



# Assembly Precautions for the Nichia 193F Series LEDs

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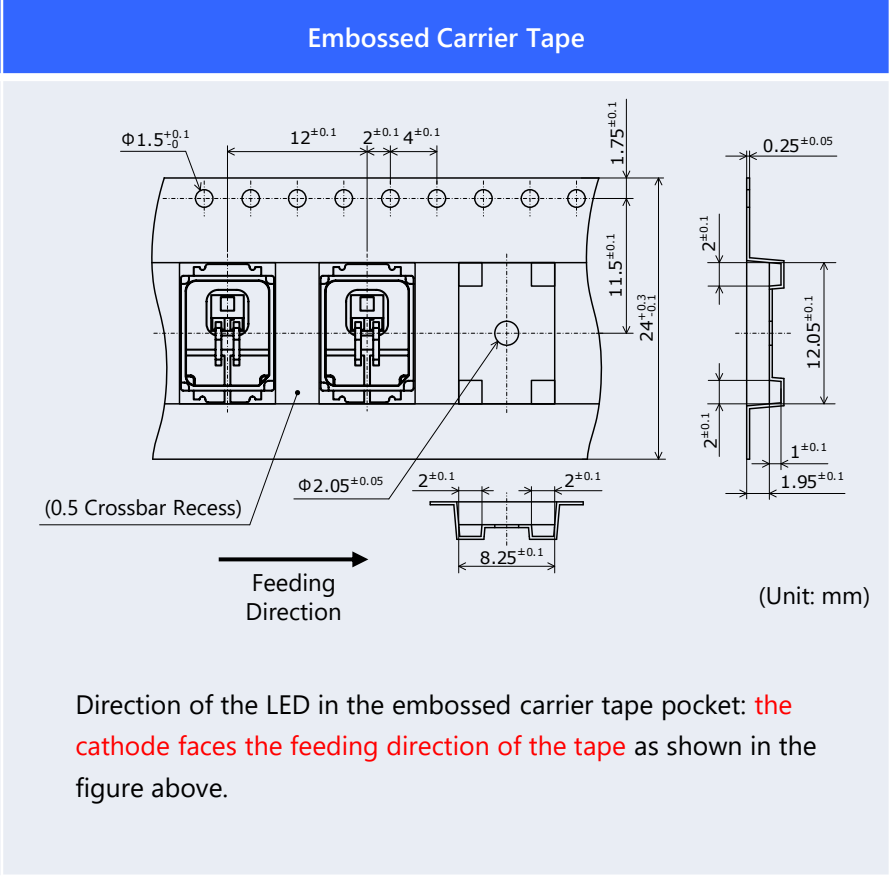
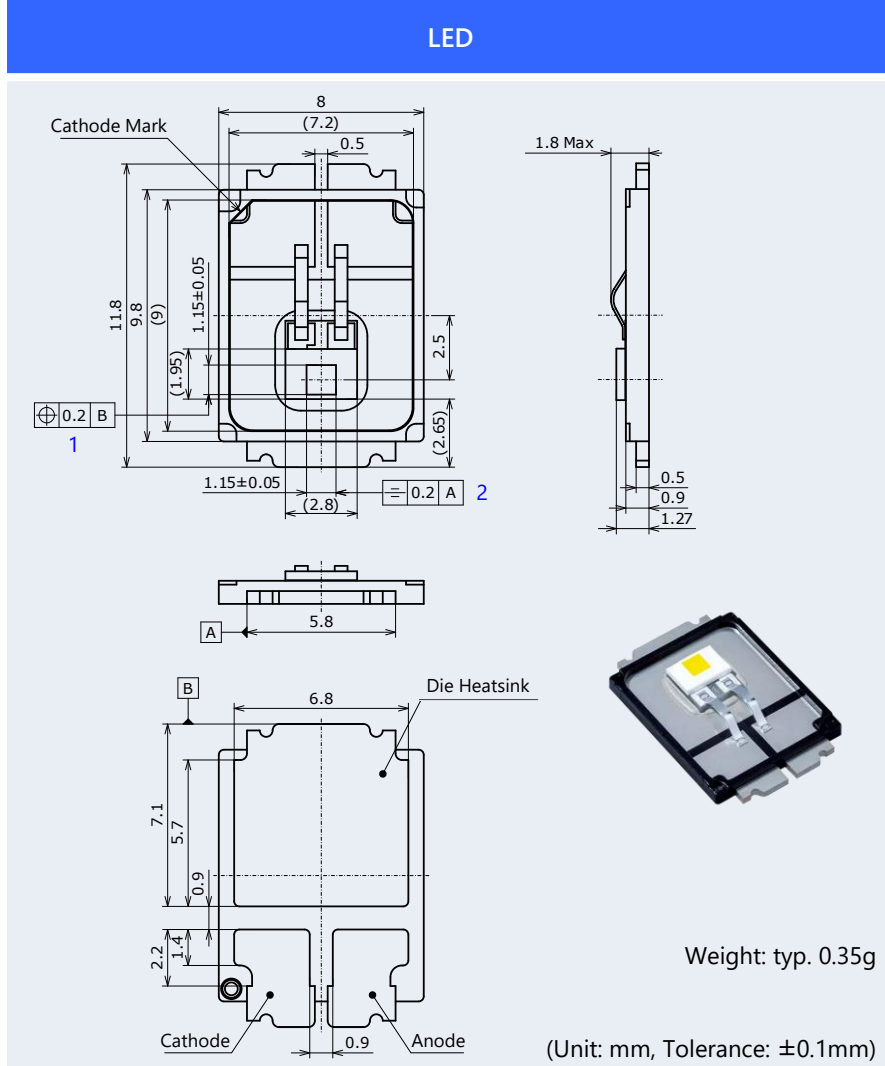
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NCSW193F, NC2W193F, NC3W193F, NC4W193F, and NC5W193F refer to Nichia part numbers. These Nichia part numbers within this document are merely Nichia's part numbers for those Nichia products and are not related nor bear resemblance to any other company's product that might bear a trademark.

