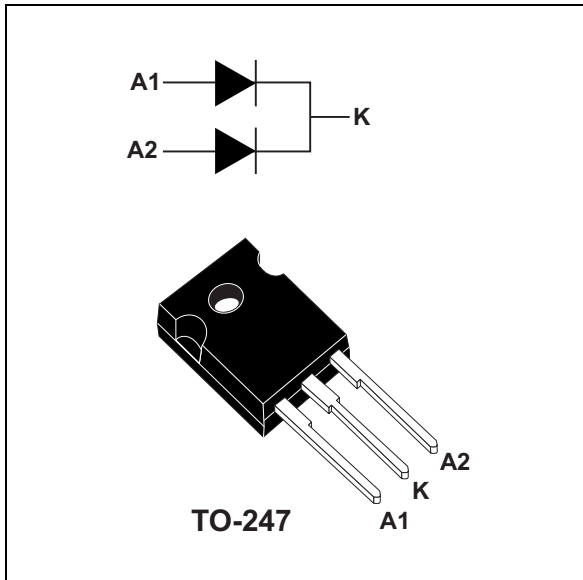


650 V power Schottky silicon carbide diode

Datasheet - production data



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 minimal capacitive turn-off behavior is independent of temperature.

Especially suited for use in PFC applications, this ST SiC diode will boost the performance in hard switching conditions.

Table 1. Device summary

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

Features

- No or negligible reverse recovery
- Switching behavior independent of temperature
- Dedicated to PFC applications
- 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 | | 650 | V |
| I _{F(RMS)} | Forward rms current | | 58 | A |
| I _{F(AV)} | Average forward current | T _c = 110 °C ⁽¹⁾ , DC, per diode | 20 | A |
| | | T _c = 95 °C, DC, per device | 40 | |
| I _{FSM} | Surge non repetitive forward current | t _p = 10 ms sinusoidal, T _c = 25 °C | 70 | A |
| | | t _p = 10 ms sinusoidal, T _c = 125 °C | 60 | |
| | | t _p = 10 μs square, T _c = 25 °C | 280 | |
| I _{FRM} | Repetitive peak forward current | T _c = 110 °C ⁽¹⁾ , T _j = 175 °C, δ = 0.1 | 80 | A |
| T _{stg} | Storage temperature range | | -55 to +175 | °C |
| T _j | Operating junction temperature ⁽²⁾ | | -40 to +175 | °C |

- Value based on R_{th(j-c)} max.
- $\frac{dP_{tot}}{dT_j} < \frac{1}{R_{th(j-a)}}$ 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 | Per diode | 1.4 | °C/W |
| | | Total | 0.9 | |
| R _{th(c)} | Coupling | | 0.4 | |

Table 4. Static electrical characteristics per diode

| Symbol | Parameter | Tests conditions | | Min. | Typ. | Max. | Unit |
|-------------------------------|-------------------------|-------------------------|------------------------|------|------|------|------|
| I _R ⁽¹⁾ | Reverse leakage current | T _j = 25 °C | V _R = 600 V | - | 60 | 300 | μA |
| | | T _j = 150 °C | | - | 420 | 3000 | |
| V _F ⁽²⁾ | Forward voltage drop | T _j = 25 °C | I _F = 20 A | - | 1.5 | 1.7 | V |
| | | T _j = 150 °C | | - | 1.85 | 2.2 | |

- t_p = 10 ms, δ < 2%
- t_p = 500 μs, δ < 2%

To evaluate the conduction losses use the following equation:

$$P = 1.0 \times I_{F(AV)} + 0.06 \times I_{F(RMS)}^2$$



Table 5. Dynamic electrical characteristics per diode

| Symbol | Parameter | Test conditions | Typ. | Unit |
|----------------|-------------------------|--|------|------|
| $Q_{cj}^{(1)}$ | Total capacitive charge | $V_R = 400\text{ V}$ | 42 | nC |
| C_j | Total capacitance | $V_R = 0\text{ V}, T_C = 25\text{ }^\circ\text{C}, F = 1\text{ MHz}$ | 960 | pF |
| | | $V_R = 400\text{ V}, T_C = 25\text{ }^\circ\text{C}, F = 1\text{ MHz}$ | 80 | |

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

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

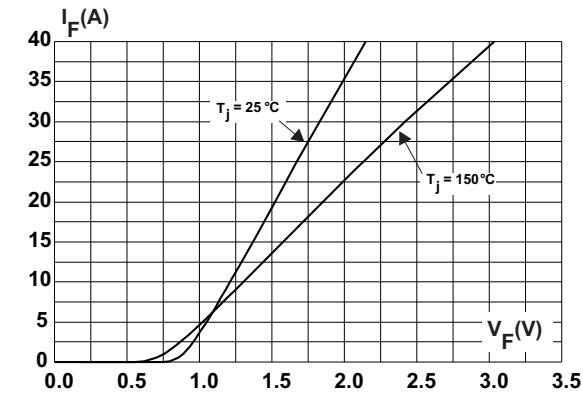


Figure 2. Reverse leakage current versus reverse voltage applied (maximum values per diode)

