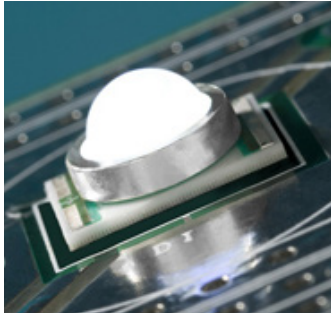


# XLamp® XR-C LEDs



## PRODUCT DESCRIPTION

The XLamp® XR-C LED gives lighting designers the flexibility and performance to create the next generation of LED lighting products. XLamp XR-C LEDs feature electrically neutral thermal path, low thermal resistance and support for a wide range of drive currents.

XLamp LEDs bring high performance and quality of light to a wide range of lighting applications, including color-changing, portable and personal, outdoor, indoor-directional, transportation, stage and studio, commercial and emergency-vehicle lighting.

## FEATURES

- Available in amber, red-orange & red
- Maximum drive current: up to 700 mA
- Low thermal resistance: as low as 12 °C/W
- Maximum junction temperature: 150 °C
- Industry-leading JEDEC standard pre-qualification testing
- Reflow solderable – JEDEC J-STD-020C compatible
- Electrically neutral thermal path
- 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		15	
Viewing angle (FWHM)	degrees		90	
Temperature coefficient of voltage - red-orange, red	mV/°C		-2.3	
Temperature coefficient of voltage - amber	mV/°C		-1.8	
ESD classification (HBM per Mil-Std-883D)			Class 2	
DC forward current - red-orange, red	mA			700
DC forward current - amber	mA			350
Reverse voltage	V			5
Forward voltage (@ 350 mA)	V		2.2	2.5
Forward voltage (@ 700 mA) - red-orange, red	V		2.4	
LED junction temperature*	°C			150

**\* Note: For lumen maintenance data, see the XLamp LED Reliability document.**

### FLUX CHARACTERISTICS (T<sub>J</sub> = 25 °C)

The following tables list standard kit numbers and performance bins for XR-C color LEDs. Kit numbers completely describe an order code's chromaticity regions and luminous flux range. For a complete description of the order-code nomenclature, please consult the Bin and Order Code Formats section (page 10).

Color	Minimum Luminous Flux (lm) @ 350 mA		Dominant Wavelength (nm)				Kit Number	Order Code
			Minimum		Maximum			
	Group	Flux (lm)	Group	DWL (nm)	Group	DWL (nm)		
Amber	J	23.5	A2	585	A3	595	00J01	XRCAMB-L1-0000-00J01
			A3	590	A3	595	00J03	XRCAMB-L1-0000-00J03
	K2	30.6	A2	585	A3	595	00K01	XRCAMB-L1-0000-00K01
			A3	590	A3	595	00K03	XRCAMB-L1-0000-00K03
	M2	39.8	A2	585	A3	595	00M01	XRCAMB-L1-0000-00M01
			A3	590	A3	595	00M03	XRCAMB-L1-0000-00M03

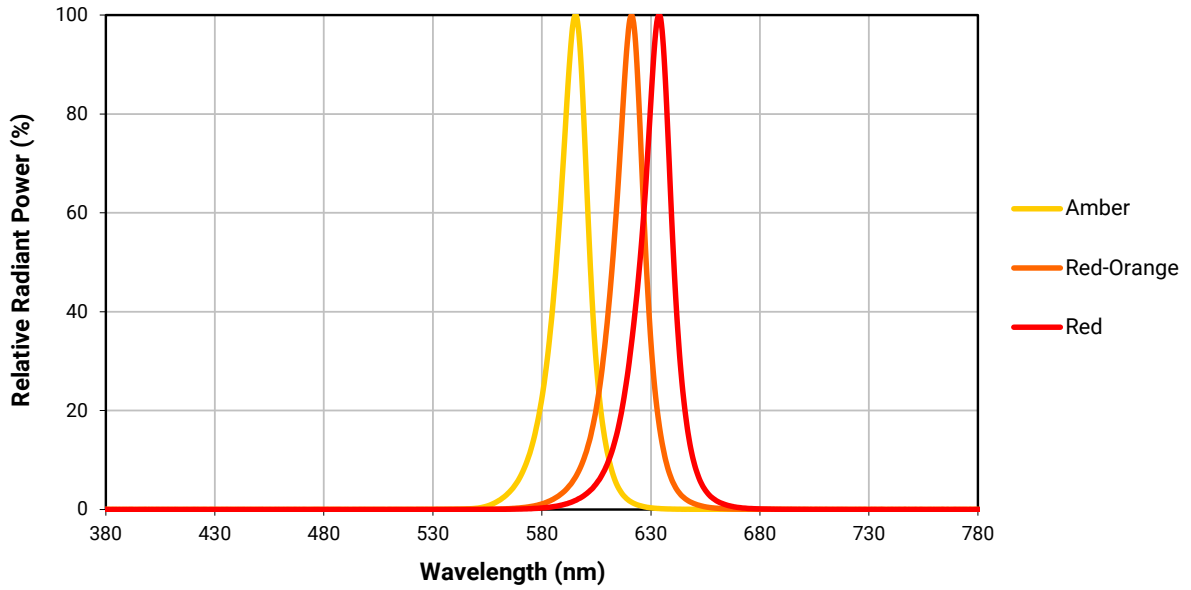
Color	Minimum Luminous Flux (lm) @ 350 mA		Dominant Wavelength (nm)				Kit Number	Order Code
			Minimum		Maximum			
	Group	Flux (lm)	Group	DWL (nm)	Group	DWL (nm)		
Red-Orange	K2	30.6	O3	610	O4	620	00K01	XRCRDO-L1-0000-00K01
			O3	610	O3	615	00K02	XRCRDO-L1-0000-00K02
			O4	615	O4	620	00K03	XRCRDO-L1-0000-00K03
	M2	39.8	O3	610	O4	620	00M01	XRCRDO-L1-0000-00M01
			O3	610	O3	615	00M02	XRCRDO-L1-0000-00M02
			O4	615	O4	620	00M03	XRCRDO-L1-0000-00M03

