

Cree® XLamp® CM Family LEDs

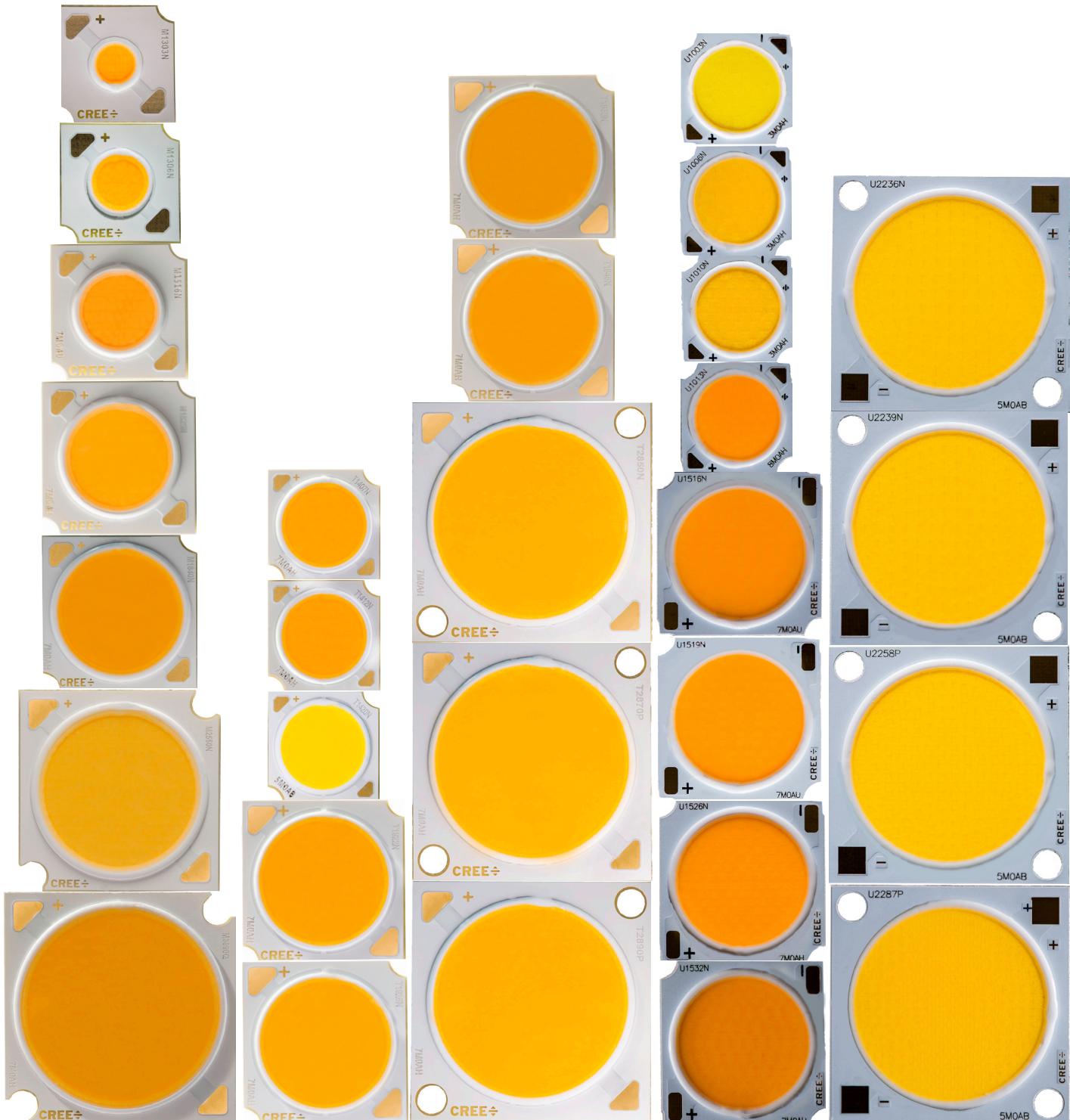


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INTRODUCTION

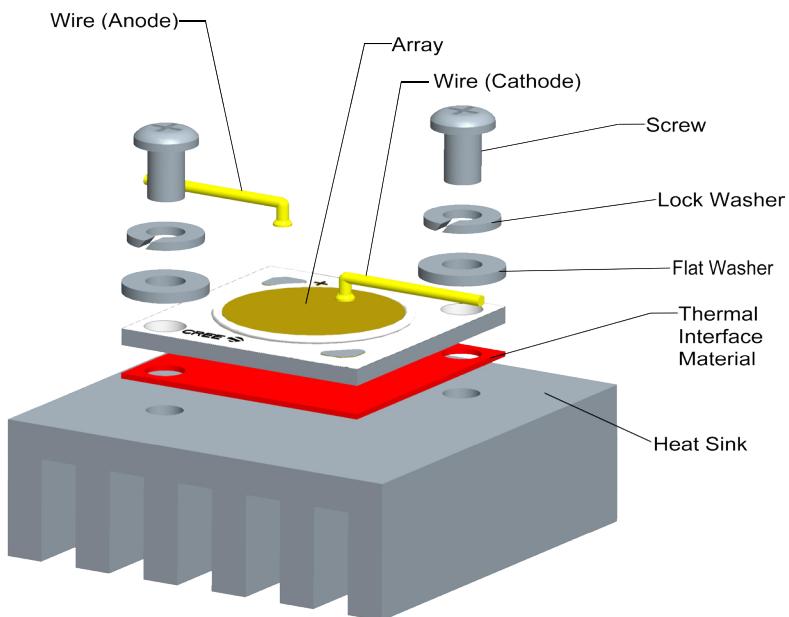
This application note applies to XLamp® CM family LEDs, which have order codes in the following format:

CMxxxxx-xxxx-xxxxxxxx

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

HANDLING XLAMP® CM FAMILY LEDs

In general, CM family LEDs are attached directly to a heat sink via screws or a connector and discrete wires are used to deliver power to the LED, as illustrated below. A thermal interface material (TIM) must be applied between the CM family LED and the heat sink to properly maintain thermal performance.



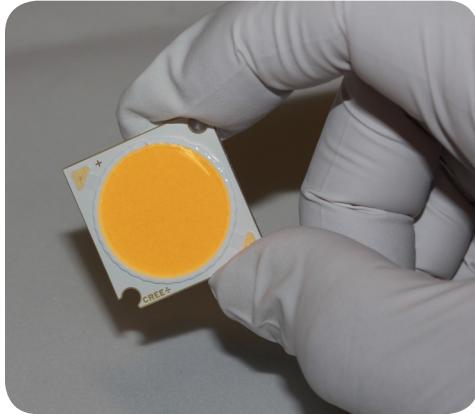
Cree recommends the following at all times when handling XLamp CM family LEDs or assemblies containing XLamp CM family LEDs:

- 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 CM family LEDs with appropriate ESD grounding.
- Cree recommends handling CM family LEDs wearing clean, lint-free gloves.

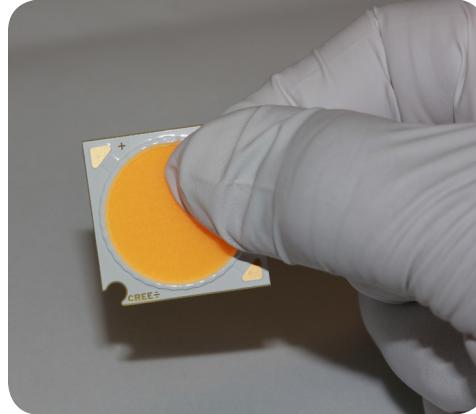
Manual Handling

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

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CORRECT

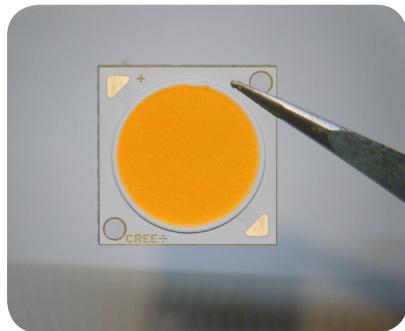


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WRONG

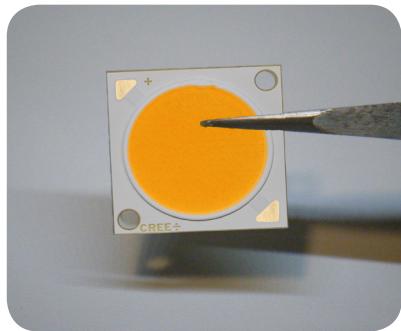


When using tweezers to handle XLamp CM family LEDs, do not touch the lens with the tweezers.

✓
CORRECT



✗
WRONG



HEAT SINK, LAYOUT, THERMAL INTERFACE

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

Attaching a CM family LED to a heat sink is most often accomplished by inserting a pad of TIM, thermally conductive epoxy, or thermal grease between the CM 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 (Rth) are related.

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

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](#). 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.

Cree recommends securing CM 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 CM family LEDs over relatively thick TIMs, such as thermal pads, to avoid catastrophic mechanical damage to the LED.

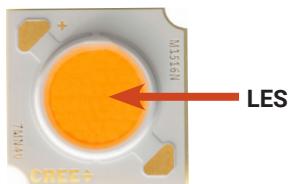
CM family LEDs and thermal interface materials are secured either by screws through the pair of diagonally opposite screw holes or by the use of an LED holder (see the section on LED Connectors). When using the screw holes to secure CM family LEDs, Cree recommends #4 (/40) or M2.5 screws. Excessive torque 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 CM family LEDs as several of these compounds have been shown to be chemically incompatible with LEDs.

CASE TEMPERATURE MEASUREMENT POINT

XLamp CM family LED case temperature can be measured at either solder pad. Cree recommends attaching the thermocouple with conductive epoxy.

