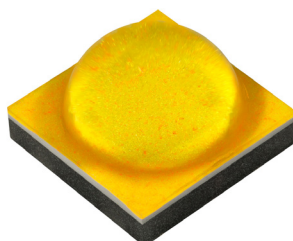


# XLamp® XP-G4 Pro9™ LEDs



## PRODUCT DESCRIPTION

XLamp® XP-G4 LEDs are the fourth generation of Cree LED's standard-setting XP-G product family, featuring both best in class efficacy and an optimized optical profile that maximizes on axis light output. With the same mechanical dimensions as XP-G3, the XP-G4 is an easy upgrade path for many high power LED designs.

The Pro9™ version of the XP-G4 LED delivers up to 10% higher efficacy for 90 and 95 color rendering index (CRI) over standard version LEDs without sacrificing color rendering quality.

XLamp XP-G4 Pro9 LEDs are optimized for indoor directional lighting applications where optical control and light quality are critical.

## FEATURES

- Available in 3-step & 5-step EasyWhite® bins at 2700 K–4000 K CCT
- Available in 90- and 95-CRI minimum
- Binned at 85 °C
- Maximum drive current: 2000 mA
- Low thermal resistance: 1.3 °C/W
- Wide viewing angle: 120°
- Unlimited floor life at ≤ 30 °C/85% RH
- Reflow solderable - JEDEC J-STD-020C
- RoHS and REACH compliant
- UL® recognized component (E349212)

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Cree LED / 4001 E. Hwy. 54, Suite 2000 / Durham, NC 27709 USA / +1.919.313.5330 / [www.cree-led.com](http://www.cree-led.com)

## CHARACTERISTICS

Characteristics	Unit	Minimum	Typical	Maximum
Thermal resistance, junction to solder point	°C/W		1.3	
Viewing angle (FWHM)	degrees		120	
Temperature coefficient of voltage	mV/°C		-1.3	
ESD withstand voltage (HBM per Mil-Std-883D)			Class 3B	
DC forward current	mA			2000
Reverse voltage	V			5
Forward voltage (@ 700 mA, 85 °C)	V		2.8	3.3
CRI R9 (90 CRI minimum)		50		
CRI R9 (95 CRI minimum)		60		
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.

## FLUX CHARACTERISTICS, ORDER CODES & BINS ( $I_F = 700 \text{ mA}$ , $T_J = 85^\circ \text{C}$ )

The following tables provide order codes for XLamp XP-G4 Pro9 LEDs. For a complete description of how the flux and chromaticity groups are reflected in the bin code and order code nomenclature, please see the Bin and Order Code Formats section (page 11).

Nominal CCT	CRI		Minimum Luminous Flux (lm) @ 700 mA			3-Step		5-Step	
	Min.	Typ	Code	Flux (lm) @ 85 °C	Flux (lm) @ 25 °C*	Group	Order Code	Group	Order Code
4000 K	90	92	B5	290	316	40G	XPGEWT-01-0000-0P000UK5G	40E	XPGEWT-01-0000-0P000UK5E
			B4	280	305	40G	XPGEWT-01-0000-0P000UJ5G	40E	XPGEWT-01-0000-0P000UJ5E
			B3	270	294	40G	XPGEWT-01-0000-0P000UH5G	40E	XPGEWT-01-0000-0P000UH5E
	95	98	B4	280	305	40G	XPGEWT-01-0000-0P000ZJ5G	40E	XPGEWT-01-0000-0P000ZJ5E
			B3	270	294	40G	XPGEWT-01-0000-0P000ZH5G	40E	XPGEWT-01-0000-0P000ZH5E
			B2	260	284	40G	XPGEWT-01-0000-0P000ZG5G	40E	XPGEWT-01-0000-0P000ZG5E
3500 K	90	92	B5	290	316	40G	XPGEWT-01-0000-0P000UK6G	35E	XPGEWT-01-0000-0P000UK6E
			B4	280	305	40G	XPGEWT-01-0000-0P000UJ6G	35E	XPGEWT-01-0000-0P000UJ6E
			B3	270	294	35G	XPGEWT-01-0000-0P000UH6G	35E	XPGEWT-01-0000-0P000UH6E
			B2	260	284	35G	XPGEWT-01-0000-0P000UG6G	35E	XPGEWT-01-0000-0P000UG6E
	95	98	B4	280	305	35G	XPGEWT-01-0000-0P000ZJ6G	35E	XPGEWT-01-0000-0P000ZJ6E
			B3	270	294	35G	XPGEWT-01-0000-0P000ZH6G	35E	XPGEWT-01-0000-0P000ZH6E
			B2	260	284	35G	XPGEWT-01-0000-0P000ZG6G	35E	XPGEWT-01-0000-0P000ZG6E
			B1	250	273	35G	XPGEWT-01-0000-0P000ZF6G	35E	XPGEWT-01-0000-0P000ZF6E
3000 K	90	92	B4	280	305	35G	XPGEWT-01-0000-0P000UJ7G	30E	XPGEWT-01-0000-0P000UJ7E
			B3	270	294	35G	XPGEWT-01-0000-0P000UH7G	30E	XPGEWT-01-0000-0P000UH7E
			B2	260	284	30G	XPGEWT-01-0000-0P000UG7G	30E	XPGEWT-01-0000-0P000UG7E
			B1	250	273	30G	XPGEWT-01-0000-0P000UF7G	30E	XPGEWT-01-0000-0P000UF7E
	95	98	B3	270	294	30G	XPGEWT-01-0000-0P000ZH7G	30E	XPGEWT-01-0000-0P000ZH7E
			B2	260	284	30G	XPGEWT-01-0000-0P000ZG7G	30E	XPGEWT-01-0000-0P000ZG7E
			B1	250	273	30G	XPGEWT-01-0000-0P000ZF7G	30E	XPGEWT-01-0000-0P000ZF7E

### Notes:

- Cree LED maintains a tolerance of  $\pm 7\%$  on flux and power measurements,  $\pm 0.005$  on chromaticity (CCx, CCy) measurements and  $\pm 2$  on CRI measurements. See the Measurements section (page 13).
- XLamp XP-G4 Pro9 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.
- \* Flux values @ 25 °C are calculated and for reference only.

