

## PRODUCT NOTE

# PRIME SILICON WAFERS FOR MEMS APPLICATIONS

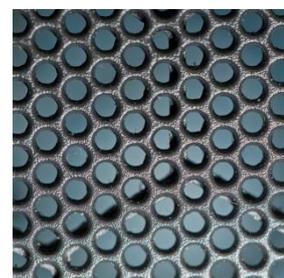
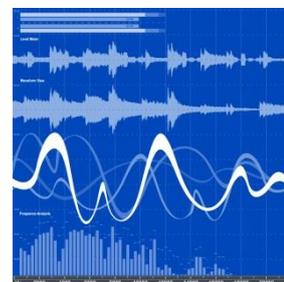
### Wafer solutions for leading-edge technology development

MEMS components are used in a wide variety of systems ranging from low volume sensoric elements in harsh industrial environments to high volume consumer goods. MEMS is forecasted to impact almost every product category bringing together silicon based microelectronics and micromachining technology in the same package or on the same chip.

MEMS components require superior mechanical properties of the base silicon material. Topsil fulfills these requirements from all part of the electronics industry grounded on more than half a century's experience in manufacturing premium quality silicon wafers. The manufacture is based on Float Zone and Czochralski technology, respectively.

Topsil has specialised in growing Float Zone crystals with superior control of dopant content and distribution and with very low levels of contaminants. This is especially beneficial for applications requiring very low concentrations of oxygen such as power MEMS components, high efficiency microstructured solar cells and photodiodes as well as RF MEMS devices on high resistivity silicon.

To complete the range of MEMS products, Topsil also offers Czochralski wafers. Czochralski wafers are traditionally being used in MEMS applications with focus on the mechanical parameters and not on the bulk properties of the silicon. Most applications require low oxygen content, but a limit of 18 ppma (new ASTM) is sufficient in many cases.



Most of the high volume components such as MEMS accelerometers and MEMS microphones are built on Czochralski wafers with superior mechanical wafer characteristics.

Parameters of Topsil Float Zone and Czochralski MEMS wafer substrates are listed below. Other parameters than those in the table are possible upon request:

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	<b>Czochralski</b>	<b>Float Zone</b>	<b>Float Zone</b>
Diameter	100-150 mm	50-150 mm*	100-150 mm*
Crystal orientation	<100> <110> <111> <211>	<100> <111> <211>	<100> <111> <211>
Orientation accuracy	<0.5°	<0.5°	<0.5°
Type and dopant	Undoped, n-type, p-type	Undoped, n-type, p-type	Undoped, n-type, p-type
Dopant	As, B, P, and Sb	P, B	P, B
Bulk resistivity	0.001-60	1-30,000	1-30,000
Bulk lifetime	>20 μs	>1,000 μs	>1,000 μs
Wafer thickness	200-1,500 μm	200-1,500 μm	200-1,500 μm
Wafer thickness tolerance	±15 μm	±15 μm	±5 μm
TTV	<5 μm or <9 μm	<5 μm or <9 μm	<2.5 μm
TIR	<3 μm	<3 μm	<1 μm
Wafer surface finish	Single side polished, Double side polished	Single side polished	Double side polished

\*200 mm under development.

## 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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