

SPECIFICATION FOR APPROVAL

Customer :

Customer Part No. :

P-tec Part No. : PLBT3535C6-WDRGBW-K3

Time : 2019/08/26

Customer Confirmation	Approval	Checked By	Prepared By
		RS	MS

PLBT3535C6-WDRGBW-K3

- ◆ **Outline (L* W*H): 3.4*3.5*1.47mm**
- ◆ **Good thermal dissipation & optical uniformity**



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Features

- RoHS2.0 Compliant
- Package din 12mm tape on 7" diameter reels
- EIA STD package
- Compatible with automatic placement equipment and infrared reflow solder process
- Preconditioning: accelerate to JEDEC level 3
- Serial data transmission signal by (DATA CLK) two line
- One pixel contains R, G, and B color that each can achieve 256 level brightness grayscale, which forms 16, 777, 216 combination colors.
- Supports sleep /wake-up mode. In sleep mode, the LED's current was lower than 5uA.

Applications

- Telecommunication, office automation, home appliances, industrial equipment
- Status indicator
- Signal and symbol luminaire
- Front panel backlighting
- Full-color strip.
- Indoor decorative lighting / curtain display

■ Maximum Rating(Ta=25°C)

Parameter	Symbol	Rating	Unit
IC Power Supply Voltage	VDD	< 6.5	V
LED voltage	V _{led}	4.5-5.5	V
Rate of data signal	F _{CLK}	15	MHZ
The max led output Current	I _{OMAX}	20 / channel	mA
Power dissipation;	P _D	<400	mW
Soldering Temperature ^{*1}	T _{SD}	260	°C
Operating Temperature Range		-40°C to +85°C	
Storage Temperature Range		-40°C to +105°C	

**■ Typical Product Characteristics(Ta=25°C;VDD=5V)**

Characteristics	Symbol		Min.	Typ.	Max.	Unit	Test condition
Luminous Intensity	IV	V	-	550	-	mcd	I _F =20mA
		G	-	1700	-		
		B	-	300	-		
		W	-	2500	-		
Dominant Wavelength	λ_d	V	615	-	630	nm	I _F =20mA
		G	520	-	535		
		B	460	-	475		
Color Coordinate	x			0.25			I _F =20mA
	y			0.25			
View Angle	2θ _{1/2}		-	120	-	deg	I _F =20mA

■ Electrical Characteristics (Ta=25°C ;VDD=5V)

Characteristics	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	V _{DD}		4.5	5.0	5.5	V
Input high voltage	V _{IH}		2.7	-	VDD+0.4	V
Input low voltage	V _{IL}		-0.4	-	1.0	V
The clock high level width	T _{CLKH}		30	-	-	ns
The clock low level width	T _{CLKL}		30	-	-	ns
Data set up time	T _{SETUP}		10	-	-	ns
Data hold time	T _{HOLD}		5	-	-	ns
Working current(IC)	IDD	I _{out} = “OFF”	-	-	2	mA
Static current	I _{Sleep}	Sleep mold			5	uA
ESD pressure	V _{ESD}	HBM		6000		V

