IGBT

High speed 5 FAST IGBT in TRENCHSTOP™ 5 technology

IGW50N65F5

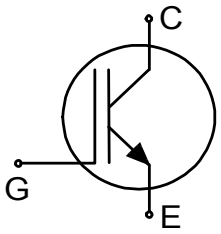
650V IGBT high speed switching series fifth generation

Data sheet

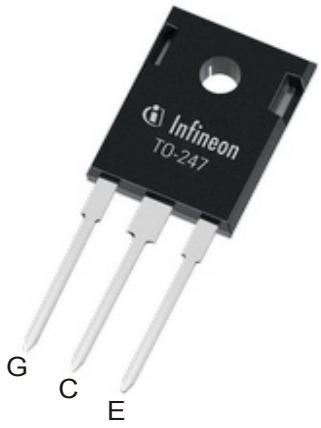
Industrial Power Control

High speed 5 FAST IGBT in TRENCHSTOP™ 5 technology

Features and Benefits:



High speed F5 technology offering
• Best-in-Class efficiency in hard switching and resonant topologies
• 650V breakdown voltage
• Low Q_G
• Ideal fit with SIC Schottky Diode in boost converters
• Maximum junction temperature 175°C
• Qualified according to JEDEC for target applications
• Pb-free lead plating; RoHS compliant
• Complete product spectrum and PSpice Models: http://www.infineon.com/igbt/



Applications:

• Solar converters
• Uninterruptible power supplies
• Welding converters
• Mid to high range switching frequency converters

Package pin definition:

• Pin 1 - gate
• Pin 2 & backside - collector
• Pin 3 - emitter

Pb Green Halogen-Free RoHS

Key Performance and Package Parameters

Type	V_{CE}	I_C	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Marking	Package
IGW50N65F5	650V	50A	1.6V	175°C	G50EF5	PG-TO247-3

Table of Contents

Description 2
Table of Contents 3
Maximum Ratings 4
Thermal Resistance 4
Electrical Characteristics 4
Electrical Characteristics Diagrams 7
Package Drawing 12
Testing Conditions 13
Revision History 14
Disclaimer 14

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	V_{CE}	650	V
DC collector current, limited by T_{vjmax} T_C = 25°C value limited by bondwire T_C = 100°C	I_C	 80.0 56.0	A
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	150.0	A
Turn off safe operating area $V_{CE} \le 650V$, $T_{vj} \le 175°C$	-	150.0	A
Gate-emitter voltage Transient Gate-emitter voltage ($t_p \le 10\mu s$, D < 0.010)	V_{GE}	±20 ±30	V
Power dissipation T_C = 25°C Power dissipation T_C = 100°C	P_{tot}	305.0 152.5	W
Operating junction temperature	T_{vj}	-40...+175	°C
Storage temperature	T_{stg}	-55...+150	°C
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s		260	°C
Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction - case	$R_{th(j-c)}$		0.50	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		40	K/W

Electrical Characteristic, at T_{vj} = 25°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°C T_{vj} = 125°C T_{vj} = 175°C	 - - -	 1.60 1.80 1.90	 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°C T_{vj} = 175°C	 - -	 - -	 40.0 2000.0	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

Electrical Characteristic, at T_{vj} = 25°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		-	13.0	-	nH

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic, at T_{vj} = 25°C						
Turn-on delay time	$t_{d(on)}$	T_{vj} = 25°C, V_{CC} = 400V, I_C = 25.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 12.0Ω, $R_{G(off)}$ = 12.0Ω, $L\sigma$ = 30nH, $C\sigma$ = 30pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	21	-	ns
Rise time	t_r		-	15	-	ns
Turn-off delay time	$t_{d(off)}$		-	175	-	ns
Fall time	t_f		-	18	-	ns
Turn-on energy	E_{on}		-	0.49	-	mJ
Turn-off energy	E_{off}		-	0.16	-	mJ
Total switching energy	E_{ts}		-	0.65	-	mJ
Turn-on delay time	$t_{d(on)}$	T_{vj} = 25°C, V_{CC} = 400V, I_C = 6.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 12.0Ω, $R_{G(off)}$ = 12.0Ω, $L\sigma$ = 30nH, $C\sigma$ = 30pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	19	-	ns
Rise time	t_r		-	4	-	ns
Turn-off delay time	$t_{d(off)}$		-	195	-	ns
Fall time	t_f		-	10	-	ns
Turn-on energy	E_{on}		-	0.11	-	mJ
Turn-off energy	E_{off}		-	0.04	-	mJ
Total switching energy	E_{ts}		-	0.15	-	mJ

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic, at T_{vj} = 150°C						
Turn-on delay time	$t_{d(on)}$	T_{vj} = 150°C, V_{CC} = 400V, I_C = 25.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 12.0Ω, $R_{G(off)}$ = 12.0Ω, $L\sigma$ = 30nH, $C\sigma$ = 30pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	20	-	ns
Rise time	t_r		-	15	-	ns
Turn-off delay time	$t_{d(off)}$		-	202	-	ns
Fall time	t_f		-	3	-	ns
Turn-on energy	E_{on}		-	0.68	-	mJ
Turn-off energy	E_{off}		-	0.21	-	mJ
Total switching energy	E_{ts}		-	0.89	-	mJ
Turn-on delay time	$t_{d(on)}$	T_{vj} = 150°C, V_{CC} = 400V, I_C = 6.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 12.0Ω, $R_{G(off)}$ = 12.0Ω, $L\sigma$ = 30nH, $C\sigma$ = 30pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	18	-	ns
Rise time	t_r		-	5	-	ns
Turn-off delay time	$t_{d(off)}$		-	245	-	ns
Fall time	t_f		-	12	-	ns
Turn-on energy	E_{on}		-	0.18	-	mJ
Turn-off energy	E_{off}		-	0.06	-	mJ
Total switching energy	E_{ts}		-	0.24	-	mJ

