MINMAX®

MAEU01-HI Series
Electric Characteristic Note

MAEU01-HI Series EC Note

DC-DC CONVERTER 1W, Ultra-High Insulation, SIP Package

Features

- **Industrial Standard SIP-7 Package**
- **Ultra-high I/O Isolation 8000VDC with Reinforced Insulation, rate for 480Vrms working voltage**
- **Operating Ambient Temp. Range -40℃ to +95℃**
- **Short Circuit Protection**
- **UL/cUL/IEC/EN 62368-1 Safety Approval**

Applications

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

Product Overview

The MINMAX MAEU01-HI series is a new range of high performance 1W DC-DC converter within encapsulated SIP-7 package which specifically design for high isolation applications where reinforced insulation and high working voltage are required. There are 9 models available for input voltage of 5, 12, 24VDC. The I/O isolation is specified for 8000VDC with reinforced insulation, which rated for 480Vrms working voltage. Further features include short circuit protection and operating ambient temp. range by -40°C to 95°C.

These converters offer a cost-effective solution for wind turbine, solar panel, transportation systems, industrial control equipment where a high I/O isolation and insulation with working voltage is required.

Table of contents

Model Selection Guide

Model Number	Input Voltage (Range)	Output Voltage	Output Current	Input Current		Max. capacitive Load	Efficiency (typ.)
			Max.	@Max. Load	@No Load		@Max. Load
	VDC	VDC	mA	mA(typ.)	mA(typ.)	μF	%
MAEU01-05S05HI	5 (4.5 ~ 5.5)	5	200	253	50	220	79
MAEU01-05S12HI		12	84	252			80
MAEU01-05S15HI		15	68	252			81
MAEU01-12S05HI	12 (10.8 ~ 13.2)	5	200	105	35	220	79
MAEU01-12S12HI		12	84	104			81
MAEU01-12S15HI		15	68	108			79
MAEU01-24S05HI	24 (21.6 ~ 26.4)	5	200	55	20	220	76
MAEU01-24S12HI		12	84	53			79
MAEU01-24S15HI		15	68	54			79

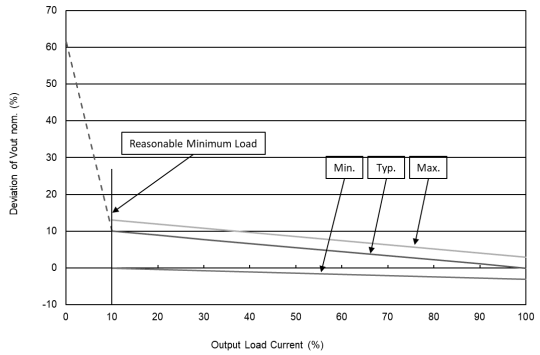
Input Specifications

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			

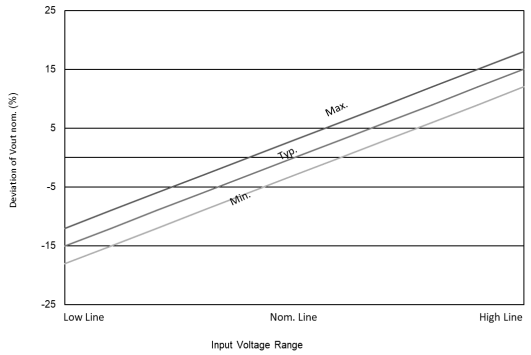
Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy		---	±1.0	±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	---	---	75	mV P-P
Temperature Coefficient		---	±0.01	±0.02	%/℃
Short Circuit Protection	Continuous, Automatic Recovery				

Output Voltage Tolerance



Output Voltage VS Output Load Current



Output Voltage VS Input Voltage Range

Isolation, Safety Standards

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds Reinforced insulation, rated for 480Vrms working voltage	3000	---	---	VAC
	Tested for 1 second	8000	---	---	VDC
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100kHz, 1V	---	20	---	pF
Safety Approvals	UL/cUL 62368-1 recognition(UL certificate), IEC/EN 62368-1(CB-report)				

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Switching Frequency		---	60	---	kHz
MTBF (calculated)	MIL-HDBK-217F@25℃, Ground Benign	4,373,058	---	---	Hours

