XL-408RGBC-WS2812B **技术数据表 Technical Data Sheet**

F5 草帽 幻彩透明 插件式发光二极管

模型图仅供参考

特点（Characteristics）：

＊ 外观尺寸（L/W/H）:5.8*4.8*5.0*28.2mm

outline Dimensions (L / w / h): 5.8*4.8*5.0*28.2mm

＊ 发光颜色及胶体: 七彩幻彩/透明胶体

Luminous color and colloid: Colorful magic/Transparent colloid

＊ 环保工艺符合 ROHS 要求

Environmental protection products Complied With ROHS Directive

＊ 湿气敏感性等级（MSL）:2 级

Moisture sensitivity level（MSL） : 2 levels

＊ EIA 规范标准包装

EIA standard packaging

＊ 适用于 SMT 贴片自动化生产

Suitable for SMT automatic production

＊ 适用于红外线回流焊制程

应用领域（Product application）：

＊ LED 全彩发光字灯串

Led full-color luminous word lamp string,

＊ LED 全彩模组

led full-color module

＊ LED 幻彩软硬灯条，LED 护栏管

Led magic color soft and hard light strip, LED guardrail tube

＊ LED 外观，情景照明

Led appearance, scene lighting

＊ LED 异性屏

Led heterosexual screen

＊ 各种电子产品，电器设备跑马灯

All kinds of electronic products, electrical equipment, runninglights




WS2812b 功能特点/Ws2812b Functional characteristics：

1. F5 灯珠内部集成高质量外控单线级联恒流 IC 和优质 RGB LED 芯片，体积小巧，外围简单。

The F5ball interior integrates high-quality external single-line cascade IC and high-quality RGB LED chips, which are small in size and simple on the periphery.

2. 内置 IC 恒流精度高，内部 RGB 芯片预先分光处理。发光高度一致，白光效果纯正。

BUILT-IN IC constant current high precision, internal RGB chip pre-optical processing. High Degree of uniformity of light, white light effect pure.

3. 整形转发强化技术，单线数据传输，可无限级联。

Plastic forwarding enhancement technology, single-line data transmission, can be cascaded.

4. 数据传输频率 800Kbps/秒，可实现画面刷新速率 30 帧 / 秒时，不小于 1024 点。

The data transmission frequency is 800Kbps per second, and the screen refresh rate can be achieved at 30 frames per second, not less than 1024 points.

5. 输出端口 PWM 控制能够实现 256 级灰度调节，端口扫描频率 1.5KHz / s。

The output port PWM control can achieve 256 levels of grayscale adjustment, and the port scan frequency is 1.5 KHz / S.

6. 采用优化预置 12mA/通道恒流模式，低压驱动级联数量最大化。高恒流精度，片内误差<1.5%，片间误差<3%。Optimized preset 12mA / channel constant current mode is adopted to maximize the number of low-voltage drive cascades. High constant current accuracy, intraslice error & lt; 1.5 %, interslice error & lt; 3 %.

7. 内置低压强化模块，VDD 在 4.5-5.5V 以上 100%正常工作。

With the built-in low-pressure reinforcement module, VDD is 100 % functional above 4.5-5.5 V.

8. 超强数据整形能力：接受完本单元数据自动将后续数据整形输出。

Super data shaping ability: accept this unit data automatically will follow the data shaping output.

目录

Catalogue

电性参数
Electrical Characteristics

极限参数（Ta=25℃）Absolute Maximum Rating（ta=25 ℃）

电气参数 Electrical parameters	符号 Symbol	极限范围 limit range	单位 Unit
供电电压 Supply Voltage	VDD	3.5-5.5	V
逻辑输入电压 Logic input Voltage	VDI	-0.5～VDD+5.5	V
RGB 输出电流 RGB Output current	Lol1	12	mA
工作温度 Operating Temperature	Topr	-40～+85℃	
存储温度 Storage Temperature	Tstg	-40～+85℃	
回流焊温度 Circle solder Temperature	Tsol	260°C For 6 Seconds	
抗静电能力 ESD Sensitivity	ESD	2000V HBM	

光电特性参数（Ta=25℃） Optical-electrical parameter(ta=25 ℃)

