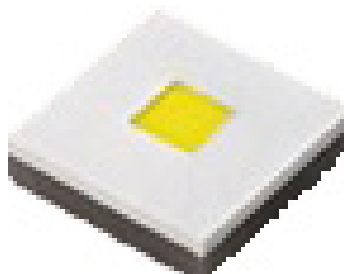


PRELIMINARY

Cree® XLamp® XP-P LEDs



PRODUCT DESCRIPTION

FEATURES

- ANSI-compatible chromaticity bins
- Maximum drive current: 3000 mA
- Low thermal resistance: 4.2 °C/W
- Wide viewing angle: 115°
- Unlimited floor life at ≤ 30 °C/85% RH
- Reflow solderable - JEDEC J-STD-020C
- Electrically neutral thermal path

TABLE OF CONTENTS

| | |
|--|----|
| Characteristics | 2 |
| Flux Characteristics | 3 |
| Relative Spectral Power Distribution | 4 |
| Relative Flux vs. Junction Temperature..... | 4 |
| Electrical Characteristics..... | 5 |
| Relative Flux vs. Current | 5 |
| Relative Chromaticity vs Current and Temperature | 6 |
| Typical Spatial Distribution..... | 7 |
| Thermal Design | 7 |
| Performance Groups – Luminous Flux..... | 8 |
| Performance Groups – Chromaticity..... | 9 |
| Cree’s Standard Cool White Kits Plotted on ANSI Standard Chromaticity Regions | 10 |
| Cree’s Standard Neutral White Kits Plotted on ANSI Standard Chromaticity Regions | 11 |
| Cree’s Standard Chromaticity Kits | 12 |
| Bin and Order Code Formats..... | 13 |
| Reflow Soldering Characteristics..... | 14 |
| Notes | 15 |
| Mechanical Dimensions | 16 |
| Tape and Reel..... | 17 |
| Packaging..... | 18 |

PRELIMINARY

CHARACTERISTICS

| Characteristics | Unit | Minimum | Typical | Maximum |
|--|---------|---------|---------|---------|
| Thermal resistance | °C/W | | 4.2 | |
| Viewing angle (FWHM) | degrees | | 115 | |
| Temperature coefficient of voltage | mV/°C | | -1.2 | |
| ESD withstand voltage (HBM per Mil-Std-883D) | V | | | 8000 |
| DC forward current | mA | | | 3000 |
| Reverse voltage | V | | | 5 |
| Forward voltage (@ 1000 mA, 25 °C) | V | | 3.1 | 3.5 |
| Forward voltage (@ 1500 mA, 25 °C) | V | | 3.25 | |
| Forward voltage (@ 2000 mA, 25 °C) | V | | 3.37 | |
| Forward voltage (@ 3000 mA, 25 °C) | V | | 3.58 | |
| LED junction temperature | °C | | | 150 |

PRELIMINARY

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

The following table provides order codes for XLamp XP-P LEDs. For a complete description of the order code nomenclature, please see the Bin and Order Code Formats section (page 13). For definitions of the chromaticity kits, please see the Cree's Standard Chromaticity Kits section (page 12).

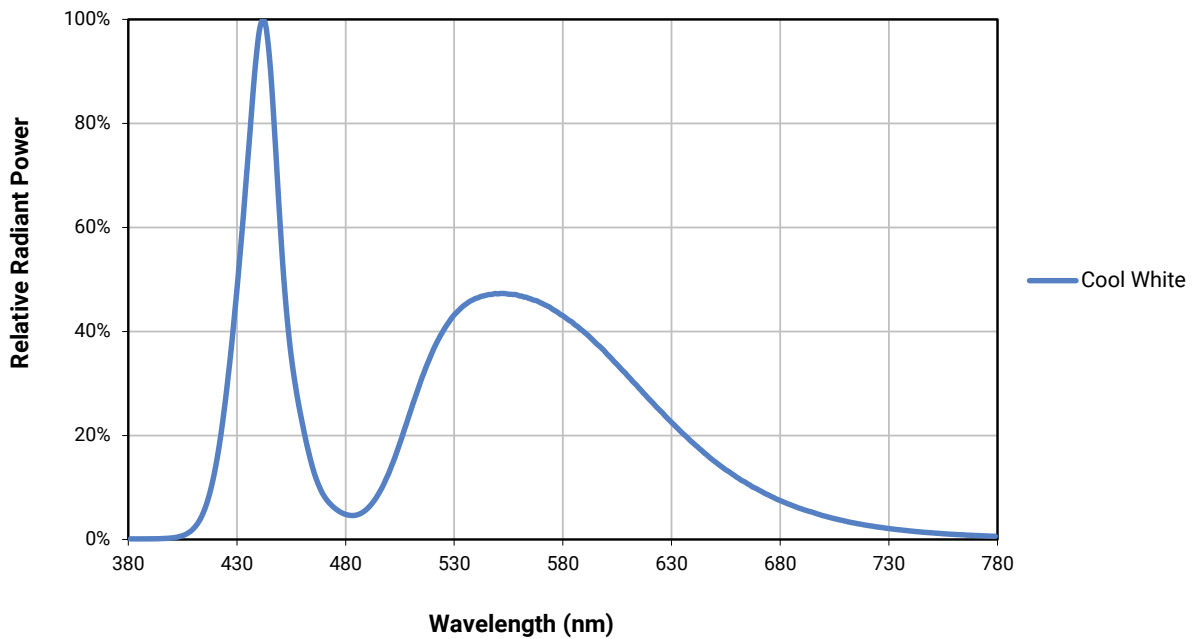
| Chromaticity | | Minimum Luminous Flux (lm) @ 1000 mA | | Order Codes |
|--------------|--------|--------------------------------------|-----------|--------------------------|
| Kit | CCT | Code | Flux (lm) | 65 CRI Typical |
| DT | 7000 K | U5 | 360 | XPPAWT-H0-0000-0000U50DT |
| E1 | 6500 K | U5 | 360 | XPPAWT-H0-0000-0000U50E1 |
| CV | 6000 K | U5 | 360 | XPPAWT-H0-0000-0000U50CV |
| DV | 6000 K | U5 | 360 | XPPAWT-H0-0000-0000U50DV |
| CW | 5700 K | U5 | 360 | XPPAWT-H0-0000-0000U50CW |
| E2 | 5700 K | U5 | 360 | XPPAWT-H0-0000-0000U50E2 |
| E3 | 5000 K | U5 | 360 | XPPAWT-H0-0000-0000U50E3 |

