

50W isolated DC-DC converter DIP package  
Wide input and regulated single output



Patent Protection  
**CE** Report EN62368-1  
**UK CA** Report BS EN62368-1  
**RoHS**

## FEATURES

- Wide 2:1 input voltage range
- High efficiency up to 88%
- I/O isolation test voltage 3k VDC
- Input under-voltage protection, output short-circuit, over-current, over-voltage protection, over-temperature protection
- Operating ambient temperature range(Tc): -40°C to +105°C
- Dimensions: 25.82 x 22.80 x 7.20 mm

VRF24\_DD-50WR4 series of isolated 50W DC-DC converter products with a wide 2:1 input voltage range. They efficiencies of up to 88%, input to output isolation is tested with 3000VDC and the converter safety operate ambient temperature of -40°C to +105°C, input under-voltage protection, output short-circuit, over-current, over-voltage protection, over-temperature protection, which makes them widely used in communication and industrial control applications.

## Selection Guide

Certification	Part No. ①	Input Voltage (VDC)		Output		Full Load Efficiency (%) Min./Typ.	Capacitive Load (µF)Max.
		Nominal (Range)	Max ②	Voltage (VDC)	Current(mA) Max.		
EN/BS EN	VRF2405DD-50WR4	24 (18-36)	40	5	10000	86/88	18900
	VRF2412DD-50WR4			12	4167	86/88	3700
	VRF2415DD-50WR4			15	3333	86/88	2000
	VRF2424DD-50WR4			24	2083	86/88	1000
	VRF2428DD-50WR4			28	1786	86/88	1000

Notes:

- ① All index testing methods are obtained by add enhanced peripherals to the product (see Fig.3), otherwise the product may not work properly;  
 ② Exceeding the maximum input voltage may cause permanent damage.

## Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Input Current (full load/no-load)	24VDC nominal input	--	2367/15	2422/30	mA
Reflected Ripple Current		--	300	--	
Surge Voltage (1sec. max.)		-0.7	--	50	VDC
Start-up Voltage		--	--	18	
Under-voltage Protection		11	13	--	
Start-up Time	Nominal input & constant resistance load	--	30	100	ms
Input Filter		C filter			
Hot Plug		Unavailable			
Ctrl *	Module on	Ctrl pin open or pulled high (TTL 3-12VDC)			
	Module off	Ctrl pin pulled low to GND (0-1.2VDC)			
	Input current when off	--	6	12	mA

Note: \*The Ctrl pin voltage is referenced to input GND.

## Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Output Voltage Accuracy ①	5%-100% load	--	±1	±3	%
Linear Regulation	Input voltage variation from low to high at full load	--	±0.2	±0.5	

Load Regulation <sup>②</sup>	5%-100% load	--	±0.5	±1	%
Transient Recovery Time	25% load step change, nominal input voltage	--	250	500	μs
Transient Response Deviation <sup>③</sup>	25% load step change, input voltage range	--	±5	±8	%
Temperature Coefficient	Full load	--	--	±0.03	%/°C
Ripple & Noise <sup>④</sup>	20MHz bandwidth, input voltage range, 5%-100% load	--	250	350	mVp-p
Hold-up Time	Full operating temperature range, nominal input voltage, full load	0.001	--	--	ms
Trim	Input voltage range	90	--	110	%Vo
Output Over-voltage Protection		110	140	160	
Output Over-current Protection	Normal temperature, input voltage range	110	140	200	%Io
Output Short-circuit Protection	Input voltage range	Continuous, self-recovery			
Over-temperature protection		--	--	140	°C

Note:  
 ① Output voltage accuracy for 0%-5% load is ±5% max;  
 ② Load regulation for 0% -100% load increases to ±3%;  
 ③ The Transient Response Deviation test using the peripheral circuit recommended in Fig.3;  
 ④ The "parallel cable" method is used for Ripple and Noise test, and the peripheral circuit recommended in Fig.3, please refer to DC-DC Converter Application Notes for specific information.

