

# Cree® XLamp® MK-R2 LEDs



## PRODUCT DESCRIPTION

The XLamp® MK-R2 EasyWhite® LED builds on the breakthrough performance of the original MK-R by enabling high-voltage driver solutions while providing a small, uniform, single point source for precise optical control. The MK-R2 shares the same mechanical footprint as the original MK-R, providing customers with a seamless upgrade path and shortening the LED luminaire and retrofit lamp design cycle.

MK-R2 LEDs are designed for high-output, directional lighting applications and are the ideal replacement for lighting applications that currently use inefficient halogen lamps. MK-R2 LEDs are optimized for use in track, accent, lamp retrofit, downlighting and other applications where color quality, consistency and optical control are required.

## FEATURES

- Available in 4-step and 2-step EasyWhite bins at 2700 K & 3000 K, 80-CRI minimum
- Maximum drive current: 420 mA
- Low thermal resistance: 1.7 °C/W
- Maximum junction temperature: 150 °C
- Binned at 85 °C
- Viewing angle: 120°
- Unlimited floor life at ≤ 30 °C/85% RH
- Reflow solderable - JEDEC J-STD-020C
- Electrically neutral thermal path
- RoHS and REACH compliant
- UL® recognized component (E349212)

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## CHARACTERISTICS

Characteristics	Unit	Minimum	Typical	Maximum
Thermal resistance, junction to solder point	°C/W		1.7	
Viewing angle - full width half maximum (FWHM)	degrees		120	
Temperature coefficient of voltage	mV/°C		-28	
ESD withstand voltage (HBM per Mil-Std-883D)	V			8000
DC forward current	mA			420
Reverse current	mA			100
Forward voltage (@ 233 mA, 85 °C)	V		36	
Forward voltage (@ 233 mA, 25 °C)	V			42
LED junction temperature	°C			150

## FLUX CHARACTERISTICS, STANDARD ORDER CODES AND BINS ( $I_F = 233 \text{ mA}$ , $T_J = 85 \text{ °C}$ )

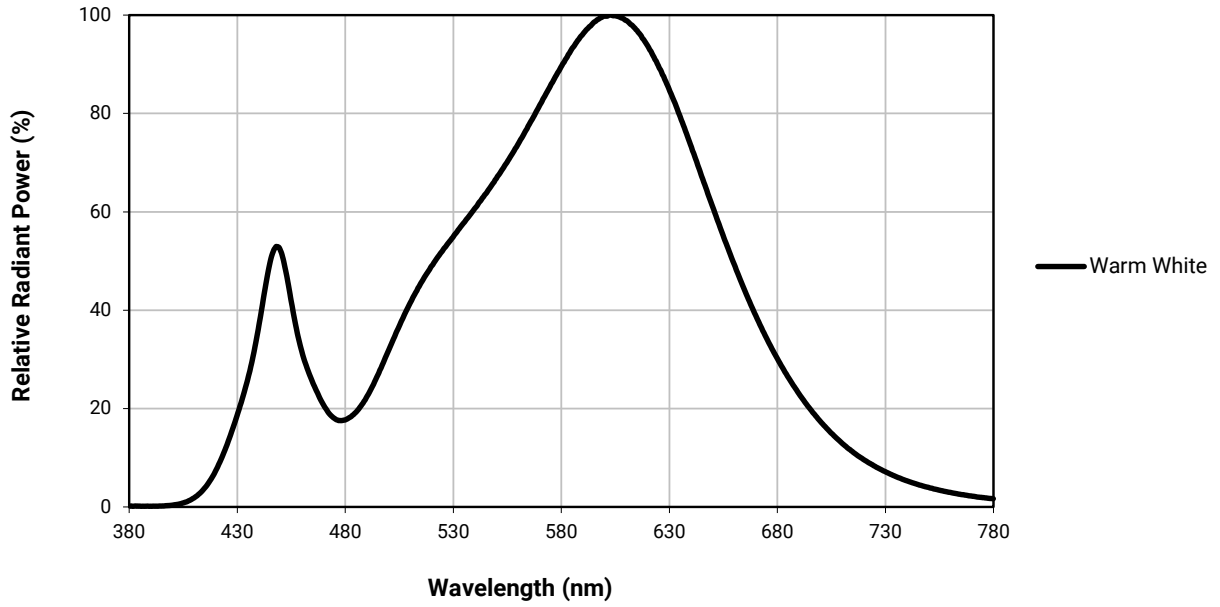
The following tables provide order codes for XLamp MK-R2 EasyWhite LEDs. For a complete description of the order code nomenclature, please reference Bin and Order Code Formats (page 8).