Color	Minimum Luminous Flux (lm) @ 350 mA		Dominant Wavelength (nm)				Kit Number	Order Code
			Minimum		Maximum			
	Group	Flux (lm)	Group	DWL (nm)	Group	DWL (nm)		
Red	J	23.5	R2	620	R3	630	00J01	XRCRED-L1-0000-00J01
			R2	620	R2	625	00J02	XRCRED-L1-0000-00J02
	K2	30.6	R2	620	R3	630	00K01	XRCRED-L1-0000-00K01
			R2	620	R2	625	00K02	XRCRED-L1-0000-00K02
	M2	39.8	R2	620	R3	630	00M01	XRCRED-L1-0000-00M01
			R2	620	R2	625	00M02	XRCRED-L1-0000-00M02

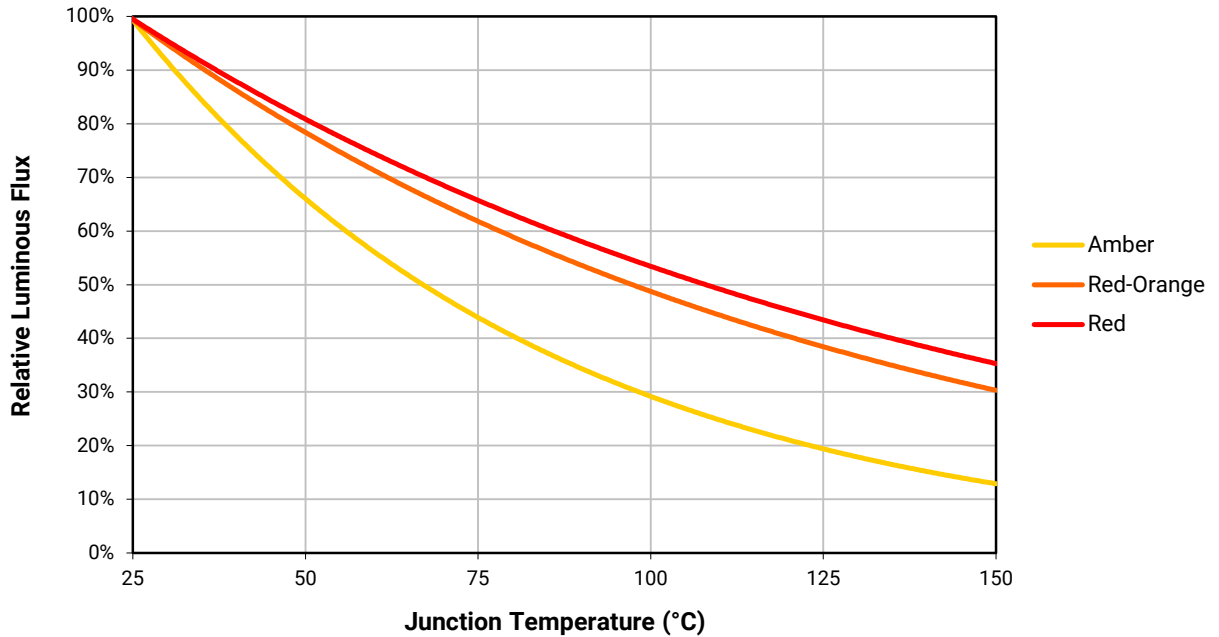
**Notes:**

- Cree LED maintains a tolerance of ±7% on flux and power measurements, ±0.005 on chromaticity (CCx, CCy) measurements and ±2 on CRI measurements. See the Measurements section (page 12).
- XR-C 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 or DWL bin restrictions specified by the order code.

