

## Features

- Wide 2 : 1 Input Voltage Range(9~18V,18~36V,36~75V)
- Input / Output Isolation Voltage: 1.5kVDC
- High Efficiency
- High Power Density
- Extended Operating Temperature Range: -55°C to+95°C
- Output Short Circuit Protection:  
Continuous & Auto Recovery
- Over Voltage Protection: Clamp Mode
- Fixed Switching Frequency
- Shielded Metal Case with Insulated Baseplate
- Lead Free Design, RoHS Compliant
- Industry Standard Pinout
- Customer Design Available
- Meet Safety Standard : IEC / EN60950-1



## Description

The MRD5 Series are isolated 5W DC/DC converters. Designed with highly efficiency, allow the operating temperature range of these units to be -55°C to +95°C in a DIP package with industry-standard footprint. Further features include wide 2 : 1 input voltage range, remote on/off control, short-circuit protection and over voltage protection.

## Applications

These converters are well suitable for battery operated equipment, measurement equipment, telecom, wireless network, Industry control system, everywhere where isolated, tightly regulated voltages and compact size are required.

## Technical Specification

All specifications are typical at nominal input, full load and 25°C unless otherwise stated.

Model Number	Input Voltage Range	Output Voltage (Vdc)	Output Current (mA)		Input Current (mA)		Eff. <sup>(2)</sup> (%)	Capacitive Load, max. <sup>(3)</sup> (uF)
			Min. Load <sup>(1)</sup>	Full. Load	No Load	Full Load		
MRD5-12S1	9~18V Nominal:12Vdc	5	0	1000	17	555	79	1000
MRD5-12S2		12	0	416	21	527	83	220
MRD5-12D3		±15	0	±167	27	543	81	47
MRD5-24S1	18~36V Nominal:24Vdc	5	0	1000	9	278	79	1000
MRD5-24S2		12	0	416	12	267	82	200
MRD5-24D3		±15	0	±167	15	268	82	47
MRD5-48S1	36~75V Nominal:48Vdc	5	0	1000	5	139	79	1000
MRD5-48S2		12	0	416	7	134	82	133
MRD5-48D3		±15	0	±167	8	134	82	47

**Input Specifications**

Input Voltage	12V nominal input	9-18V
	24V nominal input	18-36V
	48V nominal input	36-75V
Input filter		Pi Type
Input surge voltage (100ms max.)	12V nominal input	25V
	24V nominal input	50V
	48V nominal input	100V
Input reflected ripple current	Nominal Vin and full load	70mA <sub>p-p</sub> typ.
Start up time	Nominal Vin and constant resistive load	1300ms typ.
Reverse voltage protection		1.0A max

**Environmental Specifications**

Operating ambient temperature	-55°C to +95°C (with derating)	
Maximum case temperature	+100°C	
Storage temperature range	-55°C to +125°C	
Relative humidity	5% to 95% RH	
Temperature coefficient	±0.02% / °C max.	

**Output Specifications**

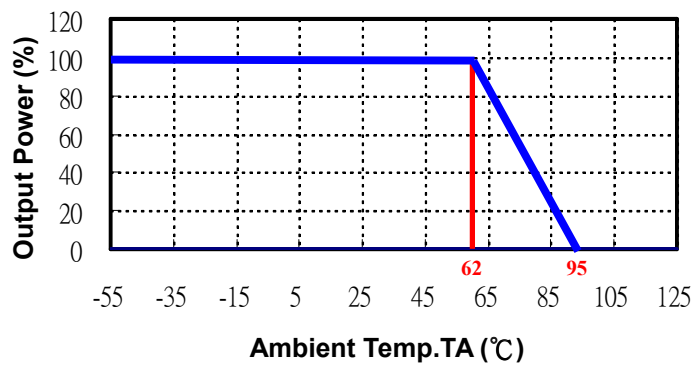
Output power	5 Watts max.		
Voltage accuracy	Full load and nominal Vin	±1%	
Minimum load	See table		
Line regulation	LL to HL at full load	±0.8%	
	25% load to full load	Single	±1.0%
	Balanced load	Dual	±1.0%
Load Regulation	Unbalanced load 25% to 100% full load		±5%
Ripple and Noise	20MHz bandwidth	75mV <sub>p-p</sub> max.	
Over voltage protection (Zener Diode Clamp)	5V <sub>out</sub> models	6.2V	
	12V <sub>out</sub> models	15V	
	15V <sub>out</sub> models	18V	
Capacitive load	See table		
Over load protection	% of full load at nominal input	150% typ.	
Short circuit protection	Continuous, automatic recovery		
Transient response settling time	50% load step change	1300us typ.	
Transient response over shoot	di/dt=0.8A/μs	≤ ±5% of V <sub>o</sub>	