EMC Specifications

Parameter	Standards & Level			Performance
EMI (5)	Conduction	EN 55032	With external components	Class A
	Radiation		Without external components	
EMS (5)	EN 55035			
	ESD	EN 61000-4-2 Air ± 15kV , Contact ± 8kV		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 100A/m (1 min.), 1000A/m (1 sec.)		A

Environmental Specifications

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

Notes

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

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

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

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

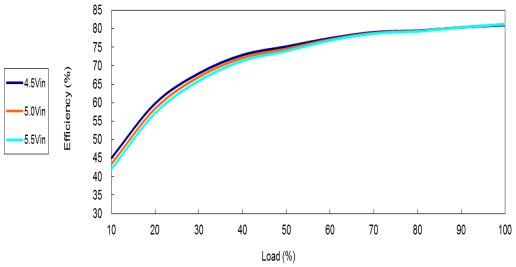
5 The external components might be required to meet EMI/EMS standard for some of test items. Please contact MINMAX for the solution in detail.

6 Specifications are subject to change without notice.

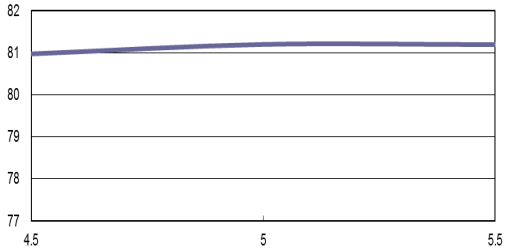
7 The repeated high voltage isolation testing of the converter can degrade isolation capability, to a lesser or greater degree depending on materials, construction, environment and reflow solder process. Any material is susceptible to eventual chemical degradation when subject to very high applied voltages 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

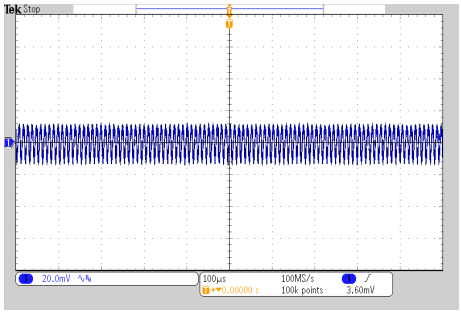
All test conditions are at 25℃ The figures are identical for MAEU01-05S05HI



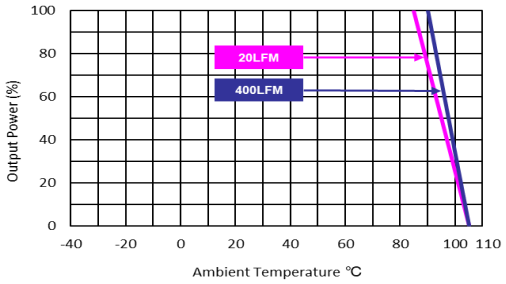
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



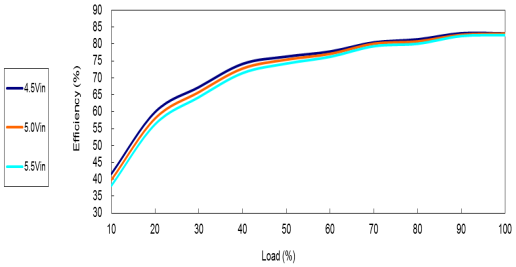
Typical Output Ripple and Noise
V_{in}=$V_{in\ nom}$; Full Load



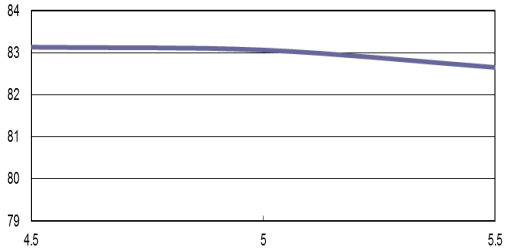
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

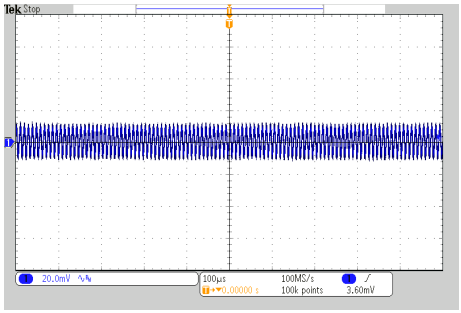
All test conditions are at 25°C The figures are identical for MAEU01-05S12HI



Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



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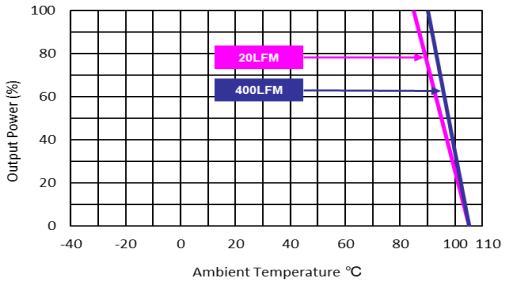

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Characteristic Curves

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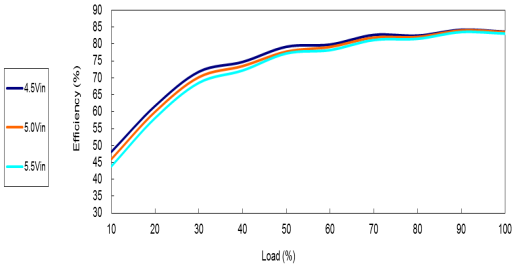

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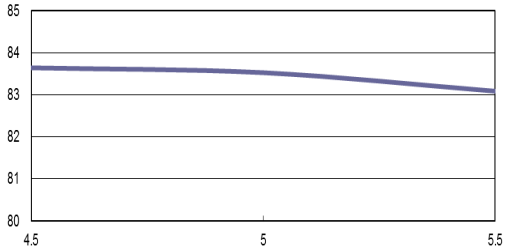
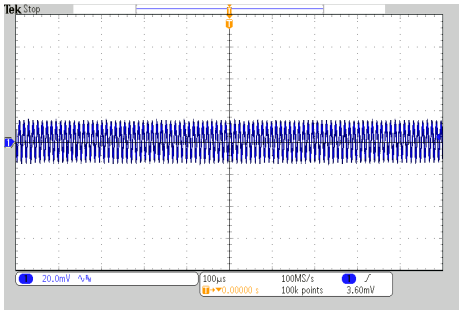


Efficiency Versus Input Voltage
Full Load



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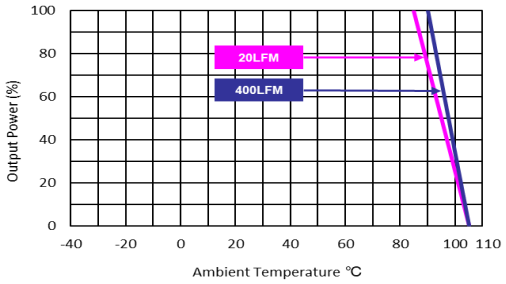

Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

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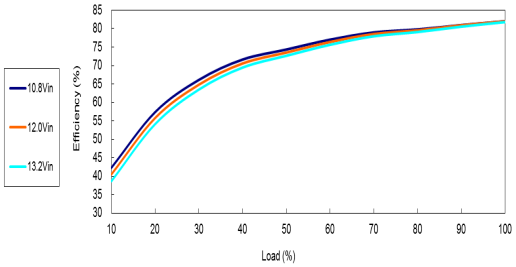
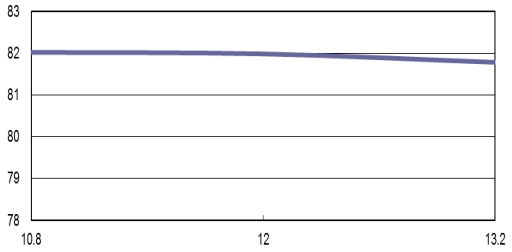


Efficiency Versus Output Current



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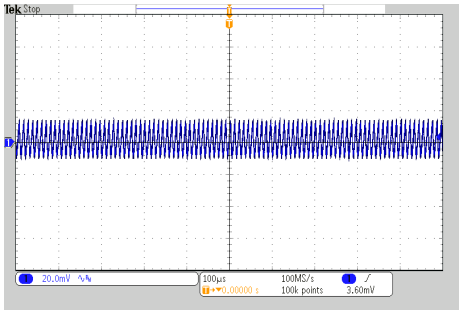
Full Load



