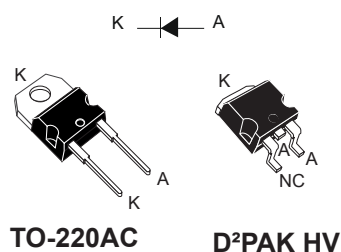


## 650 V, 10 A low $V_F$ power Schottky silicon carbide diode



### Features

- No or negligible reverse recovery
- Switching behavior independent of temperature
- Dedicated to PFC applications
- High forward surge capability
- Operating  $T_j$  from  $-40\text{ }^{\circ}\text{C}$  to  $175\text{ }^{\circ}\text{C}$
- D²PAK HV creepage distance (anode to cathode) = 5.38 mm min.
- ECOPACK2 compliant component

### Applications

- DC/DC converter
- High frequency inverter
- Snubber
- Boost PFC function

### Description

This 10 A, 650 V SiC diode is an ultra high 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.

Housed in D²PAK HV, this diode is perfectly suited for a usage in PFC applications, in charging station, DC/DC, easing the compliance to IEC-60664-1.

#### Product label



#### Product status link

[STPSC10065](#)

#### Product summary

| Symbol       | Value                         |
|--------------|-------------------------------|
| $I_{F(AV)}$  | 10 A                          |
| $V_{RRM}$    | 650 V                         |
| $T_j$ (max.) | $175\text{ }^{\circ}\text{C}$ |
| $V_F$ (typ.) | 1.30 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      |                                                                | 650         | V    |
| $I_{F(RMS)}$ | Forward rms current                  |                                                                | 22          | A    |
| $I_{F(AV)}$  | Average forward current              | $T_C = 150\text{ °C}$ , DC current <sup>(1)</sup>              | 10          | A    |
| $I_{FRM}$    | Repetitive peak forward current      | $T_C = 150\text{ °C}$ , $T_J = 175\text{ °C}$ , $\delta = 0.1$ | 42          | A    |
| $I_{FSM}$    | Surge non repetitive forward current | $t_p = 10\text{ ms}$ sinusoidal, $T_C = 25\text{ °C}$          | 48          | A    |
|              |                                      | $t_p = 10\text{ ms}$ sinusoidal, $T_C = 125\text{ °C}$         | 39          |      |
|              |                                      | $t_p = 10\text{ }\mu\text{s}$ square, $T_C = 25\text{ °C}$     | 210         |      |
| $T_{stg}$    | Storage temperature range            |                                                                | -65 to +175 | °C   |
| $T_J$        | Operating junction temperature       |                                                                | -40 to +175 | °C   |

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

**Table 2. Thermal parameters**

| Symbol        | Parameter        | Value |      | Unit |
|---------------|------------------|-------|------|------|
|               |                  | Typ.  | Max. |      |
| $R_{th(j-c)}$ | Junction to case | 1.0   | 1.5  | °C/W |

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    | 130  | $\mu\text{A}$ |
|             |                         | $T_J = 150\text{ °C}$ |                     | -    | 53   | 900  |               |
| $V_F^{(2)}$ | Forward voltage drop    | $T_J = 25\text{ °C}$  | $I_F = 10\text{ A}$ | -    | 1.30 | 1.45 | V             |
|             |                         | $T_J = 150\text{ °C}$ |                     | -    | 1.45 | 1.65 |               |
|             |                         | $T_J = 175\text{ °C}$ |                     | -    | 1.50 |      |               |

