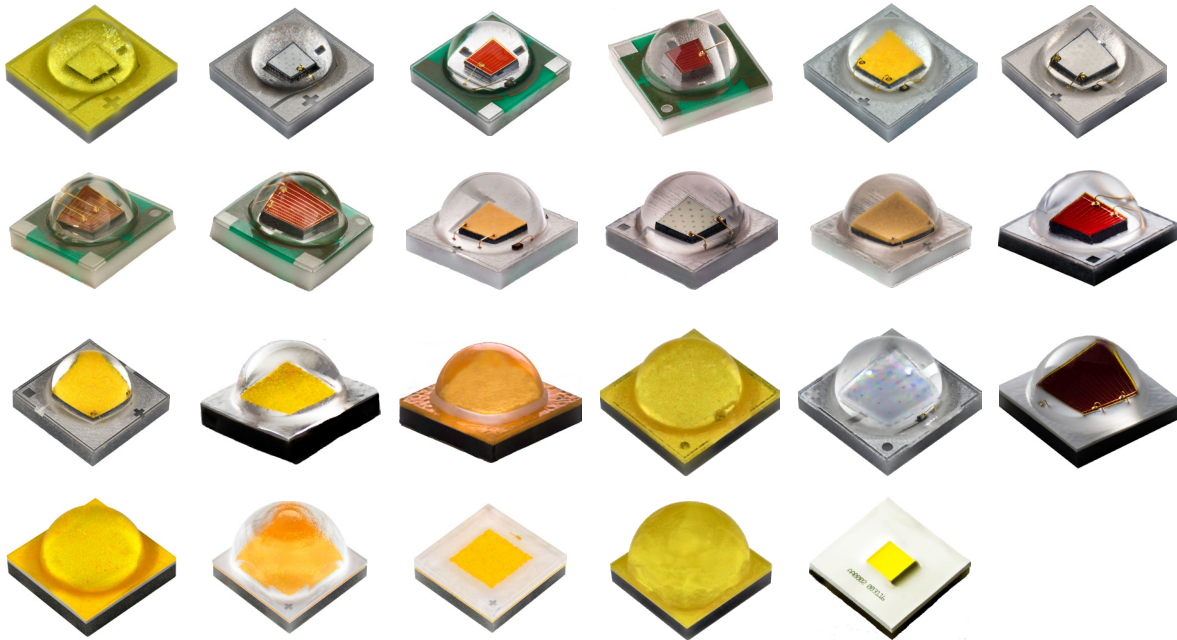


## XLamp® XP Family LEDs



### INTRODUCTION

This application note applies to XLamp® XP Family LEDs, which have order codes in the following formats.

XPCxxx-xx-xxxx-xxxxxx

XPExxx-xx-xxxx-xxxxxx

XPGxxx-xx-xxxx-xxxxxx

XPLxxx-xx-xxxx-xxxxxxxxxx

XPPxxx-xx-xxxx-xxxxxxxxxx

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

### TABLE OF CONTENTS

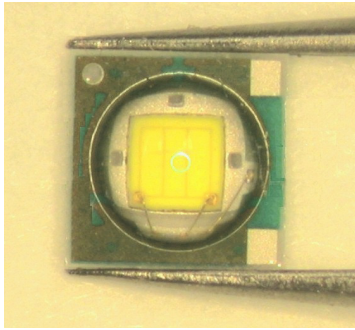
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## HANDLING XLAMP® XP FAMILY LEDS

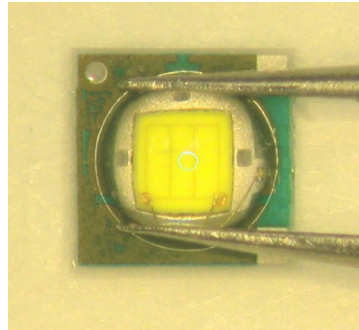
### Manual Handling

Use tweezers to grab XLamp XP 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. Excessive force on the lens could damage the LED.

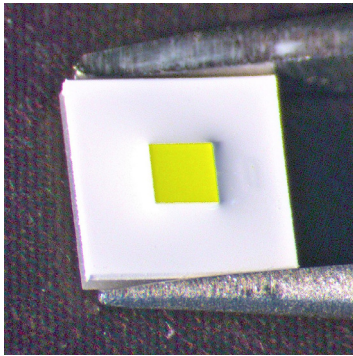
✓  
**CORRECT**



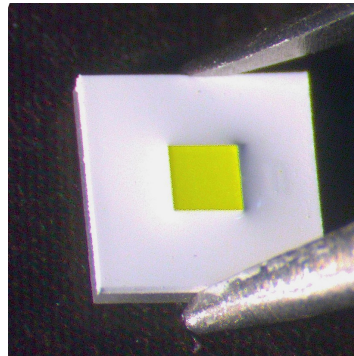
✗  
**WRONG**



✓  
**CORRECT**



✗  
**WRONG**



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

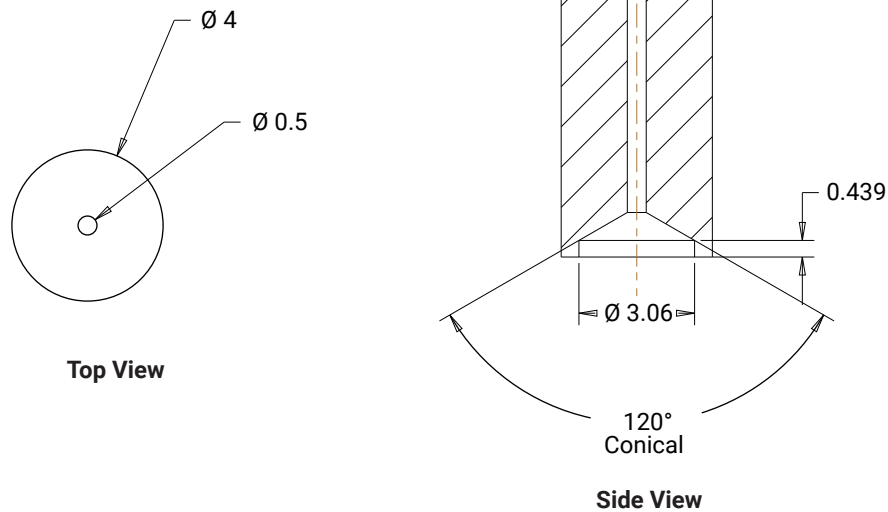
## HANDLING XLAMP® XP FAMILY LEDS - CONTINUED

## Pick &amp; Place Nozzle

The following diagram shows an example of a pick & place tool to remove XLamp XP-C, XP-E and XP-G LEDs from the factory tape & reel packaging.

