

Cree® XLamp® CXA2540 LED



PRODUCT DESCRIPTION

The XLamp CXA2540 LED array expands Cree’s family of high-flux, multi-die integrated arrays, offering high performance in an easy-to-use platform. With XLamp lighting-class reliability, the CXA2540’s uniform emitting surface enables both directional and non-directional lighting applications and luminaire and lamp designs. Available in 2-step and 4-step color consistency, and featuring a 19-mm optical source, the CXA2540 brings new levels of flux and efficacy to this form factor.

FEATURES

- Available in ANSI white bins as well as 4-step and 2-step EasyWhite™ bins at 2700 K, 3000 K, 3500 K, 4000 K and 5000 K CCT
- 80-minimum CRI option
- Forward voltage: 37 V
- 85 °C binning and characterization
- Maximum drive current: 2100 mA
- 115° viewing angle, uniform chromaticity profile
- Top-side solder connections
- Thermocouple attach point
- NEMA SSL-3 2011 standard flux bins
- Mechanical and optical footprint consistent with CXA2520 and CXA2530

TABLE OF CONTENTS

| | |
|--|----|
| Characteristics | 2 |
| Operating Limits..... | 2 |
| Flux Characteristics, Standard Order Codes and Bins | 3 |
| Flux Characteristics, Standard Order Codes and Bins, 80 CRI..... | 5 |
| Relative Spectral Power Distribution . | 6 |
| Electrical Characteristics..... | 6 |
| Relative Luminous Flux..... | 7 |
| Relative Chromaticity vs. Current and Temperature | 8 |
| Typical Spatial Distribution..... | 9 |
| Performance Groups - Brightness..... | 9 |
| Performance Groups - Chromaticity.10 | |
| Cree EasyWhite Bins Plotted on the CIE 1931 Color Space | 11 |
| Cree ANSI White Bins Plotted on the CIE 1931 Color Space..... | 12 |
| Bin and Order Code Formats | 13 |
| Mechanical Dimensions..... | 13 |
| Thermal Design..... | 14 |
| Notes..... | 14 |
| Packaging..... | 15 |

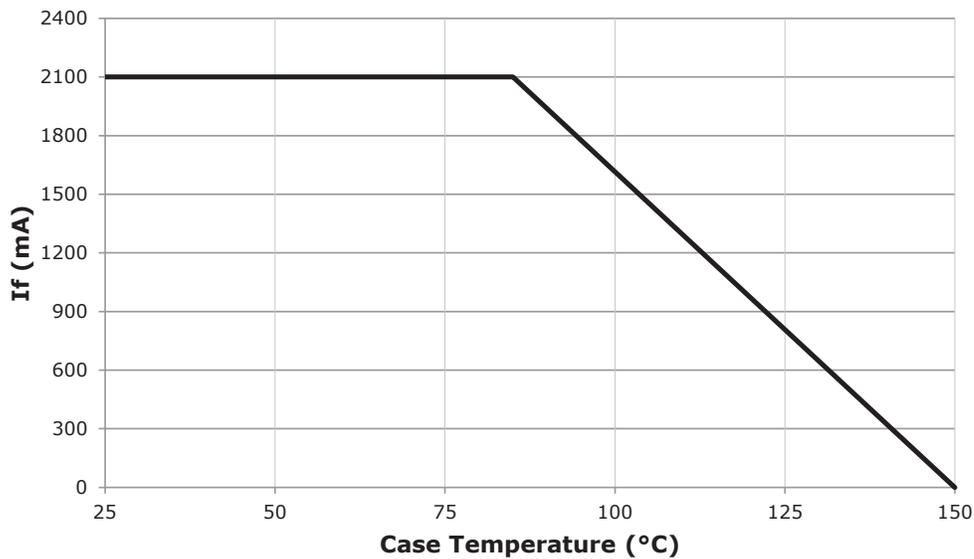
CHARACTERISTICS

| Characteristics | Unit | Minimum | Typical | Maximum |
|--|---------|---------|---------|---------|
| Viewing angle (FWHM) | degrees | | 115 | |
| ESD classification (HBM per Mil-Std-883D) | | | Class 2 | |
| DC forward current | mA | | | 2100* |
| Reverse current | mA | | | 0.1 |
| Forward voltage (@ 1100 mA, $T_j = 85\text{ }^\circ\text{C}$) | V | | 37 | |
| Forward voltage (@ 1100 mA, $T_j = 25\text{ }^\circ\text{C}$) | V | | | 42 |

* Refer to the Operating Limits section.

OPERATING LIMITS

The maximum current rating of the CXA2540 is dependent on the case temperature (T_c) when the LED has reached thermal equilibrium under steady-state operation. Please refer to the Mechanical Drawings section on page 13 for the location of the T_c measurement point.



FLUX CHARACTERISTICS, STANDARD ORDER CODES AND BINS ($I_f = 1100 \text{ mA}$, $T_j = 85 \text{ }^\circ\text{C}$)

The following tables provide order codes for XLamp CXA2540 LEDs. For a complete description of the order code nomenclature, please reference Bin and Order Code Formats (page 13).