Color	CCT Range	Minimum Luminous Flux			2-Step		4-Step	
		Group	Flux (lm) @ 85 °C	Flux (lm) @ 25 °C*	Chromaticity Region	Order Code	Chromaticity Region	Order Code
80-CRI EasyWhite	3000 K	G4	840	961	30H	MKRBWT-00-0000-0N0HG430H	30F	MKRBWT-00-0000-0N0HG430F
		G2	780	893		MKRBWT-00-0000-0N0HG230H		MKRBWT-00-0000-0N0HG230F
	2700 K	G2	780	893	27H	MKRBWT-00-0000-0N0HG227H	27F	MKRBWT-00-0000-0N0HG227F
		F4	730	847		MKRBWT-00-0000-0N0HF427H		MKRBWT-00-0000-0N0HF427F

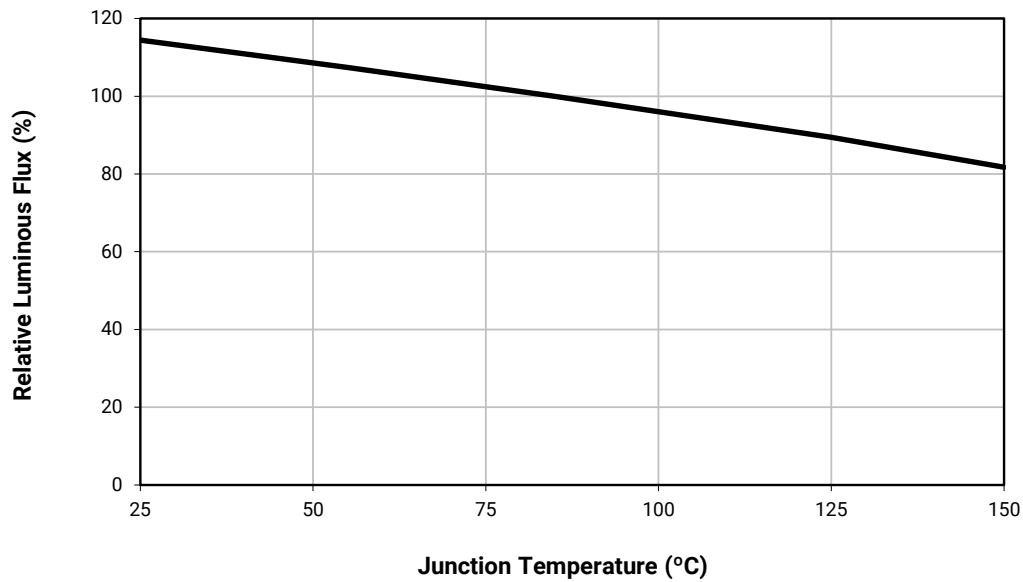
### Notes:

- Cree 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 10).
- Minimum CRI for 80-CRI White is 80.
- \* Flux values @ 25 °C are calculated and for reference only.

