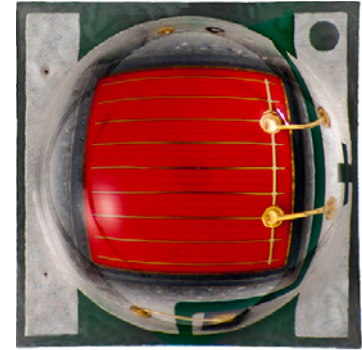


# Cree® XLamp® XB-D LEDs



## PRODUCT DESCRIPTION

The XLamp XB-D LED brings next-generation performance, price and size to all LED lighting applications. The XB-D's footprint enables smaller designs with densely packed arrays for better light mixing and concentration.

XB-D shares common footprint and uniform package design across all white and color configurations, simplifying board and optical designs for many LED systems. XB-D is optimized to dramatically lower system cost in any illumination application, from indoor and outdoor lighting to architectural and transportation lighting.

## FEATURES

- Cree's smallest lighting class LED: 2.45 X 2.45 mm
- XB-D white binned @ 85 °C; XB-D color binned @ 25 °C
- Up to 136 lm/W in cool white (@ 85 °C, 350 mA)
- Available in white, 80-minimum CRI white, and 70-minimum CRI cool white, royal blue, blue, green, amber, red-orange & red
- 1 A maximum drive current
- Wide viewing angle: from 115° (white) to 140° (red)
- Reflow solderable - JEDEC J-STD-020C compatible
- Unlimited floor life at ≤ 30 °C/85% RH
- Electrically neutral thermal path
- RoHS- and REACh-compliant
- UL-recognized component (E349212)

## TABLE OF CONTENTS

|  |    |
|--|----|
| Characteristics .....                        | 2  |
| Flux Characteristics.....                    | 3  |
| Relative Spectral Power Distribution.....    | 6  |
| Relative Flux vs. Junction Temperature ..... | 7  |
| Electrical Characteristics .....             | 8  |
| Relative Flux vs. Current .....              | 9  |
| Relative Chromaticity vs. Current .....      | 10 |
| Relative Chromaticity vs. Temperature .....  | 11 |
| Typical Spatial Distribution.....            | 11 |
| Thermal Design .....                         | 12 |
| Reflow Soldering Characteristics .....       | 13 |
| Notes.....                                   | 14 |
| Mechanical Dimensions.....                   | 15 |
| Tape and Reel .....                          | 16 |
| Packaging.....                               | 17 |



**CHARACTERISTICS**

| Characteristics   | Unit    | Minimum | Typical | Maximum |
|---|---------|---------|---------|---------|
| Thermal resistance, junction to solder point - white, royal blue, blue        | °C/W    |         | 6.5     |         |
| Thermal resistance, junction to solder point - green                          | °C/W    |         | 11      |         |
| Thermal resistance, junction to solder point - amber                          | °C/W    |         | 7       |         |
| Thermal resistance, junction to solder point - red-orange, red                | °C/W    |         | 5       |         |
| Viewing angle (FWHM) - white  | degrees |         | 115     |         |
| Viewing angle (FWHM) - royal blue, blue, green                                | degrees |         | 135     |         |
| Viewing angle (FWHM) - amber, red-orange, red                                 | degrees |         | 140     |         |
| Temperature coefficient of voltage - white                                    | mV/°C   |         | -2.5    |         |
| Temperature coefficient of voltage - royal blue, blue, green                  | mV/°C   |         | -3.3    |         |
| Temperature coefficient of voltage - amber, red-orange, red                   | mV/°C   |         | -2      |         |
| ESD withstand voltage (HBM per Mil-Std-883D) - white, royal blue, blue, green | V       |         |         | 8000    |
| ESD classification (HBM per Mil-Std-883D) - amber, red-orange, red            |         |         | Class 2 |         |
| DC forward current  | mA      |         |         | 1000    |
| Reverse voltage   | V       |         |         | -5      |
| Forward voltage (@ 350 mA, 85 °C) - white                                     | V       |         | 2.9     | 3.5     |
| Forward voltage (@ 350 mA, 25 °C) - royal blue, blue                          | V       |         | 3.1     | 3.7     |
| Forward voltage (@ 350 mA, 25 °C) - green                                     | V       |         | 3.3     | 3.9     |
| Forward voltage (@ 350 mA, 25 °C) - amber, red-orange, red                    | V       |         | 2.25    | 2.6     |
| LED junction temperature  | °C      |         |         | 150     |

## FLUX CHARACTERISTICS - WHITE ( $T_j = 85\text{ }^\circ\text{C}$ )

The following table provides several base order codes for XLamp XB-D 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 the XLamp XB-D Binning and Labeling document.

| Color                        | CCT Range |        | Base Order Codes<br>Min. Luminous Flux<br>@ 350 mA |                      |                       | Calculated Minimum<br>Luminous Flux (lm)** |         | Order Code                |
|------------------------------|-----------|--------|--|----------------------|-----------------------|--|---------|---------------------------|
|                              | Min.      | Max.   | Group  | Flux (lm)<br>@ 85 °C | Flux (lm)<br>@ 25 °C* | 700 mA                                     | 1000 mA |                           |
| Cool White                   | 5000 K    | 8300 K | R3   | 122                  | 139                   | 210  | 271     | XBDAWT-00-0000-000000F51  |
|                              |           |        | R2   | 114                  | 130                   | 196  | 253     | XBDAWT-00-0000-000000E51  |
| 70 CRI Minimum<br>Cool White | 5000 K    | 8300 K | R3   | 122                  | 139                   | 210  | 271     | XBDAWT-00-0000-000000BF51 |
|                              |           |        | R2   | 114                  | 130                   | 196  | 253     | XBDAWT-00-0000-000000BE51 |
| Neutral White                | 3700 K    | 5000 K | R2   | 114                  | 130                   | 196  | 253     | XBDAWT-00-0000-000000LEE4 |
|                              |           |        | Q5   | 107                  | 122                   | 184  | 237     | XBDAWT-00-0000-000000LDE4 |
|                              |           |        | Q4   | 100                  | 114                   | 172  | 222     | XBDAWT-00-0000-000000LCE4 |
| 80 CRI Minimum<br>White      | 2600 K    | 6200 K | Q4   | 100                  | 114                   | 172  | 222     | XBDAWT-00-0000-000000HCE7 |
|                              |           |        | Q3   | 93.9                 | 107                   | 162  | 208     | XBDAWT-00-0000-000000HBE7 |
|                              |           |        | Q2   | 87.4                 | 100                   | 150  | 194     | XBDAWT-00-0000-000000HAE7 |
| Warm White                   | 2600 K    | 3700 K | Q4   | 100                  | 114                   | 172  | 222     | XBDAWT-00-0000-000000LCE7 |
|                              |           |        | Q3   | 93.9                 | 107                   | 162  | 208     | XBDAWT-00-0000-000000LBE7 |
|                              |           |        | Q2   | 87.4                 | 100                   | 150  | 194     | XBDAWT-00-0000-000000LAE7 |

