

3W isolated DC/DC converter
Wide input voltage and regulated dual/single output



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

FEATURES

- Ultra compact SIP package
- Wide 2:1 input voltage range
- Operating ambient temperature range: -40°C to +85°C
- I/O isolation test voltage: 1.5k VDC
- Low output ripple & noise
- Short circuit protection (self-recovery)
- Remote On/Off
- High power density
- Meets EN60950 standard

WRA_S-3WR2 & WRB_S-3WR2 series are isolated 3W DC-DC converter productions with a wide 2:1 input voltage range and input isolation is tested with 1500VDC. The product has a relatively compact SIP-8 plastic package, and features high efficiency, operating ambient temperature of -40°C to +85°C, remote control, and continuous short-circuit protection. The smaller size and cost-effective design make the converter an ideal solution in communication, instruments, and industrial electronics applications.

Selection Guide

Certification	Part No.	Input Voltage (VDC)		Output		Full Load Efficiency (%) Min./Typ.	Capacitive Load ² (μF)Max.
		Nominal (Range)	Max. ¹	Voltage(VDC)	Current (mA) Max./Min.		
EN	WRA0505S-3WR2	5 (4.5-9)	11	±5	±250/±13	72/74	1000
	WRA0512S-3WR2			±12	±104/±5	75/77	470
	WRA0515S-3WR2			±15	±83/±4	75/77	330
	WRA0524S-3WR2			±24	±52/±3	74/76	220
	WRB0503S-3WR2			3.3	758/38	66/68	1800
	WRB0505S-3WR2			5	500/25	71/73	2200
	WRB0509S-3WR2			9	278/14	72/74	1000
	WRB0512S-3WR2			12	208/10	75/77	680
	WRB0515S-3WR2			15	167/8	72/74	470
	WRB0524S-3WR2			24	104/5	74/76	330
	WRA1205S-3WR2	12 (9-18)	20	±5	±300/±15	76/78	1000
	WRA1209S-3WR2			±9	±167/±8	76/78	680
	WRA1212S-3WR2			±12	±125/±6	77/79	470
	WRA1215S-3WR2			±15	±100/±5	78/80	330
	WRB1203S-3WR2			3.3	758/38	73/75	2700
	WRB1205S-3WR2			5	600/30	74/76	2200
	WRB1206S-3WR2			6	500/25	77/79	1800
	WRB1209S-3WR2			9	333/17	77/79	1000
	WRB1212S-3WR2			12	250/13	80/82	680
	WRB1215S-3WR2			15	200/10	81/83	470
	WRB1224S-3WR2	24	125/6	79/81	330		
	WRA2405S-3WR2	24 (18-36)	40	±5	±300/±15	77/79	1000
	WRA2409S-3WR2			±9	±167/±8	79/81	680
	WRA2412S-3WR2			±12	±125/±6	81/83	470
WRA2415S-3WR2	±15			±100/±5	81/83	330	
WRB2403S-3WR2	3.3			758/38	72/74	2700	
WRB2405S-3WR2	5			600/30	79/81	2200	
WRB2409S-3WR2	9			333/17	81/83	1000	

EN	WRB2412S-3WR2	24 (18-36)	40	12	250/13	81/83	680
	WRB2415S-3WR2			15	200/10	81/83	470
	WRB2424S-3WR2			24	125/6	81/83	330
EN/BS EN	WRA4805S-3WR2	48 (36-75)	80	±5	±300/±15	77/79	1000
	WRA4812S-3WR2			±12	±125/±6	80/82	470
	WRA4815S-3WR2			±15	±100/±5	80/82	330
	WRB4803S-3WR2			3.3	758/38	73/75	2700
	WRB4805S-3WR2			5	600/30	74/76	2200
	WRB4812S-3WR2			12	250/13	78/80	680
	WRB4815S-3WR2			15	200/10	82/84	470
	WRB4824S-3WR2			24	125/6	80/82	330

Notes:

- ① Exceeding the maximum input voltage may cause permanent damage;
② The specified maximum capacitive load value for positive and negative output is identical.

