

### Description

This Schottky diode is suited for high frequency switch mode power supply.

Packaged in TO-220AB narrow leads, TO-220AB and I<sup>2</sup>PAK, this device is intended to be used in notebook, game station and desktop adapters, providing in these applications a good efficiency at both low and high load.

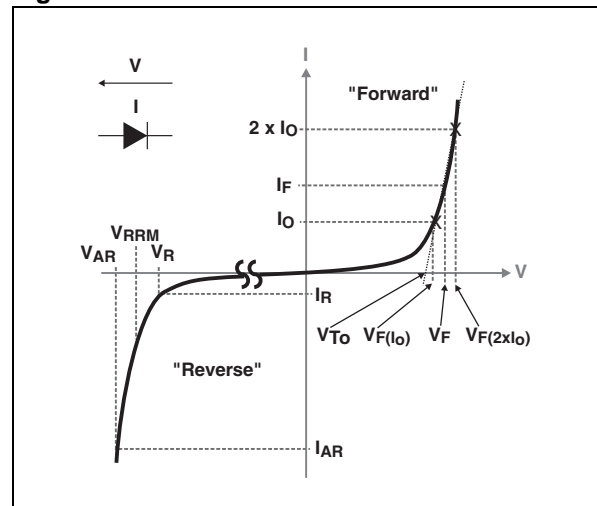
Table 1. Device summary

Symbol	Value
$I_{F(AV)}$	2 X 20 A
$V_{RRM}$	120 V
$T_j$	150 °C
$V_F$ (typ)	0.46 V

### Features

- High current capability
- Avalanche rated
- Low forward voltage drop
- High frequency operation
- ECOPACK<sup>®</sup>2 compliant component on TO-220AB.

Figure 1. Electrical characteristics<sup>(a)</sup>



- a.  $V_{ARM}$  and  $I_{ARM}$  must respect the reverse safe operating area defined in [Figure 9](#).  $V_{AR}$  and  $I_{AR}$  are pulse measurements ( $t_p < 10 \mu s$ ).  $V_R$ ,  $I_R$ ,  $V_{RRM}$  and  $V_F$  are static characteristics

# 1 Characteristics

**Table 2. Absolute ratings (limiting values with terminals 1 and 3 short circuited at T<sub>amb</sub> = 25 °C, unless otherwise specified)**

Symbol	Parameter		Value	Unit
V <sub>R</sub> RM	Repetitive peak reverse voltage		120	V
I <sub>F</sub> (RMS)	Forward rms current		30	A
I <sub>F</sub> (AV)	Average forward current	Per diode, T <sub>C</sub> = 125 °C	20	A
		Per device, T <sub>C</sub> = 115 °C	40	
I <sub>F</sub> SM	Surge non repetitive forward current	t <sub>p</sub> = 10 ms sine-wave	210	A
P <sub>ARM</sub> <sup>(1)</sup>	Repetitive peak avalanche power	T <sub>j</sub> = 125 °C, t <sub>p</sub> = 10 μs	1150	W
V <sub>ARM</sub> <sup>(2)</sup>	Maximum repetitive peak avalanche voltage	t <sub>p</sub> < 10 μs, T <sub>j</sub> < 125 °C, I <sub>AR</sub> < 7.7 A	150	V
V <sub>ASM</sub> <sup>(2)</sup>	Maximum single-pulse peak avalanche voltage	t <sub>p</sub> < 10 μs, T <sub>j</sub> < 125 °C, I <sub>AR</sub> < 7.7 A	150	V
T <sub>stg</sub>	Storage temperature range		-65 to +175	°C
T <sub>j</sub>	Maximum operating junction temperature <sup>(3)</sup>		150	°C

1. For pulse time duration deratings, please refer to [Figure 4](#). More details regarding the avalanche energy measurements and diode validation in the avalanche are provided in the STMicroelectronics Application notes AN1768, "Admissible avalanche power of schottky diodes" and AN2025, "Converter improvement using Schottky rectifier avalanche specification".
2. See [Figure 9](#)
3.  $\frac{dP_{tot}}{dT_j} < \frac{1}{R_{th(j-a)}}$  condition to avoid thermal runaway for a diode on its own heatsink

**Table 3. Thermal resistance**

Symbol	Parameter		Value	Unit
R <sub>th(j-c)</sub>	Junction to case	Per diode	1.35	°C/W
		Total	0.93	
R <sub>th(c)</sub>	Coupling		0.50	

When the two diodes 1 and 2 are used simultaneously:

$$\Delta T_j(\text{diode 1}) = P(\text{diode 1}) \times R_{th(j-c)}(\text{Per diode}) + P(\text{diode 2}) \times R_{th(c)}$$

