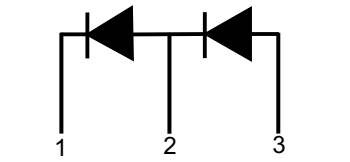
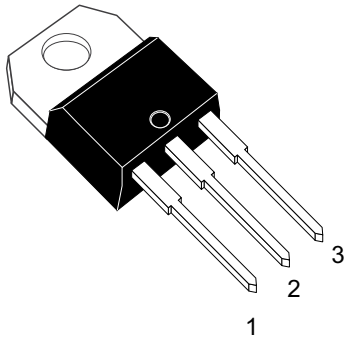
# STPSC10TH13TI

## Dual 650 V power Schottky silicon carbide diode in series

**Datasheet - production data**




Insulated TO-220AB

## 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 specific bridge-less topologies, this dual 650 V rectifier will boost the performance in hard switching conditions. Its high forward surge capability ensures a good robustness during transient phases.

**Table 1. Device summary (per diode)**

| Symbol | Value |
|---|---|
| $I_{F(AV)}$ | 10 A |
| $V_{RRM}$ | 650 V |
| $T_j$ (max.) | 175 °C |

## Features

- No or negligible reverse recovery
- Switching behavior independent of temperature
- Suited for specific bridge-less topologies
- High forward surge capability
- Insulated package:
  - Capacitance: 7 pF
  - Insulated voltage: 2500 V rms

# 1 Characteristics

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

| 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 | $T_c$ = 70 °C(1), DC current | 10 | A |
| $I_{FSM}$ | Surge non repetitive forward current | $t_p$ = 10 ms sinusoidal, $T_c$ = 25 °C<br>$t_p$ = 10 ms sinusoidal, $T_c$ = 125 °C<br>$t_p$ = 10 µs sinusoidal, $T_c$ = 25 °C | 90<br>80<br>470 | A |
| $I_{FRM}$ | Repetitive peak forward current | $T_c$ = 70 °C(1), $\delta$ = 0.1 | 41 | A |
| $T_{stg}$ | Storage temperature range | | -55 to +175 | °C |
| $T_j$ | Operating junction temperature (2) | | -40 to +175 | °C |

1. Value based on $R_{th(j-c)}$ max (per diode)
2. $\frac{dPtot}{dTj} < \frac{1}{Rth(j-a)}$ condition to avoid thermal runaway for a diode on its own heatsink

**Table 3. Thermal resistance**

| Symbol | Parameter | | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| $R_{th(j-c)}$ | Junction to case | Per diode | 3.1 | 4.1 | °C/W |
| | | Total | 1.8 | 2.3 | |
| $R_{th(c)}$ | | | | 0.5 | °C/W |

When the diodes are used simultaneously:

$\Delta T_{j(diode1)} = P_{(diode1)} \times R_{th(j-c)}$ (per diode) + $P_{(diode2)} \times R_{th(c)}$

**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 | $V_R = V_{RRM}$ | - | 9 | 100 | µA |
| | | $T_j$ = 150 °C | | - | 85 | 425 | |
| $V_F$ (2) | Forward voltage drop | $T_j$ = 25 °C | $I_F$ = 10A | - | 1.56 | 1.75 | V |
| | | $T_j$ = 150 °C | | - | 1.98 | 2.5 | |

1. Pulse test: $t_p$ = 10 ms, $\delta$ < 2%
2. Pulse test: $t_p$ = 500 µs, $\delta$ < 2%

To evaluate the conduction losses use the following equation:

$P = 1.35 \times I_{F(AV)} + 0.115 \times I_{F}^{2}{}_{(RMS)}$

**Table 5. Dynamic electrical characteristics (per diode)**

| Symbol | Parameter | Test conditions | Typ. | Unit |
|---|---|---|---|---|
| $Q_{cj}$(1) | Total capacitive charge | $V_R$ = 400 V | 28.5 | nC |
| $C_j$ | Total capacitance | $V_R$ = 0 V, $T_c$ = 25 °C, F = 1 MHz | 480 | pF |
| | | $V_R$ = 400 V, $T_c$ = 25 °C, F = 1 MHz | 48 | |