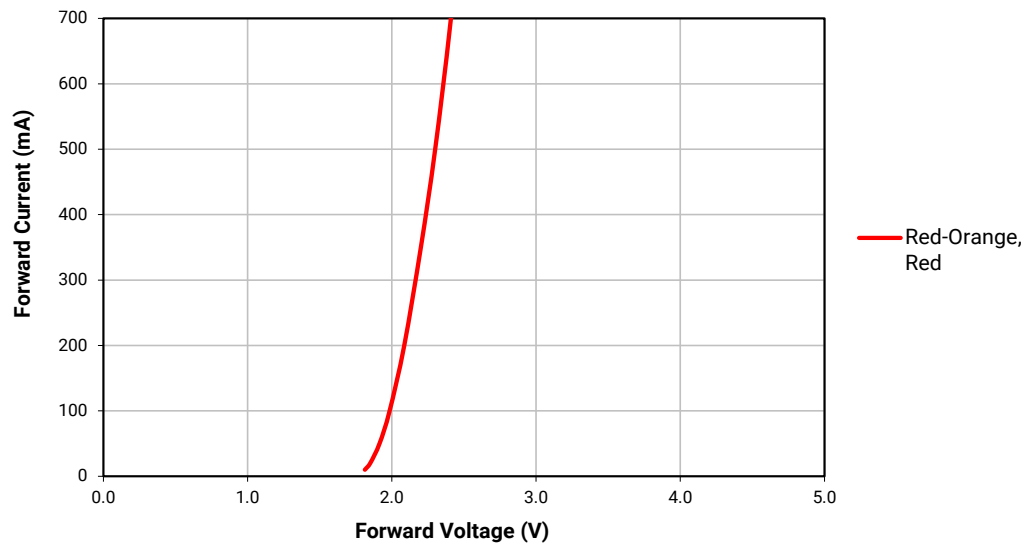
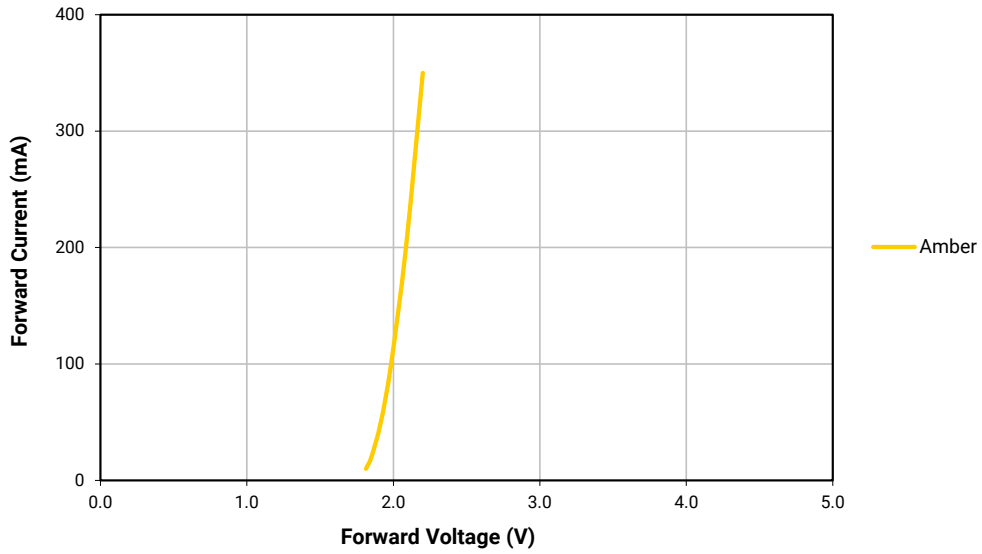
RELATIVE SPECTRAL POWER DISTRIBUTION



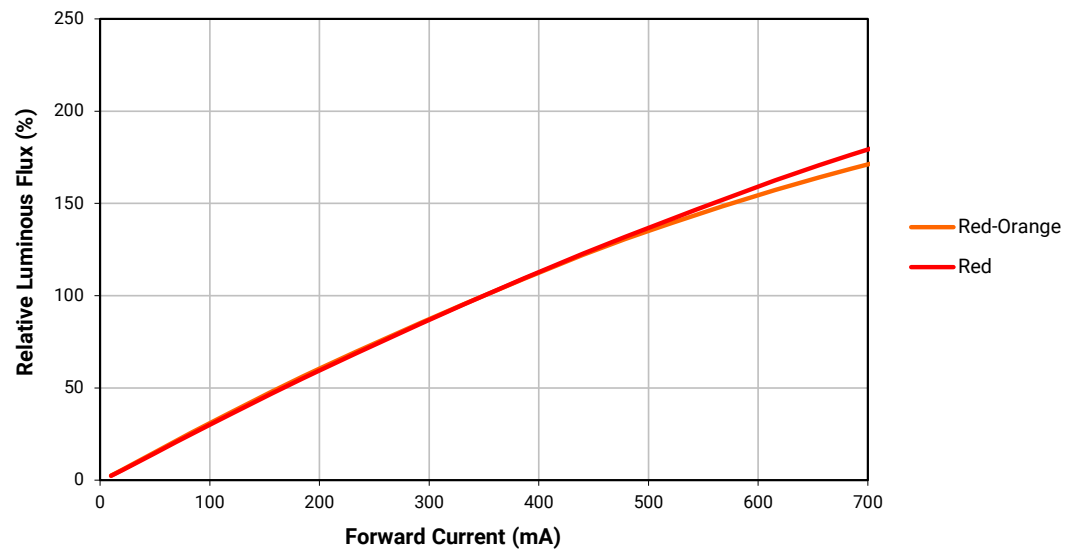
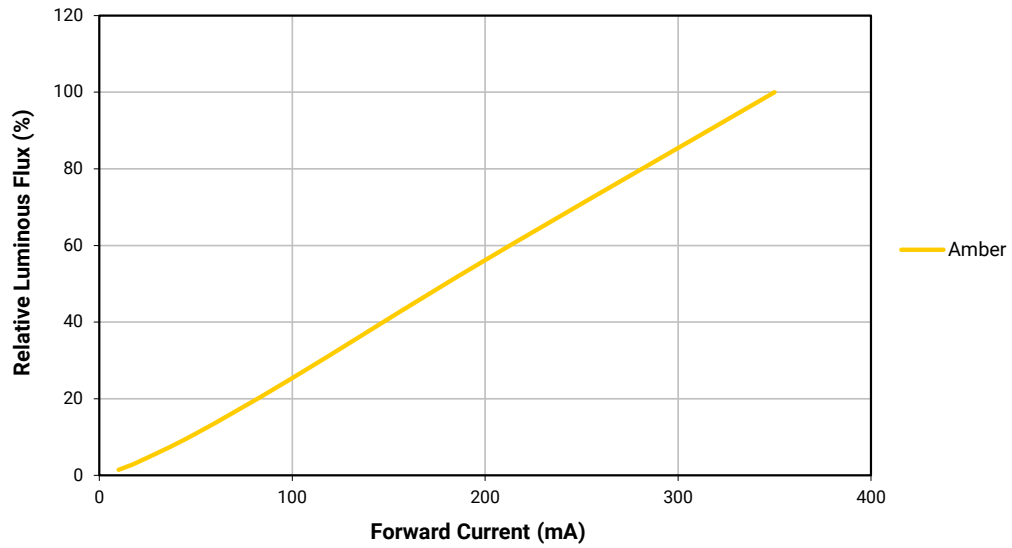
RELATIVE FLUX VS. JUNCTION TEMPERATURE ( $I_f = 350$  mA)



