

## Power Schottky rectifier

### Features

- High junction temperature capability
- Optimized trade-off between leakage current and forward voltage drop
- Low leakage current
- Avalanche capability specified

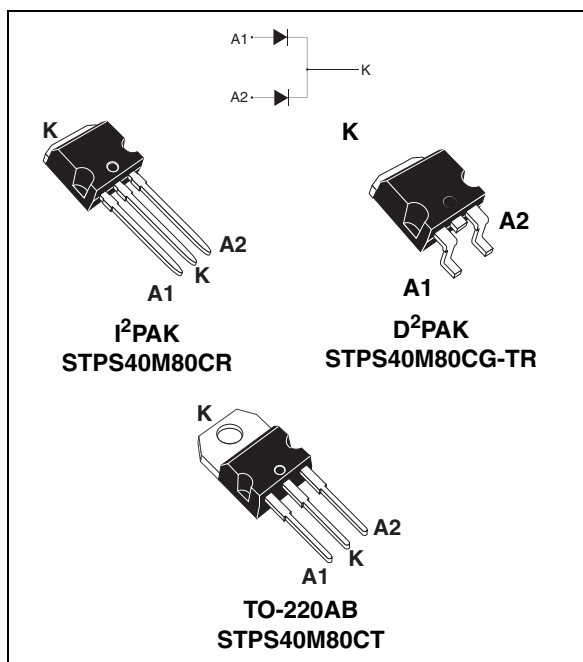
### Description

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

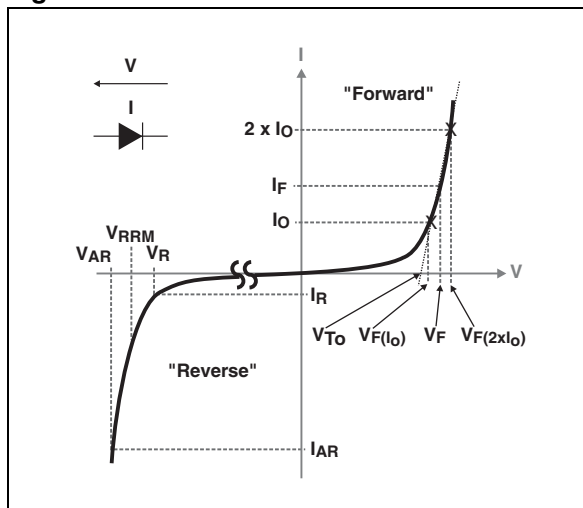
Packaged in TO-220AB, I<sup>2</sup>PAK and D<sup>2</sup>PAK, this device is particularly suited for use in notebook, game station, LCD TV and desktop adapters, providing these applications with a good efficiency at both low and high load.

**Table 1. Device summary**

| Symbol      | Value    |
|-------------|----------|
| $I_{F(AV)}$ | 2 x 20 A |
| $V_{RRM}$   | 80 V     |
| $T_J$ (max) | 175 °C   |
| $V_F$ (typ) | 475 mV   |



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



- a.  $V_{ARM}$  and  $I_{ARM}$  must respect the reverse safe operating area defined in [Figure 11](#).  $V_{AR}$  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 <sub>RRM</sub>                | Repetitive peak reverse voltage                       |                                                                        |                         | 80          | V    |
| I <sub>F(RMS)</sub>             | Forward rms current                                   |                                                                        |                         | 30          | A    |
| I <sub>F(AV)</sub>              | Average forward current, δ = 0.5                      | T <sub>c</sub> = 150 °C<br>T <sub>c</sub> = 150 °C                     | Per diode<br>Per device | 20<br>40    | A    |
| I <sub>FSM</sub>                | Surge non repetitive forward current                  | t <sub>p</sub> = 10 ms sinusoidal                                      | T <sub>c</sub> = 25 °C  | 200         | A    |
| P <sub>ARM</sub> <sup>(1)</sup> | Repetitive peak avalanche power                       | T <sub>j</sub> = 25 °C, t <sub>p</sub> = 1 μs                          |                         | 10000       | 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> < 30 A |                         | 100         | 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> < 30 A |                         | 100         | V    |
| T <sub>stg</sub>                | Storage temperature range                             |                                                                        |                         | -65 to +175 | °C   |
| T <sub>j</sub>                  | Maximum operating junction temperature <sup>(3)</sup> |                                                                        |                         | 175         | °C   |