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# 1. LED Outline Dimensions/Tape Dimensions

Table 1. NCSW193F Product Specifications



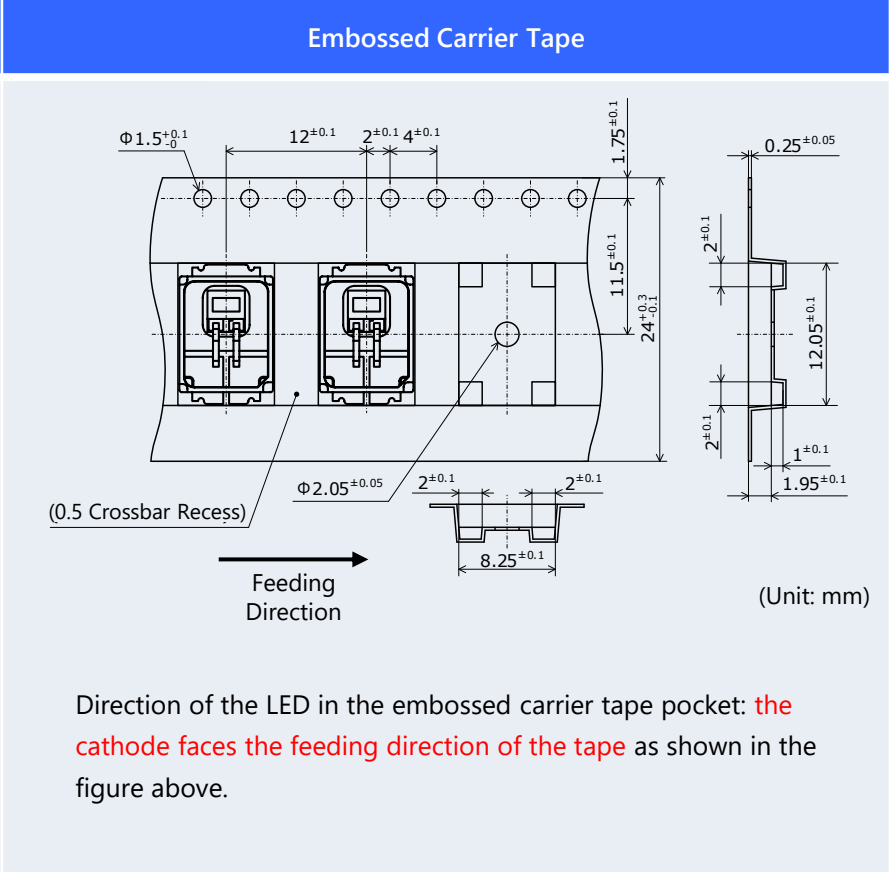
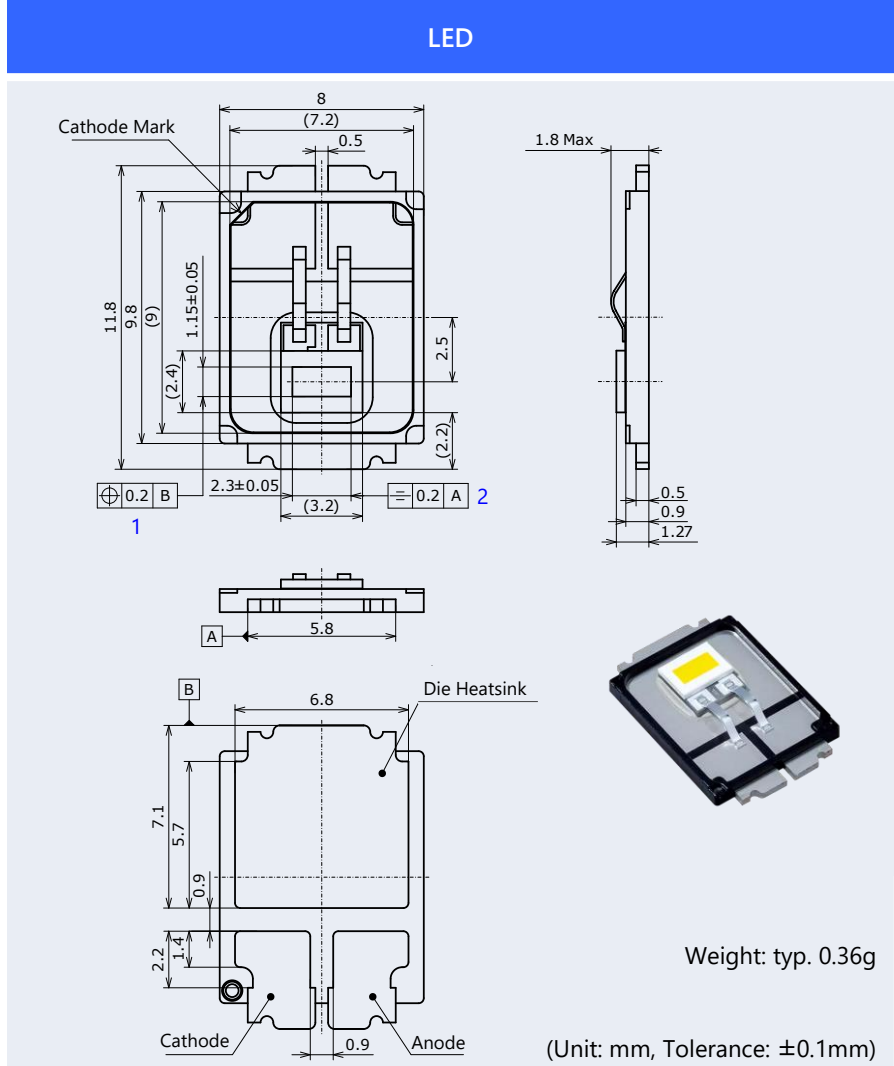
Direction of the LED in the embossed carrier tape pocket: **the cathode faces the feeding direction of the tape** as shown in the figure above.