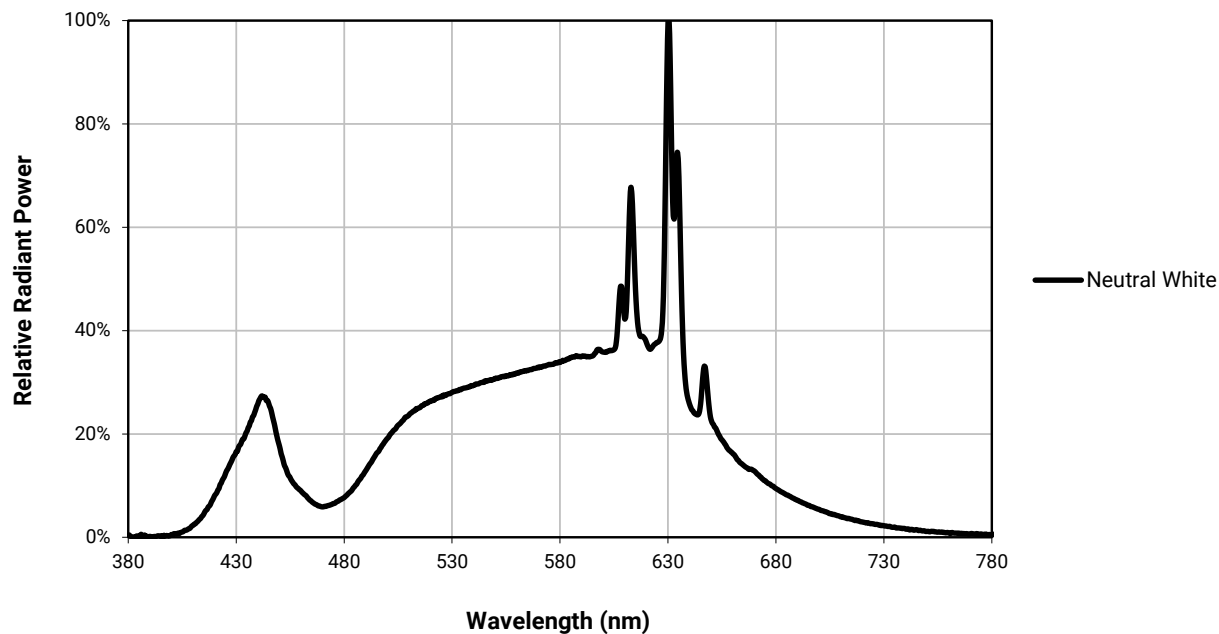
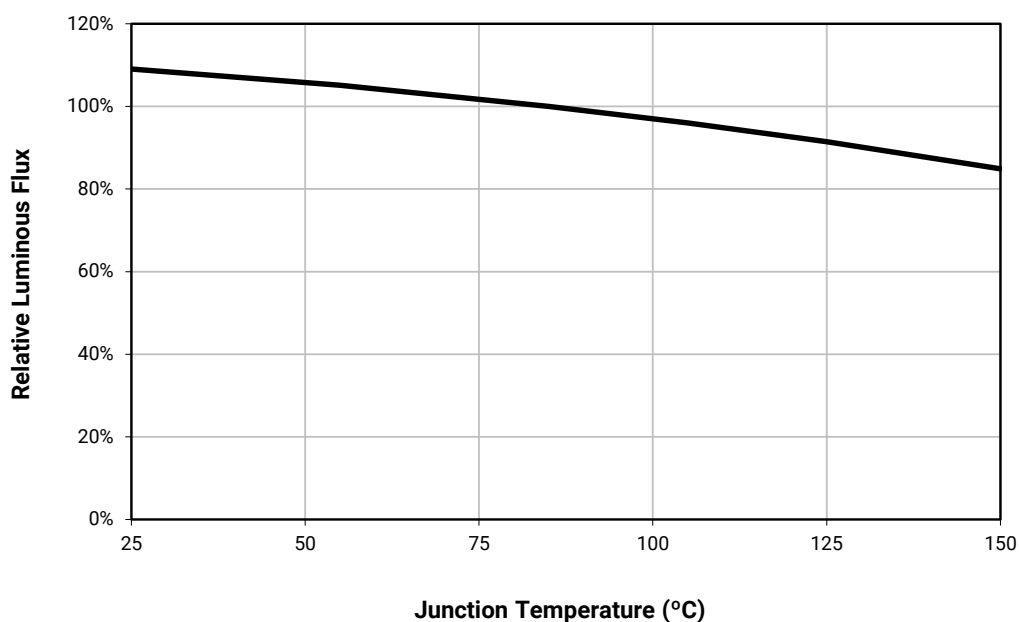
FLUX CHARACTERISTICS, ORDER CODES & BINS ( $I_F = 700 \text{ mA}$ ,  $T_J = 85^\circ \text{C}$ ) - CONTINUED

