

VB60-xxSxxLD Series

DC-DC Converter | 60W | 2"X1" | 4:1 Wide Input Voltage, Regulated Output | 1600VDC



Features

- 2"X 1" DIP Package
- Operating Temperature Range: -40°C ~ +105°C
- 4:1 Wide Input Voltage Range
- Isolation Voltage: 1600VDC
- Full Load Efficiency: 91% (typ.)
- Output Short Circuit, Over-current, Over-voltage Protection
- Designed to meet IEC/EN/BS EN/UL 62368

Product Description



The VB60-xxSxxLD series is a 60 Watt isolated DC/DC converter with ultra-wide 4:1 input voltage range. It features high efficiency, isolation voltage 1600VDC and operating temperature range of -40°C to +105°C. Typical applications are in electric power, telecom/datacom, industry control systems and measurement equipment.

Product Selection Table

Certification	Part No.	Input Voltage (VDC)		Output		Full Load Efficiency (%) Typ.	Capacitive Load (μF) Max.
		Nominal (Range)	Max.	Output Voltage (VDC)	Max. Current (mA)		
EN/UL Pending	VB60-24S05LD	24 (9~36)	40	5	12000	90	20000
	VB60-24S12LD	24 (9~36)	40	12	5000	91	6000
	VB60-24S15LD	24 (9~36)	40	15	4000	91	4000
	VB60-24S24LD	24 (9~36)	40	24	2500	91	2000
	VB60-48S05LD	48 (18~75)	80	5	12000	90	20000
	VB60-48S12LD	48 (18~75)	80	12	5000	91	6000
	VB60-48S15LD	48 (18~75)	80	15	4000	91	4000
	VB60-48S24LD	48 (18~75)	80	24	2500	91	2000

Note:

1. Suffix "H" indicates heatsink packaging, suffix "-T" indicates extension for chassis mount packaging, suffix "-DIN" indicates extension for Din-rail mount packaging;
2. The extension packaging has reverse polarity protection added internally at the input, and its full load efficiency will decrease by 2%.

Input Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Current (Full Load / No-load)	24VDC Nominal Input Voltage	5VDC Output	--	2777/25	2840/30	mA
		Others	--	2747/25	2808/30	mA
	48VDC Nominal Input Voltage	5VDC Output	--	1388/10	1420/15	mA
		Others	--	1373/15	1404/30	mA
Surge Voltage	24V Nominal Input Voltage		-0.7	--	50	VDC
	48V Nominal Input Voltage		-0.7	--	100	VDC
Start-up Voltage	24V Nominal Input Voltage		--	--	9	VDC
	48V Nominal Input Voltage		--	--	18	VDC
Start-up Time	Nominal Input and Constant Resistive Load		--	10	150	ms
Remote Control	Turn on module		Ctrl pin open or pulled high TTL (2.7-12VDC)			
	Turn off module		Ctrl pin pulled low to GND (0-1.2VDC)			
Input filter type			PI filter			
Hot Plug			Unavailable			

Output Specifications

Item	Operating conditions		Min.	Typ.	Max.	Unit
Output voltage accuracy	5%~100% load		--	±1.0	±2.0	%
	0%~5% Load		--	±2.0	±5.0	%
Line Regulation	Full load, input voltage from low limit to high limit		--	±0.2	±0.5	%
Load Regulation	5%~100% Load		--	±0.5	±1.0	%
	0%~5% Load		--	±1.5	±3.0	%
Ripple & Noise	220MHz bandwidth	5%~100% Load	--	130	--	mVp-p
		0%~5% Load	--	--	5	%Vo
Transient Recovery Time	25% load step change, nominal input voltage		--	250	500	μs
Transient response deviation	25% load step change, nominal input voltage		--	±5.0	±10.0	%
Trim	Input voltage range		90	--	110	%/°C
Over-voltage protection	Input voltage range		110	--	160	%
Over-current protection	Input voltage range		110	160	--	%
Short circuit protection	Input voltage range		Continuous, self-recovery			

Note: Ripple & noise are measured at 20MHz of bandwidth with a 10uF electrolytic capacitor and a 1uF ceramic capacitor connected inparallel at the output.

