Features

- RoHS2.0 Compliant.
- Top SMD internal integrated high-quality external control line serial cascade constant current IC; 5V application.
- Control circuit and the RGB chip in SMD 2020 components, to form complete control of pixel, color mixing uniformity and consistency.
- Grayscale adjustment：65536 levels.
- Single-line return-to-zero code transmission protocol, unlimited cascading.
- **Heat dissipation**-flip-chip LED shortens the heat dissipation path directly to substrate
- **Better Light pattern**-the face-up light emitting surface eliminates shadowing from bonding wires.
- **Enhanced reliability**-wireless bonding prevents failure from vibration or thermal cycling.

Description

The IN-PI20FTBT5R5G5B is 2.0*2.0*0.65mm Flip-chip RGB LED with integrated IC. It is a single-wire transmission LED with three channel (RGB) intelligent driving control circuit and light emitting circuit. The LED contains a signal decoding module, data buffer, and a built-in reset circuit. It has 65536 level grayscale PWM adjustment and 32 brightness adjustment.

Applications

- Full color LED string light
- LED full color module
- LED scene lighting
- Consumer electronics

Package Outline Dimensions & Pin Configuration

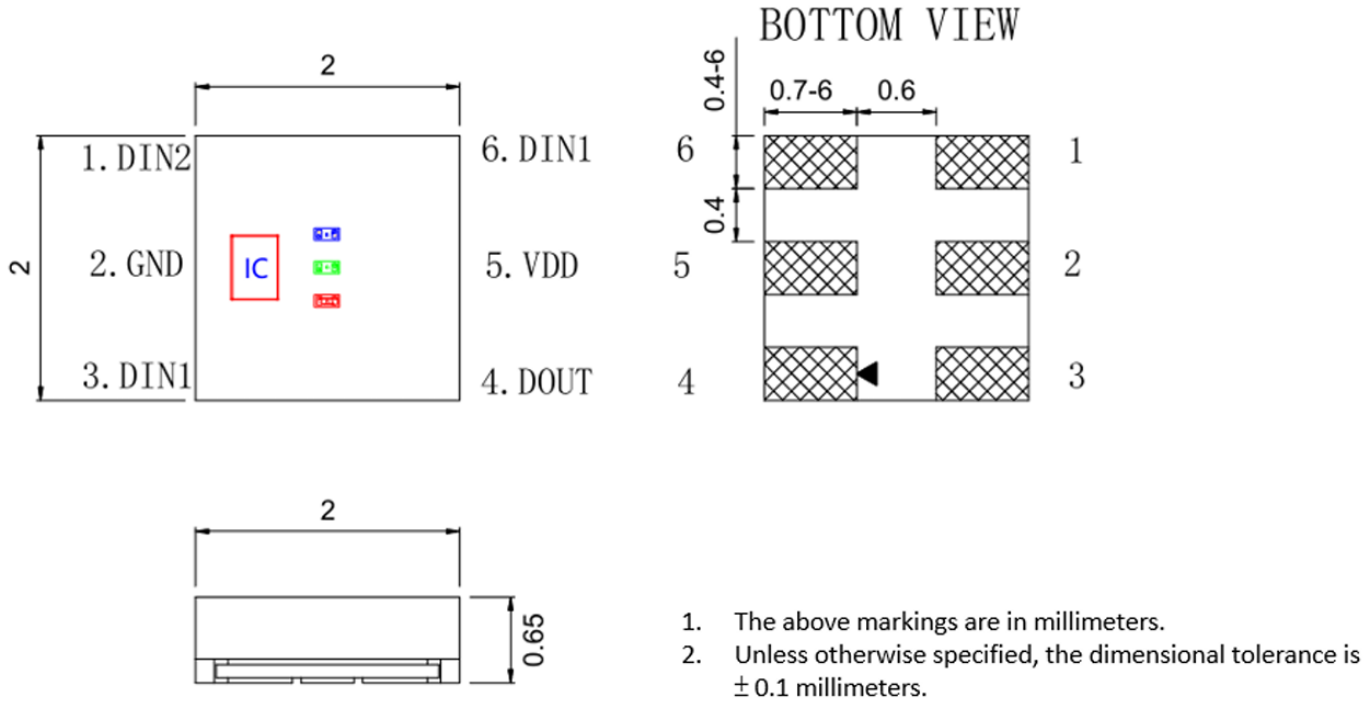
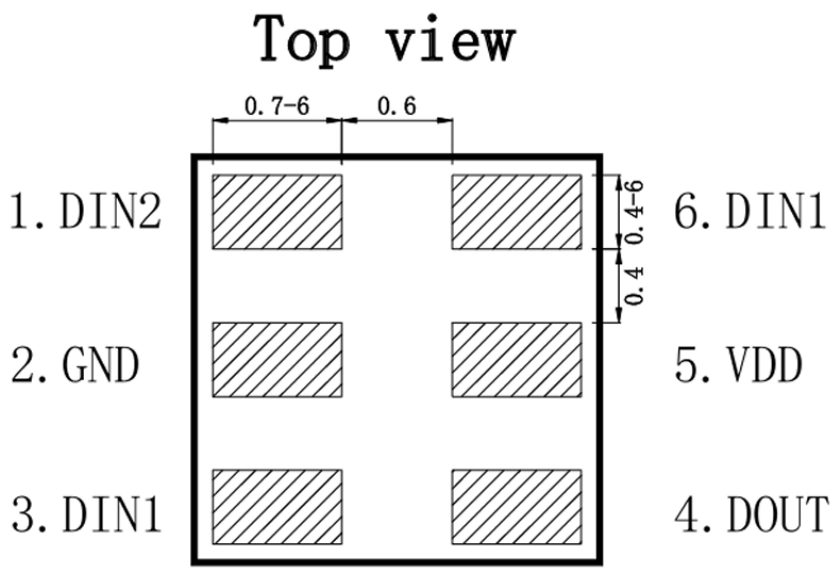


