# Cree® XLamp® CMT1945 LED

## PRODUCT DESCRIPTION

The Cree XLamp® High-Current LED Array family is optimized for best-in-class lumen output, efficacy and reliability at high drive currents. XLamp CMT LEDs deliver performance in industry-compatible packages and LESes, enabling lighting manufacturers to upgrade their designs for applications such as track, downlight and outdoor lighting. XLamp High-Current LED Arrays are available in 2-step, 3-step and 5-step EasyWhite® bins.

## FEATURES

- 14.5-mm optical source
- Available in 70-, 80- and 90- and 95-minimum CRI options
- Cree EasyWhite® 2-, 3- and 5-step binning
- Premium Color 2- and 3-step binning
- Forward voltage option: 36-V class
- 85 °C binning and characterization
- Maximum drive current: 2500 mA
- 115° viewing angle, uniform chromaticity profile
- Top-side solder connections
- RoHS and REACh compliant
- UL® recognized component (E349212)

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## CHARACTERISTICS

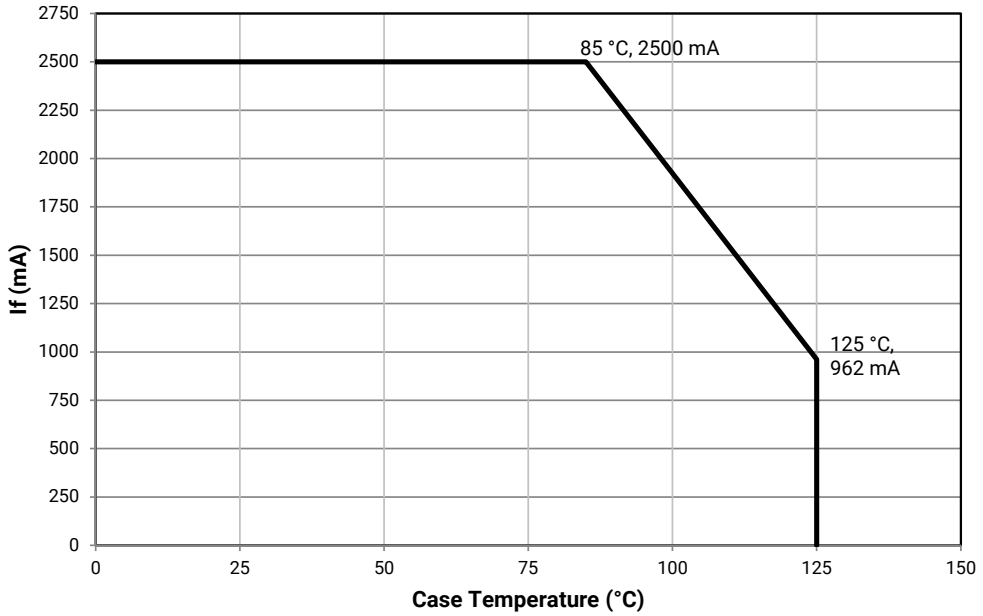
| Characteristics | Unit | Minimum | Typical | Maximum |
|---|---|---|---|---|
| Viewing angle (FWHM) | degrees | | 115 | |
| ESD withstand voltage (JEDEC JS-001-2012) | V | | Class 3A | |
| DC forward current | mA | | | 2500* |
| Reverse current | mA | | | 0.1 |
| Forward voltage (@ 1200 mA, 85 °C) | V | | 34.7 | 38.2 |

* Refer to the Operating Limits section.

## OPERATING LIMITS

The maximum current rating of the CMT1945 depends on the case temperature (Tc) when the LED has reached thermal equilibrium under steady-state operation. The graph shown below assumes that the system design employs good thermal management (thermal interface material and heat sink) and may vary when poor thermal management is employed. Either solder pad shown in the Mechanical Dimensions section on page 16 can be used as the Tc measurement point.

Another important factor in good thermal management is the temperature of the Light Emitting Surface (LES). Cree recommends a maximum LES temperature of 140 °C to ensure optimal LED lifetime. Please refer to the Thermal Design section on page 14 for more information on LES temperature measurement.

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## FLUX CHARACTERISTICS, EASYWHITE® ORDER CODES AND BINS ($I_F$ = 1200 mA, $T_J$ = 85 °C)

The following table provides order codes for XLamp CMT1945 LEDs. For a complete description of the order code nomenclature, please see the Bin and Order Code Formats section (page 15).

| Nominal CCT | CRI | | Minimum Luminous Flux (lm) | Typical Luminous Flux (lm) | 2-Step | | 3-Step | | 5-Step | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Min. | Typ | | | Group | Order Code | Group | Order Code | Group | Order Code |
| 6500 K | 70 | 73 | 6126 | 6587 | | | | | 65E | CMT1945-0000-000N0B0A65E |
| | 80 | 82 | 5723 | 6153 | | | | | 65E | CMT1945-0000-000N0H0A65E |
| 5700 K | 70 | 73 | 6251 | 6721 | | | | | 57E | CMT1945-0000-000N0B0A57E |
| | 80 | 82 | 5839 | 6279 | | | | | 57E | CMT1945-0000-000N0H0A57E |
| | 90 | 92 | 4967 | 5341 | | | 57G | CMT1945-0000-000N0U0A57G | | |
| 5000 K | 70 | 73 | 6070 | 6526 | | | | | 50E | CMT1945-0000-000N0B0A50E |
| | 80 | 82 | 5670 | 6097 | | | 50G | CMT1945-0000-000N0H0A50G | | |
| | 90 | 92 | 4967 | 5341 | | | 50G | CMT1945-0000-000N0U0A50G | | |
| 4000 K | 70 | 73 | 6024 | 6477 | | | | | 40E | CMT1945-0000-000N0B0A40E |
| | 80 | 82 | 5606 | 6027 | 40H | CMT1945-0000-000N0H0A40H | 40G | CMT1945-0000-000N0H0A40G | | |
| | 90 | 92 | 4827 | 5190 | 40H | CMT1945-0000-000N0U0A40H | 40G | CMT1945-0000-000N0U0A40G | | |
| 3500 K | 80 | 82 | 5469 | 5880 | 35H | CMT1945-0000-000N0H0A35H | 35G | CMT1945-0000-000N0H0A35G | | |
| | 90 | 92 | 4694 | 5047 | 35H | CMT1945-0000-000N0U0A35H | 35G | CMT1945-0000-000N0U0A35G | | |
| 3000 K | 70 | 73 | 5606 | 6027 | | | | | 30E | CMT1945-0000-000N0B0A30E |
| | 80 | 82 | 5310 | 5710 | 30H | CMT1945-0000-000N0H0A30H | 30G | CMT1945-0000-000N0H0A30G | | |
| | 90 | 92 | 4490 | 4828 | 30H | CMT1945-0000-000N0U0A30H | 30G | CMT1945-0000-000N0U0A30G | | |
| 2700 K | 80 | 82 | 5095 | 5479 | 27H | CMT1945-0000-000N0H0A27H | 27G | CMT1945-0000-000N0H0A27G | | |
| | 90 | 92 | 4287 | 4609 | 27H | CMT1945-0000-000N0U0A27H | 27G | CMT1945-0000-000N0U0A27G | | |
| 2200 K | 80 | 82 | 4490 | 4828 | | | 22G | CMT1945-0000-000N0H0A22G | | |

Notes

- Cree maintains a tolerance of ±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 18).
- For 80 CRI minimum LEDs, CRI R9 minimum is 0 with a ±2 tolerance. For 90 CRI minimum LEDs, CRI R9 typical is 60.

