

# Introduction

## Purpose

- Provide an Overview of Cree's XLamp XM-L White single die component

## Objective

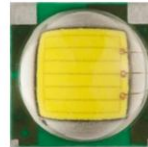
- Give a brief summary of XM-L's performance
- Highlight targeted applications for the XM-L
- Summarize XM-L's Characteristics & Order Codes
- Provide Further Details on XML's performance
- Provide Details on XML's L70 Lifetime TM-21 Projections

## Content

- 12 slides

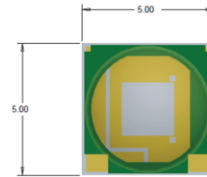
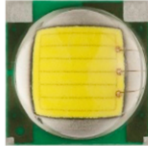
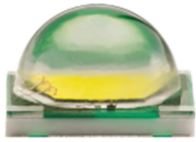
## Content

- 5 Minutes



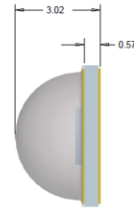
Welcome to the Cree XLamp XM-L product training. This product training module will introduce the Cree XLamp XM-L, discuss the product's features and benefits, summarize XM-L's Characteristics & Order Codes as well as highlight the targeted applications for the XM-L. Finally we will delve into more detail on XM-L's performance and provide details on XM-L's L70 Lifetime TM-21 Projections.

## XLamp XM-L White



### Shatters single-die performance expectations

- **Industry's highest flux & efficacy**
  - Cool White (6500K)
    - Up to 1000 lm @ 3 A (100 LPW)
    - Up to 300 lm @ 700 mA (148 LPW)
  - Warm White (3000K, 80 CRI)
    - Up to 790 lm @ 3A (79 LPW)
    - Up to 240 lm @ 700mA (116 LPW)
- **Enables LED systems with higher efficacy than linear FL**
- **Similar in design to industry-leading XLamp XP package**
  - Lighting class, small optical source size, flexible design



Copyright © 2010, Cree, Inc.

pg. 2



Cree XLamp XM-L White shatters performance expectations for a single die component. XM-L offers the industry's highest flux & efficacy, up to 1000 lumens at 3 Amps providing 100 lumens per watt in a Cool White 6500 Kelvin Color Temperature or up to 300 lumens @ 700 MilliAmps, 148 lumens per watt. In Warm White XM-L also leads the industry offering up to 790 lumens @ 3 Amps providing 79 Lumens Per Watt in a Warm White 3000 Kelvin Color Temperature, or up to 240 Lumens at 700 Milliamps 116 lumens per watt.

## XLamp XM-L White Applications

### Outdoor lighting

- Street & tunnel
- Parking area



Courtesy of Sunovia Energy Technologies, Inc.



Courtesy of Relume

### High-bay lighting

- Industrial
- Warehouse



Courtesy of Dialight

### Large area lighting

- Sport
- Landscape



### Indoor Directional

- Tight-focus downlight
- High lumen track light



Copyright © 2010, Cree, Inc.

pg. 3



This next slide highlights the applications that the XM-L is optimized for. Those applications include: Outdoor Lighting, High-Bay Lighting, Sports Lighting and High Lumen Indoor Directional applications. With the XM-L's industry leading flux & efficacy, you can reduce total system cost by reducing the number of LEDs needed or by achieving a higher efficiency.

## XLamp XM-L Characteristics & Order Codes

	XM-L
Max Current	3000 mA
Thermal Resistance	2.5 °C/W
Viewing Angle	125°
Typ. Vf @ 700 mA	2.9 V

- ANSI-compatible chromaticity bins
- Electrically neutral thermal path
- Symmetric design: matching optical & mechanical centers
- Reflow solderable JEDEC J-STD-020C
- RoHS- & REACH-compliant

Standard White	Cool White	Neutral White	Warm White
CCT (K)	10,000K – 5,000K	5,000K – 3,700K	3,700K – 2,600K
CRI (typ)	75	75	80

Copyright © 2011, Cree, Inc.

pg. 4



This slide shows the high performance characteristics of the XM-L. The maximum drive current is 3000 MilliAmps, and the thermal resistance is 2.5 Degrees Celsius per Watt. The viewing angle is 125 degrees and the typical forward voltage at 700 MilliAmps is 2.9 Voltage.

Similar to the LEDs in the XLamp family, the XM-L is available in ANSI compatible chromaticity bins, has an electrically neutral thermal path, and a symmetric design. In addition, XM-L is also reflow solderable and RoHS & REACH compliant and available in Cool White, Neutral White and Warm White.

