



Polysolar PV Glazing Units

Transparent and opaque amorphous-silicon thin-film glass laminate photovoltaic BIPV glazing units

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Polysolar Products & Applications



Opaque (100Wp)
(MCS certified)

Transparent (90Wp)
(MCS certified)

Transparent (90Wp)

Laminated BIPV glazing: 1100mm wide x 1300mm high x 7mm/10mm

Facades & Structures



Pitched & Flat Roofing



Conservatories & Glasshouses



Windows & Curtain walling



Polysolar Product Specifications

Dimensions		Width		1100mm+2/-1mm					
		Length		1300mm +2/-1mm					
		Thickness		7.0± 0.5mm					
		With junction box		26± 1.0mm					
Weight		24.0± 0.5Kg							
Junction Box Cable length		Downward 800mm(+) / 600mm (-)							
Module elements		Material							
Front Cover		Float glass, 3.2mm thick							
Back Cover		Float glass 3.2mm thickness							
Active Material of Cell		Amorphous Silicon (a-Si)							
Material for Encapsulation		Polyvinylbutyral (PVB), thickness: 0.76 mm							
Wiring Material		Tin & silver coated copper ribbon 0.1mm							
Junction Box Detailed		Single Junction							
		By pass diode							
IP Class		IP67							
Connecting Cable Plug		Rated voltage 1000 Volts D.C. Plug/Socket MC4 compatible Ø 4mm, cable cross section 2.5mm ²							
Transparency		Average transmittance T(%) at 400-800nm: 20±3.5%							
Frame		Not provided							
Certifications		IEC 6164 & 61730 by TÜV- Rheinland MCS by NQA, ISO 9001							
Power output	Stabilized Performance				Initial Performance				Max over current rating
	Vmpp (V)	Imp (A)	Voc (V)	Isc (A)	Vmpp (V)	Imp (A)	Voc (V)	Isc (A)	
Electrical tolerance 10%									
90W	103	0.9	137	1.15	111	1.06	140	1.2	2.0A
Temp Co-efficient				Max System Voltage					
Isc	Voc	Pmpp	Vmpp						
+0.003%/K	-0.30%/K	-0.17%/K	-0.31%/K	1000Vdc (IEC)			600Vdc (UL)		

Transparent Module

Dimensions		Width		1100mm+2/-1mm					
		Length		1300mm +2/-1mm					
		Thickness		7.0± 0.5mm					
		With junction box		21.2± 1.0mm					
Weight		24.0± 0.5Kg							
Junction Box Cable length		Downward 800mm(+) / 800mm (-)							
Module elements		Material							
Front Cover		Float glass, 3.2mm thick							
Back Cover		Thermally strengthened, 3.2mm thick [scs=10,000psi]							
Active Material of Cell		Amorphous Silicon (a-Si)							
Material for Encapsulation		Polyvinylbutyral (PVB), thickness: 0.76 mm							
Wiring Material		Tin & silver coated copper ribbon 0.1mm							
Junction Box Detailed		Single Junction							
		By pass diode							
IP Class		IP65							
Connecting Cable Plug		Rated voltage 1000 Volts D.C. Plug/Socket MC4 compatible Ø 4mm, cable cross section 2.5mm ²							
Transparency		No							
Frame		Not provided							
Certifications		IEC 6164 & 61730 by TÜV- Rheinland MCS by NQA, ISO 9001							
Power output	Stabilized Performance				Initial Performance				Max over current rating
	Vmpp (V)	Imp (A)	Voc (V)	Isc (A)	Vmpp (V)	Imp (A)	Voc (V)	Isc (A)	
Electrical tolerance 10%									
100W	103	1.00	138	1.24	111	1.19	141	1.30	2.0A
Temp Co-efficient				Max System Voltage					
Isc	Voc	Pmpp	Vmpp						
+0.003%/K	-0.30%/K	-0.17%/K	-0.31%/K	1000Vdc (IEC)			600Vdc (UL)		

