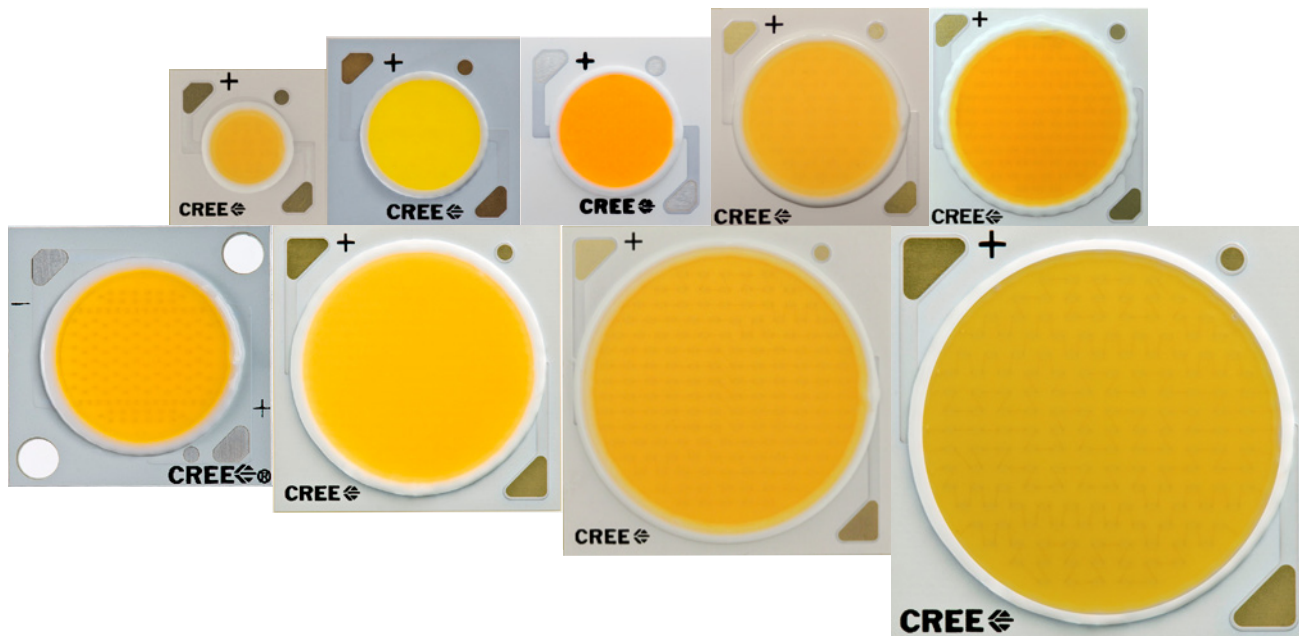


Cree® XLamp® CXA Family LEDs



INTRODUCTION

This application note applies to XLamp CXA family LEDs, which have order codes in the following format:

CXAXXXX-XXXX-XXXXXXXXXX

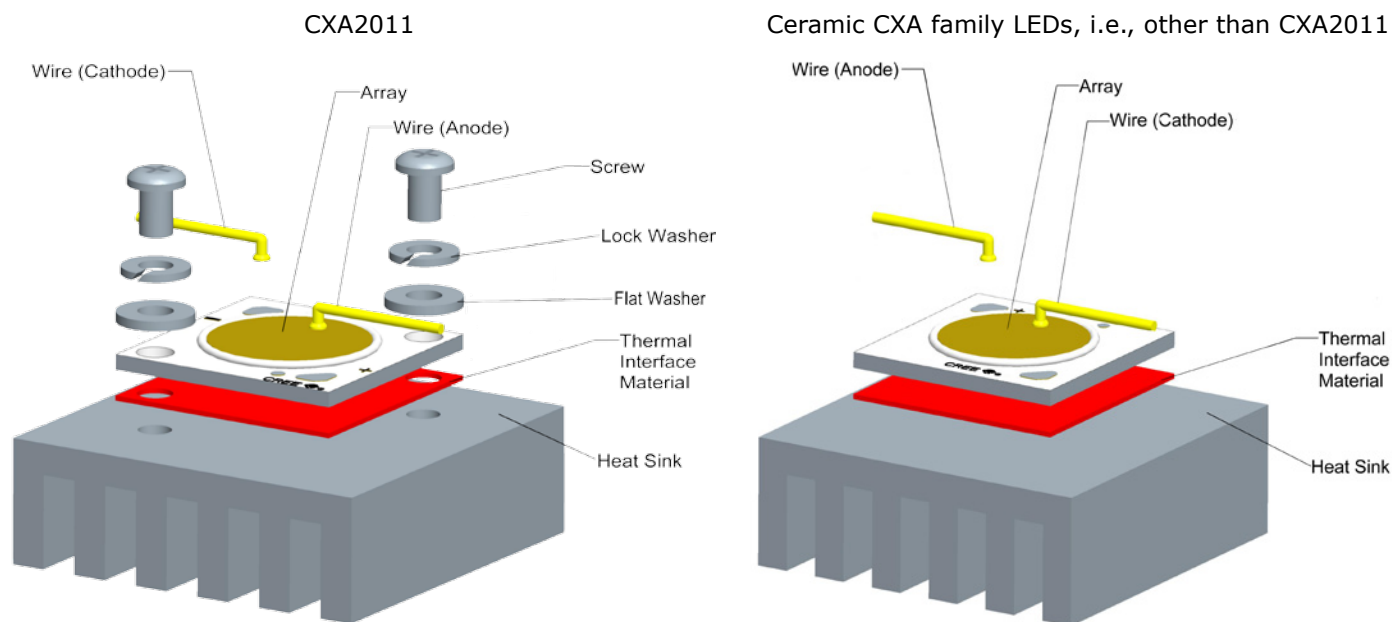
This application note explains how XLamp CXA family LEDs and assemblies containing these LEDs should be handled during manufacturing. Please read this entire document to understand how to properly handle XLamp CXA family LEDs.