Table 4. Static electrical characteristics (terminals 1 and 3 short circuited)

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
$I_R^{(1)}$	Reverse leakage current	$T_j = 25\text{ }^\circ\text{C}$	$V_R = V_{RRM}$	-	55	275	$\mu\text{A}$
		$T_j = 125\text{ }^\circ\text{C}$		-	20	50	mA
$V_F^{(2)}$	Forward voltage drop	$T_j = 125\text{ }^\circ\text{C}$	$I_F = 5\text{ A}$	-	0.46	0.51	V
		$T_j = 125\text{ }^\circ\text{C}$	$I_F = 10\text{ A}$	-	0.55	0.60	
		$T_j = 25\text{ }^\circ\text{C}$	$I_F = 20\text{ A}$	-		0.83	
		$T_j = 125\text{ }^\circ\text{C}$		-	0.63	0.69	

1. Pulse test:  $t_p = 5\text{ ms}$ ,  $\delta < 2\%$
2. Pulse test:  $t_p = 380\text{ }\mu\text{s}$ ,  $\delta < 2\%$

To evaluate the conduction losses use the following equation:

$$P = 0.52 \times I_{F(AV)} + 0.0085 \times I_{F(RMS)}^2$$

Figure 2. Average forward power dissipation versus average forward current

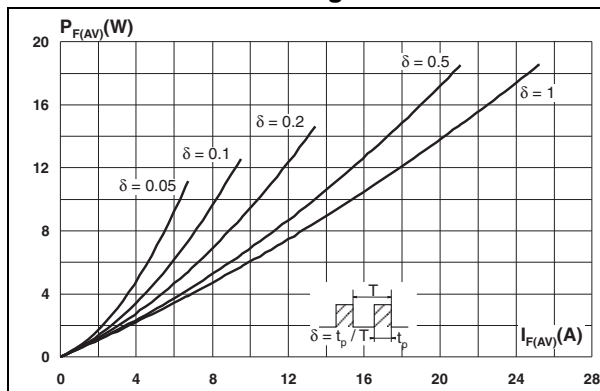


Figure 3. Average forward current versus ambient temperature ( $\delta = 0.5$ )

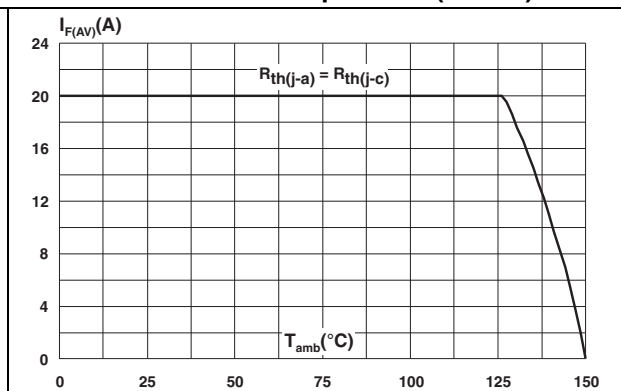


Figure 4. Normalized avalanche power derating versus pulse duration

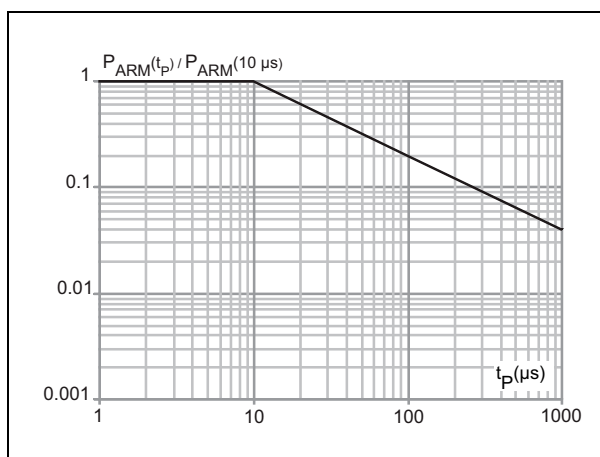
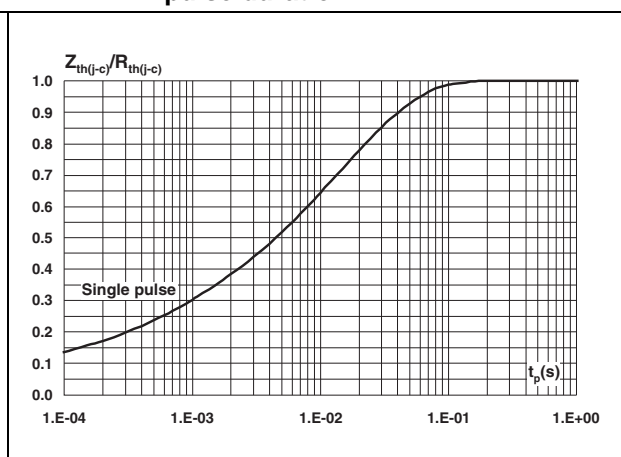
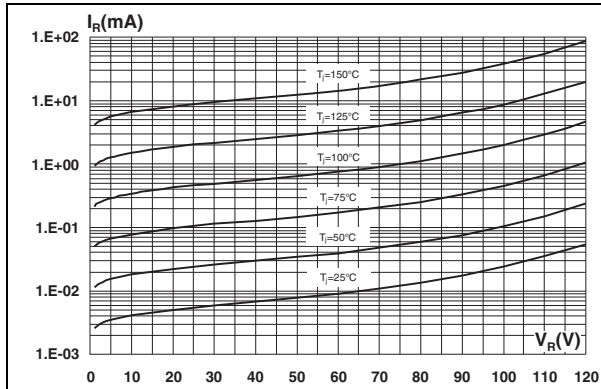


