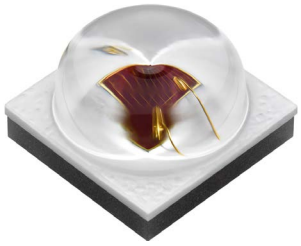
PRELIMINARY

# XLamp® XP-E2 Horizon LEDs



## PRODUCT DESCRIPTION

The XP-E2 LED is available in Horizon90 and Horizon70 options. In this document, the term XP-E2 Horizon denotes the XP-E2 Horizon LED without regard to its viewing angle. The terms Horizon90 and Horizon70 are used when necessary to differentiate the performance of the XP-E2 Horizon90 LED from the XP-E2 Horizon70 LED.

## FEATURES

- Available in far red
- ANSI-compatible chromaticity bins
- Maximum drive current: 1.5 A
- Low thermal resistance: as low as 8 °C/W
- Unlimited floor life at ≤ 30 °C/85% RH
- Reflow solderable - JEDEC J-STD-020C compatible
- Electrically neutral thermal path

Cree LED / 4001 E. Hwy. 54, Suite 2000 / Durham, NC 27709 USA / +1.919.313.5330 / www.cree-led.com

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## CHARACTERISTICS

| Characteristics | Unit | Minimum | Typical | Maximum |
|---|---|---|---|---|
| Thermal resistance, junction to solder point | °C/W | | 8 | |
| Viewing angle (FWHM) - Horizon90 | degrees | | 145 | |
| Viewing angle (FWHM) - Horizon70 | degrees | | 140 | |
| 2X peak vertical angle - Horizon90 | degrees | | 90 | |
| 2X peak vertical angle - Horizon70 | degrees | | 70 | |
| Temperature coefficient of voltage | mV/°C | | -1.0 | |
| ESD classification (HBM per Mil-Std-883D) | | | Class 3B | |
| DC forward current | mA | | | 1500 |
| Reverse voltage | V | | | 1 |
| Forward voltage (@ 350 mA, 25 °C) | V | | 1.85 | 2.4 |
| Forward voltage (@ 1000 mA, 25 °C) | V | | 2.15 | |
| LED junction temperature | °C | | | 150 |

Note

- Thermal resistance measurement was performed per the JEDEC JESD51-14 standard. See the Thermal Resistance Measurement application note for more details.

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## FLUX CHARACTERISTICS ($T_J$ = 25 °C)

The following tables provide order codes for XLamp XP-E2 Horizon LEDs. For a complete description of the order-code nomenclature, please see the Bin and Order Code Formats section (page 9).

| Color | Minimum Radiant Flux (mW) @ 350 mA | | Calculated Minimum $PF_{FR}$ (µmol/s)* | Peak Wavelength (nm) | | | | Color Order Codes |
|---|---|---|---|---|---|---|---|---|
| | | | | Minimum | | Maximum | | |
| | Group | Flux (mW) | | Group | PWL (nm) | Group | PWL (nm) | |
| Horizon90 Far Red | 27 | 375 | 2.2 | F2 | 720 | F5 | 740 | XPEBFR-LF-0000-00A01 |
| | 28 | 400 | 2.34 | F2 | 720 | F5 | 740 | XPEBFR-LF-0000-00B01 |
| | 29 | 425 | 2.49 | F2 | 720 | F5 | 740 | XPEBFR-LF-0000-00C01 |

| Color | Minimum Radiant Flux (mW) @ 350 mA | | Calculated Minimum $PF_{FR}$ (µmol/s)* | Peak Wavelength (nm) | | | | Color Order Codes |
|---|---|---|---|---|---|---|---|---|
| | | | | Minimum | | Maximum | | |
| | Group | Flux (mW) | | Group | PWL (nm) | Group | PWL (nm) | |
| Horizon70 Far Red | 27 | 375 | 2.2 | F2 | 720 | F5 | 740 | XPEBFR-LW-0000-00A01 |
| | 28 | 400 | 2.34 | F2 | 720 | F5 | 740 | XPEBFR-LW-0000-00B01 |
| | 29 | 425 | 2.49 | F2 | 720 | F5 | 740 | XPEBFR-LW-0000-00C01 |

Note:

- Cree LED maintains a tolerance of ±7% on flux and power measurements, ±0.005 on chromaticity (CCx, CCy) measurements, ±2 on CRI measurements and ±1 on dominant wavelength measurements. See the Measurements section (page 11).
- XLamp XP-E2 Horizon LED order codes specify only a minimum flux bin and not a maximum. Cree LED may ship reels in flux bins higher than the minimum specified by the order code without advance notice. Shipments will always adhere to the chromaticity bin restrictions specified by the order code.

* Calculated $PF_{FR}$ values are for reference only.

