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

FEATURES

- Ultra-Wide Input Range
- Railway Certified
- No Min. Load Requirement
- Remote On/Off
- RoHS & REACH Compliant
- High Efficiency
- Over Current, Over Voltage, and Short Circuit Protection
- 2 Pin Specifications Available
- Heatsink Available
- UL/cUL/IEC/EN 62368-1 (60905-1) Safety Approvals & CE Marking

DESCRIPTION

The MRW20 series of DC/DC converters offers up to 20 watts of output power in an ultra-compact 2” x 1” x 0.43” industry standard package. This series consists of single and dual output models with ultra-wide input range, high efficiency, and no minimum load requirements. Each model in this series is RoHS & REACH compliant, has over current, over voltage, and short circuit protection, and has two pin specifications available as well as optional heatsink. This series has UL/cUL/IEC/EN62368-1 (60950-1) safety approvals and CE marking.

MODEL SELECTION TABLE

Single Output Models

Model Number[1]	Input Voltage Range	Output Voltage	Output Current	Input Current		Ripple & Noise	Maximum Capacitive Load	Efficiency	Over Voltage Protection	Output Power
				No Load	Max Load					
MRW20-24S05	24VDC (9~36VDC)	5VDC	4000mA	25mA	958mA	50mVp-p	6800µF	87%	6.2VDC	20W
MRW20-24S12		12VDC	1670mA		960mA	100mVp-p	1200µF	87%	15VDC	
MRW20-24S15		15VDC	1330mA		955mA	100mVp-p	750µF	87%	18VDC	
MRW20-24S24		24VDC	833mA		957mA	150mVp-p	300µF	87%	30VDC	
MRW20-48S05	48VDC (18~75VDC)	5VDC	4000mA	15mA	479mA	50mVp-p	6800µF	87%	6.2VDC	20W
MRW20-48S12		12VDC	1670mA		474mA	100mVp-p	1200µF	88%	15VDC	
MRW20-48S15		15VDC	1330mA		472mA	100mVp-p	750µF	88%	18VDC	
MRW20-48S24		24VDC	833mA		473mA	150mVp-p	300µF	88%	30VDC	
MRW20-110S05	110VDC (40~160VDC)	5VDC	4000mA	10mA	216mA	50mVp-p	6800µF	84%	6.2VDC	20W
MRW20-110S12		12VDC	1670mA		212mA	100mVp-p	1200µF	86%	15VDC	
MRW20-110S15		15VDC	1330mA		211mA	100mVp-p	750µF	86%	18VDC	
MRW20-110S24		24VDC	833mA		211mA	150mVp-p	300µF	86%	30VDC	

MODEL SELECTION TABLE

Dual Output Models

Model Number[1]	Input Voltage Range	Output Voltage	Output Current	Input Current		Ripple & Noise	Maximum Capacitive Load[2]	Efficiency	Over Voltage Protection	Output Power
				No Load	Max Load					
MRW20-24D12	24VDC (9~36VDC)	±12VDC	±833mA	25mA	969mA	100mVp-p	600#µF	86%	±15VDC	20W
MRW20-24D15		±15VDC	±667mA		969mA	100mVp-p	380#µF	86%	±18VDC	
MRW20-48D12	48VDC (18~75VDC	±12VDC	±833mA	15mA	479mA	100mVp-p	600#µF	87%	±15VDC	20W
MRW20-48D15		±15VDC	±667mA		479mA	100mVp-p	380#µF	87%	±18VDC	
MRW20-110D12	110VDC (40~160VDC)	±12VDC	±833mA	10mA	211mA	100mVp-p	600#µF	86%	±15VDC	20W
MRW20-110D15		±15VDC	±667mA		212mA	100mVp-p	380#µF	86%	±18VDC	