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HANDLING XLAMP CXA FAMILY LEDs

In general, CXA family LEDs are attached directly to a heat sink and discrete wires are used to deliver power to the LED, as illustrated below.



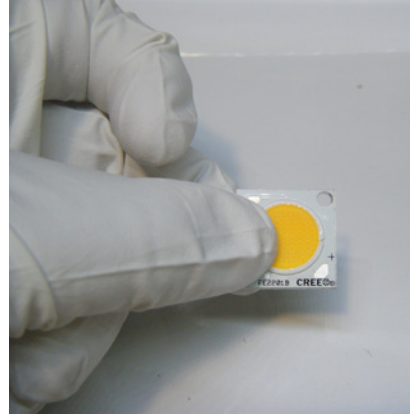
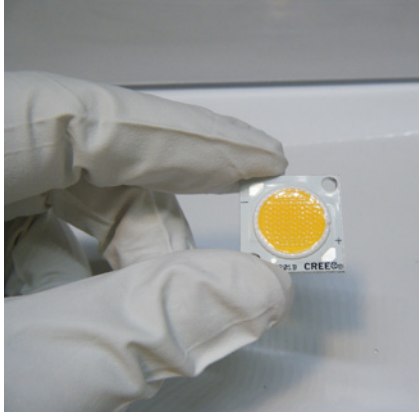
Cree recommends the following at all times when handling XLamp CXA family LEDs or assemblies containing XLamp CXA family LEDs:

- Avoid putting mechanical stress on the LED.
- Never touch the optical surface with fingers or sharp objects. The LED surface could be soiled or damaged, which could affect the optical performance of the LED
- Cree recommends always handling CXA family LEDs with appropriate ESD grounding.
- Cree recommends handling CXA family LEDs wearing powderless latex gloves.

Manual Handling

Do not touch the lens with fingers. Do not push on the lens.

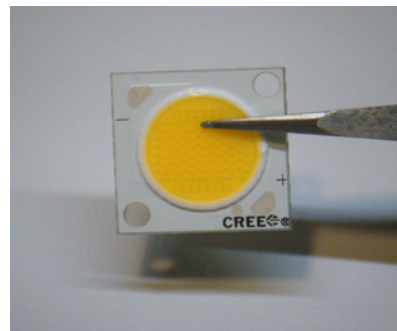
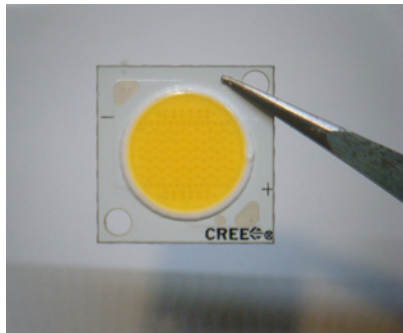
✓
CORRECT



✗
WRONG

When using tweezers to handle XLamp CXA family LEDs, do not touch the lens with the tweezers.

✓
CORRECT



✗
WRONG

HEAT SINK, LAYOUT, THERMAL INTERFACE

To insure effective thermal management for CXA family LEDs, Cree recommends the CXA family LED be attached to an appropriately sized heat sink, depending on drive current and intended operating environment. Refer to the CXA family LED data sheets for the maximum case to ambient temperature thermal resistance that must be observed to ensure the CXA family LED operates at or below its maximum rated case temperature (T_c).

Attaching a CXA family LED to a heat sink is most often accomplished by inserting a pad of thermal interface material (TIM), thermally conductive epoxy, or thermal grease between the CXA family LED and heat sink and is strongly recommended. For best thermal results, the TIM thickness should be kept to a minimum while assuring there are no voids. Good thermal conductivity is an important ingredient in a successful LED-based lamp or luminaire and is ignored at one's peril. The following formula shows how the factors that influence thermal resistance (R_{th}) are related.

$$R_{th} = \text{Thickness} / (\text{Conductivity} * \text{Area})$$

For ceramic CXA family LEDs, a reflective TIM or other backing should be used; light output and efficiency may be slightly less if a non-reflective TIM is used. The thermal performance of the TIM should not be compromised in favor of high reflectivity. The penalty for lower thermal performance is higher than the penalty for lower reflectivity.

