

Cree® XLamp® XR Family LEDs



INTRODUCTION

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

XRxxxx-xx-xxxx-xxxxxx

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

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HANDLING XLAMP® XR FAMILY LEDs

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

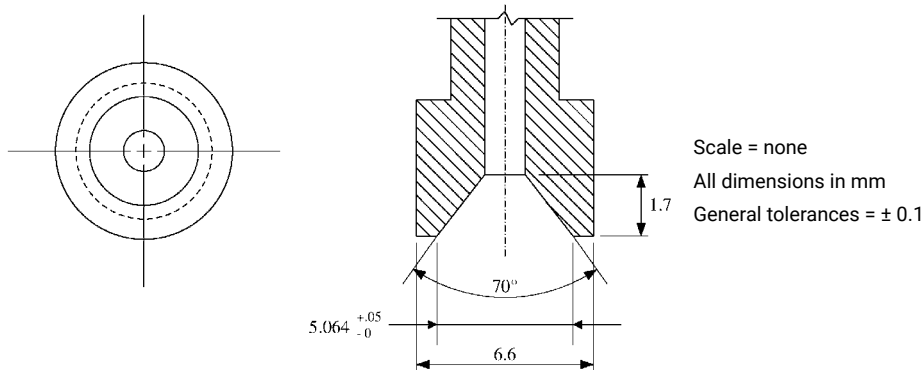
- Avoid putting mechanical stress on the LED lens.
- Never touch the optical surface with fingers or sharp objects. The LED lens surface could be soiled or damaged, which would affect the optical performance of the LED.
- Cree recommends always handling XR family LEDs with appropriate ESD grounding.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

Whenever possible, Cree recommends the use of a pick & place tool to remove XLamp XR 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 90d urethane.

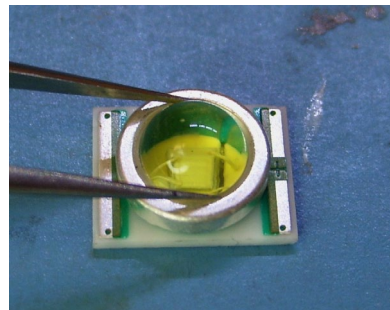
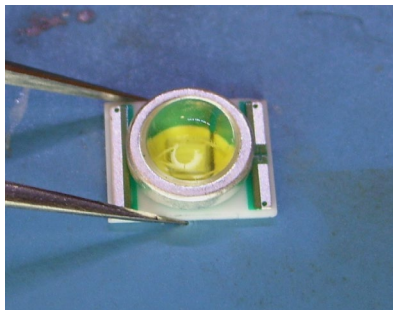
Cree recommends the pickup tool shown below for XLamp XR family LEDs.



Manual Handling

Use tweezers to grab XLamp XR 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.

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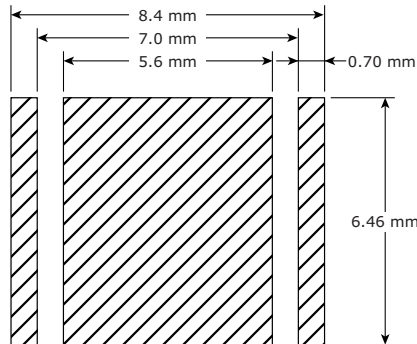


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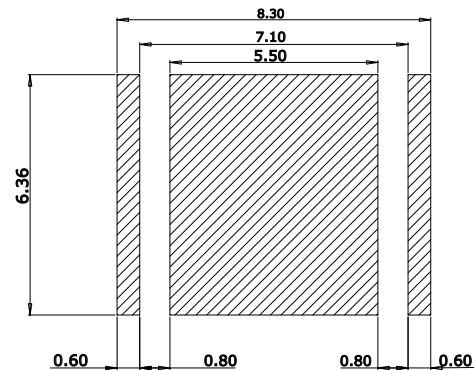
CIRCUIT BOARD PREPARATION & LAYOUTS

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

The diagram below shows the recommended PCB solder pad layout for XLamp XR family LEDs.