SPECIFICATIONS

All specifications are based on 25°C, Nominal Input Voltage, Resistive Load, 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	
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 Surge Voltage (100ms. Max.)	24V Input Models		-0.7		50	VDC
	48V Input Models		-0.7		100	
	110V Input Models		-0.7		170	
Input Filter	All Models		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 BW)	5V Model	Measured with a 10µF/25V MLCC		50		mVp-p
	12V, 15V, ±12V, ±15V Models			100		
	24V Model	Measured with a 4.7µF/50V MLCC		150		
Transient Recovery Time[3]	25% Load Step Change				300	µsec
Transient Response Deviation	25% Load Step Change			±3	±5	%
Trim Up/Down Range	% of Nominal Output Voltage				±10	%
Start-Up Time	All Models			50		mS
Temperature Coefficient					±0.02	%/ºC
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 0.7Hz typ.			
Over Load Protection	Hiccup			150		%
Over Voltage Protection			See Table			
GENERAL SPECIFICATIONS						
Typ. Efficiency	@Max Load.		See Table			
Switching Frequency				320		KHz
Isolation Voltage	Rated for 60 Seconds	I/O, Reinforced Isolation	3000			VACrms
		Input/Output to Case	1500			
Isolation Resistance	500VDC		1000			MΩ
Isolation Capacitance	100KHzm 1V			1500		pF
PHYSICAL SPECIFICATIONS						
Weight			1.43oz (40.5g)			
Dimensions (L x W x H)	Standard Case, “A” Pinning (-A Suffix)		2in x 1in x 0.43in (50.8mm x 25.4mm x 11mm)			
	Heatsink (-H Suffix)		2in x 1.22in x 0.71in (50.8mm x 31mm x 18mm)			
Case Material			Red Copper, Powder Coating			
Base Material			FR4 PCB (flammability to UL 94V-0 rated)			
Potting Material			Epoxy (flammability to UL 94V-0 rated)			
Insulated Frame Material			Non-Conductive Black Plastic (Flammability to UL 94V-0 rated)			
Pin Material			Tinned Copper			
RFI			Six-Sided Shielded, Metal Case			

SPECIFICATIONS

All specifications are based on 25°C, Nominal Input Voltage, Resistive Load, 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[4]				Min.	Max w/out Heatsink	Max. with Heatsink	Unit
	Natural Convection, Nominal Vin, Load 100% Inom	MRW20-48S12, MRW20-48S15, MRW20-48S24		-40	72	78	ºC
		MRW20-24S05, MRW20-24S12, MRW20-24S215, MRW20-24S24, MRW20-48S05, MRW20-48D12, MRW20-48D15			69	76	
		MRW20-24D12, MRW20-24D15, MRW20-110S12, MRW20-110S15, MRW20-110S24, MRW20-110D12, MRW20-110D15			66	73	
		MRW20-110S05			59	68	
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 without Heatsink			3.0			
Case Temperature					+105		ºC
Operating Humidity	Non-Condensing				95		%RH
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 & Vibration Test				Compliance to IEC/EN61373			
MTBF (Calculated)	MIL-HDBK-217F@25ºC Full Load, Ground Benign			665.100			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 EMC Specifications	Compliance with 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/3				A
	Fast Transient	EN61000-4-4	±2kV				A
	Surge	EN61000-4-5	±2kV				A
	Conducted Immunity	EN61000-4-6	10Vrms				A
	PFMF	EN61000-4-8	3A/M				A

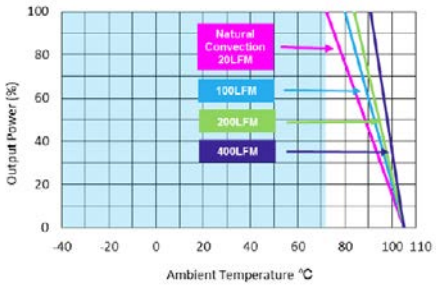
NOTES

1. To indicate “A” type pinning, add –A suffix to model number. Ex. MRW20-24S05-A
   To indicate heatsink, add –H suffix to model number. Ex. MRW20-24S05-H
   To indicate both “A” type pinning and Heatsink, add –AH to model number. Ex. MRW20-24S05-AH
2. # for each output
3. Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%.
4. Natural Convection is about 20LFM but is not equal to still air (0LFM).
5. To meet EN61000-4-4 & EN61000-4-5 an external capacitor across the input pins is required.
   Suggested Capacitors:
   24V Input Models: CHEMI-CON KY Series 390µF/63V
   48V Input Models: CHEMI-CON KY Series 330µF/100V
   110V Input Models: CHEMI-CON KXJ Series 390µF/200V
6. Other input and output voltages may be available, please contact factory.
7. It is recommended to protect the converter by a slow blow fuse in the input supply line.

