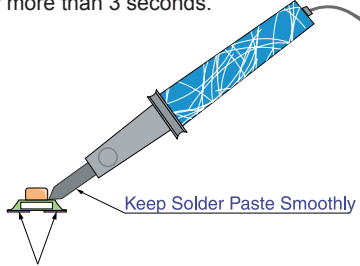


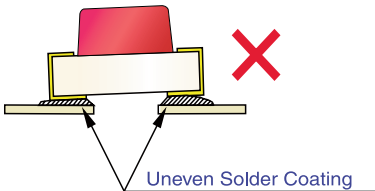
APPLICATION NOTES

General Notes

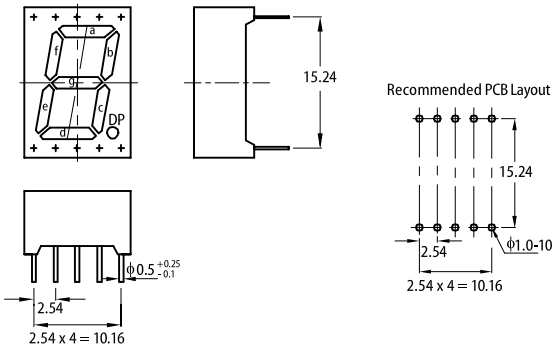
1. We recommend manual soldering operations only for repair and rework purposes. The soldering iron should be temperature-controlled to avoid damaging the component. The maximum soldering temperature is 300°C for Pb-Sn solder and 350°C for lead-free solder for normal lamps and displays. For blue (typ.:465nm), green (typ.:525nm), and all white LEDs, the maximum soldering iron temperature is 280°C. Do not place the soldering iron on the component for more than 3 seconds.



- The tip of the soldering iron should never touch the epoxy lens.
- Do not apply stress to the leads when the component is heated above 85°C, otherwise internal wire bonds may be damaged.
- Through-Hole LEDs are incompatible with reflow soldering.
- If the LED will undergo multiple soldering passes or face other processes where the part may be subjected to intense heat, please check with Kingbright for compatibility.
- SMD products must be mounted according to specified soldering pad patterns. Refer to the product datasheet for details. Solder paste must be evenly applied to each soldering pad to insure proper bonding and positioning of the component.



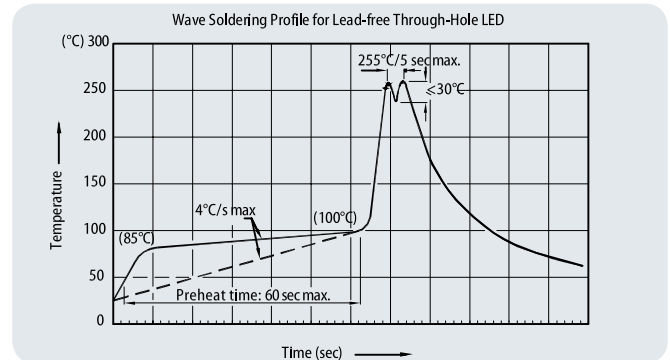
- After soldering, allow at least three minutes for the component to cool down to room temperature before further operations.
- Recommended PCB pin hole diameters for display products are listed below :
 Square pin type : $\Phi 1\text{mm}$
 Round pin type : 2 x pin diameters



9. Data subject to change without notice. For additional detail of application notes, product information, and disclaimers, please visit our website at https://www.kingbright.com/application_notes.

Recommended Wave Soldering Profiles For Kingbright Through-Hole Products

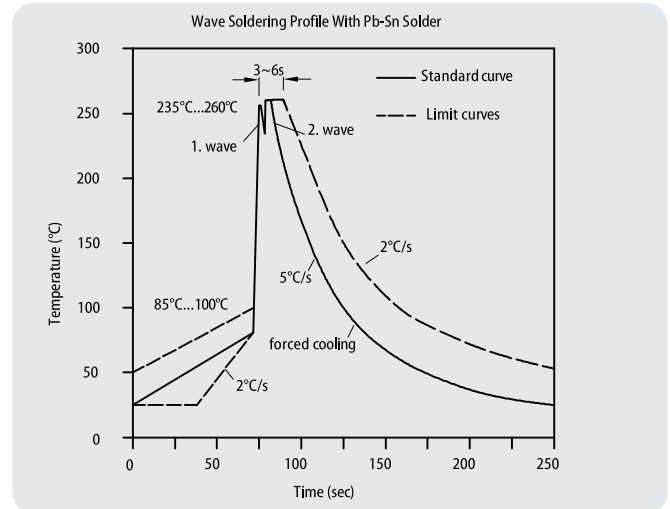
1. Lead-Free Wave Soldering Profile



Notes:

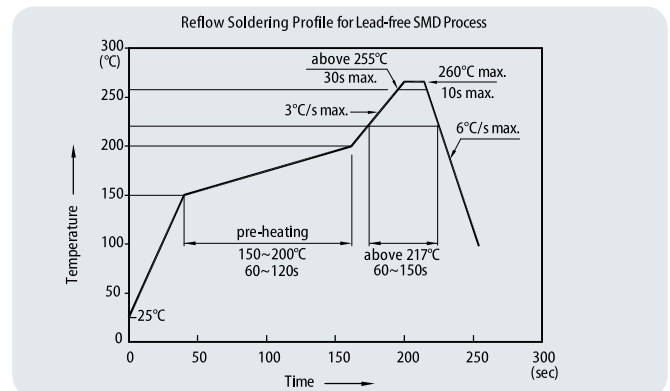
- Recommend pre-heat temperature of 105°C or less (as measured with a thermocouple attached to the LED pins) prior to immersion in the solder wave with a maximum solder bath temperature of 260°C.
- Peak wave soldering temperature between 245°C ~ 255°C for 3 sec (5 sec max).
- Do not apply stress to the epoxy resin while the temperature is above 85°C.
- Fixtures should not incur stress on the component when mounting and during soldering process.
- SAC 305 solder alloy is recommended.
- No more than one wave soldering pass.
- During wave soldering, the PCB top-surface temperature should be kept below 105°C.

2. Wave Soldering Profile With Pb-Sn Solder



Recommended Reflow Soldering Profiles For Kingbright SMD Products

1. Lead-Free Reflow Soldering Profile

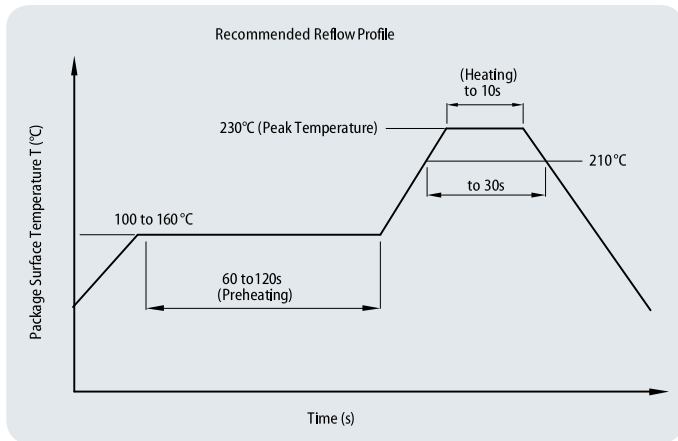


Notes:

- Don't cause stress to the LEDs while it is exposed to high temperature.
- The maximum number of reflow soldering passes is 2 times.

2. Reflow Soldering Profiles With Pb-Sn Solder

No more than two soldering passes with the recommended profile.



Static Electricity and Voltage Spikes in InGaN/GaN Products

InGaN/GaN products are sensitive to electrostatic discharge (ESD) and other transient voltage spikes. ESD and voltage spikes can affect the component's reliability, increase reverse current, and decrease forward voltage. This may result in reduced light intensity or cause component failure.

Kingbright InGaN/GaN products are stored in anti-static packaging for protection during transport and storage. Please note the anti-static measures below when handling Kingbright InGaN/GaN products.

Design Precautions

Products using InGaN/GaN components must incorporate protection circuitry to prevent ESD and voltage spikes from reaching the vulnerable component.