LIGHT-EMITTING SURFACE TEMPERATURE MEASUREMENT

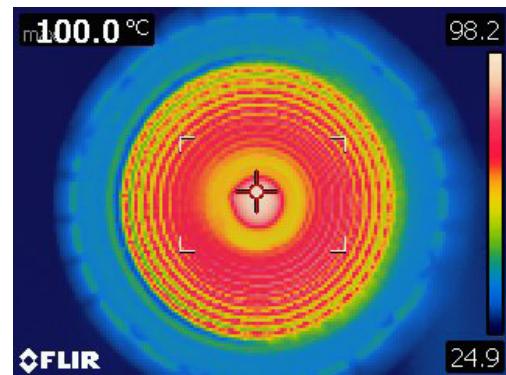
The light-emitting surface (LES) of XLamp CM family LEDs is defined as the central region of the LED, which contains the encapsulated chip array as shown below.



LES temperatures are measured using an infrared (IR) thermal imaging camera. IR cameras detect the infrared wavelength thermal emission from an object's surface, which is correlated to the surface temperature using the surface's thermal emissivity. CM family LES thermal emissivity is 0.98. Please consult the IR camera's operating instructions for proper measurement settings and guidelines. Factors that can affect the accuracy of IR thermal measurement include the distance to the object's surface, image focus and ambient conditions.

Making accurate LES temperature measurements requires the IR camera to have a direct line-of-sight view of the LES. Remove all lenses, diffusers and baffles that cover the LES before making a measurement. Measure LES temperatures when the LED has reached thermal equilibrium under steady-state operation. An example IR thermal image of a CM family LED in a luminaire is shown at the right. The LES temperature at the position of the crosshairs is reported in the upper left corner of the image.

Cree recommends a maximum LES temperature of 140 °C to ensure optimal LED lifetime.



NOTES ON SOLDERING XLAMP® CM FAMILY LEDs

XLamp CM family LEDs are designed for electrical connection using wire-attach soldering or a connector. Cree recommends the use of a connector to help ensure proper clamping force is applied to the CM family LED and to help prevent damage that can occur during wire-attach soldering.

Cree makes the following recommendations to get the maximum benefit from wire-attach soldering:

- Do not pre-heat CM family LEDs before soldering.
- Use “no clean” lead-free solder.
- Use a temperature-controlled soldering iron having a minimum 60 W of power to help ensure the temperature of the tip remains stable during soldering.
- Use a solder tip with a width of 2.6 mm (0.1 in) or greater.
- Ensure that solder tip temperature measures and does not exceed 380 °C.
- Perform soldering (including pre-tinning) on a thermally non-conductive surface.
- Ensure a contact time with bond pads of 3 seconds or less.
- Return CM family LEDs to room temperature after each soldering step. It is imperative that this recommendation be followed. Cree recommends placing the CM family LED on a thermally conductive surface such as an aluminum block for at least 10 seconds to return the LED to room temperature.

The following example hand-soldering steps are based on the above recommendations.

1. Start from ambient temperature conditions.
2. Pre-tin the first bond pad on a thermally non-conductive surface, allowing no more than a 3-second maximum contact time.
3. Let the LED return to room temperature.
4. Pre-tin the second bond pad on a thermally non-conductive surface, allowing no more than a 3-second maximum contact time.
5. Let the LED return to room temperature.
6. Pre-tin the first wire.
7. Pre-tin the second wire.
8. Solder the first wire to the first bond pad, allowing no more than a 3-second maximum contact time.
9. Let the LED return to room temperature.

10. Solder the second wire to the second bond pad, allowing no more than a 3-second maximum contact time.
11. Let the LED return to room temperature before subsequent handling.

Use caution when soldering and handling CM family LEDs to avoid damaging the LEDs. Solder reworking should be kept to a minimum because of the potential for solder-pad lifting and damage to the LED from 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.

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CORRECT



Solder Type

Cree strongly recommends using "no clean" solder with XLamp CM family LEDs so that cleaning the PCB after soldering is not required.

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

LOW TEMPERATURE OPERATION

The minimum operating temperature of these XLamp LED 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.

NOTES ON CM FAMILY LED CONNECTORS

A number of firms have developed connectors to simplify the mechanical and electrical attachment of CM family LEDs. CM family LEDs have been designed to be compatible with existing holders for CX family of LEDs. Cree has found all sampled CX family connectors tested to be compatible with CM family LEDs. Customers are encouraged to perform electrical and thermal tests to verify compatibility with connectors.

If CM 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.

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](#). 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 CM 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 CM family LEDs. Cree recommends not using these chemicals anywhere in an LED system containing XLamp CM 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)

Hermetically Sealing Luminaires

For proper LED operation and to avoid potential lumen depreciation and/or color shift, LEDs of all types must operate in an environment that contains oxygen. Simply allowing the LEDs to ventilate to air is sufficient; no extraordinary measures are required. Hermetically sealing LEDs in an enclosed space is not recommended.

HANDLING

Do not stack assemblies containing XLamp CM 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 CM family LEDs should be stacked in a way to allow at least 2-cm clearance above the LED.

