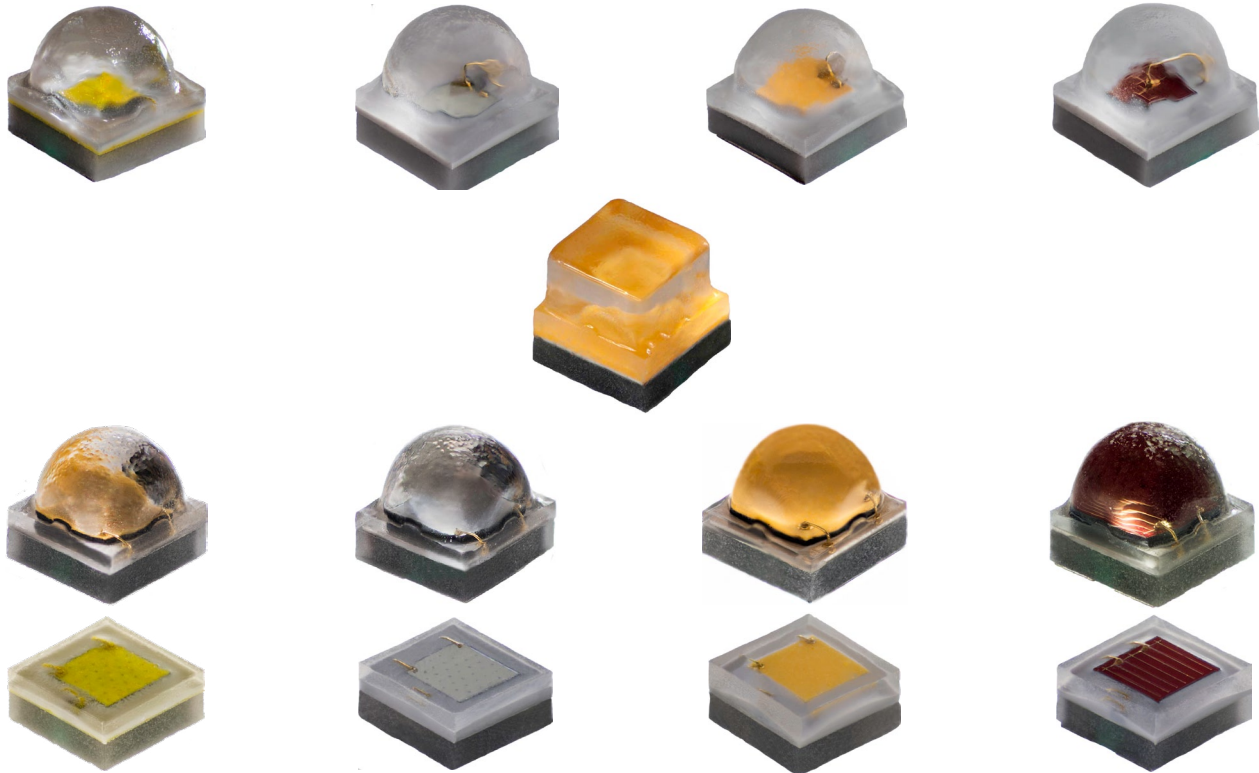


Cree® XLamp® XQ Family LEDs



INTRODUCTION

This application note applies to XLamp® XQ Family LEDs, which have order codes in the following format.

XQxxxx-xx-xxxx-xxxxxxxxxx

This application note explains how XLamp XQ Family LEDs and assemblies containing these LEDs should be handled during manufacturing. Please read the entire document to understand how to properly handle XLamp XQ Family LEDs.

