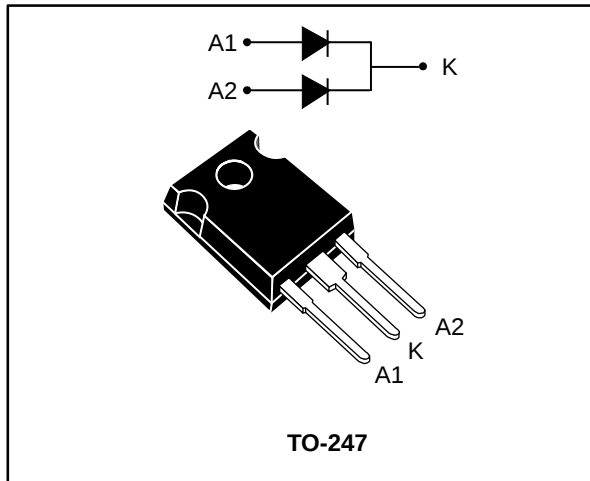


## Automotive 650 V power Schottky silicon carbide diode

Datasheet - production data



### Description

The SiC diode is a high voltage 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 minimal capacitive turn-off behavior is independent of temperature.

Used as a freewheeling or output rectification diode, this rectifier will enhance the performance and form factor of the targeted power supply or inverter.

Table 1: Device summary

| Symbol       | Value    |
|--------------|----------|
| $I_{F(AV)}$  | 2 x 20 A |
| $V_{RRM}$    | 650 V    |
| $T_j$ (max.) | 175 °C   |
| $V_F$ (typ.) | 1.30 V   |

### Features

- No reverse recovery charge in application current range
- Switching behavior independent of temperature
- Dedicated to PFC applications
- AEC-Q101 qualified
- PPAP capable
- ECOPACK®2 compliant component

# 1 Characteristics

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

| Symbol       | Parameter                                                                     |                                                                | Value       | Unit |
|--------------|-------------------------------------------------------------------------------|----------------------------------------------------------------|-------------|------|
| $V_{RRM}$    | Repetitive peak reverse voltage ( $T_j = -40\text{ °C}$ to $+175\text{ °C}$ ) |                                                                | 650         | V    |
| $I_{F(RMS)}$ | Forward rms current                                                           |                                                                | 40          | A    |
| $I_{F(AV)}$  | Average forward current                                                       | $T_c = 140\text{ °C}^{(1)}$ , DC, per diode                    | 20          | A    |
|              |                                                                               | $T_c = 130\text{ °C}^{(1)}$ , DC, per device                   | 40          |      |
| $I_{FRM}$    | Repetitive peak forward current                                               | $T_c = 140\text{ °C}$ , $T_j = 175\text{ °C}$ , $\delta = 0.1$ | 87          | A    |
| $I_{FSM}$    | Surge non repetitive forward current                                          | $t_p = 10\text{ ms}$ sinusoidal, $T_c = 25\text{ °C}$          | 90          | A    |
|              |                                                                               | $t_p = 10\text{ ms}$ sinusoidal, $T_c = 125\text{ °C}$         | 70          |      |
|              |                                                                               | $t_p = 10\text{ }\mu\text{s}$ square, $T_c = 25\text{ °C}$     | 400         |      |
| $T_{stg}$    | Storage temperature range                                                     |                                                                | -55 to +175 | °C   |
| $T_j$        | Operating junction temperature <sup>(2)</sup>                                 |                                                                | -40 to +175 | °C   |

**Notes:**

<sup>(1)</sup>Value based on  $R_{th(j-c)}$  max.

<sup>(2)</sup> $(dP_{tot}/dT_j) < (1/R_{th(j-a)})$  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 | 0.90  | °C/W |
|               |                  | Total     | 0.60  |      |
| $R_{th(c)}$   | Coupling         |           | 0.30  |      |

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

| Symbol      | Parameter               | Test conditions       |                      | Min. | Typ. | Max. | Unit          |
|-------------|-------------------------|-----------------------|----------------------|------|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25\text{ °C}$  | $V_R = V_{RRM}$      | -    | 30   | 300  | $\mu\text{A}$ |
|             |                         | $T_j = 150\text{ °C}$ |                      | -    | 280  | 2000 |               |
|             |                         | $T_j = 25\text{ °C}$  | $V_R = 600\text{ V}$ |      | 15   | 150  |               |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 25\text{ °C}$  | $I_F = 20\text{ A}$  | -    | 1.30 | 1.45 | V             |
|             |                         | $T_j = 150\text{ °C}$ |                      | -    | 1.45 | 1.65 |               |
|             |                         | $T_j = 175\text{ °C}$ |                      | -    | 1.50 |      |               |

