HOLOEYE Photonics AG

HOLOEYE Pioneers in Photonic Technology

HOLOEYE Company Profile

- **Products:** Spatial Light Modulators; Diffractive Optical Elements, Microdisplay Products and Developments
- **Head Office:** Volmerstr. 1, 12489 Berlin, Germany
- **Founded:** July 1999
- **Form of Organization:** German Aktiengesellschaft
- **Register of Corporation:** Amtsgericht Berlin-Charlottenburg
- **Number of Registration:** HRB 86350
- **Shareholders:** privately-held company, 5 shareholders
- **Management:** Sven Krueger, CEO
- **Employees:** 30
- **Quality Management:** ISO 9001-2015

Certificate

Standard ISO 9001:2015

Certificate Registr. No. 01 100 070821

Certificate Holder:

HOLOEYE

HOLOEYE Photonics AG
Volmerstr. 1
12489 Berlin
Germany

Scope: Development, production and distribution of microdisplay based components / devices and micro-optical elements as well as supply of related engineering services

Proof has been furnished by means of an audit that the requirements of ISO 9001:2015 are met.

Validity: The certificate is valid from 2020-05-23 until 2023-05-22. First certification 2007

2020-04-29

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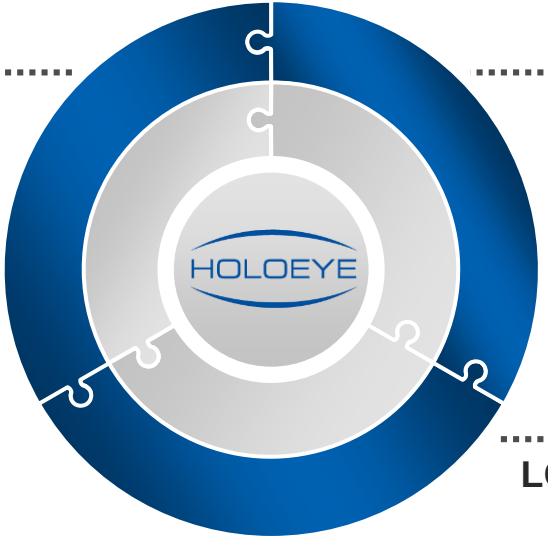
HOLOEYE Business Units

Diffractive Optics

Design and production of Diffractive Optical Elements (DOE).



Spatial Light Modulators

Dynamic optical devices based on reflective or transmissive microdisplays for phase or amplitude modulation.

LCOS Microdisplay Technology

LCOS microdisplay electronics and integration services.

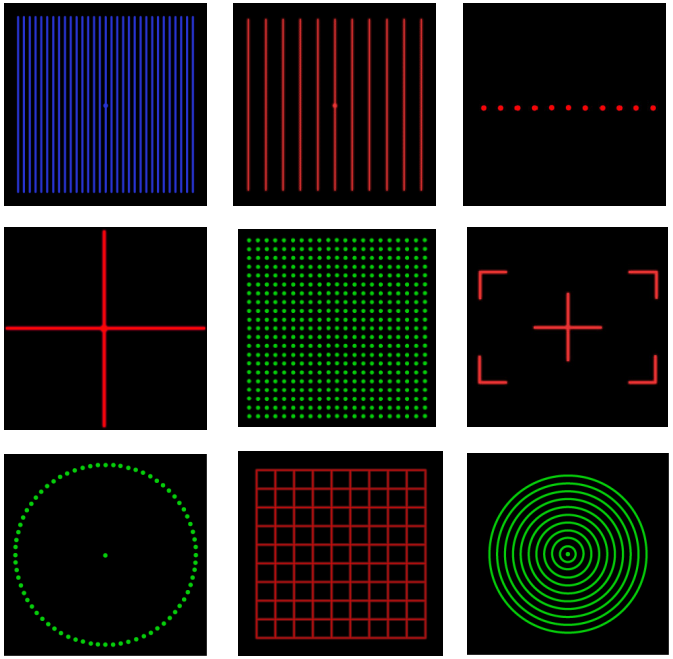
HOLOEYE Business Units

Diffractive Optical Elements (DOE)

Diffractive Optics (DOE) – Standard DOEs

HOLOEYE offers a wide choice of off-the-shelf cost-efficient standard diffractive optical elements:

- Multi Line Patterns
- Dot Matrix Patterns
- Lines & Dot Lines
- Crosshair Patterns
- Circles & Dot Circles
- Random Dot Patterns
- Viewfinder
- Special Patterns (Grids, Rings, Hexagon…)



Polymer DOE materials: Polymethyl Methacrylate (PMMA) or Polycarbonate (PC).

