MINMAX®

MFPU01H Series
Electric Characteristic Note

MFPU01H Series EC 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	%/°C
Over Load Protection	Normal Vin at 25°C	---	160	---	%
Short Circuit Protection	Continuous, Automatic Recovery				

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Parameter	60 Seconds	3000	---	---	VDC
I/O Isolation Voltage	500 VDC	10	---	---	GΩ
I/O Isolation Resistance	100kHz, 1V	---	20	---	pF
I/O Isolation Capacitance		50	80	110	kHz
Switching Frequency	MIL-HDBK-217F@25℃, Ground Benign	3,589,000	---	---	Hours
MTBF (calculated)	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(5)	Conduction	EN 55032	With external components	Class A
	Radiation			
EMS(5)	EN 55035			
	ESD	EN61000-4-2 Air ± 8kV , Contact ± 6kV		A
	Radiated immunity	EN 61000-4-3 10V/m		A
	Fast transient	EN 61000-4-4 ±2kV		A
	Surge	EN 61000-4-5 ±1kV		A
	Conducted immunity	EN 61000-4-6 10Vrms		A
	PFMF	EN 61000-4-8 3A/m		A

Environmental Specifications

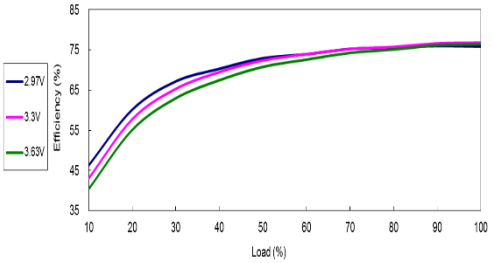
Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+90	℃
Case Temperature	---	+95	℃
Storage Temperature Range	-50	+125	℃
Humidity (non condensing)	---	95	% rel. H
Lead Temperature (1.5mm from case for 10Sec.)	---	260	℃

Notes

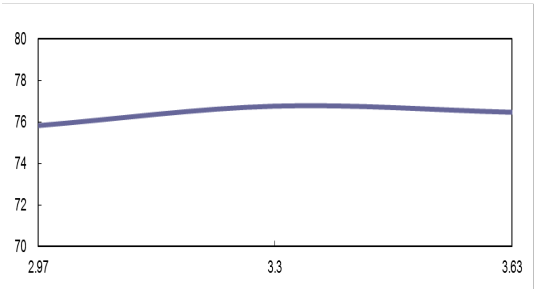
1 Specifications typical at Ta=+25℃, resistive load, nominal input voltage and rated output current unless otherwise noted.
2 These power converters require a minimum output loading to maintain specified regulation, operation under no-load conditions will not damage these modules; however they may not 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 The external components might be required to meet EMI/EMS standard for some of test items. Please contact MINMAX for the solution in detail.
6 Specifications are subject to change without notice.
7 The repeated high voltage isolation testing of the converter can degrade isolation capability, to a lesser or greater degree depending on materials, construction, environment and reflow solder process. Any material is susceptible to eventual chemical degradation when subject to very high applied voltages thus implying that the number of tests should be strictly limited. We therefore strongly advise against repeated high voltage isolation testing, but if it is absolutely required, that the voltage be reduced by 20% from specified test voltage. Furthermore, the high voltage isolation capability after reflow solder process should be evaluated as it is applied on system.

Characteristic Curves

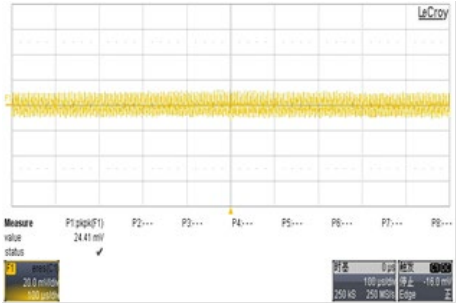
All test conditions are at 25°C The figures are identical for MFPU01-033S033H



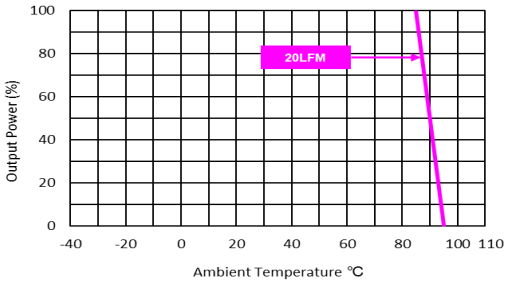
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



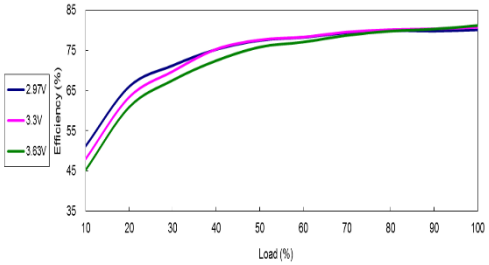
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



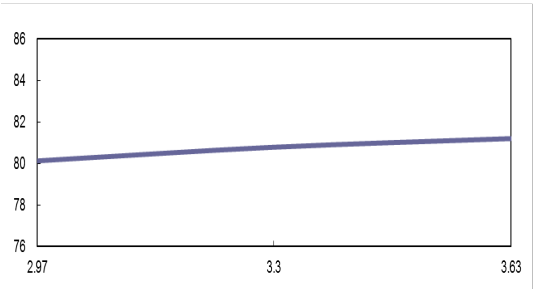
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

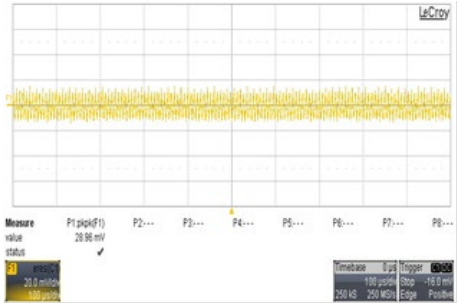
All test conditions are at 25°C The figures are identical for MFPU01-033S05H



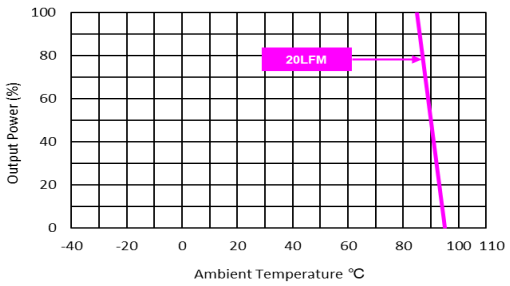
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



