Dye-sensitized Solar Cell for energy harvesting

**Dye-sensitized solar cell (DSC)**

DSCs are expected to be next-generation solar cells because of their environmentally friendly features compared to conventional solar cells.

**Features of DSC**
- High conversion efficiency at light intensity from 200 to 10,000 lux
- Operable at illuminance from 10 to 100,000 lux
- Usable even in oblique light

**DSC product lineup**

<table>
<thead>
<tr>
<th>DSC module panel</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Module Diagram" /></td>
</tr>
</tbody>
</table>

### Initial electric performance (White LED, 200 lux)

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Single cell mini module (FDSC-FSC6FG)</th>
<th>Single cell module (FDSC-FSC4)</th>
<th>8 cell module (FDSC-FDC3FG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Power ($P_m$)</td>
<td>μW</td>
<td>49</td>
<td>255</td>
<td>428</td>
</tr>
<tr>
<td>Aperture area</td>
<td>cm²</td>
<td>9</td>
<td>32</td>
<td>74</td>
</tr>
<tr>
<td>Operating Current ($I_{op}$)</td>
<td>μA</td>
<td>122 - 0.38 V</td>
<td>637 - 0.38 V</td>
<td>136 - 3.0 V</td>
</tr>
<tr>
<td>Voltage</td>
<td>V</td>
<td>DC 3.0 ± 0.2 V</td>
<td>100 mA (max)</td>
<td>185 mA (10 μs)</td>
</tr>
<tr>
<td>Output current</td>
<td>mA</td>
<td>100 (max)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current limit</td>
<td>mA</td>
<td>185 (10 μs)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Operating condition**: Surface temperature -30 ~ 50°C, Illuminance 10 ~ 100,000 lux

Electric performance will linearly increase according to intensity of illuminance (e.g. $P_m$ and $I_{op}$ under 1,000 lux are five times bigger than the ones under 200 lux).

**DSC power module**

The DSC power module can:
- realize battery-less or extend battery life of various electric devices (e.g. IoT devices).
- reduce user’s burden of designing ultra low power management circuit required for energy harvesting.

Lithium Ion Capacitor

- **Storage Device (LIC*)**: 27 mWh (=100 J) equivalent to 9mAh at 3V

* Lithium Ion Capacitor

**Electric devices**

- **Ultra low power management circuit**
- **Harvester (DSC)**
- **DSC**

Power management board
Dye-sensitized Solar Cell for energy harvesting

Applicable areas of DSC

DSC powered Wireless Sensor Network System (Applicable only in Japan)

Features

- **Batteryless**
  - Powered by Dye-sensitized Solar Cell (DSC) and Lithium Ion Capacitor (LIC)
- **Location free**
  - Long-distance Wireless communication with 920MHz band radio
- **Operable at low light illuminance by DSC**

![Diagram of DSC powered Wireless Sensor Network System]

Sensor node  Sensor station

Power consumption of various sensing devices

<table>
<thead>
<tr>
<th>Sensing devices</th>
<th>Power consumption per day (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Still cameras</td>
<td>13mW (13.6mW)</td>
</tr>
<tr>
<td>Human sensors</td>
<td>7.6mW (7.3mW)</td>
</tr>
<tr>
<td>Active ID tags</td>
<td>7.5mW (7.2mW)</td>
</tr>
<tr>
<td>Current/voltage sensors</td>
<td>5.9mW (5.6mW)</td>
</tr>
<tr>
<td>Temperature/humidity sensors</td>
<td>3.3mW (3.0mW)</td>
</tr>
</tbody>
</table>

Calculation conditions:
- Interior light
- DSC conversion efficiency: 13%
- Average illuminance: 500 lux
- Operation cycle: 15 sec on / 85 sec off

Fujikura Ltd.
1440, Mutsumi, sakura, chiba
285-8550, Japan

Email: ask-dsc@fujikura.com
Web: http://www.fujikura.co.jp/eng/