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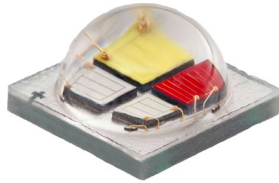
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Cree® XLamp® XM-L™ Color LEDs



PRODUCT DESCRIPTION

The XLamp® XM-L™ Color LED is a multi-color LED that provides high lumen output in a small package. Compared to discrete LEDs, XLamp XM-L Color LEDs reduce the distance between LED die, creating a small optical source for excellent optical control and efficient color mixing. XLamp XM-L Color LEDs can reduce LED system complexity by reducing the number of components required.

Cree XLamp XM-L Color LEDs bring high performance and quality of light to a wide range of lighting applications, including color-changing lighting, stage lighting, architectural lighting, indoor directional lighting, and entertainment lighting.

FEATURES

- Available in red, green, blue and white in a single 5 mm x 5 mm package
- Maximum drive current per LED die: 1 A
- Individually addressable LEDs
- Reflow solderable – JEDEC J-STD-020
- Electrically neutral thermal path
- RoHS compliant
- UL® recognized component (E349212)

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CHARACTERISTICS - COMPLETE PACKAGE

The following table lists the product characteristics for the XLamp XM-L Color LED package, measured with all LED dies on simultaneously and each LED die connected to independent drive circuits at 350 mA.

| Characteristics | Unit | Minimum | Typical | Maximum |
|--|-------------|---------|---------|---------|
| Thermal resistance, junction to solder point | °C/W | | 3.5 | |
| Viewing angle (FWHM) | degrees (°) | | 130 | |
| ESD withstand voltage (HBM per Mil-Std-883D) | V | | | 8000 |
| LED junction temperature | °C | | | 150 |

CHARACTERISTICS - PER LED DIE

The following table lists the product characteristics for each LED die within the XLamp XM-L Color LED package.

| Characteristics | Unit | Minimum | Typical | Maximum |
|--|-------|---------|---------|---------|
| Temperature coefficient of voltage - red | mV/°C | | -1.8 | |
| Temperature coefficient of voltage - green | mV/°C | | -4 | |
| Temperature coefficient of voltage - blue, white | mV/°C | | -3 | |
| DC forward current - red, green, blue, white | mA | | | 1000 |
| Forward voltage (@ 350 mA, 25 °C) - red | V | | 2.25 | 2.6 |
| Forward voltage (@ 350 mA, 25 °C) - green | V | | 3.3 | 3.9 |
| Forward voltage (@ 350 mA, 25 °C) - blue, white | V | | 3.1 | 3.7 |

FLUX CHARACTERISTICS, (T_j = 25 °C)

The following tables provide several base order codes for XM-L Color LEDs. For a complete description of the order code nomenclature, please refer to the Bin and Order Code Formats section (page 6).

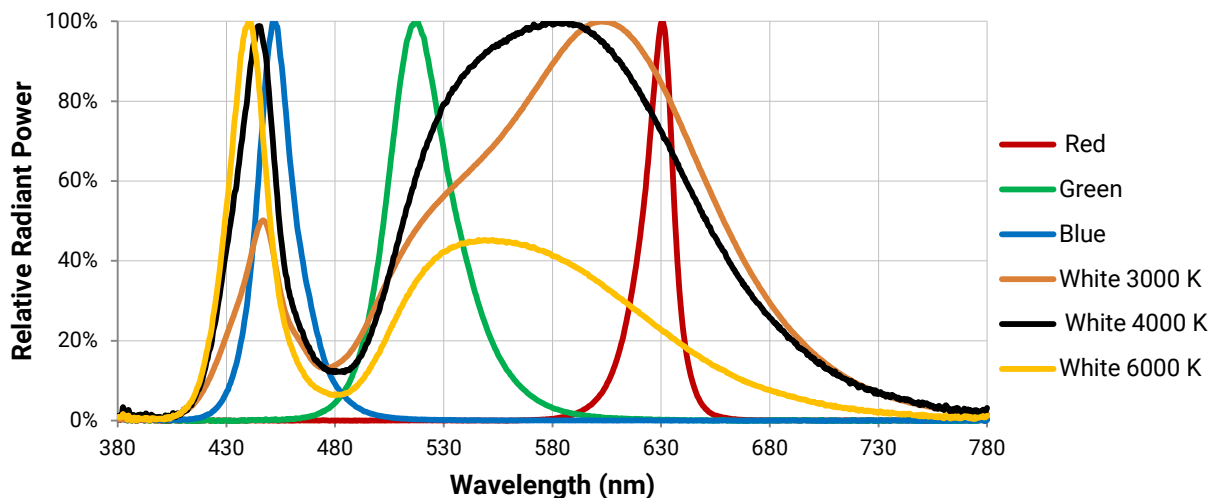
| Color | | CCT / Dominant Wavelength Range | | Minimum Luminous Flux @ 350 mA | | Order Code |
|-----------------------|---------------|---------------------------------|---------|--------------------------------|-----------|--------------------------|
| | | Minimum | Maximum | Group | Flux (lm) | |
| Color + Cool White | Red | 620 nm | 630 nm | C3 | 45.7 | XMLCTW-A0-0000-00C3AAAA1 |
| | Green | 520 nm | 535 nm | | 87.4 | |
| | Blue | 450 nm | 465 nm | | 13.9 | |
| | Cool White | 5700 K | 8000 K | | 100 | |
| Color + Neutral White | Red | 620 nm | 630 nm | C2 | 45.7 | XMLCTW-A0-0000-00C2AAAB1 |
| | Green | 520 nm | 535 nm | | 87.4 | |
| | Blue | 450 nm | 465 nm | | 13.9 | |
| | Neutral White | 3700 K | 4300 K | | 80 | |
| Color + Warm White | Red | 620 nm | 630 nm | C2 | 45.7 | XMLCTW-A0-0000-00C2AAAC1 |
| | Green | 520 nm | 535 nm | | 87.4 | |
| | Blue | 450 nm | 465 nm | | 13.9 | |
| | Warm White | 2700 K | 3700 K | | 80 | |

