SUNdidactics
SolarEnergyDidactics
SolarEducation
SolarEngineering
innovative Solarsysteme für Schule und Ausbildung
innovative solar- systems for school, college, technical education

- Solardidaktik
- Solarzellen
- Solarmodule
- Photovoltaik- Experimentiergeräte
- Photovoltaik- Gerätentwicklung
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- Solarberatung
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- solardidactics
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- solar- workshops
- solar consulting
- solar education
- solar training for teachers
- solar toys

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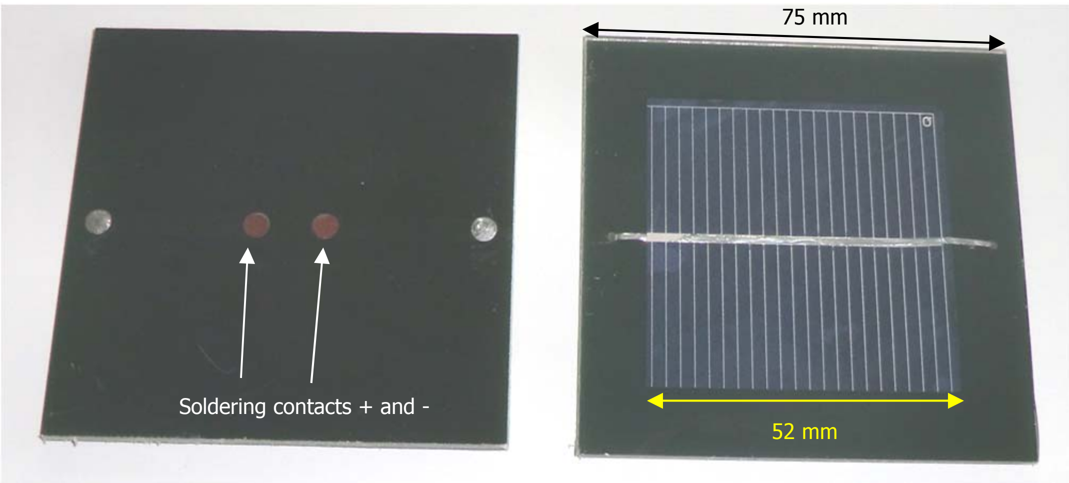
SUSEmod2- an inexpensive, powerful, robust solar module



Back side **Front side** with solar cell 52 x 52 mm

The NILS-ISFH solar module **SUSEmod2** contains the well known **NILS-ISFH solar cell 52x52 mm.** The solar cell is embedded break-proof in a plastic plate of the dimensions 75x75 mm. The surface on the solar cell is grouted/laminated super-transparent with plastic. On the back side there are 2 soldering contacts to solder on the positive and negative conductors (hookup wire). On the rear side the solar module can be stuck to smooth surfaces with double-faced adhesive tape or with glue.

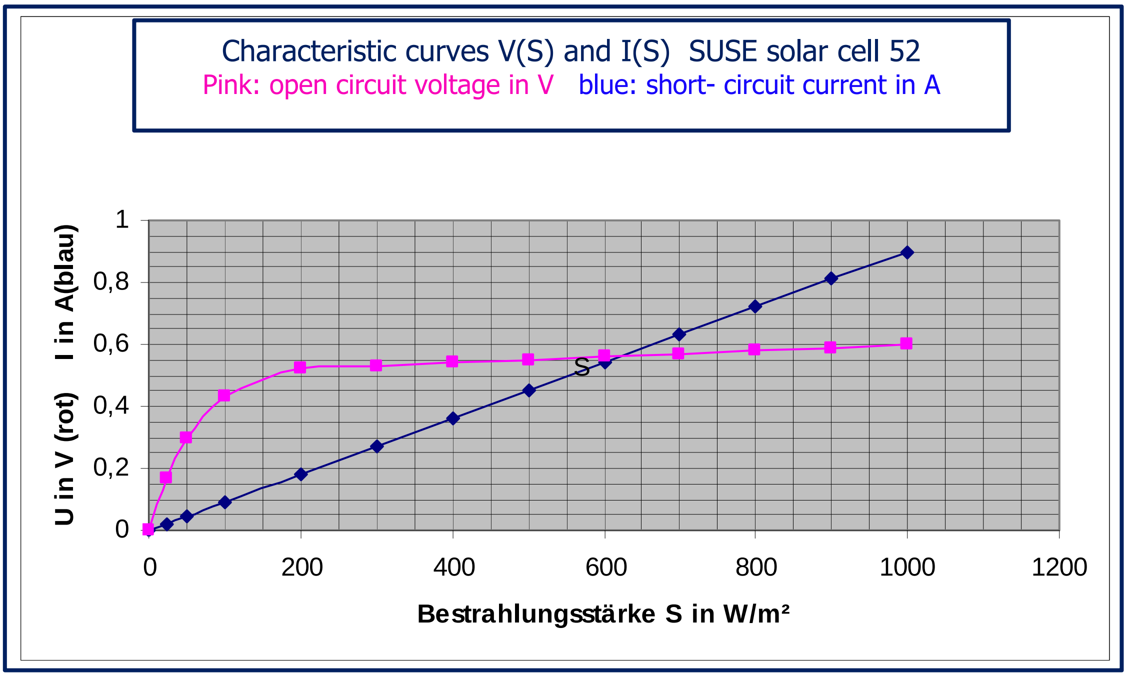
Module: Plastic base plate square 75 x 75 mm with super-transparent surface, mechanically very robust
Solar cell: Polycrystalline solar cell 52 x 52 mm, square, top surface blue, because of SiN anti reflection layer, matt finish through acidic texturing

