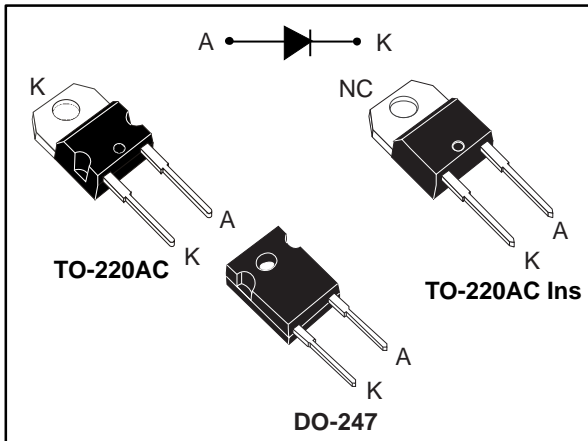


## 650 V power Schottky silicon carbide diode

Datasheet - production data



### Description

The SiC diode is a high voltage 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.

Used as a freewheeling or output rectification diode, this rectifier will enhance the performance and form factor of the targeted power supply or inverter.

### Features

- No reverse recovery charge in application current range
- Switching behavior independent of temperature
- Dedicated to PFC applications
- Insulated package TO-220AC ins:
  - Insulated voltage: 2500 V rms
  - Typical package capacitance: 7 pF
- High forward surge capability
- ECOPACK®2 compliant component
- Maximum operating:  $T_j$  175 °C

**Table 1: Device summary**

| Symbol       | Value  |
|--------------|--------|
| $I_{F(AV)}$  | 20 A   |
| $V_{RRM}$    | 650 V  |
| $T_j$ (max.) | 175 °C |
| $V_F$ (typ.) | 1.30 V |

# 1 Characteristics

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

| Symbol              | Parameter   |                                   | Value   | Unit |   |
|---------------------|---|-----------------------------------|---|------|---|
| V <sub>RRM</sub>    | Repetitive peak reverse voltage                     |                                   | 650   | V    |   |
| I <sub>F(RMS)</sub> | Forward rms current                                 |                                   | 40  | A    |   |
| I <sub>F(AV)</sub>  | Average forward current                             | TO-220AC, DO-247                  | T <sub>C</sub> = 140 °C, DC current                       | 20   | A |
|                     |   | TO-220AC Ins                      | T <sub>C</sub> = 85 °C, DC current                        |      |   |
| I <sub>FRM</sub>    | Repetitive peak forward current                     | TO-220AC, DO-247                  | T <sub>C</sub> = 140 °C, T <sub>j</sub> = 175 °C, δ = 0.1 | 87   | A |
|                     |   | TO-220AC Ins                      | T <sub>C</sub> = 85 °C, T <sub>j</sub> = 175 °C, δ = 0.1  | 83   |   |
| I <sub>FSM</sub>    | Surge non repetitive forward current                | t <sub>p</sub> = 10 ms sinusoidal | T <sub>C</sub> = 25 °C                                    | 90   | A |
|                     |   | t <sub>p</sub> = 10 ms sinusoidal | T <sub>C</sub> = 125 °C                                   | 70   |   |
|                     |   | t <sub>p</sub> = 10 μs square     | T <sub>C</sub> = 25 °C                                    | 400  |   |
| T <sub>stg</sub>    | Storage temperature range                           |                                   | -55 to +175   | °C   |   |
| T <sub>j</sub>      | Operating junction temperature range <sup>(1)</sup> |                                   | -40 to +175   | °C   |   |

**Notes:**

<sup>(1)</sup>(dP<sub>tot</sub>/dT<sub>j</sub>) < (1/R<sub>th(j-a)</sub>) condition to avoid thermal runaway for a diode on its own heatsink.