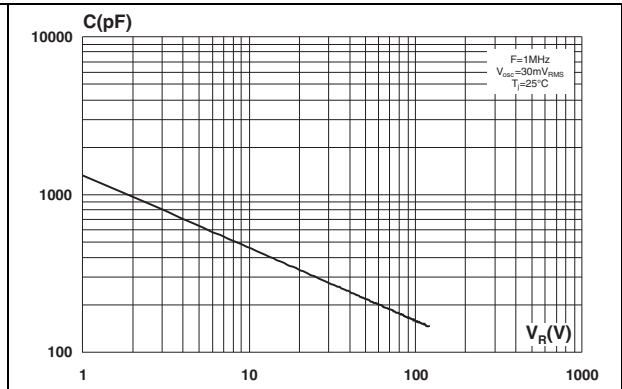
Figure 5. Relative variation of thermal impedance junction to case versus pulse duration



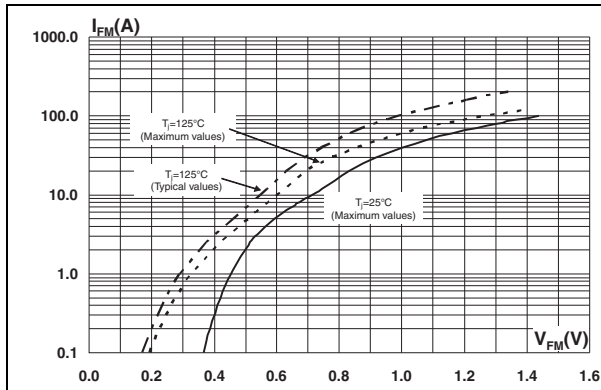
**Figure 6. Reverse leakage current versus reverse voltage applied (typical values)**



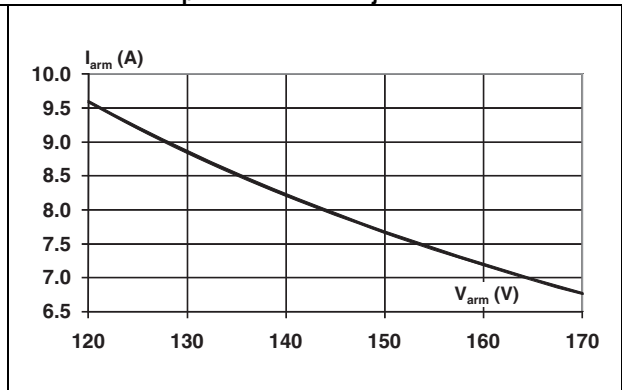
**Figure 7. Junction capacitance versus reverse voltage applied (typical values)**



