



## FSG Lens Series

for SEOUL SEMICONDUCTOR Z-POWER P4™ LEDs

- **Narrow peak**
- **High efficiency**
- **4 beams available**

The FSG lens offers lenses specifically designed for the Z-Power® P4 series LEDs from Seoul.

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

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

Typical applications are:

- Portable Lighting
- Reading Lamps
- Signs
- Architectural Lighting
- Street Lights



Z-Power® is a trademark of Seoul Semiconductor. For technical specification on LEDs please refer to the Z-Power datasheet or visit [www.seoulsemiconductor.com](http://www.seoulsemiconductor.com)

**FRAEN CORPORATION**

80 Newcrossing Road  
 Reading, MA 01867  
 Phone: 781.205.5300  
 Fax: 781.942.2426  
[optics@fraen.com](mailto:optics@fraen.com)

**FRAEN S.r.l.**

Via Stelvio, 12  
 20019 Settimo M. (MI) – Italy  
 Phone: +39-02-35.456.1  
 Fax: +39-02-335.456.239  
[info@fraen.com](mailto:info@fraen.com)

Website: [www.fraensrl.com](http://www.fraensrl.com)

*For ordering information, please contact:*

<b>NAFTA Countries</b>	<b>ARROW</b> Telephone: 1-888-9LIGHT1 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 Email: <a href="mailto:info@fraen.com">info@fraen.com</a>



## General Characteristics

---

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

---

This datasheet provides information about the following FSG series lenses.

Lens alone:






- FSG-N1-SSP4-0R
- FSG-M1-SSP4-0R
- FSG-W1-SSP4-0R
- FSG-E1-SSP4-0R

Lens and holder (assembly):

- FSG-N1-SSP4-HR
- FSG-M1-SSP4-HR
- FSG-W1-SSP4-HR
- FSG-E1-SSP4-HR



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

Lens Part Number	Type of lens	Cool White 	Warm White 	Blue 	Green 	Red 
FSG-N1-SSP4-HR	Narrow beam	6	*	6	5	6
FSG-M1-SSP4-HR	Medium beam	24	*	24	23	23
FSG-W1-SSP4-HR	Wide beam	37	*	37	37	38
FSG-E1-SSP4-HR	Elliptical beam	14 x 32	*	*	*	*

(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 	Warm White 	Blue 	Green 	Red 
FSG-N1-SSP4-HR	Narrow beam	31	*	32	37	29
FSG-M1-SSP4-HR	Medium beam	3.5	*	3.1	4.2	4.0
FSG-W1-SSP4-HR	Wide beam	1.6	*	1.3	1.8	1.7
FSG-E1-SSP4-HR	Elliptical beam	3.1	*	*	*	*

- (2) To calculate the on-axis intensity, multiply the on-axis efficiency of the lens (cd/lm) by the total flux of the Seoul P4 LED used. See “Illumination Calculations” below. For more detail on flux binning please check the Seoul P4 LED datasheet at <http://www.seoulsemicon.com/en/product/prd/zpowerLEDp4.asp>
- (3) Luminous intensity depends on the flux binning and tolerances of the LEDs. Please refer to the Seoul P4 LED datasheet for more details on flux binning and mechanical tolerances.
- (4) Typical illuminance was measured in candela per lumen with typical Seoul P4 LED. To estimate the illuminance in lux, multiply the typical illuminance by the flux (lumens) of your LED. See “Illumination Calculations” below.

\* Configuration not yet measured.



## 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 P4 LED datasheet <http://www.seoulsemicon.com/en/product/prd/zpowerLEDp4.asp> for nominal lumens values). Or for a more accurate value, refer to their .pdf spec for intensity binning.

### Example calculation:

If the Fraen narrow beam lens FSG-N1-SSP4-0R is used on a cool (“pure”) white Seoul P4 LED at 350 mA, the typical luminous flux of the LED is 80 lumens:

The calculation is: (31 candela/lumen) x (80 lumens) = 2480 candela peak on-axis.