### Notes:

- Cree maintains a tolerance of  $\pm 7\%$  on flux and power measurements,  $\pm 0.005$  on chromaticity (CCx, CCy) measurements and  $\pm 2$  on CRI measurements.
  - Typical CRI for Neutral White, 3700 K - 5000K CCT is 75.
  - Typical CRI for Warm White, 2600 K - 3700 K CCT is 80.
  - Minimum CRI for 70 CRI Minimum Cool White is 70.
  - Minimum CRI for 80 CRI Minimum White is 80.
- \* Flux values @ 25 °C are calculated and are for reference only.
- \*\* Calculated flux values at 700 mA and 1000 mA are for 85 °C and are for reference only.

**FLUX CHARACTERISTICS - COLOR (T<sub>j</sub> = 25 °C)**

The following table provides several base order codes for XLamp XB-D 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 the XLamp XB-D Binning and Labeling document.

| Color      | Dominant Wavelength Range |          |       |          | Base Order Codes<br>Min. Radiant Flux<br>(mW) @ 350 mA |           | Order Code               |
|------------|---------------------------|----------|-------|----------|--|-----------|--------------------------|
|            | Min.                      |          | Max.  |          | Group  | Flux (mW) |                          |
|            | Group                     | DWL (nm) | Group | DWL (nm) |  |           |                          |
| Royal Blue | D36                       | 450      | D57   | 465      | 34 (N)   | 550       | XBDROY-00-0000-000000N01 |
|            |                           |          |       |          | 33 (M)   | 525       | XBDROY-00-0000-000000M01 |
|            |                           |          |       |          | 32 (L)   | 500       | XBDROY-00-0000-000000L01 |
|            |                           |          |       |          | 31 (K)   | 475       | XBDROY-00-0000-000000K01 |
|            |                           |          |       |          | 30 (J)   | 450       | XBDROY-00-0000-000000J01 |

| Color | Dominant Wavelength Range |          |       |          | Base Order Codes<br>Min. Luminous Flux<br>(lm) @ 350 mA |           | Order Code               |
|-------|---------------------------|----------|-------|----------|---|-----------|--------------------------|
|       | Min.                      |          | Max.  |          | Group   | Flux (lm) |                          |
|       | Group                     | DWL (nm) | Group | DWL (nm) |   |           |                          |
| Blue  | B3                        | 465      | B6    | 485      | M2  | 39.8      | XBDBLU-00-0000-000000201 |
|       |                           |          |       |          | K3  | 35.2      | XBDBLU-00-0000-000000Z01 |
|       |                           |          |       |          | K2  | 30.6      | XBDBLU-00-0000-000000Y01 |

| Color | Dominant Wavelength Range |          |       |          | Base Order Codes<br>Min. Luminous Flux<br>(lm) @ 350 mA |           | Order Code               |
|-------|---------------------------|----------|-------|----------|---|-----------|--------------------------|
|       | Min.                      |          | Max.  |          | Group   | Flux (lm) |                          |
|       | Group                     | DWL (nm) | Group | DWL (nm) |   |           |                          |
| Green | G2                        | 520      | G4    | 535      | Q5  | 107       | XBDGRN-00-0000-000000D01 |
|       |                           |          |       |          | Q4  | 100       | XBDGRN-00-0000-000000C01 |
|       |                           |          |       |          | Q3  | 93.9      | XBDGRN-00-0000-000000B01 |
|       |                           |          |       |          | Q2  | 87.4      | XBDGRN-00-0000-000000A01 |

| Color | Dominant Wavelength Range |          |       |          | Base Order Codes<br>Min. Luminous Flux<br>(lm) @ 350 mA |           | Order Code               |
|-------|---------------------------|----------|-------|----------|---|-----------|--------------------------|
|       | Min.                      |          | Max.  |          | Group   | Flux (lm) |                          |
|       | Group                     | DWL (nm) | Group | DWL (nm) |   |           |                          |
| Amber | A2                        | 585      | A3    | 595      | P3  | 73.9      | XBDAMB-00-0000-000000801 |
|       |                           |          |       |          | P2  | 67.2      | XBDAMB-00-0000-000000701 |
|       |                           |          |       |          | N4  | 62        | XBDAMB-00-0000-000000601 |
|       |                           |          |       |          | N3  | 56.8      | XBDAMB-00-0000-000000501 |

