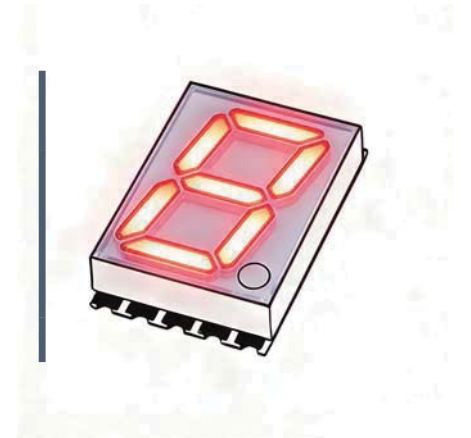
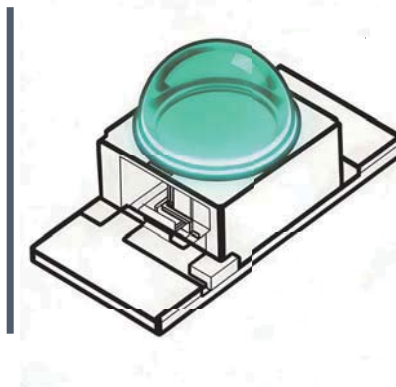


SMD LEDs



Features/产品描述

- 2020内封IC灯珠是一款集成高质量单线级联恒流驱动IC和高质量RGB LED芯片的外控恒流2020集成灯珠。其中内置控制IC 是三通道低压LED 灯串驱动芯片。芯片内部包含数据锁存电路、数据整形处理电路、数据转发电路、双振荡器、PWM 调制电路，以及R/G/B 三路LED 驱动电路。采用单线归零码的通讯协议。芯片在上电复位后，DI 口接收从MCU 传输过来的数据帧，并通过数据锁存电路将数据帧里的头24bit 数据锁存下来，并送至PWM 调制电路，以控制R/G/B LED 驱动电路的工作。数据帧的头24bit 数据被锁存下来后，剩余的数据经过内部数据整形处理电路进行整形后，通过数据转发电路及DO 口转发至下一颗级联的IC芯片。如此数据帧每经过一颗灯珠的传输，数据便减少24bit。

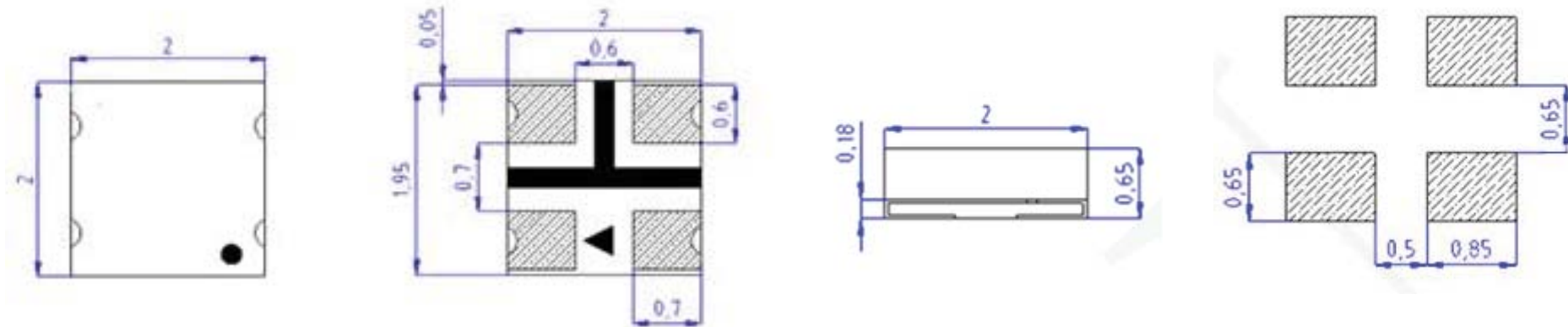
- The 2020 IC is an integrated high-quality single-wire cascade constant-current driver IC and high-quality RGB LED chip external constant-current 2020 integrated lamp beads. ONE BUILT-IN CONTROL IC is a three-channel low-voltage LED lamp string driver chip. The chip contains a data latch circuit, a data shaping circuit, a data forwarding circuit, a dual oscillator, a PWM modulation circuit, and an R/g/b three-way LED driver circuit. Communication Protocol based on single-line zeroing. After the chip is reset, the DI interface receives the data frame from MCU, and the first 24bit data in the data frame is locked by the data latch circuit, and sent to the PWM modulation circuit to control the work of the R/G/B LED drive circuit. After the first 24 bit data of the data frame is locked down, the remaining data is processed by the internal data processing circuit, and then transmitted to the next cascaded IC chip through the data transmitting circuit and the DO port. Each time a data frame passes through a light bulb, the data is reduced by 24 bits.

