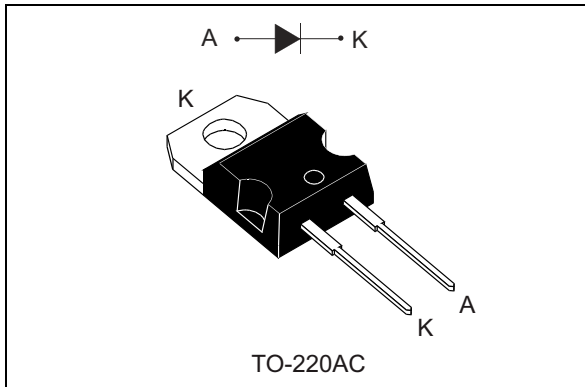


650 V power Schottky silicon carbide diode

Datasheet - production data



Features

- No or negligible reverse recovery
- Switching behavior independent of temperature
- Dedicated to PFC applications
- High forward surge capability

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. Its high forward surge capability ensures a good robustness during transient phases.

Table 1. Device summary

| Symbol | Value |
|-------------|--------|
| $I_{F(AV)}$ | 12 A |
| V_{RRM} | 650 V |
| T_j (max) | 175 °C |

1 Characteristics

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

| Symbol | Parameter | | Value | Unit |
|--------------|---|--|-------------|------|
| V_{RRM} | Repetitive peak reverse voltage | | 650 | V |
| $I_{F(RMS)}$ | Forward rms current | | 22 | A |
| $I_{F(AV)}$ | Average forward current | $T_C = 130\text{ °C}^{(1)}, \delta = 0.5$ | 12 | A |
| I_{FSM} | Surge non repetitive forward current | $t_p = 10\text{ ms sinusoidal}, T_C = 25\text{ °C}$ | 100 | A |
| | | $t_p = 10\text{ ms sinusoidal}, T_C = 125\text{ °C}$ | 90 | |
| | | $t_p = 10\text{ }\mu\text{s square}, T_C = 25\text{ °C}$ | 400 | |
| I_{FRM} | Repetitive peak forward current | $T_C = 130\text{ °C}^{(1)}, T_j = 150\text{ °C}, \delta = 0.1$ | 50 | 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 |
|---------------|------------------|-------|------|------|
| | | Typ. | Max. | |
| $R_{th(j-c)}$ | Junction to case | 1.00 | 1.4 | °C/W |

Table 4. Static electrical characteristics

| Symbol | Parameter | Tests conditions | Min. | Typ. | Max. | Unit | |
|-------------|-------------------------|-----------------------|---------------------|------|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25\text{ °C}$ | $V_R = V_{RRM}$ | - | 10 | 120 | μA |
| | | $T_j = 150\text{ °C}$ | | - | 100 | 500 | |
| $V_F^{(2)}$ | Forward voltage drop | $T_j = 25\text{ °C}$ | $I_F = 12\text{ A}$ | - | 1.56 | 1.75 | V |
| | | $T_j = 150\text{ °C}$ | | - | 1.98 | 2.5 | |

- $t_p = 10\text{ ms}, \delta < 2\%$
- $t_p = 500\text{ }\mu\text{s}, \delta < 2\%$

To evaluate the conduction losses use the following equation:

$$P = 1.35 \times I_{F(AV)} + 0.096 \times I_{F(RMS)}^2$$

Table 5. Dynamic electrical characteristics

| Symbol | Parameter | Test conditions | Typ. | Unit |
|----------------|-------------------------|--|------|------|
| $Q_{cj}^{(1)}$ | Total capacitive charge | $V_R = 400\text{ V},$ | 36 | nC |
| C_j | Total capacitance | $V_R = 0\text{ V}, T_C = 25\text{ °C}, F = 1\text{ MHz}$ | 600 | pF |
| | | $V_R = 400\text{ V}, T_C = 25\text{ °C}, F = 1\text{ MHz}$ | 60 | |