**General Specifications**

Efficiency	Nominal input	See table
Isolation voltage	Input to output	1500VDC
Isolation resistance	500VDC	10 <sup>9</sup> Ohms min.

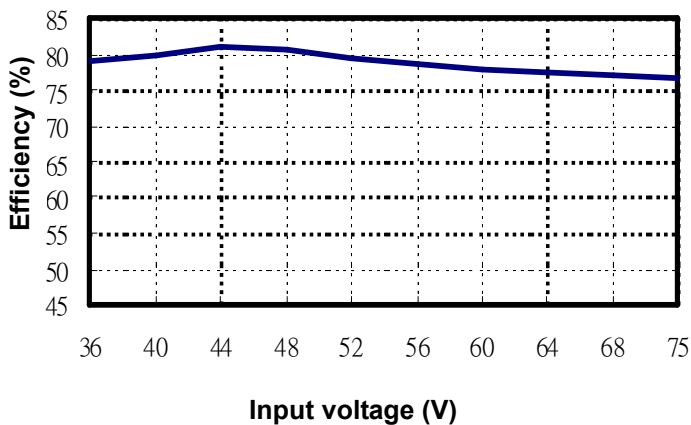
Isolation capacitance	580pF typ.	
Switching frequency	Pulse width modulation (PWM)	300kHz typ.
Reliability, calculated MTBF	1.19× 10 <sup>6</sup> Hrs	
<b>Physical Specifications</b>		
Case material	Nickel-coated copper	
Base material	Non-conductive black plastic	
Potting material	Silicon rubber (UL94V-0)	
Dimensions	1.0 × 1.0 × 0.4 Inch (25.4 × 25.4 × 10.2 mm)	
Weight	17.4g (0.62oz) typ.	

