XLamp® MX Family LEDs

INTRODUCTION

This application note applies to the XLamp® MX Family of LEDs, which have order codes in the following format:

MX6xxx-xx-xxxx-xxxxxx

MX3xxx-xx-xxxx-xxxxxx

This application note explains how XLamp MX Family of LEDs and assemblies containing these LEDs should be handled during manufacturing. Please read the entire document to understand how to properly handle XLamp MX LEDs.
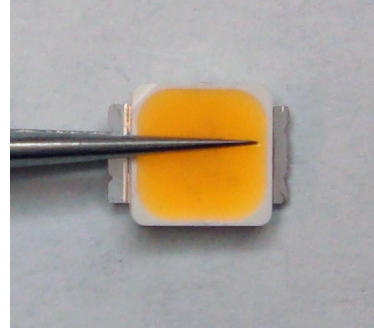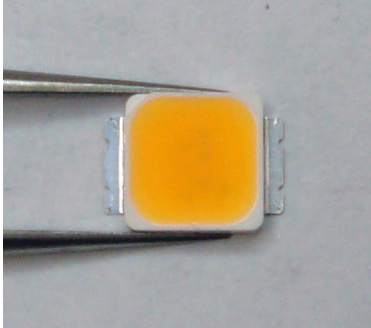
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Cree LED / 4001 E. Hwy. 54, Suite 2000 / Durham, NC 27709 USA / +1.919.313.5330 / www.cree-led.com

HANDLING XLAMP® MX FAMILY LEDS

Manual Handling

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


CORRECT

WRONG

Cree LED recommends the following at all times when handling XLamp MX 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 LED recommends always handling MX family LEDs with appropriate ESD grounding.
- Cree LED recommends handling MX family LEDs wearing clean, lint-free gloves.

Pick & Place Nozzle

For pick and place nozzles coming into contact with silicone-covered LED components, Cree LED recommends nozzles be constructed of non-metallic materials. Cree LED and several of Cree LED's customers have had good success using nozzles fabricated from 90d urethane.

Whenever possible, Cree LED recommends the use of a pick & place tool to remove the XLamp MX LEDs from the factory tape & reel packaging. Cree LED recommends the pickup tool shown below for XLamp MX Family of LEDs.
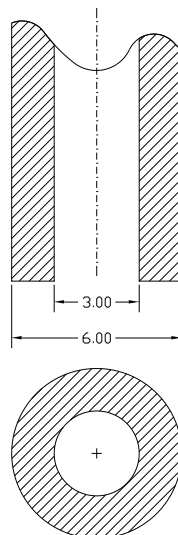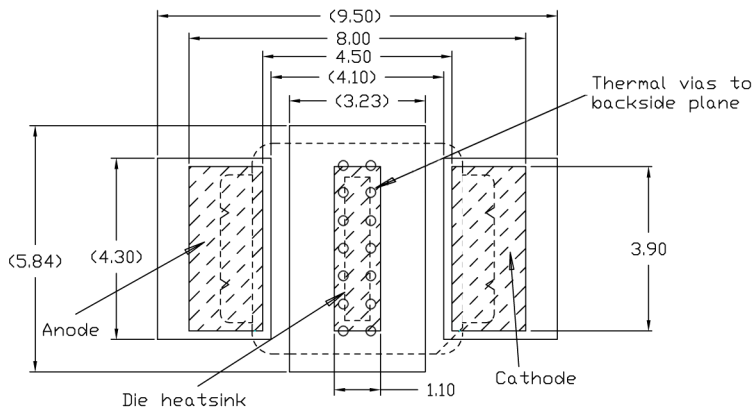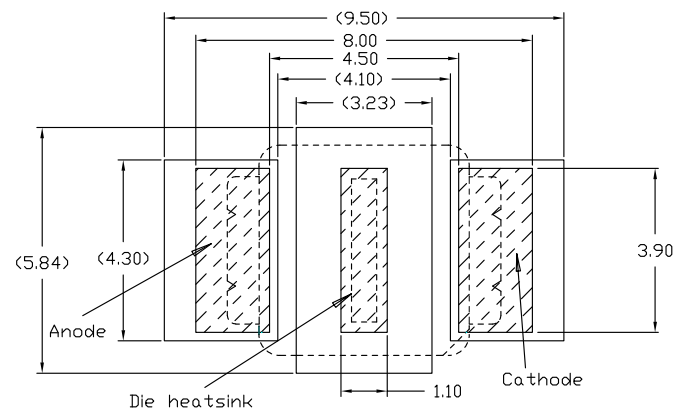

