Assembly Precautions for the Nichia 385 Series LEDs

Table of contents

1. LED Outline Dimensions/Tape and Reel Dimensions · · · · · · · · 2
2. Handling Precautions · · · · · · · · · · · · · · · · · · · 3
3. Design Recommendations for Optimal Amount of Solder · · · · · 4
4. Precautions for Setting Up a Pick-and-Place Machine/Nozzle · · · 5-8
5. Precautions When Reflow Soldering · · · · · · · · · · · · · 8
6. Verification of the Self-Alignment Capability and Tilting · · · · · · 9

The part number NF2W385AR-V2, NF2W385AR-V3 in this document are the part number of our product, and do not have any relevance or similarity to other companies' products that may have trademark rights.

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1. LED Outline Dimensions/Tape and Reel Dimensions

Table 1. NF2W385AR-V2, NF2W385AR-V3 Product Specifications

LED Outline Dimensions	Tape and Reel Dimensions
光学的中心位置 Location of the optical center 保護素子 Protection Device ダイヒートシンク Die Heat Sink Cathode / Anode Weight：typ. 0.038g (Unit : mm, Tolerance : ±0.2mm)	テーピング部 Tape Cathode Mark リール部 Reel ラベル Label Reel Size: 3,500 LEDs (Unit : mm)

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2. Handling Precautions

2.1 Handling with bare hands

Do not handle the LEDs with bare hands:

- this may contaminate the LED surface and have an effect on the optical characteristics,
- this may cause the LED to deform and/or the wire to break causing a catastrophic failure (i.e. the LED not to illuminate),
- the lead frame may cause injuries when the LED is handled with bare hands.

2.2 Handling with tweezers

Ensure that when handling the LEDs with tweezers, excessive force is not applied to the LED. Otherwise, it may cause damage to the resin (e.g. cut, scratch, chip, crack, delamination and deformation) and the wire to break causing a catastrophic failure (i.e. the LED not to illuminate).

2.3 ESD Precautions

The LEDs are sensitive to transient excessive voltages (e.g. ESD, lightning surge). If this excessive voltage occurs in the circuit, it may cause the LED to be damaged causing issues (e.g. the LED to become dimmer or not to illuminate [i.e. catastrophic failure]). When handling the LEDs, ensure that necessary measures have been taken to protect them from transient excess voltages. Refer to the applicable specification for more details.

2.4 Stacking assembled PCBs together

Do not stack assembled PCBs together. Otherwise, it may cause damage to the resin (e.g. cut, scratch, chip, crack, delamination and deformation) and the wire to break causing a catastrophic failure (i.e. the LED not to illuminate).

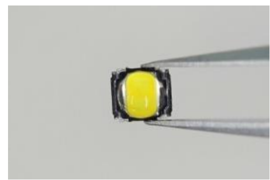
2.5 Baking

The storage/packaging requirements for the Nichia NF2W385AR-V2 LEDs are comparable to JEDEC Moisture Sensitivity Level (MSL) 3 or equivalent. Nichia used IPC/JEDEC STD-020 as a reference to rate the MSL of this LED. If the "After Opening" storage time has been exceeded or any pink silica gel beads are found, ensure that the LED are baked before use. Baking should only be done once.

Table 2. Storage/Baking Conditions

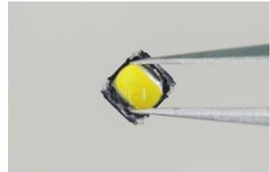
Conditions		Temperature	Humidity	Time
Storage	Before Opening Aluminum Bag	≤ 30° C	≤ 90%RH	Within 1 Year from Delivery Date
	After Opening Aluminum Bag	≤ 30° C	≤ 70%RH	≤ 168 hours
Baking (Reel is Removed from Aluminum Bag)		65±5° C	-	≥ 24 hours

✔ Correct



Suggestion: Grab/hold the LEDs with tweezers by the sides of the substrate.