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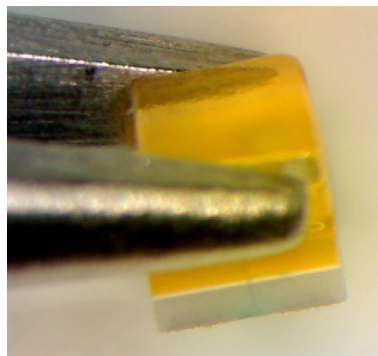
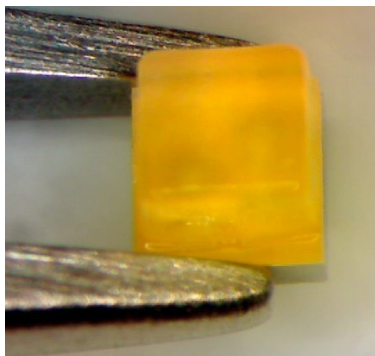
HANDLING XLAMP® XQ FAMILY LEDS

Manual Handling

Use tweezers to grab XLamp XQ Family LEDs at the base. Do not touch the lens with the tweezers. Do not touch the lens with fingers. Do not push on the lens.

Do not apply more than 600 g of shear force onto the lens. Excessive force on the lens could damage the LED.

✓
CORRECT



✗
WRONG

Cree recommends the following at all times when handling XLamp XQ Family LEDs or assemblies containing these LEDs:

- Avoid putting excessive mechanical stress on the LED lens.
- Never touch the optical surface with fingers or sharp objects. The LED lens surface could be soiled or damaged, which would affect the optical performance of the LED.
- Cree recommends always handling XQ family LEDs with appropriate ESD grounding.
- Cree recommends handling XQ family LEDs wearing clean, lint-free gloves.

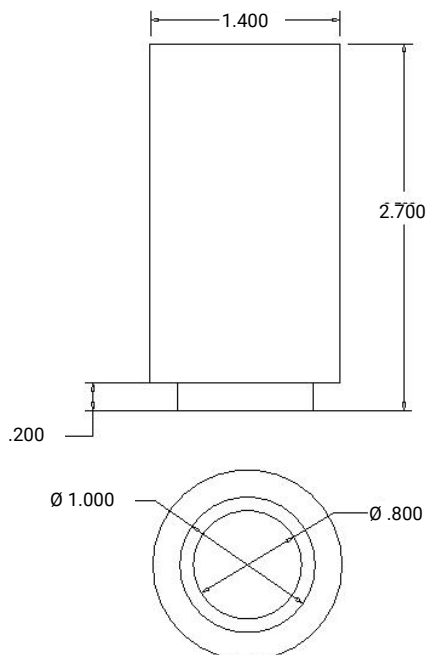
Whenever possible, Cree recommends the use of a pick & place tool to remove XLamp XQ Family LEDs from the factory tape & reel packaging.

Pick & Place Nozzle

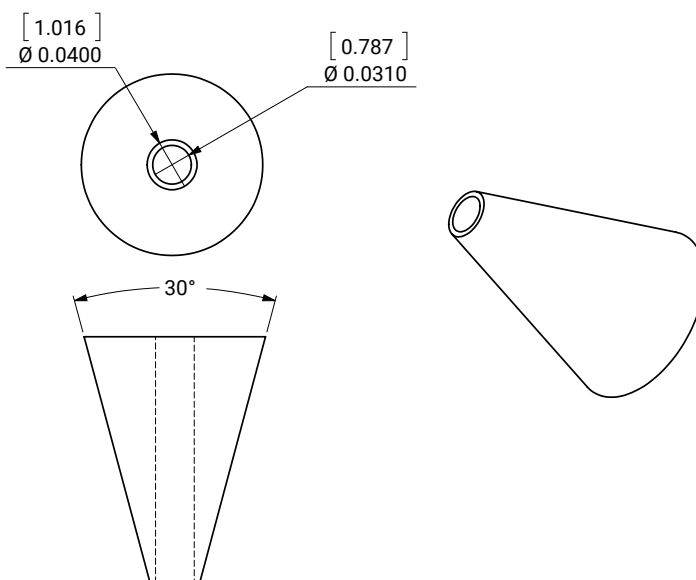
For pick and place nozzles coming into contact with silicone-covered LED components, Cree recommends nozzles be constructed of non-metallic materials. Cree and several of Cree's customers have had good success using nozzles fabricated from 95a urethane. The following pick & place tools are specific to the XQ Family LEDs.

