Cree® XLamp® CXA2 Studio LED

PRODUCT DESCRIPTION

The XLamp® CXA2 Studio LED is optimized for motion picture, studio and photography applications, delivering high light quality that meets the film industry's color spectrum requirements combined with high lumen output and high optical control. Available in 3-step EasyWhite® bins, the CXA2 Studio LED delivers high lumen output, high light quality and high efficacy in a single, easy-to-use package that eliminates the need for reflow soldering.

The CX Family LED Design Guide provides basic information on the requirements to use the CXA2 Studio LED successfully in luminaire designs.

FEATURES

- CXA Gen 2 technology and platform
- Available in SU white bins at 5600 K and 3200 K CCT with 90 CRI
- Forward voltage options: 36 V & 72 V class
- 85 °C binning and characterization
- Maximum drive current: 3600 mA (36 V), 1800 mA (72 V)
- 115° viewing angle, uniform chromaticity profile
- Top-side solder connections
- Thermocouple attach point
- NEMA SSL-3 2011 standard flux bins
- UL® recognized component (E349212)

TABLE OF CONTENTS

- Characteristics ..................................................2
- Operating Limits .............................................3
- Flux Characteristics, EasyWhite® Order Codes and Bins - 36 V ...........................................4
- Flux Characteristics, EasyWhite® Order Codes and Bins - 72 V ...........................................4
- Relative Spectral Power Distribution ...............5
- Electrical Characteristics ...............................6
- Relative Luminous Flux .....................................7
- Typical Spatial Distribution ..............................9
- Performance Groups - Brightness ....................9
- Performance Groups - Chromaticity .................9
- Cree EasyWhite® Bins Plotted on the CIE 1931 Color Space ..............................................10
- Bin and Order Code Formats .........................11
- Mechanical Dimensions .................................11
- Thermal Design .............................................12
- Notes .........................................................14
- Packaging ....................................................15
## CHARACTERISTICS

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Unit</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viewing angle (FWHM)</td>
<td>degrees</td>
<td></td>
<td></td>
<td>115</td>
</tr>
<tr>
<td>ESD withstand voltage (HBM per Mil-Std-883D)</td>
<td>V</td>
<td></td>
<td></td>
<td>8000</td>
</tr>
<tr>
<td>DC forward current (36 V)</td>
<td>mA</td>
<td></td>
<td></td>
<td>3600*</td>
</tr>
<tr>
<td>DC forward current (72 V)</td>
<td>mA</td>
<td></td>
<td></td>
<td>1800*</td>
</tr>
<tr>
<td>Reverse current (36 V, 72 V )</td>
<td>mA</td>
<td></td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td>Forward voltage (36 V, @ 2400 mA, Tj = 85 °C)</td>
<td>V</td>
<td></td>
<td></td>
<td>36</td>
</tr>
<tr>
<td>Forward voltage (36 V, @ 2400 mA, Tj = 25 °C)</td>
<td>V</td>
<td></td>
<td></td>
<td>39</td>
</tr>
<tr>
<td>Forward voltage (72 V, @ 1200 mA, Tj = 85 °C)</td>
<td>V</td>
<td></td>
<td></td>
<td>72</td>
</tr>
<tr>
<td>Forward voltage (72 V, @ 1200 mA, Tj = 25 °C)</td>
<td>V</td>
<td></td>
<td></td>
<td>78</td>
</tr>
</tbody>
</table>

* Refer to the Operating Limits section.
OPERATING LIMITS

The maximum current rating of the CXA2 Studio LED depends on the case temperature (Tc) when the LED has reached thermal equilibrium under steady-state operation. The graphs shown below assume that the system design employs good thermal management (thermal interface material and heat sink) and may vary when poor thermal management is employed. Please refer to the Mechanical Drawings section on page 11 for the location of 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 135 °C to ensure optimal LED lifetime. Please refer to the Thermal Design section on page 12 for more information on LES temperature measurement.
FLUX CHARACTERISTICS, EASYWHITE® ORDER CODES AND BINS - 36 V (I_f = 2400 mA, T_J = 85 °C)

The following tables provide order codes for XLamp CXA2 Studio LEDs. For a complete description of the order code nomenclature, please see the Bin and Order Code Formats section (page 11).

