

High speed switching series fifth generation

High speed IGBT in TRENCHSTOP™ 5 technology

Features and Benefits:

High speed H5 technology offering

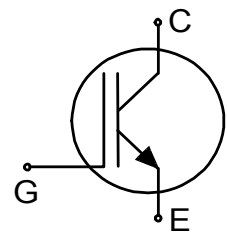
- Best-in-Class efficiency in hard switching and resonant topologies
- 650V breakdown voltage
- Low Q_G
- Maximum junction temperature 175°C
- Pb-free lead plating; RoHS compliant
- Complete product spectrum and PSpice Models:
<http://www.infineon.com/igbt/>

Potential Applications:

- Energy Generation
 - Solar String Inverter
 - Solar Micro Inverter
- Industrial Power Supplies
 - Industrial SMPS
 - Industrial UPS
- Metal Treatment
 - Welding
- Energy Distribution
 - Energy Storage
- Infrastructure – Charge
 - Charger

Product Validation:

Qualified for industrial applications according to the relevant tests of JEDEC47/20/22



Key Performance and Package Parameters

Type	V_{CE}	I_C	$V_{CEsat}, T_{vj}=25^{\circ}C$	T_{vjmax}	Marking	Package
IGB50N65H5	650V	50A	1.65V	175°C	G50EH5	PG-TO263-3



Table of Contents

Description	1
Table of Contents	2
Maximum Ratings	3
Thermal Resistance	3
Electrical Characteristics	3
Electrical Characteristics Diagrams	6
Package Drawing	11
Testing Conditions	12
Revision History	13
Disclaimer	14

High speed switching series fifth generation

Maximum Ratings

For optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.

Parameter	Symbol	Value	Unit
Collector-emitter voltage, $T_{vj} \geq 25^{\circ}\text{C}$	V_{CE}	650	V
DC collector current, limited by T_{vjmax} $T_c = 25^{\circ}\text{C}$ value limited by bondwire $T_c = 100^{\circ}\text{C}$	I_C	80.0 53.7	A
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	150.0	A
Turn off safe operating area $V_{CE} \leq 650\text{V}$, $T_{vj} \leq 175^{\circ}\text{C}$, $t_p = 1\mu\text{s}$	-	150.0	A
Gate-emitter voltage Transient Gate-emitter voltage ($t_p \leq 10\mu\text{s}$, $D < 0.010$)	V_{GE}	± 20 ± 30	V
Power dissipation $T_c = 25^{\circ}\text{C}$ Power dissipation $T_c = 100^{\circ}\text{C}$	P_{tot}	270.0 135.0	W
Operating junction temperature	T_{vj}	$-40 \dots +175$	$^{\circ}\text{C}$
Storage temperature	T_{stg}	$-55 \dots +150$	$^{\circ}\text{C}$
Soldering temperature, reflow soldering (MSL1 according to JEDEC J-STA-020)		260	$^{\circ}\text{C}$

Thermal Resistance

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
R _{th} Characteristics						
IGBT thermal resistance, junction - case	R _{th(j-c)}		-	-	0.55	K/W
Thermal resistance, min. footprint junction - ambient	R _{th(j-a)}		-	-	65	K/W
Thermal resistance, 6cm ² Cu on PCB junction - ambient	R _{th(j-a)}		-	-	40	K/W

Electrical Characteristic, at $T_{vj} = 25^{\circ}\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0V, I_C = 0.20mA$	650	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	$V_{GE} = 15.0V, I_C = 50.0A$ $T_{vj} = 25^{\circ}C$ $T_{vj} = 125^{\circ}C$ $T_{vj} = 175^{\circ}C$	- - -	1.65 1.85 1.95	2.10 - -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 0.50mA, V_{CE} = V_{GE}$	3.2	4.0	4.8	V
Zero gate voltage collector current	I_{CES}	$V_{CE} = 650V, V_{GE} = 0V$ $T_{vj} = 25^{\circ}C$ $T_{vj} = 175^{\circ}C$	- -	- 2000	50 -	μA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0V, V_{GE} = 20V$	-	-	100	nA
Transconductance	g_{fs}	$V_{CE} = 20V, I_C = 50.0A$	-	62.0	-	S

High speed switching series fifth generation

Electrical Characteristic, at $T_{vj} = 25^{\circ}\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Dynamic Characteristic						
Input capacitance	C _{ies}	V _{CE} = 25V, V _{GE} = 0V, f = 1MHz	-	3000	-	pF
Output capacitance	C _{oes}		-	50	-	
Reverse transfer capacitance	C _{res}		-	11	-	
Gate charge	Q _G	V _{CC} = 520V, I _C = 50.0A, V _{GE} = 15V	-	120.0	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L _E		-	7.0	-	nH

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic, at $T_{vj} = 25^{\circ}\text{C}$						
Turn-on delay time	$t_{d(\text{on})}$	$T_{vj} = 25^{\circ}\text{C}$, $V_{CC} = 400\text{V}$, $I_C = 50.0\text{A}$, $V_{GE} = 0.0/15.0\text{V}$, $R_{G(\text{on})} = 12.0\Omega$, $R_{G(\text{off})} = 12.0\Omega$, $L\sigma = 30\text{nH}$, $C\sigma = 30\text{pF}$ $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	23	-	ns
Rise time	t_r		-	31	-	ns
Turn-off delay time	$t_{d(\text{off})}$		-	173	-	ns
Fall time	t_f		-	40	-	ns
Turn-on energy	E_{on}		-	1.59	-	mJ
Turn-off energy	E_{off}		-	0.75	-	mJ
Total switching energy	E_{ts}		-	2.34	-	mJ
Turn-on delay time	$t_{d(\text{on})}$	$T_{vj} = 25^{\circ}\text{C}$, $V_{CC} = 400\text{V}$, $I_C = 25.0\text{A}$, $V_{GE} = 0.0/15.0\text{V}$, $R_{G(\text{on})} = 12.0\Omega$, $R_{G(\text{off})} = 12.0\Omega$, $L\sigma = 30\text{nH}$, $C\sigma = 30\text{pF}$ $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	21	-	ns
Rise time	t_r		-	15	-	ns
Turn-off delay time	$t_{d(\text{off})}$		-	180	-	ns
Fall time	t_f		-	18	-	ns
Turn-on energy	E_{on}		-	0.52	-	mJ
Turn-off energy	E_{off}		-	0.18	-	mJ
Total switching energy	E_{ts}		-	0.70	-	mJ