Functional characteristics/功能特点

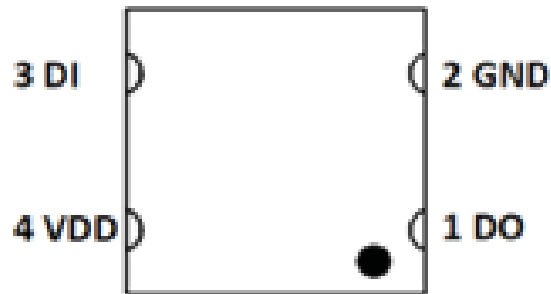
- 内置上电复位和掉电复位电路
- Built-in power-on and power-off reset circuits
- R/G/B 端口耐压最高达 13V, 驱动电流5mA
- R/G/B port withstand voltage up to 13V, Drive current 5 mA
- 内置数据整形电路，保证数据经过多级级联不会产生波形畸变累加
- Built-in data shaping circuit to ensure that the data through the cascade will not generate wave distortion accumulation

- 256 级灰度可调
- 256-level grayscale adjustable
- 数据传输频率可达 800Kbps
- Data transmission frequency can reach 800Kbps
- 当刷新速率为 30 帧/秒时，芯片级联数可不小于 1024 点
- At a refresh rate of 30 FPS, the number of cascades can be no less than 1024
- 外观尺寸/Package (L/W/H) : 2.0×2.0×0.65 mm
- 胶体/Lens : 半透明/translucent

Package Outline and Recommended Land Pattern/外形尺寸及建议焊盘尺寸



引脚图/Pinout Diagram



序号 Serial number	符号 Symbol	功能描述 Functional description
1	DO	显示数据级联输出 (800K) Display data cascade output (800K)
2	GND	信号地及电源地 Signal ground and power supply ground
3	DI	显示数据输入 (800K) Display data input (800K)
4	VDD	内部IC电源正及RGB正极 INTERNAL IC power supply and RGB positive pole

注/ Notes: 1. 单位 : 毫米 (mm) / All dimensions are in millimeters
2. 公差: 如无特别标注则为± 0.1 mm Tolerance is ± 0.10 mm unless otherwise noted

Absolute Maximum Ratings/最大绝对额定值(Ta=25°C,VDD=5V)

参 数 Parameter	符号 Symbol	最大额定值 Rating	单 位 Unit
供电电压 Supply Voltage	Vdd	-0.5 ~ 5.5	V
R/G/B输出端口耐压 R/G/B output port voltage withstand	Vout	13	V
逻辑输入电压 Logic input voltage	Vi	-0.5 ~ Vdd + 0.5	V
工作环境温度 Operating Temperature Range	Topr	-30°C ~ +70°C	
存储环境温度 Storage Temperature Range	Tstg	-20°C ~ +60°C	
湿气敏感等级 Moisture sensitive level	MSL	5a	

Electrical Optical Characteristics/光电参数(Ta=25°C,VDD=5V)

参 数 Parameter		符号 Symbol	最小值 Min	代表值 Typ	最大值 Max	单 位 Unit	测试条件 Test Condition
供电电压 Supply Voltage		Vdd	3.5	5.0	5.5	V	---
供电电流 Supply Current		I _{DD}	---	0.5	---	mA	---
R/G/B 驱动电流 R/G/B drive current		I _{LED01}	---	5	---	mA	---
光强 Luminous Intensity	R	IV	50	---	150	mcd	IF = 5mA
	G		200	---	400		
	B		50	---	150		
主波长 Dominant Wavelength	R	λ _d	620	---	625	nm	IF = 5mA
	G		525	---	530		
	B		470	---	475		
DI 高电平输入 Di High level input		V _{IH}	0.5VDD	---	---	V	---
DI 低电平输入 Di Low level input		V _{IL}	---	---	0.25VDD	V	---