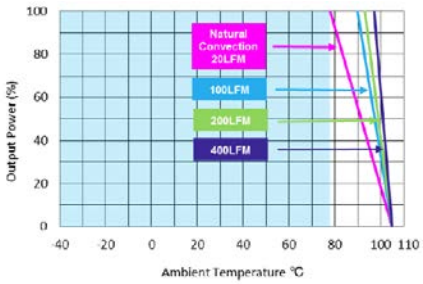
**Due to advances in technology, specifications subject to change without notice.*

DERATING CURVES

MRW20-48S12, MRW20-48S15, MRW20-48S24
Derating Curve without Heatsink



MRW20-48S12, MRW20-48S15, MRW20-48S24
Derating Curve with Heatsink



MRW20-24S05, MRW20-24S12, MRW20-24S15, MRW20-24S24,
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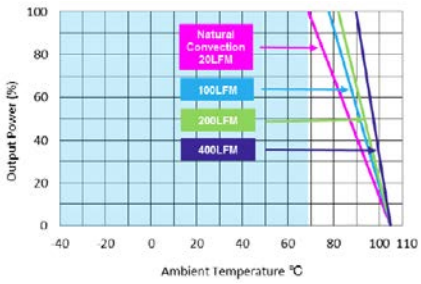
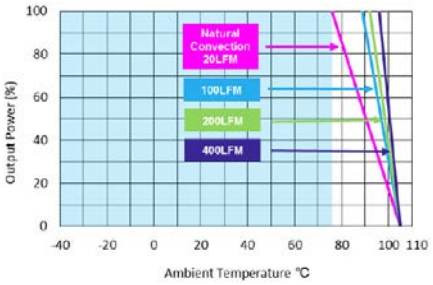
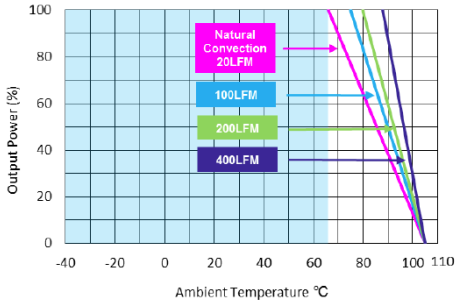
Derating Curve without Heatsink



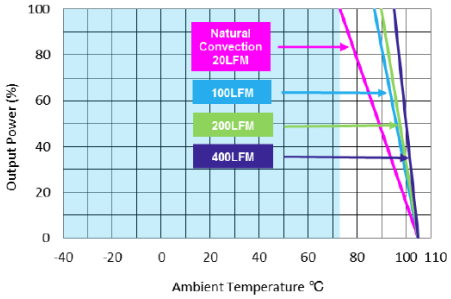
MRW20-24S05, MRW20-24S12, MRW20-24S15, MRW20-24S24,
MRW20-48S05, MRW20-48D12, MRW20-48D15
Derating Curve with Heatsink



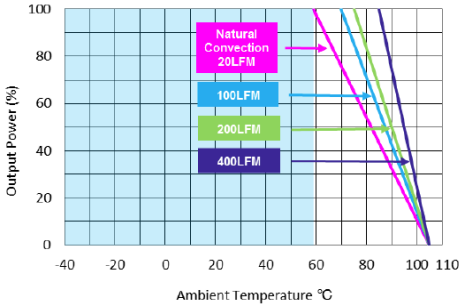
MRW20-24D12, MRW20-24D15, MRW20-110S12, MRW20-110S15,
MRW20-110S24, MRW20-110D12, MRW20-110D15
Derating Curve without Heatsink



