Light Emitting Diode

Handling Precautions of LED Products

Contents

(SE-AP00001B)
Dec. 11, 2014

1. Introduction

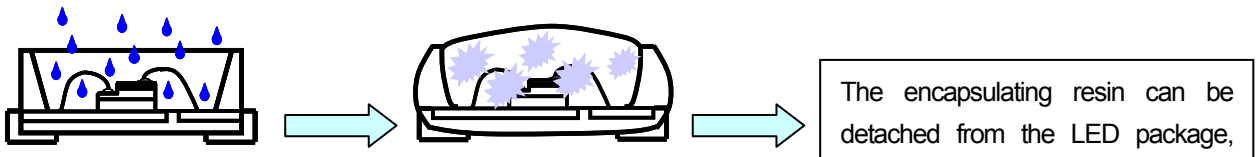
This document provides information about the handling precautions of Nichia LEDs.

2. Storage

Condition		Temperature	Humidity	Time
Storage	Before Opening Aluminum Bag	≤30°C	≤90%RH	Within 1 year from Delivery Date
	After Opening Aluminum Bag	≤30°C	≤70%RH	≤168 hours
Baking		65±5°C	-	≤24 hours

- After opening the moisture-proof aluminum bag, the soldering process should be completed within the time frame mentioned above. Unused remaining LEDs should be stored with desiccants (silica gel) in a hermetically sealed container, preferably in the original moisture-proof bag for storage.
- Upon the expiration of the "Period after Opening Aluminum Bag" or when the silica gel desiccants are no longer blue, the LEDs should be baked. The baking shall be done only once.
- When moisture absorbed in the LED package vaporizes and expands due to the heat generated during the soldering process, the encapsulating resin can be detached from the LED package, resulting in degradation of the optical characteristics.

  To minimize moisture absorption into the products during transportation and storage, the products are packed in a moisture-proof aluminum bag.



Moisture absorption into the LED package

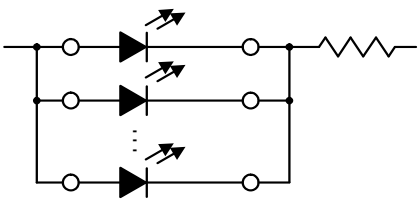
Moisture evaporation/expansion caused by soldering heat

The encapsulating resin can be detached from the LED package, resulting in degradation of the optical characteristics.

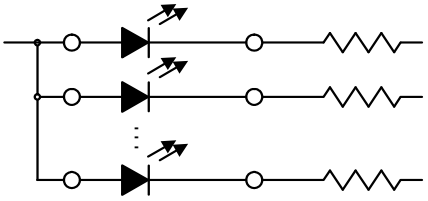
- Keep the LEDs in a hermetically sealed container during storage. When exposed to the atmosphere containing corrosive gas and the like, the property of the plated metal surface can be changed, affecting the solderability and the optical characteristics.
- Refrain from using the materials containing sulfur for gasket, adhesive agents, and so on to avoid the adverse effects on the plating surface.
- A slight amount of corrosive gas can be contained in the articles such as cardboard and rubber, and even in the air. Also, halogen substances, which affect the plating surface, can be contained in the constituents of resin.
- Even after the LEDs are mounted on the board and/or installed in a finished product, the plating surface can be affected by the gas which is volatilized from the surrounding materials or which penetrates into the assembly. Customers should take care in designing the product.
- We recommend that silicone rubber should be used for gasket. Customers should take care not to cause connection failure because of deposited low-molecular siloxane.
- The LEDs must be stored in an environment without significant temperature changes to avoid condensation.

3. Directions for use

- Customers should design the circuit to ensure that each LED is operated within the absolute maximum rating. We recommend that each LED should be operated with a constant current.
- When driving LEDs with a constant voltage, it is recommended to use circuit B. In circuit A, the electrical current through the LEDs may vary due to the variation in the forward voltage applied to each LED.



(A) Not Recommended



(B) Recommended

- Use the LEDs at the forward current. Moreover, design the circuit to ensure that no voltage is applied to the LEDs in the forward/reverse directions while they are turned off. Continuous reverse voltage can cause migration and damage to LED dice.
- It is recommended to operate the LEDs at 10% or more of the rated electric current to stabilize the LEDs' characteristics.
- For outdoor use, take necessary measures to avoid water/moisture/salt damage.

4. Handling Precautions

- When handling the product, do not touch the LED with bare hands, since it may contaminate the emitting surface and may affect the optical characteristics. Excessive force on the LED may result in the deformation and/or wire breakage, leading to no light emission.
- When dropped, the LED might be deformed and damaged.

