Features

- 3210 with integrated high quality constant current IC and RGB LED chip.
- Built-in IC, with high precision of constant current and internal RGB chips spectral processing in advance.
- Single line data transmission (return to zero code).
- Specific Shaping Transmit Technology - theoretically the number of cascaded LEDs is not restricted, but in practice the cascade length is limited by refresh-rate, power-distribution and signal-integrity requirements.
- Data transfer frequency can reach 800kbps (typical). When there's 1024 LEDs in a single string, the refresh rate can reach 30 frames per second.
- External VDD–GND decoupling capacitor is not mandatory under normal operating conditions.
- Built-in power supply reverse connects protection module, reversed power input will not damage the IC.
- MSL level 4.

Description

The IN-PI3210TFS5URGB is 3.2*1.0*1.08 mm RGB LED with integrated IC. It is a side view SMD type LED with flat diffused lens which can be used in various applications.

Applications

- Full color LED string light
- LED full color module
- LED guardrail tube
- LED scene lighting
- LED point light
- LED pixel screen
- LED shaped screen

Package Outline Dimensions & Pin Configuration

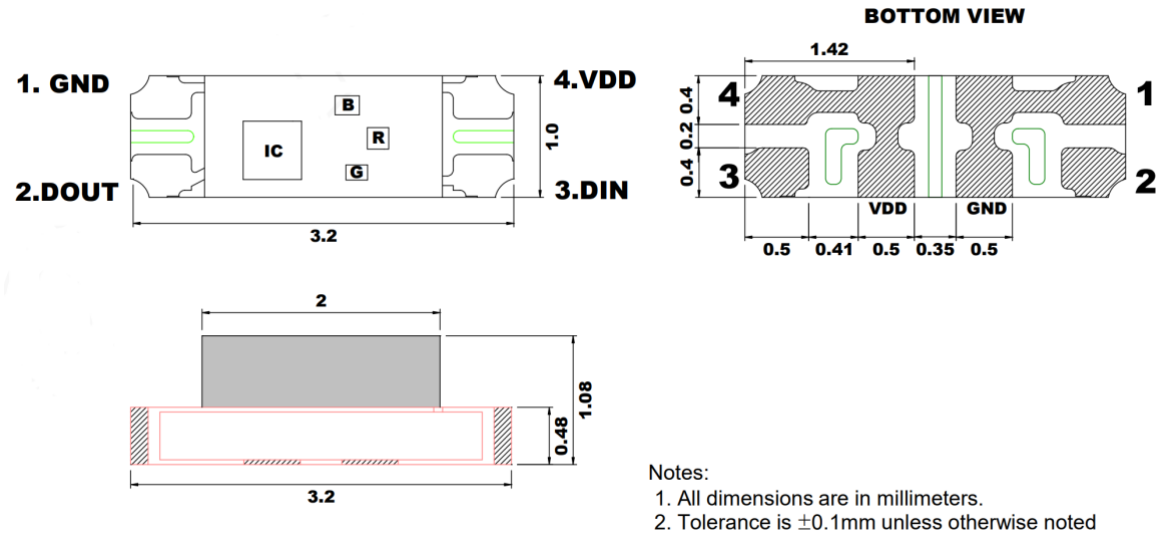
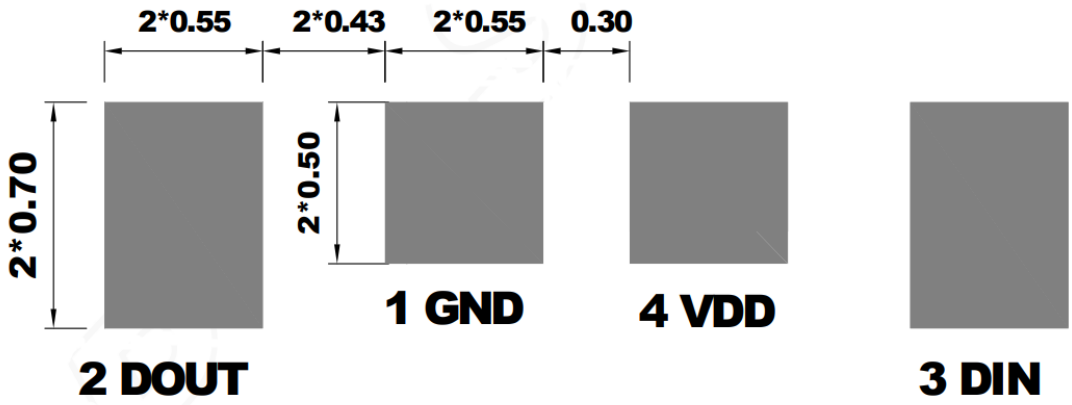