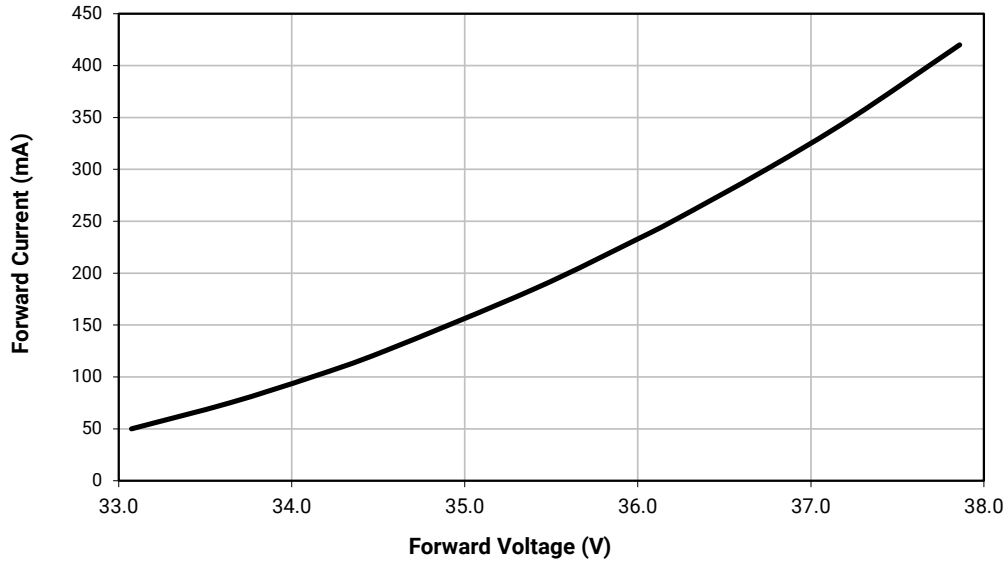
**RELATIVE SPECTRAL POWER DISTRIBUTION**



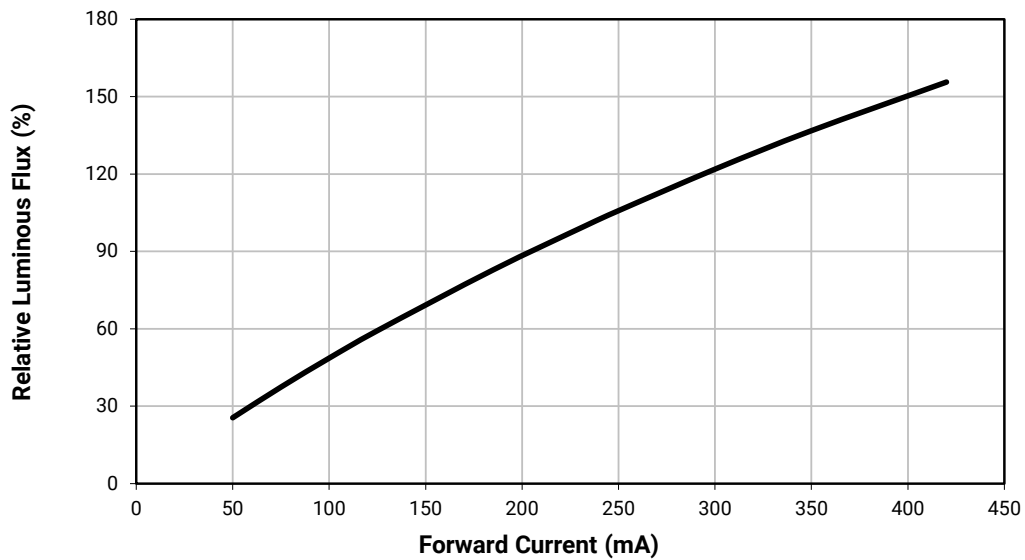
**RELATIVE FLUX VS. JUNCTION TEMPERATURE ( $I_F = 233$  mA)**



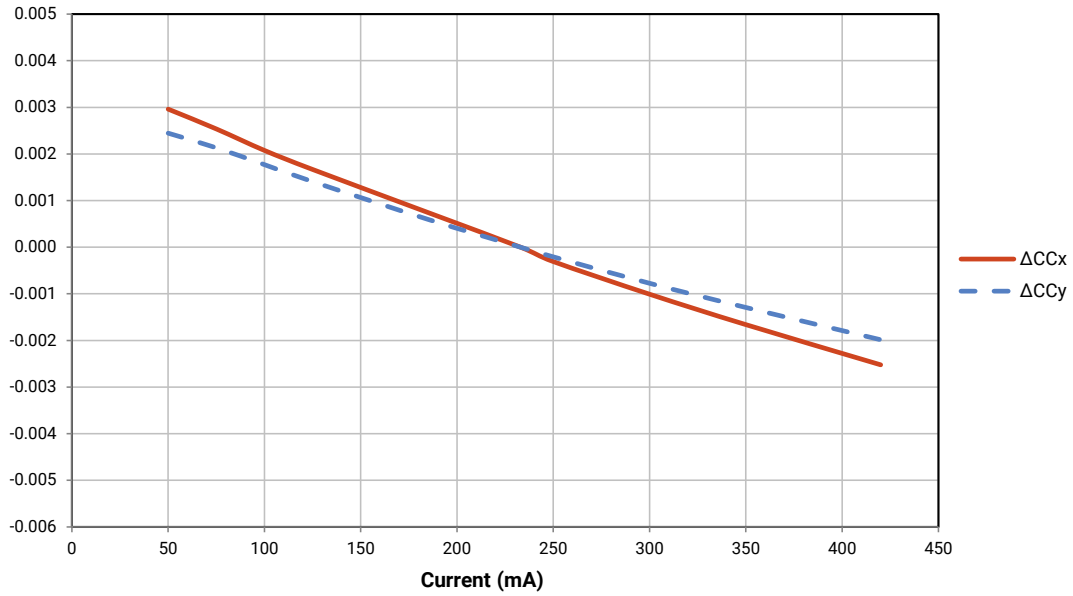
**ELECTRICAL CHARACTERISTICS ( $T_j = 85\text{ }^\circ\text{C}$ )**



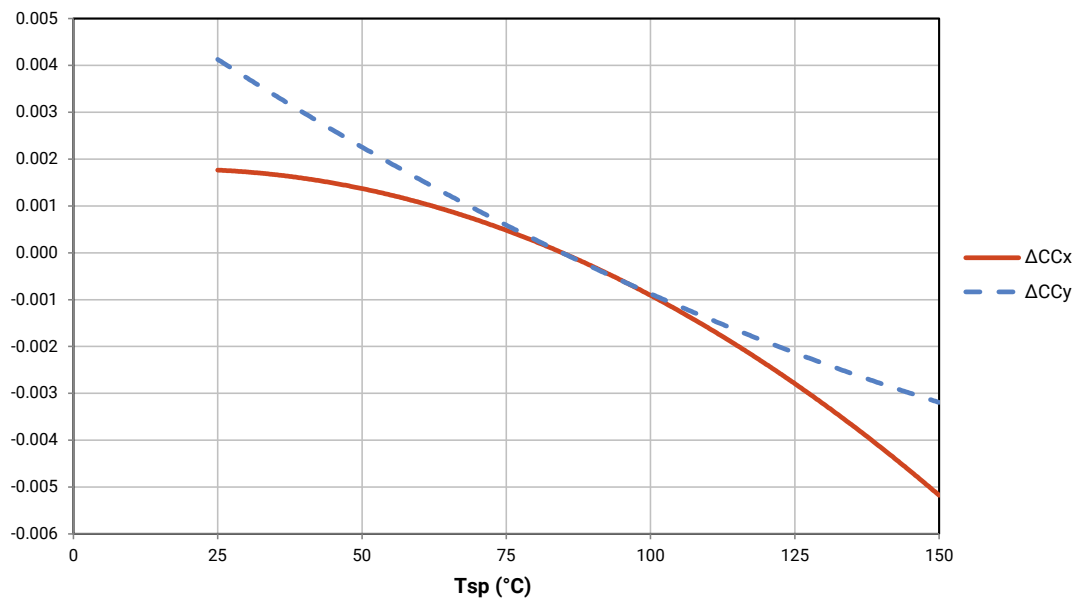
**RELATIVE FLUX VS. CURRENT ( $T_j = 85\text{ }^\circ\text{C}$ )**



