FEATURES

- ▶ **Industrial Standard 1" x 1" Package**
- ▶ **Wide 2:1 Input Voltage Range**
- ▶ **Fully Regulated Output Voltage**
- ▶ **I/O Isolation 1500VDC**
- ▶ **Operating Ambient Temp. Range -40°C to +90°C**
- ▶ **Low No Load Power Consumption**
- ▶ **No Min. Load Requirement**
- ▶ **Overload/Voltage and Short Circuit Protection**
- ▶ **Remote On/Off Control, Output Voltage Trim**
- ▶ **Shielded Metal Case with Insulated Baseplate**
- ▶ **Designed-in Conducted EMI meets EN55032 Class A & FCC Level A**
- ▶ **UL/cUL/IEC/EN 62368-1 (60950-1) Safety Approval & CE Marking**

PRODUCT OVERVIEW

The MINMAX MJW15 series is a new range of cost-optimized 15W isolated dc-dc converter within an encapsulated 1"x1" industrial standard package. There are 21 models available for 12, 24, 48VDC with wide 2:1 input voltage range and tight output voltage regulation. The MJW15 series come in a shielded metal package and internal EMI filter to meets EN55032 & FCC Part15 Class A without external components.
By state-of-the-art circuit topology and 91% high efficiency could be achieved allowing an operating temperature of -40℃ to +90℃ as well as low standby power comsumption. Further features include remote ON/OFF, over current and over voltage protection, short circuit protection and no min. load requirement as well. These DC/DC converters offer an economical solution for many cost critical applications in battery-powered equipment, instrumentation, distributed power architectures in communication, industrial electronics, energy facilities and many other critical space applications.

Model Selection Guide

Model Number	Input Voltage (Range)	Output Voltage	Output Current	Input Current		Reflected Ripple Current	Over Voltage Protection	Max. capacitive Load	Efficiency (typ.)
			Max.	@Max. Load	@No Load				@Max. Load
	VDC	VDC	mA	mA(typ.)	mA(typ.)	mA (typ.)	VDC	µF	%
MJW15-12S033	12 (9 ~ 18)	3.3	3400	1087	10	80	3.9	5800	86
MJW15-12S05		5	3000	1404	10		6.2	5100	89
MJW15-12S12		12	1250	1404	10		15	870	89
MJW15-12S15		15	1000	1404	10		18	560	89
MJW15-12S24		24	625	1389	10		30	220	90
MJW15-12D12		±12	±625	1404	15		±15	440#	89
MJW15-12D15		±15	±500	1389	15		±18	280#	90
MJW15-24S033	24 (18 ~ 36)	3.3	3400	544	8	50	3.9	5800	86
MJW15-24S05		5	3000	710	8		6.2	5100	88
MJW15-24S12		12	1250	694	8		15	870	90
MJW15-24S15		15	1000	694	8		18	560	90
MJW15-24S24		24	625	687	8		30	220	91
MJW15-24D12		±12	±625	694	10		±15	440#	90
MJW15-24D15		±15	±500	694	10		±18	280#	90
MJW15-48S033	48 (36 ~ 75)	3.3	3400	269	8	30	3.9	5800	87
MJW15-48S05		5	3000	355	8		6.2	5100	88
MJW15-48S12		12	1250	347	8		15	870	90
MJW15-48S15		15	1000	347	8		18	560	90
MJW15-48S24		24	625	343	8		30	220	91
MJW15-48D12		±12	±625	351	10		±15	440#	89
MJW15-48D15		±15	±500	347	10		±18	280#	90

