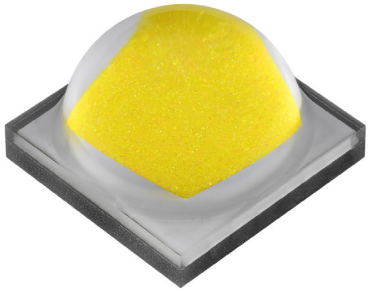
PRELIMINARY

XLamp® XP-GP LEDs



PRODUCT DESCRIPTION

XLamp® XP-G Prime LEDs are optimized for directional, high lumen lighting applications where efficacy and optical control are critical, such as roadway, industrial, and portable applications. The compact and proven 3.45 mm XP platform has an excellent ecosystem of optics and system solutions available, enabling lighting manufacturers to simplify their design process and shorten time to market.

With the same mechanical dimensions as the XP-G family, XP-G Prime is an easy drop-in for many high power LED designs. XP-G Prime provides higher efficacy and lumen output than competing high power LEDs.

FEATURES

- Available in 70-, 80- and 90-CRI white
- ANSI-compatible chromaticity bins
- 3-step and 5-step options
- Binned at 85 °C
- Maximum drive current: 2000 mA
- Low thermal resistance: 1.6 °C/W
- Wide 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)

Cree LED / 4001 E. Hwy. 54, Suite 2000 / Durham, NC 27713 USA / +1.919.313.5330 / www.cree-led.com

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CHARACTERISTICS

Characteristics	Unit	Minimum	Typical	Maximum
Thermal resistance, junction to solder point◊	°C/W		1.6	
Viewing angle (FWHM)	degrees		120	
Temperature coefficient of voltage	mV/°C		-1.3	
ESD withstand voltage (HBM per Mil-Std-883D)			Class 3B	
DC forward current	mA			2000
Forward voltage (@ 700 mA, 85 °C)	V		2.9	3.2
Reverse Voltage	V			-5
LED Junction Temperature	°C			150

Note:

◊ Thermal resistance measurement was performed per the JEDEC JESD51-14 standard. See the Thermal Resistance Measurement application note for more details.

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FLUX CHARACTERISTICS (T_J = 85 °C)

The following table provides order codes for XLamp XP-GP Standard LEDs. For a complete description of the order code nomenclature, please see the Bin and Order Code Formats section (page 15).

Chromaticity		Minimum Luminous Flux (lm) @ 700 mA					
Kit	CCT	Code	Flux (lm) @ 85 °C	Flux (lm) @25 °C*	70 CRI Minimum	80 CRI Minimum	90 CRI Minimum
1E	6500 K	D3	370	403	XPGPWT-01-0000-00000BT1E		
		D2	360	393	XPGPWT-01-0000-00000BS1E		
		D1	350	382			
		C5	340	371		XPGPWT-01-0000-00000HQ1E	
		C4	330	360		XPGPWT-01-0000-00000HP1E	
		C3	320	349			
		C2	310	338			
		C1	300	327			XPGPWT-01-0000-00000UL1E
		B5	290	316			XPGPWT-01-0000-00000UK1E
2E	5700 K	D3	370	403	XPGPWT-01-0000-00000BT2E		
		D2	360	393	XPGPWT-01-0000-00000BS2E		
		D1	350	382			
		C5	340	371		XPGPWT-01-0000-00000HQ2E	
		C4	330	360		XPGPWT-01-0000-00000HP2E	
		C3	320	349			
		C2	310	338			
		C1	300	327			XPGPWT-01-0000-00000UL2E
		B5	290	316			XPGPWT-01-0000-00000UK2E
3E	5000 K	D3	370	403	XPGPWT-01-0000-00000BT3E		
		D2	360	393	XPGPWT-01-0000-00000BS3E		
		D1	350	382			
		C5	340	371		XPGPWT-01-0000-00000HQ3E	
		C4	330	360		XPGPWT-01-0000-00000HP3E	
		C3	320	349			
		C2	310	338			
		C1	300	327			XPGPWT-01-0000-00000UL3E
		B5	290	316			XPGPWT-01-0000-00000UK3E

Notes

- Cree LED maintains a tolerance of ±7% on flux and power measurements, ±0.005 on chromaticity (CCx, CCy) measurements and a tolerance of ±2 on CRI measurements.
- XLamp 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. Shipments will always adhere to the chromaticity bin restrictions specified by the order code.

* Flux values @ 25 °C are calculated and for reference only.

PRELIMINARY

FLUX CHARACTERISTICS (T_J = 85 °C)

Chromaticity		Minimum Luminous Flux (lm) @ 700 mA					
Kit	CCT	Code	Flux (lm) @ 85 °C	Flux (lm) @25 °C*	70 CRI Minimum	80 CRI Minimum	90 CRI Minimum
4E	4500 K	D3	370	403	XPGPWT-01-0000-00000BT4E		
		D2	360	393	XPGPWT-01-0000-00000BS4E		
		D1	350	382			
		C5	340	371		XPGPWT-01-0000-00000HQ4E	
		C4	330	360		XPGPWT-01-0000-00000HP4E	
		C3	320	349			
		C2	310	338			
		C1	300	327			XPGPWT-01-0000-00000UL4E
		B5	290	316			XPGPWT-01-0000-00000UK4E
5E	4000 K	D3	370	403	XPGPWT-01-0000-00000BT5E		
		D2	360	393	XPGPWT-01-0000-00000BS5E		
		D1	350	382			
		C5	340	371		XPGPWT-01-0000-00000HQ5E	
		C4	330	360		XPGPWT-01-0000-00000HP5E	
		C3	320	349			
		C2	310	338			
		C1	300	327			XPGPWT-01-0000-00000UL5E
		B5	290	316			XPGPWT-01-0000-00000UK5E
5G	4000 K	C5	340	371		XPGPWT-01-0000-00000HQ5G	
		C4	330	360		XPGPWT-01-0000-00000HP5G	
		C3	320	349			
		C2	310	338			
		C1	300	327			XPGPWT-01-0000-00000UL5G
		B5	290	316			XPGPWT-01-0000-00000UK5G

