



鲲游光电

North Ocean Photonics

Product Brochure

以晶圆级光学奠定光子AI的基石
Building Photonic AI on Wafer Level Optics



About North Ocean Photonics

Based in Shanghai, China, North Ocean Photonics (NOP) is a leading high-tech company specializing in wafer-level optics (WLO) and optical integration.

Leveraging extensive technical expertise and advanced manufacturing capabilities, NOP is committed to exploring cutting-edge applications in the fields of photonics and optoelectronics.



Core Team

NOP's team brings together professors and PhDs from world-class universities, senior executives from globally and nationally renowned companies, as well as recipients of the prestigious National Science and Technology Progress Award.

WLO Closed-loop R&D + Mass Production Platform

Since its establishment in 2017, NOP has built state-of-the-art facilities, including nearly 10,000 square meters of ultra-cleanrooms and cutting-edge hardware platforms. The NOP Shanghai R&D and Manufacturing Center features fully equipped office spaces, research labs, and in-house Class 100 and 1000 clean rooms.



NOP has also developed advanced quality control and software systems, along with comprehensive team training programs. This has enabled the realization of a fully integrated IDM system, covering the entire process from R&D, design, process development, mass production to quality testing.

Having undergone rigorous factory inspections and quality control certifications from top-tier multinational clients, the company has become one of the few globally to achieve shipments exceeding 10KK levels in the wafer-level optics field.



Intellectual Property

NOP has formed a competitive and holistic IP system, with hundreds of patents in portfolio.

Patent Applications:
370+

China Patents: 300+

US Patents: 11

PCT Patent: 16

GB/T29490 -2013



Qualifications

NOP holds the qualifications for mass production in the consumer electronics and automotive industries:

ISO 9001

ISO 14001

ISO 45001

IATF 16949



Three Key Product Lines

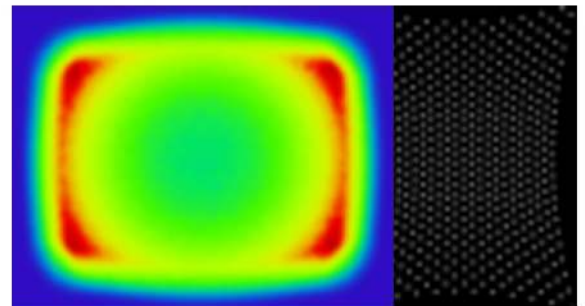
NOP has built three key product lines: sensing and machine vision, AR diffractive waveguide, and automotive LIDAR, all successfully adopted by leading clients around the globe.



Sensing and Machine Vision

Application: 3D Depth Sensing & Automatic Driving

- The core DOE of 3D depth imaging module must be designed using wafer-level processing and manufactured accordingly;
- LiDAR for autonomous driving and depth cameras.



AR Diffractive Waveguide

Application: AR Diffractive Waveguide

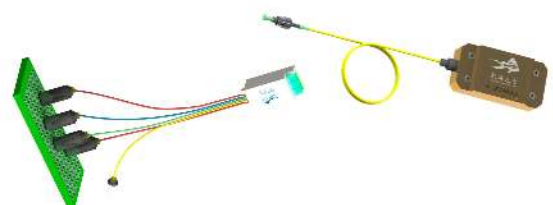
- The AR industry has tremendous potential, with the waveguide being the key display element in AR hardware with a high technical threshold.
- NOP can provide comprehensive solutions for AR waveguides that integrate multiple innovative approaches and enable cost-effective mass delivery.



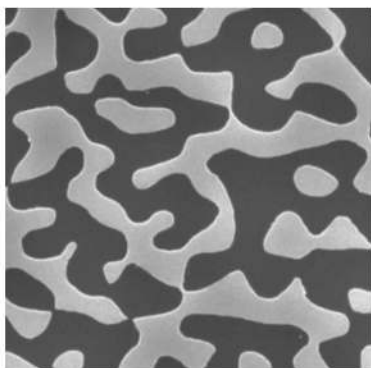
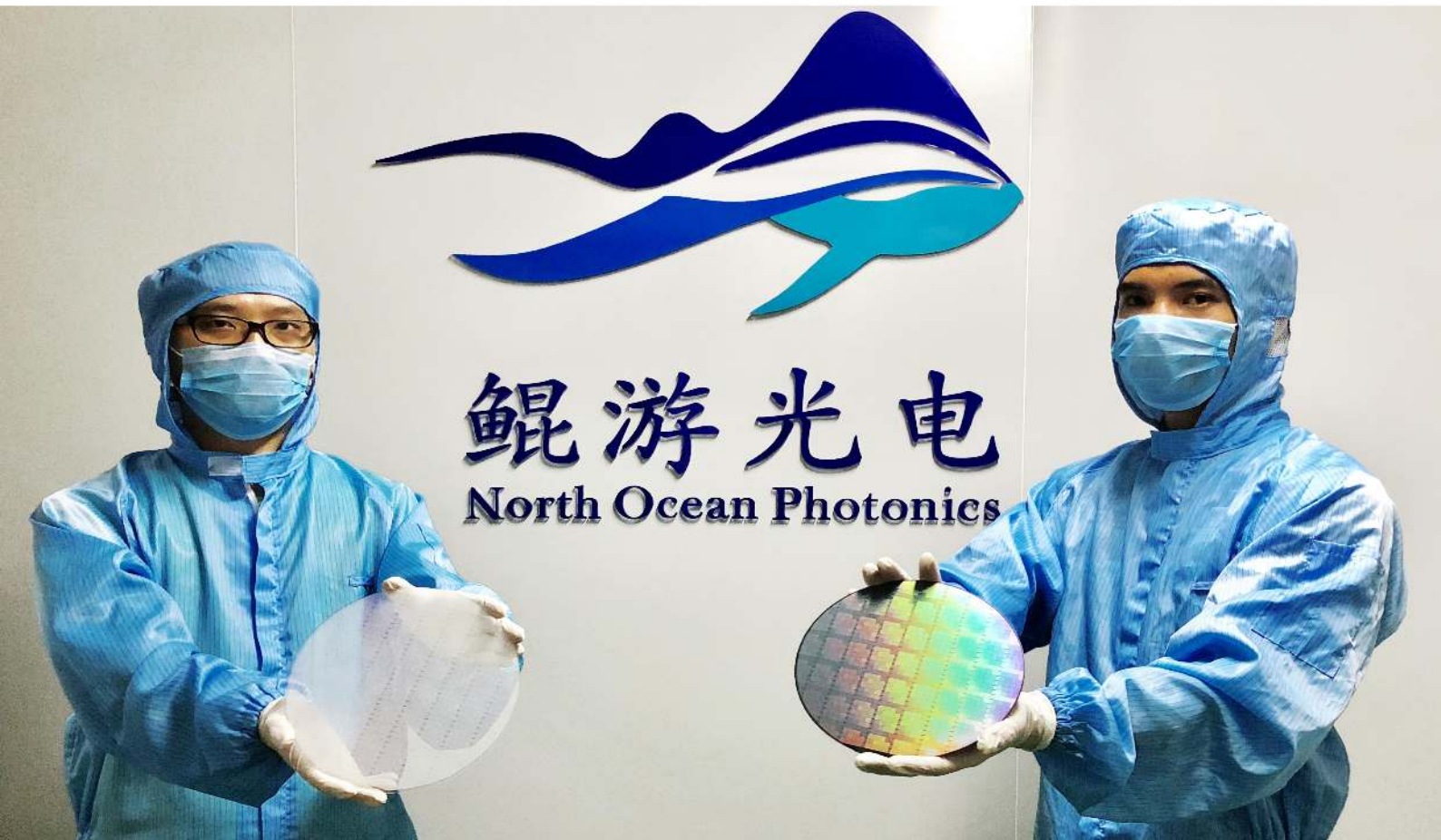
Automotive and LIDAR

Application: Fiber Optics and LIDAR

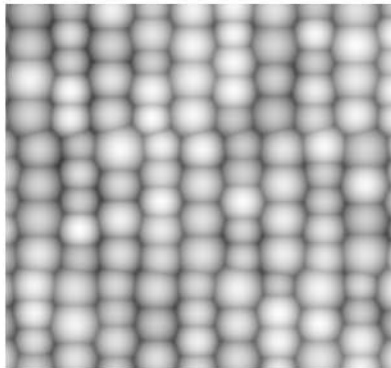
- Mainly used for high-speed (>100G) optical communication transceiver modules and high-precision coupling connections for silicon photonic chips;
- Optical transceiver module products for vehicle-mounted LiDAR, officially began to be integrated into mass production models of a well-known international brand at the beginning of 2022.