1. For temperature or pulse time duration deratings, please refer to figure 3 and 4. 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 11](#)

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 | per diode | 1.30  | °C/W |
|               |                  | total     | 0.75  |      |
| $R_{th(c)}$   | Coupling         |           | 0.20  | °C/W |

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)**

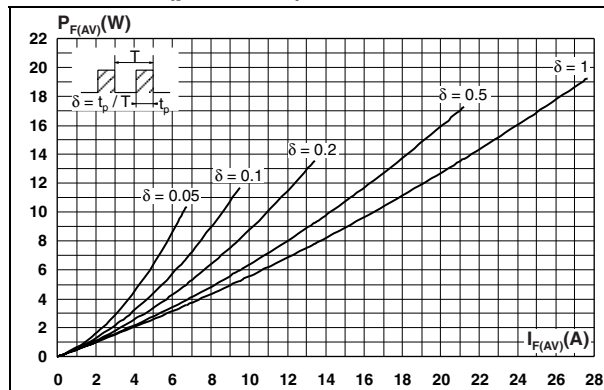
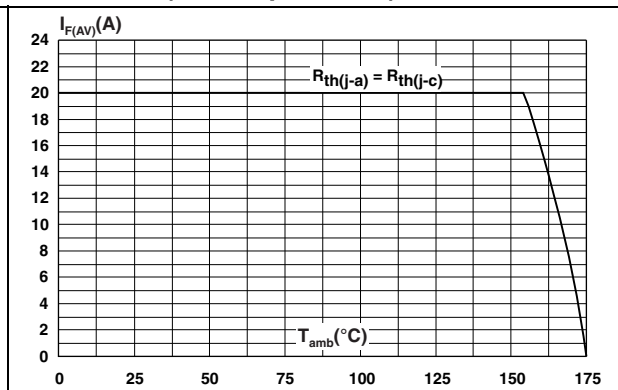
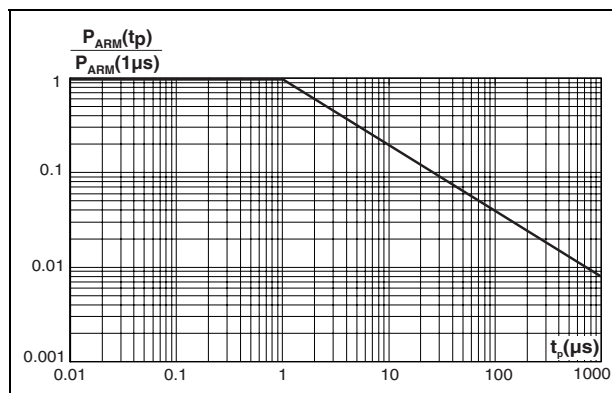
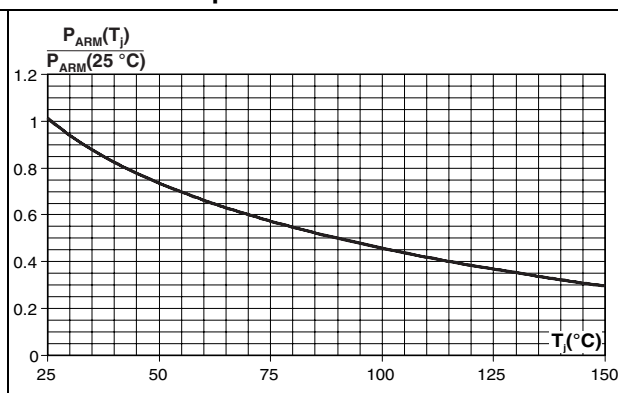
| Symbol      | Parameter               | Test conditions                     |                     | Min. | Typ.  | Max.  | Unit          |
|-------------|-------------------------|-------------------------------------|---------------------|------|-------|-------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25\text{ }^{\circ}\text{C}$  | $V_R = V_{RRM}$     | -    | 15    | 65    | $\mu\text{A}$ |
|             |                         | $T_j = 125\text{ }^{\circ}\text{C}$ |                     | -    | 15    | 40    | mA            |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 25\text{ }^{\circ}\text{C}$  | $I_F = 10\text{ A}$ | -    | 0.550 | 0.600 | V             |
|             |                         | $T_j = 125\text{ }^{\circ}\text{C}$ |                     | -    | 0.475 | 0.510 |               |
|             |                         | $T_j = 25\text{ }^{\circ}\text{C}$  | $I_F = 20\text{ A}$ | -    | 0.655 | 0.735 |               |
|             |                         | $T_j = 125\text{ }^{\circ}\text{C}$ |                     | -    | 0.570 | 0.635 |               |
|             |                         | $T_j = 25\text{ }^{\circ}\text{C}$  | $I_F = 40\text{ A}$ | -    | 0.800 | 0.920 |               |
|             |                         | $T_j = 125\text{ }^{\circ}\text{C}$ |                     | -    | 0.680 | 0.795 |               |