🚫 Incorrect



🚫 Incorrect

Caution: Do not let the tweezers touch the lens (Silicone Resin).

Figure 1. Examples of proper/improper handling with tweezers

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3. Design Recommendations for Optimal Amount of Solder

Soldering Pad Pattern/Metal Solder Stencil Aperture

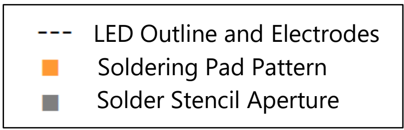


Table 3. Recommended Soldering Pad Pattern/Metal Solder Stencil Aperture

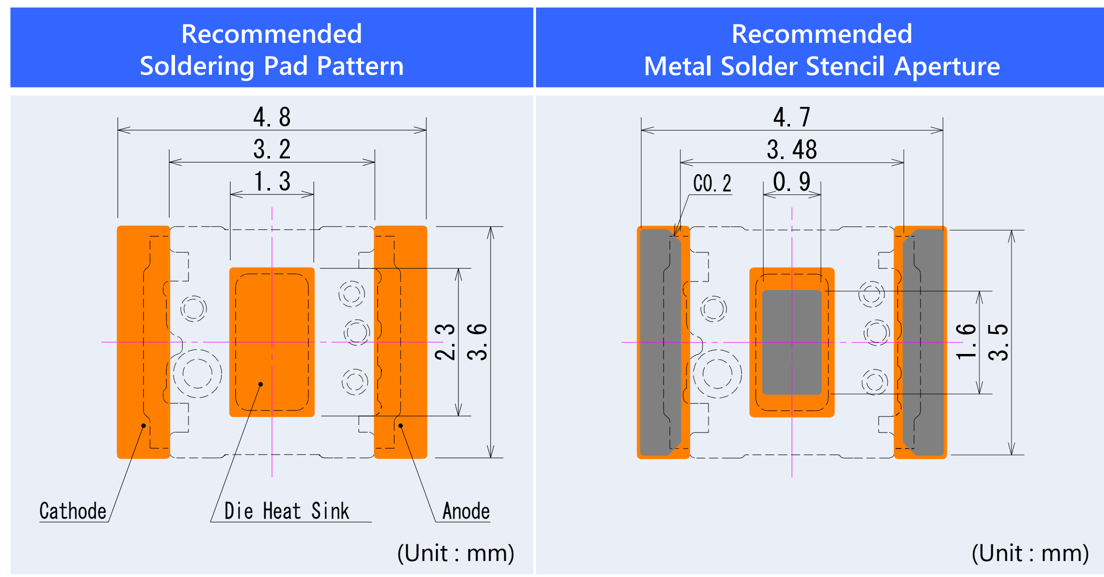
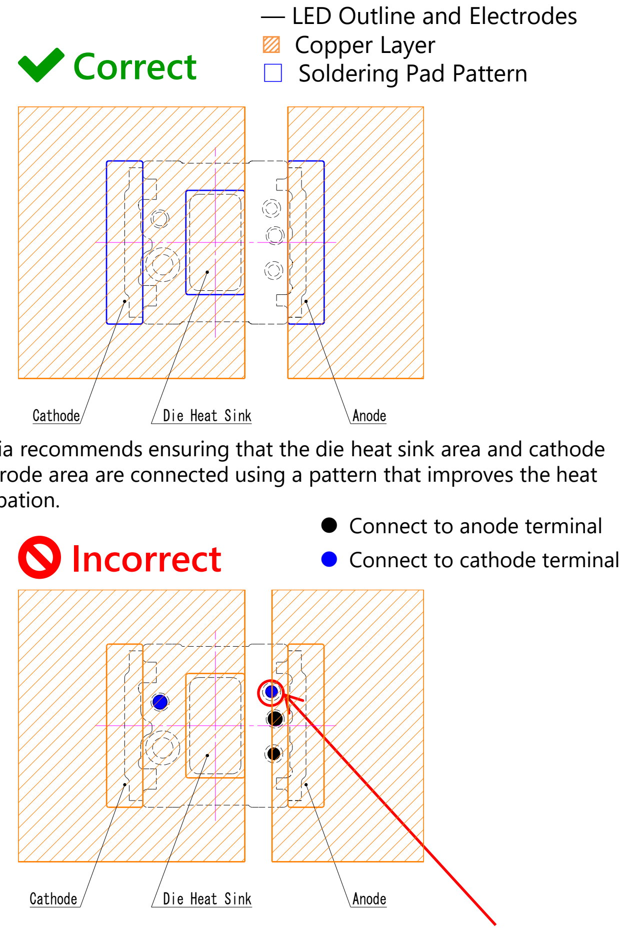