- When using tweezers, prevent excessive stress from being applied to the LEDs; otherwise, the resin surfaces might be damaged, chipped, detached from the packages and the LED packages might be deformed. What is worse, the bonding wires might break up, resulting in no light emission.
  If necessary, pick up by the package so as not to touch the encapsulating resin surface.

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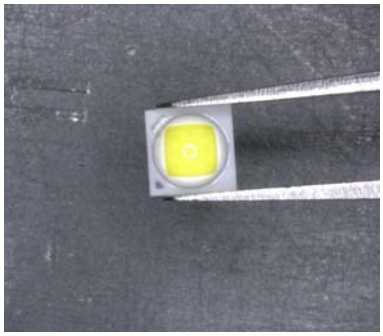

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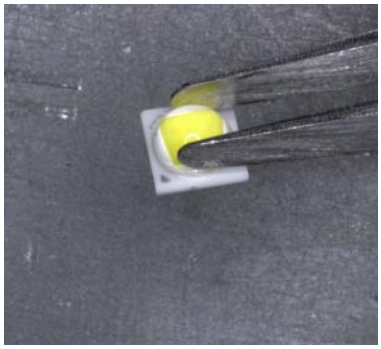

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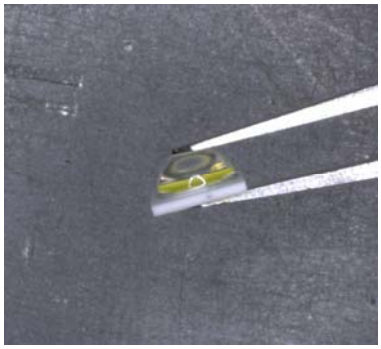

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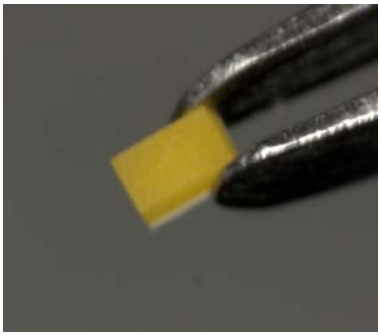

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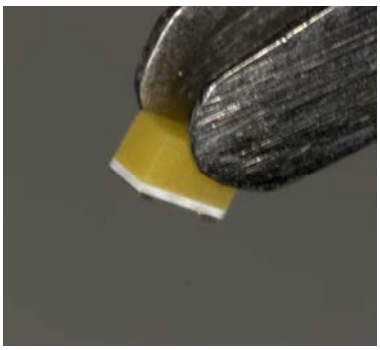

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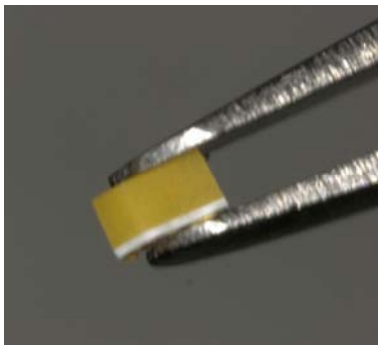
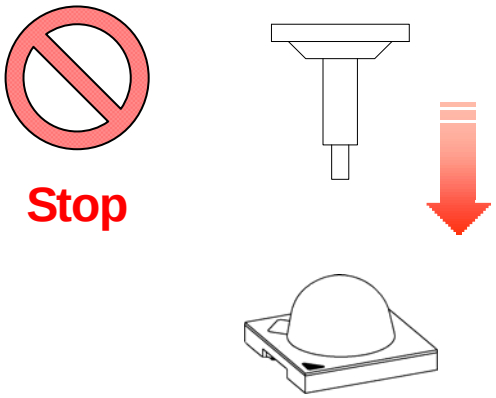
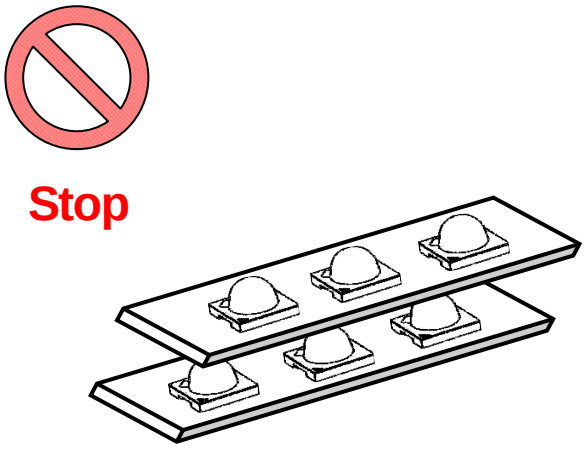


- When the encapsulant contains silicone resin, the emitting surface is relatively soft; it can be damaged, chipped, and detached from the package due to excessive force and the LED package can be deformed. What is worse, the bonding wire can break up, resulting in degradation of the reliability performance. Customers should take care not to apply stress to the emitting surface.
  When you use an automatic assembly machine, select the pick-and-place nozzle not to damage the encapsulating resin.

