

Display

This section provides guidelines for display criteria (such as brightness and resolution) and cover glass.

Attributes

Feature	Small Tablet	Tablet	Clamshell	All-in-One
Diagonal size (in.)	>=7"	>=10"	>=10.1	>=15
Minimum resolution	>=1024x768	>=1366x768	>=1366x768	>=1366x768
Aspect ratio	4:3, 16:9, 16:10	16:9	16:9	16:9
Viewing angle	Symmetrical 85°	Symmetrical 85°	>=45°	>=45°
Brightness (Figures listed are the minimum)	>=300 nits at 0 degrees , >150 nits at 40 degrees	>=400 nits at 0 degrees , >150 nits at 40 degrees	>=200 nits at 0 degrees, >150 nits at 40 degrees	>=200 nits at 0 degrees, 150 nits at 40 degrees
Backlight	LED or better	LED or better	LED or better	LED or better
ISO standard (white --> black--> white) response rate as measured as the rise time (tR) and fall time (tF) of a pixel as it changes from white to black to white	6 ms to 16 ms	6 ms to 16 ms	6 ms to 16 ms	6 ms to 16 ms
Grey to Grey response rate	6 ms	6 ms	6 ms	6 ms
Contrast ratios and color reproduction	800:1	800:1	800:1	800:1
Refresh rate	48-60 Hz	48-60 Hz	48-60 Hz	60 Hz

Aspect Ratios: Delivering a great visual experience

This section provides resolution guidelines to maximize readability and touchability, and maintain acceptable clarity for the three main aspect ratios:

- 4:3
- 16:9
- 16:10

We strongly recommend using one of these aspect ratios as other aspect ratios may result in scaling not working well.

Recommended Resolution			
Scenario	4:3	16:9	16:10
1x plateau	1024x768	1366x768	1280x800
1.4x plateau	1440x1080	1920x1080	1920x1200
1.8x plateau	<ul style="list-style-type: none">• 1920x1440• 2048x1537	2560x1440	2560x1600

You should stick to plateau boundary values to avoid screens that fall between plateaus. For example, for a 7"-9" device, avoid 1600x900 as this falls between the 1x and 1.4x plateaus and does not allow scaling system to optimize readability and touchability.

Device cover glass

To define the functional attributes for device cover glass that will provide the end customer with a high quality touch-screen experience, worthy of the Microsoft brand. Such attributes include those that preserve and protect the surface, appearance, and device, and those that improve the touch functional experience. Follow these guidelines to create a successful touch experience on a tablet mode display:

- Use glass or glass coatings designed to reduce fingerprints.
- Consider anti-glare materials and LED-based illumination to ensure screen readability in outdoor and brightly lit indoor environments.
- Choose an anti-glare material that has the following characteristics:
 - Has low haze value ($\leq 6\%$) to minimize reduction of display clarity and contrast while providing minimal friction.
 - Is finer than the sub-pixel pitch to prevent sparkling.
 - Has minimal surface friction (surface roughness of 100-500 nm (RMS). High surface friction causes the finger to skip over the surface, breaking touch contact.

Recommended cover glass attributes

Discrete cover glass applications are those in which the glass serves as a protective display cover situated on top of the touch sensing layer, but not as a physical carrier or substrate for the touch sensing layer (ITO, etc.) itself. All tests and measurements should be conducted under the conditions outlined in the Cover Glass Test and Measurements. For optimal damage resistance:

•

The cover glass should be chemically-strengthened with a minimum magnitude and depth of layer (DOL) of the compressive stress as follows. In all cases, glasses should exhibit non-frangible behavior (definition of frangible behavior: the glass energetically fragments into a large number of small pieces when impacted with sufficient penetration force):

- 0.55 mm: ≥ 700 MPa CS and > 35 microns DOL
- 0.7 mm: ≥ 750 MPa CS and > 40 microns DOL
- 1.0 mm: ≥ 750 MPa CS and > 45 microns DOL

•

4-point bend test performance (edge strength) should be as follows:

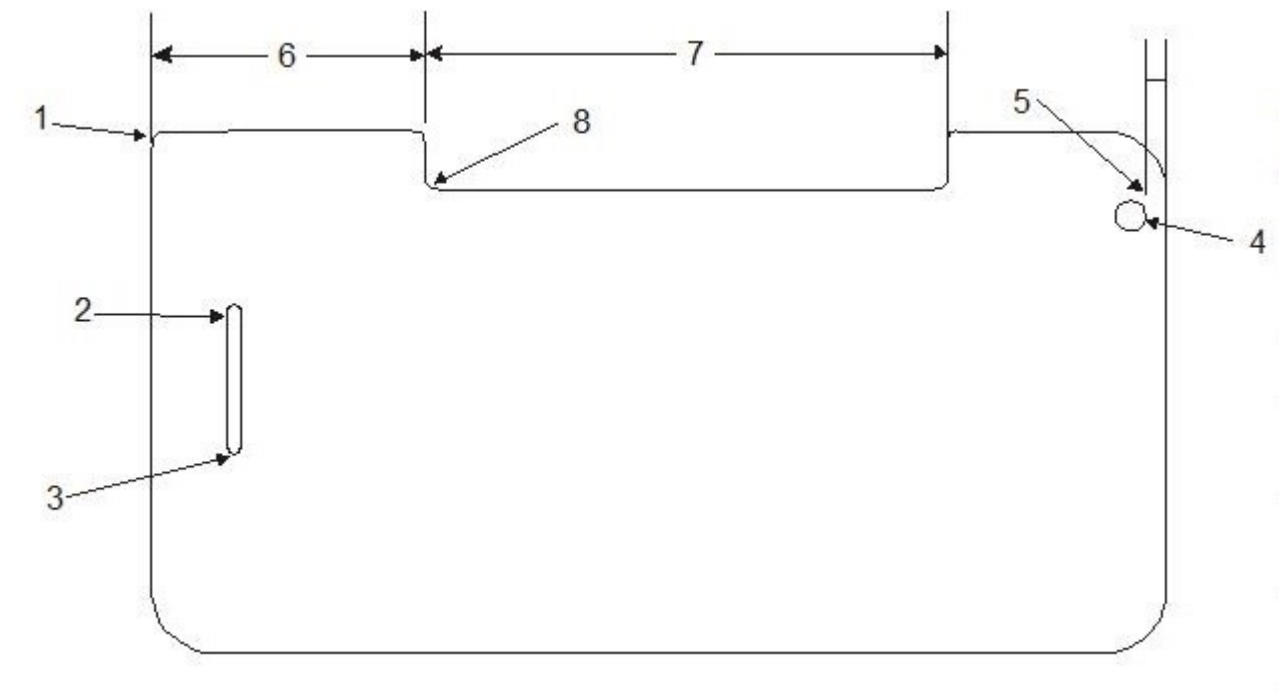
- 0.55 mm: Average peak stress = 600 MPa
- 0.7 mm: Average peak stress = 620 MPa
- 1.0 mm: Average peak stress = 620 MPa

•

Abraded ring-on-ring test performance (surface strength) should be as follows:

- 0.55 mm: Average load-to-failure = 30 kgf
- 0.7 mm: Average load-to-failure = 55 kgf
- 1.0 mm: Average load-to-failure = 100 kgf

The following is a machined cover glass part. Tests were conducted using a standard 1 mm glass.



#	Feature	Measure	Guidance
1	Outer corner	Radius	> 1.0 mm

2	Slot radius	Radius	> 1.5 mm
3	Slot width	Width	> 1.5 mm
4	Min. hole diameter	Diameter	> 1.5 mm
5	Hole-to-edge distance	Distance	> 4.0 mm
6	Width of protrusion	Width	Width > Depth
7	Width of the slot	Width	Width > Depth
8	Inner radius	Radius	> 1.0 mm

- The indentation threshold as measured with a Vickers indenter should be $\geq 5^*$ kgf.
- The Knoop scratch load to lateral cracks should be $\geq 4^*$ N.

For a high-quality touch experience:

- The recommended minimum dielectric constant is 7.0.
- The Young's Modulus of the glass should be 71.5 ± 5 GPa.
- The coefficient of thermal expansion (CTE) should be $80 \pm 4 \times 10^{-7}$ per $^{\circ}\text{C}$.
- Water absorption should meet Hydrolytic Resistance Class 2 or better.

For a high-quality viewing experience:

- The recommended optical transmission as measured through 1.0 mm thick cover glass is >91% nominal transmission across the 390-760 nm (visible) wavelength spectrum, with variation not to exceed $\pm 1\%$.

