

FLP “Flat-top” Series Lenses for LUXEON™ K2 LEDs

- **High efficiency**
- **Available in 4 different beams and 2 different lens holders**

The FLP series offers 4 lenses specifically designed for the Lumileds (1) LUXEON® K2 LEDs.

A software-optimized aspheric profile combined with a shaped front surfaces and Fresnel profiles, provide 4 different output patterns: narrow, medium, wide, and elliptical. The high collection efficiency reaches 85% of the total flux emitted from the LED.

Each of these 4 lenses can be used alone on the LUXEON® K2 LEDs, or with the Fraen lens holder. The lens holder assures the proper relative placement of the lens on the LED. Screws, adhesive, or heat-staking the 3 legs of the holder to the customer's PCB or heat sink provides an excellent optical and mechanical assembly (see Fraen Application Note for heat-staking FAN01-EN, at www.fraensrl.com).

Typical applications are:

- General illumination
- Architectural Lighting
- Flashlights
- Most applications where a compact light source is required.



- (1) LUXEON® K2 is a trademark of Lumileds Lighting, LLC. For technical specification on LEDs please refer to the LUXEON® K2 datasheet or visit <http://www.luxeon.com/> or [Luxeon K2](#)
- (2) Typical beam divergence may change with different color LEDs.

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General Characteristics

Lens Material	Optical Grade PMMA
Holder Material	PC/ABS
Operating Temperature range	-40deg C / + 95 deg C
Storage Temperature range	-40deg C / + 95 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 alcohol, as it will damage the plastic.

Optical Characteristics:

Typical total beam divergence, FWHM (degrees) (3)

Lens Part Number	Beam Shape	Luxeon K2 LEDs				Luxeon I and III Lambertian		
		Red, Orange, Amber 	Green Cyan, Blue 	Cool White 	Warm White 	Red, Orange, Amber 	Green Cyan, Blue 	Cool White 
FLP-N4-LLK2-0R	Narrow	12	12	11	11	See note (4)	See note (4)	See note (4)
FLP-M4-LLK2-0R	Medium	22	23	20	24	See note (5)	See note (5)	See note (5)
FLP-W4-LLK2-0R	Wide	42	45	44	44	38	38	38
FLP-E4-LLK2-0R	Elliptical	13x48	14x50	13x50	13x48	10x44(I) 14x44(III)	11x44	12x45



		Typical on-axis efficiency (candela/lumen) (6)(7)								
		Luxeon K2 LEDs					Luxeon I / III Lambertian			
Lens Part Number	Beam Shape	Red, Orange, Amber 	Green Cyan 	Blue 	Cool White 	Warm White 	Red, Orange, Amber 	Green Cyan 	Blue 	Cool White 
FLP-N4-LLK2-0R	Narrow	24.8	24.0	*	15	15	See note (4)	See note (4)	See note (4)	See note (4)
FLP-M4-LLK2-0R	Medium	5.8	6.8	*	3.9	4.0	See note (5)	See note (5)	See note (5)	See note (5)
FLP-W4-LLK2-0R	Wide	2.3	2.7	*	1.8	1.8	2.1 (I) 2.2 (III)	2.8 (I) 3.2 (III)	1.9 (I) 2.3 (III)	2.0 (I) 2.6 (III)
FLP-E4-LLK2-0R	Elliptical	6.1	6.5	*	4.1	4.1	7.2 (I) 3.4 (III)	8.0 (I) 5.8 (III)	6.1 (I) 4.8 (III)	7.0 (I) 6.0 (III)

* These values have not been measured.

- (3) 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.
- (4) For Narrow beam when using Luxeon I Lambertian LED or Luxeon III Lambertian LED, use Fraen part number FLP-HNB3-LL01-0. http://www.fraensrl.com/images/FLP_Lens_Series_Datasheet.pdf
- (5) For Medium beam when using Luxeon I Lambertian LED or Luxeon III Lambertian LED, use Fraen part number FLP-HMB3-LL01-0. http://www.fraensrl.com/images/FLP_Lens_Series_Datasheet.pdf
- (6) To calculate the on-axis intensity, multiply the on-axis efficiency of the lens (cd/lm) by the total flux of the Luxeon LED used. See "Illumination Calculations" below. For more detail on flux binning please check the Luxeon LED datasheet at <http://www.luxeon.com/>
- (7) Luminous intensity depends on the flux binning and tolerances of the LEDs. Please refer to the Luxeon datasheet for more details on flux binning and mechanical tolerances.
- (8) Typical illuminance measured in lux per lumen (E) with typical Luxeon™ LEDs. To estimate the illuminance in lux, multiply the typical illuminance E by the flux in lumen of the LED used. See "Illumination Calculations" below.

