

## XLamp® XFLCxx Family LEDs



### INTRODUCTION

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

XFLCxx-xx-xxxx-xxxxxxxxxx

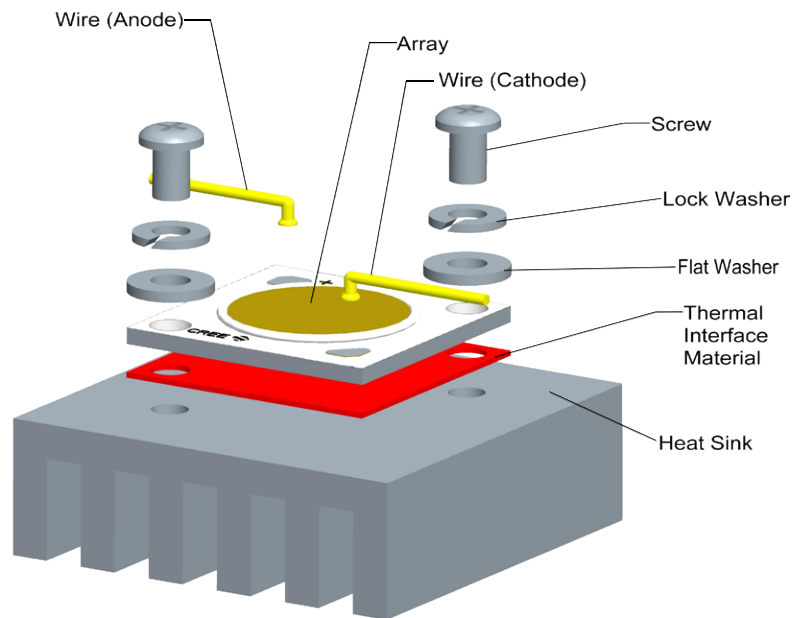
This application note explains how XLamp XFLCxx Family LEDs and assemblies containing these LEDs should be handled during manufacturing. Please read this entire document to understand how to properly handle XLamp XFLCxx Family LEDs.

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## HANDLING XLAMP® XFLCXX FAMILY LEDs

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



Cree LED recommends the following at all times when handling XLamp XFLCxx Family LEDs or assemblies containing XLamp XFLCxx 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 LED recommends always handling XLamp XFLCxx Family LEDs with appropriate ESD grounding.
- Cree LED recommends handling XLamp XFLCxx Family LEDs wearing clean, lint-free gloves.

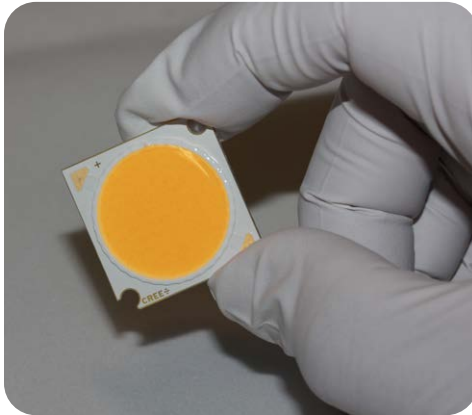
XLamp XFLCxx Family LEDs are designed for electrical connection through wired leads. The horizontal and vertical pull force of the attached solder leads should not exceed 1000 g.

## HANDLING XLAMP® XFLCXX FAMILY LEDS (CONTINUED)

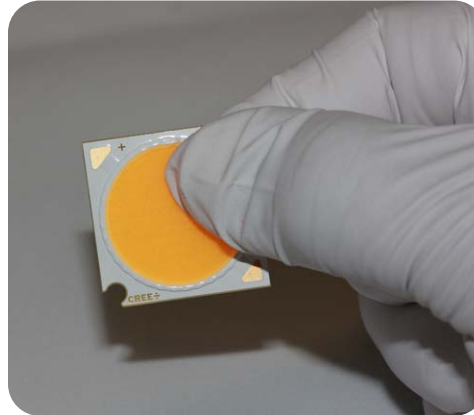
### Manual Handling

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

✓  
**CORRECT**

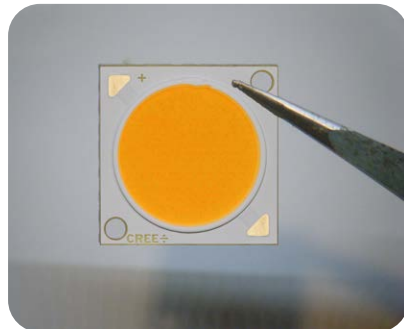


✗  
**WRONG**

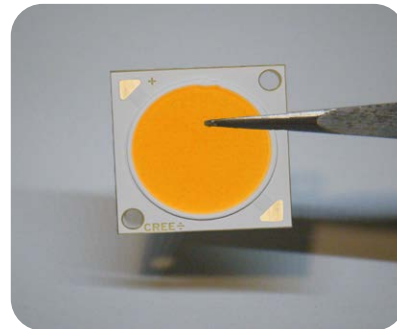


When using tweezers to handle XLamp XFLCxx Family LEDs, do not touch the lens with the tweezers.

✓  
**CORRECT**



✗  
**WRONG**



## LOW TEMPERATURE OPERATION

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

## HEAT SINK, LAYOUT, THERMAL INTERFACE

To ensure effective thermal management for XLamp XFLCxx Family LEDs, Cree LED recommends the XLamp XFLCxx Family LED be attached to an appropriately sized heat sink, depending on drive current and intended operating environment.

Cree LED recommends attaching XLamp XFLCxx Family LEDs to a heat sink with a pad of TIM or a layer of thermal grease. 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.

