

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

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 <sup>②</sup> (%) Min./Typ.	Capacitive Load <sup>③</sup> (μF)Max.
		Nominal (Range)	Max. <sup>①</sup>	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
EN/BS EN	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
EN/BS EN	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
EN/BS EN	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 <sup>①</sup>	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 <sup>①</sup>	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 <sup>②</sup>	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 <sup>③</sup>	20MHz bandwidth, 5%-100% load	VRB121DLD-20WR3	--	--	250	mVp-p
		Others	--	50	100	
Trim	Input voltage range(24V/48V input series)	90	--	110	%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	--	190	
Short-circuit Protection		Hiccup, continuous, self-recovery				
Note:						
①Output voltage accuracy of ±5VDC/±9VDC output converter for 0%-5% load is ±5% max;						
②Load regulation for 0%-100% load is ±5%;						
③*Under 0% -5% load conditions, ripple & noise does not exceed 5%Vo. The "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	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 <sup>①</sup>	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 ±4kV		perf. Criteria B
	RS	IEC/EN61000-4-3	10V/m		perf. Criteria A
	EFT	IEC/EN61000-4-4	±2kV (see Fig.3-② for recommended circuit)		perf. Criteria B
	Surge	IEC/EN61000-4-5	line to line ±2kV (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%		

