













# CBM6 BiSoN

## High Efficiency Bifacial N-type Monocrystalline Silicon Solar Cell

### Production Technology and Properties

The new photovoltaic frontier is called **BiSoN**, the **bifacial** high efficiency N-type monocrystalline silicon solar cell up to **20,4%** front efficiency (**25,5%** efficiency with **30% rear side contribution**) developed in collaboration with the **ISC Konstanz** R&D Institute (Germany).

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|---|--|
|  <b>Bifacial</b><br>85% of bifaciality factor ( $\epsilon_{ff\ rear} = \epsilon_{ff\ front} \times 0,85$ )                |  <b>LID near zero</b><br>It doesn't suffer LID-effect (Light Induced Degradation) that is near 0% instead of 2-3% occurring to all p-type cells |
|  <b>High Efficiency</b><br>20,4% front efficiency, 25,5% total efficiency with 30% rear side contribution                 |  <b>Zero PID</b><br>It doesn't suffer the harmful effects PID (Potential Induced Degradation)   |
|  <b>N-Type</b><br>N-type monocrystalline silicon solar cell   |  <b>Hot Spot Protect</b><br>100% measurement of insulation resistance in dark condition to prevent the Hot Spot                                 |
|  <b>Low Insolation</b><br>Excellent performance at low insolation due to the high shunt resistance, measured on each cell |  <b>Fraunhofer ISE</b><br>Cells calibrated by Fraunhofer ISE  |
|  <b>Fill Factor</b><br>High Fill Factor and low series resistance to reduce the cell to module losses                     |  <b>Made In Italy</b><br>Engineered and produced in Italy   |
|  <b>Electrical Performance</b><br>Stable Electrical performance over time   |  <b>Certificates</b><br>ISO 9001:2008   |

### Production and quality control

- 100% Quality control of the wafers used in production, performed at each step of the production process, from raw wafer acceptance test to the electrical testing of the cell.
- Use of a MES System for total control, traceability and production improvement.
- Soft handling production to reduce the microcrack generation, breakage rate and mechanical stress.
- Innovative integrated treatment system with zero discharge capable to recover 97% of the waste process water.

## High Efficiency Bifacial N-type Monocrystalline Silicon Solar Cell

### Front STC\* electrical characteristics

Efficiency** [%]	P <sub>mpp</sub> [W]	I <sub>sc</sub> [A]	V <sub>oc</sub> [V]	I <sub>mp</sub> [A]	V <sub>mp</sub> [V]	FF
19,60%	4,684	9,29	0,646	8,775	0,534	0,781
19,70%	4,708	9,31	0,646	8,786	0,536	0,783
19,80%	4,732	9,33	0,647	8,797	0,538	0,784
19,90%	4,756	9,35	0,647	8,808	0,540	0,786
20,00%	4,780	9,37	0,649	8,819	0,542	0,786
20,10%	4,804	9,38	0,651	8,831	0,544	0,787
20,20%	4,828	9,39	0,652	8,857	0,545	0,788
<b>20,30%</b>	4,852	9,40	0,652	8,880	0,546	0,791
20,40%	4,876	9,40	0,652	8,914	0,547	0,796

\*STC (1000 W/m<sup>2</sup>, AM 1,5 - 25°C) IEC 60904-3 Ed.2

\*\* Measurement tolerances: ± 1.5 % rel. (P<sub>MPp</sub>); ± 5 % rel. (I<sub>SC</sub>, V<sub>OC</sub>)

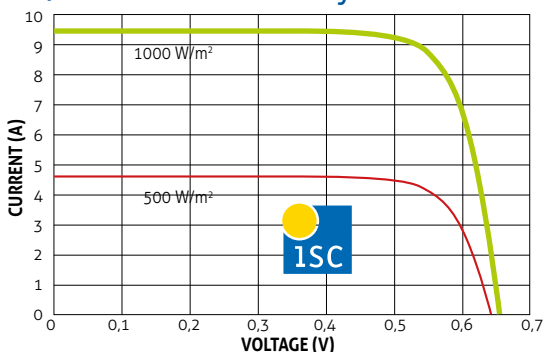
### Typical rear side contribution at **20,30%** front cell efficiency (P<sub>mpp</sub> 4.82 W and I<sub>sc</sub> 9.37 A)

