

# IXYS Solar Products

June 2019 – Issue 4

## *Harnessing energy has taken on a new dimension*

Over the past eighteen years, IXYS has been actively involved in the renewable energy industry, providing innovative and progressive solar solutions

Our range of energy efficient SolarBIT's and SolarMD modules are manufactured using monocrystalline silicon, making them typically 20% more efficient than other types of solar cells and operable in a wider spectral sensitivity range

IXYS can provide solar cells for applications such as battery chargers, RFID tagging applications, wireless sensors, smoke detectors and much more



## Applications



- Battery chargers for portables such as mobile phones, MP3 players, PDA's and toys
- Energy harvesting
- Inductive loop vehicle detection
- Power backup for wireless sensors



**Manufactured using monocrystalline silicon resulting in:**

- Higher efficiency than thin-film, amorphous or polycrystalline cells (typically 20% more efficient)
- Conversion of a wider light frequency range
- Consistent performance over time
- Extended industrial temperature range
- Higher reliability and longer life



## IXOLAR™ Solar Technology



Solar panels develop electricity in DC voltage which is different than the electrical utility grid network (AC energy). Inverters serve as the gateway between renewable energy resources and the AC electrical grid (specific voltage/frequency). IXYS supplies power semiconductor chips to the inverter - ensuring that DC-AC voltage conversion is controlled without power surges or outages. IXYS has one of the only chips able to control / regulate high voltages

IXYS also provides solar cells for applications where the cost of electricity is highest - the battery. The solar cell handles direct charging of and providing electricity for portable batteries in myriad applications, ranging from traditional alkaline battery recharging to battery charging for laptops and cell phones to RFID tagging, wireless sensors, test equipment and smoke detectors. IXYS is truly a pioneer in this industry, as no other company has a similar product on the market.

### Solar Cell Types

There are three main types of solar cell material, each with its own properties that make it unique. The following cost and performance trade-offs should be considered when comparing various solar cell materials:

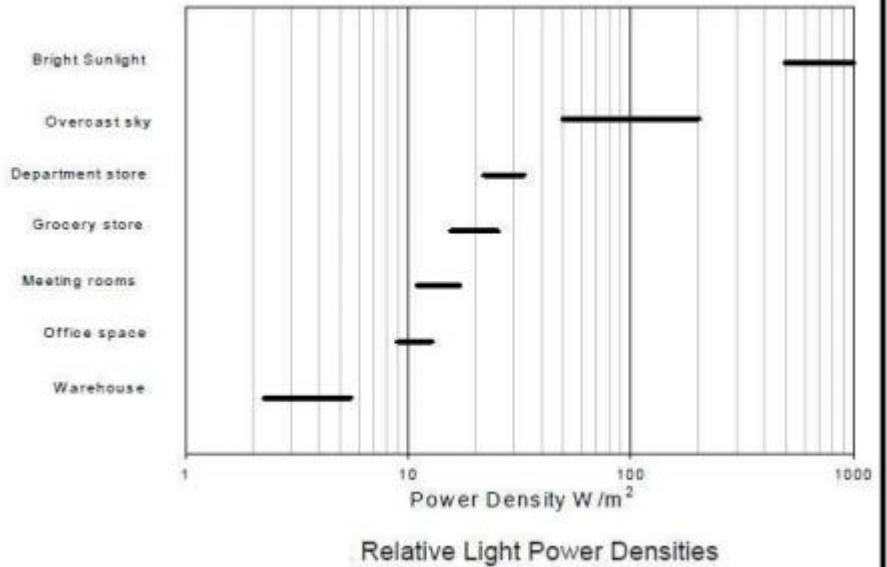
Polycrystalline cells are commonly found in outdoor applications and have a spectral sensitivity range of 500nm to 1100nm. They're in the medium price range and typically offer a 13% power conversion efficiency.

Monocrystalline cells, such as the IXOLAR™ SolarBIT's and SolarMD's, have a spectral sensitivity range from 300nm (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 18 to 25%. The surface of these cells is a homogenous dark blue or dark grey.

