



General Description

Shielded windows consist of one or more window layers with a conductive intermediate layer. They are applicable for all visual display systems, e.g. in meters and monitors.

Due to the variety of possibilities, our standard is custom-made production. The window should be selected according to following criteria:

- 1 window material
- 2 color of material
- 3 dimensions
- 4 anti-reflectivity
- 5 intermediate layers
- 6 construction
- 7 gasket type
- 8 frame finish

Shielded windows are generally used for all kinds of electric displays, e.g. LCD, LED, plasma and EL displays, etc.



Orientation of the mesh

90° - 45° - 30° - 15°

Tolerances

1. Outer dimensions

up to 23.622 inch (600 mm)
> 23.622 inch (600 mm)

Glass	Acrylic
inch (mm)	inch (mm)
± 0.020 (± 0.5)	± 0.008 (± 0.2)
± 0.079 (± 2.0)	- -

2. Material thickness (per material sheet)

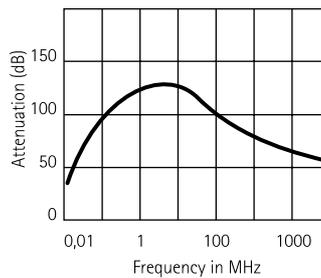
up to 0.158 inch (4 mm)
> 0.158 inch (4 mm)

Glass	Acrylic
inch (mm)	inch (mm)
± 0.008 (± 0.2)	± 0.012 (± 0.3)
± 0.016 (± 0.4)	± 0.020 (± 0.5)

Shielding Test Data

Measured on shielded window
11.811 x 11.811 inch (300 x 300 mm).

Mesh: Blackened silver plated stainless steel 100 opi.





1 Window Material

- Glass, plexiglass (acryl), makrolon (polycarbonate) and PVC can be selected.
- For further details see also construction table on page 6.

2 Color

- Base color of all materials is transparent/clear. However, for some applications it may be more advantageous to color the material yellow, green, red or amber.
- The base material for acrylic windows is colored whereas for glass windows the adhesive foil between the panes is colored.
- Please consider that with colored materials the light transmission will be affected.

3 Dimensions

- **Outer dimensions:**
There is no standard outer dimension, all windows are custom-made.
- **Material thickness:**
The material thickness for glass starts from 0,031 - 0,047 inch (0,8 - 1,2 mm), for acrylic from 0,031 inch (0,8 mm) and for polycarbonate from 0,059 inch (1,5 mm). The variety of available material thicknesses helps to meet almost all customer requirements. For a final glass-glass window, the shielding mesh and the adhesive add 0,031 inch (0,8 mm) to the thickness when laminated together.
- For further details see also construction table on page 6.

4 Anti-Reflectivity

- All materials can be supplied with anti reflective surface to avoid glaring and to enhance contrast. Different procedures can be used.

Anti-reflectivity for glass:

- Multi-layer coating per MIL SPEC 675 B (less than 0,6% remaining reflection)
- Single-layer coating per DIN 58197 (less than 1,5% remaining reflection)
- Chemical etching:
 - 5% reflection (R11G or GW 80)
 - 9% reflection (R19G or GW 100)
 - 13% reflection (R27G or GW 120)

Anti-reflectivity for plastics

- Chemical etching is the standard procedure for a good anti reflectivity with plastics which comes out very strong.
- A special coating, giving a scratch resistance in addition to anti reflectivity, can influence the intensity of reflectivity.

5 Intermediate Layers

- The intermediate layer for EMI/RFI shielding is a woven microstructure mesh. Mesh materials are copper, stainless steel or silver plated stainless steel.
- The mesh can be blackened so as to enhance contrast on the display. This does not affect the shielding performance. To avoid interferences between mesh grid pattern and monitor or display ("Moiré fringes"), simply change the orientation of the mesh by turning it a little. The number of openings per inch (opi) determine the shielding effectiveness, but also the light transmission.
- In applications with a very high resolution display which does not allow the use of a mesh, a highly conductive, transparent foil can be laminated onto the glass, or it can be equipped with a conductive ITO coating.
- **Note:**
The mesh is also available as an individual part for other applications.