XLamp XM-L Standard White Standard Order Codes						
	10,000K – 5,000K	5,000K – 4,200K	4,200K – 3,500K	3,500K – 3,200K	3,200K – 2,900K	2,900K – 2,700K
	01, 02, 03, ...	E3, F4, E4	F5, E5	F6, E6	F7, E7	F8
Min. Flux Bin						
U2						
T6	280	280				
T5	260	260				
T4		240	240	240		
T3			220	220	220	
T2				200	200	200
S6						182

Minimum luminous flux @ 700 mA (lm)

**Example Order Code: XMLAWT-00-0000-000LT50F4**

Copyright © 2011, Cree, Inc. pg. 5 **CREE**

Here are more details on the standard order codes for XM-L. As you can see, the XM-L is available in color temperatures between 2,700 Kelvin and 10,000 Kelvin.

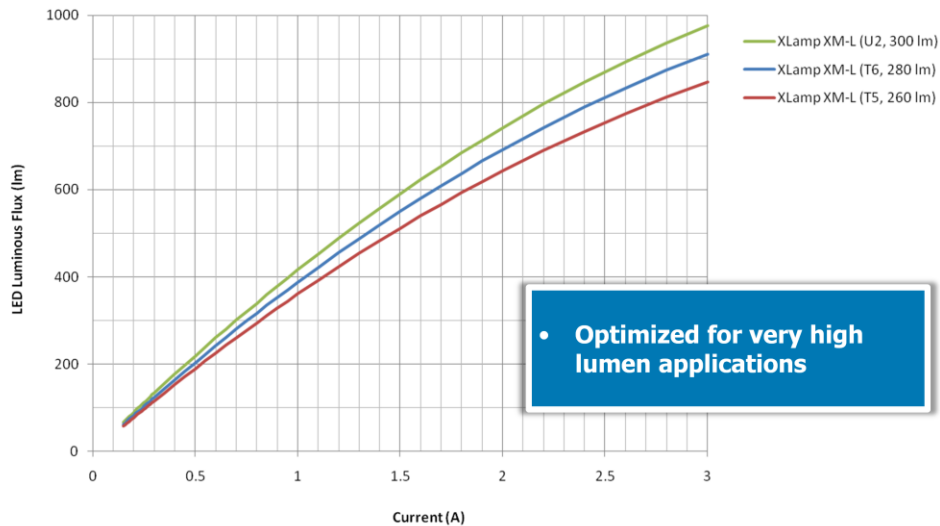
Across the top shows Chromaticity regions

The Left hand column is Cree's Bin Code

The Numbers in the boxes are the luminous flux available at binning current of 700ma, 25C

An Example of how to determine the correct order code is highlighted in green.

## XM-L Delivers 100's of Lumens Efficiently



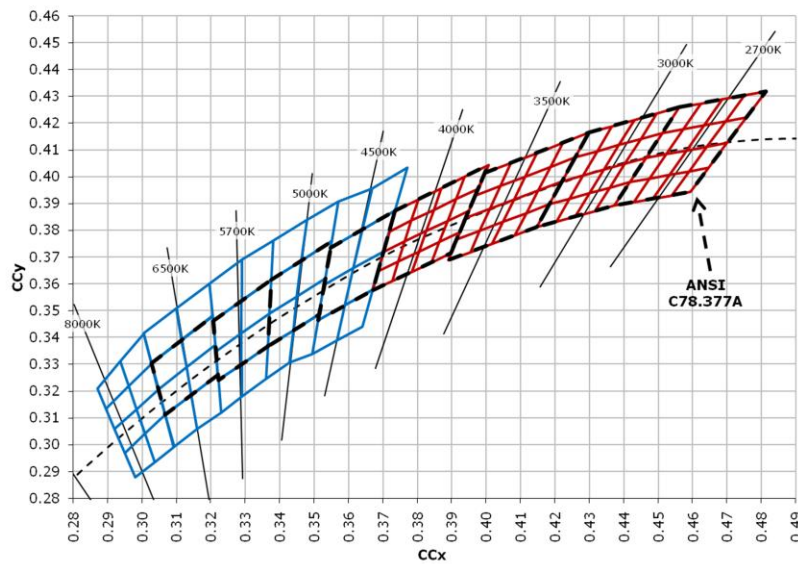
Copyright © 2011, Cree, Inc.

pg. 6



This slide speaks to how well the XM-L performs not only at nominal drive currents, but also the higher drive currents required for very high lumen applications. Being able to drive the XM-L at these drive currents allows customers to reduce the number of components used in a solution, reducing system cost. As you can see from the chart, driving the component at 3 Amps can get you up to 1000 lumens from a single die component.

