

Product Feature

- ◆ Ultra-Wide Input voltage range: 43-160VDC
- ◆ Operating ambient temperature range: -40°C - +105°C
- ◆ Isolation voltage: input-output 3000VAC, input-case 2100VAC
- ◆ High efficiency up to 90% (Typ.)
- ◆ Industry standard 1/4 brick
- ◆ Output short-circuit protection, over-current protection, and over-voltage protection, over-temperature protection mechanisms.
- ◆ Application areas: industrial control, power, instrumentation, communication, railway, etc.

Selection Guide

Part No. ^①	Input Voltage (VDC)		Output		Full Load Efficiency ^③ (%)Typ.	Capacitive Load(μF) Max.
	Nominal ^② (Range)	Max. ^③	Voltage (VDC)	Current (mA)		
SURF1D03QB-100WR5 (H)	110 (43-160)	170	3.3	22727	86	40000
SURF1D05QB-100WR5 (H)			5	20000	88	20000
SURF1D12QB-100WR5 (H)			12	8333	89	6000
SURF1D15QB-100WR5 (H)			15	6667	89	4700
SURF1D24QB-100WR5 (H)			24	4167	90	3000
SURF1D48QB-100WR5 (H)			48	2083	88	480

Notes:

- ①. Suffix plus "H" means plus heat sink package;
- ②. When input voltage at 43-66VDC, the output power and max. capacitive load need to be derated to 80%;
- ③. Exceeding the maximum input voltage may cause permanent damage;
- ④. Efficiency is measured at nominal input voltage and rated output load.

Input Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Current (Full Load/No-Load)	Nominal input series	3.3VDC Output	--	793/10	812/20	mA
		24VDC Output	--	1011/10	1034/20	
		12VDC、15VDC Output	--	1022/10	1045/20	
		5VDC、24VDC Output	--	1034/10	1058/20	
Reflected Ripple Current	Nominal input series		--	100	--	
Surge Voltage (1sec. max.)			-0.7	--	180	VDC
Start-Up Voltage	Full load		--	--	43	
Input Under-Voltage Protection			--	40	--	
Input Filter			PI filter			
Hot Plug			Unavailable			
Ctrl	Turn on module		Ctrl pin open or pulled high (TTL2.7-12VDC)			
	Turn off module		Ctrl pin pulled low to GND (0-1.2VDC)			
	Cut-off input current		--	2	7	mA

Output Specification

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Output Voltage Accuracy	Nominal input voltage, 0%-100% load		--	±1.0	±3.0	%
Linear Regulation	Vin=Min. to Max. @Full Load	3.3VDC、5VDC Output	--	±0.2	±0.5	
		Others Output	--	±0.1	±0.3	
Load Regulation	Nominal input voltage, 10%-100% load	3.3VDC、5VDC Output	--	±0.5	±1.0	
		Others Output	--	±0.3	±0.5	
Ripple & Noise①	20MHz bandwidth,10%-100% load	48VDC Output	--	200	300	mVp-p
		Others Output	--	100	200	
Transient Recovery Time	25% load step change, nominal input voltage		--	200	500	μs
Transient Response Deviation		3.3VDC、5VDC Output	--	±6.0	±9.0	%
		Others Output	--	±3.0	±5.0	
Temperature Coefficient	Full Load		--	--	±0.03	%/°C
Trim			90	--	110	%
Output Voltage			--	--	105	
Over-Temperature Protection	Surface max. temperature		--	105	115	°C
Over-Voltage Protection	Input voltage range	3.3VDC、5VDC Output	110	--	160	%Vo
		Others Output	110	--	140	
Over-Current Protection	Input voltage range		110	140	--	%Io
Short-Circuit Protection			continuous, self-recovery			
Notes: ①Ripple & Noise for 48VDC output at 0%Io-100%Io load ≤ 400mV, others outputs at 0%Io-100%Io load ≤ 300mV.						

General Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Isolation Voltage	Input-output	Electric Strength test for 1 minutewith a leakage current of 5mA max	3000	--	--	VAC
	Input-case		2100	--	--	
	output-case	Electric Strength test for 1 minutewith 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		--	2200	--	pF
Switching Frequency	PWM mode		--	200	--	KHz
MTBF	MIL-HDBK-217F@25°C		500	--	--	K Hours

Environmental Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Operating Temperature	See temperature derating curves	-40	--	+105	°C
Storage Temperature		-55	--	+125	
Storage Humidity	Non-condensing	5	--	95	%RH
Soldering Profile	Wave-soldering	260±5°C; time:5 - 10s			
	Manual-welding	360±10°C;time:3 - 5s			
Vibration	IEC/EN 61373 -Category 1,Grade B				
Cooling Test	EN60068-2-1				
Dry Heat	EN60068-2-2				
Damp Heat	EN60068-2-30				

Mechanical Specifications

Case Material	Aluminum alloy case; Black plastic bottom, flame-retardant and heat-resistant (UL94 V-0)
Package Dimensions	60.80×39.20×12.70mm
Weight	88.0g (Typ.)
Cooling Method	Free air convection or forced convection

EMC Specifications

EMI	CE	CISPR32/EN55032 150KHz-30MHz Class B CLASS B ((see Fig. 3-2 for recommended circuit)			
	RE	CISPR32/EN55032 30MHz-1GHz Class B (see Fig. 3-2 for recommended circuit)			
EMS	ESD	IEC/EN61000-4-2 GB/T17626.2 Contact ±6KV, Air ±8KV			Perf.Criteria A
	RS	IEC/EN61000-4-3 GB/T17626.3 20V/m			Perf.Criteria A
	EFT	IEC/EN61000-4-4 GB/T17626.4 ±2KV (5KHz, 100KHz) (see Fig. 3-2 for recommended circuit)			Perf.Criteria A
	Surge	IEC/EN61000-4-5 GB/T17626.5 line to line ±2KV (1.2μs/50μs 2Ω) (see Fig. 3-2 for recommended circuit)			Perf.Criteria A
	CS	IEC/EN61000-4-6 GB/T17626.6 10Vr.m.s			Perf.Criteria A

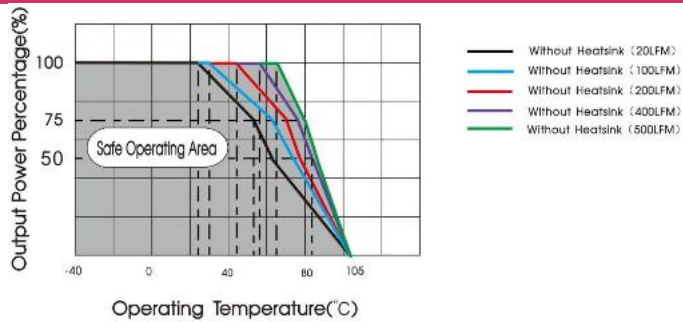
EMC Specifications(EN50155)

EMI	CE	EN50121-3-2 150kHz-500kHz 99dBuV (see Fig. 3-1 for recommended circuit) EN55016-2-1 500kHz-30MHz 93dBuV (see Fig. 3-1 for recommended circuit)			
	RE	EN50121-3-2 30MHz-230MHz 40dBuV/m at 10m (see Fig. 3-1 for recommended circuit) EN55016-2-1 230MHz-1GHz 47dBuV/m at 10m (see Fig. 3-1 for recommended circuit)			
EMS	ESD	EN50121-3-2 Contact ±6KV/Air ±8KV			Perf.Criteria A
	RS	EN50121-3-2 20V/m			Perf.Criteria A
	EFT	EN50121-3-2 ±2kv 5/50ns 5kHz (see Fig. 3-1 for recommended circuit)			Perf.Criteria A
	Surge	EN50121-3-2 line to line ±1KV (42Ω, 0.5 μ F) (see Fig. 3-1 for recommended circuit)			Perf.Criteria A
	CS	EN50121-3-2 0.15MHz-80MHz 10V r.m.s			Perf.Criteria A