Notes:

- Cree maintains a tolerance of ±7% on flux and power measurements, ±0.005 on chromaticity (CCx, CCy) measurements and ±1 nm on dominant wavelength measurements. See the Measurements section (page 11).
- Flux and chromaticity are measured with each LED die connected to independent drive circuits at 350 mA. The flux and chromaticity of each LED die within the XLamp XM-L Color LED package are measured individually.

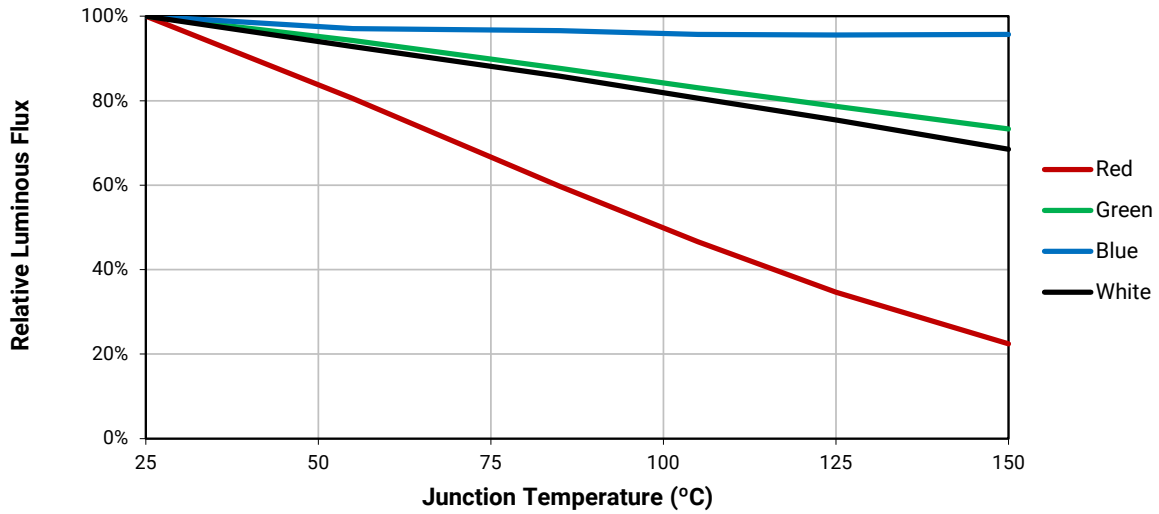
RELATIVE SPECTRAL POWER DISTRIBUTION (I_F = 350 mA PER LED DIE, 25 °C)

The following graph represents typical spectral output of the XLamp XM-L Color LED with each LED die on independently.