**Power Derating Curve**



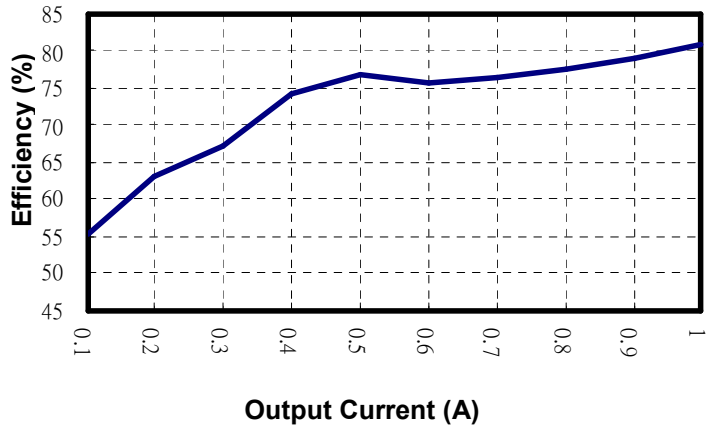
**MRD5-48S1**

**Input voltage vs. Efficiency**



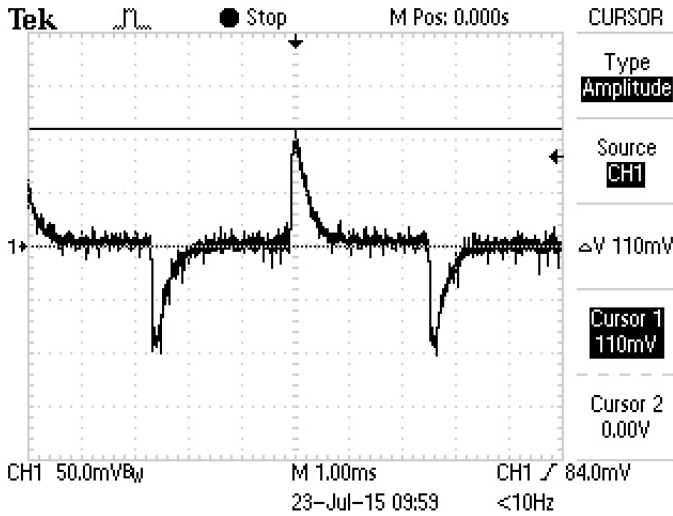
**MRD5-48S1**

**Output Current vs. Efficiency**



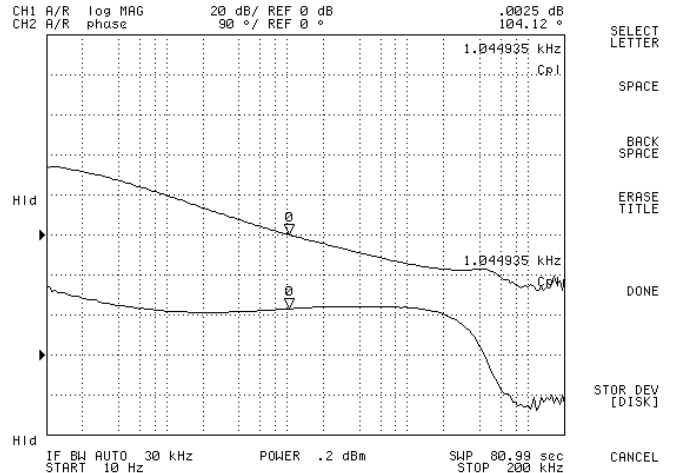


MRD5-48S1



Transient Response at 50%~100% Max Load

MRD5-48S1

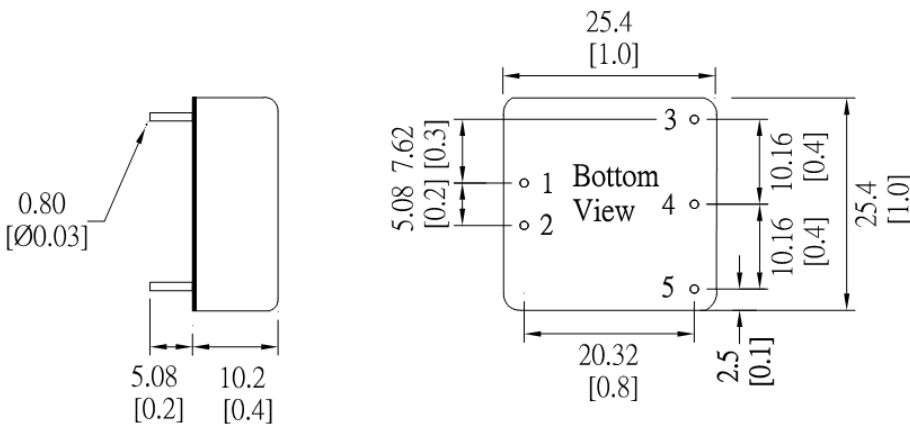


Loop Gain & Phase at Vi=48V, Full Load

**Note**

1. Io below this value will not damage these converters, however, they may not meet all listed specifications.
2. Typical value, tested at nominal input and full load.
3. For each output.

**Mechanical Dimensions**



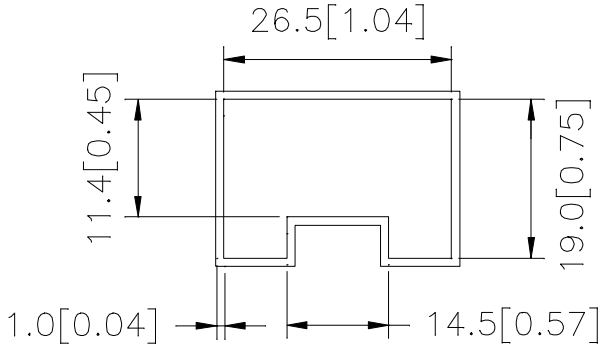
Pin Assignment		
Pin	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	No pin	Common
5	-Vout	-Vout

Unit: mm [inch]  
Tolerance:±0.5[0.02]

Specifications subject to change without notice.



