SiC

Silicon Carbide Diode

5th Generation thinQ!™

650V SiC Schottky Diode

IDW40G65C5

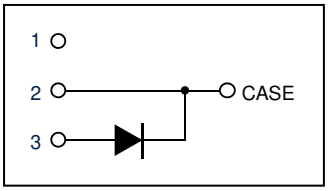
Final Datasheet

Rev. 2.2, 2013-01-15

Power Management & Multimarket

5th Generation thinQ!™ SiC Schottky Diode IDW40G65C5





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 88 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	55	nC
E_C; V_R=400V	12.8	µJ
I_F @ T_C < 110°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	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

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°C, D=1
Surge non-repetitive forward current, sine halfwave	$I_{F,SM}$	–	–	182		T_C = 25°C, t_p=10 ms
		–	–	153		T_C = 150°C, t_p=10 ms
Non-repetitive peak forward current	$I_{F,max}$	–	–	1432		T_C = 25°C, t_p=10 µs
i²t value	$\int i^2dt$	–	–	166	A²s	T_C = 25°C, t_p=10 ms
		–	–	118		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}	–	–	183	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}	–	0.6	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 mA, T_j = 25°C
Diode forward voltage	V_F	–	1.5	1.7		I_F= 40 A, T_j=25°C
		–	1.8	2.1		I_F= 40 A, T_j=150°C
Reverse current	I_R	–	2.2	220	µA	V_R=650 V, T_j=25°C
		–	0.5	150		V_R=600 V, T_j=25°C
		–	8.2	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	–	55		nC	V_R=400 V, *di/dt*=200A/µs, $I_F \le I_{F,MAX}$, T_j=150°C.
Total Capacitance	C	–	1140	–	pF	V_R=1 V, *f*=1 MHz
		–	147	–		V_R=300 V, *f*=1 MHz
		–	145	–		V_R=600 V, *f*=1 MHz

5 Electrical characteristics diagrams

Table 7

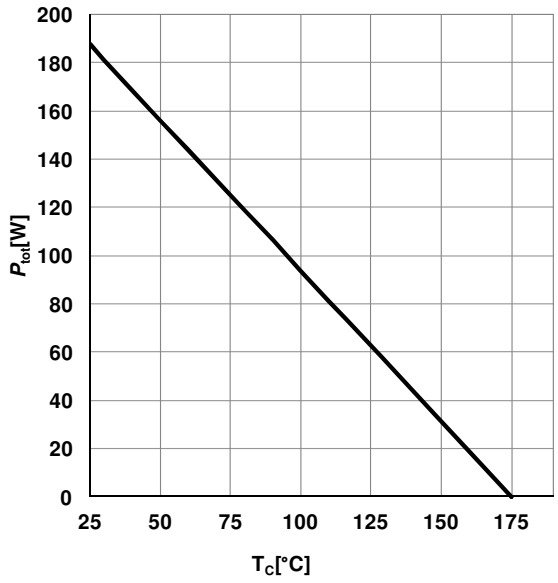
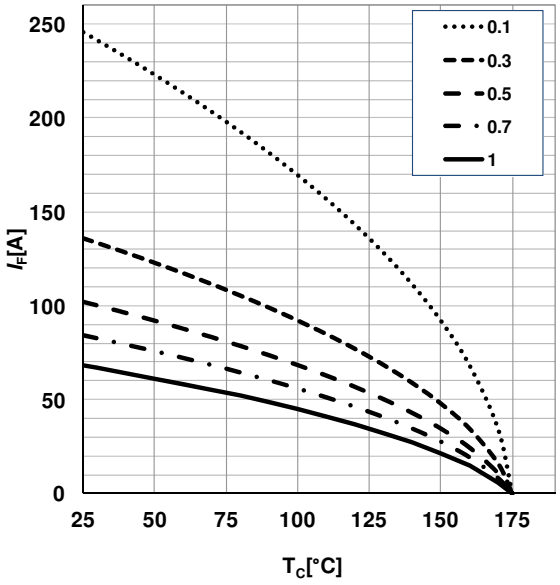
Power dissipation	Diode forward current
	
$P_{tot}=f(T_C)$; $R_{thJC,max}$	$I_F=f(T_C)$; $T_j \leq 175°C$; $R_{thJC,max}$; parameter D=duty cycle

