

## Power Schottky rectifier

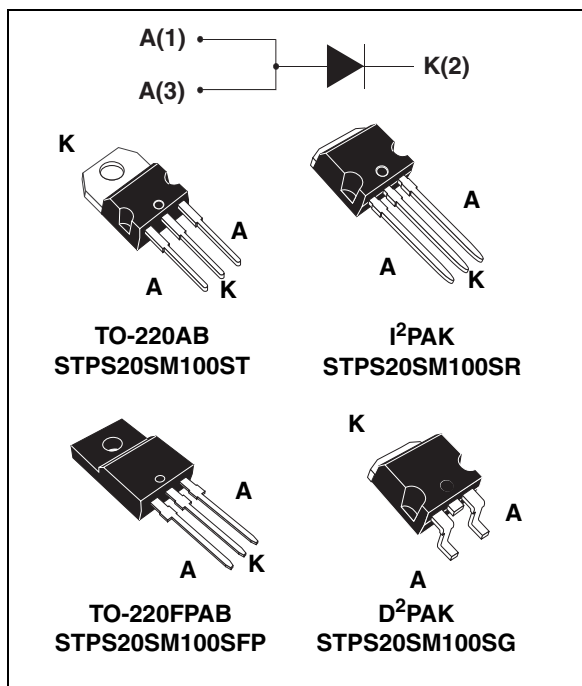
### Features

- High current capability
- Avalanche rated
- Low forward voltage drop current
- High frequency operation
- Insulated package (TO-220FPAB):
  - Insulation voltage 2000 V rms
  - Package capacitance = 12 pF

### Description

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

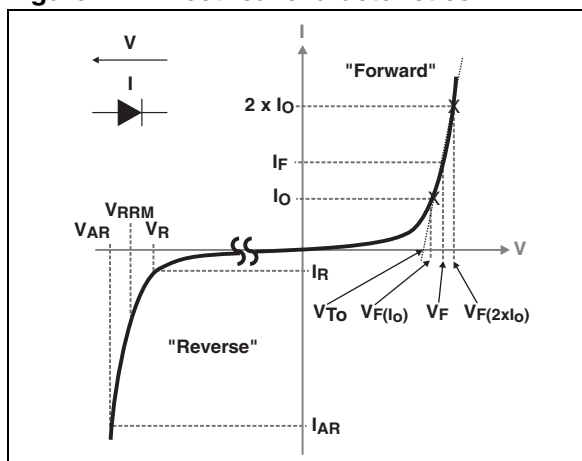
Packaged in TO-220AB, TO-220FPAB, D<sup>2</sup>PAK and I<sup>2</sup>PAK, this device is intended to be used in notebook, game station and desktop adaptors, providing in these applications a good efficiency at both low and high load.



**Table 1. Device summary**

$I_{F(AV)}$	20 A
$V_{RRM}$	100 V
$T_j$ (max)	150 °C
$V_F$ (typ)	0.480 V

**Figure 1. Electrical characteristics (a)**



- a.  $V_{ARM}$  and  $I_{ARM}$  must respect the reverse safe operating area defined in [Figure 14](#).  $V_{AR}$  and  $I_{AR}$  are pulse measurements ( $t_p < 1 \mu s$ ).  $V_R$ ,  $I_R$ ,  $V_{RRM}$  and  $V_F$  are static characteristics

