## XLamp<sup>®</sup> XN-P Color LEDs



**XN-P RGBW** 

#### **PRODUCT DESCRIPTION**

The XLamp<sup>®</sup> XN-P Color LED is a • Available in red, green, blue and either flexible, extreme high power multicolor LED platform, featuring excellent · Maximum continuous drive current per compatibility for existing 5.75 x 4.68 mm LED-based designs. Featuring more color · Individually addressable LEDs combinations than competing LEDs of . Reflow solderable - JEDEC J-STD-020 this type, XN-P Color LEDs enable many · Electrically neutral thermal path different luminaire optimizations, such as . RoHS and REACH compliant total lumen output, CCT tuning range and • UL® recognized component (E349212) 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.



XN-P RGB + PC Lime

#### **FEATURES**

- white, lime, or amber in a single package
- LED die: 3 A



XN-P RGB + PC Amber

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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 - blue, PC lime, PC amber, white	mV/°C		-1.30	
DC forward current - single color	mA			3000
Forward voltage (@ 1000 mA, 25 °C) - red	V		2.3	2.8
Forward voltage (@ 1000 mA, 25 °C) - green	V		2.8	3.2
Forward voltage (@ 1000 mA, 25 °C) - blue, PC lime, PC amber, white	V		3.1	3.4

### FLUX CHARACTERISTICS (T<sub>J</sub> = 25 °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 16).

Color		Chromaticity E Waveleng	Bins / Dominant gth Range	Minimum Luminous/ Radiant Flux @ 1 A		Typical Luminous/ Radiant Flux @ 1 A	Order Code	
		Minimum	Maximum	Group	Flux	Flux		
	Red	620 nm	630 nm		125 lm	140 lm		
Color +	Green	520 nm	535 nm	00	300 lm	330 lm	XNPACL-H0-0000-00000C3AAASQ	
Cool White	Blue	450 nm	465 nm	63	1400 mW*	1550 mW*	XNPACL-H0-0000-00000C3AAAS1 XNPACL-H0-0000-00000C3AAAS7	
	Cool White	SQ, S	S1, S7		350 lm	370 lm		
	Red	620 nm	630 nm		125 lm	140 lm		
Color + Neutral White	Green	520 nm	535 nm	C2	300 lm	330 lm	XNPACL-H0-0000-0000HC2AAAE5	
	Blue	450 nm	465 nm	62	1400 mW*	1550 mW*	XNPACL-H0-0000-0000HC2AAA5G	
	Neutral White	E5,	5G		300 lm	330 lm		
	Red	620 nm	630 nm		125 lm	140 lm		
Color +	Green	520 nm	535 nm	CD	300 lm	330 lm		
PC Lime	Blue	450 nm	465 nm	GF	1400 mW*	1550 mW*	XNFAFL-H0-0000-00000CFAAALA	
	PC Lime	L3,	, L4		380 lm	450		
	Red	620 nm	630 nm		125 lm	140 lm		
Color +	Green	520 nm	535 nm	CM	300 lm	330 lm		
PC Amber	Blue	450 nm	465 nm	Civi	1400 mW*	1550 mW*		
	PC Amber	Y	'S		200 lm	225		

\* Radiant flux for 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 ±7% on flux and power measurements, ±0.005 on chromaticity (CCx, CCy) measurements and ±1 nm on dominant wavelength measurements. See the Measurements section (page 18).
- 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<sub>J</sub> = 25 °C) - CONTINUED

Red							
Bin Code	Minimum Flux (lm)	Maximum Flux (Im)					
В	125	160					
С	160	200					

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

## Blue

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

#### White

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

PC Lime								
Bin Code	Minimum Flux (lm)	Maximum Flux (Im)						
Р	380	430						
Q	430	540						

#### **PC Amber**

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

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## 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<sub>F</sub> = 1000 mA)**



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

### **ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25 °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 versus Current and Temperature are shown for reference only.

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#### **RELATIVE CHROMATICITY VS. CURRENT - CONTINUED**





#### **RELATIVE CHROMATICITY VS. TEMPERATURE**



**Cool White** 

· Relative Chromaticity versus Current and Temperature are shown for reference only.



#### **RELATIVE CHROMATICITY VS. TEMPERATURE - CONTINUED**

PC Lime



#### **PC Amber**

•



Relative Chromaticity versus Current and Temperature are shown for reference only.



#### **RELATIVE DOMINANT WAVELENGTH VS. CURRENT**



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

#### **RELATIVE DOMINANT WAVELENGTH VS. TEMPERATURE**

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



Relative Dominant Wavelength versus Current and Temperature are shown for reference only.



### **RELATIVE FLUX VS. CURRENT (T<sub>J</sub> = 25 °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				Green			Blue		
	Bin Code	Minimum DWL (nm)	Maximum DWL (nm)	Bin Code	Minimum DWL (nm)	Maximum DWL (nm)	Bin Code	Minimum DWL (nm)	Maximum DWL (nm)
	А	620	625	2	520	525	к	450	455
	В	625	630	3	525	530	L	455	460
				4	530	535	М	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	ССх	ССу
SQ	0.3190	0.3507
	0.3267	0.3370
	0.3107	0.3043
	0.3020	0.3178

Bin Code	ССТ	Center	r Point	Major Axis	Minor Axis	Rotation Angle	
		x	у	а	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	У									
	.3670	.3578	5B	.3702	.3722	5C	.3825	.3798	5D	.3783	.3646
5A	.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.

0	$\mathbf{n}$
C	υx

Bin Code	сст	Cente	r Point	Major Axis	Minor Axis	Rotation Angle	
		x	У	а	b	(°)	
5G	4000 K	0.3818	0.3797	0.00939	0.00402	53.7	



#### **PERFORMANCE GROUPS - CHROMATICITY (CONTINUED)**



Chromaticity Bin	ССх	ССу
	0.3972	0.4986
1.2	0.3832	0.5082
LS	0.4004	0.5420
	0.4143	0.5309
	0.4004	0.5420
1.4	0.4143	0.5309
L4	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	ССх	ССу		
	0.5650	0.4240		
Ve	0.5770	0.4100		
15	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 <sub>min</sub> )	120 °C
Preheat: Temperature Max (Ts <sub>max</sub> )	170 °C
Preheat: Time (ts <sub>min</sub> to ts <sub>max</sub> )	65-150 seconds
Time Maintained Above: Temperature $(T_{L})$	217 °C
Time Maintained Above: Time $(t_L)$	45-90 seconds
Peak/Classification Temperature (Tp)	235 - 245 °C
Time Within 5 °C of Actual Peak Temperature (tp)	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**

#### 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.

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

#### 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.



**Top View** 





**Bottom View** 

All measurements are ±.13 mm unless otherwise indicated.



**Recommended PCB Footprint** 



**Recommended Stencil Opening** 



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 ±0.15 mm unless otherwise indicated.









DETAIL"I"

DETAIL"H"

ltem	Ao	Во	Ko	Po	P1	P2	Т	E	F	Do	D1	W	R
Dimension	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

