

20W isolated DC-DC converter
Wide input and regulated dual / single output



CE Patent Protection RoHS

FEATURES

- Wide 2:1 input voltage range
- High efficiency up to 90%
- No-load power consumption as low as 0.15W
- I/O isolation test voltage 1.5k VDC
- Output short-circuit, over-voltage, over-current protection
- Operating ambient temperature range: -40°C to +85°C
- Meets CISPR32/EN55032 CLASS A, without extra components
- Six-sided metal shielded package
- EN62368 approved

VRA_LD-20WR3 & VRB_LD-20WR3 series of isolated 20W DC-DC converter products with a 2:1 input voltage range. They feature efficiencies of up to 90%, 1500VDC input to output isolation, operating ambient temperature range of -40°C to +85°C, output short-circuit, over-voltage, over-current protection. They meet CLASS A of CISPR32/EN55032 EMI standards without external components and they are widely used in applications such as data transmission device, battery power supplies, tele-communication device, distributed power supply system, hybrid module system, remote control system, industrial robot system fields.

Selection Guide

Certification	Part No.	Input Voltage (VDC)		Output		Full Load Efficiency ^② (%) Min./Typ.	Capacitive Load ^③ (μF) Max.
		Nominal (Range)	Max. ^①	Voltage (VDC)	Current(mA) Max./Min.		
--	VRA1215LD-20WR3	12 (9-18)	20	±15	±667/0	85/87	625
	VRA1224LD-20WR3			±24	±417/0	86/88	220
	VRB121DLD-20WR3			110	182/9	86/88	66
CE	VRA2405LD-20WR3	24 (18-36)	40	±5	±2000/0	82/84	4800
	VRA2409LD-20WR3			±9	±1111/0	84/86	1000
	VRA2412LD-20WR3			±12	±834/0	84/86	800
	VRA2415LD-20WR3			±15	±667/0	84/86	625
--	VRA2424LD-20WR3	24 (18-36)	40	±24	±417/0	84/86	500
	VRB2403LD-20WR3			3.3	5000/0	84/86	10000
	VRB2405LD-20WR3			5	4000/0	88/90	10000
	VRB2409LD-20WR3			9	2222/0	85/87	4700
	VRB2412LD-20WR3			12	1667/0	85/87	1600
	VRB2415LD-20WR3			15	1333/0	86/88	1000
	VRB2424LD-20WR3			24	834/0	86/88	500
CE	VRA4805LD-20WR3	48 (36-75)	80	±5	±2000/0	84/86	4800
	VRA4812LD-20WR3			±12	±834/0	86/88	800
	VRA4815LD-20WR3			±15	±667/0	87/89	625
	VRB4803LD-20WR3			3.3	5000/0	84/86	10000
	VRB4805LD-20WR3			5	4000/0	88/90	10000
	VRB4809LD-20WR3			9	2222/0	87/89	4700
	VRB4812LD-20WR3			12	1667/0	87/89	1600
	VRB4815LD-20WR3			15	1333/0	88/90	1000
	VRB4824LD-20WR3			24	834/0	88/90	500

Notes: ① Exceeding the maximum input voltage may cause permanent damage;
 ② Efficiency is measured in nominal input voltage and rated output load;
 ③ 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)	12VDC input	±15V output	--	1916/12	1960/20	mA
		±24V output	--	1894/15	1938/25	
		Others	--	1894/35	1938/--	
	24VDC input	3.3V output	--	799/40	818/45	
		5V output	--	969/40	993/45	
		Others	--	947/6	969/10	
	48VDC input	3.3V output	--	400/20	409/25	
		5V output	--	485/20	497/25	
		Others	--	474/5	485/9	
Reflected Ripple Current	12VDC input	110V output	--	20	--	
	24VDC / 48VDC input		--	30	--	
Surge Voltage (1sec. max.)	12VDC input		-0.7	--	25	VDC
	24VDC input		-0.7	--	50	
	48VDC input		-0.7	--	100	
Start-up Voltage	12VDC input		--	--	9	
	24VDC input		--	--	18	
	48VDC input		--	--	36	
Start-up Time	Nominal input voltage & constant resistance load		--	10	--	ms
Input Filter			PI filter			
Ctrl ^①	Module on		Ctrl pin open or pulled high (3.5-12VDC)			
	Module off		Ctrl pin pulled low to GND (0-1.2VDC)			
	Input current when off	VRB121DLD-20WR3	--	5	--	mA
Others		--	4	7		
Hot Plug			Unavailable			

Note: ①The Ctrl pin voltage is referenced to input GND.