All dimensions in mm

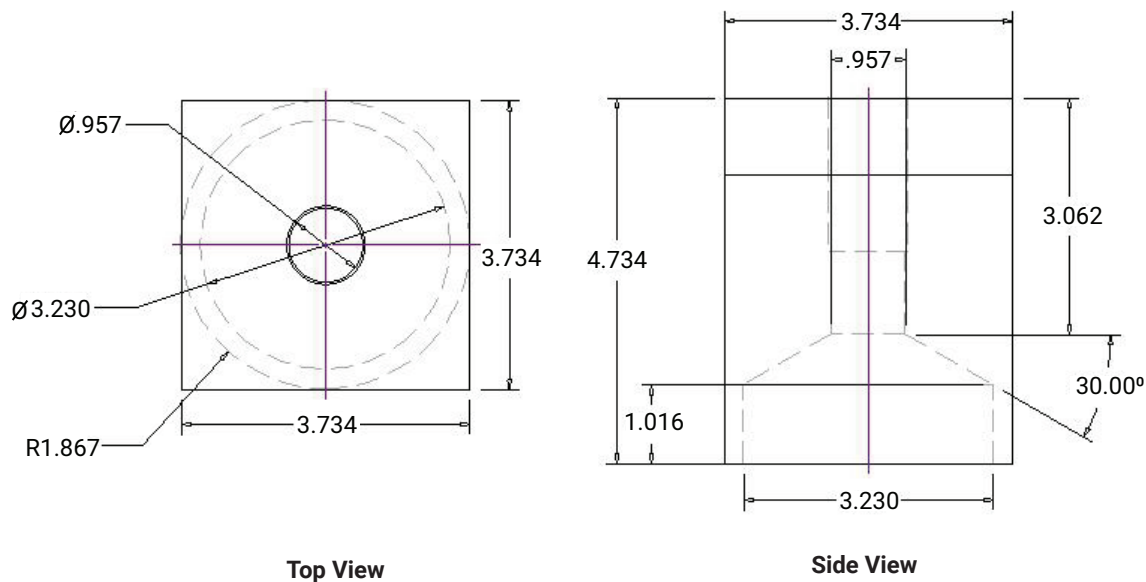
Tolerance:  $\pm 0.01$



The following diagram shows an example of a pick & place tool to remove XLamp XP-E2, XP-G2, XP-G3, XP-G4 and XP-G4 Pro9 LEDs from the factory tape & reel packaging. The nozzle is implemented in urethane.

All dimensions in mm

Tolerance:  $\pm 0.01$

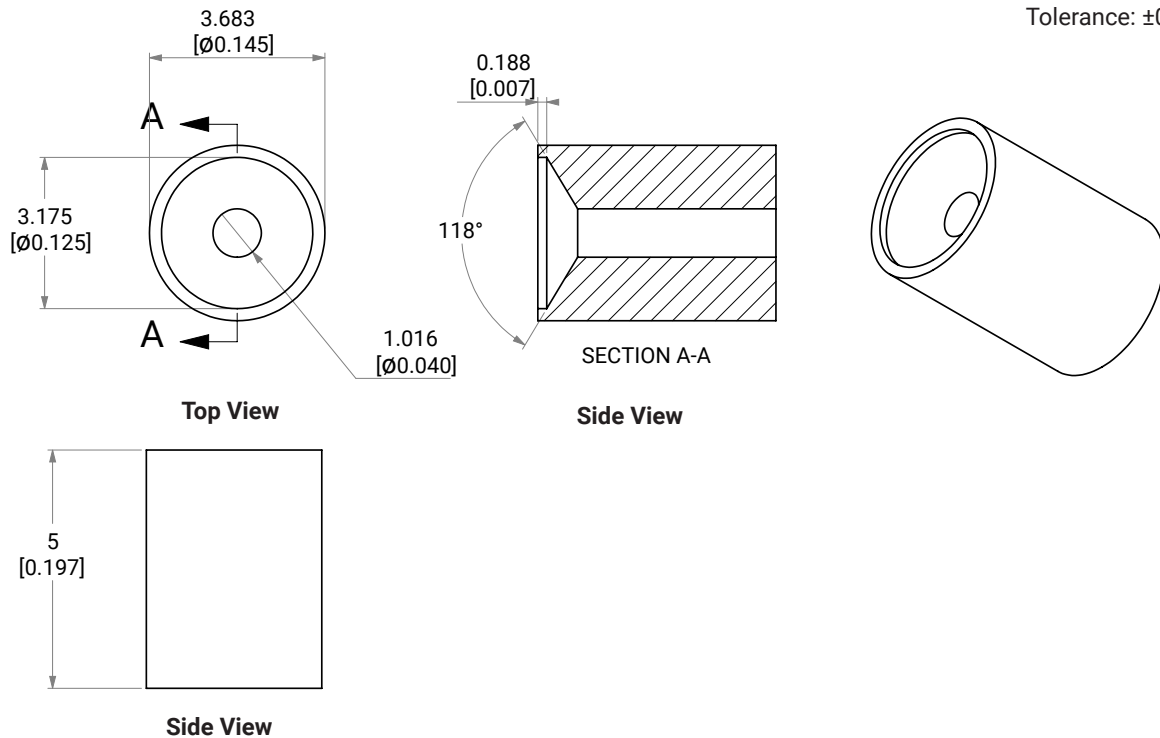


## HANDLING XLAMP® XP FAMILY LEDS - CONTINUED

The following diagram shows an example of a pick & place tool to remove XLamp XP-L High Density and XP-L2 LEDs from the factory tape & reel packaging. Cree LED and several of Cree LED's customers have had good success using nozzles fabricated from 95a urethane. The following pick & place tool, designed in conjunction with [Count On Tools](#), is specific to the XP-L High Density and XP-L2 LEDs.

All dimensions in mm [in]

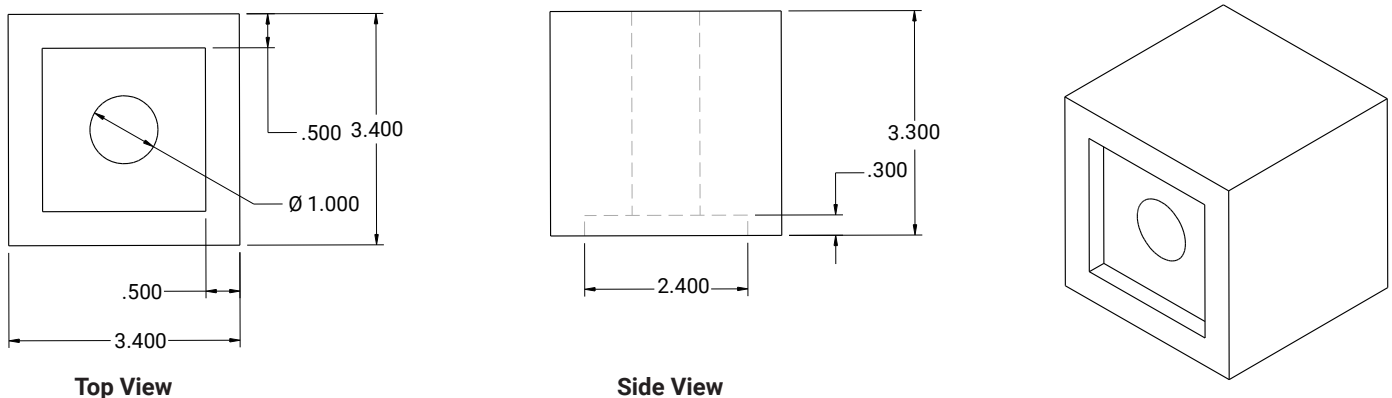
Tolerance:  $\pm 0.025$  [0.001]



The following diagram shows an example of a pick & place tool to remove XLamp XP-L High Intensity LEDs from the factory tape & reel packaging. Cree LED recommends using a spring-relieved pick and place nozzle with a spring constant of 0.05 lb-ft (0.07 N-m). Cree LED has had good success using nozzles fabricated from 95a urethane. The following pick & place tool is specific to the XP-L High Intensity LED.

