

6th Generation CoolSiC™

650V SiC Schottky Diode

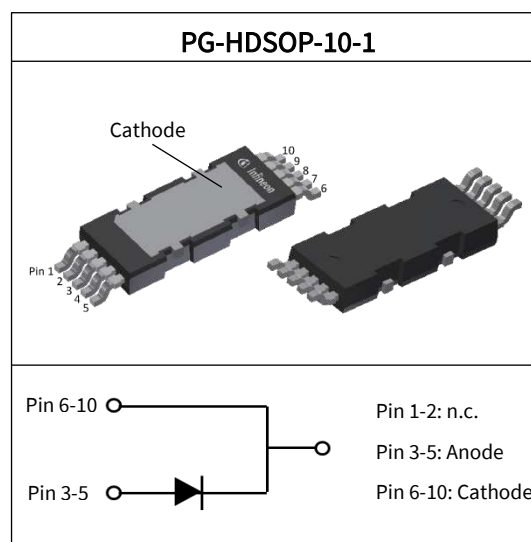
The CoolSiC™ generation 6 (G6) is the leading edge technology from Infineon for the SiC Schottky barrier diodes. The Infineon proprietary innovative G5 technology was enhanced in G6 by introducing further advancements like a novel Schottky metal system. The result is a family of products with improved efficiency over all load conditions, resulting from a lower figure of merit ($Q_C \times V_F$). 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)	17.1	nC
E_C ($V_R = 400$ V)	3.2	μJ
I_F ($T_C \leq 150$ °C, $D = 1$)	12	A
V_F ($I_F = 12$ A, $T_j = 25$ °C)	1.25	V

Table 2 Package information

Type / ordering Code	Package	Marking
IDDD12G65C6	PG-HDSOP-10-1	D1265C6



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	–	–	12	A	$T_C \leq 150\text{ °C}, D = 1$
		–	–	18		$T_C \leq 125\text{ °C}, D = 1$
		–	–	34		$T_C \leq 25\text{ °C}, D = 1$
Surge-repetitive forward current, sine halfwave ¹	$I_{F,RM}$	–	–	53		$T_C = 25\text{ °C}, t_p = 10\text{ ms}$
Surge non-repetitive forward current, sine halfwave	$I_{F,SM}$	–	–	64		$T_C = 25\text{ °C}, t_p = 10\text{ ms}$
		–	–	51		$T_C = 150\text{ °C}, t_p = 10\text{ ms}$
Non-repetitive peak forward current	$I_{F,max}$	–	–	630		$T_C = 25\text{ °C}, t_p = 10\text{ }\mu\text{s}$
i^2t value	$\int i^2 dt$	–	–	21	A ² s	$T_C = 25\text{ °C}, t_p = 10\text{ ms}$
		–	–	13		$T_C = 150\text{ °C}, t_p = 10\text{ ms}$
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}	–	–	120	W	$T_C = 25\text{ °C}, R_{thJC,max}$
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}	–	0.8	1.3	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 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

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	$T_j = 25\text{ °C}$
Diode forward voltage	V_F	–	1.25	1.35		$I_F = 12\text{ A}, T_j = 25\text{ °C}$
		–	1.5	–		$I_F = 12\text{ A}, T_j = 150\text{ °C}$
Reverse current	I_R	–	1.2	40	μA	$V_R = 420\text{ V}, T_j = 25\text{ °C}$
		–	40	–		$V_R = 420\text{ V}, T_j = 125\text{ °C}$
		–	92	–		$V_R = 420\text{ V}, T_j = 150\text{ °C}$

3.2 AC characteristics

Table 6 AC characteristics

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Total capacitive charge	Q_c	–	17.1	–	nC	$V_R = 400\text{ V}, T_j = 150\text{ °C},$ $di/dt = 200\text{ A}/\mu\text{s}, I_F \leq I_{F,MAX}$
Total capacitance	C	–	594	–	pF	$V_R = 1\text{ V}, f = 1\text{ MHz},$ $T_j = 25\text{ °C}$
		–	35	–		$V_R = 300\text{ V}, f = 1\text{ MHz},$ $T_j = 25\text{ °C}$
		–	34	–		$V_R = 600\text{ V}, f = 1\text{ MHz},$ $T_j = 25\text{ °C}$

