

## 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.

The XB-D shares common footprint and uniform package design across all white and color configurations, simplifying board and optical designs for many LED systems. The 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)

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## 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 LED Binning and Labeling document.

| Color                     | CCT Range |         | Minimum Luminous Flux @ 350 mA |                   |                    | Calculated Minimum Luminous Flux (lm)** |         | Order Code                |
|---------------------------|-----------|---------|--------------------------------|-------------------|--------------------|---|---------|---------------------------|
|                           | Minimum   | Maximum | Group                          | Flux (lm) @ 85 °C | Flux (lm) @ 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 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 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. See the Measurements section (page 14).
- 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 ( $T_j = 25\text{ }^\circ\text{C}$ )

The following tables provide 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 LED Binning and Labeling document.

| Color      | Dominant Wavelength Range |          |         |          | Minimum Radiant Flux (mW) @ 350 mA |           | Order Code               |
|------------|---------------------------|----------|---------|----------|------------------------------------|-----------|--------------------------|
|            | Minimum                   |          | Maximum |          | 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 |          |         |          | Minimum Luminous Flux (lm) @ 350 mA |           | Order Code               |
|-------|---------------------------|----------|---------|----------|-------------------------------------|-----------|--------------------------|
|       | Minimum                   |          | Maximum |          | 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 |          |         |          | Minimum Luminous Flux (lm) @ 350 mA |           | Order Code               |
|-------|---------------------------|----------|---------|----------|-------------------------------------|-----------|--------------------------|
|       | Minimum                   |          | Maximum |          | 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 |          |         |          | Minimum Luminous Flux (lm) @ 350 mA |           | Order Code               |
|-------|---------------------------|----------|---------|----------|-------------------------------------|-----------|--------------------------|
|       | Minimum                   |          | Maximum |          | 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 |

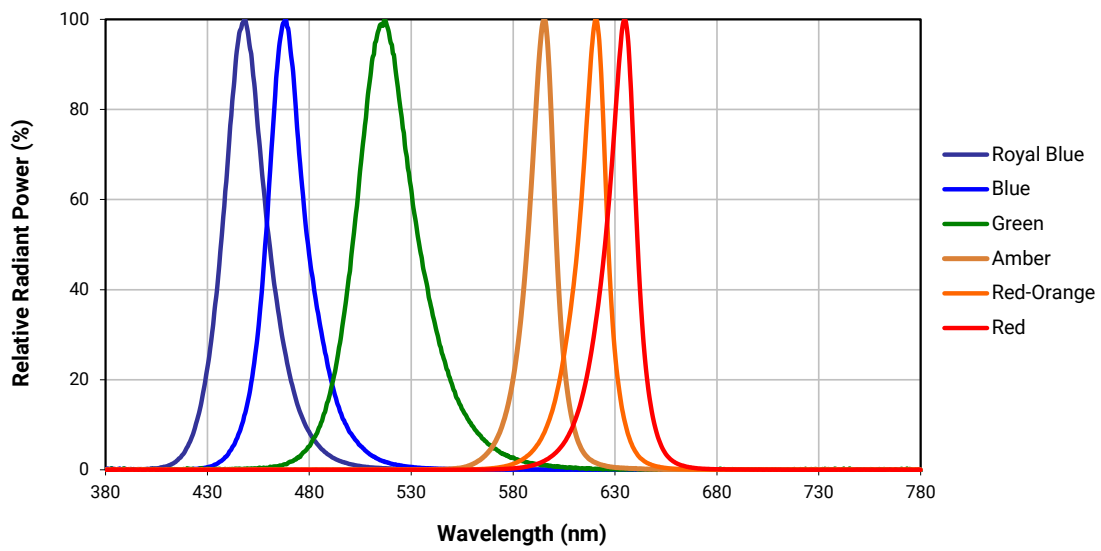
**FLUX CHARACTERISTICS - COLOR (T<sub>J</sub> = 25 °C) - CONTINUED**

| Color      | Dominant Wavelength Range |          |         |          | Minimum Luminous Flux (lm) @ 350 mA |           | Order Code               |
|------------|---------------------------|----------|---------|----------|-------------------------------------|-----------|--------------------------|
|            | Minimum                   |          | Maximum |          | Group                               | Flux (lm) |                          |
|            | Group                     | DWL (nm) | Group   | DWL (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 |

