

## 600 V power Schottky silicon carbide diode

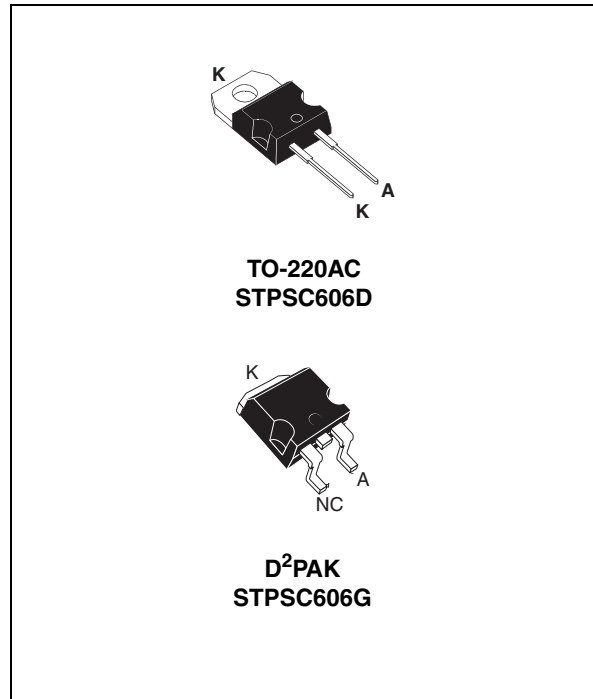
### Features

- No or negligible reverse recovery
- Switching behavior independent of temperature
- Dedicated to PFC boost diode

### Description

The SiC diode is an ultrahigh performance power Schottky diode. It is manufactured using a silicon carbide substrate. The wide bandgap material allows the design of a Schottky diode structure with a 600 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.

ST SiC diodes will boost the performance of PFC operations in hard switching conditions.



**Table 1. Device summary**

|             |        |
|-------------|--------|
| $I_{F(AV)}$ | 6 A    |
| $V_{RRM}$   | 600 V  |
| $T_J (max)$ | 175 °C |
| $Q_C (typ)$ | 6 nC   |

# 1 Characteristics

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

| Symbol       | Parameter                            |                                                          | Value       | Unit |
|--------------|--------------------------------------|----------------------------------------------------------|-------------|------|
| $V_{RRM}$    | Repetitive peak reverse voltage      |                                                          | 600         | V    |
| $I_{F(RMS)}$ | Forward rms current                  |                                                          | 18          | A    |
| $I_{F(AV)}$  | Average forward current              | $T_c = 125\text{ °C}, \delta = 0.5$                      | 6           | A    |
| $I_{FSM}$    | Surge non repetitive forward current | $t_p = 10\text{ ms sinusoidal}, T_c = 25\text{ °C}$      | 27          | A    |
|              |                                      | $t_p = 10\text{ ms sinusoidal}, T_c = 125\text{ °C}$     | 22          |      |
|              |                                      | $t_p = 10\text{ }\mu\text{s square}, T_c = 25\text{ °C}$ | 110         |      |
| $I_{FRM}$    | Repetitive peak forward current      | $\delta = 0.1, T_c = 110\text{ °C}, T_j = 150\text{ °C}$ | 27          | A    |
| $T_{stg}$    | Storage temperature range            |                                                          | -55 to +175 | °C   |
| $T_j$        | Operating junction temperature range |                                                          | -40 to +175 | °C   |

**Table 3. Thermal resistance**

| Symbol        | Parameter        | Value | Unit |
|---------------|------------------|-------|------|
| $R_{th(j-c)}$ | Junction to case | 2.8   | °C/W |

