

Description

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

Packaged in TO-220AB narrow leads, TO-220AB, TO-220FPAB and I²PAK, 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.

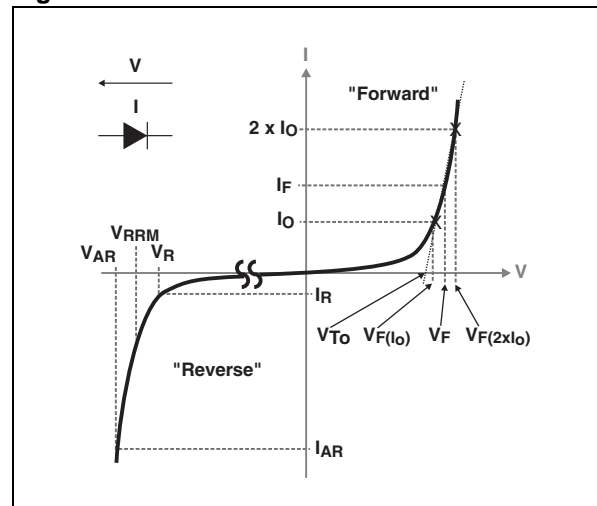
Table 1. Device summary

Symbol	Value
$I_{F(AV)}$	20 A
V_{RRM}	120 V
T_j	150 °C
V_F (typ)	0.49 V

Features

- High current capability
- Avalanche rated
- Low forward voltage drop
- High frequency operation
- Insulated package TO220FP-AB:
 - Insulated voltage: 2000 V_{RMS} sine
- ECOPACK[®]2 compliant component on TO-220AB and TO-220FPAB.

Figure 1. Electrical characteristics^(a)



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 $T_{amb} = 25\text{ °C}$, unless otherwise specified)

Symbol	Parameter		Value	Unit
V_{RRM}	Repetitive peak reverse voltage		120	V
$I_{F(RMS)}$	Forward rms current		50	A
$I_{F(AV)}$	Average forward current		20	A
I_{FSM}	Surge non repetitive forward current	$t_p = 10\text{ ms sine-wave}$	220	A
$P_{ARM}^{(1)}$	Repetitive peak avalanche power	$T_j = 125\text{ °C}, t_p = 10\text{ }\mu\text{s}$	900	W
$V_{ARM}^{(2)}$	Maximum repetitive peak avalanche voltage	$t_p < 10\text{ }\mu\text{s}, T_j < 125\text{ °C}, I_{AR} < 6\text{ A}$	150	V
$V_{ASM}^{(2)}$	Maximum single-pulse peak avalanche voltage	$t_p < 10\text{ }\mu\text{s}, T_j < 125\text{ °C}, I_{AR} < 6\text{ A}$	150	V
T_{stg}	Storage temperature range		-65 to +175	°C
T_j	Maximum operating junction temperature ⁽³⁾		150	°C

- 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".
- See [Figure 9](#)
- $\frac{dP_{tot}}{dT_j} < \frac{1}{R_{th(j-a)}}$ condition to avoid thermal runaway for a diode on its own heatsink

Table 3. Thermal resistance

Symbol	Parameter		Value	Unit
$R_{th(j-c)}$	Junction to case	TO-220AB and TO-220AB narrow leads	1.55	°C/W
		TO-220FPAB	4	

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	$T_j = 25\text{ °C}$	$V_R = V_{RRM}$	-	40	210	μA
		$T_j = 125\text{ °C}$		-	15	40	mA
$V_F^{(2)}$	Forward voltage drop	$T_j = 125\text{ °C}$	$I_F = 5\text{ A}$	-	0.49	0.54	V
		$T_j = 25\text{ °C}$	$I_F = 10\text{ A}$	-		0.75	
		$T_j = 125\text{ °C}$		-	0.57	0.62	
		$T_j = 25\text{ °C}$	$I_F = 20\text{ A}$	-		0.89	
		$T_j = 125\text{ °C}$		-	0.65	0.72	

