,711,000	---	---	Hours
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

Performance Specifications				
Parameter		Standards & Level		Performance
EMI	Conduction	EN 55032	With external components	Class A ₍₅₎
	Radiation			
EMS	EN 55024			
	ESD	EN 61000-4-2 Air ± 8kV , Contact ± 6kV		A
	Radiated immunity	EN 61000-4-3 10V/m		A
	Fast transient ⁽⁶⁾	EN 61000-4-4 ±2kV		A
	Surge ⁽⁶⁾	EN 61000-4-5 ±1kV		A
	Conducted immunity	EN 61000-4-6 10Vrms		A
	PFMF	EN 61000-4-8 3A/m		A

Environmental Specifications

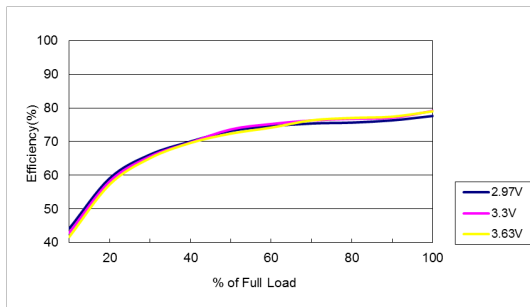
Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+90	°C
Case Temperature	---	+95	°C
Storage Temperature Range	-50	+125	°C
Humidity (non condensing)	---	95	% rel. H
Lead Temperature (1.5mm from case for 10Sec.)	---	260	°C

Notes

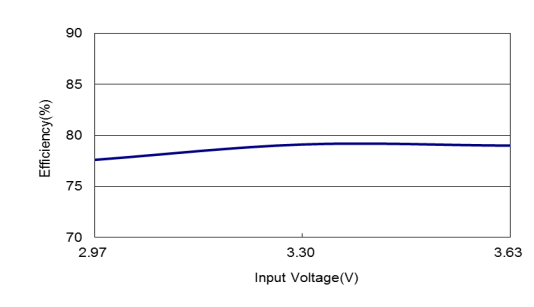
- 1 Specifications typical at Ta=+25°C, resistive load, nominal input voltage and rated output current unless otherwise noted.
- 2 These power converters require a minimum output loading to maintain specified regulation, operation under no-load conditions will not damage these modules; however they may 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 To meet EN 55032 Class A an external filter, please contact MINMAX.
- 6 To meet EN 61000-4-4 & EN 61000-4-5 an external filter requested, please contact MINMAX.
- 7 Specifications are subject to change without notice.
- 8 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 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

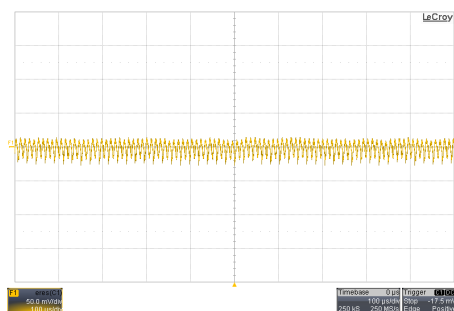
All test conditions are at 25°C The figures are identical for MAPU01-033S033H



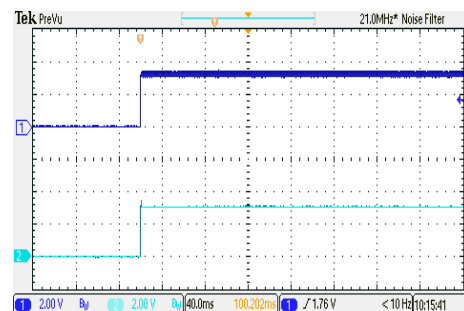
Efficiency Versus Output Current



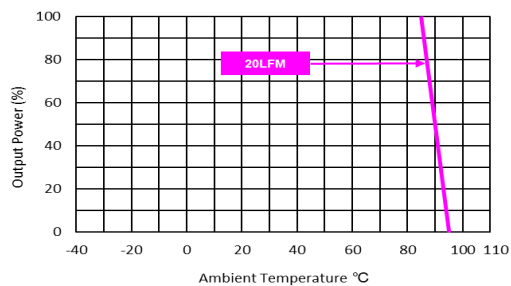
Efficiency Versus Input Voltage
Full Load



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



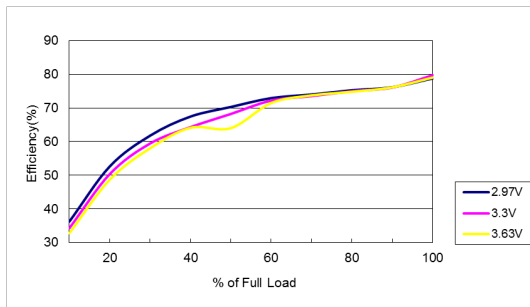
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



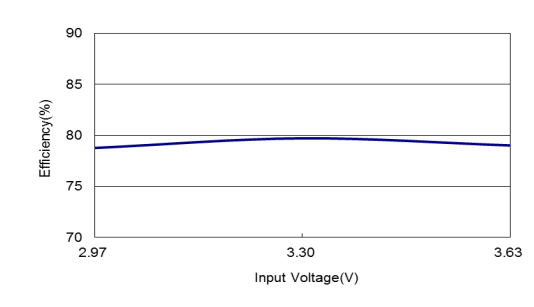
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

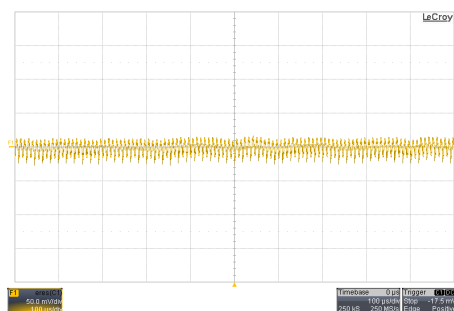
All test conditions are at 25°C The figures are identical for MAPU01-033S05H



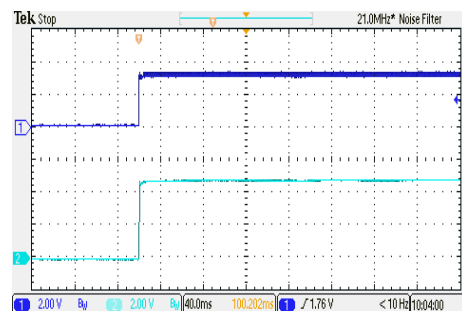
Efficiency Versus Output Current



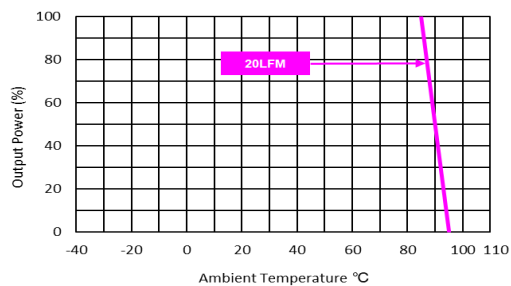
Efficiency Versus Input Voltage
Full Load



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



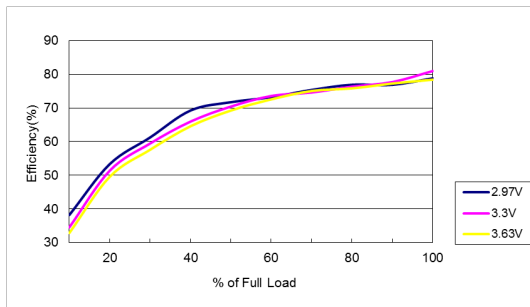
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



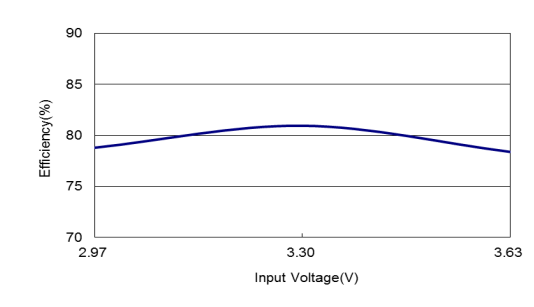
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

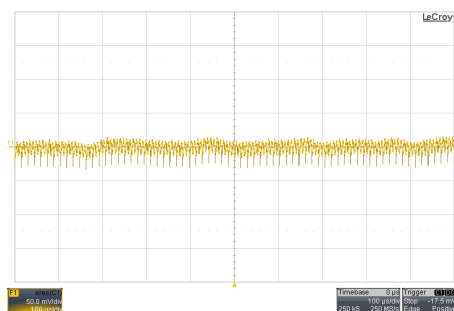
All test conditions are at 25°C The figures are identical for MAPU01-033S09H



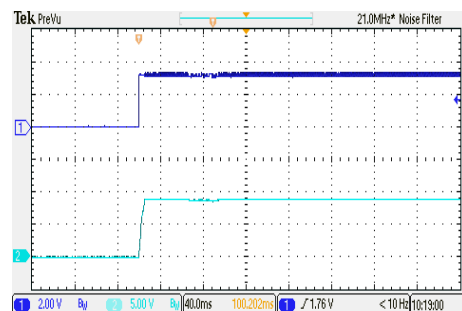
Efficiency Versus Output Current



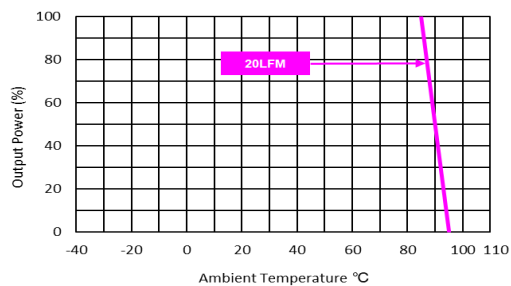
Efficiency Versus Input Voltage
Full Load



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



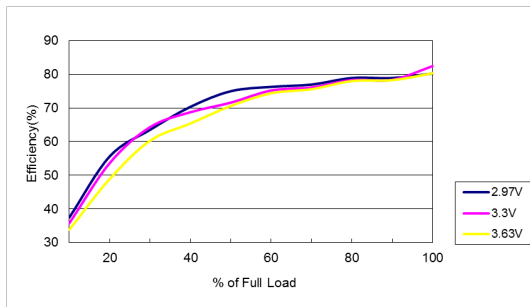
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



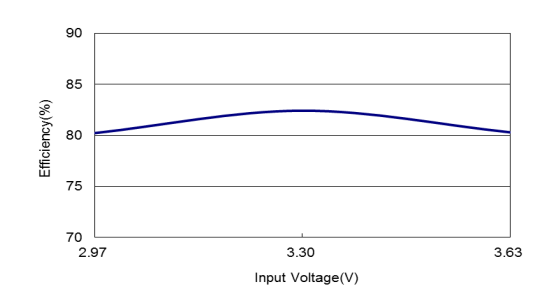
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

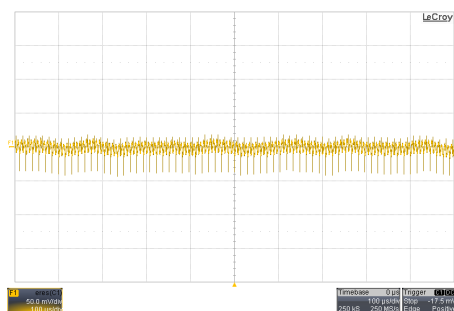
All test conditions are at 25°C The figures are identical for MAPU01-033S12H



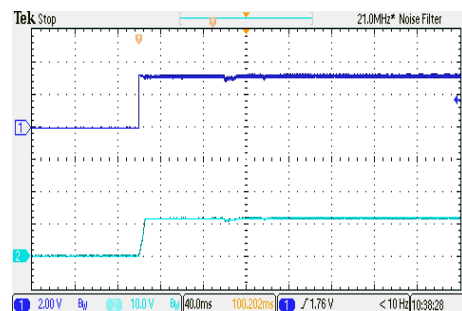
Efficiency Versus Output Current



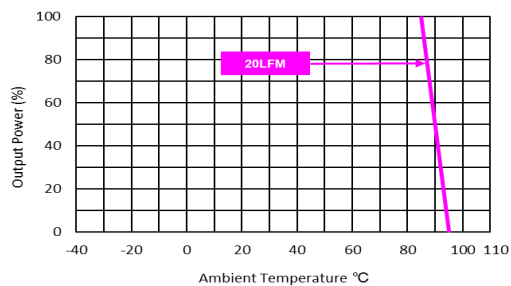
Efficiency Versus Input Voltage
Full Load