All dimensions in mm

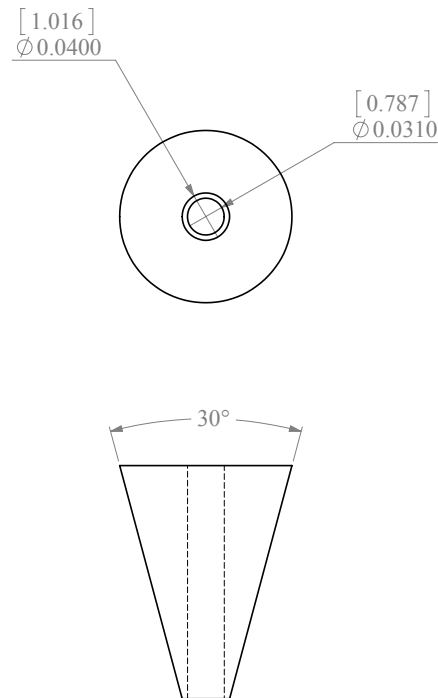
Tolerance:  $\pm 0.001$



**HANDLING XLAMP® XP FAMILY LEDS - CONTINUED**

The following diagram shows an example of a pick & place tool to remove XLamp XP-P LEDs from the factory tape & reel packaging. 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 95a urethane.

All dimensions in [mm] in  
Measurement tolerances: .xxx = .001 in

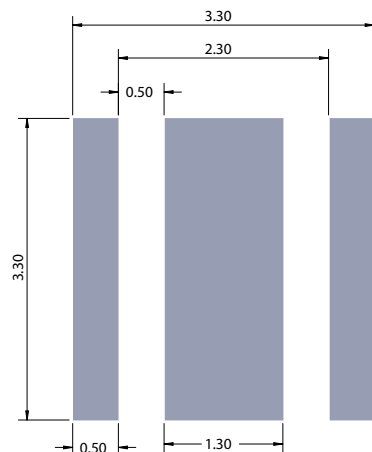


## CIRCUIT BOARD PREPARATION & LAYOUTS

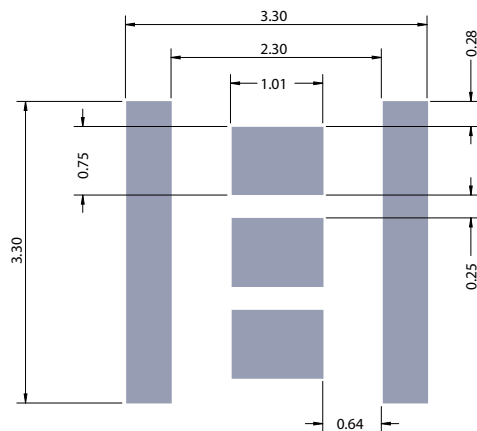
Printed circuit boards (PCBs) should be prepared and/or cleaned according to the manufacturer's specifications before placing or soldering XLamp XP Family LEDs onto the PCB.

The diagrams below show the recommended PCB solder pad layout for XLamp XP Family LEDs.

### XP-C, XP-E, XP-G

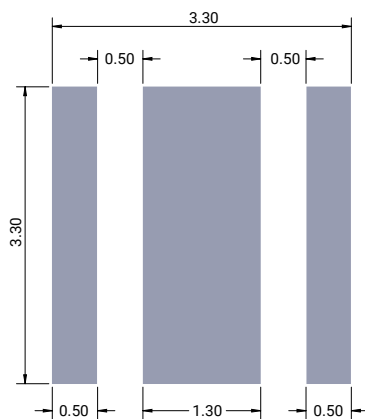


Recommended PCB Footprint

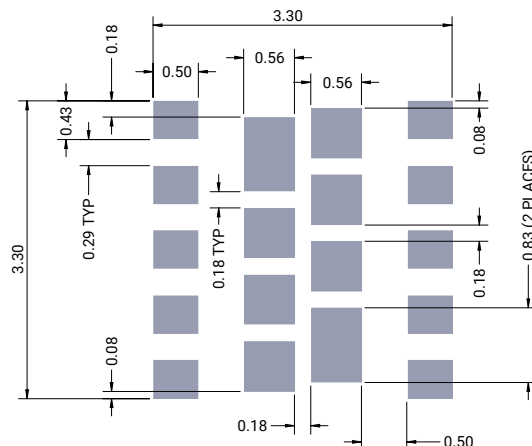


Recommended Stencil Opening

### XP-E2, XP-E2 Torch, XP-G2, XP-G3, XP-G3 Photophyll™ Select, XP-G4, XP-G4 Pro9, XP-L High Density & High Intensity, XP-L2, XP-P



Recommended PCB Footprint



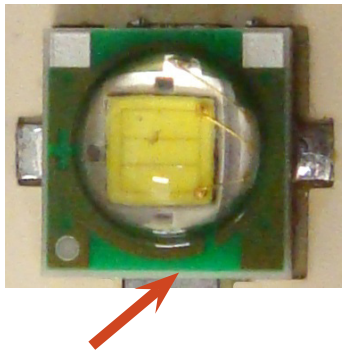
Recommended Stencil Opening\*

#### Notes:

- Cree LED recommends using thermal pad kickouts to maximize component thermal performance.
- Cree LED recommends using white solder mask material to minimize system optical loss.
- \* This stencil has been tested and optimized for the avoidance of voiding when using ALPHA® LUMET® P30 Maxrel solder paste. For other solder pastes, a "window pane" design for the thermal pad stencil may result in a lower voiding percentage. Contact your local Cree LED Field Applications Engineer for consultation regarding your specific application.

### CASE TEMPERATURE ( $T_s$ ) MEASUREMENT POINT

XLamp XP 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 XP Family LED itself. In testing, Cree LED has found such a solder pad to have insignificant impact on the resulting  $T_s$  measurement.

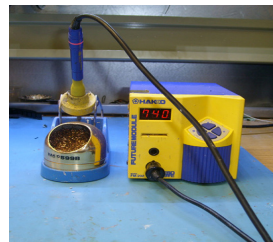
### NOTES ON SOLDERING XLAMP® XP FAMILY LEDS

XLamp XP 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 page 10.

✓  
**CORRECT**



✓  
**CORRECT**



✗  
**WRONG**

Do not wave solder XLamp XP Family LEDs. Do not hand solder XLamp XP Family LEDs.



## NOTES ON SOLDERING XLAMP® XP FAMILY LEDS - CONTINUED

### Solder Paste Type

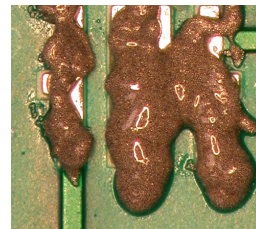
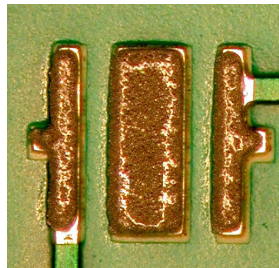
Cree LED strongly recommends using “no clean” solder paste with XLamp XP Family LEDs so that cleaning the PCB after soldering is not required. Cree LED uses [Kester® R276 solder paste](#) internally.

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 XP 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 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

Cree LED recommends keeping XLamp 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. Bare XLamp LEDs have a storage temperature range of -40 °C to 100 °C. However, the MBP, reel, tape and box have a more limited storage temperature range.

Once the MBP is opened, XLamp XP Family LEDs may be stored as MSL 1 per JEDEC J-STD-033, meaning they have unlimited floor life in conditions of  $\leq 30$  °C/85% relative humidity (RH). Regardless of the storage condition, Cree LED recommends sealing any unsoldered LEDs in the original MBP.