Table 4. Recommended Solder/Metal Solder Stencil Conditions

Item	Recommended Conditions
Stencil Thickness	150µm
Solder Paste	Sn-3.0Ag-0.5Cu

The soldering pattern shapes, metal solder stencil aperture shapes, and metal stencil thicknesses shown in Tables 3 and 4 were selected based on Nichia's recommended placement conditions.
Customers should ensure that there are no issues with the chosen placement conditions before use.



On the back of the LED, there is a circular conductive area that is connected to the electrode terminal. On the anode electrode side, the circular conductive parts of different poles are in close proximity to each other, extra caution must be taken when designing the board. To prevent the possibility of a short-circuit, do not put a copper foil wiring section directly below the circular conductive section on the anode electrode side.

Figure 2. Precautions for board design

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4. Precautions for Setting Up a Pick-and-Place Machine/Nozzle

Table 5. Cautions/Suggestions for Setting Up Equipment

Item	Recommended Conditions/Specifications	Cautions/Suggestions
Pick-and-Place machine	Modular mounter	See the note below this table.
Pick-and-Place Nozzle	Specially designed nozzle (see Figure 3)	See “Pick-and-Place Nozzle” on Page 6 for the details.
Tape-and-reel feeder	Electrical (motorized) feeder Tape width: 12mm Feed length: 8mm	See “Tape-and-Reel Feeder” on Page 6 for the details.
Nozzle height for pick-up operations	The contact surface of the nozzle head for pick operations should be adjusted to 1.7mm below the edge of the embossed carrier tape pocket.	See “Recommended Nozzle Height for Pick-up Operations” on Page 7 for the details.
Nozzle height for placement operations (i.e. placement depth)	0.2mm for placement depth	See “Recommended Nozzle Height for Placement Operations (Placement Depth)” on Page 7 for the details.
Imaging-based Automatic Inspection	Using the electrode as a reference is recommended to locate the center of the LED.	See "Imaging-based Automatic Inspection" on Page 8 for the details.

Note:

- The recommended conditions/specifications above have been determined under the following verification conditions:
  Pick-and-Place machine (modular mounter):
    - YS100 High-Speed General-Purpose Modular (manufactured by Yamaha Motor Co., Ltd.)

