

# Cree® XLamp® MX-6 LEDs

## Data Sheet

The Cree XLamp MX-6 LED provides the proven lighting-class performance and reliability of Cree XLamp LEDs in a flat-top PLCC package. The XLamp MX-6 LED continues Cree’s history of innovation in LEDs for lighting applications with wide viewing angle, unlimited floor life, uniform light output without secondary optics and electrically neutral thermal path.



The XLamp MX-6 LED brings high performance and quality of light to a wide range of lighting applications, including linear lighting, LED light bulbs, fluorescent retrofits and retail-display lighting.

### FEATURES

- Available in white (2,600 K to 8,300 K CCT)
- Maximum drive current: 1000 mA
- Wide viewing angle: 120°
- Electrically neutral thermal path
- Qualification at max drive current
- RoHS-compliant
- Unlimited floor life at  $\leq 30^{\circ}\text{C}/85\% \text{ RH}$

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## Flux Characteristics (T<sub>j</sub> = 25°C)

The following table provides several base order codes for XLamp MX-6 LEDs. It is important to note that the base order codes listed here are a subset of the total available order codes for the product family. For more order codes, as well as a complete description of the order-code nomenclature, please consult the XLamp MX-6 LED Binning and Labeling document.

Color	CCT Range		Base Order Codes Min Luminous Flux (lm) @ 300 mA		Calculated Min Luminous Flux (lm) @ 350 mA*	Order Code
	Min.	Max.	Group	Flux (lm)	Flux (lm)	
Cool White	5,000 K	8,300 K	Q4	100	114	MX6AWT-A1-0000-000C51
			Q5	107	122	MX6AWT-A1-0000-000D51
Warm White	3,700 K	4,300 K	Q3	93.9	107	MX6AWT-A1-0000-000BE5
	2,600 K	3,700 K	P4	80.6	92	MX6AWT-A1-0000-0009E7

\* Calculated values for reference purposes only.

### Notes:

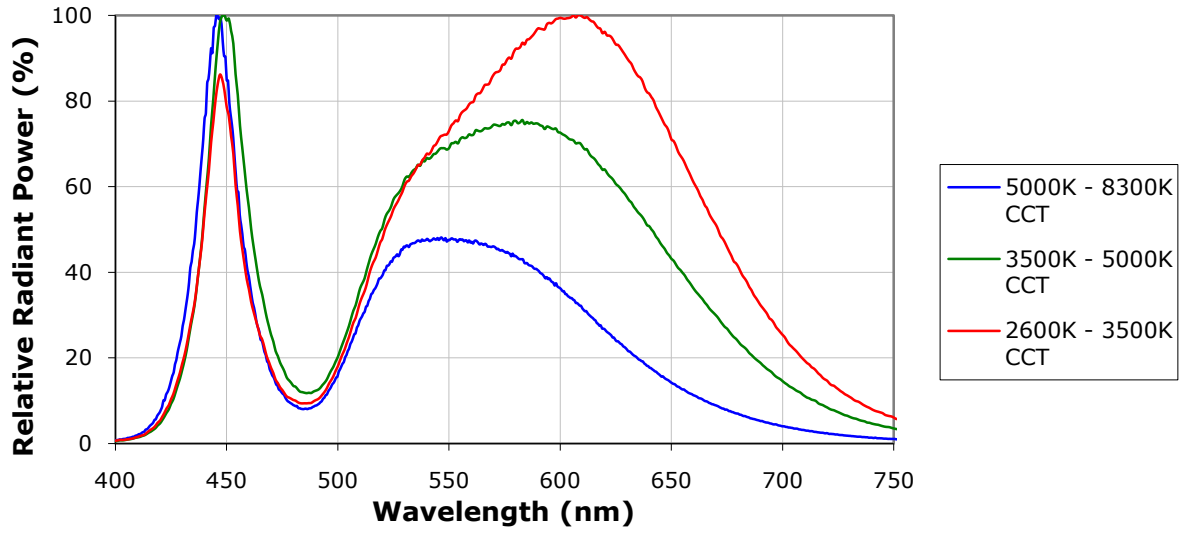
- Cree maintains a tolerance of +/- 7% on flux measurements.
- Typical CRI for Cool White (4,300 K – 8,300 K CCT) is 75.
- Typical CRI for Warm White (2,600 K – 4,300 K CCT) is 80.