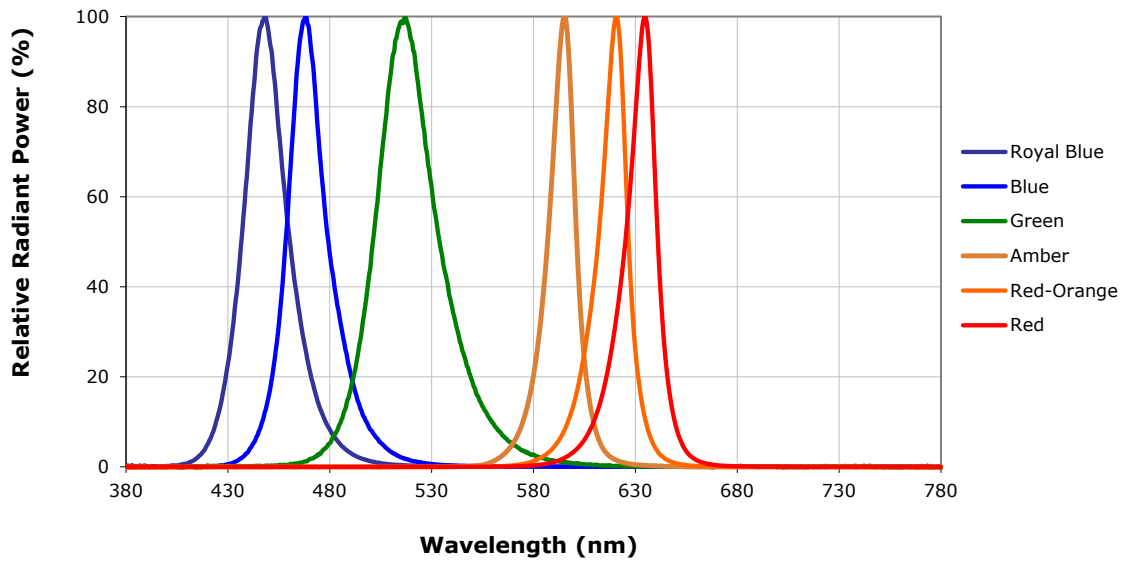
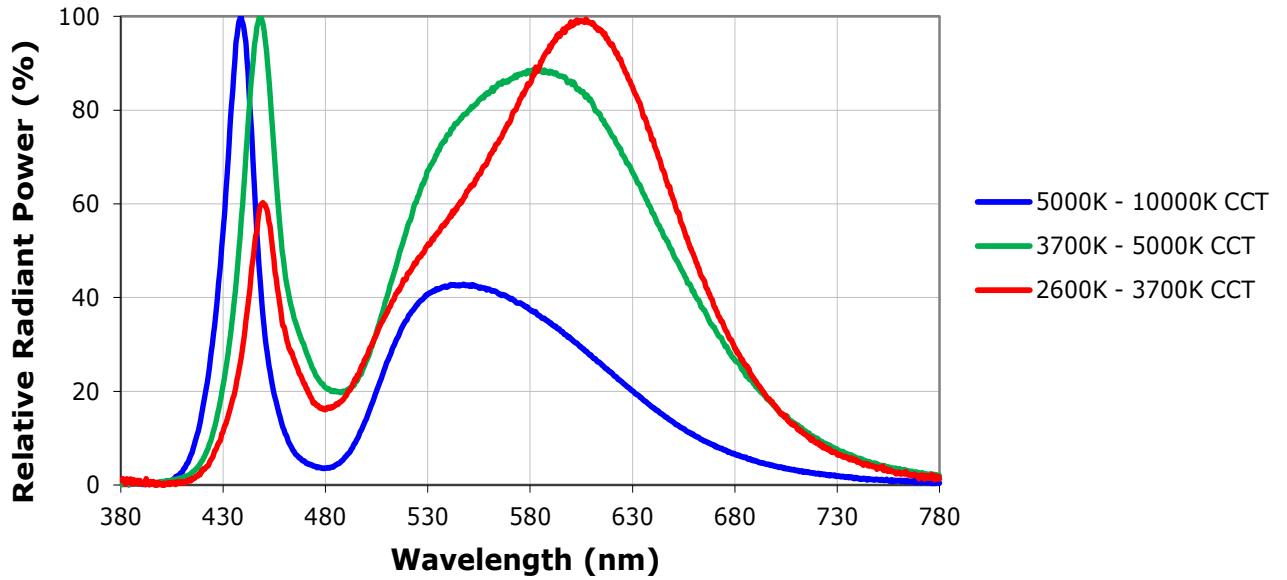
**FLUX CHARACTERISTICS - COLOR (T<sub>j</sub> = 25 °C) - CONTINUED**

| Color      | Dominant Wavelength Range |             |       |             | Base Order Codes<br>Min. Luminous Flux<br>(lm) @ 350 mA |           | Order Code               |
|------------|---------------------------|-------------|-------|-------------|---|-----------|--------------------------|
|            | Min.                      |             | Max.  |             | Group   | Flux (lm) |                          |
|            | Group                     | DWL<br>(nm) | Group | DWL<br>(nm) |   |           |                          |
| Red-Orange | O3                        | 610         | O4    | 620         | Q4  | 100       | XBDRDO-00-0000-000000C01 |
|            |                           |             |       |             | Q3  | 93.9      | XBDRDO-00-0000-000000B01 |
|            |                           |             |       |             | Q2  | 87.4      | XBDRDO-00-0000-000000A01 |
|            |                           |             |       |             | P4  | 80.6      | XBDRDO-00-0000-000000901 |
|            |                           |             |       |             | P3  | 73.9      | XBDRDO-00-0000-000000801 |

| Color | Dominant Wavelength Range |             |       |             | Base Order Codes<br>Min. Luminous Flux<br>(lm) @ 350 mA |           | Order Code               |
|-------|---------------------------|-------------|-------|-------------|---|-----------|--------------------------|
|       | Min.                      |             | Max.  |             | Group   | Flux (lm) |                          |
|       | Group                     | DWL<br>(nm) | Group | DWL<br>(nm) |   |           |                          |
| Red   | R2                        | 620         | R3    | 630         | P2  | 67.2      | XBDRED-00-0000-000000701 |
|       |                           |             |       |             | N4  | 62        | XBDRED-00-0000-000000601 |
|       |                           |             |       |             | N3  | 56.8      | XBDRED-00-0000-000000501 |

