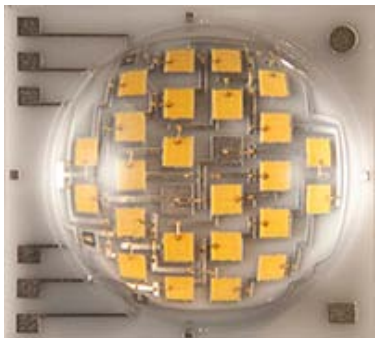
CLD-AP36 REV 0B

Cree® XLamp® MP-L EasyWhite™ LEDs



INTRODUCTION

This application note applies to XLamp MP-L EasyWhite LEDs which have order codes in the following format:

MPLEZW-XX-XXXX-XXXXXXXXX

This application note explains how XLamp MP-L EasyWhite LEDs and assemblies containing XLamp MP-L EasyWhite LEDs should be handled during manufacturing. Please read this entire document to understand how to properly handle XLamp MP-L EasyWhite LEDs.

TABLE OF CONTENTS

Cree, Inc.
4600 Silicon Drive
Durham, NC 27703
USA Tel: +1.919.313.5300

HANDLING XLAMP MP-L EASYWHITE LEDS

Cree recommends the following at all times when handling XLamp MP-L EasyWhite LEDs or assemblies containing XLamp MP-L EasyWhite LEDs:

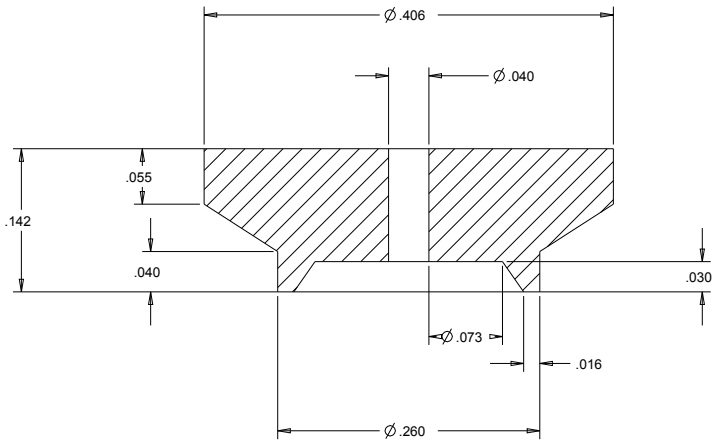
- Avoid putting mechanical stress on the LED lens.
- Never touch the optical surface with fingers or sharp objects. The LED surface could be soiled or damaged, which could affect the optical performance of the LED.

Whenever possible, Cree recommends the use of a pick and place tool to remove XLamp MP-L EasyWhite 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 MP-L EasyWhite LEDs.

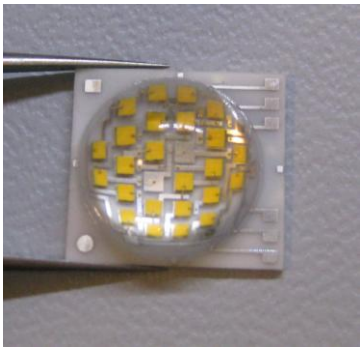


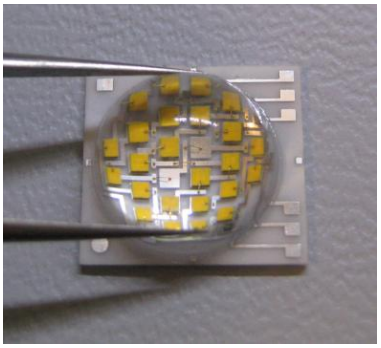
All dimensions in inches.

Manual Handling

Use tweezers to grab XLamp MP-L EasyWhite 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.

