

## Power Schottky rectifier

### Features

- High current capability
- Avalanche rated
- Low forward voltage drop
- High frequency operation

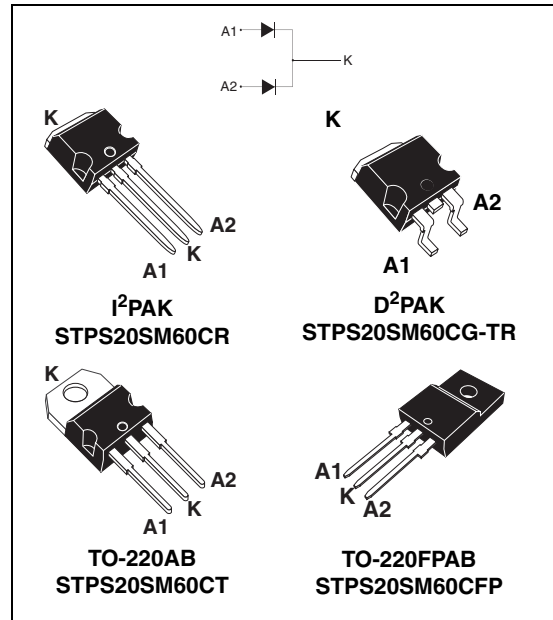
### Description

The STPS20SM60C is a dual diode Schottky rectifier, suited for high frequency switch mode power supply.

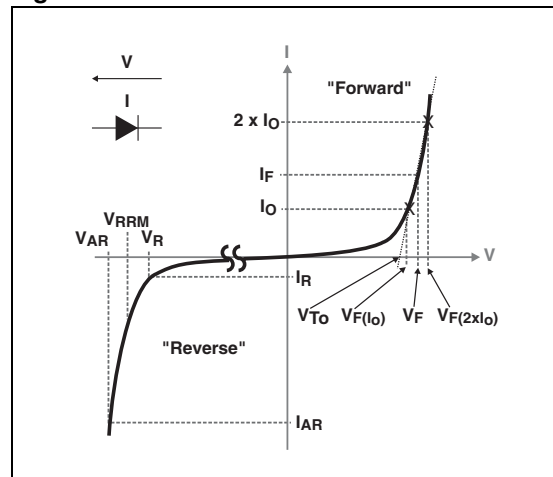
Packaged in TO-220AB, TO-220FPAB, I<sup>2</sup>PAK and D<sup>2</sup>PAK, this device is intended to be used in notebook, game station and desktop adapters, providing in these applications a good efficiency at both low and high load.

**Table 1. Device summary**

Symbol	Value
$I_{F(AV)}$	2 x 10 A
$V_{RRM}$	60 V
$V_F$ (typ)	0.420 V
$T_j$ (max)	150 °C



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

Symbol	Parameter			Value	Unit	
$V_{RRM}$	Repetitive peak reverse voltage			60	V	
$I_{F(RMS)}$	Forward rms current			30	A	
$I_{F(AV)}$	Average forward current, $\delta = 0.5$	TO-220AB, $I^2$ PAK, D <sup>2</sup> PAK	$T_c = 135\text{ °C}$ $T_c = 130\text{ °C}$	Per diode Per device	10 20	A
		TO-220FPAB	$T_c = 110\text{ °C}$ $T_c = 90\text{ °C}$	Per diode Per device	10 20	
$I_{FSM}$	Surge non repetitive forward current	$t_p = 10\text{ ms}$ sine-wave		220	A	
$P_{ARM}^{(1)}$	Repetitive peak avalanche power	$T_j = 25\text{ °C}$ , $t_p = 1\text{ }\mu\text{s}$		8700	W	
$V_{ARM}^{(2)}$	Maximum repetitive peak avalanche voltage	$t_p < 1\text{ }\mu\text{s}$ , $T_j < 150\text{ °C}$ , $I_{AR} < 32.6\text{ A}$		80	V	
$V_{ASM}^{(2)}$	Maximum single pulse peak avalanche voltage	$t_p < 1\text{ }\mu\text{s}$ , $T_j < 150\text{ °C}$ , $I_{AR} < 32.6\text{ A}$		80	V	
$T_{stg}$	Storage temperature range			-65 to +175	°C	
$T_j$	Maximum operating junction temperature <sup>(3)</sup>			150	°C	

1. For temperature or pulse time duration deratings, please refer to [Figure 4](#) and [5](#). More details regarding the avalanche energy measurements and diode validation in the avalanche are provided in the application notes AN1768 and AN2025.
2. See [Figure 14](#)
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 parameters**

