

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:

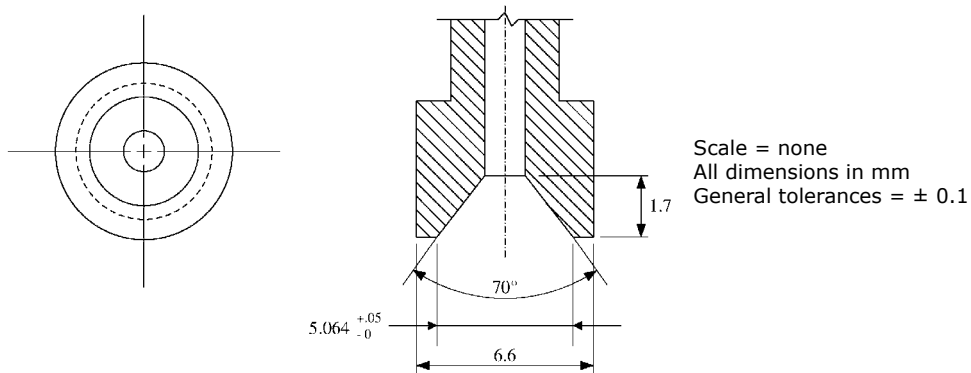
- Avoid putting mechanical stress on the LED lens.
- Never touch the optical surface with fingers or sharp objects. The LED lens surface could be soiled or damaged, which would affect the optical performance of the LED.
- Cree recommends always handling XR family LEDs with appropriate ESD grounding.
- 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 Teflon or from 90d urethane.

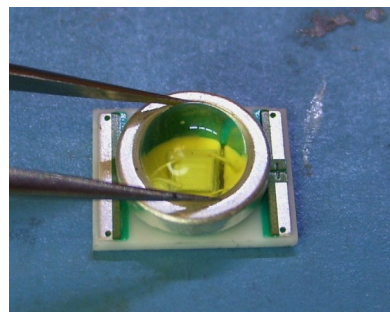
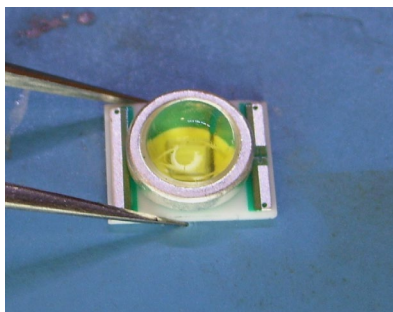
Cree recommends the pickup tool shown below for XLamp XR family LEDs.



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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CORRECT

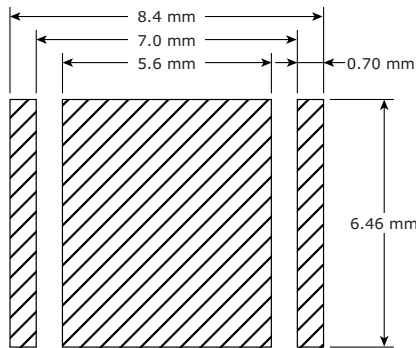


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WRONG

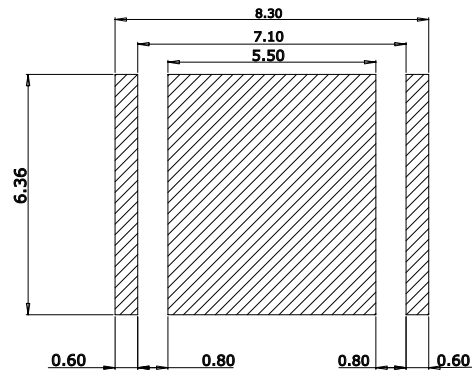
CIRCUIT BOARD PREPARATION & LAYOUTS

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.