High thermal performance + high reflectivity = best

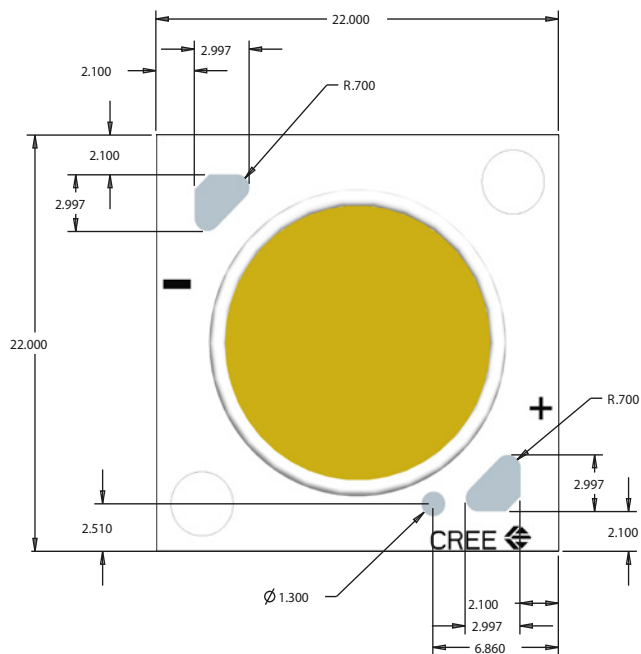
High thermal performance + low reflectivity = better

Low thermal performance + high reflectivity = bad

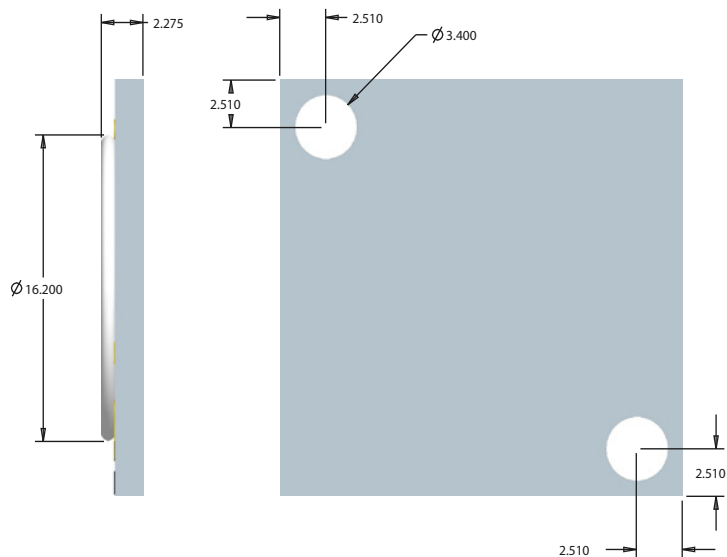
Low thermal performance + low reflectivity = worst

Cree has used Arctic Silver adhesive and Timtronics Silver Ice thermal grease in reference designs with good results. There are a number of TIMs available; some are listed in the Thermal Management of Cree XLamp LEDs application note.¹ There are a number of factors in the decision to use a particular TIM including, but not limited to, cost, availability, ease of use and manufacturing techniques, and recommending a specific TIM for any lighting application is out of the scope of this document.

¹ www.cree.com/xlamp_app_notes/thermal_management

CXA2011


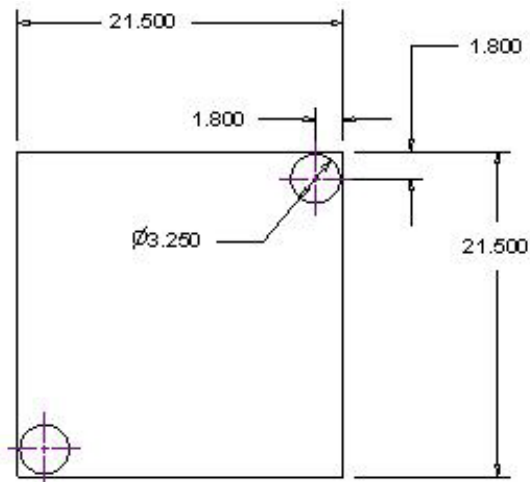
Recommended MCPCB Pad



Recommended Thermal Interface Material Stencil Pattern

All measurements are ± 0.13 mm unless otherwise indicated.

Depending on the characteristics of the TIM, the stencil pattern for the materials is shown below.



CXA2011 LEDs and thermal interface materials are secured either by screws through the pair of diagonally opposite screw holes or by the use of an LED holder (see the section on LED Connectors). When using the screw holes to secure CXA2011 LEDs, Cree recommends #4 (/40) or M2.5 screws. Excessive torque may result in damage to the LED array.

Factors that determine the appropriate screw torque are the thickness, size and type of thermal interface material and the planarity of these materials as well as that of the heat sink. Refer to the illustration on page 2 for the proper mounting method. The amount of torque that can safely be applied to mounting screws is approximately 45 newton-centimeters (4 inch-pounds). To prevent loosening of screws during vibration or thermal cycles, Cree recommends non-conductive lock washers or self-locking fasteners. Cree DOES NOT RECOMMEND the use of chemical thread lockers to secure CXA2011 LEDs as several of these compounds have been shown to be chemically incompatible with LEDs.

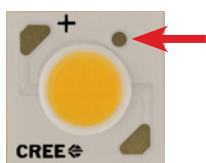
Ceramic CXA Family LEDs

Cree recommends securing ceramic CXA family LEDs to a heat sink using the structure of the lamp or luminaire, thermally conductive epoxy, which is discussed previously in this section, or an LED holder, which is discussed in the LED Connectors section. Regardless of attachment method, Cree recommends following the manufacturer's directions for application to achieve maximum thermal performance. Use caution when securing ceramic CXA family LEDs over relatively thick TIMs, such as thermal pads or thermal tape, to avoid catastrophic mechanical damage to the LED.

