



by IXYS Korea

Main Products

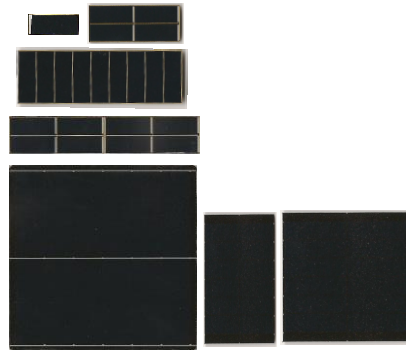
IXOLAR™ SolarBIT

IXOLAR™ SolarMD

IXOLAR™ SolarET

Typical Applications

Sales and Marketing

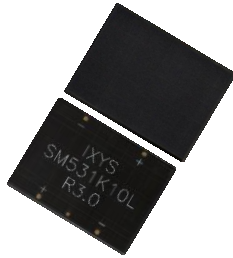
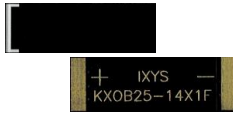


GLOBAL FOOTPRINT



Products

High Efficiency Solar Cell 25%
Monocrystalline Silicon



IXYS SOLAR



IXOLAR™ SolarBIT

- Surface Mountable
- Reflow Solderable
- Film Laminated Encapsulation
- Form Factor : 23mm x 8mm x 1.8mm

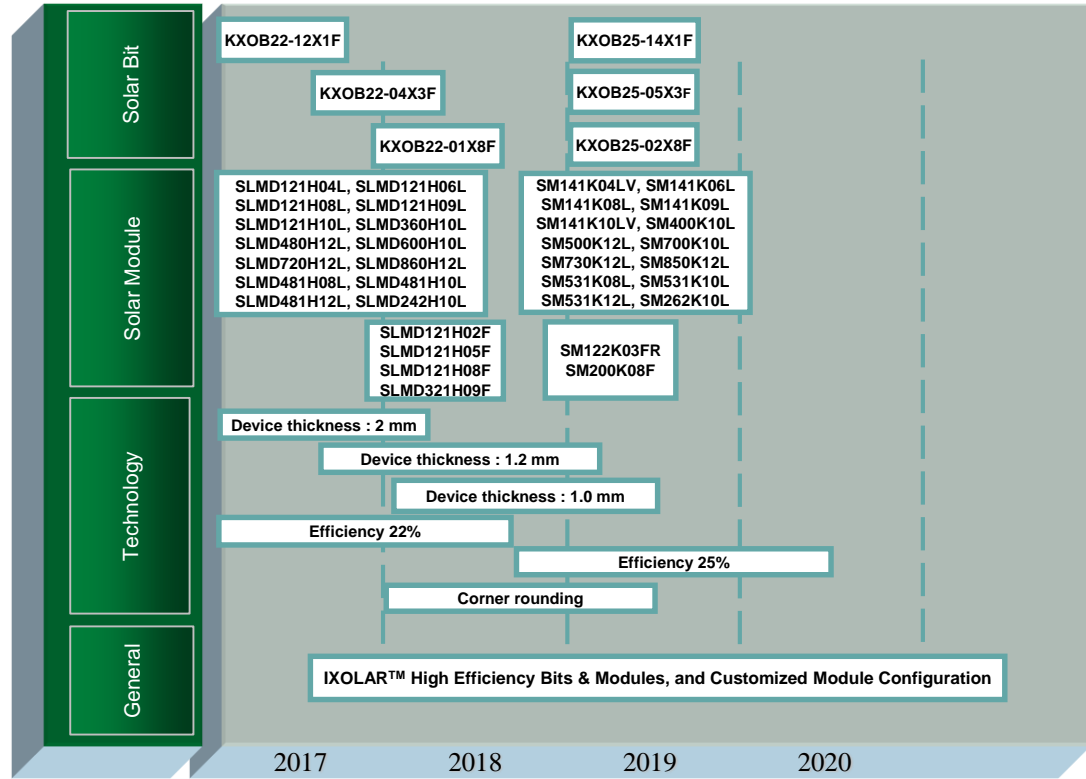
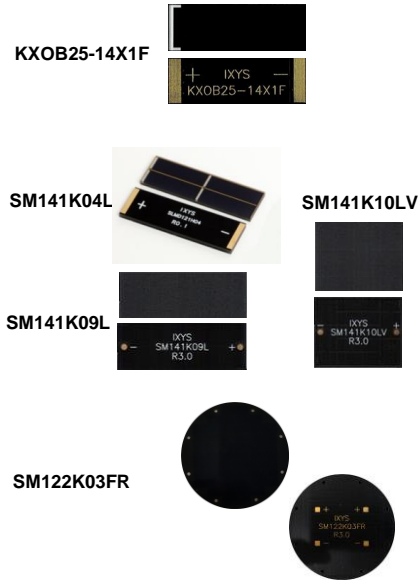
IXOLAR™ SolarMD

