

## Cree® XLamp® MHD-G LEDs



### PRODUCT DESCRIPTION

The XLamp® MHD-G LED is a new generation of high-power LED that delivers a more effective way to achieve low-cost systems than mid-power (MP) LEDs. Built using Cree's high-reliability ceramic-package technology, the XLamp MHD-G LED is able to operate at higher temperatures than MP LEDs with no reduction in rated lifetime, enabling an impressive 60% reduction in heat sink size and cost. Using many times fewer LEDs than MP LEDs to achieve the same performance, the XLamp MHD-G LED is optimized to simplify LED system designs for directional and semi-directional applications.

### FEATURES

- Flexible 18-V or 36-V options
- Maximum drive current: 1000 mA (18 V), 500 mA (36 V)
- Viewing angle: 115°
- Available in 70-CRI, 80-CRI and 90-CRI options
- Unlimited floor life at  $\leq 30\text{ }^{\circ}\text{C}/85\%\text{ RH}$
- Reflow solderable - JEDEC J-STD-020C
- Electrically neutral thermal path
- RoHS and REACH compliant
- UL® recognized component (E349212)

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## CHARACTERISTICS

MHD-G 18-V/36-V LEDs are tested and binned in production in the 36-V configuration. See the Mechanical Dimensions section on page 17 for pad layout options.

Characteristics	Unit	Minimum	Typical	Maximum
Thermal resistance, junction to solder point	°C/W		2.6	
Viewing angle (FWHM)	degrees		115	
Temperature coefficient of voltage (18 V)*	mV/°C		-8.5	
Temperature coefficient of voltage (36 V)	mV/°C		-17	
ESD withstand voltage (HBM per Mil-Std-883D)	V			8000
DC forward current (18 V)*	mA			1000
DC forward current (36 V)	mA			500
Reverse current (18 V, 36 V)*	mA			-0.1
Forward voltage (18 V, @ 700 mA, 85 °C)*	V		18.2	20
Forward voltage (36 V, @ 350 mA, 85 °C)	V		36.4	40
LED junction temperature	°C			150

\* Data for the 18-V configuration is calculated and for reference only.

## FLUX CHARACTERISTICS, EASYWHITE® ORDER CODES AND BINS

The following table provides order codes for XLamp MHD-G LEDs. For a complete description of the order code nomenclature, please see the Bin and Order Code Formats section (page 13).

Test condition:  $T_j = 85\text{ °C}$ , 36 V,  $I_f = 350\text{ mA}$

Reference condition:  $T_j = 85\text{ °C}$ , 18 V,  $I_f = 700\text{ mA}$

Nominal CCT	CRI	Minimum Luminous Flux			2-Step		3-Step		5-Step	
	Min	Group	Flux (lm) @ 85 °C	Flux (lm) @ 25 °C*	Group	Order Code	Group	Order Code	Group	Order Code
6500 K	70	M2	1380	1559					65E	MHDGWT-0000-000N0BM265E
		M4	1485	1678						MHDGWT-0000-000N0BM465E
		N2	1590	1796						MHDGWT-0000-000N0BN265E
	80	M2	1380	1559					65E	MHDGWT-0000-000N0HM265E
		M4	1485	1678						MHDGWT-0000-000N0HM465E
5700 K	70	M2	1380	1559					57E	MHDGWT-0000-000N0BM257E
		M4	1485	1678						MHDGWT-0000-000N0BM457E
		N2	1590	1796						MHDGWT-0000-000N0BN257E
5000 K	70	M2	1380	1559					50E	MHDGWT-0000-000N0BM250E
		M4	1485	1678						MHDGWT-0000-000N0BM450E
		N2	1590	1796						MHDGWT-0000-000N0BN250E
	80	M2	1380	1559			50G	MHDGWT-0000-000N0HM250G	50E	MHDGWT-0000-000N0HM250E
		M4	1485	1678				MHDGWT-0000-000N0HM450G		MHDGWT-0000-000N0HM450E
	90	K2	1200	1356			50G	MHDGWT-0000-000N0UK250G		
		K4	1290	1457				MHDGWT-0000-000N0UK450G		

### Notes

- Cree maintains a tolerance of  $\pm 7\%$  on flux and power measurements,  $\pm 0.005$  on chromaticity (CCx, CCy) measurements and a tolerance of  $\pm 2$  on CRI measurements. See the Measurements section (page 19).
- Cree XLamp MHD-E LED 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 bin restrictions specified by the order code.
- \* Flux values @ 25 °C are calculated and for reference only.