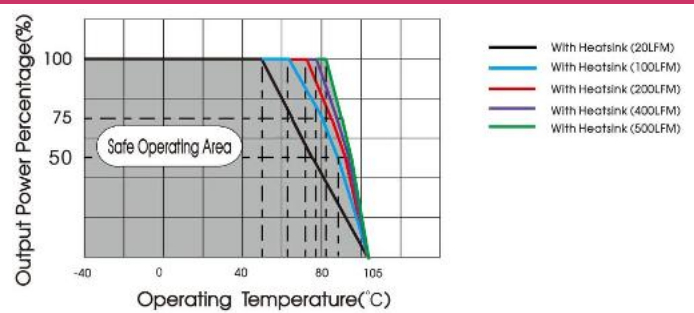
Typical Characteristic Curves

Temperature Derating Curve

SURF1D12QB-100WR5 (Vin=110V)



SURF1D12QB-100WR5H (Vin=110V)

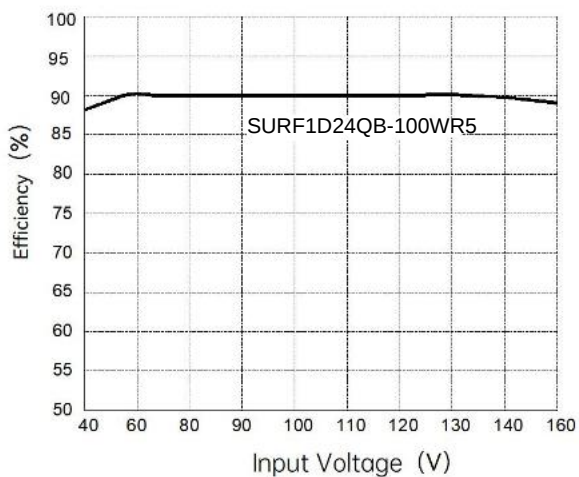


Note:

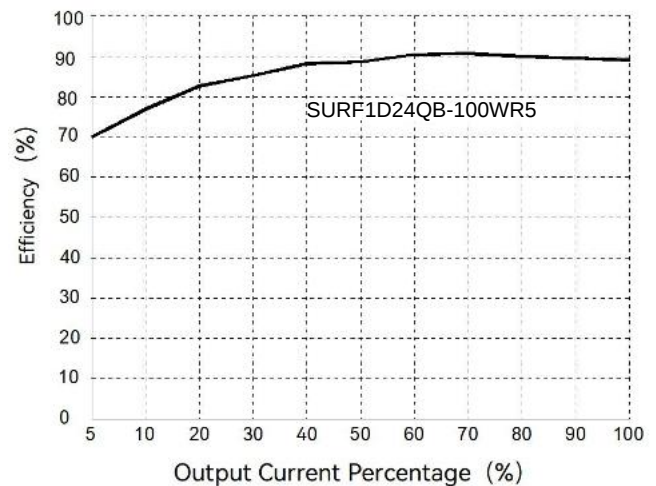
1: Temperature derating curves and efficiency curves are typical test values.

2: The temperature derating curve is tested according to our laboratory test conditions. If the actual environmental conditions used by customers are inconsistent, it is necessary to ensure that the temperature of the aluminum case of the product does not exceed 100°C, and it can be used within a rated load range.

Efficiency VS Input Voltage (Full load)

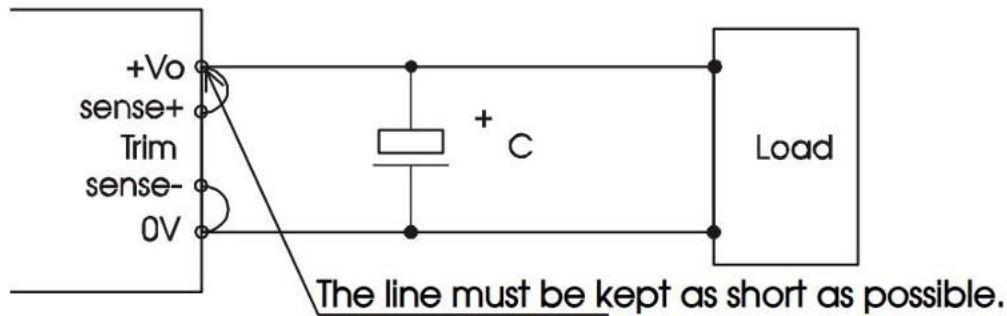


Efficiency VS Output Load (Vin=110V)



