

ASI® OEM Indoor Solar Modules

for innovative autarchic electronic devices



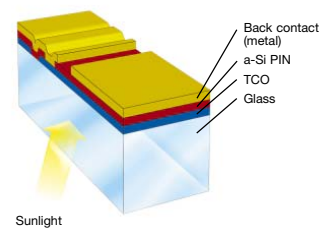
SCHOTT Solar is a leading OEM-supplier of solar modules for the electronics industry, offering a large variety of off-the-shelf modules and custom designed solar modules, adapted in size, shape and voltage to the needs of your product. With ASI® OEM technologies we can provide adequate solar modules either for outdoor or for indoor applications.

The technology of the ASI® OEM Indoor solar modules is mainly intended for light conditions as found indoors but can be used also outdoors. Power classes are available in nearly each size. The patented ASI®-technology with its special single-cell design on the basis of silicon thin film guarantees years of unflinching high performance. ASI® OEM Solar Modules are intended for use by Original Equipment Manufacturers for the power supply of autarchic electronic and electrical devices and systems. Typical applications are lighting, wireless application, sensors, watches and home automation.



Application examples

- Power even at weak illumination condition
- Stable performance
- Reliability and Quality "Made in Germany"
- Easy integration
- Excellent value for money
- No toxic materials
- Any shape and sizes in low or high volumes



Cell construction

Power even at weak illumination condition: Against other solar technologies ASI® produces high voltage even in low lux range.

Stable performance: The patented ASI®-technology with its most precise silicon module construction provides equable stable performance over many years, in comparison to most competitors.

Reliability and Quality "Made in Germany": The patented ASI®-technology with its much defined circuit and laser structuring made by automated manufacturing processes ensures favourable prices, high performance and best reliability "Made in Germany".

Easy integration: The ready made ASI®-OEM construction ensures easy integration and high resistance against UV, temperature and weather, even in the most extreme conditions.

Excellent value for money: The optimal use of raw materials and automated manufacturing processes ensures favourable prices, high performance and environmental viability for all ASI® OEM modules.

No toxic materials: In comparison to CdTe or CIS solar technology, ASI®-OEM components contain no toxic materials.

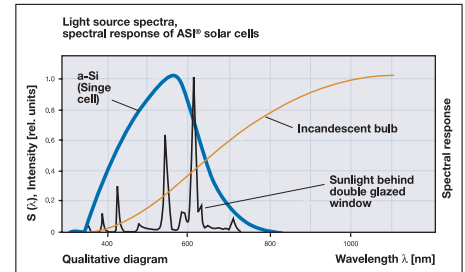
Any shape and sizes: Manufacturing capabilities enable a wide range of module designing, voltage and current in low or high volumes.

Technical Data

Characteristic data



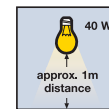
Base material	Amorphous silicon (ASI®) on float glass
Type of solar cells	a-Si single cells (PIN)
Spectral response	350 – 650 nm (Peak at 500 nm)
Connections	Contact areas for soldering, spring or other connections
Polarity	Negative label visible on front
Glass	Untrimmed edges, max. surface loading $s = 14 \text{ N/mm}^2$



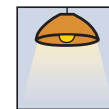
Electrical cell data*



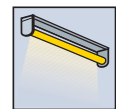
Typical data at		100 Lux	200 Lux	1000 Lux	100 mW/cm ²
Voltage at nominal power	U_{mpp} [mV]	410	430	475	620 mV
Current density at nominal power	I_{mpp} [$\mu\text{A}/\text{cm}^2$]	7.1	14.2	71	11.5 mA/cm ²
Open-circuit voltage	U_{oc} [mV]	585	610	670	820 mV
Short-circuit current density	I_{sc} [$\mu\text{A}/\text{cm}^2$]	7.4	14.8	74	13.5 mA/cm ²
Nominal power density	P_{nom} [$\mu\text{W}/\text{cm}^2$]	2.9	6.1	34	7.1 mW/cm ²



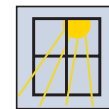
50 Lux



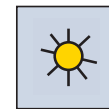
200 Lux



500 Lux



1.000 Lux



100 – 120 mW/cm² *

*) Approximation: $1 \text{ mW}/\text{cm}^2 \triangleq \text{ca. } 1250 \text{ Lux}$

*) The specified values are subject to a production tolerance of $\pm 10\%$ and remain almost unchanged under typical low indoor illumination conditions. If the solar cells are used for longer periods of time outdoors, then the power (P_{max}) stabilises at about -30% below the specified typical values. Power figures for 100/200/1000 Lux are given according to Phototronics test conditions (fluorescent light).

Quality assurance:

- Automated check during production (100%) of the fill factor FF and open-circuit voltage at 200 Lux, $FF = I_{mpp} \times U_{mpp} \div I_{sc} \times U_{oc}$
- Spot checks of module power P_{max} at 200 Lux according to Phototronics text conditions (fluorescent light). Other criteria upon mutual agreement.

