Size: 1in x 2in x 0.43in (25.4mm x 50.8mm x 11mm)

FEATURES

- Ultra Wide Input Range
- I/O Isolation 3000VAC with Reinforced Insulation
- No Minimum Load Requirement
- Remote On/Off, Output Voltage Trim
- RoHS & REACH Compliant
- Over Load, Over Voltage, and Short Circuit Protection
- Railway Standard
- UL/cUL/IEC/EN 62368-1 (60950-1) Safety Approval & CE Marking

DESCRIPTION

The MRW10 series of DC/DC converters offers up to 10 watts of output power in a compact, industrial standard package. This series consists of single and dual output models with ultra-wide input voltage range. Each model in this series has high efficiency, no minimum load requirement, as well as over load, over voltage, and short circuit protection. This series has UL/cUL/IEC/EN 62368-1 (60950-1) safety approvals and CE markings.

MODEL SELECTION TABLE

Single Output Models

Model Number[1]	Input Voltage Range	Output Voltage	Max. Output Current	Input Current		Over Voltage Protection	Maximum Capacitive Load	Efficiency	Output Power
				No Load	Max. Load				
MRW10-24S05	24VDC (9~36VDC)	5VDC	2000mA	25mA	496mA	6.2VDC	2200µF	84%	10W
MRW10-24S12		12VDC	835mA		485mA	15VDC	330µF	86%	
MRW10-24S15		15VDC	670mA		481mA	18VDC	220µF	87%	
MRW10-24S24		24VDC	417mA		474mA	30VDC	100µF	88%	
MRW10-48S05	48VDC (18~75VDC)	5VDC	2000mA	15mA	245mA	6.2VDC	2200µF	85%	10W
MRW10-48S12		12VDC	835mA		240mA	15VDC	330µF	87%	
MRW10-48S15		15VDC	670mA		241mA	18VDC	220µF	87%	
MRW10-48S24		24VDC	417mA		242mA	30VDC	100µF	86%	
MRW10-110S05	110VDC (40~160VDC)	5VDC	2000mA	10mA	111mA	6.2VDC	2200µF	82%	10W
MRW10-110S12		12VDC	835mA		107mA	15VDC	330µF	85%	
MRW10-110S15		15VDC	670mA		107mA	18VDC	220µF	85%	
MRW10-110S24		24VDC	417mA		107mA	30VDC	100µF	85%	

MODEL SELECTION TABLE

Single Output Models

Model Number[1]	Input Voltage Range	Output Voltage	Max. Output Current	Input Current		Over Voltage Protection	Maximum Capacitive Load	Efficiency	Output Power
				No Load	Max. Load				
MRW10-24D12	24VDC (9~36VDC)	±12VDC	±417mA	25mA	485mA	±15VDC	150#µF	86%	10W
MRW10-24D15		±15VDC	±335mA		481mA	±18VDC	100#µF	87%	
MRW10-48D12	48VDC (18~75VDC)	±12VDC	±417mA	15mA	234mA	±15VDC	150#µF	89%	10W
MRW10-48D15		±15VDC	±335mA		238mA	±18VDC	100#µF	88%	
MRW10-110D12	110VDC (40~160VDC)	±12VDC	±417mA	10mA	106mA	±15VDC	150#µF	86%	10W
MRW10-110D15		±15VDC	±335mA		106mA	±18VDC	100#µF	86%	

SPECIFICATIONS

All specifications are based on 25°C, Resistive Load, Nominal Input Voltage, and Rated Output Current unless otherwise noted.
We reserve the right to change specifications based on technological advances.