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4.1 Pick-and-Place Nozzle

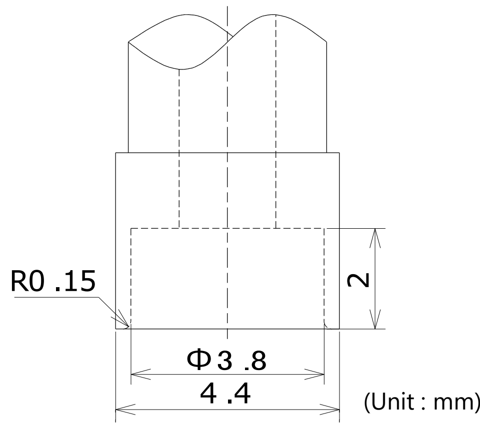

Figure 3. Recommended Nozzle Dimensions

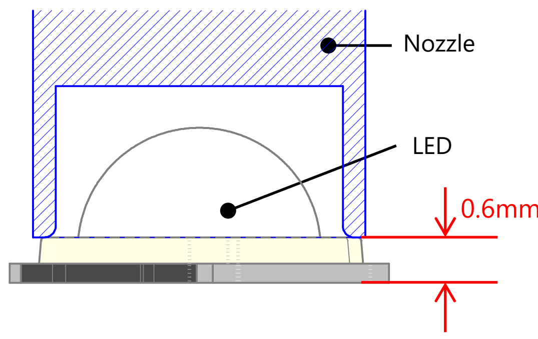

Figure 4. Cross-sectional view of a nozzle when transporting a LED to a PCB

1. As shown in Figure 4, the nozzle tip should only touch the flat corners of the LED's top surface to hold the LEDs. Ensure that it does not come in contact with the lens. The LEDs uses a silicone resin for the lens and internal pre-coating resin; the silicone resin is soft. If pressure is applied to the lens, it may cause the lens to be damaged, chipped and/or delaminated. If the lens is damaged, chipped, delaminated and/or deformed, it may cause the wire to break causing a catastrophic failure (i.e. the LED not to illuminate) and/or reliability issues (e.g. the LED to corrode and/or to become dimmer, the color/directivity to change, etc.) Ensure that no amount of pressure is applied to the lens.
2. Part height for the nozzle to pick up the LEDs: 0.6mm

4.2 Tape-and-Reel Feeder

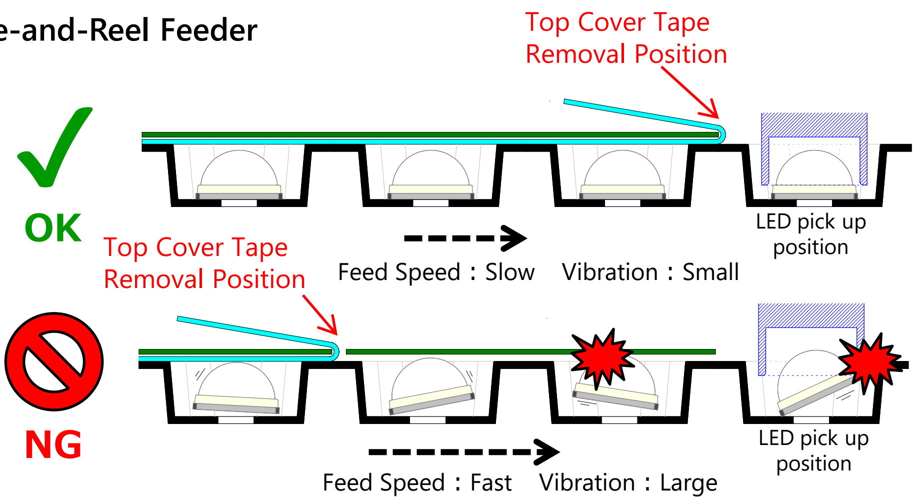

Figure 5. Examples of Correct/Incorrect Top Cover Tape Removal Positions

1. Recommended setting for the tape-and-reel feeder.
   Tape width: 12mm
   Feed length: 8mm
2. Use a tape-and-reel feeder that ensures it does not create excessive vibrations causing assembly issues.
   Example: Electrical (motorized) feeder
3. When removing the top cover tape it should be done adjacent to the target LED (See Figure 5). Otherwise, it may shake the embossed carrier tape and cause the LED to move within the tape pocket. This may cause
   - the nozzle to fail to pick up the LED or not to pick it up properly and shift while on the nozzle during the transport to the PCB (i.e. pick-up/placement failure)
   - the LED to hit the feeder cover and become damaged.

