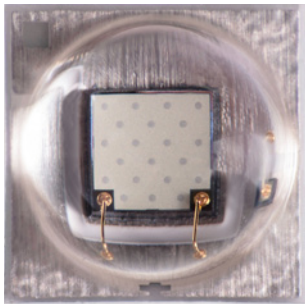
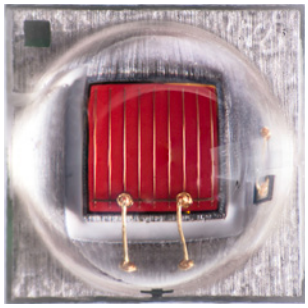
PRELIMINARY

Cree® XLamp® XP-E2 Color LEDs





PRODUCT DESCRIPTION

The XLamp XP-E2 color LEDs build on the unprecedented performance of the original XP-E by increasing lumen output up to 10% while providing a single die LED point source for precise optical control. The XP-E2 color LEDs share the same footprint as the original XP-E, providing a seamless upgrade path to more lumens and/or greater efficiency while shortening the design cycle for existing XP customers.

XLamp XP-E2 color LEDs are the ideal choice for lighting applications where high light output, maximum efficacy and precise optical control are required, such as LED retrofit lamps, outdoor lighting, portable lighting, or indoor directional lighting.

FEATURES

- Available in royal blue, blue, green, & red
- Maximum drive current: up to 1 A
- Low thermal resistance: as low as 5 °C/W
- Wide viewing angle: 130°-135°
- Unlimited floor life at ≤ 30 °C/85% RH
- Reflow solderable - JEDEC J-STD-020C compatible
- Electrically neutral thermal path

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Cree, Inc.
4600 Silicon Drive
Durham, NC 27703
USA Tel: +1.919.313.5300

PRELIMINARY

CHARACTERISTICS

Characteristics	Unit	Minimum	Typical	Maximum
Thermal resistance, junction to solder point - royal blue, blue	°C/W		9	
Thermal resistance, junction to solder point - green	°C/W		15	
Thermal resistance, junction to solder point - red	°C/W		5	
Viewing angle (FWHM) - royal blue, blue, green	degrees		135	
Viewing angle (FWHM) - red	degrees		130	
Temperature coefficient of voltage - royal blue, blue	mV/°C		-3.3	
Temperature coefficient of voltage - green	mV/°C		-3.8	
Temperature coefficient of voltage - red	mV/°C		-1.8	
ESD classification (HBM per Mil-Std-883D)			Class 2	
DC forward current - royal blue, blue, green	mA			1000
DC forward current - red	mA			700
Reverse voltage	V			5
Forward voltage (@ 350 mA) - royal blue, blue	V		3.1	3.25
Forward voltage (@ 350 mA) - green	V		3.3	3.5
Forward voltage (@ 350 mA) - red	V		2.2	2.5
Forward voltage (@ 1000 mA) - royal blue, blue	V		3.4	
Forward voltage (@ 1000 mA) - green	V		3.8	
Forward voltage (@ 1000 mA) - red	V		2.65	
LED junction temperature	°C			150

PRELIMINARY

FLUX CHARACTERISTICS (T_J = 25 °C) - COLOR

The following table provides several base order codes for XLamp XP-E2 color LEDs. 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 "Bin and Order-Code Format" on page 16.

Color	Minimum Radiant Flux @ 350 mA		Dominant Wavelength Range				Order Codes,
			Min.		Max.		
	Group	Flux (mW)	Group	DWL (nm)	Group	DWL (nm)	
Royal Blue	30	450	D3	450	D5	465	XPEBRY-L1-0000-00J01
			D3	450	D4	460	XPEBRY-L1-0000-00J02
			D4	455	D5	465	XPEBRY-L1-0000-00J03
	31	475	D3	450	D5	455	XPEBRY-L1-0000-00K01
			D3	450	D4	460	XPEBRY-L1-0000-00K02
			D4	455	D5	465	XPEBRY-L1-0000-00K03
	32	500	D3	450	D5	455	XPEBRY-L1-0000-00L01
			D3	450	D4	460	XPEBRY-L1-0000-00L02
			D4	455	D5	465	XPEBRY-L1-0000-00L03
	33	525	D3	450	D5	455	XPEBRY-L1-0000-00M01
			D3	450	D4	460	XPEBRY-L1-0000-00M02
			D4	455	D5	465	XPEBRY-L1-0000-00M03
	34	550	D3	450	D5	455	XPEBRY-L1-0000-00N01
			D3	450	D4	460	XPEBRY-L1-0000-00N02
			D4	455	D5	465	XPEBRY-L1-0000-00N03
	35	575	D3	450	D5	465	XPEBRY-L1-0000-00P01
			D3	450	D4	460	XPEBRY-L1-0000-00P02

Color	Dominant Wavelength Range				Base Order Codes Min. Luminous Flux (lm) @ 350 mA		Order Code
	Min.		Max.				
	Group	DWL (nm)	Group	DWL (nm)	Group	Flux (lm)	
Blue	B3	465	B6	485	K2	30.6	XPEBBL-L1-0000-00Y01
					K3	35.2	XPEBBL-L1-0000-00Z01
					M2	39.8	XPEBBL-L1-0000-00201
					M3	45.7	XPEBBL-L1-0000-00301

Note: Cree maintains a tolerance of ± 7% on flux and power measurements and ± 1 nm on dominant wavelength measurements.