CORRECT



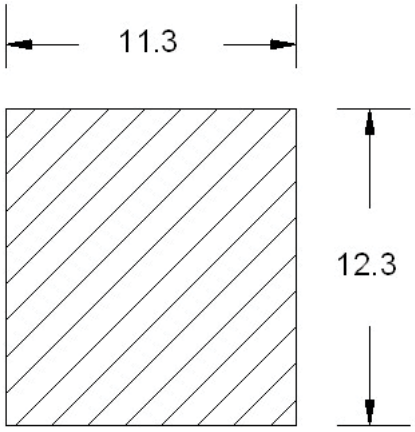


WRONG

CIRCUIT BOARD PREPARATION & LAYOUTS

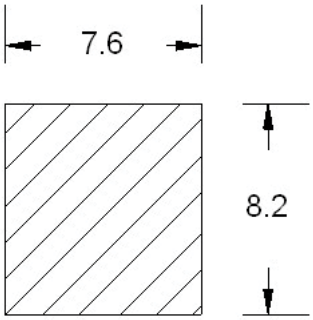
Printed circuit boards (PCBs) should be prepared and/or cleaned according to the manufacturer's specifications before placing or soldering XLamp MP-L EasyWhite LEDs onto the PCB.

The diagram below shows the recommended PCB solder pad layout and the recommended solder stencil pattern for XLamp MP-L EasyWhite LEDs.



Recommended MCPCB Solder Pad

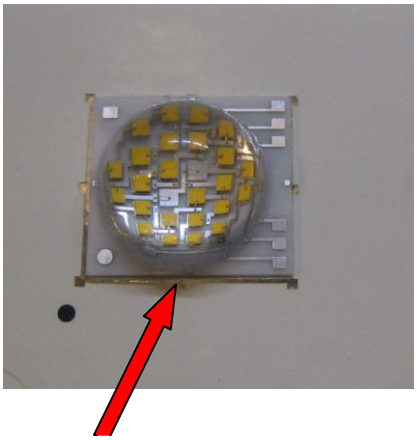
All dimensions in mm



Recommended Solder Stencil Pattern

CASE TEMPERATURE (T_S) MEASUREMENT POINT

XLamp MP-L EasyWhite LEDs 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 MP-L EasyWhite 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 MP-L EASYWHITE LEDS

XLamp MP-L EasyWhite LEDs are designed to be reflow soldered to a PCB. Reflow soldering may be done by a reflow oven or placing the PCB on a hotplate and following the reflow soldering profile listed on page 5.

Do not wave-solder XLamp MP-L EasyWhite LEDs. Do not hand-solder XLamp MP-L EasyWhite LEDs.

✓ CORRECT

WRONG

✓ CORRECT

Solder Paste Type

Cree strongly recommends using "no clean" solder paste with XLamp MP-L EasyWhite LEDs so that cleaning the PCB after reflow soldering is not required. Cree uses the following solder paste internally:

Indium Corporation of America® Part number 82676

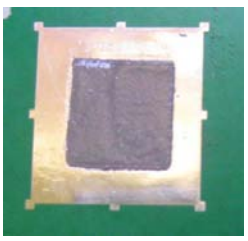
- Sn62/Pb36/Ag2 composition
- Flux: NC-SMQ92J

Cree recommends the following solder paste compositions: SnPbAg, SnAgCu and SnAg.

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 post reflow 3-mil (75-µm) bond line.

✓ CORRECT



WRONG

NOTES ON SOLDERING XLAMP XM FAMILY LEDS (CONTINUED)

After Soldering

After soldering, allow XLamp MP-L EasyWhite 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 by use of an X-ray inspection system. The selected devices should appear completely reflowed and show minimum evidence of voids between the backside of the LED package and the PCB.

Cleaning PCBs After Soldering

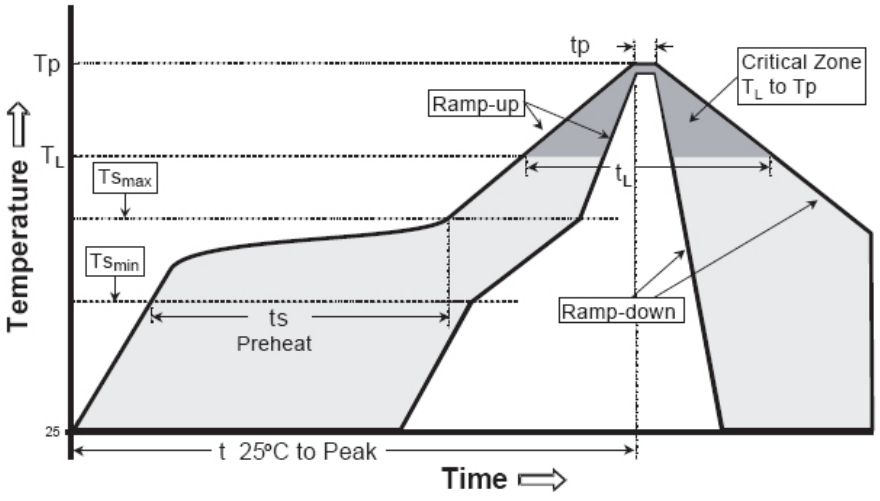
Cree recommends using "no clean" solder paste so that flux is not necessary after reflow soldering. If PCB cleaning is necessary, Cree recommends the use of isopropyl alcohol (IPA).