参数名称 Parameter	颜色 Colour	符 号 Symbol	测 试 条 件 Test conditions	最小值 Min	典型值 Typ	最大值 Max	单位 Unit
光强 light intensity	红 red	IV	IF=12mA	-	300	-	mcd
	绿 green			-	2500	-	
	蓝 blue			-	300	-	
主波长 Main wavelength	红 red	λD		620	-	630	nm
	绿 green			515	-	525	
	蓝 blue			465	-	475	
峰值波长 Peak wavelength	红 red	λP		620	-	625	nm
	绿 green			520	-	525	
	蓝 blue			465	-	470	
半光强视角 Half light angle	-	2θ1/2		-	35	-	Deg

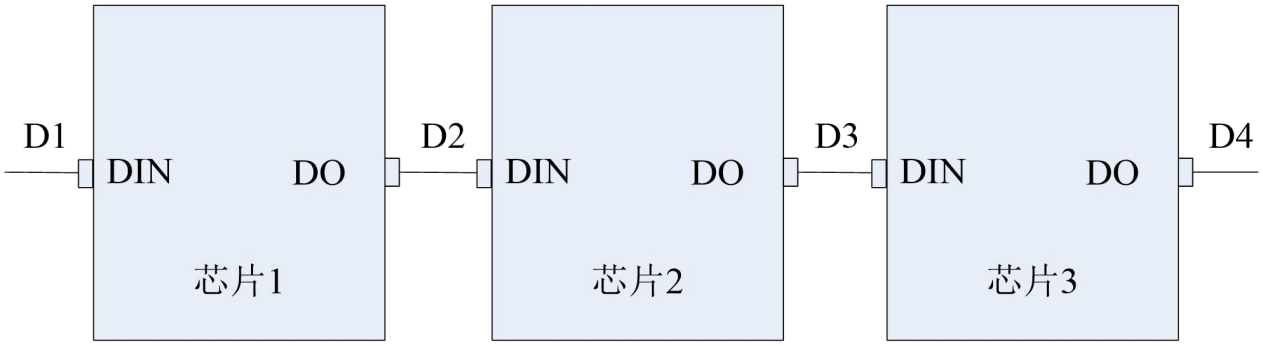
电气参数 ： Electrical parameters (ta=25 ℃):

参数 Parameter	符号 Symbol	最小 Min	典型 Typ.	最大 Max	单位 Unit	测试条件 Test conditions
芯片电源电压 Chip power supply voltage	VDD	3.5	5.0	5.5	V	-
RGB 输出电流 RGB output current	Lol1	-	12	-	mA	-
高电平输入电压 High level input voltage	VIH	0.7Vdd	-	-	V	DIN，SET
低电平输入电压 Low level input voltage	VIL	-	-	0.3Vdd	V	DIN，SET
静态功耗 Static power onsumption	LDD	-	0.3	-	mA	-

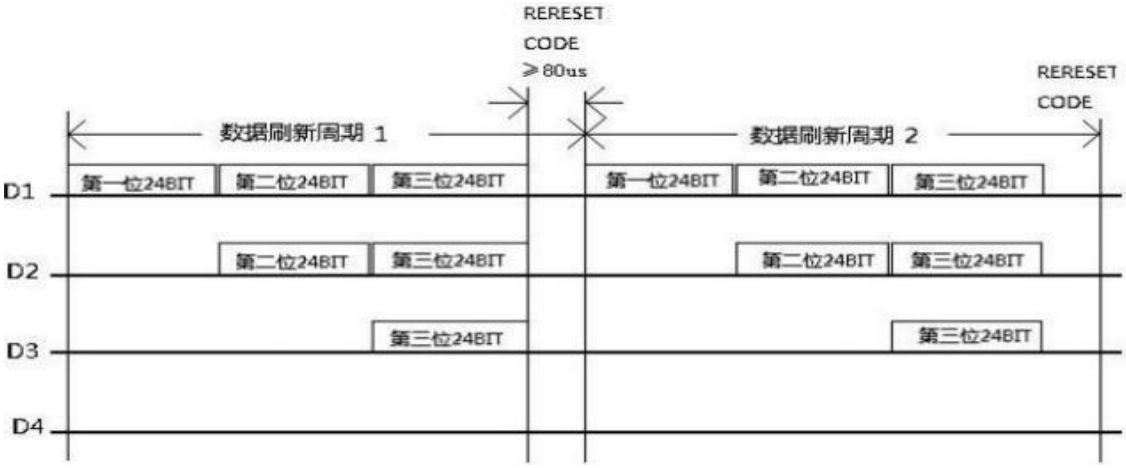
开关特性 ： Switching characteristics (ta=-40 ~ +85 ℃):