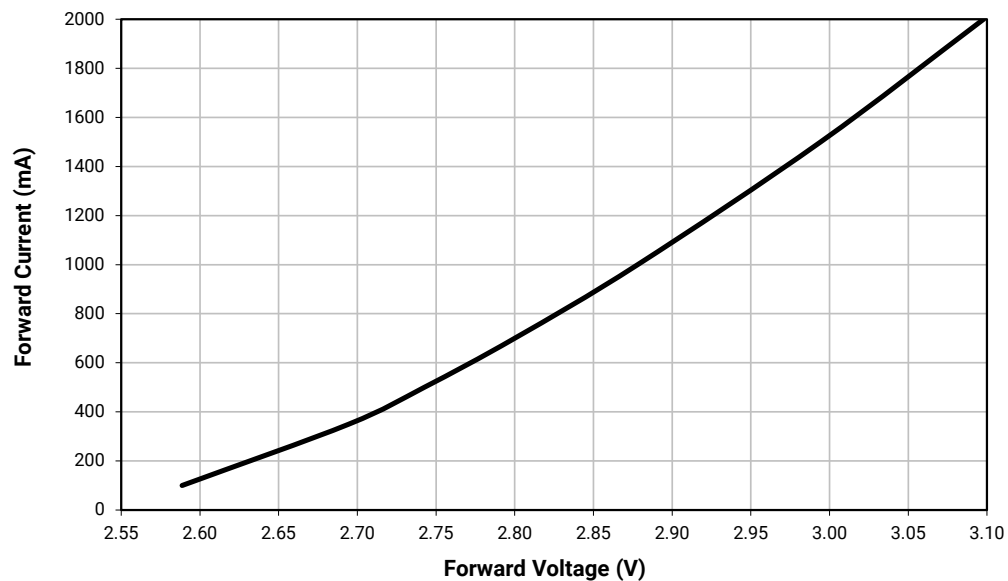
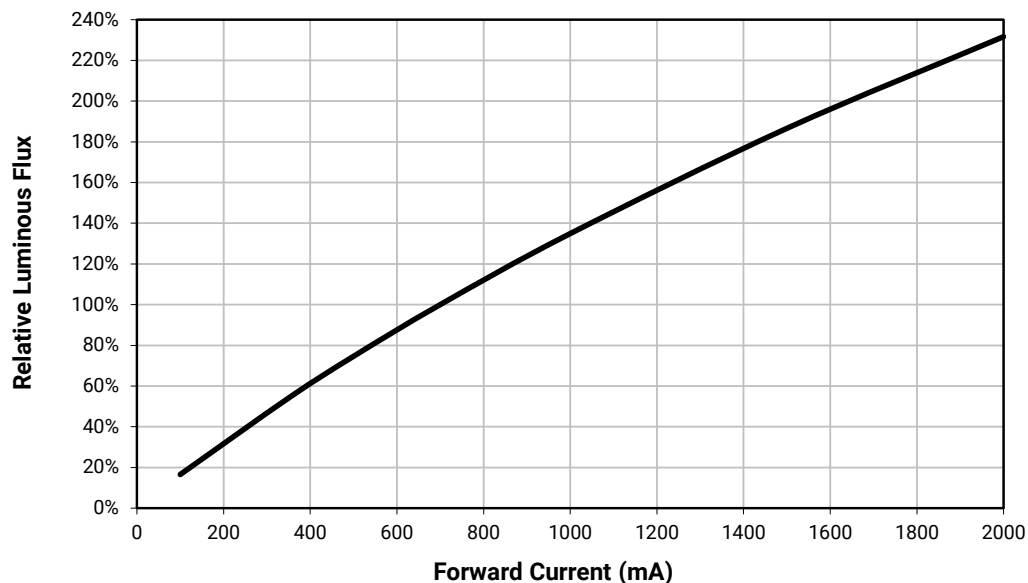
Nominal CCT	CRI		Minimum Luminous Flux (lm) @ 700 mA			3-Step		5-Step	
	Min.	Typ	Code	Flux (lm) @ 85 °C	Flux (lm) @ 25 °C*	Group	Order Code	Group	Order Code
2700 K	90	92	B2	260	284	27G	XPGEWT-01-0000-0P000UG8G	27E	XPGEWT-01-0000-0P000UG8E
			B1	250	273	27G	XPGEWT-01-0000-0P000UF8G	27E	XPGEWT-01-0000-0P000UF8E
			A5	240	262	27G	XPGEWT-01-0000-0P000UE8G	27E	XPGEWT-01-0000-0P000UE8E
			A4	230	251	27G	XPGEWT-01-0000-0P000UD8G	27E	XPGEWT-01-0000-0P000UD8E
	95	98	A5	240	262	27G	XPGEWT-01-0000-0P000ZE8G	27E	XPGEWT-01-0000-0P000ZE8E
			A4	230	251	27G	XPGEWT-01-0000-0P000ZD8G	27E	XPGEWT-01-0000-0P000ZD8E
			A3	220	240	27G	XPGEWT-01-0000-0P000ZC8G	27E	XPGEWT-01-0000-0P000ZC8E

