

Cree® XLamp® ML Family LEDs



INTRODUCTION

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

MLxxx-xx-xxxx-xxxxxx

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

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HANDLING XLAMP® ML FAMILY LEDs

Manual Handling

Use tweezers to grasp XLamp ML family LEDs at the base. Do not touch the top surface of the LED with tweezers.



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

- 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 ML family LEDs with appropriate ESD grounding.
- Cree recommends handling ML family LEDs wearing clean, lint-free gloves.

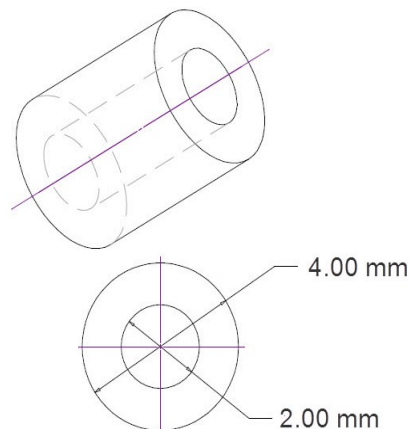
In luminaire design Cree recommends the same principle. Cover exposed LEDs to protect them during luminaire installation and routine maintenance. A transparent cover over the optical cavity of a luminaire is an example of this kind of protection.

In production environments, whenever possible, Cree recommends the use of a pick & place tool to remove the XLamp ML 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.

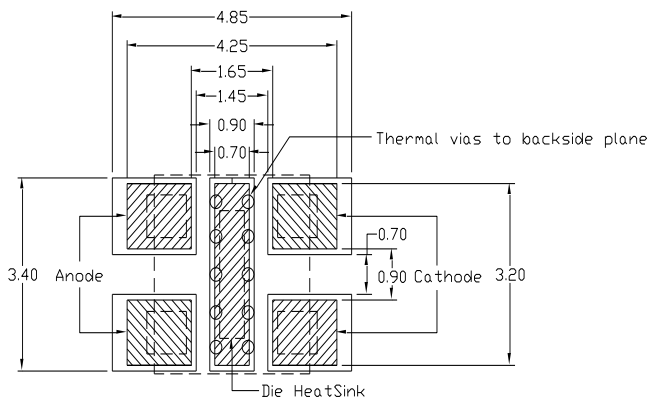
Cree recommends the pick & place tool shown below for XLamp ML Family LEDs.



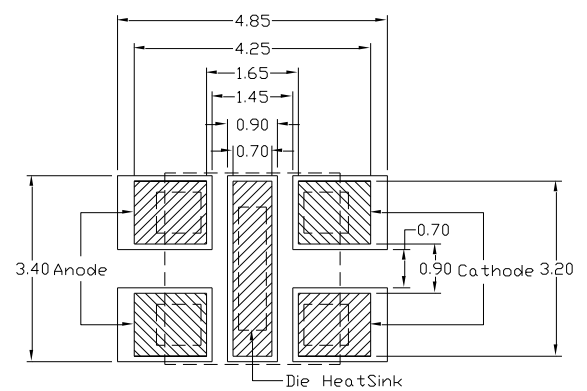
CIRCUIT BOARD PREPARATION & LAYOUTS

Printed circuit boards (PCBs) should be prepared and/or cleaned according to the manufacturer's specifications before placing or soldering XLamp ML family LEDs onto the PCB. The diagram below shows the recommended PCB solder pad layout for XLamp ML family LEDs.

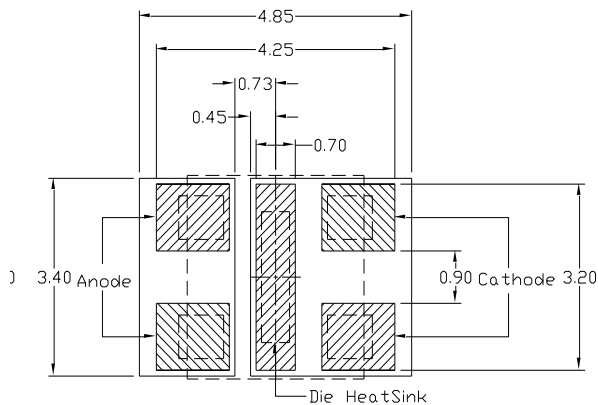
All dimensions in mm.