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

**RELATIVE SPECTRAL POWER DISTRIBUTION**



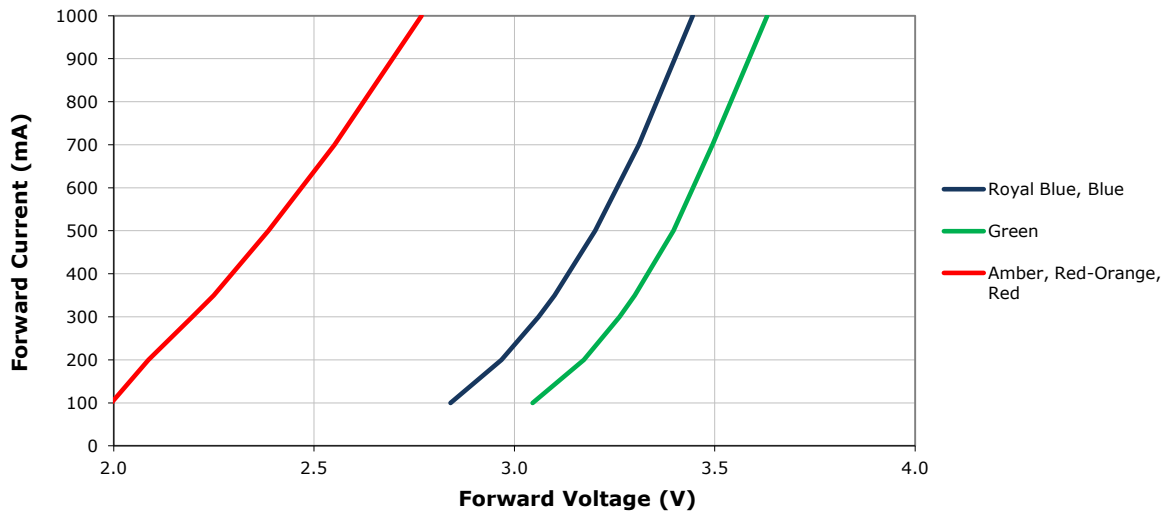
**RELATIVE FLUX VS. JUNCTION TEMPERATURE ( $I_f = 350 \text{ mA}$ )**



