IXOLAR™ SolarMD
Type SLMD121H10L

Electrical Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Typical Values</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{OC}$ Open Circuit Voltage</td>
<td>6.30</td>
<td>V</td>
</tr>
<tr>
<td>$I_{SC}$ Short Circuit Current</td>
<td>50.0</td>
<td>mA</td>
</tr>
<tr>
<td>$V_{mpp}$ Voltage at Maximum Power Point</td>
<td>5.01</td>
<td>V</td>
</tr>
<tr>
<td>$I_{mpp}$ Current at Maximum Power Point</td>
<td>44.6</td>
<td>mA</td>
</tr>
<tr>
<td>$P_{mpp}$ Maximum Peak Power</td>
<td>223.0</td>
<td>mW</td>
</tr>
<tr>
<td>FF Fill Factor</td>
<td>&gt;70</td>
<td>%</td>
</tr>
<tr>
<td>η Solar Cell Efficiency</td>
<td>22</td>
<td>%</td>
</tr>
<tr>
<td>$\Delta V_{OC}/\Delta T$ Open Circuit Voltage Temperature Coefficient</td>
<td>-2.1</td>
<td>mV/K</td>
</tr>
<tr>
<td>$\Delta J_{SC}/\Delta T$ Short Circuit Current Temperature Coefficient</td>
<td>0.12</td>
<td>mA/(cm²K)</td>
</tr>
</tbody>
</table>

All values measured at standard conditions: 1 sun (1000W/m²), Air mass 1.5, 25°C

Description

IXOLAR™ SolarMD is an IXYS product line of solar module made of monocrystalline, high efficiency solar cells. The IXOLAR™ SolarMD is ideal for charging various battery powered and handheld consumer products such as mobile phones, cameras, PDAs, MP3-Players and toys. They are also suitable for industrial applications such as wireless sensors, portable instrumentation and for charging emergency backup batteries.

With a cell efficiency of typically 22%, SolarMD gives the ability to extend run time even in "low light" conditions and increase battery life and run time in a small footprint, which can be easily accommodated in the design of portable products. The design allows for connecting SolarMD flexibly in series and/or parallel to perfectly meet the custom-specific application’s power requirements.

IXOLAR™ products have a very good photonic response over a wide range of wavelength and therefore can be used in both indoor and outdoor applications.

Features
- Monocrystalline silicon technology
- High efficiency outdoor and indoor
- Long life and stable output
- Sealed Package
- High mechanical robustness

Applications
- Battery chargers for portables such as cell phones, PDAs, GPS-Systems
- "Green" electricity generation
- Power backup for UPS, Sensors, Wearables

Advantages
- One Product for Multiple Applications
- Flexible Integration into the Application
Notes

Background

Some basic information needs to be covered to better understand what to expect in terms of the SolarMD's performance with regards to solar cell type, lighting conditions in terms of power density, and general industry standards as they relate to battery charging.

Solar Cell Types

Keep in mind these cost and performance tradeoffs when comparing various solar cell materials:

Polycrystalline cells - commonly found in outdoor applications and have a spectral sensitivity range of 500nm to 1100nm. They're in the medium price range and typically offer 13% power conversion efficiency.

Monocrystalline cells - such as the IXYS SolarMD. These have a spectral sensitivity range from 300 nm (near-ultraviolet) to 1100 nm (near-infrared), which includes visible light (400 to 700 nm). Due to this wide spectral range, they can be used in both indoor and outdoor applications. Monocrystalline or single-crystalline material is the most expensive but it does not contain impurities, and as such the power conversion efficiency does not degrade over operating time. The power conversion efficiency of commercially available monocrystalline cells ranges from 15 to 22%. The surface of these cells is a homogenous dark blue or dark grey.

Amorphous cells - Work in the spectral range of 300nm to 600nm and are used predominantly indoors in products such as solar powered calculators since they are not sensitive to the upper light spectrum and cannot take advantage of natural sunlight. They offer about 5% power conversion efficiency and are mostly used with ultra-low power devices like clocks and electronic calculators. Amorphous cells, like polycrystalline cells, suffer from efficiency degradation.

