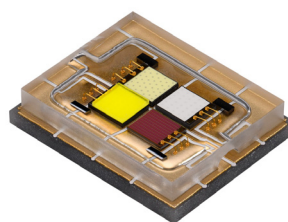
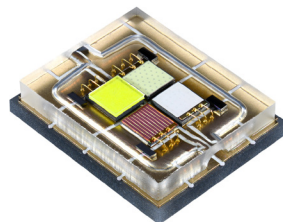


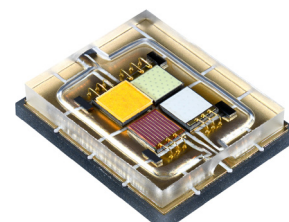
## XLamp® XN-P Color LEDs



**XN-P RGBW**



**XN-P RGB + PC Lime**



**XN-P RGB + PC Amber**

### PRODUCT DESCRIPTION

The XLamp® XN-P Color LED is a flexible, extreme high power multi-color LED platform, featuring excellent compatibility for existing 5.75 x 4.68 mm LED-based designs. Featuring more color combinations than competing LEDs of this type, XN-P Color LEDs enable many different luminaire optimizations, such as total lumen output, CCT tuning range and color rendering. XN-P Color LEDs enable easy design-in to existing 5.75 x 4.68 mm designs with the same footprint, same LES and same optical profile.

XLamp XN-P Color LEDs are optimized for color-changing lighting applications where maximum intensity and impact are required, such as entertainment moving head, architectural spot and machine vision.

### FEATURES

- Available in red, green, blue and either white, lime, or amber in a single package
- Maximum continuous drive current per LED die: 3 A
- Individually addressable LEDs
- Reflow solderable – JEDEC J-STD-020
- Electrically neutral thermal path

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## CHARACTERISTICS - COMPLETE PACKAGE

The following table lists the product characteristics for the XLamp XN-P Color LED package, measured with all LED dies on simultaneously and each LED die connected to independent drive circuits at 1000 mA.

Characteristics	Unit	Minimum	Typical	Maximum
Thermal resistance, junction to solder point	°C/W		0.7	
Viewing angle (FWHM)	degrees (°)		120	
ESD withstand voltage (HBM per Mil-Std-883D)			Class 3B	
LED junction temperature	°C			150

## CHARACTERISTICS - PER LED DIE

The following table lists the product characteristics for each LED die within the XLamp XN-P Color LED package.

Characteristics	Unit	Minimum	Typical	Maximum
Temperature coefficient of voltage - red	mV/°C		-1.87	
Temperature coefficient of voltage - green	mV/°C		-1.13	
Temperature coefficient of voltage - PC lime, PC amber, royal blue, white	mV/°C		-1.30	
DC forward current - single color	mA			3000
Forward voltage (@ 1000 mA, 25 °C) - red	V		2.3	
Forward voltage (@ 1000 mA, 25 °C) - green	V		2.9	
Forward voltage (@ 1000 mA, 25 °C) - PC lime, PC amber, royal blue, white	V		3.2	

FLUX CHARACTERISTICS ( $T_J = 25\text{ }^{\circ}\text{C}$ )

The following table provides several base order codes for XN-P Color LEDs. For a complete description of the order code nomenclature, please refer to the Bin and Order Code Formats section (page 14).

Color		Chromaticity Bins / Dominant Wavelength Range		Minimum Luminous/ Radiant Flux @ 1 A		Typical Luminous/ Radiant Flux @ 1 A	Order Code
		Minimum	Maximum	Group	Flux	Flux	
Color + Cool White	Red	620 nm	630 nm	C3	125 lm	140 lm	XNPACL-H0-0000-00000C3AAASQ XNPACL-H0-0000-00000C3AAAS1 XNPACL-H0-0000-00000C3AAAS7
	Green	520 nm	535 nm		300 lm	330 lm	
	Royal Blue	450 nm	465 nm		1400 mW*	1550 mW*	
	Cool White	SQ, S1, S7			350 lm	370 lm	
Color + Neutral White	Red	620 nm	630 nm	C2	125 lm	140 lm	XNPACL-H0-0000-0000HC2AAAE5 XNPACL-H0-0000-0000HC2AAA5G
	Green	520 nm	535 nm		300 lm	330 lm	
	Royal Blue	450 nm	465 nm		1400 mW*	1550 mW*	
	Neutral White	E5, 5G			300 lm	330 lm	
Color + PC Lime	Red	620 nm	630 nm	CP	125 lm	140 lm	XNPAPL-H0-0000-00000CPAAALA
	Green	520 nm	535 nm		300 lm	330 lm	
	Royal Blue	450 nm	465 nm		1400 mW*	1550 mW*	
	PC Lime	L3, L4			380 lm	450	
Color + PC Amber	Red	620 nm	630 nm	CM	125 lm	140 lm	XNPAPA-H0-0000-00000CMAAAYS
	Green	520 nm	535 nm		300 lm	330 lm	
	Royal Blue	450 nm	465 nm		1400 mW*	1550 mW*	
	PC Amber	YS			200 lm	225	

\* Radiant flux for Royal Blue: mW

## Notes:

- XLamp XN-P Color 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. Cree LED may ship reels with higher flux than listed above Bin Code tables unless specified. Shipments will always adhere to the chromaticity or DWL bin restrictions specified by the order code.
- Cree LED maintains a tolerance of  $\pm 7\%$  on flux and power measurements,  $\pm 0.005$  on chromaticity (CCx, CCy) measurements and  $\pm 1$  nm on dominant wavelength measurements. See the Measurements section (page 16).
- Flux and chromaticity are measured with each LED die connected to independent drive circuits at 1000 mA. The flux and chromaticity of each LED die within the XLamp XN-P Color LED package are measured individually.

