

PRINTED PHOTOVOLTAIC MODULES

DSSCs (Dye Sensitized Solar Cells) are also known as 3rd generation PV cells. They use a reversible photochemical process with a dye as a solar radiation absorber. Nature has long been the inspiration for humans, and photosynthesis is one of the most wonderful of natural phenomena. In this process plant organisms convert solar radiation into highly energetic organic compounds. The discovery of the principle of photosynthesis stimulated the minds of scientists to seek ways of applying solar energy to generate efficient renewable energy.

The DSSCs are 3rd generation photovoltaic cells based on organic compounds, without the p-n junction typical of 1st and 2nd generation solutions. The dye based solar cells feature special chemicals, capable of capturing quanta of solar radiation and turning them into electric power.

The design of DSSCs is layered and comprises two transparent panes made of TCO glass arranged in parallel with about a 40 µm gap. A light-sensitive layer of TiO₂ is deposited on one of the glass panes and coated with a metal-organic photosensitive dye (called the sensibiliser). This subsystem acts as the photo anode of the cell. The other

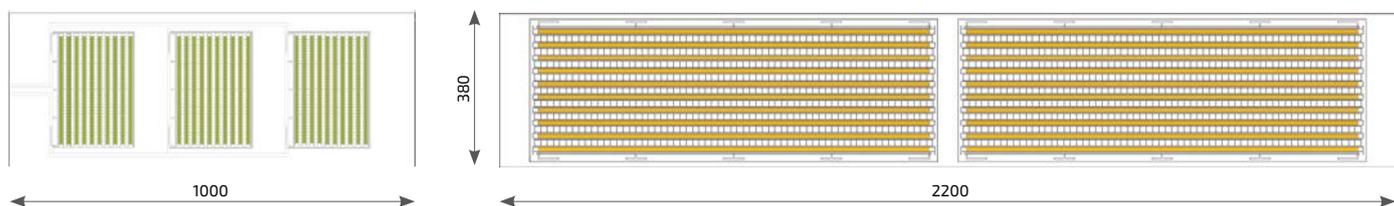
TCO pane surface is usually coated with nanoscale platinum which serves as a catalyst and the cathode of the cell system. The void between the parallel glass panes is filled with an electrolytic medium, being an I⁻/I₃⁻ redox system.

DSSC technology is an object of intense development in order to improve the efficiency of photovoltaic conversion in outdoor conditions. The current efficiency of DSSCs in laboratory conditions is around 15% and comparable with commercially available 2nd generation cells, and slightly below the performance of 1st generation ones. However, unlike silicon-based PV cells, the DSSCs feature much improved aesthetic values and lower efficiency loss in poor sun exposure conditions. The undisputed advantages of DSSCs include high transparency, customizable colours, and low power output drop vs. sunlight incidence. These features have paved the way for DSSCs into BIPV (Building Integrated Photovoltaics) to make eco-friendly civil engineering a reality. The printed design can be customized. An example of the technical parameters is shown below.

System technical specifications

DSSC module	30 cells DSSC-based process
IGU composition	2 glass panes bound with a spacer frame
Front glass	3 mm tempered FLOAT
Back glass	3 mm tempered FLOAT
Frame type	Aluminium spacer frame 10 or 18 mm
Size	1000 x 380 mm
Weight	7 kg
DC wiring	2 x 1000 mm
AC/DC connectors	MC-4 (male/female), IP65
Applications	Louvres / lightbreaks
Colours	customizable

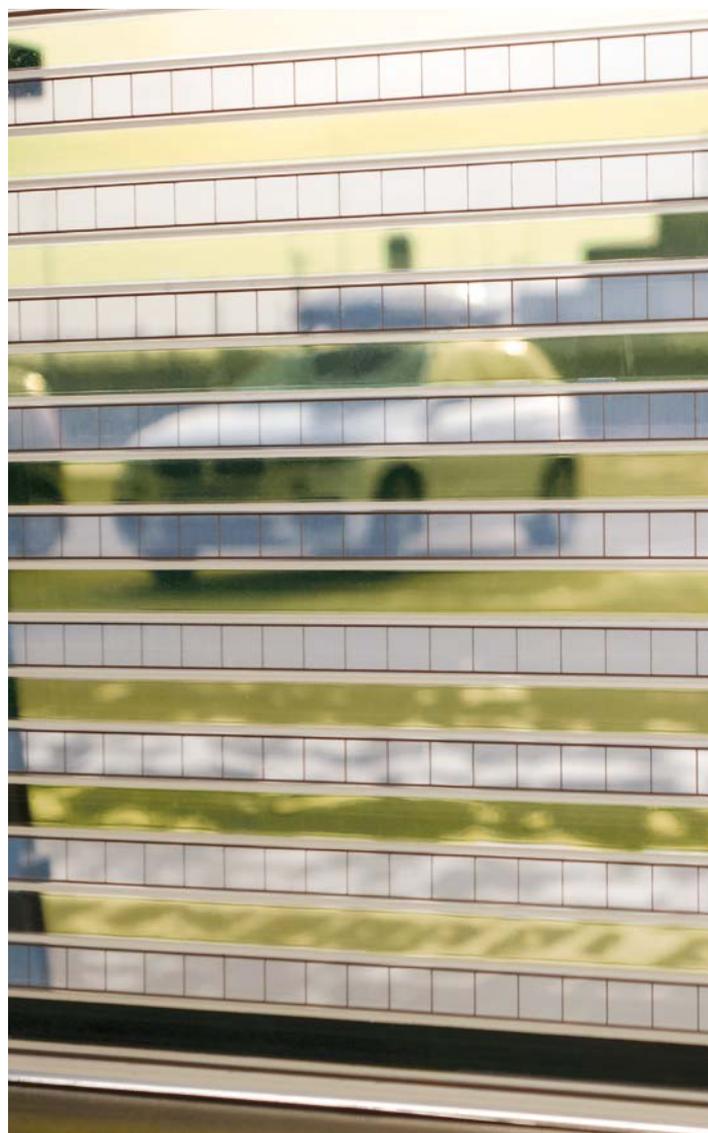
Operating conditions		
Ambient temperature	-40°C to +85°C	
Max load	5400 Pa front / e.g. snow	
	2400 Pa front and back / e.g. wind	
Impact strength	Hail: 25 mm at 23 m/s	
Electrical specifications		
Max permissible voltage	ref. IEC	600 V
Supply voltage	V _{MPP}	3,7 V
Operating current	I _{MPP}	0,36 A
Open circuit voltage	V _{OC}	6,8 V
Short-circuit current	I _{SC}	0,45 A



Printed modules



IGU with integrated printed PV cells



Printed cells