High speed switching series fifth generation

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic, at $T_{vj} = 150^{\circ}\text{C}$						
Turn-on delay time	$t_{d(\text{on})}$	$T_{vj} = 150^{\circ}\text{C}$, $V_{CC} = 400\text{V}$, $I_C = 50.0\text{A}$, $V_{GE} = 0.0/15.0\text{V}$, $R_{G(\text{on})} = 12.0\Omega$, $R_{G(\text{off})} = 12.0\Omega$, $L\sigma = 30\text{nH}$, $C\sigma = 30\text{pF}$ $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	23	-	ns
Rise time	t_r		-	29	-	ns
Turn-off delay time	$t_{d(\text{off})}$		-	190	-	ns
Fall time	t_f		-	33	-	ns
Turn-on energy	E_{on}		-	1.95	-	mJ
Turn-off energy	E_{off}		-	0.73	-	mJ
Total switching energy	E_{ts}		-	2.68	-	mJ
Turn-on delay time	$t_{d(\text{on})}$	$T_{vj} = 150^{\circ}\text{C}$, $V_{CC} = 400\text{V}$, $I_C = 25.0\text{A}$, $V_{GE} = 0.0/15.0\text{V}$, $R_{G(\text{on})} = 12.0\Omega$, $R_{G(\text{off})} = 12.0\Omega$, $L\sigma = 30\text{nH}$, $C\sigma = 30\text{pF}$ $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	20	-	ns
Rise time	t_r		-	15	-	ns
Turn-off delay time	$t_{d(\text{off})}$		-	205	-	ns
Fall time	t_f		-	26	-	ns
Turn-on energy	E_{on}		-	0.75	-	mJ
Turn-off energy	E_{off}		-	0.27	-	mJ
Total switching energy	E_{ts}		-	1.02	-	mJ

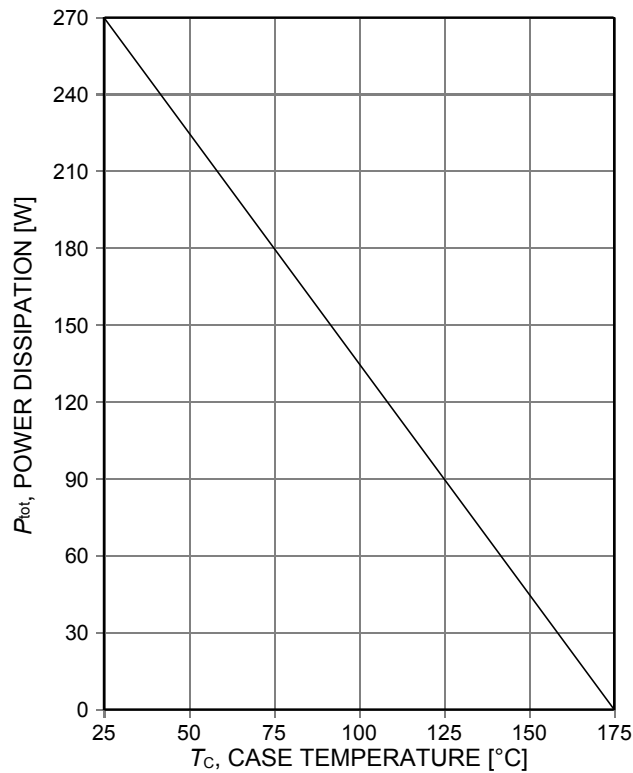


Figure 1. **Power dissipation as a function of case temperature**
($T_{vj} \leq 175^\circ\text{C}$)

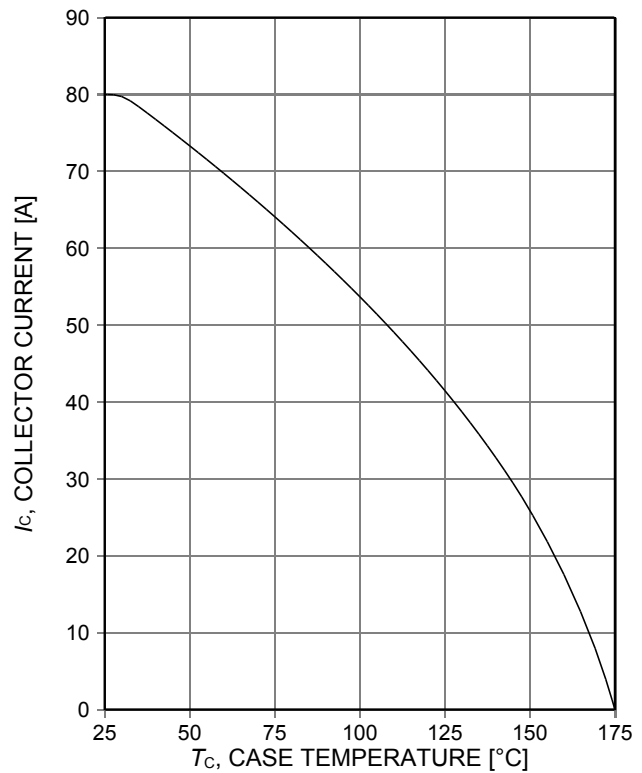


Figure 2. **Collector current as a function of case temperature**
($V_{GE} \geq 15\text{V}$, $T_{vj} \leq 175^\circ\text{C}$)