XQ-D

All dimensions in mm.
Measurement tolerances: .xxx = .001 mm



XQ-E



XQ FAMILY DESIGN GUIDELINES

Due to the unique light emission of XQ-D LEDs, Cree recommends the following guidelines to help maximize the performance of XQ-D LEDs.

LED positioning guideline

- Due to the unique light emission of XQ-D LEDs, to minimize light interference between LEDs, Cree recommends a minimum distance of 2.0 mm between XQ-D LEDs.

LED PCB guideline and recommendation

- To take advantage of the light that shines backwards from the LED, Cree recommends the use of either a highly reflective white PCB or white optic material surrounding the XQ-D LEDs. A 5% increase in light output can be realized by using a white optic.

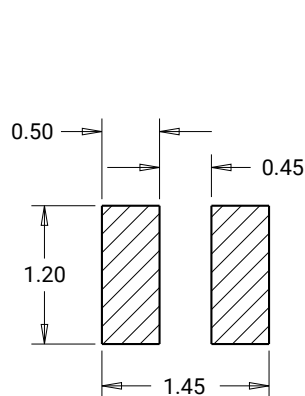
CIRCUIT BOARD PREPARATION & LAYOUTS

Printed circuit boards (PCBs) should be prepared and/or cleaned according to the manufacturer's specifications before placing or soldering XLamp XQ Family LEDs onto the PCB.

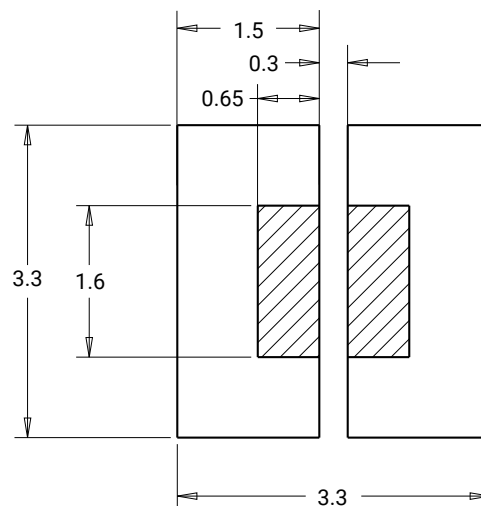
The diagram below shows the recommended PCB solder pad layout for XLamp XQ Family LEDs.

All dimensions in mm.

Measurement tolerance: .xx = ± 13 mm



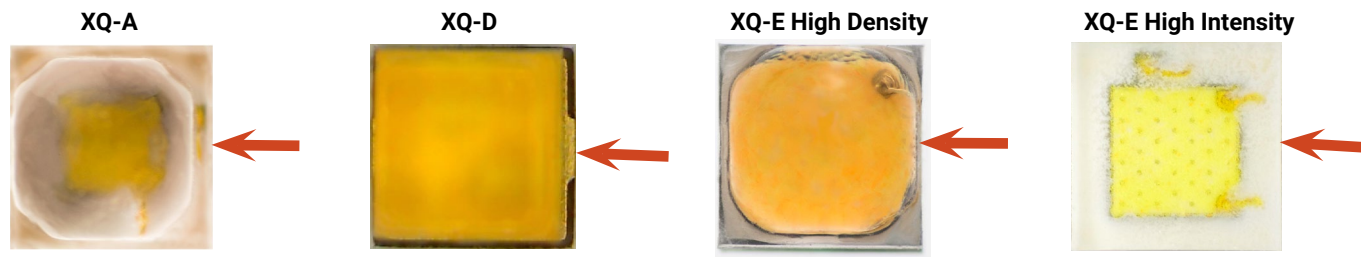
Recommended Stencil Pad



Recommended PC Board Solder Pad and Trace Layout

CASE TEMPERATURE (T_s) MEASUREMENT POINT

XLamp XQ Family LED case temperature (T_s) should be measured on the PCB surface, as close to the LED's base as possible. This measurement point is shown in the pictures below. Connect the thermocouple at a point where the voltage potential is below the rating for the meter. XQ Family LEDs do not have an isolated thermal pad and care should be exercised to avoid bridging the anode and cathode together, which may occur if the thermocouple bead is large. Cree recommends using a 36 AWG (0.01267 mm²) thermocouple wire for T_s measurements.