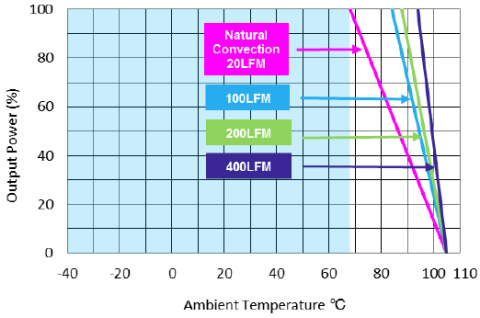
MRW20-24D12, MRW20-24D15, MRW20-110S12, MRW20-110S15,
MRW20-110S24, MRW20-110D12, MRW20-110D15
Derating Curve with Heatsink



MRW20-110S05 Derating Curve without Heatsink

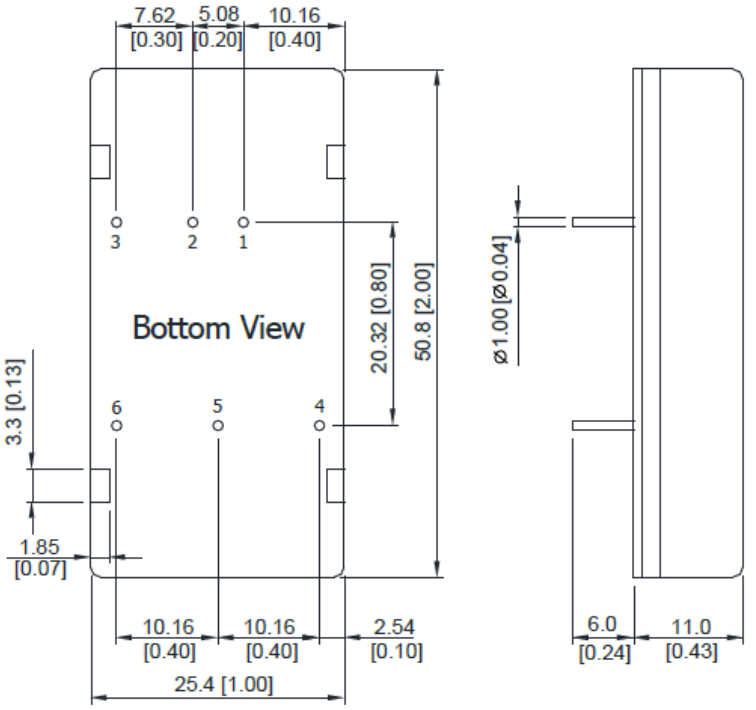


MRW20-110S05 Derating Curve with Heatsink



MECHANICAL DRAWINGS

Standard Package

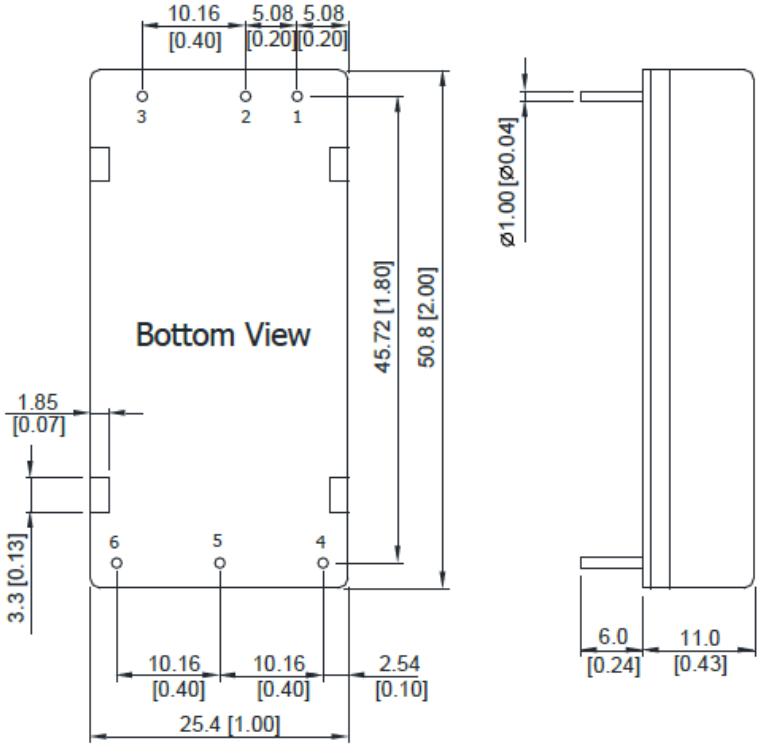


Pin Connections

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

Notes:
All dimensions in mm (inches)