All dimensions in mm..

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 MX LEDs onto the PCB.

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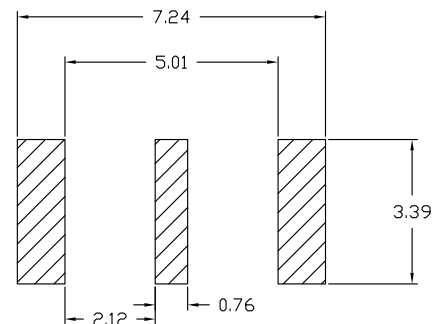

Recommended FR4 Solder Pad

Recommended MCPCB Solder Pad
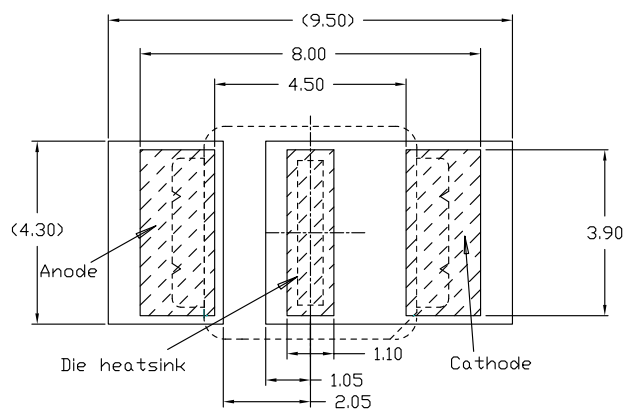

Alternative Solder Pad

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

All dimensions in mm.

For additional information about FR4 thermal vias, illustrated above, consult Cree LED's Optimizing PCB Thermal Performance for XLamp LEDs application note.

CASE TEMPERATURE (T$_S$) MEASUREMENT POINT

XLamp MX LED case temperature (Ts) 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.
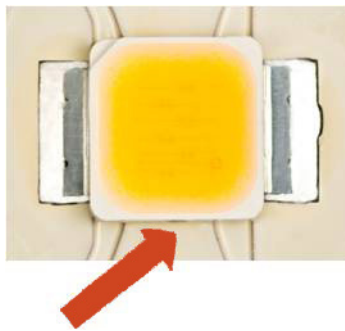
It is not required to use a solder footprint for the thermal pad that is larger than the XLamp MX LED itself. In testing, Cree LED has found such a solder pad to have insignificant impact on the resulting Ts measurement.

NOTES ON SOLDERING XLAMP® MX FAMILY LEDS

The XLamp MX Family of 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 MX Family LED Reflow Soldering Characteristics section (page 7).

Do not wave-solder XLamp MX LEDs. Do not hand-solder XLamp MX LEDs. N2 reflow is recommended.

✓ **CORRECT**

✓ **CORRECT**

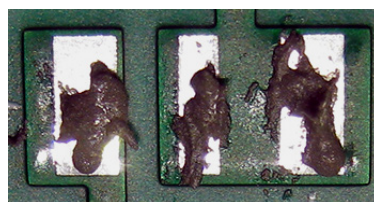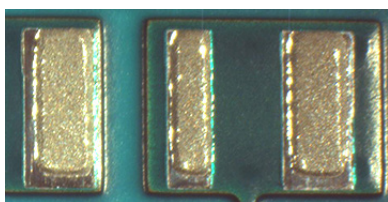🚫 **WRONG**

Solder-Paste Type

Cree LED strongly recommends using "no clean" solder paste with XLamp MX Family LEDs so that cleaning the PCB after reflow soldering is not required. Cree LED uses Kester® R276 solder paste internally.

