Features

- Top SMD internal integrated high-quality external control line serial cascade constant current IC; 5Vapplication; default on electric lights.
- Control circuit and the RGB chip in SMD 2020 components, to form a complete control of pixel, color mixing uniformity and consistency.
- The two-wire synchronous control.
- The three RGB output control, 8Bit (256) color; 5Bit (32) to adjust the brightness.
- The three constant current drive, self-detection function specific signal.
- The maximum frequency of 30MHZ serial data input.
- The double data transmission, built-in support uninterrupted oscillation PWM output, can maintain a static image.

Description

The IN-PC20TBT5R5G5B is 2.0*2.0*0.65mm RGB LED with integrated IC. It is a two-wire transmission LED with three channel (RGB) intelligent driving control circuit and light emitting circuit. The LED contains a signal decoding module, data buffer, a built-in constant current circuit, and RC oscillator. It uses CMOS process, low voltage and low power consumption. It has 256 level grayscale PWM adjustment and 32 brightness adjustment. The LED uses double line transfer output, with synchronization of Data and CLK signal.

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

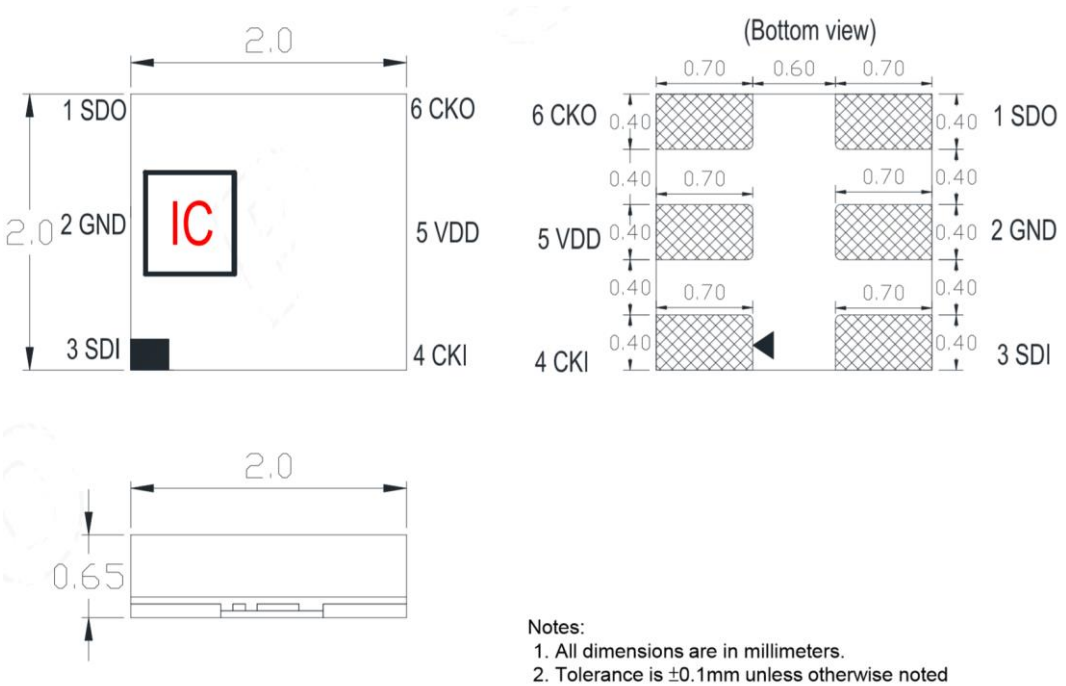


Figure 1. IN-PC20TBT5R5G5B Package Outline Dimensions

