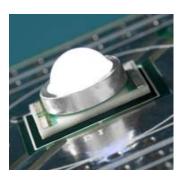


# Cree® XLamp® XR-C LEDs



### 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.

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

### **FEATURES**

- Available in white (2600 K to 10,000 K CCT), royal blue, blue, green, amber, red-orange & red
- Maximum drive current: up to 700 mA
- Low thermal resistance: as low as 12 °C/W
- Max junction temperature:
   150 °C
- Industry-leading JEDEC standard pre-qualification testing
- Reflow solderable JEDEC
   J-STD-020C compatible
- Electrically neutral thermal path
- Lumen maintenance of greater than 70% after 50,000 hours
- RoHS-compliant
- UL-recognized component (E326295)



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# FLUX CHARACTERISTICS ( $T_j = 25$ °C) - WHITE

The following tables describe the available colors and flux for XR-C LEDs by listing the correlated color temperature range for the entire family and by providing several base order codes. It is important to note that the base order codes listed here are a subset of the total available order codes for the product family. For more order codes, as well as a complete description of the order-code nomenclature, please consult the XR-E & XR-C Binning and Labeling document.

Color	CCT Range		Min Lumi	ler Codes nous Flux m)	Order Code
	Min.	Max.	Group	Flux (lm)	
			N3	56.8	XRCWHT-L1-0000-00501
			N4	62.0	XRCWHT-L1-0000-00601
Cool White	5,000 K	10,000 K	P2	67.2	XRCWHT-L1-0000-00701
Cool Wille	5,000 K	10,000 K	Р3	73.9	XRCWHT-L1-0000-00801
			P4	80.6	XRCWHT-L1-0000-00901
			Q2	87.4	XRCWHT-L1-0000-00A01
			N3	56.8	XRCWHT-L1-0000-005E4
			N4	62.0	XRCWHT-L1-0000-006E4
Neutral White	3,700 K	5,000 K	P2	67.2	XRCWHT-L1-0000-007E4
			Р3	73.9	XRCWHT-L1-0000-008E4
			P4	80.6	XRCWHT-L1-0000-009E4
			М3	45.7	XRCWHT-L1-0000-003E7
			N2	51.7	XRCWHT-L1-0000-004E7
Warm White	2,600 K	2,600 K 3,700 K	N3	56.8	XRCWHT-L1-0000-005E7
			N4	62.0	XRCWHT-L1-0000-006E7
			P2	67.2	XRCWHT-L1-0000-007E7

### 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.
- Typical CRI for Cool White & Neutral White (3,700 K 10,000 K CCT) is 75.
- Typical CRI for Warm White (2,600 K 3,700 K CCT) is 80.

# FLUX CHARACTERISTICS (T<sub>j</sub> = 25 °C) - COLOR

	Domi	nant Wav	elength F	Range		der Codes liant Flux		
Color	Min.		Ma	Max.		iW)	Order Code	
	Group DWL Group DWL Gr		Group	Flux (mW)				
Royal	D3	450	D5	465	12	250	XRCROY-L1-0000-00701	
Blue	D3	450	טט	465	13	300	XRCROY-L1-0000-00801	



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

		Domi	nant Wav	elength F	Range		der Codes		
Co	lor	Min.		Max.		Min. Luminous Flux (lm)		Order Code	
		Group	DWL (nm)	Group	DWL (nm)	Group	Flux (lm)		
DI	lue	D.O.	465	465	D4	475	G	13.9	XRCBLU-L1-0000-00G01
ы	ue	В3	405	B4	475	Н	18.1	XRCBLU-L1-0000-00H01	

	Domi	nant Wav	elength F	Range	Base Order Codes			
Color	Mi	Min.		Max.		Min. Luminous Flux (Im) Order Code		
	Group	DWL (nm)	Group	DWL (nm)	Group	Flux (lm)		
Green	G2	520	C1	E2E	М	39.8	XRCGRN-L1-0000-00M01	
Green	G2	520	G4 535		N	51.7	XRCGRN-L1-0000-00N01	

	Domi	nant Wav	elength F	lange		der Codes			
Color	Color Min.		Ma	Max.		ıminous (lm)	Order Code		
	Group	DWL (nm)	Group	DWL (nm)	Group	Flux (lm)			
							J	23.5	XRCAMB-L1-0000-00J01
Amber	A2	585	А3	595	K2	30.6	XRCAMB-L1-0000-00K01		
					M2	39.8	XRCAMB-L1-0000-00M01		

