

5th Generation thinQ!™ SiC Schottky Diode

IDW20G65C5

1 Description

ThinQ!™ 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!™ 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 44 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

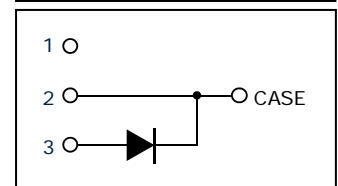
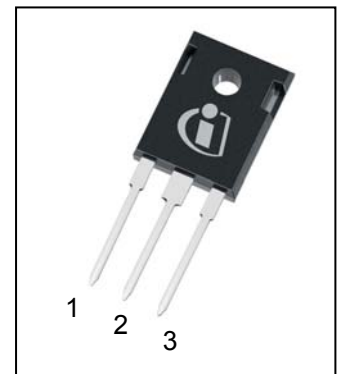


Table 1 Key Performance Parameters

| Parameter | Value | Unit |
|---------------------------|-------|------|
| V_{DC} | 650 | V |
| $Q_C; V_R=400V$ | 29 | nC |
| $E_C; V_R=400V$ | 6.6 | μJ |
| $I_F @ T_C < 120^\circ C$ | 20 | A |

Table 2 Pin Definition

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

| Type / ordering Code | Package | Marking | Related links |
|----------------------|------------|---------|--|
| IDW20G65C5 | PG-TO247-3 | D2065C5 | 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 | — | — | 20 | A | $T_C < 120^\circ\text{C}$, $D=1$ |
| Surge non-repetitive forward current, sine halfwave | $I_{F,SM}$ | — | — | 103 | | $T_C = 25^\circ\text{C}$, $t_p=10\text{ ms}$ |
| | | — | — | 87 | | $T_C = 150^\circ\text{C}$, $t_p=10\text{ ms}$ |
| Non-repetitive peak forward current | $I_{F,max}$ | — | — | 776 | | $T_C = 25^\circ\text{C}$, $t_p=10\text{ }\mu\text{s}$ |
| i^2t value | $\int i^2 dt$ | — | — | 53 | A ² s | $T_C = 25^\circ\text{C}$, $t_p=10\text{ ms}$ |
| | | — | — | 38 | | $T_C = 150^\circ\text{C}$, $t_p=10\text{ ms}$ |
| 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} | — | — | 112 | W | $T_C = 25^\circ\text{C}$ |
| Operating and storage temperature | $T_j; T_{stg}$ | -55 | — | 175 | °C | |
| Mounting torque | | — | — | 60 | Ncm | M3 and M3.5 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} | — | 1.0 | 1.3 | 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 | $I_R = 0.21 \text{ mA}$, $T_j = 25^\circ\text{C}$ |
| Diode forward voltage | V_F | – | 1.5 | 1.7 | | $I_F = 20 \text{ A}$, $T_j = 25^\circ\text{C}$ |
| | | – | 1.8 | 2.1 | | $I_F = 20 \text{ A}$, $T_j = 150^\circ\text{C}$ |
| Reverse current | I_R | – | 1.1 | 210 | μA | $V_R = 650 \text{ V}$, $T_j = 25^\circ\text{C}$ |
| | | – | 0.3 | 75 | | $V_R = 600 \text{ V}$, $T_j = 25^\circ\text{C}$ |
| | | – | 4.1 | 1450 | | $V_R = 650 \text{ V}$, $T_j = 150^\circ\text{C}$ |

Table 6 AC characteristics

| Parameter | Symbol | Values | | | Unit | Note/Test Condition |
|-------------------------|--------|--------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Total capacitive charge | Q_c | – | 29 | | 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 | – | 590 | – | pF | $V_R = 1 \text{ V}$, $f = 1 \text{ MHz}$ |
| | | – | 76 | – | | $V_R = 300 \text{ V}$, $f = 1 \text{ MHz}$ |
| | | – | 74 | – | | $V_R = 600 \text{ V}$, $f = 1 \text{ MHz}$ |