Notes

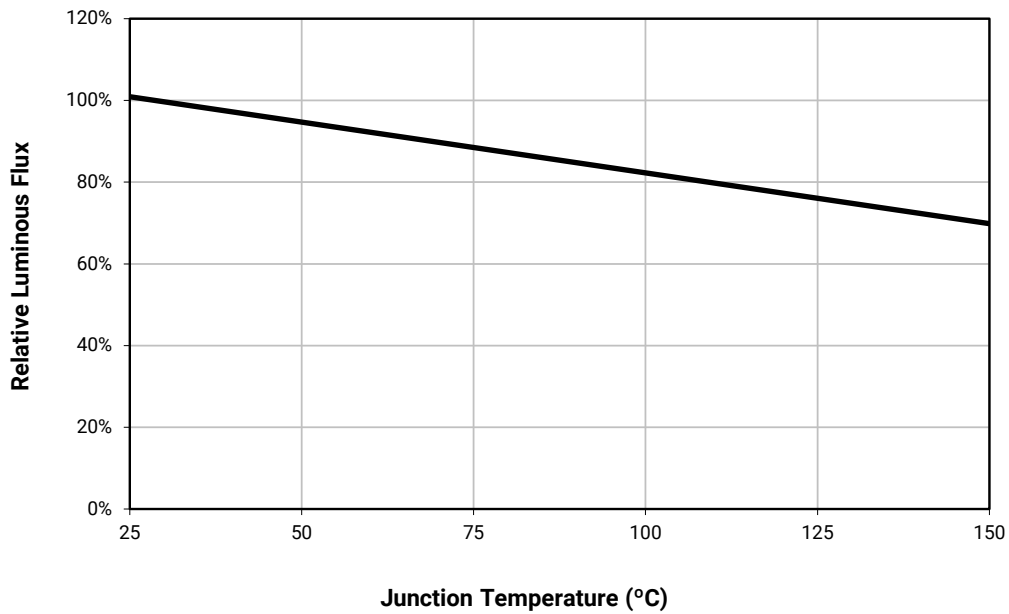
- Cree maintains a tolerance of $\pm 7\%$ on flux and power measurements, ± 0.005 on chromaticity (CCx, CCy) measurements and a tolerance of ± 2 on CRI measurements. See the Measurements section (page 15).
- Cree XLamp XP-P LED order codes specify only a minimum flux bin and not a maximum. Cree may ship 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.

PRELIMINARY

RELATIVE SPECTRAL POWER DISTRIBUTION

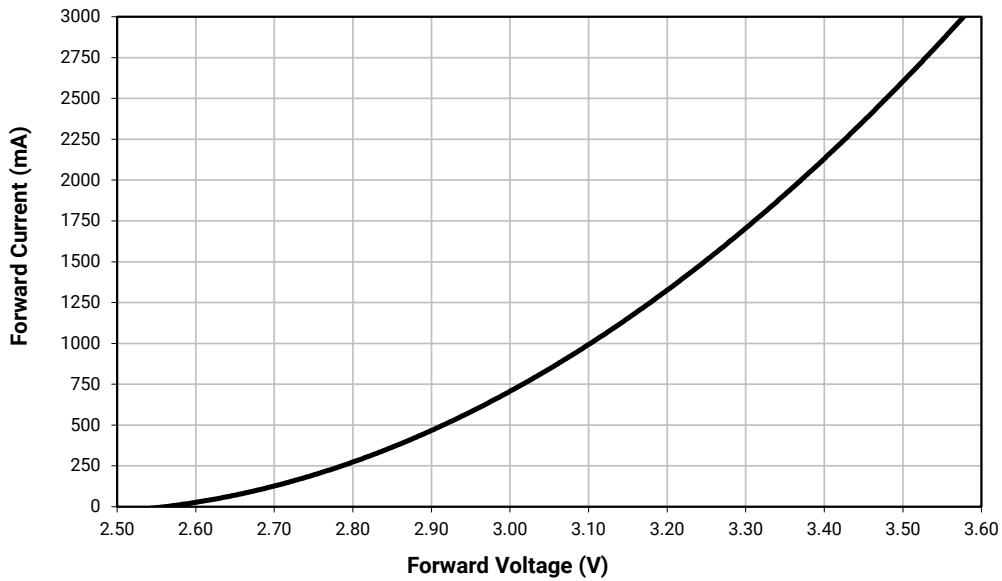


RELATIVE FLUX VS. JUNCTION TEMPERATURE ($I_F = 1000$ mA)