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4.3 Recommended Nozzle Height for Pick-up Operations

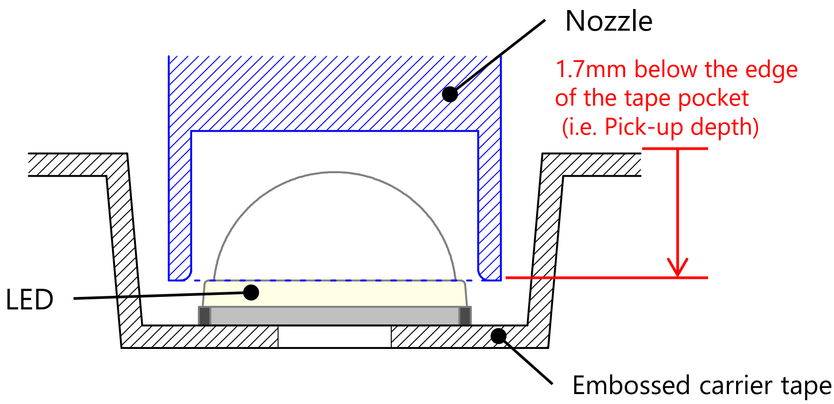

Figure 6. Cross-sectional view of a nozzle when transporting a LED to a PCB

1. Ensure that the nozzle goes down onto the LED in the tape pocket until the tip touches the flat surface around the lens.

   Pick-up depth: 1.7mm

   Note: If the reference level for the nozzle setting is at the edge of the tape pocket.

2. The recommended nozzle height for pick-up operations has been determined by Nichia under the verification conditions (See Table 5) and may not function as expected with some other pick-and-place machines. If the pick-up operations are unstable even with using the recommended nozzle height, adjust the nozzle height appropriate for the pick-and-place machine being used.

   If the pick point of the nozzle is too high,
   - it may cause insufficient suction power leading to picking errors (e.g. the nozzle's failure to pick/lift the LED into the air, incorrect picking causing the LED to tilt when in the air).

   If the pick point of the nozzle is too low,
   - it may cause issues (e.g. causing the embossed carrier tape to shake, causing the tape pocket to deform) leading to picking failure and/or damage to the LED.

4.4 Recommended Nozzle Height for Placement Operations (Placement Depth)

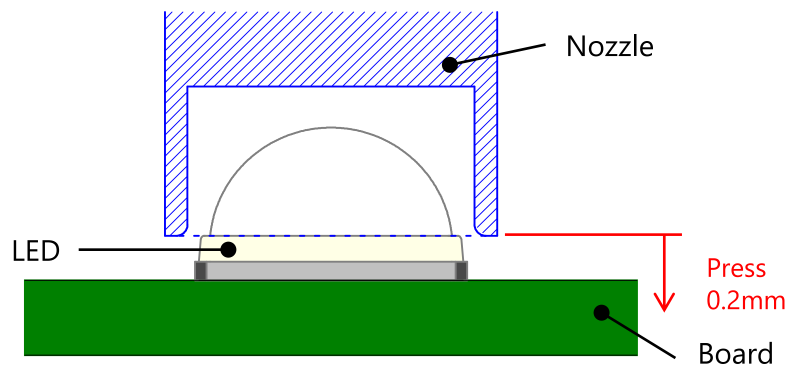

Figure 7. Recommended Nozzle Height for Placement (Placement Depth)

1. After the LED is placed onto the solder paste on the PCB, the nozzle should further press the LED 0.2mm into the PCB.

   If the release point of the nozzle is too high,
   - it may cause placement issues (e.g. the LED to stick to the nozzle after placement, the LED to become soldered to the PCB in a tilted position, etc.).

   If the release point of the nozzle is too low,
   - excessive forces may be applied to the LED during placement and it may cause the LED to become damaged.