5 Electrical characteristics diagrams

Table 7

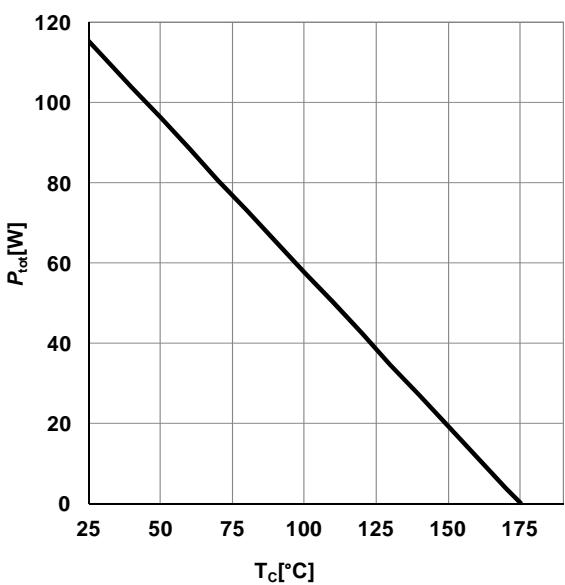
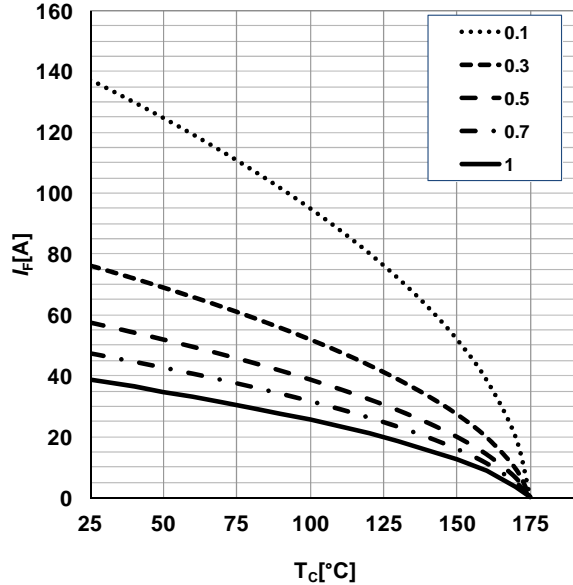
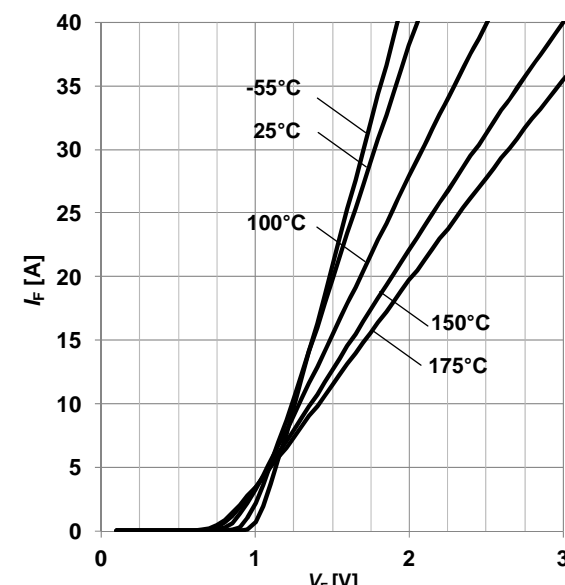
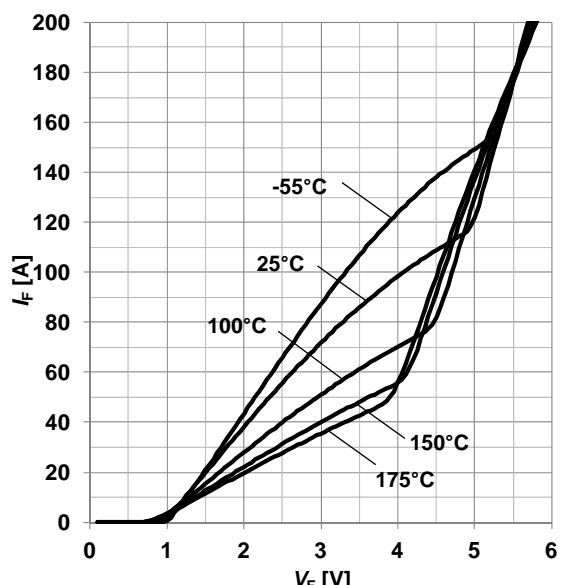
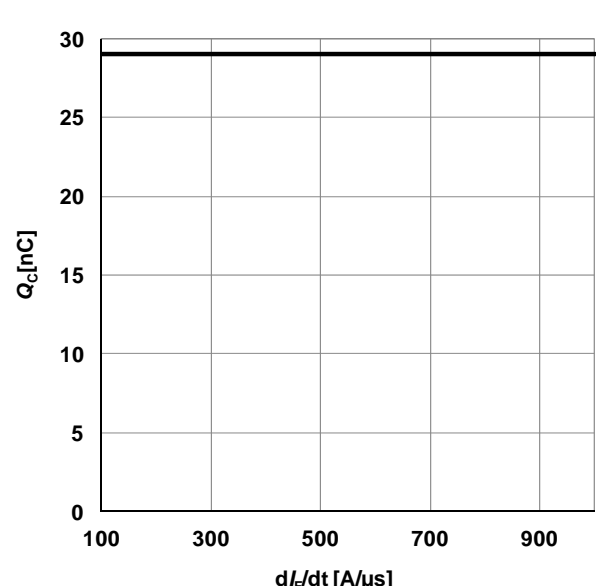
