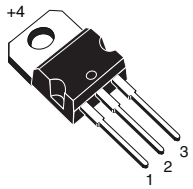
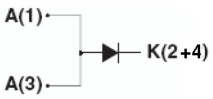
SPV1001T40

Cool bypass switch for photovoltaic application

Features

- I_F=16 A, V_R= 40 V
- Very low forward voltage drop
- Very low reverse leakage current
- 150 °C operating junction temperature





TO-220

Application

- Photovoltaic panels

Description

The SPV1001 is a system in package solution for photovoltaic application to perform a cool bypass rectifier working like a Schottky diode with much lower forward voltage drop and reverse leakage current.

It consists of a power MOS transistor properly controlled in order to charge a capacitor during the OFF time and drive its gate during the ON time with the charge previously stored in the capacitor.

ON and OFF times are properly set to reduce the average voltage drop across the drain and source terminals and consequently to reduce the power dissipation.

Table 1. Device summary

Order code	Package	Packaging
SPV1001T40	TO-220	Tube

1 Maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_R	Max DC reverse voltage	40	V
I_F	Max. forward current	16	A
T_J	Junction temperature operating range	-40 to 150	°C
T_{STG}	Storage temperature range	-40 to 175	°C
R_{TH}	Thermal resistance, junction to case	1.5	°C/W
I_{FSM}	Non repetitive peak surge (half-wave, single phase, 50 - 60 Hz)	250	A
ESD level	Human body level	≥8K	V

2 Electrical characteristics

Table 3. Electrical characteristics

Symbol	Parameter	Test conditions		Value			Unit
				Min.	Typ.	Max.	
$V_{F,AVG}$	AVG forward voltage drop	IF = 16A	T_J = 25°C	-	230	-	mV
		IF = 8A	T_J = 25°C	-	110	-	mV
			T_J = 125°C	-	270	-	mV
I_R	Reverse leakage current	VR = 40 V	T_J = 25°C	-	1	-	µA
			T_J = 125°C	-	20	-	µA
D	TON/T ratio	IF = 8A	T_J = 25°C	-	95%	-	-
			T_J = 125°C	-	75%	-	-
V_F	Forward voltage drop	IF = 8A, T_{OFF}	T_J = 25°C	-	920	-	mV
			T_J = 125°C	-	600	-	mV
		IF = 8A, T_{ON}	T_J = 25°C	-	70	-	mV
			T_J = 125°C	-	160	-	mV

Note: A heat sinker is recommended

3 Device description

As it is known in the literature a photovoltaic panel consists of a series of PV cells. In optimal conditions, all the cells are equally irradiated and work at the same current level, but, during normal operations, it could happen that some cells are partially shaded. These cells limit the current generated from the other cells fully irradiated and in the extreme cases, when these cells are completely obscured, the current flow is blocked.

In this last case the shaded cells behave like a load and the current generated from the cells fully irradiated produces over-voltages that can reach the break down threshold. This phenomenon, well known in the literature as hot spot, can cause the overheating of the shaded cells and in same cases also the permanent damaging with consequent current leakage. To prevent the hot spot issue, bypass diodes are connected in parallel to the cells string.

The device proposed in this data-sheet has the same functionality of a Schottky diode but with better performance. It has a very low forward voltage drop and a very low reverse leakage current. It consists of a power MOS transistor properly controlled in order to charge a capacitor during the OFF time and drive its gate during the ON time with the charge previously stored in the capacitor. ON and OFF times are properly set to reduce the average voltage drop across the drain and source terminals and consequently to reduce the power dissipation.