For each output

Input Specifications

Parameter	Conditions / Model	Min.	Typ.	Max.	Unit
Input Surge Voltage (100 ms 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	---	7.5	---	
	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 LC 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	Supply Off & Nominal Vin	---	3	---	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	3.3V & 5V	---	---	±0.5	%
			12V,15V & 24V	---	---	±0.2	%
		Dual Output		---	---	±1.0	%
Load Cross Regulation (Dual Output)	Asymmetrical Load 25%/100% Full Load			---	---	±5.0	%
Minimum Load	No minimum Load Requirement						
Ripple & Noise	0-20 MHz Bandwidth	3.3V & 5V Models		---	---	75	mV_{P-P}
		12V, 15V & Dual Output Models		---	---	100	mV_{P-P}
		24V Models		---	---	150	mV_{P-P}
Transient Recovery Time	25% Load Step Change			---	300	---	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	---	%
Short Circuit Protection	Hiccup Mode 0.7 Hz typ., Automatic Recovery						

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds	1500	---	---	VDC
	1 Seconds	1800	---	---	VDC
Isolation Voltage Input/Output to case		1000	---	---	VDC
I/O Isolation Resistance	500 VDC	1000	---	---	MΩ
I/O Isolation Capacitance	100KHz, 1V	---	---	1500	pF
Switching Frequency		---	330	---	KHz
MTBF(calculated)	MIL-HDBK-217F@25℃, Ground Benign	1,489,680	---	---	Hours
Safety Approvals	UL/cUL 60950-1 recognition (UL certificate), IEC/EN 60950-1 (CB-report)				
	UL/cUL 62368-1 recognition (UL certificate), IEC/EN 62368-1 (CB-report)				

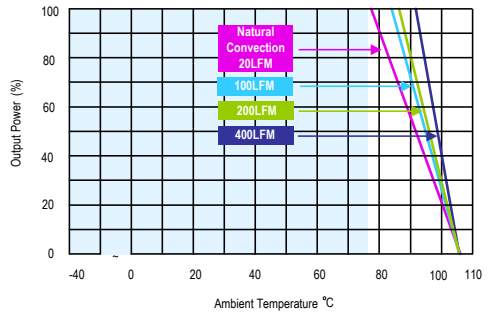
Environmental Specifications

Parameter	Conditions/Model	Min.	Max.		Unit
			without Heatsink	with Heatsink	
Operating Ambient Temperature Range Natural Convection (8) Nominal Vin, Load 100% Inom. (for Power Derating see relative Derating Curves)	MJW15-24S24, MJW15-48S24	40	+78	+82	℃
	MJW15-12S24, MJW15-12D15, MJW15-24S12 MJW15-24S15 MJW15-24D12, MJW15-24D15 MJW15-48S12, MJW15-48S15, MJW15-48D15		+75	+80	
	MJW15-48S033		+74	+79	
	MJW15-12S033, MJW15-24S033		+72	+77	
	MJW15-12S05, MJW15-12S12, MJW15-12S15 MJW15-12D12, MJW15-48D12		+71	+77	
	MJW15-24S05, MJW15-48S05		+68	+74	
Thermal Impedance	20LFM Convection without Heatsink	18.2	---		℃/W
	20LFM Convection with Heatsink	15.3	---		℃/W
	100LFM Convection without Heatsink	13.9	---		℃/W
	100LFM Convection with Heatsink	8.8	---		℃/W
	200LFM Convection without Heatsink	12.1	---		℃/W
	200LFM Convection with Heatsink	6.8	---		℃/W
	400LFM Convection without Heatsink	9.1	---		℃/W
	400LFM Convection with Heatsink	4.6	---		℃/W
Case Temperature		---	+105		℃
Storage Temperature Range		-50	+125		℃
Humidity (non condensing)		---	95		% rel. H
Cooling	Natural Convection				
RFI	Six-Sided Shielded, Metal Case				
Lead Temperature (1.5mm from case for 10Sec.)		---	260		℃

