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SiC

Silicon Carbide Diode

5th Generation thinQ!TM

650V SiC Schottky Diode

IDH04G65C5

Final Datasheet

Rev. 2.2, 2012-12-10

Power Management & Multimarket

5th Generation thinQ!TM SiC Schottky Diode

IDH04G65C5

1 Description

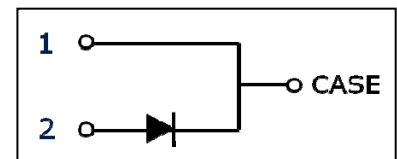
ThinQ!TM Generation 5 represents Infineon leading edge technology for the SiC Schottky Barrier diodes. The Infineon proprietary diffusion soldering process, already introduced with G3 is now combined with a new, more compact design and thin-wafer technology. The result is a new family of products showing improved efficiency over all load conditions, resulting from both the improved thermal characteristics and a lower figure of merit ($Q_c \times V_f$).

The new thinQ!TM Generation 5 has been designed to complement our 650V CoolMOSTM families: this ensures meeting the most stringent application requirements in this voltage range.



Features

- Revolutionary semiconductor material - Silicon Carbide
- Benchmark switching behavior
- No reverse recovery/ No forward recovery
- Temperature independent switching behavior
- High surge current capability
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC¹⁾ for target applications
- Breakdown voltage tested at 9 mA²⁾
- Optimized for high temperature operation



Benefits

- System efficiency improvement over Si diodes
- System cost / size savings due to reduced cooling requirements
- Enabling higher frequency / increased power density solutions
- Higher system reliability due to lower operating temperatures
- Reduced EMI

Applications

- Switch mode power supply
- Power factor correction
- Solar inverter
- Uninterruptible power supply



Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DC}	650	V
$Q_C; V_R=400V$	7	nC
$E_C; V_R=400V$	1.4	μJ
$I_F @ T_C < 150^\circ C$	4	A

Table 2 Pin Definition

Pin 1	Pin 2	Pin 3
C	A	n.a.

Type / ordering Code	Package	Marking	Related links
IDH04G65C5	PG-TO220-2	D0465C5	www.infineon.com/sic

1) J-STD20 and JESD22

2) All devices tested under avalanche conditions for a time periode of 10ms

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2 Maximum ratings

Table 3 Maximum ratings

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Continuous forward current	I_F	–	–	4	A	$T_C < 150^\circ\text{C}$, $D=1$
Surge non-repetitive forward current, sine halfwave	$I_{F,SM}$	–	–	38		$T_C = 25^\circ\text{C}$, $t_p=10$ ms
		–	–	35		$T_C = 150^\circ\text{C}$, $t_p=10$ ms
Non-repetitive peak forward current	$I_{F,max}$	–	–	215		$T_C = 25^\circ\text{C}$, $t_p=10$ μs
i^2t value	$\int i^2 dt$	–	–	7.3	A ² s	$T_C = 25^\circ\text{C}$, $t_p=10$ ms
		–	–	6.1		$T_C = 150^\circ\text{C}$, $t_p=10$ ms
Repetitive peak reverse voltage	V_{RRM}	–	–	650	V	$T_j = 25^\circ\text{C}$
Diode dv/dt ruggedness	dv/dt	–	–	100	V/ns	$V_R=0..480$ V
Power dissipation	P_{tot}	–	–	48	W	$T_C = 25^\circ\text{C}$
Operating and storage temperature	$T_j; T_{stg}$	-55	–	175	°C	
Mounting torque		–	–	70	Ncm	M3 screws

3 Thermal characteristics

Table 4 Thermal characteristics TO-220-2

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction-case	R_{thJC}	–	1.9	3.1	K/W	leaded
Thermal resistance, junction-ambient	R_{thJA}	–	–	62		
Soldering temperature, wavesoldering only allowed at leads	T_{sold}	–	–	260	°C	1.6mm (0.063 in.) from case for 10 s