## Characteristics

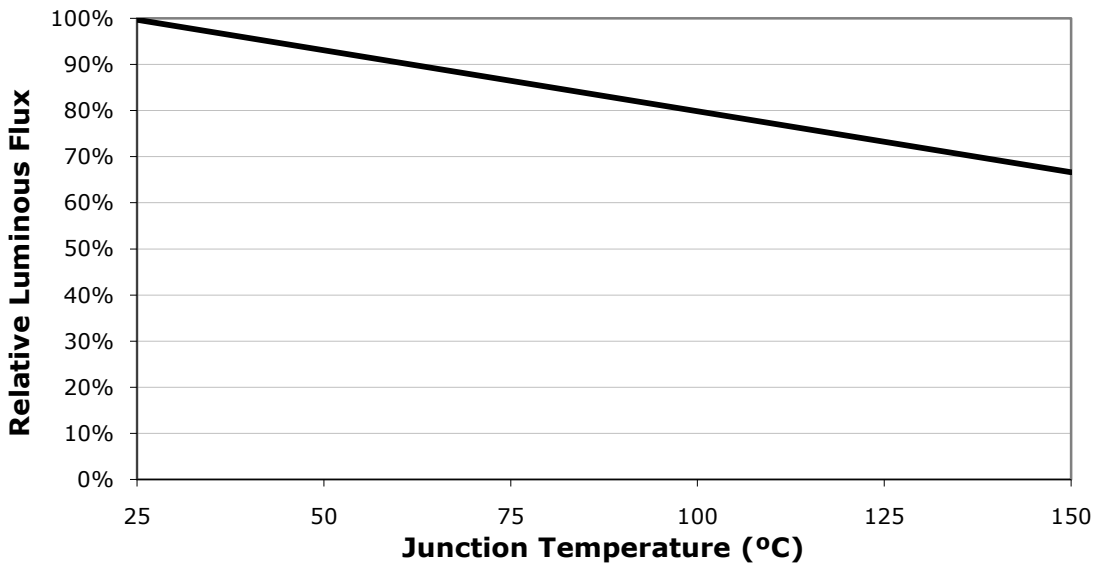
Characteristics	Unit	Minimum	Typical	Maximum
Thermal resistance, junction to solder point	°C/W		5	
Viewing angle (FWHM)	degrees		120	
Temperature coefficient of voltage	mV/°C		-3.3	
ESD classification (HBM per Mil-Std-883D)			Class 2	
DC forward current	mA			1000
Forward voltage (@ 300 mA)	V		3.3	3.8
LED junction temperature	°C			150

\* The increase of maximum forward current to 1000 mA for XLamp MX-6 White is retroactive and applies to all XLamp MX-6 White LEDs produced by Cree. This increase is the result of more extensive testing that was performed after the initial product launch.

