MFPU01H Series

Electric Characteristic Note

DC-DC CONVERTER 1W

Features

- **Industrial Standard DIP-8 Package**
- **Unregulated Output Voltage**
- **I/O Isolation 3000VDC**
- **Operating Ambient Temp. Range -40℃ to +90℃**
- **Overload and 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 MFPU01H series is a range of isolated 1W DC-DC converter modules in DIP-8 package which feature a high I/O isolation voltage rated for 3000VDC and there are 21 models available for 3.3, 5 or 12VDC input. Advanced circuit topology provides continuous overload, short circuit protection and a high efficiency up to 82% which allows operating ambient temperatures range of -40℃ to +90℃ without power derating. These converters offer a better solution for all applications where a high I/O isolation and fault condition protection are required.

Table of contents

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	VDC	mA	mA	mA(typ.)	mA(typ.)	% (max.)	μF	%
MFPU01-033S033H	3.3 (2.97 ~ 3.63)	3.3	300	6	400	45	15	220	75
MFPU01-033S05H		5	200	4	384		12		79
MFPU01-033S12H		12	84	1.68	382		12		80
MFPU01-033S15H		15	67	1.34	376		10		81
MFPU01-033D05H		±5	±100	±2	389		12	100#	78
MFPU01-033D12H		±12	±42	±0.84	382		12		80
MFPU01-033D15H		±15	±33	±0.66	370		10		81
MFPU01-05S033H	5 (4.5 ~ 5.5)	3.3	300	6	257	30	12	220	77
MFPU01-05S05H		5	200	4	250		11		80
MFPU01-05S12H		12	84	1.68	246		9		82
MFPU01-05S15H		15	67	1.34	242		8		83
MFPU01-05D05H		±5	±100	±2	250		11	100#	80
MFPU01-05D12H		±12	±42	±0.84	243		9		83
MFPU01-05D15H		±15	±33	±0.66	239		8		83
MFPU01-12S033H	12 (10.8 ~ 13.2)	3.3	300	6	107	17	8	220	77
MFPU01-12S05H		5	200	4	105		8		79
MFPU01-12S12H		12	84	1.68	104		8		81
MFPU01-12S15H		15	67	1.34	102		7		82
MFPU01-12D05H		±5	±100	±2	104		7	100#	80
MFPU01-12D12H		±12	±42	±0.84	102		7		82
MFPU01-12D15H		±15	±33	±0.66	101		7		82

* 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	
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	
Input Filter	All Models	Internal Capacitor			

Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy		---	---	±3.0	%Vnom.
Output Voltage Balance	Dual Output, Balanced Loads	---	±0.1	±1.0	%
Line Regulation	For Vin Change of 1%	---	±1.2	±1.5	%
Load Regulation	Io=10% to 100%	See Model Selection Guide			
Ripple & Noise	0-20 MHz Bandwidth	---	---	100	mV_{P-P}
Temperature Coefficient		---	±0.01	±0.02	%/℃
Over Load Protection	Normal Vin at 25℃	---	160	---	%
Short Circuit Protection	Continuous, Automatic Recovery				

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		50	80	110	kHz
MTBF (calculated)	MIL-HDBK-217F@25℃, Ground Benign	3,589,000	---	---	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

Parameter	Standards & Level			Performance
EMI	Conduction	EN 55032	With external components	Class A(5)
	Radiation			
EMS	EN 55024			
	ESD	EN61000-4-2 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

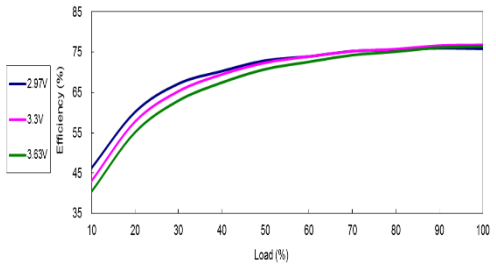
Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+90	℃
Case Temperature	---	+95	℃
Storage Temperature Range	-50	+125	℃
Humidity (non condensing)	---	95	% rel. H
Lead Temperature (1.5mm from case for 10Sec.)	---	260	℃

Notes

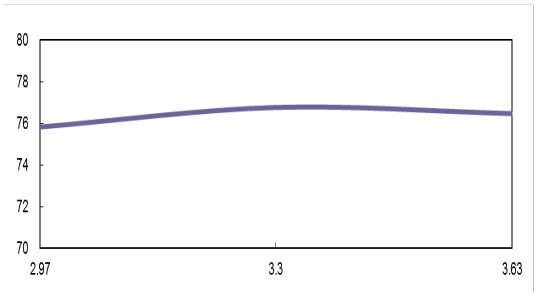
1 Specifications typical at Ta=+25℃, resistive load, nominal input voltage and rated output current unless otherwise noted.
2 These power converters require a minimum output loading to maintain specified regulation, operation under no-load conditions will not damage these modules; however they may not meet all specifications listed.
3 We recommend to protect the converter by a fast blow fuse in the input supply line.
4 Other input and output voltage may be available, please contact MINMAX.
5 To meet EN55032 Class A an external filter, please contact MINMAX.
6 To meet EN61000-4-4 & EN61000-4-5 an external capacitor across the input pins is required, 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

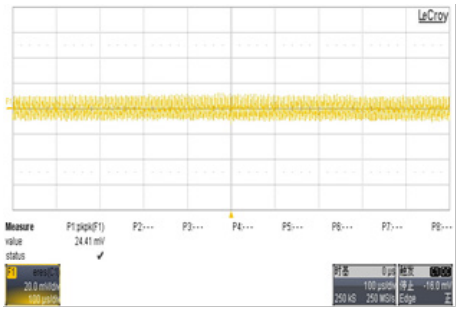
All test conditions are at 25℃ The figures are identical for MFPU01-033S033H



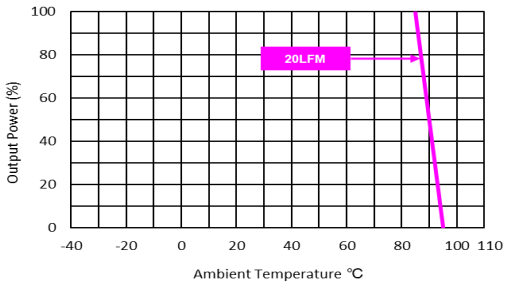
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



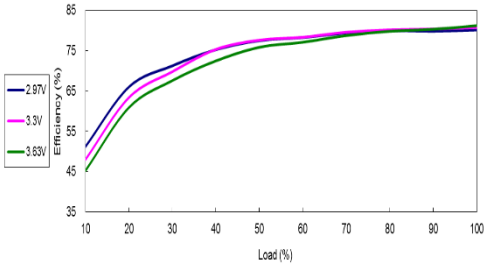
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



