SiC

Silicon Carbide Diode

5th Generation thinQ!™

650V SiC Schottky Diode

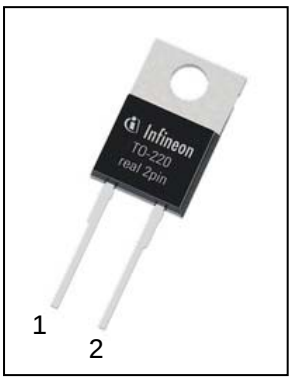
IDH04G65C5

Final Datasheet

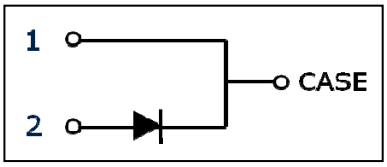
Rev. 2.2, 2012-12-10

Power Management & Multimarket

1 Description



ThinQ!™ 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 (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 9 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	7	nC
E_C; V_R=400V	1.4	µJ
I_F @ T_C < 150°C	4	A

Table 2 Pin Definition

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

Type / ordering Code	Package	Marking	Related links
IDH04G65C5	PG-TO220-2	D0465C5	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	–	–	4	A	T_C < 150°C, D=1
Surge non-repetitive forward current, sine halfwave	$I_{F,SM}$	–	–	38		T_C = 25°C, t_p=10 ms
		–	–	35		T_C = 150°C, t_p=10 ms
Non-repetitive peak forward current	$I_{F,max}$	–	–	215		T_C = 25°C, t_p=10 µs
i²t value	$\int i^2dt$	–	–	7.3	A²s	T_C = 25°C, t_p=10 ms
		–	–	6.1		T_C = 150°C, t_p=10 ms
Repetitive peak reverse voltage	V_{RRM}	–	–	650	V	T_j = 25°C
Diode dv/dt ruggedness	dv/dt	–	–	100	V/ns	V_R=0..480 V
Power dissipation	P_{tot}	–	–	48	W	T_C = 25°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}	–	1.9	3.1	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= 0.07 mA, T_j=25°C
Diode forward voltage	V_F	–	1.5	1.7		I_F= 4 A, T_j=25°C
		–	1.8	2.1		I_F= 4 A, T_j=150°C
Reverse current	I_R	–	0.2	70	µA	V_R=650 V, T_j=25°C
		–	0.05	24		V_R=600 V, T_j=25°C
		–	0.8	500		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	–	7		nC	V_R=400 V, *di/dt*=200A/µs, $I_F \leq I_{F,MAX}$, T_j=150°C
Total Capacitance	C	–	130	–	pF	V_R=1 V, *f*=1 MHz
		–	17	–		V_R=300 V, *f*=1 MHz
		–	16	–		V_R=600 V, *f*=1 MHz

5 Electrical characteristics diagrams

Table 7

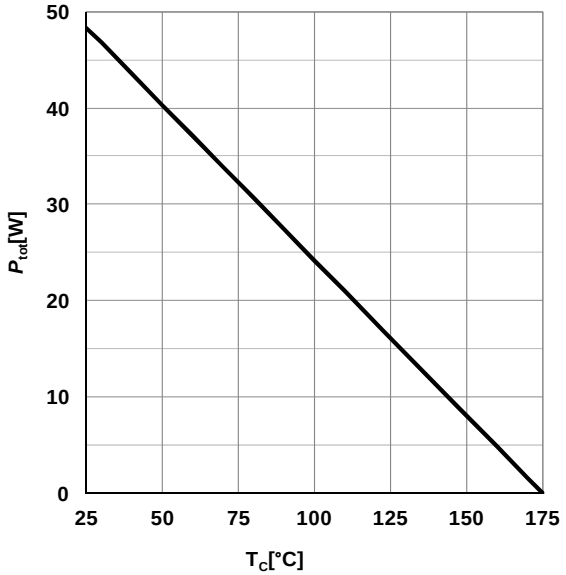
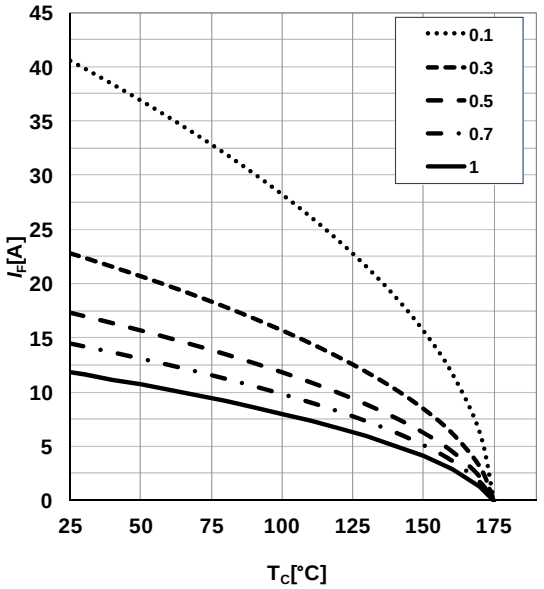
Power dissipation	Maximal diode forward current
	
