

## Handling Precautions of LED Products

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## 1. Introduction

This document contains handling precautions of LEDs made by Nichia Corporation.

## 2. Storage

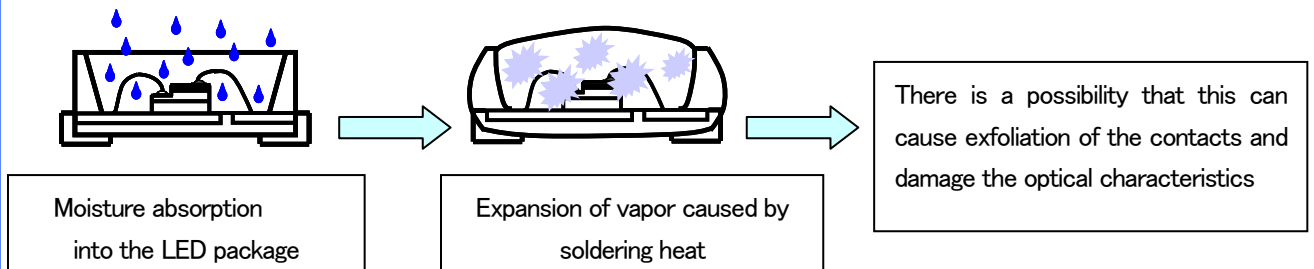
| Condition |                             | Temperature                | Humidity              | Time                             |
|-----------|-----------------------------|----------------------------|-----------------------|----------------------------------|
| Storage   | Before Opening Aluminum Bag | $\leq 30^{\circ}\text{C}$  | $\leq 90\% \text{RH}$ | Within 1 year from Delivery Date |
|           | After Opening Aluminum Bag  | $\leq 30^{\circ}\text{C}$  | $\leq 70\% \text{RH}$ | $\leq 168$ hours                 |
| Baking    |                             | $65 \pm 5^{\circ}\text{C}$ | -                     | $\leq 24$ hours                  |

● After opening the moisture-proof aluminum bag, the soldering process should be completed within the time frame mentioned above. If unused LEDs remain, they should be stored with desiccants (silica gel) in a hermetically sealed container. Nichia recommends using the original moisture-proof bag for storage.

● If past the "After Opening Aluminum Bag" time period specified above, or if the moisture desiccants (silica gel) are no longer blue, the products need to be baked. Note: Baking must only be done once.

● Interface delamination can occur due to vaporization and expansion of absorbed moisture in the LED packages caused by soldering heat, which may result in degradation of optical performance.

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



● Customers are advised to keep the LEDs in an airtight container when not in use. Exposure to a corrosive gas environment may cause the plated metal parts of the product to tarnish, which may lead to difficulties in soldering and/or adverse effects on optical characteristics. It is also recommended to return the LEDs to the original moisture-proof bag and reseal the moisture proof bag.

● Please do not use products (gasket, adhesive, etc...) that contain sulfur with the LED to avoid adverse effects on the metal plated parts of the LED.

● Very small amounts of corrosive gas may be included in corrugated cardboard, rubber and the atmosphere. Resin materials may also contain halogen which can affect the metal plating of the LED.

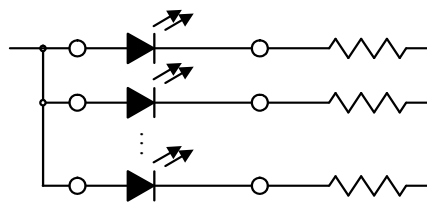
● After assembly and/or during use, the metal plating can be affected by the corrosive gases entering into the product from the external atmosphere, and gases emitted by the components and materials in close proximity of the LEDs. The above should be considered when designing.

This sheet contains tentative information, we may change contents without notice.

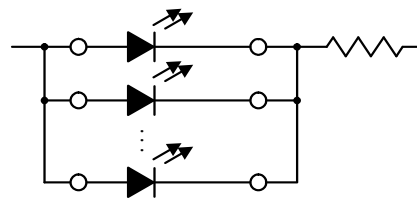
- Gasket/caulking made from silicone rubber material is recommended.  
In this case, please be careful of solder connection difficulties due to the low molecular weight of the siloxane in other silicone products.
- Condensation can occur in locations where there are rapid changes in ambient temperature. Please store the LEDs in a location where the temperature is stable.

### 3. Directions for use

- In designing a circuit, the current through each LED must not exceed the absolute maximum ratings specified for each LED. It is recommended to drive each LED with a constant current.
- When driving LEDs with a constant voltage, it is recommended to use circuit A.  
(※In circuit B, the current through the LEDs may vary due to the variation in forward voltage of the LEDs.)



