FEATURES

- ▶ Smallest Encapsulated 30W Converter
- ▶ Ultra-compact 1"×1" Package
- ▶ Ultra-wide 4:1 Input Voltage Range
- ▶ Fully Regulated Output Voltage
- ▶ Excellent Efficiency up to 90%
- ▶ I/O Isolation 1500 VDC
- ▶ Operating Ambient Temp. Range -40℃ to +80℃
- ▶ No Min. Load Requirement
- ▶ Very low no load power consumption
- ▶ Under-voltage, Overload/Voltage and Short Circuit Protection
- ▶ Remote On/Off Control, Output Voltage Trim
- ▶ Shielded Metal Case with Insulated Baseplate
- ▶ UL/cUL/IEC/EN 62368-1 Safety Approval & CE Marking

NEW

PRODUCT OVERVIEW

The MINMAX MJWI30 series is the latest range of a new generation of 30Watt isolated DC-DC power modules with ultra-wide input range of 9-36 / 18-75Vin and 14 models available for 3.3/5/12/15/24/±12/±15VDC tightly output voltage in a highest power density 75W/in^3 and ultra-compact size with dimensions of just 1.0"x1.0"x0.4" shielded and encapsulated package. Key performance featuring high efficiency up to 90%, operating ambient temp. range of -40 ℃ to +80 ℃, no min. load requirement, very low no-load power consumption, remote on/off, output voltage trim, build-in fault condition protection include under-voltage, overload, over voltage and short circuit protection

The MJWI30 series has been intensely qualified to safety approval UL/cUL/IEC/EN 62368-1 with CB report and CE marking which offer a solution for the applications where wide input voltage range, high efficiency for wide operating ambient temp. range, isolated power with fault condition protection, shield and encapsulated package and very board space limited / critical are required.

Model Selection Guide

Model Number	Input Voltage (Range)	Output Voltage	Output Current	Input Current		Over Voltage Protection	Max. capacitive Load	Efficiency (typ.)
			Max.	@Max. Load	@No Load			@Max. Load
	VDC	VDC	mA	mA(typ.)	mA(typ.)	VDC	µF	%
MJWI30-24S033	24 (9 ~ 36)	3.3	7000	1106	10	3.9	10000	87
MJWI30-24S05		5	6000	1420	10	6.2	7200	88
MJWI30-24S12		12	2500	1420	10	15	1250	88
MJWI30-24S15		15	2000	1420	10	18	800	88
MJWI30-24S24		24	1250	1420	10	30	330	88
MJWI30-24D12		±12	±1250	1420	10	±15	680#	88
MJWI30-24D15		±15	±1000	1404	10	±18	470#	89
MJWI30-48S033	48 (18 ~ 75)	3.3	7000	553	8	3.9	10000	87
MJWI30-48S05		5	6000	702	8	6.2	7200	89
MJWI30-48S12		12	2500	702	8	15	1250	89
MJWI30-48S15		15	2000	702	8	18	800	89
MJWI30-48S24		24	1250	694	8	30	330	90
MJWI30-48D12		±12	±1250	694	8	±15	680#	90
MJWI30-48D15		±15	±1000	694	8	±18	470#	90

\# For each output

Input Specifications

Parameter	Conditions / Model	Min.	Typ.	Max.	Unit
Input Surge Voltage (100ms 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	
Start Up Time (Power On)	Nominal Vin and Constant Resistive Load	---	---	30	ms
Input Filter	All Models	Internal Pi Type			

Remote On/Off Control

Parameter	Conditions	Min.	Typ.	Max.	Unit
Converter On	3.5V ~ 12V or Open Circuit				
Converter Off	0V ~ 1.2V or Short Circuit				
Control Input Current (on)	Vctrl = 5.0V	---	---	0.5	mA
Control Input Current (off)	Vctrl = 0V	---	---	-0.5	mA
Control Common	Referenced to Negative Input				
Standby Input Current	Nominal Vin	---	2	---	mA

