



# THE DATASHEET OF IDH03G65C5XKSA2



**SiC**

Silicon Carbide Diode

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

650V SiC Schottky Diode

**IDH03G65C5**

**Final Datasheet**

Rev. 2.2, 2012-12-10

**Power Management & Multimarket**

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

IDH03G65C5

### 1 Description

ThinQ!<sup>TM</sup> 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!<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

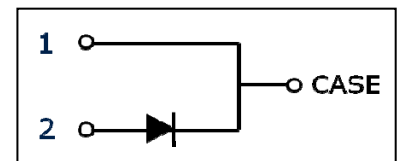
- Revolutionary semiconductor material - Silicon Carbide
- Benchmark switching behavior
- No reverse recovery/ No forward recovery
- Temperature independent switching behavior
- High surge current capability
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC<sup>1)</sup> for target applications
- Breakdown voltage tested at 6.8 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       |
| $Q_C; V_R=400V$           | 5     | nC      |
| $E_C; V_R=400V$           | 1.1   | $\mu J$ |
| $I_F @ T_C < 155^\circ C$ | 3     | A       |

**Table 2 Pin Definition**

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

| Type / ordering Code | Package    | Marking | Related links  |
|----------------------|------------|---------|--|
| IDH03G65C5           | PG-TO220-2 | D0365C5 | <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                          | $I_F$          | –      | –    | 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  |                  | $T_C = 25^\circ\text{C}$ , $t_p=10$ $\mu\text{s}$ |
| $i^2t$ value  | $\int i^2 dt$  | –      | –    | 4.7  | A <sup>2</sup> 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  | °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                          | $R_{thJC}$ | –      | 2.2  | 3.6  | 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             | $I_R = 0.05 \text{ mA}, T_j = 25^\circ\text{C}$ |
| Diode forward voltage | $V_F$    | –      | 1.5  | 1.7  |               | $I_F = 3 \text{ A}, T_j = 25^\circ\text{C}$     |
|                       |          | –      | 1.8  | 2.1  |               | $I_F = 3 \text{ A}, T_j = 150^\circ\text{C}$    |
| Reverse current       | $I_R$    | –      | 0.20 | 50   | $\mu\text{A}$ | $V_R = 650 \text{ V}, T_j = 25^\circ\text{C}$   |
|                       |          | –      | 0.04 | 18   |               | $V_R = 600 \text{ V}, T_j = 25^\circ\text{C}$   |
|                       |          | –      | 0.6  | 370  |               | $V_R = 650 \text{ V}, T_j = 150^\circ\text{C}$  |

**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

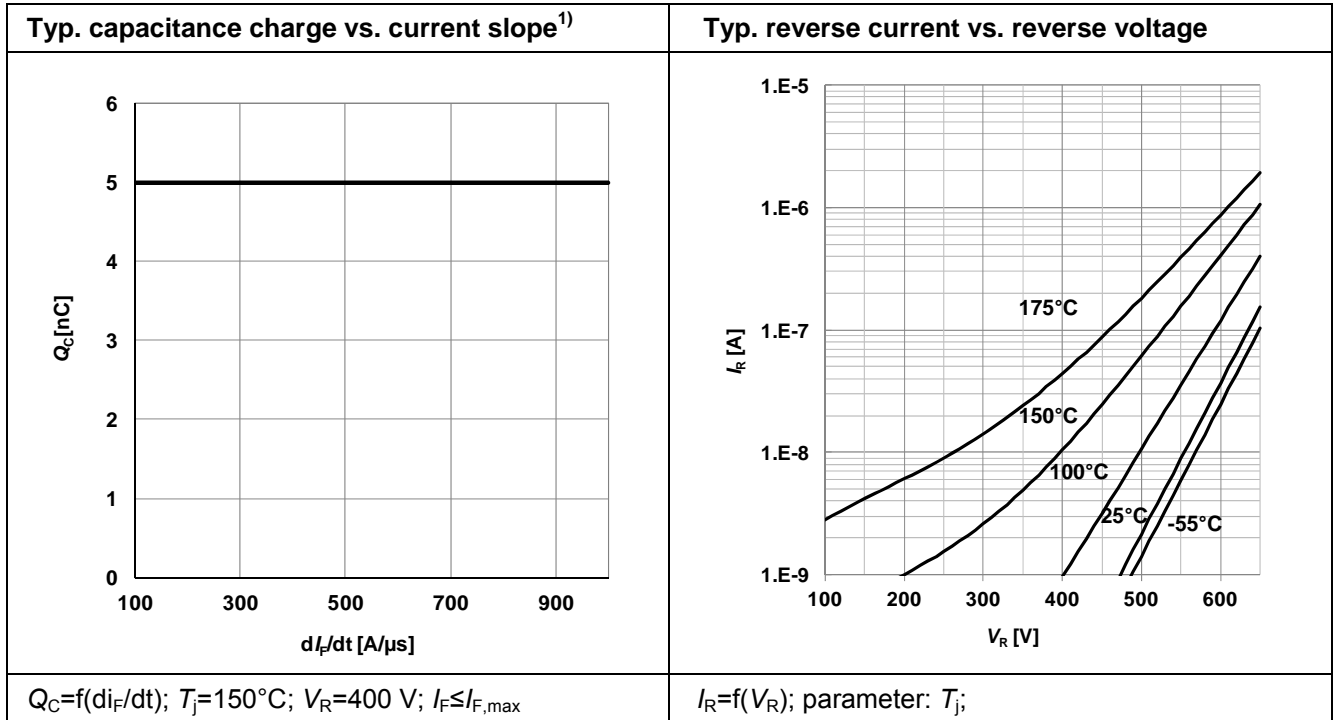
| Power dissipation              | Maximal diode forward current   |
|--------------------------------|---|
|                                |   |
| $P_{tot}=f(T_C); R_{thJC,max}$ | $I_F=f(T_C); R_{thJC,max}; T_j \leq 175^\circ\text{C}; \text{parameter } D=\text{duty cycle}$ |