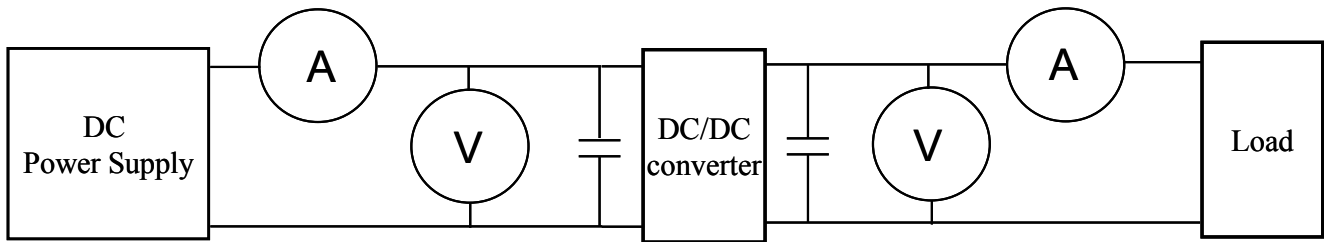
**Package Information**



PS:  
 Unit: mm [inch]  
 L= 285 mm[11.22 inch] ; ONE TUBE = 10 PCS

**Test Configurations**

All specifications are typical at nominal input, full load and 25°C unless otherwise stated.



- ⊙DC Power Supply: It offers a wide voltage and current range precisely.
- ⊙Current meter (A): Accuracy → 200μA ~ 200mA 4 ranges ±(0.2% rdg + 2 digits)  
 2000mA ~ 20A 2 ranges ±(0.3% rdg + 2 digits).
- ⊙Voltage meter (V): Accuracy → ±(0.03% rdg + 4 digits).
- ⊙Load: At full load.
- ⊙Wires: The resistance of the wires must be small.

1. Input voltage range: Narrow input voltage range (±10%)、wide input voltage range (2:1 and 4:1)。

- EX: Narrow input voltage range (±10%)
  - 5V nominal input → 4.5~5.5V
  - 12V nominal input → 10.8~13.2V
  - 24V nominal input → 21.6~26.4V
- Wide input voltage range 2:1
  - 5V nominal input → 4.5~9V
  - 12V nominal input → 9~18V
  - 24V nominal input → 18~36V
  - 48V nominal input → 36~75V
- Wide input voltage range 4:1 (W)
  - 24V nominal input → 9~36V
  - 48V nominal input → 18~75V



2. Input power :

$$P_{in} = V_{in} \times I_{in}$$

$V_{in}$  : Input voltage  
 $I_{in}$  : Input current

3. Output power :

$$P_{out} = V_{out} \times I_{out}$$

$V_{out}$  : Output voltage  
 $I_{out}$  : Output current

4. Efficiency :

$$\text{Efficiency} = \frac{P_{out}}{P_{in}} \times 100\%$$

$P_{out}$ : Output power  
 $P_{in}$ : Input power

5. Voltage accuracy:

$$\frac{|V_{out} - V_{out(nominal)}|}{V_{out}} \times 100\%$$

$V_{out}$  : Output voltage  
 $V_{out(nominal)}$  : Nominal output voltage

6. Line regulation: (1) Wide input voltage range and regulated output voltage series.

$$\frac{|V_{out(LL)} - V_{out(HL)}|}{V_{out(LL)}} \times 100\%$$

LL: Low Line input voltage  
HL: High Line input voltage

(2) Narrow input voltage range ( $\pm 10\%$ ) and unregulated output voltage series.

$$\text{Line regulation} = \left| \frac{\Delta V_{out}}{\Delta V_{in}} \right|$$

$$\Delta V_{out} = \frac{V_{out(+10\%)} - V_{out(-10\%)}}{V_{out}} \times 100\%$$

$V_{out(+10\%)}$  : Output voltage at  $V_{in} = 1.1 \times V_{in(nominal)}$  & full load

$V_{out(-10\%)}$  : Output voltage at  $V_{in} = 0.9 \times V_{in(nominal)}$  & full load