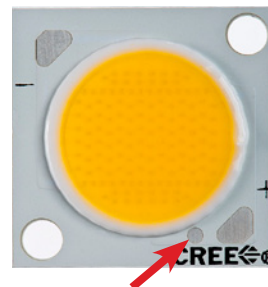
Ceramic CXA family LEDs are not designed to be attached by metal connectors, e.g., screws, nails, brads, bolts, pins, hooks or rivets, that directly contact the LED package. The use of such metal connectors can cause catastrophic mechanical damage to the LED.

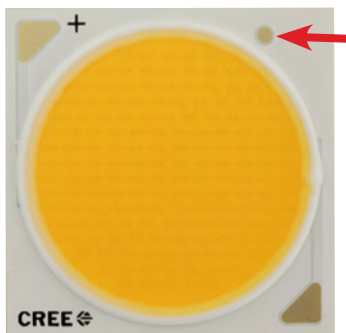
CASE TEMPERATURE MEASUREMENT POINT

XLamp CXA family LED case temperature can be measured at the designated case temperature measurement point, adjacent to the anode or plus (+) solder pad. This measurement point is shown in the pictures below. Cree recommends attaching the thermocouple with conductive epoxy.

CXA1304

CXA15xx

CXA18xx

CXA2011

CXA25xx

CXA30xx

CXA3590


NOTES ON SOLDERING XLAMP CXA FAMILY LEDS

XLamp CXA family LEDs are designed for wire-attach soldering. Cree recommends the use of a temperature controlled soldering iron with solder tip on the order of 1.8 mm (0.07"). Cree engineers have had success using temperature-controlled soldering equipment held at 300 °C (572 °F) for the CXA1520 and CXA2011 LEDs and at 250 °C (482 °F) for the other CXA family LEDs and working with a variety of lead-free solders. Cree makes no specific soldering recommendations because there are so many variables in the system of heat sink, LED, solder and solder gun. After soldering, allow XLamp CXA family LEDs to return to room temperature before subsequent handling. Premature handling of the device could result in damage to the solder joints.

Cree recommends that CXA family LEDs not be exposed to temperatures higher than 350 °C (662 °F).

Observe the following practices when soldering wire connections directly to CXA family LEDs.

1. CXA1520 LEDs should be heated to a temperature of 150-175 °C (302-347 °F) before soldering. This can be done either before or after mounting the LED on the heat sink. Before mounting, heating can be accomplished by putting the part on a hotplate. After mounting, the LED and heat sink can be heated in an oven. Cree recommends soldering wire connections to the CXA1520 LED immediately after heating.
2. Apply solder tinning to the contact pad of the CXA family LED and uniformly cover the contact pad with solder.
3. Properly solder tin wires before soldering them to a CXA family LED.
4. Ensure wires soldered to an CXA family LED have sufficient strain relief to avoid pulling up a solder pad on the LED.

Take caution when soldering and handling CXA family LEDs to avoid damaging the LEDs. Excessive heat applied for an extended time period to the wire and the contact pad can damage the contact pad on the CXA family LED and potentially melt the insulation on the wires. Solder reworking should be kept to a minimum because of the potential for solder-pad lifting and damage to the LED with multiple applications of high heat from a soldering iron. Additionally, repetitive soldering introduces potential for solder flux to build up around the solder pads, which can cause long-term degradation if not properly removed.

✓
CORRECT



Solder Paste Type

Cree strongly recommends using “no clean” solder paste with XLamp CXA family LEDs so that cleaning the PCB after soldering is not required. Cree uses Kester r276 solder paste internally.²

Cree recommends the following solder paste compositions: SnAgCu (tin/silver/copper) and SnAg (tin/silver).

LOW TEMPERATURE OPERATION

The minimum operating temperature of these XLamp components is -40 °C. To maximize lifetime, Cree recommends avoiding applications where the lamps are cycled on and off more than 10,000 cycles at temperatures below 0 °C.

² kester.com/Portals/0/documents/Electronic-Assembly-Materials.pdf

NOTES ON CXA FAMILY LED CONNECTORS

A number of firms have developed connectors to simplify the mechanical and electrical attachment of CXA family LEDs. Companies that participate in the Cree Solution Provider Program (CSP)³ can supply connectors and connector information can be accessed from the Cree website.⁴

The following firms are interconnect solution providers. Clicking on a logo below displays that firm's interconnect products for CXA family LEDs. Links are also provided below.⁵



If CXA family LEDs are to be attached with wired leads, the horizontal and vertical pull force of the attached solder leads should not exceed 1000 g.

³ Cree Solution Provide Program, www.cree.com/LED-Components-and-Modules/Tools-and-Support/Solution-Providers

⁴ Interconnect Solution Providers, www.cree.com/LED-Components-and-Modules/Tools-and-Support/Solution-Providers/Interconnect

⁵ BJB: www.bjb.com/index.php?pid=347781&lid=10

Ideal Industries, Inc.: www.idealindustries.com/products/oem/led_holders/cree.jsp

Molex: www.molex.com/molex/products/family?key=led_array_holder_for_cree_xlamp_mpl_arrays&channel=products&chanName=family&pageTitle=Introduction

SMK Corporation: www.smk.co.jp/products/series_outline/Optical_Connectors/?sid=13292&seni=&youto=null&karamu=hinban&sort=asc&no=10&tp=0

TE Connectivity LTD.: www.te.com/catalog/minf/

en/894?BML=L2VuL2luZHVzdHJpZXMvbGlnaHRpbmcvdGUtbGVkLWwhvbGRlcnMuZXh0ZXJuYWxIZWFkZXIuaHRtbA

CHEMICALS & CONFORMAL COATINGS

Below are representative lists of chemicals and materials to be used or avoided in LED manufacturing activities. For a complete and current list of recommended chemicals, conformal coatings and harmful chemicals consult Cree's Chemical Compatibility application note.⁶ The video at www.youtube.com/watch?v=t24bf9D_1SA illustrates the process Cree has developed for testing the compatibility of chemicals and materials with LEDs. You should also consult your regional Cree Field Applications Engineer.

