Main Products
IXOLAR™ SolarBIT
IXOLAR™ SolarMD
IXOLAR™ SolarET

Typical Applications
Sales and Marketing
GLOBAL FOOTPRINT

SERVING CUSTOMERS WORLDWIDE

- Products cover entire power spectrum
- Focused direct sales force
- Broad sales representative and distributor relationships
**PRODUCTS**

**IXOLAR™ SolarBIT**
- Surface Mountable Solar Bits
- Reflow Solderable
- Epoxy Coated Encapsulation
- Form Factor: 22mm x 7mm x 1.6mm

**IXOLAR™ SolarMD**
- Manual Solderable Mini Solar Modules
- Film Laminated Encapsulation
- Customized Voltage/Current Ratings
- Various Module Sizes

**IXOLAR™ SolarET**
- Solar Electronics powered by High Efficiency SolarMD
- Smart MCU Controlled.
- High Efficiency High Brightness LED flashlight
- Alkaline Battery or Li-Battery Bank
- Laser Pointer

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High Efficiency Solar Cell 22%
Monocrystalline Silicon
IXOLAR™ BIT/MD Technology Roadmap

**Solar Bit**
- KXOB22-12X1F
- KXOB22-04X3F
- KXOB22-01X8F

**Solar Module**
- SLMD121H04L
- SLMD121H09L
- SLMD960H12L
- SLMD481H08L
- SLMD481H10L
- SLMD481H12L

**Technology**
- Thin Film Lamination: less than 1.2mm
- Thin Film Lamination: 1.2mm
- Film Lamination: 2mm

**General**
- Large Module (Above 1W): SLMD242H10L
- Indoor Solar Module
- IXOLAR™ High Efficiency Bits & Modules, and Customized Module Configuration

**Indoor Solar Module**
IXOLAR™ ET Technology Roadmap

Solar Pad
- Features: 1W Solar Module, 6000mAh Li-Battery Pack, HB LED Flashlight, Quick Charger 2-ch USB 5V 1A

Mini-B
- Features: 200mW Solar Module, HB LED 1W Flashlight, AA 2pcs Rechargeable Battery

ix
- Features: 225mW Solar Module, 1000mAh Li-Battery Pack, HB LED Flashlight, Laser Pointer, Charger 1-ch USB 5V 0.5A

m
- Features: 100mW Solar Module, HB LED 0.5W Flash Light, Emergency Alarm AAA 1pcs Rechargeable Battery

SLBC-01
- Features: 100mW Solar Module, AAA, AA 2pcs Alkaline Battery Charger

Portable Solar Electronics combined with IXOLAR™ High Efficiency Module, LED, and Li-Battery
# PRODUCTS: IXOLAR™ BIT & MODULE

<table>
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<tr>
<th>Symbol</th>
<th>Unit</th>
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<th>IXOLAR™ High Efficiency SolarMD</th>
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*) Please note, all values measured at Standard Condition: 1 sun (= 100 mW/cm²), Air Mass 1.5, 25°C
### PRODUCTS: IXOLAR™ BIT & MODULE

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<th>SLMD121H10L</th>
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<td>d</td>
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<td>h</td>
<td>g</td>
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<td>Yes</td>
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<td>Yes</td>
<td>Yes</td>
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</table>

*) Please note, all values measured at Standard Condition: 1 sun (= 100 mW/cm²), Air Mass 1.5, 25°C
PRODUCTS: SolarET

SLBC-01-GRN  SLBC-01-PNK  SLBC-01-YEL

SLFL-M-BLK  SLFL-M-BLU  SLFL-M-PNK  SLFL-M-WHT

SLFL-IX-WHT  SLFL-IX-BLK  SLUC-01-WHT
IXOLAR™: SolarBIT

SolarBIT
- KXOB22-12X1F: a single cell
- KXOB22-04X3F: 4 cells in series
- KXOB22-01X8F: 8 cells in series

