

STORAGE CONDITIONS

SMD devices are usually moisture/reflow sensitive. Moisture from atmospheric humidity enters permeable packaging materials by diffusion. Assembly processed used to solder SMD packages to PCBs expose the entire package body to temperature between 160° - 260°. During solder reflow, rapid moisture expansion can result in package cracking, delamination of critical interfaces within the package, or damaged gold wire.

1. Scope: Application notes listed in this document apply to SMD products include the AA, AP, AM, APK, and AT series.
2. Unopened moisture barrier bag (MBB) shall be stored at temperature below 40° with humidity below 90%RH.
3. After the MBB has been opened, the LEDs should be used according to the floor life specified in the table below.

LEVEL	FLOOR LIFE		LEVEL	FLOOR LIFE	
	TIME	CONDITIONS		TIME	CONDITIONS
1	Unlimited	≤ 30°C / 85% RH	4	72 hours	≤ 30°C / 60% RH
2	1 year	≤ 30°C / 60% RH	5	48 hours	≤ 30°C / 60% RH
2a	4 weeks	≤ 30°C / 60% RH	5a	24 hours	≤ 30°C / 60% RH
3	168 hours	≤ 30°C / 60% RH	6	Time on Label (TOL)	≤ 30°C / 60% RH

4. 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

Note : No more than once

5. 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.
6. 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.
7. 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.

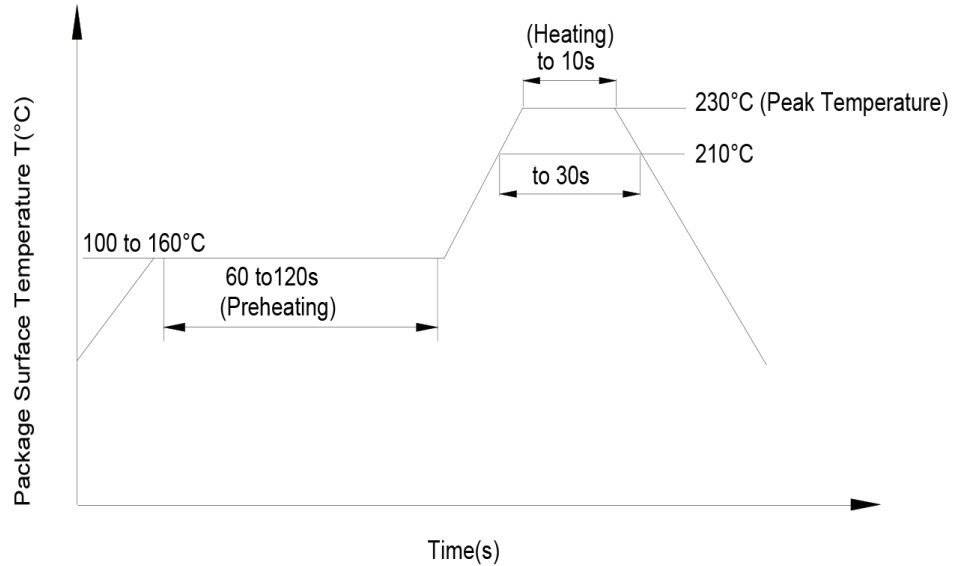
SOLDERING

1. Do not apply stress to the leads when the component is heated above 85°C, otherwise internal wire bonds may be damaged.
2. 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.
3. After soldering, allow at least three minutes for the component to cool to room temperature before further operations.