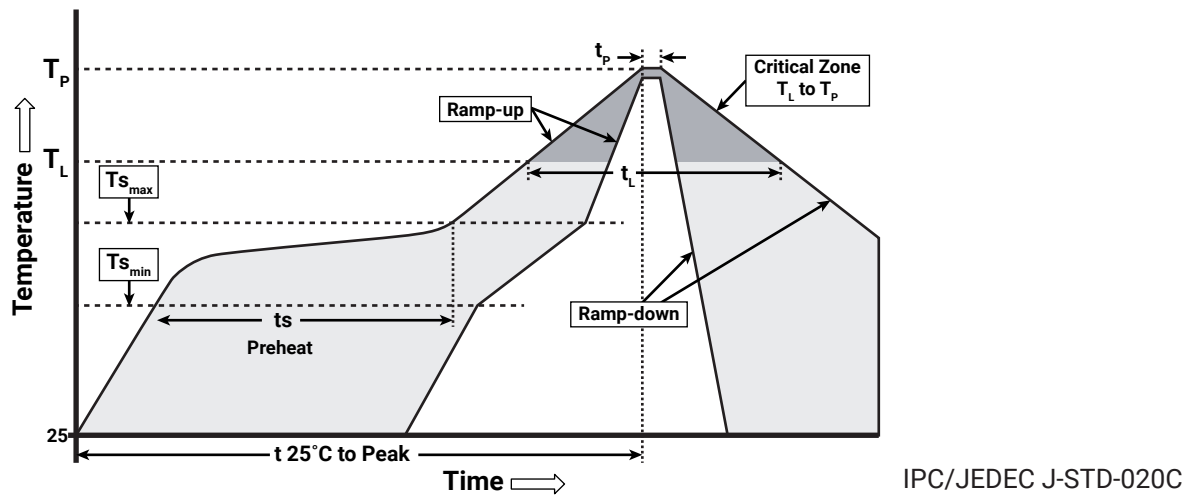
## LOW TEMPERATURE OPERATION

The minimum operating temperature of these XLamp 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® XP FAMILY LED REFLOW SOLDERING CHARACTERISTICS

In testing, Cree LED has found XLamp XP Family 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.



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.

## 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](#). The video at [www.youtube.com/watch?v=t24bf9D\\_1SA](http://www.youtube.com/watch?v=t24bf9D_1SA) illustrates the process Cree LED has developed for testing the compatibility of chemicals and materials with LEDs. You should also consult your regional Cree LED Field Applications Engineer.

### Recommended Chemicals

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

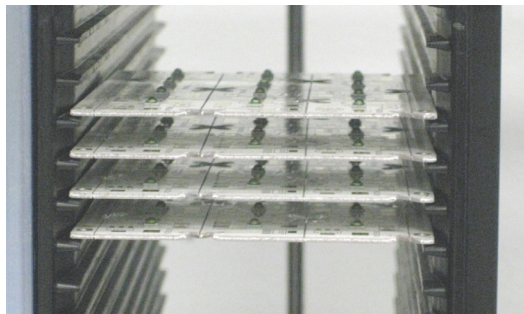
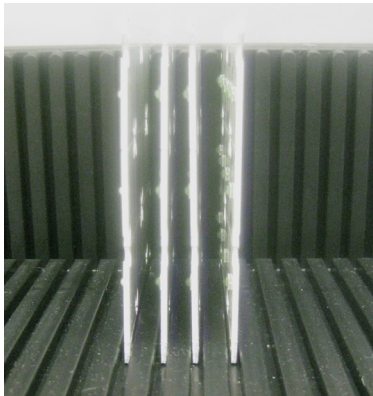
## ASSEMBLY STORAGE & HANDLING

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



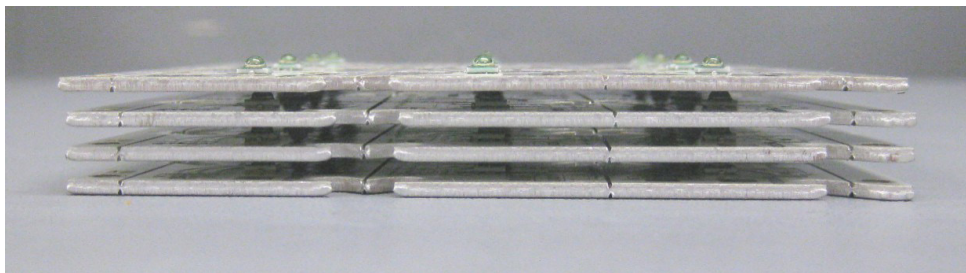
**CORRECT**



**CORRECT**



**WRONG**



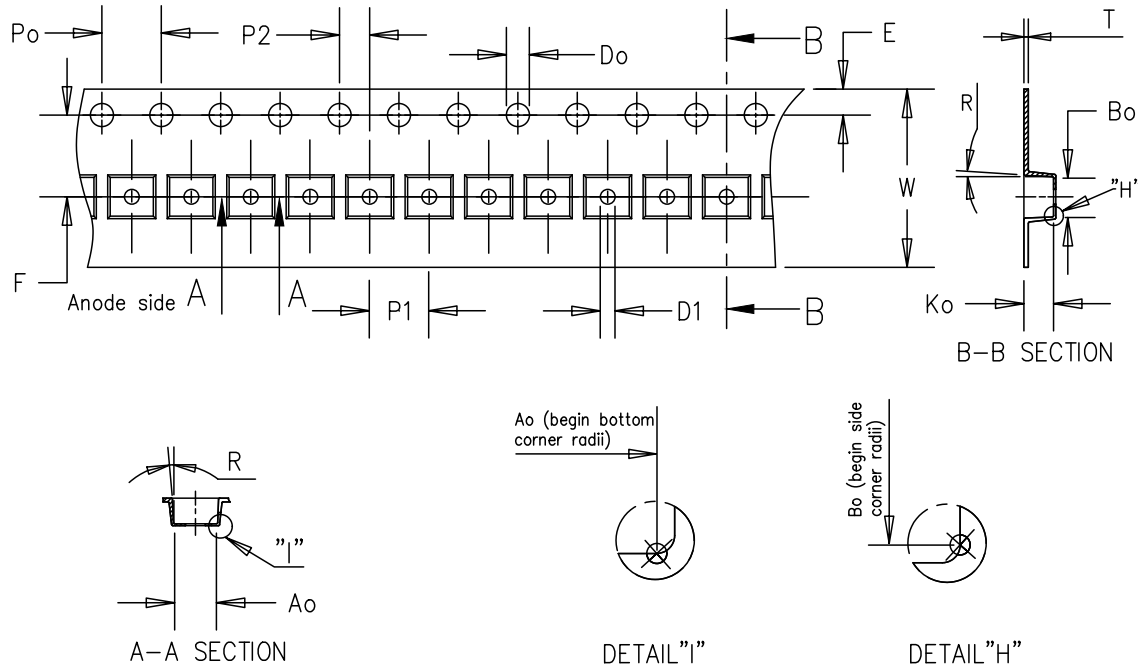
## TAPE AND REEL

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

Except as noted, all dimensions in mm.

All measurements are  $\pm 0.15$  mm unless otherwise indicated.