<sup>1</sup> The centerline of the emitting area in the lateral direction is parallel to B; the deviation in distance between the centerline and B is within ±0.1mm.  
<sup>2</sup> The deviation of the centerline of the emitting area in the longitudinal direction from the centerline of the die heatsink in the longitudinal direction is within ±0.1mm.

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# 1. LED Outline Dimensions/Tape Dimensions

Table 2. NC2W193F Product Specifications



Direction of the LED in the embossed carrier tape pocket: **the cathode faces the feeding direction of the tape** as shown in the figure above.

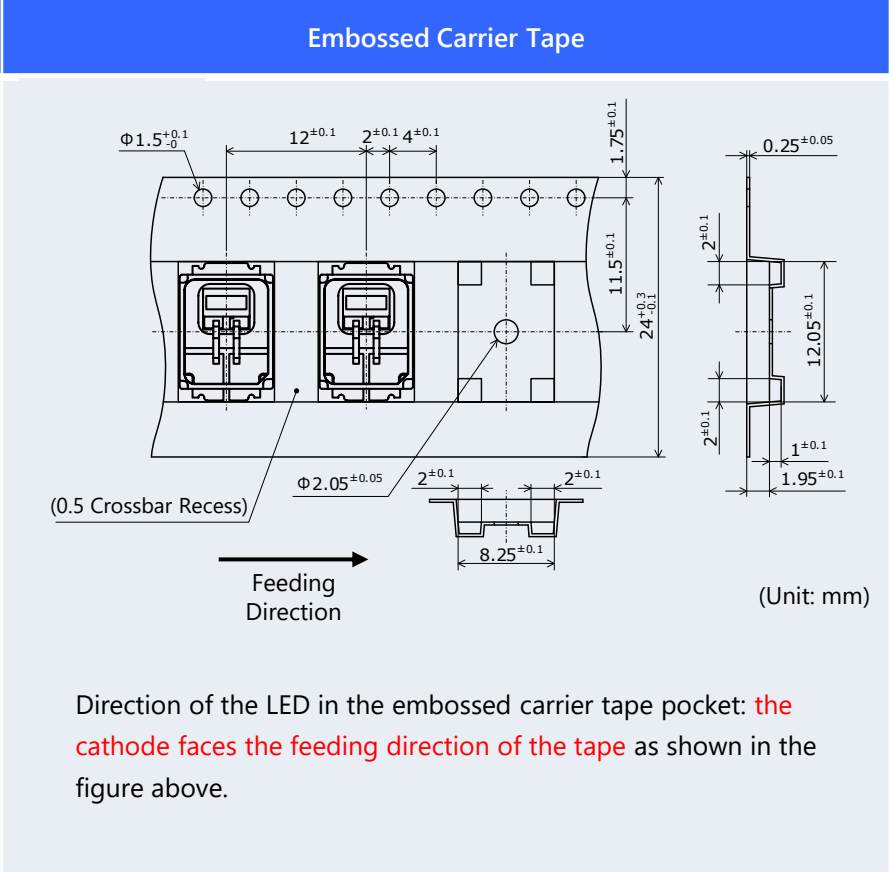
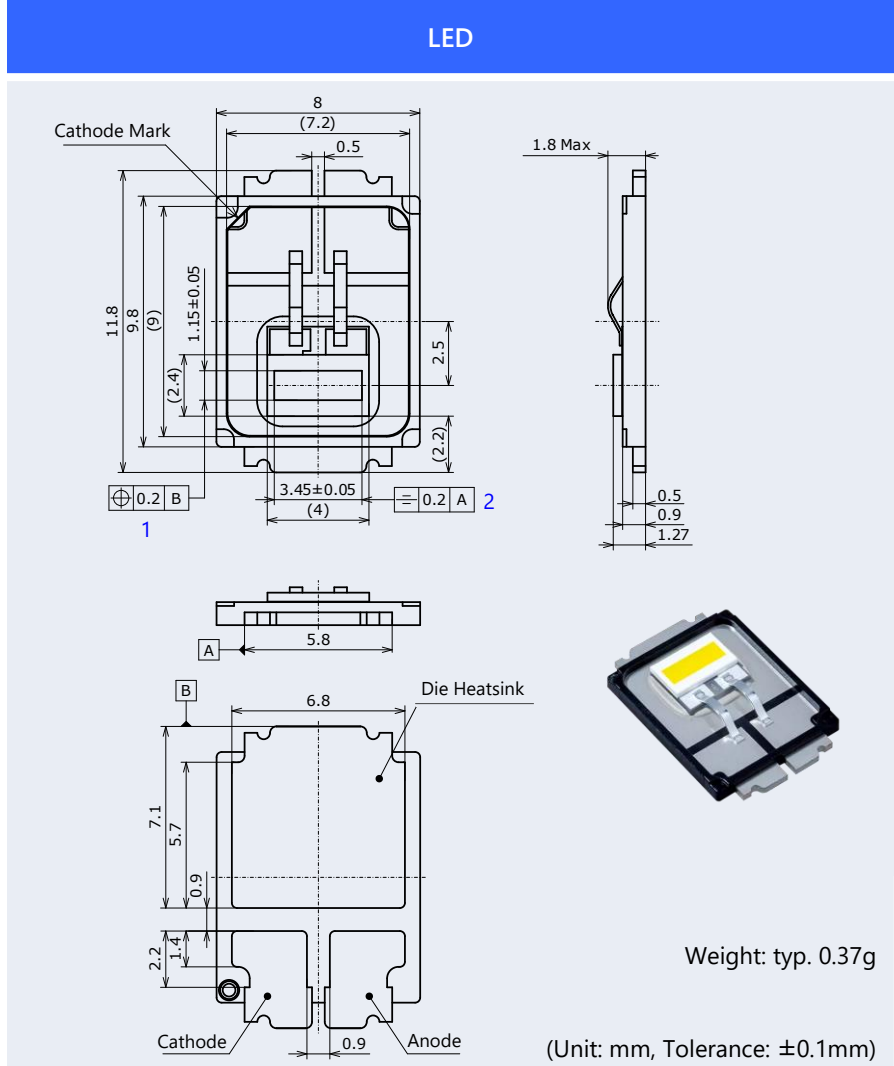
<sup>1</sup> The centerline of the emitting area in the lateral direction is parallel to B; the deviation in distance between the centerline and B is within ±0.1mm.