Input Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Current (full load /no-load)	5VDC Input	3.3V Output	--	735/40	758/85	mA
		Others		805/40	846/85	
	12VDC Input	3.3V Output	--	278/30	286/40	
		Others		314/30	338/40	
	24VDC Input	3.3V Output	--	140/20	145/40	
		Others		154/20	163/40	
	48VDC Input	3.3V Output	--	69/5	72/15	
		Others		78/5	85/15	
Reflected Ripple Current	5VDC Input		--	20	--	VDC
	12VDC Input		--	20	--	
	24VDC Input		--	55	--	
	48VDC Input		--	55	--	
Surge Voltage (1sec. max.)	5VDC Input		-0.7	--	12	VDC
	12VDC Input		-0.7	--	25	
	24VDC Input		-0.7	--	50	
	48VDC Input		-0.7	--	100	
Start-up Voltage	5VDC Input		--	--	4.5	VDC
	12VDC Input		--	--	9	
	24VDC Input		--	--	18	
	48VDC Input		--	--	36	
Input Filter			Capacitor filter			
Hot Plug			Unavailable			
Ctrl *	Module on			Ctrl pin open (high resistance)		
	Module off			Ctrl pin pulled high (current 5-10mA typ. into Ctrl.)		

Note: *For use of Ctrl, please refer to the "design reference" in this manual.

Output Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Voltage Accuracy ^①	5%-100% load, input voltage range		--	±1	±3	%
Linear Regulation ^②	Input voltage variation from low to high at full load	Main road	--	±0.2	±0.5	
		Side road	--	--	±2	
Load Regulation	5%-100% load	Main road	--	±0.6	±1	
		Side road	--	--	±3	
Transient Recovery Time	25% load step change		--	0.5	3	ms

Transient Response Deviation	25% load step change		--	±2.5	±5	%
Temperature Coefficient	Full load		--	±0.02	±0.03	%/°C
Ripple & Noise ^③	20MHz bandwidth	WRB1212S-3WR2 WRB1215S-3WR2 WRB4824S-3WR2	--	70	100	mVp-p
		WRB1224S-3WR2 WRB2415S-3WR2 WRB2424S-3WR2 WRA4805S-3WR2 WRB4803S-3WR2	--	100	150	
		Others	--	40	75	
Short-circuit Protection			Continuous, self-recovery			
Note:						
①Under the of 5%-100% load, the maximum output voltage accuracy of WRA1209S-3WR2, WRA2405S-3WR2 and WRA2415S-3WR2 auxiliary circuit is ±4%;						
②Linear Regulation for 100% load, WRA1209S-3WR2, WRA2405S-3WR2 and WRA2415S-3WR2 main road increases to ±1%, side road increases to ±2.5% ;						
③The "parallel cable" method is used for Ripple and Noise test, 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.	1500	--	--	VDC
Insulation Resistance	Input-output resistance at 500VDC	1000	--	--	MΩ
Isolation Capacitance	Input-output capacitance at 100kHz/0.1V	--	120	--	pF
Operating Temperature	See Fig. 1	-40	--	+85	°C
Storage Temperature		-55	--	+125	
Pin Soldering Resistance Temperature	Soldering spot is 1.5mm away from case for 10 seconds	--	--	+300	
Storage Humidity	Non-condensing	--	--	95	%RH
Switching Frequency (PFM Mode)	Full load, nominal input voltage	--	250	--	kHz
MTBF	MIL-HDBK-217F@25°C	1000	--	--	k hours

Mechanical Specifications

Case Material	Black plastic; flame-retardant and heat-resistant
Dimensions	22.00 x 9.50 x 12.00 mm
Weight	4.5g(Typ.)
Cooling Method	Free air convection

Electromagnetic compatibility (EMC)

Emissions	CE	CISPR32/EN55032	CLASS B (see Fig. 3-② for recommended circuit)	
	RE	CISPR32/EN55032	CLASS B (see Fig. 3-② for recommended circuit)	
Immunity	ESD	IEC/EN61000-4-2	Contact ±4kV	perf. Criteria B
	RS	IEC/EN61000-4-3	10V/m	perf. Criteria A
	EFT	IEC/EN61000-4-4	±2kV (see Fig. 3-① for recommended circuit)	perf. Criteria B
	Surge	IEC/EN61000-4-5	line to line ±2kV (see Fig. 3-① for recommended circuit)	perf. Criteria B
	CS	IEC/EN61000-4-6	3 Vr.m.s	perf. Criteria A
	Voltage dips, short interruptions and voltage variations immunity	IEC/EN61000-4-29	0%, 70%	