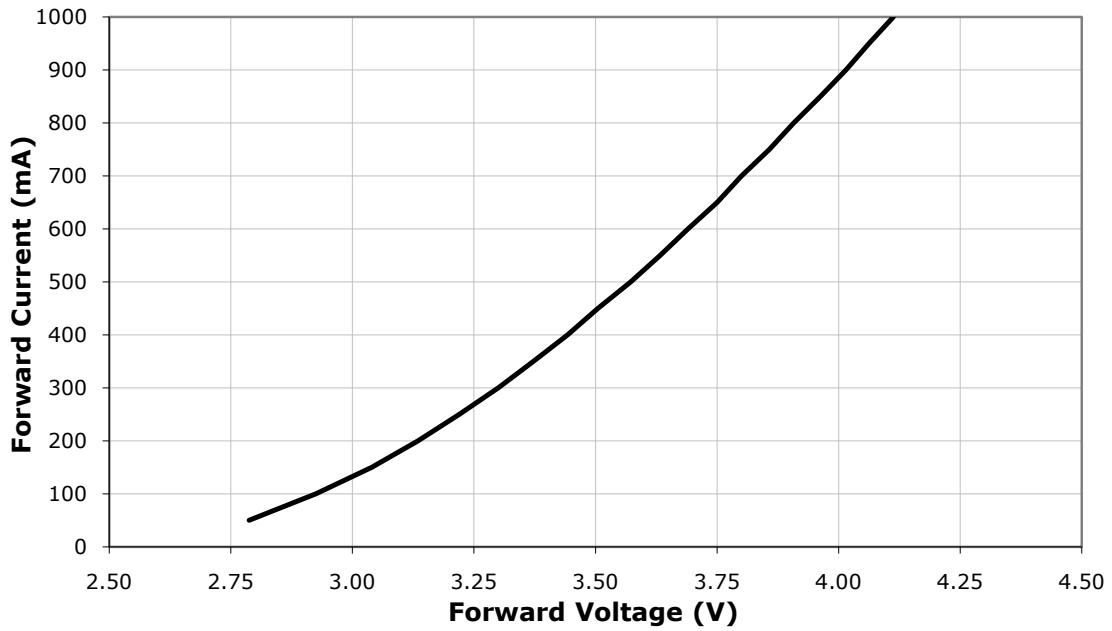
## Relative Spectral Power Distribution



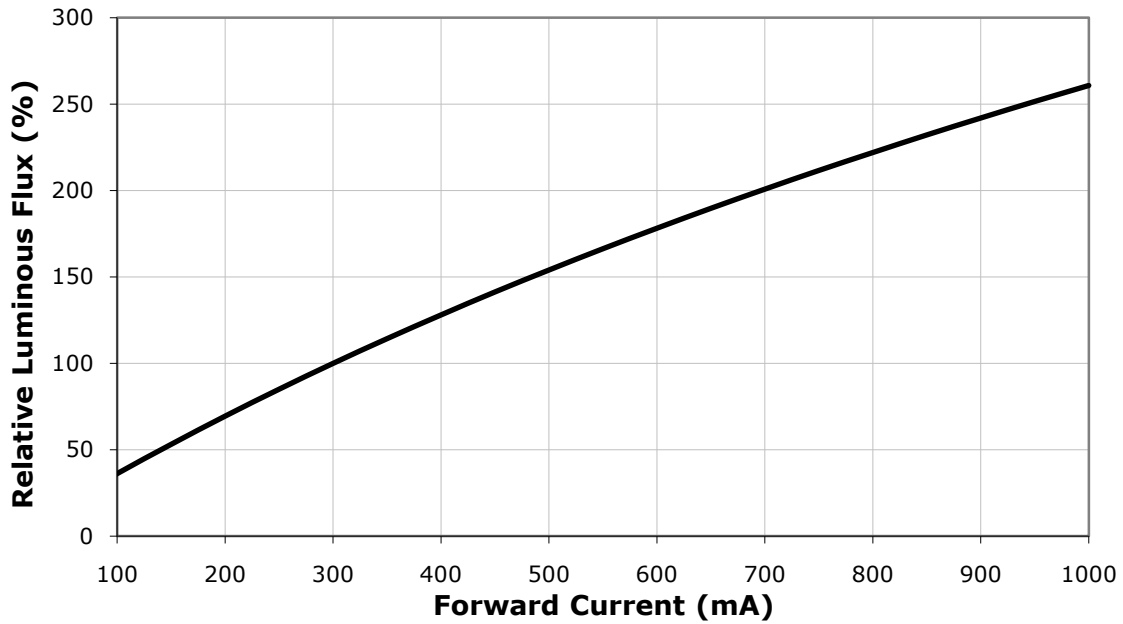
## Relative Flux vs. Junction Temperature ( $I_f = 300$ mA)



