300W, High input voltage, isolated voltage regulator single output, DC/DC module power supply

Patent Protection RoHS

FEATURES

- Wide input voltage range: 180-435VDC
- High efficiency up to 92%
- Enhanced isolation, isolation voltage: 3kVAC
- Input under-voltage protection, over-voltage protection, output over-voltage, over-current, short-circuit protection, over-temperature protection
- Shell operating temperature range Tc: -40℃ to +105℃
- Industry standard 1/2-Brick package and pin-out
- Meet the EN62368 certification standard

VRF3D_QB-300WR3G-N series output power is 300W, 180-435VDC wide input voltage range, efficiency up to 92%, isolation voltage 3000VAC, housing allowed operating temperature -40℃ to +105℃, with input under-voltage, output over-voltage/over-current/short circuit protection, over-temperature protection, widely used in industrial control, communication and other fields.

Selection Guide

Certification	Part No.	Ctrl Logic①	Input Voltage (VDC)		Output		Full Load Efficiency (%)③ Min./Typ.	Capacitive Load (μF) Max.
			Nominal (Range)	Max.②	Voltage (VDC)	Current (mA) (Max./Min.)		
--	VRF3D05HB-300WR3G-N	N	270 (180-435)	435	05	60000/0	88.5/90.5	15000
	VRF3D12HB-300WR3G-N	N			12	25000/0	88.5/90.5	8000
	VRF3D24HB-300WR3G-N	N			24	12500/0	89.5/91.5	5000
	VRF3D28HB-300WR3G-N	N			28	10800/0	89.5/91.5	4000
	VRF3D48HB-300WR3G-N	N			48	6300/0	90.0/92.0	1200

Note:
①"P" indicates positive logic, "N" indicates negative logic;
②Exceeding the maximum input voltage may cause permanent damage;
③Efficiency is measured with nominal input voltage and rated output load.

Input Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
IInput Current (full load / no-load)	Nominal input voltage	05V/12V Output	--	1228/--	1256/45	mA
		24V/28V Output	--	1215/--	1242/45	
		48V Output	--	1208/--	1235/45	
Reflected Ripple Current④	Nominal input voltage, 100% load		--	50	120	
Surge Voltage (1sec. max.)	Ctrl pin open or Ctrl pulled high		-0.7	--	500	VDC
Starting Voltage			--	--	180	
Input Under-voltage Protection			160	--	--	
Input Over-voltage Protection	Input over-voltage recovery voltage		--	465	--	
	Input over-voltage shutdown voltage		--	480	--	
Start-up Time	Nominal input voltage & constant resistance load		--	100	300	ms
Input Filter			Pi filter			
Hot Plug			Unavailable			

Ctrl②	Module open	Ctrl pin pulled GND or pulled low (0-1.2VDC)			
	Module shutdown	Ctrl pin open or TTL pulled high (3.5-12VDC)			
	Input current when turned off	--	5	10	mA

Note:
①See reflected ripple current test circuit "Design Reference" Fig 7.
②The voltage of Ctrl pin is relative to input pin GND.

Output Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Output Voltage Accuracy	0% - 100% load		--	±0.5	±2	%
Line Regulation	Full load, the input voltage is from low to high		--	±0.05	±0.5	
Load Regulation	0% - 100% load		--	±0.2	±0.5	
Transient Response Deviation	25% load step change, input voltage range	05V/12V Output	--	--	±10	
		24V/28V Output	--	--	±8	
		48V Output	--	--	±6	
Transient Recovery Time	Nominal input, 25% load step change		--	--	500	μs
Temperature Coefficient	Full load		--	--	±0.03	%/℃
Ripple & Noise①	20MHz bandwidth, 5% - 100% load②	5V Output	--	--	150	mVp-p
		12V Output	--	--	240	
		24V Output	--	--	360	
		28V Output	--	--	380	
		48V Output	--	--	480	
Over-temperature Protection	Case Temperature②		105	115	125	℃
Trim	Input voltage range		80	--	110	%Vo
Sense			--	--	105	
Output Over-voltage Protection			110	115	125	
Output Over-current Protection			110	125	160	%Io
Short-circuit Protection			Continuous, self-recovery			

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. 8.

General Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Isolation	Electric strength test for 1 minute with a leakage current of 5mA max.	Input - output	3000	--	--	VAC
		Input - Case	1500	--	--	
		Output - Case	1500	--	--	
Insulation Resistance	Input-output resistance at 500VDC		100	--	--	MΩ
	Input-output-shell, resistance at 500VDC		100	--	--	
Isolation Capacitance	Input-output capacitance at 100kHz/0.1V		--	1100	--	pF
Shell Operating Temperature Range	See Fig. 1		-40	--	+105	℃
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	℃
Vibration			10-150Hz, 5G, 0.75mm. along X, Y and Z			
Switching Frequency (PFM Mode)①	PWM mode		--	300	--	kHz
MTBF	MIL-HDBK-217F@25℃		500	--	--	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

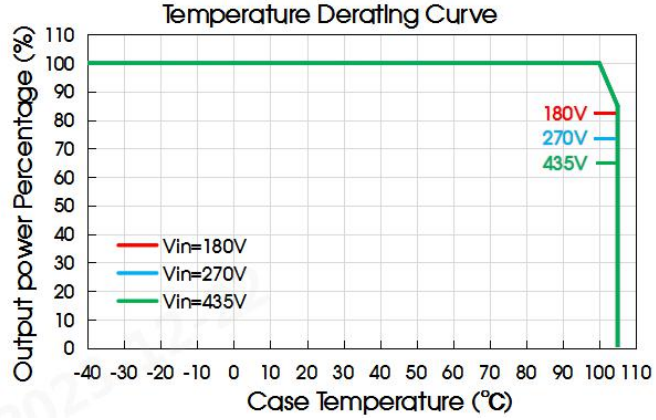
Case Material	Black flame retardant and heat resistant plastic (UL94 V-0), aluminum alloy
Dimensions	61.0 x 57.9 x 12.7 mm
Weight	140.0g (Typ.)
Cooling Method	Natural convection or forced air convection

Electromagnetic Compatibility (EMC)

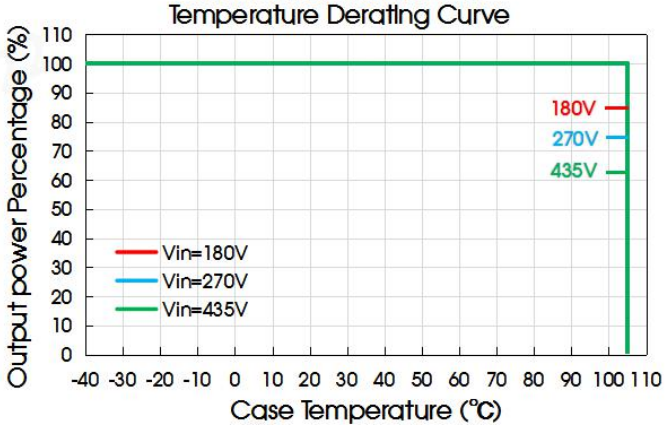
EMI	CE	CISPR32/EN55032	CLASS A (see Fig.6)	
	RE	CISPR32/EN55032	CLASS A (see Fig.6)	
EMS	ESD	IEC/EN61000-4-2	Air ±8KV/Contact ±6KV (see Fig.4)	perf. Criteria A
	RS	IEC/EN61000-4-3	20V/m (see Fig.6)	perf. Criteria A
	EFT	IEC/EN61000-4-4	±2KV (see Fig.6)	perf. Criteria A
	Surge	IEC/EN61000-4-5	line to line ±2KV (see Fig.6)	perf. Criteria A
	CS	IEC/EN61000-4-6	10 Vr.m.s (see Fig.6)	perf. Criteria A

Product Characteristic Curve

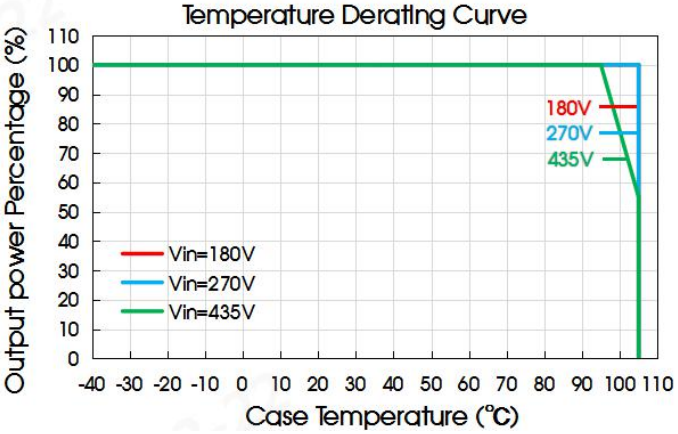
VRF3D05HB-300WR3G-N
Temperature Derating Curve



