

Low Light Energy Harvesting Photovoltaic Cells for Connected Devices

Ambient's endless power technology eliminates the hassle, expense and environmental cost of battery replacement by harvesting low light, making Ambient cells ideal for powering the next generation of smart home, consumer electronics and IoT devices.

High Power Density

Ambient low light photovoltaic cells deliver the highest performance available on the market. Compared to conventional amorphous silicon solar cells, Ambient photovoltaic cells produce 300% more energy at typical low light levels and up to 400% more energy at very low light levels.

Optimized for All Light Sources

Ambient's thin and lightweight dye sensitized PV cells deliver consistent power across all types of illumination sources including LED, fluorescent, incandescent and diffuse natural light.

Industry's Only Monolithic Single Cell Architecture

High open circuit voltage of ~870 mV at 200 lux allows efficient use of a wide range of energy harvesting solutions while retaining a single cell architecture. This single-cell approach delivers pleasing aesthetics and easy scalability -- unlike conventional amorphous silicon cells or nascent organic PV cells. Conventional indoor PV technology uses multi-cell modules which cut power output to zero if just one of the cells is shaded. Ambient's single-cell designs are exceptionally shade tolerant, maximizing energy delivery under real-world conditions.

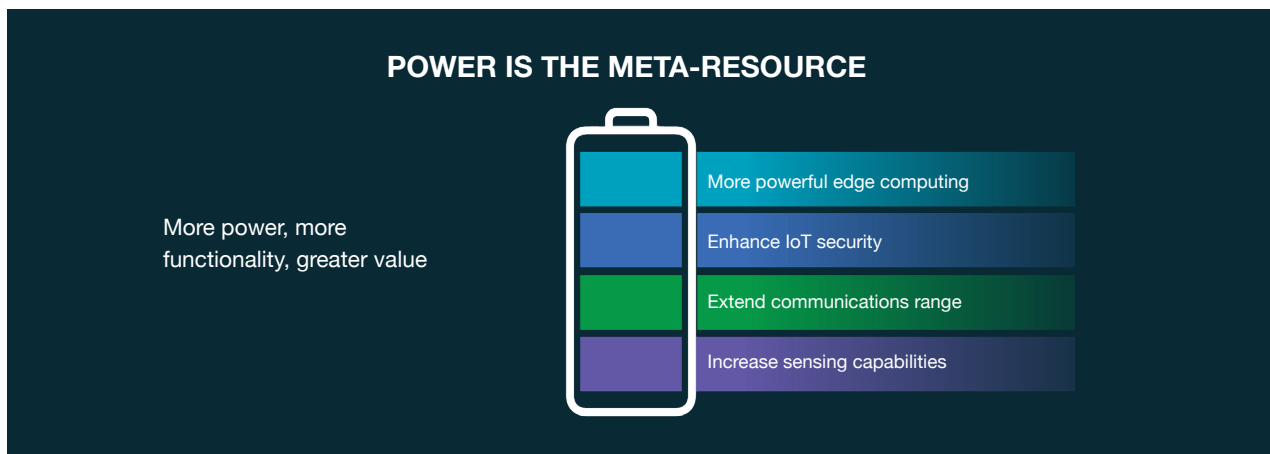
The single cell approach also enables Ambient to deliver a flexible form factor, with cells that can be made in arbitrary rectangular sizes to fit any device and satisfy virtually any power requirement. Ambient cells range from 5 cm² to 225 cm² and anywhere in between.

Superior Sustainability

Recognizing the need to lessen environmental hazards and lower carbon footprints, many manufacturers have focused on device lifetime extension and power requirement reductions. These strategies serve to cut down the number of batteries consumers will require to maintain desired functionality. Ambient's low-light PV cells do more to help manufacturers achieve electronic device sustainability goals than any other technology on the market. In addition, in keeping with our green chemistry DNA, Ambient's manufacturing processes and proprietary chemistry avoid toxics and waste.

Market-Ready Reference Designs

We offer a turnkey solution with custom-sized cells, application expertise, and energy harvesting reference designs from a wide range of leading PMIC providers.



Electrical Specifications (10 cm² cell) at 200 lux

Item	Unit	Minimum	Typical	Maximum
Voltage at Maximum Power Point (V_{MAX})	mV	700	750	780
Current at Maximum Power Point (I_{MAX})	μ A	150	175	190
Maximum Power (P_{MAX})	μ W	115	140	160
Open Circuit Voltage (V_{OC})	mV	840	870	900
Short Circuit Current (I_{SC})	μ A	160	200	200

All above specifications at 200 lux with white LED at 25° C.

Operating Conditions

Item	Unit	Minimum	Maximum
Surface Temperature	°C	-30	40
Ambient Humidity	%RH	non-condensing	

Storage Conditions

Item	Unit	Minimum	Maximum
Surface Temperature	°C	-20	45
Ambient Humidity	%RH	0	90

Precautions

Do not apply a current or voltage exceeding the maximum rating.