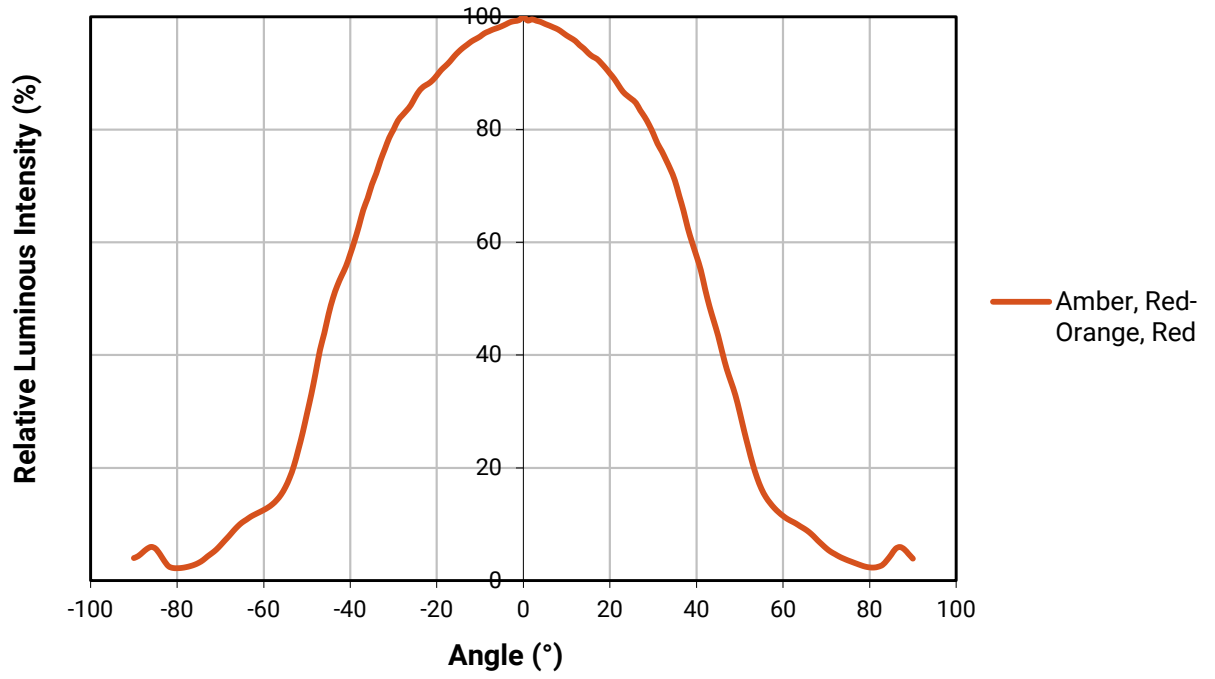
ELECTRICAL CHARACTERISTICS ( $T_j = 25\text{ }^\circ\text{C}$ )



RELATIVE FLUX VS. CURRENT ( $T_j = 25\text{ }^\circ\text{C}$ )

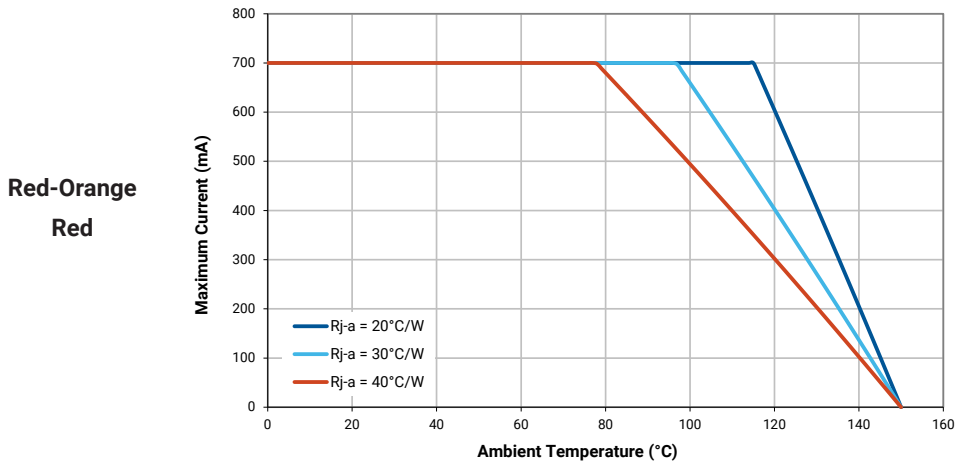
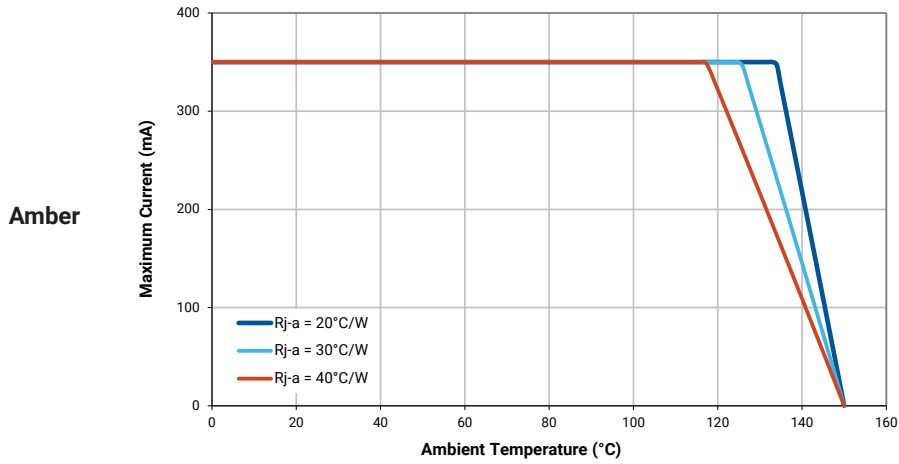


