



FD3 SERIES LENSES *for OSRAM GOLDEN DRAGON™ LEDs*

- **High efficiency**
- **Available in 2 different beams**
- **35mm diameter, sized for MR11 lamp applications**
- **Patent Pending**

The FD3 series Low Profile Tri-lens module is available for Golden dragon LEDs from Osram Optosemiconductor.

A software-optimized aspheric profile combined with front shaped micro-lens arrays enable the generation of two different lens models: narrow beam and medium beam (2).

The high collection efficiency reaches 85% of the total flux emitted from the LED.

These lenses are assembled with a 35mm diameter holder. The holder assures the proper relative placement between the lens and the Golden dragon LEDs. Heat staking the three legs of the holder to the customer's PCB or heat sink provides excellent optical and mechanical assembly (see Fraen Application Note FAN01-EN, at www.fraensrl.com).

Typical applications are:

- Reading lamps
- Signs
- Architectural Lighting
- Street Lights
- Most application where uniformity and high intensity over a wide angle is required



- (1) Golden Dragon is a trademark of Osram OptoSemiconductor. For technical specification on LEDs please refer to the Golden dragon datasheet or visit www.osram-os.com
- (2) Typical beam divergence may change with different color LEDs.

For ordering instructions, please contact

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To find a local distributor, check the Fraen website.

Website: www.fraensrl.com



General Characteristics

Lens Material	Optical Grade PMMA
Holder Material	PC ABS or Transparent PC
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 alcohol, as it will damage the plastic.



Optical Characteristics

		Typical beam total divergence (degrees)		
Lens Part Number	Type of lens	Blue Green Dragon ● ●	Yellow Red Dragon ● ●	White Dragon Chip Coated ○
FD3-N1-D01-H	Narrow beam	14.0	13.5	12.5
FD3-M1-D01-H	Medium beam	17.0	15.0	16.0

The typical total divergence is the full angle measured where the luminous intensity is half of the peak value. The typical divergence may change with different color LEDs due to different chip size and chip position tolerance.

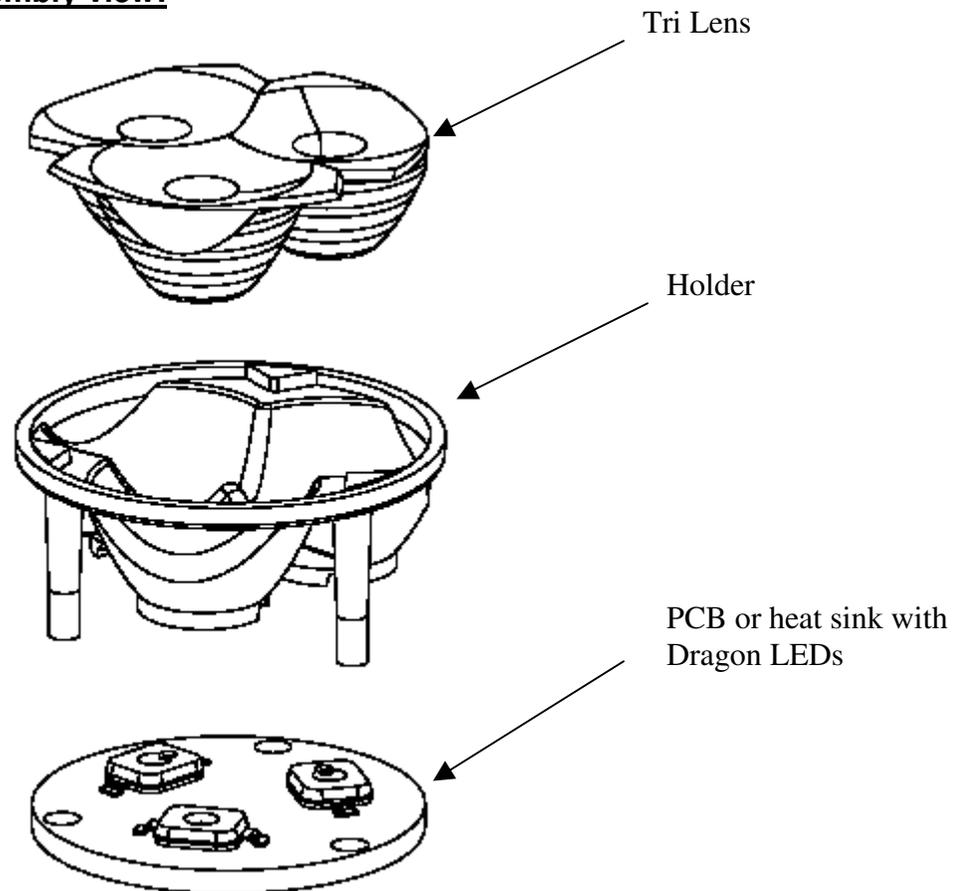
		Typical on axis efficiency (cd/lm)		
Lens Part Number	Type of lens	Blue Green Dragon ● ●	Yellow Red Dragon ● ●	White Dragon Chip Coated ○
FD3-N1-D01-H	Narrow beam	4.5	4.6	8.3
FD3-M1-D01-H	Medium beam	2.7	2.8	4.3

To calculate the on axis intensity, multiply the on axis efficiency of the lens (cd/lm) by the total flux of the Dragon LEDs you use. For more detail on flux binning please check the datasheet of the Golden Dragon LEDs by Osram OS.

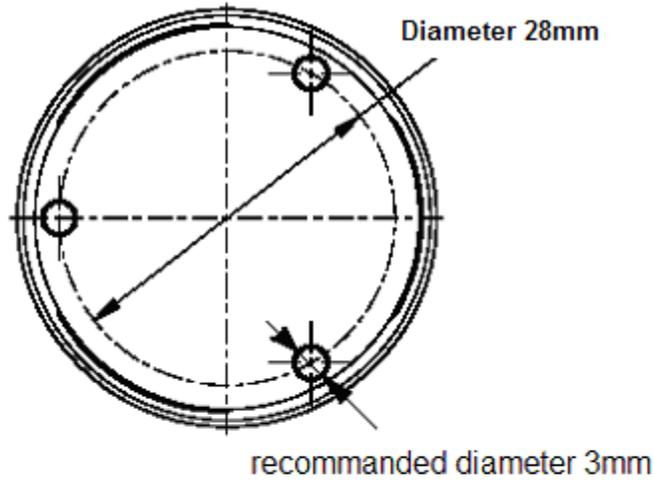
Mechanical Characteristics

For best optical performance (shown above), correct mechanical position of the lens on the LED is critical. To achieve correct lens position on the LED, the module comes pre-assembled in a holder.

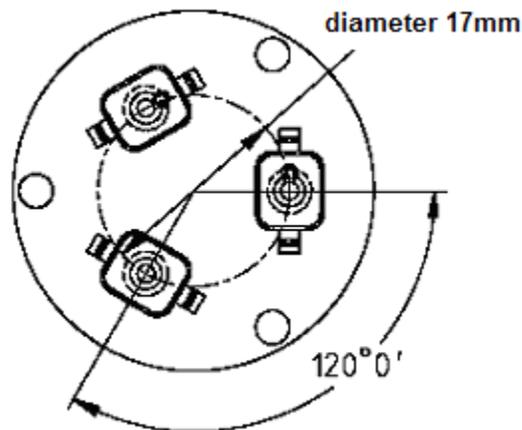
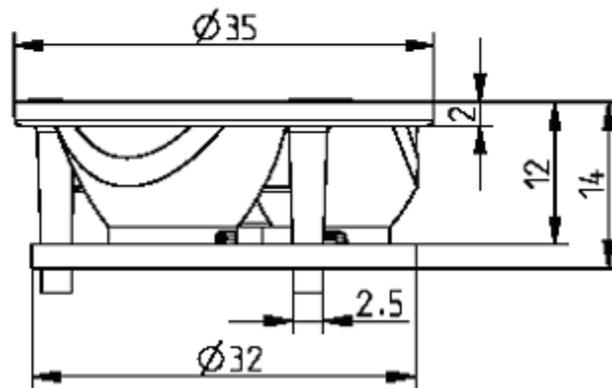
Lens + holder assembly view:



Lens + Holder assembly dimensions on PCB board:



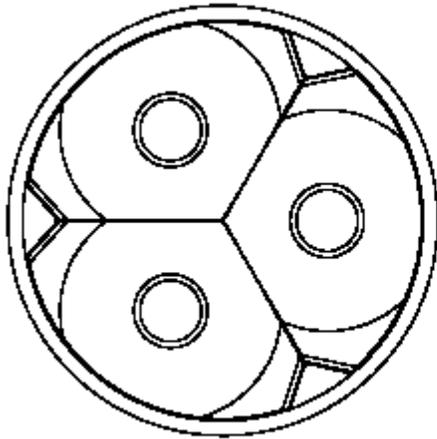
PCB with holes to heat stake the holder



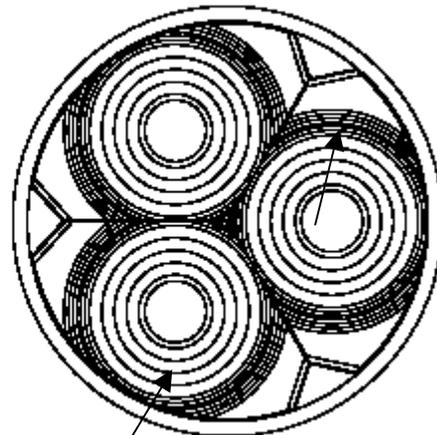
Tolerances : +/- 0.2mm

The lens can be identified by the top view:

Narrow beam lens:



Medium beam lens:



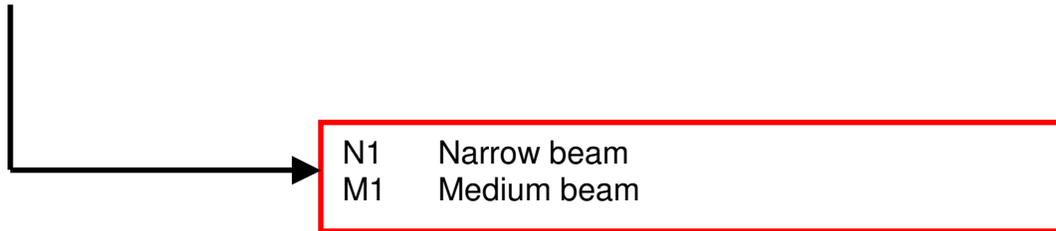
Light texture on the top lens

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"



Ordering part numbers

FD3-xx-D01-H



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Document Revision Record

Rev	Date	Author	Description
00	08-21-2006	S.A.H.	Initial Release
01	08-23-2006	S.A.H.	Added Data



FD4 SERIES LENSES **for OSRAM GOLDEN DRAGON™ LEDs**

- **High efficiency**
- **Available in medium beam**
- **Suitable for MR 16 applications**
- **Patent Pending**

The FD4 Low Profile Quad-lens module is available for Golden dragon LEDs from Osram Optosemiconductor.

The high collection efficiency reaches 85% of the total flux emitted from the LED.

The Quad-lens is a single part, made in PMMA optical grade material, incorporating four optical elements. The design allows easy handling and mechanical fixation, while maintaining high optical efficiency.

Typical applications are:

- Reading lamps
- Signs
- Architectural Lighting
- Street Lights
- Most application where uniformity and high intensity over a wide angle is required



- (1) Golden Dragon is a trademark of Osram OptoSemiconductor. For technical specification on LEDs please refer to the Golden dragon datasheet or visit www.osram-os.com
- (2) Typical beam divergence may change with different color LEDs.

For ordering instructions, please contact

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To find a local distributor, check the Fraen website



General Characteristics

Lens Material	Optical Grade PMMA
Holder Material	PC ABS
Operating Temperature range	-40 deg C / + 80 deg C
Storage Temperature range	-40 deg 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 alcohol, as it will damage the plastic.



Optical Characteristics

		Typical beam total divergence (degrees)			
Lens Part Number	Type of lens	Blue, green Dragon  	Yellow, amber, red Dragon  	White Dragon Nota 	White ThinGaN Gragon 
FD4-M1-D01-0	Medium beam	17.0	20.0	22.0	22.0

The typical total divergence is the full angle measured where the luminous intensity is half of the peak value. The typical divergence may change with different color LEDs due to different chip size and chip position tolerance.

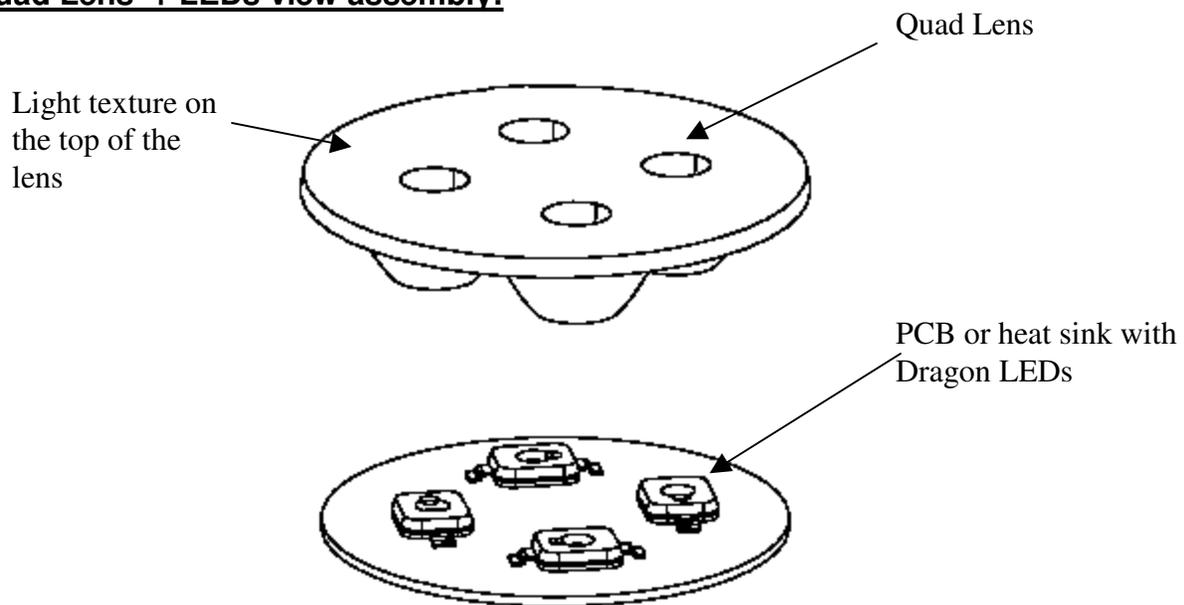
		Typical on axis efficiency (cd/lm)			
Lens Part Number	Type of lens	Blue, green Dragon  	Yellow, amber, red Dragon  	White Dragon Nota 	White ThinGaN Dragon 
FD4-M1-D01-0	Medium beam	4.9	6.4	3.3	5.6

To calculate the on axis intensity, multiply the on axis efficiency of the lens (cd/lm) by the total flux of the Dragon LEDs you use. For more detail on flux binning please check the datasheet of the Golden Dragon LEDs by Osram OS.