Output Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit	
Voltage Accuracy ^①	5%-100% load	VRA1215LD-20WR3	--	±1	±3		
	0%-100% load	VRA1224LD-20WR3	Positive output	--	±1		±3
			Negative output	--	±2		±4
		Others	--	±1	±3		
Linear Regulation	Input voltage variation from low to high at full load	Positive output	--	±0.2	±0.5	%	
		Negative output	--	±0.5	±1		
Load Regulation ^②	5%-100% load	VRA1215LD-20WR3/VRA1224LD-20WR3	Positive output	--	±0.5	±1	
			Negative output	--	±1	±1.5	
		Others	Positive output	--	±0.5	±1	
			Negative output	--	±0.5	±1.5	
Cross Regulation	Dual output with Positive output at 50% load and Negative output from 10%-100% load		--	--	±5		
Transient Recovery Time			--	300	500	μs	
Transient Response Deviation	25% load step change, Nominal input voltage	3.3V/5V/±5VDC output	--	±5	±8	%	
		Others	--	±3	±5		
Temperature Coefficient	Full load		--	--	±0.03	%/°C	
Ripple & Noise ^③	20MHz bandwidth, 5%-100% load	VRB121DLD-20WR3	--	--	250	mVp-p	
		Others	--	50	100		
Trim	Input voltage range(24V/48V input series)		--	±10	--	%Vo	

Over-voltage Protection	Input voltage range(24V/48V input series and VRA1215LD-20WR3/VRA1224LD-20WR3)	110	--	160	
Over-current Protection	Input voltage range	VRB121DLD-20WR3	--	130	%Io
		Others	110	--	
Short-circuit Protection		Hiccup, continuous, self-recovery			
Note:					
①Output voltage accuracy of $\pm 5\text{VDC}/\pm 9\text{VDC}$ output converter for 0%-5% load is $\pm 5\%$ max;					
②Load regulation for 0%-100% load is $\pm 5\%$;					
③The "parallel cable" method is used for Ripple and Noise test, please refer to DC-DC Converter Application Notes for specific information. Ripple & Noise at < 5% load is 5%Vo. Max.					

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	--	--	M Ω
Isolation Capacitance	Input-output capacitance at 100KHz/0.1V	VRB2424LD-20WR3	--	2050	pF
		VRB121DLD-20WR3	--	2000	
		Others	--	1050	
Operating Temperature	See Fig. 1	-40	--	+85	°C
Storage Temperature		-55	--	+125	
Storage Humidity	Non-condensing	5	--	95	%RH
Pin Soldering Resistance Temperature	Soldering spot is 1.5mm away from case for 10 seconds	--	--	300	°C
Max. Case Temperature	Refer to temperature derating curve (VRB121DLD-20WR3)	--	--	105	
Vibration		10-150Hz, 5G, 90 Min. along X, Y and Z			
Switching Frequency ①	PWM mode	VRB121DLD-20WR3	--	300	KHz
		Others	--	270	
MTBF	MIL-HDBK-217F@25°C	1000	--	--	K hours

Note: ①Switching frequency is measured at full load. The module reduces the switching frequency for light load (below 50%) efficiency improvement.