# 1 Characteristics

**Table 2. Absolute ratings (limiting values with terminals 1 and 3 short circuited)**

Symbol	Parameter	Value	Unit	
$V_{RRM}$	Repetitive peak reverse voltage	100	V	
$I_{F(RMS)}$	Forward rms current	30	A	
$I_{F(AV)}$	Average forward current $\delta = 0.5$	TO-220AB, D <sup>2</sup> PAK, I <sup>2</sup> PAK $T_c = 125\text{ }^\circ\text{C}$	20	A
		TO-220FPAB $T_c = 85\text{ }^\circ\text{C}$		
$I_{FSM}$	Surge non repetitive forward current	$t_p = 10\text{ ms}$ sinusoidal, terminals 1 and 3 short circuited	350	A
$P_{ARM}^{(1)}$	Repetitive peak avalanche power	$t_p = 1\text{ }\mu\text{s}$ $T_j = 25\text{ }^\circ\text{C}$	15000	W
$V_{ARM}^{(2)}$	Maximum repetitive peak avalanche voltage	$t_p < 1\text{ }\mu\text{s}$ $T_j < 150\text{ }^\circ\text{C}$ $I_{AR} < 37.5\text{ A}$	120	V
$V_{ASM}^{(2)}$	Maximum single pulse peak avalanche voltage	$t_p < 1\text{ }\mu\text{s}$ $T_j < 150\text{ }^\circ\text{C}$ $I_{AR} < 37.5\text{ A}$	120	V
$T_{stg}$	Storage temperature range	-65 to + 150		$^\circ\text{C}$
$T_j$	Maximum operating junction temperature <sup>(3)</sup>	150		$^\circ\text{C}$

- For temperature or pulse time duration deratings, refer to [Figure 4](#), and [Figure 5](#).. More details regarding the avalanche energy measurements and diode validation in the avalanche are provided in the application notes AN1768 and AN2025.
- Refer to [Figure 14](#).
- $\frac{dP_{tot}}{dT_j} < \frac{1}{R_{th(j-a)}}$  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, D <sup>2</sup> PAK, I <sup>2</sup> PAK	1.3
		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	$T_j = 25\text{ }^\circ\text{C}$	$V_R = V_{RRM}$	10	30	$\mu\text{A}$
		$T_j = 125\text{ }^\circ\text{C}$		10	30	mA
		$T_j = 25\text{ }^\circ\text{C}$	$V_R = 70\text{ V}$	5		$\mu\text{A}$
		$T_j = 125\text{ }^\circ\text{C}$		5		mA
$V_F^{(2)}$	Forward voltage drop	$T_j = 25\text{ }^\circ\text{C}$	$I_F = 5\text{ A}$	565		mV
		$T_j = 125\text{ }^\circ\text{C}$		480		
		$T_j = 25\text{ }^\circ\text{C}$	$I_F = 10\text{ A}$	685		
		$T_j = 125\text{ }^\circ\text{C}$		560	620	
		$T_j = 25\text{ }^\circ\text{C}$	$I_F = 20\text{ A}$	800	900	
		$T_j = 125\text{ }^\circ\text{C}$		630	700	

- 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:  
 $P = 0.6 \times I_{F(AV)} + 0.005 \times I_{F(RMS)}^2$

Figure 2. Average forward power dissipation versus average forward current

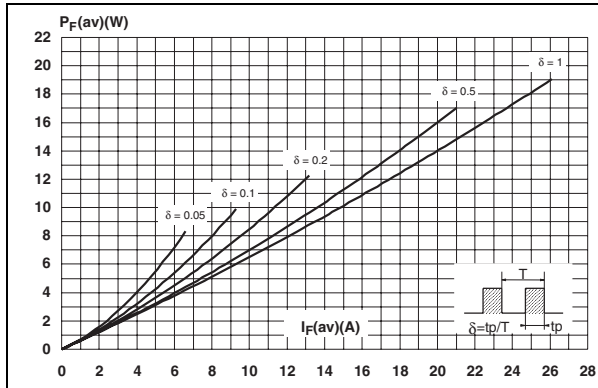


Figure 3. Average forward current versus ambient temperature ( $\delta = 0.5$ )