SPECIFICATION	TEST CONDITIONS		Min	Typ	Max	Unit
INPUT SPECIFICATIONS						
Input Voltage Range	24V Input Models		9	24	36	VDC
	48V Input Models		18	48	75	
	110V Input Models		40	110	160	
Input Surge Voltage (100ms. Max)	24V Input Models		-0.7		50	VDC
	48V Input Models		-0.7		100	
	110V Input Models		-0.7		170	
Start-Up Threshold Voltage	24V Input Models				9	VDC
	48V Input Models				18	
	110V Input Models				40	
Under Voltage Shutdown	24V Input Models			7.5		VDC
	48V Input Models			16		
	110V Input Models			37		
Input Filter			Internal Pi Type			
OUTPUT SPECIFICATIONS						
Output Voltage			See Table			
Voltage Accuracy					±1.0	%Vnom
Line Regulation	Vin=Min. to Max. @ Full Load				±0.2	%
Load Regulation	Io=0% to 100%	Single Output			±0.5	%
		Dual Output			±1.0	
Voltage Balance	Dual Outputs, Balanced Loads				±2.0	%
Output Power			See Table			
Output Current			See Table			
Minimum Load			No Minimum Load Requirement			
Maximum Capacitive Load			See Table			
Ripple & Noise (20MHz bandwidth)	5V Outputs Models	Measured with 10µF/25V MLCC		50		mVp-p
	12V, 15V, ±12V, ±15V Output Models			100		
	24V Output Models	Measured with 4.7µF/50V MLCC		150		
Transient Recovery Time[2]	25% Load Step Change				300	µsec
Transient Response Deviation	25% Load Step Change			±3	±5	%
Start-Up Time (Power On)	All Models			50		mS
Temperature Coefficient					±0.02	%/ºC
Trim Up/Down Range	% of Nominal Output Voltage				±10	%
REMOTE ON/OFF CONTROL						
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			2.5		mA
PROTECTION						
Short Circuit Protection	Automatic Recovery		Hiccup Mode 0.3Hz typ.			
Over Load Protection	Hiccup Mode			150		%
Over Voltage Protection			See Table			
GENERAL SPECIFICATIONS						
Efficiency			See Table			
Switching Frequency				280		kHz
Isolation Voltage	Reinforced Insulation, Rated for 60 seconds		3000			VACrms
Isolation Resistance	500VDC		1000			MΩ
Isolation Capacitance	100KHz, 1V			1500		pF
PHYSICAL SPECIFICATIONS						
Weight			1.43oz (40.5g)			
Dimensions (L x W x H)			1in x 2in x 0.43in (25.4mm x 50.8mm x 11mm)			
Case Material			Red Copper, Powder Coating			
Base Material			FR4 PCB (Flammability to UL 94V-0 Rated)			
Pin Material			Tinned Copper			
Potting Material			Epoxy (UL94-V0)			
Insulated Frame Material			Non-Conductive Black Plastic (Flammability to UL 94V-0 Rated)			
RFI			Six Sided Shielded, Metal Case			

SPECIFICATIONS

All specifications are based on 25°C, Resistive Load, Nominal Input Voltage, and Rated Output Current unless otherwise noted.
We reserve the right to change specifications based on technological advances.

SPECIFICATION	TEST CONDITIONS		Min	Typ	Max	Unit
ENVIRONMENTAL SPECIFICATIONS						
Operating Temperature	Natural Convection, Nominal Vin, Load 100% Inom.		Min		Max. Without Heatsink / With Heatsink	Unit
		MRW10-48D12	-40		90 / 93	ºC
		MRW10-24S24, 48D15	-40		88 / 92	
		MRW10-24S15, 48S12, 48S15, 24D15	-40		87 / 90	
		MRW10-24S12, 48S24, 24D12, 110D12, 110D15	-40		85 / 89	
		MRW10-48S05, 110S12, 110S15, 110S24	-40		84 / 88	
		MRW10-24S05	-40		82 / 86	
		MRW10-110S05	-40		78 / 83	
Storage Temperature			-50		+125	ºC
Thermal Impedance	Natural Convection without Heatsink		12.1			ºC/W
	Natural Convection with Heatsink		9.8			
	100LFM Convection without Heatsink		9.2			
	100LFM Convection with Heatsink		5.4			
	200LFM Convection without Heatsink		7.8			
	200LFM Convection with Heatsink		4.5			
	400LFM Convection without Heatsink		5.2			
	400LFM Convection with Heatsink		3.0			
Humidity	Non-Condensing				95	%RH
Case Temperature					+105	ºC
Lead Temperature	1.5mm from case for 10Sec.				260	ºC
Cooling Test			Compliance to IEC/EN60068-2-1			
Dry Heat			Compliance to IEC/EN60068-2-2			
Damp Heat			Compliance to IEC/EN60068-2-30			
Shock and Vibration Test			Compliance to IEC/EN 61373			
MTBF (Calculated)	MIL-HDBK-217F@25ºC Full Load, Ground Benign		2,845,385			Hours
SAFETY CHARACTERISTICS						
Safety Approvals	UL/cUL 60950-1 Recognition (UL Certificate) IEC/EN 60950-1 (CB Report) EN 50155 IEC 60571 UL/cUL 62368-1 recognition (UL Certificate) IEC/EN 62368-1 (CB-Report)					
General	EN 50121-3-2 Railway Applications					
EMI	Conduction	EN55032, EN55022, 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 ±2kV				A
	Conducted Immunity	EN61000-4-6 10Vrms				A
	PFMF	EN61000-4-8 3A/M				A