参数 Parameter	符号 Symbol	最小 Min	典型 Typ	最大 Max	单位 Unit	测试条件 Test conditions
传输延迟 transmission delay	Tflz	-	-	300	ns	CL=15pF,DIN→DOUT, RL=10KΩ
下降时间 fall time	tTHZ	-	-	120	us	CL=300pF,OUTR/OUTG /OUTB
输入电容 Input capacitance	CI	-	-	15	PF	-

芯片级联方法:Chip cascade method:



数据传输方式：Date transmission mode



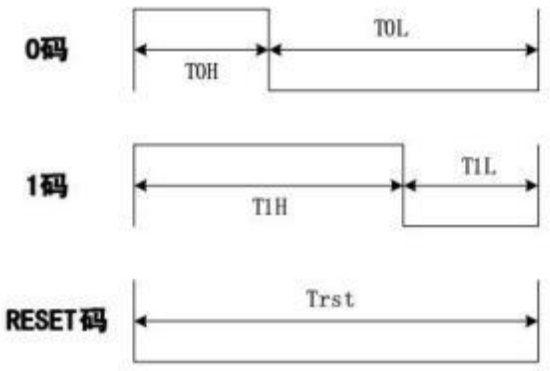
注：其中 D1 为 MCU 端发送的数据，D2、D3、D4 为级联电路自动整形转发的数据
Note: D1 refers to the data sent by MCU, and D2, D3 and D4 refer to the data automatically shaped and forwarded by cascade circuit

24bit 数据结构：24bit data structure：

G7	G6	G5	G4	G3	G2	G1	G0	R7	R6	R5	R4	R3	R2	R1	R0	B7	B6	B5	B4	B3	B2	B1	B0

注：高位先发，按照 GRB 的顺序发送数据
Note: high order first send, send data in the order of GrB

数据时序波形图:Time sequence waveform:



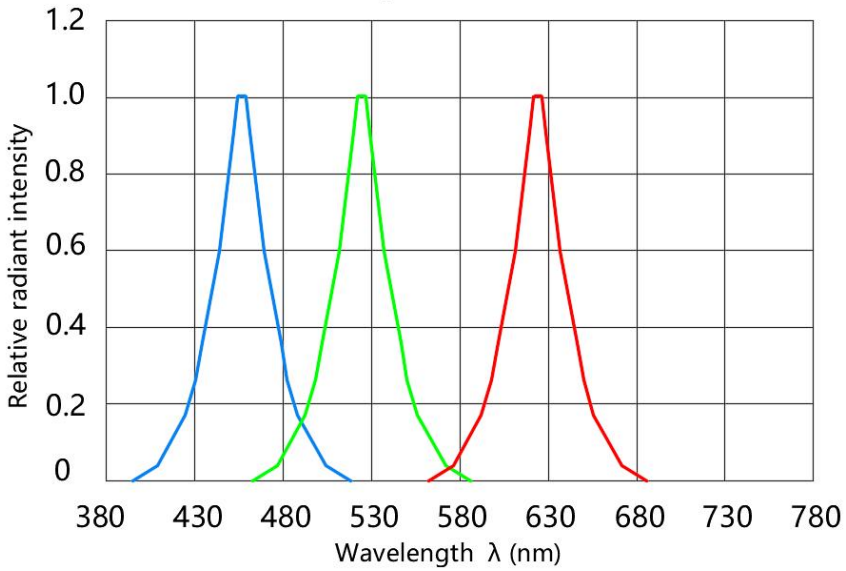
数据传输定义:**Signal transmission definition**