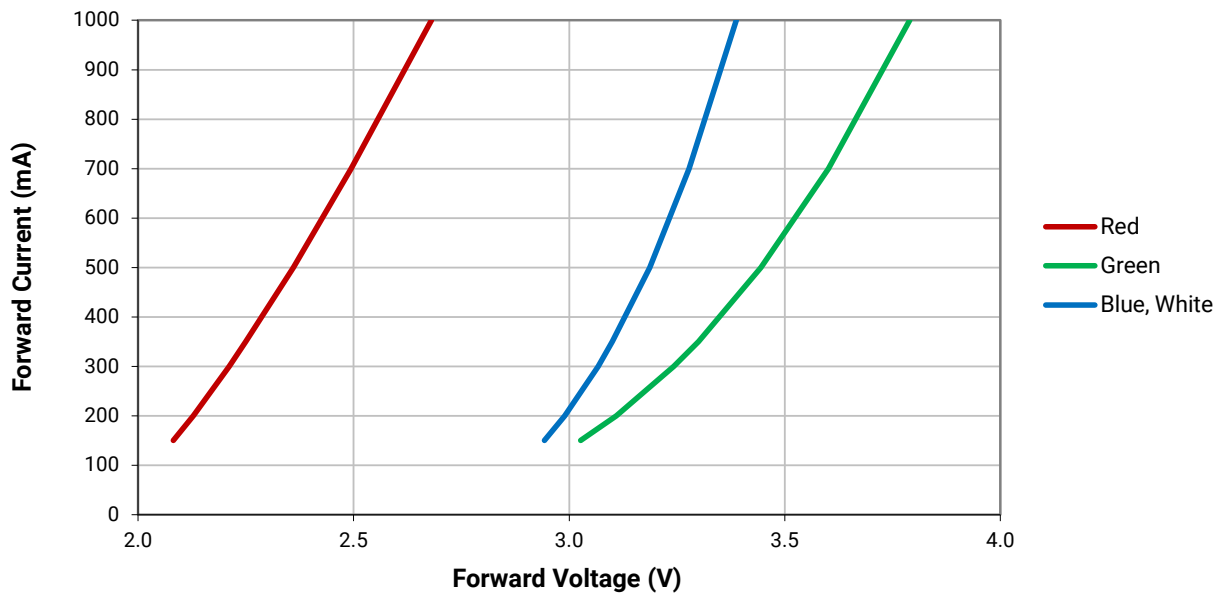
RELATIVE FLUX VS JUNCTION TEMPERATURE ($I_F = 350 \text{ mA}$)

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



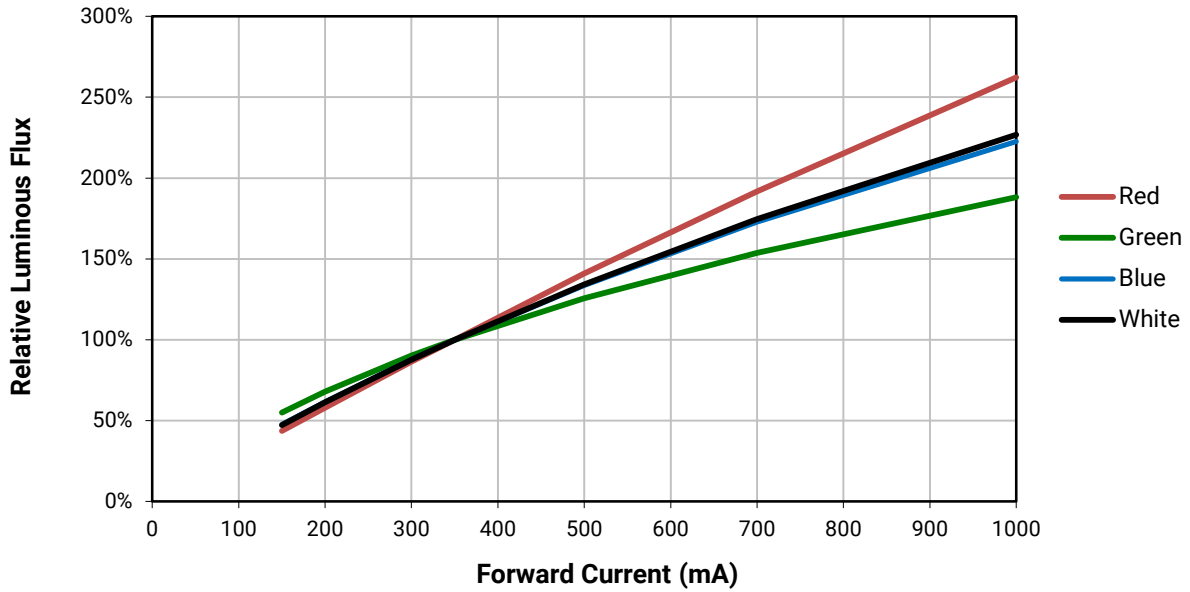
ELECTRICAL CHARACTERISTICS ($T_J = 25 \text{ °C}$)