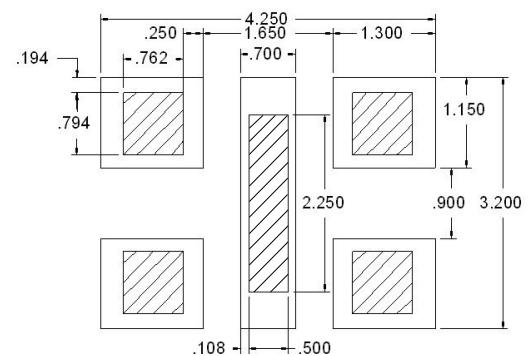
Recommended FR4 Solder Pad



Recommended MCPCB Solder Pad



Alternative Solder Pad

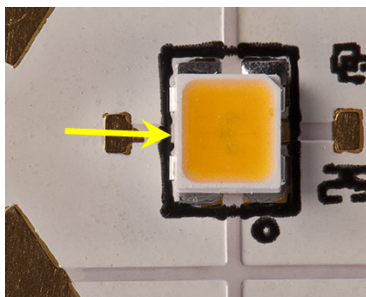


**Recommended Stencil Pattern
(Hatched Area Is Opening)**

For additional information about FR4 thermal vias, illustrated above, consult Cree's [Optimizing PCB Thermal Performance](#) application note.

CASE TEMPERATURE (T_s) MEASUREMENT POINT

XLamp ML 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 picture below.



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

XLamp ML 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 in the XLamp ML Family LED Reflow Soldering Characteristics section (page 7).

Do not wave-solder XLamp ML family LEDs. Do not hand-solder XLamp ML family LEDs. N_2 reflow is recommended.

✓
CORRECT



✓
CORRECT



✗
WRONG

Solder Paste Type

Cree strongly recommends using “no clean” solder paste with XLamp ML 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-µm) bond line, i.e., the solder joint thickness after reflow soldering.



After Soldering

After soldering, allow XLamp ML family LEDs to return to room temperature before subsequent handling. Premature handling of the device 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).

Do not use ultrasonic cleaning.

Moisture Sensitivity

XLamp ML Family LEDs are shipped in sealed, moisture-barrier bags (MBB) designed for long shelf life. If XLamp ML 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 derating table at right defines the maximum exposure time (in days) for an XLamp ML Family LED 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.

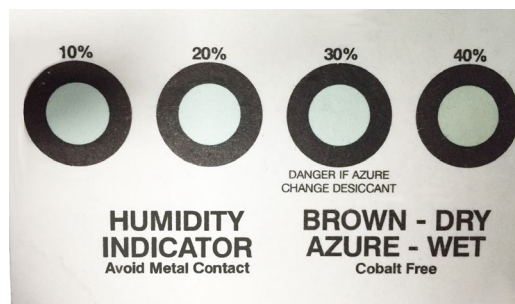
Temp.	Maximum Percent Relative Humidity						
	30%	40%	50%	60%	70%	80%	90%
35 °C	-	-	-	17	1	.5	.5
30 °C	-	-	-	28	1	1	1
25 °C	-	-	-	-	2	1	1
20 °C	-	-	-	-	2	1	1

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.

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



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



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

Baking Conditions

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

- LEDs that have been removed from the original MBB packaging.
- 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 MBB packaging 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 ML Family LEDs that have been removed from the original MBB packaging but not soldered should be stored in one of the following ways:

- Store the parts in a rigid metal container with a tight-fitting lid. Verify that the storage temperature is <30 °C, and place fresh desiccant and an RH indicator in the container to verify that the RH is no greater than 60%.
- Store the parts in a dry, nitrogen-purged cabinet or container that actively maintains the temperature at <30° and the RH at no greater than 60%.
- For short-term store only: LEDs can be resealed in the original MBB bag soon after opening. Fresh desiccant may be needed. Use the included humidity indicator card to verify <60% RH.

If an environment of <60% RH is not available for storage, XLamp ML Family LEDs should be baked (described above) before reflow soldering.