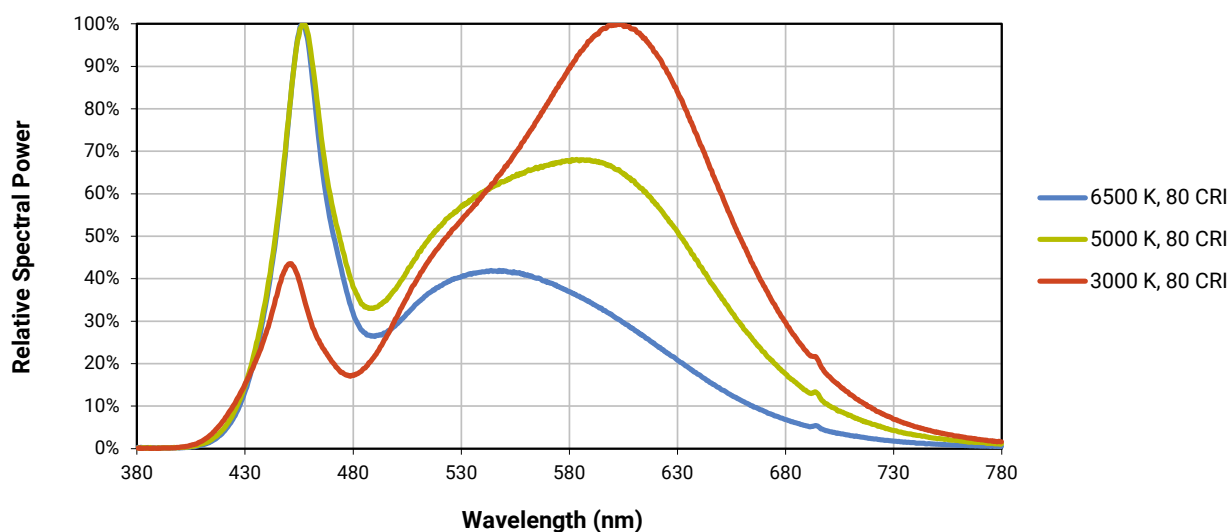
**FLUX CHARACTERISTICS, EASYWHITE® ORDER CODES AND BINS - CONTINUED**

Nominal CCT	CRI	Minimum Luminous Flux			2-Step		3-Step		5-Step	
	Min	Group	Flux (lm) @ 85 °C	Flux (lm) @ 25 °C*	Group	Order Code	Group	Order Code	Group	Order Code
4000 K	70	M2	1380	1559					40E	MHDGWT-0000-000N0BM240E
		M4	1485	1678						MHDGWT-0000-000N0BM440E
	80	K4	1290	1457	40H	MHDGWT-0000-000N0HK440H	40G	MHDGWT-0000-000N0HK440G		
		M2	1380	1559		MHDGWT-0000-000N0HM240H		MHDGWT-0000-000N0HM240G		
	90	K2	1200	1356	40H	MHDGWT-0000-000N0UK240H	40G	MHDGWT-0000-000N0UK240G		
		K4	1290	1457		MHDGWT-0000-000N0UK440H		MHDGWT-0000-000N0UK440G		
3500 K	80	K2	1200	1356	35H	MHDGWT-0000-000N0HK235H	35G	MHDGWT-0000-000N0HK235G		
		K4	1290	1457		MHDGWT-0000-000N0HK435H		MHDGWT-0000-000N0HK435G		
		M2	1380	1559		MHDGWT-0000-000N0HM235H		MHDGWT-0000-000N0HM235G		
	90	J4	1120	1265	35H	MHDGWT-0000-000N0UJ435H	35G	MHDGWT-0000-000N0UJ435G		
		K2	1200	1356		MHDGWT-0000-000N0UK235H		MHDGWT-0000-000N0UK235G		
3000 K	80	K2	1200	1356	30H	MHDGWT-0000-000N0HK230H	30G	MHDGWT-0000-000N0HK230G		
		K4	1290	1457		MHDGWT-0000-000N0HK430H		MHDGWT-0000-000N0HK430G		
		M2	1380	1559		MHDGWT-0000-000N0HM230H		MHDGWT-0000-000N0HM230G		
	90	J4	1120	1265	30H	MHDGWT-0000-000N0UJ430H	30G	MHDGWT-0000-000N0UJ430G		
		K2	1200	1356		MHDGWT-0000-000N0UK230H		MHDGWT-0000-000N0UK230G		
2700 K	80	K2	1200	1356	27H	MHDGWT-0000-000N0HK227H	27G	MHDGWT-0000-000N0HK227G		
		K4	1290	1457		MHDGWT-0000-000N0HK427H		MHDGWT-0000-000N0HK427G		
	90	J2	1040	1175	27H	MHDGWT-0000-000N0UJ227H	27G	MHDGWT-0000-000N0UJ227G		
		J4	1120	1265		MHDGWT-0000-000N0UJ427H		MHDGWT-0000-000N0UJ427G		

**Notes**

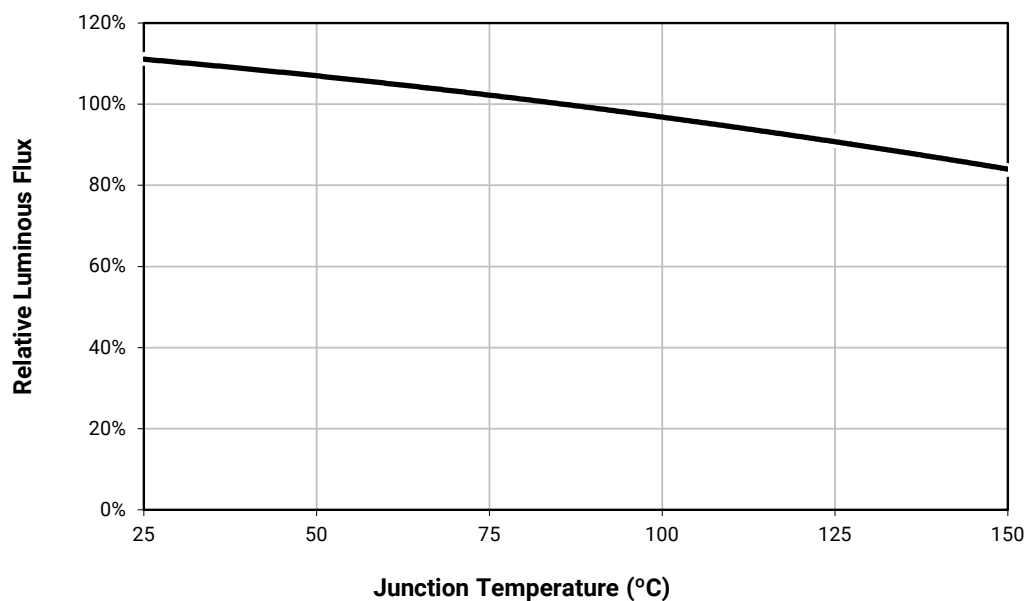
- Cree maintains a tolerance of  $\pm 7\%$  on flux and power measurements,  $\pm 0.005$  on chromaticity (CCx, CCy) measurements and a tolerance of  $\pm 2$  on CRI measurements. See the Measurements section (page 19).
- Cree XLamp MHD-E LED order codes specify only a minimum flux bin and not a maximum. 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 bin restrictions specified by the order code.
- \* Flux values @ 25 °C are calculated and for reference only.

## RELATIVE SPECTRAL POWER DISTRIBUTION

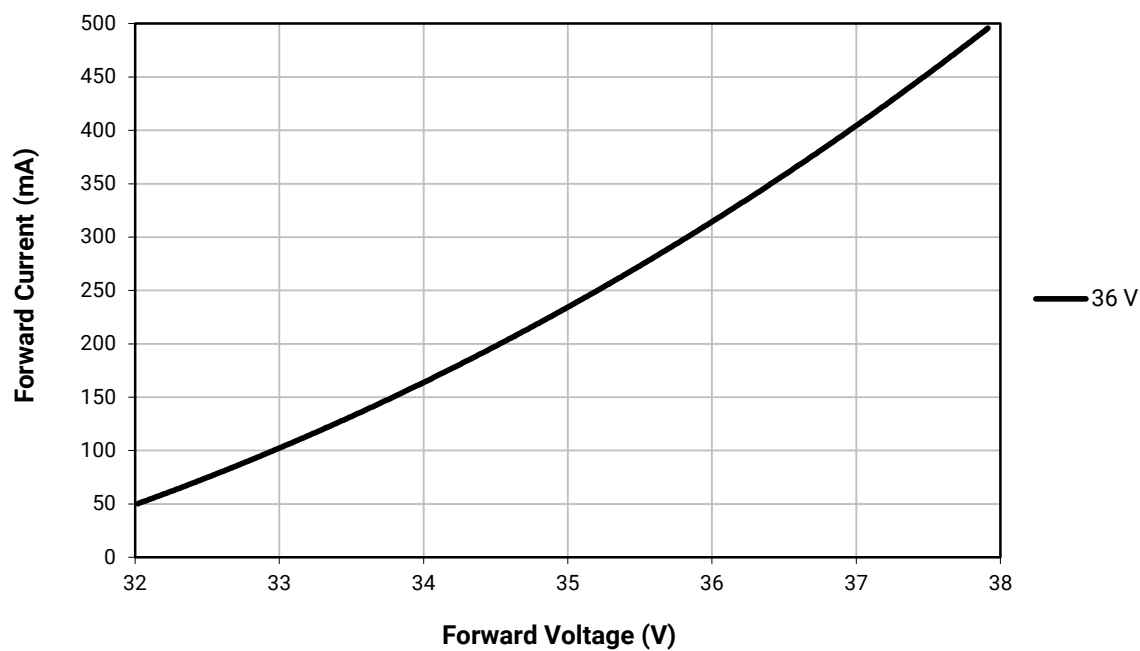
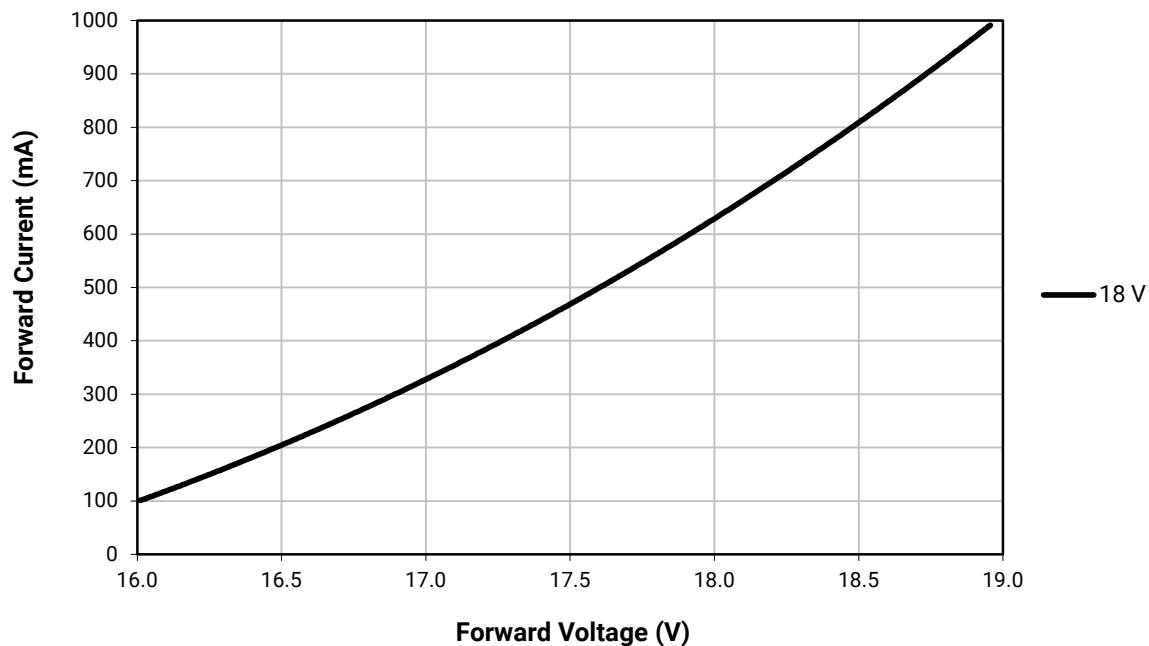