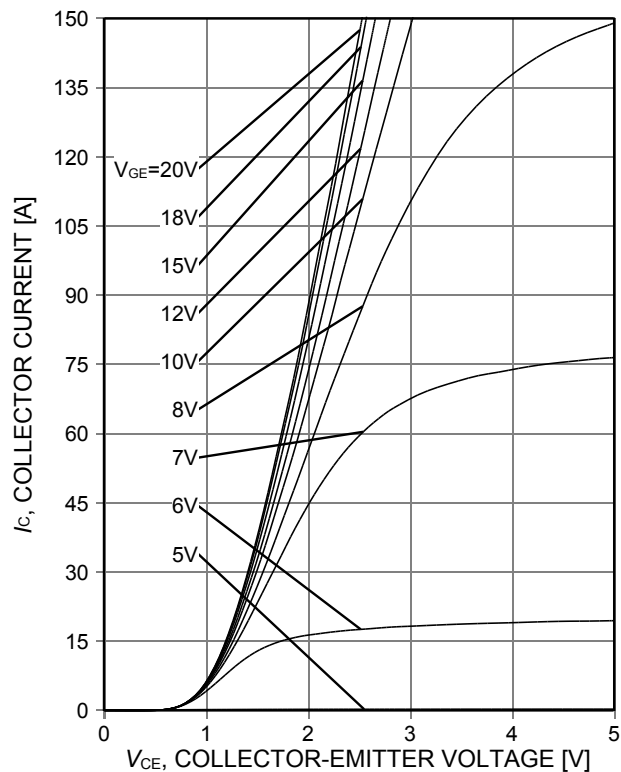


Figure 3. **Typical output characteristic**
($T_{vj} = 25^\circ\text{C}$)

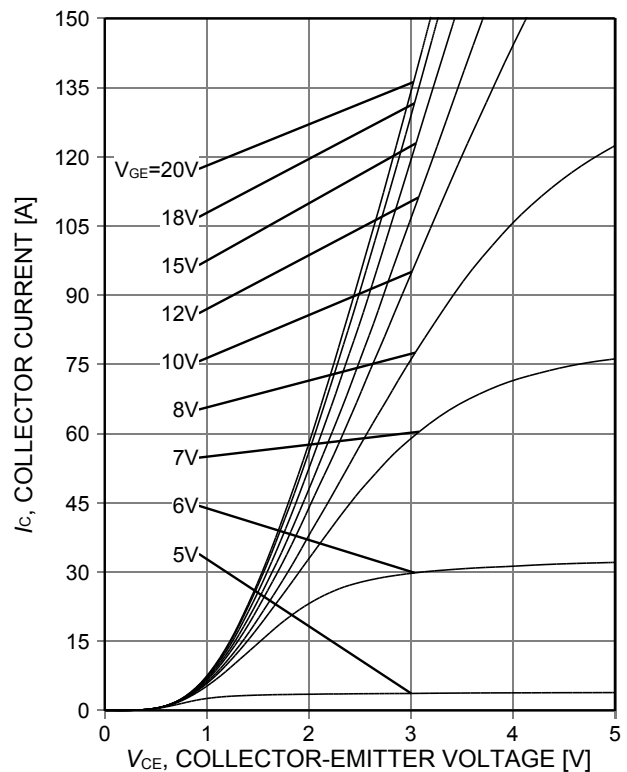


Figure 4. **Typical output characteristic**
($T_{vj} = 150^\circ\text{C}$)

High speed switching series fifth generation

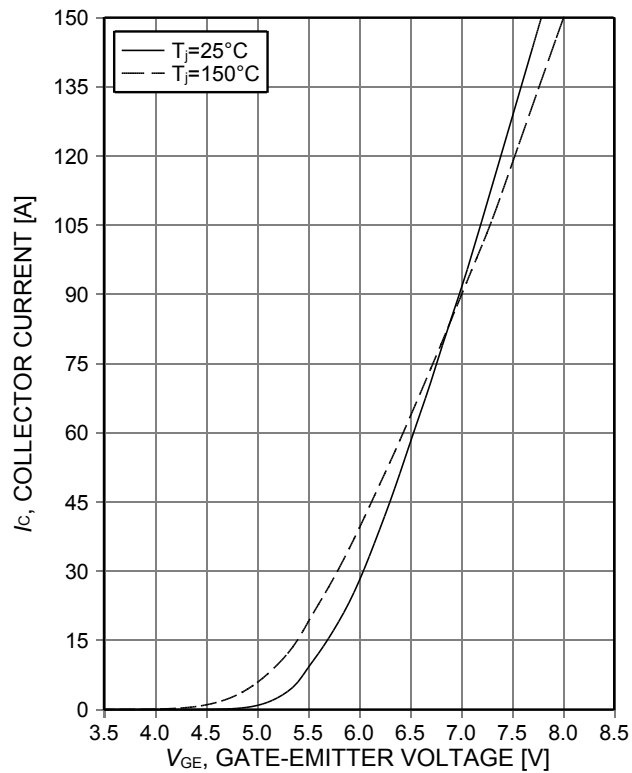


Figure 5. **Typical transfer characteristic**
($V_{CE}=20V$)

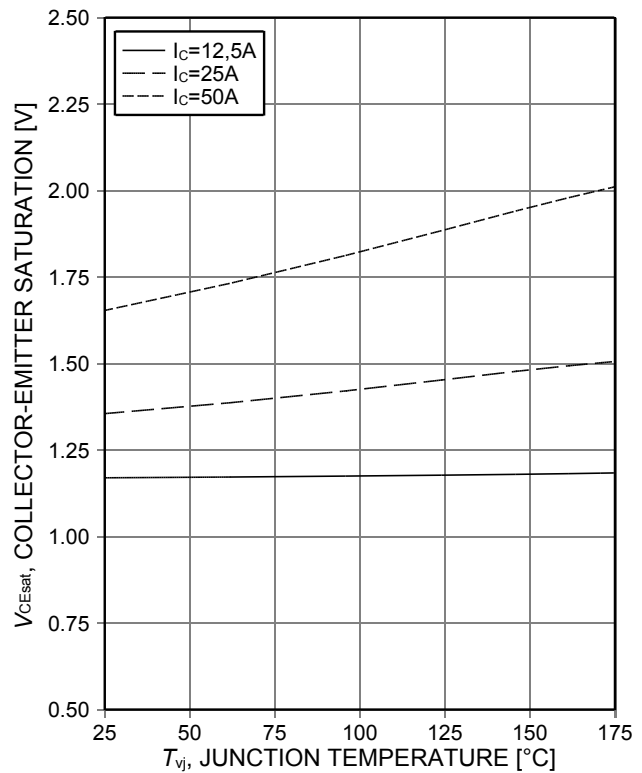


Figure 6. **Typical collector-emitter saturation voltage as a function of junction temperature**
($V_{GE}=15V$)