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Kit	CCT	Code	Flux (lm) @ 85 °C	Flux (lm) @25 °C*	70 CRI Minimum	80 CRI Minimum	90 CRI Minimum
6E	3500 K	D2	360	393	XPGPWT-01-0000-00000BS6E		
		D1	350	382	XPGPWT-01-0000-00000BR6E		
		C5	340	371			
		C4	330	360			
		C3	320	349		XPGPWT-01-0000-00000HN6E	
		C2	310	338		XPGPWT-01-0000-00000HM6E	
		C1	300	327			
		B5	290	316			XPGPWT-01-0000-00000UK6E
		B4	280	305			XPGPWT-01-0000-00000UJ6E
6G	3500 K	C3	320	349		XPGPWT-01-0000-00000HN6G	
		C2	310	338		XPGPWT-01-0000-00000HM6G	
		C1	300	327			
		B5	290	316			XPGPWT-01-0000-00000UK6G
		B4	280	305			XPGPWT-01-0000-00000UJ6G

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Chromaticity		Minimum Luminous Flux (lm) @ 700 mA					
Kit	CCT	Code	Flux (lm) @ 85 °C	Flux (lm) @25 °C*	70 CRI Minimum	80 CRI Minimum	90 CRI Minimum
6G	3500 K	C3	320	349		XPGPWT-01-0000-00000HN6G	
		C2	310	338		XPGPWT-01-0000-00000HM6G	
		C1	300	327			
		B5	290	316			XPGPWT-01-0000-00000UK6G
		B4	280	305			XPGPWT-01-0000-00000UJ6G
7E	3000 K	D1	350	382	XPGPWT-01-0000-00000BR7E		
		C5	340	371	XPGPWT-01-0000-00000BQ7E		
		C4	330	360			
		C3	320	349		XPGPWT-01-0000-00000HN7E	
		C2	310	338		XPGPWT-01-0000-00000HM6E	
		C1	300	327			
		B5	290	316			
		B4	280	305			XPGPWT-01-0000-00000UJ7E
		B3	270	294			XPGPWT-01-0000-00000UH7E
7G	3000 K	C3	320	349		XPGPWT-01-0000-00000HN7G	
		C2	310	338		XPGPWT-01-0000-00000HM7G	
		C1	300	327			
		B5	290	316			
		B4	280	305			XPGPWT-01-0000-00000UJ7G
		B3	270	294			XPGPWT-01-0000-00000UH7G
8E	2700 K	C5	340	371	XPGPWT-01-0000-00000BQ8E		
		C4	330	360	XPGPWT-01-0000-00000BP8E		
		C3	320	349			
		C2	310	338			
		C1	300	327		XPGPWT-01-0000-00000HL8E	
		B5	290	316		XPGPWT-01-0000-00000HK8E	
		B4	280	305			
		B3	270	294			
		B2	260	284			XPGPWT-01-0000-00000UG8E
		B1	250	273			XPGPWT-01-0000-00000UF8E

Notes

- Cree LED maintains a tolerance of ±7% on flux and power measurements, ±0.005 on chromaticity (CCx, CCy) measurements and a tolerance of ±2 on CRI measurements.
- XLamp 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. Shipments will always adhere to the chromaticity bin restrictions specified by the order code.

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FLUX CHARACTERISTICS (T_J = 85 °C)

Chromaticity		Minimum Luminous Flux (lm) @ 700 mA					
Kit	CCT	Code	Flux (lm) @ 85 °C	Flux (lm) @25 °C*	70 CRI Minimum	80 CRI Minimum	90 CRI Minimum
8G	2700 K	C1	300	327		XPGPWT-01-0000-00000HL8G	
		B5	290	316		XPGPWT-01-0000-00000HK8G	
		B4	280	305			
		B3	270	294			
		B2	260	284			XPGPWT-01-0000-00000UG8E
		B1	250	273			XPGPWT-01-0000-00000UF8E

Notes

- Cree LED maintains a tolerance of ±7% on flux and power measurements, ±0.005 on chromaticity (CCx, CCy) measurements and a tolerance of ±2 on CRI measurements.
- XLamp 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. Shipments will always adhere to the chromaticity bin restrictions specified by the order code.