Figure 1. Average forward power dissipation versus average forward current

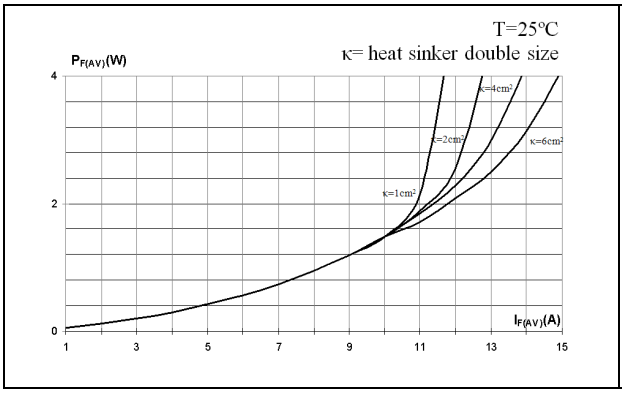


Figure 2. Forward Voltage

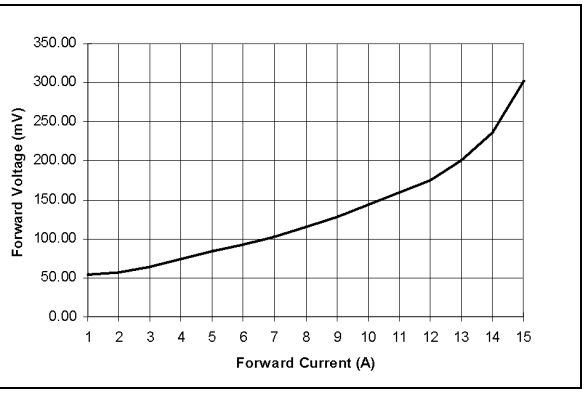
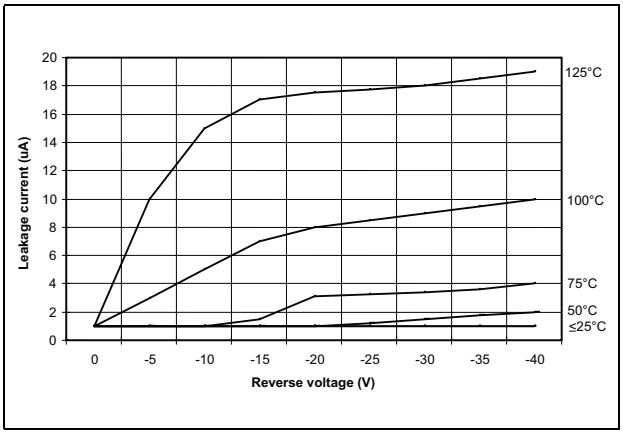


Figure 3. Leakage current



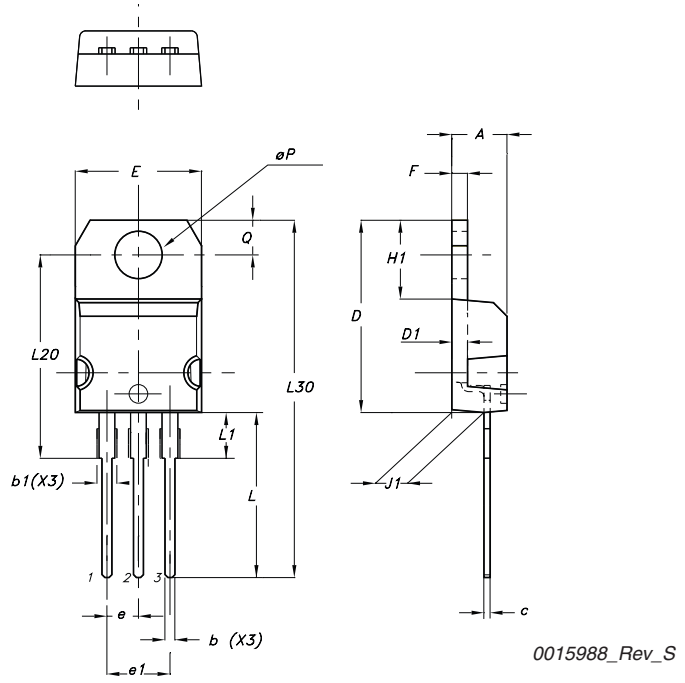
4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

Figure 4. TO-220 mechanical data

TO-220 type A mechanical data

Dim	mm		
	Min	Typ	Max
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
∅P	3.75		3.85
Q	2.65		2.95



5 Revision history

Table 4. Document revision history

Date	Revision	Changes
06-Oct-2010	1	First release

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