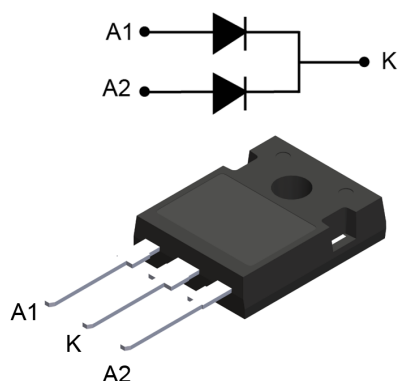


## 40 A 1200 V power Schottky silicon carbide diode



TO-247

### Features

- AEC-Q101 qualified 
- No or negligible reverse recovery
- Switching behavior independent of temperature
- Robust high-voltage periphery
- PPAP capable
- Operating  $T_j$  from  $-40\text{ }^{\circ}\text{C}$  to  $175\text{ }^{\circ}\text{C}$
- ECOPACK2 compliant

### Applications

- OBC (On Board Battery chargers)
- PHEV - EV charging stations
- Resonant LLC topology
- PFC functions (Power Factor Corrector)

### Description

The SiC diode, available in TO-247, is an ultrahigh performance power Schottky rectifier. It is manufactured using a silicon carbide substrate. The wide band-gap material allows the design of a low  $V_F$  Schottky diode structure with a 1200 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 and secondary side applications, this ST SiC diode will boost the performance in hard switching conditions. This rectifier will enhance the performance of the targeted application. Its high forward surge capability ensures a good robustness during transient phases.

#### Product status link

[STPSC40H12C-Y](#)

#### Product summary

|              |                        |
|--------------|------------------------|
| $I_{F(AV)}$  | 2 x 20 A               |
| $V_{RRM}$    | 1200 V                 |
| $T_j$ (max.) | 175 $^{\circ}\text{C}$ |
| $V_F$ (typ.) | 1.35 V                 |

#### Product label



# 1 Characteristics

**Table 1. Absolute ratings (limiting values per diode at 25 °C , unless otherwise specified)**

| Symbol       | Parameter                                                                     |                                    |                       | Value       | Unit |
|--------------|-------------------------------------------------------------------------------|------------------------------------|-----------------------|-------------|------|
| $V_{RRM}$    | Repetitive peak reverse voltage ( $T_j = -40\text{ °C}$ to $+175\text{ °C}$ ) |                                    |                       | 1200        | V    |
| $I_{F(RMS)}$ | Forward rms current                                                           |                                    |                       | 38          | A    |
| $I_{F(AV)}$  | Average forward current                                                       | $T_c = 150\text{ °C}$ , DC current | Per diode             | 20          | A    |
|              |                                                                               |                                    | Per device            | 40          |      |
| $I_{FSM}$    | Surge non repetitive forward current                                          | $t_p = 10\text{ ms}$ sinusoidal    | $T_c = 25\text{ °C}$  | 140         | A    |
|              |                                                                               | $t_p = 10\text{ ms}$ sinusoidal    | $T_c = 150\text{ °C}$ | 120         |      |
| $T_{stg}$    | Storage temperature range                                                     |                                    |                       | -55 to +175 | °C   |
| $T_j$        | Operating junction temperature range                                          |                                    |                       | -40 to +175 | °C   |

**Table 2. Thermal resistance parameters**

| Symbol        | Parameter        |            | Value |      | Unit |
|---------------|------------------|------------|-------|------|------|
|               |                  |            | Typ.  | Max. |      |
| $R_{th(j-c)}$ | Junction to case | Per diode  | 0.40  | 0.55 | °C/W |
|               |                  | Per device | 0.20  | 0.28 |      |

For more information, please refer to the following application note:

- AN5088: Rectifiers thermal management, handling and mounting recommendations

**Table 3. Static electrical characteristics (per diode)**

| Symbol      | Parameter               | Test conditions       |                     | Min. | Typ. | Max. | Unit          |
|-------------|-------------------------|-----------------------|---------------------|------|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25\text{ °C}$  | $V_R = V_{RRM}$     | -    | 10   | 120  | $\mu\text{A}$ |
|             |                         | $T_j = 150\text{ °C}$ |                     | -    | 60   | 800  |               |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 25\text{ °C}$  | $I_F = 20\text{ A}$ | -    | 1.35 | 1.50 | V             |
|             |                         | $T_j = 150\text{ °C}$ |                     | -    | 1.75 | 2.25 |               |