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

To evaluate the conduction losses use the following equation:

$$P = 0.56 \times I_{F(AV)} + 0.008 \times I_{F(RMS)}^2$$

Figure 2. Average forward power dissipation versus average forward current

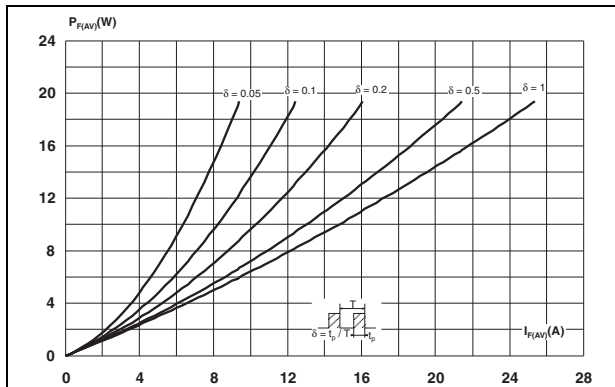


Figure 3. Average forward current versus ambient temperature (delta = 0.5)

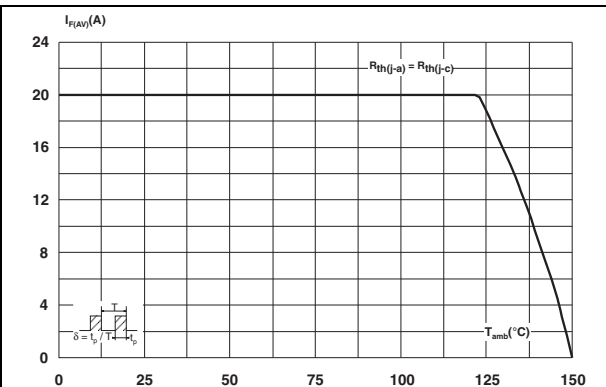


Figure 4. Normalized avalanche power derating versus pulse duration

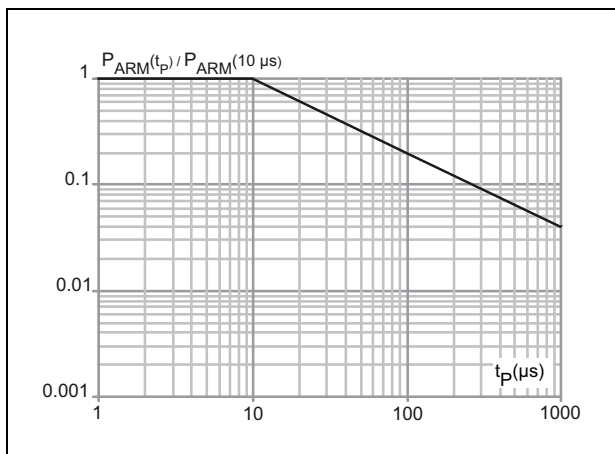


Figure 5. Relative variation of thermal impedance junction to case versus pulse duration

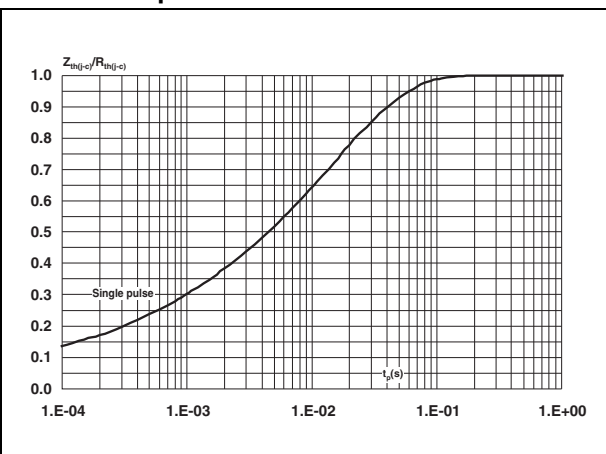


Figure 6. Reverse leakage current versus reverse voltage applied (typical values)