SPECIFICATIONS:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Unit</th>
<th>KXOB22-12X1F</th>
<th>KXOB22-04X3F</th>
<th>KXOB22-01X8F</th>
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<tr>
<td>Voc</td>
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<td>Isc</td>
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<td>mW</td>
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<td>Imax</td>
<td>mA</td>
<td>44.6</td>
<td>13.38</td>
<td>3.8</td>
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<td>mm(LxWxH)</td>
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<td>22x7x1.8</td>
<td>22x7x1.8</td>
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<td>Unit cell area</td>
<td>mm2(LxW)</td>
<td>120.00</td>
<td>36.00</td>
<td>12.00</td>
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APPLICATIONS:
- Battery chargers for portables such as cell phones, MP3-players, PDAs, and toys
- Energy harvesting
- Power backup for Zigbee, Nanonet, Bluetooth, sensors, wearables, etc.
SolarMD (Examples)

- SLMD121H04L: 20mmx6mm by 4S
- SLMD121H08L: 20mmx6mm by 8S
- SLMD480H12L: 10mmx4.8mm by 12S
- SLMD481H08L: 20mmx12mmx2P by 8S
- SLMD481H12L: 20mmx12mmx2P by 12S

SPECIFICATIONS:

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<tr>
<th>Symbol (unit)</th>
<th>SLMD121H04L</th>
<th>SLMD121H08L</th>
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<th>SLMD121H10L</th>
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APPLICATIONS:

- Battery chargers such as ETCs, cell phones, MP3-players, PDAs, and electronic toys
- Emergency backup charging, Energy harvesting, Inductive Loop Vehicle Detection
- Power backup for wireless sensors
SolarET : SLBC-01

- SLBC-01-GRN: Solar Battery Charger, Green
- SLBC-01-PNK: Solar Battery Charger, Pink
- SLBC-01-YEL: Solar Battery Charger, Yellow

FEATURES:
- Portable solar battery charger using IXOLAR™ SolarBIT, 50mA
- Charges primary alkaline battery
- Charges rechargeable alkaline battery
- Charges 2 AAs, 2 AAAs, or one each
- Solar Charger comes with 2 AAs, 2 AAAs, and 2 adaptors
- Factory charged and ready to use
- Alkaline battery is eco-friendly

USAGE:
- Various mobile electronics
- Games, electronic toys, remote controllers
- Calculators, cassettes, radios
SolarET: SLFL-M

SolarET : SLFL-M

• SLFL-M-BLK: Solar Flashlight-mini, Green
• SLFL-M-BLU: Solar Flashlight-mini, Blue
• SLFL-M-PNK: Solar Flashlight-mini, Pink
• SLFL-M-WHT: Solar Flashlight-mini, White

FEATURES:

• Portable solar flashlight using IXOLAR™ SolarMD, 50mA
• Eco-friendly rechargeable alkaline battery operated
• High brightness LED, 60 lumen
• Emergency alarm sound (100dB) for child protection
• 3 beacon modes: slow, medium, fast
• One rechargeable alkaline 1000mAh AAAs inside
• Operation hours: 4 hrs in continuous flashlight mode and 15hrs in fast beacon mode.

USAGE:

• Flashlight use at home, offices, car, fishing, hiking, etc.
• Use emergency alarm for child protection
• Use beacon modes in emergency
SolarET: SLFL-IX

SolarET : SLFL-IX

• SLFL-IX-WHT: Solar Flashlight-IX, White
• SLFL-IX-BLK: Solar Flashlight-IX, Black

FEATURES:

• Portable solar flashlight using IXOLAR™ SolarMD, 50mA
• Eco-friendly rechargeable alkaline battery operated
• High brightness LED (300mA), 90 lumen
• Dimming mode (75mA) for battery saving
• High light beacon mode
• Two rechargeable alkaline 1500mAh AAs inside
• Operation hours: 5hrs in continuous 300mA high brightness mode and 20hrs in continuous 75mA dimming mode
• Solar charging status indicator by red LED

USAGE:

• Flashlight use at home, offices, car, fishing, hiking, etc.
• Use the beacon mode for emergency signaling
• Company gift or promotion gift
SolarET: SLUC-01-miniB

SolarET : SLUC-01-miniB
- SLUC-miniB-WHT: Solar USB charger-miniB, White
- SLUC-miniB-BLK: Solar USB charger-miniB, Black