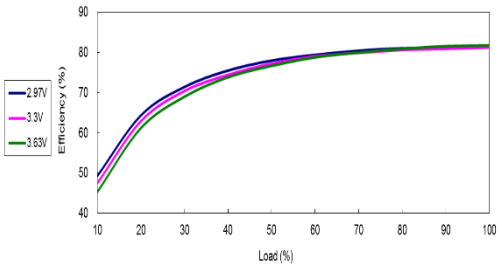
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



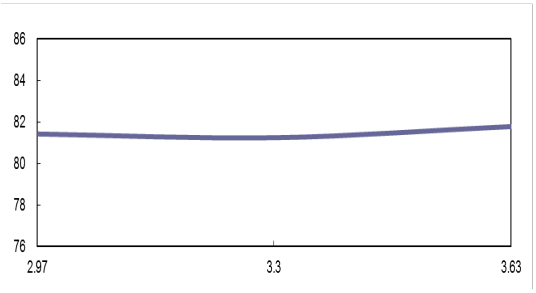
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

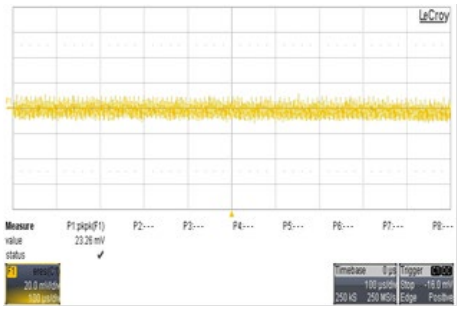
All test conditions are at 25°C The figures are identical for MFPU01-033S12H



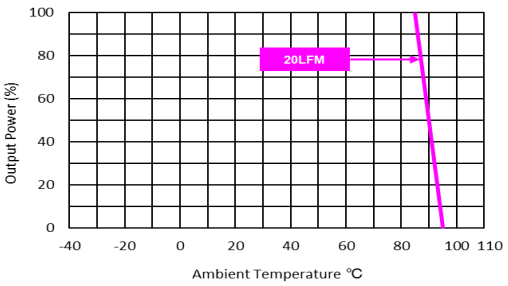
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



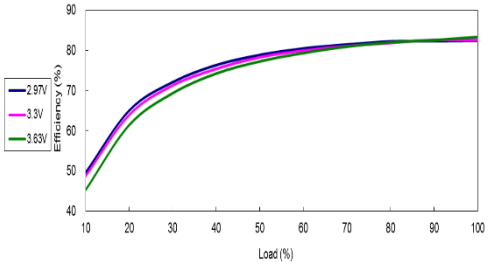
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



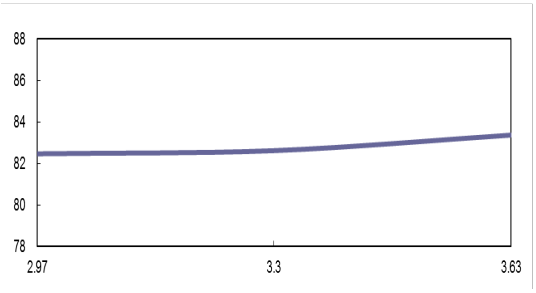
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

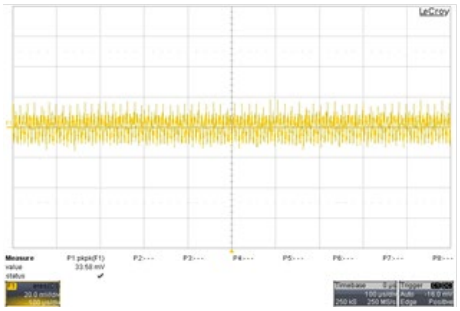
All test conditions are at 25°C The figures are identical for MFPU01-033S15H



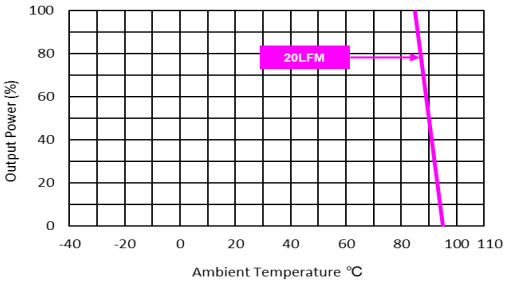
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



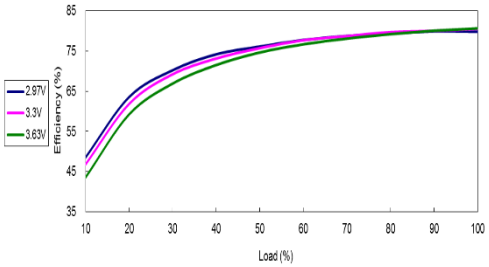
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



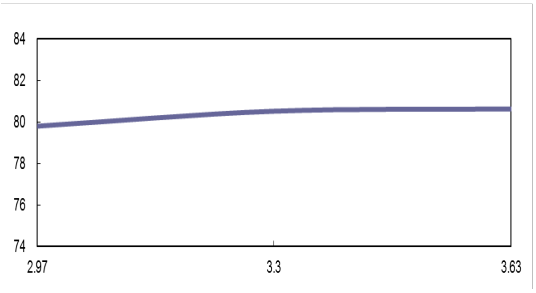
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

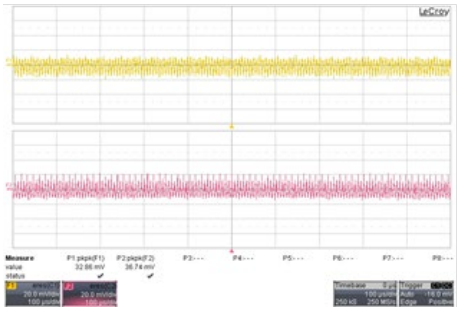
All test conditions are at 25℃ The figures are identical for MFPU01-033D05H



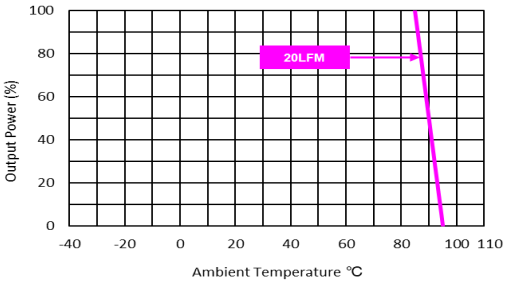
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



