FNP Lens series
for Lumileds[1] LEDs

- **High efficiency design**
- **5 beams patterns available**

The FNP lens offers low-profile lenses specifically designed for compatibility with LEDs from Lumileds Corporation.

A software-optimized aspheric profile enables the generation of several different beam output patterns: narrow, narrow spot, medium, elliptical, and wide beams[2].

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

Typical applications are:

- Reading lamps
- Architectural Lighting
- Entertainment Lighting
- Interior Lighting

(1) For technical information about Lumileds LEDs please refer to the manufacturer website: http://www.lumileds.com/

(2) Typical beam divergence varies with LED type and color.

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General Characteristics

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 – Lens 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

FNP series lenses:

- FNP-N1-N083-0R
- FNP-N2-N083-0R
- FNP-M1-N083-0R
- FNP-W1-N083-0R
- FNP-E1-N083-0R

Optical Characteristics – On-axis Intensity[3], Beam Angle[4], Field Angle[5]

LED	Beam Shape	On-axis intensity (peak)	Beam Angle (FWHM)	Field Angle (FW10%)	"D"[6]
LUXEON C	Narrow	9.3 cd/lm	13°	28°	.9 mm
	Narrow Spot	21 cd/lm	9°	20°	
	Medium	4.2 cd/lm	21°	39°	
	Wide	1.5 cd/lm	40°	36°	
	Elliptical	4 cd/lm	11° x 45°	22° x 65°	
LUXEON FlipChip 10	Narrow	6.3 cd/lm	14°	44°	.4 mm
	Narrow Spot	12.9 cd/lm	10°	23°	
	Medium	3.1 cd/lm	22°	45°	
	Wide	1.4 cd/lm	40°	63°	
	Elliptical	2.9 cd/lm	12° x 45°	30° x 64°	
LUXEON TX	Narrow	5.8 cd/lm	15°	35°	.6 mm
	Narrow Spot	10.1 cd/lm	11°	28°	
	Medium	3.2 cd/lm	23°	46°	
	Wide	1.6 cd/lm	38°	60°	
	Elliptical	2.9 cd/lm	12° x 42°	31° x 66°	

(3) 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 "Example 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.
(4) FWHM is the full angle where the beam intensity is half the on-axis peak intensity.
(5) Field angle is the full angle where the beam intensity is 10% of the on-axis peak intensity.
(6) Distance "D" required between bottom of lens and printed circuit board. See Figure 2.

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Example Calculations

To calculate intensity in candela (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 datasheet for typical flux values, drive current versus flux ratios, and color temperature and binning characteristics.

Example intensity calculations:

If a Fraen lens with an on-axis intensity of 10.1 candela per lumen (cd/lm) is used with an LED that produces 150 lumens of flux, the calculations are as follows:

On-axis intensity = (10.1 cd/lm) x (150 lumens) = 1515 candela on-axis intensity (one LED).

If 12 LEDs are used in a fixture, then the on-axis intensity = 12 LEDs x 1515 candela/LED
= 18180 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 18180 candela. If that fixture is illuminating a surface one meter distant, then the *illuminance* on that surface is 18180 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 18180 lux/ $(2m)^2$ or 4545 lux. Moving the fixture three meters from the surface decreases the illuminance to 18180 lux/$(3m)^2$ or 2020 lux.

Beam and Field Angles

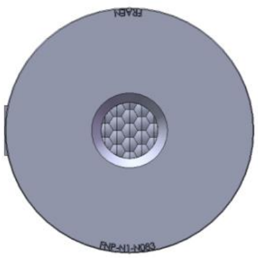
Beam and Field Angles are methods of describing the light distribution of a lens. The Beam Angle is expressed as a FWHM value (Full angular Width of the beam where it reaches Half the Maximum intensity). The Field Angle is a similar concept, sometimes expressed as FW10%, and represents the Full Width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

If the lenses in our example fixture, above, have a Beam Angle of 11° and an on-axis intensity of 18180 cd, then at ± 5.5° (half of 11°) the intensity will drop to half of 18180 or 9090 cd. If the Field Angle for the fixture is 28°, then at ± 14° (half of 28°) the intensity should be 10% of 18180 or 1818 cd.

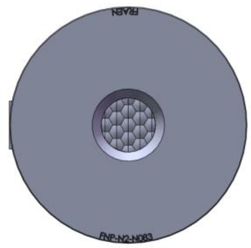
Most lenses have Beam and Field Angles that are rotationally symmetrical about the center axis of the lens. Lenses with an elliptical beam profile or optics with specifically shaped beam profiles are an exception.