Do not use ultrasonic cleaning.

XLAMP MP-L EASYWHITE LED REFLOW SOLDERING CHARACTERISTICS

In testing, Cree has found XLamp MP-L EasyWhite 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.



IPC/JEDEC J-STD-020C

XLAMP XM FAMILY LED REFLOW SOLDERING CHARACTERISTICS (CONTINUED)

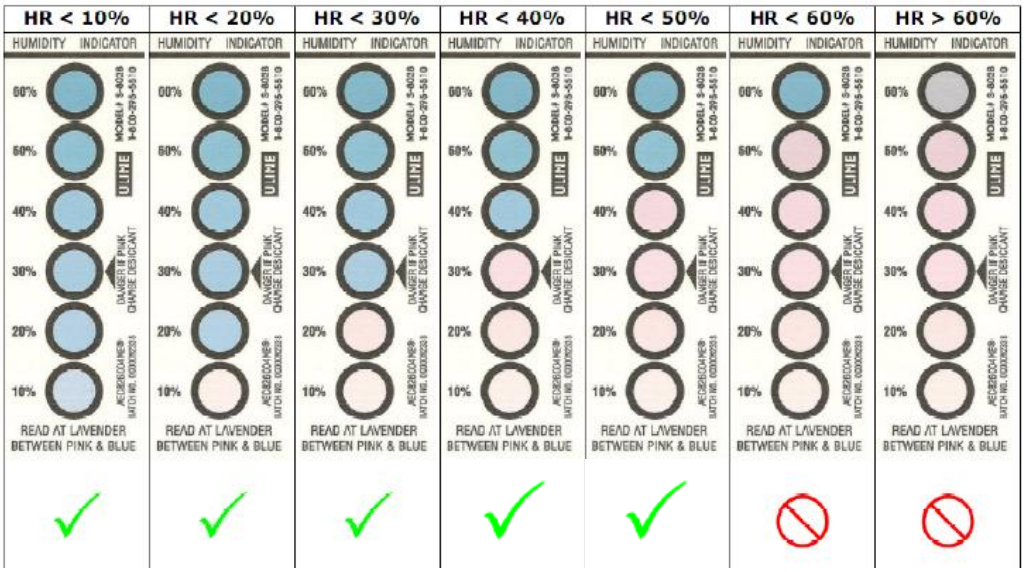
Profile Feature	Lead-Based Solder	Lead-Free Solder
Average Ramp-Up Rate (Ts_{max} to Tp)	3 °C/second max.	3 °C/second max.
Preheat: Temperature Min (Ts_{min})	100 °C	150 °C
Preheat: Temperature Max (Ts_{max})	150 °C	200 °C
Preheat: Time (ts_{min} to ts_{max})	60-120 seconds	60-180 seconds
Time Maintained Above: Temperature (T_L)	183 °C	217 °C
Time Maintained Above: Time (t_L)	60-150 seconds	60-150 seconds
Peak/Classification Temperature (Tp)	215 °C	260 °C
Time Within 5 °C of Actual Peak Temperature (tp)	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.
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.

MOISTURE SENSITIVITY

XLamp MP-L EasyWhite 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 the MBB will vary from one bag to another. Some moisture-barrier bags may appear to be drawn into a tight vacuum while others may appear to be loose. 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.



If XLamp MP-L EasyWhite 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 de-rating table defines the maximum exposure time (in days) for XLamp MP-L EasyWhite 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%
35 ºC	-	-	-	17	1	.5	.5
30 ºC	-	-	-	28	1	1	1
25 ºC	-	-	-	-	2	1	1
20 ºC	-	-	-	-	2	1	1

XLamp MP-L EasyWhite LEDs stored at <30 ºC and <60% 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 60% RH circle on the humidity indicator card is blue, then the LEDs do not need to be baked. If the 60% RH circle is pink, then the XLamp MP-L EasyWhite LEDs should be baked using the baking procedure listed in the following section.