Mechanical Specifications

Case Material	Aluminum alloy
Dimensions	50.80 x 25.40 x 11.80 mm
Weight	26.0g(Typ.)
Cooling Method	Free air convection

Electromagnetic Compatibility (EMC)

Emissions	CE	CISPR32/EN55032	CLASS A (without extra components)/ CLASS B (see Fig.3-① for recommended circuit)
	RE	CISPR32/EN55032	CLASS A (without extra components)/ CLASS B (see Fig.3-① for recommended circuit) (except VRB121DLD-20WR3)
Immunity	ESD	IEC/EN61000-4-2	Contact $\pm 4\text{KV}$ perf. Criteria B
	RS	IEC/EN61000-4-3	10V/m perf. Criteria A
	EFT	IEC/EN61000-4-4	$\pm 2\text{KV}$ (see Fig.3-② for recommended circuit) perf. Criteria B
	Surge	IEC/EN61000-4-5	line to line $\pm 2\text{KV}$ (see Fig.3-② 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% perf. Criteria B

Typical Characteristic Curves

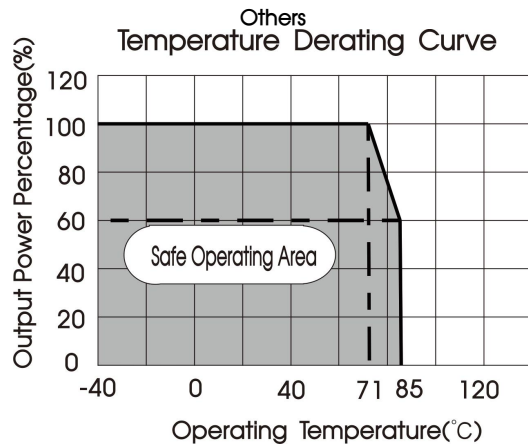
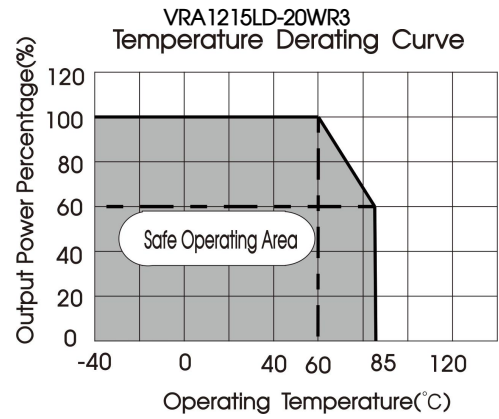
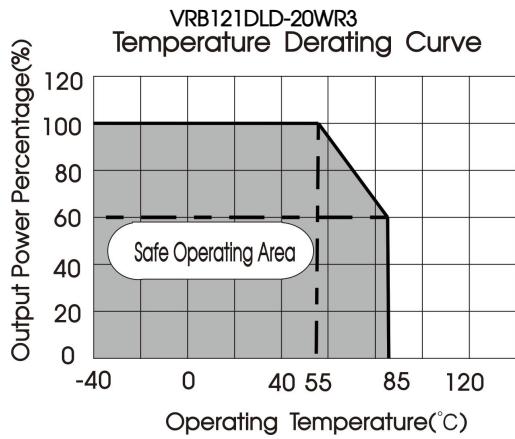
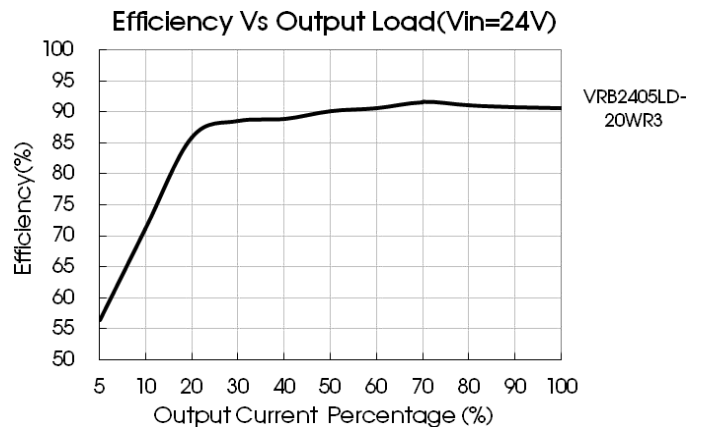
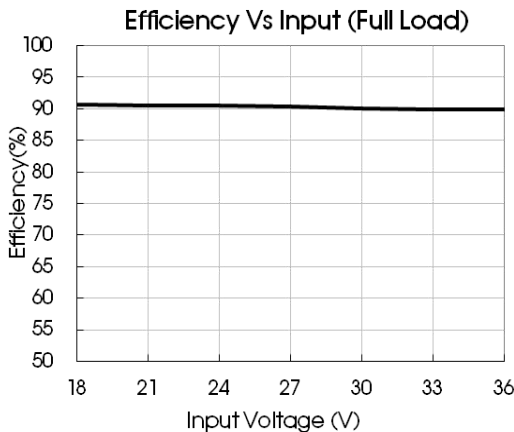
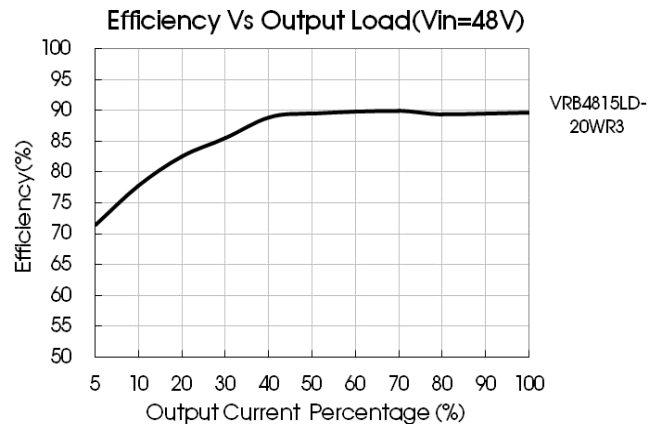
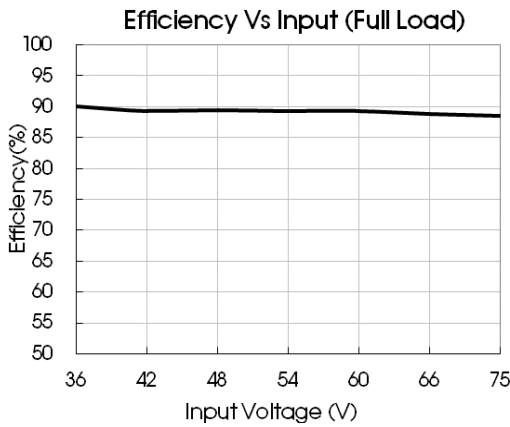
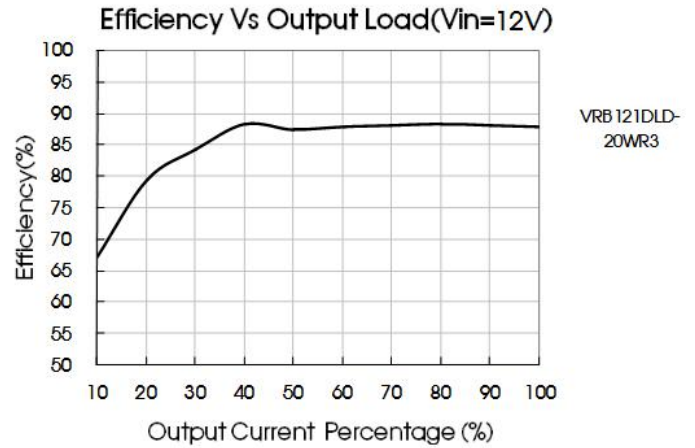
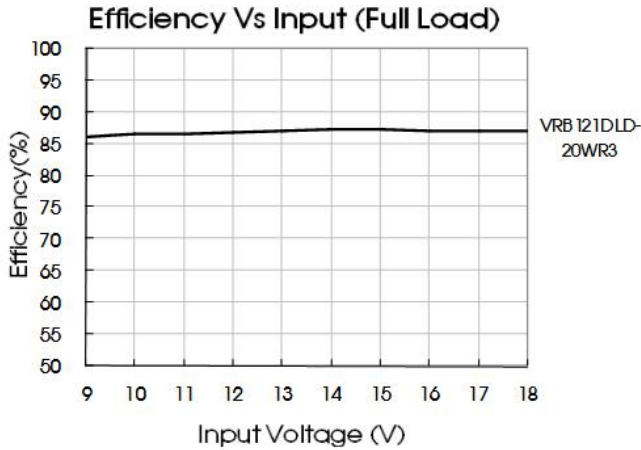


