

**SiC**

Silicon Carbide Diode

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

650V SiC Schottky Diode

**IDW40G65C5**

**Final Datasheet**

Rev. 2.2, 2013-01-15

**Power Management & Multimarket**

## 5<sup>th</sup> Generation thinQ!<sup>TM</sup> SiC Schottky Diode

IDW40G65C5

### 1 Description

ThinQ!<sup>TM</sup> Generation 5 represents Infineon leading edge technology for the SiC Schottky Barrier diodes. Thanks to the more compact design and thin-wafer technology, the new family of products shows 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!<sup>TM</sup> Generation 5 has been designed to complement our 650V CoolMOS<sup>TM</sup> families: this ensures meeting the most stringent application requirements in this voltage range.

#### Features

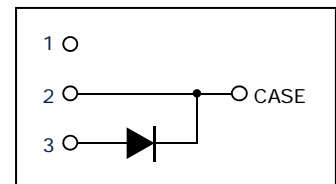
- Revolutionary semiconductor material - Silicon Carbide
- Benchmark switching behavior
- No reverse recovery/ No forward recovery
- Temperature independent switching behavior
- High surge current capability
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC<sup>1)</sup> for target applications
- Breakdown voltage tested at 88 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
$Q_C; V_R=400V$	55	nC
$E_C; V_R=400V$	12.8	$\mu J$
$I_F @ T_C < 110^\circ C$	40	A

**Table 2 Pin Definition**

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

Type / ordering Code	Package	Marking	Related links
IDW40G65C5	PG-TO247-3	D4065C5	<a href="http://www.infineon.com/sic">www.infineon.com/sic</a>

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	$I_F$	–	–	40	A	$T_C < 110^\circ\text{C}$ , $D=1$
Surge non-repetitive forward current, sine halfwave	$I_{F,SM}$	–	–	182		$T_C = 25^\circ\text{C}$ , $t_p=10\text{ ms}$
		–	–	153		$T_C = 150^\circ\text{C}$ , $t_p=10\text{ ms}$
Non-repetitive peak forward current	$I_{F,max}$	–	–	1432		$T_C = 25^\circ\text{C}$ , $t_p=10\text{ }\mu\text{s}$
$i^2t$ value	$\int i^2 dt$	–	–	166	A <sup>2</sup> s	$T_C = 25^\circ\text{C}$ , $t_p=10\text{ ms}$
		–	–	118		$T_C = 150^\circ\text{C}$ , $t_p=10\text{ ms}$
Repetitive peak reverse voltage	$V_{RRM}$	–	–	650	V	
Diode dv/dt ruggedness	$dv/dt$	–	–	100	V/ns	$V_R=0..480\text{ V}$
Power dissipation	$P_{tot}$	–	–	183	W	$T_C = 25^\circ\text{C}$
Operating and storage temperature	$T_j; T_{stg}$	-55	–	175	°C	
Mounting torque		–	50	70	Ncm	M3 and M4 screws

## 3 Thermal characteristics

Table 4 Thermal characteristics TO-247-3

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction-case	$R_{thJC}$	–	0.6	0.8	K/W	
Thermal resistance, junction-ambient	$R_{thJA}$	–	–	62		leaded
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	$I_R = 0.22 \text{ mA}, T_j = 25^\circ\text{C}$
Diode forward voltage	$V_F$	–	1.5	1.7		$I_F = 40 \text{ A}, T_j = 25^\circ\text{C}$
		–	1.8	2.1		$I_F = 40 \text{ A}, T_j = 150^\circ\text{C}$
Reverse current	$I_R$	–	2.2	220	$\mu\text{A}$	$V_R = 650 \text{ V}, T_j = 25^\circ\text{C}$
		–	0.5	150		$V_R = 600 \text{ V}, T_j = 25^\circ\text{C}$
		–	8.2	1500		$V_R = 650 \text{ V}, T_j = 150^\circ\text{C}$

**Table 6 AC characteristics**

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Total capacitive charge	$Q_c$	–	55	–	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	–	1140	–	pF	$V_R = 1 \text{ V}, f = 1 \text{ MHz}$
		–	147	–		$V_R = 300 \text{ V}, f = 1 \text{ MHz}$
		–	145	–		$V_R = 600 \text{ V}, f = 1 \text{ MHz}$