Selection of mesh and its shielding performance

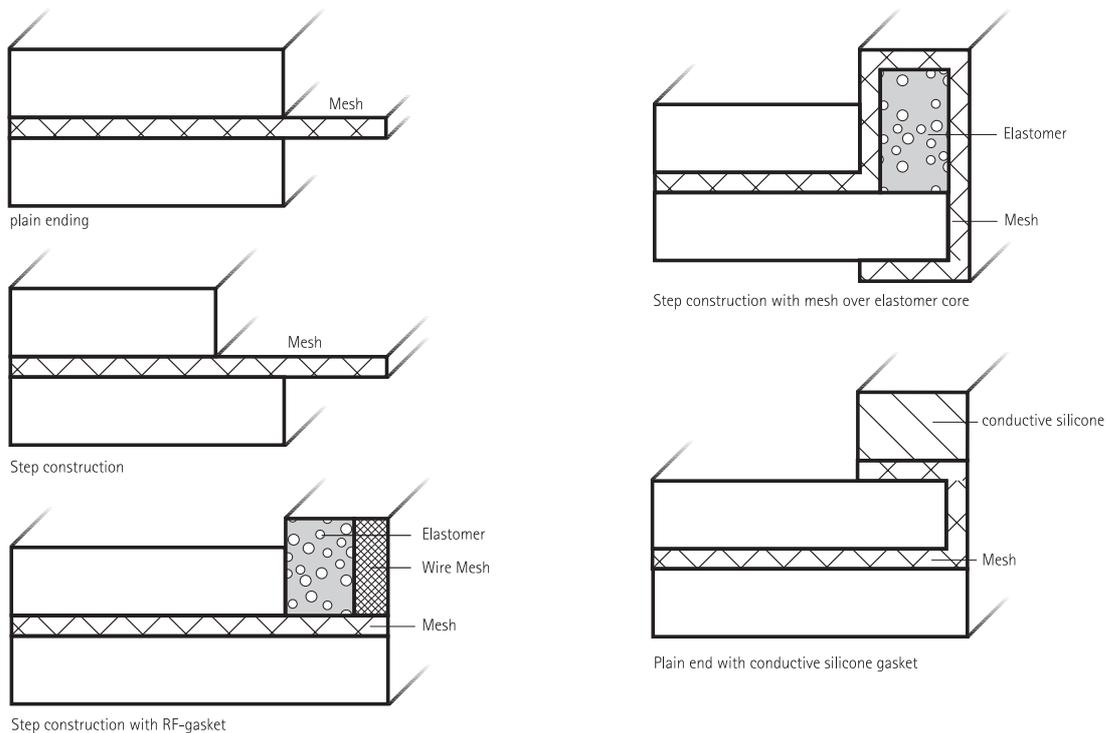
Mesh	Surface	Open. per inch	Wire ø	1 MHz	E-field 10 MHz	100 MHz	400 MHz	P-field 1 GHz	10 GHz	Max. size available	Open area %
Copper	blackened	70	0,07	110	111	98	68	64	38	47,24 x 39,37 inch (1200 x 1000 mm)	65
Copper	blackened	100	0,05	107	111	85	70	58	-	47,24 x 39,37 inch (1200 x 1000 mm)	64
Stainless steel	bright	100	0,025	110	105	88	76	62	-	47,24 x 39,37 inch (1200 x 1000 mm)	81
Silver plated stainless steel	blackened	100	0,025	128	112	92	86	80	74	27,56 x 27,56 inch (700 x 700 mm)	81
Silver plated stainless steel	blackened	165	0,05	130	124	106	100	81	61	27,56 x 27,56 inch (700 x 700 mm)	46
Silver plated stainless steel	blackened	200	0,025	128	108	98	88	86	68	27,56 x 27,56 inch (700 x 700 mm)	64

6 Construction

- The window consists of a carrier with a laminated mesh on the rear or laminated between two carriers, depending on the application.
- The mesh overlaps the carrier to serve as contact area for the gasket or installation.
- Plastic will be laminated either with adhesives or with high temperatures.
- Glass will be laminated in vacuum with double sided adhesive foils. Please note that a fully laminated glass window using a PVB interlayer (PVB = Polyvinyl Butyral) as an adhesive cannot be cleaned with solvents, because the solvent will damage the PVB interlayer.



Schematic illustration



All dimensions shown are in inches (millimeters) unless otherwise specified.

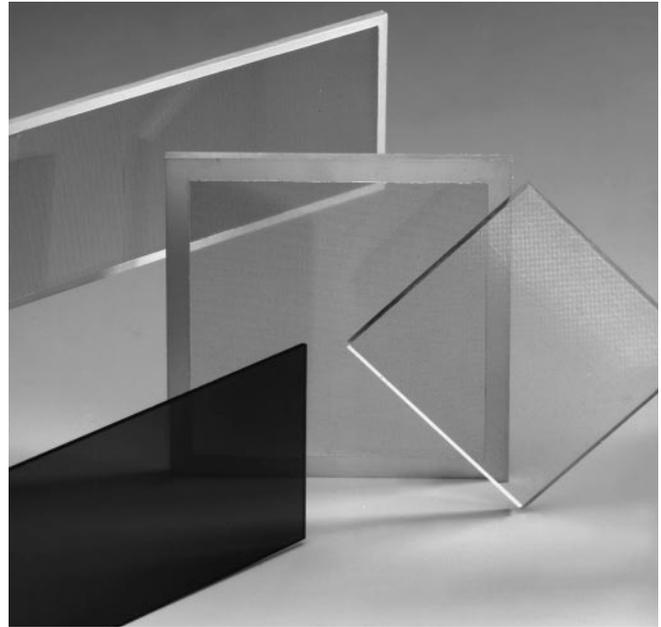


General Description

A micro-structure wire mesh is stretched in a mould and then cast into acrylic. Due to a special moulding technique, the wire mesh is smoothly embedded in the sheet and will therefore only cause a minimum of optical disturbances. If the shielded window is placed in front of a data display, there might occur interference phenomena followed by varying light intensities on the screen (Moiré fringes). A turn of the mesh by a few degrees may reduce these disturbances.

