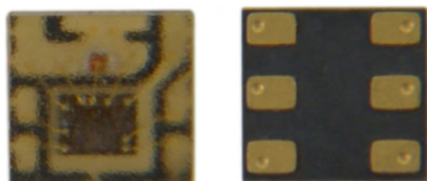


Product Specification

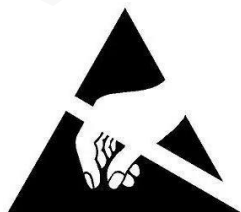


Product Model: HD108-2020

Description: 2020 SMD Smart LED

Document No.: HD108-2020RGB-RD001

Version No.: A001



ELECTROSTAIC
SENSITIVE DEVICES



1.Product description:

HD108-2020 is an intelligent externally controlled LED that integrates a control circuit and a light-emitting circuit. Its appearance is the same as a 2020 LED . Each LED is a pixel. The LED contains an intelligent digital interface data latch signal circuit. , Power supply voltage regulator circuit, built-in constant current circuit, data regeneration circuit, high precision RC oscillator, output drive adopts patented PWM technology, which effectively guarantees the color consistency of the each pixel.

The data transmission adopts clock and data signal protocol, which has long transmission distance and strong anti-interference ability.

HD108-2020 has the advantages of low voltage drive, environmental protection and energy saving, high brightness, large scattering angle, good consistency, long life 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.

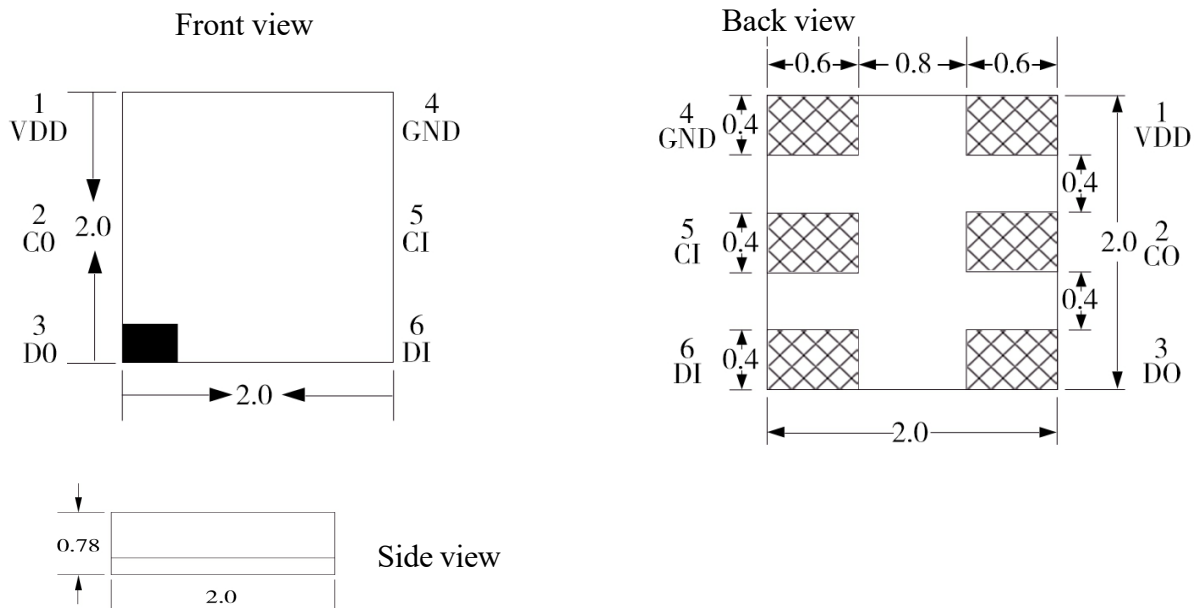
2.Main application areas:

LED full-color luminous character string light, LED full-color soft and hard light bar, 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:

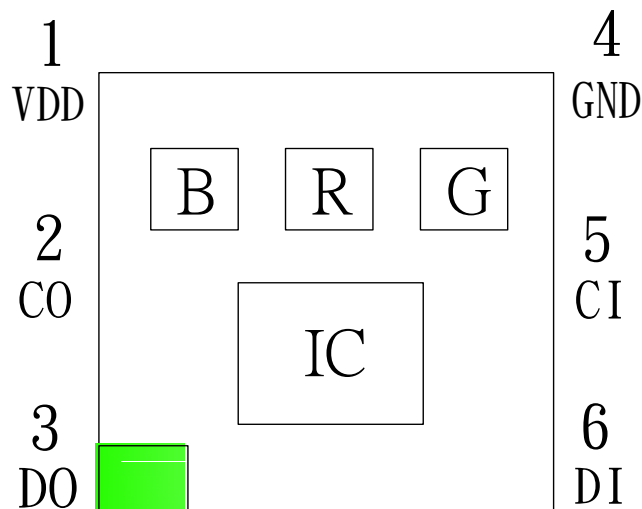
- Smart SMD integrates high-quality external control double-wire serial cascaded constant current IC.
- The control circuit and chip are integrated in SMD components to form a complete externally controlled pixel point, color,color temperature, uniform effect and high consistency,and the default output constant current value OUTR/OUTG/OUTB is 17MA
- Built-in power-on reset and power-down reset circuits, the light does not light up after power-on.
- The PWM refresh frequency is 28KHz.
- Two-wire data transmission, unlimited cascading, the maximum serial input data frequency is 32MHz
- Grayscale adjustment circuit (65536-level grayscale is adjustable).
- No data input, zero power consumption when the light is off.
- Vertical SMD surface mount package, suitable for all SMT assembly and soldering processes.
- Moisture-proof grade: LEVEL5a.
- CE, RoHS certification

4.Package size drawing:



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

5.Pin diagram and function description:



Item	Symbol	Pin Name	Function description
1	VDD	Power	power supply pin
2	DOUT	Data Output	Series data output and internal strong drive output
3	DCKO	CLK Output	Clock signal output terminal connected in series, via the internal lock regeneration and strong drive output
4	GND	Ground	The signal and power supply and grounding
5	DCKI	CLK Input	control signal Input Clock data
6	DIN	Data Input	control signal Input data

6.RGB chip characteristic parameter Ta=25°C:

Color	Wavelength(nm)	Light Intensity (mcd)	Lumen (LM)
Red	620-630	480-800	1.5-2.5
Green	520-535	1400-1800	4.5-5.5
Blue	460-475	300-600	1.0-2.0

7. Electrical parameters (limit parameters, unless otherwise specified, Ta=25°C):

Parameter	Symbol	Range	Unit
Voltage	VDD	-0.5 ~ +5.5	V
Logic input voltage	VI	GND-0.3 ~ VDD+0.3	V
Working temperature	Topt	-40 ~ +85	°C
Storage temperature	Tstg	-50 ~ +85	°C
ESD pressure (Device mode)	VESD	200	V
ESD pressure (body mode)	VESD	4000	V

8.Electrical characteristics (if no special instructions, VDD=5V, Ta=25°C):

Parameter	Symbol	Min	Typical	Max	Unit	Test Conditions
The chip supply Voltage	VDD	-	5	-	V	-
R/G/B port output current	IOUT_R	-	17	20	mA	-
Clock high level width	TCLKH	-	-	> 30	ns	-
Clock low level width	TCLKL	-	-	> 30	ns	-
Data creation time	TSETUP	-	-	> 10	ns	-
PWM output frequency	Fpwm	-	28	-	KHz	-
Static current	IDD	-	1	-	uA	-

9.Data communication protocol description (the protocol uses a two-wire protocol):

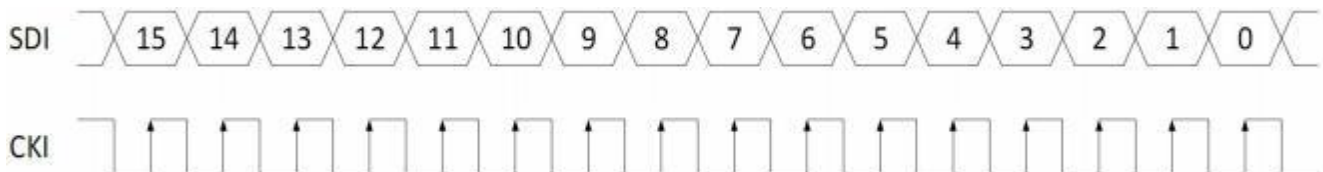
(1) Encoding protocol description

SDI	128pcs 0	LED 1	LED 2	LED 3	-----	LED N
	Start Frame	Data Frame	Data Frame	Data Frame		Data Frame