Cree LED 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 LED 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.

CORRECT

WRONG

After Soldering

After soldering, allow XLamp MX LEDs to return to room temperature before subsequent handling. Premature handling of the device could result in damage to the LED.

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

Do not use ultrasonic cleaning.

Moisture Sensitivity

XLamp MX Family LEDs are shipped in sealed, moisture-barrier bags (MBB) designed for long shelf life. If XLamp MX 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 MX 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 ºC	-	-	-	17	1	.5	.5
30 ºC	-	-	-	28	1	1	1
25 ºC	-	-	-	-	2	1	1
20 ºC	-	-	-	-	2	1	1

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

Humidity inside the 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 moisture-barrier packaging.
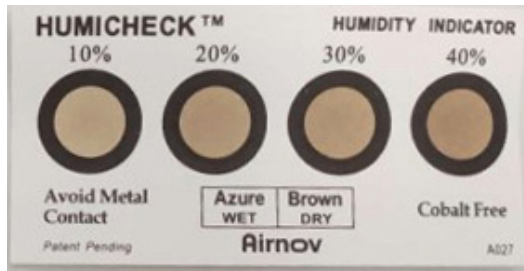
The humidity indicator card shows that the humidity has not reached 10%.
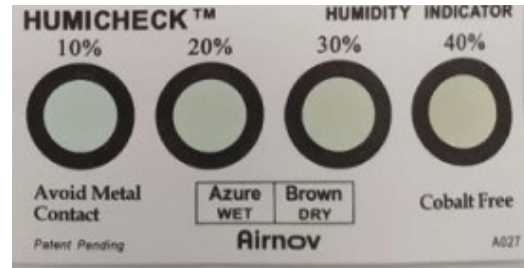
The humidity indicator card shows that the humidity level has exceeded 30%.

Baking Conditions

It is not necessary to bake all XLamp MX 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. LEDs that have not been soldered.

LEDs should be baked at 70 ºC 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 ºC. This baking operation resets the exposure time as defined in the Moisture Sensitivity section above.

Storage Conditions

XLamp MX 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 MX 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 LED recommends avoiding applications where the lamps are cycled on and off more than 10,000 cycles at temperatures below 0 °C.

XLAMP® MX FAMILY LED REFLOW SOLDERING CHARACTERISTICS

In testing, Cree LED has found XLamp MX Family of LEDs to be compatible with JEDEC J-STD-020C, using the parameters listed below. As a general guideline, Cree LED 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.
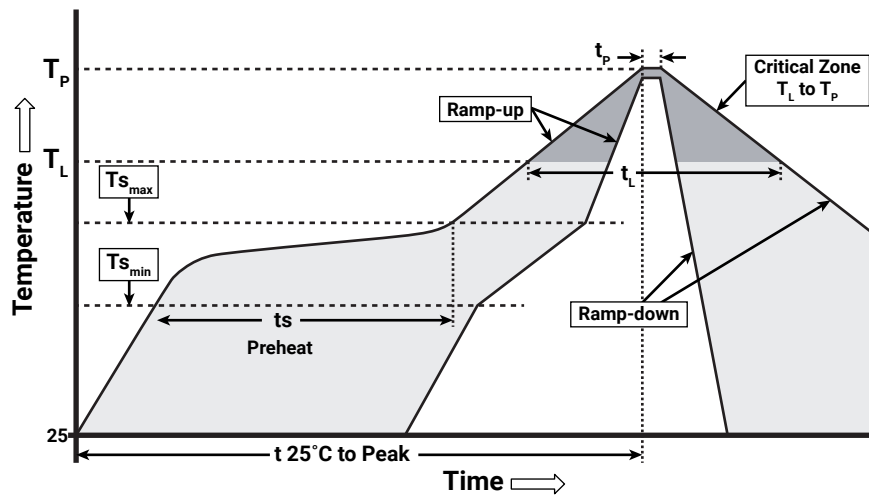
IPC/JEDEC J-STD-020C

Profile Feature	Lead-Free Solder
Average Ramp-Up Rate (Ts_{max} to T_p)	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 (T_L)	217 °C
Time Maintained Above: Time (t_L)	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.