## RELATIVE FLUX VS. JUNCTION TEMPERATURE

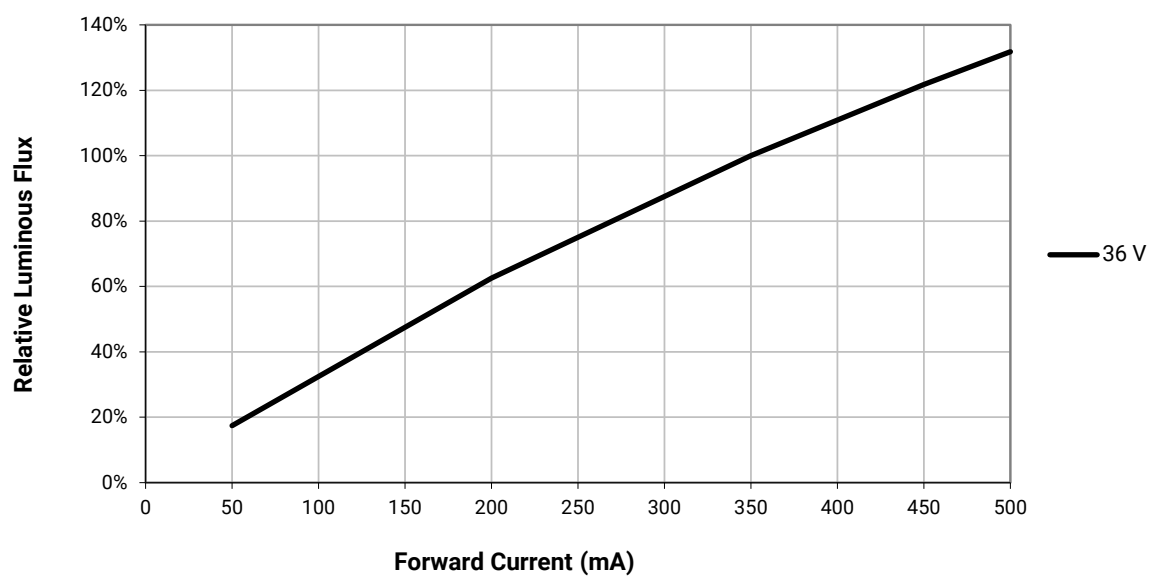
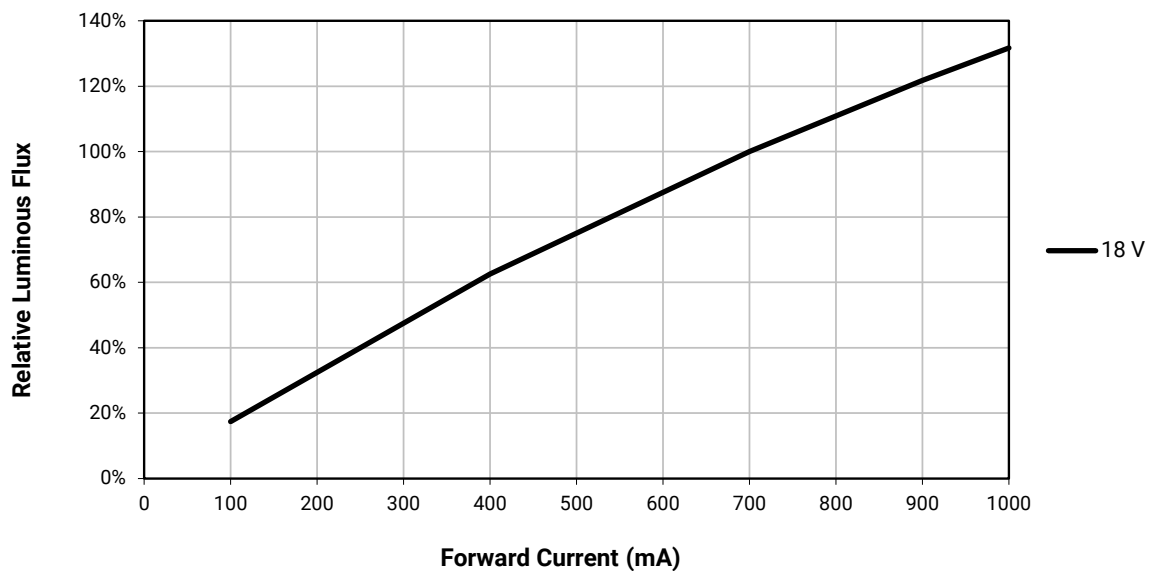
Test condition: 18 V (for reference),  $I_f = 700$  mA; 36 V,  $I_f = 350$  mA