| Color | CCT Range | Base Order Codes Min. Luminous Flux @ 1100 mA | | | 2-Step Order Code | | 4-Step Order Code | |
|-----------|-----------|---|-------------------|--------------------|---------------------|--------------------------|---------------------|--------------------------|
| | | Group | Flux (lm) @ 85 °C | Flux (lm) @ 25 °C* | Chromaticity Region | | Chromaticity Region | |
| EasyWhite | 5000K | V4 | 4545 | 5083 | 50H | CXA2540-0000-000N00V450H | 50F | CXA2540-0000-000N00V450F |
| | | W2 | 4860 | 5435 | | CXA2540-0000-000N00W250H | | CXA2540-0000-000N00W250F |
| | | W4 | 5225 | 5843 | | CXA2540-0000-000N00W450H | | CXA2540-0000-000N00W450F |
| | 4000K | V2 | 4230 | 4730 | 40H | CXA2540-0000-000N00V240H | 40F | CXA2540-0000-000N00V240F |
| | | V4 | 4545 | 5083 | | CXA2540-0000-000N00V440H | | CXA2540-0000-000N00V440F |
| | | W2 | 4860 | 5435 | | CXA2540-0000-000N00W240H | | CXA2540-0000-000N00W240F |
| | 3500K | U4 | 3955 | 4423 | 35H | CXA2540-0000-000N00U435H | 35F | CXA2540-0000-000N00U435F |
| | | V2 | 4230 | 4730 | | CXA2540-0000-000N00V235H | | CXA2540-0000-000N00V235F |
| | | V4 | 4545 | 5083 | | CXA2540-0000-000N00V435H | | CXA2540-0000-000N00V435F |
| | 3000K | U4 | 3955 | 4423 | 30H | CXA2540-0000-000N00U430H | 30F | CXA2540-0000-000N00U430F |
| | | V2 | 4230 | 4730 | | CXA2540-0000-000N00V230H | | CXA2540-0000-000N00V230F |
| | | V4 | 4545 | 5083 | | CXA2540-0000-000N00V430H | | CXA2540-0000-000N00V430F |
| | 2700K | U2 | 3680 | 4115 | 27H | CXA2540-0000-000N00U227H | 27F | CXA2540-0000-000N00U227F |
| | | U4 | 3955 | 4423 | | CXA2540-0000-000N00U427H | | CXA2540-0000-000N00U427F |
| | | V2 | 4230 | 4730 | | CXA2540-0000-000N00V227H | | CXA2540-0000-000N00V227F |

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.
- Minimum CRI for standard CRI order codes ending in 0E8, 27F, 27H, 0E7, 30F, 30H, 0E6, 35F, 35H is 80.
- Minimum CRI for standard CRI order codes ending in 0E5, 40F, 40H, 0E3, 50F, 50H is 70.
- * Flux values @ 25 °C are calculated and for reference only.

FLUX CHARACTERISTICS, STANDARD ORDER CODES AND BINS ($I_f = 1100 \text{ mA}$, $T_j = 85 \text{ }^\circ\text{C}$) - CONTINUED

| Color | CCT Range | Base Order Codes Min Luminous Flux @ 1100 mA | | | Chromaticity Regions | Order Code |
|------------|-----------|--|----------------------|-----------------------|----------------------|--------------------------|
| | | Group | Flux (lm) @ 85 °C | Flux (lm) @ 25 °C* | | |
| ANSI White | 5000K | V4 | 4545 | 5083 | 3A0, 3B0, 3C0, 3D0 | CXA2540-0000-000N0HV40E3 |
| | | W2 | 4860 | 5435 | | CXA2540-0000-000N0HW20E3 |
| | | W4 | 5225 | 5843 | | CXA2540-0000-000N0HW40E3 |
| | 4000K | V2 | 4230 | 4730 | 5A0, 5B0, 5C0, 5D0 | CXA2540-0000-000N0HV20E5 |
| | | V4 | 4545 | 5083 | | CXA2540-0000-000N0HV40E5 |
| | | W2 | 4860 | 5435 | | CXA2540-0000-000N0HW20E5 |
| | 3500K | U4 | 3955 | 4423 | 6A0, 6B0, 6C0, 6D0 | CXA2540-0000-000N0HU40E6 |
| | | V2 | 4230 | 4730 | | CXA2540-0000-000N0HV20E6 |
| | | V4 | 4545 | 5083 | | CXA2540-0000-000N0HV40E6 |
| | 3000K | U4 | 3955 | 4423 | 7A0, 7B0, 7C0, 7D0 | CXA2540-0000-000N0HU40E7 |
| | | V2 | 4230 | 4730 | | CXA2540-0000-000N0HV20E7 |
| | | V4 | 4545 | 5083 | | CXA2540-0000-000N0HV40E7 |
| | 2700K | U2 | 3680 | 4115 | 8A0, 8B0, 8C0, 8D0 | CXA2540-0000-000N0HU20E8 |
| | | U4 | 3955 | 4423 | | CXA2540-0000-000N0HU40E8 |
| | | V2 | 4230 | 4730 | | CXA2540-0000-000N0HV20E8 |

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.
- Minimum CRI for standard CRI order codes ending in 0E8, 27F, 27H, 0E7, 30F, 30H, 0E6, 35F, 35H is 80.
- Minimum CRI for standard CRI order codes ending in 0E5, 40F, 40H, 0E3, 50F, 50H is 70.
- * Flux values @ 25 °C are calculated and for reference only.

FLUX CHARACTERISTICS, STANDARD ORDER CODES AND BINS, 80 CRI ($I_f = 1100 \text{ mA}$, $T_j = 85 \text{ }^\circ\text{C}$)

The following tables provide order codes for XLamp CXA2540 80 CRI minimum LEDs. For a complete description of the order code nomenclature, please reference Bin and Order Code Formats (page 13).

| Color | CCT Range | Base Order Codes Min. Luminous Flux @ 1100 mA | | | 2-Step Order Code | | 4-Step Order Code | |
|-----------|-----------|---|-------------------|--------------------|---------------------|--------------------------|---------------------|--------------------------|
| | | Group | Flux (lm) @ 85 °C | Flux (lm) @ 25 °C* | Chromaticity Region | | Chromaticity Region | |
| EasyWhite | 5000K | V2 | 4230 | 4730 | 50H | CXA2540-0000-000N0HV250H | 50F | CXA2540-0000-000N0HV250F |
| | | V4 | 4545 | 5083 | | CXA2540-0000-000N0HV450H | | CXA2540-0000-000N0HV450F |
| | | W2 | 4860 | 5435 | | CXA2540-0000-000N0HW250H | | CXA2540-0000-000N0HW250F |
| | 4000K | U4 | 3955 | 4423 | 40H | CXA2540-0000-000N0HU440H | 40F | CXA2540-0000-000N0HU440F |
| | | V2 | 4230 | 4730 | | CXA2540-0000-000N0HV240H | | CXA2540-0000-000N0HV240F |
| | | V4 | 4545 | 5083 | | CXA2540-0000-000N0HV440H | | CXA2540-0000-000N0HV440F |