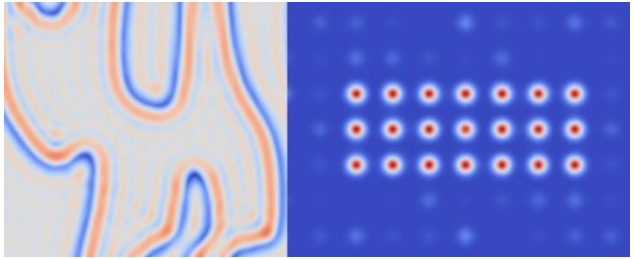
Glass DOE materials: Fused Silica glass by etching or Acrylate polymers on Soda Lime glass substrates.

Diffractive Optics (DOE) – Custom Developments

DOE Design & Simulation

Using in-house developed as well as commercially available state-of-the-art software tools and algorithms, appropriate simulation methods (paraxial or rigorous electromagnetic) are used for optimization of the DOE design.

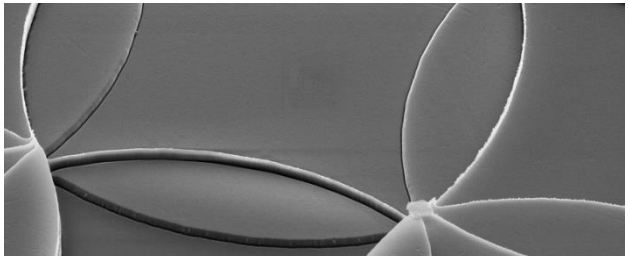
Fabrication constraints are taken into account right from the start, and a tolerance analysis is performed whenever necessary. Also the alignment requirements of the DOE within the optical system are determined, so that the assembly procedure can be designed accordingly.



DOE Mastering and Tooling

Direct write lithography processes are used to create either lithography masks or resist micro-relief profiles. Based on masks, micro-relief profiles are created by contact or projection lithography and subsequent etching processes like reactive ion etching to transfer the etch mask into the substrate.

The obtained micro-relief profiles serve as fused silica DOEs or templates for UV-curing based replication processes. Alternatively, electroplating can be used to create inverted resist profiles which are usable for embossing and molding processes of polymer materials.

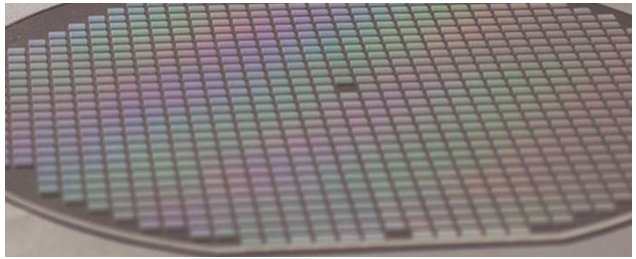


Diffractive Optics (DOE) – Custom Developments

DOE Volume Fabrication

- Bulk polymer DOEs: substrate and diffractive micro-relief surface are created by compression molding (materials: polycarbonate, PMMA, or Topas ®
- Acrylate-on-polymer DOEs: diffractive layer is created by UV curing on a polymer substrate
- Acrylate-on-glass DOEs: diffractive layer is created by UV curing on a glass substrate
- Bulk fused silica DOEs: diffractive micro-relief surface is created by reactive ion etching.

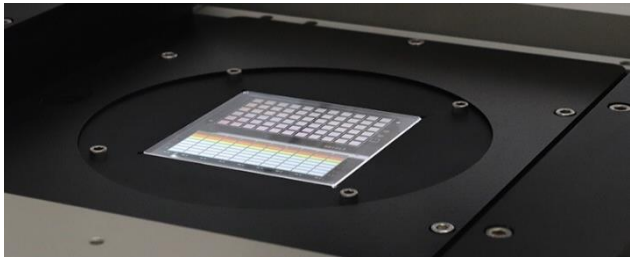
Custom size and shape. Fresnel-type surface reflections can be reduced by dielectric anti-reflective coatings, or moth-eye micro-relief surface structures.