1. Pulse test:  $t_p = 10\text{ ms}$ ,  $\delta < 2\%$

2. Pulse test:  $t_p = 500\text{ }\mu\text{s}$ ,  $\delta < 2\%$

To evaluate the conduction losses, use the following equation:

$$P = 1.07 \times I_{F(AV)} + 0.059 \times I_{F(RMS)}^2$$

For more information, please refer to the following application notes related to the power losses:

- AN604: Calculation of conduction losses in a power rectifier
- AN4021: Calculation of reverse losses on a power diode

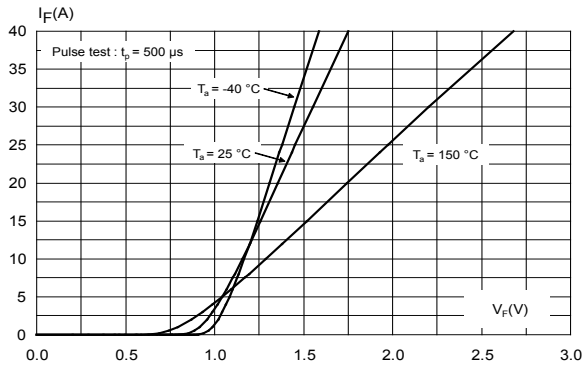
**Table 4. Dynamic electrical characteristics (per diode)**

| Symbol         | Parameter               | Test conditions                                                           | Min. | Typ. | Max. | Unit |
|----------------|-------------------------|---------------------------------------------------------------------------|------|------|------|------|
| $Q_{Cj}^{(1)}$ | Total capacitive charge | $V_R = 800 \text{ V}$                                                     | -    | 129  | -    | nC   |
| $C_j$          | Total capacitance       | $V_R = 0 \text{ V}, T_c = 25 \text{ }^\circ\text{C}, F = 1 \text{ MHz}$   | -    | 1650 | -    | pF   |
|                |                         | $V_R = 800 \text{ V}, T_c = 25 \text{ }^\circ\text{C}, F = 1 \text{ MHz}$ | -    | 110  | -    |      |

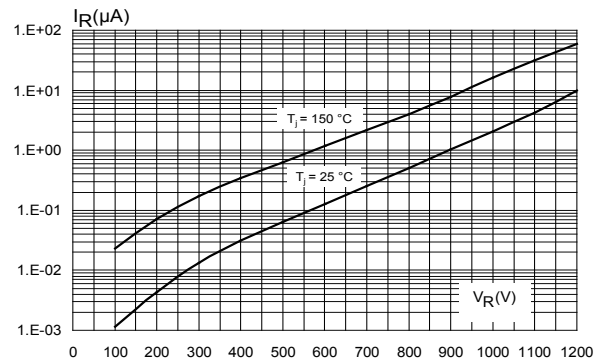
1. Most accurate value for the capacitive charge:  $Q_{Cj}(V_R) = \int_0^{V_R} C_j(V) dV$

## 1.1 Characteristics (curves)

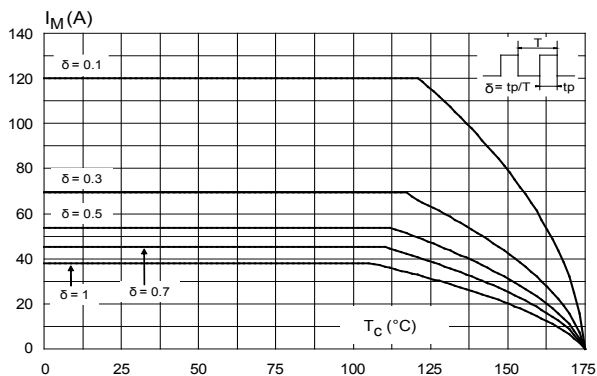
**Figure 1. Forward voltage drop versus forward current (typical values, per diode)**



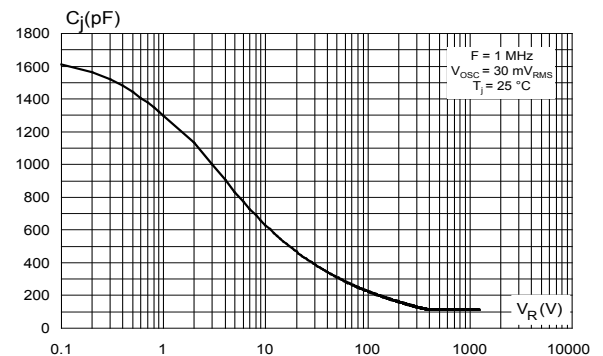
**Figure 2. Reverse leakage current versus reverse voltage applied (typical values, per diode)**