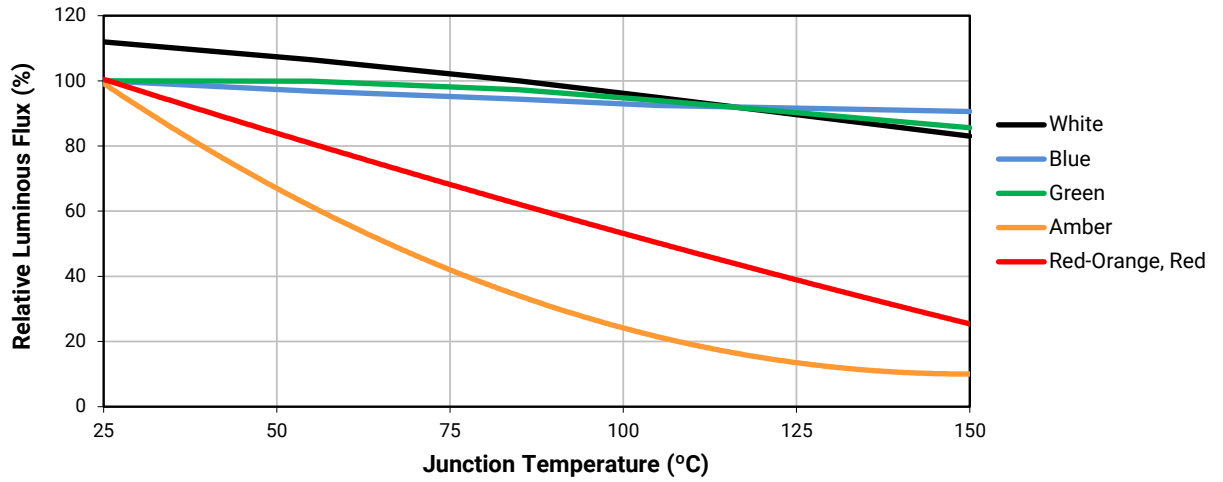
| Color | Dominant Wavelength Range |          |         |          | Minimum Luminous Flux (lm) @ 350 mA |           | Order Code               |
|-------|---------------------------|----------|---------|----------|-------------------------------------|-----------|--------------------------|
|       | Minimum                   |          | Maximum |          | Group                               | Flux (lm) |                          |
|       | Group                     | DWL (nm) | Group   | DWL (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 ±7% on flux and power measurements and ±1 nm on dominant wavelength measurements. See the Measurements section (page 14).