PRELIMINARY

FLUX CHARACTERISTICS (T_J = 25 °C) - COLOR (CONTINUED)

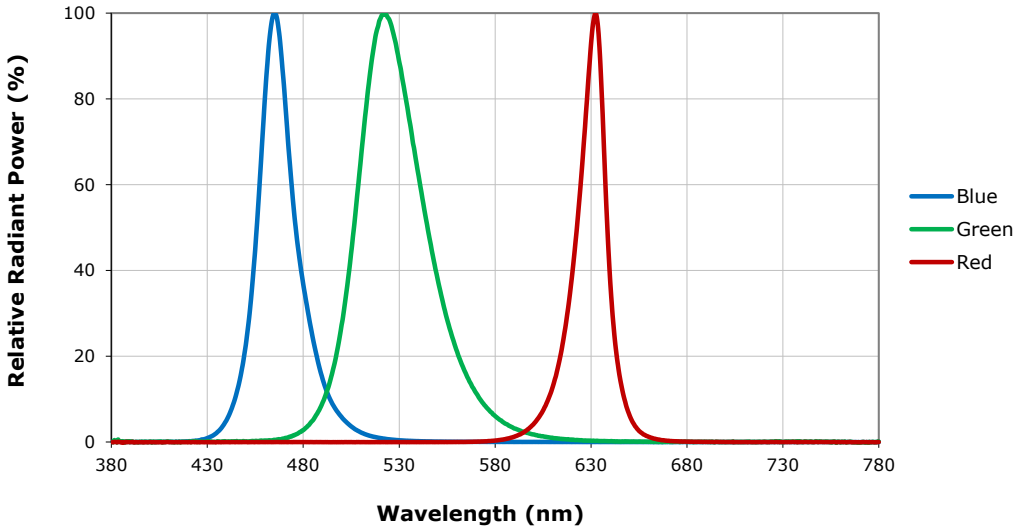
Color	Dominant Wavelength Range				Base Order Codes Min. Luminous Flux (lm) @ 350 mA		Order Code
	Min.		Max.				
	Group	DWL (nm)	Group	DWL (nm)	Group	Flux (lm)	
Green	G2	520	G4	535	Q2	87.4	XPEBGR-L1-0000-00A01
					Q3	93.9	XPEBGR-L1-0000-00B01
					Q4	100	XPEBGR-L1-0000-00C01
					Q5	107	XPEBGR-L1-0000-00D01
					R2	114	XPEBGR-L1-0000-00E01
					R3	122	XPEBGR-L1-0000-00F01

Color	Dominant Wavelength Range				Base Order Codes Min. Luminous Flux (lm) @ 350 mA		Order Code
	Min.		Max.				
	Group	DWL (nm)	Group	DWL (nm)	Group	Flux (lm)	
Red	R2	620	R3	630	N3	56.8	XPEBRD-L1-0000-00501
					N4	62.0	XPEBRD-L1-0000-00601
					P2	67.2	XPEBRD-L1-0000-00701
					P3	73.9	XPEBRD-L1-0000-00801

Note: Cree maintains a tolerance of ± 7% on flux and power measurements and ± 1 nm on dominant wavelength measurements.