	Domi	nant Wav	elength F	Range	Base Order Codes Min. Luminous			
Color	Min.		Max.		Flux (lm)		Order Code	
	Group	DWL (nm)	Group	DWL (nm)	Group	Flux (lm)		
Red-	03	610	04	620	K2	30.6	XRCRDO-L1-0000-00K01	
Orange	U3	010	04	O4 620		39.8	XRCRDO-L1-0000-00M01	

	Domi	nant Wav	elength F	Range		der Codes				
Color	Min.		Min. Max. Flux (Im)			Order Code				
	Group	DWL (nm)	Group	DWL (nm)	Group	Flux (lm)				
								J	23.5	XRCRED-L1-0000-00J01
Red	R2	620	R3	630	K2	30.6	XRCRED-L1-0000-00K01			
					M2	39.8	XRCRED-L1-0000-00M01			

Note: 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.



## **CHARACTERISTICS - WHITE, ROYAL BLUE, BLUE, GREEN**

Characteristics	Unit	Minimum	Typical	Maximum
Thermal resistance, junction to solder point	°C/W		12	
Viewing angle (FWHM) - white	degrees		90	
Viewing angle (FWHM) - royal blue, blue, green	degrees		100	
Temperature coefficient of voltage	mV/°C		-4.0	
ESD classification (HBM per Mil-Std-883D)			Class 2	
DC forward current	mA			500
Reverse voltage	V			5
Forward voltage (@ 350 mA) - white, royal blue, blue	V		3.5	4.0
Forward voltage (@ 350 mA) - green	V		3.7	4.0
Forward voltage (@ 500 mA) - white, royal blue, blue	V		3.6	
LED junction temperature*	°C			150

<sup>\*</sup> Note: For lumen maintenance data, see the Cree XLamp LED Reliability document.

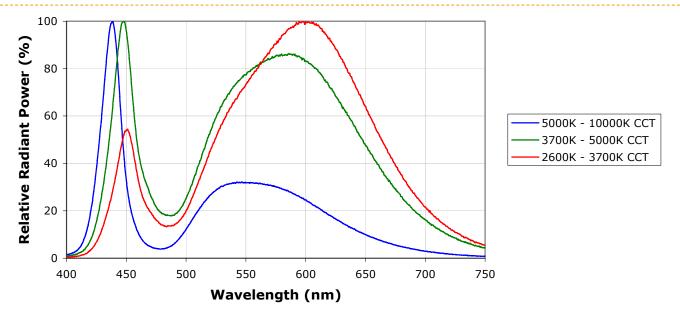
### **CHARACTERISTICS - AMBER, RED-ORANGE, RED**

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

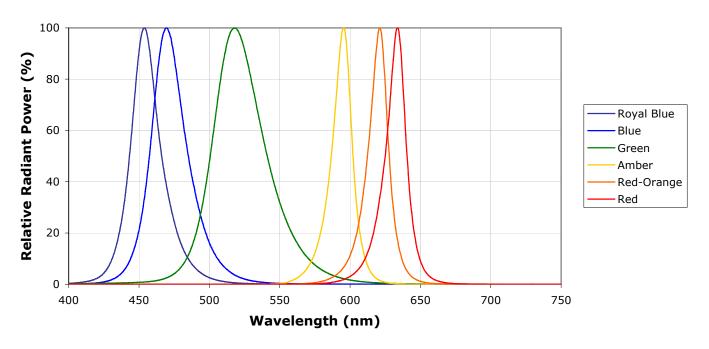
<sup>\*</sup> Note: For lumen maintenance data, see the Cree XLamp LED Reliability document.