Table 8

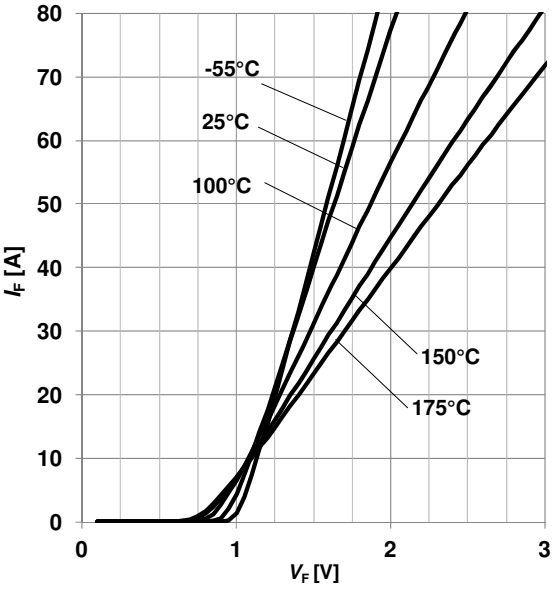
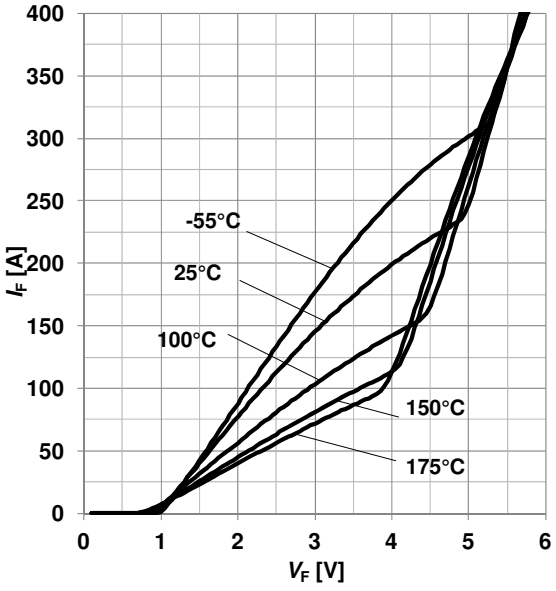
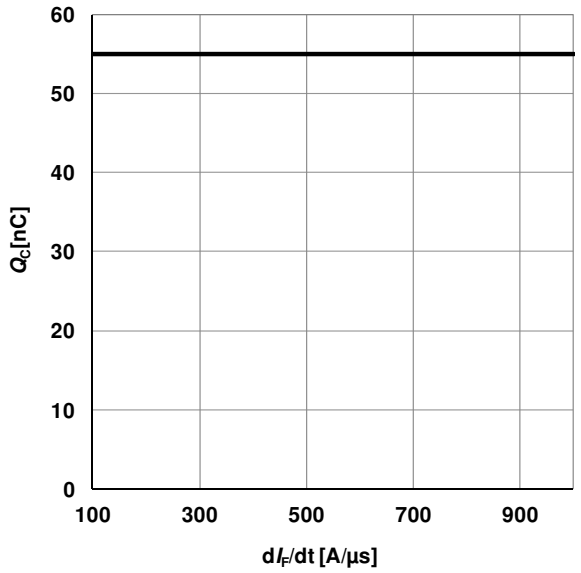
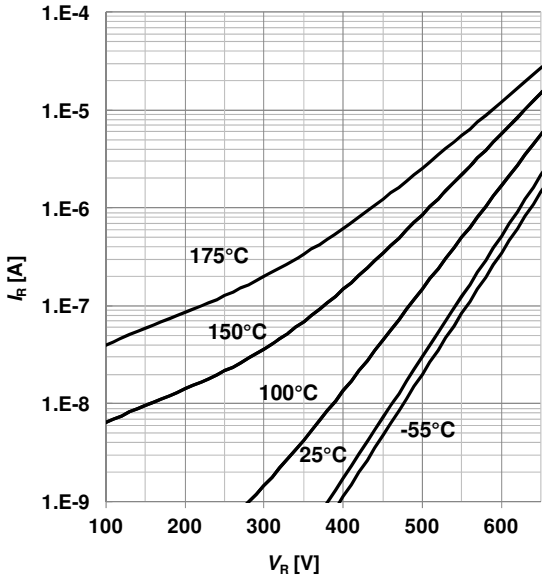
Typical forward characteristics	Typical forward characteristics in surge current
	
$I_F=f(V_F)$; t_p=200 µs; parameter: T_j	$I_F=f(V_F)$; t_p=200 µs; parameter: T_j

Table 9

Typ. capacitance charge vs. current slope[1)]	Typ. reverse current vs. reverse voltage
	
Q_C=f(di$_F$/dt); T_j=150°C; V_R=400 V; $I_F \leq I_{F,max}$	I_R=f(V_R); parameter: T_j

1) Only capacitive charge, guaranteed by design.