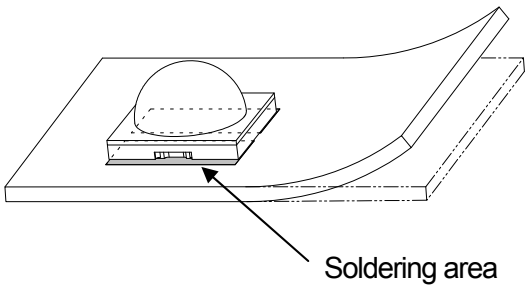


- If a pick-and-place nozzle has a smaller diameter than the LED's emitting surface, it can damage the emitting surface when collecting the LED, resulting in its emission failure. The suitable nozzle should be installed into the assembly machine. Nichia recommends the specific pick-and-place nozzles for some of our products. Customers are requested to refer to Nichia's specifications for the details.
- The LEDs' placing location can vary, when the rotary head mounting machine is used. Customers should evaluate the mounting performance in advance.
- Do not stack assembled PCBs together. Otherwise, the board can damage the resin of the LEDs underneath, resulting in chipping, detachment, deformation, wire breakage, and LED detachment. Consequently, the LED fails to emit light.

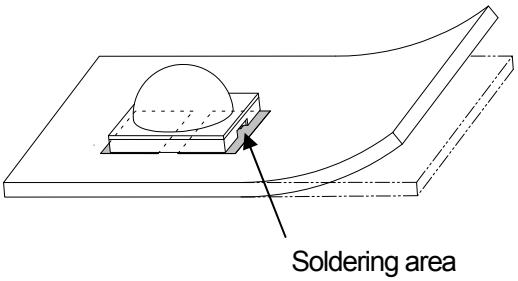


5. Design Precautions

- When bending stress is applied to the board with LEDs solder-mounted on, the LED packages can get cracked. Attach the LEDs to the board where they are less exposed to bending/twisting stress.

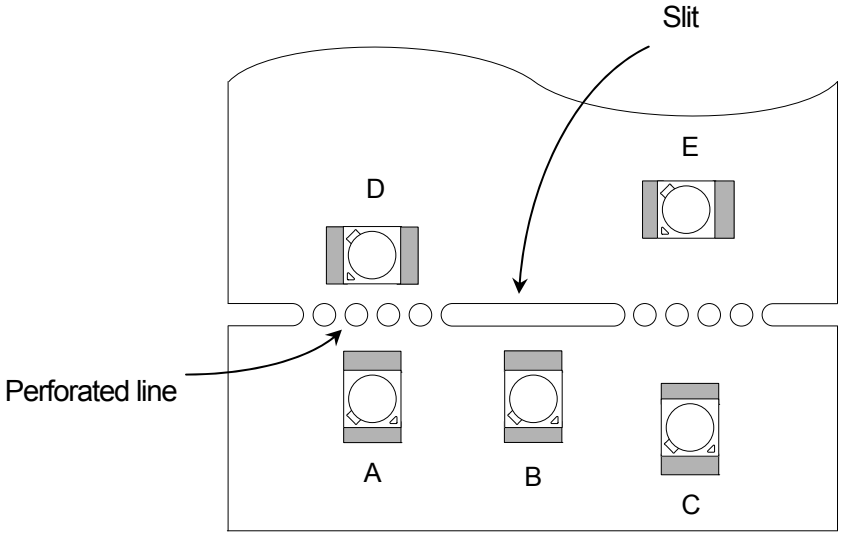


(A) Recommended



Not good.

- Around the separation area of the board, the degree of mechanical stress applied to the LEDs depends on the LED mounting location. The LEDs should be attached where the least stress is applied to them.



