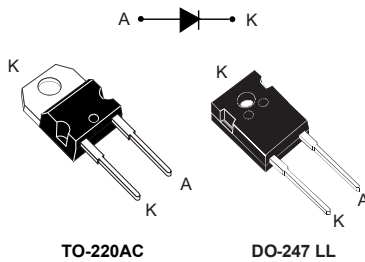


1200 V, 15 A power Schottky silicon carbide diode



Features

- No or negligible reverse recovery
- Switching behavior independent of temperature
- Robust high voltage periphery
- Operating from -40 °C to 175 °C
- Low V_F
- ECOPACK2 compliant component

Applications

- EV charging stations
- Solar boost converters
- PV converters

Description

The SiC diode, available in TO-220AC and TO-247 LL, 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 label



Product status

STPSC15H12

Product summary

| | |
|--------------|--------|
| $I_{F(AV)}$ | 15 A |
| V_{RRM} | 1200 V |
| T_j (max.) | 175 °C |
| V_F (typ.) | 1.35 V |

1 Characteristics

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

| Symbol | Parameter | | Value | Unit | |
|--------------|---|---|-----------------------|------|---|
| V_{RRM} | Repetitive peak reverse voltage ($T_j = -40\text{ °C}$ to $+175\text{ °C}$) | | 1200 | V | |
| $I_{F(RMS)}$ | Forward rms current | | 38 | A | |
| $I_{F(AV)}$ | Average forward current | TO-220AC, $T_C = 155\text{ °C}$, DC current ⁽¹⁾ | 15 | A | |
| | | DO-247 LL, $T_C = 150\text{ °C}$, DC current ⁽¹⁾ | | | |
| I_{FRM} | Repetitive peak forward current | TO-220AC, $T_C = 155\text{ °C}$, $T_j = 175\text{ °C}$, $\delta = 0.1$ | 58 | A | |
| | | DO-247 LL, $T_C = 150\text{ °C}$, $T_j = 175\text{ °C}$, $\delta = 0.1$ | 61 | | |
| I_{FSM} | Surge non repetitive forward current | $t_p = 10\text{ ms}$ sinusoidal | $T_C = 25\text{ °C}$ | 105 | A |
| | | | $T_C = 150\text{ °C}$ | 90 | |
| | | $t_p = 10\text{ }\mu\text{s}$ square | $T_C = 25\text{ °C}$ | 630 | |
| T_{stg} | Storage temperature range | | -65 to +175 | °C | |
| T_j | Operating junction temperature range | | -40 to +175 | °C | |

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

Table 2. Thermal parameters

| Symbol | Parameter | | Typ. value | Max. value | Unit |
|---------------|------------------|-----------|------------|------------|------|
| $R_{th(j-c)}$ | Junction to case | TO-220AC | 0.45 | 0.6 | °C/W |
| | | DO-247 LL | 0.50 | 0.70 | |

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

- AN5088 : Rectifiers thermal management, handling and mounting recommendations

Table 3. Static electrical characteristics

| Symbol | Parameter | Test conditions | | Min. | Typ. | Max. | Unit |
|----------------------|-------------------------|-----------------------|---------------------|------|------|------|---------------|
| I_R ⁽¹⁾ | Reverse leakage current | $T_j = 25\text{ °C}$ | $V_R = V_{RRM}$ | - | 7.5 | 90 | μA |
| | | $T_j = 150\text{ °C}$ | | - | 45 | 600 | |
| V_F ⁽²⁾ | Forward voltage drop | $T_j = 25\text{ °C}$ | $I_F = 15\text{ A}$ | - | 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:

$$P = 1.09 \times I_{F(AV)} + 0.0775 \times I_F^2 (RMS)$$

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

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------|-------------------------|---|------|------|------|------|
| $Q_{Cj}^{(1)}$ | Total capacitive charge | $V_R = 800 \text{ V}$ | - | 94 | - | nC |
| C_j | Total capacitance | $V_R = 0 \text{ V}, T_c = 25 \text{ }^\circ\text{C}, F = 1 \text{ MHz}$ | - | 1200 | - | pF |
| | | $V_R = 800 \text{ V}, T_c = 25 \text{ }^\circ\text{C}, F = 1 \text{ MHz}$ | - | 78 | - | |