FEATURES:
- Solar USB battery charger using IXOLAR™ SolarMD, 50mA
- Input : DC 5V, 600mA by micro USB
- Output : DC 5V, 600mA by standard USB
- 3.7V 1000mAh Li-Polymer battery operated
- High brightness LED (75mA), 38 lumen
- Charging time: 90min by USB 5V 600mA and 20hrs by 1sun
- Laser pointer, red
- LED Flashlight: continuous mode, beacon mode

USAGE:
- Charges smart phone (iPhone, Galaxy, etc.), MP3 using USB connector
- Flashlight use at home, offices, car, fishing, hiking, etc.
- Laser pointer use at presentation and signaling
- Use the beacon flashlight mode for emergency signaling
- Company gift or promotion gift
IXOLAR™: Typical Applications

- Wireless / Remote Sensors
  - ZIGBEE
  - NANONET
- Portable Electronics such as:
  - Cell Phones
  - GPS Systems
  - Automotive Keypads
  - Sport watches
  - PDAs
- Small and compact PV-arrays for Chargers
- Light Sensors
- Mobile Medical Systems
- ... any application where extending battery life is a benefit.
APPLICATIONS

ETC: Electronic Toll Collection, using SLMD960H12L
SEoul COMMUNICATIONS (a part of SAMSUNG): http://www.samsungnavi.co.kr/
AIRPOINT: http://www.airpoint.co.kr/
ITRONICS: http://www.itronics.co.kr/
Energy Harvesting, using KXOB22-12X1F
http://www.corechips.co.kr/

Energy harvesting

<table>
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<tr>
<th>Energy Harvesting Source</th>
<th>Converted Energy (mW)</th>
<th>Frequency (Hz)</th>
<th>Effective Size (cm²)</th>
<th>Energy Density (mW/cm²)</th>
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Power Management

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Solar Powerchip

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APPLICATIONS

INDUCTIVE LOOP VEHICLE DETECTOR, using SLMD481H12L
http://www.moru.com/

Why Inductive Loop Vehicle Detector?

We all know why we mainly used inductive loop vehicle detector for traffic signal control during last 100 years.

The typical reasons are known as

- Widely proved vehicle detect technology
- Fast reliability, detect accuracy and economy
- Easy to design the microscopic detect area
- Long life

What is NexLoop™?

NexLoop™ is upgraded inductive loop vehicle detector for next 100 years.

The main features are

- Works with traditional inductive loop vehicle detect principle
- Installable on the road surface close to the legacy loop head
- Wireless and micro-power operable with solar energy
- Eliminates troublesome lead in cable
SAMRT CROSSWALK LIGHTING SYSTEM

DAEJUN SI
SAMRT CROSSWALK LIGHTING SYSTEM

DAEJUN SI
SOLAR PAPER for York Station

Full charge of iPhone 6 in about 2.5 hours
Wireless Sensor Network for TI


TEAM MEMBERS:

- Joey Sankman

EXECUTIVE SUMMARY

A wireless sensor platform with energy harvesting for self-powered operation is presented. A new bq25504 BoosterPack is combined with the LaunchPad hub collects data from the nodes and plots it in Excel in real-time.

WHAT'S THE MOTIVATION FOR THIS PROJECT?

Recently, energy harvesting has garnered great interest in order to enable autonomous wireless sensor networks. Continual advances in RF and low-power technologies have made it feasible to implement small-form factor batteries and energy transducers for powering wireless sensors indefinitely.
Advantages of IXOLAR™ SolarBIT

IXOLAR™ SolarBIT
- can connect as many BITs to match an application
- has high mechanical robustness
- is surface mount package
- makes possible automatic pick & place mounting
- requires no hand mounting
- reflow soldering compatible
- tape & reel packaging

Why do IXOLAR™ not degrade over time like other solar technologies?
- IXOLAR™ cells are made from mono-crystalline silicon free from impurities that reduce the output voltage, current and resulting efficiency.
- In comparison polycrystalline, thin film and amorphous materials contain impurities causing an efficiency reduction of 20% in the first 10 to 100 operating hours, following an exponential function.
IXOLAR™ Product Nomenclature

- KXOB = SolarBIT
- SLMD = SolarMD
- SLUC = SolarET USB Charger
- SLFL = SolarET Flashlight
- SLBC = SolarET Battery Charger

**EXAMPLE:**

**KXOB22- 12X1F**

SolarBIT
22% cell efficiency
12 : 120mm² cell size
1 : one cell

**EXAMPLE:**

**SLMD121H10L**

SolarMD
121 : 120mm² cell size
H : 22% high cell efficiency
10 : 10 cells in series
L : film laminated encapsulation

**EXAMPLE:**

**SLUC-01-WHT**

SolarET USB Charger
01 : model #
WHT : White color
IXOLAR™ High Efficiency SolarBIT.