DOE Quality Assurance and Implementation Support

After fabrication: validation of compliance of the DOEs with the specification experimentally. Optical key properties can be monitored using automated equipment.

For integrated solutions like a DOE-based laser projection module, HOLOEYE can be part of a joint development effort involving vendors for those products.



HOLOEYE Business Units

Spatial Light Modulators (SLM)

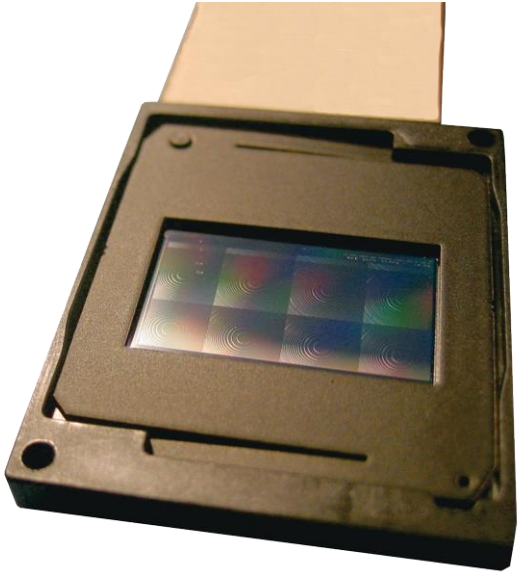
Spatial Light Modulators

Spatial light modulator (SLM) is a general term describing devices that are used to modulate amplitude, phase, or polarization of light waves in space and time. HOLOEYE´s Spatial Light Modulator systems are based on translucent (LCD) or reflective (LCOS) liquid crystal microdisplays. The use of LC materials in SLMs is based on their optical and electrical anisotropy.

Spatial Light Modulators

HOLOEYE offers Spatial Light Modulators optimized for different applications and wavelength ranges from 420 nm up to 1700 nm.

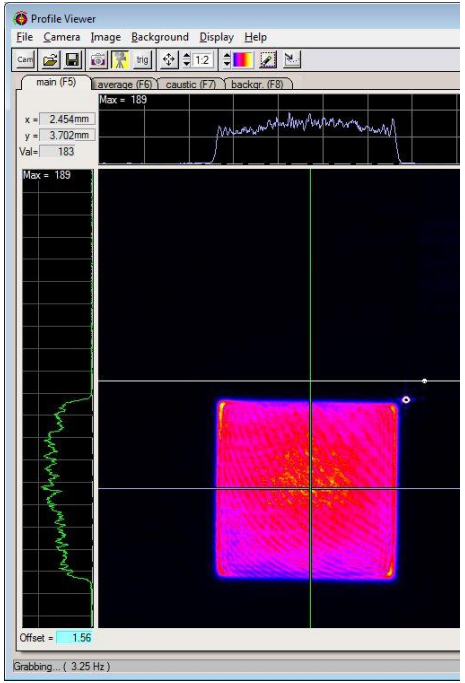
- **Resolutions: 1024 x 768 Pixel - 4094 x 2464 Pixel**
- **Wavelength Range: 420 nm – 1700 nm**
- **Phase Shift: Min. 2 Pi @ specified wavelength range**
- **Pixel Pitch: 36 µm down to 3.74 µm**
- **Active Area: 1.8“, 0.7“, 0.55“**
- **Addressing: 8 bit phase levels**
- **Signal Formats: DVI / HDMI**



Spatial Light Modulators

Possible Spatial Light Modulator Applications:

- Imaging & Projection
- Display Applications
- Holography (Display holography, holographic memory, holographic recording and security systems, including digital holography)
- Holographic Projection
- Beam Splitting
- Laser Beam Shaping
- Coherent Wavefront Modulation
- Phase Shifting
- Optical Tweezers
- Laser Pulse Modulation



SLM Software

All HOLOEYE Spatial Light Modulators are simply addressed via standard DVI, HDMI or DisplayPort. This means the SLM actually acts like a standard monitor device and no special software or drivers are necessary to operate the SLM. For an easy start and even more convienent operation HOLOEYE provides a comprehensive software package with the SLM:

Pattern Generator Software:

The software allows the simple generation of diverse dynamic optical functions like gratings, lenses, axicons and apertures as well as the calculation of diffractive optical elements (DOE) from user defined images.