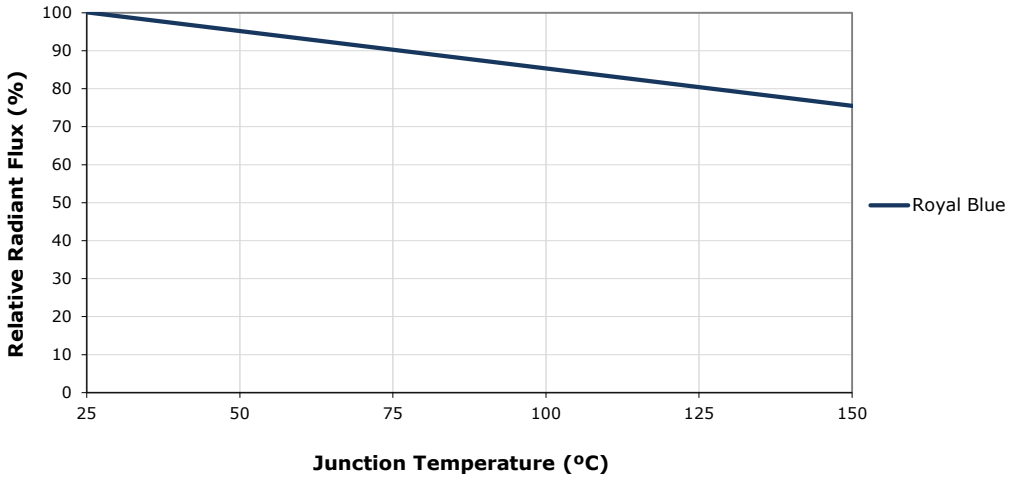
PRELIMINARY

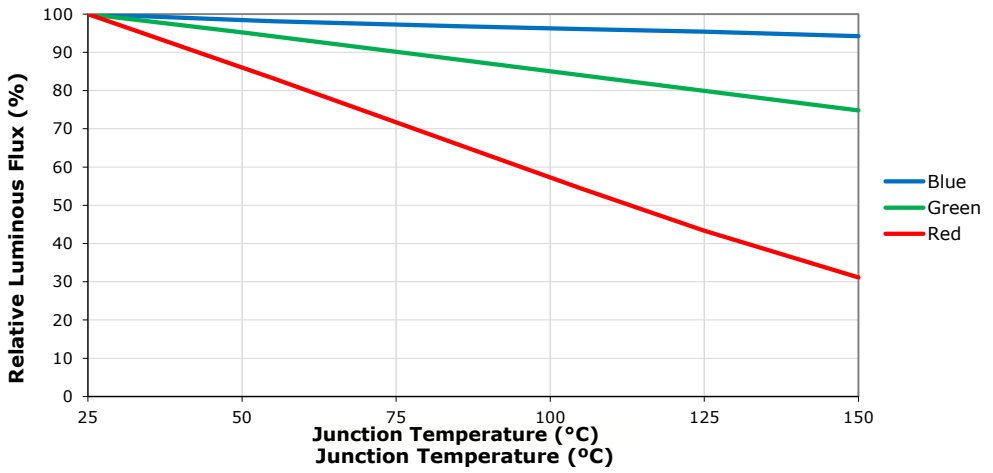
RELATIVE SPECTRAL POWER DISTRIBUTION



PRELIMINARY

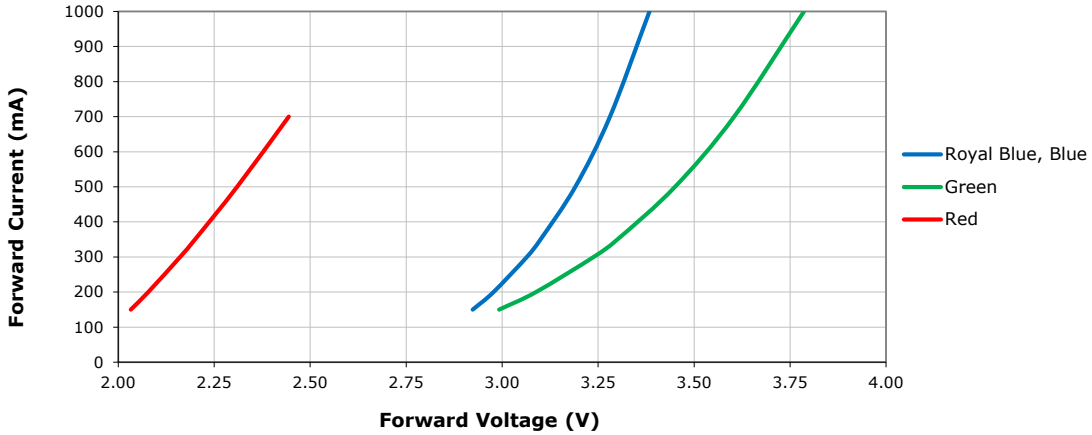
RELATIVE FLUX VS. JUNCTION TEMPERATURE (I_F = 350 mA)





PRELIMINARY

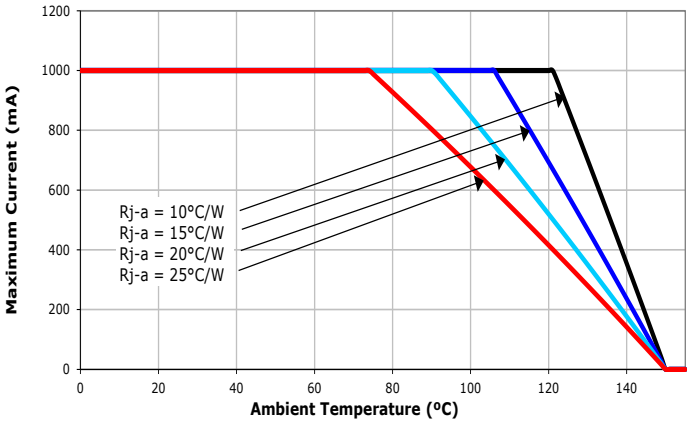
ELECTRICAL CHARACTERISTICS (T_J = 25 °C)



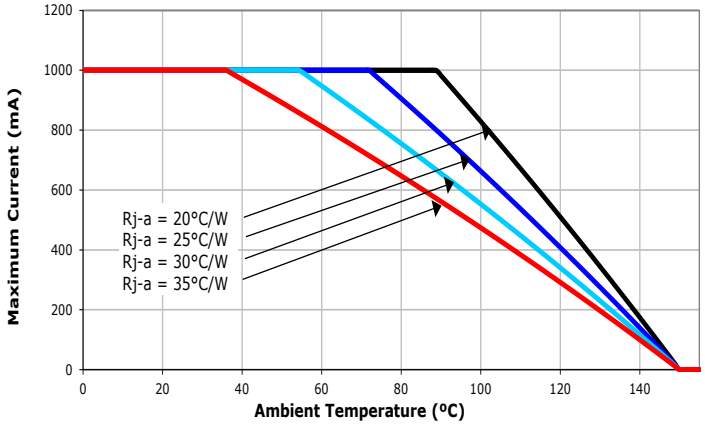
PRELIMINARY

THERMAL DESIGN

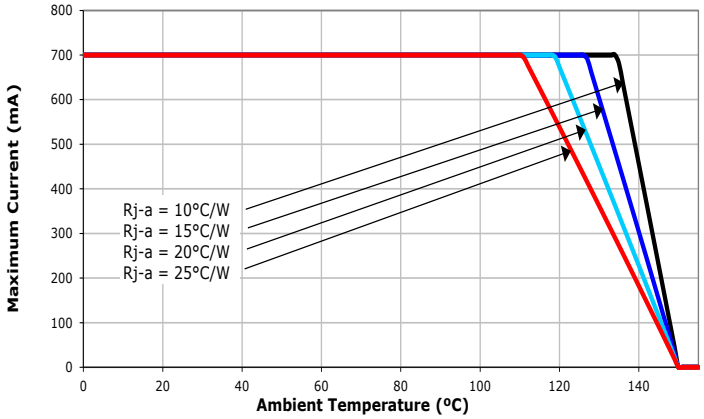
The maximum forward current is determined by the thermal resistance between the LED junction and ambient. It is crucial for the end product to be designed in a manner that minimizes the thermal resistance from the solder point to ambient in order to optimize lamp life and optical characteristics.