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## FLUX CHARACTERISTICS, PREMIUM COLOR ORDER CODES AND BINS ($I_F$ = 1200 mA, $T_J$ = 85 °C)

### Fidelity

| Nominal CCT | CRI* | | Minimum Luminous Flux (lm) | Typical Luminous Flux (lm) | 2-Step | |
|---|---|---|---|---|---|---|
| | Min. | Typ | | | Group | Order Code |
| 4000 K | 95 | 98 | 4323 | 4648 | L5A | CMT1945-0000-000N0Z0AL5A |
| 3500 K | 95 | 98 | 4207 | 4524 | 35H | CMT1945-0000-000N0Z0A35H |
| 3000 K | 95 | 98 | 3934 | 4230 | 30H | CMT1945-0000-000N0Z0A30H |
| 2700 K | 95 | 98 | 3725 | 4005 | 27H | CMT1945-0000-000N0Z0A27H |

### Specialty

| Nominal CCT | CRI | | Minimum Luminous Flux (lm) | Typical Luminous Flux (lm) | 2-Step | | 3-Step | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Min. | Typ | | | Group | Order Code | Group | Order Code | Group | Order Code |
| 3100 K | 90 | 92 | 4490 | 4828 | | | 31Q | CMT1945-0000-000N0U0A31Q | | |
| 3000 K | 80 | 82 | 5310 | 5710 | L7B | CMT1945-0000-000N0H0AL7B | | | | |
| | 90 | 92 | 4490 | 4828 | | | 30Q | CMT1945-0000-000N0U0A30Q | 30U | CMT1945-0000-000N0U0A30U |
| | 95 | 98 | 3934 | 4230 | L7C | CMT1945-0000-000N0Z0AL7C | | | | |

Notes

- Cree maintains a tolerance of ±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 18).
- For 80 CRI minimum LEDs, CRI R9 minimum is 0 with a ±2 tolerance. For 90 CRI minimum LEDs, CRI R9 typical is 60.

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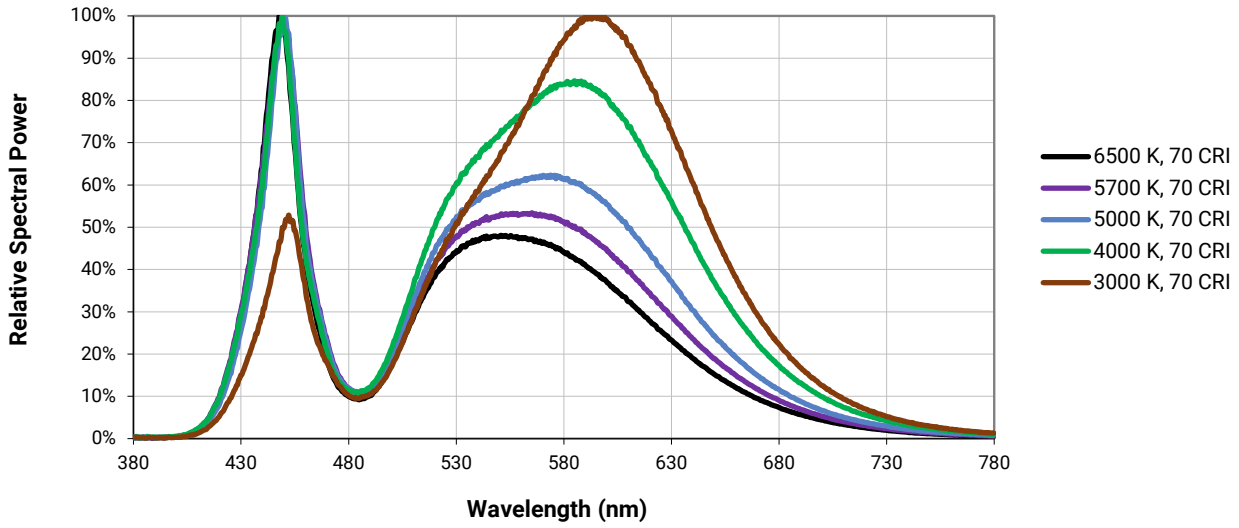
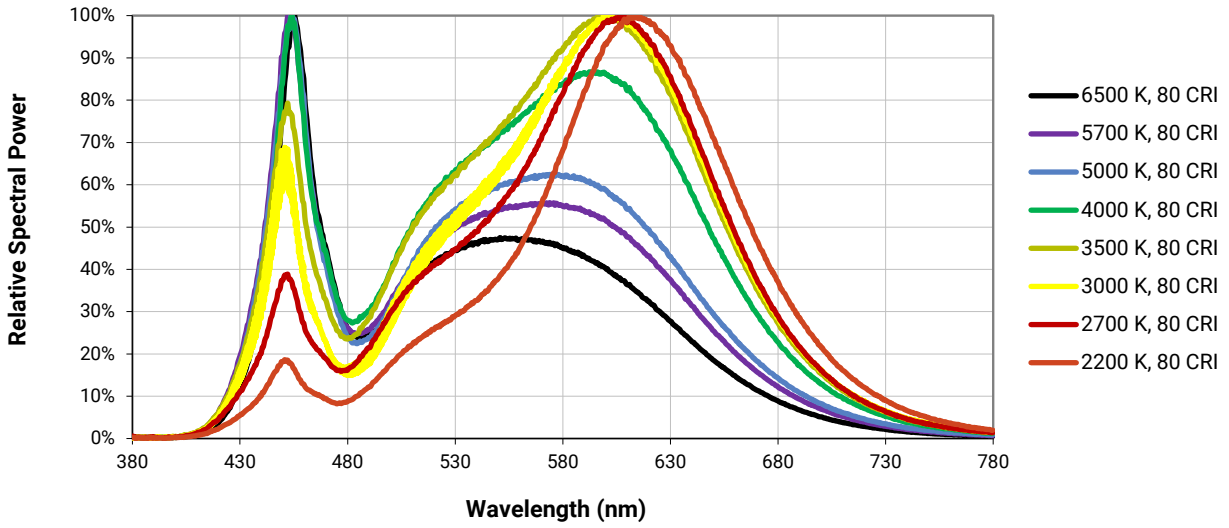
## RELATIVE SPECTRAL POWER DISTRIBUTION, EASYWHITE® LEDS

The following graphs are the result of a series of pulsed measurements at 1200 mA and $T_J$ = 85 °C.