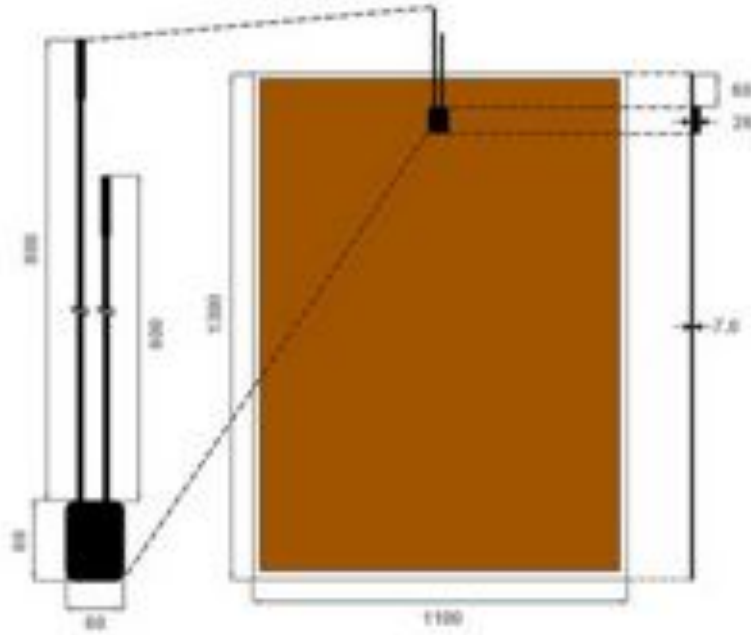
Opaque module

Transparent Module with Edge Connected Junction box

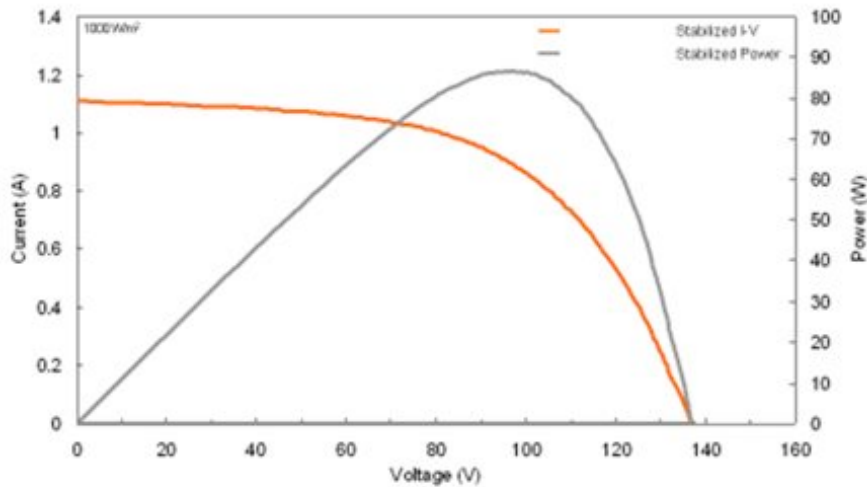
Dimensions	Width	1100mm+2/-1mm							
	Length	1300mm +jcn box = 1311mm							
	Thickness	9.8± 0.5mm							
	With junction box	10.0± 1.0mm							
Weight	33.5± 0.5Kg								
Junction Box Cable length	Sideways 890mm x 2								
Module elements	Material								
Front Cover	Float glass, 3.2mm thick								
Back Cover	6.0mm Thick Glass, Tempered [surface compress. Stress > 10,000psi]								
Active Material of Cell	Amorphous Silicon (a-Si)								
Material for Encapsulation	Polyvinylbutyral (PVB), thickness: 0.76 mm								
Wiring Material	Tin & silver coated copper ribbon 0.1mm								
Junction Box Detailed	Single Junction								
	By pass diode								
IP Class	IP65								
Connecting Cable Plug	Rated voltage 1000 Volts D.C. Plug/Socket MC4 compatible Ø 4mm, cable cross section 2.5mm ²								
Transparency	17.5±3.5% avg. transmittance T(%) at 400-800nm								
Frame	Not provided								
Certifications	MCS pending								
Power output	Stabilized Performance				Initial Performance				Max over current rating
	Vmpp (V)	Impp (A)	Voc (V)	Isc (A)	Vmpp (V)	Impp (A)	Voc (V)	Isc (A)	
	Electrical tolerance 10%								
90W	103	0.9	137	1.15	111	1.06	140	1.20	2.0A
	Temp Co-efficient				Max System Voltage				
	Isc	Voc	Pmpp	Vmpp					
	+0.003%/K	-0.30%/K	-0.17%/K	-0.31%/K	1000Vdc (IEC)		600Vdc (UL)		