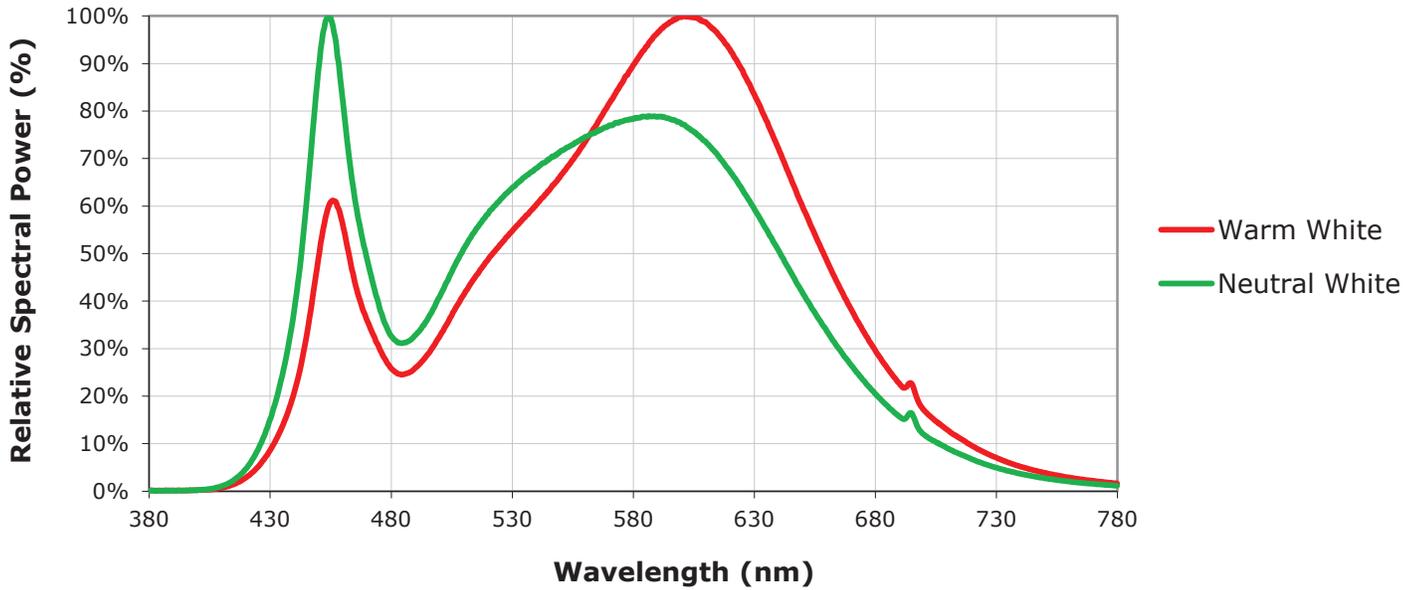
| Color | CCT Range | Base Order Codes Min Luminous Flux @ 1100 mA | | | Chromaticity Regions | Order Code |
|------------|-----------|--|-------------------|--------------------|----------------------|--------------------------|
| | | Group | Flux (lm) @ 85 °C | Flux (lm) @ 25 °C* | | |
| ANSI White | 5000K | V2 | 4230 | 4730 | 3A0, 3B0, 3C0, 3D0 | CXA2540-0000-000N0HV20E3 |
| | | V4 | 4545 | 5083 | | CXA2540-0000-000N0HV40E3 |
| | | W2 | 4860 | 5435 | | CXA2540-0000-000N0HW20E3 |
| | 4000K | U4 | 3955 | 4423 | 5A0, 5B0, 5C0, 5D0 | CXA2540-0000-000N0HU40E5 |
| | | V2 | 4230 | 4730 | | CXA2540-0000-000N0HV20E5 |
| | | V4 | 4545 | 5083 | | CXA2540-0000-000N0HV40E5 |

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.
- Minimum CRI for 80 CRI order codes ending in 0E5, 40F, 40H, 0E3, 50F, 50H is 80.
- * Flux values @ 25 °C are calculated and for reference only.

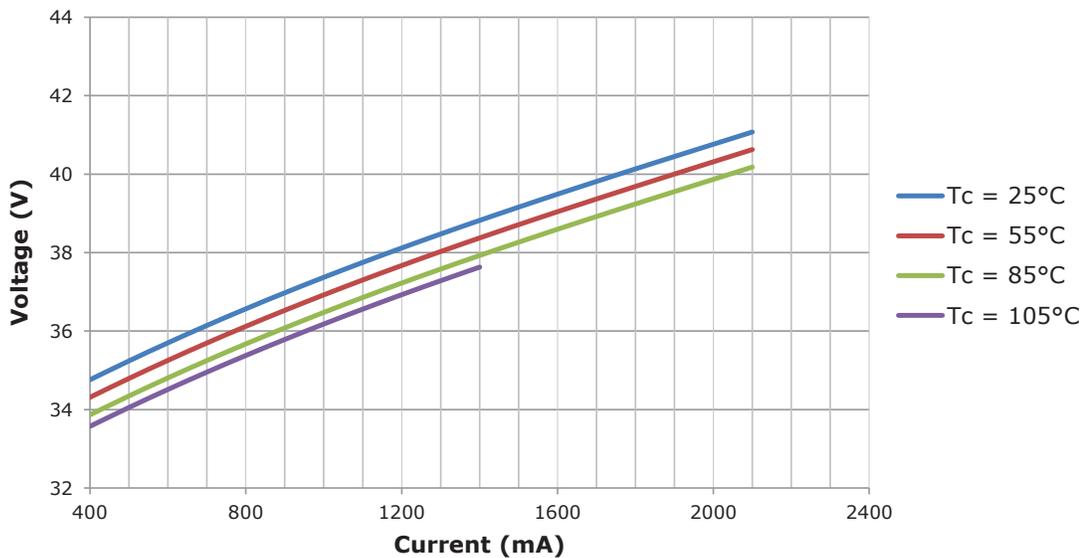
RELATIVE SPECTRAL POWER DISTRIBUTION ($I_f = 1100 \text{ mA}$, $T_j = 85 \text{ }^\circ\text{C}$)

The following graph is the result of a pulsed measurement at 1100 mA and $T_j = 85 \text{ }^\circ\text{C}$.