FLUX CHARACTERISTICS ( $T_J = 25\text{ }^{\circ}\text{C}$ ) - CONTINUED

## Red

Bin Code	Minimum Flux (lm)	Maximum Flux (lm)
B	125	160
C	160	200

## Green

Bin Code	Minimum Flux (lm)	Maximum Flux (lm)
F	300	370
G	370	460

## Royal Blue

Bin Code	Minimum Flux (mW)	Maximum Flux (mW)
K	1400	1750
L	1750	2200

## White

Bin Code	Minimum Flux (lm)	Maximum Flux (lm)
2	300	350
3	350	430
4	430	540

## PC Lime

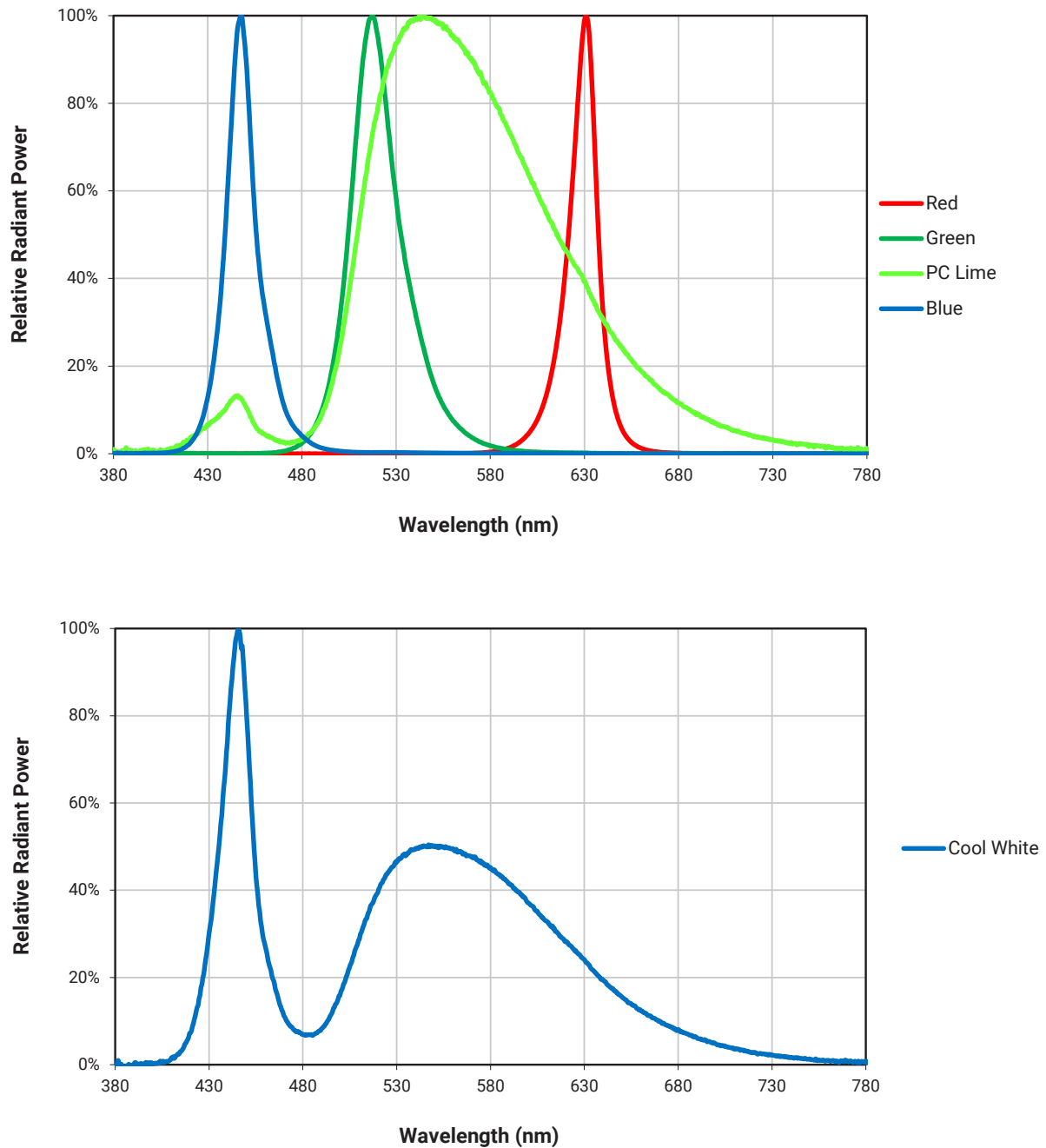
Bin Code	Minimum Flux (lm)	Maximum Flux (lm)
P	380	430
Q	430	540

## PC Amber

Bin Code	Minimum Flux (lm)	Maximum Flux (lm)
M	200	310
N	310	380

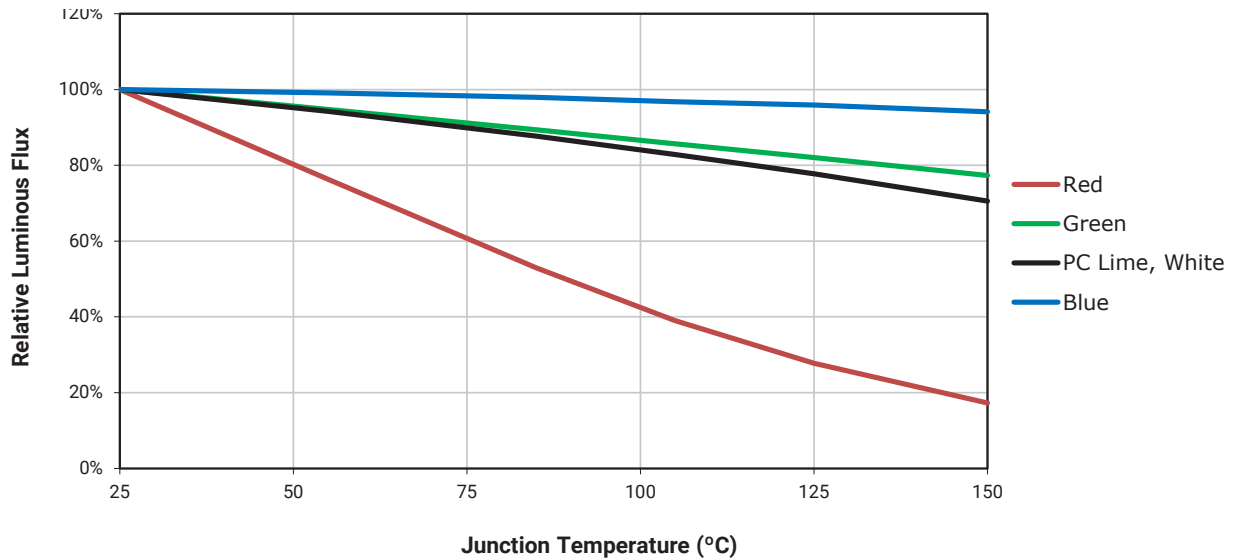
**RELATIVE SPECTRAL POWER DISTRIBUTION ( $I_F = 1000$  mA PER LED DIE, 25 °C)**

The following graphs represent typical spectral output of the XLamp XN-P Color LED with each LED die on independently.



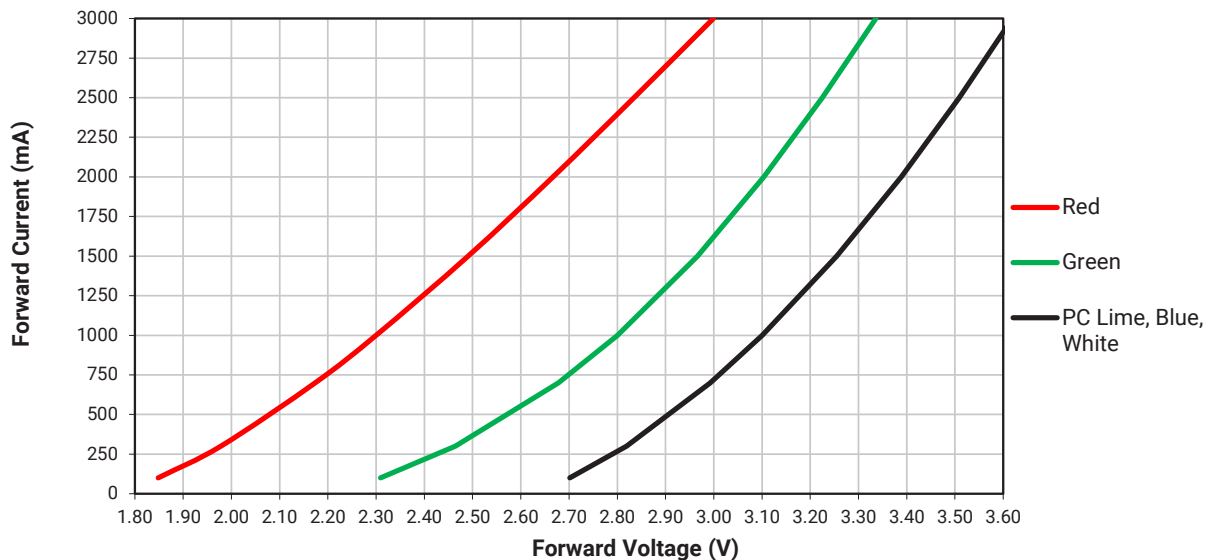
## RELATIVE FLUX VS JUNCTION TEMPERATURE ( $I_F = 1000 \text{ mA}$ )

The following graph represents typical performance of each LED die in the XLamp XN-P Color LED.