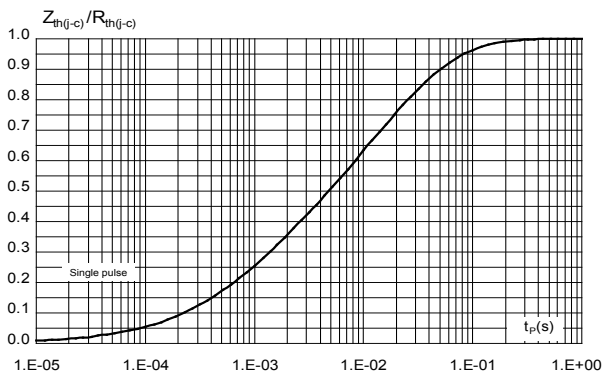
**Figure 3. Peak forward current versus case temperature (per diode)**



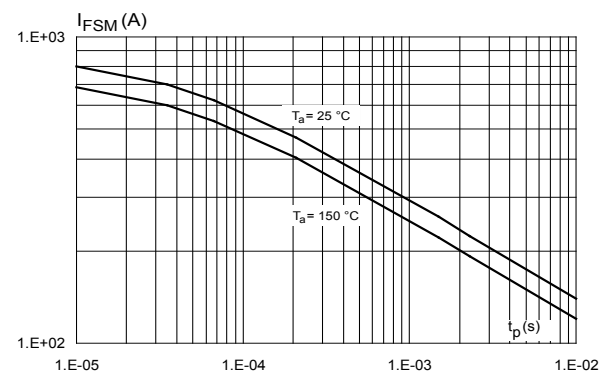
**Figure 4. Junction capacitance versus reverse voltage applied (typical values, per diode)**



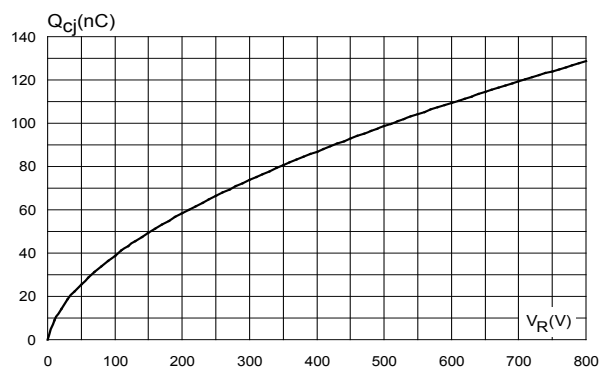
**Figure 5. Relative variation of thermal impedance junction to case versus pulse duration**