<sup>2</sup> The deviation of the centerline of the emitting area in the longitudinal direction from the centerline of the die heatsink in the longitudinal direction is within ±0.1mm.

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# 1. LED Outline Dimensions/Tape Dimensions

Table 3. NC3W193F Product Specifications



Direction of the LED in the embossed carrier tape pocket: **the cathode faces the feeding direction of the tape** as shown in the figure above.

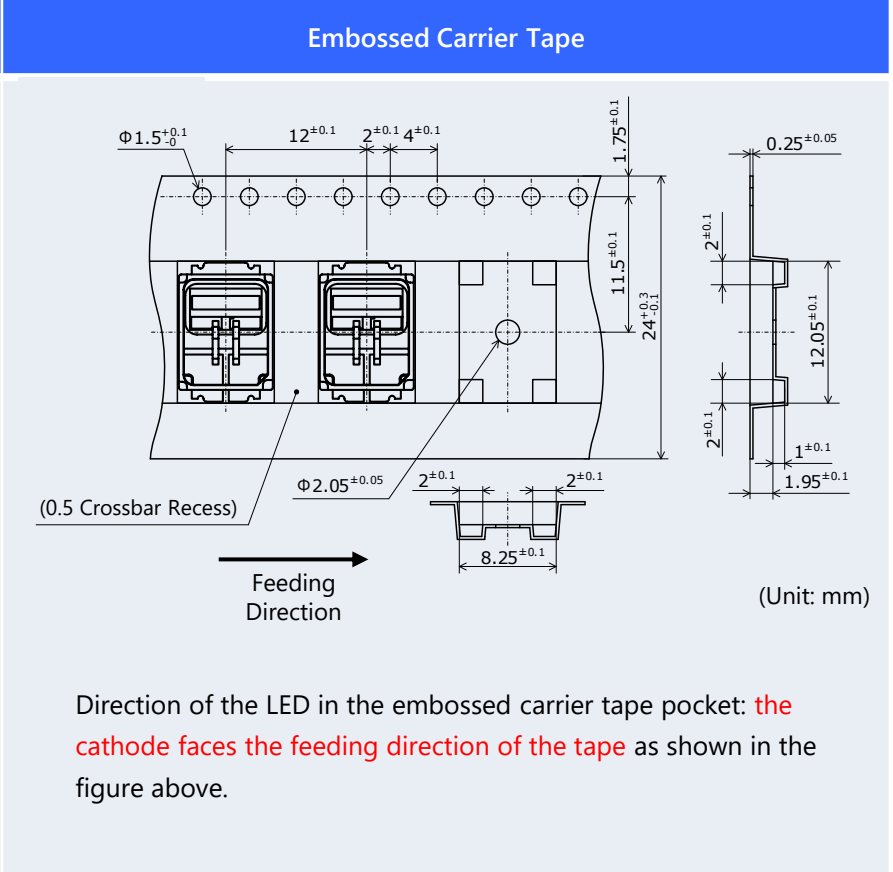
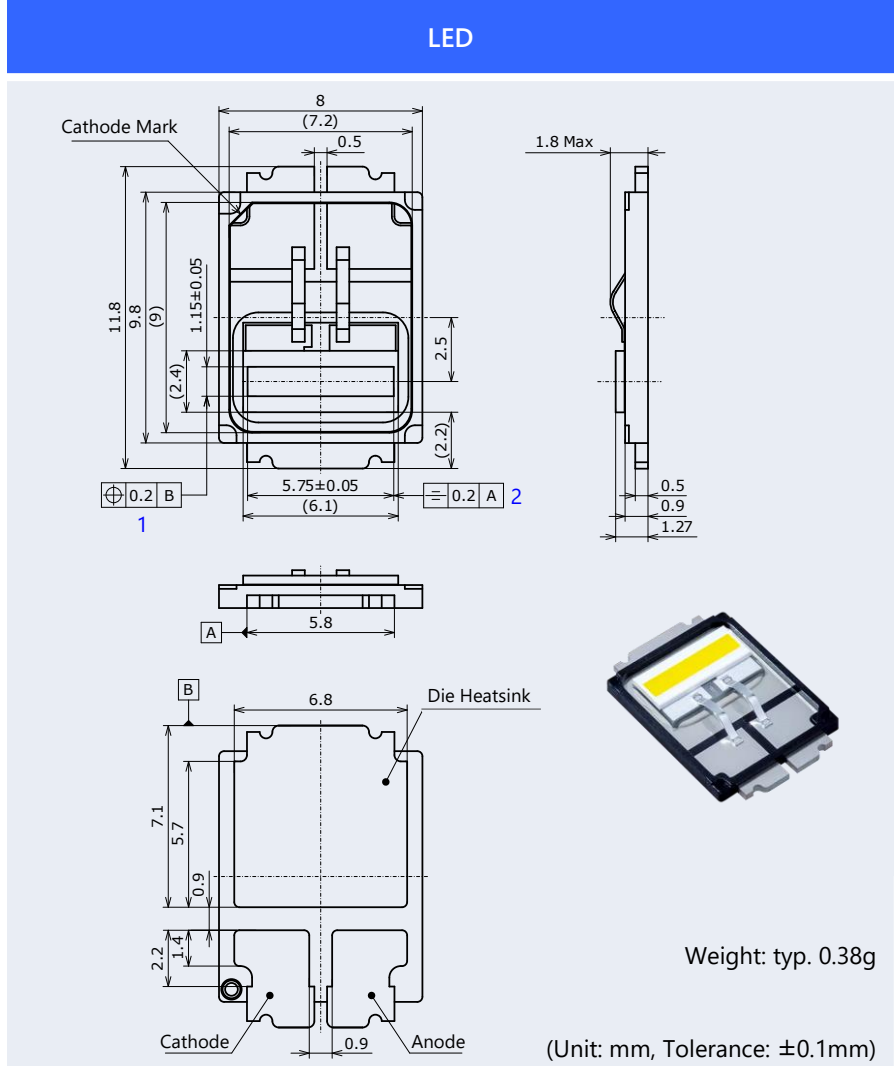
<sup>1</sup> The centerline of the emitting area in the lateral direction is parallel to B; the deviation in distance between the centerline and B is within  $\pm 0.1$ mm.  
<sup>2</sup> The deviation of the centerline of the emitting area in the longitudinal direction from the centerline of the die heatsink in the longitudinal direction is within  $\pm 0.1$ mm.

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# 1. LED Outline Dimensions/Tape Dimensions

Table 5. NC5W193F Product Specifications



Direction of the LED in the embossed carrier tape pocket: **the cathode faces the feeding direction of the tape** as shown in the figure above.

<sup>1</sup> The centerline of the emitting area in the lateral direction is parallel to B; the deviation in distance between the centerline and B is within  $\pm 0.1$ mm.

<sup>2</sup> The deviation of the centerline of the emitting area in the longitudinal direction from the centerline of the die heatsink in the longitudinal direction is within  $\pm 0.1$ mm.