## General Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Isolation	Input-output Electric Strength Test for 1 minute with a leakage current of 1mA max.	3000	--	--	VDC
Insulation Resistance	Input-output resistance at 500VDC	1000	--	--	MΩ
Isolation Capacitance	Input-output capacitance at 100kHz/0.1V	--	100	--	pF
Operating Temperature (Tc)	See Fig. 1	-40	--	+105	°C
Storage Humidity	Non-condensing	5	--	95	%RH
Storage Temperature		-55	--	+125	°C
Pin Soldering Resistance Temperature	Soldering spot is 1.5mm away from case for 10 seconds	--	--	260	
Altitude		Altitude: ≤2000m (Atmospheric pressure: 80~110kPa)			
Vibration		① JESD22-b103 level 1: 10-1000hz, 10g, 1mm xyz 4 cycles each; ② JESD22-b103 level 2: 10-2000hz, 20g, 1.5mm, xyz 4 cycles each; also compatible with 10-150Hz, 5G, 0.75mm .alongX, Y and Z			
Switching Frequency *	PWM mode	--	500	--	kHz
Switching Cycle		1	--	3.5	us
MTBF	MIL-HDBK-217F@25°C	1000	--	--	k hours

Note: \*Switching frequency is measured at full load. The module reduces the switching frequency for light load (below 50%) efficiency improvement.

## Mechanical Specifications

Case Material	Black plastic; flame-retardant and heat-resistant (UL94-V0)
Dimensions	25.82 x 22.80 x 7.20 mm
Weight	12.9g(Typ.)
Cooling method	Free air convection

## Electromagnetic Compatibility (EMC)

Emissions	CE	CISPR32/EN55032	CLASS B (see Fig.4-② for recommended circuit)	
	RE	CISPR32/EN55032	CLASS B (see Fig.4-② for recommended circuit)	
Immunity	ESD	IEC/EN61000-4-2	Contact ±6kV, Air ±8kV	perf. Criteria B
	RS	IEC/EN61000-4-3	10V/m (see Fig.4-① for recommended circuit)	perf. Criteria A
	EFT	IEC/EN61000-4-4	100kHz ±2kV (see Fig.4-① for recommended circuit)	perf. Criteria B
	Surge	IEC/EN61000-4-5	line to line ±2kV (see Fig.4-① for recommended circuit)	perf. Criteria B
	CS	IEC/EN61000-4-6	3 Vr.m.s (see Fig.4-① for recommended circuit)	perf. Criteria A