Symbol	Parameter		Value	Unit	
$R_{th(j-c)}$	Junction to case	TO-220AB	per diode	2.00	°C/W
		$I^2$ PAK, D <sup>2</sup> PAK	total	1.13	
			TO-220FPAB	per diode	
		total	4.05		
$R_{th(c)}$	Coupling	TO-220AB, $I^2$ PAK, D <sup>2</sup> PAK		0.25	°C/W
		TO-220FPAB		3.20	

When the two diodes 1 and 2 are used simultaneously:

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

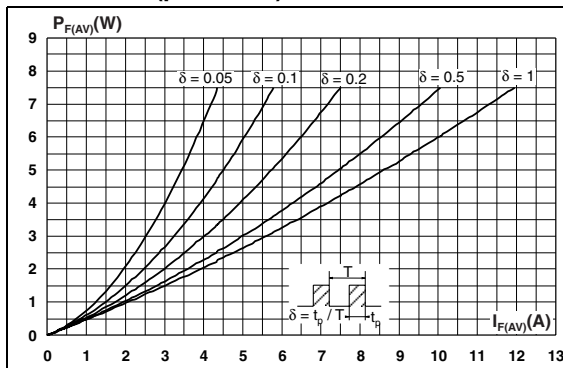
**Table 4. Static electrical characteristics (per diode)**

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	40	$\mu\text{A}$
		$T_j = 125\text{ }^\circ\text{C}$		-	5	25	$\text{mA}$
$V_F^{(2)}$	Forward voltage drop	$T_j = 25\text{ }^\circ\text{C}$	$I_F = 5\text{ A}$	-	0.505	0.545	V
		$T_j = 125\text{ }^\circ\text{C}$		-	0.420	0.475	
		$T_j = 25\text{ }^\circ\text{C}$	$I_F = 10\text{ A}$	-	0.580	0.645	
		$T_j = 125\text{ }^\circ\text{C}$		-	0.525	0.600	

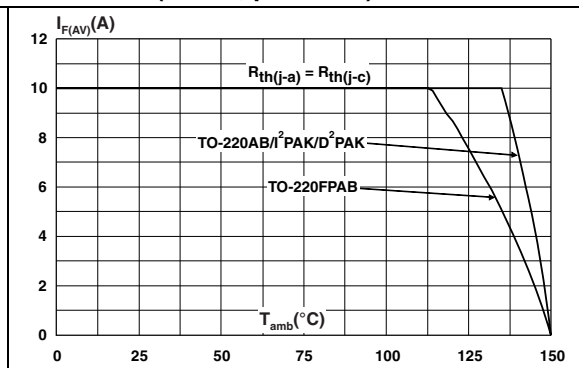
1. Pulse test:  $t_p = 5\text{ ms}$ ,  $\delta < 2\%$
2. Pulse test:  $t_p = 380\text{ }\mu\text{s}$ ,  $\delta < 2\%$

To evaluate the conduction losses use the following equation:  
 $P = 0.455 \times I_{F(AV)} + 0.0145 \times I_{F(RMS)}^2$

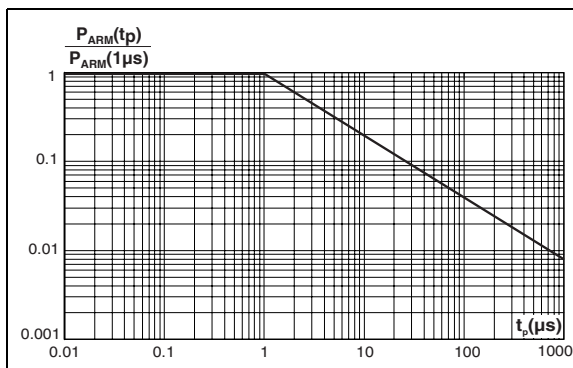
**Figure 2. Average forward power dissipation versus average forward current (per diode)**



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



**Figure 4. Normalized avalanche power derating versus pulse duration**



**Figure 5. Normalized avalanche power derating versus junction temperature**

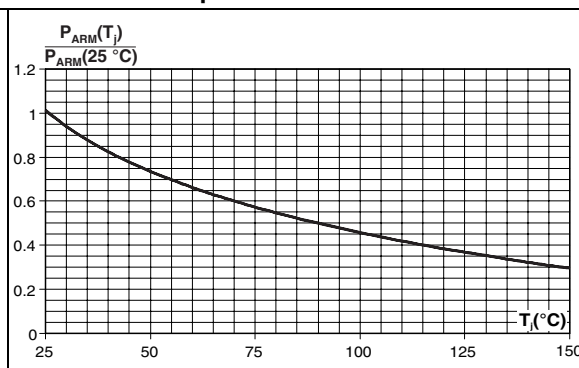


Figure 6. Non repetitive surge peak forward current versus overload duration (maximum values, per diode)