The units electrical ratings are measured under Standard Test Conditions (STC) and have been delivered on the specific table of electrical characteristics as shown above. A photovoltaic module may produce more current and/or voltage than reported at STC. Sunny, cool weather and reflection from snow or water can increase current and power output. Therefore, the values of Isc and Voc marked on the units should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor capacities, fuse sizes, and size of controls connected to PV output. [STC]: 1000 W/m², AM 1.5, 25 °C. The exactly measured electrical characteristics are shown on the label of the units. All electrical data is average production data and is subject to a measuring equipment tolerance; module nominal power is subject to a tolerance of ±2% and power class is sorted on basis of +4.99Wp/-0Wp. Manufacturer warranty: 5 years Performance Warranty; 10years @ 90% of power rating & 25years @ 80% of power rating.

Transparent Unit Dimensions (PS-C series):



Transparent Unit Performance (current and power v. voltage):



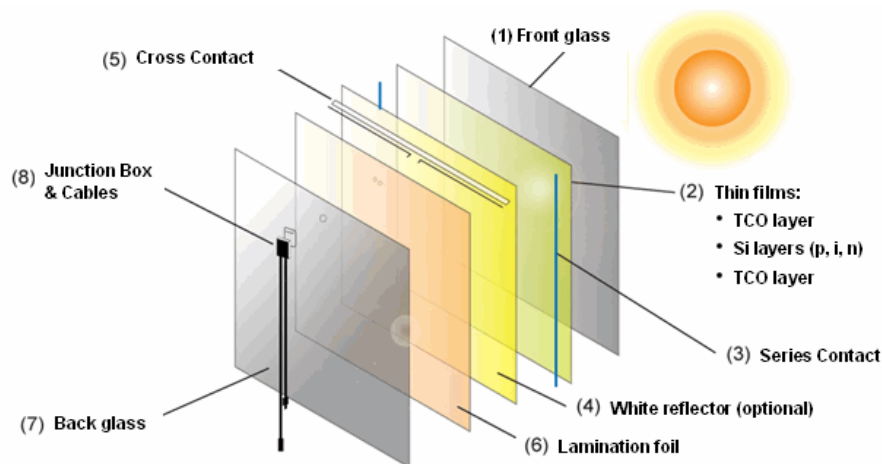
Warranted Manufacture

Manufactured on a state-of-art Oerlikon thin-film line, Polysolar's units are warranted to generate at least 80% of their nominal power output for twenty five years and 90% for ten years. They also come with a five-year manufacturer's product warranty. IEC 6164 & 61730 and MCS certification (for UK FiT).

Unique Technology – transparent solar cells

Polysolar's unique transparent BIPV glazing units use a thin-film of amorphous silicon (α -Si) sandwiched between laminated glass sheets. Unlike common cSi modules which use an opaque metal layer to collect the electrical power, Polysolar's units use Zinc Oxide transparent conductors (TCO) on both sides. This allows the whole module to be transparent. The thin silicon layer lets through around 20% of the visible spectrum (400-800nm) which gives the unit an amber tint. Polysolar's transparent units have the added advantage in producing electricity from light on either side of the module, giving crucial flexibility in orientation.

Polysolar's opaque units incorporate an additional white layer to reflect light back through the unit to generate ~10% extra power:



Watt-for-watt, Polysolar's α -Si is lower cost (and much less resource intensive) than conventional c-Si to manufacture. Approximately one year of PV generation will recover the energy required to manufacture a Polysolar unit – one of the best environmental returns in the renewable energy industry.

