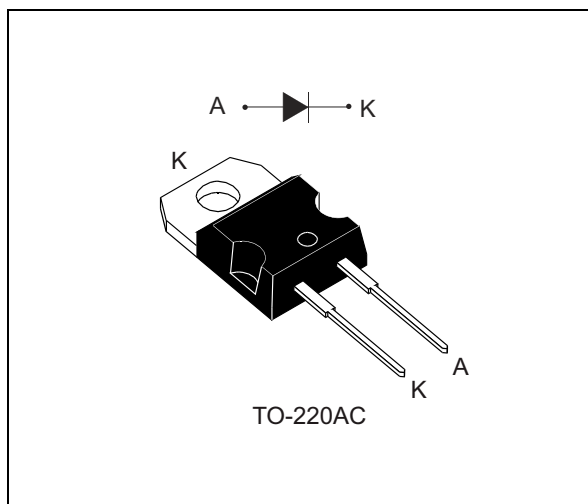


## Automotive 650 V power Schottky silicon carbide diode

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 and is ideal for automotive applications.

Especially suited for use as boost diode, this rectifier will enhance the performance in hard switching conditions. Its high forward surge capability ensures a good robustness during transient phases.

### Features

- No or negligible reverse recovery
- Switching behavior independent of temperature
- Dedicated to PFC applications
- High forward surge capability
- AEC-Q101 qualified
- PPAP capable
- ECOPACK®2 compliant component

Table 1. Device summary

| Symbol              | Value  |
|---------------------|--------|
| $I_{F(AV)}$         | 12 A   |
| $V_{RRM}$           | 650 V  |
| $T_j \text{ (max)}$ | 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, $T_j = -40\text{ °C}$ |                                                                      | 650         | V    |
| $I_{F(RMS)}$ | Forward rms current                                    |                                                                      | 22          | A    |
| $I_{F(AV)}$  | Average forward current                                | $T_c = 120\text{ °C}^{(1)}$ , $\delta = 0.5$                         | 12          | A    |
| $I_{FSM}$    | Surge non repetitive forward current                   | $t_p = 10\text{ ms}$ sinusoidal, $T_c = 25\text{ °C}$                | 92          | A    |
|              |                                                        | $t_p = 10\text{ ms}$ sinusoidal, $T_c = 125\text{ °C}$               | 84          |      |
|              |                                                        | $t_p = 10\text{ }\mu\text{s}$ square, $T_c = 25\text{ °C}$           | 470         |      |
| $I_{FRM}$    | Repetitive peak forward current                        | $T_c = 120\text{ °C}^{(1)}$ , $T_j = 175\text{ °C}$ , $\delta = 0.1$ | 51          | A    |
| $T_{stg}$    | Storage temperature range                              |                                                                      | -65 to +175 | °C   |
| $T_j$        | Operating junction temperature <sup>(2)</sup>          |                                                                      | -40 to +175 | °C   |

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

2.  $\frac{dP_{tot}}{dT_j} < \frac{1}{R_{th(j-a)}}$  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 | 1.2   | 1.7  | °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   | $\mu\text{A}$ |
|             |                         | $T_j = 150\text{ °C}$ |                     | -    | 100  |               |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 25\text{ °C}$  | $I_F = 12\text{ A}$ | -    | 1.56 | V             |
|             |                         | $T_j = 150\text{ °C}$ |                     | -    | 1.98 |               |

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:

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

**Table 5. Dynamic electrical characteristics**

| Symbol         | Parameter               | Test conditions                                                  | Typ. | Unit |
|----------------|-------------------------|------------------------------------------------------------------|------|------|
| $Q_{cj}^{(1)}$ | Total capacitive charge | $V_R = 400\text{ V}$                                             | 29.3 | nC   |
| $C_j$          | Total capacitance       | $V_R = 0\text{ V}$ , $T_c = 25\text{ °C}$ , $F = 1\text{ MHz}$   | 530  | pF   |
|                |                         | $V_R = 300\text{ V}$ , $T_c = 25\text{ °C}$ , $F = 1\text{ MHz}$ | 55   |      |