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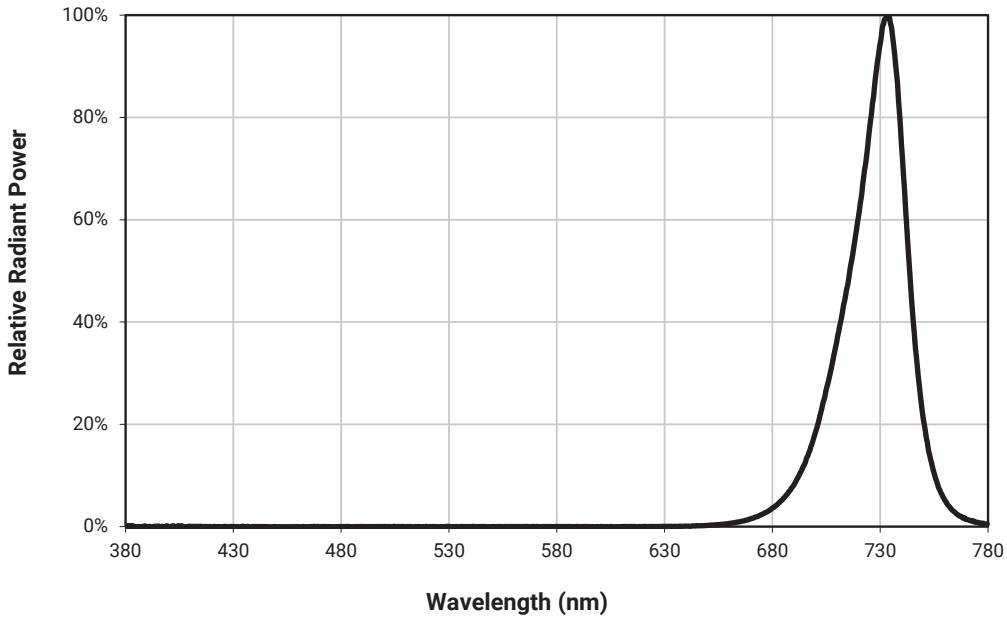
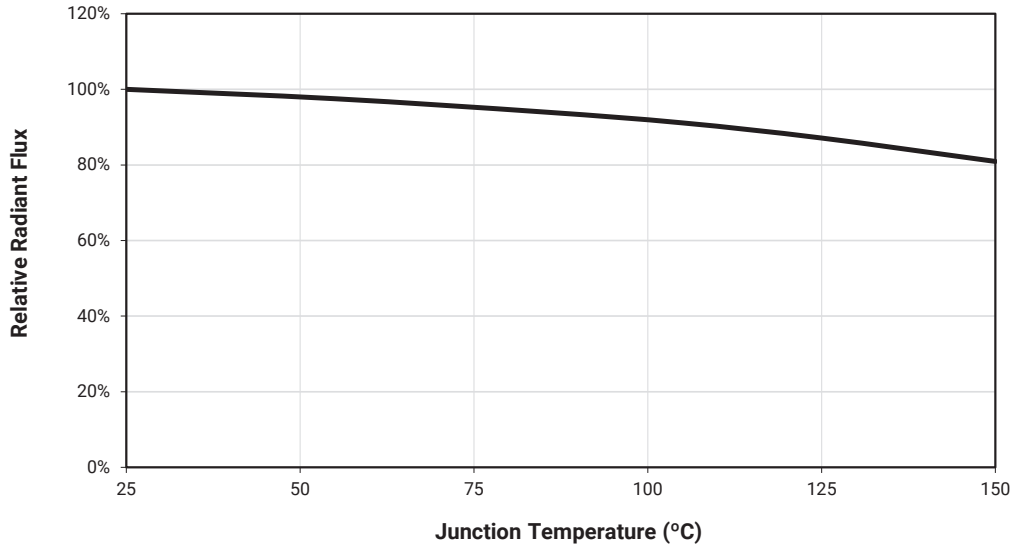
## RELATIVE SPECTRAL POWER DISTRIBUTION