参数 **Parameter**	符号 **Symbol**	最小值 **Min**	典型 **Typ**	最大值 **Max**	单位 **Unit**
输入 0 码高电平时间 Input 0 code high level time	Tin0h	-	0.4	-	us
输入 1 码高电平时间 Input 1 code high level time	Tin1h	-	0.8	-	us
输入 0 码低电平时间 Input 0 code low level time	T0L	-	0.85	-	us
输入 1 码低电平时间 Input 1 code low level time	T1L	-	0.45	-	us
0 码/1 码周期 0 code /1 code cycle	T0/T1	-	1.25	-	us
RESET 码低电平时间 Reset code low level time	reset	50	-	-	us

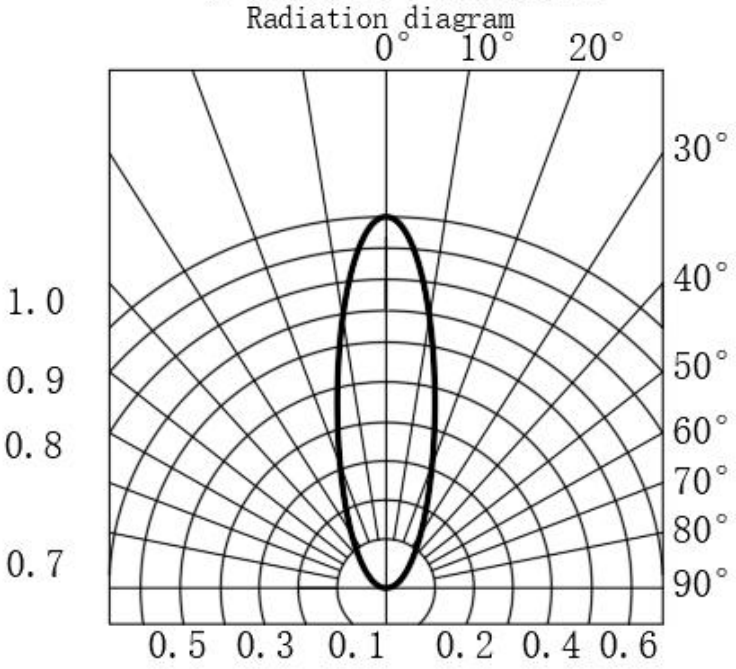
典型特性曲线

Typical Characteristics Curves

光谱分布曲线
Relative Spectral Distrbution



相对辐射强度与空间角度关系
Radiation diagram

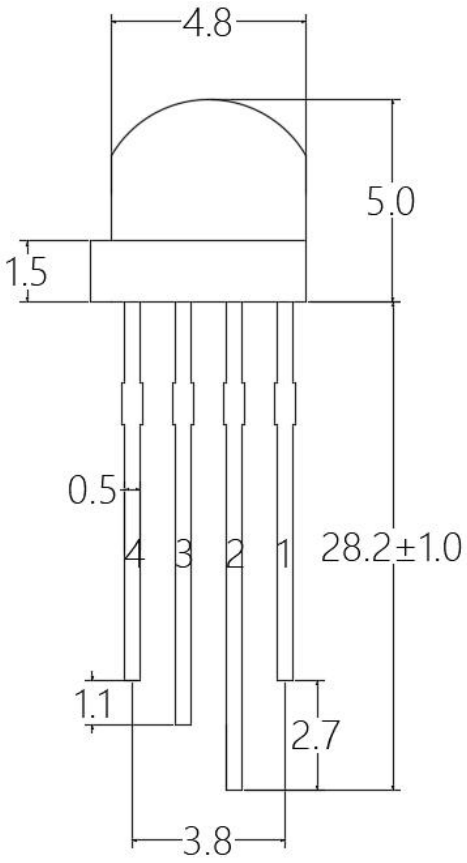


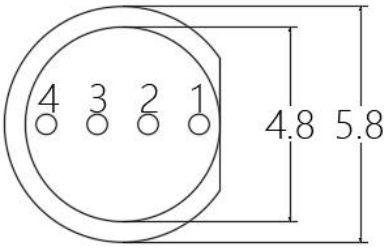
可靠性试验

Reliability Test Items And Conditions

类别 Class	测试项目 Test item	测试环境 Testing environment	测试时间 Testing time	数量 Qty	失效数量 Fail qty
耐久性测试 Endurance test	工作寿命 Working life	Ta=25℃±5℃,IF=12mA	1000hrs	22 PCS	0/1
	高温高湿实验 High temperature and high humidity experiment	Ta= 85±5℃, RH= 85～90%	1000hrs	22 PCS	0/1
	高温储存 High-temperature storage	环境温度Ta= 85±5℃	1000hrs	22 PCS	0/1
	低温储存 Low temperature storage	环境温度 Ta= -40±5℃	1000hrs	22 PCS	0/1
环境测试 Environmental testing	冷热循环 Cold and hot cycle	100℃±5℃ ～ -40℃±5℃ 30mins 5mins 30mins	100 Circles	22 PCS	0/1
	冷热冲击 Hot and cold impact	105℃±5℃ ～ -45℃±5℃ 5mins 5mins	100 Circles	22 PCS	0/1
机械测试 Mechanical Test	耐焊接实验 Resistance to Soldering Heat	焊锡温度 T.sol= 250 ± 5℃	2times	22 PCS	0/1
	引脚折弯实验 Lead Integrity	Load 2.5N(0.25kgf) 0° ~ 90° ~0°	3times	22 PCS	0/1

外形尺寸
Outline Dimension





1 DIN
2 GND
3 VDD
4 DOU

备注： 1.以上尺寸单位均为 mm
Remarks: All dimensions are in millimeters.
2.未特别标注公差的尺寸公差均为±0.25mm
Tolerance is ±0.25mm unless otherwise noted

引脚电路图及引脚功能：

序号 Serial number	符号 Symbol	功能描述 Function description
1	DI	显示数据输入 Display data input
