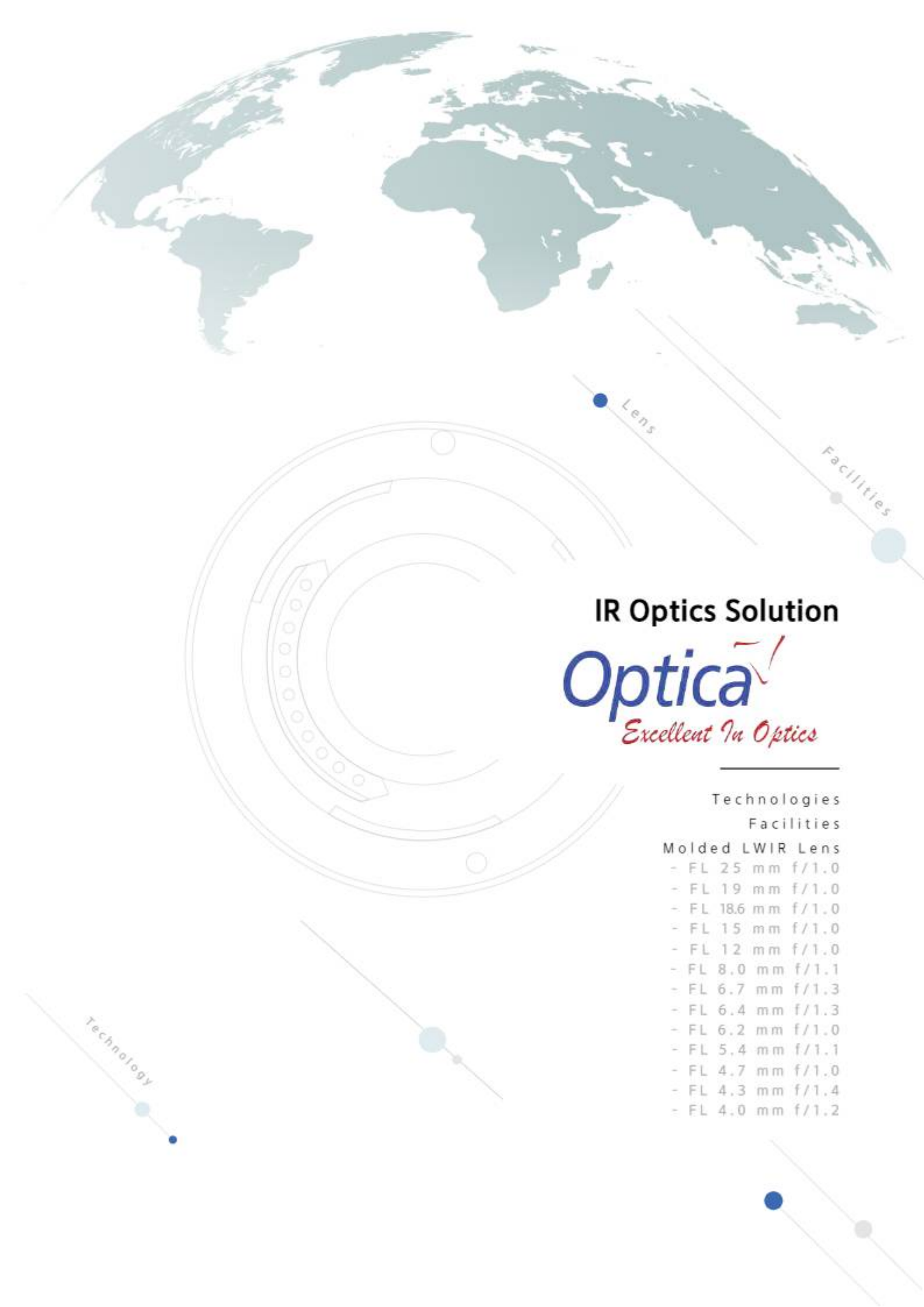




IR Optics Solution

Optica
Excellent In Optics

Technologies

Facilities

Molded LWIR Lens

- FL 25 mm f/1.0
- FL 19 mm f/1.0
- FL 18.6 mm f/1.0
- FL 15 mm f/1.0
- FL 12 mm f/1.0
- FL 8.0 mm f/1.1
- FL 6.7 mm f/1.3
- FL 6.4 mm f/1.3
- FL 6.2 mm f/1.0
- FL 5.4 mm f/1.1
- FL 4.7 mm f/1.0
- FL 4.3 mm f/1.4
- FL 4.0 mm f/1.2

Optics Technologies

Save the manufacturing costs by about 20~30%

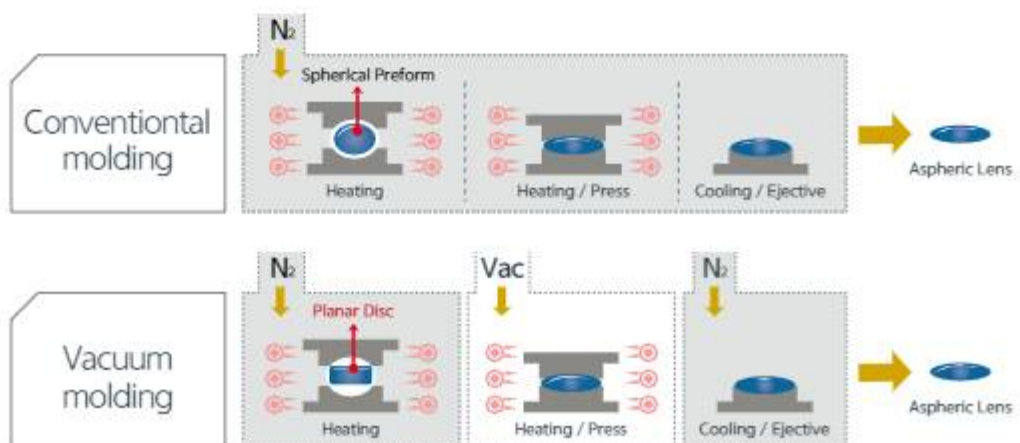
- Vacuum molding using unique mold
- Molding of diffractive-aspheric lens
- Fabrication of preform using a thermal process
- Finished lens molding (FLM) without post-processing