Start Frame128Bits	0000 0000 0000 0000	0000 0000 0000 0000	0000 0000 0000 0000	0000 0000 0000 0000
	16Bits	16Bits	16Bits	16Bits

Data Frame	1	Brightness adjustment	BLUE	GREEN	RED
	1Bits	15Bits	16Bits	16Bits	16Bits
		High priority	High priority	High priority	High priority

End Frame	1111 1111 1111 1111	1111 1111 1111 1111	1111 1111 1111 1111	1111 1111 1111 1111
	16Bits	16Bits	16Bits	16Bits



(2) 65536 gray level

data (MSB...LSB)	Duty cycle
0000 0000 0000 0000	0/65536
0000 0000 0000 0001	1/65536
0000 0000 0000 0010	2/65536
.....	
1111 1111 1111 1101	65533/65536
1111 1111 1111 1110	65534/65536
1111 1111 1111 1111	65535/65536

(3) Brightness adjustment (control the current of the three ports OUTR\OUTG\OUTB at the same time)

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

(4) Refresh rate

Frame rate= $1/((128+(64*\text{points}))*\text{CKI period})$ (unit frame/second)

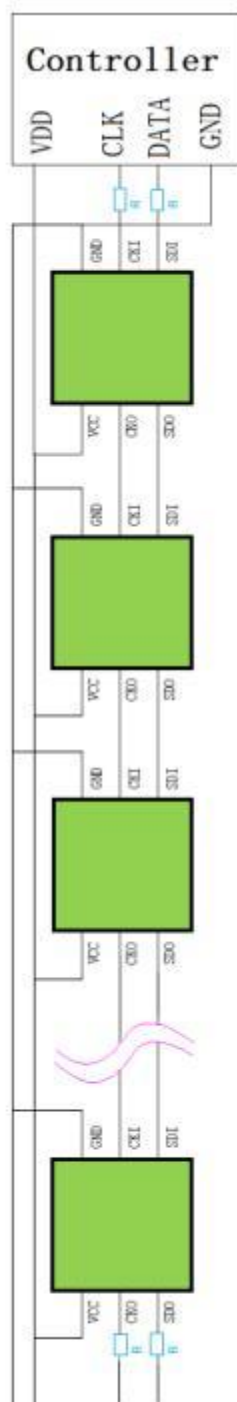
For example: 1024 points, CKI frequency is 1MZH, then frame rate = 15 frames/second.

(5) Data structure (Ta=25°C):

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
G15	G14	G13	G12	G11	G10	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0
R15	R14	R13	R12	R11	R10	R9	R8	R7	R6	R5	R4	R3	R2	R1	R0

Note: The high bit is sent first, and the data is sent in the order of (B15 → B14 → R0)

10. Typical application circuit:

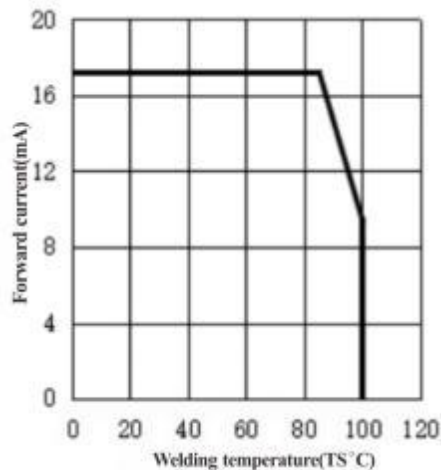


The DIN and BIN input and output terminals of the product need to be connected in series when necessary. The size of the protective resistor R depends on the number of cascaded LEDs. The more the number of cascades, the smaller R.

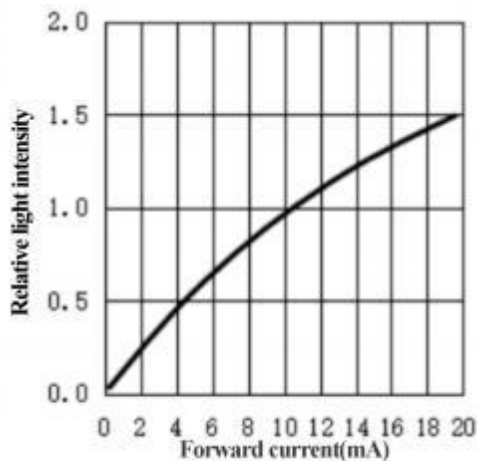
Generally, a value between 27-51 ohms is recommended. The recommended value is 100 ohms, the VDD series resistance is 27-100 ohms and the recommended value is 33 ohms.