Table 10

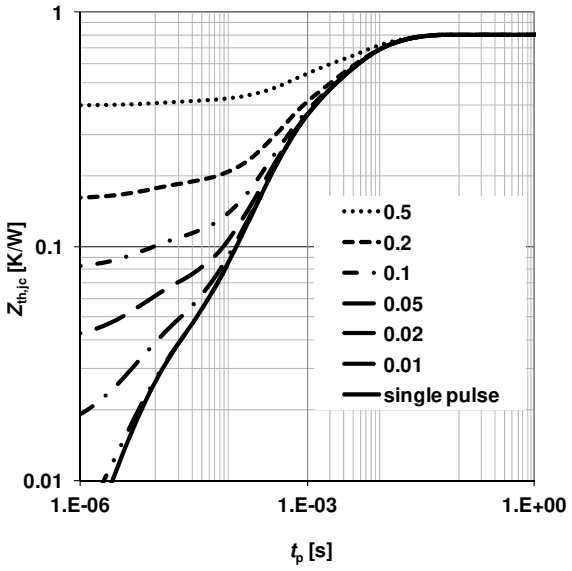
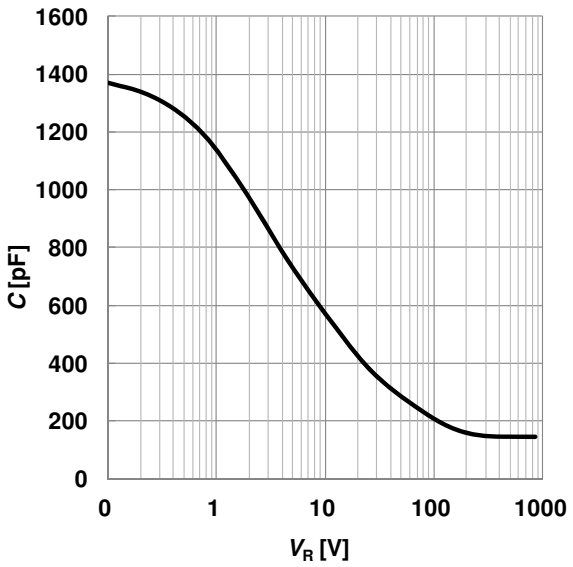
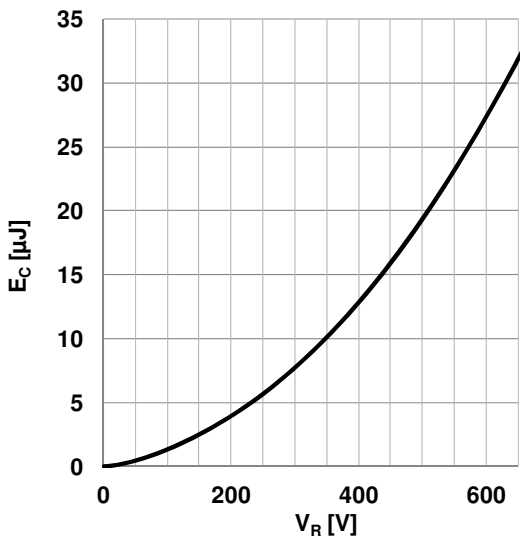
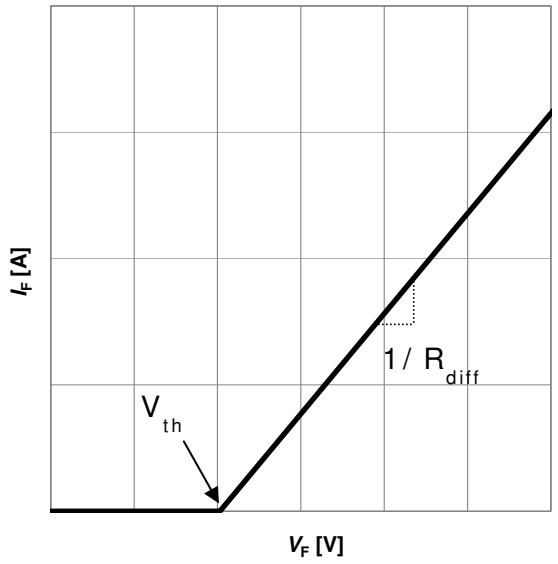
Max. transient thermal impedance	Typ. capacitance vs. reverse voltage
	
