

## FEATURES

- ▶ Compact DIP-16 Package
- ▶ Ultra-wide 4:1 Input Voltage Range
- ▶ Fully Regulated Output Voltage
- ▶ I/O Isolation 1500 VDC
- ▶ Operating Ambient Temp. Range -40°C to +85°C
- ▶ Under-voltage, Overload and Short Circuit Protection
- ▶ Remote On/Off Control
- ▶ Designed-in Conducted EMI meets EN55022 Class A & FCC Level A
- ▶ UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval



## PRODUCT OVERVIEW

Minmax's MDWI03 series power modules are in mini-DIP DC-DC converters that operate over input voltage ranges of 9-36VDC and 18-75VDC which provide precisely regulated output voltages of 3.3V, 5V, 12V, 15V, 24V,  $\pm 5V$ ,  $\pm 12V$  and  $\pm 15VDC$ .

Pin compatible with the MDW1000 series, the MDWI03 offers a power rating up to 3W and a typical full-load efficiency of 80%, under-voltage, over load/short circuit protection, remote on/off control and conducted EMI compliance to EN55022 class A.

The MDWI03 series is an excellent selection for data communication equipment, mobile battery driven equipment, distributed power system, telecommunication equipment, mixed analog/digital subsystem, process/machine control equipment, computer peripheral equipment and industrial robot system.

## Model Selection Guide

Model Number	Input Voltage (Range) VDC	Output Voltage VDC	Output Current		Input Current		Max. capacitive Load $\mu F$	Efficiency (typ.) @Max. Load %
			Max. mA	Min. mA	@Max. Load mA(typ.)	@No Load mA(typ.)		
MDWI03-24S033	24 (9 - 36)	3.3	600	90	110	30	220	75
MDWI03-24S05		5	600	90	160		220	78
MDWI03-24S12		12	250	38	156		47	80
MDWI03-24S15		15	200	30	156		47	80
MDWI03-24S24		24	125	19	156		47	80
MDWI03-24D05		$\pm 5$	$\pm 300$	$\pm 45$	162		47#	77
MDWI03-24D12		$\pm 12$	$\pm 125$	$\pm 19$	156		47#	80
MDWI03-24D15		$\pm 15$	$\pm 100$	$\pm 15$	156		47#	80
MDWI03-48S033		48 (18 - 75)	3.3	600	90		55	20
MDWI03-48S05	5		600	90	80	220	78	
MDWI03-48S12	12		250	38	78	47	80	
MDWI03-48S15	15		200	30	78	47	80	
MDWI03-48S24	24		125	19	78	47	80	
MDWI03-48D05	$\pm 5$		$\pm 300$	$\pm 45$	81	47#	77	
MDWI03-48D12	$\pm 12$		$\pm 125$	$\pm 19$	78	47#	80	
MDWI03-48D15	$\pm 15$		$\pm 100$	$\pm 15$	78	47#	80	

# For each output

## Input Specifications

Parameter	Model	Min.	Typ.	Max.	Unit
Input Surge Voltage (1 sec. max.)	24V Input Models	-0.7	---	50	VDC
	48V Input Models	-0.7	---	100	
Start-Up Threshold Voltage	24V Input Models	4.5	6	8.5	
	48V Input Models	8.5	12	17	
Under Voltage Shutdown	24V Input Models	---	---	8	
	48V Input Models	---	---	16	
Short Circuit Input Power		---	---	2000	mW
Input Filter	All Models	Internal PI Type			
Conducted EMI		Compliance to EN 55022,class A and FCC part 15,class A			

**Remote On/Off Control**

Parameter	Conditions	Min.	Typ.	Max.	Unit
Converter On	2.5V ~ 5.5V or Open Circuit				
Converter Off	-0.7V ~ 0.8V				
Control Input Current (on)	Vctrl = Min. to Max.	---	---	-400	μA
Control Input Current (off)	Vctrl = Min. to Max.	---	---	-400	μA
Control Common	Referenced to Negative Input				
Standby Input Current	Nominal Vin	---	---	5	mA

**Output Specifications**

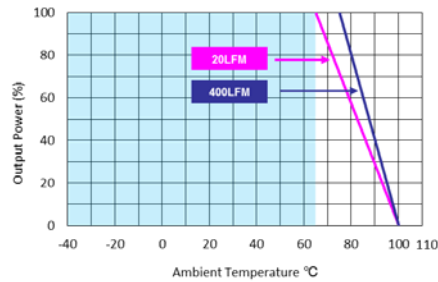
Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy		---	---	±2.0	%Vnom.
Output Voltage Balance	Dual Output, Balanced Loads	---	±1.0	±2.0	%
Line Regulation	Vin=Min. to Max. @Full Load	---	±0.5	±1.0	%
Load Regulation	Io=15% to 100%	---	±0.5	±1.2	%
Ripple & Noise	0-20 MHz Bandwidth	---	50	100	mV <sub>P-P</sub>
Transient Recovery Time	25% Load Step Change	---	300	600	μsec
Transient Response Deviation		---	±3	---	%
Temperature Coefficient		---	±0.01	±0.02	%/°C
Over Load Protection	Foldback	110	150	---	%
Short Circuit Protection	Continuous, Automatic Recovery				