11. Typical optical characteristic curve:

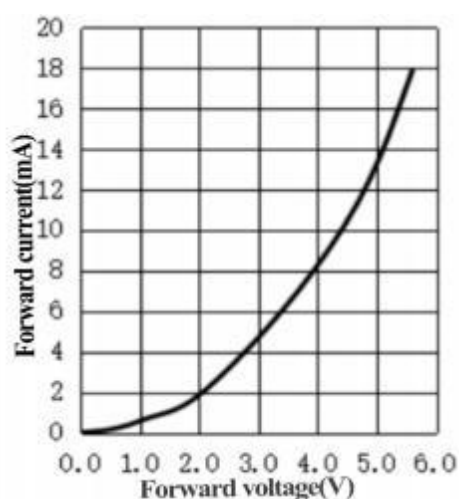
Welding temperature VS Forward current



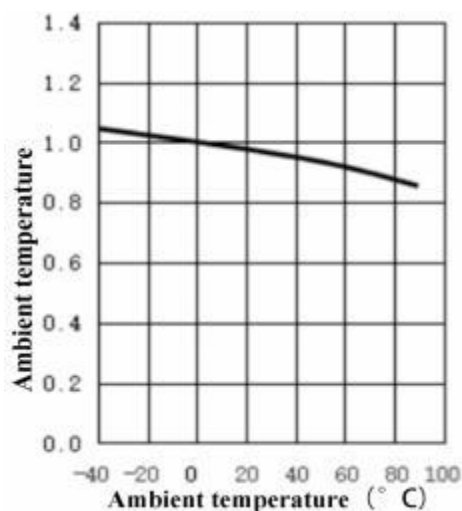
Forward current VS Relative light intensity



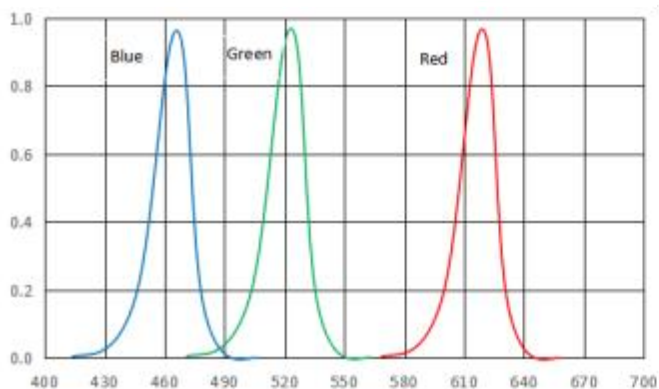
Forward voltage VS Forward current



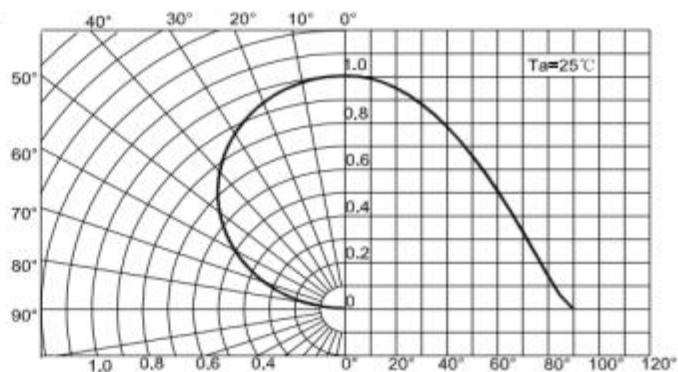
Ambient temperature VS Relative light intensity