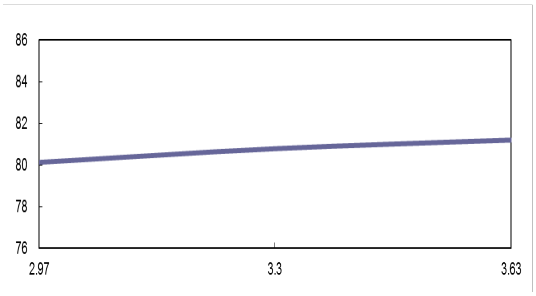
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

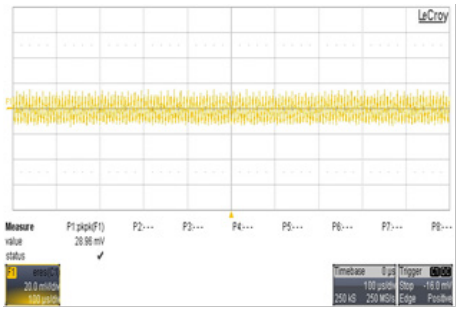
All test conditions are at 25℃ The figures are identical for MFPU01-033S05H



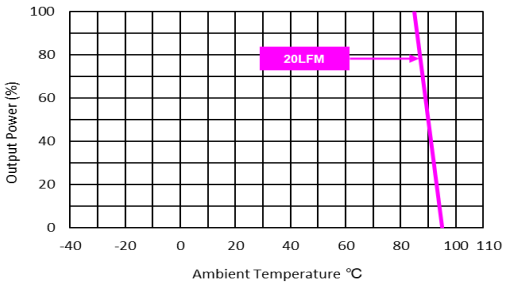
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



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



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

Characteristic Curves

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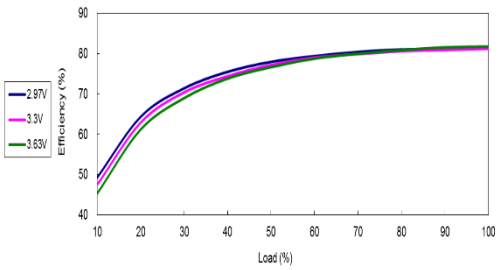
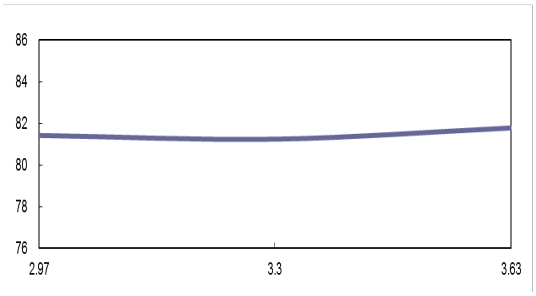
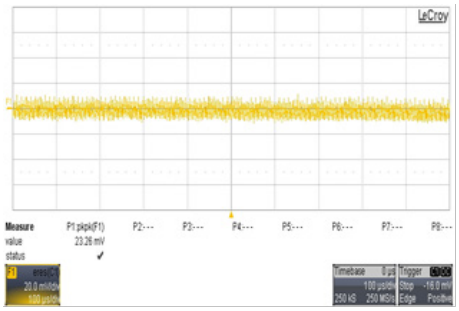


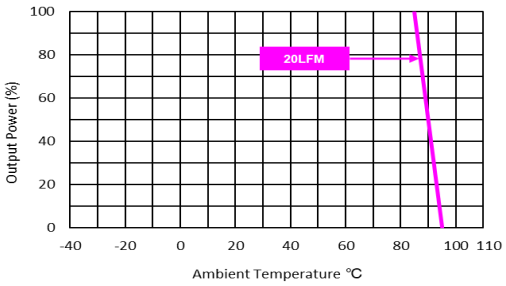
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



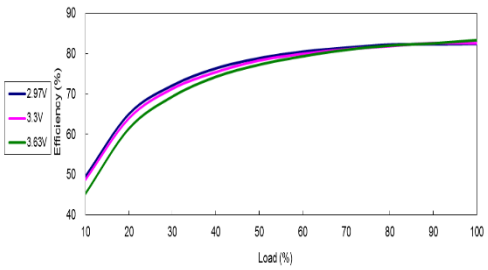
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



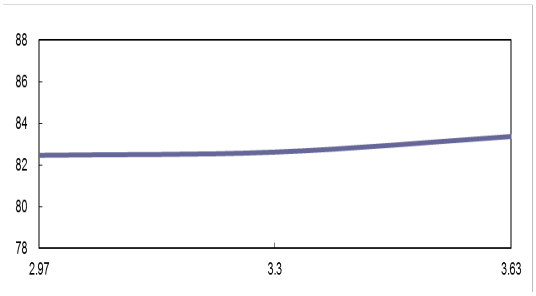
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

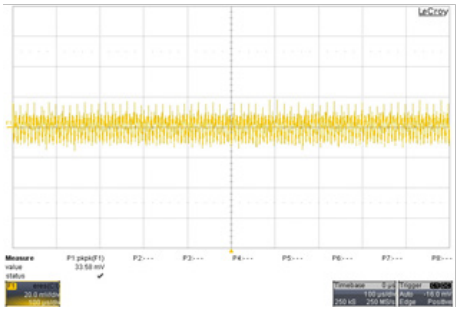
All test conditions are at 25℃ The figures are identical for MFPU01-033S15H



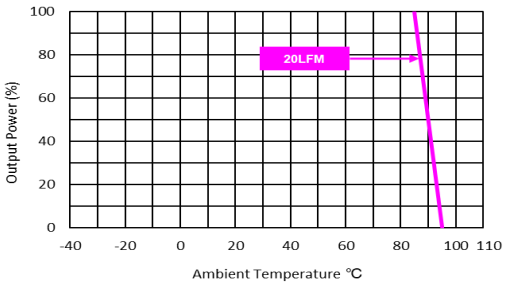
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



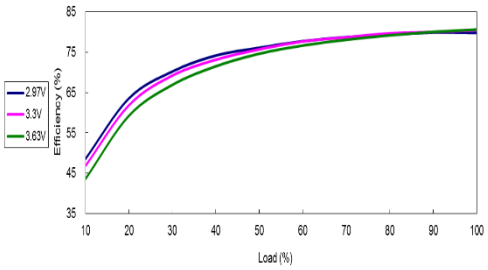
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



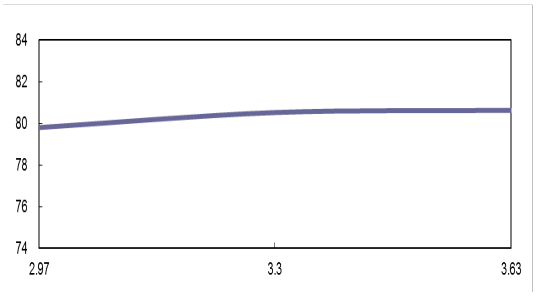
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