1. 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, per diode)**

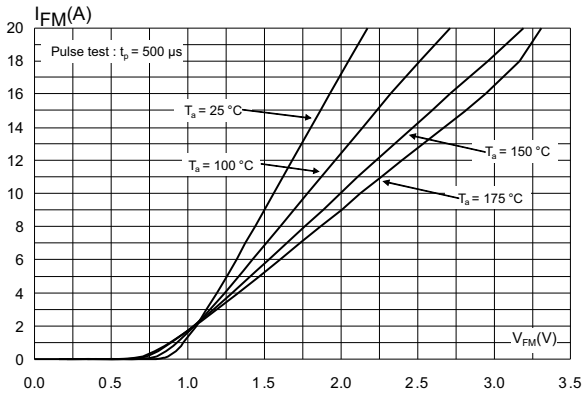



**Figure 2. Forward voltage drop versus forward current (typical values, high level, per diode)**

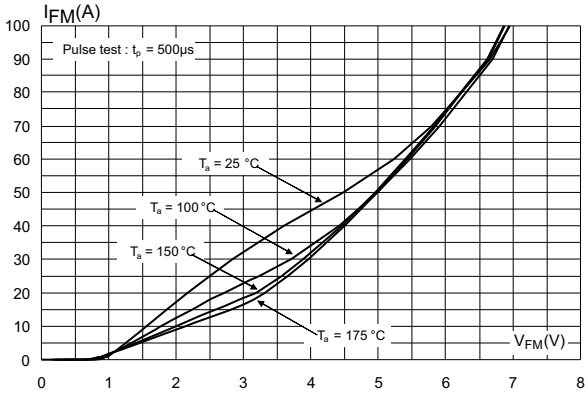



**Figure 3. Reverse leakage current versus reverse voltage applied (typical values, per diode)**

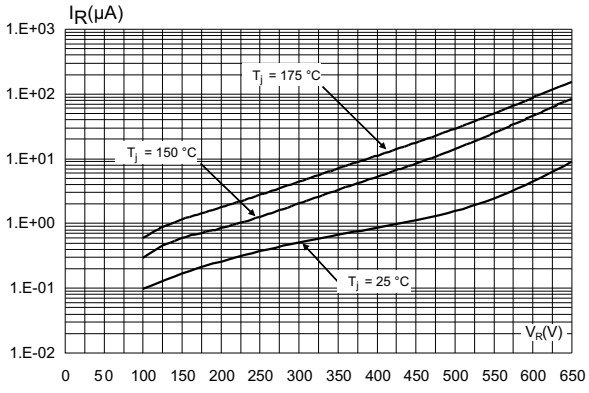



**Figure 4. Peak forward current versus case temperature (per diode)**

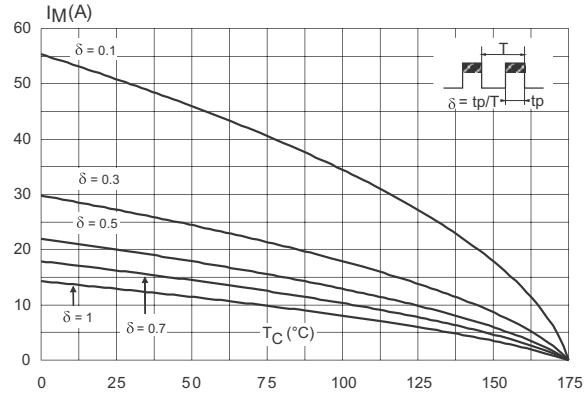


**Figure 5. Junction capacitance versus reverse voltage applied (typical values, per diode)**

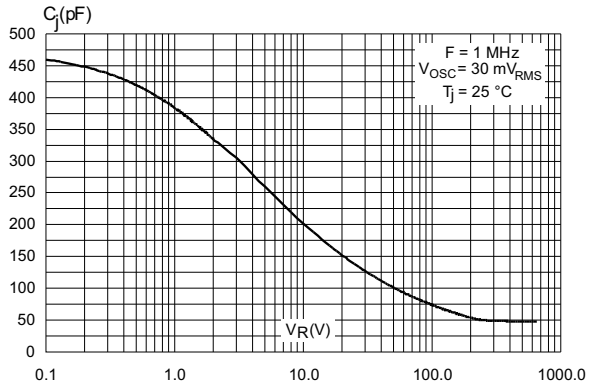