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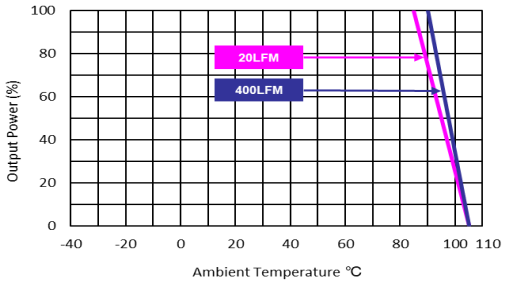

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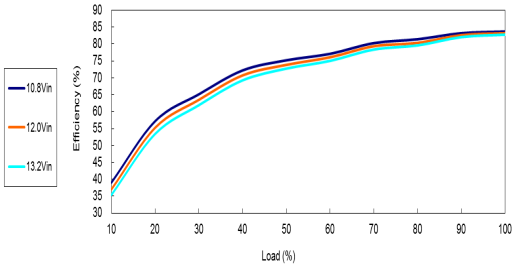

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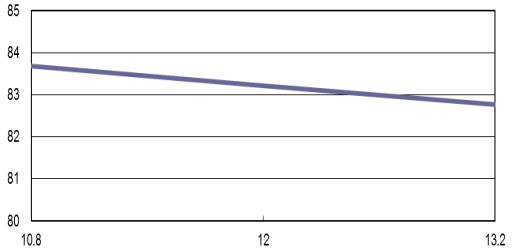

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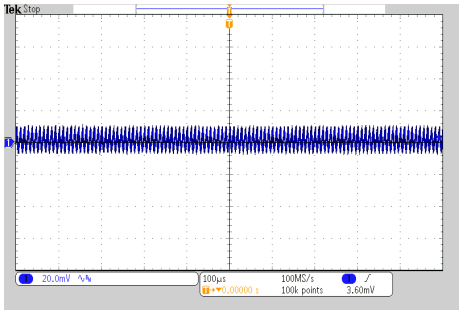

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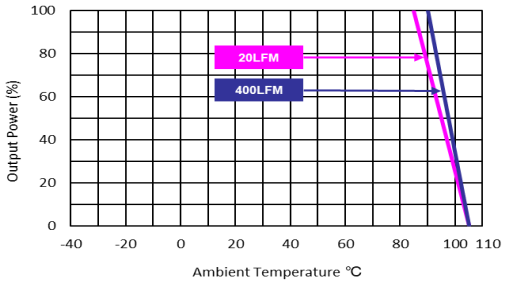

Derating Output Current Versus Ambient Temperature and Airflow
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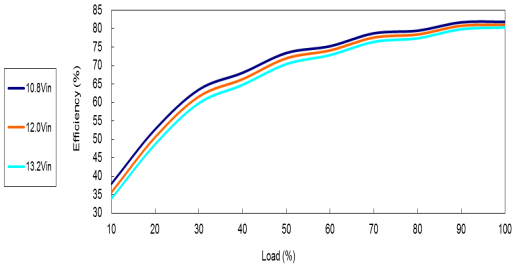
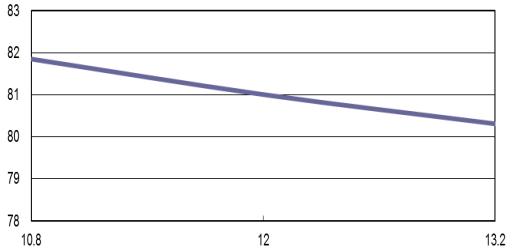


Efficiency Versus Output Current



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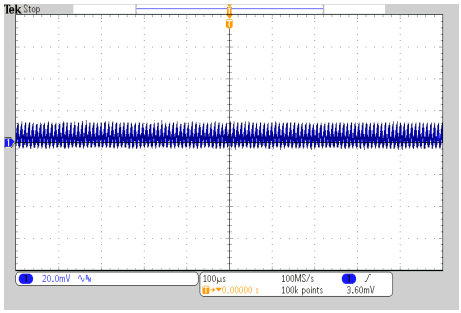
Full Load



