



## PREMIUM FLOAT ZONE SILICON FOR DEMANDING POWER APPLICATIONS

### - material solutions with a highly proven standard

Premium Float Zone (PFZ) silicon has the lowest resistivity variation of any in-situ doped silicon crystalline product on the market. This is of paramount importance for high and medium power semiconductor devices working under high loads and in extreme environments. The low resistivity variation guarantees safe and predictable operating limits for these critical components.

Power MOSFET and IGBT technologies form the basis for many electronically controlled power devices. Driving the increased demand for these products are such issues as comfort, functionality and new industry standards. DC-DC converters, steering aids and increased battery capacity requirements for automotive vehicles are examples of those areas driving the high demand. In addition, new application areas requesting electronically controlled power devices will continue to emerge. To support the demand for more semiconductors in every day appliances, Topsil offers a large range of Float Zone silicon products including NTD silicon for high power applications and the Premium Float Zone (PFZ) silicon for medium and high applications. The PFZ growth process is an optimized, high throughput growth process that allows tight control over all of the important silicon parameters. Some of the features of PFZ silicon are

- Tight resistivity tolerances
- Low levels of performance degrading impurities
- High minority carrier lifetime

Tight resistivity control is necessary not only for one particular growth cycle, but for all growth cycles at a certain specification. Wafer-to-wafer variation and ingot-to-ingot variation must be kept low to fulfil the requirements. Since many of the specifications call for higher resistivity PFZ types, very accurate gas control systems must be employed as well as full control of the feedstock material is mandatory. As a result of the more accurate process control systems, higher resistivity types of PFZ silicon ( $> 40 \Omega\text{cm}$ ) is competitive to Czochralski silicon in terms of yield and pricing and is rapidly becoming the preferred material solution for high frequency power MOSFET's and IGBT's devices with voltage ratings down to 250 V.



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Topsil is among the world leading suppliers of Float Zone silicon for a number of applications. Focus on R&D at Topsil has resulted in continuous Float Zone product development. Topsil was the first company in the world to market NTD Float Zone products. Topsil have since developed several Float Zone products including the PFZ growth process. This combined with state-of-the-art wafering processes makes Topsil NTD Float Zone silicon the best choice for a high power semiconductor product.

Topsil offers Float Zone ingot and wafer substrates with the listed typical parameters. Other product parameters than those in the table are possible on request.

Growth method	In-situ Gas Phase Doped Float Zone Silicon	
Ingot diameter	100-150 mm	
Crystal orientation	<100>, <111>*	
Oxygen and Carbon concentration	< 10 <sup>16</sup> cm <sup>-3</sup>	
Wafer thickness	> 200 µm depending on wafer diameter	
Wafer surface finish	As-cut, Lapped, Etched, Grinded, Polished	
Type and Dopant	N (phosphorous)**	P (Boron)**
Bulk resistivity range	0.5-5000 Ωcm	
Resistivity tolerance	±8% - ±20%	±6% - ±20%
Radial resistivity variation (ASTM F81 planC)	< 8% - < 20%	< 6% - < 20%
Striations	±10% - ±20%	±7% - ±10%
Minority carrier lifetime	> 500 µs	> 100 µs

\*<111> is not available in 6" diameter.

\*\* Listed specifications are dependant on bulk resistivity and ingot diameter. Tighter limits are possible.

For more than 45 years, Topsil has serviced the semiconductor industry with FZ and CZ silicon crystals and wafers. In close collaboration with our customers, research external institutions and partners, our dedicated R&D team has continued to introduce new world-class specified products to the market, in order to achieve our goal of being your full range silicon partner.

With a technological base as one of the few industrial manufactures of Float-Zone crystals, Topsil has a strong focus on optimised production technology and flexibility, and our ISO 9001 certified quality engagement of the whole organisation, secures a high level of support and on-time delivery of top-quality products.