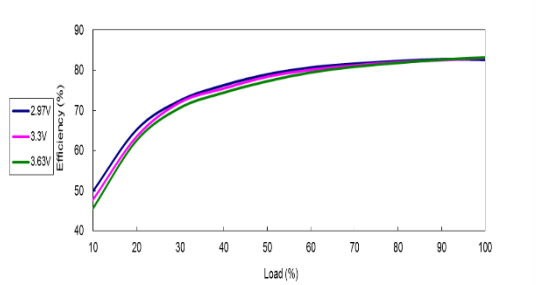
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



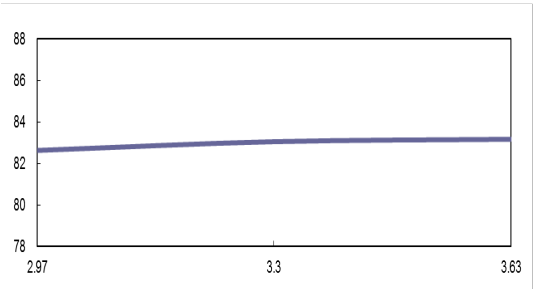
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

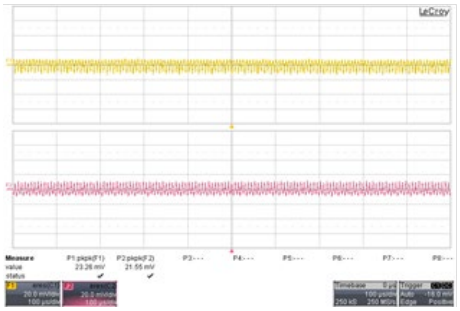
All test conditions are at 25°C The figures are identical for MFPU01-033D12H



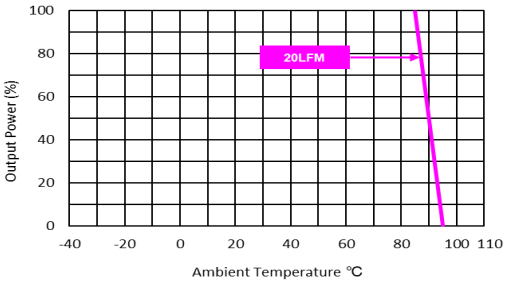
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



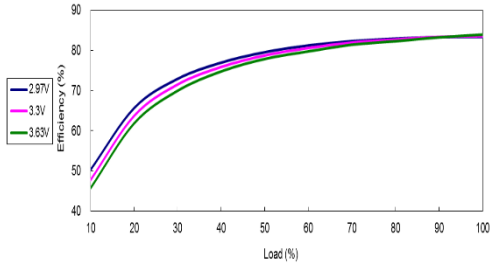
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



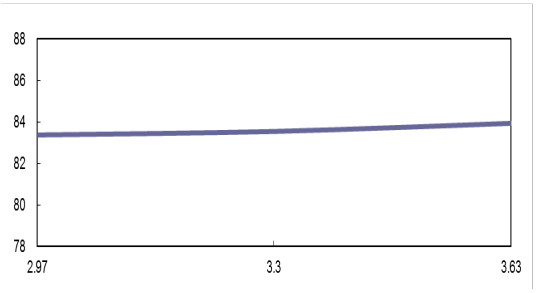
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

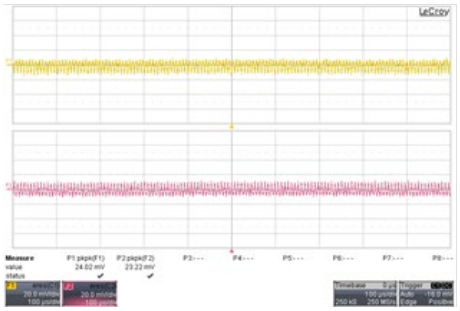
All test conditions are at 25°C The figures are identical for MFPU01-033D15H



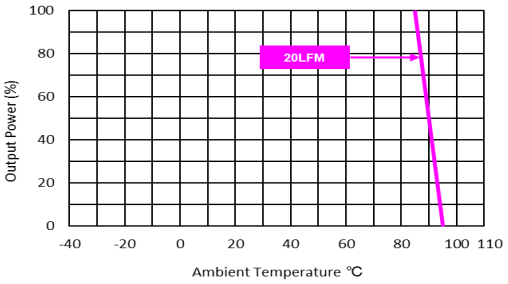
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



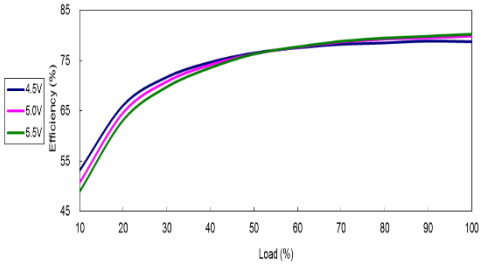
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



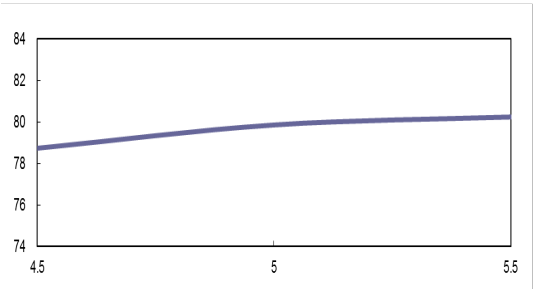
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

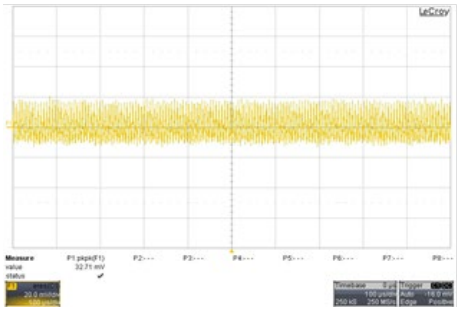
All test conditions are at 25°C The figures are identical for MFPU01-05S033H



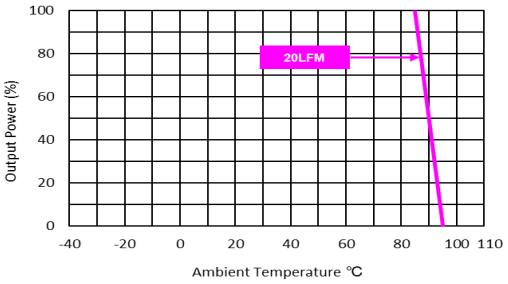
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



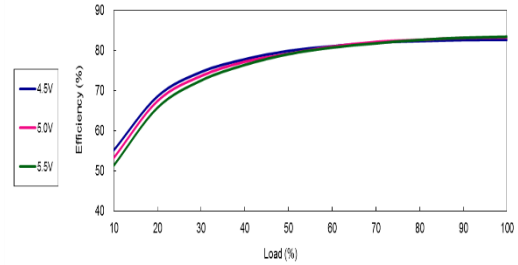
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