ELECTRICAL CHARACTERISTICS

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

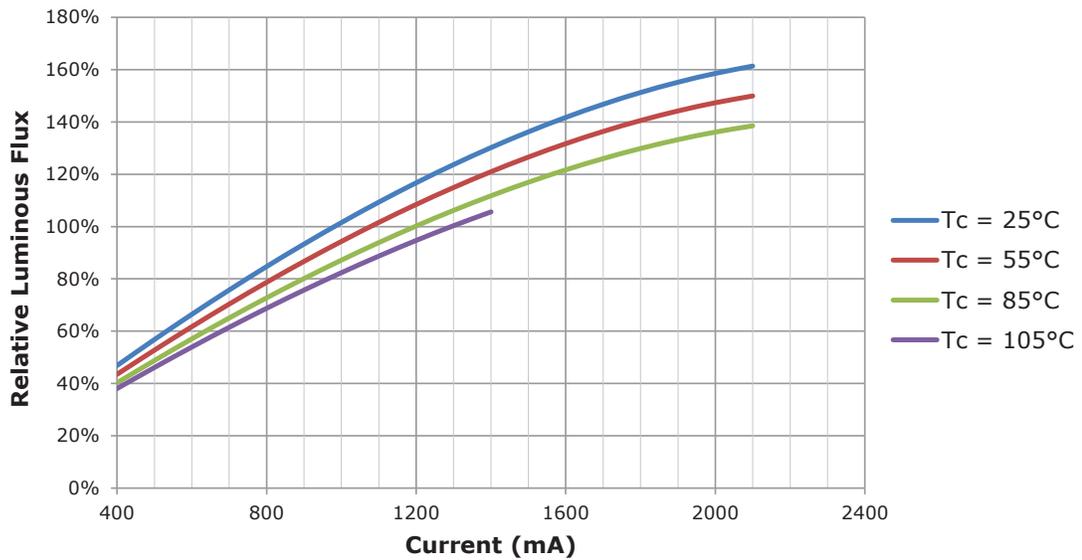


RELATIVE LUMINOUS FLUX

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

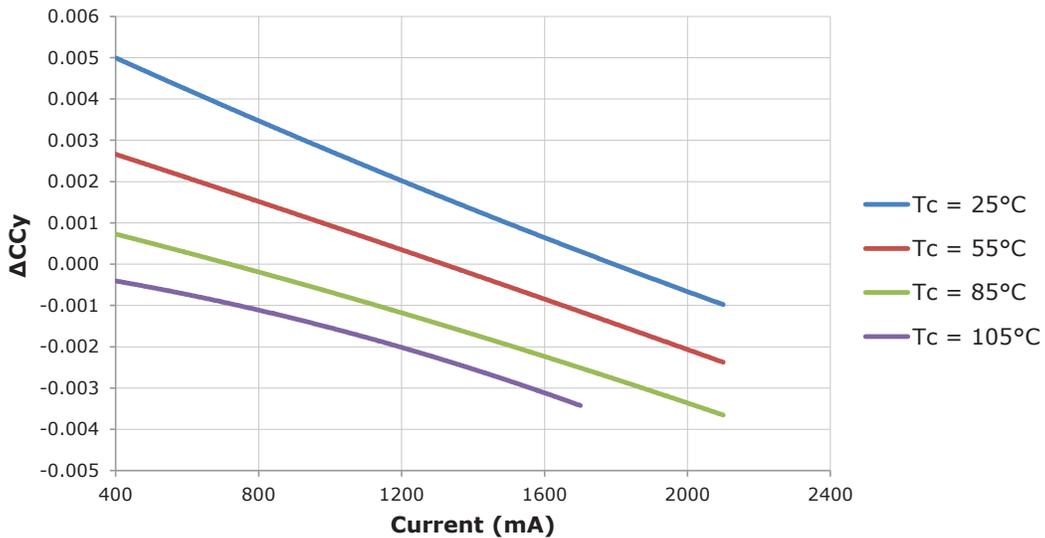
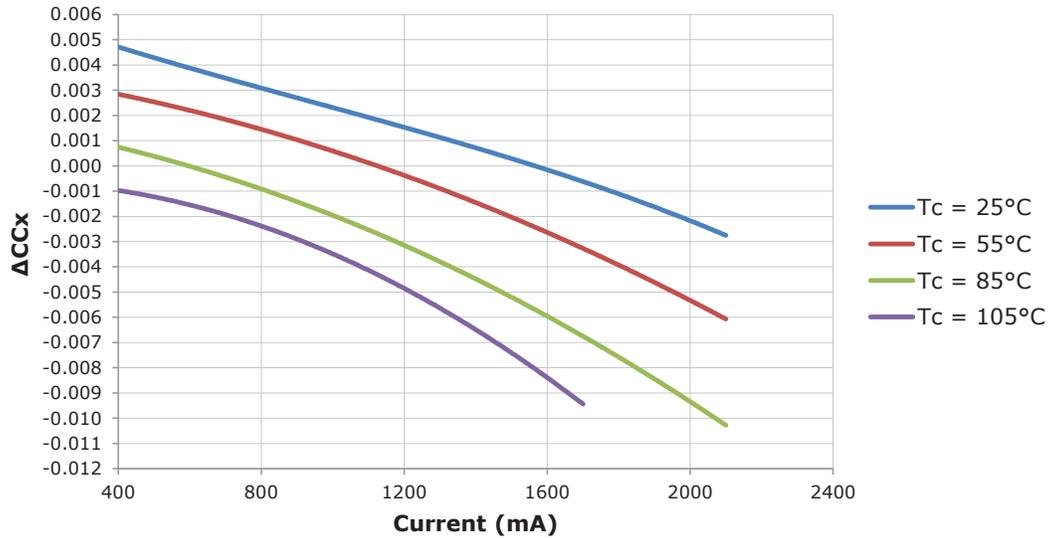
- Measurements of CXA2540 at steady-state operation at the given conditions, divided by
- Flux measured during binning, which is a pulsed measurement at 1100 mA at $T_j = 85\text{ }^\circ\text{C}$.