Royal Blue, Blue



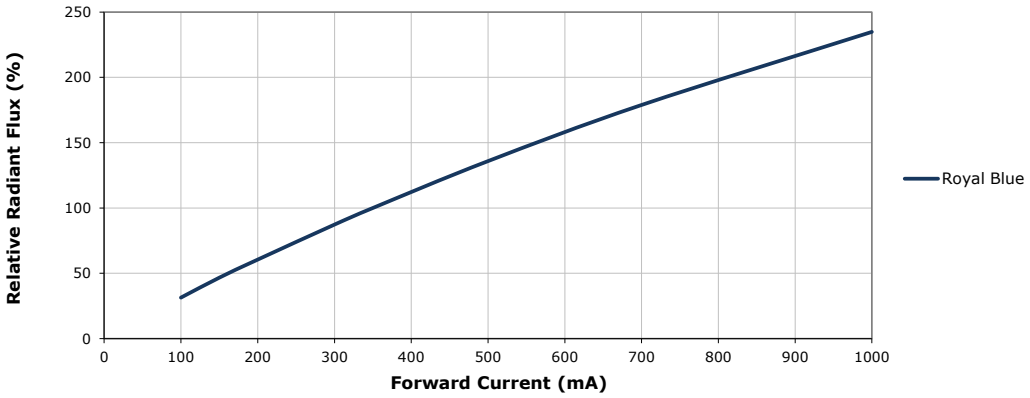
Green

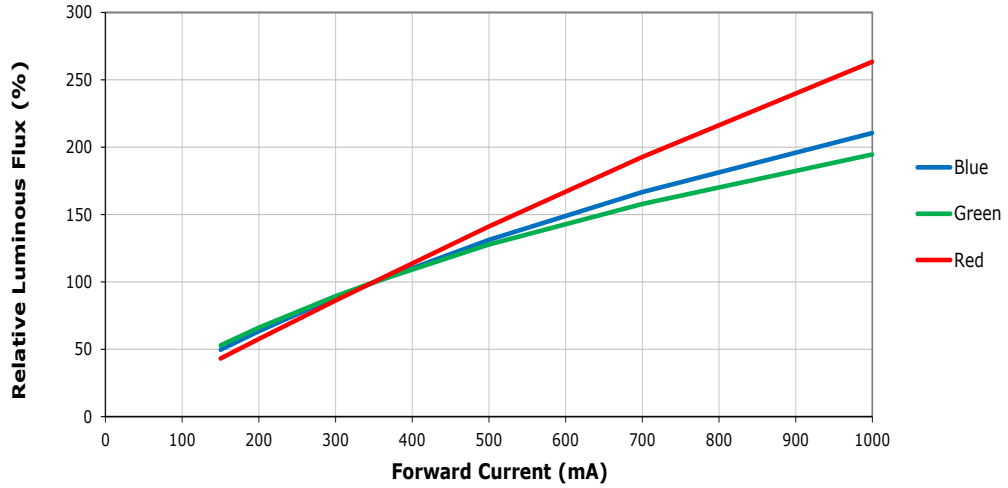


Red

PRELIMINARY

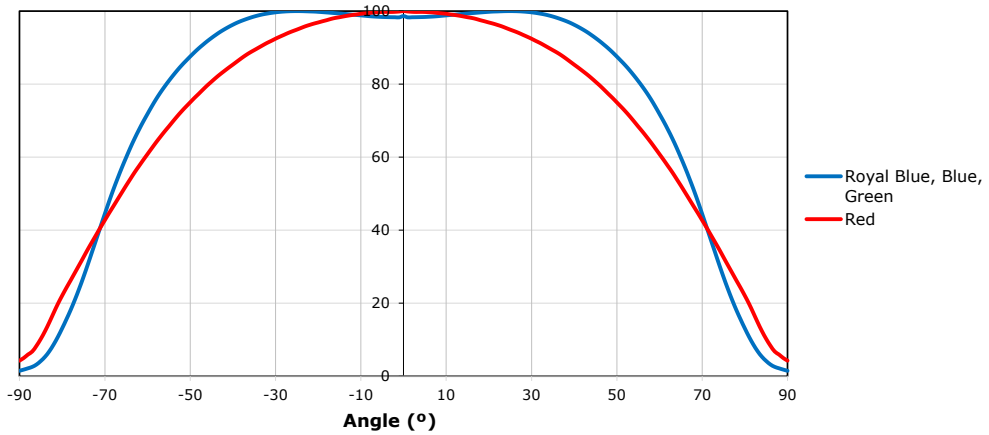
RELATIVE FLUX VS. CURRENT (T_J = 25 °C)





PRELIMINARY

TYPICAL SPATIAL DISTRIBUTION

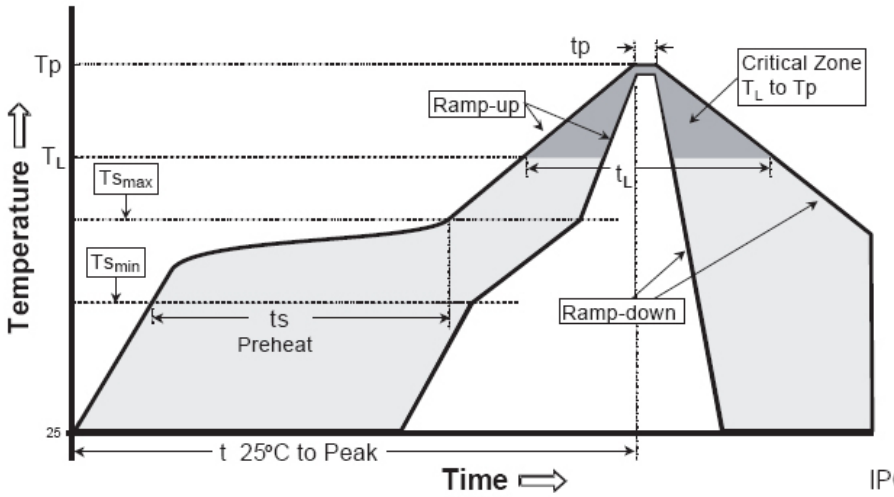


PRELIMINARY

REFLOW SOLDERING CHARACTERISTICS

In testing, Cree has found XLamp XP-E2 color 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.



IPC/JEDEC J-STD-020C

Profile Feature	Lead-Based Solder	Lead-Free Solder
Average Ramp-Up Rate (Ts_{max} to Tp)	3 °C/second max.	3 °C/second max.
Preheat: Temperature Min (Ts_{min})	100 °C	150 °C
Preheat: Temperature Max (Ts_{max})	150 °C	200 °C
Preheat: Time (ts_{min} to ts_{max})	60-120 seconds	60-180 seconds
Time Maintained Above: Temperature (T_L)	183 °C	217 °C
Time Maintained Above: Time (t_L)	60-150 seconds	60-150 seconds
Peak/Classification Temperature (Tp)	215 °C	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.