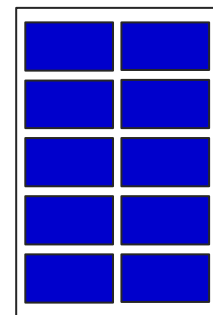
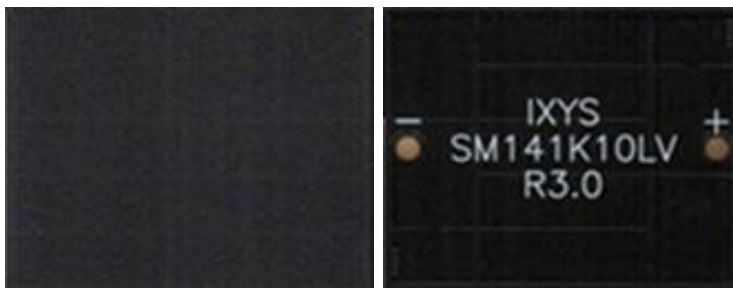
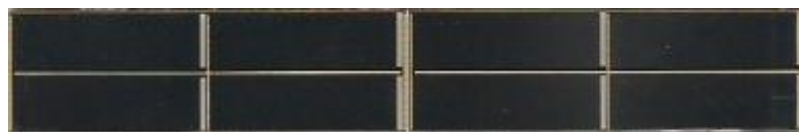
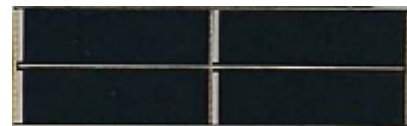
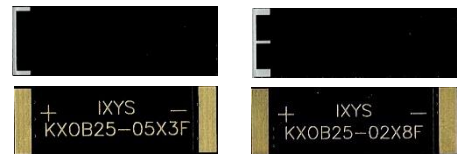
Finally, amorphous cells, which work in the spectral range of 300nm to 600nm, are used predominantly indoors in products such as solar powered calculators since they are not sensitive to the upper light spectrum and cannot take advantage of natural sunlight. They offer about 5% power conversion efficiency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

### Relative Lighting Power Density

The figure opposite compares relative power density for various lighting conditions in units of Watts per square meter ( $W/m^2$ ). 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.



## IXOLAR™ SolarBIT

SolarBIT's are monocrystalline, high-efficiency solar cells in a surface mount package. They're robust and can be used in harsh environments. SolarBIT's have a very high (25%) power conversion efficiency, which means that 25% 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.

With a cell efficiency of typically 25% measured at wafer level, SolarBIT's give the ability to extend run time even in 'low light' conditions, 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 SolarBIT's flexibly in series and/or parallel to perfectly meet the applications power requirement.

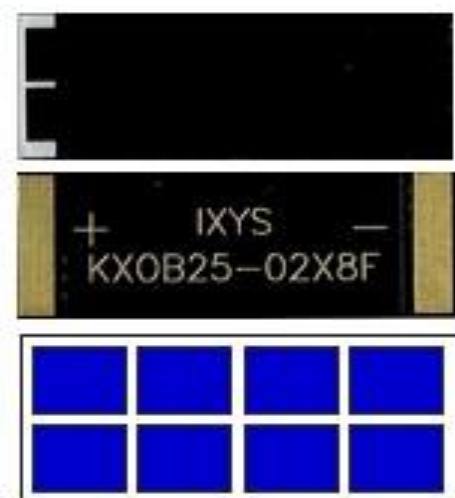
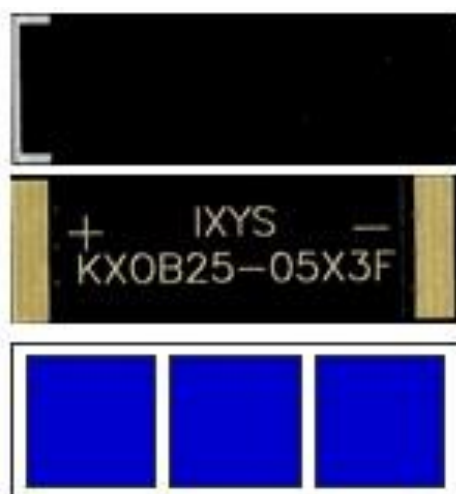
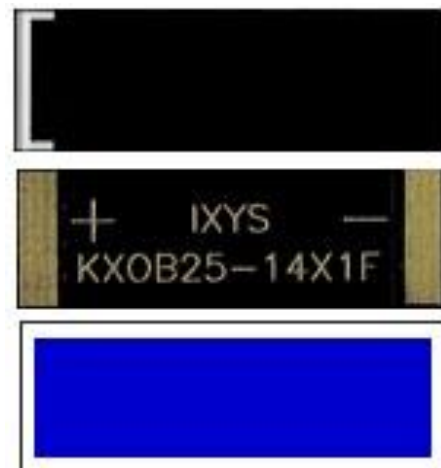
### KXOB25-14X1F – Single cell SolarBIT