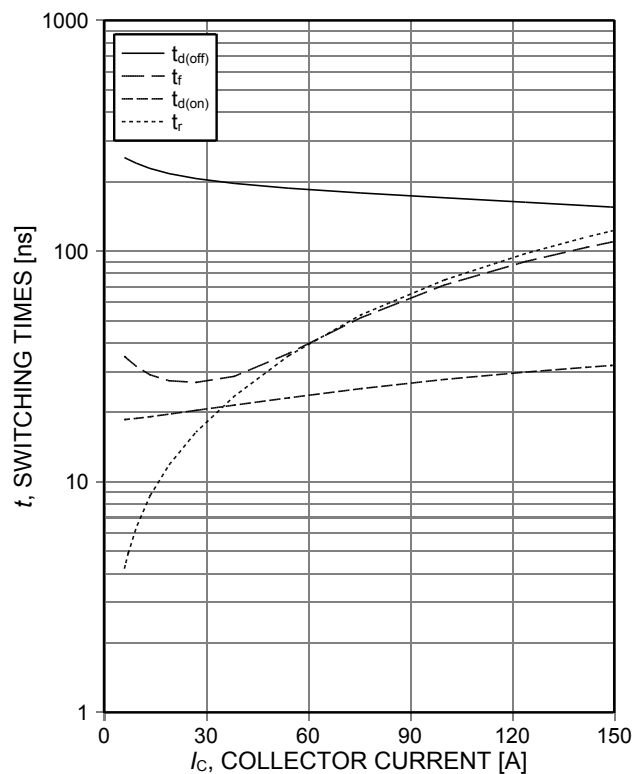


Figure 7. **Typical switching times as a function of collector current**
(inductive load, $T_{vj}=150^{\circ}C$, $V_{CE}=400V$, $V_{GE}=0/15V$, $r_G=12\Omega$, Dynamic test circuit in Figure E)

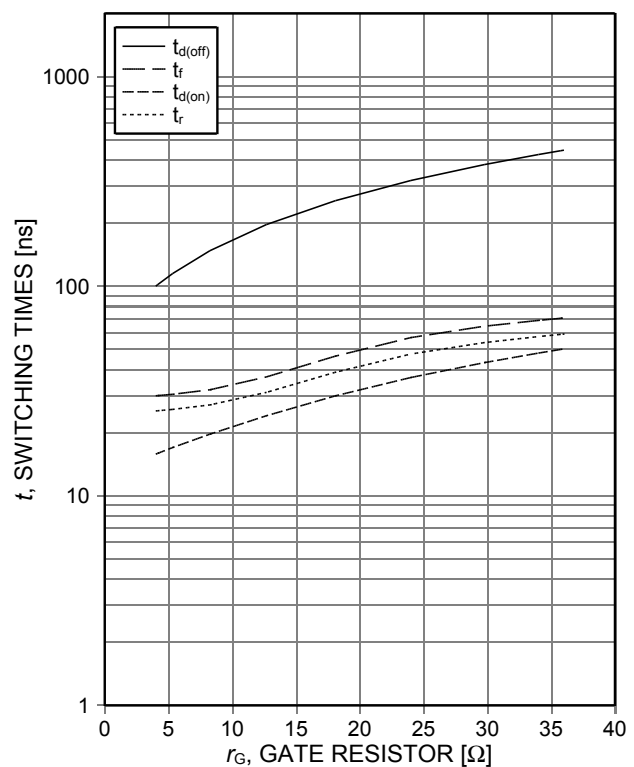


Figure 8. **Typical switching times as a function of gate resistor**
(inductive load, $T_{vj}=150^{\circ}C$, $V_{CE}=400V$, $V_{GE}=0/15V$, $I_C=50A$, Dynamic test circuit in Figure E)

High speed switching series fifth generation

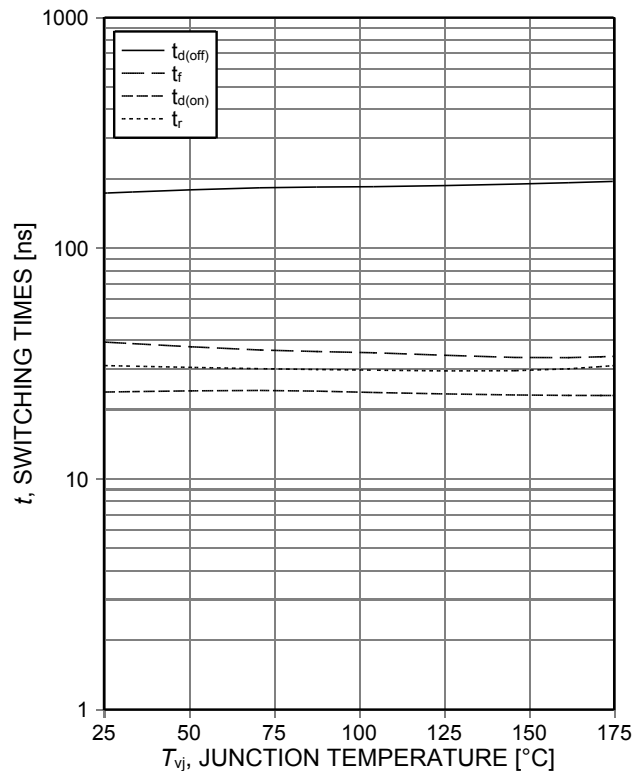


Figure 9. **Typical switching times as a function of junction temperature**
(inductive load, $V_{CE}=400V$, $V_{GE}=0/15V$, $I_C=50A$, $r_G=12\Omega$, Dynamic test circuit in Figure E)