**General Specifications**

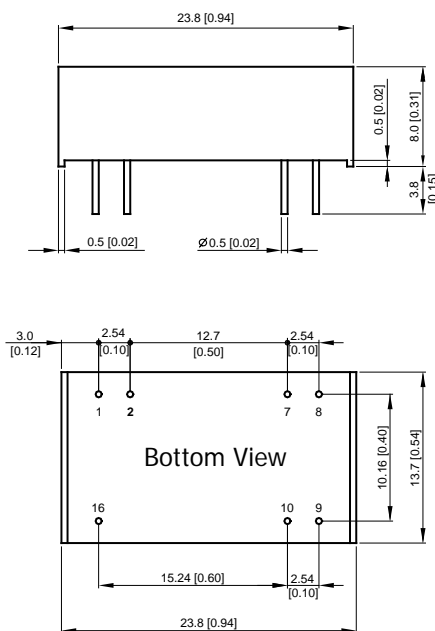
Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds	1500	---	---	VDC
	1 Second	1800	---	---	VDC
I/O Isolation Resistance	500 VDC	1000	---	---	MΩ
I/O Isolation Capacitance	100kHz, 1V	---	350	500	pF
Switching Frequency		---	350	---	kHz
MTBF (calculated)	MIL-HDBK-217F@25°C, Ground Benign	300,000		Hours	
Safety Approvals	UL/cUL 62368-1 recognition(UL certificate), IEC/EN 62368-1 & 60950-1(CB-report)				

**Environmental Specifications**

Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+85	°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 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 Specifications are subject to change without notice.

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

**Pin Connections**

Pin	Single Output	Dual Output
1	-Vin	-Vin
2	Remote On/Off	Remote On/Off
7	NC	NC
8	NC	Common
9	+Vout	+Vout
10	-Vout	-Vout
16	+Vin	+Vin

NC: No Connection

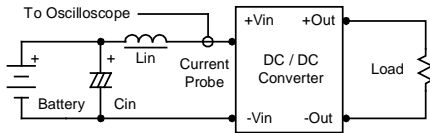
- ▶ All dimensions in mm (inches)
- ▶ Tolerance: X.X±0.25 (X.XX±0.01)  
X.XX±0.13 (X.XXX±0.005)
- ▶ Pin diameter  $\varnothing 0.5 \pm 0.05$  (0.02±0.002)

**Physical Characteristics**

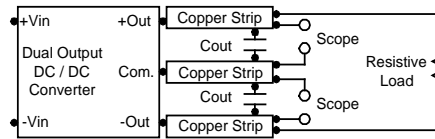
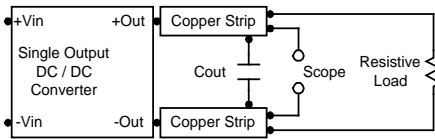
Case Size	: 23.8x13.7x8.0 mm (0.94x0.54x0.31 inches)
Case Material	: Non-Conductive Black Plastic (flammability to UL 94V-0 rated)
Pin Material	: Copper Alloy with Gold Plate Over Nickel Subplate
Weight	: 5.4g

**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**
**Remote On/Off**

Positive logic remote on/off turns the module on during a logic high voltage on the remote on/off pin, and off during a logic low. To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal and the -Vin terminal. The switch can be an open collector or equivalent. A logic low is -0.7V to 0.8V. A logic high is 2.5V to 5.5V. The maximum sink current of the switch at on/off terminal during a logic low is -300  $\mu$ A. The maximum sink current of the switch at on/off terminal during a logic high is -200 $\mu$ A or open.

**Overcurrent Protection**

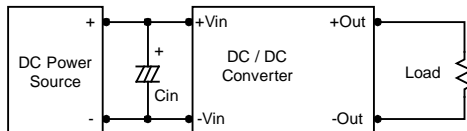
To provide protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure current limiting for an unlimited duration. At the point of current-limit inception, the unit shifts from voltage control to current control. The unit operates normally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

**Input Source Impedance**

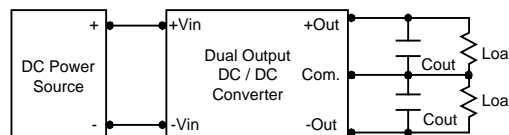
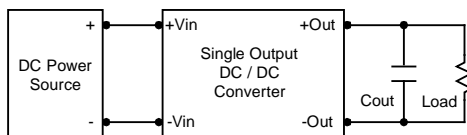
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module.

In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor 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 4.7 $\mu$ F for the 24V input devices and a 2.2 $\mu$ F for the 48V 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.


**Maximum Capacitive Load**

The MDWI03 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. 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°C. The derating curves are determined from measurements obtained in a test setup.