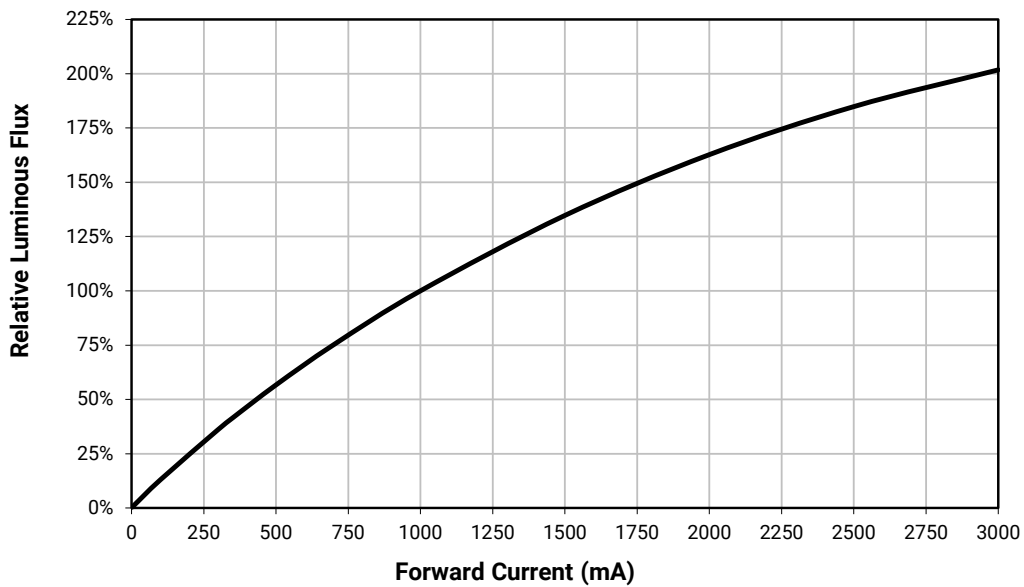


PRELIMINARY

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

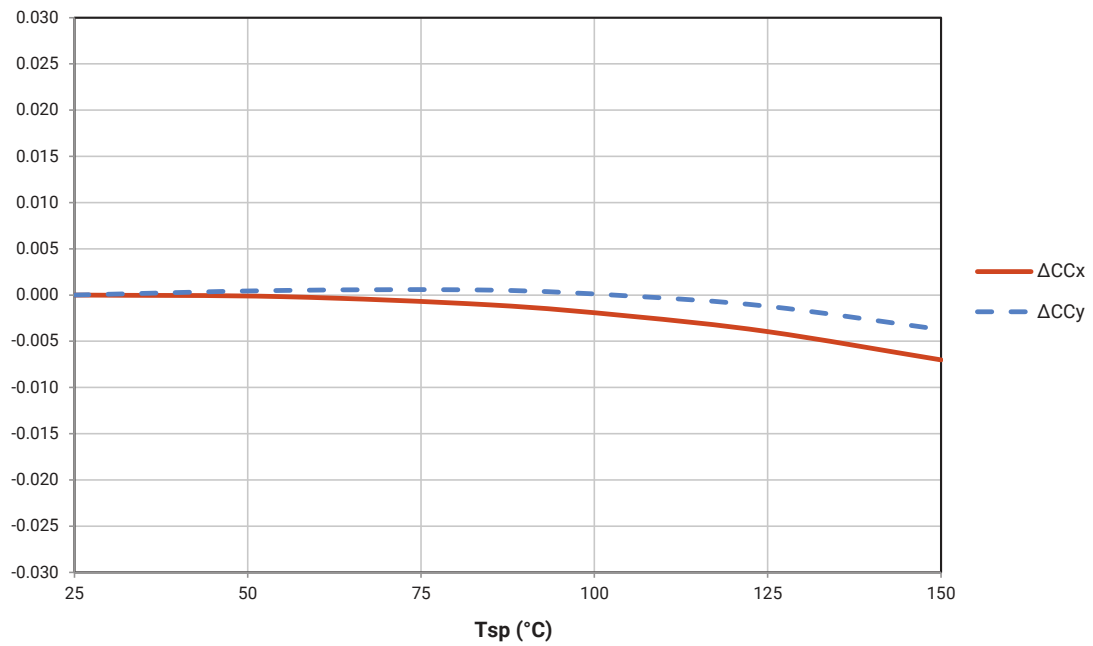
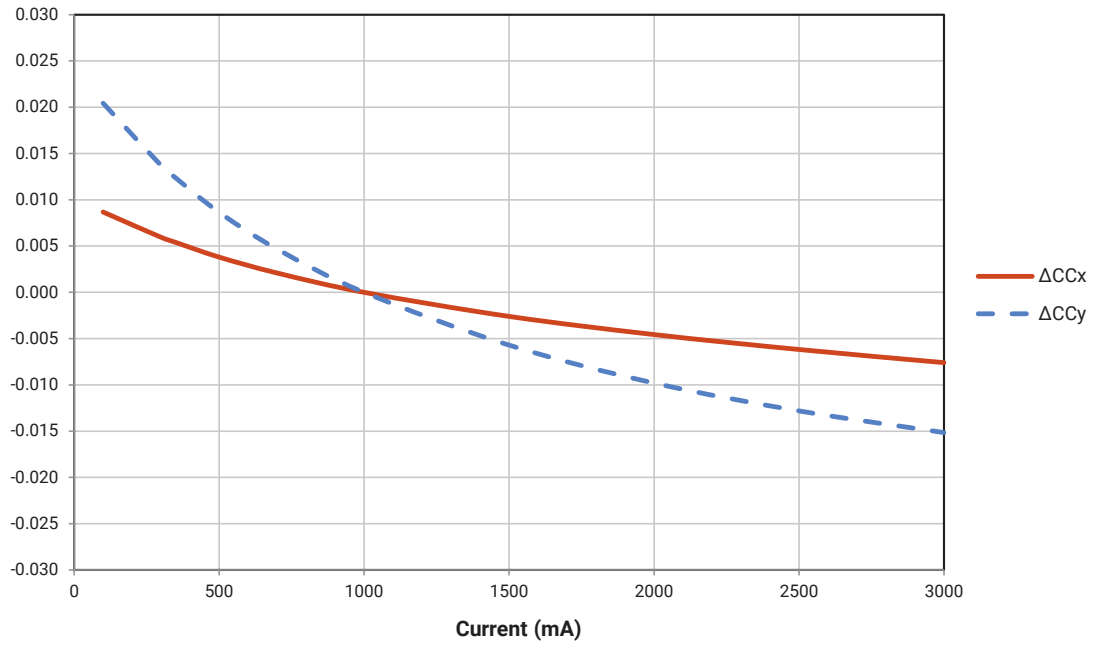


RELATIVE FLUX VS. CURRENT ($T_j = 25\text{ }^\circ\text{C}$)