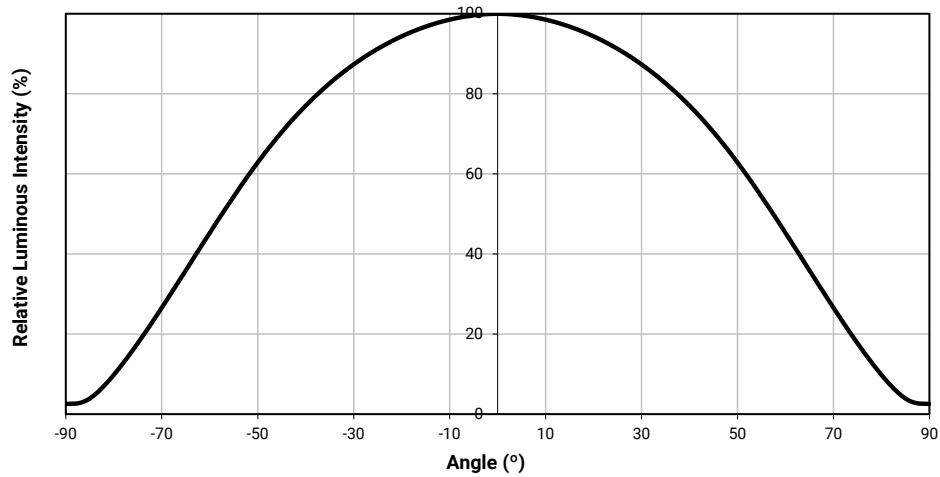
**RELATIVE CHROMATICITY VS. CURRENT - WARM WHITE ( $T_j = 85\text{ }^\circ\text{C}$ )**



**RELATIVE CHROMATICITY VS. TEMPERATURE - WARM WHITE ( $I_F = 233\text{ mA}$ )**

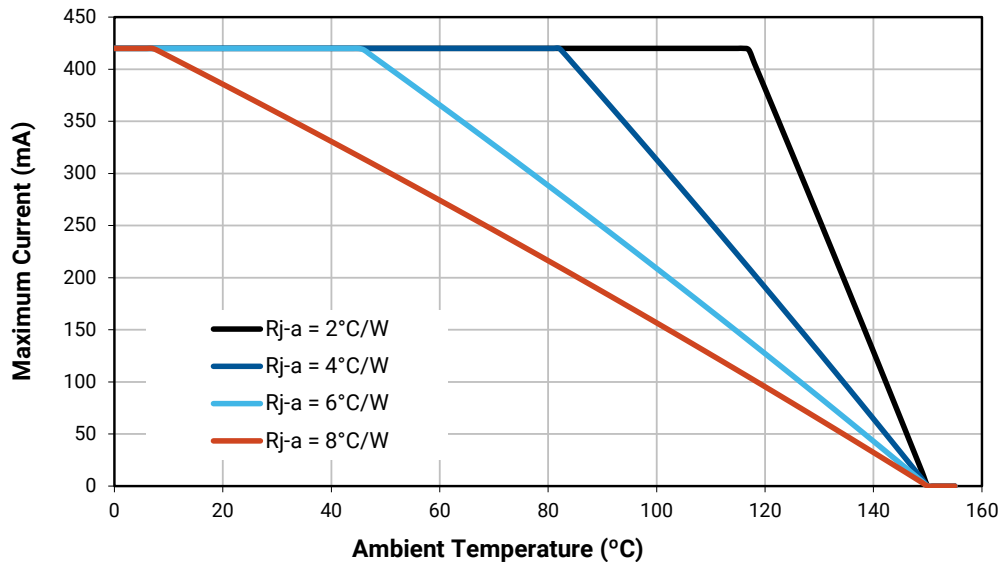


**TYPICAL SPATIAL DISTRIBUTION**



**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 - BRIGHTNESS ( $I_F = 233 \text{ mA}$ ,  $T_J = 85 \text{ }^\circ\text{C}$ )**

XLamp MK-R2 LEDs are tested for luminous flux and placed into one of the following bins.