### KXOB25-05X3F – 3-cell SolarBIT

### KXOB25-02X8F – 8-cell SolarBIT

#### Features and benefits

- Surface mount solderable device SMD
- Suitable for automatic pick-and-place
- Furnace reflow solderable
- Film laminated encapsulation
- Form factor – 23mm × 8mm × 1.8mm



## IXOLAR™ SolarBIT

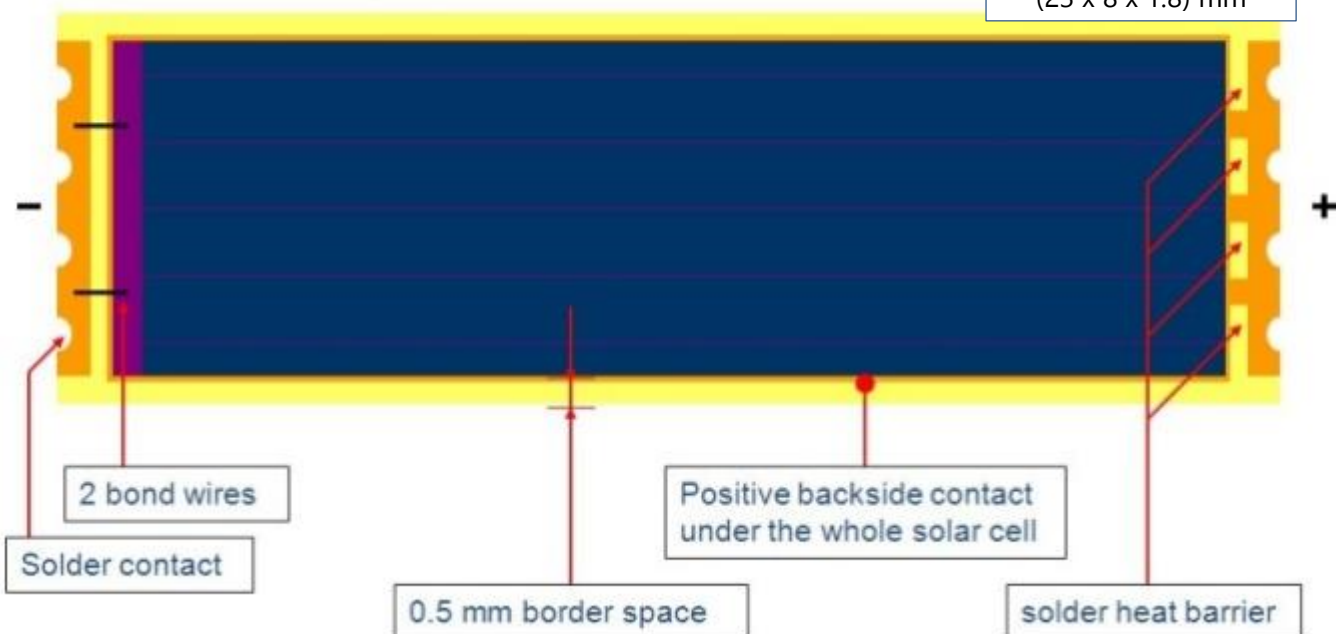
Part	Open circuit voltage Voc V	Short circuit current Isc mA	Max. output power P <sub>MAX</sub> mW	Max. output voltage V <sub>MAX</sub> V	Max. output current I <sub>MAX</sub> mA	Cell Area (LxW) mm <sup>2</sup>	Recommended MPPT IC
KXOB25-14X1F	0.69	58.60	30.70	0.56	55.00	142	BQ25504,05,70
KXOB25-05X3F	2.07	19.50	30.70	1.67	18.4	47	BQ25504,05,70
KXOB25-02X8F	5.53	6.30	26.30	4.46	5.90	15	BQ25504,05,70