- 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

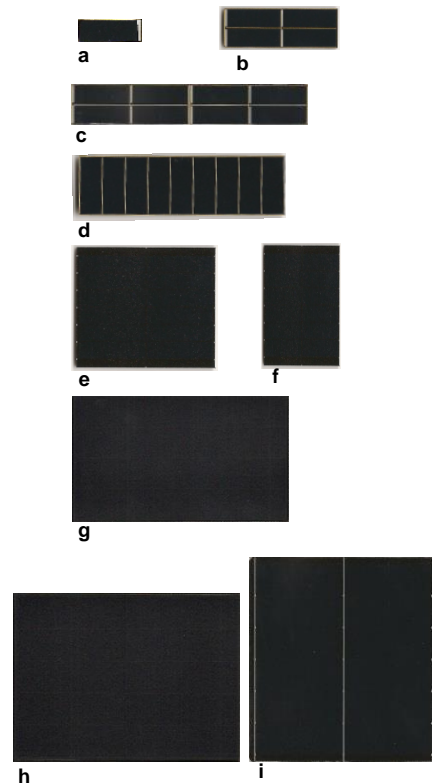
IXOLAR BIT/MD Technology Roadmap



Products : IXOLAR™ BIT&MODULE

SYMBOL	Unit	IXOLAR™ High Efficiency SolarBIT			IXOLAR™ High Efficiency SolarMD			
		KXOB25-14X1F	KXOB25-05X3F	KXOB25-02X8F	SM141K04L	SM141K04LV	SM141K06L	SM141K06LV
1.Voc	V	0.69	2.07	5.53	2.76	2.76	4.15	4.15
2.Isc	mA	58.6	19.5	6.3	58.6	58.6	58.6	58.6
3.Pmax	mW	30.7	30.7	26.3	122.9	122.9	184.4	184.4
4.Vmax	V	0.56	1.67	4.46	2.23	2.23	3.35	3.35
5.Imax	mA	55.0	18.4	5.9	55.1	55.1	55.1	55.1
6.Jsc	mA/cm ²	41.4	41.4	41.4	41.4	41.4	41.4	41.4
7.Fill Factor	%	>70	> 70	> 60	> 70	> 70	> 70	> 70
8.Cell Efficiency	%	25.0	25.0	25.0	25.0	25.0	25.0	25.0
9.ΔVOC/ΔT	mV/K	-1.74	-5.22	-13.92	-7.0	-7.0	-10.4	-10.4
10.ΔJSC/ΔT	mA/(cm ² K)	0.0265	0.0088	0.0028	0.0265	0.0265	0.0265	0.0265
11.Dimensions	mm(LxWxH)	23x8x1.8	23x8x1.8	23x8x1.8	29x23x1.8	45x15x1.8	42x23x1.8	45x22x1.8
12.Unit cell size	mm(LxW)	21.5x6.59	7.2x6.59	5.4x2.83	21.5x6.59	21.5x6.59	21.5x6.59	21.5x6.59
13.Cells in series	cells	1	3	8	4	4	6	6
14.Package	-	a	a	a	b	b	b	b
15.Pack quantity	-	20/tube	20/tube	20/tube	40/blister	50/blister	20/blister	20/blister
16.Weight	grams	0.5	0.5	0.5	2.5	3.5	5.0	5.5
17.Unit cell area	mm ² (LxW)	142.00	47.00	15.28	120.00	120.00	120.00	120.00
18.Datasheet	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes

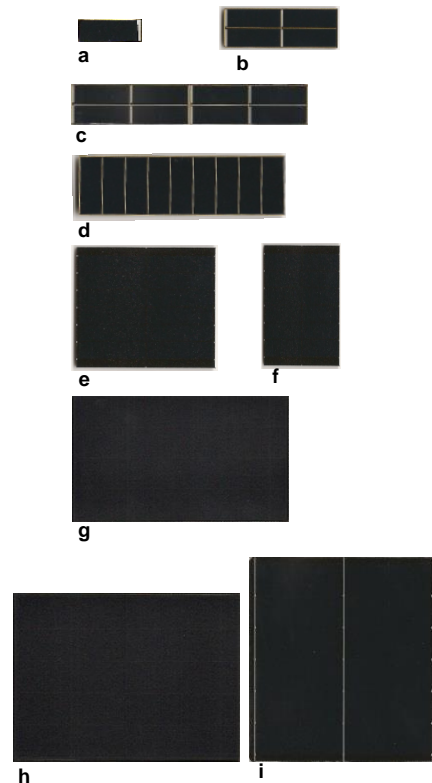
*) Please note, all values measured at Standard Condition: 1 sun (= 100 mW/cm²), Air Mass 1.5, 25°C



Products : IXOLAR™ BIT&MODULE

Symbol	Unit	IXOLAR™ High Efficiency SolarMD							
		SM141K08L	SM141K08LV	SM141K09L	SM141K10L	SM141K10LV	SM400K10L	SM500K12L	SM700K10L
1.Voc	V	5.53	5.53	6.22	6.91	6.91	6.91	8.29	6.91
2.Isc	mA	58.6	58.6	58.6	58.6	58.6	16.4	21.0	29.5
3.Pmax	mW	245.8	245.8	276.5	307.3	307.3	85.7	132.3	154.3
4.Vmax	V	4.46	4.46	5.02	5.58	5.58	5.58	6.70	5.58
5.Imax	mA	55.1	55.1	55.1	55.1	55.1	15.4	19.8	27.7
6.Jsc	mA/cm ²	41.4	41.4	41.4	41.4	41.4	41.4	41.4	41.4
7.Fill Factor	%	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70
8.Cell Efficiency	%	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
9.ΔVOC/ΔT	mV/K	-13.9	-13.9	-15.7	-17.4	-17.4	-17.4	-20.9	-17.4
10.ΔJSC/ΔT	mA/(cm ² K)	0.0265	0.0265	0.0265	0.0265	0.0265	0.0074	0.0095	0.0133
11.Dimensions	mm(LxWxH)	88x15x1.8	45x29x1.8	63x23x1.8	70x23x1.8	45x36x1.8	33x15x1.8	24x32x1.8	24x36x1.8
12.Unit cell size	mm(LxW)	21.5x6.59	21.5x6.59	21.5x6.59	21.5x6.59	21.5x6.59	21.5x6.59	21.5x6.59	21.5x6.59
13.Cells in series	cells	8	8	9	10	10	6	6	6
14.Package	-	c	b	d	e	e	b	f	f
15.Pack quantity	-	20/blister	20/blister	20/blister	20/blister	25/blister	50/blister	50/blister	50/blister
16.Weight	grams	5.0	5.0	5.0	5.0	5.0	2.0	5.5	5.5
17.Unit cell area	mm ² (LxW)	120.00	47.00	47.00	47.00	47.00	120.00	120.00	120.00
18.Datasheet	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

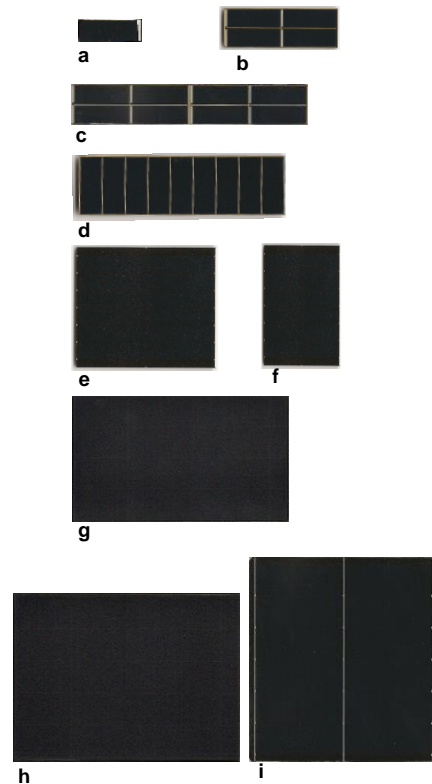
*) Please note, all values measured at Standard Condition: 1 sun (= 100 mW/cm²), Air Mass 1.5, 25°C



