

## FEATURES

- ▶ Industrial Standard DIP-16 Package
- ▶ Encapsulated 2W Converter
- ▶ Unregulated Output Voltage
- ▶ Ultra-high I/O Isolation 8000VDC with Reinforced Insulation, rate for 300Vrms Working Voltage
- ▶ Wide Operating Ambient Temp. Range
- ▶ Short Circuit Protection
- ▶ UL/cUL/IEC/EN 62368-1 Safety Approval



## PRODUCT OVERVIEW

The MINMAX MDEU02-HI Series is an encapsulated 2W DC-DC converter in an industry-standard DIP-16 package, designed for applications requiring exceptional isolation and reliability. This series consists of 15 models, supporting 5 VDC, 12 VDC, and 15 VDC input voltages, providing excellent flexibility for diverse system designs. Featuring ultra-high 8000 VDC I/O isolation with reinforced insulation rated for 300 Vrms working voltage, it offers outstanding protection for sensitive circuits and ensures safe operation in high-voltage or industrial environments.

The MDEU02-HI Series includes short-circuit protection and operates reliably across a wide ambient temperature range, delivering stable and efficient isolated power in compact form. Certified to UL/cUL/IEC/EN 62368-1, this series combines robust isolation, compact encapsulated design, and high reliability, making it an ideal choice for industrial control, measurement, and high-safety insulation applications.

### Model Selection Guide

Model Number	Input Voltage (Range)	Output Voltage	Output Current	Input Current		Load Regulation	Max. Capacitive Load	Efficiency (typ.)
				Max.	@No Load			@Max. Load
	VDC	VDC	mA	mA (typ.)	mA (typ.)	% (max.)	μF	%
MDEU02-05S05HI	5 (4.5 ~ 5.5)	5	400	615	60	12	330	65
MDEU02-05S12HI		12	165	609		10		65
MDEU02-05S15HI		15	133	605		10		66
MDEU02-05D12HI		±12	±83	553		10	72	
MDEU02-05D15HI		±15	±66	542		10	73	
MDEU02-12S05HI	12 (10.8 ~ 13.2)	5	400	256	30	12	330	65
MDEU02-12S12HI		12	165	254		10		65
MDEU02-12S15HI		15	133	252		10		66
MDEU02-12D12HI		±12	±83	224		10	74	
MDEU02-12D15HI		±15	±66	220		10	75	
MDEU02-24S05HI	24 (21.6 ~ 26.4)	5	400	128	15	12	330	65
MDEU02-24S12HI		12	165	127		10		65
MDEU02-24S15HI		15	133	126		10		66
MDEU02-24D12HI		±12	±83	112		10	74	
MDEU02-24D15HI		±15	±66	110		10	75	

\*Please refer to the attached graph for the minimum load value.