**Horizon90, Horizon70**




## RELATIVE FLUX VS. JUNCTION TEMPERATURE ($I_F$ = 350 mA)

**Horizon90, Horizon70**



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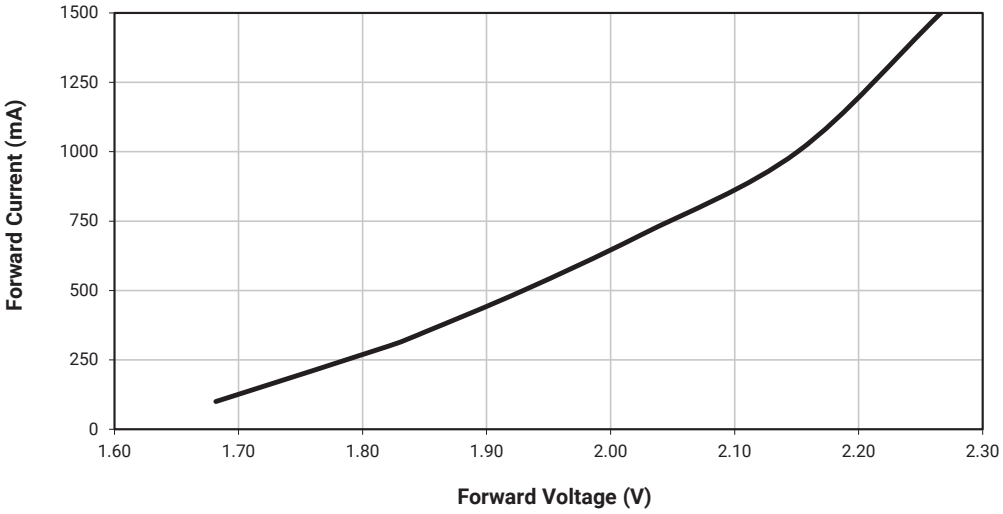
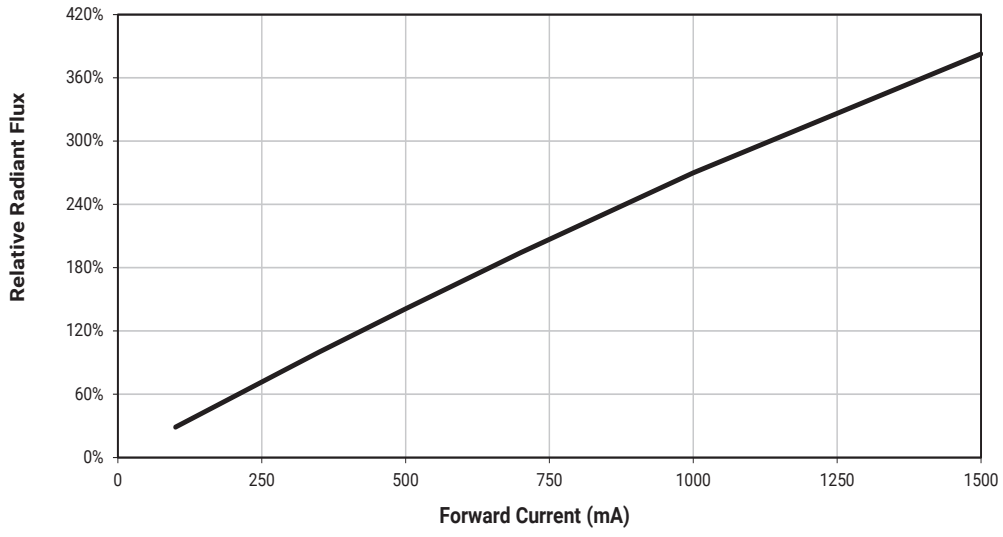
## ELECTRICAL CHARACTERISTICS ($T_J$ = 25 °C)