**Table 3: Thermal parameters**

| Symbol               | Parameter        | Package      | Value |      | Unit |
|----------------------|------------------|--------------|-------|------|------|
|                      |                  |              | Typ.  | Max. |      |
| R <sub>th(j-c)</sub> | Junction to case | TO-220AC     | 0.60  | 0.90 | °C/W |
|                      |                  | DO-247       |       |      |      |
|                      |                  | TO-220AC Ins | 1.60  | 2.50 |      |

**Table 4: Static electrical characteristics**

| Symbol                        | Parameter               | Test conditions         |                                   | Min. | Typ. | Max. | Unit |
|-------------------------------|-------------------------|-------------------------|-----------------------------------|------|------|------|------|
| I <sub>R</sub> <sup>(1)</sup> | Reverse leakage current | T <sub>j</sub> = 25 °C  | V <sub>R</sub> = V <sub>RRM</sub> | -    | 30   | 300  | μA   |
|                               |                         | T <sub>j</sub> = 150 °C |                                   | -    | 280  | 2000 |      |
|                               |                         | T <sub>j</sub> = 25 °C  | V <sub>R</sub> = 600 V            | -    | 15   | 150  |      |
| V <sub>F</sub> <sup>(2)</sup> | Forward voltage drop    | T <sub>j</sub> = 25 °C  | I <sub>F</sub> = 20 A             | -    | 1.30 | 1.45 | V    |
|                               |                         | T <sub>j</sub> = 150 °C |                                   | -    | 1.45 | 1.65 |      |
|                               |                         | T <sub>j</sub> = 175 °C |                                   | -    | 1.5  |      |      |

**Notes:**

<sup>(1)</sup>Pulse test: t<sub>p</sub> = 5 ms, δ < 2%

<sup>(2)</sup>Pulse test: t<sub>p</sub> = 500 μs, δ < 2%

To evaluate the conduction losses use the following equation:

$$P = 1.02 \times I_{F(AV)} + 0.039 \times I_{F(RMS)}^2$$

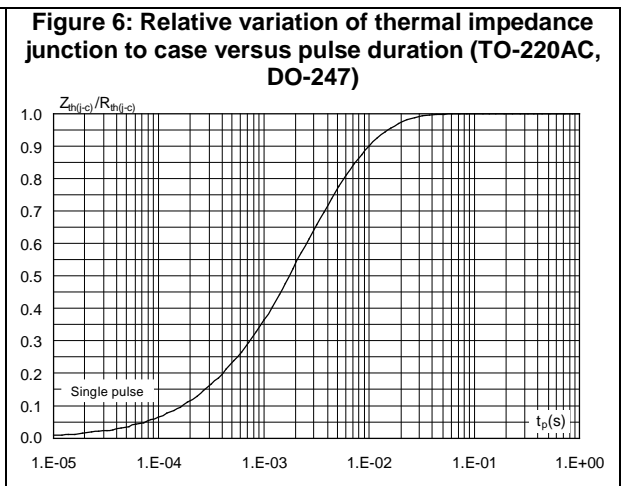
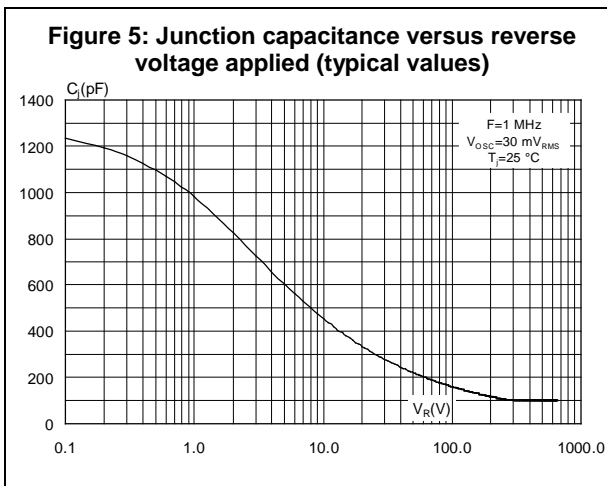
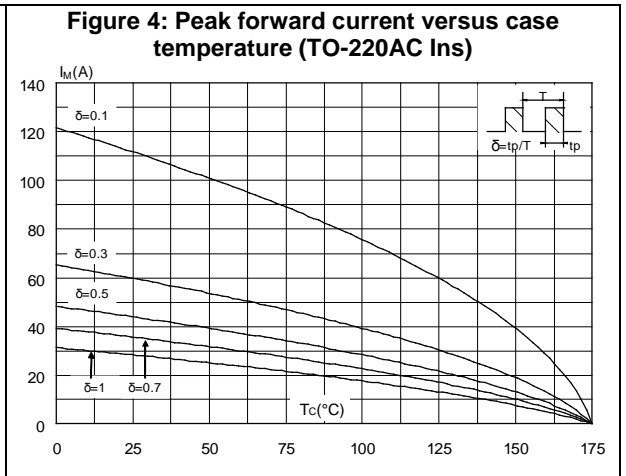
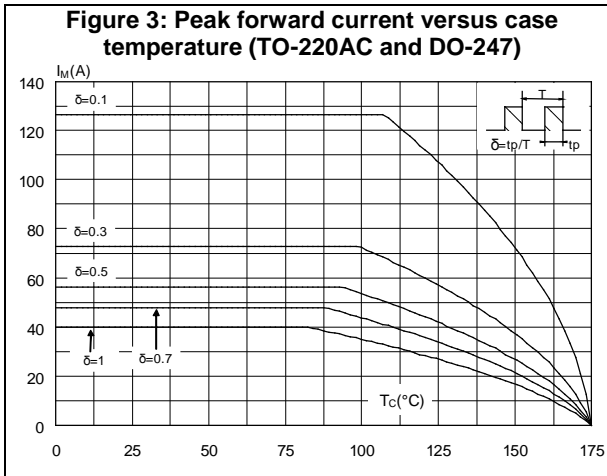
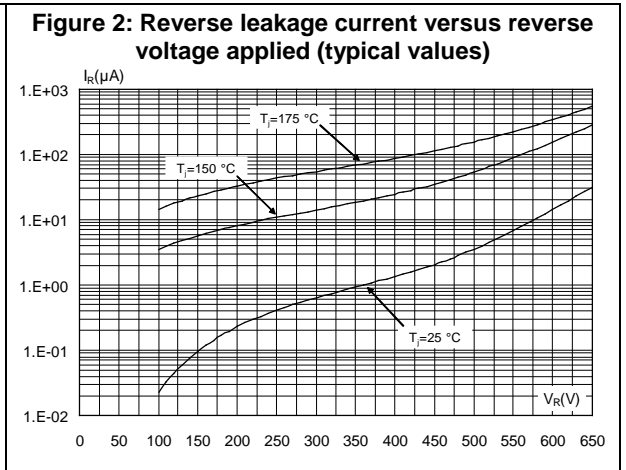
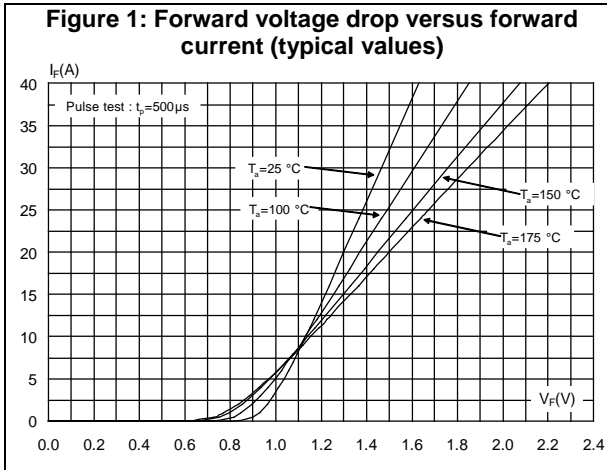
**Table 5: Dynamic electrical characteristics**