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

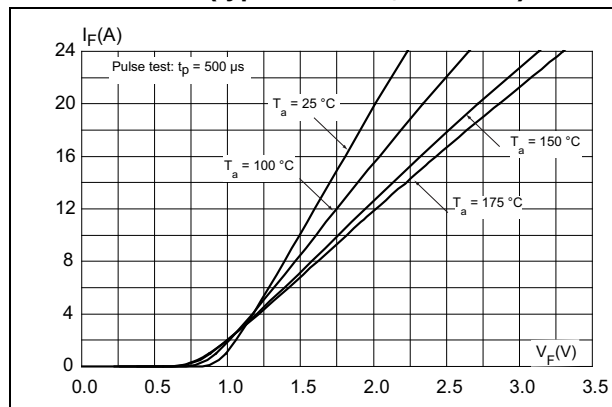
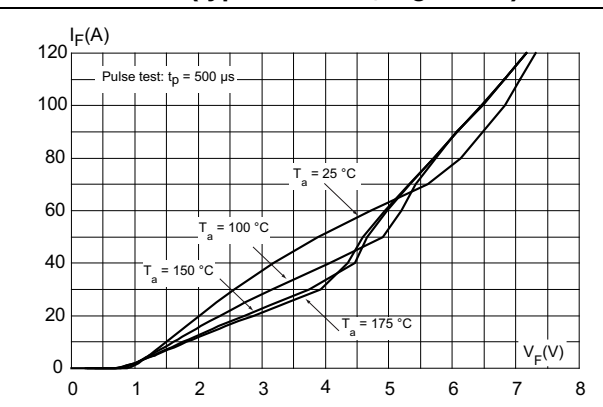
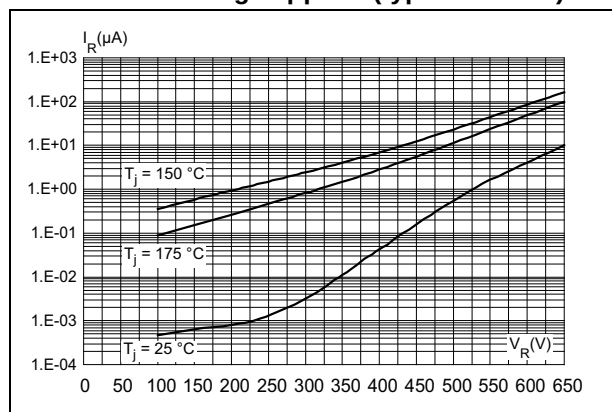
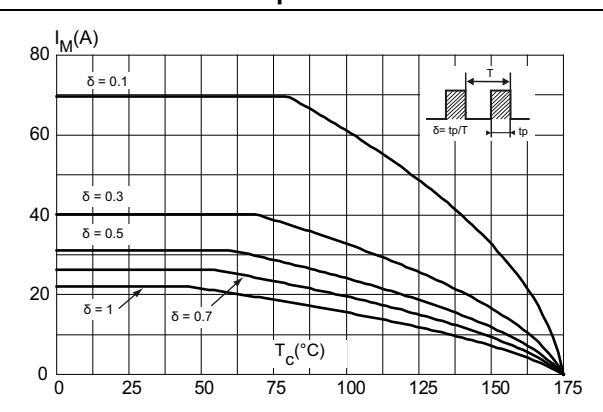
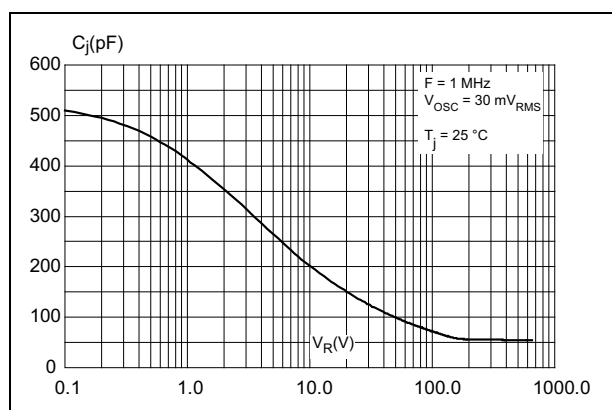
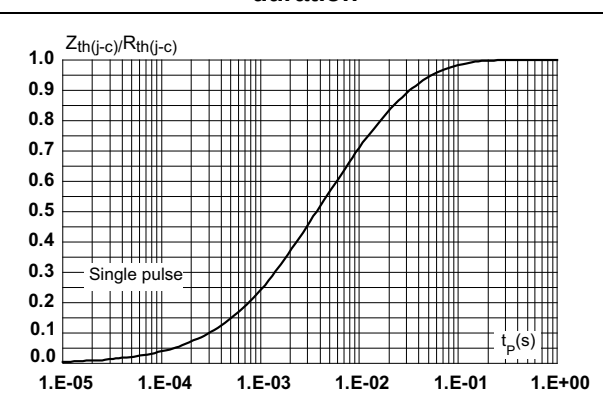
**Figure 1. Forward voltage drop versus forward current (typical values, low level)****Figure 2. Forward voltage drop versus forward current (typical values, high level)****Figure 3. Reverse leakage current versus reverse voltage applied (typical values)****Figure 4. Peak forward current versus case 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)