**Notes:**

<sup>(1)</sup>Pulse test:  $t_p = 5\text{ ms}$ ,  $\delta < 2\%$

<sup>(2)</sup>Pulse test:  $t_p = 500\text{ }\mu\text{s}$ ,  $\delta < 2\%$

To evaluate the conduction losses use the following equation:

$$P = 1.02 \times I_{F(AV)} + 0.039 \times I_{F(RMS)}^2$$

Table 5: Dynamic electrical characteristics (per diode)

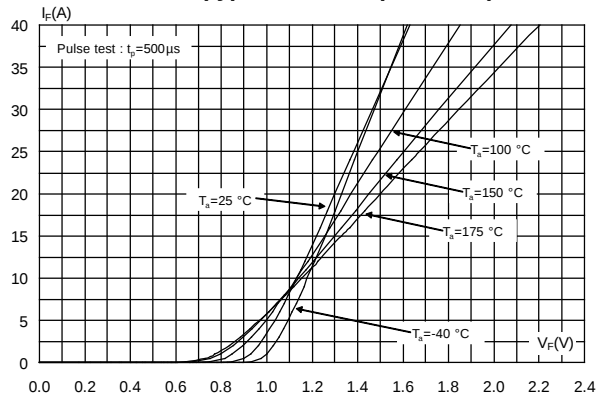
| Symbol         | Parameter               | Test conditions                                                           | Min. | Typ. | Max. | Unit |
|----------------|-------------------------|---------------------------------------------------------------------------|------|------|------|------|
| $Q_{Cj}^{(1)}$ | Total capacitive charge | $V_R = 400 \text{ V}$                                                     | -    | 62   | -    | nC   |
| $C_j$          | Total capacitance       | $V_R = 0 \text{ V}, T_c = 25 \text{ }^\circ\text{C}, F = 1 \text{ MHz}$   | -    | 1250 | -    | pF   |
|                |                         | $V_R = 400 \text{ V}, T_c = 25 \text{ }^\circ\text{C}, F = 1 \text{ MHz}$ | -    | 100  | -    |      |

**Notes:**

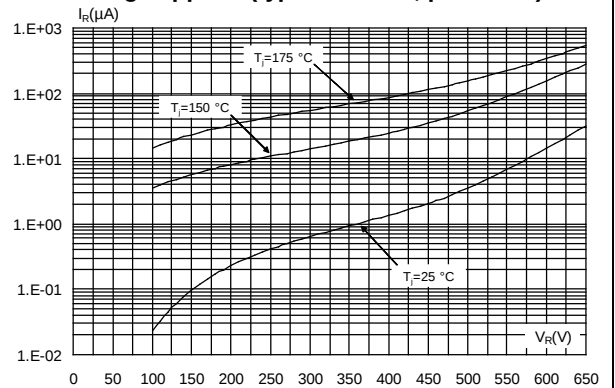
<sup>(1)</sup>Most accurate value for the capacitive charge:  $Q_{Cj} = \int_0^{V_{OUT}} C_j(V_R) \cdot dV_R$

## 1.1 Characteristics (curves)

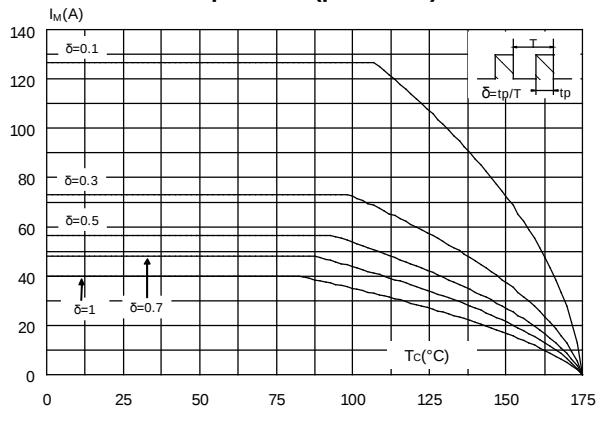
**Figure 1: Forward voltage drop versus forward current (typical values, per diode)**



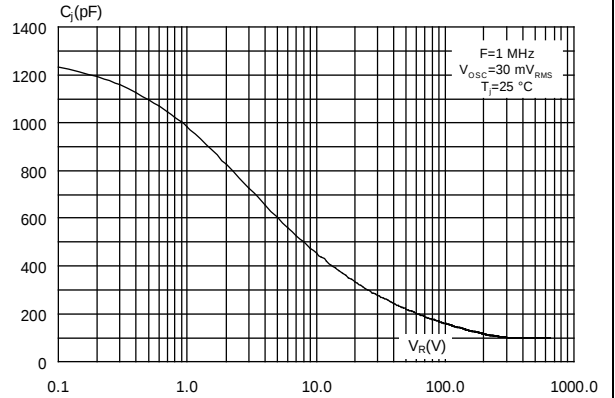
**Figure 2: Reverse leakage current versus reverse voltage applied (typical values, per diode)**