Figure 1. IN-PI3210TFS5URGB Package Outline Dimensions

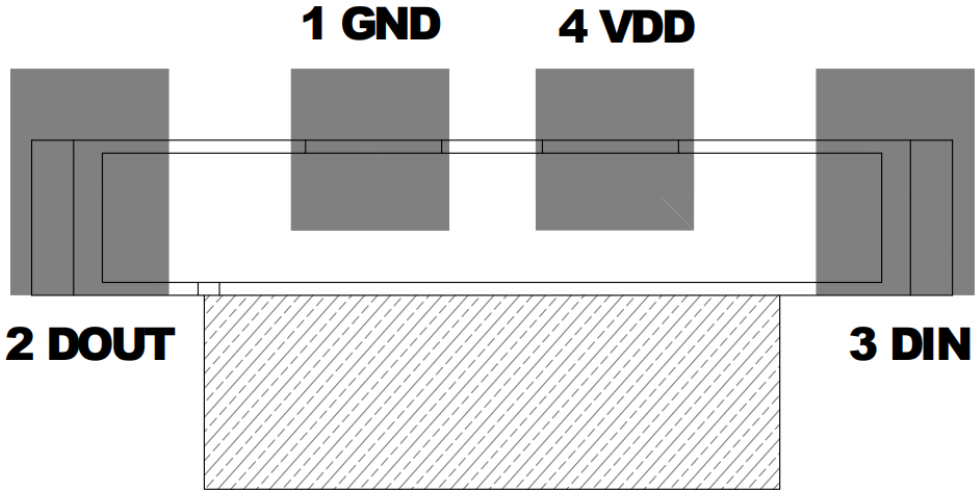
Pin Configuration

Number	Symbol	Function Description
1	GND	Ground
2	DOUT	Control data signal output
3	DIN	Control data signal input
4	VDD	Power supply LED

Recommended Dimensions for PCB



Schematic diagram of the side mount



Notes:
1. Dimensions are in millimeters, 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
Logic input voltage	V_{IN}	-0.5 ~VDD+0.5	V
Operating temperature	T_{OPT}	−40 ~ +80	°C
Storage temperature	T_{STG}	−40 ~ +80	°C
ESD withstand pressure (HBM)	V_{ESD}	2K	V
ESD withstand pressure (DM)	V_{ESD}	200	V

