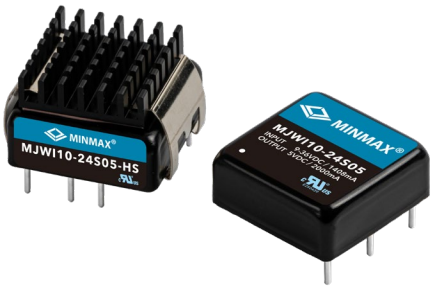
FEATURES

- ▶ **Ultra-compact 1"×1" Package**
- ▶ **Ultra-wide 4:1 Input Voltage Range**
- ▶ **Fully Regulated Output Voltage**
- ▶ **High Efficiency up to 87%**
- ▶ **I/O Isolation 1500 VDC**
- ▶ **Operating Ambient Temp. Range -40℃ to +80℃**
- ▶ **Under-voltage, Overload and Short Circuit Protection**
- ▶ **Remote On/Off Control**
- ▶ **Shielded Metal Case with Insulated Baseplate**
- ▶ **Conducted EMI EN 55032 Class A Approved**
- ▶ **UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval & CE Marking**



UL 62368-1 C US Scheme

PRODUCT OVERVIEW

The MINMAX MJWI10 series are cost optimized DC-DC converter modules offering 10W output power in a 1"x1"x0.4" shielded metal package with industry standard pinout. All models provide ultra-wide 4:1 input voltage range and fixed output voltage regulation. State-of-the-art circuit topology provides a high efficiency up to 87% which allows an operating temperature range of -40°C to +80°C. Further features include remote On/Off, under-voltage, overload and short circuit protection and safety approval UL/cUL/IEC/EN 62368-1(60950-1) with CB report and CE marking. Typical applications for these converters are battery operated equipment, instrumentation, distributed power architectures in communication and industrial electronics and other space critical applications.

Model Selection Guide

Model Number	Input Voltage (Range)	Output Voltage	Output Current		Input Current		Max. capacitive Load	Efficiency (typ.)
			Max.	Min.	@Max. Load	@No Load		@Max. Load
	VDC	VDC	mA	mA	mA(typ.)	mA(typ.)	μF	%
MJWI10-24S033	24 (9 ~ 36)	3.3	2200	330	352	30	560	86
MJWI10-24S05		5	2000	300	496		560	84
MJWI10-24S051		5.1	2000	300	506		560	84
MJWI10-24S12		12	830	125	483		150	86
MJWI10-24S15		15	660	100	474		150	87
MJWI10-24S24		24	410	62	477		68	86
MJWI10-24D05		±5	±1000	±150	496		220#	84
MJWI10-24D12		±12	±410	±62	477		100#	86
MJWI10-24D15		±15	±330	±50	474		100#	87
MJWI10-48S033	48 (18 ~ 75)	3.3	2200	330	180	20	560	85
MJWI10-48S05		5	2000	300	248		560	84
MJWI10-48S051		5.1	2000	300	253		560	84
MJWI10-48S12		12	830	125	241		150	86
MJWI10-48S15		15	660	100	237		150	87
MJWI10-48S24		24	410	62	238		68	86
MJWI10-48D05		±5	±1000	±150	248		220#	84
MJWI10-48D12		±12	±410	±62	238		100#	86
MJWI10-48D15		±15	±330	±50	237		100#	87

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	---	---	9	
	48V Input Models	---	---	18	
Under Voltage Shutdown	24V Input Models	---	---	8.5	
	48V Input Models	---	---	17	
Short Circuit Input Power	All Models	---	2500	---	mW
Input Filter		Internal Pi Type			

Remote On/Off Control

Parameter	Conditions	Min.	Typ.	Max.	Unit
Converter On	2.5V ~ 50V or Open Circuit				
Converter Off	0~1.0V or Short Circuit (Pin 2 and Pin 6)				
Control Input Current (on)	Vctrl = 5V	---	---	500	μA
Control Input Current (off)	Vctrl = 0V	---	---	-500	μA
Control Common	Referenced to Negative Input				
Standby Input Current	Nominal Vin	---	---	10	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	---	±0.3	±1.0	%
Load Regulation	Io=15% to 100%	---	±0.5	---	%
Ripple & Noise	0-20 MHz Bandwidth	---	---	100	mV_{p-p}
Transient Recovery Time	25% Load Step Change	---	300	600	μsec
Transient Response Deviation		---	±3	±6	%
Temperature Coefficient		---	±0.01	±0.02	%/℃
Over Load Protection	Hiccup	110	150	---	%
Short Circuit Protection	Hiccup Mode, 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	---	---	1500	pF
Switching Frequency		---	450	---	kHz
MTBF(calculated)	MIL-HDBK-217F@25℃, Ground Benign		350,000		Hours
Safety Approvals	UL/cUL 62368-1 recognition(UL certificate), IEC/EN 62368-1 & 60950-1(CB-report)				