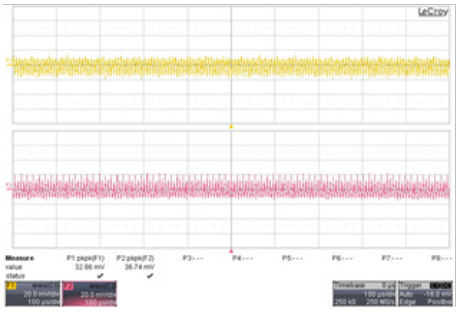
All test conditions are at 25℃ The figures are identical for MFPU01-033D05H



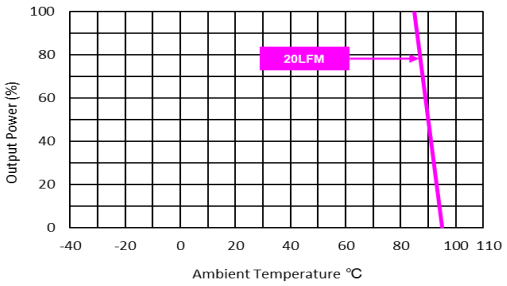
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



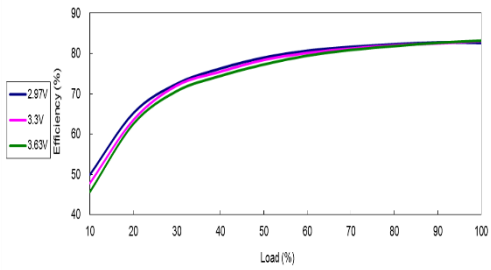
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



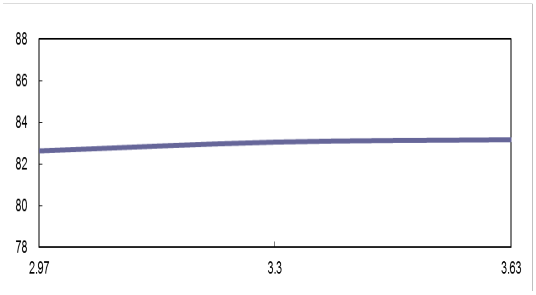
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

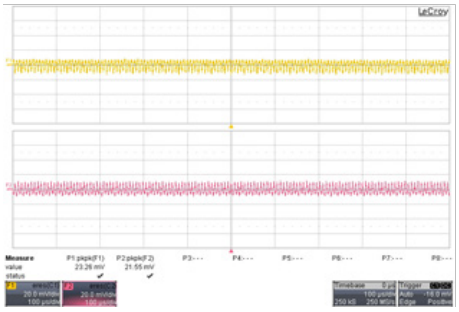
All test conditions are at 25℃ The figures are identical for MFPU01-033D12H



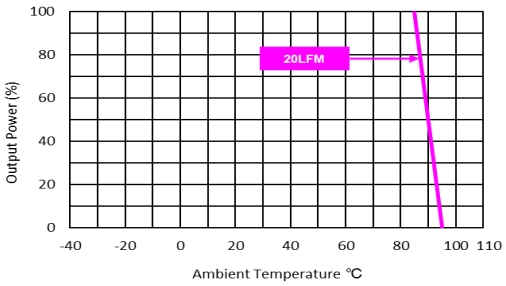
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



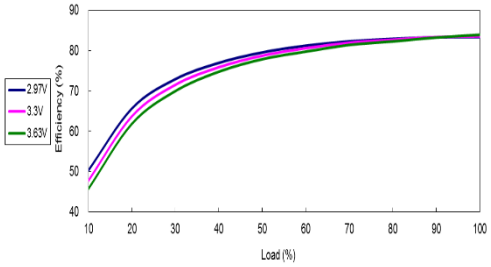
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



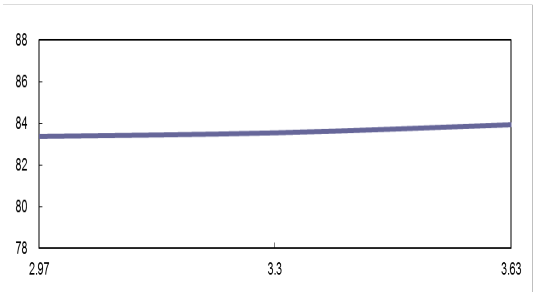
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

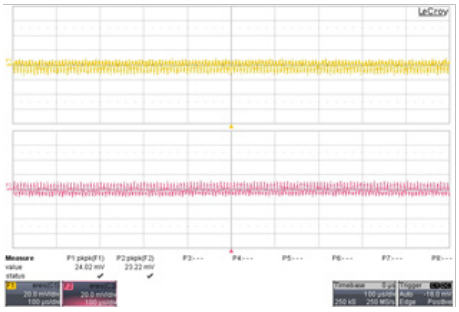
All test conditions are at 25℃ The figures are identical for MFPU01-033D15H



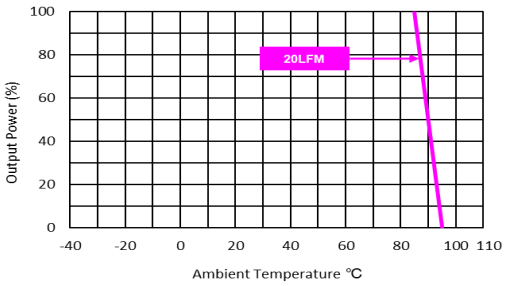
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



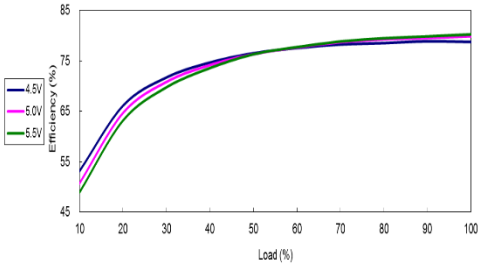
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



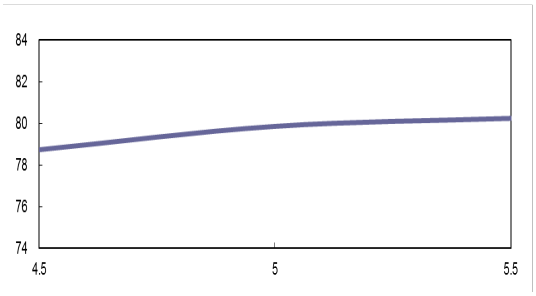
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

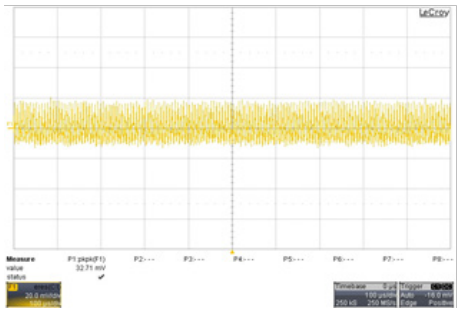
All test conditions are at 25℃ The figures are identical for MFPU01-05S033H