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



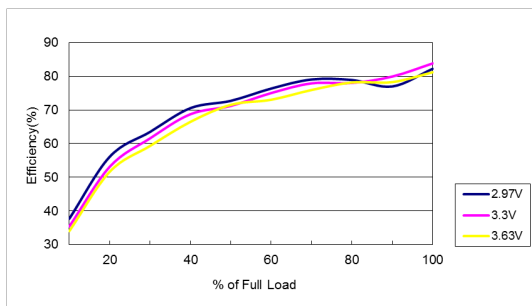
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



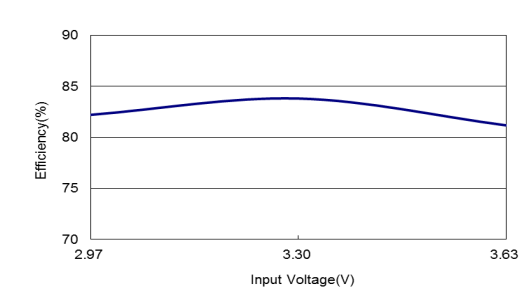
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

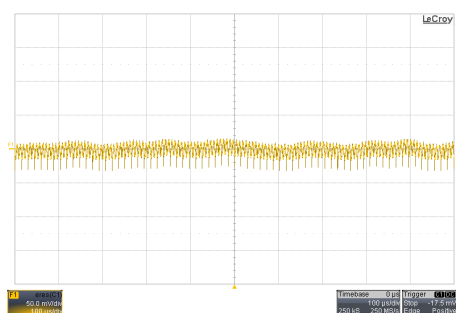
All test conditions are at 25°C The figures are identical for MAPU01-033S15H



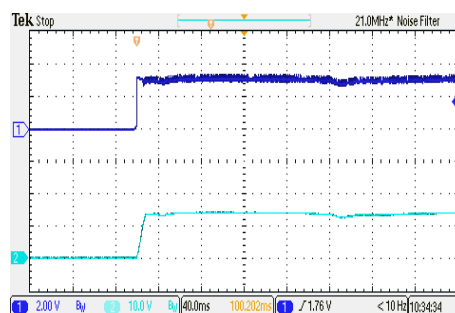
Efficiency Versus Output Current



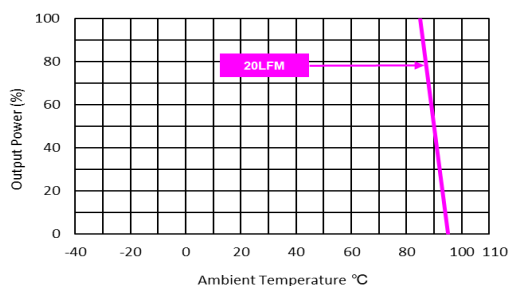
Efficiency Versus Input Voltage
Full Load



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



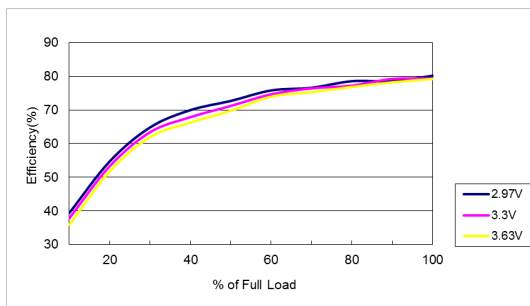
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



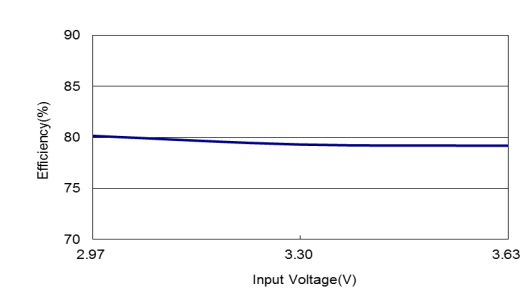
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

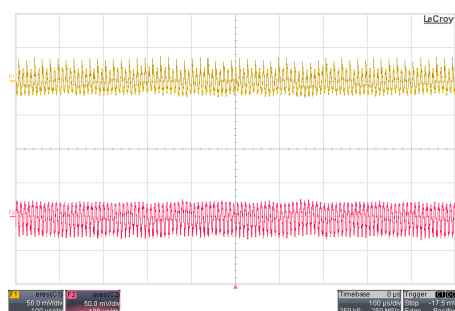
All test conditions are at 25°C The figures are identical for MAPU01-033D05H



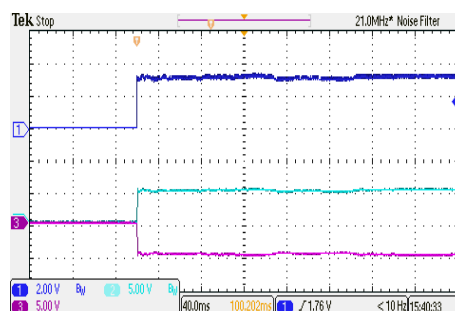
Efficiency Versus Output Current



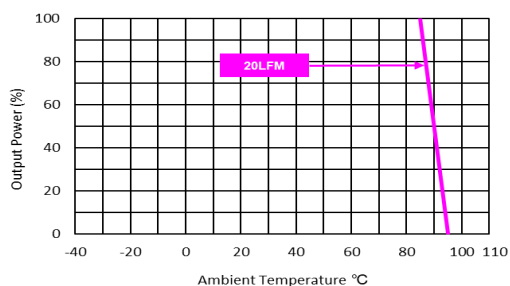
Efficiency Versus Input Voltage
Full Load



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



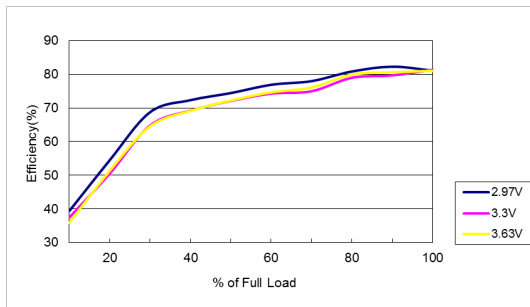
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



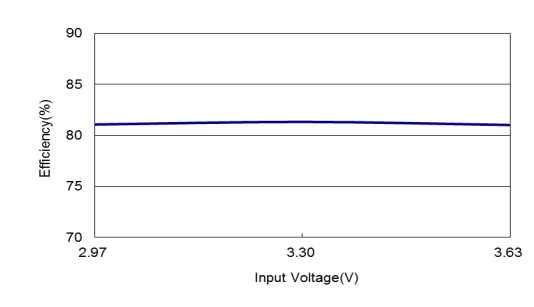
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

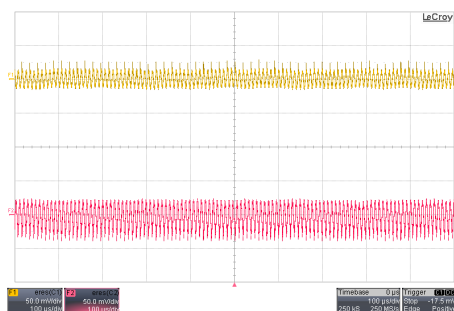
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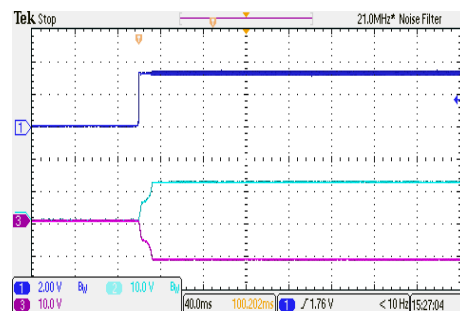
Efficiency Versus Output Current



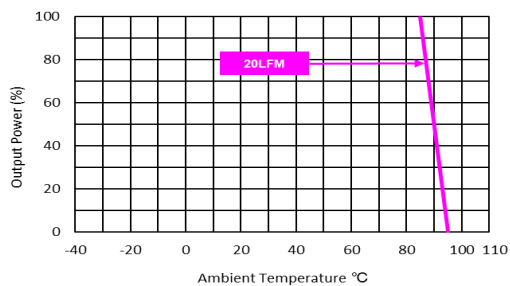
Efficiency Versus Input Voltage
Full Load



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



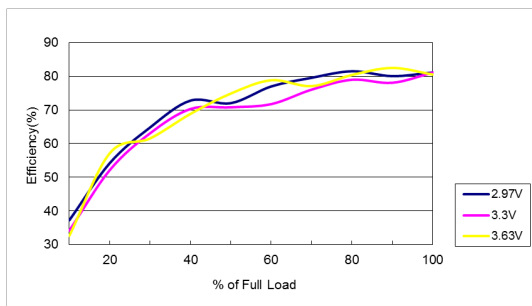
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



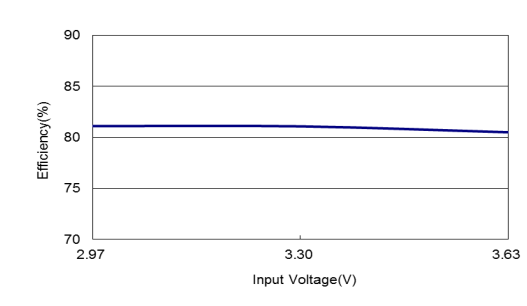
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

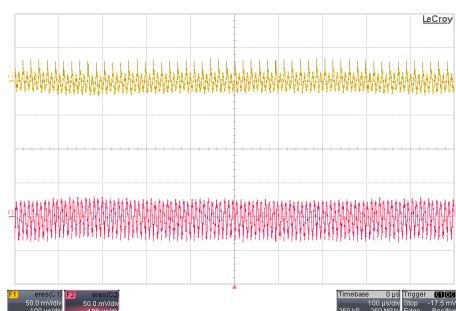
All test conditions are at 25°C The figures are identical for MAPU01-033D15H



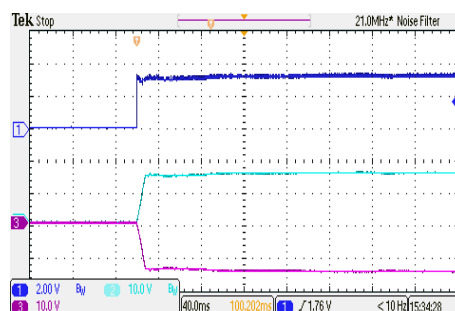
Efficiency Versus Output Current



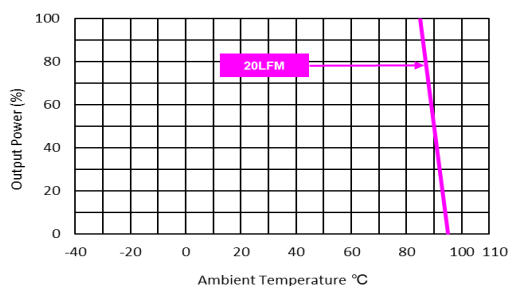
Efficiency Versus Input Voltage
Full Load



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



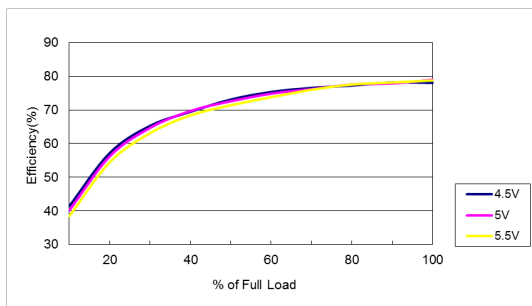
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



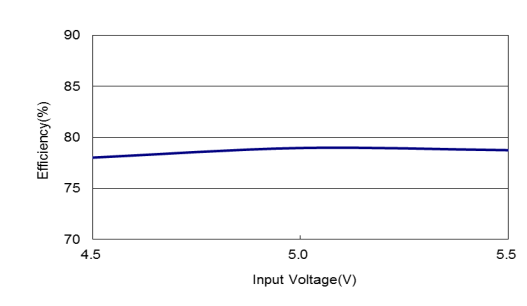
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

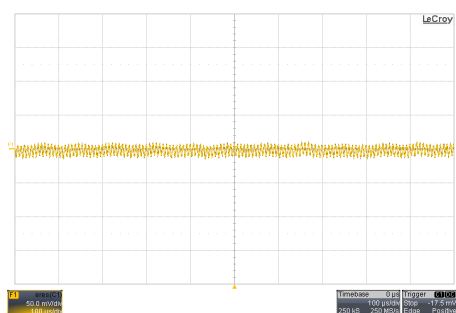
All test conditions are at 25°C The figures are identical for MAPU01-05S033H