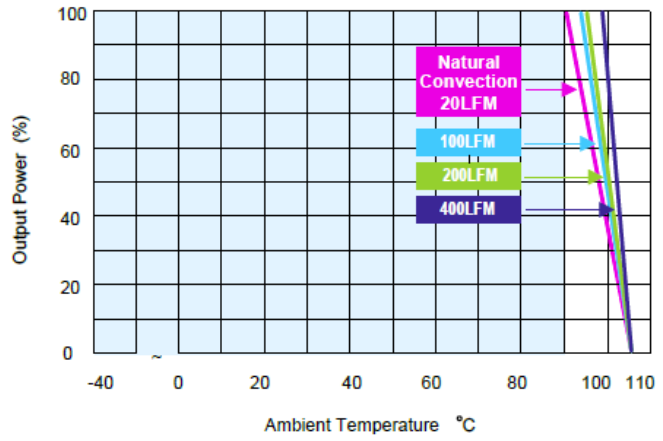
NOTES

1. Two pinning types are available. Add “A” to model number to indicate A pinning (See mechanical drawings for more detail)
Heat sink is also available. Add “HS” to model number to indicate Heatsink.
2. Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%.
3. It is recommended to protect the converter by a slow blow fuse in the input supply line.
4. Other input and output voltages may be available, please contact factory.
5. Natural convection is about 20LFM but is not equal to still air (0 LFM).
6. To meet EN61000-4-4 & EN61000-4-5 an external capacitor across the pins is required.
Suggested capacitors:
24V In: CHEMI-CON KY Series 390µF/63V
48V In: CHEMI-CON KY Series 330µF/100V
110V In: CHEMI-CON KXG Series 220µF/250V.

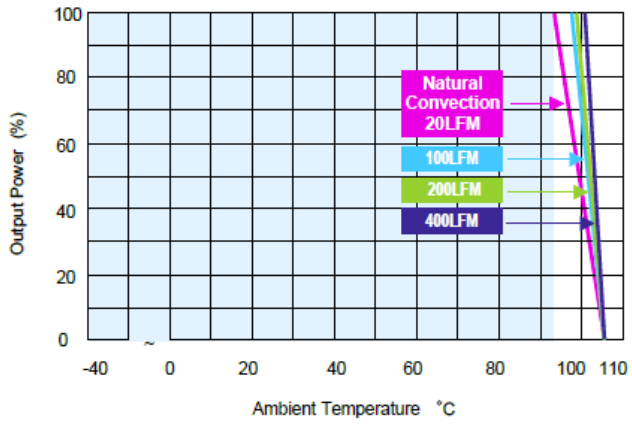
**Due to advances in technology, specifications subject to change without notice.*

DERATING CURVES

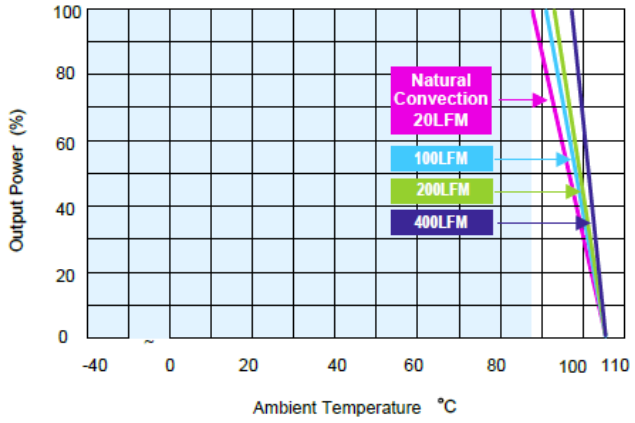
MRW10-48D12 Derating Curve without Heatsink



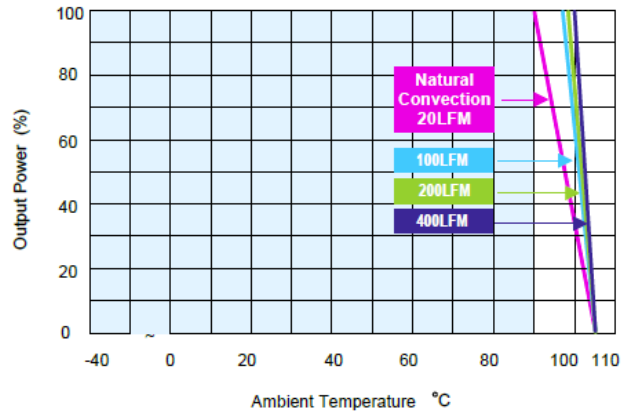
MRW10-48D12 Derating Curve with Heatsink