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4.6 Imaging-based Automatic Inspection

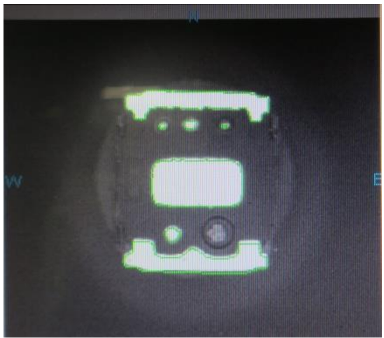

Figure 8. Recommended reference points to detect, recognize, or locate the electrodes

1. Nichia recommends using the electrodes as a reference to locate the center of the LED.

5. Precautions When Reflow Soldering

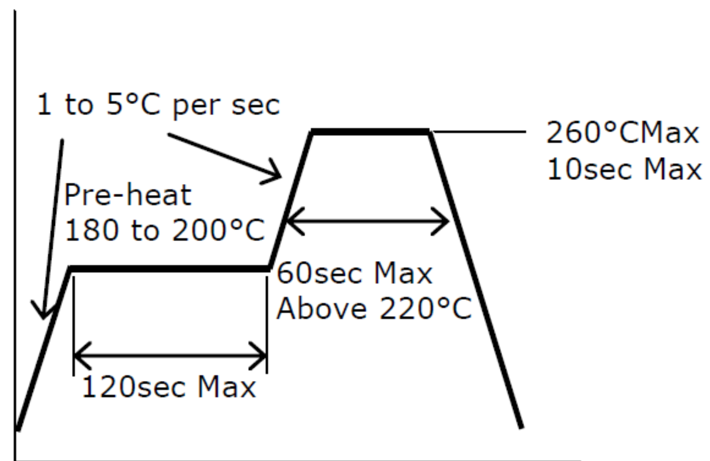

Figure 9. Recommended Reflow Soldering Condition (Lead-free Solder)

1. Reflow soldering must not be performed more than twice.
2. Using the recommended reflow soldering conditions (See Figure 8 to the left) as a reference, modify if necessary, the recommended reflow conditions specified by the manufacturer of the solder paste being used.

   Note: To ensure that these reflow conditions have no negative effect on the LEDs, perform sufficient verification prior to use.
3. When cooling the LEDs from the peak temperature a gradual cooling slope is recommended; do not cool the LEDs rapidly.
4. During reflow soldering, the heat and atmosphere in the reflow oven may cause the optical characteristics to degrade. In particular, reflow soldering performed with an air atmosphere may have a greater negative effect on the optical characteristics than if a nitrogen atmosphere is used; Nichia recommends using a nitrogen reflow atmosphere.

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6. Verification of the Self-Alignment Capability and Tilting

Self-alignment was confirmed using the soldering pad pattern and metal solder stencil aperture shape shown in Table 3 in Section 2.

6.1 Test Materials

Substrate: CEM3 on one side; copper foil thickness: 35μm; board thickness: 0.9mm
Stencil thickness: 120μm, 150μm, 200μm
Number of LEDs tested per condition: 10

6.2 Evaluation Results

The LED placement position was intentionally shifted before reflow and the position was checked after reflow; the self-alignment was confirmed as good for all conditions.

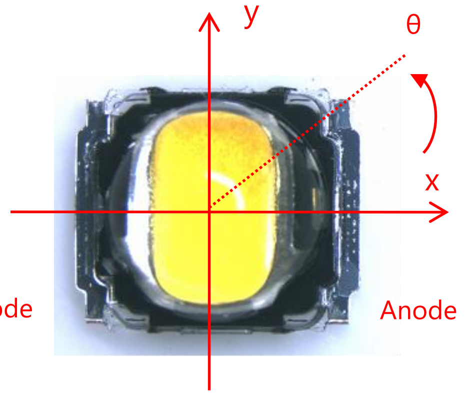

Figure 10. LED misalignment Conditions

Table 6. Misalignment Evaluation Results

			x direction +0.2mm	x direction -0.2mm	y direction +0.2mm	y direction -0.2mm	θ direction 30°	θ direction 45°
Position before reflow								
Appearance after reflow	Stencil thickness	120μm						
		150μm						
		200μm						

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NICHIA CORPORATION
491 Oka, Kaminaka-Cho, Anan-Shi,
TOKUSHIMA 774-8601, JAPAN
http://www.nichia.co.jp
Phone: +81-884-22-2311 Fax: +81-884-21-0148

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