



## FC Lens series for Cree XLamp® 7090 XR and XR-E LEDs

- **High efficiency**
- **4 beams available**
- **Easy assembly**

The FC lens offers low-profile lenses specifically designed for the XLamp® 7090XR and XR-E LEDs<sup>(1)</sup> from Cree.

A software-optimized aspheric profile enables the generation of several different beam output patterns: narrow, medium, elliptical, and wide beams.

The high collection efficiency reaches 85% of the total flux emitted by the LEDs.

Lens holders are available in black, and provide the proper alignment between the LEDs and the lenses, and set the correct distance between the lens and LED.

The lens holder can be glued to the PCB to provide a secure assembly.

Typical applications are:

- Reading lamps
- Signs
- Architectural Lighting
- Street Lights



Cree® XLamp is a trademark of Cree, Inc. For technical information about these LEDs please refer to the Cree® XLamp datasheet or visit <http://www.cree.com/products/xlamp.asp> or [http://www.cree.com/products/xlamp7090\\_xre.asp](http://www.cree.com/products/xlamp7090_xre.asp)

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|                           |                                                                                                                                 |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>NAFTA Countries</b>    | <b>ARROW</b><br>Telephone: 1-888-9LIGHT1<br>email: <a href="mailto:lightingsolutions@arrow.com">lightingsolutions@arrow.com</a> |
| <b>European Countries</b> | Please contact Fraen S.r.l. for distributor's information<br>Email: <a href="mailto:info@fraen.com">info@fraen.com</a>          |



## General Characteristics

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|                             |                       |
|-----------------------------|-----------------------|
| Lens Material               | Optical Grade PMMA    |
| Holder Material             | PC, black color       |
| Operating Temperature range | -40deg C / + 80 deg C |
| Storage Temperature range   | -40deg C / + 80 deg 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

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This datasheet provides information about the new FC series lenses:

- FC-N2-XR79-0R
- FC-M2-XR79-0R
- FC-W2-XR79-0R
- FC-E2-XR79-0R

The N2 and M2 part numbers have replaced the N1 and M1 part numbers:

- FC-N1-XR79-0
- FC-M1-XR79-0



## Optical Characteristics – Beam Angle (degrees, Full Angle)

| Lens Part Number            | Type of lens    | Cool White<br> | Warm White<br> | Blue<br> | Green<br> | Red<br> |
|-----------------------------|-----------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| FC-N2-XR79-0R               | Narrow beam     | 8                                                                                               | 8                                                                                               | 12                                                                                          | 12                                                                                           | 12                                                                                         |
| FC-M2-XR79-0R               | Medium beam     | 21                                                                                              | 20                                                                                              | 22                                                                                          | 22                                                                                           | 22                                                                                         |
| FC-W2-XR79-0R               | Wide beam       | 29                                                                                              | 28                                                                                              | 28                                                                                          | 28                                                                                           | 28                                                                                         |
| FC-E2-XR79-0R               | Elliptical beam | 8 x 44                                                                                          | 8 x 44                                                                                          | 13x45                                                                                       | 13x45                                                                                        | 13x45                                                                                      |
| FC-N1-XR79-0 <sup>(5)</sup> | Narrow beam     | 9                                                                                               | -                                                                                               | 9                                                                                           | 9                                                                                            | 9                                                                                          |
| FC-M1-XR79-0 <sup>(5)</sup> | Medium beam     | 28                                                                                              | -                                                                                               | 22                                                                                          | 22                                                                                           | 26                                                                                         |

(1) The typical divergence varies with LED color due to different chip size and chip position tolerance. The typical total divergence is the full angle measured where the luminous intensity is half of the peak value.