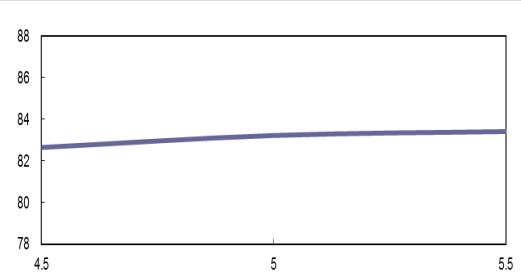
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

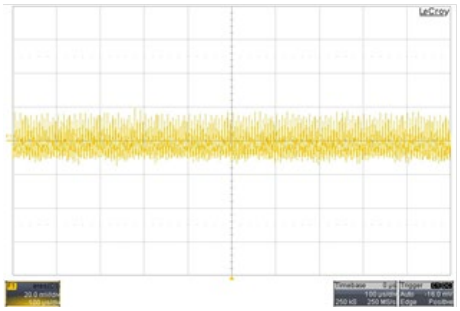
All test conditions are at 25°C The figures are identical for MFPU01-05S05H



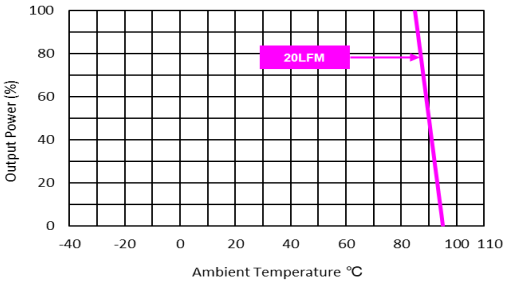
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



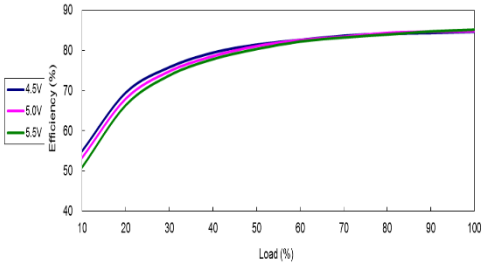
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



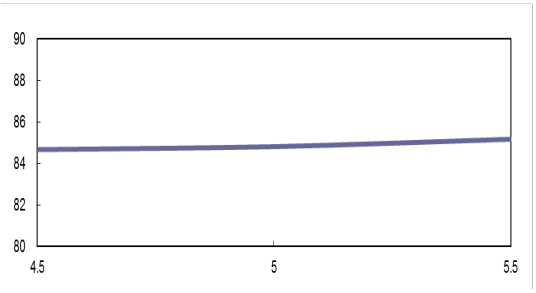
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

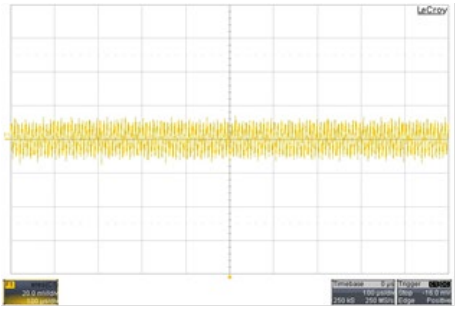
All test conditions are at 25°C The figures are identical for MFPU01-05S12H



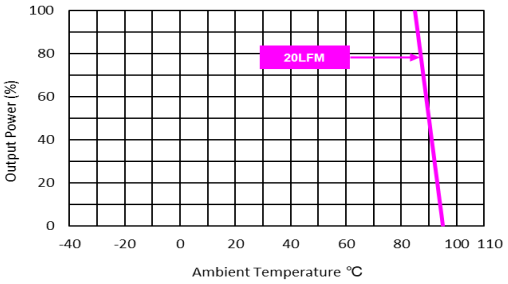
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



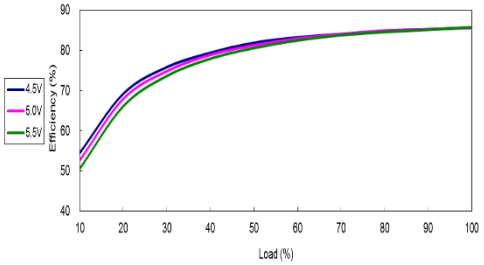
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



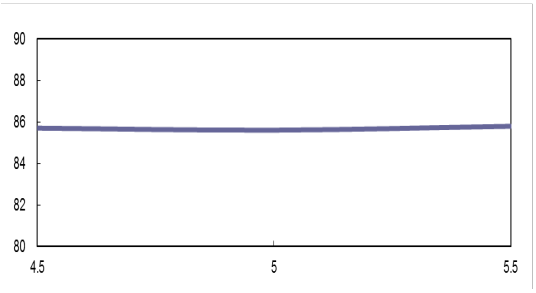
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

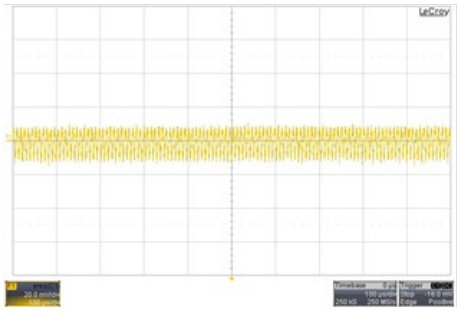
All test conditions are at 25°C The figures are identical for MFPU01-05S15H



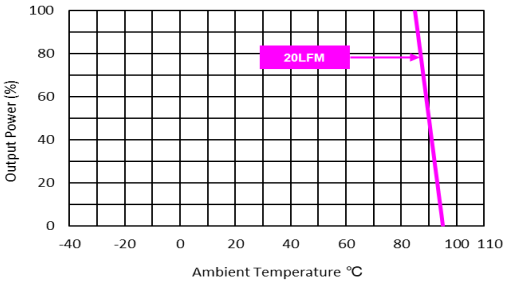
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



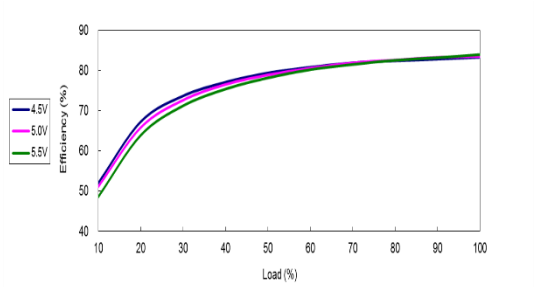
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