4 Electrical characteristics

Table 5 Static characteristics

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
DC blocking voltage	V_{DC}	650	–	–	V	$I_R = 0.07 \text{ mA}, T_j = 25^\circ\text{C}$
Diode forward voltage	V_F	–	1.5	1.7		$I_F = 4 \text{ A}, T_j = 25^\circ\text{C}$
		–	1.8	2.1		$I_F = 4 \text{ A}, T_j = 150^\circ\text{C}$
Reverse current	I_R	–	0.2	70	μA	$V_R = 650 \text{ V}, T_j = 25^\circ\text{C}$
		–	0.05	24		$V_R = 600 \text{ V}, T_j = 25^\circ\text{C}$
		–	0.8	500		$V_R = 650 \text{ V}, T_j = 150^\circ\text{C}$

Table 6 AC characteristics

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Total capacitive charge	Q_c	–	7	–	nC	$V_R = 400 \text{ V}, di/dt = 200 \text{ A}/\mu\text{s}, I_F \leq I_{F,MAX}, T_j = 150^\circ\text{C}$
Total Capacitance	C	–	130	–	pF	$V_R = 1 \text{ V}, f = 1 \text{ MHz}$
		–	17	–		$V_R = 300 \text{ V}, f = 1 \text{ MHz}$
		–	16	–		$V_R = 600 \text{ V}, f = 1 \text{ MHz}$

5 Electrical characteristics diagrams

Table 7

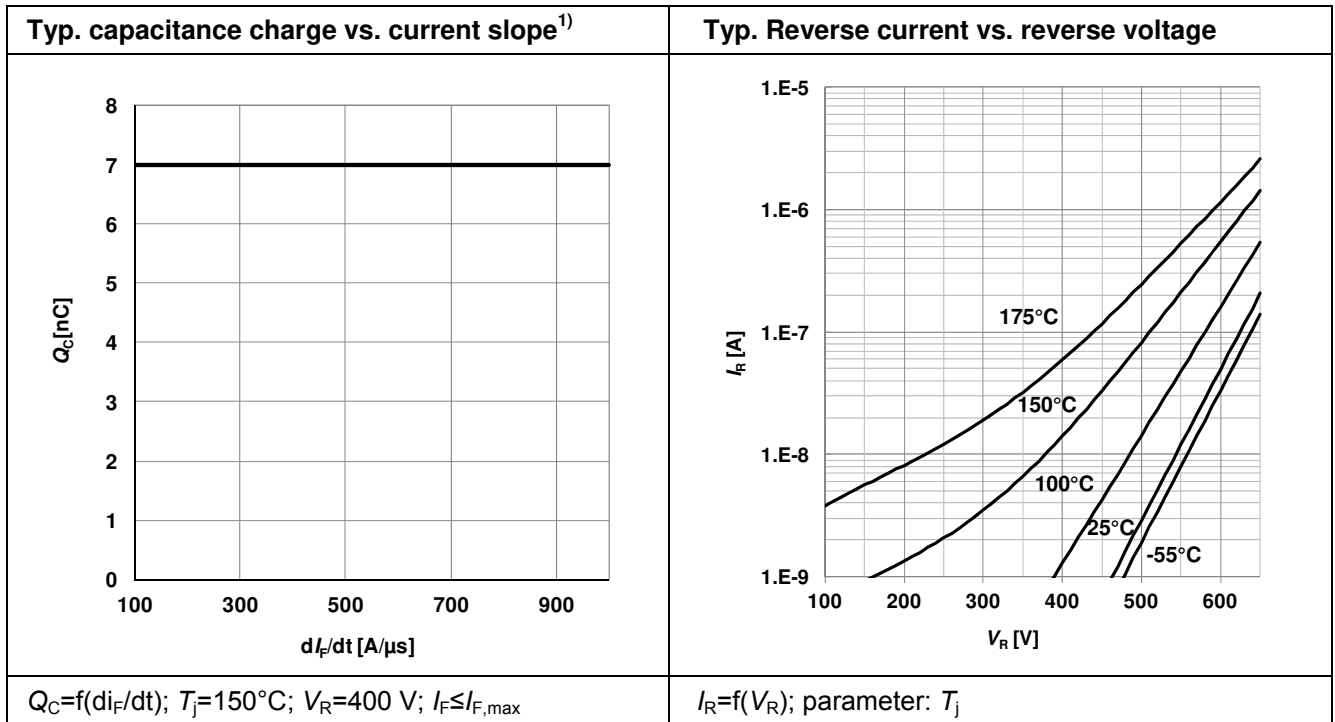
Power dissipation	Maximal diode forward current
$P_{tot}=f(T_C); R_{thJC,max}$	$I_F=f(T_C); R_{thJC,max}; T_j \leq 175^\circ\text{C}; \text{parameter } D=\text{duty cycle}$

Table 8

Typical forward characteristics	Typical forward characteristics in surge current
$I_F=f(V_F); t_p=200 \mu\text{s}; \text{parameter: } T_j$	$I_F=f(V_F); t_p=200 \mu\text{s}; \text{parameter: } T_j$

Electrical characteristics diagrams

Table 9



1) Only capacitive charge, guaranteed by design.

