

# 6<sup>th</sup> Generation CoolSiC™

## 650V SiC Schottky Diode

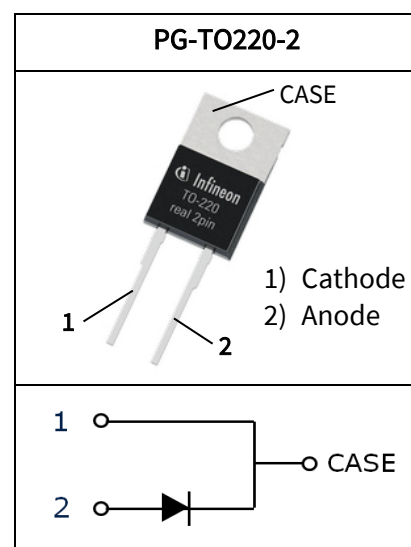
The CoolSiC™ generation 6 (G6) is the leading edge technology from Infineon for the SiC Schottky barrier diodes. The Infineon proprietary innovative G5 technology was enhanced in G6 by introducing further advancements like a novel Schottky metal system. The result is a family of products with improved efficiency over all load conditions, resulting from a lower figure of merit ( $Q_C \times V_F$ ). The CoolSiC™ Schottky diode 650 V G6 has been designed to complement our 600 V and 650 V CoolMOS™ 7 families, meeting the most stringent application requirements in this voltage range.

**Table 1 Key performance parameters**

| Parameter                            | Value | Unit |
|--------------------------------------|-------|------|
| $V_{RRM}$                            | 650   | V    |
| $Q_C$ ( $V_R = 400$ V)               | 26.8  | nC   |
| $E_C$ ( $V_R = 400$ V)               | 5.3   | μJ   |
| $I_F$ ( $T_C \leq 135$ °C, $D = 1$ ) | 20    | A    |
| $V_F$ ( $I_F = 20$ A, $T_j = 25$ °C) | 1.25  | V    |

**Table 2 Package information**

| Type / ordering Code | Package    | Marking |
|----------------------|------------|---------|
| IDH20G65C6           | PG-TO220-2 | D2065C6 |



## Features

- Best in class forward voltage (1.25 V)
- Best in class figure of merit ( $Q_C \times V_F$ )
- High dv/dt ruggedness (150 V/ns)

## Benefits

- System efficiency improvement
- System cost and size savings due to the reduced cooling requirements
- Enabling higher frequency and increased power density

## Potential Applications

- Power factor correction in SMPS
- Solar inverter
- Uninterruptible power supply

## Product Validation

- Qualified for industrial applications according to the relevant tests of JEDEC (J-STD20 and JESD22)



