

SiC

Silicon Carbide Diode

5th Generation thinQ!TM

650V SiC Schottky Diode

IDH03G65C5

Final Datasheet

Rev. 2.2, 2012-12-10

Power Management & Multimarket

5th Generation thinQ!TM SiC Schottky Diode

IDH03G65C5

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 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

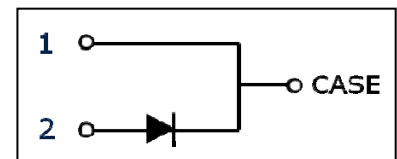
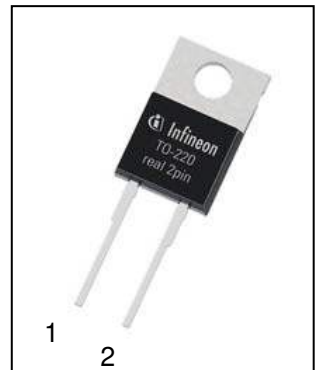


Table 1 Key Performance Parameters

| 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 |
|----------------------|------------|---------|----------------------------------------------------------------|
| IDH03G65C5 | PG-TO220-2 | D0365C5 | 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 | – | – | 3 | A | $T_C < 155^\circ\text{C}$, $D=1$ |
| Surge non-repetitive forward current, sine halfwave | $I_{F,SM}$ | – | – | 31 | | $T_C = 25^\circ\text{C}$, $t_p=10\text{ ms}$ |
| | | – | – | 29 | | $T_C = 150^\circ\text{C}$, $t_p=10\text{ ms}$ |
| Non-repetitive peak forward current | $I_{F,max}$ | – | – | 178 | | $T_C = 25^\circ\text{C}$, $t_p=10\text{ }\mu\text{s}$ |
| i^2t value | $\int i^2 dt$ | – | – | 4.7 | A ² s | $T_C = 25^\circ\text{C}$, $t_p=10\text{ ms}$ |
| | | – | – | 4.2 | | $T_C = 150^\circ\text{C}$, $t_p=10\text{ ms}$ |
| 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} | – | – | 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 | μA | $V_R = 650 \text{ V}, T_j = 25^\circ\text{C}$ |
| | | – | 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

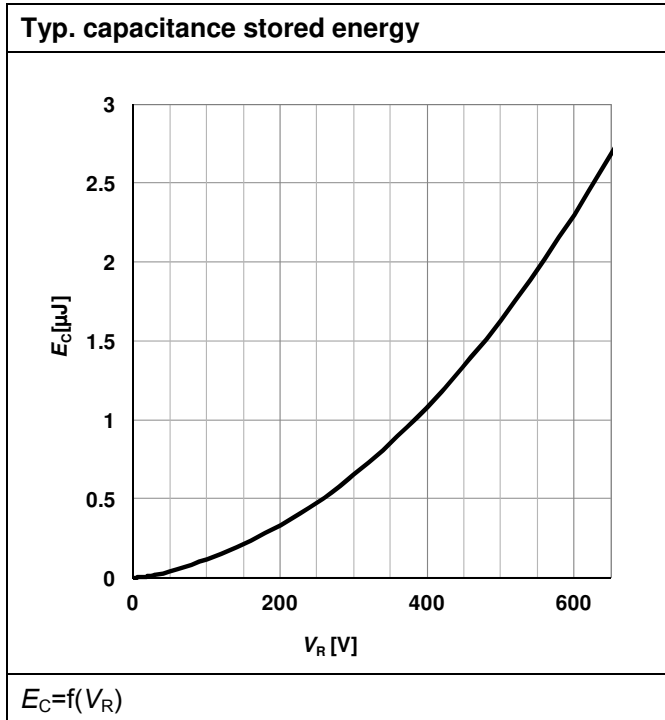
| Typ. capacitance charge vs. current slope ¹⁾ | Typ. reverse current vs. reverse voltage |
|------------------------------------------------------------------------------|------------------------------------------|
| | |
| $Q_C=f(dI_F/dt); T_j=150^\circ\text{C}; V_R=400\text{ V}; I_F\leq I_{F,max}$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