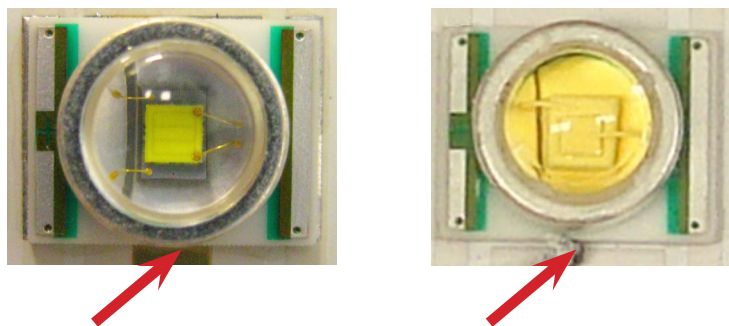
Recommended solder pad for XLamp XR family LEDs



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 LEADS

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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CORRECT



✗
WRONG

✓
CORRECT



Solder Paste Type

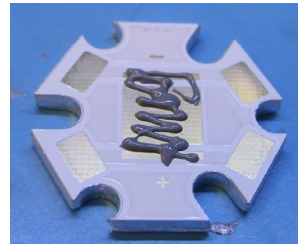
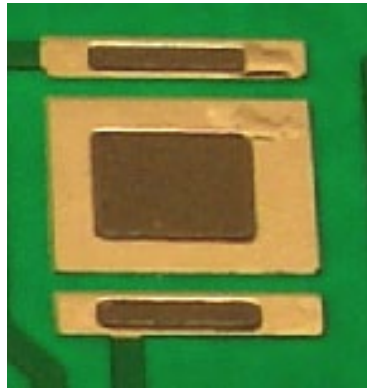
Cree strongly recommends using "no clean" solder paste with XLamp XR family LEDs so that cleaning the PCB after soldering is not required. Cree uses [Kester® R276 solder paste](#) internally.

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

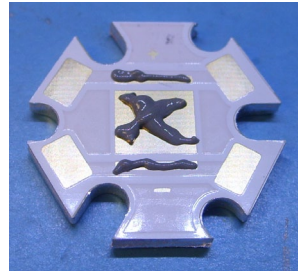
Solder Paste Thickness

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 3-mil (75-µm) bond line, i.e., the solder joint thickness after reflow soldering.

✓
CORRECT



✗
WRONG



✗
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.

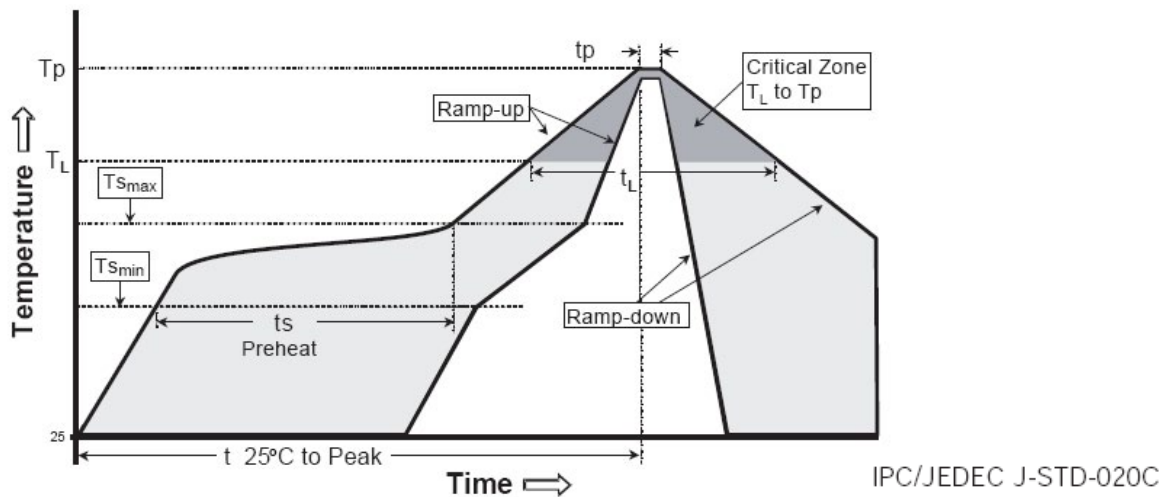
Cleaning PCBs After Soldering

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 solder paste used.

Note that this general guideline may not apply to all PCB designs and configurations of reflow soldering equipment.