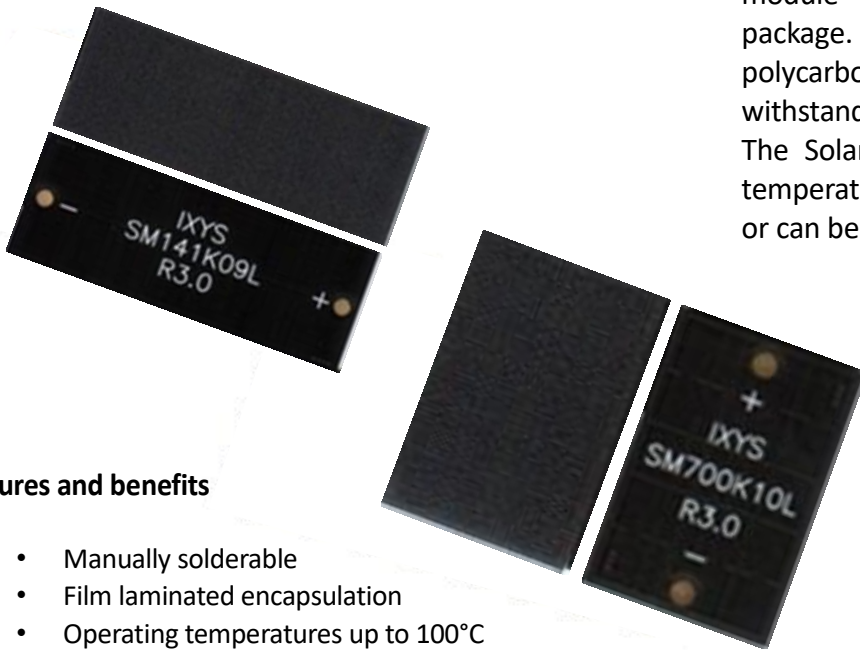
### Advantages of IXOLAR™ SolarBIT's

- Connect as many bits as required for application
- High mechanical robustness
- Surface mount package
- Can be used in automatic pick and place machines
- Requires no hand mounting
- Reflow soldering compatible
- Tape and reel packaging

Dimensions:(to scale)  
(23 x 8 x 1.8) mm



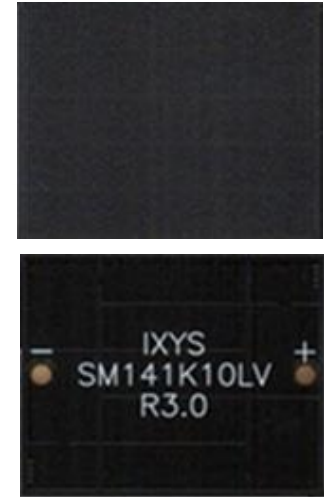
## IXOLAR™ SolarMD module



The IXOLAR Solar MD is named after the module concept, multiple dies in one package. They are encapsulated with polycarbonate (PC) film, which can withstand 100°C operating temperatures. The SolarMD can be soldered with low temperature silver paste and oven cured or can be manually soldered

