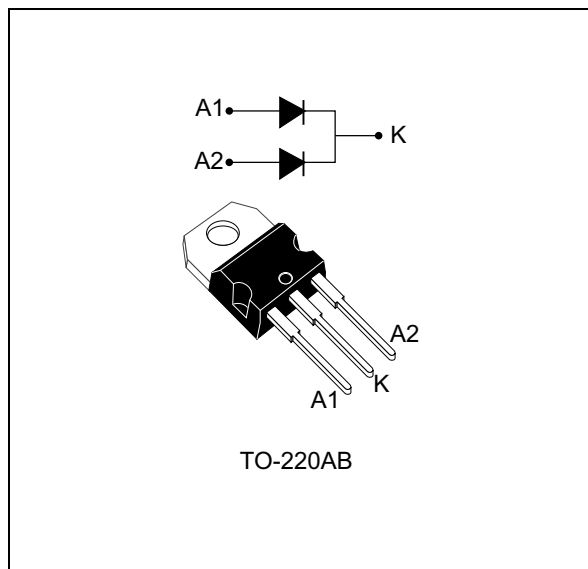


## 650 V power Schottky silicon carbide diode

Datasheet - production data



### Features

- No or negligible reverse recovery
- Switching behavior independent of temperature
- High forward surge capability
- ECOPACK<sup>®</sup>2 compliant component

### Description

The SiC diode is an ultrahigh performance power Schottky diode. It is manufactured using a silicon carbide substrate. The wide band-gap material allows the design of a Schottky diode structure with a 650 V rating. Due to the Schottky construction, no recovery is shown at turn-off and ringing patterns are negligible. The minimized capacitive charge at turn-off behavior is independent of temperature.

Especially suited for use in interleaved or bridgeless topologies, this dual-diode rectifier will boost the performance in hard switching conditions. Its high forward surge capability ensures a good robustness during transient phases.

Table 1. Device summary

| Symbol      | Value   |
|-------------|---------|
| $I_{F(AV)}$ | 2 x 8 A |
| $V_{RRM}$   | 650 V   |
| $T_j (max)$ | 175 °C  |

# 1 Characteristics

**Table 2. Absolute ratings (limiting values per diode at 25 °C unless otherwise specified)**

| Symbol              | Parameter                                     |                                                                           |            | Value       | Unit |
|---------------------|-----------------------------------------------|---------------------------------------------------------------------------|------------|-------------|------|
| V <sub>RRM</sub>    | Repetitive peak reverse voltage               |                                                                           |            | 650         | V    |
| I <sub>F(RMS)</sub> | Forward rms current                           |                                                                           |            | 22          | A    |
| I <sub>F(AV)</sub>  | Average forward current                       | T <sub>C</sub> = 140 °C <sup>(1)</sup> , DC                               | Per diode  | 8           | A    |
|                     |                                               | T <sub>C</sub> = 135 °C <sup>(2)</sup> , DC                               | Per device | 16          | A    |
| I <sub>FSM</sub>    | Surge non repetitive forward current          | t <sub>p</sub> = 10 ms sinusoidal, T <sub>C</sub> = 25 °C                 |            | 75          | A    |
|                     |                                               | t <sub>p</sub> = 10 ms sinusoidal, T <sub>C</sub> = 125 °C                |            | 69          |      |
|                     |                                               | t <sub>p</sub> = 10 μs square, T <sub>C</sub> = 25 °C                     |            | 420         |      |
| I <sub>FRM</sub>    | Repetitive peak forward current               | T <sub>C</sub> = 140 °C <sup>(1)</sup> , T <sub>j</sub> = 175 °C, δ = 0.1 |            | 34          | A    |
| T <sub>stg</sub>    | Storage temperature range                     |                                                                           |            | -65 to +175 | °C   |
| T <sub>j</sub>      | Operating junction temperature <sup>(3)</sup> |                                                                           |            | -40 to +175 | °C   |