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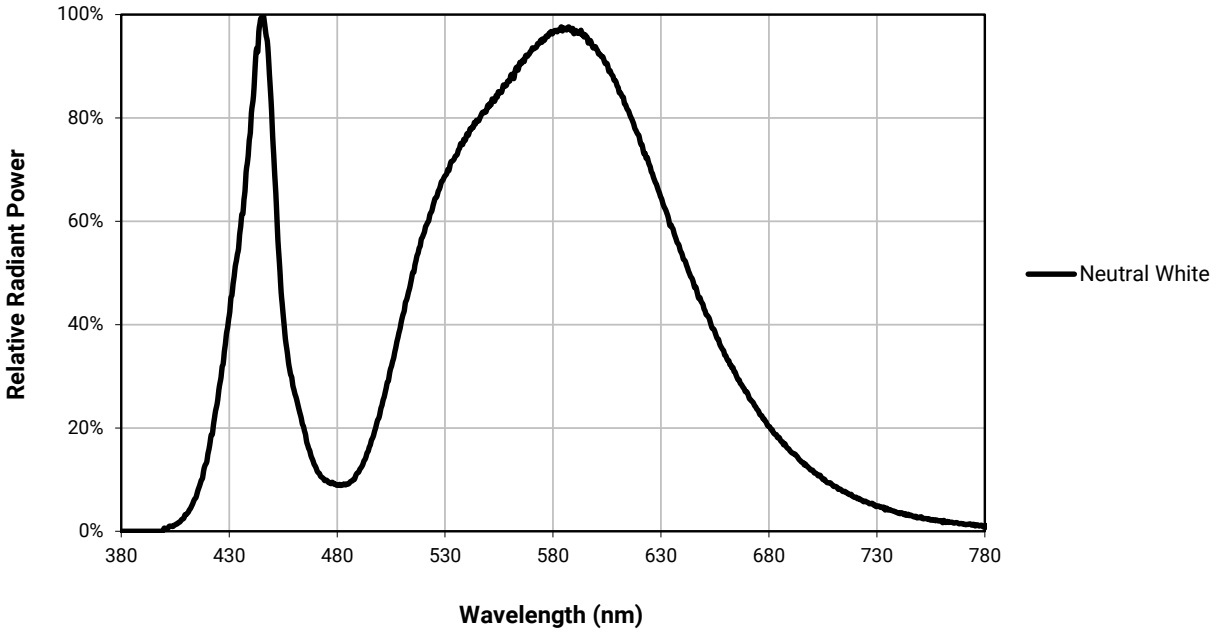
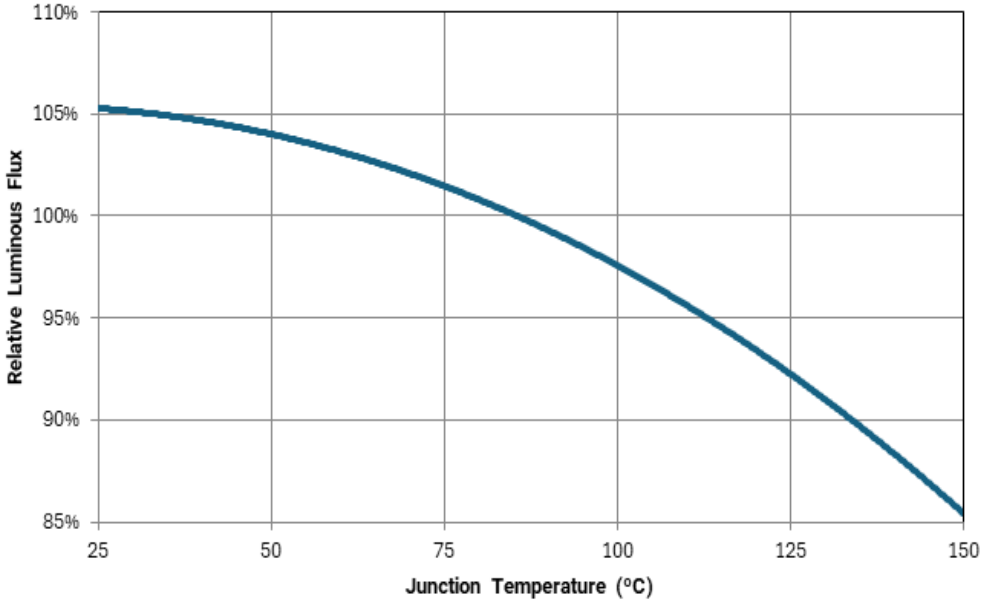
PRELIMINARY

RELATIVE SPECTRAL POWER DISTRIBUTION

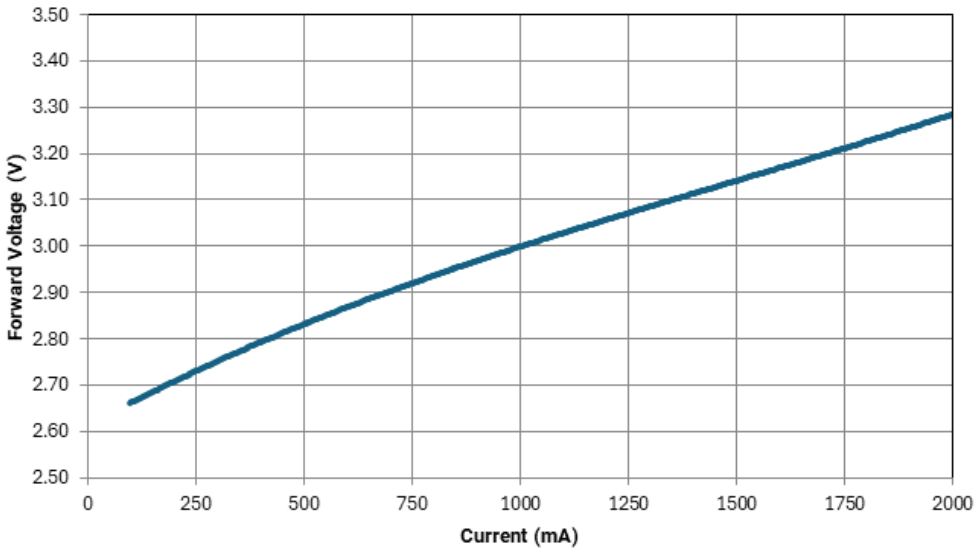


RELATIVE FLUX VS. JUNCTION TEMPERATURE (I_F = 700 mA)