**RELATIVE SPECTRAL POWER DISTRIBUTION**



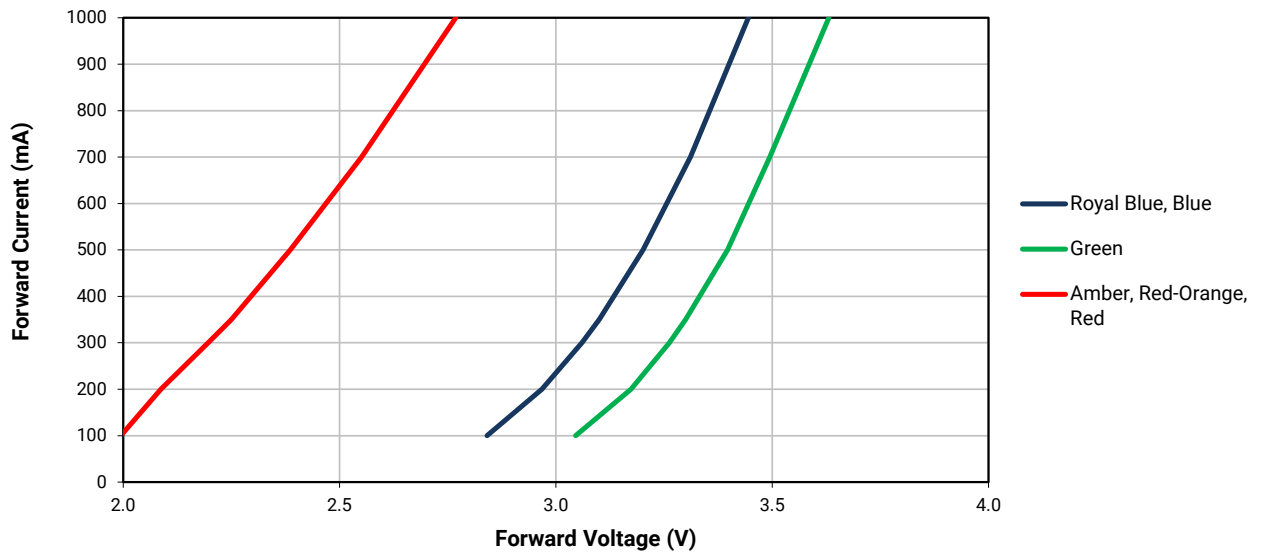
**RELATIVE FLUX VS. JUNCTION TEMPERATURE ( $I_F = 350$  mA)**



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

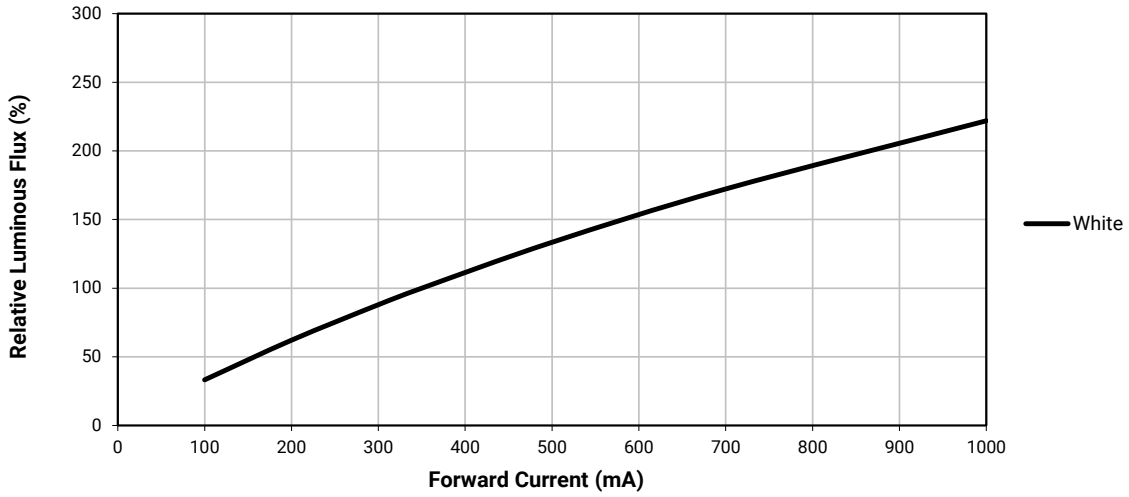


**ELECTRICAL CHARACTERISTICS ( $T_j = 25\text{ }^\circ\text{C}$ )**

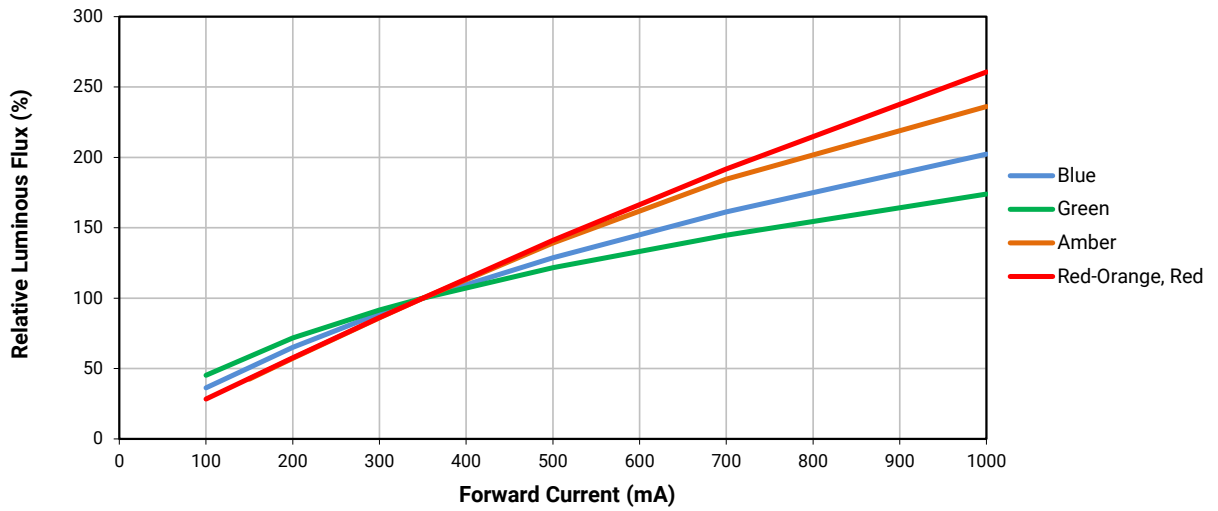