1. Pulse test:  $t_p = 5\text{ ms}$ ,  $\delta < 2\%$

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

To evaluate the conduction losses, use the following equation:

$$P = 0.97 \times I_{F(AV)} + 0.068 \times I_F^2 \text{ (RMS)}$$

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

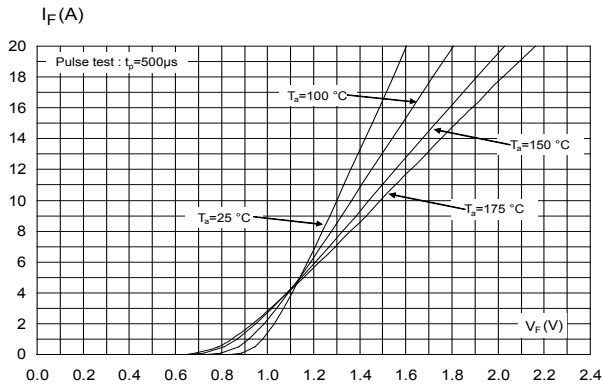
**Table 4. Dynamic electrical characteristics**

| Symbol         | Parameter               | Test conditions                                                           | Typ. | Unit |
|----------------|-------------------------|---------------------------------------------------------------------------|------|------|
| $Q_{Cj}^{(1)}$ | Total capacitive charge | $V_R = 400 \text{ V}$                                                     | 34   | nC   |
| $C_j$          | Total capacitance       | $V_R = 0 \text{ V}, T_c = 25 \text{ }^\circ\text{C}, F = 1 \text{ MHz}$   | 670  | pF   |
|                |                         | $V_R = 400 \text{ V}, T_c = 25 \text{ }^\circ\text{C}, F = 1 \text{ MHz}$ | 55   |      |

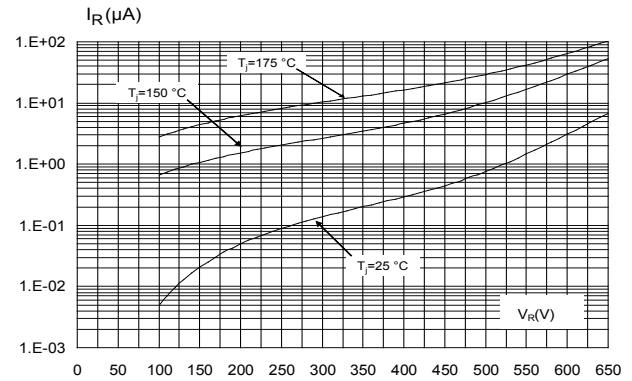
1. Most accurate value for the capacitive charge:  $Q_{Cj}(V_R) = \int_0^{V_R} C_j(V) dV$

## 1.1 Characteristics (curves)

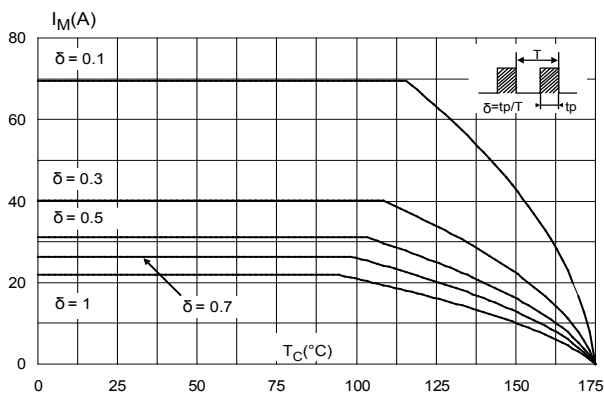
**Figure 1. Forward voltage drop versus forward current (typical values)**



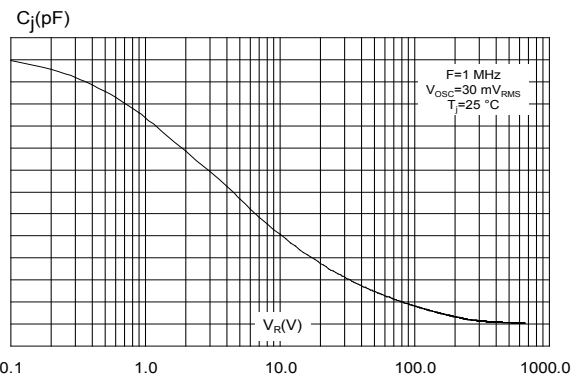
**Figure 2. Reverse leakage current versus reverse voltage applied (typical values)**