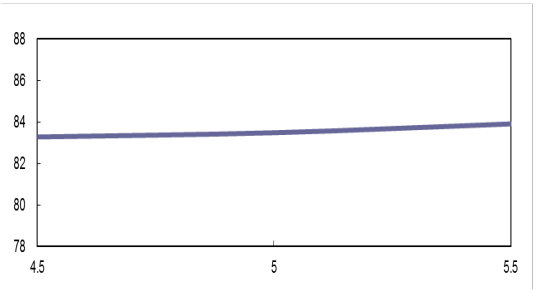
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

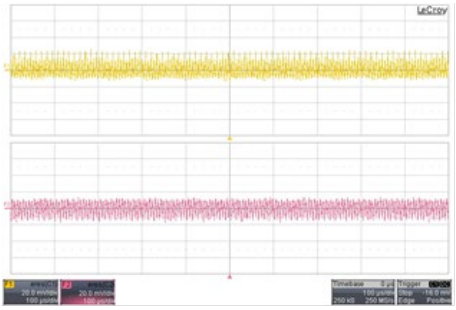
All test conditions are at 25°C The figures are identical for MFPU01-05D05H



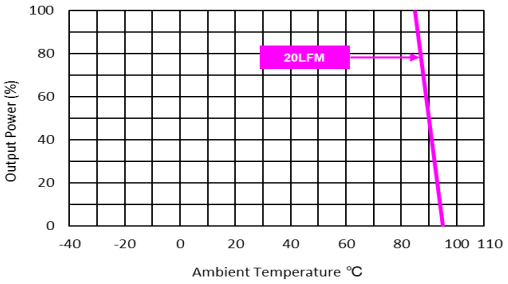
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



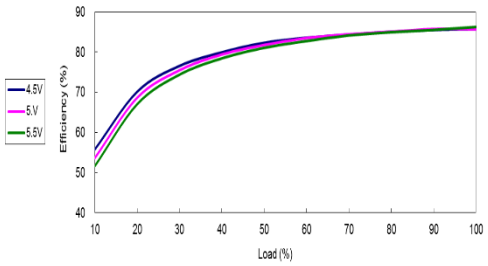
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



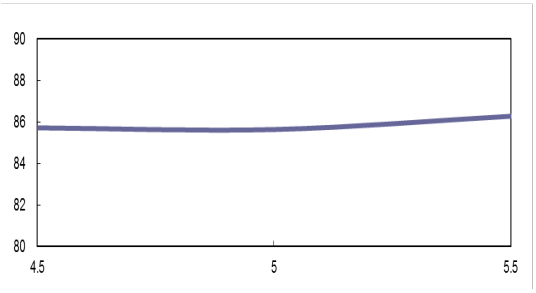
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

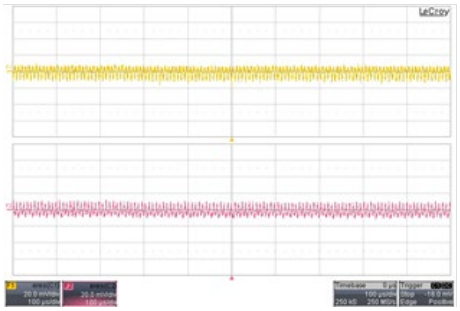
All test conditions are at 25°C The figures are identical for MFPU01-05D12H



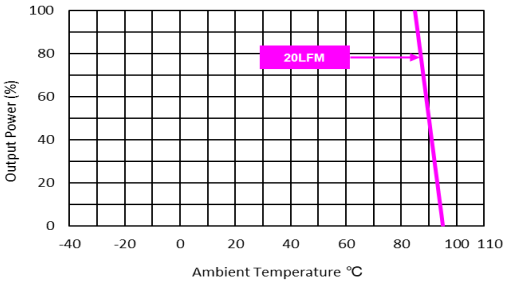
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



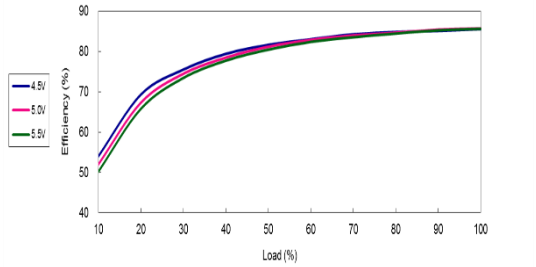
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



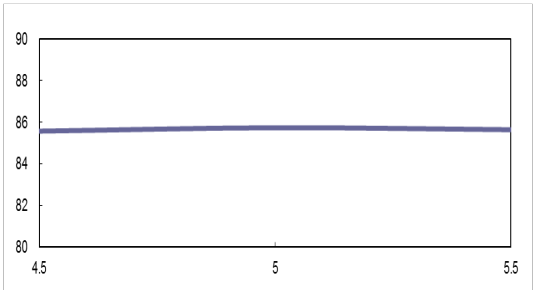
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

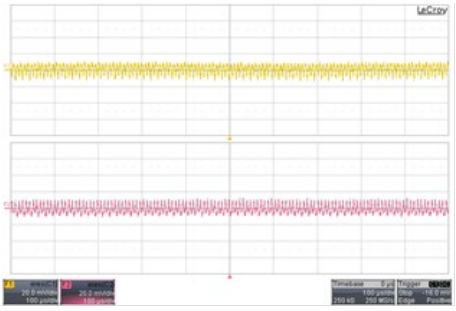
All test conditions are at 25°C The figures are identical for MFPU01-05D15H



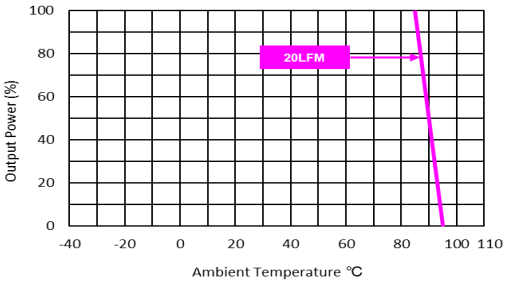
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



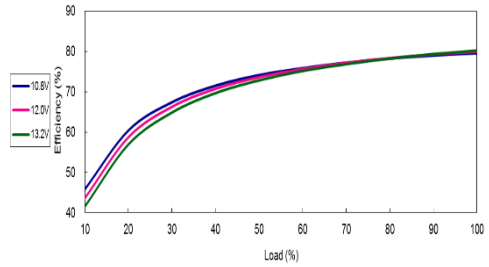
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