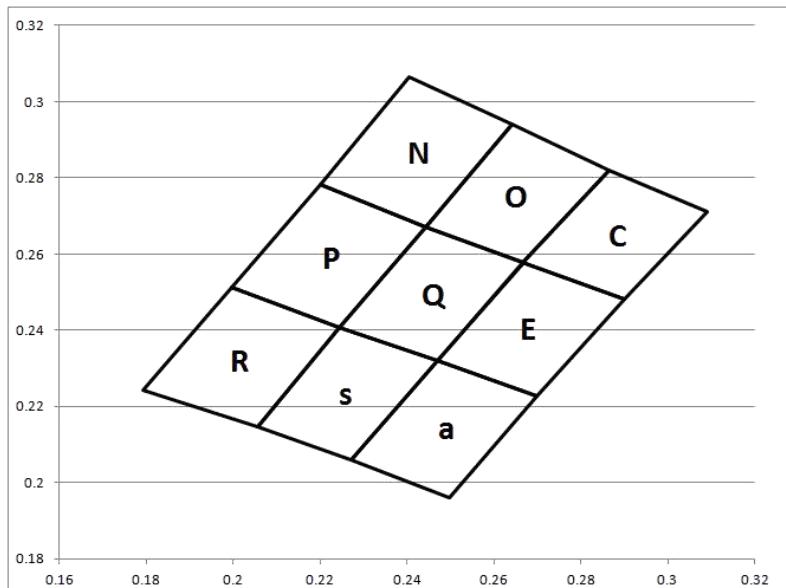


■ Range of Bins

1) Luminous Intensity-White (I_F = 20mA)

Bin Code	Min. IV (mcd)	Max. IV (mcd)
16	1300	1700
17	1700	2200
18	2200	2800
19	2800	3600
20	3600	4800

■ Color Coordinate Comparison-White



Color Rank

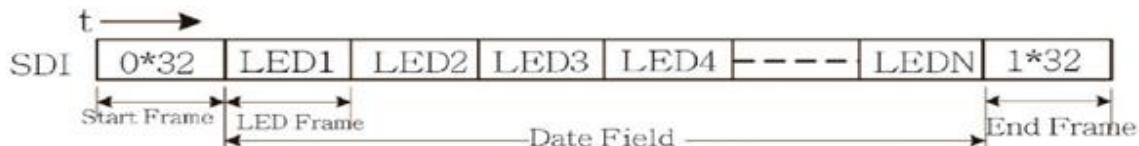
Bin	X	Y	X	Y	X	Y	X	Y
C	0.2865	0.2819	0.3091	0.2712	0.2899	0.2482	0.2667	0.2578
N	0.22	0.2783	0.2406	0.3064	0.2643	0.294	0.2444	0.2672
O	0.2444	0.2672	0.2643	0.294	0.2865	0.2819	0.2667	0.2578
E	0.2667	0.2578	0.2899	0.2482	0.27	0.2227	0.247	0.232
P	0.22	0.2783	0.1996	0.2513	0.2244	0.2407	0.2444	0.2672
Q	0.2444	0.2672	0.2244	0.2407	0.2471	0.232	0.2669	0.2579
R	0.1996	0.2513	0.1792	0.2243	0.2056	0.2148	0.2244	0.2407
S	0.2244	0.2407	0.2056	0.2148	0.2273	0.2061	0.2471	0.232
a	0.2471	0.232	0.2273	0.2061	0.2498	0.1959	0.27	0.2227



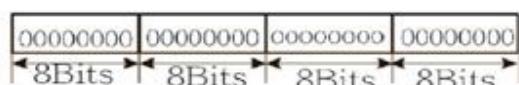
■ Function description

(1) Series data structure

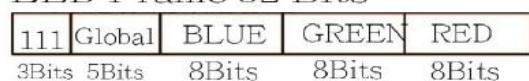
Tandem N-LED



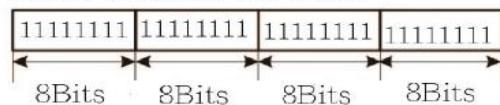
Start Frame 32 Bits



LED Frame 32 Bits



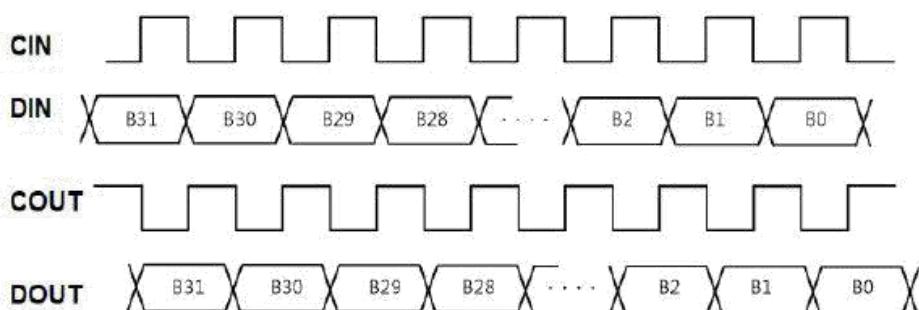
LED Frame 32 Bits



(2) 5-Bit (level 32) brightness adjustment (simultaneous control of OUTR\OUTG\OUTB three port current)