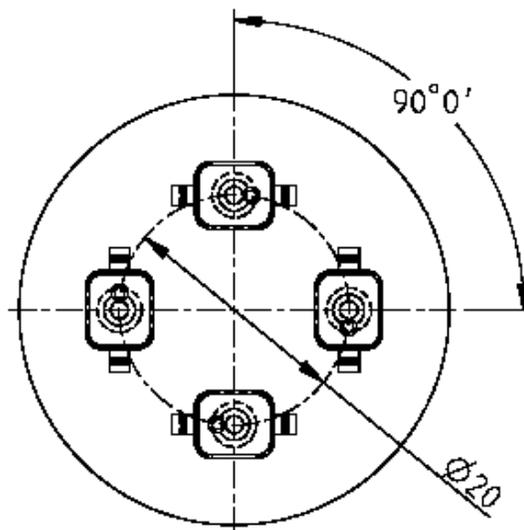
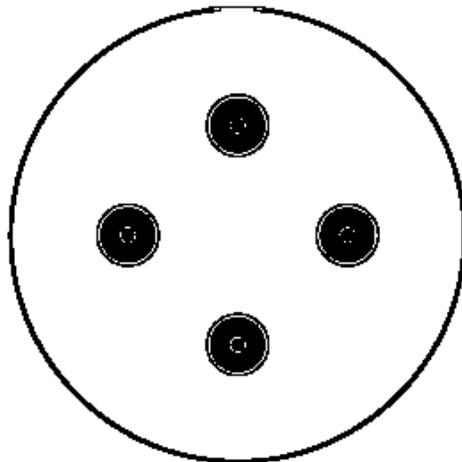
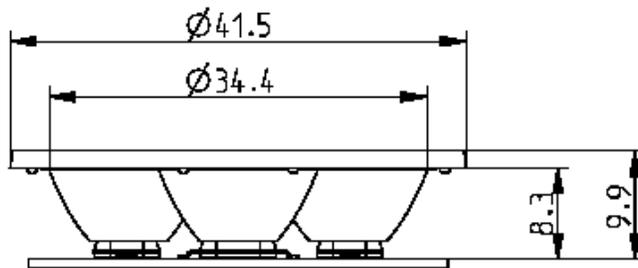
Mechanical Characteristics

For best optical performance (shown above), correct mechanical position of the lens on the LED is critical. To achieve correct lens position on the PCB review the following assembly dimensions and orientation.

Quad Lens + LEDs view assembly:



Lens assembly on LEDs, dimensions on PCB board:



PCB with Dragon
LEDs positions

tolerances: +_0.2mm



Ordering part number

FD4-M1-D01-0

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Rev	Date	Author	Description
00	08-21-2006	S.A.H.	Initial Release
01	08-31-2006	S.A.H.	Added Technical Data



FDG SERIES LENSES for OSRAM GOLDEN DRAGON™ LEDs

- High efficiency
- Available in 4 different beams
- Patent pending

The FDG Series offers a complete range of lenses especially designed for the Golden Dragon ⁽¹⁾ LEDs from Osram Optosemiconductor.

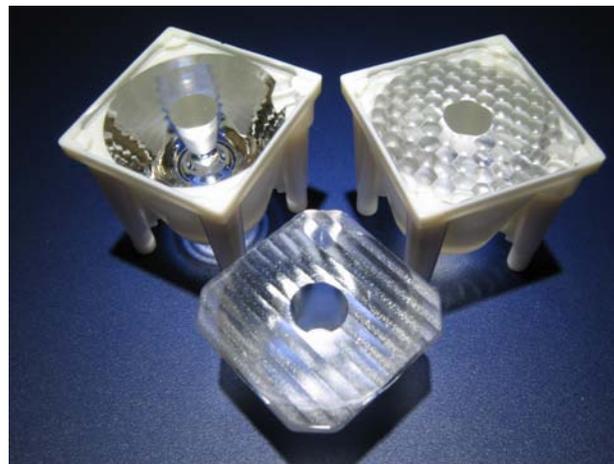
A software-optimized aspheric profile combined with front shaped micro-lens arrays enable the generation of four different lens models: narrow beam, medium beam, wide beam, and elliptical pattern (2).

The high collection efficiency reaches 85% of the total flux emitted by the LEDs. Lens holders are available either in white PC/ABS or transparent PC, and provide the proper alignment between the LEDs and the lenses. If a holder is not used, a special spacer ring must be used to assure proper alignment.

Heat staking the four legs of the holder to the customer's PCB or heat sink provides excellent optical and mechanical assembly (see Fraen Application Note FAN01-EN (at www.fraensrl.com)).

Typical applications are:

- Reading lamps
- Signs
- Architectural Lighting
- Street Lights



- (1) Golden Dragon™ is a trademark of Osram Optosemiconductor. For technical specifications on the LEDs please refer to the Golden Dragon datasheet or visit www.osram-os.com
- (2) Typical beam divergence may change with different color LEDs.

For ordering instructions, please contact

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To find a local distributor, check the Fraen website.

Website: www.fraensrl.com



General Characteristics

Lens Material	Optical Grade PMMA
Holder Material	PC ABS or Transparent PC
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 alcohol, as it will damage the plastic.



Optical Characteristics:

Typical beam total divergence (degrees)		Blue / Green Dragon	Yellow / Red Dragon	White Dragon		
		ThinGaN	ThinFilm	NOTA	Volume casting	Chip coating
Lens Part Number	Type of lens	LxW5SG	LxW5SF	LWW5SG	ZWW5SG	LWW5SG
FDG-N1-D01-xx	Narrow beam	6.0	6.0	9.0	7.0	6.5
FDG-M1-D01-xx	Medium beam	21.0	21.0	22.0	21.0	20.5
FDG-W1-D01-xx	Wide beam	34.5	35.0	32.0	33.5	33.5
FDG-E1-D01-xx	Elliptical beam	11.0 * 19.5	10.0 * 19.5	13.0 * 20.0	13.0 * 20.0	10.0 * 20.0

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.

Typical on efficiency	Axis (cd/lm)	Blue Dragon	Green Dragon	Yellow Dragon	Red Dragon	White Dragon		
		ThinGaN	ThinGaN	ThinFilm	ThinFilm	NOTA	Volume casting	Chip coating
Lens Part Number	Type of lens	LBW5SG	LGW5SG	LxW5SF	LxW5SF	LWW5SG	ZWW5SG	LWW5SG
FDG-N1-D01-xx	Narrow beam	29.2	43.3	30.5	34.2	18.9	24.7	44.5
FDG-M1-D01-xx	Medium beam	3.8	5.6	3.8	3.8	4.3	4.6	5.6
FDG-W1-D01-xx	Wide beam	1.5	2.2	1.6	1.5	2.1	2.0	2.2
FDG-E1-D01-xx	Elliptical beam	6.5	9.7	6.5	6.9	7.0	7.5	10.0

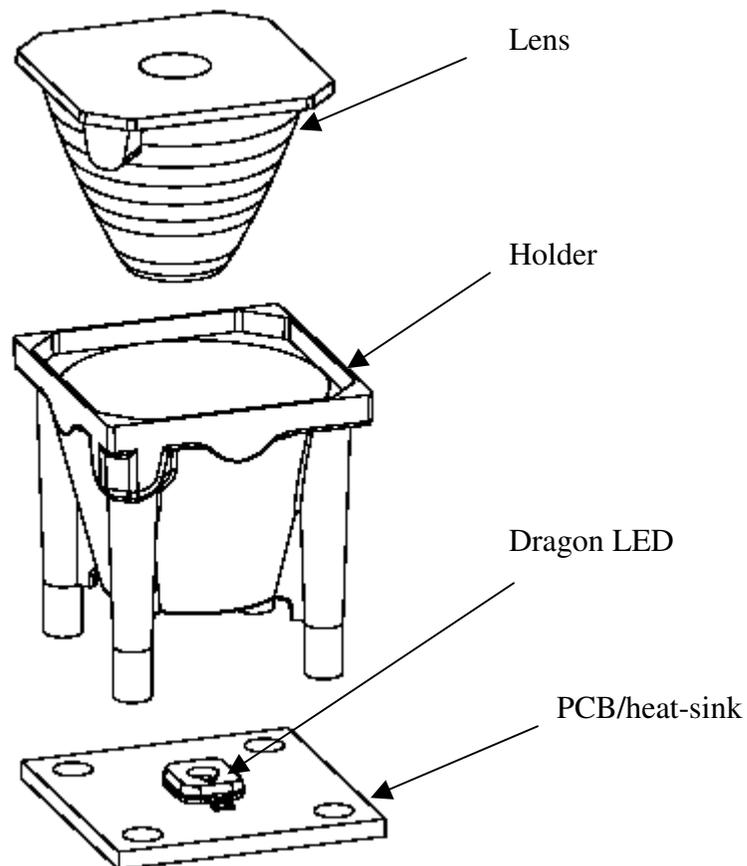
To estimate the on-axis intensity, multiply the on-axis efficiency of the lens (cd/lm) by the total flux of the Golden Dragon LED used. Please note that the above measurements have been taken with Dragon LEDs powered at 100mA. The efficiency can vary with the current driving the LEDs. For more detail on flux binning please check the Golden Dragon LED datasheet at www.osram-os.com

