DC/DC 150W Brick Converter

VRF4D_QB-150WR3G-N Series

MORNSUN®

150W, Wide input voltage, isolated voltage regulator single output, DC/DC module power supply

RoHS

FEATURES

- Wide input voltage range: 400-800VDC
- Shell operating temperature range Tc: -40℃ to +100℃
- High efficiency up to 88%
- Enhanced isolation, isolation voltage: 4250VDC
- Input under-voltage protection, output over-voltage, over-current, short-circuit protection, over-temperature protection
- Industry standard 1/4-Brick package and pin-out

VRF4D_QB-150WR3G-N series output power is 150W, 400-800VDC wide input voltage range, isolation voltage 4250VDC, housing allowed operating temperature -40℃ to +100℃, with input under-voltage protection, output over-voltage, over-current, short-circuit protection, over-temperature protection.

Selection Guide

Part No.	Ctrl Logic①	Input Voltage (VDC)		Output		Full Load Efficiency③ (%)Min./Typ.	Capacitive Load (uF) Max.
		Nominal (Range)	Max.②	Voltage (VDC)	Current (mA) Max./Min.		
VRF4D28QB-150WR3G-N	N	540 (400-800)	800	28	5.36/0	86/88	1800
VRF4D48QB-150WR3G-N	N	540 (400-800)	800	48	3.13/0	86/88	1100

Note:
① "N" indicates negative logic.
②Exceeding the maximum input voltage may cause permanent damage.
③Efficiency is measured with nominal input voltage and rated output load.
④The product picture is for reference only. For details, please refer to the actual product.

Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Input Current (full load)	Nominal input voltage	--	--	600	mA
Input Current (no load)	Nominal input voltage	--	10	20	
Reflected Ripple Current④	Nominal input voltage, full load	--	150	--	
Input impulse Voltage (1sec. max.)	Nominal input voltage	-0.7	--	850	VDC
Starting Voltage		--	--	400	
Input Under-voltage Protection	Under-voltage protection release	370	--	400	
	Under-voltage protection start	360	--	390	
Start-up Time		--	--	600	ms
Ctrl②	Input current when turned off	--	10	20	mA
	Module open	Ctrl pin pulled -Vin or pulled low (0-0.9VDC)			
	Module shutdown	Ctrl pin open or TTL pulled high (3.5-12VDC)			
Input Filter		C filter			
Hot Plug		Unavailable			

Note:
①See reflected ripple current test circuit "Design Reference" Fig 6;
②The voltage of Ctrl pin is relative to input pin -Vin.

Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Output Voltage Accuracy	0% - 100% load	--	--	±1	%
Line Regulation	Full load, the input voltage is from low to high	--	±0.3	±0.5	
Load Regulation	0% - 100% load	--	±0.3	±0.5	
Minimum load		0	--	--	
Transient Response Deviation	25% load step change, input voltage range	--	±3	±5	
Transient Recovery Time	Nominal input, 25% load step change	--	350	500	μs
Temperature Coefficient	Full load	--	±0.03	--	%/℃
Ripple & Noise①	20MHz bandwidth, 0%-100% load②	--	150	200	mVp-p
Trim	28V Output	80	--	110	%Vo
	48V Output	90	--	110	
Sense		--	--	105	
Over-Temperature Protection	540VDC invput, case Temperature③	100	--	130	℃
Over-current Protection		110	--	--	%Io
Short-circuit Protection		Hiccup, continuous, self-recover			
Over-voltage Protection	28V Output	⩽ 35V (hiccup)			
	48V Output	⩽ 63V (hiccup)			

Note:
①The "Tip and barrel" method is used for ripple and noise test, please refer to DC-DC Converter Application Notes for specific information;
②The case temperature test points are shown in "Design Reference" Fig. 7.