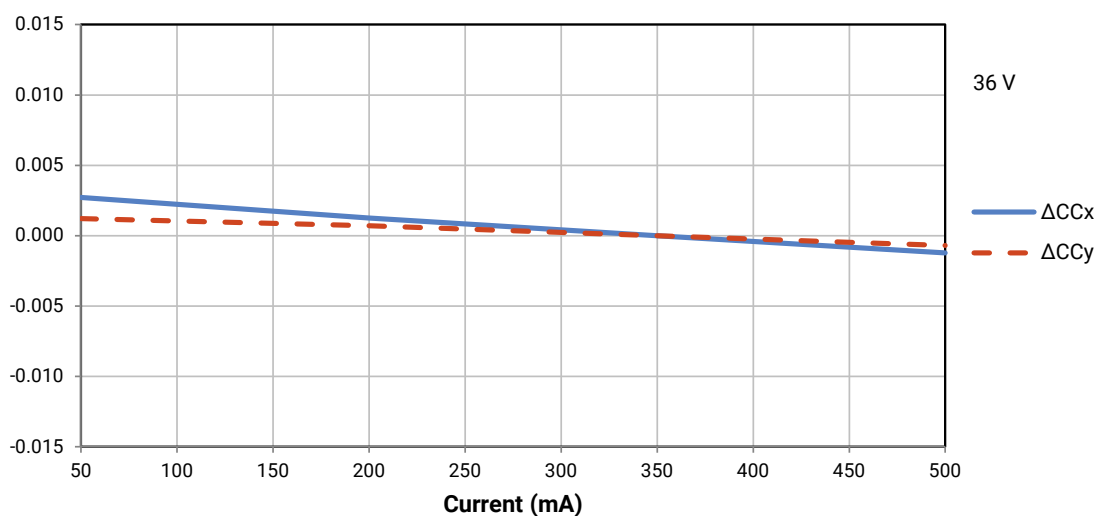
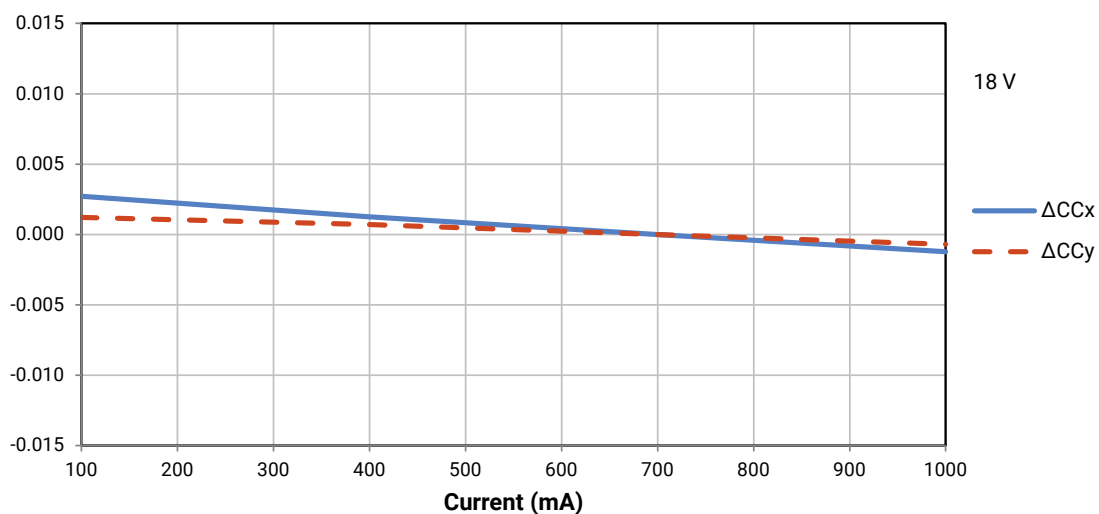
**ELECTRICAL CHARACTERISTICS ( $T_j = 85^\circ\text{C}$ )**



RELATIVE FLUX VS. CURRENT ( $T_j = 85^\circ\text{C}$ )



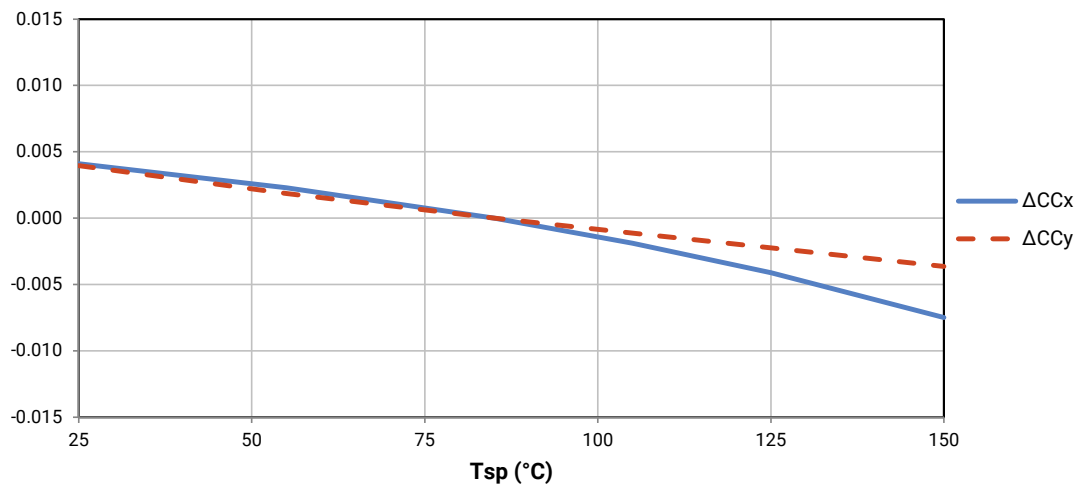
## RELATIVE CHROMATICITY VS. CURRENT (WARM WHITE)





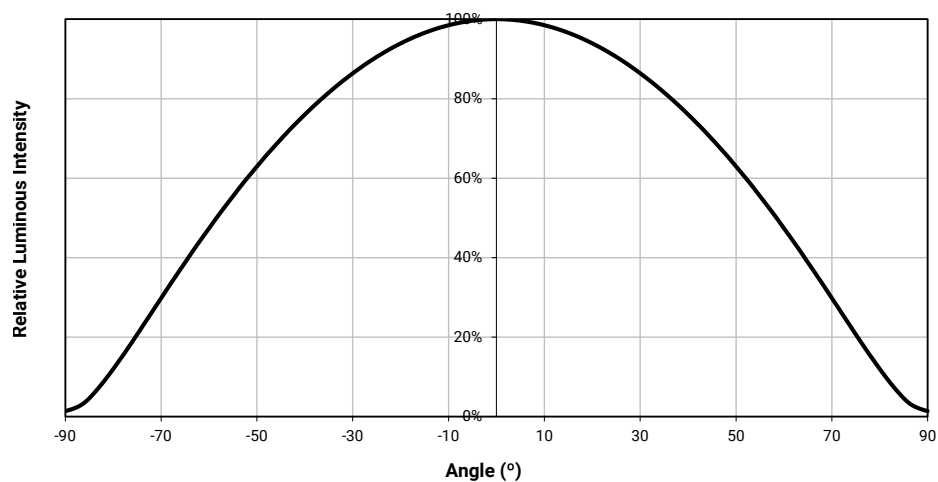
## RELATIVE CHROMATICITY VS. TEMPERATURE (WARM WHITE)