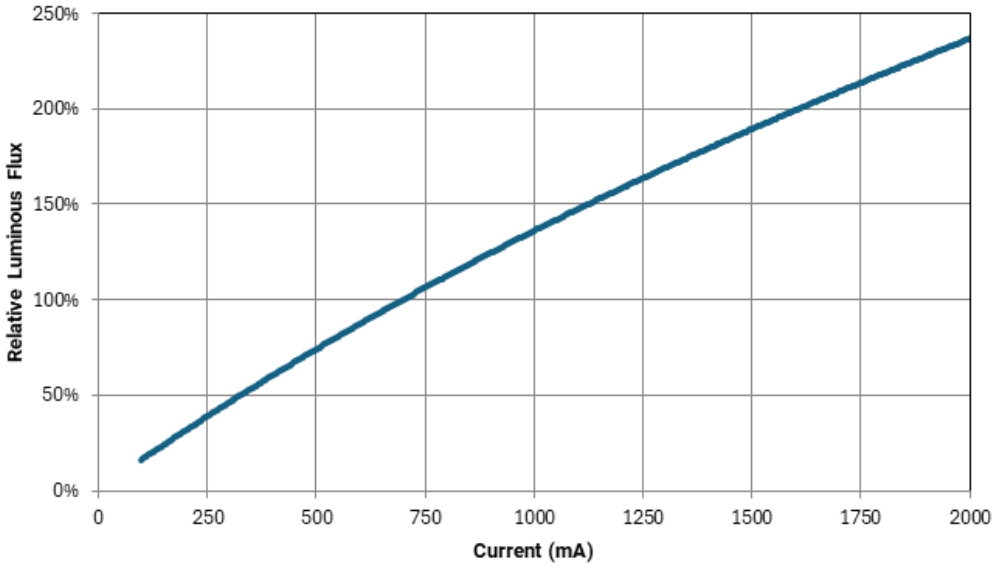


PRELIMINARY

ELECTRICAL CHARACTERISTICS (T_J = 85 °C)

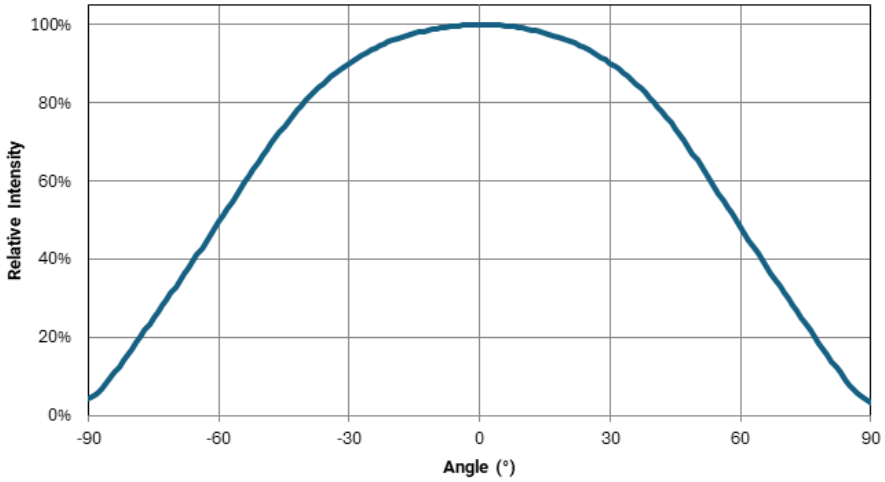


RELATIVE LUMINOUS FLUX VS. CURRENT (T_J = 85 °C)



PRELIMINARY

TYPICAL SPATIAL DISTRIBUTION



PRELIMINARY

PERFORMANCE GROUPS - LUMINOUS FLUX

XLamp XP-GP LEDs are tested for luminous flux and placed into one of the following luminous-flux groups.