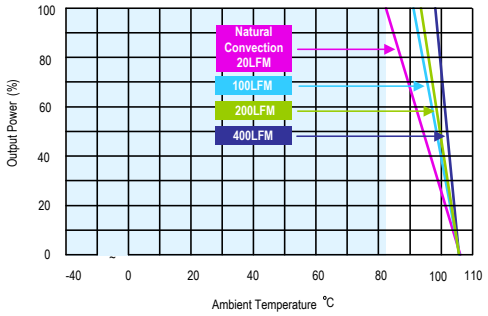
EMC Specifications

Parameter	Standards & Level		Performance
EMI	Conduction	EN55032, FCC part 15	Class A
EMS	EN55024		
	ESD	EN61000-4-2 Air± 8kV , Contact ±6kV	A
	Radiated immunity	EN61000-4-3 10V/m	A
	Fast transient (6)	EN61000-4-4 ±2kV	A
	Surge (6)	EN61000-4-5 ±1kV	A
	Conducted immunity	EN61000-4-6 10V/rms	A
	PFMF	EN61000-4-8 3A/m	A

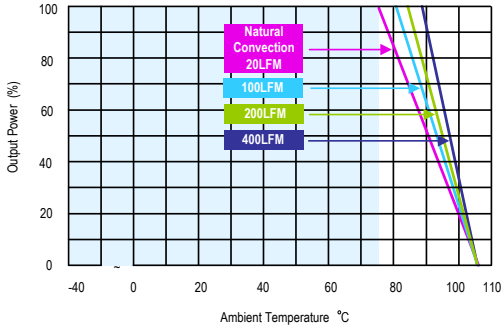
Power Derating Curve



MJW15-24S24, MJW15-48S24
Derating Curve without Heatsink



MJW15-24S24, MJW15-48S24
Derating Curve with Heatsink



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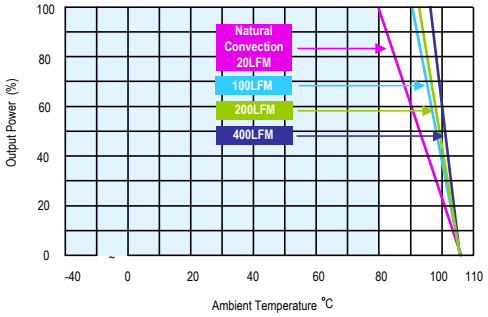
MJW15-48D15
Derating Curve without Heatsink



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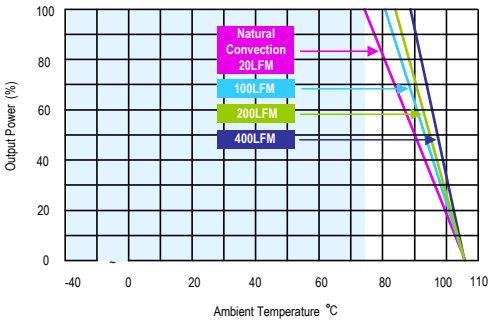
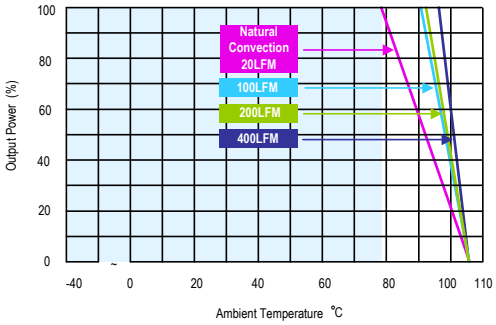
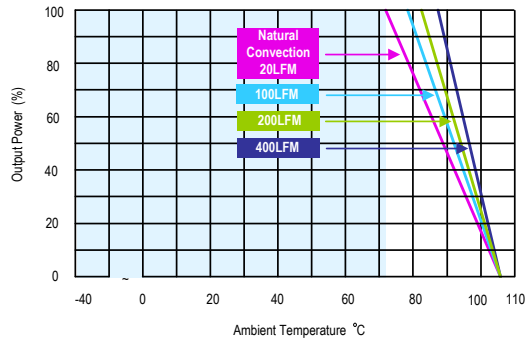
MJW15-48D15
Derating Curve with Heatsink