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 LED's Chemical Compatibility Application Note.

Recommended Chemicals

In testing, Cree LED has found the following chemicals to be safe to use with XLamp MX Family LEDs.

- Water
- Isopropyl alcohol (IPA)

Chemicals Tested as Harmful

In general, subject to the specifics in Cree LED's Chemical Compatibility Application Note, Cree LED has found certain chemicals to be harmful to XLamp MX Family LEDs. Cree LED recommends not using these chemicals anywhere in an LED system containing XLamp MX 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 MX 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 MX LEDs, Cree LED 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 MX Family of LEDs. PCBs or assemblies containing XLamp MX Family of LEDs should be stacked in a way to allow at least 1-cm clearance.

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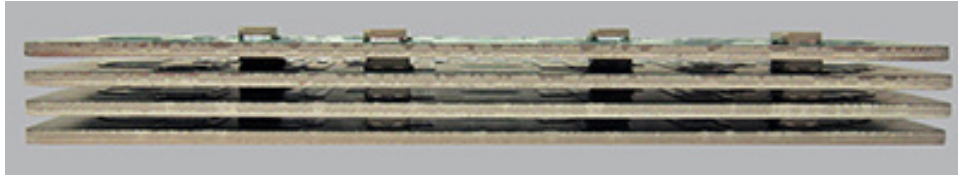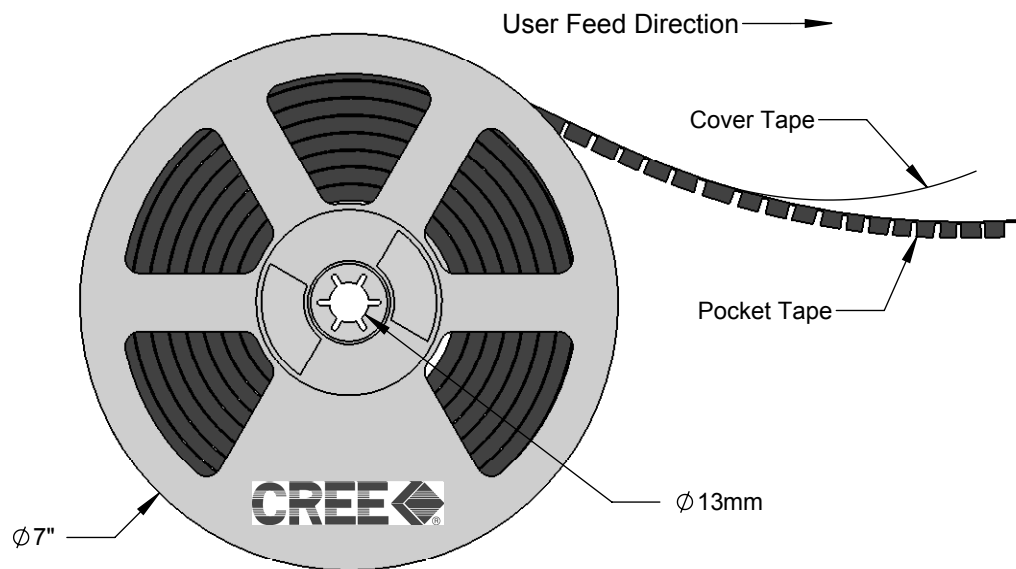
✓

CORRECT

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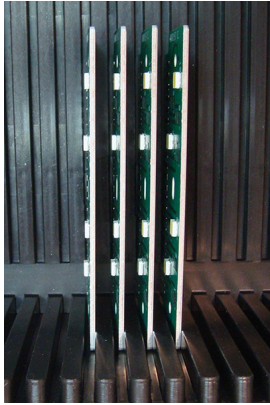
CORRECT

