

Silicon (Si) datasheet

Material specifications	
Transmission Range	1.2 to 15 microns ¹
Refractive Index	3.4223 @ 5 microns ^{1,2}
Reflection Loss	46.2% at 5 microns (2 surfaces)
Absorption Coefficient	0.01 cm ⁻¹ at 3 microns
dN/dT	160 x 10 ⁻⁶ /°C ³
dN/du	10.4 microns
Density	2.33 g/cc
Melting Point	1420 °C
Thermal Conductivity	163.3 W m ⁻¹ K ⁻¹ at 273 K
Thermal Expansion	2.6 x 10 ⁻⁶ / at 20°C
Hardness	Knoop 1150
Specific Heat Capacity	703 J Kg ⁻¹ K ⁻¹
Dielectric Constant	13 at 10 GHz
Youngs Modulus (E)	131 GPa ⁴
Shear Modulus (G)	79.9 GPa ⁴
Bulk Modulus (K)	102 GPa
Elastic Coefficients	C11=167; C12=65; C44=80 ⁴
Apparent Elastic Limit	124.1MPa (18000 psi)
Poisson Ratio	0.266 ⁴
Solubility	Insoluble in Water
Molecular Weight	28.09
Class/Structure	Cubic diamond, Fd3m

Notes: Silicon is grown by Czochralski pulling techniques (CZ) and contains some oxygen which causes an absorption band at 9 microns. To avoid this, Silicon can be prepared by a Float-Zone (FZ) process. Optical Silicon is generally lightly doped (5 to 40 ohm cm) for best transmission above 10 microns. Silicon has a further pass band 30 to 100 microns which is effective only in very high resistivity uncompensated material. Doping is usually Boron (p-type) and Phosphorus (n-type).

References:

- (1) Handbook Optical Constants, ed Palik, V1, ISBN 0-12-544420-6
- (2) Li, Refractive Index of Germanium etc, J.Phys Chem, V9, p561, (1980)
- (3) Icenogle et al, Appl. Opt. V15, 2348 (1976)
- (4) Wortman & Evans, V36, (1), P153 (1965)