(A) Recommended

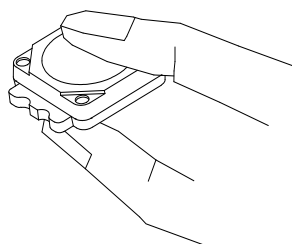


(B) Not Recommended

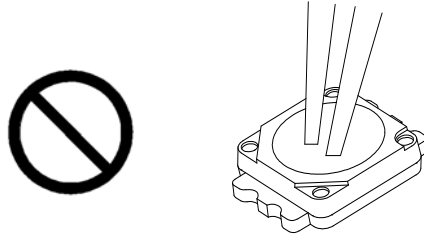
- The LEDs should be operated with forward bias. The driving circuit must be designed so that the LEDs are not subjected to forward or reverse voltage while it is off. If reverse voltage is continuously applied to the LEDs, It may cause migration resulting in LED damage.
- For stabilizing the LED characteristics, it is recommended to operate at 10% of the rated current or higher
- For outdoor use, necessary measures should be taken to prevent water, moisture and salt air damage.

### 4. Handling Precautions

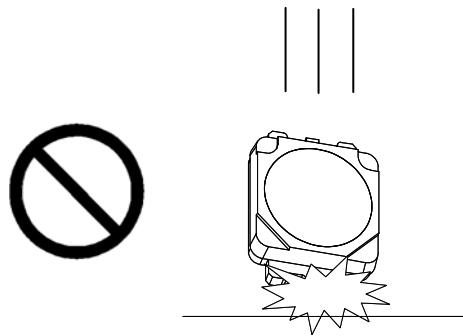
- When handling the product, do not touch with bare hands as since it may contaminate the surface and may affect the optical characteristics.  
Excessive force on the LED may cause the product to deform and die/wire bonds to break, which will cause the LEDs not to illuminate.



- When handling the product with tweezers, make sure that excessive force is not applied to the resin portion of the product. Failure to comply may cause the resin to be cut, chipped, delaminated, deformed, and die/wire bonds to break, which will cause the LEDs not to illuminate.



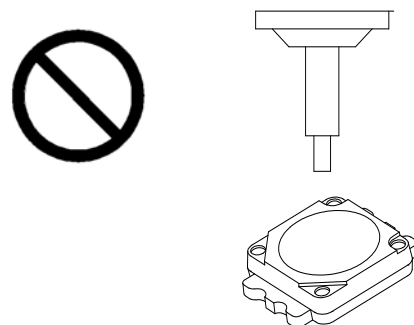
- If the product is dropped, it may cause damage.



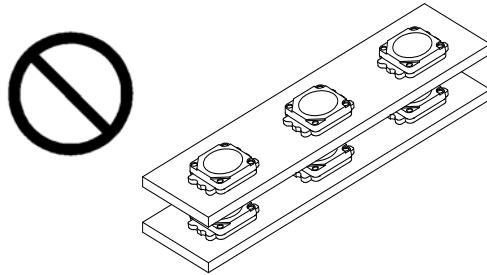
- When using a pick and place machine, please make sure that the nozzle does not come in contact with the encapsulating resin.

- If the nozzle does contact the resin directly, the resin may deform and it also may cause the wire bonds to break which will cause the LEDs not to illuminate.

When using a nozzle that rotates, please confirm that there are no misplacements on the board.



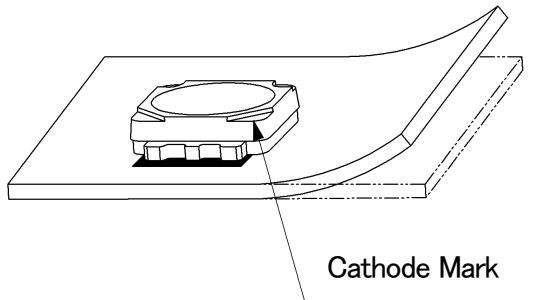
- Do not stack assembled PCBs together. Failure to comply may cause the resin portion of the product to be cut, chipped, delaminated, deformed, and/or the die/wire bonds to break, which will cause the LEDs not to illuminate.



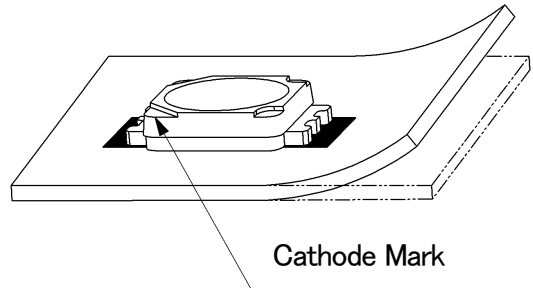
## 5. Design Precautions

- Bending the PCB after mounting the LEDs can cause the LED package to break.

The LEDs should be placed in a position where it would minimize the stress from bending and twisting.