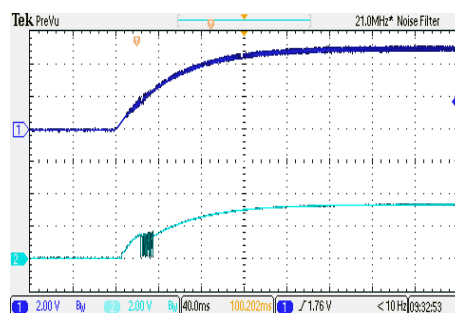
Efficiency Versus Output Current



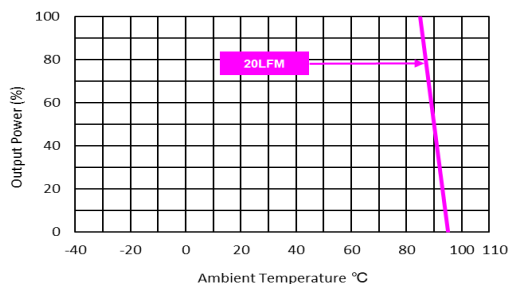
Efficiency Versus Input Voltage
Full Load



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



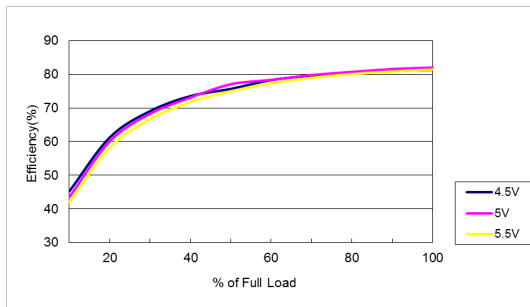
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



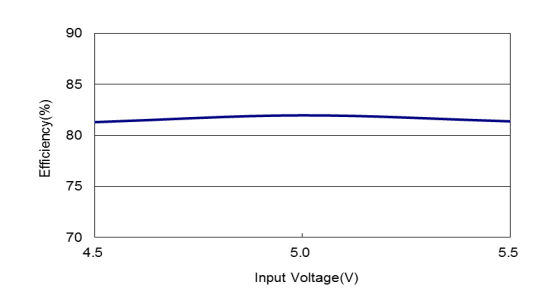
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

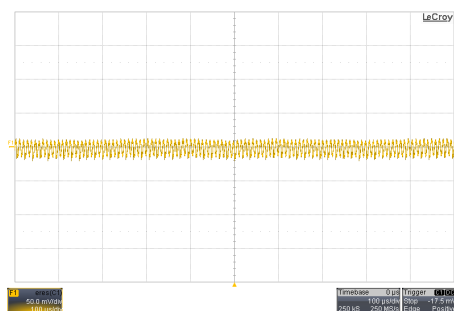
All test conditions are at 25°C The figures are identical for MAPU01-05S05H



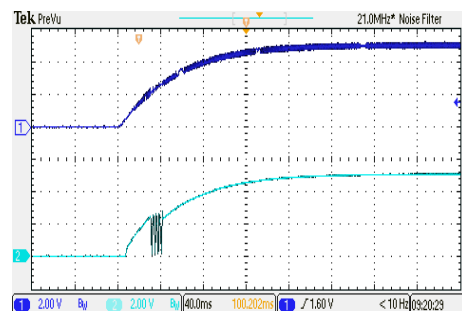
Efficiency Versus Output Current



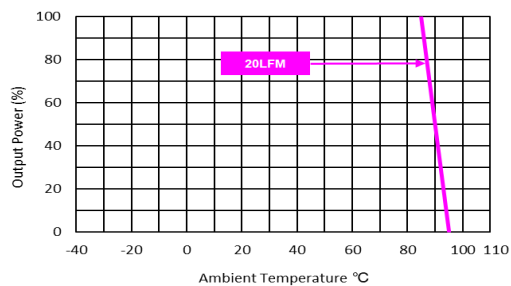
Efficiency Versus Input Voltage
Full Load



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



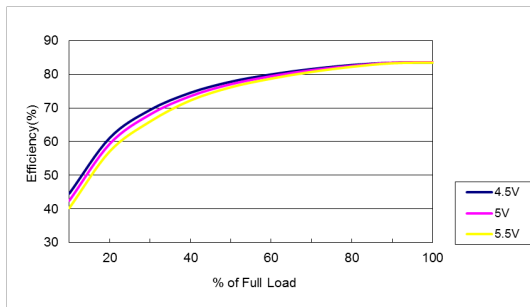
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



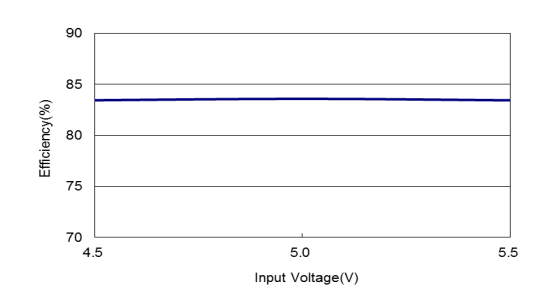
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

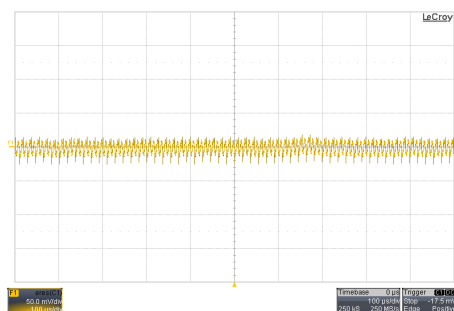
All test conditions are at 25°C The figures are identical for MAPU01-05S09H



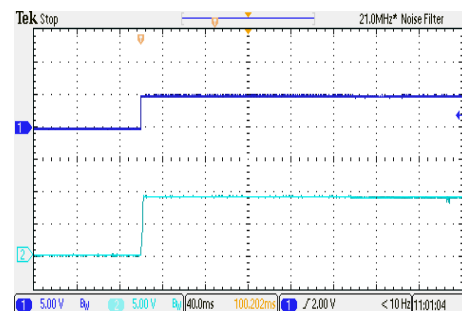
Efficiency Versus Output Current



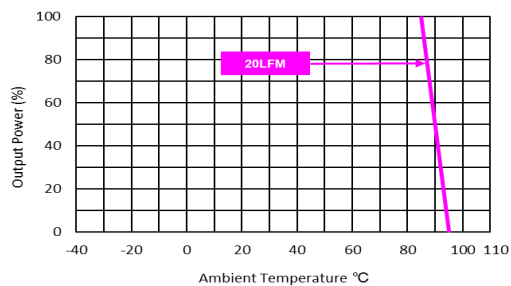
Efficiency Versus Input Voltage
Full Load



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



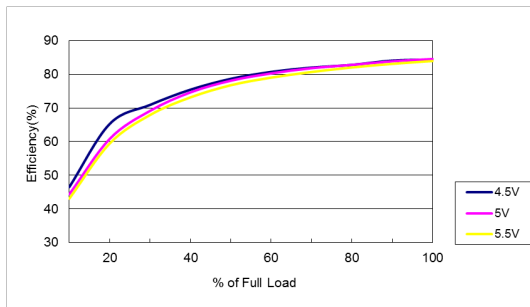
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



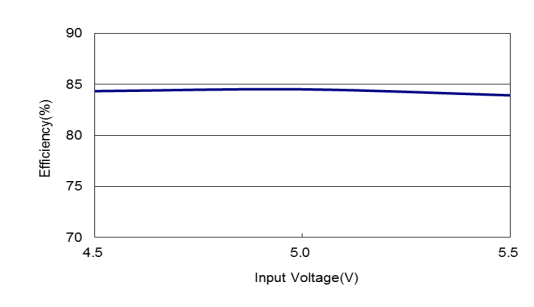
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

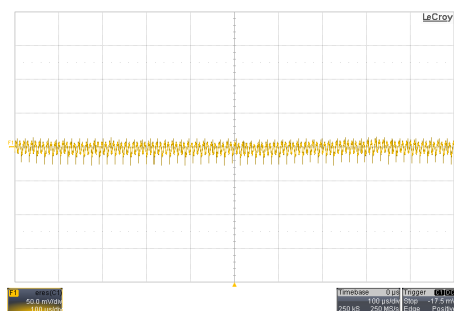
All test conditions are at 25°C The figures are identical for MAPU01-05S12H



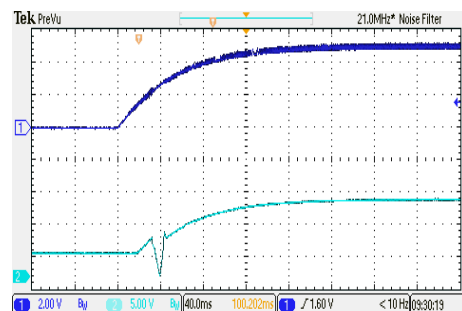
Efficiency Versus Output Current



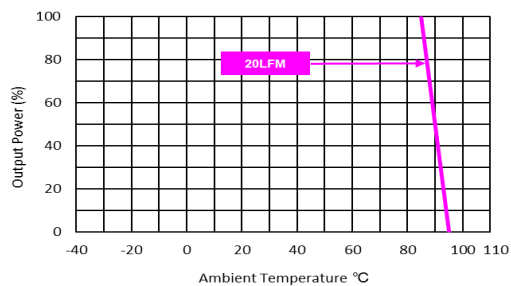
Efficiency Versus Input Voltage
Full Load



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



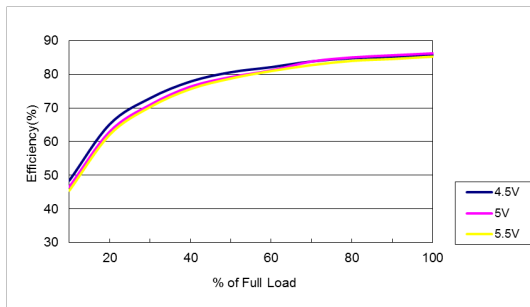
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



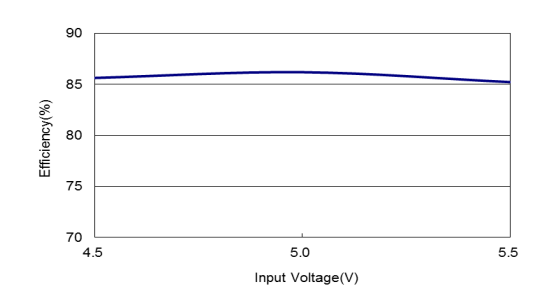
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

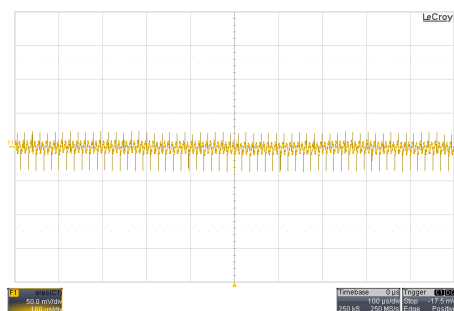
All test conditions are at 25°C The figures are identical for MAPU01-05S15H



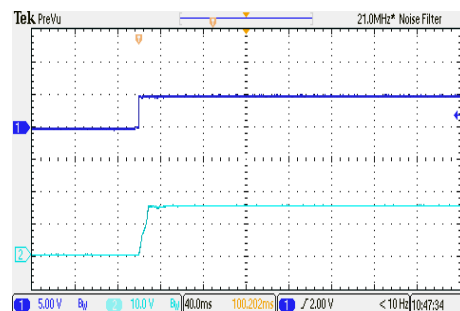
Efficiency Versus Output Current



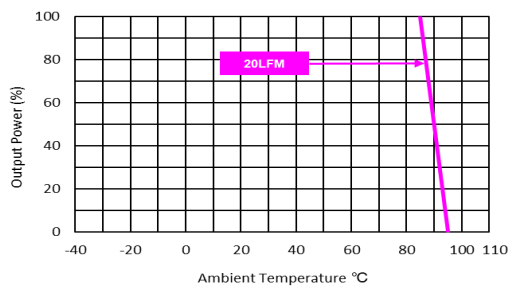
Efficiency Versus Input Voltage
Full Load



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



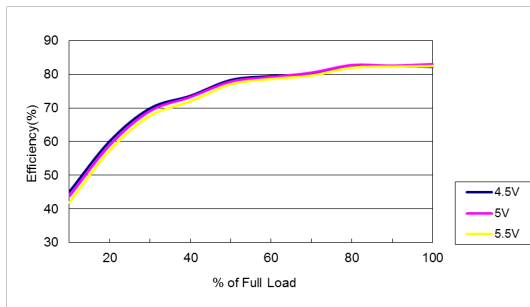
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



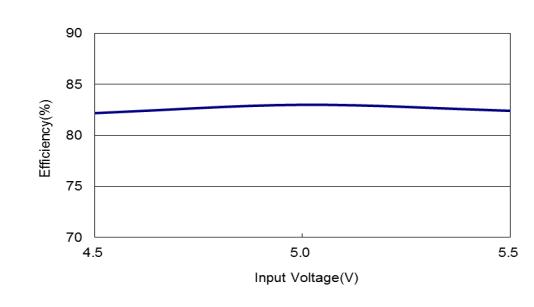
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

