



MINMAX[®]

MFSU01 Series

Electric Characteristic Note

MFSU01 Series EC Note

DC-DC CONVERTER 1W

Features

- ▶ Industrial Standard DIP-8 Package
- ▶ Unregulated Output Voltage
- ▶ I/O Isolation 1500VDC
- ▶ Operating Ambient Temp. Range -40°C to +85°C
- ▶ Short Circuit Protection



Applications

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

Product Overview

The MINMAX MFSU01 series is a range of isolated 1W DC-DC converter modules in DIP-8. There are 9 models available for 5, 12 or 24VDC input. Advanced circuit topology provides continuous short circuit protection and a high efficiency up to 83% which allows operating ambient temperatures range of -40°C to +85°C without power derating. These converters offer a better solution for all applications where 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.	@Max. Load			@No Load
	VDC	VDC	mA	mA(typ.)	mA(typ.)	% (max.)	μF	%
MFSU01-05S05	5 (4.5 ~ 5.5)	5	200	250	30	11	220	80
MFSU01-05S12		12	84	246		9		82
MFSU01-05S15		15	67	242		8		83
MFSU01-12S05	12 (10.8 ~ 13.2)	5	200	105	17	8	220	79
MFSU01-12S12		12	84	104		8		81
MFSU01-12S15		15	67	102		8		82
MFSU01-24S05	24 (21.6 ~ 26.4)	5	200	53	10	8	220	78
MFSU01-24S12		12	84	53		8		80
MFSU01-24S15		15	67	52		7		81

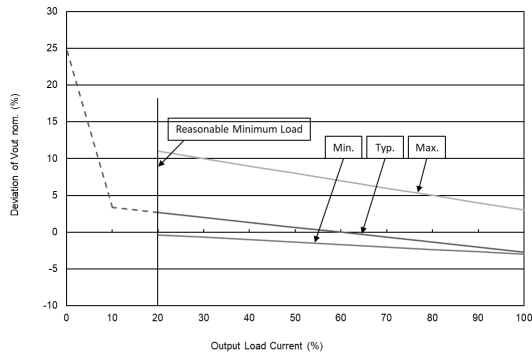
Input Specifications

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

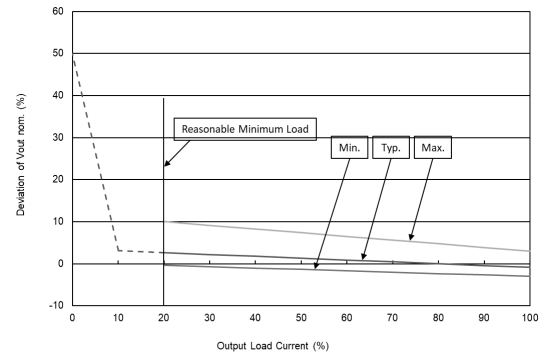
Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy		---	---	±3.0	%Vnom.
Line Regulation	For Vin Change of 1%	---	±1.2	±1.5	%
Load Regulation	Io=10% to 100%	See Model Selection Guide (Operation at lower load will not damage the converter, but it may not meet all specifications)			
Ripple & Noise	0-20 MHz Bandwidth	---	---	100	mV _{P-P}
Temperature Coefficient		---	±0.01	±0.02	%/°C
Short Circuit Protection	Continuous, Automatic Recovery				

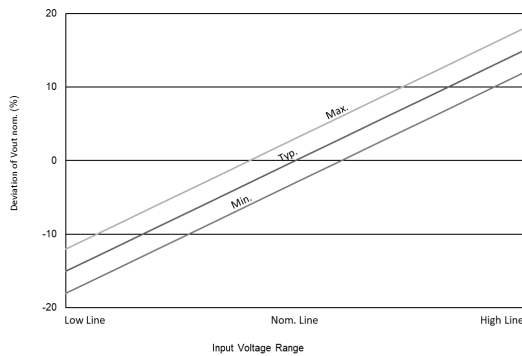
Output Voltage Tolerance



Output Voltage VS Output Load Current
For 5V Output Models



Output Voltage VS Output Load Current
For 12V & 15V Output Models



Output Voltage VS Input Voltage Range

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds	1500	---	---	VDC
	1 Second	1800	---	---	VDC
I/O Isolation Resistance	500 VDC	1000	---	---	MΩ
I/O Isolation Capacitance	100kHz, 1V	---	20	---	pF
Switching Frequency		20	50	95	kHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	5,067,163	---	---	Hours