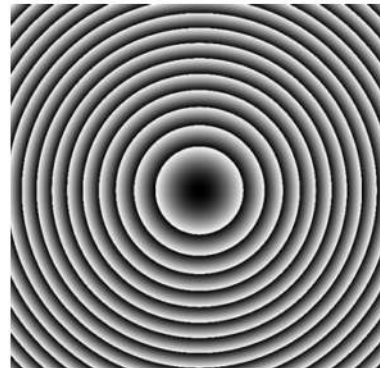
Sensing and Machine Vision



DOE



MLA



Fresnel Lens



Film

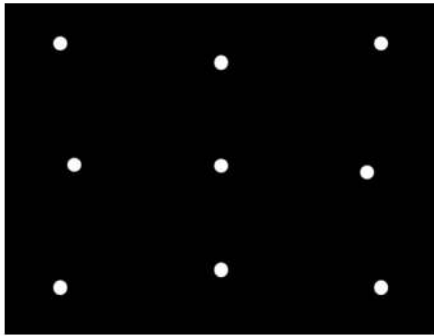
■ Product Portfolio

Product Series	Product Category	Applications
DOE - Multiple materials and multi step structures available; - Minimum feature size around 300nm;	Beam Splitter: Splits the laser beam into an arbitrary number of spot patterns;	3D Structural Light
	Multifocal Component: Focuses the laser along the axial propagation direction to generate multiple focal points;	Laser Cutting
	Special Pattern Projector: Projects customized patterns required by the user, such as circles, scan frames, crosses, and so on.	Widely used in various scenarios
MLA - Multiple materials available; - Grayscale lithography, thermal reflow, and machining available; - Dual-sided anti-reflective coating available;	Laser Diffuser: Using a randomized micro-lens array structure to evenly distribute the laser light over the target field of view.	TOF Depth Sensing
	Regular MLA: with various periodic arrangements (e.g., rectangular, hexagonal, linear, etc.)	Meeting various customized application requirements.
	Collimating/Focused Micro-Lenses: Spherical or aspherical micro-lenses	Collimating the laser beam or focusing the light in front of the receiver
Film - Production based on Lithography/etching process; - Minimum feature linewidth is around 2 μm; - Layer coating reflectivity customizable;	Projection Mask: Projection light patterns customizable	Projection Light Module
	Code disk: High-precision photolithography-etched light and dark code tracks	Displacement Sensor
	Reticle: Crosshair or concentric circle patterns	Reference Object
Fresnel Lens - Production based on NIL process; - Minimum ring pitch/line height can approach the micrometer scale;	Collimating/Focusing Components: Quantizing the lens into a series of ring structures, compressing the lens structure into a near-planar configuration.	Focusing, illumination, and homogenization applications
Wire Grid Polarizer - Production based on NIL/etching process; - compatible with UV, visible, and IR applications.	Polarizer / Polarizing Beam Splitter: By leveraging the subwavelength metallic grating structure, selectively transmits or reflects light based on its polarization state.	Projection systems, Biometric sensing, Photolithography and semiconductor equipment

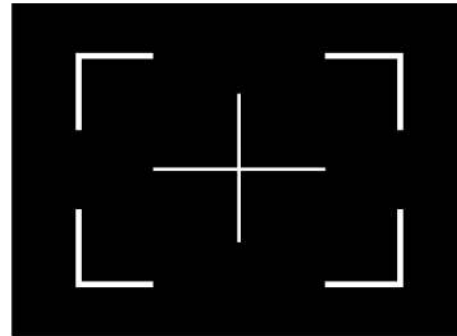
DOE

NOP can provide integrated solutions with customized design and standardized production.

1. Pattern Customization

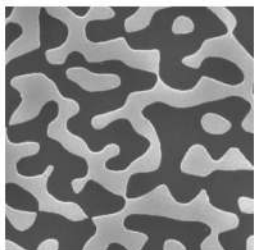


Scattered Dots



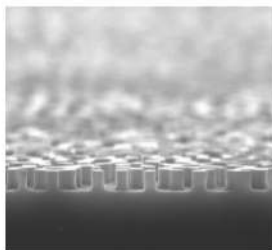
Customized Pattern

2. Wide selection of materials to meet various needs



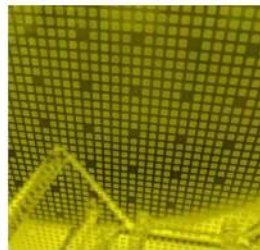
Pure Silicon

- High Reliability
- High Optical Performance



Pure Quartz/Sapphire

- High Optical Performance
- High Mechanical Performance



POG

- High Cost-effectiveness
- High Production Capacity



Pure Polymer

- Low Cost & High Production Capacity
- Impact & High-temperature Resistant



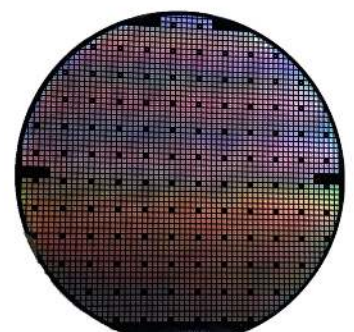
ITO Customization

- Fabricate ITO Coated Substrate
 - Eye Protection
-

3. From expedited sample verifications to mass production with various wafer sizes

Provide different wafer sizes on demand:
4 inch、6 inch、8 inch

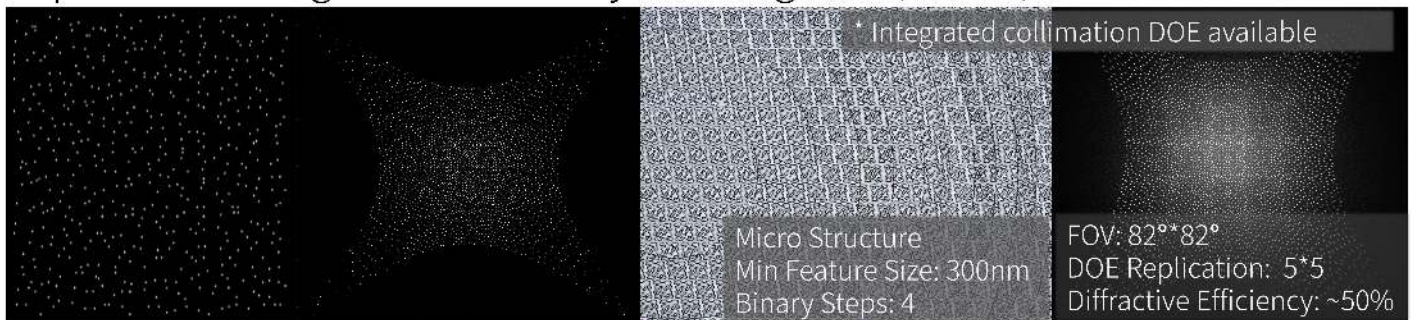
02



■ DOE Product Category

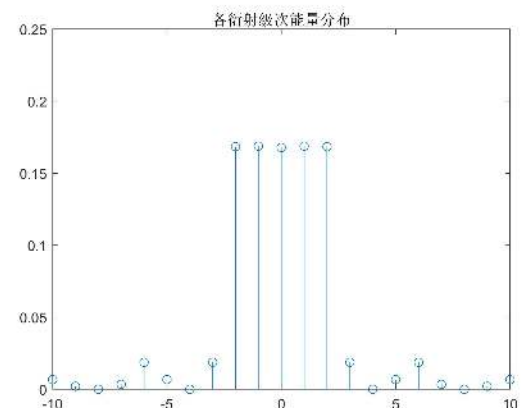
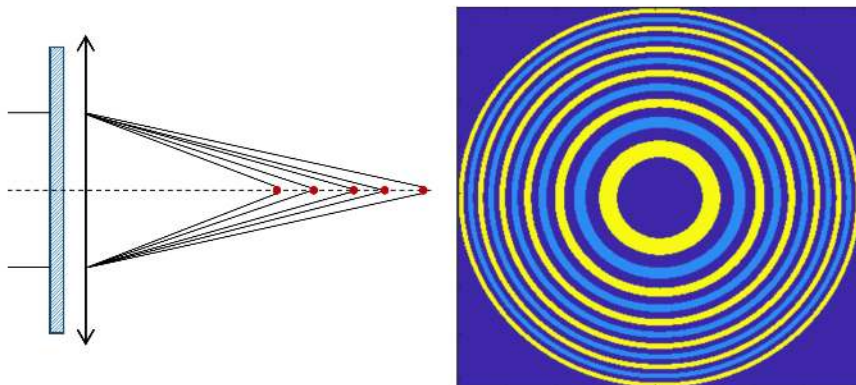
Beam Splitter: Splits the laser beam into an arbitrary number of spot patterns, widely used in 3D structural light.

- Provide solutions based on light source parameters
- Selectable single or dual-piece combination
- Optimized design for uniformity
- Big FOV ($>120^\circ$) available



Multifocal Component: Focuses the laser along the axial propagation direction to generate multiple focal points, widely used in laser cutting.

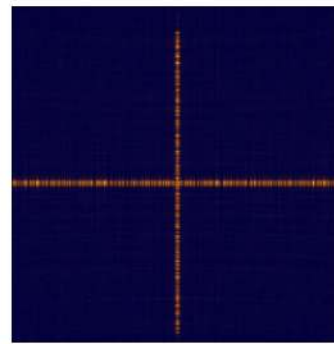
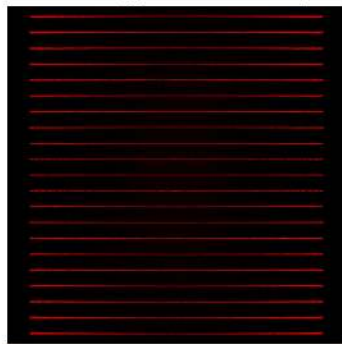
- Multiple Binary Steps
- Wide selection of materials: quartz/silicon/POG
- Focal point count and spacing are customizable
- AR Coating, Reflectivity $\leq 0.5\%$



■ DOE Product Category

Special Pattern Projector: Projects customized patterns required by the user, such as circles, scan frames, crosses, and so on, widely used in various scenarios.