PRELIMINARY

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

In testing, Cree has found XLamp XP-E2 color LEDs to have unlimited floor life in conditions ≤ 30 ºC/85% relative humidity (RH). Moisture testing included a 168-hour soak at 85 ºC/85% RH followed by 3 reflow cycles, with visual and electrical inspections at each stage.

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.

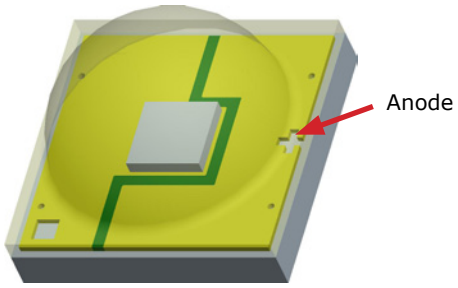
Vision Advisory Claim

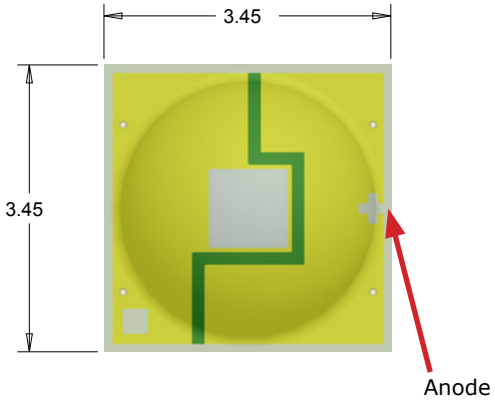
WARNING: Do not look at exposed lamp in operation. Eye injury can result. See LED Eye Safety at www.cree.com/xlamp_app_notes/led_eye_safety.

PRELIMINARY

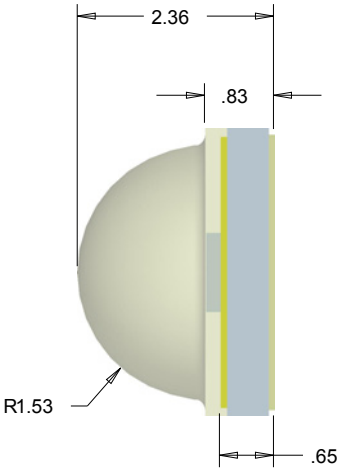
MECHANICAL DIMENSIONS (T_A = 25 °C)

All measurements are ±.13 mm unless otherwise indicated.

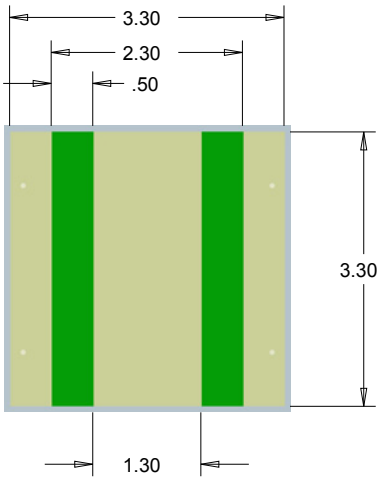




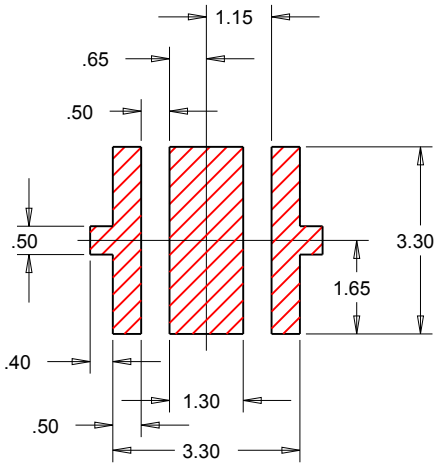
Top View



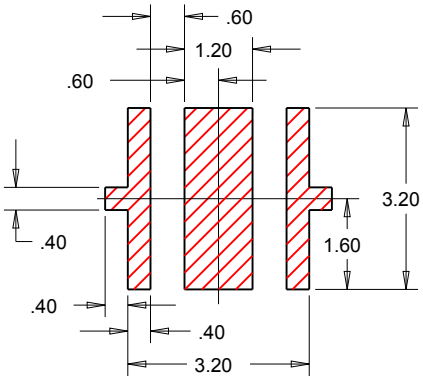
Side View



Bottom View



Recommended PCB Solder Pad



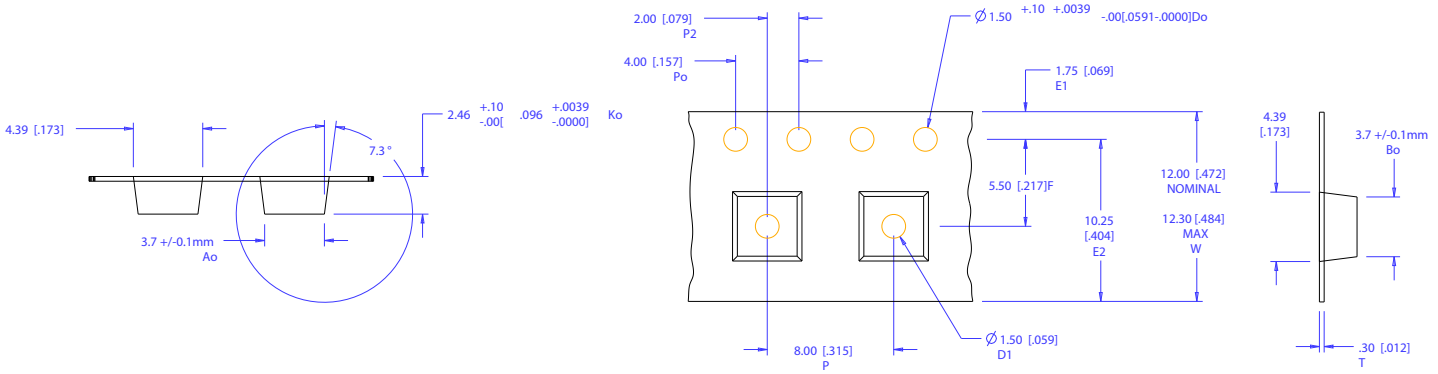
Recommended Stencil Pattern
Hatched Area is Opening