## Notes:

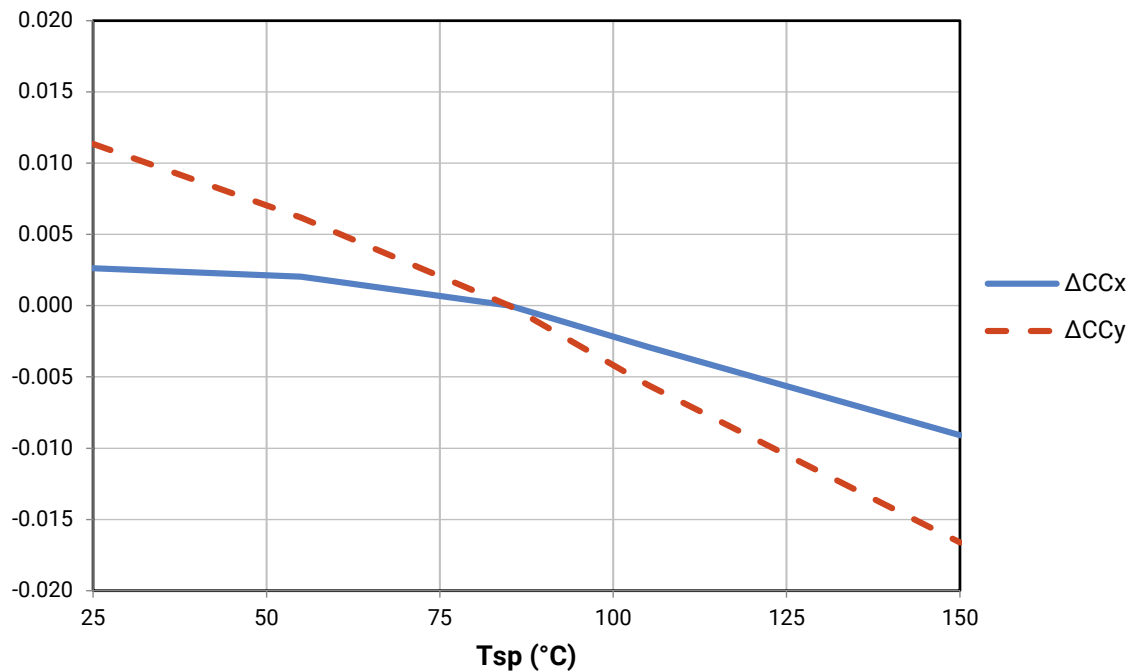
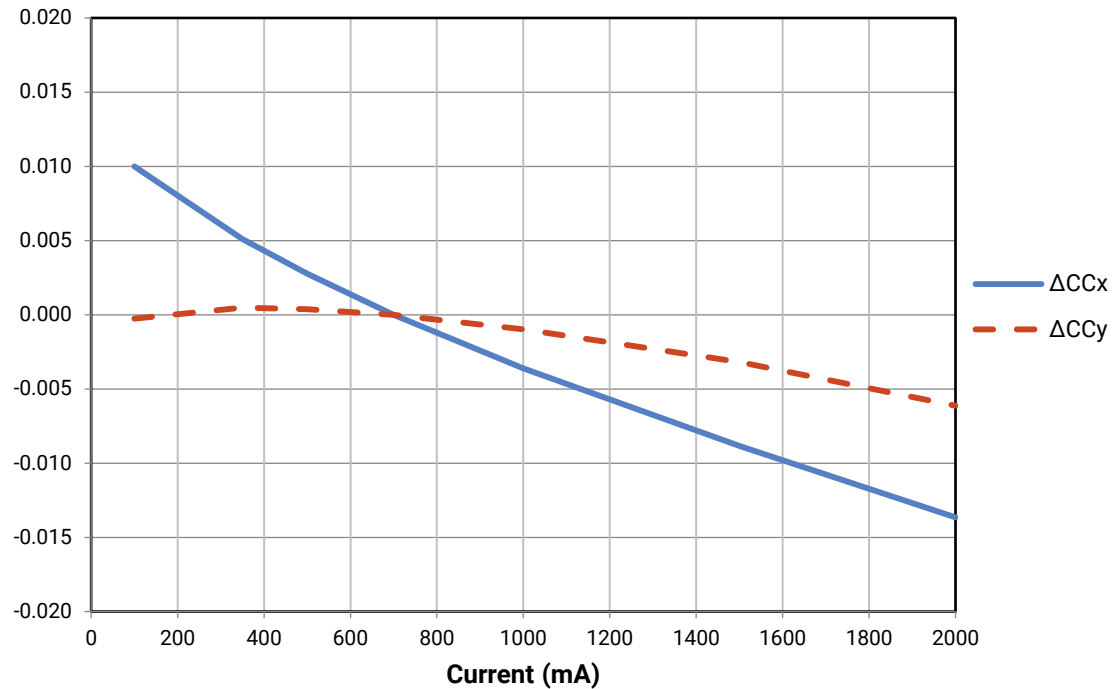
- Cree LED maintains a tolerance of  $\pm 7\%$  on flux and power measurements,  $\pm 0.005$  on chromaticity (CCx, CCy) measurements and  $\pm 2$  on CRI measurements. See the Measurements section (page 13).
- XLamp XP-G4 Pro9 LED order codes specify only a minimum flux bin and not a maximum. Cree LED 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.
- \* Flux values @ 25 °C are calculated and for reference only.

## RELATIVE SPECTRAL POWER DISTRIBUTION

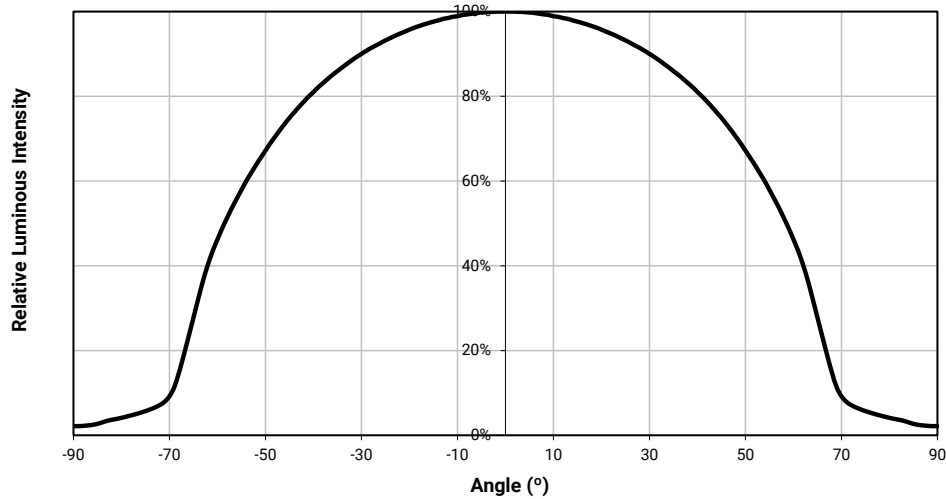
RELATIVE FLUX VS. JUNCTION TEMPERATURE ( $I_f = 700$  mA)

ELECTRICAL CHARACTERISTICS ( $T_j = 85^\circ\text{C}$ )RELATIVE LUMINOUS FLUX VS. CURRENT ( $T_j = 85^\circ\text{C}$ )

## RELATIVE CHROMATICITY VS. CURRENT AND TEMPERATURE

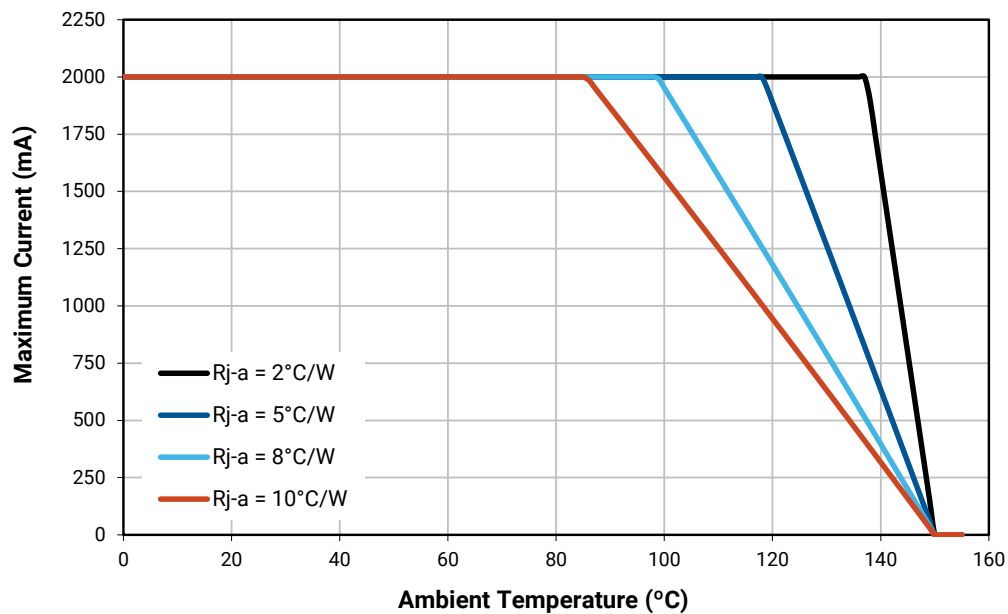


## TYPICAL SPATIAL DISTRIBUTION



## THERMAL DESIGN

The maximum forward current is determined by the thermal resistance between the LED junction and ambient. It is crucial for the end product to be designed in a manner that minimizes the thermal resistance from the solder point to ambient in order to optimize lamp life and optical characteristics.