Table 10

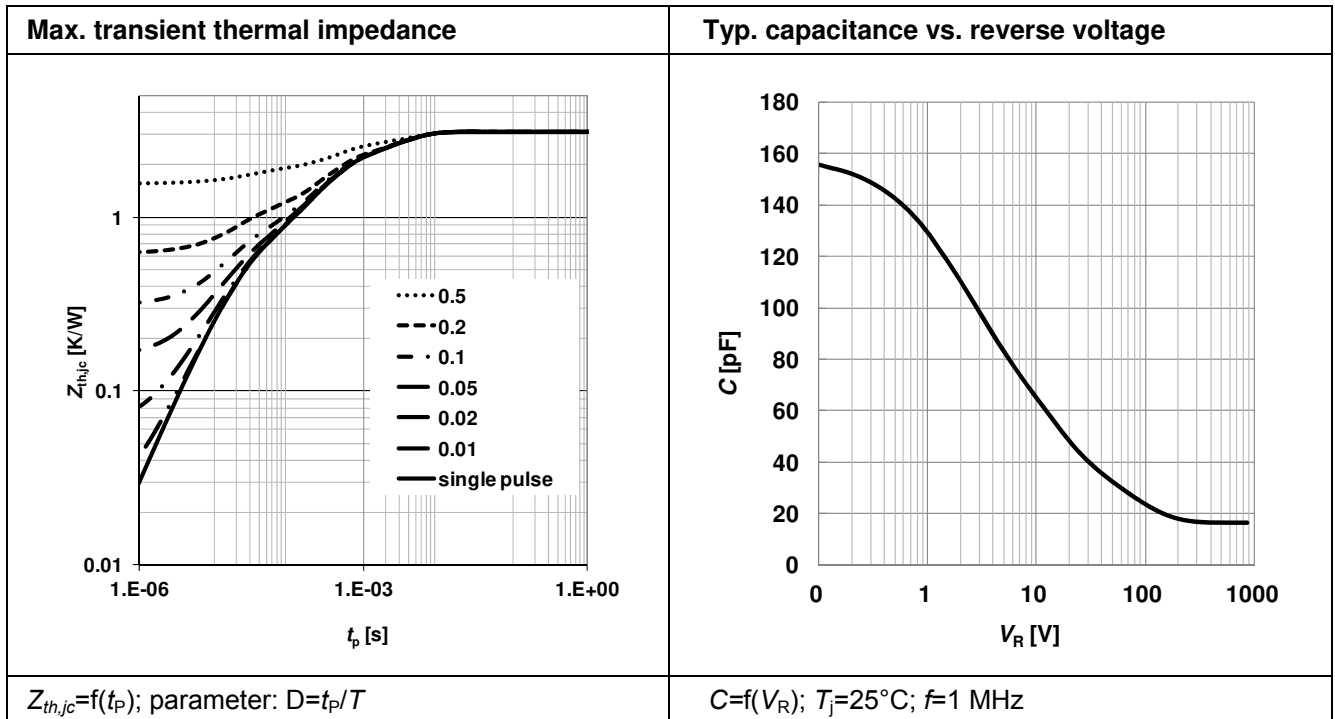
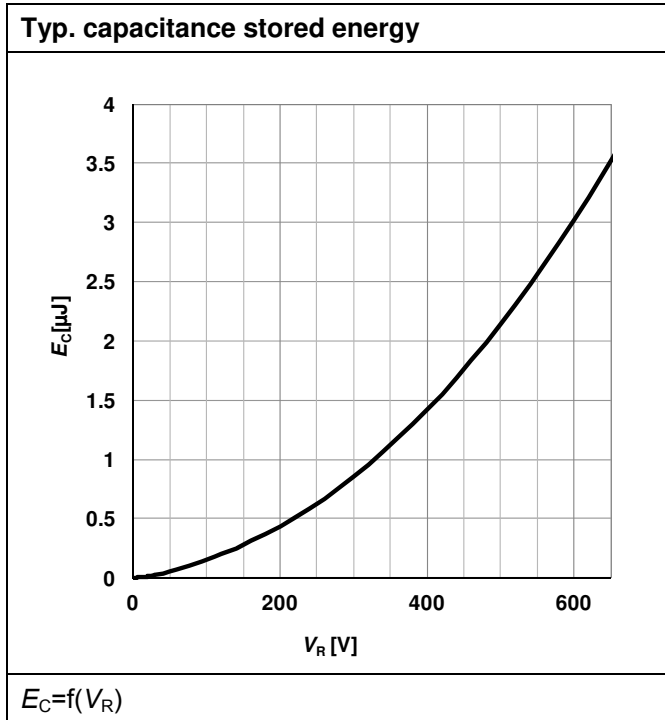


