

OptiML™ Micro-Optics Technologies

Save Time and Costs with Miniaturized Optical Devices

DOC's integrated micro optic subassemblies (IMOS) enable the seamless integration of wafer-level optics with many types of active and passive devices. By combining elements on both sides of a wafer or on multiple wafers, an IMOS is formed. Integration with active components (lasers, detectors, sensors) as well as passive optical elements (mirrors, filters, gratings) at the wafer or die level enables significant size reduction, cost savings and improved performance.

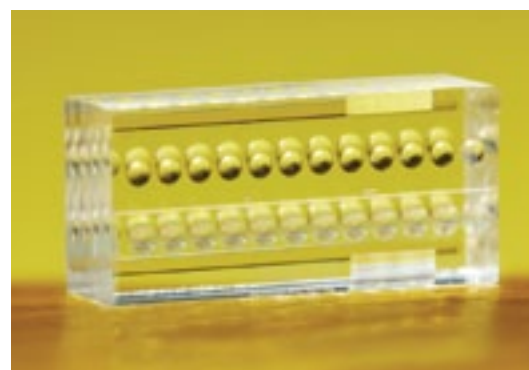
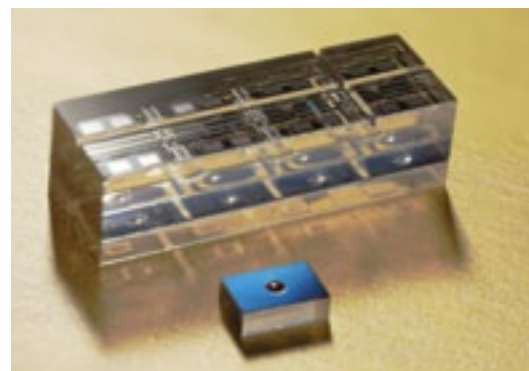
DOC's IMOS offer three significant advantages over conventional solutions - miniaturization, part-to part consistency and reduced costs. By assembling the IMOS parts in parallel (a single step at the wafer level), DOC saves time and reduces manufacturing variability over traditional manufacturing approaches, which rely on individual assembly steps for each component. The functionality and versatility of DOC's IMOS make high-performance solutions possible in a wide range of applications, including optical communications, medical, gesture recognition and micro-projectors.

Parallel Optics

DOC's parallel optics solutions enable parallel module manufacturers to address the continuous demand from the market for higher-density higher-speed data rate and upgrade their backplanes to support 40 and 100 Gbps Ethernet speed rates. DOC's patented lens technology provides increased bandwidth, reduces modal noise due to back reflection into the laser and attenuates the power of the launch, which is important for eye safety and signal regulation.

DOC's in-line source monitoring technology features real-time monitoring and adjustment of laser power for maximum source performance. The monitoring technology is built into the lens array to ensure consistently high performance – a necessary feature as data rates move to 40 and 100 Gbps.

DOC parallel optical solutions include 1x12 Transmit, 1x12 Receiver, 4+4 Transceiver (for QSFP applications), 12+12 Transceiver (for CXP applications). All the transmit products can be outfitted with DOC's patented monitoring lens technology.



Greater efficiency, performance and cost savings with customized micro-optics

As the micro optics industry rapidly evolves, the need for unique refractive and diffractive optical elements that meet specific performance, cost and volume requirements is growing at a faster pace than ever. To stay ahead of industry demands, DigitalOptics Corporation (DOC) products are designed to offer customized wafer-based micro optic solutions for next-generation defense, communication, semiconductor and medical applications. By providing complete, in-house product development services, from design to fabrication, DOC solutions offer its customers greater efficiency, superior quality and significant cost savings as compared to working with multiple designers and fabricators.



Leverage Powerful Fabrication Facilities

DigitalOptics Corporation utilize high resolution lithographic techniques in combination with precision glass-etching capabilities providing manufacturers with customized, high-quality optical elements. Wafer-based lithography offers four distinct advantages over conventional manufacturing methods: miniaturization, high precision, customization and cost efficiency.

Employing multiple tool sets and materials in its state-of-the-art 100,000 ft² ISO certified facility, DOC fabricates optical elements with sub-micron features to match each application's customized requirements. Comprehensive, automated, in-house test systems provide full process and quality controls.