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



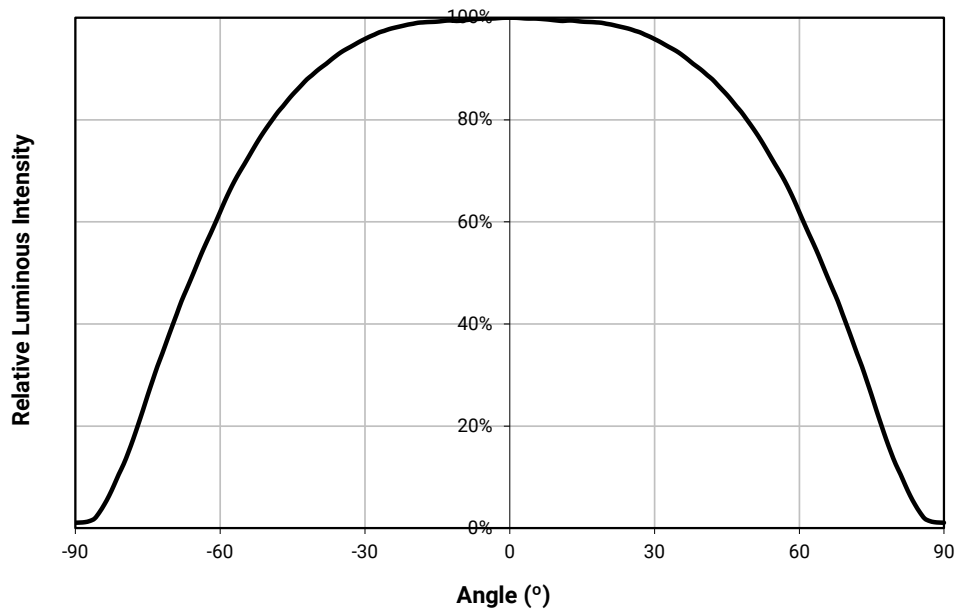
RELATIVE FLUX VS. CURRENT ($T_j = 25\text{ }^\circ\text{C}$)

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



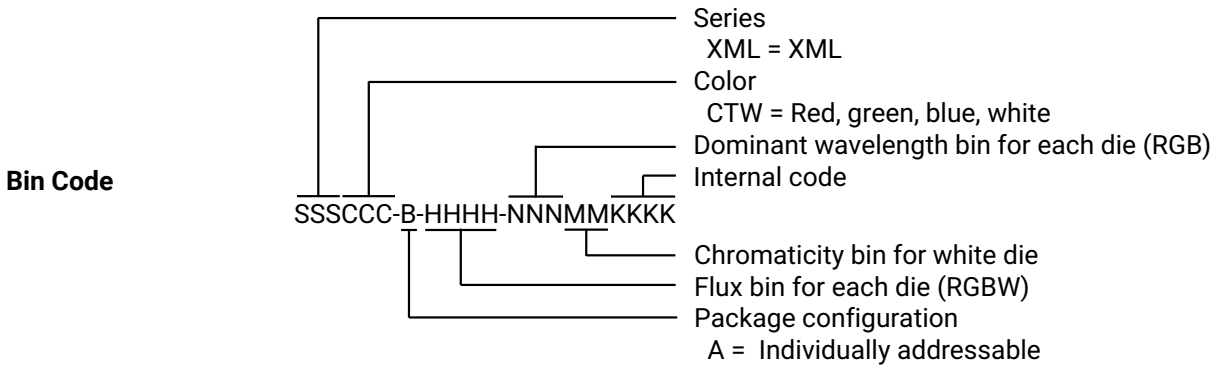
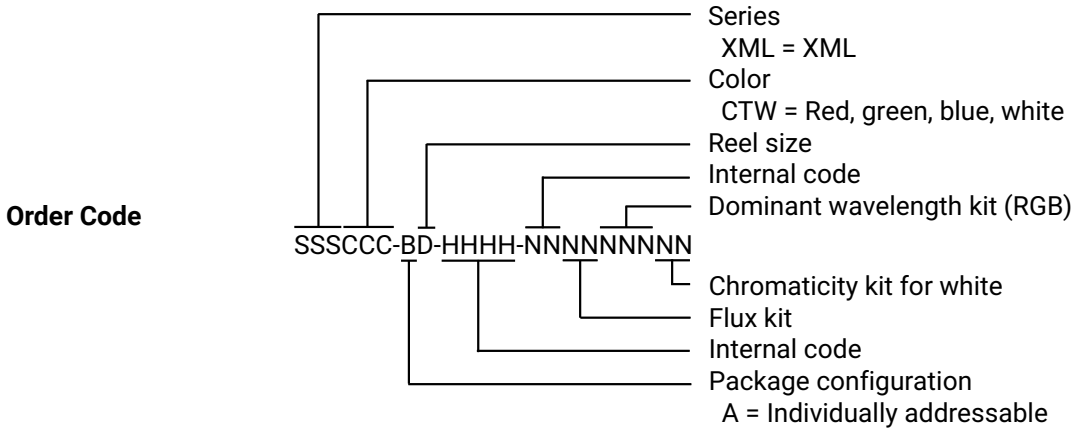
TYPICAL SPATIAL DISTRIBUTION