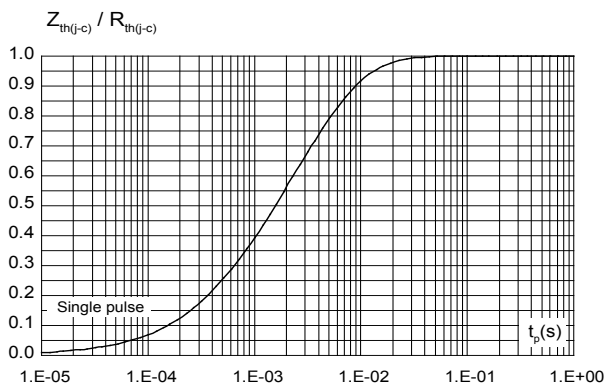
**Figure 3. Peak forward current versus case temperature**



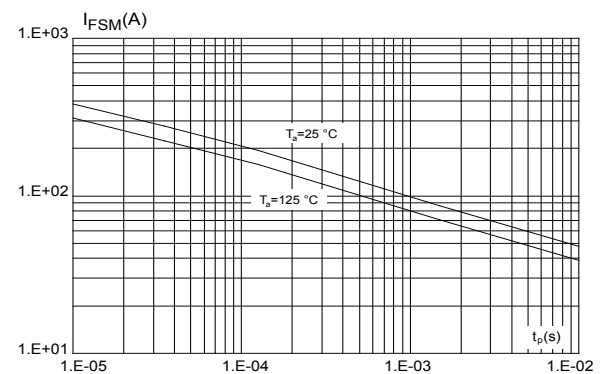
**Figure 4. Junction capacitance versus reverse voltage applied (typical values)**



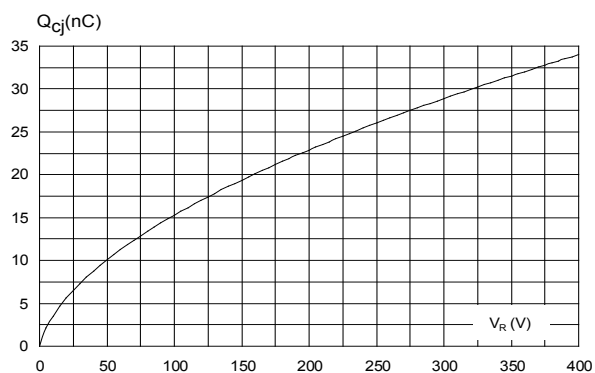
**Figure 5. Relative variation of thermal impedance junction to case versus pulse duration**



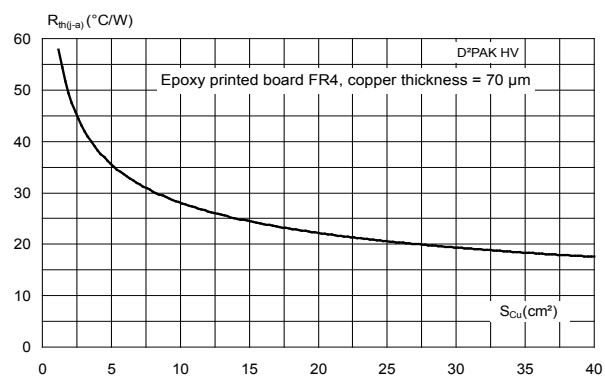
**Figure 6. Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform)**



