FEATURES

- **Industrial Standard DIP-16 Package**
- **Unregulated Output Voltage**
- **Ultra-high I/O Isolation 8000VDC with Reinforced Insulation, rate for 300Vrms Working Voltage**
- **Operating Ambient Temp. Range -25℃ to +80℃**
- **Conducted EMI EN 55032 Class A Approved**
- **UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval**

PRODUCT OVERVIEW

The MINMAX MDEU02-HI series is a range of isolated 2W DC-DC converter modules in DIP-16 package which feature a Ultra-high I/O isolation voltage rated for 8000VDC with reinforced insulation, using for electricity and energy applications. Further feature include EN 55032 class A compliant as well. There are 15 Models available for 5, 12, and 24VDC input. These converters offer a cost-effective solution for wind turbine, solar panel, transporation systems, industrial control equipments where a very high I/O isolation is required.

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	%
MDEU02-05S05HI	5 (4.5 ~ 5.5)	5	400	8	615	60	12	330	65
MDEU02-05S12HI		12	165	3	609		10		65
MDEU02-05S15HI		15	133	2.5	605		10		66
MDEU02-05D12HI		±12	±83	±1.5	553		10	100#	72
MDEU02-05D15HI		±15	±66	±1	542		10		73
MDEU02-12S05HI	12 (10.8 ~ 13.2)	5	400	8	256	30	12	330	65
MDEU02-12S12HI		12	165	3	254		10		65
MDEU02-12S15HI		15	133	2.5	252		10		66
MDEU02-12D12HI		±12	±83	±1.5	224		10	100#	74
MDEU02-12D15HI		±15	±66	±1	220		10		75
MDEU02-24S05HI	24 (21.6 ~ 26.4)	5	400	8	128	15	12	330	65
MDEU02-24S12HI		12	165	3	127		10		65
MDEU02-24S15HI		15	133	2.5	126		10		66
MDEU02-24D12HI		±12	±83	±1.5	112		10	100#	74
MDEU02-24D15HI		±15	±66	±1	110		10		75

* Min. Output Current for Lower Load Regulation

For each output

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		---	±2.0	±4.0	%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=20% to 100%	See Model Selection Guide			
Ripple & Noise	0-20MHz Bandwidth	---	---	150	mV_{P-P}
Temperature Coefficient		---	±0.01	±0.02	%/°C
Short Circuit Protection	0.5 Second Max., Automatic Recovery				

Isolation, Safety Standards

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds Reinforced insulation, rated for 300Vrms working voltage	4000	---	---	VAC
	Tested for 1 second	8000	---	---	VDC
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100kHz, 1V	---	15	20	pF
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)				

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Switching Frequency		50	80	100	kHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	2,000,000	---	---	Hours

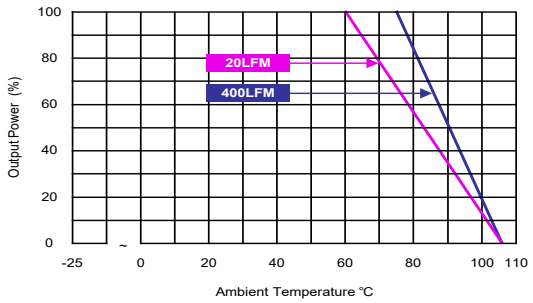
EMC Specifications

Parameter	Standards & Level			Performance
$EMI_{(5)}$	Conduction	EN55032	With external components	Class A
	Radiation			
$EMS_{(5)}$	EN55024			
	ESD	EN61000-4-2 air ± 8kV , Contact ± 6kV		A
	Radiated immunity	EN61000-4-3 10V/m		A
	Fast transient	EN61000-4-4 ±2kV		A
	Surge	EN61000-4-5 ±1kV		A
	Conducted immunity	EN61000-4-6 10Vrms		A
	PFMF	EN61000-4-8 3A/m		A

Environmental Specifications

Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-25	+80	°C
Case Temperature	---	+105	°C
Storage Temperature Range	-50	+125	°C
Humidity (non condensing)	---	95	% rel. H
Lead Temperature (1.5mm from case for 10Sec.)	---	260	°C

