Assembly Precautions for the Nichia 757 Series LEDs

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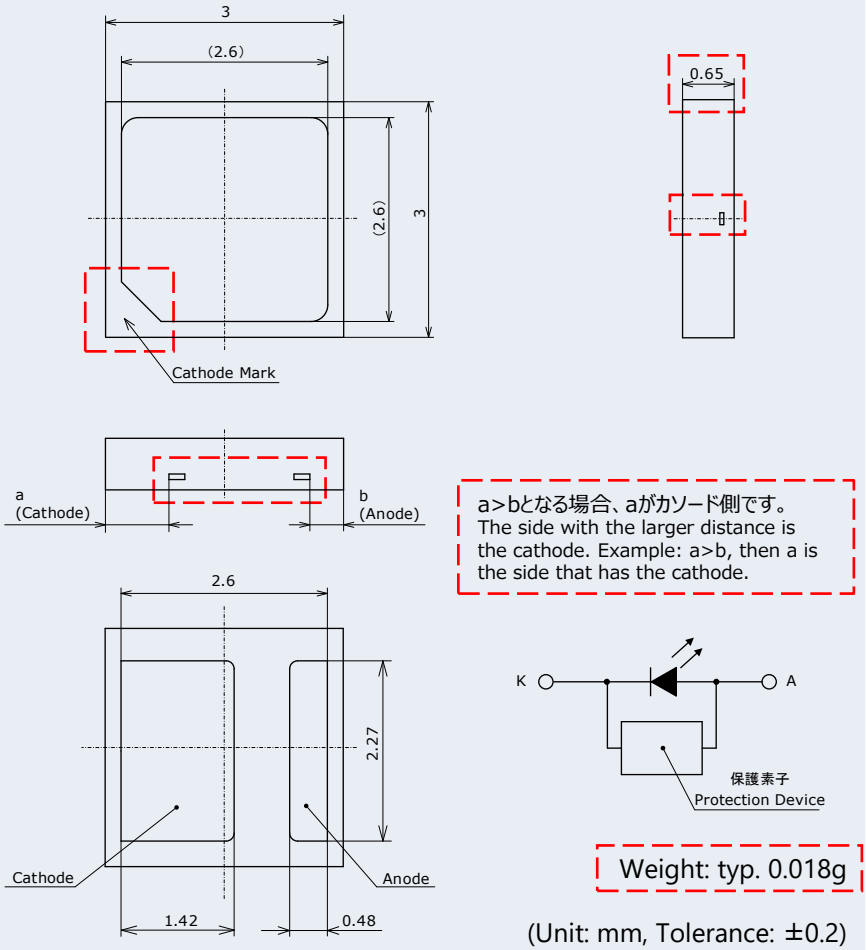
1. LED Outline Dimensions/ Tape and Reel Dimensions

Table 1. Nichia 757G-V1, 757G, 757GR-V1U4, 757-Optisolis™ Series

Specific feature for this series

LED Outline Dimensions



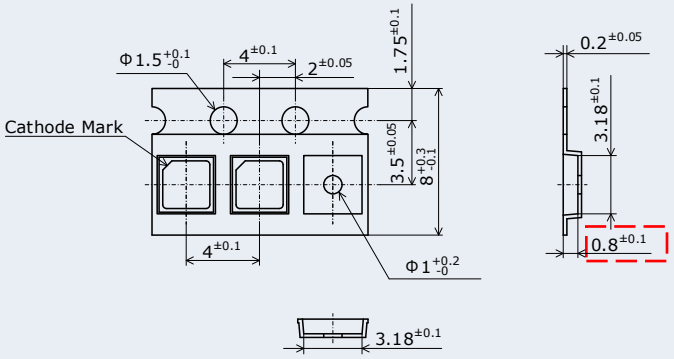
a>bとなる場合、aがカソード側です。
The side with the larger distance is the cathode. Example: a>b, then a is the side that has the cathode.

Weight: typ. 0.018g

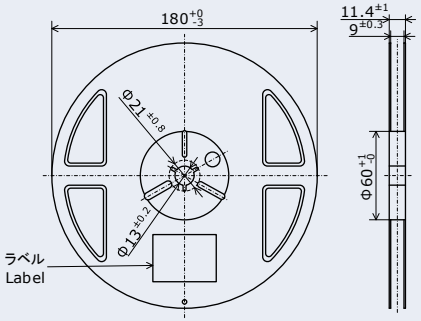
(Unit: mm, Tolerance: ±0.2)

Tape and Reel Dimensions(Standard S-Reel)

テーピング部
Tape



リール部（標準 S Reel）[1]
Reel (Standard S Reel)[1]



＊ 数量は1リールにつき 5000個入りです。
Reel Size: 5000pcs

＊ JIS C 0806電子部品テーピングに準拠しています。
The tape packing method complies with JIS C 0806 (Packaging of Electronic Components on Continuous Tapes).

＊ 実装作業の中断などでエンボスキャリアテープをリールに巻き取る場合、エンボスキャリアテープを強く(10N以上)締めないで下さい。
LEDがカバーテープに貼り付く可能性があります。
When the tape is rewound due to work interruptions, no more than 10N should be applied to the embossed carrier tape.
The LEDs may stick to the top cover tape.