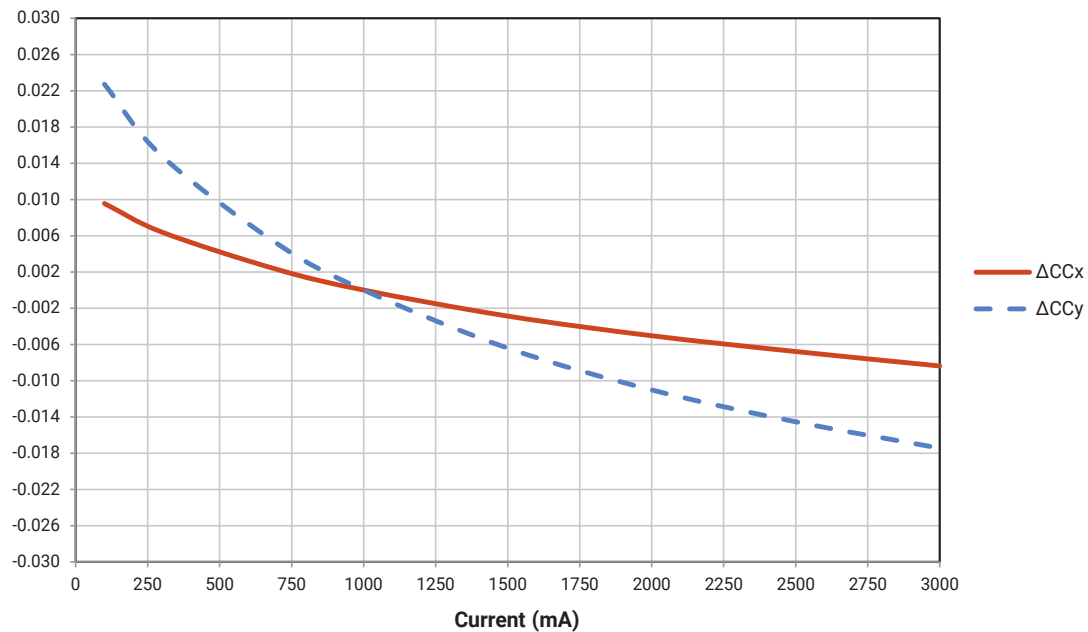
## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ \text{C}$ )

The following graph represents typical performance of each LED die in the XLamp XN-P Color LED.

