SiC

Silicon Carbide Diode

5th Generation thinQ!™

650V SiC Schottky Diode

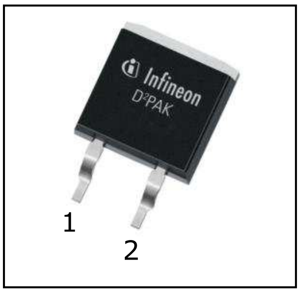
IDK10G65C5

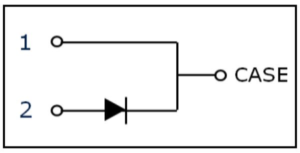
Final Data Sheet

Rev. 2.1, 2017-08-11

Power Management & Multimarket

5th Generation thinQ!™ SiC Schottky Diode IDK10G65C5





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 22 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 = 400 V)	15	nC
E_C (V_R = 400 V)	3.5	µJ
I_F (T_C < 140°C)	10	A

Table 2 Pin Definition

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

Type / ordering Code	Package	Marking	Related links
IDK10G65C5	PG-TO263-2	D1065C5	www.infineon.com/sic

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

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	–	–	10	A	$T_C < 140°C$, $D = 1$
Surge non-repetitive forward current, sine halfwave	$I_{F,SM}$	–	–	82		$T_C = 25°C$, $t_p = 10$ ms
		–	–	71		$T_C = 150°C$, $t_p = 10$ ms
Non-repetitive peak forward current	$I_{F,max}$	–	–	431		$T_C = 25°C$, $t_p = 10$ µs
i²t value	$\int i^2dt$	–	–	34	A²s	$T_C = 25°C$, $t_p = 10$ ms
		–	–	25		$T_C = 150°C$, $t_p = 10$ 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}	–	–	89	W	$T_C = 25°C$
Operating and storage temperature	$T_j;T_{stg}$	-55	–	175	°C	–

3 Thermal characteristics

Table 4 Thermal characteristics TO-263-2

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction-case	R_{thJC}	–	1.0	1.7	K/W	–
Thermal resistance, junction-ambient 1)	R_{thJA}	–	–	62		SMD version, device on PCB, minimal footprint
		–	35	–		SMD version, device on PCB, 6 cm² cooling area

1) Device on 40 mm * 40mm * 1.5 mm one layer epoxy PCB FR4 with 6 cm² copper area (thickness 70 µm) for cathode connection, PCB is vertical without air stream cooling.

4 Electrical characteristics

Table 5 Static characteristics

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
DC blocking voltage	V_{DC}	650	–	–	V	$I_R = 0.18$ mA, $T_j = 25°C$
Diode forward voltage	V_F	–	1.5	1.8		$I_F = 10$ A, $T_j = 25°C$
		–	1.8	2.2		$I_F = 10$ A, $T_j = 150°C$
Reverse current	I_R	–	0.5	180	µA	$V_R = 650$ V, $T_j = 25°C$
		–	0.13	64		$V_R = 600$ V, $T_j = 25°C$
		–	2.0	1250		$V_R = 650$ V, $T_j = 150°C$

Table 6 AC characteristics

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Total capacitive charge	Q_c	–	15	–	nC	$V_R = 400$ V, $di/dt = 200$A/µs $I_F \leq I_{F,MAX}$, $T_j = 150°C$.
Total Capacitance	C	–	300	–	pF	$V_R = 1$ V, $f = 1$ MHz
		–	40	–		$V_R = 300$ V, $f = 1$ MHz
		–	39	–		$V_R = 600$ V, $f = 1$ MHz