Group Code	Minimum Luminous Flux (lm) @ 700 mA	Maximum Luminous Flux (lm) @ 700 mA
A1	200	210
A2	210	220
A3	220	230
A4	230	240
A5	240	250
B1	250	260
B2	260	270
B3	270	280
B4	280	290
B5	290	300
C1	300	310
C2	310	320
C3	320	330
C4	330	340
C5	340	350
D1	350	360
D2	360	370
D3	370	380
D4	380	390
D5	390	400

PRELIMINARY

PERFORMANCE GROUPS - CHROMATICITY

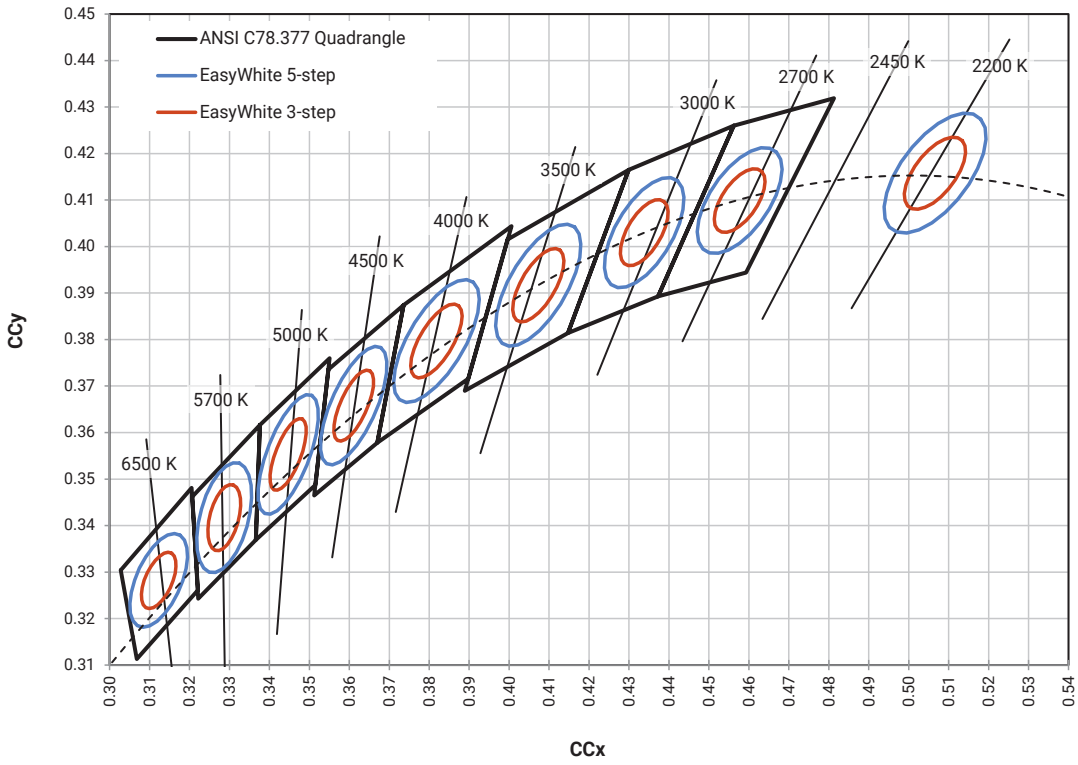
XLamp XP-GP LEDs are tested for chromaticity and placed into one of the regions defined by the following bounding coordinates.

EasyWhite Color Temperatures – 3-Step Ellipse						
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
6G	3500 K	0.4073	0.3917	0.00927	0.00414	54.0
7G	3000 K	0.4338	0.4030	0.00834	0.00408	53.2
8G	2700 K	0.4577	0.4099	0.00834	0.00420	48.5

EasyWhite Color Temperatures – 5-Step Ellipse						
Bin Code	CCT	Center Point		Major Axis	Minor Axis	Rotation Angle (°)
		x	y	a	b	
1E	6500 K	0.3123	0.3282	0.01110	0.00550	61.0
2E	5700 K	0.3287	0.3417	0.01230	0.00600	72.0
3E	5000 K	0.3447	0.3553	0.01400	0.00520	65.0
4E	4500 K	0.3611	0.3658	0.01420	0.00550	61.5
5E	4000 K	0.3818	0.3797	0.01565	0.00670	53.7
6E	3500 K	0.4073	0.3917	0.01545	0.00690	54.0
7E	3000 K	0.4338	0.4030	0.01390	0.00680	53.2
8E	2700 K	0.4577	0.4099	0.01350	0.00700	48.5

PRELIMINARY

EASYWHITE® BINS PLOTTED ON THE 1931 CIE COLOR SPACE (T_J = 85 °C)

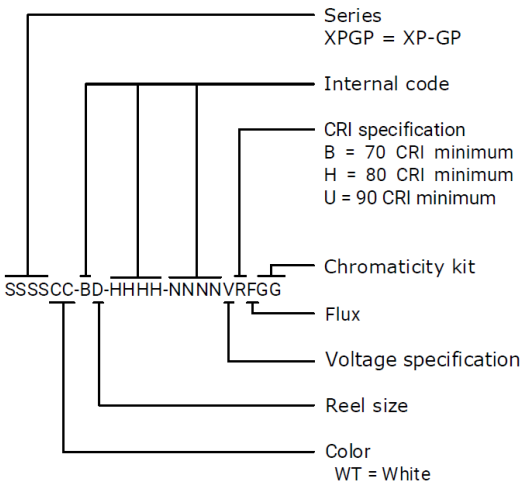


PRELIMINARY

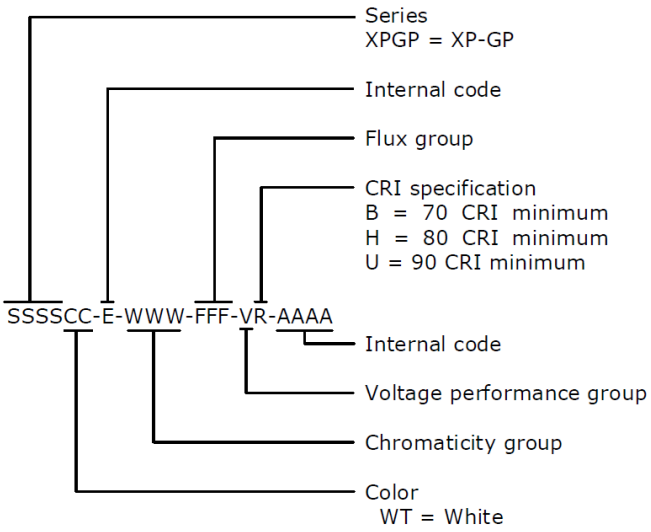
BIN AND ORDER CODE FORMATS

XP-GP bin codes and order codes are configured in the following manner:

Order Code



Bin Code

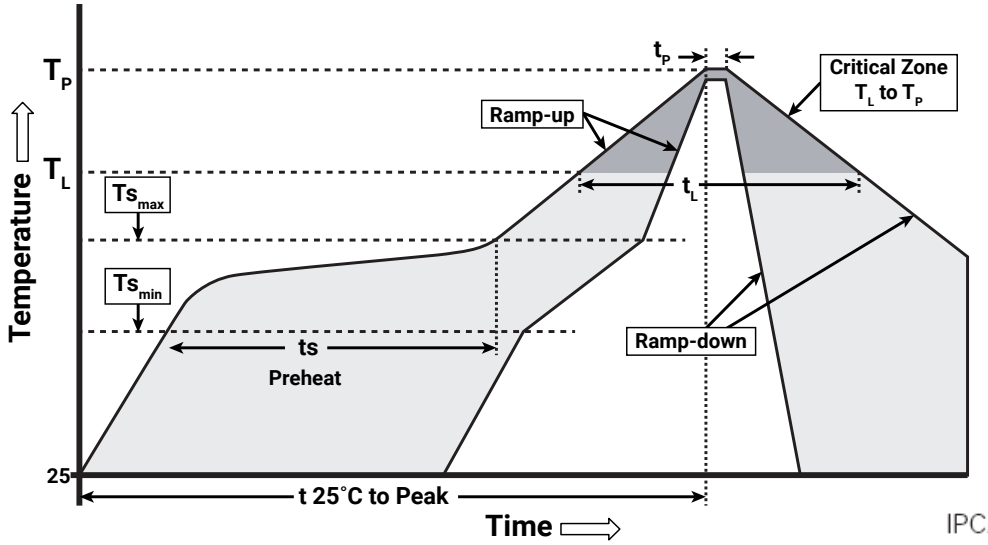


PRELIMINARY

REFLOW SOLDERING CHARACTERISTICS

In testing, Cree LED has found XLamp XP-GP LEDs to be compatible with JEDEC J-STD-020C, with the exception of the peak temperature requirements listed in the table 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 (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 topside of the package, measured on the package body surface.

PRELIMINARY

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. Cree LED did not perform Room Temperature Operating Life (RTOL) testing on the XP-GP LED.

Lumen Maintenance

Cree LED 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 LED'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 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 XP-GP LEDs may be stored as MSL 1 per JEDEC J-STD-033, meaning they have unlimited floor life in conditions of ≤ 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 Declaration. REACH banned substance information (REACH Article 67) is also available upon request.

PRELIMINARY

NOTES - CONTINUED

UL® Recognized Component

This product meets the requirements to be considered a UL Recognized Component with 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

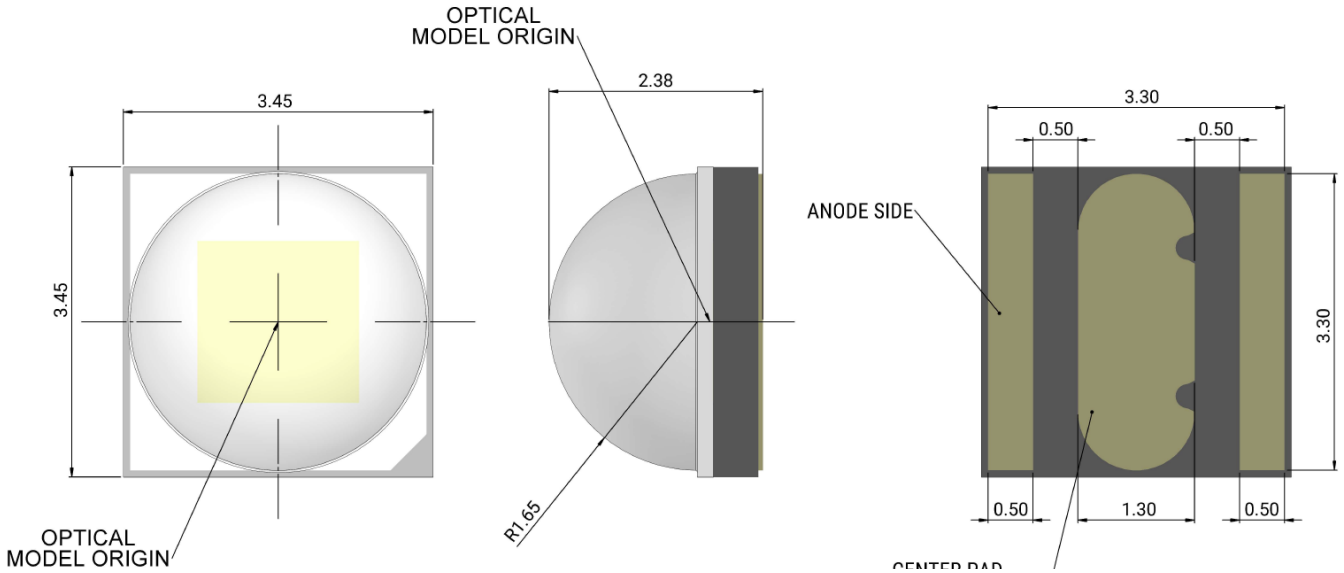
WARNING: Do not look at an exposed lamp in operation. Eye injury can result. For more information about LEDs and eye safety, please refer to the LED Eye Safety application note.