Output Specifications

Parameter	Conditions / Model		Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy			---	---	±1.0	%Vnom.
Output Voltage Balance	Dual Output, Balanced Loads		---	---	±2.0	%
Line Regulation	Vin=Min. to Max. @Full Load	Single Output	---	---	±0.2	%
		Dual Output	---	---	±0.5	%
Load Regulation	Io=0% to 100%	Single Output	---	---	±0.2	%
		Dual Output	---	---	±1.0	%
Cross Regulation (Dual)	Asymmetrical Load 25% / 100% FL		---	---	±5.0	%
Minimum Load	No minimum Load Requirement					
Ripple & Noise (measured with output capacitors(3))	20 MHz Bandwidth	3.3 & 5 Vo Models	---	---	75	mV P-P
		12 & 15 & 24 Vo Models	---	---	75	mV P-P
		Dual Output Models	---	---	75	mV P-P
Transient Recovery Time	25% Load Step Change		---	250	---	μsec
Transient Response Deviation			---	±3	±5	%
Temperature Coefficient			---	---	±0.02	%/°C
Trim Up / Down Range	% of Nominal Output Voltage		---	---	±10	%
Over Load Protection	Hiccup		---	150	---	%
Over Voltage Protection	Zener Diode Clamp		---	125	---	% of Vo
Short Circuit Protection	Continuous, Automatic Recovery (Hiccup Mode 0.6Hz 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	60 Seconds	1000	---	---	VDC
I/O Isolation Resistance	500 VDC	1000	---	---	MΩ
I/O Isolation Capacitance	100kHz, 1V	---	---	1500	pF
Switching Frequency	3.3 Vo Models	---	175	---	kHz
	5 Vo Models	---	248	---	kHz
	12 & 15 & 24 & Dual Vo Models	---	285	---	kHz
MTBF(calculated)	MIL-HDBK-217F@25°C, Ground Benign	1,310,710	---	---	Hours
Safety Approvals(Pending)	UL/cUL 62368-1 recognition (UL certificate), IEC/EN 62368-1				

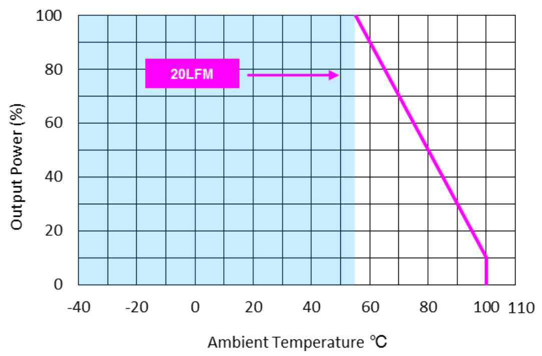
Environmental Specifications

Parameter	Min.	Max. without Heatsink	Max. with Heatsink	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	-40	55	TBD	℃
Case Temperature	---	+105		℃
Storage Temperature Range	-55	+125		℃
Humidity (non condensing)	---	95		% rel. H
Lead Temperature (1.5mm from case for 10 sec.)	---	260		℃

EMC Specifications

Parameter		Standards & Level		Performance
EMI	Conduction	EN 55032, FCC part 15		Class A(6)
EMS	EN 55035			
	ESD	Direct discharge	Indirect discharge HCP & VCP	A
		EN61000-4-2 Air ± 8kV, Contact ± 6kV	Contact ± 6kV	
	Radiated immunity	EN 61000-4-3 10V/m		A
	Fast transient(7)	EN 61000-4-4 ±2kV		A
	Surge(7)	EN 61000-4-5 ±2kV		A
	Conducted immunity	EN 61000-4-6 10Vrms		A
	PFMF	EN61000-4-8 100A/m Continuous; 1000A/m 1sec.		A

Power Derating Curve

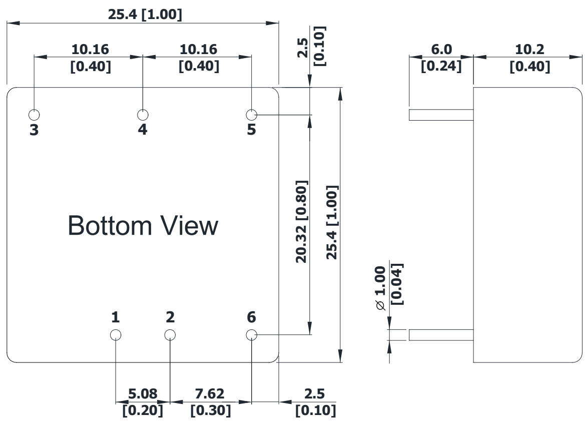


Notes

1 Specifications typical at Ta=+25℃, resistive load, nominal input voltage, 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 Ripple & Noise measurement with a 0.1μF MLCC and a 47μF MLCC.
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 The standard module meets EN 55032 Class A with external components. For further information, please contact MINMAX.
7 To meet EN 61000-4-4 & EN 61000-4-5 an external capacitor across the input pins is required, please contact MINMAX.
8 Specifications are subject to change without notice.