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)

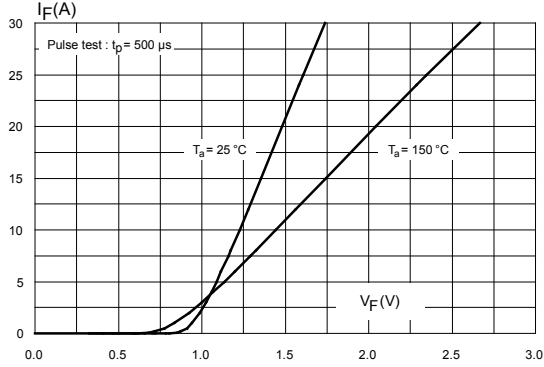


Figure 2. Reverse leakage current versus reverse voltage applied (typical values)

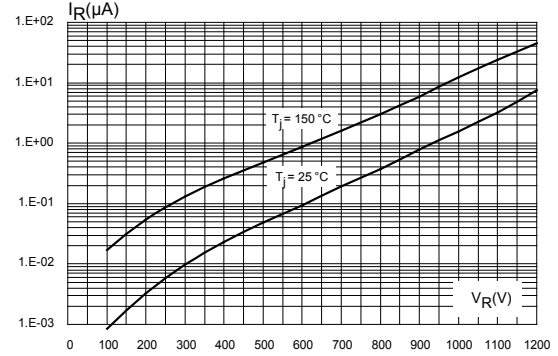


Figure 3. Peak forward current versus case temperature (TO-220AC)

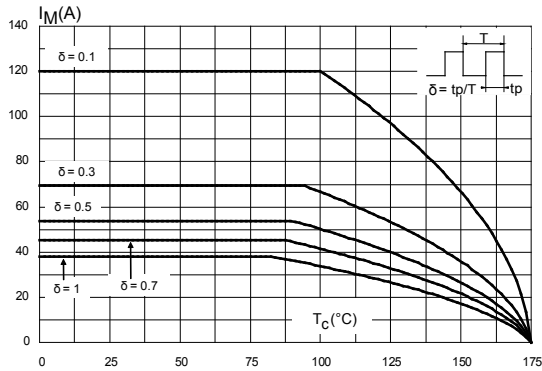


Figure 4. Peak forward current versus case temperature (DO-247 LL)

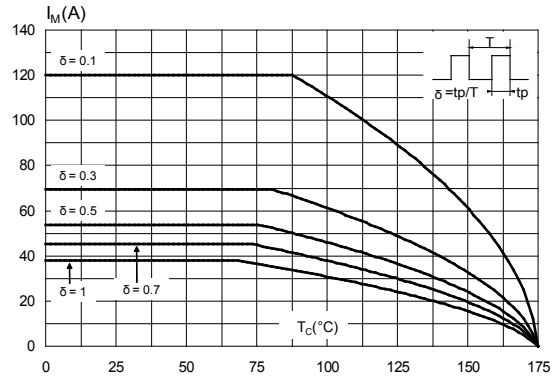


Figure 5. Junction capacitance versus reverse voltage applied (typical values)

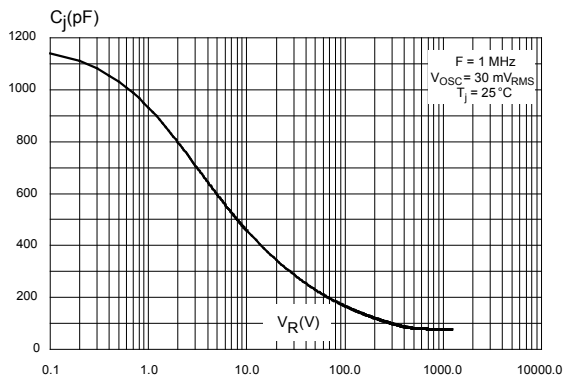


Figure 6. Relative variation of thermal impedance junction to case versus pulse duration (TO-220AC)

