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Product specification

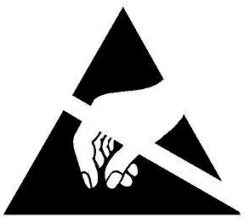
Product No.: LC8816E-RGBX

Description: 5050 SMD CHIP 0.25W intelligent external control LED

Date： 2024-10-07

Document No.: LC8816E-5050RGBX-SPC-0002-A01

Version No.: A01



ELECTROSTAIC
SENSITIVE DEVICES

Customer review			LED Color		
Approved	Confirm	Make	Approved	Confirm	Make
			Mr Zhao	Mr Zhao	Mr Chang
☐ Accept		☐ Not accept	Date：2024-10-07		

Revision record

NO.	Date	Version number	Revise contents	Reviser	Note
1	2023-12-20	A00	Version No.	Mr Chang	
2	2024-10-07	A01	Typical Application Circuit	Mr Chang	
3					
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Catalogue

1.Product description:

LC8816E-RGBX is an intelligent external controlled LED light source integrating control circuit and light emitting circuit. Each LED light source is a pixel point.LED light source contains intelligent digital interface data latch signal circuit, Power supply stabilization circuit, built-in constant current circuit, data regeneration circuit.High-precision RC oscillator, the output driver adopts patented PWM technology, which effectively ensures the stability and color consistency of LED light source.

Data transmission adopts single-wire signal series protocol, which has long transmission distance and strong anti-interference ability.

LC8816E-RGBX has the advantages of low voltage drive, environmental protection and energy saving, high brightness, large scattering angle, good consistency, long lifespan and so on. The control circuit is integrated inside the LED, which makes the application circuit design easier, less original parts, and small in size. Beautiful, easier to install.

2. Main application areas:

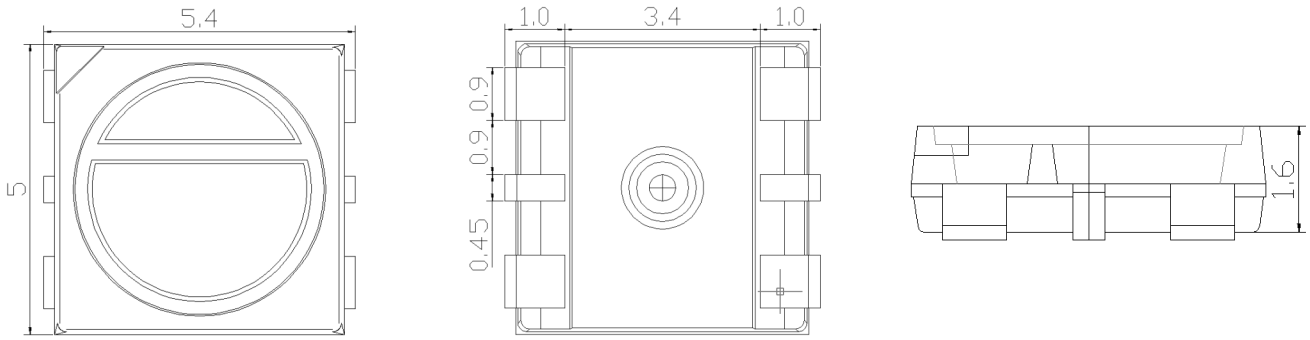
LED full-color luminous character string light, LED full-color flexible and hard led strip, LED point light source, LED pixel screen, LED special-shaped screen, LED full-color module, car lights, shoe lights, toys, audio, home appliances, and various electronics product.

3.Feature:

- The control circuit and chip are integrated in LED components to form a complete externally controlled pixel point.
- LED internal integration of high quality external control single-wire serial cascade constant current IC.
- Default output constant current value OUTR/OUTG/OUTB is 8mA,OUTW is 16.5MA.
- Standard data signal transmission rate is 800Kbps.
- PWM scanning frequency is 1.5KHz.
- 8 bit data per color, 256 grayscale adjustable, with good color consistency.
- There is no self-test mode when powering on, the light doesn’t light up when there is no signal input.
- Low power consumption and energy saving.
- Vertical SMD surface mount package, suitable for all SMT assembly and soldering processes.
- Moisture-proof grade: LEVEL5a.
- Product certification: CE, RoHS.
- System certification: IATF16949, ISO13485, ISO9001.

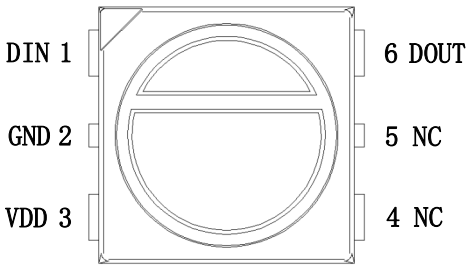
4.Package size drawing:

Front view **Back view** **Side view**



Remarks:All dimensions are marked in millimeters and the tolerance is ±0.15mm, unless otherwise specified

5.Pin function description:



No.	Symbol	Pin	Function description
1	DIN	Data Input	Control data signal input pin
2	GND	Ground or negative end of the power supply	Ground
3	VDD	Positive terminal of power supply	Positive power supply
4	NC	Empty feet	Empty feet
5	NC	Empty feet	Empty feet
6	DOUT	data output	Control data signal output pin

6.Chip characteristic parameter:

Color	Wavelength(nm) Color temperature(k)	Light intensity (mcd)	Lumen (lm)	CRI (Ra)	Color tolerance (SDCM)	Product No.
Red	620-630	400-800	1.2-2.0	/	/	LC8816E-RGBX
Green	520-535	1000-1800	3.0-5.0	/	/	
Blue	460-475	200-400	0.5-1.2	/	/	
White	3000/6000K	/	4-8	≥90	≤5	

7.Maximum rating:

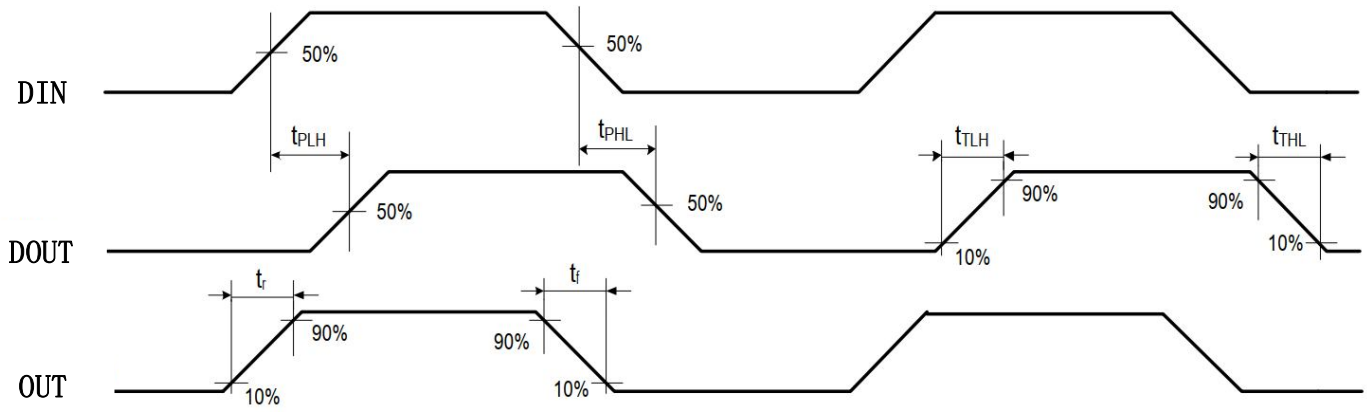
Parameter	Symbol	Range	Unit
Logic supply voltage	V_{DD}	3～5.5	V
RGB output port voltage pressure	V_{DS}	12	V
Logic input voltage	V_I	-0.5～+5.5	V
Working temperature	T_{opt}	-40～+85	℃
Storage temperature	T_{stg}	-50～+85	℃
ESD pressure（HBM）	V_{ESD}	3000	V

8.Electrical characteristics:

Parameter	Symbol	Min	Typical	Max	Unit	Test conditions
Chip input voltage	V_{DD}	-	5	-	V	-
R/G/B port output current	I_{OUT}	-	8	-	mA	-
W port output current		-	16.5	-	mA	
High Level Input Voltage	V_{IH}	-	0.5V_{DD}	-	V	-
Low level input voltage	V_{IL}	-	0.25V_{DD}	-	V	-
PWM scan frequency	F_{pwm}	-	1.5	-	KHz	-
Quiescent Current	I_{DD}	-	3	-	mA	-

9.Dynamic parameters:

Parameter	Symbol	Min	Typical	Max	Unit	Test conditions
Data transfer rate	F_{DIN}	-	800	-	Kbps	-
DOUT Transmission delay	t_{PLH}	-	80	-	ns	DIN→DOUT
	t_{PHL}	-	80	-	ns	
Output current conversion time	t_r	-	150	-	ns	$I_{OUTR/G/B}$=8MA I_{OUTW}=16.5MA
	t_f	-	400	-	ns	



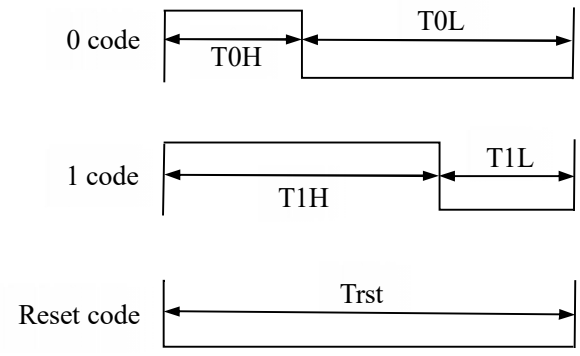
10.Data output time:

Name	Description	Min	Typical	Max	Allowable error	Unit
T	Symbol period	1.2	-	-	-	US
T0H	0 code, high level time	-	0.3	-	±0.05	US
T1H	1 code, high level time	-	0.9	-	±0.05	US
T0L	0 code, low level time	-	0.9	-	±0.05	US
T1L	1 code, low level time	-	0.3	-	±0.05	US
Trst	Reset code，low level time	≥80	-	-	-	US

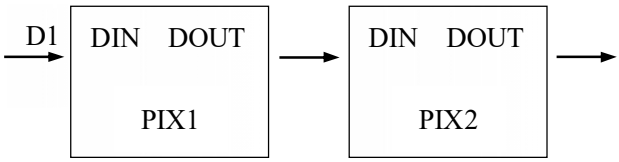
11.Coding timing description:

The chip protocol uses a unipolar return-to-zero code, and each symbol must have a low level. Each symbol of this protocol starts with a high level, and the time width of the high level determines the "0" code or the "1" code.

