

# 6<sup>th</sup> Generation CoolSiC™

## 650V SiC Schottky Diode

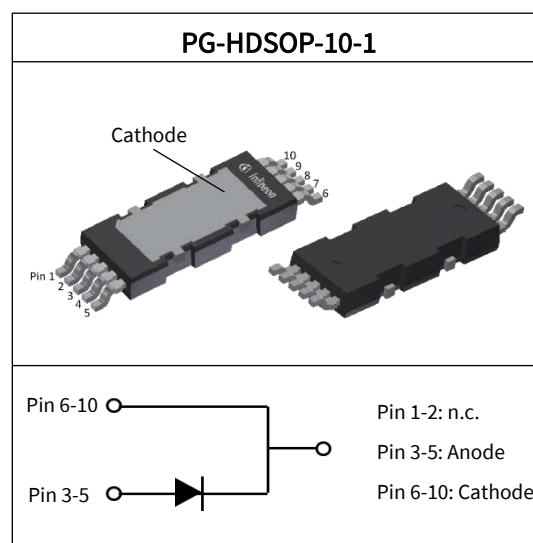
The CoolSiC™ generation 6 (G6) is the leading edge technology from Infineon for the SiC Schottky barrier diodes. The Infineon proprietary innovative G5 technology was enhanced in G6 by introducing further advancements like a novel Schottky metal system. The result is a family of products with improved 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)               | 9.6   | nC   |
| $E_C$ ( $V_R = 400$ V)               | 1.6   | μJ   |
| $I_F$ ( $T_C \leq 150$ °C, $D = 1$ ) | 6     | A    |
| $V_F$ ( $I_F = 6$ A, $T_j = 25$ °C)  | 1.25  | V    |

**Table 2 Package information**

| Type / ordering Code | Package       | Marking |
|----------------------|---------------|---------|
| IDDD06G65C6          | PG-HDSOP-10-1 | D0665C6 |



## 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                                   | $I_F$              | –      | –    | 6    | A                | $T_C \leq 150\text{ °C}, D = 1$                   |
|                                                              |                    | –      | –    | 10   |                  | $T_C \leq 125\text{ °C}, D = 1$                   |
|                                                              |                    | –      | –    | 18   |                  | $T_C \leq 25\text{ °C}, D = 1$                    |
| Surge-repetitive forward current, sine halfwave <sup>1</sup> | $I_{F, RM}$        | –      | –    | 26   |                  | $T_C = 25\text{ °C}, t_p = 10\text{ ms}$          |
| Surge non-repetitive forward current, sine halfwave          | $I_{F, SM}$        | –      | –    | 38   |                  | $T_C = 25\text{ °C}, t_p = 10\text{ ms}$          |
|                                                              |                    | –      | –    | 30   |                  | $T_C = 150\text{ °C}, t_p = 10\text{ ms}$         |
| Non-repetitive peak forward current                          | $I_{F, max}$       | –      | –    | 410  |                  | $T_C = 25\text{ °C}, t_p = 10\text{ }\mu\text{s}$ |
| $i^2t$ value                                                 | $\int i^2 dt$      | –      | –    | 7.2  | A <sup>2</sup> s | $T_C = 25\text{ °C}, t_p = 10\text{ ms}$          |
|                                                              |                    | –      | –    | 4.6  |                  | $T_C = 150\text{ °C}, t_p = 10\text{ ms}$         |
| 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                                            | $P_{tot}$          | –      | –    | 73   | W                | $T_C = 25\text{ °C}, R_{thJC, max}$               |
| Operating and storage temperature                            | $T_j$<br>$T_{stg}$ | –55    | –    | 175  | °C               | –                                                 |

## 2 Thermal characteristics

Table 4 Thermal characteristics

| Parameter                                            | Symbol     | Values |      |      | Unit | Note/Test condition                                                                                                                                                                           |
|------------------------------------------------------|------------|--------|------|------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                      |            | Min.   | Typ. | Max. |      |                                                                                                                                                                                               |
| Thermal resistance, junction-case                    | $R_{thJC}$ | –      | 1.2  | 2.0  | K/W  | –                                                                                                                                                                                             |
| Thermal resistance, junction-ambient                 | $R_{thJA}$ | –      | –    | 62   |      | Device on PCB, minimal footprint                                                                                                                                                              |
| Thermal resistance, junction-ambient for SMD version | $R_{thJA}$ | –      | 35   | 45   |      | Device on 40*40*1.5 mm epoxy PCB FR4 (one layer, 70 $\mu\text{m}$ thickness) with 6 $\text{cm}^2$ copper for cathode connection and cooling, PCB vertically placed without air stream cooling |
| Soldering temperature                                | $T_{sold}$ | –      | –    | 260  | °C   | Allowed only reflow soldering                                                                                                                                                                 |