1. Value based on  $R_{th(j-c)}$  max (per diode)

2. Value based on  $R_{th(j-c)}$  max (per device)

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 parameters**

| Symbol        | Parameter        |            | Typ. | Max. | Unit |
|---------------|------------------|------------|------|------|------|
| $R_{th(j-c)}$ | Junction to case | Per diode  | 1.3  | 1.6  | °C/W |
|               |                  | Per device | 0.8  | 0.95 |      |
| $R_{th(c)}$   | Coupling         |            | -    | 0.3  |      |

When the diodes 1 and 2 are used simultaneously:

$$\Delta T_j(\text{diode 1}) = P(\text{diode1}) \times R_{th(j-c)}(\text{Per diode}) + P(\text{diode2}) \times R_{th(c)}$$

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

| Symbol      | Parameter               | Tests conditions      |                    | Min. | Typ. | Max. | Unit          |
|-------------|-------------------------|-----------------------|--------------------|------|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25\text{ °C}$  | $V_R = V_{RRM}$    | -    | 7    | 80   | $\mu\text{A}$ |
|             |                         | $T_j = 150\text{ °C}$ |                    | -    | 65   | 335  |               |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 25\text{ °C}$  | $I_F = 8\text{ A}$ | -    | 1.56 | 1.75 | V             |
|             |                         | $T_j = 150\text{ °C}$ |                    | -    | 1.98 | 2.5  |               |

1.  $t_p = 10\text{ ms}$ ,  $\delta < 2\%$

2.  $t_p = 500\text{ }\mu\text{s}$ ,  $\delta < 2\%$

To evaluate the conduction losses use the following equation:

$$P = 1.35 \times I_{F(AV)} + 0.144 \times I_{F(RMS)}^2$$

Table 5. Dynamic electrical characteristics (per diode)

| Symbol         | Parameter               | Test conditions                                                          | Typ. | Unit |
|----------------|-------------------------|--------------------------------------------------------------------------|------|------|
| $Q_{cj}^{(1)}$ | Total capacitive charge | $V_R = 400\text{ V}$                                                     | 23.5 | nC   |
| $C_j$          | Total capacitance       | $V_R = 0\text{ V}, T_C = 25\text{ }^{\circ}\text{C}, F = 1\text{ MHz}$   | 414  | pF   |
|                |                         | $V_R = 400\text{ V}, T_C = 25\text{ }^{\circ}\text{C}, F = 1\text{ MHz}$ | 38   |      |

1. Most accurate value for the capacitive charge:  $Q_{cj} = \int_0^{V_{OUT}} c_j(V_R).dv_R$

Figure 1. Forward voltage drop versus forward current (typical values, low level, per diode)

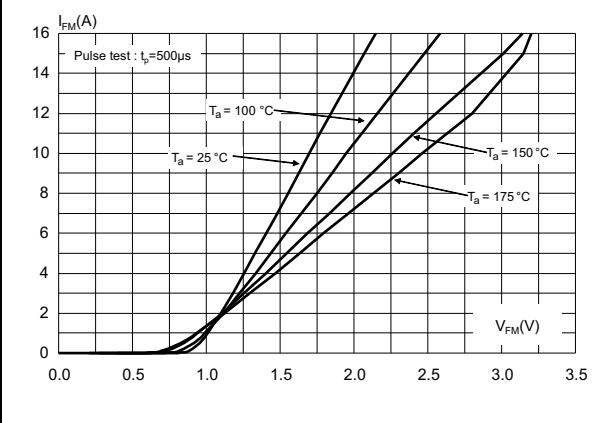


Figure 2. Forward voltage drop versus forward current (typical values, high level, per diode)