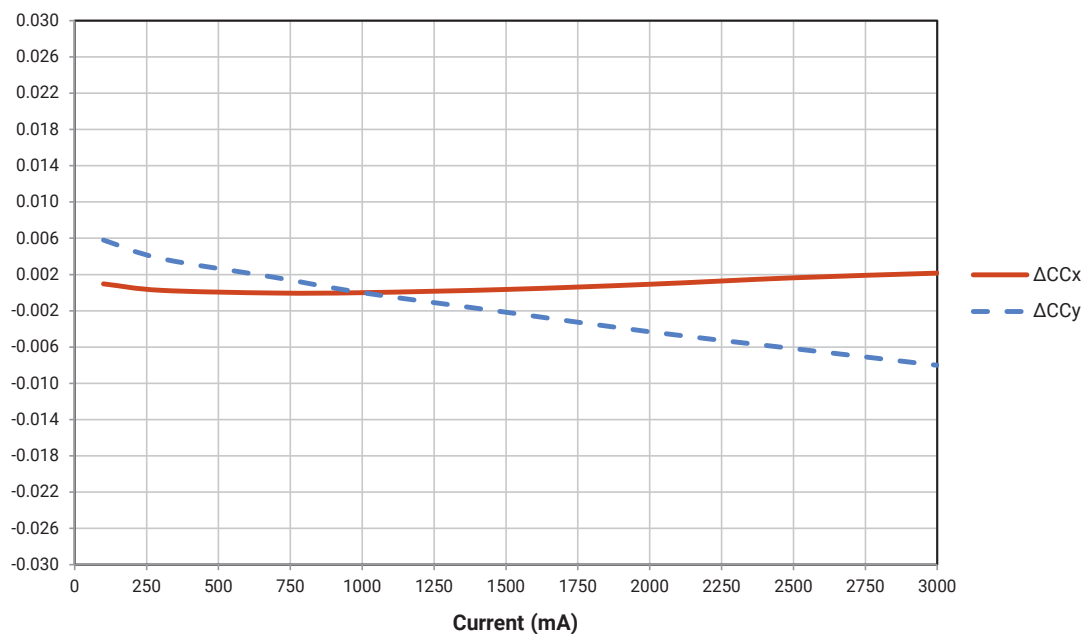


## RELATIVE CHROMATICITY VS. CURRENT

## Cool White

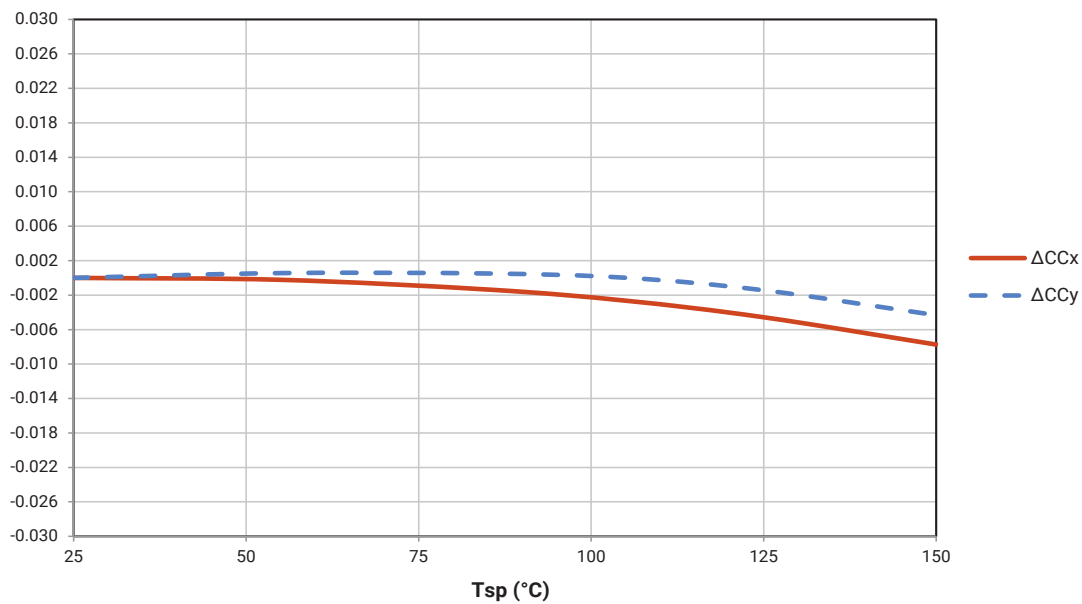


## PC Lime

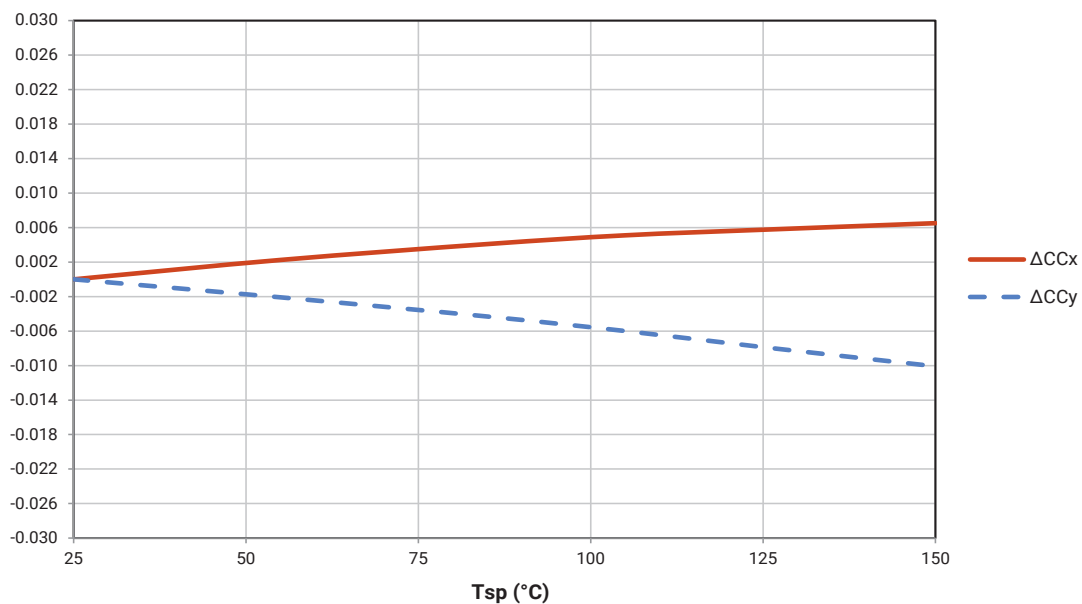


## RELATIVE CHROMATICITY VS. TEMPERATURE

## Cool White



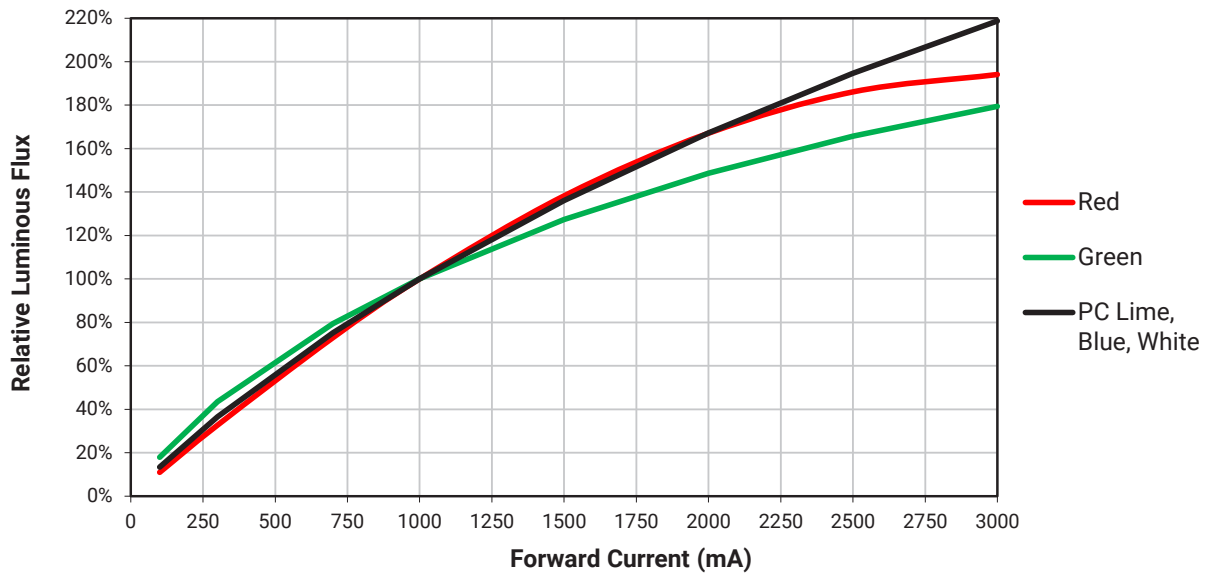
## PC Lime





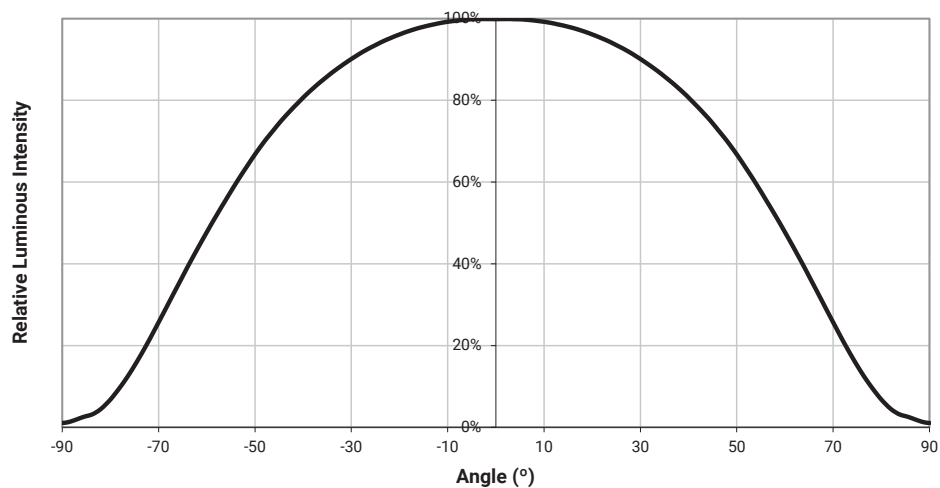
## RELATIVE FLUX VS. CURRENT ( $T_j = 25^\circ\text{C}$ )

The following graph represents typical performance of each LED die in the XLamp XN-P Color LED.



## TYPICAL SPATIAL DISTRIBUTION

The following graph represents typical output of the XLamp XN-P Color LED with all four LEDs on simultaneously.



## PERFORMANCE GROUPS - DOMINANT WAVELENGTH

XLamp XN-P Color LEDs are tested for dominant wavelength (DWL) and placed into one of the regions defined by the following bounding coordinates.

### Red

Bin Code	Minimum DWL (nm)	Maximum DWL (nm)
A	620	625
B	625	630

### Green

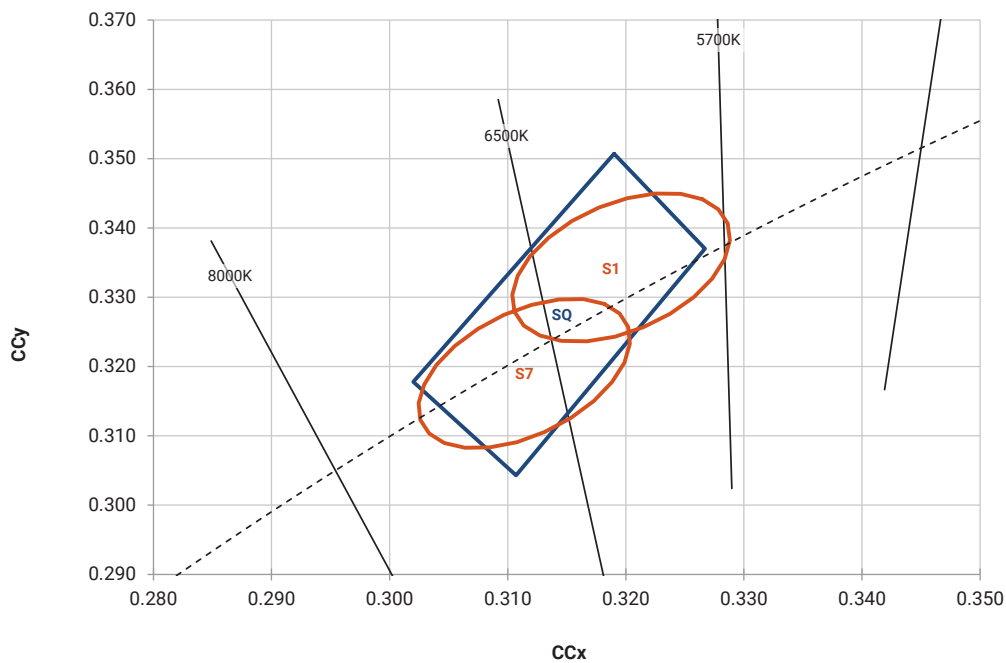
Bin Code	Minimum DWL (nm)	Maximum DWL (nm)
2	520	525
3	525	530
4	530	535