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

| Symbol      | Parameter               | Tests conditions      |                    | Min. | Typ. | Max. | Unit          |
|-------------|-------------------------|-----------------------|--------------------|------|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25\text{ °C}$  | $V_R = V_{RRM}$    | -    | 15   | 75   | $\mu\text{A}$ |
|             |                         | $T_j = 150\text{ °C}$ |                    | -    | 100  | 750  |               |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 25\text{ °C}$  | $I_F = 6\text{ A}$ | -    | 1.4  | 1.7  | V             |
|             |                         | $T_j = 150\text{ °C}$ |                    | -    | 1.6  | 2.1  |               |

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:

$$P = 1.20 \times I_{F(AV)} + 0.15 \times I_{F(RMS)}^2$$

**Table 5. Other parameters**

| Symbol | Parameter               | Test conditions                                                                                      | Typ. | Unit |
|--------|-------------------------|------------------------------------------------------------------------------------------------------|------|------|
| $Q_c$  | Total capacitive charge | $V_r = 400\text{ V}, I_F = 6\text{ A}, di_F/dt = -200\text{ A}/\mu\text{s}$<br>$T_j = 150\text{ °C}$ | 6    | nC   |
| C      | Total capacitance       | $V_r = 0\text{ V}, T_c = 25\text{ °C}, F = 1\text{ Mhz}$                                             | 375  | pF   |
|        |                         | $V_r = 400\text{ V}, T_c = 25\text{ °C}, F = 1\text{ Mhz}$                                           | 30   |      |

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

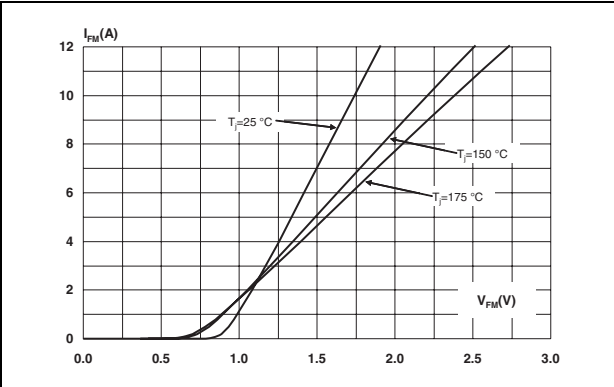


Figure 2. Reverse leakage current versus reverse voltage applied (maximum values)

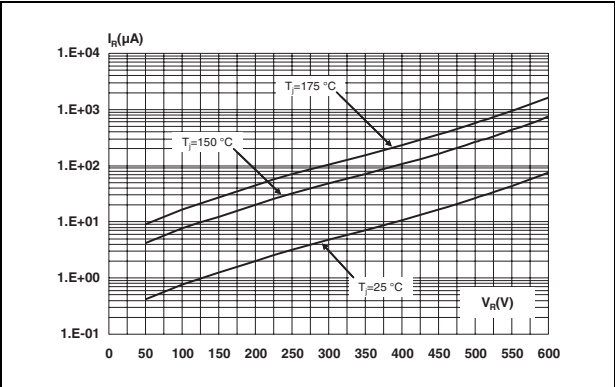


Figure 3. Peak forward current versus case temperature

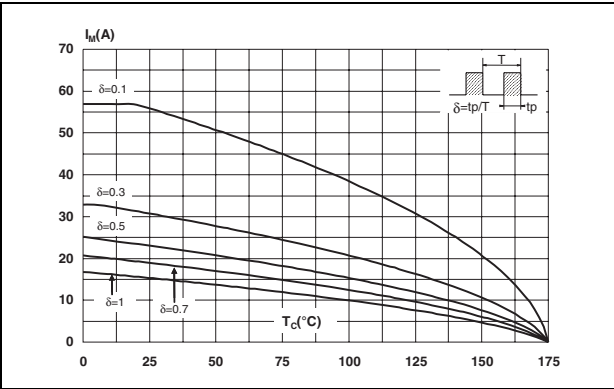


Figure 4. Junction capacitance versus reverse voltage applied (typical values)