Pin Configuration

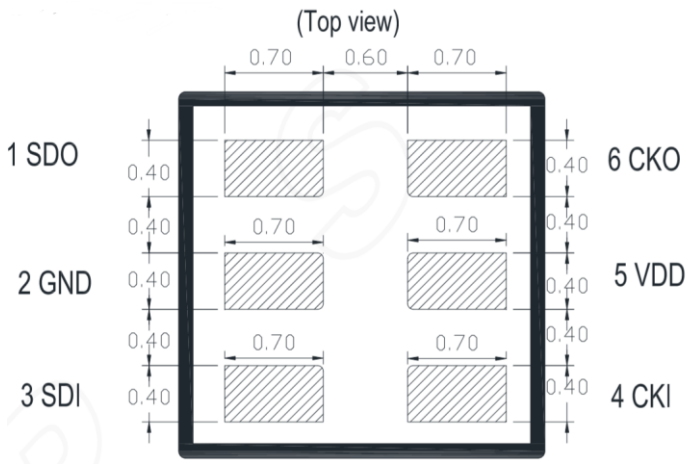
Item	Symbol	Pin Name	Function description
1	SDO	Data Input	control signal output data
2	GND	Ground	The signal and power supply and grounding
3	SDI	Data Input	control signal Input data
4	CKI	CLK Input	control signal Input Clock data
5	VDD	Power	power supply pin
6	CKO	CLK Output	control signal output Clock data

Figure 2. IN-PC20TBT5R5G5B Pin Configuration

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

Number	Symbol	Pin Name	Function Description
1	SDO	Data Output	control signal output data
2	GND	Ground	The signal and power supply grounding
3	SDI	Data Input	control signal Input data
4	CKI	CLK Input	control signal Input Clock data
5	VDD	Power	power supply pin
6	CKO	CLK Output	control signal output Clock data

Soldering Pad Size



Absolute Maximum Rating *(Ta = 25 ℃, VSS=0V)*

Parameter	Symbol	Range	Unit
Power supply voltage	V_{DD}	+3.7～+5.5	V
Logic input voltage	V_{IN}	-0.3 ~VDD+0.3	V
Operating temperature	T_{OPT}	−40 ~ +80	℃
Storage temperature	T_{STG}	−40 ~ +80	℃
ESD pressure (HBM)	V_{ESD}	4K	V
ESD pressure (DM)	V_{ESD}	200	V

LED Characteristics *(T_A = 25℃)*

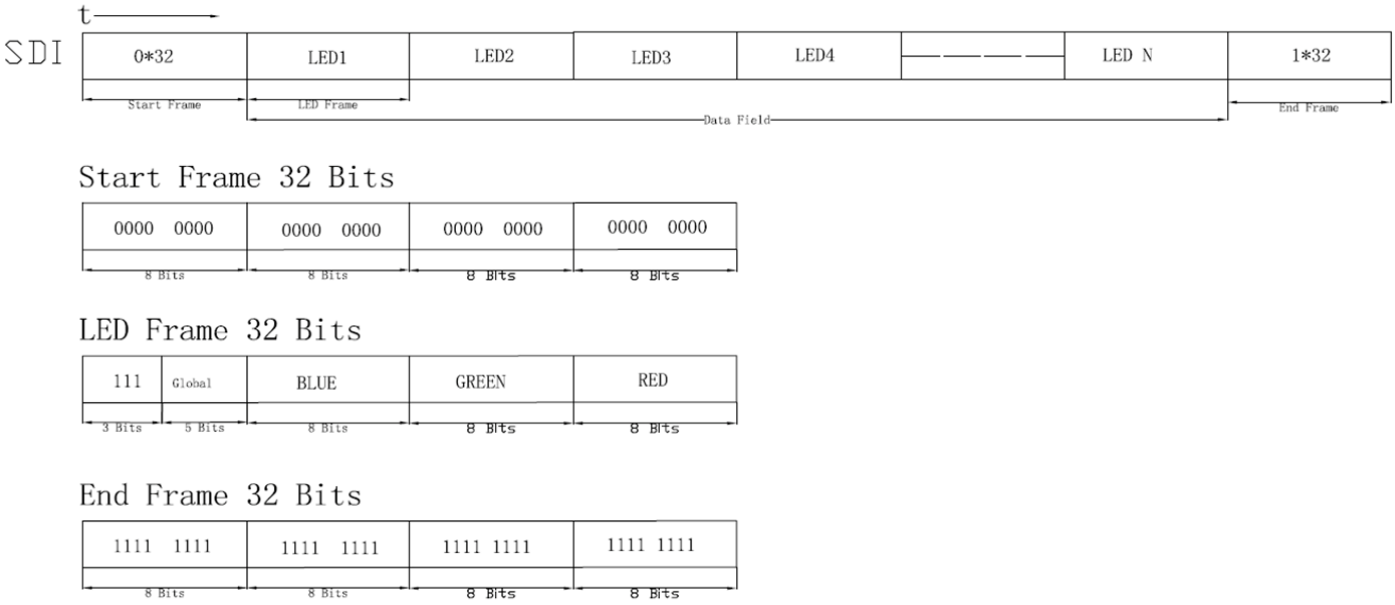
Color	5mA	
	Wavelength(nm)	Light Intensity(mcd)
Red	620-630	100-200
Green	520-530	300-500
Blue	460-475	50-100