DATA MSB ↔ LSB	Driving Current
00000	0/31
00001	1/31
00010	2/31
...	
11110	30/31
11111	31/31(max)

(3) PWM input/output signals relations





■ Function description

Data MSB—	Duty Cycle
00000000	0/256(min)
00000001	1/256
00000010	2/256
...	
11111101	253/256
11111110	254/256
11111111	255/256(max)

(4) Sleep and power saving mode

LED supports the sleep/wake-up modes for power-saving purpose. After the IC receives 24-bit 0's BGR data (that is BLUE[7:0]=8h00, G[7:0]=8h00, R[7:0]=8h00), in the meantime, both of the data in 3-bits flag and 5-bits DIMMING is 8h' A0' (that is FLAG[2:0] =3b101 and DIMMING [4:0] =5b00000), the IC will enter sleep mode, its current is about 1uA.

The IC will wake up from sleep mode once receiving the new data with the data of Flag[2:0] 、 DIMMING [4:0] is not 8h"A0"; after wake-up, all sleeping circuits in IC return to normal working mode within 1ms. Since it takes 1ms for a sleeping IC returning to normal function mode, it is recommended for a host to wait for 1ms to send display data and command after issuing a wake-up command

32 bits 0	Flag[2:0]=3'b101	Dimming[4]=5'b00000	Blue[8'h00]	Green[8'h00]	Red[8'h00]	Sleep mode
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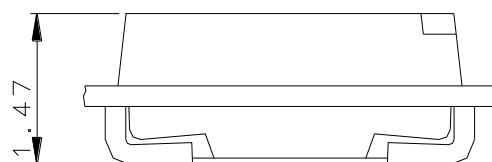
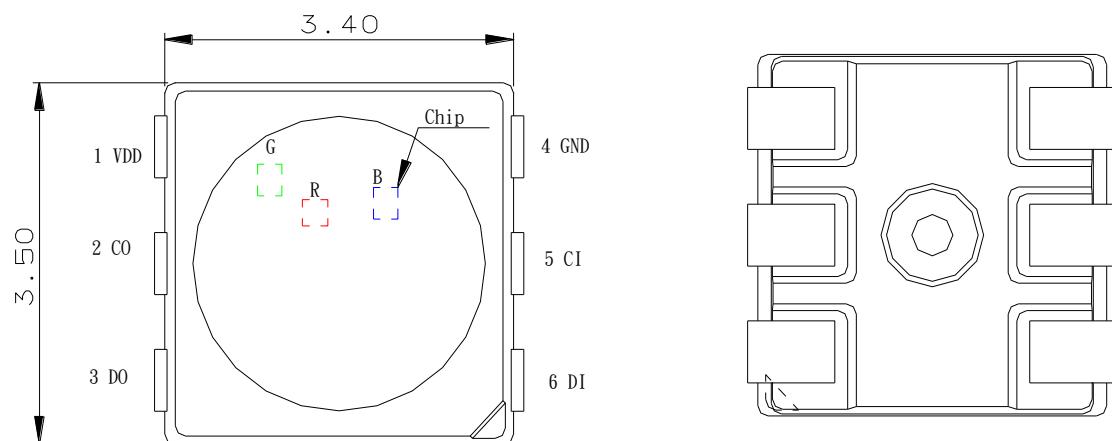
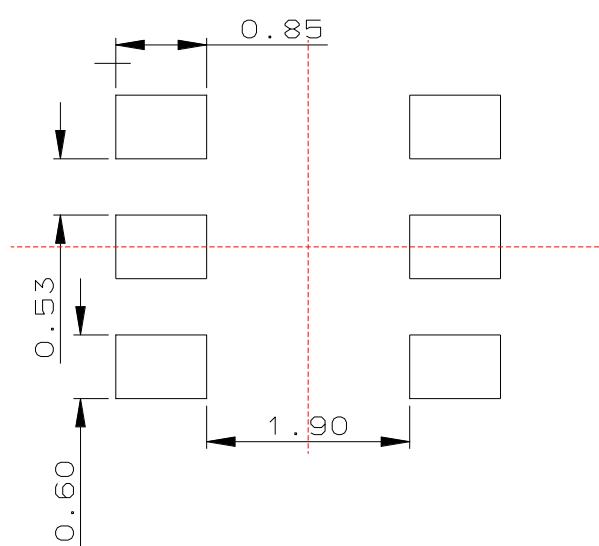
Case 1:

Lamp 1	Lamp 2	Lamp 3
1xx11118hFF8hFF8hFF	101000008h008h008h00	101000008h008h008h00
Normal mode	Sleep mode	Sleep mode

Case 2:

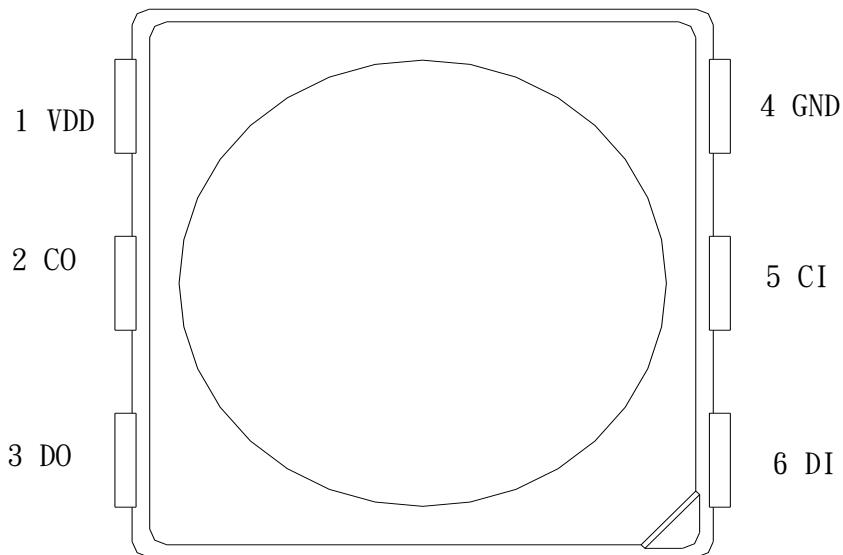
Lamp 1	Lamp 2	Lamp 3
1xx11118hFF8hFF8hFF	101000008h008h008h00	1xx11118h1F8h1F8h1F
Normal mode	Sleep mode	Normal mode

In case 2, while lamp2 is under sleep mode, in the following data transfer process, the state of lamp 2 will be not changed as long as the 32 bits data for lamp 2 is received with data of Flag[2:0] 、 DIMMING[4:0] being 8h" A0" . It means lamp2 will keep in sleep mode as well. In the situation, lamp2 can pass through the remaining data to lamp 3 (32bits) to change the display data of lamp 3. In other words, the sleeping chip is able to pass the data to the next chips.

**Dimensions****Recommend Padlayout**

- § All dimensions are in millimeters.
- § Tolerance is ± 0.1 mm unless other specified
- § Specifications are subject to change without notice