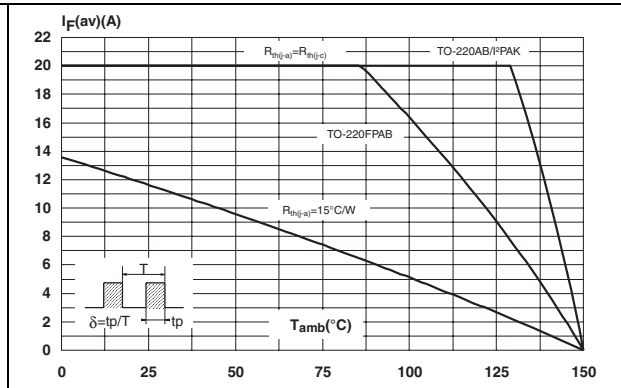


Figure 4. Normalized avalanche power derating versus pulse duration

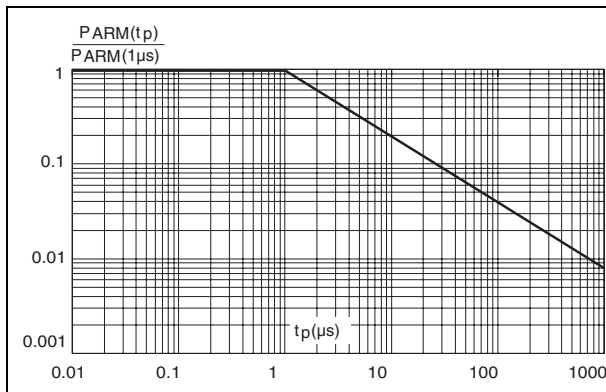


Figure 5. Normalized avalanche power derating versus junction temperature

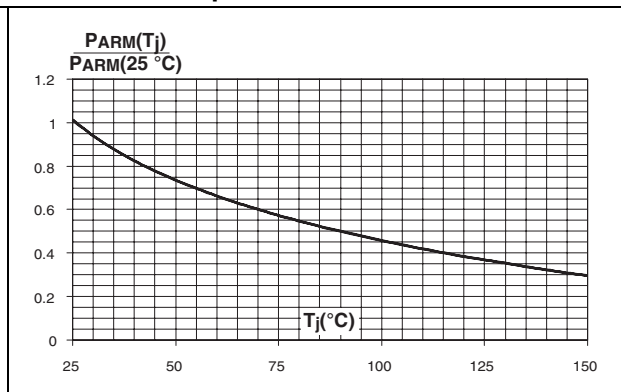


Figure 6. Non repetitive surge peak forward current versus overload duration, maximum values

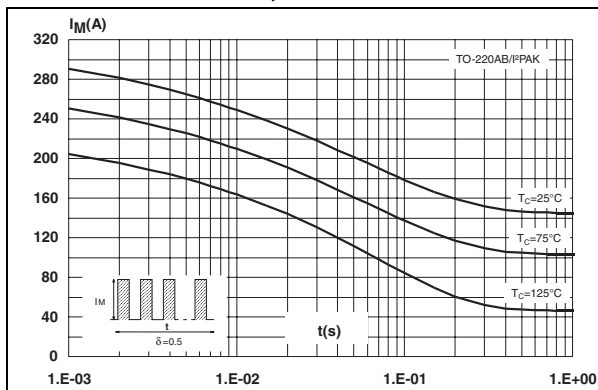
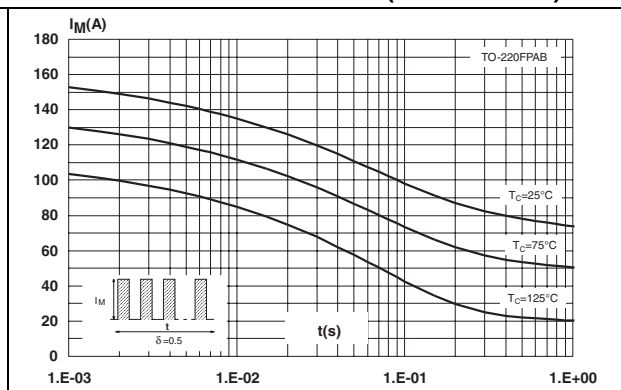
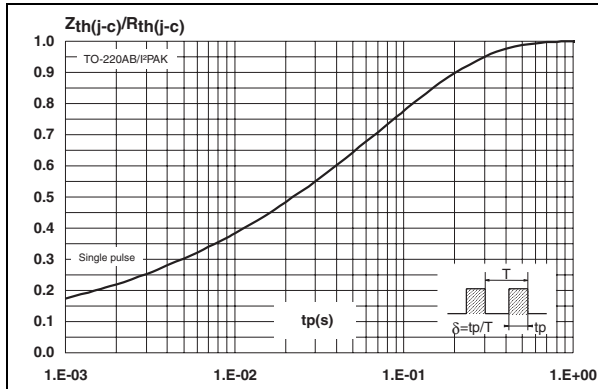