Relative spectral distribution chart



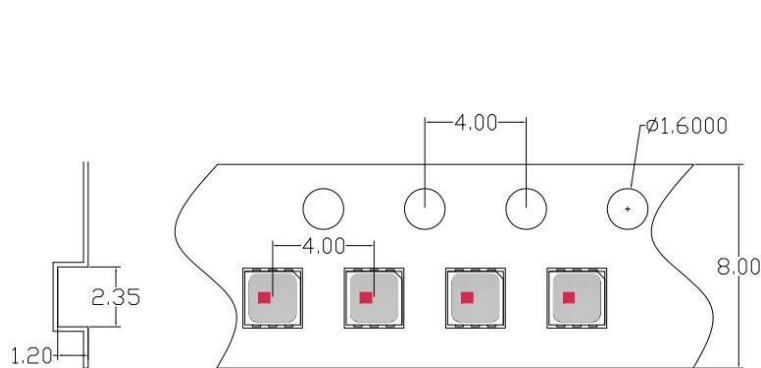
Relative spectral distribution chart



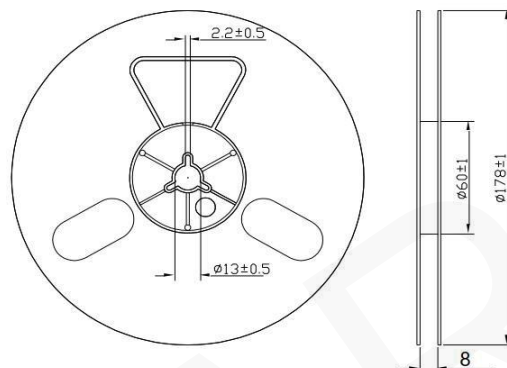
12. Reliability Test :

Test Item	Test Conditions	Duration/Cycle	Quantity	Ac/Re
Resistance to Soldering Heat	260°C/10sec	3 Min.	22PCS	0/1
Temperature cycle	-40°C 30min ↑↓25°C(5min) 100°C 30min	200 cycles	22PCS	0/1
Thermal Shock	-40°C 20min ↑↓ 10sec 100°C 20min	300 cycles	100PCS	0/1
High temperature and humidity storage	Ta=85°C RH=85%	1000 hours	22PCS	0/1
High Temperature Storage	Ta=100°C	1000 hours	22PCS	0/1
Low Temperature Storage	Ta=-40°C	1000 hours	22PCS	0/1
Room Temperature Operation life	Ta=25°C IF=Typical value	1000 hours	22PCS	0/1

13. Packaging:



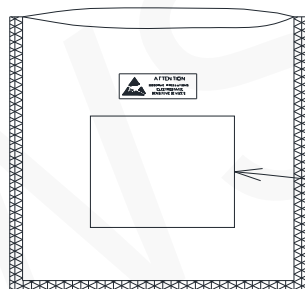
Carrier tape specifications



Reel specifications

Note: The tolerance is $\pm 0.1\text{mm}$, unit: mm.

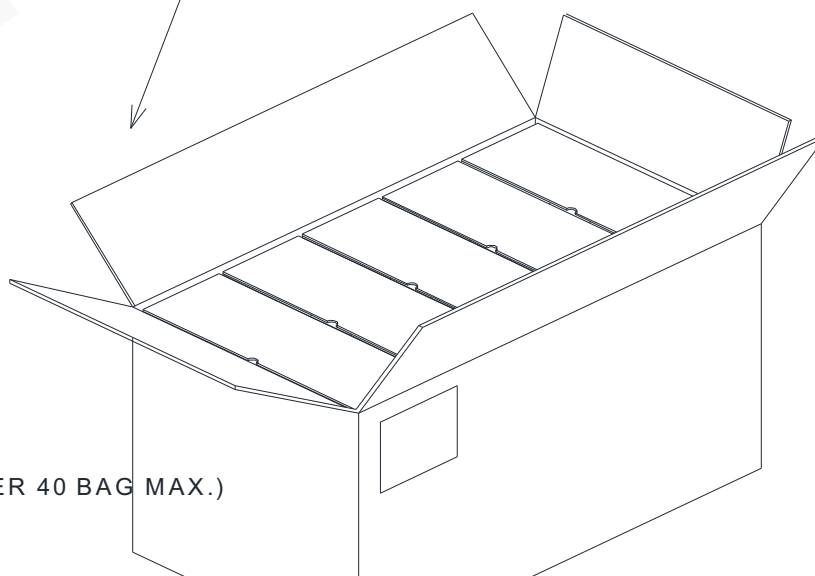
ESD POLYETHYLENE BAG



LED SMD
PRODUCT NO. : HD108-2020
QUANTITY: 4000PCS
Lot No.: NST2025051002-11
DATE: 2025-05-10
[Barcode]

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.

