# SiC

Silicon Carbide Diode

## $5^{th}$ Generation thinQ!$^{TM}$

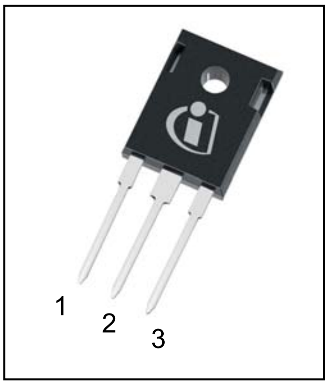
650V SiC Schottky Diode

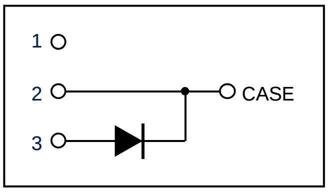
# IDW30G65C5

## Final Datasheet

Rev. 2.2, 2013-01-15

# $5^{th}$ Generation thinQ!™ SiC Schottky Diode — IDW30G65C5




## 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 (Qc x Vf).

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[1)] for target applications
- Breakdown voltage tested at 66 mA[2)]
- 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 | 42 | nC |
| $E_C$; $V_R$=400V | 9.7 | µJ |
| $I_F$@ $T_C$ < 115°C | 30 | A |

**Table 2 Pin Definition**

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

| Type / ordering Code | Package | Marking | Related links |
|---|---|---|---|
| IDW30G65C5 | PG-TO247-3 | D3065C5 | www.infineon.com/sic |

1) J-STD20 and JESD22
2) All devices tested under avalanche conditions for a time periode of 10ms

# Table of Contents

## 2 Maximum ratings

**Table 3 Maximum ratings**

| Parameter | Symbol | Values | | | Unit | Note/Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Continuous forward current | $I_F$ | – | – | 30 | A | $T_C$ < 115°C, D=1 |
| Surge non-repetitive forward current, sine halfwave | $I_{F,SM}$ | – | – | 165 | | $T_C$ = 25°C, $t_p$=10 ms |
| | | – | – | 139 | | $T_C$ = 150°C, $t_p$=10 ms |
| Non-repetitive peak forward current | $I_{F,max}$ | – | – | 1106 | | $T_C$ = 25°C, $t_p$=10 µs |
| i²t value | $\int i^2 dt$ | – | – | 136 | A²s | $T_C$ = 25°C, $t_p$=10 ms |
| | | – | – | 97 | | $T_C$ = 150°C, $t_p$=10 ms |
| Repetitive peak reverse voltage | $V_{RRM}$ | – | – | 650 | V | |
| Diode dv/dt ruggedness | $dv/dt$ | – | – | 100 | V/ns | $V_R$=0..480 V |
| Power dissipation | $P_{tot}$ | – | – | 150 | W | $T_C$ = 25°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 | $R_{thJC}$ | – | 0.8 | 1.0 | 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**

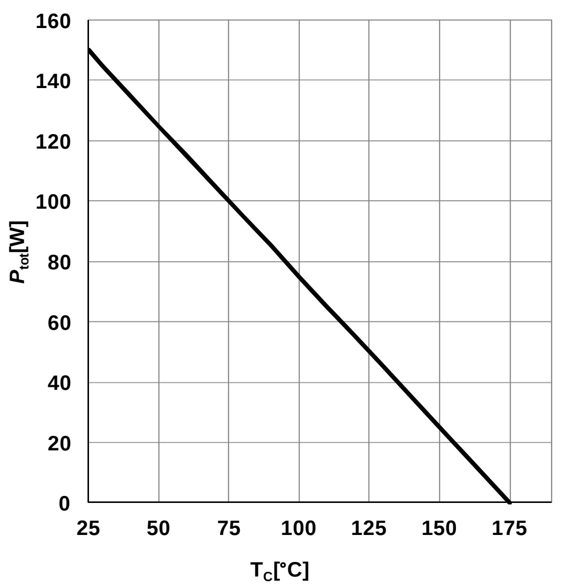
| Parameter | Symbol | Values | | | Unit | Note/Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| DC blocking voltage | $V_{DC}$ | 650 | – | – | V | $I_R$= 0.22 mA, $T_j$ = 25°C |
| Diode forward voltage | $V_F$ | – | 1.5 | 1.7 | | $I_F$= 30 A, $T_j$=25°C |
| | | – | 1.8 | 2.1 | | $I_F$= 30 A, $T_j$=150°C |
| Reverse current | $I_R$ | – | 1.6 | 220 | µA | $V_R$=650 V, $T_j$=25°C |
| | | – | 0.4 | 110 | | $V_R$=600 V, $T_j$=25°C |
| | | – | 6.1 | 1500 | | $V_R$=650 V, $T_j$=150°C |