## Electrical Characteristics ( $T_j = 25^\circ\text{C}$ )

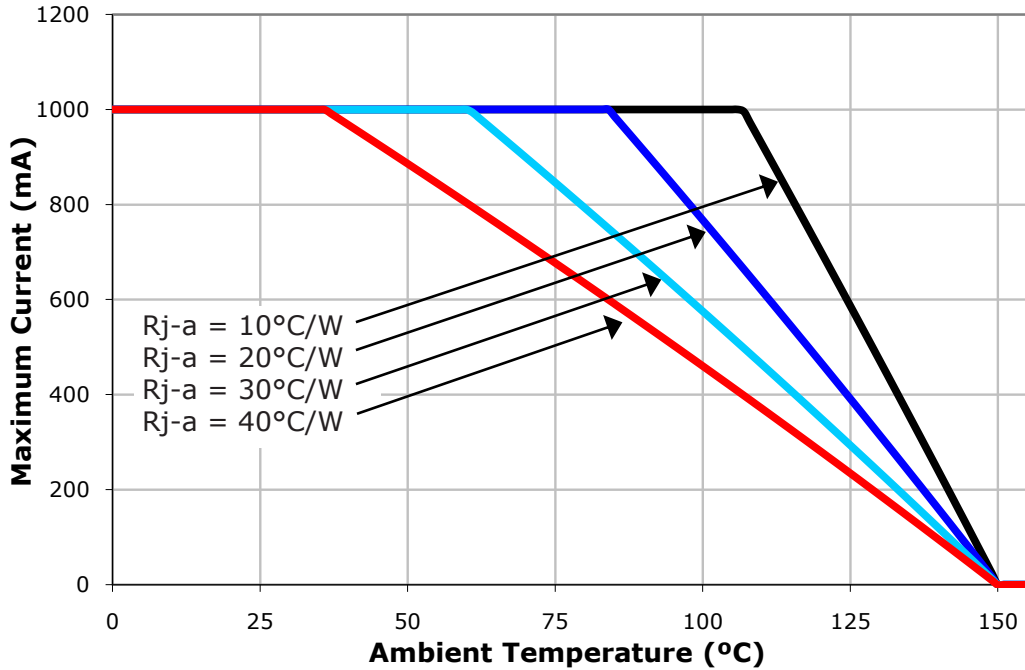


## Relative Flux vs. Current ( $T_j = 25^\circ\text{C}$ )

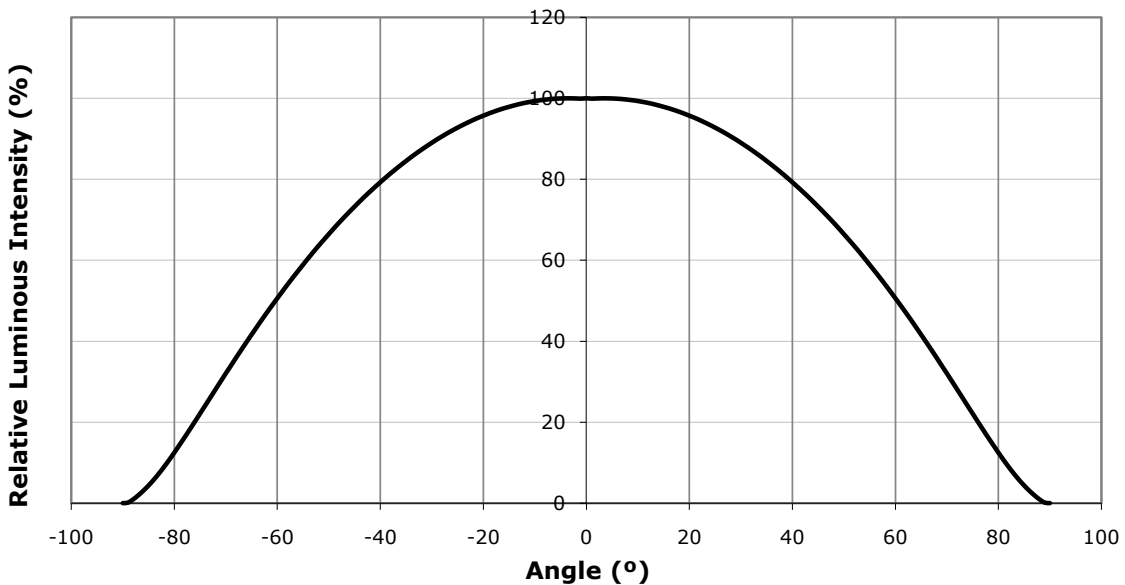


## Thermal Design

The maximum forward current is determined by the thermal resistance between the LED junction and ambient. It is crucial for the end product to be designed in a manner that minimizes the thermal resistance from the solder point to ambient in order to optimize lamp life and optical characteristics.



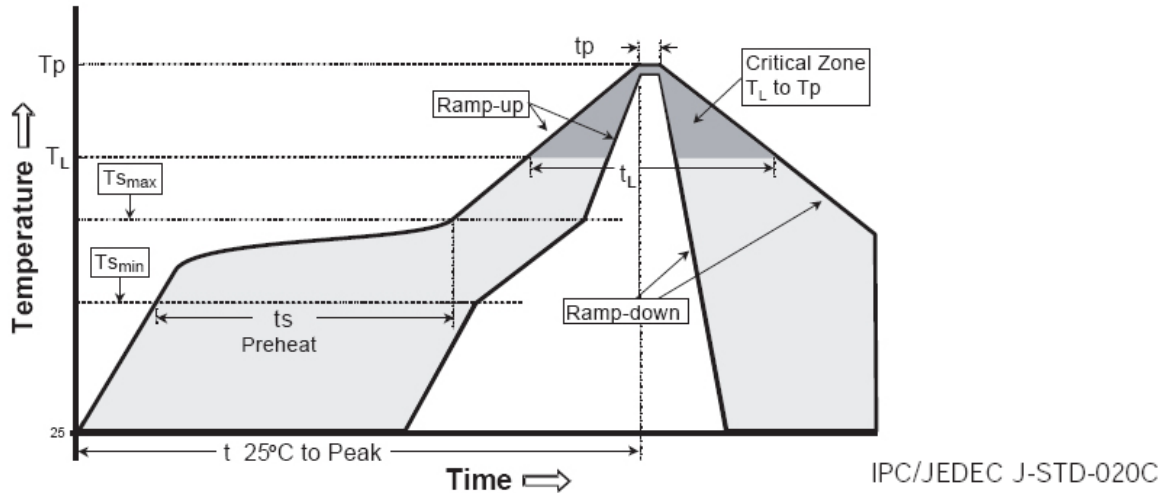
## Typical Spatial Distribution



## Reflow Soldering Characteristics

In testing, Cree has found XLamp MX-6 LEDs to be compatible with JEDEC J-STD-020C, using the parameters listed below. As a general guideline, Cree recommends that users follow the recommended soldering profile provided by the manufacturer of solder paste used.

Note that this general guideline may not apply to all PCB designs and configurations of reflow soldering equipment.



Profile Feature	Lead-Based Solder	Lead-Free Solder
Average Ramp-Up Rate ( $T_{s_{max}}$ to $T_p$ )	3°C/second max.	3°C/second max.
Preheat: Temperature Min ( $T_{s_{min}}$ )	100°C	150°C
Preheat: Temperature Max ( $T_{s_{max}}$ )	150°C	200°C
Preheat: Time ( $t_{s_{min}}$ to $t_{s_{max}}$ )	60-120 seconds	60-180 seconds
Time Maintained Above: Temperature ( $T_l$ )	183°C	217°C
Time Maintained Above: Time ( $t_l$ )	60-150 seconds	60-150 seconds
Peak/Classification Temperature ( $T_p$ )	215°C	260°C
Time Within 5°C of Actual Peak Temperature ( $t_p$ )	10-30 seconds	20-40 seconds
Ramp-Down Rate	6°C/second max.	6°C/second max.
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.

