

SiC

Silicon Carbide Diode

5th Generation thinQ!™

650V SiC Schottky Diode

IDK03G65C5

Final Data Sheet

Rev. 2.1, 2017-08-11

Power Management & Multimarket

5th Generation thinQ!™ SiC Schottky Diode

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 ($Q_C \times V_f$).

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 6.8 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

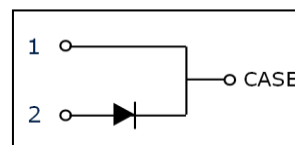
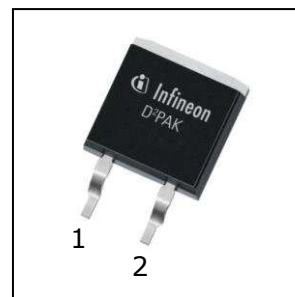
Parameter	Value	Unit
V_{DC}	650	V
$Q_C (V_R = 400 \text{ V})$	5	nC
$E_C (V_R = 400 \text{ V})$	1.1	μJ
$I_F (T_C < 155^\circ\text{C})$	3	A

Table 2 Pin Definition

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

Type / ordering Code	Package	Marking	Related links
IDK03G65C5	PG-TO263-2	D0365C5	www.infineon.com/sic

IDK03G65C5



1) J-STD20 and JESD22

2) All devices tested under avalanche conditions for a time period of 10 ms

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

2 Maximum ratings

Table 3 Maximum ratings

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Continuous forward current	I_F	–	–	3	A	$T_C < 155^\circ\text{C}$, $D = 1$
Surge non-repetitive forward current, sine halfwave	$I_{F,SM}$	–	–	31		$T_C = 25^\circ\text{C}$, $t_p = 10\text{ ms}$
		–	–	29		$T_C = 150^\circ\text{C}$, $t_p = 10\text{ ms}$
Non-repetitive peak forward current	$I_{F,max}$	–	–	178		$T_C = 25^\circ\text{C}$, $t_p = 10\text{ }\mu\text{s}$
i^2t value	$\int i^2 dt$	–	–	4.7	A ² s	$T_C = 25^\circ\text{C}$, $t_p = 10\text{ ms}$
		–	–	4.2		$T_C = 150^\circ\text{C}$, $t_p = 10\text{ ms}$
Repetitive peak reverse voltage	V_{RRM}	–	–	650	V	$T_j = 25^\circ\text{C}$
Diode dv/dt ruggedness	dv/dt	–	–	100	V/ns	$V_R = 0..480\text{ V}$
Power dissipation	P_{tot}	–	–	42	W	$T_C = 25^\circ\text{C}$
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}	–	2.2	3.6	K/W	–
Thermal resistance, junction-ambient ¹⁾	R_{thJA}	–	–	62		SMD version, device on PCB, minimal footprint
		–	35	–		SMD version, device on PCB, 6 cm ² cooling area

1) Device on 40 mm * 40 mm * 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	$I_R = 0.05 \text{ mA}$, $T_j = 25^\circ\text{C}$
Diode forward voltage	V_F	–	1.5	1.8		$I_F = 3 \text{ A}$, $T_j = 25^\circ\text{C}$
		–	1.8	2.2		$I_F = 3 \text{ A}$, $T_j = 150^\circ\text{C}$
Reverse current	I_R	–	0.15	50	μA	$V_R = 650 \text{ V}$, $T_j = 25^\circ\text{C}$
		–	0.03	18		$V_R = 600 \text{ V}$, $T_j = 25^\circ\text{C}$
		–	0.6	370		$V_R = 650 \text{ V}$, $T_j = 150^\circ\text{C}$

Table 6 AC characteristics

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Total capacitive charge	Q_c	–	5	–	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	–	100	–	pF	$V_R = 1 \text{ V}$, $f = 1 \text{ MHz}$
		–	13.0	–		$V_R = 300 \text{ V}$, $f = 1 \text{ MHz}$
		–	12.8	–		$V_R = 600 \text{ V}$, $f = 1 \text{ MHz}$