### **RELATIVE SPECTRAL POWER DISTRIBUTION**



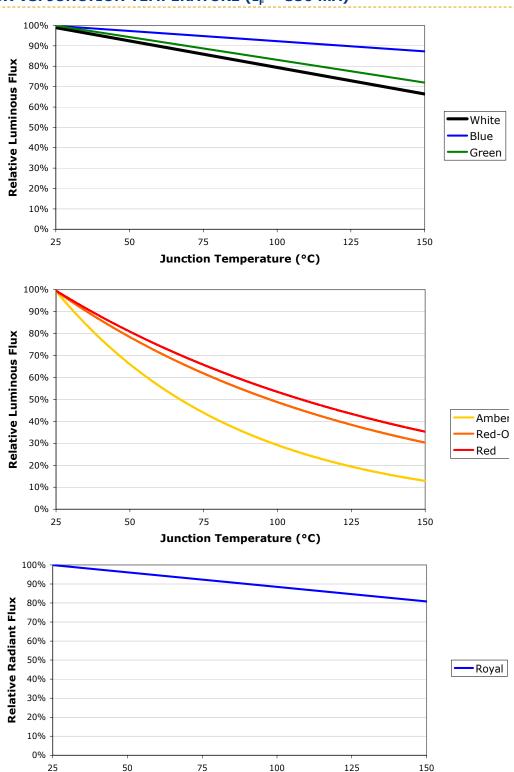




Color



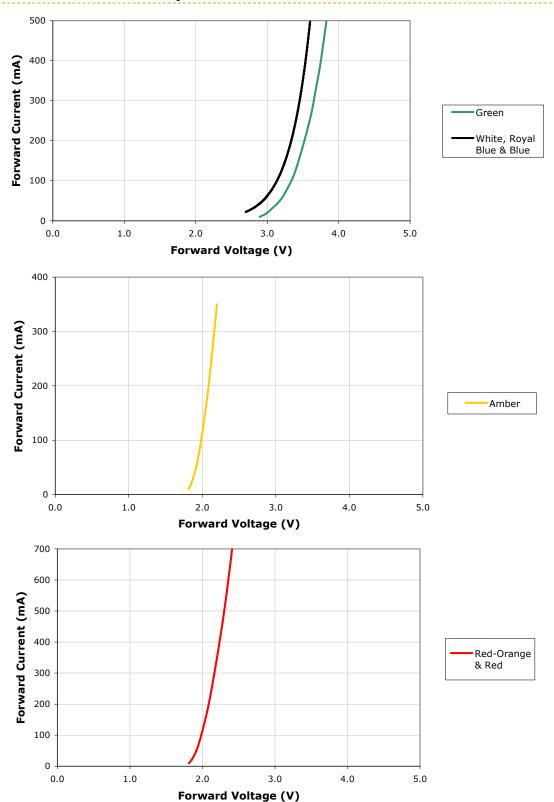
# RELATIVE FLUX VS. JUNCTION TEMPERATURE ( $I_F = 350 \text{ mA}$ )



Junction Temperature (°C)



# **ELECTRICAL CHARACTERISTICS (T<sub>j</sub> = 25 °C)**

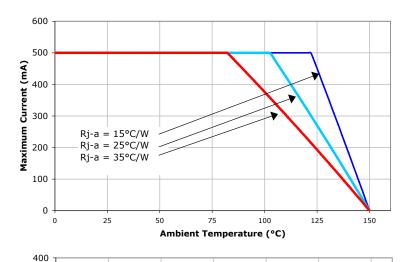


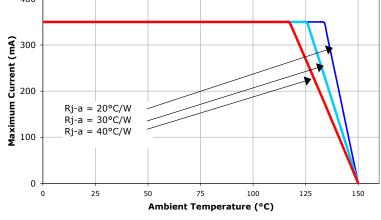


### THERMAL DESIGN

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.