Key Technology 1

Vacuum-molding technique

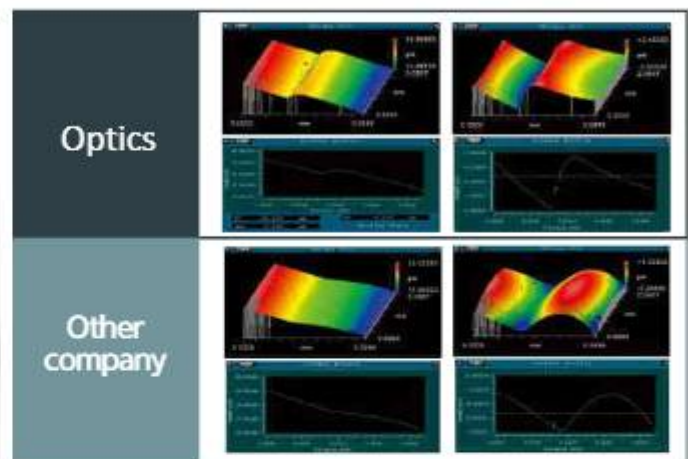
- Molding under high-vacuum (below 0.1 Pa) condition to use a planar-type preform
- Unique design of mold for vacuum molding



Key Technology 2

Molding technique of diffractive-aspheric lens

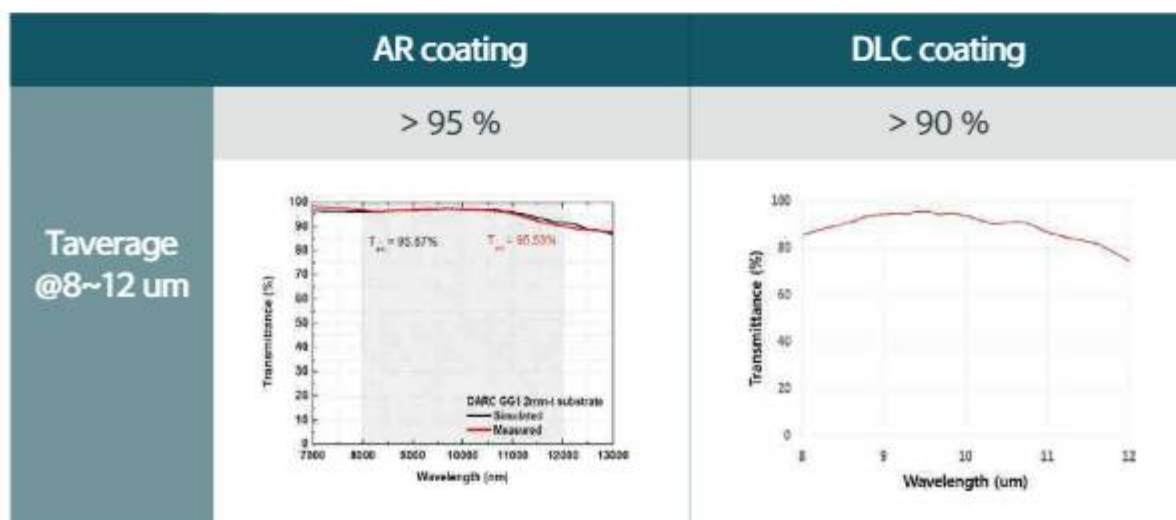
- Mass-production of diffractive-aspheric lens
- Fabrication of high-quality diffractive-aspheric lens



Key Technology 3

High efficiency coating technique for FIR range (@ 8~12 μm)

- AR(anti-reflective) coating
- DLC(diamond-like-carbon) coating



Horizontal FOV Across Compatible Detector Formats

Part no.				VN 4.012	VN 4.314	VN 4.710	VN 5.411	VN 6.210	VN 6.413	VN 6.713	VN 8.010	VN 1210	VN 1510	VN 1810	VN 1910	VN 2510
EFL (mm)				4.0	4.3	4.7	5.4	6.2	6.4	6.7	8.0	12	15	18.6	19	25
Fno.				1.2	1.4	1.0	1.1	1.0	1.3	1.3	1.0	1.0	1.0	1.0	1.0	10
Horizontal Resolution of Detector (pixels)	80	Pixel pitch	35 um		36.7		30.0									
			25 um				21.4		18							
			17 um													
			12 um													
	160	Pixel pitch	35 um													
			25 um	56.6	52.7	52.4										
			17 um	38.8	35.6	34.2	29.2									
			12 um				20.5		17.2							
	206	Pixel pitch	35 um													
			25 um								38					
			17 um													
			12 um						22.2							
	320	Pixel pitch	35 um													
			25 um													
			17 um	75.9	73.1			51.4		47	40.2	25.6	20.6	16.7	16.2	12.4
			12 um	54.4	50.5	50	41.5	36		33	28	18.2	14.6	11.8	11.5	8.8
	384	Pixel pitch	35 um													
			25 um													
			17 um	90	90			62.5		57	48.6	30.6	24.5	20	19.4	14.8
			12 um	64.9	61.1	62		43.3		40	33.8	21.8	17.5	14.2	13.8	10.5
	640	Pixel pitch	25 um													
			17 um												32.2	
			12 um					75			58.3	35.8	28.7	23.5	22.8	17.4
			10 um	88.4	87.9	97.5		61.2		55.8	47.6	30	24.5	19.6	19.1	14.6

Note : Each lens is optimized for a specific detector format represented by bold values.
This table shows values for other compatible detector formats with non-optimal performance.

Athermalized fixed focus

o Molded LWIR Lens FL 25.0 mm f/1.0 (Model VN2510)

Introduction



- **Precision molded LWIR lenses using chalcogenide glass**
High-volume, cost effective manufacturing
Optimized for the 8~12 um wavelength range
- **High performance LWIR lenses**
FL 25.0 mm, f/1.0 lens
Use of diffractive-aspheric lens
Ultralight, wide-angle, VGA and qVGA lens
- **Suitable for use with qVGA and qqVGA detectors and smaller**
- **Applications and capabilities**
Thermal imaging and thermography
Drone thermal imaging