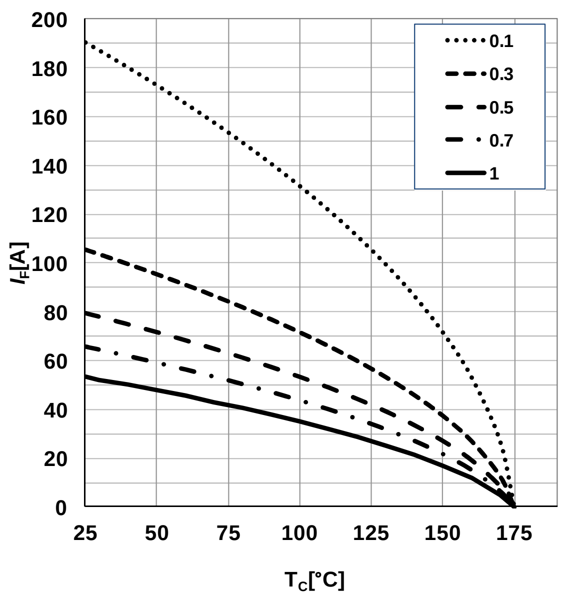
**Table 6 AC characteristics**

| Parameter | Symbol | Values | | | Unit | Note/Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Total capacitive charge | $Q_c$ | – | 42 | | nC | $V_R$=400 V, $di/dt$=200A/µs, $I_F \leq I_{F,MAX}$, $T_j$=150°C. |
| Total Capacitance | $C$ | – | 860 | – | pF | $V_R$=1 V, $f$=1 MHz |
| | | – | 111 | – | | $V_R$=300 V, $f$=1 MHz |
| | | – | 110 | – | | $V_R$=600 V, $f$=1 MHz |

# 5 Electrical characteristics diagrams

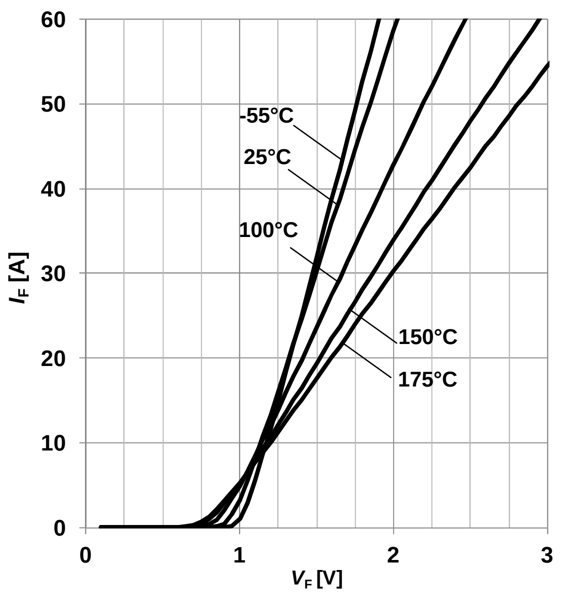
**Table 7**

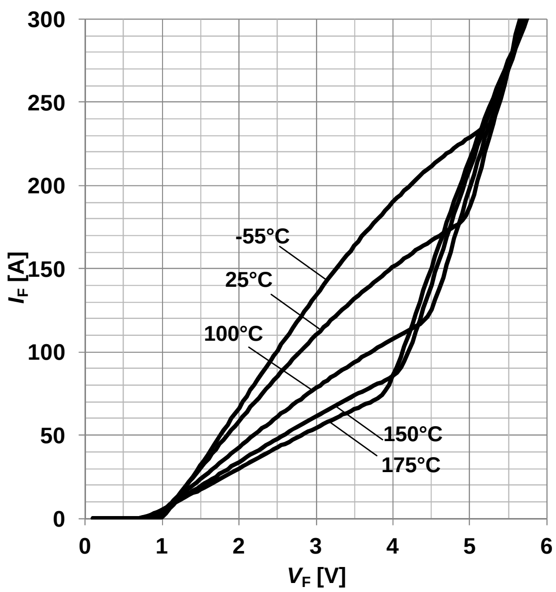
<table>
<tr><th>Power dissipation</th><th>Diode forward current</th></tr>
<tr><td>