5 Electrical characteristics diagrams

Table 7

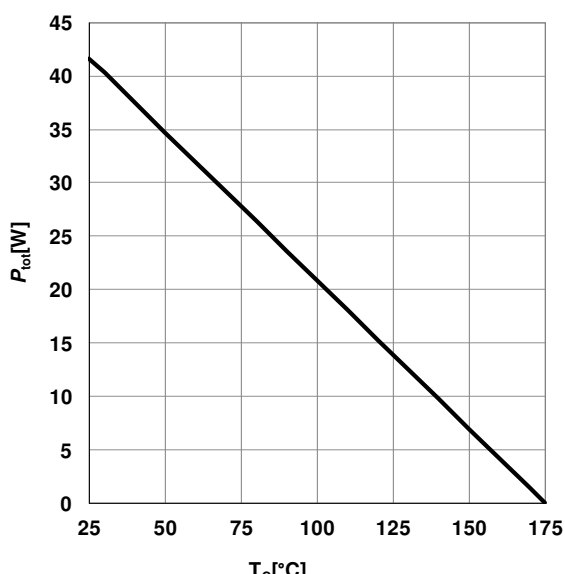
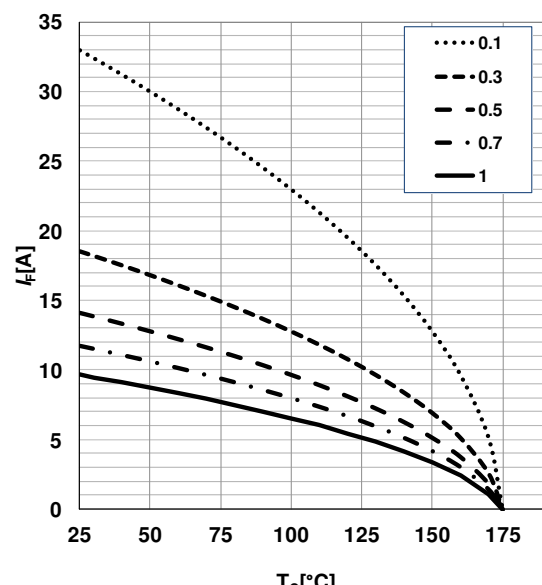
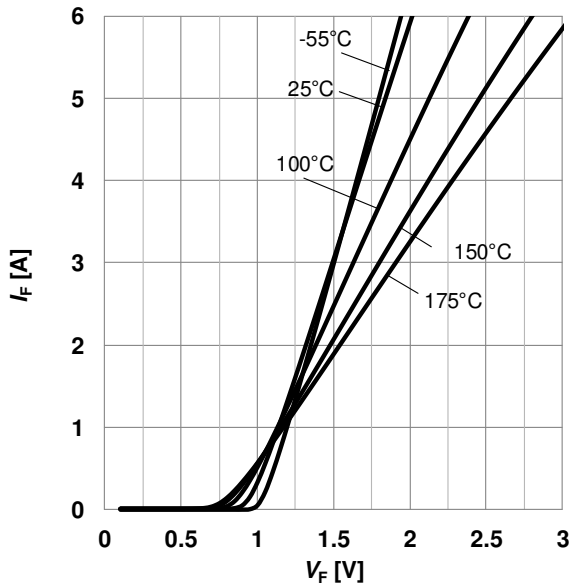
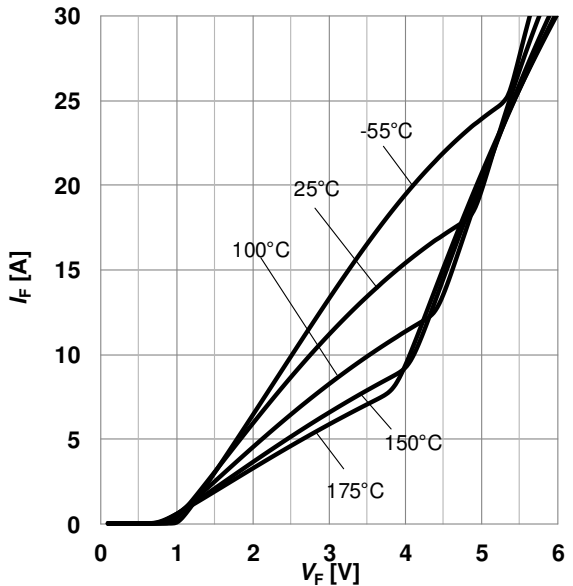
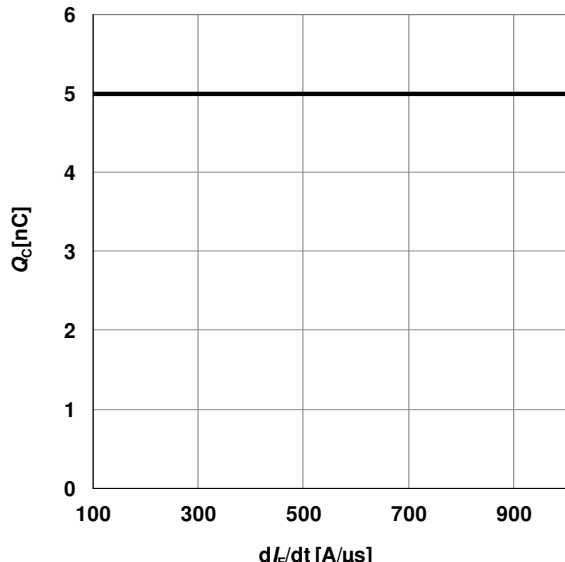
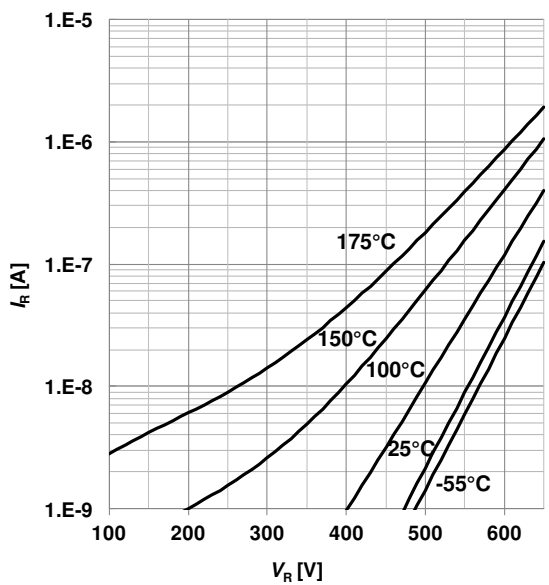
Power dissipation	Maximal diode forward current
	