Test condition: 18 V (for reference),  $I_f = 700$  mA; 36 V,  $I_F = 350$  mA



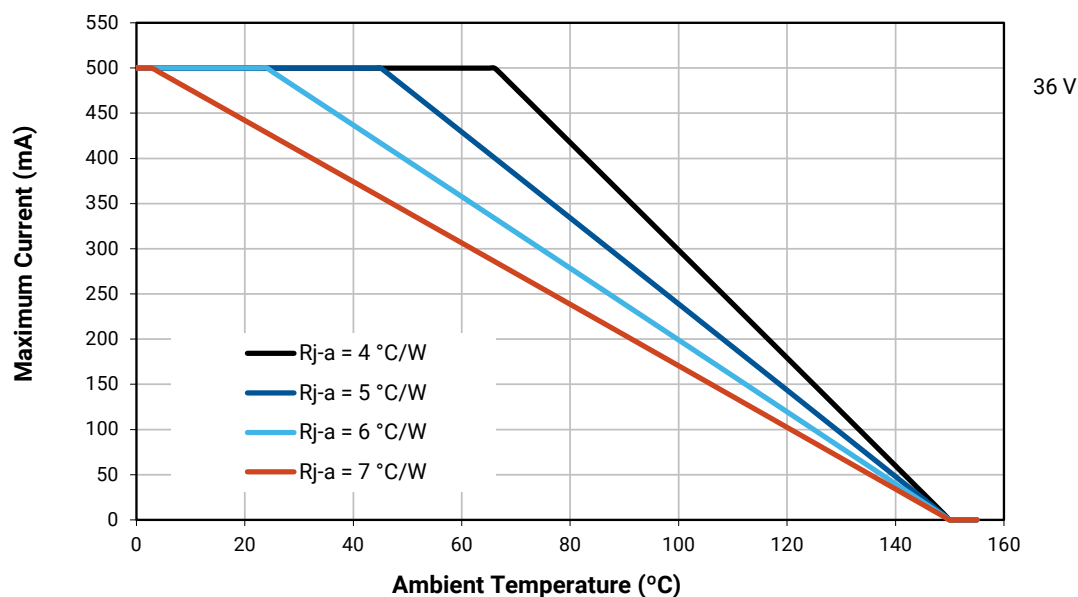
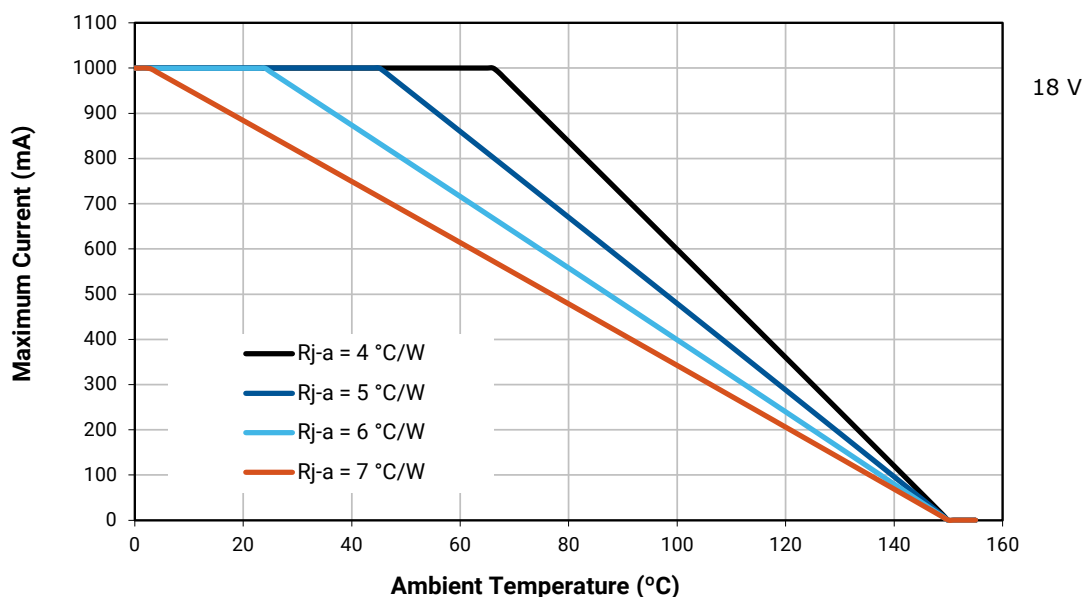
## TYPICAL SPATIAL DISTRIBUTION

Test condition: 18 V (for reference),  $I_f = 700$  mA; 36 V,  $I_F = 350$  mA



## 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.



## PERFORMANCE GROUPS – LUMINOUS FLUX ( $T_j = 85\text{ }^{\circ}\text{C}$ )

XLamp MHD-G LEDs are tested for luminous flux and placed into one of the following bins.

Group Code	Minimum Luminous Flux	Maximum Luminous Flux
J2	1040	1120
J4	1120	1200
K2	1200	1290
K4	1290	1380
M2	1380	1485
M4	1485	1590
N2	1590	1710
N4	1710	1830

## PERFORMANCE GROUPS – CHROMATICITY

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

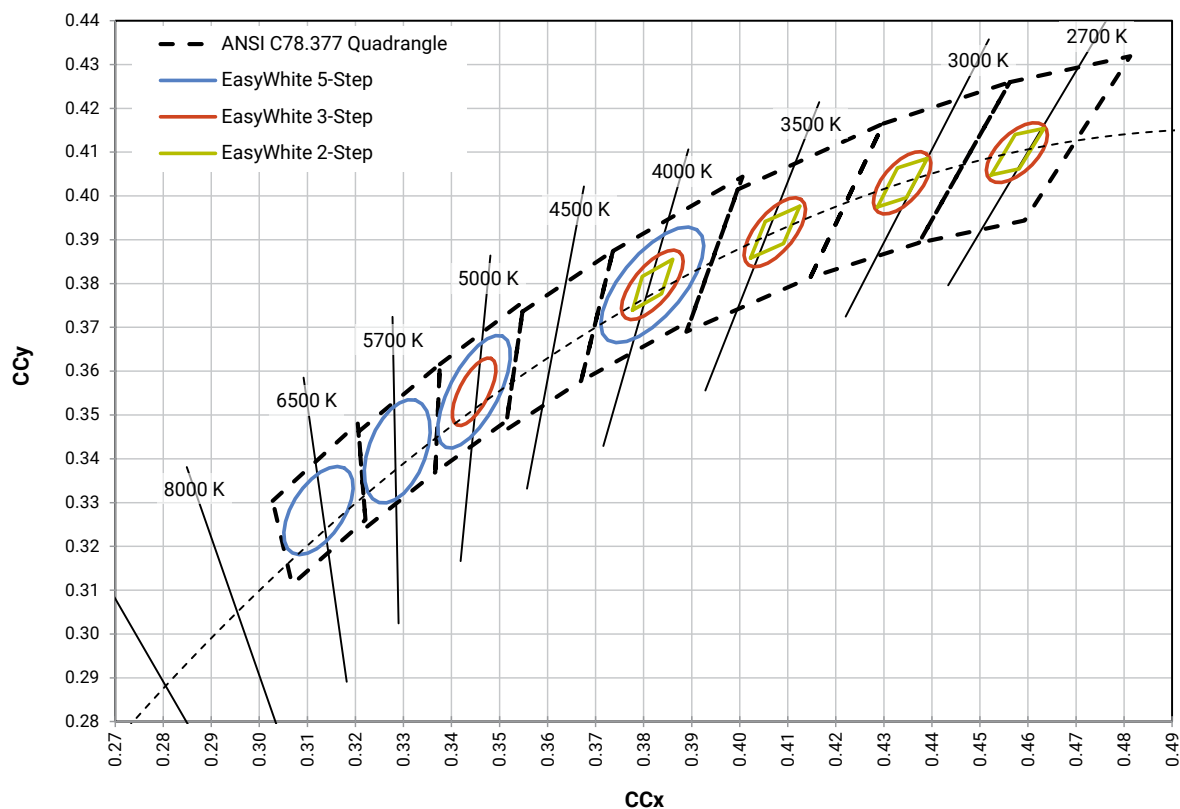
EasyWhite Color Temperatures – 2-Step			
Code	CCT	x	y
40H	4000 K	0.3777	0.3739
		0.3797	0.3816
		0.3861	0.3855
		0.3838	0.3777
35H	3500 K	0.4022	0.3858
		0.4053	0.3942
		0.4125	0.3977
		0.4091	0.3891
30H	3000 K	0.4287	0.3975
		0.4328	0.4064
		0.4390	0.4086
		0.4347	0.3996
27H	2700 K	0.4524	0.4048
		0.4574	0.4140
		0.4633	0.4154
		0.4581	0.4062