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



1) Only capacitive charge, guaranteed by design.

Table 10

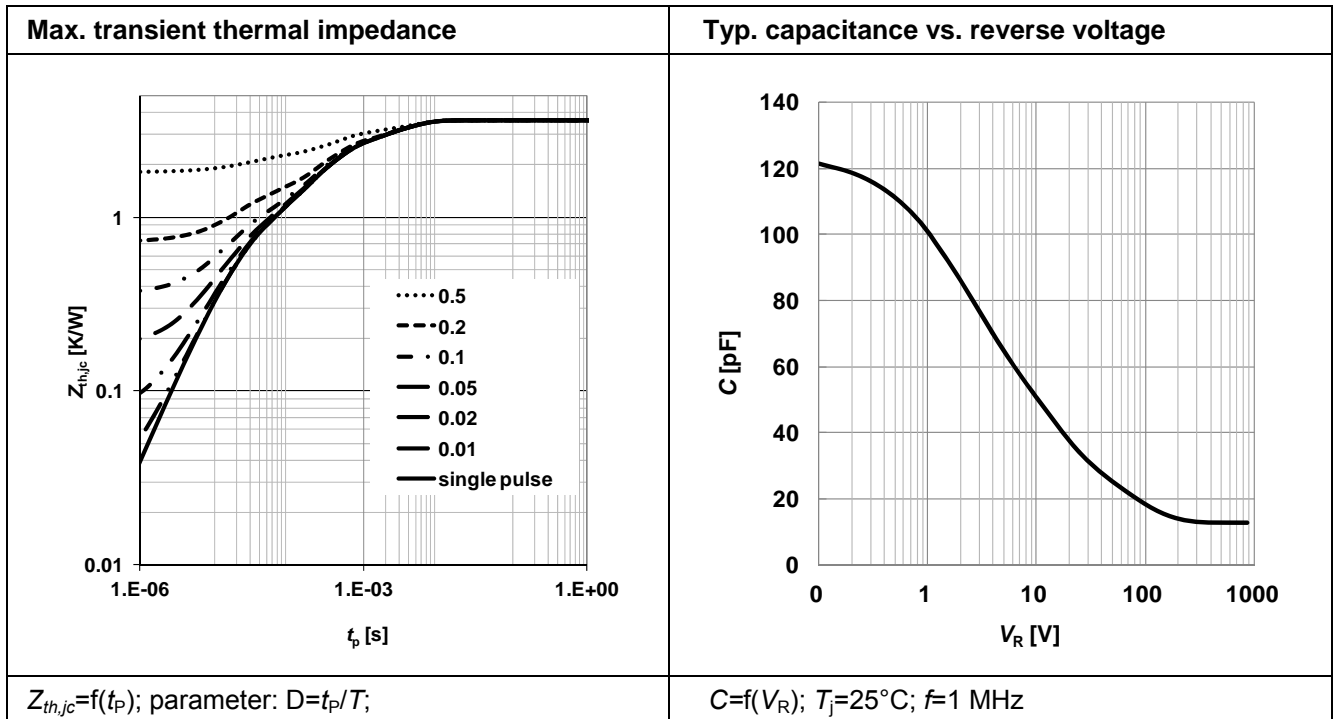
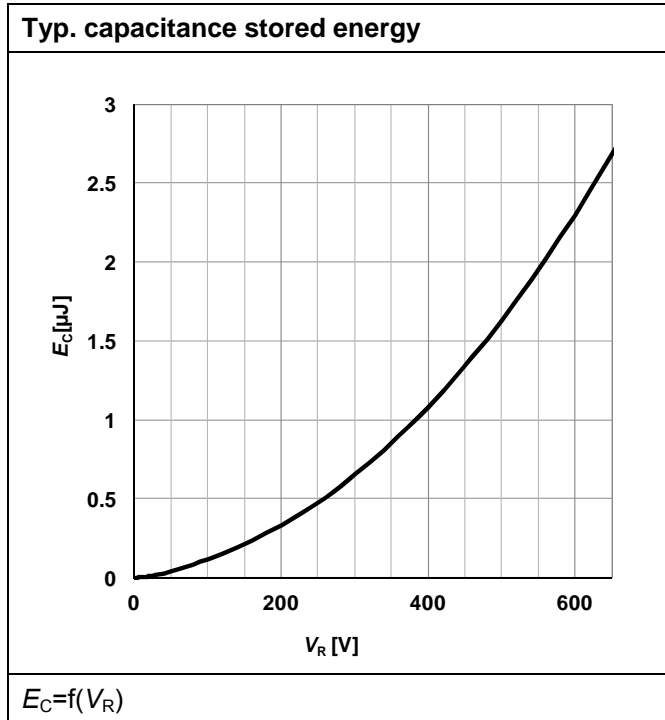