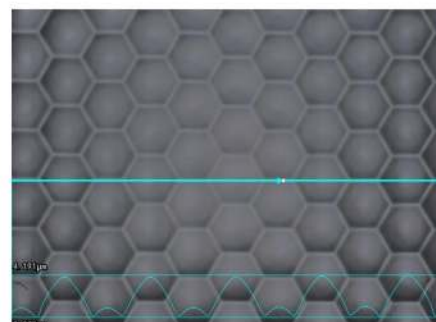
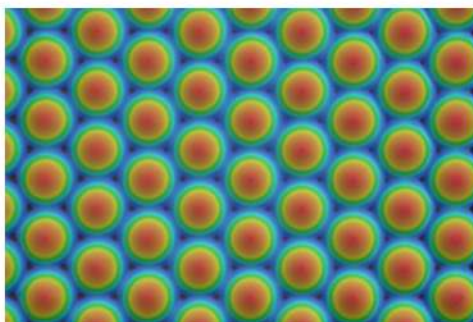
- Diffractive Efficiency $\geq 70\%$
- Big FOV ($>120^\circ$) available
- Customizable wavelengths and patterns
- Zero-order control $\leq 0.3\%$
- Glass and polymer substrate available



■ MLA

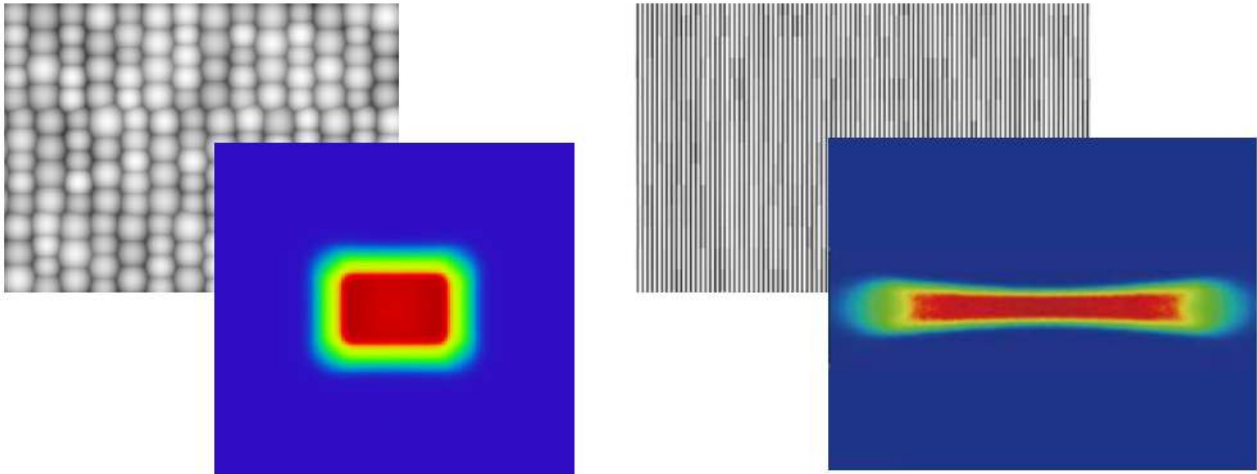
Regular MLA: With various periodic arrangements (e.g., rectangular, hexagonal, linear, etc.), meeting various customized application requirements.

- 255-level grayscale processing
- Pitch Range: tens to hundreds of micrometers
- Capable of processing spherical, aspherical, and other surface shapes
- Wide selection of materials: quartz/silicon/POG
- Duty cycle near 100%
- Coating available



■ MLA

Laser Diffuser: Using a randomized micro-lens array structure to evenly distribute the laser light over the target field of view, widely used in TOF Depth Sensing.



■ Standard Product List

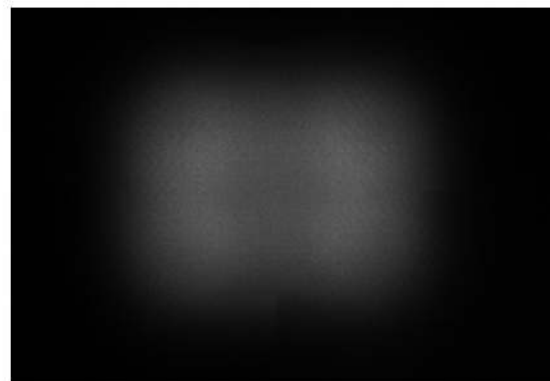
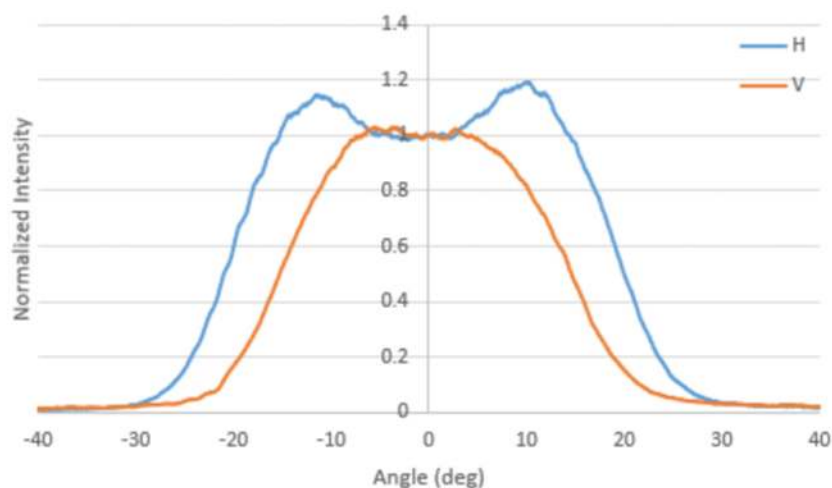
FOV	Material	Thickness	Transmittance	Spec
120X56	POG	0.4mm	>90%	D-R120X56-0.4
120X20	POG	0.4mm	>90%	D-L120X20-0.4
118X28	POG	0.4mm	>90%	D-L118X28-0.4
110X90	POG	0.4mm	>90%	D-R110X90-0.4
95X80	POG	0.4mm	>90%	D-R95X80-0.4
90X70	POG	0.4mm	>90%	D-R90X70-0.4
72X58	POG	0.4mm	>90%	D-R72X58-0.4
72X55	POG	0.4mm	>90%	D-R72X55-0.4
68X54	POG	0.4mm	>90%	D-R68X54-0.4
60X45	POG	0.4mm	>90%	D-R60X45-0.4
55X01A	POG	0.4mm	>90%	D-L55X01A-0.4
40X30	POG	0.4mm	>90%	D-R40X30-0.4
47X01	POG	0.4mm	>90%	D-L47X01-0.4
27X14	POG	0.4mm	>90%	D-ROA27X14-04
19X19	POG	0.4mm	>90%	D-R19X19-0.4

■ Diffuser D-R40X30A

➤ Key Performance Parameters

Shape of Diffusion	Rectangle	Material	Polymer on Glass
Divergency Angle	40°X30°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



Notes:

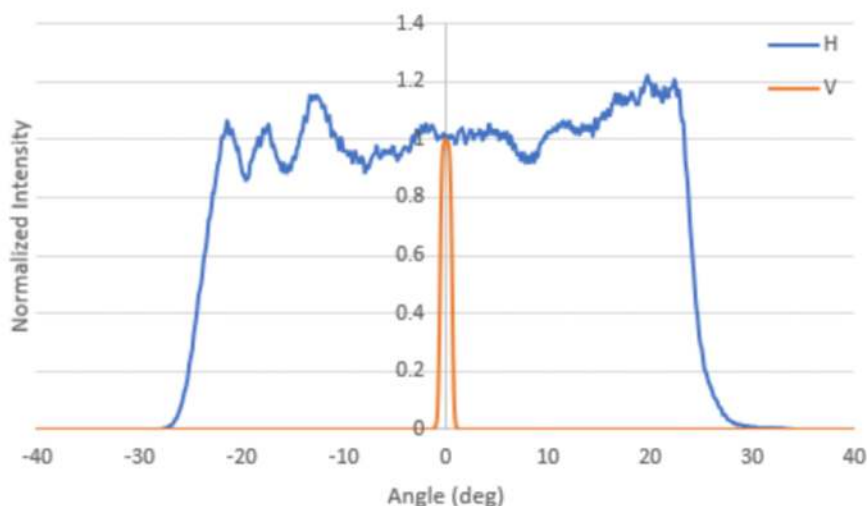
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-L47X01A

➤ Key Performance Parameters

Shape of Diffusion	Line	Material	Polymer on Glass
Divergency Angle	47°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



Notes:

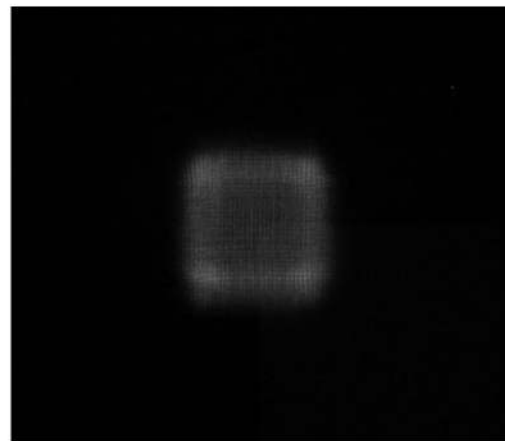
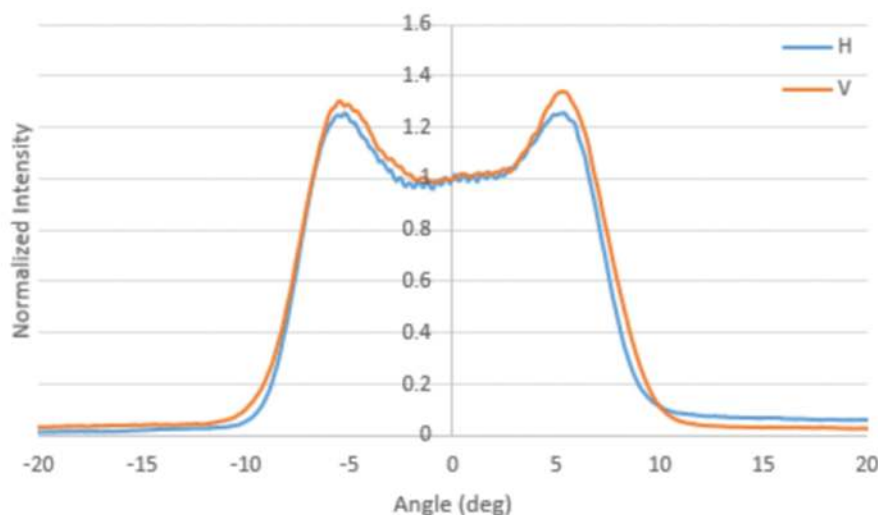
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-R19X19A