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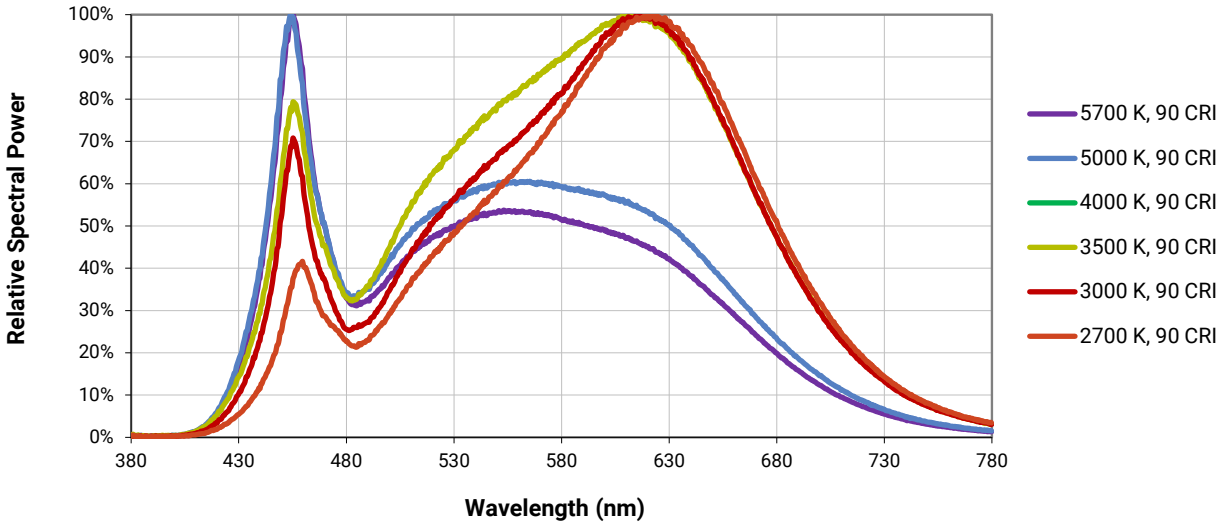
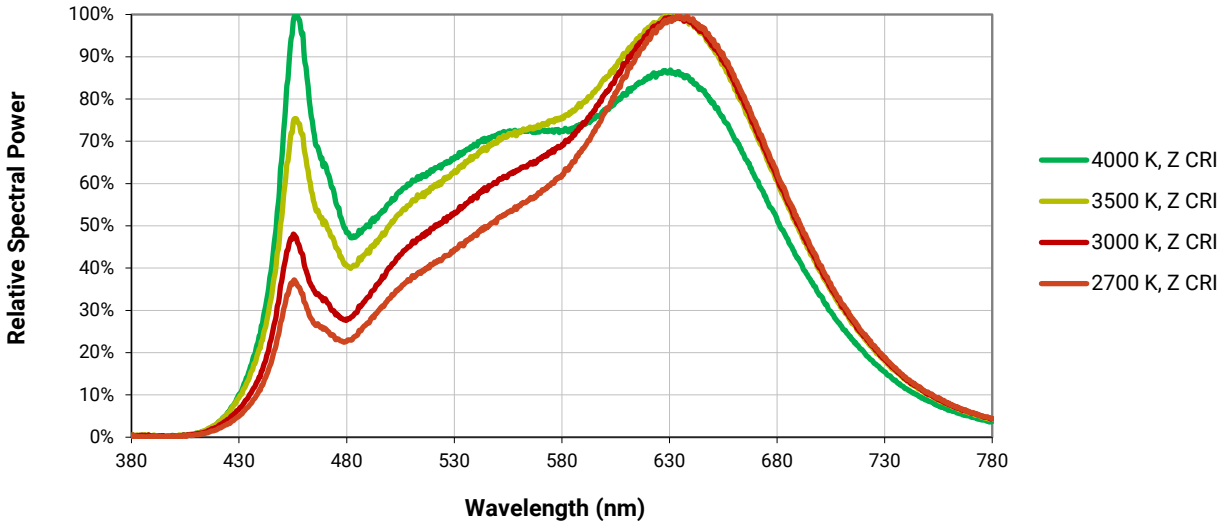
## RELATIVE SPECTRAL POWER DISTRIBUTION, EASYWHITE® LEDS - CONTINUED




## RELATIVE SPECTRAL POWER DISTRIBUTION, PREMIUM COLOR LEDS

The following graphs are the result of a series of pulsed measurements at 1200 mA and $T_J$ = 85 °C.

### Fidelity

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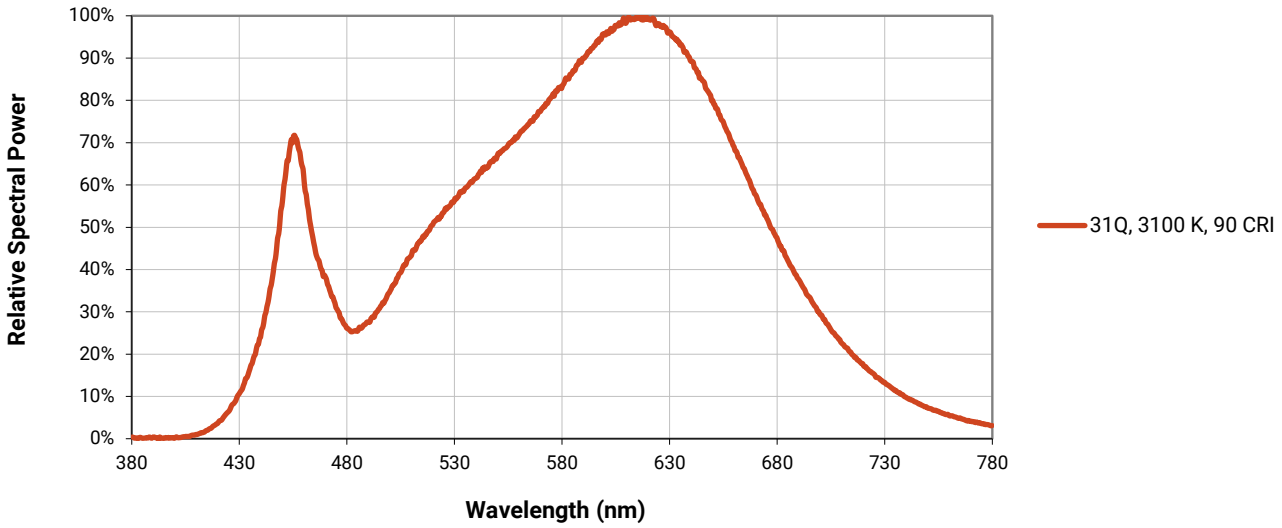
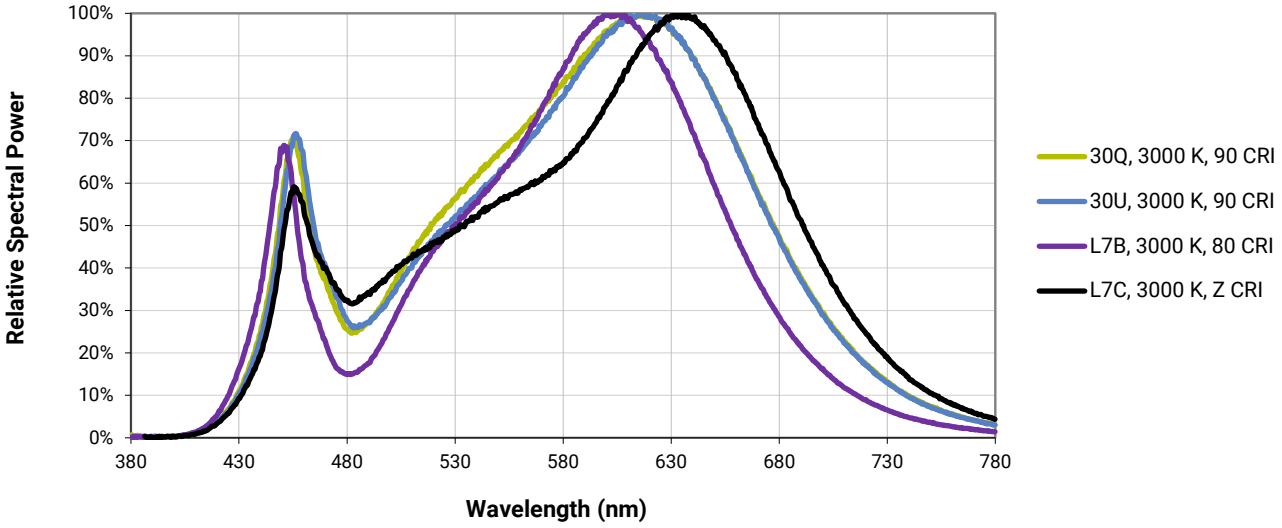
## RELATIVE SPECTRAL POWER DISTRIBUTION, PREMIUM COLOR LEDS - CONTINUED