Profile Feature	Lead-Based Solder	Lead-Free Solder
Average Ramp-Up Rate ($T_{S_{max}}$ to T_p)	3 °C/second max.	3 °C/second max.
Preheat: Temperature Min ($T_{S_{min}}$)	100 °C	150 °C
Preheat: Temperature Max ($T_{S_{max}}$)	150 °C	200 °C
Preheat: Time ($t_{s_{min}}$ to $t_{s_{max}}$)	60-120 seconds	60-180 seconds
Time Maintained Above: Temperature (T_L)	183 °C	217 °C
Time Maintained Above: Time (t_L)	60-150 seconds	60-150 seconds
Peak/Classification Temperature (T_p)	215 °C	260 °C
Time Within 5 °C of Actual Peak Temperature (t_p)	10-30 seconds	20-40 seconds
Ramp-Down Rate	6 °C/second max.	6 °C/second max.
Time 25 °C to Peak Temperature	6 minutes max.	8 minutes max.

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

MOISTURE SENSITIVITY

XLamp XR family LEDs are shipped in sealed, moisture-barrier bags (MBB) designed for long shelf life. Each MBB is backfilled with inert nitrogen gas after being evacuated. As a result, the visual appearance of pressure in the MBB will vary from one bag to another. Visual appearance of the MBB is not an indicator of humidity in the MBB.

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

HR < 10%	HR < 20%	HR < 30%	HR < 40%	HR < 50%	HR < 60%	HR > 60%
<p>HUMIDITY INDICATOR</p> <p>MODEL# 8-4028 1-400-795-8110</p> <p>60% 50% 40% 30% 20% 10%</p> <p>ACROSS THE RANGE DANGER IF PINK CHANGE DESICCANT</p> <p>READ AT LAVENDER BETWEEN PINK & BLUE</p>	<p>HUMIDITY INDICATOR</p> <p>MODEL# 8-4028 1-400-795-8110</p> <p>60% 50% 40% 30% 20% 10%</p> <p>ACROSS THE RANGE DANGER IF PINK CHANGE DESICCANT</p> <p>READ AT LAVENDER BETWEEN PINK & BLUE</p>	<p>HUMIDITY INDICATOR</p> <p>MODEL# 8-4028 1-400-795-8110</p> <p>60% 50% 40% 30% 20% 10%</p> <p>ACROSS THE RANGE DANGER IF PINK CHANGE DESICCANT</p> <p>READ AT LAVENDER BETWEEN PINK & BLUE</p>	<p>HUMIDITY INDICATOR</p> <p>MODEL# 8-4028 1-400-795-8110</p> <p>60% 50% 40% 30% 20% 10%</p> <p>ACROSS THE RANGE DANGER IF PINK CHANGE DESICCANT</p> <p>READ AT LAVENDER BETWEEN PINK & BLUE</p>	<p>HUMIDITY INDICATOR</p> <p>MODEL# 8-4028 1-400-795-8110</p> <p>60% 50% 40% 30% 20% 10%</p> <p>ACROSS THE RANGE DANGER IF PINK CHANGE DESICCANT</p> <p>READ AT LAVENDER BETWEEN PINK & BLUE</p>	<p>HUMIDITY INDICATOR</p> <p>MODEL# 8-4028 1-400-795-8110</p> <p>60% 50% 40% 30% 20% 10%</p> <p>ACROSS THE RANGE DANGER IF PINK CHANGE DESICCANT</p> <p>READ AT LAVENDER BETWEEN PINK & BLUE</p>	<p>HUMIDITY INDICATOR</p> <p>MODEL# 8-4028 1-400-795-8110</p> <p>60% 50% 40% 30% 20% 10%</p> <p>ACROSS THE RANGE DANGER IF PINK CHANGE DESICCANT</p> <p>READ AT LAVENDER BETWEEN PINK & BLUE</p>
✓	✓	✓	✗	✗	✗	✗

If XLamp XR family LEDs are exposed to moist environments after opening the MBB packaging but before soldering, damage to the LED may occur during the soldering operation.

The following derating table defines the maximum exposure time (in days) for XLamp XR family LEDs in the listed humidity and temperature conditions. LEDs with exposure time longer than the time specified below must be baked according to the baking conditions listed below.

Temperature	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

XLamp LEDs stored at < 30 °C and < 30% RH will not require baking before reflow soldering. One method to verify these conditions is to keep the humidity indicator card with the LEDs. If the 30% RH circle on the humidity indicator card is blue, the LEDs do not need to be baked. If the 30% RH circle is pink, XLamp LEDs should be baked using the baking procedure listed on the next page.

MOISTURE SENSITIVITY (CONTINUED)

Cree recommends keeping XLamp LEDs in their sealed moisture-barrier packaging until immediately prior to use. Cree also recommends returning any unused LEDs to the resealable moisture-barrier bag and closing the bag immediately after use.