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## 2. Handling Precautions

### 2.1 Prohibited area

Do not touch the prohibited area shown in Figure 1. This may cause the LED malfunction (e.g. the LED not to illuminate).

### 2.2 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 or to be damaged causing a catastrophic failure (i.e. the LED not to illuminate),
- the electrodes and/or the die heatsink may cause injuries when the LED is handled with bare hands.

### 2.3 Handling with tweezers

Ensure that when handling the LEDs with tweezers, grab/hold the LEDs by the package (i.e. the black part) and ensure that excessive force is not applied to the LED. Otherwise, it may cause damage to the LED (e.g. cut, scratch, chip, crack, etc.) and have an effect on the optical characteristics and/or the reliability. See Figure 2.

### 2.4 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.

### 2.5 Stacking assembled PCBs together

Do not stack assembled PCBs together. Otherwise, it may cause damage to the LED (e.g. cut, scratch, chip, crack, etc.) and have an effect on the optical characteristics and/or the reliability.

### 2.6 Storage

The storage/packaging requirements for the Nichia 193F Series LEDs are comparable to JEDEC Moisture Sensitivity Level (MSL) 2 or equivalent. Nichia used IPC/JEDEC STD-020 as a reference to rate the MSL of the LEDs. Table 6 shows the required storage conditions for the LEDs.