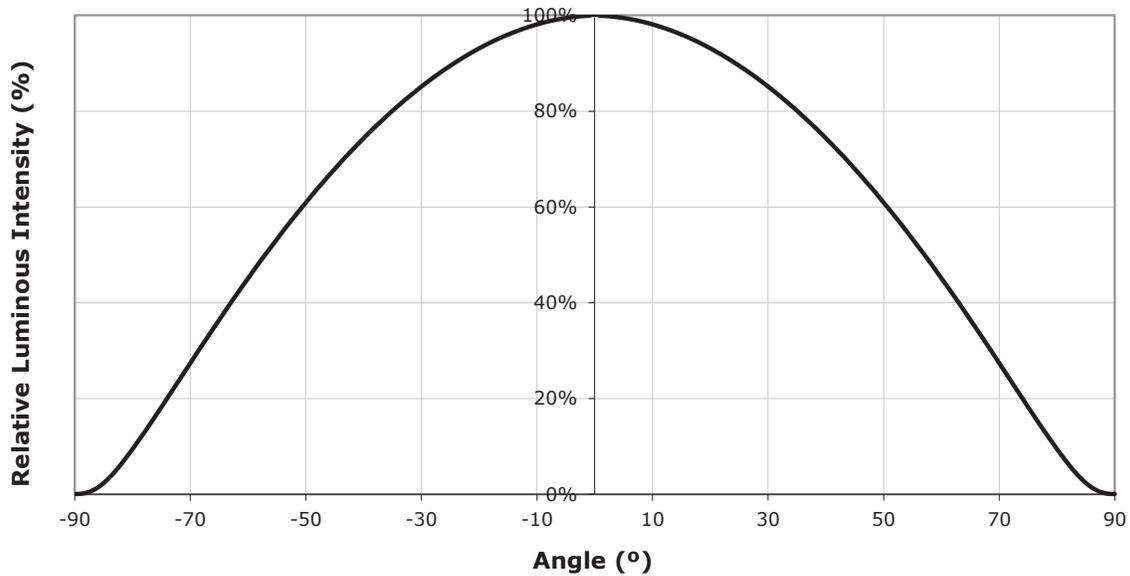
For example, at steady-state operation of $T_c = 55\text{ }^\circ\text{C}$, $I_f = 1800\text{ mA}$, the relative luminous flux ratio is 140% in the chart below. A CXA2540 LED that measures 4600 lm during binning will deliver 6440 lm (4600×1.4) at steady-state operation of $T_c = 55\text{ }^\circ\text{C}$, $I_f = 1800\text{ mA}$.



RELATIVE CHROMATICITY VS. CURRENT AND TEMPERATURE (3000 K, 80 CRI)

The following graphs are the result of a series of steady-state measurements. Relative chromaticity is provided as shift from the chromaticity measured during binning, which is a pulsed measurement at 1100 mA at $T_j = 85^\circ\text{C}$.



TYPICAL SPATIAL DISTRIBUTION

PERFORMANCE GROUPS - BRIGHTNESS ($I_f = 1100 \text{ mA}$, $T_j = 85 \text{ °C}$)

XLamp CXA2540 LEDs are tested for luminous flux and placed into one of the following bins.

| Group Code | Min. Luminous Flux @ 1100 mA | Max. Luminous Flux @ 1100 mA |
|------------|------------------------------|------------------------------|
| U2 | 3680 | 3955 |
| U4 | 3955 | 4230 |
| V2 | 4230 | 4545 |
| V4 | 4545 | 4860 |
| W2 | 4860 | 5225 |
| W4 | 5225 | 5590 |

PERFORMANCE GROUPS - CHROMATICITY ($T_j = 85\text{ }^\circ\text{C}$)

XLamp CXA2540 LEDs are tested for chromaticity and placed into one of the regions defined by the following bounding coordinates.

| EasyWhite Color Temperatures – 4-Step | | | |
|---------------------------------------|-------|--------|--------|
| Code | CCT | x | y |
| 50F | 5000K | 0.3407 | 0.3459 |
| | | 0.3415 | 0.3586 |
| | | 0.3499 | 0.3654 |
| | | 0.3484 | 0.3521 |
| 40F | 4000K | 0.3744 | 0.3685 |
| | | 0.3782 | 0.3837 |
| | | 0.3912 | 0.3917 |
| | | 0.3863 | 0.3758 |
| 35F | 3500K | 0.3981 | 0.3800 |
| | | 0.4040 | 0.3966 |
| | | 0.4186 | 0.4037 |
| | | 0.4116 | 0.3865 |
| 30F | 3000K | 0.4242 | 0.3919 |
| | | 0.4322 | 0.4096 |
| | | 0.4449 | 0.4141 |
| | | 0.4359 | 0.3960 |
| 27F | 2700K | 0.4475 | 0.3994 |
| | | 0.4573 | 0.4178 |
| | | 0.4695 | 0.4207 |
| | | 0.4589 | 0.4021 |

| EasyWhite Color Temperatures – 2-Step | | | |
|---------------------------------------|-------|--------|--------|
| Code | CCT | x | y |
| 50H | 5000K | 0.3429 | 0.3507 |
| | | 0.3434 | 0.3571 |
| | | 0.3475 | 0.3604 |
| | | 0.3469 | 0.3539 |
| 40H | 4000K | 0.3784 | 0.3741 |
| | | 0.3804 | 0.3818 |
| | | 0.3867 | 0.3857 |
| | | 0.3844 | 0.3778 |
| 35H | 3500K | 0.4030 | 0.3857 |
| | | 0.4061 | 0.3941 |
| | | 0.4132 | 0.3976 |
| | | 0.4099 | 0.3890 |
| 30H | 3000K | 0.4291 | 0.3973 |
| | | 0.4333 | 0.4062 |
| | | 0.4395 | 0.4084 |
| | | 0.4351 | 0.3994 |
| 27H | 2700K | 0.4528 | 0.4046 |
| | | 0.4578 | 0.4138 |
| | | 0.4638 | 0.4152 |
| | | 0.4586 | 0.4060 |