## PERFORMANCE GROUPS - LUMINOUS FLUX ( $T_j = 85^\circ\text{C}$ )

XLamp XP-G4 Pro9 LEDs are tested for luminous flux and placed into one of the following luminous-flux groups.

Group Code	Minimum Luminous Flux (lm) @ 700 mA	Maximum Luminous Flux (lm) @ 700 mA
A3	220	230
A4	230	240
A5	240	250
B1	250	260
B2	260	270
B3	270	280
B4	280	290
B5	290	300
C1	300	310
C2	310	320

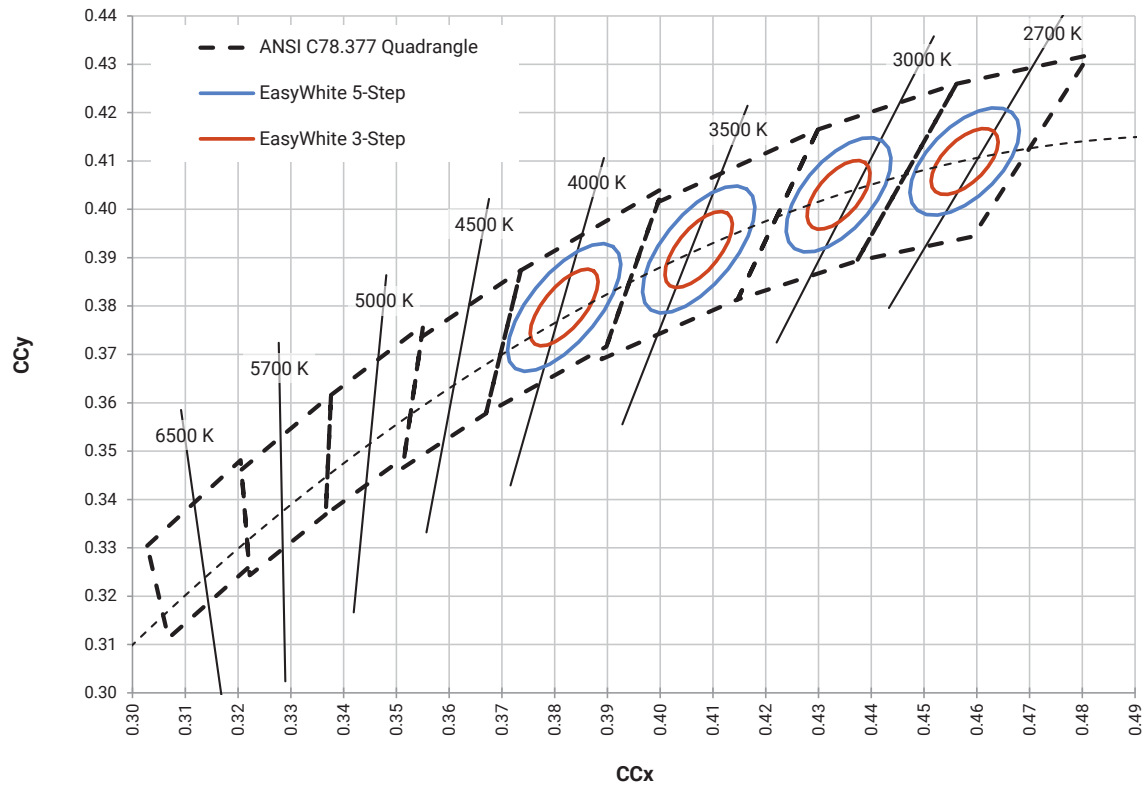
## PERFORMANCE GROUPS - CHROMATICITY

XLamp XP-G4 Pro9 LEDs are tested for chromaticity and placed into one of the regions defined by the following bounding coordinates.

EasyWhite Color Temperatures – 3-Step Ellipse						
Bin Code	CCT	Center Point		Major Axis	Minor Axis	Rotation Angle (°)
		x	y	a	b	
40G	4000 K	0.3818	0.3797	0.00939	0.00402	53.7
35G	3500 K	0.4073	0.3917	0.00927	0.00414	54.0
30G	3000 K	0.4338	0.4030	0.00834	0.00408	53.2
27G	2700 K	0.4577	0.4099	0.00834	0.00420	48.5