Optical Specifications

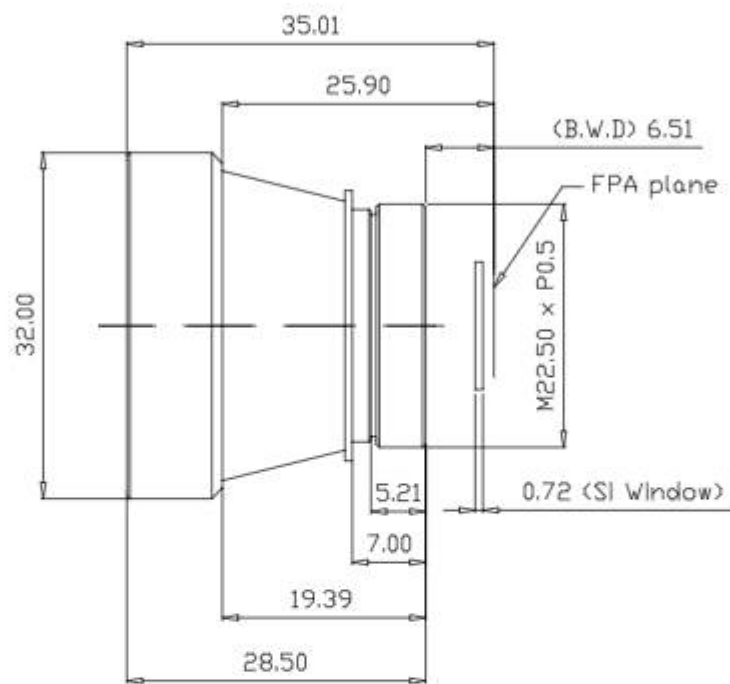
- **Focal length** 25.0 mm
- **Aperture-based f-number** f/1.0
- **Maximum image circle** 11 mm
- **Waveband** 8~12 um
- **Focus range** 6.5 m to infinity
- **Transmittance** > 95 % (AR coating)
> 90 % (DLC coating)
- **Field of view (FOV)**

Sensor array	Pixel size (um)	FOV (deg)		
		H	V	D
640 X 512	12	17.4	14.0	22.2
640 X 480	12	17.4	13.1	21.7
384 X 288	17	14.8	11.2	18.5
	12	10.5	7.9	13.1
320 X 240	17	12.4	9.3	15.6
	12	8.8	6.6	11.0

Note : Each lens is optimized for a specific detector format represented by bold values. This table shows values for other compatible detector formats with non-optimal performance.

Mechanical Specifications

- Lens mount Threaded (M21.5 x P0.5)
- Weight 28.7 g
- Sealing IP67 / on front
- Dimension



Environmental Specifications

- Operating temperature -35 ~ +60 °C
- Storage temperature -55 ~ +85 °C

Athermalized fixed focus

o Molded LWIR Lens FL 19 mm f/1.0 (Model VN1910)

Introduction



- **Precision molded LWIR lenses using chalcogenide glass**
High-volume, cost effective manufacturing
Optimized for the 8~12 μm wavelength range
- **High performance LWIR lenses**
FL 19 mm, f/1.03 lens
Use of diffractive-aspheric lens
Ultralight, wide-angle, passively athermalized LWIR lens
- **Suitable for use with VGA and qVGA detectors and smaller**
- **Applications and capabilities**
Thermal imaging and thermography
Automotive vision enhancement

Optical Specifications

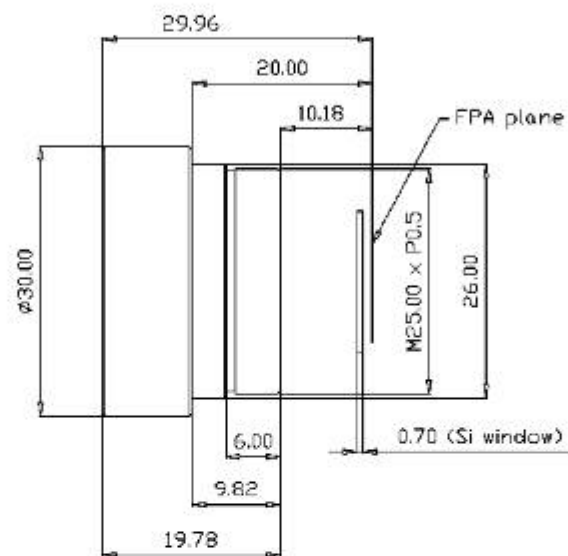
- **Focal length** 19 mm
- **Aperture-based f-number** f/1.03
- **Maximum image circle** 14.2 mm
- **Waveband** 8~12 μm
- **Focus range** 2.7 m to infinity
- **Transmittance** > 95 % (AR coating)
> 90 % (DLC coating)
- **Field of view (FOV)**

Sensor Array	Pixel size (μm)	FOV (deg)		
		H	V	D
640 X 480	17	32.2	24.2	40.1
	12	22.8	17.2	28.4
384 X 288	17	19.4	14.6	24.2
	12	13.8	10.4	17.2
320 X 240	17	16.2	12.2	20.2
	12	11.5	8.6	14.3

Note : Each lens is optimized for a specific detector format represented by bold values. This table shows values for other compatible detector formats with non-optimal performance.

Mechanical Specifications

- Lens mount Threaded (M25 x P0.5)
- Weight 35 g
- Sealing IP67 / on front
- Dimension



Environmental Specifications

- Operating temperature -35 ~ +60 °C
- Storage temperature -55 ~ +85 °C

Athermalized fixed focus

o Molded LWIR Lens FL 18.6 mm f/1.0 (Model VN1810)

Introduction

- Precision molded LWIR lenses using chalcogenide glass
High-volume, cost effective manufacturing
Optimized for the 8~12 um wavelength range
- High performance LWIR lenses
FL 18.6 mm, f/1.0 lens
Use of diffractive-aspheric lens
Ultralight, wide-angle, VGA and qVGA lens
- Suitable for use with qVGA and qqVGA detectors and smaller
- Applications and capabilities
Thermal imaging and thermography
Drone thermal imaging