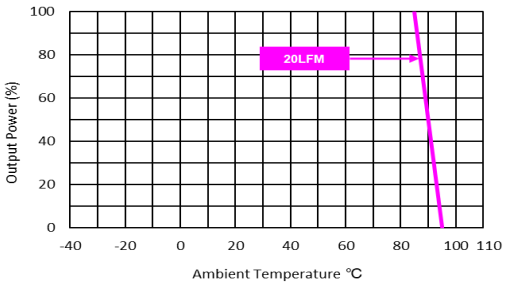
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



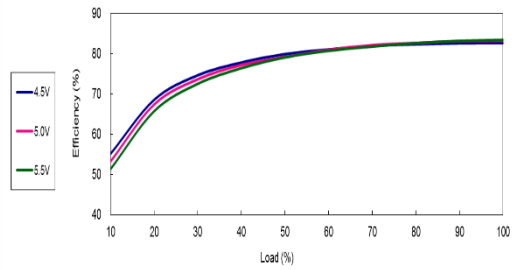
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



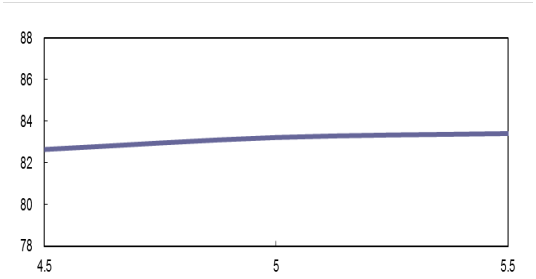
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

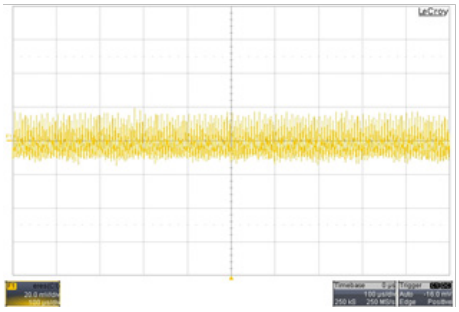
All test conditions are at 25℃ The figures are identical for MFPU01-05S05H



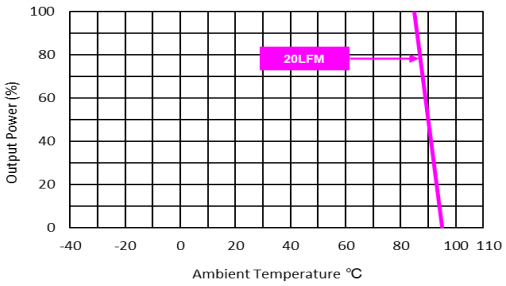
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



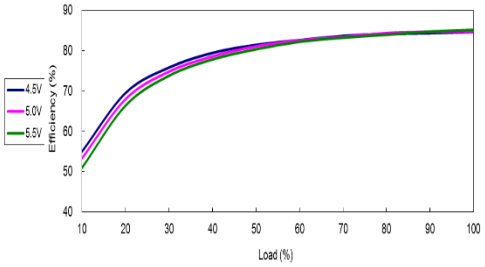
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



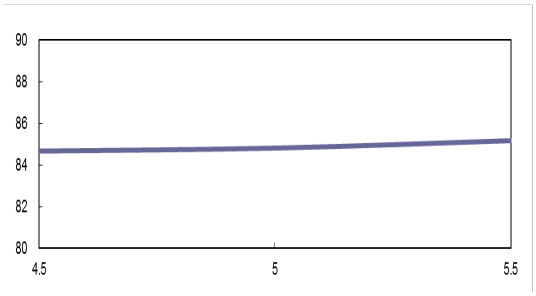
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

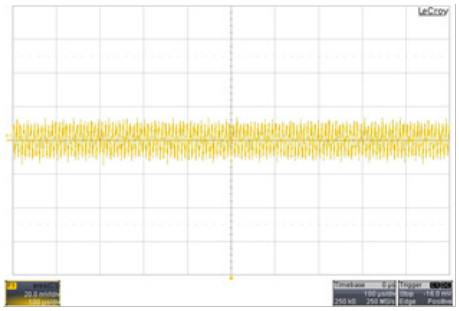
All test conditions are at 25℃ The figures are identical for MFPU01-05S12H



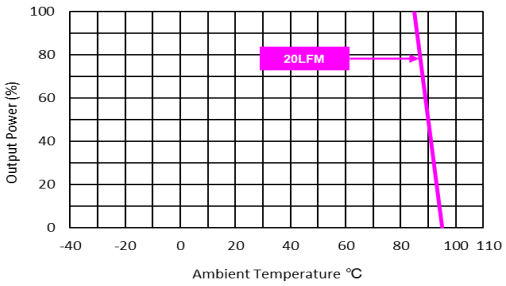
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



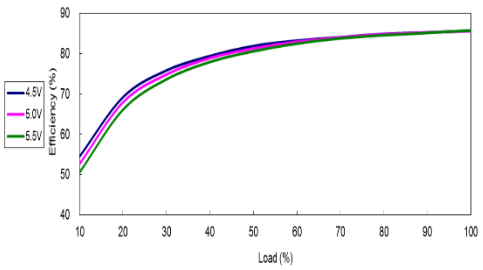
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



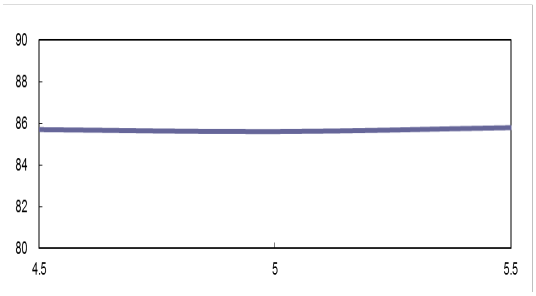
Derating Output Power Versus Ambient Temperature
$V_{in}=V_{in\ nom}$

Characteristic Curves

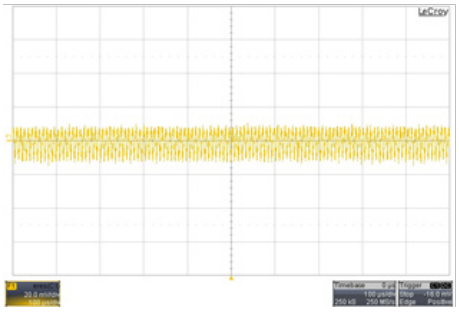
All test conditions are at 25℃ The figures are identical for MFPU01-05S15H



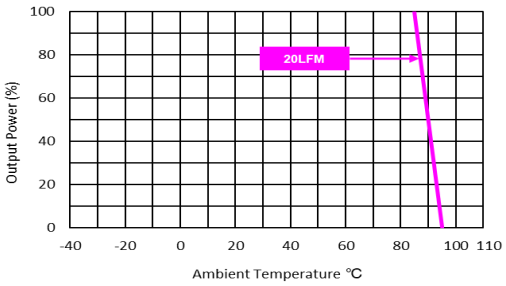
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