It is not required to use a solder footprint for the thermal pad that is larger than the XLamp XQ Family LED itself. In testing, Cree has found such a solder pad to have insignificant impact on the resulting T_s measurement.

NOTES ON SOLDERING XLAMP® XQ FAMILY LEDs

XLamp XQ Family LEDs are designed to be reflow soldered to a PCB. Reflow soldering may be done by a reflow oven or by placing the PCB on a hotplate and following the reflow soldering profile listed on page 8.

Do not wave solder XLamp XQ Family LEDs. Do not hand solder XLamp XQ Family LEDs.

✓
CORRECT



✓
CORRECT



✗
WRONG

NOTES ON SOLDERING XLAMP® XQ FAMILY LEDS - CONTINUED

Solder Paste Type

Cree strongly recommends using “no clean” solder paste with XLamp XQ Family LEDs so that cleaning the PCB after reflow soldering is not required. Cree uses [Kester® R276 solder paste](#) internally.

Cree recommends the following solder paste compositions: SnAgCu (tin/silver/copper) and SnAg (tin/silver).

Solder Paste Thickness

The choice of solder and the application method will dictate the specific amount of solder. For the most consistent results, an automated dispensing system or a solder stencil printer is recommended. Cree has seen positive results using solder thickness that results in a 4-mil (102- μ m) bond line, i.e., the solder joint thickness after reflow soldering.


CORRECT




WRONG

After Soldering

After soldering, allow XLamp XQ Family LEDs to return to room temperature before subsequent handling. Handling of the device, especially around the lens, before cooling could result in damage to the LED.

Cree recommends verifying the solder process by checking the consistency of the solder bond of several trial PCBs after reflow. This can be done by X-ray or by shearing selected devices from the circuit board. The solder should appear completely re-flowed (no solder grains evident). The solder areas should show minimum evidence of voids on the backside of the package and the PCB.

Cleaning PCBs After Soldering

Cree recommends using “no clean” solder paste so that flux cleaning is not necessary after reflow soldering. If PCB cleaning is necessary, Cree recommends the use of isopropyl alcohol (IPA).

Do not use ultrasonic cleaning.

MOISTURE SENSITIVITY

Cree recommends keeping XLamp LEDs in the provided, resealable moisture-barrier packaging (MBP) until immediately prior to soldering. Unopened MBPs that contain XLamp LEDs do not need special storage for moisture sensitivity. Bare XLamp LEDs have a storage temperature range of -40 °C to 100 °C. However, the MBP, reel, tape and box have a more limited storage temperature range.

Once the MBP is opened, XLamp XQ Family LEDs may be stored as MSL 1 per JEDEC J-STD-033, meaning they have unlimited floor life in conditions of ≤ 30 °C/85% relative humidity (RH). Regardless of storage condition, Cree recommends sealing any unsoldered LEDs in the original MBP.