Package Specifications

Mechanical Dimensions



Pin Connections

Pin	Single Output	Dual Output
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	Trim	Common
5	-Vout	-Vout
6	Remote On/Off	Remote On/Off

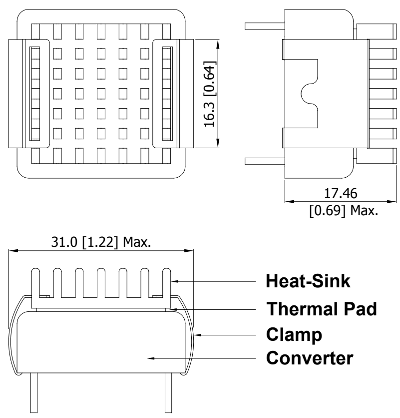
- All dimensions in mm (inches)
- Tolerance: X.X±0.5 (X.XX±0.02)
  X.XX±0.25 (X.XXX±0.01)
- Pin diameter ⌀ 1.0 ±0.05 (0.04±0.002)

Physical Characteristics

Case Size	:	25.4x25.4x10.2mm (1.0x1.0x0.4 inches)
Case Material	:	Copper
Base Material	:	FR4 PCB (flammability to UL 94V-0 rated)
Pin Material	:	Tinned Copper
Weight	:	25g

Heatsink (Option –HS)

Mechanical Dimensions



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

- The advantages of adding a heatsink are:

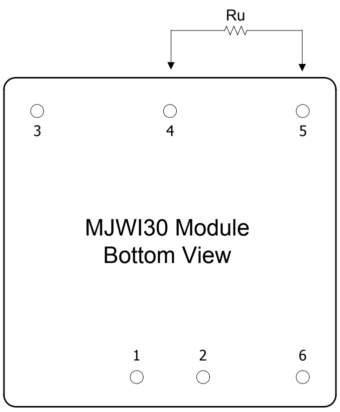
1. To improve heat dissipation and increase the stability and reliability of the DC-DC converters at high operating temperatures.
2. To increase operating temperature of the DC-DC converter, please refer to Derating Curve.

Order Code Table

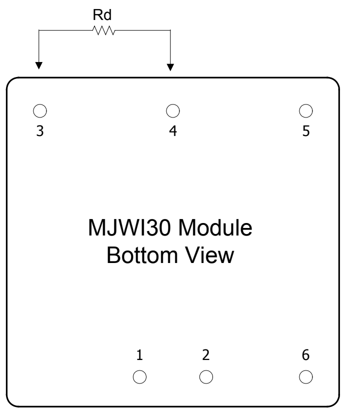
Standard	With heatsink
MJWI30-24S033	MJWI30-24S033-HS
MJWI30-24S05	MJWI30-24S05-HS
MJWI30-24S12	MJWI30-24S12-HS
MJWI30-24S15	MJWI30-24S15-HS
MJWI30-24S24	MJWI30-24S24-HS
MJWI30-24D12	MJWI30-24D12-HS
MJWI30-24D15	MJWI30-24D15-HS
MJWI30-48S033	MJWI30-48S033-HS
MJWI30-48S05	MJWI30-48S05-HS
MJWI30-48S12	MJWI30-48S12-HS
MJWI30-48S15	MJWI30-48S15-HS
MJWI30-48S24	MJWI30-48S24-HS
MJWI30-48D12	MJWI30-48D12-HS
MJWI30-48D15	MJWI30-48D15-HS

External Output Trimming

Output can be externally trimmed by using the method shown below



Trim Up



Trim Down

MJWI30-XXS033 Trim Table

Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox0.99	Vox0.98	Vox0.97	Vox0.96	Vox0.95	Vox0.94	Vox0.93	Vox0.92	Vox0.91	Vox0.90	Volts
Rd=	72.64	32.49	19.10	12.41	8.39	5.72	3.80	2.37	1.25	0.36	KOhms
Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox1.01	Vox1.02	Vox1.03	Vox1.04	Vox1.05	Vox1.06	Vox1.07	Vox1.08	Vox1.09	Vox1.10	Volts
Ru=	60.49	27.14	16.03	10.47	7.14	4.91	3.33	2.14	1.21	0.47	KOhms