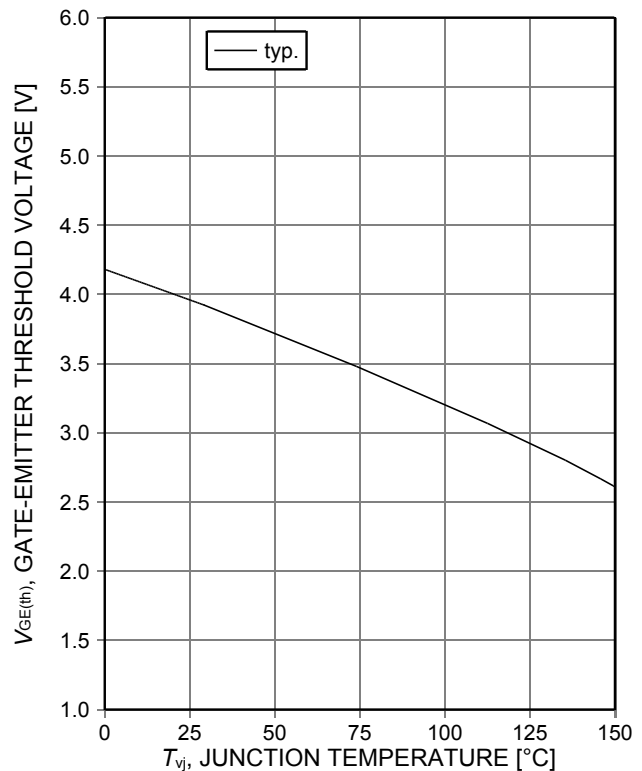


Figure 10. **Gate-emitter threshold voltage as a function of junction temperature**
($I_C=0.5mA$)

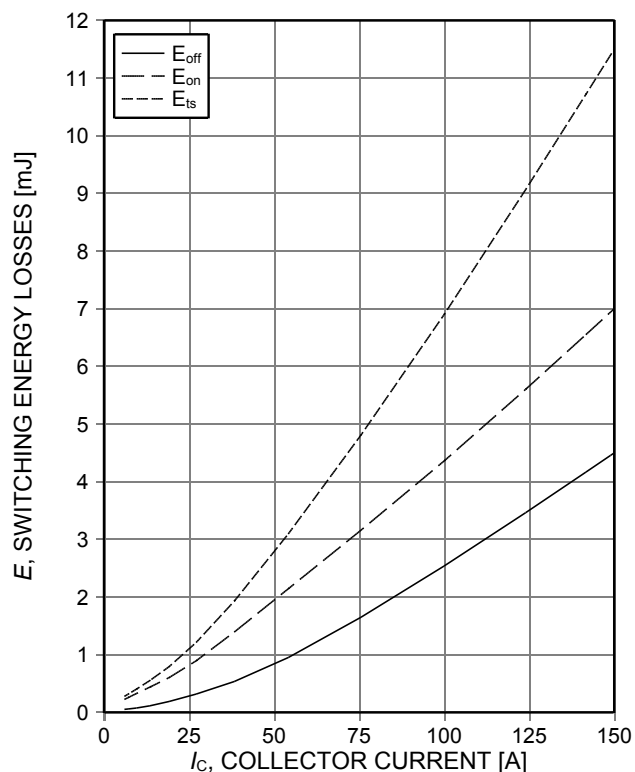


Figure 11. **Typical switching energy losses as a function of collector current**
(inductive load, $T_{vj}=150^\circ C$, $V_{CE}=400V$, $V_{GE}=0/15V$, $r_G=12\Omega$, Dynamic test circuit in Figure E)

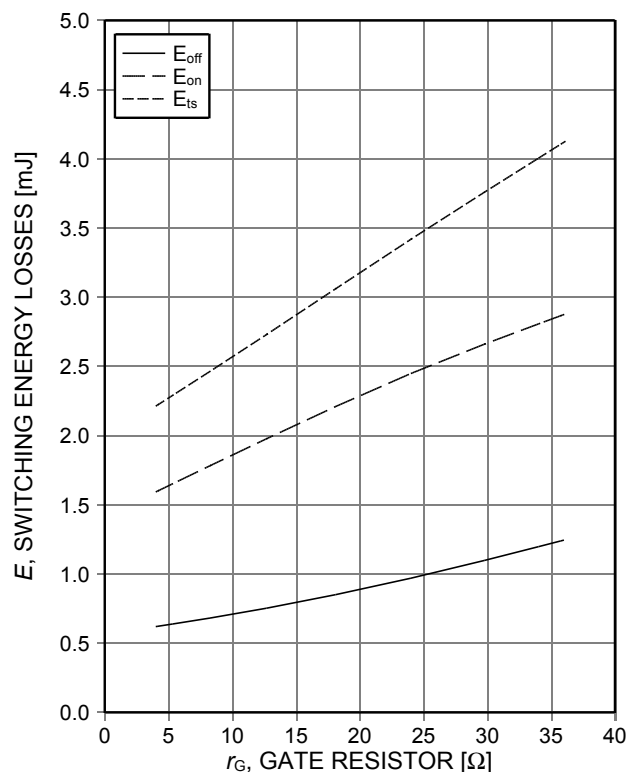


Figure 12. **Typical switching energy losses as a function of gate resistor**
(inductive load, $T_{vj}=150^\circ C$, $V_{CE}=400V$, $V_{GE}=0/15V$, $I_C=50A$, Dynamic test circuit in Figure E)