Table 6. Storage 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	Within 1 Year

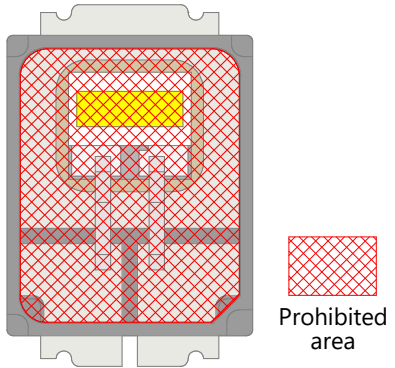
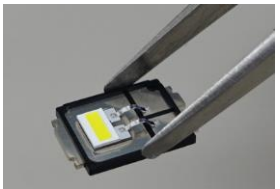


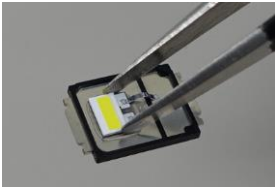
Figure 1. Prohibited area

✓ Correct



Suggestion: Grab/hold the LEDs with tweezers by the package.

✗ Incorrect



Caution: Do not touch the prohibited area.

Figure 2. Correct/Incorrect Examples of Handling with Tweezers

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### 3. Design Recommendations for Optimal Amount of Solder Soldering Pad Pattern/Metal Solder Stencil Aperture

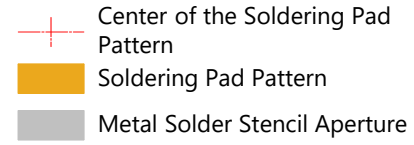


Table 7. Recommended Soldering Pad Pattern/Metal Solder Stencil Aperture<sup>3</sup>

Recommended Soldering Pad Pattern	Recommended Metal Solder Stencil Aperture	
	Pattern Recommended in the Specification	Modified Pattern <sup>4</sup>
<p>(Unit: mm)</p>	<p>(Unit: mm)</p>	<p>(Unit: mm)</p>

Table 8. Recommended Solder/Metal Solder Stencil Conditions<sup>3</sup>

Item	Recommended Conditions
Metal Solder Stencil (Thickness)	120μm
Solder Paste (Composition)	Sn-3.0Ag-0.5Cu

<sup>3</sup> The recommended soldering pad pattern, metal solder stencil aperture, and thickness of the metal solder stencil provided in Tables 7 and 8 have been determined under Nichia's conditions: ensure that there are no issues with the chosen assembly conditions prior to use.

<sup>4</sup> If the aperture is large, the solder paste may not be applied evenly (i.e. thinner for the middle area of the aperture) in the solder printing process causing the amount of the solder paste applied to the soldering pad pattern to vary for each operation. This modified pattern has four small apertures for the die heatsink instead of one large aperture while the total area of the aperture is almost the same as that for the pattern recommended in the specification.

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

Table 9. Cautions/Suggestions for Setting up the Equipment

Item	Recommended Conditions/Specifications	Cautions/Suggestions
Pick-and-place machine	Modular mounter	YS100 High-Speed General-Purpose Modular (manufactured by Yamaha Motor Co., Ltd.)
Pick-and-place nozzle	Nozzle specifically designed for the LEDs (see Figure 3)	See "4.1 Pick-and-Place Nozzle" on Page 10 for details.
Tape-and-reel feeder	Electrical (motorized) feeder	Tape width: 24mm Feeder pitch: 12mm
Top cover tape removal position	Immediately before pick-up	See "4.2 Tape-and-Reel Feeder" on Page 11 for details.
Nozzle height for pick-up operations	The contact surface of the nozzle head for pick operations should be adjusted to 1.05mm below the edge of the embossed carrier tape pocket.	See "4.3 Recommended Nozzle Height for Pick-up Operations" on Page 11 for details.
Nozzle height for placement operations (i.e. placement depth)	0.2mm for the placement depth	See "4.4 Recommended Nozzle Height for Placement Operations (Placement Depth)" on Page 12 for details.
Imaging-based automatic inspection	To locate the center of the LED, using the electrodes and die heatsink as a reference is recommended.	See "4.5 Imaging-based Automatic Inspection" on Page 12 for details.

