# 6th 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 x 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 ($T_C \leq 145\ °C$, $D = 1$)	20	A
V_F (I_F = 20 A, T_j = 25 °C)	1.25	V

Table 2   Package information

Type / ordering Code	Package	Marking
IDDD20G65C6	PG-HDSOP-10-1	D2065C6

PG-HDSOP-10-1

Cathode

Pin 6-10
Pin 3-5

Pin 1-2: n.c.
Pin 3-5: Anode
Pin 6-10: Cathode
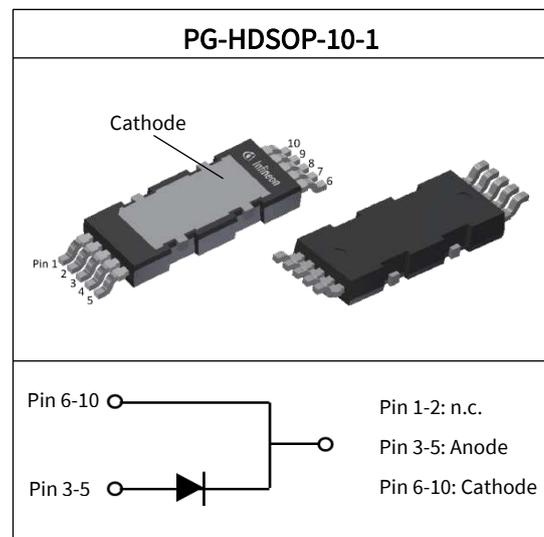
Features

- Best in class forward voltage (1.25 V)
- Best in class figure of merit (Q_c x 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)

Table of Content

1   Maximum ratings

Table 3   Maximum ratings

Parameter	Symbol	Values			Unit	Note/Test condition
		Min.	Typ.	Max.		
Continuous forward current	I_F	–	–	20	A	$T_C \leq 145\ °C$, $D = 1$
		–	–	27		$T_C \leq 125\ °C$, $D = 1$
		–	–	51		$T_C \leq 25\ °C$, $D = 1$
Surge-repetitive forward current, sine halfwave[1]	$I_{F,RM}$	–	–	87		$T_C = 25\ °C$, $t_p = 10$ ms
Surge non-repetitive forward current, sine halfwave	$I_{F,SM}$	–	–	99		$T_C = 25\ °C$, $t_p = 10$ ms
		–	–	79		$T_C = 150\ °C$, $t_p = 10$ ms
Non-repetitive peak forward current	$I_{F,max}$	–	–	780		$T_C = 25\ °C$, $t_p = 10$ µs
i²t value	$\int i^2 dt$	–	–	49	A^2s	$T_C = 25\ °C$, $t_p = 10$ ms
		–	–	31		$T_C = 150\ °C$, $t_p = 10$ ms
Repetitive peak reverse voltage	V_{RRM}	–	–	650	V	$T_C = 25\ °C$
Diode dv/dt ruggedness	dv/dt	–	–	150	V/ns	$V_R = 0..480$ V
Power dissipation	P_{tot}	–	–	169	W	$T_C = 25°C$, $R_{thJC,max}$
Operating and storage temperature	T_j 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}	–	0.5	0.9	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 µm thickness) with 6 cm² copper for cathode connection and cooling, PCB vertically placed without air stream cooling
Soldering temperature	T_{sold}	–	–	260	°C	Allowed only reflow soldering

[1] 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	$T_j = 25\,°C$
Diode forward voltage	V_F	–	1.25	1.35		$I_F = 20\,A$, $T_j = 25\,°C$
		–	1.5	–		$I_F = 20\,A$, $T_j = 150\,°C$
Reverse current	I_R	–	2.0	67	µA	$V_R = 420\,V$, $T_j = 25\,°C$
		–	66	–		$V_R = 420\,V$, $T_j = 125\,°C$
		–	153	–		$V_R = 420\,V$, $T_j = 150\,°C$

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	$V_R = 400\,V$, $T_j = 150\,°C$, di/dt = 200 A/µs, $I_F \le I_{F,MAX}$
Total capacitance	C	–	970	–	pF	$V_R = 1\,V$, $f = 1\,MHz$, $T_j = 25\,°C$
		–	57	–		$V_R = 300\,V$, $f = 1\,MHz$, $T_j = 25\,°C$
		–	55	–		$V_R = 600\,V$, $f = 1\,MHz$, $T_j = 25\,°C$