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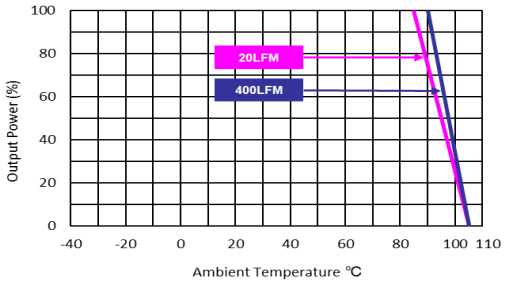
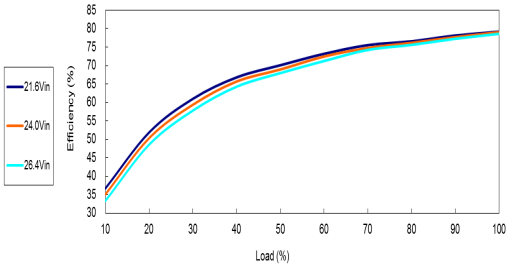


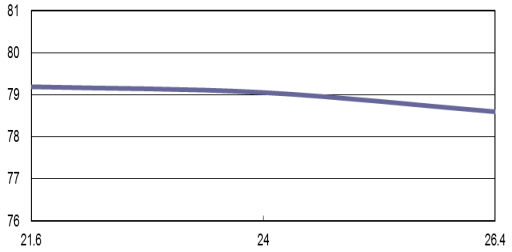
Derating Output Current Versus Ambient Temperature and Airflow
V_{in}=$V_{in\ nom}$

Characteristic Curves

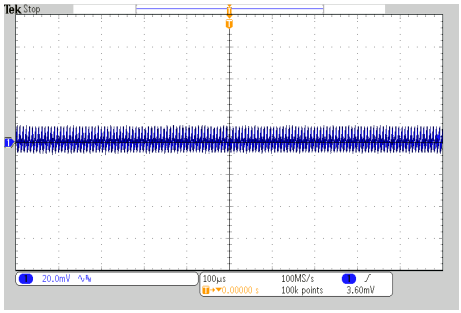
All test conditions are at 25°C The figures are identical for MAEU01-24S05HI



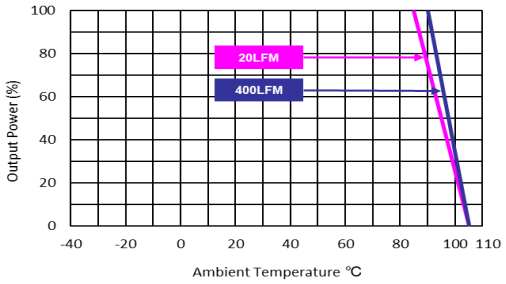
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



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



Derating Output Current Versus Ambient Temperature and Airflow
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Characteristic Curves

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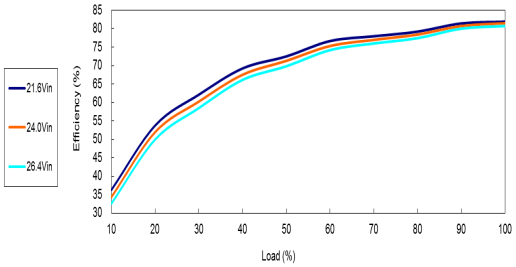
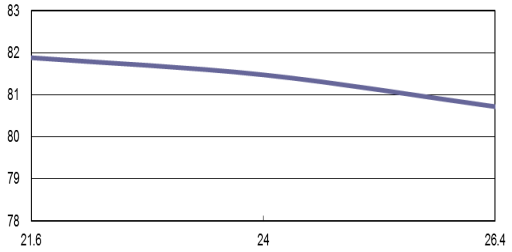
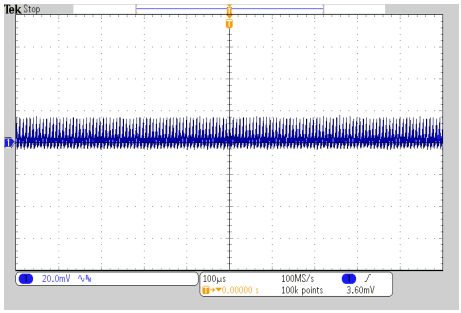


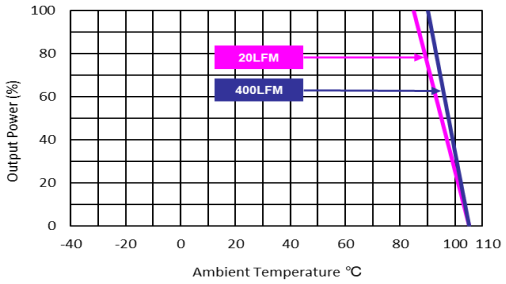
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