General specifications

Item	Operating conditions	Min.	Typ.	Max.	Unit
Isolation Voltage	Input-Output, Test Time 1 minute, leakage current less than 1mA	1600	--	--	VDC

Insulation Resistance	Input-Output, Insulation Voltage 500VDC	1000	--	--	MΩ
Isolation Capacitance	Input-Output, 100KHz/0.1V	--	2200	--	pF
Operating Temperature	See below: Temperature Derating Curve	-40	--	105	°C
Storage Temperature		-50	--	125	°C
Storage Humidity	No Condensation	5	--	95	%RH
Soldering Profile	Wave soldering	260±5°C; time: 5 - 10s			
	Manual soldering	360± 10°C; time: 3 - 5s			
Switching Frequency	PWM Mode	--	300	--	kHz
Vibration	IEC/EN 61373 Body 1 Class B				
MTBF	MIL-HDBK-217F@25°C	>1000Kh			

Mechanical Specifications

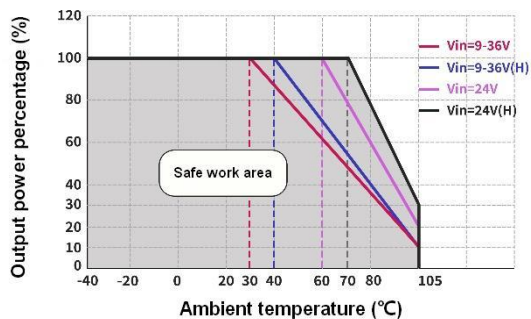
Case Material	Aluminum alloy
Mechanical Dimensions	50.80 * 25.40 * 11.80mm
Weight	41.0g (typ.)
Cooling Method	Free air convection

Electromagnetic Compatibility (EMC)

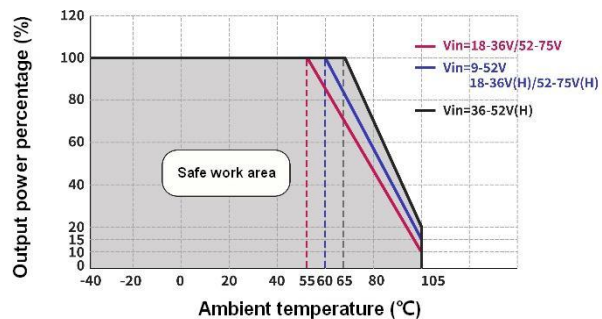
EMI	CE	CISPR32/EN55032 CLASS A (Recommended circuit 2-1) / CLASS B (Recommended circuit 2-3)			
	RE	CISPR32/EN55032 CLASS A (Recommended circuit 2-1) / CLASS B (Recommended circuit 2-3)			
EMS	ESD	IEC/EN61000-4-2 Contact±6KV			Perf. Criteria B
	RS	IEC/EN61000-4-3 10V/m			Perf. Criteria A
	EFT	IEC/EN61000-4-4 ±2KV (Recommended circuit 2-1)			Perf. Criteria B
	Surge	IEC/EN61000-4-5 line to line ±2KV (Recommended circuit 2-1)			Perf. Criteria B
	CS	IEC/EN61000-4-6 10V.r.m.s			Perf. Criteria A

Product Characteristic Curve

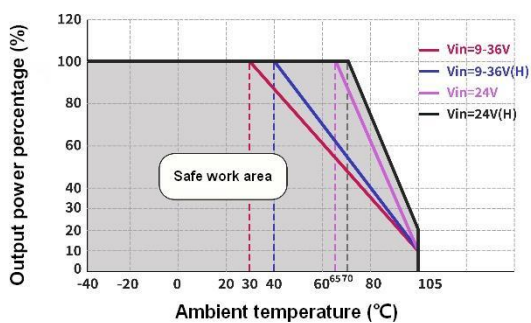
Temperature Derating Curve (VB60-24S05LD(H))



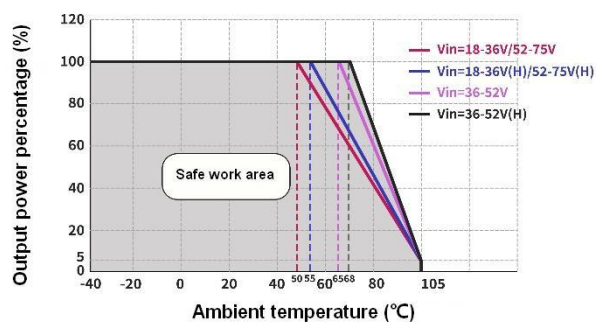
Temperature Derating Curve (VB60-48S05LD(H))