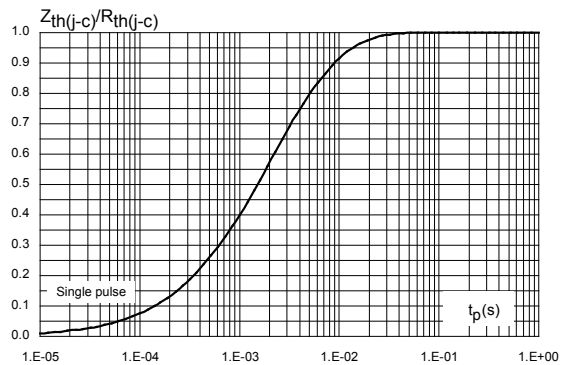


Figure 7. Relative variation of thermal impedance junction to case versus pulse duration (DO-247 LL)

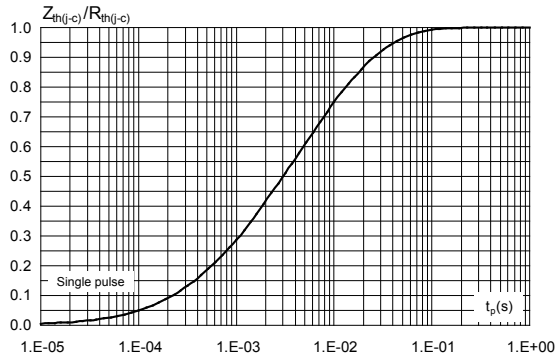


Figure 8. Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform)

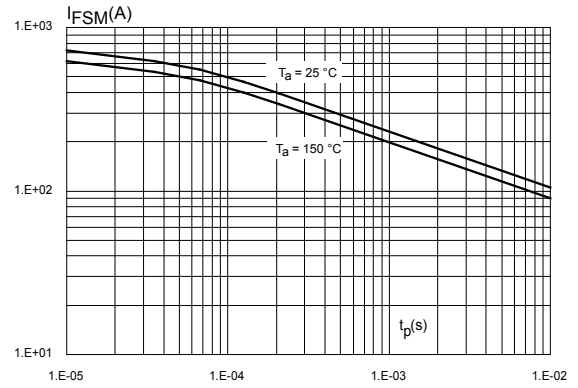
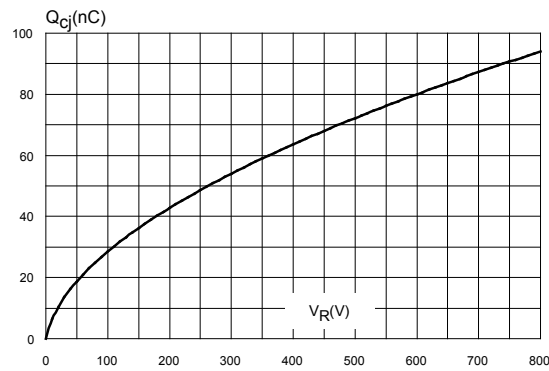


Figure 9. Total capacitive charges versus reverse voltage applied (typical values)