Baking Conditions

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

1. LEDs that have been removed from the original MBB packaging.
2. LEDs that have been exposed to a humid environment longer than listed in the Moisture Sensitivity section above.
3. LED that have not been soldered.

Baking Procedure

Baking the LEDs will remove moisture from the package and reset the exposure time, as defined in the Moisture Sensitivity section above. Cree recommends baking any LEDs that may have been exposed to excessive moisture.

1. Remove LEDs or reel of LEDs from MBB packaging.
2. LEDs may be baked on the original reels.
3. Bake LEDs or reel of LEDs at 80 °C for 24 hours.
4. Reflow solder the parts within one hour of baking or immediately store the parts in a container with < 20% RH (relative humidity).

IMPORTANT: Do not bake reels of LEDs at temperatures higher than 80 °C.

Storage Conditions

XLamp XR family LEDs that have been unsealed from the original packaging but not soldered should be stored in one of the following ways:

- Store the parts in a rigid metal container with tight fitting lid. Place fresh dessicant and a RH indicator in the container to verify < 20% RH.
- Store the parts in a dry, nitrogen-purged cabinet or container that actively maintains < 20% RH.
- For short-term storage only: LEDs can be resealed in the original MBB bag soon after opening. Fresh dessicant may be needed. Use the included humidity indicator card to verify < 20% RH.

If an environment of < 20% RH is not available for storage, XLamp XR family LEDs should be baked (described above) one hour before reflow soldering.

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.

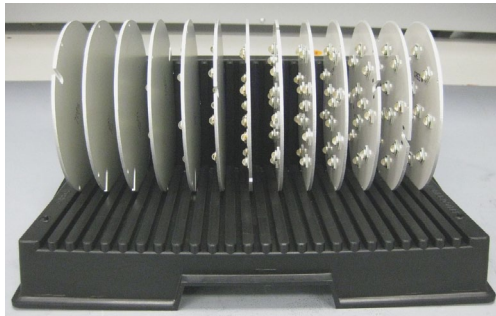
ASSEMBLY STORAGE & HANDLING

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 2 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.