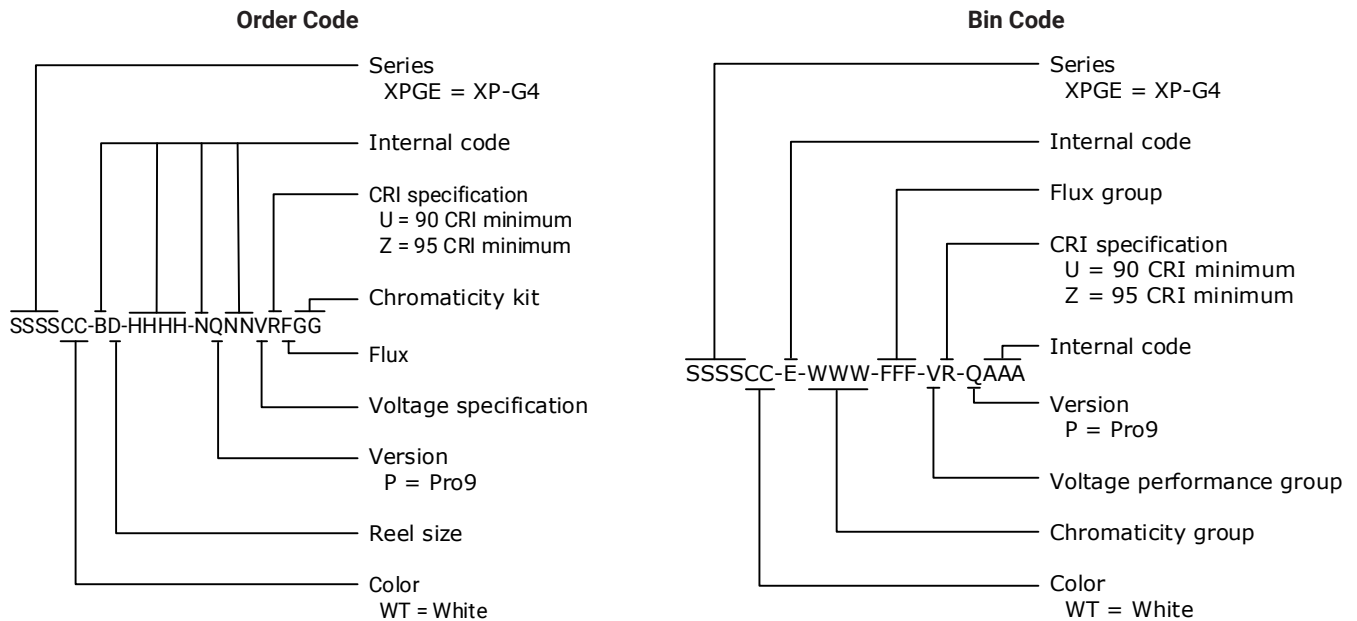
EasyWhite Color Temperatures – 5-Step Ellipse						
Bin Code	CCT	Center Point		Major Axis	Minor Axis	Rotation Angle (°)
		x	y	a	b	
40E	4000 K	0.3818	0.3797	0.01565	0.00670	53.7
35E	3500 K	0.4073	0.3917	0.01545	0.00690	54.0
30E	3000 K	0.4338	0.4030	0.01390	0.00680	53.2
27E	2700 K	0.4577	0.4099	0.01350	0.00700	48.5

## EASYWHITE® CHROMATICITY REGIONS PLOTTED ON THE 1931 CIE CURVE



## BIN AND ORDER CODE FORMATS

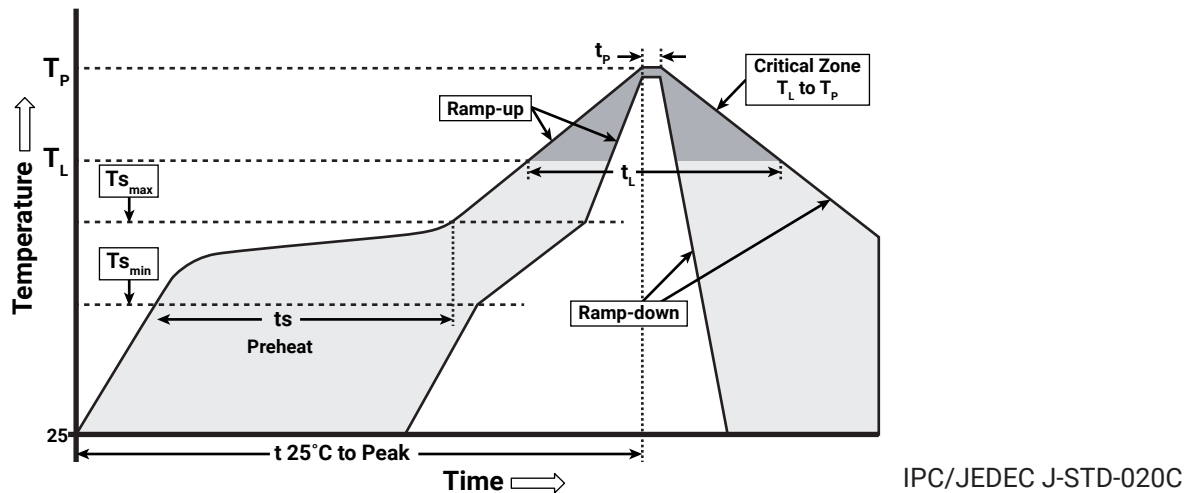
Bin codes and order codes for XP-G4 Pro9 LEDs are configured in the following manner:



## REFLOW SOLDERING CHARACTERISTICS

In testing, Cree LED has found XLamp XP-G4 Pro9 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 the topside of the package, measured on the package body surface.

## NOTES

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### LED Use

Use of this LED in information displays utilizing LCD Backlights and other emissive pixel display technology is prohibited ("Use Restrictions").

### 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-G4 Pro9 LEDs may be stored as MSL 1 per JEDEC J-STD-033, meaning they have unlimited floor life in conditions of  $\leq 30^{\circ}\text{C}/85\%$  relative humidity (RH). Regardless of the storage condition, Cree LED recommends sealing any unsoldered LEDs in the original MBP.

### RoHS Compliance

The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2011/65/EC (RoHS2), as implemented January 2, 2013. RoHS Declarations for this product can be obtained from your Cree LED representative or from the [Product Ecology](#) section of the Cree LED website.

### REACH Compliance

REACH substances of very high concern (SVHCs) information is available for this product. Since the European Chemical Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future, please contact a Cree LED

## NOTES - CONTINUED

representative to insure you get the most up-to-date REACH SVHC Declaration. REACH banned substance information (REACH Article 67) is also available upon request.

### **UL® Recognized Component**

This product meets the requirements to be considered a UL Recognized Component with Level 4 enclosure consideration. The LED package or a portion thereof has been investigated as a fire and electrical enclosure per ANSI/UL 8750.