(Unit: mm)

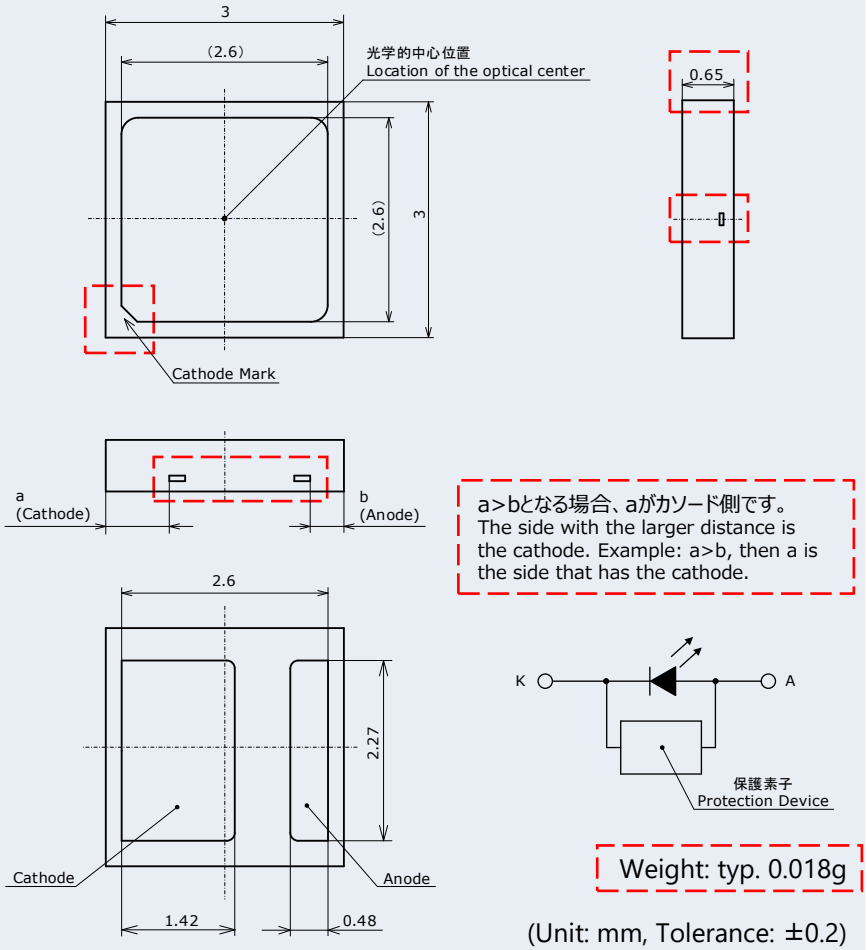
[1] There is also an option to have a larger reel (L-Reel). See Table 5.

1. LED Outline Dimensions/ Tape and Reel Dimensions

Table 2. Nichia 757G-V2, 757G-V3 Series

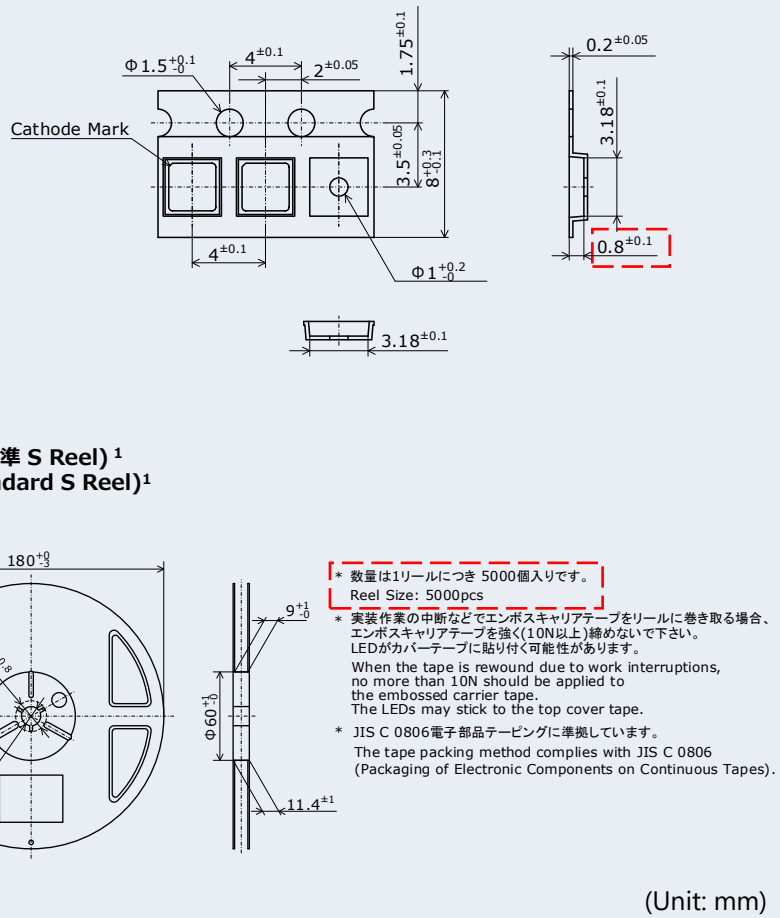
Specific feature for this series

LED Outline Dimensions



(Unit: mm, Tolerance: ±0.2)

Tape and Reel Dimensions(Standard S-Reel)



(Unit: mm)

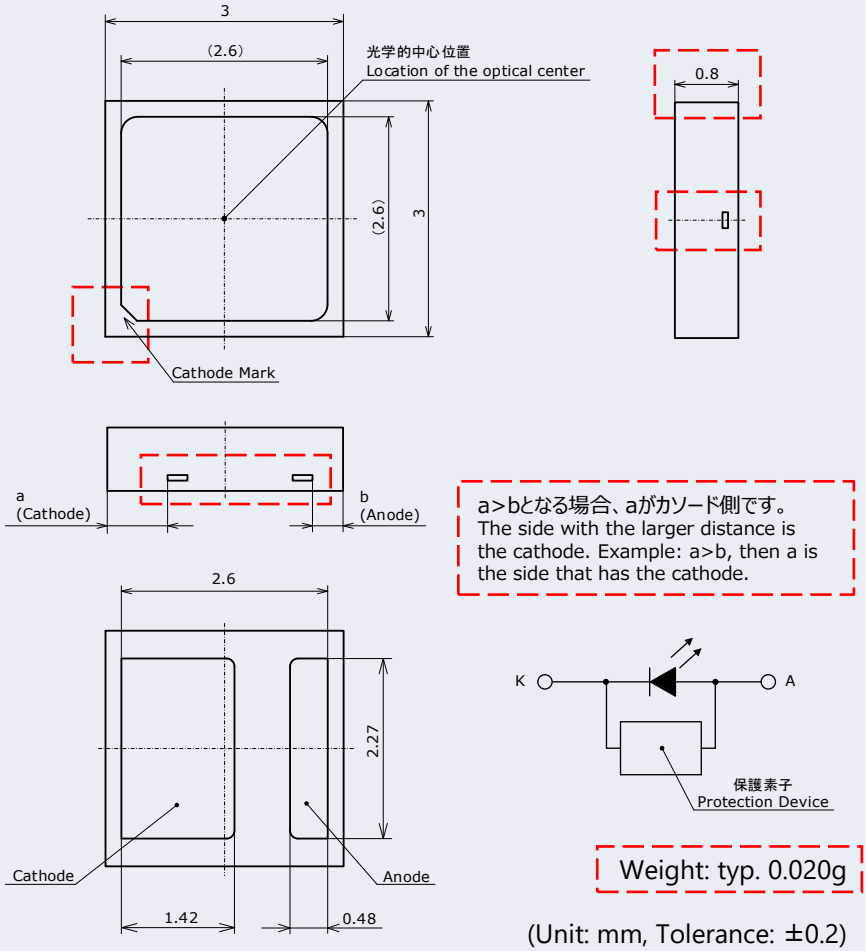
[1] There is also an option to have a larger reel (L-Reel). See Table 5.

