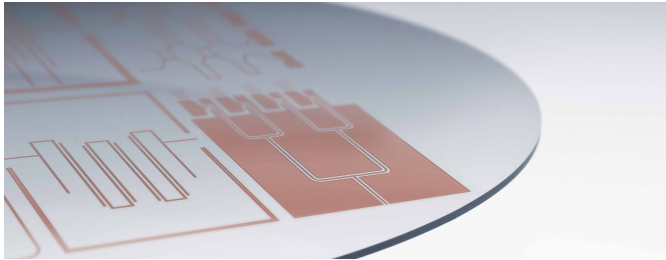


BOROFLOAT® 33 – Electrical Properties

The sum of its properties is what makes it unique.

BOROFLOAT® 33 from Germany is the world’s first floated borosilicate flat glass. It combines superior quality and excellent flatness with outstanding thermal, optical, chemical and mechanical features. The chemical composition and physical properties of BOROFLOAT® 33 are in accordance with DIN ISO 3585 and DIN EN 1748 T1. Rediscover BOROFLOAT® 33 and experience the infinite potential of our most versatile material platform. BOROFLOAT® – Inspiration through Quality.



Can be easily processed by using all state-of-the-art semiconductor structuring technologies

Key benefits:

Unique combination of electrical properties

- Low dielectric constant in combination with low loss tangent
- High electrical volume resistivity
- Anodically bondable
- Homogeneous material based on amorphous structure
- Available in broad range of sizes and thicknesses

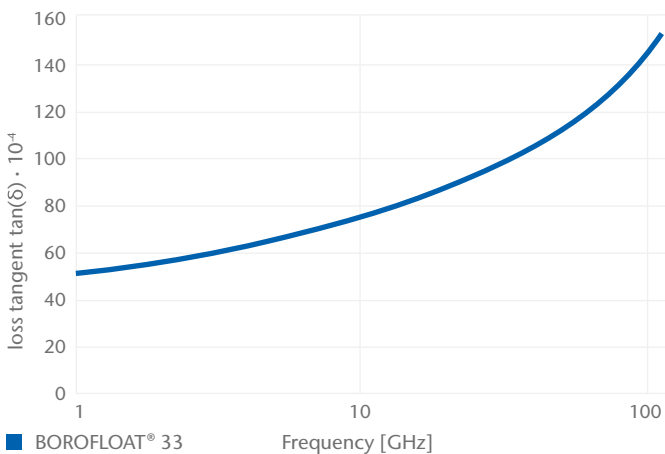
Dielectrical properties

Dielectric constant (permittivity) ϵ_r	1 MHz, 25°C	4.6
loss tangent $\tan(\delta)^* [10^{-4}]$	1 MHz, 25°C	48

Frequency [GHz]	1	2	2.45	5	10	15	24	77	110
Dielectric constant (permittivity) ϵ_r	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
loss tangent $\tan(\delta)^* [10^{-4}]$	51	56	58	66	75	82	91	127	152

Dependence of dielectric constant and loss tangent on frequency

Frequency dependent loss tangent $\tan(\delta)$



* The data ranging from 1 GHz to 15 GHz are measured using a split-post-dielectric resonator method (SPDR) and have an accuracy for the loss tangent of approx. 10^{-5} . The data ranging from 20 GHz to 110 GHz are obtained by using an Fabry-Perot Open Resonator (FPOR). The measurements have been done at room temperature (25°C +/- 3°C)

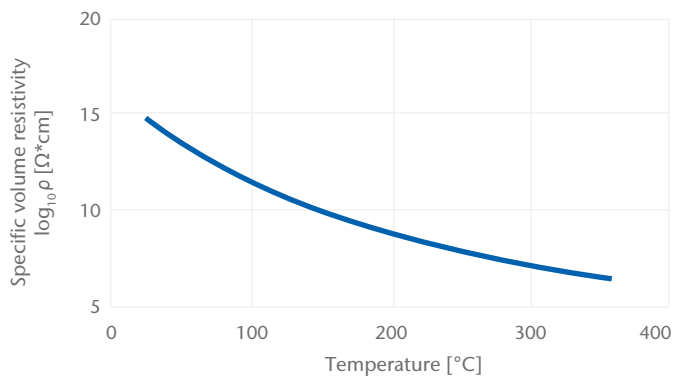


Temperature dependent loss tangent $\tan(\delta)$ at 10 GHz frequency

Temperature [K]	234	254	275	293	313	323	332
Dielectric constant (permittivity) ϵ_r	4.4	4.5	4.5	4.5	4.5	4.5	4.5
loss tangent $\tan(\delta)$ * [10^{-4}]	68	70	72	75	78	79	80

Electrical resistivity

Specific volume resistivity	
Temperature [°C]	$\log_{10} \rho$ [$\Omega \cdot \text{cm}$]
25	14.8
250	8.0
350	6.5
Temperature of the specific electrical resistivity at $10^8 \Omega \cdot \text{cm}$	
T_{k100} [°C]	250



■ BOROFLOAT® 33

All values listed on the data sheet are not guaranteed reference values.

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