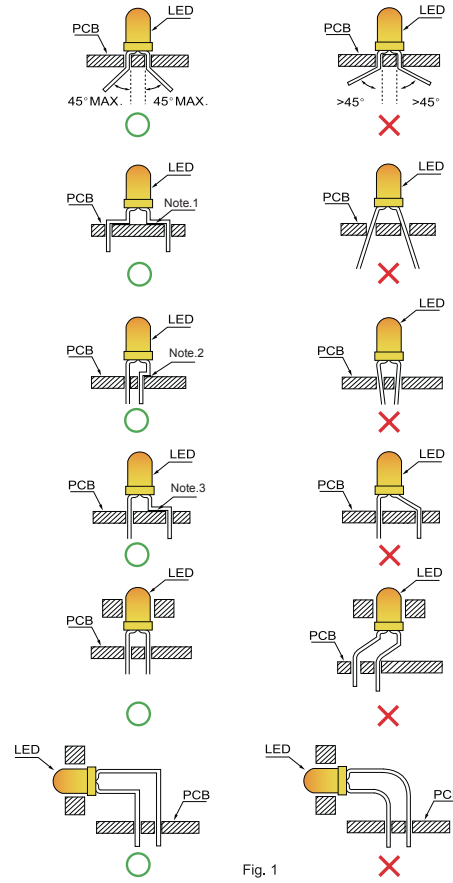
ESD Protection During Production

Static discharge can result when static-sensitive products come in contact with the operator or other conductors. The following procedures may decrease the possibility of ESD damage:

1. Minimize friction between the product and surroundings to avoid static buildup.
2. All manufacturing and testing equipment should be grounded.
3. All personnel in an ESD protected area should wear antistatic garments and wrist straps.
4. Set up ESD protection areas using grounded metal plating for component handling.
5. All workstations that handle IC and ESD-sensitive components must maintain an electrostatic potential of 150V or less.
6. Relative humidity levels maintained between 40% and 60% in production area are recommended to avoid the build-up of static electricity – Ref JEDEC/JESD625-A and JEDEC/J-STD-033.
7. Use anti-static packaging for transport and storage.
8. All anti-static equipment and procedures should be periodically inspected and evaluated for proper functionality.

LED Mounting Method

1. The lead pitch of the LED must match the pitch of the mounting holes on the PCB during component placement. Lead-forming may be required to insure the lead pitch matches the hole pitch. Refer to (Fig.1) for proper lead forming procedures.



“○” Correct mounting method “X” Incorrect mounting method

2. When soldering wires to the LED, each wire joint should be separately insulated with heat-shrink tube to prevent short-circuit contact. Do not bundle both wires in one heat shrink tube to avoid pinching the LED leads. Pinching stress on the LED leads may damage the internal structures and cause failure. (Fig.2)

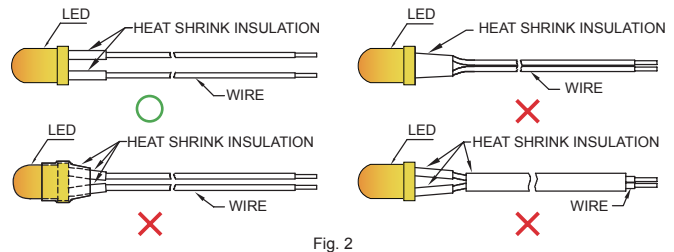


Fig. 2

3. Use stand-offs (Fig.3) or spacers (Fig.4) to securely position the LED above the PCB.

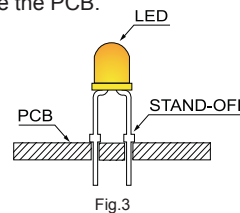


Fig.3

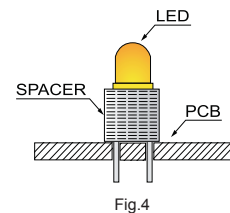


Fig.4

- Do not route PCB trace in the contact area between the leadframe and the PCB to prevent short-circuits.

Lead Forming Procedures

- Maintain a minimum of 3mm clearance between the base of the LED lens and the first lead bend. (Fig.5 and 6)

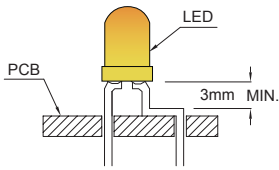


Fig. 5

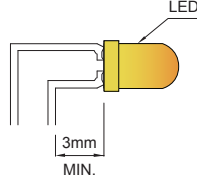


Fig. 6

- Lead forming or bending must be performed before soldering, never during or after soldering.
- Do not stress the LED lens during lead-forming in order to prevent fractures in the epoxy lens and damage the internal structures.
- During soldering, component covers and holders should leave clearance to avoid placing damaging stress on the LED during soldering. (Fig.7)

