

# Solar Cell Coverglasses

Designed and manufactured to provide radiation protection

## Qioptiq

- Design and manufacture of radiation-stable Coverglasses
- Over 40 years of Space Heritage
- Space Qualified
- Choice of glass types (CMX, CMG, CMO)
- Worlds leading manufacturer
- Bespoke solutions

### Minimum Coverglass Transmission specifications with 0.10mm thick CMX, CMG and CMO glass types

		350 - 400nm	400 - 450nm	450 - 700nm	600 - 800nm	650 - 900nm	450 - 1100nm	900 - 1800nm	IR Cut-off	Min Emittance	Front Surface Resistance
<b>CMX</b>	Uncoated	73.5	91.5	94.0	95.0	95.0	95.0	95.0		0.88	
<b>CMG</b>		83.5	92.5	94.5	95.0	95.0	95.0	95.0		0.88	
<b>CMO</b>		88.0	94.0	94.5	95.0	95.0	95.0	95.0		0.88	
<b>CMX</b>	AR	73.5	93.0	96.5	97.5	97.5	96.5	96.5		0.88	
<b>CMG</b>		83.5	94.0	97.0	97.5	97.5	96.5	96.5		0.88	
<b>CMO</b>		88.0	95.5	97.0	97.5	97.5	96.5	96.5		0.88	
<b>CMX</b>	Conductive	73.5	94.0	96.5	97.0	97.0	96.5	96.0		0.86	<10M Ohms
<b>CMG</b>	AR	83.5	95.0	97.0	97.0	97.0	96.5	96.0		0.86	<10M Ohms
<b>CMO</b>		88.0	96.0	97.0	97.0	97.0	96.5	96.0		0.86	<10M Ohms
<b>CMX</b>	Conductive	71.0	89.0	94.0	95.0	95.0	94.5	94.5		0.84	<5K Ohms
<b>CMG</b>		80.0	89.0	94.0	95.0	95.0	94.5	94.5		0.84	<5K Ohms
<b>CMO</b>		80.0	89.0	94.0	95.0	95.0	94.5	94.5		0.84	<5K Ohms
<b>CMX</b>	UV Reflector	73.5	92.0	96.0	96.5	96.5	96.0	94.0		0.86	
<b>CMG</b>		83.5	93.0	96.5	96.5	96.5	96.0	94.0		0.86	
<b>CMO</b>		88.0	94.5	96.5	96.5	96.5	96.0	94.0		0.86	
<b>CMX</b>	AR/IRR Silicon	73.5	89.0	96.0	96.0	96.0	95.0		1165+/-	0.86	
<b>CMG</b>	Blue Red Silicon	83.5	90.0	96.0	96.0	96.0	95.0		50nm	0.86	
<b>CMO</b>		88.0	92.0	96.0	96.0	96.0	95.0			0.86	
<b>CMX</b>	UVR/IRR	73.5	92.0	96.5	96.5	96.5	95.0		1315+/-	0.86	
<b>CMG</b>	Triple Junction	83.5	93.0	96.5	96.5	96.5	95.0		35nm	0.86	
<b>CMO</b>	(PS 703)	88.0	88.0	96.5	96.5	96.5	95.0			0.86	

1. All spectral data measured at normal incidence in 1.43 matching index
2. Tolerances on specification values are available from relevant product specifications
3. Spectral data is for 0.10mm/0.004" coverglasses, please refer to relevant specification for spectral performance of other thicknesses.

### Mechanical Properties

<b>Thickness:</b>	0.050mm to 0.50mm / 0.002" to 0.02" Special thicknesses on request
<b>Tolerancing:</b>	LxW ± 0.05mm / 0.002"
<b>Surface Finish:</b>	As drawn to: MIL-PRF-13830B, 80/50 scratch dig
<b>Parallelism:</b>	0.05mm per 20mm
<b>Perpendicularity:</b>	90° ± 0° 30'
<b>Coating:</b>	Uncoated area, masked by coating tooling, shall not exceed 1% of the total coverglass area
<b>Edge Quality:</b>	Chemically etched for strength enhancement
<b>Toughening:</b>	CMX and CMG glass can be chemically toughened if required
<b>Humidity Resistance:</b>	98% ± 2% relative humidity for 72 hours @ 50°C ± 20°C
<b>Adhesion:</b>	Using cellulose tape to MIL-M-13508
<b>Abrasion:</b>	20 strokes with 6mm pencil type eraser to MIL-E-12397 loaded to 10N
<b>Radiation Resistance:</b>	UV exposure, electron, low energy proton, high energy proton - please refer to relevant specifications
<b>Thermal Cycling:</b>	Details on request

### Physical Properties

	CMX	CMG	CMO
<b>Density:</b>	2.60 ± 0.02g cm <sup>3</sup>	2.54 ± 0.02g cm <sup>3</sup>	2.54 ± 0.02g cm <sup>3</sup>
<b>Thermal Expansion Coefficient:</b>			
Average over range -100°C to 100°C	6.0 ± 0.75 x 10 <sup>-6</sup> /°C	5.5 ± 0.75 x 10 <sup>-6</sup> /°C	5.5 ± 0.75 x 10 <sup>-6</sup> /°C
Average over range -100°C to 200°C	6.5 ± 0.75 x 10 <sup>-6</sup> /°C	6.0 ± 0.75 x 10 <sup>-6</sup> /°C	6.0 ± 0.75 x 10 <sup>-6</sup> /°C
Average over range +30°C to 200°C	7.0 ± 0.75 x 10 <sup>-6</sup> /°C	6.5 ± 0.75 x 10 <sup>-6</sup> /°C	6.5 ± 0.75 x 10 <sup>-6</sup> /°C
<b>Youngs Modulus:</b>	75.0 ± 2 GNm <sup>-2</sup>	77.0 ± 2 GNm <sup>-2</sup>	70 ± 2 GNm <sup>-2</sup>
<b>Poissons Ratio:</b>	0.21 ± 0.05	0.20 ± 0.05	0.22 ± 0.05
<b>Bulk Resistivity:</b>			
At 20°C	11.5 ± 1 log ohm meter	13.5 ± 1 log ohm meter	16.0 ± 1 log ohm meter
At 60°C	10.0 ± 1 log ohm meter	11.5 ± 1 log ohm meter	14.0 ± 1 log ohm meter
<b>Refractive Index:</b>	1.524 – 1.530	1.513 – 1.519	1.510 – 1.516

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