<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 |               | $I_F = 6\text{ A}, T_j = 25\text{ °C}$    |
|                       |          | –      | 1.5  | –    |               | $I_F = 6\text{ A}, T_j = 150\text{ °C}$   |
| Reverse current       | $I_R$    | –      | 0.6  | 20   | $\mu\text{A}$ | $V_R = 420\text{ V}, T_j = 25\text{ °C}$  |
|                       |          | –      | 20   | –    |               | $V_R = 420\text{ V}, T_j = 125\text{ °C}$ |
|                       |          | –      | 46   | –    |               | $V_R = 420\text{ V}, T_j = 150\text{ °C}$ |

### 3.2 AC characteristics

Table 6 AC characteristics

| Parameter               | Symbol | Values |      |      | Unit | Note/Test Condition                                                                                  |
|-------------------------|--------|--------|------|------|------|------------------------------------------------------------------------------------------------------|
|                         |        | Min.   | Typ. | Max. |      |                                                                                                      |
| Total capacitive charge | $Q_C$  | –      | 9.6  | –    | 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      | –      | 302  | –    | pF   | $V_R = 1\text{ V}, f = 1\text{ MHz},$<br>$T_j = 25\text{ °C}$                                        |
|                         |        | –      | 18   | –    |      | $V_R = 300\text{ V}, f = 1\text{ MHz},$<br>$T_j = 25\text{ °C}$                                      |
|                         |        | –      | 17   | –    |      | $V_R = 600\text{ V}, f = 1\text{ MHz},$<br>$T_j = 25\text{ °C}$                                      |