Item	Unit	Maximum Rating
Forward Voltage	mV	Maximum Voc +10%
Reverse bias maximum	mV	-100

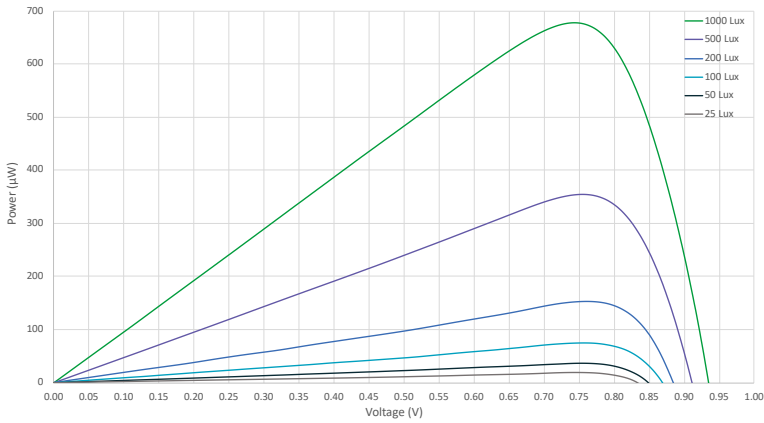
Effective Service Life

The following Highly Accelerated Life Tests (HALT) have been designed to demonstrate an effective service life of ten years provided that the device is used in accordance with applicable specifications. Devices which pass the test demonstrate less than 20% degradation in electrical performance following the HALT procedure.

Test Condition	Test Parameters
Light soaking (Open circuit and load)	2,000 hours at 20,000 lux
Thermal Aging (dark)	1,000 hours at 50° C 200 hours at 65° C
Damp heat	1,000 hours at 42° C/93% RH
Temperature cycling	50 cycles -20 to 65° C

P-V Curve

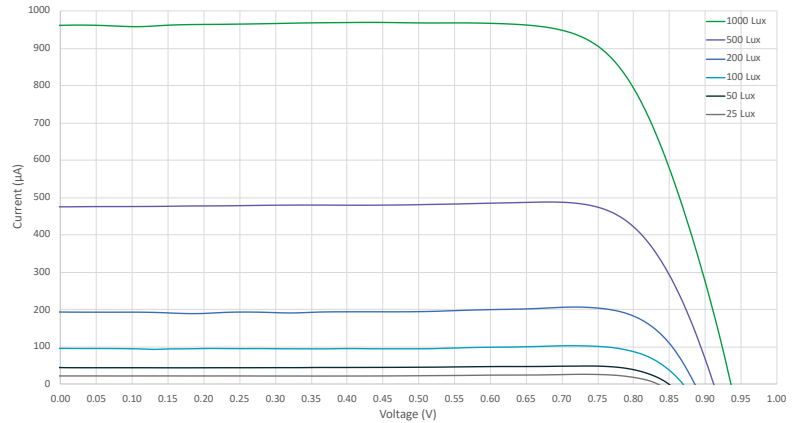
Power-Voltage Curves of 10 cm² Ambient Photonics Low-Light PV Cell



Unlike conventional silicon solar cells, Ambient PV cells have nearly fixed maximum power point of 750 mV resulting in easier integration with energy harvesting circuits.

I-V Curve

Current-Voltage Curves of 10 cm² Ambient Photonics Low-Light PV Cell

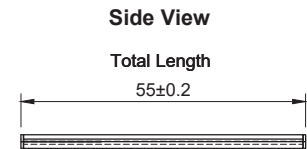
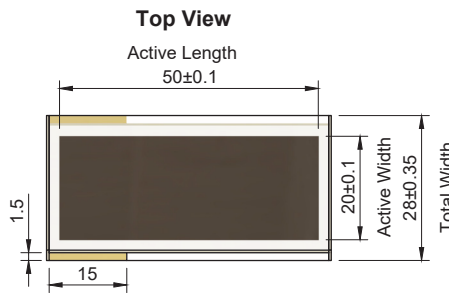
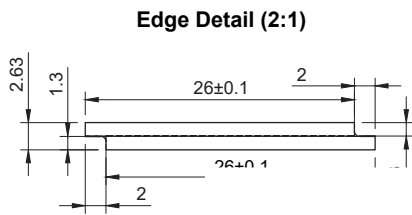


Ambient PV cells maintain a high open circuit voltage and high current density in all lighting conditions enabling energy harvesting in lower light, at higher efficiency and delivering more power than conventional silicon solar cells.

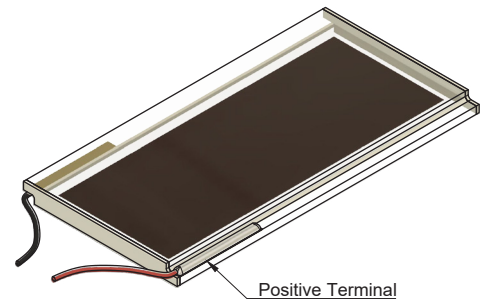
Irradiance (Lux)	VOC (V)	ISC (µA)	VMAX (V)	PMAX (µW)
25	.8380	33.6	.7208	24.2
50	.8489	48.9	.7529	36.5
100	.8691	102.6	.7566	75.6
200	.8864	206.2	.7607	152.9
500	.9116	487.4	.7548	354.9
1000	.9354	968.6	.7431	678.2

Typical electrical characteristics for 10 cm² Ambient Low Light PV cell as measured with a source meter and LED source. Maximum power (P_{MAX}) and open circuit voltage (V_{OC}) are linear with respect to irradiance, while maximum power point voltage (V_{MAX}) remains virtually constant.

Indicative Dimensions



Example of Wire Attachment (Not To Scale)



Ambient cells can be manufactured in a range of aspect ratios and sizes from 5 cm² to 225 cm². The diagram below depicts indicative dimensions for a 10 cm² PV cell.

For an Ambient PV cell of any size:

- Total Length is Active Length + 5mm ±0.2mm
- Total Width is Active Width +8mm ±0.35

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