SLM Configuration Manager Software:

With the Configuration Manager you can change geometrical settings and the electro-optical response by applying a new gamma curve or another digital drive scheme.

SLM Slideshow Player Software:

This software is used to display of images and image sequences on the SLM. It is possible to adjust the frame rate and to generate different playlists.

SLM Display SDK:

The SLM Display Software Development Kit (SDK) is an interface to show images and data/phase arrays directly on the SLM. There are versions available for C or C++ compiler, LabVIEW, MATLAB®, Octave or Python™.

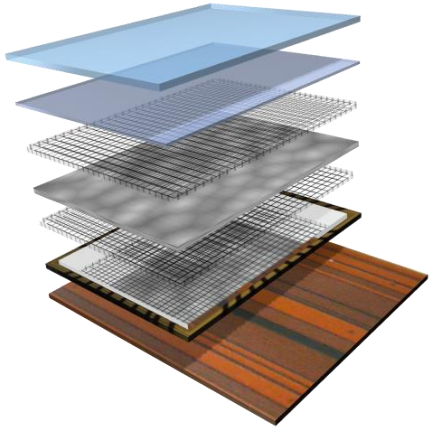
HOLOEYE Business Units

LCOS Microdisplay Technology

LCOS Microdisplay Technology

LCOS (Liquid Crystal on Silicon) is a reflective microdisplay technology based on a silicon backplane.

Using standard CMOS processes, microdisplays with extremely small pixels, high fill factor (pixel aperture ratio) and low fabrication costs can be realized.

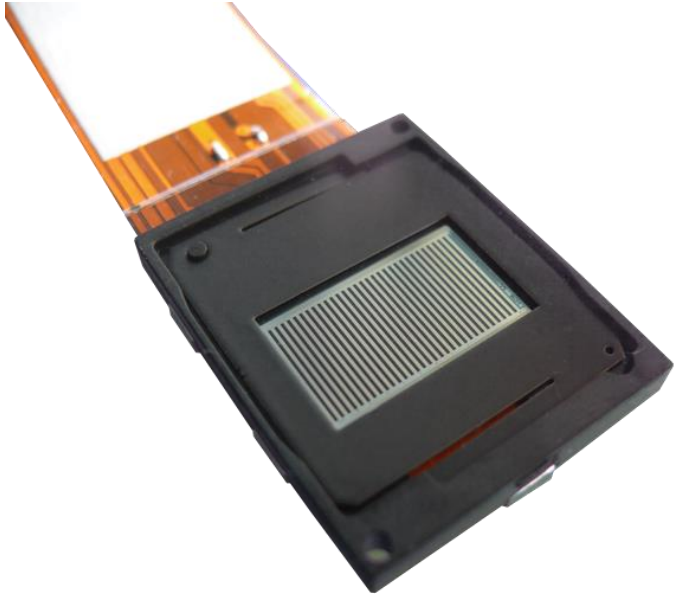


LCOS micodisplays in consumer projection products typically have lifetimes >20,000 hours at operating temperatures of +10°C to + 70°C for the visible waveband (420 - 700 nm). For single panel color projection a color field sequential (CFS) display addresses three monochromatic images corresponding to the primary colors (RGB) in a repetitive sequence and is illuminated by a triggered light source.

LCOS Microdisplay Technology

Applications:

- Industrial Projection (Fringe/Pattern Projection - Metrology, 3D-Sensor, Rapid Prototyping, Lithography, IR-projection)
- Industrial Imaging (Data-Displays, Medical, Simulation)
- HUDs and HMDs in automotive, airborne and defense industries
- High resolution NTE/EVF systems
- SLMs for R&D and phase applications



LCOS Microdisplay Technology

HOLOEYE Services:
HOLOEYE specializes in custom designs using LCOS to meet the requirements of industrial customers. We offer design, prototyping and manufacturing services.

- Custom microdisplays (LC design and packaging)
- Drive board design, firmware programming, drive sequence programming
- Prototyping and mechanical assembly
- Management of development projects
- Product qualification for speciality markets (e.g. medical, avionics, telecommunication)
- Application based test systems
- Secure supply for long life products (medical, telecommunation, avionics, defense)
- LCOS based optics design for imaging and non-imaging applications

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