Optical Specifications

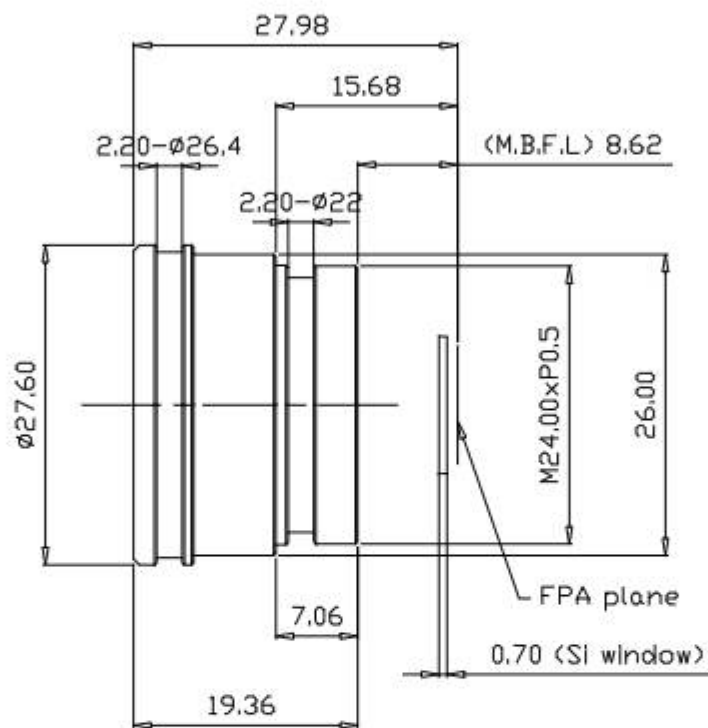
- Focal length 18.6 mm
- Aperture-based f-number f/1.0
- Maximum image circle 10.6 mm
- Waveband 8~12 um
- Focus range 3.6 m to infinity
- Transmittance
> 95 % (AR coating)
> 90 % (DLC coating)
- Field of view (FOV)

Sensor array	Pixel size (um)	FOV (deg)		
		H	V	D
640 X 512	12	23.5	18.8	30.1
640 X 480	12	23.5	17.7	29.4
384 X 288	17	20	15	25
	12	14.2	10.6	17.7
320 X 240	17	16.7	12.5	20.8
	12	11.8	8.9	14.7

Note : Each lens is optimized for a specific detector format represented by bold values. This table shows values for other compatible detector formats with non-optimal performance.

Mechanical Specifications

- Lens mount Threaded (M25 x P0.5)
- Weight 28.5 g
- Sealing IP67 / on front
- Dimension



Environmental Specifications

- Operating temperature -35 ~ +60 °C
- Storage temperature -55 ~ +85 °C

Athermalized fixed focus

o Molded LWIR Lens FL 15 mm f/1.0 (Model VN1510)

Introduction



- **Precision molded LWIR lenses using chalcogenide glass**
High-volume, cost effective manufacturing
Optimized for the 8–12 μm wavelength range
- **High performance LWIR lenses**
FL 15 mm, f/1.0 lens
Use of diffractive-aspheric lens
Ultralight, wide-angle, passively athermalized LWIR lens
- **Suitable for use with VGA and qVGA detectors and smaller**
- **Applications and capabilities**
Thermal imaging and thermography
Automotive vision enhancement

Optical Specifications

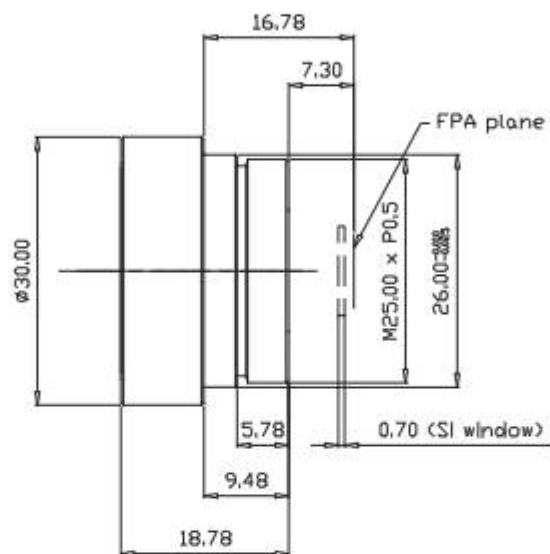
- **Focal length** 15.0 mm
- **Aperture-based f-number** f/1.03
- **Maximum image circle** 8.16 mm
- **Waveband** 8–12 μm
- **Focus range** 1.7 m to infinity
- **Transmittance** > 95 % (AR coating)
> 90 % (DLC coating)
- **Field of view (FOV)**

Sensor array	Pixel size (μm)	FOV (deg)		
		H	V	D
640 X 480	12	28.7	21.7	35.5
384 X 288	17	24.5	18.5	30.4
	12	17.5	13.1	21.7
320 X 240	17	20.6	15.5	25.5
	12	14.6	11	18.2

Note : Each lens is optimized for a specific detector format represented by bold values. This table shows values for other compatible detector formats with non-optimal performance.

Mechanical Specifications

- Lens mount Threaded (M25 x P0.5)
- Weight 30 g
- Sealing IP67 / on front
- Dimension



Environmental Specifications

- Operating temperature $-35 \sim +60^{\circ}\text{C}$
- Storage temperature $-55 \sim +85^{\circ}\text{C}$

Athermalized fixed focus

o Molded LWIR Lens FL 12.0 mm f/1.0 (Model VN1210)

Introduction



- **Precision molded LWIR lenses using chalcogenide glass**
High-volume, cost effective manufacturing
Optimized for the 8~12 μm wavelength range
- **High performance LWIR lenses**
FL 12 mm, f/1.0 lens
Use of diffractive-aspheric lens
Ultralight, wide-angle, passively athermalized LWIR lens
- **Suitable for use with qVGA and qqVGA detectors and smaller**
- **Applications and capabilities**
Thermal imaging and thermography
Automotive vision enhancement

Optical Specifications

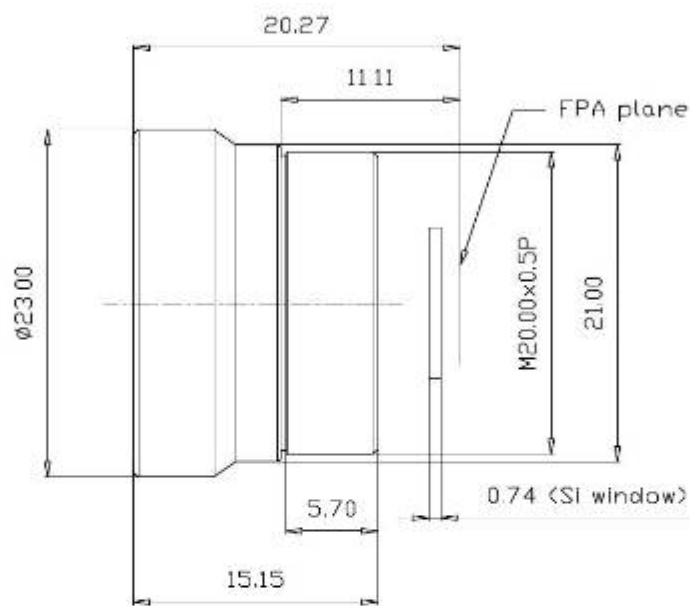
- **Focal length** 12.0 mm
- **Aperture-based f-number** f/1.0
- **Maximum image circle** 9.0 mm
- **Waveband** 8~12 μm
- **Focus range** 1.8 m to infinity
- **Transmittance**
> 95 % (AR coating)
> 90 % (DLC coating)
- **Field of view (FOV)**