1. LED Outline Dimensions/ Tape and Reel Dimensions

Table 3. Nichia 757H Series

Specific feature for this series

LED Outline Dimensions



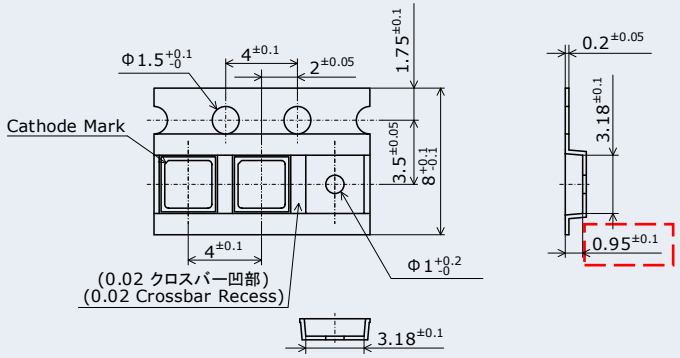
a>bとなる場合、aがカソード側です。
The side with the larger distance is the cathode. Example: a>b, then a is the side that has the cathode.

Weight: typ. 0.020g

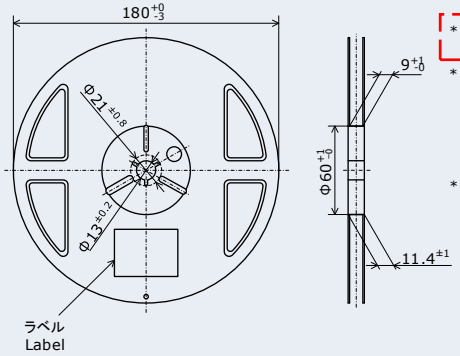
(Unit: mm, Tolerance: ±0.2)

Tape and Reel Dimensions(Standard S-Reel)

テーピング部
Tape



リール部（標準 S Reel）[1]
Reel (Standard S Reel)[1]



* 数量は1リールにつき 4000個入りです。
Reel Size: 4000pcs
* 実装作業の中断などでエンボスキャリアテープをリールに巻き取る場合、エンボスキャリアテープを強く(10N以上)締めないで下さい。
LEDがカバーテープに貼り付く可能性があります。
When the tape is rewound due to work interruptions, no more than 10N should be applied to the embossed carrier tape.
The LEDs may stick to the top cover tape.
* JIS C 0806電子部品テーピングに準拠しています。
The tape packing method complies with JIS C 0806 (Packaging of Electronic Components on Continuous Tapes).

(Unit: mm)

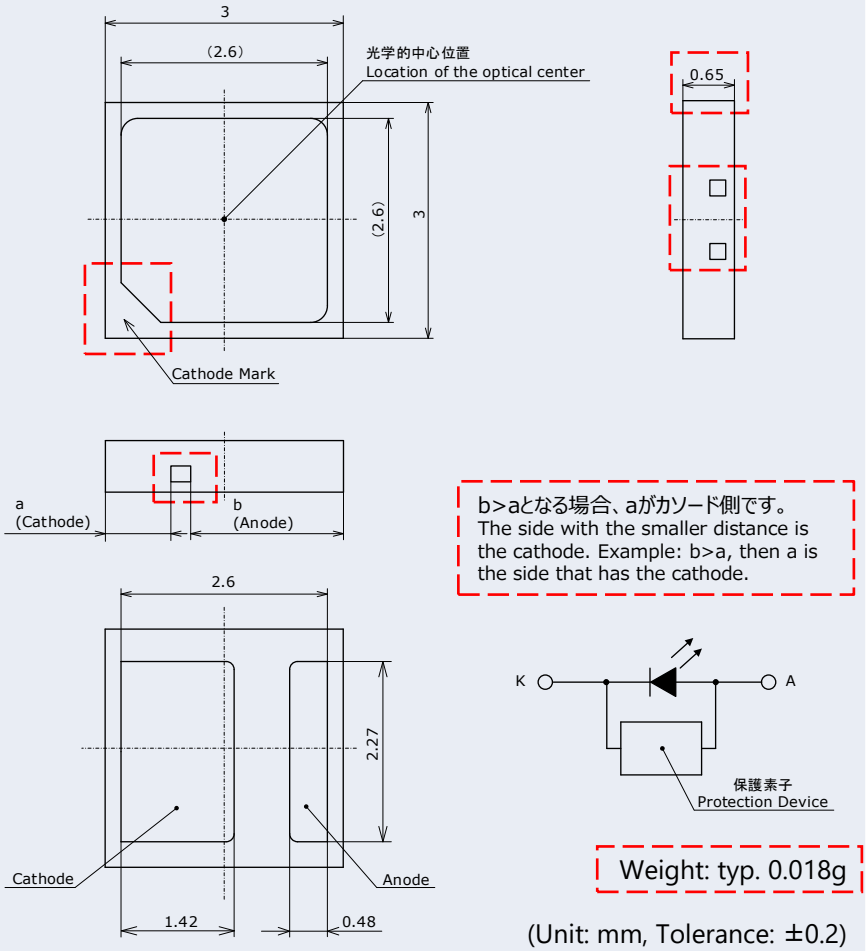
[1] There is also an option to have a larger reel (L-Reel). See Table 5.