**Figure 7. Total capacitive charges versus reverse voltage applied (typical values)**



**Figure 8. Thermal resistance junction to ambient versus copper surface under tab (typical values)**



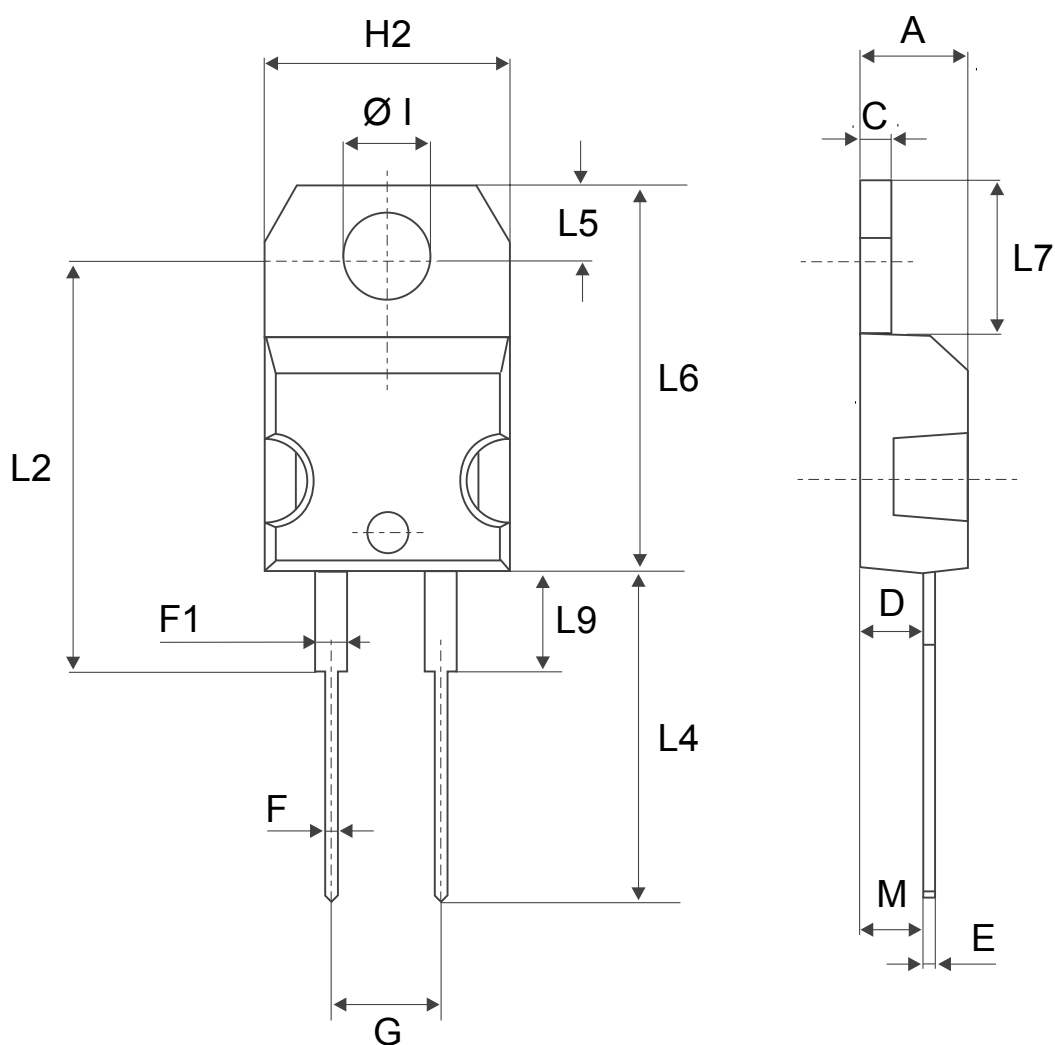
## 2 Package information

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](http://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 9.** TO-220AC package outline