## XLamp XM-L White Chromaticity Bins (ANSI)

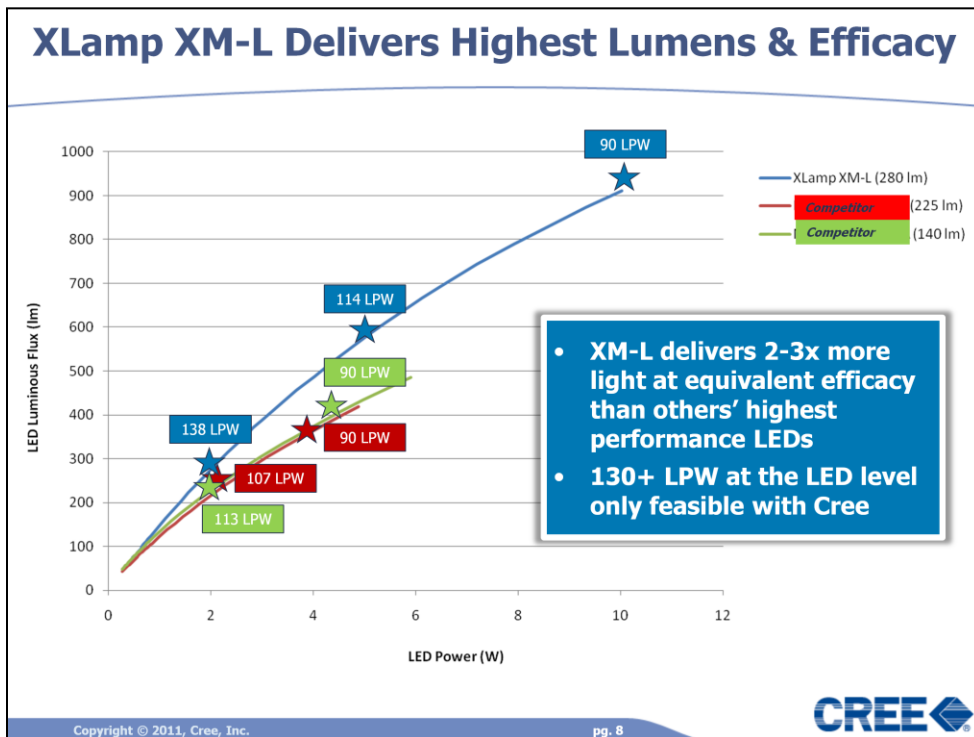


Copyright © 2011, Cree, Inc.

pg. 7



Like other Cree XLamp components, the XM-L is available in standard ANSI Compatible Chromaticity Bins.



This chart shows the performance of XM-L compared to its nearest competitors. At 2 Watts, the XM-L is the only LED that can provide more than 130 lumens per watt. Comparing efficacy, the XM-L is able to maintain an efficacy of 90 Lumens Per Watt at a much higher luminous flux, over 900 lumens compared with competitor parts that can only maintain a 90 Lumens Per Watt efficacy at 3 to 4 hundred Lumens. Again this chart reinforces just how much better the XM-L is compared to the competition.



## Higher Performance LEDs = Lower System Cost

Part		Competitor	Competitor	Cree XLamp XM-L
System Efficacy: 75 LPW	Current	750 mA	800 mA	<b>1900 mA</b>
	# of LEDs & Optics	53	43	<b>20</b>
System Efficacy: 100 LPW	Current	150 mA	320 mA	<b>650 mA</b>
	# of LEDs & Optics	209	93	<b>50</b>
ANSI Bins?		No	No	<b>Yes</b>
Thermal Res. (°C/W)		6	12 (to cathode)	<b>2.5</b>

System assumptions: 10,000 delivered lumens, 90% optical efficiency, 85% electrical efficiency, Tsp = 80°C

Copyright © 2011, Cree, Inc.