4 Diagrams

$P_{tot} = f(T_C)$
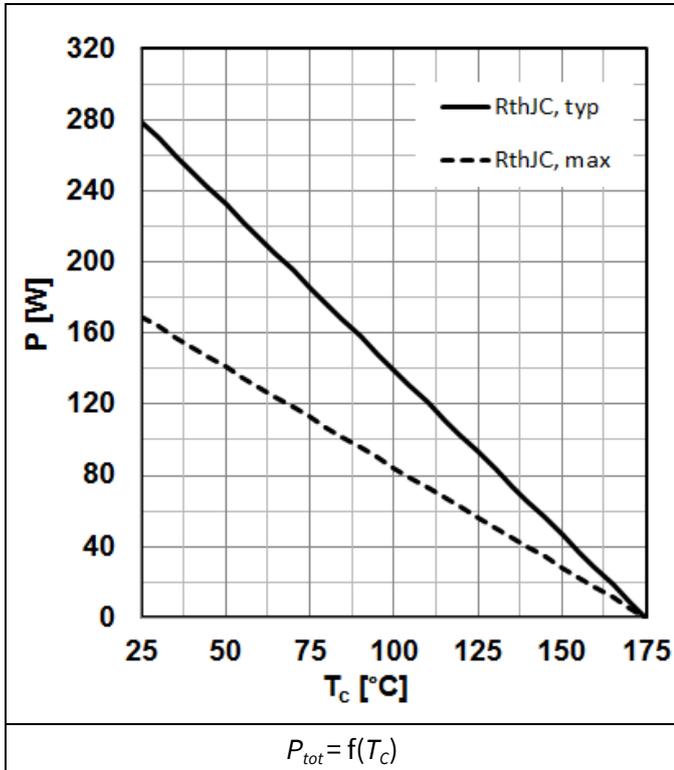
Figure 1   Power dissipation

$I_F = f(T_C)$; $R_{thJC,max}$; $T_j \le 175\ °C$; parameter: $D = t_P/T$
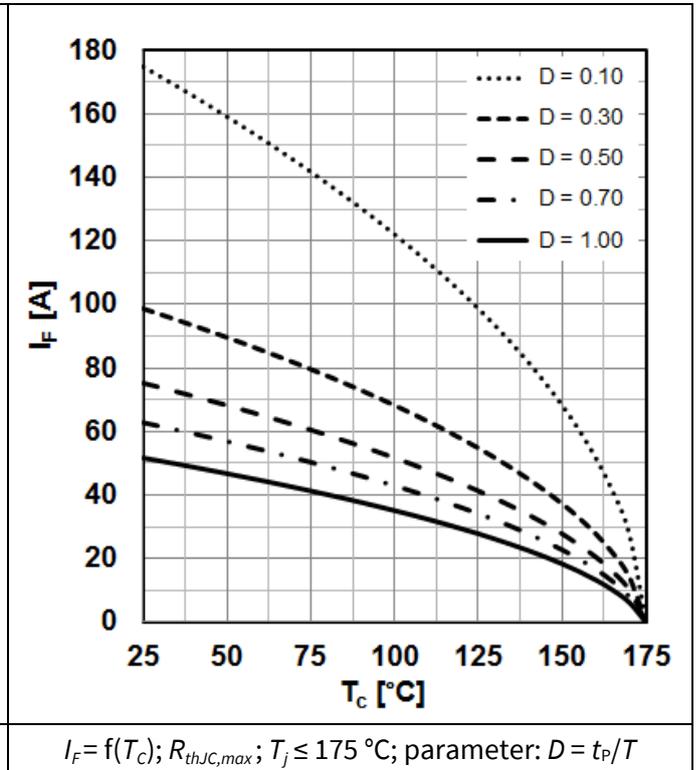
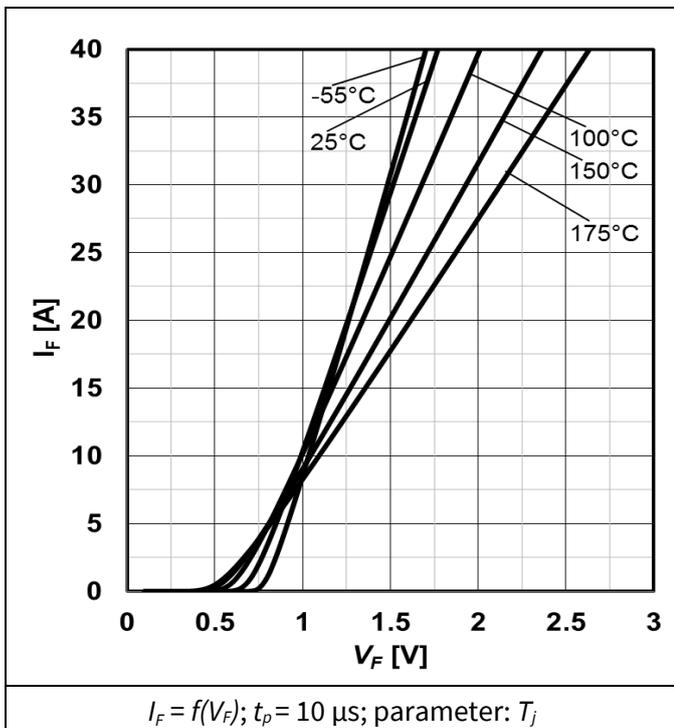Figure 2   Max. forward current