The following graph represents typical output of the XLamp XM-L Color LED with all four LEDs on simultaneously.



BIN AND ORDER CODE FORMATS

Bin codes and order codes are configured in the following manner:



PERFORMANCE GROUPS – LUMINOUS FLUX

Each LED die in the XLamp XM-L Color LED is tested individually for luminous flux and placed into one of the following luminous-flux groups.

| Color | Group Code | Minimum Luminous Flux (lm) @ 350 mA | Maximum Luminous Flux (lm) @ 350 mA |
|-------|------------|-------------------------------------|-------------------------------------|
| Red | M | 45.7 | 87.4 |
| | N | 87.4 | 114 |
| Green | N | 87.4 | 114 |
| | P | 114 | 148 |
| Blue | F | 13.9 | 39.8 |
| White | 2 | 80 | 100 |
| | 3 | 100 | 120 |
| | 4 | 120 | 140 |

- Flux and chromaticity are measured with each LED die connected to independent drive circuits at 350 mA.

PERFORMANCE GROUPS - CHROMATICITY ($I_F = 350$ mA PER LED DIE)

The white LED die in the XLamp XM-L Color LED is individually tested for chromaticity at 350 mA and placed into one of the regions defined by the bounding coordinates shown below.

| Region | x | y | Region | x | y |
|--------|------|------|--------|------|------|
| WM | .295 | .297 | WC | .316 | .332 |
| | .308 | .311 | | .317 | .319 |
| | .310 | .300 | | .308 | .311 |
| | .298 | .288 | | .306 | .322 |
| WB | .306 | .322 | WF | .314 | .355 |
| | .308 | .311 | | .316 | .332 |
| | .295 | .297 | | .306 | .322 |
| | .292 | .306 | | .301 | .342 |
| WE | .301 | .342 | WD | .329 | .345 |
| | .306 | .322 | | .329 | .330 |
| | .292 | .306 | | .317 | .319 |
| | .287 | .321 | | .316 | .332 |
| WN | .308 | .311 | WG | .329 | .369 |
| | .317 | .319 | | .329 | .345 |
| | .318 | .308 | | .316 | .332 |
| | .310 | .300 | | .314 | .355 |

| Region | x | y | Region | x | y | Region | x | y | Region | x | y |
|--------|-------|-------|--------|-------|-------|--------|-------|-------|--------|-------|-------|
| 5A | .3670 | .3578 | 5B | .3702 | .3722 | 5C | .3825 | .3798 | 5D | .3783 | .3646 |
| | .3702 | .3722 | | .3736 | .3874 | | .3869 | .3958 | | .3825 | .3798 |
| | .3825 | .3798 | | .3869 | .3958 | | .4006 | .4044 | | .3950 | .3875 |
| | .3783 | .3646 | | .3825 | .3798 | | .3950 | .3875 | | .3898 | .3716 |
| 7A | .4147 | .3814 | 7B | .4221 | .3984 | 7C | .4342 | .4028 | 7D | .4259 | .3853 |
| | .4221 | .3984 | | .4299 | .4165 | | .4430 | .4212 | | .4342 | .4028 |
| | .4342 | .4028 | | .4430 | .4212 | | .4562 | .4260 | | .4465 | .4071 |
| | .4259 | .3853 | | .4342 | .4028 | | .4465 | .4071 | | .4373 | .3893 |

PERFORMANCE GROUPS – DOMINANT WAVELENGTH

The red, green and blue LED dies in the XLamp XM-L Color LED are tested individually for dominant wavelength (DWL) and sorted into one of the DWL bins defined below.

| Color | DWL Group | Minimum DWL @ 350 mA | Maximum DWL @ 350 mA |
|-------|-----------|----------------------|----------------------|
| Blue | K | 450 | 455 |
| | L | 455 | 460 |
| | M | 460 | 465 |
| Green | 2 | 520 | 525 |
| | 3 | 525 | 530 |
| | 4 | 530 | 535 |
| Red | A | 620 | 630 |