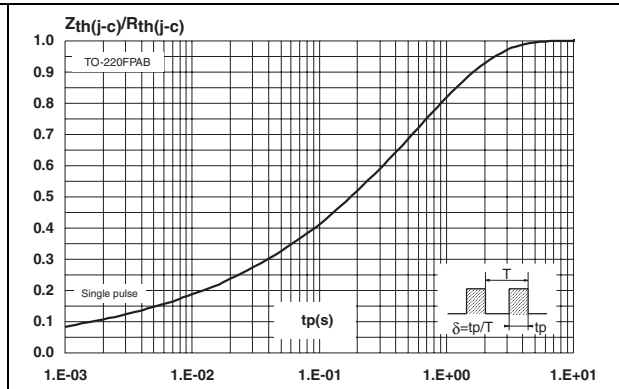
Figure 7. Non repetitive surge peak forward current versus overload duration, maximum values (TO-220FPAB)



**Figure 8. Relative variation of thermal impedance junction to case versus pulse duration**



**Figure 9. Relative variation of thermal impedance junction to case versus pulse duration (TO-220FPAB)**



**Figure 10. Reverse leakage current versus reverse voltage applied (typical values)**

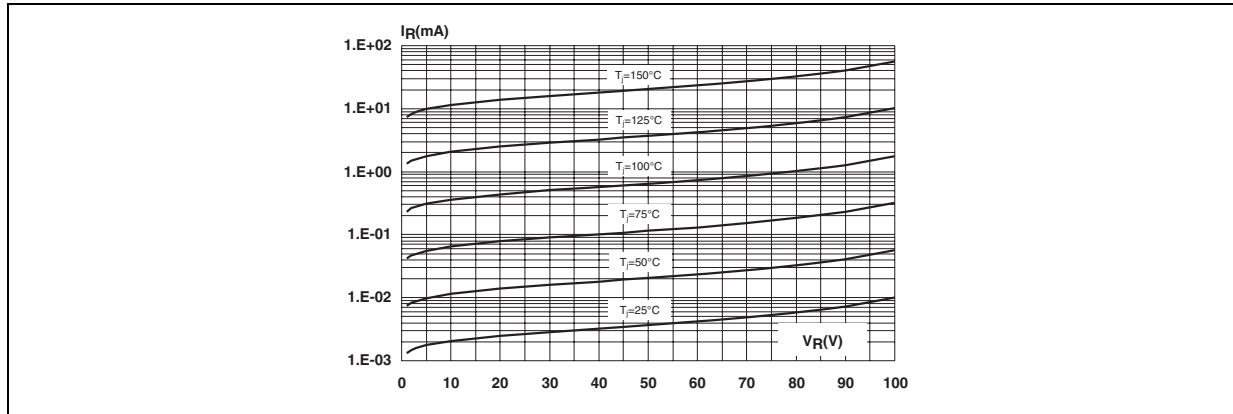


Figure 11. Junction capacitance versus reverse voltage applied (typical values)

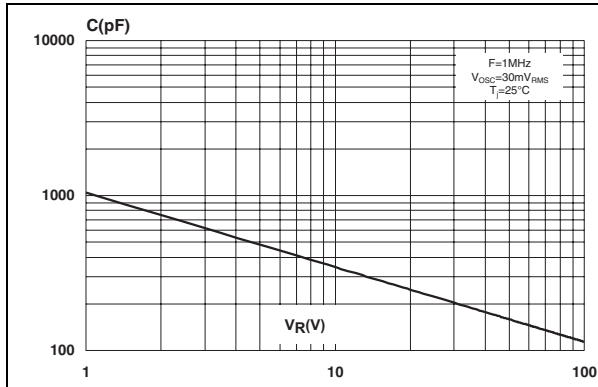


Figure 12. Forward voltage drop versus forward current (terminals 1 and 3 short circuited)

