

High-Brightness Device General Assembly and Application Guidance

INTRODUCTION

All semiconductors – and most electronic devices in general – are susceptible to both moisture ingress as well as immersion or contact with water. The details in this application note provide high-level guidance for handling, protecting, and assembling the associated LED devices from Cree LED.

PROTECTION FROM MOISTURE INGRESS

Moisture Sensitivity Level (MSL) ratings are a classification system established by the Joint Electron Device Engineering Council (JEDEC) to indicate how susceptible an LED device is to moisture-induced damage during the soldering process. The MSL rating specifies the allowable exposure time to ambient room conditions before the device must be mounted to prevent damage from moisture expansion during reflow soldering. For instance, an LED with an MSL rating of 1 can be exposed indefinitely, while an LED with an MSL rating of 6 must be mounted within a very short time after opening its package. Proper handling and storage according to MSL ratings are crucial to ensure the reliability and longevity of LEDs in electronic applications. A listing of MSL classifications, ratings, and floor conditions is presented in the following table.

MSL Level	Floor Life	
	Time	Conditions
1	Unlimited	≤ 30 °C/ 85% RH
2	1 year	≤ 30 °C/ 60% RH
2a	4 weeks	≤ 30 °C/ 60% RH
3	168 hours	≤ 30 °C/ 60% RH
4	72 hours	≤ 30 °C/ 60% RH
5	48 hours	≤ 30 °C/ 60% RH
5a	24 hours	≤ 30 °C/ 60% RH

Many of the Cree LED high-brightness devices are MSL 3-5a, and they may require baking if the floor life maximum exposure conditions are exceeded. The standard baking condition for all Cree LED high-brightness devices except for the UHD111A LED is a 24 hour soak at 80 °C and ≤ 5% RH. (The UHD111A LED requires a 60 °C soak for 4 hours at ≤ 5% RH.) Only the reel should be baked – any packing materials or boxes should be removed before placing the reels in the baking oven. Moisture indicators within the reel bag will also help to alert the end user if baking is required. However, care must be taken to understand the storage conditions rather than primarily relying on just the moisture indicators.

In outdoor applications – or those applications exposed to sustained > 50% RH – it is important to remember that the devices can still undergo moisture ingress unless properly protected. Very general guidance on protecting outdoor applications of high-brightness parts is listed below. (Specific applications will require specific solutions as appropriate.)

1. Seal the pins by potting the devices after reflow to protect from moisture ingress at the pin contact points. This also protects the board and other shorter components from moisture.
2. Energize the installation at some frequency to heat up the LED components and drive off any residual moisture. For installations that are rarely used, energizing the installation for one hour every week is a good starting point for design parameters.

PROTECTION FROM THE ELEMENTS: WATER

Based on the design and materials of the different components, Cree LED high-brightness devices can be classified into three different application areas: outdoor, semi-outdoor, and indoor.

Outdoor LEDs are designed and engineered for outdoor applications in which the devices are exposed to the elements 100% of the time. The primary strengths of these designs are enhanced adhesion amongst the many internal layers, especially with respect to resistance from the harmful UV radiation from the sun and direct exposure to rain. Although the body of the devices is waterproof, it is important that the reflowed leads are potted with a silicone material to protect from moisture ingress via the leads. Examples of outdoor rated Cree LED product families include the LY6, LX6, LMW, and LMX series.

Semi-outdoor components strike a balance between moisture resistance and component brightness. The primary strengths include materials that promote good adhesion between all the internal layers while maximizing the ability of the component to direct light out. These components must be protected from direct exposure to the elements via a sealed housing. Water immersion is likely destructive to these components. Examples of semi outdoor rated Cree LED product families include the LM6, LW6, LQ6, and LR6 series.

Indoor LEDs are designed for use in applications where the temperature and relative humidity are specifically controlled. Water immersion will likely cause device failure and prolonged exposure to UV light will lead to shorter device lifetimes. These components are primarily designed for brightness, contrast, and long-term performance stability.

CLOSING REMARKS

For answers to questions related to protecting these high-brightness devices from moisture ingress and water, please contact your local Cree LED salesperson. This application note provides guidance and does not imply any specific warranty or guarantee.