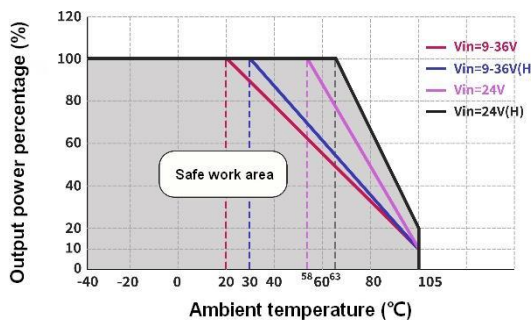
Temperature Derating Curve (VB60-24S12LD(H), VB60-24S15LD(H))



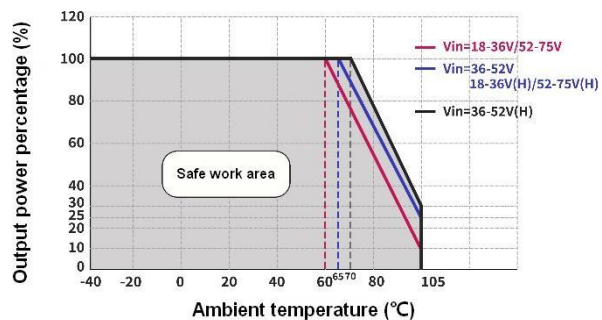
Temperature Derating Curve (VB60-48S12LD(H), VB60-48S15LD(H))



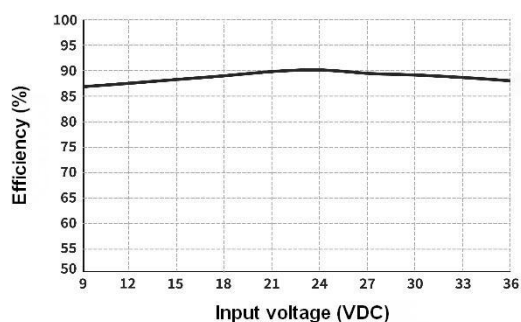
Temperature Derating Curve (VB60-24S24LD(H))



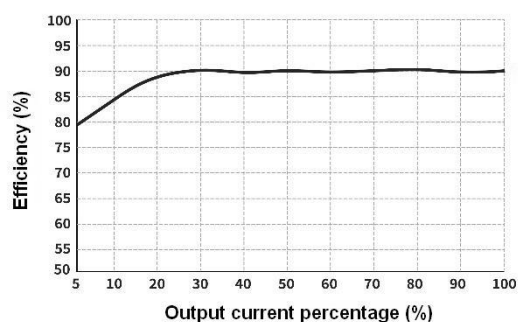
Temperature Derating Curve (VB60-48S24LD(H))



EfficiencyVS Input Voltage Curve (Full Load, VB60-24S05LD)

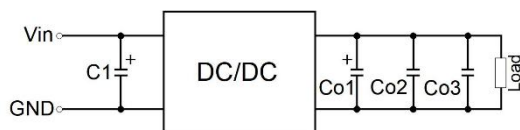


EfficiencyVS Output Load Curve (Vin=24V, VB60-24S05LD)



Design Reference - Application Circuit

Typical Application Circuit Design



(Figure 1)

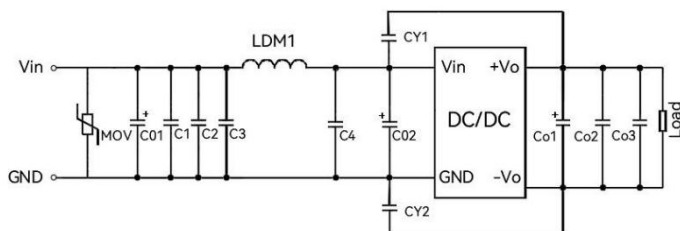
Recommended Capacitive Load Value Table

Vout	C1	Co1	Co2	Co3
5VDC	100μF/100V	330μF/50V	1μF/16V	10μF/16V
12/15VDC	100μF/100V	330μF/50V	1μF/25V	10μF/25V
24VDC	100μF/100V	100μF/50V	1μF/50V	10μF/50V

All DC/DC converters in this series are tested before shipment according to the recommended application circuit (Figure 1). To further reduce input and output ripple, the external input and output capacitors C1, Co1, Co2, Co3 can be increased or capacitors with low equivalent series impedance can be selected. Under safe and reliable operating conditions, the maximum capacitance of the filter capacitor must not exceed the maximum capacitive load of the product.