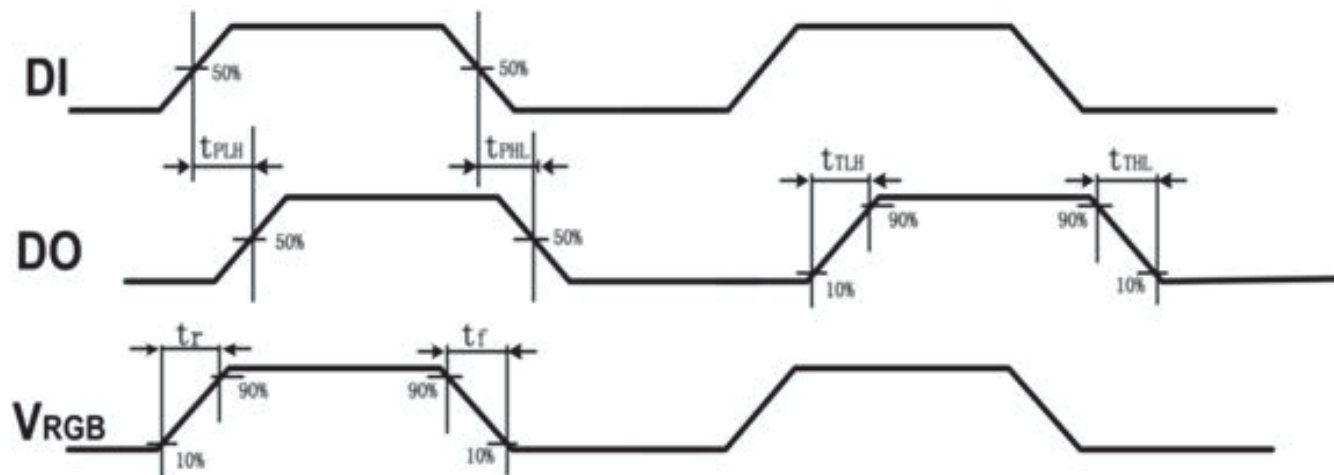
Electrical Optical Characteristics/光电参数(Ta=25°C,VDD=5V)

参 数 Parameter	符号 Symbol	最小值 Min	代表值 Typ	最大值 Max	单 位 Unit	测试条件 Test Condition
数据传输速度 Data transfer speed	F _{DATA}	---	800	---	kHz	---
R/G/B口的PWM频率 PWM FREQUENCY OF R/G/B port	F _{PWM}	---	1.5	---	kHz	---
数据转发传输延迟 Data forward transmission delay	T _{PLH}	---	0.21	---	us	DI→DO信号延时, DO端口对地负载电容30pF DI→DO signal delay, DO port load capacitance to ground 30pF
	T _{PHL}	---	0.21	---		
DO电平转换时间 Do level transition time	T _{TLH}	---	0.018	---	us	DO端口对地负载电容30pF DO port load capacitance to ground is 30pF
	T _{THL}	---	0.018	---		
RGB口电平转换时间(注1) RGB Port Level Conversion Time (Note 1)	Tr	---	0.15	---	us	I _{LED} =5mA, RGB端口串接200Ω电阻至VDD, 对地负载电容30pF I _{LED} = 5mA; RGB ports connected to VDD via series 200Ω resistors, with a 30pF load capacitance to ground.
	Tf	---	0.40	---		