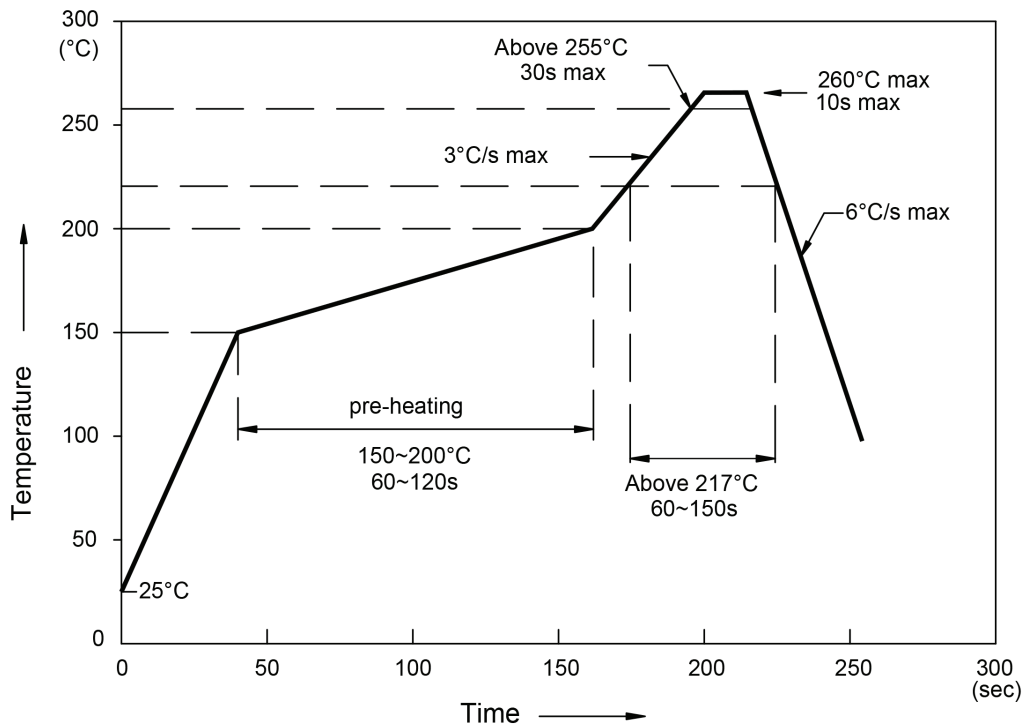
4. The SMD LED Iron Soldering (with 1.5mm Iron tip) condition:

SOLDERING IRON	SOLDERING TEMPERATURE	MAXIMUM SOLDERING TIME
1.5mm tip size	$\leq 350^{\circ}\text{C}$	3s

5. Soldering Profile with Pb-Sn Solder



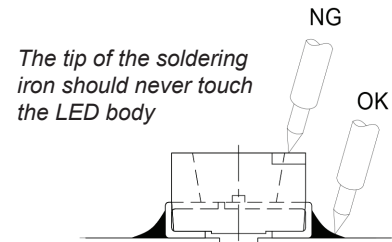
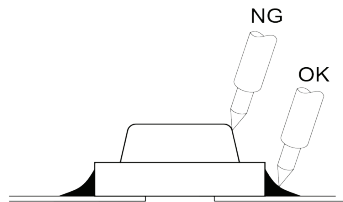
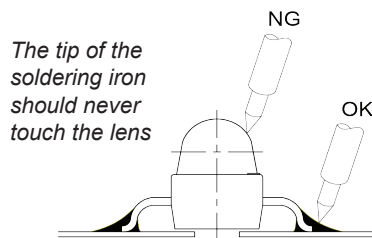
6. Lead-Free Soldering Profile



Note:

1. Don't cause stress to the LEDs while it is exposed to high temperature.
2. The maximum number of reflow soldering passes is 2 times.
3. Reflow soldering is recommended. Other soldering methods are not recommended as they might casuse damage to the product.

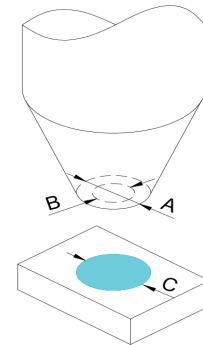
- If component soldering is to be performed more than twice, please consult with Kingbright for suggested conditions.
- Manual soldering is not recommended unless necessary such as when repair or rework is required.
- Soldering iron power shall not exceed 30 W. The recommended maximum temperature for lead and unlead soldering is 300°C and 350°C respectively. For blue (typical λ_d 465 nm), green (typical λ_d 525 nm), 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, and the iron should never touch the LED body.