$I_F = f(V_F)$; $t_p = 10\ \mu s$; parameter: T_j

Figure 3   Typ. forward characteristics
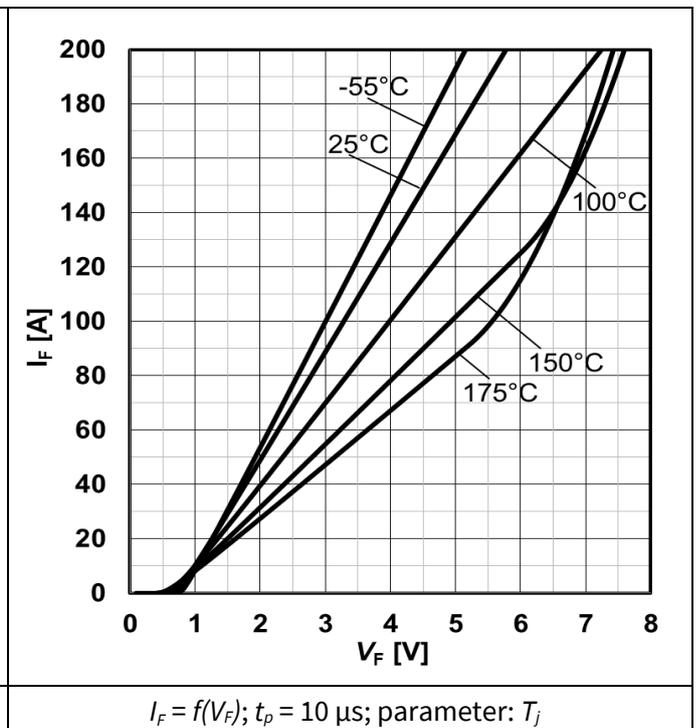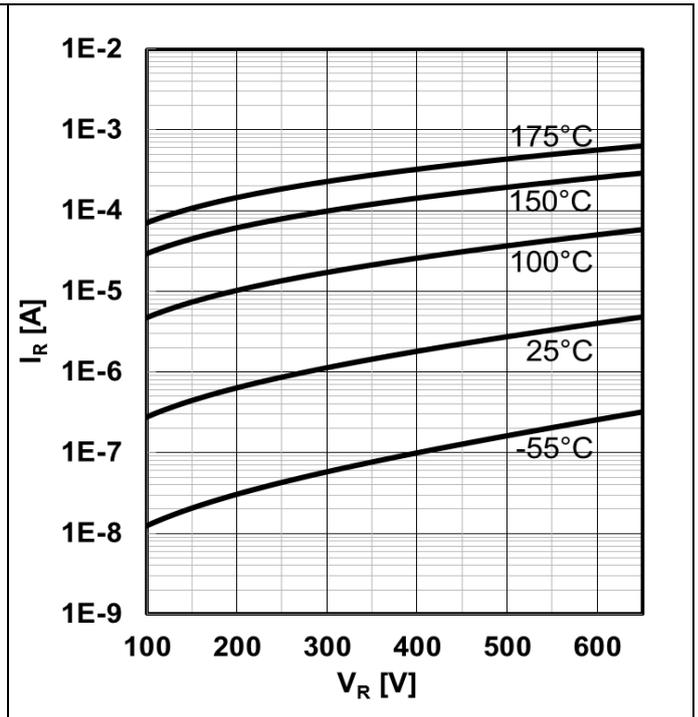
$I_F = f(V_F)$; $t_p = 10\ \mu s$; parameter: T_j