## 4 Diagrams

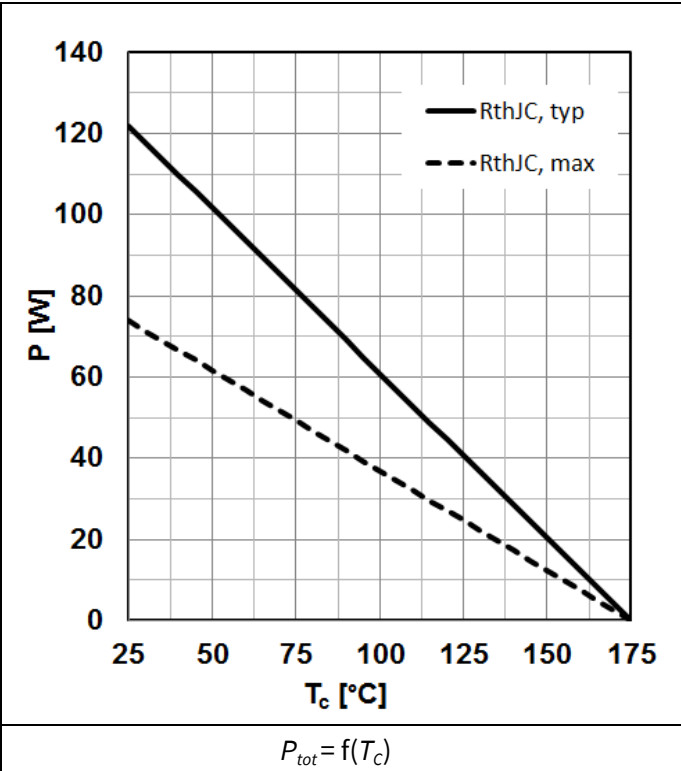


Figure 1 Power dissipation

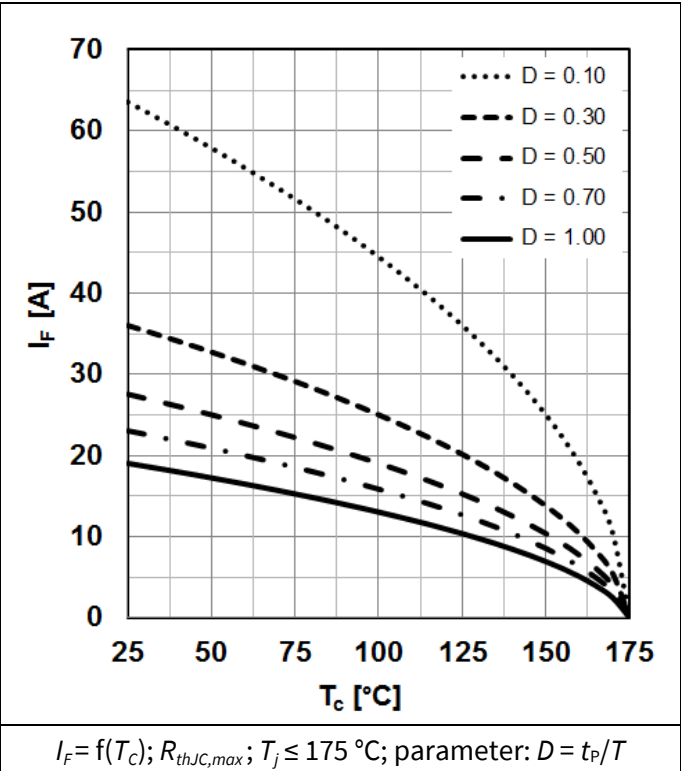


Figure 2 Max. forward current

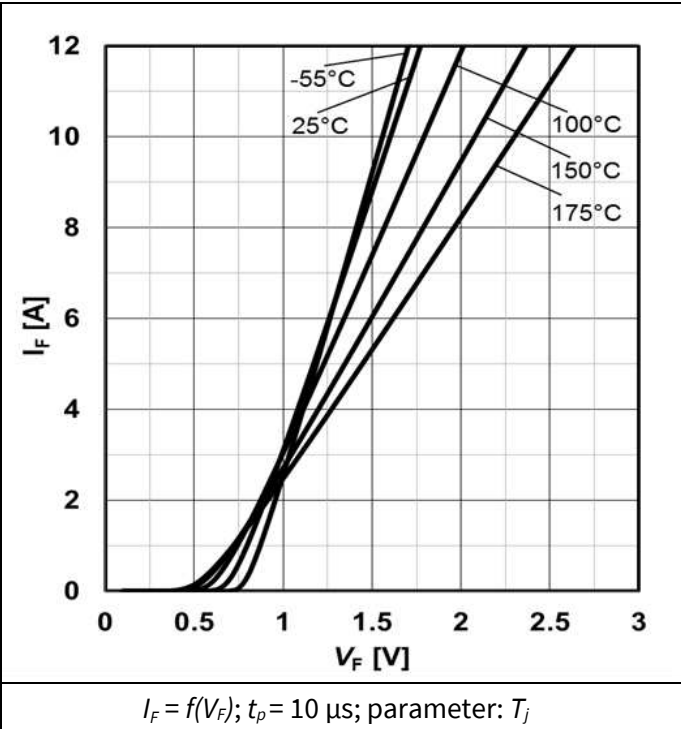


Figure 3 Typ. forward characteristics