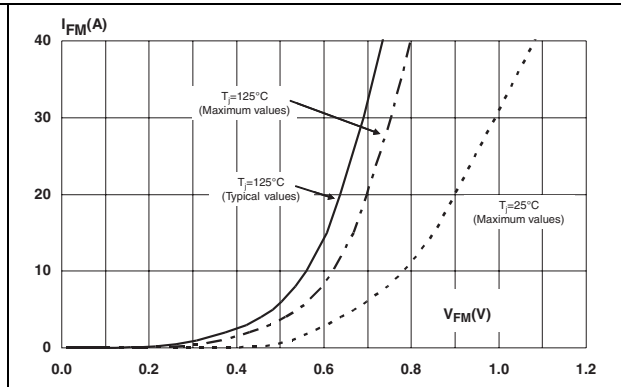


Figure 13. Thermal resistance junction to ambient versus copper surface under tab for D<sup>2</sup>PAK

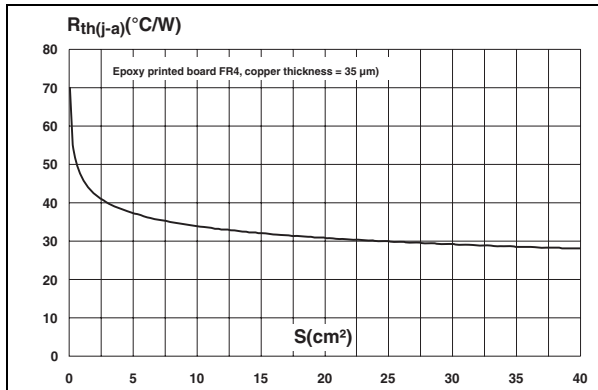
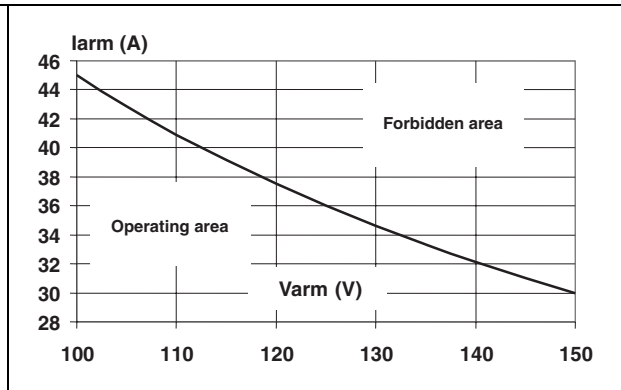


Figure 14. Reverse safe operating area ( $t_p < 1 \mu s$  and  $T_j < 150 \text{ }^\circ\text{C}$ )



## 2 Package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.4 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](http://www.st.com). ECOPACK® is an ST trademark.

**Table 5. TO-220AB dimensions**

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
C	1.23	1.32	0.048	0.051
D	2.40	2.72	0.094	0.107
E	0.49	0.70	0.019	0.027
F	0.61	0.88	0.024	0.034
F1	1.14	1.70	0.044	0.066
F2	1.14	1.70	0.044	0.066
G	4.95	5.15	0.194	0.202
G1	2.40	2.70	0.094	0.106
H2	10	10.40	0.393	0.409
L2	16.4 typ.		0.645 typ.	
L4	13	14	0.511	0.551
L5	2.65	2.95	0.104	0.116
L6	15.25	15.75	0.600	0.620
L7	6.20	6.60	0.244	0.259
L9	3.50	3.93	0.137	0.154
M	2.6 typ.		0.102 typ.	
Diam.	3.75	3.85	0.147	0.151

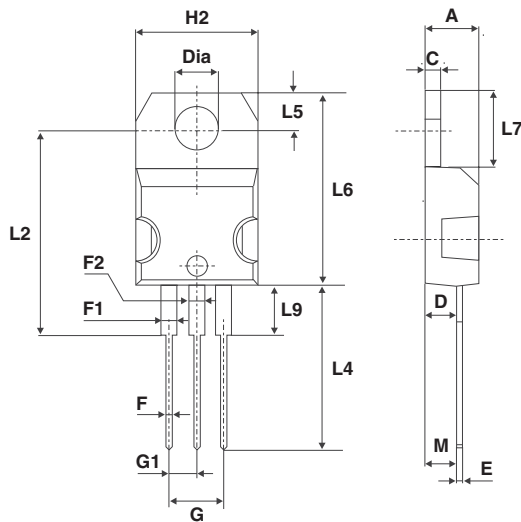


Table 6. TO-220FPAB dimensions

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

Mounting (soldering) the I<sup>2</sup>PAK metal slug (heatsink) with alloy, like a surface mount device, IS NOT PERMITTED. A standard through-hole mounting is mandatory.