$P_{\text{tot}} = f(T_c); R_{\text{thJC,max}}$	$I_F = f(T_c); R_{\text{thJC,max}}; T_j \leq 175^\circ\text{C};$ Parameter D = duty cycle

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

1) Only capacitive charge, guaranteed by design.

Table 10

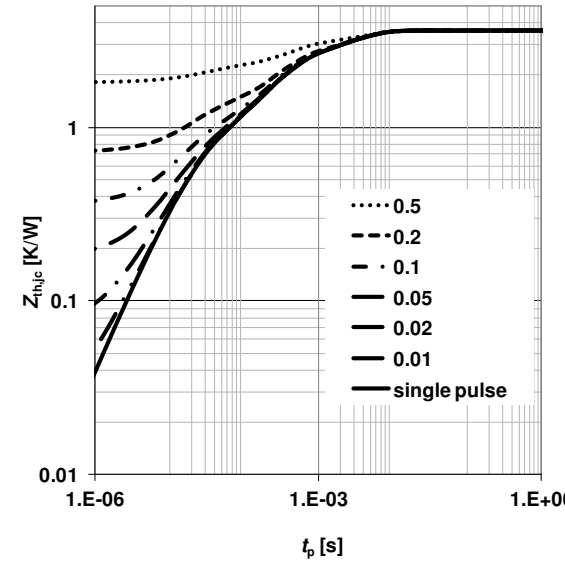
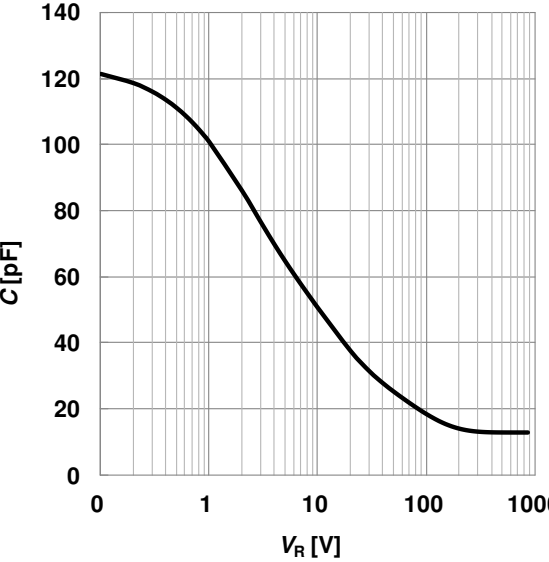
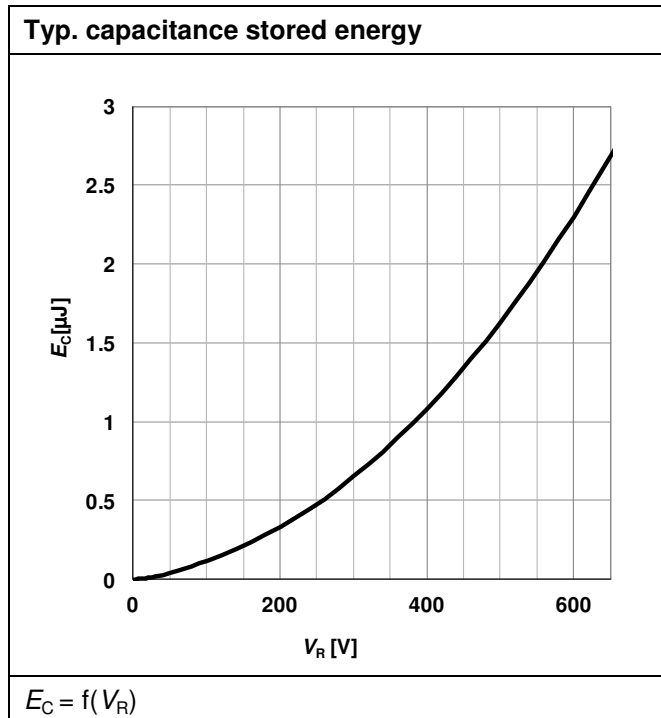
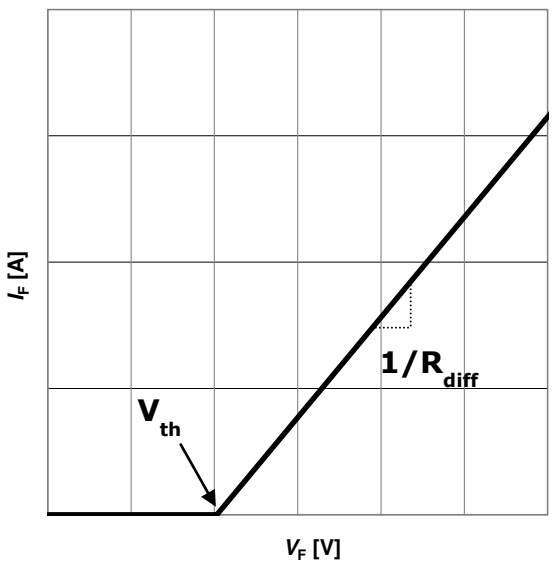
Max. transient thermal impedance	Typ. capacitance vs. reverse voltage
	