EMC Specifications

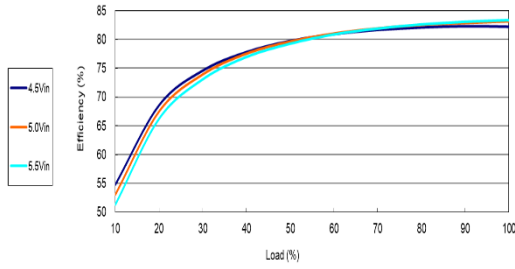
Parameter	Standards & Level		Performance
EMI ₍₅₎	Conduction	EN 55032	With external components Class B
	Radiation		
EMS ₍₅₎	EN 55024, EN 55035		A
	ESD	Direct discharge EN61000-4-2 Air ± 8kV	
		Radiated immunity	EN 61000-4-3 10V/m
	Fast transient	EN 61000-4-4 ±2kV	
	Surge	EN 61000-4-5 ±1kV	
	Conducted immunity	EN 61000-4-6 10Vrms	
	PFMF	EN 61000-4-8 30A/m	

Environmental Specifications				
	Parameter	Min.	Max.	Unit
	Operating Ambient Temperature Range	-40	+85	°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

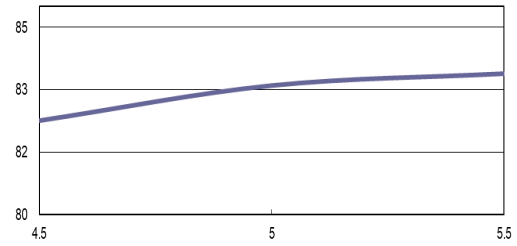
Notes	
1	Specifications typical at Ta=+25°C, resistive load, nominal input voltage and rated output current unless otherwise noted.
2	These power converters require a minimum output loading to maintain specified regulation, operation under no-load conditions will not damage these modules; however they may not meet all specifications listed.
3	We recommend to protect the converter by a 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

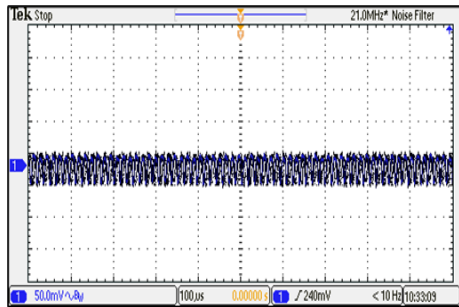
All test conditions are at 25°C The figures are identical for MFSU01-05S05



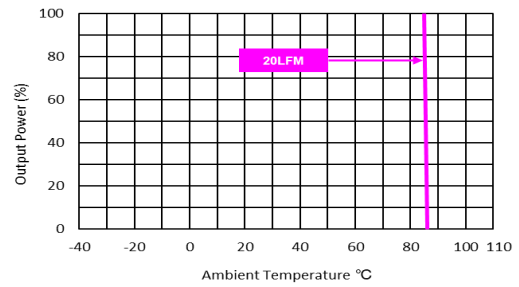
Efficiency Versus Output Current



Efficiency Versus Input Voltage Full Load



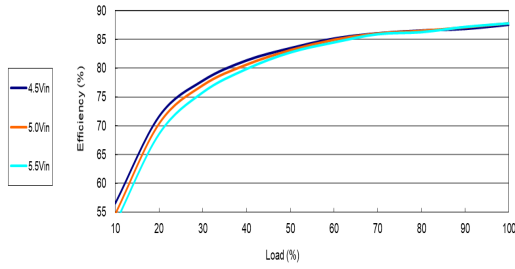
Typical Output Ripple and Noise
 $V_{in} = V_{in\ nom}$; Full Load