4 Diagrams

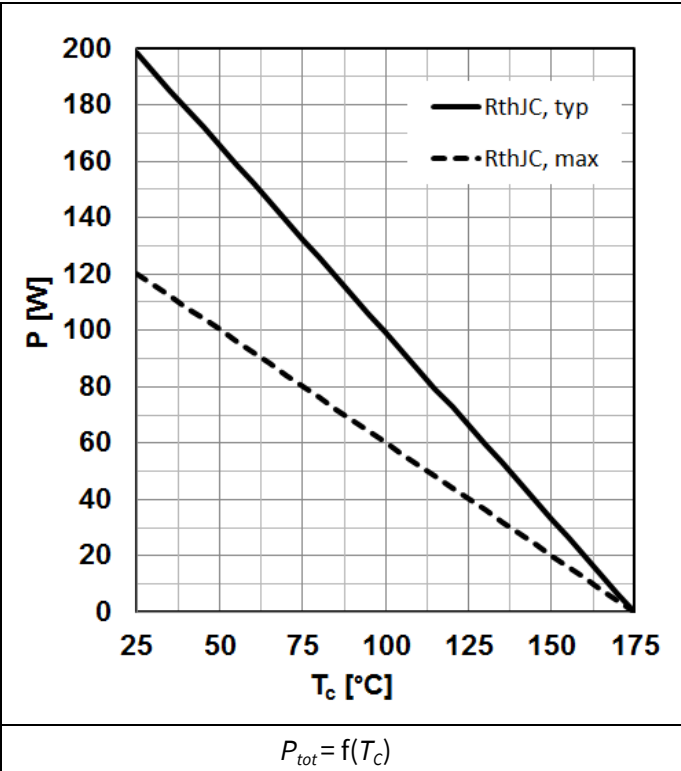


Figure 1 Power dissipation

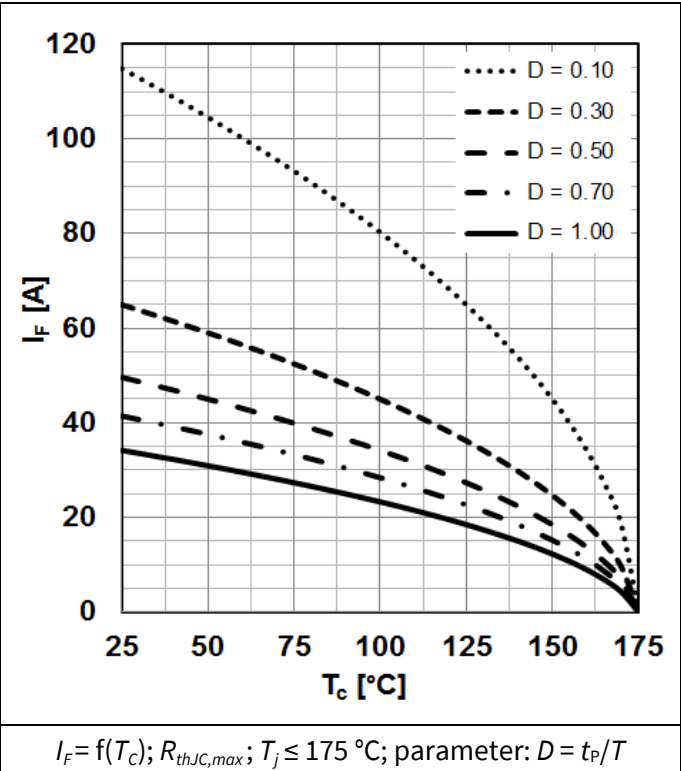


Figure 2 Max. forward current

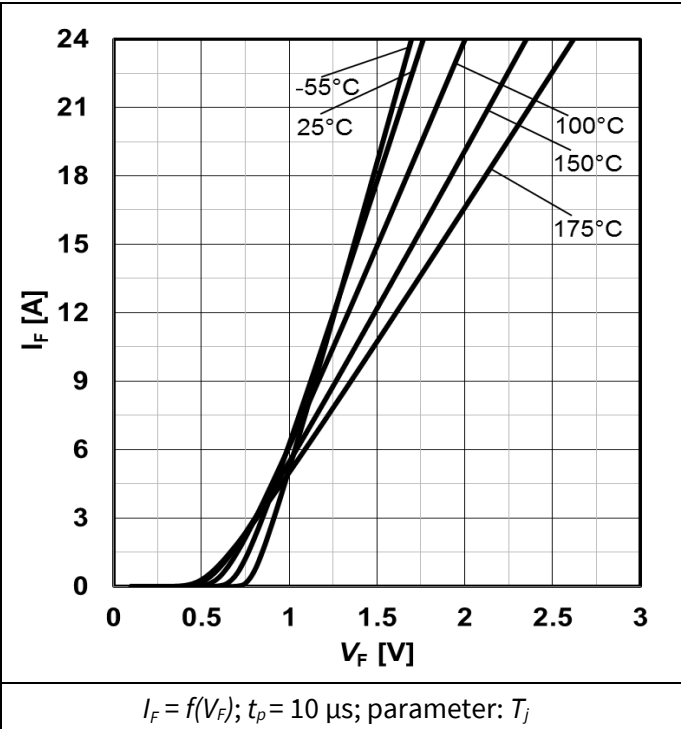


