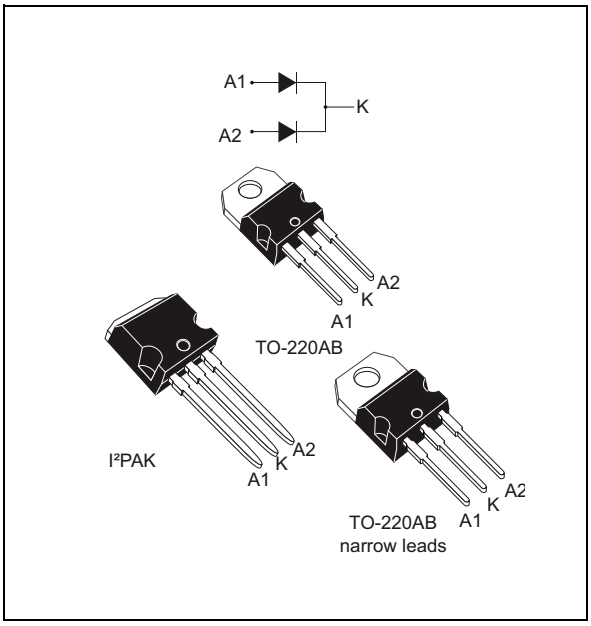
STPS40SM120C

Power Schottky rectifier

Datasheet - production data



Features

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

Description

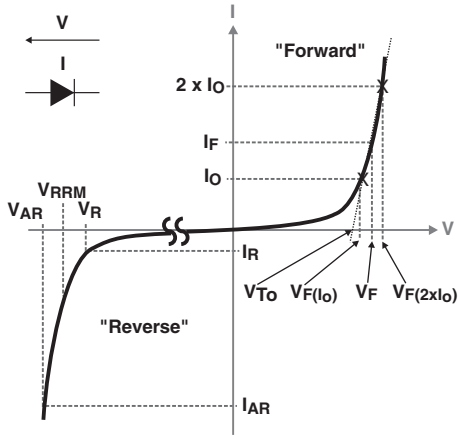
This Schottky diode is suited for high frequency switch mode power supply.

Packaged in TO-220AB narrow leads, TO-220AB 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
$I_{F(AV)}$	2 X 20 A
V_{RRM}	120 V
T_j	150 °C
V_F (typ)	0.46 V

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 µs). 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 °C, unless otherwise specified)

Symbol	Parameter		Value	Unit
V_{RRM}	Repetitive peak reverse voltage		120	V
$I_{F(RMS)}$	Forward rms current		30	A
$I_{F(AV)}$	Average forward current	Per diode, T_C = 125 °C	20	A
		Per device, T_C = 115 °C	40	
I_{FSM}	Surge non repetitive forward current	t_p = 10 ms sine-wave	210	A
P_{ARM}(1)	Repetitive peak avalanche power	T_j = 125 °C, t_p = 10 µs	1150	W
V_{ARM}(2)	Maximum repetitive peak avalanche voltage	t_p < 10 µs, T_j < 125 °C, I_{AR} < 7.7 A	150	V
V_{ASM}(2)	Maximum single-pulse peak avalanche voltage	t_p < 10 µs, T_j < 125 °C, I_{AR} < 7.7 A	150	V
T_{stg}	Storage temperature range		-65 to +175	°C
T_j	Maximum operating junction temperature(3)		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. $\frac{dPtot}{dTj} < \frac{1}{Rth(j-a)}$ 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	Per diode	1.35	°C/W
		Total	0.93	
$R_{th(c)}$	Coupling		0.50	

When the two diodes 1 and 2 are used simultaneously:

ΔT_j(diode 1) = P(diode 1) x $R_{th(j-c)}$(Per diode) + P(diode 2) x $R_{th(c)}$

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 °C	$V_R = V_{RRM}$	-	55	275	µA
		T_j = 125 °C		-	20	50	mA
V_F(2)	Forward voltage drop	T_j = 125 °C	I_F = 5 A	-	0.46	0.51	V
		T_j = 125 °C	I_F = 10 A	-	0.55	0.60	
		T_j = 25 °C	I_F = 20 A	-		0.83	
		T_j = 125 °C		-	0.63	0.69	

1. Pulse test: t_p = 5 ms, δ < 2%
2. Pulse test: t_p = 380 µs, δ < 2%

To evaluate the conduction losses use the following equation:

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

Figure 2. Average forward power dissipation versus average forward current

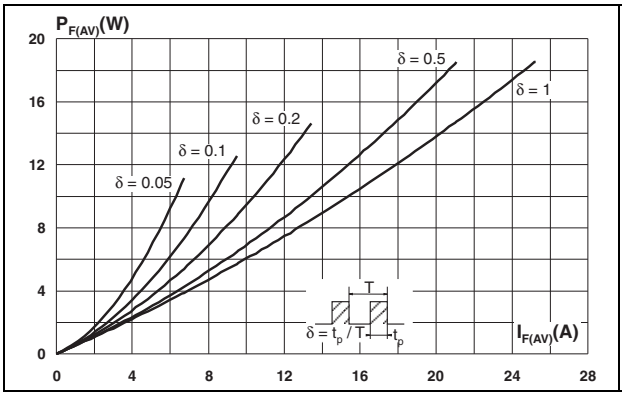


Figure 3. Average forward current versus ambient temperature (δ = 0.5)

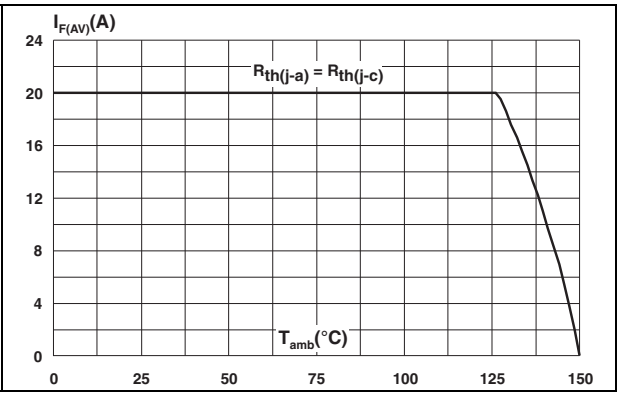


Figure 4. Normalized avalanche power derating versus pulse duration

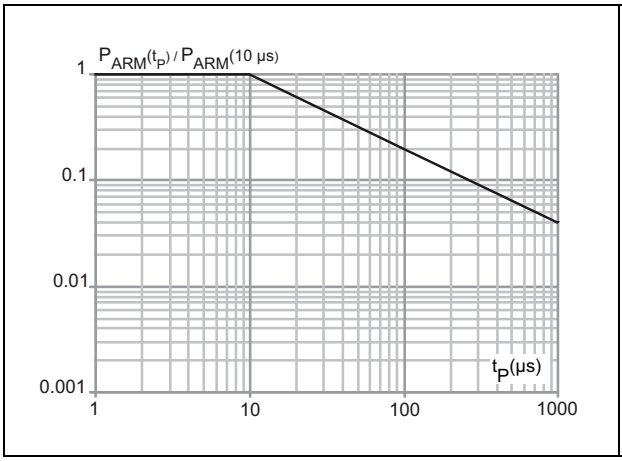


Figure 5. Relative variation of thermal impedance junction to case versus pulse duration

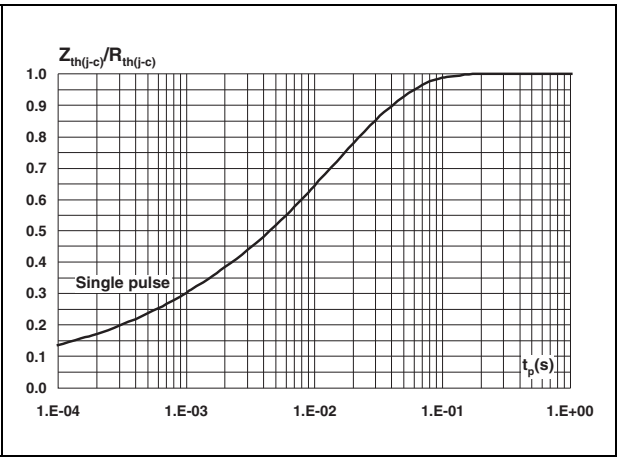


Figure 6. Reverse leakage current versus reverse voltage applied (typical values)

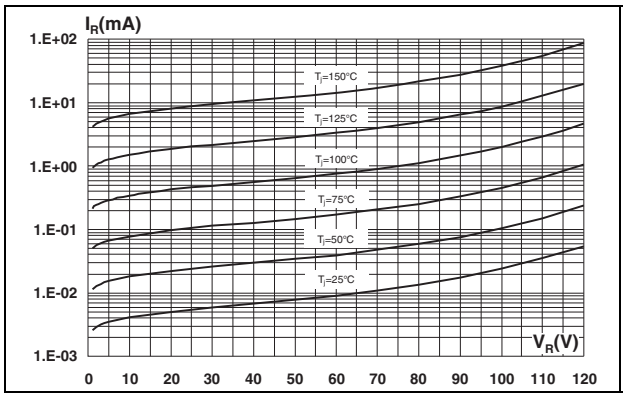


Figure 7. Junction capacitance versus reverse voltage applied (typical values)