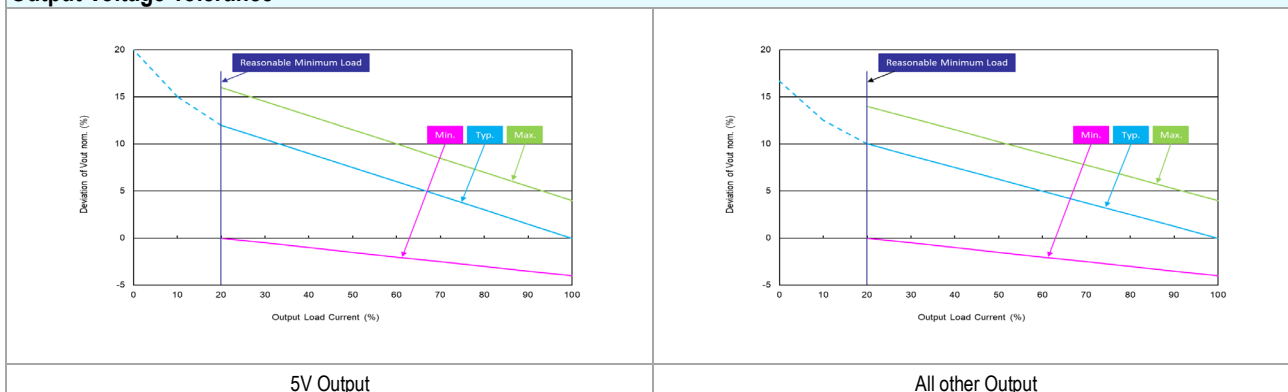
# For each output

**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	VDC
	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 <sub>P-P</sub>
Temperature Coefficient		---	±0.01	±0.02	%/°C
Short Circuit Protection	0.5 Second Max., Automatic Recovery				

**Output Voltage Tolerance**

**Isolation, Safety Standards**

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds	4000	---	---	VAC
	Reinforced insulation, rated for 300Vrms working voltage	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) UL/cUL 62368-1 recognition(UL certificate), IEC/EN 62368-1(CB-report)				

**General Specifications**

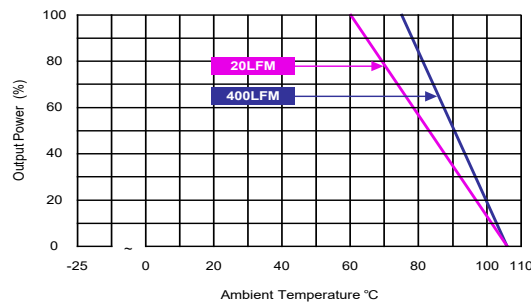
Parameter	Conditions	Min.	Typ.	Max.	Unit
Switching Frequency		50	80	100	kHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	3,154,574	---	---	Hours

**EMC Specifications**

Parameter	Standards & Level			Performance
EMI <sub>(s)</sub>	Conduction	EN 55032	With external components	Class A
	Radiation			
EMS <sub>(s)</sub>	EN 55035			
	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 (For Power Derating see relative 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

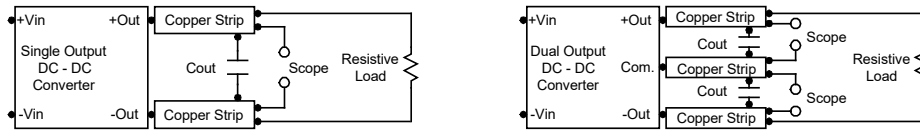
**Power Derating Curve**

**Notes**

- 1 Specifications typical at Ta=+25°C, resistive load, nominal input voltage and rated output current unless otherwise noted.
- 2 Please do not operate the product without a minimum load condition.
- 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.



**Test Setup**
**Peak-to-Peak Output Noise Measurement Test**

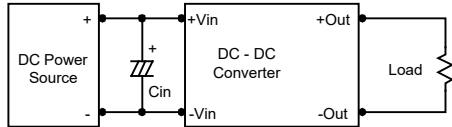
Use a  $C_{out}$  0.47 $\mu$ F ceramic capacitor. Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20 MHz. Position the load between 50 mm and 75 mm from the DC-DC Converter.


**Technical Notes**
**Maximum Capacitive Load**

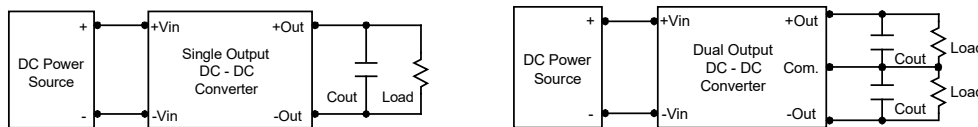
The MDEU02-HI series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. For optimum performance we recommend 100 $\mu$ F maximum capacitive load for dual outputs and 330 $\mu$ F 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 < 1.0 $\Omega$  at 100 kHz) capacitor of a 2.2 $\mu$ F for the 5V input devices, a 1.0 $\mu$ F for the 12V input devices and a 0.47 $\mu$ F 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 3.3 $\mu$ F 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 $^{\circ}$ C. The derating curves are determined from measurements obtained in a test setup.

