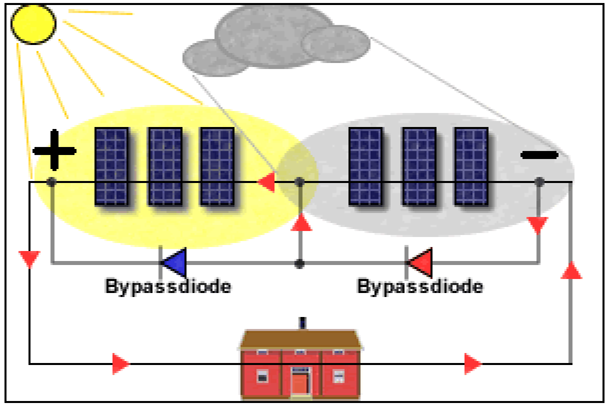
NEWSLETTER 002-2009

Power Rectifiers for Solar Photovoltaic Applications

Taiwan Semiconductor is currently expanding its Solar Photvoltaic Applications porfolio.
We have launched this Newsletter to provide the best possible support, explain the major differences between Blocking and Bypass diodes and add our recommendation for each application.

Blocking diodes and Bypass diodes are NOT the same application.
Often the actual diode type is the same, but serves different purposes.
See the illustration below for examples of both. The explanation follows on the next page.



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Bypass Diodes

When a part of the PV module is overcast, the overcast block is not able to produce as much current as the sunlit block. Since all cells are connected in series, the same amount of current has to flow through each cell. The sunlit cells will force the overcast cells to pass more current than their new short circuit current. The only way the overcast cells can operate at a current higher than their short circuit current is to operate in a region of negative voltage that causes a net voltage loss to the system. The current multiplied by this negative voltage gives the negative power produced by the overcast cells. In other words, the overcast cells dissipate power as heat and cause “hot spots”. The overcast cells will reduce the overall IV curve of the group of cells. The effect of the overcast is also dependent on how the module is overcast. One cell overcast by 75% is worse than three cells overcast by 25% each. If overcasting cannot be avoided, it should be spread over more cells. One way to minimize the effect the overcast has on a single module in a series string, is to use bypass diodes in the junction box. Bypass diodes allow current to pass around overcast cells thereby reducing the voltage losses in the module. When a module becomes overcast its bypass diode becomes “forward biased” and begins to conduct current through itself. All current greater than the overcast cell’s new short circuit current is “bypassed” through the diode, thus reducing drastically the amount of local heating at the overcast area. The diode also holds the entire overcast module or group of cells to a small negative voltage of approximately -0.7 volts, thus limiting the reduction in the array output.

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Blocking Diodes

Diodes placed in series with cells or modules can perform another function that of blocking reverse leakage current backwards through the modules. There are two situations in which blocking diodes can help prevent this phenomenon.

1. Blocking reverse flow of current from the battery through the module at night. In battery charging systems, the module potential drops to zero at night, the battery could therefore discharge all night backwards through the module. This would not be harmful to the module but result in the loss of precious energy from the battery bank. Diodes placed in the circuit between the module and the battery can block any night-time leakage flow.

2. Blocking reverse flow down damaged modules from parallel modules during the day. Blocking diodes placed ahead of separate series wired strings in high voltage systems can perform yet another function during daylight conditions. If one string becomes severely shaded, or if there is a short circuit in one of the modules, the blocking diode prevents the other strings from loosing current backwards down the shaded or damaged string. The shaded or damaged string is “isolated” from the others, and more current is sent on to the load. In this configuration, the blocking diodes are sometimes called “isolation diodes”.

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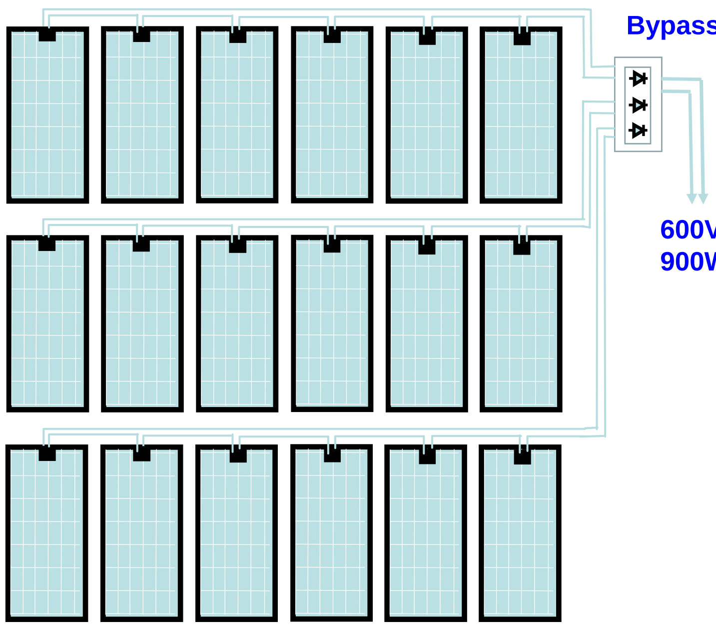
<u>Example</u>