## PERFORMANCE GROUPS - CHROMATICITY ( $T_j = 85^\circ\text{C}$ ) - CONTINUED

EasyWhite Color Temperatures – 3-Step Ellipse						
Bin Code	CCT	Center Point		Major Axis	Minor Axis	Rotation Angle (°)
		x	y	a	b	
50G	5000 K	0.3447	0.3553	0.00840	0.00312	65.0
40G	4000 K	0.3818	0.3797	0.00939	0.00402	53.7
35G	3500 K	0.4073	0.3917	0.00927	0.00414	53.2
30G	3000 K	0.4338	0.4030	0.00834	0.00408	53.2
27G	2700 K	0.4577	0.4099	0.00834	0.00420	48.5

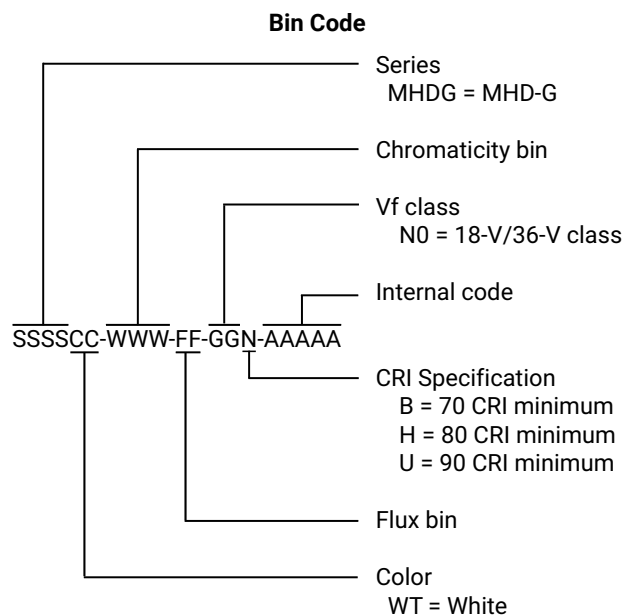
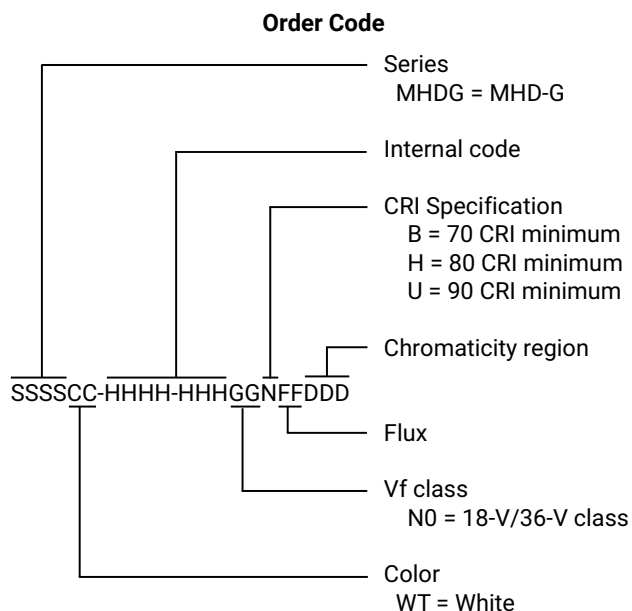
EasyWhite Color Temperatures – 5-Step Ellipse						
Bin Code	CCT	Center Point		Major Axis	Minor Axis	Rotation Angle (°)
		x	y	a	b	
65E	6500 K	0.3123	0.3282	0.01110	0.00550	61.0
57E	5700 K	0.3287	0.3417	0.01230	0.00600	72.0
50E	5000 K	0.3447	0.3553	0.01400	0.00520	65.0
40E	4000 K	0.3818	0.3797	0.01565	0.00670	53.7

## CREE'S STANDARD WHITE CHROMATICITY REGIONS PLOTTED ON THE 1931 CIE CURVE



## BIN AND ORDER CODE FORMATS

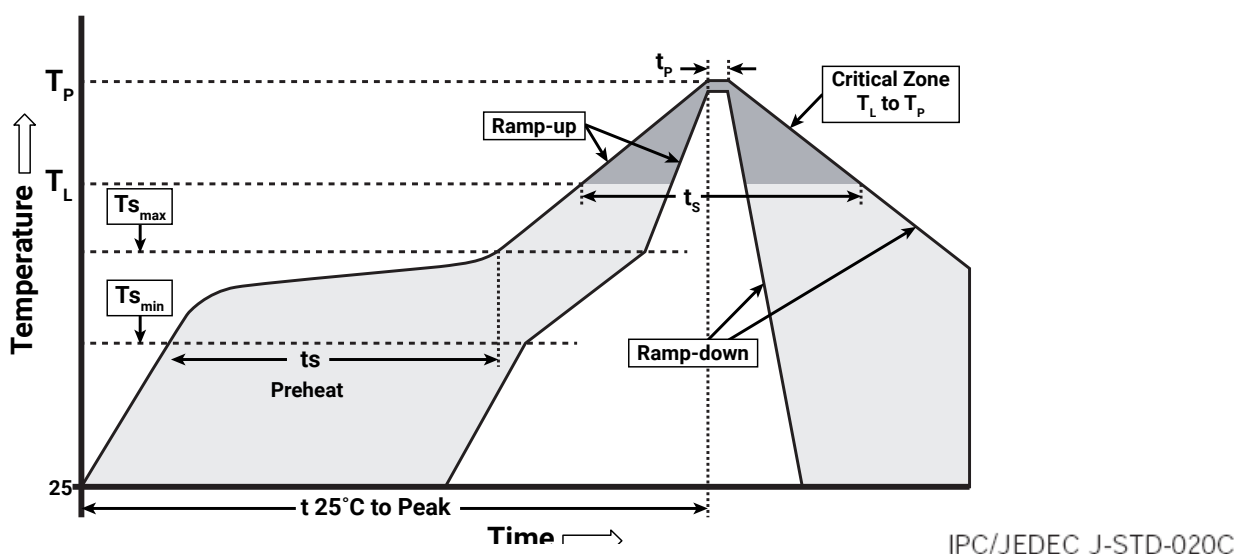
Bin codes and order codes for MHD-G LEDs are configured in the following manner:



## REFLOW SOLDERING CHARACTERISTICS

In testing, Cree has found XLamp MHD-G 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 the solder paste used.

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



Profile Feature	Lead-Free Solder
Average Ramp-Up Rate ( $T_{s_{max}}$ to $T_P$ )	1.2 °C/second
Preheat: Temperature Min ( $T_{s_{min}}$ )	120 °C
Preheat: Temperature Max ( $T_{s_{max}}$ )	170 °C
Preheat: Time ( $t_{s_{min}}$ to $t_{s_{max}}$ )	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

### Measurements

The luminous flux, radiant power, chromaticity 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'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 as specifications.

### Pre-Release Qualification Testing

Please read the [LED Reliability Overview](#) for details of the qualification process Cree applies to ensure long-term reliability for XLamp LEDs and details of Cree's pre-release qualification testing for XLamp LEDs.

### Lumen Maintenance

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](#).

Please read the [Long-Term Lumen Maintenance application note](#) for more details on Cree'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 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 MHD-G LEDs may be stored as MSL 1 per JEDEC J-STD-033, meaning they have unlimited floor life in conditions of  $\leq 30^{\circ}\text{C}/85\%$  relative humidity (RH). Regardless of the storage condition, Cree 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 representative or from the Product Documentation sections of [www.cree.com](http://www.cree.com).

### 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 representative to insure you get the most up-to-date REACH Declaration. REACH banned substance information (REACH Article 67) is also available upon request.