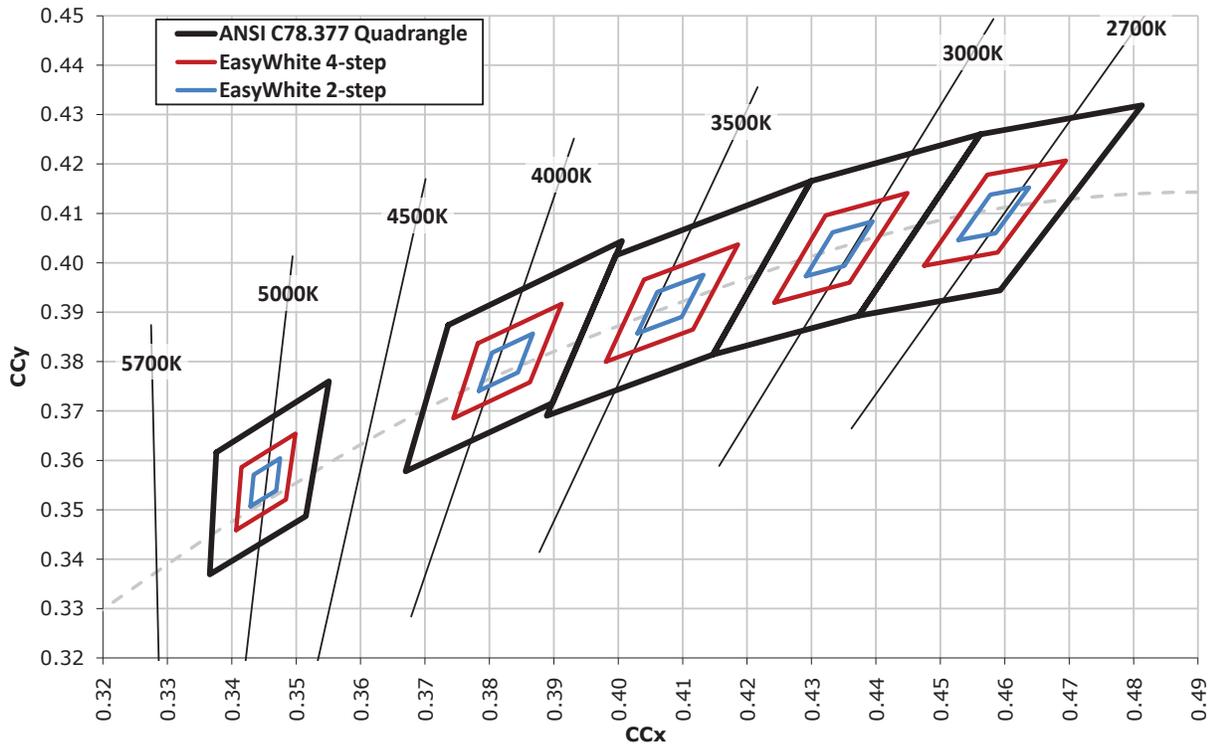
| ANSI White Bins | | | | |
|-----------------|-------|----------|-------|-------|
| Code | CCT | Bin Code | x | y |
| 0E3 | 5000K | 3A0 | .3371 | .3490 |
| | | | .3451 | .3554 |
| | | | .3440 | .3427 |
| | | | .3366 | .3369 |
| | | 3B0 | .3376 | .3616 |
| | | | .3463 | .3687 |
| | | | .3451 | .3554 |
| | | | .3371 | .3490 |
| | | 3C0 | .3463 | .3687 |
| | | | .3551 | .3760 |
| | | | .3533 | .3620 |
| | | | .3451 | .3554 |
| | | 3D0 | .3451 | .3554 |
| | | | .3533 | .3620 |
| | | | .3515 | .3487 |
| | | | .3440 | .3427 |

| ANSI White Bins | | | | |
|-----------------|-------|----------|-------|-------|
| Code | CCT | Bin Code | x | y |
| 0E5 | 4000K | 5A0 | .3670 | .3578 |
| | | | .3702 | .3722 |
| | | | .3825 | .3798 |
| | | | .3783 | .3646 |
| | | 5B0 | .3702 | .3722 |
| | | | .3736 | .3874 |
| | | | .3869 | .3958 |
| | | | .3825 | .3798 |
| | | 5C0 | .3825 | .3798 |
| | | | .3869 | .3958 |
| | | | .4006 | .4044 |
| | | | .3950 | .3875 |
| | | 5D0 | .3783 | .3646 |
| | | | .3825 | .3798 |
| | | | .3950 | .3875 |
| | | | .3898 | .3716 |