Note: All temperatures refer to topside of the package, measured on the package body surface.



## Notes

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### Lumen Maintenance Projections

Based on internal long-term reliability testing, Cree currently projects cool white and neutral white (chromaticity bins 0A – 6D4) XLamp MX-6 LEDs to maintain an average of 70% or higher lumen maintenance after 10,000 hours, provided the LED is operated with a constant current of up to 500 mA and ambient air temperature around the LED is maintained at or below 85°C.

Based on internal long-term reliability testing, Cree currently projects warm white (chromaticity bins 7A1 – 8D4) XLamp MX-6 LEDs to maintain an average of 70% or higher lumen maintenance after 25,000 hours, provided the LED is operated with a constant current of up to 500 mA and ambient air temperature around the LED is maintained at or below 85°C.

Please read the XLamp Long-Term Lumen Maintenance application note for more details on Cree's lumen maintenance testing and forecasting. Please read the XLamp Thermal Management application note for details on how thermal design, ambient temperature and drive current affect the LED junction temperature.

### ENERGY STAR Recommendation

Cree currently recommends a maximum drive current of 350 mA for XLamp MX-6 white in designs seeking the ENERGY STAR\* 35,000 hour lifetime rating ( $\geq 94.1\%$  luminous flux @ 6000 hours) or 25,000 hour lifetime rating ( $\geq 91.8\%$  luminous flux @ 6000 hours).

\* These lifetime ratings are based on the current ENERGY STAR Solid State Lighting Luminaires V1.1 (December 12, 2008) and ENERGY STAR Integral LED Lamps V1.0 (December 3, 2009) lumen maintenance criteria.

### Moisture Sensitivity

In testing, Cree has found XLamp MX-6 LEDs to have unlimited floor life in conditions  $\leq 30^{\circ}\text{C}$  / 85% relative humidity (RH). Moisture testing included a 168 hour soak at  $85^{\circ}\text{C}$  / 85% RH followed by 3 reflow cycles, with visual and electrical inspections at each stage.

### RoHS Compliance

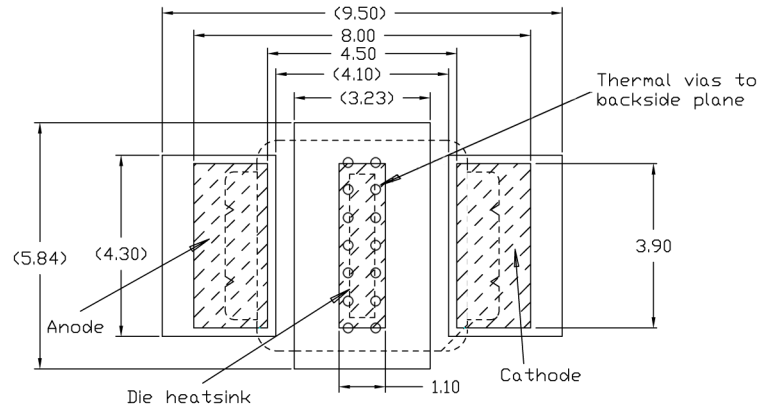
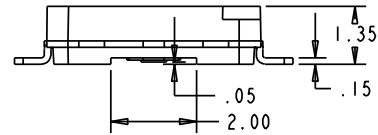
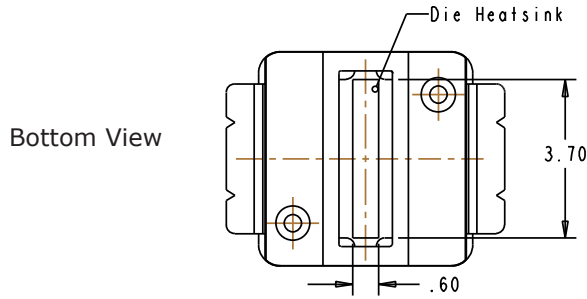
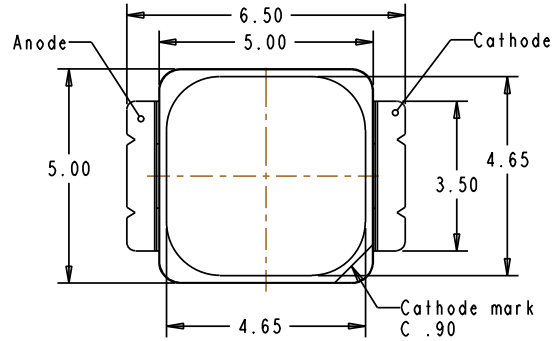
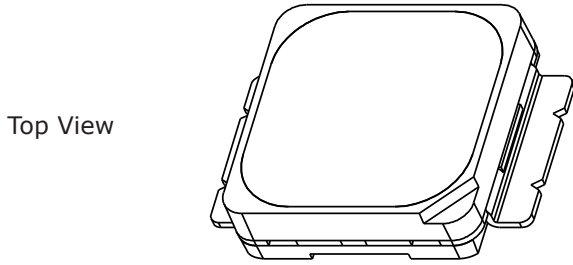
The levels of environmentally sensitive, persistent biologically toxic (PBT), persistent organic pollutants (POP), or otherwise restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS), as amended through April 21, 2006.