Table 11



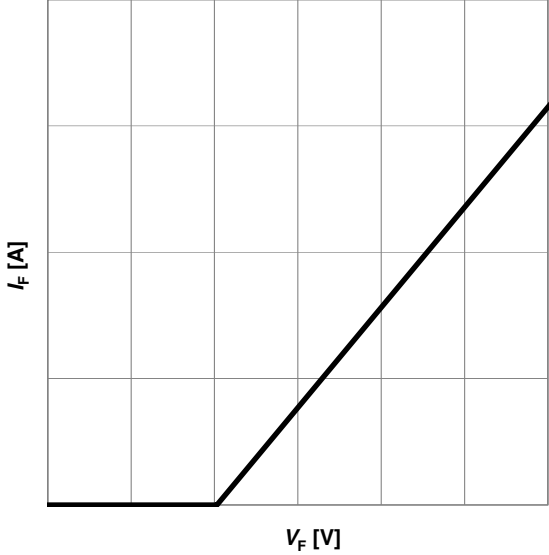
6 Simplified Forward Characteristics Model

Table 12

Equivalent forward current curve	Mathematical Equation
<p style="text-align: center;">$V_F = f(I_F)$</p>	$V_F = V_{TH} + R_{DIFF} \cdot I_F$ $V_{TH}(T_j) = -0.001 \cdot T_j + 1.04 \text{ [V]}$ $R_{DIFF}(T_j) = 3.21 \cdot 10^{-6} \cdot T_j^2 + 3.21 \cdot 10^{-4} \cdot T_j + 0.116 \text{ [\Omega]}$
	T_j in °C; $-55^\circ\text{C} < T_j < 175^\circ\text{C}$; $I_F < 8 \text{ A}$

9 Simplified Forward Characteristics Model

Table 12

Equivalent forward current curve	Mathematical Equation
 <p>The graph shows a coordinate system with a grid. The vertical axis is labeled I_F [A] and the horizontal axis is labeled V_F [V]. The curve starts at a constant voltage value for a range of current, then increases linearly with current.</p>	
$V_F = f(I_F)$	T_j in °C; $-55^\circ\text{C} < T_j < 175^\circ\text{C}$; $I_F < 8$ A