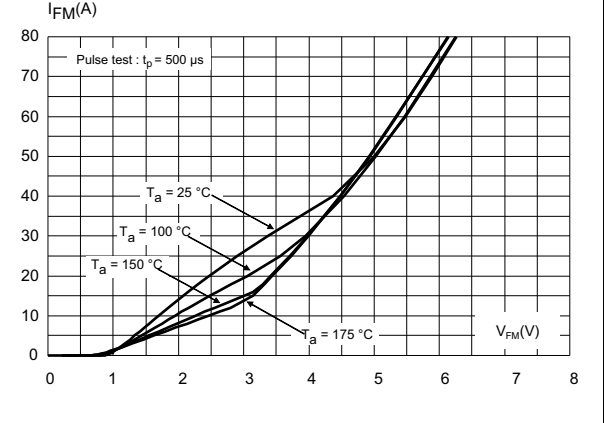


Figure 3. Reverse leakage current versus reverse voltage applied (typical values, per diode)

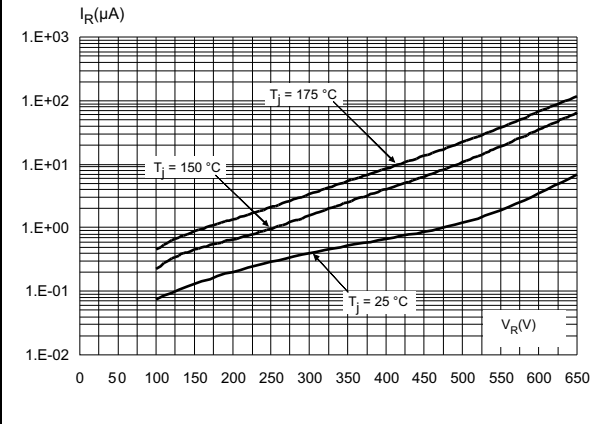


Figure 4. Peak forward current versus case temperature (per diode)

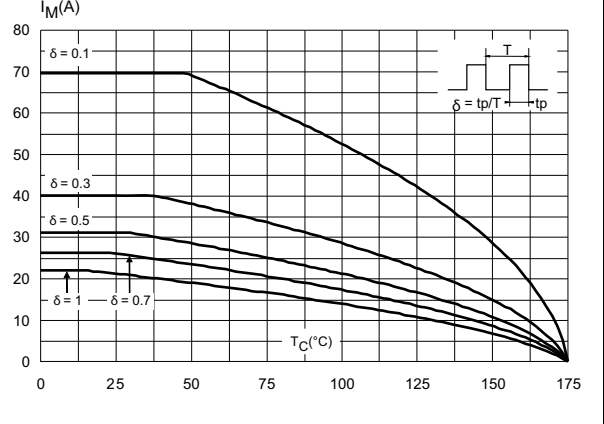


Figure 5. Junction capacitance versus reverse voltage applied (typical values, per diode)

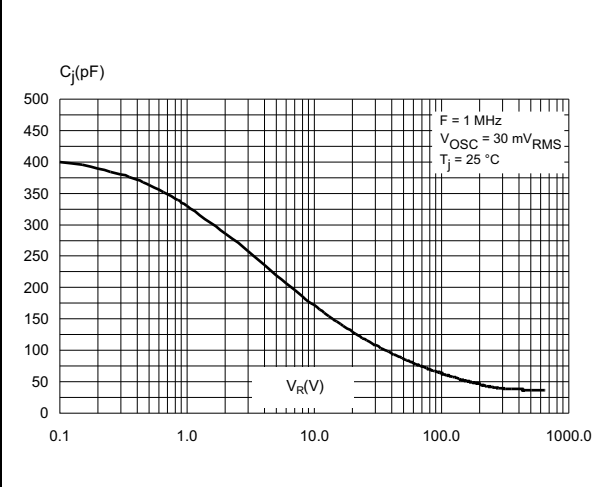


Figure 6. [Relative variation of thermal impedance junction to case versus pulse duration