### Features and benefits

- Manually solderable
- Film laminated encapsulation
- Operating temperatures up to 100°C
- Customised voltage and current ratings
- Various module sizes
- No degradation of power output
- No loss of frequency response
- Provides usability under most lighting conditions, indoors and outdoors



Part <sup>⌚</sup>	Open circuit-voltage <sup>⌚</sup> Voc <sup>⌚</sup> V <sup>⌚</sup>	Short circuit-current <sup>⌚</sup> Isc <sup>⌚</sup> mA <sup>⌚</sup>	Max. output-power <sup>⌚</sup> P <sub>MAX</sub> <sup>⌚</sup> mW <sup>⌚</sup>	Max. output-voltage <sup>⌚</sup> V <sub>MAX</sub> <sup>⌚</sup> V <sup>⌚</sup>	Max. output-current <sup>⌚</sup> I <sub>MAX</sub> <sup>⌚</sup> mA <sup>⌚</sup>	Cell Area <sup>⌚</sup> (LxW) <sup>⌚</sup> mm <sup>2</sup> <sup>⌚</sup>	Recommended <sup>⌚</sup> MPPT IC <sup>⌚</sup>
SM141K04L <sup>⌚</sup>	2.76 <sup>⌚</sup>	58.60 <sup>⌚</sup>	122.90 <sup>⌚</sup>	2.23 <sup>⌚</sup>	55.10 <sup>⌚</sup>	142 <sup>⌚</sup>	BQ25504,05,70 <sup>⌚</sup>
SM141K04LV <sup>⌚</sup>	2.76 <sup>⌚</sup>	58.60 <sup>⌚</sup>	122.90 <sup>⌚</sup>	2.23 <sup>⌚</sup>	55.10 <sup>⌚</sup>	142 <sup>⌚</sup>	BQ25504,05,70 <sup>⌚</sup>
SM141K06L <sup>⌚</sup>	4.15 <sup>⌚</sup>	58.60 <sup>⌚</sup>	184.40 <sup>⌚</sup>	3.35 <sup>⌚</sup>	55.10 <sup>⌚</sup>	142 <sup>⌚</sup>	BQ25504,05,70 <sup>⌚</sup>
SM141K06LV <sup>⌚</sup>	4.15 <sup>⌚</sup>	58.60 <sup>⌚</sup>	184.40 <sup>⌚</sup>	3.35 <sup>⌚</sup>	55.10 <sup>⌚</sup>	142 <sup>⌚</sup>	BQ25504,05,70 <sup>⌚</sup>
SM141K08L <sup>⌚</sup>	5.53 <sup>⌚</sup>	58.60 <sup>⌚</sup>	245.80 <sup>⌚</sup>	4.46 <sup>⌚</sup>	55.10 <sup>⌚</sup>	142 <sup>⌚</sup>	SPV1050 <sup>⌚</sup>
SM141K08LV <sup>⌚</sup>	5.53 <sup>⌚</sup>	58.60 <sup>⌚</sup>	245.80 <sup>⌚</sup>	4.46 <sup>⌚</sup>	55.10 <sup>⌚</sup>	142 <sup>⌚</sup>	SPV1050 <sup>⌚</sup>
SM141K09L <sup>⌚</sup>	6.22 <sup>⌚</sup>	58.60 <sup>⌚</sup>	276.50 <sup>⌚</sup>	5.02 <sup>⌚</sup>	55.10 <sup>⌚</sup>	142 <sup>⌚</sup>	SPV1050 <sup>⌚</sup>
SM141K10L <sup>⌚</sup>	6.91 <sup>⌚</sup>	58.60 <sup>⌚</sup>	307.30 <sup>⌚</sup>	5.58 <sup>⌚</sup>	55.10 <sup>⌚</sup>	142 <sup>⌚</sup>	SPV1050 <sup>⌚</sup>