**Horizon90, Horizon70**




## RELATIVE FLUX VS. CURRENT ($T_J$ = 25 °C)

**Horizon90, Horizon70**



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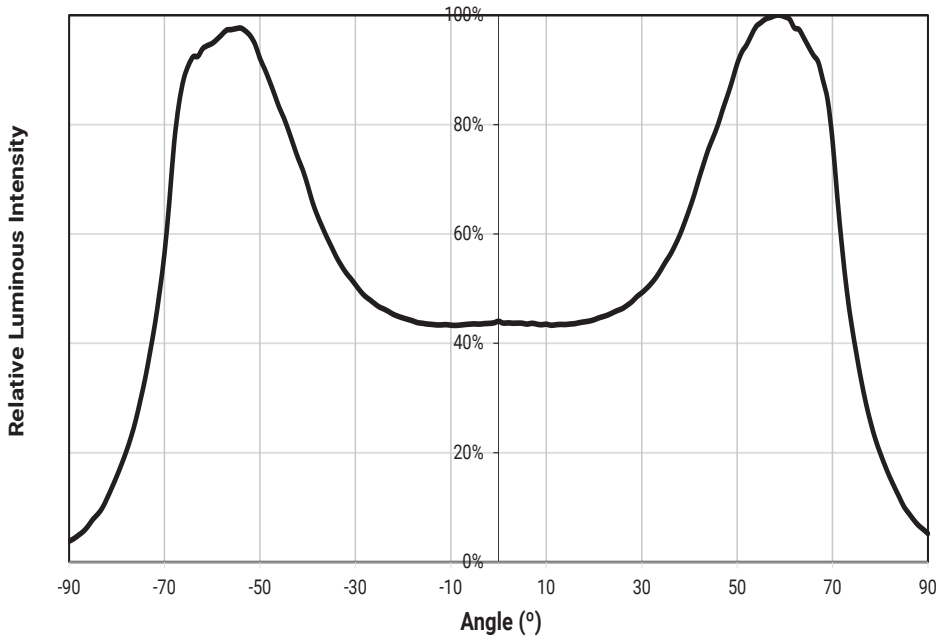
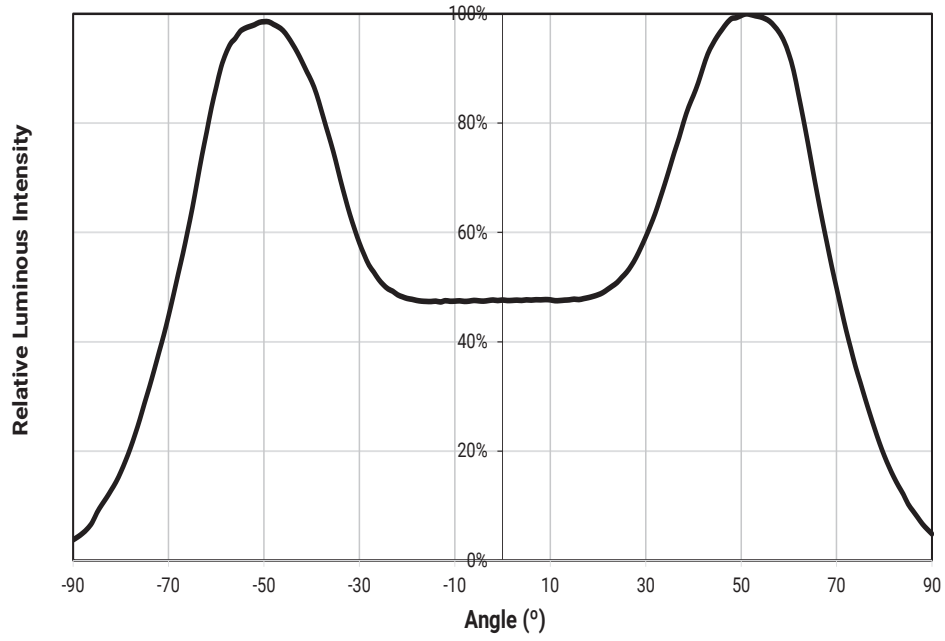
## TYPICAL SPATIAL DISTRIBUTION

**Horizon90**




**Horizon70**



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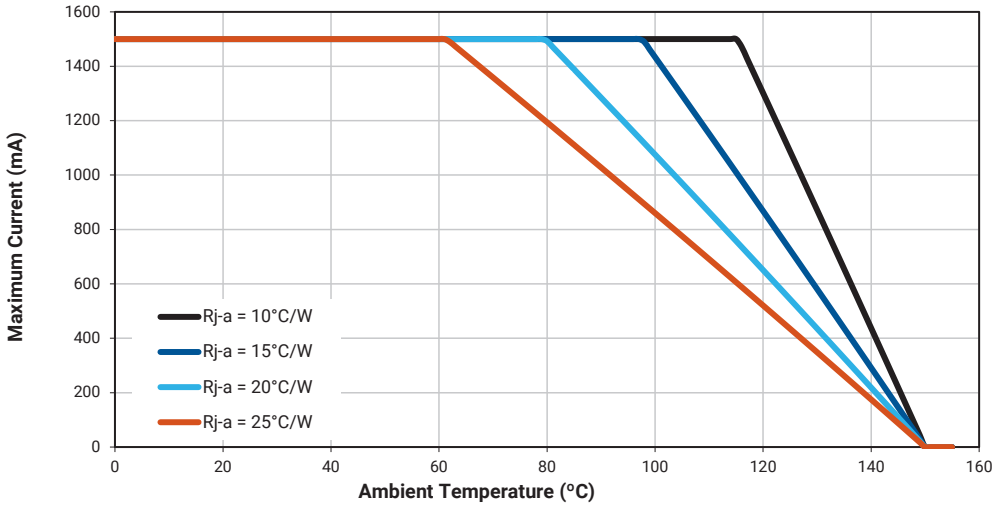
## THERMAL DESIGN

**Horizon90, Horizon70**




## PERFORMANCE GROUPS - RADIANT FLUX ($T_J$ = 25 °C)

XLamp XP-E2 Horizon LEDs are tested for radiant flux and sorted into one of the following radiant-flux bins:

| Group | Minimum Radiant Flux (mW) @ 350 mA | Maximum Radiant Flux (mW) @ 350 mA |
|---|---|---|
| 27 | 375 | 400 |
| 28 | 400 | 425 |
| 29 | 425 | 450 |