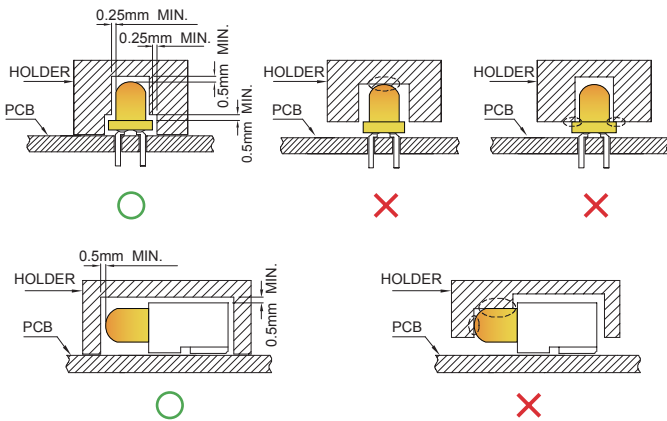


Fig. 7

- During lead forming, use tools or jigs to hold the leads securely so that the bending force will not be transmitted to the LED lens and its internal structures. Do not perform lead forming once the component has been mounted onto the PCB. (Fig.8)

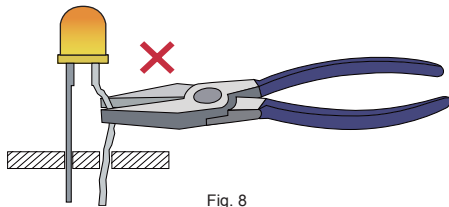


Fig. 8

- Do not bend the leads more than twice. (Fig.9)

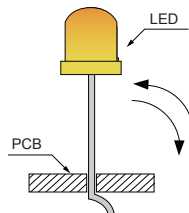


Fig. 9

- After soldering or other high-temperature assembly, allow the LED to cool down to 50°C before applying outside force (Fig.10). In general, avoid placing excess force on the LED to avoid damage. For any questions, please consult with Kingbright representative for proper handling procedures.

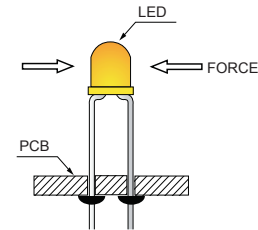


Fig. 10

Cleaning

For SMD and through-hole LEDs

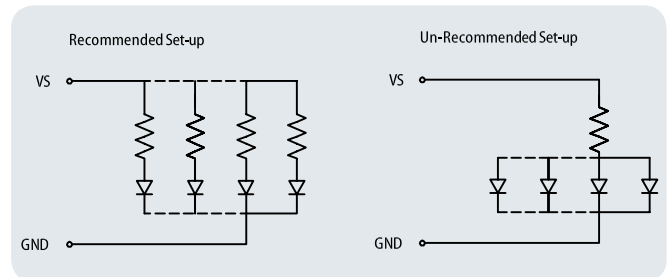
- Isopropyl alcohol or deionizer water are recommended for cleaning. Do not use acidic solvents or unknown chemicals, as they might cause corrosion or damage to the component.
- Lightly wipe away any surface contaminants, and allow the component to dry under room temperature before further usage. Do not soak the component in solution.

For LED Displays

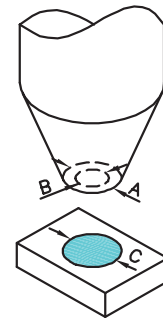
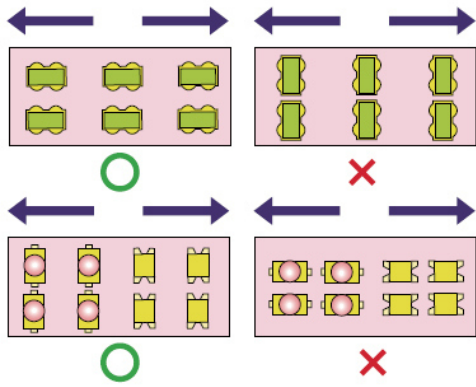
- The component should be washed with only water, and immediately dried by forced-air to remove excess moisture. Do not use harsh organic solvents because they might damage the plastic parts.
- The cleaning process should take place at room temperature and the component should not be washed for more than one minute.

Miscellaneous Design Notes

- Protective current-limiting resistors may be necessary to operate the LEDs within the specified range.
- LEDs mounted in parallel should each be placed in series with its own current-limiting resistor.

