

**SiC**

Silicon Carbide Diode

**5<sup>th</sup> Generation thinQ!<sup>TM</sup>**

650V SiC Schottky Diode

**IDK04G65C5**

**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 JEDEC<sup>1)</sup> for target applications
- Breakdown voltage tested at 9 mA<sup>2)</sup>
- 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**

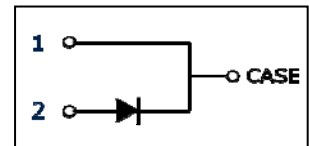
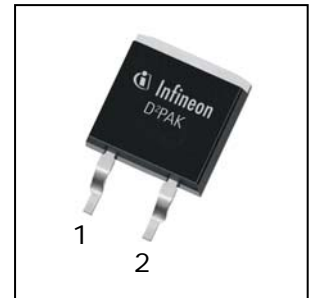
Parameter	Value	Unit
$V_{DC}$	650	V
$Q_C; V_R=400V$	7	nC
$E_C; V_R=400V$	1.4	μJ
$I_F @ T_C < 150^\circ C$	4	A

**Table 2 Pin Definition**

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

Type / ordering Code	Package	Marking	Related links
IDK04G65C5	PG-TO263-2	D0465C5	<a href="http://www.infineon.com/sic">www.infineon.com/sic</a>

### IDK04G65C5



1) J-STD20 and JESD22

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

## Table of Contents

1	Description.....	2
2	Maximum ratings.....	4
3	Thermal characteristics.....	4
4	Electrical characteristics.....	5
5	Electrical characteristics diagrams.....	6
6	Simplified Forward Characteristics Model .....	8
7	Package outlines.....	9
8	Revision History.....	10

## 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		$T_C = 25^\circ\text{C}$ , $t_p=10\text{ ms}$
		–	–	35		$T_C = 150^\circ\text{C}$ , $t_p=10\text{ ms}$
Non-repetitive peak forward current	$I_{F,max}$	–	–	215		$T_C = 25^\circ\text{C}$ , $t_p=10\text{ }\mu\text{s}$
$i^2t$ value	$\int i^2 dt$	–	–	7.3	A <sup>2</sup> s	$T_C = 25^\circ\text{C}$ , $t_p=10\text{ ms}$
		–	–	6.1		$T_C = 150^\circ\text{C}$ , $t_p=10\text{ ms}$
Repetitive peak reverse voltage	$V_{RRM}$	–	–	650	V	$T_j = 25^\circ\text{C}$
Diode dv/dt ruggedness	$dv/dt$	–	–	100	V/ns	$V_R=0..480\text{ V}$
Power dissipation	$P_{tot}$	–	–	48	W	$T_C = 25^\circ\text{C}$
Operating and storage temperature	$T_j; T_{stg}$	-55	–	175	°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	$R_{thJC}$	–	1.9	3.1	K/W	
Thermal resistance, junction-ambient <sup>1)</sup>	$R_{thJA}$	–	–	62		SMD version, device on PCB, minimal footprint
			35			SMD version, device on PCB, 6cm <sup>2</sup> cooling area

1) Device on 40mm\*40mm\*1.5mm one layer epoxy PCB FR4 with 6cm<sup>2</sup> copper area (thickness 70µm) 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	$I_R = 0.67 \text{ mA}, T_j = 25^\circ\text{C}$
Diode forward voltage	$V_F$	–	1.5	1.8		$I_F = 4 \text{ A}, T_j = 25^\circ\text{C}$
		–	1.8	2.2		$I_F = 4 \text{ A}, T_j = 150^\circ\text{C}$
Reverse current	$I_R$	–	0.2	670	$\mu\text{A}$	$V_R = 650 \text{ V}, T_j = 25^\circ\text{C}$
		–	0.05	180		$V_R = 600 \text{ V}, T_j = 25^\circ\text{C}$
		–	0.8	2600		$V_R = 650 \text{ V}, T_j = 150^\circ\text{C}$

**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

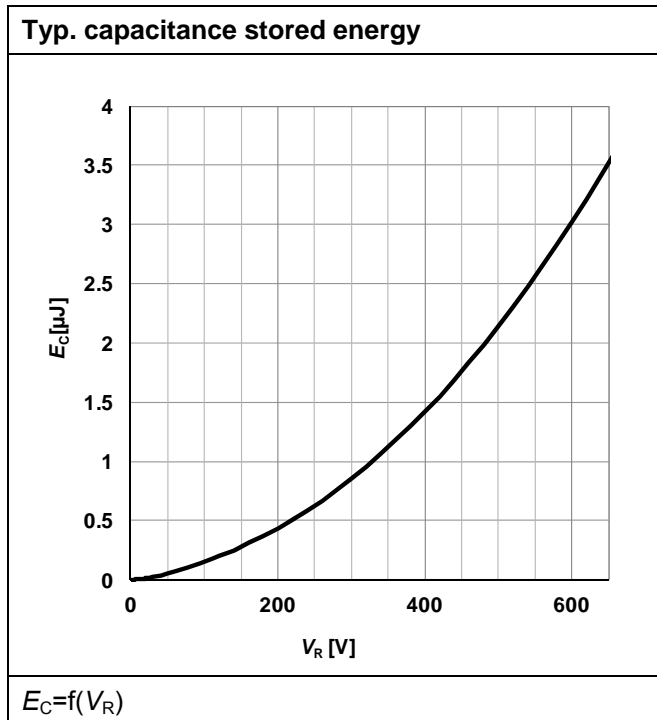
Typ. capacitance charge vs. current slope <sup>1)</sup>	Typ. Reverse current vs. reverse voltage
$Q_C=f(dI_F/dt); T_j=150^\circ\text{C}; V_R=400\text{ V}; I_F\leq I_{F,max}$	$I_R=f(V_R); \text{parameter: } T_j;$