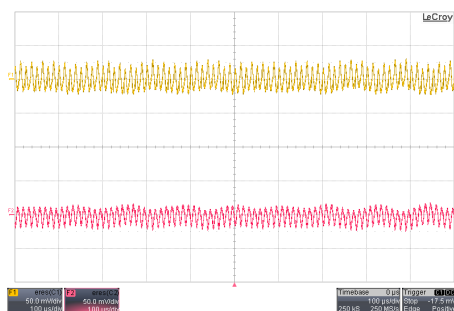
All test conditions are at 25°C The figures are identical for MAPU01-05D05H



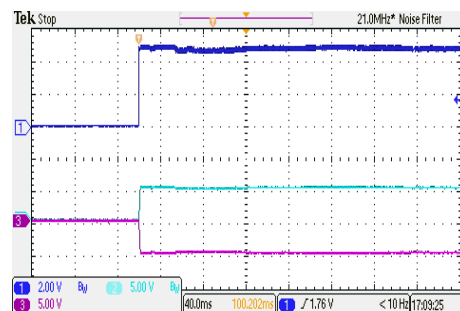
Efficiency Versus Output Current



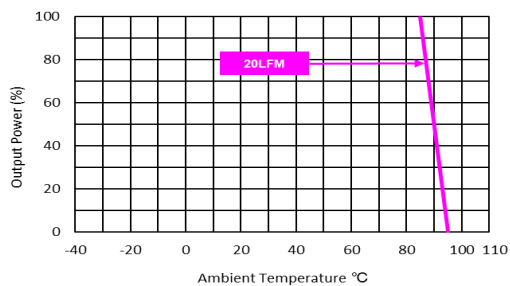
Efficiency Versus Input Voltage
Full Load



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



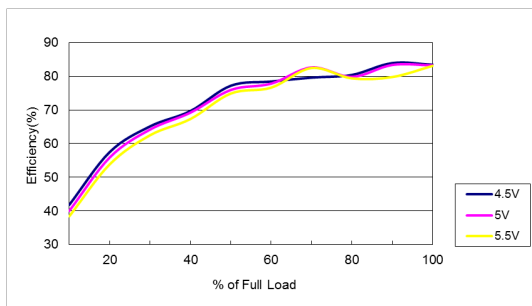
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



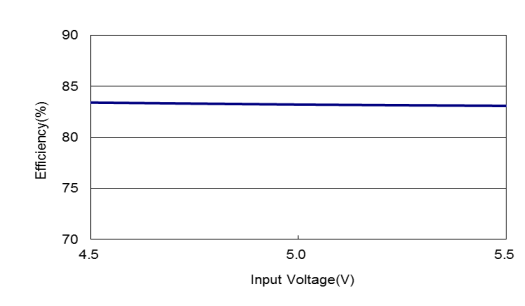
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

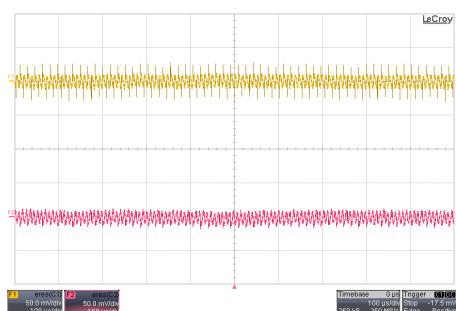
All test conditions are at 25°C The figures are identical for MAPU01-05D12H



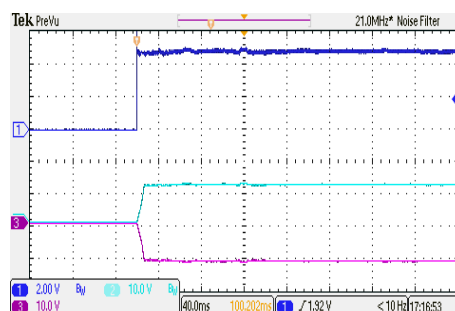
Efficiency Versus Output Current



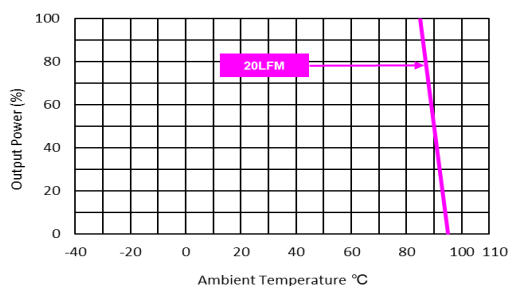
Efficiency Versus Input Voltage
Full Load



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



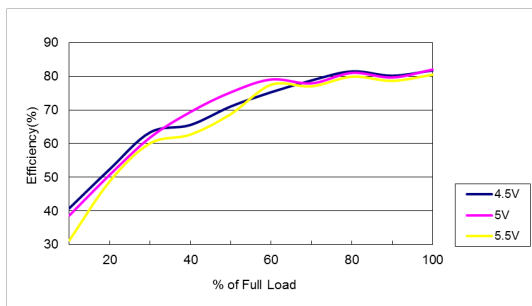
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



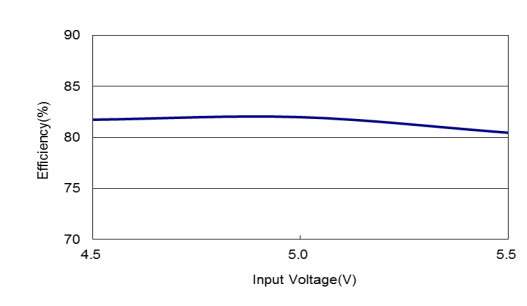
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

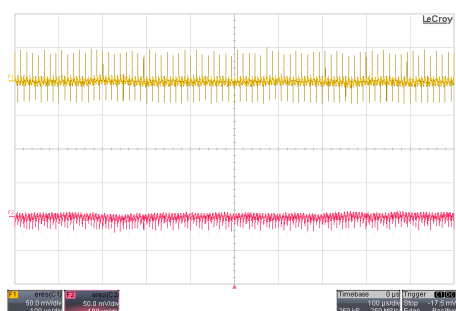
All test conditions are at 25°C The figures are identical for MAPU01-05D15H



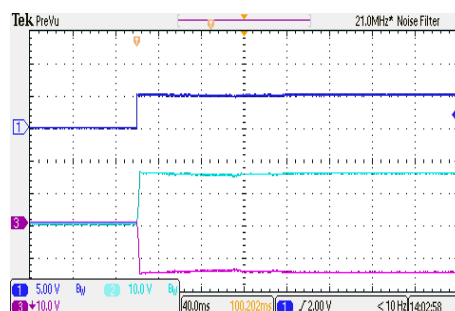
Efficiency Versus Output Current



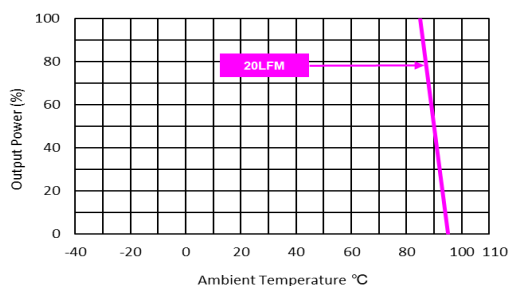
Efficiency Versus Input Voltage
Full Load



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



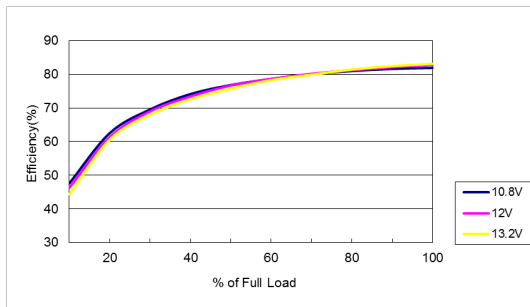
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



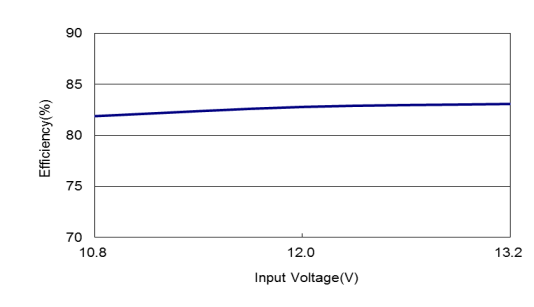
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

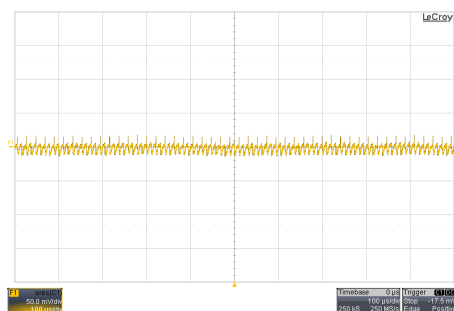
All test conditions are at 25°C The figures are identical for MAPU01-12S033H



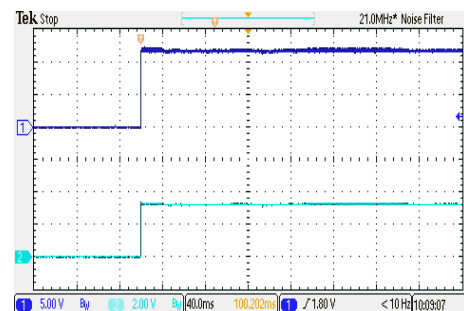
Efficiency Versus Output Current



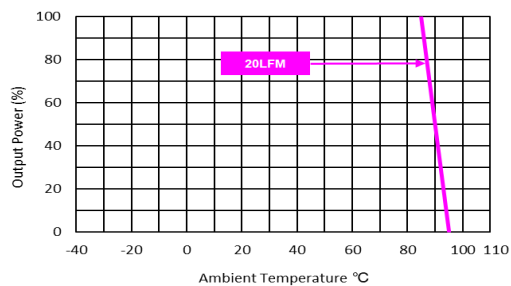
Efficiency Versus Input Voltage
Full Load



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



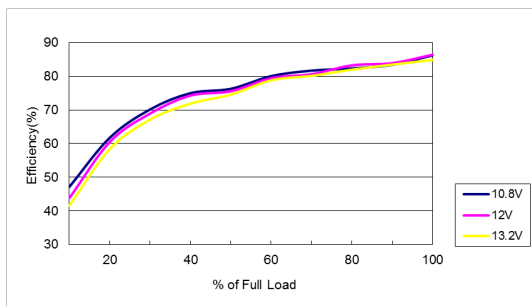
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



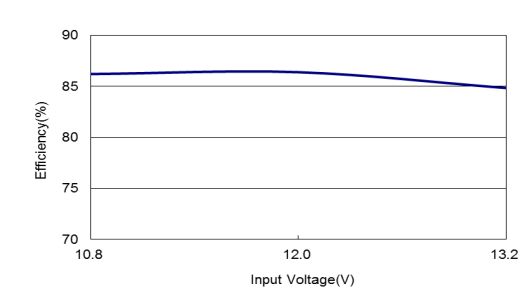
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

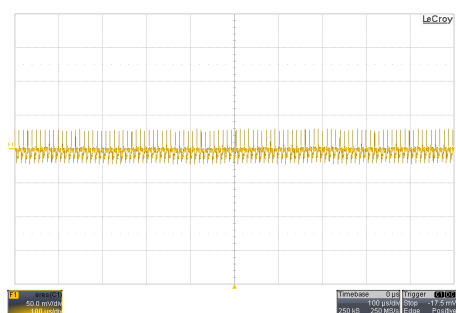
All test conditions are at 25°C The figures are identical for MAPU01-12S05H



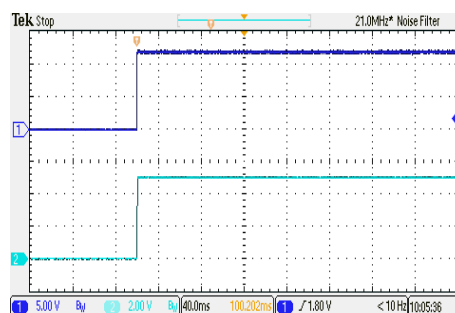
Efficiency Versus Output Current



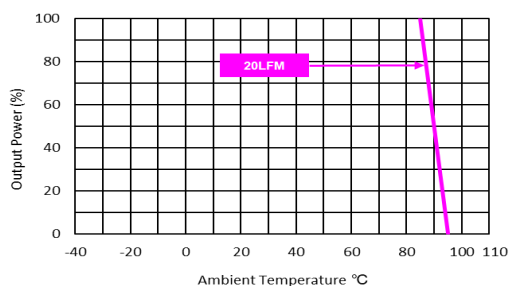
Efficiency Versus Input Voltage
Full Load