TYPICAL SPATIAL DISTRIBUTION



THERMAL DESIGN

The maximum forward current is determined by the thermal resistance between the LED junction and ambient. Given an existing thermal resistance of 12 °C/W or 15 °C/W between the junction and the solder point, 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 - BRIGHTNESS

Amber, red-orange and red XR-C LEDs are tested for luminous flux and placed into one of the following luminous-flux groups:

Group	Minimum Luminous Flux @ 350 mA (lm)	Maximum Luminous Flux @ 350 mA (lm)
J	23.5	30.6
K2	30.6	35.2
K3	35.2	39.8
M2	39.8	45.7
M3	45.7	51.7
N2	51.7	56.8
N3	56.8	62.0
N4	62.0	67.2

## PERFORMANCE GROUPS - DOMINANT WAVELENGTH

Color XR-C LEDs are tested for dominant wavelength (DWL) and placed into one of the DWL groups defined below.

Color	DWL Group	Minimum DWL (nm) @ 350 mA	Maximum DWL (nm) @ 350 mA
Amber	A2	585	590
	A3	590	595
Red-Orange	O3	610	615
	O4	615	620
Red	R2	620	625
	R3	625	630

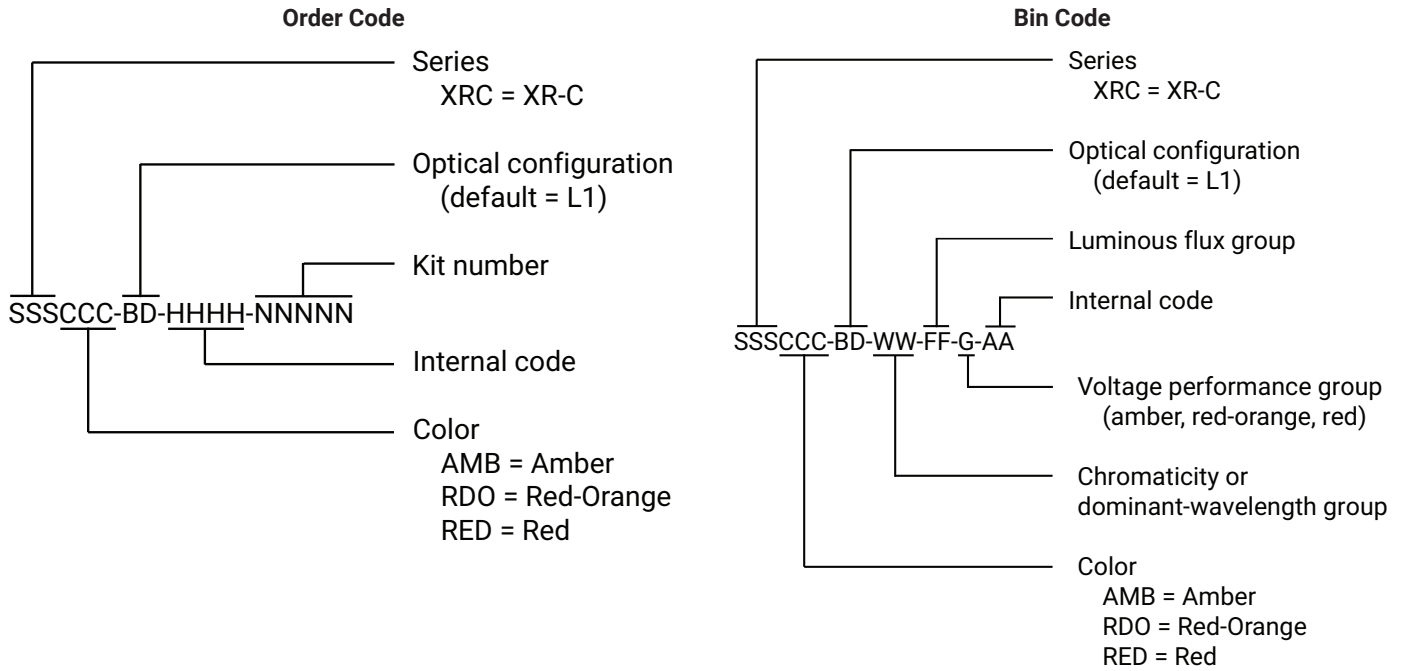
## PERFORMANCE GROUPS - FORWARD VOLTAGE

Amber, red-orange and red XR-C LEDs are tested for forward voltage and placed into one of the forward voltage groups defined below.