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

Cree LED 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 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.

XLamp XFLCxx Family LEDs and thermal interface materials should be secured by M5 screws through the pair of 2.5 mm radius outer screw holes. 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 LED recommends non-conductive lock washers or self-locking fasteners. Cree LED DOES NOT RECOMMEND the use of chemical thread lockers to secure XLamp XFLCxx Family LEDs as several of these compounds have been shown to be chemically incompatible with LEDs.

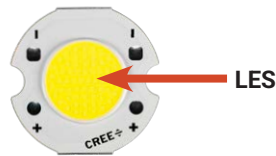
Cree LED recommends using the inner 3 mm holes in the XFLC10, XFLC15 and XFLC20 LEDs only for optical alignment. Do not put screws into these inner 3 mm holes.

## CASE TEMPERATURE MEASUREMENT POINT

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

## LIGHT-EMITTING SURFACE TEMPERATURE MEASUREMENT

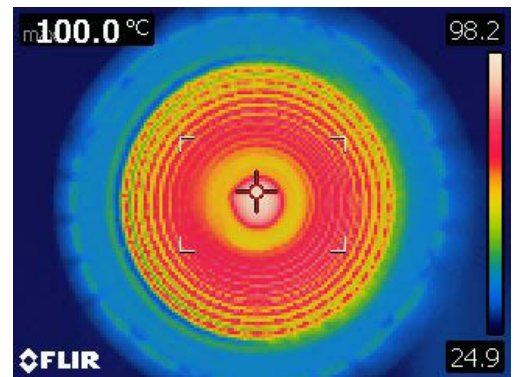
The light-emitting surface (LES) of XLamp XFLCxx family LEDs is defined as the central region of the LED, which contains the encapsulated chip array as shown below.



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



## NOTES ON SOLDERING XLAMP® XFLCXX FAMILY LEDS

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

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

- Do not pre-heat XLamp XFLCxx 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 XLamp XFLCxx Family LEDs to room temperature after each soldering step. It is imperative that this recommendation be followed. Cree LED recommends placing the XLamp XFLCxx 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 XLamp XFLCxx 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.

### Solder Type

Cree LED strongly recommends using “no clean” solder with XLamp XFLCxx family LEDs so that cleaning the PCB after soldering is not required. Cree LED recommends the following solder compositions: SnAgCu (tin/silver/copper) and SnAg (tin/silver).

## 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 LED's [Chemical Compatibility Application Note](#).

### Recommended Chemicals

In testing, Cree LED has found the following chemicals to be safe to use with XLamp XFLCxx Family LEDs.

- Water
- Isopropyl alcohol (IPA)

### Chemicals Tested as Harmful

In general, subject to the specifics in Cree LED's [Chemical Compatibility Application Note](#), Cree LED has found certain chemicals to be harmful to XLamp XFLCxx Family LEDs. Cree LED recommends not using these chemicals anywhere in an LED system containing XLamp XFLCxx 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 XFLCxx 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 XFLCxx 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 XFLCxx family LEDs. Force transferred through the bubble wrap can potentially damage the LED.

✓  
**CORRECT**



✗  
**WRONG**

✓  
**CORRECT**

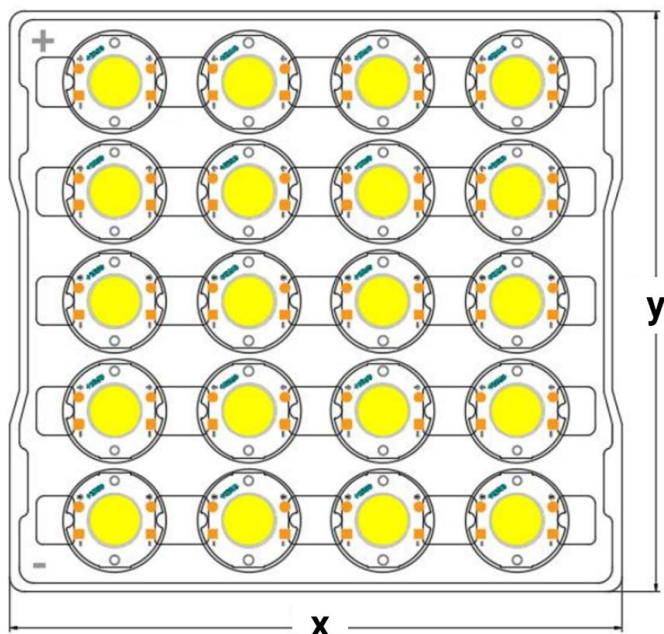


✗  
**WRONG**

## TRAY PACKAGING

All XFLCxx LEDs are packaged in trays, which are then sealed in electrostatic bags and shipped in a cardboard carton.

Except as noted, all dimensions in mm



| Product | x (mm) | y (mm) | Tray Count | Tray Thickness (mm) |
|---------|--------|--------|------------|---------------------|
| XFLC05  | 201    | 191    | 36         | 8                   |
| XFLC08  | 201    | 191    | 36         | 8                   |
| XFLC10  | 201    | 191    | 20         | 8                   |
| XFLC15  | 201    | 191    | 20         | 8                   |
| XFLC20  | 201    | 201    | 25         | 8                   |

Trays are packaged in the following way:

- Five trays are stacked and a cover tray is applied to the top tray to form a tray unit
- The tray unit is packed in a moisture barrier bag (MBB) and heat sealed
- The MBB is packed in an inner box
- One to seven inner boxes ship per outer carton based on total order size