

### Features

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

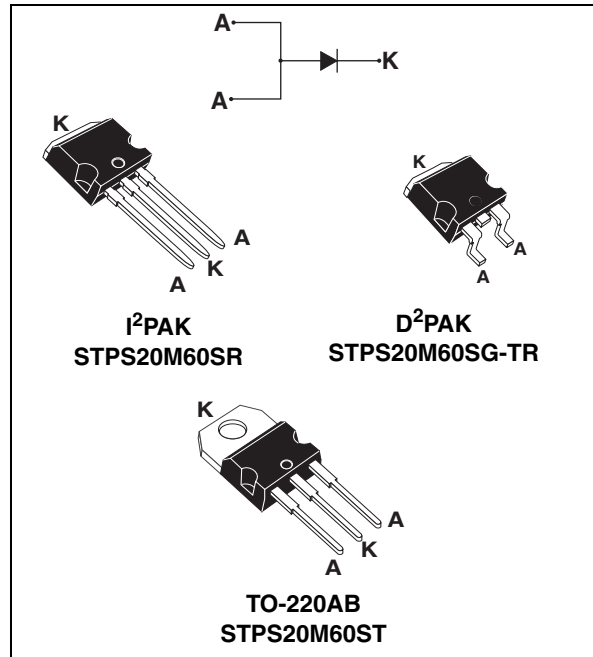
### Description

The STPS20M60S is a single Schottky diode, suited for high frequency switch mode power supply.

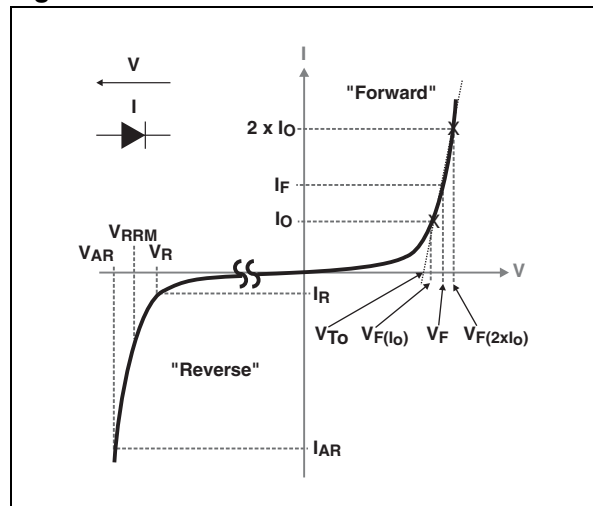
Packaged in TO-220AB, I<sup>2</sup>PAK and D<sup>2</sup>PAK, this device is intended to be used in notebook, game station and desktop adapters, providing in these applications a good efficiency at both low and high load.

**Table 1. Device summary**

| Symbol      | Value   |
|-------------|---------|
| $I_{F(AV)}$ | 20 A    |
| $V_{RRM}$   | 60 V    |
| $V_F$ (typ) | 0.365 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 12](#).  $V_{AR}$  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 at  $T_{amb} = 25\text{ °C}$ , unless otherwise specified)**

| Symbol                          | Parameter                                             |                                                                        |             | Value       | Unit |
|---------------------------------|-------------------------------------------------------|------------------------------------------------------------------------|-------------|-------------|------|
| V <sub>RRM</sub>                | Repetitive peak reverse voltage                       |                                                                        |             | 60          | V    |
| I <sub>F(RMS)</sub>             | Forward rms current                                   |                                                                        |             | 90          | A    |
| I <sub>F(AV)</sub>              | Average forward current, δ = 0.5                      | T <sub>c</sub> = 135 °C                                                | Per package | 20          | A    |
| I <sub>FSM</sub>                | Surge non repetitive forward current                  | t <sub>p</sub> = 10 ms sine-wave                                       |             | 600         | A    |
| P <sub>ARM</sub> <sup>(1)</sup> | Repetitive peak avalanche power                       | T <sub>j</sub> = 25 °C, t <sub>p</sub> = 1 μs                          |             | 26400       | W    |
| V <sub>ARM</sub> <sup>(2)</sup> | Maximum repetitive peak avalanche voltage             | t <sub>p</sub> < 1 μs, T <sub>j</sub> < 150 °C, I <sub>AR</sub> < 99 A |             | 80          | V    |
| V <sub>ASM</sub> <sup>(2)</sup> | Maximum single-pulse peak avalanche voltage           | t <sub>p</sub> < 1 μs, T <sub>j</sub> < 150 °C, I <sub>AR</sub> < 99 A |             | 80          | 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 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 12](#)

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 |
|---------------|------------------|-------|------|
| $R_{th(j-c)}$ | Junction to case | 1.0   | °C/W |