Group Code	Minimum Luminous Flux	Maximum Luminous Flux
D2	510	550
D4	550	590
E2	590	635
E4	635	680
F2	680	730
F4	730	780
G2	780	840
G4	840	900
H2	900	970
H4	970	1040
J2	1040	1120
J4	1120	1200
K2	1200	1290

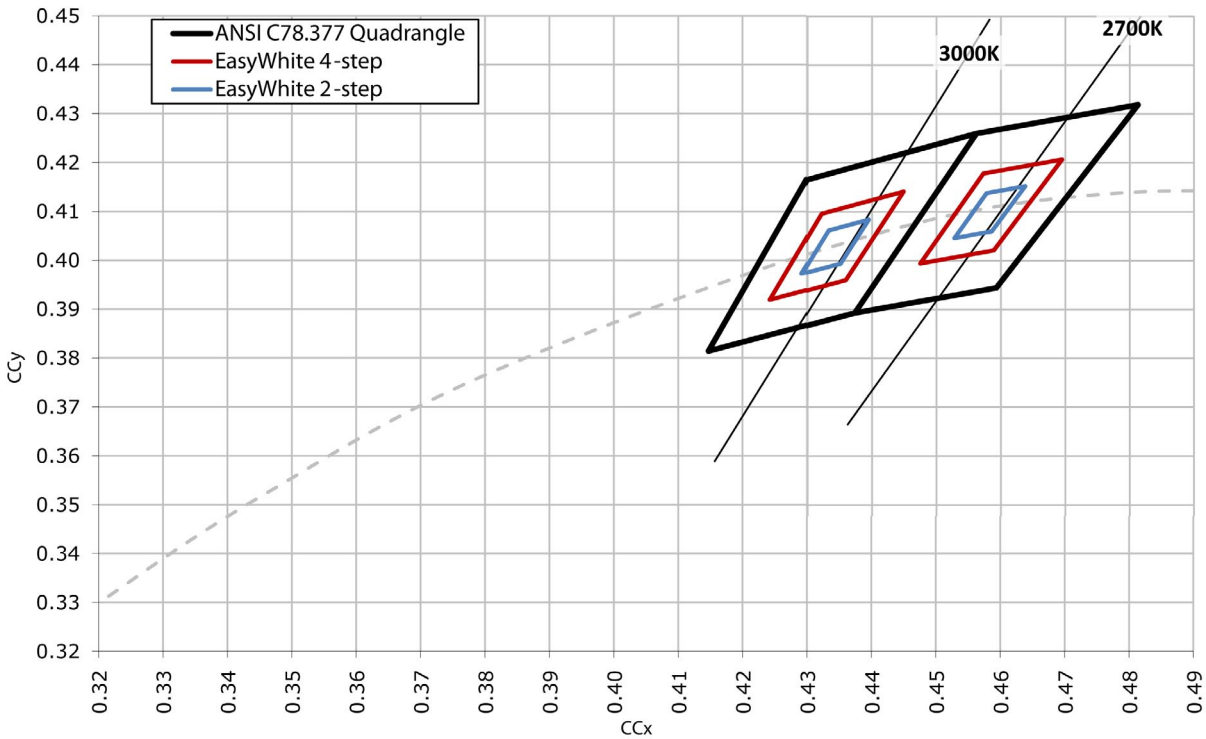
**PERFORMANCE GROUPS - CHROMATICITY ( $T_J = 85 \text{ }^\circ\text{C}$ )**

XLamp MK-R2 LEDs are tested for chromaticity and placed into one of the regions defined by the following bounding coordinates.

EasyWhite Color Temperatures – 4-Step			
Code	CCT	x	y
30F	3000 K	0.4242	0.3919
		0.4322	0.4096
		0.4449	0.4141
		0.4359	0.3960
27F	2700 K	0.4475	0.3994
		0.4573	0.4178
		0.4695	0.4207
		0.4589	0.4021

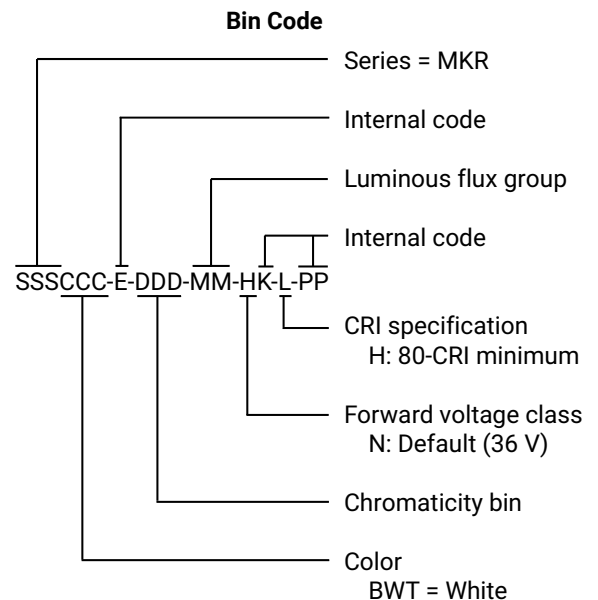
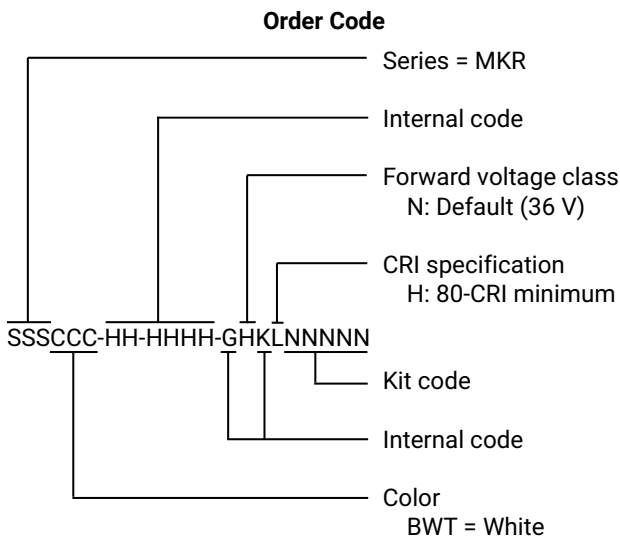
EasyWhite Color Temperatures – 2-Step			
Code	CCT	x	y
30H	3000 K	0.4291	0.3973
		0.4333	0.4062
		0.4395	0.4084
		0.4351	0.3994
27H	2700 K	0.4528	0.4046
		0.4578	0.4138
		0.4638	0.4152
		0.4586	0.4060