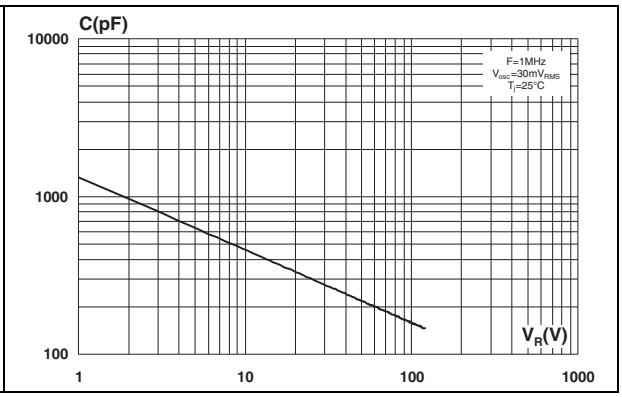


Figure 8. Forward voltage drop versus forward current

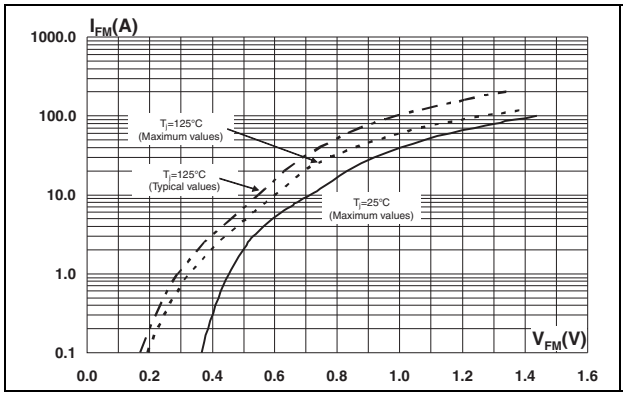
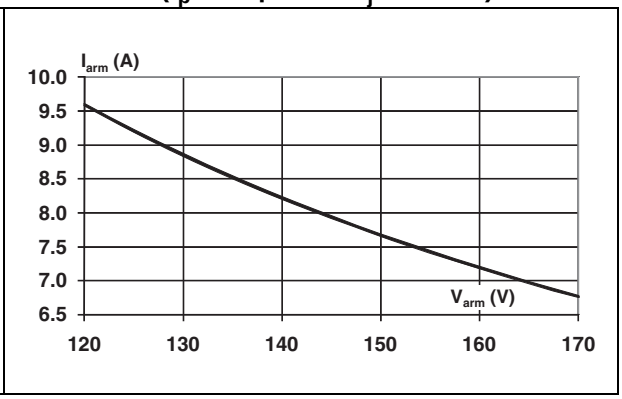


Figure 9. Reverse safe operating area (t_p < 10 µs and T_j < 125 °C)



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® 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