$Z_{th,jc}$=f(t_P); parameter: D=t_P/T	C=f(V_R); T_j=25°C; f=1 MHz

Table 11

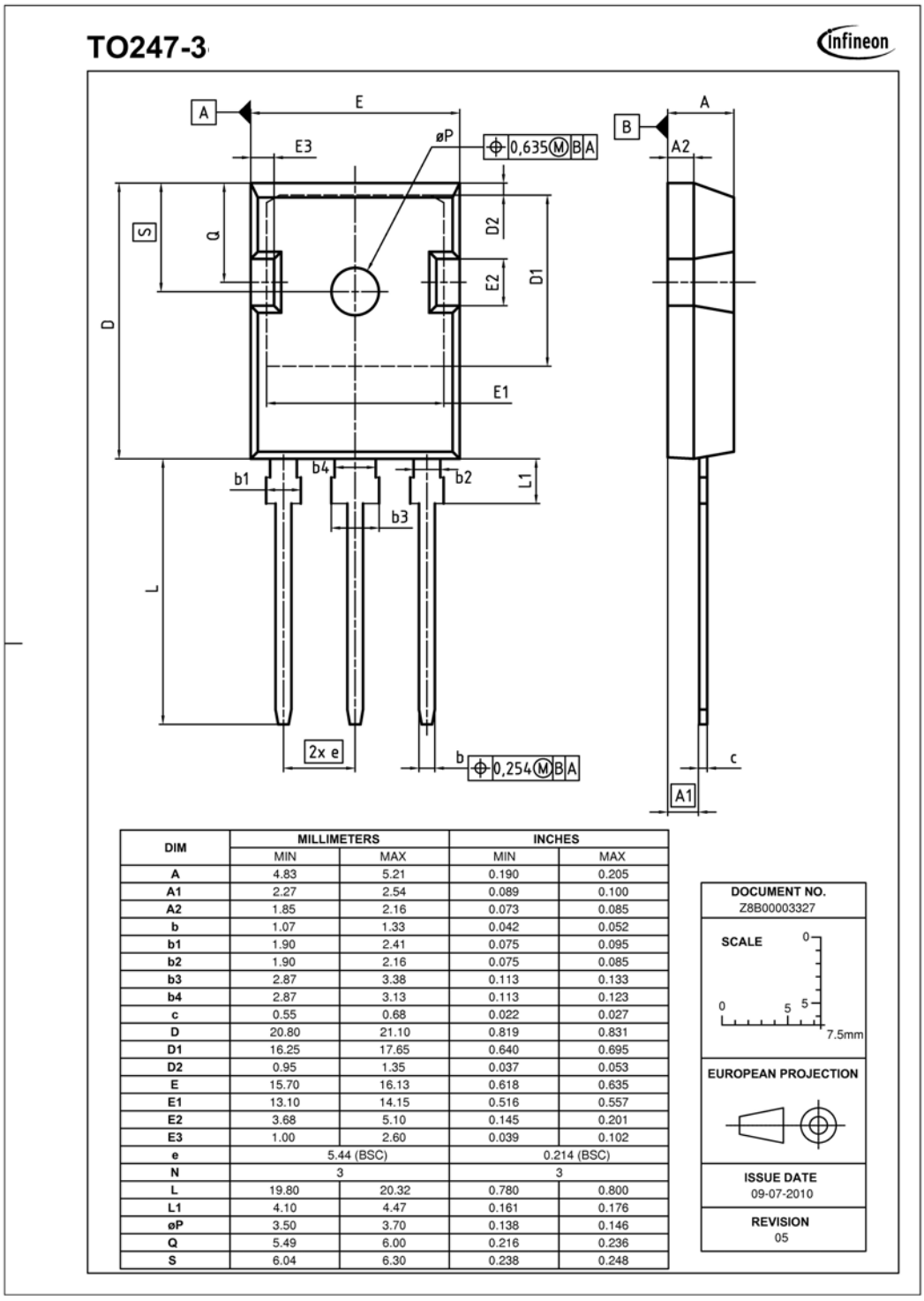
Typ. capacitance stored energy

E_C=f(V_R)

6 Simplified Forward Characteristics Model

Table 12

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

7 Package outlines



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
0 5 5 7.5mm

EUROPEAN PROJECTION

ISSUE DATE
09-07-2010

REVISION
05

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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