PRELIMINARY

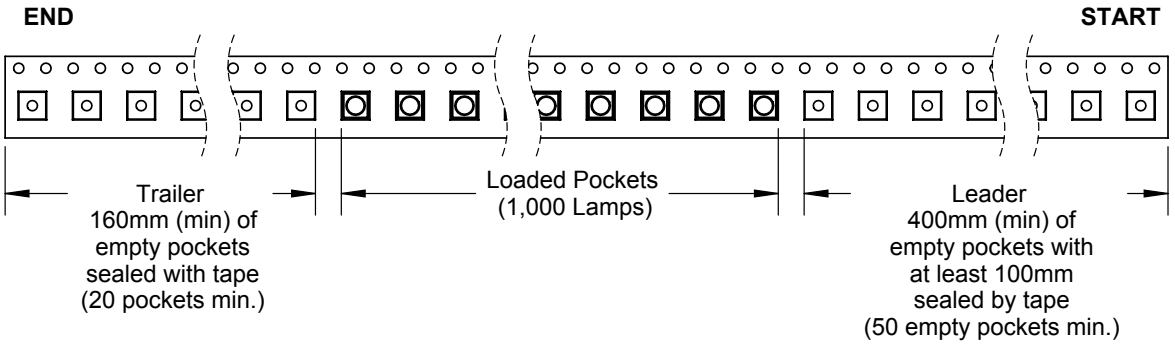
TAPE AND REEL

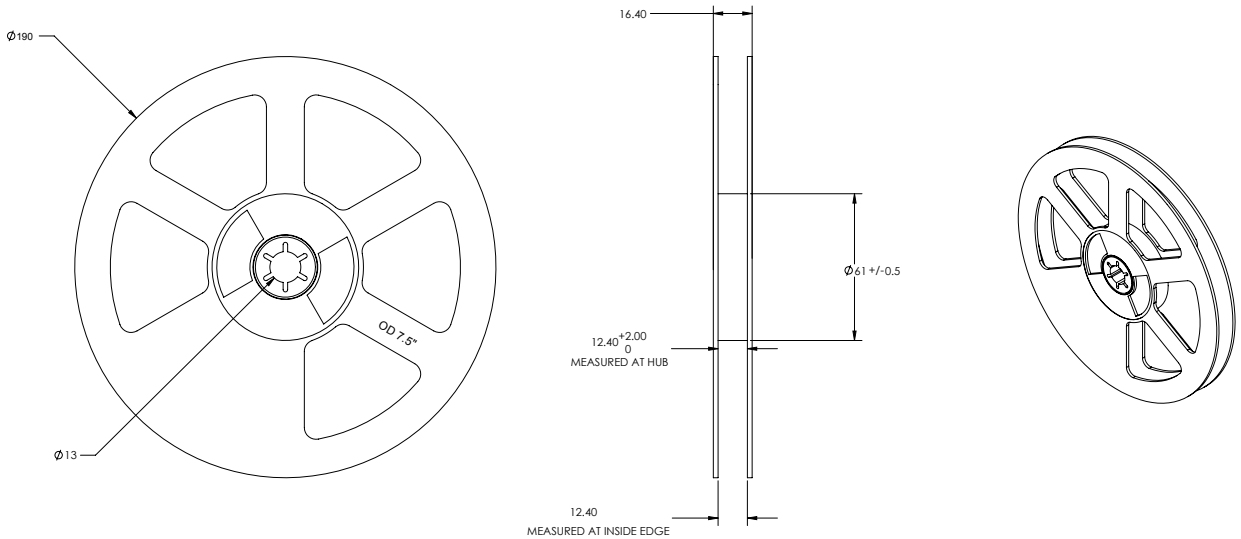
All Cree carrier tapes conform to EIA-481D, Automated Component Handling Systems Standard.

All dimensions in mm.