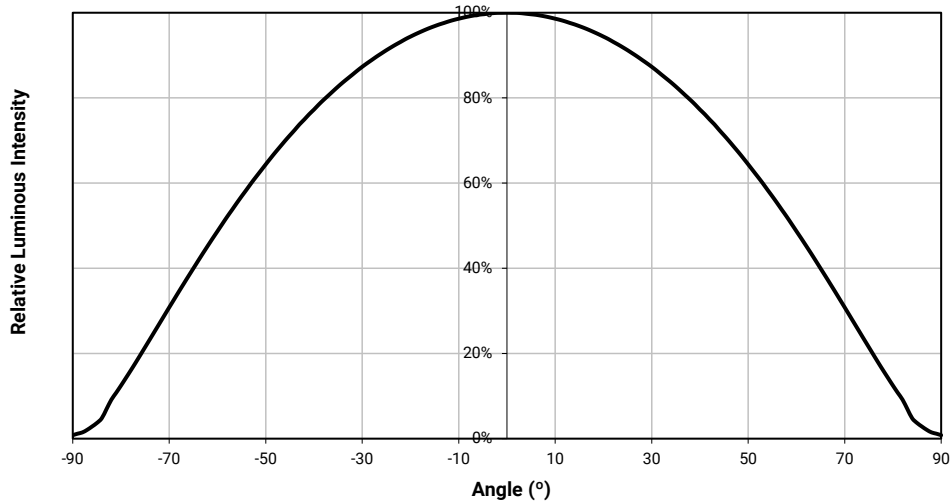
PRELIMINARY

RELATIVE CHROMATICITY VS CURRENT AND TEMPERATURE



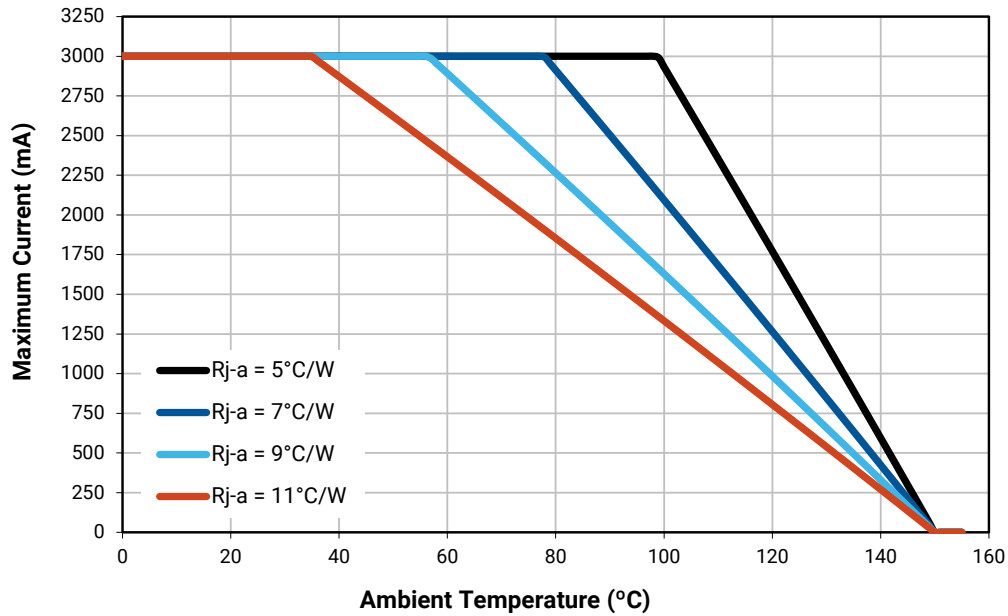
PRELIMINARY

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.



PRELIMINARY

PERFORMANCE GROUPS – LUMINOUS FLUX

XLamp XP-P LEDs are tested for luminous flux and placed into one of the following luminous-flux groups:

| Group Code | Minimum Luminous Flux (lm) @ 1000 mA | Maximum Luminous Flux (lm) @ 1000 mA |
|------------|---|---|
| U4 | 340 | 360 |
| U5 | 360 | 380 |
| U6 | 380 | 400 |
| V2 | 400 | 420 |