Illumination Calculations

To calculate peak candela: Select a lens and LED from the "Typical on-axis efficiency" table above. Find the corresponding "candela/lumen" value. Multiply that value by the lumens output from your LED (refer to the K2 LED datasheet <http://www.luxeon.com/pdfs/DS51.pdf> for nominal lumens values).

Example - Fraen medium beam lens # FLP-M4-LLK2-0R on cool white K2 LED # LXXK2-PW14T00: The table above indicates this lens produces 21 candela/lumen with a cool white K2 LED. The LED datasheet indicates 80 lumens minimum and 85 lumens typical at 1000mA current. Choosing 85 lumens, the calculation is: (21 candela/lumen) x (85 lumens) = 1785 candela peak on-axis.



The beam angle specified in the “Typical total beam divergence” table above indicates 24 degrees full beam-width measured at half-peak. This means at 12 degrees off-axis (half of 24 degrees), the intensity should be half of 1785 candela, or 892 candelas.

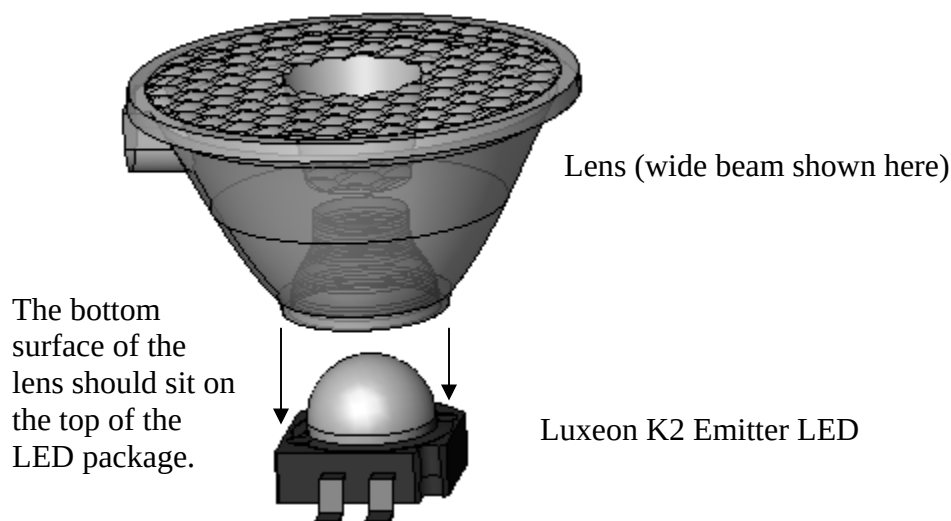
1 candela at 1-meter distance produces 1 Lux. This means the peak intensity at 1 meter will be 1785 lux. The intensity decreases as a function of the distance squared, so at 2 meters the peak intensity will be $1785 / (2^2) = 446$ lux. At 3 meters distance, the peak intensity will be $1785 / (3^2) = 198$ lux.

Mechanical Characteristics

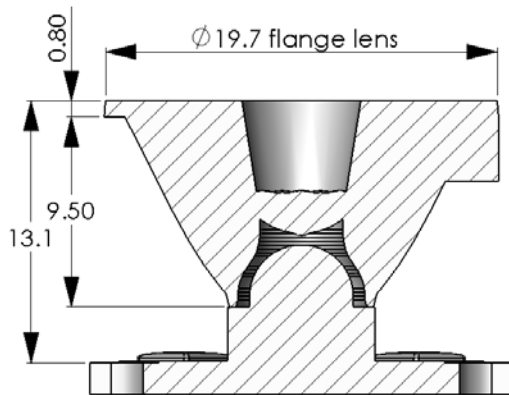
The FLP Flat-top series of lenses has been designed specifically for the Luxeon Lambertian K2 LEDs. The FLP lenses can be used either alone or with holder.

One lens holder version provides 3 mounting legs for heat staking the lens assembly to a printed circuit board or heat sink. The other lens holder version provides a surface for adhesive and screw holes for self-threading screws or rivets. Either holder also helps to center the lens to the LED. To order a lens assembly (with holder), please see the “Ordering Part Numbers” section at the end of this datasheet.

