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Product Specifications

Model： HD107S-2121

Description： 2121 SMD Smart LED

Document No： HD107S-2121RGB-RD001

Version No： A00

ELECTROSTAIC
SENSITIVE DEVICES

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1. Product Overview:

HD107S-2121 is an intelligent externally-controlled light source integrating control driver and LED emitting chips. Each LED light source is one pixel. The internal structure integrates an MCU digital interface, data latch, LED driver and other circuits. Through an external MCU, individual grayscale control, cascading control, and color-matrix lighting can be achieved. Data transmission uses a dual-line serial protocol (clock+data),featuring long transmission distance and strong anti-interference capability.

2. Main Applications:

LED full-color string lights, LED flexible/rigid strips, LED pixel lights, LED pixel screens, special-shaped LED screens, LED full-color modules, automotive atmosphere lights, and indicator lights for various electronic products

3. Main Product Features：

- Built-in driver + LED in one, forming a complete external-control pixel point.
- Integrated dual-line serial constant-current IC (clock + data).
- Default constant-current output: B/R/G = 17 mA.
- Supports max. clock input frequency 32 MHz; data transmission rate 32 Mbps.
- PWM scanning frequency: 27 kHz.
- 8-bit per color, 256-level grayscale adjustable, excellent color consistency.
- No power-on self-test mode; LEDs stay off without signal.
- SMD white bracket, 120° viewing angle, high brightness, high stability.
- Suitable for SMT and wave-soldering.
- RoHS & REACH compliant.
- Moisture sensitivity level: MSL 4.

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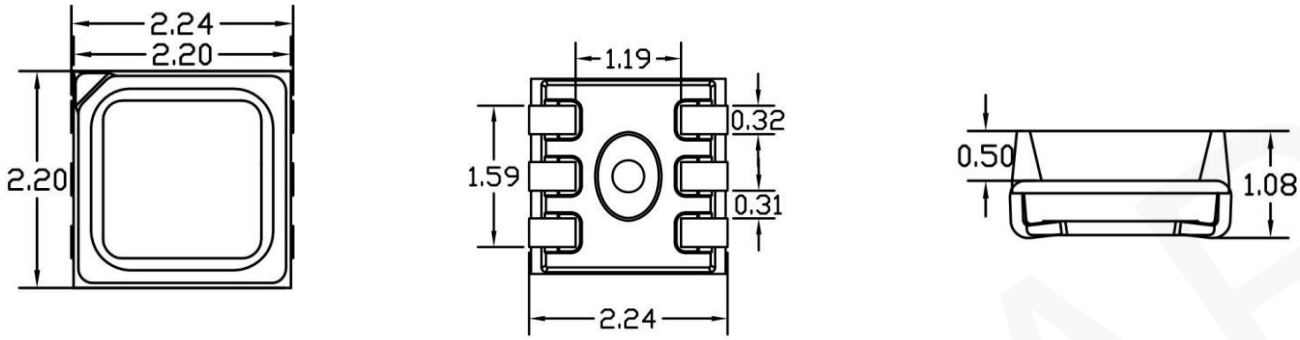
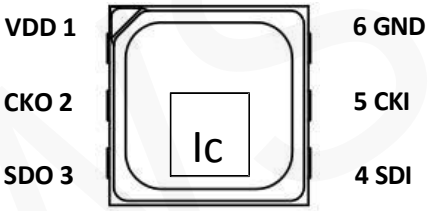
4. Mechanical Dimensions:

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



Remark： All dimensions in mm; tolerance ±0.15 mm

5. Pin Definition:



NO.	SYMBOL	PIN	FUNCTION
1	VDD	Power positive	Power supply positive terminal
2	CKO	Clock output	Clock signal output pin
3	SDO	Data output	Data signal output pin
4	SDI	Data input	Data signal input pin
5	CKI	Clock input	Clock signal input pin
6	GND	Ground / power negative	Ground or power supply negative terminal

6. **Optical Characteristics:（Ta=25℃， VDD=5V)**

Color	Wavelength（nm）	Luminous flux（mcd）	Lumen（lm）
Red	620-630	600-1200	1.2-2.2
Green	520-530	800-1500	2.5-4.0
Blue	460-470	400-800	1.0-2.0