➤ Key Performance Parameters

Shape of Diffusion	Square	Material	Polymer on Glass
Divergency Angle	19°X19°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



Notes:

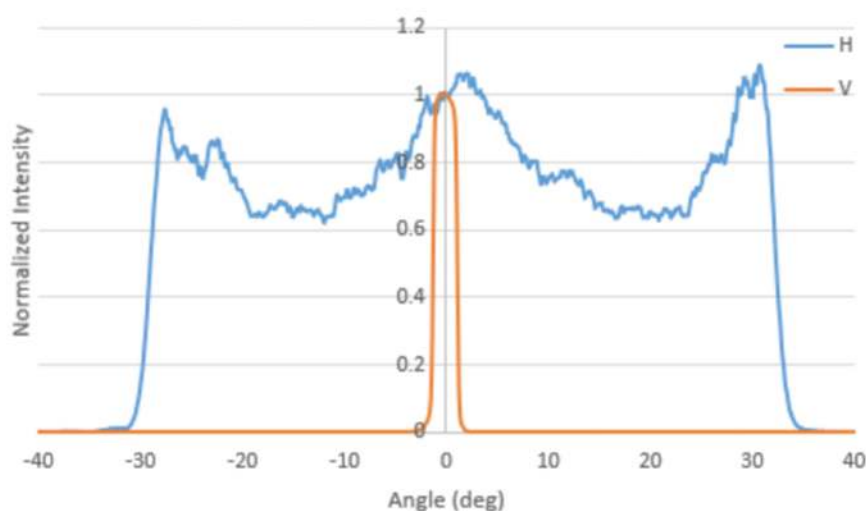
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-L55X01A

➤ Key Performance Parameters

Shape of Diffusion	Line	Material	Polymer on Glass
Divergency Angle	55°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



Notes:

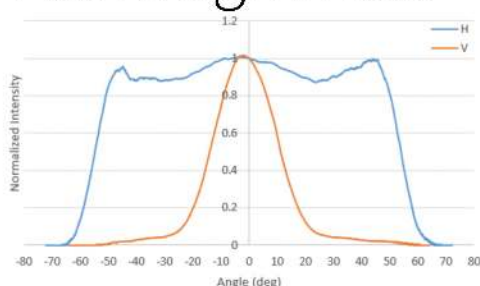
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-L118X28B

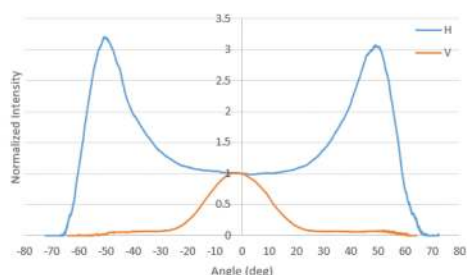
➤ Key Performance Parameters

Shape of Diffusion	Line	Material	Polymer on Glass
Divergency Angle	118°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



➤ Spherical light field



Notes:

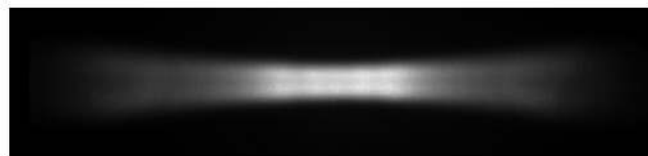
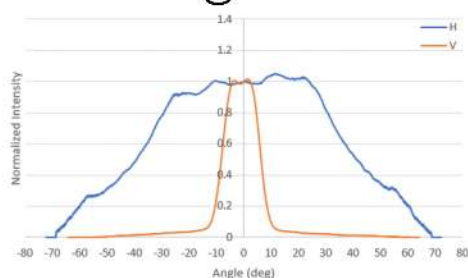
1. Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
2. Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-L120X20A

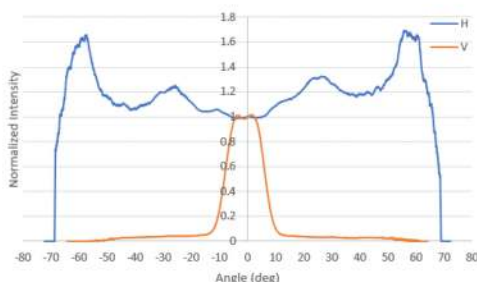
➤ Key Performance Parameters

Shape of Diffusion	Line	Material	Polymer on Glass
Divergency Angle	120°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



➤ Spherical light field



Notes:

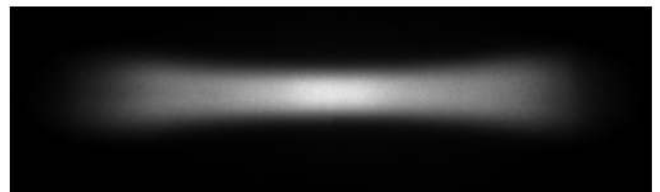
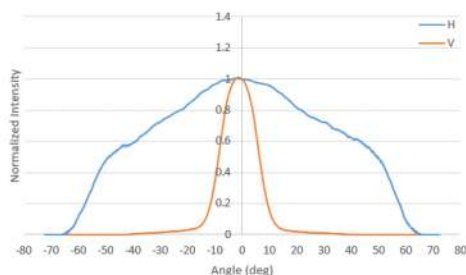
1. Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
2. Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-L120X20B

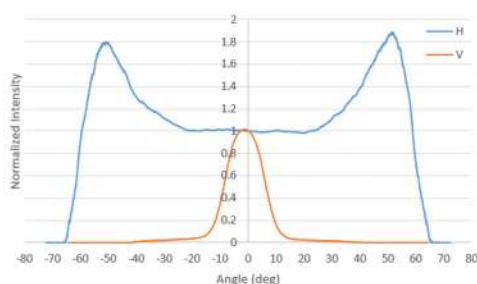
➤ Key Performance Parameters

Shape of Diffusion	Line	Material	Polymer on Glass
Divergency Angle	120°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



➤ Spherical light field



Notes:

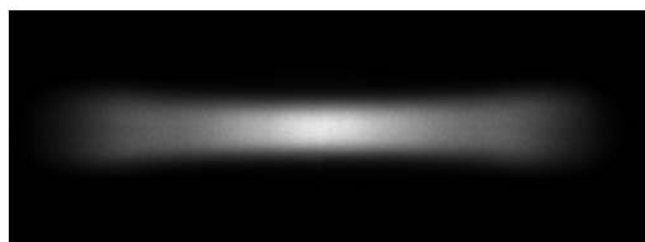
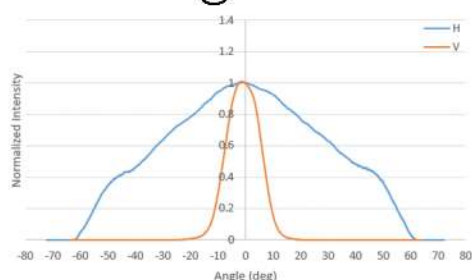
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-L120X20C

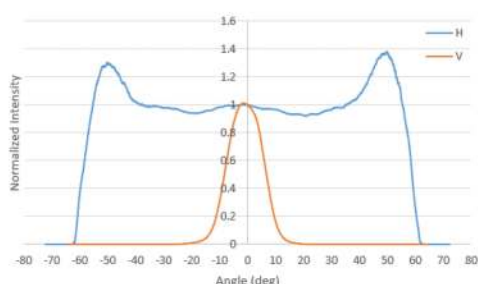
➤ Key Performance Parameters

Shape of Diffusion	Line	Material	Polymer on Glass
Divergency Angle	120°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



➤ Spherical light field



Notes:

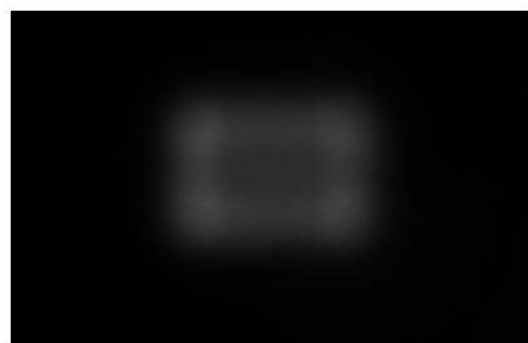
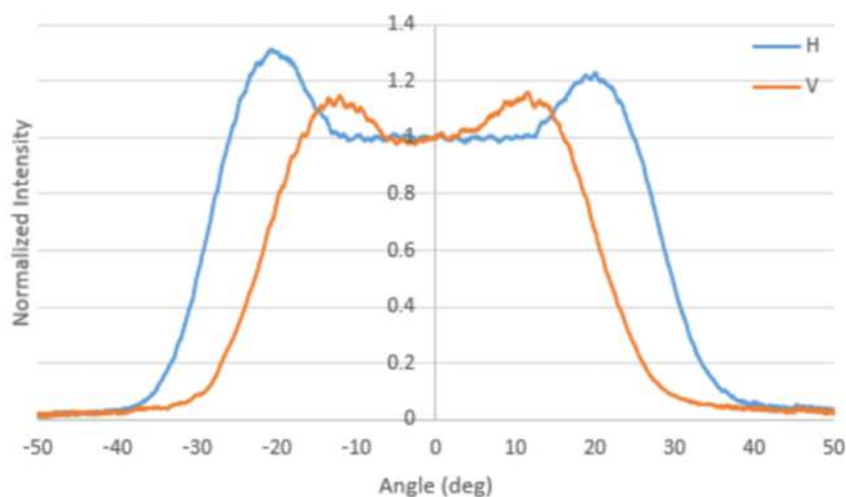
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-R60X45A