General Specifications

Item		Operating Conditions	Min.	Typ.	Max.	Unit
Isolation	Input - Output	Electric strength test for 1min., leakage current <5mA	4250	--	--	VDC
	Input - Case		3000	--	--	
	Output - Case		1500	--	--	
Insulation Resistance	Input - Output	Test Voltage: 500VDC	100	--	--	MΩ
Shell Operating Temperature		See Page 3 for the product feature curve	-40	--	+100	℃
Storage Temperature			-55	--	+125	
Storage Humidity		Non-condensing	5	--	95	%RH
Pin Soldering Resistance Temperature*		Wave-soldering, Max. 10 seconds	--	--	260	℃
		Soldering spot is 1.5mm away from case for 10 seconds	--	--	300	
Switching Frequency		PWM mode	--	130	--	kHz
MTBF		MIL-HDBK-217F@25℃	500	--	--	k hours
Sinusoidal Vibration			20-2000Hz, 20G, 1.52mm. along X, Y and Z			

Note: *The Pin Soldering Temperature can withstand is not the actual set temperature of the soldering iron, but the temperature required for a good soldering point. The actual set temperature by the customer is comprehensively determined based on the thickness of the PCB, the size of the copper cladding, the power of the soldering iron, and the selection of the soldering iron tip.

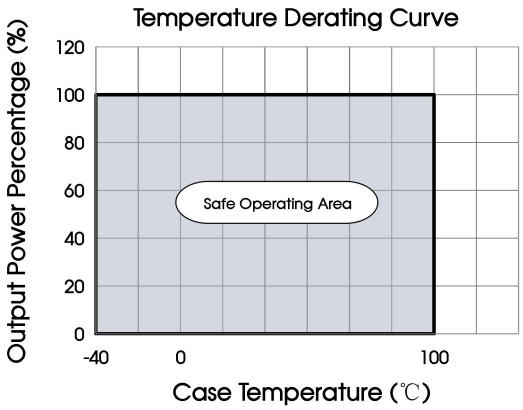
Mechanical Specifications

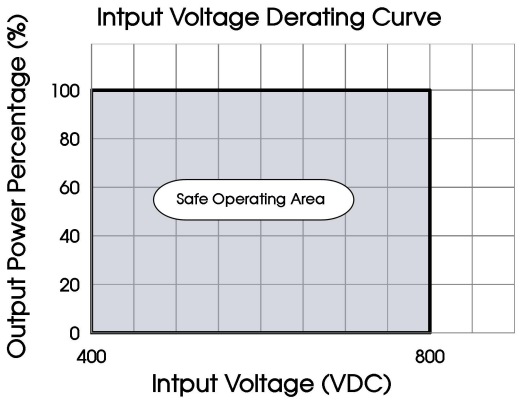
Case Material	Aluminum alloy & Black flame retardant and heat resistant plastic (UL94 V-0)
Dimensions	57.90 x 36.80 x 12.70 mm
Weight	78g (Typ.)
Cooling Method	Conduction heat dissipation (heat sink)

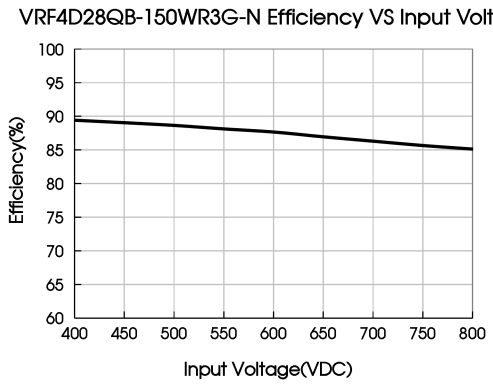
Electromagnetic Compatibility (EMC)

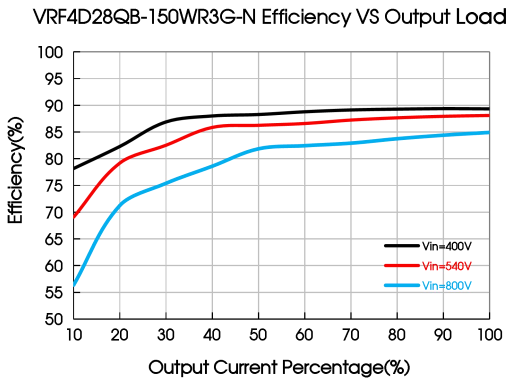
EMI	CE	CISPR32/EN55032	CLASS B (see Fig. 4 for recommended circuit)	
	RE	CISPR32/EN55032	CLASS B (see Fig. 4 for recommended circuit)	
EMS	ESD	IEC/EN61000-4-2	Contact ±6kV/Air ±8kV (see Fig. 3 for recommended circuit)	perf. Criteria A
	RS	IEC/EN61000-4-3	10V/m (see Fig. 4 for recommended circuit)	perf.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