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

7 Package outlines

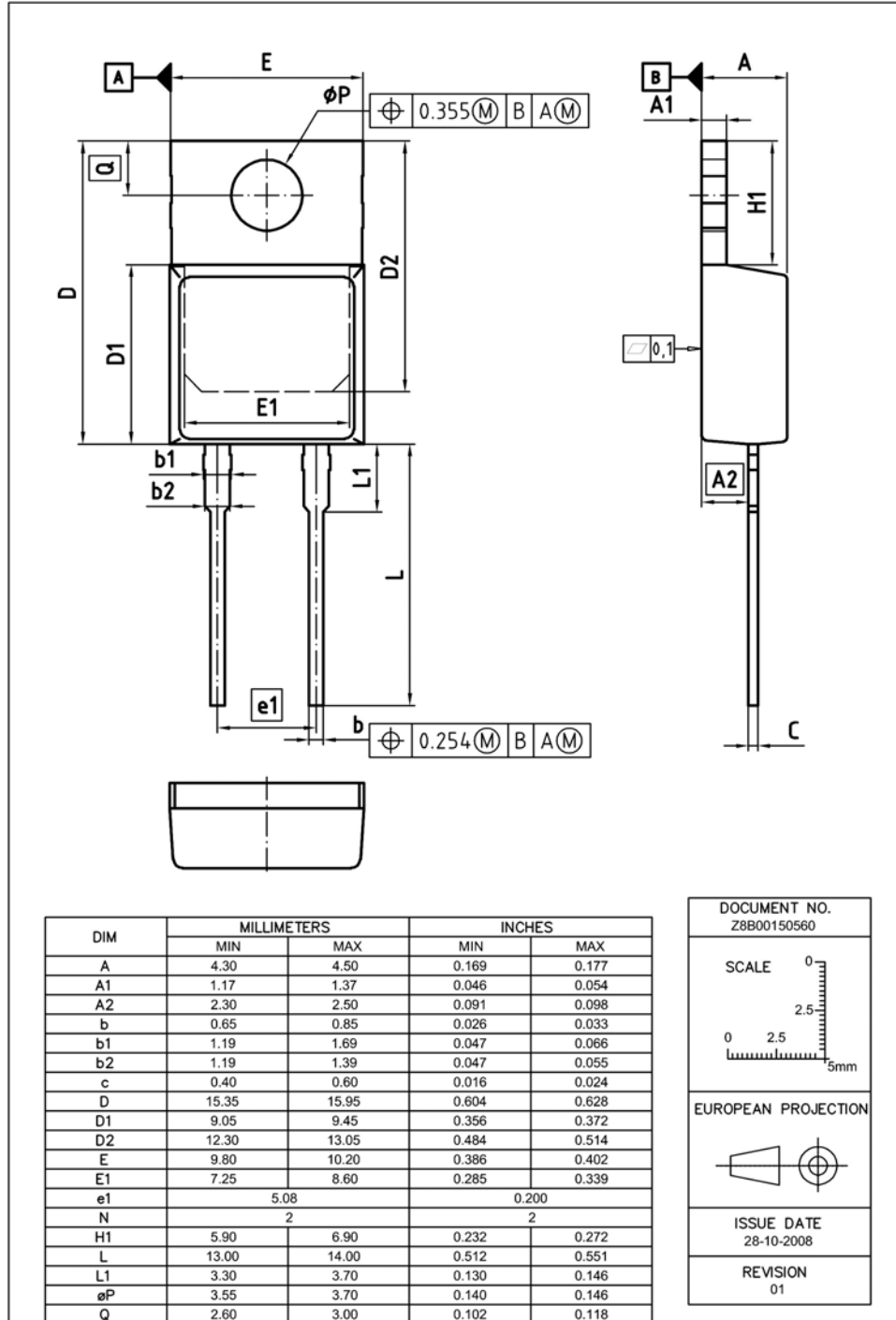


Figure 1 Outlines TO-220, dimensions in mm/inches

8 Revision History

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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