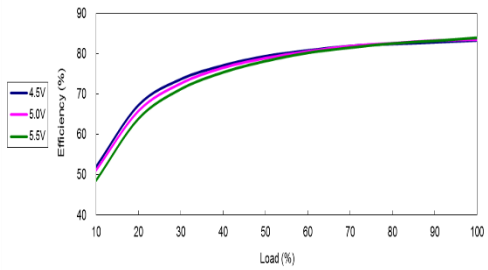
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



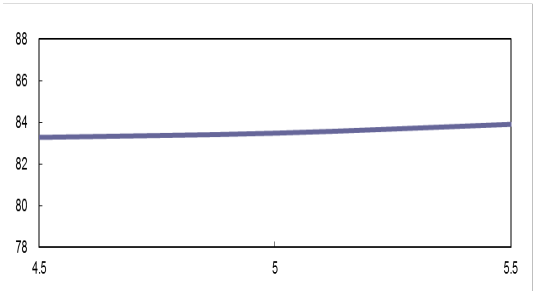
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

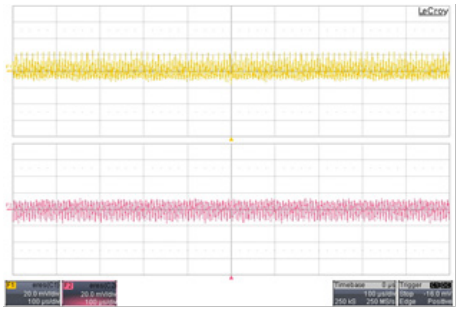
All test conditions are at 25℃ The figures are identical for MFPU01-05D05H



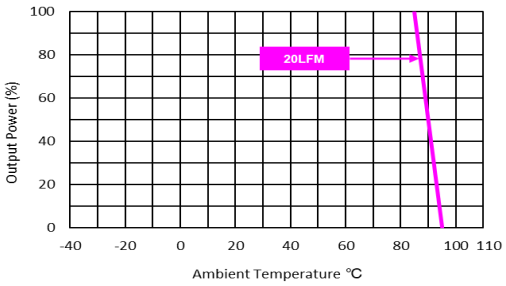
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



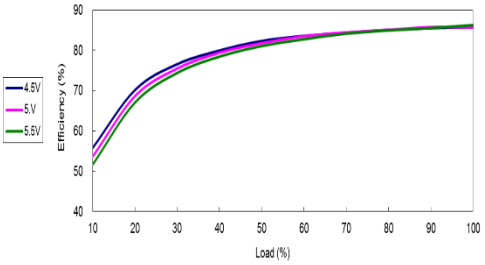
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



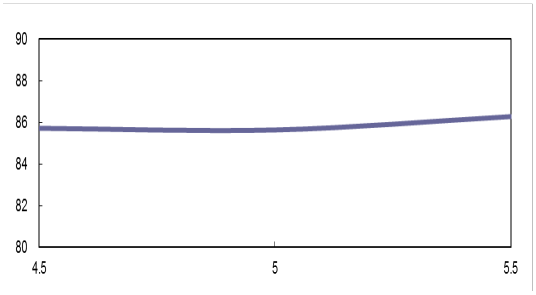
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

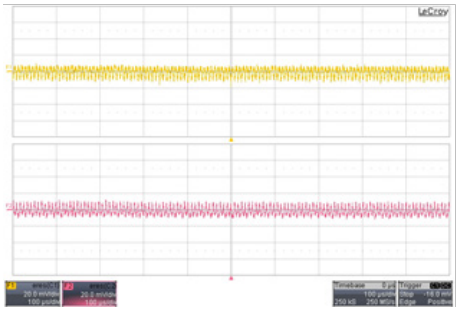
All test conditions are at 25℃ The figures are identical for MFPU01-05D12H



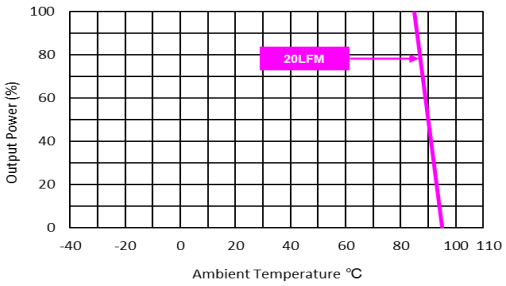
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



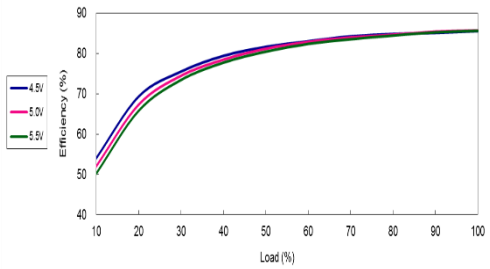
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



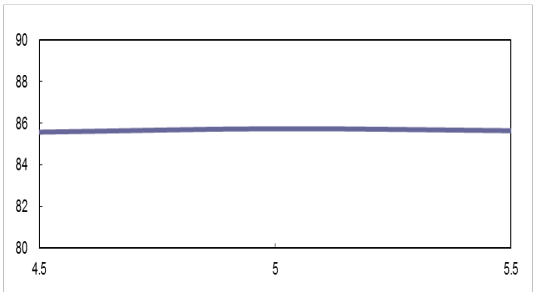
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

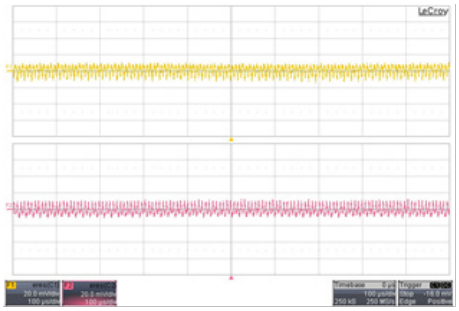
All test conditions are at 25℃ The figures are identical for MFPU01-05D15H



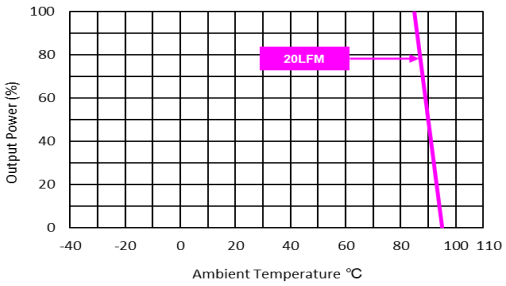
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



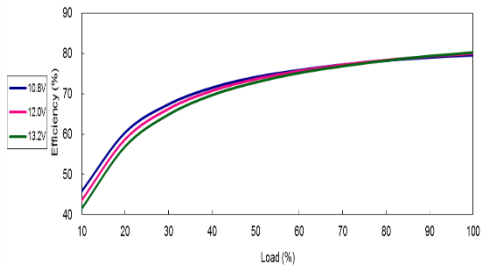
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