Peripheral Circuit Design and Application - EMC Recommended Circuit

EMI Recommended Circuit Design and Application 1

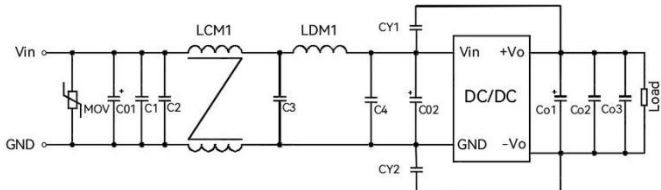


(Figure 2-1)

Recommended Parameter Table

Model	Vin:24V	Vin:48V
C1/C2	4.7μF/50V	4.7μF/100V
C3/C4	10μF/50V	20μF/100V
C01	680μF/50V	1000μF/100V
C02	330μF/50V	470μF/100V
Co1	100μF/100V	330μF/50V
Co2/Co3	Refer to capacitor parameters in Figure 1	
CY1/CY2	2.2nF	2.2nF
LDM1	2.2uH	2.2uH
MOV	14D470K	/

EMI Recommended Circuit Design and Application 2



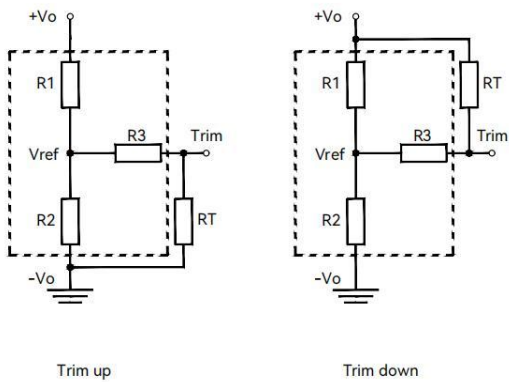
(Figure 2-2)

Recommended Parameter Table

Model	Vin:24V	Vin:48V
C1/C2	4.7μF/50V	4.7μF/100V
C3/C4	10μF/50V	20μF/100V
C01	680μF/50V	1000μF/100V
C02	330μF/50V	470μF/100V
Co1	100μF/100V	330μF/50V
Co2, Co3	Refer to capacitor parameters in Figure 1	
CY1/CY2	2.2nF	2.2nF
LCM1	2.2mH	10mH
LDM1	2.2uH	2.2uH
MOV	14D470K	/

Peripheral Circuit Design and Application - Trim Circuit Design

Trim Usage Circuit Design and Application



(Figure 3)

Calculation of Trim Resistor

Vout(V)	R1(KΩ)	R2(KΩ)	R3(KΩ)	Vref(V)
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

Up: $R_t = \frac{nR_2}{R_2 - n} - R_3$ $n = \frac{V_{ref}}{V_o - V_{ref}} * R_1$
Down: $R_t = \frac{nR_1}{R_1 - n} - R_3$ $n = \frac{V_o - V_{ref}}{V_{ref}} * R_2$

Recommended thermal test scheme

Recommended thermal test

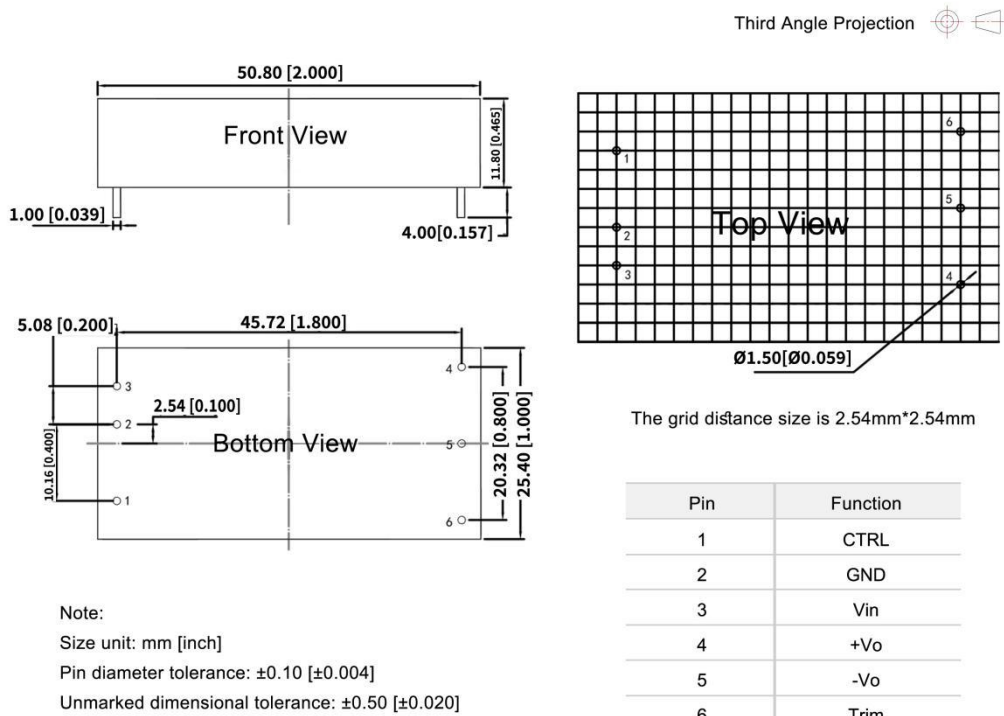
During application, the product thermal design can be evaluated in conjunction with the product temperature derating curve; or the stable operating range of the product can be determined by testing the temperature at point H in Figure 4. When the temperature at point H is below 100°C, it is the stable operating range of the product.