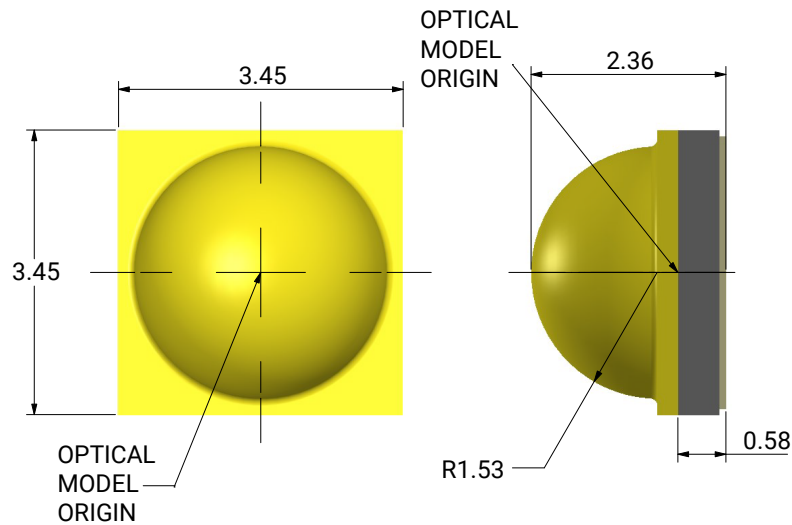
### **Vision Advisory**

**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](#).

## MECHANICAL DIMENSIONS ( $T_A = 25\text{ }^{\circ}\text{C}$ )

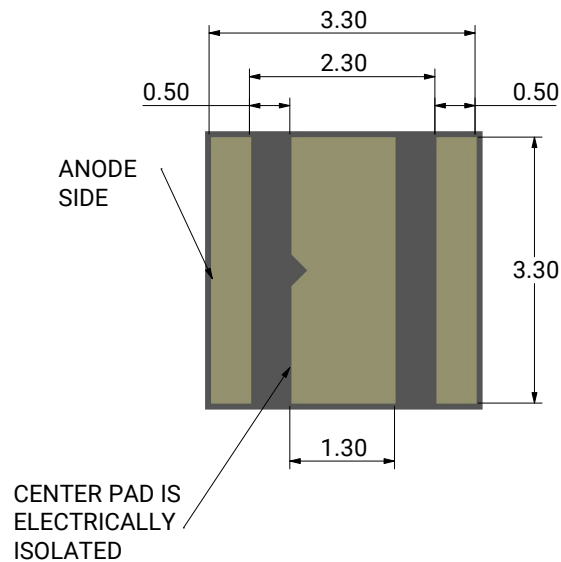
Thermal vias, if present, are not shown on these drawings.

All measurements are  $\pm 0.13\text{ mm}$  unless otherwise indicated.

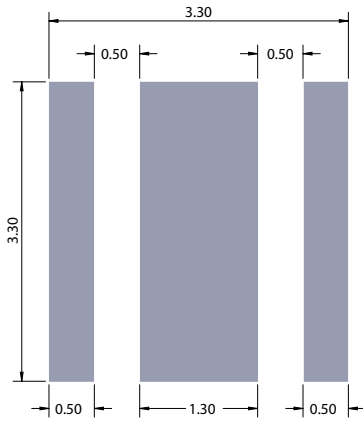


Top View

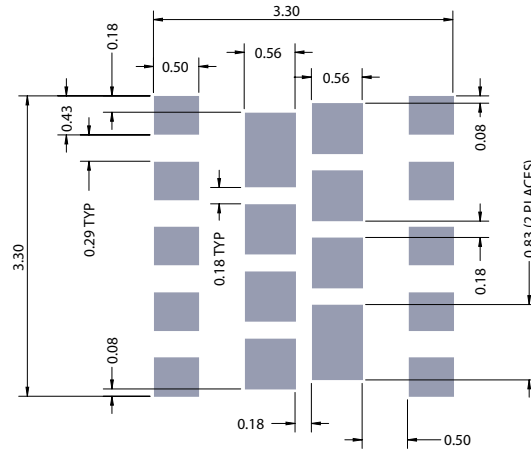
Side View



Bottom View

MECHANICAL DIMENSIONS ( $T_A = 25\text{ }^{\circ}\text{C}$ ) - CONTINUEDAll measurements are  $\pm 0.13\text{ mm}$  unless otherwise indicated.