**Figure 6. Relative variation of thermal impedance junction to case versus pulse duration**

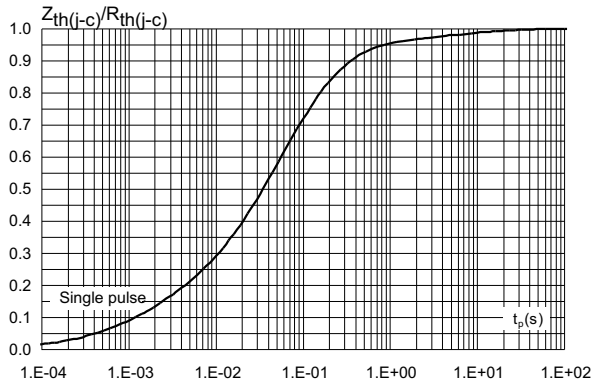



**Figure 7. Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform, per diode)**

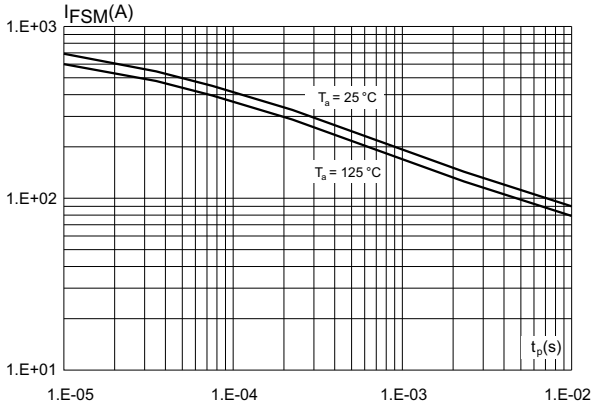
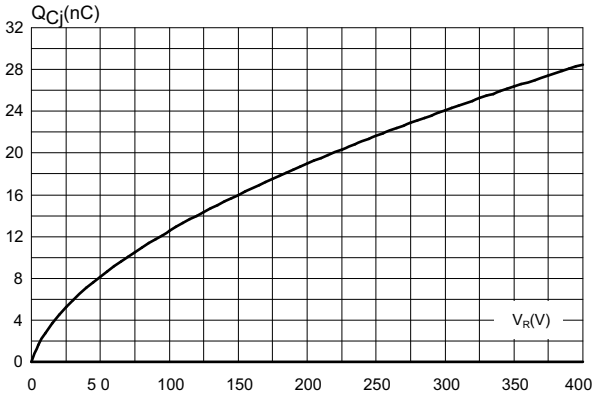



**Figure 8. Total capacitive charges versus reverse voltage applied (typical values, per diode)**



# 2 Package information

- Epoxy meets UL94, V0
- Lead-free package
- Cooling method: by conduction (C)
- Recommended torque value: 0.4 to 0.6 N·m

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 Insulated TO-220AB package information