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



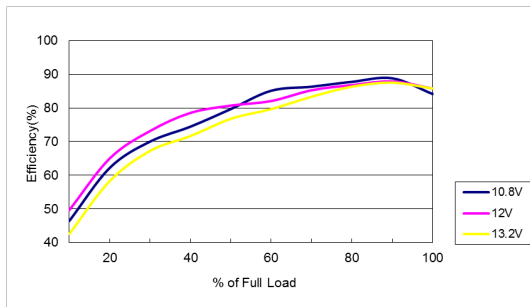
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



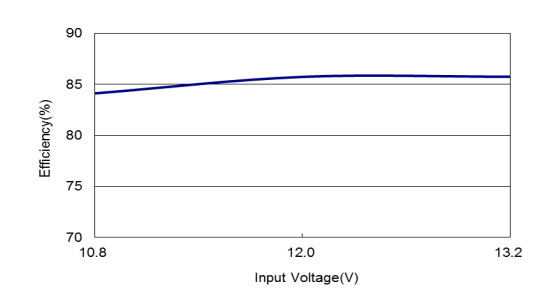
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

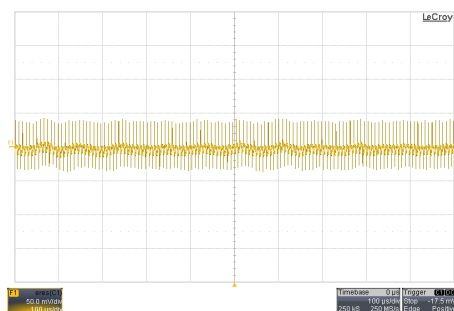
All test conditions are at 25°C The figures are identical for MAPU01-12S09H



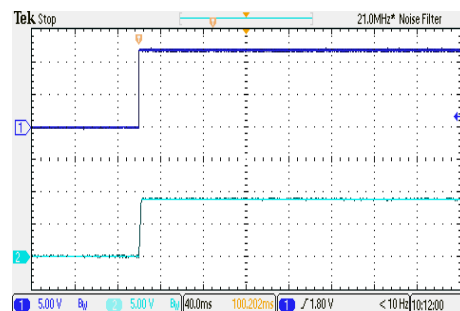
Efficiency Versus Output Current



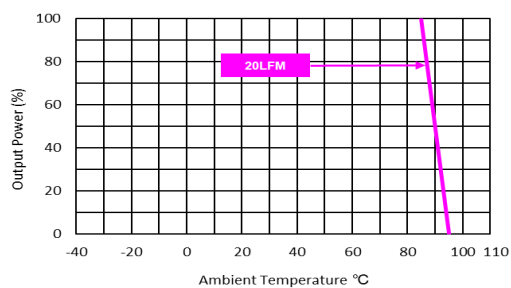
Efficiency Versus Input Voltage
Full Load



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



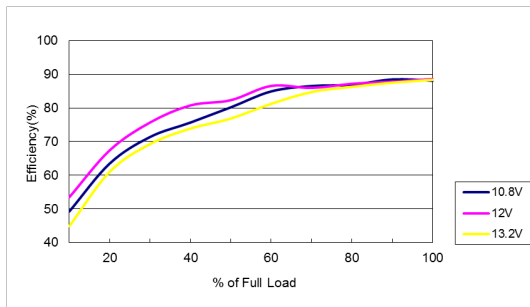
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



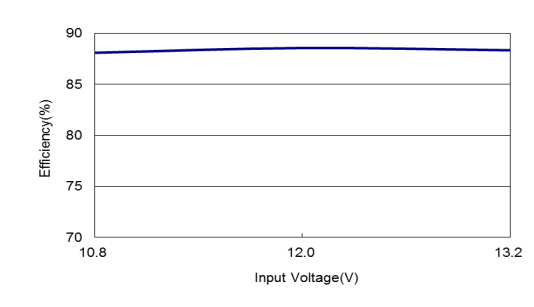
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

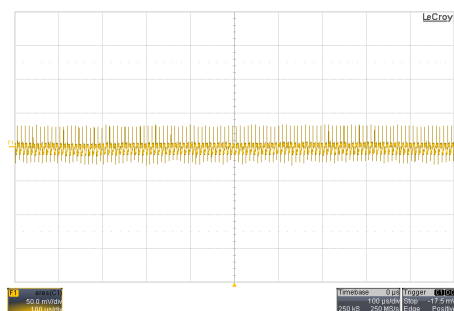
All test conditions are at 25°C The figures are identical for MAPU01-12S12H



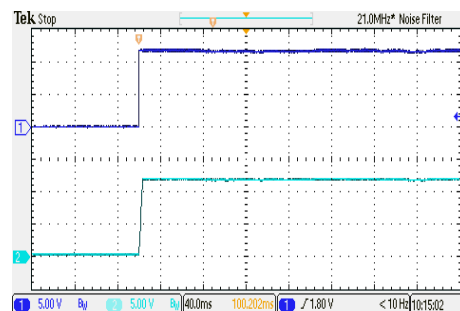
Efficiency Versus Output Current



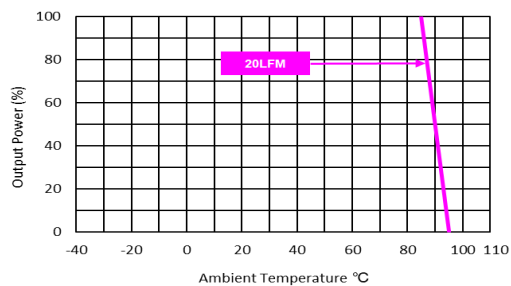
Efficiency Versus Input Voltage
Full Load



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



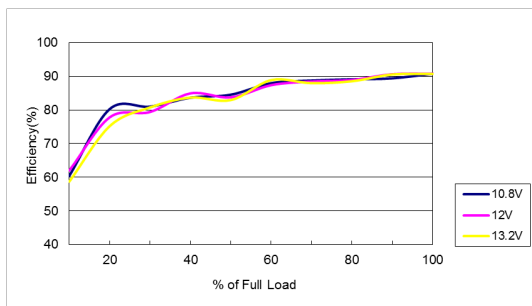
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



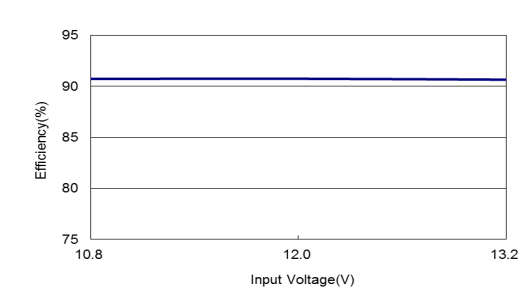
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

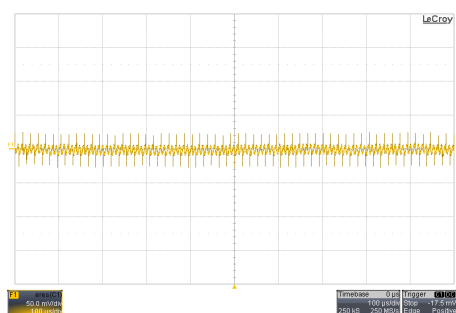
All test conditions are at 25°C The figures are identical for MAPU01-12S15H



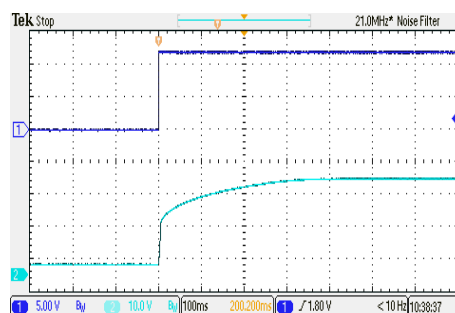
Efficiency Versus Output Current



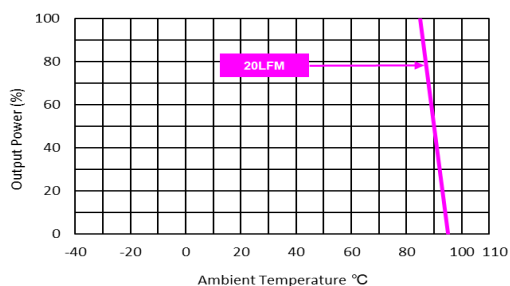
Efficiency Versus Input Voltage
Full Load



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



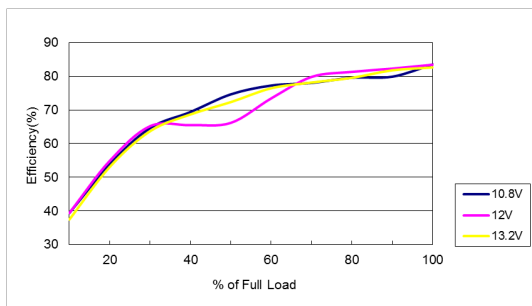
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



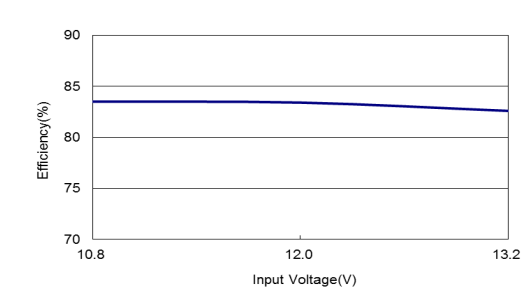
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

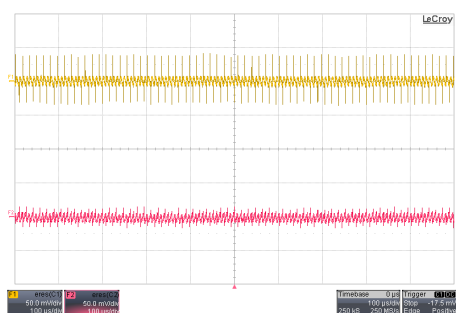
All test conditions are at 25°C The figures are identical for MAPU01-12D05H



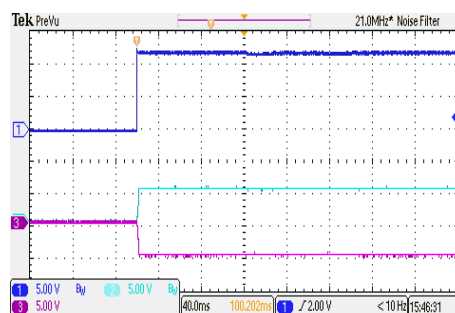
Efficiency Versus Output Current



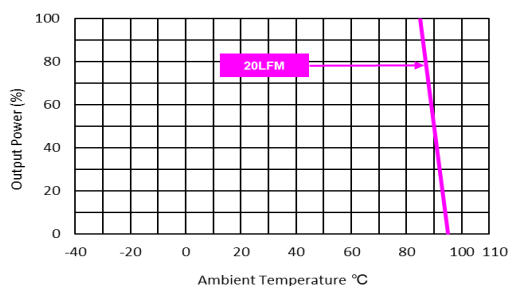
Efficiency Versus Input Voltage
Full Load



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



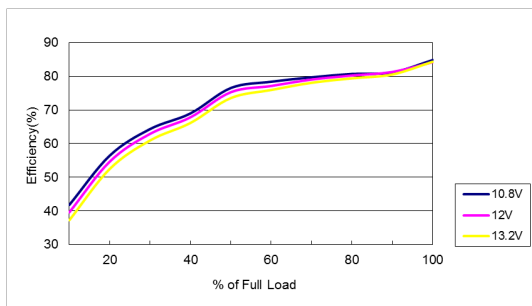
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



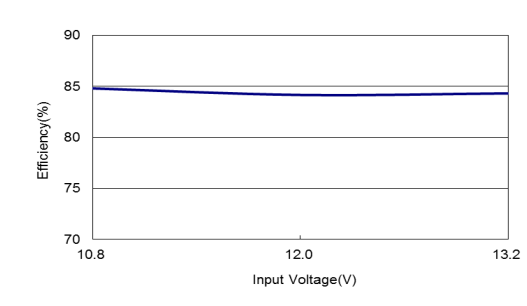
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

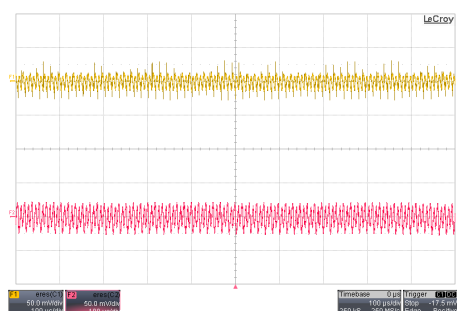
All test conditions are at 25°C The figures are identical for MAPU01-12D12H