High speed switching series fifth generation

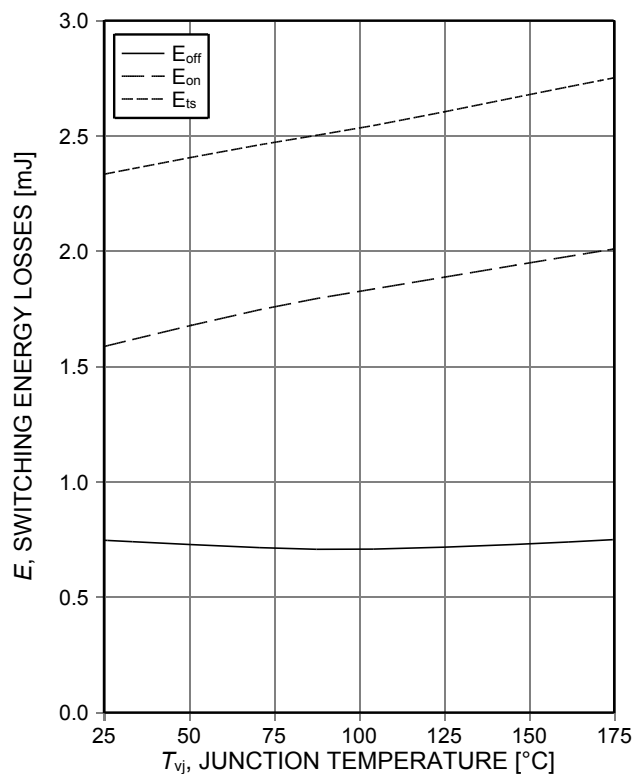


Figure 13. **Typical switching energy losses as a function of junction temperature**
(inductive load, $V_{CE}=400V$, $V_{GE}=0/15V$, $I_C=50A$, $r_G=12\Omega$, Dynamic test circuit in Figure E)

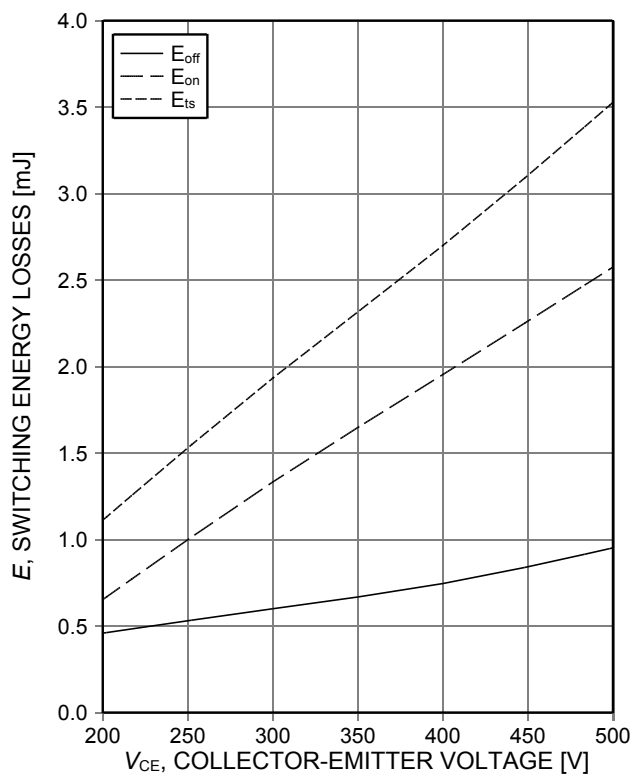


Figure 14. **Typical switching energy losses as a function of collector emitter voltage**
(inductive load, $T_{vj}=150^\circ C$, $V_{GE}=0/15V$, $I_C=50A$, $r_G=12\Omega$, Dynamic test circuit in Figure E)

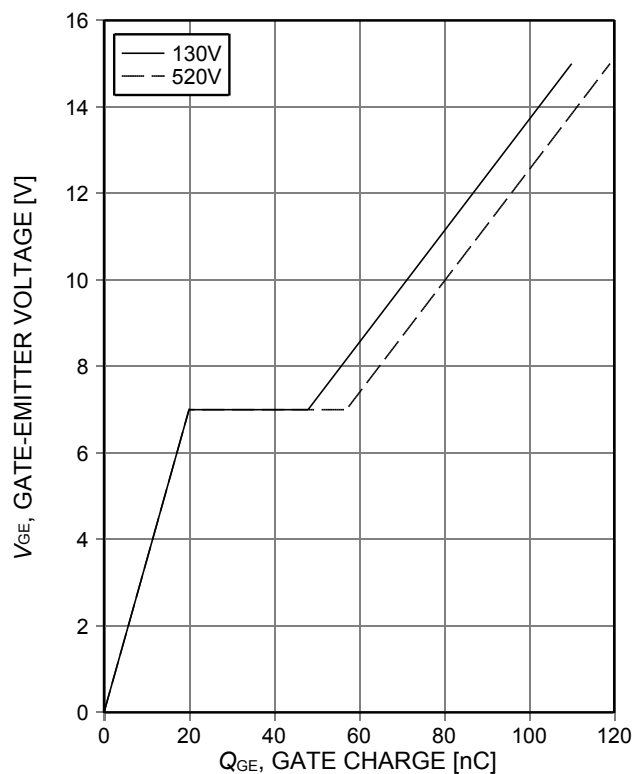


Figure 15. **Typical gate charge**
($I_C=50A$)

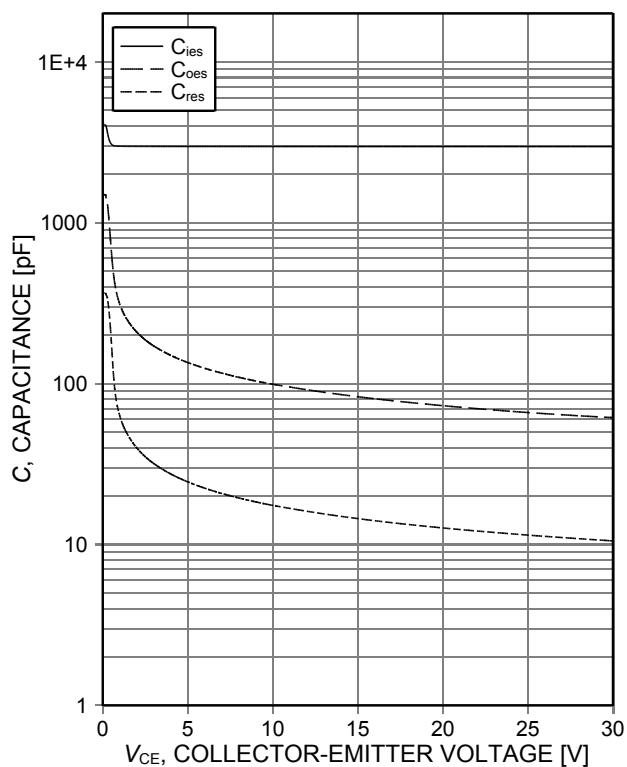


Figure 16. **Typical capacitance as a function of collector-emitter voltage**
($V_{GE}=0V$, $f=1MHz$)