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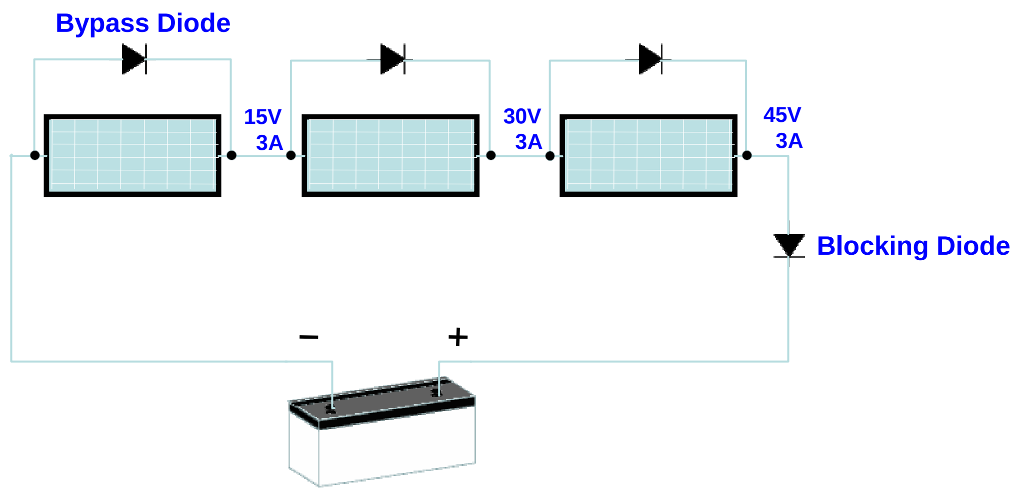
Example (continued)



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Power Rectifiers for Solar Photovoltaic Applications

Rectifier Overview for Solar Applications

Schottky Rectifiers
VBR = 20 - 150V
IFAV = 3 - 40A
VF = 0.55 - 0.95V
Tjmax = 150° C
Axial / Power Pack

High Temperature Schottky Rectifiers
VBR = 45 - 200V
IFAV = 3 - 40A
VF = 0.55 - 0.95V
Tjmax = 175° C - 200° C
Axial / Power Pack

High Voltage Rectifiers
VBR = 50 - 1000V
IFAV = 3 - 16A
VF = 0.90 - 1.10V
Tjmax = 150° C
Axial / Power Pack

High Voltage Glass Passivated Rectifiers
VBR = 50 - 1000V
IFAV = 3 - 16A
VF = 0.90 - 1.10V
Tjmax = 150° C
Axial / Power Pack

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Schottky Rectifiers

Axial

single die	SR30x Series SR50x Series SR80x Series

D²Pak

single die	SRAS10xx Series SRAS16xx Series SRAS20xx Series
dual dice	MBRS10xxCT Series SRA10xx Series MBRS15xxCT Series SRA16xx Series MBRS20xxCT Series SRA20xx Series MBRS25xxCT Series

Power Pack

single die	SRA10xx Series SRA16xx Series SRA20xx Series
dual dice	MBR10xxCT Series SR10xx Series MBR15xxCT Series SR16xx Series MBR20xxCT Series MBR25xxCT Series MBR30xxCT Series SR20xx Series MBR40xxPT Series

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High Temperature Schottky Rectifiers

New Release

Axial

single die	SR120x Series SR150x Series

Power Pack

dual dice	MBR10HxxxCT MBR20HxxxCT

D2Pak

dual dice MBRS10HxxxCT
MBRS20HxxxCT

High Voltage Glass Passivated Rectifiers

Axial

single die	1N5400G Series 6AxxG Series

Power Pack

single die	GPA80x Series GPA160x Series GP80x Series GP160x Series

High Voltage Rectifiers

Axial

single die	1N5400 Series 6Axx Series

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Rectifier Selection for Solar Applications

Bypass & Blocking Diodes

Small Current Panels

Low Voltage Modules - Axial Schottky Rectifiers

High Voltage Modules - Axial Glass Passivated Rectifier

High Current Panels

Low Voltage Modules - Power Pack Schottky Rectifiers

High Voltage Modules - Power Pack Glass Passivated Rectifier