15. Storage and Operation Instructions:

Operation Instructions

1. Packaging 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 LEDs absorb moisture, the moisture will expand during reflow soldering, causing the colloid to detach from the bracket 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.

Table 1: Definition of Material Moisture Resistance Level (MSL) as Specified by IPC/JEDEC J-STD-020

Moisture resistance rating	Workshop lifespan after packaging is opened	
	Time	Condition
LEVEL1	No limited	$\cong 30^{\circ}\text{C}/85\% \text{ RH}$
LEVEL2	1 year	$\cong 30^{\circ}\text{C}/60\% \text{ RH}$
LEVEL2a	4 weeks	$\cong 30^{\circ}\text{C}/60\% \text{ RH}$
LEVEL3	168 hours	$\cong 30^{\circ}\text{C}/60\% \text{ RH}$
LEVEL4	72 hours	$\cong 30^{\circ}\text{C}/60\% \text{ RH}$
LEVEL5	48 hours	$\cong 30^{\circ}\text{C}/60\% \text{ RH}$
LEVEL5a	24 hours	$\cong 30^{\circ}\text{C}/60\% \text{ RH}$
LEVEL6	Ready to use	$\cong 30^{\circ}\text{C}/60\% \text{ RH}$

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

1.2 Storage and Use After Unpacking:

- Before unpacking, check the expiration date and ensure there are no leaks.
- Environmental lifespan of vacuum aluminum bags after unpacking: In environments $\leq 30^{\circ}\text{C}/60\% \text{ RH}$, online use is not recommended to exceed 24 hours. If the above environmental requirements are not met, newstar recommended that the unpacking operation time not exceed 2 hours.
- Residual material after opening should be sealed within 12 hours in a workshop environment $\leq 30^{\circ}\text{C}/60\% \text{ RH}$ and stored according to conditions 1.1.

1.3 LED devices in vacuum packaging that are not opened and are in good condition (without being resealed) can be used directly within 90 days. However, LED devices within 90-180 days need to be dehumidified at low temperature before use.

1.4 LED devices in vacuum-sealed packaging that are intact (not resealed) but have been stored for more than 180 days must undergo high-temperature dehumidification before use.

2. Product Dehumidification:

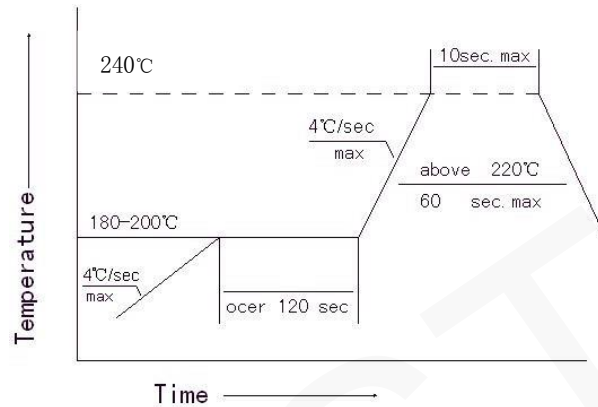
2.1 Low-Temperature Dehumidification:

- Unpack the vacuum packaging and remove the entire reel of LED devices.