**CREE EASYWHITE® BINS PLOTTED ON THE 1931 CIE COLOR SPACE ( $T_j = 85^\circ\text{C}$ )**



**BIN AND ORDER CODE FORMATS**

Bin codes and order codes are configured as follows.

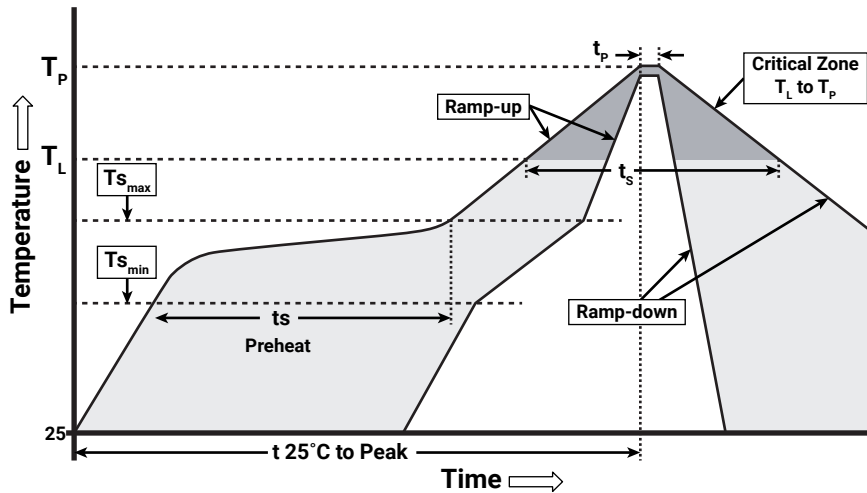




REFLOW SOLDERING CHARACTERISTICS

In testing, Cree has found XLamp MK-R2 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 the 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

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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### 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'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 as specifications.

### Pre-Release Qualification Testing

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

### Lumen Maintenance

Cree 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'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 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 MK-R2 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 storage condition, Cree 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 representative or from the [Product Ecology](#) section of the Cree 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 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.

**NOTES - CONTINUED**

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**UL® Recognized Component**

Level 4 enclosure consideration. The LED package or a portion thereof has been investigated as a fire and electrical enclosure per ANSI/UL 8750.