## Optical Characteristics – On-Axis Intensity (candela/lumen)

| Lens Part Number            | Type of lens    | Cool White<br> | Warm White<br> | Blue<br> | Green<br> | Red<br> |
|-----------------------------|-----------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| FC-N2-XR79-0R               | Narrow beam     | 27                                                                                                | 27                                                                                                | 18                                                                                            | 18                                                                                             | 19                                                                                           |
| FC-M2-XR79-0R               | Medium beam     | 4.1                                                                                               | 4.1                                                                                               | 2.9                                                                                           | 2.9                                                                                            | 3.3                                                                                          |
| FC-W2-XR79-0R               | Wide beam       | 2.4                                                                                               | 2.4                                                                                               | 1.9                                                                                           | 1.9                                                                                            | 2.4                                                                                          |
| FC-E2-XR79-0R               | Elliptical beam | 4.8                                                                                               | 4.8                                                                                               | 3.5                                                                                           | 3.5                                                                                            | 3.5                                                                                          |
| FC-N1-XR79-0 <sup>(5)</sup> | Narrow beam     | 21                                                                                                | -                                                                                                 | 15                                                                                            | 17                                                                                             | 10                                                                                           |
| FC-M1-XR79-0 <sup>(5)</sup> | Medium beam     | 2.7                                                                                               | -                                                                                                 | 3.3                                                                                           | 3.7                                                                                            | 1.9                                                                                          |

- (2) To calculate the on-axis intensity, multiply the on-axis efficiency of the lens (cd/lm) by the total flux of the Cree XLamp 7090® XR and XR-E LED used. See "Illumination Calculations" below. For more detail on flux binning please check the Cree LED datasheet at <http://www.cree.com/products/xlamp.asp>
- (3) Luminous intensity depends on the flux binning and tolerances of the LEDs. Please refer to the Cree XLamp datasheet for more details on flux binning and mechanical tolerances.
- (4) Typical illuminance measured in lux per lumen (E) with typical Cree 7090 XR-E LED. To estimate the illuminance in lux, multiply the typical illuminance E by the flux in lumen of the LED used. See "Illumination Calculations" below.
- (5) FC-N1-XR79-0 and FC-M1-XR79-0 have been replaced by FC-N2-XR79-0R and FC-M2-XR79-0R.



## Illumination Calculations

To calculate peak candela: Find the central spot “on-axis intensity” value in the table above, then multiply this value by the lumens output from your LED (refer to the XLamp LED datasheet <http://www.cree.com/products/pdf/XLamp7090XR-E.pdf> or <http://www.cree.com/products/pdf/XLamp7090XR.pdf> for nominal lumens values). Or for a more accurate calculation, refer to the intensity binning tables [http://www.cree.com/products/xlamp\\_docs.asp](http://www.cree.com/products/xlamp_docs.asp).

### Example calculation:

If the Fraen narrow beam lens FC-N2-XR79-0R is used on a cool white Cree XR-E LED at 350 mA, the typical luminous flux of the LED is 80 lumens:

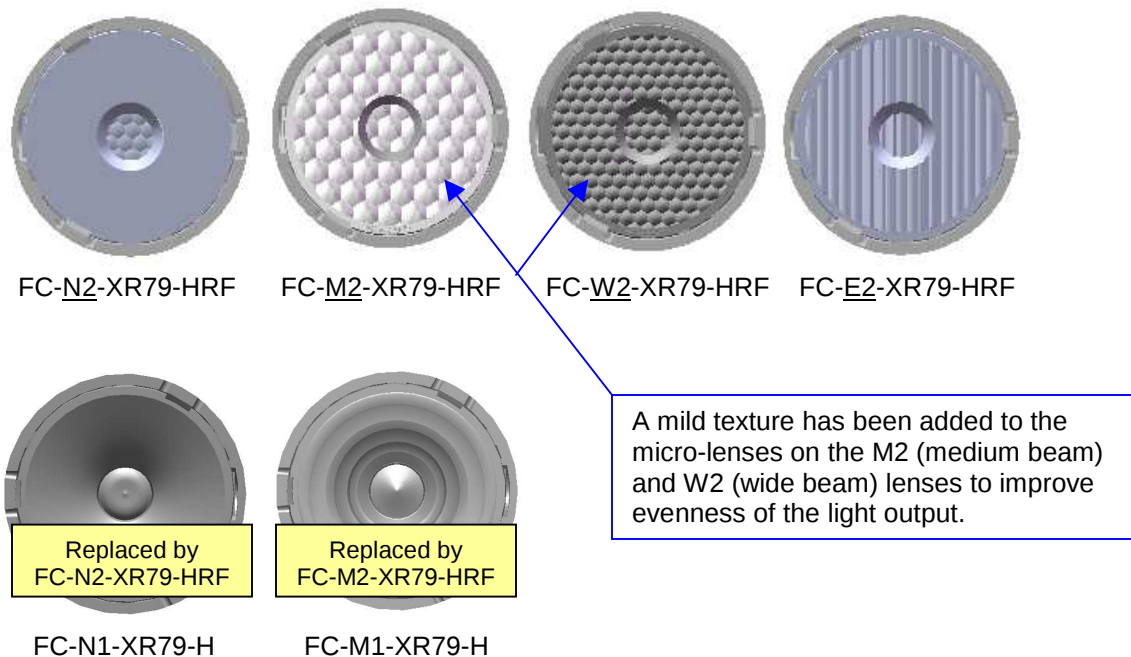
The calculation is: (27 candela/lumen) x (80 lumens) = 2160 candela peak on-axis.

The beam angle specified in the table above is 8 degrees full beam-width measured at half-peak. This means at 4 degrees off-axis (half of 8 degrees), the intensity should be half of 2160 candela, or 1080 candelas.

1 candela at 1-meter distance produces 1 Lux. This means the peak intensity at 1 meter will be 2160 lux. The intensity decreases as a function of the distance squared, so at 2 meters the peak intensity will be  $2160 / (2^2) = 540$  lux. At 3 meters distance, the peak intensity will be  $2160 / (3^2) = 240$  lux.

## Mechanical Characteristics

**Figure 1. Identifying the lenses by their front views**

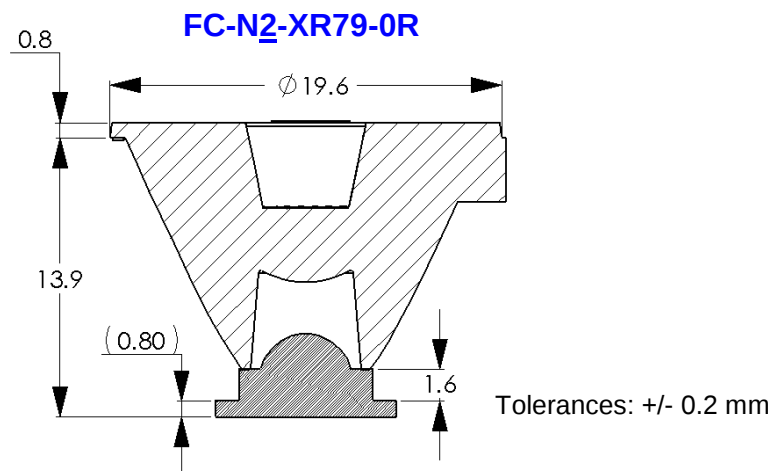




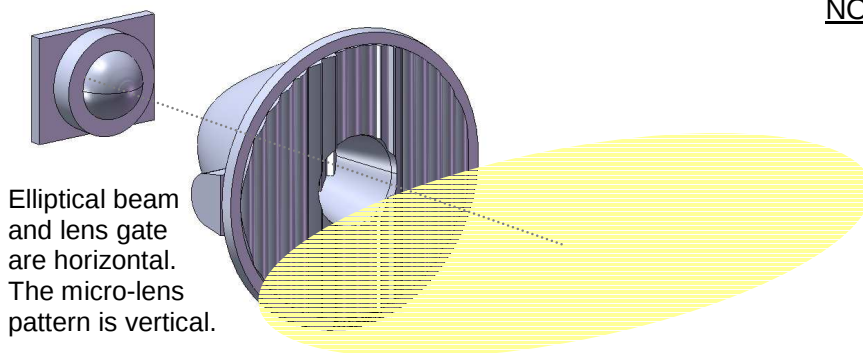
The FC series lenses are available either assembled to a holder or without a holder. The holder provides the correct alignment (concentricity, height, and orientation) of the lens to the LED. Orientation control is important for the elliptical beam lens.