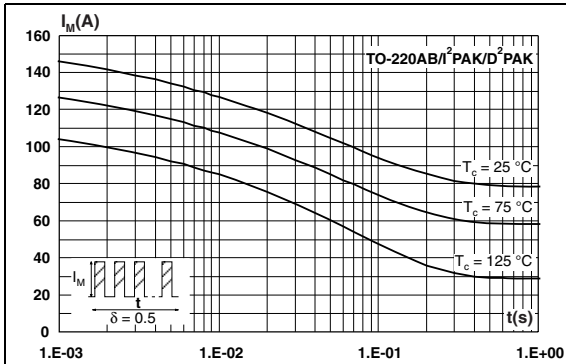


Figure 7. Non repetitive surge peak forward current versus overload duration (maximum values, per diode)

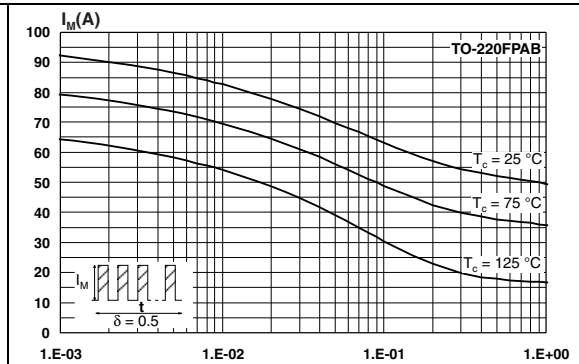


Figure 8. Relative thermal impedance junction to case versus pulse duration

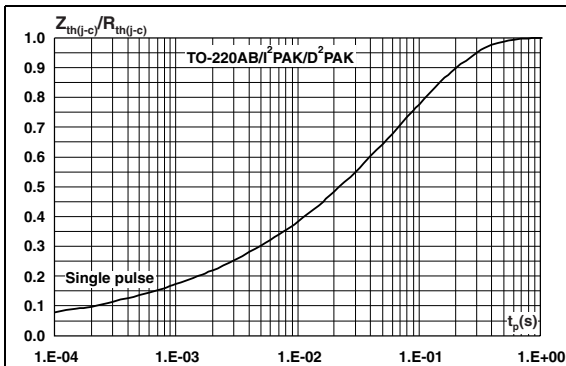


Figure 9. Relative thermal impedance junction to case versus pulse duration

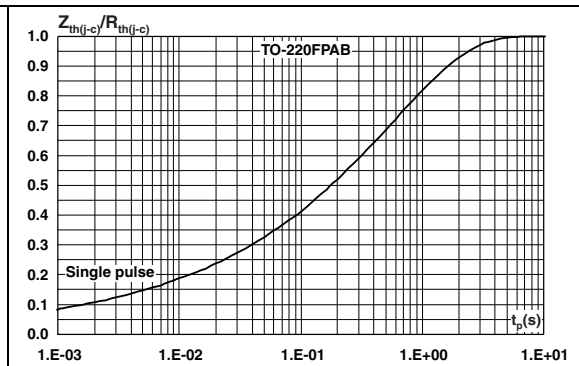


Figure 10. Reverse leakage current versus reverse voltage applied (typical values, per diode)

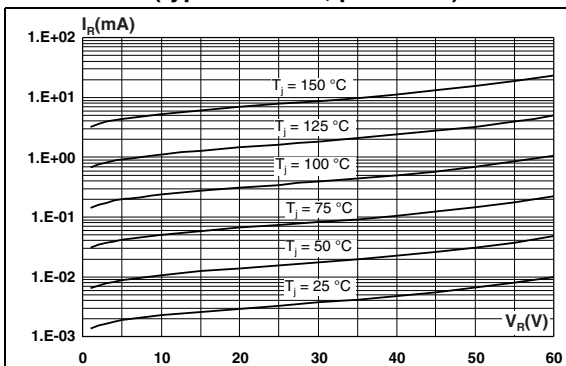


Figure 11. Junction capacitance versus reverse voltage applied (typical values, per diode)