## 5 Electrical characteristics diagrams

Table 7

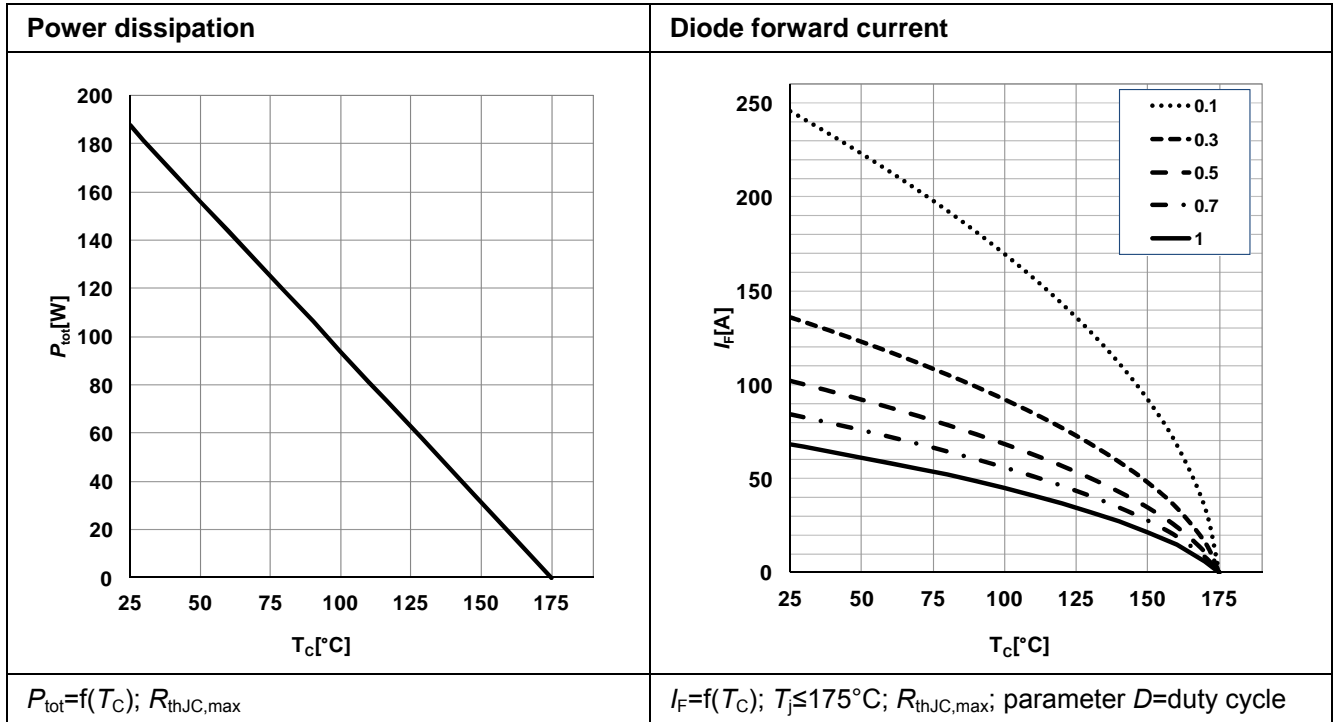


Table 8

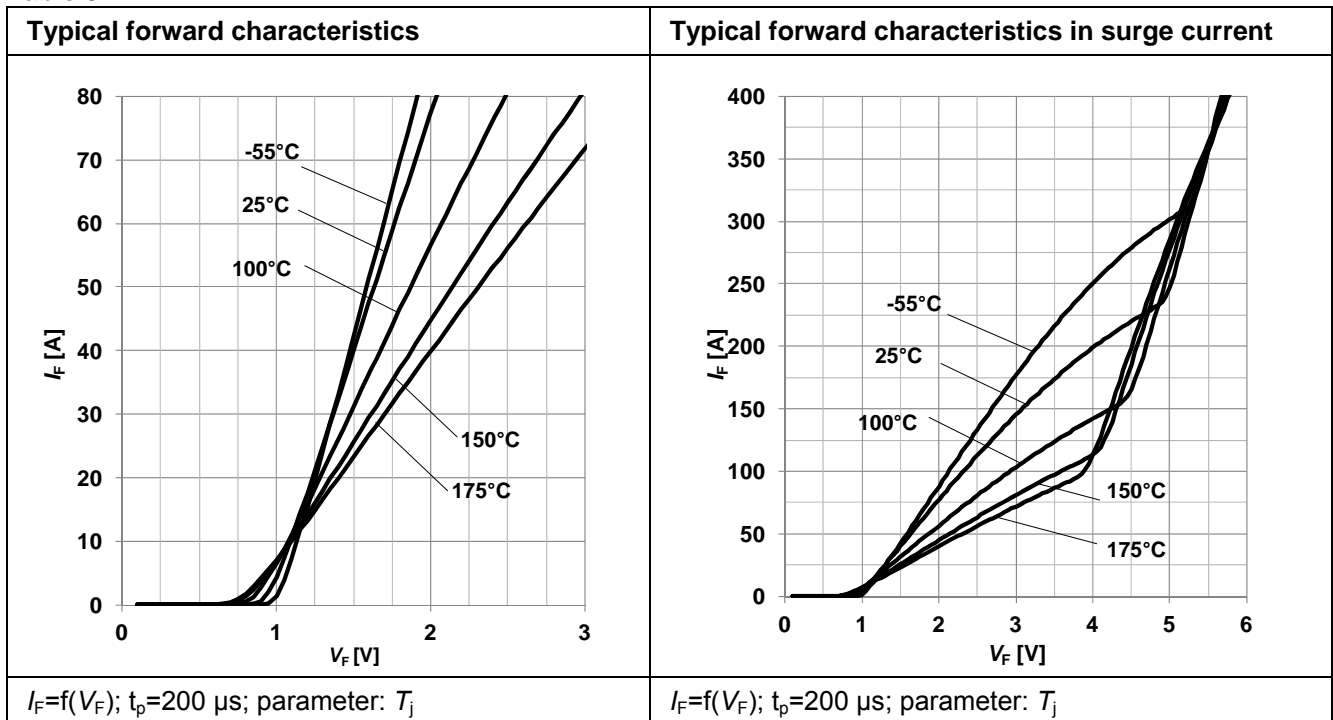


Table 9

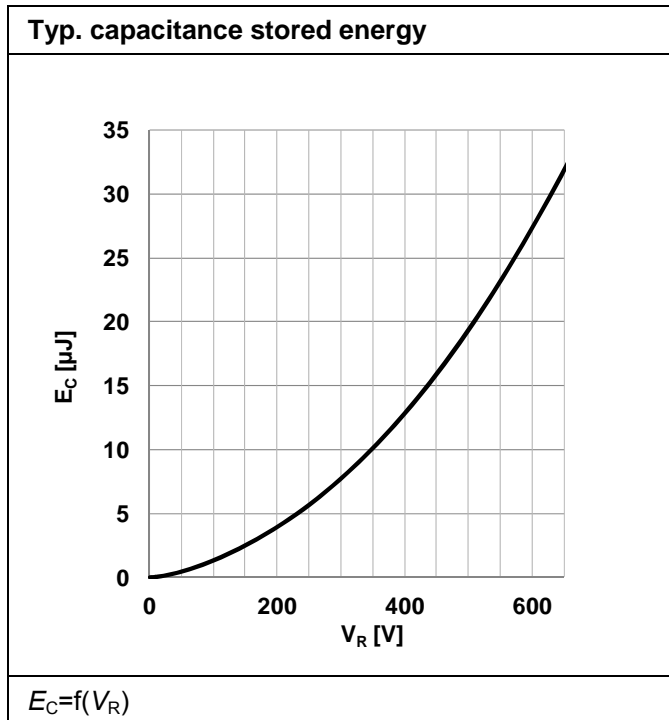
Typ. capacitance charge vs. current slope <sup>1)</sup>	Typ. reverse current vs. reverse voltage