注1/Note1: 为了减少RGB端口的开关对电源电压的冲击, tr/tf比较缓慢, 不影响点亮

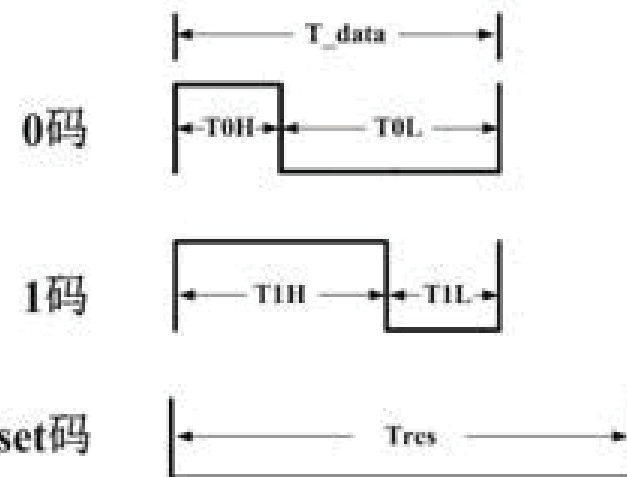
To reduce the impact of RGB port switches on the supply voltage, TR/TF is slow and which does not affect the illumination

Data transmission / 数据传输

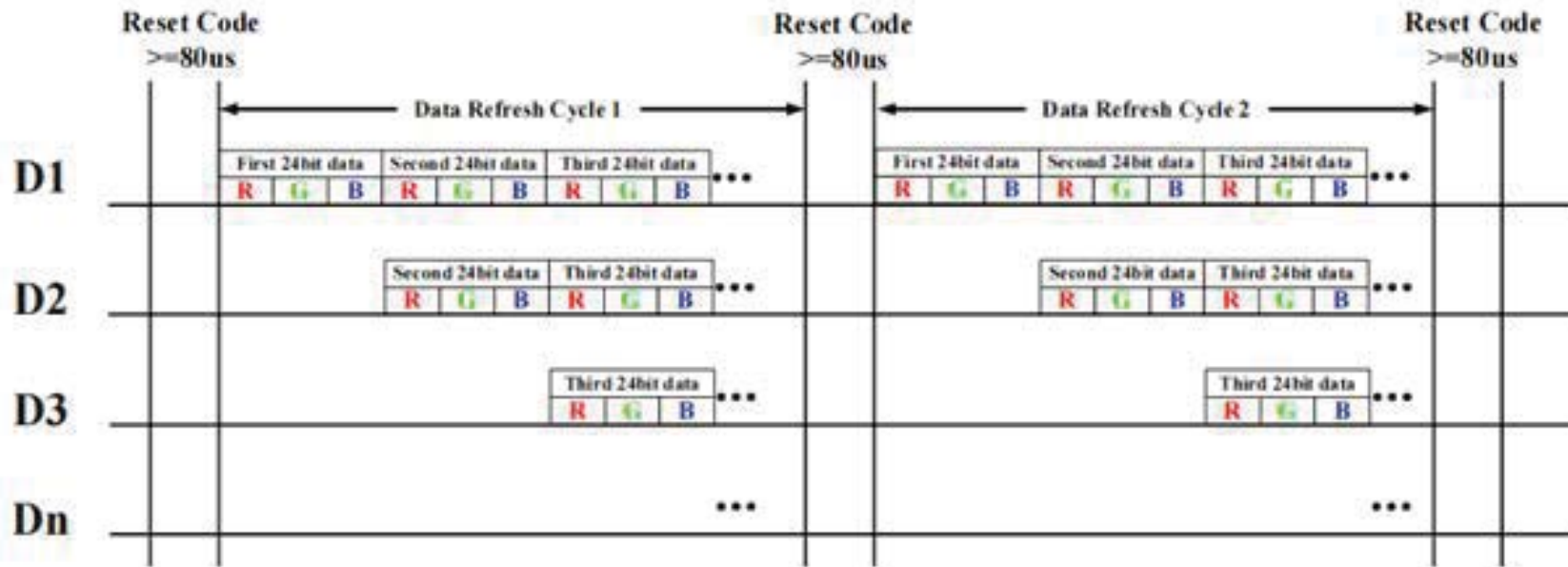


参 数 Parameter	符号 Symbol	最小值 Min	代表值 Typ	最大值 Max	单 位 Unit
输入0码高电平时间 Enter a 0-yard high-level time	Tin0h	---	0.25	0.47	us
输入1码高电平时间 Enter 1 yard high level time	Tin1h	0.58	0.85	1.0	
输入0码低电平时间 Enter the zero yard low level time	T0L	---	1.0	---	us
输入1码低电平时间 Enter 1 yard low level time	T1L	---	0.40	---	
0码/1码周期 Zero-yard-per-yard period	T0/T1	1.2	1.25	---	us
RESET码低电平时间 Reset Code Low level time	Treset	80	---	---	