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4.1 Pick-and-Place Nozzle

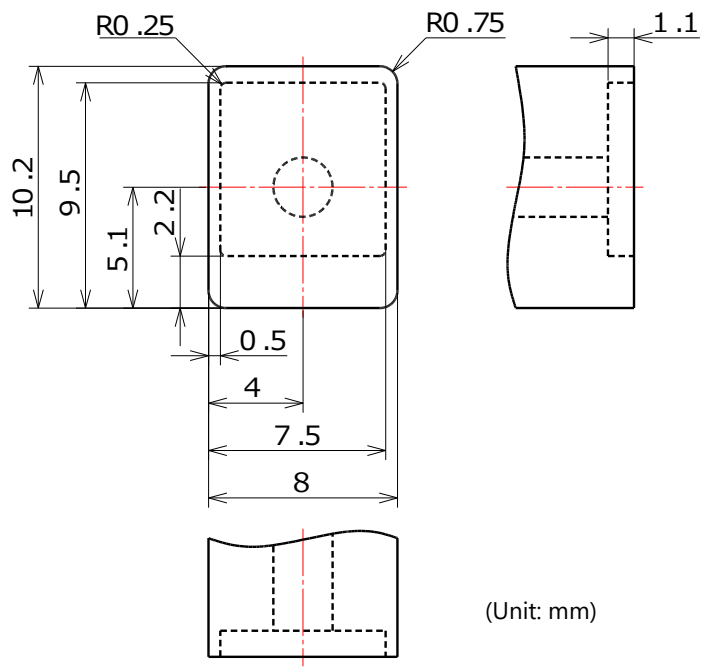


Figure 3. Recommended Nozzle Dimensions

1. Use a pick-and-place nozzle that does not come in contact with the bonding ribbons of the LED. Figure 3 shows the recommended dimensions for the pick-and-place nozzle. Ensure that the size and shape of the nozzle tip are appropriate for the LEDs. Otherwise, this may damage the LED (i.e. scratch, chip, crack, deformation, etc.), affecting the optical characteristics and/or the reliability, or causing the LED not to illuminate. This may also lead to an incorrect pick up (i.e. the LED is picked up in a tilted position).
2. When setting the LED pick-up position, ensure that the center of the nozzle and the center of the LED are aligned and that the nozzle is oriented correctly (see Figure 4). If the nozzle does not pick up the LED at the center of the LED, and/or if the orientation of the nozzle is incorrect, this may damage the LED (i.e. scratch, chip, crack, deformation, etc.), affecting the optical characteristics and/or the reliability, or causing the LED not to illuminate. This may also lead to an incorrect pick up (i.e. the LED is picked up in a tilted position).

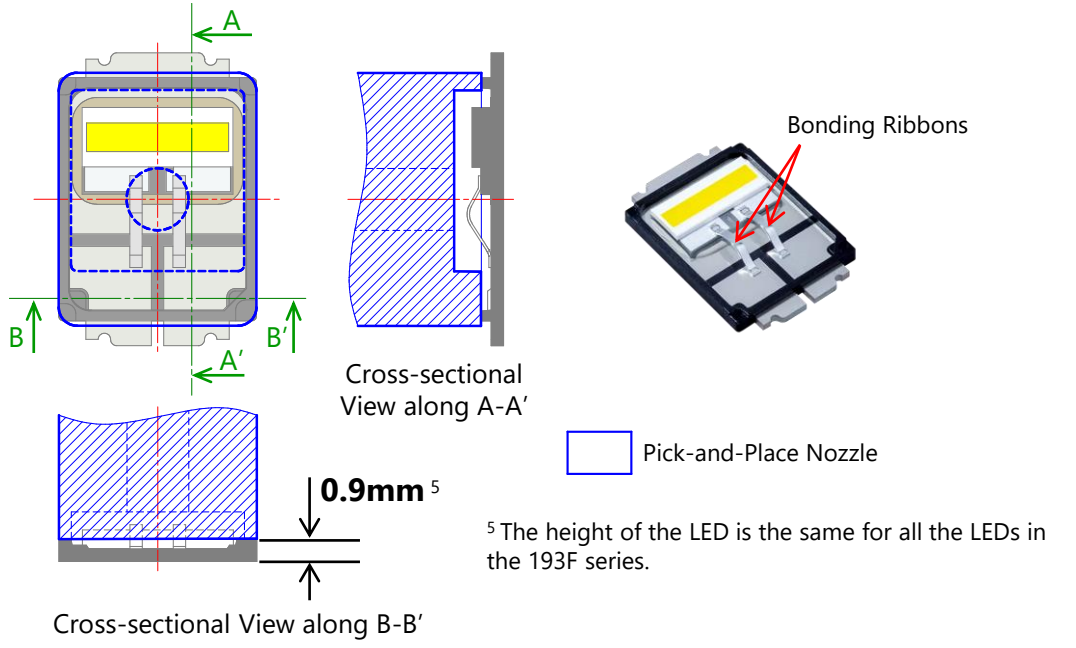


Figure 4. LED Pick-up Position (the NC5W193F LED is shown as an example.)

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### 4.2 Tape-and-Reel Feeder

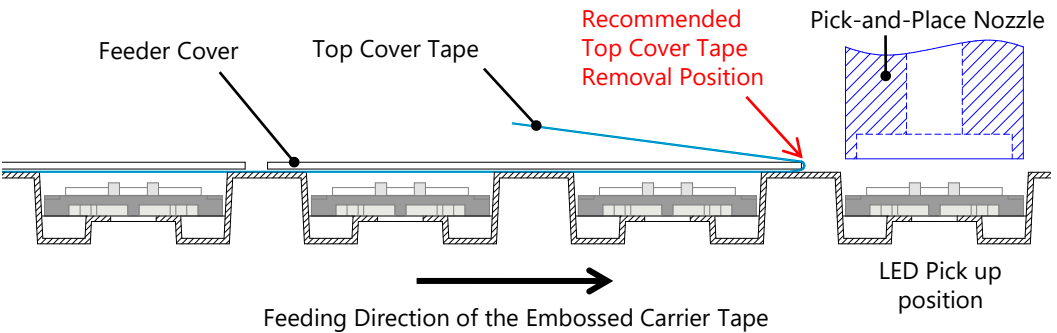


Figure 5. Recommended Top Cover Tape Removal Position

1. For the tape-and-reel feeder, the tape width is set to 24mm and the feeder pitch is set to 12mm.
2. Use a tape-and-reel feeder that ensures it does not create excessive vibrations causing assembly issues.  
Example: Electric (motorized) feeder
3. It is recommended to remove the top cover tape at the recommended position shown in Figure 5 (i.e. immediately before LED pick-up).
4. When handling the reel of the LEDs, ensure that excessive force is not applied to the bonding ribbons of the LEDs. Otherwise, this may cause the ribbons to deform causing the LED to be damaged or not to illuminate.