Superior Design Leads to Superior Results

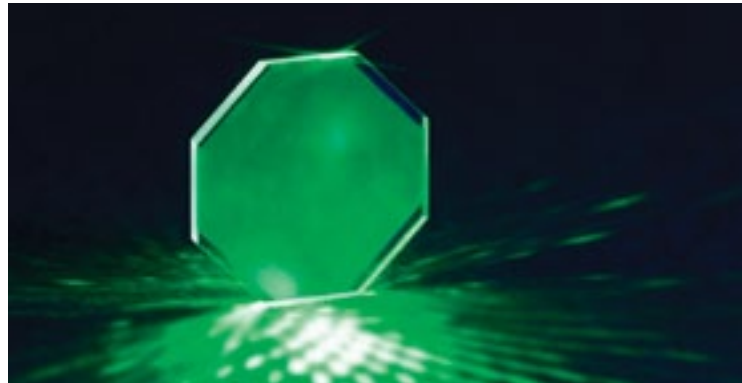
DOC employs one of the industry's largest internal teams of optical designers and application engineers. Using advanced design and simulations tools along with its advanced wafer-level optic fabrication capabilities enables DOC to offer its customers high-volume, high-precision, cost-effective manufacturing of products for a variety of markets, including military, optical communications, infrared systems, metrology, medical, semiconductor equipment and vision systems.

DOC Offerings Include

- Single-side and double-side wafer processing
- Diffractive and refractive lenses
- Metal patterns and apertures
- In-house dielectric coatings
- Integration with passive and active components
- Variety of materials

Contact a DOC sales representative for more information.

3025 Orchard Parkway | San Jose, CA 95134 | T +1.704.887.3154 | www.doc.com



High-Quality High-Performance Diffractive Optics

DOC's diffractive optical elements (DOEs) provide precise, customized patterns for a broad spectrum of applications, including semiconductor lithography, optical targeting, optical positioning, beam shaping and light source homogenization and sensors. They provide ideal solutions for narrow spectrum optical systems, such as bar-code frame generators, optical diffusers for biomedical applications and off-axis illumination elements for lithography. DOC also offers some off-the-shelf products including linear grating, line generator, spot array generator and cross-hair pattern.

Defense and Security

DOC's next-generation optical solutions address the advanced needs of defense and security with industry leading micro optic elements. Commercial aircraft and defense equipment, vehicles and communications devices depend on DOC's innovative processes to increase efficiency and reduce costs while meeting stringent new standards for performance. DOC builds custom diffractive elements for controlled angle illumination and diffractive and refractive aspheric lenses in materials such as silicon, fused silica, germanium and other glass substrates. Applications include Heads-Up display, night vision, laser targeting and thermal imaging.

Illumination Systems

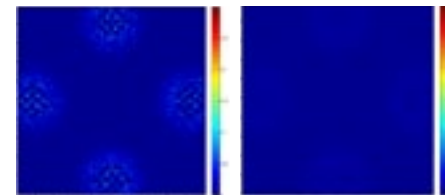
DOC's illumination solutions are custom designed to optimize illumination systems in high-performance lithography and inspection manufacturing tools. These solutions use controlled angle diffusers to enable optimum illumination of masks — minimizing feature size and maximizing the operating process window for the tool. As the node size is reduced from generation to generation, the need for precision pupil specifications is becoming more critical to support this process. DOC technology can address this need in several ways: higher resolution, more intensity levels and stray light reduction. DOC's low stray light solutions suppress the diffractive scatter within the dark regions of the pupil. This provides higher contrast, reduced optical flare, and a dramatic improvement in the overall signal to-noise ratio of the source pupil definition. Implementing this approach using DOC's advanced DUV lithography capabilities, reduces stray light by up to 60%.

Diffractive Optical Elements

- Diffusers
- Beam shapers
- Beam steering optics
- Pattern generators
- Gratings
- Homogenizers
- Beam splitters
- Lenses
- Spot array generators
- Chromatic correctors

Applications

- Free-form designs for Source Mask Optimization (SMO)
- Off-axis illumination for optical/ DUV scanners
- Reticle and wafer inspection equipment
- Medical applications
- Gesture applications
- Head-mounted displays
- Ultra-compact imaging systems
- Optical sensors
- Machine vision systems
- Missile guidance systems
- Near-field wavefront correction and beam shaping