2	GND	信号地及电源地 Signal ground and power ground
3	VDD	内部IC电源正及RGB正极 Internal IC power positive and RGB positive
4	DO	显示数据级联输出 Display data cascade output

包装
Packaging

*袋装
In Bags

*防潮抗静电包装
Moisture Proof and Anti-Electrostatic Foil Bag

◇ 标签说明 Label Expantion

CPN：批号/档位　　LOT：日期/封装颜色

MPN：型号　　VF：电压代码

WL：波长代码　　IV：亮度代码

ORIGIN：产地　　QTY：数量

PACKAQE：封装

使用注意事项（1）

Precautions (1)

1. **应用 APPLY**

此 LED 可使用于一些普通的电子设备，例如办公设备，通信设备、房屋装饰，若 LED 用在一些可靠性要求较高的情况下，如航空运输，交通控制及医辽器械时，一定需参考销售提供之资料进行使用。

This LED can be used in some ordinary electronic equipment, such as office equipment, communication equipment, house decoration, if LED is used in some high reliability requirements, such as air transportation, traffic control and medical liao equipment, must refer to the information provided by sales.

2. 储存 Keep in storage

贮存 LED 的环境，温度不超过 30℃，相对湿度不超过 70%。 建议 LED 在原包装箱里日期不超过三个月 进行使用，如果需加长贮存时间，建议放在干燥箱内，并加放干燥剂， 或者充入氮气。

Storage environment of LED with temperature not exceeding 30℃ and relative humidity not exceeding 70%.It is recommended that LDE be used in the original box for no more than three months. If longer storage time is required, put it in the drying box and add desiccant or filled with nitrogen.

3. 清洗 Clean

当用化学品清洗胶体时必须特别小心，因为有些化学品对胶体表面有损伤并引起褪色如三氯乙烯、丙、酮等。可用乙醇擦拭、浸渍，时间在常温下不超过 3 分钟。

Special care must be taken when cleaning colloids with chemicals, as some chemicals have damage to the colloidal surface and cause fading such as trichloroethylene, propylene, ketone, etc.It can be wiped and soaked with ethanol for no more than 3 minutes at room temperature.

4. 引脚配置 Feet assembly

（1）必需离胶体 2 毫米才能折弯支架。

It must be 2 mm from the colloid to bend the bracket.

（2）支架成形必须用夹具或由专业人员来完成。

Support forming must be done with fixtures or by a professional.