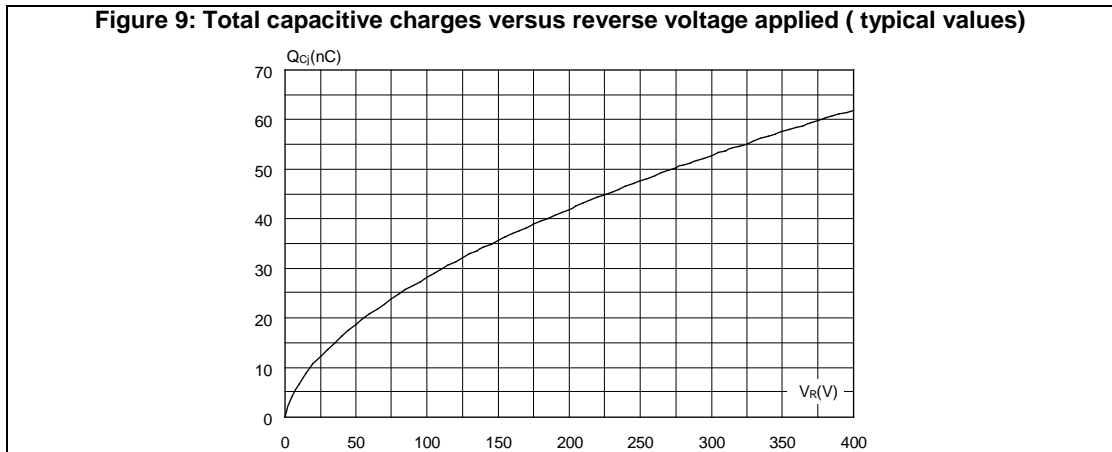
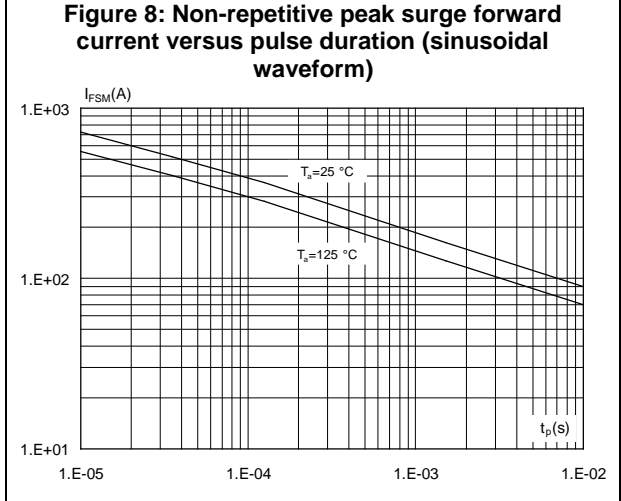
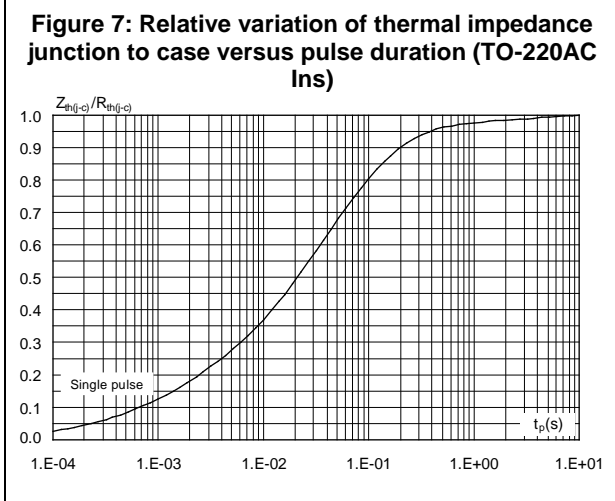
| Symbol         | Parameter               | Test conditions   | Min. | Typ. | Max. | Unit |
|----------------|-------------------------|---|------|------|------|------|
| $Q_{Cj}^{(1)}$ | Total capacitive charge | $V_R = 400 \text{ V}$   | -    | 62   | -    | nC   |
| $C_j$          | Total capacitance       | $V_R = 0 \text{ V}, T_c = 25 \text{ }^\circ\text{C}, F = 1 \text{ MHz}$   | -    | 1250 | -    | pF   |
|                |                         | $V_R = 400 \text{ V}, T_c = 25 \text{ }^\circ\text{C}, F = 1 \text{ MHz}$ | -    | 100  | -    |      |