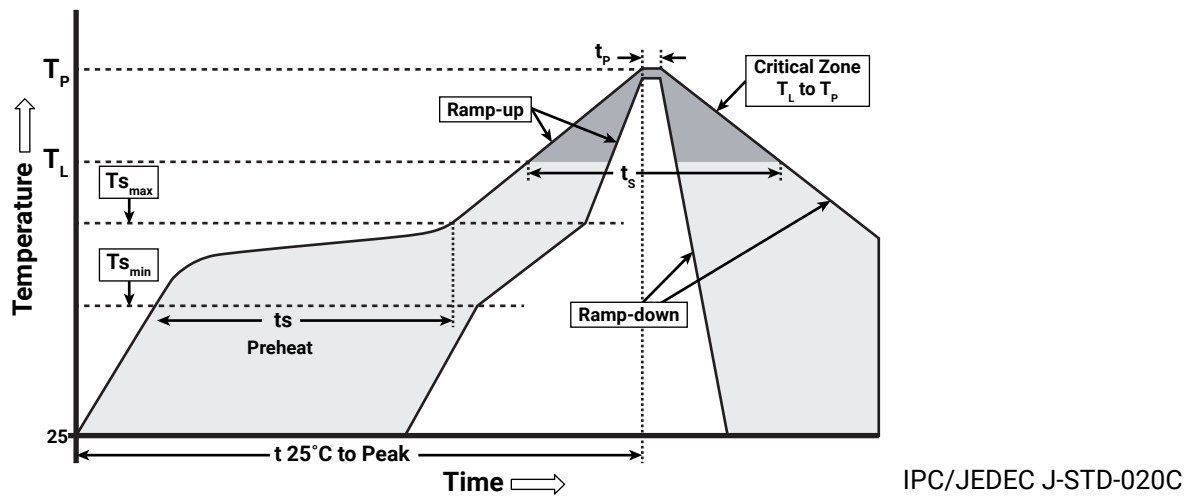
ESD

XQ-A and XQ-D LEDs have an ESD class rating of 1. Cree recommends following the JESD 625 standard, "Requirements for Handling Electrostatic-Discharge-Sensitive (ESDS) Devices," when handling XQ-A and XQ-D LEDs or any LED component. Passing a static charge through an electrostatic-discharge-sensitive device can result in performance degradation or catastrophic failure of the device.

XLAMP® XQ FAMILY LED REFLOW SOLDERING CHARACTERISTICS

In testing, Cree has found XLamp XQ Family LEDs to be compatible with JEDEC J-STD-020C, using the parameters listed below. As a general guideline, Cree recommends that users follow the recommended soldering profile provided by the manufacturer of the solder paste used, and therefore it is the lamp or luminaire manufacturer's responsibility to determine applicable soldering requirements.

Note that this general guideline is offered as a starting point and may require adjustment for certain PCB designs and configurations of reflow soldering equipment.



Profile Feature	Lead-Free Solder
Average Ramp-Up Rate ($T_{s_{max}}$ to T_P)	1.2 °C/second
Preheat: Temperature Min ($T_{s_{min}}$)	120 °C
Preheat: Temperature Max ($T_{s_{max}}$)	170 °C
Preheat: Time ($t_{s_{min}}$ to $t_{s_{max}}$)	65-150 seconds
Time Maintained Above: Temperature (T_L)	217 °C
Time Maintained Above: Time (t_L)	45-90 seconds
Peak/Classification Temperature (T_P)	235 - 245 °C
Time Within 5 °C of Actual Peak Temperature (t_p)	20-40 seconds
Ramp-Down Rate	1 - 6 °C/second
Time 25 °C to Peak Temperature	4 minutes max.

Note: All temperatures refer to topside of the package, measured on the package body surface.

CHEMICALS & CONFORMAL COATINGS

Below are representative lists of chemicals and materials to be used or avoided in LED manufacturing activities. For a complete and current list of recommended chemicals, conformal coatings and harmful chemicals consult Cree's [Chemical Compatibility Application Note](#). The video at www.youtube.com/watch?v=t24bf9D_1SA illustrates the process Cree has developed for testing the compatibility of chemicals and materials with LEDs. You should also consult your regional Cree Field Applications Engineer.

Recommended Cleaning Solutions

Cree has found the following chemicals to be safe to use with XLamp XQ Family LEDs.

- Water
- Isopropyl alcohol (IPA)

Chemicals Tested as Harmful

In general, subject to the specifics in Cree's [Chemical Compatibility Application Note](#), Cree has found certain chemicals to be harmful to XLamp XQ Family LEDs. Cree recommends not using these chemicals anywhere in an LED system containing XLamp XQ Family LEDs. The fumes from even small amounts of the chemicals may damage the LEDs.