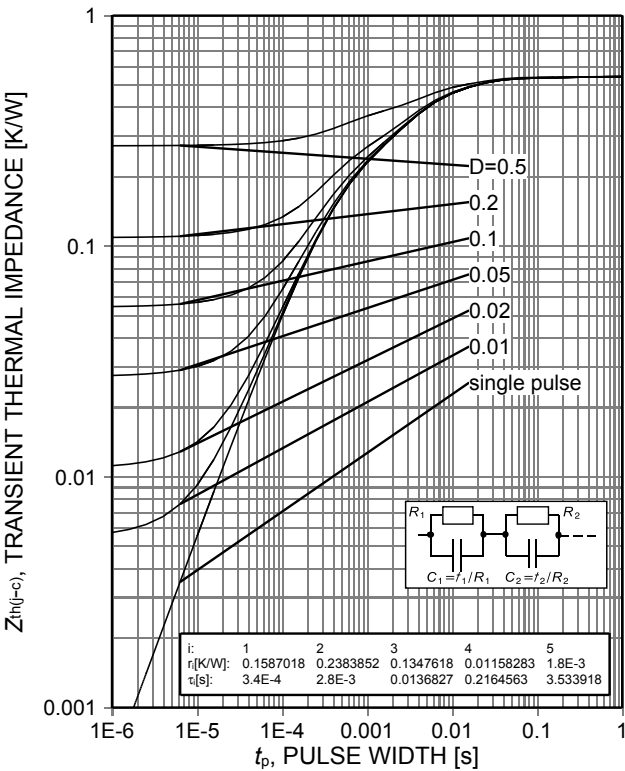
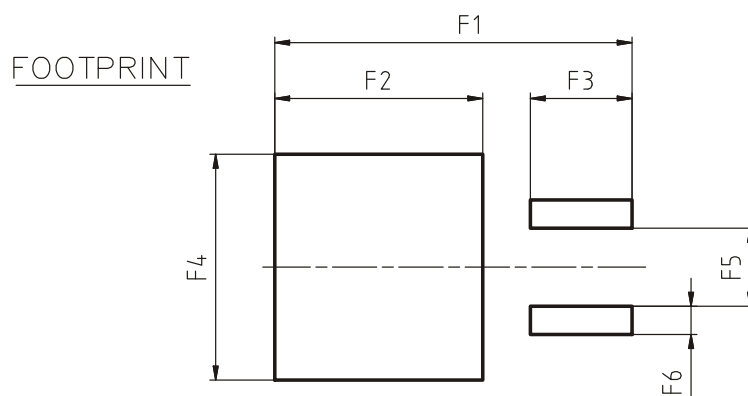
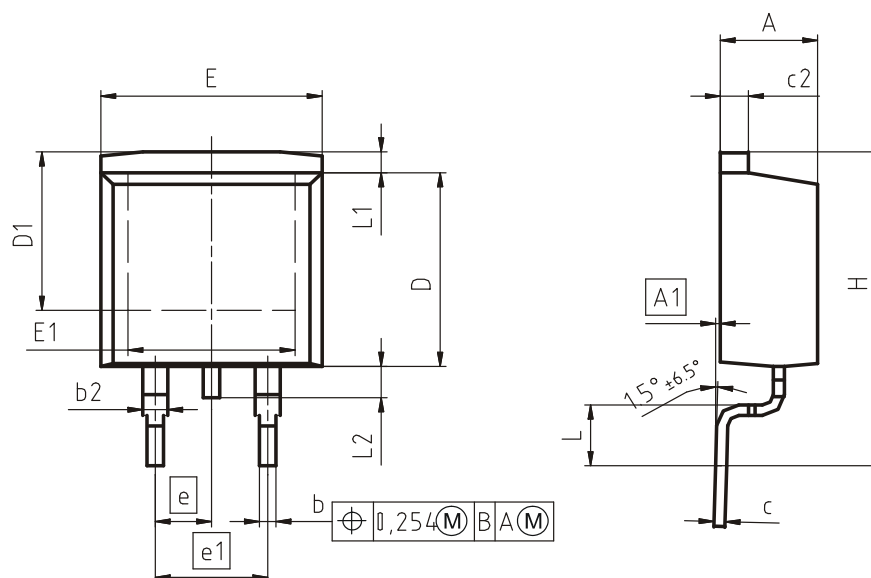


Figure 17. IGBT transient thermal impedance
($D=t_p/T$)

Package Drawing PG-TO263-3



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	0.00	0.25	0.000	0.010
b	0.65	0.85	0.026	0.033
b2	0.95	1.15	0.037	0.045
c	0.33	0.65	0.013	0.026
c2	1.17	1.40	0.046	0.055
D	8.51	9.45	0.335	0.372
D1	7.10	7.90	0.280	0.311
E	9.80	10.31	0.386	0.406
E1	6.50	8.60	0.256	0.339
e	2.54		0.100	
e1	5.08		0.200	
N	2		2	
H	14.61	15.88	0.575	0.625
L	2.29	3.00	0.090	0.118
L1	0.70	1.60	0.028	0.063
L2	1.00	1.78	0.039	0.070
F1	16.05	16.25	0.632	0.640
F2	9.30	9.50	0.366	0.374
F3	4.50	4.70	0.177	0.185
F4	10.70	10.90	0.421	0.429
F5	3.65	3.85	0.144	0.152
F6	1.25	1.45	0.049	0.057