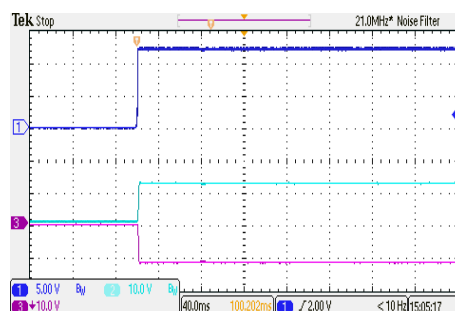
Efficiency Versus Output Current



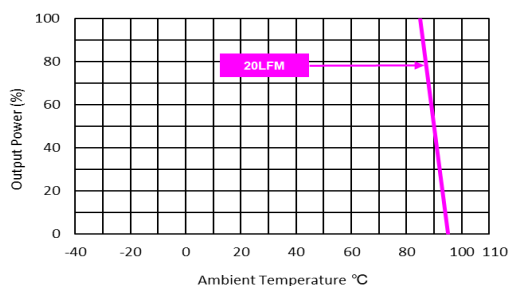
Efficiency Versus Input Voltage
Full Load



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



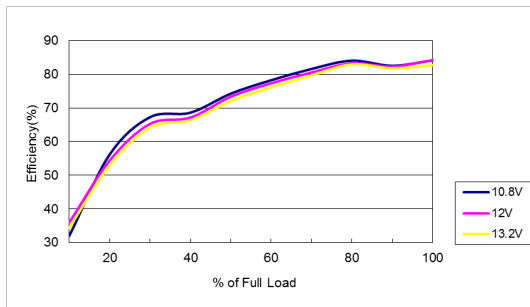
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



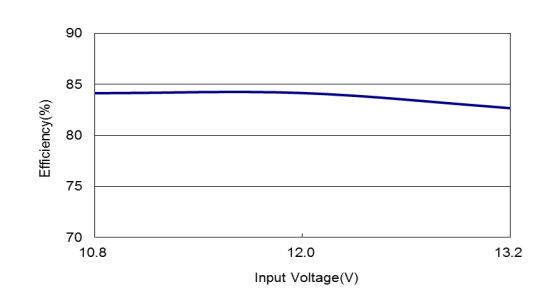
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

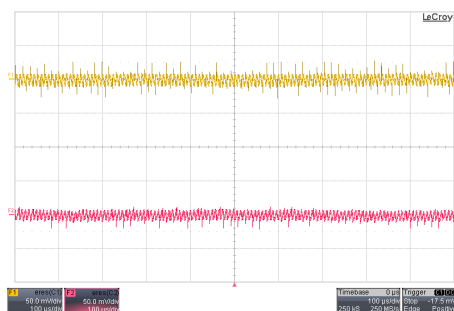
All test conditions are at 25°C The figures are identical for MAPU01-12D15H



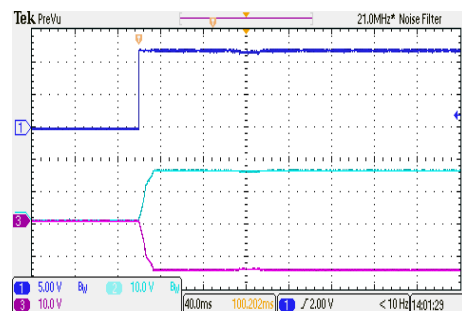
Efficiency Versus Output Current



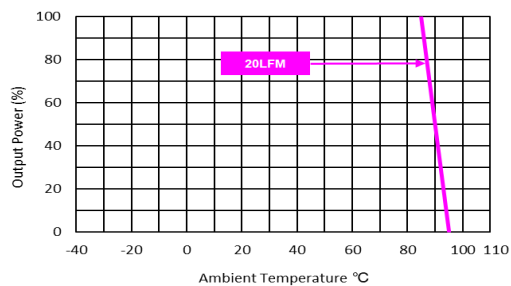
Efficiency Versus Input Voltage
Full Load



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



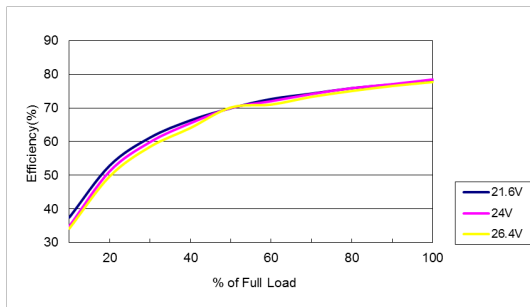
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



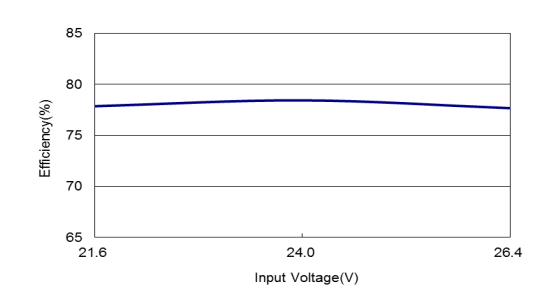
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

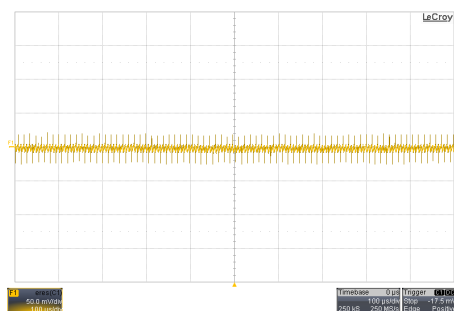
All test conditions are at 25°C The figures are identical for MAPU01-24S033H



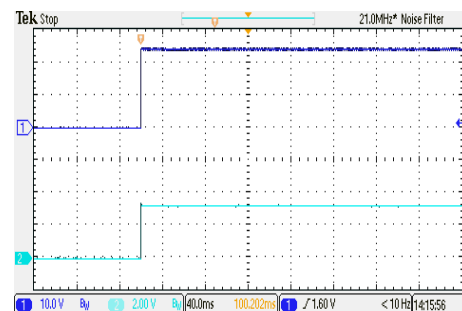
Efficiency Versus Output Current



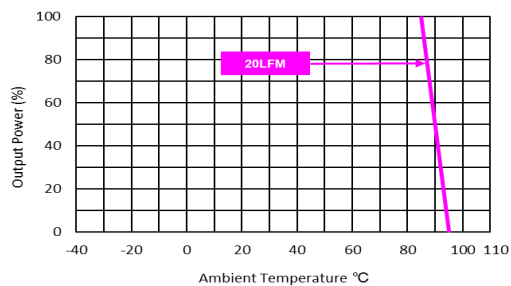
Efficiency Versus Input Voltage
Full Load



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



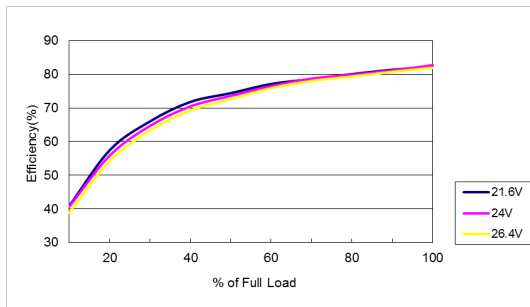
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



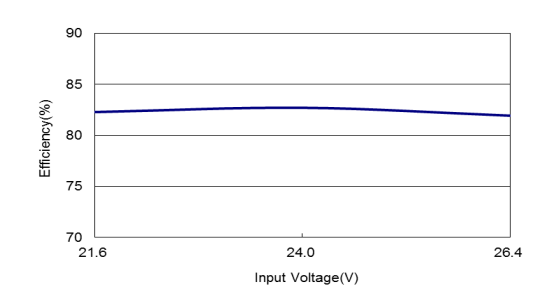
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

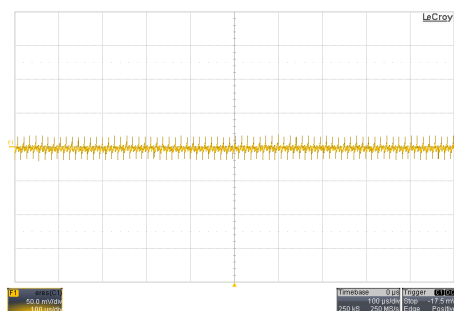
All test conditions are at 25°C The figures are identical for MAPU01-24S05H



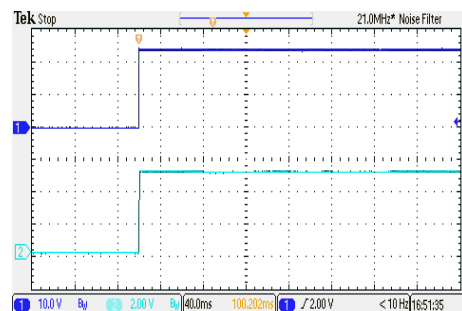
Efficiency Versus Output Current



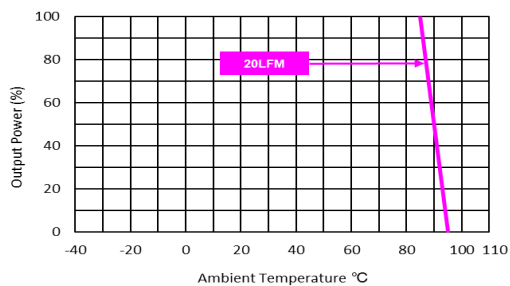
Efficiency Versus Input Voltage
Full Load



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



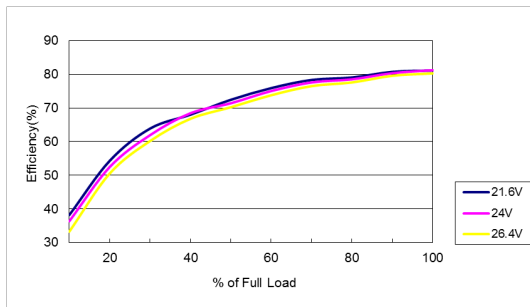
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



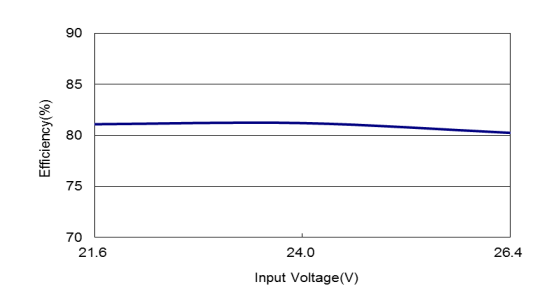
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

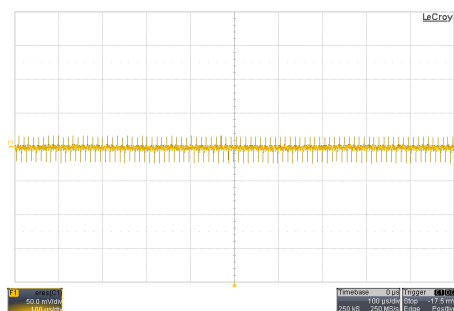
All test conditions are at 25°C The figures are identical for MAPU01-24S09H



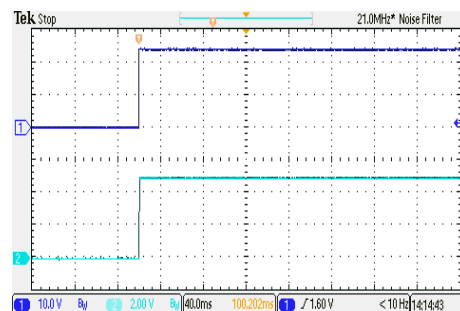
Efficiency Versus Output Current



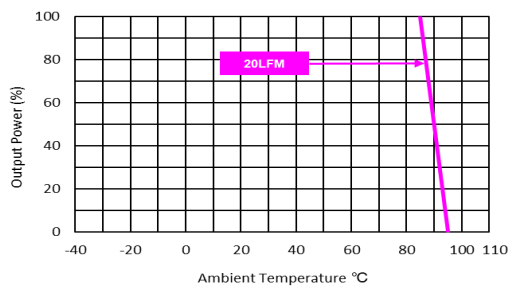
Efficiency Versus Input Voltage
Full Load