View and dimensions of lens on K2 LED (lens shown without lens holder):



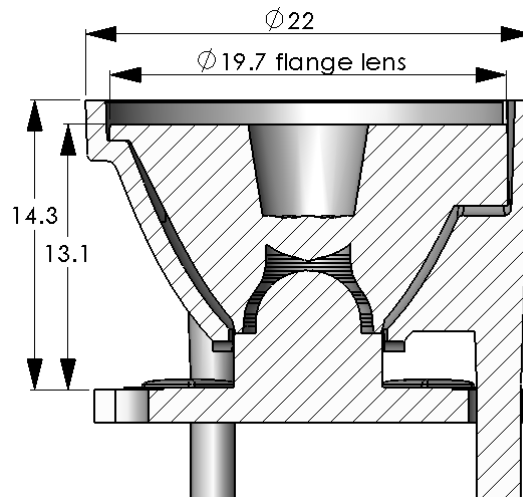
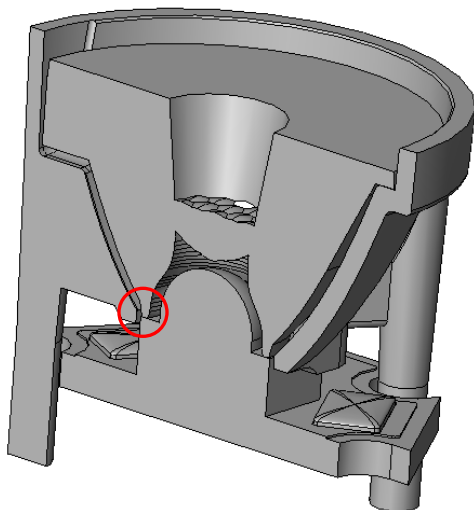
Lens dimensions shown on next page...



Dimensions of lens on K2 LED (lens shown without lens holder):

Dimensions tolerance is $\pm 0.2\text{mm}$

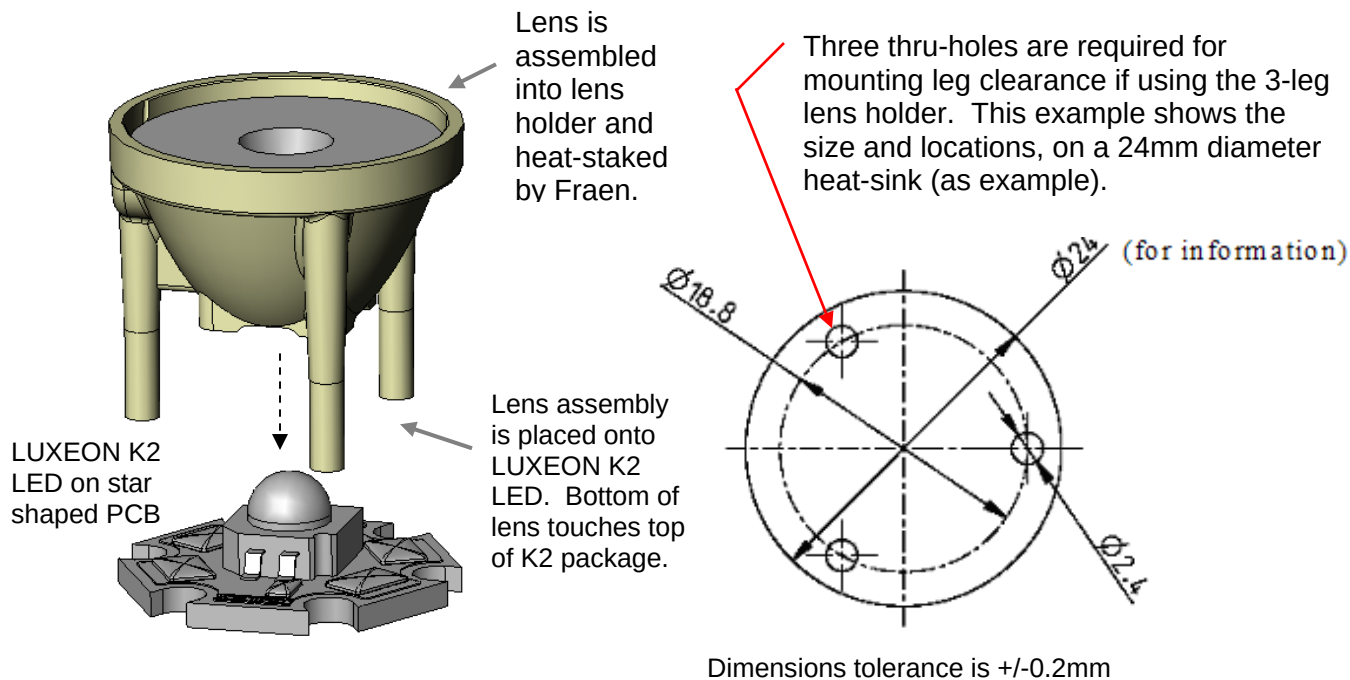
View and dimensions of lens + holder assembly (-HRL option, lens holder with legs) on K2 LED:



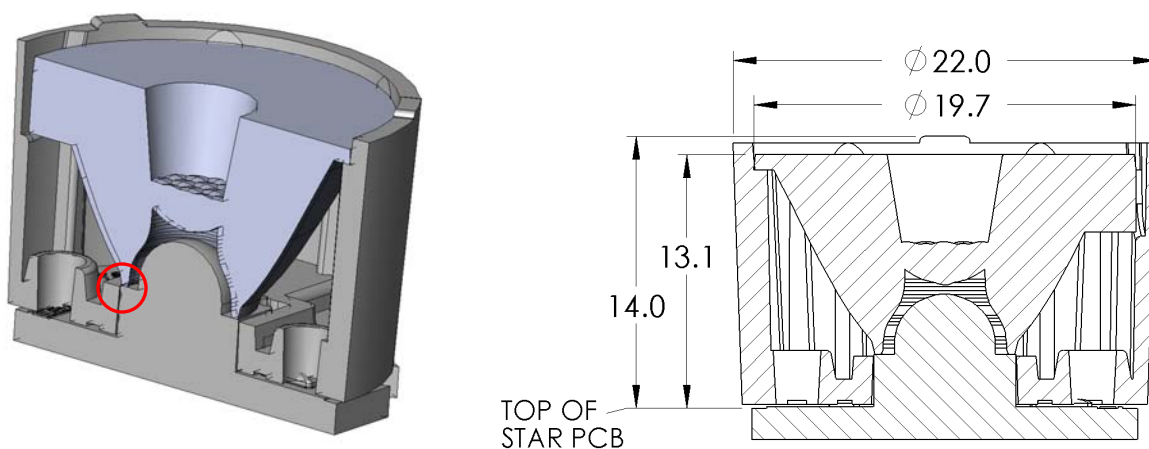
Dimensions tolerance is $\pm 0.2\text{mm}$

X-section views:

FLP flat-top narrow-beam lens assembly (with 3-leg holder) on LUXEON K2 LED. Notice that the bottom of the lens touches the top of the K2 LED package (shown on star-shaped PCB). The square shape on the bottom of the holder aligns the holder (and lens) to the square LED package.