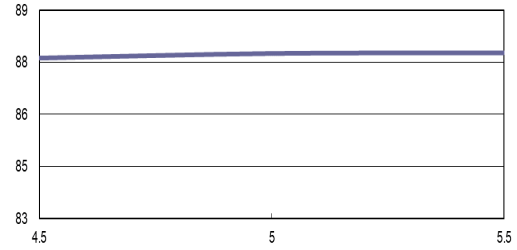
Derating Output Power Versus Ambient Temperature
 $V_{in} = V_{in\ nom}$

Characteristic Curves

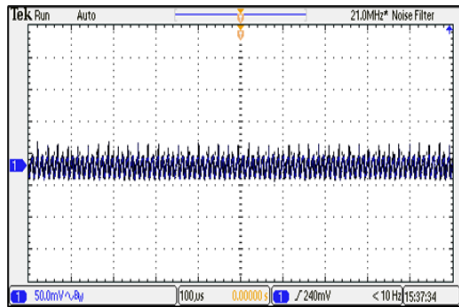
All test conditions are at 25°C The figures are identical for MFSU01-05S12



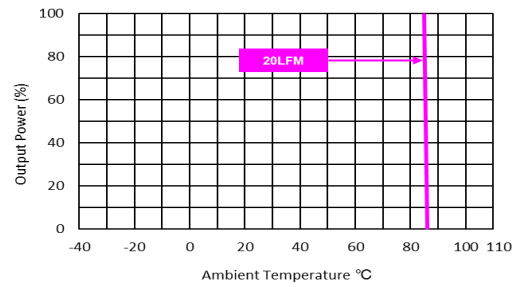
Efficiency Versus Output Current



Efficiency Versus Input Voltage Full Load



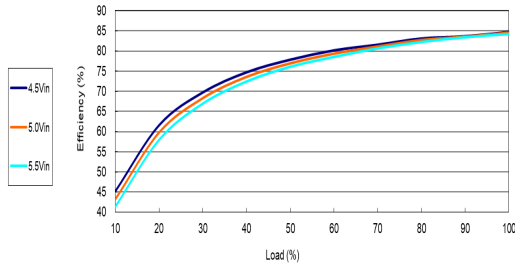
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



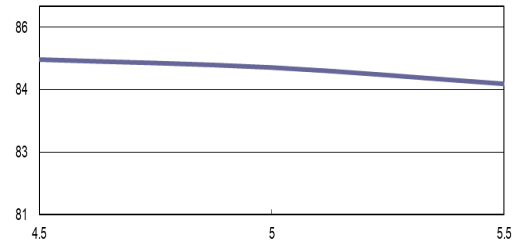
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

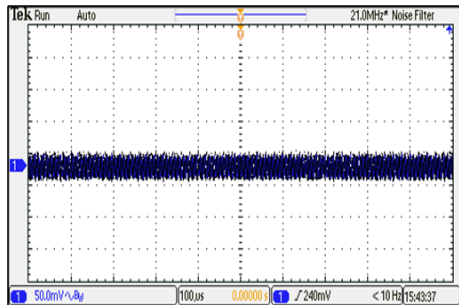
All test conditions are at 25°C The figures are identical for MFSU01-05S15



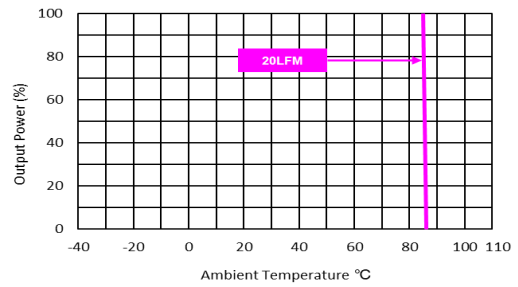
Efficiency Versus Output Current



Efficiency Versus Input Voltage Full Load



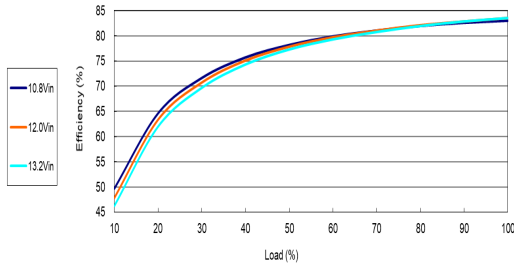
Typical Output Ripple and Noise
 $V_{in}=V_{in\ nom}$; Full Load