MRW10-24S24, 48D15
Derating Curve without Heatsink



MRW10-24S24, 48D15
Derating Curve with Heatsink



MRW10-24S15, 48S12, 48S15, 24D15
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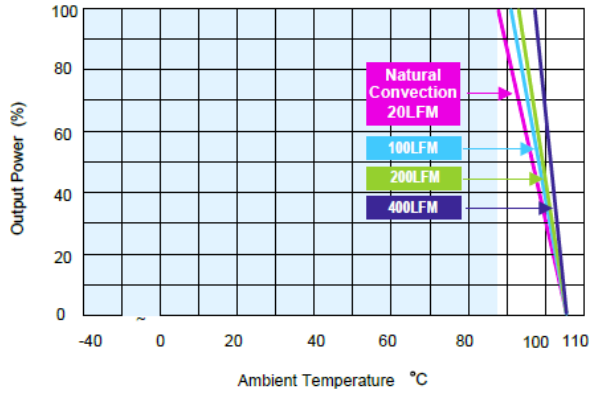

MRW10-24S15, 48S12, 48S15, 24D15
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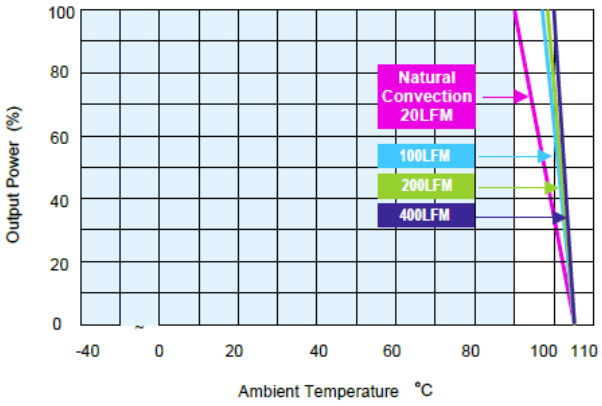
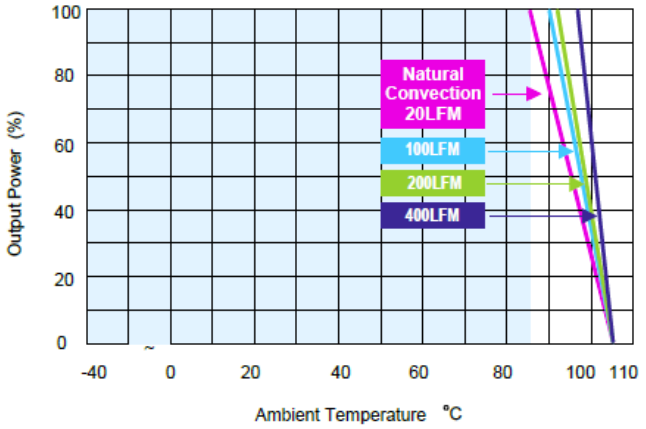
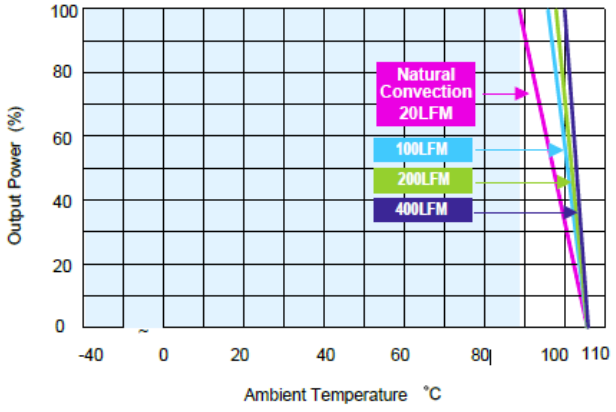


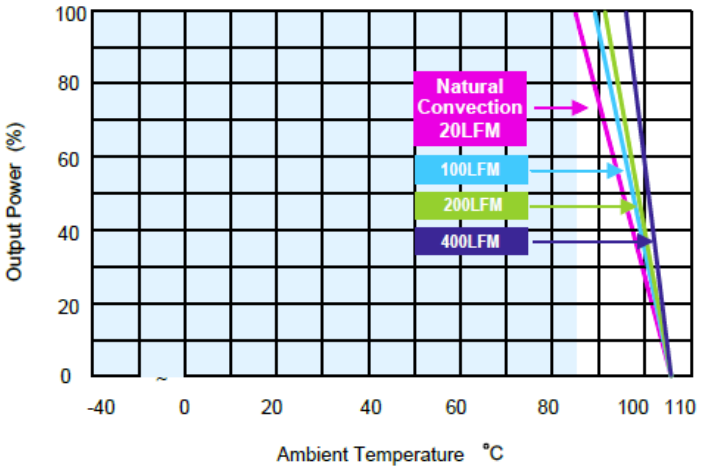
MRW10-24S12, 48S24, 24D12, 110D12, 110D15
Derating Curve without Heatsink