**Figure 9. Insulated TO-220AB package outline**

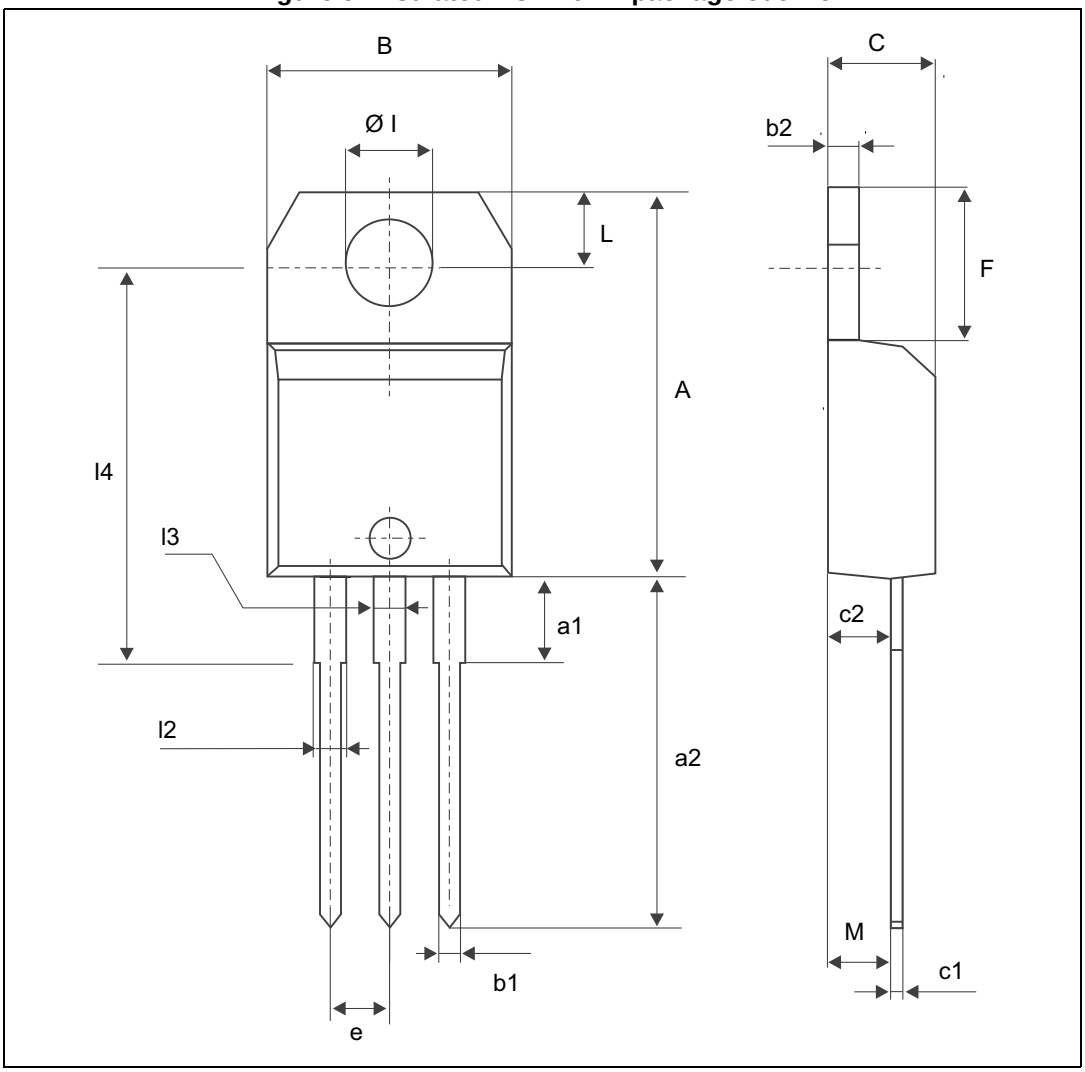


**Table 6. Insulated TO-220AB package mechanical data**

| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 15.20 | | 15.90 | 0.598 | | 0.625 |
| a1 | | 3.75 | | | 0.147 | |
| a2 | 13.00 | | 14.00 | 0.511 | | 0.551 |
| B | 10.00 | | 10.40 | 0.393 | | 0.409 |
| b1 | 0.61 | | 0.88 | 0.024 | | 0.034 |
| b2 | 1.23 | | 1.32 | 0.048 | | 0.051 |
| C | 4.40 | | 4.60 | 0.173 | | 0.181 |
| c1 | 0.49 | | 0.70 | 0.019 | | 0.027 |
| c2 | 2.40 | | 2.72 | 0.094 | | 0.107 |
| e | 2.40 | | 2.70 | 0.094 | | 0.106 |
| F | 6.20 | | 6.60 | 0.244 | | 0.259 |
| ØI | 3.75 | | 3.85 | 0.147 | | 0.151 |
| I4 | 15.80 | 16.40 | 16.80 | 0.622 | 0.646 | 0.661 |
| L | 2.65 | | 2.95 | 0.104 | | 0.116 |
| l2 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| l3 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| M | | 2.60 | | | 0.102 | |

# 3 Ordering information

**Table 7. Ordering information**

| Order code | Marking | Package | Weight | Base qty | Delivery mode |
|---|---|---|---|---|---|
| STPSC10TH13TI | STPSC 10TH13TI | Insulated TO-220AB | 2.3g | 50 | Tube |

# 4 Revision history

**Table 8. Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 24-Jun-2013 | 1 | First issue. |
| 07-Nov-2013 | 2 | Updated Figure 1 and Figure 2. |
| 05-Jan-2016 | 3 | Updated *Table 7*.<br>Format updated to current standard. |

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