Figure 1. IN-PI20FTBT5R5G5B Package Outline Dimensions

Pin Configuration

Number	Symbol	Pin Name	Function Description
1	DIN2	Thermal data processing	Thermal data signal processing
2	GND	Ground	Power grounding
3	DIN1	Data input	Control data signal input
4	DOUT	Data output	Control data signal output
5	VDD	Power supply	Power supply pins
6	DIN1	Data input	Control data signal input

PCB recommended pad size：



Notes:
1. Dimension in millimeter, tolerance is ±0.1mm unless otherwise noted.

Absolute Maximum Rating *(Ta = 25 ℃)*

Parameter	Symbol	Range	Unit
Power supply voltage	V_{DD}	+3.7～+5.5	V
Operating temperature	T_{OPT}	−40 ~ +85	℃
Storage temperature	T_{STG}	−40 ~ +85	℃
ESD pressure (HBM)	V_{ESD}	2K	V

LED Characteristics *(T_a = 25℃)*

Color	**IN-PI20FTBT5R5G5B** (4.9mA)	
	Wavelength(nm)	Light Intensity(mcd)
Red	620-625	50-100
Green	525-535	140-280
Blue	465-475	40-80

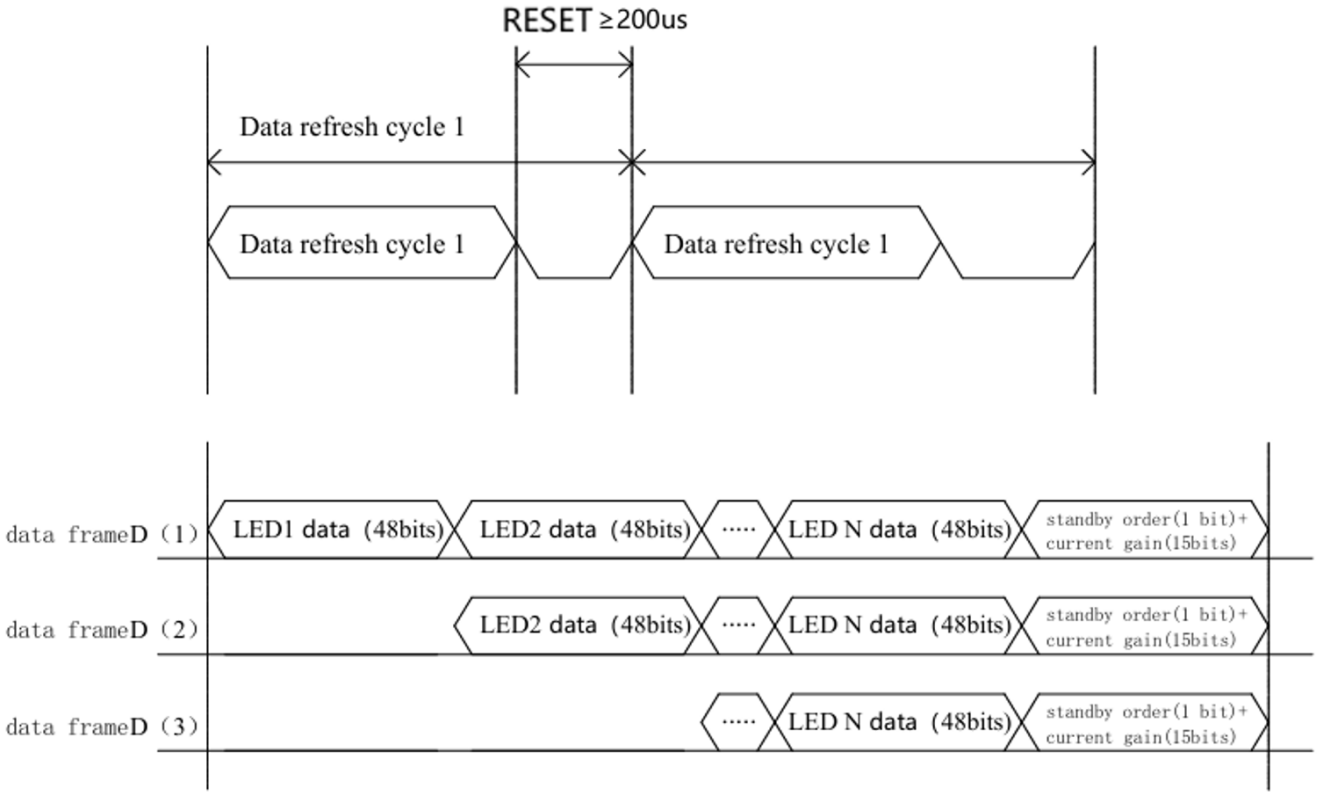
Recommended Operating Ranges *(Ta=-25℃)*