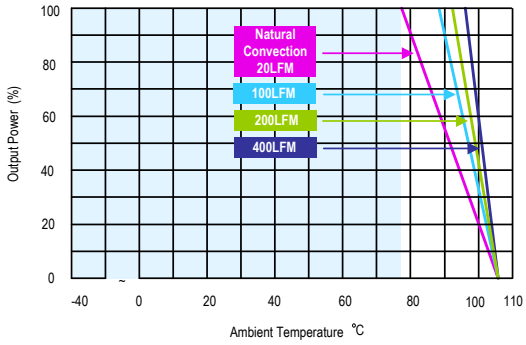
MJW15-48S033
Derating Curve without Heatsink



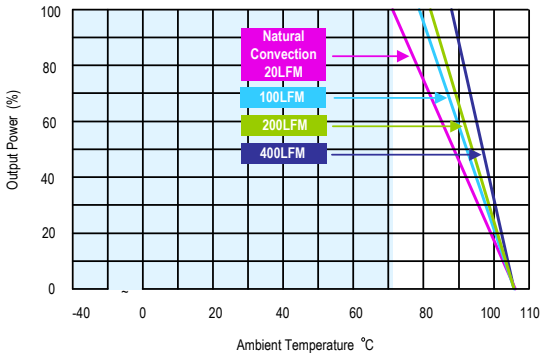
MJW15-48S033
Derating Curve with Heatsink



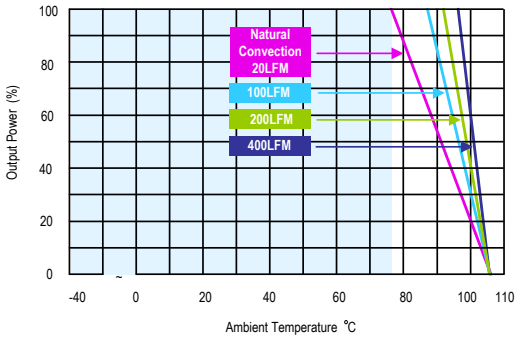
MJW15-12S033, MJW15-24S033
Derating Curve without Heatsink



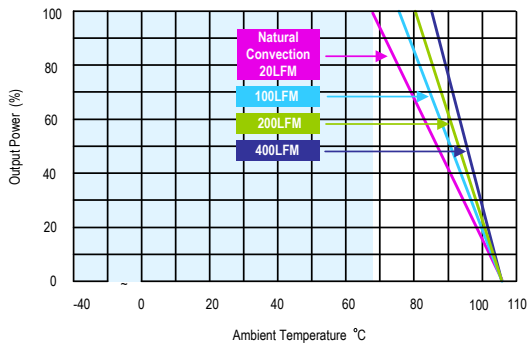
MJW15-12S033, MJW15-24S033
Derating Curve with Heatsink



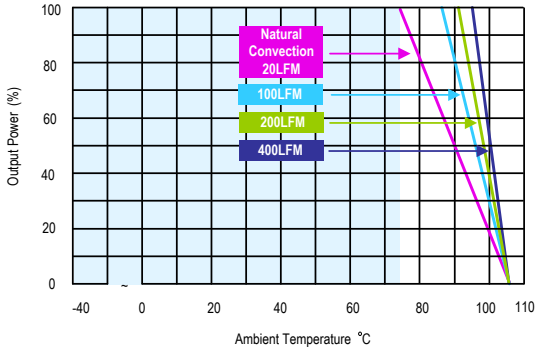
MJW15-12S05, MJW15-12S12, MJW15-12S15, MJW15-12D12, MJW15-48D12
Derating Curve without Heatsink



MJW15-12S05, MJW15-12S12, MJW15-12S15, MJW15-12D12, MJW15-48D12
Derating Curve with Heatsink