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

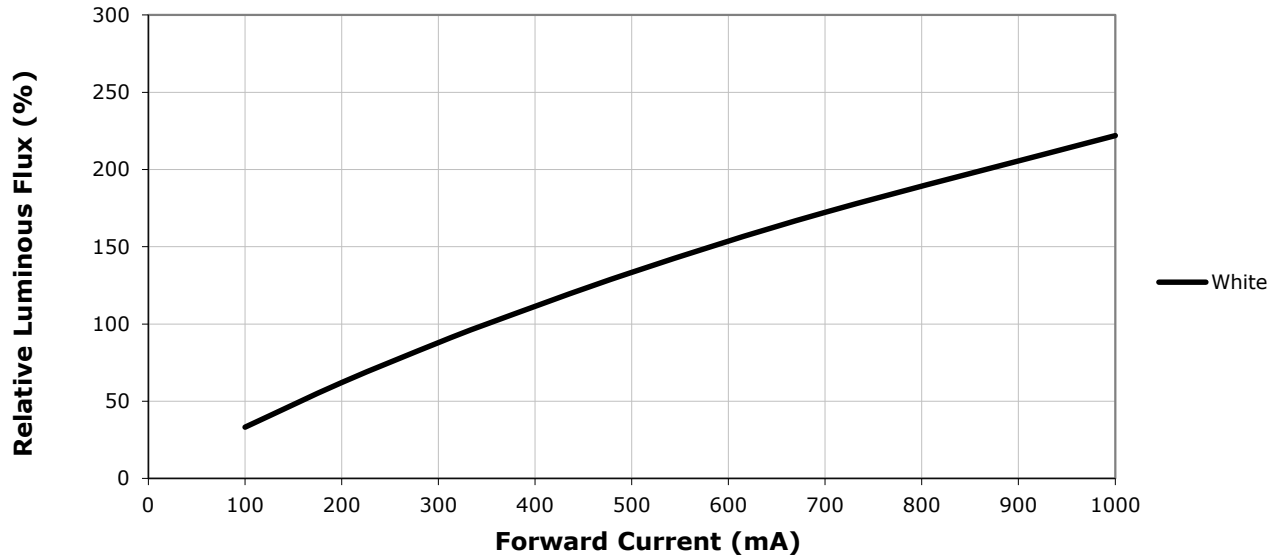


**ELECTRICAL CHARACTERISTICS ( $T_j = 25\text{ }^\circ\text{C}$ )**

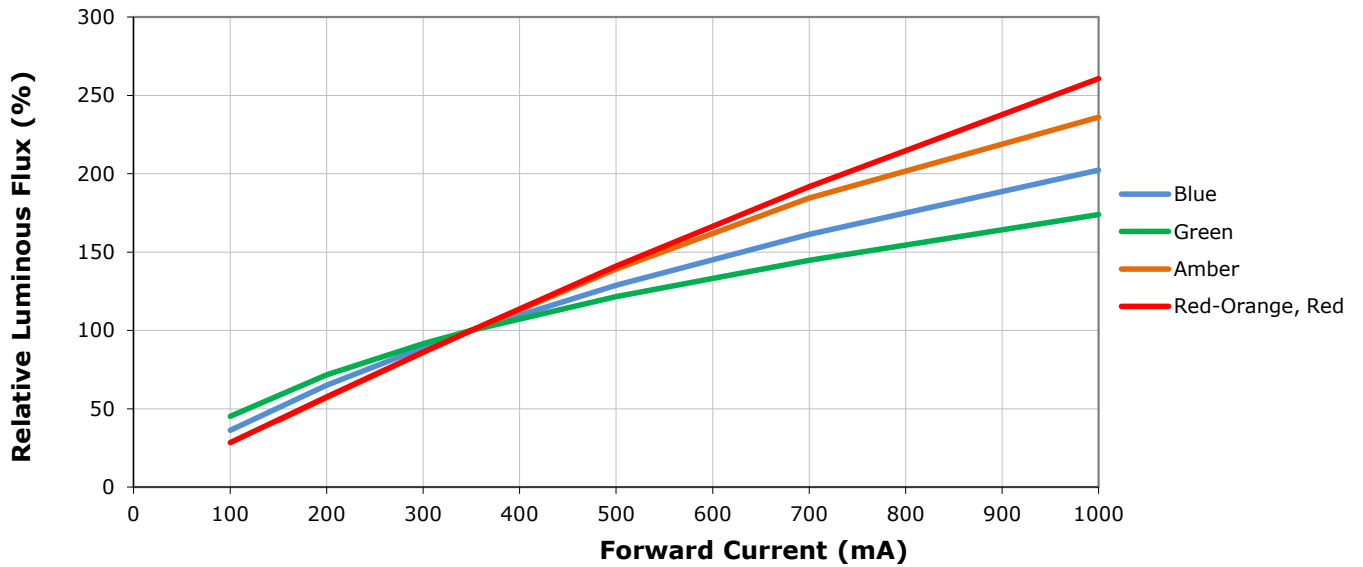




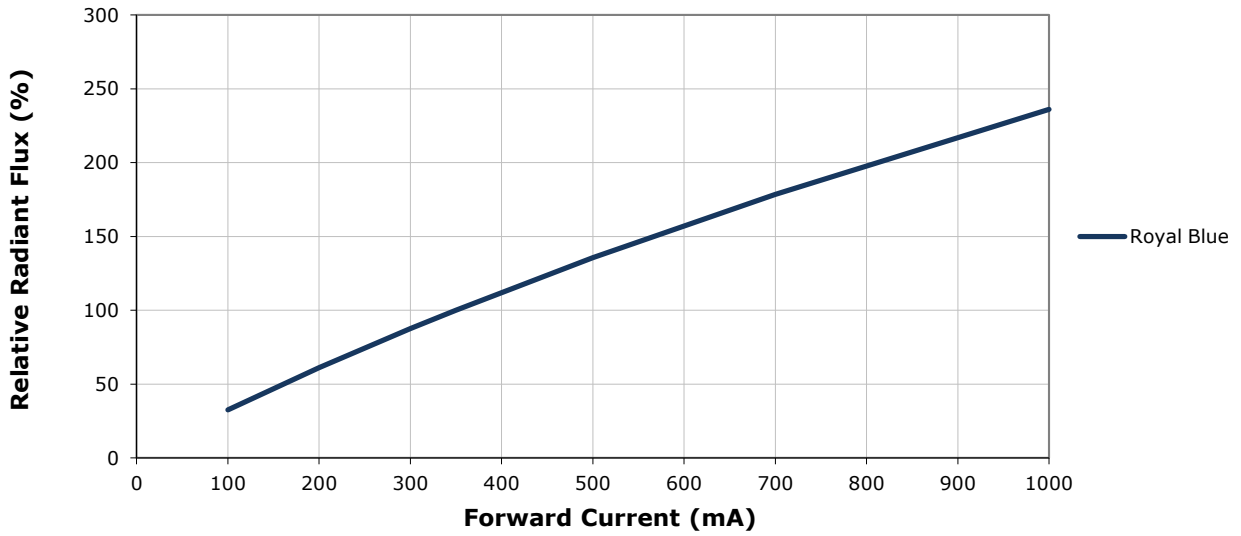
**RELATIVE FLUX VS. CURRENT ( $T_j = 85\text{ }^\circ\text{C}$ )**



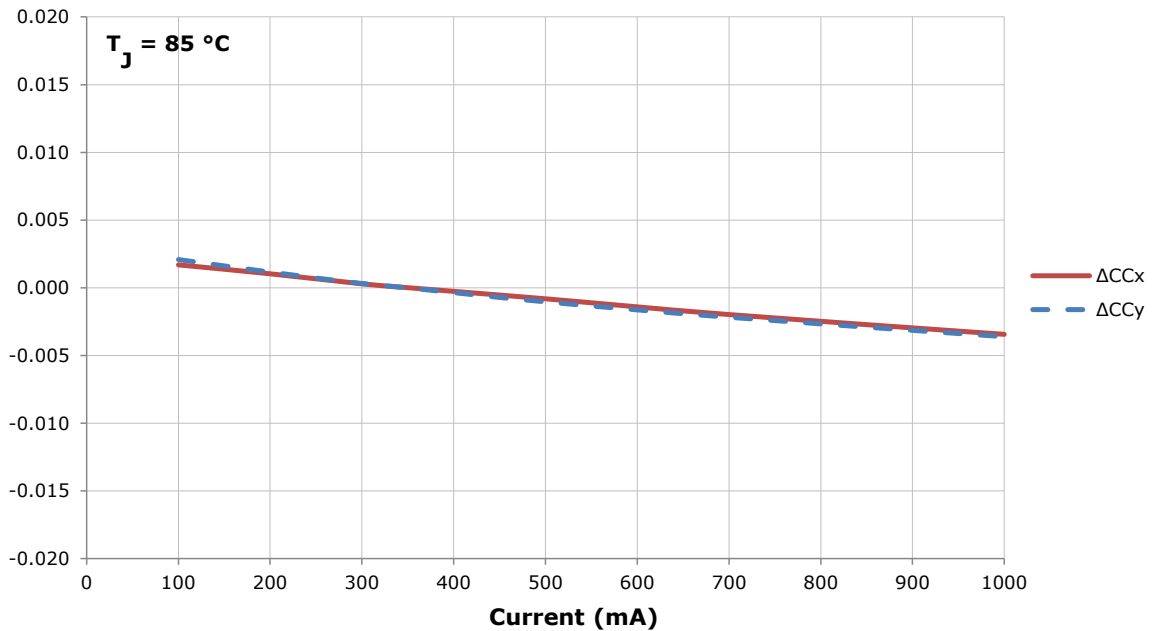
**RELATIVE FLUX VS. CURRENT ( $T_j = 25\text{ }^\circ\text{C}$ )**