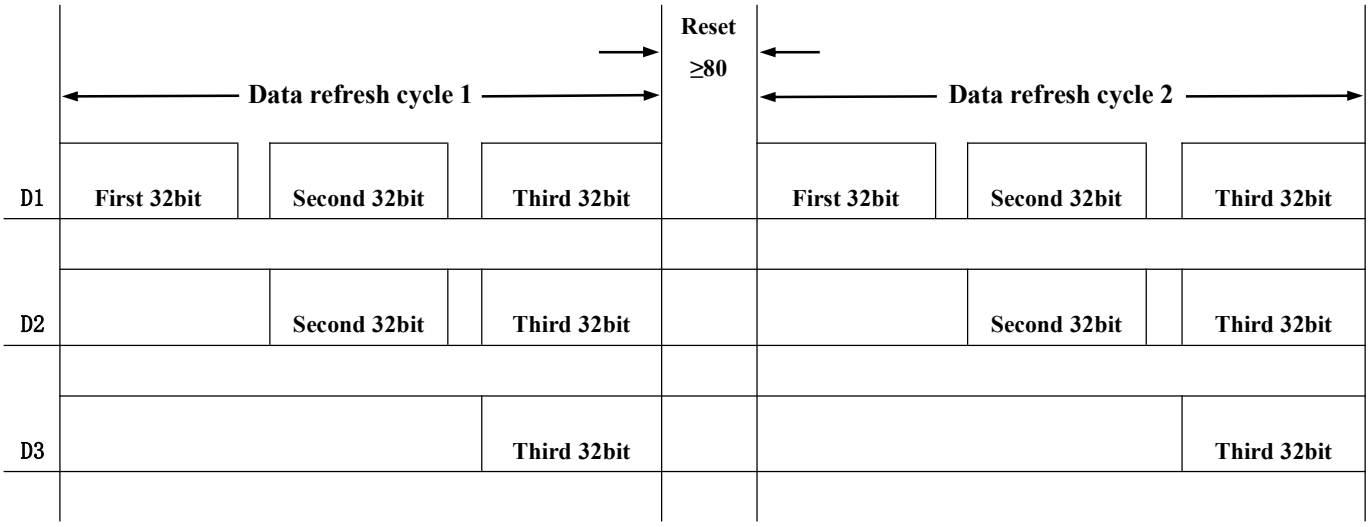
Input Code：



Connection Mode:



12.Data transmission method:



Note: D1 is the data sent by the MCU, and D2, D3, and D4 are the data that the cascade circuit automatically reshapes and forwards.

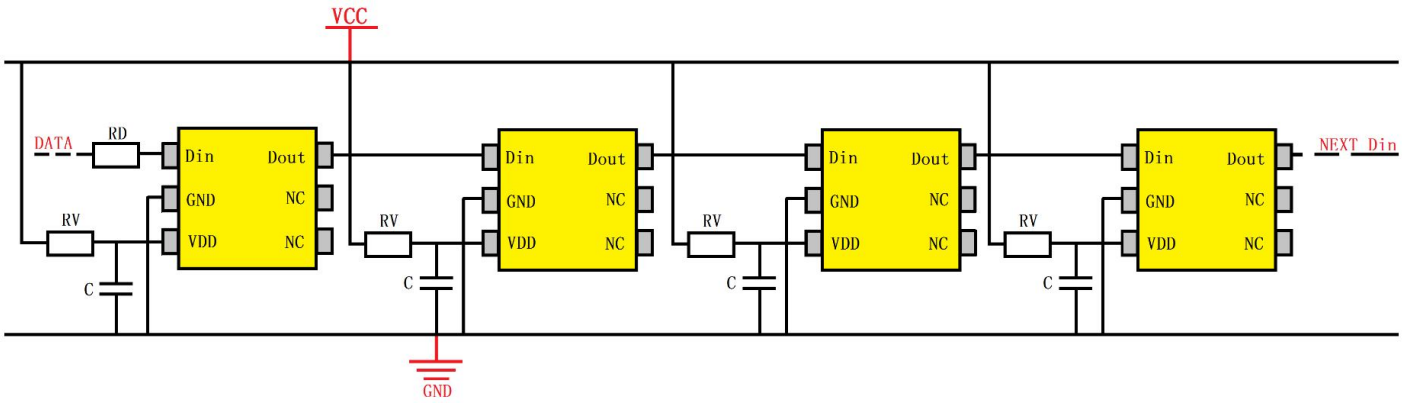
Trst+32bit data of the first LED+32bit data of the second LED+...+32bit data of the Nth LED+Trst.

13.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	W7	W6	W5	W4	W3	W2	W1	W0

Note: The high bit is sent first, and the data is sent in the order of GRBW (G7 → G6 →……W0).

14. Typical application circuit:



The input DIN and output DOUT, need to be connected in series if necessary, the size of the protection resistance R depends on the number of cascade leds, the more the number of cascades, the smaller the resistance value, the general recommendation is between 510-620 ohms, the recommended value is 560 ohms.

Typical application circuit parameters include power input voltage VCC, current limiting resistor RV, chip VDD voltage regulator CIN, input/output protection resistor RD.

Chip supply voltage VDD: VDD=VCC-(IDD+IIN)*RV,

The chip IIN is the operating current of the voltage regulator circuit inside the chip, IDD is the static current, and the RV resistance value ensures VDD>7V.