Polysolar's thin-film glazing units offer considerably better energy yields than conventional crystalline silicon technologies (c-Si). Polysolar units are specifically designed for building integration applications (BIPV). Superior low light performance, temperature tolerance and shade resistance negates the need for ventilation or optimum orientation and positioning. In the UK, on average, Polysolar PV units will deliver 25% kWh/kWp more energy over the course of a year than c-Si modules.

Polysolar works with Sheffield University to independently characterise the unique performance of Polysolar's PV glass under UK climatic conditions. Over a year's worth of live results from www.sheffieldsolarfarm.group.shef.ac.uk show a yield of 1000kWh per kWp from Polysolar units.

Competitive Edge

Polysolar's BIPV glazing units are used as a high-performance, cost-effective alternative to regular façade and roof cladding materials, laminate glazing and conventional photovoltaic modules. They offer substantial performance, aesthetic and financial benefits to architects and developers and have a distinct competitive edge over existing solar panels and substitute building materials:

- **Unique see-through transparency**

Up to now, semi-transparency in photovoltaic modules has only been possible by patterning small areas of opaque PV modules by removing the PV layers. This has been done by laser ablation of thin-film cells and also by laser drilling and area patterning of crystalline cells or embedding cells in clear glass. Polysolar's transparent PV units are the world's first truly transparent mass produced PV glass units. In addition Polysolar single junction modules are unique in offering two-sided operational PV capability that can deliver a 50% higher kWh/kWp than conventional single-sided PV (Vertically mounted east & west facing transparent Polysolar units generate power from both morning & afternoon sunlight) www.sheffieldsolarfarm.group.shef.ac.uk/polysolar-semi-transparent-mounted-vertically.html

- **Lowest-cost transparent PV in world**

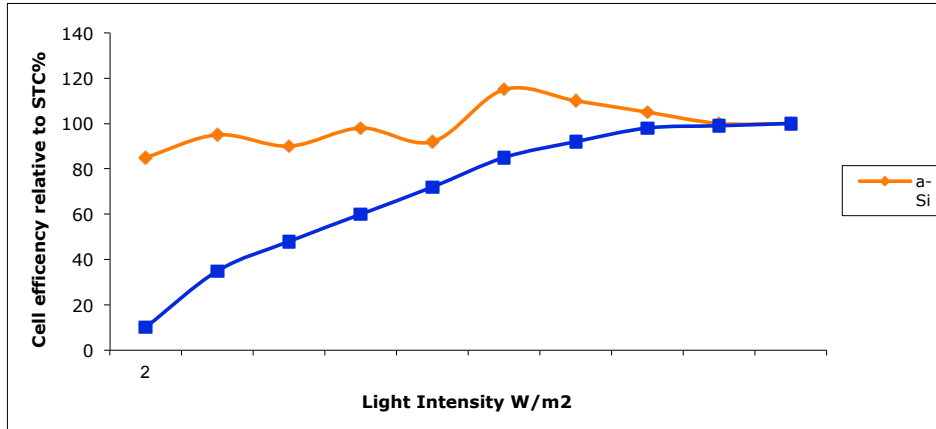
Our advanced manufacturing methods and scale economies enable Polysolar's transparent units to be produced at the same very low costs as any other high-volume photovoltaic module. In contrast, laser ablation, drilling and short-run hand assembly processes make alternative semi-transparent PV modules significantly more expensive.