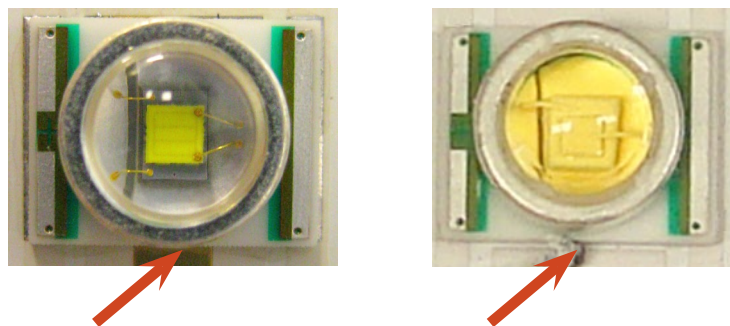
**Recommended solder pad
for XLamp XR family LEDs**



**Recommended stencil pattern
for XLamp XR family LEDs
(hatched area is opening)**

CASE TEMPERATURE (T_s) MEASUREMENT POINT

XLamp XR family LED case temperature (T_s) should be measured on the PCB surface, as close to the LED's thermal pad as possible. This measurement point is shown in the pictures below.



It is not required to use a solder footprint for the thermal pad that is larger than the XLamp XR 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® XR FAMILY LEDs

XLamp XR 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 the previous page.

Do not wave solder XLamp XR family LEDs. Do not hand solder XLamp XR family LEDs.

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Solder Paste Type

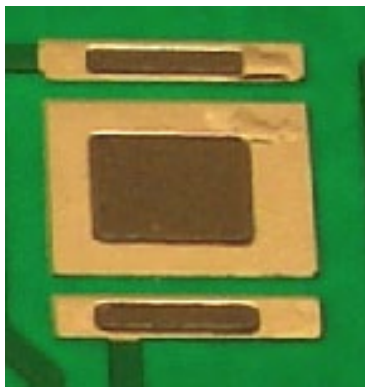
Cree strongly recommends using “no clean” solder paste with XLamp XR family LEDs so that cleaning the PCB after soldering is not required. Cree uses [Kester® R276 solder paste](#) internally.

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

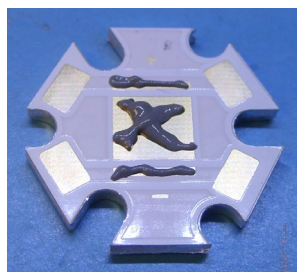
Solder Paste Thickness

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.

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WRONG

After Soldering

After soldering, allow XLamp XR family LEDs to return to room temperature before subsequent handling. Premature handling of the device, especially around the lens, 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. After 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.

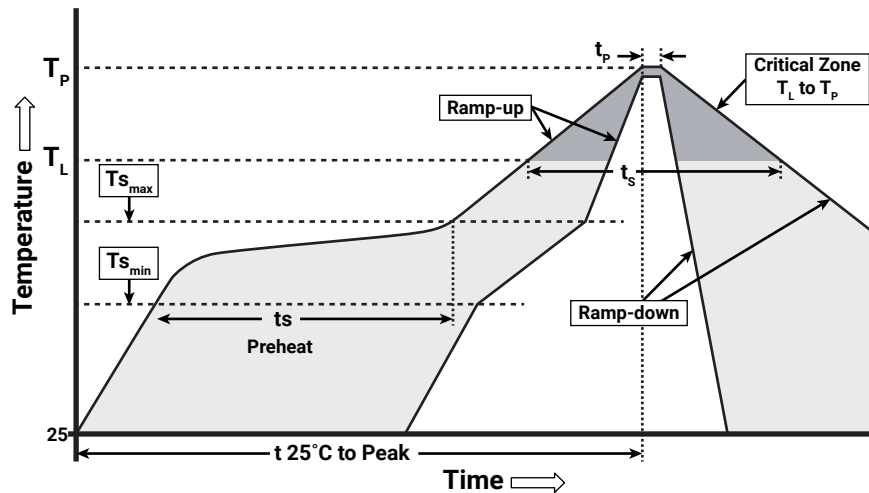
Cleaning PCBs After Soldering

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).