**Figure 8. Forward voltage drop versus forward current**



**Figure 9. Reverse safe operating area ( $t_p < 10 \mu\text{s}$  and  $T_j < 125^\circ\text{C}$ )**



## 2 Package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value for TO-220AB: 0.4 N·m to 0.6 N·m

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

**Figure 10. TO-220AB narrow leads dimension definitions**

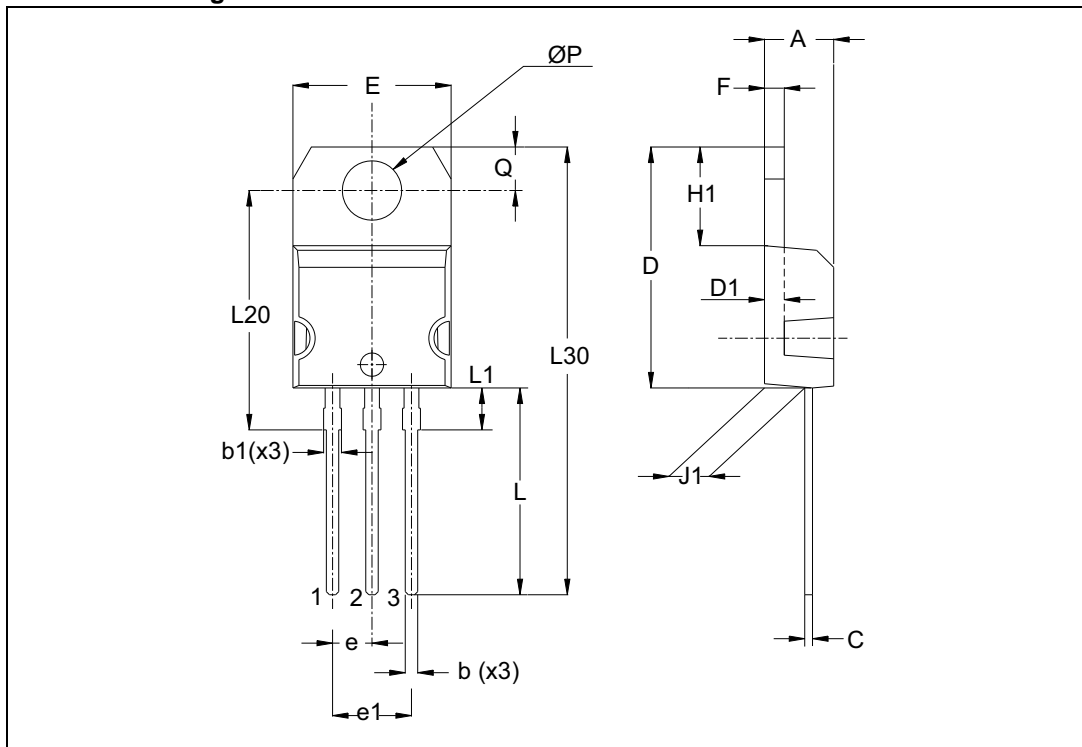


Table 5. TO-220AB narrow leads dimension values

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40		4.60	0.17		0.18
b	0.61		0.88	0.024		0.034
b1	0.95		1.20	0.037		0.047
c	0.48		0.70	0.019		0.027
D	15.25		15.75	0.60		0.62
D1	1.27			0.05		
E	10.00		10.40	0.39		0.41
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.19		0.20
F	1.23		1.32	0.048		0.052
H1	6.20		6.60	0.24		0.26
J1	2.40		2.72	0.095		0.107
L	13.00		14.00	0.51		0.55
L1	2.60		2.90	0.102		0.114
L20	15.40			0.61		
L30	28.90			1.14		
∅P	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



Table 6. TO-220AB dimension values

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.17	0.181
b	0.61	0.88	0.024	0.035
b1	1.14	1.50	0.045	0.059
c	0.48	0.70	0.019	0.027
D	15.25	15.75	0.60	0.62
D1	1.27 typ.		0.05 typ.	
E	10	10.40	0.39	0.41
e	2.40	2.70	0.094	0.106
e1	4.95	5.15	0.19	0.20
F	1.23	1.32	0.048	0.052
H1	6.20	6.60	0.24	0.26
J1	2.40	2.72	0.094	0.107
L	13	14	0.51	0.55
L1	3.50	3.93	0.137	0.154
L20	16.40 typ.		0.64 typ.	
L30	28.90 typ.		1.13 typ.	
∅P	3.75	3.85	0.147	0.151
Q	2.65	2.95	0.104	0.116