**Notes:**

<sup>(1)</sup>Most accurate value for the capacitive charge:  $Q_{Cj} = \int_0^{V_{OUT}} C_j(V_R) \cdot dV_R$

# 1.1 Characteristics (curves)





## 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.

- Cooling method: by conduction (C)
- Epoxy meets UL 94,V0
- Recommended torque value: 0.55 N·m for TO-220AC and TO-220AC Ins
- Maximum torque value: 0.7 N·m for TO-220AC and TO-220AC Ins
- Recommended torque value: 0.8 N·m for DO-247
- Maximum torque value: 1 N·m for DO-247

### 2.1 TO-220AC package information

Figure 10: TO-220AC package outline

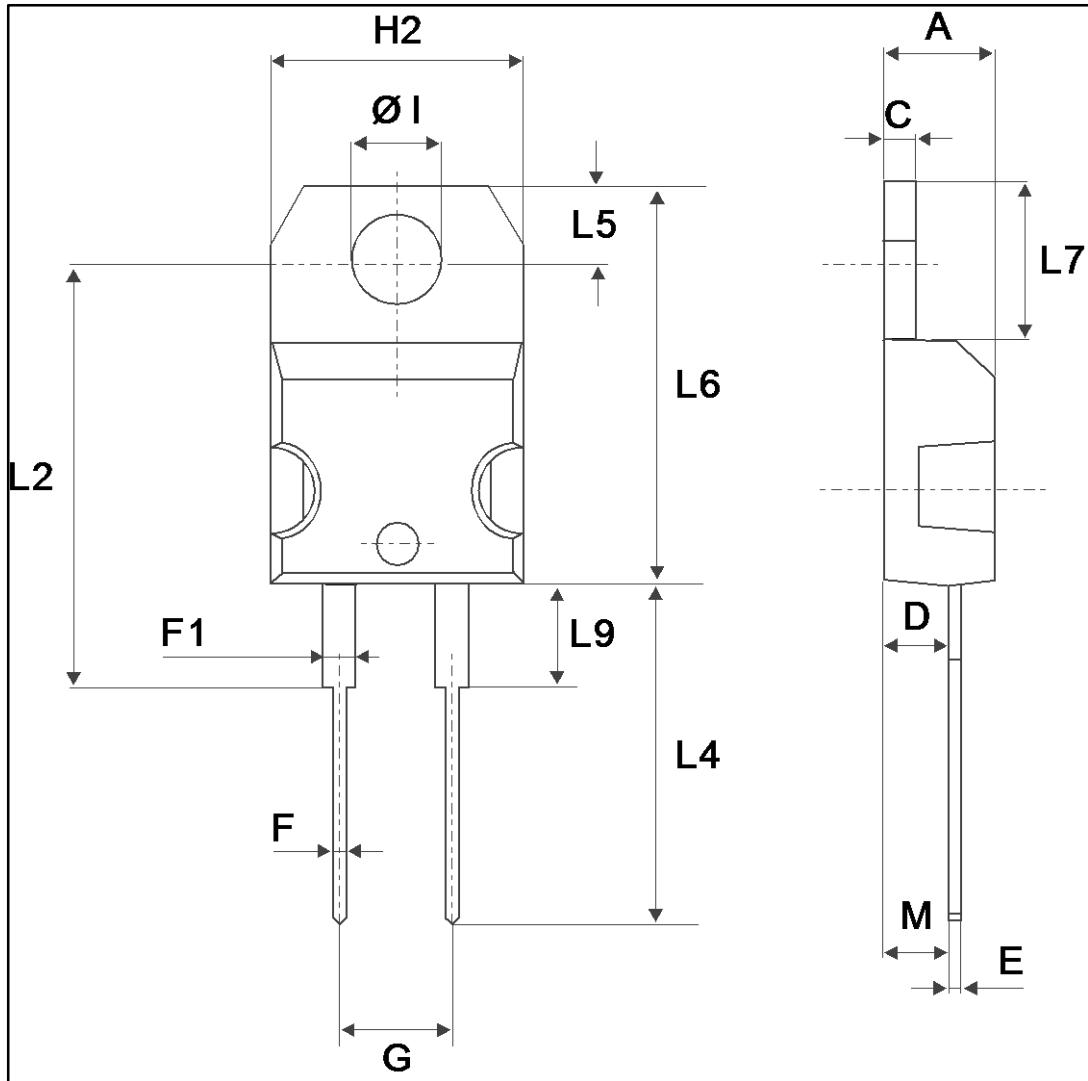


Table 6: TO-220AC package mechanical data

| 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. |       |
| Diam | 3.75        | 3.85  | 0.147      | 0.151 |