Recommended PCB Footprint



Recommended Stencil Openings\*

## 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.

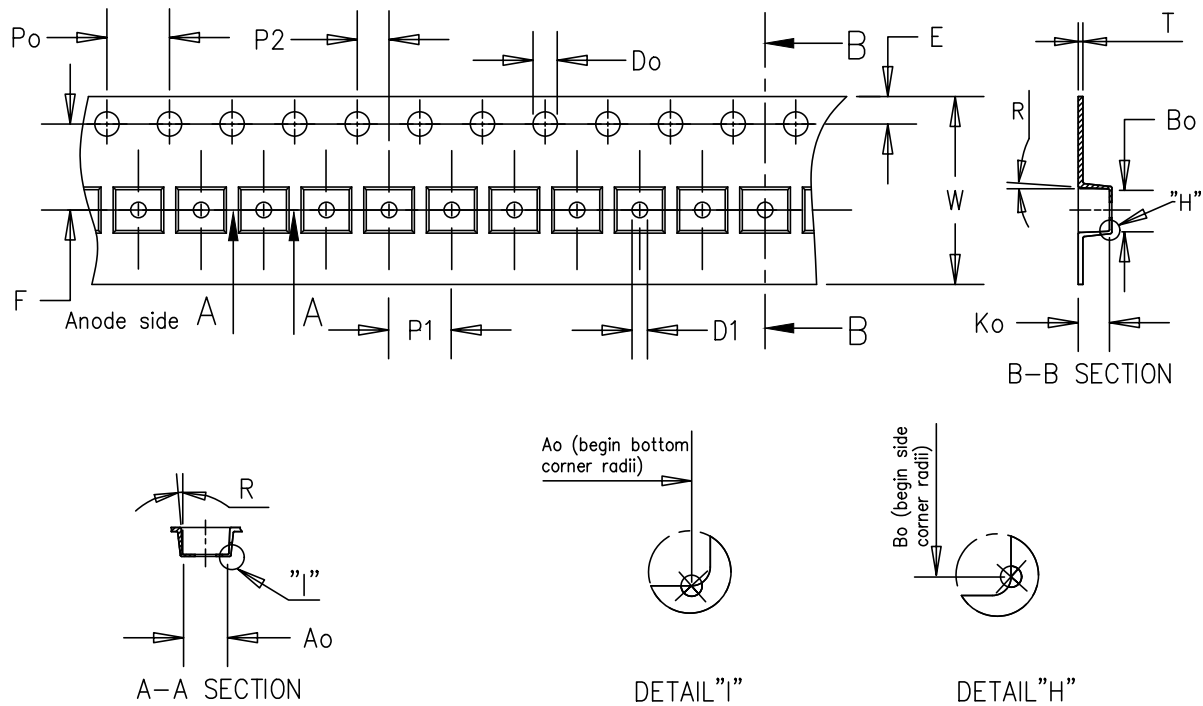


## TAPE AND REEL

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

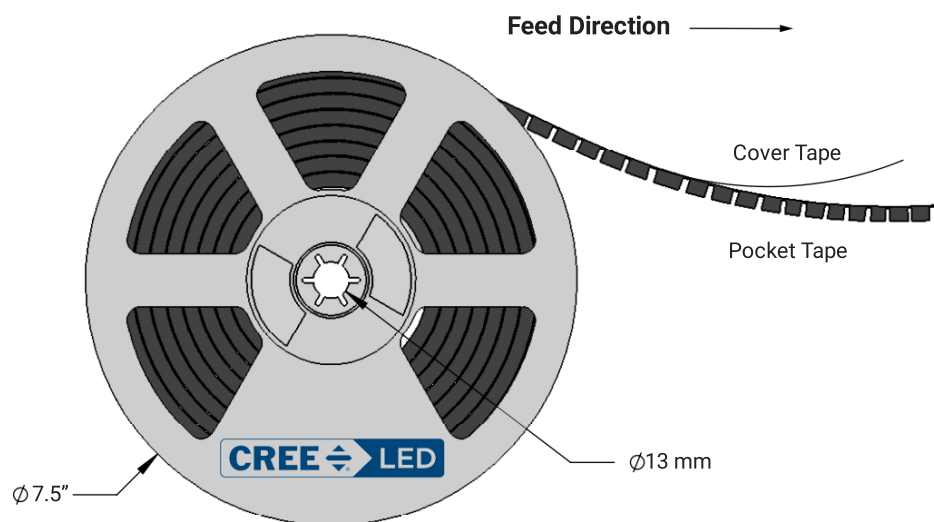
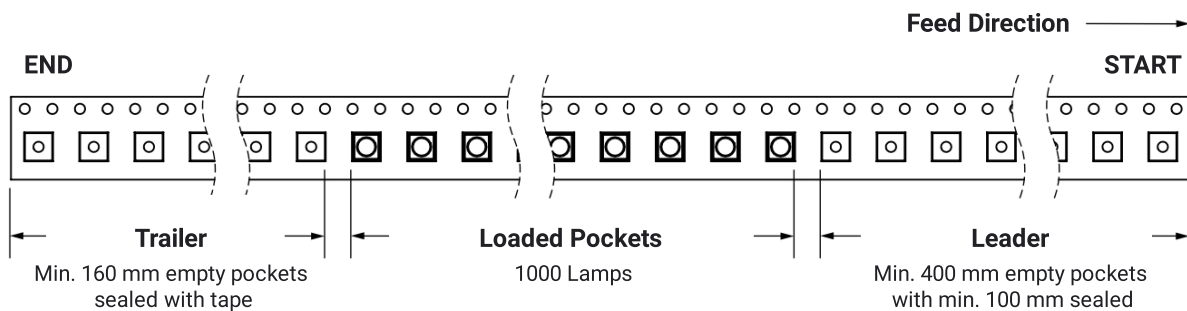
All dimensions in mm.

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



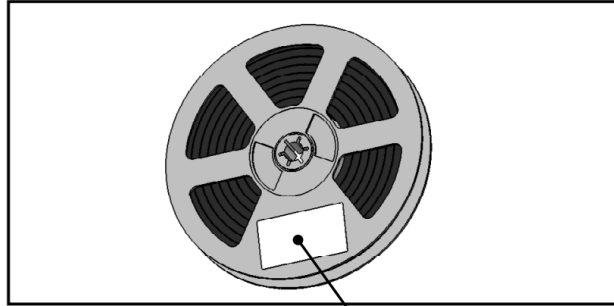
Item	Ao	Bo	Ko	Po	P1	P2	T	E	F	Do	D1	W	R
Dim.	3.70	3.70	2.40	4.00	8.00	2.00	0.30	1.75	5.50	1.55	1.50	12.00	5°

## TAPE AND REEL - CONTINUED



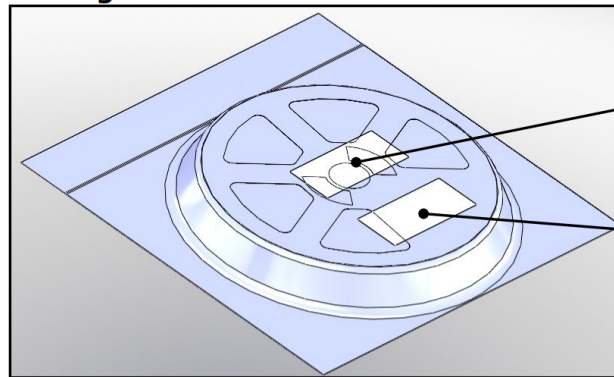
## PACKAGING

## Unpackaged Reel



Label with Cree LED Bin  
Code, Quantity, Reel ID

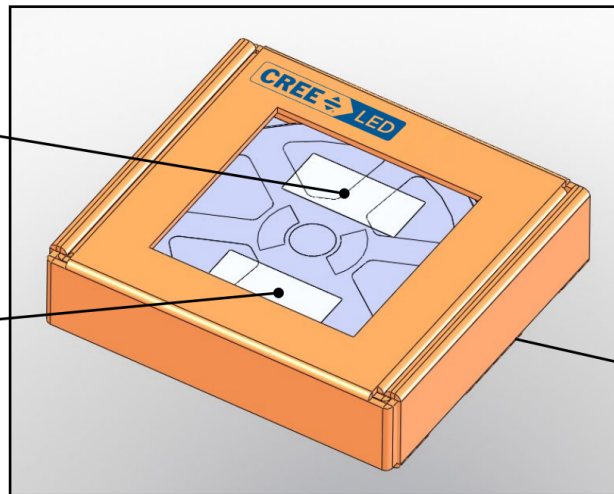
## Packaged Reel



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)