XLAMP® XR FAMILY LED REFLOW SOLDERING CHARACTERISTICS

In testing, Cree has found XLamp XR 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 may not apply to all PCB designs and configurations of reflow soldering equipment.



IPC/JEDEC J-STD-020C

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.

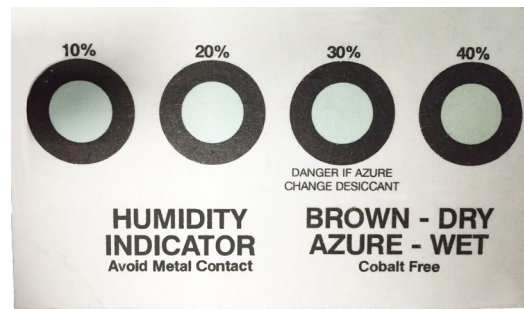
MOISTURE SENSITIVITY

Cree recommends keeping XLamp XR-C 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.

Humidity inside the MBP can be checked immediately after opening the MBP by inspecting the humidity indicator card. The pictures below provide a guide on how to read the humidity indicator card immediately after opening the MBP.



The humidity indicator card shows that the humidity has not reached 10%.



The humidity indicator card shows that the humidity level has exceeded 30%.

Once the MBP is opened, XLamp XR-C LEDs should be handled and stored as MSL 4 per JEDEC J-STD-033, meaning they have limited exposure time before damage to the LED may occur during the soldering operation. The table on the right specifies the maximum exposure time in days depending on temperature and humidity conditions. LEDs with exposure time longer than the specified maximums must be baked according to the baking conditions listed below.

Temp.	Maximum Percent Relative Humidity						
	30%	40%	50%	60%	70%	80%	90%
30 °C	9	5	4	3	1	1	1
25 °C	12	7	5	4	2	1	1
20 °C	17	9	7	6	2	2	1

Baking Conditions

It is not necessary to bake all XLamp LEDs. Only the LEDs that meet all of the following criteria must be baked:

- LEDs that have been removed from the original MBP.
- LEDs that have been exposed to a humid environment longer than listed in the Moisture Sensitivity section above.
- LEDs that have not been soldered.

LEDs should be baked at 70 °C for 24 hours. LEDs may be baked on the original reels. Remove LEDs from the MBP before baking. Do not bake parts at temperatures higher than 70 °C. This baking operation resets the exposure time as defined in the Moisture Sensitivity section above.

Storage Conditions

XLamp LEDs that have been removed from the original MBP but not soldered yet should be stored in a room or cabinet that will maintain an atmosphere of 25 ± 5 °C and no greater than 10% RH (relative humidity). For LEDs stored in these conditions, storage time does not add to exposure time as defined in the Moisture Sensitivity section above.

LOW TEMPERATURE OPERATION

The minimum operating temperature of these XLamp LED components is -40 °C. To maximize lifetime, Cree recommends avoiding applications where the lamps are cycled on and off more than 10,000 cycles at temperatures below 0 °C.