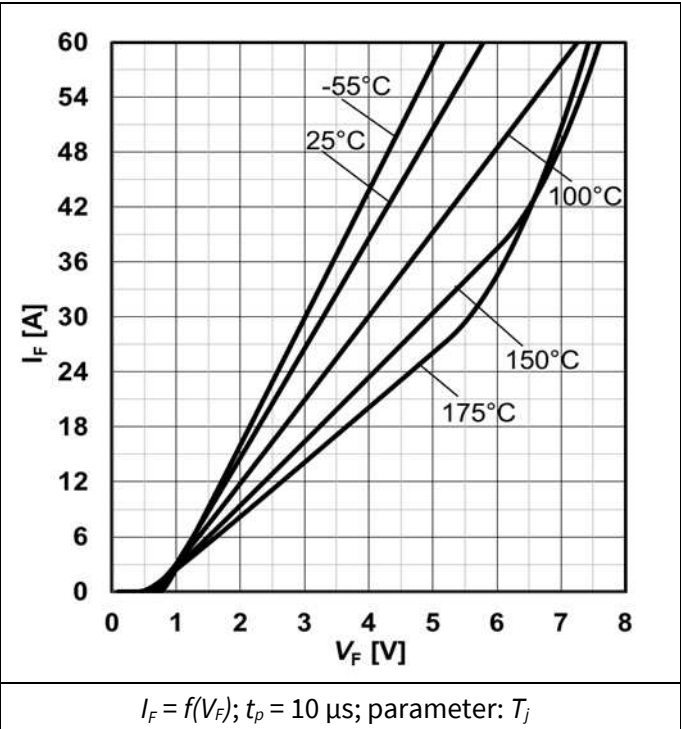


Figure 4 Typ. forward characteristics  
in surge current

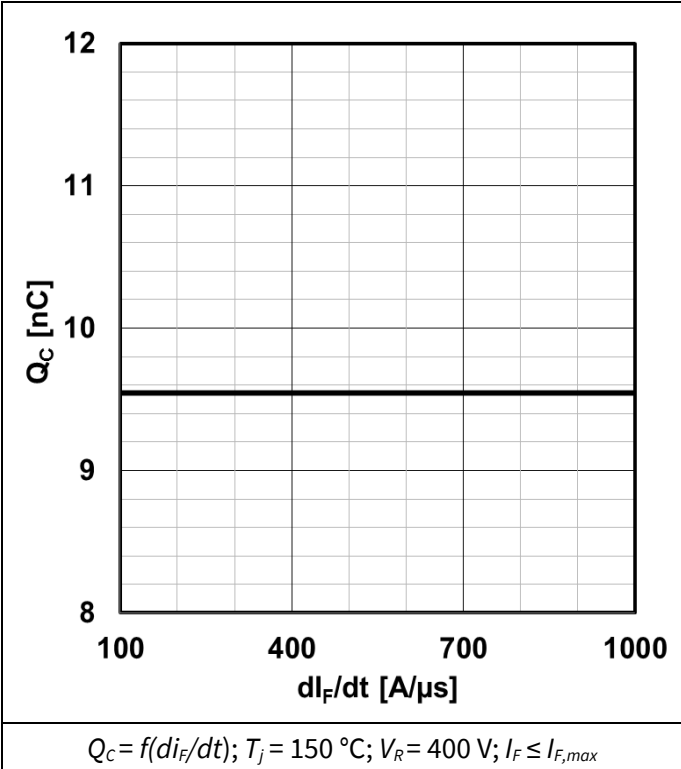


Figure 5 Typ. cap. charge vs. current slope

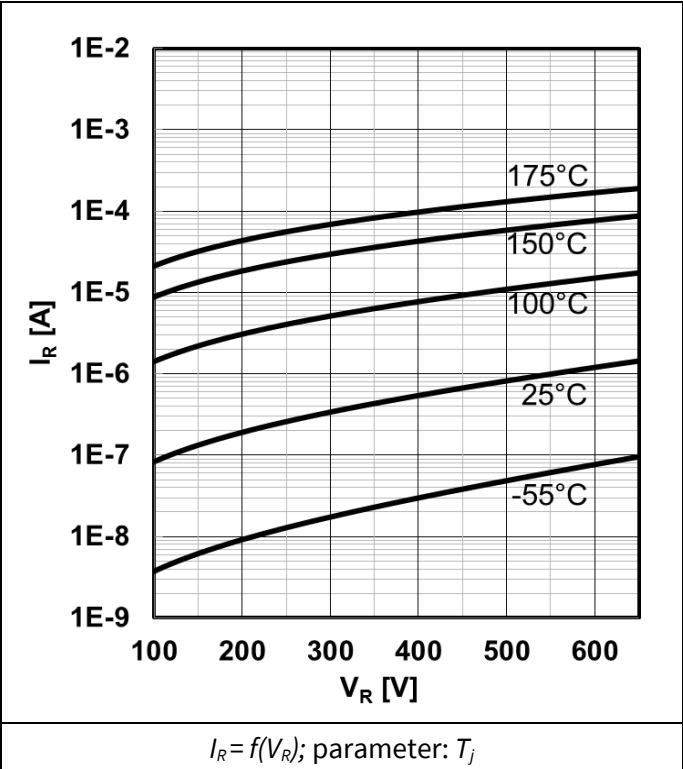


