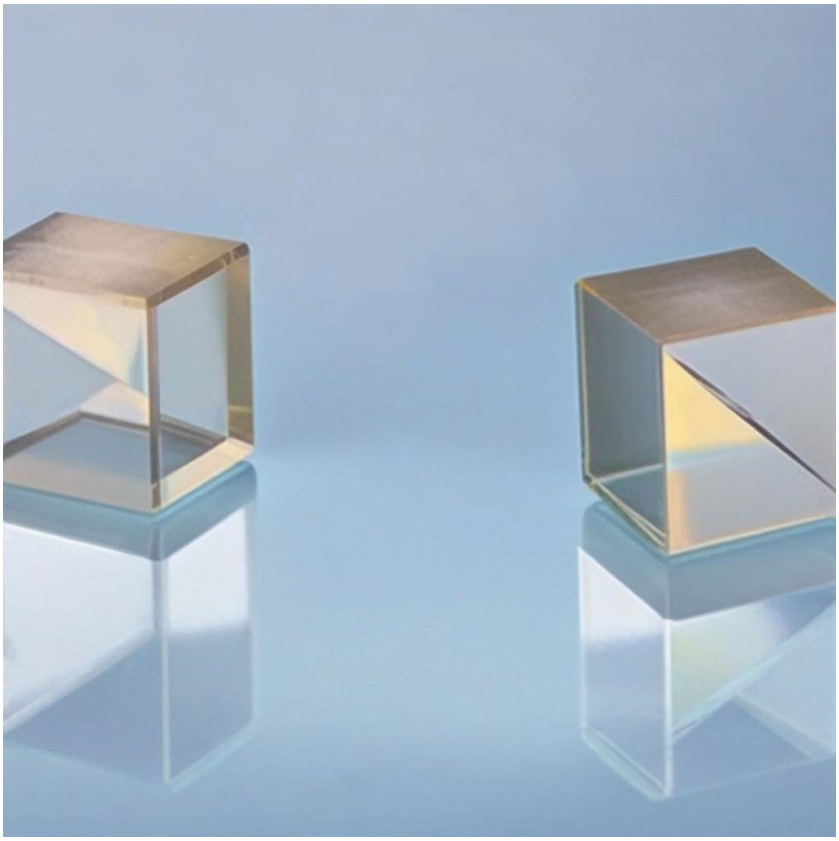
Photonics On Crystals

POC-OC-122509-Electronic Grade Diamond Crystal Datasheet

1 Main Features

- Exceptional thermal conductivity (>2000 W/m·K) ideal for heat dissipation applications.
- High electron and hole mobility (>2000 $cm^2/V·s$) for advanced electronic and optoelectronic devices.
- Ultra-low impurity levels (Nitrogen [N]: <5 ppb, Boron [B]: <1 ppb) for high purity applications.
- Customizable dimensions up to Ø110 mm with precise edge quality (surface roughness Ra <0.5 nm).
- Superior dielectric properties with wide bandgap (5.47 eV) suitable for high-frequency applications.



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2. Material General Description

Electronic Grade Diamond is a synthetic diamond material engineered using Chemical Vapor Deposition (CVD) technology. It offers unparalleled thermal, electronic, and optical properties. Featuring ultra-low defect densities (~10^{14} cm^{-3}) and minimal impurities, it is the material of choice for high-power electronic devices, quantum computing, and advanced thermal management systems. Its intrinsic characteristics, including a wide bandgap and high carrier mobility, make it a

leading solution for high-performance semiconductor applications. These diamonds are available in single-crystal and polycrystalline forms, each tailored to specific industrial and scientific needs.

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3. General Applications and Examples

- **Thermal Management:** Utilized in high-power laser systems and microelectronics as heat spreaders due to its exceptional thermal conductivity.
- **Quantum Computing:** Ideal for hosting nitrogen-vacancy (NV) centers, enabling high-sensitivity magnetometry and quantum communication.
- **Semiconductor Devices:** Advanced material for power electronics, including high-voltage diodes and field-effect transistors.
- **High-Precision Optics:** Applicable in high-power laser windows and X-ray optics with minimal thermal distortion.
- **High-Energy Physics:** Essential in particle detectors for its excellent radiation hardness and high charge collection efficiency.

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4. Chemical, Physical, and Structural Properties

Properties	Single Crystal	Polycrystalline	Notes
Thermal Conductivity (W/m·K)	>2000	>1900	Measured at room temperature.
Electron Mobility ($cm^2/V·s$)	>2000	>1000	At a field of 0.5 V/µm.
Hole Mobility ($cm^2/V·s$)	>2000	>1800	
Bandgap (eV)	5.47	5.47	Wide bandgap characteristic.
Nitrogen Impurities [N] (ppb)	<5	<50	EPR measured.
Boron Impurities [B] (ppb)	<1	<1	SIMS measured.
Thermal Expansion Coefficient (ppm/K)	1.0 ± 0.1	1.0 ± 0.1	Measured at 300 K.

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5. Optical, Laser, or Nonlinear Optical Properties

Optical Properties	Value
Refractive Index	2.41 (average)
Transmission Range	225 nm - 25 µm
Absorption Coefficient	<0.1 cm^{-1} @ 10.6 µm

Scattering Loss	<0.02% @ 1064 nm
Surface Roughness (Ra)	<0.5 nm (single-crystal polished)

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6. Spectrum Transmission Curves

Transmission data for Electronic Grade Diamond shows excellent transparency across the ultraviolet (UV), visible, and infrared (IR) spectrum, extending from 225 nm to 25 µm. This wide range makes it suitable for diverse optical applications.

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7. Coating Specification

- **Anti-Reflective Coatings:** Available for specific wavelengths (e.g., 1064 nm or 1550 nm) to reduce reflection losses.
- **Protective Coatings:** Custom coatings for durability in high-energy applications, including multilayer dielectric or diamond-like carbon (DLC) coatings.

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8. Standard Fabrication Specifications

Specification	Value
Crystal Orientation	{100} ± 3°
Standard Sizes (mm)	2x2, 4x4, 5x5, 10x10
Thickness Tolerance	±0.02 mm
Laser Cut Angle	3° ± 0.1°
Edge Quality (mm)	<0.2
Surface Roughness (Ra)	<0.5 nm

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9. POC Strength and Capabilities

Photonics On Crystals (POC) specializes in high-precision synthetic diamond solutions, offering unparalleled quality in electronic-grade diamonds. Our advanced CVD technology enables low defect density and high purity, ensuring reliability and performance for demanding applications. POC supports customized dimensions, coating options, and integration into high-tech systems, backed by a robust R&D team and state-of-the-art facilities.

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10. Standard Products

Dimensions (mm)	Thickness (mm)	Orientation	Price (USD)
2x2	0.5	{100} ± 3°	$150

Photonics On Crystals

4x4	0.5	{100} ± 3°	$250
10x10	1.0	{100} ± 3°	$450
Custom Sizes	**Upon Request**	**Variable**	**TBD**