## 2.2 TO-220AC Ins package information

Figure 11: TO-220AC Ins package outline

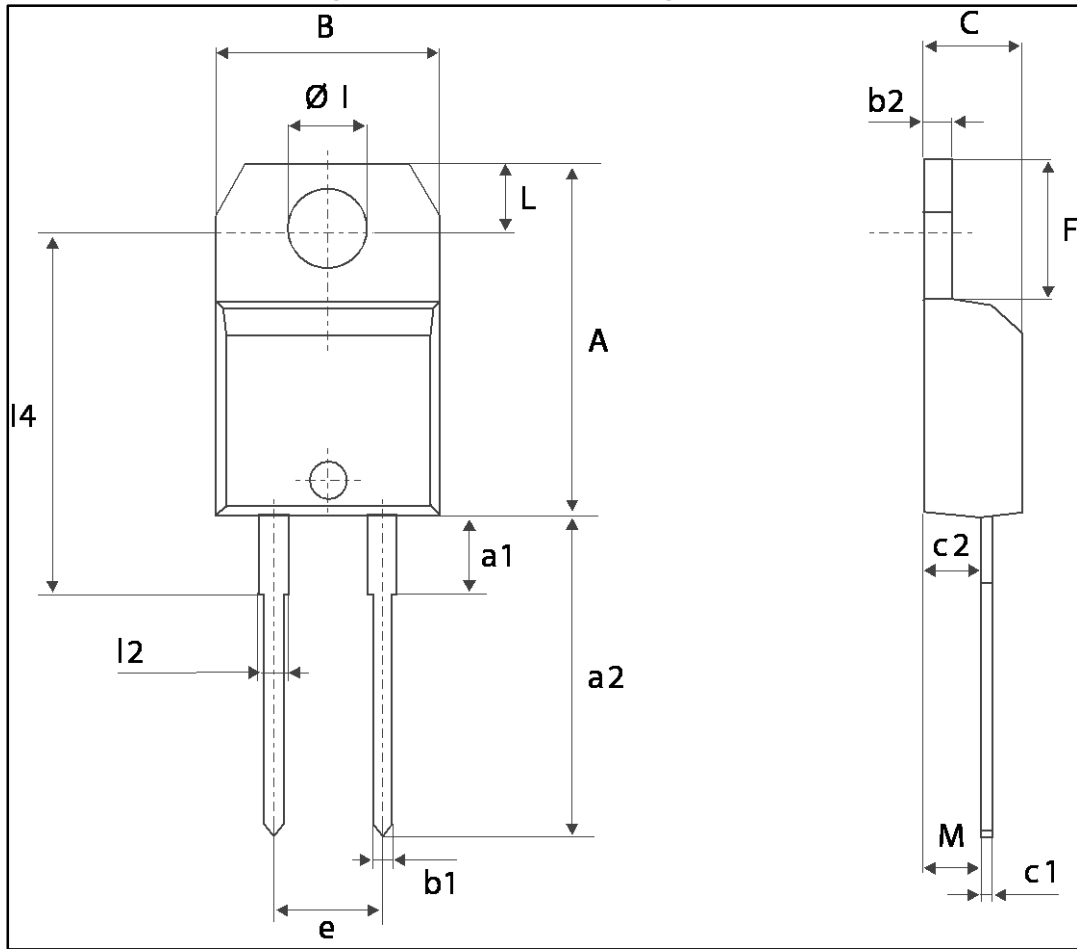


Table 7: TO-220AC Ins package mechanical data

| Ref. | Dimensions  |       |            |       |
|------|-------------|-------|------------|-------|
|      | Millimeters |       | Inches     |       |
|      | Min.        | Max.  | Min.       | Max.  |
| A    | 15.20       | 15.90 | 0.598      | 0.625 |
| a1   | 3.75 typ.   |       | 0.147 typ. |       |
| 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    | 4.80        | 5.40  | 0.189      | 0.212 |
| F    | 6.20        | 6.60  | 0.244      | 0.259 |
| Øl   | 3.75        | 3.85  | 0.147      | 0.151 |