PRELIMINARY

MECHANICAL DIMENSIONS (T_A = 25 °C)

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

All measurements are ±.13 mm unless otherwise indicated.

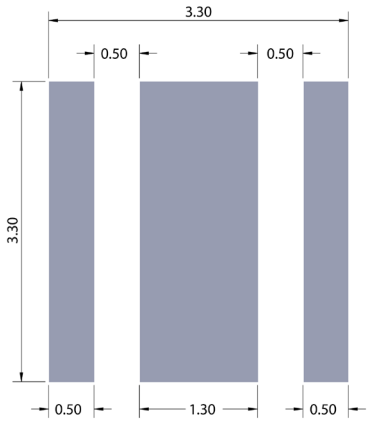


Top View **Side View** **Bottom View**

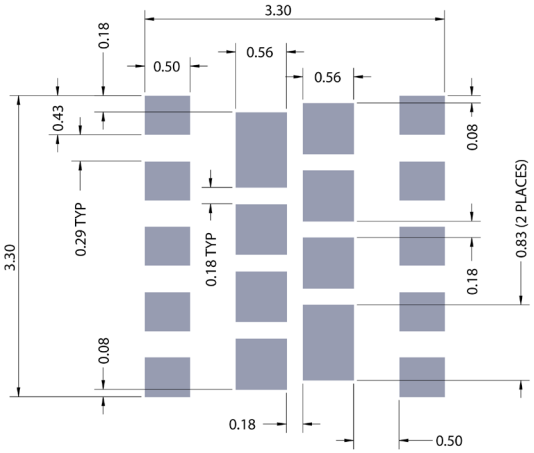
PRELIMINARY

MECHANICAL DIMENSIONS (T_A = 25 °C) - CONTINUED

All measurements are ±.13 mm unless otherwise indicated.



Recommended PCB Footprint



Recommended Stencil Openings*

Notes:

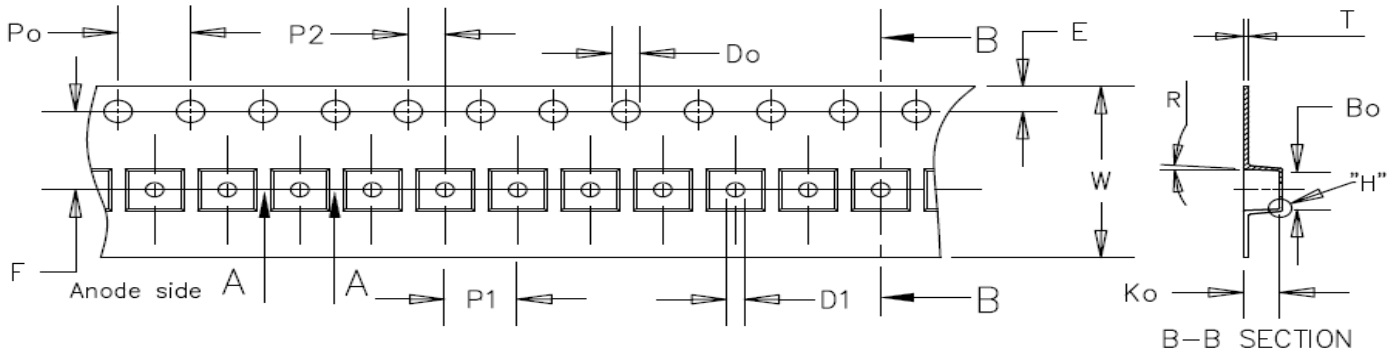
- Cree LED recommends using thermal pad kickouts to maximize component thermal performance.
- Cree LED recommends using white solder mask material to minimize system optical loss.

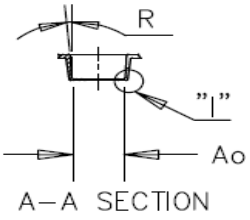
* This stencil has been tested and optimized for the avoidance of voiding when using ALPHA® OM-362 solder paste. For other solder pastes, a "window pane" design for the thermal pad stencil may result in a lower voiding percentage. Contact your local Cree LED representative for consultation regarding your specific application.

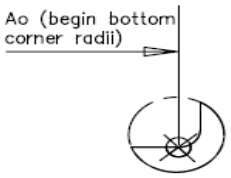
PRELIMINARY

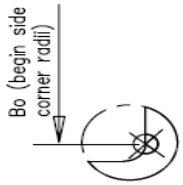
TAPE AND REEL

All Cree LED carrier tapes conform to EIA-481D, Automated Component Handling Systems Standard.
All dimensions in mm. All measurements are ±.15 mm unless otherwise indicated.