Recommended Operating Ranges *(unless otherwise specified, TA=-20 ~ +70 ℃, VDD=4.5 ~ 5.5V,VSS=0V)*

Parameter	Symbol	Min.	Typ.	Max	Unit	Test conditions
The chip supply voltage	V_{DD}	-	5.0	5.5	V	-
R/G/B port pressure	VDS,MAX	-	-	17	V	-
The maximum LED output current	I_{max}	-	-	20	mA	-
The clock high level width	TCLKH	-	17	-	ns	-
The clock low level width	TCLKL	-	17	-	ns	-
Data set up time	TSETUP	-	-	10	ns	-
The frequency of PWM	F_{PWM}	-	4	-	KHZ	-
Static power consumption	I_{DD}	-	1	-	mA	-

Feature Descriptions

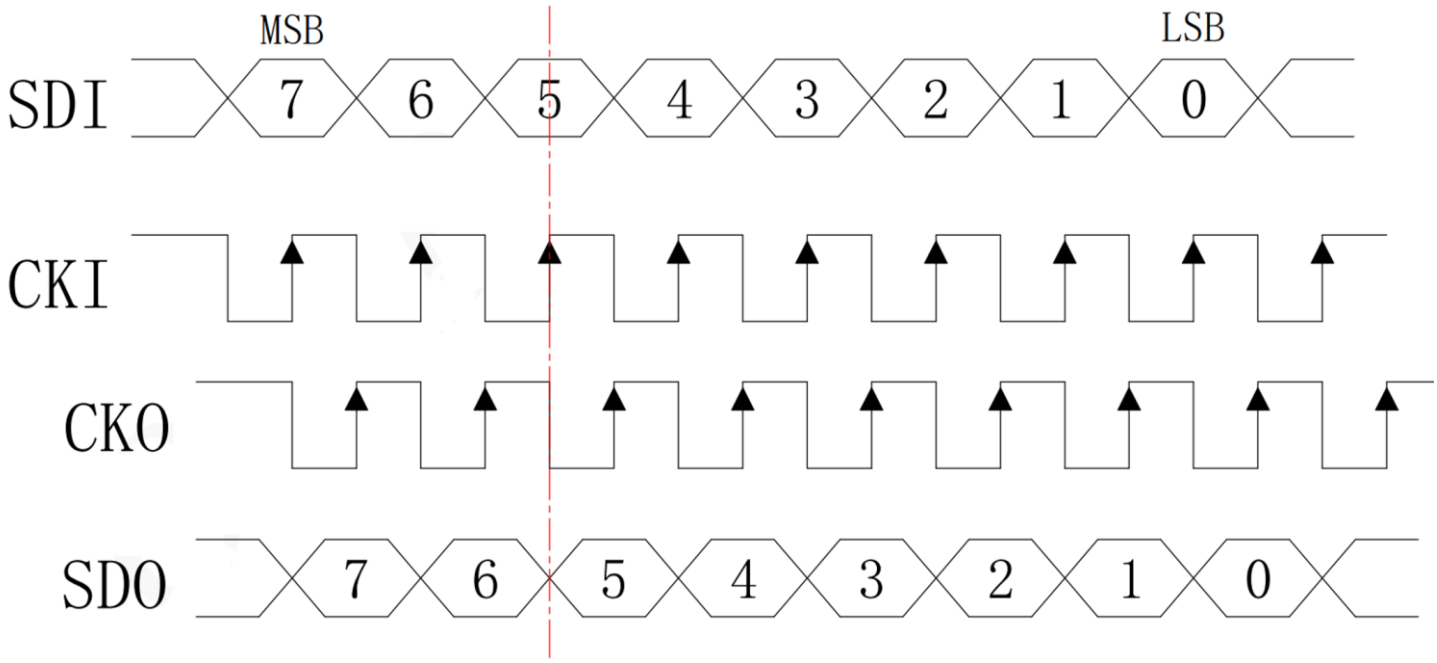
(1) Series data structure



(2) 256 level gray level

Data	Duty Cycle
MSB……..LSB	
0000 0000	**0/256**
0000 0001	**1/256**
0000 0010	**2/256**
–	–
–	–
–	–
–	–
–	–
–	–
11111101	**253/256**
1111 1110	**254/256**
1111 1111	**255/256**

(3) PWM input / output signal relationship



SDI transitions on the falling edge of CKI, and the current chip is read on the rising edge of CKI.
SDO transitions on the rising edge of CKI and reads into the next chip on the falling edge of CKI.