Products : IXOLAR™ BIT&MODULE

Symbol	Unit	IXOLAR™ High Efficiency SolarMD							
		SM730K12L	SM850K12L	SM101K09L	SM101K12L	SM351K09L	SM531K08L	SM531K10L	SM531K12L
1.Voc	V	8.29	8.29	6.22	8.29	6.22	5.53	6.91	8.29
2.Isc	mA	30.0	35.1	41.9	41.9	147.3	217.8	217.8	217.8
3.Pmax	mW	188.6	220.5	197.5	263.4	694.6	913.0	1141.3	1369.5
4.Vmax	V	6.70	6.70	5.02	6.70	5.02	4.46	5.58	6.70
5.Imax	mA	28.2	32.9	39.3	39.3	138.3	204.5	204.5	204.5
6.Jsc	mA/cm ²	41.4	41.4	41.4	41.4	41.4	41.4	41.4	41.4
7.Fill Factor	%	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70
8.Cell Efficiency	%	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
9.ΔVOC/ΔT	mV/K	-20.9	-20.9	-15.7	-20.9	-15.7	-13.9	-17.4	-20.9
10.ΔJSC/ΔT	mA/(cm ² K)	0.0136	0.0159	0.0189	0.0189	0.0666	0.0985	0.0985	0.0985
11.Dimensions	mm(LxWxH)	33x32x1.8	38.5x33x1.8	47x23x1.8	45x32x1.8	57x64x1.8	89x52x1.8	89x65x1.8	89x77x1.8
12.Unit cell size	mm(LxW)	15.4x4.71	18.0x4.71	21.5x4.71	21.5x4.71	21.5x6.59	6.0x6.59	10.8x4.71	10.8x6.59
13.Cells in series	cells	12	12	9	12	9	8	10	12
14.Package	-	e	e	d	e	h	g	h	i
15.Pack quantity	-	25/blister	25/blister	20/blister	20/blister	bulk	bulk	bulk	bulk
16.Weight	grams	4.5	4.5	5.5	6.0	12.0	16.0	18.0	20.0
17.Unit cell area	mm ² (LxW)	73.00	85.00	101.00	101.00	142.00	40.00	51.00	71.00
18.Datasheet	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*) 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

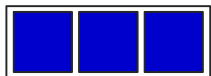


SLFL-IX-BLK



SLUC-01-WHT

IXOLAR™ : Solar BIT



SolarBIT

- KXOB25-14X1F : a single cell
- KXOB25-05X3F : 3 cells in series
- KXOB25-02X8F : 8 cells in series

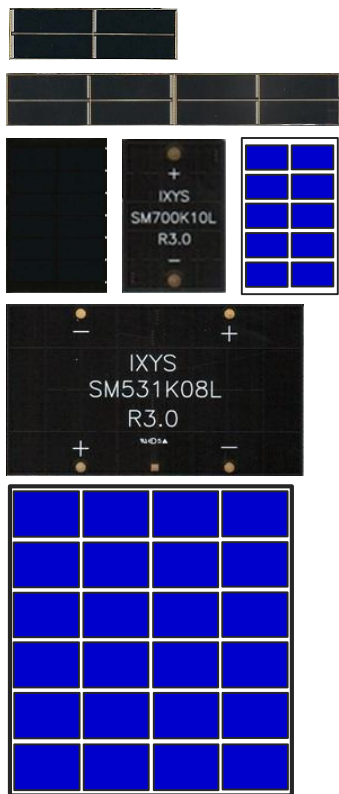
SPECIFICATIONS:

Symbol	Unit	KXOB25-14X1F	KXOB25-05X3F	KXOB25-02X8F
Voc	V	0.69	2.07	5.53
Isc	mA	58.6	19.5	6.3
Pmax	mW	30.7	30.7	26.3
Vmax	V	0.56	1.67	4.46
Imax	mA	55.0	18.4	5.9
Dimensions	mm(LxWxH)	23x8x1.8	23x8x1.8	23x8x1.8
Unit cell area	mm ² (LxW)	141.68	47.45	15.28

APPLICATIONS:

- Battery chargers for various kinds of sensors, Asset trackers, and IoT applications
- Energy harvesting
- Power backup for sensors, wearables, Nanonet, Bluetooth, Wi-Fi etc.

