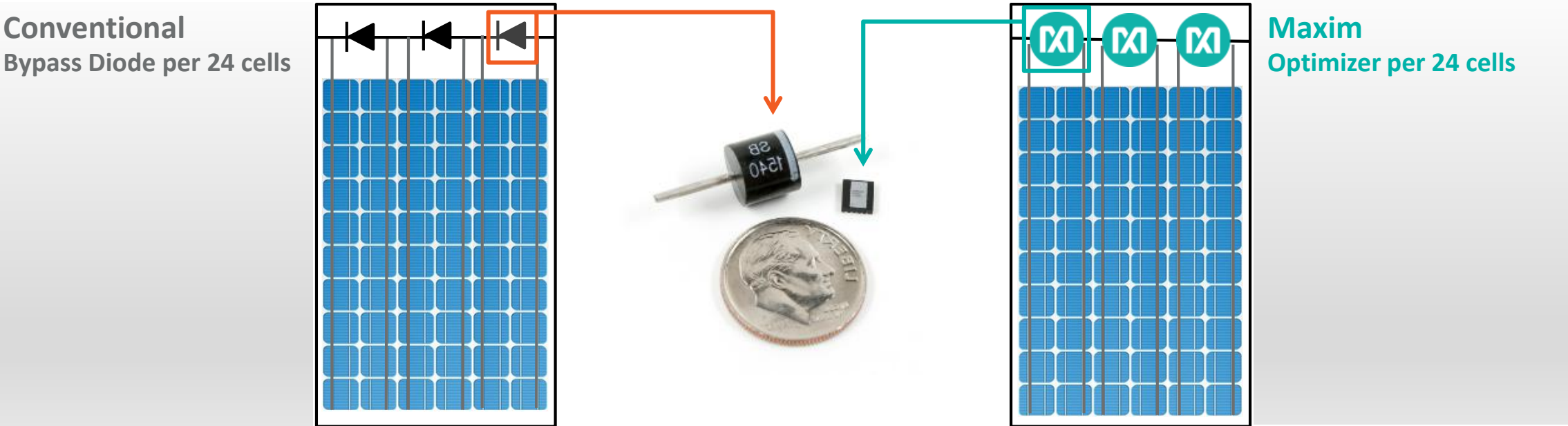


Maxim Submodule Optimizers

Residential and Commercial DC Optimization

Submodule Optimization



- Simplicity
- Performance
- Value
- Reliability

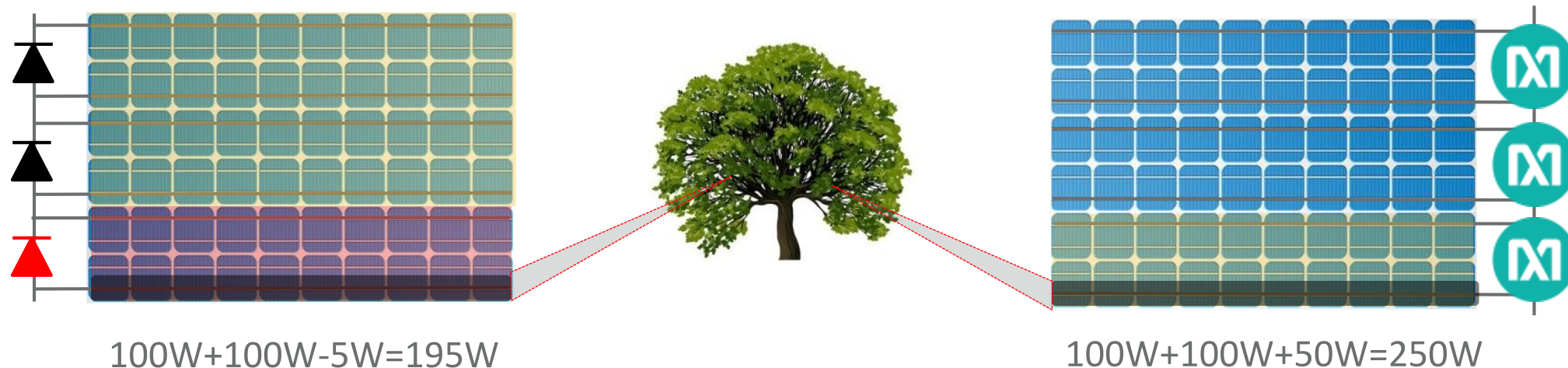
Factory installed, no added system components or complexity