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



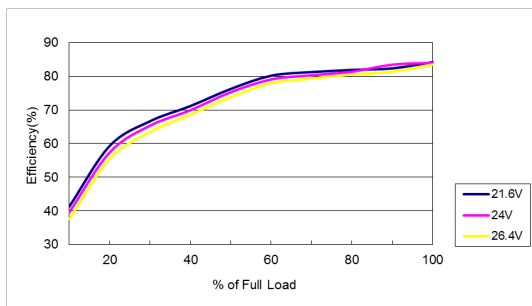
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



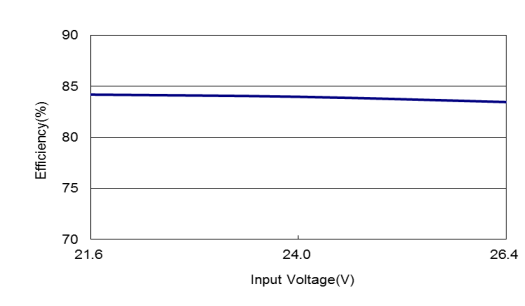
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

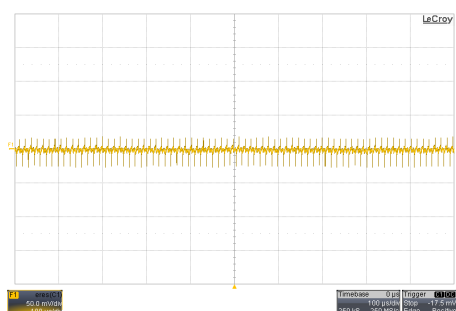
All test conditions are at 25°C The figures are identical for MAPU01-24S12H



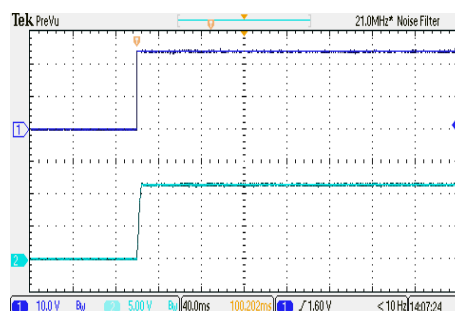
Efficiency Versus Output Current



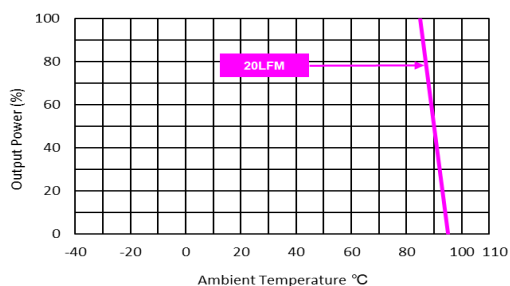
Efficiency Versus Input Voltage
Full Load



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



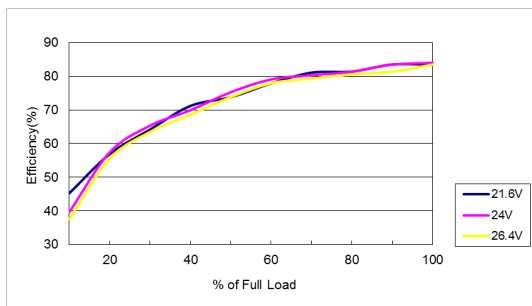
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



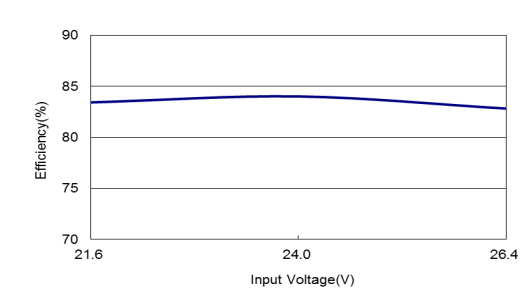
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

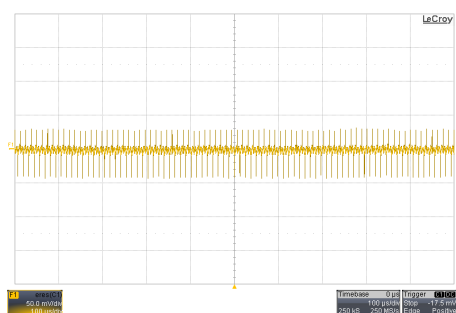
All test conditions are at 25°C The figures are identical for MAPU01-24S15H



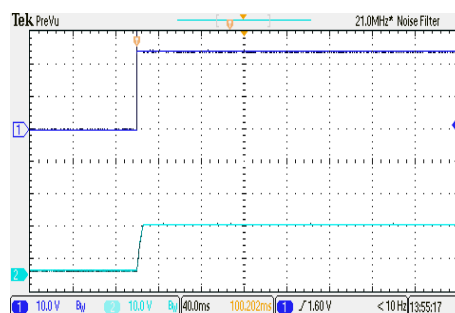
Efficiency Versus Output Current



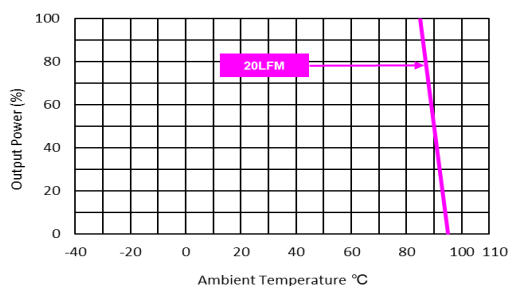
Efficiency Versus Input Voltage
Full Load



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



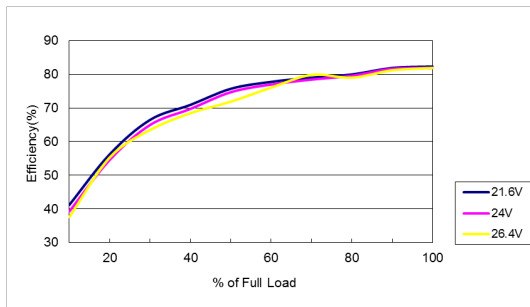
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



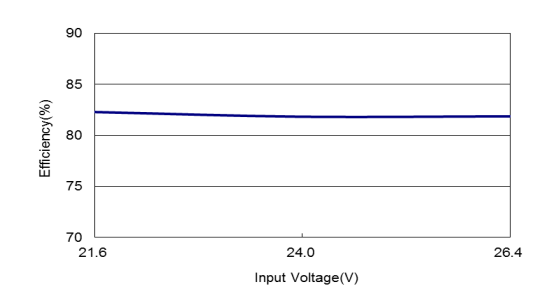
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

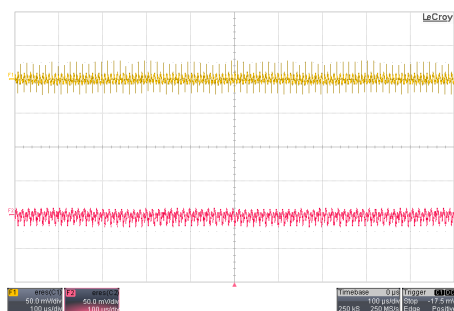
All test conditions are at 25°C The figures are identical for MAPU01-24D05H



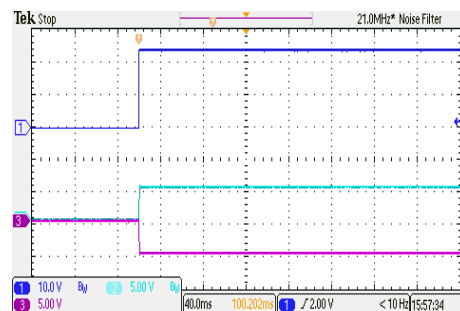
Efficiency Versus Output Current



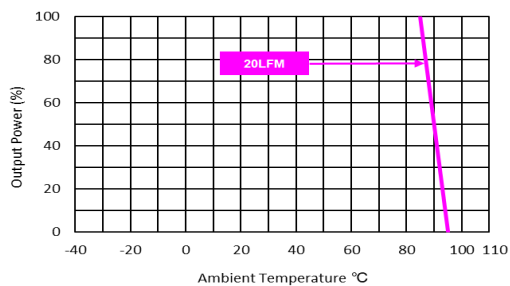
Efficiency Versus Input Voltage
Full Load



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



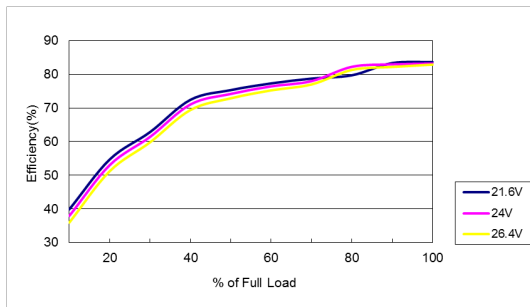
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



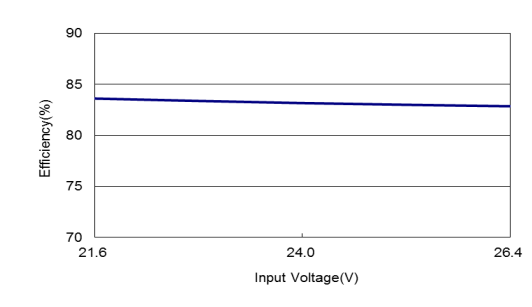
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

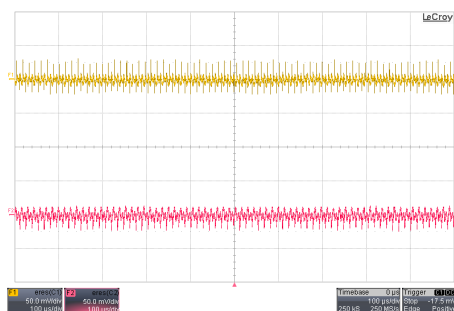
All test conditions are at 25°C The figures are identical for MAPU01-24D12H



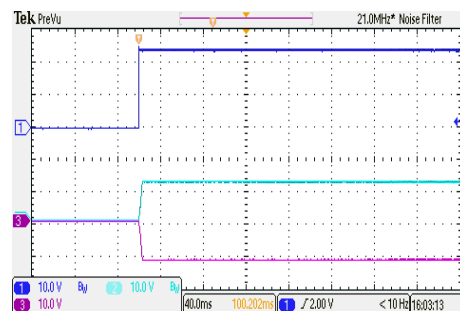
Efficiency Versus Output Current



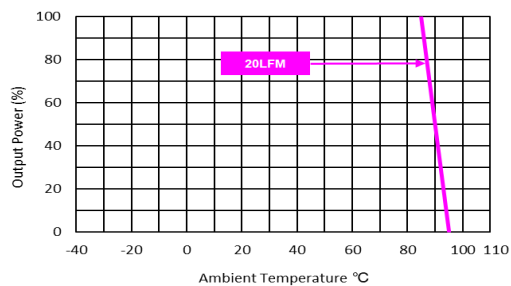
Efficiency Versus Input Voltage
Full Load



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



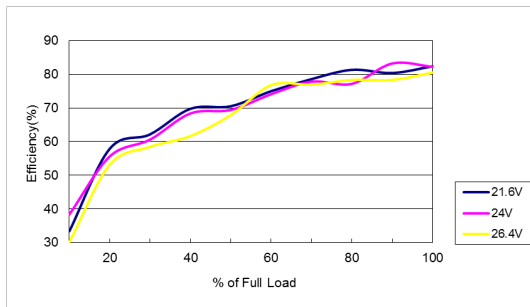
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



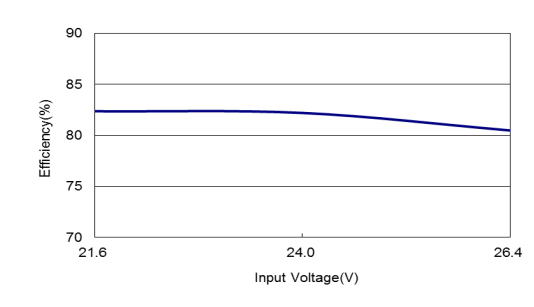
Derating Output Current Versus Ambient Temperature and Airflow
 $V_{in}=V_{in\ nom}$

Characteristic Curves

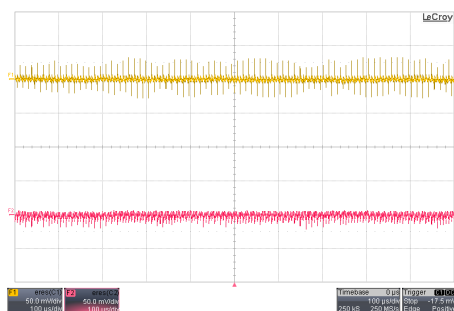
All test conditions are at 25°C The figures are identical for MAPU01-24D15H