（3）支架成形必须在焊接前完成。

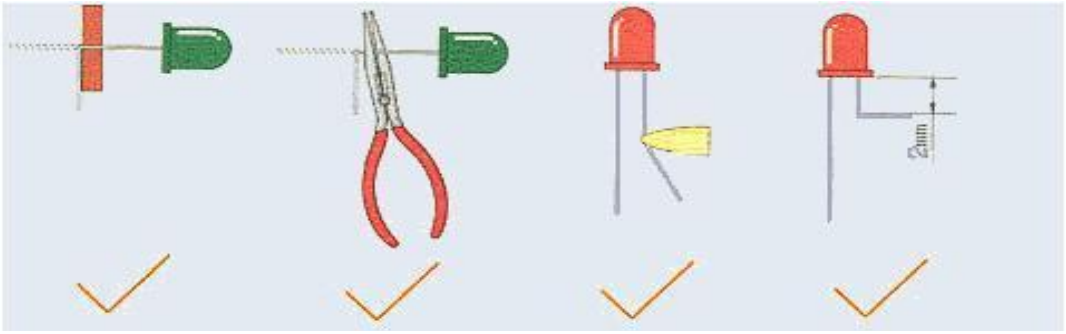
Support forming must be completed before welding.

（4）支架成形需保证引脚和间距与线路板上一致。

The pins and spacing are the same as on the circuit board.

（5）焊接必须在正常温度下进行，当 LED 正常焊接到 PCB 板上后，应尽量避免在 LED 引脚处施加机械压力。

Welding must be performed at normal temperature and when LED is normally welded to the PCB plate, avoid applying mechanical pressure at LED pins at a minimum.



使用注意事项（2）

Precautions （2）

5. 焊接 Weld

当焊接时，必需在胶体底部 2mm 以下进行焊接，在焊接时，应尽力避免浸渍 LED 胶体，在刚焊接完后，应避免在引脚上加外力或者摇动 LED 胶体。

When welding, welding must be conducted below 2mm of colloid bottom. When welding, try to avoid soaking LED colloid. After welding, avoid adding external force on the pin or shaking LED colloid.

推荐的焊接条件

烙铁焊接		波峰焊接	
焊接温度 Soldering Temperature	300℃ Max	预热 Pre - heat	100℃ Max
		预热时间 Pre- heat time	60sec.Max
焊接时间 Soldering time	3 sec.Max	焊接温度 Soldering Temperature	240℃.Max
		焊接时间 Soldering time	6sec.max

过高的焊接温度和长时间的焊接会导致 LED 变形和失效

Excessive welding temperature and prolonged welding can lead to LED deformation and failure

6. 静电防护 Electrostatic protection

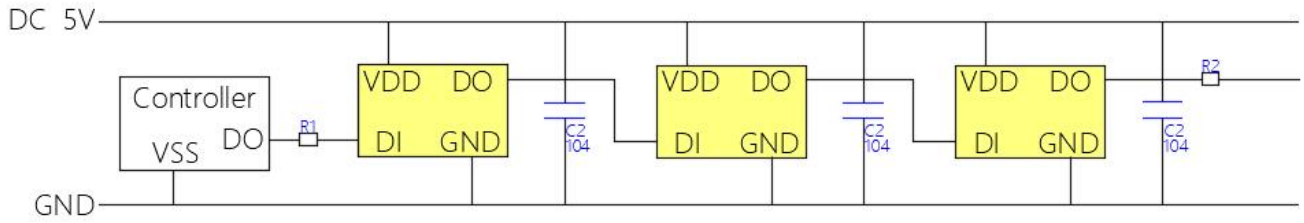
静电和电流的急剧升高将会对 LED 产生损害，InGaN 系列产品使用时请使用防静电装置，如防护带和手套注意：使用时人体放电模式 HBM<1000V；机器放电模式<100V。

High increase of static electricity and current will damage LED. Use antistatic devices such as protective belts and gloves. Note: human discharge mode HBM <1000V; machine discharge mode <100V.