LED Characteristics *(Ta = 25℃)*

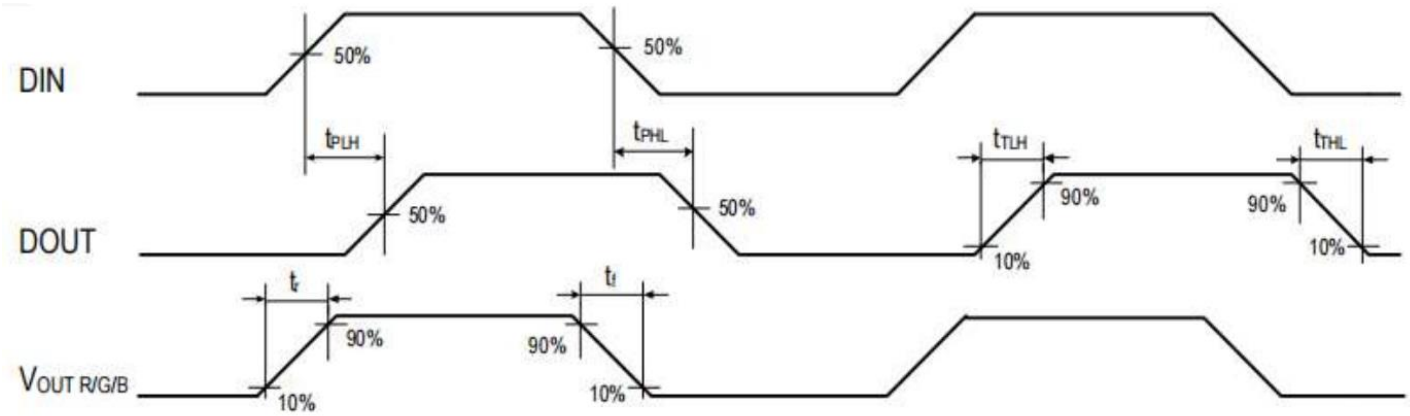
Color	IN-PI3210TFS5URGB (5mA)	
	Wavelength(nm)	Light Intensity(mcd)
Red	620-630	60-120
Green	520-535	160-320
Blue	460-475	40-80

Recommended Operating Ranges

Parameter	Symbol	Min.	Typ.	Max	Unit	Test conditions
The chip supply voltage	V_{DD}	-	5.0	-	V	-
The signal input flip threshold	V_{IH}	0.7*VDD	-	-	V	VDD=5.0V
	V_{IL}	-	-	0.3*VDD	V	VDD=5.0V
The frequency of PWM	F_{PWM}	-	4.0	-	kHz	-
Static Supply Current	I_{DD}	-	0.25	-	mA	-

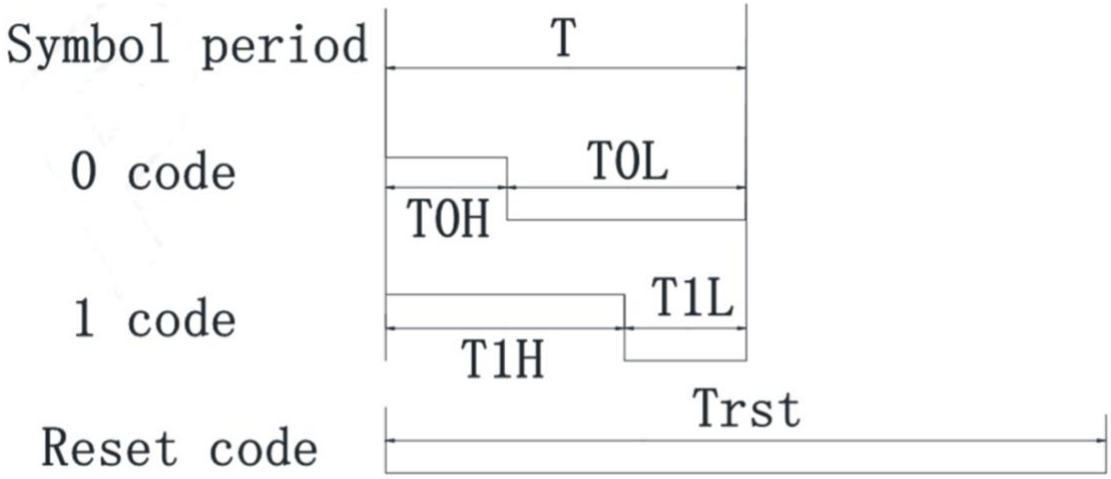
Switching Characteristics

Parameter	Symbol	Min.	Typ.	Max	Unit	Test conditions
The speed of data transmission	*fDIN*	-	800	-	kbps	The duty ratio of 60%
DOUT transmission delay	T_{PLH}	-	100	-	ns	The load capacitance out of port to ground is 30pF, signal transmission delay from DIN to DOUT.
	T_{PHL}	-	100	-	ns	
I_{OUT} Rise/Fall Time	T_r	-	200	-	ns	IOUT = 5mA, out R / G / B port series connection 200 Ω resistor to VDD, load capacitance to ground 30pF.
	T_f	-	280	-	ns	
DOUT Conversion time	T_{TLH}	-	15	-	ns	The load capacitance of DOUT port to ground is 30pF.
	T_{THL}	-	24	-	ns	