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 Chemicals

In testing, Cree has found the following chemicals to be safe to use with XLamp XR 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 XR family LEDs. Cree recommends not using these chemicals anywhere in an LED system containing XLamp XR 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

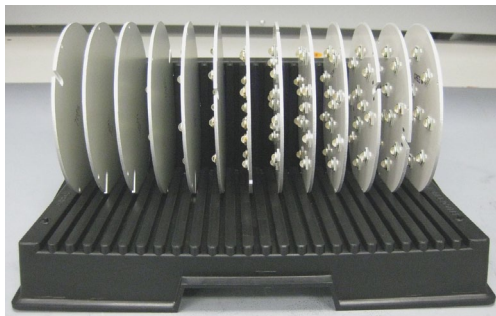
For proper LED operation and to avoid potential lumen depreciation and/or color shift, LEDs of all types must operate in an environment that contains oxygen. Simply allowing the LEDs to ventilate to air is sufficient; no extraordinary measures are required. Hermetically sealing LEDs in an enclosed space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

ASSEMBLY STORAGE & HANDLING

Do not stack PCBs or assemblies containing XLamp XR family LEDs so that anything rests on the XLamp LED lens. Force applied to the XLamp LED lens may result in the lens being knocked off. PCBs or assemblies containing XLamp XR 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 XR family LEDs. Force from the bubble wrap can potentially damage the LED.

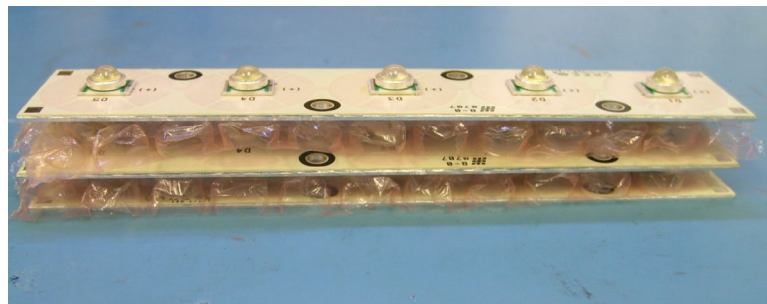
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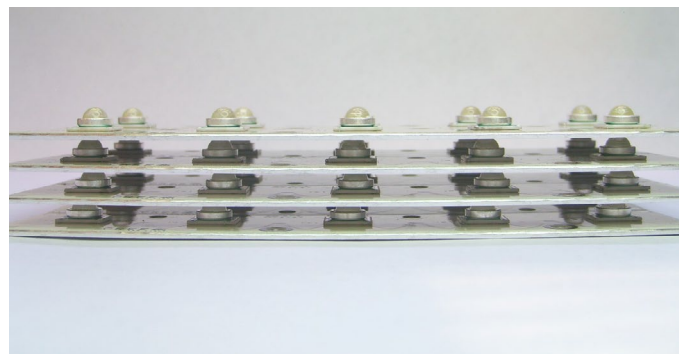
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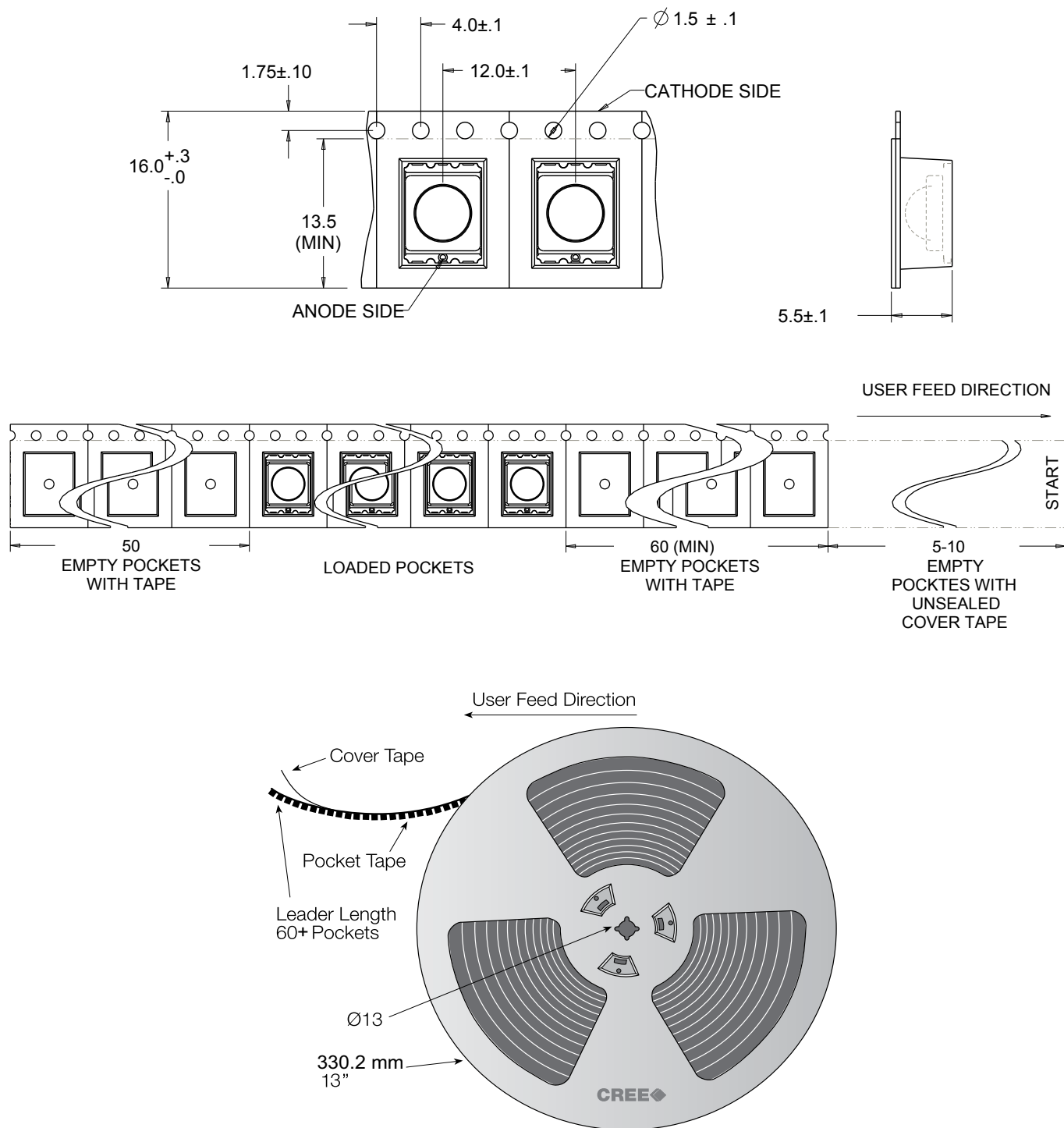