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## 1 Maximum ratings

Table 3 Maximum ratings

| Parameter                                                    | Symbol        | Values |      |      | Unit             | Note/Test condition                               |
|--------------------------------------------------------------|---------------|--------|------|------|------------------|---------------------------------------------------|
|                                                              |               | Min.   | Typ. | Max. |                  |                                                   |
| Continuous forward current                                   | $I_F$         | –      | –    | 20   | A                | $T_C \leq 135\text{ °C}, D = 1$                   |
|                                                              |               | –      | –    | 22   |                  | $T_C \leq 125\text{ °C}, D = 1$                   |
|                                                              |               | –      | –    | 41   |                  | $T_C \leq 25\text{ °C}, D = 1$                    |
| Surge-repetitive forward current, sine halfwave <sup>1</sup> | $I_{F,RM}$    | –      | –    | 87   |                  | $T_C = 25\text{ °C}, t_p = 10\text{ ms}$          |
| Surge non-repetitive forward current, sine halfwave          | $I_{F,SM}$    | –      | –    | 99   |                  | $T_C = 25\text{ °C}, t_p = 10\text{ ms}$          |
|                                                              |               | –      | –    | 79   |                  | $T_C = 150\text{ °C}, t_p = 10\text{ ms}$         |
| Non-repetitive peak forward current                          | $I_{F,max}$   | –      | –    | 780  |                  | $T_C = 25\text{ °C}, t_p = 10\text{ }\mu\text{s}$ |
| $i^2t$ value                                                 | $\int i^2 dt$ | –      | –    | 49   | A <sup>2</sup> s | $T_C = 25\text{ °C}, t_p = 10\text{ ms}$          |
|                                                              |               | –      | –    | 31   |                  | $T_C = 150\text{ °C}, t_p = 10\text{ ms}$         |
| Repetitive peak reverse voltage                              | $V_{RRM}$     | –      | –    | 650  | V                | $T_C = 25\text{ °C}$                              |
| Diode dv/dt ruggedness                                       | $dv/dt$       | –      | –    | 150  | V/ns             | $V_R = 0..480\text{ V}$                           |
| Power dissipation                                            | $P_{tot}$     | –      | –    | 108  | W                | $T_C = 25\text{ °C}, R_{thJC,max}$                |
| Operating and storage temperature                            | $T_j$         | -55    | –    | 175  | °C               | –                                                 |
|                                                              | $T_{stg}$     |        |      |      |                  |                                                   |
| Mounting torque                                              | –             | –      | –    | 70   | Ncm              | M3 screw                                          |

## 2 Thermal characteristics

Table 4 Thermal characteristics (PG-TO-220-2)

| Parameter                                                  | Symbol     | Values |      |      | Unit | Note/Test condition                   |
|------------------------------------------------------------|------------|--------|------|------|------|---------------------------------------|
|                                                            |            | Min.   | Typ. | Max. |      |                                       |
| Thermal resistance, junction-case                          | $R_{thJC}$ | –      | 0.8  | 1.3  | K/W  | –                                     |
| Thermal resistance, junction-ambient                       | $R_{thJA}$ | –      | –    | 62   |      | lead                                  |
| Soldering temperature, wavesoldering only allowed at leads | $T_{sld}$  | –      | –    | 260  | °C   | 1.6 mm (0.063 in.) from case for 10 s |

<sup>1</sup> The surge-repetitive forward current test was performed with 1000 pulses (half-wave rectified sine with the 10 ms period).

## 3 Electrical characteristics

### 3.1 Static characteristics

Table 5 Static characteristics

| Parameter             | Symbol   | Values |      |      | Unit          | Note/Test condition                          |
|-----------------------|----------|--------|------|------|---------------|----------------------------------------------|
|                       |          | Min.   | Typ. | Max. |               |                                              |
| DC blocking voltage   | $V_{DC}$ | 650    | –    | –    | V             | $T_j = 25\text{ °C}$                         |
| Diode forward voltage | $V_F$    | –      | 1.25 | 1.35 |               | $I_F = 20\text{ A}$ , $T_j = 25\text{ °C}$   |
|                       |          | –      | 1.5  | –    |               | $I_F = 20\text{ A}$ , $T_j = 150\text{ °C}$  |
| Reverse current       | $I_R$    | –      | 2.0  | 67   | $\mu\text{A}$ | $V_R = 420\text{ V}$ , $T_j = 25\text{ °C}$  |
|                       |          | –      | 66   | –    |               | $V_R = 420\text{ V}$ , $T_j = 125\text{ °C}$ |
|                       |          | –      | 153  | –    |               | $V_R = 420\text{ V}$ , $T_j = 150\text{ °C}$ |