Forward Voltage Group	Minimum Forward Voltage @ 350 mA	Maximum Forward Voltage @ 350 mA
B	1.75	2.0
C	2.0	2.25
D	2.25	2.5

## BIN AND ORDER CODE FORMATS

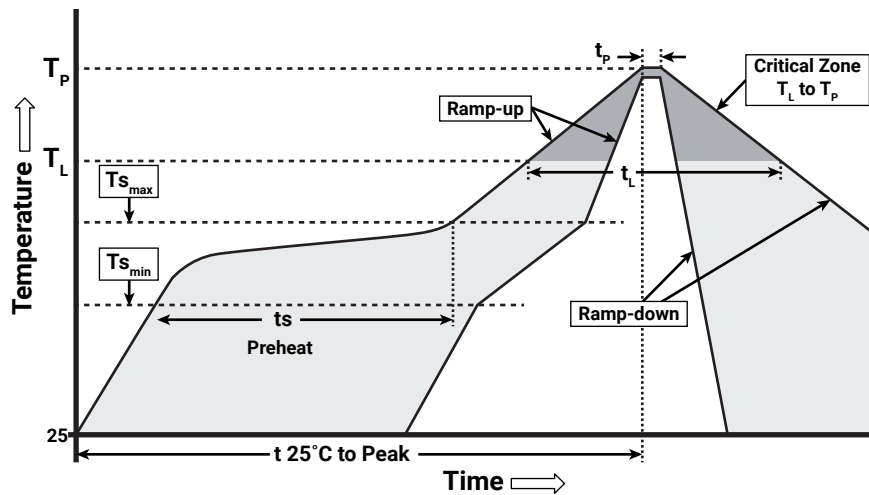
Bin codes and order codes are configured in the following manner:



## REFLOW SOLDERING CHARACTERISTICS

In testing, Cree LED has found XR-C 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 ( $T_{s_{max}}$ 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.

## 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 XR-C 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 XR-C LEDs should be handled and stored as MSL 4 per JEDEC J-STD-033, meaning they have limited exposure time before damage to the LED may occur during the soldering operation. The table on the right specifies the maximum exposure time in days depending on temperature and humidity conditions. LEDs with exposure time longer than the specified maximums must be baked according to the baking conditions listed below.

Temp.	Maximum Percent Relative Humidity						
	30%	40%	50%	60%	70%	80%	90%
30 °C	9	5	4	3	1	1	1
25 °C	12	7	5	4	2	1	1
20 °C	17	9	7	6	2	2	1

### Baking Conditions

It is not necessary to bake all XLamp LEDs. Only the LEDs that meet all of the following criteria must be baked:

LEDs that have been removed from the original MBP.

LEDs that have been exposed to a humid environment longer than listed in the Moisture Sensitivity section above.

LEDs that have not been soldered.

LEDs should be baked at 70 °C for 24 hours. LEDs may be baked on the original reels. Remove LEDs from the MBP before baking. Do not bake parts at temperatures higher than 70 °C. This baking operation resets the exposure time as defined in the Moisture Sensitivity section above.

## NOTES - CONTINUED

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### Storage Conditions

XLamp LEDs that have been removed from the original MBP but not soldered yet should be stored in a room or cabinet that will maintain an atmosphere of  $25 \pm 5$  °C and no greater than 10% RH (relative humidity). For LEDs stored in these conditions, storage time does not add to exposure time as defined in the Moisture Sensitivity section above.

### 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 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

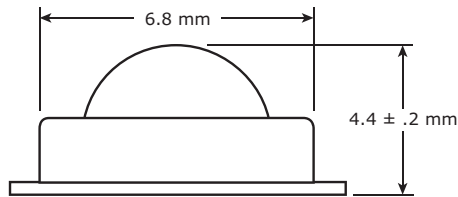
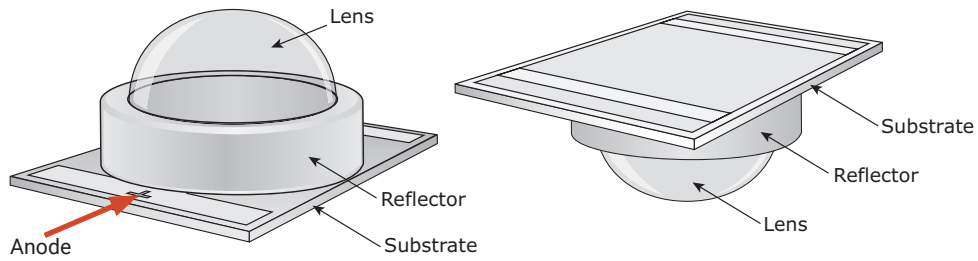
**WARNING:** Do not look at an exposed lamp in operation. Eye injury can result. For more information about LEDs and eye safety, please refer to the [LED Eye Safety application note](#).