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

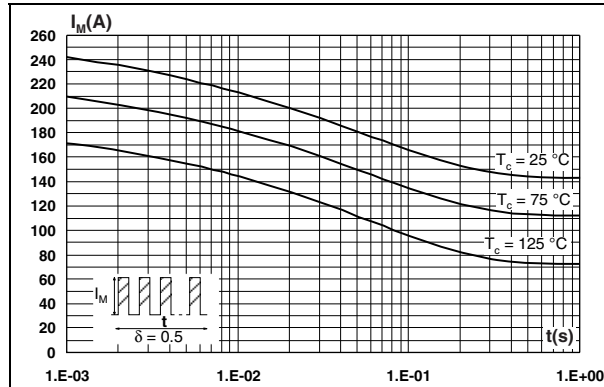
2. Pulse test:  $t_p = 380\text{ }\mu\text{s}$ ,  $\delta < 2\%$

To evaluate the conduction losses use the following equation:

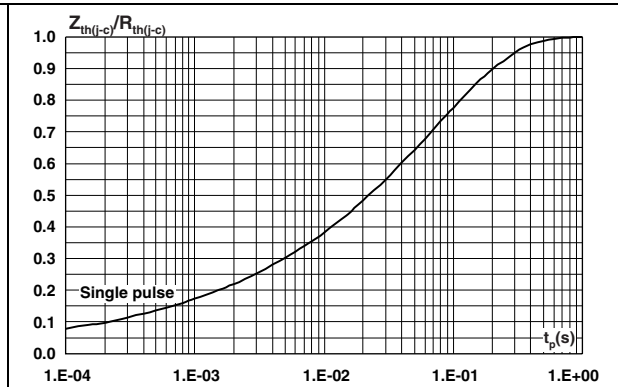
$$P = 0.475 \times I_{F(AV)} + 0.008 \times I_F^2(RMS)$$

**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**

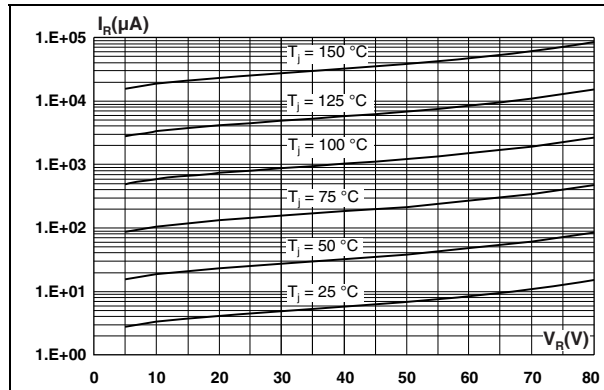
**Figure 6. Non repetitive surge peak forward current versus overload duration (maximum values, per diode)**