Over 60% reduction in stray light using advanced lithography tool

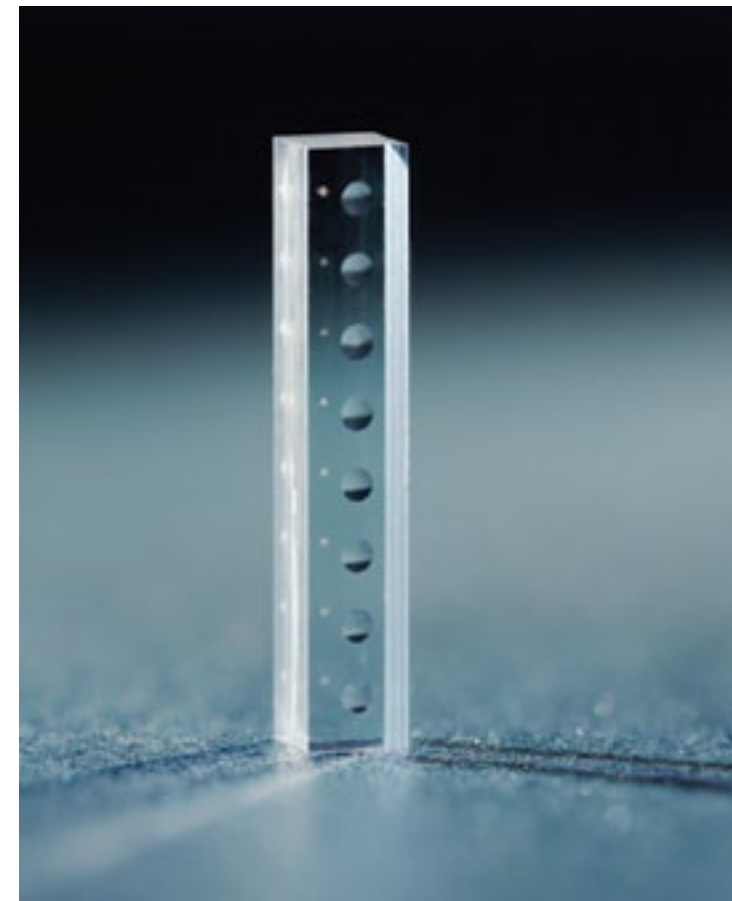
DOC Diffractive Optics

Wavelength	193nm to 14um
Materials	Quartz, fused-silica, silicon, germanium; other materials upon request
Pattern	Sub-micron patterning & alignment capabilities, single & double-sided
Dimensions	0.5mm to 125.0mm
Projection Angles	Wide: up to 120 degrees (full angle)
Coatings	Anti-reflective coating and metallization capabilities
Zero Order Efficiency	Typically < 1.5%
Efficiency	Varies by design

Achieve Superior Performance with Refractive Optics

DOC's wafer-level fabrication technique revolutionizes refractive optical element manufacturing by delivering significantly higher manufacturing efficiencies than traditional, time consuming grinding, molding and polishing. DOC's lithographic manufacturing process simultaneously forms up to several thousands of lenses with submicron precision, guaranteeing a level of performance and thermal stability that surpasses conventional manufacturing processes with precision registration between lenses in an array: typically < 0.1um. Its wafer based fabrication technologies include direct etching and replication. Direct etching lithographically etches pure glass or Silicon and delivers exceptional environmental performance; thermal, mechanical and chemical stability; and superior optical and geometric performance. Replication is a high-volume solution that features a polymer-on-glass substrate for excellent environmental performance and stability.

DOC's ultra-precise processes enable manufacturers to add mirrors, micro-labels and registration features to the lens components. Its refractive elements provide unmatched unit-to-unit repeatability, unparalleled metrology infrastructure, broad wavelength bandwidth and lens optimization solutions for high-performance applications.



Refractive Optical Elements

- Spherical and aspherical lenses
- Full fill factor lens array (Fly's Eyes)
- 1D and 2D micro lens arrays
- Arbitrary shapes
- Single-sided and double-sided lenses

Applications

- Datacom
- Telecom
- Medical
- IR vision
- Industrial and beam shaping

Advantages

- Lithographic precision alignment
- Volume scalability
- Small form factors
- Compact functional integration
- State-of-the-art metrology
- Optical design expertise
- Robust monolithic parts



DOC Refractive Optics

Wavelengths	Materials and applications from 193nm to 14um
Lens Materials	Fused-silica, silicon, IR materials, polymers
Lens Diameters	0.01mm up to 10mm
Lens Sags	<10µm up to 750µm
Wafer Sizes	150mm and 200mm
Coatings	Anti-reflective coating and metallization capabilities