### Vision Advisory Claim

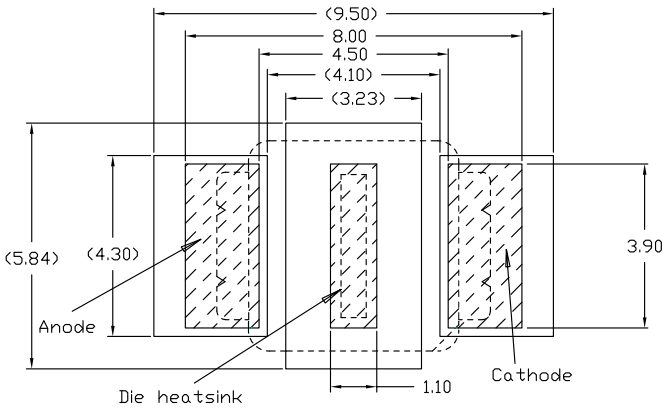
Users should be cautioned not to stare at the light of this LED product. The bright light can damage the eye.

# Mechanical Dimensions (T<sub>A</sub> = 25°C)

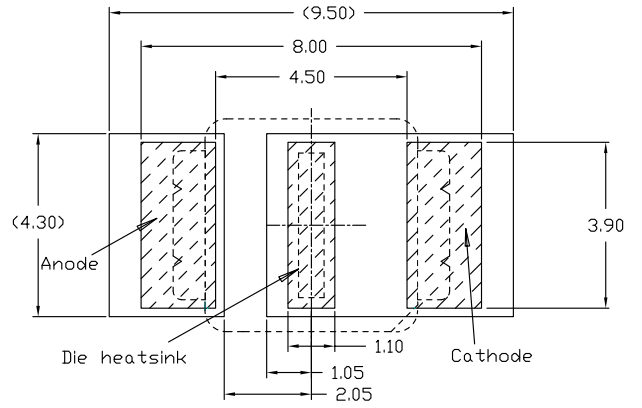
All measurements are ±.13 mm unless otherwise indicated.