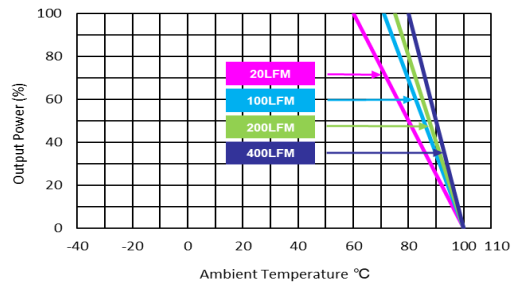
EMC Specifications

Parameter	Standards & Level			Performance
$EMI_{(6)}$	Conduction	EN 55032	Without external components	Class A
	Radiation		With external components	
$EMS_{(6)}$	EN 55035			
	ESD	EN 61000-4-2 Air ± 8kV , Contact ±6kV		A
	Radiated immunity	EN 61000-4-3 10V/m		A
	Fast transient	EN 61000-4-4 ±2kV		A
	Surge	EN 61000-4-5 ±1kV		A
	Conducted immunity	EN 61000-4-6 10Vrms		A
	PFMF	EN 61000-4-8 3A/m		A

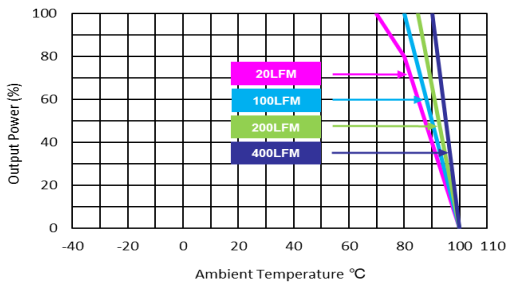
Environmental Specifications

Parameter	Min.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-40	+80	℃
Case Temperature	---	+100	℃
Storage Temperature Range	-50	+125	℃
Humidity (non condensing)	---	95	% rel. H
RFI	Six-Sided Shielded, Metal Case		
Lead Temperature (1.5mm from case for 10Sec.)	---	260	℃

Power Derating Curve



Derating Curve without Heatsink



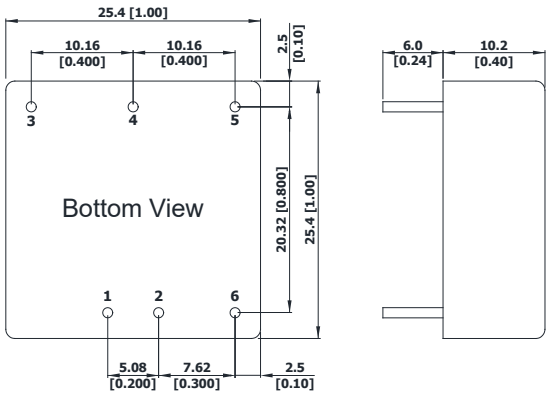
Derating Curve with Heatsink

Notes

1 Specifications typical at Ta=+25℃, 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 MINMAX.
6 The external components might be required to meet EMI/EMS standard for some of test items. Please contact MINMAX for the solution in detail.
7 Specifications are subject to change without notice.
8 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 1.0 [0.04]
2	-Vin	-Vin	Ø 1.0 [0.04]
3	+Vout	+Vout	Ø 1.0 [0.04]
4	No Pin	Common	Ø 1.0 [0.04]
5	-Vout	-Vout	Ø 1.0 [0.04]
6	Remote On/Off	Remote On/Off	Ø 1.0 [0.04]

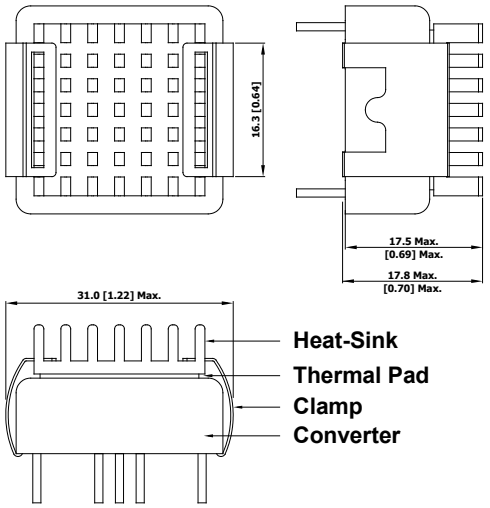
- ▶ All dimensions in mm (inches)
- ▶ Tolerance: X.X±0.5 (X.XX±0.02)
  X.XX±0.25 (X.XXX±0.01)
- ▶ Pin diameter tolerance: X.X±0.05 (X.XX±0.002)