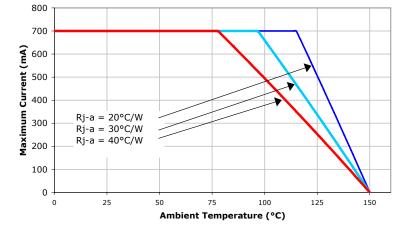






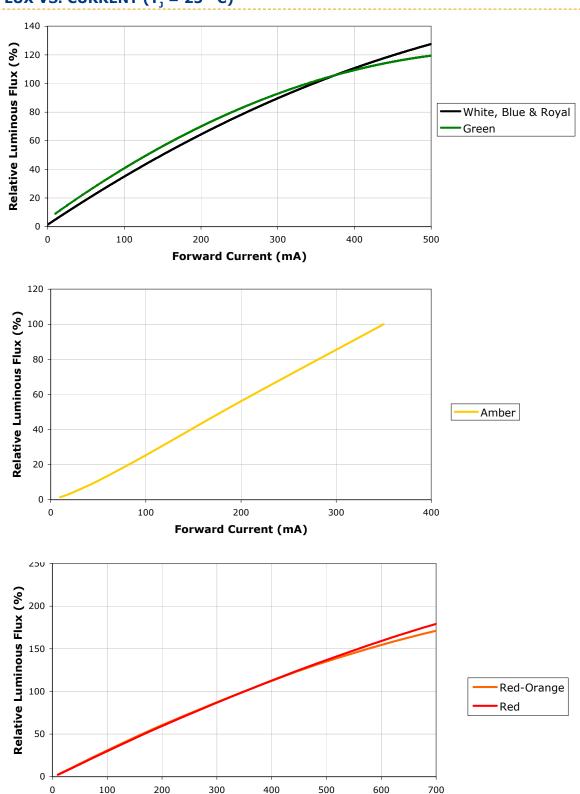
Red-Orange Red

**Amber** 





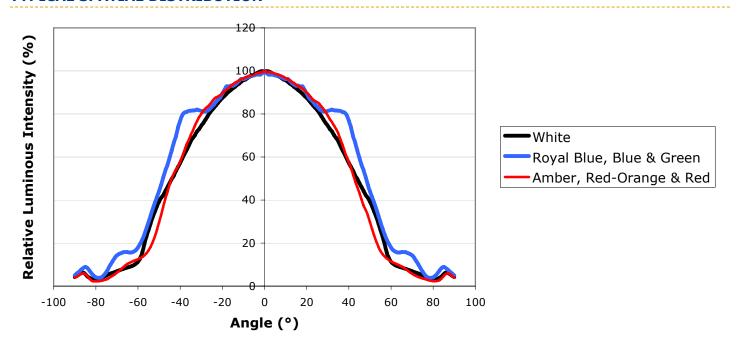
# RELATIVE FLUX VS. CURRENT ( $T_1 = 25$ °C)



Forward Current (mA)



### **TYPICAL SPATIAL DISTRIBUTION**

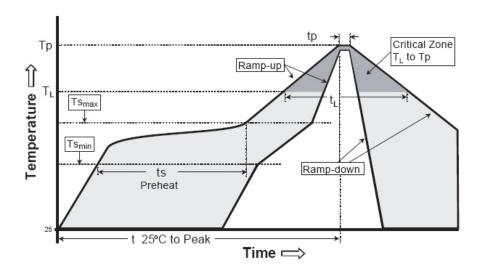




### **REFLOW SOLDERING CHARACTERISTICS**

In testing, Cree has found XLamp XR-C 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 solder paste used.

Note that this general guideline may not apply to all PCB designs and configurations of reflow soldering equipment.



Profile Feature	Lead-Based Solder	Lead-Free Solder
Average Ramp-Up Rate (Ts <sub>max</sub> to Tp)	3 °C/second max.	3 °C/second max.
Preheat: Temperature Min (Ts <sub>min</sub> )	100 °C	150 °C
Preheat: Temperature Max (Ts <sub>max</sub> )	150 °C	200 °C
Preheat: Time (ts <sub>min</sub> to ts <sub>max</sub> )	60-120 seconds	60-180 seconds
Time Maintained Above: Temperature (T <sub>L</sub> )	183 °C	217 °C
Time Maintained Above: Time (t <sub>L</sub> )	60-150 seconds	60-150 seconds
Peak/Classification Temperature (Tp)	215 ℃	260 °C
Time Within 5 °C of Actual Peak Temperature (tp)	10-30 seconds	20-40 seconds
Ramp-Down Rate	6 °C/second max.	6 °C/second max.
Time 25 °C to Peak Temperature	6 minutes max.	8 minutes max.

Note: All temperatures refer to topside of the package, measured on the package body surface.



### **NOTES**

### **Lumen Maintenance Projections**

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 at www.cree.com/xlamp\_app\_notes/LM80\_results.

Please read the XLamp Long-Term Lumen Maintenance application note at www.cree.com/xlamp\_app\_notes/lumen\_maintenance for more details on Cree's lumen maintenance testing and forecasting. Please read the XLamp Thermal Management application note at www.cree.com/xlamp\_app\_notes/thermal\_management for details on how thermal design, ambient temperature, and drive current affect the LED junction temperature.