DOCUMENT NO. Z8B00003324	
SCALE	0 5 5 7.5mm
EUROPEAN PROJECTION	
ISSUE DATE 30-08-2007	
REVISION 01	

Testing Conditions

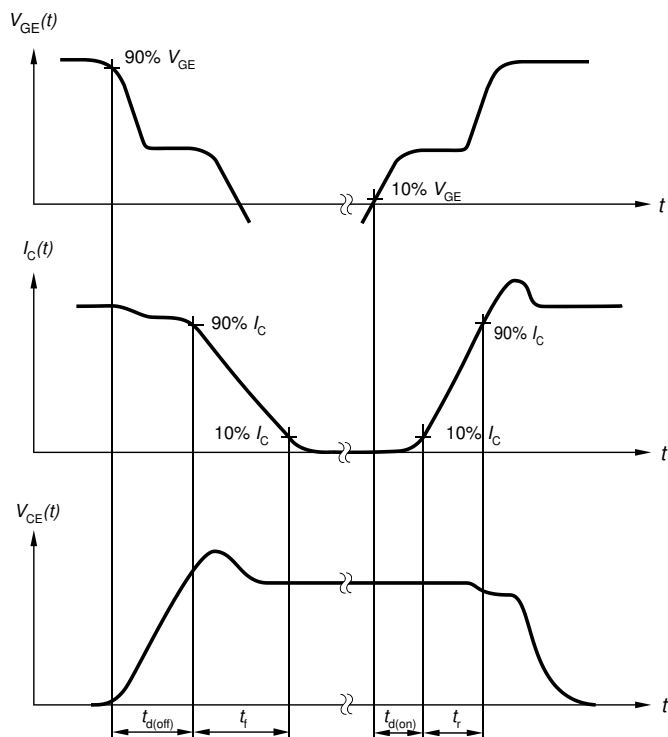


Figure A. Definition of switching times

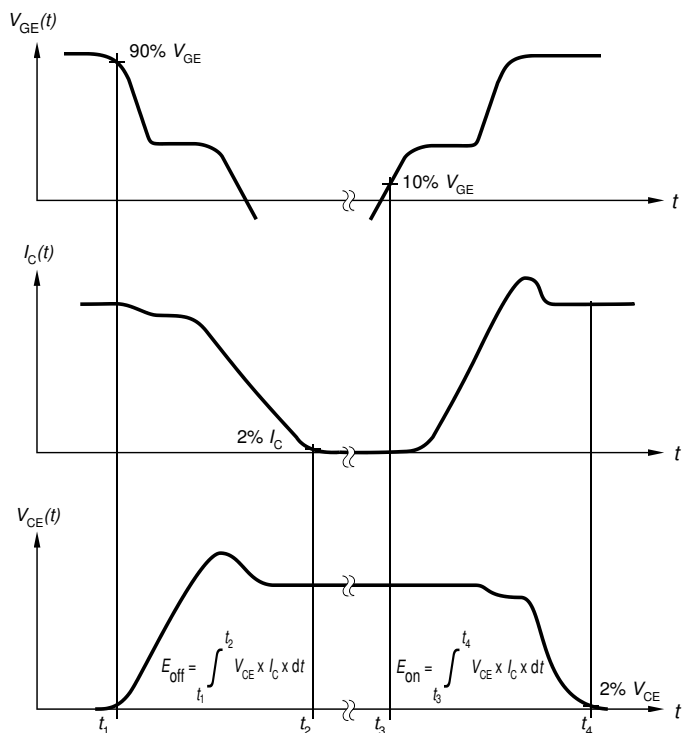


Figure B. Definition of switching losses

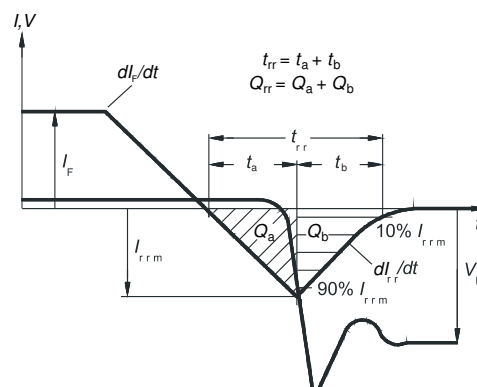


Figure C. Definition of diode switching characteristics

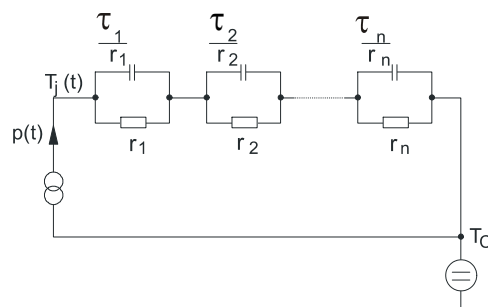


Figure D. Thermal equivalent circuit

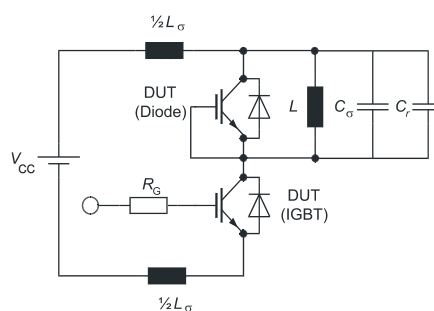


Figure E. **Dynamic test circuit**
Parasitic inductance L_{σ} ,
parasitic capacitor C_{σ} ,
relief capacitor C_r ,
(only for ZVT switching)

High speed switching series fifth generation

Revision History

IGB50N65H5

Revision: 2018-01-11, Rev. 2.2

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.1	2017-05-19	Final data sheet
2.2	2018-01-11	Remove of Pb-free symbol and editorial changes.

Trademarks

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

Published by
Infineon Technologies AG
81726 München, Germany
© Infineon Technologies AG 2018.
All Rights Reserved.

Important Notice

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.

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

Please note that this product is not qualified according to the AEC Q100 or AEC Q101 documents of the Automotive Electronics Council.

Warnings

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.