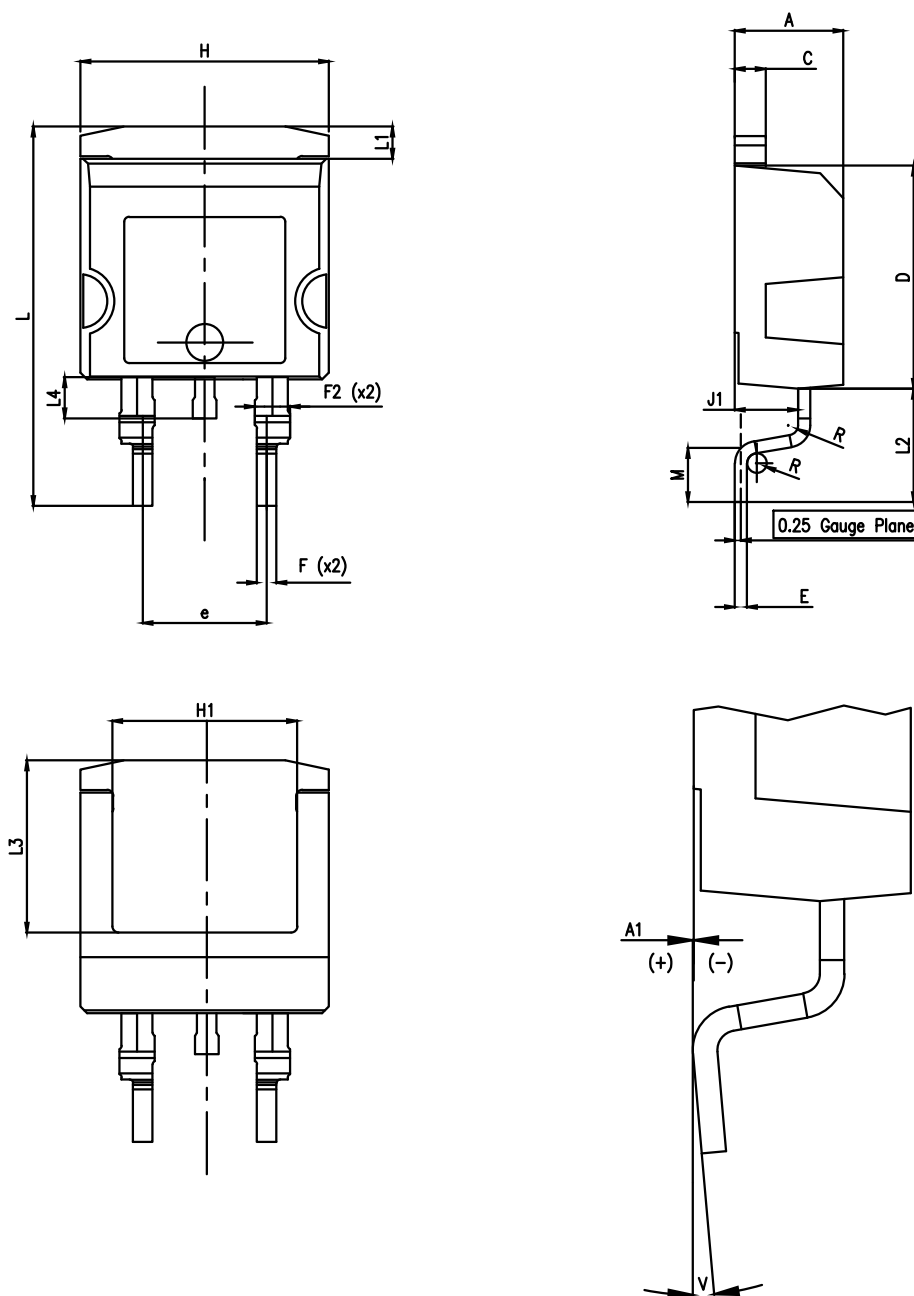
**Table 5. TO-220AC package mechanical data**

| 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. |       |
| ØI   | 3.75        | 3.85  | 0.147      | 0.151 |

## 2.2 D<sup>2</sup>PAK high voltage package information

- Epoxy meets UL94, V0

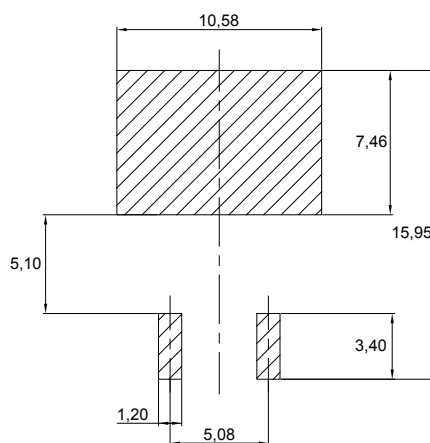
**Figure 10. D<sup>2</sup>PAK high voltage package outline**





