Glass Wafer

Specification

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SCHOTT Thin Glass and Wafer products are the result of deep technological expertise. With a product portfolio of more than 100 optical glasses, special materials and wafer processing technologies, we are a valuable partner to customers worldwide in developing highly differentiated solutions for the semiconductor and biotech industry.

This specification provides a full overview for our glass wafer manufacturing competencies. It describes our hot forming and processing standard capabilities we offer to the market. Due to the variety of customer requirements please feel free to contact our sales organization in order to discuss your requests in detail. Our sales is supported by application engineering in order to give customers needed support for best solutions.

Beside this glass wafer specification SCHOTT has additional **Datasheets** for information about glass types and their physical and chemical properties as well for specific process or product related information. Please contact our sales for any needed support.

Typical Applications

• AF 32® eco	Wafer-Level Chip-Scale Packaging (WLCSP) Wafer-Level Optics (WLO) Thin Film Battery (TFB) Interposer Substrates Ultra-Thin Glass (UTG)
• MEMpax® / BOROFLOAT® 33	Micro Electro-Mechanical Systems (MEMS) Microfluidics
• FOTURAN® II	RF-MEMS-Sensors Microfluidics Micro-Optics IC Interposer
• D 263® T eco / D 263® T	IR-Cut Filter Touch Panel Microfluidics Lab-On-a-Chip Fingerprint Sensors
• B 270® , B 270® i	Wafer-Level Chip-Scale Packaging (WLCSP) Optoelectronics

Main Properties of Glass Wafers

- Excellent transmission
- Superior fire-polished surface finish for Down-Draw glass types
- Variety of available glass types matching your individual application needs
- Superior wafer flatness through state-of-the-art double side polishing processes
- Customized structuring
- Wide range of available thicknesses from 0.025 mm up to 3 mm
- Outstanding dielectric properties (specific data available on request)
- Suitable solutions for different bonding technologies
- High quality processing following international industry standards
- Customized properties available upon request (geometry, quality)

Glass Wafer from SCHOTT

SCHOTT has several processes for wafer glass manufacturing and processing.
This guide will present a brief overview of the glass wafer properties and their specific advantages:

1. Overview of glass types
2. Glass formats & geometrical properties
3. Wafer quality
4. Structuring capabilities
5. Packaging methods
6. Contacts

1. Overview of Glass Types

SCHOTT offers a range of glass types produced in various hot forming technologies. The **Down-Draw** (DD) technology is the main process to produce glass wafers with superior surface quality directly out of the hot forming process without the need for any additional surface treatment (e.g. D 263® T eco, AF 32® eco). Our **Up-Draw** (e.g. B 270® i) and **Float** (BOROFLOAT® 33) production technologies are dedicated to materials where the customer applications may require additional surface treatment (lapping & polishing). Further details on physical and chemical properties of the above glass types are available in separate specifications of each glass type.