■ PIN Configuration

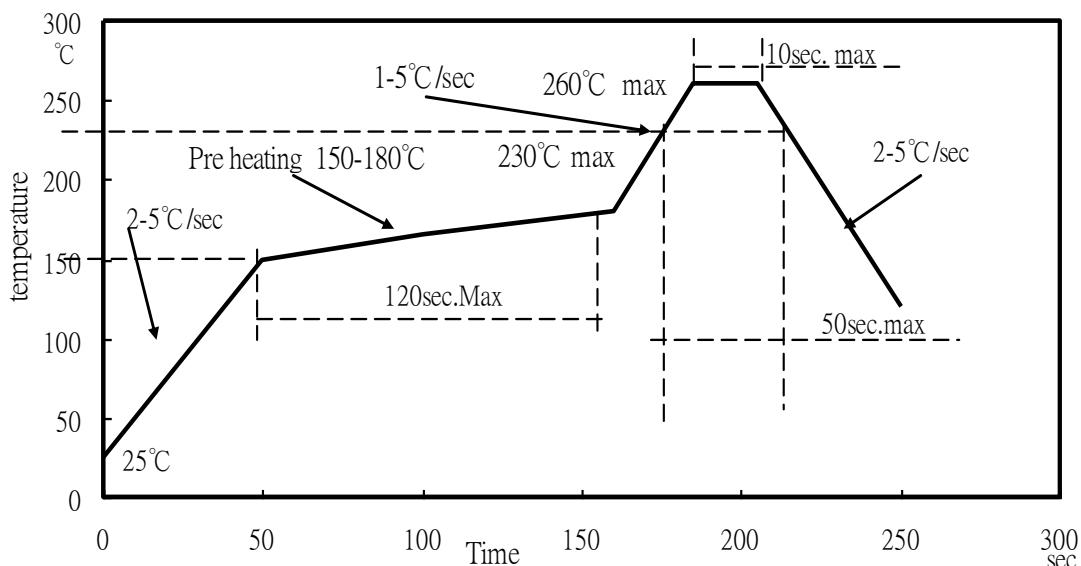


No.	Symbol	Function description
1	VDD	Supply voltage
2	CO	Clock output
3	DO	Data output
4	GND	Ground
5	CI	Clock input
6	DI	Data input



■ Reflow Profile

1. IR reflow soldering Profile for Lead Free solder



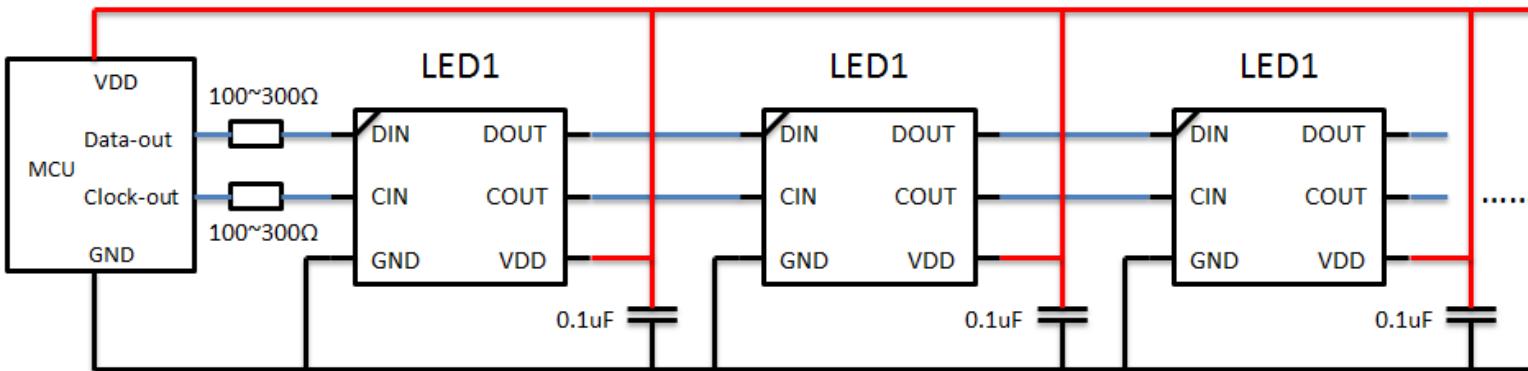
Notes:

1. We recommend the reflow temperature at 240°C ($\pm 5^\circ\text{C}$), and the maximum soldering temperature should be limited to 260°C.
2. Don't cause stress to the silicone resin while it is exposed to high temperature.
3. Number of reflow process shall not be more than 3 times.



■ Test Circuit and Precautions for Use

1. Typical application circuit



Notes:

When the first LED is connected to the MCU, a resistance R is needed in series between its signal input line and the MCU. The size of R depends on the number of cascade beads. The more cascades, the smaller resistance R is used. It is generally recommended that the value be between 100-1K. Usually the recommended value is around 300 R. In order to make the LEDs work more stably, a parallel capacitor is needed between VDD and GND of each

2. Precautions for Use

2.1. Over-current-proof

Customer must apply resistors for protection; otherwise slight voltage shift will cause big current change (Burn-out will happen).