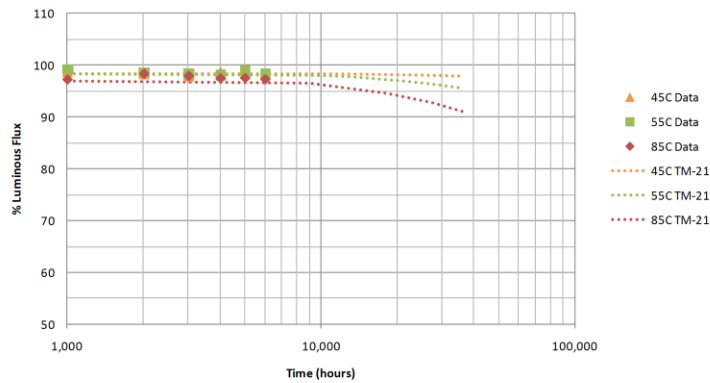
pg. 9



This table shows how the XM-L delivers lower system cost versus the competition. In a 10,000 lumen system, with a efficacy goal of 75 Lumens Per Watt assuming, 90% optical efficiency, 85% electrical efficiency, and a Tsp of 85 degrees, the optimal system using XM-L as a solution would be 20 XM-Ls driven at 1900 MilliAmps. In comparison, competitors would need to use 43-53 LEDs driven at 750- 800 MilliAmps to deliver at the desired efficacy. Using fewer LEDs will reduce the LED spend along with the cost of the rest of the system, as fewer LEDs means a simpler more cost effective design.

In another example, assuming the same parameters and a efficacy goal of 100 Lumens Per Watt, the case for an XM-L based solution is even stronger. To achieve a 10,000 lumen solution at 100 Lumens per watt, you could drive 50 XM-Ls at 650 MilliAmps. To achieve that same level of efficacy, you would need to use 93 LEDs for one competitor and 209 of another competitor at much lower drive currents.

## XLamp XM-L White L70 Lifetime (TM-21)



Current	Ta/Tsp	Test Duration	$\alpha$	$\beta$	Calculated L70	Reported L70
2000 mA	45°C	6,048 hrs	1.459E-07	9.847E-01	2,340,000 hrs	L70 (6k) > 36,300 hrs
2000 mA	55°C	6,048 hrs	9.543E-07	9.887E-01	362,000 hrs	L70 (6k) > 36,300 hrs
2000 mA	85°C	6,048 hrs	2.155E-06	9.834E-01	158,000 hrs	L70 (6k) > 36,300 hrs

### Notes:

- These extrapolations are for informational purposes only and are not a warranty or a specification.
- Extrapolated lifetimes are subject to change without notice.

Copyright © 2011, Cree, Inc.

pg. 10



This slide provides data on the how truly robust the XM-L is. Driven at 2000 MilliAmps, using the TM-21 testing and calculation methodology, the calculated L70 lifetime projection for the XM-L at a Ta/Tsp Temperature of 45 Degrees C is 2.3 Million hours or more than 260 years!

Even at a Ta/Tsp temperature of 85 Degrees C the TM-21 L70 lifetime projection is 158,000 Hours which is over 18 years.

In fact, looking at the above chart, after 6000 hours, even at 85 Degrees C, luminous flux is over 95% of rated lumens.

These performance levels, particularly at 2000 MilliAmps are well above any other component on the market.

## **XLamp XM-L – Summary**

- **The XLamp XM-L shatters expectations of what is possible in a single die component**
- **XM-L is the best component on the market for applications that require thousands of lumens, including outdoor, high bay and sports lights.**
- **XM-L has all of the features and performance characteristics you have come to expect from an XLamp component including a full range of chromaticity options**
- **XM-L industry best efficacy can drive fewer LEDs per system and thus Lower System Cost**
- **Lifetime projections for XM-L are unprecedented at high drive currents.**

The XLamp XM-L shatters expectation of what is possible in a single die component

XM-L is the best component on the market for applications that require thousands of lumens, including outdoor, high bay and sports lights.

XM-L has all of the features and performance characteristics you have come to expect from an XLamp component including a full range of chromaticity options.

XM-L delivers the industry's best efficacy allowing you to use fewer LEDs per system and lowering system cost.

Lifetime projections for XM-L are unprecedented at high drive currents.



PORTABLE

RESIDENTIAL

OFFICE

RETAIL

ARCHITECTURAL

OUTDOOR

**LED lighting: Energy efficient & planet friendly.**

**Cree. Leading the LED lighting revolution.**

Join Cree's LED lighting revolution. We invite you to see how our high-performance, high-efficiency LEDs are lighting up the world.