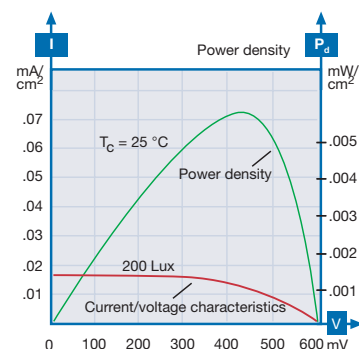
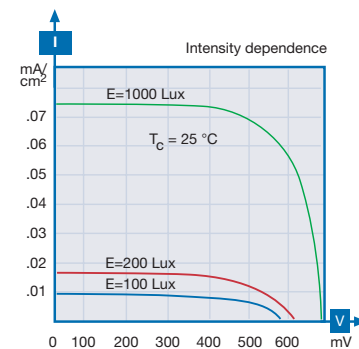
Benchmark:

The ASI®-technology is the most suitable solar technology for indoor application. It produces high voltages in low illumination levels down to 50 Lux.

Cell temperature coefficients



Power	TK (P_{nom})	-0.2	%/K
Open-circuit voltage	TK (U_{oc})	-0.33	%/K
Short-circuit current	TK (I_{sc})	+0.08	%/K



Illumination Conditions



The following table shows the daily energy output in mWh of an ASI® Solar Module with an area of 10 cm².

Daily energy output referred to a module area with a surface *) of 10 cm ²	Energy output
Poor indoor illumination (illuminance 200 Lux for 10 hours)	0.46 mWh
Adequate indoor illumination, offices, e.g. (2.000 Lux for 10 hours)	2.5 mWh
Window sill under poor daylight illumination (illuminance about 2.500 Lux for 8 hours)	5.0 mWh
Window sill under bright daylight illumination (average 15.000 Lux for 10 hours)	37.5 mWh

*) The energy output may modestly deviate from the given values depending on the module dimensions.

Solar Module Calculation



The autonomous photovoltaic system has to be designed according to the energy consumption (Wh), system voltage (V) and installation light conditions (Lux). An "all day" operating system should be designed with the lowest irradiation.

Calculation Example:

Illumination: 500 Lux
System Voltage: 3.0 Volt (3.4 Volt module at 200 Lux needed)
Daily energy consumption
(stand by): $1 \mu\text{A} \times 3.44 \text{ V} \times 24 \text{ h} = 83 \mu\text{Wh}$
Daily energy consumption
(operation): $2,000 \mu\text{A} \times 3.44 \text{ V} \times 60 \text{ s} = 287 \mu\text{Wh}$
Total energy consumption:
 $83 \mu\text{Wh} + 287 \mu\text{Wh} + 10 \% \text{ electrical losses}$
 $= 0.41 \text{ mWh}$

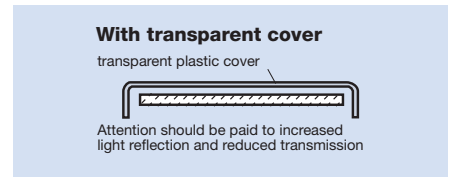
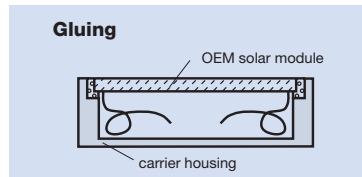
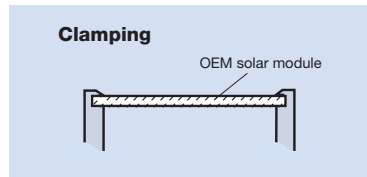
In combination with a capacity, which can overtake the illumination energy the module area surface should be 10 cm² for poor indoor illumination (200 Lux for 10 hours).
i.e. ASI 2 Oi 08/040/035 with active size 31 mm x 32 mm

Limits



Permissible module temperature	-40 to +85°C
Relative humidity	Max. 75 % without condensation
Soldering conditions	300°C - 350°C; 3 s (flux-cored solder) solder wire recommendations on request

Module integration - Examples

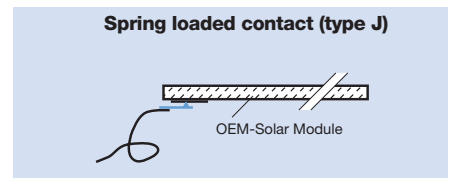
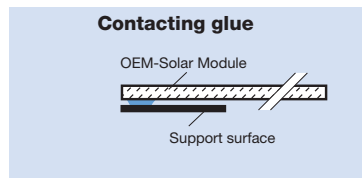
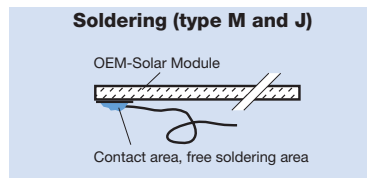


Corrosion protection: Usually ASI®-OEM indoor modules are applied indoors, and are protected against typical indoor conditions. In case of extremely high humidity, condensation or direct exposure to water the solar modules require additional protection (Please request for detailed "Handling Specification").