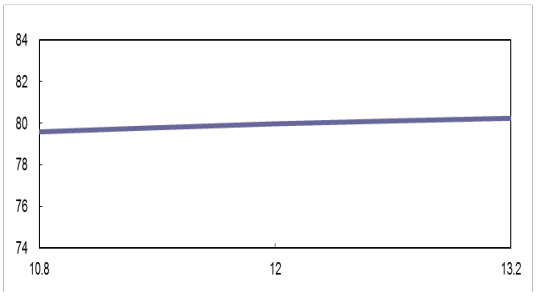
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

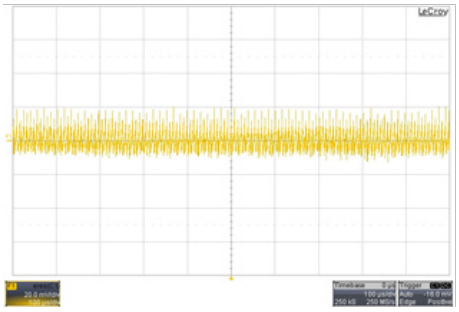
All test conditions are at 25℃ The figures are identical for MFPU01-12S033H



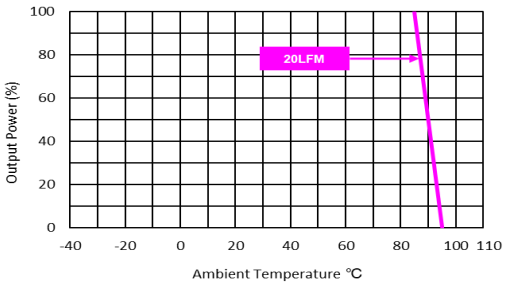
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



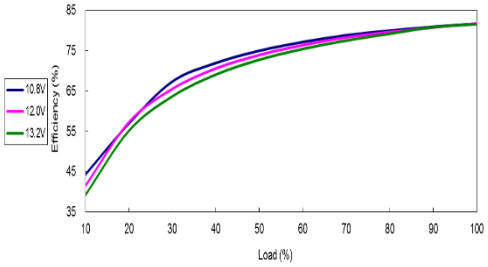
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



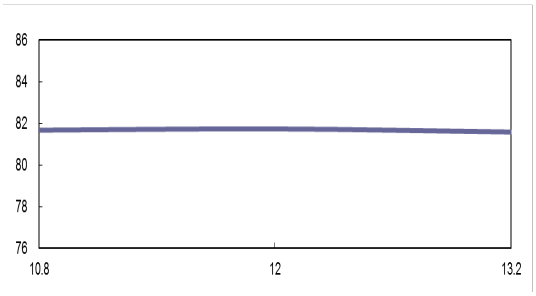
Derating Output Power Versus Ambient Temperature
$V_{in}=V_{in\ nom}$

Characteristic Curves

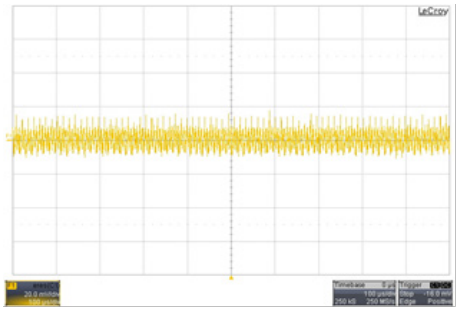
All test conditions are at 25℃ The figures are identical for MFPU01-12S05H



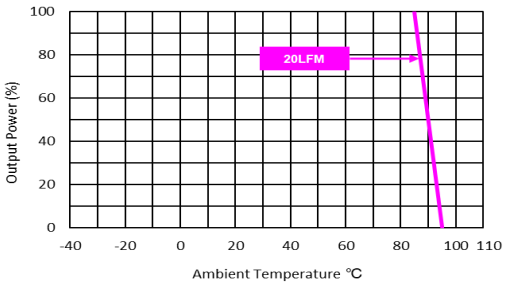
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



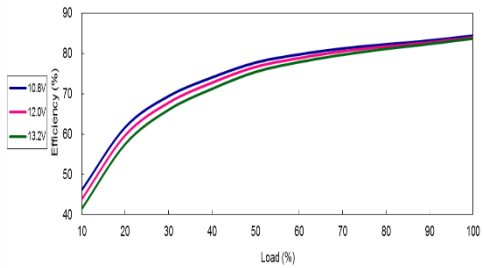
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



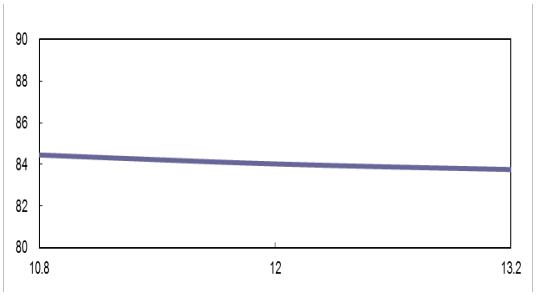
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

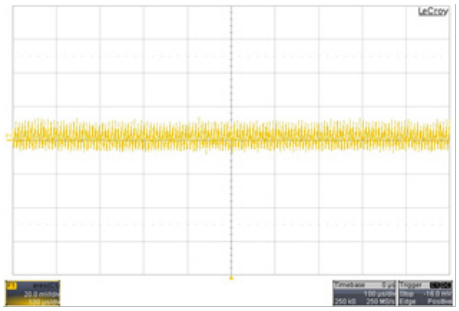
All test conditions are at 25℃ The figures are identical for MFPU01-12S12H



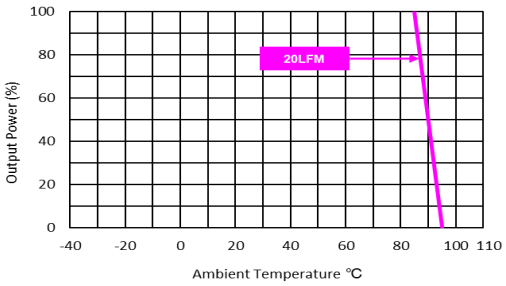
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



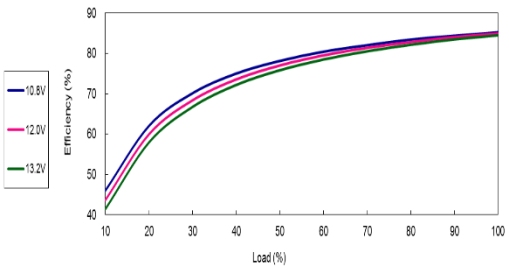
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



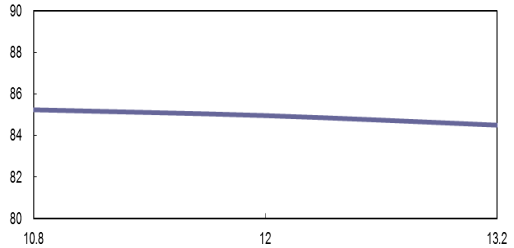
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

