

PRODUCT NOTE

NEUTRON TRANSMUTATION DOPED (NTD) SILICON FOR DEMANDING POWER APPLICATIONS

Material solutions for very high and high power devices

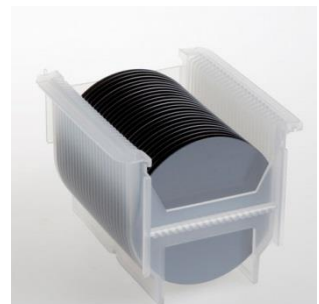
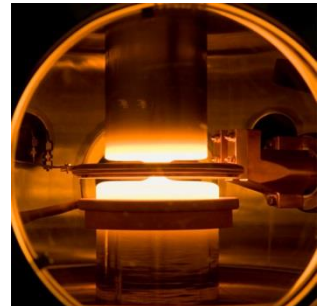
Neutron Transmutation Doped (NTD) silicon has the lowest resistivity variation of any crystalline silicon product on the market. This is of paramount importance for very high and high power semiconductor devices working under extreme loads. The record low resistivity variations guarantee safe and predictable operating limits for these critical components.

Thyristors, Diodes and Solid State Transistors all rely on uniformity of the basis material over large areas. Normal silicon monocrystalline growth cannot guarantee this uniformity. However, by use of neutron transmutation doping (NTD process) on undoped float zone silicon, Si^{30} isotopes can be transformed into n-type dopants in the form of P^{31} .

Topsil is market leading supplier of NTD silicon for demanding power applications. This position has been earned through an uninterrupted focus on NTD and continuous enhancements of product capabilities and products since Topsil co-invented the NTD-process in the 1970s.

Topsil is supporting customers with NTD products in the widest range of resistivities ranging from 5 Ωcm to 1500 Ωcm . Key properties for Topsil NTD products are

- The tightest resistivity tolerances of any silicon crystalline product
- Low levels of performance degrading impurities
- High minority carrier lifetime



The NTD silicon has premium technical properties and offers resistivity stability in production processes from the highest through the lowest resistivities.

The standard parameters for Topsil NTD silicon wafers are listed below. Other product parameters are possible upon request.

CONTACT

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Growth method	Neutron Transmutation Doped Float Zone Silicon
Bulk resistivity range	5-1500 Ωcm
Resistivity tolerance	±5% - ±12%*
Radial resistivity variation (ASTM F81 planC)	<4% - <12%*
Striations	Not detectable
Minority carrier lifetime	>300 μs depending on bulk resistivity
Ingot diameter	50-154 mm
Crystal orientation	<100>, <111>**
Type and Dopant	N (phosphorous)
Oxygen and Carbon concentration	<2.0 10 ¹⁶ cm ⁻³
Wafer thickness	>200 μm depending on wafer diameter
Wafer surface finish	As-cut, Lapped, Etched, Grinded, Polished

*Depending on bulk resistivity and ingot diameter.

**<111> is not available in 200 mm.

Topsil Semiconductor Materials A/S

Topsil is a world leading supplier of ultrapure silicon to the global semiconductor industry. Engaging in long term relations with customers, Topsil focuses on premium quality, an efficient production process and a safe delivery of products.

Silicon is used in electronic components to aid conversion and control of electrical power. Topsil provides ultrapure silicon mainly for the most demanding purposes, based on extensive knowledge and significant investments in new technology, facilities and equipment.

Headquartered in Copenhagen Cleantech Park, Topsil spans production sites in Denmark and Poland and sales locations in Europe, Asia and the US. Topsil is publicly listed at the Nasdaq OMX Copenhagen stock exchange and was founded in 1959.

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