</td><td>


</td></tr>
<tr><td>$P_{tot}$=f($T_C$); $R_{thJC,max}$</td><td>$I_F$=f($T_C$); $T_j$≤175°C; $R_{thJC,max}$; parameter $D$=duty cycle</td></tr>
</table>

**Table 8**

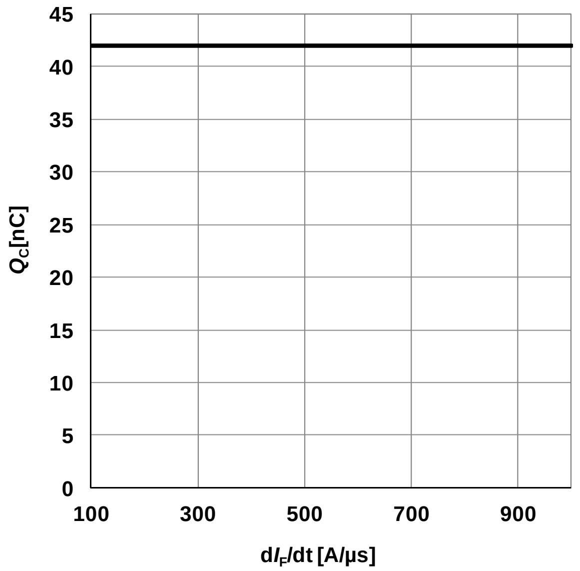
<table>
<tr><th>Typical forward characteristics</th><th>Typical forward characteristics in surge current</th></tr>
<tr><td>


</td><td>


</td></tr>
<tr><td>$I_F$=f($V_F$); $t_p$=200 µs; parameter: $T_j$</td><td>$I_F$=f($V_F$); $t_p$=200 µs; parameter: $T_j$</td></tr>
</table>

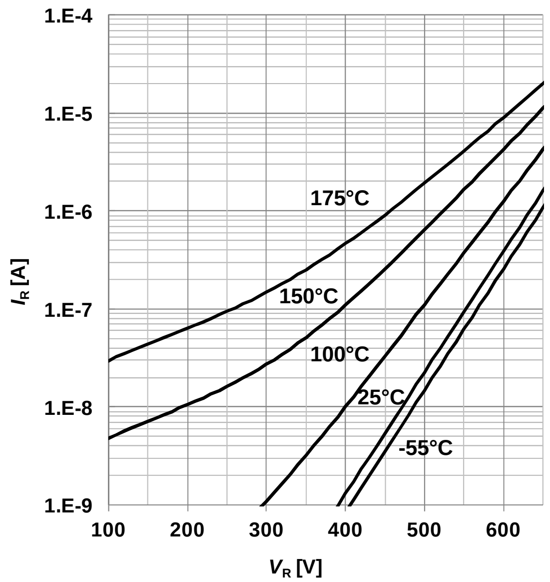
**Table 9**

**Typ. capacitance charge vs. current slope**[1)]




$Q_C$=f($di_F$/dt); $T_j$=150°C; $V_R$=400 V; $I_F \leq I_{F,max}$

**Typ. reverse current vs. reverse voltage**

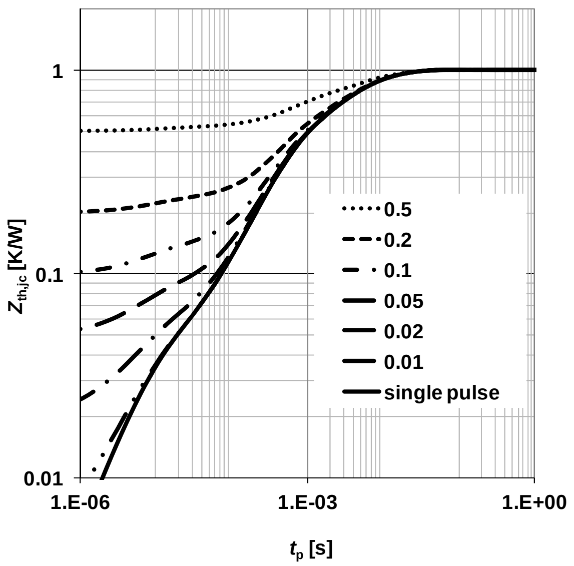



$I_R$=f($V_R$); parameter: $T_j$

1) Only capacitive charge, guaranteed by design.

