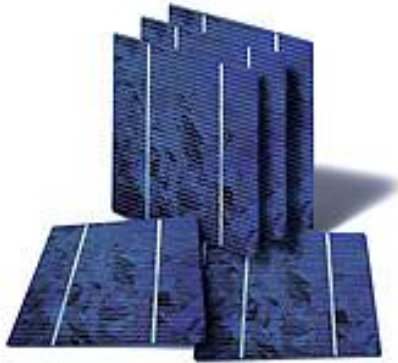
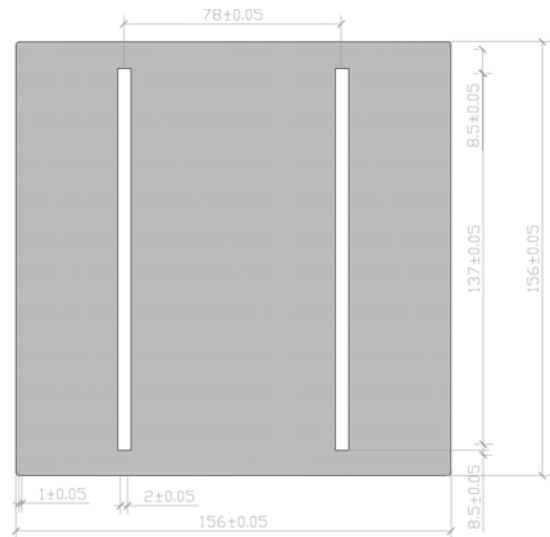
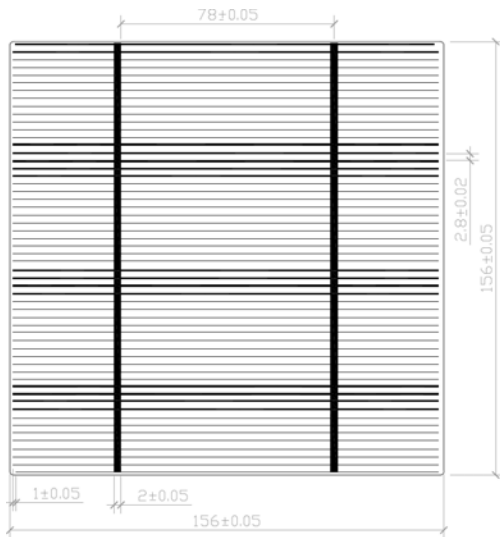




## PHOTOVOLTAIC SOLAR ENERGY CELLS POLYCRYSTALLINE – SI-ESF-C-P156X156



- High efficiency solar cells with anisotropic etched surface.
- Low reverse current, high shunting resistance and dependability.
- Proper handling from incoming inspection through production, outgoing inspection and packaging.
- 100% checked reverse current and visual appearance.
- Small light-induced degradation.



| Size               | Thickness   | Front side (-)  | Rear side (+)   |
|--------------------|-------------|---|---|
| 156 x 156 ± 0.5 mm | 200 ± 30 µm | 1.6 mm<br>busbars (Ag)<br>blue antireflection coating (Si <sub>3</sub> N <sub>4</sub> ) | 2.3 mm<br>wide soldering pads (Ag)<br>back surface field (Al) |

| ELECTRICAL CHARACTERISTICS |                      |                      |                      |                     |                     |        |
|----------------------------|----------------------|----------------------|----------------------|---------------------|---------------------|--------|
| Efficiency (%)             | P <sub>mpp</sub> (W) | V <sub>mpp</sub> (V) | I <sub>mpp</sub> (A) | V <sub>oc</sub> (V) | I <sub>sc</sub> (A) | FF (%) |
| > 18.00                    | 4.38                 | 0.534                | 8.204                | 0.635               | 8.700               | 79.30  |
| 17.80-18.00                | 4.33                 | 0.532                | 8.141                | 0.633               | 8.650               | 79.10  |
| 17.60-17.80                | 4.29                 | 0.531                | 8.075                | 0.631               | 8.632               | 78.80  |
| 17.40-17.60                | 4.24                 | 0.529                | 8.015                | 0.630               | 8.580               | 78.55  |
| 17.20-17.40                | 4.20                 | 0.526                | 7.972                | 0.627               | 8.548               | 78.35  |
| 17.00-17.20                | 4.14                 | 0.523                | 7.920                | 0.626               | 8.495               | 78.02  |
| 16.80-17.00                | 4.09                 | 0.521                | 7.875                | 0.624               | 8.470               | 77.65  |
| 16.60-16.80                | 4.05                 | 0.517                | 7.819                | 0.620               | 8.428               | 77.45  |
| 16.40-16.60                | 3.99                 | 0.514                | 7.780                | 0.619               | 8.378               | 77.10  |
| 16.00-16.40                | 3.90                 | 0.510                | 7.654                | 0.614               | 8.261               | 76.91  |

| THERMAL CHARACTERISTICS   |     |         |
|---|-----|---------|
| Temperature coefficient of voltage at maximum power (V <sub>mpp</sub> ) | %/K | - 0,363 |
| Temperature coefficient of current at maximum power (I <sub>mpp</sub> ) | %/K | + 0,071 |
| Temperature coefficient of maximum power γ (P <sub>mpp</sub> )          | %/K | - 0,369 |