Remote Sense Application

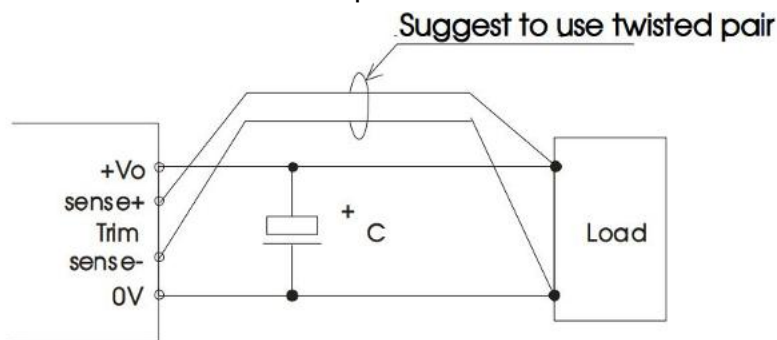
1. Remote Sense Connection if not used:



Note:

- (1) If the sense function is not used for remote regulation the user must connect the +Sense to + Vo and -Sense to 0V at the DC-DC converter pins and will compensate for voltage drop across pins only.
- (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:



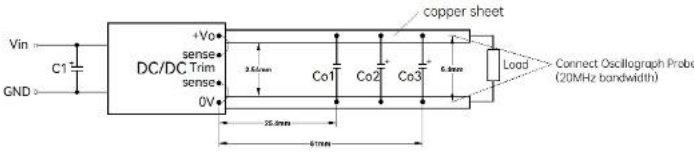
Note:

- (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.
- (2) 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.

Typical Circuit Design And Application

Ripple & Noise Recommended Circuit (Fig.1)

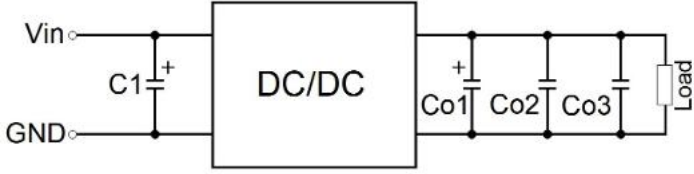
Recommended Capacitive Load Value Table

	Vout(VDC)	C1(uF)	Co1(μF)	Co2(μF)	Co3(μF)
	3.3VDC	100	1	10	1000
	5VDC				680
	12/15/24/48VDC				220

All the DC-DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 1.

Recommended Circuit (Fig.2)

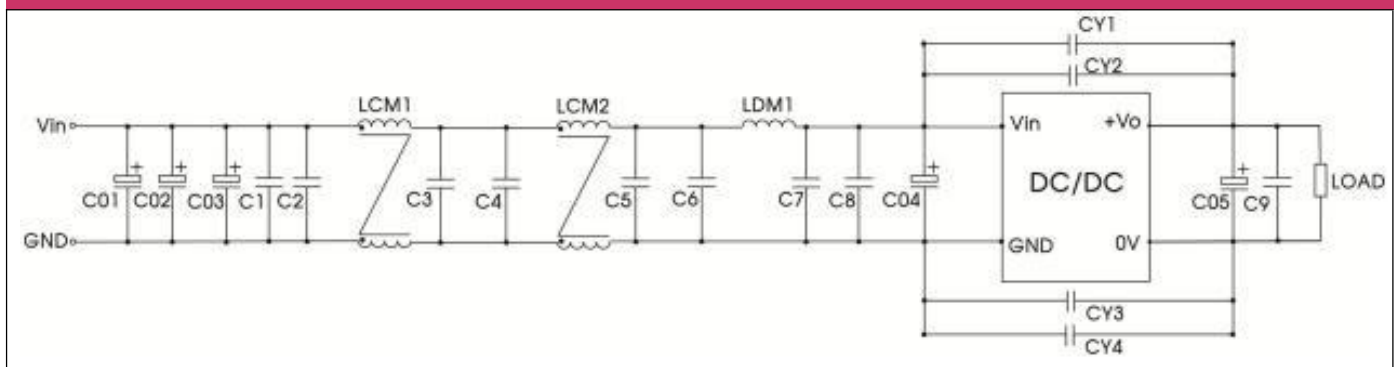
Recommended Capacitive Load Value Table

	Vout(VDC)	C1(uF)	Co1(μF)	Co2(μF)	Co3(μF)
	3.3VDC	100	1	10	1000
	5VDC				680
	12/15/24/48VDC				220

If the customer does not use the recommended circuit provided by our company, please be sure to parallel a 100uF electrolytic capacitor at the input end to suppress the possible surge voltage at the input end.