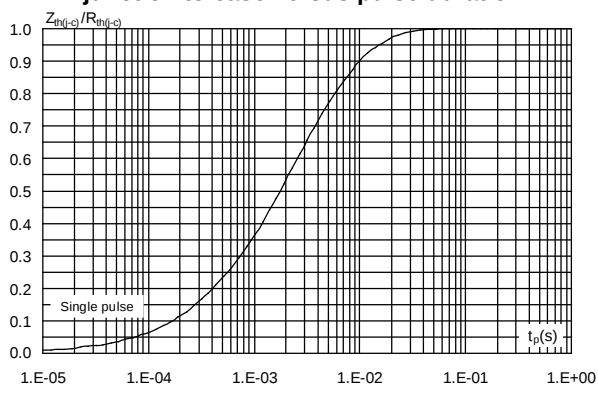
**Figure 3: Peak forward current versus case temperature (per diode)**



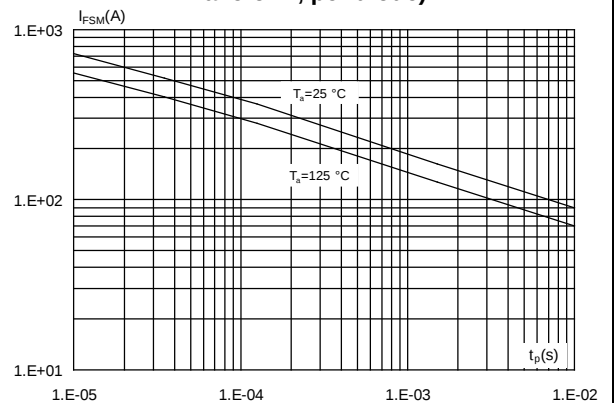
**Figure 4: Junction capacitance versus reverse voltage applied (typical values, per diode)**

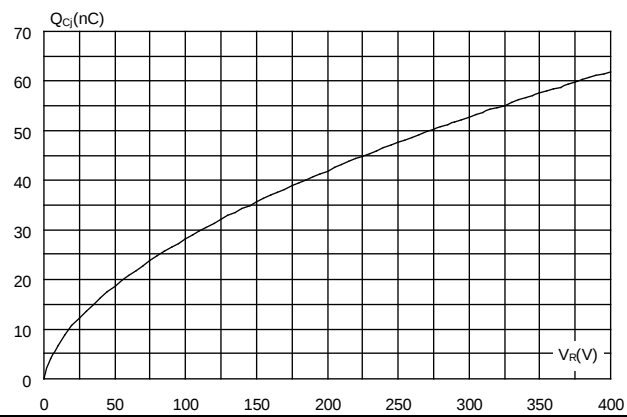


**Figure 5: Relative variation of thermal impedance junction to case versus pulse duration**



**Figure 6: Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform, per diode)**



**Figure 7: Total capacitive charges versus reverse voltage applied (typical values, per diode)**

## 2 Package information

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.

- Epoxy meets UL 94,V0
- Recommended torque value: 0.8 N·m
- Maximum torque value: 1 N·m