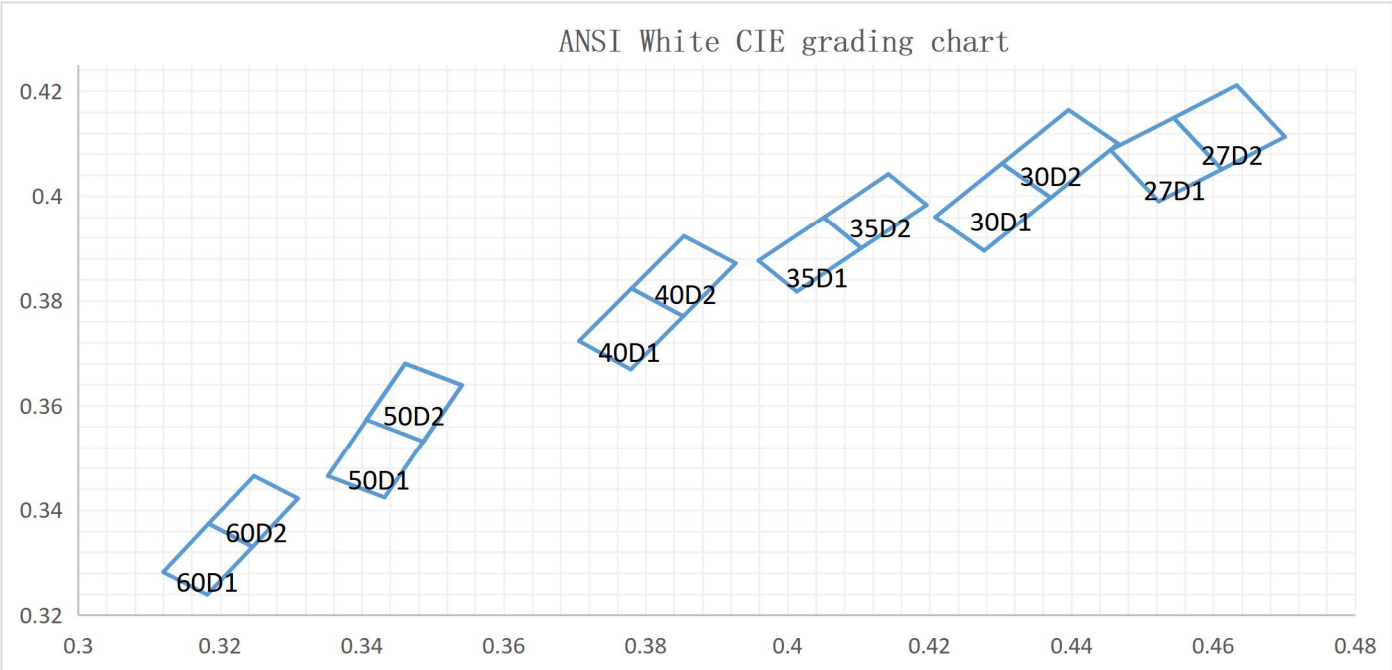
The larger the RV resistance, the lower the system power consumption, but the system anti-interference ability is weak, the smaller the RV resistance, the larger the power consumption, the higher the operating temperature, the design of the circuit needs to choose the resistance RV according to the system application environment, the relationship between VCC and RV is shown in the following table:

V_{CC}	12V	/
R_V	33	/

C is the chip filter capacitor, which is used to stabilize the VDD voltage of the chip and ensure the normal operation of the chip. The recommended value of C is 0.1UF.

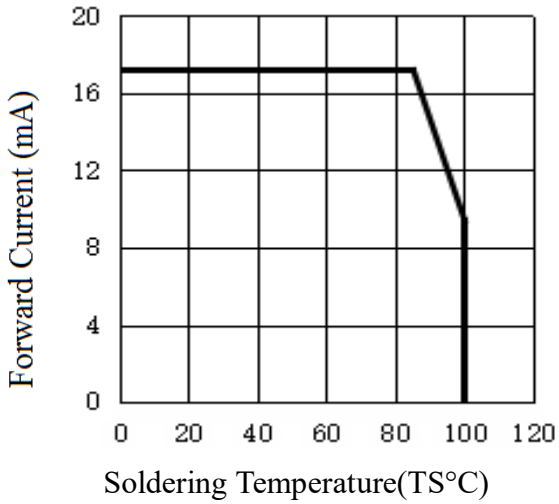
15.White light grade division chart:

Bin NO.	X1	Y1	X2	Y2	X3	Y3	X4	Y4	Luminous flux (lm)	Temperature (TC)	Color tolerance SDCM
27D1	0.4523	0.399	0.4455	0.4088	0.4544	0.4149	0.4612	0.4051	4-6	2635-2900	≤5
27D2	0.4612	0.4051	0.4544	0.4149	0.4633	0.4211	0.4701	9-15	4-6	2565-2815	≤5
30D1	0.4277	0.3895	0.4208	0.396	0.4302	0.4062	0.4371	0.3997	4-6	2960-3225	≤5
30D2	0.4371	0.3997	0.4302	0.4062	0.4396	0.4164	0.4466	0.41	4-6	2890-3135	≤5
35D1	0.4013	0.3817	0.3959	0.3876	0.4051	0.3959	0.4104	0.39	5-7	3370-3740	≤5
35D2	0.4104	0.39	0.4051	0.3959	0.4142	0.4042	0.4196	0.3983	5-7	3225-3560	≤5
40D1	0.3779	0.3669	0.3706	0.3723	0.378	0.3823	0.3853	0.3639	5-7	3870-4250	≤5
40D2	0.3853	0.377	0.378	0.3823	0.3854	0.3923	0.3927	0.3639	5-7	3760-4110	≤5
50D1	0.3432	0.3424	0.3352	0.3465	0.3461	0.368	0.3541	0.333	5-7	4885-5450	≤5
50D2	0.3487	0.3531	0.3406	0.3573	0.3461	0.368	0.3541	0.3422	5-7	4665-5170	≤5
60D1	0.3182	0.3239	0.312	0.3282	0.3184	0.3374	0.3246	0.333	5-7	5870-6545	≤5
60D2	0.3246	0.333	0.3184	0.3374	0.3248	0.3465	0.331	0.3422	5-7	5560-6160	≤5

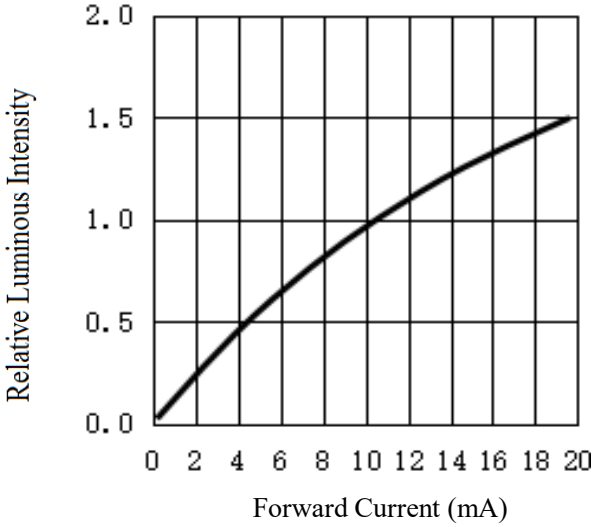


16.Photoelectric characteristic curve:

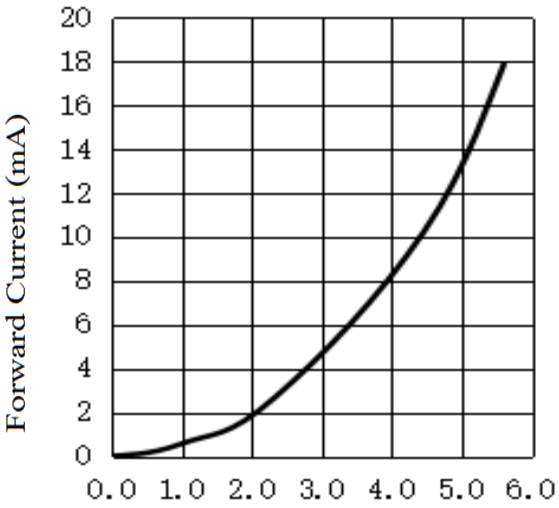
Welding temperature VS Forward current



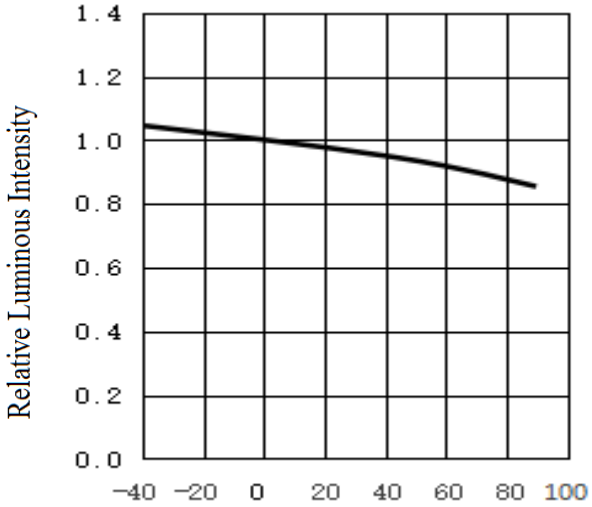
Forward current VS Relative light intensity



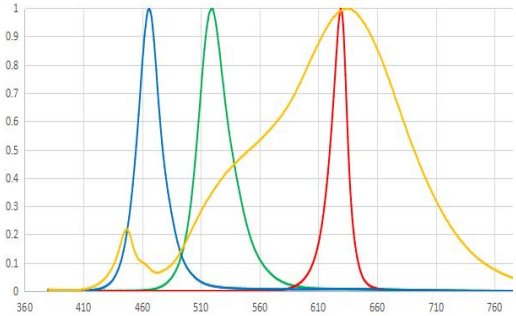
Forward voltage VS Forward current



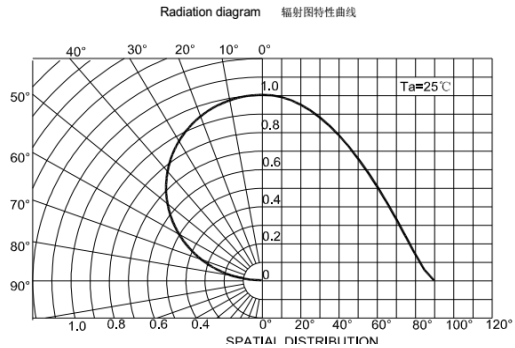
Ambient temperature VS Relative light intensity



Relative spectral distribution chart

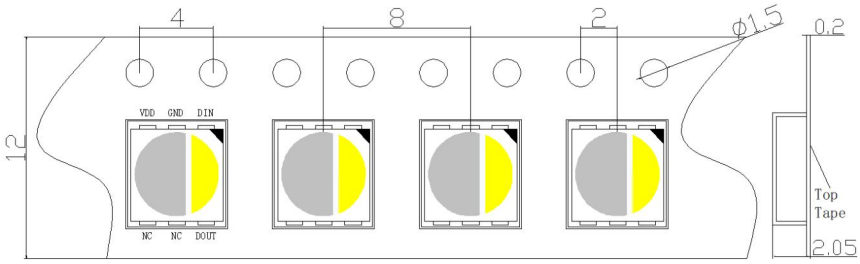


Radiation pattern characteristic curve

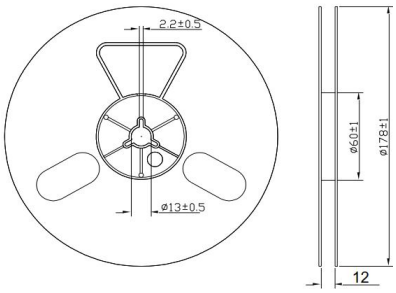


17. Packing specifications:

Carrier tape specifications (unit: mm)

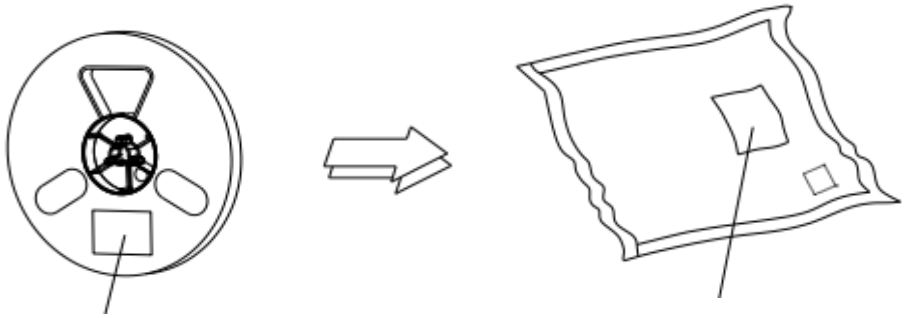


Reel size:(178*12mm)