时序波形图/Sequential wave map



Data transmission / 数据传输



注：其中D1为MCU端发送的数据，D2、D3、Dn为级联电路自动整形转发的数据。

Note: Where D1 is the data sent by the MCU, D2, D3, and Dn are the data automatically transferred by the cascading circuit.

24bit数据结构/24 bit data structure

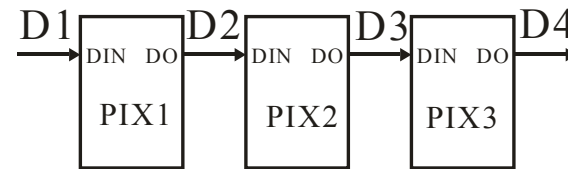


注：高位先发，按照GRB的顺序发送数据

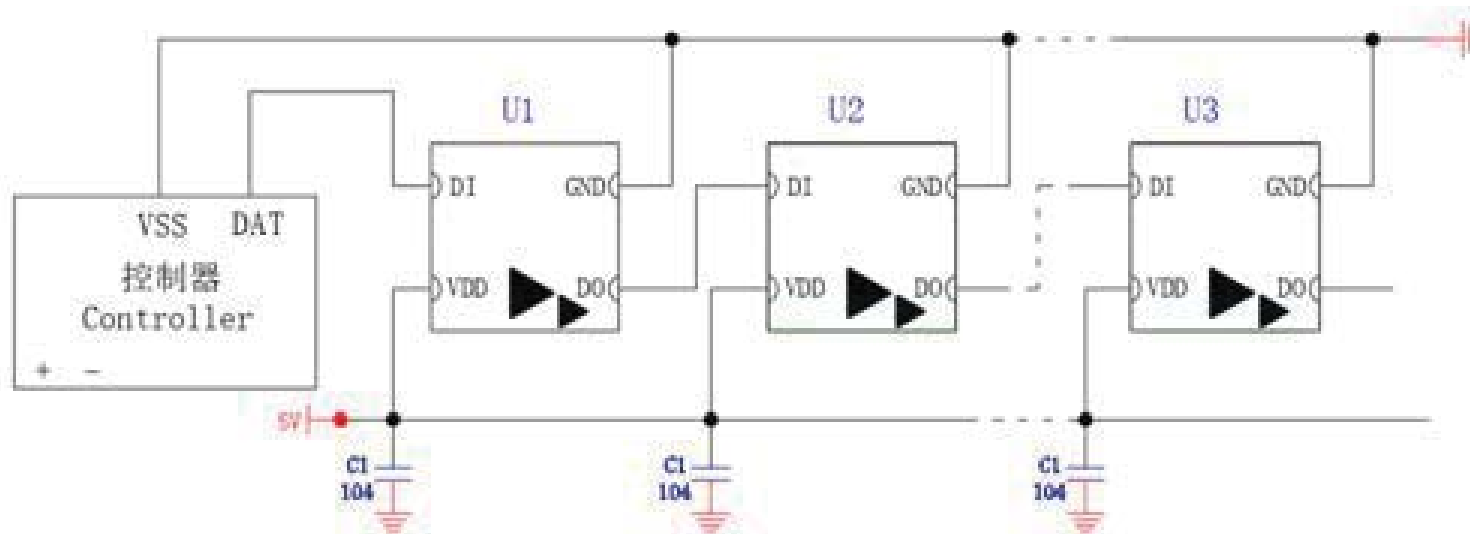
Note: Higher-level starts, sending data in GRB order