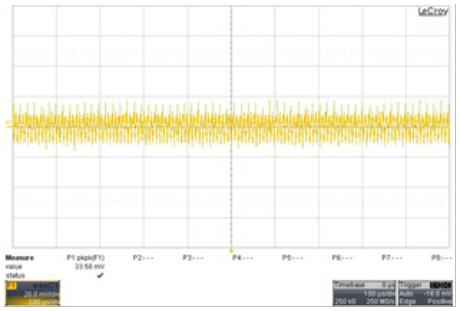
All test conditions are at 25℃ The figures are identical for MFPU01-12S15H



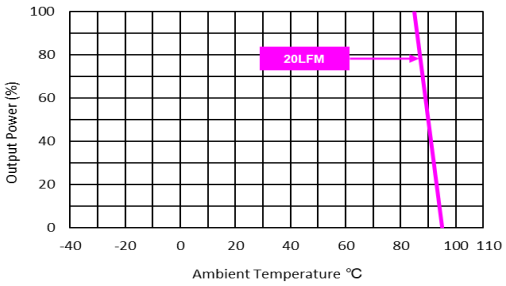
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



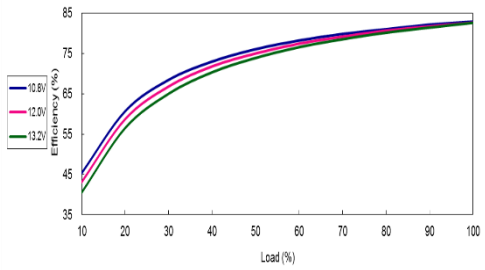
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



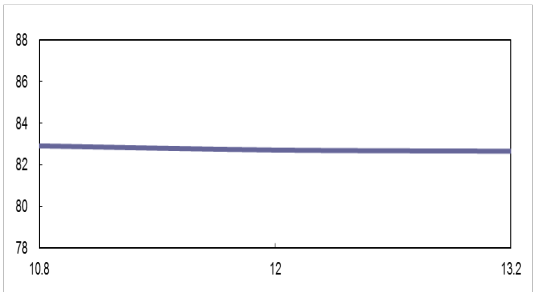
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

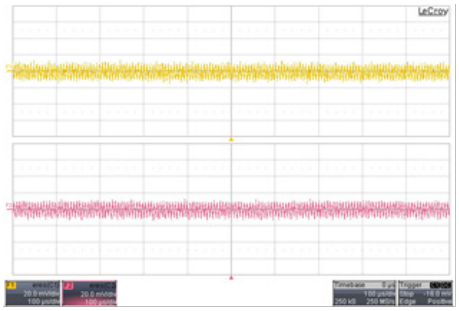
All test conditions are at 25℃ The figures are identical for MFPU01-12D05H



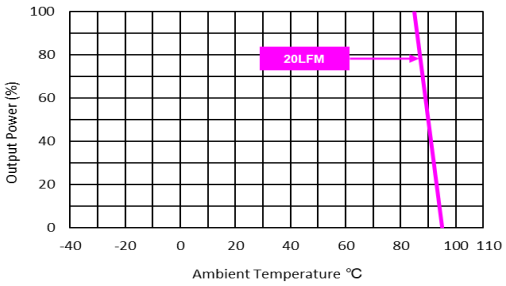
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



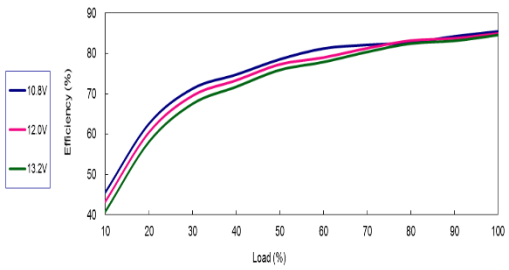
Typical Output Ripple and Noise
$V_{in}=V_{in\ nom}$; Full Load



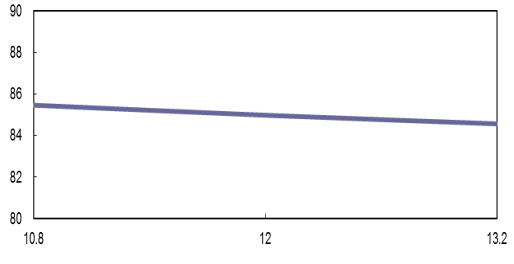
Derating Output Power Versus Ambient Temperature
$V_{in}=V_{in\ nom}$

Characteristic Curves

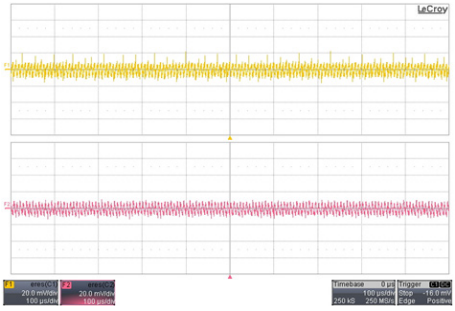
All test conditions are at 25℃ The figures are identical for MFPU01-12D12H



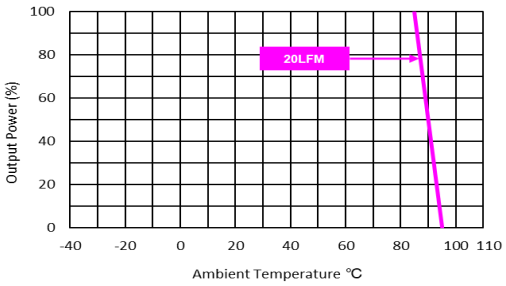
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



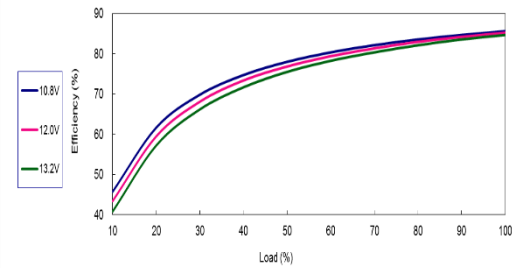
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



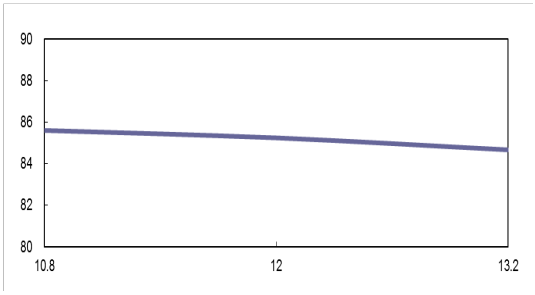
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

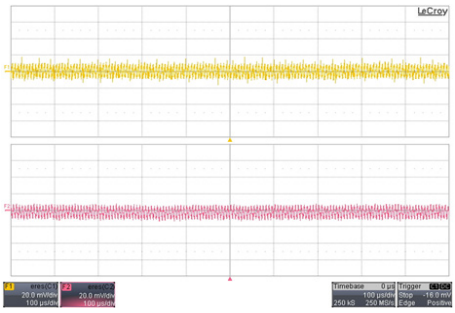
All test conditions are at 25℃ The figures are identical for MFPU01-12D15H