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 MP-L EasyWhite 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.

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 packing.
2. LEDs may be baked on the original reels.
3. Bake LEDs or reel of LEDs at 80 ºC for 24 hrs.
4. Reflow solder the parts within one hour of baking or immediately store the parts in a container with <10% RH (relative humidity).

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

Storage Conditions

XLamp MP-L EasyWhite 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 MP-L EasyWhite LEDs should be baked (described above) before reflow soldering.

MOUNTING METHODS FOR THE CREE XLAMP MP-L EASYWHITE LED

Cree XLamp MP-L EasyWhite LEDs may be mounted either directly to a heat sink or to a PCB.

Mounting directly to heat sink

Since the electrical contacts are on the top side of the XLamp MP-L EasyWhite LED and the thermal pad is electrically isolated (shown in the Figure 1 below), this allows for direct mounting to a heat sink as in Figure 2. When mounting the XLamp MP-L EasyWhite LED directly to a heat sink, Cree recommends using a thermal interface between the LED and the heat sink such as a thermal adhesive, gap filler, thermal grease, or phase change material. Cree has seen positive results using Arctic Silver® thermal adhesive. Once the LED is mounted to the heat sink a connector or wires will be required to be attached to the top electrical contacts. Cree has had positive results using flex cables and a Hot Bar Bonding System to solder the flex cables to the LED. An example of a Hot Bar Bonding System is shown in Figure 3 and the flex cables are shown in Figure 4.

Figure 1.

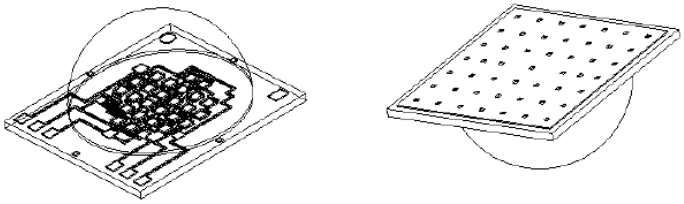


Figure 2. Heat sink

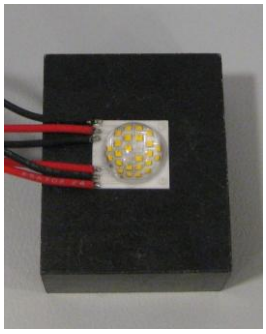
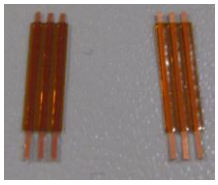


Figure 3. Hot bar machine

Figure 4. Flex cable



Mounting Directly to PCB

Mounting the XLamp MP-L EasyWhite LED to a MCPCB can be done by using a reflow oven or hot plate and following the reflow soldering characteristic stated in the XLamp MP-L EasyWhite LED Reflow Soldering Characteristics section above. Attaching a connector or soldering wires to the top electrical contacts will be required. Cree has had positive results using a Hot Bar Bonding System to attach flex cables to the LED and PCB, shown in Figure 6.

Figure 5. MCPCB

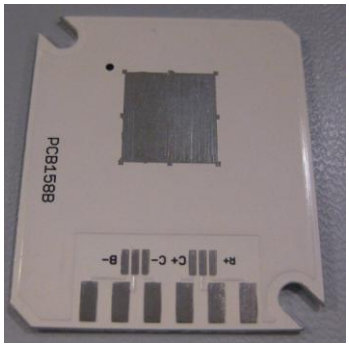
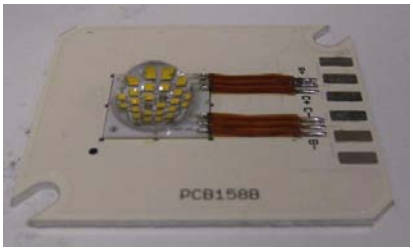


Figure 6. MCPCB with Flex cables



Another method for mounting the Cree XLamp MP-L EasyWhite LED involves milling out the thermal pad location on the MCPCB, shown in Figure 7, and using 0603 package surface mount (SMT) zero-ohm jumpers. If a copper PCB is used, a one step reflow solder process can be used to mount the XLamp MP-L EasyWhite LED and jumpers, shown in Figure 8. If an aluminum PCB is used, thermal adhesive needs to be used first to mount the LED to the PCB and then the resistors need to be reflow soldered. Cree has had positive results using Arctic Silver thermal adhesive to mount the XLamp MP-L EasyWhite LED to the milled out PCB.