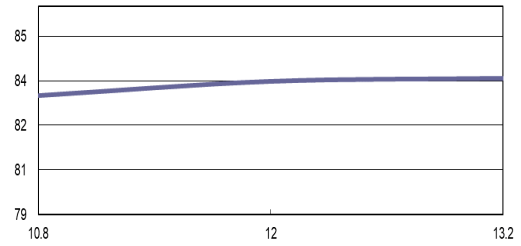
Derating Output Power Versus Ambient Temperature
 $V_{in}=V_{in\ nom}$

Characteristic Curves

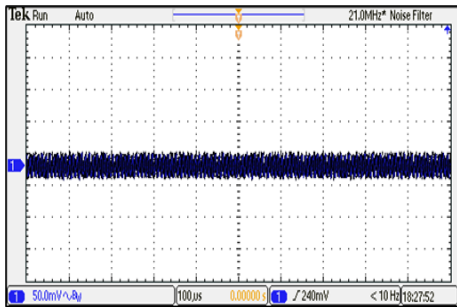
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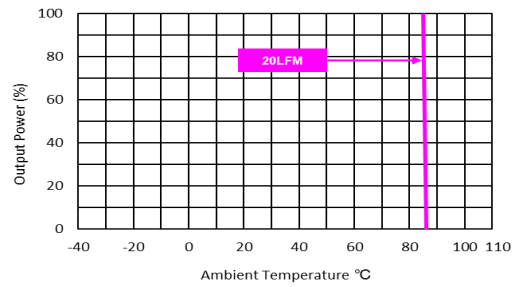
Efficiency Versus Output Current



Efficiency Versus Input Voltage Full Load



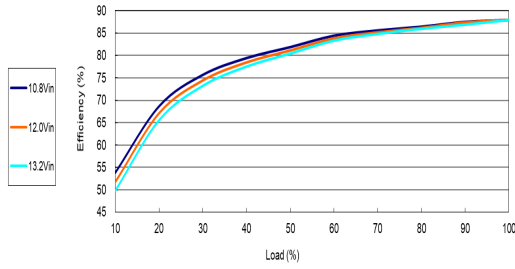
Typical Output Ripple and Noise
 $V_{in} = V_{in\ nom}$; Full Load



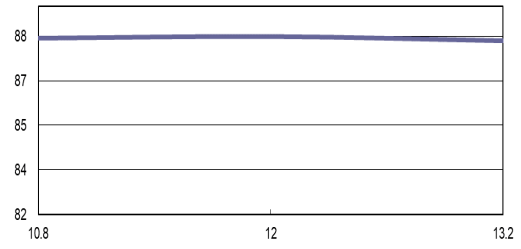
Derating Output Power Versus Ambient Temperature
 $V_{in} = V_{in\ nom}$

Characteristic Curves

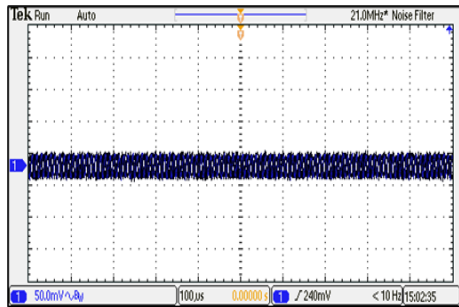
All test conditions are at 25°C The figures are identical for MFSU01-12S12