Note: The marked tolerance is ±0.1mm, unit: mm

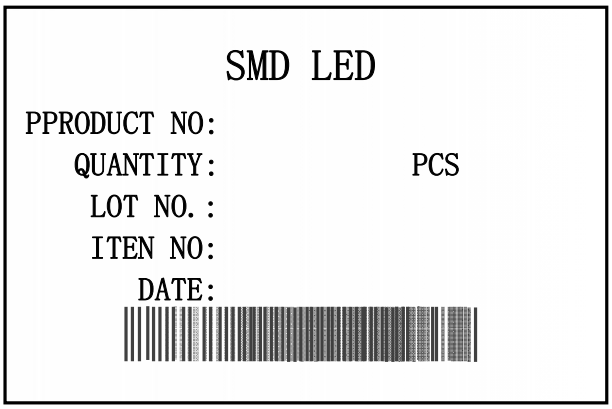
Moisture-proof bag packaging:



Labeling bit　　Labeling bit

Label description:

PRODUCT No: Product model
QUANTITY: Package quantity
LOT NO: Order number
ITEN NO: Part number
DATE: Production date



Label diagram

Note: SMD5050 series packaging standard is 1000PCS/bag, except for special requirements.

18.Reliability Test:

Item	Test Conditions	Proof time /Cycle	Quantity	Reference standard	Ac/Re
Reflow resistance verification	260℃/10sec	2times	22PCS	JEITA ED-4701 300 301	0/1
Thermal cycle	-40℃ 30min ↑ ↓ 25℃(5min) 100℃ 30min	200 cycles	22PCS	JEITA ED-4701 100 105	0/1
Thermal Shock	-40℃ 20min ↑ ↓ 10sec 100℃ 20min	300 cycles	100PCS	MIL-STD-202G	0/1
High temperature and high humidity storage	Ta=85℃ RH=85%	168 hours	22PCS	JEITA ED-4701 100 103	0/1
High Temperature Storage	Ta=85℃	500 hours	22PCS	JEITA ED-4701 200 201	0/1
Low Temperature Storage	Ta=-40℃	1000 hours	22PCS	JEITA ED-4701 200 202	0/1
Common Temperature aging	Ta=25℃ IF= Typical value	1000 hours	22PCS	JESD22-A 108D	0/1

19.Notice:

SMD LED Usage Notice

Thank you for using the LED chip of Shenzhen LED Color Co., Ltd. In order to enhance your understanding of the characteristics of our products, and to facilitate you to quickly grasp the basic operations of the products, in order to minimize or avoid unnecessary products caused by human factors damaged, so that it can better serve your production, specially for some standard use in the process of use for corresponding instructions. At the same time even if the same specification LED, its reliability and design level in the actual application field, operation mode, use conditions They are all related. This instruction manual cannot cover all the problems that customers may encounter during use. We apologize for the inconvenience caused!

1. Transportation and storage:

SMD LEDs are packaged in moisture-proof and anti-static aluminum foil bags. Avoid squeezing or piercing the packaging bag during transportation, and take necessary anti-static protection measures. Before the product is produced, if air leakage or damage is found, please stop using it directly and do the necessary use after high temperature dehumidification. In the process of product replacement, placement, finished product shipment, and installation, care should be taken to prevent external force from colliding and squeezing the LED, causing external force to damage the LED.

If the aluminum foil bag has been discovered before production, unsealed, damaged, or leaked, please return it to the original factory for dehumidification testing in time, and never use it online.

2. Packing and storage:

SMD LED is a humidity-sensitive element. Packaging the LED in an aluminum foil bag is to prevent the LED from absorbing moisture during transportation and storage. A desiccant is placed in the packaging bag to absorb moisture. If the LED absorbs moisture, the moisture will expand when the LED is reflowed, causing the gel to separate from the bracket, or damage the key alloy wire, causing the product to fail. For this reason, the vacuum moisture-proof packaging is to avoid moisture in the packaging bag. **The moisture-proof grade of this product is LEVEL5a.**

Diagram 1: Definition of Material Moisture Resistance Level (MSL) specified by IPC/JEDEC J-STD-020

Moisture Resistance level	Workshop life after unpacking	
	Time	Condition
LEVEL1	Unlimited	≦30℃/85 % RH
LEVEL2	1year	≦30℃/60 % RH
LEVEL2a	4weeks	≦30℃/60 % RH
LEVEL3	168hours	≦30℃/60 % RH
LEVEL4	72hours	≦30℃/60 % RH
LEVEL5	48hours	≦30℃/60 % RH
LEVEL5a	**24hours**	**≦30℃/60 % RH**
LEVEL6	Ready-to-use	≦30℃/60 % RH

2.1 Storage in vacuum packaging: It is recommended that SMD series LEDs be stored in a drying cabinet with a built-in desiccant. The storage environment should be at a temperature of 20°C-30°C, humidity:

below 60%, and the storage time should not exceed two months.

2.2 Storage and use after unpacking:

a. Before unpacking, check the validity period of the package and ensure that there is no air leakage.

b. Workshop life of the exposed environment after the vacuum aluminum bag is unpacked: In the condition of≤30℃/60%RH, the online use time does not exceed 24 hours (Level 5), and the 5050 and shade series are recommended not to exceed 12 hours. If it does not meet the above environmental requirements, it is recommended that the unpacking operation time should not exceed 2 hours.

c. The remaining materials after unpacking should be sealed within 12H in the workshop environment of ≤30℃/60%RH and stored in accordance with conditions 2.1.

2.3 If the LED device is exposed to the air for 24 hours, and the environment meets the requirements of 2.1 and 2.2, the LED device can be used after low-temperature baking and dehumidification.

2.4 When the LED device is exposed to the air for more than 24 hours (or the environment does not meet the requirements of 2.1 and 2.2), the LED device needs to be baked at high temperature and dehumidified before use.