1. LED Outline Dimensions/ Tape and Reel Dimensions

Table 4. Nichia 757G-P5, 757GR-V3, 757GR-V4 Series

Specific feature for this series

LED Outline Dimensions



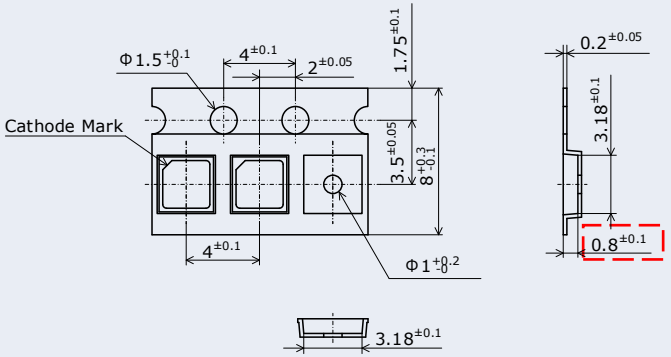
b>aとなる場合、aがカソード側です。
The side with the smaller distance is the cathode. Example: b>a, then a is the side that has the cathode.

Weight: typ. 0.018g

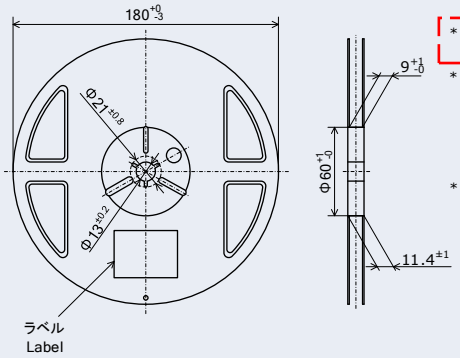
(Unit: mm, Tolerance: ±0.2)

Tape and Reel Dimensions(Standard S-Reel)

テーピング部
Tape



リール部（標準 S Reel）[1]
Reel (Standard S Reel)[1]



＊ 数量は1リールにつき 5000個入りです。
Reel Size: 5000pcs

＊ 実装作業の中断などでエンボスキャリアテープをリールに巻き取る場合、エンボスキャリアテープを強く(10N以上)締めないで下さい。
LEDがカバーテープに貼り付く可能性があります。
When the tape is rewound due to work interruptions, no more than 10N should be applied to the embossed carrier tape.
The LEDs may stick to the top cover tape.

＊ JIS C 0806電子部品テーピングに準拠しています。
The tape packing method complies with JIS C 0806 (Packaging of Electronic Components on Continuous Tapes).

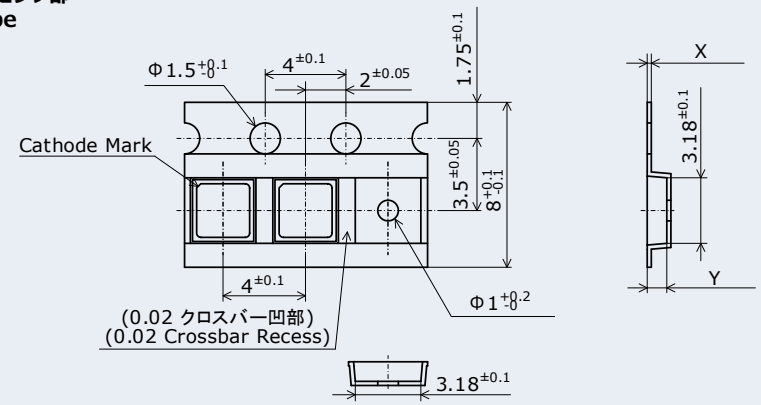
(Unit: mm)

[1] There is also an option to have a larger reel (L-Reel). See Table 5.

Table 5. Nichia 757 Series Taping Specifications (L-Reel)

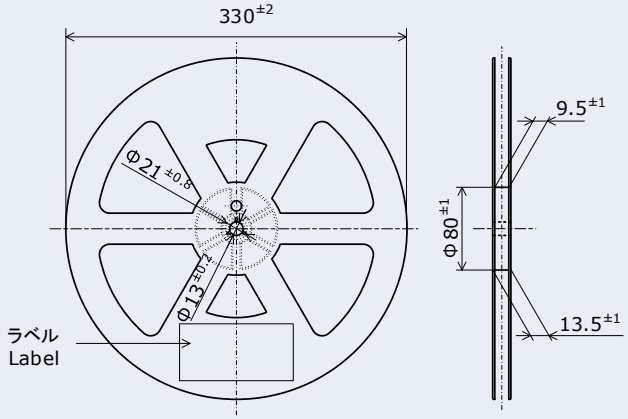
Tape and Reel Dimensions(Larger Reel Option)

テーピング部
Tape



Nichia 757 Series	X	Y	数量 Reel Size
757G-V1,757G,757GR-V1U4, 757-Optisolis™,757G-V2, 757G-V3,757G-P5,757GR-V3, 757GR-V4	0.15±0.05	0.80	20000pcs
757H	0.2±0.05	0.95	16000pcs

リール部（オプション L Reel）
Reel (Option L Reel)



＊ 実装作業の中断などでエンボスキャリアテープをリールに巻き取る場合、
エンボスキャリアテープを強く(10N以上)締めないで下さい。
LEDがカバーテープに貼り付く可能性があります。

When the tape is rewound due to work interruptions,
no more than 10N should be applied to
the embossed carrier tape.
The LEDs may stick to the top cover tape.

＊ JIS C 0806電子部品テーピングに準拠しています。

The tape packing method complies with JIS C 0806
(Packaging of Electronic Components on Continuous Tapes).

(Unit: mm)

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).