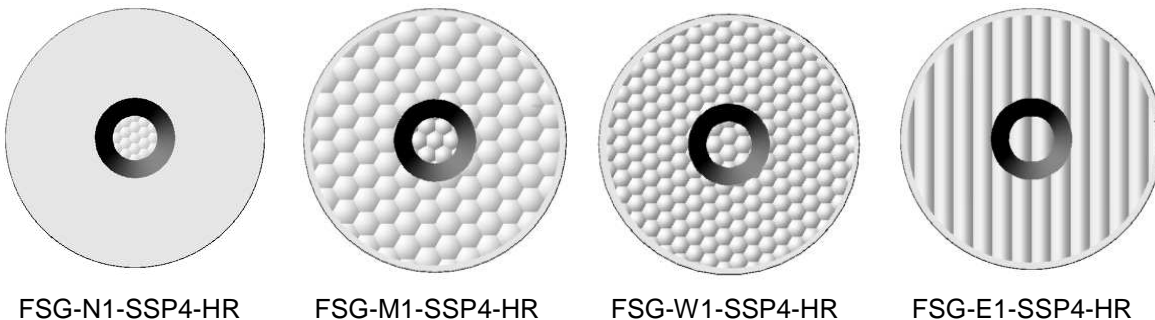
The beam angle specified in the table above is 6 degrees full beam-width measured at half-peak. This means at 3 degrees off-axis (half of 6 degrees), the intensity should be half of 2480 candela, or 1240 candelas.

1 candela at 1-meter distance produces 1 Lux. This means the peak intensity at 1 meter will be 2480 lux. The intensity decreases as a function of the distance squared, so at 2 meters the peak intensity will be  $2480 / (2^2) = 620$  lux. At 3 meters distance, the peak intensity will be  $2480 / (3^2) = 276$  lux.

## Mechanical Characteristics

---

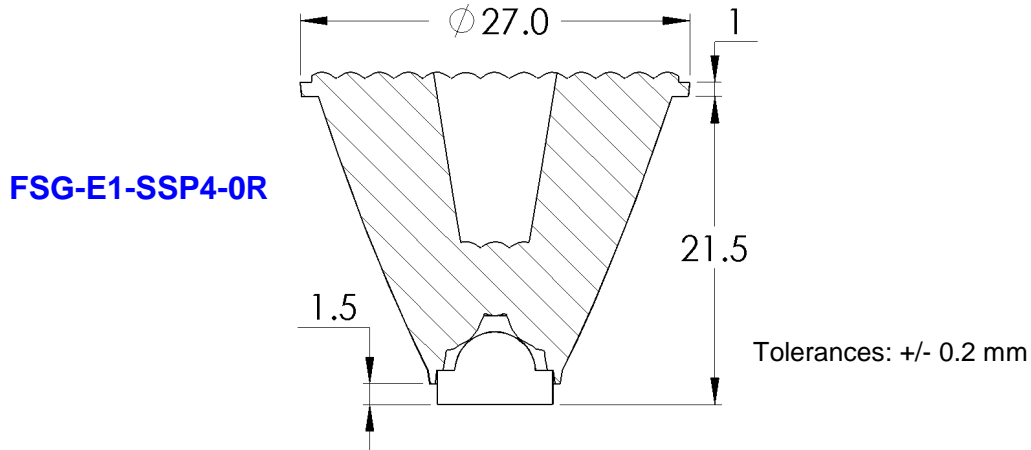
**Figure 1. Identifying the lenses by their front views**