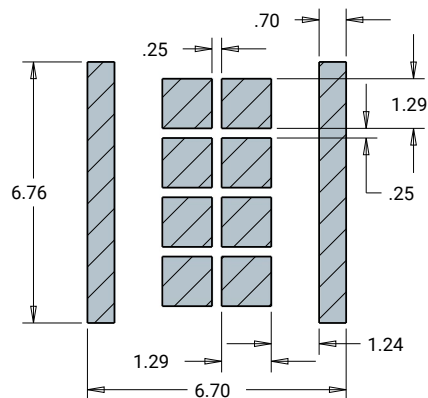
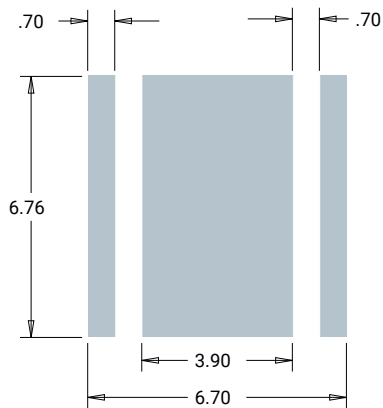
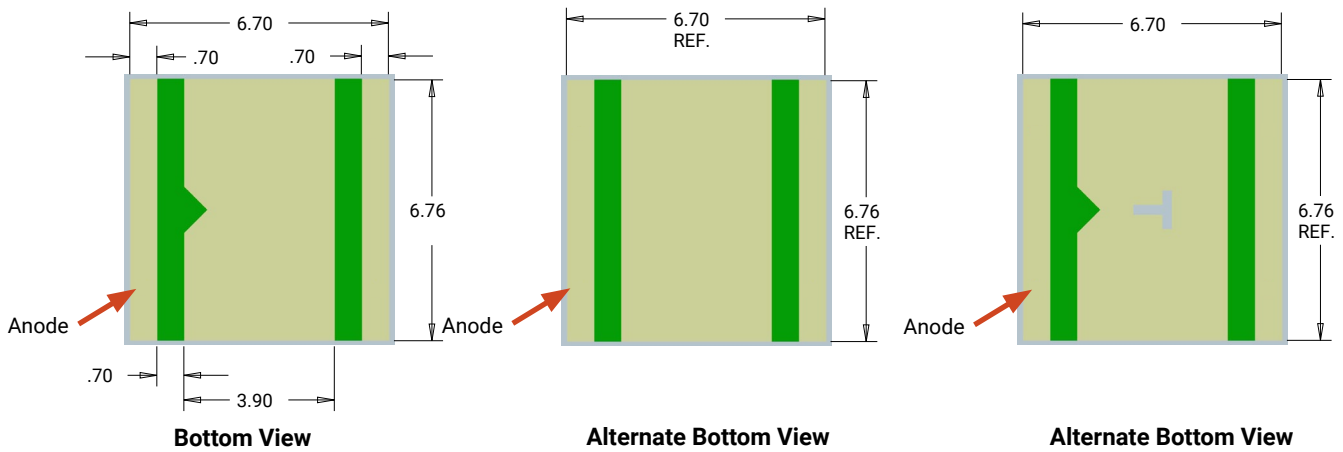
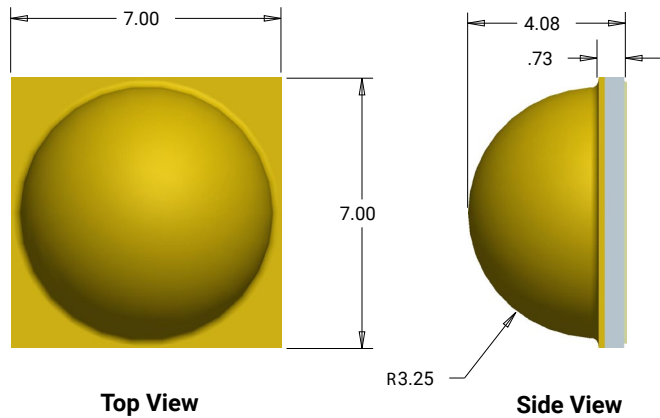
**Vision Advisory**

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**

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

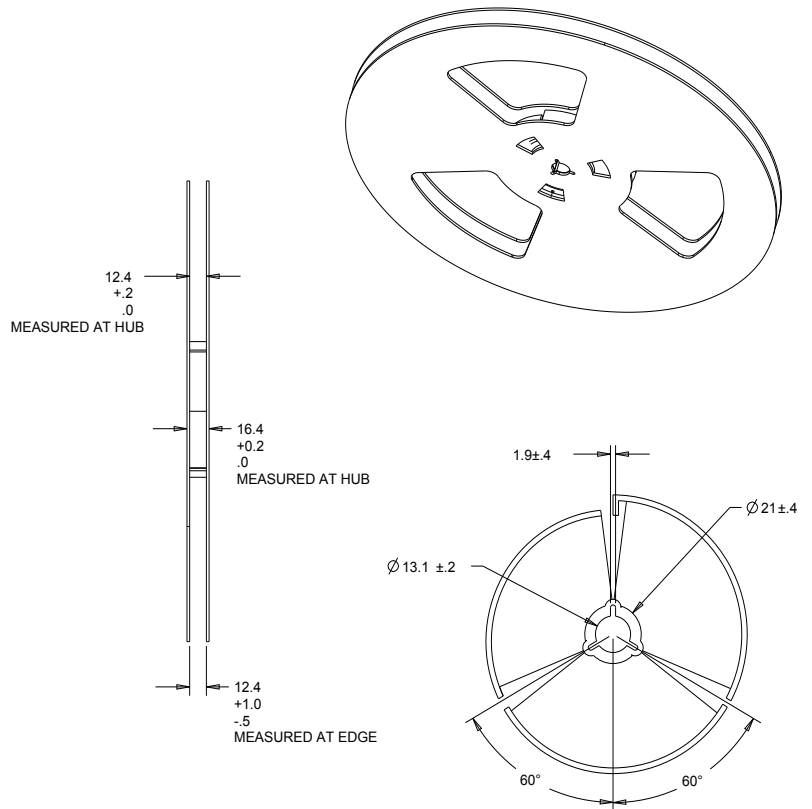
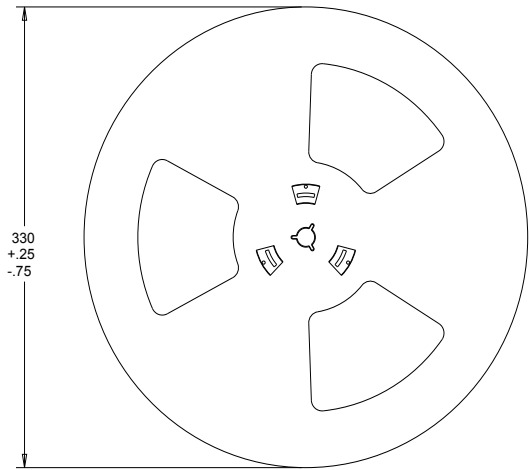
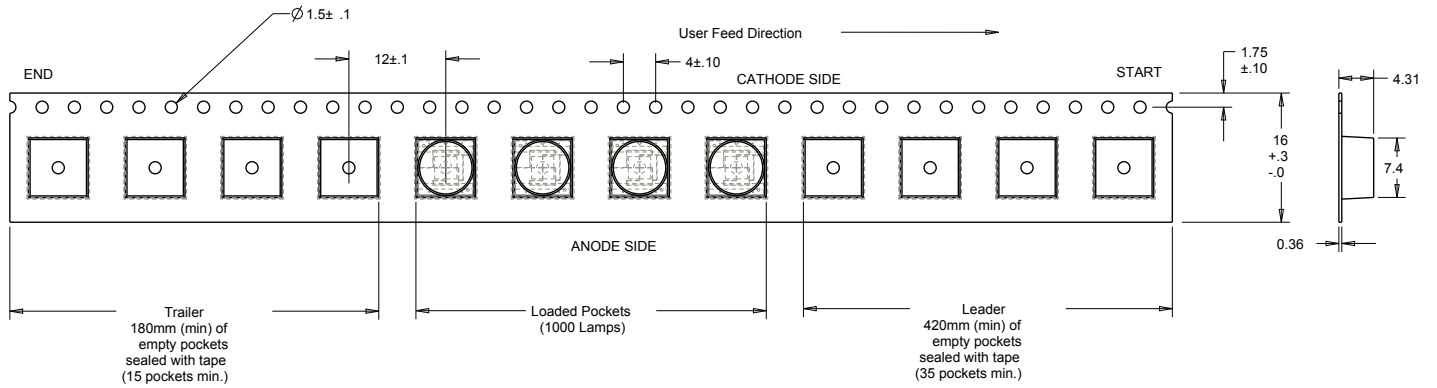
All measurements are  $\pm 0.13$  mm unless otherwise indicated.