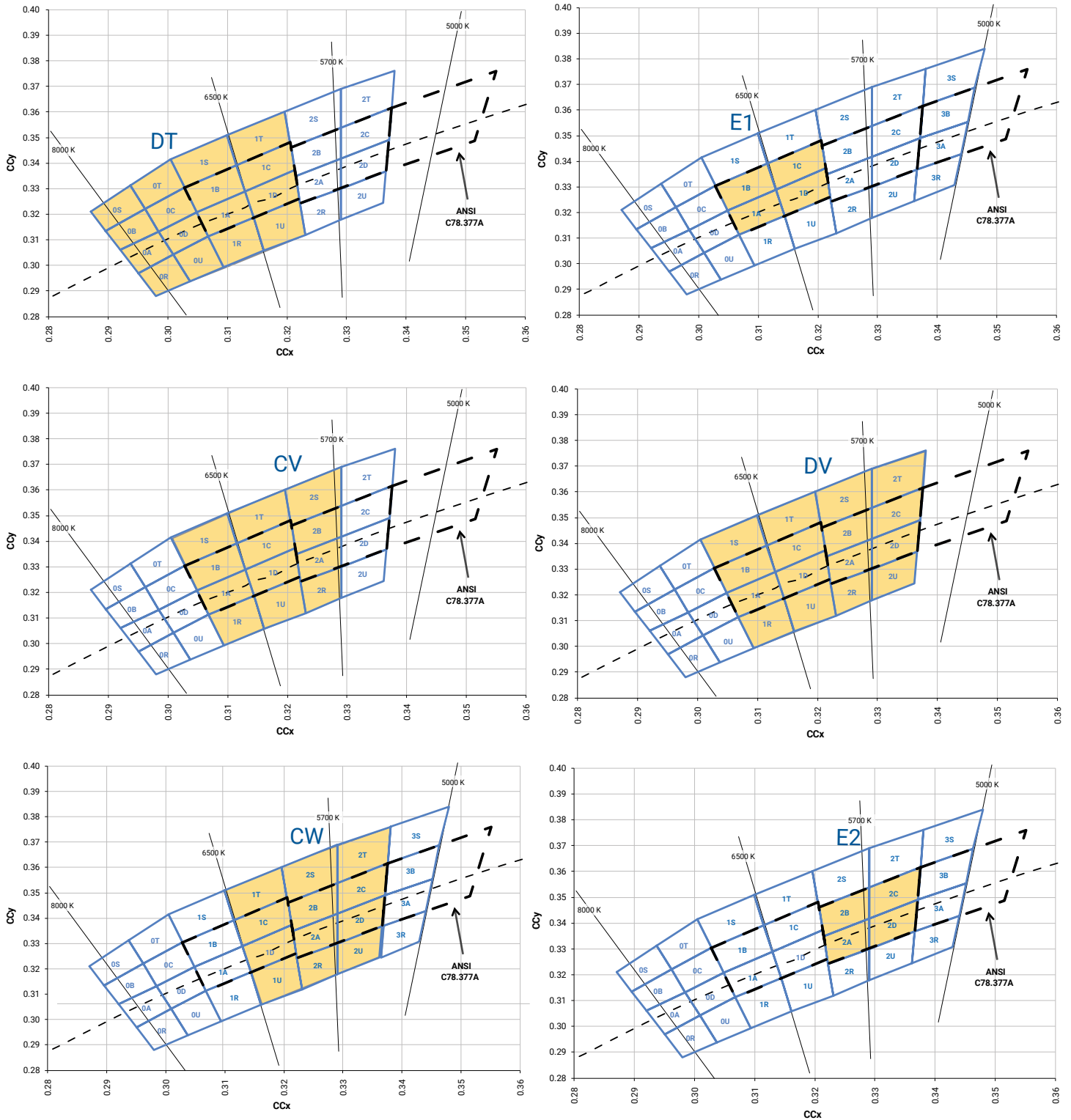
PRELIMINARY

PERFORMANCE GROUPS – CHROMATICITY

| Region | x | y | Region | x | y | Region | x | y | Region | x | y |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0A | 0.2950 | 0.2970 | 0B | 0.2920 | 0.3060 | 0C | 0.2984 | 0.3133 | 0D | 0.2984 | 0.3133 |
| | 0.2920 | 0.3060 | | 0.2895 | 0.3135 | | 0.2962 | 0.3220 | | 0.3048 | 0.3207 |
| | 0.2984 | 0.3133 | | 0.2962 | 0.3220 | | 0.3028 | 0.3304 | | 0.3068 | 0.3113 |
| | 0.3009 | 0.3042 | | 0.2984 | 0.3133 | | 0.3048 | 0.3207 | | 0.3009 | 0.3042 |
| 0R | 0.2980 | 0.2880 | 0S | 0.2895 | 0.3135 | 0T | 0.2962 | 0.3220 | 0U | 0.3037 | 0.2937 |
| | 0.2950 | 0.2970 | | 0.2870 | 0.3210 | | 0.2937 | 0.3312 | | 0.3009 | 0.3042 |
| | 0.3009 | 0.3042 | | 0.2937 | 0.3312 | | 0.3005 | 0.3415 | | 0.3068 | 0.3113 |
| | 0.3037 | 0.2937 | | 0.2962 | 0.3220 | | 0.3028 | 0.3304 | | 0.3093 | 0.2993 |
| 1A | 0.3048 | 0.3207 | 1B | 0.3028 | 0.3304 | 1C | 0.3115 | 0.3391 | 1D | 0.3130 | 0.3290 |
| | 0.3130 | 0.3290 | | 0.3115 | 0.3391 | | 0.3205 | 0.3481 | | 0.3213 | 0.3373 |
| | 0.3144 | 0.3186 | | 0.3130 | 0.3290 | | 0.3213 | 0.3373 | | 0.3221 | 0.3261 |
| | 0.3068 | 0.3113 | | 0.3048 | 0.3207 | | 0.3130 | 0.3290 | | 0.3144 | 0.3186 |
| 1R | 0.3068 | 0.3113 | 1S | 0.3005 | 0.3415 | 1T | 0.3099 | 0.3509 | 1U | 0.3144 | 0.3186 |
| | 0.3144 | 0.3186 | | 0.3099 | 0.3509 | | 0.3196 | 0.3602 | | 0.3221 | 0.3261 |
| | 0.3161 | 0.3059 | | 0.3115 | 0.3391 | | 0.3205 | 0.3481 | | 0.3231 | 0.3120 |
| | 0.3093 | 0.2993 | | 0.3028 | 0.3304 | | 0.3115 | 0.3391 | | 0.3161 | 0.3059 |
| 2A | 0.3215 | 0.3350 | 2B | 0.3207 | 0.3462 | 2C | 0.3290 | 0.3538 | 2D | 0.3290 | 0.3417 |
| | 0.3290 | 0.3417 | | 0.3290 | 0.3538 | | 0.3376 | 0.3616 | | 0.3371 | 0.3490 |
| | 0.3290 | 0.3300 | | 0.3290 | 0.3417 | | 0.3371 | 0.3490 | | 0.3366 | 0.3369 |
| | 0.3222 | 0.3243 | | 0.3215 | 0.3350 | | 0.3290 | 0.3417 | | 0.3290 | 0.3300 |
| 2R | 0.3222 | 0.3243 | 2S | 0.3196 | 0.3602 | 2T | 0.3290 | 0.3690 | 2U | 0.3290 | 0.3300 |
| | 0.3290 | 0.3300 | | 0.3290 | 0.3690 | | 0.3381 | 0.3762 | | 0.3366 | 0.3369 |
| | 0.3290 | 0.3180 | | 0.3290 | 0.3538 | | 0.3376 | 0.3616 | | 0.3361 | 0.3245 |
| | 0.3231 | 0.3120 | | 0.3207 | 0.3462 | | 0.3290 | 0.3538 | | 0.3290 | 0.3180 |
| 3A | 0.3371 | 0.3490 | 3B | 0.3376 | 0.3616 | 3R | 0.3366 | 0.3369 | 3S | 0.3381 | 0.3762 |
| | 0.3451 | 0.3554 | | 0.3463 | 0.3687 | | 0.3440 | 0.3428 | | 0.3480 | 0.3840 |
| | 0.3440 | 0.3427 | | 0.3451 | 0.3554 | | 0.3429 | 0.3307 | | 0.3463 | 0.3687 |
| | 0.3366 | 0.3369 | | 0.3371 | 0.3490 | | 0.3361 | 0.3245 | | 0.3376 | 0.3616 |