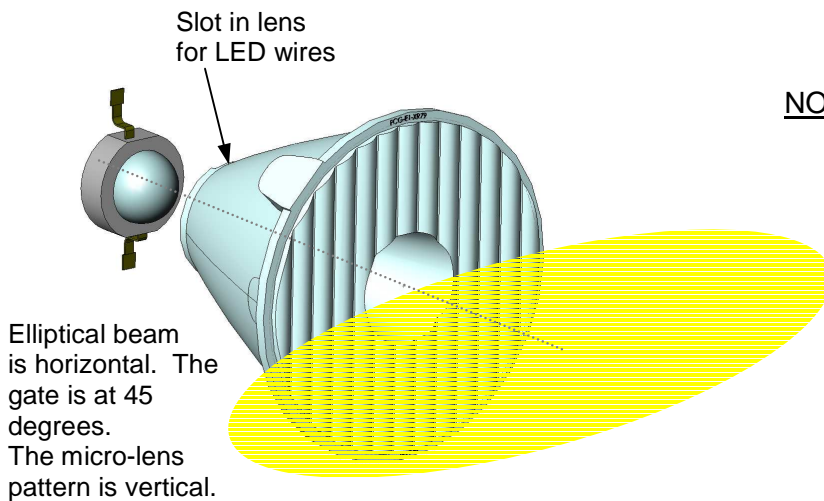
Continued on next page...

**Figure 2. Correct vertical distance between FSG lens and Seoul P4 LED**

The lens is correctly positioned as shown in the figure below. The Fraen lens touches the LED package, but not the LED dome lens. The Fraen lens is self-centering on the LED package.



**Figure 3. Elliptical beam orientation**

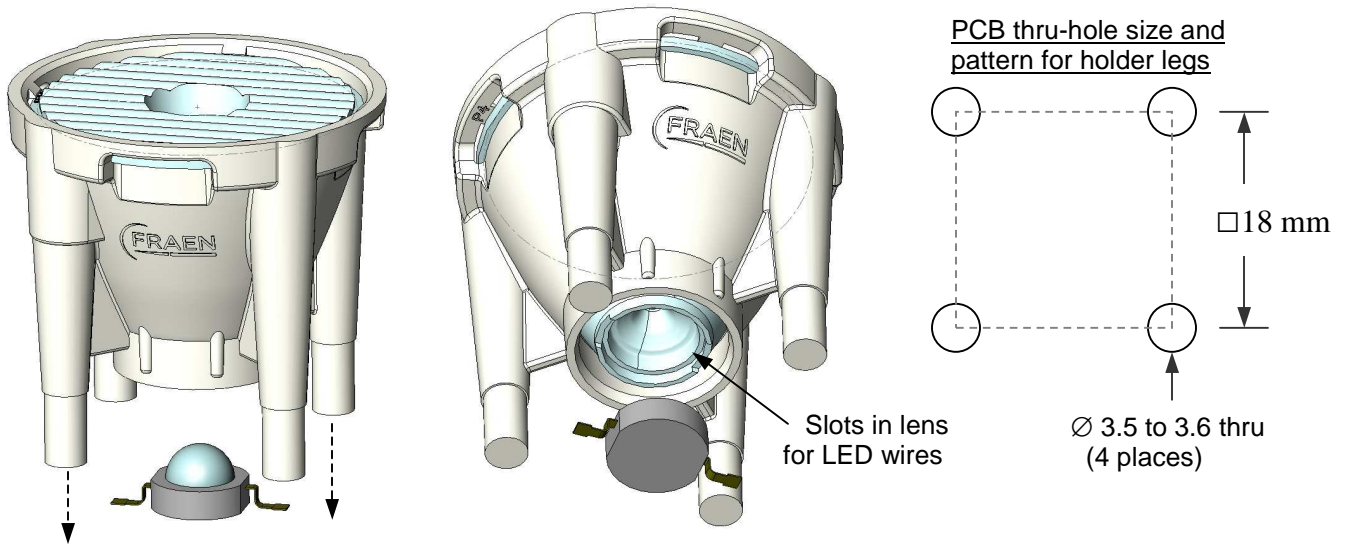


**NOTE:** The elliptical beam lens produces a beam shape that is perpendicular to the microlens pattern on the output face of the lens. It is important to consider the orientation of the LEDs and the desired elliptical beam orientation when designing the printed circuit board layout.