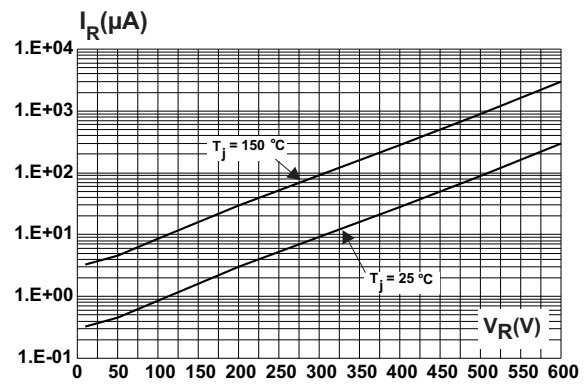


Figure 3. Peak forward current versus case temperature (per diode)

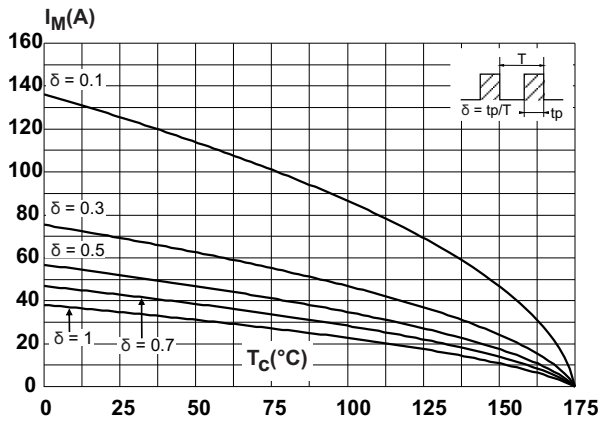


Figure 4. Junction capacitance versus reverse voltage applied (typical values, per diode)

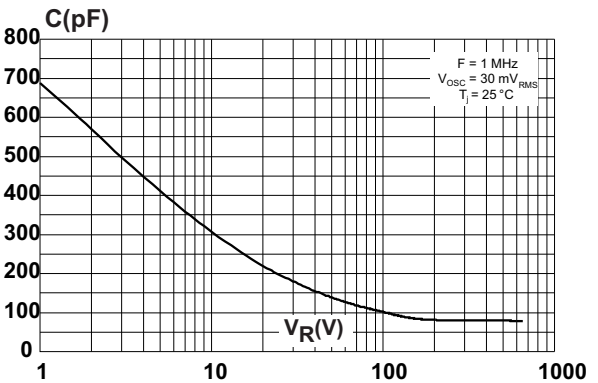


Figure 5. Relative variation of thermal impedance junction to case versus pulse duration

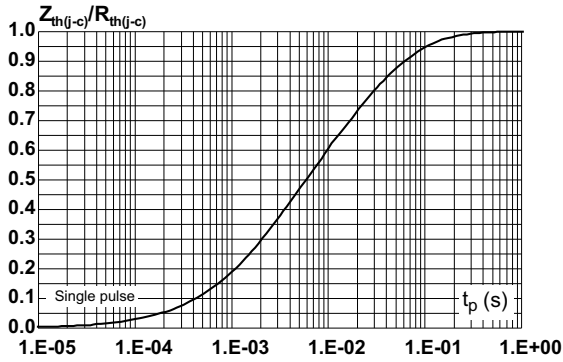


Figure 6. Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform, per diode)

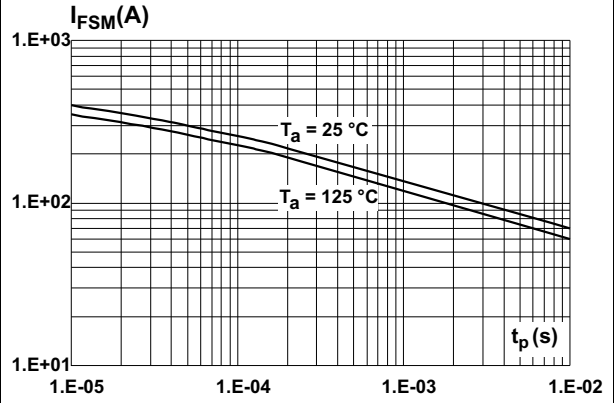
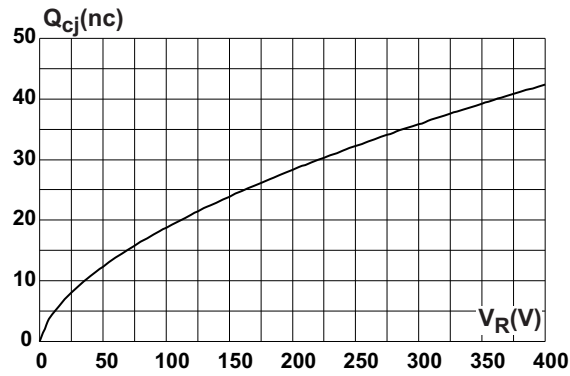


Figure 7. Total capacitive charges versus reverse voltage applied (typical values per diode)



2 Package information

- Epoxy meets UL94, V0
- Cooling method: conduction (C)
- Recommended torque value:
 - TO-247 0.55 N·m (1.0 N·m maximum)

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. ECOPACK® is an ST trademark.