MJWI30-XXS05 Trim Table

Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox0.99	Vox0.98	Vox0.97	Vox0.96	Vox0.95	Vox0.94	Vox0.93	Vox0.92	Vox0.91	Vox0.90	Volts
Rd=	139.38	62.91	37.42	24.68	17.03	11.94	8.29	5.56	3.44	1.74	KOhms
Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox1.01	Vox1.02	Vox1.03	Vox1.04	Vox1.05	Vox1.06	Vox1.07	Vox1.08	Vox1.09	Vox1.10	Volts
Ru=	107.37	48.26	28.56	18.71	12.80	8.86	6.05	3.94	2.29	0.98	KOhms

MJWI30-XXS12 Trim Table

Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox0.99	Vox0.98	Vox0.97	Vox0.96	Vox0.95	Vox0.94	Vox0.93	Vox0.92	Vox0.91	Vox0.90	Volts
Rd=	413.55	184.55	108.22	70.05	47.15	31.88	20.98	12.80	6.44	1.35	KOhms
Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox1.01	Vox1.02	Vox1.03	Vox1.04	Vox1.05	Vox1.06	Vox1.07	Vox1.08	Vox1.09	Vox1.10	Volts
Ru=	351.00	157.50	93.00	60.75	41.40	28.50	19.29	12.37	7.00	2.70	KOhms

MJWI30-XXS15 Trim Table

Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox0.99	Vox0.98	Vox0.97	Vox0.96	Vox0.95	Vox0.94	Vox0.93	Vox0.92	Vox0.91	Vox0.90	Volts
Rd=	530.73	238.61	141.24	92.56	63.35	43.87	29.96	19.53	11.41	4.92	KOhms
Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox1.01	Vox1.02	Vox1.03	Vox1.04	Vox1.05	Vox1.06	Vox1.07	Vox1.08	Vox1.09	Vox1.10	Volts
Ru=	422.77	189.89	112.26	73.44	50.15	34.63	23.54	15.22	8.75	3.58	KOhms

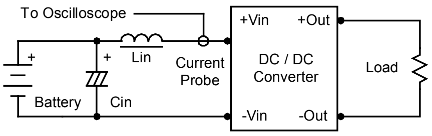
MJWI30-XXS24 Trim Table

Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox0.99	Vox0.98	Vox0.97	Vox0.96	Vox0.95	Vox0.94	Vox0.93	Vox0.92	Vox0.91	Vox0.90	Volts
Rd=	598.65	267.77	157.48	102.33	69.24	47.18	31.43	19.61	10.42	3.07	KOhms
Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox1.01	Vox1.02	Vox1.03	Vox1.04	Vox1.05	Vox1.06	Vox1.07	Vox1.08	Vox1.09	Vox1.10	Volts
Ru=	487.13	218.01	128.30	83.45	56.54	38.60	25.78	16.17	8.69	2.71	KOhms

Test Setup

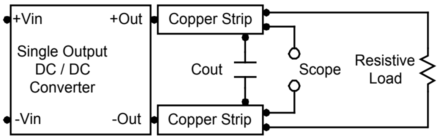
Input Reflected-Ripple Current Test Setup

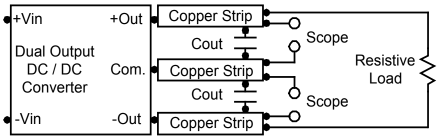
Input reflected-ripple current is measured with a inductor Lin (4.7μH) and Cin (220μF, ESR < 1.0Ω at 100 KHz) to simulate source impedance. Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 KHz.



Peak-to-Peak Output Noise Measurement Test

Use a 47μF and 0.1μF 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.

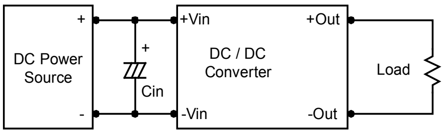
The switch can be an open collector or equivalent. A logic low is 0V to 1V. A logic high is 2.5V to 50V. The maximum sink current at on/off terminal during a logic low is -500μA. The maximum allowable leakage current of the switch at on/off terminal (2.5 to 50V) is 500μA.

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.

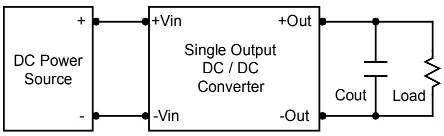
Input Source Impedance

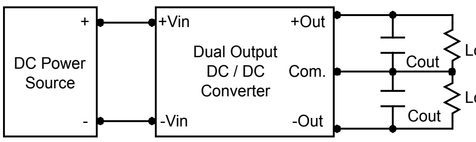
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module.
In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.
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 MJWI30 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°C. The derating curves are determined from measurements obtained in a test setup.