### **Figure 2. Correct vertical distance between FC lens and 7090 XR-E LED**

**NOTE:** If the FC lens is used with no lens holder, the user must provide a mechanical method to set the correct distance between the lens and LED. For example, the lens flange can be located in the lamp housing to center the lens to the LED and establish 13.9 mm from the lens flange to the user's PC board. For N2, M2, W2, E2 lenses, the lens touches the LED.



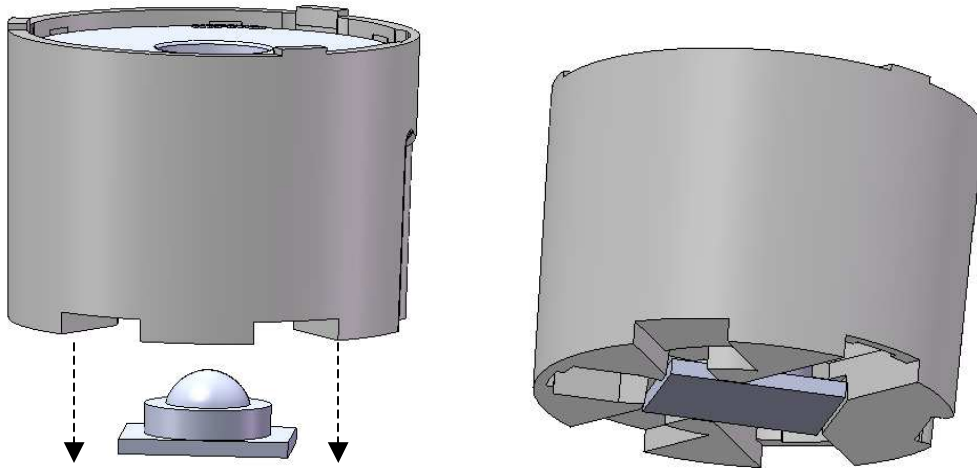
### **Figure 3. Elliptical beam orientation**



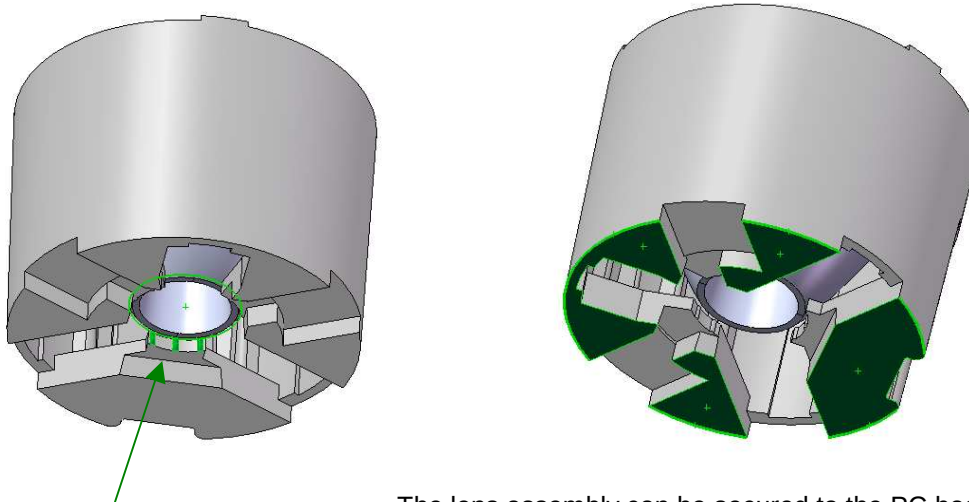
To produce a horizontal elliptical beam, the lens needs to be orientated such that the micro-lenses are positioned vertically. The elliptical beam lens assembly (with holder) will only fit the Cree LED in this orientation (with elliptical beam and rectangular LED substrate aligned). The LED orientation on the PC board should be coordinated with the beam orientation.