Tolerance: X.X±0.75 (X.XX±0.03)
X.XX±0.25 (X.XXX±0.01)
Pin Diameter Ø 1.0±0.05 (0.04±0.002)

"A" Pinning Option (-A Suffix)

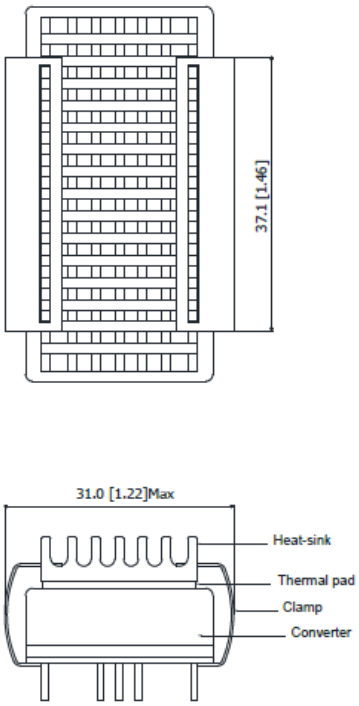


Pin Connections

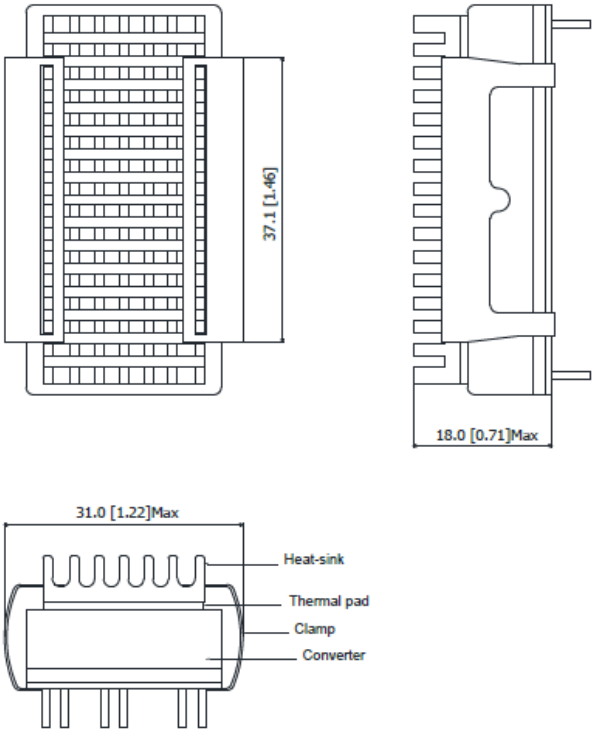
Pin	Single Output	Dual Output
1	+Vin	+Vin
2	-Vin	-Vin
3	Remote On/Off	Remote On/Off
4	+Vout	+Vout
5	-Vout	Common
6	Trim	-Vout

Notes:
All dimensions in mm (inches)
Tolerance: X.X±0.75 (X.XX±0.03)
X.XX±0.25 (X.XXX±0.01)
Pin diameter Ø 1.0±0.05 (0.04±0.002)

Heatsink Option (-H Suffix)