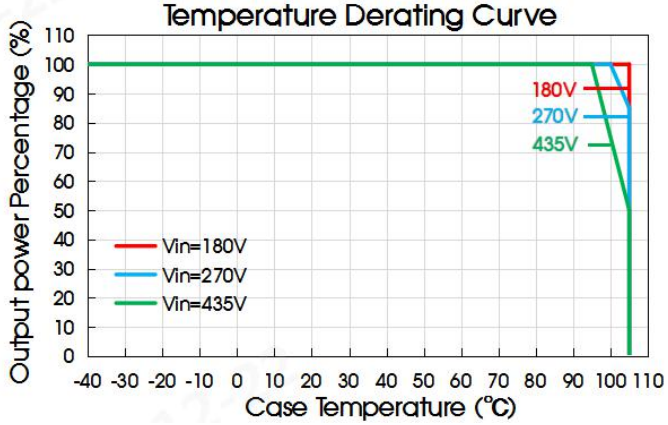
VRF3D12HB-300WR3G-N
Temperature Derating Curve



VRF3D24HB-300WR3G-N
Temperature Derating Curve



VRF3D28HB-300WR3G-N
Temperature Derating Curve



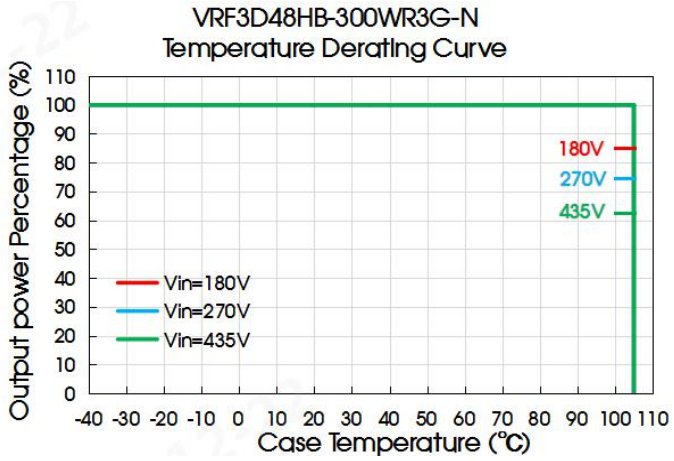


Fig.1

Remote Sense Application

1. Remote Sense Connection if not used：

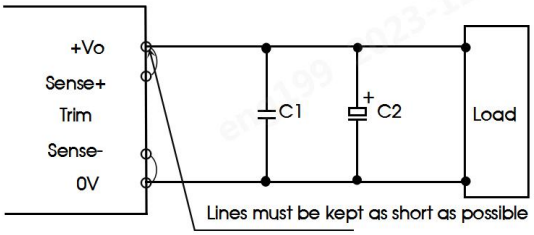


Fig. 2

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

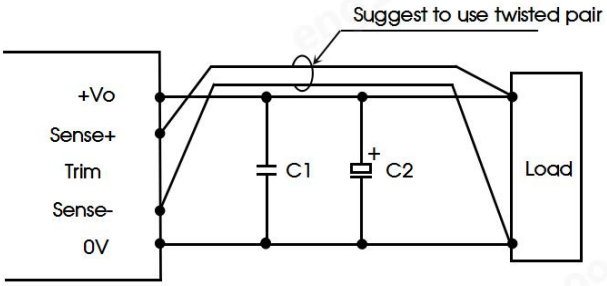


Fig. 3

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

All the DC/DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 4.
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.

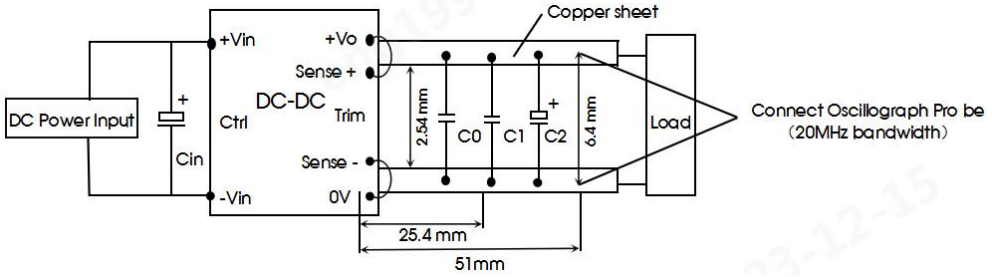


Fig. 4

Part No.	Cin Selection Guide	C0 Selection Guide	C1 Selection Guide	C2 Selection Guide
05V	100uF/500V	1uF/50V	10uF/50V Tantalum capacitor	2000uF/10V Polymer capacitor
12V		1uF/50V	10uF/50V Tantalum capacitor	1000uF/35V Polymer capacitor
24V		1uF/50V	10uF/50V Tantalum capacitor	680uF/50V Polymer capacitor
28V		1uF/50V	10uF/50V Tantalum capacitor	470uF/50V Polymer capacitor
48V		4.7uF/100V	/	330uF/100V Polymer capacitor

