Photonics On Crystals

POC-OC-122477-Silicon Crystal Datasheet

1 Main Features

- Excellent light transmission properties in the 1-7 μm band, ideal for infrared applications.
- Transparent in the far infrared spectrum from 30-300 μm, rare in other optical materials.
- High thermal conductivity and low density, perfect for laser mirror substrates.
- Durable single-crystal structure with low absorption rates.
- Ideal for 3-5 μm mid-wave infrared optical windows and filters.

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2. Material General Description

Silicon single crystal is a highly durable material known for its excellent optical transmission in the infrared spectrum, spanning from 1 to 7 μm. Its unique property of transparency in the far-infrared range (30-300 μm) makes it an ideal choice for specialized optical components. The material is commonly used in mid-wave infrared (MWIR) optical systems due to its outstanding transmission and minimal absorption. The crystalline structure is strong and insoluble in water, ensuring stability and robustness for demanding applications. Thanks to its high thermal conductivity and low density, silicon crystals are also utilized in laser mirror substrates and filters.

Photonics On Crystals (POC) provides high-purity silicon crystals with customizable dimensions and orientations to meet specific application needs. These crystals are grown using the Czochralski (CZ) or Float-Zone (FZ) methods, ensuring premium quality and performance.

3. General Applications and Examples

Silicon crystals find extensive applications across diverse scientific and industrial fields due to their exceptional optical and thermal properties:

1. **Infrared Optics**
   Silicon crystals are commonly used in infrared optical systems for their transmission capabilities in the 1-7 µm range. These systems include infrared imaging, thermal imaging cameras, and spectroscopic instruments.
2. **Mid-Wave Infrared (MWIR) Windows and Lenses**
   Silicon's low absorption and high transmission in the 3-5 µm range make it ideal for MWIR optical windows and lenses used in defense, aerospace, and industrial applications.
3. **Laser Mirror Substrates**
   With high thermal conductivity and low density, silicon crystals are optimal for manufacturing substrates in laser mirrors, especially in high-power laser systems.
4. **Optical Filters**
   The material is often employed in optical filters for specific infrared wavelengths due to its precise transmission range and stability.
5. **Semiconductor Applications**
   Besides optical uses, silicon crystals are integral to the semiconductor industry, serving as a base material for microelectronic components.

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4. Chemical, Physical, and Structural Properties

Property	Specification
Material Grade	CZ, FZ; Intrinsic Silicon
Max Crystal Size	Ø300 mm
Growing Method	CZ/FZ
Crystal Structure	Monocrystalline
Type	N-type/P-type
Cleavage Planes	<111>
Density	2.33 g/cm³
Thermal Conductivity	148 W/m·K
Thermal Expansion	2.6 × 10^-6 /K
Mohs Hardness	7
Melting Point	1,410°C

Specific Heat Capacity	700 J/kg·K

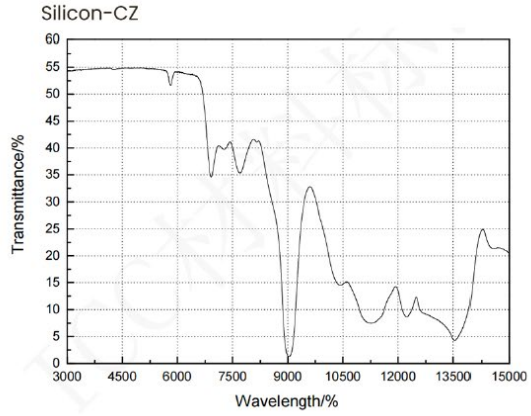
5. Optical, Laser, or Nonlinear Optical Properties

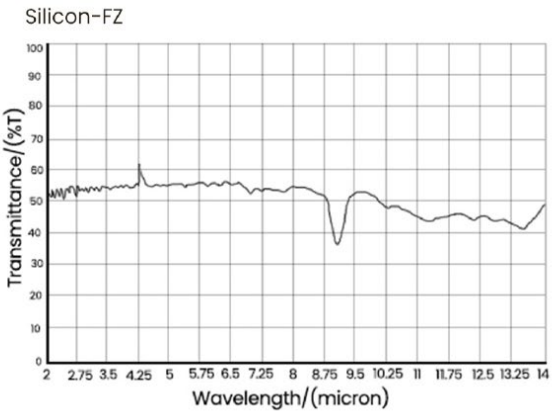
Optical Property	Specification
Transmittance Range	1.2-15 µm
Transmittance	>95% in the 1-6 µm range
Refractive Index	3.42 (at 1.5 µm)
Absorption Coefficient	10^-3 @10.6 µm
Thermal Lens Effects	Negligible for standard power
Laser Damage Threshold	>10 J/cm² @1064 nm, 10 ns

6. Spectrum Transmission Curves

Two transmission curves are provided:

1. CZ Silicon Transmission Curve: Highlights transparency in the 1-15 µm range with minimal loss.
2. FZ Silicon Transmission Curve: Demonstrates high transmission in the far-infrared spectrum, up to 300 µm.





7. Coating Specification

Photonics On Crystals (POC) offers anti-reflection (AR) coatings optimized for the 1-7 µm range to enhance performance in optical systems. Custom coatings for MWIR and LWIR applications are also available upon request.

Coating Type	Wavelength Range	Reflection Loss	Durability
Standard AR Coating	1-7 µm	<0.5%	Scratch-resistant
Custom Coating	On demand	<0.3%	High durability

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8. Standard Fabrication Specifications

Specification	Details
Flatness	λ/8 @632.8 nm
Parallelism	<1 arcmin
Surface Quality	40-20 (scratch-dig)
Clear Aperture	>90%
Bevel	<0.25 mm × 45°
Length Tolerance	±0.1 mm
Coating Options	Customizable as per user request

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9. POC Strength and Capabilities

Photonics On Crystals (POC) specializes in the development and supply of high-quality silicon crystals for advanced optical applications. With expertise in crystal growth and precision fabrication, POC ensures every product meets stringent performance requirements. Key strengths include:

- Customizable silicon crystals tailored to client specifications.
- Advanced coating capabilities for enhanced optical performance.
- Reliable delivery and competitive pricing for global markets.
- Comprehensive technical support for design and integration.

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10. Standard Products

Product	Dimensions	Coating	Price (USD)
Silicon Window	Ø100 mm	AR (1-7 µm)	300
Silicon Lens	Ø50 mm	AR (3-5 µm)	150
Custom Silicon Parts	On request	Custom Coating	Based on spec.

For custom products, please contact POC for detailed discussions on dimensions, coatings, and other requirements.