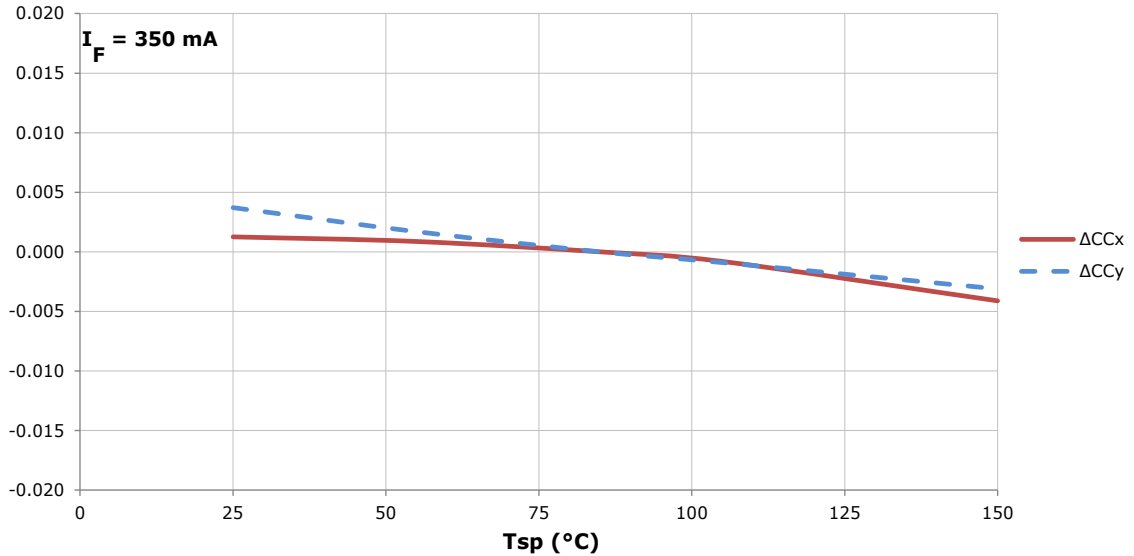
**RELATIVE FLUX VS. CURRENT ( $T_j = 25\text{ }^\circ\text{C}$ ) - CONTINUED**