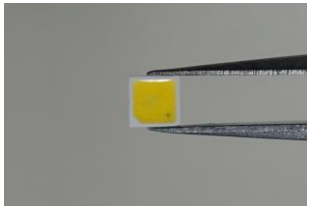
2.5 Baking

The storage/packaging requirements for the NICHIA 757 series 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 6. Storage/Baking Conditions

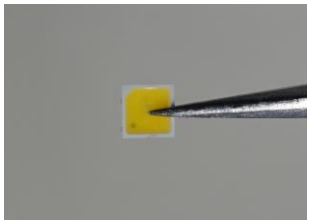
Conditions		Temperature	Humidity	Time
Storage	Before Opening Aluminum Bag	≤ 30° C	≤ 90%RH	Within 1 Year from Delivery Date
	After Opening Aluminum Bag	≤ 30° C	≤ 70%RH	≤ 168 hours
Baking (Reel is Removed from Aluminum Bag)		65±5° C	-	≥ 24 hours

✔ Correct

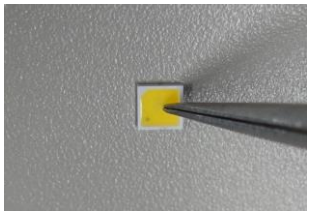


Suggestion: Grab/hold the LEDs with tweezers by the sides of the substrate.

⊘ Incorrect



⊘ Incorrect

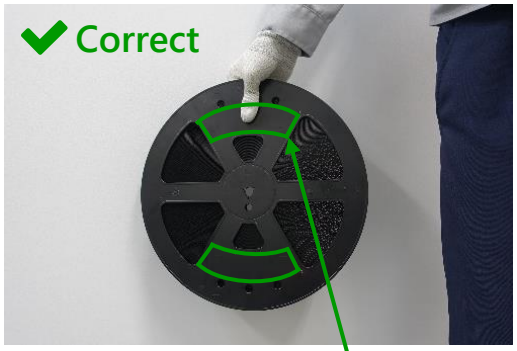


Caution: Do not let the tweezers touch the encapsulating resin.

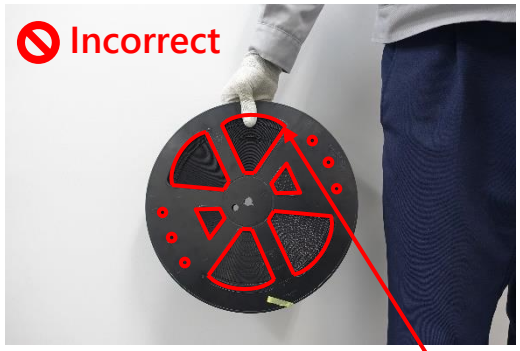
Figure 1. Examples of proper/improper handling with tweezers

2.6 Handling the larger-sized 757 reels (L-Reel)

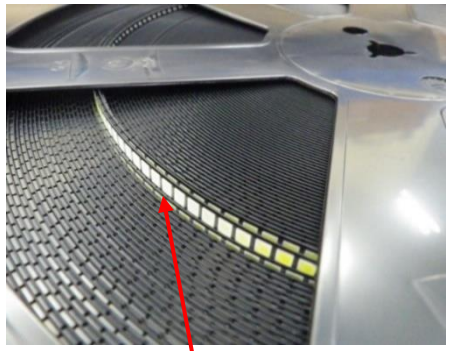
When handling the larger-sized 757 reels ensure that excessive force is not applied to the outer edge of the reel where the embossed carrier tape is exposed. Holding the reel with only one hand may cause the embossed carrier tape to unwind. Additionally, holding it with only one hand may cause the embossed carrier tape to collapse.



Hold the outer edge of the reel where the tape is not exposed.



Do not hold the reel where the tape is exposed.



Embossed carrier tape is collapsed.

Figure 2. Examples of proper/improper handling of the Large reel

2.7 Handling the aluminum moisture-proof bags for the larger-sized 757 reels (L-Reel)

When handling the aluminum moisture-proof bag, do not hold the part of the bag where the larger-sized reel is located. If the reel is held even when it is inside the aluminum moisture-proof bag, it may cause the embossed carrier tape to unwind.

Hold the bag at the heated seal

Do not hold the part of the bag that contains the reel.

Figure 3. Examples of proper/improper handling of the aluminum moisture-proof bags for the Large reel

3. Design Recommendations for Optimal Amount of Solder

Soldering Pad Pattern/Metal Solder Stencil Aperture

Table 7. Recommended Soldering Pad Pattern/Metal Solder Stencil Aperture

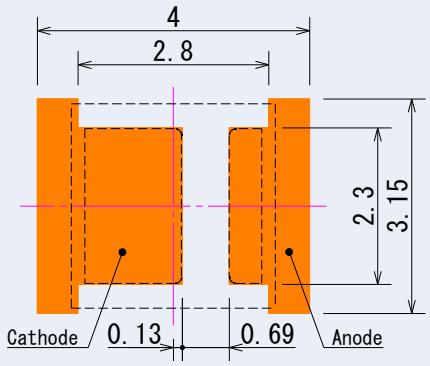
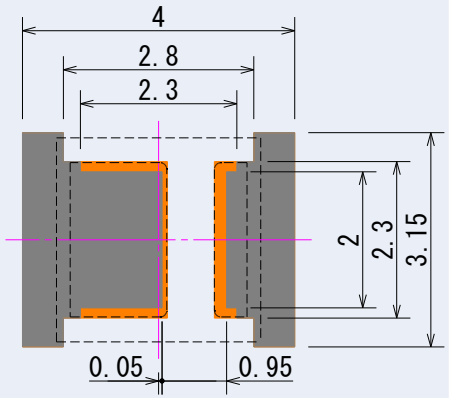
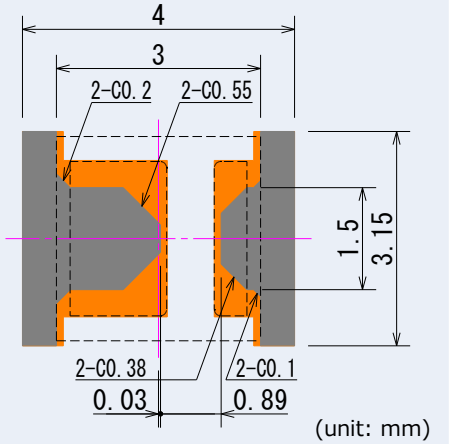
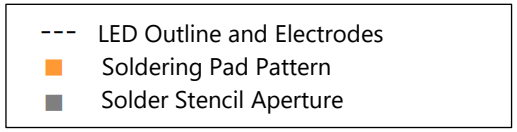
	Recommended Soldering Pad Pattern	Recommended Metal Solder Stencil Aperture
Solder Pad Pattern and Stencil Aperture as recommended in the specification	 (unit: mm)	 (unit: mm)
Modified Stencil Aperture	Same as above	 (unit: mm)