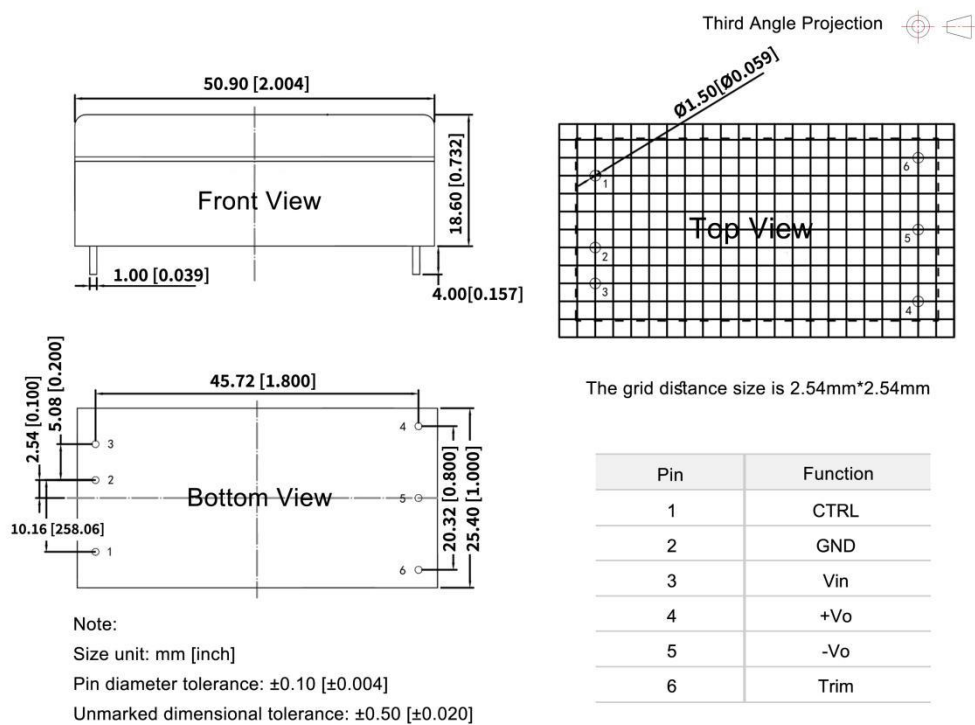
(Figure 4)

Dimensions and Recommended Layout

VB60-xxSxxLD Dimensions and Recommended Layout



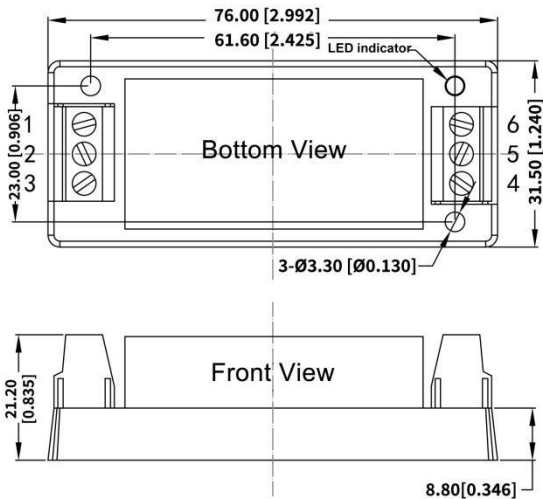
VB60-xxSxxLDH Dimensions and Recommended Layout