Technical data with an irradiation of 1000 W/m², T = 25°C, AM = 1.5, Tolerance 3 %

Physical value	Symbol	Numerical value	Physical unit	Annotations
Dimensions		52 x 52 x 0.22	mm	Square cell
Open circuit voltage	U_{oc}	0.61	V	Typical for silicon
Short-circuit current	I_{sc}	0.9	A	Proportional to the light intensity S
El. power	P	0.42	W	With solar spectrum, AM 1.5
Efficiency factor	η	16.0	%	Quality feature
Filling factor	FF	77.5	%	FF is a quality feature
Current density	j	33.3	mA/cm²	j is a quality feature
Thermal behavior Open circuit voltage U_{oc}		- 0.36	% /K	The voltage decreases with warming by 0.36% per 1° C = per 1K
Thermal behavior Short-circuit current I_{sc}		+ 0.06	% /K	The short-circuit current increases by 0.06 % per1°C = 1K

The characteristic curves of the solar cell in the module SUSEmod2

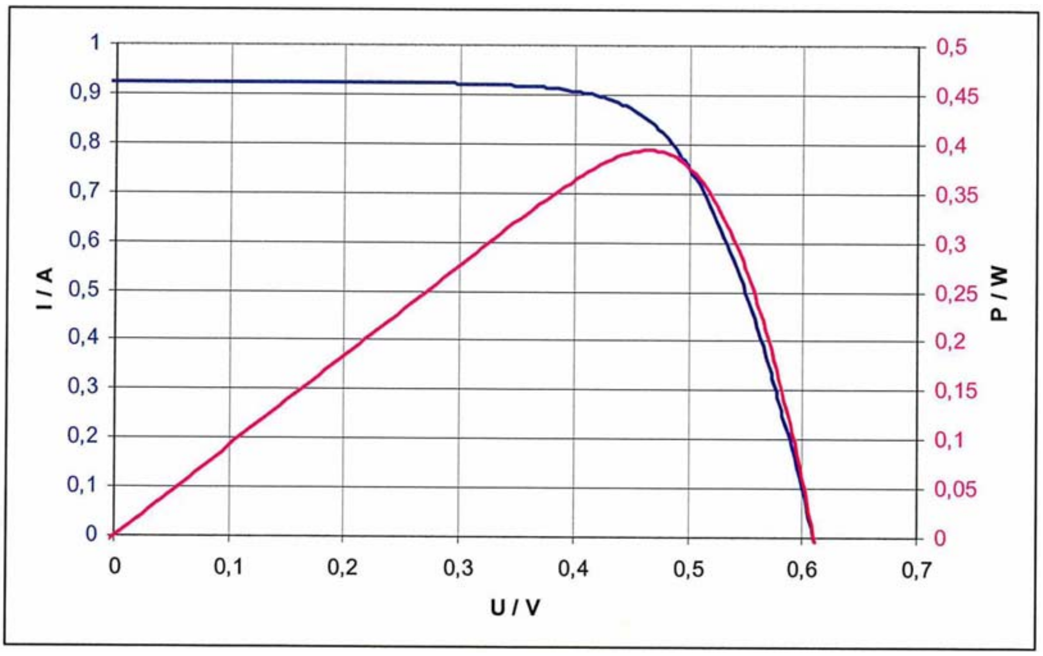
1. Dependence of open circuit voltage and short-circuit current from the light intensity (irradiance S in W/m²)