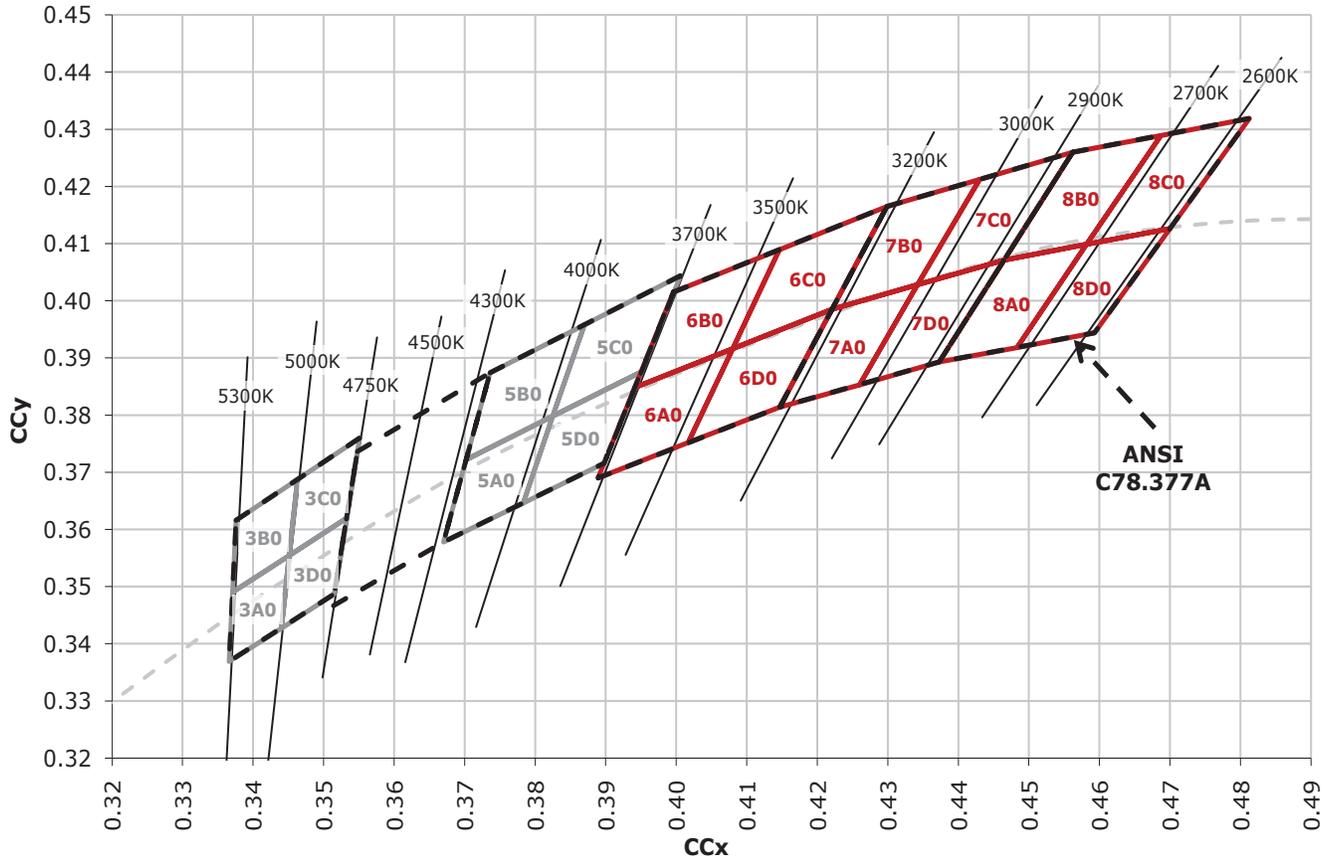
| ANSI White Bins | | | | |
|-----------------|-------|----------|-------|-------|
| Code | CCT | Bin Code | x | y |
| 0E6 | 3500K | 6A0 | .3889 | .3690 |
| | | | .3941 | .3848 |
| | | | .4080 | .3916 |
| | | | .4017 | .3751 |
| | | 6B0 | .3941 | .3848 |
| | | | .3996 | .4015 |
| | | | .4146 | .4089 |
| | | | .4080 | .3916 |
| | | 6C0 | .4080 | .3916 |
| | | | .4146 | .4089 |
| | | | .4299 | .4165 |
| | | | .4221 | .3984 |
| | | 6D0 | .4017 | .3751 |
| | | | .4080 | .3916 |
| | | | .4221 | .3984 |
| | | | .4147 | .3814 |

| ANSI White Bins | | | | | ANSI White Bins | | | | |
|-----------------|-------|----------|-------|-------|-----------------|-------|----------|-------|-------|
| Code | CCT | Bin Code | x | y | Code | CCT | Bin Code | x | y |
| 0E7 | 3000K | 7A0 | .4147 | .3814 | 0E8 | 2700K | 8A0 | .4373 | .3893 |
| | | | .4221 | .3984 | | | | .4465 | .4071 |
| | | | .4342 | .4028 | | | | .4582 | .4099 |
| | | | .4259 | .3853 | | | | .4483 | .3919 |
| | | 7B0 | .4221 | .3984 | | | 8B0 | .4465 | .4071 |
| | | | .4299 | .4165 | | | | .4562 | .4260 |
| | | | .4430 | .4212 | | | | .4687 | .4289 |
| | | | .4342 | .4028 | | | | .4582 | .4099 |
| | | 7C0 | .4342 | .4028 | | | 8C0 | .4582 | .4099 |
| | | | .4430 | .4212 | | | | .4687 | .4289 |
| | | | .4562 | .4260 | | | | .4813 | .4319 |
| | | | .4465 | .4071 | | | | .4700 | .4126 |
| | | 7D0 | .4259 | .3853 | | | 8D0 | .4483 | .3919 |
| | | | .4342 | .4028 | | | | .4582 | .4099 |
| | | | .4465 | .4071 | | | | .4700 | .4126 |
| | | | .4373 | .3893 | | | | .4593 | .3944 |

CREE EASYWHITE BINS PLOTTED ON THE CIE 1931 COLOR SPACE ($T_j = 85^\circ\text{C}$)