Figure 4   Typ. forward characteristics
in surge current
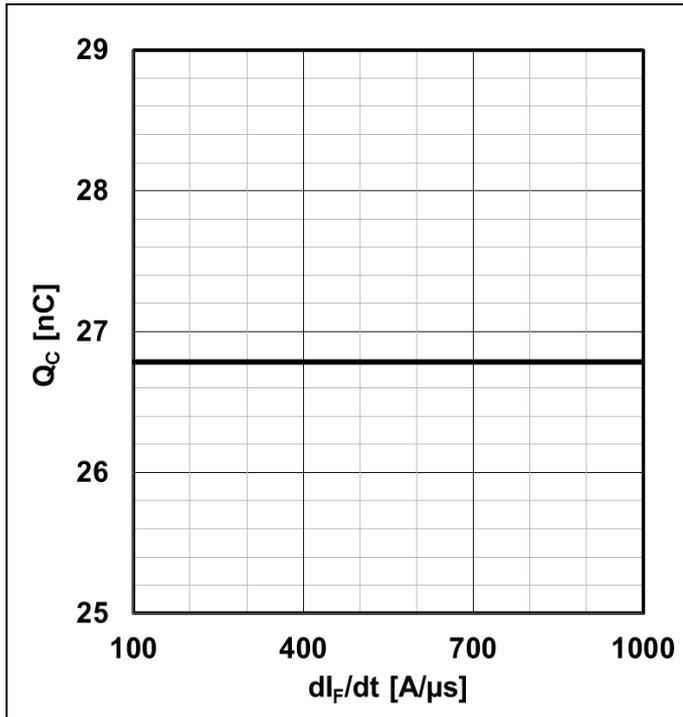
$Q_C = f(di_F/dt)$; $T_j = 150\ °C$; $V_R = 400\ V$; $I_F \leq I_{F,max}$

Figure 5   Typ. cap. charge vs. current slope

$I_R = f(V_R)$; parameter: T_j

Figure 6   Typ. reverse current vs. reverse voltage
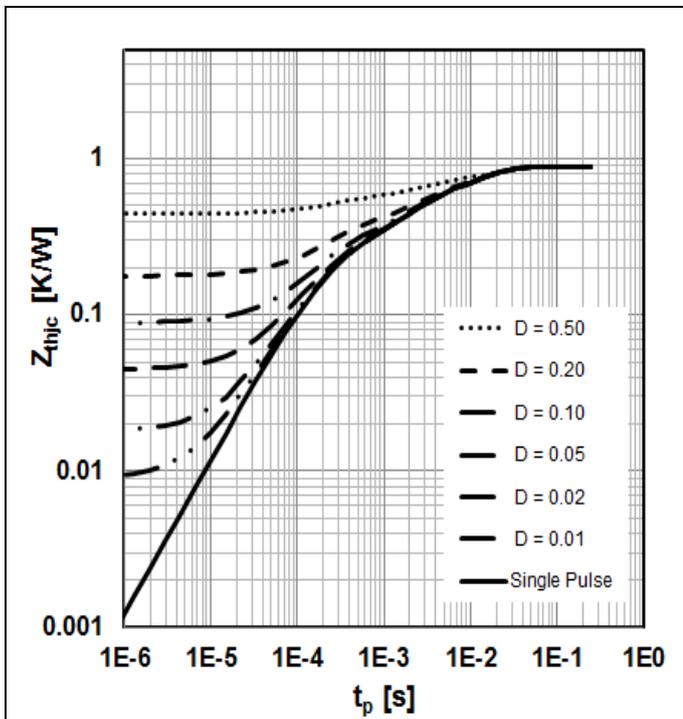
$Z_{th,jc} = f(t_P)$; parameter: $D = t_P/T$