- **Higher electrical energy output for UK conditions**

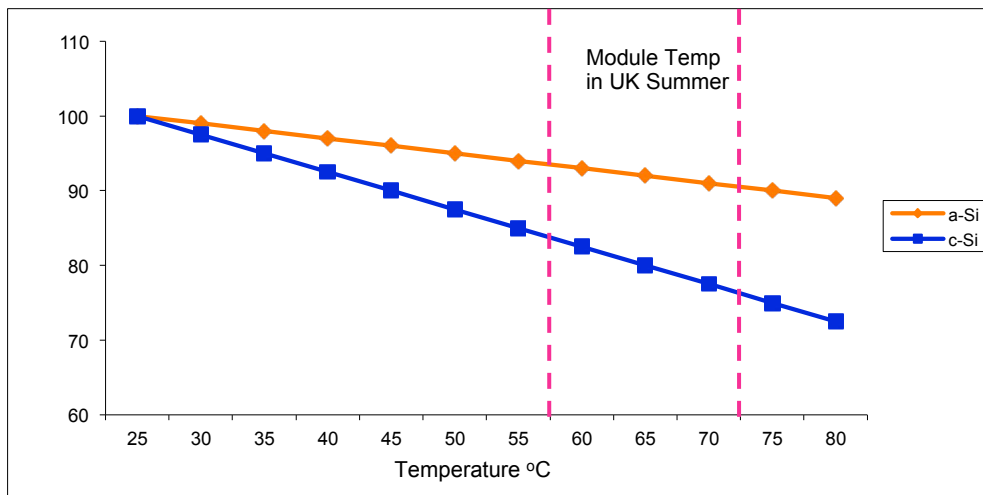
On cloudy days and in winter when light levels fall, Polysolar's a-Si units maintain their conversion efficiency while the performance of crystalline-silicon drops dramatically. Study findings from the 17th European Photovoltaic Conference in 2001 showed that a-Si units in Oxford (UK)

yielded over 25% more kWh (useful electrical energy) per kWp (rated power output) than crystalline-Si modules.

- **Low sensitivity to temperature changes**



Direct sunlight in summer can cause PV module temperatures to rise sharply. Polysolar’s a-Si units maintain good performance at high temperatures while the conversion efficiency of crystalline-Si modules falls quickly. This makes Polysolar units ideal in high temperature situations and Building Integrated BIPV applications where ventilation is problematic. Polysolar units can therefore be fitted directly to surfaces and insulation.



- **Reduced Position and shading dependency**

Polysolar PV units are unusually high voltage ~140v. This offers not only the advantage of reduced electrical system losses but means that our units can be connected in parallel rather than long series strings in order to bring the voltage up to mains requirements. The benefit of short strings is that should one panel be shaded or facing a different orientation the

whole array is not impacted by the lowest performing element. With each panel operating optimally, micro-inverters are not required and positioning of the system is less of a concern.

- **Higher financial return from energy generation**

The combination of very low cost per watt, low-light performance and less sensitivity to temperature means that Polysolar's units not only generate more units of electricity per year for a lower capital outlay but offer a lower cost per m² as a building material. Financial returns accrue where the PV energy displace that bought from the grid or where feed-in-tariffs are paid for PV energy generated. In building applications where Polysolar's PV glazing units substitute as an alternative to weather protection or shading materials, they can be even more cost effective.

- **Superior functionality and lifetime durability**

For building integrated applications the aesthetics of the photovoltaic installation are important and help secure planning. The Polysolar glazing units offer a consistent coverage, are laminated and available with heat strengthened or tempered glass. Where insulated glazing is required, the units can be incorporated into double (A Rated 1.2 – u-value) glazed units. Transparent units are available with edge mounted connectors (as well as face-mounted connectors) for totally hidden wiring. The UV-blocking, IR-reflective and tinted coatings that form an integral part of the photovoltaic function are equally significant in glazing energy management.

Installation options

Several mounting systems are commercially available for our 1300mm x 1100mm frameless laminate units. Polysolar can supply a range of its own mounting systems, structures, options and components that meet our installation guidance and most applications. Inverters suitable for thin-film modules are available from a wide range of manufacturers and suppliers.



Polysolar is a Cambridge, UK award-winning specialist developer of transparent photovoltaic glazing for building-integrated applications.

In addition to offering the World's first truly transparent thin-film Building Integrated PV glazing product, Polysolar is working with major industrial and research partners to develop the next-generation of large-area colourless transparent Building Integrated Organic PV glazing. With our patent-protected organic photovoltaic technology, we aim to offer energy generating glazing to everyone.

Our long term strategic R&D partnering and a constant focus on cost efficiency, place Polysolar at the true frontier of PV glazing.