**NOTE:** The elliptical beam lens produces a beam shape that is perpendicular to the microlens pattern on the output face of the lens. The lens holder is designed to align the elliptical pattern with the rectangular shape of the Cree LED substrate. It is important to consider the orientation of the LEDs and the desired elliptical beam orientation when designing the printed circuit board layout.

**Figure 4. Installation of lens assembly onto Cree LED**



The new FC-N2-XR79-HRF (and M2, W2 and E2) lens assemblies will fit onto the Cree LED at only 2 orientations: 0 degrees and 180 degrees. The bottom of this new –HRF lens holder has a rectangle shape to control lens orientation (important for “E2” elliptical beam lens application). After installation, the bottom of the holder should be at the same datum/plane as the bottom of the Cree LED.



Small crush-ribs inside the round hole will center the lens assembly on the round body of the Cree LED.

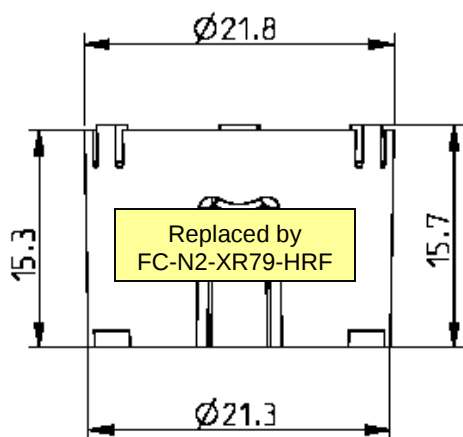
The lens assembly can be secured to the PC board by using glue or silicone RTV. To avoid glue on the lens and LED, apply it along the outside diameter edge, or apply a very thin film on areas shown in green.

**CAUTION:** Do not use instant glue (containing cyanoacrylates). Always test the glue on a sample assembly and check the results and performance 24 hours later. Some adhesives produce fumes that will damage the surfaces of the plastic lens, lens holder, or LED.

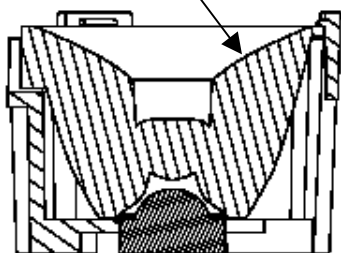
**Figure 5. Overall dimensions of FC- 2-XR79-HRF series lens assemblies**

The new FC- 2-XR79-HRF assemblies (shown at right) are ~ 0.4 mm larger diameter than the previous FC- 1-XR79-H assemblies shown below.