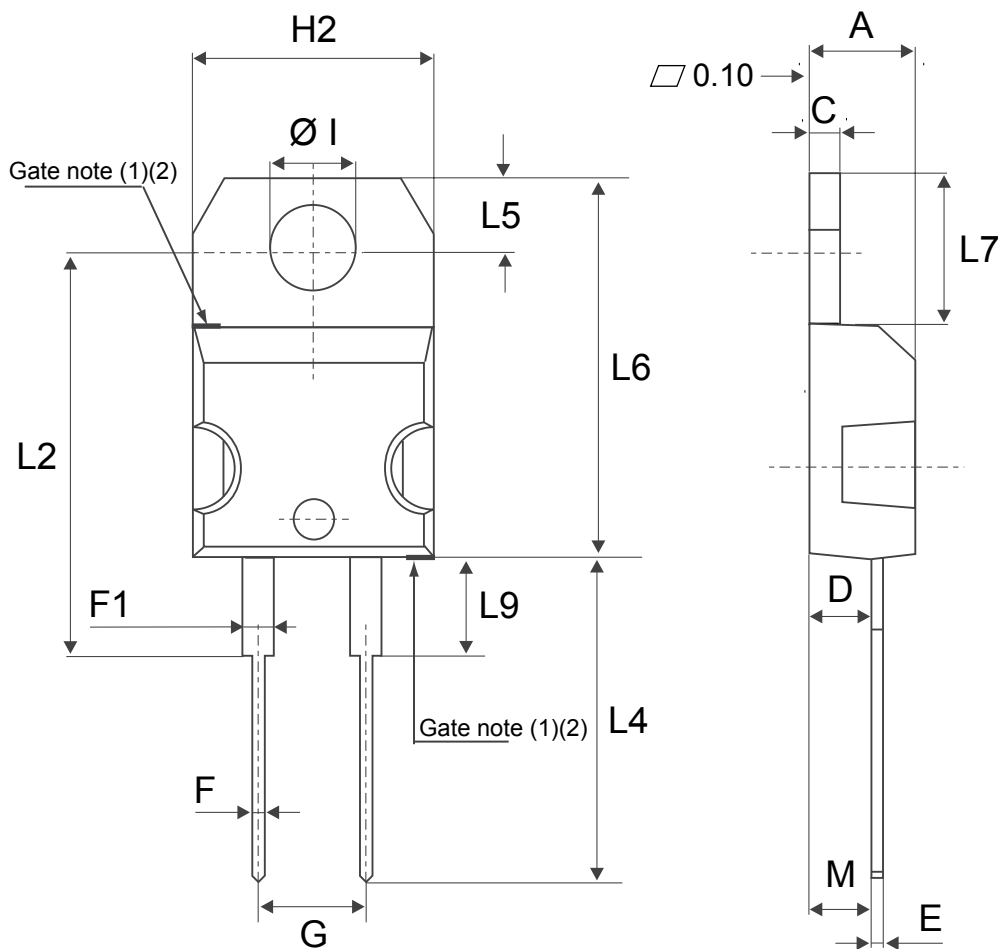
2 Package information

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. ECOPACK is an ST trademark.

2.1 TO-220AC package information

- Epoxy meets UL 94,V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.55 N·m
- Maximum torque value: 0.70 N·m

Figure 10. TO-220AC package outline



(1) :Max resin gate protusion 0.5 mm

(2) :Resin gate position is accepted in each of the two positions shown on the drawings or their symmetrical

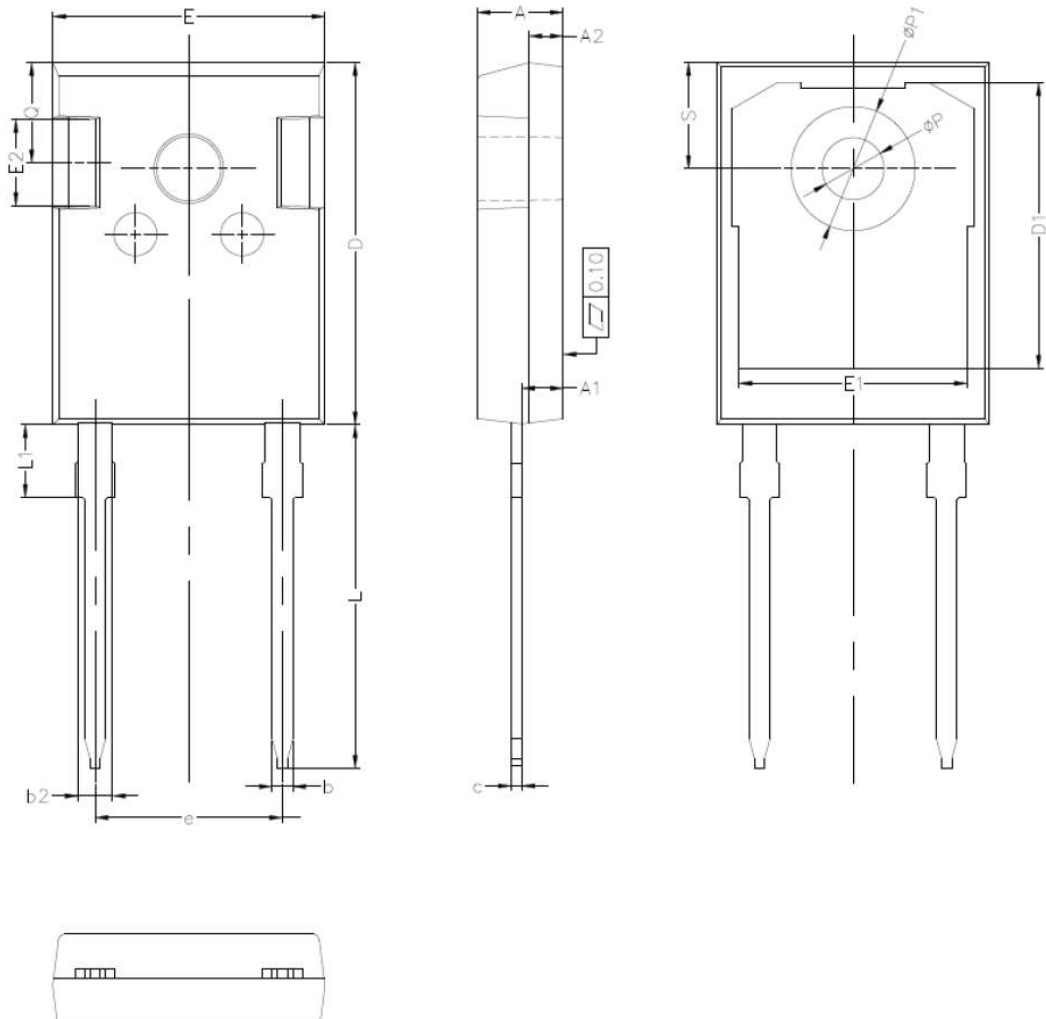
Table 5. TO-220AC package mechanical data