If you want to further reduce the input and output ripple, you can increase the external capacitors C1, Co1, Co2, and Co3 at the input and output, or use capacitors with a smaller equivalent impedance in series. However, the capacitance value must not exceed the maximum capacitive load of the product.

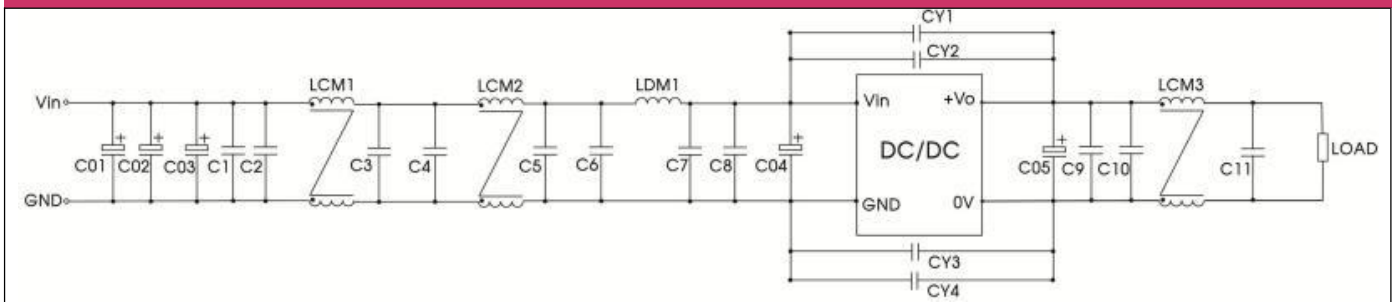
EMC Recommended Circuit (Fig.3-1)



EMC Recommended Parameter Table

C01,C02,C03,C04	220uF/200V electrolytic capacitor
C05	220uF/63V electrolytic capacitor
LDM1	1.5uH Shielded inductor
C1,C2,C3,C4,C5,C6,C7,C8,C9	2.2uF/250V
CY1,CY2,CY3,CY4	2200pF/400VAC, Y safety capacitor
LCM1	FL2D-30-472
LCM2	FL2D-30-102

EMC Recommended Circuit (Fig.3-2)

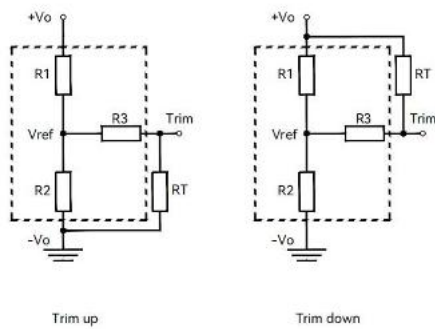


EMC Recommended Parameter Table

C01,C02,C03,C04	220uF/200V electrolytic capacitor
C05	220uF/63V electrolytic capacitor
LDM1	1.5uH Shielded inductor
C1,C2,C3,C4,C5,C6,C7,C8,C9,C10,C11	2.2uF/250V
CY1,CY2,CY3,CY4	2200pF/400VAC,Y safety capacitor
LCM1	FL2D-30-472
LCM2	FL2D-30-102
LCM3	FL2D-70-360C
	FL2D-A3-360C
	FL2D-B5-360C

rim Recommended Circuit Fig.5

Trim Recommended Component Parameters



Trim resistor connections (dashed line shows internal resistor network)

