FLP4 Series Quad-Lens
for Nichia NCSx119 and NCSx219[1] LEDs

- **High efficiency**
- **Four LED capacity**
- **Compact enough for MR-16 sized applications**

The FLP4 Quad-Lens offers a compact, 50mm diameter 4-up optic suitable for use in MR16 applications.

The FLP4 Quad-Lens has been specifically designed to realize maximum performance when used with today's high output LEDs. The quad-lens' high collection efficiency typically delivers up to 85% of the total flux emitted by the LEDs.

A software-optimized aspheric profile enables the generation of four different beam patterns: Narrow, Medium and Wide beams[2].

The FLP4 Quad-Lens consists of four PMMA lenses in a polycarbonate holder, providing proper optic alignment and easy installation into fixtures.

Mechanical attachment features are varied and include legs (for heat staking), a central boss (for screw attachment) and a mounting flange (for retaining rings).

Typical applications are:

- MR-16 LED lamps
- Reading Lamps
- Task Lighting
- Architectural lighting
- General illumination
- Applications requiring a compact light source with high on-axis intensity

(1) For technical information about Nichia NCSx119/219 LEDs please refer to the Nichia LEDs datasheet web-link: http://www.nichia.co.jp/en/product/led.html

(2) Typical beam divergence may change with LED color temperature and binning.

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General Characteristics

Materials

Lens Material	Optical Grade PMMA
Holder Material	Polycarbonate: Black, White, Transparent
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 tri-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 FLP4 Quad-lens for Nichia NCSxx19 LEDs.

Beam Angle	Black Holder	White Holder	Transparent Holder
Narrow Beam	FLP4-N1-SPL-HLC	FLP4-N1-SPL-HLCW	FLP4-N1-SPL-HLCT
Medium Beam	FLP4-M1-SPL-HLC	FLP4-M1-SPL-HLCW	FLP4-M1-SPL-HLCT
Wide Beam	FLP4-W1-SPL-HLC	FLP4-W1-SPL-HLCW	FLP4-W1-SPL-HLCT

Optical Characteristics[1] – On-axis Intensity[2], Beam Angle[3], Field Angle[4]

LED	Beam Shape	On-axis Intensity (peak)	Beam Angle (FWHM)	Field Angle (FW10%)
119 White	Narrow	13.4 cd/lm	12°	24°
	Medium	3.6 cd/lm	24°	44°
	Wide	1.4 cd/lm	41°	63°
219 White	Narrow	13.7 cd/lm	12°	24°
	Medium	3.6 cd/lm	24°	44°
	Wide	1.4 cd/lm	41°	63°

(1) Typical performance. Optical characteristics may change with LED color, color temperature and binning
(2) 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.
(3) FWHM is the full angle where the beam intensity is half the on-axis peak intensity
(4) 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 FLP4 lens with an on-axis intensity of 7.6 candela per lumen (cd/lm) is used with an LED that produces 103 lumens of flux, the calculations are as follows:

On-axis intensity = (7.6 cd/lm) x (103 lumens) = 783 candela on-axis intensity (one LED).

With four LEDs used with an FLP4, then the on-axis intensity = 4 LEDs x 783 candela (per LED)
= 3132 cd (on-axis – 4 LEDs)

An explanation of illuminance and the effect of distance

One candela at 1-meter distance produces 1 lux. In the above example, the four LEDs in a quad-lens produced 3132 candela. If that fixture is illuminating a surface one meter distant, then the *illuminance* on that surface is 3132 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 3132 lux/ $(2m)^2$ or 783 lux. Moving the fixture three meters from the surface decreases the illuminance to 3132 lux/$(3m)^2$ or 348 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.

The FLP4 lens in our example, above, has a Beam Angle of 14.5° and an on-axis intensity of 3132 cd. At ± 7.25° (half of 14.5°) the intensity will drop to half of 3132 or 1566 cd. The Field Angle for the FLP4 is 30°. At ± 15° (half of 30°) the intensity should be 10% of 3132 or 313 cd.