Data transmission / 数据传输

连接方式/Connection Method



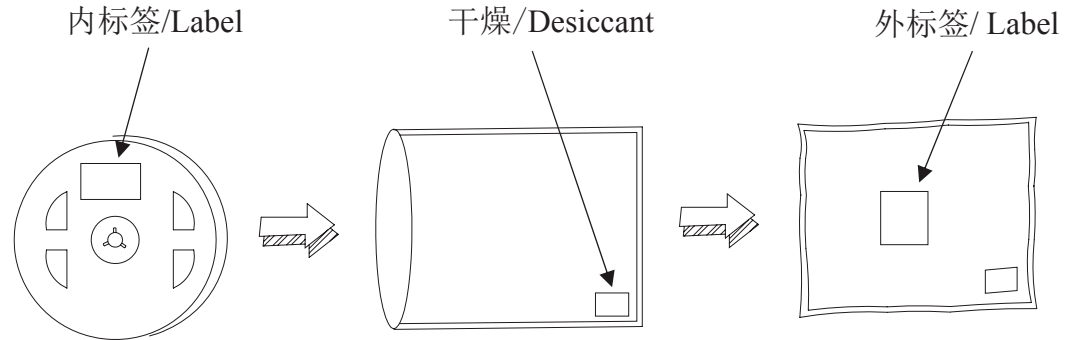
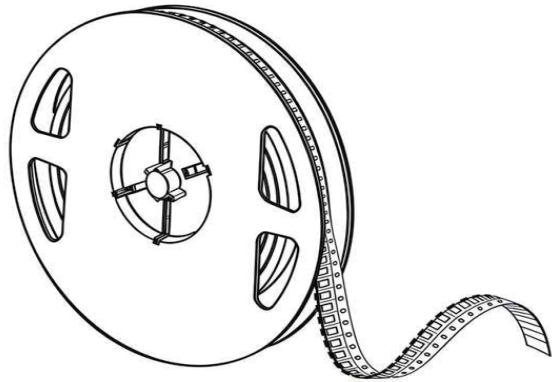
应用电路/application circuit(电源电压5V/Power supply voltage 5V)



注：产品应用中驱控灯珠级联数量及控制器参数配置、驱动电源品质均有较大差异，故请在批量使用产品前，客户方务必自行验证产品兼容性，我司不承诺满足客户所有应用需求。

Note: In the application of the product, there are big differences in the number of the cascade of the driving lights, the configuration of the controller parameters and the quality of the driving power, we are not committed to meeting all the application requirements of our customers.

Packaging Specifications/包装规格

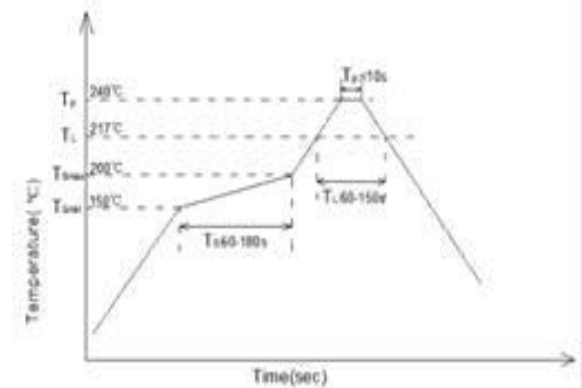


Soldering Specification/建议焊接温度曲线

本LED 器件属于潮湿敏感性元件，经过用下面所列参数检测证明，表面贴装型LED 符合JEDEC J-STD-020C 标准。建议作业前检查回流焊设备的峰值温度/时间是否控制在 $240 \pm 5^\circ\text{C} / \leq 10$

秒，无铅锡膏的温度曲线建议(作为一般指导原则，建议遵循所用焊锡膏制造商推荐使用的焊接温度曲线。)/The LED device is a moisture-sensitive element. The surface-mount LED meets the JEDEC J-STD-020C standard by testing the following parameters. It is recommended to check if the peak temperature/time of reflow equipment is controlled at $240 \pm 5^\circ\text{C} / \leq 10$ seconds before operation, temperature curve recommendations for lead-free solder paste (as a general guideline, it is recommended to follow the soldering temperature curve recommended by the manufacturer of the solder paste used)

