

**FEATURES**

- ▶ Smallest Encapsulated 12W Converter
- ▶ Industrial Standard DIP-16 Package
- ▶ Wide 2:1 Input Voltage Range
- ▶ Fully Regulated Output Voltage
- ▶ I/O Isolation 1500 VDC
- ▶ Operating Ambient Temp. Range -40°C to +85°C
- ▶ Low No Load Power Consumption
- ▶ No Min. Load Requirement
- ▶ Under-voltage, Overload and Short Circuit Protection
- ▶ Shielded Metal Case with Insulated Baseplate
- ▶ Conducted EMI EN 55032 Class A
- ▶ UL/cUL/IEC/EN 62368-1 Safety Approval & CE Marking


**PRODUCT OVERVIEW**

The MDW12 series gives designers the flexibility to match the choice of converter to specific application requirements. The high power density of MDW12 series, at 59W/in<sup>3</sup>, is expected to make it popular with manufacturers of industrial, medical, transportation and power generation equipment where space-constrained designs. This product offers a full 12Watt isolated DC-DC converter within a small encapsulated DIP-16 package which occupied only 0.5in<sup>2</sup> of PCB space. There are 21 models available for 12, 24 & 48VDC with wide 2:1 input voltage range. Further features included under-voltage protection, overload protection, short circuit protection, very low no load power consumption, no min. load requirement and conducted EMI class A approved as well. High efficiency allows operating temperatures range of -40°C to 85°C. All models have been qualified per the CB scheme with safety approvals to UL/cUL/IEC/EN 62368-1.

**Model Selection Guide**

Model Number	Input Voltage (Range)	Output Voltage	Output Power	Output Current	Input Current		Max. capacitive Load	Efficiency (typ.)
					Max.			
	VDC	VDC	W	mA	@Max. Load mA(typ.)	@No Load mA(typ.)	μF	@Max. Load %
MDW12-12S05	12 (9 ~ 18)	5	12	2400	1205	20	1500	83
MDW12-12S051		5.1	12.24	2400	1229		1500	83
MDW12-12S12		12	12	1000	1149		680	87
MDW12-12S15		15	12	800	1136		680	88
MDW12-12S24		24	12	500	1136		220	88
MDW12-12D12		±12	12	±500	1149		#470	87
MDW12-12D15		±15	12	±400	1149		#220	87
MDW12-24S05	24 (18 ~ 36)	5	12	2400	602	10	1500	83
MDW12-24S051		5.1	12.24	2400	614		1500	83
MDW12-24S12		12	12	1000	575		680	87
MDW12-24S15		15	12	800	568		680	88
MDW12-24S24		24	12	500	568		220	88
MDW12-24D12		±12	12	±500	575		#470	87
MDW12-24D15		±15	12	±400	575		#220	87
MDW12-48S05	48 (36 ~ 75)	5	12	2400	301	7	1500	83
MDW12-48S051		5.1	12.24	2400	307		1500	83
MDW12-48S12		12	12	1000	287		680	87
MDW12-48S15		15	12	800	284		680	88
MDW12-48S24		24	12	500	284		220	88
MDW12-48D12		±12	12	±500	287		#470	87
MDW12-48D15		±15	12	±400	287		#220	87

# For each output

Input Specifications							
Parameter	Conditions / Model	Min.	Typ.	Max.	Unit		
Input Surge Voltage (1 sec. max.)	12V Input Models	-0.7	---	25	VDC		
	24V Input Models	-0.7	---	50			
	48V Input Models	-0.7	---	100			
Start-Up Threshold Voltage	12V Input Models	---	---	9			
	24V Input Models	---	---	18			
	48V Input Models	---	---	36			
Under Voltage Shutdown	12V Input Models	---	8	---			
	24V Input Models	---	16	---			
	48V Input Models	---	34	---			
Start Up Time (Power On)	Nominal Vin and Constant Resistive Load	---	30	---	mS		
Input Filter	All Models	Internal Pi Type					

