

**FEATURES**

- ▶ **Small Footprint:**  
24.0 x 18.1 mm (0.94 x 0.71 inches)
- ▶ **Wide 2:1 Input Range**
- ▶ **Fully regulated Output**
- ▶ **Operating Temp. Range -40°C to +85°C**
- ▶ **Short Circuit Protection**
- ▶ **I/O-isolation 1500 VDC**
- ▶ **Input Filter meets EN55022, class A and FCC, level A**
- ▶ **Qualified for lead-free reflow solder process according IPC/JEDEC J-STD-020D.1**
- ▶ **Water rinsing available (Optional)**
- ▶ **3 Years Product Warranty**


**PRODUCT OVERVIEW**

The MINMAX MSDW1 series is a range of isolated 2W DC/DC converter modules featuring fully regulated output voltages and wide 2:1 input voltage ranges. The products come in a compact SMD package with a small footprint and low package height of just 8.0 mm (0.31 inch). All models are qualified for lead free reflow solder processes according IPC J-STD-020D.1 standard.

An excellent efficiency allows an operating temperature range of -40°C to +85°C (with Derating). The compact dimensions of these DC/DC converters make them an ideal solution for many space critical applications in battery-powered equipment and instrumentation.

**Model Selection Guide**

Model Number	Input Voltage (Range) VDC	Output Voltage VDC	Output Current		Input Current		Reflected Ripple Current mA(typ.)	Max. capacitive Load μF	Efficiency (typ.) @Max. Load %
			Max. mA	Min. mA	@Max. Load mA(typ.)	@No Load mA(typ.)			
MSDW1011	5 (4.5 ~ 9)	3.3	500	125	471	40	100	2200	70
MSDW1012		5	400	100	548			1000	73
MSDW1013		12	167	42	534			170	75
MSDW1014		15	134	33	582			110	73
MSDW1015		±5	±200	±50	667			470#	64
MSDW1016		±12	±83	±21	615			100#	69
MSDW1017		±15	±67	±17	598			47#	71
MSDW1021	12 (9 ~ 18)	3.3	500	125	184	20	25	2200	73
MSDW1022		5	400	100	217			1000	77
MSDW1023		12	167	42	209			170	80
MSDW1024		15	134	33	220			110	80
MSDW1025		±5	±200	±50	242			470#	73
MSDW1026		±12	±83	±21	224			100#	78
MSDW1027		±15	±67	±17	226			47#	78
MSDW1031	24 (18 ~ 36)	3.3	500	125	96	10	15	2200	72
MSDW1032		5	400	100	109			1000	77
MSDW1033		12	167	42	109			170	80
MSDW1034		15	134	33	108			110	81
MSDW1035		±5	±200	±50	119			470#	74
MSDW1036		±12	±83	±21	112			100#	78
MSDW1037		±15	±67	±17	110			47#	80
MSDW1041	48 (36 ~ 75)	3.3	500	125	49	8	10	2200	71
MSDW1042		5	400	100	57			1000	73
MSDW1043		12	167	42	53			170	79
MSDW1044		15	134	33	55			110	79
MSDW1045		±5	±200	±50	62			470#	71
MSDW1046		±12	±83	±21	57			100#	77
MSDW1047		±15	±67	±17	57			47#	77

# For each output

### Input Specifications

Parameter	Model	Min.	Typ.	Max.	Unit
Input Surge Voltage (1 sec. max.)	5V Input Models	-0.7	---	11	VDC
	12V Input Models	-0.7	---	25	
	24V Input Models	-0.7	---	50	
	48V Input Models	-0.7	---	100	
Start-Up Threshold Voltage	5V Input Models	3.5	4	4.5	
	12V Input Models	4.5	7	9	
	24V Input Models	8	12	18	
	48V Input Models	16	24	36	
Under Voltage Shutdown	5V Input Models	---	3.5	4	
	12V Input Models	---	6.5	8.5	
	24V Input Models	---	11	17	
	48V Input Models	---	22	34	
Reverse Polarity Input Current	All Models	---	---	1	A
Short Circuit Input Power		---	---	1500	mW
Internal Power Dissipation		---	---	1800	mW
Conducted EMI		Compliance to EN 55022,class A and FCC part 15,class A			

### Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy		---	---	±2.0	%Vom.
Output Voltage Balance	Dual Output, Balanced Loads	---	±1.0	±2.0	%
Line Regulation	Vin=Min. to Max.	---	±0.3	±0.5	%
Load Regulation	Io=25% to 100%	---	±0.5	±0.75	%
Ripple & Noise	0-20 MHz Bandwidth	---	---	50	mV P-P
Transient Recovery Time	25% Load Step Change	---	100	300	µsec
Transient Response Deviation		---	±3	±5	%
Temperature Coefficient		---	±0.01	±0.02	%/°C
Short Circuit Protection	Continuous				

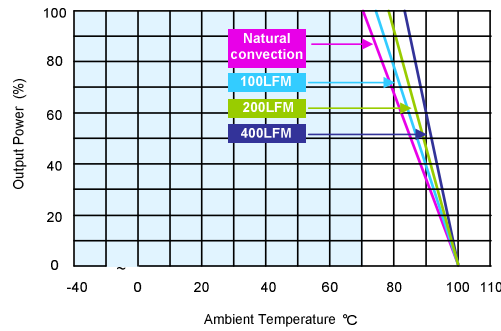
### General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage (rated)	60 Seconds	1500	---	---	VDC
I/O Isolation Resistance	500 VDC	1000	---	---	MΩ
I/O Isolation Capacitance	100KHz, 1V	---	250	420	pF
Switching Frequency		---	300	---	KHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	1,000,000			Hours
Safety Approvals	UL/cUL 60950-1 recognition (CSA certificate), IEC/EN 60950-1(CB-scheme)				
Moisture Sensitivity Level (MSL)	IPC/JEDEC J-STD-020D.1	Level 2			

### Environmental Specifications

Parameter	Conditions	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	Natural Convection	-40	+85	°C
Case Temperature		---	+90	°C
Storage Temperature Range		-50	+125	°C
Humidity (non condensing)		---	95	% rel. H
Cooling	Free-Air convection			
Lead Temperature (1.5mm from case for 10Sec.)		---	260	°C