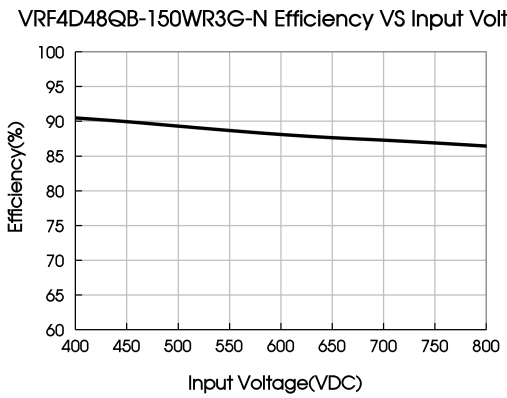
Product Characteristic Curve

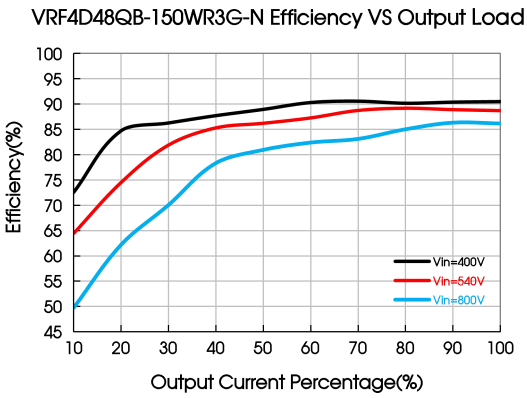












Remote Sense Application

1. Remote Sense Connection if not used

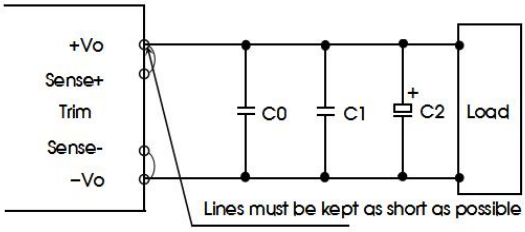


Fig. 1

Note：
(1) If the sense function is not used for remote regulation the user must connect the Sense+ to +Vo and Sense- to -Vo.
(2) The connections between Sense lines and their respective power lines must be kept as short as possible, otherwise they may be picking up noise, interference and or causing unstable operation of the power module.

2. Remote Sense Connection used for Compensation

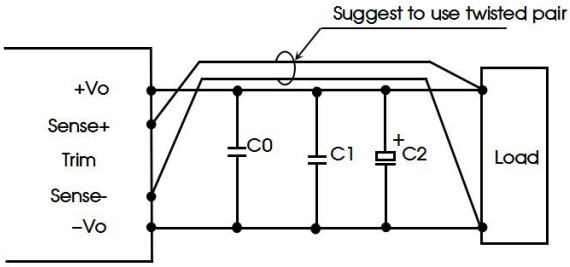


Fig. 2

Note:
(1) Using remote sense with long wires may cause unstable output, please contact technical support if long wires must be used.
(2) PCB-tracks or cables/wires for Remote Sense must be kept as short as possible. Twisted pair or shielded wires are suggested for remote compensation and must be kept as short as possible.
(3) We recommend using adequate cross section for PCB-track layout and or cables to connect the power supply module to the load in order to keep the voltage drop below 0.3V and to make sure the power supply's output voltage remains within the specified range.
(4) Note that large wire impedance may cause oscillation of the output voltage and or increased ripple. Consult technical support or factory for further advice of sense operation.

Design Reference

1. Typical application

If the EMC recommended circuit not being used, please be sure to connect an electrolytic capacitor of at least 47uF in parallel with the input terminal to suppress the surge voltage that may be generated at the input terminal, and a capacitor larger than the minimum capacitive load in parallel with the output terminal to stabilise the product output working condition.