5 Electrical characteristics diagrams

Table 7

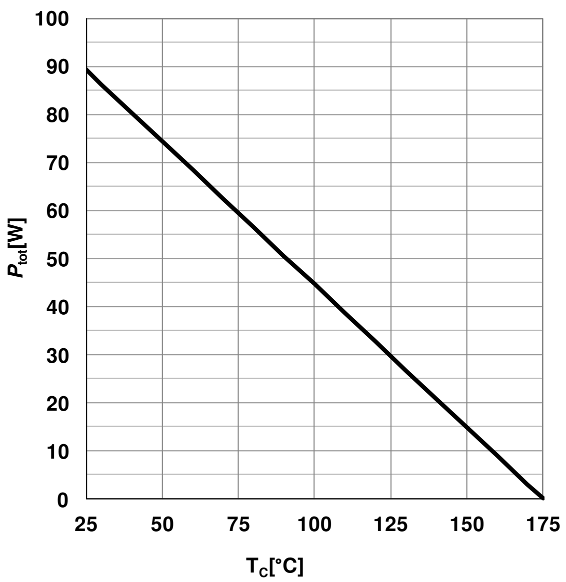
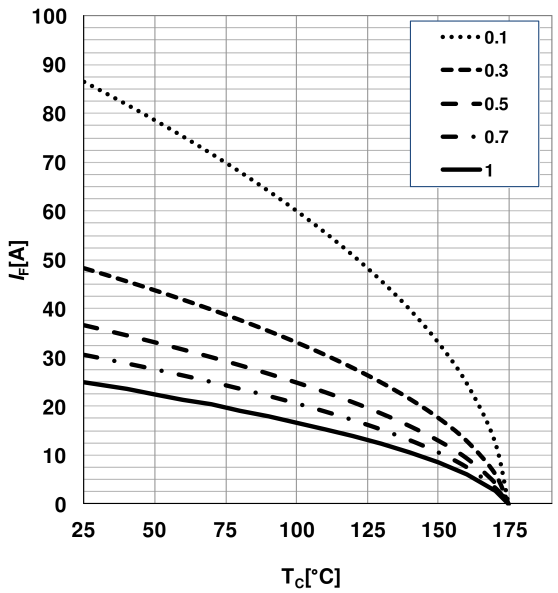
Power dissipation	Diode forward current
	
$P_{tot} = f(T_C)$; $R_{thJC,max}$	$I_F = f(T_C)$; $T_j \leq 175°C$; $R_{thJC,max}$; Parameter: D = duty cycle

Table 8

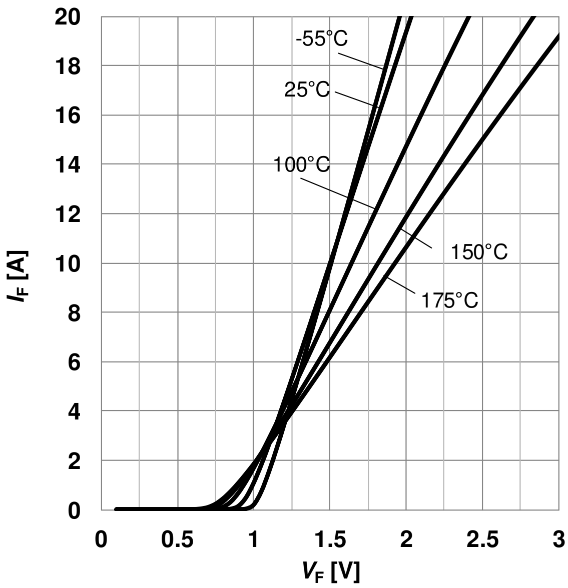
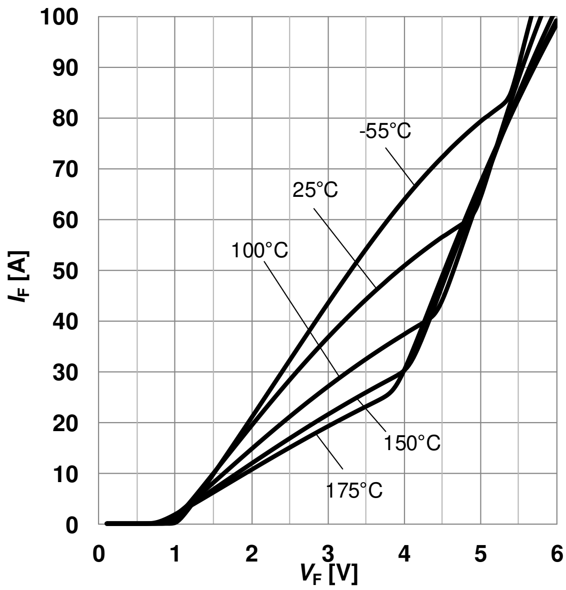
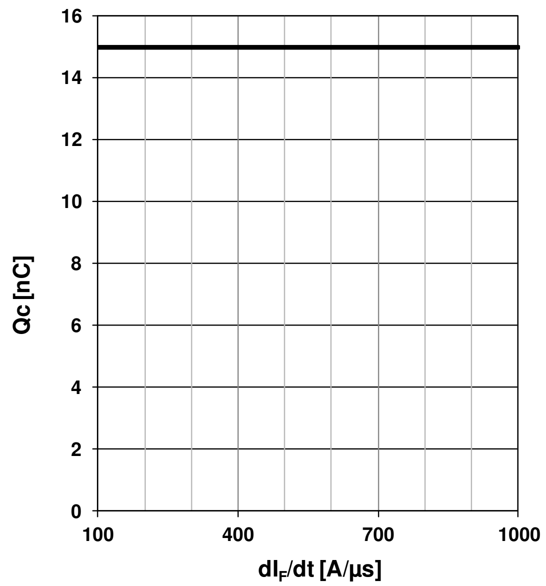
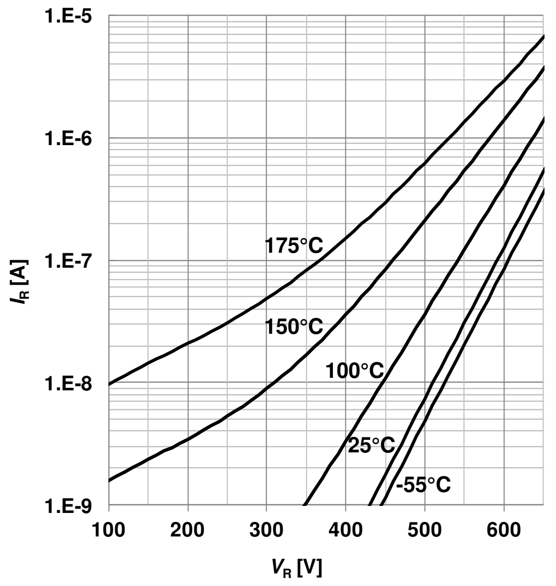
Typical forward characteristics	Typical forward characteristics in surge current
	
