



FCM Series Color Mixing Lens for Cree XLamp¹ XM-LTM LEDs

- High efficiency TIR lens
- Available in three beam profiles
- Excellent color mixing

The FCM lens series has been specifically designed to deliver excellent uniformity and color mixing with modern multi-chip LED sources.

A software-optimized aspheric profile enables the generation of three different beam output patterns: narrow, medium, and wide² profiles.

The design of the FCM series maximizes collection of the light emitted by the LED, resulting in a system that delivers illumination in a useful and efficient manner.

Designed to offer excellent color mixing with multi-chip RGBW or multi-chip tunable white LEDs, the FCM is a suitable solution to a wide ranges of applications including:

- Architectural lighting
- Entertainment and stage lighting
- Retail lighting
- Museum lighting
- Variable RGB illumination
- Wall washing
- General illumination
- Any applications requiring excellent uniformity and color mixing



1. XLamp XM-L is a trademark of Cree Inc. For technical specification on LEDs please refer to the datasheet or visit <http://www.cree.com/>
2. Beam angles may vary with LED color, LED binning and LED position

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General Characteristics

Materials

Lens Material	Optical Grade PMMA
Operating Temperature range	-40° C / + 80° C
Storage Temperature range	-40° C / + 80°C

Average transmittance in visible spectrum (400 – 700nm) >90%, as measured using 3mm thick Optical Grade PMMA.

Please note that flow lines and weld lines on the external surfaces of the lenses are acceptable if the optical performance of the lens is within the specification described in the section “OPTICAL CHARACTERISTICS”

IMPORTANT NOTE – Lenses handling and cleaning:

- *Handling: Always use gloves to handle lenses and/or handle the lenses only by the flange. Never touch the outside surfaces of the lenses with fingers; finger oils and contamination will absorb or refract light.*
- *Cleaning: Clean lenses only if necessary. Use only soap and water to clean the surfaces and lenses. Never expose the lenses to solvents such as alcohol, as it will damage the plastic.*

Scope

This datasheet provides information about the FCM lens series.

FCM-N1-R	FCM Narrow Beam
FCM-M1-R	FCM Medium Beam
FCM-W1-R	FCM Wide Beam



Optical Characteristics – On-axis Intensity¹, Beam Angle², Field Angle³

LED	Beam Shape	On-axis Intensity (peak)	Beam Angle (FWHM)	Field Angle (FW10%)
XM-L White	Narrow	8.1 cd/lm	13°	27°
	Medium	3.1 cd/lm	24°	41°
	Wide	0.7 cd/lm	40°	71°
XM-L Color (RGBW)	Narrow	6.2 cd/lm	15°	30°
	Medium	2.9 cd/lm	23°	43°
	Wide	0.6 cd/lm	40°	71°

- (1) To calculate the on-axis intensity (cd), multiply the on-axis value, above, of the lens (cd/lm) by the total flux (lm) of the LED used. See “Illumination Calculations” below. Luminous intensity depends on the flux binning and tolerances of the LEDs. Please refer to the LED datasheet for more details on flux binning.
- (2) FWHM is the full angle where the beam intensity is half the on-axis peak intensity
- (3) Field angle is the full angle where the beam intensity is 10% of the on-axis peak intensity

Example Calculations

To calculate intensity (cd): Find the central spot on-axis intensity (cd/lm) for the lens and then multiply this value by the luminous flux (lm) of the LED. Refer to the LED’s datasheet for typical flux values; drive current versus flux ratios; color temperature and binning characteristics.

Example intensity calculations:

If a Fraen lens with an on-axis intensity of 21 candela per lumen (cd/lm) is used with an LED that produces 105 lumens of flux, the calculations are as follows:

On-axis intensity = (21 cd/lm) x (105 lumens) = 2205 candela on-axis intensity (one LED).

If 12 LEDs are used in a fixture, then the on-axis intensity = 12 LEDs x 2205 candela/LED
= 26460 cd (on-axis – 12 LEDs)

An explanation of illuminance and the effect of distance

One candela at 1-meter distance produces 1 lux. In the above example, the 12 LED fixture produced 26460 candela. If that fixture is illuminating a surface one meter distant, then the *illuminance* on that surface is 26460 lux.

Illuminance decreases with the square of the distance. If you move the fixture so that it is two meters from the surface, then the illuminance falls to 26460 lux/ (2m)² or 6615 lux. Moving the fixture three meters from the surface decreases the illuminance to 26460 lux/(3m)² or 2940 lux.