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

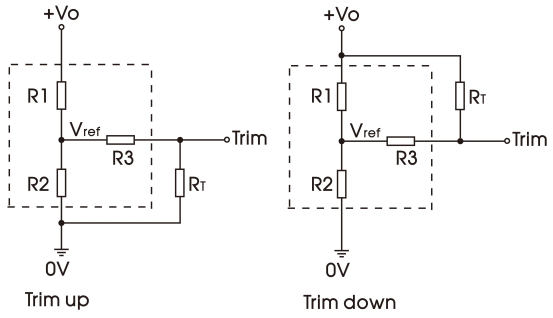


Fig.5
TRIM resistor connection (dashed line shows internal resistor network)

Calculation formula of Trim resistance:

$$\text{up: } R_T = \frac{aR_2}{R_2-a} - R_3 \qquad a = \frac{Vref}{Vo'-Vref} \cdot R_1$$

$$\text{down: } R_T = \frac{aR_1}{R_1-a} - R_3 \qquad a = \frac{Vo'-Vref}{Vref} \cdot R_2$$

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.

Vout (VDC)	R1 (KΩ)	R2 (KΩ)	R3 (KΩ)	Vref (V)
05	8.7	2.87	10.3	1.25
12	10.91	2.87	11.5	2.5
24	24.77	2.87	12.9	2.5
28	29.4	2.87	12.9	2.5
48	52.28	2.87	13.30	2.5

4. EMC Compliance Circuit

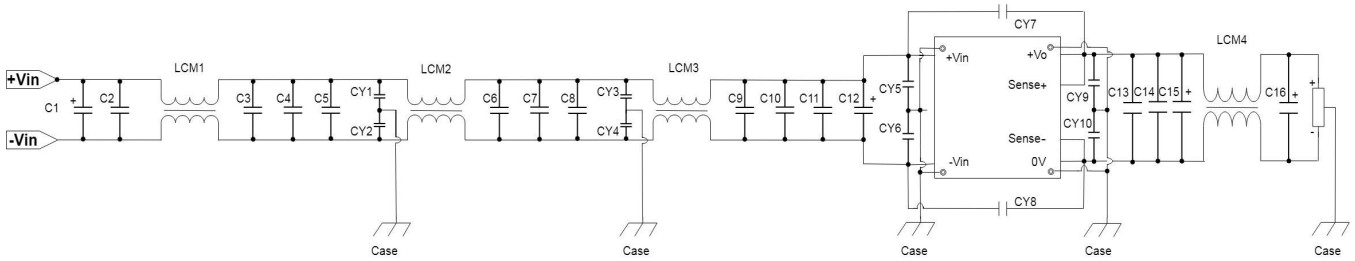


图 6

Components	Parameter description:
C1, C12	47uF/500V (Electrolytic capacitor)
C2, C3, C6, C9	2.2μF/450V (Film capacitor)
C4, C5, C7, C8, C10, C11	0.1μF/630V (Ceramic capacitor)
C13, C14	1μF/100V (Ceramic capacitor)
C15, C16	330μF/63V (Electrolytic capacitor)
LCM1	10mH, Recommended to use MORNSUN P/N:FL2D-30-103B
LCM2	7mH, Recommended to use MORNSUN P/N:FL2D-30-702B
LCM3	4uH (Nickel zinc), Recommended to use MORNSUN P/N:FL2D-D0-040
LCM4	300uH, Recommended to use MORNSUN P/N:FL2D-F5-301
CY1, CY2, CY3, CY4	4.7nF/400VAC*2
CY5, CY6	NC
CY7, CY8, CY9, CY10	1nF/400VAC

5. Reflected ripple current--test circuit

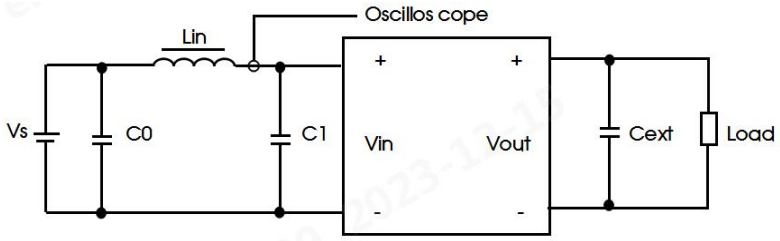


Fig. 7

Components	Parameter description:
C0	NC
Lin	22uH/4.7A
C1	100uF/500V
Cext	See application circuit Fig.4 C0/C1/C2

6. 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.8 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.