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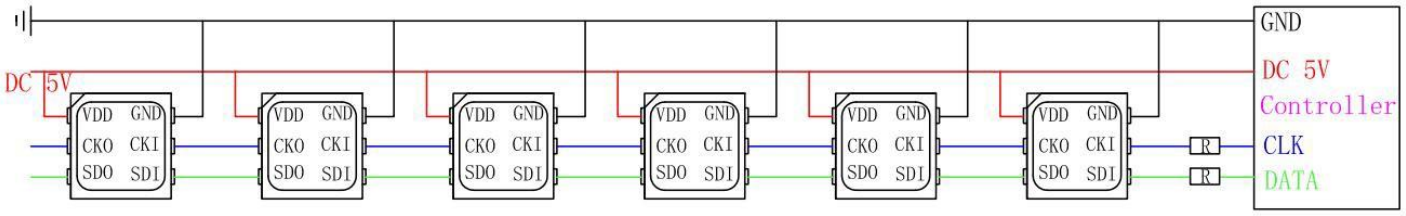
7. Absolute Maximum Ratings:

Data	Symbol	Range	Unit
Logic supply voltage	V_{DD}	0.5～5.5	V
RGB port withstand voltage	V_{DS}	24	V
Logic input voltage	V_I	-0.3～+VDD+0.3	V
Operating temperature	T_{opt}	-40～+85	℃
Storage temperature	T_{stg}	-50～+85	℃
ESD（HBM）	V_{ESD}	3000	V

8. Electrical Characteristics:（Ta=25℃， VDD=5V)

Data	Symbol	Min	Typical value	Max	Unit	Testing condition
Chip input voltage	V_{DD}	-	5	-	V	-
R/G/B Port output current	I_{OUT}	-	17	-	mA	-
High-level input voltage	V_{IH}	3.4	-	5.3	V	-
Low-level input voltage	V_{IL}	-0.3	-	1.6	V	-
PWM Scan frequency	F_{pwm}	-	27	-	KHz	-
Static current	I_{DD}	-	1	-	UA	-

9. Typical Application Circuits:



If necessary, a protection resistor R should be connected in series with the input terminals CKI and SDI, and the output terminals CKO and SDO. The value of R depends on the number of cascaded LEDs; the more LEDs cascaded, the smaller R becomes. A value between 27 and 51 ohms is generally recommended, with 33 ohms being a preferred value.

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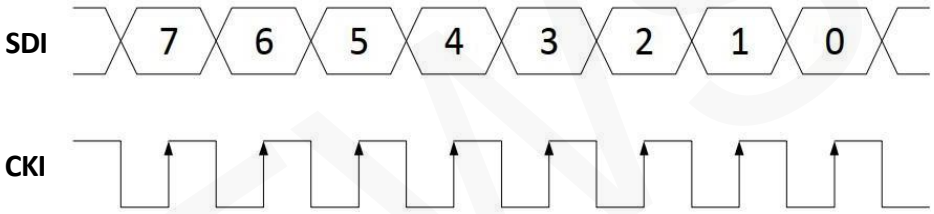
10. Data Communication Protocol:

Dual-line protocol, N LEDs in cascade.

SDI	32pcs0	LED1 Data	LED2 Data	LED3 Data	.....	LED N Data	32pcs1
	start byte	Data bytes 1	Data bytes 2	Data bytes 3	.....	Data bytes N	End data byte

Display data bytes	111	Brightness (5 bits)	8-bit Blue	8-bit Green	8-bit Red
		MSB first	MSB first	MSB first	MSB first

start byte	0000 0000	0000 0000	0000 0000	0000 0000
end byte	1111 1111	1111 1111	1111 1111	1111 1111



256 -level grayscale：

Data（MSB...LSB）	Duty cycle
0000 0000	0/256
0000 0001	1/256
0000 0010	2/256
.....	.....
1111 1101	253/256
1111 1110	254/256
1111 1111	255/256

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Overall brightness：

Data（MSB...LSB）	Current adjustment
0 0000	0/31
0 0001	1/31
0 0010	2/31
.....	.....
1 1101	29/31
1 1110	30/31
1 1111	31/31

Refresh rate：

Frame rate = 1 / ((64 + 32×LED_count) × CKI period

Example： 1024 pixels， CKI=1 MHz → 30 FPS

11. **Data Structure:**

注：高位先发，按照 BGR 的顺序发送数据(B7 → B6 →……R0)

Note: High starting, send data based on BGR sequence.