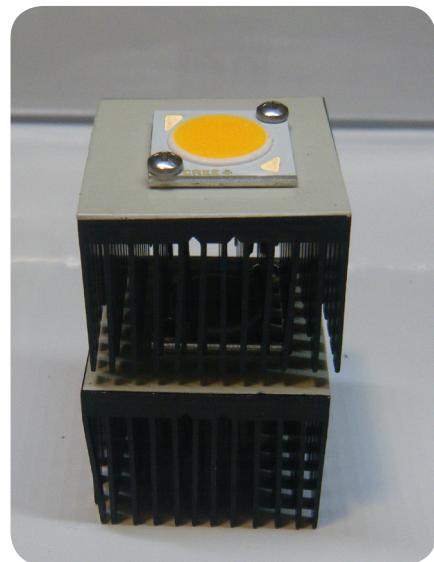
Do not use bubble wrap directly on top of the XLamp CM family LEDs. Force transferred through the bubble wrap can potentially damage the LED.

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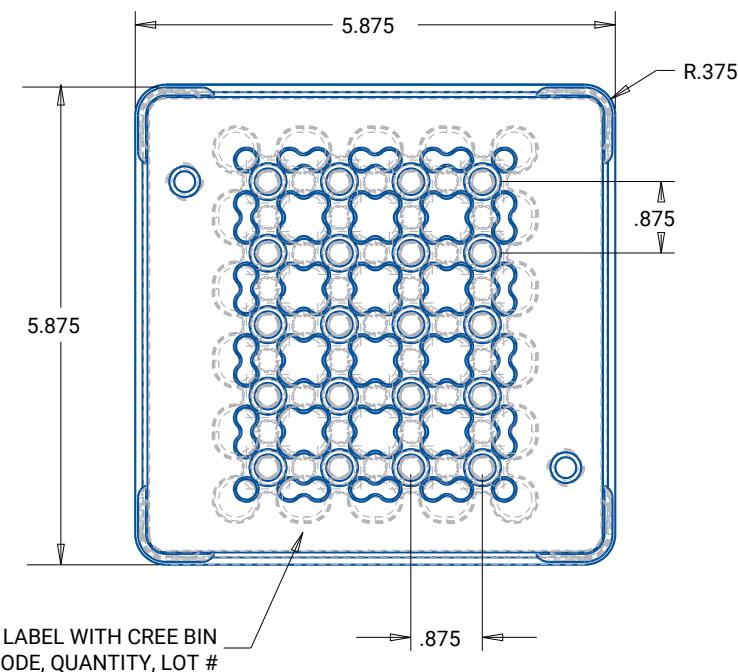
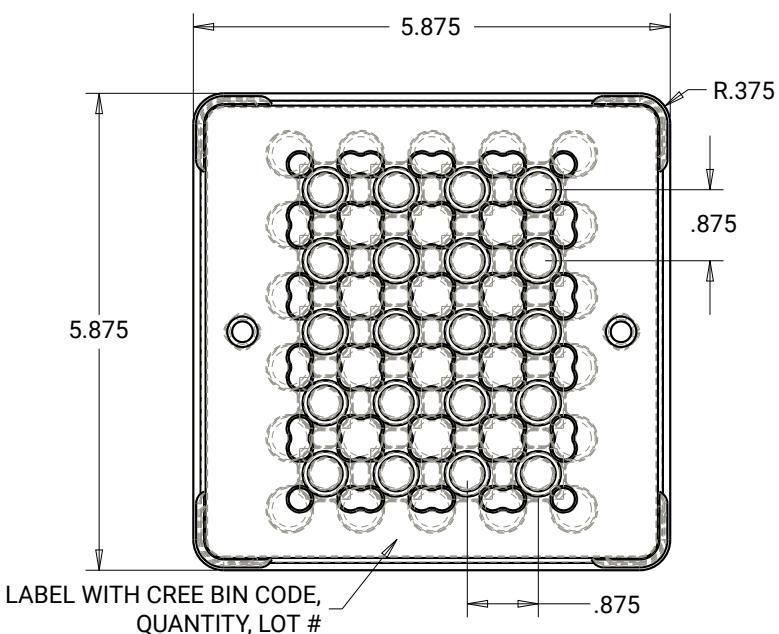


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WRONG

PACKAGING

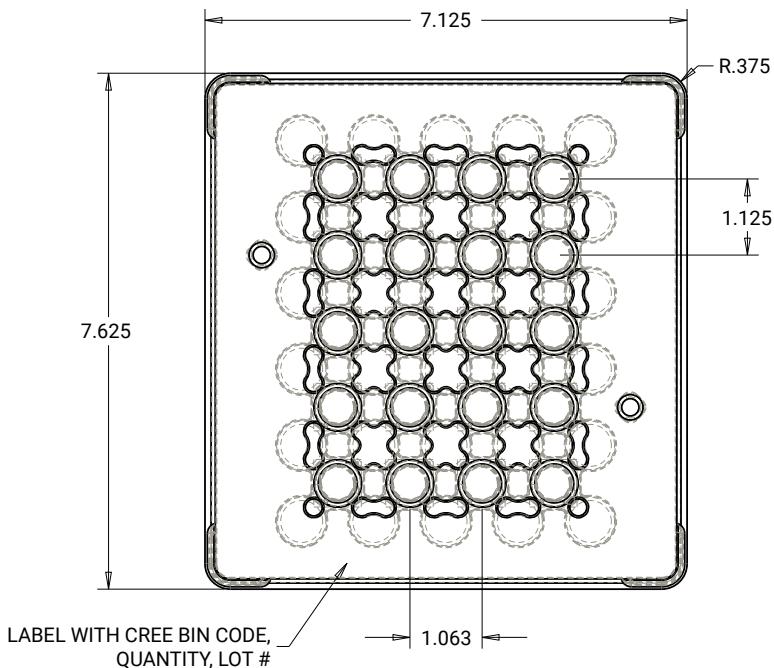
Drawing dimensions are in inches.