Physical Characteristics

Case Size	:	25.4x25.4x10.2mm (1.0x1.0x0.4 inches)
Case Material	:	Metal With Non-Conductive Baseplate
Base Material	:	FR4 PCB (flammability to UL 94V-0 rated)
Pin Material	:	Copper Alloy
Weight	:	15g

Heatsink (Option –HS)

Mechanical Dimensions



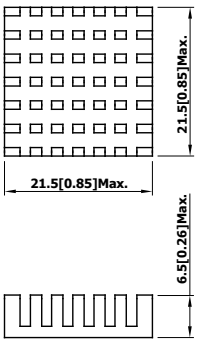
Heatsink Material: Aluminum
Finish: Anodic treatment (black)
Weight: 2g

▶ The advantages of adding a heatsink are:

1. To improve heat dissipation and increase the stability and reliability of the DC-DC converters at high operating temperatures.
2. To increase Operating temperature of the DC-DC converter, please refer to Derating Curve.

Order Code Table	
Standard	With heatsink
MJWI10-24S033	MJWI10-24S033-HS
MJWI10-24S05	MJWI10-24S05-HS
MJWI10-24S051	MJWI10-24S051-HS
MJWI10-24S12	MJWI10-24S12-HS
MJWI10-24S15	MJWI10-24S15-HS
MJWI10-24S24	MJWI10-24S24-HS
MJWI10-24D05	MJWI10-24D05-HS
MJWI10-24D12	MJWI10-24D12-HS
MJWI10-24D15	MJWI10-24D15-HS
MJWI10-48S033	MJWI10-48S033-HS
MJWI10-48S05	MJWI10-48S05-HS
MJWI10-48S051	MJWI10-48S051-HS
MJWI10-48S12	MJWI10-48S12-HS
MJWI10-48S15	MJWI10-48S15-HS
MJWI10-48S24	MJWI10-48S24-HS
MJWI10-48D05	MJWI10-48D05-HS
MJWI10-48D12	MJWI10-48D12-HS
MJWI10-48D15	MJWI10-48D15-HS

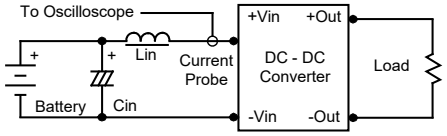
Order Code For Heatsink kit (including: Heatsink x1, Clamp x 2, Thermal Pad x1)
HS-J001



Test Setup

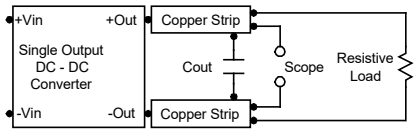
Input Reflected-Ripple Current Test Setup

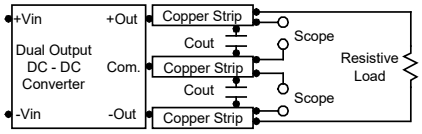
Input reflected-ripple current is measured with a inductor Lin (4.7μH) and Cin (220μF, ESR < 1.0Ω at 100 kHz) to simulate source impedance. Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 kHz.



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

Remote On/Off

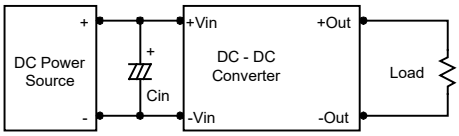
Positive logic remote on/off turns the module on during a logic high voltage on the remote on/off pin, and off during a logic low. To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal and the -Vin terminal.
The switch can be an open collector or equivalent. A logic low is 0V to 1V. A logic high is 2.5V to 50V. The maximum sink current at on/off terminal during a logic low is -500μA. The maximum allowable leakage current of the switch at on/off terminal (2.5 to 50V) is 500μA.

Overload 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.

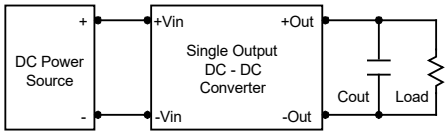
Input Source Impedance

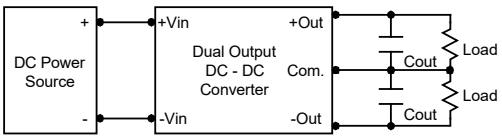
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module.
In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.
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 < 1.0Ω at 100 kHz) capacitor of a 6.8μF for the 24V and 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 4.7μF capacitors at the output.





Maximum Capacitive Load

The MJWI10 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 100℃. The derating curves are determined from measurements obtained in a test setup.