### 3.2 AC characteristics

Table 6 AC characteristics

| Parameter               | Symbol | Values |      |      | Unit | Note/Test Condition                                                                                         |
|-------------------------|--------|--------|------|------|------|-------------------------------------------------------------------------------------------------------------|
|                         |        | Min.   | Typ. | Max. |      |                                                                                                             |
| Total capacitive charge | $Q_c$  | –      | 26.8 | –    | nC   | $V_R = 400\text{ V}$ , $T_j = 150\text{ °C}$ ,<br>$di/dt = 200\text{ A}/\mu\text{s}$ , $I_F \leq I_{F,MAX}$ |
| Total capacitance       | C      | –      | 970  | –    | pF   | $V_R = 1\text{ V}$ , $f = 1\text{ MHz}$ ,<br>$T_j = 25\text{ °C}$                                           |
|                         |        | –      | 57   | –    |      | $V_R = 300\text{ V}$ , $f = 1\text{ MHz}$ ,<br>$T_j = 25\text{ °C}$                                         |
|                         |        | –      | 55   | –    |      | $V_R = 600\text{ V}$ , $f = 1\text{ MHz}$ ,<br>$T_j = 25\text{ °C}$                                         |

## 4 Diagrams

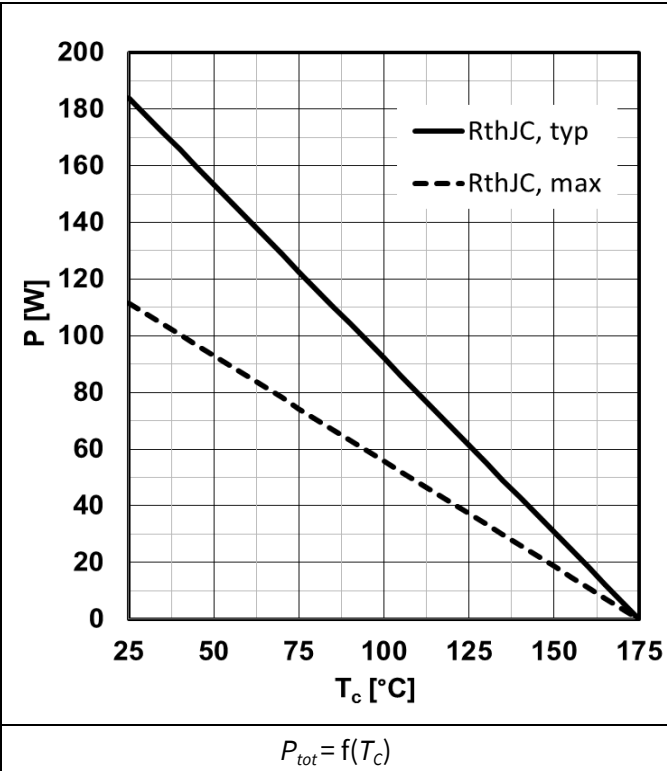


Figure 1 Power dissipation

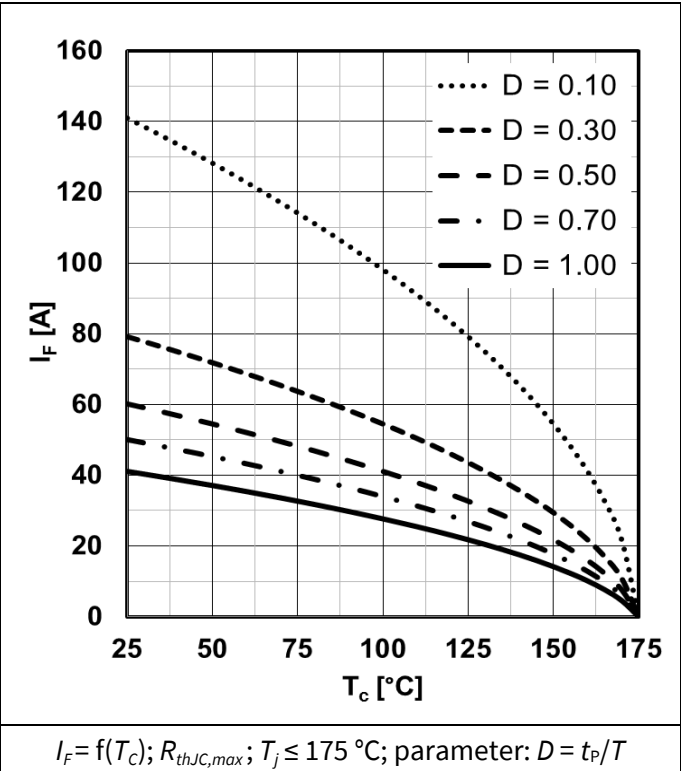


Figure 2 Max. forward current

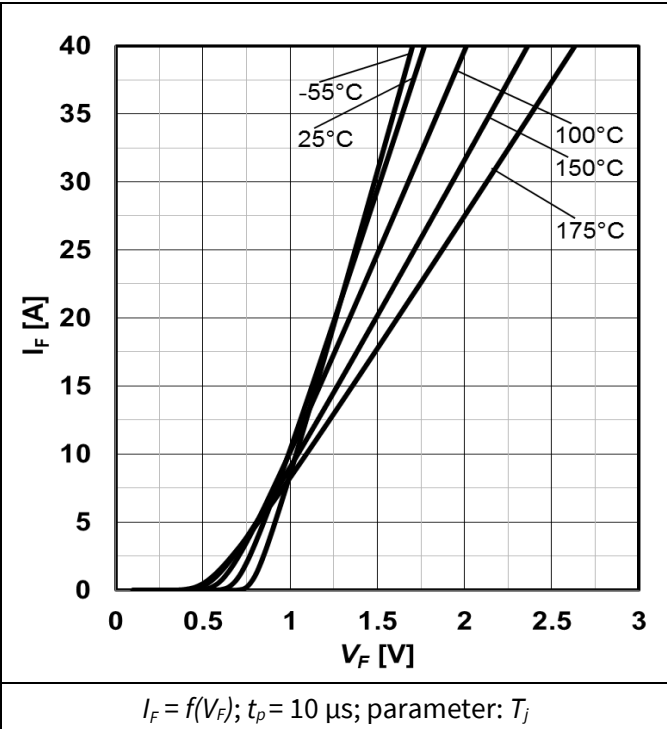


Figure 3 Typ. forward characteristics

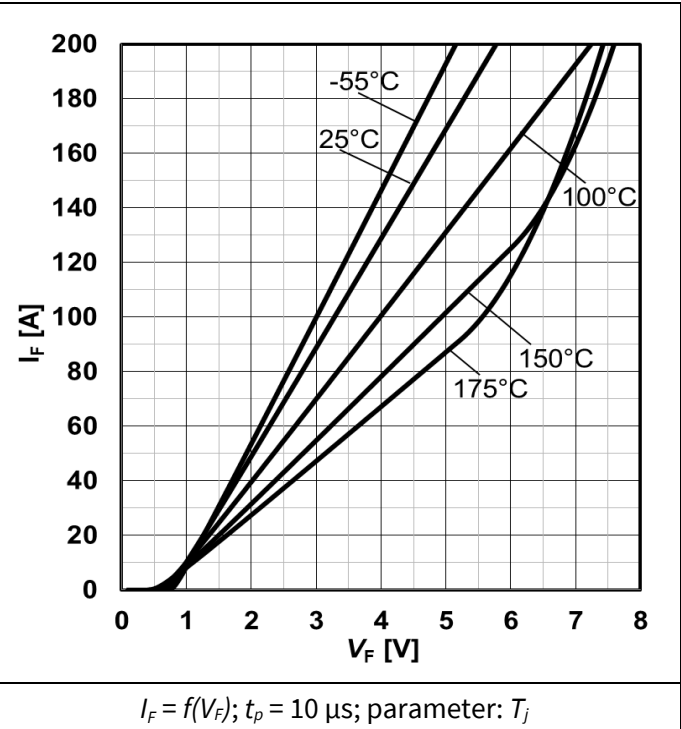
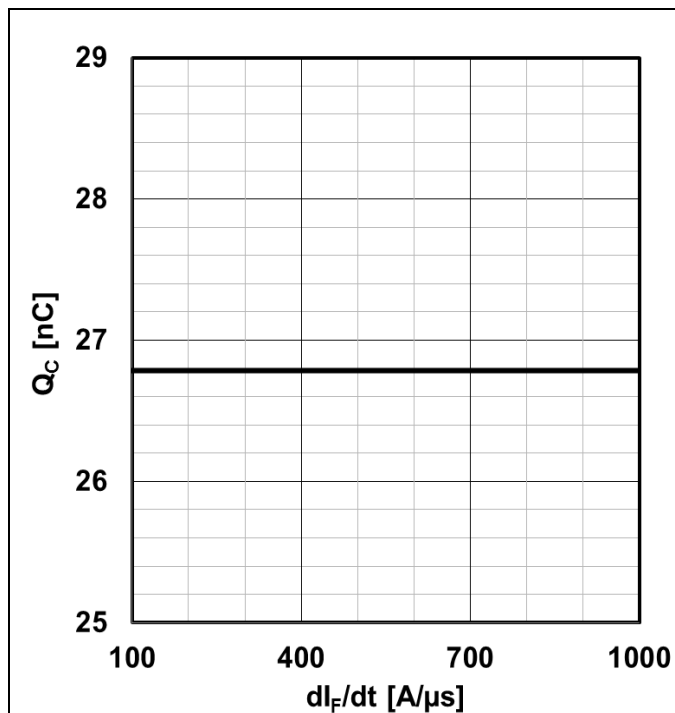
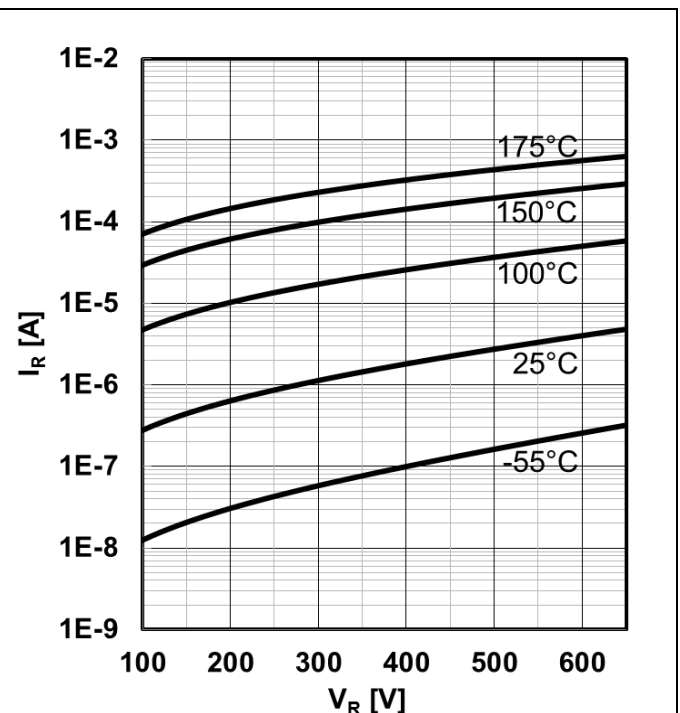


