

SiC

Silicon Carbide Diode

5th Generation thinQ!TM

650V SiC Schottky Diode

IDK03G65C5

Final Data Sheet

Rev. 2.0, 2013-07-20

Power Management & Multimarket

5th Generation thinQ!™ SiC Schottky Diode

1 Description

ThinQ!™ 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!™ Generation 5 has been designed to complement our 650V CoolMOS™ 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 6.8 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

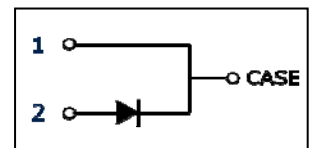
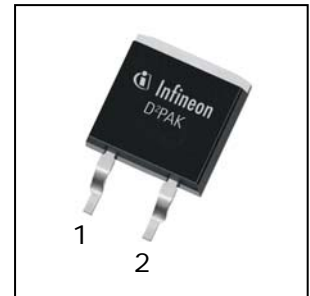
Parameter	Value	Unit
V_{DC}	650	V
$Q_C; V_R=400V$	5	nC
$E_C; V_R=400V$	1.1	μJ
$I_F @ T_C < 155^\circ C$	3	A

Table 2 Pin Definition

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

Type / ordering Code	Package	Marking	Related links
IDK03G65C5	PG-TO263-2	D0365C5	www.infineon.com/sic

IDK03G65C5



1) J-STD20 and JESD22

2) All devices tested under avalanche conditions for a time period 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	–	–	3	A	$T_C < 155^\circ\text{C}$, $D=1$
Surge non-repetitive forward current, sine halfwave	$I_{F,SM}$	–	–	31		$T_C = 25^\circ\text{C}$, $t_p=10$ ms
		–	–	29		$T_C = 150^\circ\text{C}$, $t_p=10$ ms
Non-repetitive peak forward current	$I_{F,max}$	–	–	178		$T_C = 25^\circ\text{C}$, $t_p=10$ μs
i^2t value	$\int i^2 dt$	–	–	4.7	A ² s	$T_C = 25^\circ\text{C}$, $t_p=10$ ms
		–	–	4.2		$T_C = 150^\circ\text{C}$, $t_p=10$ 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}	–	–	42	W	$T_C = 25^\circ\text{C}$
Operating and storage temperature	$T_j; T_{stg}$	-55	–	175	$^\circ\text{C}$	

3 Thermal characteristics

Table 4 Thermal characteristics TO-263-2

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction-case	R_{thJC}	–	2.2	3.6	K/W	
Thermal resistance, junction-ambient ¹⁾	R_{thJA}	–	–	62		SMD version, device on PCB, minimal footprint
			35			SMD version, device on PCB, 6cm ² cooling area

1) Device on 40mm*40mm*1.5mm one layer epoxy PCB FR4 with 6cm² copper area (thickness 70 μm) for drain connection, PCB is vertical without air stream cooling.

4 Electrical characteristics

Table 5 Static characteristics

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
DC blocking voltage	V_{DC}	650	–	–	V	$I_R = 0.5 \text{ mA}, T_j = 25^\circ\text{C}$
Diode forward voltage	V_F	–	1.5	1.8		$I_F = 3 \text{ A}, T_j = 25^\circ\text{C}$
		–	1.8	2.2		$I_F = 3 \text{ A}, T_j = 150^\circ\text{C}$
Reverse current	I_R	–	0.15	500	μA	$V_R = 650 \text{ V}, T_j = 25^\circ\text{C}$
		–	0.03	130		$V_R = 600 \text{ V}, T_j = 25^\circ\text{C}$
		–	0.6	1900		$V_R = 650 \text{ V}, T_j = 150^\circ\text{C}$

Table 6 AC characteristics

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Total capacitive charge	Q_c	–	5	–	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	–	100	–	pF	$V_R = 1 \text{ V}, f = 1 \text{ MHz}$
		–	13.0	–		$V_R = 300 \text{ V}, f = 1 \text{ MHz}$
		–	12.8	–		$V_R = 600 \text{ V}, f = 1 \text{ MHz}$

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

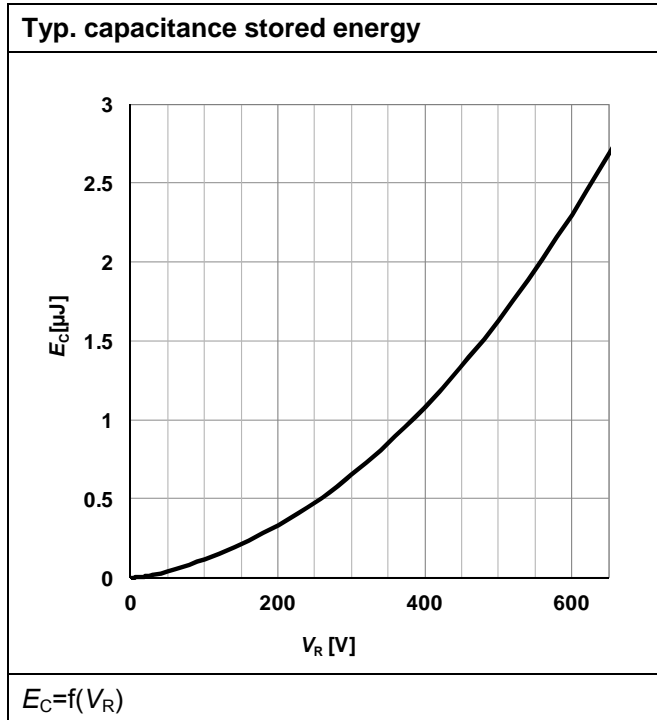
Typ. capacitance charge vs. current slope ¹⁾	Typ. reverse current vs. reverse voltage
$Q_C=f(dI_F/dt); T_j=150^{\circ}\text{C}; V_R=400\text{ V}; I_F\leq I_{F,max}$	$I_R=f(V_R); \text{parameter: } T_j;$

1) Only capacitive charge, guaranteed by design.