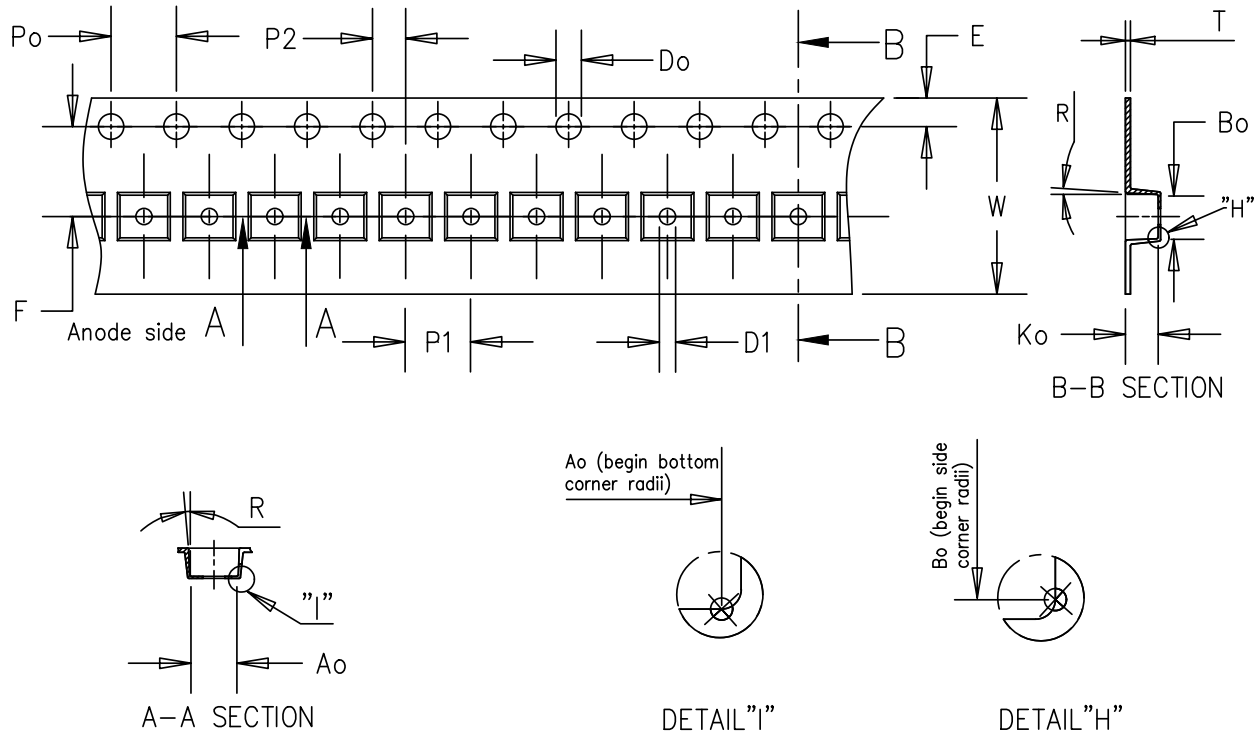
## XP-C, XP-E



Item	Ao	Bo	Ko	Po	P1	P2	T	E	F	Do	D1	W	R
Dim.	3.75	3.75	2.10	4.00	8.00	2.00	0.30	1.75	5.50	1.50	1.50	12.00	8°

## TAPE AND REEL - CONTINUED

## XP-E2, XP-E2 Torch, XP-G2, XP-G3, XP-G3 Photophyll™ Select, XP-G4, XP-G4 Pro9

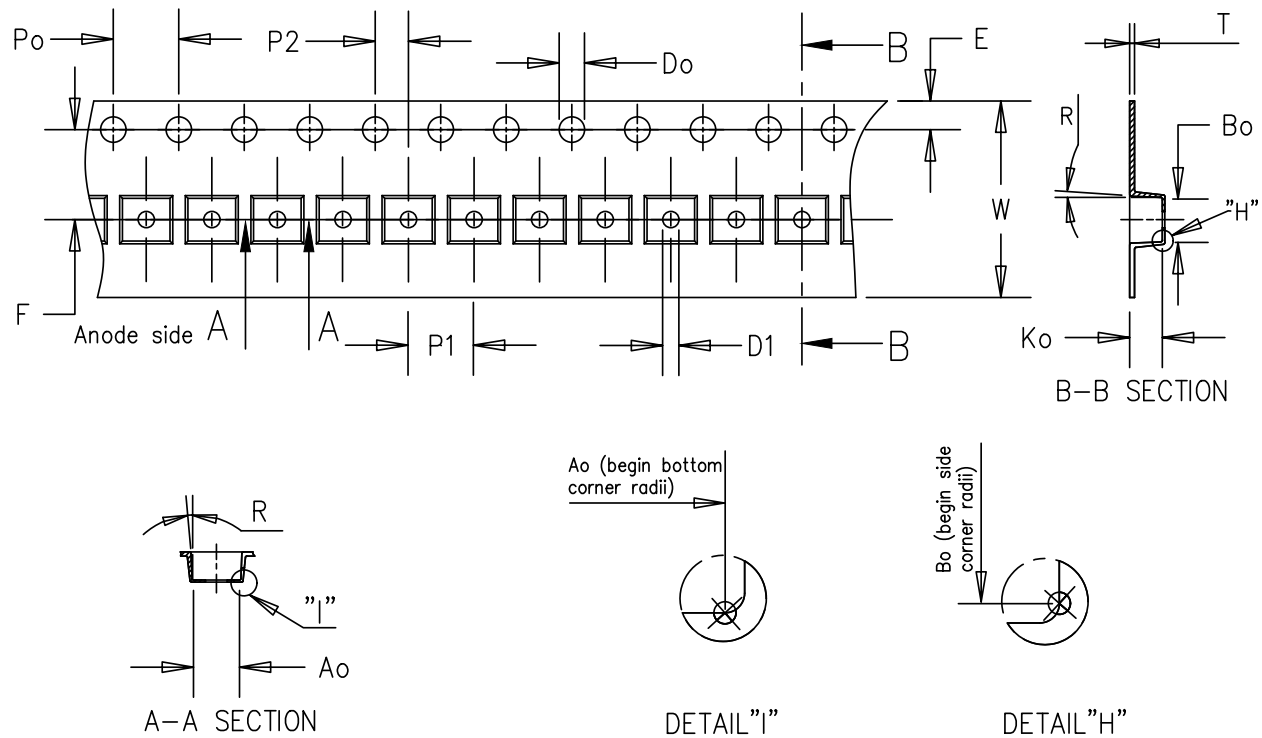


Item	Ao	Bo	Ko	Po	P1	P2	T	E	F	Do	D1	W	R
Dim.	3.70	3.70	2.40	4.00	8.00	2.00	0.30	1.75	5.50	1.55	1.50	12.00	5°



## TAPE AND REEL - CONTINUED

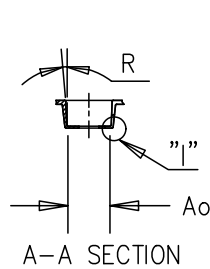
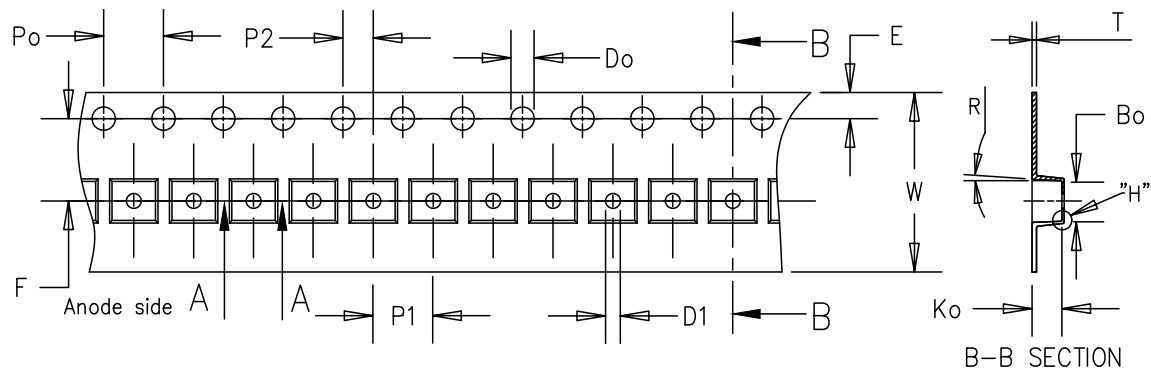
## XP-G