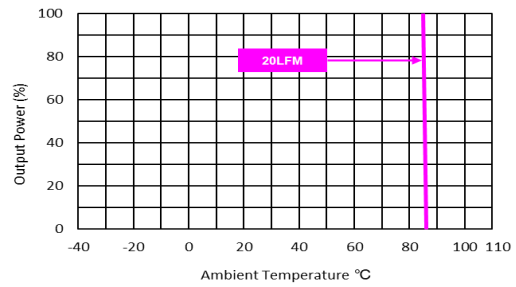
Efficiency Versus Output Current



Efficiency Versus Input Voltage Full Load



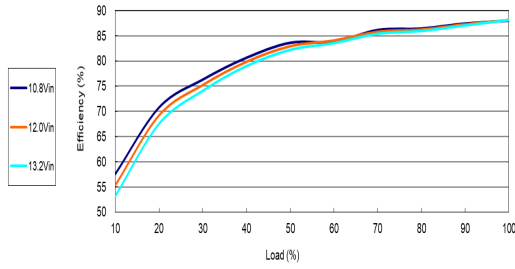
Typical Output Ripple and Noise
 $V_{in} = V_{in\ nom}$; Full Load



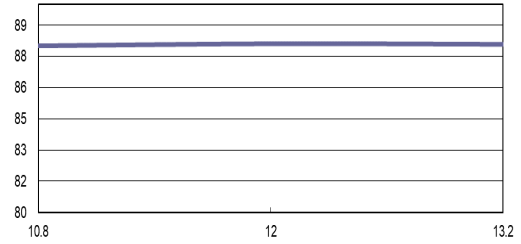
Derating Output Power Versus Ambient Temperature
 $V_{in} = V_{in\ nom}$

Characteristic Curves

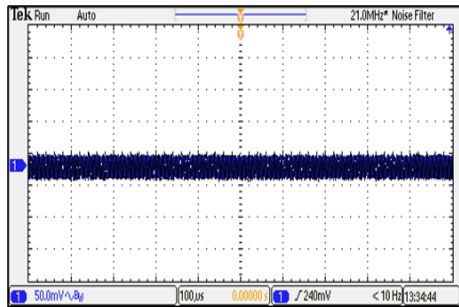
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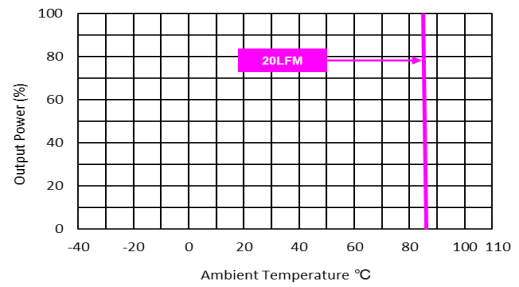
Efficiency Versus Output Current



Efficiency Versus Input Voltage Full Load



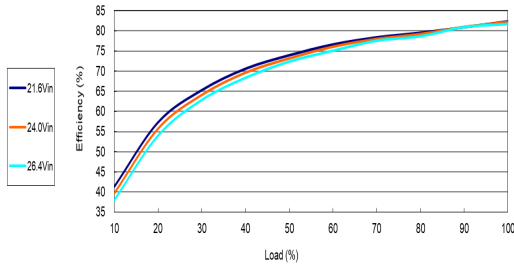
Typical Output Ripple and Noise
 $V_{in} = V_{in\ nom}$; Full Load



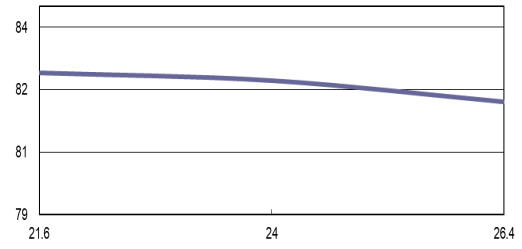
Derating Output Power Versus Ambient Temperature
 $V_{in} = V_{in\ nom}$

Characteristic Curves

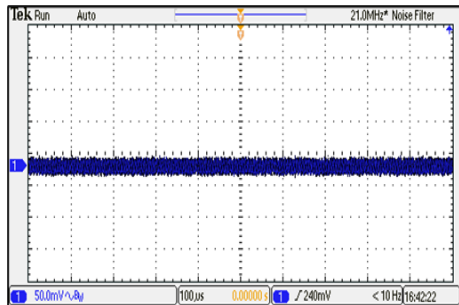
All test conditions are at 25°C The figures are identical for MFSU01-24S05



