EIC Diodes in Solar photovoltaic (PV) Systems

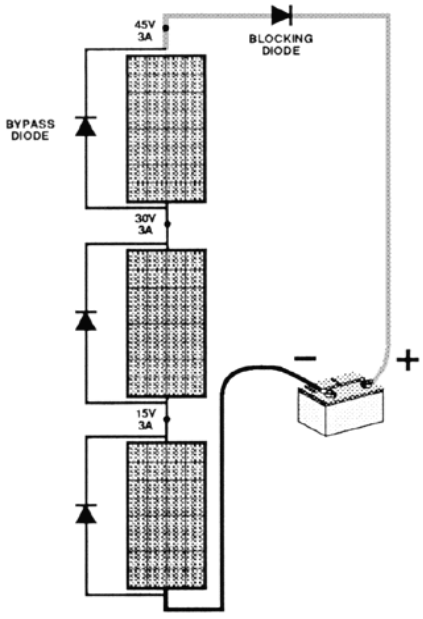
Diodes and PV cells are both devices made from P-type and N-type silicon that allow electrical current to flow in one direction only.

Silicon PV cells react to sunlight, causing electrons to flow into the cell, whilst current flow in the reverse direction is prevented using the electrostatic field at the PN junction.

Problems can arise when the PV modules are connected in series, or if part of the cell array is shaded. In these cases there is the need for external diodes that play two important roles.

BYPASS DIODES

Here a diode is fitted across each panel (in parallel) in a multi panel set up. When one of the panels in the system is damaged, weak, or (most likely) in shade, then there is the risk that full current from the rest of the panels will pass through the shaded panel and cause overheating damage. In this case the bypass diode conducts, thereby allowing the current from the good solar cells to flow in the external circuit rather than forward biasing each good cell. The maximum reverse bias across the poor cell is reduced to about a single diode drop, thus limiting the current and preventing hot-spot heating.



BLOCKING DIODES

It is often recommended that a diode be fitted to prevent reverse current flow back through a solar panel at night time. This occurs because in battery charging systems, the module potential drops to zero at night, and the battery could discharge all night backwards through the module. This would not be harmful to the module, but would result in loss of precious energy from the battery bank.

A blocking diode is not necessary if a charge controller is being used in the system.

Low Vf Rectifiers

F1200
SMC1200
FT2000
FTB2000
SMC2000
MUR1520
MURB1520
MUR1520S
MURB1520S
SMC1520
P600J

Schottky Diodes

MBR1645
MBR2045
MBR2545
MBRB2545 (dual)
MBRB4030
SD945
SD1545
SD1645
SD2045

Selecting the correct diode

Critical to any PV system is overall efficiency. Solar panels usually have an efficiency rating somewhere between 40% and 60%. To achieve this, losses in every single device must be minimised.

For the diodes, this is particularly important at times of peak sunshine when the device is blocking current flow, and therefore a low leakage part is essential.

Additionally when the part is active as a bypass circuit, low forward losses are also required.

A fairly obvious requirement is that the part is able to operate at high temperatures. Diodes are tested at an ambient temperature of 75ºC, for at least one hour, to be considered suitable for these applications.

Finally the diode must be able to withstand power surges; such as those caused by lightening or when cables are disconnected.

EIC has a range of diodes that are ideally suited to solar applications because they have:

*** Overvoltage protection**
*** High forward surge capability**
*** High frequency operation**
*** High efficiency**
*** Lower power losses**
*** Low forward voltage drop**
*** Packaging to assist low junction temperatures (D2Pak and T0-220)**
*** Space saving SMC package option**

Type No.	Max. Average Forward Rectified Current		Max. Repetitive Peak Reverse Voltage	Max. Repetitive Peak Forward Current	Max. Peak Forward Surge Current	Max. Forward Voltage Drop at Ta=25°C		Max. Reverse Current at Ta=25°C	Max. Reverse Recovery Time	Package Outline
	$I_{F(AV)}$ @ T_a (A)	(°C)	V_{RRM} (V)	I_{FRM} (A)	I_{FSM} (A)	V_F @ I_F (V)	(A)	I_R (µA)	Trr (ns)	
Low Vf Rectifiers										
P600J	6	60	600	-	400	0.9	6	5	-	D6
F1200D	12	50	200	80	390	0.85	5	25	200	D6
SMC1200D	12	50	200	80	390	0.85	5	25	200	SMC
FT2000AD/KD	20	100(Tc)	200	80	390	0.84	5	25	200	TO-220AC
FTB2000AD/KD	20	100(Tc)	200	80	390	0.84	5	25	200	D^2PAK
SMC2000D	20	100(Tc)	200	80	390	0.84	5	25	200	SMC
MUR1520/S	15	150(Tc)	200	-	200	1.05	15	10	35	TO-220AC
MURB1520/S	15	150(Tc)	200	-	200	1.05	15	10	35	D^2PAK
SMC1520	15	150(Tc)	200	-	200	1.05	15	10	35	SMC
Schottky Rectifiers										
MBR2045CT	20	135(Tc)	45	-	150	0.57	10	0.1mA	-	TO-220AB
MBR2545CT	30	130(Tc)	45	30	150	0.82	30	0.2mA	-	TO-220AB
MBRB2545CT	30	130(Tc)	45	-	150	0.82	30	0.2mA	-	D^2PAK
MBRB4030	40	115(Tc)	30	-	300	0.55	40	0.35	-	D^2PAK
SD1545	15	25(Tc)	45	-	300	0.54	15	0.2mA	-	DO-201
MBR1645	16	25	45		300	0.55	16	0.2mA	-	TO-220AB
SD1645	16	25	45		300	0.55	16	0.2mA	-	DO-201
SD2045	20	25(Tc)	45	-	410	0.55	20	0.26mA	-	D6