Figure 3 Typ. forward characteristics

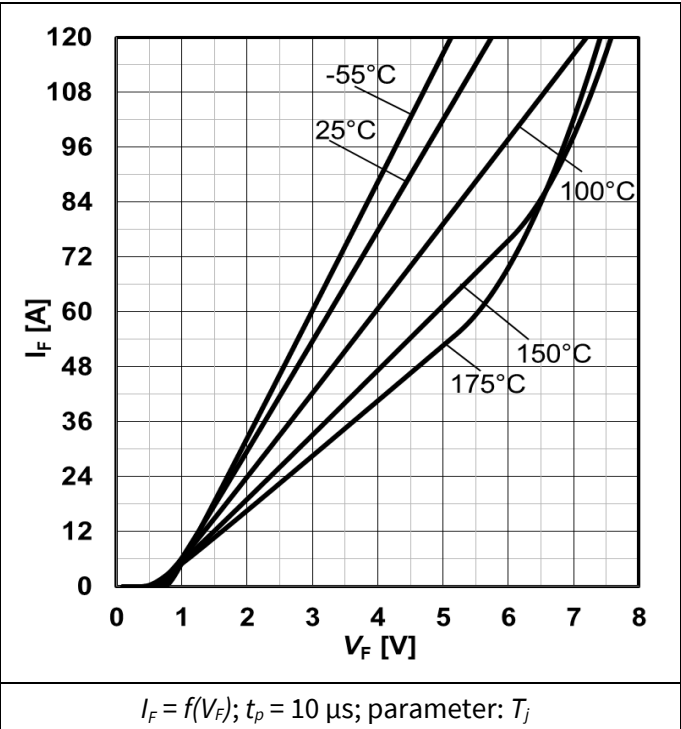
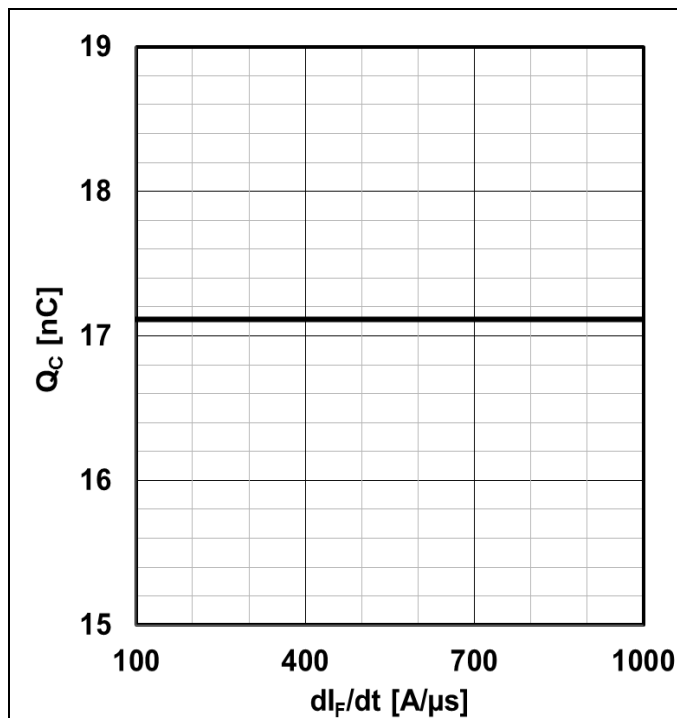
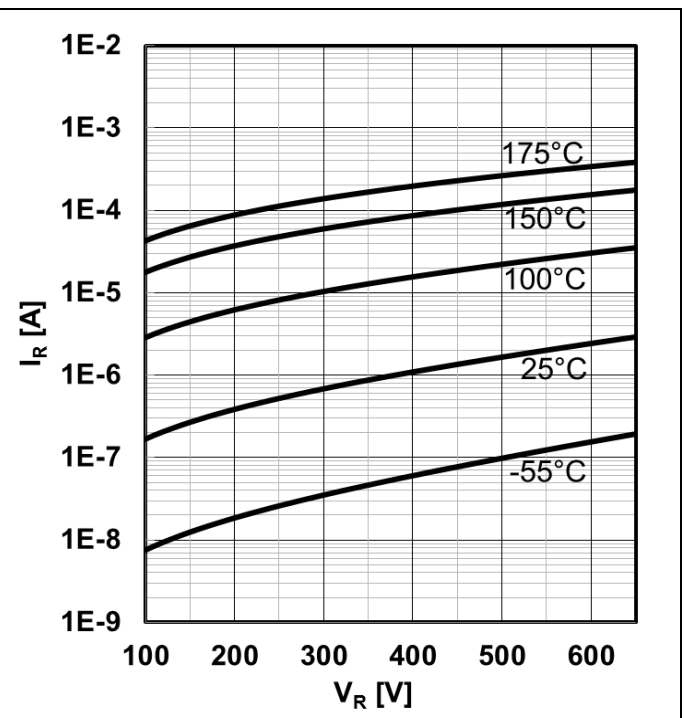