$Q_C=f(dI_F/dt); T_j=150^{\circ}\text{C}; V_R=400\text{ V}; I_F\leq I_{F,max}$	$I_R=f(V_R); \text{parameter: } T_j$

1) Only capacitive charge, guaranteed by design.

Table 10

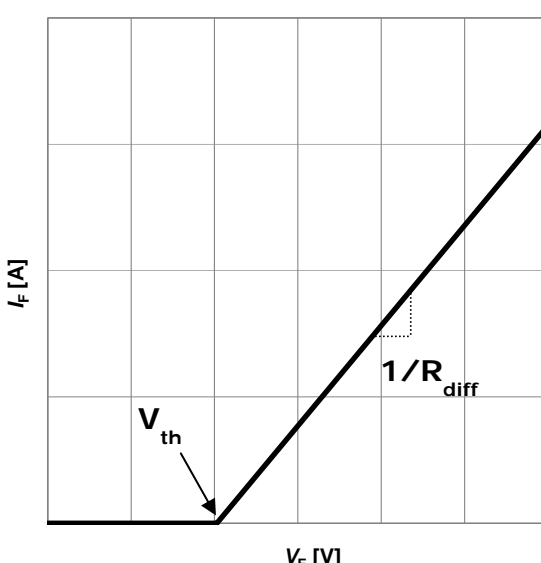
Max. transient thermal impedance	Typ. capacitance vs. reverse voltage
$Z_{th,jc}=f(t_p); \text{parameter: } D=t_p/T$	$C=f(V_R); T_j=25^{\circ}\text{C}; f=1\text{ MHz}$