**TAPE AND REEL**

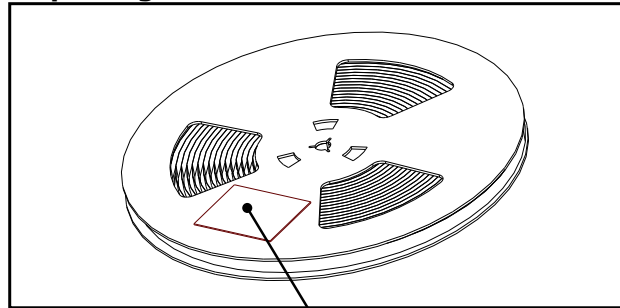
All Cree carrier tapes conform to EIA-481D, Automated Component Handling Systems Standard.

All dimensions in mm.



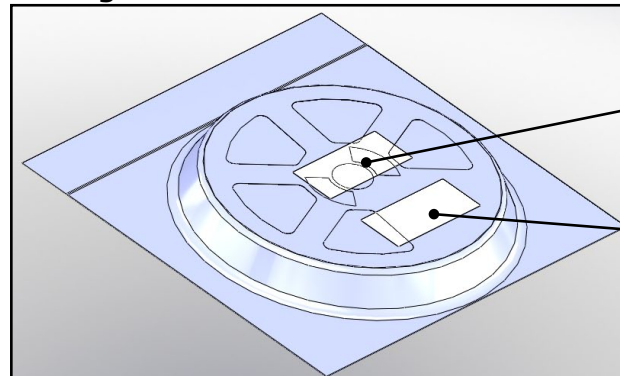
**PACKAGING**

**Unpackaged Reel**



Label with Cree Bin Code,  
Quantity, Reel ID

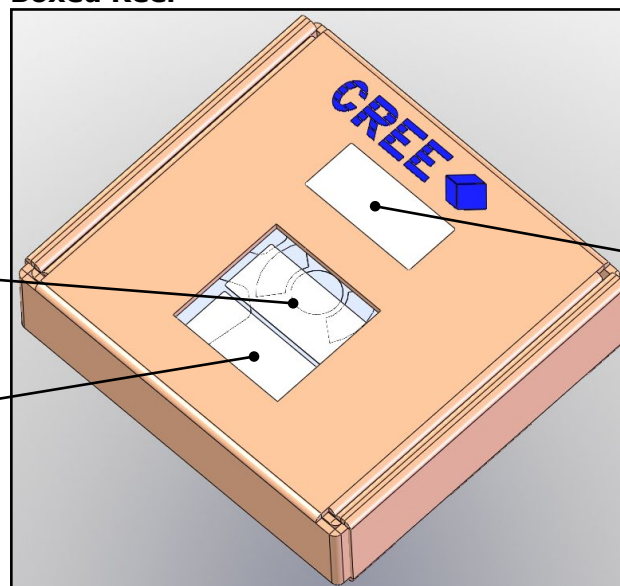
**Packaged Reel**



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 #

Patent Label

Label with Cree Bin Code,  
Quantity, Reel ID