Mechanical Characteristics

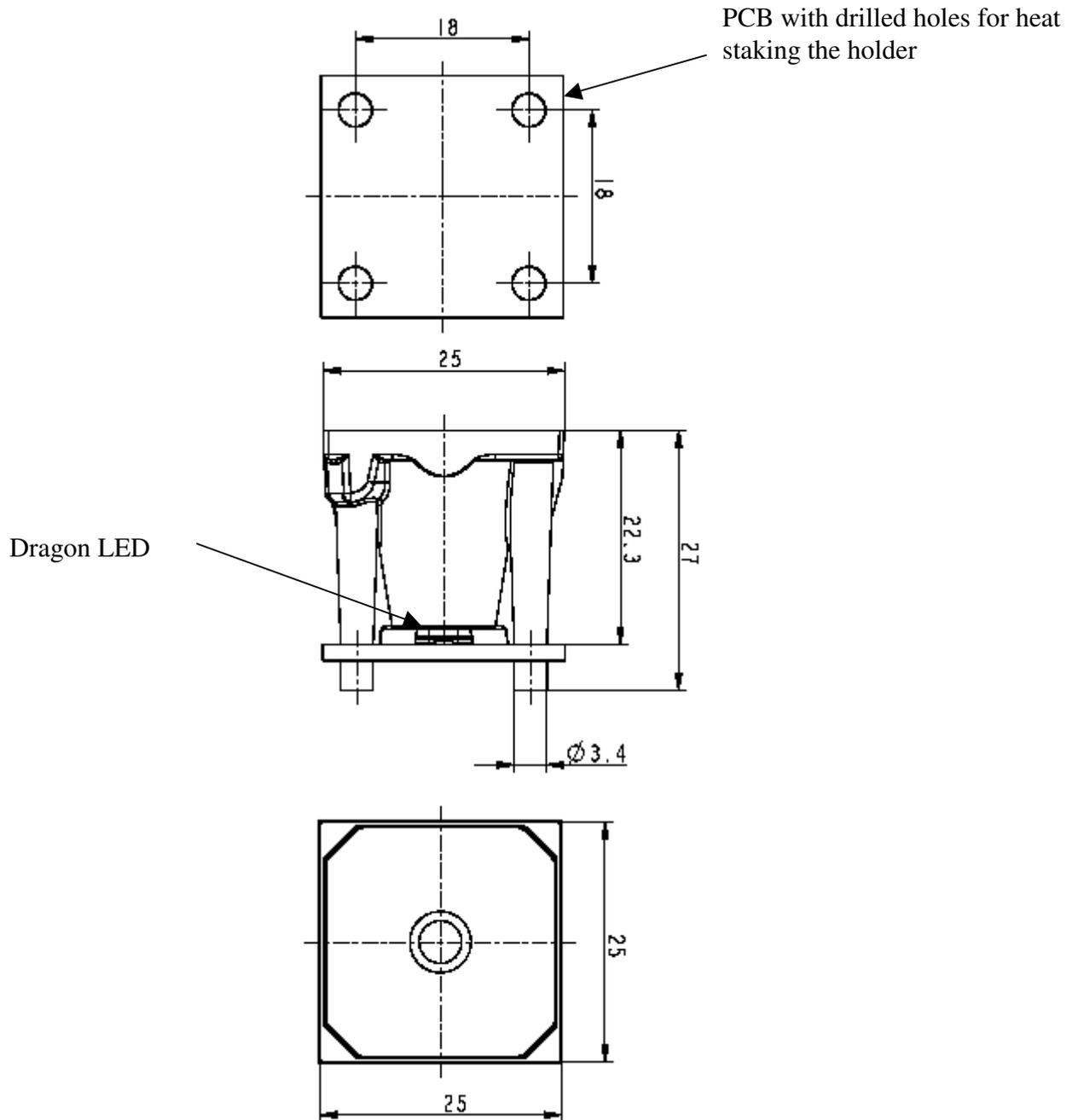
For best optical performance (shown above), correct mechanical position of the lens on the LED is critical.

To achieve correct lens position on the LED, the lens must be used either a holder, or spacer ring.

Lens + Holder assembly view:



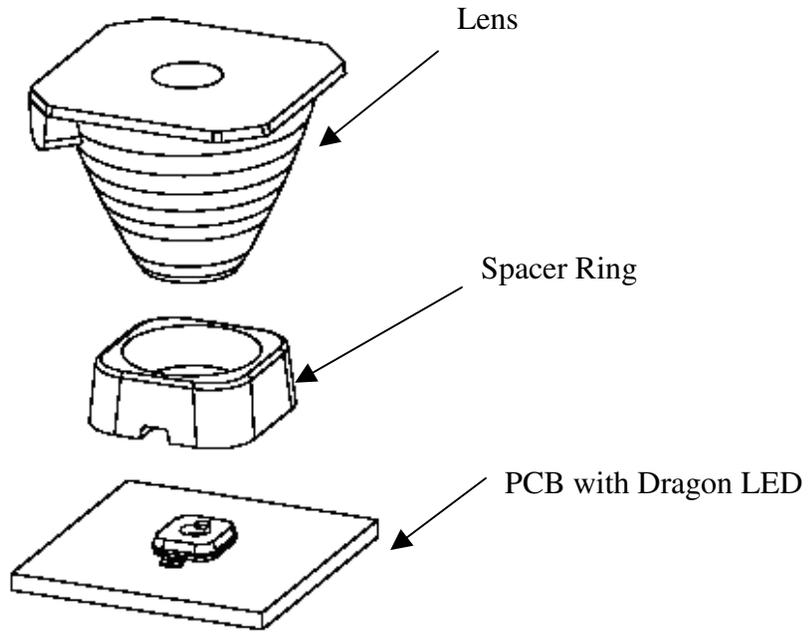
Lens + holder assembly dimensions on a PCB:



Tolerances: +/- 0.2mm where not specified

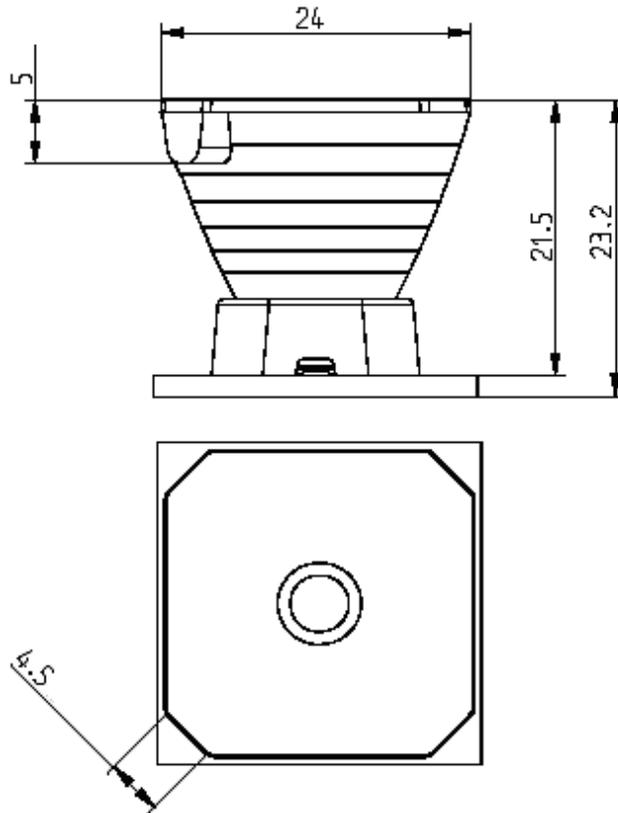


Lens + spacer ring assembly view:





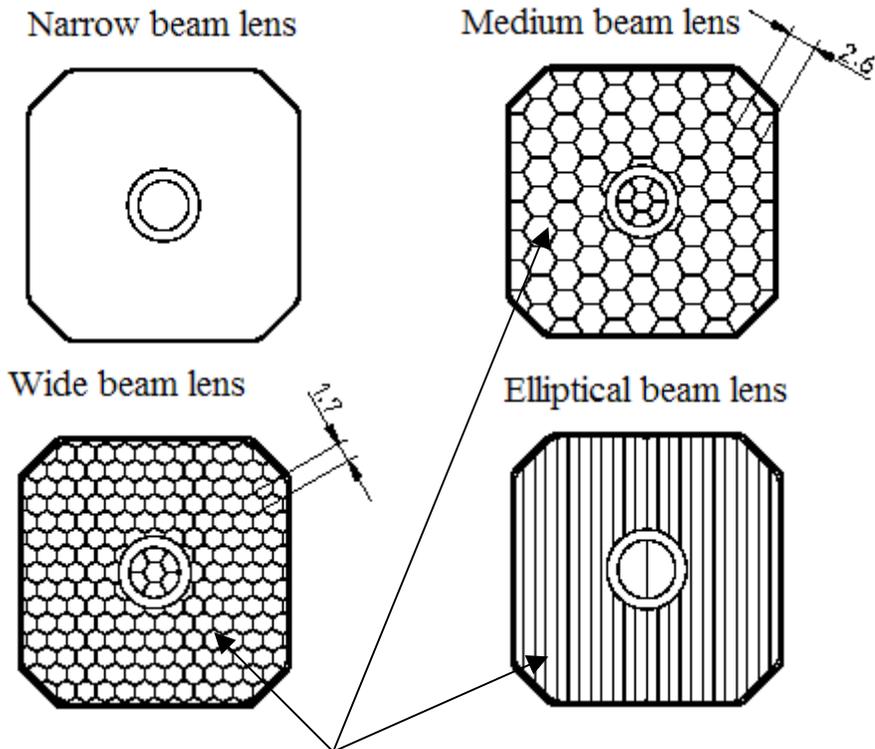
Lens + spacer ring assembly dimensions: Tolerances: +/- 0.2mm where not specified.



The outside mechanical dimensions of the lenses (Narrow, Medium, Wide, and Elliptical beam) are the same, except the height and top surface pattern of the lens.

The lens can be recognized by the top view:

Top Lens views:

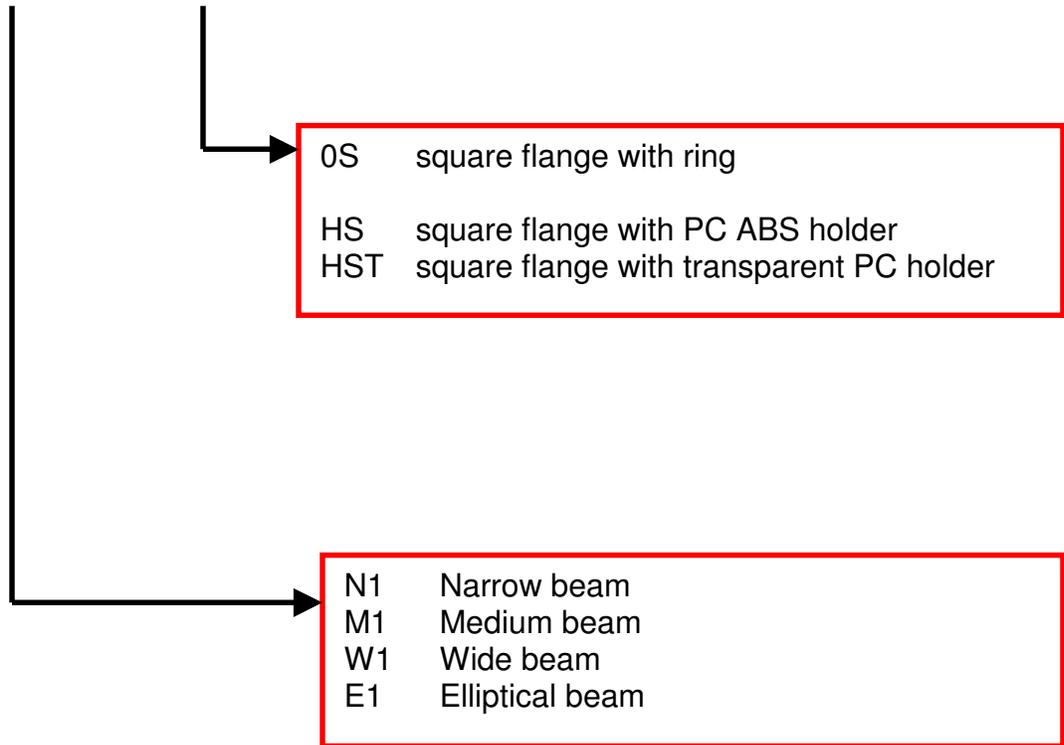


Light texture on the micro-lenses improves evenness of the beam.



Ordering part numbers

FDG-xx-D01-zz



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Document Revision Record

Rev	Date	Author	Description



FDP SERIES LENSES For OSRAM GOLDEN DRAGON LEDs

- **High efficiency**
- **Available in 2 different beams**
- **Patent pending**

The FDP Series offer low-profile lenses especially designed for the Golden Dragon ⁽¹⁾ LEDs from Osram Optosemiconductor.

A software-optimized aspheric profile combined with front shaped micro-lens arrays enables the generation narrow beam and medium beam output patterns (2).

The high collection efficiency reaches 85% of the total flux emitted by the LEDs. Lens holders are available either in white PC/ABS or transparent PC, and provide the proper alignment between the LEDs and the lenses.

Heat staking the four legs of the holder to the customer's PCB or heat sink provides excellent optical and mechanical assembly (see Fraen Application Note FAN01-EN (at www.fraensrl.com)).

Typical applications are:

- Reading lamps
- Signs
- Architectural Lighting
- Street Lights



- (1) Golden Dragon is a trademark of Osram OptoSemiconductor. For technical specification on LEDs please refer to the Golden Dragon datasheet or visit www.osram-os.com
- (2) Typical beam divergence may change with different color LEDs.

For ordering instructions, please contact

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To find a local distributor, check the Fraen website.

Website: www.fraensrl.com



General Characteristics

Lens Material	Optical Grade PMMA
Holder Material	PC ABS or Transparent PC
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 alcohol, as it will damage the plastic.



Optical Characteristics

Typical beam total divergence (degrees)		Blue / Green Dragon	Yellow / Red Dragon	White Dragon		
		ThinGaN	ThinFilm	NOTA	Volume casting	Chip coating
Lens Part Number	Type of lens	LxW5SG	LxW5SF	LWW5SG	ZWW5SG	LWW5SG
FDP-N1-D01-xx	Narrow beam	9.0	9.0	13.0	11.0	9.5
FDP-M1-D01-xx	Medium beam	14.5	15.0	18.0	16.0	13.5

The typical total divergence is the full angle measured where the luminous intensity is half of the peak value. The typical divergence may change with different color LEDs due to different chip size and chip position tolerance.