Dimensions and Recommended Layout

VB60-xxSxxLD-T Dimensions

Third Angle Projection 

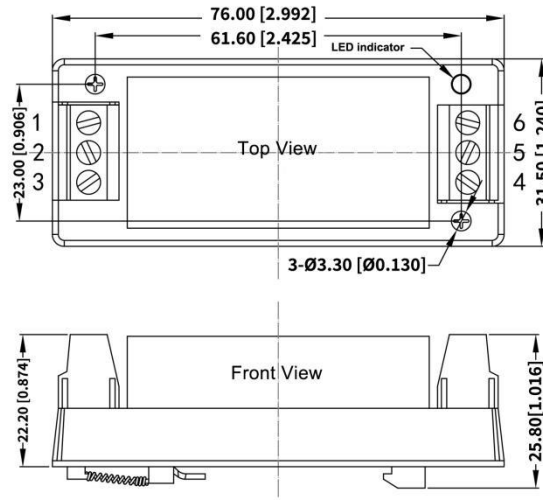


Pin	Function
1	CTRL
2	GND
3	Vin
4	+Vo
5	-Vo
6	Trim

Note:
Size unit: mm [inch]
Wire diameter: 24-12AWG
Tightening force distance: Max0.4N · m
Unmarked tolerance: ± 1.00 [± 0.039]

VB60-xxSxxLD-DIN Dimensions

Third Angle Projection 



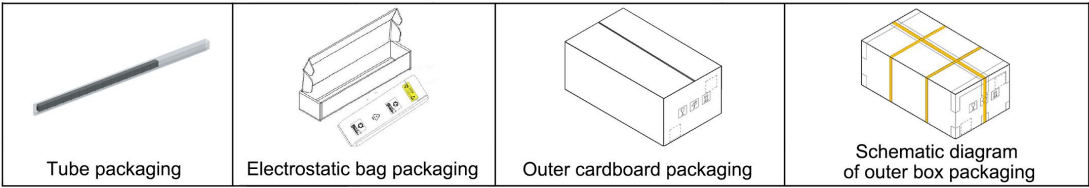
Pin	Function
1	CTRL
2	GND
3	Vin
4	+Vo
5	-Vo
6	Trim

Note:
Size unit: mm [inch]
Wire diameter: 24-12AWG
Tightening force distance: Max0.4N · m
Rail type: TS35, rail needs to be grounded
Unmarked tolerance: ± 1.00 [± 0.039]

Packaging Information

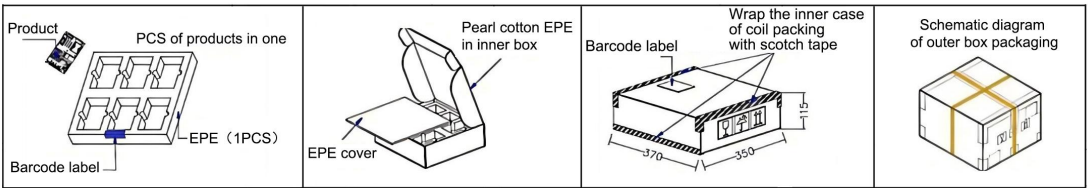
Model series (tube packaging)	Quantity per tube (pcs/tube)	Quantity per antistatic bag (pcs/bag)	Inner carton quantity (pcs/carton)	Full carton quantity(pcs)
VB60-xxSxxLD	19	38	114	456
VB60-xxSxxLDH	19	38	114	456

The schematic diagram of tube packaging is shown below:



Model series (pearl cotton)	Quantity (pcs/tray)	Inner carton quantity (pcs/carton)	Outercarton quantity (pcs/carton)
VB60-xxSxxLD-T	28	84	168
VB60-xxSxxLD-DIN	28	84	168

The schematic diagram of pearl cotton packaging is shown below:



Product precautions

1. The input voltage should not exceed the specified range value, otherwise it may cause permanent and irreparable damage;
2. 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;
3. The maximum capacitive load is tested within the input voltage range and under full load conditions;
4. Unless otherwise specified, all indicators in this manual are measured at $T_a=25\text{ }^{\circ}\text{C}$, humidity<75% RH, nominal input voltage, and output rated load;
5. All indicator testing methods in this manual are based on our company's corporate standards;
6. Our company can provide product customization, and specific requirements can be directly contacted by our technical personnel;
7. Product specifications are subject to change without prior notice.

Manufacturer contact information

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