### Royal Blue

Bin Code	Minimum DWL (nm)	Maximum DWL (nm)
K	450	455
L	455	460
M	460	465

## PERFORMANCE GROUPS - CHROMATICITY

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

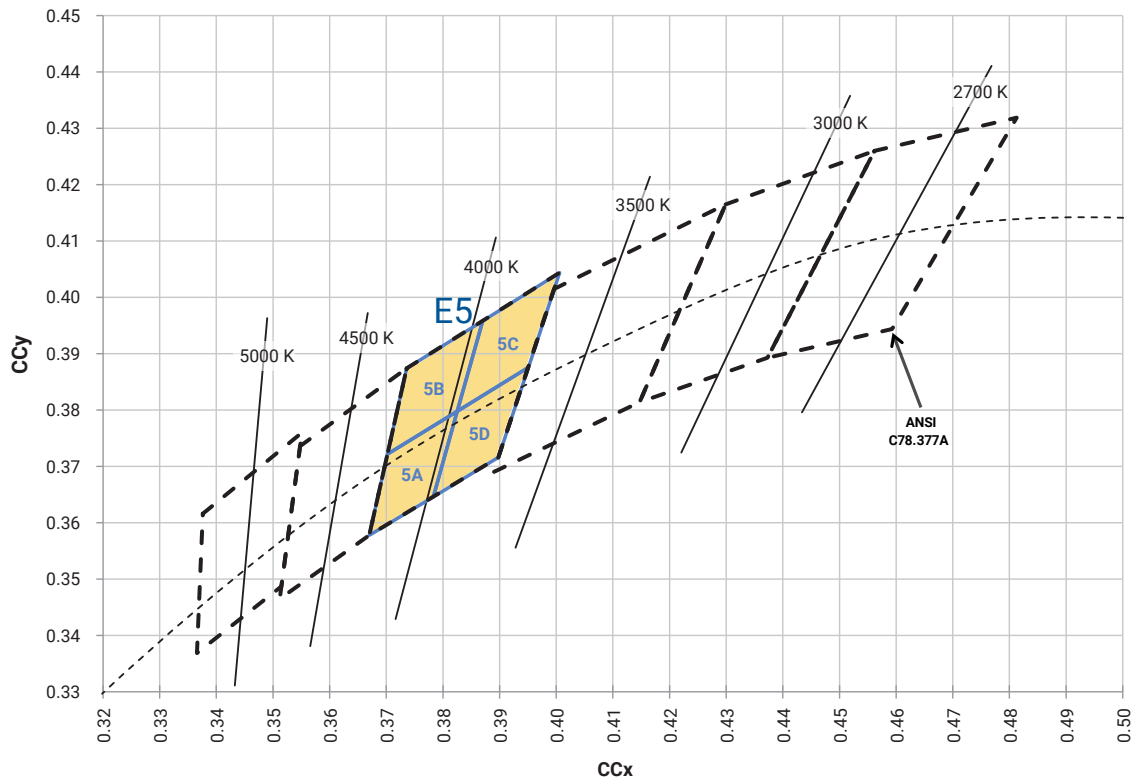


Chromaticity Bin	CCx	CCy
SQ	0.3190	0.3507
	0.3267	0.3370
	0.3107	0.3043
	0.3020	0.3178

Bin Code	CCT	Center Point		Major Axis	Minor Axis	Rotation Angle (°)
		x	y	a	b	
S1	6100 K	0.3196	0.3343	0.012	0.0075	54.7
S7	6700 K	0.3114	0.319	0.0121	0.0071	56.0

## PERFORMANCE GROUPS - CHROMATICITY (CONTINUED)

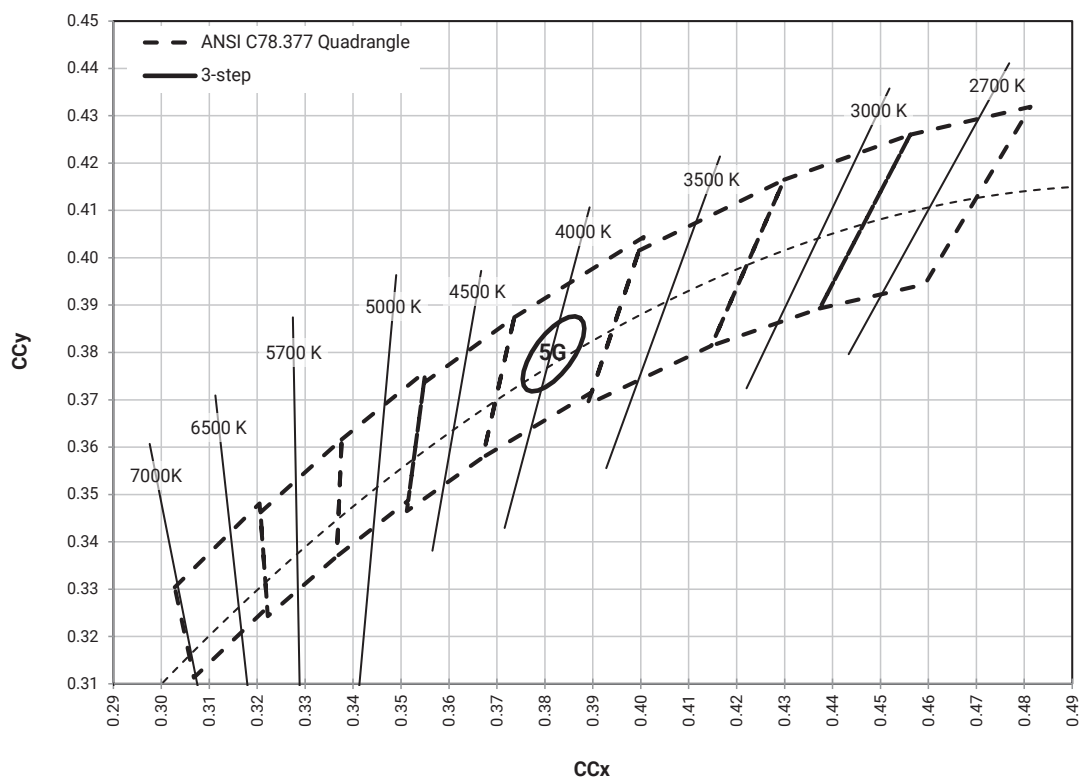
XLamp XN-P white LEDs are tested for chromaticity and placed into one of the regions defined by the following bounding coordinates.