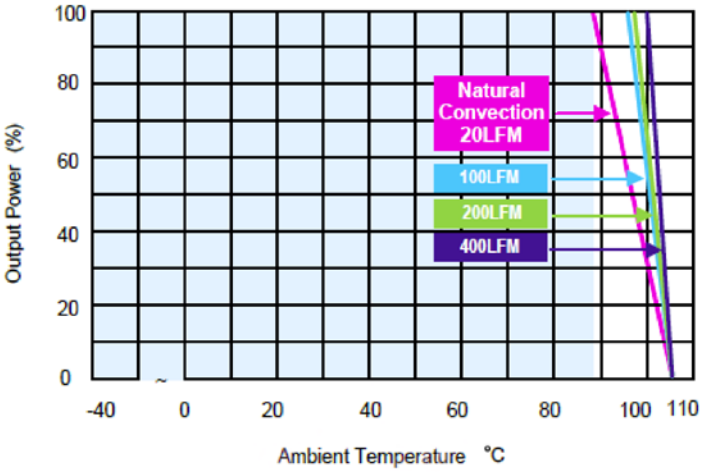
DHZ110-24S12, 48S24, 24D12, 110D12, 110D15
Derating Curve with Heatsink



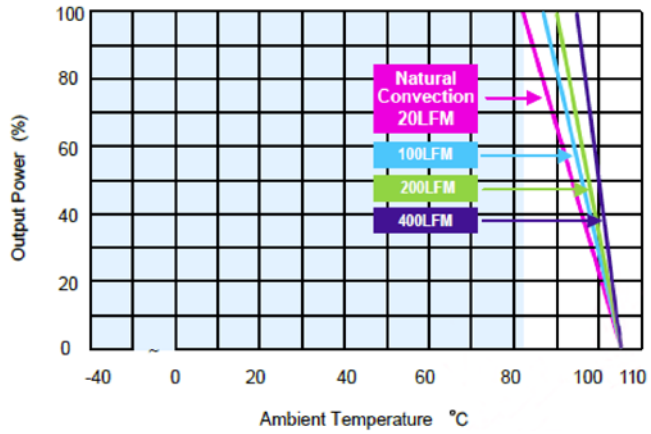
MRW10-48S05, 110S12, 110S15, 110S24
Derating Curve without Heatsink



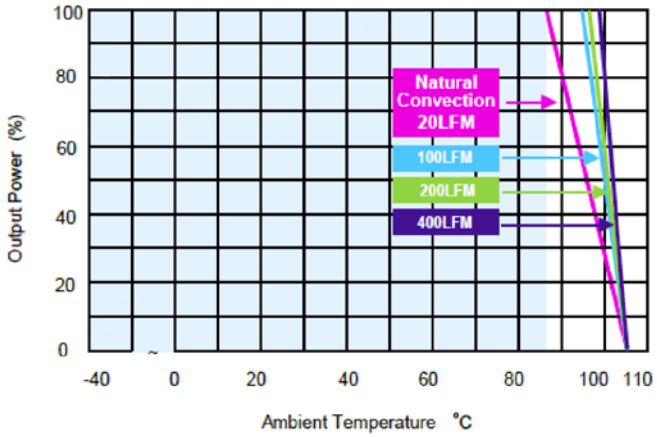
MRW10-48S05, 110S12, 110S15, 110S24
Derating Curve with Heatsink



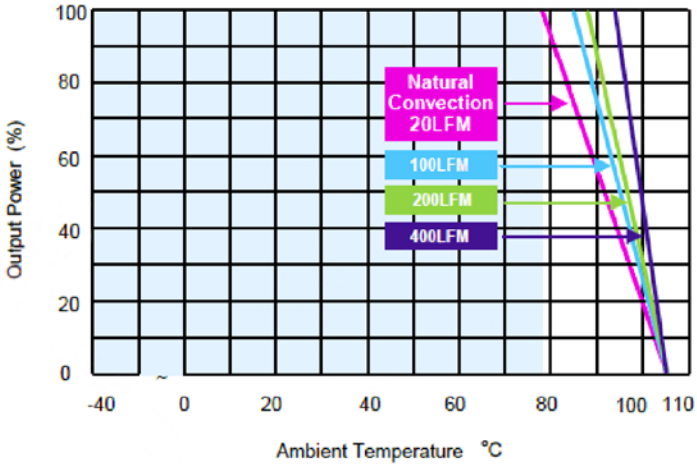
MRW10-24S05 Derating Curve without Heatsink