- 1.2 Bake the LEDs on the original reel, laying them flat to prevent deformation.
- 1.3 Place the entire reel of LEDs in a 70°C oven and bake for 24 hours. (Note: Do not bake the entire reel of LED devices at temperatures above 70°C, as the LED reel carrier is prone to deformation at temperatures above 70°C.).
- 1.4 LED devices can only be used for normal operation after baking is complete.
- 1.5 It is recommended that all color light products be dehumidified at low temperatures for better performance.。
 - 1.5.1.1 1.5.1 High-Temperature Dehumidification Method: 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.
 - 1.5.1.2
 - 1.5.1.3 1.5.1.1 Standard SMD LED chips: 80°C/2H - 135°C/4~8H
 - 1.5.1.4
 - 1.5.1.5 1.5.1.2 Chip LED chips: 80°C/2H - 135°C/2~4H. After naturally cooling in the oven for half an hour, begin tape winding. Tape winding must be completed within 4 hours (during this time, the LED chips should be placed in a drying cabinet; newstar recommended to control the humidity in the drying cabinet below 30% RH).
 - 1.5.1.6
 - 1.5.1.7 1.5.1.3 After tape winding, dehumidify at 70°C/12~24H and then vacuum pack. Prolonged baking is not recommended to avoid oxidation.
 - 1.5.1.8
 - 1.5.1.9 1.5.2 Moisture Control for Assembled LED Components
 - 1.5.1.10
 - 1.5.1.11 1.5.2.1 For products requiring secondary SMT processes or high temperatures, necessary moisture control should be implemented before secondary soldering after the initial soldering. Exposure to ($\leq 30^{\circ}\text{C}/60\%\text{RH}$) conditions should not exceed 2 hours. If the interval between secondary high-temperature production is long, the material after the initial soldering must undergo necessary dehumidification (baking in an oven at $70^{\circ}\text{C}\pm 5^{\circ}\text{C}$ 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 dehumidified again before the secondary high-temperature production (baking in an oven at $70^{\circ}\text{C}\pm 5^{\circ}\text{C}$ for at least 12 hours) to ensure the product remains dry before the high-temperature process. Low-humidity baking conditions: $70^{\circ}\text{C}\pm 5^{\circ}\text{C}$ for at least 12 hours. High-temperature baking conditions: $130^{\circ}\text{C}\pm 5^{\circ}\text{C}$ for 4~6 hours.
 - 1.5.1.12
 - 1.5.1.13 1.5.2.2 Reflow soldering is not recommended for more than 2 hours. For subsequent tests and above, reliability risks and first article acceptance must be assessed in advance if necessary, and the effects of high-temperature baking must be considered for other components.。

1.6 Welding:

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



Temperature Curve Characteristics	Lead Solder	Lead-Free
Average ramp rate (Ts max to Tp)	Max 3°C/second	Max 3°C/second
Preheat: Minimum temperature (Ts min)	100°C	150°C
Preheat: Maximum temperature (Ts max)	150°C	200°C
Preheat: Time (ts min to ts max)	60-120 seconds	60-180 seconds
Time maintained above temperature: Temperature (TL)	183 °C	217 °C
Time maintained above temperature: Time (tL)	60-150 seconds	60-150 seconds
Peak / classification temperature (TP)	215 °C	240 °C
Time within 5°C of actual peak temperature (tp)	<10 seconds	<10 seconds
Cooling rate	Max 6°C/second	Max 6°C/second
Time required to ramp from 25 °C to peak temperature	Max 6 minutes	Max 6 minutes

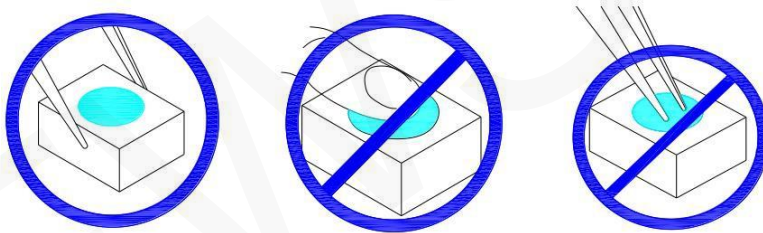
1.6.2 Manual soldering: Manual soldering with a soldering iron and a heated platform is not recommended.

1.7 SMT nozzle requirements: (Blue circles indicate the nozzle inner diameter as shown in Figure 1 and Figure 2)



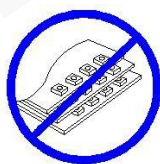
To prevent air pressure leakage, the outer diameter of the SMD nozzle must not exceed the size of the LED, the inner diameter of the nozzle should be as large as possible, and the tip of the nozzle should be made of a soft material to prevent scratching or damaging the surface of the LED colloid during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

1.8 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.



1.9 Control of Hazardous Substances:

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

1.10 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, the maximum ambient temperature should be taken into account. The maximum operating temperature of the product should not exceed 50°C (i.e., $\leq 50^{\circ}\text{C}$, 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. It is 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 Our company will not be liable for any problems arising from use outside the specifications.
9. 2 LEDs can emit very strong light that can damage the eyes. Precautions should be taken, and prolonged direct viewing of LED lights with the naked eye should be avoided.
9. 3 Before large-scale use, you should communicate with relevant personnel in our company to understand more detailed specifications.
9. 4 We regret that we may not be able to notify you in a timely manner of any changes to the shape and specifications of LED products.

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