The input data SDI starts to transition on the falling edge of CKI. After the transition is stable, it can be read on the rising edge of CKI;

The output data SDO can only be output after the input data SDI is read in, and SDI is read in at the rising edge of CKI, so SDO is output on the rising edge of CKI.

CKI rising edge moment:
It is to read the SDI of this level chip and output the SDO of this level at the same time, which is the moment when the input data SDI_{next} of the next level chip is read.

If CKI and CKO are synchronized and the signals are exactly the same, then at the moment of the rising edge of CKI, all chips will input data and output data! This is an extremely unstable situation, and all data transfers will go haywire.

Therefore, the waveforms of CKI and CKO need to be staggered; at the same time, the time delay problem existing between systems needs to be staggered, and CKO should be designed uniformly to be better than CKI reduce half Clock.

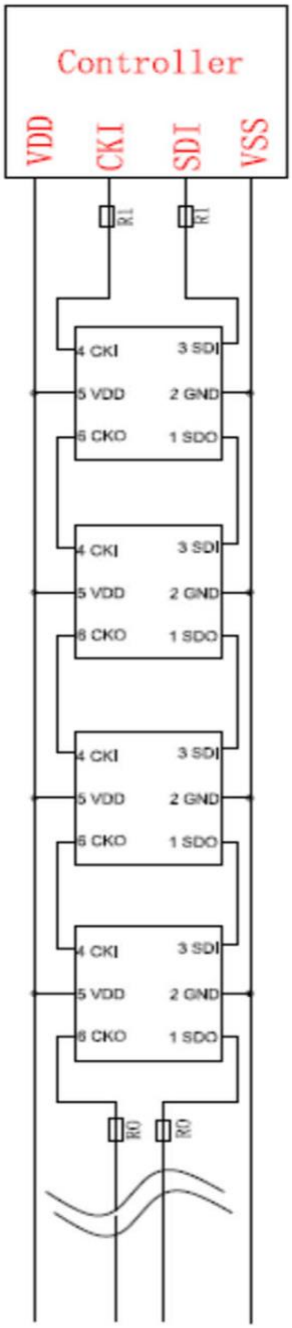
(4) 5-Bit (level 32) brightness adjustment (simultaneous control of OUTR\OUTG\OUTB three ports current):