POCKET SIZE	
Ao -	3.7mm +/-0.1mm
Bo -	3.7mm +/-0.1mm
Ko -	2.46mm +0.1/-0mm

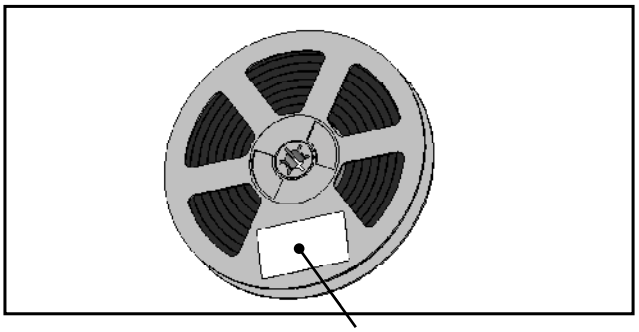




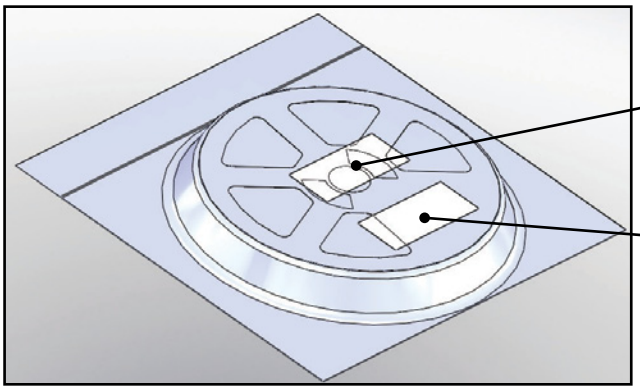
PRELIMINARY

PACKAGING

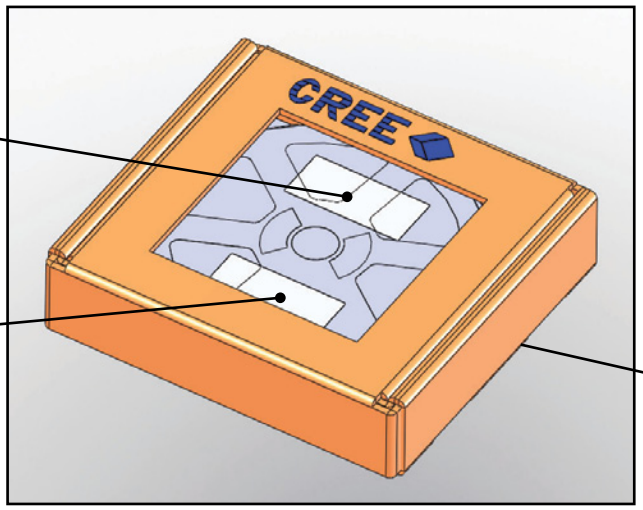
Unpackaged Reel



Packaged Reel



Boxed Reel



PRELIMINARY

BIN AND ORDER-CODE FORMAT

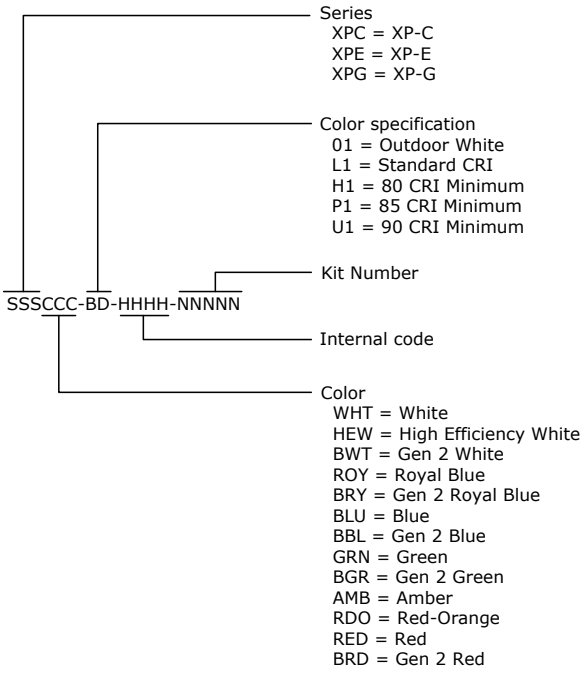
This document describes the product nomenclature required to select and order Cree's XLamp XP-E2 color LEDs. XLamp XP-E2 color LEDs are tested and sorted into bins which are then combined into orderable kits identified by an order code.

All XLamp LEDs are tested and sorted by color and brightness into a unique bin. Each bin contains LEDs from only one color and brightness group and is uniquely identified by a bin code. Color XLamp LEDs are sorted by dominant wavelength (color) and luminous or radiant flux (brightness). Amber, red-orange and red LEDs are additionally binned into forward voltage bins. LEDs are shipped on reels containing LEDs from one bin and are always labeled with the appropriate bin code.

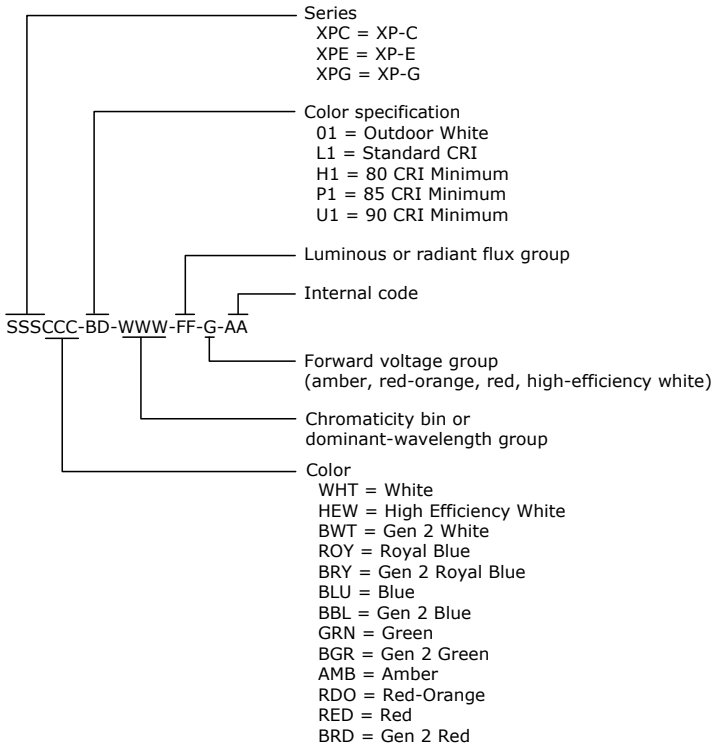
Kits contain LEDs from a number of similar bins and are fully defined by their order codes. A full explanation of the order codes for XLamp XP-E2 color LEDs, as well as a list of standard order codes, is provided in this document.

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

Order Code



Bin Code



PRELIMINARY

PERFORMANCE GROUPS – BRIGHTNESS

XLamp XP-E2 color LEDs (except Royal Blue) are tested for luminous flux and placed into one of the following luminous-flux groups:

Group Code	Min. Luminous Flux @ 350 mA (lm)	Max. 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
P2	67.2	73.9
P3	73.9	80.6
P4	80.6	87.4
Q2	87.4	93.9
Q3	93.9	100
Q4	100	107
Q5	107	114
R2	114	122
R3	122	130
R4	130	139
R5	139	148
S2	148	156
S3	156	164

PERFORMANCE GROUPS – RADIANT FLUX (T_J = 25 °C)

XLamp XT-E2 Royal Blue LEDs are tested for radiant flux and placed into one the following bins.

Group Code	Minimum Radiant Flux (mW)	Maximum Radiant Flux (mW)
31 (K)	475	500
32 (L)	500	525
33 (M)	525	550
34 (N)	550	575
35 (P)	575	600
36 (Q)	600	625

PRELIMINARY

PERFORMANCE GROUPS – DOMINANT WAVELENGTH

Color XLamp LEDs are tested for dominant wavelength (DWL) and sorted into one of the DWL bins defined below.