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
	$V_F = V_{TH} + R_{DIFF} \cdot I_F$ $V_{TH}(T_j) = -0.001 \cdot T_j + 1.04 \text{ [V]}$ $R_{DIFF}(T_j) = 3.21 \cdot 10^{-6} \cdot T_j^2 + 3.21 \cdot 10^{-4} \cdot T_j + 0.116 \text{ [\Omega]}$
$V_F = f(I_F)$	$T_j$ in °C; $-55^\circ\text{C} < T_j < 175^\circ\text{C}$ ; $I_F < 8 \text{ A}$



## 7 Package outlines

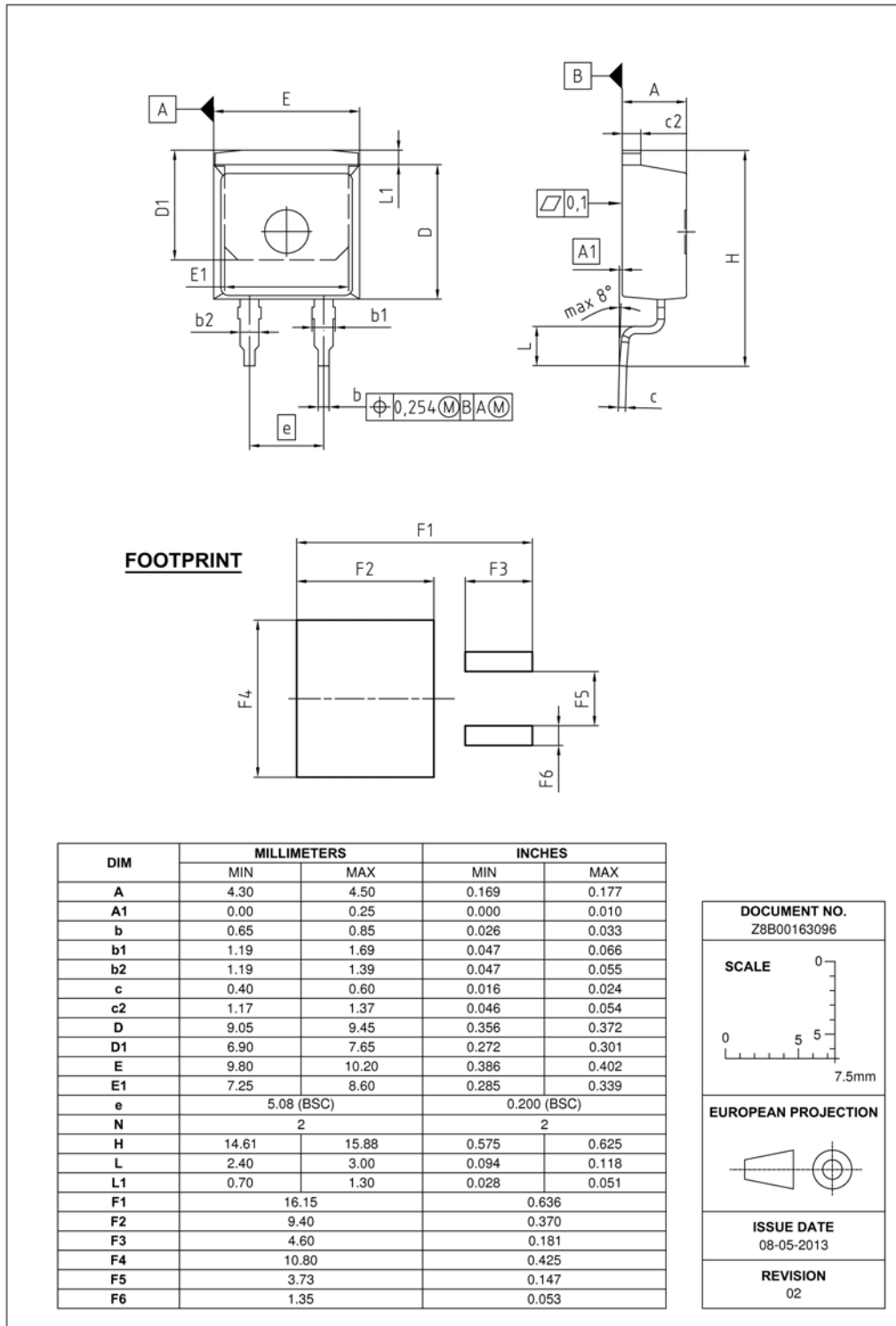


Figure 1 Outlines TO-263, dimensions in mm/inches

## 8 Revision History

### 5<sup>th</sup>. Generation thinQ!<sup>TM</sup> 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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