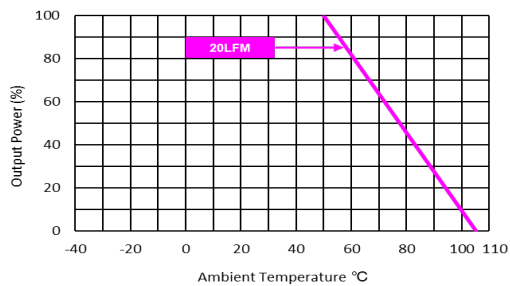
Output Specifications						
Parameter	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage Setting Accuracy		---	---	±1.0	%Vnom.	
Output Voltage Balance	Dual Output, Balanced Loads	---	±1.0	±2.0	%	
Line Regulation	Vin=Min. to Max. @Full Load	---	±0.2	±0.8	%	
Load Regulation	Io=0% to 100%	---	---	±1.0	%	
Load Cross Regulation (Dual Output Models)	Asymmetrical Load 25/100% Full Load	---	---	±5.0	%	
Minimum Load	No minimum Load Requirement					
Ripple & Noise	0-20 MHz Bandwidth	Measured with a 2.2µF/50V MLCC	---	70	---	mV <sub>P-P</sub>
Transient Recovery Time	25% Load Step Change		---	---	500	µsec
Transient Response Deviation			---	±3	±5	%
Temperature Coefficient			---	±0.01	±0.02	%/°C
Over Load Protection	Hiccup		---	160	---	%
Short Circuit Protection	Continuous, Automatic Recovery (Hiccup Mode 0.3Hz typ.)					

General Specifications						
Parameter	Conditions	Min.	Typ.	Max.	Unit	
I/O Isolation Voltage	60 Seconds	1500	---	---	VDC	
	1 Second	1800	---	---	VDC	
Isolation Voltage Input/Output to case		1000	---	---	VDC	
I/O Isolation Resistance	500 VDC	1000	---	---	MΩ	
I/O Isolation Capacitance	100kHz, 1V	---	---	2200	pF	
Switching Frequency		---	480	---	kHz	
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	2,537,215	---	---	Hours	
Safety Approvals	UL/cUL 62368-1 recognition(UL certificate), IEC/EN 62368-1 & 60950-1(CB report)					

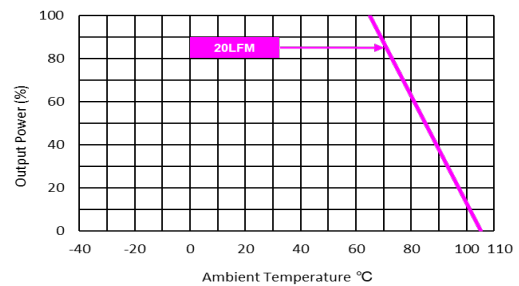
EMC Specifications				
Parameter	Standards & Level			Performance
EMI <sub>(s)</sub>	Conduction	EN 55032	Without external components	Class A
	Radiation		With external components	
EMS <sub>(s)</sub>	EN 55035			
	ESD	Direct discharge	Indirect discharge HCP & VCP	
		EN 61000-4-2 Air ± 8kV, Contact ± 6kV	Contact ± 6kV	
	Radiated immunity	EN 61000-4-3 20V/m		
	Fast transient	EN 61000-4-4 ±2kV		
	Surge	EN 61000-4-5 ±2kV		
	Conducted immunity	EN 61000-4-6 10Vrms		
PFFM	EN 61000-4-8 100A/m, 1000A/m for 1 sec			

**Environmental Specifications**

Parameter	Model	Min.	Max.	Unit
Operating Temperature Range Nominal Vin, Load 100% Inom. (for Power Derating see relative Derating Curves)	MDW12-12S05, MDW12-12S051, MDW12-24S05 MDW12-24S051, MDW12-48S05, MDW12-48S051	-40	+50	°C
	MDW12-12S12, MDW12-12S15, MDW12-12S24 MDW12-24S12, MDW12-24S15, MDW12-24S24 MDW12-48S12, MDW12-48S15, MDW12-48S24 MDW12-12D12, MDW12-12D15, MDW12-24D12 MDW12-24D15, MDW12-48D12, MDW12-48D15		+65	
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**