Color	DWL Group	Min. DWL (nm) @ 350 mA	Max. DWL (nm) @ 350 mA
Royal Blue	D3	450	455
	D4	455	460
	D5	460	465
Blue	B3	465	470
	B4	470	475
	B5	475	480
	B6	480	485
Green	G2	520	525
	G3	525	530
	G4	530	535
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 XLamp LEDs are tested for forward voltage and sorted into one of the forward voltage bins defined below.

Forward Voltage Group	Min. Forward Voltage @ 350 mA	Max. Forward Voltage @ 350 mA
B	1.75	2.0
C	2.0	2.25
D	2.25	2.5
E	2.5	2.75
F	2.75	3.0
G	3.0	3.25
H	3.25	3.5
J	3.5	3.75

PRELIMINARY

STANDARD ORDER CODES AND BINS (XP-E2 COLOR, T_J = 25 °C)

XLamp XP-E2 LED Standard Order Codes - Royal Blue							
Color	Minimum Radiant Flux @ 350 mA		Dominant Wavelength (nm)				Order Codes
			Min.		Max.		
	Group	Flux (mW)	Group	DWL (nm)	Group	DWL (nm)	
Royal Blue	30	450	D3	450	D5	465	XPEBRY-L1-0000-00J01
			D3	450	D4	460	XPEBRY-L1-0000-00J02
			D4	455	D5	465	XPEBRY-L1-0000-00J03
	31	475	D3	450	D5	455	XPEBRY-L1-0000-00K01
			D3	450	D4	460	XPEBRY-L1-0000-00K02
			D4	455	D5	465	XPEBRY-L1-0000-00K03
	32	500	D3	450	D5	455	XPEBRY-L1-0000-00L01
			D3	450	D4	460	XPEBRY-L1-0000-00L02
			D4	455	D5	465	XPEBRY-L1-0000-00L03
	33	525	D3	450	D5	455	XPEBRY-L1-0000-00M01
			D3	450	D4	460	XPEBRY-L1-0000-00M02
			D4	455	D5	465	XPEBRY-L1-0000-00M03
	34	550	D3	450	D5	455	XPEBRY-L1-0000-00N01
			D3	450	D4	460	XPEBRY-L1-0000-00N02
			D4	455	D5	465	XPEBRY-L1-0000-00N03
	35	575	D3	450	D5	465	XPEBRY-L1-0000-00P01
			D3	450	D4	460	XPEBRY-L1-0000-00P02

* Cree XLamp XP Family order codes specify only a minimum flux bin and not a maximum. Cree 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.

PRELIMINARY

STANDARD ORDER CODES AND BINS (XP-E2 COLOR, T_J = 25 °C) - CONTINUED

XLamp XP-E2 LED Standard Order Codes - Color							
Color	Min. Luminous Flux (lm) @ 350 mA*		Dominant Wavelength (nm)				Order Codes
			Min.		Max.		
	Group	Flux (lm)	Group	DWL (nm)	Group	DWL (nm)	
Blue	K2	30.6	B3	465	B6	485	XPEBBL-L1-0000-00Y01
			B3	465	B5	480	XPEBBL-L1-0000-00Y02
			B4	470	B5	480	XPEBBL-L1-0000-00Y05
	K3	35.2	B3	465	B6	485	XPEBBL-L1-0000-00Z01
			B3	465	B5	480	XPEBBL-L1-0000-00Z02
			B4	470	B5	480	XPEBBL-L1-0000-00Z05
	M2	39.8	B3	465	B6	485	XPEBBL-L1-0000-00201
			B3	465	B5	480	XPEBBL-L1-0000-00202
			B4	470	B5	480	XPEBBL-L1-0000-00205
	M3	45.7	B3	465	B6	485	XPEBBL-L1-0000-00301
			B3	465	B5	480	XPEBBL-L1-0000-00302
			B4	470	B5	480	XPEBLU-L1-0000-00305
Green	Q2	87.4	G2	520	G4	535	XPEBGR-L1-0000-00A01
			G2	520	G3	530	XPEBGR-L1-0000-00A02
			G3	525	G4	535	XPEBGR-L1-0000-00A03
	Q3	93.9	G2	520	G4	535	XPEBGR-L1-0000-00B01
			G2	520	G3	530	XPEBGR-L1-0000-00B02
			G3	525	G4	535	XPEBGR-L1-0000-00B03
	Q4	100	G2	520	G4	535	XPEBGR-L1-0000-00C01
			G2	520	G3	530	XPEBGR-L1-0000-00C02
			G3	525	G4	535	XPEBGR-L1-0000-00C03
	Q5	107	G2	520	G4	535	XPEBGR-L1-0000-00D01
			G2	520	G3	530	XPEBGR-L1-0000-00D02
			G3	525	G4	535	XPEBGR-L1-0000-00D03
	R2	114	G2	520	G4	535	XPEBGR-L1-0000-00E01
			G2	520	G3	530	XPEBGR-L1-0000-00E02
			G3	525	G4	535	XPEBGR-L1-0000-00E03
	R3	122	G2	520	G4	535	XPEBGR-L1-0000-00F01
			G2	520	G3	530	XPEBGR-L1-0000-00F02
			G3	525	G4	535	XPEBGR-L1-0000-00F03
Red	N3	56.8	R2	620	R3	630	XPEBRD-L1-0000-00501
			R2	620	R2	625	XPEBRD-L1-0000-00502
	N4	62	R2	620	R3	630	XPEBRD-L1-0000-00601
			R2	620	R2	625	XPEBRD-L1-0000-00602
	P2	67.2	R2	620	R3	630	XPEBRD-L1-0000-00701
			R2	620	R2	625	XPEBRD-L1-0000-00702
	P3	73.9	R2	620	R3	630	XPEBRD-L1-0000-00801
			R2	620	R2	625	XPEBRD-L1-0000-00802

* Cree XLamp XP Family order codes specify only a minimum flux bin and not a maximum. Cree 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.