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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 ≤ 30 °C/85% RH
- Reflow solderable - JEDEC J-STD-020C
- Electrically neutral thermal path
- RoHS and REACH compliant
- UL® recognized component (E349212)

TABLE OF CONTENTS

| | |
|---|----|
| Characteristics | 2 |
| Flux Characteristics, EasyWhite® Order Codes and Bins | 3 |
| Relative Spectral Power Distribution | 5 |
| Relative Flux vs. Junction Temperature... | 5 |
| Electrical Characteristics..... | 6 |
| Relative Flux vs. Current | 7 |
| Relative Chromaticity vs. Current..... | 8 |
| Relative Chromaticity vs. Temperature.... | 9 |
| Typical Spatial Distribution..... | 9 |
| Thermal Design | 10 |
| Performance Groups – Luminous Flux.. | 11 |
| Performance Groups – Chromaticity..... | 11 |
| Cree’s Standard White Chromaticity Regions Plotted on the 1931 CIE Curve. | 12 |
| Bin and Order Code Formats | 13 |
| Reflow Soldering Characteristics..... | 14 |
| Notes | 15 |
| Mechanical Dimensions | 17 |
| Electrical Configuration | 19 |
| Tape and Reel..... | 20 |
| Packaging..... | 21 |



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 |
| 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, ± 0.005 on chromaticity (CCx, CCy) measurements and a tolerance of ± 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.

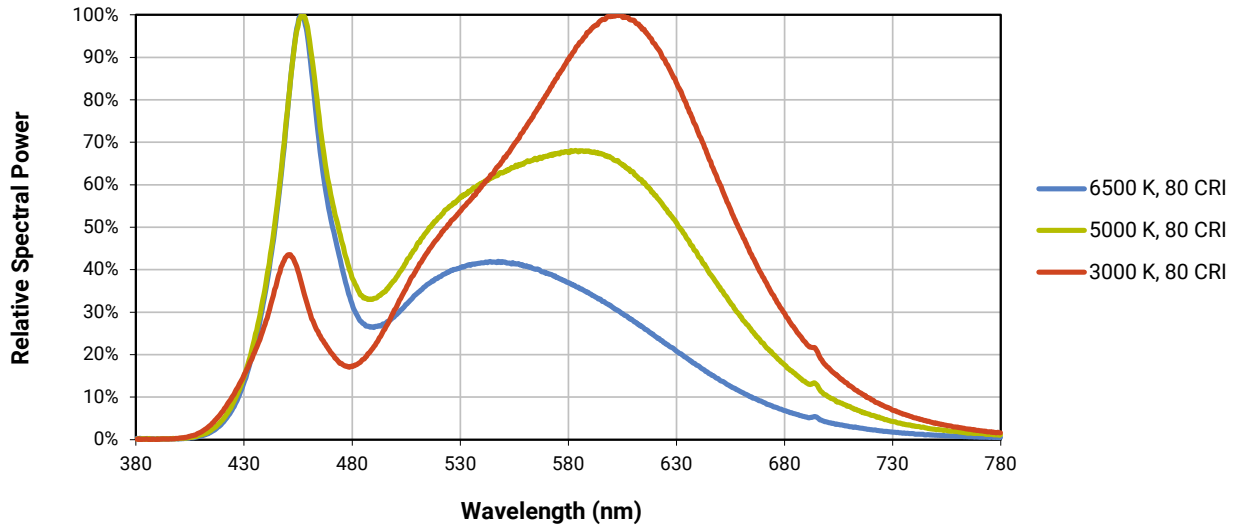
FLUX CHARACTERISTICS, EASYWHITE® ORDER CODES AND BINS - CONTINUED

| 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

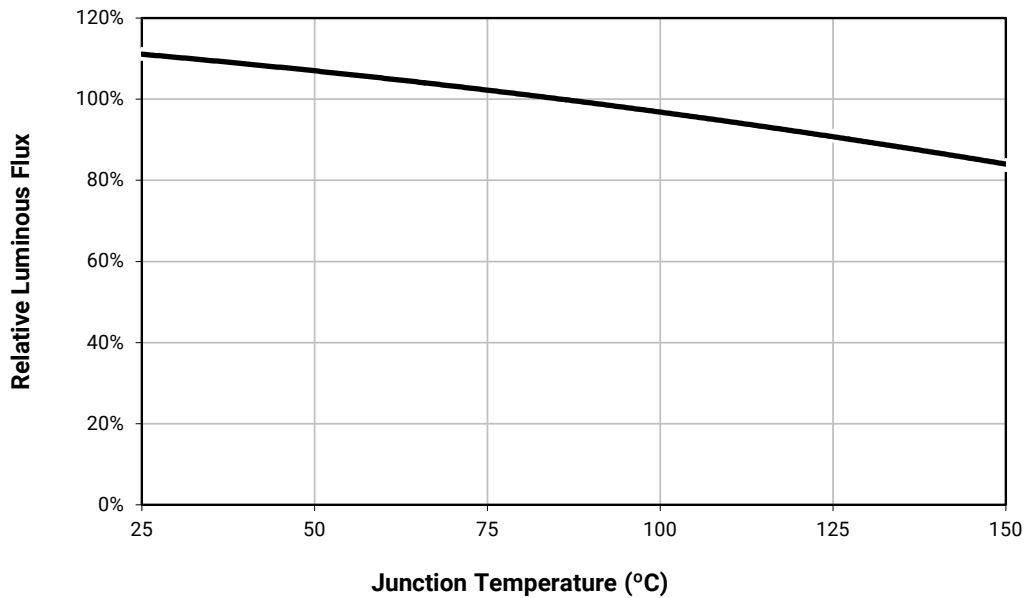
- Cree maintains a tolerance of $\pm 7\%$ on flux and power measurements, ± 0.005 on chromaticity (CCx, CCy) measurements and a tolerance of ± 2 on CRI measurements. See the Measurements section (page 19).
- Cree XLamp MHD-E LED order codes specify only a minimum flux bin and not a maximum. Cree may 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