2.2. Storage

1). To store the products is recommended with following conditions:

Humidity: 60% R.H. Max.

Temperature: 5°C~30°C (41°F~86°F)

2). Shelf life in sealed bag: 12 months at <5°C~30°C and <60% R.H. after the package is Opened, the products should be used within a week or they should be stored at ≤20%R.H. with zip-lock sealed bag.

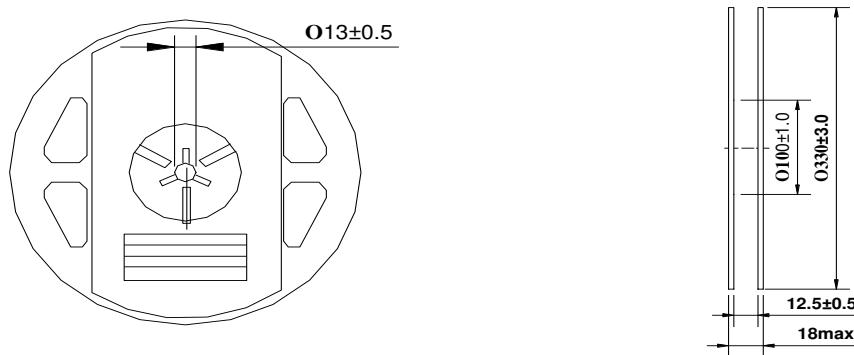
2.3. Baking

The products are not used up within a week, and please bake them before using:

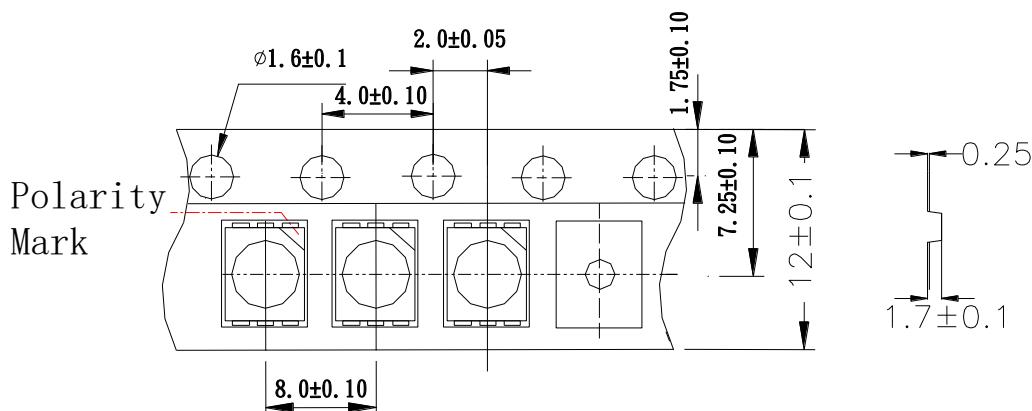
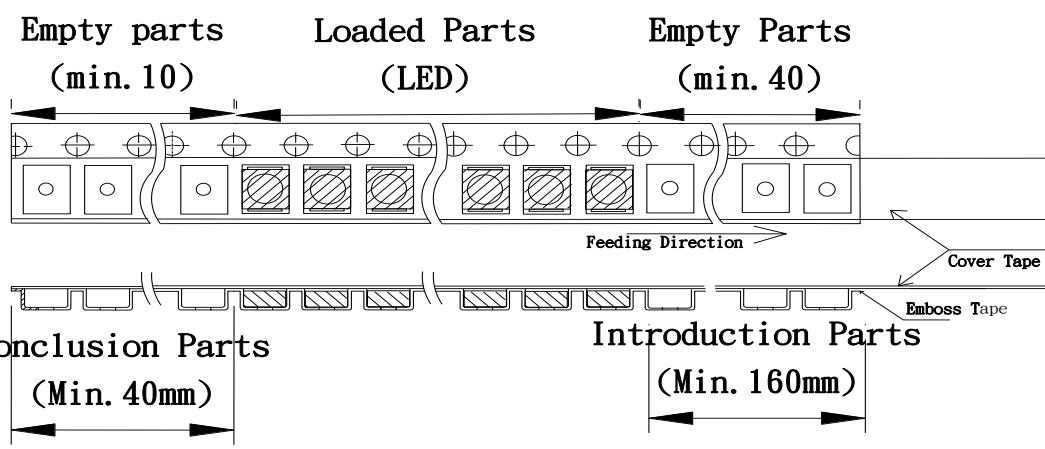
1). 60±3°C X 6hrs and <5% RH, for reel