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.

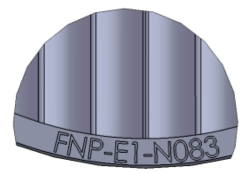
Mechanical Characteristics



FNP-N1-N083-0R
Lens has a *textured*
front surface



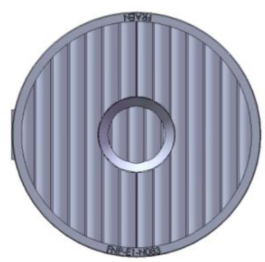
FNP-N2-N083-0R
Lens has a *polished*
front surface



All lenses have their part number
on the lens flange

FNP-M1-N083-0R
Lens has *lightly textured* micro
lenses on front surface

FNP-W1-N083-0R
Lens has *polished* micro
lenses on front surface



FNP-E1-N083-0R
Lens has *ribbed* micro lenses
on front surface

Figure 1. Identifying the lenses by their front views

NOTE: The user must provide a mechanical method to set the correct position of the lens on the LED.

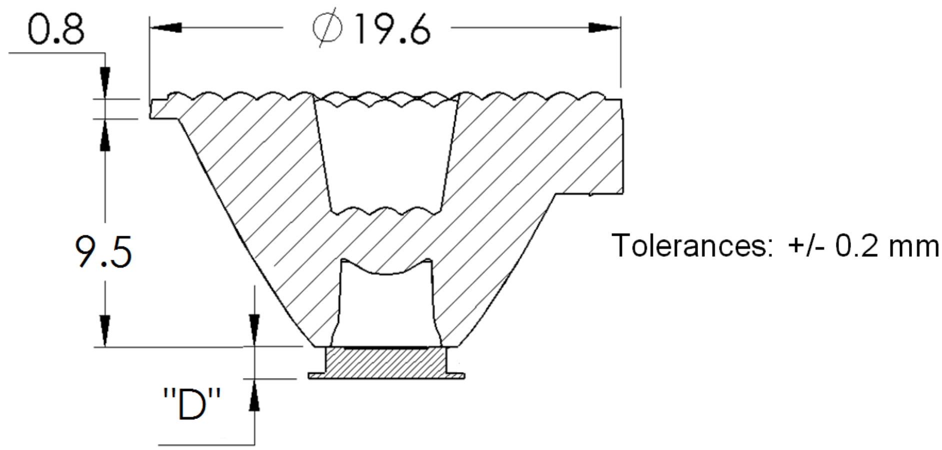
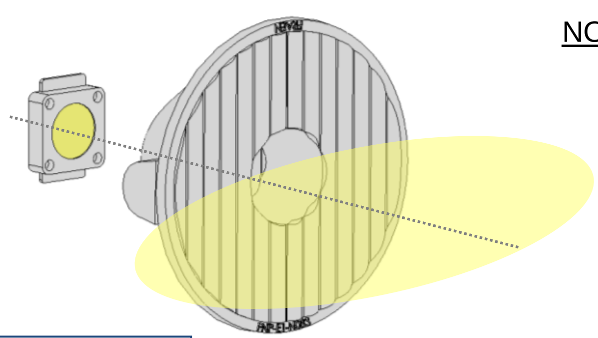


Figure 2. Correct vertical position of the FNP lens and LED

NOTE: A generic LED package is shown in this datasheet to illustrate LED and optic placement. The distance, "D" between the LED and bottom of the optic shown above is measured relative to the bottom of the LED (top of printed circuit board). Refer to the LED datasheet for LED-specific dimensions.



NOTE: The FNP-E1 elliptical beam lens produces a beam shape that is perpendicular to the micro-lens ribs on the output face of the lens. The lens holder should be designed to align the elliptical rib pattern with the LED package such that the elliptical output is oriented as desired. It is important to consider the orientation of the LEDs and the desired elliptical beam orientation when designing the printed circuit board/lens holder.

The LED contacts and micro-lens ribs are *vertical*.

The elliptical beam and lens gate are *horizontal*.

Figure 3. Elliptical beam orientation

Ordering Part Numbers

FNP-__-N083-0R

0R: no holder

Caution: Lens alignment and spacing must be set by the user (see Figures 2 and 3).

N1: Narrow Beam
N2: Narrow Spot
M1: Medium Beam
W1: Wide Beam
E1: Elliptical beam

Caution: The orientation of the elliptical beam lens is controlled by the lens orientation. See Figure 3.

For assistance, please contact Fraen http://www.fraen.com/optics/contact-us/.