Figure 7   Max. transient thermal
impedance
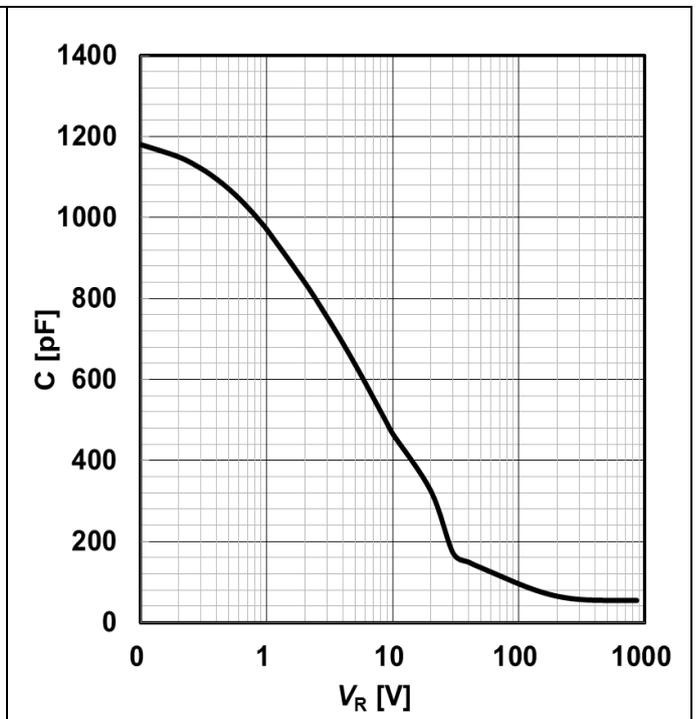
$C = f(V_R)$; $T_j = 25\ °C$; $f = 1\ MHz$
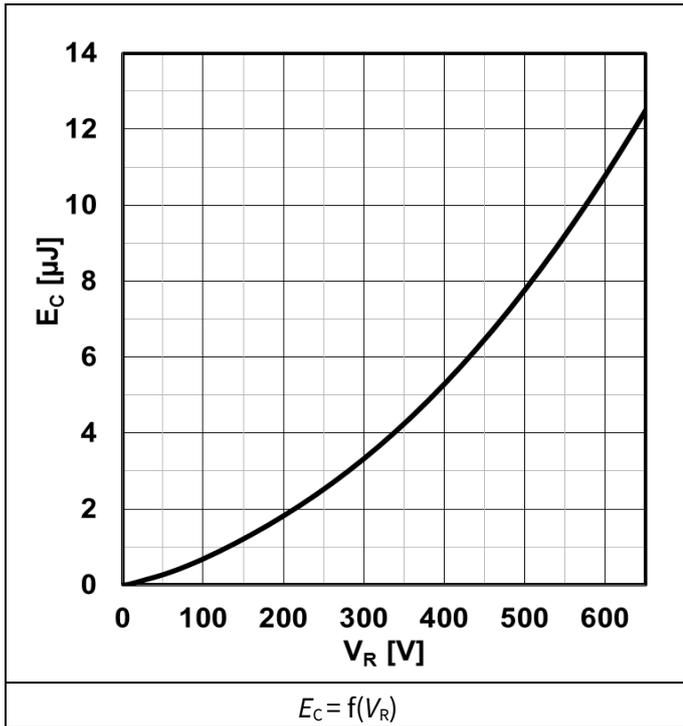
Figure 8   Typ. capacitance vs. reverse voltage