### **Moisture Sensitivity**

XLamp LEDs are shipped in sealed, moisture-barrier bags (MBB) designed for long shelf life. If XLamp LEDs are exposed to moist environments after opening the MBB packaging but before soldering, damage to the LED may occur during the soldering operation. The following derating table defines the maximum exposure time (in days) for an XLamp LED in the

Town	<b>Maximum Percent Relative Humidity</b>								
Temp.	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		

listed humidity and temperature conditions. LEDs with exposure time longer than the time specified below must be baked according to the baking conditions listed below.

Cree recommends keeping XLamp LEDs in their sealed moisture-barrier packaging until immediately prior to use. Cree also recommends returning any unused LEDS to the resealable moisture-barrier bag and closing the bag immediately after use.

### **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 MBB packaging.
- 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 80 °C for 24 hours. LEDs may be baked on the original reels. Remove LEDs from MBB packaging before baking. Do not bake parts at temperatures higher than 80 °C. This baking operation resets the exposure time as defined in the Moisture Sensitivity section above.

### Storage Conditions

XLamp LEDs that have been removed from original MBB packaging 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.



### **NOTES - CONTINUED**

### **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 amended through June 8, 2011. RoHS Declarations for this product can be obtain from your Cree representative or obtained from the Product Ecology section of www.cree.com.

### **Vision Advisory Claim**

WARNING: Do not look at exposed lamp in operation. Eye injury can result. See LED Eye Safety at www.cree.com/xlamp\_app\_notes/led\_eye\_safety.

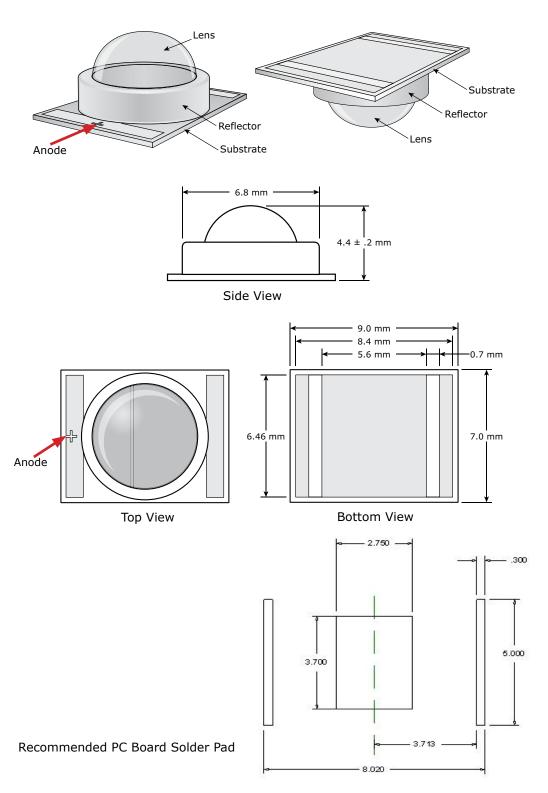
### **Intellectual Property**

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



# **MECHANICAL DIMENSIONS (TA = 25 °C)**

### All measurements are ±.1mm unless otherwise indicated.

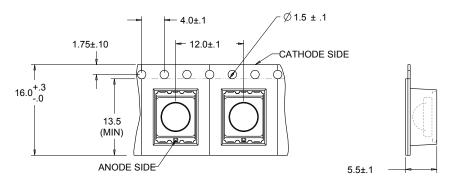




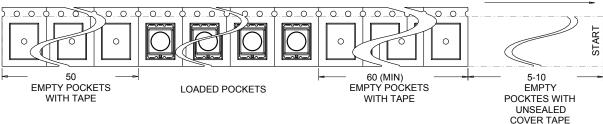
# **TAPE AND REEL**

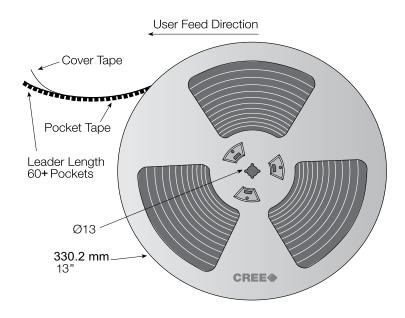
All Cree carrier tapes conform to EIA-481D, Automated Component Handling Systems Standard.

### All dimensions in mm.



# USER FEED DIRECTION







### DRY PACKAGING AND PACKAGING

# Label with Cree Bin Code, Qty, Reel ID

