LiDAR – Sensing Your Vision
Why Glass Solutions Play a Key Role in Improving LiDAR Sensor
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Introduction to SCHOTT
SCHOTT worldwide presence –
42 production sites / 26 sales offices

North America
- Canada
- Mexico
- USA

Middle East and North Africa
- Dubai
- Tunisia

South America
- Argentina
- Brazil
- Columbia

Europe
- Austria
- Croatia
- Czech Republic
- Denmark
- Finland
- France
- Germany
- Great Britain
- Russian Federation
- Spain
- Switzerland
- Turkey

Asia and Oceania
- China
- India
- Indonesia
- Japan
- Korea
- Malaysia
- Singapore
- Taiwan
- Thailand
- Australia

in 34 countries

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Broad product portfolio for many industries
Glass solutions from SCHOTT can improve your LiDAR sensor
Glass and glass-to-metal sealed components protect LiDAR sensors, while maintaining a high optical performance

LiDAR components incl. MEMS mirrors and high-power lasers require protection from humidity and atmospheric influences, while offering superior performance.

Protective windows, optical path components and hermetic packages from SCHOTT address these challenges.

- **Protective window**
  - Protective glass windows in different shapes
  - Anti-reflective and hard coating

- **Optical path**
  - Optical glass
  - Filters
  - Mirrors/ Beam splitters
  - Aspherical Lenses

- **Hermetic packaging**
  - Highly reliable encapsulation for:
    - Laser diodes
    - Photo diodes
    - MEMS mirrors
High-quality **protective windows** are needed to withstand harsh conditions

**Challenges**

- The LiDAR sensor has to reliably function at a high level to provide a continuous situational picture.
- LiDAR systems need protection from rain, temperature fluctuations and impacts from gravel, rocks, and other debris.
- Protective windows must feature high transmission that allows near infrared (NIR) to pass through, while attenuating visible ambient light.
The advantages of **protective windows** made out of glass lie in a longer life-time and a higher optical reliability.

**RG Filter glasses**
- High NIR transmittance and strong absorption in the visible range
- Different thicknesses available: 0.3 mm to 6 mm
- Available for 905nm and 1.550nm
- Thermal toughening to increase strength

**BOROFLOAT® 33**
- Outstanding thermal resistance
- Exceptionally high transparency
- High chemically durability
- Excellent mechanical strength

**AR Coatings**
- AR Coating with a hardness close to Sapphire
- Outstanding scratch resistance, ensuring long term performance
- Excellent coating adhesion to surface
- Applied and proven for defense and watch applications
- High visible transmission
The advantages of **protective windows** made out of glass lie in a longer life-time and a higher optical reliability.

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<td>• Atmospheric deposit leads to surface roughness</td>
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Filters, substrates and lenses – high performance for the optical path

Challenges

• In the optical path of a LiDAR system, the precision of the interacting components is key because the laser beam cannot afford any single photon loss.

• LiDAR sensors must deliver long lasting good image quality regardless of temperature differences or aggressive climate conditions.

• High transmission and a thermalized lens system design are commonly considered.

• LiDAR sensors require superior overall imaging quality, while being compact and lightweight.
Filters, substrates and lenses – high performance for the optical path

BOROFLOAT® 33
- Outstanding thermal resistance
- Exceptionally high transparency
- High chemically durability
- Excellent mechanical strength

D263® T eco
- Very high transparency across a wide range
- Suited for chemical toughening
- Wide range of thicknesses without need of polishing
- Ideal substrate for any type of optical filters

MEMpax®
- Precise match in thermal expansion with Si
- Suited for anodic bonding
- Exceptionally high transparency
- Excellent thermal and mechanical resistance
- Optimal coating substrate for both reflective and anti reflective coatings
- No surface or subsurface damages
Filters, substrates and lenses – high performance for the optical path

**Filter Substrates**
- Absorption filter – independent on angle of incidence
- Steep cut-on wavelength enables excellent S/N ratio
- Cut-on wavelength custom made
- Good polishing capability
- RoHS and REACH compliant

**Optical Glass**
- More than 99%\(^1\) internal transmittance at 905 and 1530 nm
  - thickness of 10 mm assumed
- High refractive index glass
- Low or negative dn/dT or very high dn/dT for temperature compensation
- Low CTE < 6 ppm/K
- Good chemical resistance
- Precision moldable glasses

**Aspherical Lenses**
- Custom designed products at competitive prices
- From single piece for prototype to series production levels
- Available in high transmission optical glass and fused silica materials
- Coating: All lenses can be coated to specific custom designs
- Master the entire value chain from raw glass to aspherical coated lenses

\(^1\) thickness of 10 mm assumed
Hermetic packages protect and power LiDAR sensors to withstand harsh conditions

Challenges

• Laser diodes, photo diodes and MEMS mirrors must be protected against internal condensation and harsh external elements of the driving environment in all types of LiDAR sensor devices.

• Professional support and consulting is needed when it comes to product size, shape, materials, technology, and all-round R&D support as well as solutions optimized for competitive, high-volume manufacturing.
Hermetic packages protect and power LiDAR sensors to withstand harsh conditions

**Robust packages**
- Air tightness: $< 1 \times 10^{-8}$ mbar l/s to protect against harsh automotive conditions (dust, moisture)
- THT is robust against vibration
- Inert material and plating system against corrosion

**Improved performance**
- Package can be designed to have vacuum to improve MEMs sweeping angle, response time, and reduce power consumption
- Excellent heat dissipation improves laser efficiency and maintains the wavelength

**Excellent heat dissipation**
- TEC design to cool high power lasers and control constant wavelength
- Cu as heatsink to quickly dissipate heat load from laser to package

**High optical precision**
- Metal cap with special glass and advanced optical design
- Angled window, AR coating to minimize reflection
- Near Infrared (NIR) filter and other coating options

**Custom-made or off-the-shelf**
- Product size, shape
- THT, SMD style
- I/O numbers
- Coating materials, etc.

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THT = Through Hole Technology  
TEC = Thermal Electrical Cooler  
SMD = Surface Mount Device

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Please check out our LiDAR microsite
SCHOTT’s value proposition for different LiDAR technologies

360° mechanical LiDAR
- MEMS LiDAR
- Mirror-mechanical LiDAR
- Flash LiDAR

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SCHOTT offers the broadest glass solution portfolio for LiDAR sensors on the market. All from one source.

**OUR OFFER**
*The broadest glass solutions portfolio on the market. All from one source.*

**OUR DRIVE**
*With our passion to innovate we tailor solutions for your visions.*

**OUR MINDSET**
*We are proactive consultants. A partner that offers a holistic approach.*
Please visit our Microsite & our Opportunity Lab!

Sensing your Vision

https://microsites.schott.com/us-lidar/english/

Challenge glass!
Challenge us!
The SCHOTT Opportunity Lab allows easy access to the experts of anything having to do with glass.

Contact us

https://www.us.schott.com/innovation/opportunity-lab-contact/