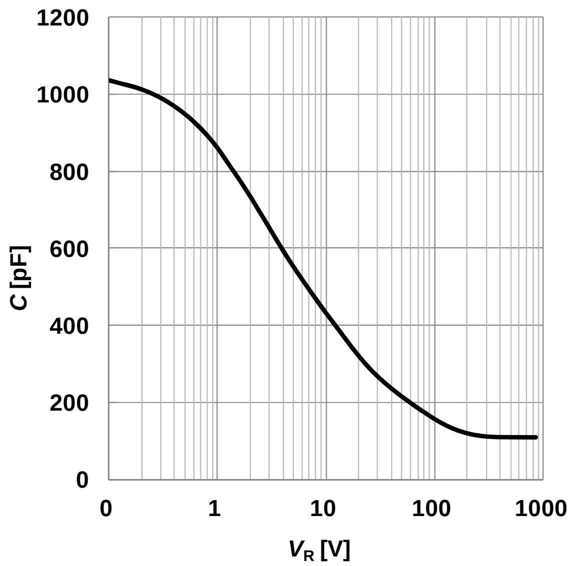
**Table 10**

**Max. transient thermal impedance**



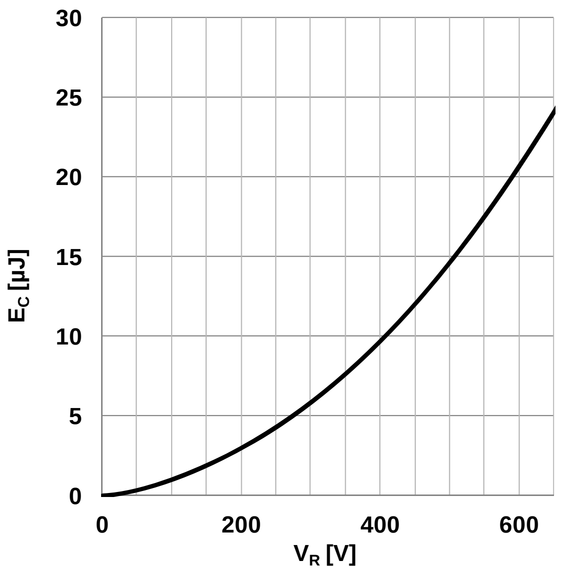

$Z_{th,jc}$=f($t_P$); parameter: D=$t_P$/$T$

**Typ. capacitance vs. reverse voltage**



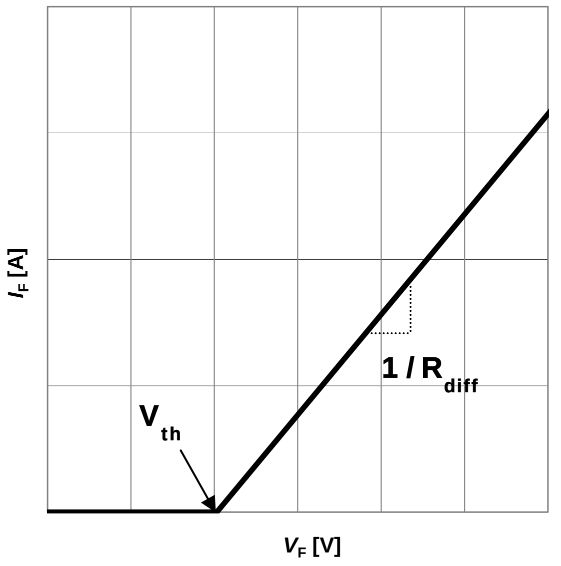

$C$=f($V_R$); $T_j$=25°C; $f$=1 MHz

**Table 11**

| Typ. capacitance stored energy |
|---|
|  |
| $E_C = f(V_R)$ |

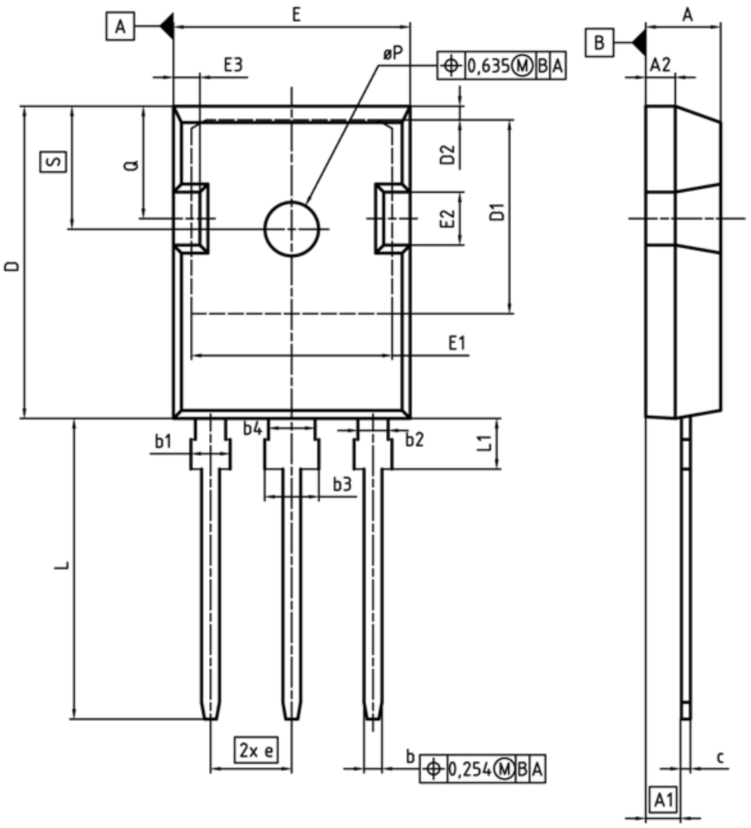
# 6 Simplified Forward Characteristics Model

**Table 12**

| Equivalent forward current curve | Mathematical Equation |
|---|---|
|  | $V_F = V_{TH} + R_{DIFF} \cdot I_F$<br>$V_{TH}(T_j) = -0.001 \cdot T_j + 1.04 \; [\mathrm{V}]$<br>$R_{DIFF}(T_j) = 4.3 \cdot 10^{-7} \cdot T_j^{\,2} + 4.3 \cdot 10^{-5} \cdot T_j + 0.015 \; [\Omega]$ |
| $V_F = f(I_F)$ | $T_j$ in °C; -55°C < $T_j$ < 175°C; $I_F$ < 60 A |

# 7 Package outlines

**TO247-3**




| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 4.83 | 5.21 | 0.190 | 0.205 |
| A1 | 2.27 | 2.54 | 0.089 | 0.100 |
| A2 | 1.85 | 2.16 | 0.073 | 0.085 |
| b | 1.07 | 1.33 | 0.042 | 0.052 |