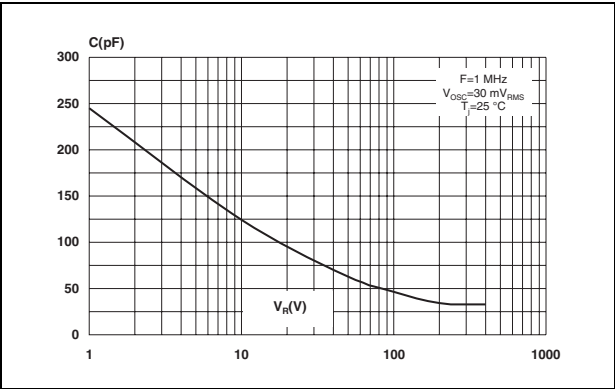


Figure 5. Relative variation of thermal impedance junction to case versus pulse duration

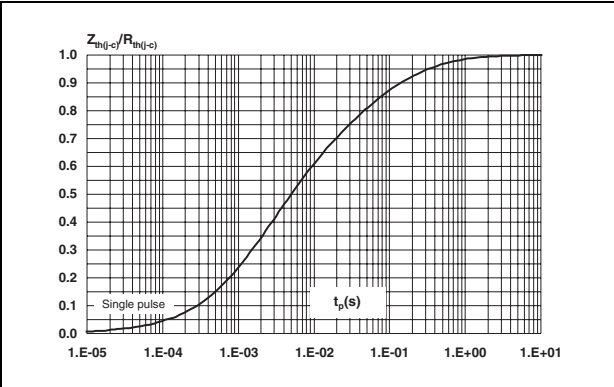


Figure 6. Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform)

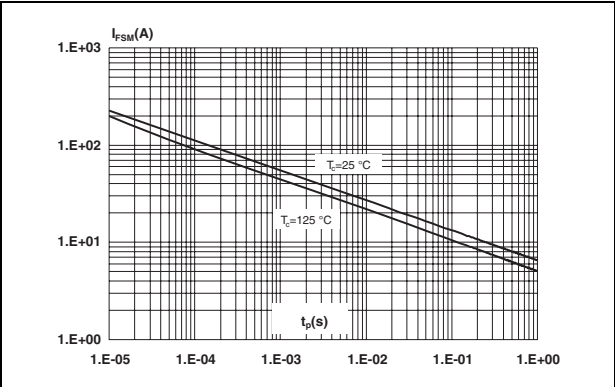
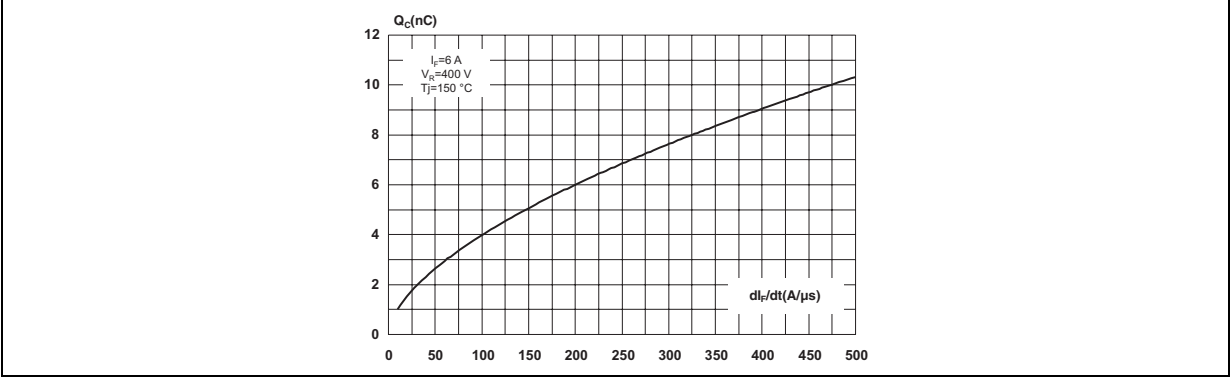