IXOLAR™ : SolarMD



SolarMD (Examples)

- SM141K04LV : 21.5mm x 6.59mm by 4S
- SM141K08L : 21.5mm x 6.59mm by 8S
- SM700K10L : 10.8mm x 6.59mm by 10S
- SM531K12L : 21.5mm x12.25mm x 2P by 12S

SPECIFICATIONS:

Symbol (unit)	SM141K06L	SM141K08L	SM141K09L	SM141K10L	SM700K10L	SM500K12L	SM101K12L	SM531K08L	SM531K10L	SM531K12L
Voc (V)	4.15	5.53	6.22	6.91	6.91	8.29	8.29	5.53	6.91	8.29
Isc (mA)	58.6	58.6	58.6	58.6	29.5	21.0	41.9	217.8	217.8	217.8
Pmax (mW)	184.4	245.8	276.5	307.3	154.3	132.3	263.4	913.0	1141.3	1369.5
Vmax (V)	3.35	4.46	5.02	5.58	5.58	6.70	6.70	4.46	5.58	6.70
Imax (A)	55.1	55.1	55.1	55.1	27.7	19.8	39.3	204.5	204.5	204.5
Dimensions (mm)	42x23x1.8	88x15x1.8	63x23x1.8	45x36x1.8	24x36x1.8	24x32x1.8	45x32x1.8	89x52x1.8	89x65x1.8	89x77x1.8
Unit cell area (mm ²)	141.68	141.68	141.68	141.68	71.17	50.87	101.26	263.37	263.37	263.37

APPLICATIONS:

- Battery chargers such as sensors, asset trackers, IoTs, ETCs, cell phones, MP3-players, PDAs etc.
- Emergency backup charging, Energy harvesting, Inductive Loop Vehicle Detection
- Power backup for wireless sensors, GPS, wearables

Typical Application

- **Wireless / Remote Sensors**
 - Blue tooth
 - Wi-Fi
 - NANONET
- **Light Sensors**
 - Light intensity measurement
 - Light spectrum analysis
- **IoTs**
 - Container asset tracking
 - Farm animal eartags : sheeps, cattles etc.
 - Equipment asset tracking
 - RFID tags
- **Portable Electronics such as:**
 - ETCs
 - Cell Phones
 - Automotive Keypads
 - Sport watches
- **Mobile Medical Systems**
- ***... any application where extending battery life is a benefit.***

Markets

ETC : Electronic Toll Collection, using SLMD4235

MPEON(a part of SAMSUNG): <http://www.samsunghavi.co.kr/>

ITRONICS: <http://www.itronics.co.kr/>



Markets

Energy Harvesting, using KXOB22-12X1F

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

Hybrid Energy Harvesting Chip

No external power supply
Energy sources : Piezoelectric, Electromagnetic, Thermoelectric, indoor solar cell, Microwave, Electrostatic
Input voltage : 1.1V ~ 1kV, Consumption current : under 11uA
Voltage regulation : 3.3V(Fixed)/5.0V(Fixed)/3.0V~5.5V(Adj.)

Power Management / Monitoring

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

Energy harvesting

Energy Harvesting Source	Converted Energy (mW)	Frequency (Hz)	Effective Size (cm ²)	Energy Density (mW/cm ²)
Impact Energy	32	2	400	0.08
Vibration Energy	1.7	60	0.08	21.3
Strain Energy (Flexible Piezo Patch®)	3.59	8.3	0.22	16.3
Power Management	Specification			Remark
PowerManagement Chip	입력 전압 : 4.5~5.5V 크기 : 31 X 31 X 3mm	총전 전류 : 2mA 출력 power : 0.5mA@3.9V Regulating, 음방전 보호, 정전압출력		GS Caltech/ GSNanoTech 백박전자용 중앙 전 최보통합 패키 지 ODM 개발
Solar Powerchip	Solar 총전 광량 : 10,000 lux 이상 크기 : 31 X 31 X 4.7mm	출력 power : 0.5mA@3.9V		