| b1 | 1.90 | 2.41 | 0.075 | 0.095 |
| b2 | 1.90 | 2.16 | 0.075 | 0.085 |
| b3 | 2.87 | 3.38 | 0.113 | 0.133 |
| b4 | 2.87 | 3.13 | 0.113 | 0.123 |
| c | 0.55 | 0.68 | 0.022 | 0.027 |
| D | 20.80 | 21.10 | 0.819 | 0.831 |
| D1 | 16.25 | 17.65 | 0.640 | 0.695 |
| D2 | 0.95 | 1.35 | 0.037 | 0.053 |
| E | 15.70 | 16.13 | 0.618 | 0.635 |
| E1 | 13.10 | 14.15 | 0.516 | 0.557 |
| E2 | 3.68 | 5.10 | 0.145 | 0.201 |
| E3 | 1.00 | 2.60 | 0.039 | 0.102 |
| e | 5.44 (BSC) | | 0.214 (BSC) | |
| N | 3 | | 3 | |
| L | 19.80 | 20.32 | 0.780 | 0.800 |
| L1 | 4.10 | 4.47 | 0.161 | 0.176 |
| øP | 3.50 | 3.70 | 0.138 | 0.146 |
| Q | 5.49 | 6.00 | 0.216 | 0.236 |
| S | 6.04 | 6.30 | 0.238 | 0.248 |

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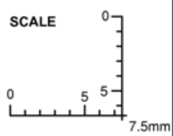
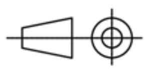
SCALE




EUROPEAN PROJECTION



ISSUE DATE
09-07-2010

REVISION
05

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

# 8 Revision History

**5th Generation thinQ!TM 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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