Region	x	y	Region	x	y	Region	x	y	Region	x	y
5A	.3670	.3578	5B	.3702	.3722	5C	.3825	.3798	5D	.3783	.3646
	.3702	.3722		.3736	.3874		.3869	.3958		.3825	.3798
	.3825	.3798		.3869	.3958		.4006	.4044		.3950	.3875
	.3783	.3646		.3825	.3798		.3950	.3875		.3898	.3716

## PERFORMANCE GROUPS - CHROMATICITY (CONTINUED)

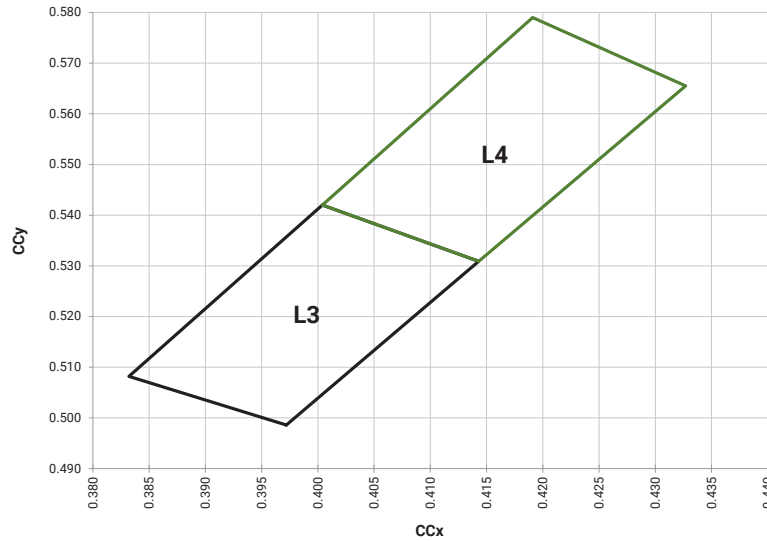
XLamp XN-P white LEDs are tested for chromaticity and placed into one of the regions defined by the following bounding coordinates.



Bin Code	CCT	Center Point		Major Axis	Minor Axis	Rotation Angle (°)
		x	y	a	b	
5G	4000 K	0.3818	0.3797	0.00939	0.00402	53.7

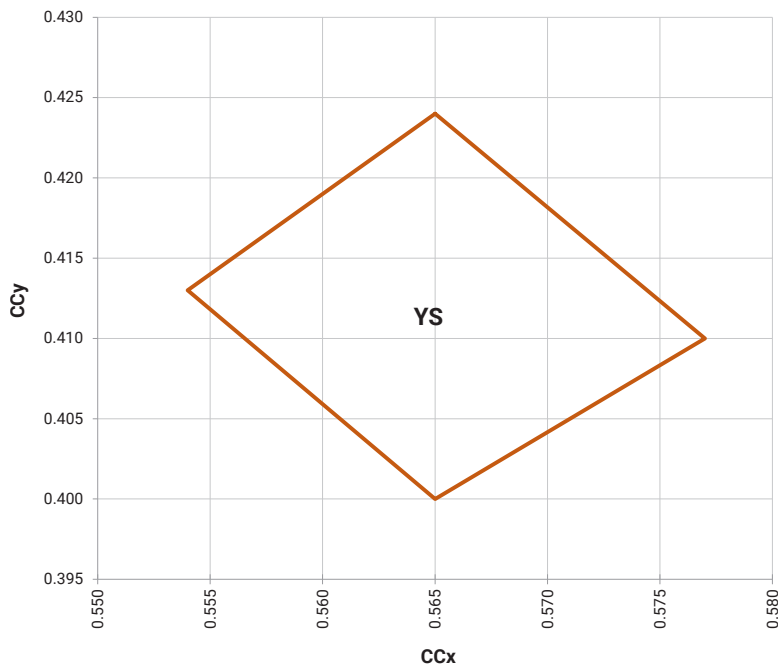
## PERFORMANCE GROUPS - CHROMATICITY (CONTINUED)

XLamp XN-P PC lime LEDs are tested for chromaticity and placed into one of the regions defined by the following bounding coordinates.



Chromaticity Bin	CCx	CCy
L3	0.3972	0.4986
	0.3832	0.5082
	0.4004	0.5420
	0.4143	0.5309
L4	0.4004	0.5420
	0.4143	0.5309
	0.4327	0.5655
	0.4191	0.5790

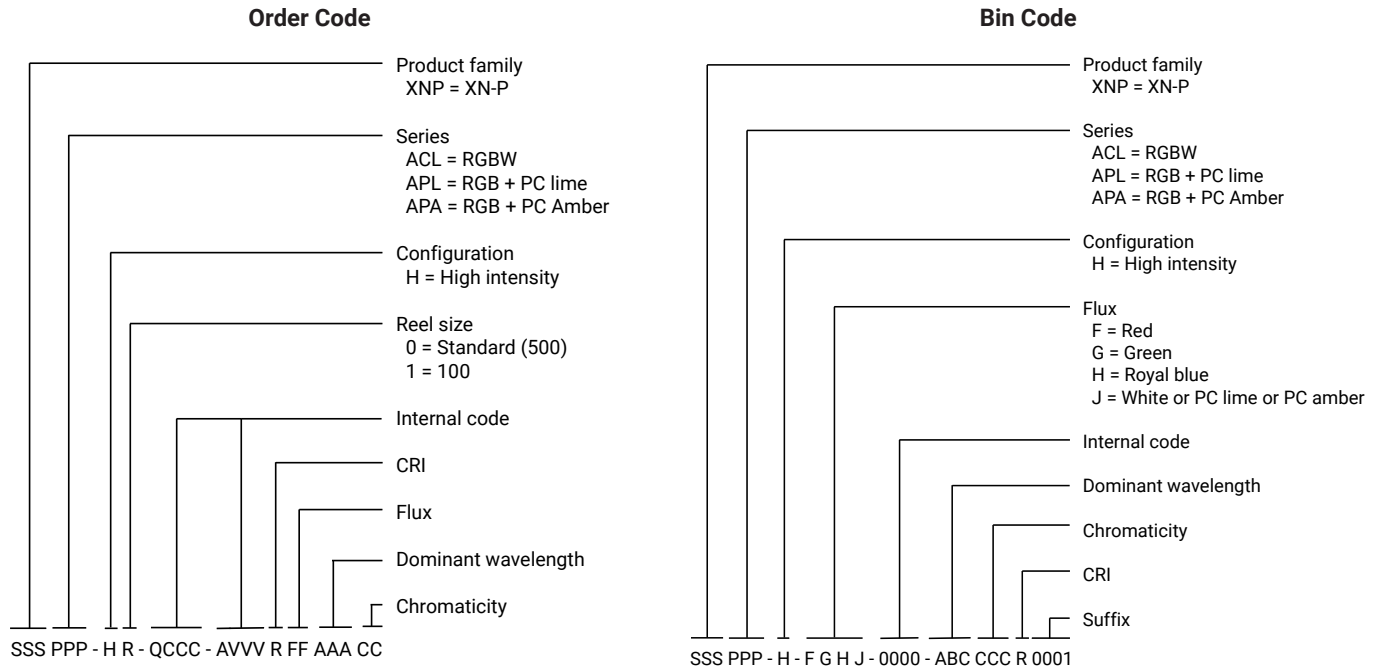
XLamp XN-P PC amber LEDs are tested for chromaticity and placed into one of the regions defined by the following bounding coordinates.