Typical Characteristic Curves

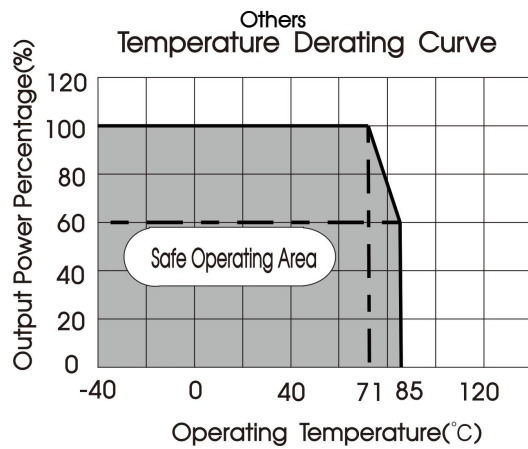
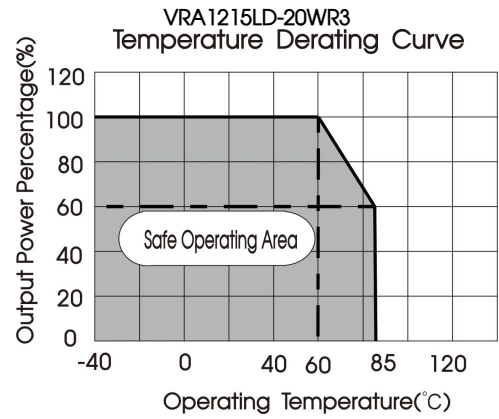
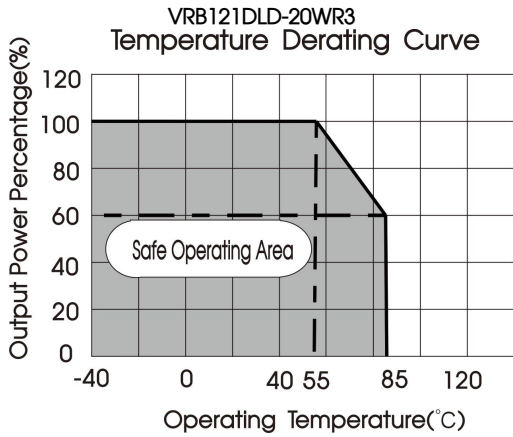
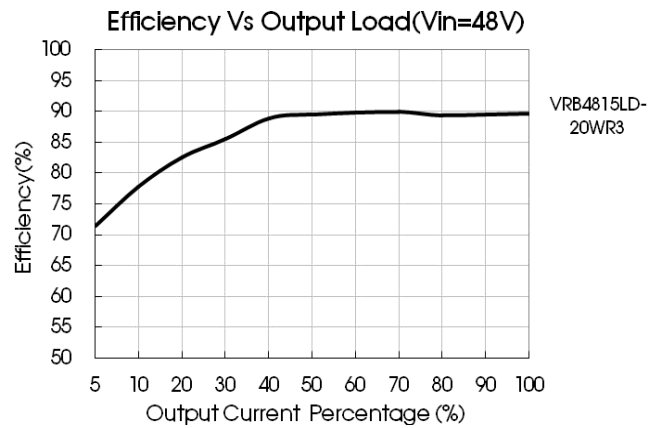
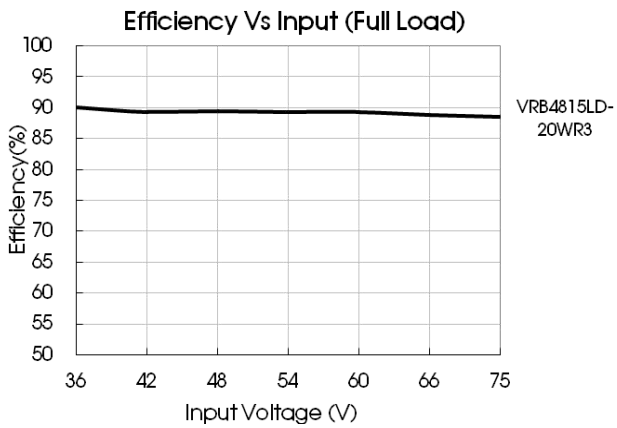
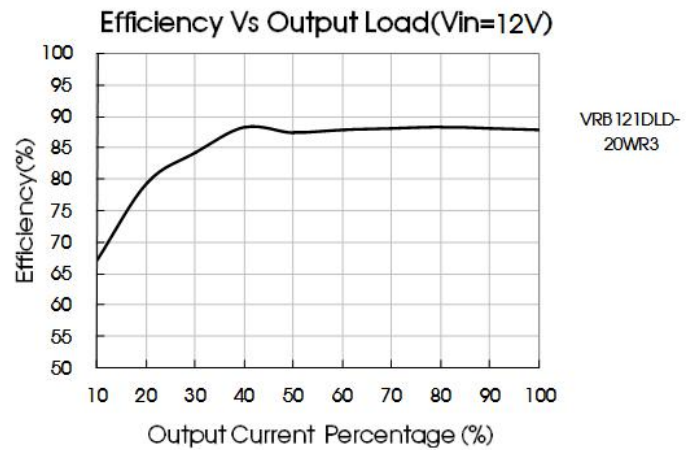
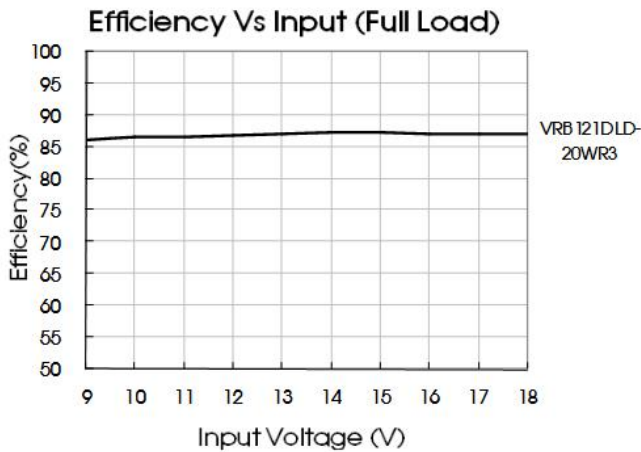
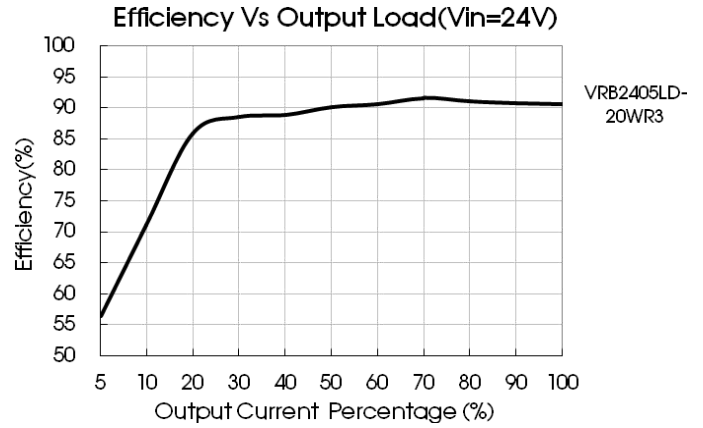
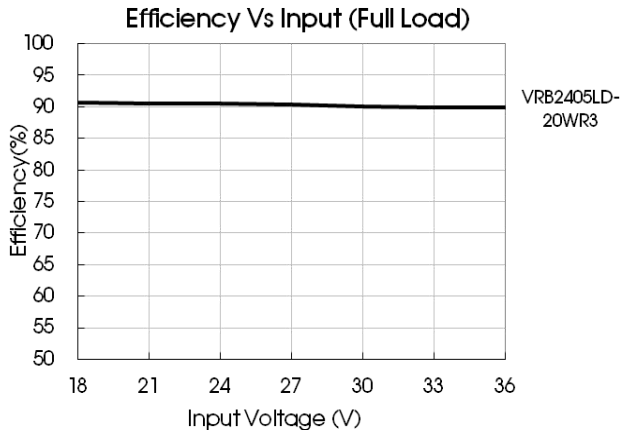


Fig. 1



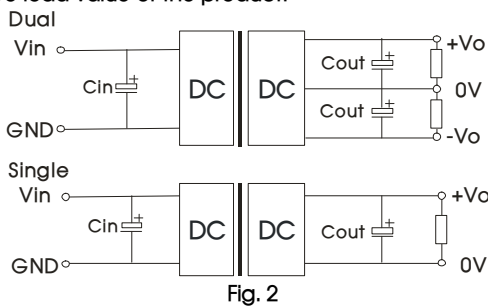


## Design Reference

### 1. Typical application

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

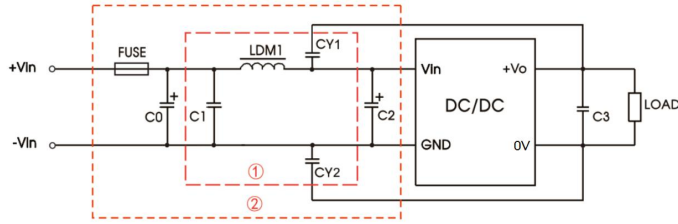
Input and/or output ripple can be further reduced by appropriately increasing the input & output capacitor values  $C_{in}$  and  $C_{out}$  and/or by selecting capacitors with a low ESR (equivalent series resistance). Also make sure that the capacitance is not exceeding the specified max. capacitive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