2). 125±3°C X 2hrs, for single LED

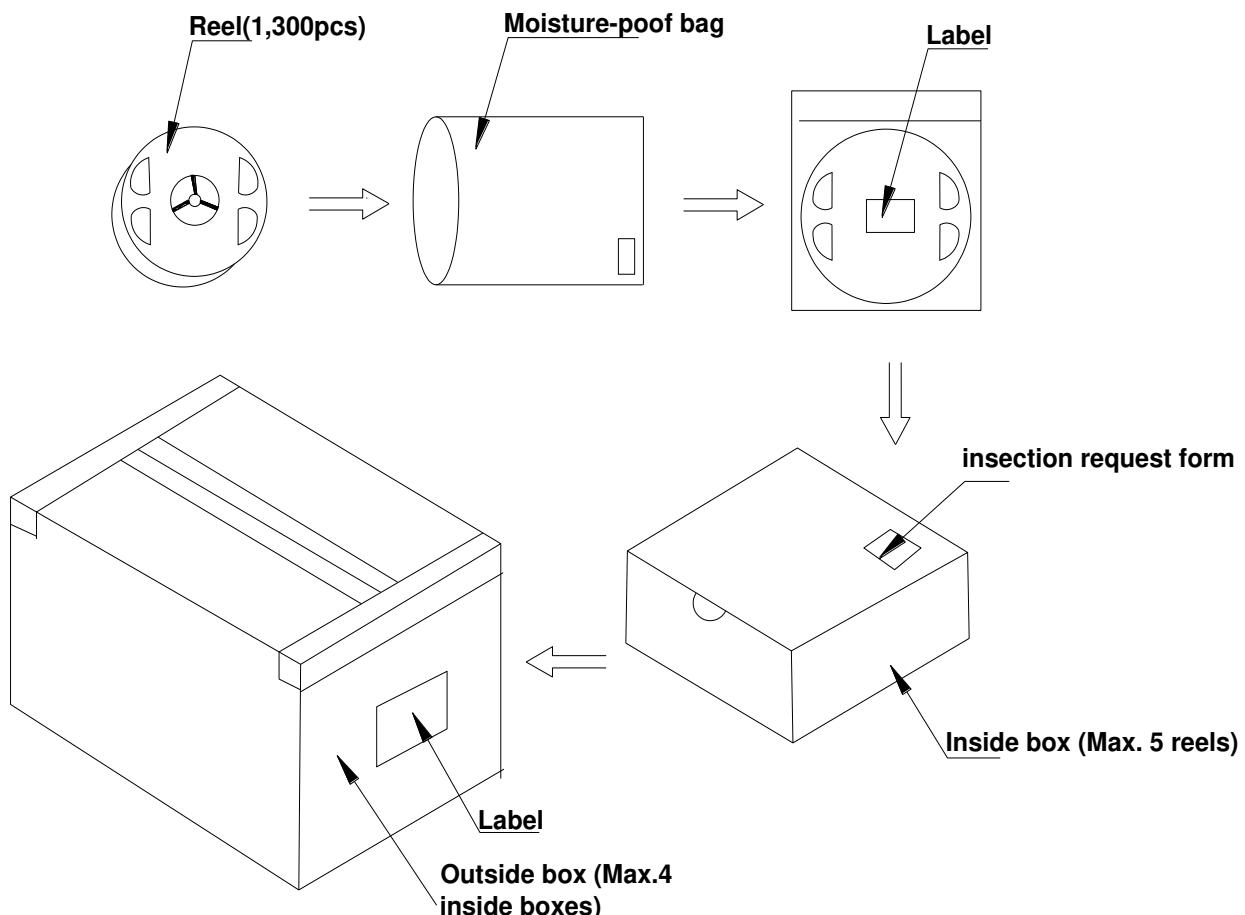
It is normal to see slight color fading of carrier (light yellow) after baking in process.