Tolerance: $\pm .13$ mm

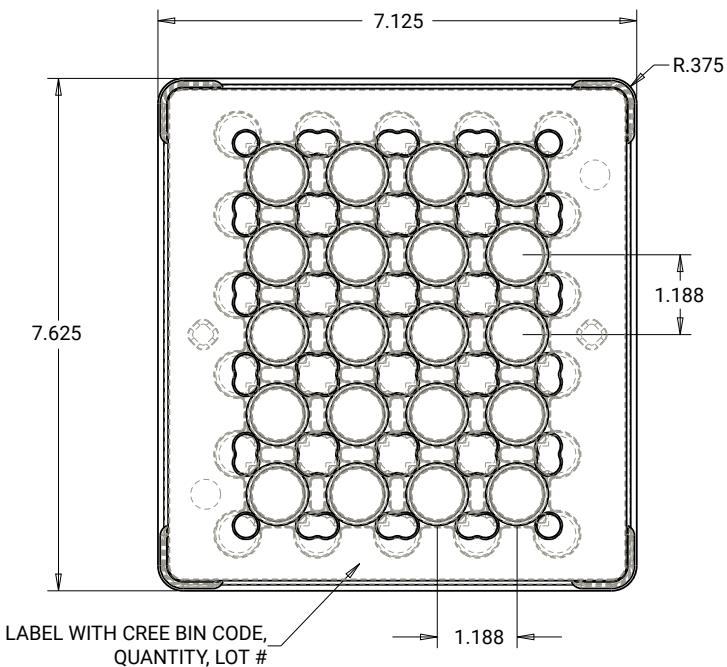
CMA1303, CMA1306**CMA1516**

PACKAGING - CONTINUED

CMA1825 & CMA1840

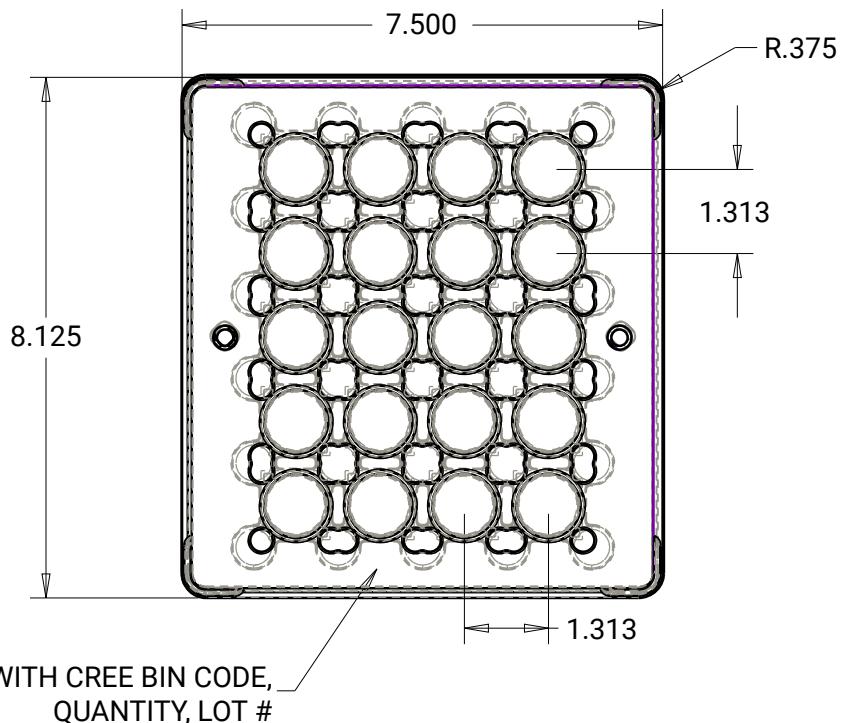


CMA2550

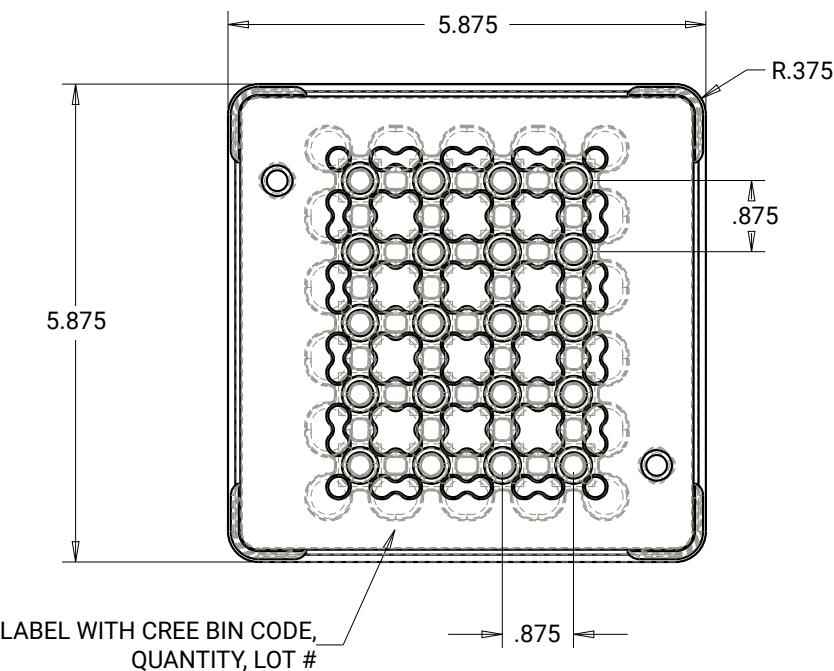


PACKAGING - CONTINUED

CMA3090

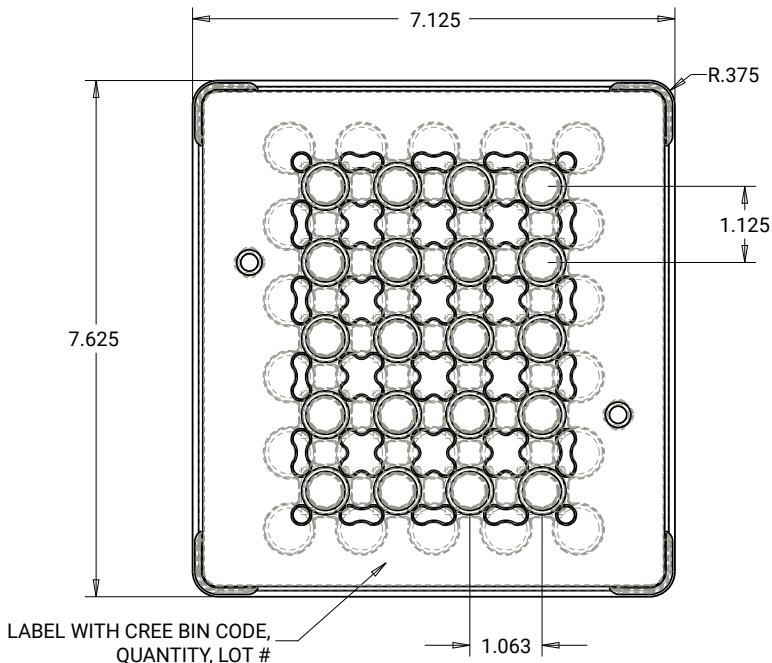


CMT1407, CMT1412 & CMT1420