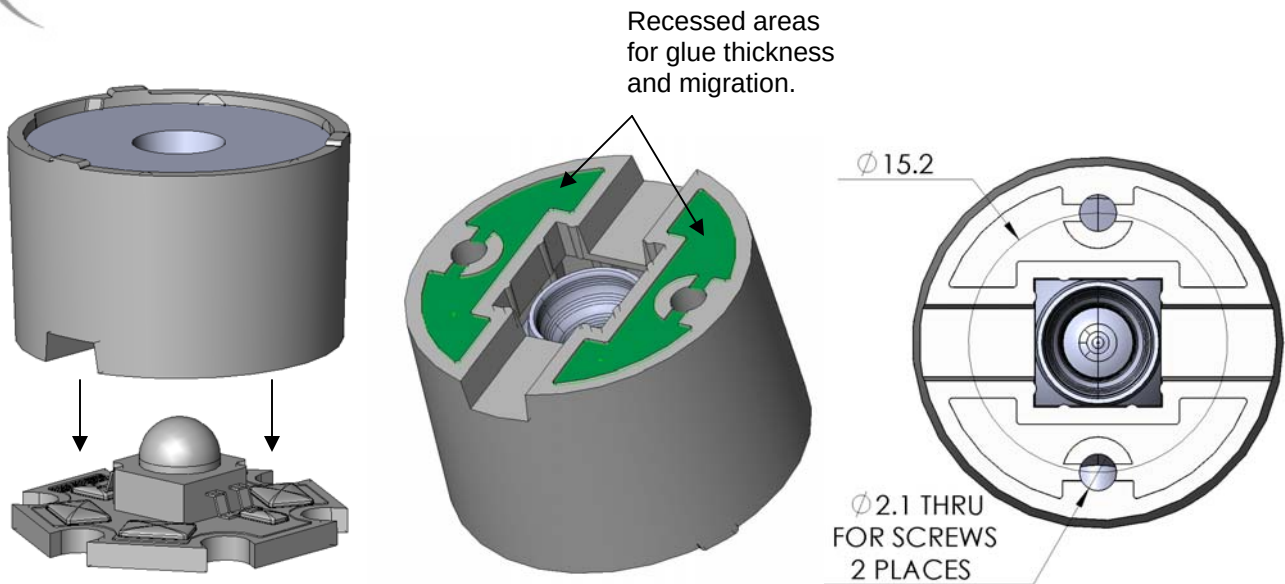


View and dimensions of lens + holder assembly (-HRF option, lens holder flat on bottom, no legs) on K2 LED:



X-section views:

FLP flat-top narrow-beam lens assembly (with flat-bottom holder) on LUXEON K2 LED. Notice that the bottom of the lens touches the top of the K2 LED package (shown on star-shaped PCB). The square shape on the bottom of the holder aligns the holder (and lens) to the square LED package.



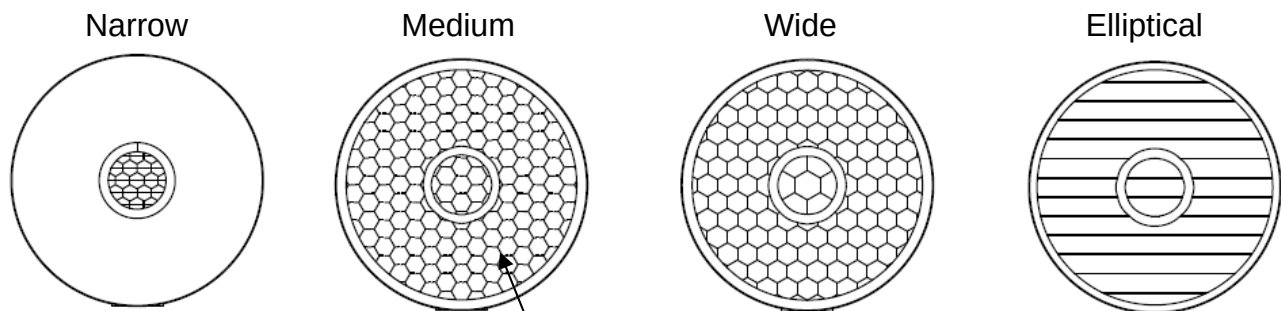
The lens assembly can be secured to the PC board by using glue or silicone RTV. To avoid glue on the lens and LED, apply it along the outside diameter edge, or apply a very thin film on areas shown above in green. Alternatively, screws can be used for example ISO1481-ST2.9 metric.

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.

Identifying the lenses by their front views:

The outside mechanical dimensions of the lenses (Narrow, Medium, Wide, and Elliptical beam lenses) are the same, except the front of the lens. The lens can be recognized by their unique front views:

Front views of lenses:



The medium beam lens has a light texture on the micro-lenses.



Ordering part numbers

For lens only (no holder)

FLP-__4-LLK2-0R



Lens Type:

N = Narrow beam lens
M = Medium beam lens
W = Wide beam lens
E = Elliptical beam lens

For assembly (lens + holder)

FLP-__4-__-HR__



Holder Type:

L = Legs on holder, for heat staking to PCB.
F = Flat, no legs on holder. Can be glued or screwed to PCB.



LED Type:

LL = Luxeon Lambertian I / III
K2 = Luxeon K2



Lens Type:

N = Narrow beam lens
M = Medium beam lens
W = Wide beam lens
E = Elliptical beam lens

Examples:

FLP-N4-LLK2-0R	Lens, narrow beam, for Luxeon I, III, or K2 LED, no holder, round flange.
FLP-N4-K2-HRL	Lens, narrow beam, for Luxeon K2 LED, assembled to a round holder with legs for heat staking to a PC board.
FLP-W4-LL-HRF	Lens, wide beam, for Luxeon Lambertian I / III LED, assembled to a round holder with flat bottom (no legs) for screws or gluing to a PC board.

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Document Revision Record

Rev	Date	Author	Description
01	09 Sept 2008	C. Jones	Added -HRF holder option.
00	18 July 2007	C. Jones	Initial Release