- Chemicals that might outgas aromatic hydrocarbons (e.g., toluene, benzene, xylene)
- Methyl acetate or ethyl acetate (i.e., nail polish remover)
- Cyanoacrylates (i.e., "Superglue")
- Glycol ethers (including Radio Shack® Precision Electronics Cleaner - dipropylene glycol monomethyl ether)
- Formaldehyde or butadiene (including Ashland® PLIOBOND® adhesive)

Hermetically Sealing Luminaires

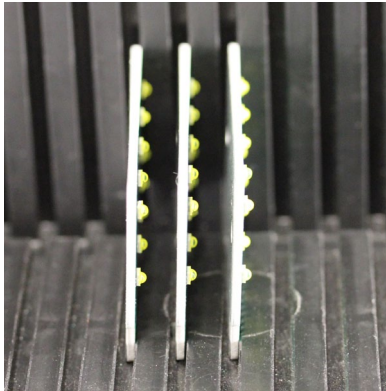
For proper LED operation and to avoid potential lumen depreciation and/or color shift, LEDs of all types must operate in an environment that contains oxygen. Simply allowing the LEDs to ventilate to air is sufficient; no extraordinary measures are required. Hermetically sealing LEDs in an enclosed space is not recommended.

ASSEMBLY STORAGE & HANDLING

Do not stack PCBs or assemblies containing XLamp XQ Family LEDs so that anything rests on the LED lens. Force applied to the LED lens may result in the lens being knocked off. PCBs or assemblies containing XLamp XQ Family LEDs should be stacked in a way to allow at least 1 cm clearance above the LED lens.

Do not use bubble wrap directly on top of XLamp XQ Family LEDs. Force from the bubble wrap can potentially damage the LED.

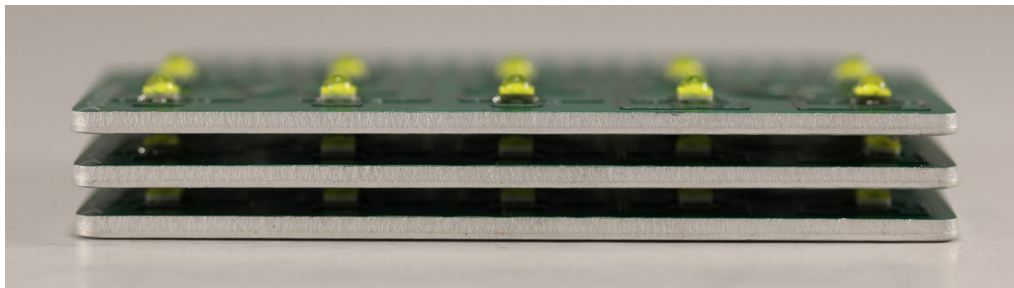
✓
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CORRECT