Three MPPT per module for granular performance optimization

Reduce Capex and LCOE with longer strings and mismatch recovery

Technology proven over 20 years in mission critical applications

Deep MPPT Granularity



Limited By the Weakest Cell



Each Cell-String Optimized

- Conventional PV Modules are current limited by the weakest cell
- Shaded, Soiled, Cracked, or Aged Cells weaken the entire string or are bypassed
- Maxim Optimizers mitigate mismatch for up to 30% more power in a variety of challenged conditions

Flexible PV System Design



- Residential Flexibility
 - > String modules of different orientations in series
 - > Combine strings of different length on a single MPP channel
 - > No external boxes, gateways, trunk cabling, or network communications



- Commercial
 - > Increased number of modules per string; reduce homeruns
 - > Tighter row pitch with minimal row-shade losses
 - > Choose simplest stringing method without performance penalty



- Shade and Soiling Tolerance
 - > Design with fewer constraints to shading objects
 - > Reduce cleaning and maintenance requirements

Residential System Design Flexibility



Directly combine strings of different length

i.e. 10 panels in parallel with 12:
+5% energy increase

Parallel Mismatch Operation



Series connect panels facing different directions

i.e. East panels in series with West: +12% energy increase

Series Mismatch Operation



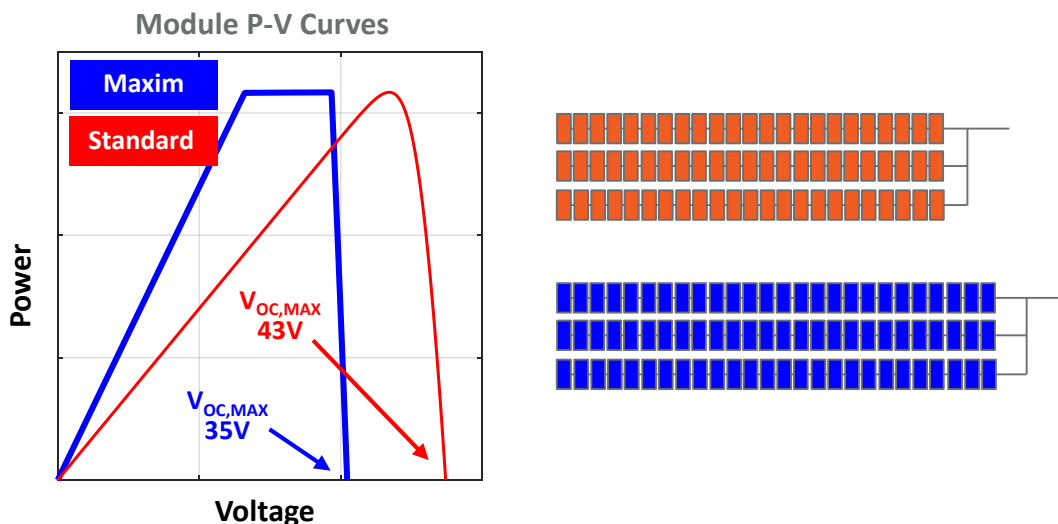
Series connect panels of different tilts

i.e. 10° panels in series with 25° panels: +1.6% energy increase

Multiple Mounting Planes

- Distributed MPPT enables flexible PV site design
- No performance penalty design; use the “easiest” installation

Longer Strings



Design Parameter		Standard	Maxim
Min Design Temp*		-10°C	--
Max VOC		43V	35V
# Modules Per String	600V	14	16
	1000V	23	26

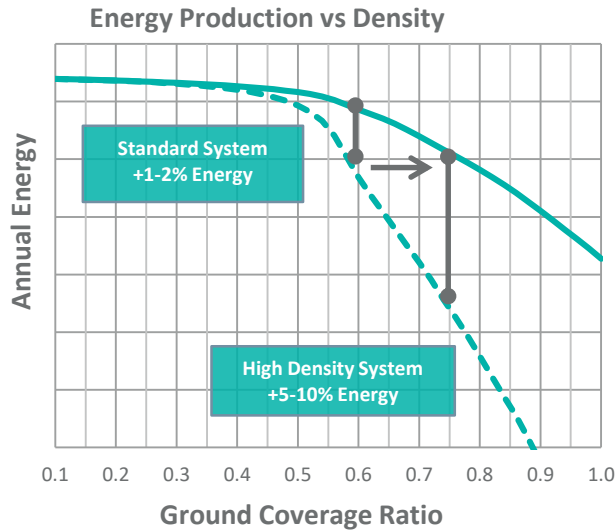
10-20% Longer strings enables system capex cost savings