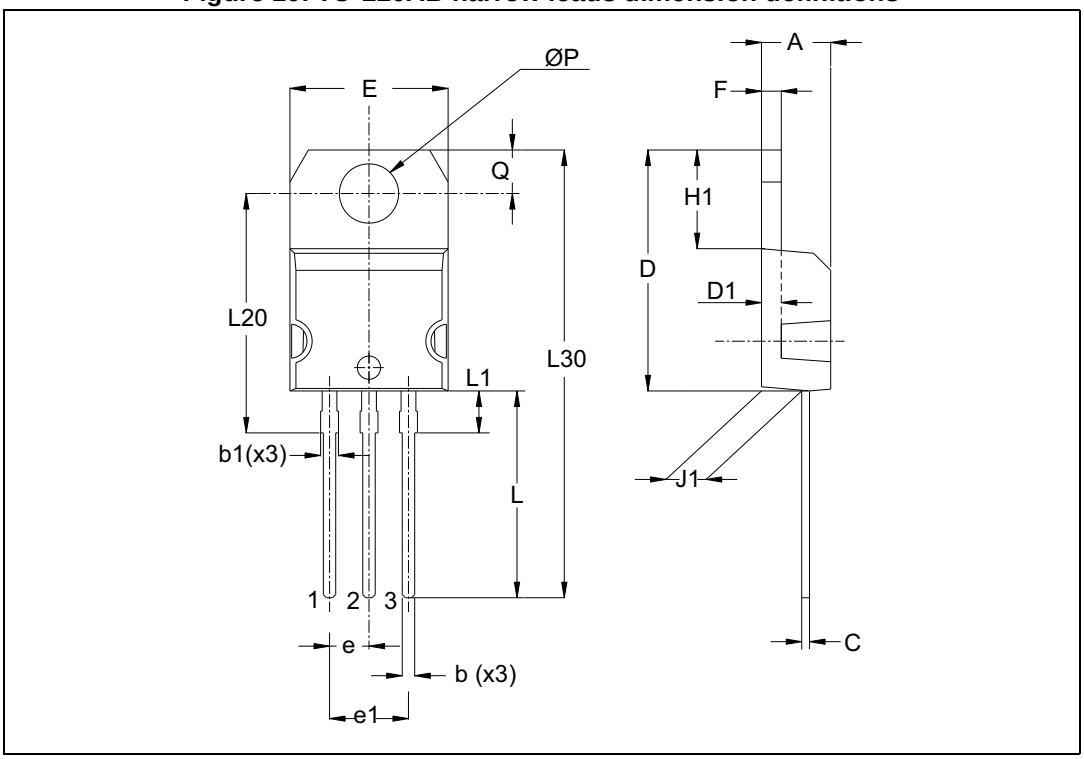
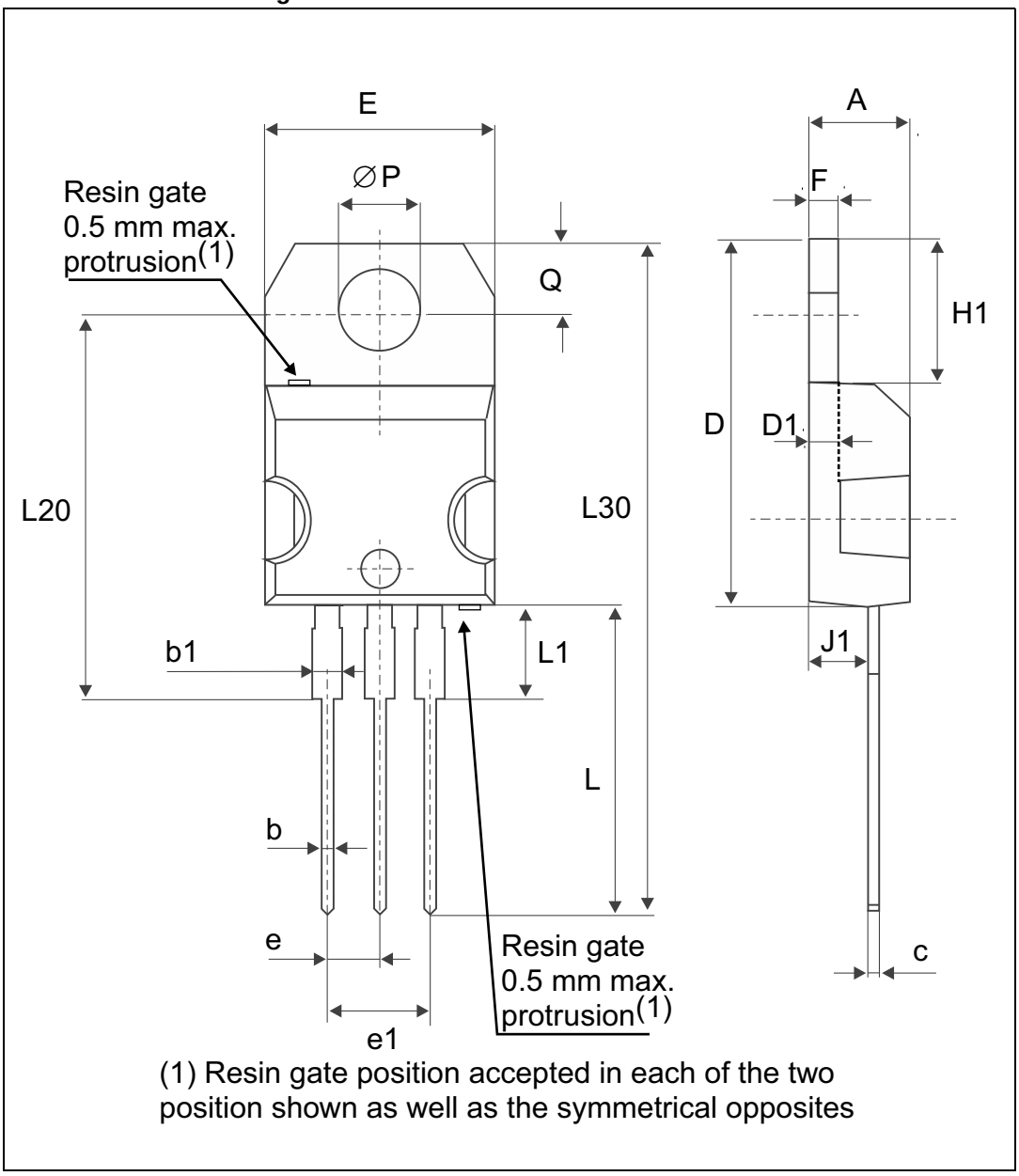