P_{tot}=f(T_C); $R_{thJC,max}$	I_F=f(T_C); $R_{thJC,max}$;T_j≤175°C; parameter D=duty cycle

Table 8

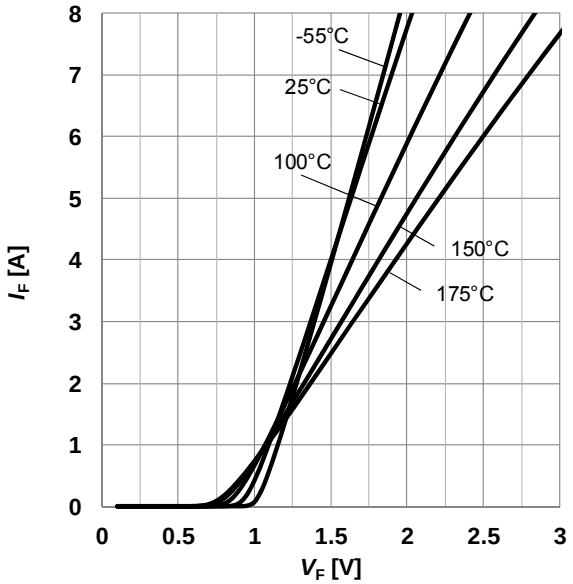
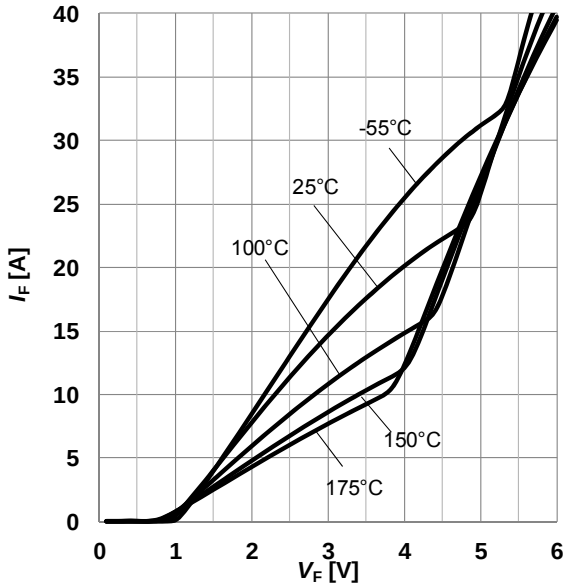
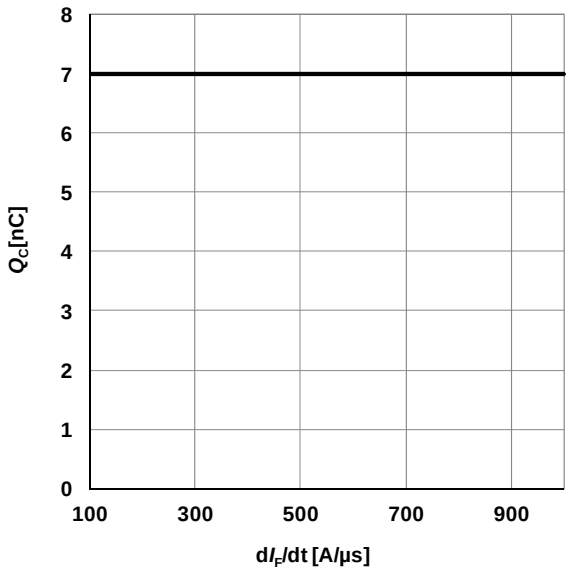
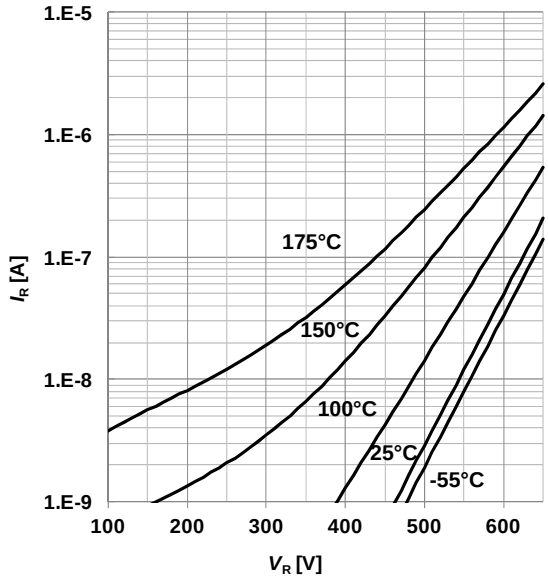
Typical forward characteristics	Typical forward characteristics in surge current
	