Vin(VDC)		Cin(μF)	
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:

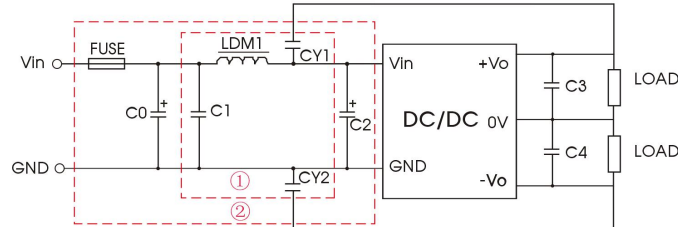


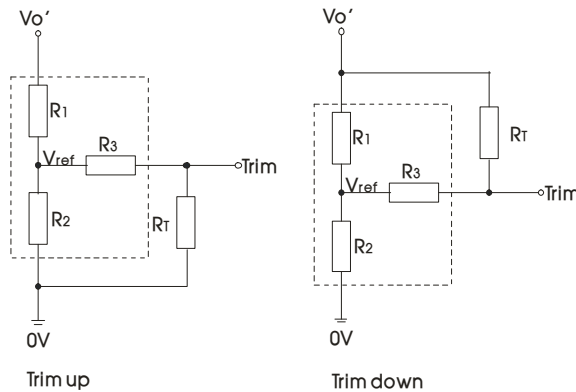
Fig. 3

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:12VDC, 24VDC	Vin: 48VDC
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)



TRIM resistor connection (dashed line shows internal resistor network)

Calculating Trim resistor values:

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

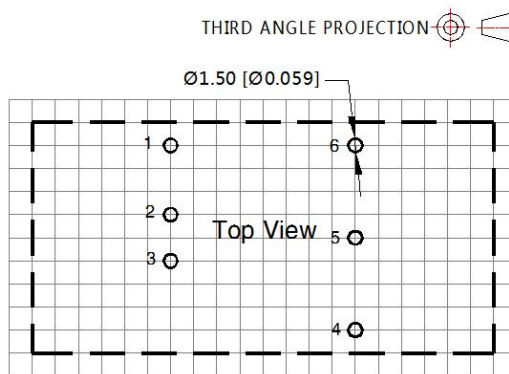
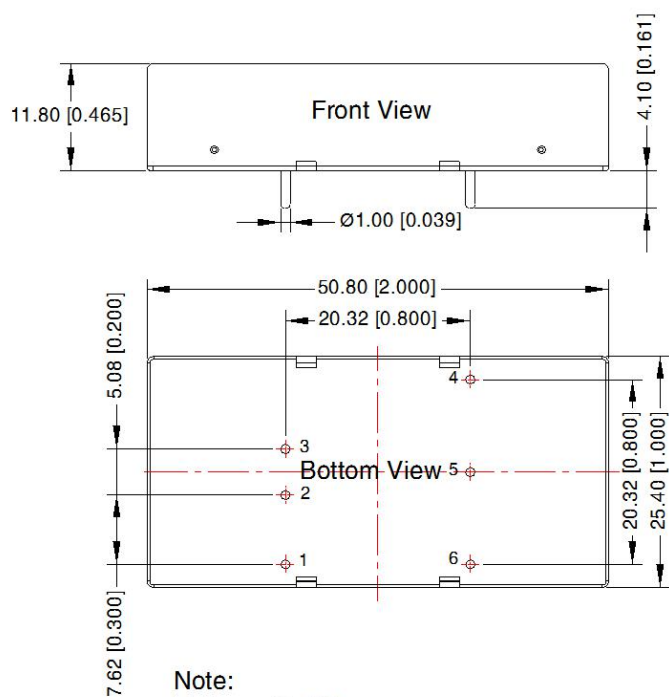
$R_T$  = Trim Resistor value;  
 $\alpha$  = self-defined parameter.

Vout(V)	R1(kΩ)	R2(kΩ)	R3(kΩ)	Vref(V)
3.3	4.775	2.87	12.4	1.25
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

4. The products do not support parallel connection of their output

5. 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



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

Notes:

1. For additional information on Product Packaging please refer to [www.mornsun-power.com](http://www.mornsun-power.com). The Packaging bag number of Horizontal package: 58200035;
2. 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;
3. The maximum capacitive load offered were tested at input voltage range and full load;
4. 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;
5. All index testing methods in this datasheet are based on company corporate standards;
6. We can provide product customization service, please contact our technicians directly for specific information;
7. Products are related to laws and regulations: see "Features" and "EMC";
8. 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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