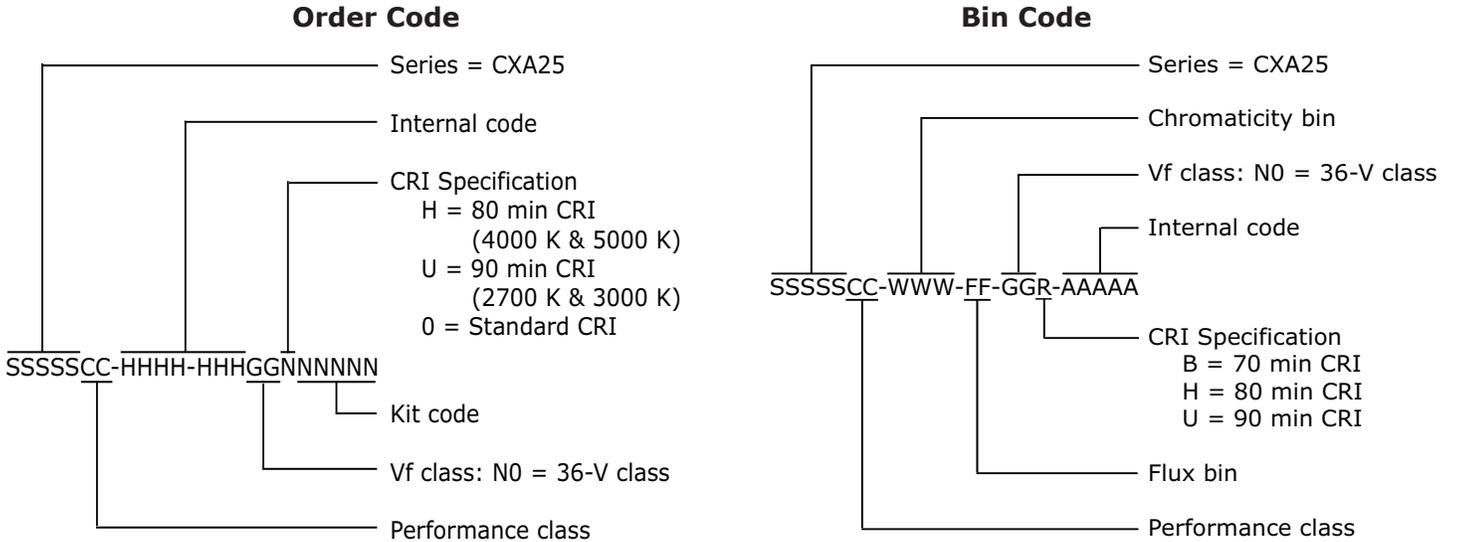


CREE ANSI WHITE BINS PLOTTED ON THE CIE 1931 COLOR SPACE ($T_j = 85\text{ }^\circ\text{C}$)



BIN AND ORDER CODE FORMATS

Bin codes and order codes are configured as follows:



MECHANICAL DIMENSIONS

Dimensions are in mm.

Tolerances unless otherwise

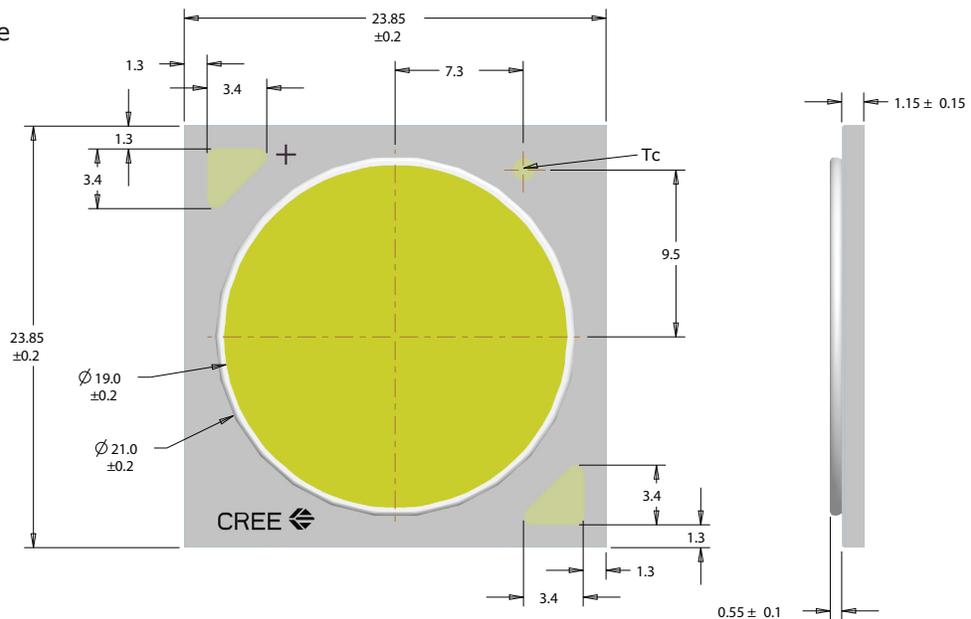
specified:

.x ± .10

.xx ± .03

.xxx ± .010

x° ± 1° x ± .10



THERMAL DESIGN

The CXA 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 (T_c). No additional calculations are required to ensure the CXA LED is being operated within its designed limits. Please refer to page 2 for the Operating Limit specification.

For performing thermal simulation, Cree has measured the bottom of the package, commonly referred to as the solder point (T_{sp}), and found this value to be equivalent to the T_c location at the top of the package once the LED has reached thermal equilibrium. There is no need to calculate for T_j inside the package, as the thermal management design process, specifically from T_{sp} to ambient, remains identical to any other LED component. For more information on thermal management of Cree XLamp LEDs, please refer to the XLamp Thermal Management application note at www.cree.com/xlamp_app_notes/thermal_management.

NOTES

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.

Please read the XLamp Long-Term Lumen Maintenance application note at 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 for details on how thermal design, ambient temperature, and drive current affect the LED junction temperature.

Vision Advisory Claim

Users should be cautioned not to stare at the light of this LED product. The bright light can damage the eye.

PACKAGING

Cree CXA2540 LEDs are packaged in trays of 20, which are then combined in boxes of 5 trays, or 100 LEDs. Boxes of 100 LEDs are of the same performance bin.

Dimensions are in inches.

Tolerances:

.x ± .1

.xx ± .05

.xxx ± .005

x° ± 1°