Sensor array	Pixel size (μm)	FOV (deg)		
		H	V	D
640 X 480	12	35.8	27.1	44.5
	10	30	22.6	37.2
384 X 288	17	30.6	23.1	38
	12	21.8	16.4	27
320 X 240	17	25.6	19.3	31.8
	12	18.2	13.7	22.7

Note : Each lens is optimized for a specific detector format represented by bold values. This table shows values for other compatible detector formats with non-optimal performance.

Mechanical Specifications

- Lens mount Threaded (M20 x P0.5)
- Weight 14.8 g
- Sealing IP67 / on front
- Dimension



Environmental Specifications

- Operating temperature $-35 \sim +60^{\circ}\text{C}$
- Storage temperature $-55 \sim +85^{\circ}\text{C}$

Athermalized fixed focus

o Molded LWIR Lens FL 8.0 mm f/1.0 (Model VN8.010)

Introduction



- **Precision molded LWIR lenses using chalcogenide glass**
High-volume, cost effective manufacturing
Optimized for the 8~12 μm wavelength range
- **High performance LWIR lenses**
FL 8.0 mm, f/1.0 lens
Use of diffractive-aspheric lens
Ultralight, wide-angle, passively athermalized LWIR lens
- **Suitable for use with qVGA and qqVGA detectors and smaller**
- **Applications and capabilities**
Thermal imaging and thermography
Automotive vision enhancement

Optical Specifications

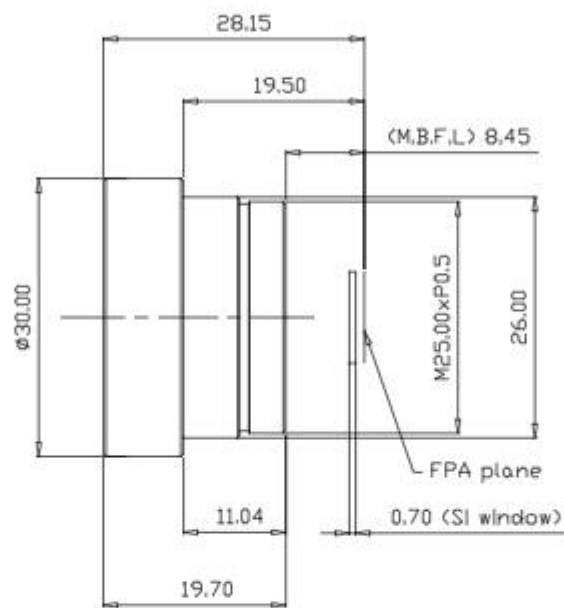
- **Focal length** 8.0 mm
- **Aperture-based f-number** f/1.0
- **Maximum image circle** 8.7 mm
- **Waveband** 8~12 μm
- **Focus range** 4.8 m to infinity
- **Transmittance**
> 95 % (AR coating)
> 90 % (DLC coating)
- **Field of view (FOV)**

Sensor array	Pixel size (μm)	FOV (deg)		
		H	V	D
640 X 480	12	58.3	42.5	76.5
	10	47.6	35.1	61.1
384 X 288	17	48.6	35.8	62.5
	12	33.6	25.0	42.5
320 X 240	17	40.0	29.6	50.8
	12	27.8	20.8	35.0

Note : Each lens is optimized for a specific detector format represented by bold values. This table shows values for other compatible detector formats with non-optimal performance.

Mechanical Specifications

- Lens mount Threaded (M25 x P0.5)
- Weight 27.5 g
- Sealing IP67 / on front
- Dimension



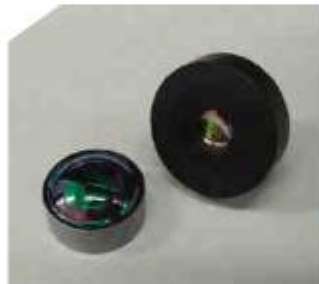
Environmental Specifications

- Operating temperature -35 ~ +60 °C
- Storage temperature -55 ~ +85 °C

Athermalized fixed focus

o Molded LWIR Lens FL 6.7 mm f/1.3 (Model VN6.713)

Introduction



- Precision molded LWIR lenses using chalcogenide glass
High-volume, cost effective manufacturing
Optimized for the 8~12 μm wavelength range
- High performance LWIR lenses
FL 6.7 mm, f/1.3 lens
Use of diffractive-aspheric lens
Ultralight, wide-angle, passively athermalized LWIR lens
- Suitable for use with qVGA and qqVGA detectors and smaller
- Applications and capabilities
Thermal imaging and thermography
Automotive vision enhancement