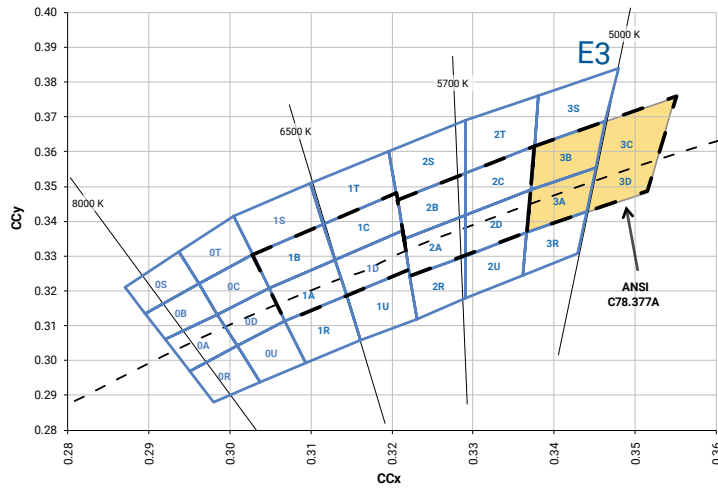
PRELIMINARY

CREE'S STANDARD COOL WHITE KITS PLOTTED ON ANSI STANDARD CHROMATICITY REGIONS



PRELIMINARY

CREE'S STANDARD NEUTRAL WHITE KITS PLOTTED ON ANSI STANDARD CHROMATICITY REGIONS



PRELIMINARY

CREE'S STANDARD CHROMATICITY KITS

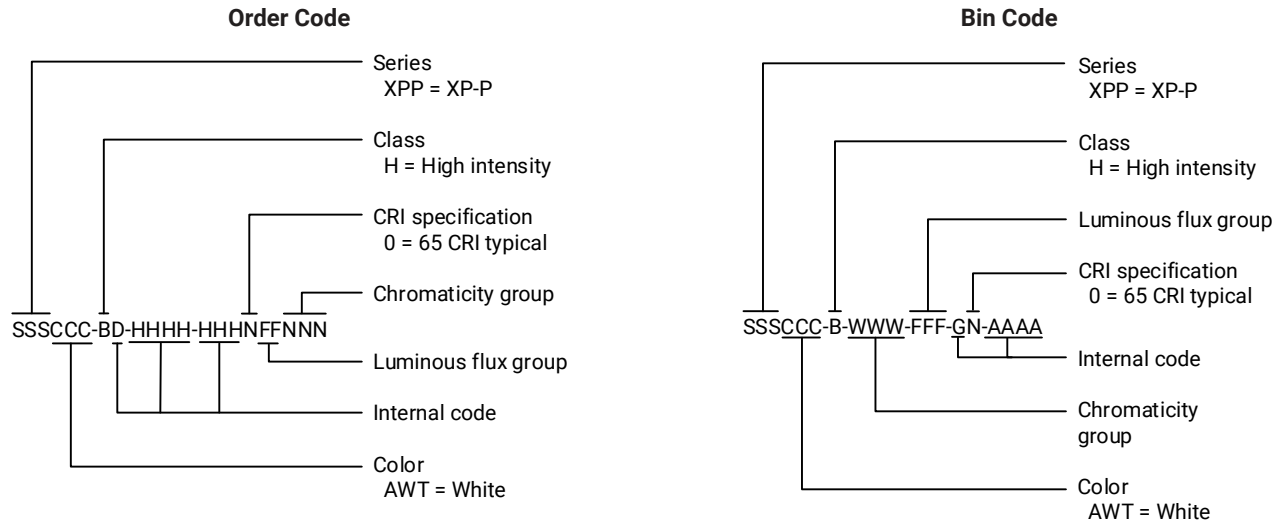
The following table provides the chromaticity bins associated with chromaticity kits.

| Color | CCT | Kit | Chromaticity Bins |
|---------------|--------|-----|--|
| Cool White | 7000 K | DT | 0A, 0B, 0C, 0D, 0R, 0S, 0T, 0U, 1A, 1B, 1C, 1D, 1R, 1S, 1T, 1U |
| | 6500 K | E1 | 1A, 1B, 1C, 1D |
| | 6000 K | CV | 1A, 1B, 1C, 1D, 1R, 1S, 1T, 1U, 2A, 2B, 2R, 2S |
| | 6000 K | DV | 1A, 1B, 1C, 1D, 1R, 1S, 1T, 1U, 2A, 2B, 2C, 2D, 2R, 2S, 2T, 2U |
| | 5700 K | CW | 1C, 1D, 1T, 1U, 2A, 2B, 2C, 2D, 2R, 2S, 2T, 2U |
| | 5700 K | E2 | 2A, 2B, 2C, 2D |
| Neutral White | 5000 K | E3 | 3A, 3B, 3C, 3D |

PRELIMINARY

BIN AND ORDER CODE FORMATS

XP-P bin codes and order codes are configured in the following manner:

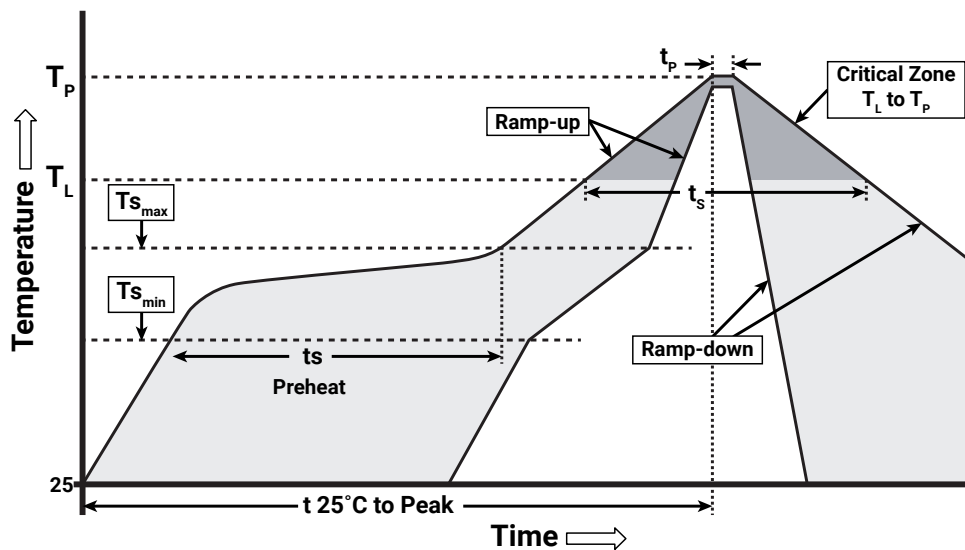


PRELIMINARY

REFLOW SOLDERING CHARACTERISTICS

In testing, Cree has found XLamp XP-P 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_s) | 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.

PRELIMINARY

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.

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 XP-P 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.