"A" Pinning Option with Heatsink



Physical Characteristics

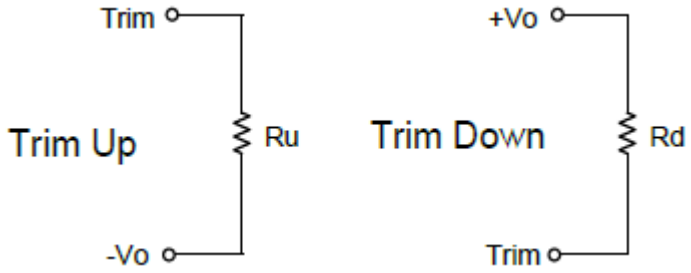
Heatsink Material: Aluminum
Finish: Black Anodized Coating
Weight: 0.32oz (9g)

Advantages of Heatsink:

1. Improve heat dissipation and increase stability/reliability of DC/DC converter 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 method shown below:



5V Models

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=	156.81	70.69	41.99	27.64	19.03	13.29	9.18	6.11	3.72	1.80	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
Rd=	119.77	53.70	31.67	20.66	14.05	9.65	6.50	4.14	2.31	0.84	KOhms

12V Models

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
Rd=	344.74	154.37	90.92	59.19	40.15	27.46	18.39	11.59	6.31	2.07	KOhms

15V Models

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
Rd=	482.88	215.89	126.89	82.40	55.70	37.90	25.18	15.65	8.23	2.30	KOhms

24V Models

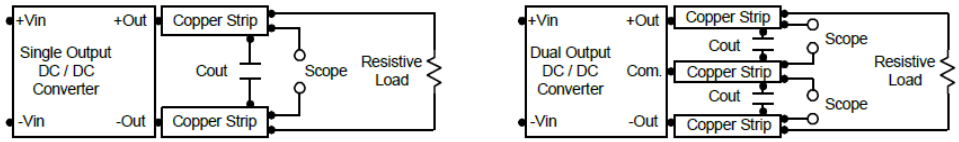
Trim Down	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox0.99	Vox0.98	Vox0.97	Vox0.96	Vox0.95	Vox0.94	Vox0.93	Vox0.92	Vox0.91	Vox0.90	Volts
Rd=	598.97	267.93	157.59	102.42	69.31	47.25	31.48	19.66	10.46	3.11	KOhms

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
Rd=	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

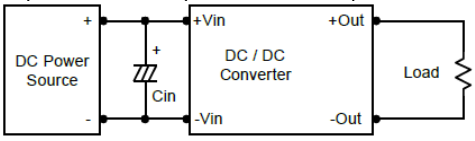
To provide hiccup mode protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure overload for an unlimited duration.

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 data sheet.

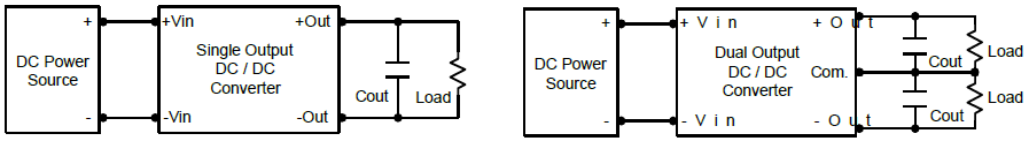
Input Source Impedance

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 a 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.

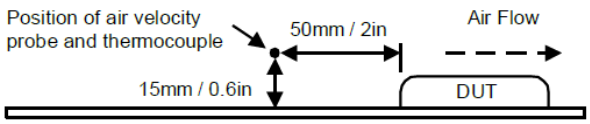


Maximum Capacitive Load

This 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 the measurements obtained in a test setup.



MODEL NUMBER SETUP

MRW	20	-	24	S	05	-	A	H
Series Name	Output Power		Input Voltage	Output Quantity	Ouptut Voltage		Pinning Option	Heatsink
			24: 9~36VDC **48:** 18~75VDC **110:** 40~160VDC	**S:** Single **D:** Dual	**05:** 5VDC **12:** 12VDC **15:** 15VDC **24:** 24VDC **12:** ±12VDC **15:** ±15VDC		**A:** A Pinning	**H:** Heatsink **AH:** A Pinning w/ Heatsink

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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