Timing Waveforms

1. Input Code

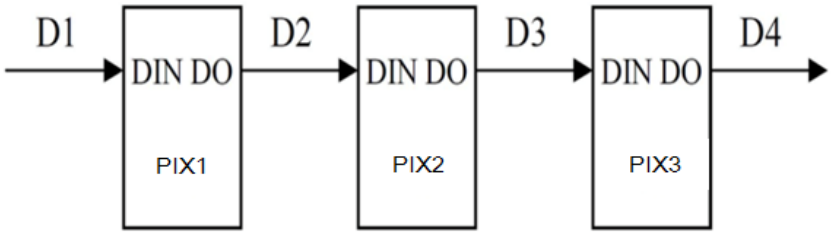


2. The data transmission time

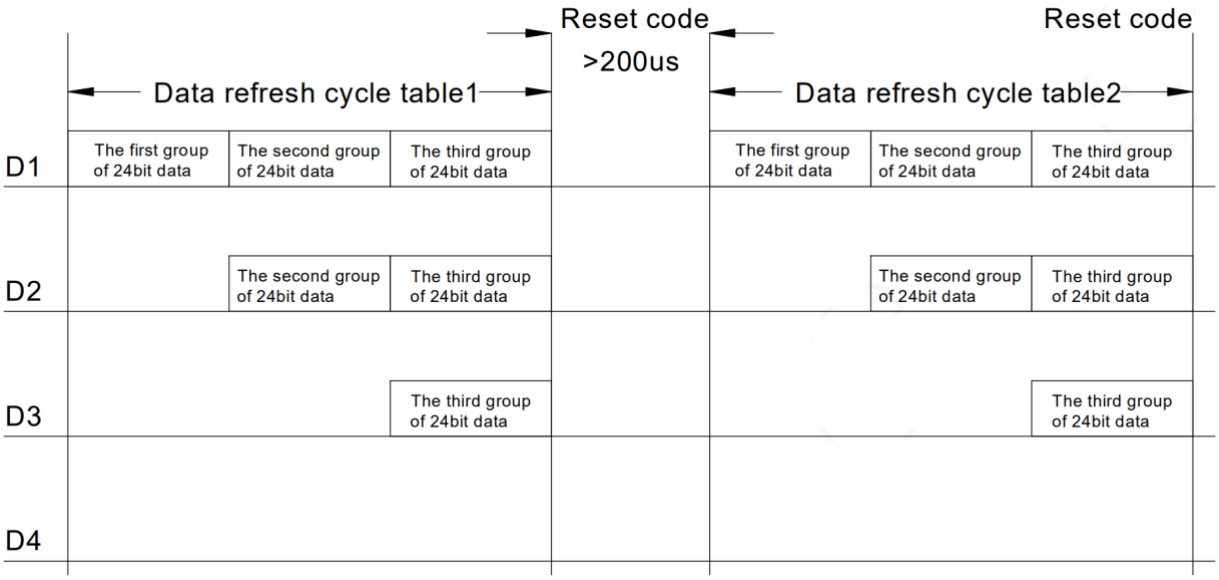
Name		Min	Standard Value	Max	Unit
T	Code Period	1.20	-	-	μs
T0H	0 code, high level time	0.2	0.3	0.4	μs
T0L	0 code, low level time	0.8	-	-	μs
T1H	1 code, high level time	0.65	0.75	1.0	μs
T1L	1 code, low level time	0.2	-	-	μs
Trst	Reset code, low level time	>200	-	-	μs

1.The protocol uses a unipolar zeroing code. Each symbol must have a low level. Each symbol in this protocol starts with a high level. The high time width determines the "0" or "1" code.
2.When writing programs, the minimum symbol period is 1.2μs.
3.The high time of “0” code and “1” code should be in accordance with the stipulated range in the above table. The low time requirement of “0” code and “1” code is less than 20μs.