$Z_{th,jc} = f(t_p)$; parameter: $D = t_p/T$	$C = f(V_R)$; $T_j = 25^\circ\text{C}$; $f = 1\text{ MHz}$

Table 11



6 Simplified forward characteristics model

Table 12

Equivalent forward current curve	Mathematical Equation
	$V_F = V_{TH} + R_{DIFF} \cdot I_F$ $V_{TH}(T_j) = -0.001 \cdot T_j + 1.04 \text{ [V]}$ $R_{DIFF}(T_j) = 4.82 \cdot 10^{-6} \cdot T_j^2 + 4.82 \cdot 10^{-4} \cdot T_j + 0.174 \text{ [}\Omega\text{]}$
$V_F = f(I_F)$	$T_j \text{ [}^\circ\text{C]}; -55^\circ\text{C} < T_j < 175^\circ\text{C}; I_F < 6 \text{ A}$

7 **Package outlines**

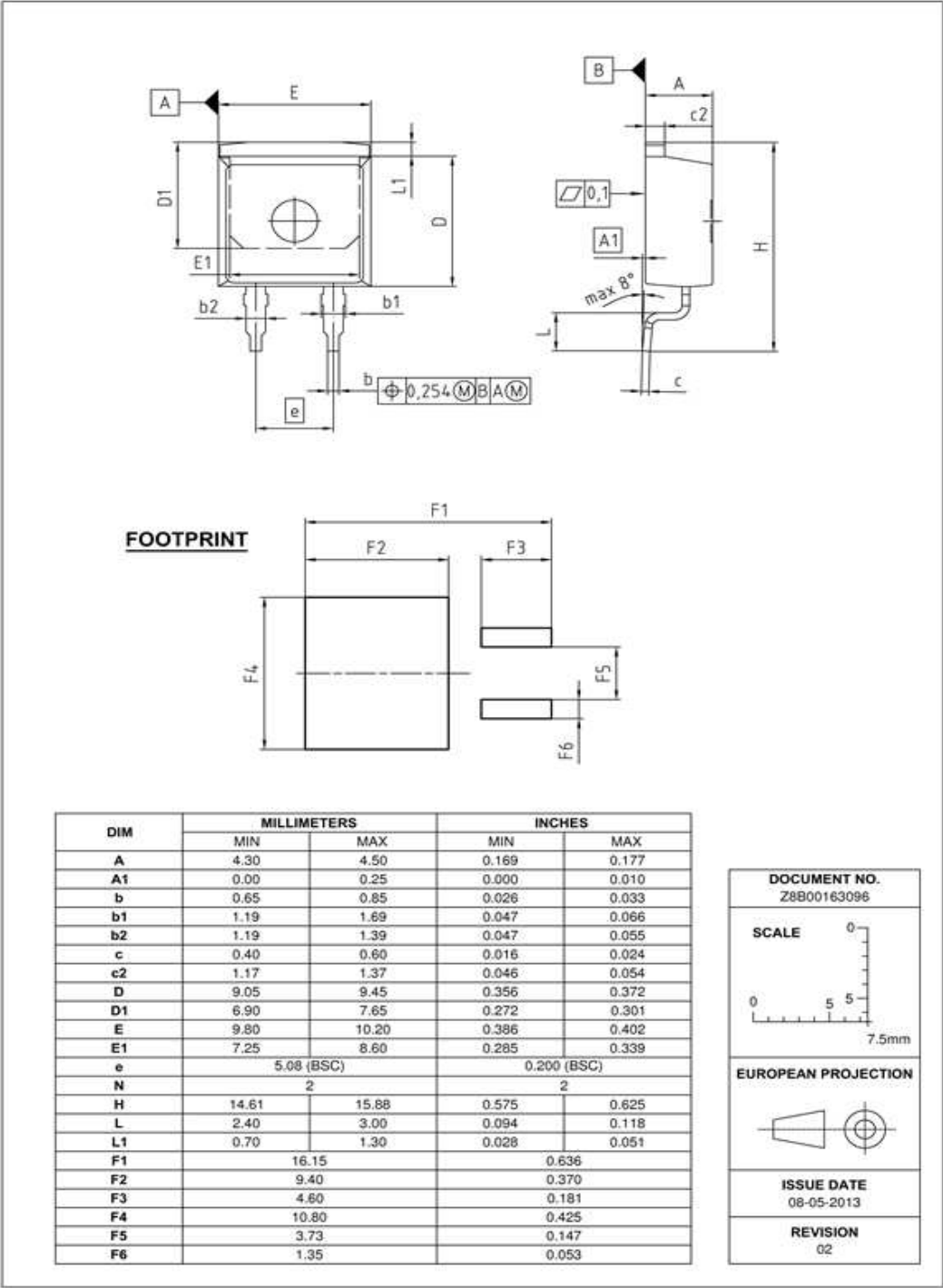


Figure 1 Outlines TO-263-2, dimensions in mm/inch

Revision History

IDK03G65C5

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

Trademarks of Infineon Technologies AG

AURIX™, C166™, CanPAK™, CIPOS™, CoolGaN™, CoolMOS™, CoolSET™, CoolSiC™, CORECONTROL™, CROSSAVE™, DAVE™, DI-POL™, DrBlade™, EasyPIM™, EconoBRIDGE™, EconoDUAL™, EconoPACK™, EconoPIM™, EiceDRIVER™, eupec™, FCOS™, HITFET™, HybridPACK™, Infineon™, ISOFACE™, IsoPACK™, i-Wafer™, MIPAQ™, ModSTACK™, my-d™, NovalithIC™, OmniTune™, OPTIGA™, OptiMOS™, ORIGA™, POWERCODE™, PRIMARION™, PrimePACK™, PrimeSTACK™, PROFET™, PRO-SiL™, RASIC™, REAL3™, ReverSave™, SatRIC™, SIEGET™, SiPMOS™, SmartLEWIS™, SOLID FLASH™, SPOC™, TEMPFET™, thinQ!™, TRENCHSTOP™, TriCore™.

Trademarks updated August 2015

Other Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

We Listen to Your Comments

Any information within this document that you feel is wrong, unclear or missing at all? Your feedback will help us to continuously improve the quality of this document. Please send your proposal (including a reference to this document) to:

erratum@infineon.com

Published by

Infineon Technologies AG

81726 München, Germany

© 2017 Infineon Technologies AG

All Rights Reserved.

Legal Disclaimer

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie").

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

Information

For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office (www.infineon.com).

Warnings

Due to technical requirements, components may contain dangerous substances. For information on the types in question, please contact the nearest Infineon Technologies Office.

The Infineon Technologies component described in this Data Sheet may be used in life-support devices or systems and/or automotive, aviation and aerospace applications or systems only with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support, automotive, aviation and aerospace device or system or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.