Figure 6 Typ. reverse current vs. reverse voltage

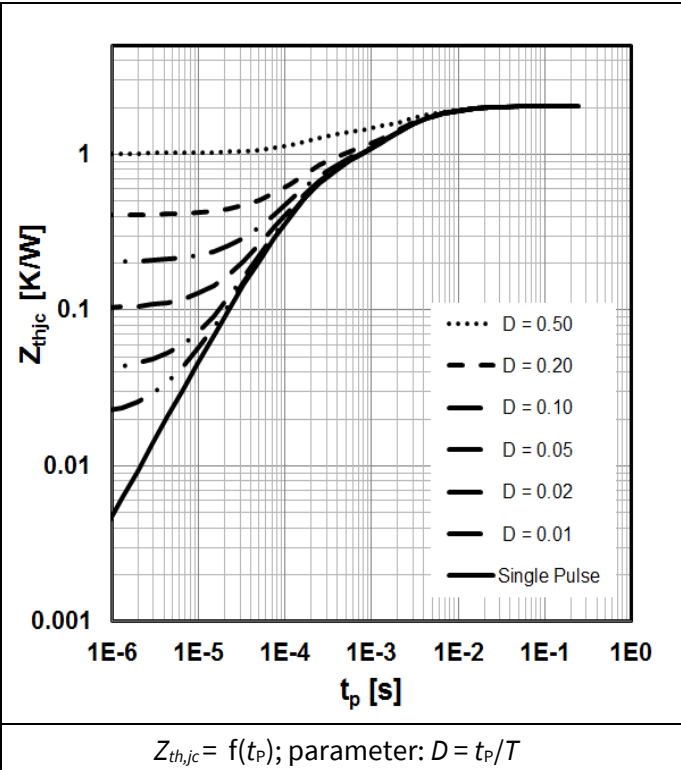


Figure 7 Max. transient thermal impedance

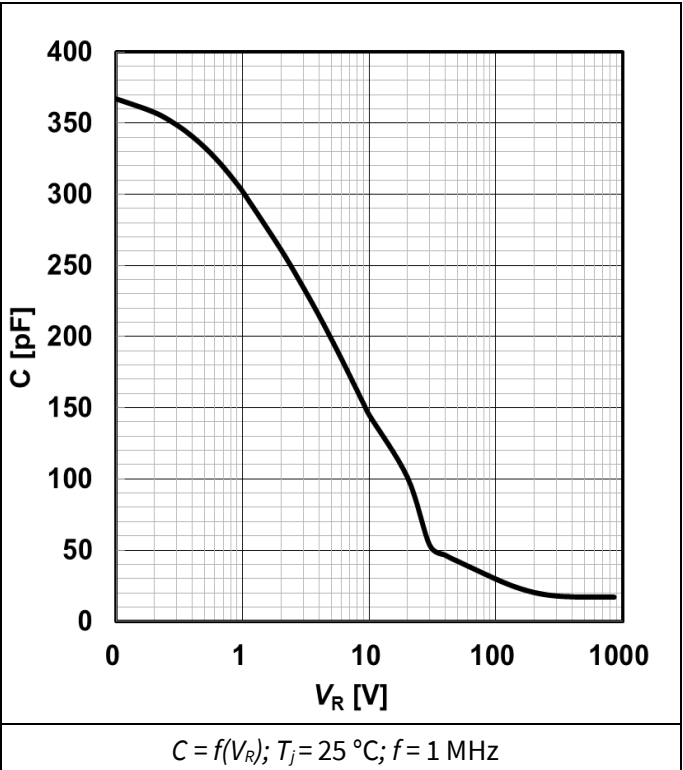


Figure 8 Typ. capacitance vs. reverse voltage