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WRONG

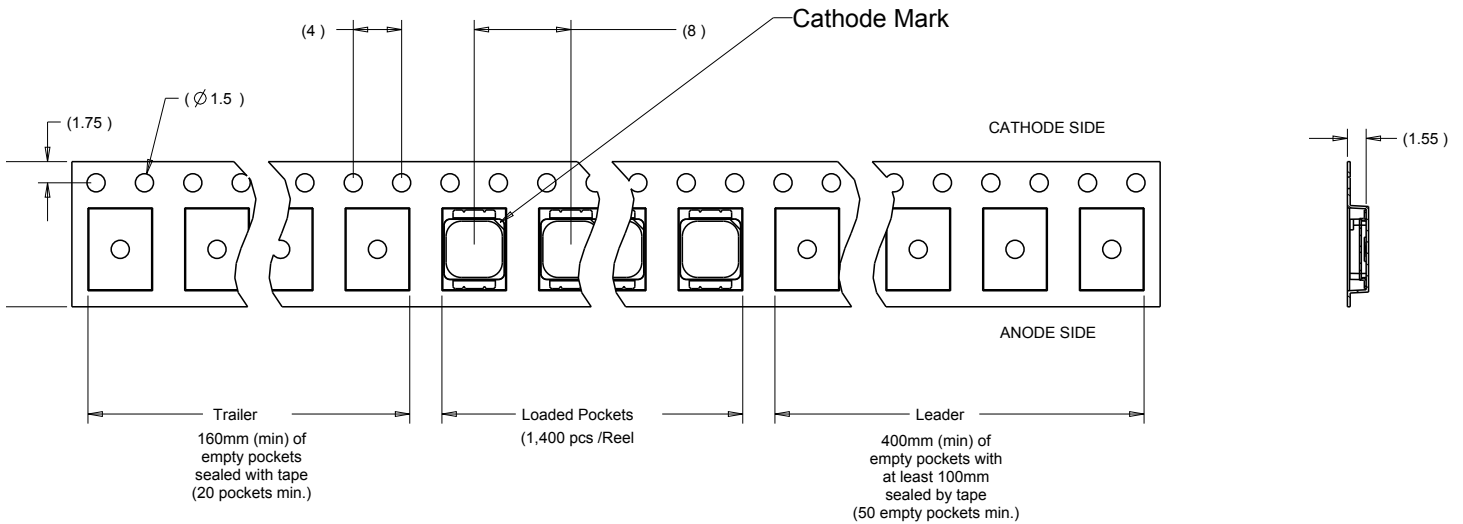## TAPE AND REEL

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

Except as noted, all dimensions in mm.

(4)　(8)　Cathode Mark

(∅1.5)

(1.75)

CATHODE SIDE

ANODE SIDE

(1.55)

Trailer
160mm (min) of
empty pockets
sealed with tape
(20 pockets min.)

Loaded Pockets
(1,400 pcs /Reel

Leader
400mm (min) of
empty pockets with
at least 100mm
sealed by tape
(50 empty pockets min.)