Table 7. I<sup>2</sup>PAK dimensions

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

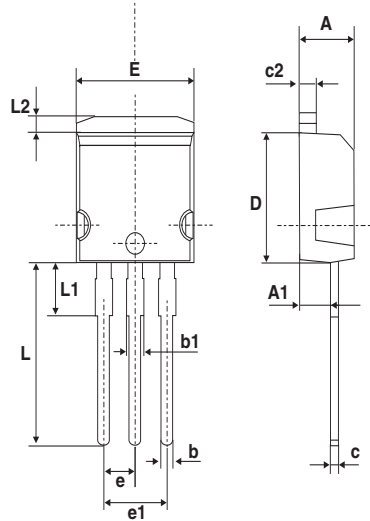
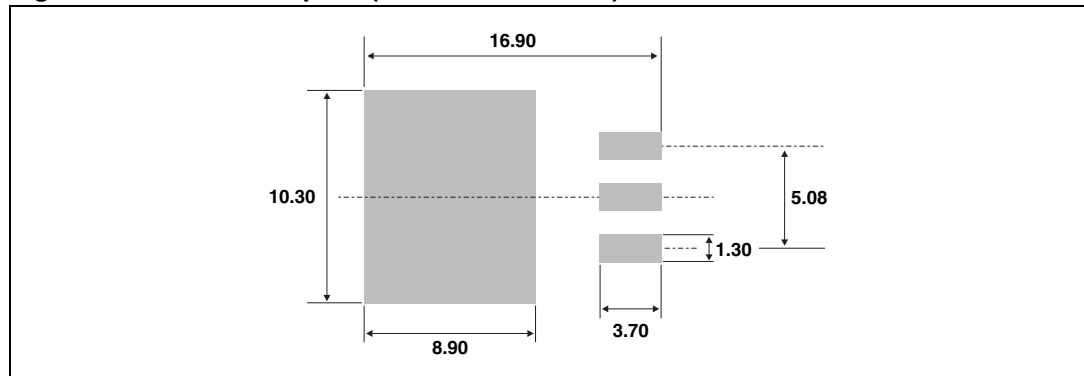




Table 8. D<sup>2</sup>PAK dimensions

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
A1	2.49	2.69	0.098	0.106
A2	0.03	0.23	0.001	0.009
B	0.70	0.93	0.027	0.037
B2	1.14	1.70	0.045	0.067
C	0.45	0.60	0.017	0.024
C2	1.23	1.36	0.048	0.054
D	8.95	9.35	0.352	0.368
E	10.00	10.40	0.393	0.409
G	4.88	5.28	0.192	0.208
L	15.00	15.85	0.590	0.624
L2	1.27	1.40	0.050	0.055
L3	1.40	1.75	0.055	0.069
M	2.40	3.20	0.094	0.126
R	0.40 typ.		0.016 typ.	
V2	0°	8°	0°	8°

Figure 15. D<sup>2</sup>PAK footprint (dimensions in mm)



### 3 Ordering information

**Table 9. Ordering information**

Order code	Marking	Package	Weight	Base qty	Delivery mode
STPS20SM100ST	PS20SM100ST	TO-220AB	2.2 g	50	Tube
STPS20SM100SFP	PS20SM100SFP	TO-220FPAB	1.70 g	50	Tube
STPS20SM100SR	PS20SM100SR	I <sup>2</sup> PAK	1.49 g	50	Tube
STPS20SM100SG-TR	PS20SM100SG	D <sup>2</sup> PAK	1.48 g	1000	Tape and reel

### 4 Revision history

**Table 10. Document revision history**

Date	Revision	Changes
25-Mar-2009	1	First issue.
16-Apr-2010	2	Updated package graphic for TO-220AB on front page and in <a href="#">Table 5</a> .

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