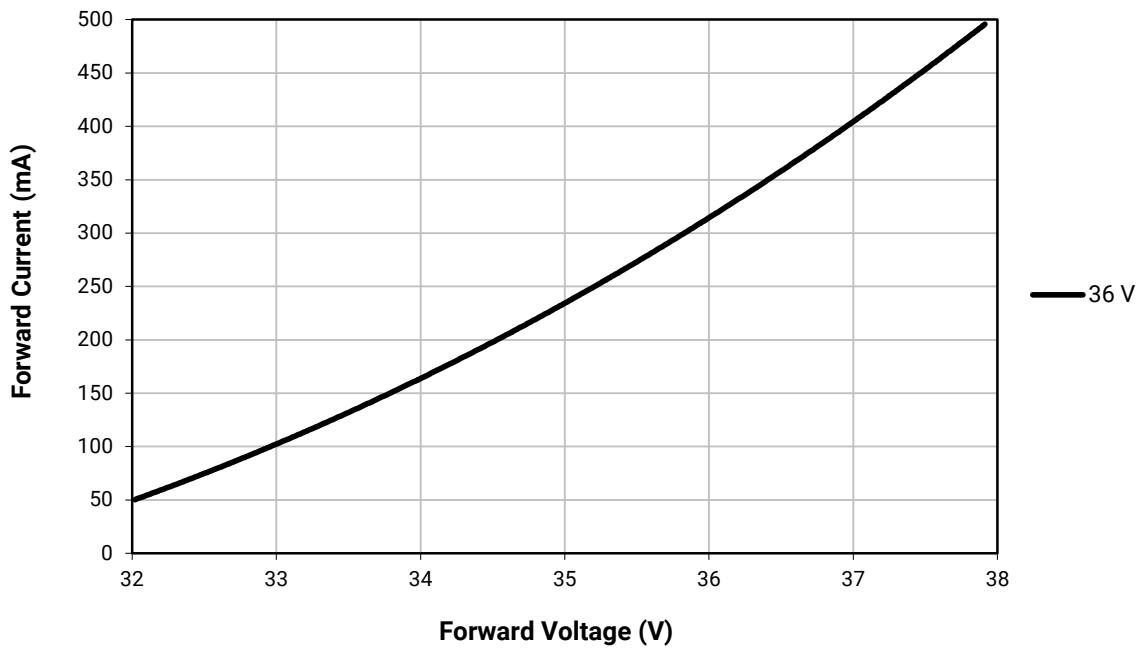
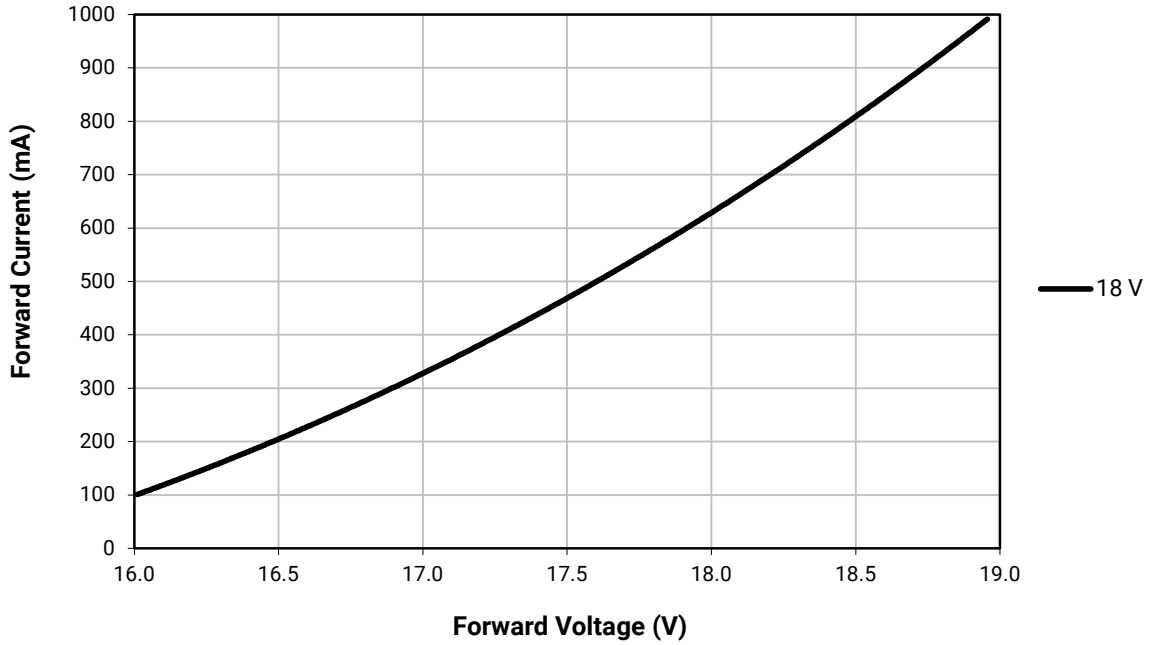