3. Connection Scheme



4. Data Transfer Format



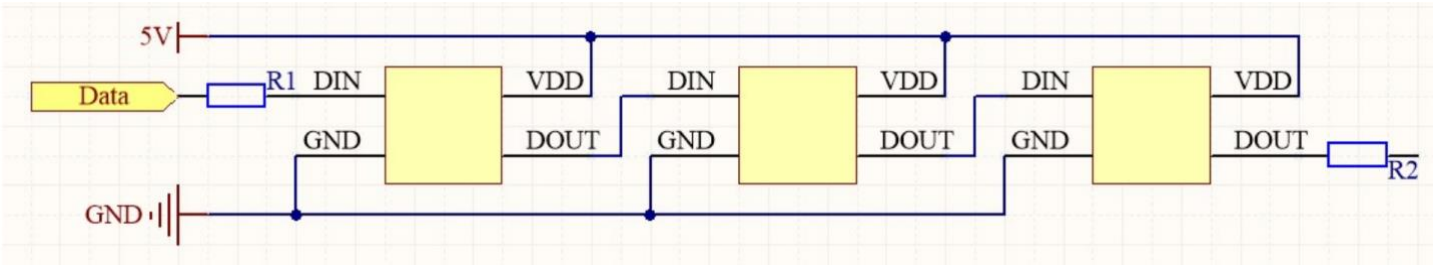
Note: D1 is sent by the MCU, D2, D3, D4 for data forwarding automatic shaping cascade circuit.

5. 24-bit data format

G7	G6	G5	G4	G3	G2	G1	G0	R7	R6	R5	R4
R3	R2	R1	R0	B7	B6	B5	B4	B3	B2	B1	B0

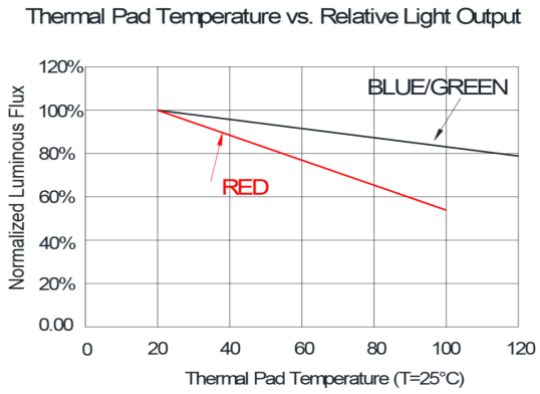
Note: high starting, in order to send data (G7 - G6 - ....B0)