**Power Derating Curve**

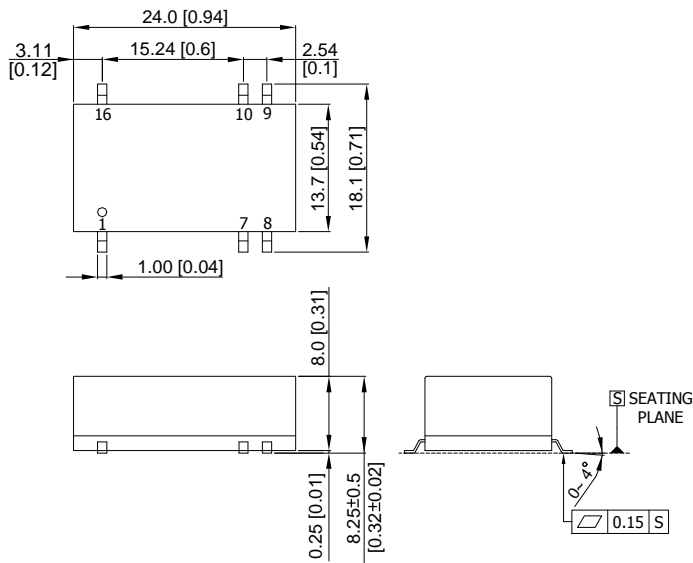


**Notes**

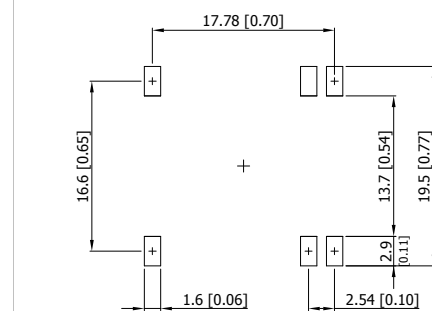
- 1 Specifications typical at Ta=+25°C, resistive load, nominal input voltage and rated output current unless otherwise noted.
- 2 Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%
- 3 These power converters require a minimum output loading to maintain specified regulation, operation under no-load conditions will not damage these modules; however they may not meet all specifications listed.
- 4 We recommend to protect the converter by a slow blow fuse in the input supply line.
- 5 Other input and output voltage may be available, please contact factory.
- 6 That "natural convection" is about 20LFM but is not equal to still air (0 LFM).
- 7 To order the converter for water rinsing process, please add a suffix-W (e.g.MSDW1012-W) to order code.
- 8 Specifications are subject to change without notice.

**Package Specifications**

**Mechanical Dimensions**



**Connecting Pin Patterns**



- ▶ All dimensions in mm (inches)
- ▶ Tolerance: X.X±0.25 (X.XX±0.01)  
X.XX±0.13 (X.XXX±0.005)
- ▶ 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**

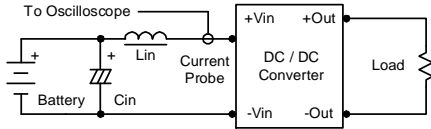
Case Size	: 24.0x13.7x8.0mm (0.94x0.54x0.31 inches)
Case Material	: Non-Conductive Black Plastic (flammability to UL 94V-0 rated)
Pin Material	: phosphor bronze
Weight	: 5.1g

## Test Setup

### Input Reflected-Ripple Current Test Setup

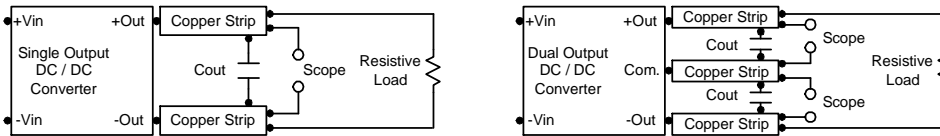
Input reflected-ripple current is measured with an inductor  $L_{in}$  (4.7 $\mu$ H) and  $C_{in}$  (220 $\mu$ F, ESR < 1.0 $\Omega$  at 100 KHz) to simulate source impedance. Capacitor  $C_{in}$ , offsets possible battery impedance.

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  $C_{out}$  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

### Overcurrent Protection

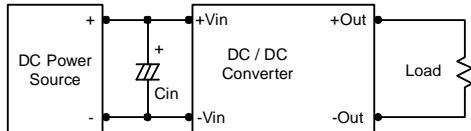
To provide protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure current limiting for an unlimited duration. At the point of current-limit inception, the unit shifts from voltage control to current control. The unit operates normally once the output current is brought back into its specified range.

### 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.

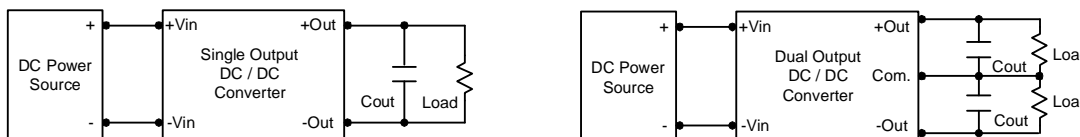
In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor on the input to insure startup.

By using a good quality low Equivalent Series Resistance (ESR < 1.0 $\Omega$  at 100 kHz) capacitor of a 8.2 $\mu$ F for the 5V input devices, a 3.3 $\mu$ F for the 12V input devices and a 1.5 $\mu$ F for the 24V and 48V 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 3.3 $\mu$ F capacitors at the output.



### Maximum Capacitive Load

The MSDW1000 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. 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 90°C. The derating curves are determined from measurements obtained in a test setup.