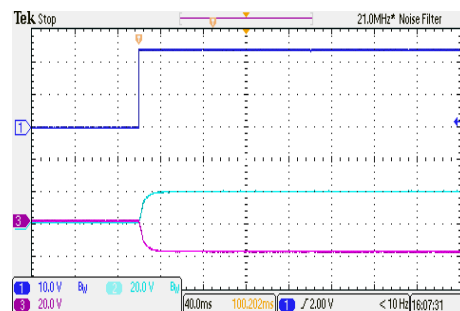
Efficiency Versus Output Current



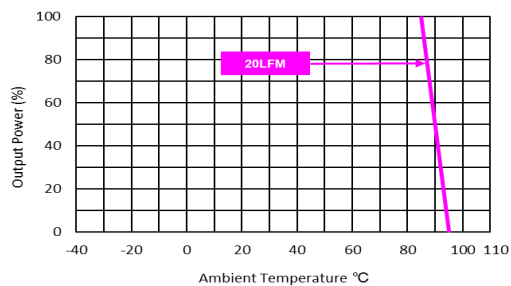
Efficiency Versus Input Voltage
Full Load



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



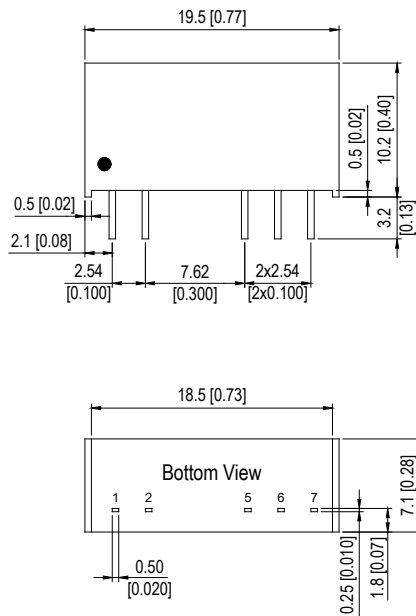
Typical Input Start-Up and Output Rise Characteristic
 $V_{in}=V_{in\ nom}$; Full Load



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

Package Specifications

Mechanical Dimensions



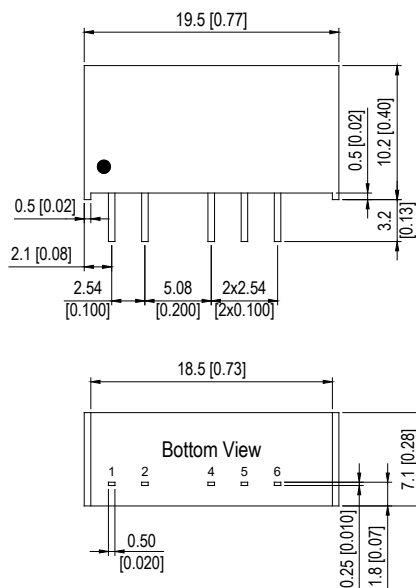
Pin Connections

Pin	Single Output	Dual Output
1	+Vin	+Vin
2	-Vin	-Vin
5	-Vout	-Vout
6	No Pin	Common
7	+Vout	+Vout

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

Package Specifications with "A" Pinning (order code suffix A)

Mechanical Dimensions



Pin Connections

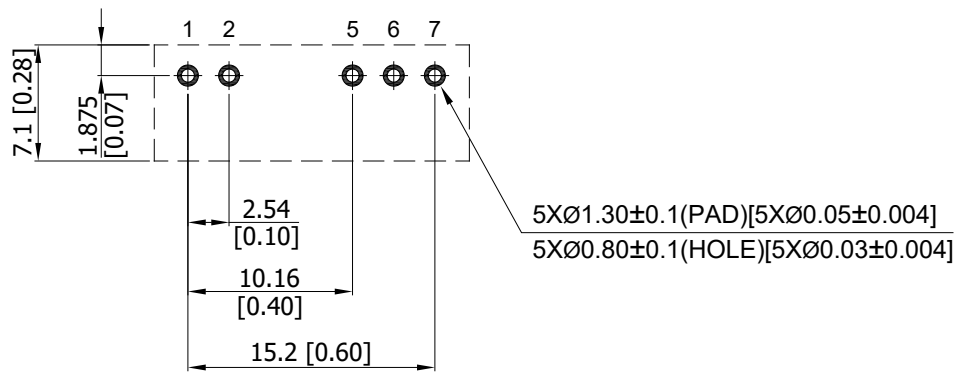
Pin	Single Output	Dual Output
1	+Vin	+Vin
2	-Vin	-Vin
4	-Vout	-Vout
5	No Pin	Common
6	+Vout	+Vout

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

Physical Characteristics

Case Size	: 19.5x7.1x10.2mm (0.77x0.28x0.40 inches)
Case Material	: Non-Conductive Black Plastic (flammability to UL 94V-0 rated)
Pin Material	: Alloy 42
Weight	: 3.1g

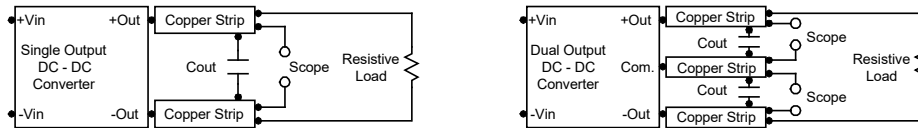
Recommended Pad Layout for Single & Dual Output Converter



Test Setup

Peak-to-Peak Output Noise Measurement Test

Use a Cout 0.33 μ F 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.



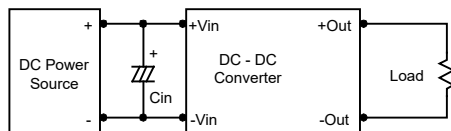
Technical Notes

Maximum Capacitive Load

The MA01-HI series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. The maximum capacitance can be found in the data sheet.

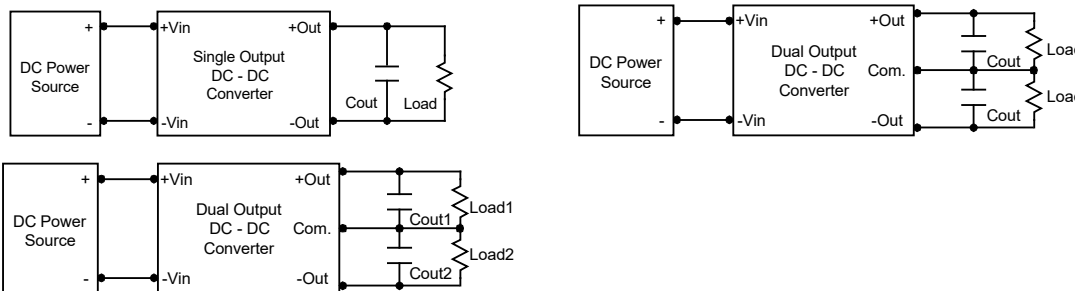
Input Source Impedance

The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup. Capacitor mounted close to the power module helps ensure stability of the unit, it is recommended to use a good quality low Equivalent Series Resistance (ESR < 1.0 Ω at 100 kHz) capacitor of a 2.2 μ F for the 5V input devices, a 1.0 μ F for the 12V,15V input devices and a 0.47 μ F for the 24V devices.



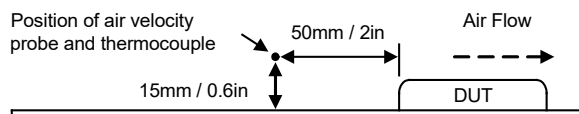
Output Ripple Reduction

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

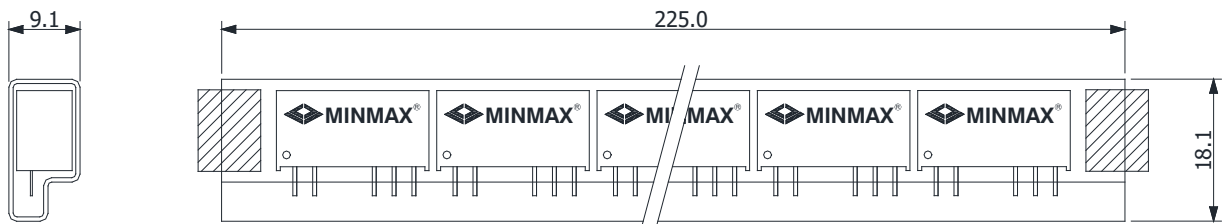


Thermal Considerations

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 100°C. The derating curves are determined from measurements obtained in a test setup.



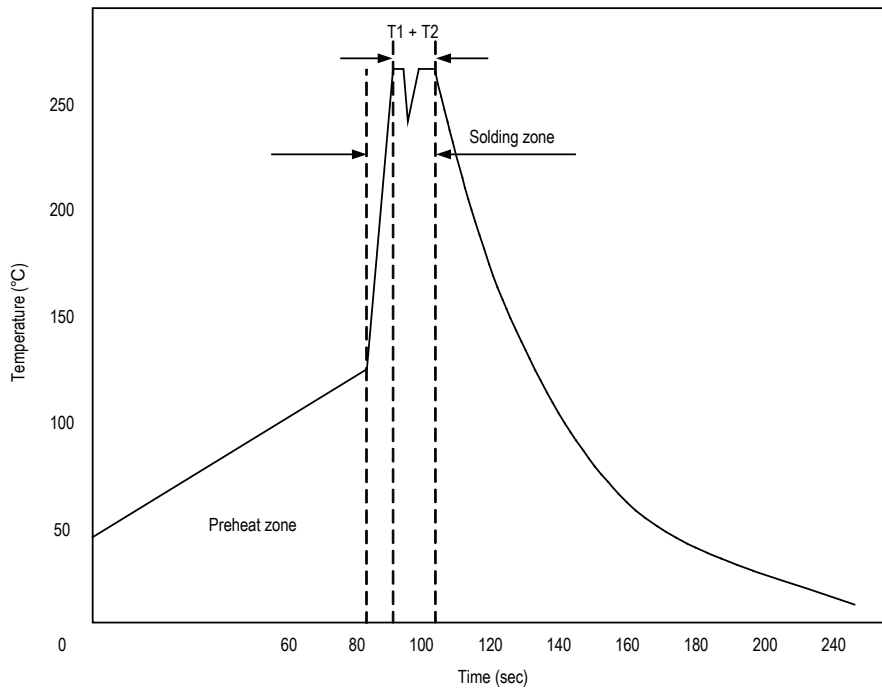
Packaging Information



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	A	PU	01	-	033	S	033	H	(A)
	Package Type SIP-7	Protection Overload Protection Short Circuit Protection ±10% Input Range Output Regulation Unregulated	Output Power 1 Watt		Input Voltage Range 033: 2.97 ~ 3.63 VDC 05: 4.5 ~ 5.5 VDC 12: 10.8 ~ 13.2 VDC 24: 21.6 ~ 26.4 VDC	Output Quantity S: Single D: Dual	Output Voltage 033: 3.3 VDC 05: 5 VDC 09: 9 VDC 12: 12 VDC 15: 15 VDC	I/O Isolation Voltage 3000 VDC	"A" Pinning

MTBF and Reliability

The MTBF of MAPU01H series of DC-DC converters has been calculated using

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

Model	MTBF	Unit
MAPU01-033S033H(A)	3,762,447	Hours
MAPU01-033S05H(A)	5,056,798	
MAPU01-033S09H(A)	5,009,365	
MAPU01-033S12H(A)	5,047,612	
MAPU01-033S15H(A)	5,029,840	
MAPU01-033D05H(A)	3,751,110	
MAPU01-033D12H(A)	3,803,556	
MAPU01-033D15H(A)	3,711,349	
MAPU01-05S033H(A)	4,810,436	
MAPU01-05S05H(A)	4,957,204	
MAPU01-05S09H(A)	4,063,003	
MAPU01-05S12H(A)	5,388,448	
MAPU01-05S15H(A)	5,237,198	
MAPU01-05D05H(A)	3,758,093	
MAPU01-05D12H(A)	3,767,768	
MAPU01-05D15H(A)	3,687,442	
MAPU01-12S033H(A)	5,027,981	
MAPU01-12S05H(A)	5,010,347	
MAPU01-12S09H(A)	5,010,347	
MAPU01-12S12H(A)	5,273,368	
MAPU01-12S15H(A)	5,357,821	
MAPU01-12D05H(A)	5,172,053	
MAPU01-12D12H(A)	3,828,842	
MAPU01-12D15H(A)	3,728,907	
MAPU01-24S033H(A)	5,173,654	
MAPU01-24S05H(A)	5,057,091	
MAPU01-24S09H(A)	5,142,866	
MAPU01-24S12H(A)	5,273,368	
MAPU01-24S15H(A)	5,337,821	
MAPU01-24D05H(A)	4,942,066	
MAPU01-24D12H(A)	5,008,905	
MAPU01-12D15H(A)	5,029,246	