The open circuit voltage (exp. Function!) is 0 in total darkness, increases strongly with low irradiances and then increases just slightly up to the maximum value of 0.6 V with 1000 W/m² (bright sunshine with blue sky, solar cell adjusted towards the sun).

The short- circuit current is a linear function through the origin and increases in a linear fashion from 0 in total darkness up to 0.9 A with 1000 W/m².

2. The I(V) and P(V) characteristic curves of the solar cell with S = 1000 W/m² and T = 25°C

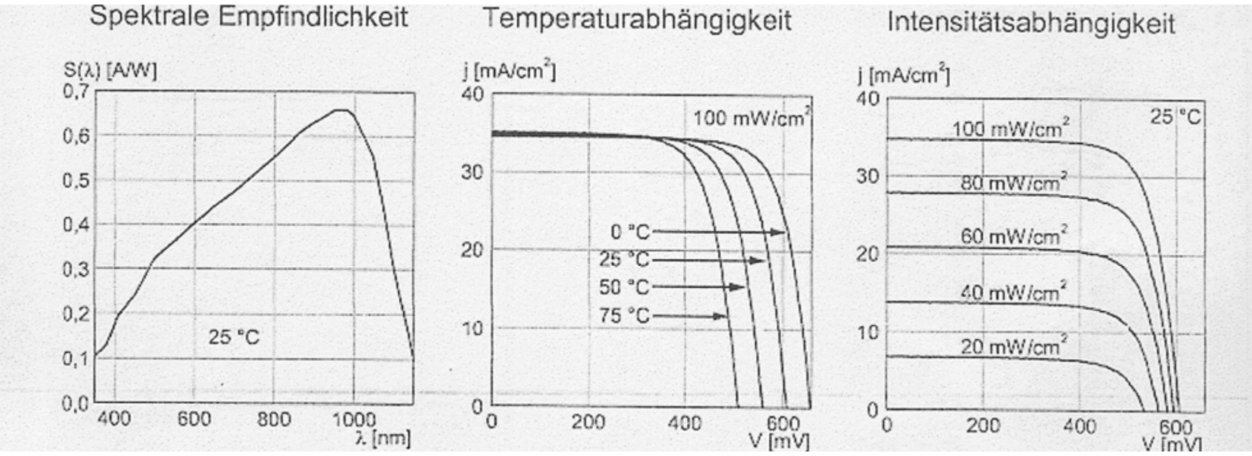


The **blue curve** shows a dependence of the short-circuit current from the open circuit voltage with an irradiance of 1000 W/m² and a temperature of 25°C.
The **red graph** shows the electric power of the solar cell (the product of V*I for each point of the blue curve over V) with the maximum power point MPP in the maximum of this curve at about 0.4 W.

With the photovoltaic measurement device SUSE 5.15 these curves can be recorded experimentally.

3. Additional data

Spectral sensivity **Temperature dependence** **Intensity dependence**



In the figures oft the current- voltage- characteristic curves the current is shown per area unit. The absolute values are obtained by multiplying the cell area with the according current values.

The **graph on the left-hand side** shows the **spectral sensitivity** in dependence of the light's wavelength, the maximum sensitivity is at about 950 nm in the near infrared.

The **graph in the middle** shows the **j(V) curve in dependence of the temperature**, it is recognizable, that the open circuit voltage decreases, if the temperature rises, the short-circuit current increases just slightly with warming (j is the current density = short-circuit current in mA per cm² cell area).

The **graph on the right** hand side shows the **intensity dependence of the j(V) curves** in dependence of the irradiance S of the incoming light (1000 W/m² corresponds to the bright sunshine in the summer with blue, cloudless sky, 0 W/m² is absolute darkness).