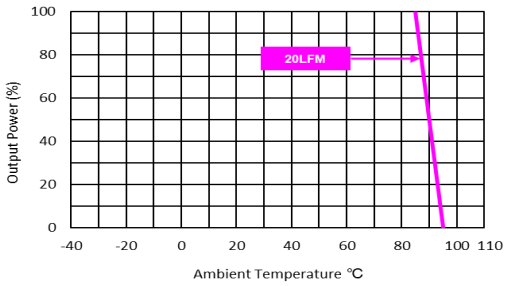
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



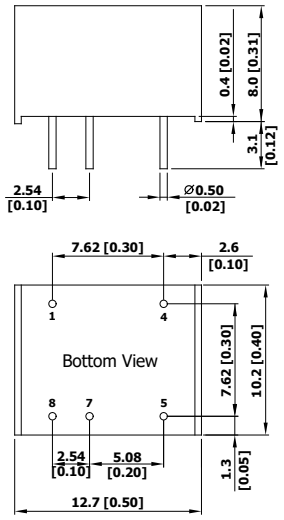
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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

Package Specifications

Mechanical Dimensions



Pin Connections

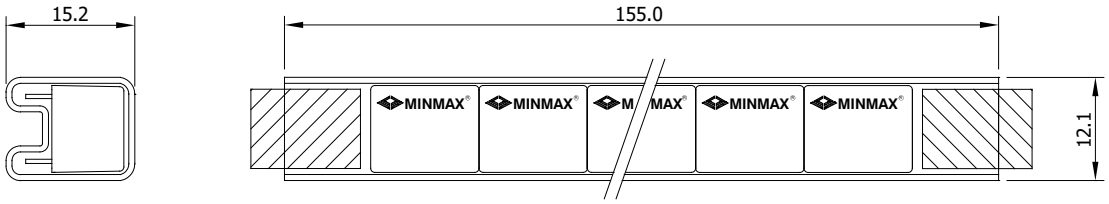
Pin	Single Output	Dual Output
1	-Vin	-Vin
4	+Vin	+Vin
5	+Vout	+Vout
7	-Vout	Common
8	No Pin	-Vout

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

Physical Characteristics

Case Size	:	12.7x8.0x10.2mm (0.50x0.31x0.40 inches)
Case Material	:	Non-Conductive Black Plastic (flammability to UL 94V-0 rated)
Pin Material	:	Phosphor Bronze with Tin Plate Over Nickel Subplate
Weight	:	1.95g

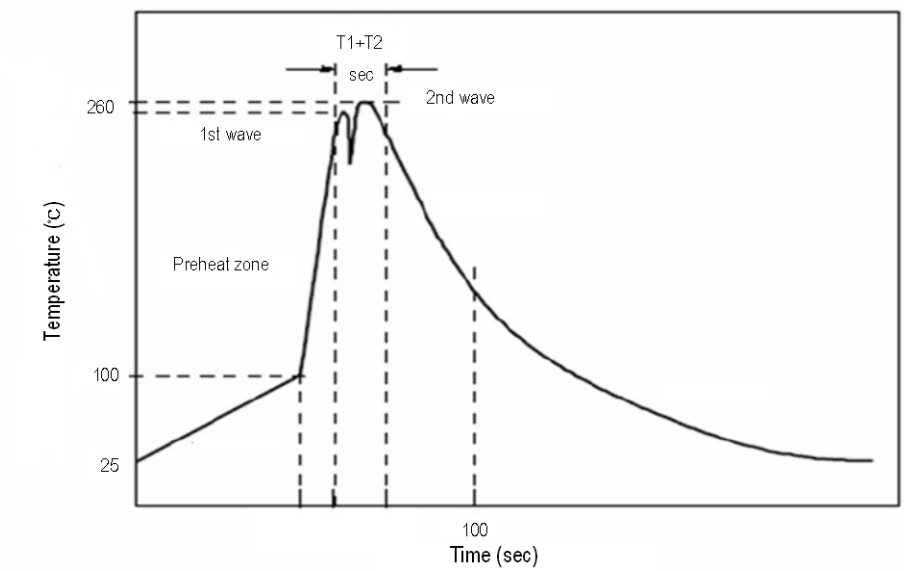
Packaging Information



Unit: mm
10 PCS per TUBE

Wave Soldering Considerations

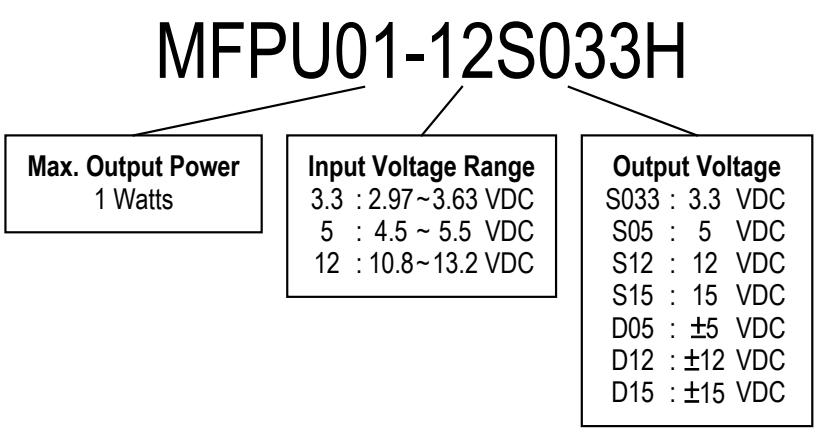
Lead free wave solder profile



Profile Feature	Reference Parameter
Heating rate during preheat	Rise temp. speed：3 ℃/sec max.
Final preheat temperature	Preheat temp.：100~130 ℃
Peak temperature	Peak temp.：250~260 ℃
Time within peak temperature	Peak time(T1+T2)：4~6 sec
Ramp-down rate	5 ℃/sec max.

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



MTBF and Reliability

The MTBF of MFPU01H series of DC-DC converters has been calculated using

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

Model	MTBF	Unit
MFPU01-033S033H	4,392,484	Hours
MFPU01-033S05H	5,434,939	
MFPU01-033S12H	5,366,388	
MFPU01-033S15H	5,261,534	
MFPU01-033D05H	3,589,096	
MFPU01-033D12H	3,767,890	
MFPU01-033D15H	3,773,299	
MFPU01-05S033H	4,966,609	
MFPU01-05S05H	5,825,475	
MFPU01-05S12H	6,189,121	
MFPU01-05S15H	6,262,271	
MFPU01-05D05H	3,889,557	
MFPU01-05D12H	4,296,665	
MFPU01-05D15H	4,101,781	
MFPU01-12S033H	4,821,143	
MFPU01-12S05H	4,954,425	
MFPU01-12S12H	5,632,584	
MFPU01-12S15H	5,534,393	
MFPU01-12D05H	3,699,041	
MFPU01-12D12H	3,966,298	
MFPU01-12D15H	3,966,298	