Markets


INDUCTIVE LOOP VEHICLE DETECTOR, using SLMD481H12L

<http://www.moru.com/>

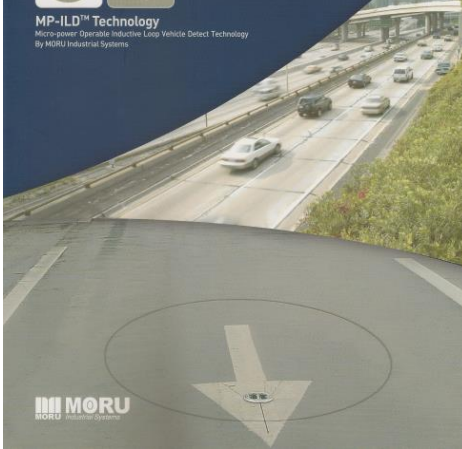
World Best NexLoop™ is Next Generation Loop Detector

NexLoop™

MP-ILD™ Technology based
Wireless Inductive Loop Vehicle Detector

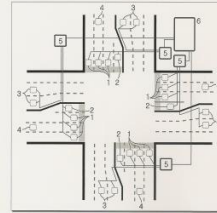


MP-ILD™ Technology
Micro-power Operable Inductive Loop Vehicle Detect Technology
By MORU Industrial Systems



MORU Industrial Systems

Why Inductive Loop Vehicle Detector?

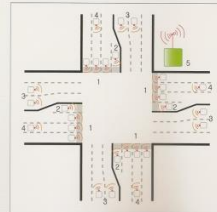


We all know why we mainly used inductive loop vehicle detector for traffic signal control during last 100 years.

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



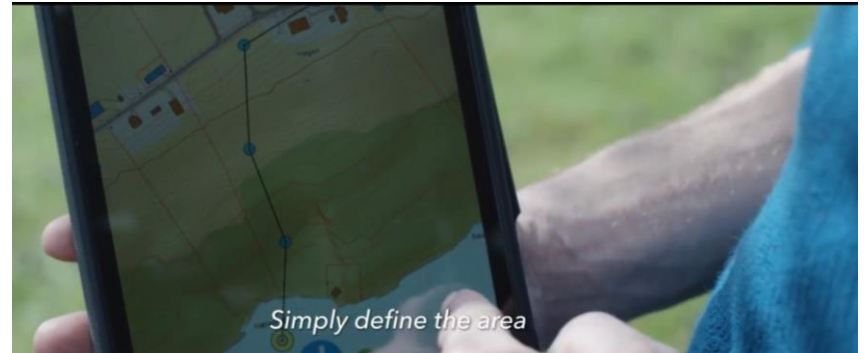
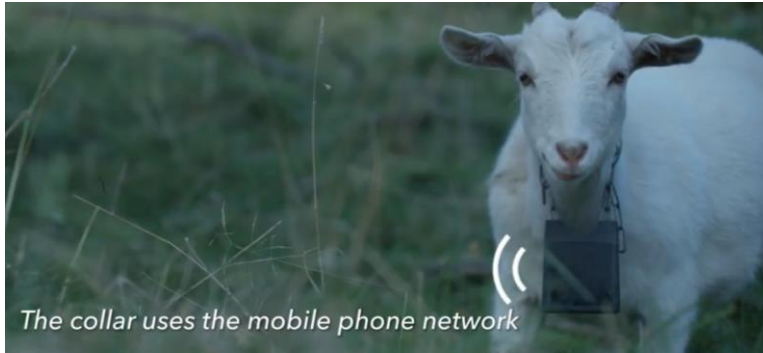
Markets