Typical on - axis efficiency (cd/lm)		Blue Dragon	Green Dragon	Yellow Dragon	Red Dragon	White Dragon		
		ThinGaN	ThinGaN	ThinFilm	ThinFilm	NOTA	Volume casting	Chip coating
Lens Part Number	Type of lens	LBW5SG	LGW5SG	LxW5SF	LxW5SF	LWW5SG	ZWW5SG	LWW5SG
FDP-N1-D01-xx	Narrow beam	13.1	18.4	12.8	14.9	9.6	12.4	17.1
FDP-M1-D01-xx	Medium beam	5.8	8.4	6.0	6.5	5.2	6.5	9.0

To calculate the on axis intensity, multiply the on axis efficiency of the lens (cd/lm) by the total flux of the Dragon LEDs you use. For more detail on flux binning please check the datasheet of the Golden Dragon LEDs by Osram OS.



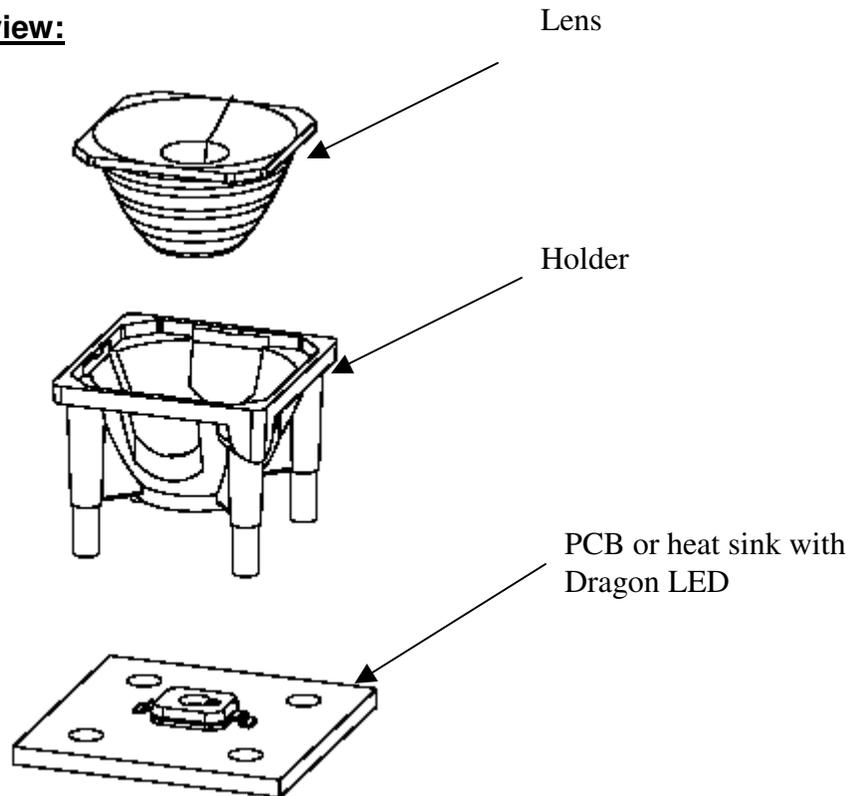
Mechanical Characteristics

IMPORTANT - Assembly information:

For best optical performance (shown above), correct mechanical position of the lens on the LED is critical.

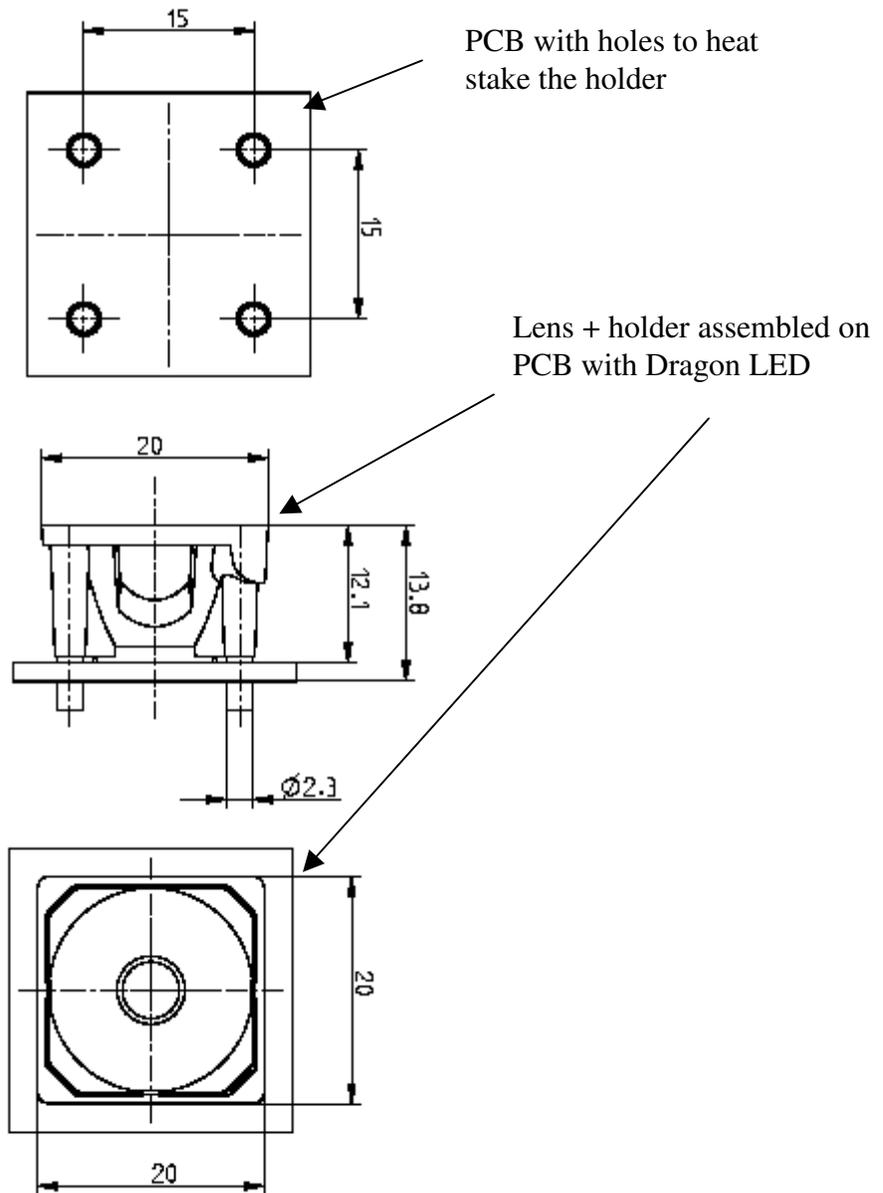
To achieve correct lens position the lens must be used with a lens holder. If the lens is used alone (without a Fraen lens holder), the user should provide mechanical features in their lamp or fixture to assure the lens is concentrically aligned to the LED.