To produce a horizontal elliptical beam, the lens needs to be orientated such that the micro-lenses are positioned vertically. The LED orientation on the PC board should be coordinated with the beam orientation.



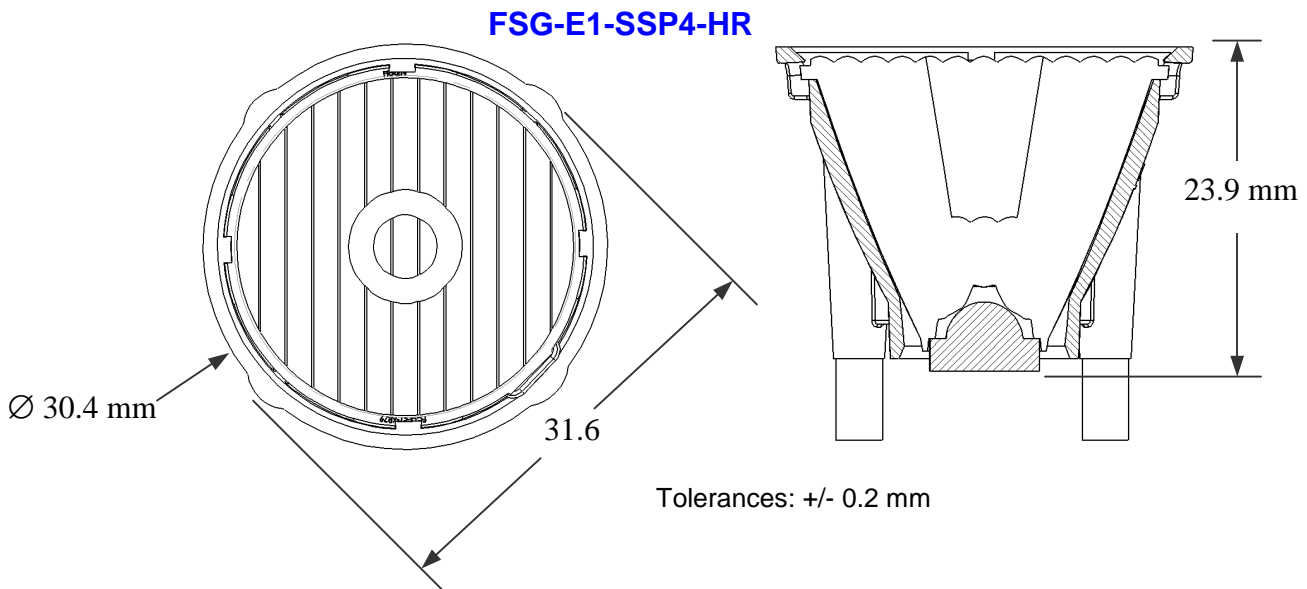
**Figure 4. Installation of lens assembly onto Seoul LED**



For installation onto a printed circuit board, holes thru the PCB will allow the legs of the holder to protrude through the PCB and can be heat-staked or glued in place. See Fraen Application Note FAN-01EN [http://www.fraensrl.com/images/FRN\\_FHSLenses\\_HeatStake.pdf](http://www.fraensrl.com/images/FRN_FHSLenses_HeatStake.pdf) 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 only on the legs of the lens holder.

**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 FSG- 1-SSP4-HR series lens assemblies**





## Ordering part numbers

FSG-\_\_1-SSP4-\_\_

OR: Lens alone (no holder)  
HR: Lens with white PC holder

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

Caution: The orientation of the elliptical beam lens is controlled by the slot on the bottom of the lens (see Figure 3 and 4).

*Published by Fraen Corporation.*

*All data contained in this document is the property of Fraen Corporation and may change without notice.*

Rev	Date	Author	Description
00	08 December 2008	C. Jones	Initial Release