SM141K10LV <sup>⌚</sup>	6.91 <sup>⌚</sup>	58.60 <sup>⌚</sup>	307.30 <sup>⌚</sup>	5.58 <sup>⌚</sup>	55.10 <sup>⌚</sup>	142 <sup>⌚</sup>	SPV1050 <sup>⌚</sup>
SM400K10L <sup>⌚</sup>	6.91 <sup>⌚</sup>	16.40 <sup>⌚</sup>	85.70 <sup>⌚</sup>	5.58 <sup>⌚</sup>	15.40 <sup>⌚</sup>	40 <sup>⌚</sup>	BQ25504,05,70 <sup>⌚</sup>
SM500K12L <sup>⌚</sup>	8.29 <sup>⌚</sup>	21.00 <sup>⌚</sup>	132.30 <sup>⌚</sup>	6.70 <sup>⌚</sup>	19.80 <sup>⌚</sup>	51 <sup>⌚</sup>	BQ25504,05,70 <sup>⌚</sup>
SM700K10L <sup>⌚</sup>	6.91 <sup>⌚</sup>	29.50 <sup>⌚</sup>	154.30 <sup>⌚</sup>	5.58 <sup>⌚</sup>	27.70 <sup>⌚</sup>	71 <sup>⌚</sup>	BQ25504,05,70 <sup>⌚</sup>
SM730K12L <sup>⌚</sup>	8.29 <sup>⌚</sup>	30.00 <sup>⌚</sup>	188.60 <sup>⌚</sup>	6.70 <sup>⌚</sup>	28.20 <sup>⌚</sup>	73 <sup>⌚</sup>	BQ25504,05,70 <sup>⌚</sup>
SM850K12L <sup>⌚</sup>	8.29 <sup>⌚</sup>	35.10 <sup>⌚</sup>	220.50 <sup>⌚</sup>	6.70 <sup>⌚</sup>	32.90 <sup>⌚</sup>	85 <sup>⌚</sup>	BQ25504,05,70 <sup>⌚</sup>
SM101K09L <sup>⌚</sup>	6.22 <sup>⌚</sup>	41.90 <sup>⌚</sup>	197.50 <sup>⌚</sup>	5.02 <sup>⌚</sup>	39.30 <sup>⌚</sup>	101 <sup>⌚</sup>	BQ25504,05,70 <sup>⌚</sup>
SM101K12L <sup>⌚</sup>	8.29 <sup>⌚</sup>	41.90 <sup>⌚</sup>	263.40 <sup>⌚</sup>	6.70 <sup>⌚</sup>	39.30 <sup>⌚</sup>	101 <sup>⌚</sup>	BQ25504,05,70 <sup>⌚</sup>
SM351K09L <sup>⌚</sup>	6.22 <sup>⌚</sup>	147.30 <sup>⌚</sup>	694.60 <sup>⌚</sup>	5.02 <sup>⌚</sup>	138.30 <sup>⌚</sup>	118 <sup>⌚</sup>	LTC3103 <sup>⌚</sup>
SM531K08L <sup>⌚</sup>	5.53 <sup>⌚</sup>	217.80 <sup>⌚</sup>	913.00 <sup>⌚</sup>	4.46 <sup>⌚</sup>	204.50 <sup>⌚</sup>	527 <sup>⌚</sup>	LTC3103 <sup>⌚</sup>
SM531K10L <sup>⌚</sup>	6.91 <sup>⌚</sup>	217.80 <sup>⌚</sup>	1141.30 <sup>⌚</sup>	5.58 <sup>⌚</sup>	204.50 <sup>⌚</sup>	527 <sup>⌚</sup>	LTC3103 <sup>⌚</sup>
SM531K12L <sup>⌚</sup>	8.29 <sup>⌚</sup>	217.80 <sup>⌚</sup>	1369.50 <sup>⌚</sup>	6.70 <sup>⌚</sup>	204.50 <sup>⌚</sup>	527 <sup>⌚</sup>	LTC3103 <sup>⌚</sup>
SM262K10L <sup>⌚</sup>	6.91 <sup>⌚</sup>	<sup>⌚</sup> 1088.80 <sup>⌚</sup>	5706.30 <sup>⌚</sup>	5.58 <sup>⌚</sup>	1022.60 <sup>⌚</sup>	2633 <sup>⌚</sup>	LT3652 <sup>⌚</sup>