Recommended FR4 Solder Pad



Recommended MCPB Solder Pad

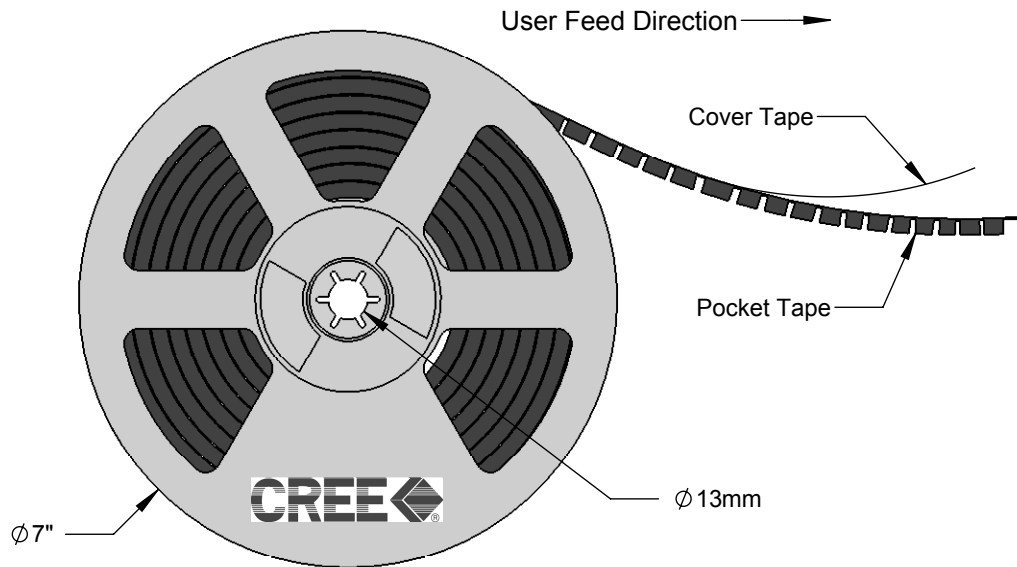
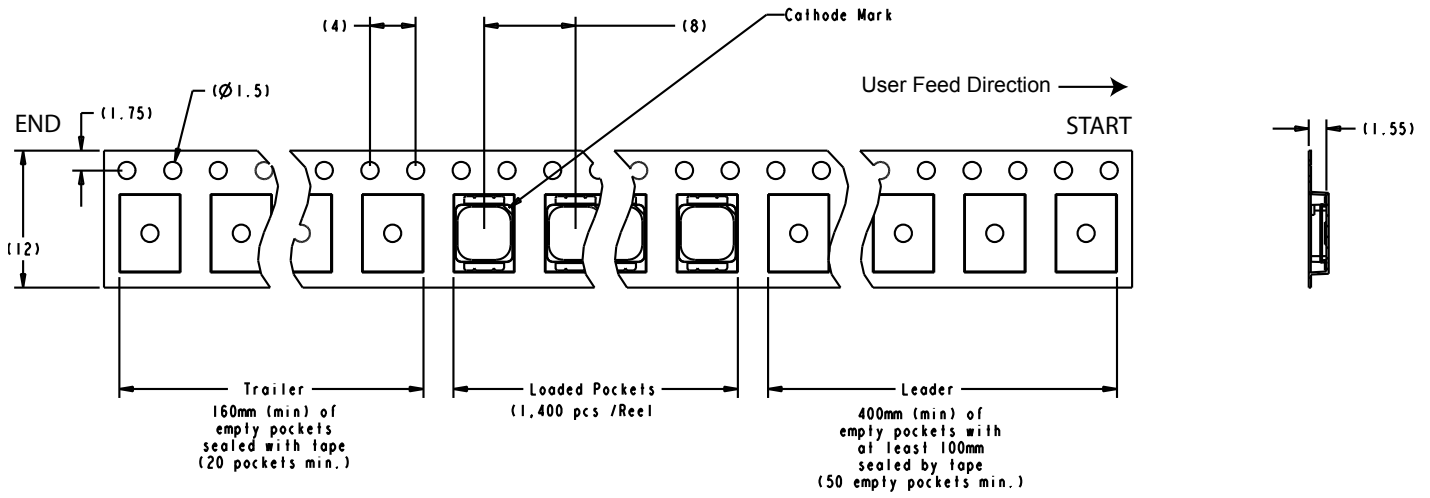


Alternative Solder Pad



# Tape and Reel

All dimensions in mm.



# Packaging

All dimensions in mm.