Shading: During installation care should be taken to ensure that the active photovoltaic area is not shaded. The cells (strips), which produce the least current due to shading, determine the total module current.

Contacting

Contacting methods:



Preparation before soldering: The panels have several connections. All types have metal coatings as points (M) or stripes (J, JF, JFJ). The wires can be soldered directly on blank coating. However type MF and JF have punched removable foil points or stripes. These have to be taking off before soldering!

Soldering specification: The solder point exists of Nickel. An adequate solder wire is needed to get best results.

Solder station:

flat soldering tip temperature controlled

Soldering temperature:

300 – 350°C, typically 325°C, max 350°C

Soldering time:

typical 3 s

Please request for detailed "Handling Specification".

Dimensions and weights



Maximum module size	976 mm x 576 mm
Cell thickness	3.2 mm ± 0.3 mm (standard) 2.3 mm ± 0.3 mm (option) (thinner glass on request)
Weight	Length (m) x width (m) x thickness (mm) x 2.5 = Weight in kg

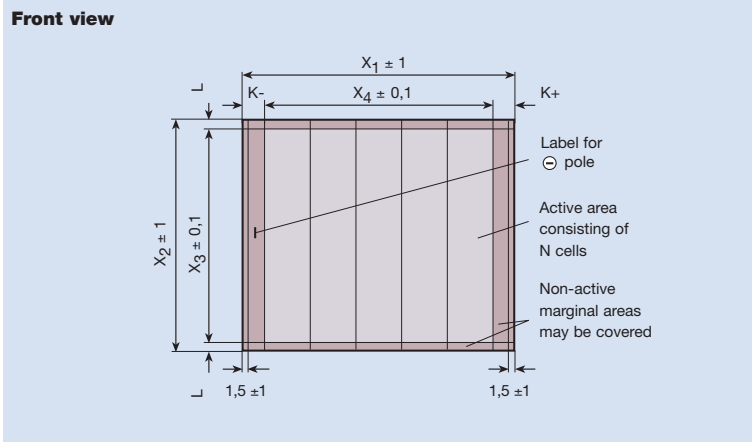
Nomenclature (for instance)



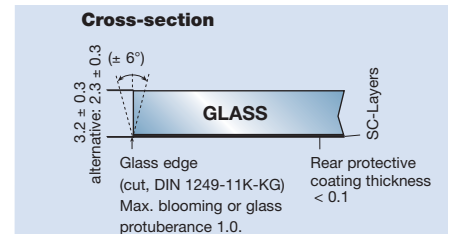
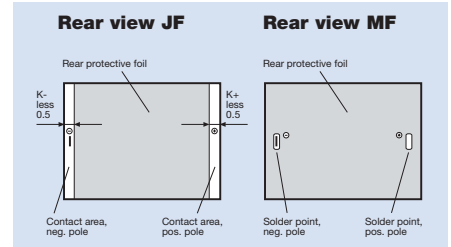
ASI	3	Oi	05	/	048	/	096	JF	Module version
									Overall dimension in mm parallel to cell arrangement (X_2)
									Overall dimension in mm normal to cell arrangement (X_1)
									Number of cells (N)
									Technology designation referred to spectrum and intensity of illumination QEM indoor
									Glass thickness in mm
Technology: ASI®									

Please ask for detailed
“List of available designs”

Dimensions and tolerances (in mm)



$X_1; X_2 = \max.$ 576 mm x 976 mm
 $X_1; X_2 = \geq 20$ mm for glass thickness 3.2 mm
 X_3 mult. by $X_4 =$ active module area
 $N =$ Number of cells



Module versions (multiple versions possible)



Rear side protection:	
<input type="checkbox"/> Version F	with transparent protection foil – Standard
<input type="checkbox"/> Version C	without protection foil
Contact area (for Version F):	
<input type="checkbox"/> Version M	with removable foil points for contact areas
<input type="checkbox"/> Version J	with removable foil stripes for contact areas
<input type="checkbox"/> Version JJ	with free stripes for contact areas
Extra options:	
<input type="checkbox"/> Version I	with isolation circle for a drilling hole
<input type="checkbox"/> Version K	circular solar module
<input type="checkbox"/> Version N	with cables and sealed solder area
Other options on request	

Customized solar modules

Besides a broad range of standard modules, customized versions in ASI® thinfilm technology can be specially manufactured for series production. Here, the solar module is based on a dedicated semiconductor design. The glass base area of 100 x 60 cm² is subdivided to form submodules according to the customer's layout specification. Electrically inactive regions are provided between these submodules, and a computer controlled glass-cutting machine makes the cut without damaging the active layers. Due to the high degree of automation and the low setting up costs, the ASI® thinfilm technology represents the most economic method of manufacturing small customized modules.

The solar modules are available in a range of:

- Size (max. 576 x 976 mm²)
- Shapes (rectangular (standard), round)
- Electrical voltages (number of cells)
- Even transparent and inactive areas can be incorporated



MANAGEMENTSYSTEM
DQS-zertifiziert nach
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