

# SILICON CARBIDE SUBSTRATES

## Product Specifications

6H SUBSTRATES

4H SUBSTRATES

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## SILICON CARBIDE MATERIAL PROPERTIES

| Polytype                     | Single Crystal 4H                          | Single Crystal 6H                          |
|------------------------------|--|--|
| Lattice Parameters           | a=3.076 Å<br>c=10.053 Å                    | a=3.073 Å<br>c=15.117 Å                    |
| Stacking Sequence            | ABCB                                       | ABCACB                                     |
| Band-gap                     | 3.26 eV                                    | 3.03 eV                                    |
| Density                      | $3.21 \cdot 10^3 \text{ kg/m}^3$           | $3.21 \cdot 10^3 \text{ kg/m}^3$           |
| Therm. Expansion Coefficient | $4-5 \times 10^{-6}/\text{K}$              | $4-5 \times 10^{-6}/\text{K}$              |
| Refraction Index             | $n_o = 2.719$<br>$n_e = 2.777$             | $n_o = 2.707$<br>$n_e = 2.755$             |
| Dielectric Constant          | 9.6  | 9.66                                       |
| Thermal Conductivity         | 490 W/mK                                   | 490 W/mK                                   |
| Break-Down Electrical Field  | $2 - 4 \cdot 10^8 \text{ V/m}$             | $2 - 4 \cdot 10^8 \text{ V/m}$             |
| Saturation Drift Velocity    | $2.0 \cdot 10^5 \text{ m/s}$               | $2.0 \cdot 10^5 \text{ m/s}$               |
| Electron Mobility            | $800 \text{ cm}^2/\text{V} \cdot \text{S}$ | $400 \text{ cm}^2/\text{V} \cdot \text{S}$ |
| hole Mobility                | $115 \text{ cm}^2/\text{V} \cdot \text{S}$ | $90 \text{ cm}^2/\text{V} \cdot \text{S}$  |
| Mohs Hardness                | ~9   | ~9   |

## 6H N-TYPE SiC, 2 WAFER SPECIFICATION

| SUBSTRATE PROPERTY         | S6H-51-N-PWAM-250  | S6H-51-N-PWAM-330 | S6H-51-N-PWAM-430 |
|----------------------------|--|-------------------|-------------------|
| Description                | Production Grade 6H SiC Substrate  |                   |                   |
| Polytype                   | 6H   |                   |                   |
| Diameter                   | (50.8 ± 0.38) mm   |                   |                   |
| Thickness                  | (250 ± 25) μm  | (330 ± 25) μm     | (430 ± 25) μm     |
| Carrier Type               | n-type   |                   |                   |
| Dopant                     | Nitrogen   |                   |                   |
| Resistivity (RT)           | 0.02 ~ 0.1 Ω · cm  |                   |                   |
| Surface Roughness          | < 0.5 nm (Si-face CMP Epi-ready); <1 nm (C- face Optical polish)                         |                   |                   |
| FWHM                       | <50 arcsec   |                   |                   |
| Micropipe Density          | ≤ 30 cm <sup>-2</sup>  |                   |                   |
| Surface Orientation        |  |                   |                   |
| On axis                    | <0001> ± 0.5°  |                   |                   |
| Off axis                   | 3.5° toward <11-20> ± 0.5°   |                   |                   |
| Primary flat orientation   | Parallel {1-100} ± 5°  |                   |                   |
| Primary flat length        | (16 ± 1.7) mm  |                   |                   |
| Secondary flat orientation | Si-face:90° cw. from orientation flat ± 5°<br>C-face:90° ccw. from orientation flat ± 5° |                   |                   |
| Secondary flat length      | (8 ± 1.7) mm   |                   |                   |
| Surface Finish             | Single or double face polished   |                   |                   |
| Packaging                  | Single wafer box or multi wafer box  |                   |                   |
| Usable area                | ≥ 90 %   |                   |                   |
| Edge exclusion             | 1 mm   |                   |                   |

## 6H SEMI-INSULATING SIC, 2 WAFER SPECIFICATION

| SUBSTRATE PROPERTY         | S6H-51-SI-PWAM-250   | S6H-51-SI-PWAM-330 | S6H-51-SI-PWAM-430 |
|----------------------------|--|--------------------|--------------------|
| Description                | Production Grade 6H SEMI Substrate   |                    |                    |
| Polytype                   | 6H   |                    |                    |
| Diameter                   | (50.8 ± 0.38) mm   |                    |                    |
| Thickness                  | (250 ± 25) μm  | (330 ± 25) μm      | (430 ± 25) μm      |
| Resistivity (RT)           | 90% >1E5 Ω · cm  |                    |                    |
| Surface Roughness          | < 0.5 nm (Si-face CMP Epi-ready); <1 nm (C- face Optical polish)                         |                    |                    |
| FWHM                       | <50 arcsec   |                    |                    |
| Micropipe Density          | ≤ 50 cm <sup>-2</sup>  |                    |                    |
| Surface Orientation        |  |                    |                    |
| On axis                    | <0001> ± 0.5°  |                    |                    |
| Off axis                   | 3.5° toward <11-20> ± 0.5°   |                    |                    |
| Primary flat orientation   | Parallel {1-100} ± 5°  |                    |                    |
| Primary flat length        | (16 ± 1.7) mm  |                    |                    |
| Secondary flat orientation | Si-face:90° cw. from orientation flat ± 5°<br>C-face:90° ccw. from orientation flat ± 5° |                    |                    |
| Secondary flat length      | (8 ± 1.7) mm   |                    |                    |
| Surface Finish             | Single or double face polished   |                    |                    |
| Packaging                  | Single wafer box or multi wafer box  |                    |                    |
| Usable area                | ≥ 90 %   |                    |                    |
| Edge exclusion             | 1 mm   |                    |                    |