MJW15-24S05, MJW15-48S05
Derating Curve without Heatsink



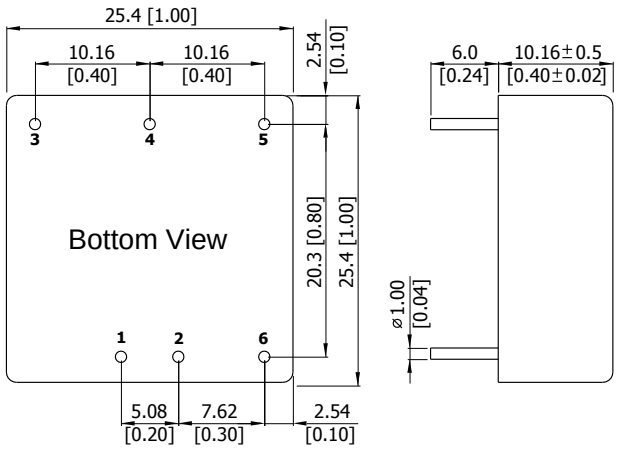
MJW15-24S05, MJW15-48S05
Derating Curve with Heatsink

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 Ripple & Noise measured with a 1μF 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 To meet EN61000-4-4 & EN61000-4-5 an external capacitor across the input pins is required.
Suggested capacitor : 12XXX, XXS033, XXS05: CHEMI-CON KY Series 470μF/100V.
Other Models: CHEMI-CON KY Series 220μF/100V.
7 That "natural convection" is about 20LFM but is not equal to still air (0 LFM).
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

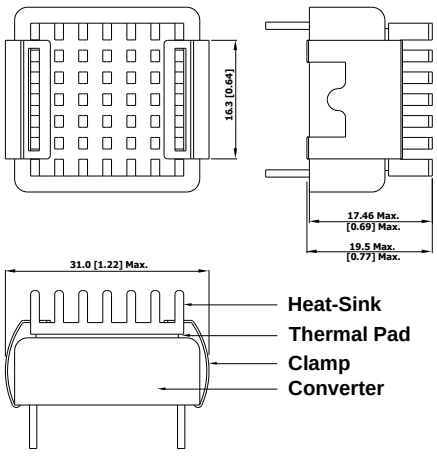
- ▶All dimensions in mm (inches)
- ▶Tolerance: X.X±0.5 (X.XX±0.02)
  X.XX±0.25 (X.XXX±0.01)
- ▶Pin diameter ∅ 1.0 ±0.05 (0.04±0.002)

Physical Characteristics

Case Size	:	25.4x25.4x10.16mm (1.0x1.0x0.4 inches)
Case Material	:	Aluminium Alloy, Black Anodized Coating
Base Material	:	FR4 PCB (flammability to UL 94V-0 rated)
Pin Material	:	Tinned Copper
Weight	:	15g

Heatsink (Option –HS)

Mechanical Dimensions



Heatsink Material: Aluminum

Finish: Anodic treatment (black)

Weight: 2g

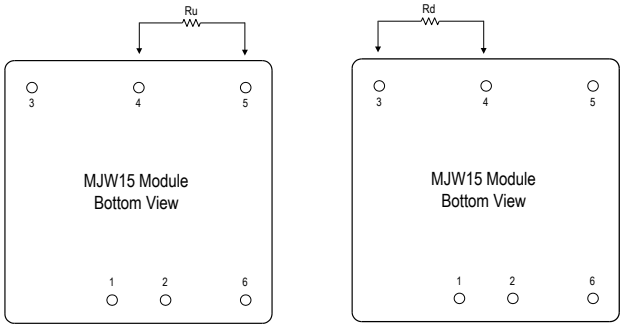
▶The advantages of adding a heatsink are:

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.

External Output Trimming

Output can be externally trimmed by using the method shown below



MJW15-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=	72.61	32.55	19.20	12.52	8.51	5.84	3.94	2.51	1.39	0.50	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=	60.84	27.40	16.25	10.68	7.34	5.11	3.51	2.32	1.39	0.65	KOhms

MJW15-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=	138.88	62.41	36.92	24.18	16.53	11.44	7.79	5.06	2.94	1.24	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=	106.87	47.76	28.06	18.21	12.30	8.36	5.55	3.44	1.79	0.48	KOhms