Parameter	Symbol	Min.	Typ.	Max	Unit	Test conditions
The chip input voltage	V_{DD}	3.7	5.0	5.5	V	-
Signal input flip threshold	VIH	0.5*VDD	-	-	V	VDD=5.0V
	VIL	-	-	0.5*VDD	V	
R/G/B output drive current	I_{DOUT}	0.4	4.9	13	mA	V_{DS}=1V
The frequency of PWM	F_{PWM}	-	8	-	KHZ	-
Static power consumption	I_{DD}	-	0.23	-	mA	VDD=5V
Transfer rate	F_{DIN}	-	1500	-	Kbps	-

Suggested data transmission time

Name		Min	Actual Value	Max	Unit
T	Symbol Period	0.65	-	-	μs
T0H	0 code, high level time	0.18	0.20	0.22	μs
T0L	0 code, low level time	0.43	0.45	0.47	μs
T1H	1 code, high level time	0.43	0.45	0.47	μs
T1L	1 code, low level time	0.18	0.20	0.22	μs
Trst	Reset code, low level time	>200	-	-	μs

Data transmission method（Ta=25℃）

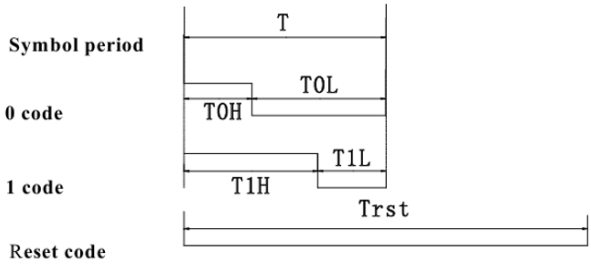


Notes:

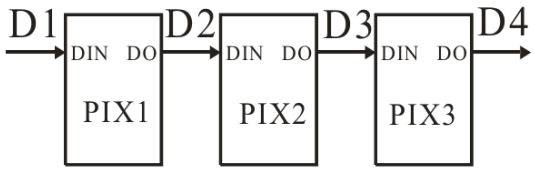
D1 is the data sent by the MCU, and D2, D3, and Dn are the data automatically shaped and forwarded by the cascade circuit.