RELATIVE FLUX VS. JUNCTION TEMPERATURE

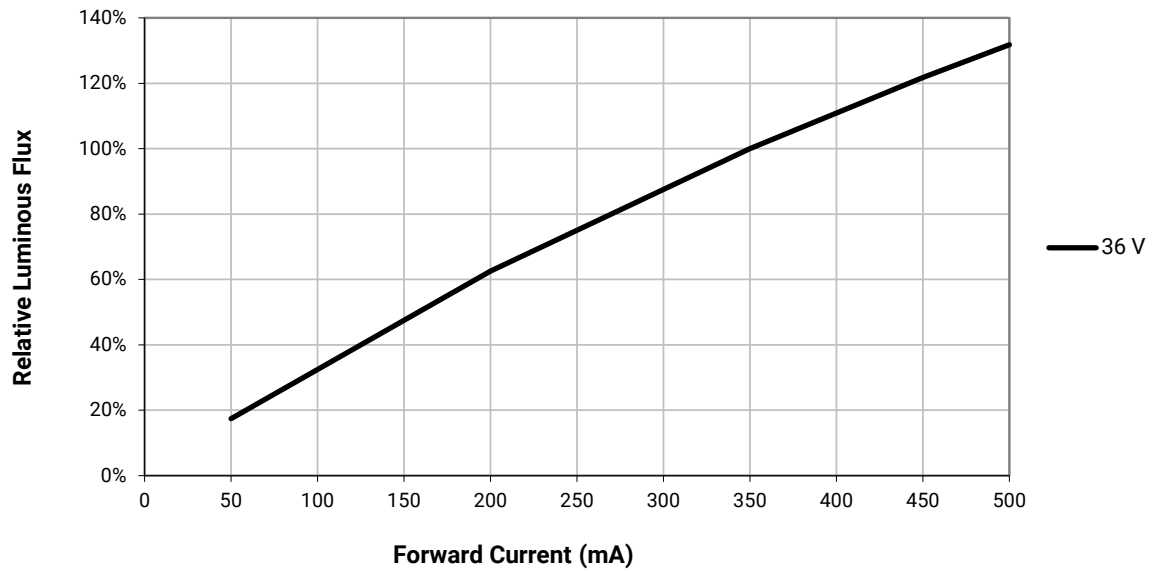
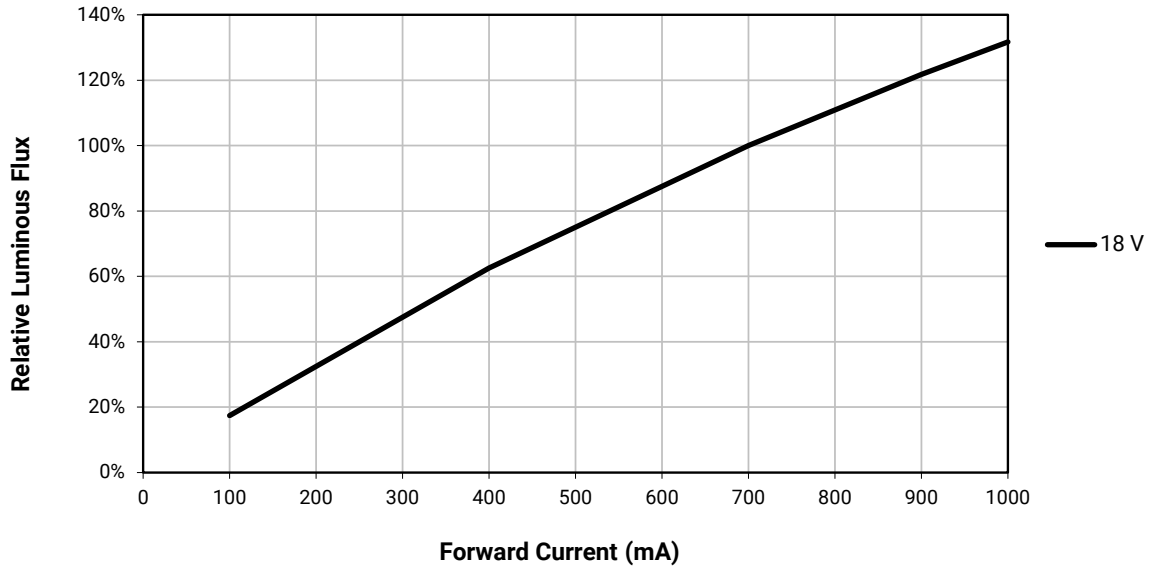
Test condition: 18 V (for reference), $I_f = 700 \text{ mA}$; 36 V, $I_f = 350 \text{ mA}$



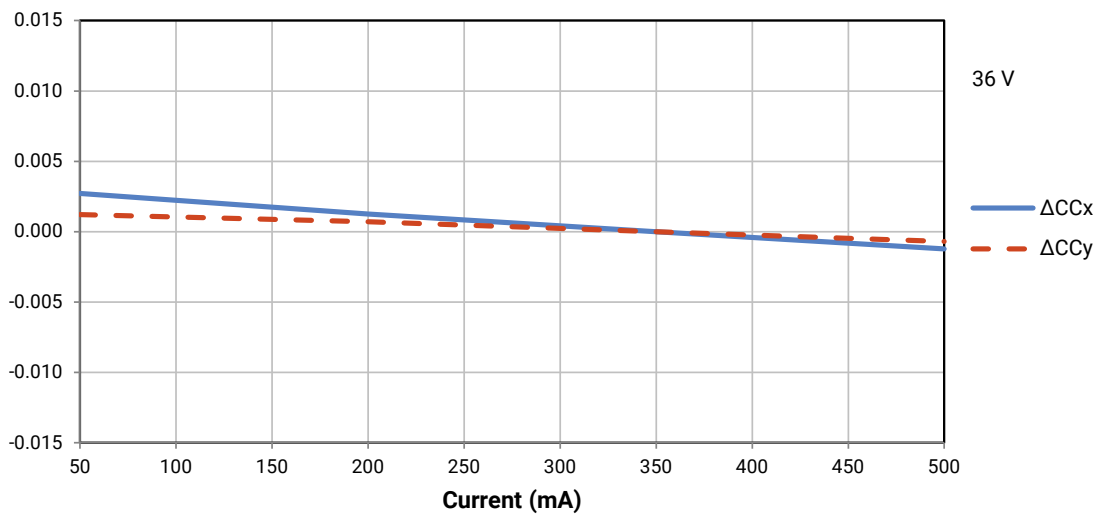
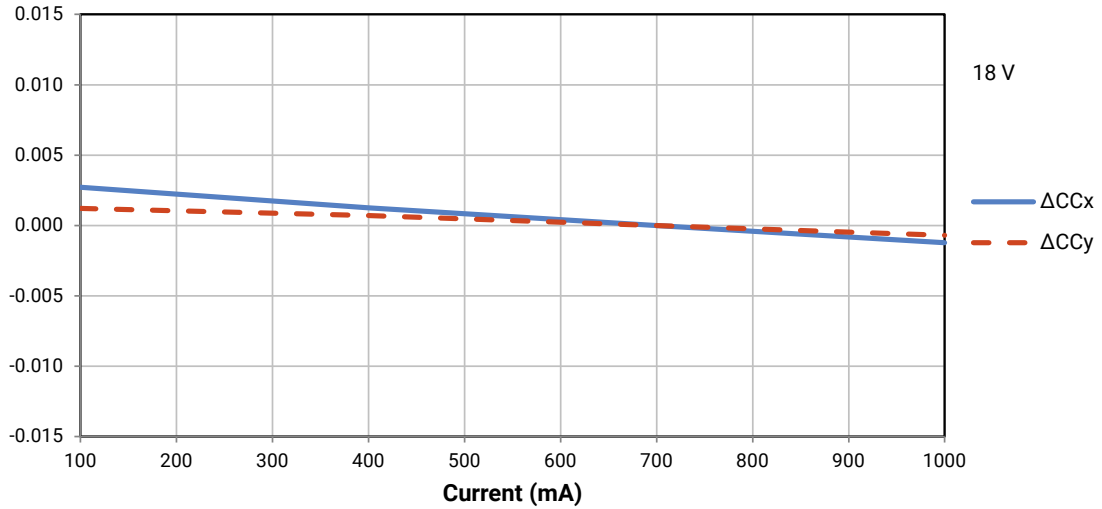
ELECTRICAL CHARACTERISTICS ($T_j = 85^\circ\text{C}$)