Vout(V)	R1(KΩ)	R2(KΩ)	R3(KΩ)	Vref(V)
3.3	10	6.064	13.622	1.24
5	2.4	2.344	13.622	2.5
12	8.2	2.153	17.346	2.5
15	12	2.388	21.016	2.5
24	10	1.158	10.714	2.5
48	58.7	3.21	11	2.5

$$\text{Up : } R_t = \frac{nR_2}{R_2 - n} - R_3$$

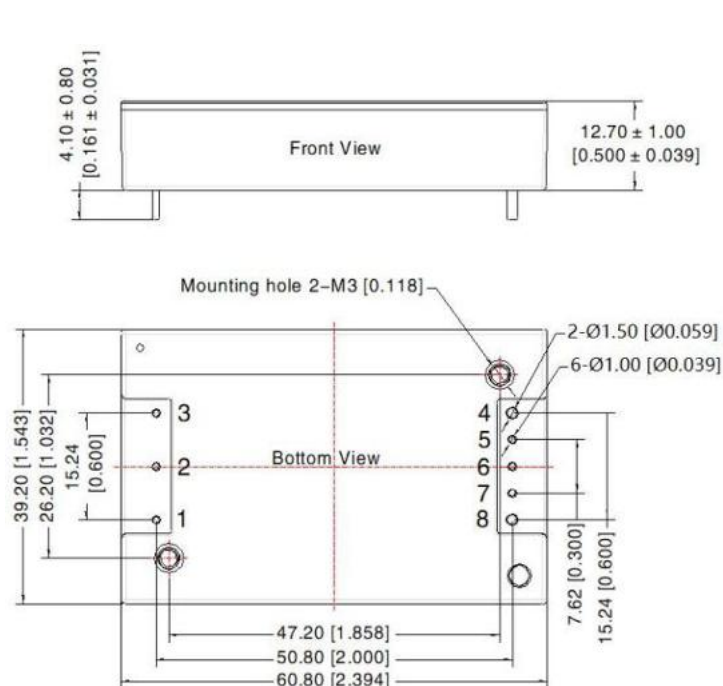
$$n = \frac{V_{ref}}{V_o - V_{ref}} * R_1$$

$$\text{Down : } R_t = \frac{nR_1}{R_1 - n} - R_3$$

$$n = \frac{V_o - V_{ref}}{V_{ref}} * R_2$$

Dimensions and Recommended Layout

PCB Printing Layout

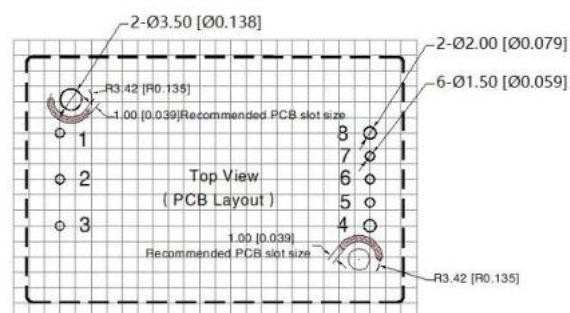


Note:

Unit: mm[inch]

Pin section tolerances: $\pm 0.10 [\pm 0.004]$

General tolerances: $\pm 0.50 [\pm 0.020]$



The grid distance is 2.54mm x2.54mm

Pin Definition Table

Pin	Single
1	Vin
2	Ctrl
3	GND
4	-Vo
5	Sense-
6	Trim
7	Sense+
8	+Vo

Packaging Instructions

Packaging information

Model series	Product quantity (pcs/pipe (tray))	Inner carton quantity (pcs/ carton)	Outer carton quantity (pcs/ carton)
SURF1DxxQB-100WR5	35	140	270

Note:

- ✧ The input voltage should not exceed the specified range value, otherwise it may cause permanent and irreparable damage;
- ✧ It is recommended to use at a load of over 5%. If the load is below 5%, the ripple index of the product may exceed the specifications, but it does not affect the reliability of the product;
- ✧ The maximum capacitive load is tested within the input voltage range and under full load conditions;
- ✧ Unless otherwise specified, all indicators in this manual are measured at Ta=25 °C, humidity<75% RH, nominal input voltage, and output rated load;
- ✧ All indicator testing methods in this manual are based on our company's corporate standards;
- ✧ Our company can provide product customization, and specific requirements can be directly contacted by our technical personnel;
- ✧ Product specifications are subject to change without prior notice.