I_F=f(V_F); t_p=200 µs; parameter: T_j	I_F=f(V_F); t_p=200 µs; parameter: T_j

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

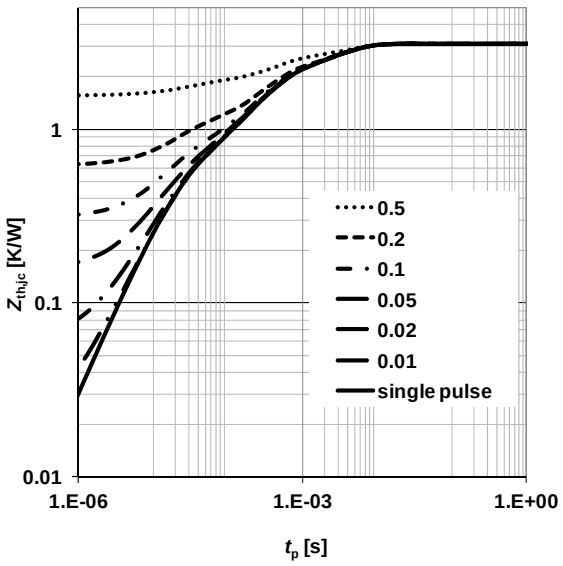
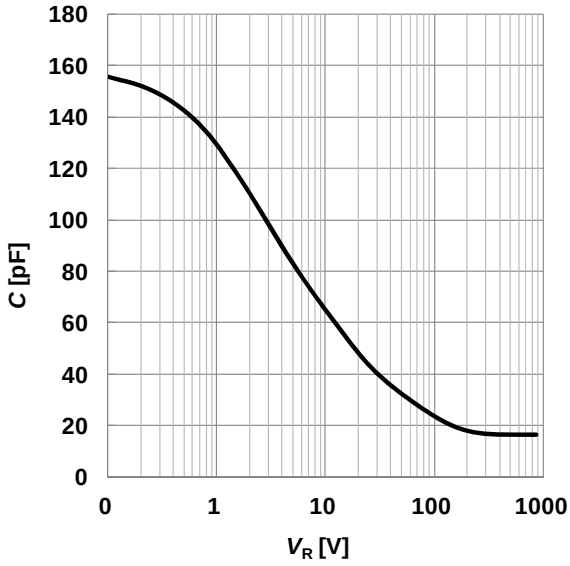
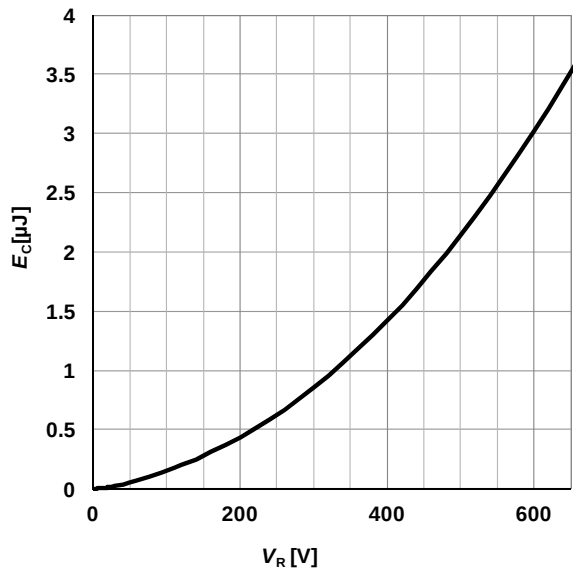
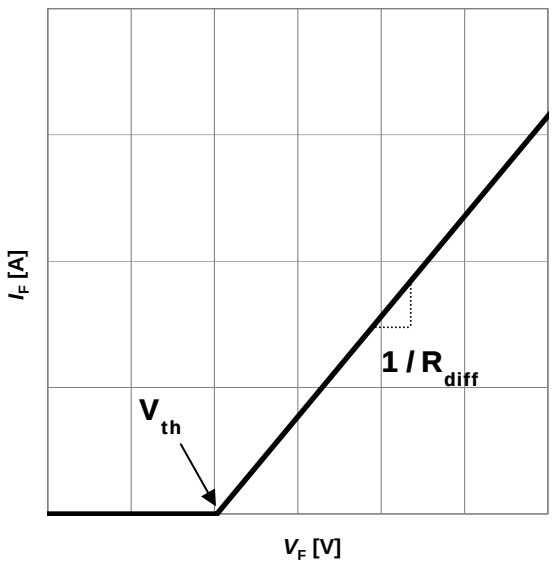
Max. transient thermal impedance	Typ. capacitance vs. reverse voltage
	