**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 | $T_j = 25\text{ °C}$  | -    | 30    | 125   | $\mu\text{A}$ |
|             |                         | $T_j = 125\text{ °C}$ | -    | 20    | 75    | mA            |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 25\text{ °C}$  | -    | 0.465 | 0.500 | V             |
|             |                         | $T_j = 125\text{ °C}$ | -    | 0.365 | 0.405 |               |
|             |                         | $T_j = 25\text{ °C}$  | -    | 0.520 | 0.565 |               |
|             |                         | $T_j = 125\text{ °C}$ | -    | 0.450 | 0.505 |               |

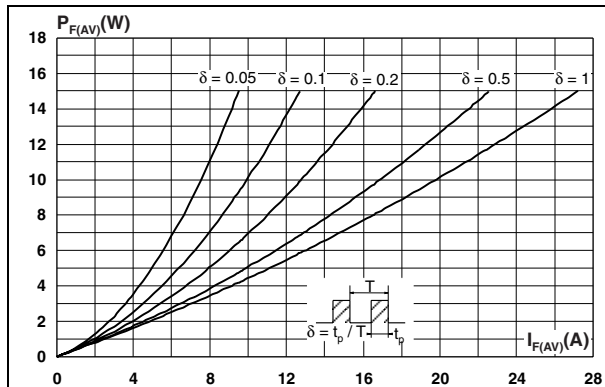
1. Pulse test:  $t_p = 5\text{ ms}$ ,  $\delta < 2\%$

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

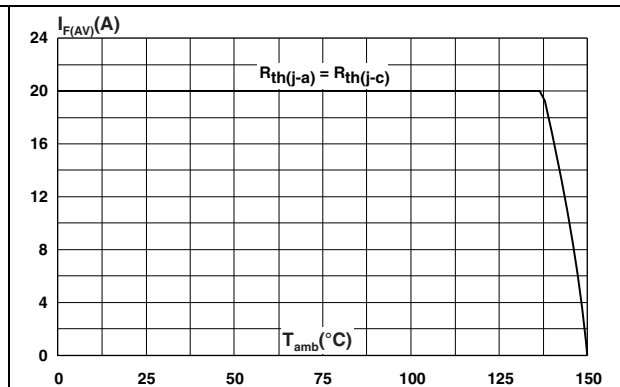
To evaluate the conduction losses use the following equation:

$$P = 0.380 \times I_{F(AV)} + 0.0063 \times I_{F(RMS)}^2$$

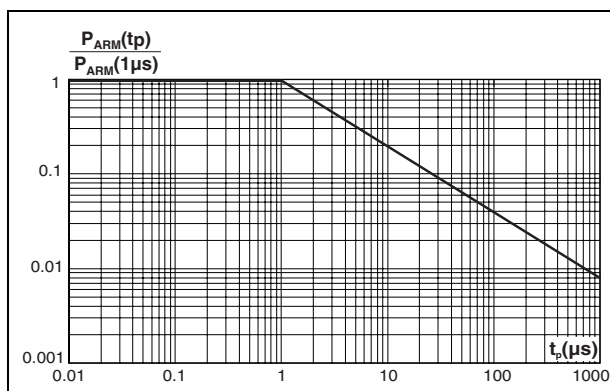
**Figure 2. Average forward power dissipation versus average forward current**



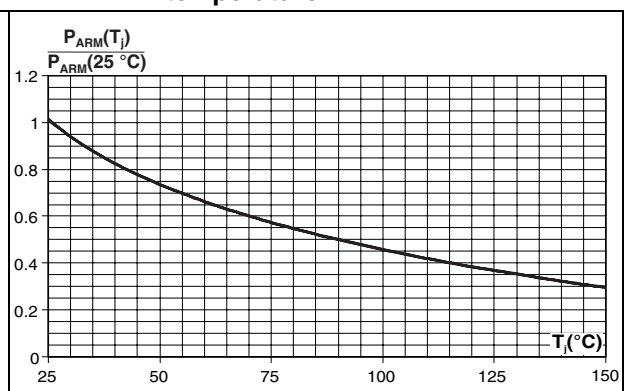
**Figure 3. Average forward current versus ambient temperature ( $\delta = 0.5$ )**



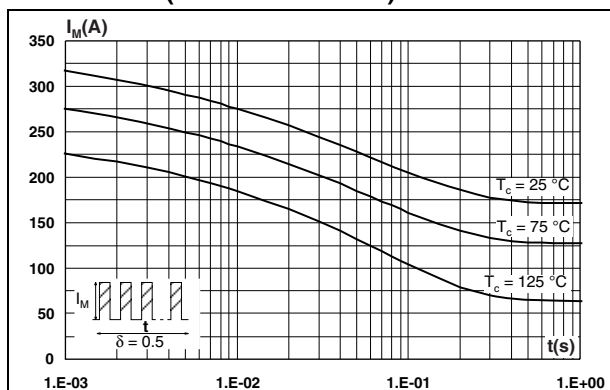
**Figure 4. Normalized avalanche power derating versus pulse duration**