Fig. 1



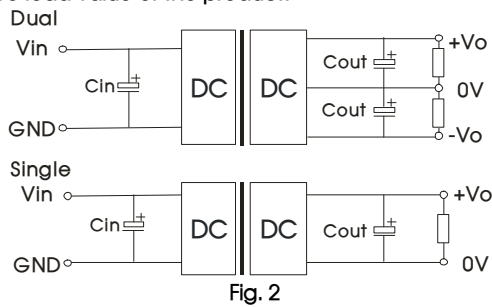


Design Reference

1. Typical application

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

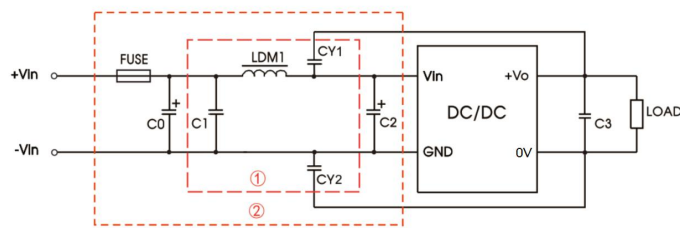
Input and/or output ripple can be further reduced by appropriately increasing the input & output capacitor values C_{in} and C_{out} and/or by selecting capacitors with a low ESR (equivalent series resistance). Also make sure that the capacitance is not exceeding the specified max. capacitive load value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



Vin(VDC)		Cin(uF)	
12		100µF/25V	
24		100µF/50V	
48		100µF/100V	
Single Vout (VDC)	Cout (µF)	Dual Vout (VDC)	Cout (µF)
3.3/5	470/16V	±5	220/16V
9/12/15	220/25V	±9/±12/±15	100/25V
24	100/50V	±24	100/50V
110	--	--	--

2. EMC compliance circuit

Single:



Dual:

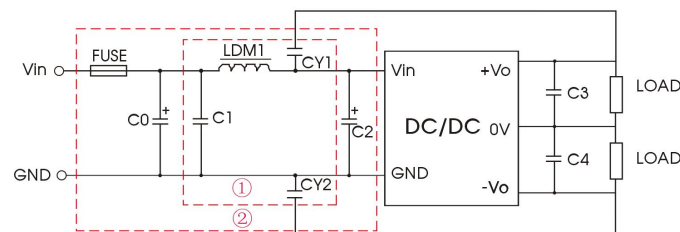


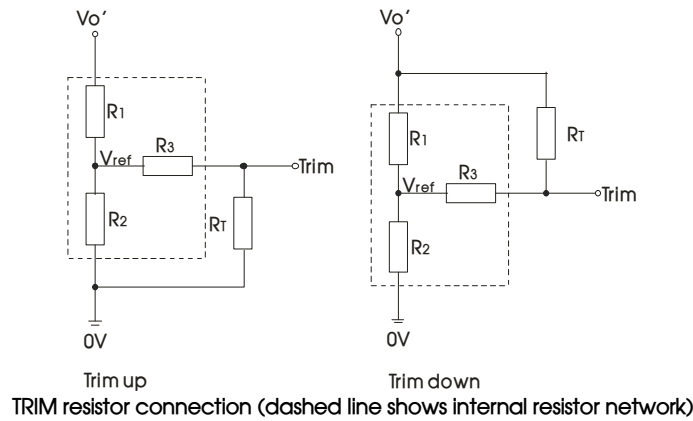
Fig. 3

Notes: For EMC tests we use Part ① in Fig. 3 for emissions and part ② for immunity test. Selecting based on needs.

