



## Properties of SiO<sub>2</sub> and Si<sub>3</sub>N<sub>4</sub> at 300K

**Dielectric layers** are just as indispensable to integrated circuit fabrication as the semiconductor itself and interconnecting metallization. Dielectric layers are used primarily to **isolate** active circuits from each other and to provide mechanical and chemical **protection** to the device itself. Dielectric layers are also widely used in the fabrication of components essential to circuit functionality such as capacitors and MOS transistors. Lastly, dielectric layers are also used as **masking** materials during wafer fabrication itself.

Two dielectric workhorses in device fabrication are the **silicon dioxide (SiO<sub>2</sub>)** and the **silicon nitride (Si<sub>3</sub>N<sub>4</sub>)**. Aside from being used for masking purposes, the former is extensively used in electrical isolation and as capacitor dielectric and MOS gate oxide while the latter is widely used as the final **glassivation** layer of the die. The properties of SiO<sub>2</sub> and Si<sub>3</sub>N<sub>4</sub> at 300 deg K are presented in Table 1.

**Table 1. Properties of Silicon Dioxide (SiO<sub>2</sub>) and Silicon Nitride (Si<sub>3</sub>N<sub>4</sub>) at 300K**

Properties	SiO <sub>2</sub>	Si <sub>3</sub> N <sub>4</sub>
Structure	Amorphous	Amorphous
Melting Point (deg C)	approx. 1600	---
Density (g/cm <sup>3</sup> )	2.2	3.1
Refractive Index	1.46	2.05
Dielectric Constant	3.9	7.5
Dielectric Strength (V/cm)	10 <sup>7</sup>	10 <sup>7</sup>
Infrared Absorption Band (μm)	9.3	11.5 - 12.0
Energy Gap at 300K (eV)	9	approx. 5.0
Linear Coefficient of Thermal Expansion, ΔL/L/ΔT (1/deg C)	5 x 10 <sup>-7</sup>	---
Thermal Conductivity at 300 K (W/cm-degK)	0.014	---
DC Resistivity at 25 C (ohm-cm)	10 <sup>14</sup> - 10 <sup>16</sup>	approx. 10 <sup>14</sup>
DC Resistivity at 500C (ohm-cm)	---	2 x 10 <sup>13</sup>
Etch Rate in Buffered HF (angstroms/min)	1000	5 - 10

**LINKS:** [Dielectric](#); [Glassivation](#); [Thermal Oxidation](#); [Si, Ge, GaAs Properties](#); [What is a semiconductor?](#); [IC Manufacturing](#)

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