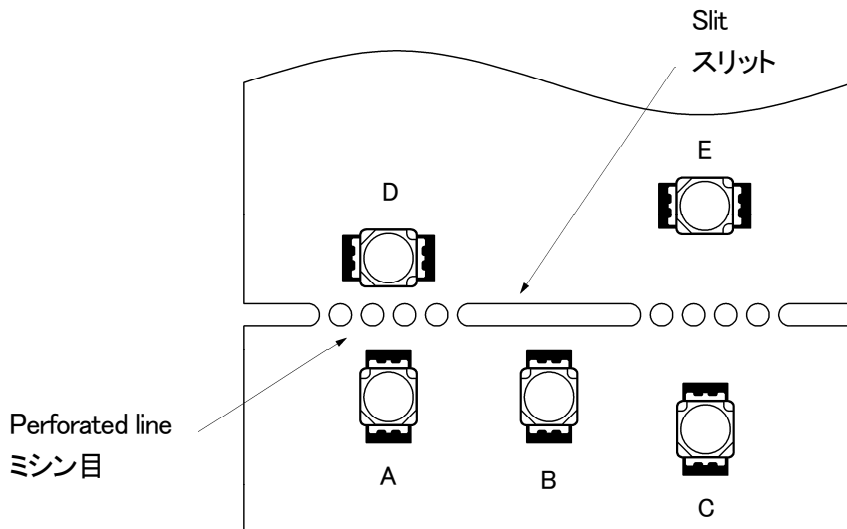


(A) Preferable



(B) Non-preferable

- The position and orientation of the LEDs affect how much mechanical stress is exerted on the LEDs placed near the perforation lines. The LEDs should be placed in a way to minimize the stress on the LEDs when bending the board.



Stress A > B > C > D > E

- Please separate boards with special jigs instead of using hands.

## 6. Electrostatic Discharge (ESD)

- Products are sensitive to static electricity or surge voltage. ESD can damage a die and its reliability.

When handling products, using ESD precautions are strongly recommended, including:

- Eliminating static charge
- Grounded wriststrap, ESD footwear, clothes, and floors
- Grounded workstation equipment and tools
- ESD table/shelf mat made of conductive materials

- Proper grounding is required for all devices, equipment, and machinery used in product assembly. Surge protection should be designed for commercial products.

- Tools or equipment with insulating materials such as glass or plastic should use proper measures against ESD, such as:

- Dissipating static charge with conductive materials
- Preventing charge generation with moisture
- Neutralizing the charge with ionizers

- When evaluating performance characteristics of LEDs in the product's application, please check whether the LEDs have been damaged by ESD. This can be checked by testing forward voltage or lighting it up at low current.

- ESD damaged LEDs may have current flow at low voltage or no light at low current.

Failure criteria:  $V_F < 2.0V$  at  $I_F = 0.5mA$

※ The above-mentioned failing judgment standard is a typical value, and it might be different according to the products. Please make sure to ask for and obtain the specifications and confirm the contents separately.

## 7. Thermal Management

- Proper thermal management is important when designing LED products. LED chip temperatures are affected by PCB thermal resistance and LED spacing on the board.

- Please design products so that LED chip temperatures do not exceed the maximum Junction Temperature. Ambient temperature ( $T_a$ ) or solder point temperature ( $T_s$ ) should be used to choose appropriate drive current to dissipate heat from the product.

## 8. Cleaning

- Isopropyl alcohol (IPA) should be used if cleaning is required. Other solvents may cause LEDs to prematurely fail due to the damage to the resin portion. Effects of other solvents should be verified prior to use. Please be advised that the use of CFCs such as Freon is strictly regulated.

- Ultrasonic cleaning is not recommended since it may have adverse effects on the LED. If ultrasonic cleaning must be used, a pre-test should be done before cleaning, to confirm whether any damage to the LEDs will occur.

## 9. Eye Safety

- Please proceed with caution when viewing directly any LEDs driven at high current, or viewing LEDs with optical instruments which may greatly increase damage to the eyes.
- When incorporating the LED into a product, please be careful to avoid adverse effects on the human body caused by light stimulation.
- 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. However, please be advised that some countries and regions have adopted standards based on the IEC laser safety standard IEC 60825-1:2011, which still includes LEDs in its scope. Most of Nichia's LEDs can be classified as belonging into either the Exempt Group or Risk Group 1. High-power LEDs, that emit light containing blue wavelengths, may be classified as Risk Group 2.

## 10. Others

- The LEDs described in this application note are intended to be used for standard electronic equipments that do not affect the health or a life of a person when the LEDs fail. (e.g. office, communication, measurement, and household commodities.) Please consult with Nichia Sales in advance for information on the applications that can affect the health or a life of a person when the LEDs fail. (e.g. airplanes, aerospace, submersible repeaters, nuclear reactor control system, automobiles, traffic control equipment, life support systems, and safety devices.)
- The customer shall not reverse engineer, disassemble, or analyze the LEDs prior to having a written consent from Nichia. When defective LEDs are found, the customer shall inform Nichia directly before disassembling or analyzing.
- Customer specific specifications must be signed by both parties before volume production begins.
- The appearance and specifications of the product may be modified for improvement without notice.
- Nichia's website contains general information taken from the LED specifications.  
Please make sure to obtain the latest specification document and confirm the contents before using the LED..