Parameter description

Model	Vin:12V/24V	Vin:48V
FUSE	Choose according to actual input current	
C0	680µF/100V	680µF/100V
C1	1µF/50V	1µF/100V
C2	330µF/50V	330µF/100V
C3 / C4	Refer to the Cout in Fig.2	
LDM1	4.7µH	
CY1/ CY2	1nF/2KV	

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



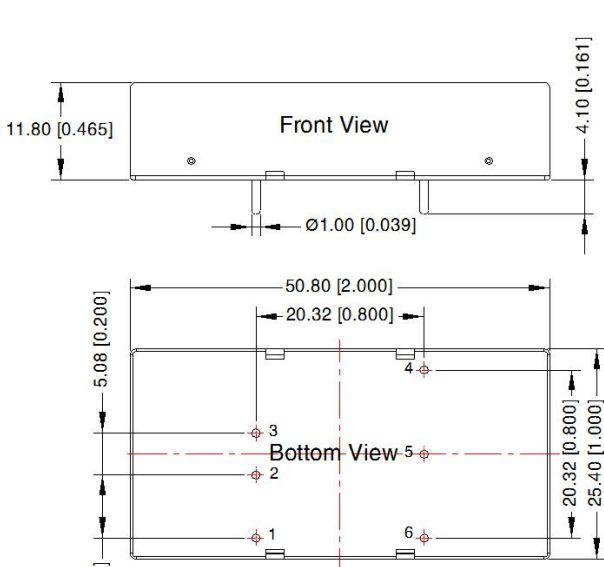
Calculating Trim resistor values:

$$\begin{aligned} \text{up: } R_T &= \frac{\alpha R_2}{R_2 - \alpha} \cdot R_3 & \alpha &= \frac{V_{ref}}{V_{o'} - V_{ref}} \cdot R_1 & R_T &= \text{Trim Resistor value;} \\ \text{down: } R_T &= \frac{\alpha R_1}{R_1 - \alpha} \cdot R_3 & \alpha &= \frac{V_{o'} - V_{ref}}{V_{ref}} \cdot R_2 & \alpha &= \text{self-defined parameter.} \end{aligned}$$

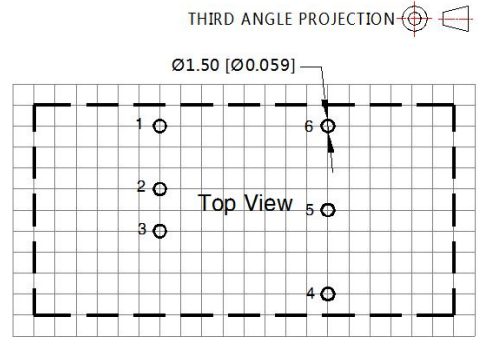
Vout(V)	R1(K Ω)	R2(K Ω)	R3(K Ω)	Vref(V)
3.3	4.801	2.87	12.4	1.24
5	2.883	2.87	10	2.5
9	7.500	2.87	15	2.5
12	11.000	2.87	15	2.5
15	14.494	2.87	15	2.5
24	24.872	2.87	17.8	2.5
110	130.43	3.00	22	2.5

- 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

Horizontal Package Dimensions and Recommended Layout



Note:
Unit: mm[inch]
Pin diameter tolerances: $\pm 0.10[\pm 0.004]$
General tolerances: $\pm 0.50[\pm 0.020]$



Note: Grid 2.54*2.54mm

Pin-Out		
Pin	Single	Dual
1	Ctrl	Ctrl
2	GND	GND
3	Vin	Vin
4	+Vo	+Vo
5	Trim	0V
6	0V	-Vo

Notes:

- For additional information on Product Packaging please refer to www.mornsun-power.com. The Packaging bag number of Horizontal package: 58200035;
- We suggest to use module at load of over 5%, if not, the ripple of the product may exceeds the specification, but does not affect the reliability of the product;
- 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 Ta=25°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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