Table 11



## 6 Simplified Forward Characteristics Model

Table 12

Equivalent forward current curve	Mathematical Equation
	$V_F = V_{TH} + R_{DIFF} \cdot I_F$ $V_{TH}(T_j) = -0.001 \cdot T_j + 1.04 \text{ [V]}$ $R_{DIFF}(T_j) = 3.2 \cdot 10^{-7} \cdot T_j^2 + 3.2 \cdot 10^{-5} \cdot T_j + 0.012 \text{ [\Omega]}$
$V_F = f(I_F)$	$T_j$ in °C; $-55^\circ\text{C} < T_j < 175^\circ\text{C}$ ; $I_F < 80 \text{ A}$



## 7 Package outlines

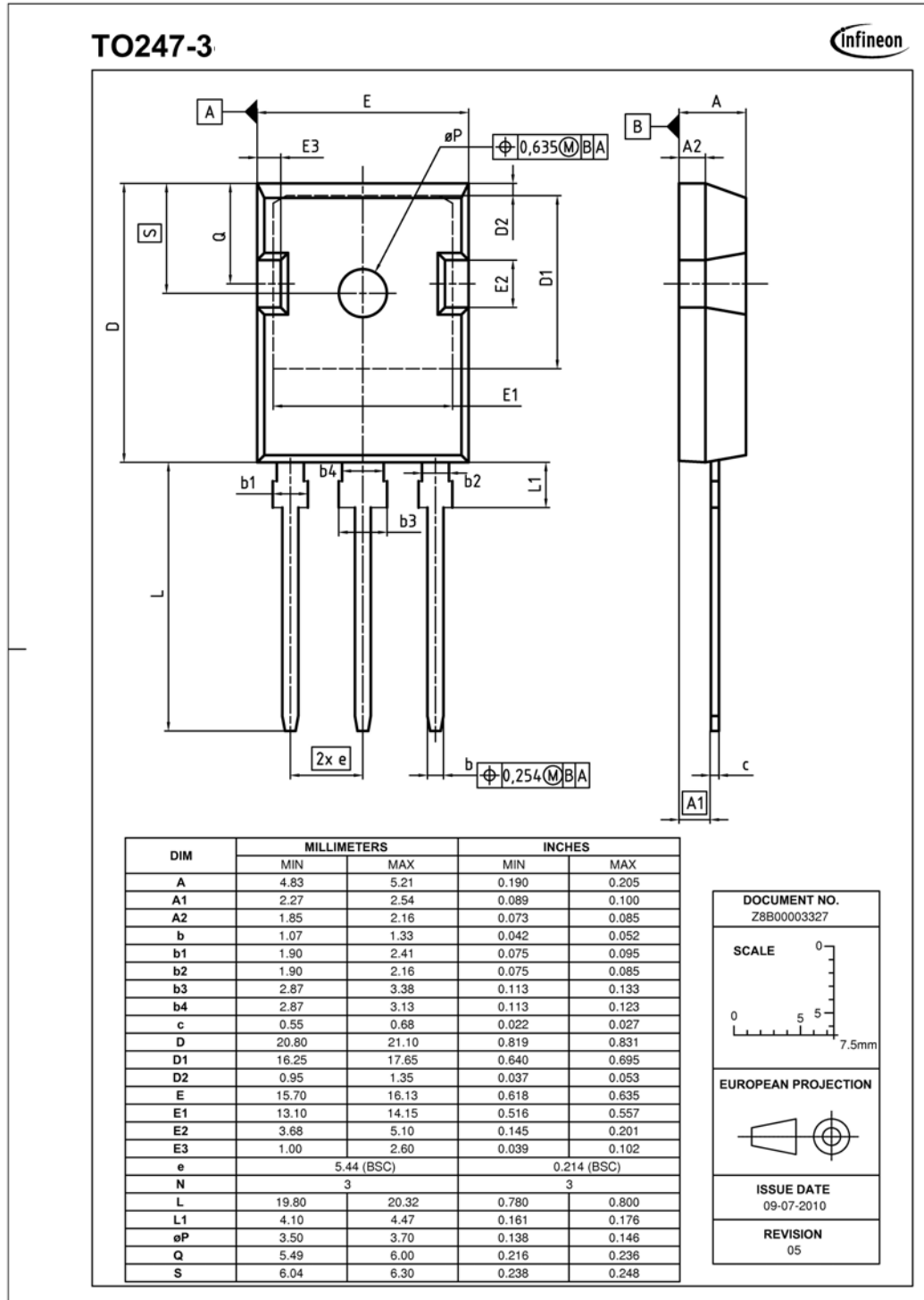


Figure 1 Outlines TO-247, dimensions in mm/inches

## 8 Revision History

### 5<sup>th</sup> Generation thinQ!<sup>TM</sup> SiC Schottky Diode

#### Revision History: 2013-01-15, 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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