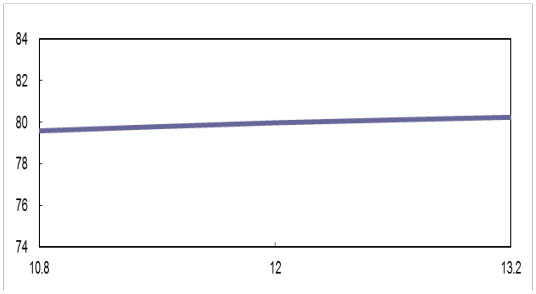
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

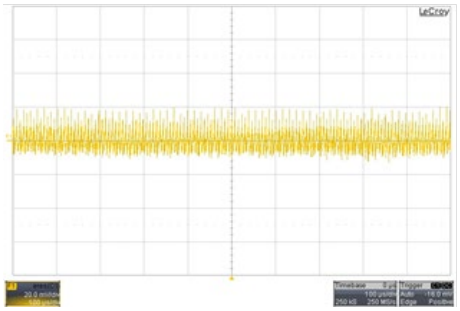
All test conditions are at 25°C The figures are identical for MFPU01-12S033H



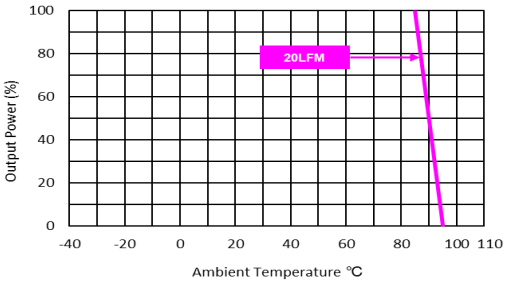
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



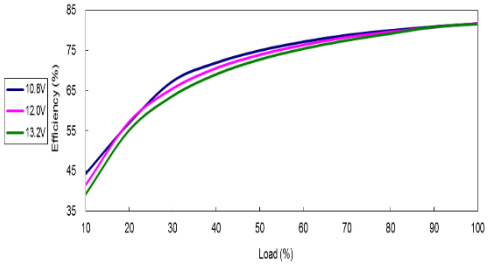
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



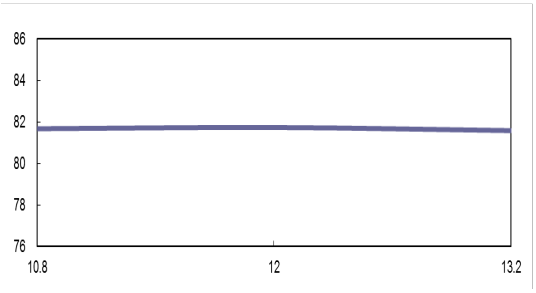
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

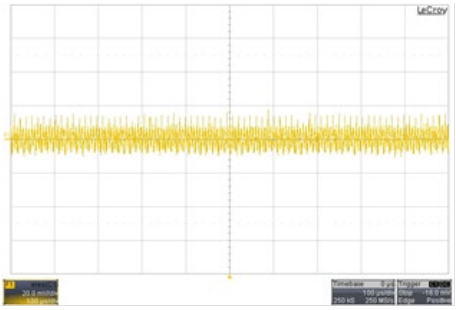
All test conditions are at 25°C The figures are identical for MFPU01-12S05H



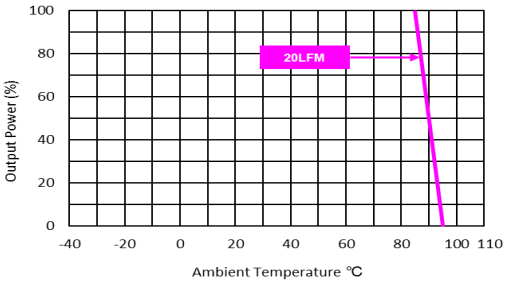
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



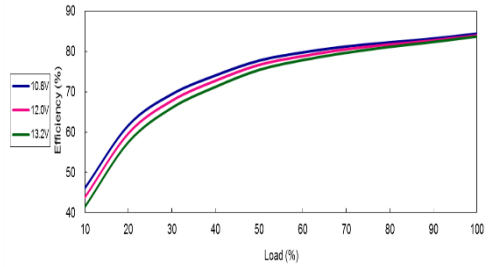
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



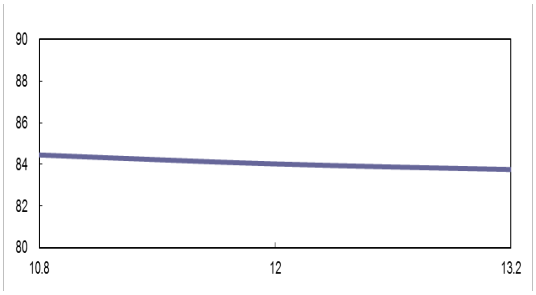
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

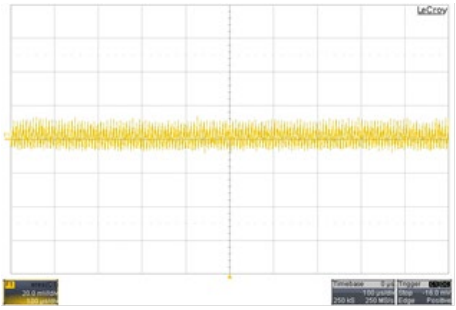
All test conditions are at 25°C The figures are identical for MFPU01-12S12H



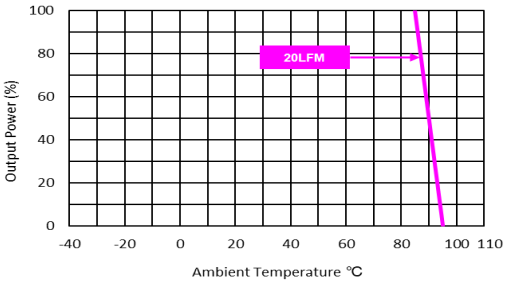
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



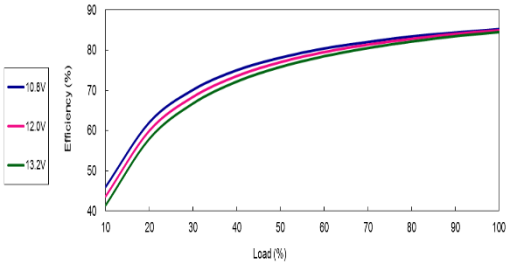
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