$I_F = f(V_F)$; $t_p = 200$ µs; parameter: T_j	$I_F = f(V_F)$; $t_p = 200$ µs; parameter: T_j

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

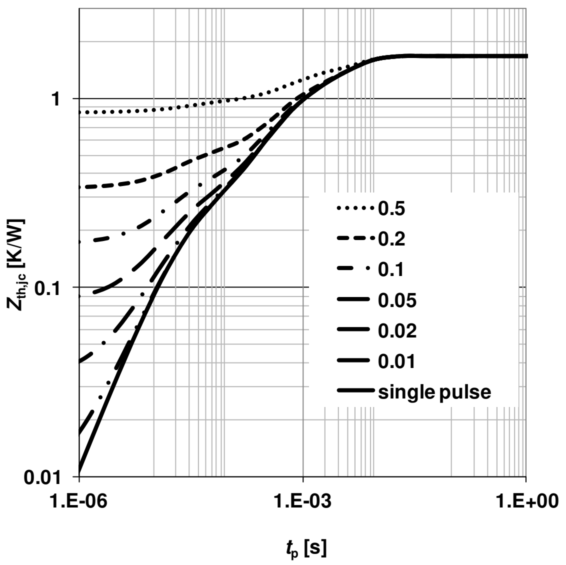
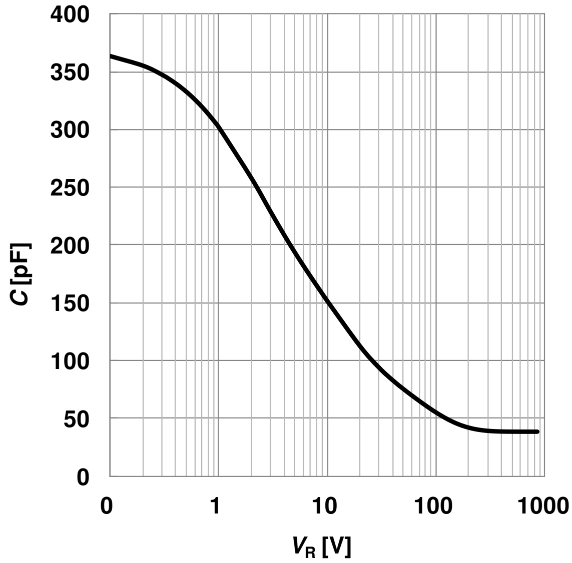
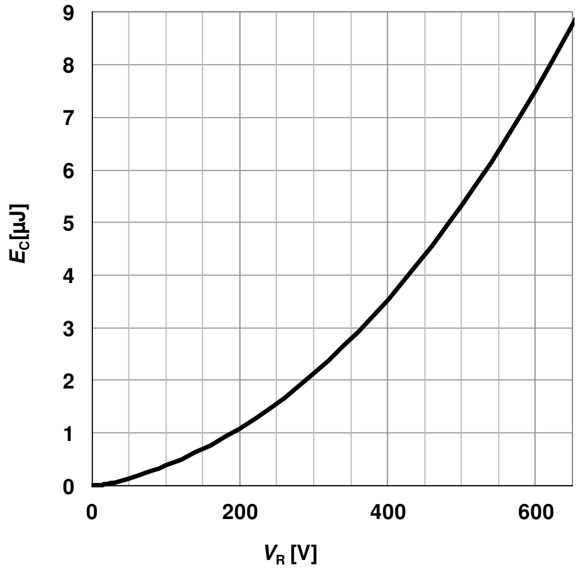
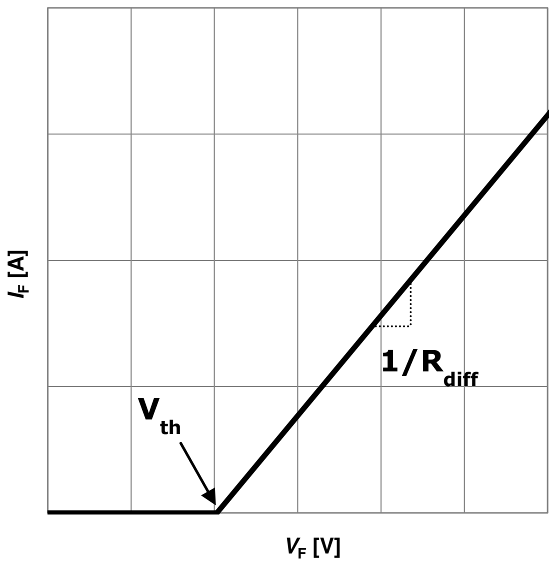
Max. transient thermal impedance	Typ. capacitance vs. reverse voltage
	