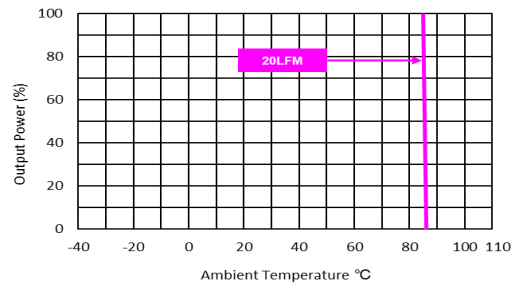
Efficiency Versus Output Current



Efficiency Versus Input Voltage Full Load



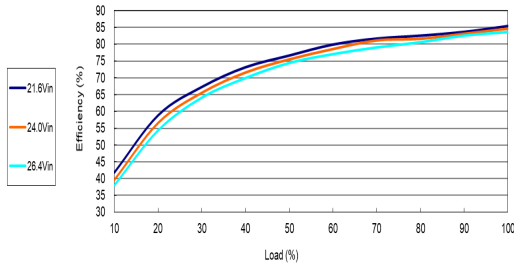
Typical Output Ripple and Noise
 $V_{in} = V_{in\ nom}$; Full Load



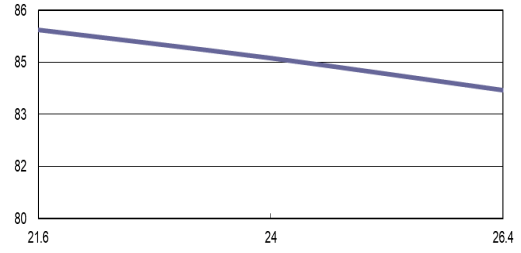
Derating Output Power Versus Ambient Temperature
 $V_{in} = V_{in\ nom}$

Characteristic Curves

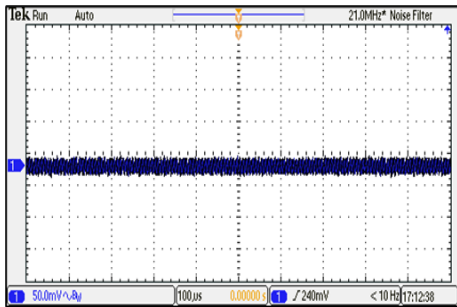
All test conditions are at 25°C The figures are identical for MFSU01-24S12



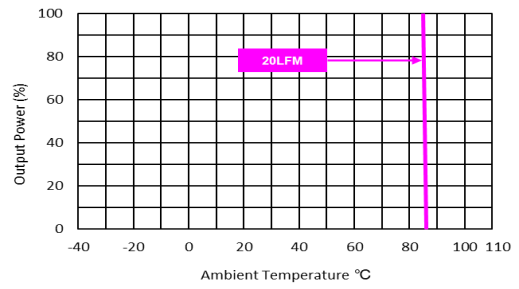
Efficiency Versus Output Current



Efficiency Versus Input Voltage Full Load



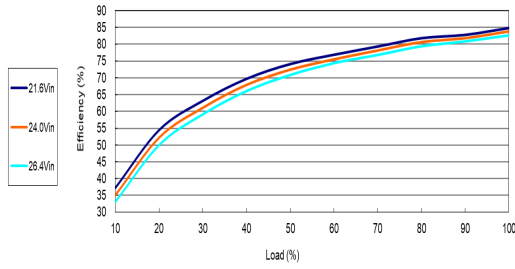
Typical Output Ripple and Noise
 $V_{in} = V_{in\ nom}$; Full Load



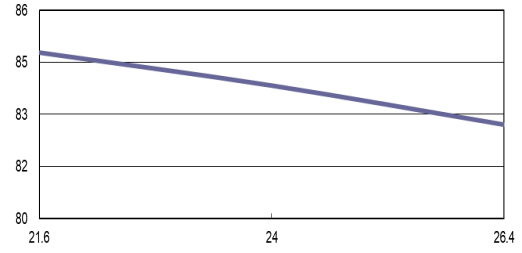
Derating Output Power Versus Ambient Temperature
 $V_{in} = V_{in\ nom}$