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

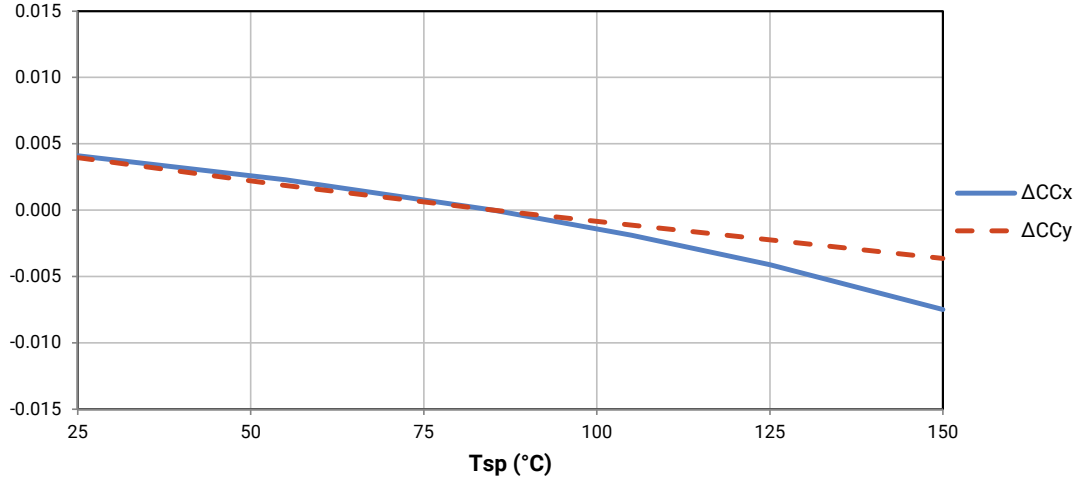


RELATIVE CHROMATICITY VS. CURRENT (WARM WHITE)



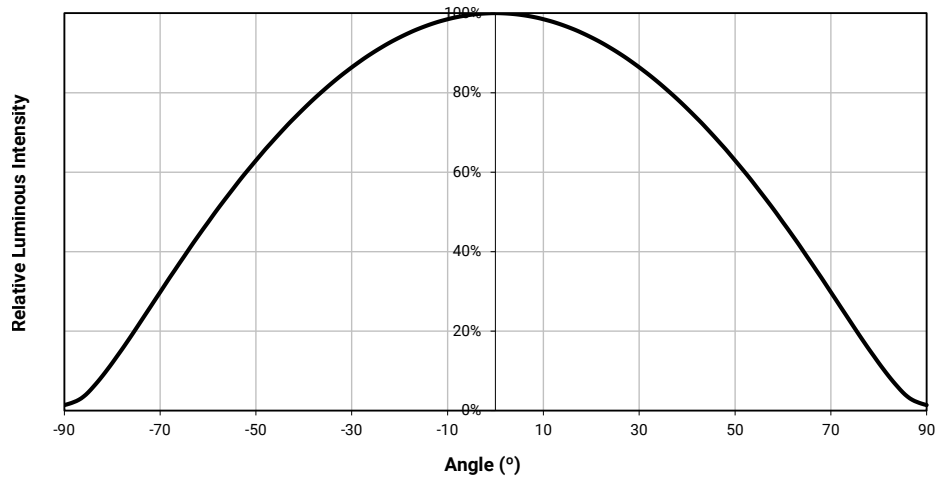
RELATIVE CHROMATICITY VS. TEMPERATURE (WARM WHITE)

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



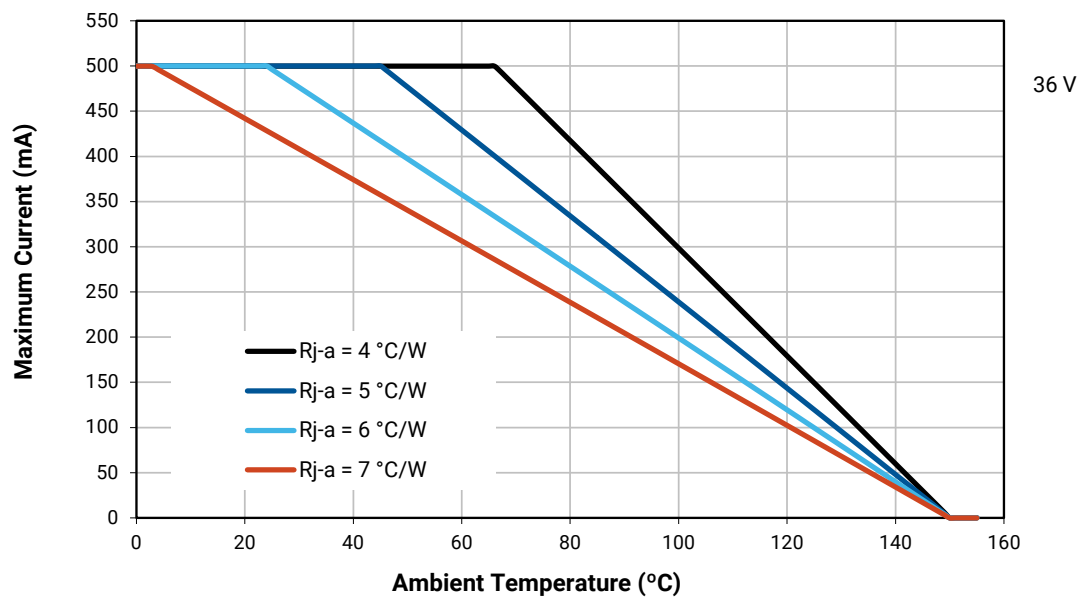
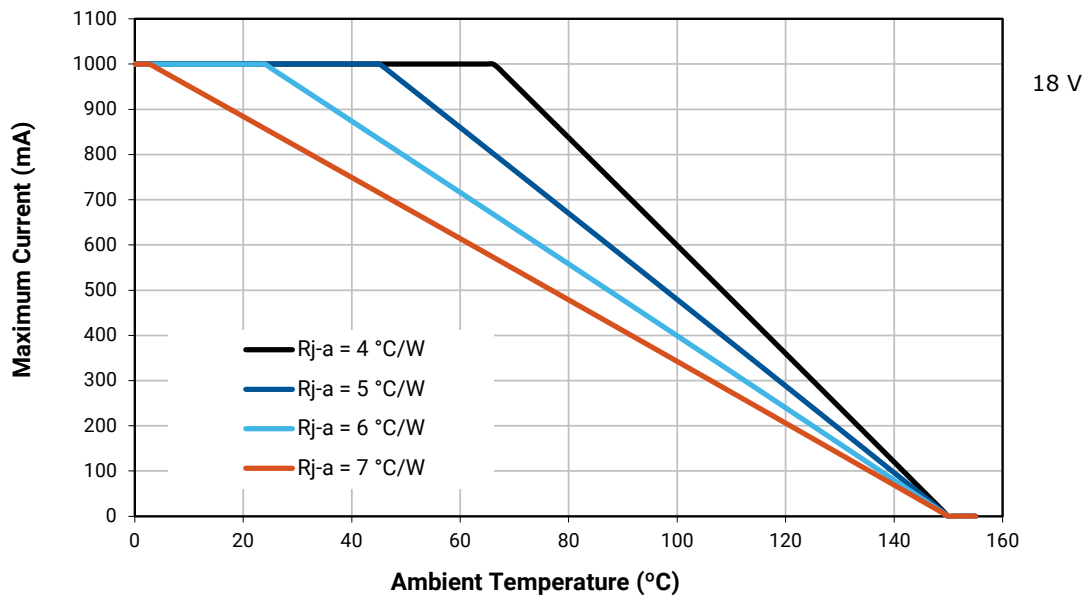
TYPICAL SPATIAL DISTRIBUTION