温度曲线描述	无铅回流焊
最低预热温度(Tsmin)	150°C
最高预热温度(Tsmax)	200°C
预热区时间(Tsmin to Tsmax)(ts)	60-180 S
平均升温速率(Tsmax to Tp)	<3°C/S
液相温度(TL)	217°C
液相区保温时间(tL)	60-150 S
峰值温度(Tp)	240°C
高温区停留时间(tp)	<10 S
降温速率	<6°C/S
室温至峰值温度停留时间	<6 min



Cautions/注意事项

使用/ Application

1. LED器件容易受到机械外力的破坏，在表面上施加压力将会影响发光二极管的可靠性。在这样的情况下，装配使用产品时必须遵守相应的处理措施，避免任何的压力施加给本LED 器件的任何部分，所以在使用时请采用气动吸嘴，否则会导致发光二极管损坏和可靠性降低影响其寿命。并检查贴片机设备的吸嘴装置与产品匹配性，以不伤及产品胶体为宜。

The LED device is vulnerable to mechanical forces, and applying pressure to the surface will affect the reliability of the light-emitting diode. In such cases, the assembly of the product must comply with the corresponding treatment measures to avoid any pressure applied to any part of this LED device, so in use, please use pneumatic nozzle, otherwise, it will lead to light-emitting diode damage and reduce the reliability of its life, and check the SMT equipment suction nozzle device and product compatibility, not to hurt the product Gel is appropriate.

2. 回流焊接次数不可超过1次，建议检查终端产品是否需要经历二次回流焊工艺，二次回流焊工艺具有一定品质风险性，如需请自行评估并尽量缩短二次回流焊间隔时间（建议不超过4小时）。

The number of reflow soldering shall not exceed 1 time. It is recommended to check whether the terminal products need to go through reflow soldering process, which has certain quality risk, if necessary, please self-assessment and minimize the reflow interval time (not more than 4 hours is recommended) .

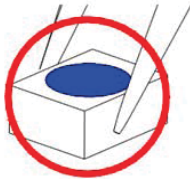
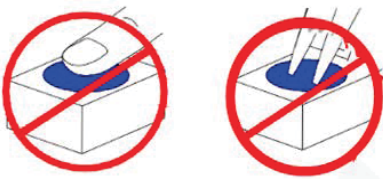
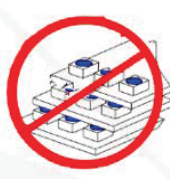
3. 当手动焊接时，建议采用 20W 的防静电烙铁，焊头的温度必须控制在360℃以下/3 秒，焊接次数为1 次。

When manual welding, it is recommended to use 20W antistatic soldering iron. The temperature of welding head should be controlled below 360 °c/3 seconds and the welding times should be 1.

4. 焊接期间，加热时不要在本LED器件上添加任何压力。

During welding, do not add any pressure to the LED when heating.

5. 使用操作示意图/USE THE ACTION DIAGRAM

使用镊子或合适的工具，沿侧表面夹取元件。 Using tweezers or a suitable tool, clamp the element along the side surface.	不可直接用手或尖锐金属压胶体表面，它可能会损坏内部电路。 Do not press colloidal surfaces directly by hand or sharp metal; it may damage internal circuits.	不要将焊接好的发光二极管堆叠放置，会导致发光二极管划伤及胶体受损造成死灯。 Do not stack the welded light-emitting diode. This can cause light-emitting diode scratches, Gel damage and a dead light.
		

存储/ Storage

1. 未打开原始包装的情况下，建议储存的环境为:温度：5℃~30℃；湿度：60%RH 以下。当库存超过两个月，使用前应做除湿处理，条件 60℃/8 小时。

Before opening original package, it is recommended to store them in the following environment: Temperature: 5℃~30℃, Humidity: 60% RH max. When the inventory over 2 months, Should be done before treatment using dehumidification, Temperature: 60℃/8 hours.