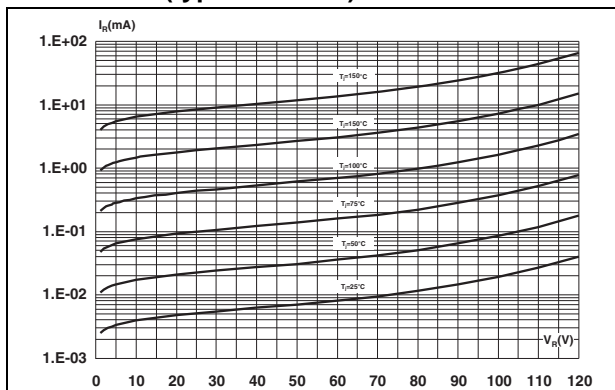


Figure 7. Junction capacitance versus reverse voltage applied (typical values)

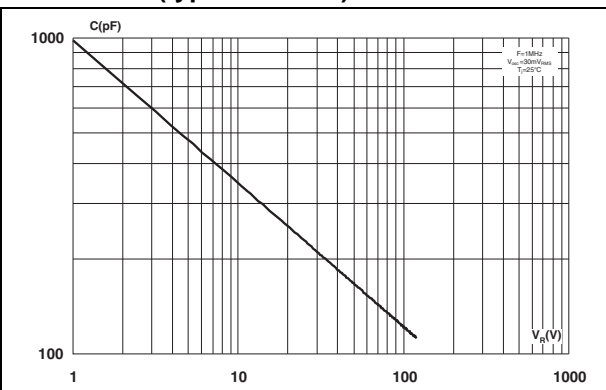


Figure 8. Forward voltage drop versus forward current

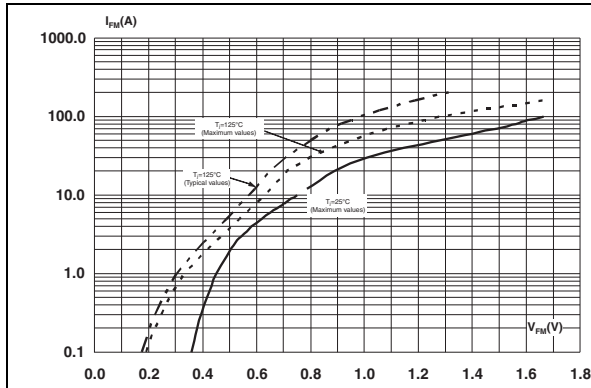
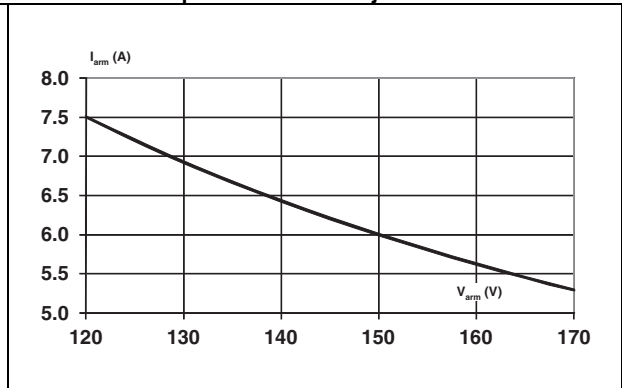


Figure 9. Reverse safe operating area ($t_p < 10 \mu\text{s}$ and $T_j < 125^\circ\text{C}$)



2 Package information

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

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 10. TO-220AB narrow leads dimension definitions