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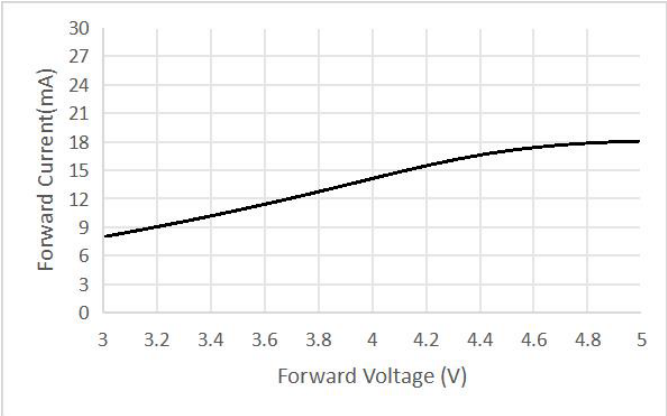
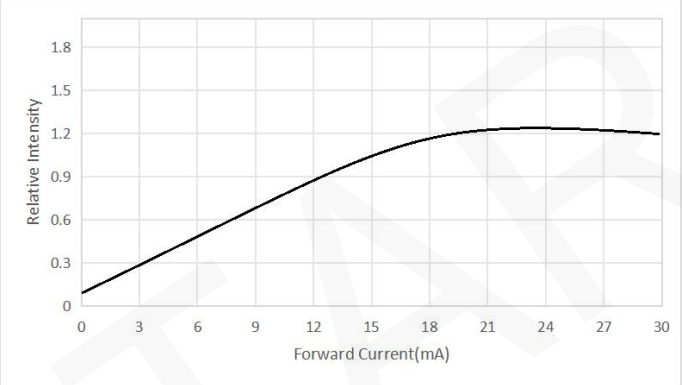
12. Optoelectronic Curves:

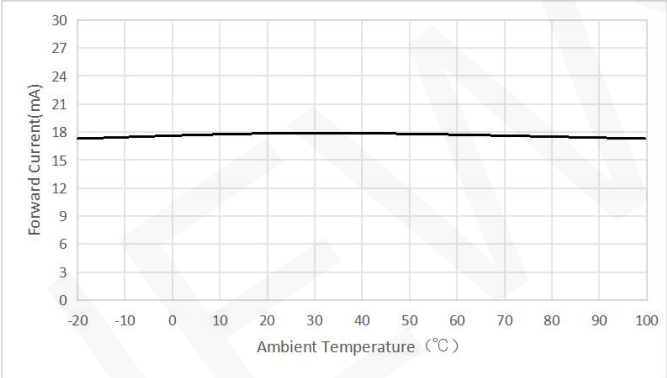
1.Forward voltage current characteristic curves



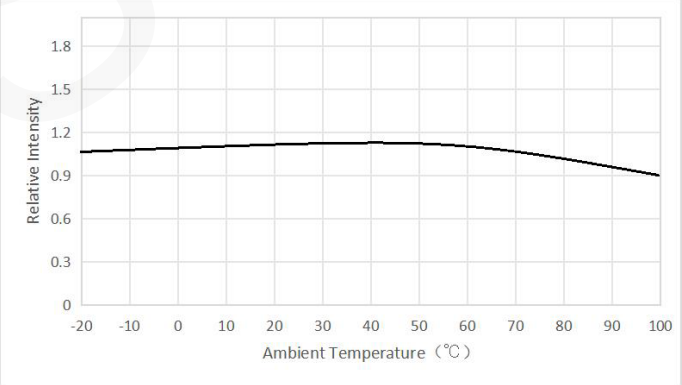
2.Forward current versus relative light intensity characteristic curve



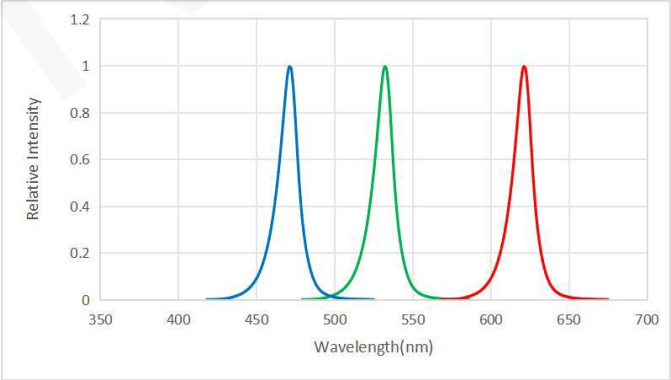
3.Ambient temperature versus forward current characteristic curves