STANDARD ORDER CODES AND BINS

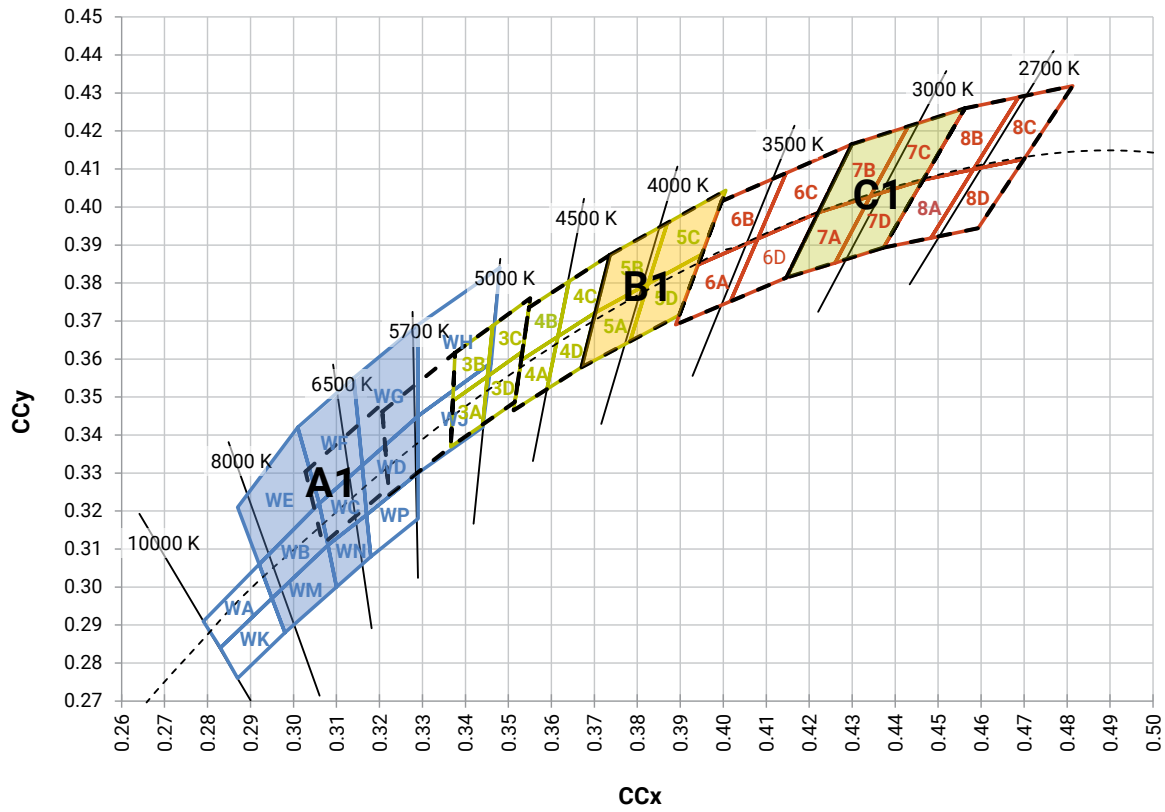
The following table list standard kit numbers and performance bins. Kit numbers completely describe an order code's color or chromaticity bins and luminous flux range.

| Color | Minimum Luminous Flux (lm) @ 350 mA* | | DWL / Chromaticity Bins | Kit Number |
|-------|--------------------------------------|-----------|--------------------------------|------------|
| | Group | Flux (lm) | | |
| Red | M | 45.7 | A | 00C3AAA1 |
| Green | N | 87.4 | 2, 3, 4 | |
| Blue | F | 13.9 | K, L, M | |
| White | 3 | 100 | WC, WD, WF, WG, WB, WE, WM, WN | |
| Red | M | 45.7 | A | 00C2AAAB1 |
| Green | N | 87.4 | 2, 3, 4 | |
| Blue | F | 13.9 | K, L, M | |
| White | 2 | 80 | 5A, 5B, 5C, 5D | |
| Red | M | 45.7 | A | 00C2AAAC1 |
| Green | N | 87.4 | 2, 3, 4 | |
| Blue | F | 13.9 | K, L, M | |
| White | 2 | 80 | 7A, 7B, 7C, 7D | |

For other flux and chromaticity combinations, contact Cree or an authorized distributor.

- * Cree XLamp XM-L Color 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 or DWL bin restrictions specified by the order code.