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WRONG

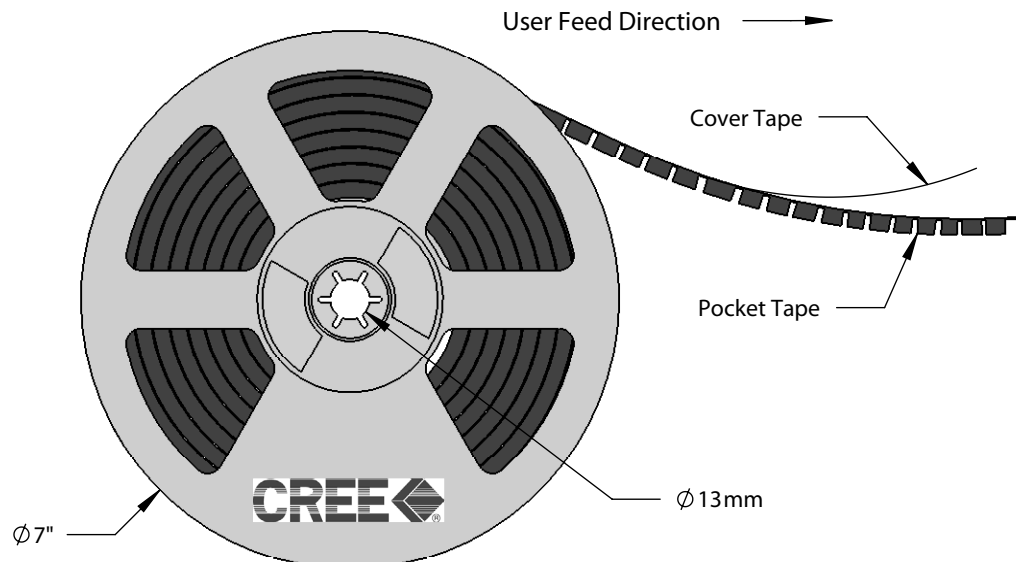
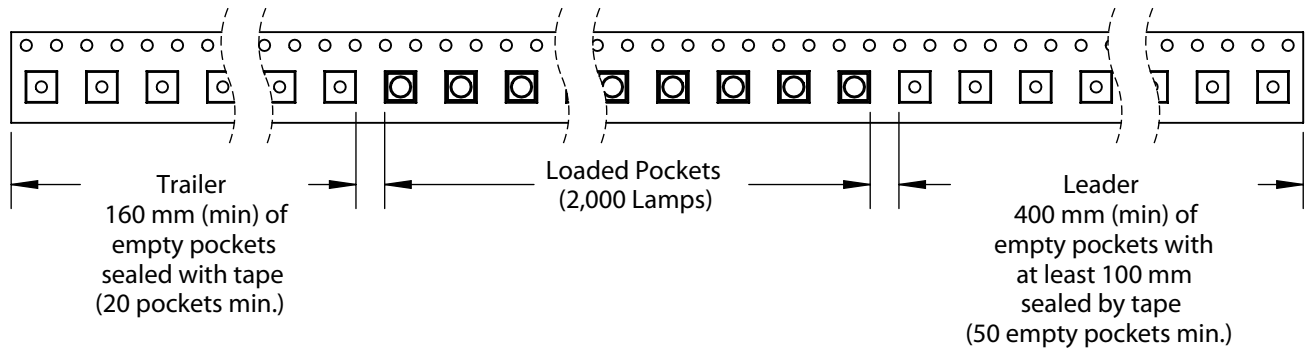
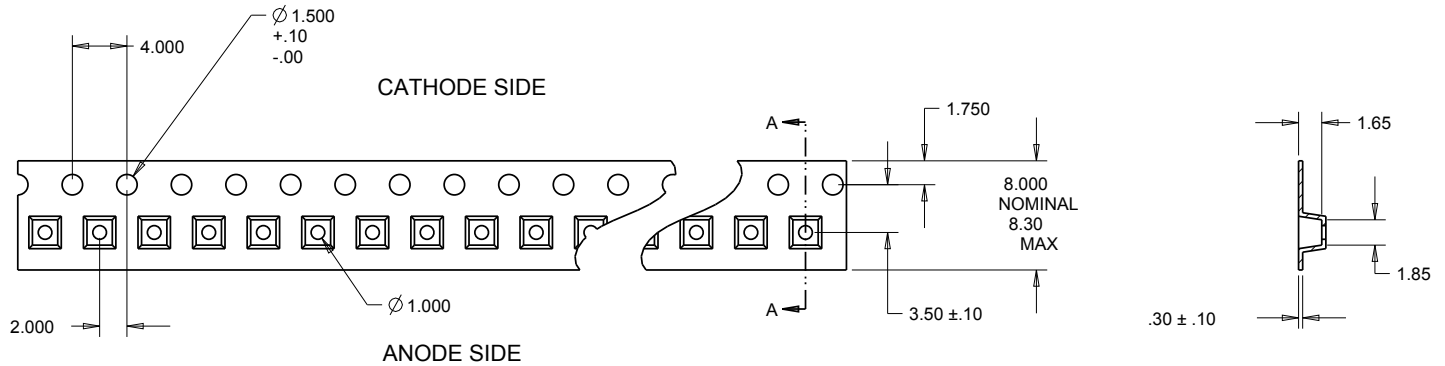


TAPE AND REEL

All Cree carrier tapes conform to EIA-481D, Automated Component Handling Systems Standard.