### Specialty

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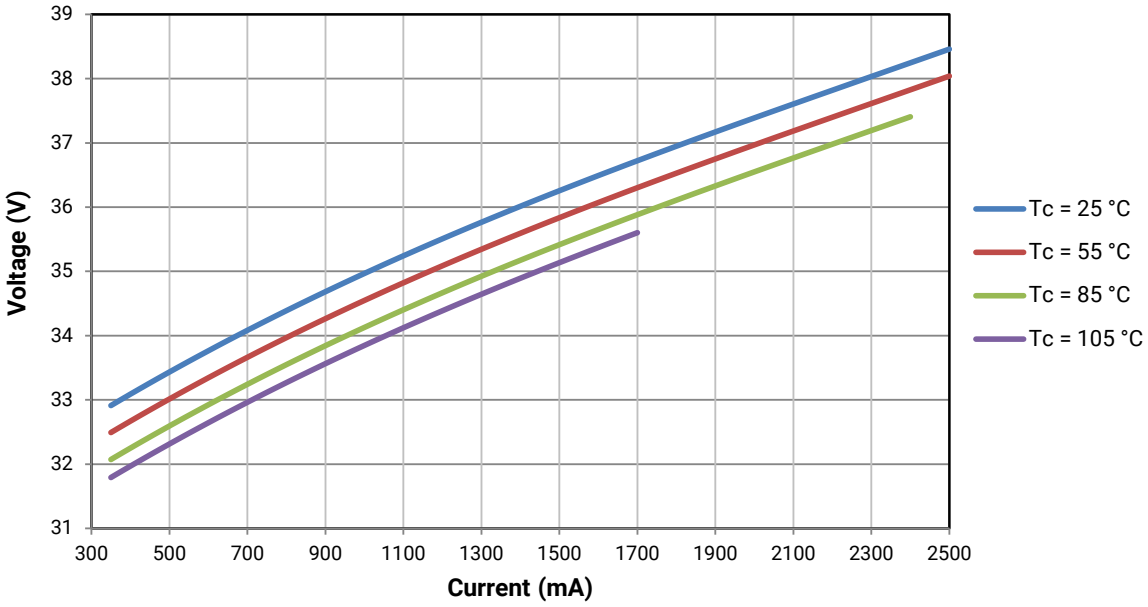
## ELECTRICAL CHARACTERISTICS

The following graph is the result of a series of steady-state measurements.

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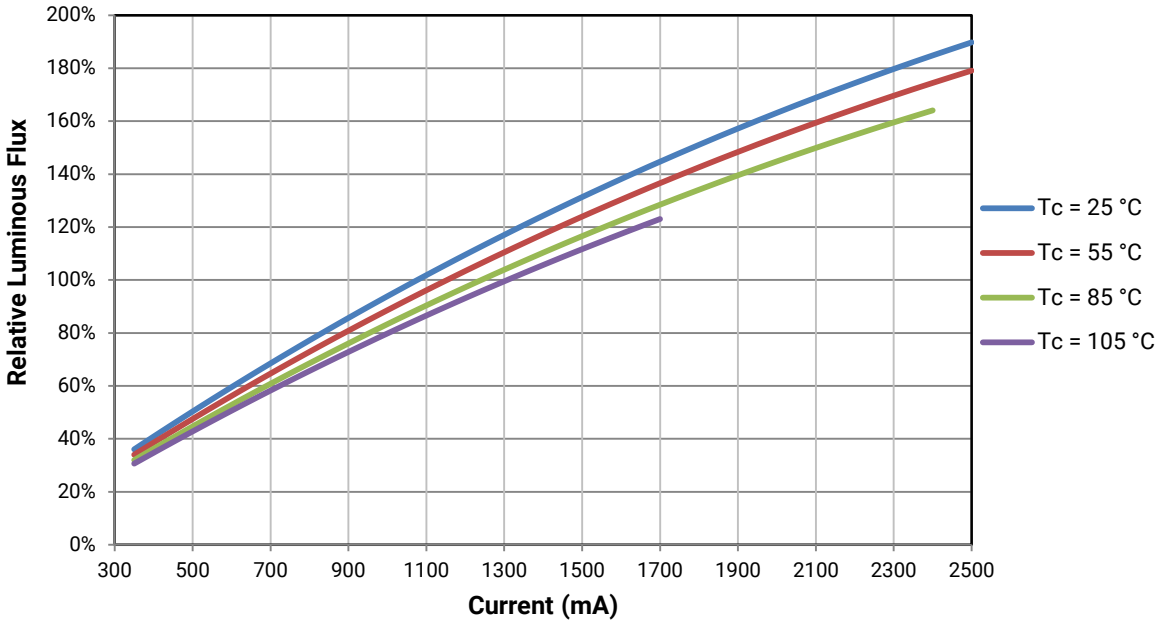
## RELATIVE LUMINOUS FLUX

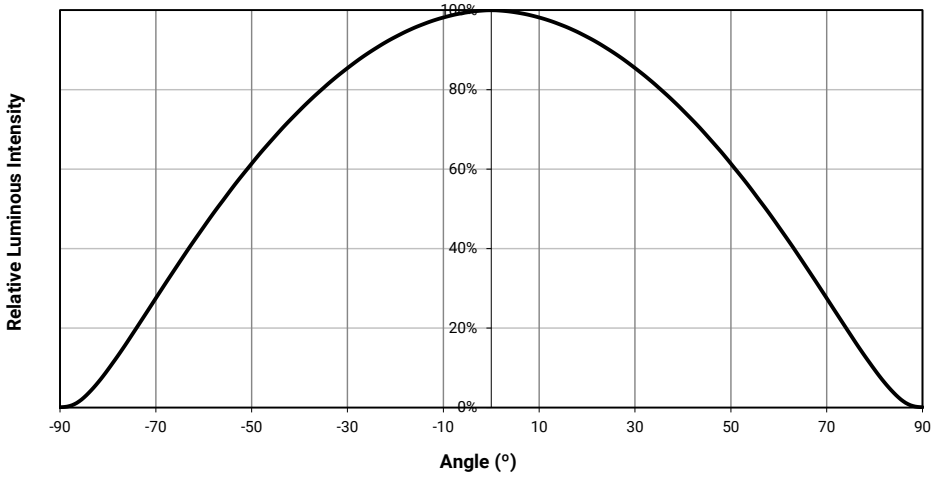
The relative luminous flux values provided below are the ratio of:

- Measurements of CMT1945 at steady-state operation at the given conditions, divided by
- Flux measured during binning, which is a pulsed measurement at 1200 mA at $T_J$ = 85 °C.