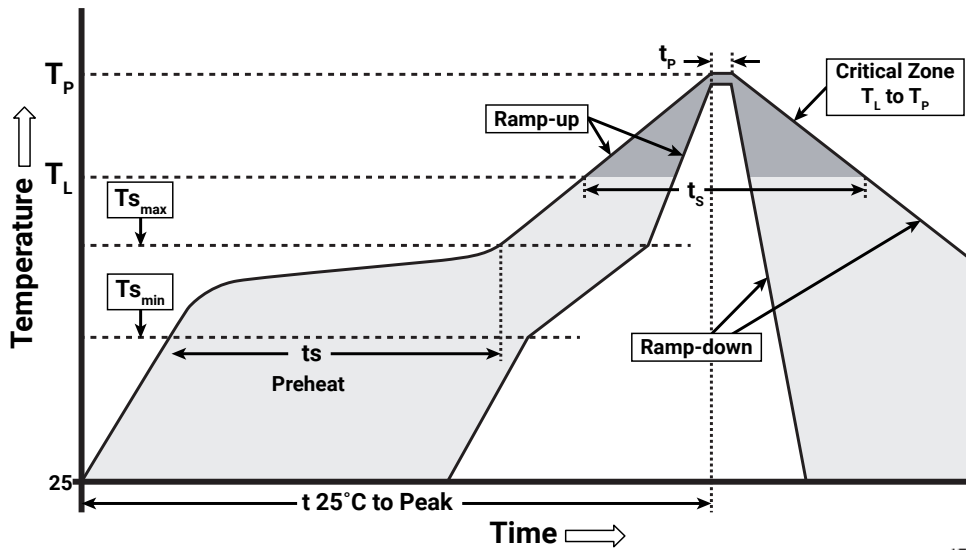
STANDARD ORDER CODES AND BINS - CONTNUED



REFLOW SOLDERING CHARACTERISTICS

In testing, Cree has found XLamp XM-L Color 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, 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 ($T_{s_{max}}$ 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 the topside of the package, measured on the package body surface.

NOTES

Measurements

The luminous flux, radiant power, chromaticity, forward voltage and CRI measurements in this document are binning specifications only and solely represent product measurements as of the date of shipment. These measurements will change over time based on a number of factors that are not within Cree'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 applies to ensure long-term reliability for XLamp LEDs and details of Cree's pre-release qualification testing for XLamp LEDs.

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.