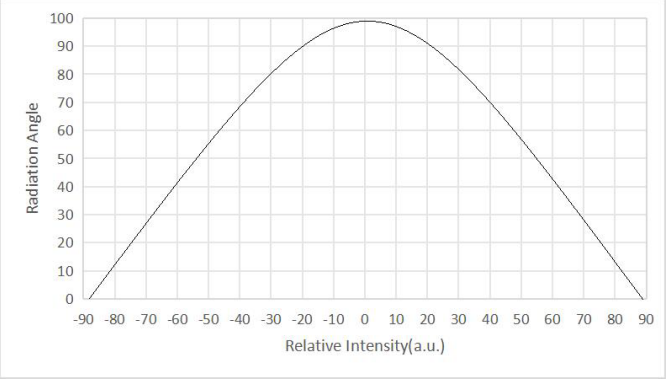
4.Ambient temperature and relative light intensity characteristic curves



5.Spectral distribution diagram



6.Radiation curve



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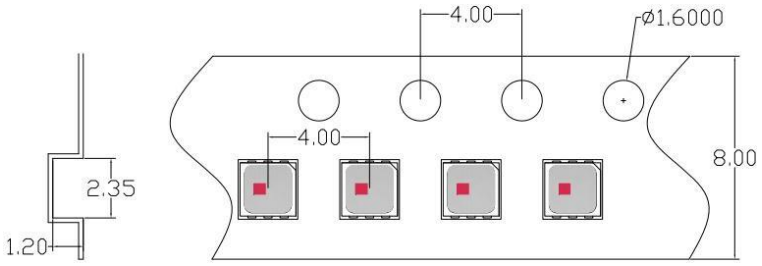
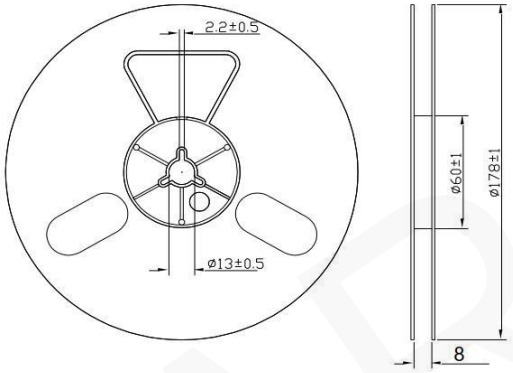
13. Packaging:

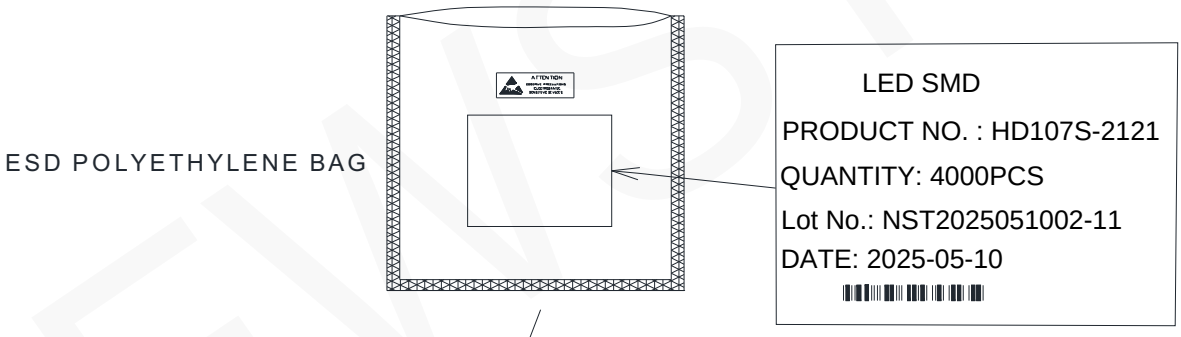


Carrier tape specifications

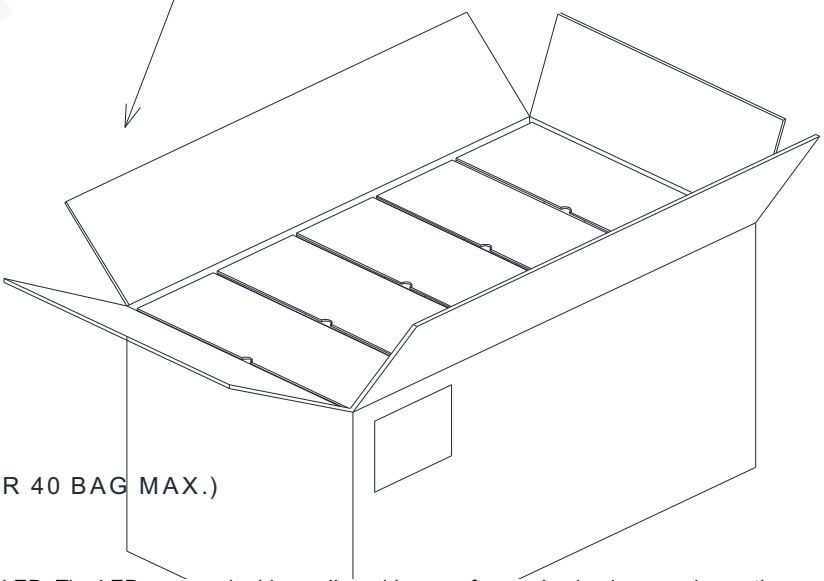


Reel specifications

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



LABEL SKETCHING



CARDBOARD (INNER 40 BAG MAX.)

The reel pack is applied in SMD LED. The LEDs are packed in cardboard boxes after packaging in normal or anti-electrostatic bags. cardboard boxes will be used to protect the LEDs from mechanical shocks during transportation. The boxes are not water resistant and therefore must be kept away from water and moisture.

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14. **Reliability Tests:**

Item	Test conditions	Verification time/Cycle	QTY	Refered standard	Ac/ Re
Reflow soldering resistance verification	260℃/10sec	2Cycle	25PCS	JEITA ED-4701 300 301	0/1
Thermal shock	-40℃ 30min ↑↓ 10sec 100℃ 30min	200 cycles	100PCS	MIL-STD-202G	0/1
High temperature and high humidity storage	Ta=85℃ RH=85 %	500 hours	25PCS	JEITA ED-4701 100 103	0/1
High temperature storage	Ta=85℃	500 hours	25PCS	JEITA ED-4701 200 201	0/1
Low temperature storage	Ta=-40℃	500 hours	25PCS	JEITA ED-4701 200 202	0/1
Aging at room temperature	Ta=25℃ IF= Typical value	1000 hours	25PCS	JESD22-A 108D	0/1

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15. **Operating Instructions:**

Operating Instructions

1. **Package storage:**

SMD LEDs are moisture-sensitive components. Aluminum foil packaging is used to prevent the LEDs from absorbing moisture during transportation and storage. A desiccant is also placed inside the packaging to absorb moisture. If the LED absorbs moisture, it will expand during reflow soldering, causing the colloid to detach from the lead frame or damaging the bond wires, leading to product failure. For this reason, vacuum moisture-proof packaging is used to prevent moisture from entering the packaging bag. **This product has a moisture resistance rating of LEVEL4**。

Sheet 1：IPC/JEDEC J-STD-020 Specified material moisture resistance rating（MSL) definition

Moisture resistance rating	Workshop lifespan after packaging is opened	
	Time	Condition
LEVEL1	Unrestricted	≦30℃/85 % RH
LEVEL2	1 year	≦30℃/60 % RH
LEVEL2a	4 weeks	≦30℃/60 % RH
LEVEL3	168 hours	≦30℃/60 % RH
LEVEL4	72 hours	≦30℃/60 % RH
LEVEL5	48 hours	≦30℃/60 % RH
LEVEL5a	24 hours	≦30℃/60 % RH
LEVEL6	Ready to use	≦30℃/60 % RH

Vacuum Packaging Storage: We recommended that SMD series LEDs be stored in a desiccant cabinet with a built-in desiccant at a temperature of 20℃-30℃ and a humidity below 60%, for a period not exceeding 3 months.