| Ref. | Dimensions | | | |
|------|-------------|-------|-----------------------------|-------|
| | Millimeters | | Inches (for reference only) | |
| | 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 | 2.60 typ. | | 0.102 typ. | |
| Diam | 3.75 | 3.85 | 0.147 | 0.151 |

2.2 DO-247 LL 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 11. DO-247 LL package outline



Note: This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

Table 6. DO-247 LL package mechanical data

| Ref. | Dimensions | | | |
|------|-------------|-------|-----------------------------|-------|
| | Millimeters | | Inches (for reference only) | |
| | Min. | Max. | Min. | Max. |
| A | 4.70 | 5.31 | 0.185 | 0.209 |
| A1 | 2.21 | 2.59 | 0.087 | 0.102 |
| A2 | 1.50 | 2.49 | 0.059 | 0.098 |
| b | 0.99 | 1.40 | 0.039 | 0.055 |
| b2 | 1.65 | 2.39 | 0.065 | 0.094 |
| c | 0.38 | 0.89 | 0.015 | 0.035 |
| D | 20.80 | 21.46 | 0.819 | 0.845 |
| D1 | 13.08 | | 0.515 | |
| E | 15.49 | 16.26 | 0.610 | 0.640 |
| e | 10.88 typ. | | 0.428 | |
| E1 | 13.06 | | 0.514 | |
| E2 | 3.43 | 5.10 | 0.135 | 0.200 |
| L | 19.80 | 20.32 | 0.779 | 0.800 |
| L1 | | 4.50 | | 0.177 |
| P | 3.50 | 3.70 | 0.137 | 0.146 |
| P1 | 7.00 | 7.40 | 0.275 | 0.292 |
| Q | 5.38 | 6.20 | 0.219 | 0.244 |
| S | 6.16 typ. | | 0.243 | |

3 Ordering information

Table 7. Ordering information

| Order code | Marking | Package | Weight | Base qty. | Delivery mode |
|--------------|--------------|-----------|--------|-----------|---------------|
| STPSC15H12D | STPSC15H12D | TO-220AC | 1.86 g | 50 | Tube |
| STPSC15H12WL | STPSC15H12WL | DO-247 LL | 5.9 g | 30 | Tube |

Revision history

Table 8. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 10-May-2016 | 1 | Initial version |
| 05-Sep-2017 | 2 | Added DO-247 LL package. Updated Section "Features", Section 1:"Characteristics" and Table 8: "Ordering information". |
| 03-Apr-2018 | 3 | Updated Section 2.2 DO-247 LL package information. |
| 23-Jun-2021 | 4 | Added Section STPOWER, Section Sustainable technology and Applications. Updated Table 4 and Section 2.2 DO-247 LL package information. |

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. For additional information about ST trademarks, please refer to www.st.com/trademarks. 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.

© 2021 STMicroelectronics – All rights reserved