Current level	numerical value (MSB.....LSB)	Current adjustment	Corresponding current value (mA)	Remarks
1	00000	0/31	0	Suggested Current: 1-10 Current Regulation Level
2	00001	1/31	0.581	
3	00010	2/31	1.162	
4	00011	3/31	1.743	
5	00100	4/31	2.324	
6	00101	5/31	2.905	
7	00110	6/31	3.486	
8	00111	7/31	4.067	
9	01000	8/31	4.648	
*10	01001	9/31	5.229	
11	01010	10/31	5.81	Based on the heat dissipation of the product, the current of this product is recommended to be used at a maximum of 5.229 mA, and the current regulation level of 11-31 is not recommended.
12	01011	11/31	6.391	
13	01100	12/31	6.972	
14	01101	13/31	7.553	
15	01110	14/31	8.134	
16	01111	15/31	8.715	
17	10000	16/31	9.296	
18	10001	17/31	9.877	
19	10010	18/31	10.458	
20	10011	19/31	11.039	
21	10100	20/31	11.62	
22	10101	21/31	12.201	
23	10110	22/31	12.782	
24	10111	23/31	13.363	
25	11000	24/31	13.944	
26	11001	25/31	14.525	
27	11010	26/31	15.106	
28	11011	27/31	15.687	
29	11100	28/31	16.268	
30	11101	29/31	16.849	
31	11110	30/31	17.43	
32	11111	31/31	18	

(5) Refresh Rate

Frame rate = 1/ ((64+ (32* points)) *CKI (cycle), (unit: frames per second)
Such as: 1024 points, CKI frequency is 1MHZ, is =30 frames per second frame rate.

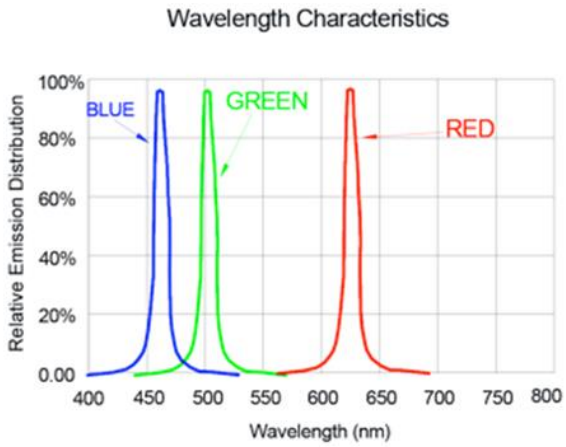
Typical Application Circuit

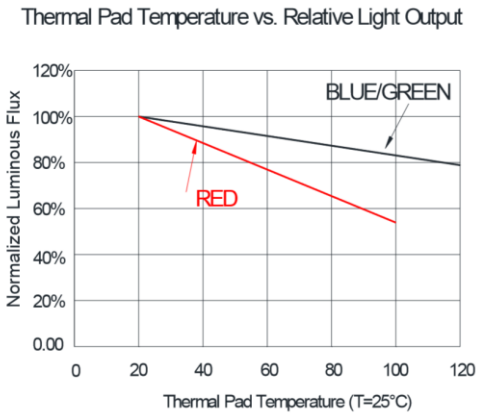


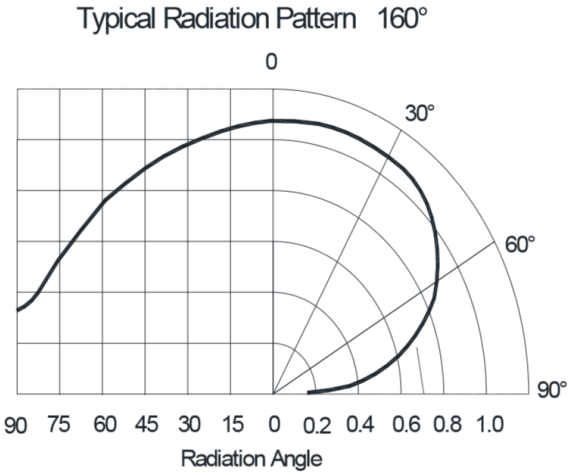
To avoid circuity surge from damaging the IC, protection resistor is suggested to be added in the circuit design. Capacitors are also suggested to be added to enhance the stability of IC performance.

**When used in LED strip where LED pitch is short, protection resistors are suggested to be placed at signal line input/output and clock line input/output. Suggested resistor values at R1= R0 of about 550 ohms.
**When used in module or general applications where pitch is long, protection resistor value needs to be adjusted based on pitch distance and line material.