Package outlines

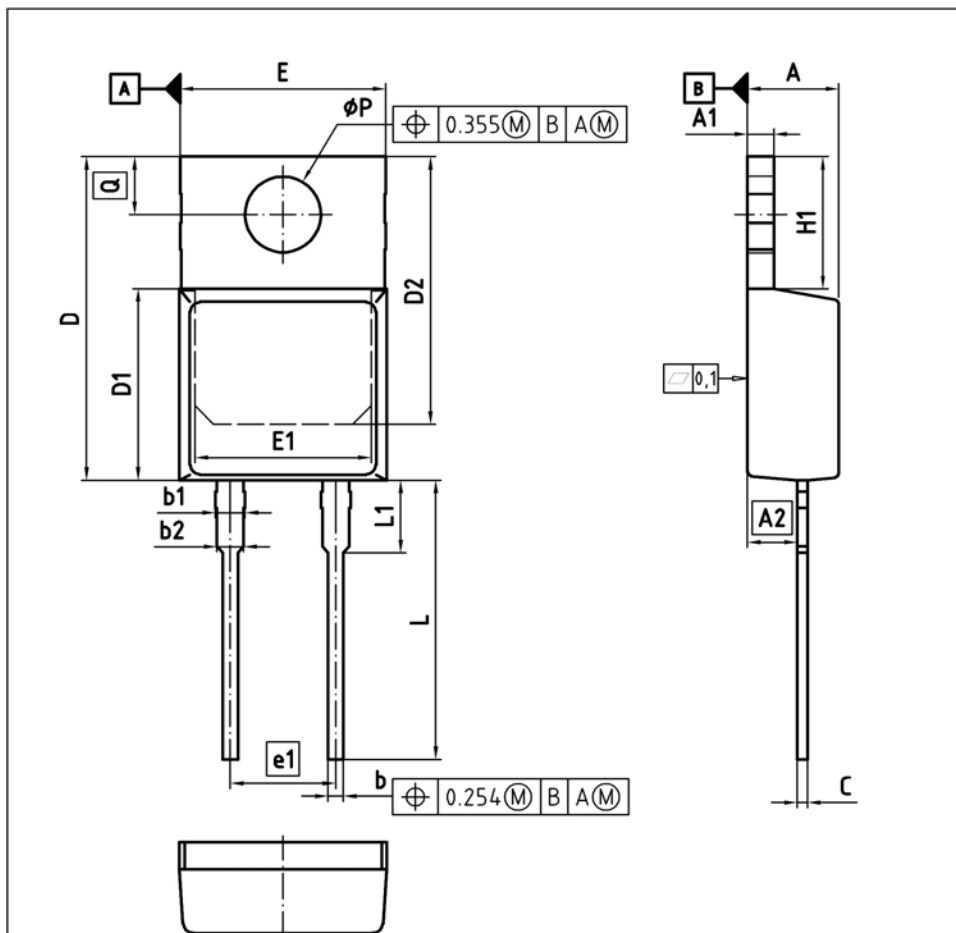
7 Package outlines

9 Simplified Forward Characteristics Model

Table 12

Equivalent forward current curve	Mathematical Equation
$V_F = f(I_F)$	T_j in °C; $-55^\circ\text{C} < T_j < 175^\circ\text{C}$; $I_F < 8\text{ A}$

Package outlines



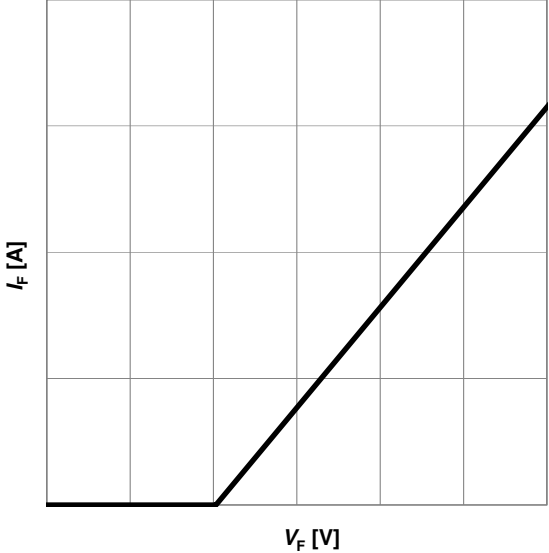
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.50	0.169	0.177
A1	1.17	1.37	0.046	0.054
A2	2.30	2.50	0.091	0.098
b	0.65	0.85	0.026	0.033
b1	1.19	1.69	0.047	0.066

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9 Simplified Forward Characteristics Model

Table 12

Equivalent forward current curve	Mathematical Equation
 <p>The graph shows a coordinate system with a grid. The vertical axis is labeled I_F [A] and the horizontal axis is labeled V_F [V]. The curve starts at a constant voltage value for a range of current, then increases linearly with current.</p>	
$V_F = f(I_F)$	T_j in °C; $-55^\circ\text{C} < T_j < 175^\circ\text{C}$; $I_F < 8$ A

Package outlines

Figure 1 Outlines TO-220, dimensions in mm/inches

8 Revision History

5th Generation thinQ!TM SiC Schottky Diode

Revision History: 2012-12-10, Rev. 2.2

Previous Revision:

Revision	Subjects (major changes since last version)
2.0	Release of the final datasheet.
2.1	Reverse current values, maximum diode forward voltage.
2.2	Reverse current values, tested avalanche current, simplified calculation model

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