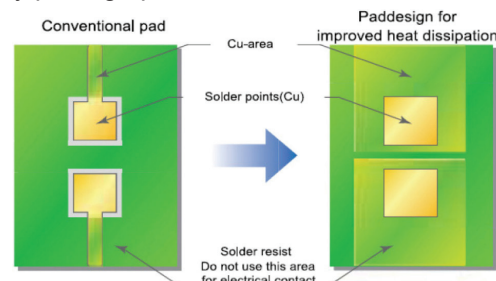
- For the rework of SMD LED without side surface leads, refer to QFN rework methods. Special attention should be made for proper thermal isolation of surrounding electronic components.

- For LEDs with silicone encapsulation such as the AA and AT 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.

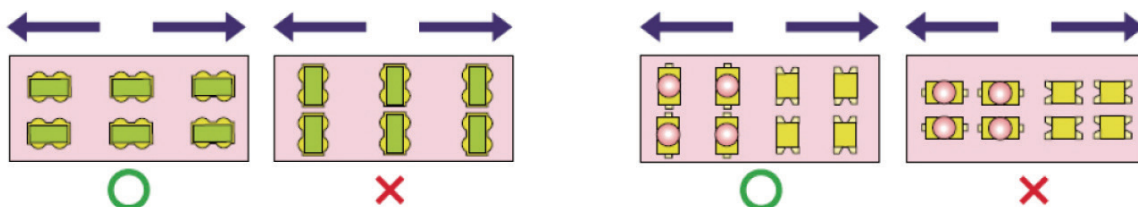
A is the outer diameter pick-up nozzle, B is the inner diameter of pick-up nozzle, and C is the light emitting area of LED



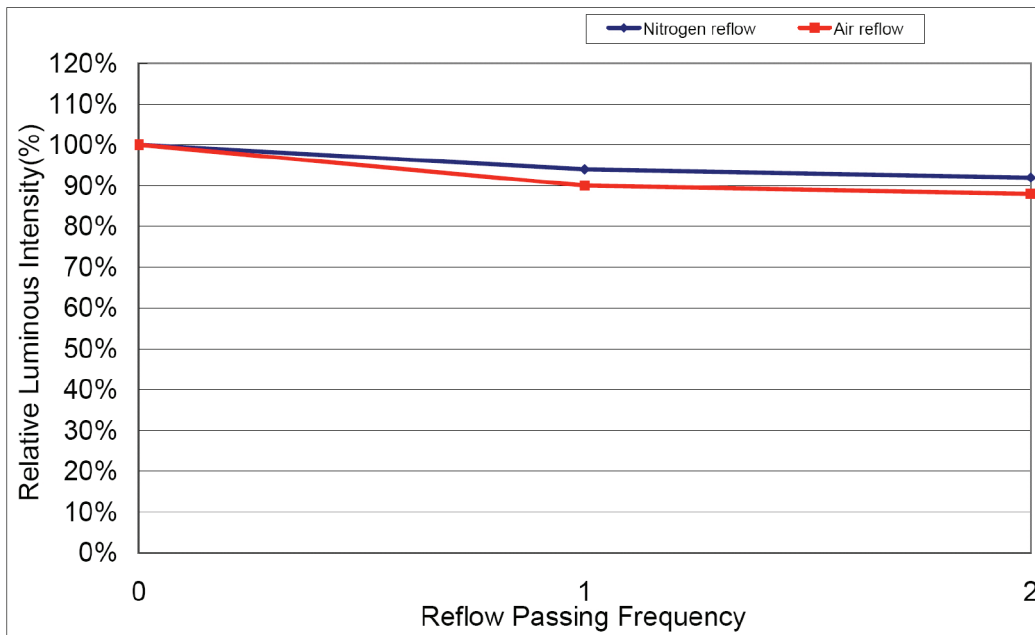
- There shall be no gap between the nozzle and the surface of the LED when picking up. It is recommended to use a soft nozzle to avoid damage caused by excessive stress. Slowing down the pick-up process may help if the nozzle is having difficulty picking up the LED.
- Optimal usage of high-power LED 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.



- During soldering, SMD components should be mounted such that the leads are placed perpendicular to the direction of PCB travel to insure the solder on each lead melts simultaneously during reflow.