**Part number definition**

SM141K04L – 1 bank of 4 cells (21.5mm×6.59mm)  
SM141K06L – 1 bank of 6 cells (21.5mm×6.59mm)  
SM141K08L – 1 bank of 8 cells (21.5mm×6.59mm)  
SM141K09L – 1 bank of 9 cells (21.5mm×6.59mm)  
SM141K10L – 1 bank of 10 cells (21.5mm×6.59mm)

SM101K09L – 1 bank of 9 cells (21.5mm×4.71mm)  
SM101K12L – 1 bank of 12 cells (21.5mm×4.71mm)

SM400K10L – 2 banks of 5 cells (6mm×6.59mm)

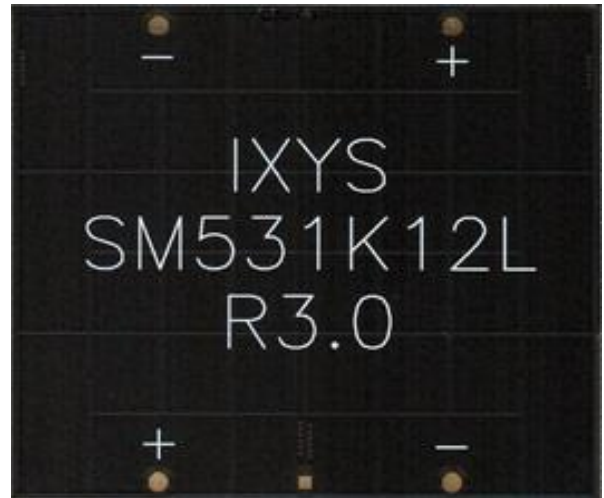
SM351K09L – 1 bank of 9 cells

SM730K12L – 2 banks of 6 cells

SM850K12L – 2 banks of 6 cells (18mm×4.71mm)

SM531K08L – 2 banks of 8 cells (21.5mm×12.25mm)  
SM531K10L – 2 banks of 10 cells (21.5mm×12.25mm)  
SM531K12L – 2 banks of 12 cells (21.5mm×12.25mm)

SM700K10L – 1 bank of 10 cells (10.8mm×6.59mm)



**MORU NexLoop vehicle detection**

This next generation represents a huge step forward for inductive loop detection. It utilises the IXYS SolarMD module to charge an onboard battery, making the NexLoop truly wireless



**SamsungNavi Mpeon SET-540**

Electronic navigation and toll collection device utilising the IXYS SolarMD module



## Introducing the revolutionary Solar-Pad Li-polymer charger



To charge Apple iPhones and iPads, and Galaxy phones and Tabs  
MP3, PSP, PMP and PDA, etc



### Features of SLPD-01 Solar-Pad

- Solar powered by 1W solar cell with 22% efficiency
- Li-polymer battery pack of 6000mAh (1000 charging cycles)
- Quick USB charging of portable electronics by 1.5A rate
- Quick USB charging into SLPD-01 by 1.2A rate
- Smart charging to prevent overcharge and over discharge by microcontroller
- Safe, reliable and longer lifetime charging by Li battery charger IC
- Charges both Apple's iPhone's and iPads and Galaxy phones and tablets by smart sensing
- High brightness 1W LED flashlight for outdoor camping etc.
- Two flashlight modes: continuous and blinking



For more information on the SLPD-01 Solar Pad please contact Eric Choi(ychoi@littelfuse.com).



IXYS Korea Ltd's ISO9001:2008  
quality system is registered by BSI



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