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



Derating Output Current Versus Ambient Temperature and Airflow
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Characteristic Curves

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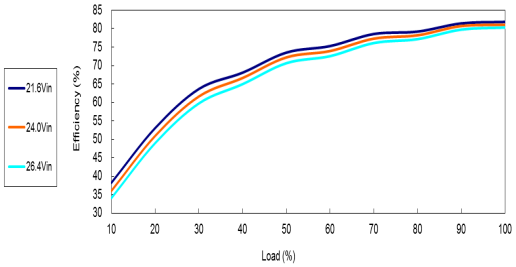
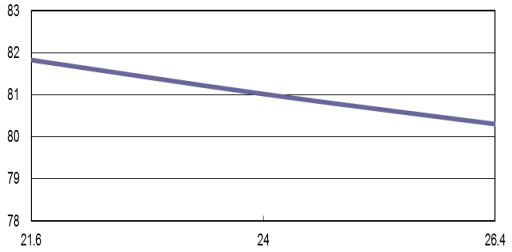
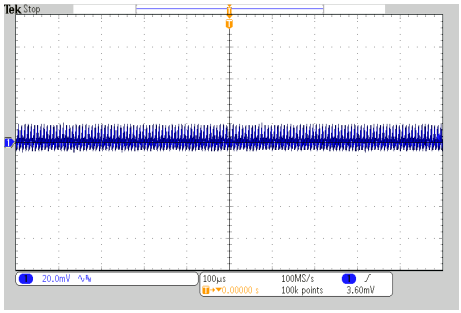


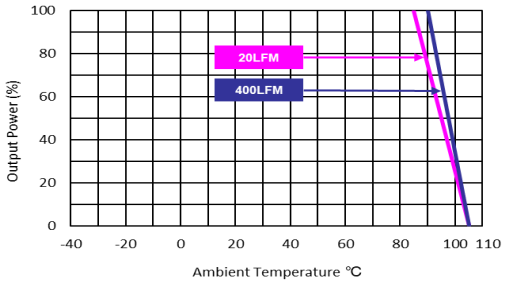
Efficiency Versus Output Current



Efficiency Versus Input Voltage
Full Load



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



Derating Output Current Versus Ambient Temperature and Airflow
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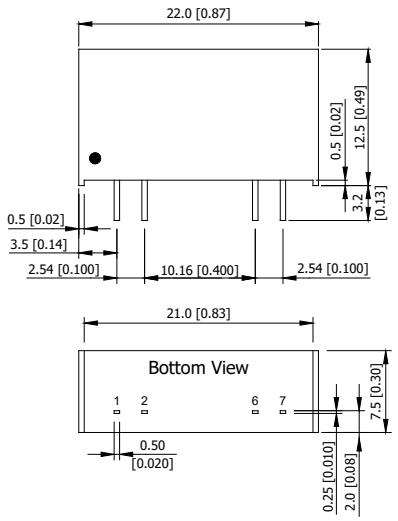
Package Specifications

Mechanical Dimensions



Pin Connection

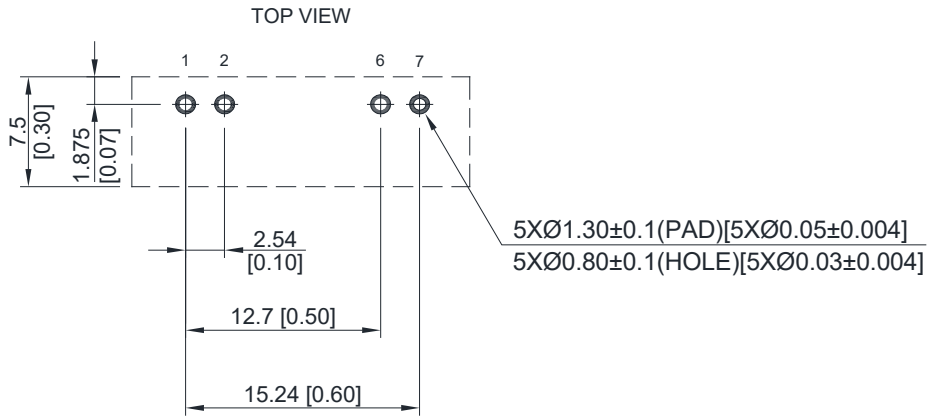
Pin	Function
1	+Vin
2	-Vin
6	-Vout
7	+Vout