1.1 Storage and use after unpacking：

a. Before unpacking, check the expiration date and ensure there are no leaks.

b. Environmental lifespan of vacuum aluminum bags after unpacking: Under conditions of ≤30℃/60%RH, online usage time is not recommended to exceed 24 hours. If the above environmental requirements are not met, We newstar recommended that the unpacking operation time not exceed 2 hours.

c. After opening, any remaining material should be sealed within 12 hours in a workshop environment of ≤30℃/60%RH and stored according to the conditions in 1.1.

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1.2 LED devices inside vacuum-sealed packaging that are intact (without secondary sealing) can be used directly if they are less than 90 days old. However, LED devices stored for 90-180 days require low-temperature dehumidification before use.

1.3 The LED devices inside the vacuum packaging are intact (not resealed), but have been stored for more than 180 days. They require high-temperature dehumidification before use.

2. Product dehumidification:

2.1 Low-temperature dehumidification method：

2.1.1 Open the vacuum packaging and remove the entire tray of LED devices from it.

2.1.2 Bake on the original reel, laying it flat to prevent deformation.

2.1.3 Place the entire reel of LEDs in a 70℃ oven and bake for 24 hours. (Note: Do not bake the entire reel of LEDs at a temperature higher than 70℃, as LED reel carriers are prone to deformation at temperatures above 70℃.)

2.1.4 Only after baking is complete can the LED devices be used for normal operation.

2.1.5 We recommended that all color light products be dehumidified at low temperatures for better results.

2.2 High-temperature dehumidification method：

2.2.1 After separating the LED chips according to their BIN grade, unwrap the tape and lay them flat on a stainless steel tray. The thickness of the flat layer should not exceed 2 cm

2.2.2 Standard SMD LEDs: High-temperature baking temperature 80℃/2H-135℃/4～8H

2.2.3 Chip LEDs: High-temperature baking temperature 80℃/2H-135℃/2～4H. After naturally cooling in the oven for half an hour, begin tape weaving. Tape weaving must be completed within 4 hours (during this time, the LEDs should be placed in a drying cabinet; We recommended to control the humidity in the drying cabinet below 30% RH)

2.2.4 After tape weaving, dehumidify at 70℃/12～24H and then vacuum pack. Prolonged baking is not recommended to avoid oxidation.

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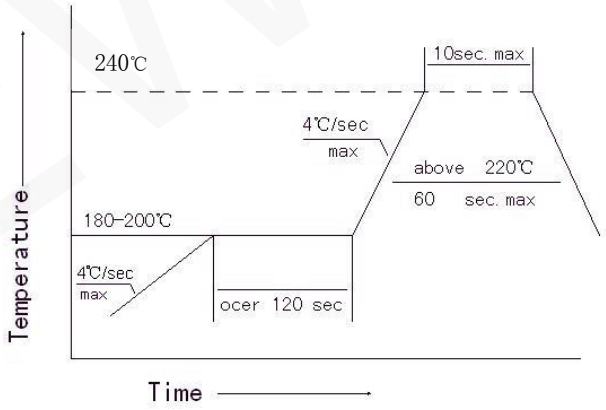
2.3 Moisture Control for Assembled LED Components

2.3.1 For products requiring secondary SMT processes or high temperatures, necessary moisture control measures should be taken before secondary soldering after the first soldering. Exposure to (≤30℃ /60%RH) conditions should not exceed 2 hours. If the interval between the second high-temperature production is long, the material after the first soldering must undergo necessary dehumidification (baking in an oven at 70℃±5℃ for at least 12 hours), followed by vacuum sealing and storage. Alternatively, the product can be stored in a constant temperature and humidity chamber, and then dehumidified again before the second high-temperature production (baking in an oven at 70℃±5℃ for at least 12 hours) to ensure the product is not damp before the high-temperature process. Low-humidity baking conditions: 70℃±5℃ for at least 12 hours. High-temperature baking conditions: 130℃±5℃ for 4-6 hours.

2.3.2 Reflow soldering is not recommended for more than 2 hours. For subsequent tests and above, reliability risks and first-article acceptance must be assessed beforehand, and the effects of high-temperature baking on other components must be considered.