**NOTES - CONTINUED**

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**UL® Recognized Component**

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**

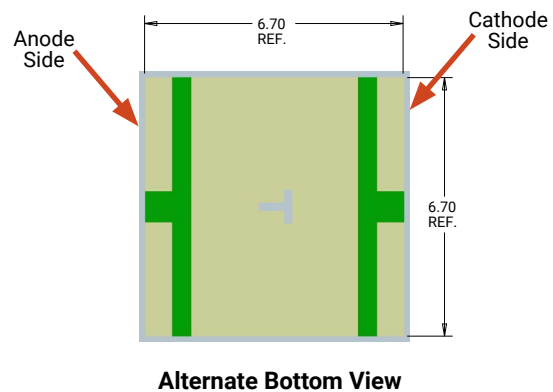
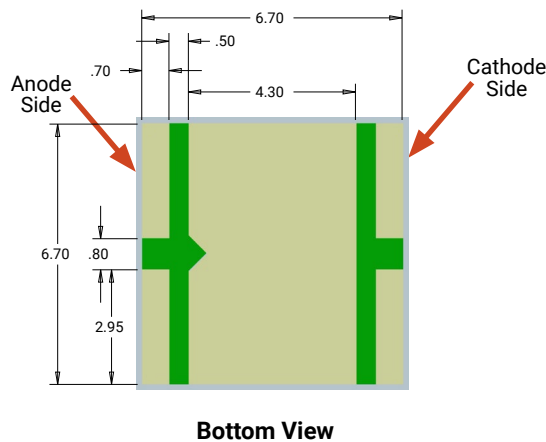
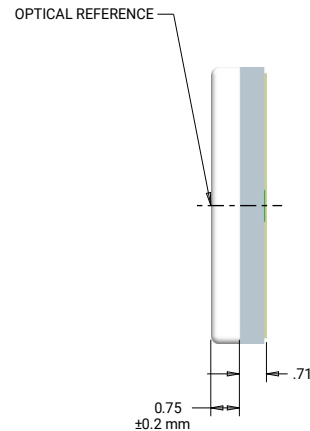
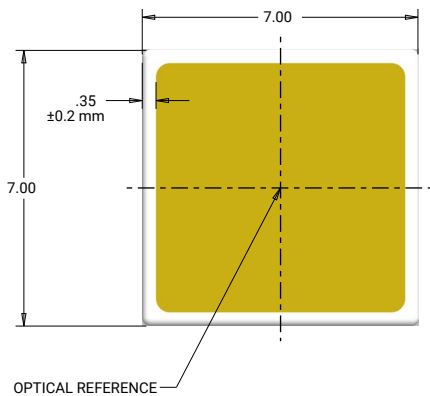
WARNING: Do not look at an exposed lamp in operation. Eye injury can result. For more information about LEDs and eye safety, please refer to the [LED Eye Safety application note](#).



## MECHANICAL DIMENSIONS

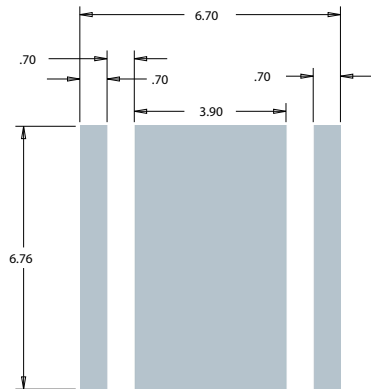
Thermal vias, if present, are not shown on these drawings.

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

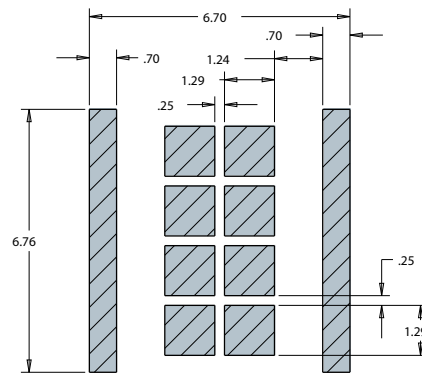


## MECHANICAL DIMENSIONS - CONTINUED

### 18-V Configuration

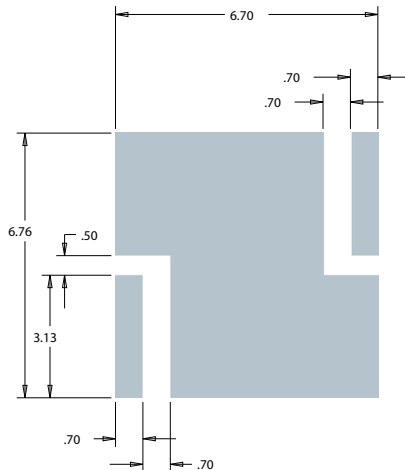


**Recommended PCB Solder Pad**

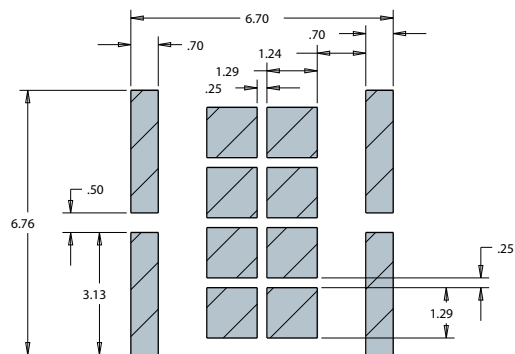


**Recommended Stencil Pattern  
(Shaded Area Is Open)**

### 36-V Configuration

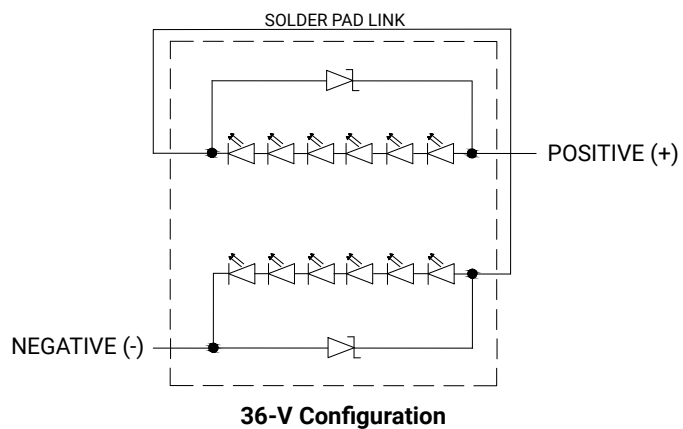
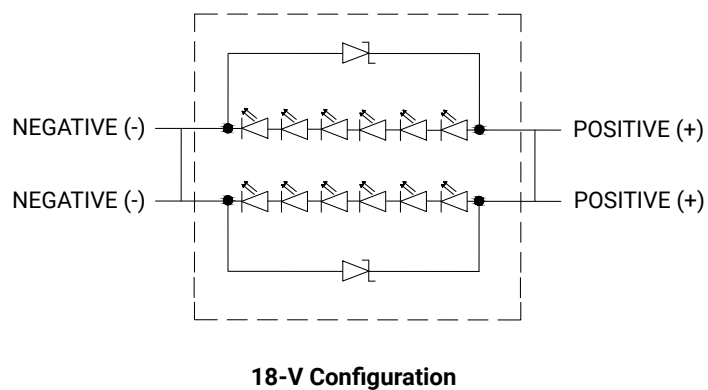