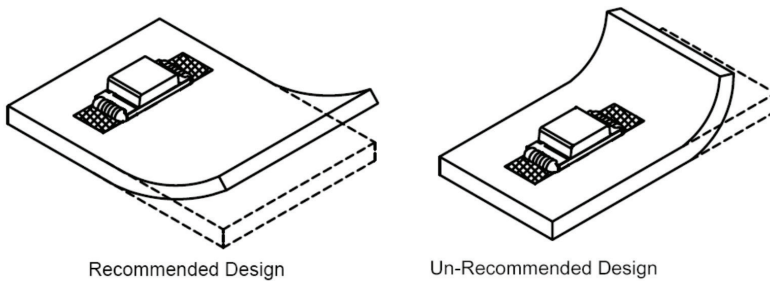


15. Nitrogen reflow soldering is recommended. Air reflow soldering condition can cause optical degradation under the influence of heat and atmosphere. The packaging resin is susceptible to discoloration because of its property change and oxidation under the influence of the heat during the reflow soldering process. Nitrogen reflow can prevent packaging resin discoloration from oxidation and prevent luminous flux decrease. Moreover, nitrogen reflow can prevent solder paste from oxidation, contributing to the improvement of solder wettability. The nitrogen concentration should be increased to approximately 1,000ppm during reflow.
16. Comparison of luminous intensity decrease between air reflow and nitrogen reflow:

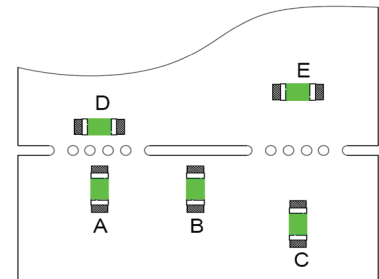


17. Notes for PCB singulation after soldering:

- a. When separating the soldered PCB into individual assemblies, the board may be subjected to bending tension that could damage the soldered LED components. Please reduce the bending or torsion stress on the board to protect the LED.



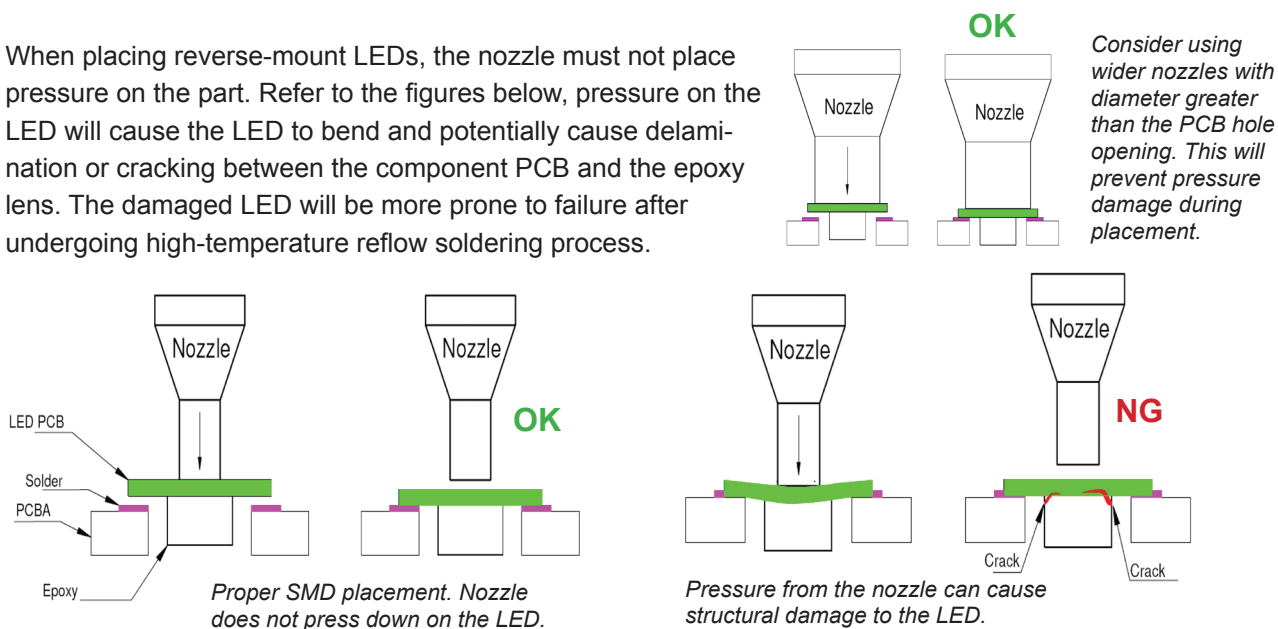
- b. The stress on the LED during PCB singulation depends on the position of the LED components on the board. Suggest placing the LEDs at the least stressful areas on the board.
- c. Suggest using dedicated jigs to singulate the PCB sheet into individual assemblies. Avoid singulation by hand.