Table 8. Recommended Solder/Metal Solder Stencil Conditions

Item	Recommended Conditions
Stencil Thickness	100μm
Solder Paste	Sn-3.0Ag-0.5Cu



The Modified Stencil Aperture should be used to control LED tilting and solder balling. See section 6. Verification of the Self-Alignment Capability for details.

The soldering pattern shapes, metal solder stencil aperture shapes, and metal stencil thicknesses shown in Tables 7 and 8 were selected based on Nichia's recommended placement conditions.
Customers should ensure that there are no issues with the chosen placement conditions before use.

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

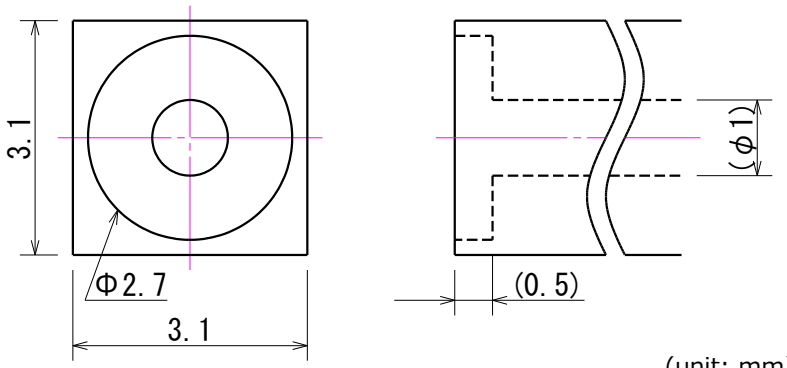
Table 9. Cautions/Suggestions for Setting Up Equipment

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 4)	See “Pick-and-Place Nozzle” on Page 11 for the details.
Tape-and-reel feeder	Electrical (motorized) feeder Tape width: 8mm Feed length: 4mm	See “Tape-and-Reel Feeder” on Page 12 for the details.
Nozzle height for pick-up operations	The contact surface of the nozzle head for pick operations should be adjusted to the top surface of the embossed carrier tape pocket.	See “Recommended Nozzle Height for Pick-up Operations” on Page 12 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 13 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 Page13 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.)

4.1 Pick-and-Place Nozzle

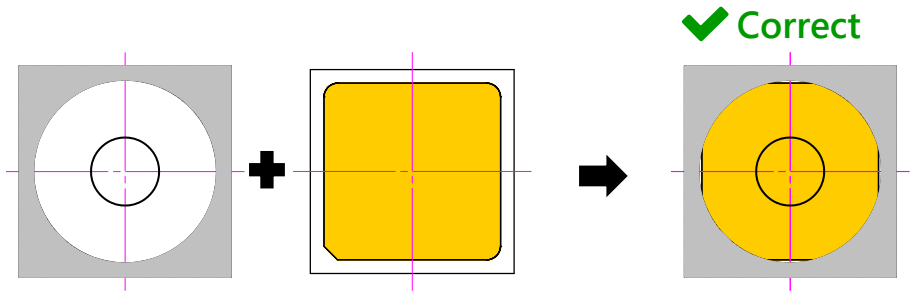


(unit: mm)

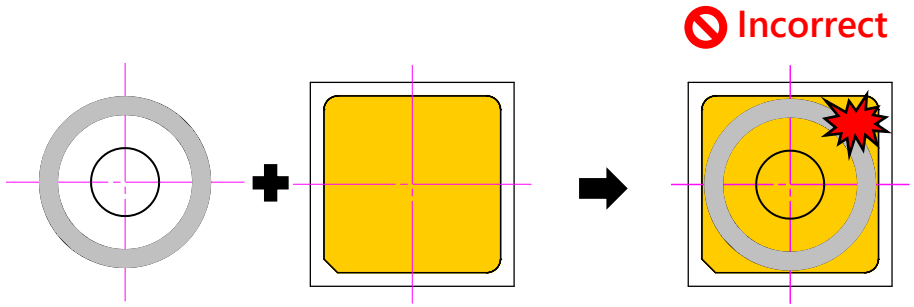
Figure 4. Recommended Nozzle Dimensions

Ensure sure that the nozzle suction area is larger than the encapsulating resin area of the LED (2.6mm x 2.6mm) to avoid possible damage to the emission area resulting in the LED not illuminating.

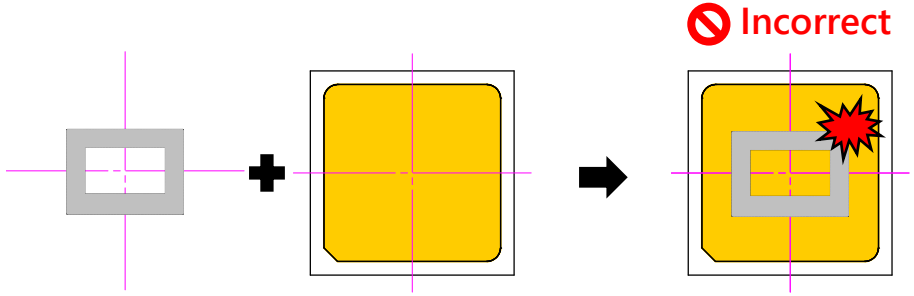
See Figure 5 for examples of how the nozzle position and size effects the pick-up of the LED.