Characteristic Curves

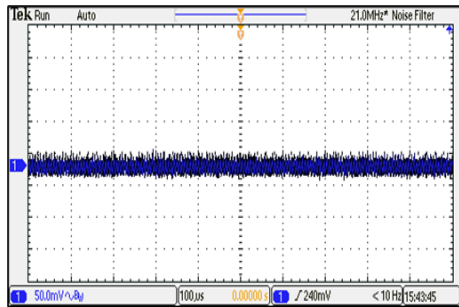
All test conditions are at 25°C The figures are identical for MFSU01-24S15



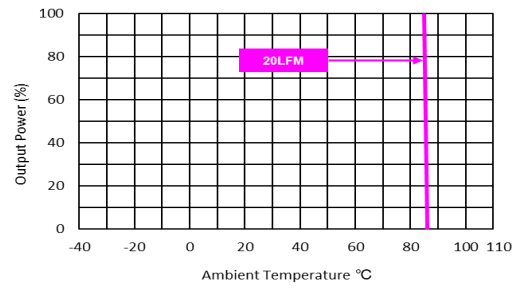
Efficiency Versus Output Current



Efficiency Versus Input Voltage Full Load



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



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

Package Specifications

Mechanical Dimensions

Top View: 12.7 [0.50] mm width, 10.2 [0.40] mm height.

Side View: 8.0 [0.31] mm height, 3.1 [0.12] mm pin height.

Bottom View: 12.7 [0.50] mm width, 10.2 [0.40] mm height. Pin 1 at (0,0), Pin 4 at (7.62, 0), Pin 7 at (0, 7.62), Pin 5 at (7.62, 7.62).

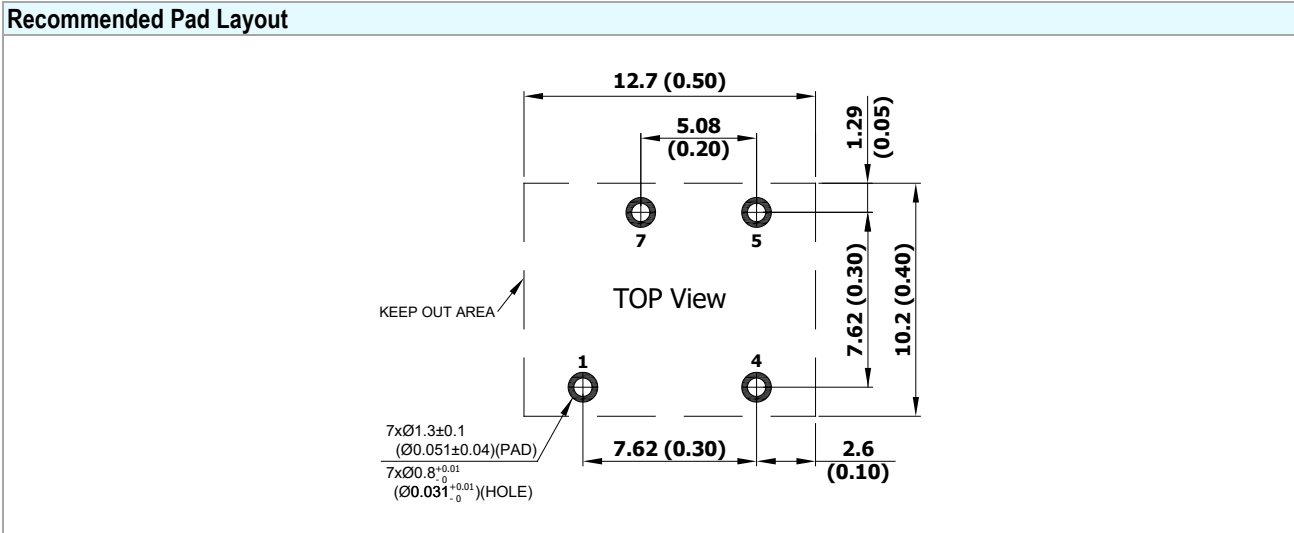
Pin Connections

Pin	Function	Diameter mm (inches)
1	-Vin	∅ 0.5 [0.02]
4	+Vin	∅ 0.5 [0.02]
5	+Vout	∅ 0.5 [0.02]
7	-Vout	∅ 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