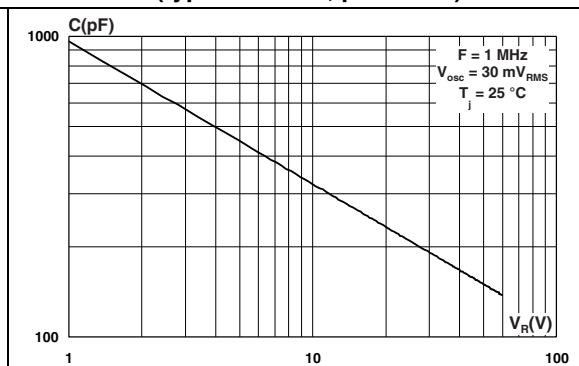


Figure 12. Forward voltage drop versus forward current (per diode)

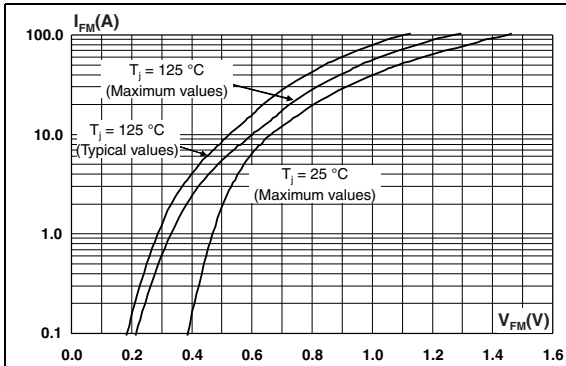


Figure 13. Thermal resistance junction to ambient versus copper surface under tab

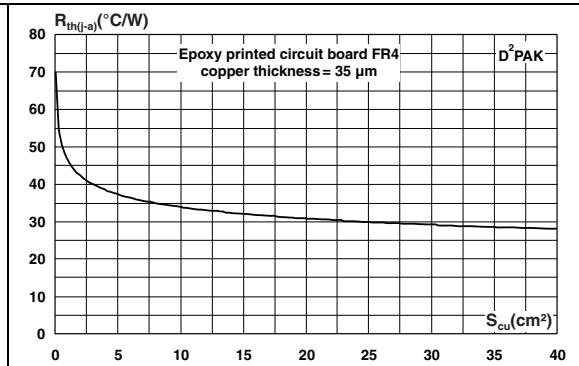
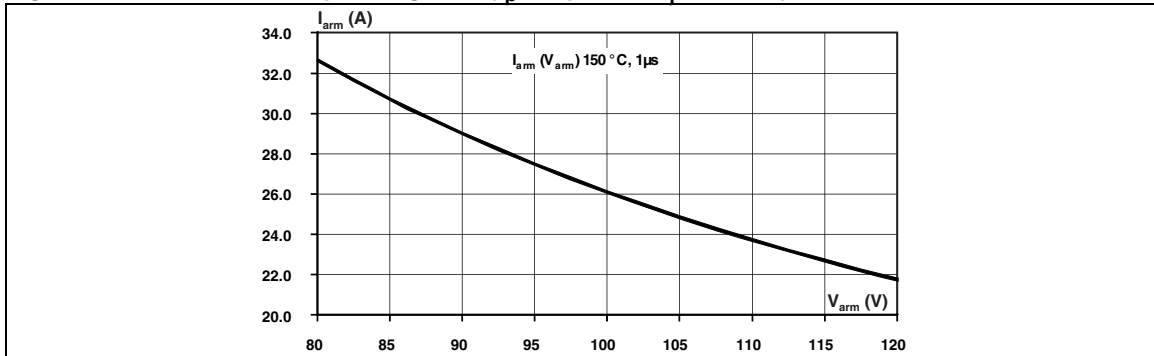


Figure 14. Reverse safe operating area ( $t_p < 1\text{ }\mu\text{s}$  and  $T_j < 150\text{ }^\circ\text{C}$ )