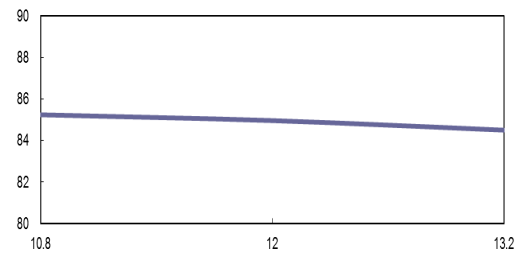
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

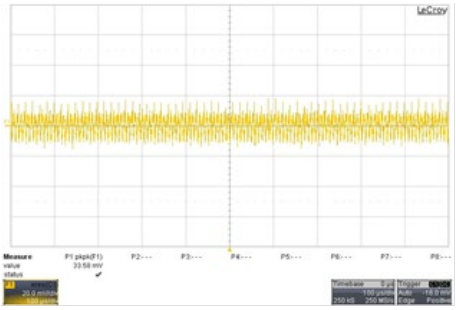
All test conditions are at 25°C The figures are identical for MFPU01-12S15H



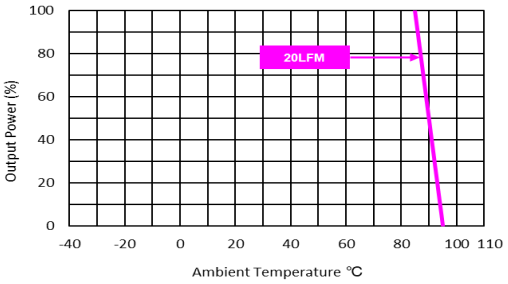
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



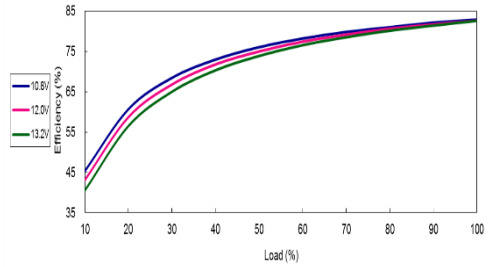
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



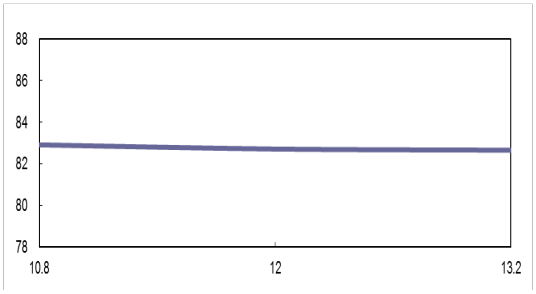
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

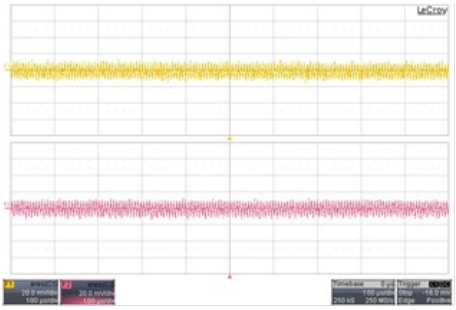
All test conditions are at 25℃ The figures are identical for MFPU01-12D05H



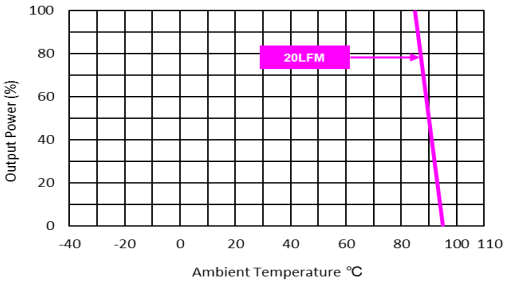
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



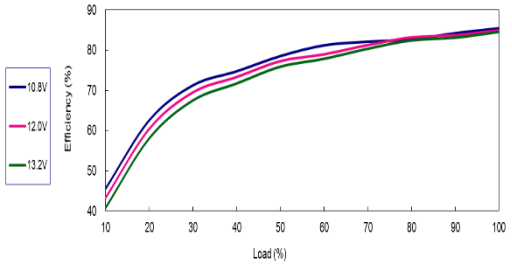
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



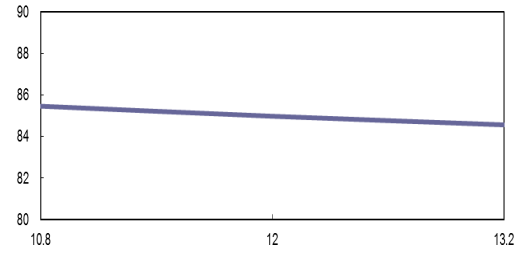
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

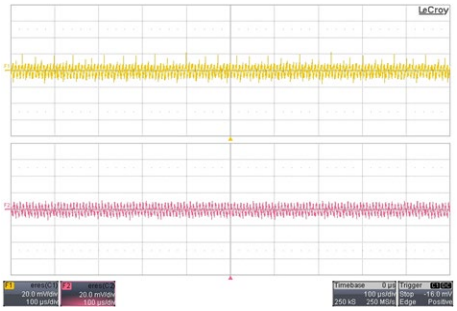
All test conditions are at 25°C The figures are identical for MFPU01-12D12H



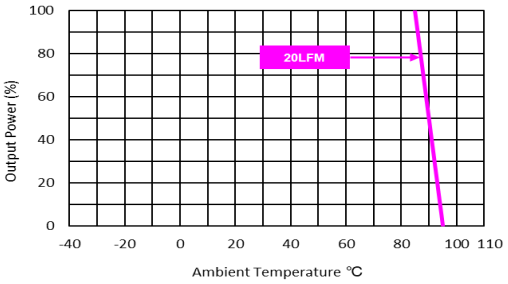
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



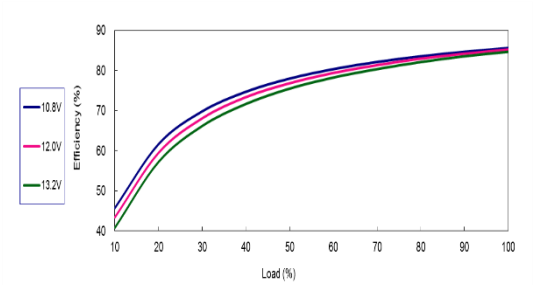
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