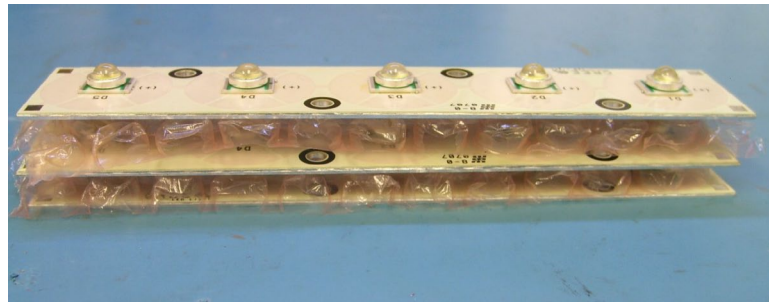
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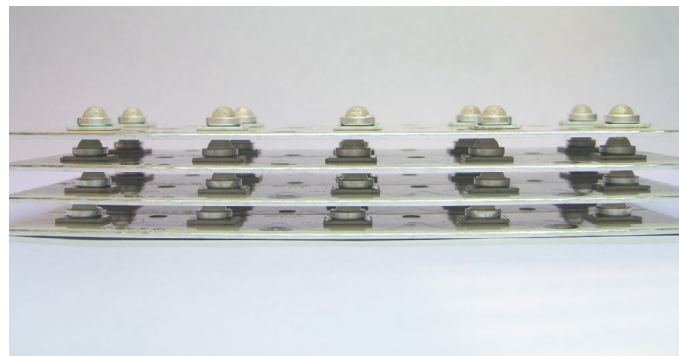
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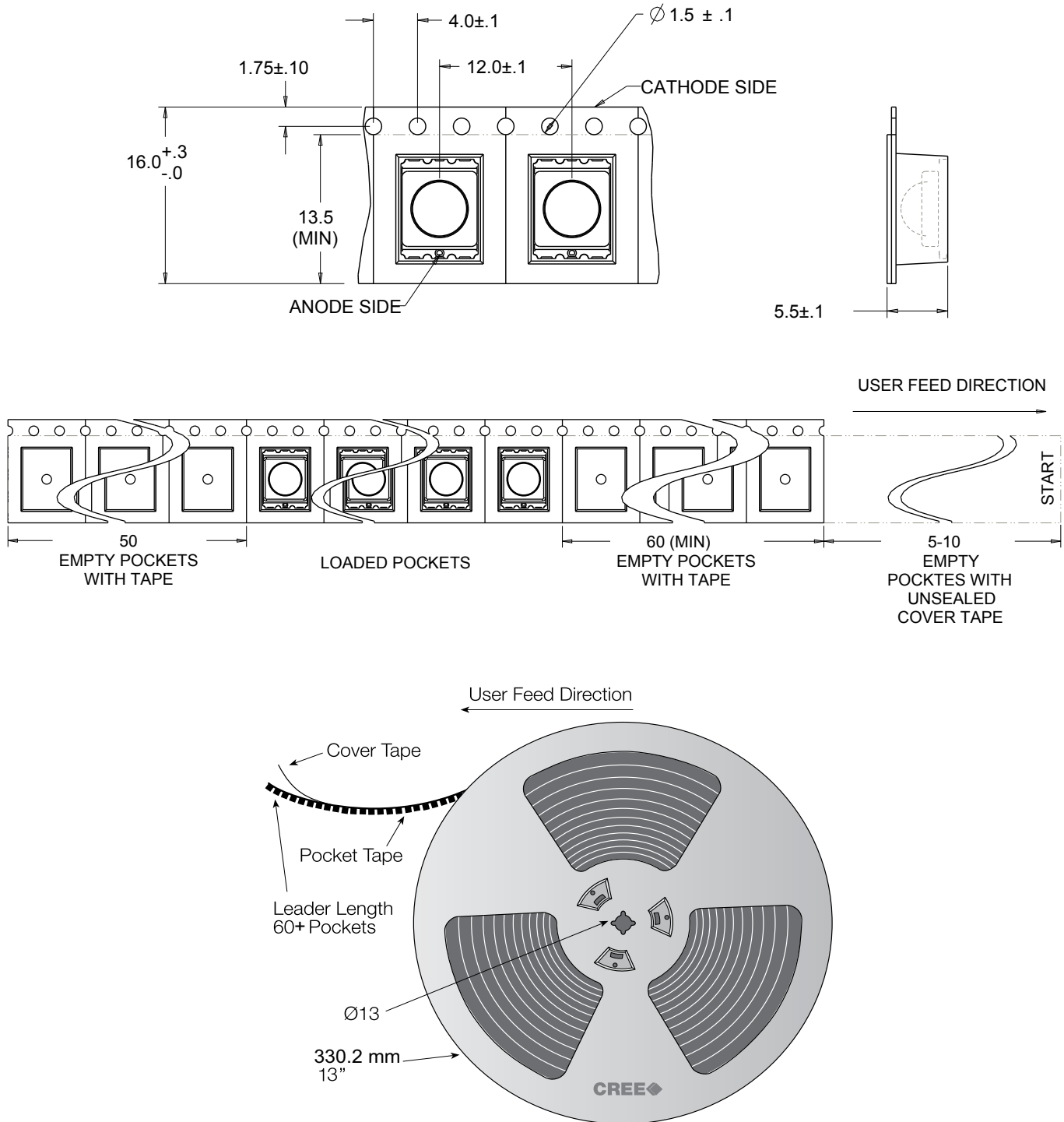


WRONG



TAPE AND REEL

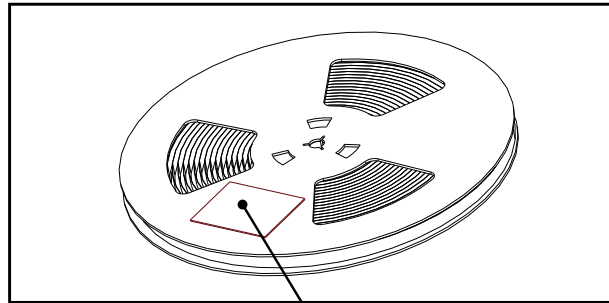
All Cree carrier tapes conform to EIA-481D, Automated Component Handling Systems Standard.