## 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.	
Dia.	3.75	3.85	0.147	0.151

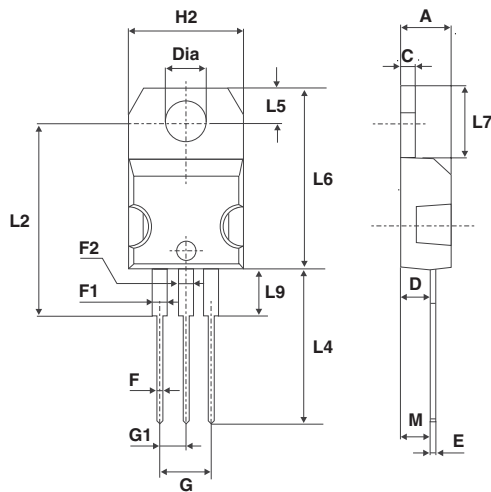


Table 6. TO-220FPAB dimensions

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.4	4.9	0.173	0.192
B	2.5	2.9	0.098	0.114
D	2.45	2.75	0.096	0.108
E	0.4	0.7	0.016	0.028
F	0.6	1	0.024	0.039
F1	1.15	1.7	0.045	0.067
F2	1.15	1.7	0.045	0.067
G	4.95	5.2	0.195	0.205
G1	2.4	2.7	0.094	0.106
H	10	10.7	0.394	0.421
L2	16 Typ.		0.630 Typ.	
L3	28.6	30.6	1.126	1.205
L4	9.8	10.7	0.386	0.421
L6	15.8	16.4	0.622	0.646
L7	9	9.9	0.354	0.390
Dia.	2.9	3.5	0.114	0.138

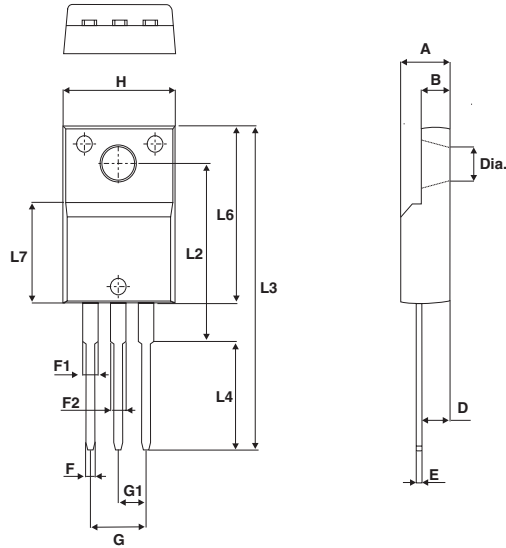


Table 7. D<sup>2</sup>PAK dimensions

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)

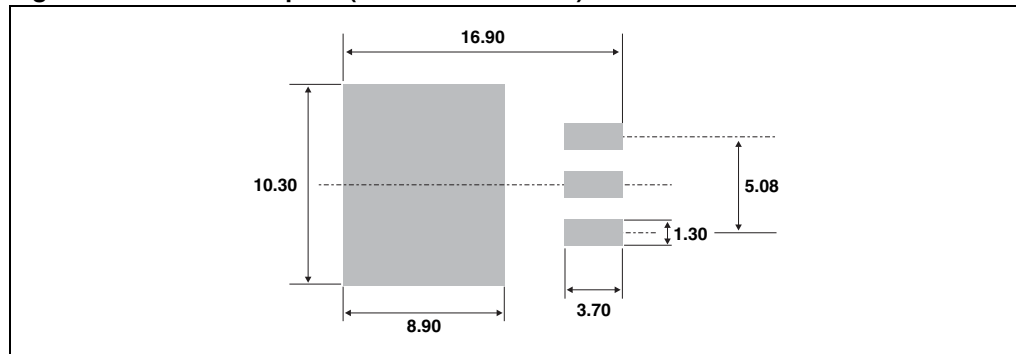
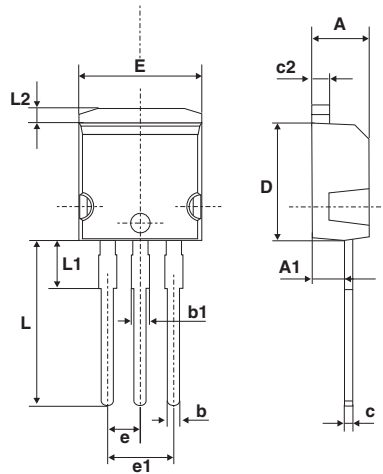




Table 8. I<sup>2</sup>PAK dimensions

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



### 3 Ordering information

Table 9. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
STPS20SM60CT	STPS20SM60CT	TO-220AB	2.20 g	50	Tube
STPS20SM60CFP	PS20SM60CFP	TO-220FPAB	2.0 g	50	Tube
STPS20SM60CR	STPS20SM60CR	I <sup>2</sup> PAK	1.49 g	50	Tube
STPS20SM60CG-TR	STPS20SM60CG	D <sup>2</sup> PAK	1.48 g	1000	Tape and reel

### 4 Revision history

Table 10. Revision history

Date	Revision	Changes
14-Oct-2011	1	Initial release.

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