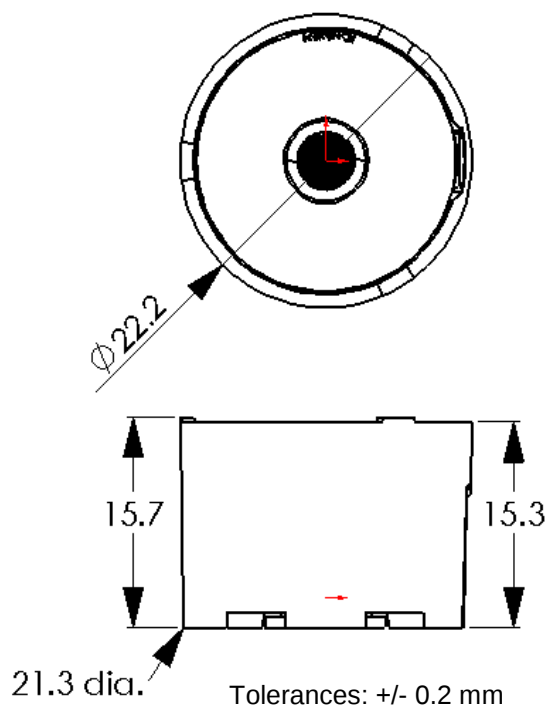
### FC-N1-XR79-H



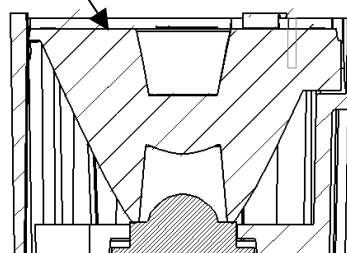
"Curved-top" lens



### FC-N2-XR79-HRF

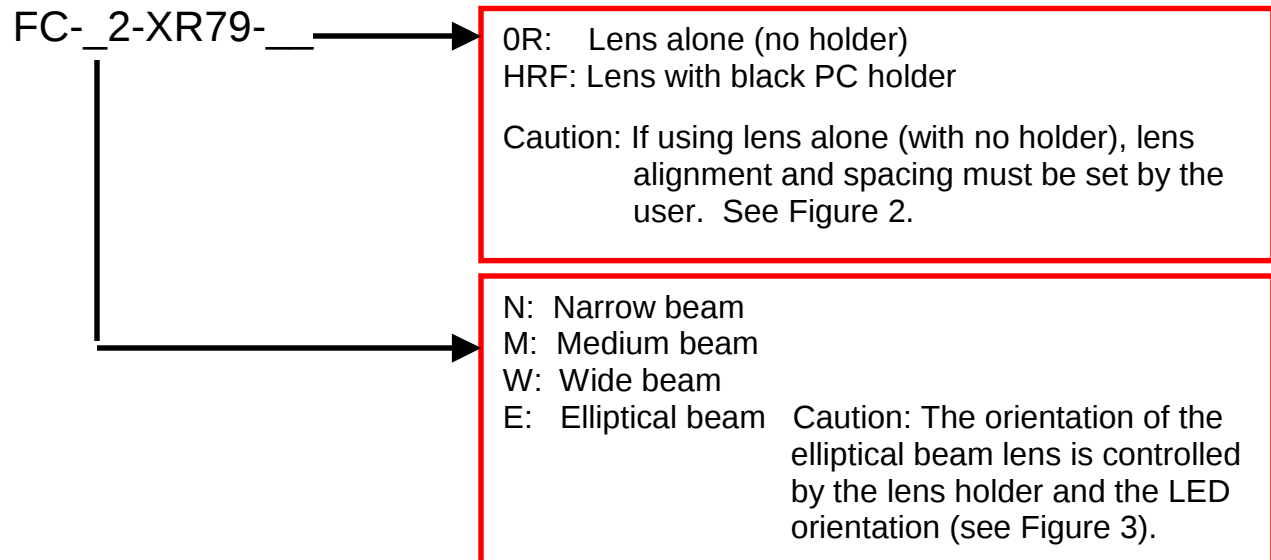


"Flat-top" lens





## Ordering part numbers



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| Rev | Date               | Author       | Description                                                                                                   |
|-----|--------------------|--------------|---------------------------------------------------------------------------------------------------------------|
| 05  | 16 October, 2007   | C. Jones     | Texture added to M2 and W2 lenses to improve homogeneity (evenness) of light output.                          |
| 04  | 05 September, 2007 | C. Jones     | Replaced N1 and M1 with N2, M2, W2, and E2 family. Added figures 2,3, 4, and 5 and illumination calculations. |
| 03  | 26 March 2007      | D. DeGaetano | Added Wide and Elliptical timing of official release                                                          |
| 02  | 4 December 2006    | D. DeGaetano | Revised holder mechanical drawing                                                                             |
| 01  | 27 November 2006   | D. DeGaetano | Official Datasheet                                                                                            |
| 00  | 10 October 2006    | D. DeGaetano | Preliminary Datasheet                                                                                         |