Ideal size and position for the pick-up nozzle



Example A: (Outer dimension φ2.5) = Not Recommended



Example B: (Outer dimension 1.7x1.2) = Not Recommended

(unit: mm)

Figure 5. Examples of the pick-up by different nozzles

4.2 Tape-and-Reel Feeder

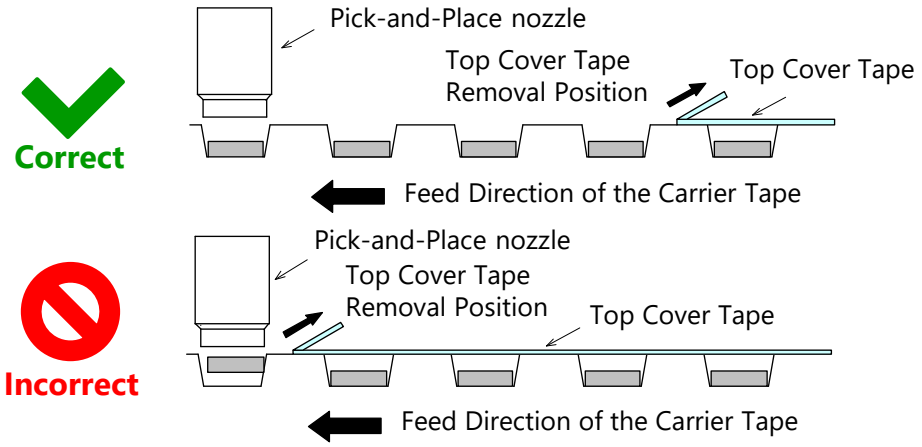


Figure 6. Examples of Correct/Incorrect Top Cover Tape Removal Positions

1. Recommended setting for the tape-and-reel feeder.
   Tape width: 8mm
   Feed length: 4mm
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 past three LEDs away from the target LED (See Figure 6). 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.

4.3 Recommended Nozzle Height for Pick-up Operations

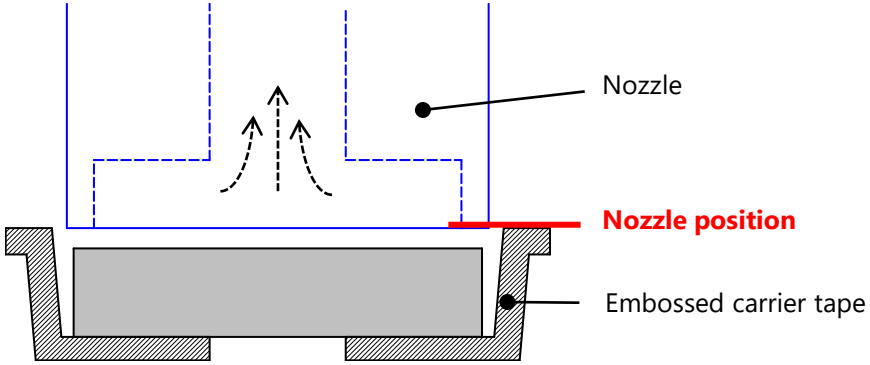


Figure 7. Cross-sectional view of a nozzle when transporting an Nichia 757 series LEDs to a PCB

1. Ensure that the nozzle only goes down to the top edge of the tape pocket and does not directly come into contact with the LED.
   Note: The reference level for the nozzle setting is at the top 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 9) 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)

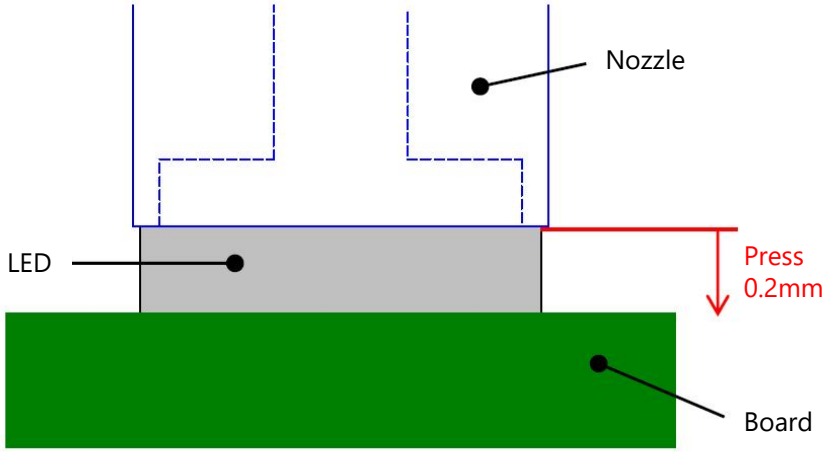


Figure 8. Recommended Nozzle Height for Placement (Placement Depth)

1. After the LED is mounted onto 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.

4.5 Imaging-based Automatic Inspection

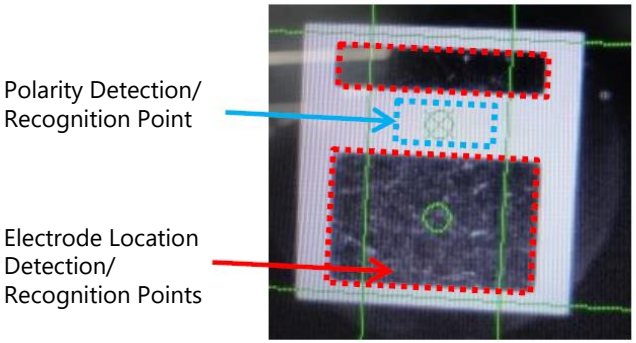


Figure 9. Recommended reference points to detect, recognize, or locate the polarity/electrodes

1. Nichia recommends using the electrodes as a reference to locate the center of the LED.
2. If the imaging device has trouble detecting/recognizing the electrodes due to the uniqueness of the electrode pattern, adjust it to detect/recognize the outer portions of the electrodes (i.e. the areas circled in red in Figure 9 to the left).
3. If an automatic polarity detector is used for the LEDs, set up the imaging device to detect the empty space between the anode and cathode electrodes (i.e. Polarity Detection/Recognition Point in Figure 9 to the left). In the example in Figure 9, the equipment measures the brightness of the empty space against the threshold to locate the electrodes and/or determine the polarity.