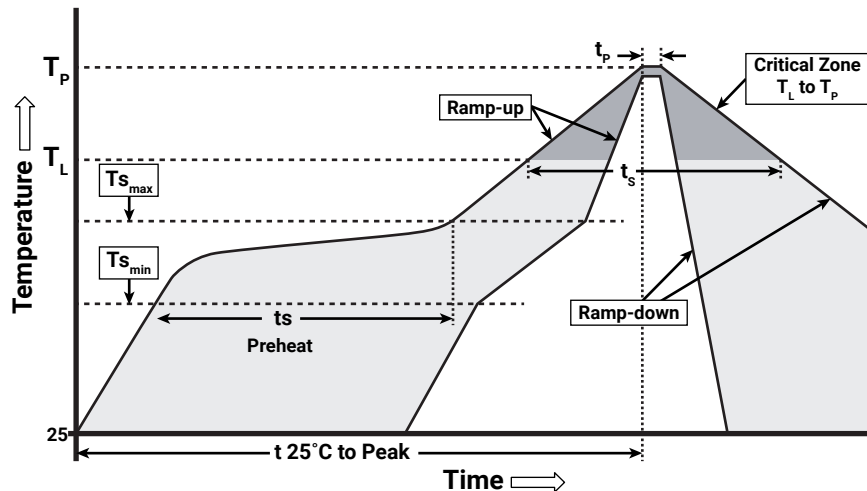
LOW TEMPERATURE OPERATION

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.

XLAMP® ML FAMILY LED REFLOW SOLDERING CHARACTERISTICS

In testing, Cree has found XLamp ML 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 (Ts _{max} to Tp)	1.2 °C/second
Preheat: Temperature Min (Ts _{min})	120 °C
Preheat: Temperature Max (Ts _{max})	170 °C
Preheat: Time (ts _{min} to ts _{max})	65-150 seconds
Time Maintained Above: Temperature (TL)	217 °C
Time Maintained Above: Time (tl)	45-90 seconds
Peak/Classification Temperature (Tp)	235 - 245 °C
Time Within 5 °C of Actual Peak Temperature (tp)	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.

Note: While the high reflow temperatures (above) have been approved, Cree's best practice guideline for reflow is to use as low a temperature as possible during the reflow soldering process for these LEDs.

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 ML 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 ML family LEDs. Cree recommends not using these chemicals anywhere in an LED system containing XLamp ML 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.

Potential of Silver Tarnishing

XLamp ML Family LEDs contain silver-plated parts that may tarnish (turn black) over time when exposed to oxidizing substances such as sulfur, chlorine, or other halides. Oxidation of the leads can reduce the ability to make a good solder connection and affect the light output of the LED. Exposure to oxidizing substances can come from materials used near the LED during manufacturing or from the air around the LEDs during storage.

To reduce the potential of tarnishing for XLamp ML Family LEDs, Cree recommends that customers minimize exposure of the LEDs to oxidizing substances at all times, including storage, manufacturing and product testing. Potential sources of oxidizing substances include paper, air filters, some cleaning chemicals, cardboard boxes and rubber anti-static mats.

ASSEMBLY STORAGE & HANDLING

Do not stack PCBs or assemblies containing XLamp ML family LEDs. PCBs or assemblies containing XLamp ML family LEDs should be stacked in a way to allow at least 1-cm clearance.