Figure 4 Typ. forward characteristics
in surge current



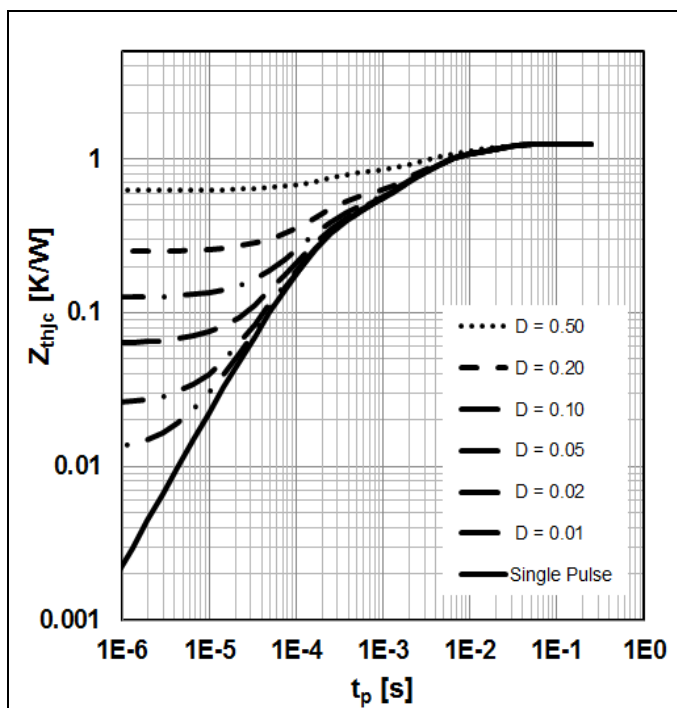
$$Q_C = f(di_F/dt); T_j = 150\text{ °C}; V_R = 400\text{ V}; I_F \leq I_{F,max}$$