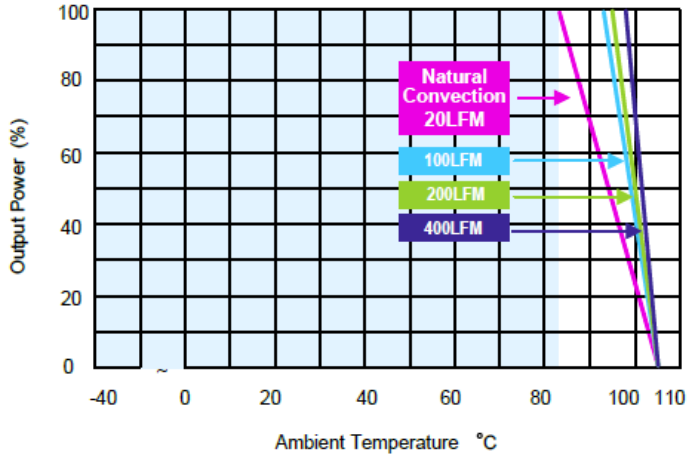
MRW10-24S05 Derating Curve with Heatsink



MRW10-110S05 Derating Curve without Heatsink

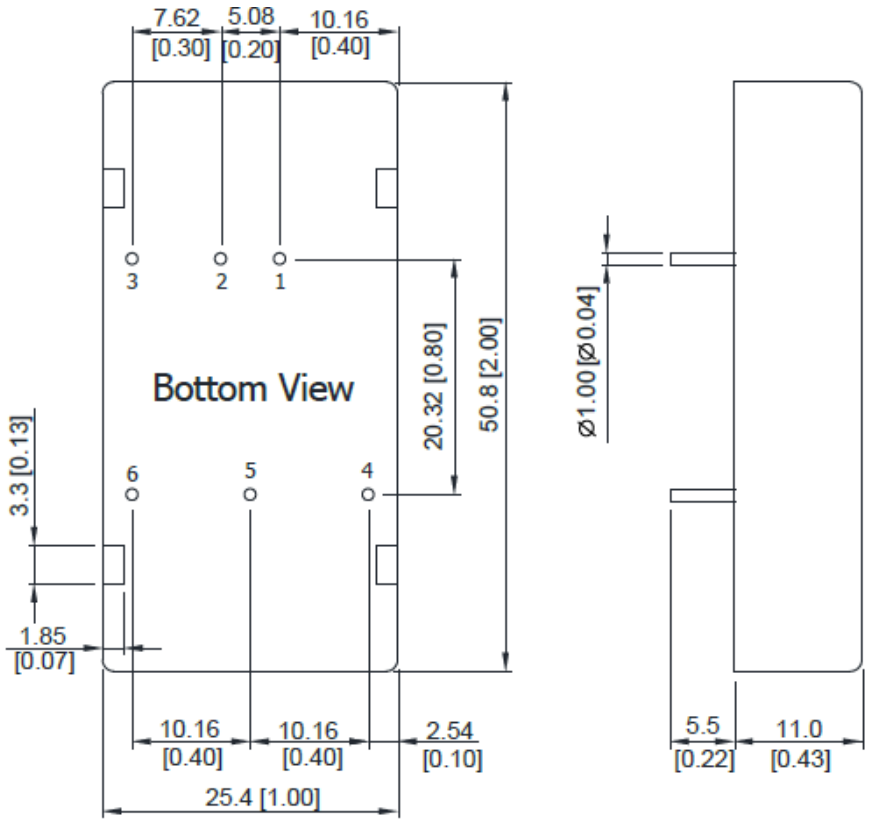


MRW10-110S05 Derating Curve with Heatsink



MECHANICAL DRAWINGS

Standard

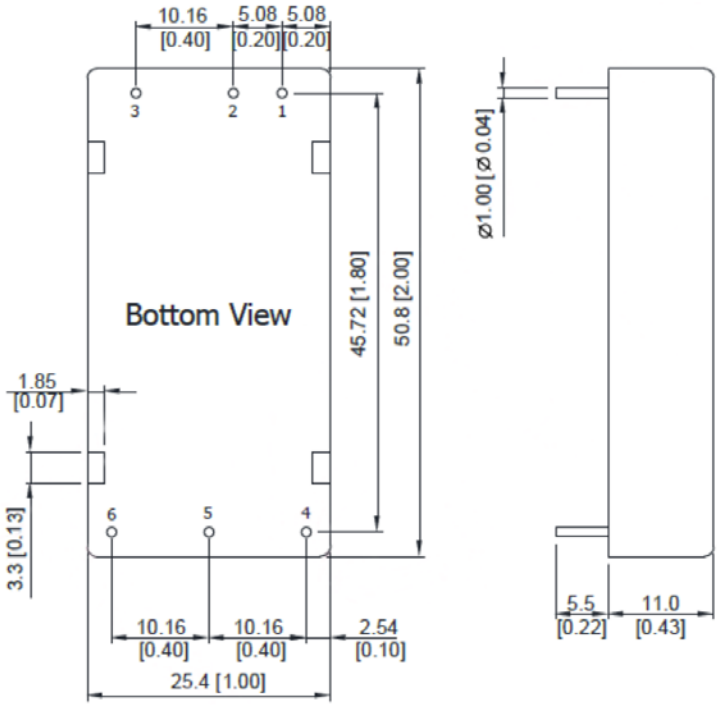


PIN CONNECTIONS

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

All dimensions in mm (inches)
Tolerance: X.X±0.75 (X.XX±0.03)
X.XX±0.25 (X.XXX±0.01)
Pin Diameter Ø1.0±0.05 (0.04±0.002)

"A" Pinning



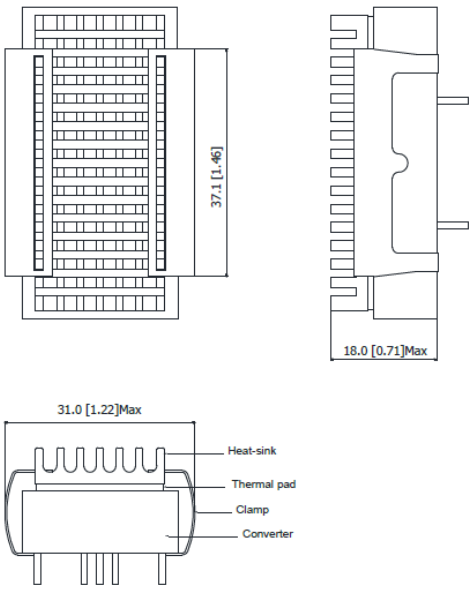
PIN CONNECTIONS