Typical Characteristic Curves

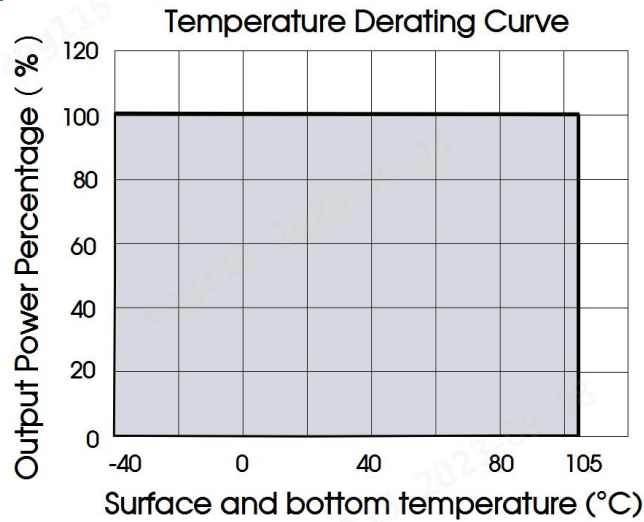


Fig.1

Heat dissipation diagram

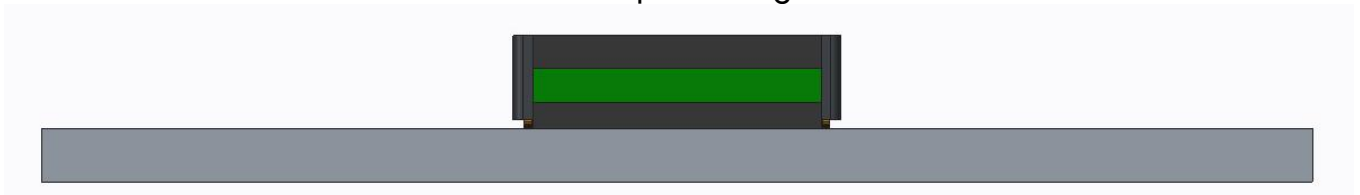


Fig. 2

Note: Recommended heat dissipation application, as shown in Fig. 2, heat dissipation plate size length width height is 164mm\*78mm\*0.9mm, copper thickness 2OZ

Design Reference

1. Typical application

All DC-DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 3.

Input and/or output ripple can be further reduced by appropriately increasing the input & output capacitor values  $C_{in}$  and  $C_{out}$  and/or by selecting capacitors with a low ESR (equivalent series resistance). Also make sure that the capacitance is not exceeding the specified max. capacitive load value of the product.

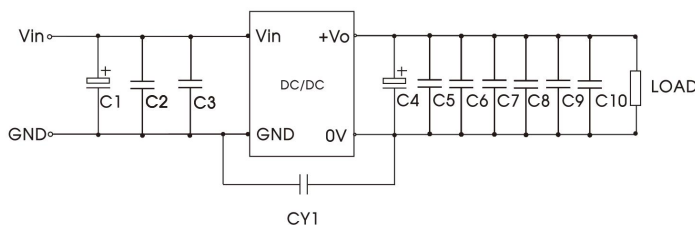


Fig. 3

Vout (VDC)	5V	12V/15V	24V/28V
C1	330uF/50V		
C2/C3	4.7uF/50V		
C4	440uF/16V	440uF/35V	440uF/50V
C5/C6/C7/C8	10uF/16V	10uF/25V	10uF/50V
C9	1uF/16V	1uF/25V	1uF/50V
C10	10uF/16V	10uF/25V	10uF/50V
CY1	Y2/222K/250VAC		

Note: C9 and C10 are recommended capacitors for parallel line testing

2. EMC compliance circuit

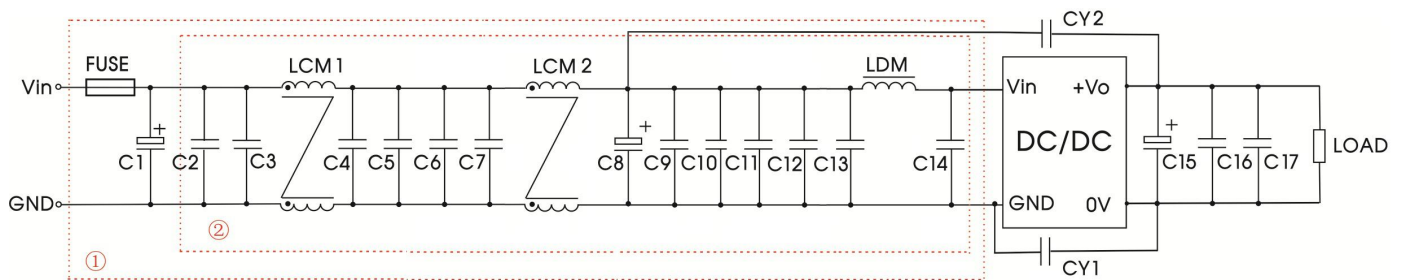
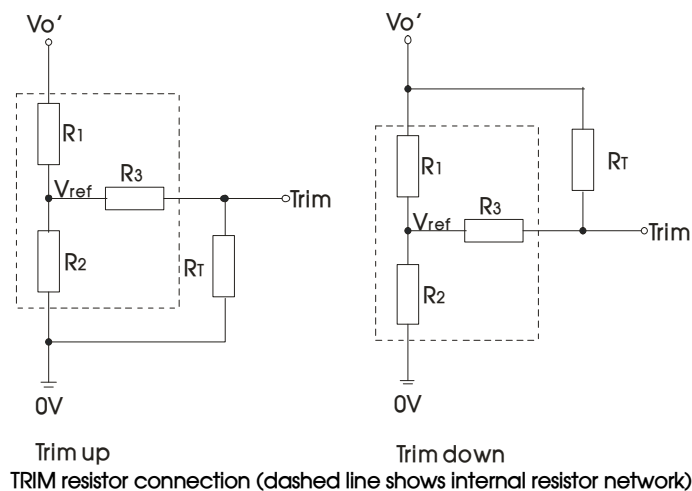