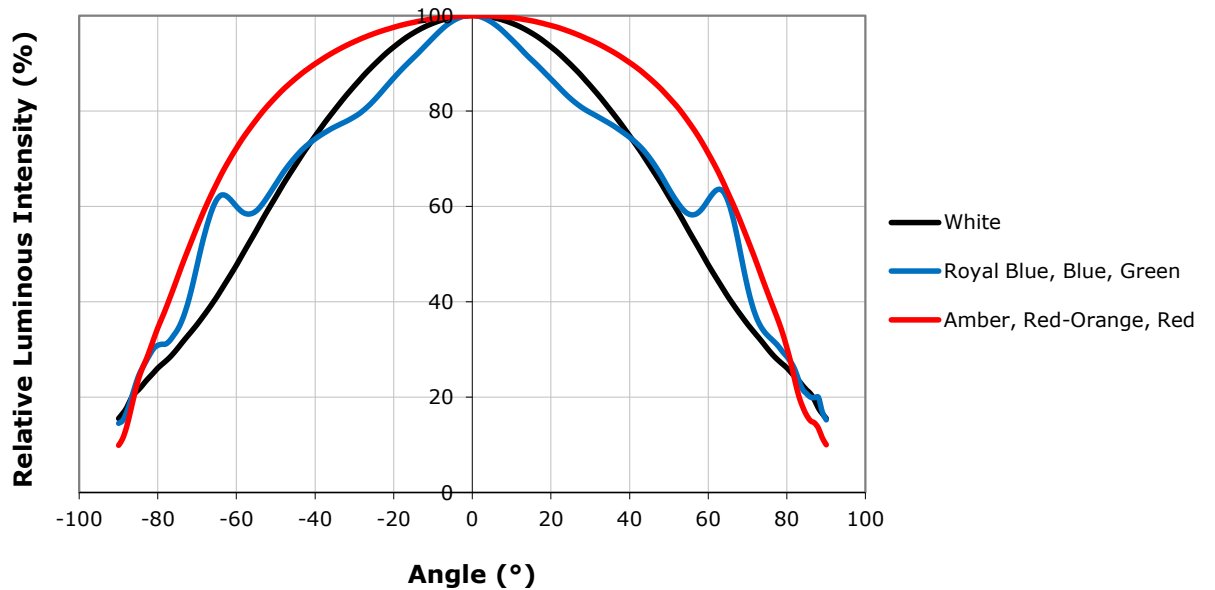
**RELATIVE CHROMATICITY VS. CURRENT (WARM WHITE)**



**RELATIVE CHROMATICITY VS. TEMPERATURE (WARM WHITE)**

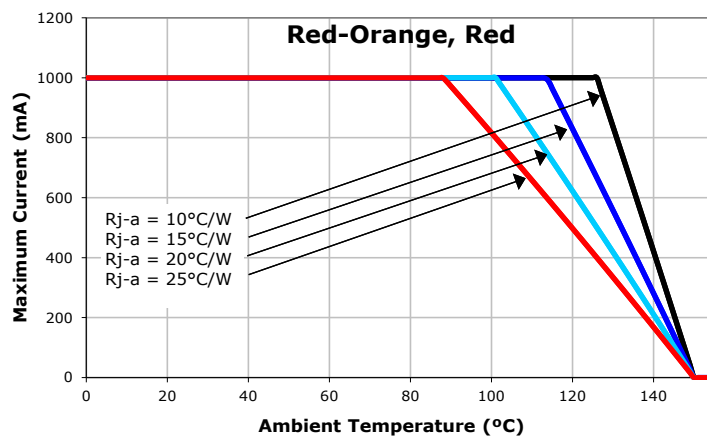
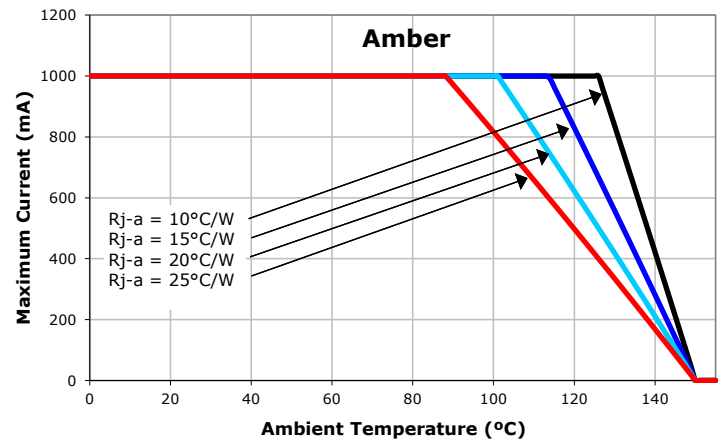
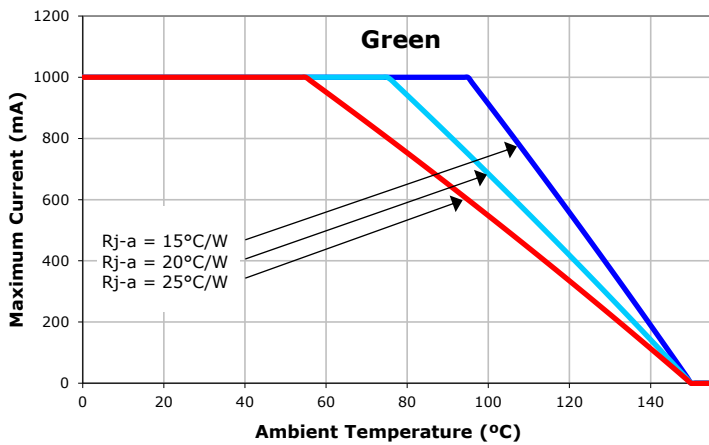
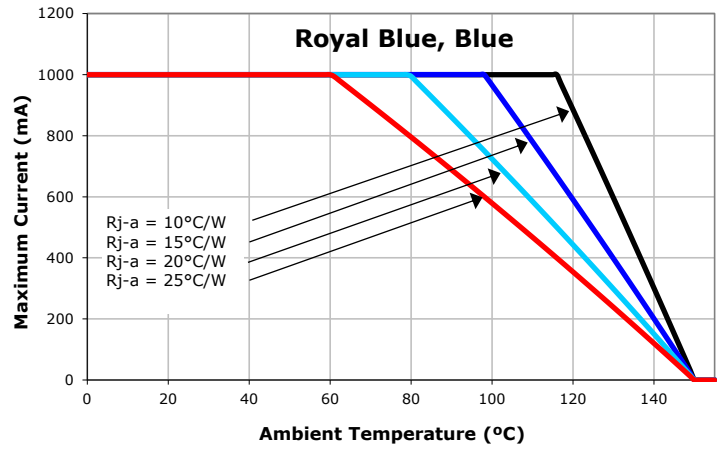
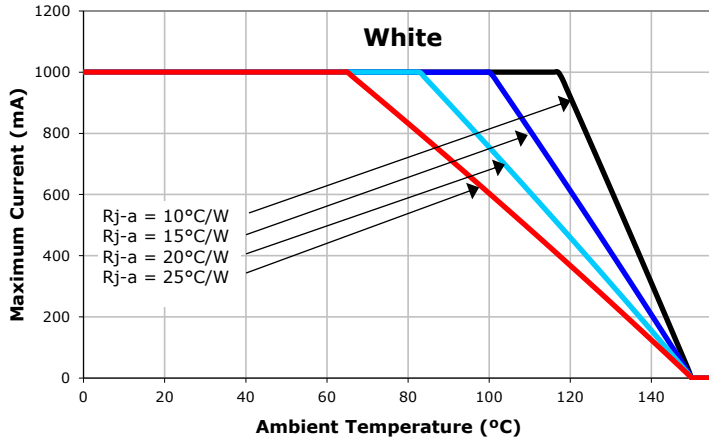


**TYPICAL SPATIAL DISTRIBUTION**



### 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.



## REFLOW SOLDERING CHARACTERISTICS

In testing, Cree has found XLamp XB-D 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.



| Profile Feature                                       | Lead-Based Solder | Lead-Free Solder |
|---|-------------------|------------------|
| Average Ramp-Up Rate ( $T_{s_{max}}$ to $T_p$ )       | 3 °C/second max.  | 3 °C/second max. |
| Preheat: Temperature Min ( $T_{s_{min}}$ )            | 100 °C            | 150 °C           |
| Preheat: Temperature Max ( $T_{s_{max}}$ )            | 150 °C            | 200 °C           |
| Preheat: Time ( $t_{s_{min}}$ to $t_{s_{max}}$ )      | 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 ( $T_p$ )             | 215 °C            | 260 °C           |
| Time Within 5 °C of Actual Peak Temperature ( $t_p$ ) | 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.

## NOTES

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### **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](http://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](http://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](http://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 XB-D LEDs to have unlimited floor life in conditions  $\leq 30$  °C/85% relative humidity (RH). Moisture testing included a 168-hour soak at 85 °C/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.

### **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 Ecology section of [www.cree.com](http://www.cree.com).

### **REACH Compliance**

REACH substances of high concern (SVHCs) information is available for this product. Since the European Chemical Agency (ECHA) has published notices 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. Historical REACH banned substance information (substances restricted or banned in the EU prior to 2010) is also available upon request.