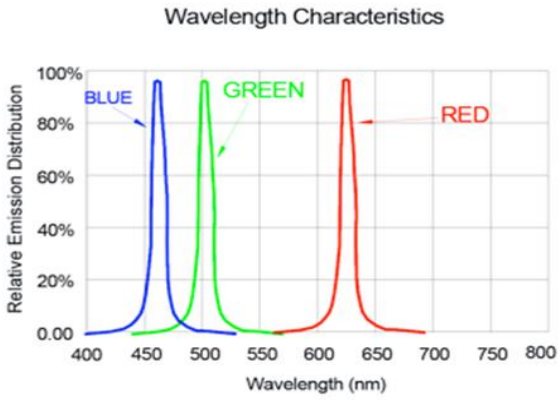
Typical Application Circuit

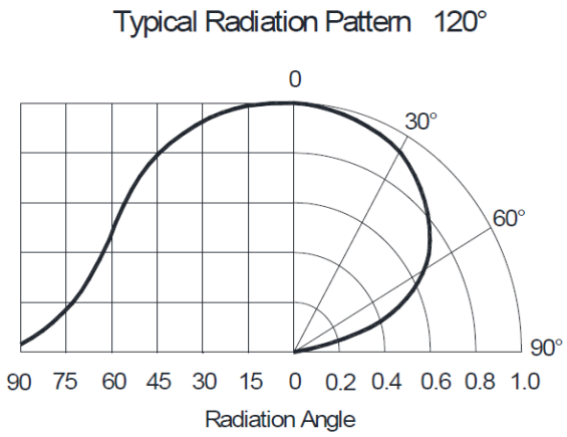


Note:
1. In practical application circuits, to prevent instantaneous high voltage damage to the internal signal input and output pins of the IC caused by live plugging and unplugging during testing, protective resistors should be connected in series at the signal input and output terminals. In addition, in order to ensure more stable operation between IC chips, the decoupling capacitance between each LED is essential.
2. Application: used for soft lamp strip or hard light, lamp beads transmission distance is short, suggested in signal in time the data line input and output end of each connected in series protection resistors, ex: R1 is about 500 ohms.
3. Application: used for modules or general shaped products. The transmission distance between lamp beads is long. Due to different wire materials and transmission distances, the protective resistance of the signal line connected in series at both ends will be slightly different; Based on actual usage.

LED Performance Graph



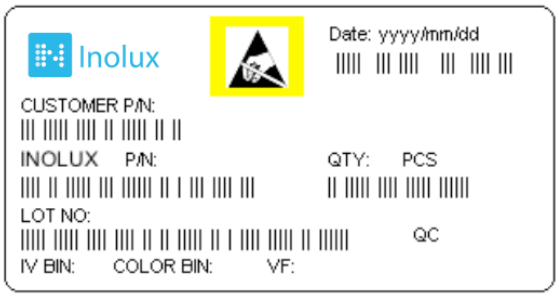




Ordering Information

Product	Emission Color	Iv (mcd)	Orderable Part Number
IN-PI3210TFS5URGB	R	60-120	IN-PI3210TFS5URGB
	G	160-320	
	B	40-80	

Label Specifications



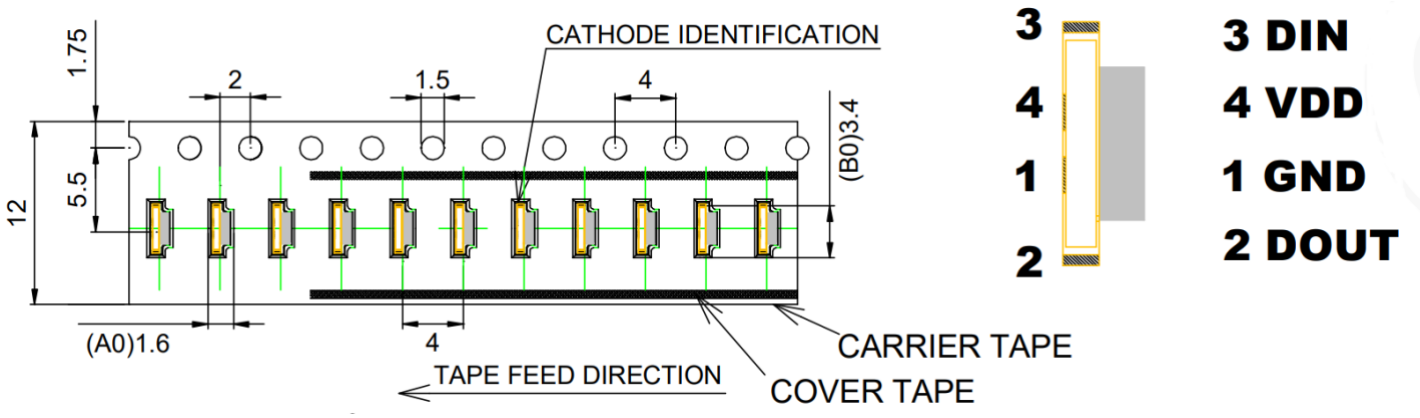
Inolux P/N:

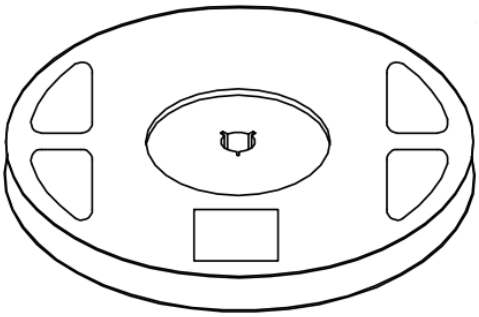
I	N	PI	-	3210	T	F	S	5	U	R	G	B	-	X	X	X	X
Inolux		Product		Package	Die Qty.	Variation	Orientation	Current	Lens	Color	Color	Color		Customized Stamp-off			
		PI- Single trace IC PC- Clock Function IC		3210TF = 3.2 x 1.0 x 1.08 mm flat lens			S = Side Mount	5 = 5mA	U = Diffused	R = 624 nm	G = 520 nm	B = 470 nm					

Lot No.:

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

Packaging





REEL(178x12mm)
(INNER 3000PCS LED MAX)

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.

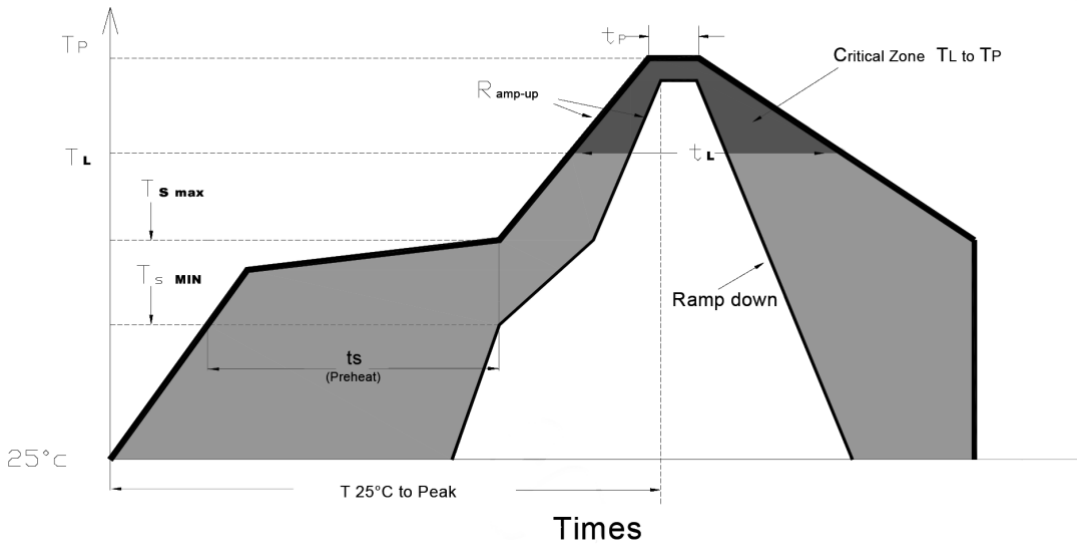
1.4 After opening the package, the LEDs should be kept at 30℃ or less and 60%RH or less.

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

1.6 If the moisture adsorbent material has evaporated 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 Max (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.

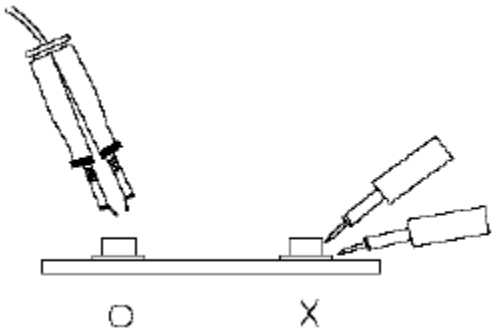
Note: Excessive soldering temperature and / or time might result in deformation of the LED lens or catastrophic failure of the LED.

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 damage 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	07-03-2023
Format adjustment		1.1	09-28-2026

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