Figure 5 Typ. cap. charge vs. current slope



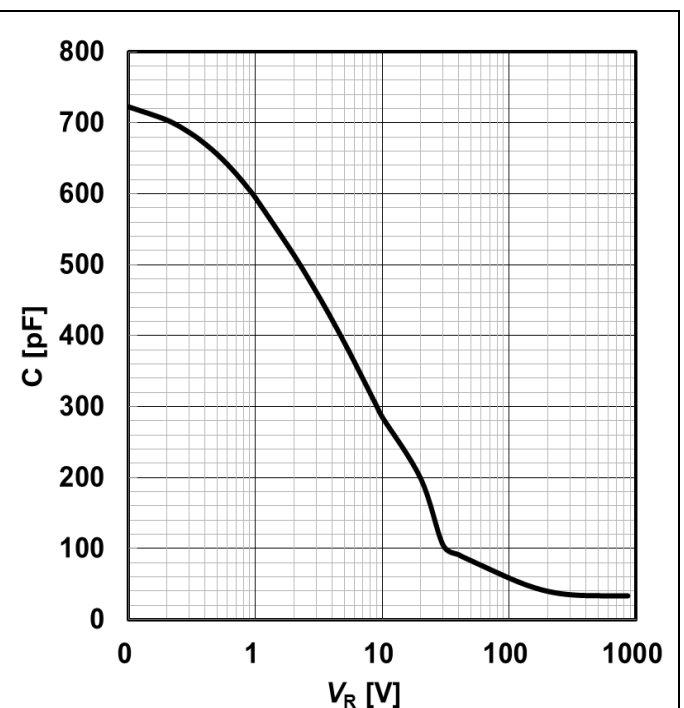
$$I_R = f(V_R); \text{parameter: } T_j$$

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



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

Figure 8 Typ. capacitance vs. reverse voltage

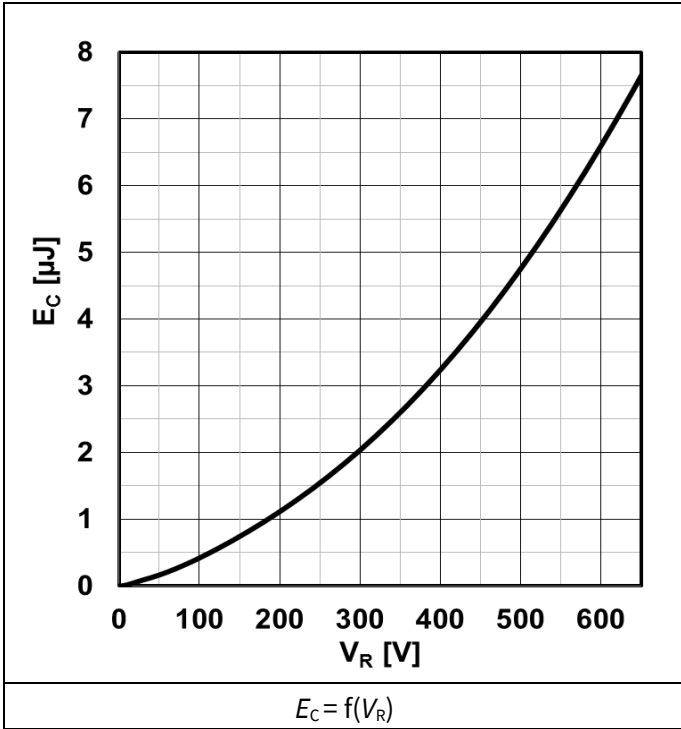


Figure 9 Typ. capacitance stored energy

5 Simplified forward characteristic

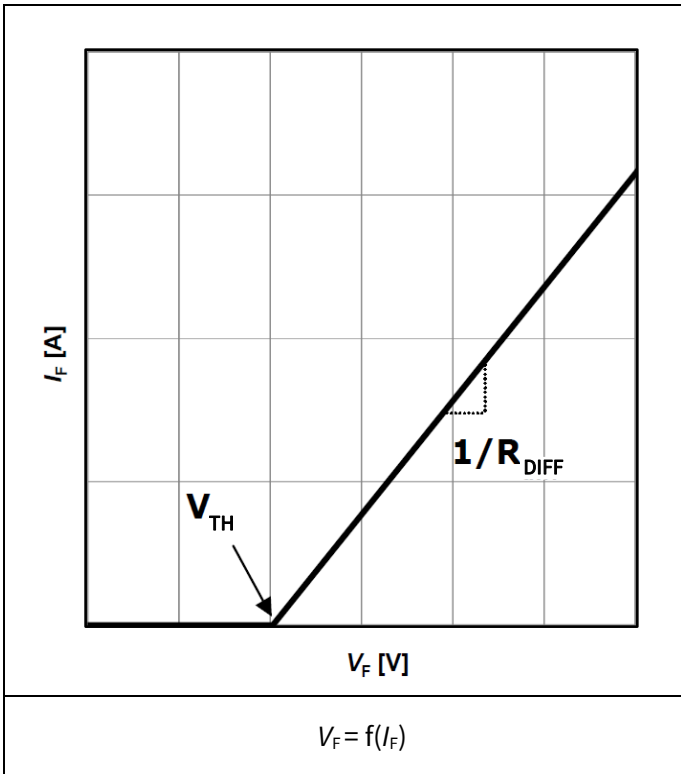


Figure 10 Equivalent forward current curve

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

Threshold voltage (V_{TH}):