Time series waveform diagram

Input code type



Connection method



48 bits data structure:

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
B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0

Notes: High bit first, data is sent in the order of RGB

- 48 bits of data from the first chip + 48 bits of data from the second chip + ... + 48 bits of data from the Nth chip + 1 bit of standby command + 15 bits of current gain data.
- 48 bits of grayscale data structure: high bit first, sent in the order of RGB.

S0	GR4	GR3	GR2	GR1	GR0	GG4	GG3	GG2	GG1	GG0	GB4	GB3	GB2	GB1	GB0

The current gain data is 16 bits in total, S0 is the standby command bit: when the chip is working normally, S0 sends 0 by default; when the chip needs to enter the standby sleep mode, S0 sends 1; the red, green and blue light current gain adjustment bits are 5 bits each, corresponding to 5 bits (GR4~GR0) respectively. The system sends 5 bits of red light first, then 5 bits of green light, and then 5 bits of blue light. The high bit GR4 is sent first, and the low bit GB0 is sent last.

Current gain parameter sending format			
Standby command	**Red**	**Green**	**Blue**
S0	GR4 , GR3 , GR2,GR1 , GR0	GG4 , GG3 , GG2,GG1 , GG0	GB4 , GB3 , GB2,GB1 , GB0

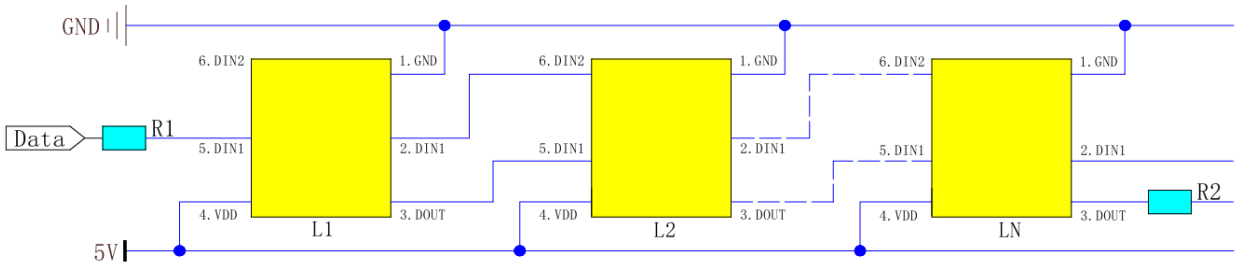
The typical maximum output current of OUT R/G/B is: 13mA. At the same time, users can set the current value by changing the current gain value. For reference current values, please refer to the following table:

Current regulation level	Corresponding current value (mA)
00000	0.4
00001	0.8
00010	1.2
00011	1.6
00100	2.0
00101	2.4
00110	2.8
00111	3.2
01000	3.6
01001	4.0
01010	4.5
01011	4.9
01100	5.3
01101	5.7
01110	6.1
01111	6.5
10000	6.9
10001	7.3
10010	7.7
10011	8.1
10100	8.5
10101	8.9
10110	9.3
10111	9.7
11000	10.1
11001	10.5
11010	10.9
11011	11.3
11100	11.7
11101	12.1
11110	12.5
11111	13.0

Notes:

1. The above current values are theoretical data, and the actual current values may be slightly different.
2. Recommended current: 4.9mA.
3. For product heat dissipation, the maximum recommended current for this product is: 4.9mA, and the current adjustment level of 5.3-13mA is not recommended.