**RELATIVE FLUX VS. CURRENT ( $T_j = 85\text{ }^\circ\text{C}$ )**



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



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



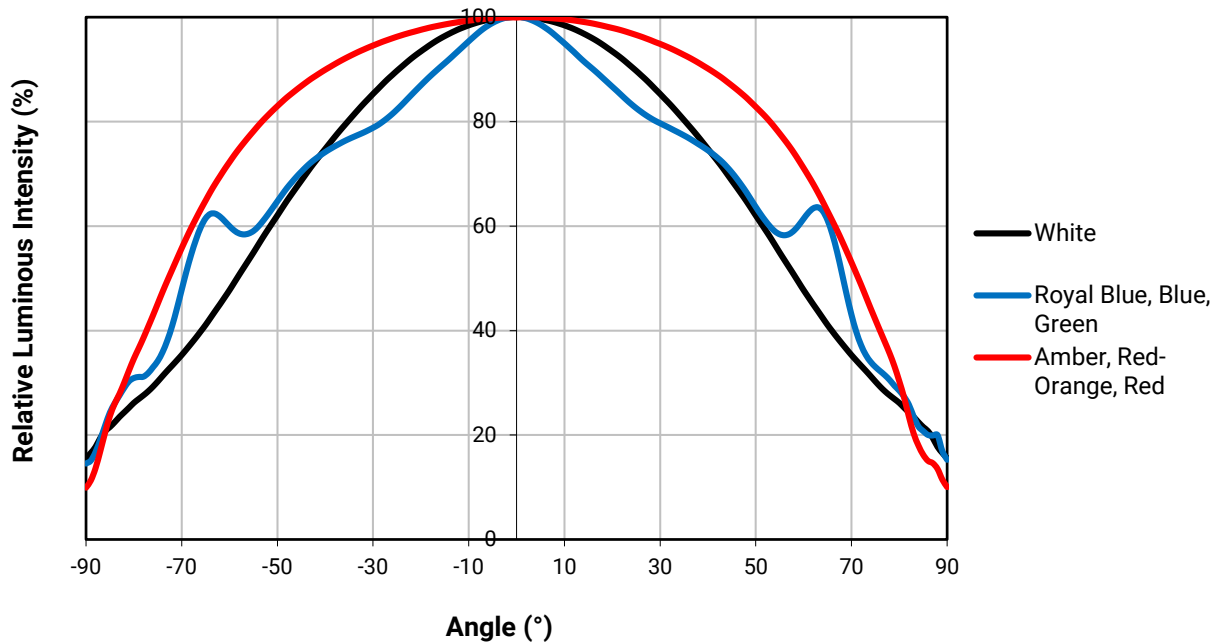
**RELATIVE CHROMATICITY VS. CURRENT (WARM WHITE)**



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

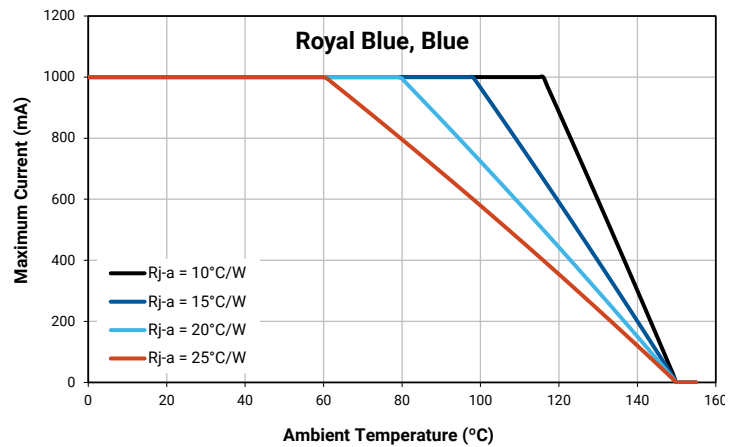
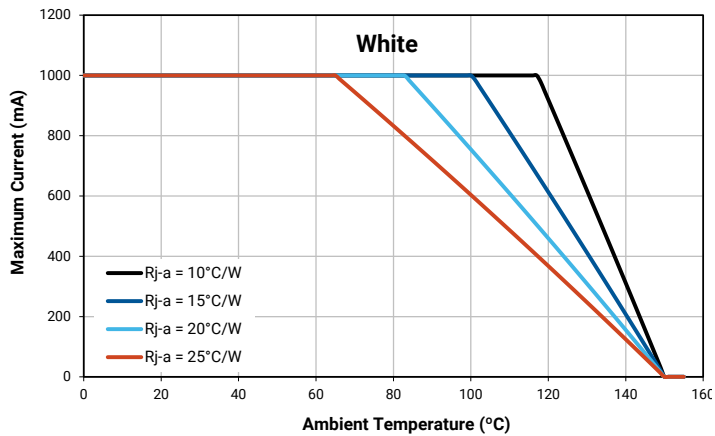


