TIGER Neo III

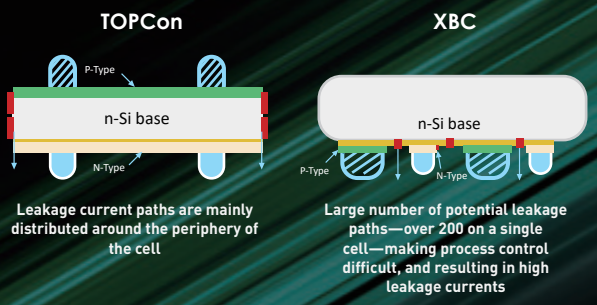
JinKO Solar

Low Light Champion

Put aside the high power and efficiency as well as high bifacility, TOPCon's excel in low irradiance performance stands it out in rooftop applications.The low irradiance performance of photovoltaic modules is directly related to the energy generation efficiency and stability of solar power systems, significantly impacting their power output capabilities. Although TOPCon's high bifaciality may not be fully utilized in monofacial settings, its excellent low irradiance performance can be adequately leveraged.

Optimized Leakage Current Path Distribution

TOPCon solar cells feature a tunneling oxide layer formed on their surface, which effectively reduces leakage current paths. These paths are primarily located around the perimeter of the cell rather than in the grid line areas, significantly minimizing leakage routes and effectively controlling leakage current. In contrast, cells utilizing other technologies often have a higher number of grid lines on the back electrodes, which increases the leakage pathways. This exacerbates leakage issues under low irradiance conditions, making TOPCon a more effective performer in this aspect.



Leakage current paths are mainly distributed around the periphery of the cell

Large number of potential leakage paths—over 200 on a single cell—making process control difficult, and resulting in high leakage currents

Good Parallel Resistance Characteristics

The parallel resistance (Rsh) of a solar cell is closely linked to its low irradiance performance; a higher Rsh indicates better performance under these conditions. The structural design of TOPCon allows for relatively larger parallel resistance, reducing current losses even in low irradiance scenarios and maintaining robust energy generation capabilities. For instance, during reverse bias voltage testing, the leakage current of TOPCon cells is significantly lower than that of several other structural types, laying a solid foundation for their impressive performance under low light conditions.

Reduced Front Grid Line Shading

TOPCon cells utilize a bifacial contact structure, which aids in minimizing shading caused by front grid lines, thereby enhancing the cell's light absorption efficiency. In low irradiance environments, even with weaker light intensity, these cells can absorb as much light as possible and convert it into electrical energy, thereby boosting their power generation capabilities.

Better Rear Heat Dissipation

Compared to certain complex back structures found in other solar technologies, TOPCon cells have a simpler rear structure that allows for more efficient heat dissipation. Under low irradiance conditions, the operating temperature of the cells can affect performance. Superior heat dissipation ensures that TOPCon cells can operate stably even in low light, reducing performance degradation due to elevated temperatures.

Passivation Layer Reduces Carrier Recombination Losses

The passivation layer in TOPCon technology effectively minimizes carrier recombination losses. In low irradiance scenarios, the generation of charge carriers is relatively limited; if recombination losses are high, it severely impacts the cell's performance. TOPCon's passivation layer mitigates these losses, maintaining good cell performance even in low-light environments and enhancing the energy conversion efficiency of the cells.

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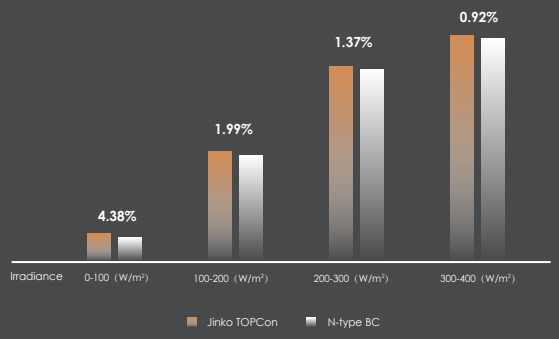
Performance of TOPCon in Field Tests Under Low Irradiance Conditions

Yinchuan, Ningxia 2025.6.1-6.30

CPVT

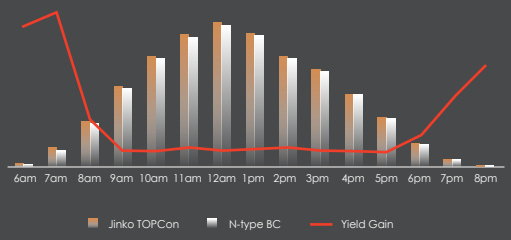
The Single-watt Power Generation Gain of N-type TOPCon over N-type BC is up to **4.38%** in low-light conditions



Chengdu, Sichuan 2025.7.9-7.21

TÜVRheinland Precisely Right.

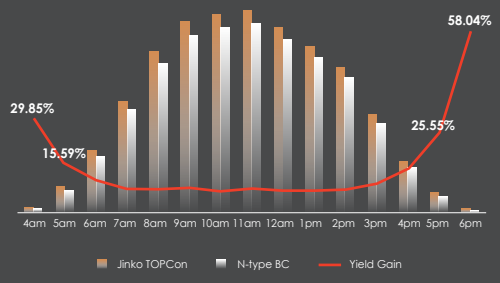
In 6:00-8:00 + 18:00-20:00 Period
The gain of TOPCon compared to BC is **7.18%**



Kagoshima, Japan 2025.6.1-6.30

TÜVNORD

Under low-light conditions(0-400W/m²)
The gain of TOPCon compared to BC is as high as **10.81%**



Haikou, Hainan 2024.11-2025.3

Under low-light conditions(100-400W/m²)
The gain of TOPCon compared to BC is as high as **7.83%**

Month	Sunny	Overcast	Rainy
2024.11	6	2	8
2024.12	12	16	3
2025.1	19	10	2
2025.2	9	9	10
2025.3	5	8	8
Total	**51**	**45**	**31**

During the 127-day detection period, there were a total of 76 cloudy and rainy days, accounting for **60%**

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