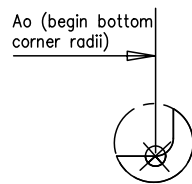
Item	$A_o$	$B_o$	$K_o$	$P_o$	$P_1$	$P_2$	$T$	$E$	$F$	$D_o$	$D_1$	$W$	$R$
Dim.	3.75	3.75	2.10	4.00	8.00	2.00	0.30	1.75	5.50	1.50	1.50	12.00	8°

## TAPE AND REEL - CONTINUED

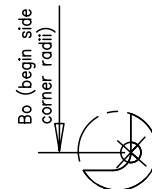
## XP-L High Density



A-A SECTION



DETAIL "I"



DETAIL "H"

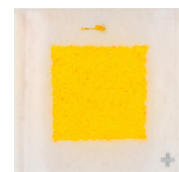
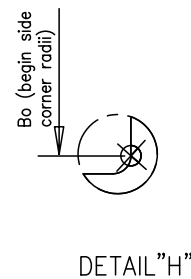
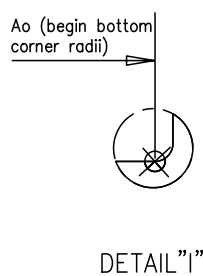
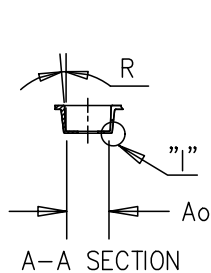
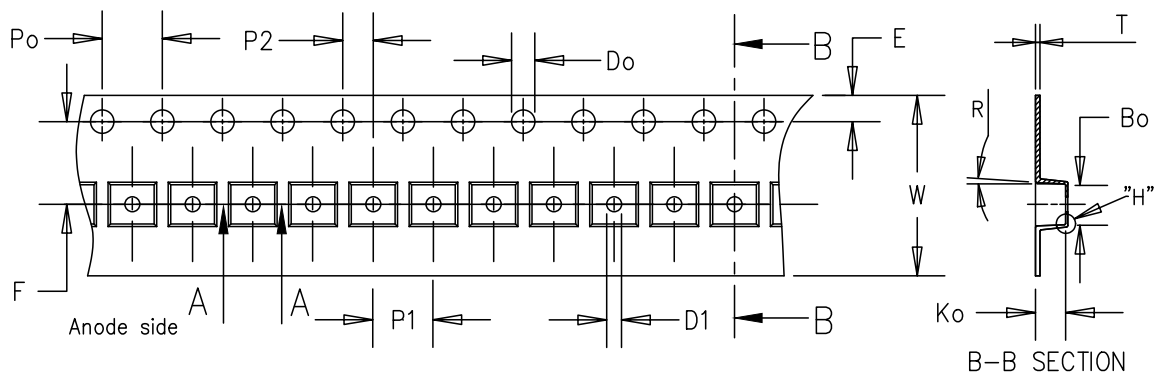


Anode Side

Item	Ao	Bo	Ko	Po	P1	P2	T	E	F	Do	D1	W	R
Dim.	3.75	3.75	2.90	4.00	8.00	2.00	0.30	1.75	5.50	1.50	1.50	12.00	3°

## TAPE AND REEL - CONTINUED

## XP-L High Intensity

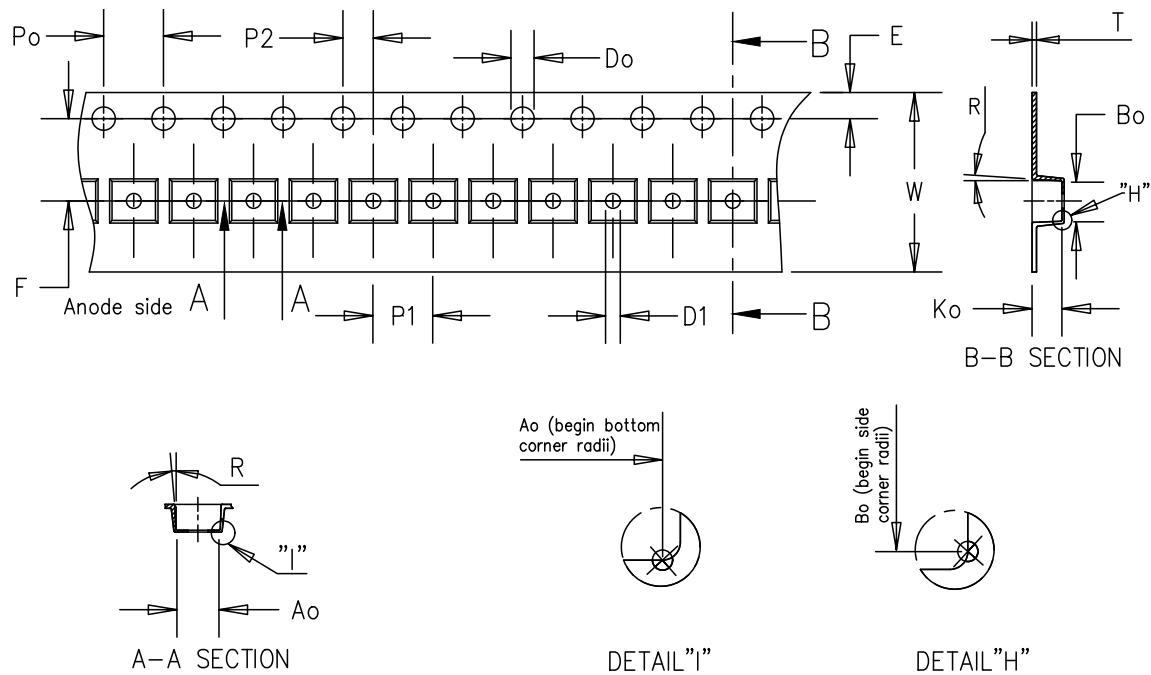


Anode Side

Item	Ao	Bo	Ko	Po	P1	P2	T	E	F	Do	D1	W	R
Dim.	3.70	3.70	1.20	4.00	8.00	2.00	0.30	1.75	5.50	1.50	1.50	12.00	3°