$$E_C = f(V_R)$$

Figure 9   Typ. capacitance stored energy

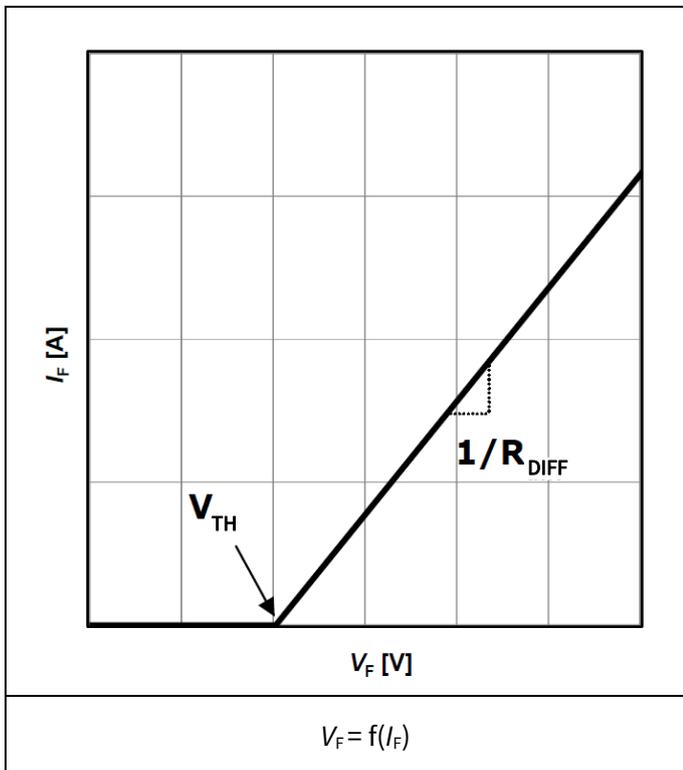# 5   Simplified forward characteristic

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

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

Differential resistance (R_{DIFF}):
$$R_{DIFF}(T_j) = A \times T_j^2 + B \times T_j + C \ [\Omega]$$
$$A = 6.19 \times 10^{-7}$$
$$B = 4.50 \times 10^{-5}$$
$$C = 2.38 \times 10^{-2}$$

$V_F = f(I_F)$	T_j [°C]; -55 °C ≤ T_j ≤ 175 °C; I_F ≤ 20 A

Figure 10   Equivalent forward current curve   Figure 11   Mathematical Equation
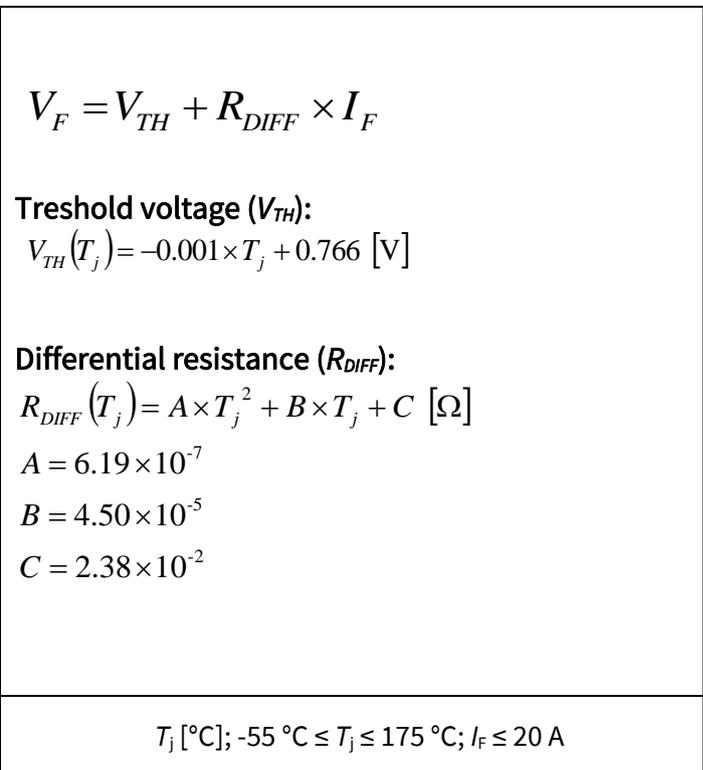
6   Package outlines

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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REVISION
01

SCALE 5:1

0 1 2 3 4 5mm

EUROPEAN PROJECTION

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

Revision History

IDDD20G65C6

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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