LED Performance Graph



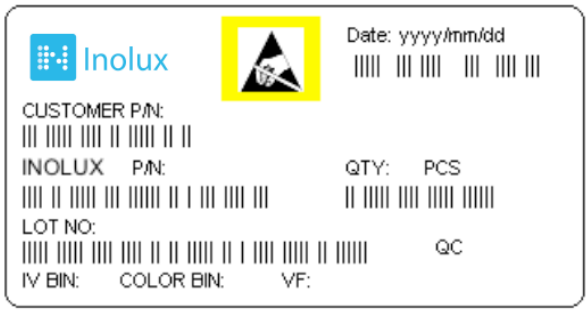




Ordering Information

Product	Emission Color	IV(mcd)	Orderable Part Number
IN-PC20TBT5R5G5B	R	100-200	IN-PC20TBT5R5G5B
	G	300-500	
	B	50-100	

Label Specifications



Inolux P/N:

I	N	PC	-	20	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		20TB = 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

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.

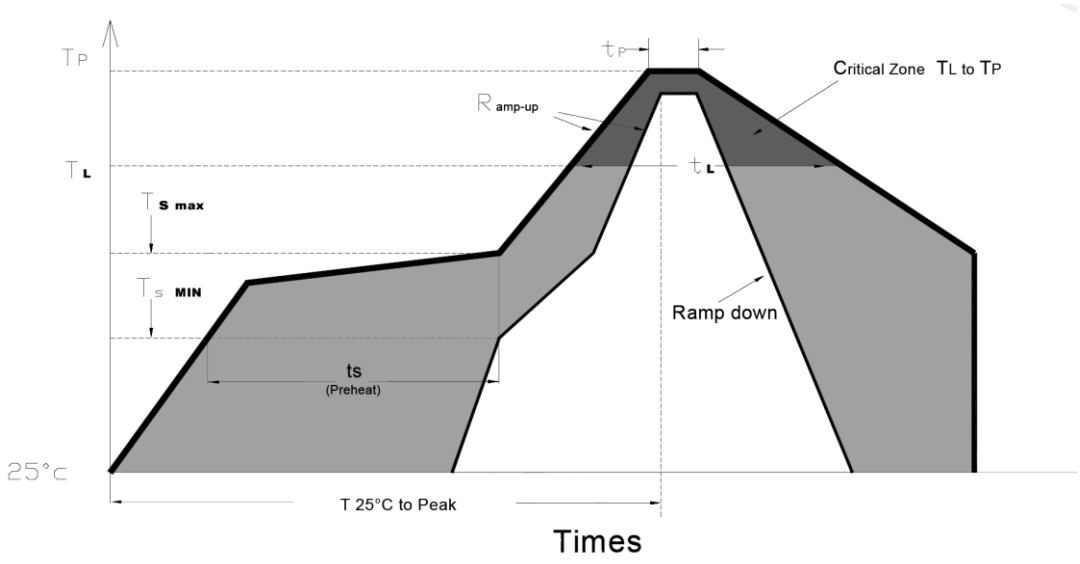
1.4 After opening the package, the LEDs should be kept at 30℃ or less and 60%RH or less.

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.

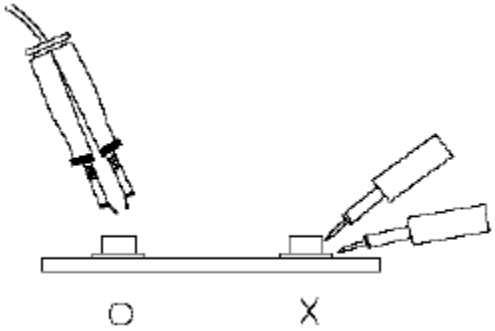
Note: Excessive soldering temperature and / or time might result in deformation of the LED lens or catastrophic failure of the LED.

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	03-20-2020
Added operating principles of CKI and CKO	6	1.1	10-31-2023

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