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



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 ($T_j = 85\text{ °C}$)

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.

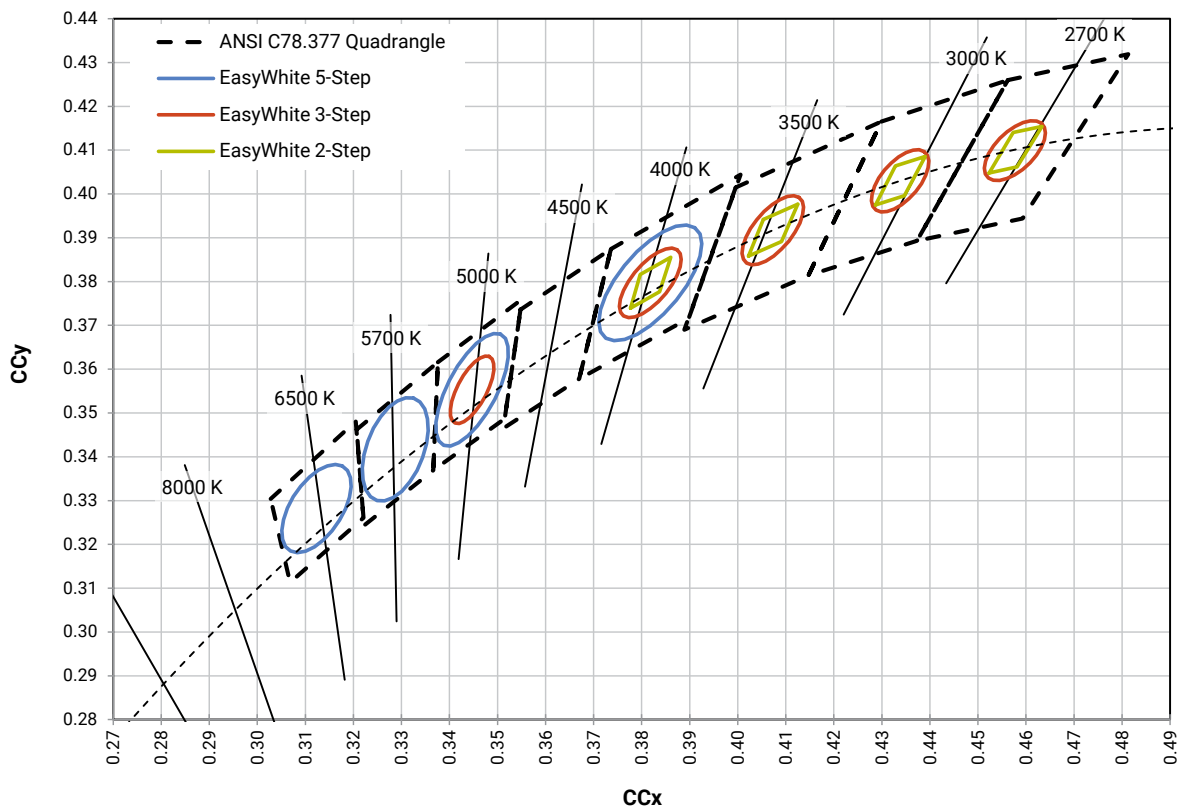
| EasyWhite Color Temperatures – 2-Step | | | |
|---------------------------------------|--------|--------|--------|
| Code | CCT | x | y |
| 40H | 4000 K | 0.3777 | 0.3739 |
| | | 0.3797 | 0.3816 |
| | | 0.3861 | 0.3855 |
| | | 0.3838 | 0.3777 |
| 35H | 3500 K | 0.4022 | 0.3858 |
| | | 0.4053 | 0.3942 |
| | | 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 ($T_j = 85\text{ }^\circ\text{C}$) - 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 |