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TAPE AND REEL

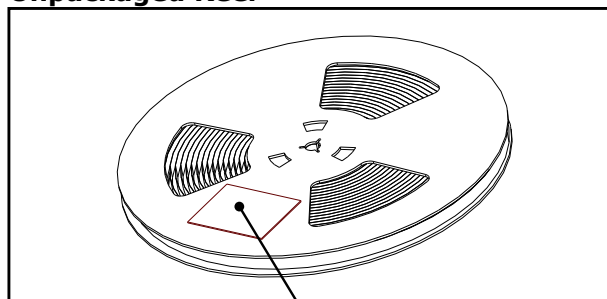
All Cree carrier tapes conform to EIA-481D, Automated Component Handling Systems Standard.



PACKAGING AND LABELS

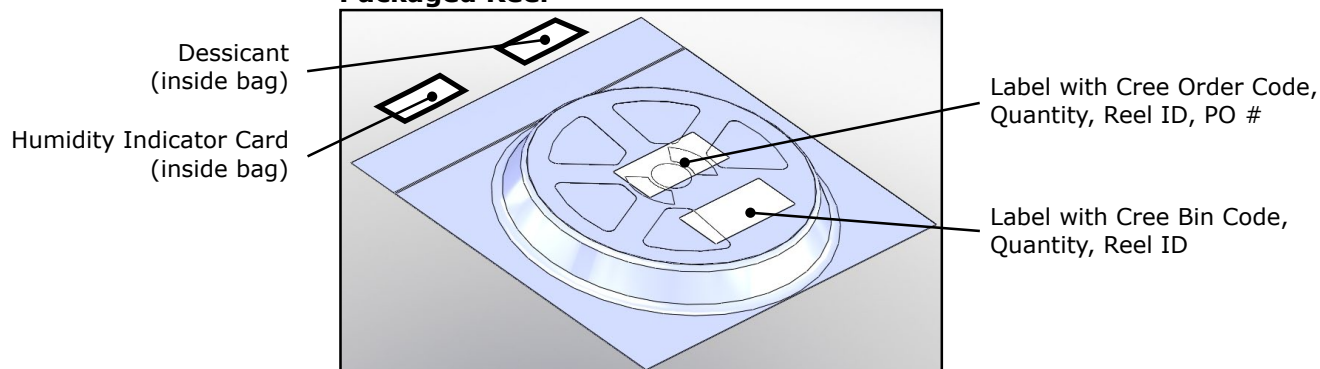
The diagrams below show the packaging and labels Cree uses to ship XLamp XR family LEDs. XLamp XR family LEDs are shipped in tape loaded on a reel. Each box contains only one reel in a moisture barrier bag.

Unpackaged Reel



Label with Cree Bin Code,
Quantity, Reel ID

Packaged Reel



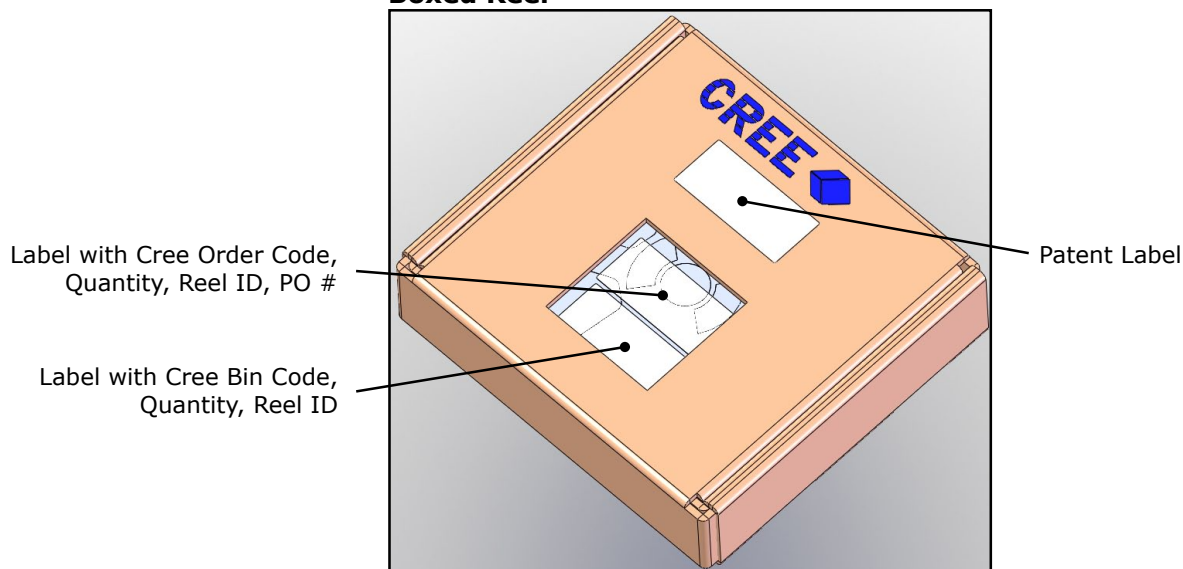
Dessicant
(inside bag)

Humidity Indicator Card
(inside bag)

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