PACKAGING AND LABELS

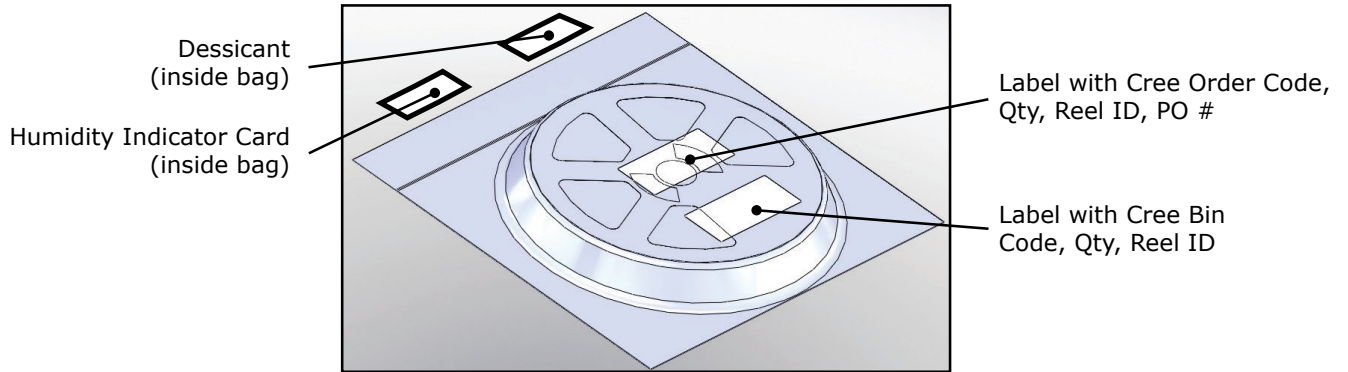
The diagrams below show the packaging and labels Cree uses to ship XLamp XR family LEDs. XLamp XR family LEDs are shipped in tape loaded on a reel. Each box contains only one reel in a moisture barrier bag.

Unpackaged Reel



Label with Cree Bin Code, Qty, Reel ID

Packaged Reel



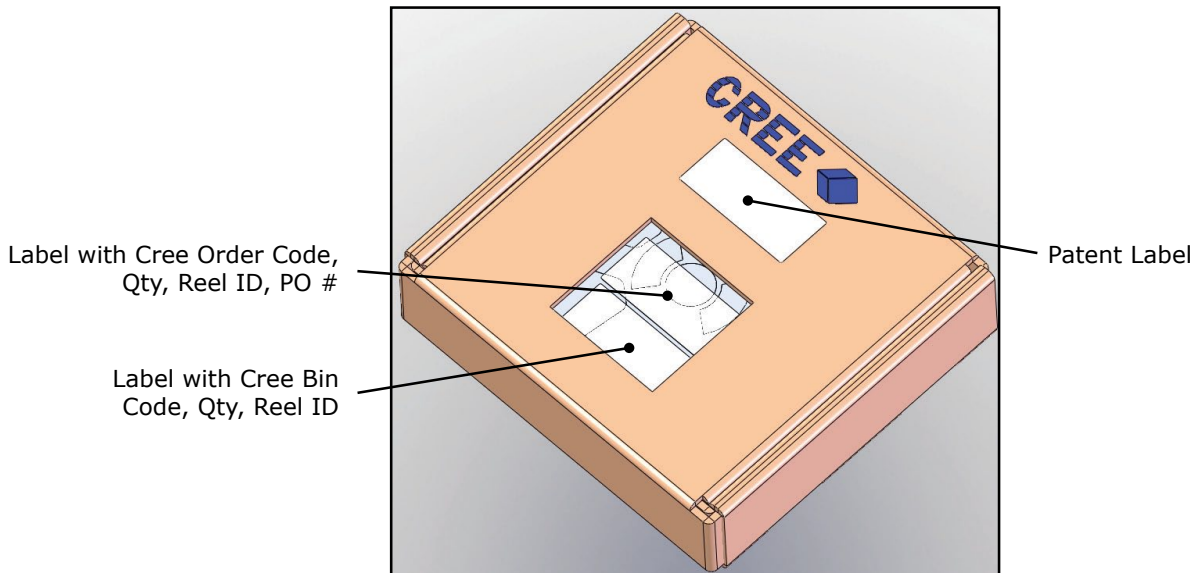
Dessicant (inside bag)

Humidity Indicator Card (inside bag)

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

Label with Cree Bin Code, Qty, Reel ID

Boxed Reel



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

Label with Cree Bin Code, Qty, Reel ID

Patent Label