Figure 7. Total capacitive charges versus  $di_F/dt$  (typical values)



## 2 Package information

- Epoxy meets UL94, V0
- Cooling method: convection (C)
- Recommended torque: 0.4 to 0.6 N·m

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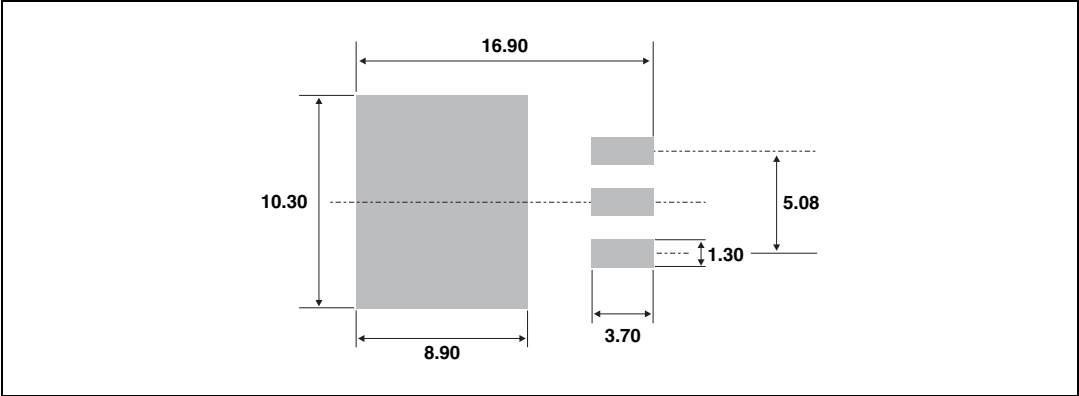
**Table 6. TO-220AC dimensions**

| 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 |

Table 7. D<sup>2</sup>PAK dimensions

| Ref. | Dimensions  |       |            |       |
|------|-------------|-------|------------|-------|
|      | Millimeters |       | Inches     |       |
|      | Min.        | Max.  | Min.       | Max.  |
| A    | 4.40        | 4.60  | 0.173      | 0.181 |
| A1   | 2.49        | 2.69  | 0.098      | 0.106 |
| A2   | 0.03        | 0.23  | 0.001      | 0.009 |
| B    | 0.70        | 0.93  | 0.027      | 0.037 |
| B2   | 1.14        | 1.70  | 0.045      | 0.067 |
| C    | 0.45        | 0.60  | 0.017      | 0.024 |
| C2   | 1.23        | 1.36  | 0.048      | 0.054 |
| D    | 8.95        | 9.35  | 0.352      | 0.368 |
| E    | 10.00       | 10.40 | 0.393      | 0.409 |
| G    | 4.88        | 5.28  | 0.192      | 0.208 |
| L    | 15.00       | 15.85 | 0.590      | 0.624 |
| L2   | 1.27        | 1.40  | 0.050      | 0.055 |
| L3   | 1.40        | 1.75  | 0.055      | 0.069 |
| M    | 2.40        | 3.20  | 0.094      | 0.126 |
| R    | 0.40 typ.   |       | 0.016 typ. |       |
| V2   | 0°          | 8°    | 0°         | 8°    |

Figure 8. Footprint (dimensions in mm)



### 3 Ordering information

**Table 8. Ordering information**

| Order code   | Marking   | Package            | Weight | Base qty | Delivery mode |
|--------------|-----------|--------------------|--------|----------|---------------|
| STPSC606D    | STPSC606D | TO-220AC           | 1.86 g | 50       | Tube          |
| STPSC606G-TR | STPSC606G | D <sup>2</sup> PAK | 1.48 g | 1000     | Tape and reel |

### 4 Revision history

**Table 9. Document revision history**

| Date        | Revision | Changes      |
|-------------|----------|--------------|
| 24-Sep-2009 | 1        | First issue. |

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