Typical Characteristic Curves

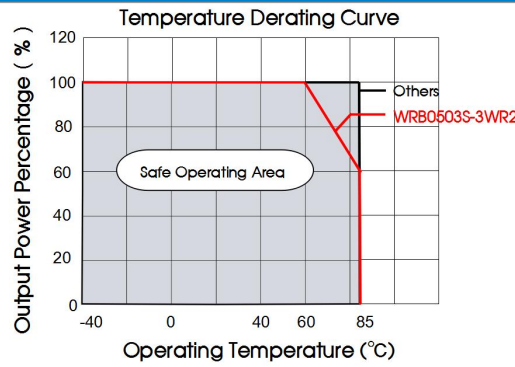
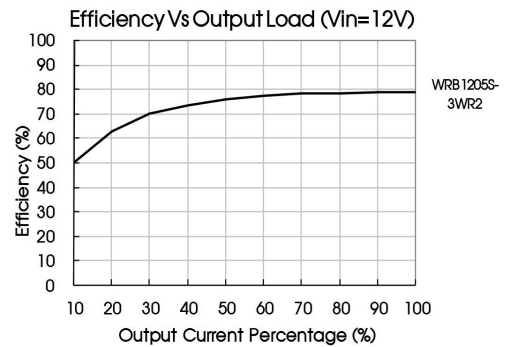
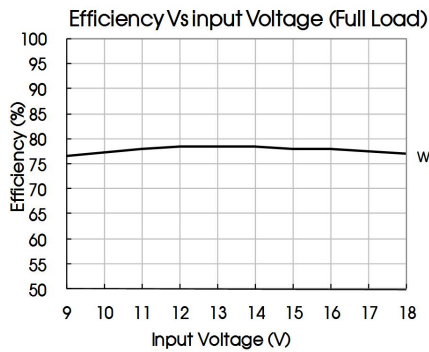
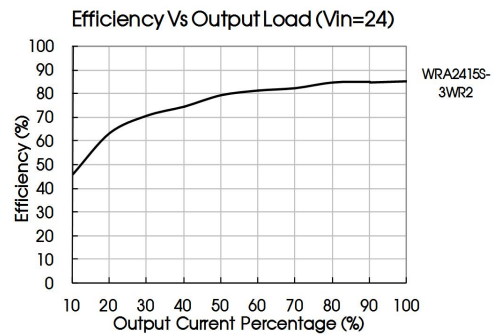
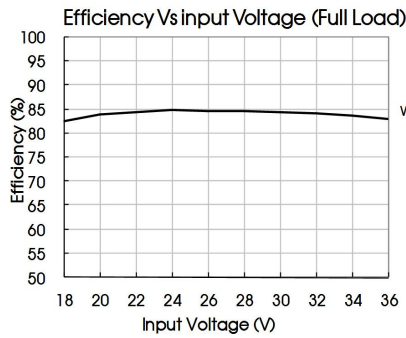


Fig 1



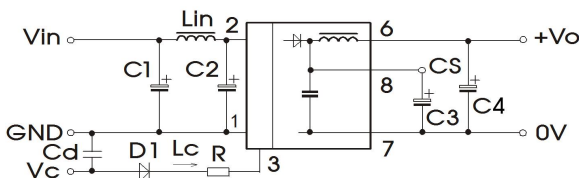
Design Reference

1. Typical application

All DC-DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 2.

Input and/or output ripple can be further reduced by appropriately increasing the input & output capacitor values C1, C2, C3 and C4 and/or by selecting capacitors with a low ESR (equivalent series resistance). C3 is used to reduce ripple. No need to add C3, if ripple meets the demand. Appropriate filter capacitance shall be chosen, start-up problems may be caused if the capacitance is too large. For each output circuit, under the condition of safe and reliable operation, the max. capacity of its filter capacitor should be lower than the max. capacitive load.