Description

IXOLAR™ SolarBITS are IXYS' product line of SolarBITS made of monocrystalline, high efficiency solar cells. The IXOLAR™ SolarBITS is designed for charging various battery powered and handheld consumer products such as mobile phones, cameras, RF-ID Tag, 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% measured at a wafer level, SolarBITS give 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 connecting SolarBITS flexibly in series and/or parallel to perfectly meet the application's power requirements.

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

Product and Ordering Information (Package Level)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Open Circuit Voltage</th>
<th>Short Circuit Current</th>
<th>TYP Voltage</th>
<th>TYP Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>KXOB22-04X3F</td>
<td>1.80</td>
<td>15</td>
<td>1.50</td>
<td>13.30</td>
</tr>
</tbody>
</table>

(parameters given are typical values)

Dimensions L x W x H: 22 x 7 x 1.8 [mm]

SolarBITS Weight: 0.5 grams

SolarBITS are compliant to the RoHS Norm.

Electrical Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Cell Parameter</th>
<th>Typical</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voc</td>
<td>open circuit voltage</td>
<td>1.80</td>
<td>V</td>
</tr>
<tr>
<td>Jsc</td>
<td>short circuit current density (water level)</td>
<td>42.4</td>
<td>mA/cm²</td>
</tr>
<tr>
<td>Vmp</td>
<td>voltage at max power point</td>
<td>1.50</td>
<td>V</td>
</tr>
<tr>
<td>Isc</td>
<td>current density at max power point (water level)</td>
<td>37.2</td>
<td>mA/cm²</td>
</tr>
<tr>
<td>Pmp</td>
<td>maximum peak power (water level)</td>
<td>16.8</td>
<td>mW/cm²</td>
</tr>
<tr>
<td>FF</td>
<td>fill factor</td>
<td>&gt; 65</td>
<td>%</td>
</tr>
<tr>
<td>Tj</td>
<td>solar cell efficiency (water level)</td>
<td>32</td>
<td>%</td>
</tr>
<tr>
<td>ΔVxST</td>
<td>open circuit voltage, coefficient (water level)</td>
<td>-2.1</td>
<td>mV/K</td>
</tr>
<tr>
<td>ΔJxST</td>
<td>short circuit current, coefficient (water level)</td>
<td>0.12</td>
<td>mA/cm²</td>
</tr>
</tbody>
</table>

* All values measured at Standard Condition: 1 sun (~ 100 milliwatt), Air Mass 1.5, 25°C

Features

- Monocrystalline silicon technology
- High efficiency outdoor and indoor
- Long life and stable output
- Sealed Package
- High mechanical robustness
- Surface Mount Package
- RoHS Compliant

Applications

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

Advantages

- Automatic Pick & Place Mounting
- One Product for Multiple Applications
- Flexible integration into the Application
North and South AMERICA :
MARKETING : Steve Krausse, IXYS COLORADO
SALES : Ray Segall, IXYS LONGBEACH

EUROPE and Middle EAST :
Sales & Marketing : Nick Tarling, Neil Lejeune, Manuel Nardiello, Ludo Thijssens, Harry Van Turnhout

ASIA :
Sales & Marketing : Eric Choi, IXYS KOREA
IXOLAR™ Solar Products are Monocrystalline Silicon resulting in:

- Higher Efficiency over Thin Film, Amorphous or Polycrystalline Cells
  - Typically 20% more efficient and higher current density for same surface area
  - IXOLAR™ is the most efficient in small SolarBIT and SolarMD applications

- Conversion of a Wider Frequency Range of Light
  - Provides usability under most lighting conditions
  - Indoors and outdoors
  - Incandescent, fluorescent, etc.

- Consistent Performance Over Time
  - No degradation of power output
  - No loss of frequency response

- Extended Industrial Temperature Range

- Higher Reliability / Longer Life