Figure 12. I<sup>2</sup>PAK dimension definitions

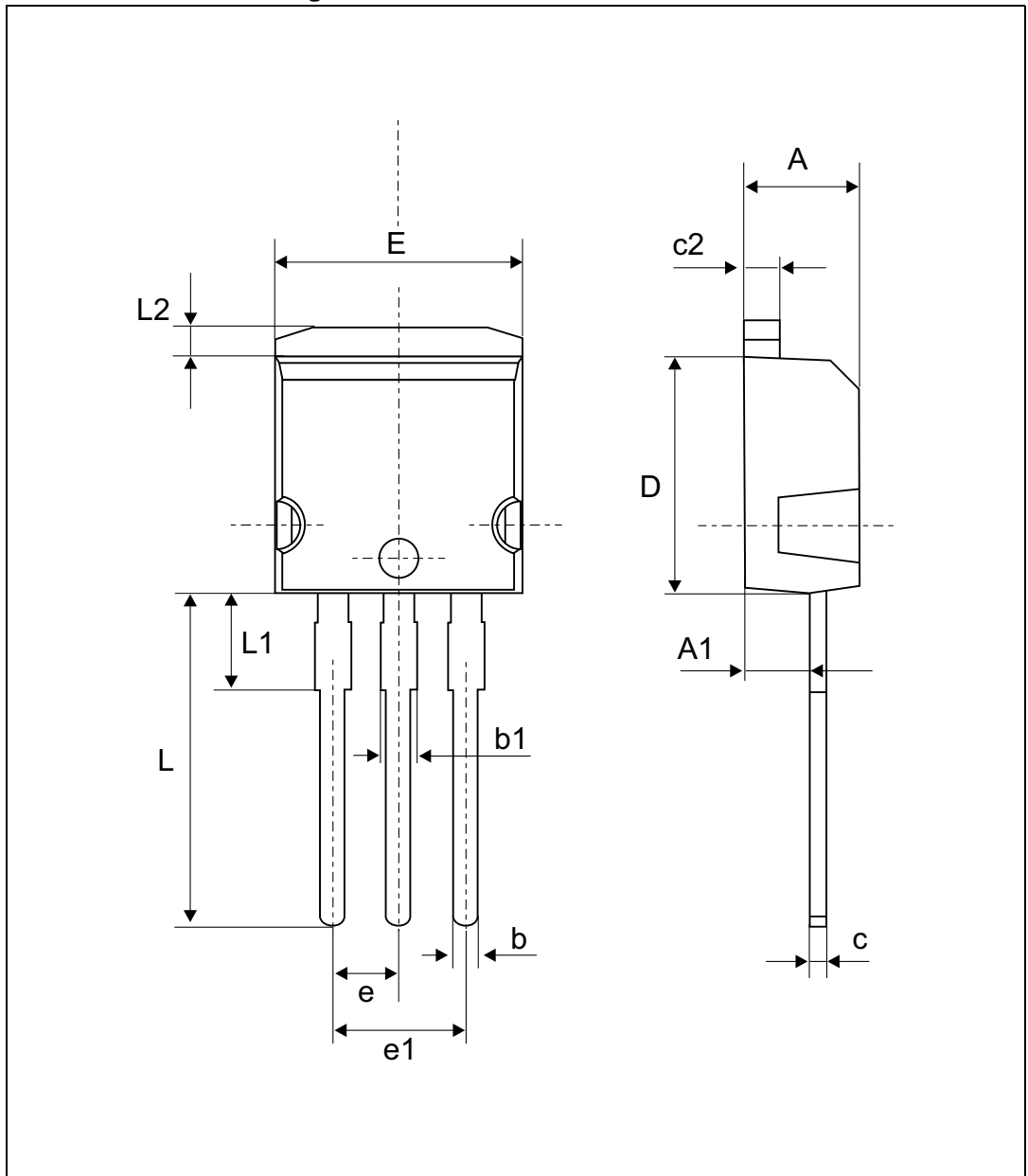


Table 7. I<sup>2</sup>PAK dimension values

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
A1	2.40	2.72	0.094	0.107
b	0.61	0.88	0.024	0.035
b1	1.14	1.70	0.044	0.067
c	0.49	0.70	0.019	0.028
c2	1.23	1.32	0.048	0.052
D	8.95	9.35	0.352	0.368
e	2.40	2.70	0.094	0.106
e1	4.95	5.15	0.195	0.203
E	10	10.40	0.394	0.409
L	13	14	0.512	0.551
L1	3.50	3.93	0.138	0.155
L2	1.27	1.40	0.050	0.055

### 3 Ordering information

**Table 8. Ordering information**

Order code	Marking	Package	Weight	Base qty	Delivery mode
STPS40SM120CR	PS40SM120CR	I <sup>2</sup> PAK	1.49 g	50	Tube
STPS40SM120CTN	PS40SM120CTN	TO-220AB narrow leads	1.9 g	50	Tube
STPS40SM120CT	PS40SM120CT	TO-220AB	2.2 g	50	Tube

### 4 Revision history

**Table 9. Document revision history**

Date	Revision	Changes
02-Apr-2012	1	First issue.
04-Nov-2014	2	Added TO-220AB and TO-220FPAB package information.

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