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



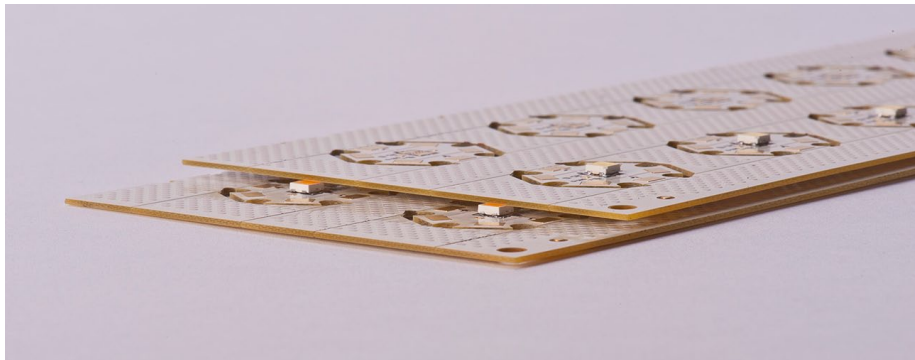
CORRECT



CORRECT



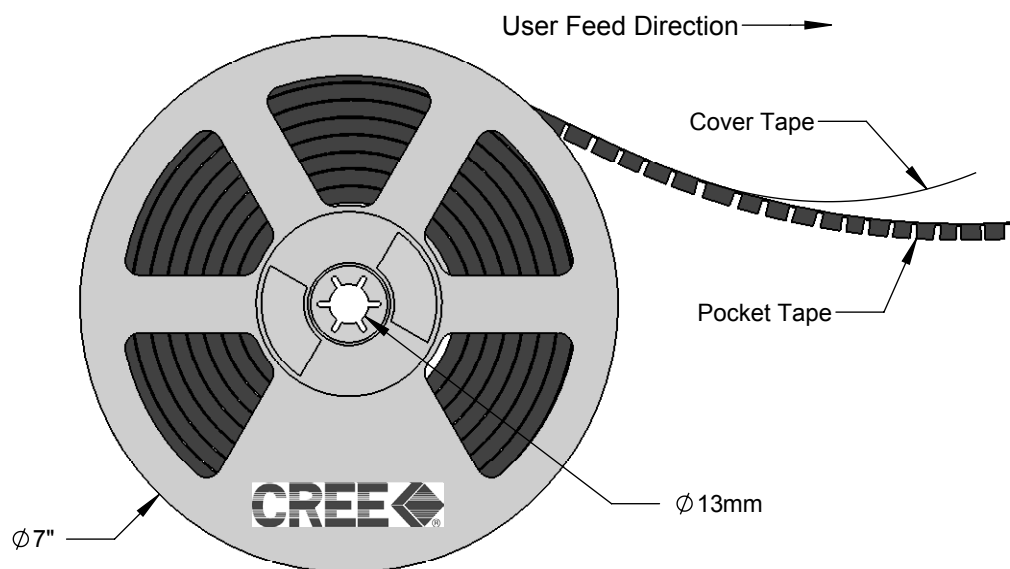
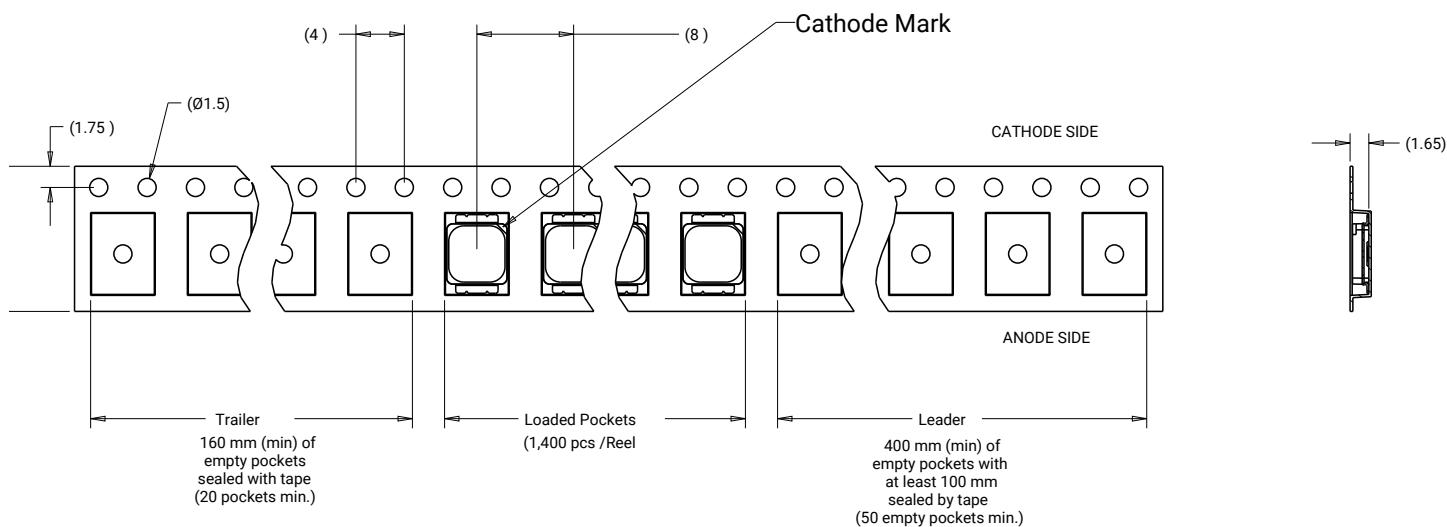
WRONG



TAPE AND REEL

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

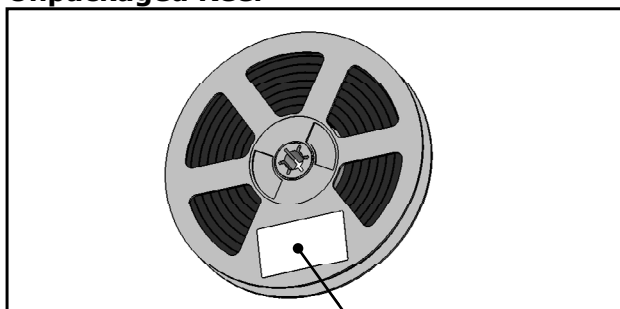
Except as noted, all dimensions in mm.