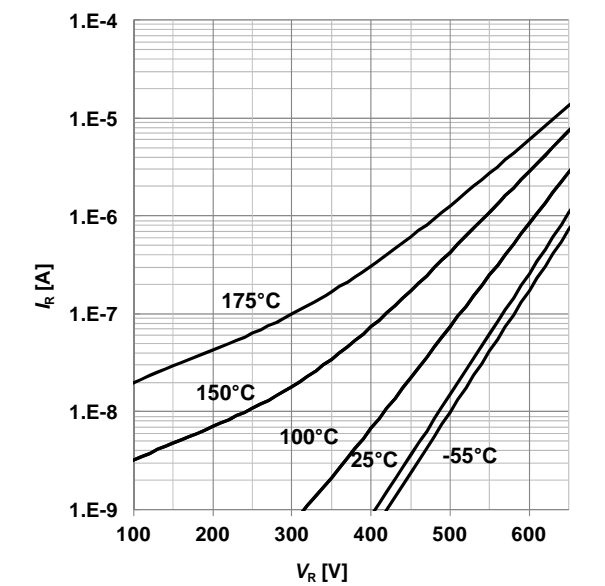
| Power dissipation | Diode forward current |
|--|--|
|  |  |
| $P_{\text{tot}} = f(T_c); R_{\text{thJC,max}}$ | $I_F = f(T_c); T_j \leq 175^\circ\text{C}; R_{\text{thJC,max}}; \text{parameter } D = \text{duty cycle}$ |