Power Derating Curve

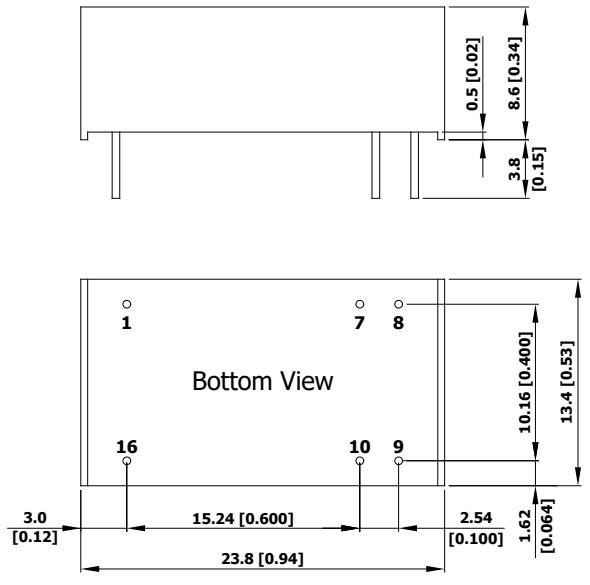


Notes

1 Specifications typical at Ta=+25°C, resistive load, nominal input voltage and rated output current unless otherwise noted.
2 These power converters require a minimum output loading to maintain specified regulation, operation under no-load conditions will not damage these modules; however they may not meet all specifications listed.
3 We recommend to protect the converter by a slow blow fuse in the input supply line.
4 Other input and output voltage may be available, please contact MINMAX.
5 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 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.

Package Specifications

Mechanical Dimensions



Pin Connections

Pin	Single Output	Dual Output	Diameter mm (inches)
1	-Vin	-Vin	Ø 0.5 [0.02]
7	NC	NC	Ø 0.5 [0.02]
8	NC	Common	Ø 0.5 [0.02]
9	+Vout	+Vout	Ø 0.5 [0.02]
10	-Vout	-Vout	Ø 0.5 [0.02]
16	+Vin	+Vin	Ø 0.5 [0.02]

NC: No Connection

- 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)

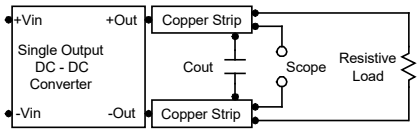
Physical Characteristics

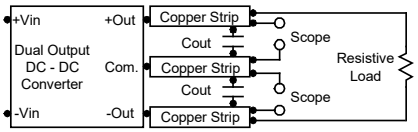
Case Size	:	23.8x13.4x8.6mm (0.94x0.53x0.34 inches)
Case Material	:	Plastic resin (flammability to UL 94V-0 rated)
Pin Material	:	Phosphor Bronze
Weight	:	5.1g

Test Setup

Peak-to-Peak Output Noise Measurement Test

Use a Cout 0.47μF ceramic capacitor. Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20 MHz. Position the load between 50 mm and 75 mm from the DC-DC Converter.





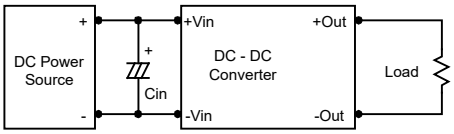
Technical Notes

Maximum Capacitive Load

The MDEU02-HI series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. For optimum performance we recommend 100μF maximum capacitive load for dual outputs and 330μF capacitive load for single outputs. The maximum capacitance can be found in the data sheet.

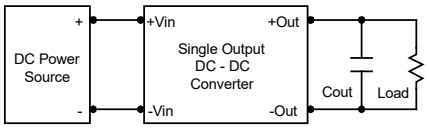
Input Source Impedance

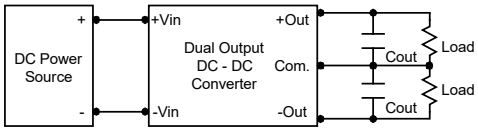
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.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



Output Ripple Reduction

A good quality low ESR capacitor placed as close as practicable across the load will give the best ripple and noise performance. To reduce output ripple, it is recommended to use 3.3μF capacitors at the output.





Thermal Considerations

Many conditions affect the thermal performance of the power module, such as orientation, airflow over the module and board spacing. To avoid exceeding the maximum temperature rating of the components inside the power module, the case temperature must be kept below 105°C. The derating curves are determined from measurements obtained in a test setup.