## PERFORMANCE GROUPS - PEAK WAVELENGTH

XLamp XP-E2 Horizon LEDs are tested for peak wavelength (PWL) and sorted into one of the PWL bins defined below.

| Color | PWL Group | Minimum PWL (nm) @ 350 mA | Maximum PWL (nm) @ 350 mA |
|---|---|---|---|
| Far Red | F2 | 720 | 725 |
| | F3 | 725 | 730 |
| | F4 | 730 | 735 |
| | F5 | 735 | 740 |

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## PERFORMANCE GROUPS - FORWARD VOLTAGE

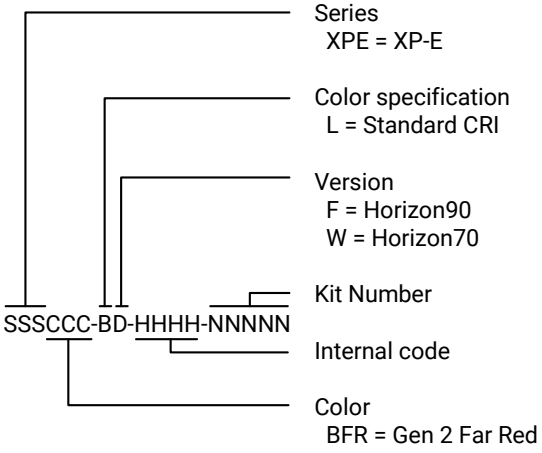
XLamp XP-E2 Horizon LEDs are tested for forward voltage and sorted into one of the forward voltage bins defined below.

| Forward Voltage Group | Minimum Forward Voltage (V) @ 350 mA | Maximum Forward Voltage (V) @ 350 mA |
|---|---|---|
| A | 1.5 | 1.75 |
| B | 1.75 | 2.0 |
| C | 2.0 | 2.25 |
| D | 2.25 | 2.5 |

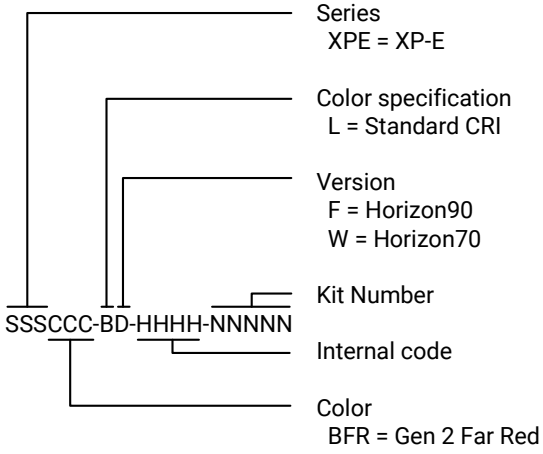
## BIN AND ORDER CODE FORMATS

XP-E2 Horizon bin codes and order codes are configured in the following manner:

**Order Code**




**Bin Code**



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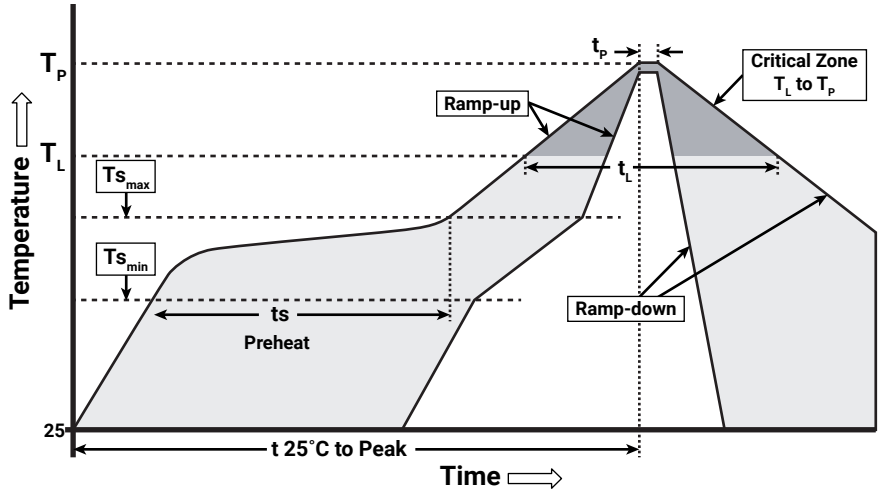
## REFLOW SOLDERING CHARACTERISTICS

In testing, Cree LED has found XLamp XP-E2 Horizon 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 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 ($T_L$) | 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.

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## NOTES

**Measurements**

The luminous flux, radiant power, chromaticity, forward voltage and CRI measurements in this document are binning specifications only and solely represent product measurements as of the date of shipment. These measurements will change over time based on a number of factors that are not within Cree LED's control and are not intended or provided as operational specifications for the products. Calculated values are provided for informational purposes only and are not intended or provided as specifications.