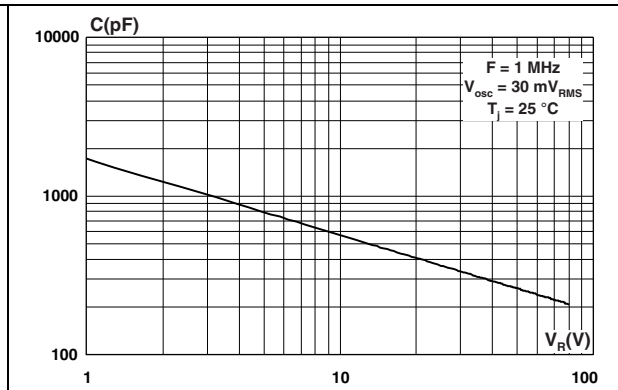
**Figure 7. Relative thermal impedance junction to case versus pulse duration**



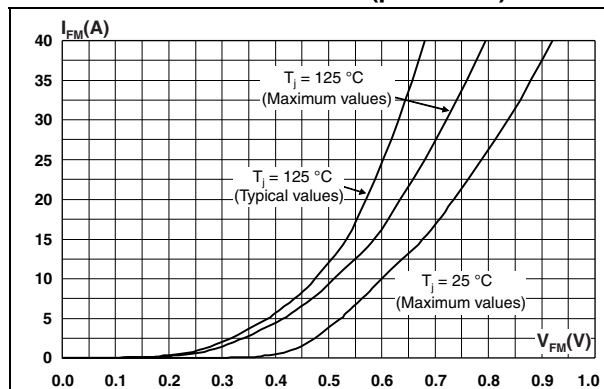
**Figure 8. Reverse leakage current versus reverse voltage applied (typical values, per diode)**



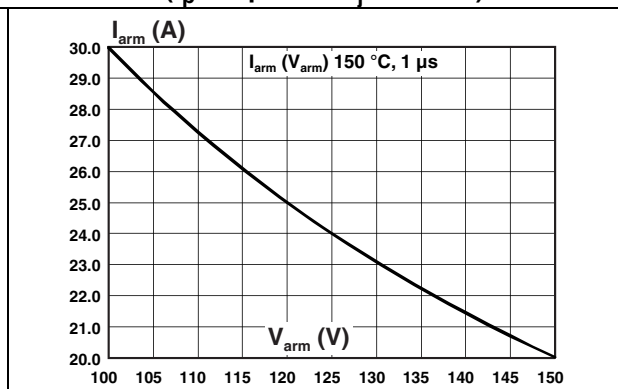
**Figure 9. Junction capacitance versus reverse voltage applied (typical values, per diode)**