➤ Key Performance Parameters

Shape of Diffusion	Rectangle	Material	Polymer on Glass
Divergency Angle	60°X45°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



Notes:

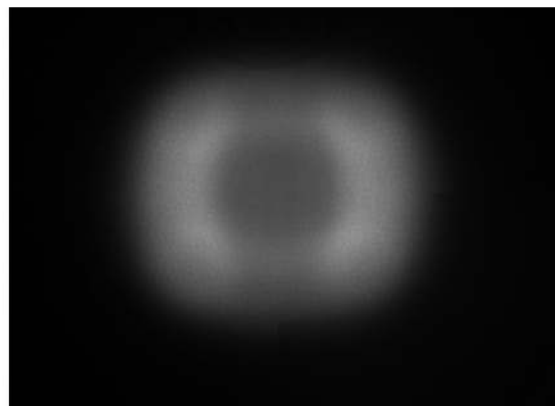
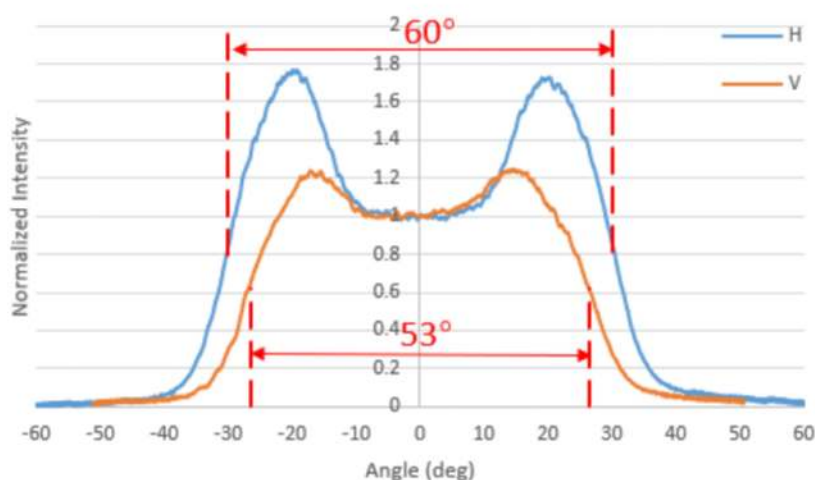
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-R60X45C

➤ Key Performance Parameters

Shape of Diffusion	Rectangle	Material	Polymer on Glass
Window Efficiency @60X46	$\geq 70\%$	Transmittance	$> 90\%$
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



Notes:

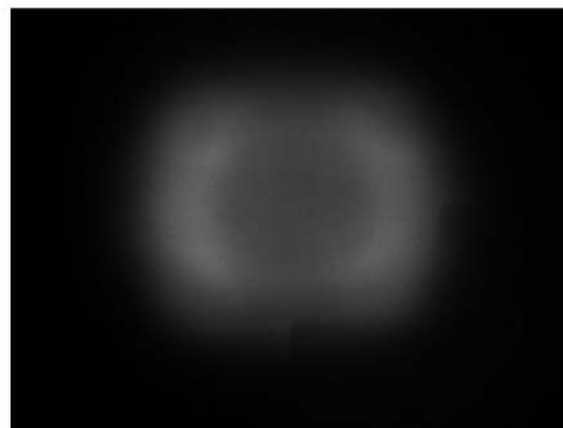
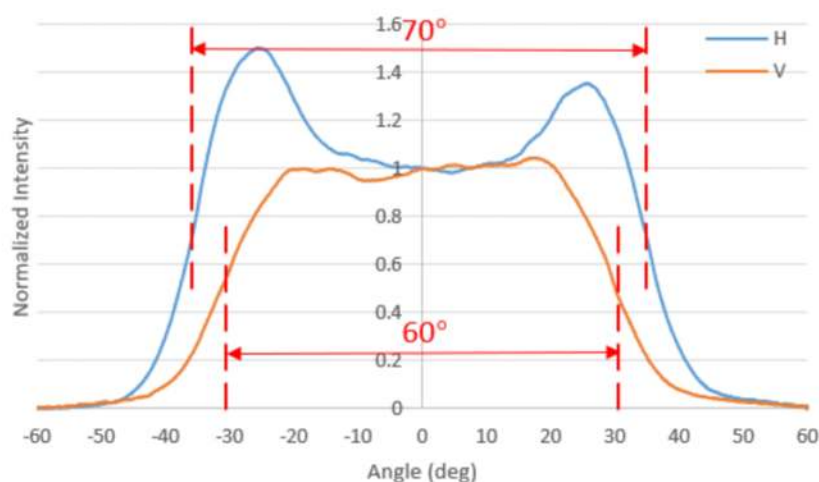
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-R68X54A

➤ Key Performance Parameters

Shape of Diffusion	Rectangle	Material	Polymer on Glass
Window Efficiency @68X54	$\geq 70\%$	Transmittance	$> 90\%$
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



Notes:

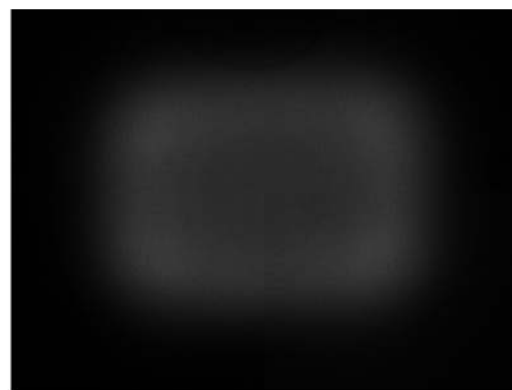
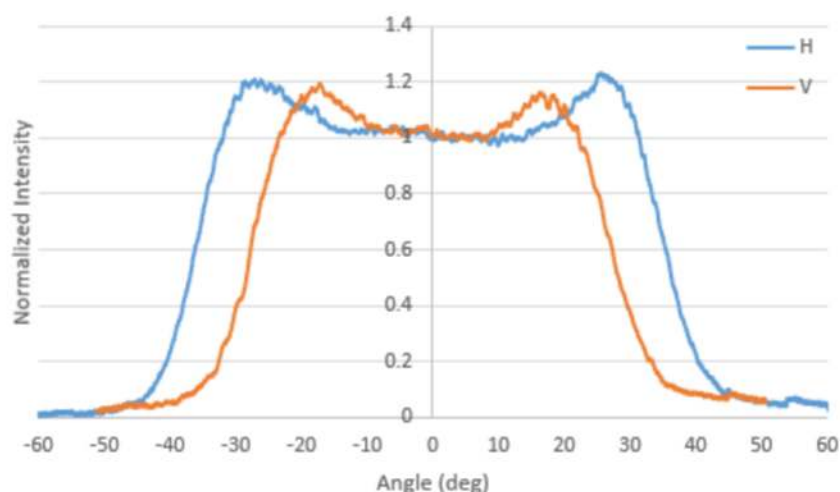
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-R72X55A

➤ Key Performance Parameters

Shape of Diffusion	Rectangle	Material	Polymer on Glass
Divergency Angle	72°X55°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



Notes:

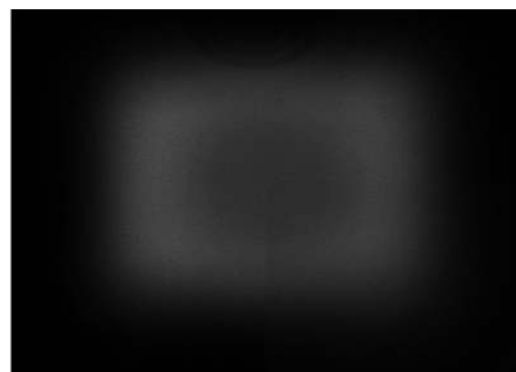
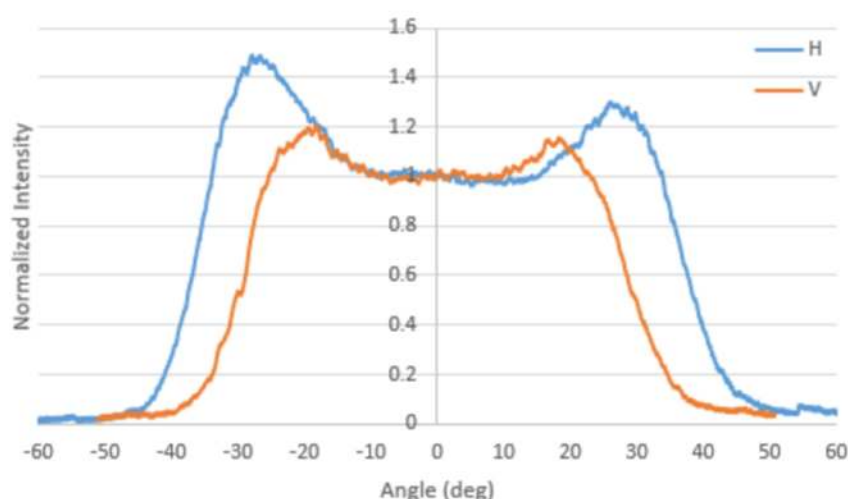
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-R72X58B

➤ Key Performance Parameters

Shape of Diffusion	Rectangle	Material	Polymer on Glass
Divergency Angle	72°X58°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



Notes:

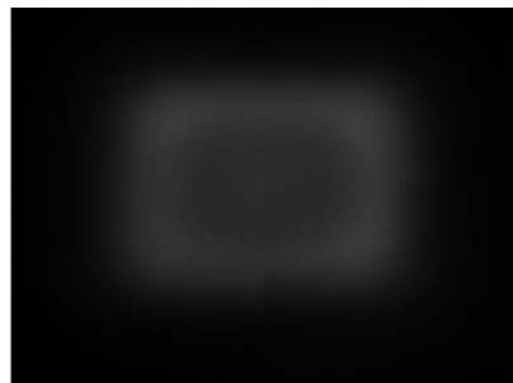
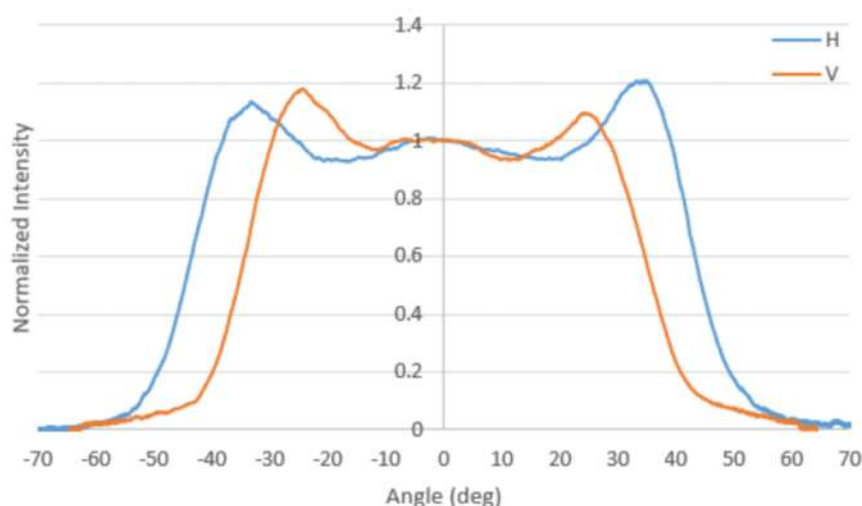
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-R90X70B

➤ Key Performance Parameters

Shape of Diffusion	Rectangle	Material	Polymer on Glass
Divergency Angle	90°X70°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



Notes:

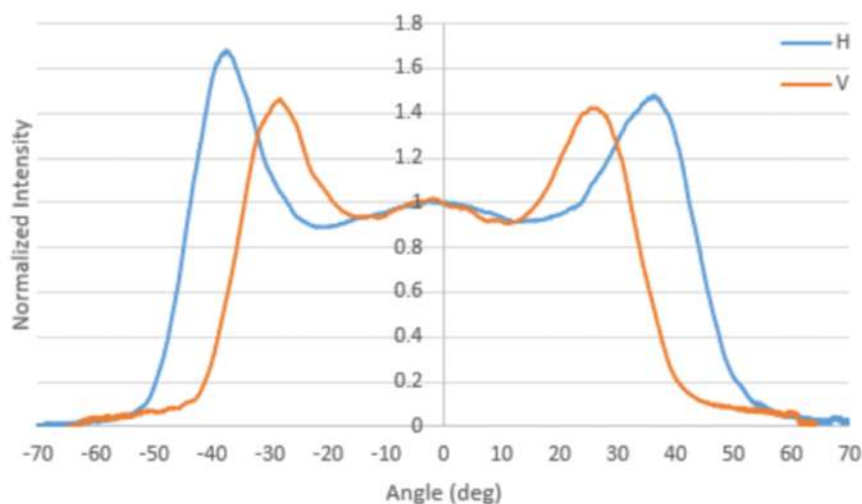
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-R90X70C

➤ Key Performance Parameters

Shape of Diffusion	Rectangle	Material	Polymer on Glass
Divergency Angle	90°X70°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



Notes:

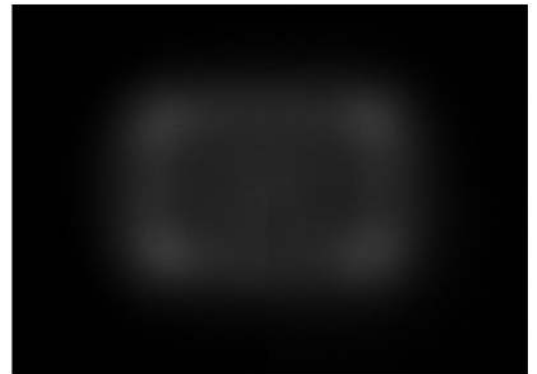
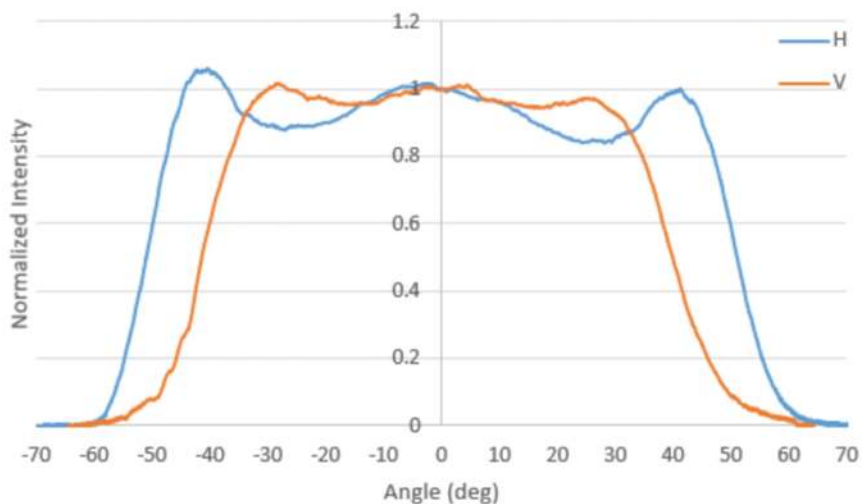
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-R90X70D

➤ Key Performance Parameters

Shape of Diffusion	Rectangle	Material	Polymer on Glass
Divergency Angle	90°X70°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



Notes:

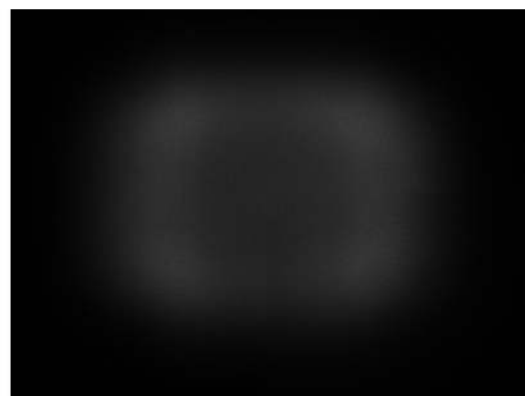
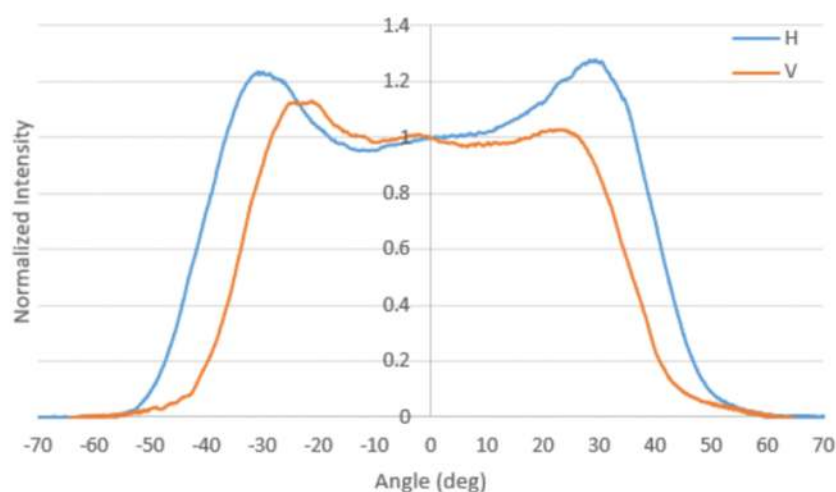
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-R90X70E

➤ Key Performance Parameters

Shape of Diffusion	Rectangle	Material	Polymer on Glass
Divergency Angle	90°X70°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



Notes:

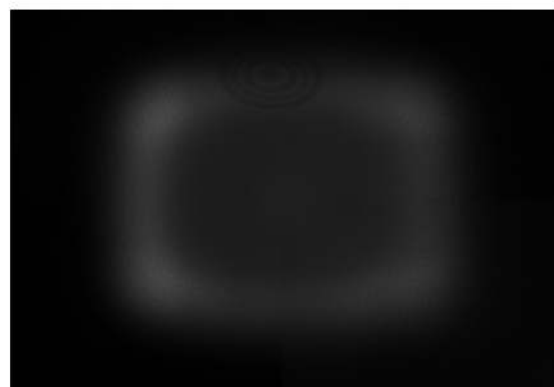
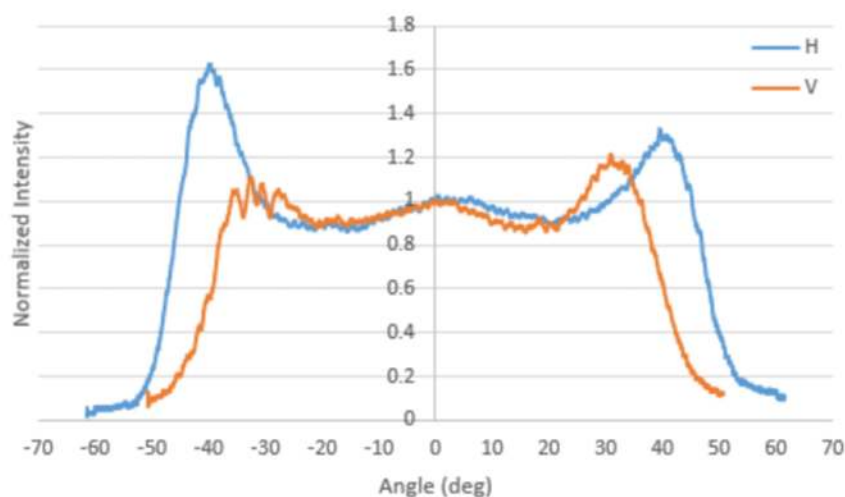
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-R95X80A