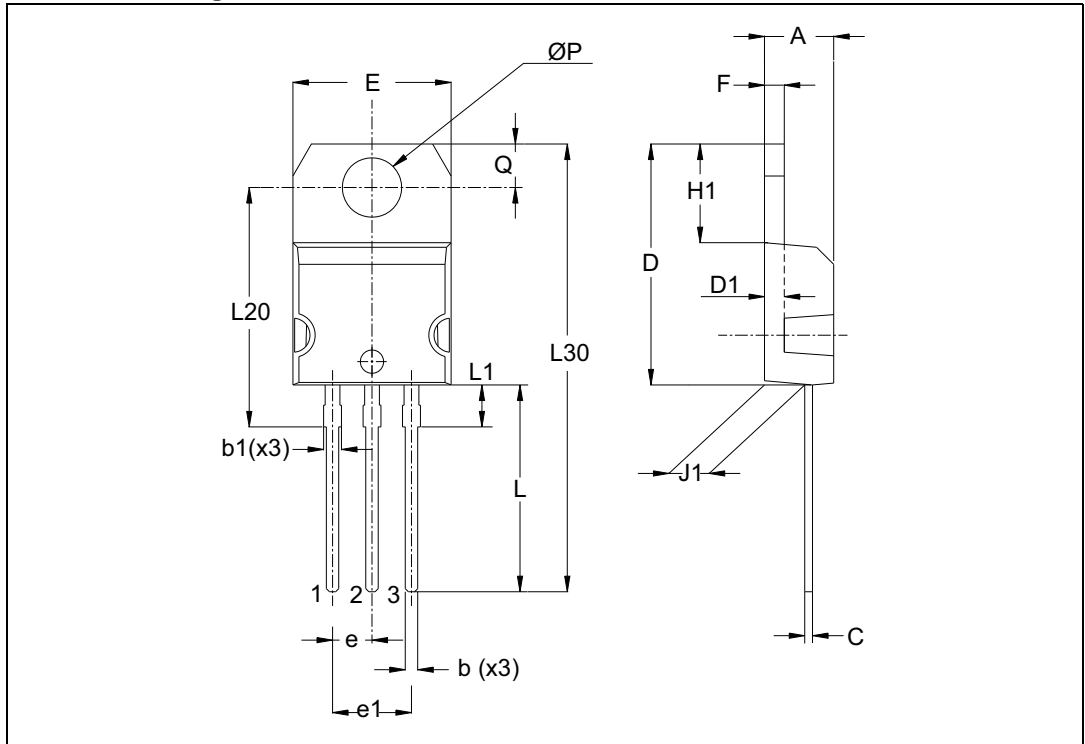


Table 5. TO-220AB narrow leads dimension values

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		
ØP	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.	
ØP	3.75	3.85	0.147	0.151
Q	2.65	2.95	0.104	0.116