Cover glass attributes for integrated touch applications

Integrated touch cover glass applications are those in which the glass serves as a protective display cover as well as a physical carrier or substrate for the touch sensing layer (ITO, etc.) itself. Integrated touch cover glass applications are also known as one-glass solutions (OGS). All tests and measurements should be conducted under the conditions as outlined in the Cover Glass Test and Measurements section.

The following lists our guidance for optimal damage resistance:

-

The cover glass should be chemically-strengthened with a minimum magnitude and depth of layer (DOL) of the compressive stress (CS) as follows. In all cases, glasses should exhibit non-frangible behavior (definition of frangible behavior: the glass energetically fragments into a large number of small pieces when impacted with sufficient penetration force):

- 0.55 mm: ≥ 500 MPa CS and > 25 microns DOL

- 0.7 mm: ≥ 550 MPa CS and > 37 microns DOL
- 1.0 mm: ≥ 550 MPa CS and > 55 microns DOL

•
4-point bend test performance (edge strength) should be as follows:

- 0.55 mm: Average peak stress = 600 MPa, B10 > 450 MPa
- 0.7 mm: Average peak stress = 620 MPa, B10 > 500 MPa
- 1.0 mm: Average peak stress = 620 MPa B10 > 500 MPa

•
Abraded ring-on-ring test performance (surface strength) should be as follows:

- 0.55 mm: Average load-to-failure = 13 kgf
- 0.7 mm: Average load-to-failure = 20 kgf
- 1.0 mm: Average load-to-failure = 29 kgf

•
Refer to Figure 2 - Machined cover glass part for general design guidance on machined cover glass parts. Note that holes and/or slots are not recommended on cover glass that is to be used for integrated touch applications due to compromises in edge strength.

•
The indentation threshold as measured with a Vickers indenter should be ≥ 5 kgf.

•
The Knoop scratch load to lateral cracks should be ≥ 4 N.

The following lists our guidance for a high quality touch experience:

- The recommended minimum dielectric constant is 7.0.
- The Young's Modulus of the glass should be 71.5 ± 5 GPa.
- The coefficient of thermal expansion (CTE) should be $80 \pm 4 \times 10^{-7}$ per $^{\circ}\text{C}$.
- Water absorption should meet Hydrolytic Resistance Class 2 or better.

The following lists our guidance for a high quality viewing experience:

- The recommended optical transmission as measured through 1.0 mm thick cover glass is $>91\%$ nominal transmission across the 390-760 nm (visible) wavelength spectrum, with variation not to exceed $\pm 1\%$.

Cover glass tests and measurements

•
Bare glass. All measurements should be made on bare glass having no coatings, films, or other types of surface treatments applied.

•
Controlled environment. All testing should be carried out in a controlled environment ($23 \pm 2^{\circ}\text{C}$, $50 \pm 5\%$ RH)

-

4-Point Bend. Horizontal bending testing using 18mm loading spans, and 36mm support spans. Nominal crosshead rate of 5mm/min. Preferred sample geometry is 44mmx60mm. Breaking stress is reported based on ASTM C158. Sample geometries beyond the preferred geometry may require consultation by Corning on span selection.

-

Abraded Ring-on-Ring (AROR). Abrasion with 90 grit Silicon Carbide @ 5psi, 5 seconds, ¼" mask; retained strength measured through Ring on Ring, ½" load ring, 1" support ring. Nominal crosshead rate of 1.2mm/min. Abrasion centered on the glass sample and placed in the center of the loading ring for testing. Breaking load is reported. Preferred sample geometry is 50mmx50mm. ASTM C1499 can be used as a reference for some of the aspects of the ring on ring procedure.

-

Indentation. A Vickers indenter is used to introduce a series of indents in a glass samples, stepping through a range of repeated loads and held at the maximum load for 10 seconds, samples are inspected to assess the load where >50% of the indents exhibit evidence of radial cracks after a fixed period of time once the indents have been created. Loading/unloading rates = 0.2mm/min.

-

Scratch Threshold. A Knoop indenter is used to place a series of 10mm scratches in a sample. Repeated scratches are performed over a range of loads, samples are inspected to assess the load where >50% of the scratches exhibit evidence of lateral cracks after a fixed period of time once the scratches have been created.

[Send comments about this topic to Microsoft](#)

© 2018 Microsoft