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

Differential resistance (R_{DIFF}):

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

$$A = 1.03 \times 10^{-6}$$

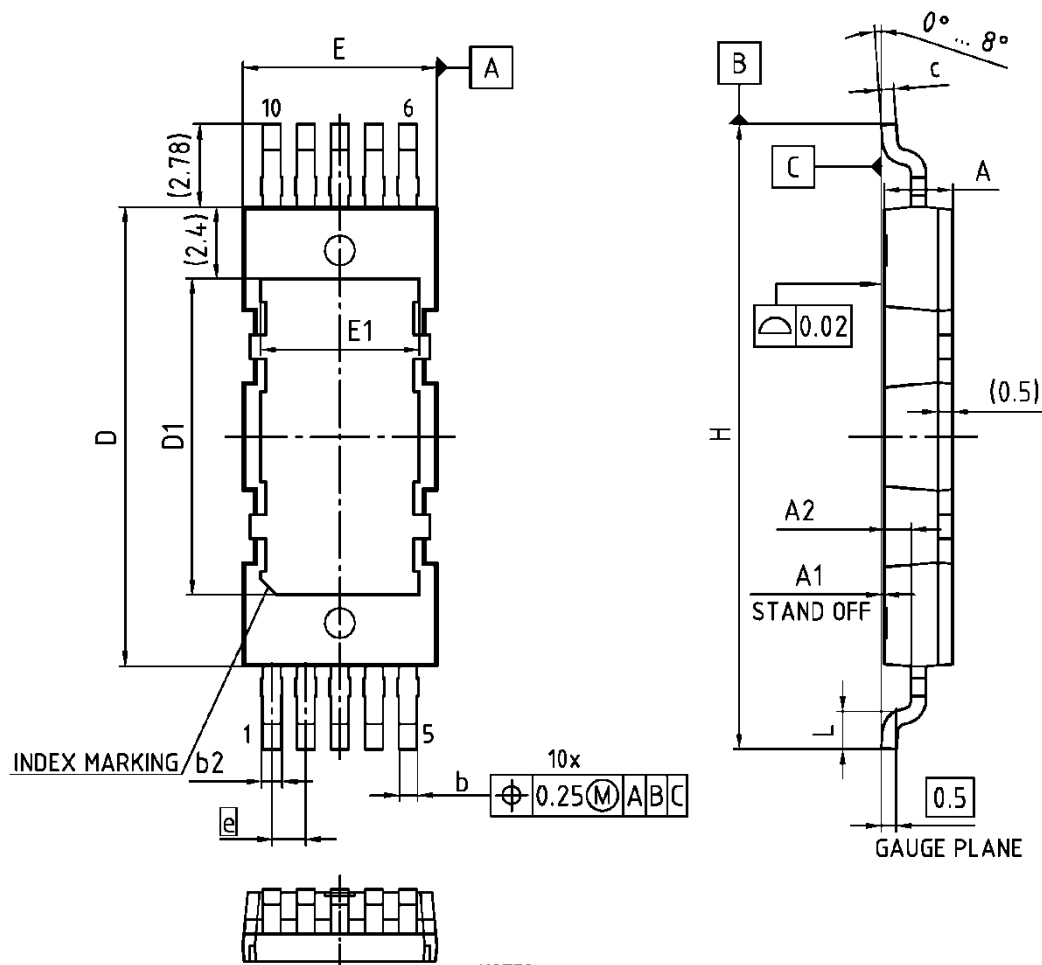
$$B = 7.45 \times 10^{-5}$$

$$C = 3.93 \times 10^{-2}$$

$$T_j \text{ [}^\circ\text{C]}; -55 \text{ }^\circ\text{C} \leq T_j \leq 175 \text{ }^\circ\text{C}; I_F \leq 12 \text{ A}$$

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 SURFACES 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

DOCUMENT NO. 78B00184263
REVISION 01
SCALE 5:1 0 1 2 3 4 5mm
EUROPEAN PROJECTION
ISSUE DATE 06.02.2017

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

Revision History

IDDD12G65C6

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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Published by

Infineon Technologies AG

81726 München, Germany

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