Single



Dual

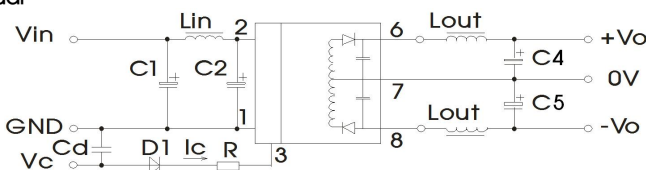


Fig. 2

Vin	5VDC&12VDC	24VDC&48VDC
C1	100μF/25V	10μF/100V
C2	47μF/25V	1μF/100V
Lin	4.7μH-12μH	
C3	10μF/50V-22 μF/50V	
C4/C5	100μF/50V(Typ.)	
Lout	2.2μH-10μH	
Cd	47nF/100V	

2. EMC compliance circuit

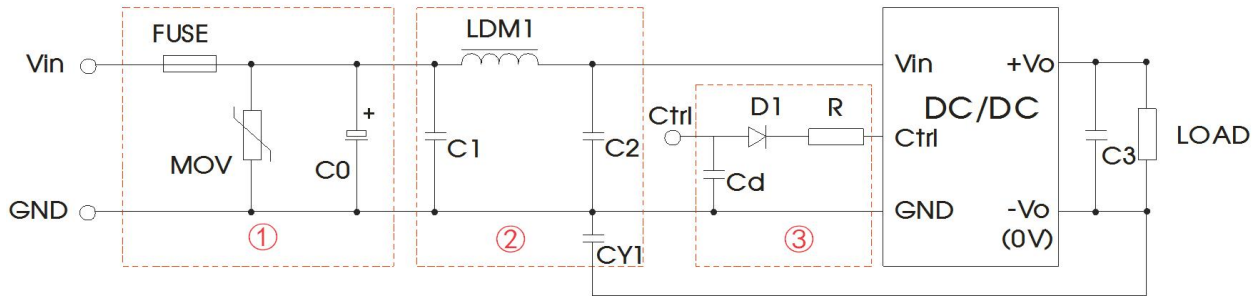


Fig. 3

Parameter description:

Model	Vin: 5VDC	Vin: 12VDC	Vin: 24VDC	Vin: 48VDC
FUSE	Slow-blow, selecting based on needs			
MOV	--	S14K20	S20K30	S14K60
C0	680µF/25V	680µF/25V	330µF/50V	330µF/100V
C1	4.7µF/50V			4.7µF/100V
LDM1	12µH			
C2	4.7µF/50V			4.7µF/100V
C3	Refer to the Cout in Fig.2			
CY1	1nF/2kV			
D1	RB160M-60V/1A			
R	In accordance with the formula: $R = \frac{V_C - V_D - 1.0}{I_C} - 300$			
Cd	47nF/100V			

Notes:

- ① For EMC tests we use Part ① in Fig. 3 for immunity and part ② for emissions test. Selecting based on needs.
- ② V_C is the voltage of the Ctrl end relative to the GND of the input grounding; V_D is the positive-going conduction pressure drop of D1; I_C is the current flows into the Ctrl end and its value is generally 5-10mA, see Fig. 3-③ for the peripheral circuit of Ctrl end;
- ③ If there is no recommended parameters, no external component is required.

3. Ctrl end

The modules are of normal output when the Ctrl end is suspended or of high resistance; the modules turn off when connecting with high level (relative to the input grounding); notice that the current flows into the pin shall be 5 - 10mA, the modules will be permanently damaged if the current exceeds its max. value (20mA in general).

The value of R can be derived as follows:

$$R = \frac{V_C - V_D - 1.0}{I_C} - 300$$

For detailed parameter, please refer to EMC compliance circuit in this manual.

4. Input current

When the electricity is provided by the unstable power supply, please make sure that the range of the output voltage fluctuation and the ripple voltage of the power supply do not exceed the indicators of the modules. Input current of power supply should afford the flash start up current of this kind of DC/DC module(see Fig. 4).