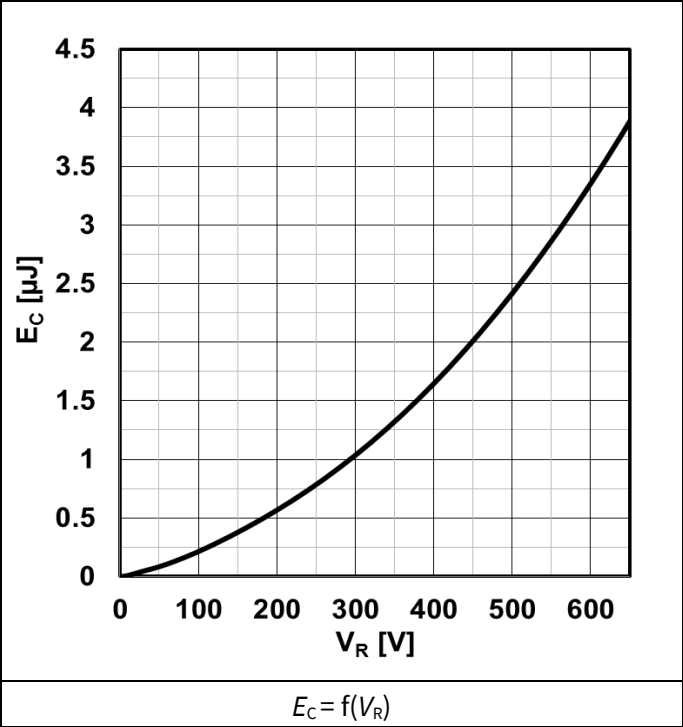


Figure 9 Typ. capacitance stored energy

## 5 Simplified forward characteristic

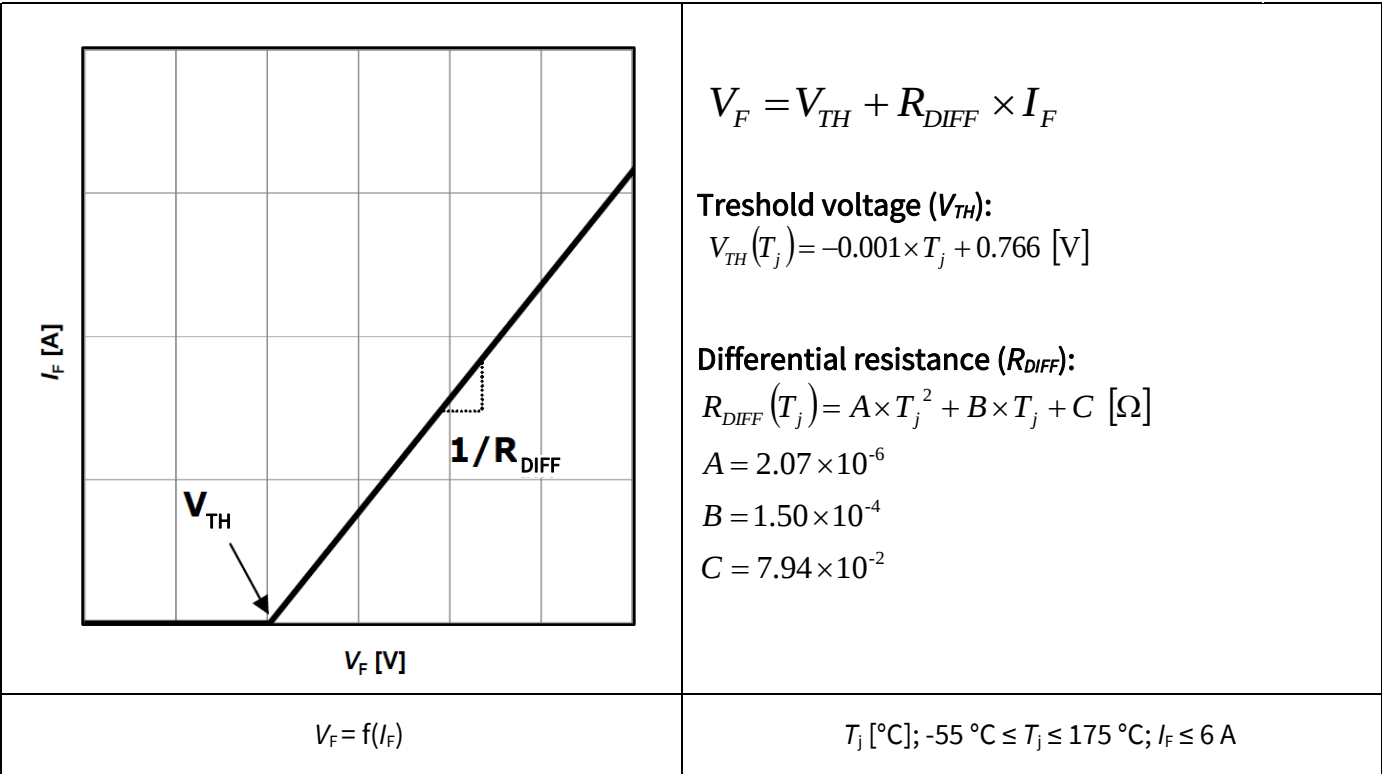
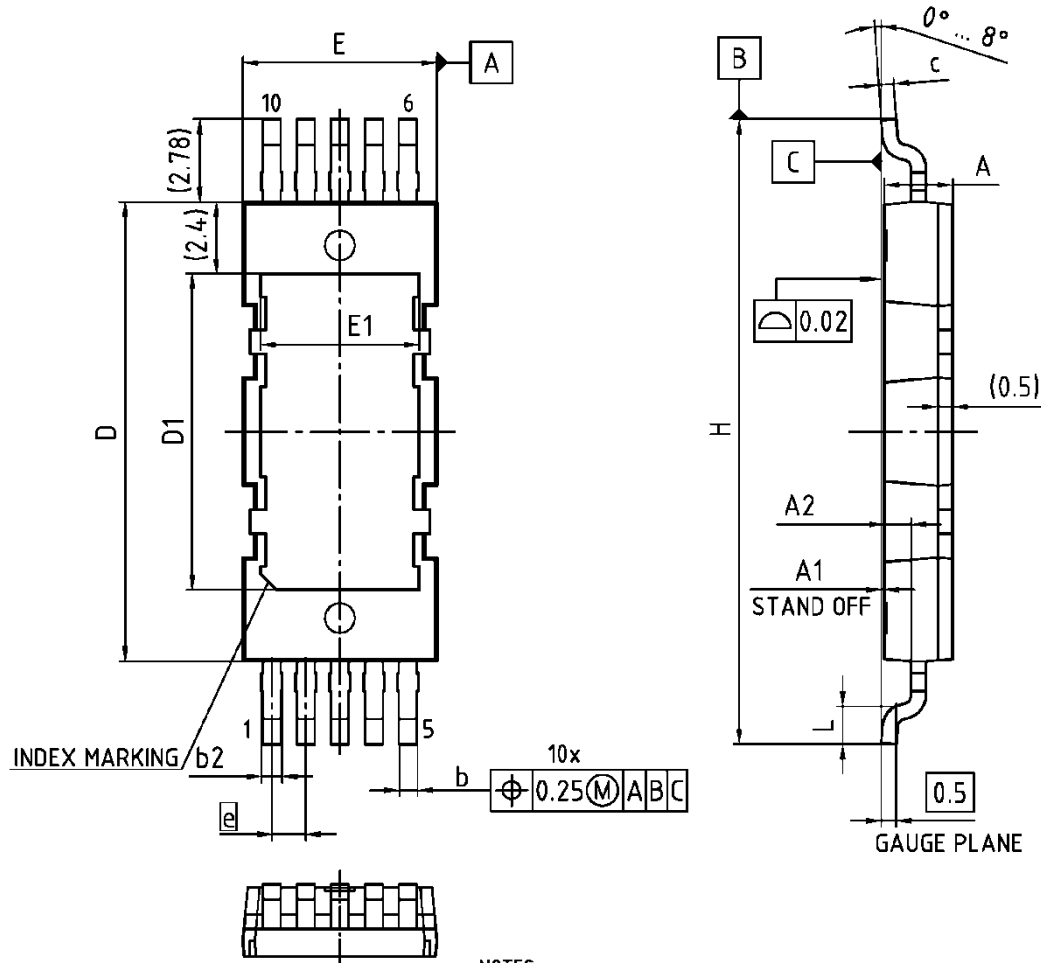