Stress: A>B>C>D>E

- The board should not be separated by hand but with the specified tool/machine.
- The solder can get cracked due to thermal stress during usage. Customers should verify the aluminum board in advance.
- Some volatile organic compounds (VOCs) emitted from the materials (housing, gasket, adhesive agent, secondary lens, lens cover, etc.) used surrounding the LEDs can permeate the lens and the encapsulating resin. In a closed assembly, in particular, the VOCs get discolored, when exposed to the thermal/optical energy. Consequently, the light output can be significantly decreased and/or the chromaticity can shift. In such cases, when the environment is opened, the symptoms can disappear. Customers should evaluate the optical performance of the LED-assembled product, if the LED is operated within a closed assembly.

6. Electrostatic Discharge (ESD)

- LED products are sensitive to static electricity or surge voltage. ESD can damage LED dice, resulting in degradation of the reliability performance.
  When handling the LED products, necessary precautions should be taken including the following:
  - To eliminate static charge by using wrist straps, conductive garment/shoes/floor mats, etc.
  - To eliminate static charge by grounding machines and tools in workplaces,
  - To set work bench, stocks, floors made from conductive materials.
- Customers should protect the machines, tools, and devices against surge voltage by grounding them.
- Customers should take necessary measures when using insulating materials such as glass and plastic for the tools and machines. For example,
  - To dissipate static charge with conductive materials
  - To prevent static buildup by humidification
  - To neutralize electric charge with ionizers
- During the characteristics measurement of the LED-assembled product, customers are advised to confirm whether the LEDs are damaged by ESD. The damaged LEDs can be detected by measuring the forward voltage when low electrical current (1 mA or less; recommended) is applied to them.
  The turn-on voltage in the forward direction will be decreased in the ESD-damaged LEDs.
  The criterion should be: V_F<2.0V at I_F=0.5mA
  The above criterion is for typical LED models. It will vary depending on specific LED models. Customers should refer to the specifications for the criterion.

7. Thermal Management

- Proper thermal management is necessary when using LED products. Temperature elevation of the LED die varies depending on the board's heat resistance and the LEDs' pitch.
  Customers should design the LED products with a good heat dissipation system so as not to exceed the maximum junction temperature (Tj max) due to the surrounding conditions.
- The drive current should be determined based on the ambient temperature (Ta) to design the heat dissipation performance of the LED products.

8. Cleaning

- Do not clean the LEDs with a wet cloth, benzin, thinner, etc.
- Isopropyl alcohol (IPA) should be used if cleaning is required. Other cleaning agents may affect the LED package and resin, resulting in failure. Customers should evaluate them prior to use. Please be advised that the use of fluorocarbon solvent is strictly regulated worldwide.
- Customers should take care not to damage the resin when wiping the dirt off the emitting surfaces.
- Refrain from ultrasonic cleaning. If necessary, customers should confirm whether ultrasonic cleaning will affect the LEDs installed in the final product, since the LEDs can be affected depending on the ultrasonic power and the board installation method.

9. Eye Safety

- Staring at the LEDs may cause injury to human eyes, when the light output is increased or when the light is collected with optical devices.
- Staring at the flashing light may cause a feeling of discomfort due to the optical stimulation. When installing the LEDs into the fixture, the optical stimulation should be taken into consideration.
- In 2006, the International Electrical Commission (IEC) published IEC 62471:2006 Photobiological safety of lamps and lamp systems, which added LEDs in its scope. On the other hand, the IEC 60825-1:2007 laser safety standard removed LEDs from its scope, although they had been covered by the standard issued in 2001. However, please be advised that some countries and regions have adopted standards based on the IEC laser safety standard IEC 60825-1: Edition 1.2, which included LEDs in its scope.
  In IEC 62471, LEDs are classified into some risk groups according to the radiant flux, emission spectrum, directivity patterns, etc. High power LEDs which emit light containing blue wavelengths may be classified into Risk Group 2.

10. Others

- The LEDs described in this application note are intended to be used for ordinary electronic equipments such as office/communication equipments, measurement devices, and household appliances. Please consult Nichia Sales staff in advance for information on the applications in which exceptional quality and reliability performance are required, in particular when the failure or malfunction may jeopardize lives and pose health hazards to humans (e.g. airplanes, aerospace, submersible repeaters, nuclear reactor control systems, traffic control equipments, burning appliances, life support systems, and safety devices.)
- Customers shall not reverse engineer, disassemble, or analyze the LEDs prior to having a written consent from Nichia. When defective LEDs are found, customers are required to directly inform Nichia before disassembling or analyzing them.
- The products' appearances and specifications may be modified for improvement without notice.
- Nichia's website contains general information described by the LEDs' specifications.
  Make sure to obtain the latest specifications and to confirm the contents before using the LEDs.