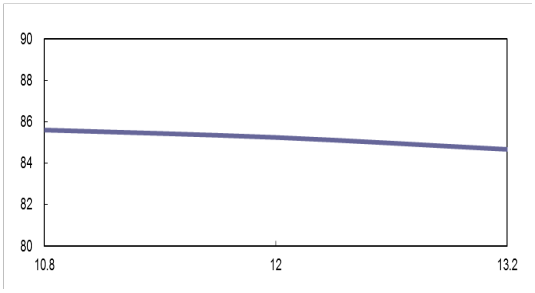
Derating Output Power Versus Ambient Temperature
V_{in}=$V_{in\ nom}$

Characteristic Curves

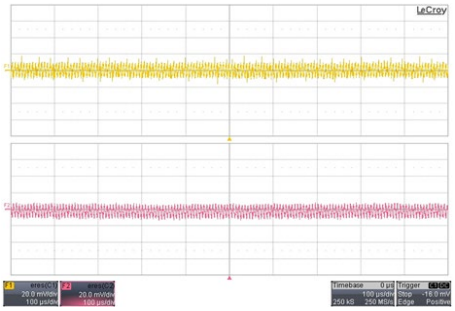
All test conditions are at 25°C The figures are identical for MFPU01-12D15H



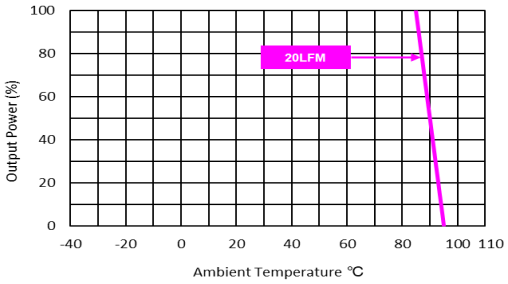
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



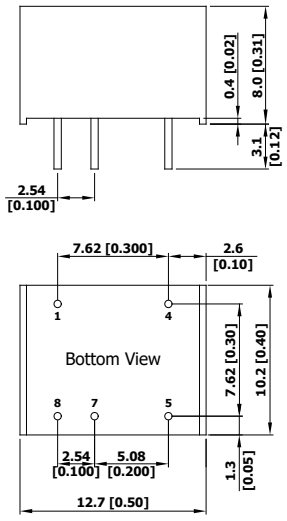
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



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

Package Specifications

Mechanical Dimensions



Pin Connections

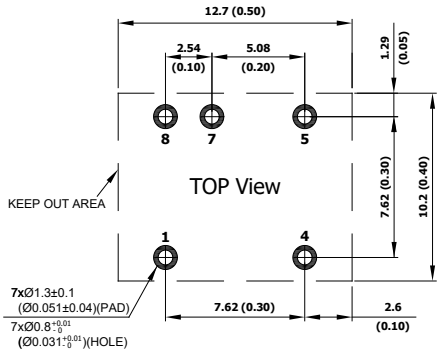
Pin	Single Output	Dual Output	Diameter mm (inches)
1	-Vin	-Vin	Ø 0.5 [0.02]
4	+Vin	+Vin	Ø 0.5 [0.02]
5	+Vout	+Vout	Ø 0.5 [0.02]
7	-Vout	Common	Ø 0.5 [0.02]
8	No Pin	-Vout	Ø 0.5 [0.02]

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

Physical Characteristics

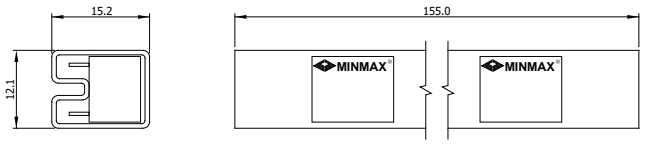
Case Size	:	12.7x8.0x10.2mm (0.50x0.31x0.40 inches)
Case Material	:	Non-Conductive Black Plastic (flammability to UL 94V-0 rated)
Pin Material	:	Phosphor Bronze
Weight	:	1.95g

Recommended Pad Layout for Single & Dual Output Converter

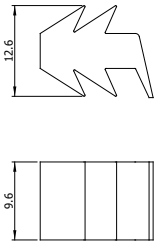


Packaging Information for Tube

Tube



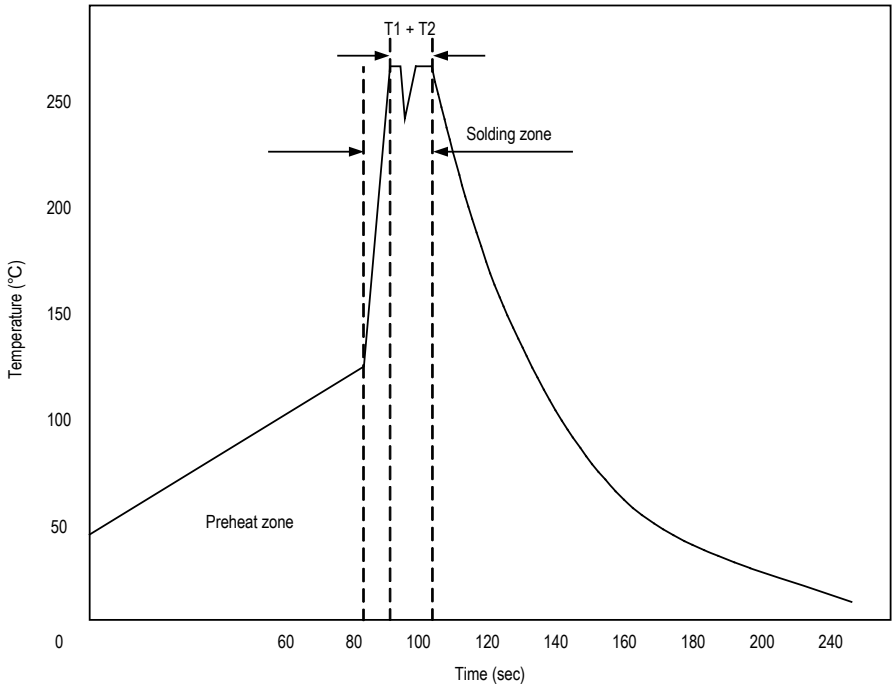
Plug



Unit: mm
10 PCS per TUBE

Wave Soldering Considerations

Lead free wave solder profile



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

Hand Welding Parameter

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

Hand Welding: Soldering iron：Power 60W

Welding Time: 2~4 sec

Temp.: 380~400℃

Part Number Structure

M	F	PU	01	-	033	S	033	H
	Package Type DIP-8	Protection Over Current 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	Output Quantity S: Single D: Dual	Output Voltage 033: 3.3 VDC 05: 5 VDC 12: 12 VDC 15: 15 VDC	I/O Isolation Voltage 3000 VDC

MTBF and Reliability

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

MIL-HDBK 217F NOTICE2, Operating Temperature 25℃, 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	