

**FEATURES**

- ▶ Industrial SMD Package
- ▶ Ultra-high I/O Isolation 8000VDC with Reinforced Insulation, rate for 300Vrms Working Voltage
- ▶ Qualified for IGBT and High Isolation Applications
- ▶ Operating Ambient Temp. Range -25°C to +80°C
- ▶ Water-washable Process Available(option)
- ▶ Tape & Reel Package Available
- ▶ UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval


**PRODUCT OVERVIEW**

The MINMAX MSDEU02-HI series is a range of isolated 2W DC-DC converter modules in SMD package which feature a Ultra-high I/O-isolation voltage rated for 8000VDC with reinforced insulation. There are 15 Models available for 5, 12, and 24VDC input. These converters offer a cost-effective solution for wind turbine, solar panel, transportation systems, industrial control equipments and some IGBT driver applications where a very high I/O-isolation is required.

**Model Selection Guide**

Model Number	Input Voltage (Range) VDC	Output Voltage VDC	Output Current		Input Current		Load Regulation % (max.)	Max. capacitive Load μF	Efficiency (typ.) @Max. Load %
			Max.	Min.	@Max. Load	@No Load			
			mA	mA	mA(typ.)	mA(typ.)			
MSDEU02-05S05HI	5 (4.5 ~ 5.5)	5	400	8	615	90	12	330	65
MSDEU02-05S12HI		12	165	3	609		10		65
MSDEU02-05S15HI		15	133	2.5	605		10		66
MSDEU02-05D12HI		±12	±83	±1.5	553		10	100#	72
MSDEU02-05D15HI		±15	±66	±1	542		10		73
MSDEU02-12S05HI	12 (10.8 ~ 13.2)	5	400	8	256	40	12	330	65
MSDEU02-12S12HI		12	165	3	254		10		65
MSDEU02-12S15HI		15	133	2.5	252		10		66
MSDEU02-12D12HI		±12	±83	±1.5	224		10	100#	74
MSDEU02-12D15HI		±15	±66	±1	220		10		75
MSDEU02-24S05HI	24 (21.6 ~ 26.4)	5	400	8	128	30	12	330	65
MSDEU02-24S12HI		12	165	3	127		10		65
MSDEU02-24S15HI		15	133	2.5	126		10		66
MSDEU02-24D12HI		±12	±83	±1.5	112		10	100#	74
MSDEU02-24D15HI		±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	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	0-20 MHz Bandwidth	---	---	150	mV <sub>P-P</sub>
Temperature Coefficient		---	±0.01	±0.02	%/°C
Short Circuit Protection	0.5 Second Max., Automatic Recovery				

**Isolation, Safety Standards**

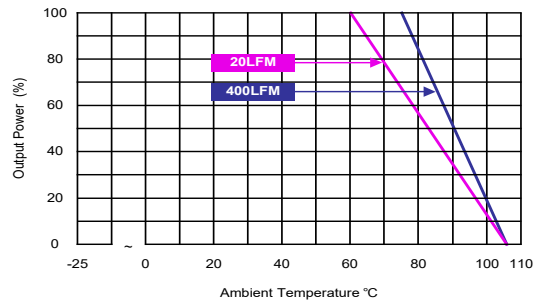
Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds Reinforced insulation, rated for 300Vrms working voltage	4000	---	---	VAC
	Tested for 1 second	8000	---	---	VDC
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100kHz, 1V	---	15	20	pF
Safety Approvals	UL/cUL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

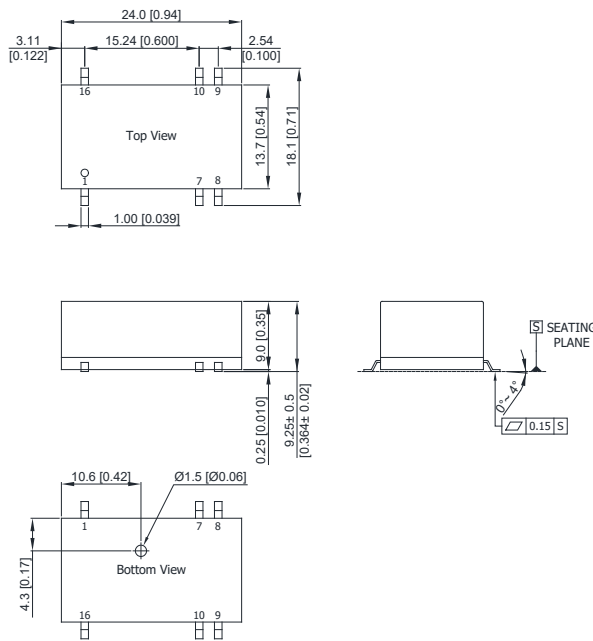
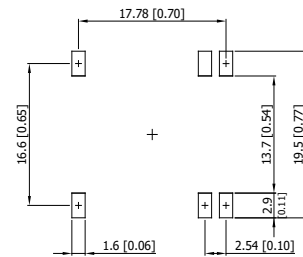
Parameter	Conditions	Min.	Typ.	Max.	Unit
Switching Frequency		50	80	100	kHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	2,000,000	---	---	Hours
Moisture Sensitivity Level (MSL)	IPC/JEDEC J-STD-020D.1	Level 2			