**Pre-Release Qualification Testing**

Please read the LED Reliability Overview for details of the qualification process Cree LED applies to ensure long-term reliability for XLamp LEDs and details of Cree LED's pre-release qualification testing for XLamp LEDs.

**Lumen Maintenance**

Cree LED now uses standardized IES LM-80-08 and TM-21-11 methods for collecting long-term data and extrapolating LED lumen maintenance. For information on the specific LM-80 data sets available for this LED, refer to the public LM-80 results document.

Please read the Long-Term Lumen Maintenance application note for more details on Cree LED's lumen maintenance testing and forecasting. Please read the Thermal Management application note for details on how thermal design, ambient temperature, and drive current affect the LED junction temperature.

**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.

Once the MBP is opened, XLamp XP-E2 Horizon LEDs may be stored as MSL 1 per JEDEC J-STD-033, meaning they have unlimited floor life in conditions of ≤ 30 ºC/85% relative humidity (RH). Regardless of the storage condition, Cree LED recommends sealing any unsoldered LEDs in the original MBP.

**Vision Advisory**

WARNING: Do not look at an exposed lamp in operation. Eye injury can result. For more information about LEDs and eye safety, please refer to the LED Eye Safety application note.

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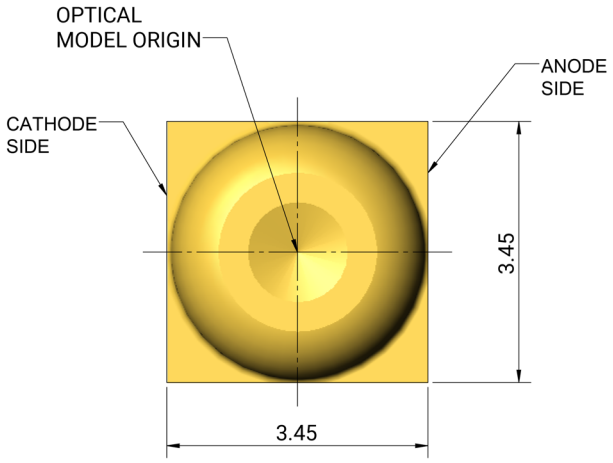
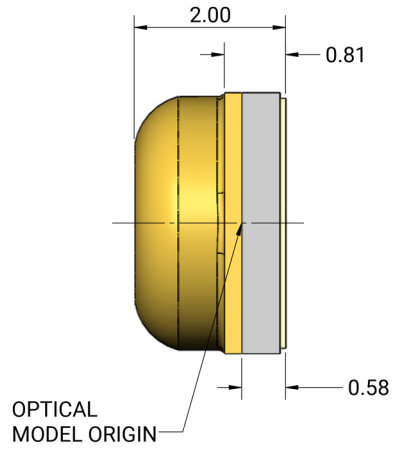
## MECHANICAL DIMENSIONS

Thermal vias, if present, are not shown on these drawings.

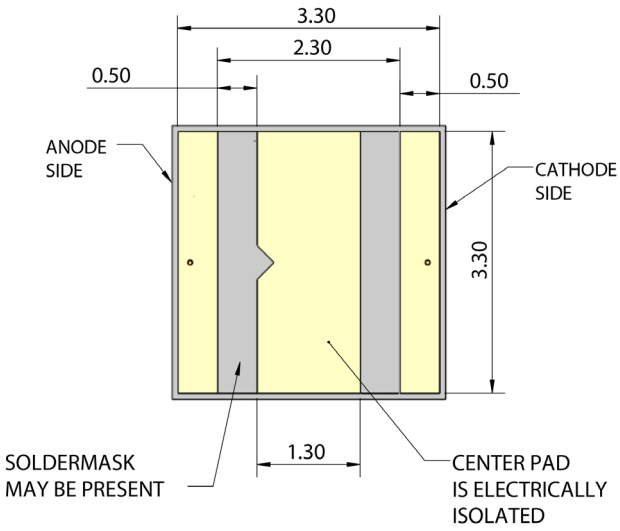
All measurements are ±.13 mm unless otherwise indicated.