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

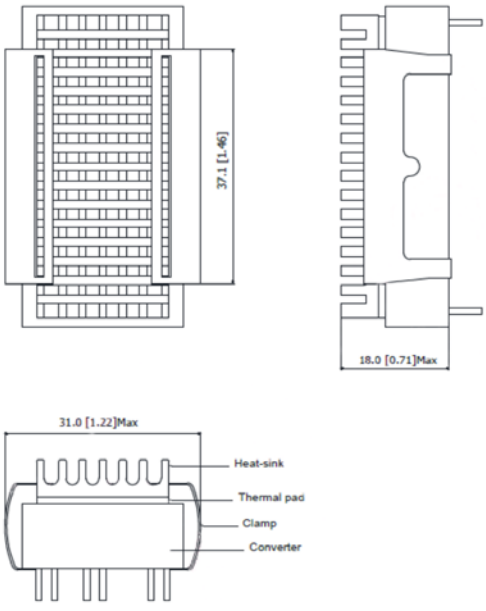
All dimensions in mm (inches)
Tolerance: X.X±0.75 (X.XX±0.03)
X.XX±0.25 (X.XXX±0.01)
Pin Diameter Ø1.0 ±0.05 (0.04±0.002)

HEATSINK OPTIONS

Standard



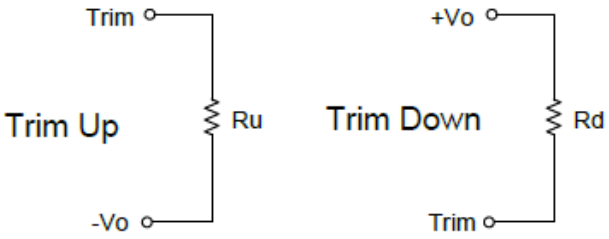
"A" Pinning



Heatsink Material: Aluminum
Finish: Black Anodized Coating
Weight: 9g
Advantages of Heatsink: Improve heat dissipation and increase stability and reliability of converter at high operating temperature.

EXTERNAL OUTPUT TRIMMING

Output can be externally trimmed by using the method shown below.