Beam and Field Angles

Beam and Field Angles are methods of describing the light distribution of a lens. The Beam Angle is expressed as a FWHM value (Full angular Width of the beam where it reaches Half the Maximum intensity). The Field Angle is a similar concept, sometimes expressed as FW10%, and represents the Full Width angle where the beam reaches 10% of maximum intensity.

If the lenses in our example fixture, above, have a Beam Angle of 10° and an on-axis intensity of 26460 cd, then at $\pm 5^\circ$ (half of 10°) the intensity will drop to half of 26460 or 13230 cd. If the Field Angle for the fixture is 19° , then at $\pm 9.5^\circ$ (half of 19°) the intensity should be 10% of 26460 or 2646 cd.

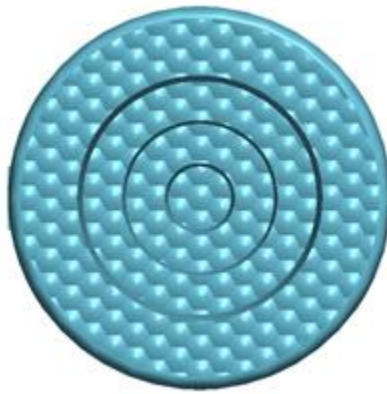
Most lenses have Beam and Field Angles that are rotationally symmetrical about the center axis of the lens. Lenses with an elliptical beam profile or optics with specifically shaped beam profiles are the exception.

Intensity, illuminance, Beam and Field Angle are all important factors to be considered in a fixture design. Some applications may require specific ratios between the Beam and Field Angle values.

