by IXYS Korea

Main Products
- IXOLAR™ SolarBIT
- IXOLAR™ SolarMD
- IXOLAR™ SolarET

Typical Applications
Sales and Marketing
GLOBAL FOOTPRINT

IXYS R&D, Manufacturing, Sales & Distribution
External Foundries

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
IXOLAR™ BIT/MD Technology Roadmap

KXOB22-12X1F
SLMD121H04L
SLMD121H09L
SLMD960H12L
SLMD481H10L

Solar Bit

KXOB22-04X3F
KXOB22-01X8F

Solar Module

SLMD121H04L, SLMD121H06L, SLMD121H08L, SLMD121H09L, SLMD121H10L, SLMD360H10L, SLMD480H12L, SLMD600H10L, SLMD720H12L, SLMD860H12L, SLMD481H08L, SLMD481H10L, SLMD481H12L
SLMD121H02F, SLMD121H05F, SLMD121H08F, SLMD321H09F

Film Lamination: 2mm

Thin Film Lamination: less than 1.2mm

Technology

Large Module (Above 1W):
SLMD242H10L

Indoor Solar Module

General

IXOLAR™ High Efficiency Bits & Modules, and Customized Module Configuration

2014  2015  2016  2017
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

SLBC-01

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

m

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

General

Portable Solar Electronics combined with IXOLAR™ High Efficiency Module, LED, and Li-Battery

Downloaded from Arrow.com.
## PRODUCTS: IXOLAR™ BIT & MODULE

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Unit</th>
<th>IXOLAR™ High Efficiency SolarBIT</th>
<th>IXOLAR™ High Efficiency SolarMD</th>
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<td>KXOB22-04X3F</td>
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<tr>
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<td>mW</td>
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<td>4. Vmax</td>
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<td>8. Cell Efficiency</td>
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<td>9. ΔVOC/ΔT</td>
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<td>13. Cells in series</td>
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<td>a</td>
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<td>15. Pack quantity</td>
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<td>20/tube</td>
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<td>18. Datasheet</td>
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*) Please note, all values measured at Standard Condition: 1 sun (= 100 mW/cm²), Air Mass 1.5, 25°C
### IXOLAR™ High Efficiency SolarMD

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<tr>
<th>Symbol</th>
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<th>SLMD720H12L</th>
<th>SLMD860H12L</th>
<th>SLMD960H09L (SLMD4235)</th>
<th>SLMD121H10L</th>
<th>SLMD321H09L</th>
<th>SLMD481H08L</th>
<th>SLMD481H10L</th>
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<td>ΔVOC/ΔT</td>
<td>mV/K</td>
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<td>-2.10</td>
<td>-2.10</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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</tbody>
</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>
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<td>mA</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>
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<td>12.00</td>
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</tbody>
</table>

**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:

<table>
<thead>
<tr>
<th>Symbol (unit)</th>
<th>SLMD121H04L</th>
<th>SLMD121H08L</th>
<th>SLMD121H09L</th>
<th>SLMD960H12L</th>
<th>SLMD480H12L</th>
<th>SLMD121H10L</th>
<th>SLMD600H10L</th>
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<td>480.00</td>
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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**

**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 2AAs, 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.
ETC: Electronic Toll Collection, using SLMD960H12L
SEOUL COMMUNICATIONS (a part of SAMSUNG): [http://www.samsungnavi.co.kr/](http://www.samsungnavi.co.kr/)
AIRPOINT: [http://www.airpoint.co.kr/](http://www.airpoint.co.kr/)
ITRONICS: [http://www.itronics.co.kr/](http://www.itronics.co.kr/)
Energy Harvesting, using KXOB22-12X1F

http://www.corechips.co.kr/

Energy harvesting

<table>
<thead>
<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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<tbody>
<tr>
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<td>400</td>
<td>0.08</td>
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<td>60</td>
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<td>21.3</td>
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<td>Strain Energy (Flexible PIIoO-Patch®)</td>
<td>3.59</td>
<td>8.3</td>
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Power Management

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<th>Specification</th>
<th>Remark</th>
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<td>Solar Powerchip</td>
<td>Solar: 충전 광량 : 10,000 lux 이상  크기 : 31 X 31 X 4.7mm  출력 power : <a href="mailto:0.5mA@3.9V">0.5mA@3.9V</a></td>
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</tbody>
</table>

Monitoring: Energy harvesting voltage/current, Stored voltage, Load voltage/current

Input source: AC/DC Energy harvesting
gSensor measurement and analysis
Wireless sensor data display and logging
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
- Best reliability, detect accuracy and economy
- Free 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
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 to collect data from the nodes and plot 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 technology make 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:**

**KXOB**22- 12X1F

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

**EXAMPLE:**

**SLMD**121H10L

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

Downloaded from Arrow.com.
IXOLAR™ High Efficiency SolarBIT.

Description
IXOLAR™ SolarBITs are IXYS' product line of SolarBITs made of monocrystalline, high efficiency solar cells. The IXOLAR™ SolarBITs is an ideal 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 [V]</th>
<th>Short Circuit Current [mA]</th>
<th>Typ Voltage @ Pmax [V]</th>
<th>Typ Current @ Pmax [mA]</th>
</tr>
</thead>
<tbody>
<tr>
<td>KXOB22-04X3F</td>
<td>1.89</td>
<td>15</td>
<td>1.50</td>
<td>13.38</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 Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voc</td>
<td>open circuit voltage</td>
<td>1.89 V</td>
</tr>
<tr>
<td>Jsc</td>
<td>short circuit current density (water-exposed)</td>
<td>42.4 mA/cm²</td>
</tr>
<tr>
<td>Vmp</td>
<td>voltage at max power point</td>
<td>1.50 V</td>
</tr>
<tr>
<td>Isup</td>
<td>current density at maximum power point (water-exposed)</td>
<td>37.2 mA/cm²</td>
</tr>
<tr>
<td>Pmp</td>
<td>maximum peak power (water-exposed)</td>
<td>18.6 mW/cm²</td>
</tr>
<tr>
<td>FF</td>
<td>fill factor</td>
<td>&gt; 60 %</td>
</tr>
<tr>
<td>fsc</td>
<td>solar cell efficiency (water-exposed)</td>
<td>32 %</td>
</tr>
<tr>
<td>ΔVmp/ΔT</td>
<td>open circuit voltage temp. coefficient (water-exposed)</td>
<td>-2.1 mV/K</td>
</tr>
<tr>
<td>ΔJsc/ΔT</td>
<td>short circuit current temp. coefficient (water-exposed)</td>
<td>0.12 mA/(V*K)</td>
</tr>
</tbody>
</table>

* All values measured at Standard Condition: 1 sun (100 mW/cm²), 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
- Retrofit Solareables

Applications
- Battery charger for portable devices such as cell phones, PDAs, GPS Systems, etc.
- "Green" electricity generation
- Power backup for UPS, Sensors, Wearables

Advantages
- Automatic Pick & Place Mounting
- One Product for Multiple Applications
- Flexible integration into the application

IXYS reserves the right to change limits, test conditions and dimensions. © 2010 IXYS. All rights reserved.
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