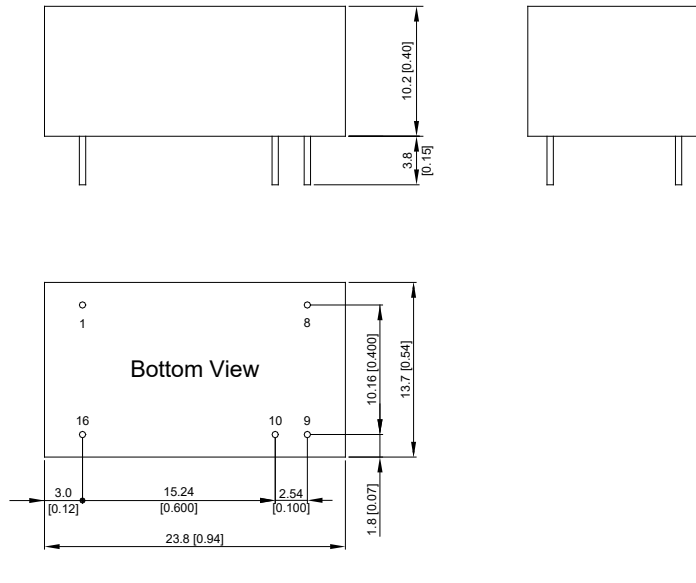
MDW12-12S05, MDW12-12S051, MDW12-24S05, MDW12-24S051  
MDW12-48S05, MDW12-48S051



MDW12-12S12, MDW12-12S15, MDW12-12S24, MDW12-24S12  
MDW12-24S15, MDW12-24S24, MDW12-48S12, MDW12-48S15  
MDW12-48S24, MDW12-12D12, MDW12-12D15, MDW12-24D12  
MDW12-24D15, MDW12-48D12, MDW12-48D15

**Notes**

- 1 Specifications typical at Ta=+25°C, resistive load, nominal input voltage and rated output current unless otherwise noted.
- 2 Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%.
- 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.

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

**Pin Connections**

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

NC: No Connection

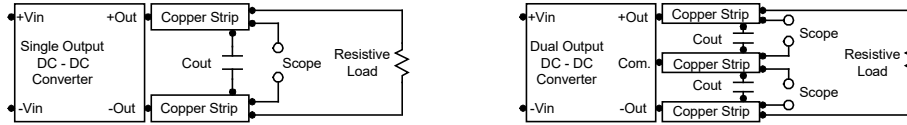
- ▶ All dimensions in mm (inches)
- ▶ Tolerance:  $X.X \pm 0.5$  ( $X.XX \pm 0.02$ )  
 $X.XX \pm 0.25$  ( $X.XXX \pm 0.01$ )
- ▶ Pin diameter tolerance:  $X.X \pm 0.05$  ( $X.XX \pm 0.002$ )

**Physical Characteristics**

Case Size	: 23.8x13.7x10.2 mm (0.94x0.54x0.40 inches)
Case Material	: Metal With Non-Conductive Baseplate
Pin Material	: Copper Alloy
Weight	: 8.6g

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

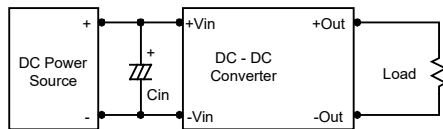
Refer to the output specifications or add 4.7 $\mu$ F capacitor if the output specifications undefine  $C_{out}$ . Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20 MHz. Position the load between 50 mm and 75 mm from the DC-DC Converter.


**Technical Notes**
**Overload Protection**

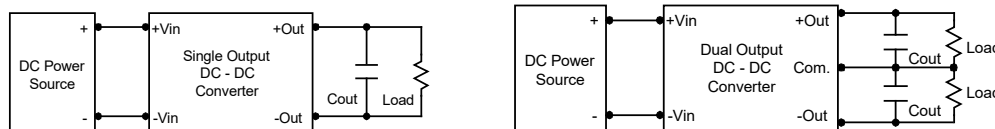
To provide hiccup mode protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure overload for an unlimited duration.

**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 on the input to insure startup. By using a good quality low Equivalent Series Resistance (ESR < 1.0 $\Omega$  at 100 kHz) capacitor of a 2.2 $\mu$ F for the 12V, 24V and 48V input devices, capacitor mounted close to the power module helps ensure stability of the unit.


**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 2.2 $\mu$ F capacitors at the output.


**Maximum Capacitive Load**

The MDW12 series has limitation of maximum connected capacitance on the output. The power module may operate in current limiting mode during start-up, affecting the ramp-up and the startup time. Connect capacitors at the point of load for best performance. The maximum capacitance can be found in the data sheet.

**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.