Voltage Limiting

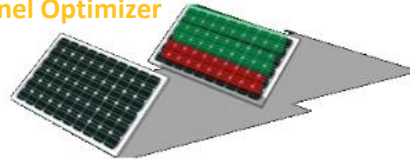
Enables 20-35% Longer Strings

- Limit 60-cell module output to 35V across all temperatures and irradiances
- Enables more modules on small systems and fewer strings on large systems
- Longer strings amortize fixed costs over more kW and enable lower effective \$/W

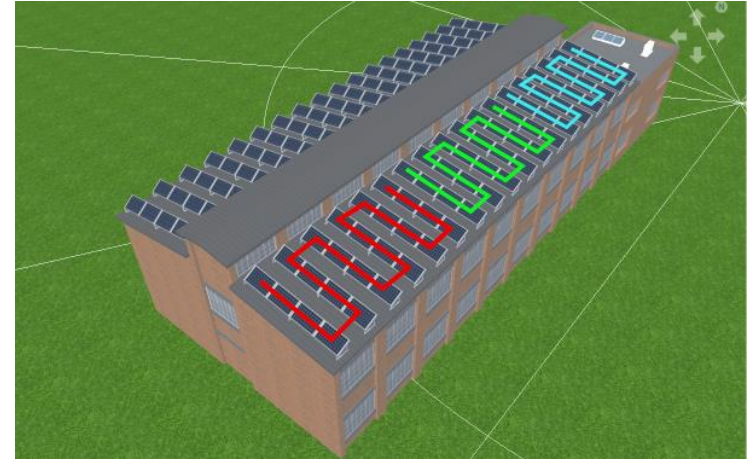
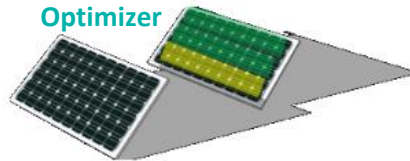
Commercial System Design Flexibility



Conventional or
Panel Optimizer



Solar Cell
Optimizer

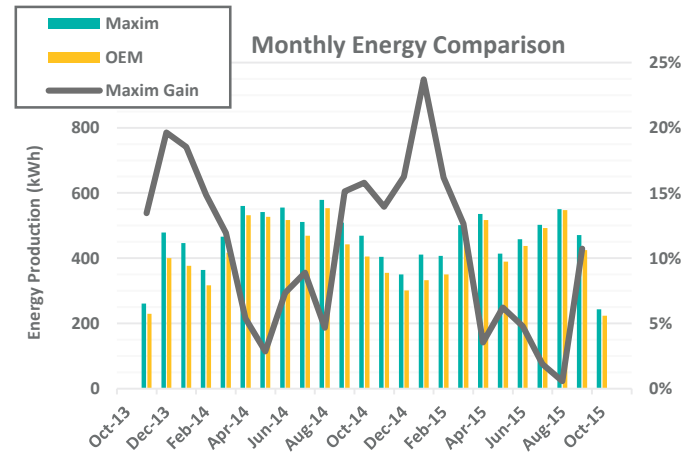


- Mitigate effect of row shading caused by tight row pitches
- Install more modules on area constrained systems
- Enables 10-20% denser rooftop systems with no performance penalty