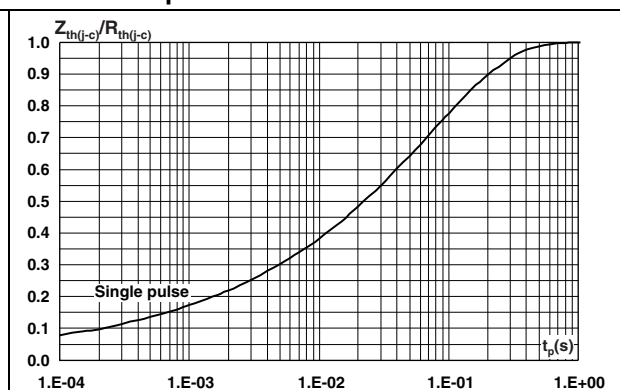
**Figure 5. Normalized avalanche power derating versus junction temperature**



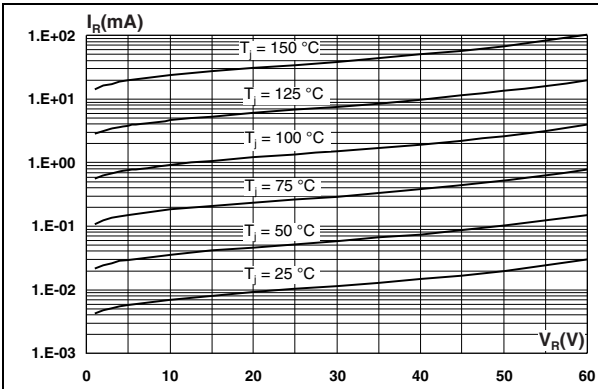
**Figure 6. Non repetitive surge peak forward current versus overload duration (maximum values)**



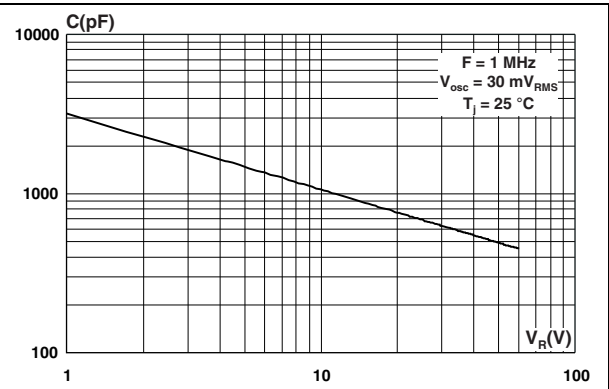
**Figure 7. Relative variation of thermal impedance junction to case versus pulse duration**



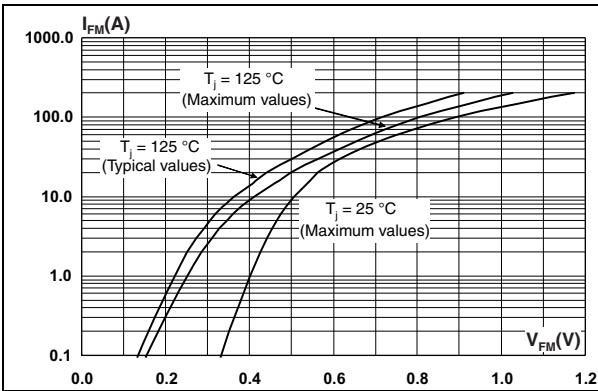
**Figure 8. Reverse leakage current versus reverse voltage applied (typical values)**



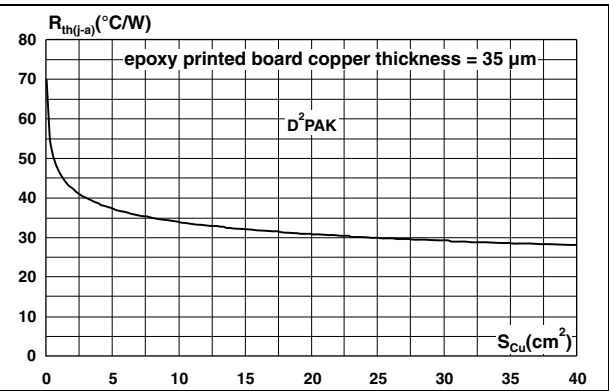
**Figure 9. Junction capacitance versus reverse voltage applied (typical values)**