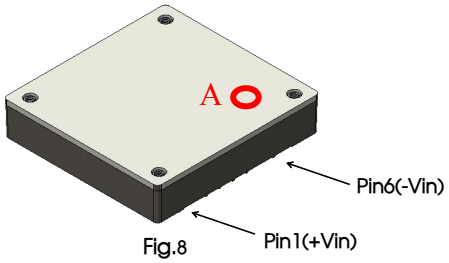
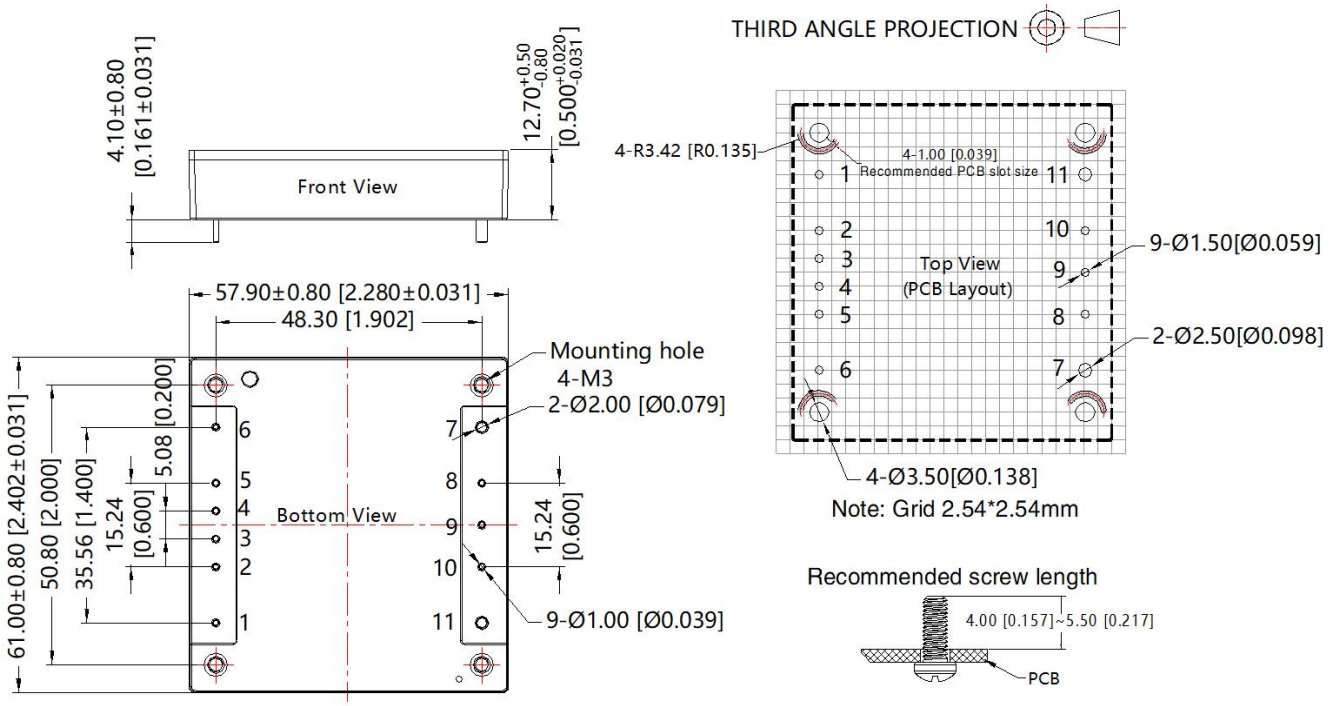


Fig.8

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

8. 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, 4, 5, 6, 8, 9, 10diameter: 1.00[0.039]
Pin7, 11diameter: 2.00[0.079]
Pin diameter tolerances: ±0.10[±0.004]
General tolerances: ±0.50[±0.020]
Mounting hole screwing torque: Max 0.4 N・m

Pin-Out			
Pin	Mark	Pin	Mark
1	+Vin	7	0V
2	Ctrl	8	Sense-
3	NC	9	Trim
4	NC	10	Sense+
5	NC	11	+Vo
6	-Vin		

Note:
1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58200069;
2. The maximum capacitive load offered were tested at input voltage range and full load;
3. Unless otherwise specified, data in this datasheet should be tested under the conditions of Ta=25℃, humidity<75%RH with nominal input voltage and rated load;
4. All index testing methods in this datasheet are based on our company corporate standards;
5. We can provide product customization service and match filter module;
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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