For example, at steady-state operation of Tc = 55 °C, $I_F$ = 2100 mA, the relative luminous flux ratio is 160% in the chart below. A CMT1945 LED that measures 5710 lm during binning will deliver 9136 lm (5710 * 1.6) at steady-state operation of Tc = 55 °C, $I_F$ = 2100 mA.




## TYPICAL SPATIAL DISTRIBUTION

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## PERFORMANCE GROUPS - CHROMATICITY ($T_J$ = 85 °C)

XLamp CMT1945 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 |

| EasyWhite Color Temperatures – 3-Step Ellipse | | | | | | |
|---|---|---|---|---|---|---|
| Bin Code | CCT | Center Point | | Major Axis | Minor Axis | Rotation Angle (°) |
| | | x | y | a | b | |
| 57G | 5700 K | 0.3287 | 0.3417 | 0.00738 | 0.00360 | 72.0 |
| 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 | 54.0 |
| 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 |
| 22G | 2200 K | 0.5066 | 0.4158 | 0.00980 | 0.00480 | 45.5 |

| 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 |
| 30E | 3000 K | 0.4338 | 0.4030 | 0.01390 | 0.00680 | 53.2 |

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## PREMIUM COLOR PERFORMANCE GROUPS - CHROMATICITY ($T_J$ = 85 °C)

XLamp CMT1945 LEDs are tested for chromaticity and placed into one of the regions defined by the following bounding coordinates.

### Fidelity

| EasyWhite Color Temperatures – 2-Step | | | |
|---|---|---|---|
| Code | CCT | x | y |
| L5A | 4000 K | 0.3764 | 0.3711 |
| | | 0.3784 | 0.3787 |
| | | 0.3847 | 0.3826 |
| | | 0.3825 | 0.3748 |
| 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 |

### Specialty

| EasyWhite Color Temperatures – 2-Step | | | |
|---|---|---|---|
| Code | CCT | x | y |
| L7B | 3000 K | 0.4263 | 0.3848 |
| | | 0.4296 | 0.3916 |
| | | 0.4361 | 0.3938 |
| | | 0.4326 | 0.3868 |
| L7C | 3000 K | 0.4192 | 0.3754 |
| | | 0.4224 | 0.3823 |
| | | 0.4291 | 0.3847 |
| | | 0.4257 | 0.3777 |

| EasyWhite Color Temperatures – 3-Step Ellipse | | | | | | |
|---|---|---|---|---|---|---|
| Bin Code | CCT | Center Point | | Major Axis | Minor Axis | Rotation Angle (°) |
| | | x | y | a | b | |
| 31Q | 3100 K | 0.4236 | 0.3888 | 0.00848 | 0.00455 | 50.3 |
| 30Q | 3000 K | 0.4305 | 0.3935 | 0.00834 | 0.00408 | 53.2 |
| 30U | 3000 K | 0.4274 | 0.3837 | 0.00834 | 0.00408 | 53.2 |

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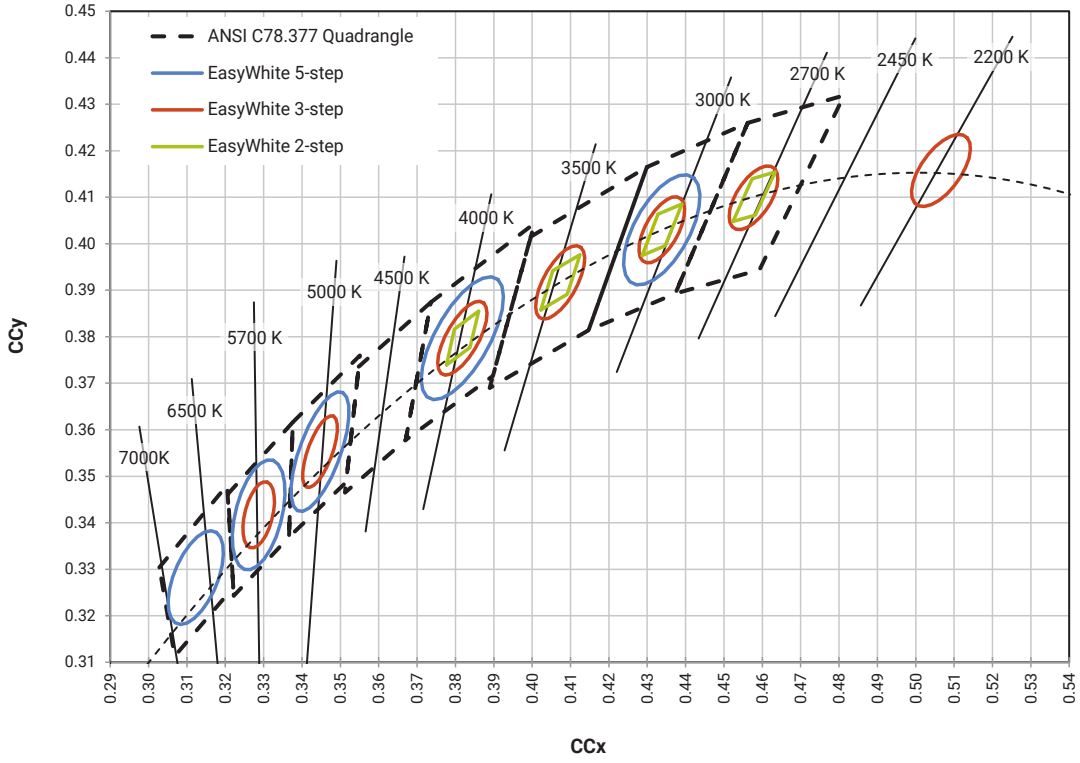
## CREE EASYWHITE® BINS PLOTTED ON THE 1931 CIE COLOR SPACE ($T_J$ = 85 °C)