**Top View**




**Side View**

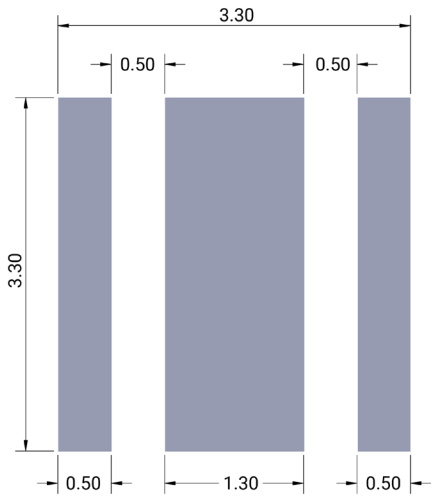


# PRELIMINARY

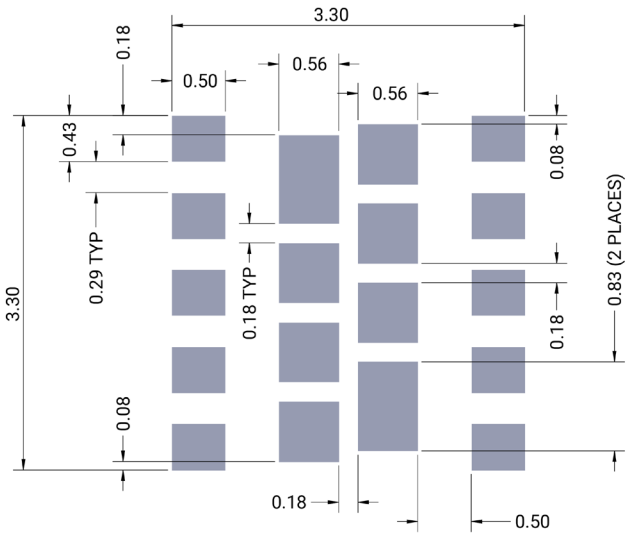
## MECHANICAL DIMENSIONS - CONTINUED

Thermal vias, if present, are not shown on these drawings.

All measurements are ±.13 mm unless otherwise indicated.




**Recommended PCB Footprint**




**Recommended Stencil Opening**

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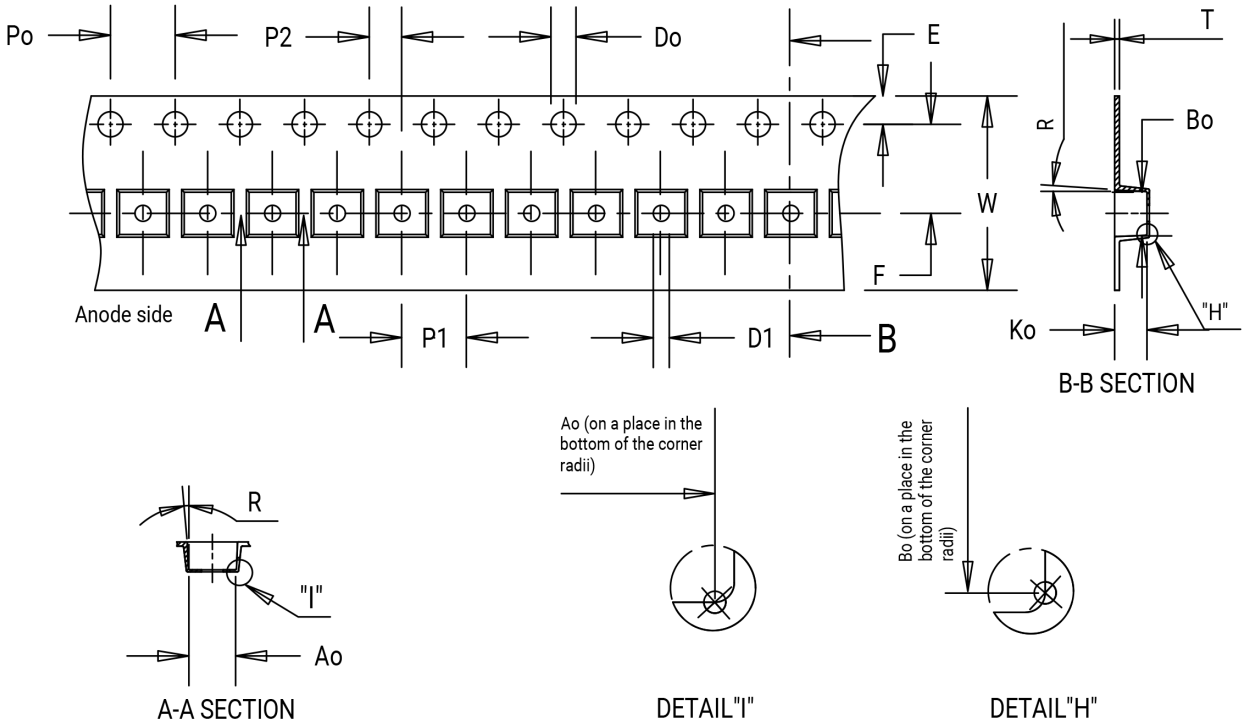
## TAPE AND REEL

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

All dimensions in mm.

All measurements are ±.15 mm unless otherwise indicated.