Figure 7. Milled Copper MCPCB

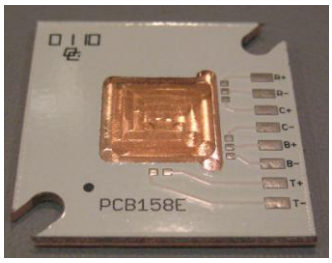
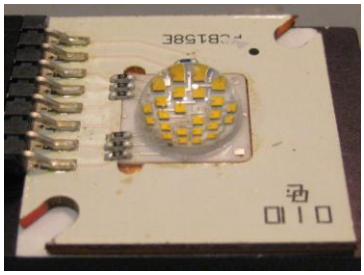


Figure 8.



CHEMICALS & CONFORMAL COATINGS

In the sections below we list a representative list of chemicals and materials to be used or avoided in LED manufacturing activities. For a complete and current list of recommended chemicals, conformormal coatings and harmful chemicals consult Cree's Chemical Compatibility Application Note.[1] 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 MP-L EasyWhite LEDS.

- Water
- Isopropyl alcohol (IPA)
- Non-silicon thermal grease
- Arctic Silver® & Arctic Alumina™ brand thermal adhesive
- 3M™ Scotch™-Weld epoxy adhesive DP-190 (polymeric diamante, kaolin)

Recommended Conformal Coatings

In testing, Cree has found the following conformal coatings to be safe to use with XLamp MP-L EasyWhite LEDs. Conformal coating should not be applied directly to or over the LED lens, as this may affect LED optical performance and reliability.

- Dow Corning® 3-1953
- Dow Corning 1-4105
- Dow Corning 1-2577
- Dymax® 9-20557
- Humiseal® 1H20AR1/S
- Humiseal UV40
- Humiseal 1B51NS
- Humiseal 1B73
- Humiseal 1C49LV
- Shat-R-Shield®
- Specialty Coating Systems™ – Parylene

Chemicals Tested as Harmful

In testing, Cree has found the following chemicals to be harmful to XLamp MP-L EasyWhite LEDs. Cree recommends not using these chemicals anywhere in an LED system containing XLamp MP-L EasyWhite LEDs. The fumes from even small amounts of these chemicals may damage the LEDs.

- Chemicals that might outgas hydrocarbons (e.g., toluene, benzene, xylene)
- Methyl acetate or ethyl acetate (ie., 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)
- Dymax 984-LVUF conformal coating
- Loctite® Sumo Glue
- Loctite 384 adhesive
- Loctite 7387 activator
- Loctite 242 threadlocker
- Loctite 242 threadlocker

1 www.cree.com/~/media/Files/Cree/LED%20Components%20and%20Modules/XLamp/XLamp%20Application%20Notes/XLamp_Chemical_Comp.pdf

Potential of Silver Tarnishing

XLamp MP-L EasyWhite LEDs contain silver plated parts that may tarnish (turn black) over time when exposed to oxidizing substances such as sulfur, chlorine, or other halogen compounds. 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 MP-L EasyWhite 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

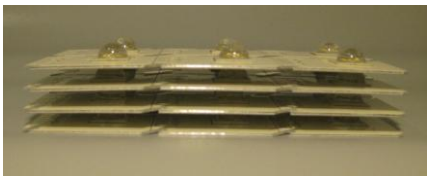
Do not stack PCBs or assemblies containing XLamp MP-L EasyWhite LEDs so that anything rests on the LED lens. Force applied to the LED lens may result in the lens being damaged. PCBs or assemblies containing XLamp MP-L EasyWhite LEDs should be stacked in a way to allow at least 2 cm above the LED lens.

Do not use bubble wrap directly on top of the XLamp MP-L EasyWhite LEDs. Force from the bubble wrap can potentially damage the LED.