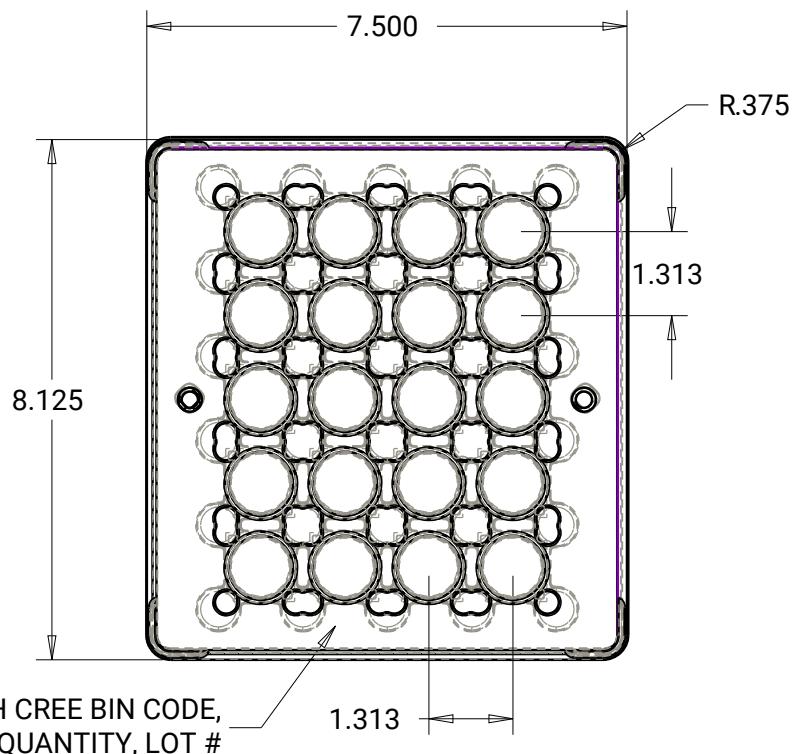


PACKAGING - CONTINUED

CMT1922, CMT1925, CMT1930 & CMT1945



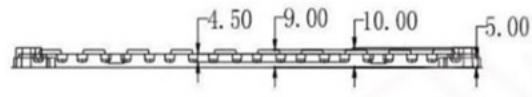
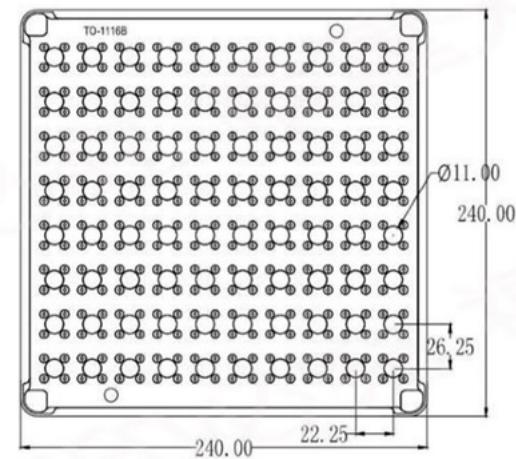
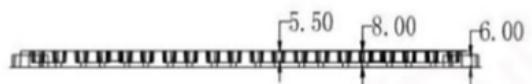
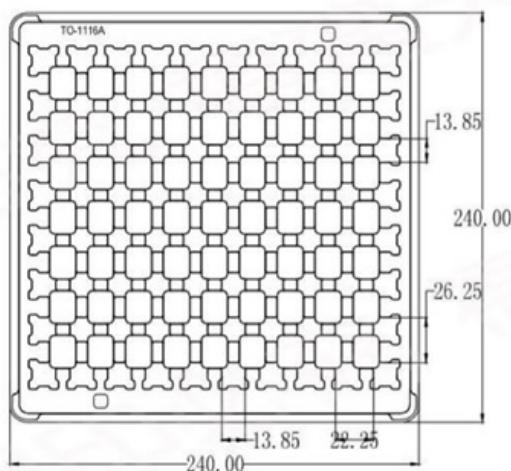
CMT2850, CMT2870 & CMT2890



PACKAGING - CONTINUED

Dimensions are in mm.