- 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)

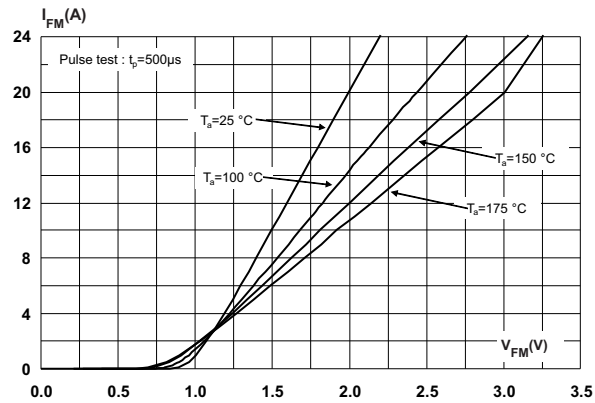


Figure 2. Forward voltage drop versus forward current (typical values, high level)

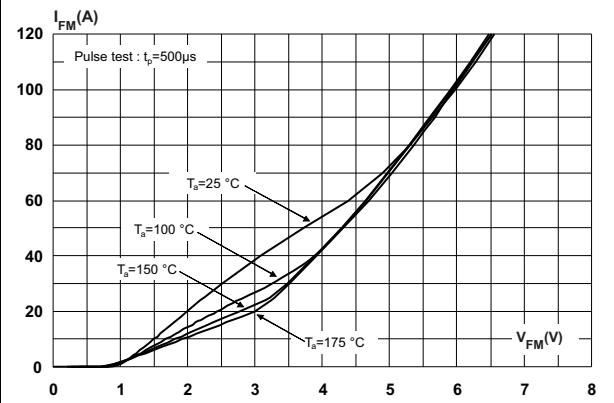


Figure 3. Reverse leakage current versus reverse voltage applied (typical values)

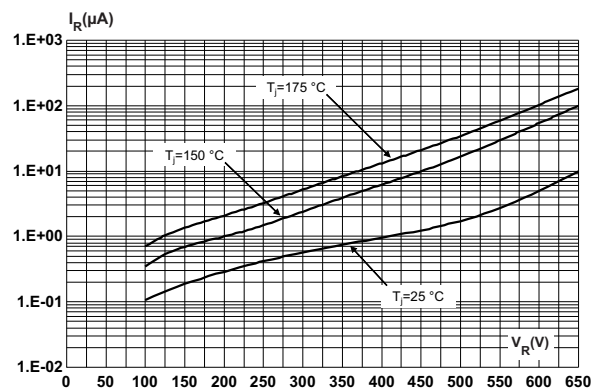


Figure 4. Peak forward current versus case temperature

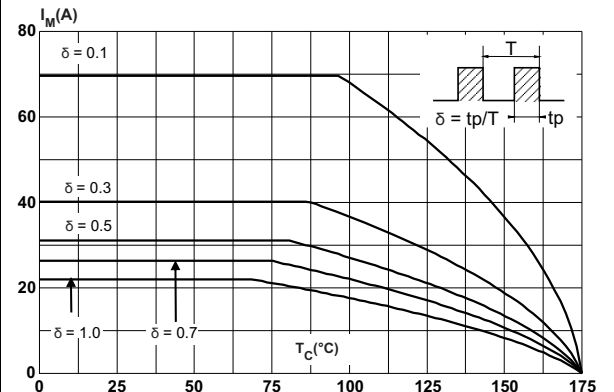


Figure 5. Junction capacitance versus reverse voltage applied (typical values)