Custom-made shielded windows with specific dimensions will be cut out of the sheet. Afterwards, a groove will be milled all the way around the edge of the sheet in a step construction. This groove will be plated with silver (silver busbar) and provides the contact to the wire mesh. The window can then be mounted on the chassis by means of a conductive gasket or by using a conductive adhesive. Shielded windows used in front of a display should be mounted in a way that the mesh side of the window is placed as close to the LED/LCD as possible.

New: UV-block with 390 nm excellent protection of LCDs.



Material

■ Type of Plastic - Cast Acrylic:

- Max. size: 45.276 x 33.465 inch
(1150 x 850 mm)
- Thickness: 0.079 in, 0.098 in, 0.118 in, 0.158 in
(2 mm, 2.5 mm, 3 mm, 4 mm)
- Tolerances: ± 0.008 inch (± 0.2 mm)
- Working Temp. Range: -40° to $+70^{\circ}$ C

■ Mesh - stainless steel, 100 OPI

- Surface: bright or blackened
- Wire diameter: 0.001 inch (0.025 mm)
- Light transmission: 78 %

■ Silver paint:

- Electrodag 1415

Filter

In addition to being used as an EMI shield, the shielded window can be used as a contrast filter. More than 55 different transparent colours are available, making it possible to choose a contrast filter adapted to the wave length (colour) of the signal source (display). This allows for the greatest possible light transmission while simultaneously excluding secondary light to achieve a clear and easily read signal.





Shielded Acrylic Window

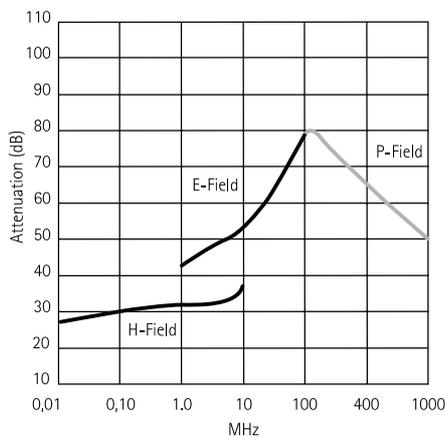
Reflection

Reflections from shielded windows can be eliminated by using a uniquely developed surface treatment, consisting of optical micro-particles. The surface density can be applied in 5 standard types to suit the individual product, eliminating possible glare from surroundings without luminous loss or distortion of the visual signal. This surface treatment can be applied to the complete shielded window or to selected parts.

with mat.-finish	Reflection in %
A 1	64 - 65
A 2	61 - 62
A 3	58 - 59
A 4	55 - 56
A 5	49 - 50

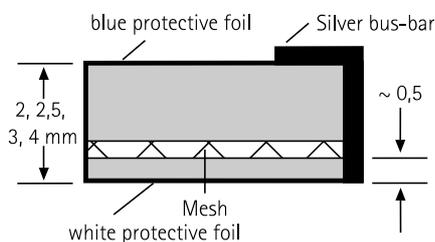
Shielding Performance

Test Window:
9,843 x 9,843 inch (250 x 250 mm) according to modified MIL-STD 285



Construction

■ Butt edge with bus-bar



Mechanical Properties

	Test	Unit	Values
Tensile strength	DIN 53455	N/mm ²	65 - 68
Compressive strength	DIN 53454	-	125
Flexural strength	DIN 53452	-	120
Impact strength	DIN 53453	kJ/m ²	12
Modulus of elasticity	DIN 53457	N/mm ²	3000
Elongation at break	DIN 53455	%	3 - 4
Hardness	DIN 53456	N/mm ²	175

Thermal Properties

	Test	Unit	Values
Heat stability-Vicat	DIN 53460	°C	110
Forming temperature	-	°C	150 - 170
Coefficient of linear thermal expansion	VDE 0304	mm/m°C	0.08
Specific heat	-	kJ/kg K	1.46

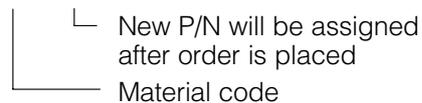
Other Properties

Test	Unit	Values	
Specific gravity	DIN 53479	g/cm ³	1.18 - 1.19
Water absorption	at 20°C / 24 h	%	0.17

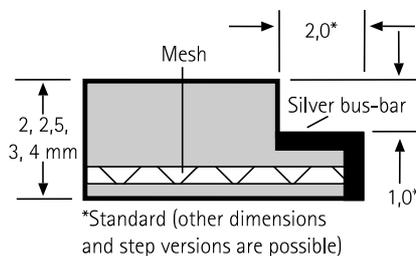
Ordering Information

The ordering code consists of the material code, followed by a new assigned P/N (including all necessary dimensions, tolerances and process steps):

LT/DCA/xxxx



■ Step with bus-bar



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