SolarMD Description

SolarMD is made of monocrystalline, high-efficiency solar cells in a surface mountable package. They're robust and can be used in harsh environments. Solar cells used in SolarMD have a very high (22%) power conversion efficiency, which means that 22% of the light energy is converted into electrical energy. They're extremely useful in applications requiring solar power generation in a limited space.

Monocrystalline cells can be used in indoor and outdoor applications because they have a wide spectral sensitivity, 300 to 1100 nm. However, the output power of a solar cell is proportional (over a wide range) to the incoming light energy, and irradiance is generally much higher outdoors. The values in the data sheet are measured at "standard condition" of 1 sun, which is equal to 1000W per square meter sunlight irradiance at a defined light spectrum (air mass of 1.5) and 25°C cell temperature.

Moisture Sensitivity, Reflow Soldering and Washing Information

IXYS has characterized the moisture reflow sensitivity of the film laminated SolarMD using IPC/JEDEC standard J-STD-020. The film laminated SolarMD meets the standard MSL level 1 soak requirements of 85°C/85%RH for 168hrs.

Moisture uptake from atmospheric humidity occurs by diffusion. During the soldering process to the electrode, the combination of moisture uptake and high temperature soldering may lead to moisture induced delamination and cracking of the component. To prevent this, this component must be handled with care in soldering. The film laminated SolarMD is not recommended for high temperature surface mount soldering reflow. SLMD121H10L is encapsulated by the lamination with EVA and polymer film and thus excessively high temperatures soldering reflow is prohibited.

SLMD121H10L is recommended to solder terminals by using oven curable solder paste, for instance, LORD PC10678HV silver conductor or paste designed for screen print application and curable in convection oven at the profile of 100°C for 30 minutes or 150°C for 15 minutes. Manual soldering is also recommended with under 260°C for 2 sec. IXYS does not recommend the use of chlorinated solvents for washing.
Relative Light Power Density

The figure below compares relative power density for various lighting condition in units of Watts per square meter (W/m²). The reference standard condition is 1 Sun and is equal to 1000 Watts per square meter of sunlight irradiance at a constant 25°C cell temperature and at 1.5 Air Mass (Air Mass stands for a well defined light spectrum which appears if the sunlight goes through the earth’s atmosphere at a defined angle).

As the chart clearly shows, the power density of typical indoor lighting is dramatically lower than that of sunlight. Not only is irradiance from indirect and artificial light lower; the spectrum is also narrower.

In typical Office Space lighting with a spectrum produced from incandescent or halogen light bulbs, the power output may be roughly 100 times less than bright sunlight. It may be 200 to 500 times less with fluorescent lighting due to the further limited spectrum.
Typical Curves

Figure 1 – Current-Voltage Characteristics

![Current-Voltage Characteristics graph]

Figure 2 – Short Circuit Current Density Vs. Temperature

![Short Circuit Current Density vs Temperature graph]
Figure 3 – Open Circuit Voltage Vs. Temperature (per unit cell)

Figure 4 – Open Circuit Voltage Vs. Irradiance (Per unit cell)
Figure 5 – External Quantum Efficiency

![EQE vs. λ (nm) graph]

Cross-section view of the device showing the quantum efficiency as a function of wavelength (λ). The graph displays the external quantum efficiency (EQE) in percent (%) on the y-axis and wavelength (λ) in nanometers (nm) on the x-axis. The data points are indicated by red squares, and the curve illustrates the efficiency across various wavelengths.
Outline Drawing & Ordering Information

Front-side View

Back-side View

Front-side View details

Back-side View details

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>SLMD</th>
<th>121</th>
<th>H</th>
<th>10</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Type Code</td>
<td>120mm² Cell Size</td>
<td>22% High cell efficiency</td>
<td>No. of Cells in Series</td>
<td>Film Laminated Encapsulation</td>
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<tr>
<td>SLMD121H10L</td>
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Order code: SLMD121H10L

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