- 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

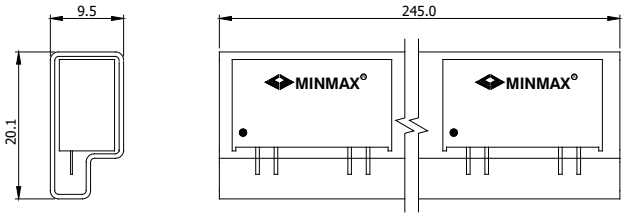
Case Size	:	22.0x7.5x12.5mm (0.87x0.30x0.49 inches)
Case Material	:	Plastic resin (flammability to UL 94V-0 rated)
Pin Material	:	Alloy 42
Weight	:	4.1g

Recommended Pad Layout

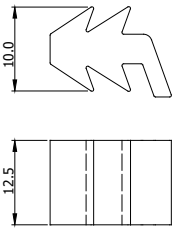


Packaging Information for Tube

Tube



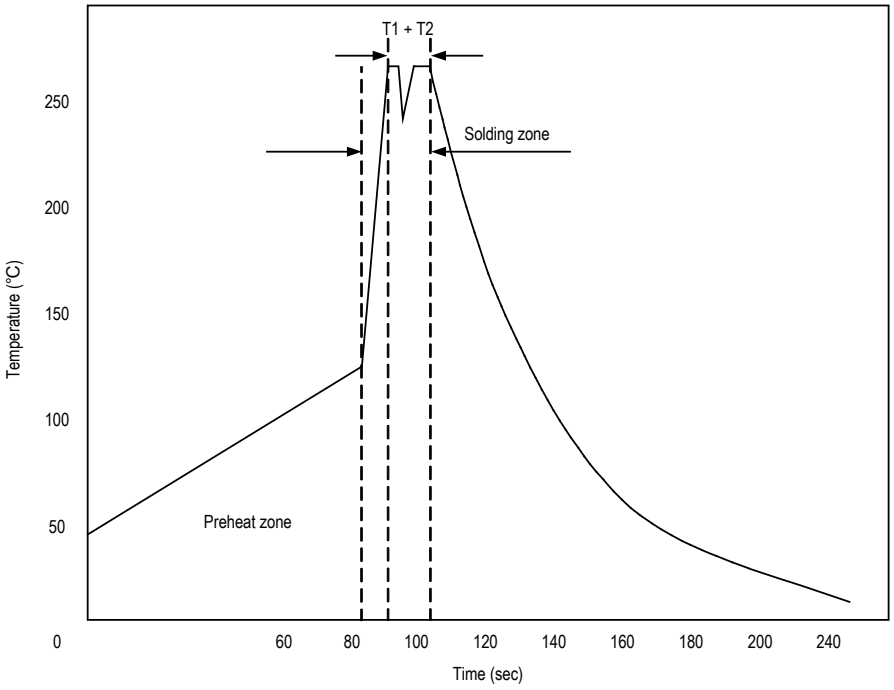
Plug



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	A	EU	01	-	05	S	05	HI
	Package Type SIP-7	Application Ultra-High Isolation ±10% Input Range Output Regulation Unregulated	Output Power 1 Watt		Input Voltage Range 05: 4.5 ~ 5.5 VDC 12: 10.8 ~ 13.2 VDC 24: 21.6 ~ 26.4 VDC	Output Quantity S: Single	Output Voltage 05: 5 VDC 12: 12 VDC 15: 15 VDC	I/O Isolation Voltage 8000 VDC

MTBF and Reliability

The MTBF of MAEU01-HI series of DC-DC converters has been calculated using

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

Model	MTBF	Unit
MAEU01-05S05HI	4,573,386	Hours
MAEU01-05S12HI	4,629,678	
MAEU01-05S15HI	4,681,932	
MAEU01-12S05HI	4,573,298	
MAEU01-12S12HI	4,695,408	
MAEU01-12S15HI	4,548,605	
MAEU01-24S05HI	4,373,058	
MAEU01-24S12HI	4,563,621	
MAEU01-24S15HI	4,548,908	