➤ Key Performance Parameters

Shape of Diffusion	Rectangle	Material	Polymer on Glass
Divergency Angle	95°X80°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



Notes:

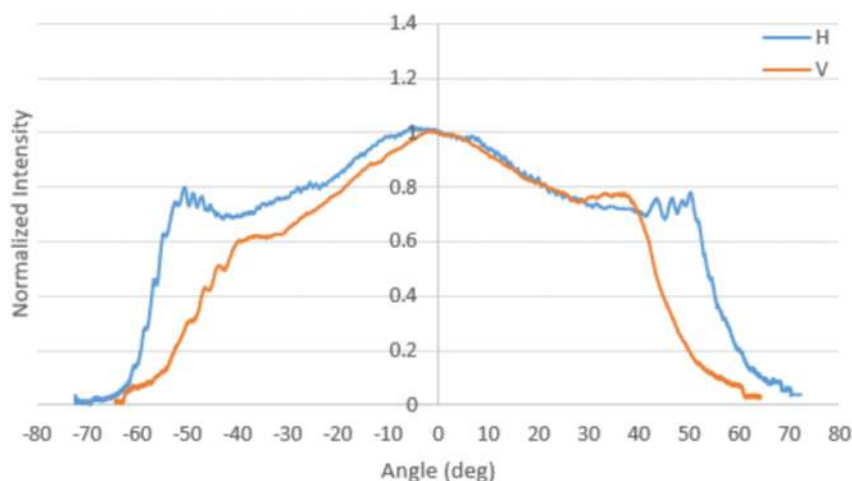
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-R110X90B

➤ Key Performance Parameters

Shape of Diffusion	Rectangle	Material	Polymer on Glass
Divergency Angle	110°X90°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



Notes:

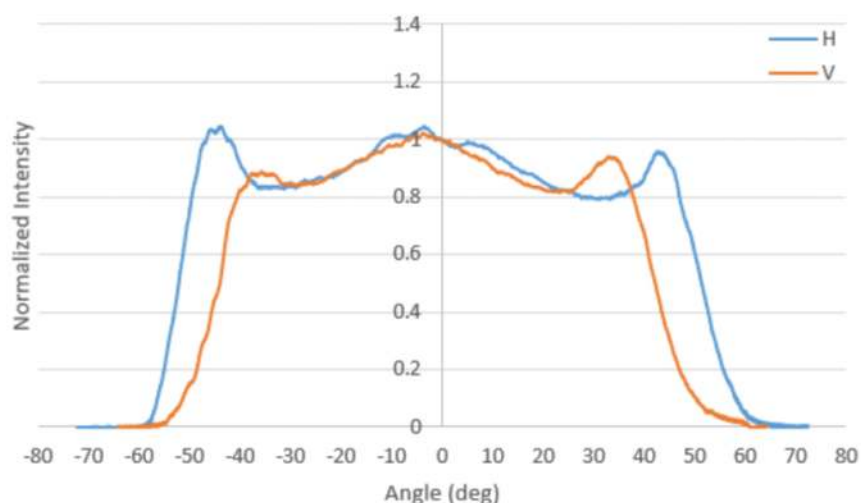
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-R110X90C

➤ Key Performance Parameters

Shape of Diffusion	Rectangle	Material	Polymer on Glass
Divergency Angle	110°X90°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



Notes:

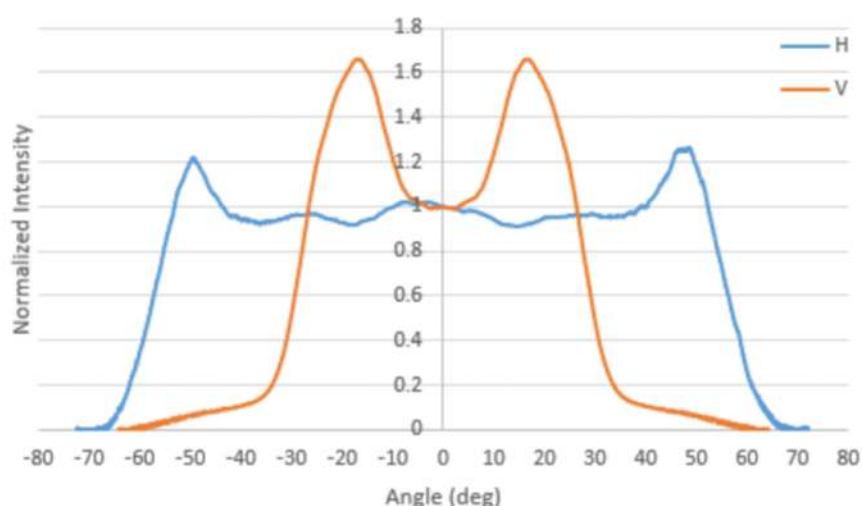
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-R120X56B

➤ Key Performance Parameters

Shape of Diffusion	Rectangle	Material	Polymer on Glass
Divergency Angle	120°X56°	Transmittance	>90%
Transmission Spectrum	400~2000nm	Temperature Tolerance	-40°C~120°C

➤ Plane light field



Notes:

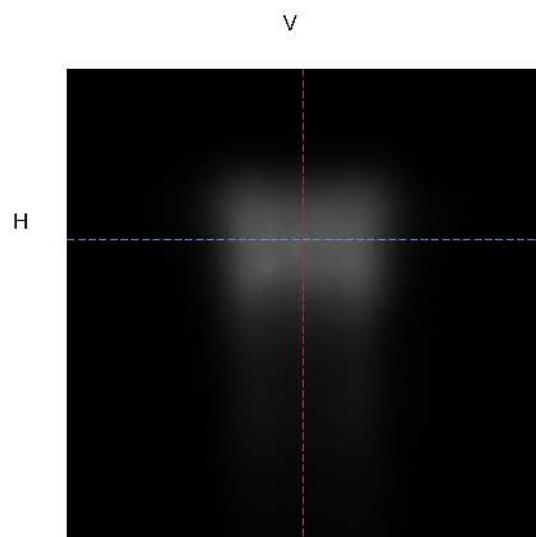
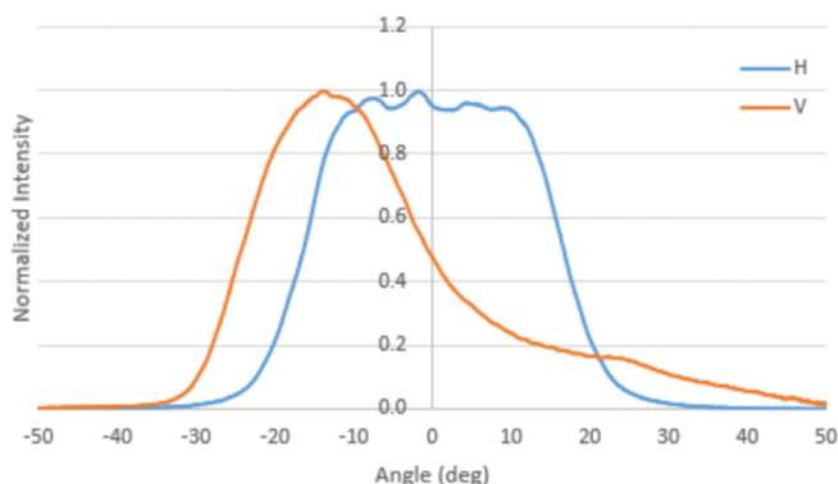
- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

■ Diffuser D-ROA27X14A

➤ Key Performance Parameters

Shape of Diffusion	Rectangle	Material	Polymer on Glass
Divergency Angle @80%	27°X14°	Transmittance	>90%
Off-axis Angle	13°	Transmission Spectrum	400~2000nm
Temperature Tolerance	-40°C~120°C	-	-

➤ Plane light field



Notes:

- Parameters mentioned above are tested by 940nm collimated light source. The actual diffusion angle of products may vary depending on the wavelength and light source.
- Please avoid touching the microstructure surface of diffuser.

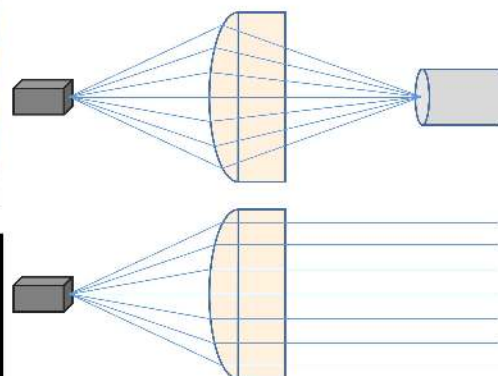
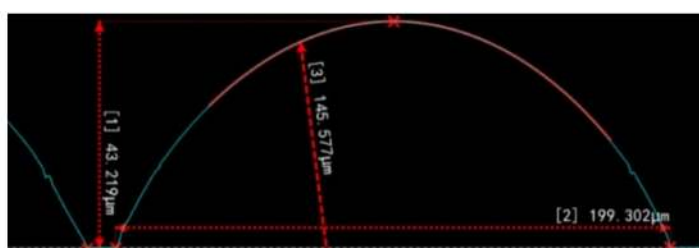
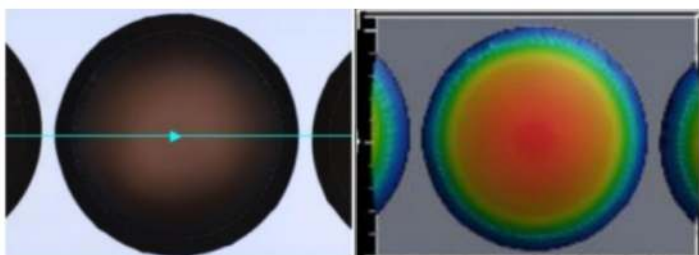
■ MLA

Collimating/Focused Micro-Lenses: Spherical or aspherical micro-lenses, widely used in optical communication area. The laser can be efficiently collimated and coupled to meet the optical path requirements of lasers, optical waveguides, optical fibers, and optical detectors.