2.5 LED devices in the vacuum package are not opened, and the packaging is intact (no secondary sealing), and the LED devices within 90 days can be used directly, but the LED devices within 90-180 days need to be dehumidified at low temperature before use.

2.6 The LED device in the vacuum package has not been opened, and the package is intact (without secondary sealing), but the LED device must be dehumidified at high temperature for more than 180 days before use.

2.7 LED is a surface mount component. For example, after the LED is damp, under the high temperature condition of reflow soldering, the LED bracket and the packaging glue may peel off, and its luminous efficiency will be affected, resulting in a decrease in brightness or variation of luminous color.

2.8 The LED electrode and bracket are made of silver-plated copper alloy. The silver layer on the outer surface is easily affected by corrosive gas. Please avoid contact with corrosive environment to cause discoloration of the LED, so as to avoid deterioration of the solder ability of the LED or affect the photoelectric performance. Please avoid sudden changes in ambient temperature and humidity, especially in high humidity environments that are prone to condensation.

3. Product dehumidification:

3.1 Low temperature dehumidification method:

3.1.1 Unpack the vacuum package and take out the entire plate of LED devices from the vacuum package.

3.1.2 Bake on the original reel, and flatten it to avoid deformation of the reel.

3.1.3 Place the entire tray of LEDs in a 70°C oven and bake for 24 hours(note: the entire tray of LED devices can’t be baked at a temperature higher than 70°C, as the LED reel may be deformed if it is above 70°C).

3.1.4 After the baking is completed, the LED devices can be used for normal operations.

3.1.5 It's recommended that all color light products be dehumidified at low temperatures for better results.

3.2 High dehumidification method:

3.2.1 After dividing according to the BIN level, unwrap the tape, and place the LEDs in the stainless steel plate flat, and the flat thickness shall not be greater than 2CM.

3.2.2 Conventional PPA (3535/5050/2835 LEDs), the high-temperature baking temperature is 80℃/2H-120℃/2H-150℃/6H, and then the temperature in the oven is naturally cooled for half an hour to start braiding. The braiding must be completed within 4H (the leds should be placed in the drying cabinet during the waiting period. Inside, It is recommended that the humidity of the drying cabinet be controlled within 30%RH)

3.2.3 PPA built-in IC leds high temperature baking temperature 80℃/2H-135℃/6～8H.

3.2.3 CHIP type LEDs are baked at a high temperature of 80℃/2H-135℃/4H, and then naturally cool down in the oven for half an hour before taping. The taping must be completed within 4H (the leds should be placed in a drying cabinet during the waiting period It is recommended that the humidity of the drying cabinet be controlled within 30%RH).

3.2.4 Vacuum packaging after dehumidification at 70 ℃/12H after tape weaving.

3.3 Moisture-proof control of the assembled led components

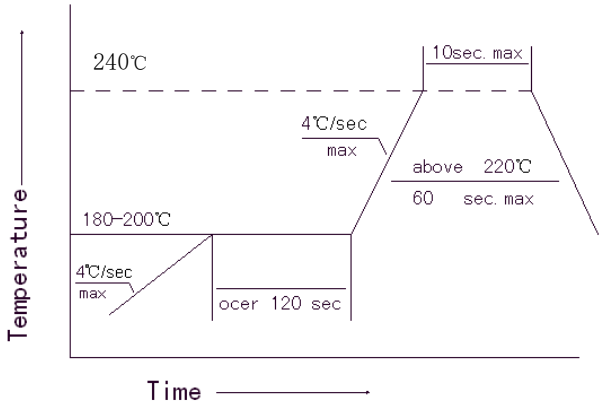
3.3.1 For products that require a secondary SMT process or high temperature, the necessary moisture-proof treatment should also be done before the secondary welding after the completion of the first welding. Exposure to the condition of (≦**30℃/60%RH**), the longest No more than **2H**. If the time between the second high-temperature production is longer, the material after the first welding must be dehumidified (bake in an oven at **70℃±5℃** for no less than **12** hours), and then vacuum-sealed for storage , or store the product in a constant temperature and humidity oven in a drying oven, before secondary high-temperature production, perform dehumidification(bake in an oven at **70°C ± 5°C** for no less than **12** hours) to ensure that the product is not damp before the high-temperature process, the low-humidity baking conditions: **70°C±5°C** baking not less than **12** hours, high-temperature baking conditions: **130°C±5°C** baking for **5** hours, the normal reflow soldering operation accumulatively does not exceed **2** times. If necessary, the reliability risk must be assessed in advance, and the impact of high temperature baking must be considered for other components.

3.3.2 For products with extrusion process or high-temperature protection treatment, it is recommended that the products do the necessary dehumidification work before the product undergoes the protection process, and bake in an oven at **130 °C ± 5 °C** for **5** hours to eliminate the moisture absorbed by the product when it is exposed to the air during testing, aging, and transportation, so as to prevent the moisture wrapped on the surface of the material from slowly entering the material after the product is protected, causing the product to fail. Pls evaluate the yield before extrusion of the led with built-in IC. Generally, solid extrusion process is

not recommended for the lamp beads with built-in IC.

4. Welding:

4.1 Reflow soldering : It is verified by LED Color using the parameters listed below that the surface mount LED meets the JEDEC J-STD-020C standard. As a general guideline,LED Color recommends that customers follow the soldering temperature curve recommended by the manufacturer of the solder paste used. Please note that this general guideline may not apply to all PCB designs and reflow soldering equipment configurations.