✓ CORRECT

✓ CORRECT

⊘ WRONG

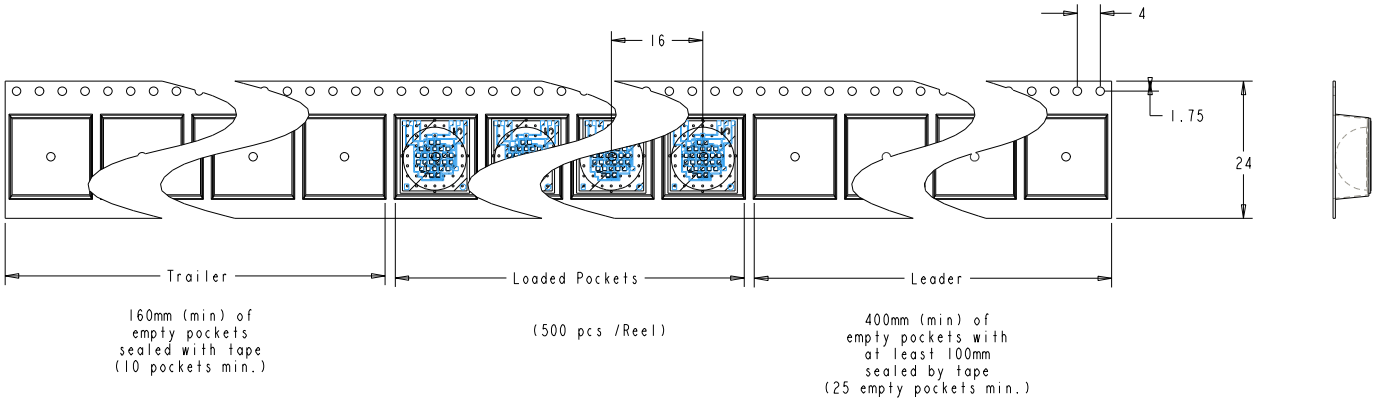


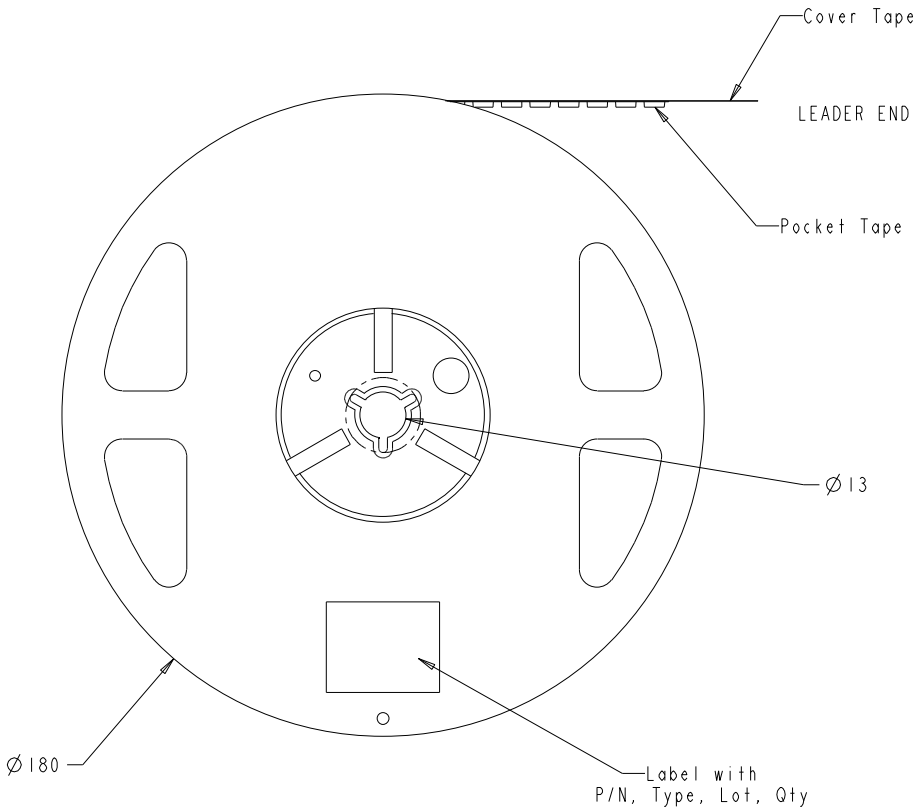
⊘ WRONG

MECHANICAL DRAWINGS: TAPE AND REEL

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

All dimensions in mm.





PACKAGING & LABELS

The diagrams below show the packing and labels Cree will use to ship XLamp MP-L EasyWhite LEDs. XLamp MP-L EasyWhite LEDs are shipped in tape loaded on a reel. Each moisture barrier bag contains only one reel. Each box may contain multiple reels.