Optical Specifications

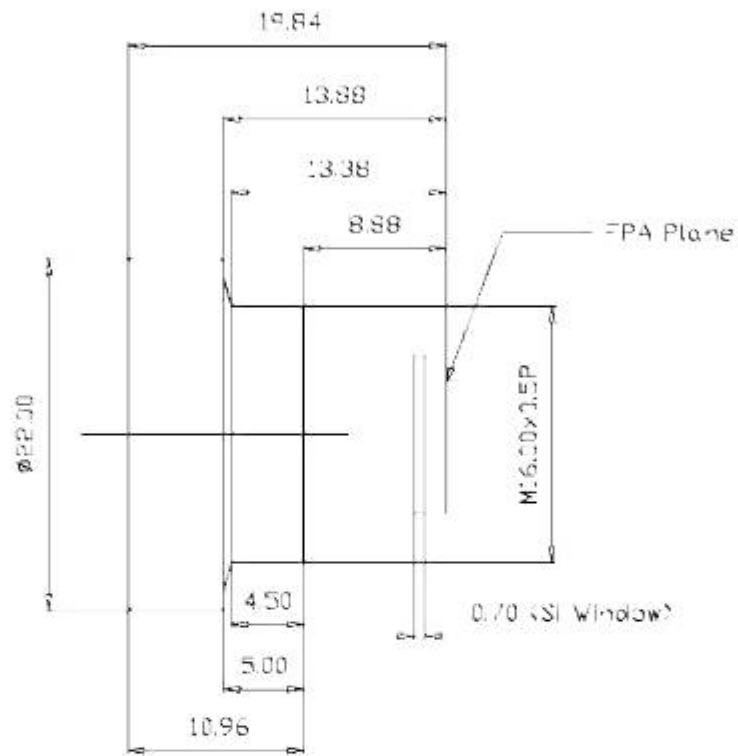
- Focal length 6.7 mm
- Aperture-based f-number f/1.3
- Maximum image circle 8.4 mm
- Waveband 8~12 μm
- Focus range 0.26 m to infinity
- Transmittance
> 95 % (AR coating)
> 90 % (DLC coating)
- Field of view (FOV)

Sensor array	Pixel size (μm)	FOV (deg)		
		H	V	D
384 X 288	17	57.0	42.3	72.5
	12	40.0	30.0	50.0
320 X 240	17	47.0	35.0	60.0
	12	33.0	25.0	41.4

Note : Each lens is optimized for a specific detector format represented by bold values. This table shows values for other compatible detector formats with non-optimal performance.

Mechanical Specifications

- Lens mount Threaded (M16 x P0.5)
- Weight 9.7 g
- Sealing IP67 / on front
- Dimension



Environmental Specifications

- Operating temperature -35 ~ +60 °C
- Storage temperature -55 ~ +85 °C

Athermalized fixed focus

o Molded LWIR Lens FL 6.4 mm f/1.3 (Model VN6.413)

Introduction



- **Precision molded LWIR lenses using chalcogenide glass**
High-volume, cost effective manufacturing
Optimized for the 8~12 um wavelength range
- **High performance LWIR lenses**
FL 6.4 mm, f/1.2 lens
Use of diffractive-aspheric lens
Ultralight, wide-angle, passively athermalized LWIR lens
- **Applications and capabilities**
Thermal imaging and thermography

Optical Specifications

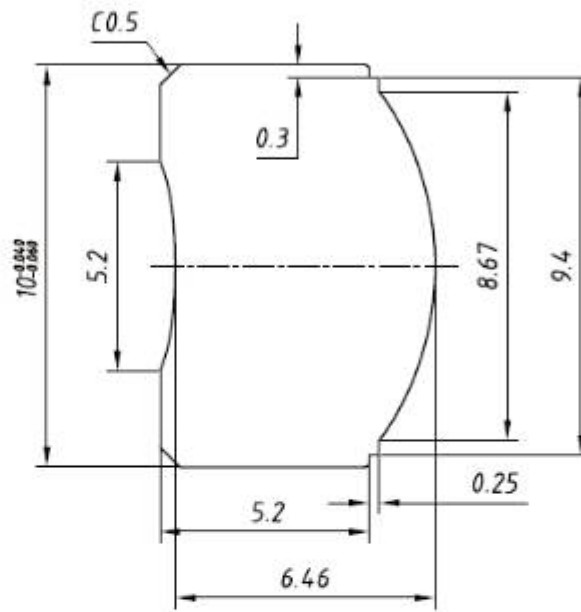
- **Focal length** 6.41 mm
- **Aperture-based f-number** f/1.28
- **Waveband** 8~12 um
- **Focus range** 0.34 m to infinity
- **Transmittance** > 95 % (AR coating)
> 90 % (DLC coating)
- **Field of view (FOV)**

Sensor array	Pixel size (um)	FOV (deg)		
		H	V	D
206 x 156	12	22.2	16.8	28
160 x 120	12	17.2	13	21.5
80 x 60	25	18	13.4	22.5

Note : Each lens is optimized for a specific detector format represented by bold values. This table shows values for other compatible detector formats with non-optimal performance.

Mechanical Specifications

- Weight 2.15 g
- Sealing IP67 / on front
- Dimension



Environmental Specifications

- Operating temperature $-35 \sim +60^{\circ}\text{C}$
- Storage temperature $-55 \sim +85^{\circ}\text{C}$

Athermalized fixed focus

o Molded LWIR Lens FL 6.2 mm f/1.0 (Model VN6.210)

Introduction



- **Precision molded LWIR lenses using chalcogenide glass**
High-volume, cost effective manufacturing
Optimized for the 8~12 μm wavelength range
- **High performance LWIR lenses**
FL 6.2 mm, f/1.0 lens
Use of diffractive-aspheric lens
Ultralight, wide-angle, passively athermalized LWIR lens
- **Suitable for use with qVGA and qqVGA detectors and smaller**
- **Applications and capabilities**
Thermal imaging and thermography
Automotive vision enhancement

Optical Specifications

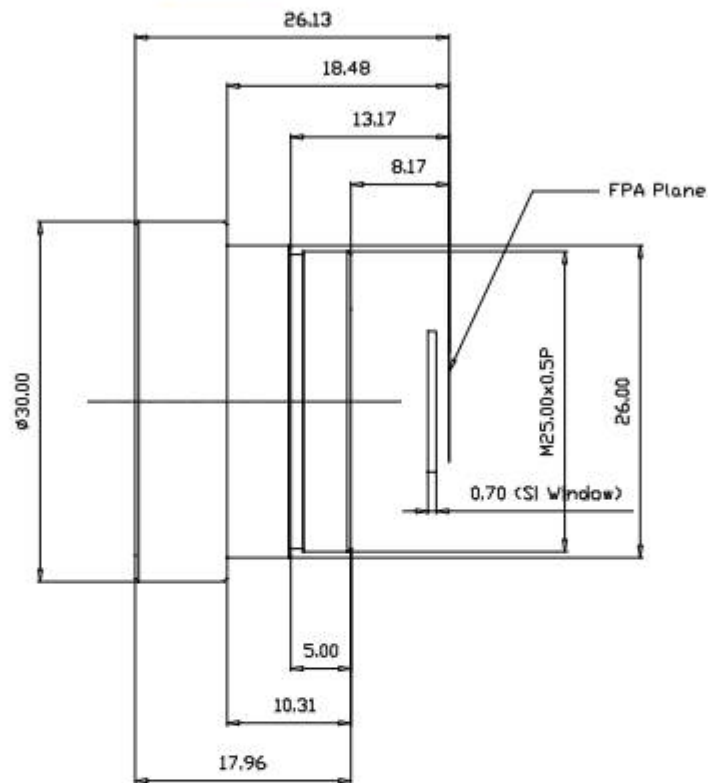
- **Focal length** 6.2 mm
- **Aperture-based f-number** f/1.0
- **Maximum image circle** 10 mm
- **Waveband** 8~12 μm
- **Focus range** 0.41 m to infinity
- **Transmittance** > 95 % (AR coating)
> 90 % (DLC coating)
- **Field of view (FOV)**