### Intellectual Property

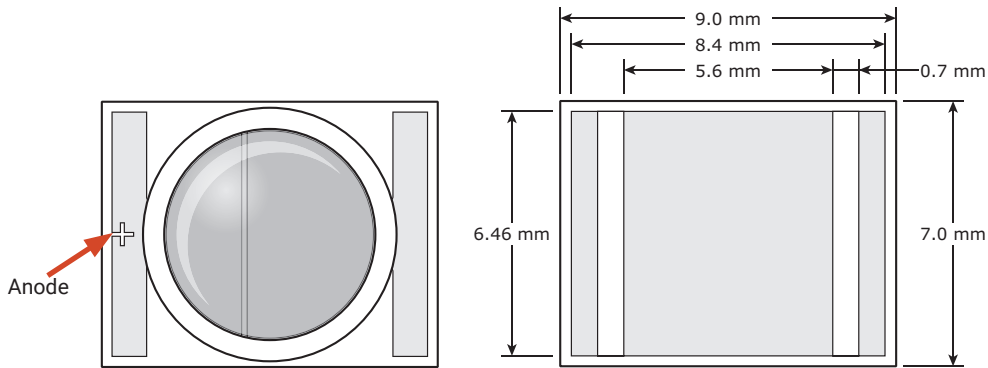
For remote phosphor applications, a separate license to certain Cree LED patents is required.

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

All measurements are  $\pm 1\text{ mm}$  unless otherwise indicated.

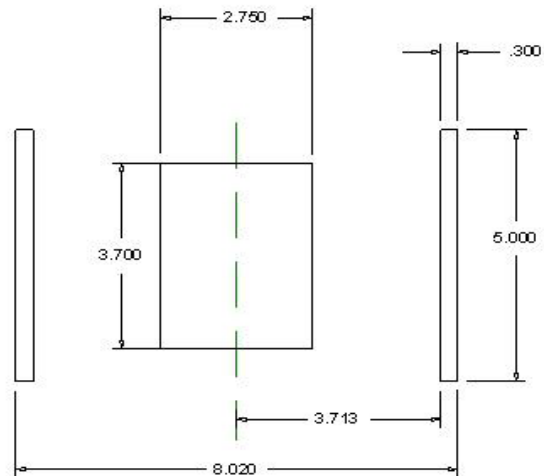


Side View



Top View

Bottom View

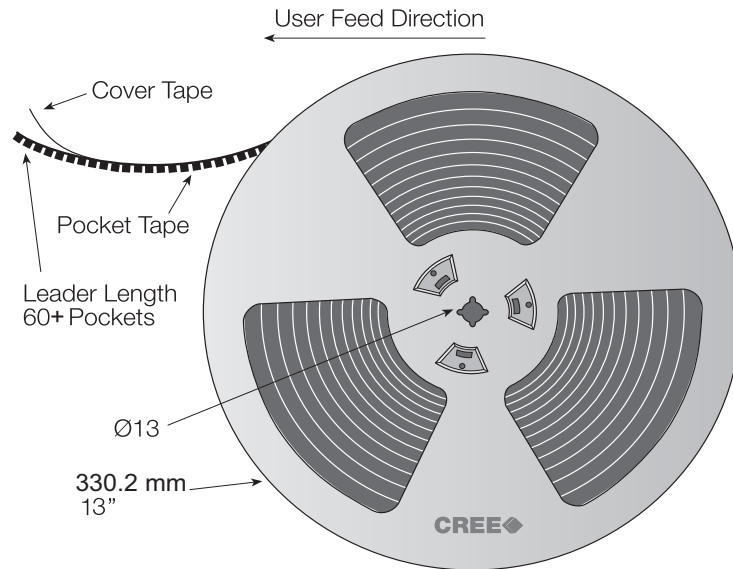
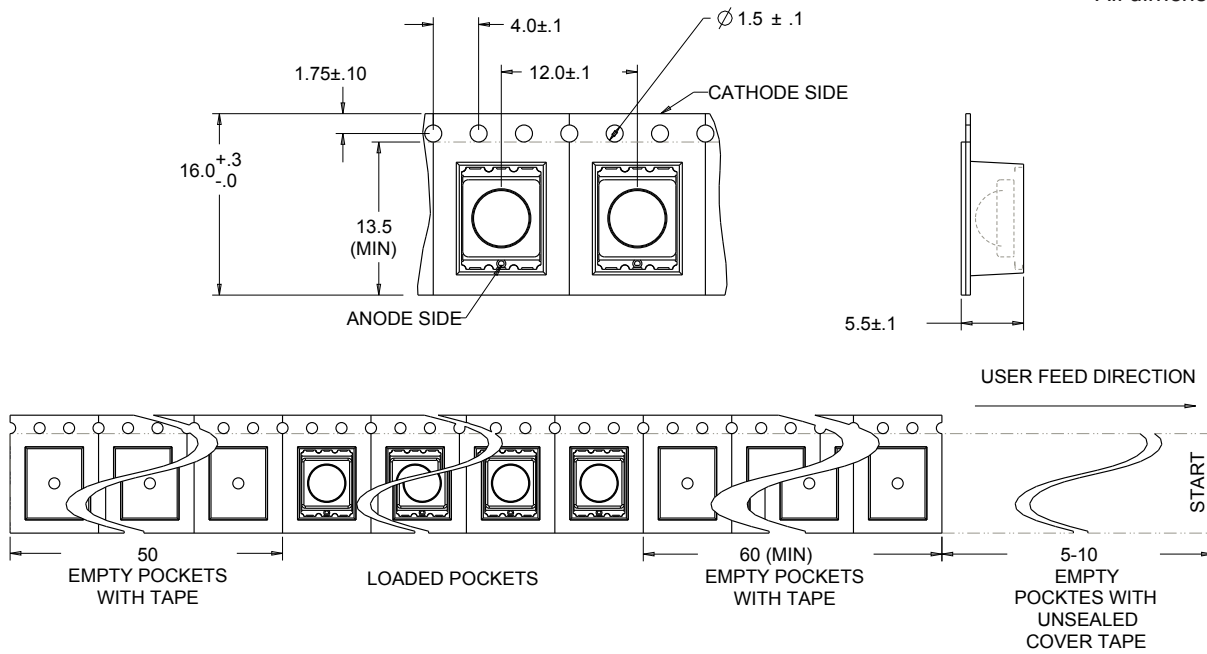