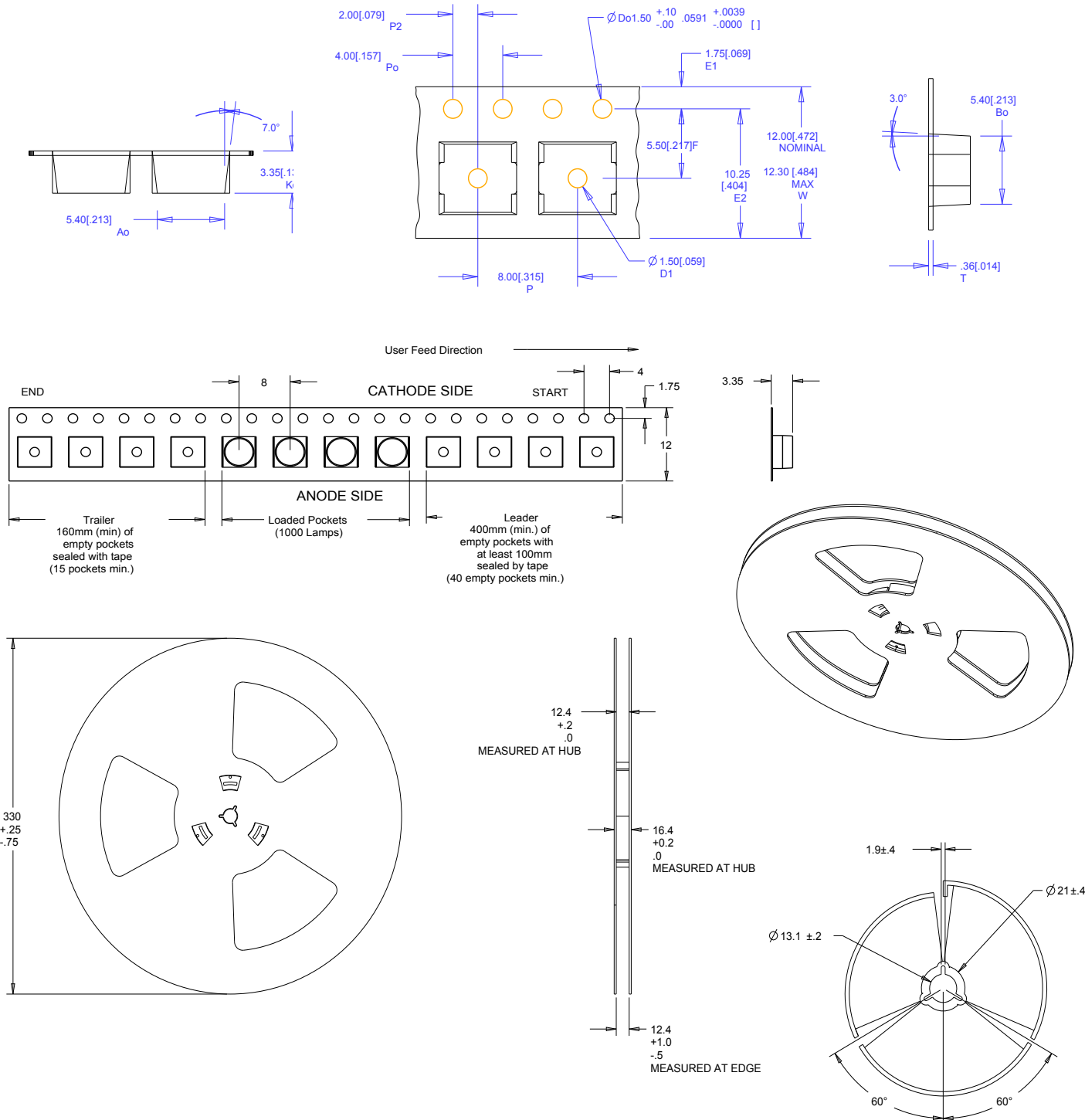
UL® Recognized Component

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.

TAPE AND REEL

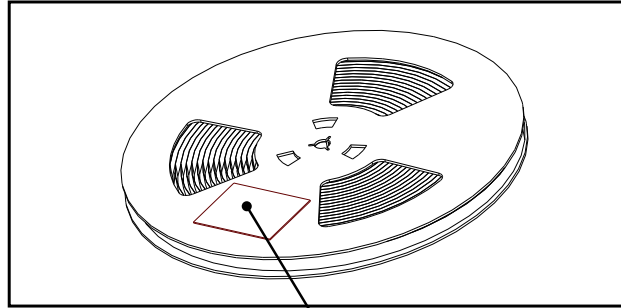
All Cree carrier tapes conform to EIA-481D, Automated Component Handling Systems Standard.

All dimensions in mm.



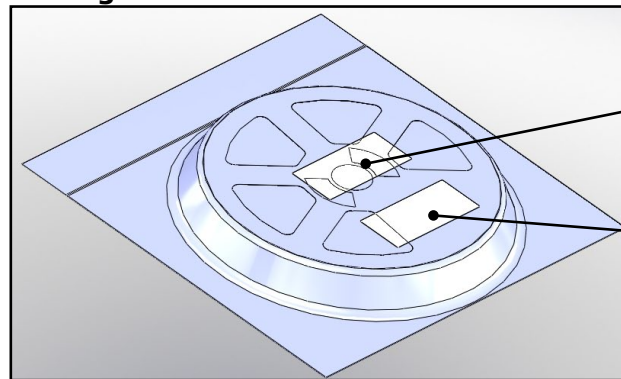
PACKAGING

Unpackaged Reel



Label with Cree Bin Code,
Quantity, Reel ID

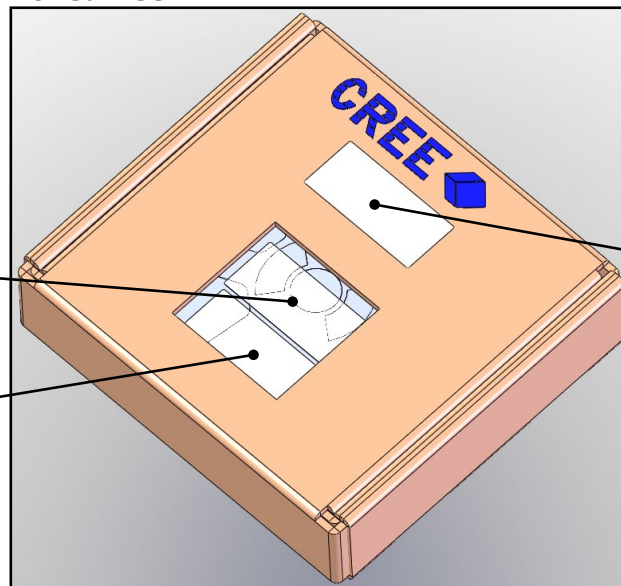
Packaged Reel



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