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 |
|--|--|
|  |  |
| $Q_C = f(di_F/dt)$; $T_j = 150^\circ\text{C}$; $V_R = 400\text{ V}$; $I_F \leq I_{F,max}$ | $I_R = f(V_R)$; parameter: T_j |

1) Only capacitive charge, guaranteed by design.

Table 10

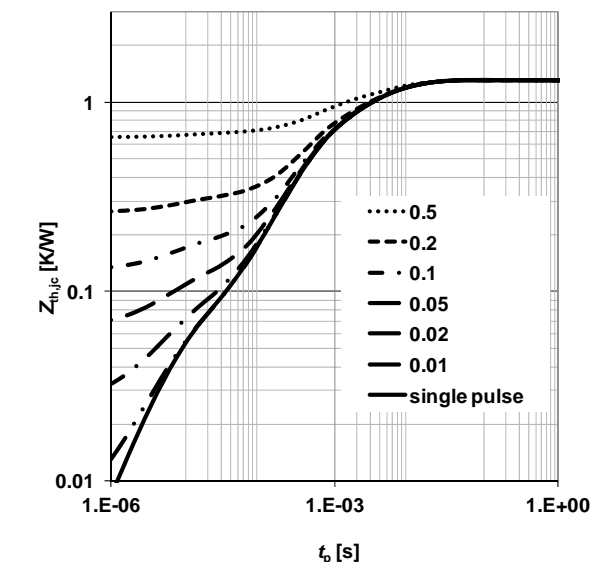
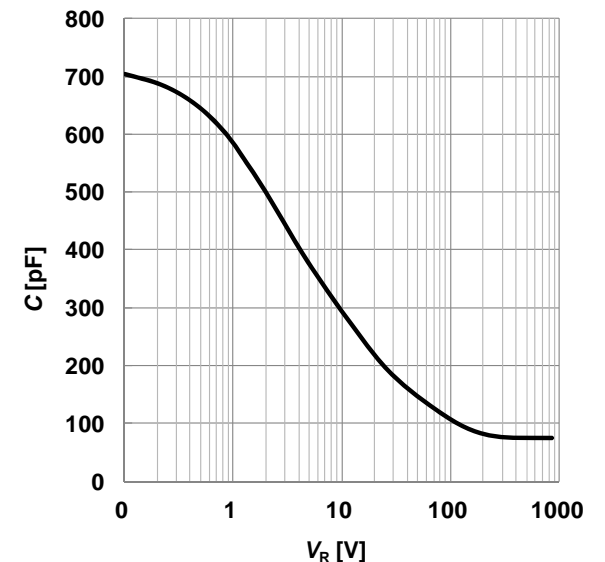
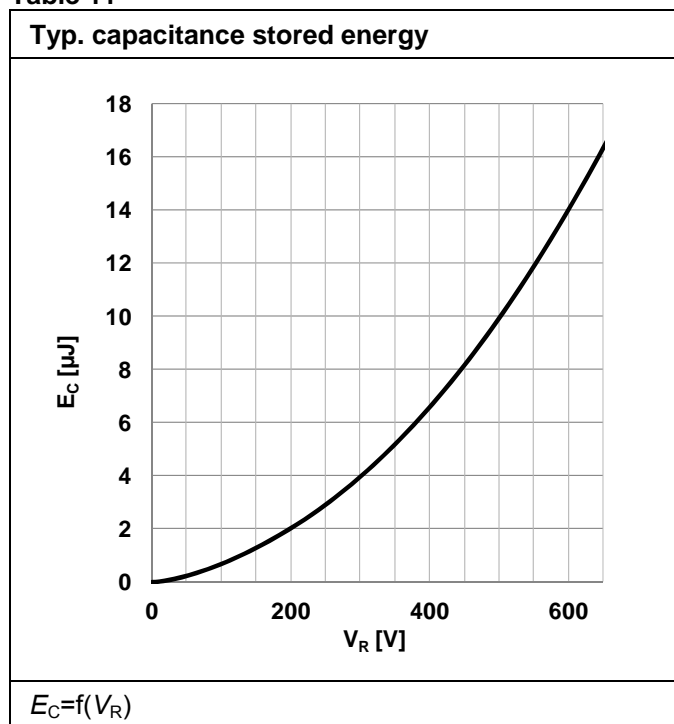
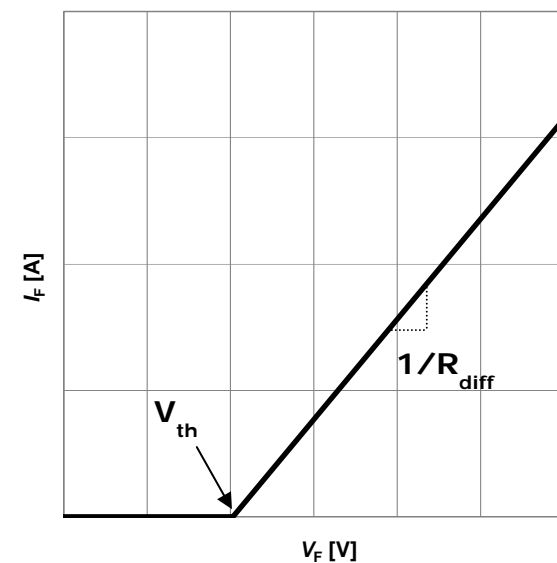
| Max. transient thermal impedance | Typ. capacitance vs. reverse voltage |
|---|--|
|  |  |
| $Z_{th,jc} = f(t_p)$; parameter: $D = t_p / T$ | $C = f(V_R)$; $T_j = 25^\circ\text{C}$; $f = 1\text{ MHz}$ |

Table 11



6 Simplified Forward Characteristics Model

Table 12

| Equivalent forward current curve | Mathematical Equation |
|--|---|
|  <p>$V_F = f(I_F)$</p> | $V_F = V_{TH} + R_{DIFF} \cdot I_F$ $V_{TH}(T_j) = -0.001 \cdot T_j + 1.04 \text{ [V]}$ $R_{DIFF}(T_j) = 6.4 \cdot 10^{-7} \cdot T_j^2 + 6.4 \cdot 10^{-5} \cdot T_j + 0.023 \text{ [}\Omega\text{]}$ |
| | $T_j \text{ in } ^\circ\text{C}; -55^\circ\text{C} < T_j < 175^\circ\text{C}; I_F < 40 \text{ A}$ |