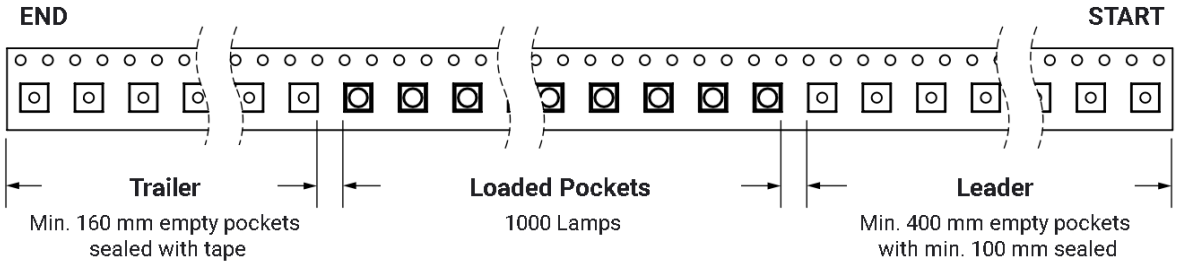

| Item | Ao | Bo | Ko | Po | P1 | P2 | T | E | F | Do | D1 | W | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dim. | 3.70 | 3.70 | 2.40 | 4.00 | 8.00 | 2.00 | 0.30 | 1.75 | 5.50 | 1.55 | 1.50 | 12.00 | 5° |

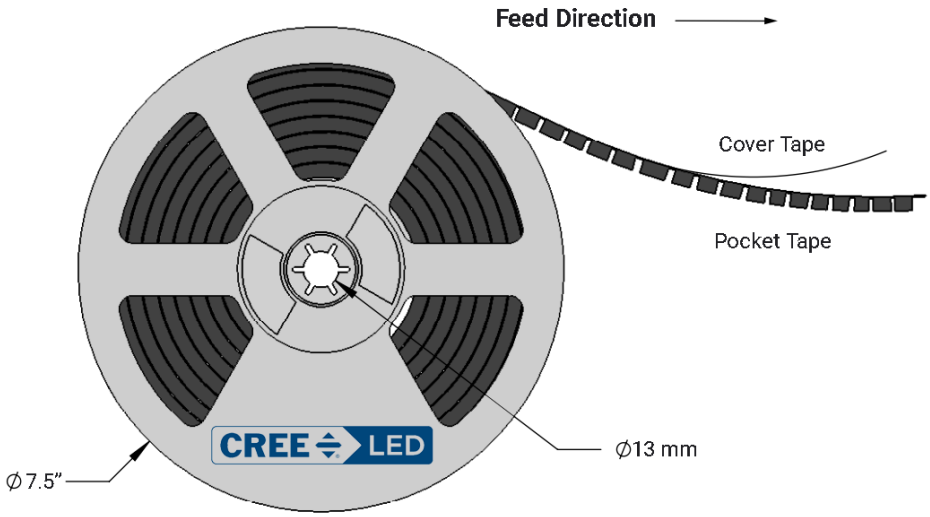
# PRELIMINARY

## TAPE AND REEL - CONTINUED

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

All dimensions in mm.



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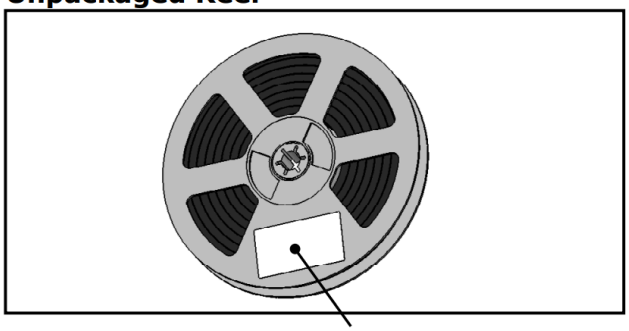
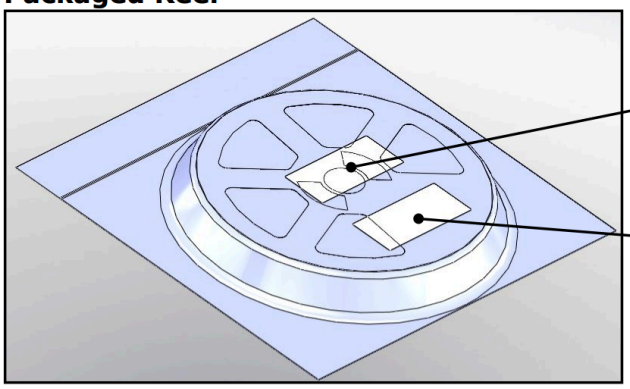
## PACKAGING

**Unpackaged Reel**




**Packaged Reel**




**Boxed Reel**