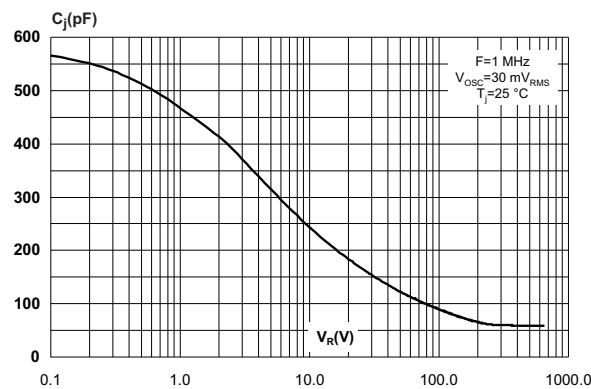


Figure 6. Relative variation of thermal impedance junction to case versus pulse duration

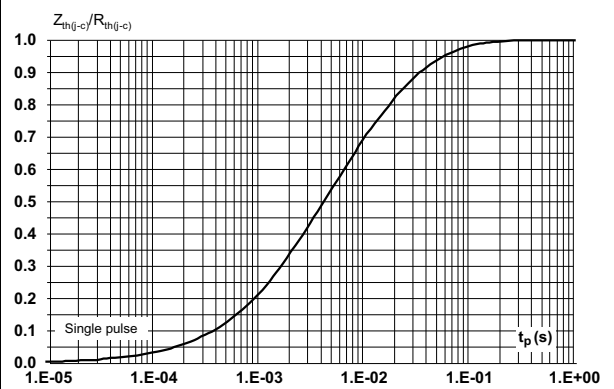


Figure 7. Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform)

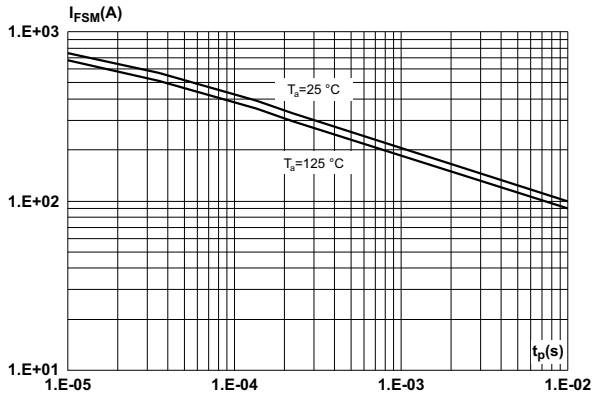
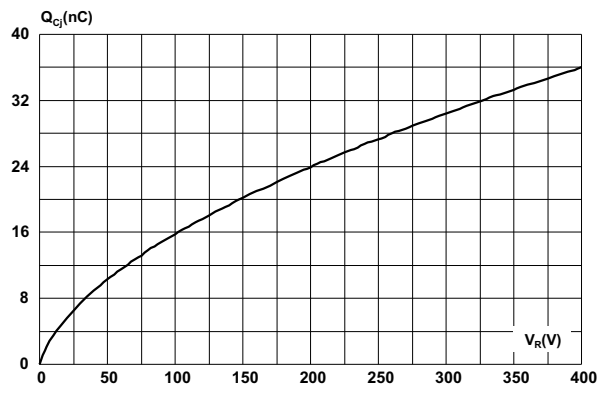


Figure 8. Total capacitive charges versus reverse voltage applied (typical values)



2 Package information

- Epoxy meets UL94, V0
- Recommended torque value: 0.55 N·m
- Maximum torque value: 0.7 N·m
- Cooling method: conduction (C)