All the DC/DC converters of this series are tested before delivery using thetypical circuit diagram shown in Fig.3.

Input and or output ripple can be further reduced by appropriately increasing the input & output capacitor values Cin and Cout 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.

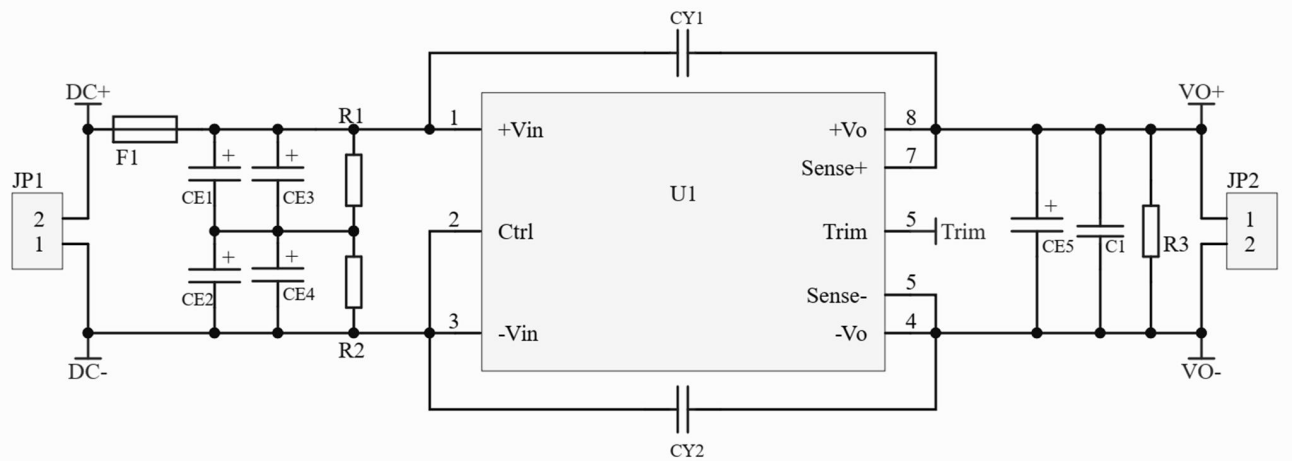


Fig. 3: Typical circuit diagram

Part No.	F1	CE1/CE2/ CE3/CE4	R1/R2	CY1/CY2	CE5	C1	R3
VRF4D28QB-150WR3G-N	2A, slow-blow	47uF/450V	3MΩ/1206/ 500V	Y1/102M/ 500VAC	470uF/35V (solid-state	225K/100V/1206	4.7KΩ/1206
VRF4D48QB-150WR3G-N					330uF/63V (solid-state		10KΩ/1206