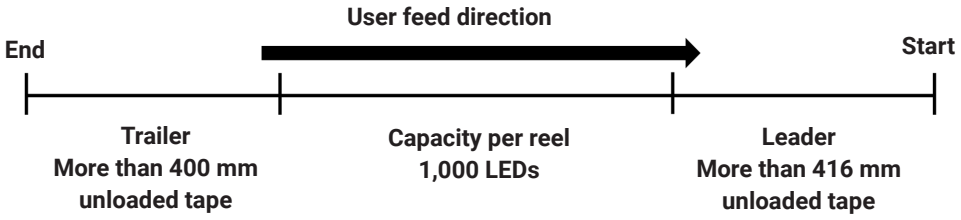






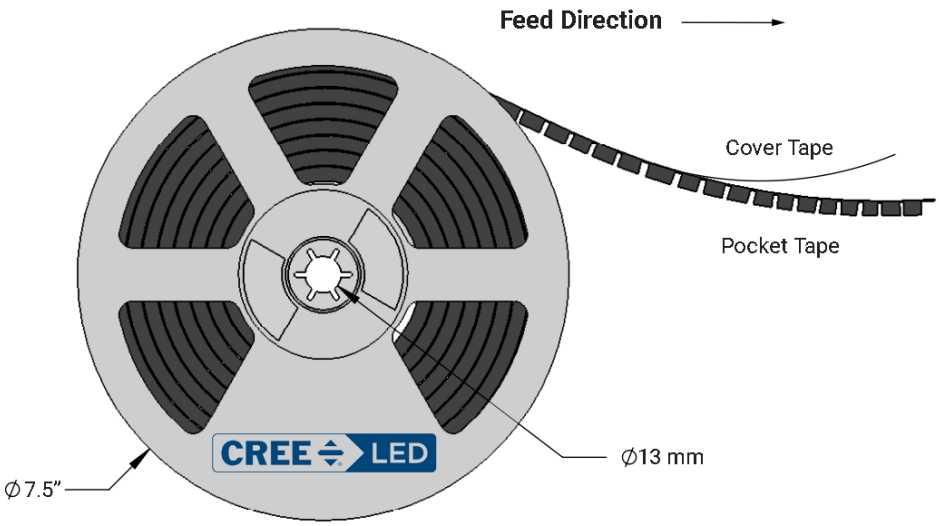


Item	Ao	Bo	Ko	P1	F	W
Dim.	3.70	3.70	2.65	8.00	5.50	12.00



PRELIMINARY

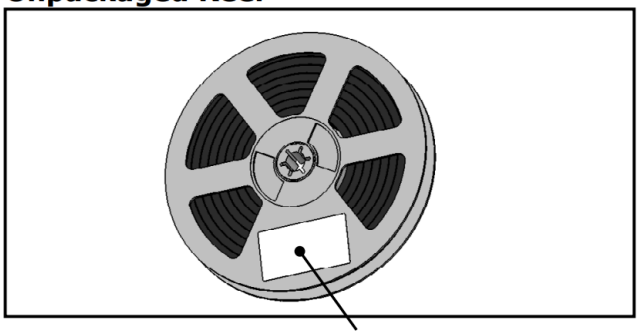
TAPE AND REEL - CONTINUED



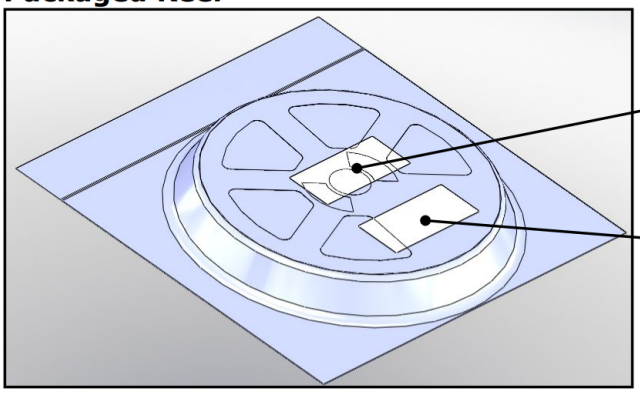
PRELIMINARY

PACKAGING

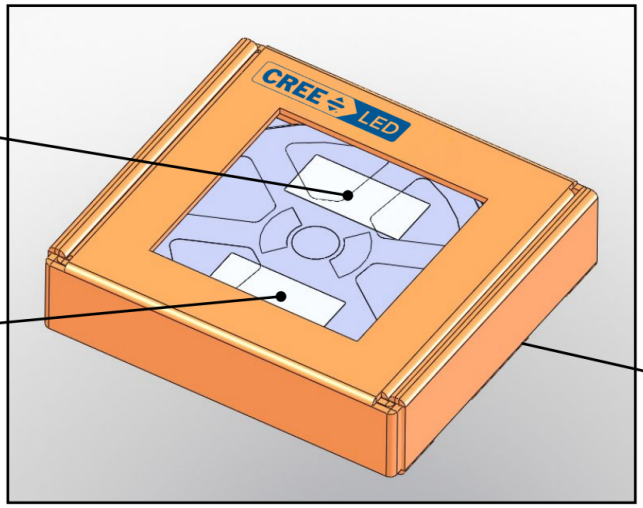
Unpackaged Reel



Packaged Reel



Boxed Reel



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