使用注意事项（3）

Precautions (3)

7.应用线路图：Application circuit diagram:



在实际应用电路中，为防止产品在测试时带电插拔产生的瞬间高压损伤 IC 内部电源及 信号输入输出脚，应在信号输入及输出端串接保护电阻。此外，为了使各 IC 芯片间更 稳定工作，各灯珠间的退偶电容则必不可少；

1.产品两端所并的退偶电容一般不建议省略；

2.产品的信号输入及输出端必需串接保护电阻 R1/R2,因线材及传输距离不同，在信号线两端串接的保护电阻会略有不同； R1/R2 的大小取决于级联灯珠的数量，级联数量越多，则 R1/R2 越小，灯珠间传输距离长，一般建议在 20-2K Ω之间取值，建议通常建议取值 在 500 欧左右；以实际使用情况定；R2 可接地。

In practical application circuits,To prevent instantaneous high voltage generated by live plugging during product testing Damage to IC internal power supply and signal input/output pins Protective resistors should be connected in series at the signal input and output terminals .In addition, in order to ensure more stable operation between IC chips The decoupling capacitance between each lamp bead is essential:

1、It is generally not recommended to omit the decoupling capacitors connected at both ends of the pr... ;

2、The signal input and output terminals of the product must be connected in series with protective r...； Due to differences in wire material and transmission distance； The size of r1/r2 depends on the number of cascaded lamp beads ， The more cascades, the smaller r1/r2 ； Long transmission distance between lamp beads， Generally recommended between 20-2k ω Value between， The recommended value is usually around 500 euros; Based on actual usage； R2 can be grounded .

使用注意事项（3）

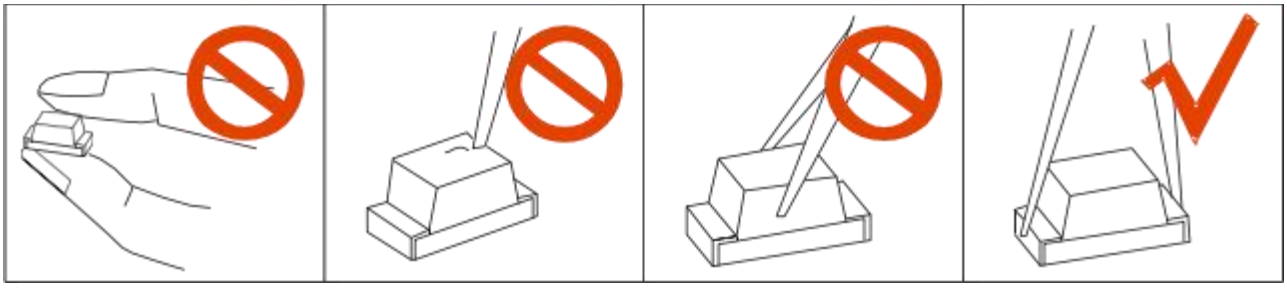
Precautions （3）

8、其他事项：

Others：

*直接用手拿取产品不但会污染封装树脂表面，也可能由于静电等因素导致产品性能的改变。过度的压力也可能直接影响封装内部的管芯和金线，因此请勿对产品施加过度压力，特别当产品处于高温状态下，例如在回　　流焊接过程中。

*When handling the product, touching the encapsulant with bare hands will not only contaminate its surface, but also affect on its optical characteristics. Excessive force to the encapsulant might result in catastrophic failure of the LEDs due to die breakage or wire deformation. For this reason, please do not put excessive stress on LEDs, especially when the LEDs are heated such as during Reflow Soldering.



*LED 的环氧树脂封装部分相当脆弱，请勿用坚硬、尖锐的物体刮、擦封装树脂部分。在用镊子夹取的时候也应当小心注意。

*The epoxy resin of encapsulant is fragile, so please avoid scratch or friction over the epoxy resin surface. While handling the product with tweezers, do not hold by the epoxy resin, be careful.

9、眼睛保护忠告：

Safety Advice For Human Eyes

*LED 发光时，请勿直视发光光源，特别是对于一些光强较高的 LED，强光可能伤害你的眼睛。

*Viewing direct to the light emitting center of the LEDs, especially those of great Luminous Intensity, will cause great hazard to human eyes. Please be careful.