## TAPE AND REEL - CONTINUED

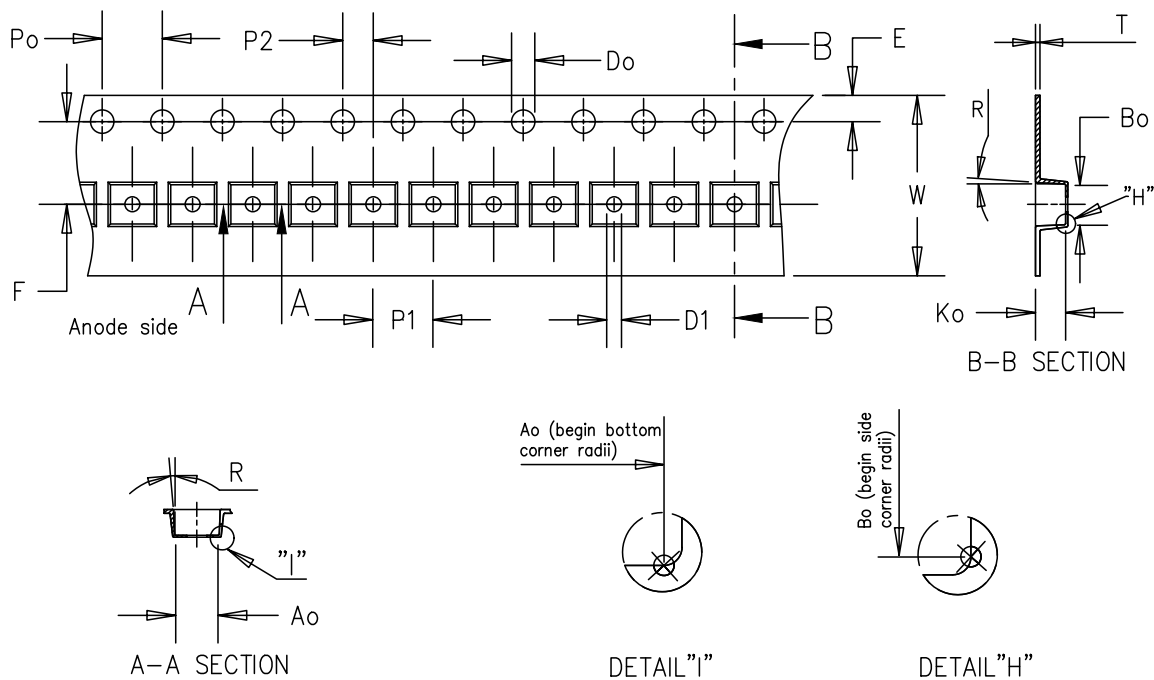
## XP-L2



Item	Ao	Bo	Ko	Po	P1	P2	T	E	F	Do	D1	W	R
Dim.	3.75	3.75	2.90	4.00	8.00	2.00	0.30	1.75	5.50	1.50	1.50	12.00	3°

## TAPE AND REEL - CONTINUED

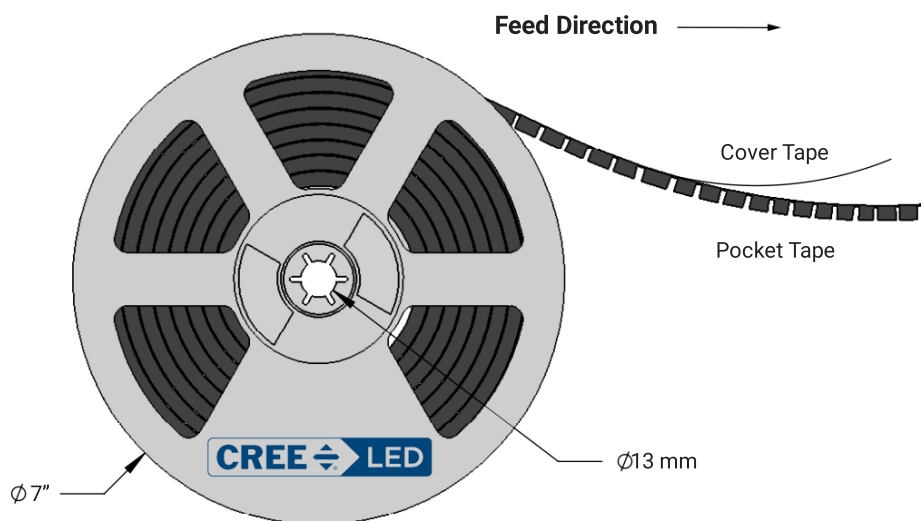
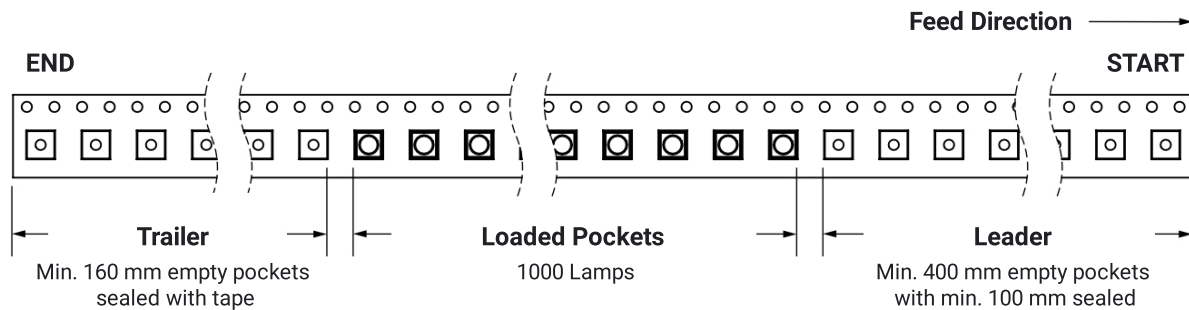
## XP-P



Item	Ao	Bo	Ko	Po	P1	P2	T	E	F	Do	D1	W	R
Dim.	3.70	3.70	1.20	4.00	8.00	2.00	0.30	1.75	5.50	1.50	1.50	12.00	3°

## TAPE AND REEL - CONTINUED

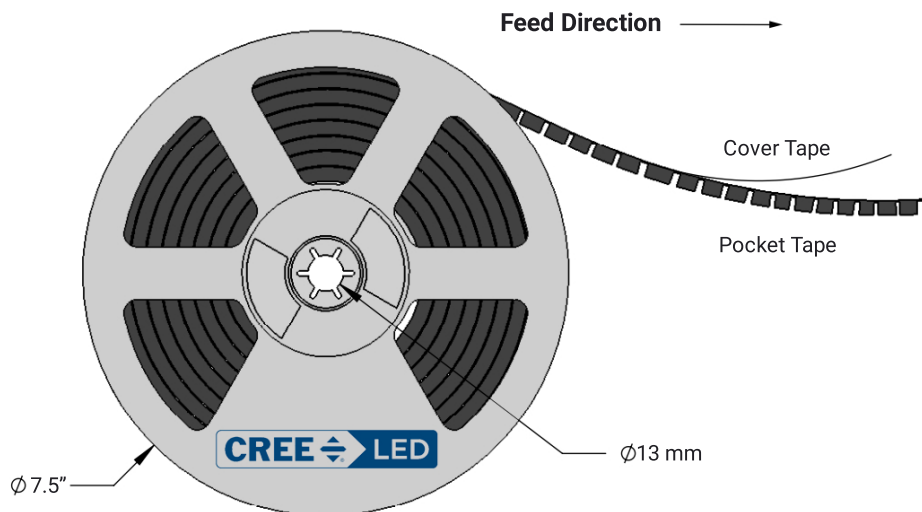
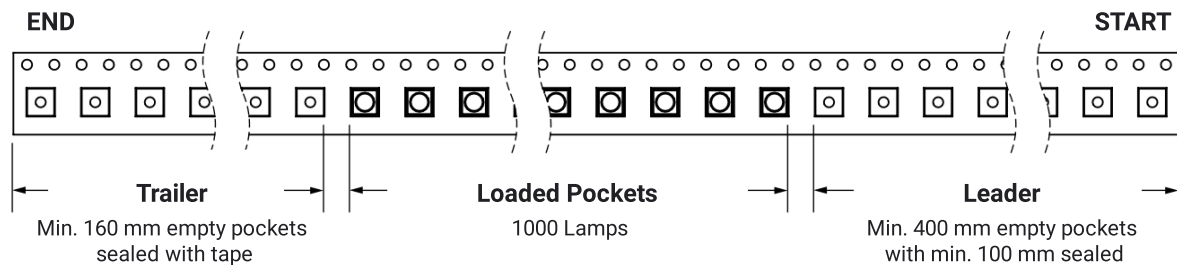
## XP-C, XP-E, XP-G, XP-P





