FEATURES

- **Industry Standard DIP-16 Package**
- **Unregulated Output Voltage**
- **I/O Isolation 4000VAC with Reinforced Insulation, rated for 300Vrms Working Voltage**
- **Low I/O Leakage Current < 2μA**
- **Operating Ambient Temp. Range -25℃ to +80℃**
- **Medical EMC Standard with 4th Edition of EMI EN 55011 and EMS EN 60601-1-2 Approved**
- **Medical Safety with 1xMOPP & 2xMOOP per 3.2 Edition of IEC/EN 60601-1 & ANSI/AAMI ES60601-1 Approved**
- **Risk Management Report Acquisition according to ISO 14971**
- **UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval & CE Marking**

PRODUCT OVERVIEW

Introducing the MINMAX MDHU100 series - 2W DC-DC isolated converters designed to meet stringent safety and performance standards. These modules provide an impressive high I/O isolation voltage of 4000 VAC with reinforced insulation, rated for a stable 300Vrms working voltage, all packaged in a compact SMD package.

Featuring 15 models with 5V, 12V, or 24VDC input options and offering single or dual output voltages, the MDHU100 series caters to a variety of application needs. This product stands out as the optimal solution for applications in instrumentation, industrial controls, medical equipment, and scenarios where a certified supplementary- or reinforced insulation system is imperative to comply with required safety standards.

The MDHU100 series is approved to IEC/EN/ES 60601-1 3.2 Edition for 1xMOPP & 2xMOOP and comes with an ISO 14971 Medical Device risk management file, ensuring not only adherence to high-performance standards but also compliance with strict safety benchmarks.

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			@Max. Load
	VDC	VDC	mA	mA (typ.)	mA (typ.)	% (max.)	μF	%
MDHU102	5 (4.5 ~ 5.5)	5	400	606	60	12	330	66
MDHU104		12	165	600		10		66
MDHU105		15	133	605		10		66
MDHU108		±12	±83	553		10	100#	72
MDHU109		±15	±66	542		10		73
MDHU112	12 (10.8 ~ 13.2)	5	400	253	30	12	330	66
MDHU114		12	165	250		10		66
MDHU115		15	133	252		10		66
MDHU118		±12	±83	224		10	100#	74
MDHU119		±15	±66	220		10		75
MDHU122	24 (21.6 ~ 26.4)	5	400	126	15	12	330	66
MDHU124		12	165	125		10		66
MDHU125		15	133	126		10		66
MDHU128		±12	±83	112		10	100#	74
MDHU129		±15	±66	110		10		75

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 (Operation at lower load will not damage the converter, but it may not meet all specifications)			
Ripple & Noise	0-20 MHz Bandwidth	---	100	150	mV_{P-P}
Temperature Coefficient		---	±0.01	±0.02	%/℃
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
Leakage Current	240VAC, 60Hz	---	---	2	μA
I/O Isolation Resistance	500 VDC	10	---	---	GΩ
I/O Isolation Capacitance	100kHz, 1V	---	15	20	pF
Safety Standards	UL/cUL 60950-1, CSA C22.2 No. 60950-1				
	ANSI/AAMI ES 60601-1, CAN/CSA-C22.2 No. 60601-1				
	IEC/EN 60950-1, IEC/EN 60601-1 3.2 Edition 1xMOPP & 2xMOOP				
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)				
	ANSI/AAMI ES 60601-1 1xMOPP & 2xMOOP recognition (UL certificate), IEC/EN 60601-1 3.2 Edition (CB-report)				

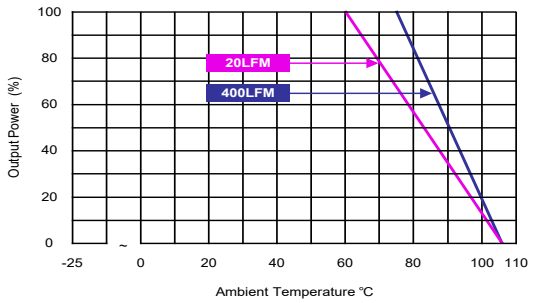
General Specifications

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

Environmental Specifications

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

Power Derating Curve



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.

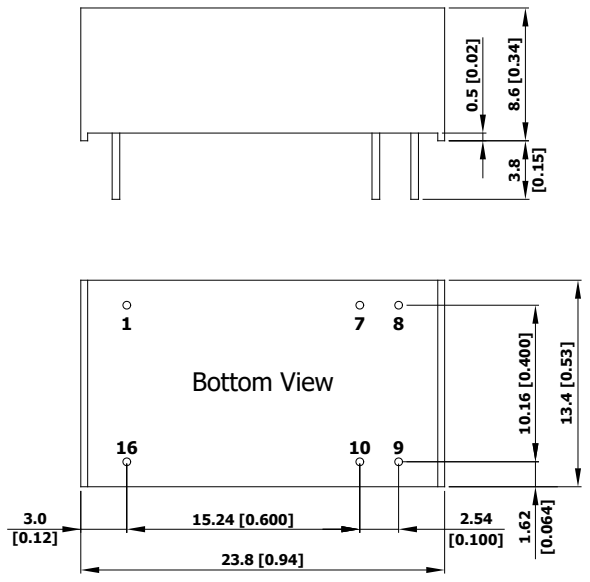
4 Other input and output voltage may be available, please contact MINMAX.

5 Specifications are subject to change without notice.

6 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



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±0.25 (X.XX±0.01)
  X.XX±0.13 (X.XXX±0.005)
- Pin diameter tolerance: X.X±0.05 (X.XX±0.002)

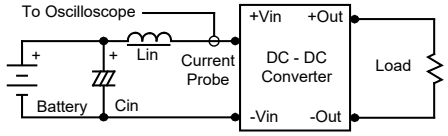
Physical Characteristics

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

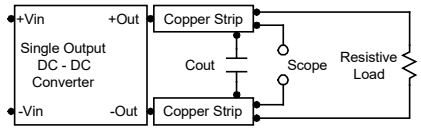
Input Reflected-Ripple Current Test Setup

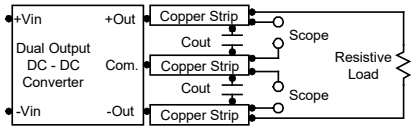
Input reflected-ripple current is measured with a inductor Lin (4.7μH) and Cin (220μF, ESR < 1.0Ω at 100 kHz) to simulate source impedance. Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 kHz.



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.





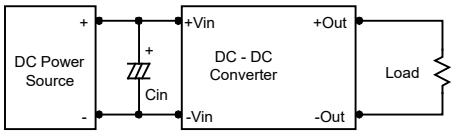
Technical Notes

Maximum Capacitive Load

The MDHU100 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.

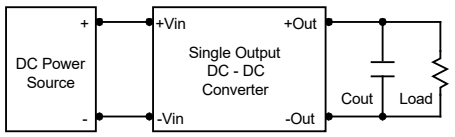
Input Source Impedance

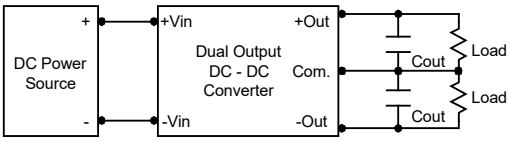
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.
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.