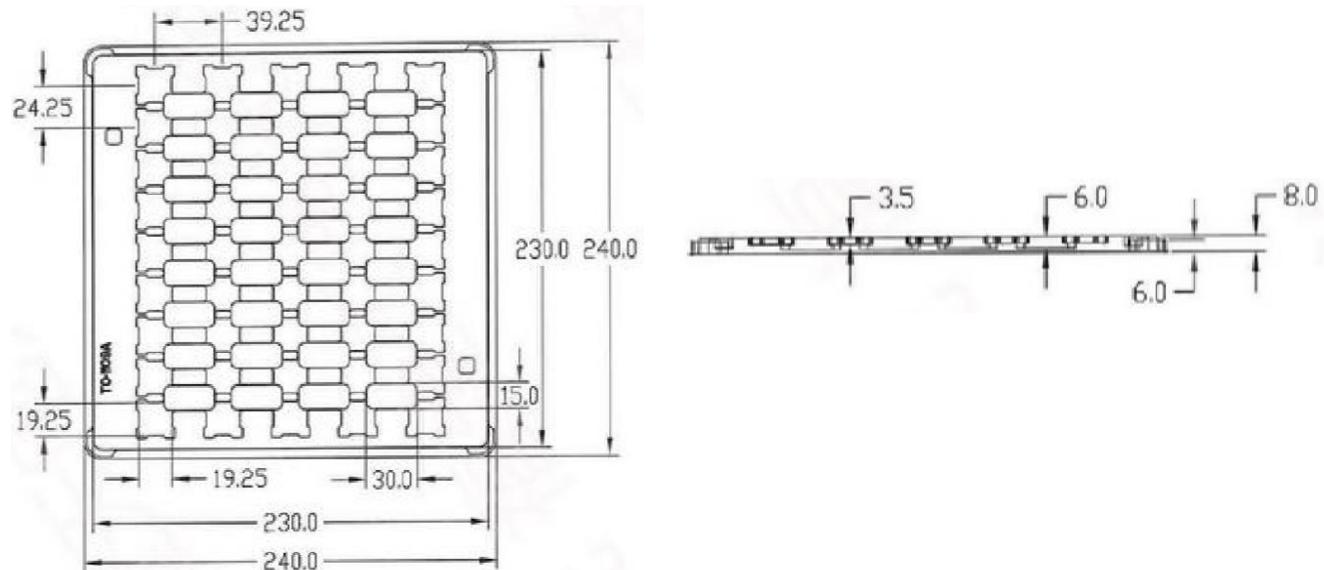
Tolerances: ± 0.5 mm

CMU1003, CMU1006, CMU1010, CMU1013**Load Tray****Upper Tray**

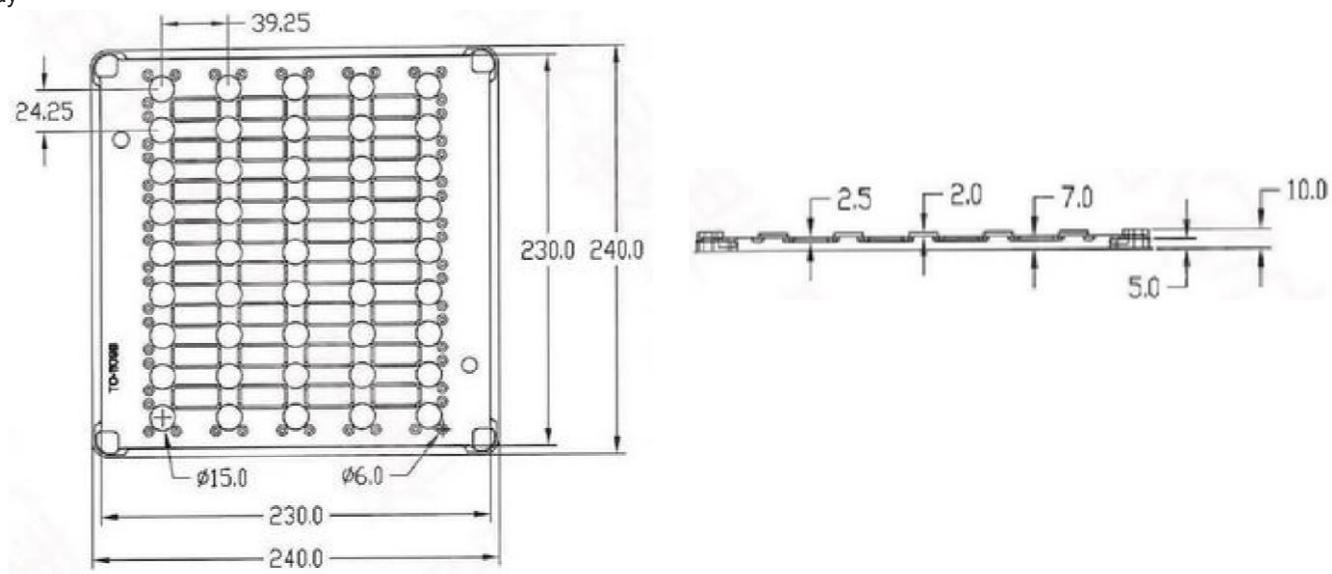
PACKAGING - CONTINUED

CMU1516, CMU1519, CMU1526, CMU1532

Load Tray



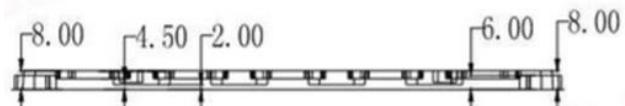