User Feed Direction

Cover Tape

Pocket Tape
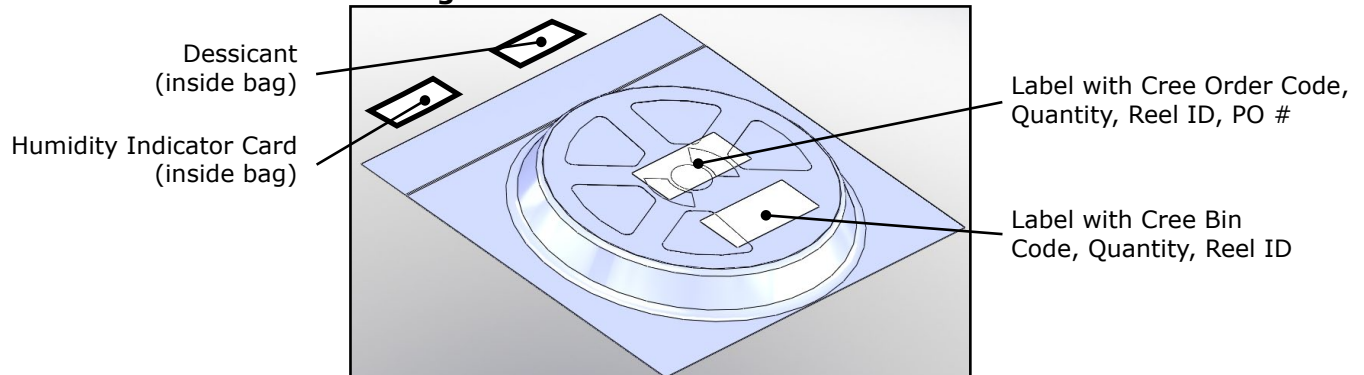
CREE

∅7"

∅13mm

PACKAGING & LABELS

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

Unpackaged Reel
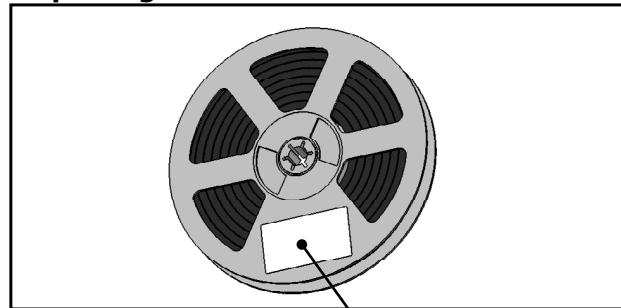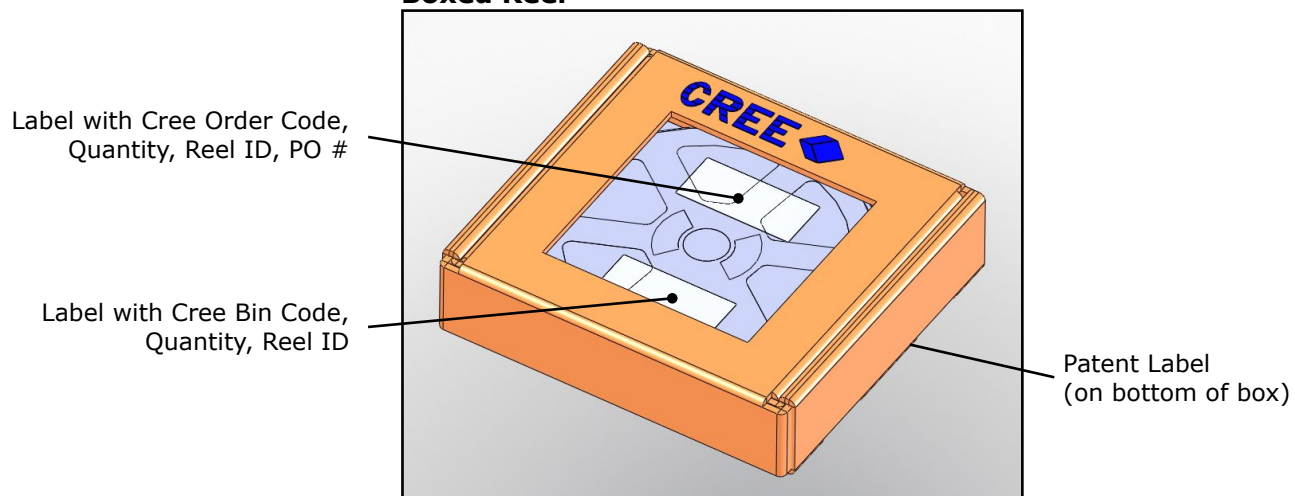

Label with Cree Bin Code, Quantity, Reel ID

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)