MRW10-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=	137.88	61.93	36.61	23.95	16.35	11.29	7.67	4.96	2.85	1.16	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=	108.09	48.39	28.49	18.54	12.56	8.58	5.74	3.61	1.95	0.62	KOhms

MRW10-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=	419.81	187.68	110.30	71.61	48.40	32.93	21.87	13.58	7.13	1.98	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=	344.74	154.37	90.92	59.19	40.15	27.46	18.39	11.59	6.31	2.07	KOhms

MRW10-XXS15

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=	602.92	269.91	158.91	103.41	70.10	47.90	32.05	20.15	10.90	3.50	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=	482.88	215.89	126.89	82.40	55.70	37.90	25.18	15.65	8.23	2.30	KOhms

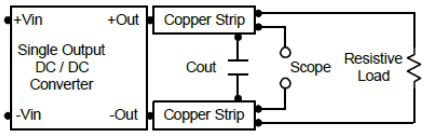
MRW10-XXS24

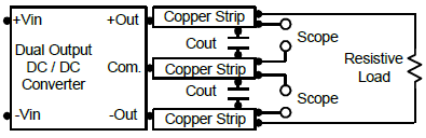
Trim Down	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox0.99	Vox0.98	Vox0.97	Vox0.96	Vox0.95	Vox0.94	Vox0.93	Vox0.92	Vox0.91	Vox0.90	Volts
Rd=	598.97	267.93	157.59	102.42	69.31	47.25	31.48	19.66	10.46	3.11	KOhms
Trim Up	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox1.01	Vox1.02	Vox1.03	Vox1.04	Vox1.05	Vox1.06	Vox1.07	Vox1.08	Vox1.09	Vox1.10	Volts
Ru=	486.83	217.87	128.21	83.38	56.49	38.56	25.75	16.14	8.67	2.69	KOhms

TEST SETUP

Peak-to-Peak Output Noise Measurement Test

Use a 1µF ceramic capacitor and a 10µF tantalum capacitor. Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20MHz. Position the load between 50mm and 75mm 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 3) during a logic low is -100µA.

Overload Protection

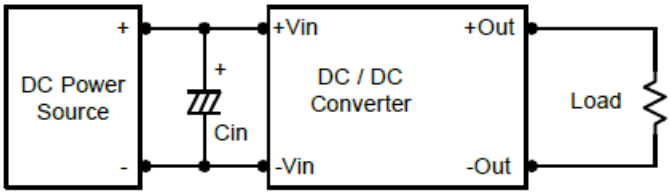
To protect hiccup mode protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure overload for an unlimited duration.

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 redundant voltage control that reduces the risk of output overvoltage. The OVP level can be found in the output data.

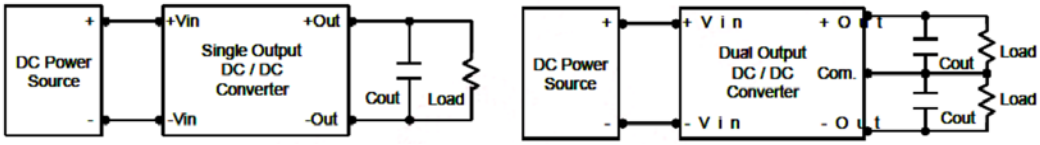
Input Source Impedance

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 100KHz) capacitor of 4.7µF for the 24V input devices, a 2.2µF for the 48V devices and a 1µF for the 110V 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.

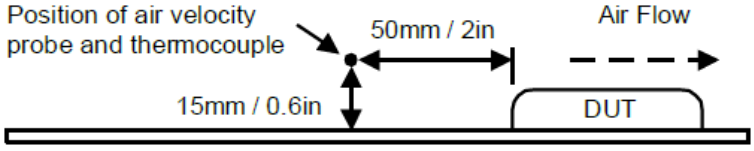


Maximum Capacitive Load

The MRW10 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 105ºC. The derating curves are determined from measurements obtained in a test setup.



COMPANY INFORMATION

Wall Industries, Inc. has created custom and modified units for over 50 years. Our in-house research and development engineers will provide a solution that exceeds your performance requirements on-time and on budget. Our ISO9001-2008 certification is just one example of our commitment to producing a high quality, well-documented product for our customers.

Our past projects demonstrate our commitment to you, our customer. Wall Industries, Inc. has a reputation for working closely with its customers to ensure each solution meets or exceeds form, fit and function requirements. We will continue to provide ongoing support for your project above and beyond the design and production phases. Give us a call today to discuss your future projects.

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