**Table 6. D<sup>2</sup>PAK high voltage package mechanical data**

| Ref. | Dimensions |      |       |
|------|------------|------|-------|
|      | Min.       | Typ. | Max.  |
| A    | 4.30       | -    | 4.70  |
| A1   | 0.03       | -    | 0.20  |
| C    | 1.17       | -    | 1.37  |
| D    | 8.95       | -    | 9.35  |
| e    | 4.98       | -    | 5.18  |
| E    | 0.50       | -    | 0.90  |
| F    | 0.78       | -    | 0.85  |
| F2   | 1.14       | -    | 1.70  |
| H    | 10.00      | -    | 10.40 |
| H1   | 7.40       | -    | 7.80  |
| J1   | 2.49       | -    | 2.69  |
| L    | 15.30      | -    | 15.80 |
| L1   | 1.27       | -    | 1.40  |
| L2   | 4.93       | -    | 5.23  |
| L3   | 6.85       | -    | 7.25  |
| L4   | 1.5        | -    | 1.7   |
| M    | 2.6        | -    | 2.9   |
| R    | 0.20       | -    | 0.60  |
| V    | 0°         | -    | 8°    |

**Figure 11. D<sup>2</sup>PAK high voltage footprint in mm**


**Note:** For package and tape orientation, reel and inner box dimensions and tape outline please check TN1173.

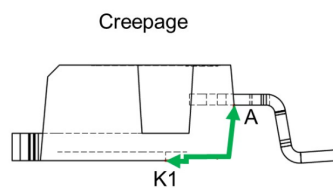
## 2.2.1 Creepage distance between anode and cathode

**Table 7. Creepage distance between anode and cathode**

| Symbol             | Parameter                                                        |                       | Value | Unit |
|--------------------|------------------------------------------------------------------|-----------------------|-------|------|
| Cd <sub>A-K1</sub> | Minimum creepage distance between A and K1 (with top coating)    | D <sup>2</sup> PAK HV | 5.38  | mm   |
| Cd <sub>A-K2</sub> | Minimum creepage distance between A and K2 (without top coating) |                       | 3.48  |      |

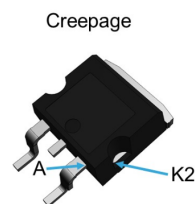
*Note:* D<sup>2</sup>PAK HV creepage distance (anode to cathode) = 5.38 mm min. (refer to IEC 60664-1)

**Figure 12. Creepage with top coating**



Minimum distance between A & K1 = 5.38 mm (with top coating)

**Figure 13. Creepage without top coating**



Minimum distance between A & K2 = 3.48 mm (without top coating)

### 3 Ordering information

**Table 8. Ordering information**

| Order code      | Marking    | Package               | Weight | Base qty. | Delivery mode |
|-----------------|------------|-----------------------|--------|-----------|---------------|
| STPSC10065D     | PSC10065D  | TO-220AC              | 1.86 g | 50        | Tube          |
| STPSC10065G2-TR | PSC10065G2 | D <sup>2</sup> PAK HV | 1.48 g | 1000      | Tape and reel |

## Revision history

**Table 9. Document revision history**

| Date        | Revision | Changes                                                                                                                              |
|-------------|----------|--------------------------------------------------------------------------------------------------------------------------------------|
| 13-Jun-2017 | 1        | First issue.                                                                                                                         |
| 18-Jul-2017 | 2        | Updated <a href="#">Table 3. Static electrical characteristics</a> .                                                                 |
| 23-Mar-2021 | 3        | Inserted STPOWER logo and product label "ST Sustainable".<br>Added D <sup>2</sup> PAK HV package information.<br>Minor text changes. |

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