Principles of Applied Circuits

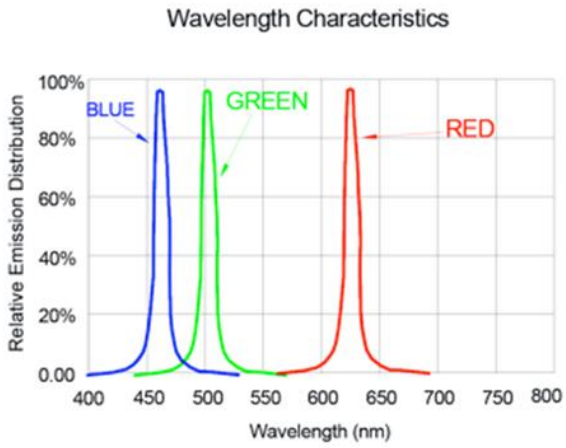


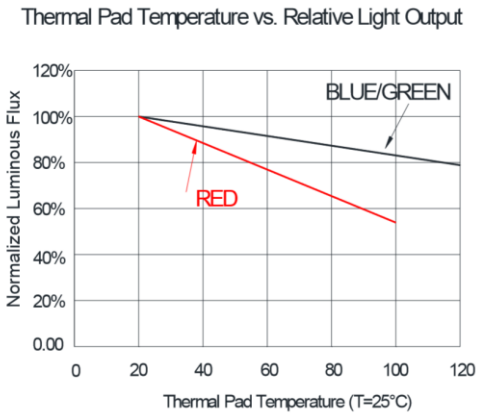
In application, to prevent the instantaneous high voltage generated by the live plugging and unplugging of the product during testing from damaging the internal signal input and output pins of the IC, a protective resistor should be connected in series at the signal input and output ends. In addition, to make the IC chips work more stably, the decoupling capacitors between the LEDs are indispensable.

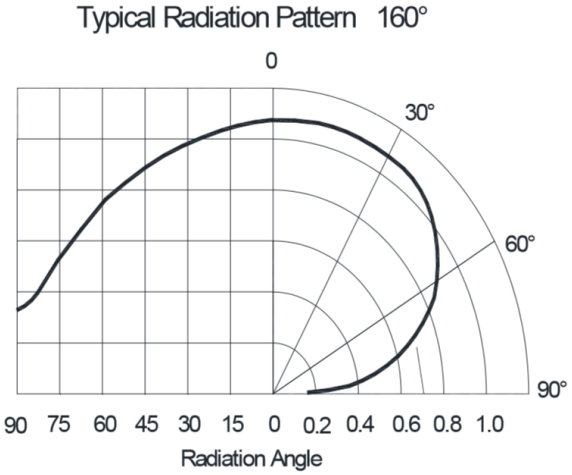
Application 1: For soft or hard light strips, the transmission distance between the LEDs is short. It is recommended to connect a protective resistor in series at the signal input and output ends, that is, R1=R2 is about 500 ohms.

Application 2: For modules or other products, the transmission distance between the LEDs is long. Due to different wire materials and transmission distances, the protective resistors connected in series at both ends of the signal will be slightly different; depending on the actual application.

Photoelectric characteristic



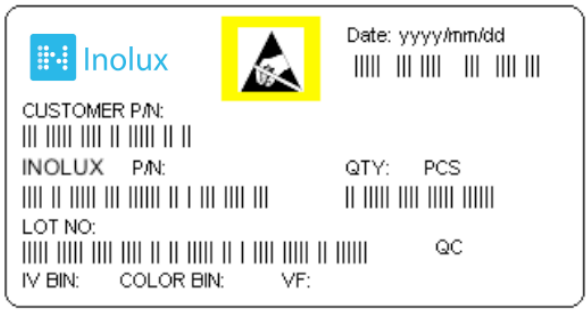




Ordering Information

Product	Emission Color	Iv(mcd)	Orderable Part Number
IN-PI20FTBT5R5G5B	R	50-100	IN-PI20FTBT5R5G5B
	G	140-280	
	B	40-80	