Singulation Stress: A>B>C>D>E

18. For AP series top-firing LEDs, the solder paste should not exceed the thickness of the LED component PCB substrate to prevent excess solder paste from overflowing and seeping under the epoxy lenses, damaging the internal structures during reflow.

19. When placing reverse-mount LEDs, the nozzle must not place pressure on the part. Refer to the figures below, pressure on the LED will cause the LED to bend and potentially cause delamination or cracking between the component PCB and the epoxy lens. The damaged LED will be more prone to failure after undergoing high-temperature reflow soldering process.



CLEANING

1. Do not use acidic solvents or unknown chemicals to clean the component. Before using any cleaning solvent, check to insure the chemical composition will not corrode or damage epoxy resin, organosilicates, silicone resin, and silver plating, in order to prevent accidental damage or degraded function.
2. Typically we suggest ethanol for cleaning SMD LEDs. Lightly wipe away any surface contaminants and avoid excessive force that might damage the lens surface or internal structures. Allow to dry under room temperature conditions before further usage. Do not soak the SMD LED in ethanol or other solutions.

DESIGN PRECAUTIONS

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

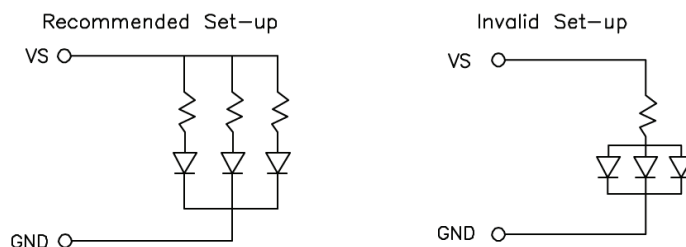
ELECTROSTATIC DISCHARGE PROTECTION

SMD products are electrostatic discharge (ESD) sensitive. Common symptoms observed in an ESD damaged device include unusual forward voltage and reverse current measurements. To prevent devices from being damaged by ESD, please adhere to the advices listed below.

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.

CIRCUIT DESIGN NOTES

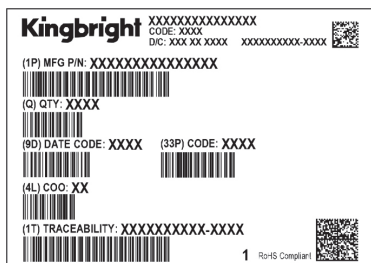
1. Protective current-limiting resistors may be necessary to operate the LEDs within the specified range, otherwise slight voltage shifts will create large current surge and cause burn out failure.
2. LEDs mounted in parallel should each be placed in series with its own current-limiting resistor.



3. The driving circuit should be designed to avoid reverse voltages and transient voltage spikes when the circuit is powered up or shut down.
4. High temperatures can reduce device performance and reliability. Keep LED devices away from heat sources for best performance.
5. It is recommended to operate the LED at the binning current (typ. 20mA) to minimize visible difference in chromaticity and intensity. If the LEDs are to be driven at low current levels (e.g. 2mA), please consult with Kingbright for appropriate design.
6. Excess driving current and/or operating temperature higher than recommended conditions may result in severe light degradation or premature failure.