Chromaticity Bin	CCx	CCy
YS	0.5650	0.4240
	0.5770	0.4100
	0.5650	0.4000
	0.5540	0.4130

## BIN AND ORDER CODE FORMATS

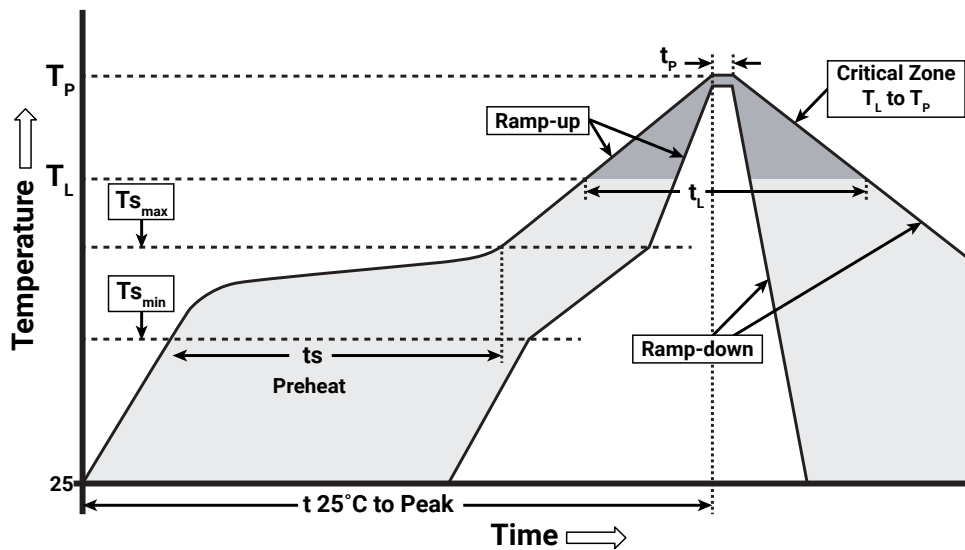
Bin codes and order codes for XN-P LEDs are configured in the following manner:



## REFLOW SOLDERING CHARACTERISTICS

In testing, Cree LED has found XLamp XN-P Color 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 ( $Ts_{max}$ to $T_p$ )	1.2 °C/second
Preheat: Temperature Min ( $Ts_{min}$ )	120 °C
Preheat: Temperature Max ( $Ts_{max}$ )	170 °C
Preheat: Time ( $ts_{min}$ to $ts_{max}$ )	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 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.

### 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 XN-P Color 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 the storage condition, Cree LED recommends sealing any unsoldered LEDs in the original MBP.

### Vented LED

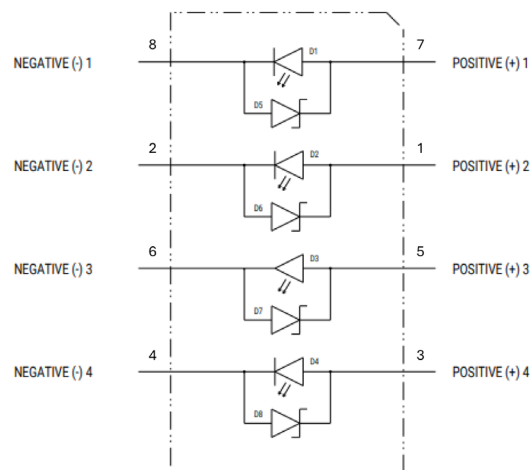
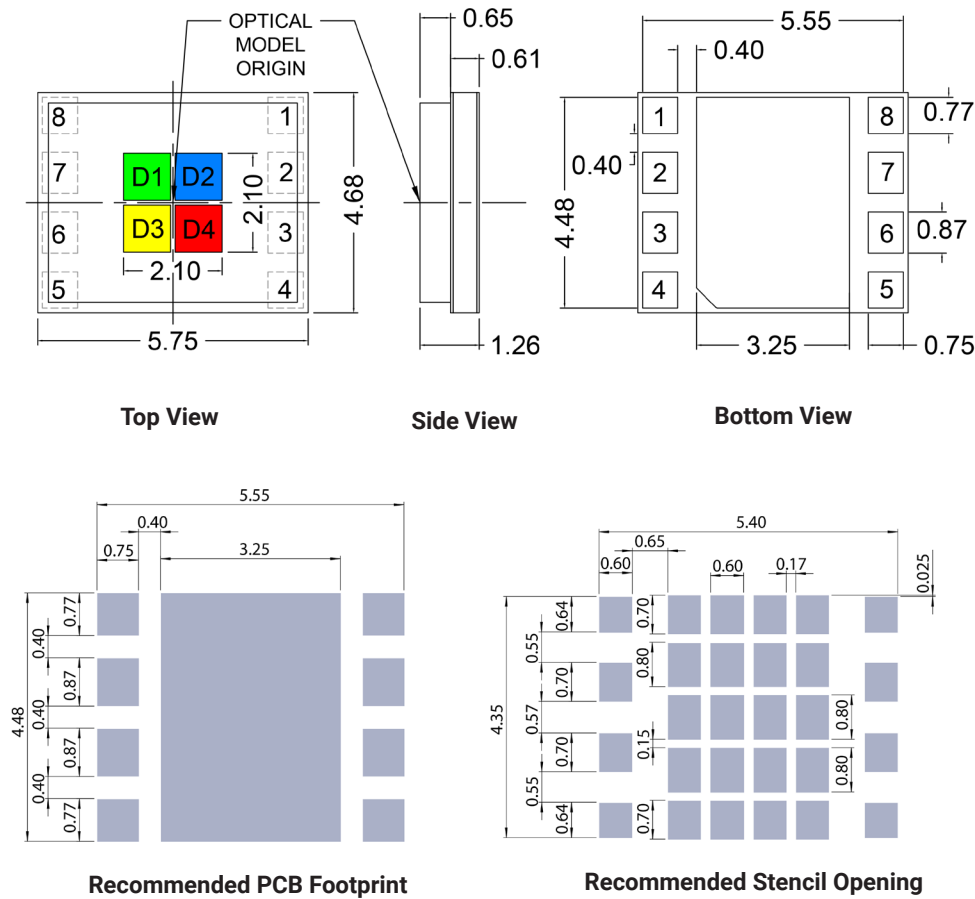
The XN-P Color LED is vented. Keep liquids away from the LED so that liquids do not wick inside and affect the die.