- Design, manufacturing, and testing capabilities based on 8-inch process.
- Customizable single microlenses, 1D and 2D microlens arrays according to customer requirements.
- The position accuracy of MLA $\leq 1\mu\text{m}$ based on wafer level lito process.
- Double sides AR coating available.

Optical Specifications

Material	Silicon/Quartz/Polymer on Glass
Wavelength	1250 nm ~ 1650 nm
Sagittal Height	0.05 mm ~ 0.100 mm
Lens Aperture	0.02 mm ~ 2.0 mm $\pm 5\%$
Curvature Radius	0.2 mm ~ 2.0 mm $\pm 5\%$
Conic Coefficient	0 to -5.0 ± 0.5
AR Coating	Double Sides
Reflectivity (Single side)	$\leq 0.5\%$



Focused Micro-Lenses
Efficiently focus and couple laser light into optical fibers and active devices.

Collimating Micro-Lenses
High-quality collimation of the output light from lasers and optical fibers.

Film

Film: With photolithography design and manufacturing capabilities, we are able to produce a range of patterned optical devices, which can be used in fields such as projection lamp masks, encoders, and graticules.

- Design, manufacturing, and testing capabilities based on 8-inch process.
- Coatings and mask patterns can be processed based on requirements.
- Minimum Linewidth $\leq 1\mu\text{m}$.
- Outline customizable based on requirements.
- Compliant with RoHS.

Optical Specifications

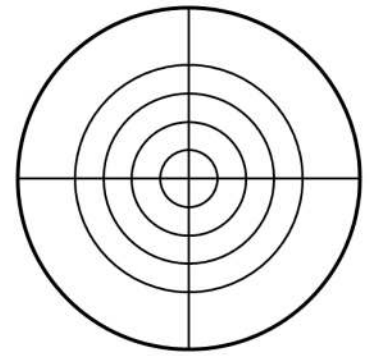
Material	Ultra-clear glass, soda-lime glass, quartz, etc.
Maximum Size	8 inch
Minimum Linewidth	1 μm
Linewidth Tolerance	-0.25 / +0.50 μm
OD @450nm	>5.0
Coating Material	Reflectivity or AR、Chromium film



Projection Lamp Masks



Glass Encoder Disc

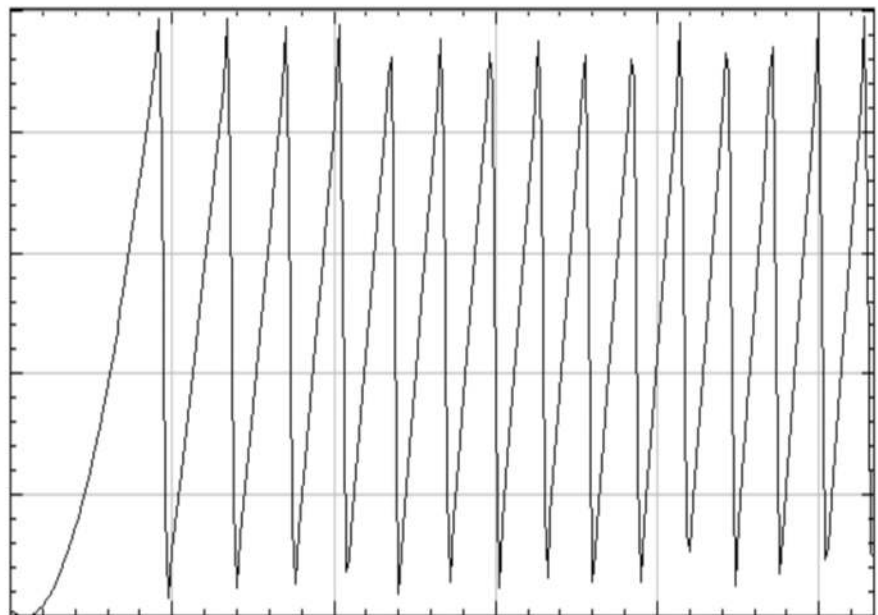
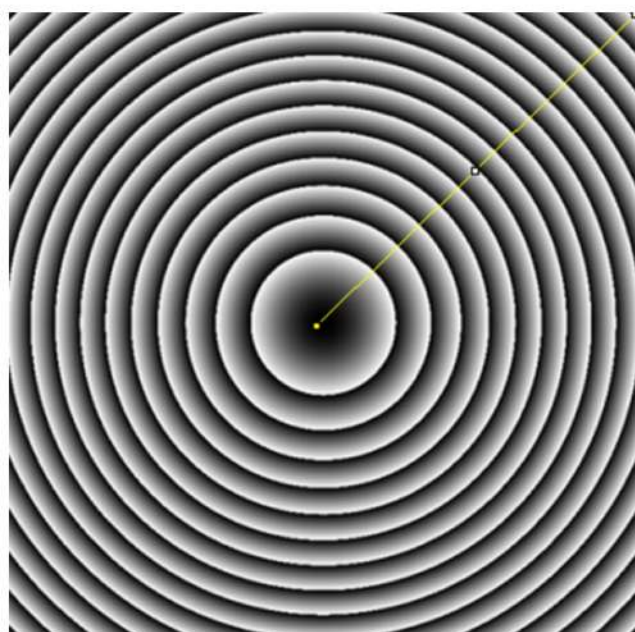


Glass Graticule Plate

■ Fresnel Lens

Fresnel Lens: Quantizing the lens into a series of ring structures, compressing the lens structure into a near-planar configuration, widely used in focusing, illumination, and homogenization applications.

- Nano-imprinting process,
- Min processing ring bandwidth and sagittal height are at micron level.
- Continuous or step-like Fresnel structures can be processed based on design requirements.
- Outline customizable based on requirements.
- Coating available.

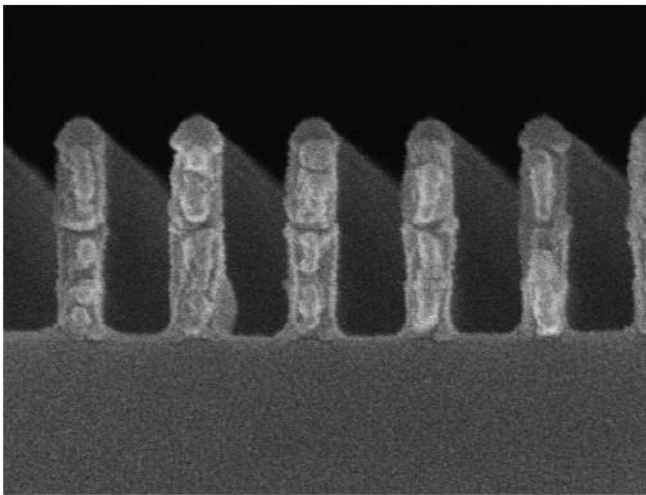
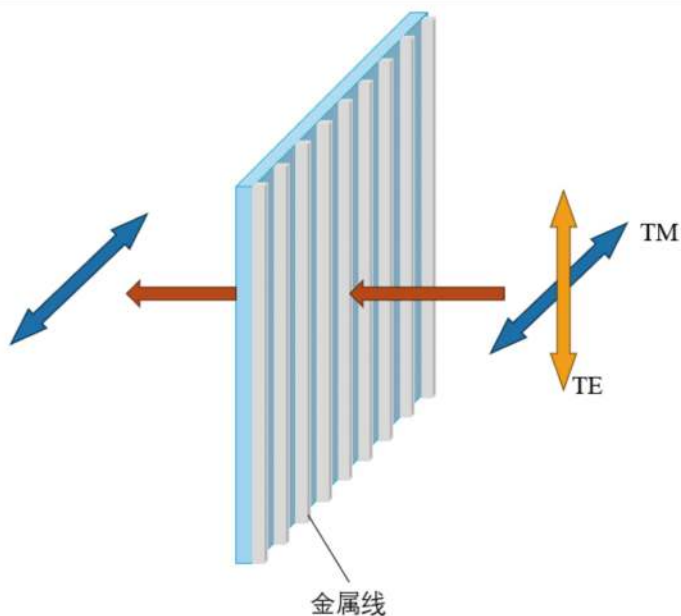


■ Wire Grid Polarizer

Wire Grid Polarizer: By utilizing a metallic wire grid structure on a glass substrate, selectively filters incident light based on its polarization state. It offers key advantages such as compact size, easy integration, wide operational wavelength range, and large acceptance angle. These features make it widely applicable in fields such as polarized remote sensing, medical diagnostics, optical communication, and liquid crystal waveplates.

- covers a broad spectral range from UV to visible and IR.
- custom-cut into various shapes according to design specifications.
- AR coating available.

Optical Specifications	
Material	Glass Substrate
Wavelength	420-700nm
Transmittance	>80%
Extinction Ratio	>800:1
Incident Angle	±20°
Temperature Tolerance	-40 to 200 °C
Scratch-Dig	80-50 Scratch-Dig





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