Recommended PC Board Solder Pad

TAPE AND REEL

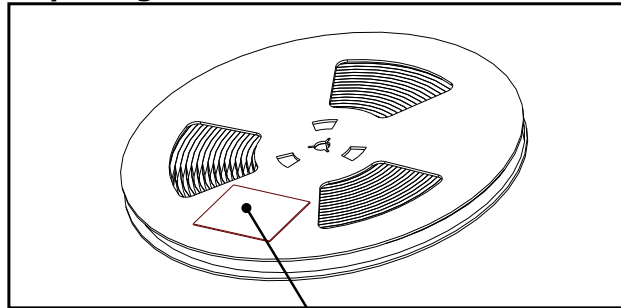
All Cree LED carrier tapes conform to EIA-481D, Automated Component Handling Systems Standard.

All dimensions in mm.



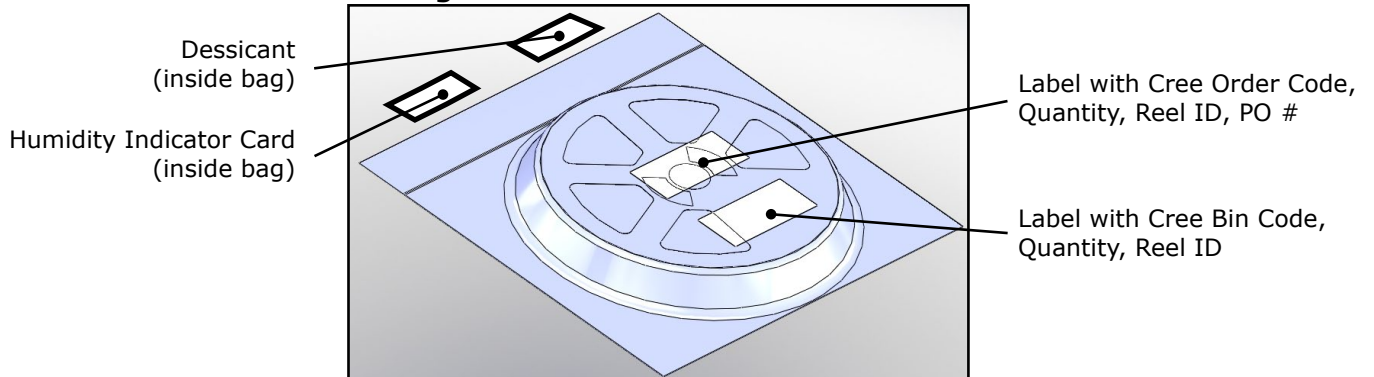
PACKAGING

Unpackaged Reel



Label with Cree Bin Code,  
Quantity, Reel ID

Packaged Reel



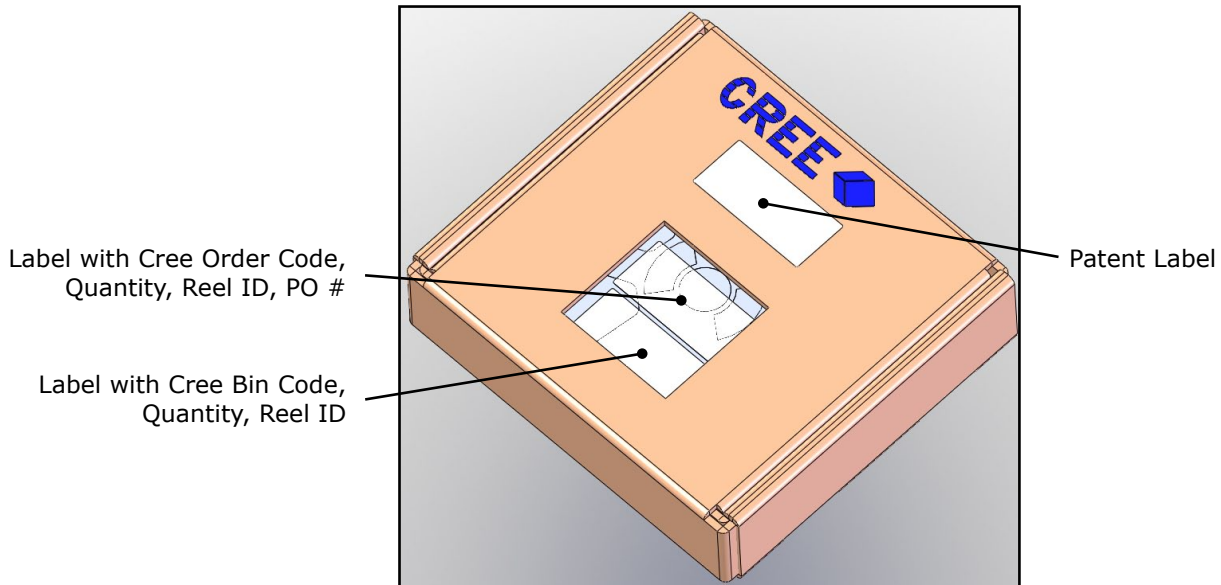
Dessicant  
(inside bag)

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