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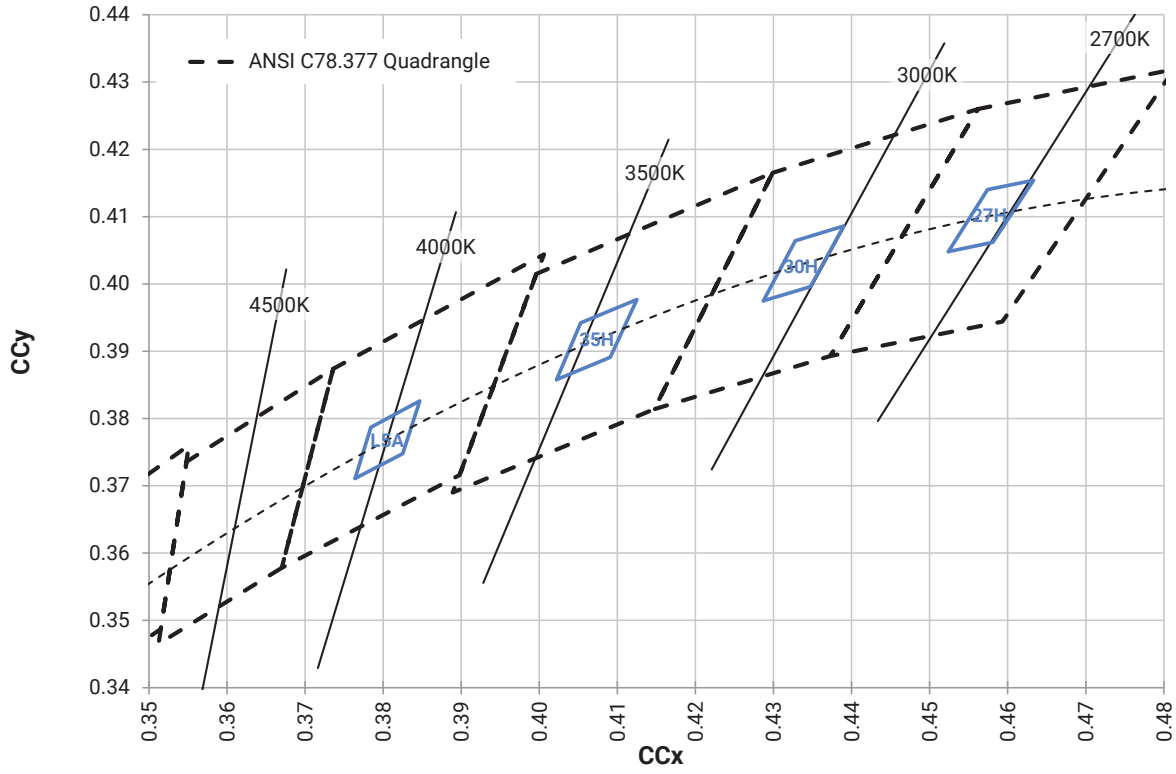
## CREE PREMIUM COLOR BINS PLOTTED ON THE 1931 CIE COLOR SPACE ($T_J$ = 85 °C)

### Fidelity (2-step)

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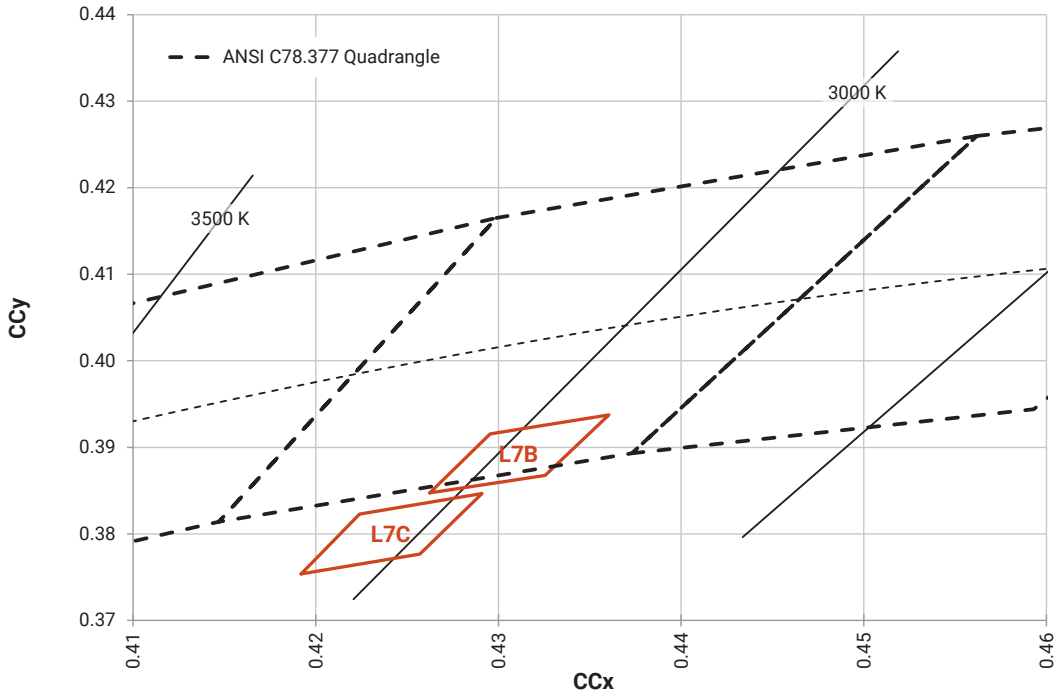
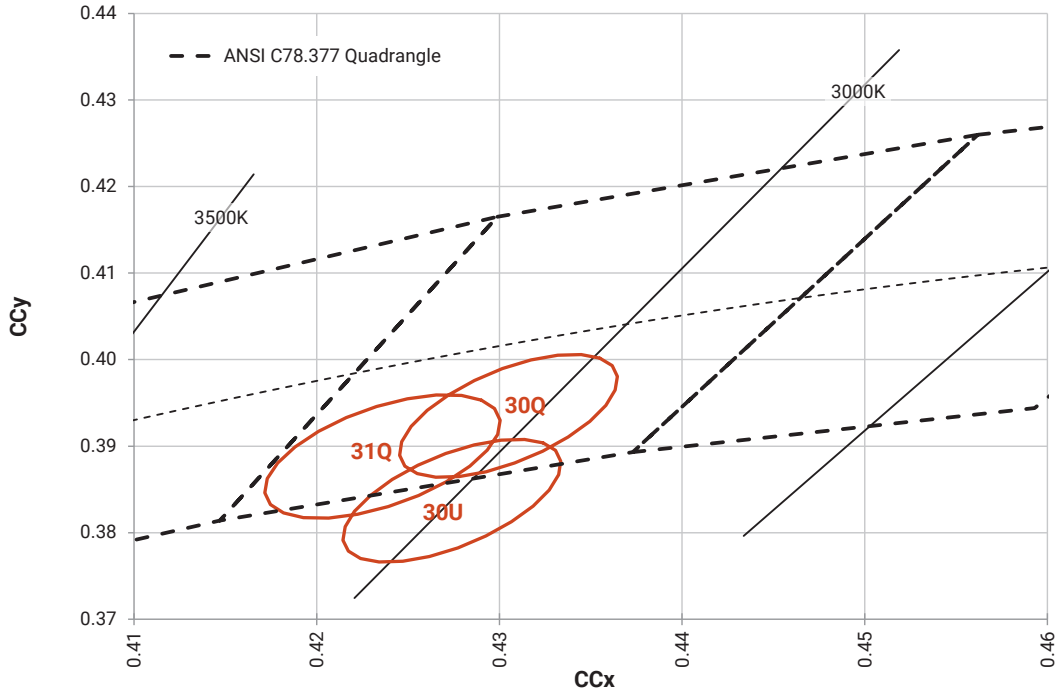
## CREE PREMIUM COLOR BINS PLOTTED ON THE 1931 CIE COLOR SPACE ($T_J$ = 85 °C) - CONTINUED