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-220AC package information

Figure 9. TO-220AC package outline

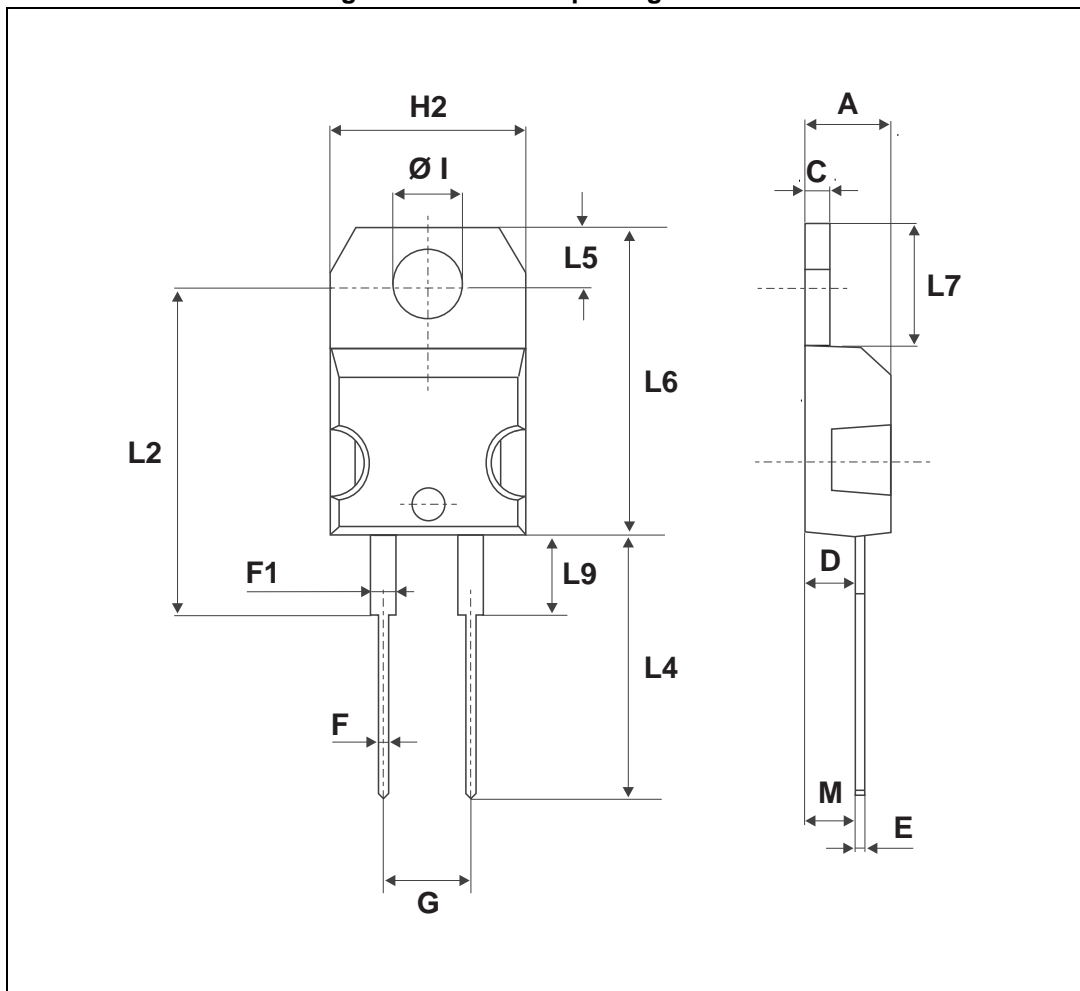


Table 6. TO-220AC package mechanical data

| 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 |
| G | 4.95 | 5.15 | 0.194 | 0.202 |
| H2 | 10.00 | 10.40 | 0.393 | 0.409 |
| L2 | 16.40 typ. | | 0.645 typ. | |
| L4 | 13.00 | 14.00 | 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. | |
| Diam. I | 3.75 | 3.85 | 0.147 | 0.151 |

3 Ordering information

Table 7. Ordering information

| Order code | Marking | Package | Weight | Base qty | Delivery mode |
|--------------|------------|----------|--------|----------|---------------|
| STPSC12H065D | PSC12H065D | TO-220AC | 1.86 g | 50 | Tube |

4 Revision history

Table 8. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 27-Nov-2014 | 1 | First issue. |
| 13-Jul-2015 | 2 | Removed D ² PAK package information and updated Table 7 . |

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2015 STMicroelectronics – All rights reserved