## MECHANICAL DIMENSIONS

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

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



### Color

D1: Green

D2: Blue

D3: White, PC Lime, PC Amber

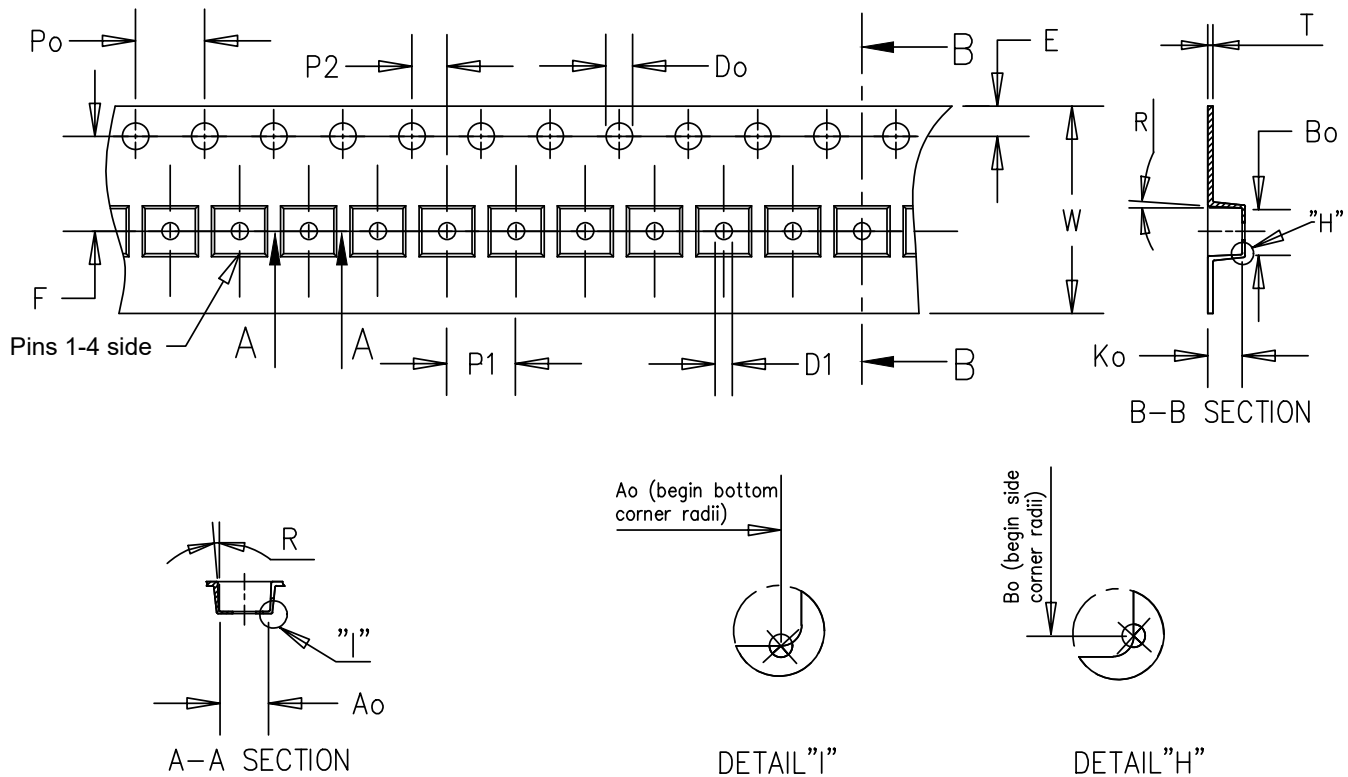
D4: Red

## TAPE AND REEL

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

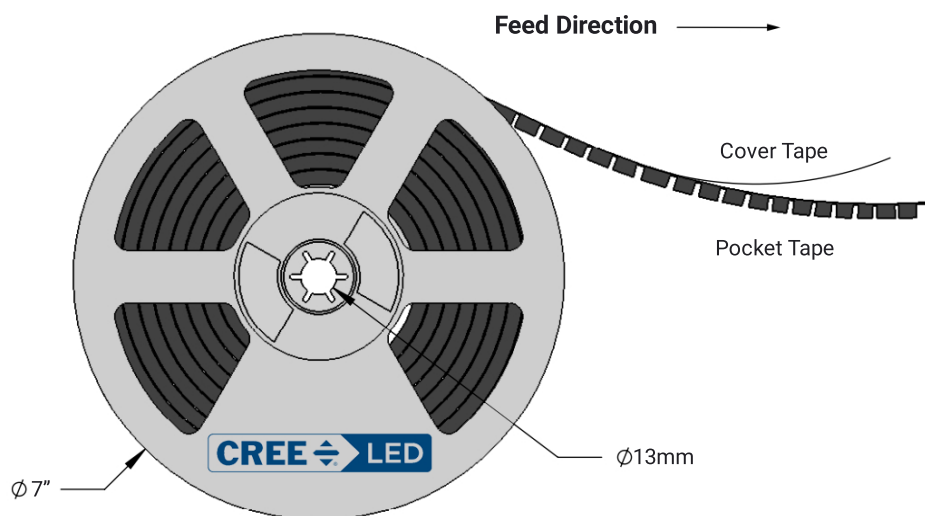
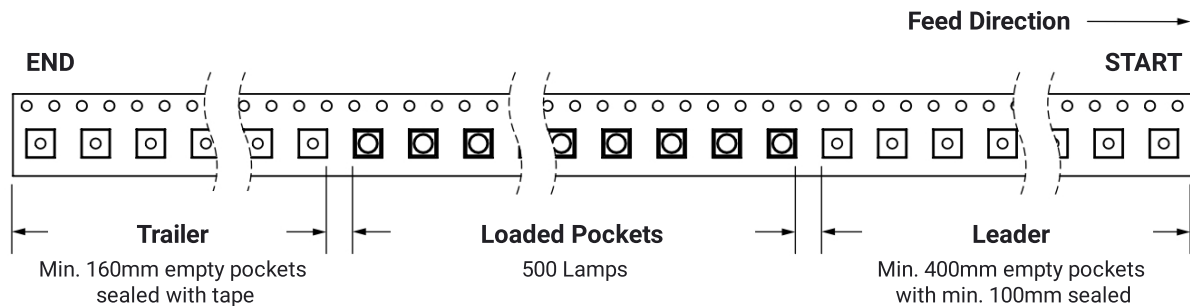
All dimensions in mm.

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



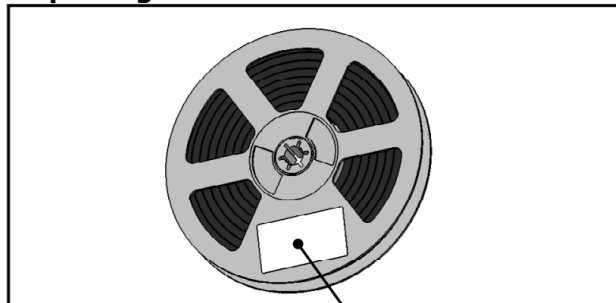
Item	$Ao$	$Bo$	$Ko$	$Po$	$P1$	$P2$	$T$	$E$	$F$	$Do$	$D1$	$W$	$R$
Dim.	4.96	6.05	1.60	4.00	12.00	2.00	0.30	1.75	7.50	1.50	1.50	16.00	3°

## TAPE AND REEL - CONTINUED



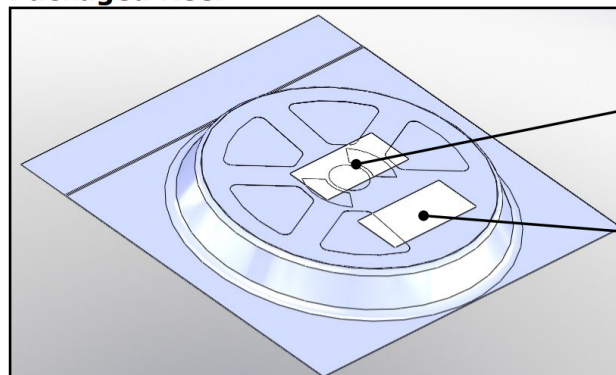
## PACKAGING

## Unpackaged Reel



Label with Cree LED Bin Code, Quantity, Reel ID

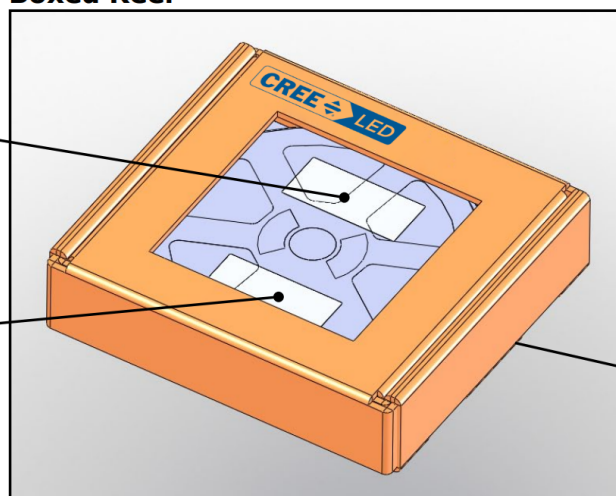
## Packaged Reel



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)