3. Soldering:

3.1 Reflow Soldering: Surface mount LEDs must conform to JEDEC J-STD-020C standards. The following principles are recommended:



Temperature profile characteristics	Lead-containing solder	Lead-free solder
Average heating rate (Ts max toTp)	Maximum 3℃/second	Maximum 3℃/second
Preheating： Min temperature (Ts min)	100℃	150℃
Preheating： Max temperature (Ts max)	150℃	200℃
Preheating： Time(ts min tots max)	60-120 second	60-180 second
Duration of maintaining high temperature: Temperature (TL)	183 ℃	217 ℃

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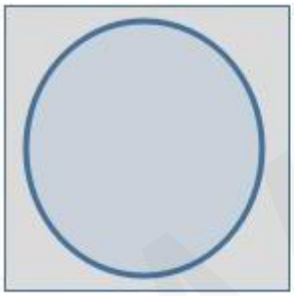
Duration of maintaining high temperature: Time (t L)	60-150 second	60-150 second
Peak/Classification Temperature (T P)	215 ℃	240 ℃
Time within 5°C of the actual peak temperature (tp)	<10 second	<10 second
Cooling rate	Maximum 6℃/second	Maximum 6℃/second
Time required to reach peak temperature from 25°C	Maximum 6 minutes	Maximum 6 minutes

3.2 Manual soldering: We not recommended to use a manual soldering iron and heated platform.

4. SMT nozzle requirements: (Blue circles indicate the inner diameter of the nozzle, as shown in Figure 1 and Figure 2)

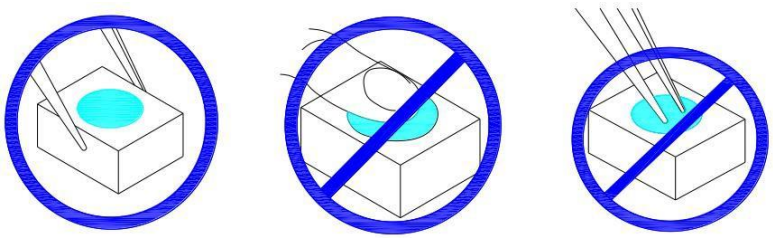


OK(吸咀外径小于灯珠面）

NG(吸咀外径大于灯珠面）

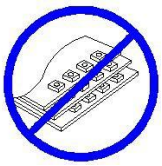
To prevent air pressure leakage, the outer diameter of the SMD nozzle must not exceed the LED size, while the inner diameter of the nozzle should be as large as possible. We newstar recommended that the nozzle tip be made of a soft material to prevent scratching or damaging the LED's encapsulated surface during pickup. The component dimensions must be accurately determined within the pickup/placement mechanism.

5. Material handling method: Use tweezers to pick up the material. Do not press the colloid or puncture it with sharp objects. Do not stack the material.



Do not stack the products together, as this may damage the internal circuitry.

Do not use in acidic environments with a pH < 7.



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6. Hazardous substance control:

When we need to apply any materials to LED products, please pay attention to the control of hazardous substances. The content of bromine alone must be less than 900 PPM, the content of chlorine alone must be less than 900 PPM, and the total content of bromine and chlorine in the outer sealant must be less than 1500 PPM when applying to LED products.

7. Thermal design requirements:

For LED products, heat dissipation design is crucial. When designing the product, consider the heat generated by the LEDs, the thermal resistance of the PCB board, the density of the LED array, and the input power, all of which contribute to temperature increases. To avoid excessive heat generation, ensure the LEDs operate within the maximum specifications required in the product datasheet. When setting the LED drive power, We recommend that the maximum ambient temperature should be taken into account. The maximum operating temperature of the product should not exceed 50℃ (i.e., ≤50℃, referring to the operating temperature at the GND pin of the LED).

8. Antistatic and surge protection:

Static electricity and power surges can damage LED products. Therefore, appropriate protective measures must be taken. To protect LED products, anti-static wrist straps and gloves must be worn whenever and wherever LEDs are handled. All equipment and instruments must be grounded. We recommended that each product undergo relevant electrical testing before shipment to identify defective products caused by static electricity. The potential for power surges to damage LEDs should be considered during circuit design.

9. Special statement:

9.1 If the product is used outside the specifications, We will not be liable for any problems that arise.

9.2 LEDs can emit very strong light that can damage the eyes. Precautions should be taken, and prolonged direct eye contact with LED lights should be avoided.

9.3 Before using it on a large scale, you should communicate with our's sales to understand more detailed specifications.

9.4 We apologize that we may not be able to notify you of any changes to the shape and specifications of our LED products in a timely manner.。

This instruction manual cannot cover all the problems that customers may encounter during use. We apologize for any inconvenience this may cause!