Additional irradiation from rear side (% of front side illumination)	10%	15%	20%	25%	30%
<b>Bifacial gain</b>	<b>8,5%</b>	<b>12,8%</b>	<b>17,0%</b>	<b>21,3%</b>	<b>25,5%</b>
<b>Equivalent efficiency</b>	<b>22,0%</b>	<b>22,9%</b>	<b>23,8%</b>	<b>24,6%</b>	<b>25,5%</b>
P <sub>mpp</sub>	5,264	5,470	5,676	5,883	6,089
I <sub>sc</sub>	10,166	10,565	10,963	11,361	11,759

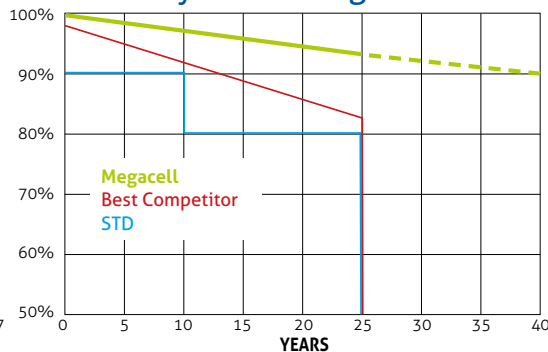
### Physical Characteristics

	Front	Back
<b>Product</b>	Monocrystalline Silicon Cell using N type wafer	
<b>Dimensions</b>	156 x 156 +/- 0,5 mm	
<b>Materials</b>	Alkaline texturized surface Blue & Light Blue silicon nitride AR coating	
<b>Bus bar</b>	<b>Positive pole (+),</b> three bus bar 1,50 +/- 0,1mm Distance axis: 52 mm	<b>Negative pole (-),</b> three bus bar 1,50 +/- 0,1 mm Distance axis: 52 mm
<b>Thickness (Si)</b>	180 - 200 +/- 20 µm	

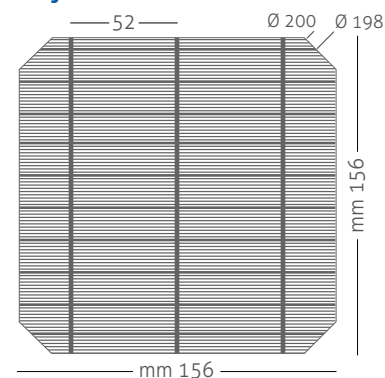
### Typical I-V curve at 20,30% front efficiency



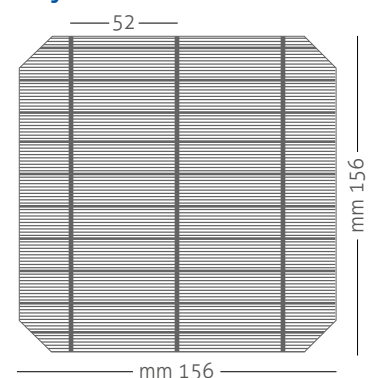
### Expected glass-glass module warranty when using BiSoN cells



### Layout front



### Layout rear



### Temperature coefficients

- Power - 0.397 % / K
- Current + 0.041 % / K
- Voltage - 0.280 % / K

### Processing recommendation

Solder joint Copper ribbons coated with:

- 10 - 15 µm:
- 60 % Sn / 38 % Pb / 2 % Ag
- 60 % Sn / 40 % Pb

Cells per bypass diode:

- Maximum 24 cells per bypass diode.

### Storage remarks

Keep the cells at room temperature and in a dry and clean atmosphere (25°C ± 5°C).