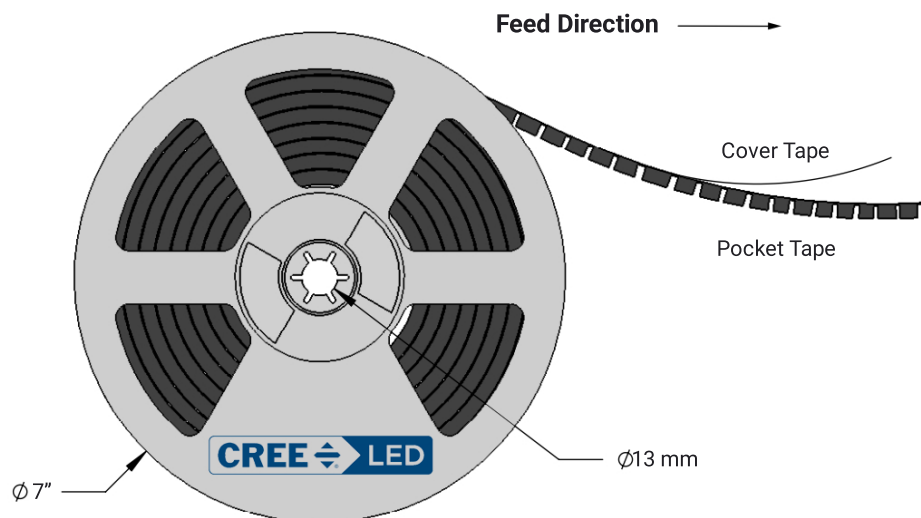
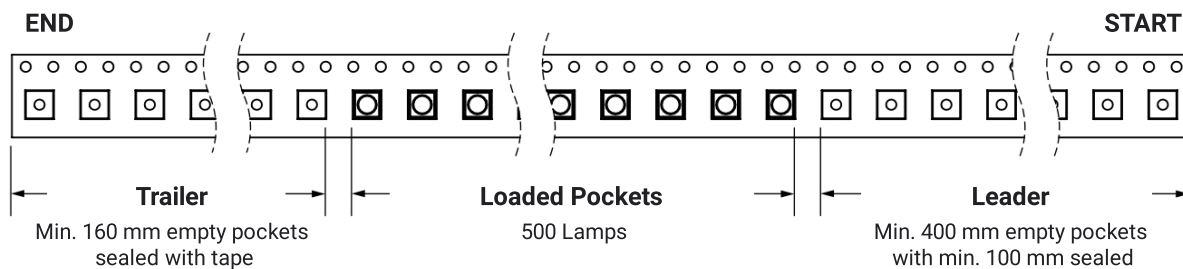
## TAPE AND REEL - CONTINUED

XP-E2, XP-E2 Torch, XP-G2, XP-G3, XP-G3 Photophyll™ Select, XP-G4, XP-G4 Pro9



## TAPE AND REEL - CONTINUED

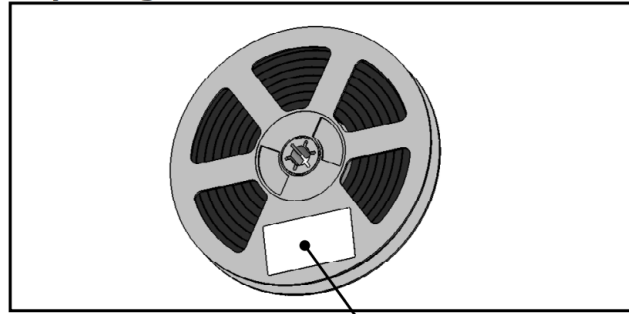
## XP-L High Density &amp; High Intensity, XP-L2



## PACKAGING & LABELS

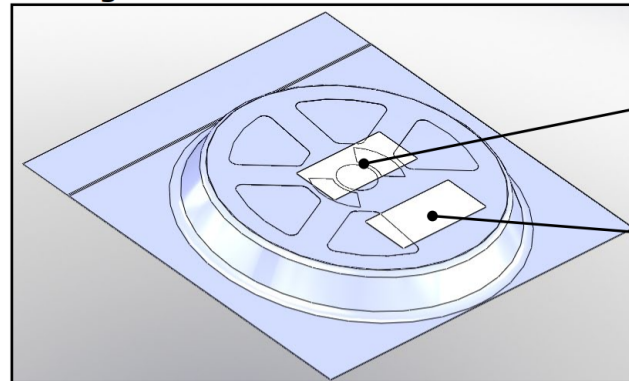
The diagrams below show the packaging and labels Cree LED uses to ship XLamp XP Family LEDs. XLamp XP Family LEDs are shipped in tape loaded on a reel. Each box contains only one reel in a moisture barrier bag.

### Unpackaged Reel



Label with Cree LED Bin Code, Quantity, Reel ID

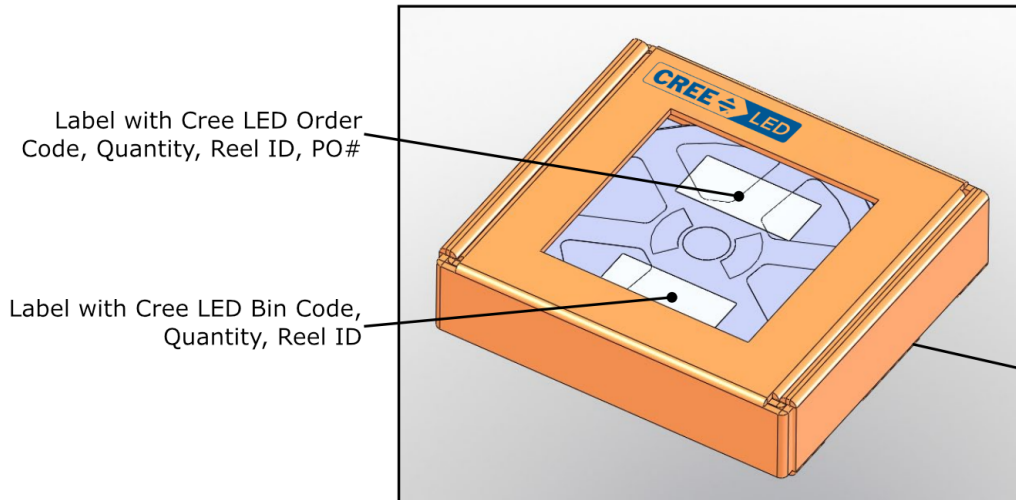
### Packaged Reel



Label with Cree LED Order Code, Quantity, Reel ID, PO#

Label with Cree LED Bin Code, Quantity, Reel ID

### Boxed Reel



Label with Cree LED Order Code, Quantity, Reel ID, PO#

Label with Cree LED Bin Code, Quantity, Reel ID

Patent Label (on bottom of box)