**TYPICAL SPATIAL DISTRIBUTION**



**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 the solder paste used.

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 ( $T_{s_{max}}$ 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 ( $t_p$ )                 | 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 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'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 XB-D 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 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 Ecology](#) section of the Cree 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 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.

**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.

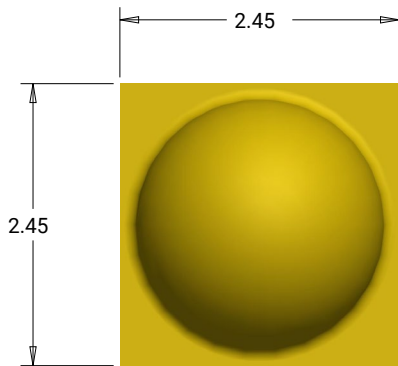
**Vision Advisory**

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.



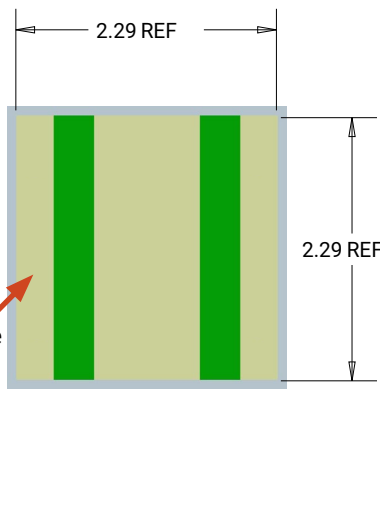
**Top View**



**Side View**



**Bottom View**



**Alternate Bottom View**



**Alternate Bottom View**



**MECHANICAL DIMENSIONS - CONTINUED**



**Recommended PCB Solder Pad**

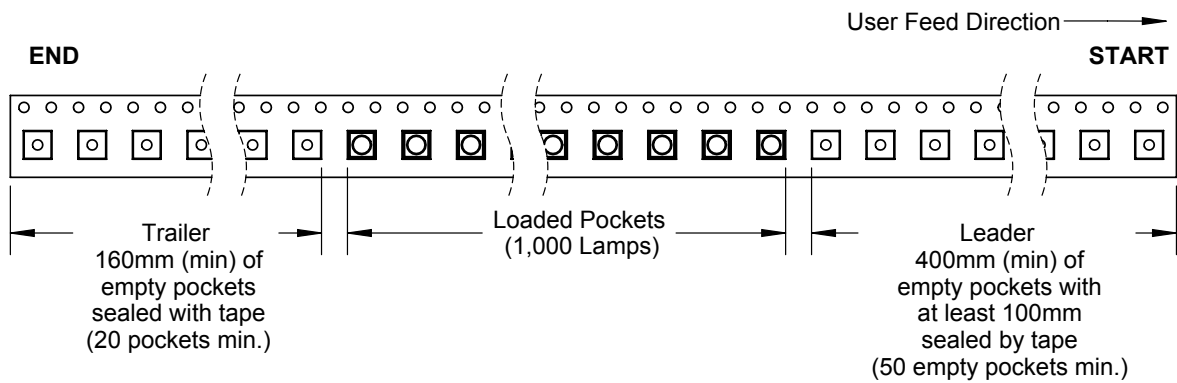


**Recommended Stencil Pattern  
(Hatched Area is Opening)**

**TAPE AND REEL**

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

Except as noted, all dimensions in mm



**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  
(on bottom of box)