Table 11



## 6 Simplified Forward Characteristics Model

Table 12

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

7 Package outlines

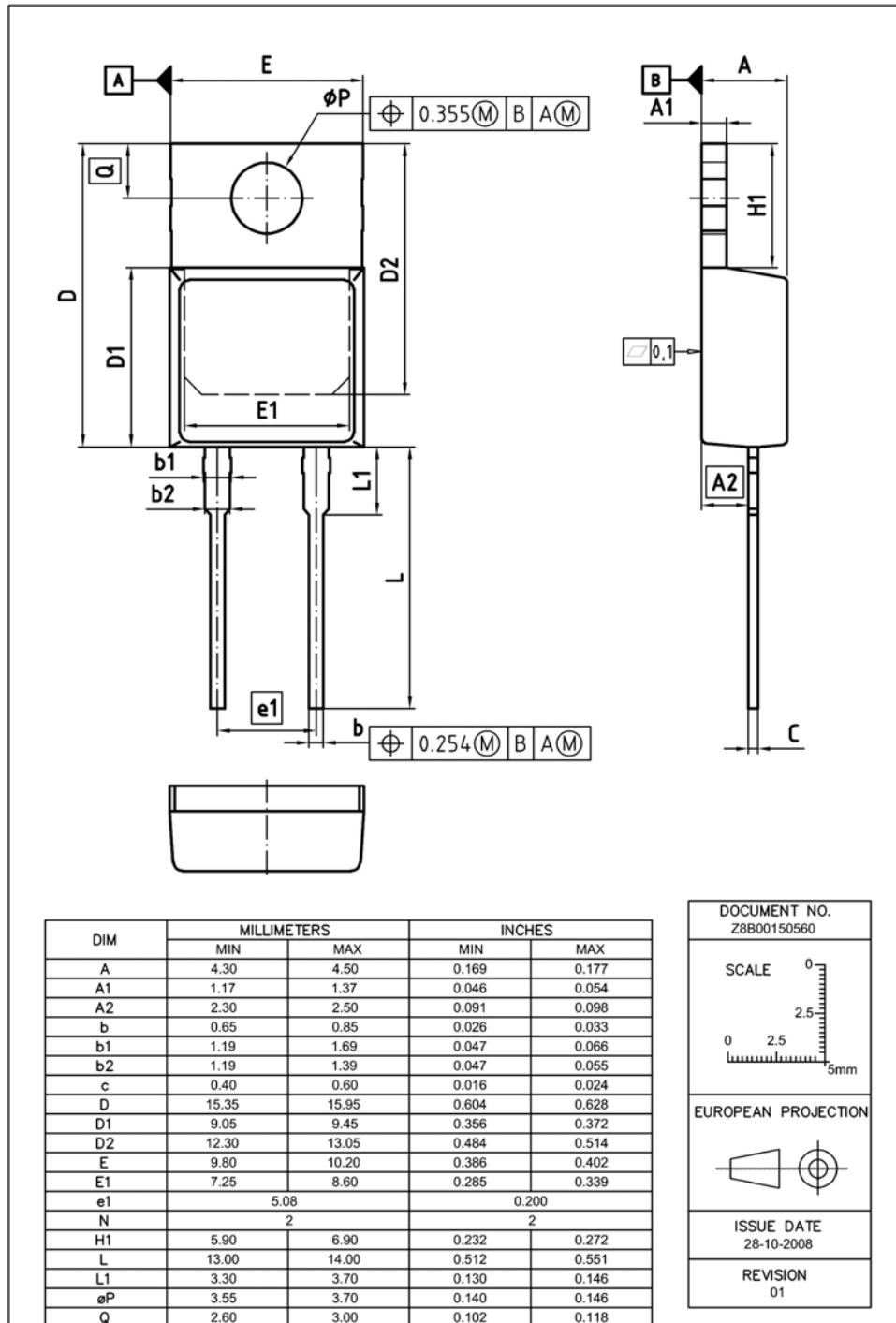


Figure 1 Outlines TO-220, dimensions in mm/inches

## 8 Revision History

### 5<sup>th</sup> Generation thinQ!<sup>TM</sup> 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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Edition 2012-12-10

Published by

Infineon Technologies AG

81726 Munich, Germany

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