Properties	Units/ Condition	D 263® T eco D 263® T	AF 32® eco	MEMpax®	BOROFLOAT® 33	B 270®	B 270® i	FOTURAN® II
Optical Properties								
Refractive index n_D		1.5230 as drawn	1.5099 as drawn	1.4714	1.47133	1.5229 as drawn	1.5229 as drawn	1.513
Luminous Transmittance τ_{vD65} (at thickness)	%	91.7 (1.1 mm)	91.9 (1.1 mm)	92.9 (1.1 mm)	92.7 (1.1 mm)	91.7 (2 mm)	91.7 (2 mm)	91.7
Abbe value ν_e		55.0	62.4	65.4	65.4	58.3	58.3	64
Thermal Properties								
CTE α (20 °C, 300 °C)	$10^{-6}K^{-1}$	7.2	3.2	3.3	3.25	9.4	9.4	8.5
Transformation temperature *Tg*	°C	557	717	532	525	536	542	455
Mechanical Properties								
Density ρ *(annealed at 40°C/h)	g/cm³	2.51*	2.43*	2.22*	2.2	2.56	2.56	2.37
Young's modulus *E*	kN/mm²	73	75	63	64	70	71	78
Poisson's ratio μ		0.208	0.238	0.196	0.2	0.25	0.22	0.22
Knoop hardness	*HK* 0.1/20	470	490	430	480	500	500	480
Chemical Properties								
Hydrolytic resistance acc. to ISO 719	Class	HGB 1	HGB 1	HGB 1	HGB 1	HGB 3	HGB 3	HGB 4
Acid resistance acc. to DIN 12116	Class	S 2	S 4	S 1	S 1	S 2	S 2	S 1
Alkali resistance acc. to DIN ISO 695	Class	A 2	A 3	A 2	A 2	A 2	A 1	A 2
Electrical Properties								
Dielectric constant ε_r	1 MHz 1 GHz 5 GHz	6.7 6.4 6.3	5.1 5.1 5.1	4.8 4.4 4.4	4.8 4.4 4.4	7.0 6.6 6.6	7.5 6.7 6.7	6.8 6.4 6.3
Dissipation factor tan δ	1 MHz 1 GHz 5 GHz	$61 \cdot 10^{-4}$ $74 \cdot 10^{-4}$ $101 \cdot 10^{-4}$	$28 \cdot 10^{-4}$ $35 \cdot 10^{-4}$ $49 \cdot 10^{-4}$	$38 \cdot 10^{-4}$ $58 \cdot 10^{-4}$ $73 \cdot 10^{-4}$	$38 \cdot 10^{-4}$ $58 \cdot 10^{-4}$ $73 \cdot 10^{-4}$	$26 \cdot 10^{-4}$ $52 \cdot 10^{-4}$ $77 \cdot 10^{-4}$	$32 \cdot 10^{-4}$ $59 \cdot 10^{-4}$ $84 \cdot 10^{-4}$	$69 \cdot 10^{-4}$ $84 \cdot 10^{-4}$ $109 \cdot 10^{-4}$

Additional properties

Additional Properties	D 263® T eco D 263® T	AF 32® eco	MEMpax®	BOROFLOAT® 33	B 270®	B 270® i	FOTURAN® II
Hot Forming Technology	Down- Draw	Down- Draw	Down- Draw	Microfloat	Down- Draw	Up- Draw	
Ultra-thin glass possible	✓	✓	✓		✓		
Alkaline content	✓		✓	✓	✓	✓	✓
Anodic bonding with Si	✓		✓	✓	✓	✓	✓
Electrostatic bonding	✓	✓	✓	✓	✓	✓	✓
Adhesive bonding	✓	✓	✓	✓	✓	✓	✓
Chemical toughening	✓		✓	✓	✓	✓	
Wafer quality requests lapping & polishing				✓		✓	✓

2. Glass Formats & Geometrical Properties

Formats per glass types

Upon request, SCHOTT also offers customized formats and shapes within the limits of production and processing capabilities, beyond those listed below.

Sizes		D 263® T eco D 263® T	AF 32® eco	MEMpax®	BOROFLOAT® 33	B 270®	B 270® i	FOTURAN® II
Formats wafer	min. max.	2 inch 12 inch	2 inch 12 inch	2 inch 12 inch	4 inch 12 inch	2 inch 12 inch	4 inch 12 inch	4 inch 8 inch
Thickness range	min. max.	0.03 mm 1.1 mm	0.025 mm 1.1 mm	0.2 mm 0.7 mm	0.5 mm 3.0 mm	0.3 mm 0.9 mm	0.8 mm 3.0 mm	0.5 mm 3.0 mm