Figure 12. TO-220FPAB dimension definitions

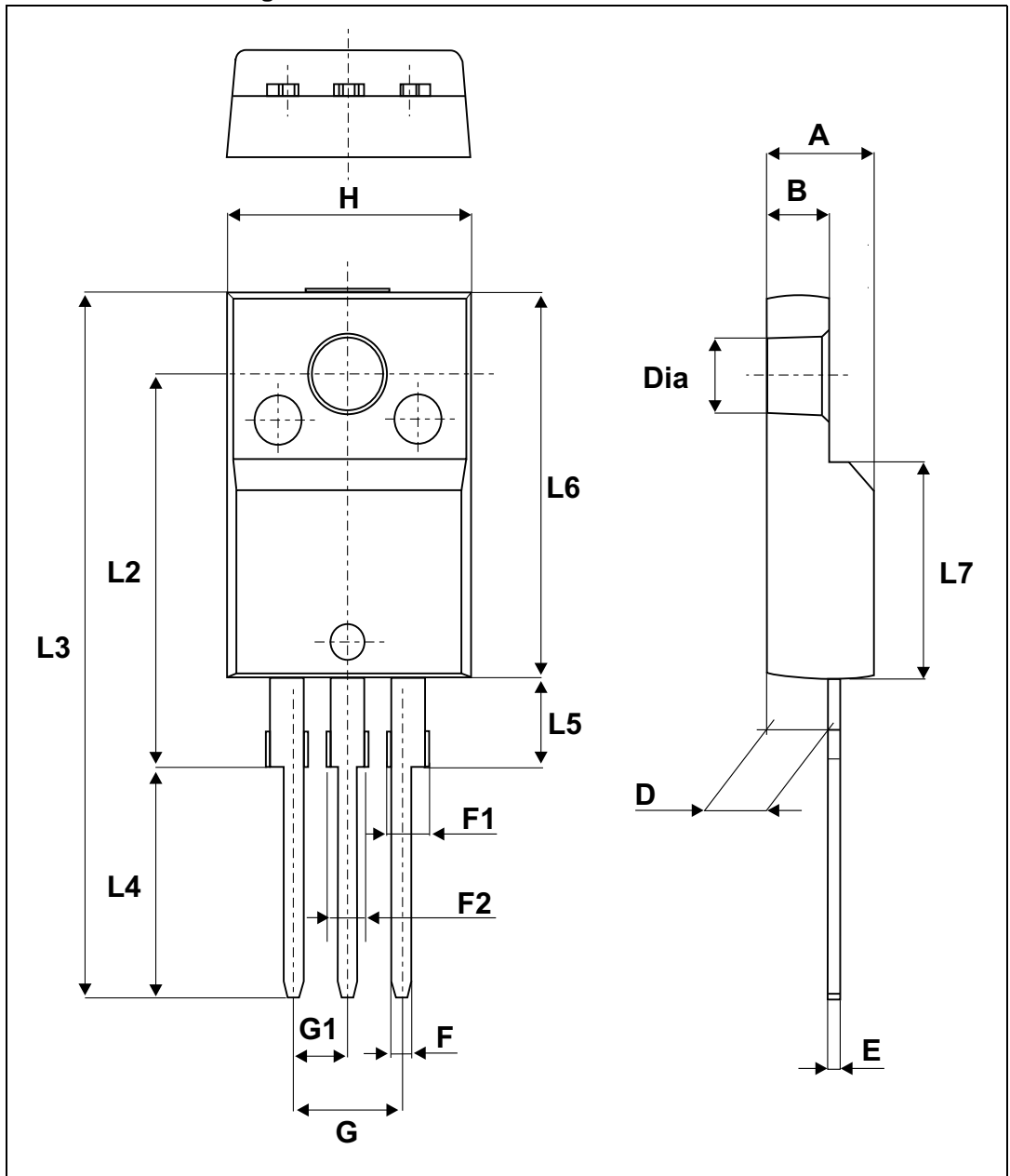


Table 7. TO-220FPAB dimension values

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.4	4.6	0.173	0.181
B	2.5	2.7	0.098	0.106
D	2.5	2.75	0.098	0.108
E	0.45	0.70	0.018	0.027
F	0.75	1	0.030	0.039
F1	1.15	1.70	0.045	0.067
F2	1.15	1.70	0.045	0.067
G	4.95	5.20	0.195	0.205
G1	2.4	2.7	0.094	0.106
H	10	10.4	0.393	0.409
L2	16 Typ.		0.63 Typ.	
L3	28.6	30.6	1.126	1.205
L4	9.8	10.6	0.386	0.417
L5	2.9	3.6	0.114	0.142
L6	15.9	16.4	0.626	0.646
L7	9.00	9.30	0.354	0.366
Dia.	3.00	3.20	0.118	0.126