### Speciality (2-step)




### Speciality (3-step)

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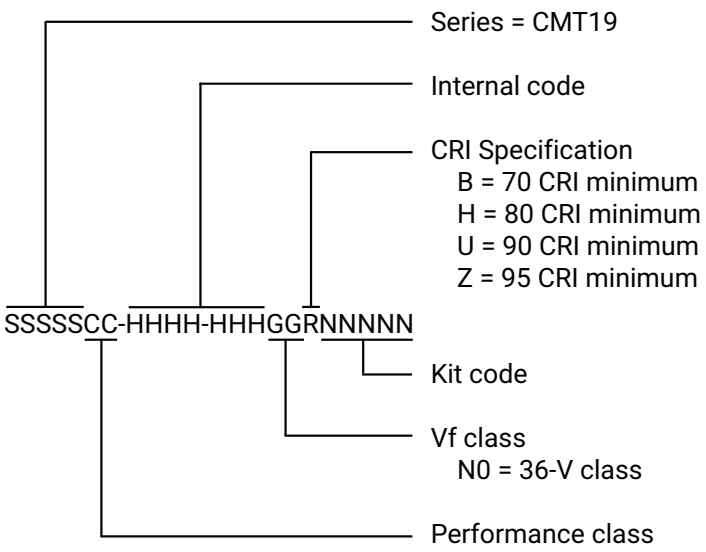
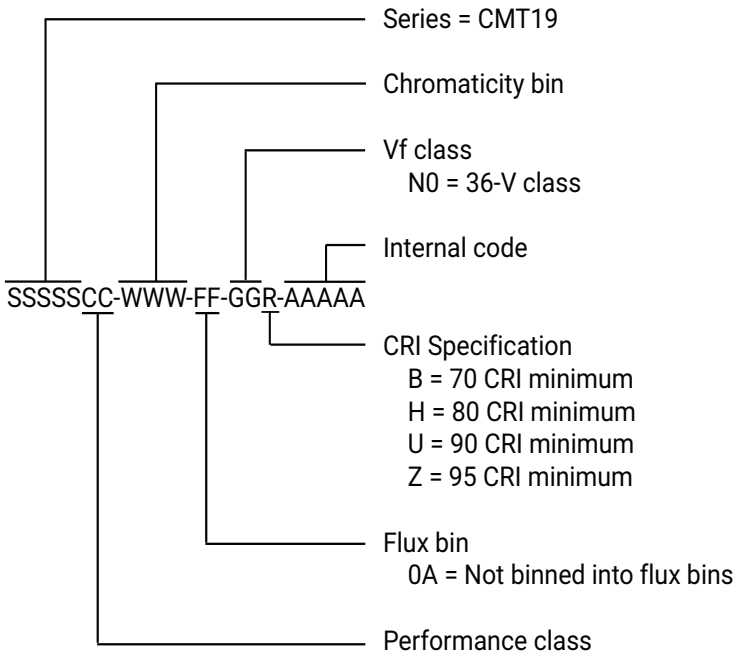
## BIN AND ORDER CODE FORMATS

Bin codes and order codes are configured as follows:

**Order Code**




**Bin Code**

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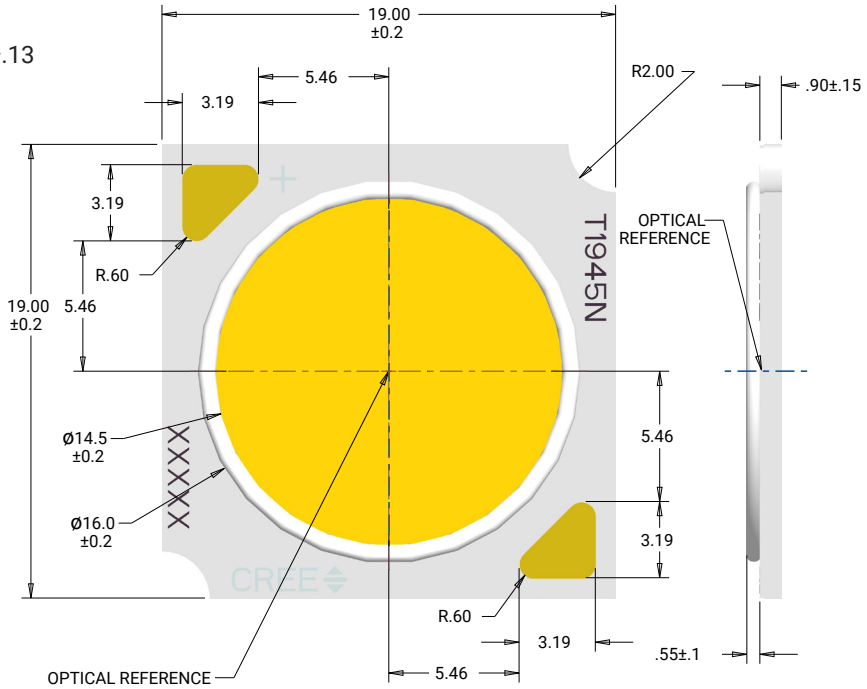
## MECHANICAL DIMENSIONS

Dimensions are in mm.

Tolerances unless otherwise specified: ±.13

x° ± 1°




**Meaning of LED marking**

T1945N = 36-V CMT1945

$X_1\ X_2\ X_3\ X_4\ X_5$

X1 CCT

- 1 = 6500 K
- 2 = 5700 K
- 3 = 5000 K
- 5 = 4000 K
- 6 = 3500 K
- 7 = 3000 K
- 8 = 2700 K
- A = 2200 K

X2

- M = EasyWhite or Fidelity LED on the black-body line
- Q = Specialty LED below the black-body line
- U = Specialty LED below the black-body line

X3 X4 Flux bin

- 0A = Not binned into flux bins

X5 CRI

- B = 70 CRI min
- H = 80 CRI min
- U = 90 CRI min
- Z = 95 CRI min

Tc measurement point: either the anode or cathode solder pad

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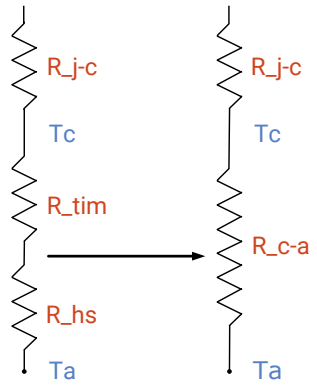
## THERMAL DESIGN

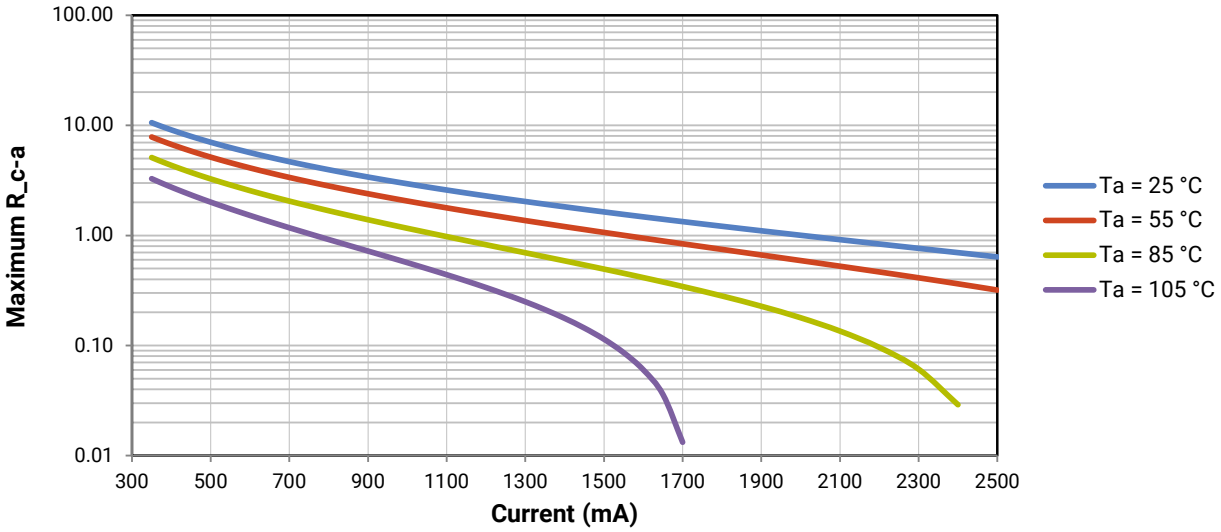
The CMT family of LED arrays can include over a hundred different LED die inside one package, and thus over a hundred different junction temperatures ($T_J$). Cree has intentionally removed junction-temperature-based operating limits and replaced the commonplace maximum $T_J$ calculations with maximum ratings based on forward current ($I_F$) and case temperature (Tc). No additional calculations are required to ensure the CMT LED is being operated within its designed limits. LES temperature measurement provides additional verification of good thermal design. Please refer to page 2 for the Operating Limit specification.