**6H N-TYPE SIC,5mm\*5mm, 10mm\*10mm WAFER SPECIFICATION : Thickness:330μm/430μm**

**6H N-TYPE SIC,15mm\*15mm, 20mm\*20mm WAFER SPECIFICATION: Thickness:330μm/430μm**



## 4H N-TYPE SiC, 2 WAFER SPECIFICATION

| SUBSTRATE PROPERTY         | S4H-51-N-PWAM-330  | S4H-51-N-PWAM-430 |               |
|----------------------------|--|-------------------|---------------|
| Description                | Production Grade   | 4H SiC Substrate  |               |
| Polytype                   | 4H   |                   |               |
| Diameter                   | (50.8 ± 0.38) mm   |                   |               |
| Thickness                  | (250 ± 25) μm  | (330 ± 25) μm     | (430 ± 25) μm |
| Carrier Type               | n-type   |                   |               |
| Dopant                     | Nitrogen   |                   |               |
| Resistivity (RT)           | 0.012 - 0.0028 Ω · cm  |                   |               |
| Surface Roughness          | < 0.5 nm (Si-face CMP Epi-ready); <1 nm (C- face Optical polish)                         |                   |               |
| FWHM                       | <50 arcsec   |                   |               |
| Micropipe Density          | ≤ 30 cm <sup>-2</sup>  |                   |               |
| Surface Orientation        |  |                   |               |
| On axis                    | <0001> ± 0.5°  |                   |               |
| Off axis                   | 4° or 8° toward <11-20> ± 0.5°   |                   |               |
| Primary flat orientation   | Parallel {1-100} ± 5°  |                   |               |
| Primary flat length        | (16 ± 1.7) mm  |                   |               |
| Secondary flat orientation | Si-face:90° cw. from orientation flat ± 5°<br>C-face:90° ccw. from orientation flat ± 5° |                   |               |
| Secondary flat length      | (8 ± 1.7) mm   |                   |               |
| Surface Finish             | Single or double face polished   |                   |               |
| Packaging                  | Single wafer box or multi wafer box  |                   |               |
| Usable area                | ≥ 90 %   |                   |               |
| Edge exclusion             | 1 mm   |                   |               |

## 4H N-TYPE SiC, 3 WAFER SPECIFICATION

| SUBSTRATE PROPERTY         | S4H-76-N-PWAM-330  | S4H-76-N-PWAM-430 |
|----------------------------|--|-------------------|
| Description                | Production Grade 4H SiC Substrate  |                   |
| Polytype                   | 4H   |                   |
| Diameter                   | (76.2 ± 0.38) mm   |                   |
| Thickness                  | (350 ± 25) μm  | (430 ± 25) μm     |
| Carrier Type               | n-type   |                   |
| Dopant                     | Nitrogen   |                   |
| Resistivity (RT)           | 0.015 - 0.028Ω · cm  |                   |
| Surface Roughness          | < 0.5 nm (Si-face CMP Epi-ready); <1 nm (C- face Optical polish)                         |                   |
| FWHM                       | <50 arcsec   |                   |
| Micropipe Density          | ≤ 20 cm <sup>-2</sup>  |                   |
| TTV/Bow /Warp              | < 25μm   |                   |
| Surface Orientation        |  |                   |
| On axis                    | <0001> ± 0.5°  |                   |
| Off axis                   | 4° or 8° toward <11-20> ± 0.5°   |                   |
| Primary flat orientation   | <11-20>±5.0°   |                   |
| Primary flat length        | 22.22 mm±3.17mm  |                   |
| Secondary flat orientation | Si-face:90° cw. from orientation flat ± 5°<br>C-face:90° ccw. from orientation flat ± 5° |                   |
| Secondary flat length      | 11 ± 1.7 mm  |                   |
| Surface Finish             | Single or double face polished   |                   |
| Packaging                  | Single wafer box or multi wafer box  |                   |
| Scratch                    | None   |                   |
| Usable area                | ≥ 90 %   |                   |
| Edge exclusion             | 2mm  |                   |

**4H N-TYPE SIC,5mm\*5mm, 10mm\*10mm WAFER SPECIFICATION : Thickness:330μm/430μm**

**4H N-TYPE SIC,15mm\*15mm, 20mm\*20mm WAFER SPECIFICATION: Thickness:330μm/430μm**