- Generally: Vin= 5V series Iave =1296mA
 Vin=12V series Iave =631mA
 Vin=24V series Iave =303mA
 Vin=48V series Iave =157mA

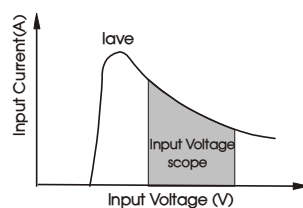


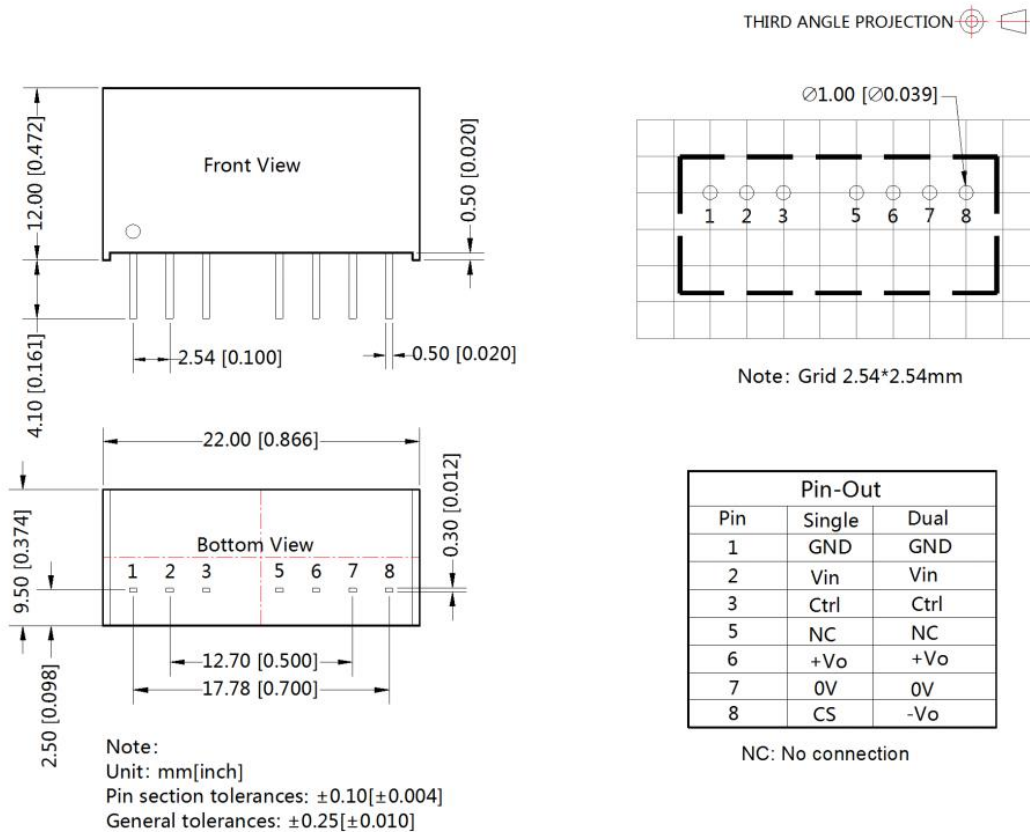
Fig. 4

5. Output load requirements

When using, the minimum load of the module output should not be less than 5% of the nominal load. In order to meet the performance parameters of this datasheet, please connect a 5% dummy load in parallel at the output end, the dummy load is generally a resistor, please note that the resistor needs to be used in derating.

6. For additional information please refer to DC-DC converter application notes on www.mornsun-power.com

Dimensions and Recommended Layout



Notes:

- For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58210004;
- Recommend to use module with more than 5% load, if not, the ripple of the product may exceeds the specification, but does not affect the reliability of the product;
- It is recommended that the load imbalance of the dual output is $\leq \pm 5\%$. If it exceeds $\pm 5\%$, the performance of the product cannot be guaranteed to meet as datasheet marked. For details, please contact our technical staff;
- The maximum capacitive load offered were tested at input voltage range and full load;
- 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;
- All index testing methods in this datasheet are based on company corporate standards;
- We can provide product customization service, please contact our technicians directly for specific information;
- Products are related to laws and regulations: see "Features" and "EMC";
- 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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