Recommended Chemicals

In testing, Cree has found the following chemicals to be safe to use with XLamp CXA family LEDs.

- Water
- Isopropyl alcohol (IPA)

Chemicals Tested as Harmful

In general, subject to the specifics in Cree's Chemical Compatibility application note, Cree has found certain chemicals to be harmful to XLamp CXA family LEDs. Cree recommends not using these chemicals anywhere in an LED system containing XLamp CXA family LEDs. The fumes from even small amounts of the chemicals may damage the LEDs.

- Chemicals that might outgas aromatic hydrocarbons (e.g., toluene, benzene, xylene)
- Methyl acetate or ethyl acetate (i.e., nail polish remover)
- Cyanoacrylates (i.e., "Superglue")
- Glycol ethers (including Radio Shack® Precision Electronics Cleaner - dipropylene glycol monomethyl ether)
- Formaldehyde or butadiene (including Ashland PLIOBOND® adhesive)

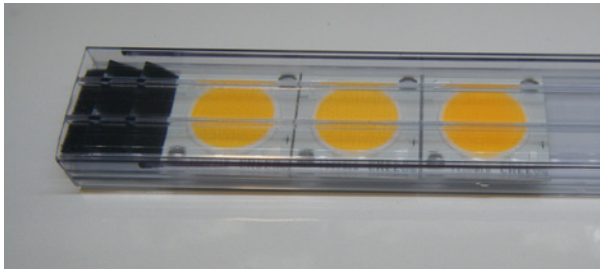
⁶ www.cree.com/products/pdf/XLamp_Chemical_Comp.pdf

HANDLING

Do not stack assemblies containing XLamp CXA family LEDs so that anything rests on the LED lens. Force applied to the LED lens may result in the lens being damaged. Assemblies containing XLamp CXA family LEDs should be stacked in a way to allow at least 2-cm clearance above the LED.

Do not use bubble wrap directly on top of the XLamp CXA family LEDs. Force transferred through the bubble wrap can potentially damage the LED.

✓
CORRECT



✗
WRONG

✓
CORRECT



✗
WRONG

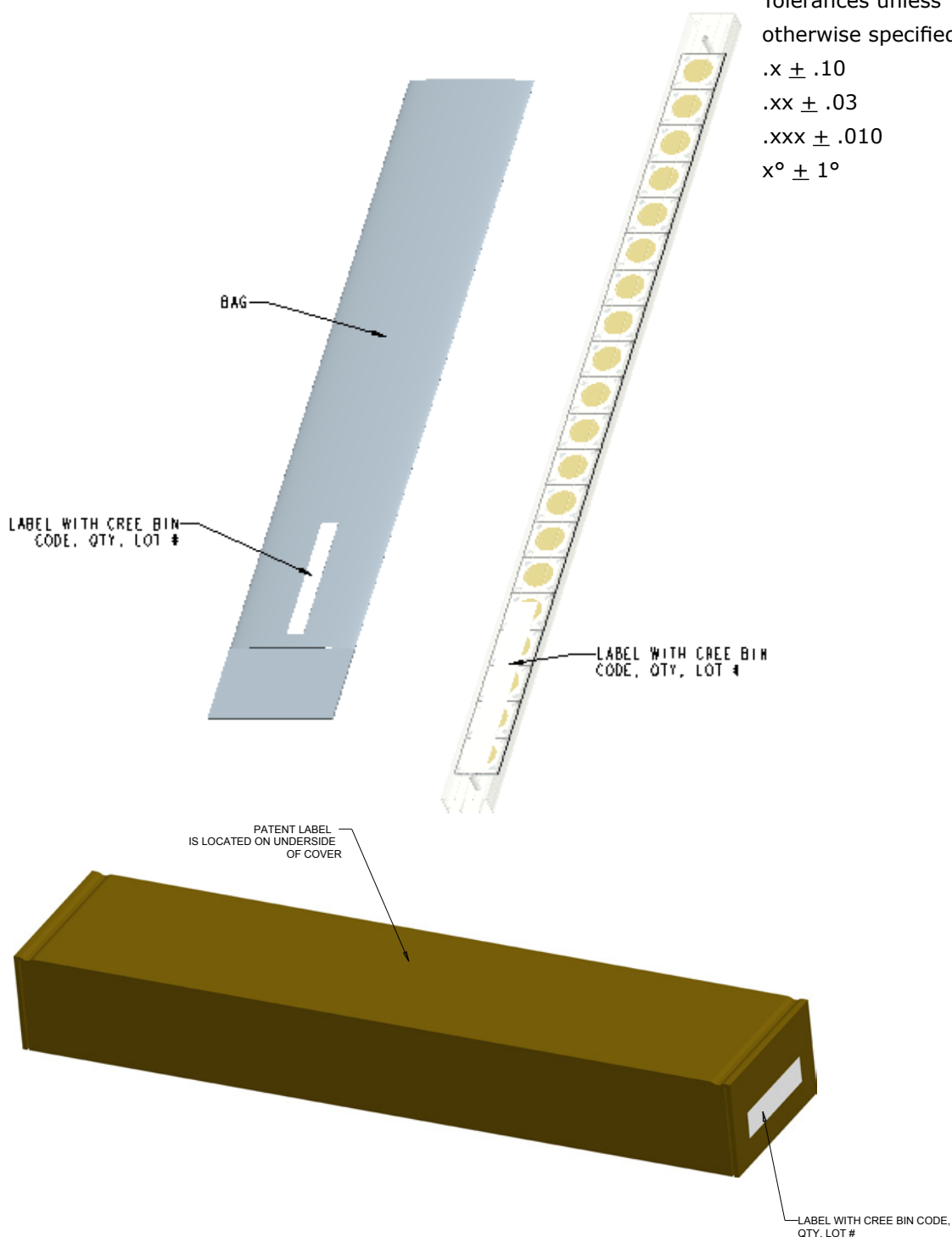
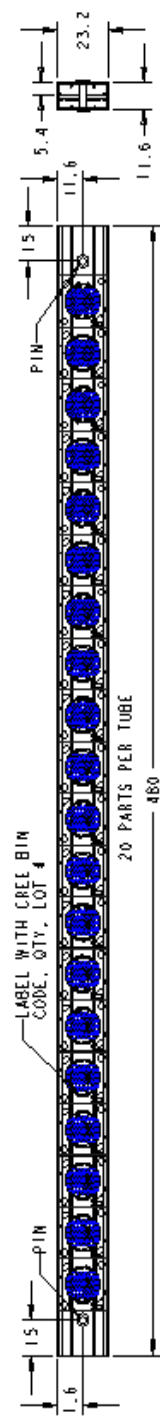
PACKAGING