### 2.3 DO-247 package information

Figure 12: DO-247 package outline

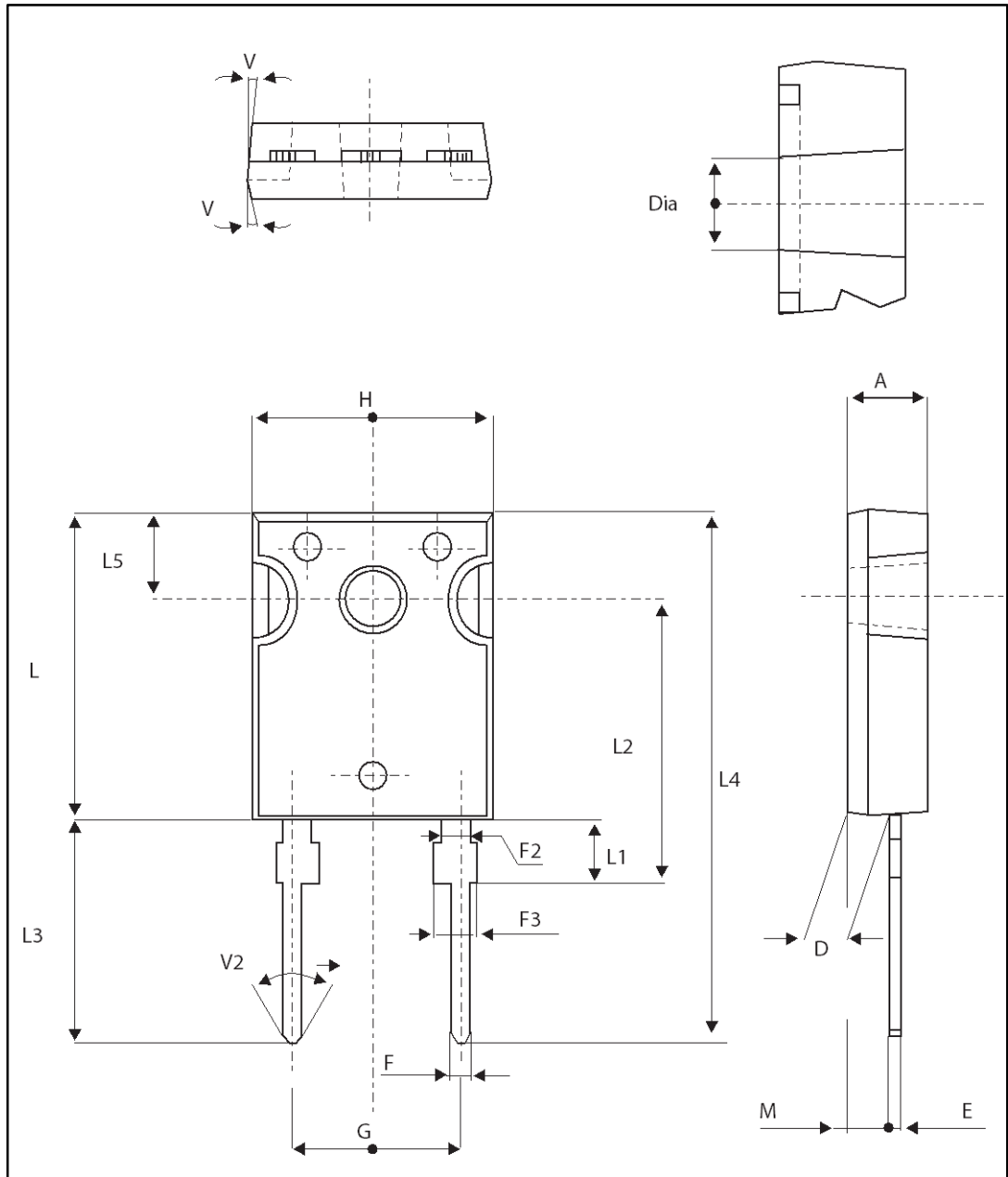


Table 8: DO-247 package mechanical data

| Ref. | Dimensions  |       |            |       |
|------|-------------|-------|------------|-------|
|      | Millimeters |       | Inches     |       |
|      | Min.        | Max.  | Min.       | Max.  |
| A    | 4.85        | 5.15  | 0.191      | 0.203 |
| D    | 2.20        | 2.60  | 0.086      | 0.102 |
| E    | 0.40        | 0.80  | 0.015      | 0.031 |
| F    | 1.00        | 1.40  | 0.039      | 0.055 |
| F2   | 2.00 typ.   |       | 0.078 typ. |       |
| F3   | 2.00        | 2.40  | 0.078      | 0.094 |
| G    | 10.90 typ.  |       | 0.429 typ. |       |
| H    | 15.45       | 15.75 | 0.608      | 0.620 |
| L    | 19.85       | 20.15 | 0.781      | 0.793 |
| L1   | 3.70        | 4.30  | 0.145      | 0.169 |
| L2   | 18.50 typ.  |       | 0.728 typ. |       |
| L3   | 14.20       | 14.80 | 0.559      | 0.582 |
| L4   | 34.60 typ.  |       | 1.362 typ. |       |
| L5   | 5.50 typ.   |       | 0.216 typ. |       |
| M    | 2.00        | 3.00  | 0.078      | 0.118 |
| V    | 5°          |       | 5°         |       |
| V2   | 60°         |       | 60°        |       |
| Dia. | 3.55        | 3.65  | 0.139      | 0.143 |

### 3 Ordering information

Table 9: Ordering information

| Order code   | Marking    | Package      | Weight | Base qty. | Delivery mode |
|--------------|------------|--------------|--------|-----------|---------------|
| STPSC20065D  | PSC20065D  | TO-220AC     | 1.86 g | 50        | Tube          |
| STPSC20065DI | PSC20065DI | TO-220AC Ins | 2.12 g | 50        | Tube          |
| STPSC20065W  | PSC20065W  | DO-247       | 4.4    | 50        | Tube          |

### 4 Revision history

Table 10: Document revision history

| Date        | Revision | Changes     |
|-------------|----------|-------------|
| 02-May-2016 | 1        | First issue |

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