$V_{out}$  : Output voltage at  $V_{in} = V_{in(nominal)}$  & full load

$$\Delta V_{in} = \frac{V_{in(+10\%)} - V_{in(-10\%)}}{V_{in(nominal)}} \times 100\%$$

$V_{in(+10\%)}$  : Input voltage =  $1.1 \times V_{in(nominal)}$

$V_{in(-10\%)}$  : Input voltage =  $0.9 \times V_{in(nominal)}$

$V_{in(nominal)}$  : Nominal Input voltage

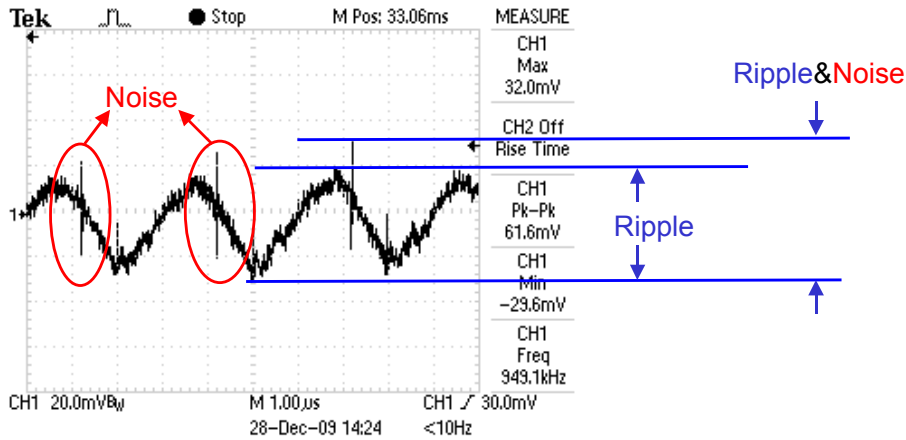
7. Load regulation :

$$\frac{|V_{out(FL)} - V_{out(NL)}|}{V_{out(FL)}} \times 100\%$$

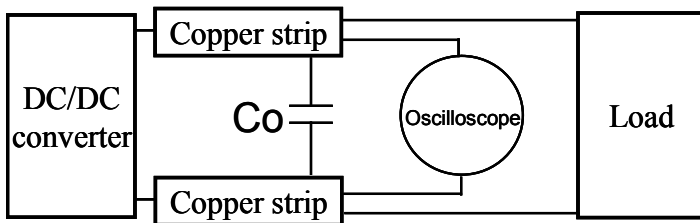
$V_{out(FL)}$ : Output voltage at full load

$V_{out(NL)}$ : Output voltage at 25% full load or 10% full load

8. Ripple and Noise: as shown below. The bandwidth is 0-20MHz.

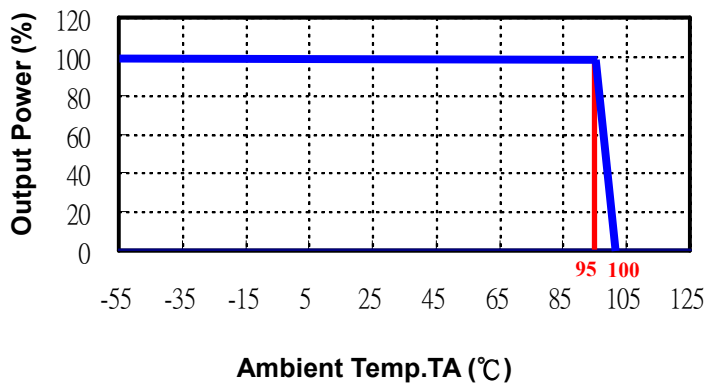


Output Ripple&Noise measurement test circuit: as shown below.



Co: usually 0.47uF.

9. Temperature derating curve: The DC-DC converter will operate over a wider temperature range if less power is drawn from the output and the device is already running. The temperature derating curve shows the operating power-temperature range. As shown below.



10. Switching frequency: The nominal operating frequency of the DC-DC converters.

11. Input to output isolation: The dielectric breakdown strength test between input and output circuits. This is the isolation voltage the device is capable of withstanding for a specified time, usually 1 second or 1 minute.