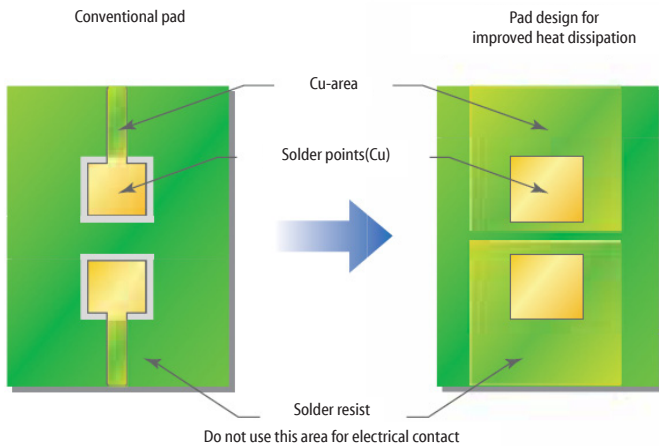


- The driving circuit should be designed to avoid reverse voltages and transient voltage spikes when the circuit is powered up or shut down.
- High temperatures can reduce device performance and reliability. Keep LED devices away from heat source for best performance.
- The safe operation current should be chosen after considering the maximum ambient temperature of the operating environment.
- During soldering, SMD components should be mounted such that the leads are placed perpendicular to the direction of PCB travel to ensure the solder on each lead melts simultaneously during reflow.



A is the outer diameter of the pick-up nozzle
 B is the inner diameter of the pick-up nozzle
 C is the diameter of lens

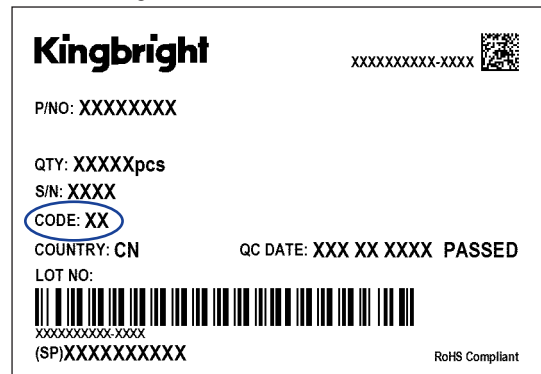
7. Optimal usage of high-power LED devices requires careful design by the end-user to optimize heat dissipation, such as increasing the size of the metal backing around the soldering pad. Refer to the product datasheet for specific design recommendations regarding heat dissipation.



Restrictions on Product Use

1. Not all devices and product families are available in every country.
2. The light output from UV, blue, white, and other high-power LEDs may cause injury to the human eye when viewed directly.
3. LED devices may contain gallium arsenide (GaAs) material. GaAs is harmful if ingested. GaAs dust and fumes are toxic. Do not break, cut, or pulverize LED devices. Do not dissolve LEDs in chemical solvents.
4. Semiconductor devices can fail or malfunction due to their sensitivity to electrical fluctuation and physical stress. It is the responsibility of the user to observe all safety standards when using Kingbright products, in order to avoid situations in which the malfunction or failure of a Kingbright product could cause injury, property damage, or the loss of human life. In developing designs, please insure that Kingbright products are used within specified operating conditions as set forth in the most recent product specification datasheet.
5. For LEDs with silicone encapsulation such as the KA and KT series, the outer diameter of the pick-up nozzle must be longer than that of the LED's light emitting area. i. e. $A > C$, and B shall be shorter than the width of the LED.

6. The size of the nozzle should be as large as possible if the tape is not involved.
7. The LEDs should not be exposed to an environment where high level of moisture or corrosive gases are present.
8. Prolonged reverse bias should be avoided, as it could cause metal migration, leading to an increase in leakage current or causing a short circuit.
9. Excess driving current and/or operating temperature higher than recommended conditions may result in severe light degradation or premature failure.
10. It is not recommended to assemble LEDs of different color or intensity bins together, as there may be perceivable color or intensity variation. Each bag contains parts from the same bin code. The bin code is printed on the bag's label as below.