<table>
<thead>
<tr>
<th>Nominal CCT</th>
<th>CRI</th>
<th>Minimum Luminous Flux</th>
<th>Chromaticity Regions</th>
<th>Order Code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Typ</td>
<td>Group</td>
<td>Flux (lm) @ 85 °C</td>
</tr>
<tr>
<td>5600 K</td>
<td>93</td>
<td>95</td>
<td>BB</td>
<td>9,500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BD</td>
<td>10,000</td>
</tr>
<tr>
<td>3200 K</td>
<td>93</td>
<td>95</td>
<td>AB</td>
<td>8,500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AD</td>
<td>9,000</td>
</tr>
</tbody>
</table>

FLUX CHARACTERISTICS, EASYWHITE® ORDER CODES AND BINS - 72 V (I_f = 1200 mA, T_J = 85 °C)

The following tables provide order codes for XLamp CXA2 Studio LEDs. For a complete description of the order code nomenclature, please see the Bin and Order Code Formats section (page 11).

<table>
<thead>
<tr>
<th>Nominal CCT</th>
<th>CRI</th>
<th>Minimum Luminous Flux</th>
<th>Chromaticity Regions</th>
<th>Order Code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Typ</td>
<td>Group</td>
<td>Flux (lm) @ 85 °C</td>
</tr>
<tr>
<td>5600 K</td>
<td>93</td>
<td>95</td>
<td>BB</td>
<td>9,500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BD</td>
<td>10,000</td>
</tr>
<tr>
<td>3200 K</td>
<td>93</td>
<td>95</td>
<td>AB</td>
<td>8,500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AD</td>
<td>9,000</td>
</tr>
</tbody>
</table>

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 14).
- Cree XLamp CXA2 Studio 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 (36 V, $I_F = 2400$ mA; 72 V, $I_F = 1200$ mA, $T_J = 85$ °C)

The following graph is the result of a series of pulsed measurements at 2400 mA for the 36-V CXA2 Studio LED and 1200 mA for the 72-V CXA2 Studio LED and $T_J = 85$ °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 CXA2 Studio at steady-state operation at the given conditions, divided by
• Flux measured during binning, which is a pulsed measurement at 2400 mA at $T_J = 85 \, ^\circ\text{C}$ for the 36-V CXA2 Studio LED.

Using the 36-V CXA2 Studio LED as an example, at steady-state operation of $T_c = 55 \, ^\circ\text{C}, I_F = 3200 \, \text{mA}$, the relative luminous flux ratio is 120% in the chart below. A CXA2 Studio LED that measures 10,000 lm during binning will deliver 12,000 lm ($10,000 \times 1.2$) at steady-state operation of $T_c = 25 \, ^\circ\text{C}, I_F = 3200 \, \text{mA}$. 
The relative luminous flux values provided below are the ratio of:

- Measurements of CXA2 Studio at steady-state operation at the given conditions, divided by
- Flux measured during binning, which is a pulsed measurement at 1200 mA at $T_J = 85 \, ^\circ C$ for the 72-V CXA2 Studio LED.

Using the 72-V CXA2 Studio LED as an example, at steady-state operation of $T_c = 55 \, ^\circ C$, $I_F = 1600 \, mA$, the relative luminous flux ratio is 120% in the chart below. A CXA2 Studio LED that measures 10,000 lm during binning will deliver 12,000 lm ($10,000 \times 1.2$) at steady-state operation of $T_c = 55 \, ^\circ C$, $I_F = 1600 \, mA$. 