Table 10

Max. transient thermal impedance	Typ. capacitance vs. reverse voltage
$Z_{th,jc}=f(t_p); \text{parameter: } D=t_p/T;$	$C=f(V_R); T_j=25^{\circ}\text{C}; f=1\text{ MHz}$

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>	$V_F = V_{TH} + R_{DIFF} \cdot I_F$ $V_{TH}(T_j) = -0.001 \cdot T_j + 1.04 \text{ [V]}$ $R_{DIFF}(T_j) = 4.82 \cdot 10^{-6} \cdot T_j^2 + 4.82 \cdot 10^{-4} \cdot T_j + 0.174 \text{ [\Omega]}$
	T_j in °C; $-55^\circ\text{C} < T_j < 175^\circ\text{C}$; $I_F < 6 \text{ A}$

7 Package outlines

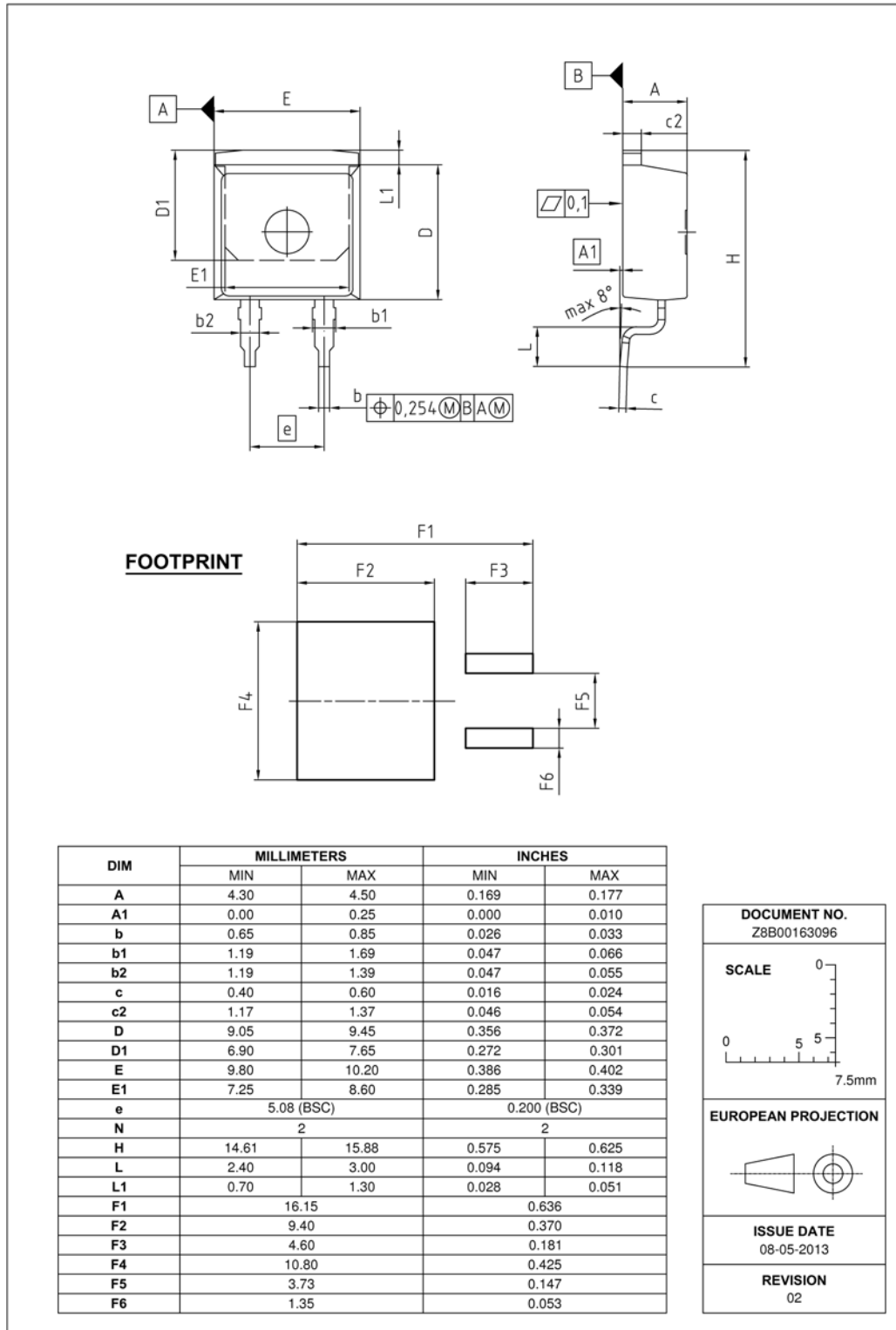


Figure 1 Outlines TO-220, dimensions in mm/inches

8 Revision History

5th. Generation thinQ!TM SiC Schottky Diode

Revision History: 2013-07-20, Rev. 2.0

Previous Revision:

Revision	Subjects (major changes since last version)
2.0	Release of final data sheet

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