**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)**



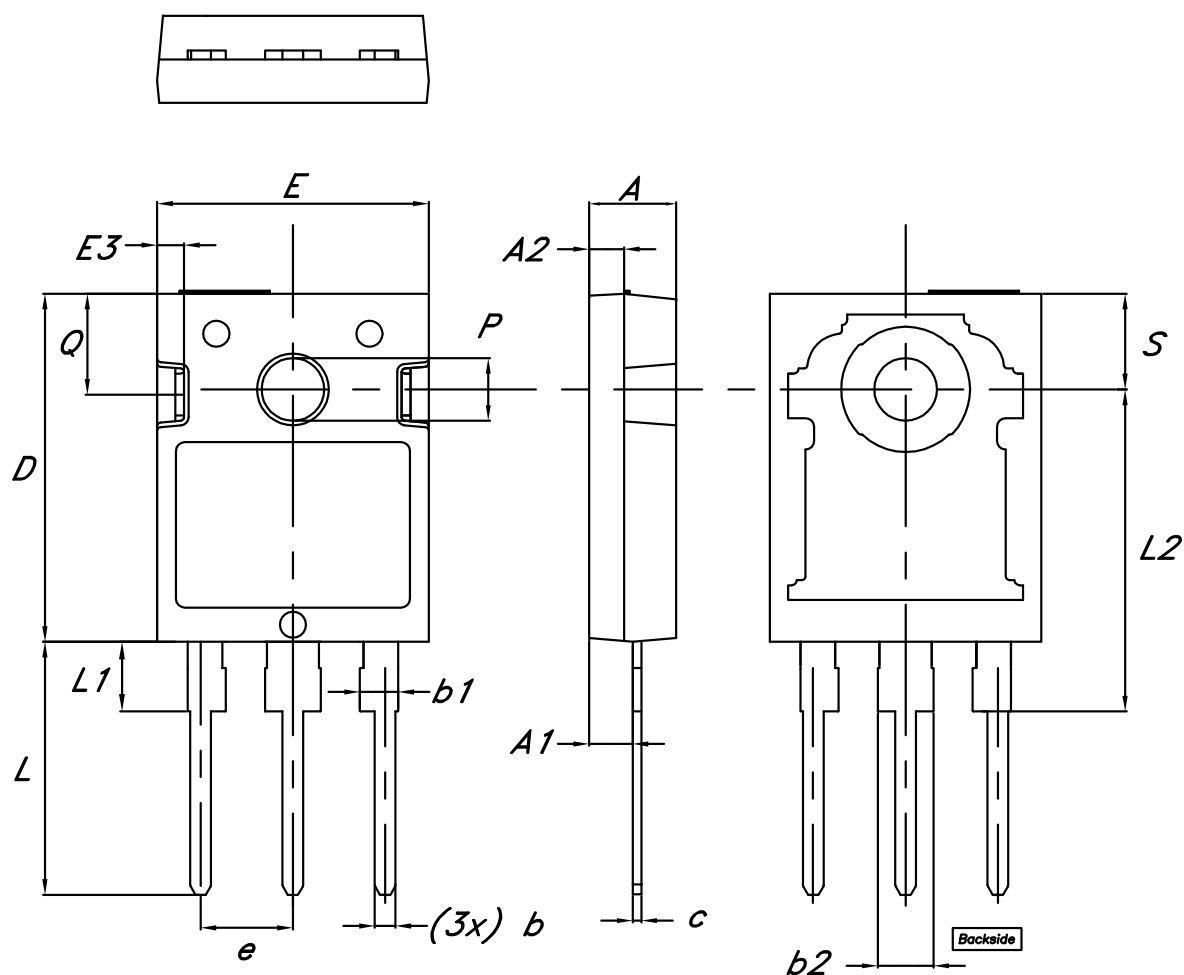
## 2 Package information

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](http://www.st.com). ECOPACK is an ST trademark.

### 2.1 TO-247 package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.8 N·m
- Maximum torque value: 1.0 N·m

**Figure 8. TO-247 package outline**



**Table 5. TO-247 package mechanical data**

| Ref. | Dimensions  |       |       |                             |       |       |
|------|-------------|-------|-------|-----------------------------|-------|-------|
|      | Millimeters |       |       | Inches (for reference only) |       |       |
|      | Min.        | Typ.  | Max.  | Min.                        | Typ.  | Max.  |
| A    | 4.85        | 5.00  | 5.15  | 0.191                       | 0.197 | 0.203 |
| A1   | 2.20        |       | 2.60  | 0.086                       |       | 0.102 |
| A2   | 1.90        | 2.00  | 2.10  | 0.075                       | 0.078 | 0.083 |
| 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    | 19.85       | 20.00 | 20.15 | 0.781                       | 0.787 | 0.793 |
| E    | 15.45       | 15.60 | 15.75 | 0.608                       | 0.614 | 0.620 |
| E3   | 1.45        |       | 1.65  | 0.057                       |       | 0.065 |
| 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   | 18.30       | 18.50 | 18.70 | 0.720                       | 0.728 | 0.737 |
| ØP   | 3.55        |       | 3.65  | 0.139                       |       | 0.143 |
| Q    | 5.65        |       | 5.95  | 0.222                       |       | 0.234 |
| S    | 5.30        | 5.50  | 5.70  | 0.209                       | 0.216 | 0.224 |

### 3 Ordering information

**Table 6. Ordering information**

| Order code    | Marking    | Package | Weight | Base qty. | Delivery mode |
|---------------|------------|---------|--------|-----------|---------------|
| STPSC40H12CWY | SC40H12CWY | TO-247  | 5.40 g | 30        | Tube          |

## Revision history

Table 7. Document revision history

| Date        | Revision | Changes      |
|-------------|----------|--------------|
| 27-Jan-2021 | 1        | First issue. |

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