2. 打开原始包装后，建议储存环境为： 温度 5~30℃；湿度 60% 以下。

After opening original package, the storage ambient for the LEDs should be in 5~30℃ temperature and 60% or less relative humidity

3. LED 是湿度敏感元件，为避免元件吸湿，建议打开包装后，将其储存在有干燥剂的密闭容器内，或者储存在氮气防潮柜内。

In order to avoid moisture absorption, it is recommended that the LEDs that out of the original package should be stored in a sealed container with appropriate desiccant, or in desiccators with nitrogen ambient.

4. 打开包装后，元件应该在 24 小时（1 天）使用；且贴片后应尽快做焊接。

The LEDs should be used within 24hrs (1day) after opening the package. Once been mounted, soldering should be quick.

5. 如果干燥剂失效或者元件暴露于空气中超过 24 小时（1 天），应作除湿处理。烘烤条件：60℃，24 小时。

If the moisture absorbent material (silica gel) has faded away or the LEDs stored out of original package for more than 24hrs (1 day), baking treatment should be performed using the conditions: 60℃ at least 24 hours.

IPC/JEDEC J-STD-020 防潮等级(MSL)定义

防潮等级/MSL	包装拆封后车间寿命/Floor Life	
	时间/Time	条件/Condition
LEVEL1	---	≤30℃/85%RH
LEVEL2	1 年/1 year	≤30℃/60%RH
LEVEL2a	4 周/4 weeks	≤30℃/60%RH
LEVEL3	168 小时/168 hours	≤30℃/60%RH
LEVEL4	72 小时/72 hours	≤30℃/60%RH
LEVEL5	48 小时/48 hours	≤30℃/60%RH
LEVEL5a	24 小时/24 hours	≤30℃/60%RH
LEVEL6	取出即用 Use immediately after opening	≤30℃/60%RH

ESD 静电防护/ ESD (Electrostatic Discharge)-Protection

1. 接触 LED 时应佩戴防静电腕带或者防静电手套。
A conductive wrist strap or anti-electrostatic glove should be worn when handling these LEDs
2. 所有的机器设备、工制具、工作桌、料架等等，
应该做适当的接地保护（接地阻抗值 10Ω 以内）。
All devices, equipment, machinery, work tables and storage racks, etc. must be properly grounded (Grounding impedance value within 10Ω)
3. 储存或搬运 LED 应使用防静电料袋、防静电盒以及防静电周转箱，严禁使用普通塑料制品。
Use anti-static package or boxes to carry and storage LEDs. And ordinary plastic package or boxes is forbidden to use.
4. 建议在作业过程中，使用离子风扇来压制静电的产生。
Use ionizer to neutralize the static charge during handling or operating.
5. 距离 LED 元件 1 英尺距离的环境范围内静电场电压小于 100V。
All surfaces and objects within 1 ft close to LEDs measure less than 100V.

光电参数公差/ Rank Tolerance

正向电压 REF / VF : $\pm 0.05V$

亮度 CAT / IV : $\pm 10\%$

色度坐标 X / Y : ± 0.005

波长 HUE/WLD: $\pm 1nm$

清洗/ Cleaning

建议使用异丙醇等醇类溶液清洗 LED，严禁使用腐蚀性溶液清洗。

Use alcohol-based cleaning solvents such as IPA (isopropyl alcohol) to clean LEDs if necessary

其他/ Others

1. 本规格所描述的 LED 定义应用在普通的电子设备范围（例如办公设备、通讯设备等等）。如果有更为严苛的信赖度要求，特别是当元件失效或故障时可能会直接危害到生命和健康时（如航天、运输、交通、医疗器械、安全保护等等），请事先知会敝司业务人员。

The LEDs described here are intended to be used for ordinary electronic equipment (such as office equipment, communication equipment and household applications). Consult Sales in advance for the applications in which exceptional reliability is required, particularly when the failure or malfunction of the LEDs may directly jeopardize life or health. (such as in aviation, transportation, traffic control equipment, medical and life support systems and safety devices).

2. 高亮度 LED 产品点亮时可能会对人眼造成伤害，应避免从正上方直视。

The light output from the high luminous intensity LEDs may cause injury to human eyes when viewed directly.

3. 出于持续改善的目的，产品外观和参数规格可能会在没有预先通知的情况下作改良性变化。

The appearance and specifications of the product may be modified for improvement without prior notice.