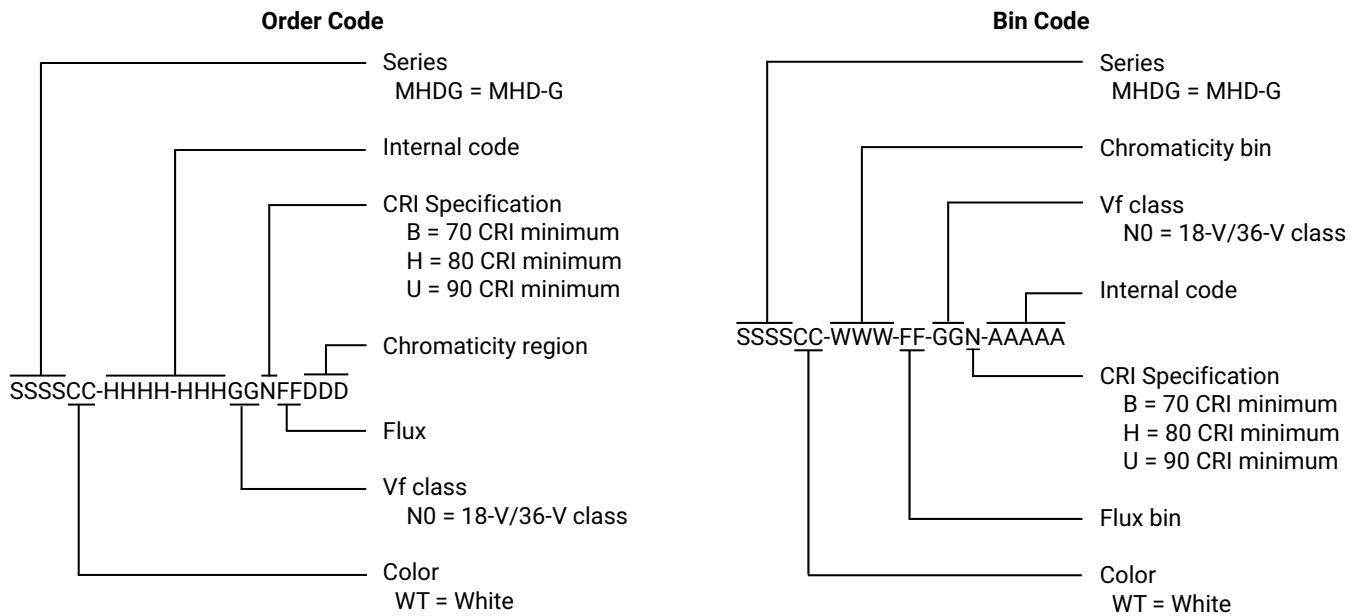
| EasyWhite Color Temperatures – 5-Step Ellipse | | | | | | |
|---|--------|--------------|--------|------------|------------|--------------------|
| Bin Code | CCT | Center Point | | Major Axis | Minor Axis | Rotation Angle (°) |
| | | x | y | a | b | |
| 65E | 6500 K | 0.3123 | 0.3282 | 0.01110 | 0.00550 | 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

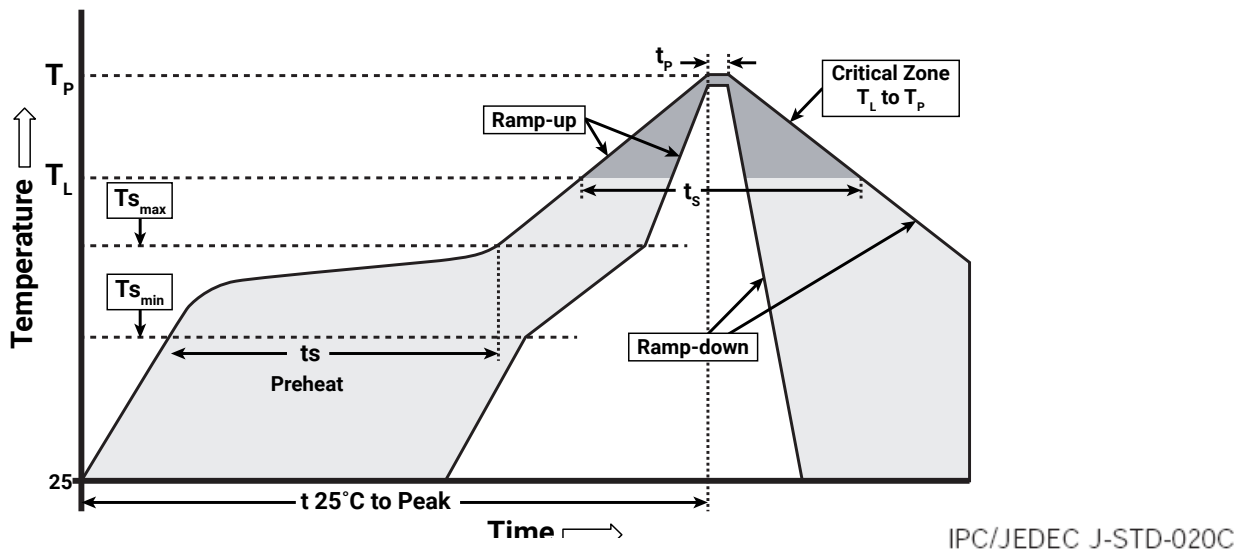
Bin codes and order codes for MHD-G LEDs are configured in the following manner:



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, 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 MHD-G 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 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 Declaration. REACH banned substance information (REACH Article 67) is also available upon request.

NOTES - CONTINUED

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.

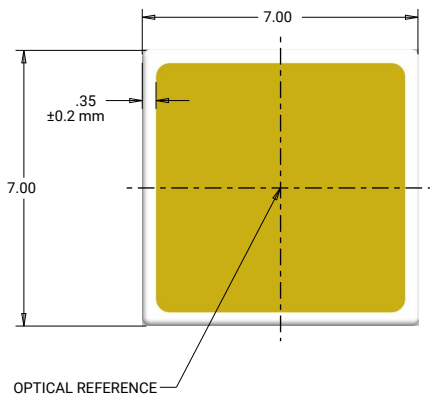
Vision Advisory

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](#).

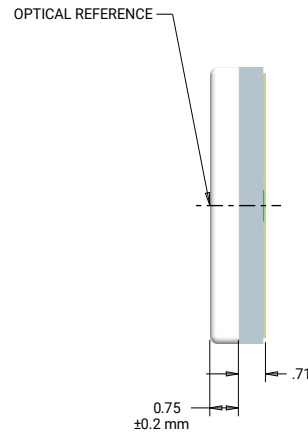
MECHANICAL DIMENSIONS

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

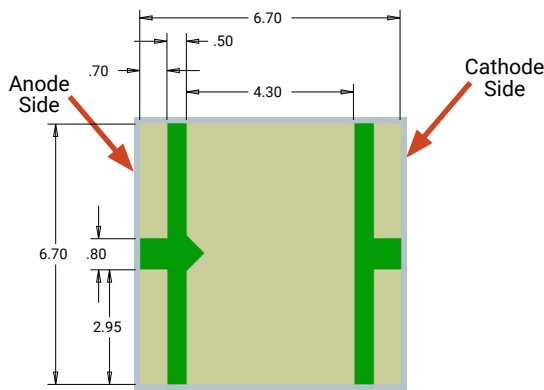
All measurements are $\pm .13$ mm unless otherwise indicated.