Figure 4 Typ. forward characteristics  
in surge current



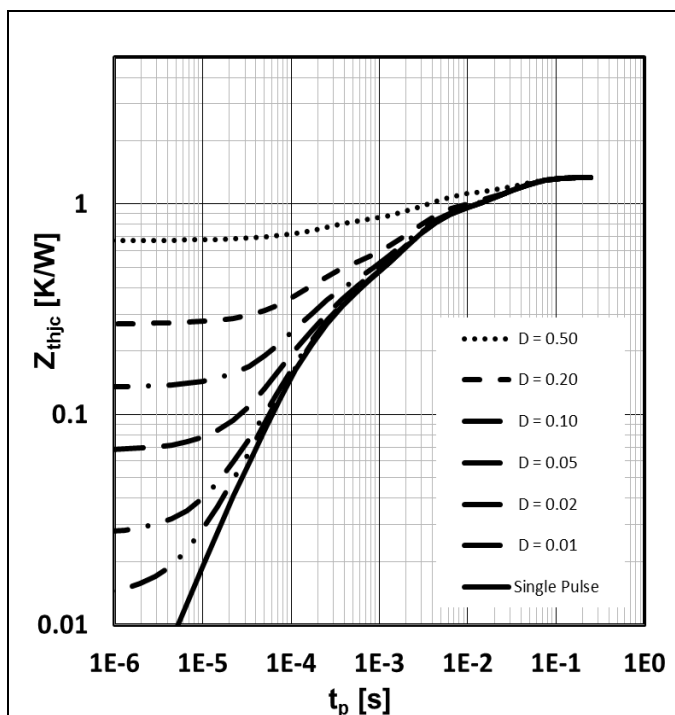
$$Q_C = f(di_F/dt); T_j = 150^\circ\text{C}; V_R = 400\text{ V}; I_F \leq I_{F,max}$$

Figure 5 Typ. cap. charge vs. current slope



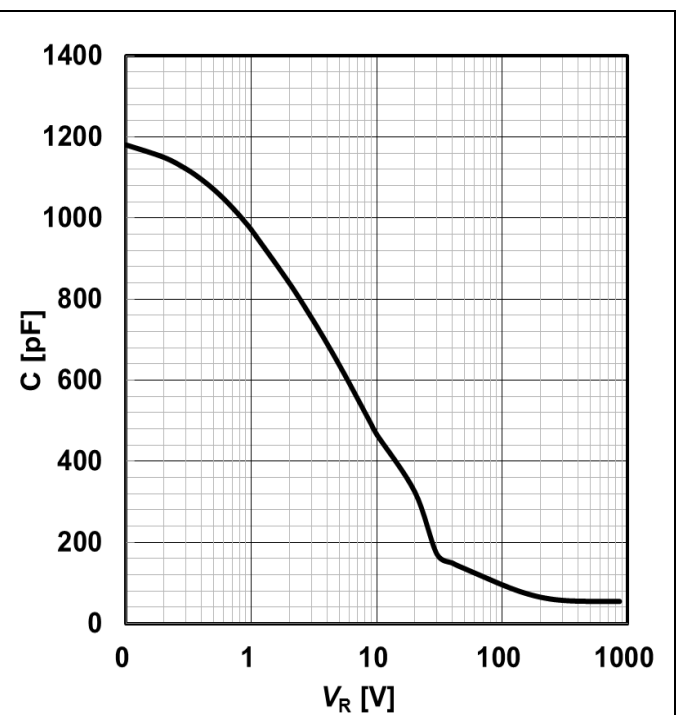
$$I_R = f(V_R); \text{parameter: } T_j$$