$Z_{th,jc} = f(t_P)$; parameter: $D = t_P/T$	$C = f(V_R)$; $T_j = 25°C$; $f = 1$ MHz

Table 11

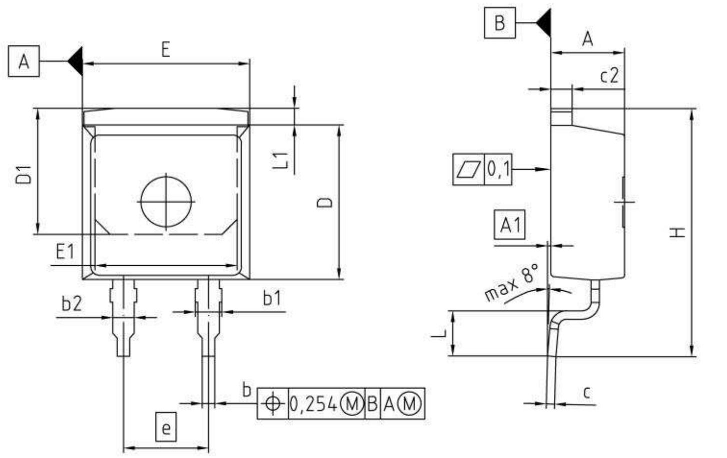
Typ. capacitance stored energy

$E_C = f(V_R)$

6 Simplified forward characteristics model

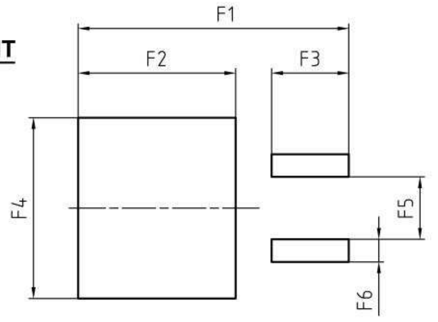
Table 12

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] $R_{DIFF}(T_j) = 1.29 \cdot 10^{-6} \cdot T_j^2 + 1.29 \cdot 10^{-4} \cdot T_j + 0.047$ [Ω]
$V_F = f(I_F)$	T_j [°C]; -55°C < T_j < 175°C; I_F < 20 A

7 Package outlines



FOOTPRINT



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.50	0.169	0.177
A1	0.00	0.25	0.000	0.010
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
c2	1.17	1.37	0.046	0.054
D	9.05	9.45	0.356	0.372
D1	6.90	7.65	0.272	0.301
E	9.80	10.20	0.386	0.402
E1	7.25	8.60	0.285	0.339
e	5.08 (BSC)		0.200 (BSC)	
N	2		2	
H	14.61	15.88	0.575	0.625
L	2.40	3.00	0.094	0.118
L1	0.70	1.30	0.028	0.051
F1	16.15		0.636	
F2	9.40		0.370	
F3	4.60		0.181	
F4	10.80		0.425	
F5	3.73		0.147	
F6	1.35		0.053	

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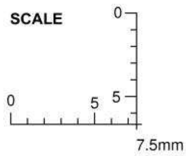
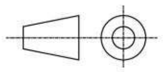
SCALE



EUROPEAN PROJECTION



ISSUE DATE
08-05-2013

REVISION
02

Figure 1 Outlines TO-263-2, dimensions in mm/inch

Revision History

IDK10G65C5

Revision: 2017-09-06, Rev. 2.1

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.1	2017-09-06	Updated IR,max values in table 5

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