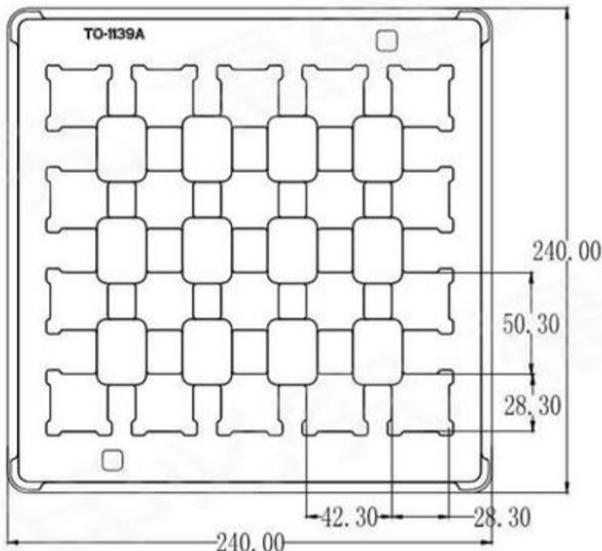
Upper Tray



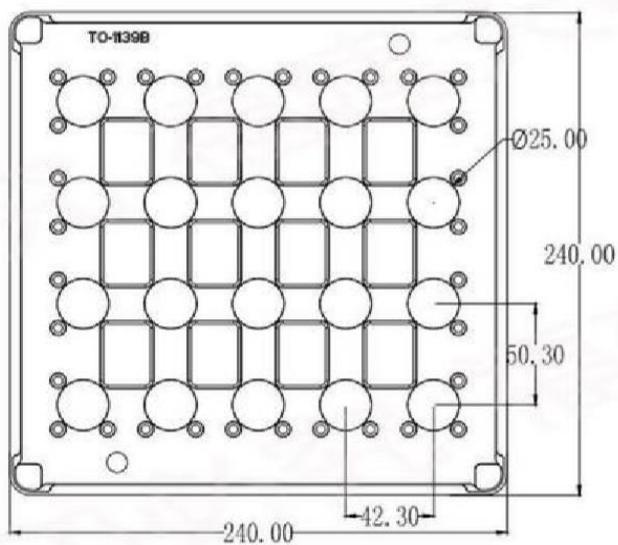
PACKAGING - CONTINUED

CMU2236, CMU2239, CMU2258, CMU2287

Load Tray



Upper Tray



2D BARCODE FORMAT

The format of the 2D barcode found on the bottom side of CMU family LEDs is shown below.