$Z_{th,jc}$=f(t_P); parameter: D=t_P/T	C=f(V_R); T_j=25°C; f=1 MHz

Table 11

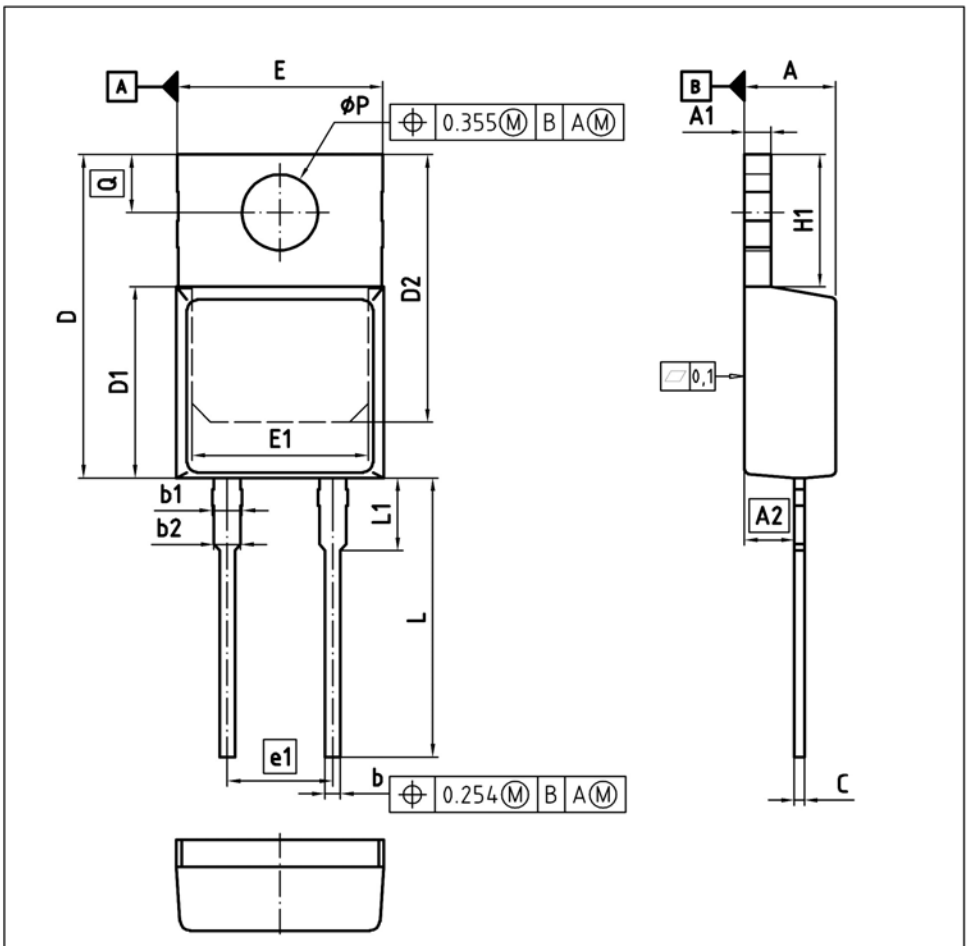
Typ. capacitance stored energy

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] $R_{DIFF}(T_j) = 3.21 \cdot 10^{-6} \cdot T_j^2 + 3.21 \cdot 10^{-4} \cdot T_j + 0.116$ [Ω]
V_F=f(I_F)	T_j in °C; -55°C < T_j < 175°C; I_F < 8 A

7 Package outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.50	0.169	0.177
A1	1.17	1.37	0.046	0.054
A2	2.30	2.50	0.091	0.098
b	0.65	0.85	0.026	0.033
b1	1.19	1.69	0.047	0.066
b2	1.19	1.39	0.047	0.055
c	0.40	0.60	0.016	0.024
D	15.35	15.95	0.604	0.628
D1	9.05	9.45	0.356	0.372
D2	12.30	13.05	0.484	0.514
E	9.80	10.20	0.386	0.402
E1	7.25	8.60	0.285	0.339
e1	5.08		0.200	
N	2		2	
H1	5.90	6.90	0.232	0.272
L	13.00	14.00	0.512	0.551
L1	3.30	3.70	0.130	0.146
øP	3.55	3.70	0.140	0.146
Q	2.60	3.00	0.102	0.118

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SCALE 0 2.5 5mm

EUROPEAN PROJECTION

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REVISION
01

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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