Sensor array	Pixel size (μm)	FOV (deg)		
		H	V	D
640 X 480	12	75.0	54.6	99.5
384 X 288	17	62.5	46.0	80.5
	12	43.3	32.2	54.6
320 X 240	17	51.4	38.2	65.4
	12	36.0	26.8	45.1

Note : Each lens is optimized for a specific detector format represented by bold values. This table shows values for other compatible detector formats with non-optimal performance.

Mechanical Specifications

- Lens mount Threaded (M25 x P0.5)
- Weight 30 g
- Sealing IP67 / on front
- Dimension



Environmental Specifications

- Operating temperature $-35 \sim +60^{\circ}\text{C}$
- Storage temperature $-55 \sim +85^{\circ}\text{C}$

Athermalized fixed focus

o Molded LWIR Lens FL 5.4 mm f/1.1 (Model VN5.411)

Introduction



- **Precision molded LWIR lenses using chalcogenide glass**
High-volume, cost effective manufacturing
Optimized for the 8~12 um wavelength range
- **High performance LWIR lenses**
FL 5.4 mm, f/1.1 lens
Use of diffractive-aspheric lens
Ultralight, wide-angle, passively athermalized LWIR lens
- **Applications and capabilities**
Thermal imaging and thermography

Optical Specifications

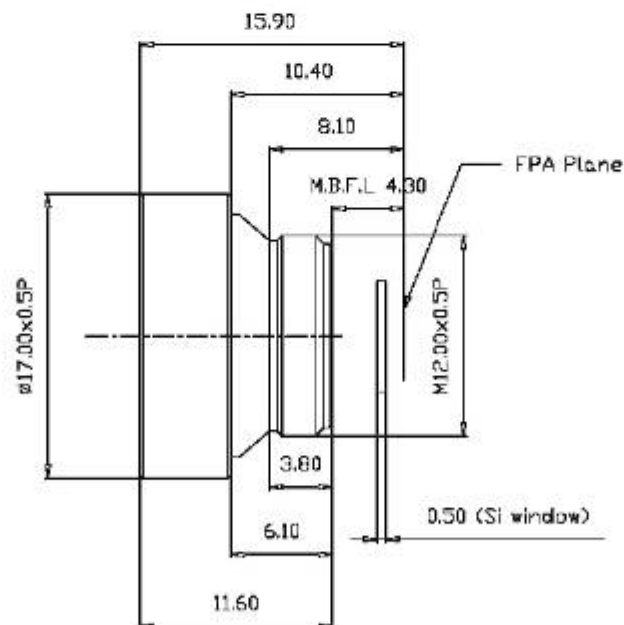
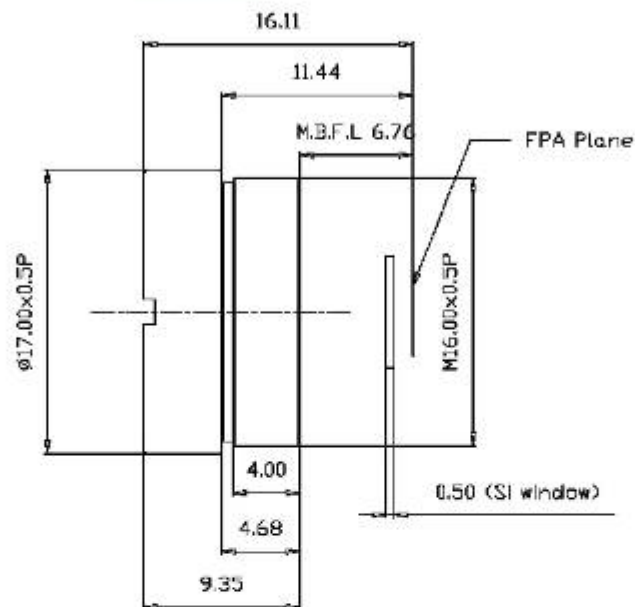
- **Focal length** 5.4 mm
- **Aperture-based f-number** f/1.14
- **Waveband** 8~12 um
- **Focus range** 0.2 m to infinity
- **Transmittance** > 95 % (AR coating)
> 90 % (DLC coating)
- **Field of view (FOV)**

Sensor array	Pixel size (um)	FOV (deg)		
		H	V	D
320 x 240	12	41.5	30.9	52.4
160 x 120	17	29.2	21.8	36.6
	12	20.5	15.4	25.7
80 x 60	35	30.0	22.5	37.7
	25	21.4	16.0	26.8

Note : Each lens is optimized for a specific detector format represented by bold values. This table shows values for other compatible detector formats with non-optimal performance.

Mechanical Specifications

- Weight ~5.6 g
- Sealing IP67 / on front
- Dimension



Environmental Specifications

- Operating temperature $-35 \sim +60^{\circ}\text{C}$
- Storage temperature $-55 \sim +85^{\circ}\text{C}$

Athermalized fixed focus

o Molded LWIR Lens FL 4.7 mm f/1.0 (Model VN4.710)

Introduction



- **Precision molded LWIR lenses using chalcogenide glass**
High-volume, cost effective manufacturing
Optimized for the 8~12 μm wavelength range
- **High performance LWIR lenses**
FL 4.7 mm, f/1.0 lens
Use of diffractive-aspheric lens
Ultralight, wide-angle, passively athermalized LWIR lens
- **Applications and capabilities**
Thermal imaging and thermography

Optical Specifications

- **Focal length** 4.7 mm
- **Aperture-based f-number** f/1.05 mm
- **Waveband** 8~12 μm
- **Focus range** 0.24 m to infinity
- **Transmittance** > 95 % (AR coating)
> 90 % (DLC coating)
- **Field of view (FOV)**

Sensor array	Pixel size (μm)	FOV (deg)		
		H	V	D
384 x 288	12	62	44.4	83
320 x 240	12	50	36.4	65.2
160 x 120	25	52.4	38	68.6
	17	34.2	25.3	43.6

Note : Each lens is optimized for a specific detector format represented by bold values. This table shows values for other compatible detector formats with non-optimal performance.