There is no need to calculate for $T_J$ inside the package, as the thermal management design process, specifically from solder point ($T_{SP}$) to ambient ($T_a$), remains identical to any other LED component. For more information on thermal management of Cree XLamp LEDs, please refer to the Thermal Management application note. For CMT soldering recommendations and more information on thermal interface materials (TIM), LES temperature measurement, and connection methods, please refer to the Cree XLamp CM Family LEDs soldering and handling document.

To keep the CMT1945 LED at or below the maximum rated Tc, the case to ambient temperature thermal resistance (R_c-a) must be at or below the maximum R_c-a value shown on the following graph, depending on the operating environment. The y-axis in the graph is a base 10 logarithmic scale.

As the figure at right shows, the R_c-a value is the sum of the thermal resistance of the TIM (R_tim) plus the thermal resistance of the heat sink (R_hs).

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## 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. Cree did not perform Room Temperature Operating Life (RTOL) testing on the CMT1945 LED.

### 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.

### 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 rom 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.

### 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.

### 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.

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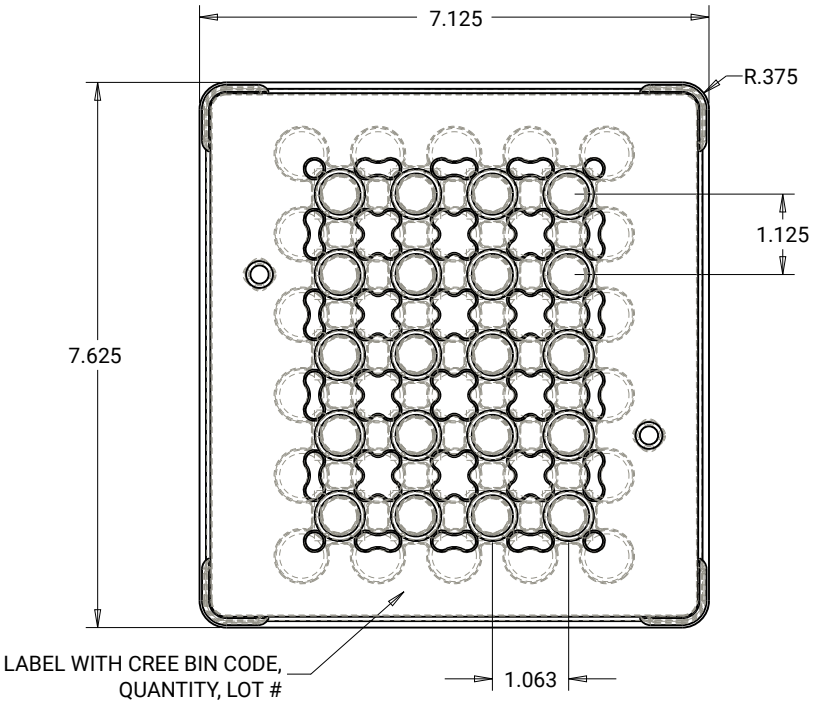
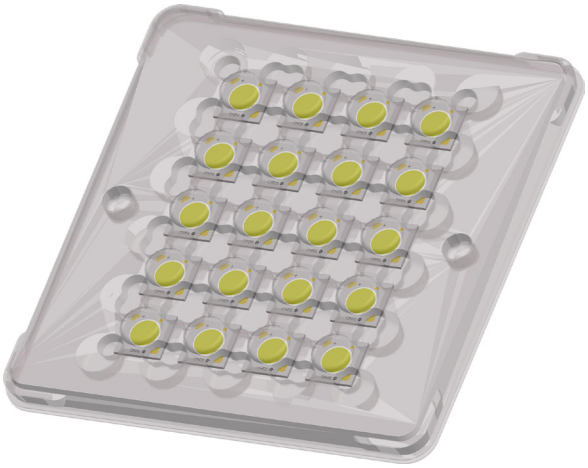
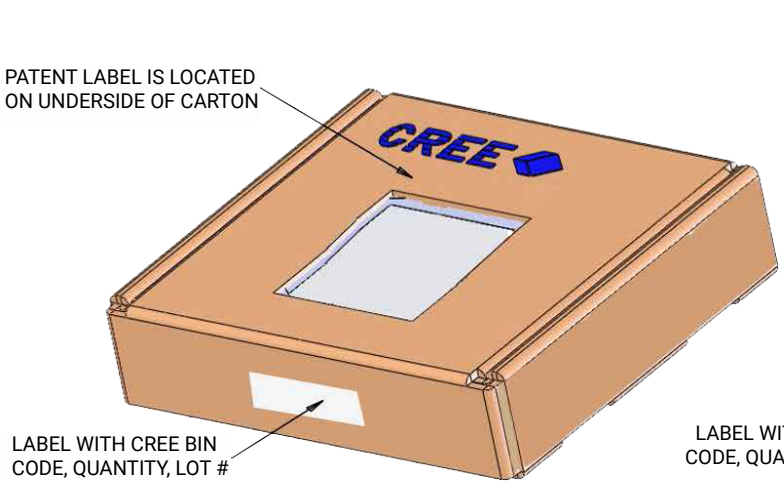
## PACKAGING

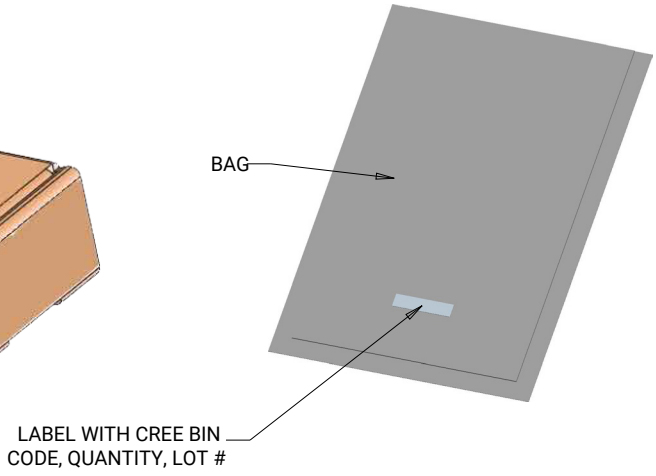
Cree CMT1945 LEDs are packaged in trays of 20. Five trays are sealed in an anti-static bag and placed inside a carton, for a total of 100 LEDs per carton. Each carton contains 100 LEDs from the same performance bin.

Dimensions are in inches.
Tolerances: ±.13
x° ±1°



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LifeElectronics
Живое партнерство

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