![Relative Luminous Flux Chart](chart.png)
TYPICAL SPATIAL DISTRIBUTION

PERFORMANCE GROUPS - BRIGHTNESS (36 V, I_F = 2400 mA; 72 V, I_F = 1200 mA, T_J = 85 °C)

XLamp CXA2 Studio LEDs are tested for luminous flux and placed into one of the following bins.

<table>
<thead>
<tr>
<th>Group Code</th>
<th>Minimum Luminous Flux</th>
<th>Maximum Luminous Flux</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>8,500</td>
<td>9,000</td>
</tr>
<tr>
<td>AD</td>
<td>9,000</td>
<td>9,500</td>
</tr>
<tr>
<td>BB</td>
<td>9,500</td>
<td>10,000</td>
</tr>
<tr>
<td>BD</td>
<td>10,000</td>
<td>11,000</td>
</tr>
<tr>
<td>CB</td>
<td>11,000</td>
<td>12,000</td>
</tr>
</tbody>
</table>

PERFORMANCE GROUPS - CHROMATICITY (T_J = 85 °C)

XLamp CXA2 Studio LEDs are tested for chromaticity and placed into one of the regions defined by the following bounding coordinates.

<table>
<thead>
<tr>
<th>Bin Code</th>
<th>CCT</th>
<th>Center Point</th>
<th>Major Axis</th>
<th>Minor Axis</th>
<th>Rotation Angle (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>56Q</td>
<td>5600 K</td>
<td>0.3310</td>
<td>0.3330</td>
<td>0.0084</td>
<td>0.00312</td>
</tr>
<tr>
<td>32Q</td>
<td>3200 K</td>
<td>0.4183</td>
<td>0.3898</td>
<td>0.0089</td>
<td>0.0045</td>
</tr>
</tbody>
</table>
CREE EASYWHITE® BINS PLOTTED ON THE CIE 1931 COLOR SPACE ($T_J = 85 \, ^\circ\text{C}$)
**BIN AND ORDER CODE FORMATS**

Bin codes and order codes are configured as follows:

**Order Code**
- Series = CXB35
- Internal code
- CRI Specification
  - U = 90 CRI minimum
- Kit code
- Vf class
  - N0 = 36-V class
  - R0 = 72-V class
- Performance class

**Bin Code**
- Series = CXB35
- Chromaticity bin
- Vf class
  - N0 = 36-V class
  - R0 = 72-V class
- Internal code
- CRI Specification
  - U = 90 CRI minimum
- Flux bin
- Performance class

**MECHANICAL DIMENSIONS**

Dimensions are in mm.

Tolerances unless otherwise specified: ±.13 x° ±1°

**Meaning of B3590X**
- B3590N = 36-V CXA2 Studio
- B3590R = 72-V CXA2 Studio
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 that the CXA LED is being operated within its designed limits. LES temperature measurement provides additional verification of good thermal design. Please refer to page 3 for the Operating Limit specifications.

There is no need to calculate for T_J inside the package, as the thermal management design process, specifically from 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 CXA soldering recommendations and more information on thermal interface materials (TIM), LES temperature measurement, and connection methods, please refer to the Cree XLamp CX Family LEDs soldering and handling document. The CX Family LED Design Guide provides basic information on the requirements to use Cree XLamp CXA LEDs successfully in luminaire designs.

To keep the CXA2 Studio LED at or below the maximum rated T_c, 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 graphs, 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).
THERMAL DESIGN - CONTINUED

Graph showing the maximum R_c-a as a function of current for different temperatures (Ta) with 72 V applied.

- Ta = 25 °C
- Ta = 55 °C
- Ta = 85 °C
- Ta = 105 °C

The graph includes a current range from 200 mA to 1800 mA and a maximum R_c-a range from 0.01 to 100.00.
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.

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 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.
PACKAGING

Cree CXA2 Studio LEDs are packaged in trays of 10. Five trays are sealed in an anti-static bag and placed inside a carton, for a total of 50 LEDs per carton. Each carton contains 50 LEDs from the same performance bin.

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