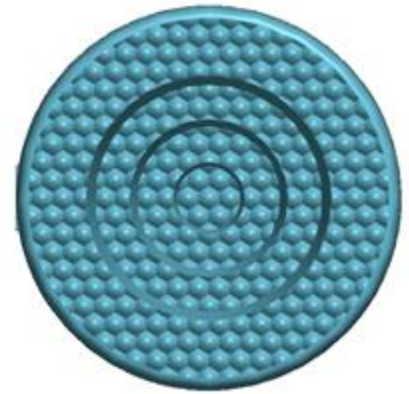
Mechanical Characteristics



Narrow Beam
Small, textured micro-lenses



Medium Beam
Large, textured micro-lenses



Wide Beam
Small, polished micro-lenses

Figure 1: Identifying the lenses by their appearance

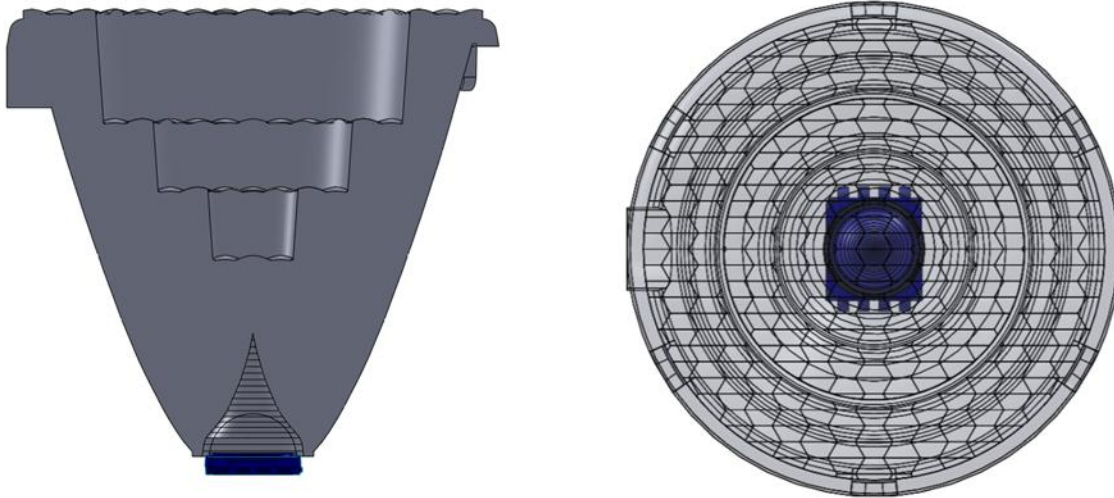
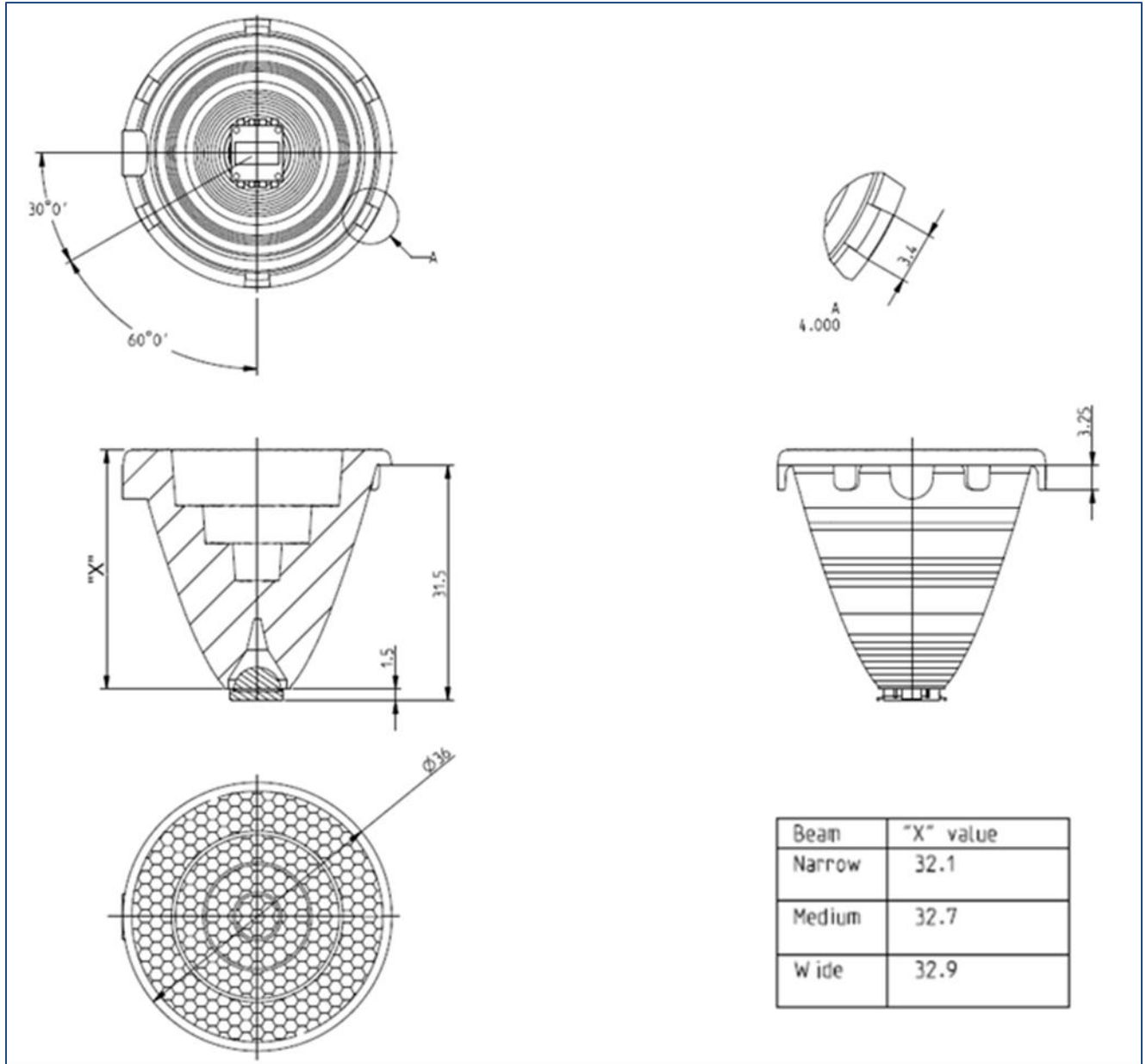


Figure 2: Showing alignment between the lens and the LED

When properly positioned, the bottom of the lens is coincident with the LED package (left) and centered on the dome of the LED (right)



All dimensions in millimeters. Dimension tolerance: $\pm 0.2\text{mm}$

Figure 3: Dimensions of the FCM lens

Mechanical CAD design files available upon request



Ordering Part Numbers

FCM-_1-R



N: Narrow beam
M: Medium beam
W: Wide beam