Cree CXA2011 LEDs are packaged in tubes of 20, which are then combined in boxes of 5 tubes, or 100 LEDs. Boxes of 100 LEDs are of the same performance bin.

Dimensions are in mm.

Tolerances unless
otherwise specified:

$.x \pm .10$

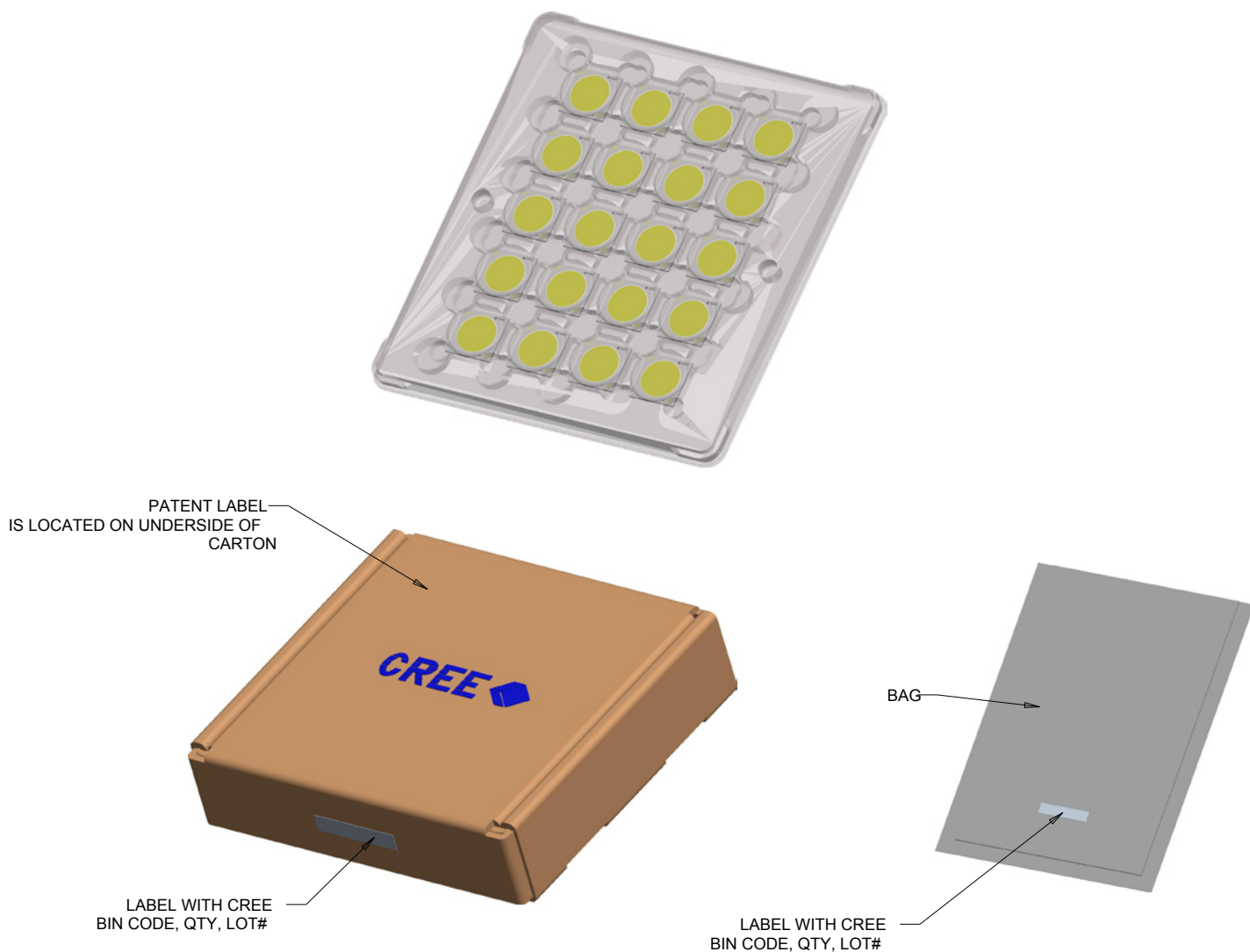
$$.xx \pm .03$$
$$.xxx \pm .010$$
$$x^0 + 1^0$$