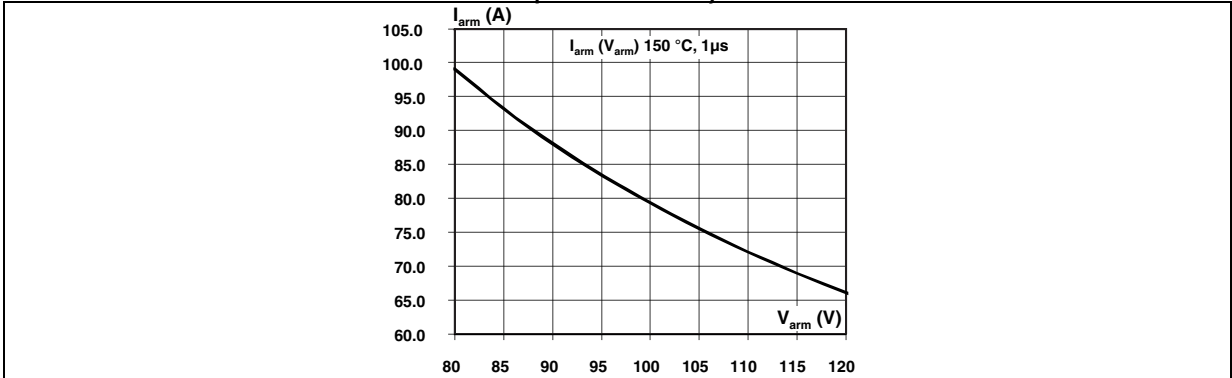
**Figure 10. Forward voltage drop versus forward current**



**Figure 11. Thermal resistance junction to ambient versus copper surface under tab**



**Figure 12. 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. |       |
| Dia. | 3.75        | 3.85  | 0.147      | 0.151 |

Technical drawing of a 100mm x 100mm x 10mm plate. The drawing includes a top view, a side view, and a detail view of the corner. Dimensions are labeled as follows:

- Top View:** L (Overall Length), L2 (Distance from top edge to top of hole), L3 (Distance from top of hole to bottom of hole), E (Overall Width), G (Distance from bottom edge to bottom of hole), B (Distance from bottom of hole to bottom edge), B2 (Distance from bottom of hole to bottom edge).
- Side View:** A (Overall Height), C2 (Distance from top edge to top of hole), D (Distance from top of hole to bottom of hole), R (Radius of corner), A1 (Distance from top edge to top of hole), C (Distance from top of hole to bottom of hole).
- Detail View:** A2 (Distance from top edge to top of hole), M (Distance from top edge to top of hole), V2 (Distance from top edge to top of hole).

\* FLAT ZONE NO LESS THAN 2mm

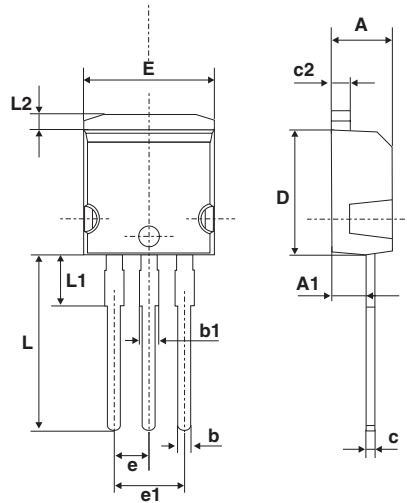
| Ref. | Dimensions  |       |            |       |
|------|-------------|-------|------------|-------|
|      | Millimeters |       | Inches     |       |
|      | Min.        | Max.  | Min.       | Max.  |
| A    | 4.40        | 4.60  | 0.173      | 0.181 |
| A1   | 2.49        | 2.69  | 0.098      | 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°    |

Technical drawing showing the front and side views of a mechanical part with the following dimensions:

- Overall width: 16.90
- Overall height: 10.30
- Bottom width: 8.90
- Side view width: 3.70
- Side view height (from base): 5.08
- Side view height (from base to top of last step): 1.30

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 |



### 3 Ordering information

**Table 8. Ordering information**

| Order code     | Marking     | Package            | Weight | Base qty | Delivery mode |
|----------------|-------------|--------------------|--------|----------|---------------|
| STPS20M60ST    | STPS20M60ST | TO-220AB           | 2.2 g  | 50       | Tube          |
| STPS20M60SR    | STPS20M60SR | I <sup>2</sup> PAK | 1.49 g | 50       | Tube          |
| STPS20M60SG-TR | STPS20M60SG | D <sup>2</sup> PAK | 1.48 g | 1000     | Tape and reel |

### 4 Revision history

**Table 9. Revision history**

| Date        | Revision | Changes         |
|-------------|----------|-----------------|
| 11-Oct-2011 | 1        | Initial release |

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