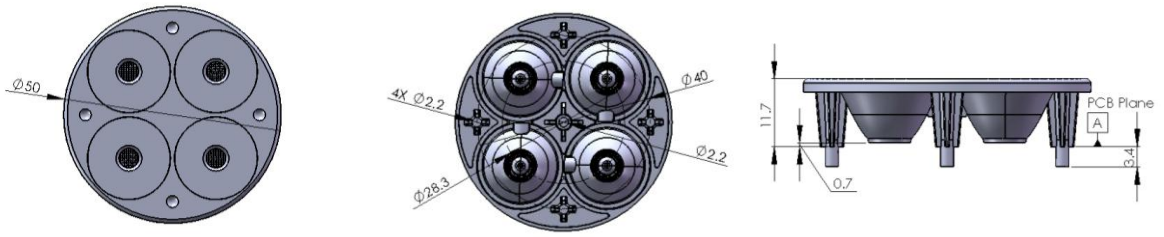
Most lenses have Beam and Field Angles that are rotationally symmetrical about the center axis of the lens. Lenses with an elliptical beam profile or optics with specifically shaped beam profiles are the exception.

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 - Polished Face | Medium - Textured Microlenses | Wide - Polished Microlenses

Figure 1 – Identifying the FLP4 quad lenses by their appearance



All dimensions in millimeters

Figure 2: FLP4 layout and dimensions
(Mechanical CAD files available)

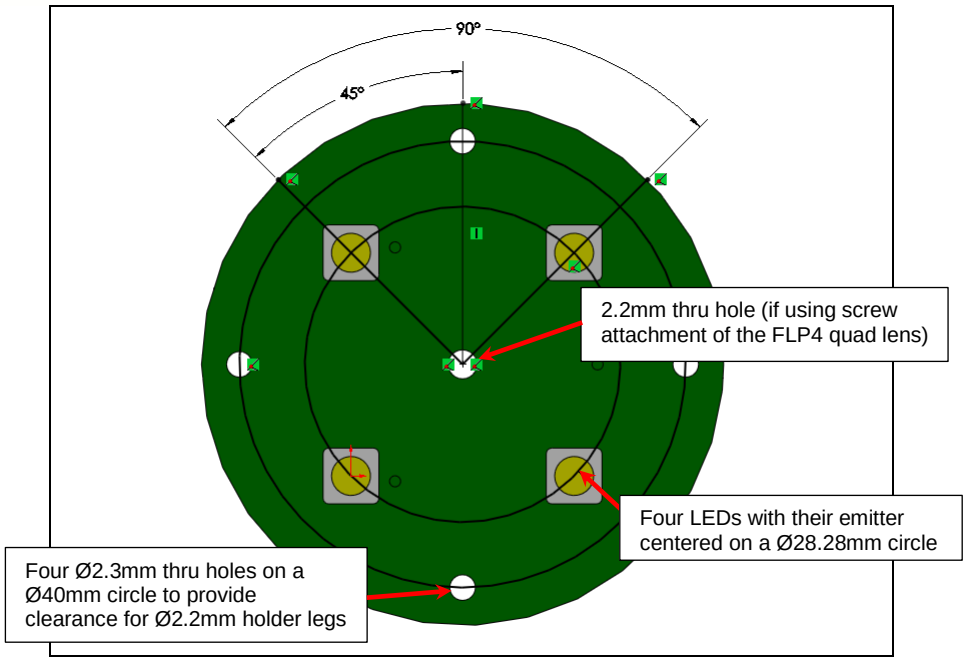


Figure 3: Layout details of the PCB with LEDs

Ordering Part Numbers

FLP4-_1-SPL-[ ]

HLC: Lens in a black holder
HLCW: Lens in a white holder
HLCT: Lens in a transparent holder

N – Narrow Beam
M – Medium Beam
W – Wide Beam