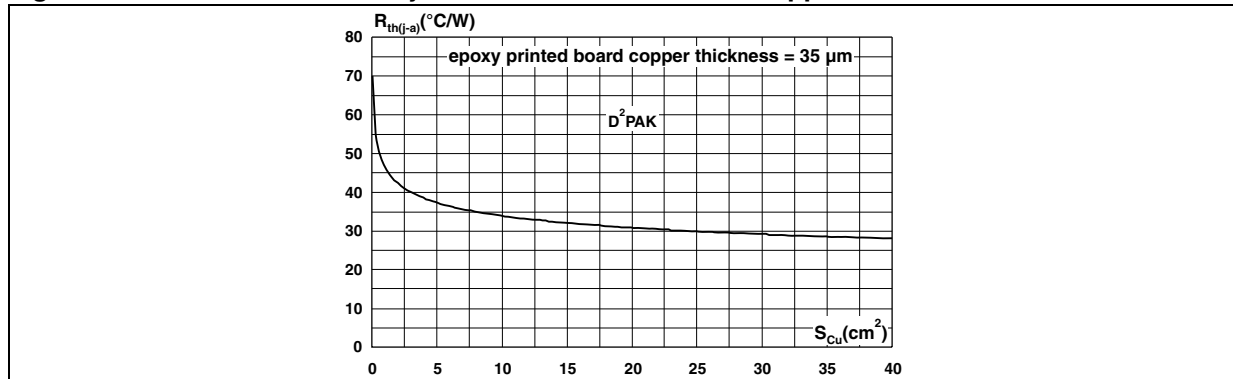


**Figure 10. Forward voltage drop versus forward current (per diode)**



**Figure 11. Reverse safe operating area ( $t_p < 1\text{ }\mu\text{s}$  and  $T_j < 150^\circ\text{C}$ )**



**Figure 12. Thermal resistance junction to ambient versus copper surface under tab for D<sup>2</sup>PAK**

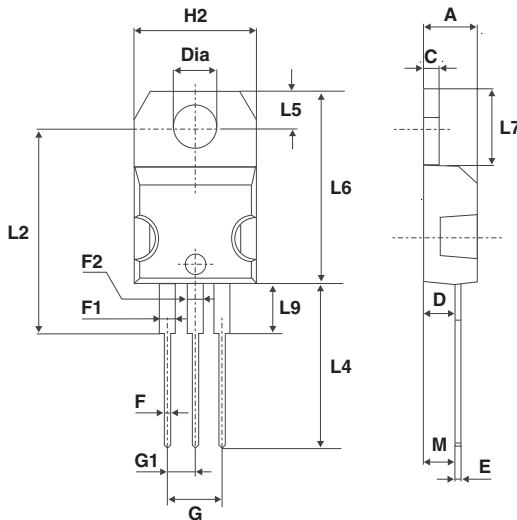
## 2 Package information

- 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. D<sup>2</sup>PAK dimensions**

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

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

\* FLAT ZONE NO LESS THAN 2mm

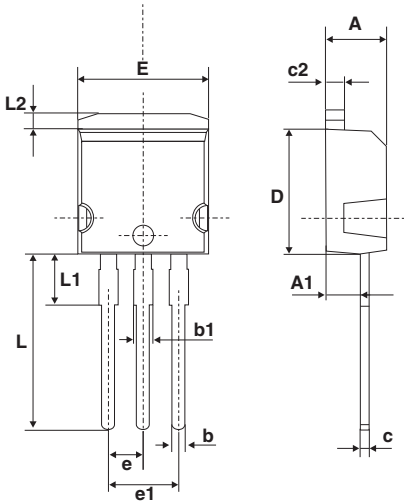
| Ref. | Dimensions  |       |            |       |
|------|-------------|-------|------------|-------|
|      | Millimeters |       | Inches     |       |
|      | Min.        | Max.  | Min.       | Max.  |
| A    | 4.40        | 4.60  | 0.173      | 0.181 |
| A1   | 2.49        | 2.69  | 0.098    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

**Figure 13. D<sup>2</sup>PAK footprint (dimensions in mm)**

Technical drawing of a stepped block. The front view on the left shows a rectangular block with a width of 8.90 and a height of 10.30. The top view on the right shows a stepped profile with a total width of 16.90. The block has three steps of decreasing width from left to right. The rightmost step has a width of 3.70 and a height of 1.30. The total height of the block is 10.30, and the total width is 16.90. The drawing includes dimension lines and numerical values for all measurements.

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 |
|----------------|-------------|--------------------|--------|----------|---------------|
| STPS40M80CT    | STPS40M80CT | TO-220AB           | 1.9 g  | 50       | Tube          |
| STPS40M80CR    | STPS40M80CR | I <sup>2</sup> PAK | 1.49 g | 50       | Tube          |
| STPS40M80CG-TR | STPS40M80CG | D <sup>2</sup> PAK | 1.48 g | 1000     | Tape and reel |

### 4 Revision history

**Table 9. Revision history**

| Date        | Revision | Changes      |
|-------------|----------|--------------|
| 11-Apr-2011 | 1        | First issue. |

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