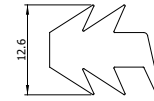
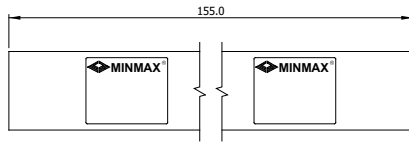
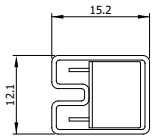
Case Size	: 12.7x8.0x10.2mm (0.50x0.31x0.40 inches)
Case Material	: Plastic resin (flammability to UL 94V-0 rated)
Pin Material	: Phosphor Bronze
Weight	: 2.1g



Packaging Information for Tube

Tube

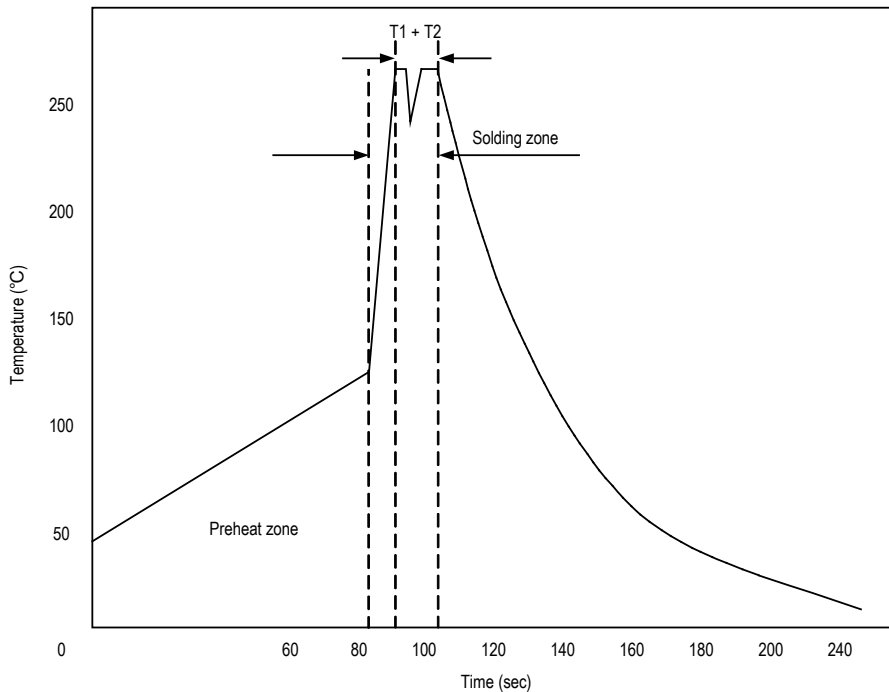
Plug



Unit: mm
10 PCS per TUBE

Wave Soldering Considerations

Lead free wave solder profile



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

Hand Welding Parameter

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

Hand Welding: Soldering iron : Power 60W

Welding Time: 2~4 sec

Temp.: 380~400°C

Part Number Structure							
M	F	SU	01	-	05	S	05
	Package Type DIP-8	Protection Short Circuit Protection	Output Power 1 Watt		Input Voltage Range	Output Quantity S: Single	Output Voltage
		±10% Input Range			05: 4.5 ~ 5.5 VDC		05: 5 VDC
		Output Regulation Unregulated			12: 10.8 ~ 13.2 VDC		12: 12 VDC
					24: 21.6 ~ 26.4 VDC		15: 15 VDC

MTBF and Reliability		
The MTBF of MFSU01 series of DC-DC converters has been calculated using MIL-HDBK 217F NOTICE2, Operating Temperature 25°C, Ground Benign.		
Model	MTBF	Unit
MFSU01-05S05	5,426,133	Hours
MFSU01-05S12	5,301,870	
MFSU01-05S15	5,090,709	
MFSU01-12S05	5,290,929	
MFSU01-12S12	5,218,877	
MFSU01-12S15	5,067,163	
MFSU01-24S05	5,469,299	
MFSU01-24S12	5,173,918	
MFSU01-24S15	5,428,380	