### **UL Recognized Component**

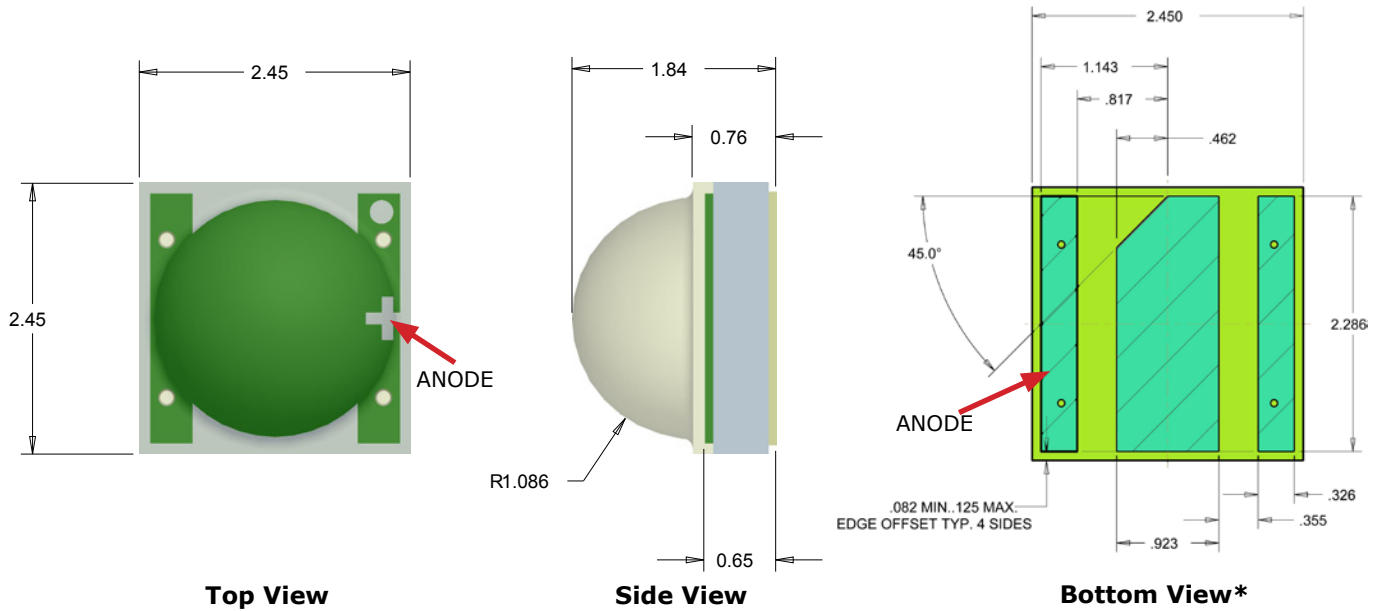
Level 4 enclosure consideration. The LED package or a portion thereof has been investigated as a fire and electrical enclosure per ANSI/UL 8750.

### **Vision Advisory Claim**

WARNING: Do not look at exposed lamp in operation. Eye injury can result. See the LED Eye Safety application note at [www.cree.com/xlamp\\_app\\_notes/led\\_eye\\_safety](http://www.cree.com/xlamp_app_notes/led_eye_safety).

**MECHANICAL DIMENSIONS**

All measurements are  $\pm .13$  mm unless otherwise indicated.



\* Note: In December, 2012, Cree changed the thermal pad of the XB-D package to include the anode notch illustrated above. XB-D LEDs produced prior to implementation of this change may have a different visual appearance.

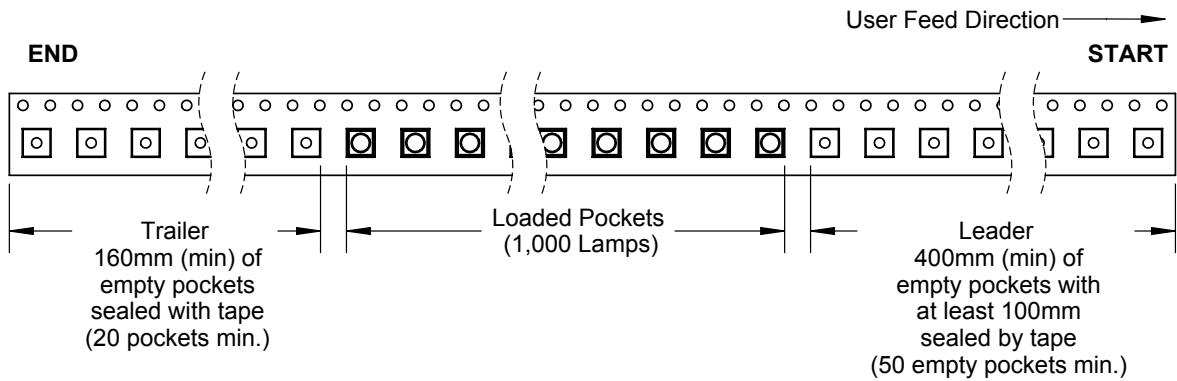


**TAPE AND REEL**

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

All dimensions in mm

Tolerance unless specified: .XX ± .25, .XXX ± .125, X° ± .5°





### PACKAGING

#### Unpackaged Reel



Label with Cree Bin Code, Qty, Reel ID

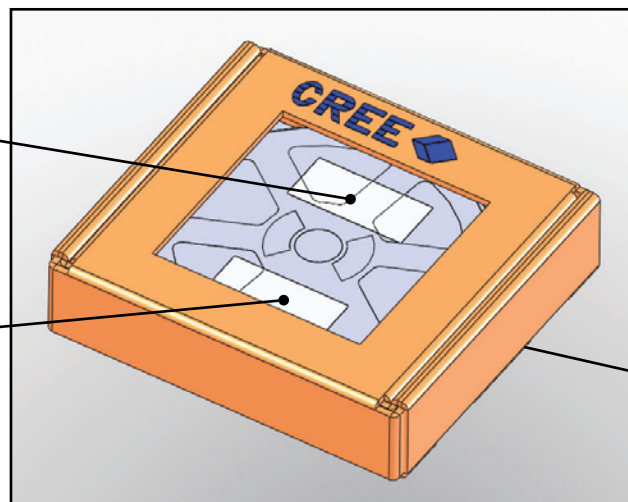
#### Packaged Reel



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

Label with Cree Bin Code, Qty, Reel ID

#### Boxed Reel



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

Label with Cree Bin Code, Qty, Reel ID

Patent Label (on bottom of box)