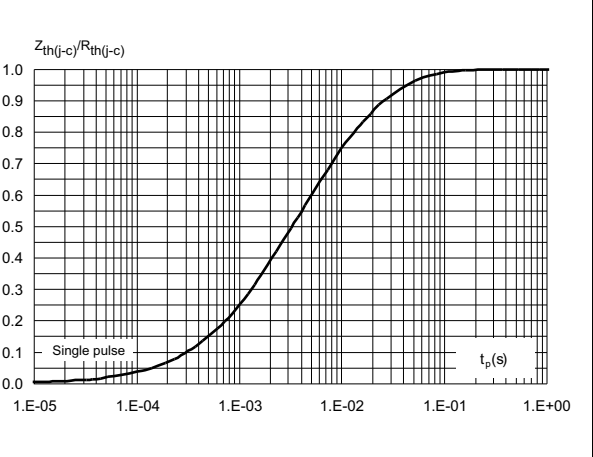


Figure 7. Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform, per diode)

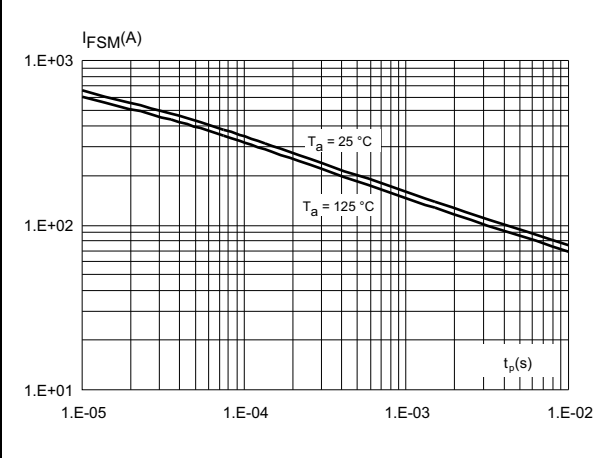
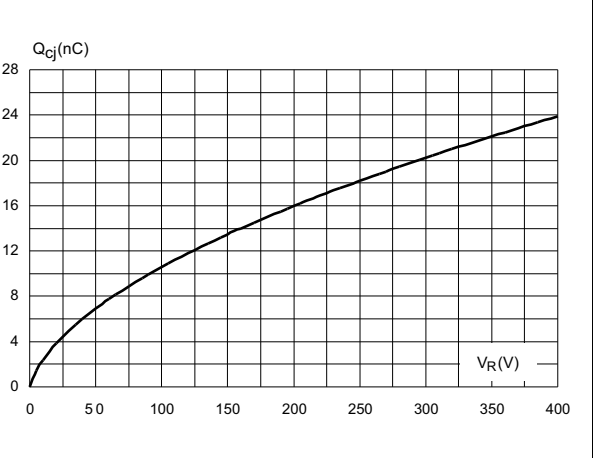


Figure 8. Total capacitive charges versus reverse voltage applied (typical values, per diode)



## 2 Package information

- Epoxy meets UL94, V0
- Cooling method: 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.