5. Precautions When Reflow Soldering

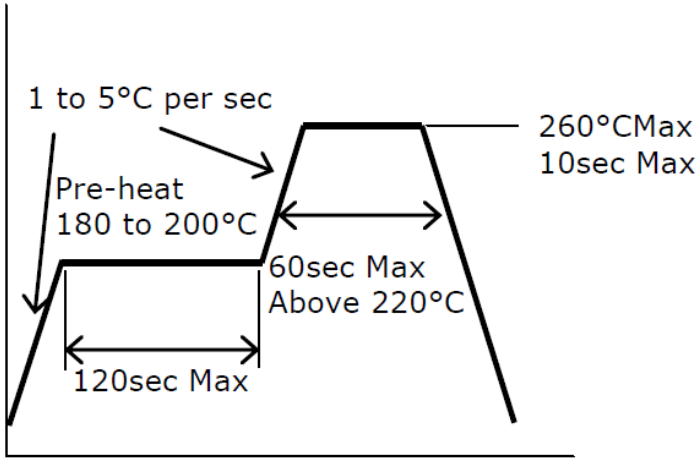


Figure 10. Recommended Reflow Soldering Condition (Lead-free Solder)

1. Reflow soldering must not be performed more than twice.
2. Using the recommended reflow soldering conditions (See Figure 10 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.

6. Verification of the Self-Alignment Capability and Tilting

6.1 Self-Alignment Capability Method/Conditions

Nichia has verified the self-alignment capability of the LEDs using two different solder stencil apertures shown on page 9. Evaluation LEDs were placed on specified points or intentionally rotated to create a parallel/angular misalignment from the center of the soldering pad pattern (see Figure 11 to the right). After reflow soldering, LED positions and angles were measured for each stencil aperture to determine the amount of misalignment.

Board: CEM3
Board thickness: 1.6mm
Copper Thickness: 35µm
Metal Solder Stencil Thickness: 100µm
Parallel Deviation Condition: Δx,y = x=+0.2mm, y=+0.2mm, y=-0.2mm
Angular Deviation Condition: Δθ = 30°, 45°
Sample Size: 15 LEDs per condition (i.e. stencil aperture)

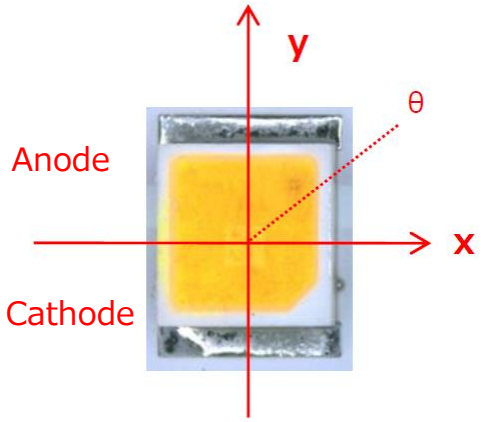


Figure 11. LED misalignment Conditions

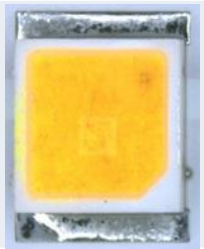
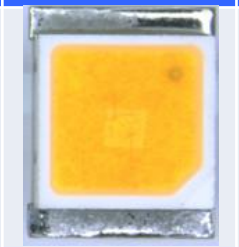
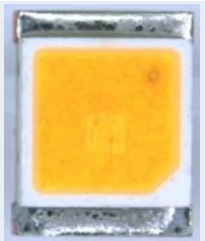
6.2 Self-Alignment Capability Conclusions

LED Parallel Misalignment
- If the misalignment is within 0.2mm in both the x and y coordinates, it will not have an effect on the self-alignment capability.

LED Angular Misalignment
- Since all the rotated LEDs moved back to the correction position (i.e. the center of the soldering pad pattern) by themselves during reflow soldering, there are no issues with the self-alignment capability against the evaluated angular deviation.

For more details, refer to Table 10 on the next page.

Table 10. Misalignment Evaluation Results

Condition		Ref.	x : +0.2mm	y: +0.2mm	y: -0.2mm	θ=30°	θ=45°
After Reflow	Stencil Aperture as recommended in the specification						
	Modified Stencil Aperture						

6.3 Tilting Measurement

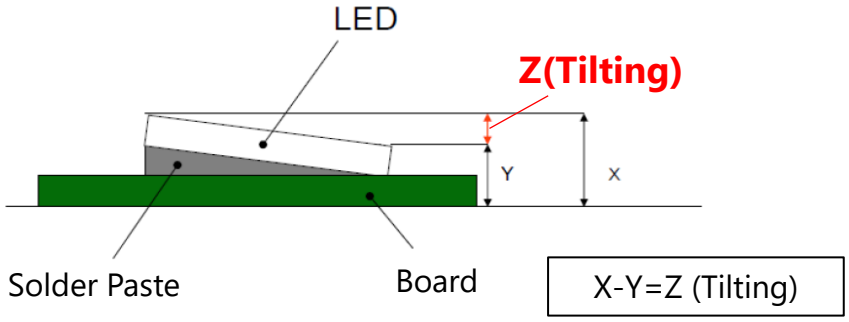


Figure 12. Tilting Measurement Method

Table 11. Tilting Measurement Results

Stencil Design	Z (Tilting)
Stencil Aperture as recommended in the specification	0.060mm
Modified Stencil Aperture	0.042mm

Sample Size: 15 LEDs per condition (i.e. stencil aperture)

The tilting was less with LEDs soldered using the modified stencil aperture.

- The size of aperture on the modified stencil is 77.5% of the one recommended in the specification. If tilting occurs, try adjusting the amount of solder paste to see if the result improves.

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