Figure 6 Typ. reverse current vs. reverse voltage



$$Z_{th,jc} = f(t_p); \text{parameter: } D = t_p/T$$

Figure 7 Max. transient thermal impedance



$$C = f(V_R); T_j = 25^\circ\text{C}; f = 1\text{ MHz}$$

Figure 8 Typ. capacitance vs. reverse voltage

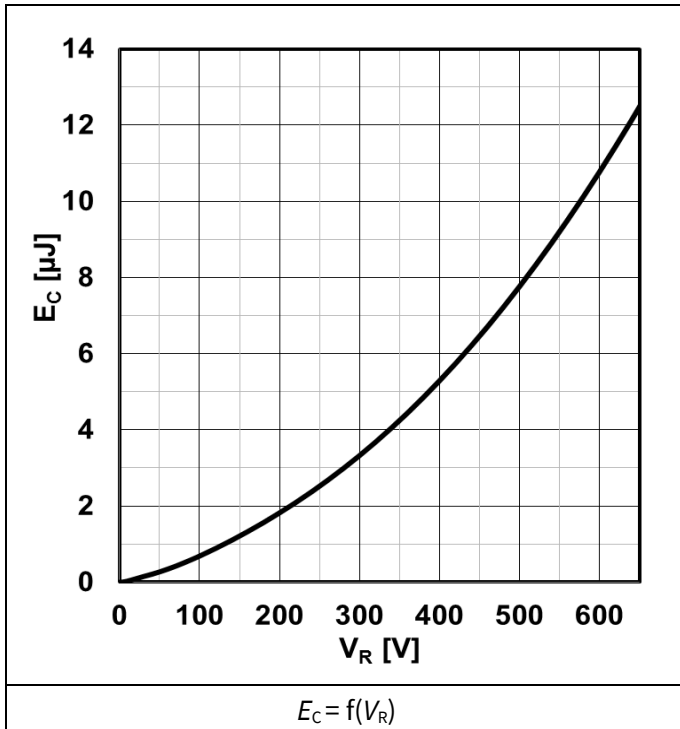


Figure 9 Typ. capacitance stored energy

## 5 Simplified forward characteristic

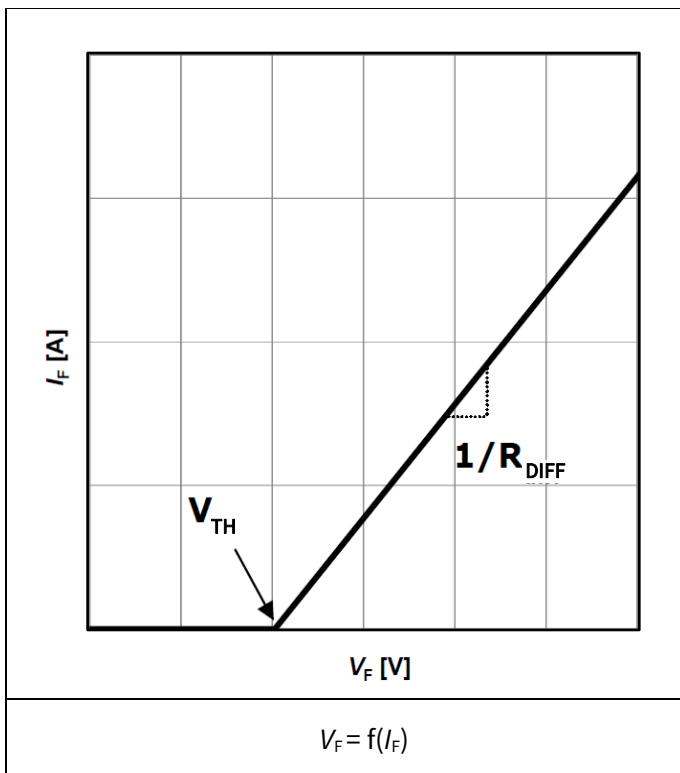


Figure 10 Equivalent forward current curve

$$V_F = V_{TH} + R_{DIFF} \times I_F$$

Threshold voltage ( $V_{TH}$ ):

$$V_{TH}(T_j) = -0.001 \times T_j + 0.766 \text{ [V]}$$

Differential resistance ( $R_{DIFF}$ ):

$$R_{DIFF}(T_j) = A \times T_j^2 + B \times T_j + C \text{ [}\Omega\text{]}$$

$$A = 6.19 \times 10^{-7}$$

$$B = 4.50 \times 10^{-5}$$

$$C = 2.38 \times 10^{-2}$$

$$T_j \text{ [}^\circ\text{C]}; -55^\circ\text{C} \leq T_j \leq 175^\circ\text{C}; I_F \leq 20 \text{ A}$$