Athermalized fixed focus

o Molded LWIR Lens FL 4.3 mm f/1.4 (Model VN4.314)

Introduction



- **Precision molded LWIR lenses using chalcogenide glass**
High-volume, cost effective manufacturing
Optimized for the 8~12 μm wavelength range
- **High performance LWIR lenses**
FL 4.3 mm, f/1.4 lens
Use of diffractive-aspheric lens
Ultralight, wide-angle, passively athermalized LWIR lens
- **Applications and capabilities**
Thermal imaging and thermography

Optical Specifications

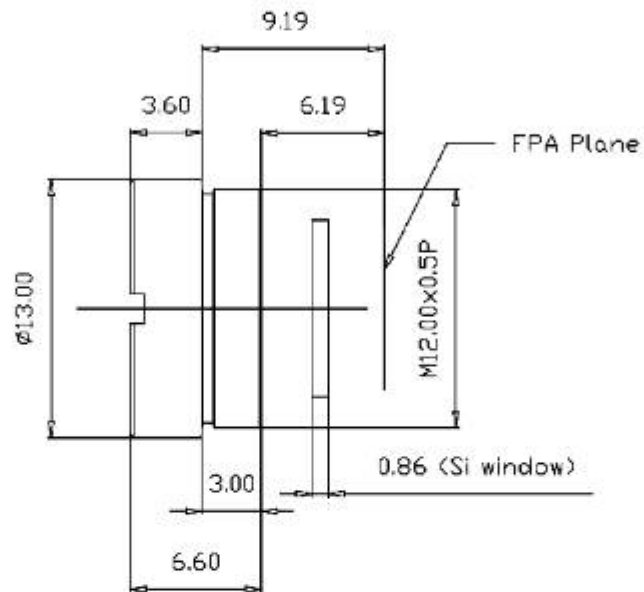
- **Focal length** 4.3 mm
- **Aperture-based f-number** f/1.39
- **Waveband** 8~12 μm
- **Focus range** 0.1 m to infinity
- **Transmittance** > 95 % (AR coating)
> 90 % (DLC coating)
- **Field of view (FOV)**

Sensor Array	Pixel size (μm)	FOV (deg)		
		H	V	D
384 X 288	17	90	65.2	120
	12	61.1	45.4	78
320 X 240	17	73.1	53.8	94.5
	12	50.5	37.7	63.8
160 X 120	25	52.7	39.3	66.7
	17	35.6	26.7	44.6
80 X 60	35	36.7	27.5	46

Note : Each lens is optimized for a specific detector format represented by bold values. This table shows values for other compatible detector formats with non-optimal performance.

Mechanical Specifications

- Lens mount Threaded (M12 x P0.5)
- Weight 2.3 g
- Sealing IP67 / on front
- Dimension



Environmental Specifications

- Operating temperature $-35 \sim +60^{\circ}\text{C}$
- Storage temperature $-55 \sim +85^{\circ}\text{C}$

Athermalized fixed focus

o Molded LWIR Lens FL 4.0 mm f/1.2 (Model VN4.012)

Introduction



- **Precision molded LWIR lenses using chalcogenide glass**
High-volume, cost effective manufacturing
Optimized for the 8–12 μm wavelength range
- **High performance LWIR lenses**
FL 4.0 mm, f/1.18 lens
Use of diffractive-aspheric lens
Ultralight, wide-angle, passively athermalized LWIR lens
- **Suitable for use with qVGA and qqVGA detectors and smaller**
- **Applications and capabilities**
Thermal imaging and thermography
Automotive vision enhancement

Optical Specifications

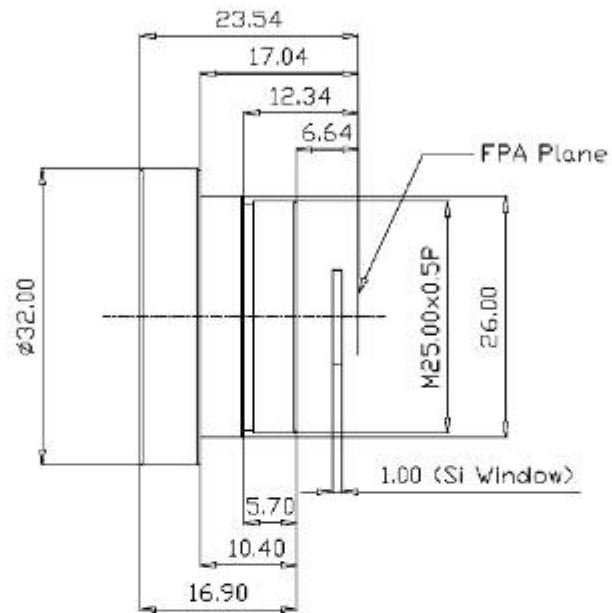
- **Focal length** 4.0 mm
- **Aperture-based f-number** f/1.18
- **Maximum image circle** 8.6mm
- **Waveband** 8–12 μm
- **Focus range** 0.1 m to infinity
- **Transmittance**
> 95 % (AR coating)
> 90 % (DLC coating)
- **Field of view (FOV)**

Sensor Array	Pixel size (μm)	FOV (deg)		
		H	V	D
384 X 288	17	90	68.7	112.6
	12	64.9	49	80.1
320 X 240	17	75.9	57.7	93.5
	12	54.4	41.1	67.4
160 X 120	25	56.6	42.7	70.1
	17	38.8	29.2	48.3

Note : Each lens is optimized for a specific detector format represented by bold values. This table shows values for other compatible detector formats with non-optimal performance.

Mechanical Specifications

- Lens mount Threaded (M25 x P0.5)
- Weight 28g
- Sealing IP67 / on front
- Dimension



Environmental Specifications

- Operating temperature -35 ~ +60 °C
- Storage temperature -55 ~ +85 °C



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