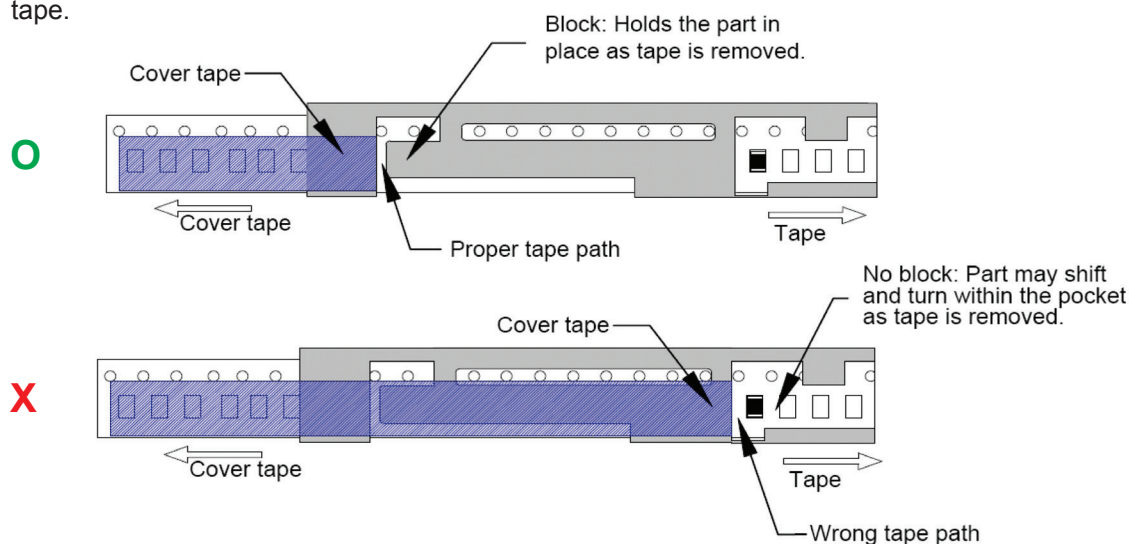
RESTRICTIONS ON PRODUCT USE

1. If a reverse bias continuously applied to the products, such operation can cause migration resulting in LED damage.
2. The information contained within this document is subject to change without notice. Before referencing this document, please confirm that it is the most current version available.
3. Not all devices and product families are available in every country.
4. The light output from UV, blue, white, and other high-power LEDs may cause injury to the human eye when viewed directly.
5. 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.
6. 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.
- 7.



Mixing bins is not recommended as it could result in visible difference in chromaticity or intensity (Bin code is printed on the label as shown left).

8. 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.
9. Please do not apply stress directly to the LED during handling.
10. As silicone encapsulation is permeable to gases, some corrosive substances such as H₂S might corrode silver plating of leadframe. Special care should be taken if an LED with silicone encapsulation is to be used near such substances.
11. The LEDs should not be exposed to an environment where high level of moisture or corrosive gases are present.
12. Prolonged reverse bias should be avoided, as it could cause metal migration, leading to an increase in leakage current or causing a short circuit.
13. Choosing the right feeder for small SMD components:
 - (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.
 - (2) Feeder without block is more suitable for larger size components (such as 3216, 3528).
 - (3) Please insure the removed cover tape is properly threaded through the feeder as it is removed from the tape.



14. The tape feeding parameters should be optimized depending on the LED shape. Flat-lens LEDs can be picked up at high speed; on the other hand, LEDs with shaped lenses cannot be picked up at high speed. The center of gravity of LEDs domed lenses is located higher. Moreover, the lenses may adhere to the top cover tape. When LEDs with domed lenses are fed and picked up at excessive high speed, they may become tilted within the tape cavities or adhere to the cover tape and fall out during the pickup process.

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1. The information included in this document reflects representative usage scenarios and is intended for technical reference only.
2. The part number, type, and specifications mentioned in this document are subject to future change and improvement without notice. Before production usage customer should refer to the latest datasheet for the updated specifications.
3. When using the products referenced in this document, please make sure the product is being operated within the environmental and electrical limits specified in the datasheet. If customer usage exceeds the specified limits, Kingbright will not be responsible for any subsequent issues.

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