Figure 11 Mathematical Equation

## 6 Package outlines

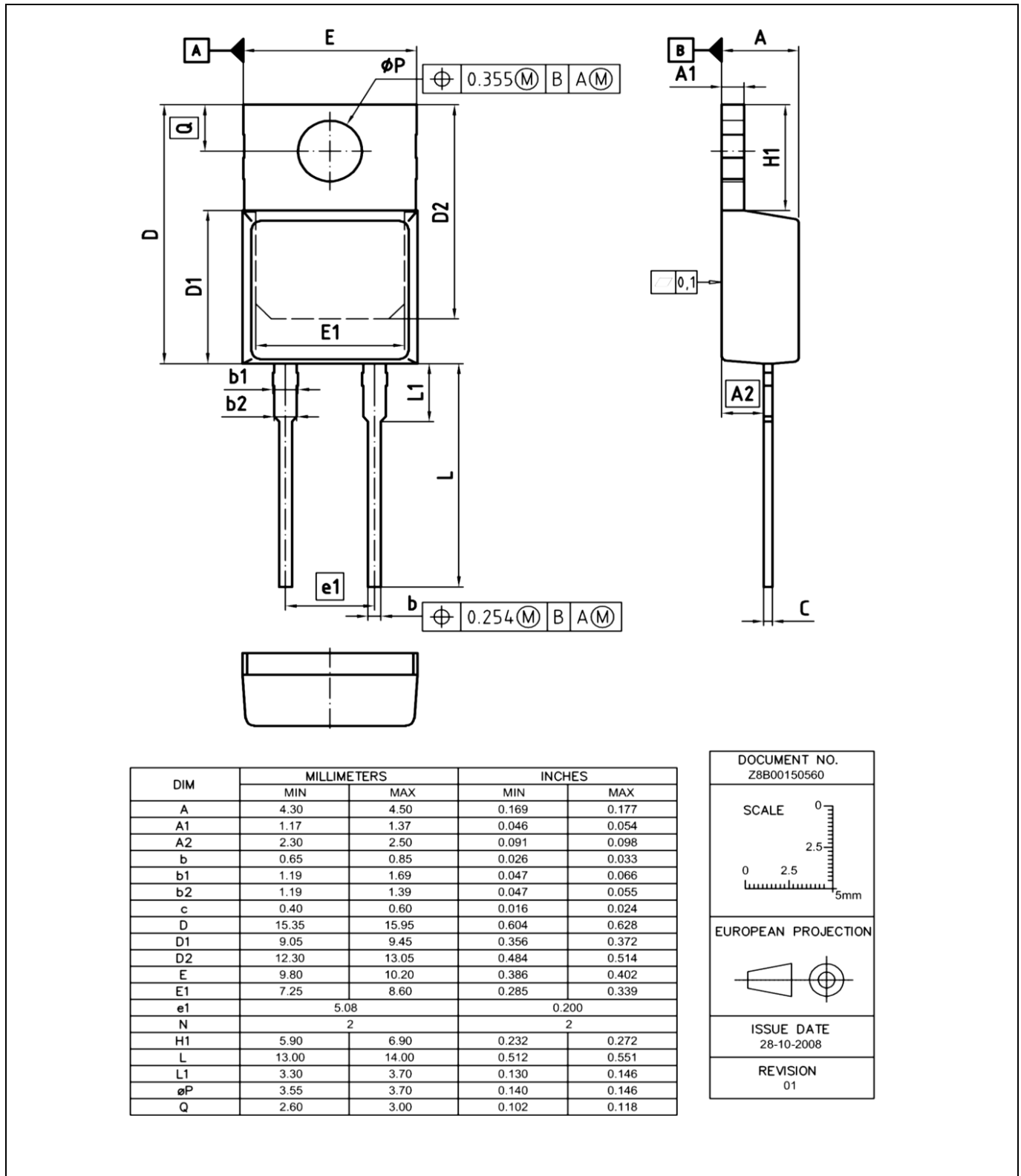


Figure 12 Outlines of the package PG-TO220-2, dimensions in mm/inches

## Revision History

### Major changes since the last revision

| Revision | Date       | Subject (major changes since last revision) |
|----------|------------|---------------------------------------------|
| 2.0      | 2017-05-23 | Release of final version                    |
|          |            |                                             |
|          |            |                                             |

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