Fig. 4

Parameter description:

Model	Vin: 24VDC	
Vout (VDC)	5V/24V/28V	12V/15V
FUSE	Select fuse value according to actual input current	
C1	1000uF/50V	
C9/C10/C11/C12/C13	4.7uF/50V	
C14	0.1uF/50V	
LCM2	350uH*2, recommended to use MORNSUN' s FL2D-30-351	
C8	330uF/50V	660uF/50V
LDM	2.2uH	
C15	Refer to the Cout in Fig.3 C4	
C16/C17	Refer to the Cout in Fig.3 C9, C10	
CY1	Y2/222K/250VAC	
CY2	/	Y2/222K/250VAC
LCM1	/	4.7mH*2, recommended to use MORNSUN' s FL2D-30-472
C2/C3	/	4.7uF/50V
C4/C5/C6/C7	4.7uF/50V	
Note: For 12V/15V models can meet CLASSA by simplifying circuit ② and retaining only C6, C7, LCM2, C8, C9, C10, C11, C14, LDM; For other output models can meet CLASSA by simplifying circuit ② and retaining only C8, C9, C10, C11, C14, LDM.		

3. Trim Function for Output Voltage Adjustment (open if unused)



Calculating Trim resistor values:

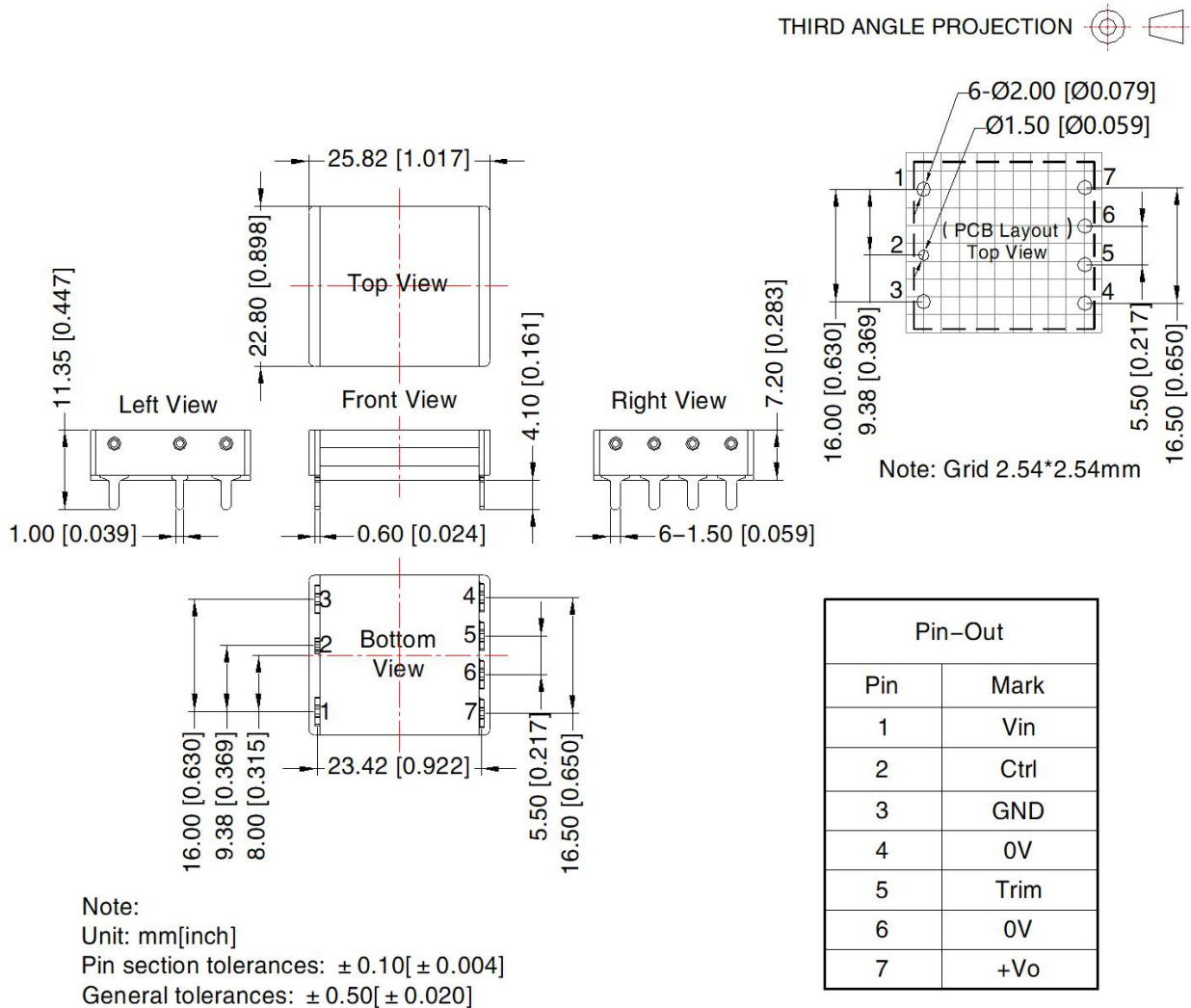
$$\begin{aligned} \text{up: } R_T &= \frac{\alpha R_2}{R_2 - \alpha} \cdot R_3 & \alpha &= \frac{V_{ref}}{V_{o'} - V_{ref}} \cdot R_1 \\ \text{down: } R_T &= \frac{\alpha R_1}{R_1 - \alpha} \cdot R_3 & \alpha &= \frac{V_{o'} - V_{ref}}{V_{ref}} \cdot R_2 \end{aligned}$$

$R_T$  = Trim Resistor value  
 $\alpha$  = self-defined parameter  
 $V_{o'}$  = desired output voltage

Vout(V)	R1(k $\Omega$ )	R2(k $\Omega$ )	R3(k $\Omega$ )	Vref(V)
5	5.1	5.1	12	2.495
12	10.91	2.87	15	2.495
15	14.35	2.87	15	2.495
24	43.96	5.1	27	2.495
28	29.73	2.87	17.4	2.495

- The products do not support parallel connection of their output
- For additional information please refer to DC-DC converter application notes on [www.mornsun-power.com](http://www.mornsun-power.com)

### Dimensions and Recommended Layout



Note:

1. For additional information on Product Packaging please refer to [www.mornsun-power.com](http://www.mornsun-power.com). Packaging bag number: 58210371;
2. The maximum capacitive load offered were tested at input voltage range and full load;
3. Unless otherwise specified, parameters in this datasheet were measured under the conditions of  $T_a=25^{\circ}\text{C}$ , humidity<75%RH with nominal input voltage and rated output load;
4. All index testing methods in this datasheet are based on company corporate standards;
5. We can provide product customization service, please contact our technicians directly for specific information;
6. Products are related to laws and regulations: see "Features" and "EMC";
7. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

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