SMART CROSSWALK LIGHTING SYSTEM



Markets

Virtual fence for animal



Markets

Container asset tracker



Markets

Animal tracker



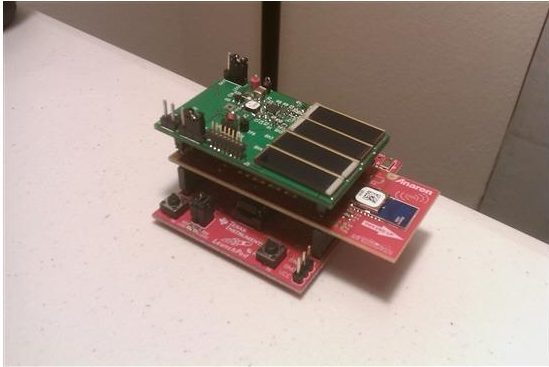
Markets

SOLAR PAPER for York Station



Wireless Sensor Network for TI

Wireless Sensor Network + bq25504 Energy Harvesting BoosterPack for LaunchPad



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. A 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 such that it is feasible to implement small-form factor batteries and energy transducers for powering wireless sensors indefinitely.

Advantages of IXOLAR™

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 monocrystalline 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
- SM = SolarMD
- SLUC =SolarET USB Charger
- SLFL = SolarET Flashlight
- SLBC = SolarET Battery Charger

EXAMPLE:

KXOB25- 14X1F

SolarBIT

25% cell efficiency

14 : 141mm² cell size

1 : one cell

EXAMPLE:

SM141K10L

SolarMD

141 : 141mm² cell size

K : 25% high cell efficiency

10 : 10 cells in series

L : film laminated encapsulation

IXOLAR™ Datasheet

IXYS

Preliminary

KXOB25-14X1F

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 25% 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)

Part Number	Open Circuit Voltage [V]	Short Circuit Current [mA]	Typ. Voltage @ P_{max} [V]	Typ. Current @ P_{max} [mA]
KXOB25-14X1F	0.69	58.8	0.56	55.0

(Parameters given are typical values)

Dimensions (L x W x H): 23 x 8 x 1.8 [mm]

SolarBITs Weight: 0.5 grams

Storage Temperature: -40°C ~ +90°C

Operation Temperature: -40°C ~ +80°C

SolarBITs are compliant to the RoHS Norm.

Electrical Characteristics

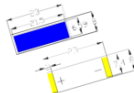
Symbol	Cell Parameter	Typical Ratings *	Units
V_{oc}	open circuit voltage	600	mV
I_{sc}	short circuit current	58.8	mA
V_{mp}	voltage at max. power point	560	mV
I_{mp}	current at max. power point	55.0	mA
P_{mp}	maximum peak power	30.7	mW
FF	fill factor	> 70	%
η	solar cell efficiency	25	%
$\Delta V_{oc}/\Delta T$	open circuit voltage temp. coefficient	-1.7	mV/K
$\Delta I_{sc}/\Delta T$	short circuit current temp. coefficient	25.5	uA/K

* All values measured at standard condition: 1 sun (= 100 mW/cm²), Air Mass 1.5, 25°C

IXYS reserves the right to change limits, test conditions and dimensions
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 Rev. July 2018

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Features

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

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

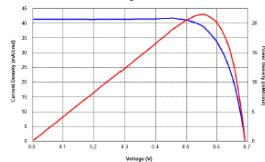
IXYS

Preliminary

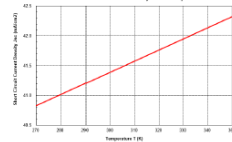
KXOB25-14X1F

Typical SolarBIT Performance Data

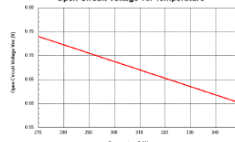
Current-Voltage Characteristics



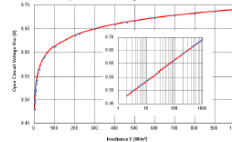
Short Circuit Current Density vs. Temperature



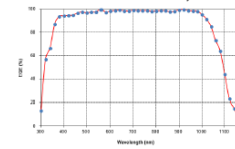
Open Circuit Voltage vs. Temperature



Open Circuit Voltage vs. Irradiance



External Quantum Efficiency



IXYS reserves the right to change limits, test conditions and dimensions
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 Rev. July 2018

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Summary

IXOLAR™ Solar Products are Monocrystalline Silicon *resulting in:*

- **Higher Efficiency over Thin Film, Amorphous or Polycrystalline Cells**
 - Typically 20%-40% 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**