**Packing****● Dimensions of Reel (Unit: mm)**

Note: 01.The tolerance unless mentioned is $\pm 0.2\text{mm}$.
02.The measured unit is "mm".

● Dimensions of Tape (Unit: mm)**● Arrangement of Tape****Notes:**

1. Empty component pockets sealed with top cover tape
2. The max number of consecutive missing SMD is 2pcs;
3. The cathode is put towards the tape sprocket hole in accordance with ANSI/EIA RS-481 specifications;
4. 1,300 pcs per reel;
5. The remainders will be packed in a multiplication of 500pcs.

**■ Packing****● Packaging Specifications****Notes:**

Reeled product (max.1,300) is packed in a sealed moisture-proof bag. Five bags are packed in an inner box (size: about 260 X 230 X 100 mm) and four inner boxes are in an outer box (size: about 480 X 275 X 215 mm). On the label of moisture-poof bag, there should be the information of Part No., Lot No. and quantity number; also the total quantity number should be on inspection request form on outer box.

■ Precautions

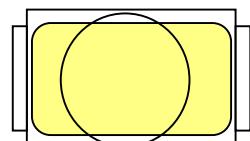
1. Abnormal situation caused by improper setting of collet

To choose the right collet is the key issue in improving the product's quality. LED is different from other electronic components, which is not only about electrical output but also for optical output. This characteristic made LED more fragile in the process of SMT. If the collet's lowering down height is not well set, it will bring damage to the gold wire at the time of collet's picking up and loading which will cause the LED fail to light up, light up now and then or other quality problems

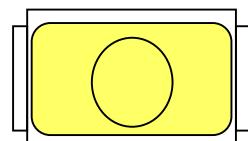
2. How to choose the collet

During SMT, please choose the collet that has larger outer diameter than the lighting area of lens, in case that improper position of collet will damage the gold wire inside the LED. Different collets fit for different products, please refer to the following pictures cross out

Outer diameter of collet should be larger than the lighting area



Picture 1(√)



Picture 2(X)

3. Other points for attention

A. No pressure should be exerted to the epoxy shell of the SMD under high temperature.

B. Do not scratch or wipe the lens since the lens and gold wire inside are rather fragile and cross out easy to break.

C. LED should be used as soon as possible when being taken out of the original package, and should be stored in anti-moisture and anti-ESD package.

4. This usage and handling instruction is only for your reference.

■ Test Items and Results of Reliability

Test Item	Test Conditions	Duration/ Cycle	Ac/Re	Number of Damage	Reference
Normal Temperature Life	T _a =23°C(±5°C) I _F =20mA	1008 hrs	0/1	0/22	JESD22 A-108
High Temperature Life	T _a =85°C(±5°C) I _F =20mA	1008 hrs	0/1	0/22	JESD22 A-108
High Humidity Heat Life	T _a =85°C(±5°C) RH=85% I _F =20mA	1008 hrs	0/1	0/22	JESD22 A-108
Thermal shock	-45°C/30min~105°C /30min (±5°C)	1008 hrs	0/1	0/22	JESD22 A-104
Electrostatic Discharge (ESD) Test	According to the SPEC	3 cycles	0/1	0/22	AEC Q101-001
Low Temperature Storage	T _a =-40°C	1008 hrs	0/1	0/22	JESD22-A103D
High Temperature Storage	T _a =105°C	1008 hrs	0/1	0/22	JESD22-A103D

***Criteria for Judging**

Item	Symbol	Condition	Criteria for Judgment of Pass	
			Min	Max
Luminous Intensity	I _V	I _F =20mA	LSL ^{*2} ×0.7	-

[Note]

LSL^{*2}: Lower Specification Level