Geometrical properties

Property	Thickness / Condition	Specification / Tolerance
Format tolerances	depending on thickness	± 0.1 mm to ± 0.2 mm
Thickness tolerances	≤ 0.5 mm > 0.5 mm lapped & polished	± 5.0 µm ± 10.0 µm ± 20.0 µm
TTV	≤ 0.5 mm 0.5 mm to 0.7 mm > 0.7 mm	≤ 5.0 µm to ≤ 10.0 µm ≤ 10.0 µm ≤ 15.0 µm
Warp	< 0.2 mm 0.2 mm to 0.5 mm > 0.5 mm	≤ 300 µm to ≤ 2000 µm ≤ 80 µm to ≤ 200 µm ≤ 100 µm to ≤ 200 µm
Roughness (Ra)	Down-Draw lapped & polished	≤ 0.5 nm ≤ 1.5 nm
Edge grinding (bevel width)	≥ 0.2 mm ≤ 0.7 mm > 0.7 mm	C- or Facet-shape 0.1 mm to 0.5 mm 0.1 mm to 0.7 mm
Notch & Flat (SEMI standard)	< 0.2 mm ≥ 0.2 mm	flat only (cut only) flat and notch double flat and notch possible

3. Wafer Quality

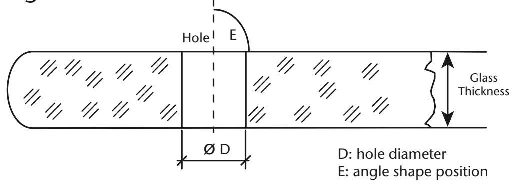
Quality Property	Condition	Specification
Inspection condition	cleaned uncleaned (cut glass only)	clean room at class 100 controlled room climate
Inspection time	unaided eyes	15 seconds
Inspection illumination		1.5 klux to 180 klux distance 15 cm to 30 cm
Inspection procedure Visual properties		100 % inspection
Wafer cleaning	removing of removable particles < 5 – 10 µm	clean room, cleaning machine supported by US/MS, DI-water
Wafer quality level	scratch / dig MIL-PRF-13830B	10/5 – 60/40
Edge quality (chips)		≤ 100 µm to 300 µm
Wafer laser marking (serial number possible)	thickness ≥ 0.3 mm	Fonts: Arial, DOT, SEMI Size: 1 mm to 5 mm
Reporting	on request	quality report for each shipment

4. Structuring Capabilities

With our ultrasonic lapping (USSL) technology, SCHOTT has established a specific solution for structured glass wafers. Ultrasonic lapping requires a lapping and polishing surface treatment processing.

Structuring Property	Level	USSL (Fig. 1)
Thickness range	standard advanced	≥ 0.5 mm ≥ 0.4 mm
Element shape		round holes only
Wafer size	standard advanced	100 mm to 150 mm ≤ 200 mm
Element size		0.4 mm to 1.1 mm
Position & form element tolerance	standard advanced	± 80 µm ± 50 µm
Pitch	standard advanced	≥ 1.75 mm ≥ 1.30 mm
Edge to edge distance	standard advanced	≥ 1.20 mm ≥ 0.90 mm
Angle shape position	standard advanced	(90 ± 0.5) degree (90 ± 0.3) degree
Taper angle		(90 ≤ 0.5) degree
Surface quality		10/5 – 40/20
Element quality (chips)	standard advanced	≤ 100 µm ≤ 50 µm
Surface treatment	requested	lapping & polishing

Fig. 1



5. Packaging Methods

Depending on format and thickness we can offer various packaging methods. Basis are standard wafer boxes. Packing is done either inside or outside clean room. Clean room conditions: class 1000 including vacuum bags.

Packing method	Wafer Size	Interlayer	Picture
Wafer box SCHOTT standard	4 inch to 12 inch	paper, Tyvek	
Wafer box SEMI standard	4 inch to 8 inch		
Cassette box (coin stack)	6 inch to 12 inch	spacer rings, Tyvek, plastic layer	

6. Contacts

Please feel free to contact us for any question related to our products or your projects. With a network of our Application Engineering which is situated worldwide we will find suitable solutions for your projects.

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