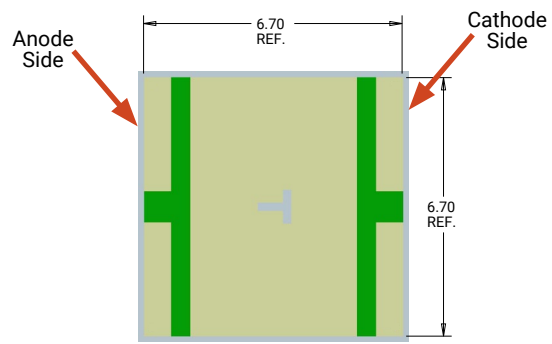
Top View



Side View



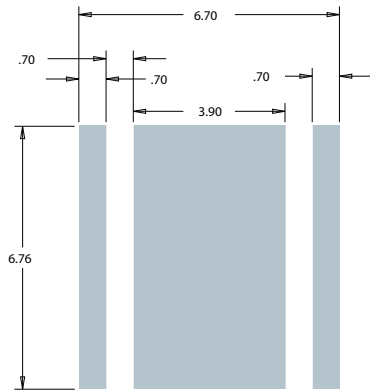
Bottom View



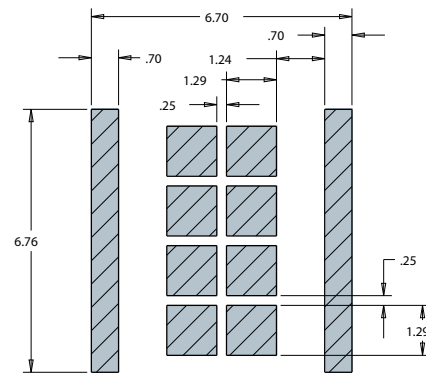
Alternate Bottom View

MECHANICAL DIMENSIONS - CONTINUED

18-V Configuration

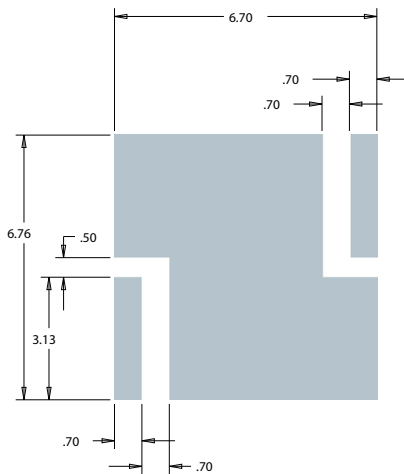


Recommended PCB Solder Pad

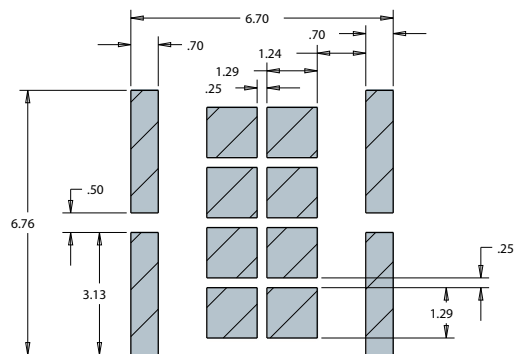


**Recommended Stencil Pattern
(Shaded Area Is Open)**

36-V Configuration

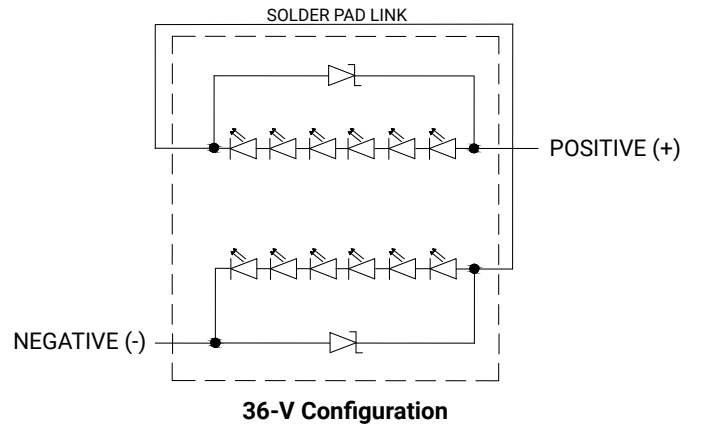
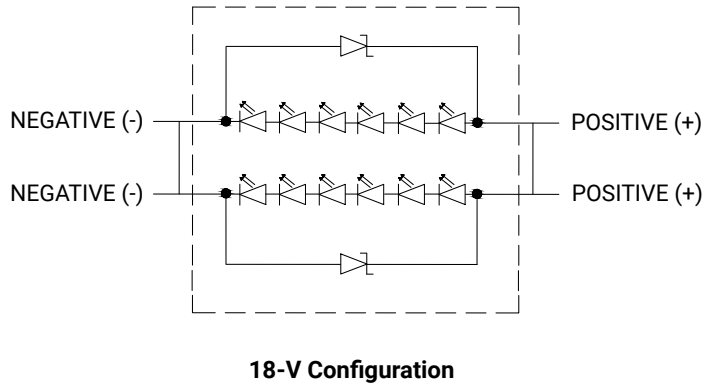