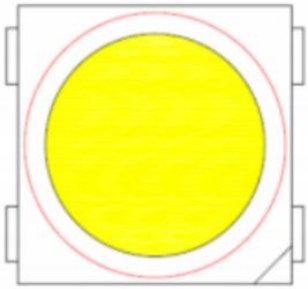
Profile Feature	Lead-Based Solder	Lead-Free Solder
Average Ramp-Up Rate (Ts max to Tp)	3 ℃/second max	3℃/second max
Preheat: Temperature Min (Ts min)	100℃	150℃
Preheat: Temperature Max (Ts max)	150℃	200℃
Preheat: Time (ts min to ts max)	60-120 seconds	60-180 seconds
Time to maintain high temperature: Temperature (TL)	183 ℃	217 ℃
Time to maintain high temperature: Time (t L)	60-150 seconds	60-150 seconds
Peak/Classification Temperature (T P)	215 ℃	240 ℃
Time Within 5℃ of Actual Peak Temperature (tp)	<10 seconds	<10 seconds
Ramp-Down Rate	6 ℃/second max	6 ℃/second max
Time to rise from 25 ℃ to peak temperature	<6 minutes max	<6 minutes max

4.2 Manual soldering: It is recommended to use an electric soldering iron with a power not exceeding 60W, and control the temperature of the soldering iron not to exceed 350°C. The electric soldering iron stays on the bracket pins for no more than 3 seconds during each soldering. If repeated soldering is required, the interval stay time is not Less than 3 seconds to avoid long-term high temperature damage to the LED. During the soldering process, do not touch or squeeze the surface of the LED lamp bead to avoid damage to the inside of the LED. At the same time, please pay attention to avoid the electric soldering iron on the LED surface colloid and PPA Burns and other injuries.

Note: All temperatures refer to the temperature measured on the upper surface of the package body. When soldering, do not forcefully press the surface of the colloid when the material is heated.

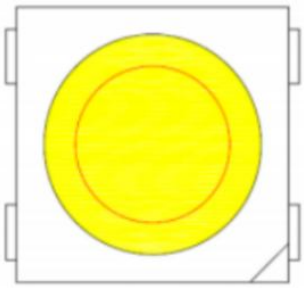
5. SMT nozzle requirements: (Red circle refers to the inner diameter of the nozzle, see picture 1 and picture 2)

picture 1



OK (the inner diameter of the nozzle is larger than the light-emitting area of the led)

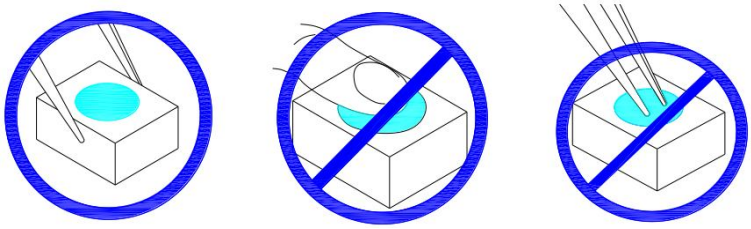
picture 2



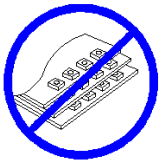
NG (the inner diameter of the nozzle is smaller than the light-emitting area of the led)

In order to prevent air pressure leakage, the outer diameter of the SMD nozzle should not exceed the size of the LED, and the inner diameter of the nozzle should be as large as possible. The tip of the nozzle should be made of soft material to prevent scratching or damaging the LED gel surface during suction. The size of the component must be Accurate in the pick and place machine.

6. Material picking method: use tweezers to pick up the material. Do not press the colloid or sharp objects to puncture the colloid. The materials cannot be stacked.



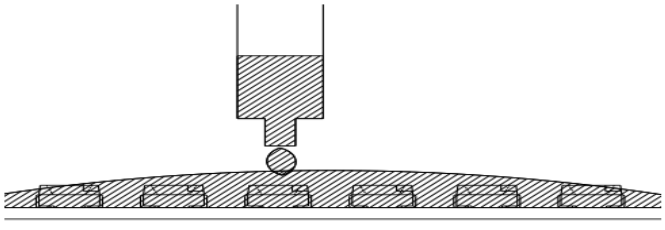
Do not stack products together, it may damage the internal circuit,



Cannot be used in acidic places with PH<7

7. Hazardous substance control:

When we need to use the external sealant to coat the LED products, we should ensure that the external sealant matches the LED packaging glue, because most of the LED packaging glue is silica gel and epoxy glue, it has oriented oxidation and aligned moisture absorption. It is necessary to prevent the external sealing material from entering the LED to cause damage to the LED. The content of a single bromine element is required to be less than 900PPM, and the content of a single chlorine element is required to be less than 900PPM. When applying LED products, the total content of bromine and chlorine in the outer sealant must be less than 1500PPM.



8. Thermal design requirements:

For LED products, the design of heat dissipation is very important. When designing the product, please consider the heat generated by the LED, the thermal resistance of the PCB board, the density of the LED arrangement, and the input electric power will all increase the temperature. In order to avoid excessive heat generation, it is necessary to ensure that the LED runs within the maximum specification range required in the product specification. When setting the driving power of the LED, the highest ambient temperature should be considered. The maximum working temperature of the product cannot exceed 50℃ (i.e.≤50 ℃, referring to the working temperature at the GND position of the pin of the LED).

9. Anti-static and surge protection:

Static electricity and surges can damage the LED products. Therefore, corresponding protective measures must be taken. In order to protect the LED products, no matter what time or occasion, as long as you touch the LED, you need to wear an anti-static wristband and anti-static gloves. All equipment and instruments must be grounded. It is recommended that each product is inspected before shipment, and there should be related electrical tests to select defective products caused by static electricity. When designing the circuit, consider eliminating the possibility of surges from harming LEDs.

10. Special statement:

10.1 If it is used outside of the specification, our company will not be responsible for any problems.

10.2 The LED can emit a strong light that can damage the eyes. Take precautions and do not look directly at the LED light with the naked eye for too long.

10.3 Before mass use, you should communicate with relevant personnel of our company to understand more detailed specifications.

10.4 If the shape and specifications of LED products are changed, please forgive me for not being able to inform in time.