7 Package outlines

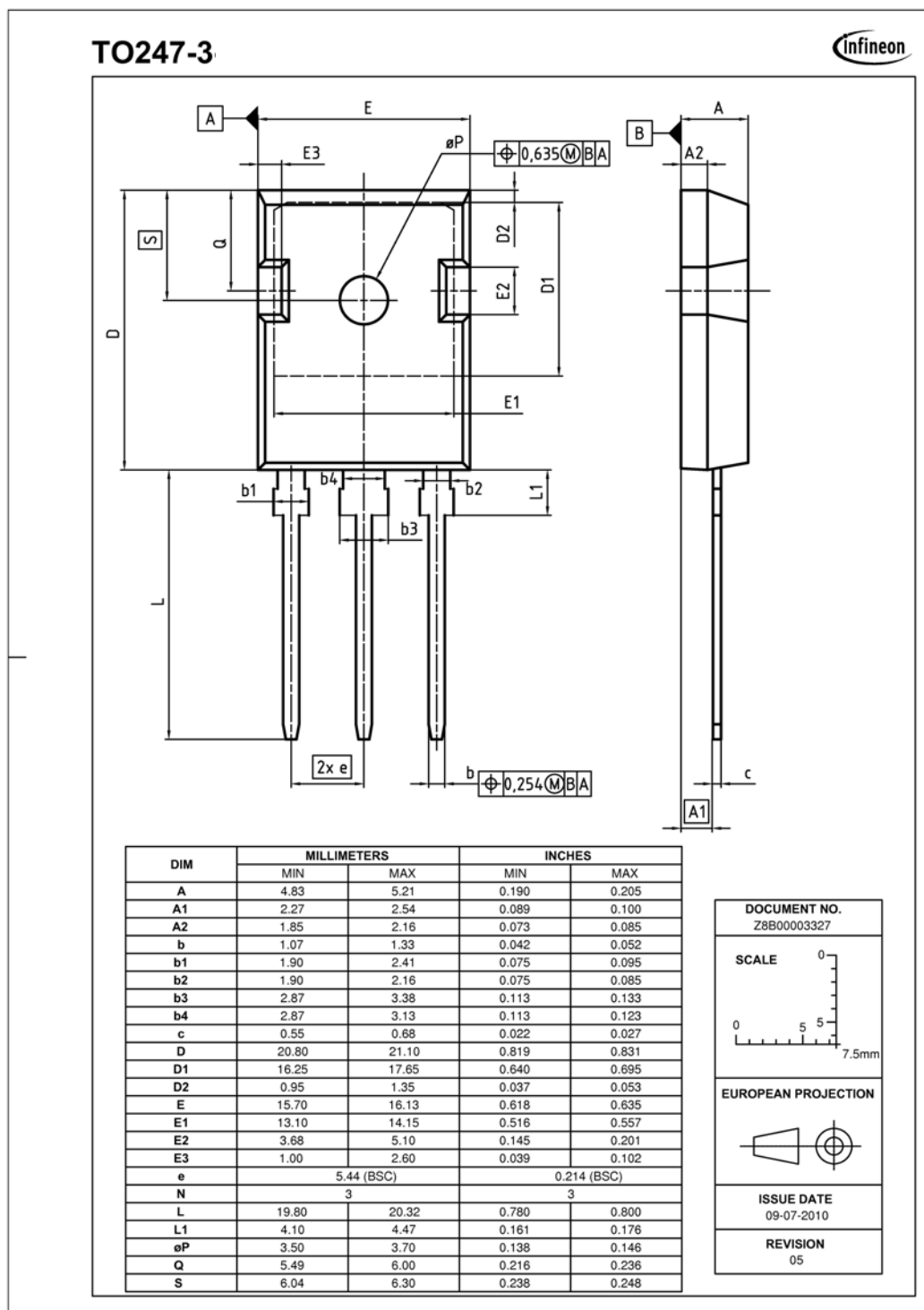


Figure 1 Outlines TO-247, dimensions in mm/inches

8 Revision History

5th Generation thinQ!™ 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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