2.1 TO-247 package information

Figure 8. TO-247 package outline

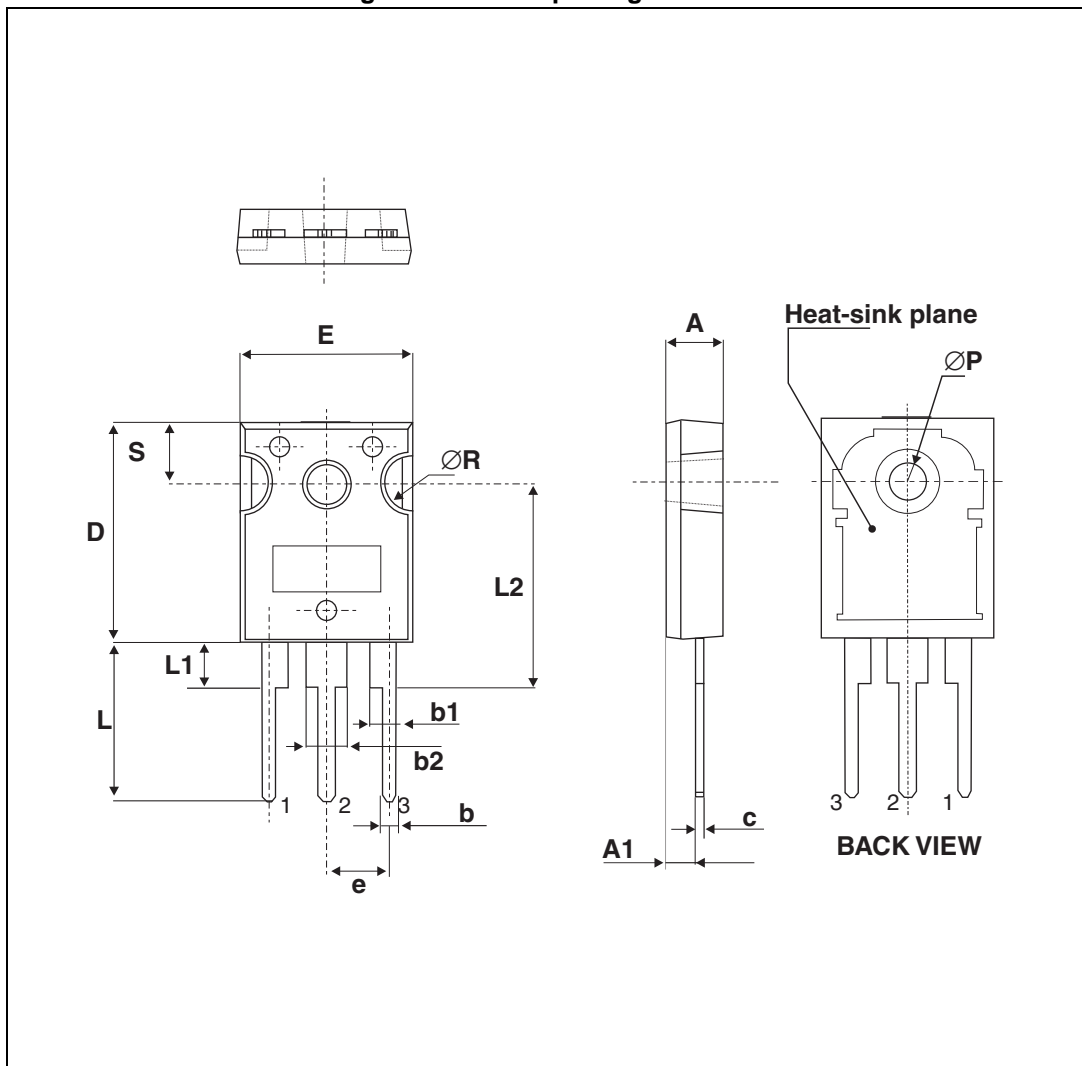


Table 6. TO-247 package mechanical data

| 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 ⁽¹⁾ | 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 typ. | | | 0.728 typ. | | |
| ∅P ⁽²⁾ | 3.55 | | 3.65 | 0.139 | | 0.143 |
| ∅R | 4.50 | | 5.50 | 0.177 | | 0.217 |
| S | 5.30 | 5.50 | 5.70 | 0.209 | 0.216 | 0.224 |

1. Dimension D plus gate protrusion does not exceed 20.5 mm
2. 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 |
|--------------|--------------|---------|--------|----------|---------------|
| STPSC40065CW | STPSC40065CW | TO-247 | 4.43 g | 30 | Tube |

4 Revision history

Table 8. Document revision history

| Date | Revision | Changes |
|-------------|----------|--------------|
| 19-Jun-2015 | 1 | First issue. |

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