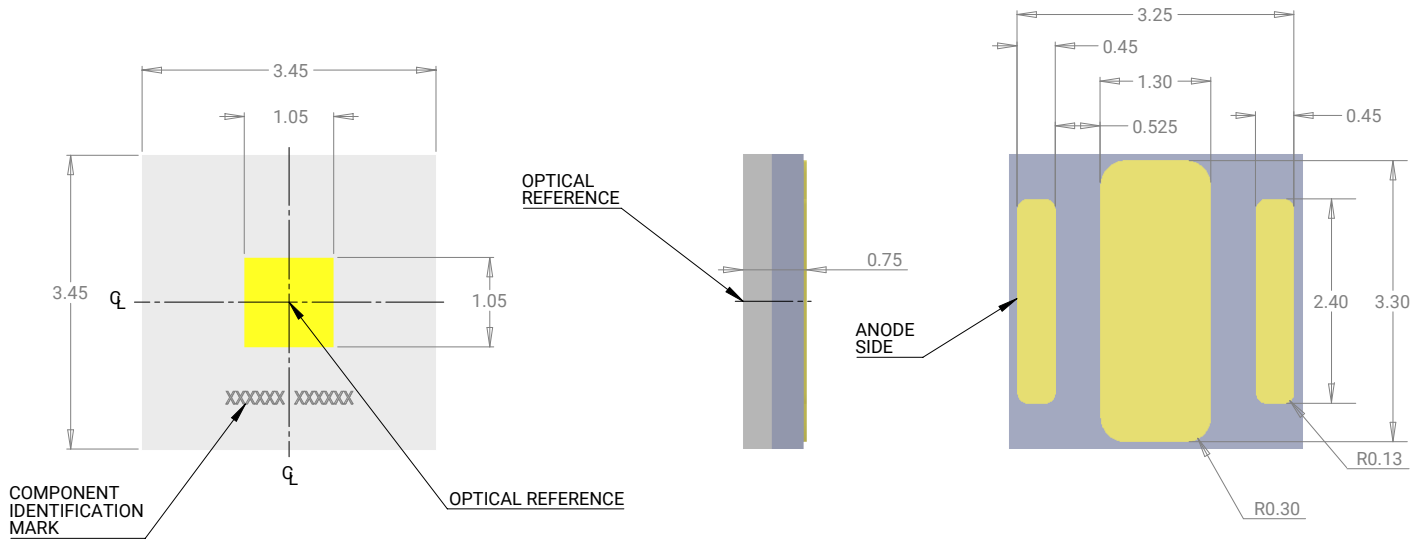
Vision Advisory

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](#).

PRELIMINARY

MECHANICAL DIMENSIONS (T_A = 25 °C)

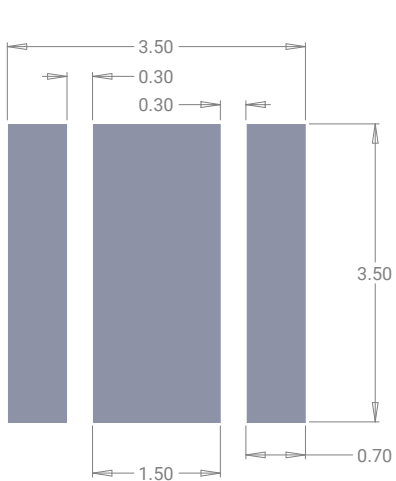
Thermal vias, if present, are not shown on these drawings.
All dimensions are ±.1 mm unless otherwise indicated.



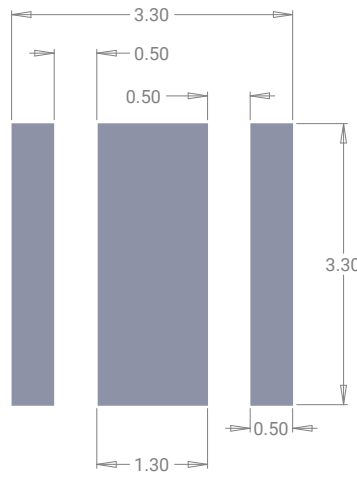
Top View

Side View

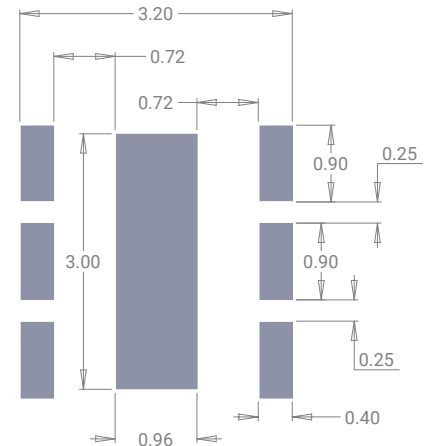
Bottom View



Recommended Copper Layout



**Recommended Solder Pad
(Solder Resist Pattern)**



Recommended Stencil Openings*

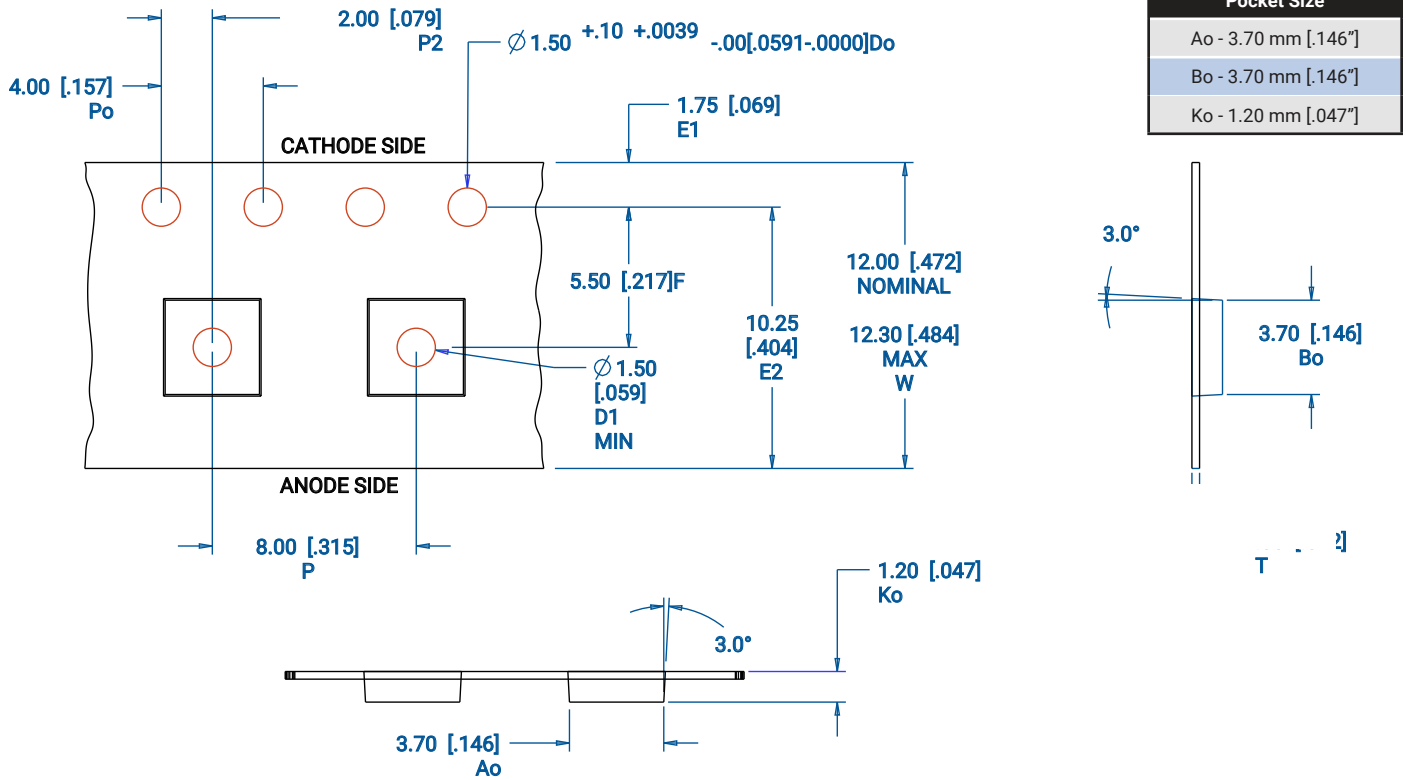
Notes:

- Cree recommends using thermal pad kickouts to maximize component thermal performance.
- Cree recommends using white solder mask material to minimize system optical loss.
- * This stencil has been tested and optimized for the avoidance of voiding when using ALPHA® LUMET® P30 Maxrel solder paste. For other solder pastes, a "window pane" design for the thermal pad stencil may result in a lower voiding percentage. Contact your local Cree Field Applications Engineer for consultation regarding your specific application.

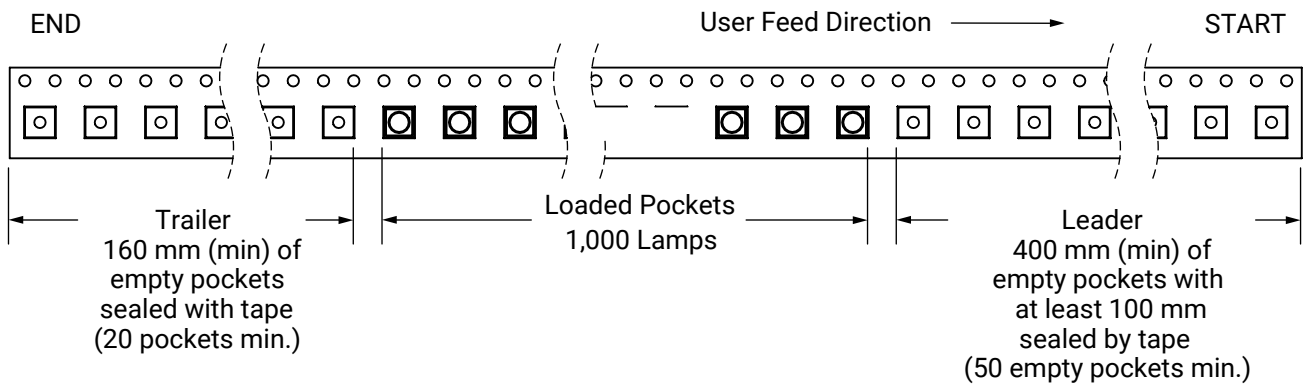
PRELIMINARY

TAPE AND REEL

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



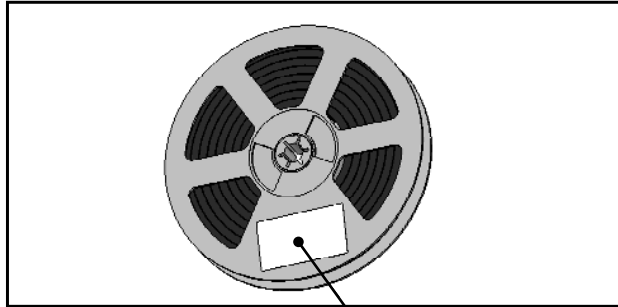
| Pocket Size | |
|-------------|-----------------|
| Ao | 3.70 mm [.146"] |
| Bo | 3.70 mm [.146"] |
| Ko | 1.20 mm [.047"] |



PRELIMINARY

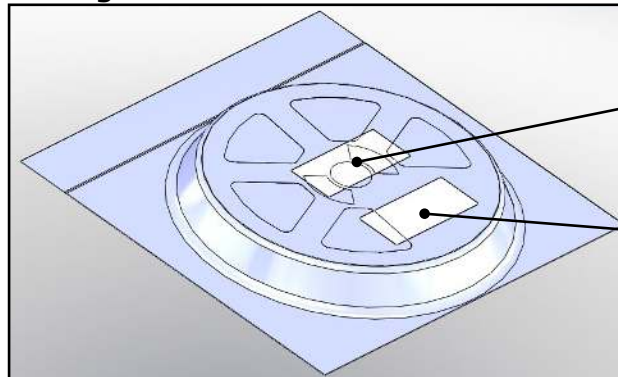
PACKAGING

Unpackaged Reel



Label with Cree Bin Code,
Quantity, Reel ID

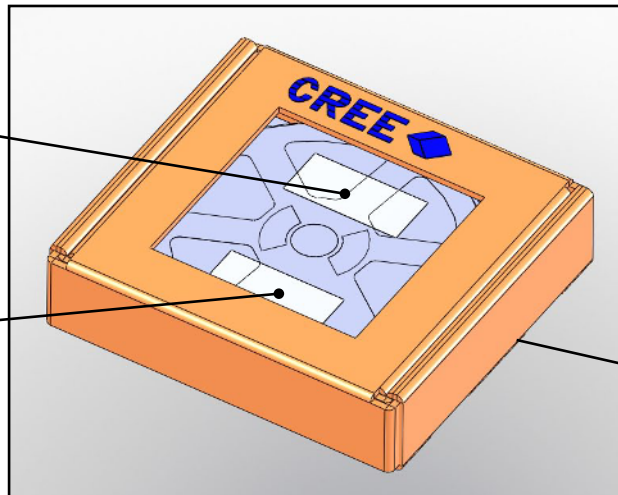
Packaged Reel



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)