Mismatch Tolerance



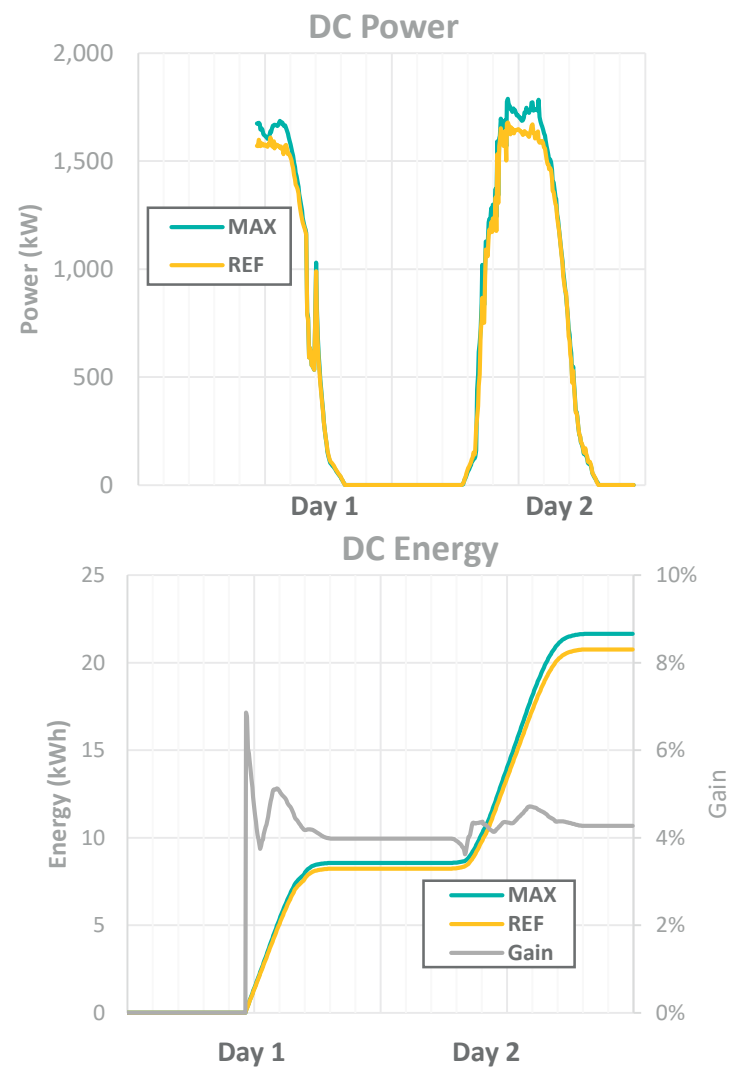
Soiling Patterns



Shade Mitigation

- Many conditions unexpectedly and severely degrade system power production
- Relax O&M requirements and impact of unforeseen environmental influences

Shaded Performance Example

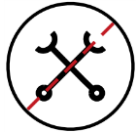


String	Energy (kWh)
Maxim	21.7
Other MLPE	20.8
Gain	4.3%



- Two palm trees equally affecting MAXIM and Panel Optimizer strings
- Maxim submodule optimizer outperforms panel optimizer by > 4%

Installation Simplicity



No Add-On Components

- No external boxes to install or communication networks to debug
- Broad compatibility with string inverters from all manufacturers

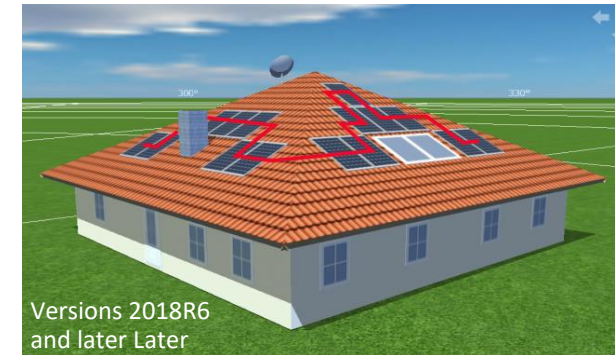
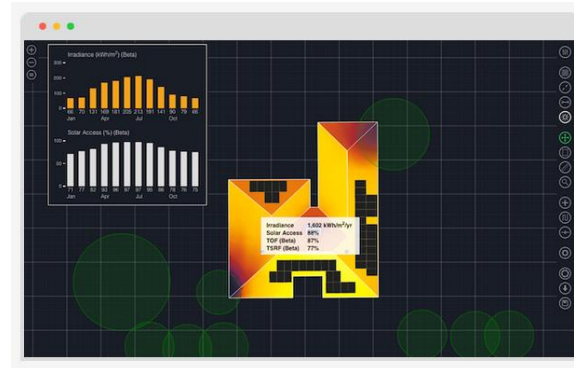


Inverter Compatibility

Modeling with Maxim Submodule Optimizers







Versions 6.0 and later



Versions 2018R6 and later

- System design with Maxim optimizers is a built-in to the industry leading modeling tools

Competitive Comparison

Benefit	 Diode	 Maxim Optimizer	 Panel Optimizer	 Micro-Inverter
Triple MPPT Per Module	✗	✓	✗	✗
Increase String Length	✗	✓	✓	✓
Increase Ground Coverage and Density	✗	✓	✗	✗
Eliminate Hot Spots & Diode Failures	✗	✓	✗	✗
Broad Inverter Compatibility	✓	✓	✗	✗
Proven High Reliability	✗	✓	✗	✗
Factory integrated, zero install time	✓	✓	✗	✗

Reduce Installation Costs, Improve Performance, Minimize Investment Risk



The Only Module Integrated Optimization Solution



maxim
integrated™