### 2.1 TO-220AB package information

Figure 9. TO-220AB package outline

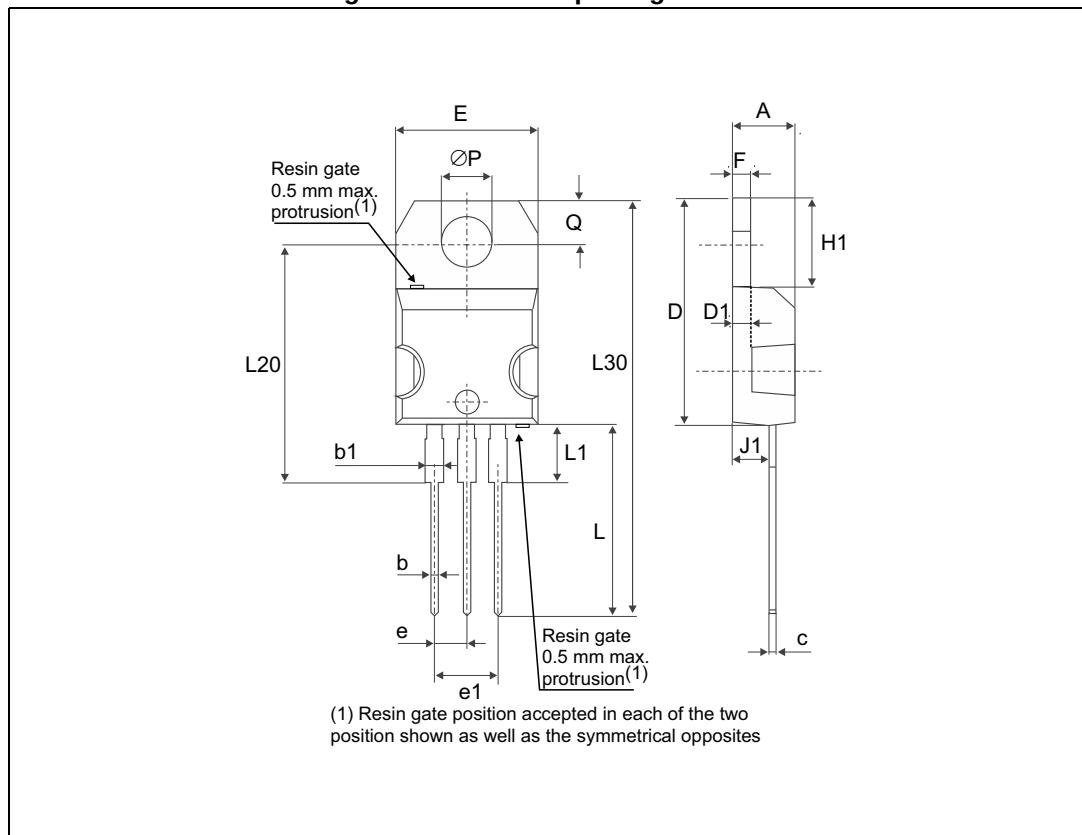


Table 6. TO-220AB package mechanical data

| Ref. | Dimensions  |       |       |                       |       |       |
|------|-------------|-------|-------|-----------------------|-------|-------|
|      | Millimeters |       |       | Inches <sup>(1)</sup> |       |       |
|      | Typ.        | Min.  | Max.  | Typ.                  | Min.  | Max.  |
| A    |             | 4.40  | 4.60  |                       | 0.17  | 0.18  |
| b    |             | 0.61  | 0.88  |                       | 0.024 | 0.035 |
| b1   |             | 1.14  | 1.70  |                       | 0.045 | 0.067 |
| 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    | 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       |       |       | 0.64                  |       |       |
| L30  | 28.90       |       |       | 1.13                  |       |       |
| ØP   |             | 3.75  | 3.85  |                       | 0.147 | 0.151 |
| Q    |             | 2.65  | 2.95  |                       | 0.104 | 0.116 |

1. Values in inches are converted from mm and rounded to 4 decimal digits.

### 3 Ordering information

Table 7. Ordering information

| Order code    | Marking       | Package  | Weight | Base qty | Delivery mode |
|---------------|---------------|----------|--------|----------|---------------|
| STPSC16H065CT | STPSC16H065CT | TO-220AB | 1.86 g | 50       | Tube          |

### 4 Revision history

Table 8. Document revision history

| Date        | Revision | Changes                                                                |
|-------------|----------|------------------------------------------------------------------------|
| 24-Jun-2013 | 1        | First issue.                                                           |
| 07-Nov-2013 | 2        | Updated Figure 1 and Figure 2.                                         |
| 20-Mar-2014 | 3        | Updated Table 3.                                                       |
| 02-Nov-2015 | 4        | Updated cover page and Table 7.<br>Format updated to current standard. |
| 07-Dec-2015 | 5        | Updated <a href="#">Table 7</a> .                                      |

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