Lens + holder assembly view:

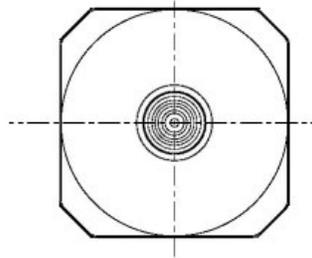


Lens + Holder assembly dimensions on PCB board:

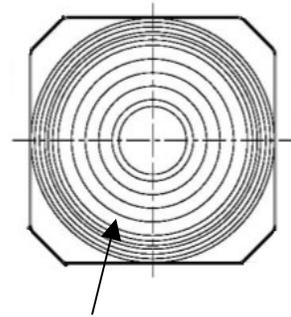
tolerances : +_0.2mm



The lens can be identified by the top view:



Narrow beam lens:



Medium beam lens:

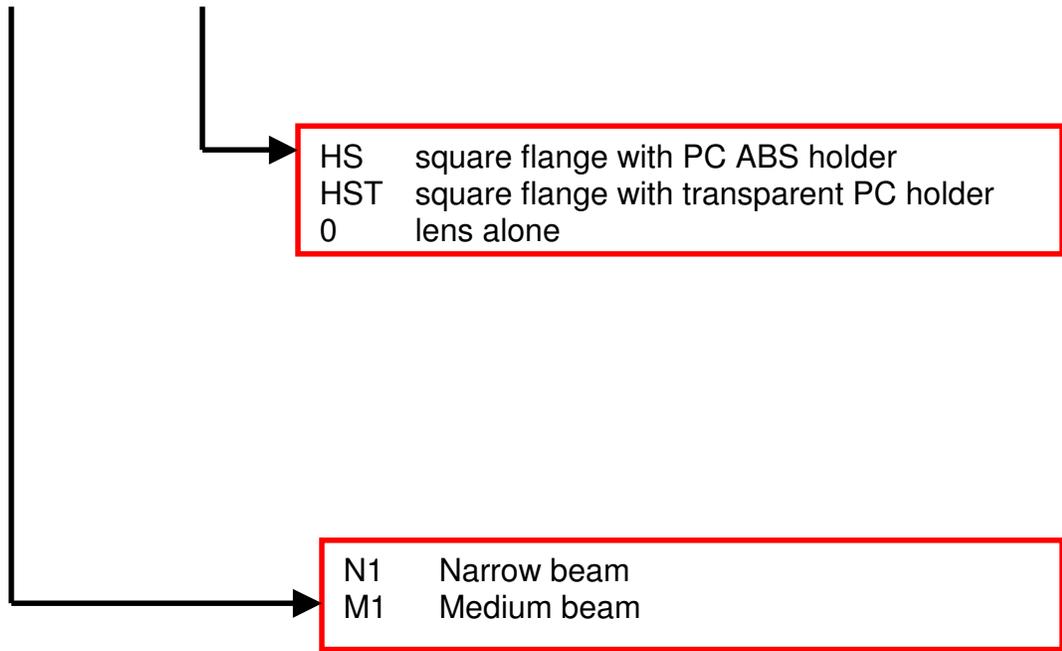
Light texture on the top lens

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".



Ordering part numbers

FDP-xx-D01-zz



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Document Revision Record

Rev	Date	Author	Description
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FRC SERIES REFLECTORS for OSRAM OSTAR™ LEDs:

- High efficiency
- Available in 2 different beams

The FRC series offers two reflectors especially designed for the OSTAR™ LED from Osram Opto Semiconductors Inc (1).

A software-optimized aspheric profile combined with precision facets provides narrow and medium beam patterns with homogeneous central spots and useful peripheral spilled light.

The high collection efficiency reaches 88% of the total flux emitted from the LED.

Three locating legs assure proper relative placement between the reflector and the OSTAR™ LED.

Typical applications are:

- Portable lighting (flashlights, bicycle, etc.)
- Architectural Lighting
- Most application requiring a bright central spot with peripheral spilled light.



(1) OSTAR™ is a trademark of OSRAM Opto Semiconductors Inc. For technical specification on LEDs please refer to the OSTAR™ datasheet or visit <http://www.osram-os.com/>

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Website: www.fraensrl.com



Material Characteristics

Reflector Material	ULTEM 1010 Polyetherimide, with aluminum reflective coating.
Operating Temperature range	- 40C / + 150C
Storage Temperature range	- 40C / + 150C

Please note that small defects in the reflective coating, and flow lines and weld lines on the surfaces of the reflectors are acceptable if the optical performance of the reflector is within the specification described in the section "OPTICAL CHARACTERISTICS"

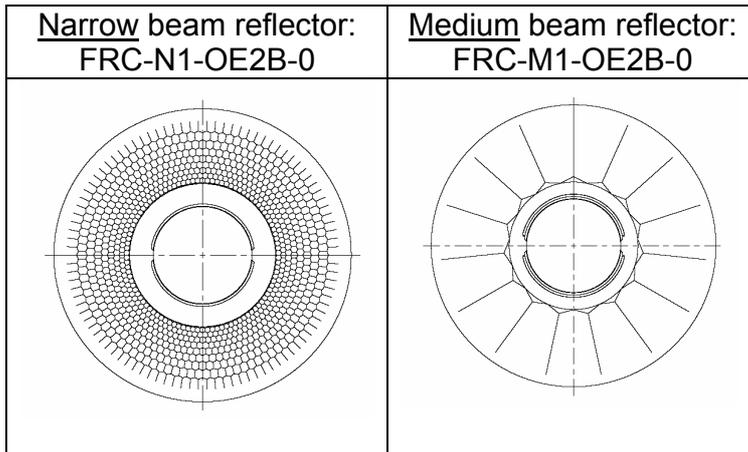
Assembly Information

IMPORTANT - Assembly information:

For best optical performance, correct mechanical position of the reflector on the OSTAR™ LED is critical.

Continued on next page...

Identifying Reflectors by Their Appearance



Optical Characteristics: Beam Divergence and On-axis Efficiency

Typical Beam Divergence, full beam width (degrees)		Central spot, at ½ peak intensity		Whole beam including spilled light, at cut-off
Reflector Part Number	Reflector Name	Beam angle: Full width ½ maximum	Beam style	Full width, at cutoff (degrees)
FRC-N1-OE2B-0	Narrow beam	See next data table below		100
FRC-M1-OE2B-0	Medium beam	See next data table below		100



Optical Characteristics: On-Axis Efficiency

Optical Performance On-axis efficiency (candela/lumen) and beam angle (degrees)			Central Spot		Spilled Light	
			On-axis intensity Cd/lm	Beam angle Degrees FWHM	~ spill intensity Cd/lm	Beam angle Degrees FWHM
Fraen Reflector Part Number	Reflector Name	Osram OStar LED	Cd/lm	Degrees FWHM	Cd/lm	Degrees FWHM
FRC-N1-OE2B-0	Narrow beam	4-chip with dome lens	9.6	11	0.2	100
		4-chip no dome lens	21.7	7	0.3	100
		6-chip with dome lens	7.2	12	0.2	100
		6-chip no dome lens	14.4	8	0.3	100
FRC-M1-OE2B-0	Medium beam	4-chip with dome lens	2.4	25	0.2	100
		4-chip no dome lens	2.3	27	0.3	100
		6-chip with dome lens	2.3	27	0.2	100
		6-chip no dome lens	2.1	26	0.3	100