PACKAGING & LABELS

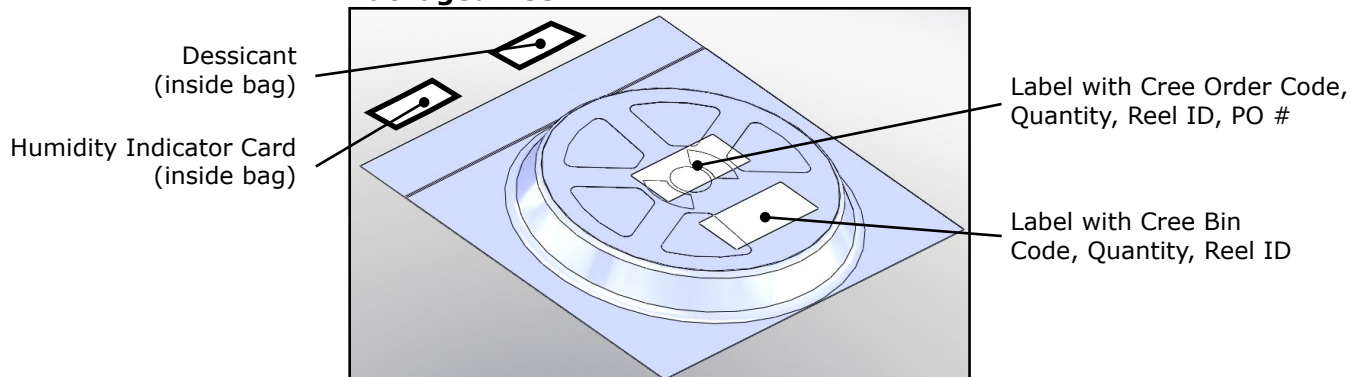
The diagrams below show the packaging and labels Cree uses to ship XLamp ML family LEDs. XLamp ML family LEDs are shipped in tape loaded on a reel. Each box contains only one reel in a moisture barrier bag.

Unpackaged Reel



Label with Cree Bin Code,
Quantity, Reel ID

Packaged Reel



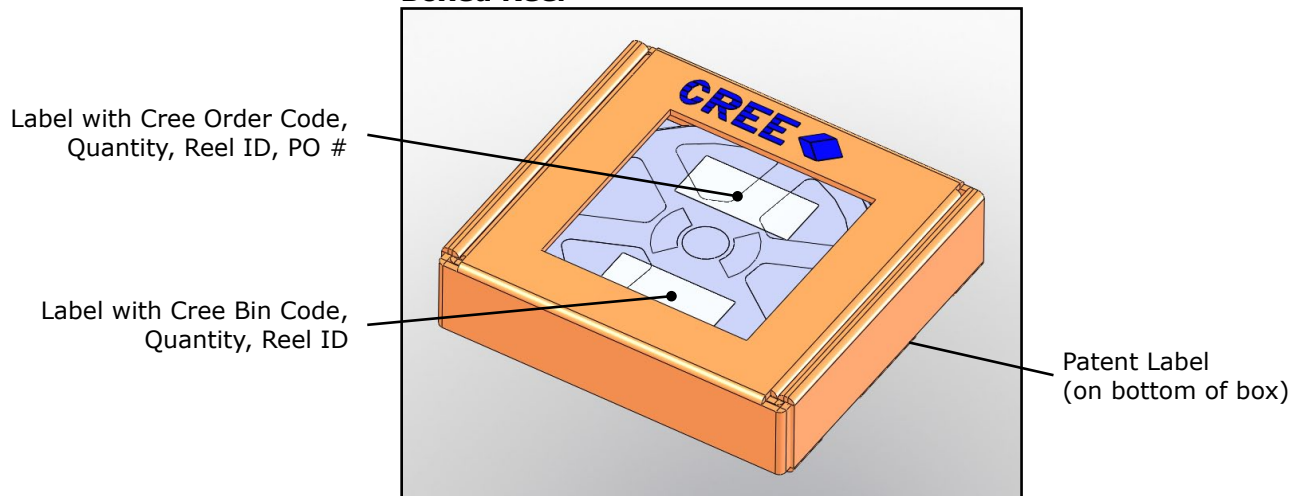
Dessicant
(inside bag)

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
(on bottom of box)