## PHOTOVOLTAIC SOLAR ENERGY

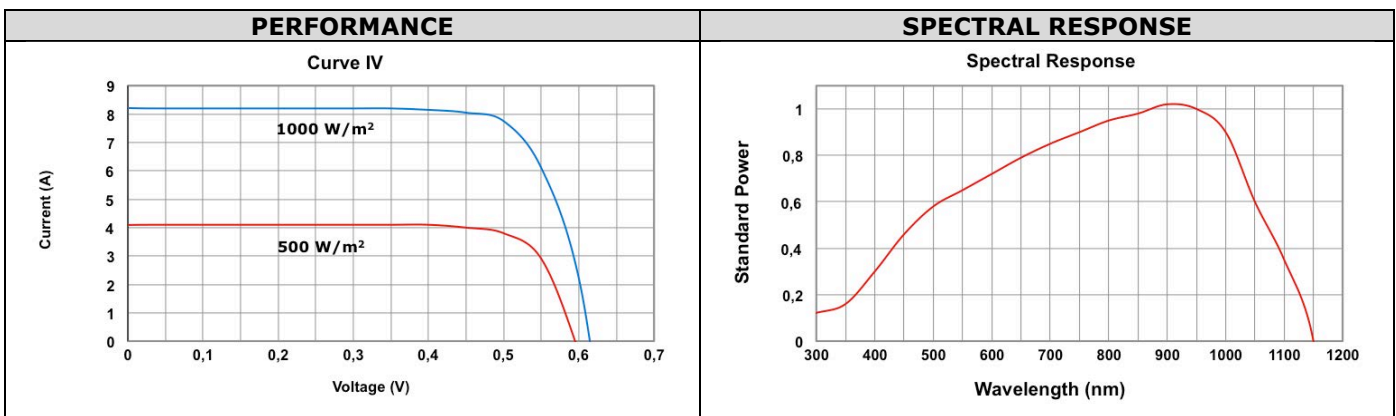
### CELLS POLYCRYSTALLINE – SI-ESF-C-P156X156

| MECHANICAL CHARACTERISTICS            |  |
|---------------------------------------|--|
| <b>Growth Method</b>                  | CZ                                       |
| <b>Conductive Type</b>                | P  |
| <b>Dopant</b>                         | Boron (B)                                |
| <b>Orientation</b>                    | <100>                                    |
| <b>Off Orientation</b>                | <± 3°                                    |
| <b>Resistivity (ρ)</b>                | 0.5 – 3 Ω cm                             |
| <b>Minority Carrier Life (τ d)</b>    | > 10 μS                                  |
| <b>Oxygen Content (O<sub>2</sub>)</b> | ≤ 1.0 × 10 <sup>18</sup> cm <sup>3</sup> |
| <b>Carbon Content (C)</b>             | ≤ 2.0 × 10 <sup>17</sup> cm <sup>3</sup> |
| <b>Dislocation Density (Nd)</b>       | ≤ 3,000/cm <sup>2</sup>                  |
| <b>Size</b>                           | 156 x 156 ± 0.5 mm                       |
| <b>Diameter</b>                       | 200 ± 0.5 mm                             |
| <b>Thickness</b>                      | 200 ± 30 μm                              |
| <b>TTV</b>                            | < 30 μm                                  |

| MEASUREMENTS PERFORMED IN ACCORDANCE WITH STANDARD TEST METHODS<br>EN 60904-3 AND ASTM E1036, CORRECTED TO STANDARD TEST CONDITIONS (STC) |                  |                            |
|---|------------------|----------------------------|
| <b>Air quality/Spectral distribution</b>  | AM               | 1,5 ASTM G173-03e1 (2,008) |
| <b>Luminous intensity/Radiation</b>   | W/m <sup>2</sup> | 1000                       |
| <b>Cell temperature</b>   | ° C              | 25 ± 2                     |

| TEST ACCURACY                                    |             |
|--|-------------|
| <b>Temperature coefficient of power γ (Pmpp)</b> | + 1,50% rel |
| <b>Efficiency</b>                                | ± 0,25% abs |

| MEASUREMENTS PERFORMED IN SOLAR SIMULATOR      |                         |
|--|-------------------------|
| <b>Class</b>                                   | AAA (según IEC 60904-4) |
| <b>Power measurement uncertainty is within</b> | ± 3 %                   |



| INTENSITY DEPENDENCE               |                |                |             |
|------------------------------------|----------------|----------------|-------------|
| <b>Intensity (W/m<sup>2</sup>)</b> | <b>Isc (*)</b> | <b>Voc (*)</b> | <b>Pmpp</b> |
| 1000                               | 1.0            | 1.000          | 1.000       |
| 900                                | 0.9            | 0.995          | 0.897       |
| 800                                | 0.8            | 0.987          | 0.795       |
| 500                                | 0.5            | 0.964          | 0.487       |
| 300                                | 0.3            | 0.935          | 0.284       |
| 200                                | 0.2            | 0.910          | 0.185       |

(\*) Ratio of Voc (Isc) at reduced intensity to Voc (Isc) at 1.000 W/m<sup>2</sup>