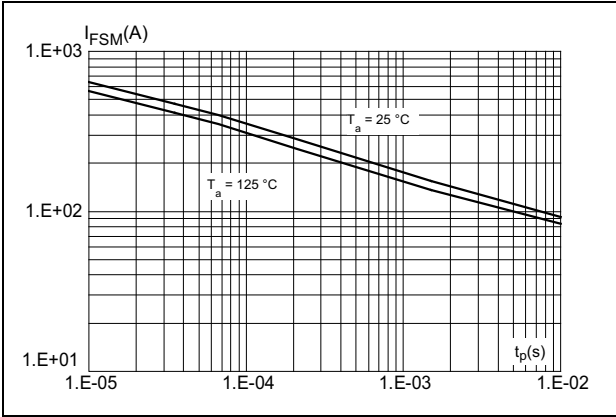
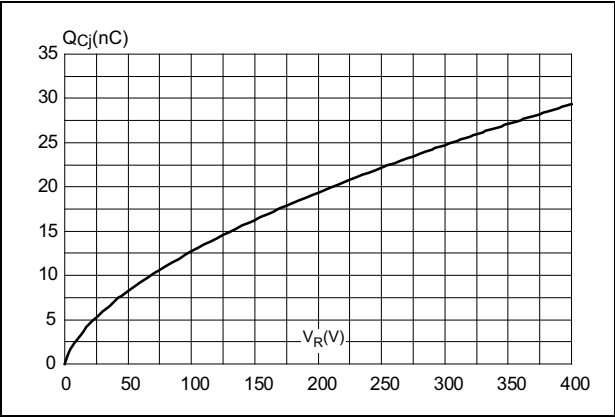


Figure 8. Total capacitive charges versus reverse voltage applied (typical values)



## 2 Package information

- Epoxy meets UL94, V0
- Recommended torque value (TO-220AC): 0.55 N·m
- Maximum torque value: 0.7 N·m for TO-220AC
- Cooling method: conduction (C)

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

**Figure 9. TO-220AC dimension definitions**

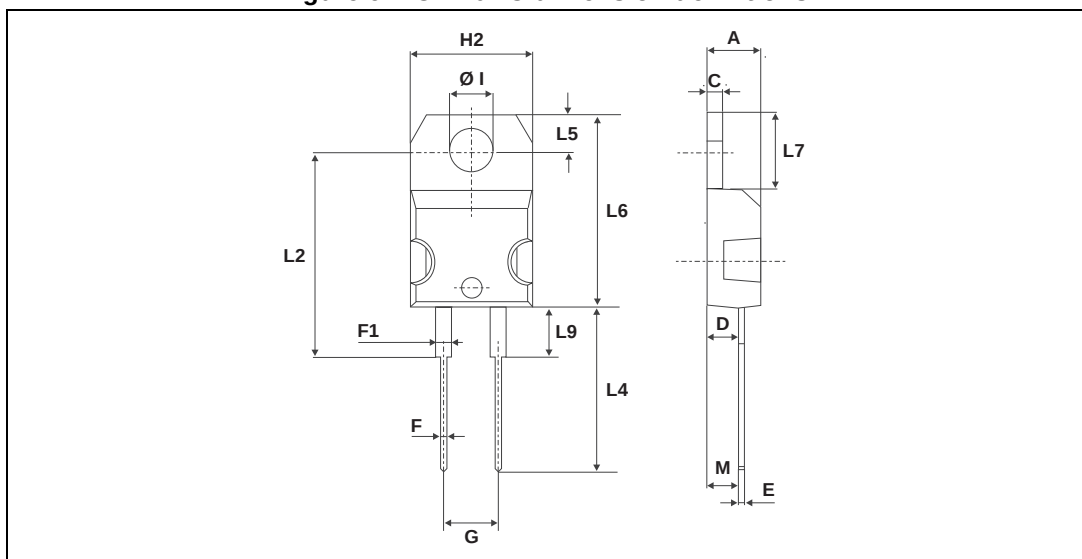


Table 6. TO-220AC dimension values

| 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 |
|---------------|-------------|----------|--------|----------|---------------|
| STPSC12C065DY | PSC12C065DY | TO-220AC | 1.86 g | 50       | Tube          |

### 4 Revision history

Table 8. Document revision history

| Date        | Revision | Changes      |
|-------------|----------|--------------|
| 13-Jan-2015 | 1        | First issue. |

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