Figure 13. I²PAK dimension definitions

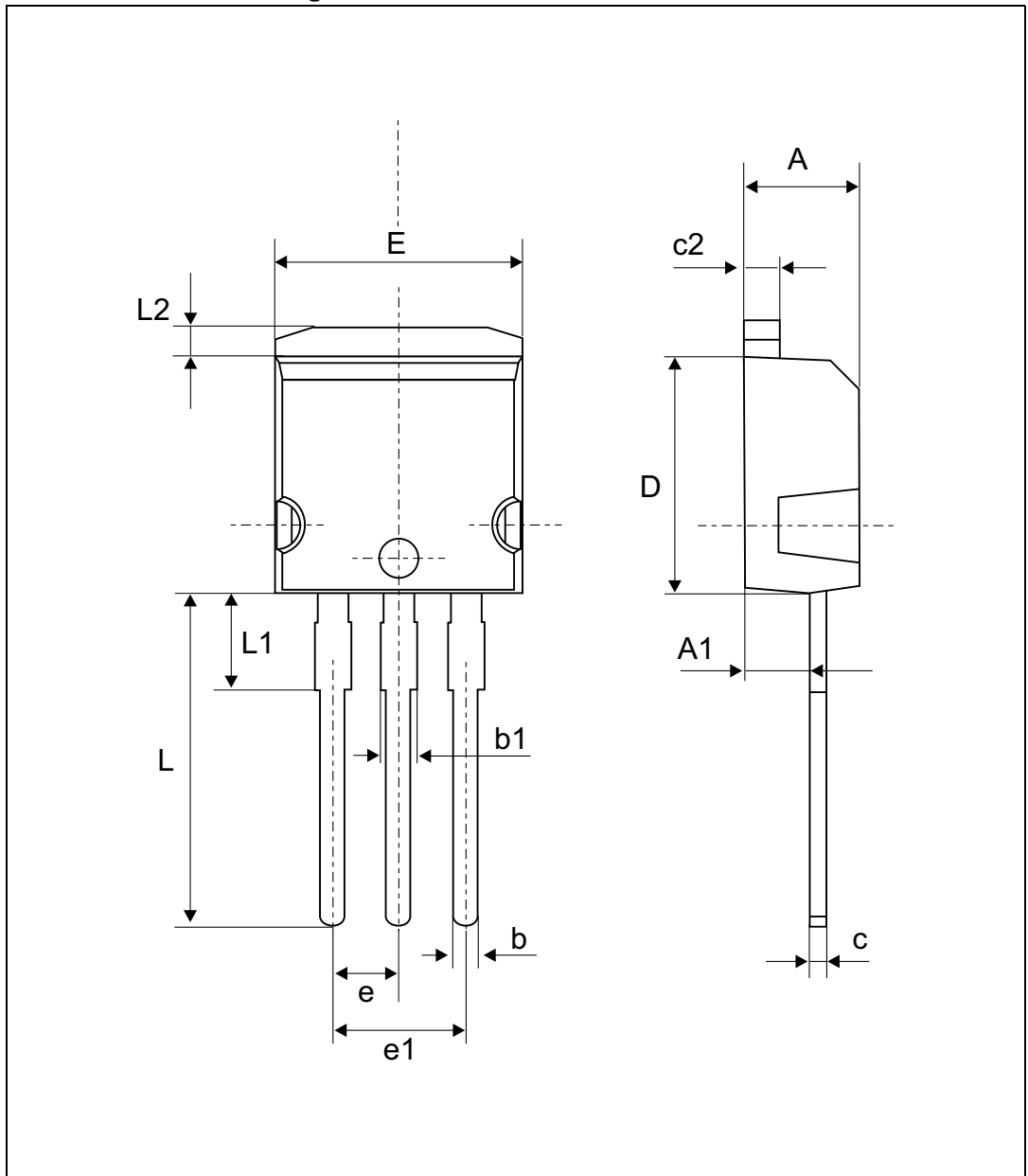


Table 8. I²PAK dimension values

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 9. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
STPS20SM120SR	PS20SM120SR	I ² PAK	1.49 g	50	Tube
STPS20SM120STN	PS20SM120STN	TO-220AB narrow leads	1.9 g	50	Tube
STPS20SM120ST	PS20SM120ST	TO-220AB	2.2 g	50	Tube
STPS20SM120SFP	PS20SM120SFP	TO-220FPAB	1.7 g	50	Tube

4 Revision history

Table 10. Document revision history

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

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