2. EMC compliance circuit

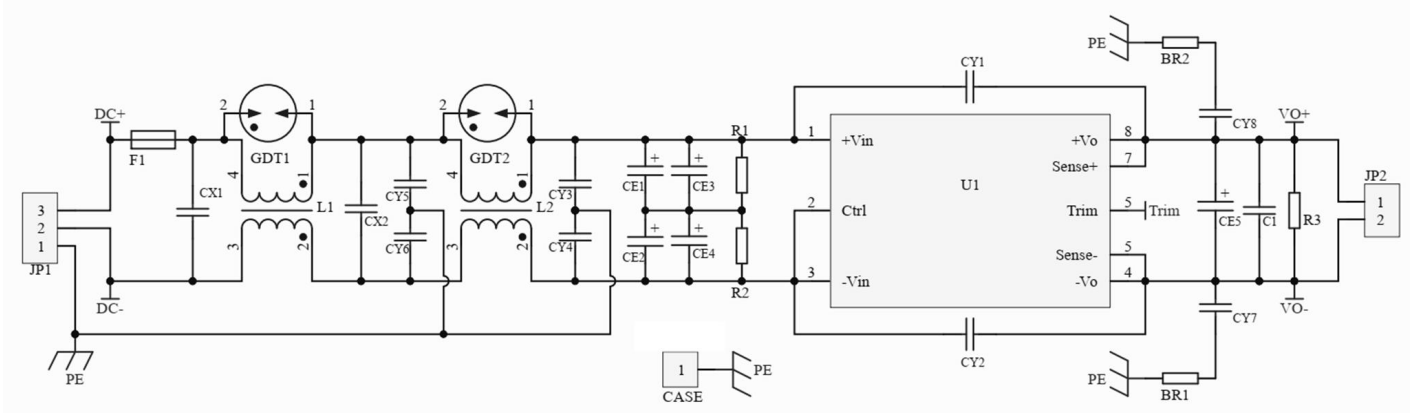


Fig. 4: EMC recommended ciruit

Components		Recommended value
F1		2A, slow-blow
CE1/CE2/CE3/CE4		47uF/450V
R1/R2		3MΩ/1206/500V
CY1/CY2/CY3/CY4/CY5/CY6		Y1/102M/500VAC
CE5	28V output	470uF/35V (solid-state capacitor)
	48V output	330uF/63V (solid-state capacitor)
C1		225K/100V/1206
R3	28V output	4.7kΩ/1206
	48V output	10kΩ/1206
CX1/CX2		105K/1000VDC
L1/L2		10mH, recommend MORNSUN P/N: FL2D-30-103
GDT1/GDT2		300V/1kA
CY7/CY8		Y1/222M/400VAC
BR1/BR2		ZF-04/T3.5*1.5*2.35HP/G159±25%

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

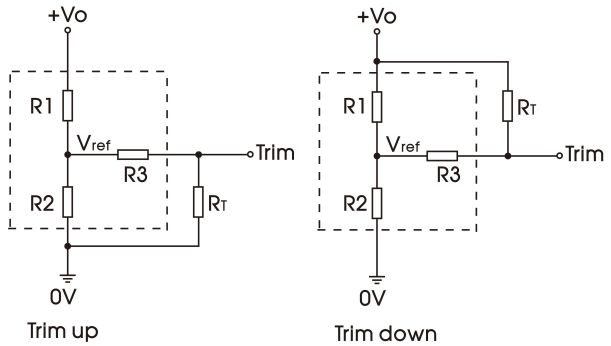


Fig. 5: TRIM resistor connection
(dashed line shows internal resistor network)

Calculation formula of Trim resistance:

$$\text{up: } R_T = \frac{aR_2}{R_2 - a} - R_3 \qquad a = \frac{V_{ref}}{V_o' - V_{ref}} \cdot R_1$$

$$\text{down: } R_T = \frac{aR_1}{R_1 - a} - R_3 \qquad a = \frac{V_o' - V_{ref}}{V_{ref}} \cdot R_2$$

Note:
a = Self-defined parameter, accurate to two decimal places;
R_T (kΩ): Resistance of Trim.
Vo' is the actual output voltage.
Vref (VDC) indicates the reference voltage.

Part No.	R1 (kΩ)	R2 (kΩ)	R3 (kΩ)	Vref (V)
VRF4D28QB-150WR3G-N	24	2.332	17.8	2.485
VRF4D48QB-150WR3G-N	47	2.564	20	2.485

4. Reflected ripple current--test circuit

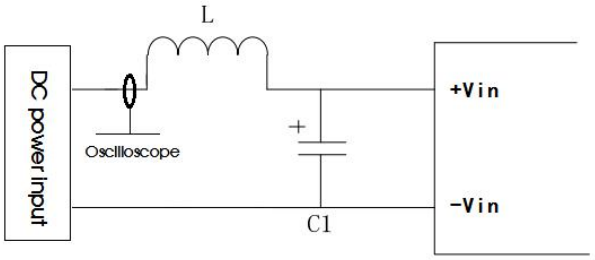


Fig. 6

Components	Recommended value
L	10uH
C4	47uF, refer to CE1-CE4 of application circuit

5. Recommended scheme for thermal testing

In the application process, the thermal design of the product can be evaluated with the product temperature derating curve; or by testing the temperature of point A in Fig. 7 to determine the stable working range of the product, when the temperature of point A is lower than 105℃, it is the stable working range of the product.