Label Specifications



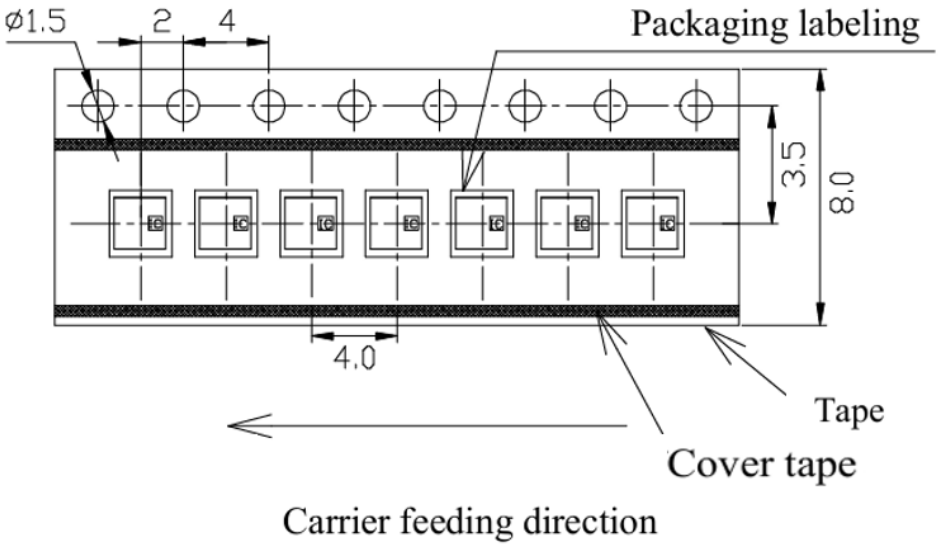
Inolux P/N:

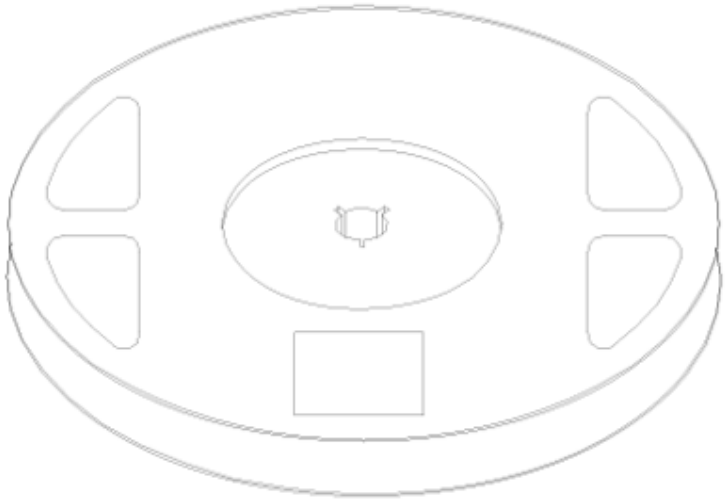
I	N	PI	-	20F	T	B	T	5	R	5	G	5	B	-	X	X	X	X
Inolux		Product		Package	Die Qty.	Variation	Orientation	Current	Color	Current	Color	Current	Color		Customized Stamp-off			
		PI- Single trace IC PC- Clock Function IC		20FTB = Flip chip 2.0 x 2.0 x 0.65 mm, (6 pins)			T = Top Mount	5 = 5mA	R = 624 nm	5 = 5mA	G = 520 nm	5 = 5mA	B = 470 nm					

Lot No.:

Z	2	0	1	7	01	24	001
Internal Tracker	Year (2017, 2018, ...)				Month	Date	Serial

Packaging standards





reel(195x8mm)

Precautions

Please read the following notes before using the product:

1. Storage

1.1 Do not open moisture proof bag before the products are ready to use.

1.2 Before opening the package, the LEDs should be kept at 30℃ or less and 80%RH or less.

1.3 The LEDs should be used within a year.

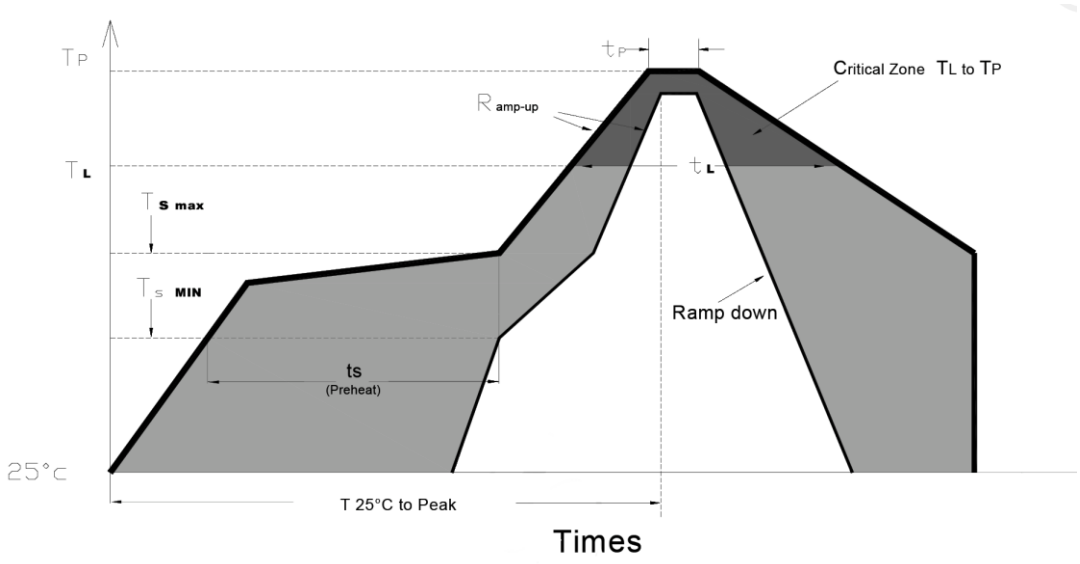
1.4 After opening the package, the LEDs should be kept at 30℃ or less and 60%RH or less.

1.5 The LEDs should be used within 72 hours after opening the package.

1.6 If the moisture adsorbent material has fabled away or the LEDs have exceeded the storage time, baking treatment should be performed using the following conditions. Baking treatment: 60±5℃ for 24 hours.

2. Soldering Condition

Recommended soldering conditions:



Profile Feature	Lead-Free Solder
Average Ramp-Up Rate (Ts_{max} to Tp)	3℃/second max.
Preheat: Temperature Min (Ts_{min})	150℃
Preheat: Temperature Min (Ts_{max})	200℃
Preheat: Time (ts_{min} to ts_{max})	60-180 seconds
Time Maintained Above: Temperature (T_L)	217 ℃
Time Maintained Above: Time (t_L)	60-150 seconds
Peak/Classification Temperature (T_P)	240 ℃
Time Within 5℃ of Actual Peak Temperature (tp)	<10 seconds
Ramp-Down Rate	6℃/second max.
Time 25 ℃ to Peak Temperature	<6 minutes max.

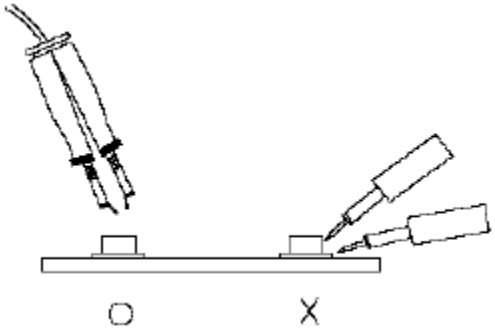
Note: Excessive soldering temperature and / or time might result in deformation of the LED lens or catastrophic failure of the LED.

3. Soldering Iron

Each terminal is to go to the tip of soldering iron temperature less than 260℃ for 5 seconds within once in less than the soldering iron capacity 25W. Leave two seconds and more intervals, and do soldering of each terminal. Be careful because the damage of the product is often started at the time of the hand solder.

4. Repairing

Repair should not be done after the LEDs have been soldered. When repairing is unavoidable, a double-head soldering iron should be used (as below figure). It should be confirmed beforehand whether the characteristics of the LEDs will or will not be damaged by repairing.



5. Caution in ESD

Static Electricity and surge damages the LED. It is recommended to use a wristband or anti-electrostatic glove when handling the LED. All devices, equipment and machinery must be properly grounded.

Revision History

Changes since last revision	Page	Version No.	Revision Date
Initial Release		1.0	04-15-2025

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