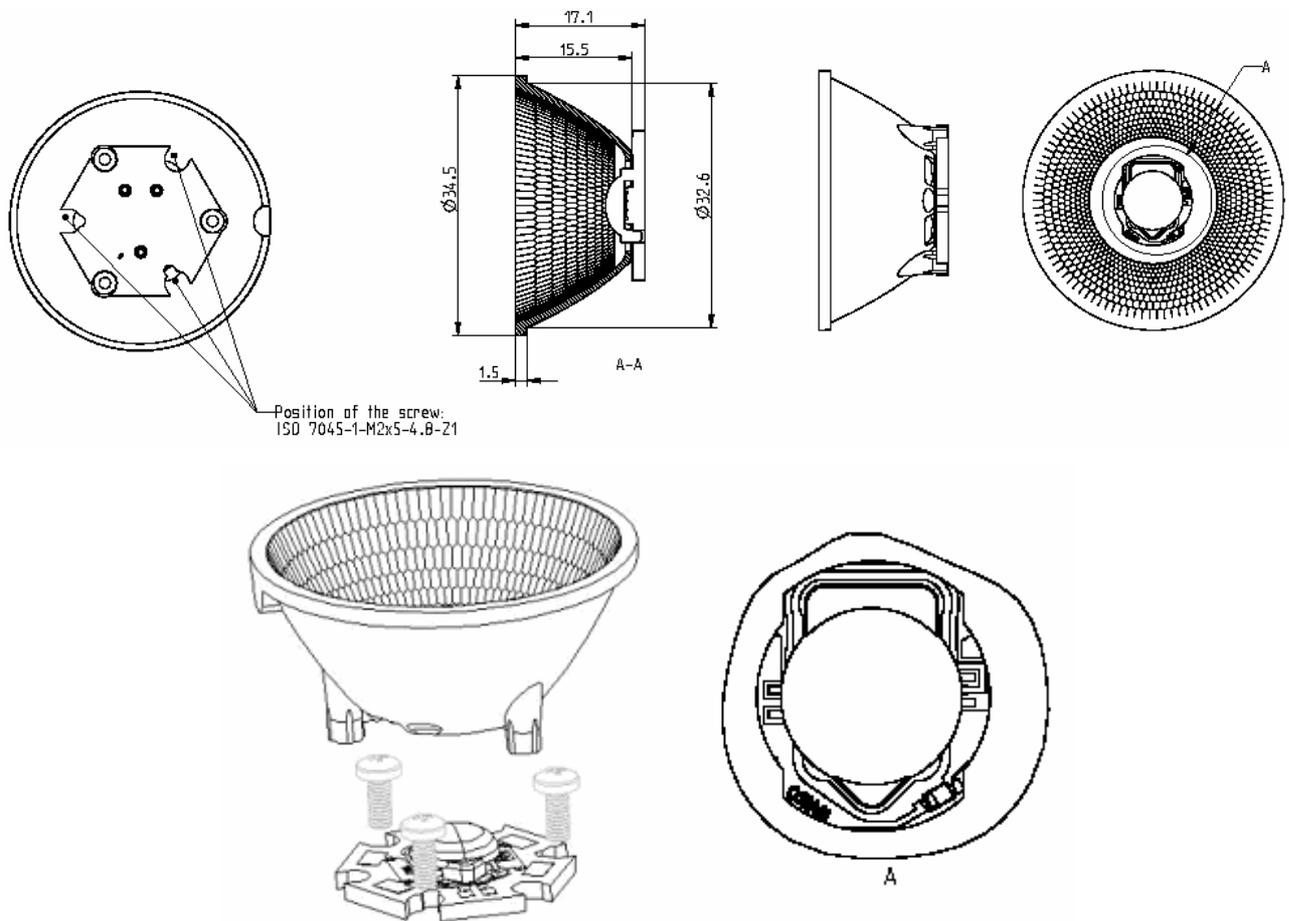
- (2) To estimate the on-axis intensity, multiply the on-axis efficiency of the reflector (cd/lm) by the total flux of the OSTAR™ LED used. For more detail on flux binning please check the OSTAR™ LED datasheet at [Osram OStar site](#)
- (3) Luminous intensity depends on the flux binning and tolerances of the LEDs. Please refer to the OSTAR™ datasheet for more details on flux binning and mechanical tolerances.

Note: These values have been calculated using the efficiency values of the reflector listed above and the formula $E = I / d^2$, where **E** is the irradiance in lux, **I** the intensity in cd, and **d** the distance between the reflector output and the measured point.

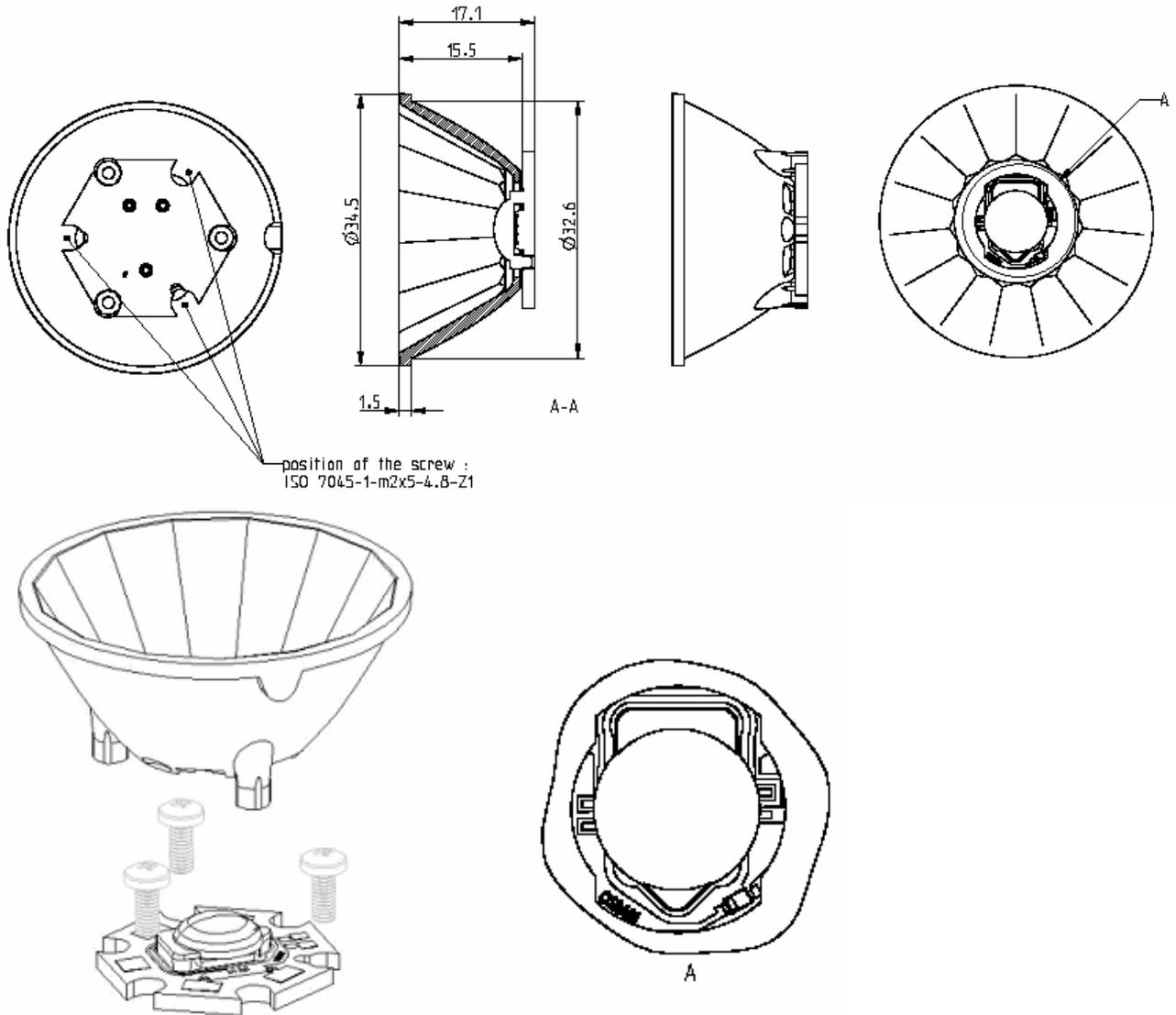
- (4) Typical illuminance measured in lux per lumen (E) with typical OSTAR™ LEDs. Based on White LED. To estimate the illuminance in lux, multiply the typical illuminance E by the flux in lumens of the LED used.
- (5) Illuminance output depends on the flux (lumens) of the LEDs.

Mechanical dimensions

Narrow beam reflector:



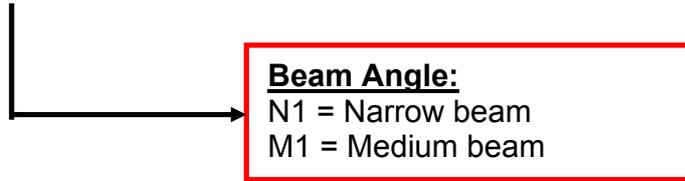
Medium beam reflector:





Ordering Part Numbers

FRC-xx-OE2B-0



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Document Revision Record

Rev	Date	Author	Description
00	06 June 2006	C. Jones	For review, pre-release.
01	28 June 2006	M.Thorailer	Update optical performances with measurements taken.
02	17 July 2006	M.Thorailer / C. Jones	Added data, mechanical dimensions, assembly views with LEDs.
03	21 March 2007	D. DeGaetano/C.Jones	Added 6-chip Ostar optical performance data.