### 4.3 Recommended Nozzle Height for Pick-up Operations

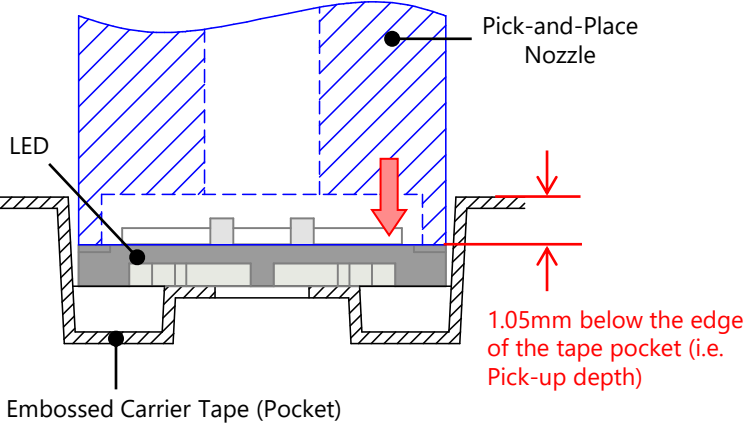


Figure 6. Recommended Nozzle Height for Pick-up Operations

1. Ensure that the nozzle goes down onto the LED in the tape pocket until the tip touches the package (i.e. the black part).  
Pick-up depth: 1.05mm  
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 specific 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 appropriately 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.

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### 4.4 Recommended Nozzle Height for Placement Operations (Placement Depth)

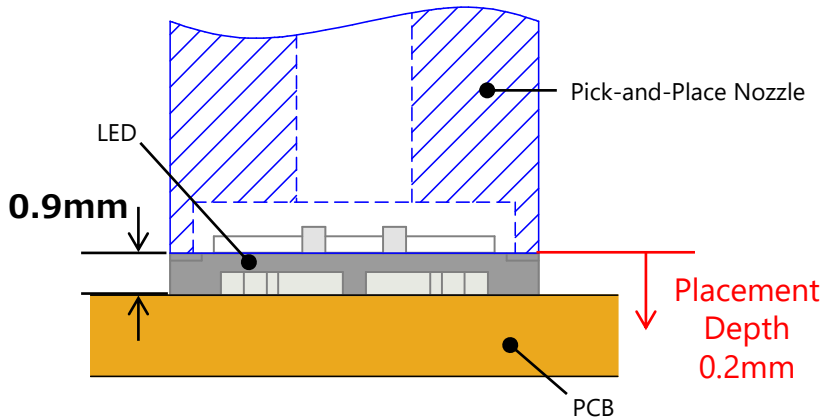


Figure 7. Recommended Nozzle Height for Placement (Placement Depth)

1. The nozzle should further press the LED 0.2mm onto the PCB from the height where the LED first touches solder paste.
  - 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 be mounted in an incorrect place/rotated position, 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

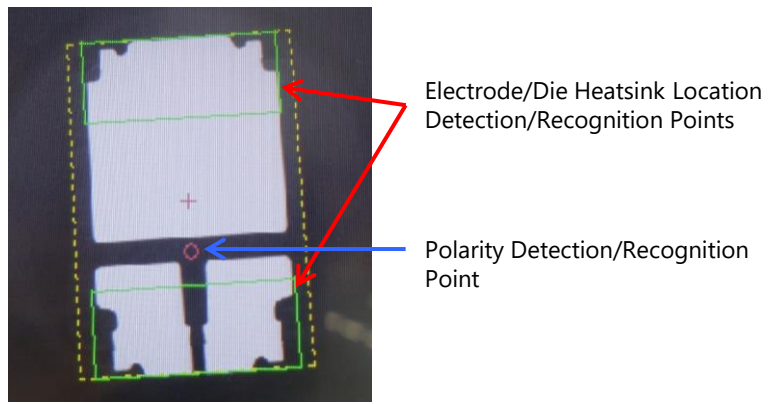


Figure 8. Example of Reference Point to Detect, Recognize, or Locate the Electrodes/Die Heatsink

1. Nichia recommends using the electrodes and die heatsink as a reference to locate the center of the LED.
2. If the imaging device has trouble detecting/recognizing the electrodes/die heatsink, adjust the settings (i.e. the brightness of the light, etc.) of the pick-and-place machine.
3. If an automatic polarity detector is used for the LEDs, set up the imaging device to detect the empty space between the die heatsink and electrodes (i.e. Polarity Detection/Recognition Point in Figure 8 to the left). In the example in Figure 8, the equipment measures the brightness of the empty space against the threshold to locate the electrodes and/or determine the polarity.

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## 5. Precautions When Reflow Soldering

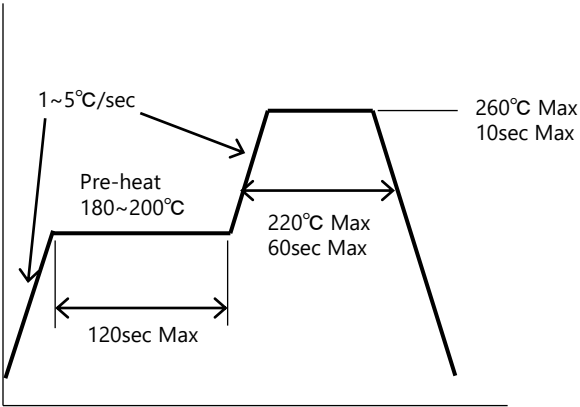


Figure 9. Recommended Reflow Soldering Condition (Lead-free Solder)

1. Reflow soldering must not be performed more than twice.
2. Nichia recommends using the reflow soldering conditions detailed in Figure 9 to the left; use the recommended reflow conditions specified by the manufacturer of the solder paste being used if it works better for the chosen application.

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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