Figure 10 Equivalent forward current curve

Figure 11 Mathematical Equation

## 6 Package outlines



### NOTES:

1. INDUSTRIAL QUALITY GRADE
2. ALL DIMENSIONS REFER TO JEDEC STANDARD TO-252 AND DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
3. ALL METAL SUFACES ARE TIN PLATED, EXCEPT AREA OF CUT.

| DIMENSIONS | MILLIMETERS |       |
|------------|-------------|-------|
|            | MIN         | MAX   |
| A          | 2.20        | 2.35  |
| A1         | 0.00        | 0.15  |
| A2         | 0.89        | 1.10  |
| b          | 0.57        | 0.63  |
| b2         | 0.57        | 0.93  |
| c          | 0.46        | 0.58  |
| D          | 15.20       | 15.60 |
| D1         | 10.50       | 10.70 |
| E          | 6.40        | 6.60  |
| E1         | 5.20        | 5.50  |
| e          | 1.14        |       |
| N          | 10          |       |
| H          | 20.81       | 21.11 |
| L          | 1.20        | 1.40  |

|                             |
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Figure 12 Outlines of the package PG-HDSOP-10-1, dimensions in millimeters

## Revision History

IDDD06G65C6

**Revision: 2018-02-26, Rev. 2.0**

Previous Revision

| Revision | Date       | Subjects (major changes since last revision) |
|----------|------------|----------------------------------------------|
| 2.0      | 2018-02-26 | Release of final version                     |

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