**Recommended PCB Solder Pad**



**Recommended Stencil Pattern  
(Shaded Area Is Open)**

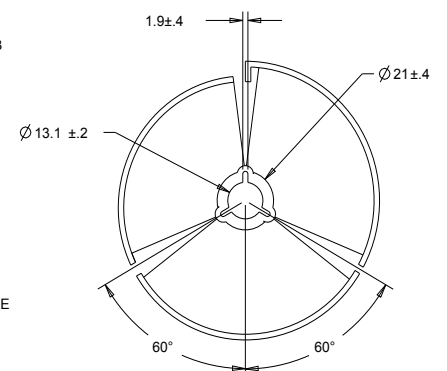
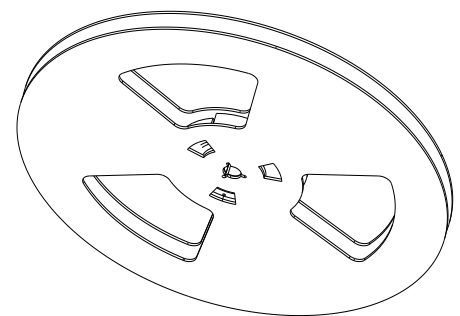
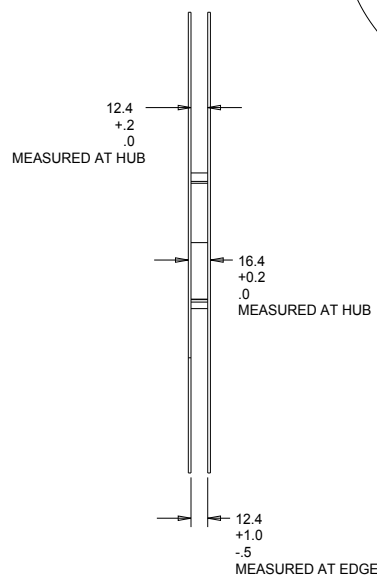
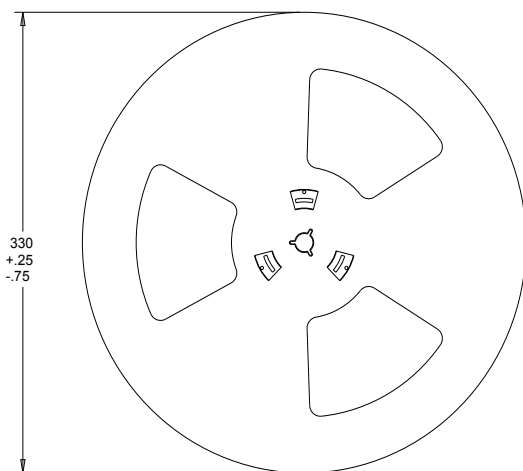
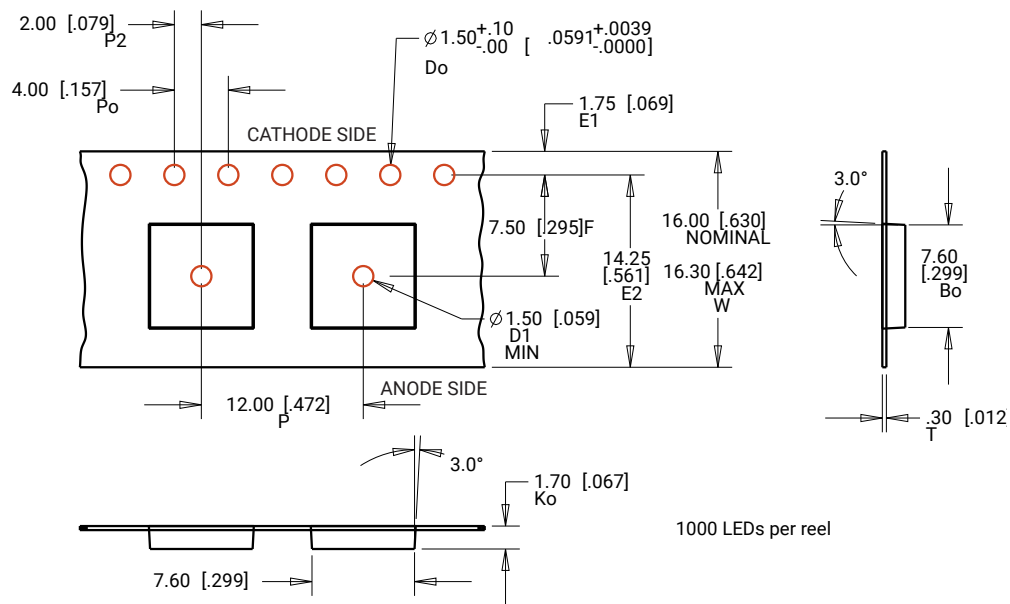
## ELECTRICAL CONFIGURATION



## TAPE AND REEL

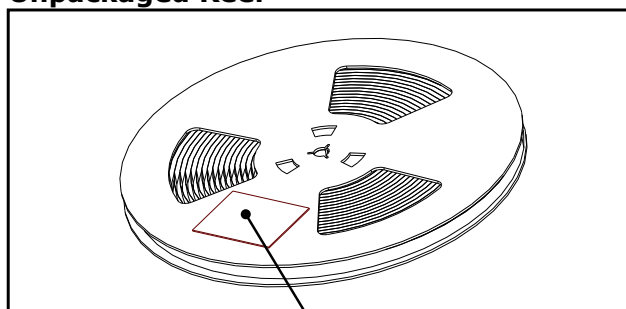
All Cree carrier tapes conform to EIA-481D, Automated Component Handling Systems Standard.

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



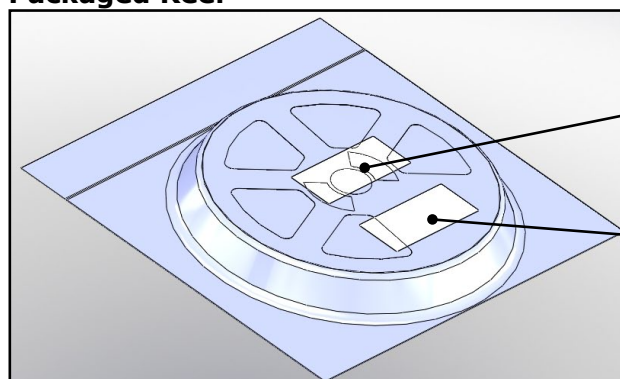
## PACKAGING

### Unpackaged Reel



Label with Cree Bin Code,  
Quantity, Reel ID

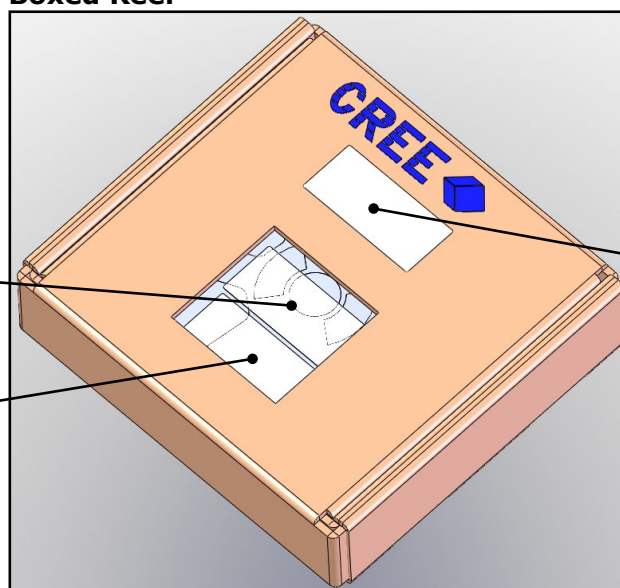
### Packaged Reel



Label with Cree Order Code,  
Quantity, Reel ID, PO #

Label with Cree Bin Code,  
Quantity, Reel ID

### Boxed Reel



Label with Cree Order Code,  
Quantity, Reel ID, PO #

Label with Cree Bin Code,  
Quantity, Reel ID

Patent Label