Except as noted, all dimensions in mm.

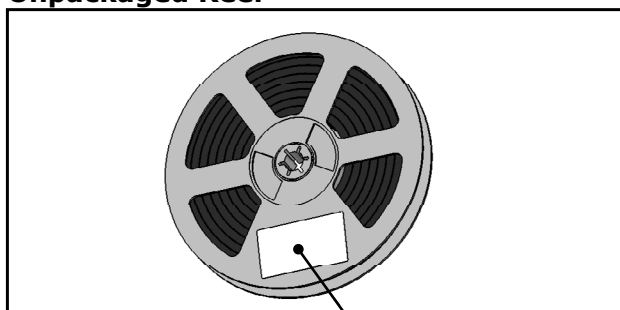
Measurement tolerances unless indicated otherwise: .xx = ± 0.25 mm, .xxx = ± 0.125 mm



PACKAGING & LABELS

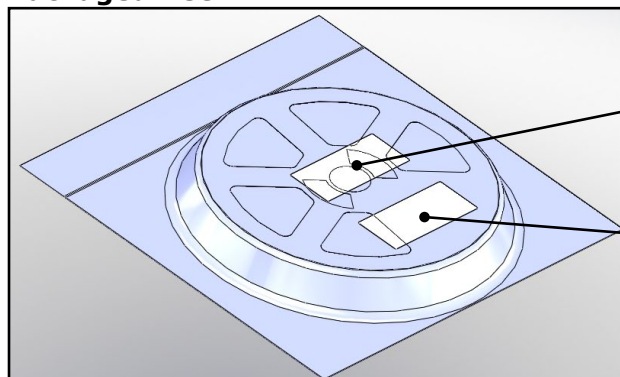
The diagrams below show the packaging and labels Cree uses to ship XLamp XQ Family LEDs. XLamp XQ Family LEDs are shipped in tape loaded on a reel. Each box contains only one reel in a moisture barrier bag.

Unpackaged Reel



Label with Cree Bin Code,
Quantity, Reel ID

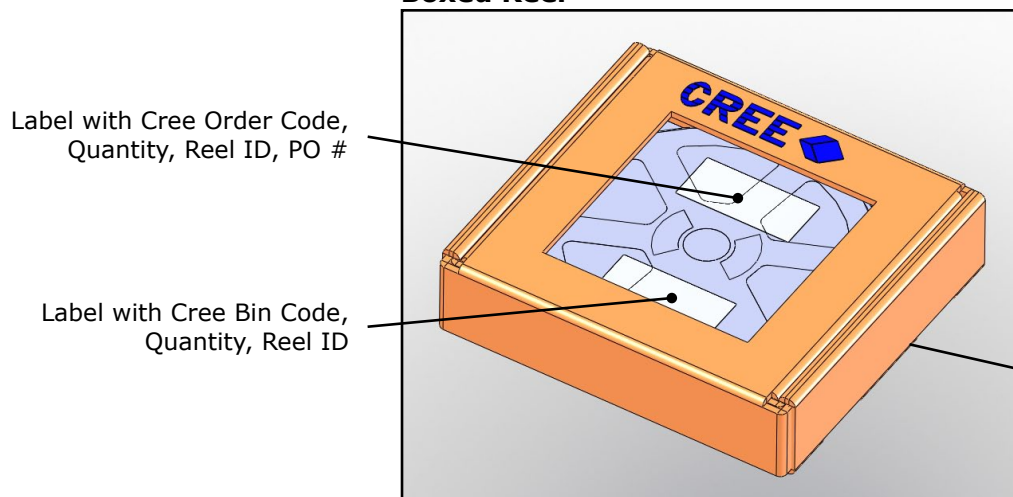
Packaged Reel



Label with Cree Order Code,
Quantity, Reel ID, PO #

Label with Cree Bin Code,
Quantity, Reel ID

Boxed Reel



Label with Cree Order Code,
Quantity, Reel ID, PO #

Label with Cree Bin Code,
Quantity, Reel ID

Patent Label
(on bottom of box)