MJW15-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

MJW15-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

MJW15-XXS24 Trim Table

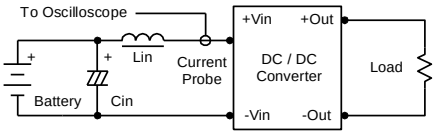
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox0.99	Vox0.98	Vox0.97	Vox0.96	Vox0.95	Vox0.94	Vox0.93	Vox0.92	Vox0.91	Vox0.90	Volts
Rd=	598.66	267.78	157.49	102.34	69.25	47.19	31.44	19.62	10.43	3.08	KOhms
Trim up	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox1.01	Vox1.02	Vox1.03	Vox1.04	Vox1.05	Vox1.06	Vox1.07	Vox1.08	Vox1.09	Vox1.10	Volts
Ru=	487.14	218.02	128.31	83.46	56.55	38.61	25.79	16.18	8.70	2.72	KOhms

Order Code Table	
Standard	With heatsink
MJW15-12S033	MJW15-12S033-HS
MJW15-12S05	MJW15-12S05-HS
MJW15-12S12	MJW15-12S12-HS
MJW15-12S15	MJW15-12S15-HS
MJW15-12S24	MJW15-12S24-HS
MJW15-12D12	MJW15-12D12-HS
MJW15-12D15	MJW15-12D15-HS
MJW15-24S033	MJW15-24S033-HS
MJW15-24S05	MJW15-24S05-HS
MJW15-24S12	MJW15-24S12-HS
MJW15-24S15	MJW15-24S15-HS
MJW15-24S24	MJW15-24S24-HS
MJW15-24D12	MJW15-24D12-HS
MJW15-24D15	MJW15-24D15-HS
MJW15-48S033	MJW15-48S033-HS
MJW15-48S05	MJW15-48S05-HS
MJW15-48S12	MJW15-48S12-HS
MJW15-48S15	MJW15-48S15-HS
MJW15-48S24	MJW15-48S24-HS
MJW15-48D12	MJW15-48D12-HS
MJW15-48D15	MJW15-48D15-HS

Test Setup

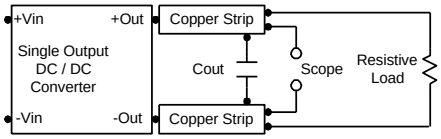
Input Reflected-Ripple Current Test Setup

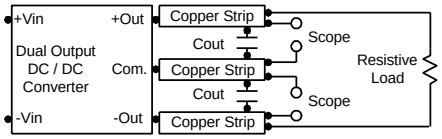
Input reflected-ripple current is measured with a inductor Lin (4.7μH) and Cin (220μF, ESR < 1.0Ω at 100 KHz) to simulate source impedance. Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 KHz.



Peak-to-Peak Output Noise Measurement Test

Use a 1μ 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 0V to 1.2V. A logic high is 3.5V to 12V. The maximum sink current at the on/off terminal (Pin 6) during a logic low is -500μA. The maximum allowable leakage current of a switch connected to the on/off terminal (Pin 6) at logic high (3.5V to 12V) is 10mA.

Overload Protection

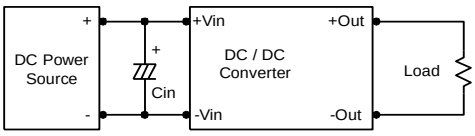
To provide hiccup mode protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure overload for an unlimited duration.

Overvoltage Protection

The output overvoltage clamp consists of control circuitry, which is independent of the primary regulation loop, that monitors the voltage on the output terminals. The control loop of the clamp has a higher voltage set point than the primary loop. This provides a redundant voltage control that reduces the risk of output overvoltage. The OVP level can be found in the output data.

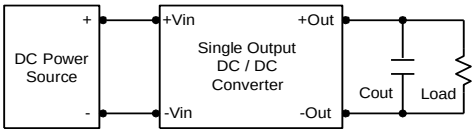
Input Source Impedance

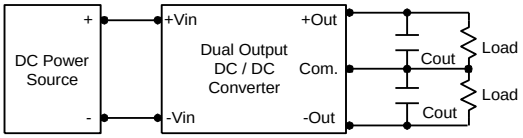
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup. 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 10μF 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 MJW15 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℃. The derating curves are determined from measurements obtained in a test setup.