PACKAGING - CONTINUED

Beginning in April, 2013, Cree will be implementing a change from tube to tray packaging of CXA15xx, CXA2520 and CXA2530 LEDs. The change will occur in phases, and different CXA LEDs will be receiving the tray packaging at different times. After the change, customers will receive only the new tray packaging and stop receiving the tube packaging.

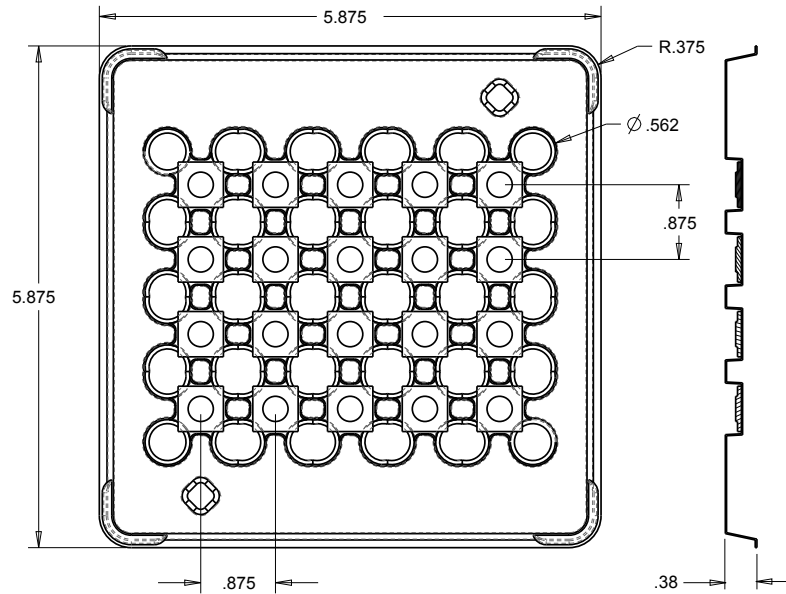
Cree is not repackaging inventory at our distributors that already exists in tube packaging. Customers purchasing through a distributor may not see the packaging change until the current tube inventory is depleted from distributor stock.

Ceramic CXA family 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.



PACKAGING - CONTINUED

CXA1304



Dimensions are in inches.

Tolerances:

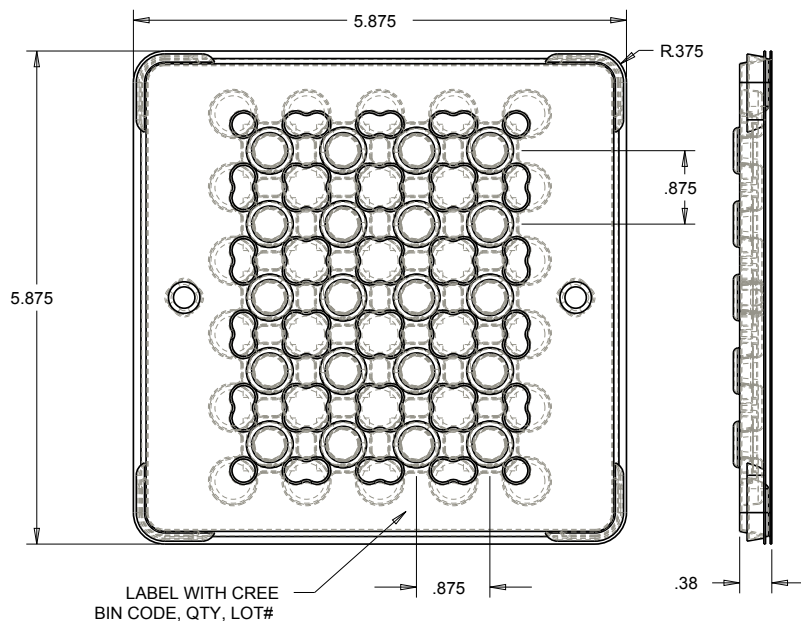
.x $\pm .1$

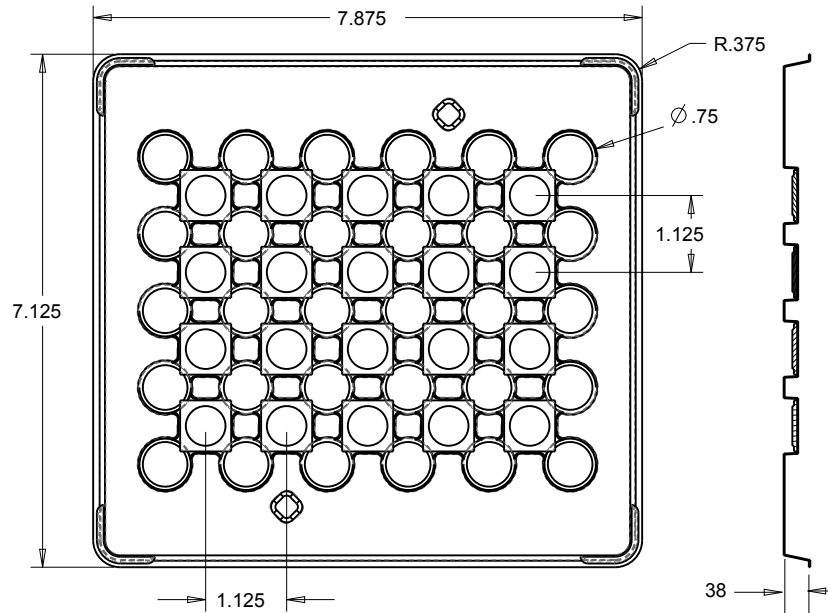
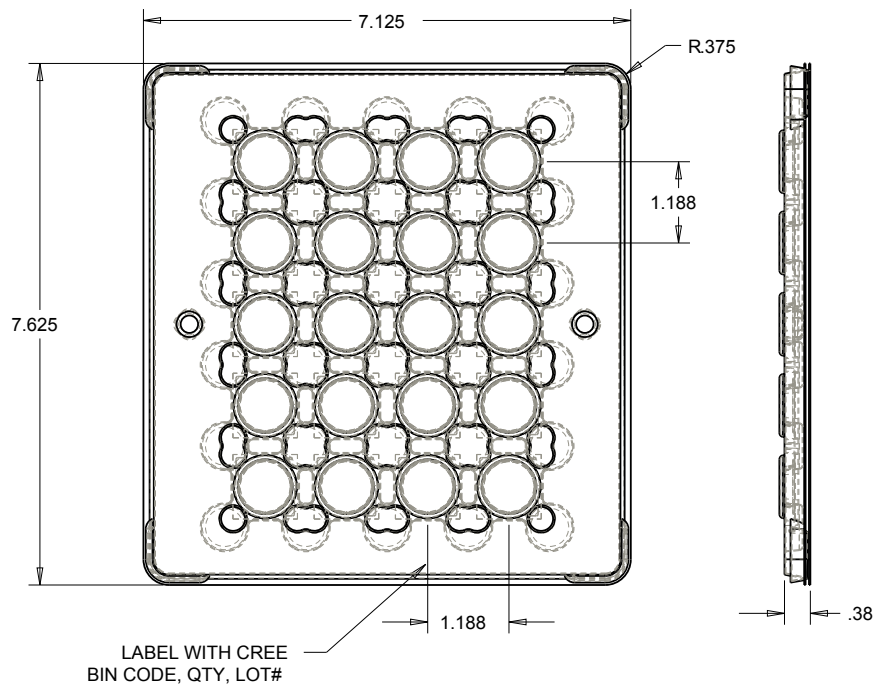
.xx $\pm .05$

.xxx $\pm .005$

x° $\pm 1^\circ$

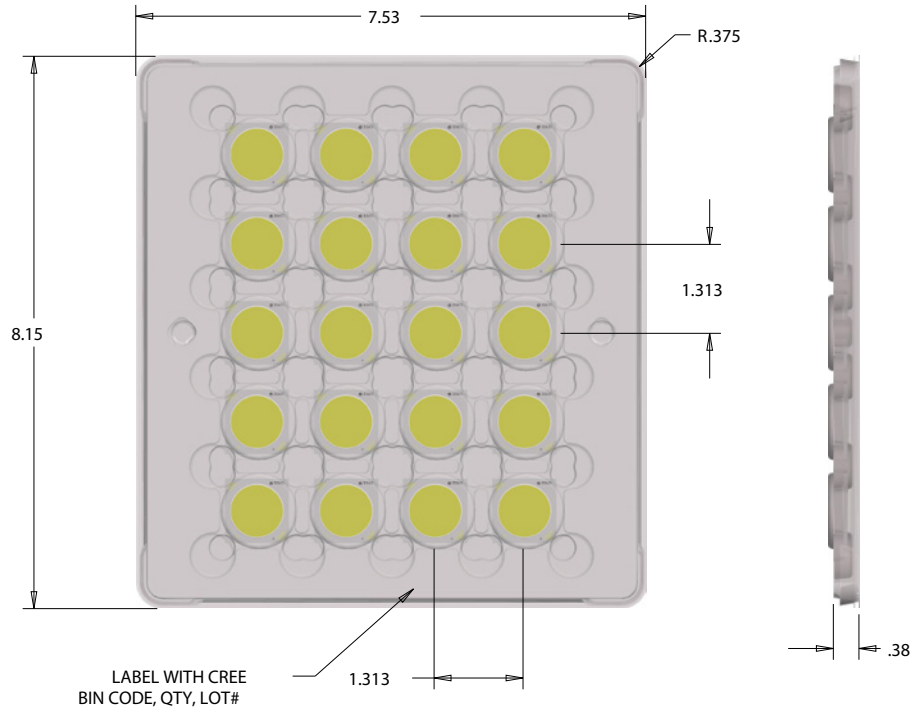
CXA15xx



PACKAGING - CONTINUED
CXA18xx

CXA25xx


PACKAGING - CONTINUED

CXA30xx



CXA3590