### 2.1 TO-247 package information

Figure 8: TO-247 package outline

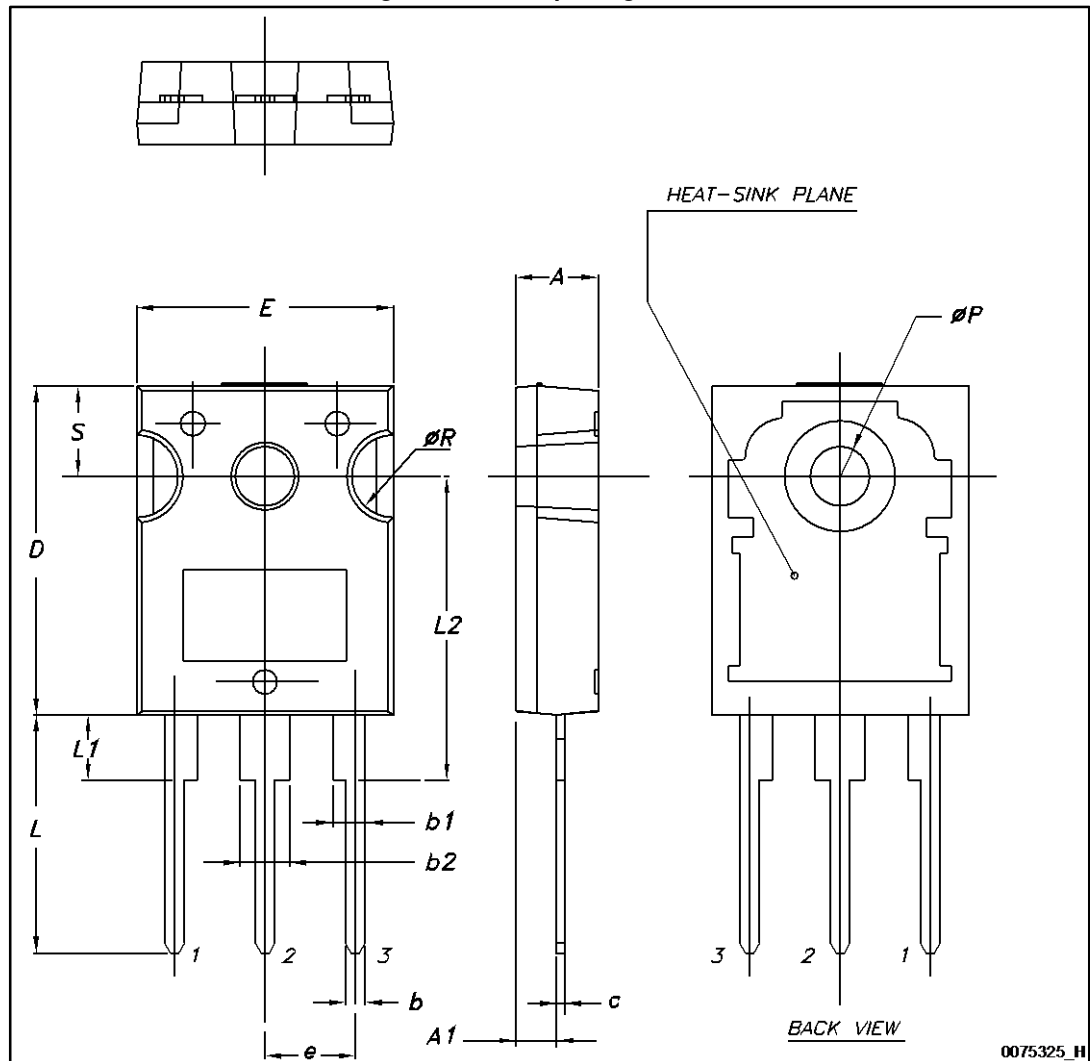


Table 6: TO-247 package mechanical data

| Ref.              | Dimensions  |       |       |        |       |       |
|-------------------|-------------|-------|-------|--------|-------|-------|
|                   | Millimeters |       |       | Inches |       |       |
|                   | Min.        | Typ.  | Max.  | Min.   | Typ.  | Max.  |
| A                 | 4.85        |       | 5.15  | 0.191  |       | 0.203 |
| A1                | 2.20        |       | 2.60  | 0.086  |       | 0.102 |
| b                 | 1.00        |       | 1.40  | 0.039  |       | 0.055 |
| b1                | 2.00        |       | 2.40  | 0.078  |       | 0.094 |
| b2                | 3.00        |       | 3.40  | 0.118  |       | 0.133 |
| c                 | 0.40        |       | 0.80  | 0.015  |       | 0.031 |
| D <sup>(1)</sup>  | 19.85       |       | 20.15 | 0.781  |       | 0.793 |
| E                 | 15.45       |       | 15.75 | 0.608  |       | 0.620 |
| e                 | 5.30        | 5.45  | 5.60  | 0.209  | 0.215 | 0.220 |
| L                 | 14.20       |       | 14.80 | 0.559  |       | 0.582 |
| L1                | 3.70        |       | 4.30  | 0.145  |       | 0.169 |
| L2                |             | 18.50 |       |        | 0.728 |       |
| ØP <sup>(2)</sup> | 3.55        |       | 3.65  | 0.139  |       | 0.143 |
| ØR                | 4.50        |       | 5.50  | 0.177  |       | 0.217 |
| S                 | 5.30        | 5.50  | 5.70  | 0.209  | 0.216 | 0.224 |

**Notes:**

<sup>(1)</sup>Dimension D plus gate protusion does not exceed 20.5 mm

<sup>(2)</sup>Resin thickness around the mounting hole is not less than 0.9 mm.

### 3 Ordering information

Table 7: Ordering information

| Order code    | Marking     | Package | Weight | Base qty. | Delivery mode |
|---------------|-------------|---------|--------|-----------|---------------|
| STPSC40065CWY | PSC40065CWY | TO-247  | 4.43 g | 30        | Tube          |

### 4 Revision history

Table 8: Document revision history

| Date        | Revision | Changes                      |
|-------------|----------|------------------------------|
| 11-May-2016 | 1        | First issue.                 |
| 12-May-2016 | 2        | Updated cover page footnote. |

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