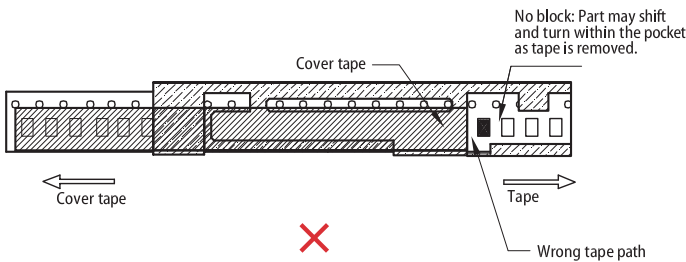
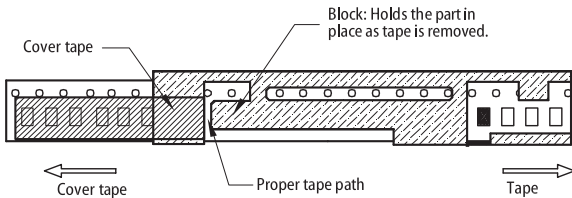
11. For the 1608 and 1005 series, an ESD ionizer should be used during SMT pick-and-place process to neutralize the charge and hence reduce electrostatic attraction.
12. Please do not apply stress directly to the LED during handling.
13. As silicone encapsulation is permeable to gases, some corrosive substances such as H_2S might corrode silver plating of leadframe. Special care should be taken if an LED with silicone encapsulation is to be used near such substances.
14. The LEDs should not be exposed to an environment where high level of moisture or corrosive gases are present.
15. Prolonged reverse bias should be avoided, as it could cause metal migration, leading to an increase in leakage current or causing a short circuit.

16. Choosing the right feeder for small SMD components:

16.1 When processing smaller SMD components (such as 0603, 1005, 1608, 1612, 1615, 2012), please use feeder with block to hold the part in place during cover tape removal, in order to prevent the component jumping or turning within the tape due to vibration or static cling.

16.2 Feeder without block is more suitable for larger size components (such as 3216, 3528).

16.3 Please insure the removed cover tape is properly threaded through the feeder as it is removed from the tape.



Storage Control For SMD Products

- Before a sealed moisture barrier bag (MBB) is opened, contained LEDs shall be kept in an environment with temperature below 40°C and humidity below 90% RH. MBB shall be kept sealed until LEDs contained in the bag are ready to be used. Once MBB is opened, it shall be stored in an environment with temperature range of 5°C~30°C and humidity below 60% RH.
- After the MBB has been opened, the LEDs should be used according to the floor life specified in the table below.

IPC/JEDEC J-STD-020 Moisture Sensitivity Levels

Level	Floor Life	
	Time	Conditions
1	Unlimited	≤30°C / 85% RH
2	1 year	≤30°C / 60% RH
2a	4 weeks	≤30°C / 60% RH
3	168 hours	≤30°C / 60% RH
4	72 hours	≤30°C / 60% RH
5	48 hours	≤30°C / 60% RH
5a	24 hours	≤30°C / 60% RH
6	Time on Label (TOL)	≤30°C / 60% RH

- If the Humidity Indicator Card (HIC)'s 10 % mark has changed, or the LEDs have not been used within the floor life specified, they should be baked with the following conditions to reset the floor life:

Type	Temperature	Humidity	Bake Time
When still in carrier tape	60±3°C	<5%RH	100H
When out of carrier tape	110°C	/	10H

* Not more than once

- Do not store LEDs in an environment where high humidity or acidic/basic chemicals are present, as they will degrade the LED's metallic surfaces.
- LED leadframe and soldering pads (cathode and anode) are plated with gold, tin, or other metals. Under long-term exposure to open air, the exposed pins and pads may become oxidized causing poor solderability. Therefore opened but unused parts must be stored in sealed containers. Suggest to store unused parts in the original moisture barrier bag.
- Moisture control for components already mounted on PCB: If the PCB will not undergo additional reflow soldering or high-temperature processes, then no special treatment is required for the mounted moisture-sensitive SMD components. If the PCB will undergo multiple reflow soldering or other high-temperature processes, including rework, then the SMD component's cumulative exposure time until the final high-temperature process must be controlled to within the specified time limit.

For Through-Hole Products

- Avoid continued exposure to the condensing moisture environment and keep the product away from rapid transitions in ambient temperature.
- LEDs should be stored with temperature ≤30°C and relative humidity < 60%.
- Product in the original sealed package is recommended to be assembled within 72 hours of opening. Product in opened package for more than a week should be baked for 30 (+10/-0) hours at 85 ~ 100°C.
- The LED leadframe surface is plated with silver. When the leadframe is stored under high-humidity environments, or exposed to certain chemical elements or gases, the surface may become discolored. Please maintain the cleanliness of the storage environment.
- If the storage conditions do not meet specification standards, the component pins may become oxidized requiring re-plating and re-sorting before use. Suggest customers consume LEDs as soon as possible, and avoid long-term storage of large inventories.