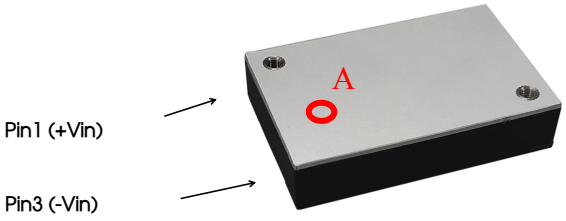
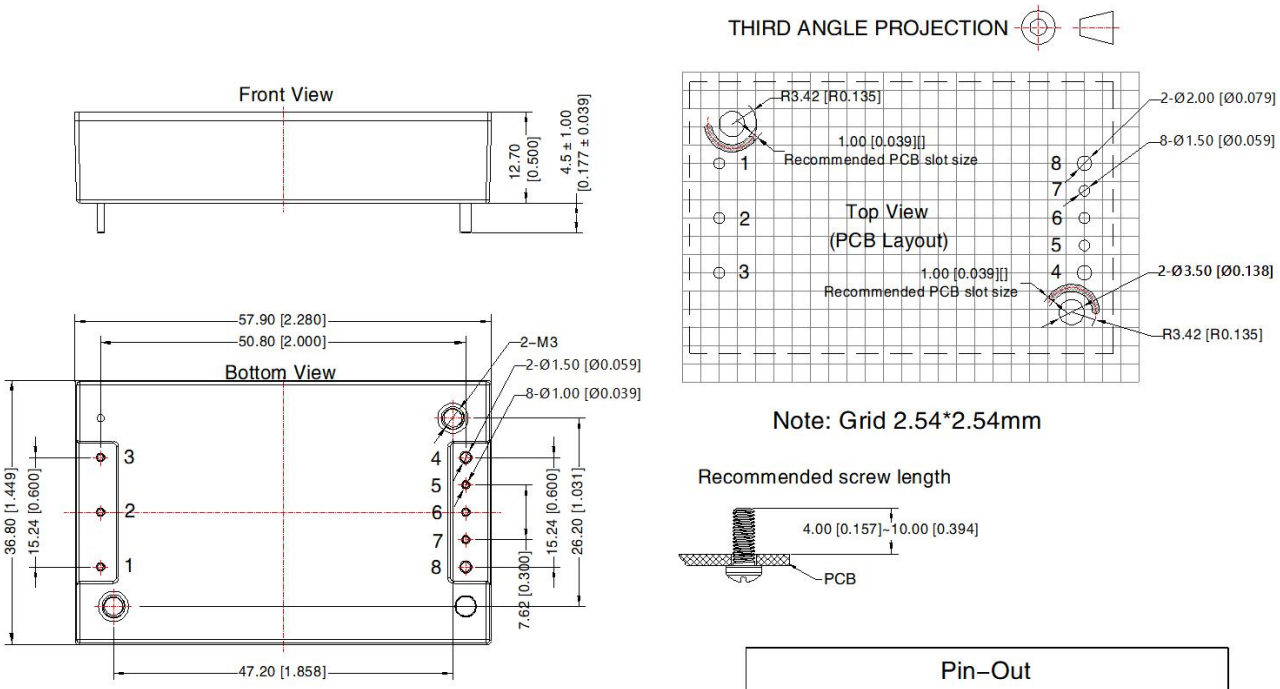


Fig. 7

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

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

Dimensions and Recommended Layout



Note:
Unit: mm[inch]
Pin1, 2, 3, 5, 6, 7's diameter: 1.00 [0.039]
Pin4, 8's diameter: 1.50 [0.059]
Pin diameter tolerances: ± 0.10 [± 0.004]
General tolerances: ± 0.50 [± 0.020]
Mounting hole screwing torque: M3，0.4 N · m ± 10%

Pin–Out			
Pin	Mark	Pin	Mark
1	+Vin	5	Sense–
2	Ctrl	6	Trim
3	–Vin	7	Sense+
4	–Vo	8	+Vo

Note:
1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58010113;
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 Ta=25℃, 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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