**Environmental Specifications**

Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-25	+80	°C
Case Temperature	---	+90	°C
Storage Temperature Range	-50	+125	°C
Humidity (non condensing)	---	95	% rel. H
Lead-free reflow solder process	IPC/JEDEC J-STD-020D.1		

**Power Derating Curve**

**Notes**

- 1 Specifications typical at  $T_a = +25^\circ\text{C}$ , 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 It is not recommended to use water-washing process on SMT units.
- 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.

**Package Specifications**
**Mechanical Dimensions**

**Connecting Pin Patterns**


- ▶ 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)

**Pin Connections**

Pin	Single Output	Dual Output
1	-Vin	-Vin
7	NC	NC
8	NC	Common
9	+Vout	+Vout
10	-Vout	-Vout
16	+Vin	+Vin

NC: No Connection

**Physical Characteristics**

Case Size	: 24.0x13.7x9.0mm (0.94x0.54x0.35 inches)
Case Material	: Plastic resin (flammability to UL 94V-0 rated)
Pin Material	: Phosphor bronze
Weight	: 3.75g

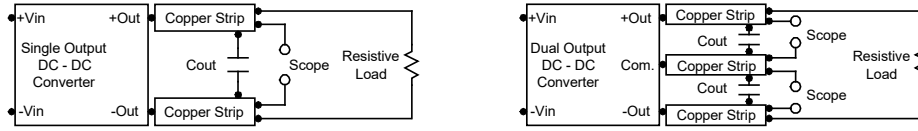
**Order Code Table**

Standard	For water-washable process
MSDEU02-05S05HI	MSDEU02-05S05HI-W
MSDEU02-05S12HI	MSDEU02-05S12HI-W
MSDEU02-05S15HI	MSDEU02-05S15HI-W
MSDEU02-05D12HI	MSDEU02-05D12HI-W
MSDEU02-05D15HI	MSDEU02-05D15HI-W
MSDEU02-12S05HI	MSDEU02-12S05HI-W
MSDEU02-12S12HI	MSDEU02-12S12HI-W
MSDEU02-12S15HI	MSDEU02-12S15HI-W
MSDEU02-12D12HI	MSDEU02-12D12HI-W
MSDEU02-12D15HI	MSDEU02-12D15HI-W
MSDEU02-24S05HI	MSDEU02-24S05HI-W
MSDEU02-24S12HI	MSDEU02-24S12HI-W
MSDEU02-24S15HI	MSDEU02-24S15HI-W
MSDEU02-24D12HI	MSDEU02-24D12HI-W
MSDEU02-24D15HI	MSDEU02-24D15HI-W

### 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.



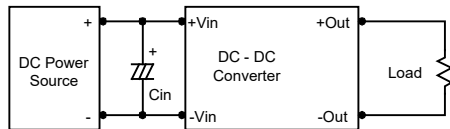
### Technical Notes

#### Maximum Capacitive Load

The MSDEU02-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.

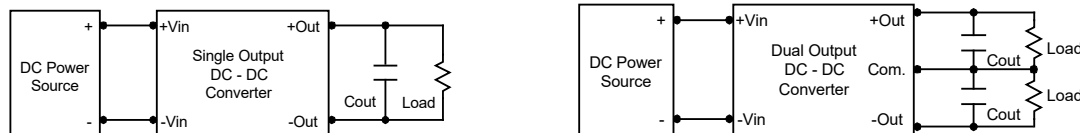
#### Input Source Impedance

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 90°C. The derating curves are determined from measurements obtained in a test setup.