Recommended PCB Solder Pad



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

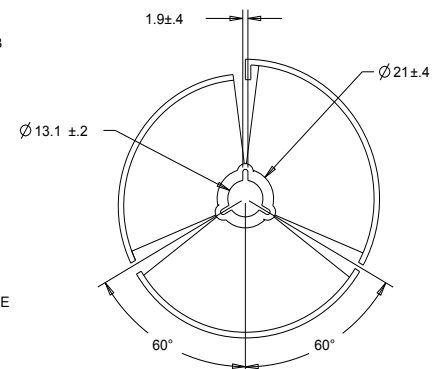
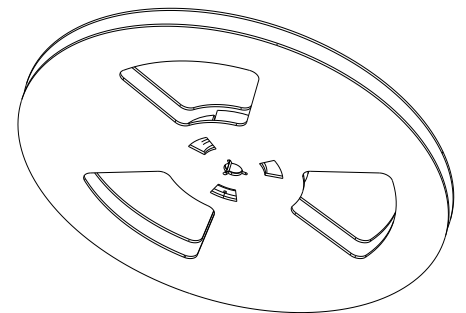
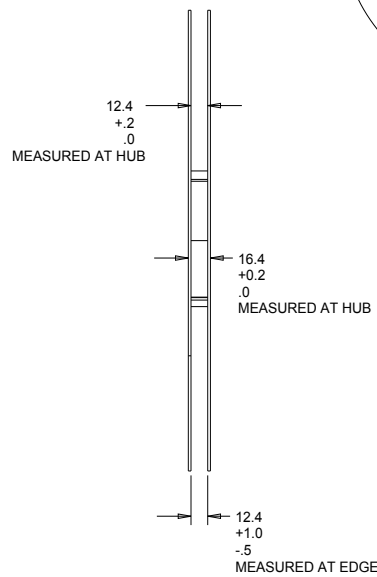
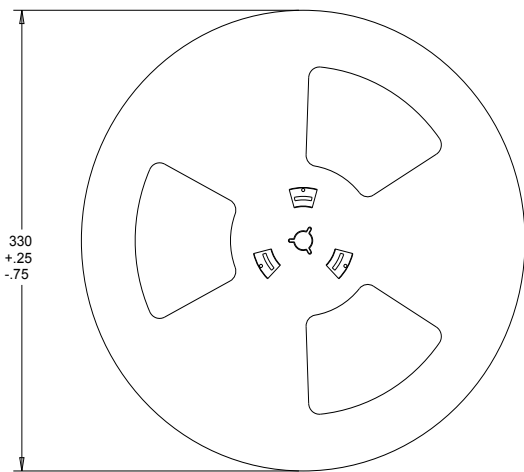
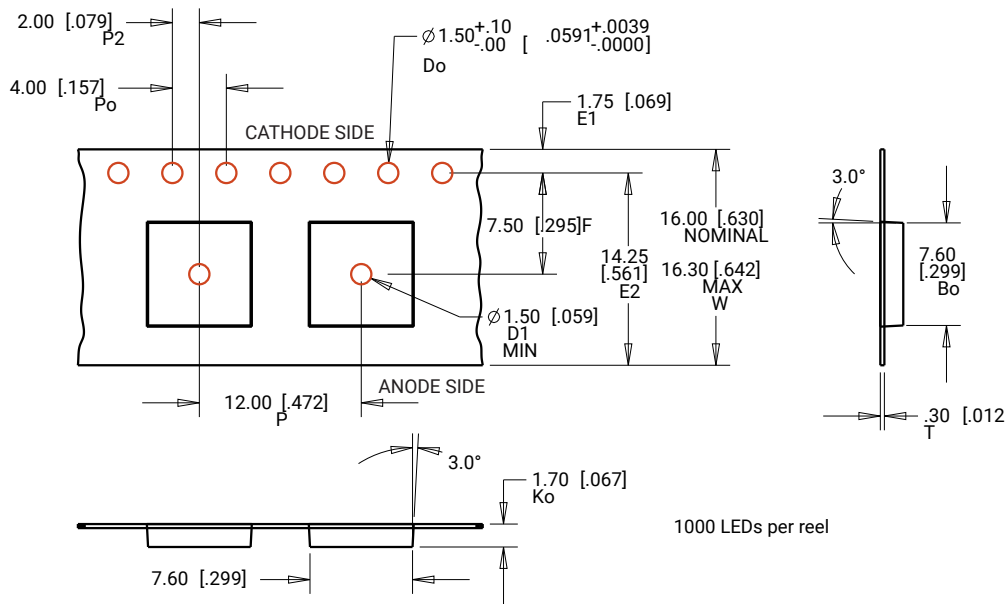
ELECTRICAL CONFIGURATION



TAPE AND REEL

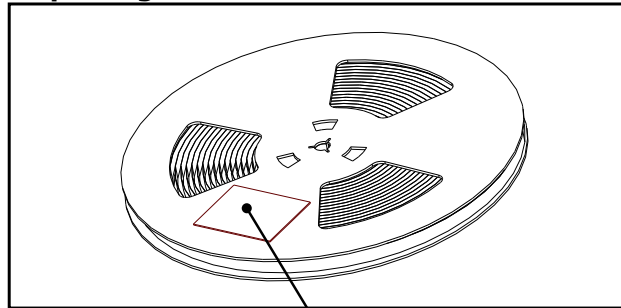
All Cree carrier tapes conform to EIA-481D, Automated Component Handling Systems Standard.

All measurements are ± 0.13 mm unless otherwise indicated.



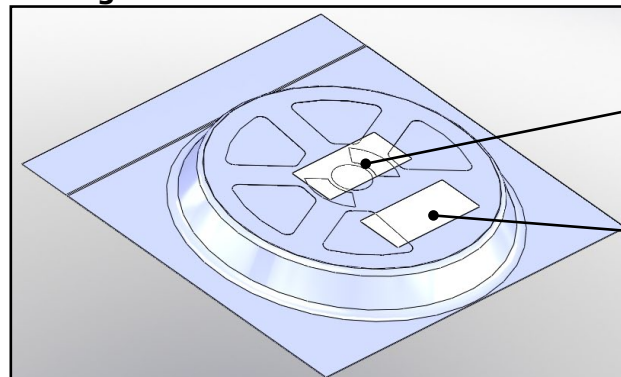
PACKAGING

Unpackaged Reel



Label with Cree Bin Code,
Quantity, Reel ID

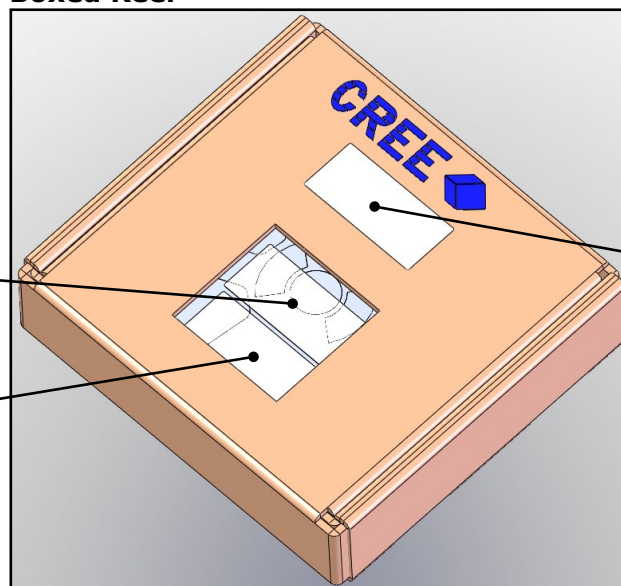
Packaged Reel



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