Table 5. TO-220AB narrow leads dimension values

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	
∅P	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116

Figure 11. TO-220AB dimension definitions



(1) Resin gate position accepted in each of the two position shown as well as the symmetrical opposites

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. I²PAK dimension definitions

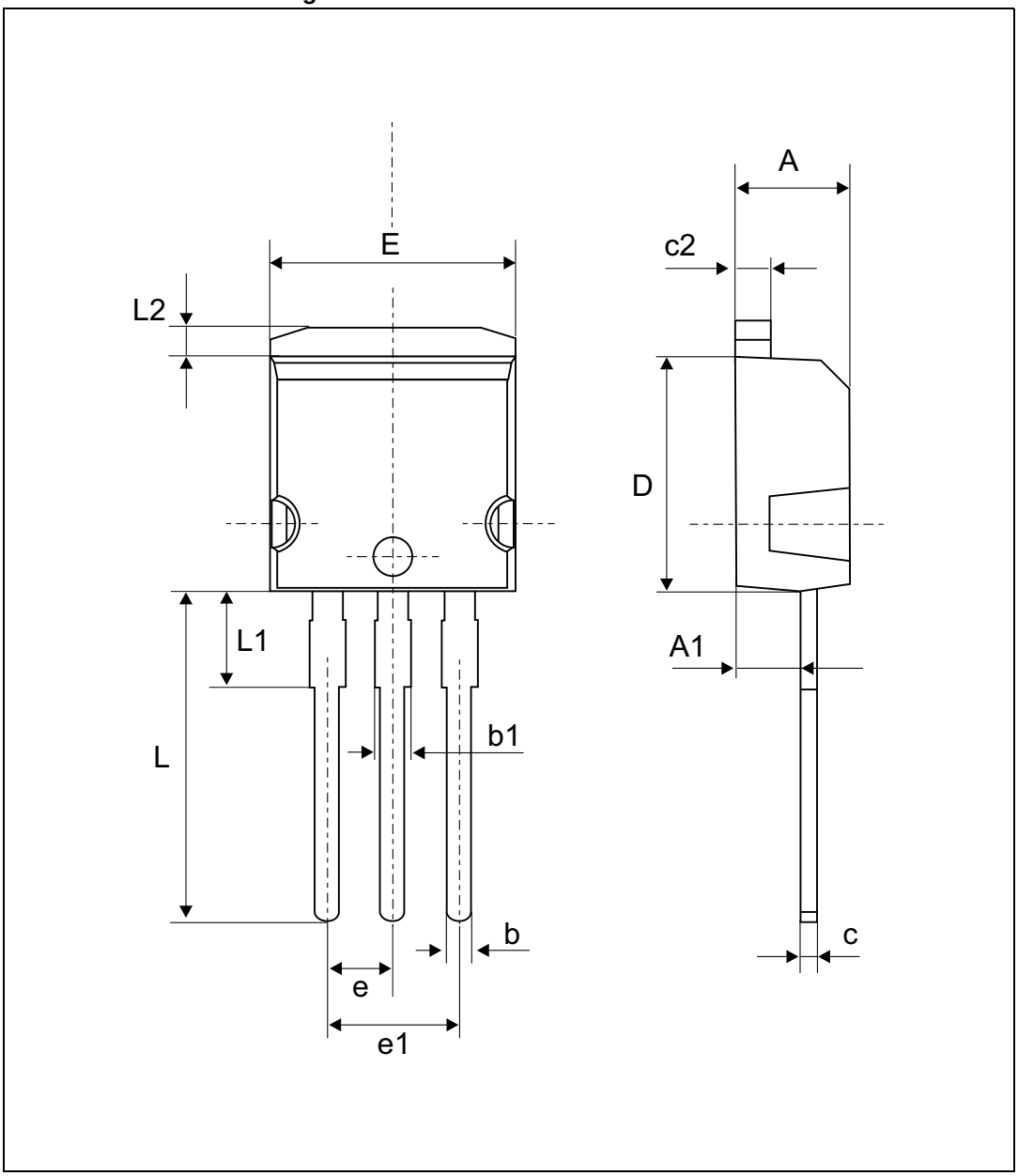


Table 7. I²PAK dimension values

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 8. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
STPS40SM120CR	PS40SM120CR	I^2PAK	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.