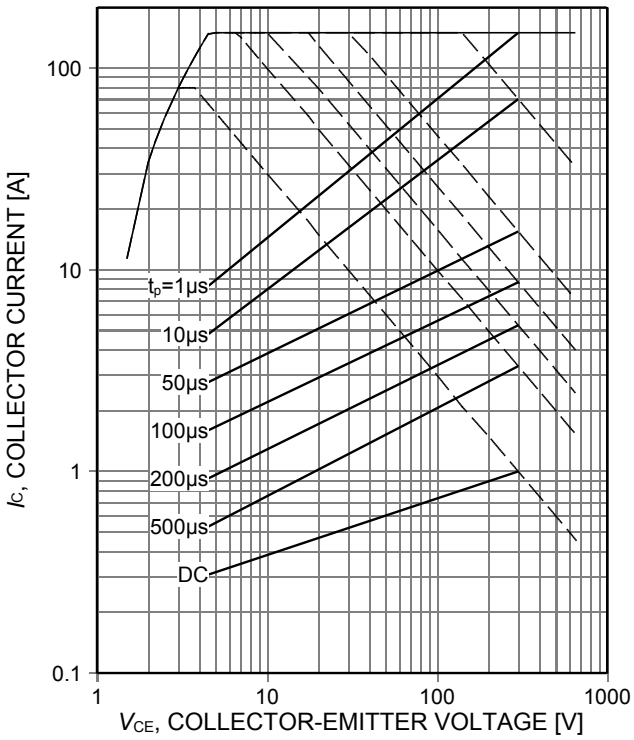


Figure 1. **Forward bias safe operating area**
(D=0, T_C=25°C, T_{vj}≤175°C; V_{GE}=15V.
Recommended use at V_{GE}≥7.5V)

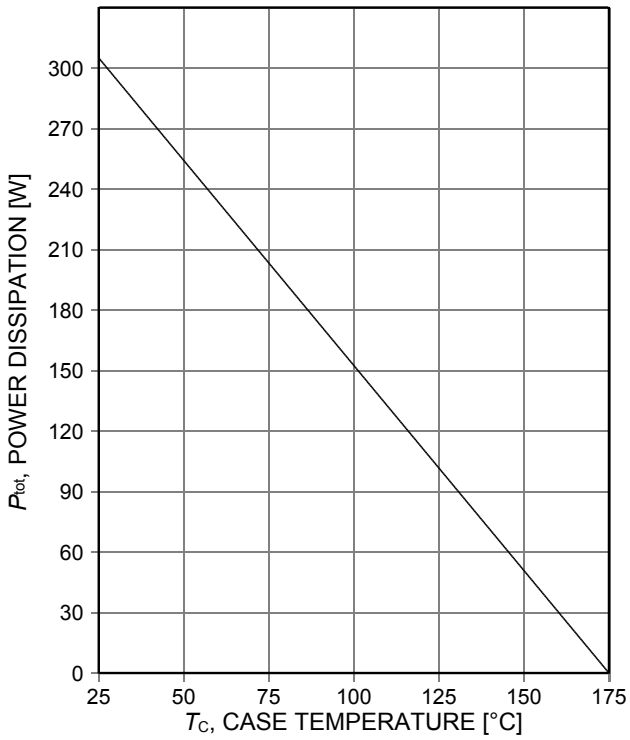


Figure 2. **Power dissipation as a function of case temperature**
(T_{vj}≤175°C)

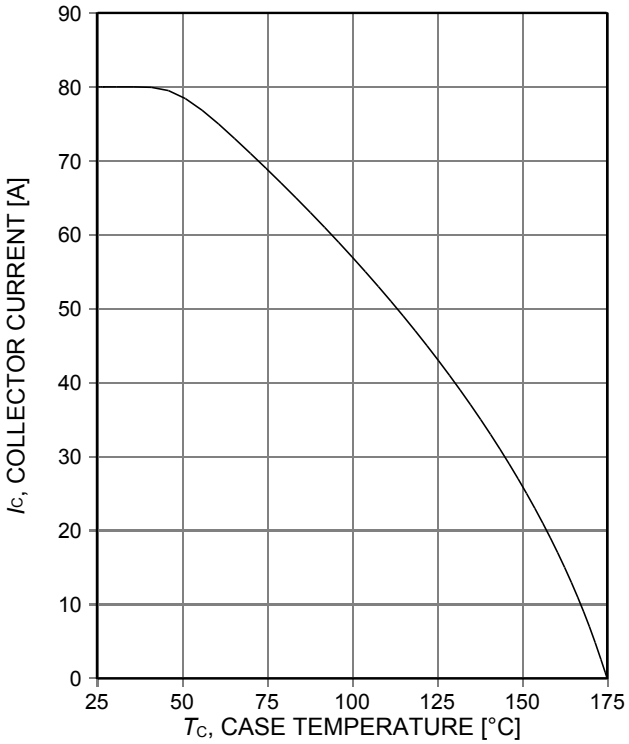


Figure 3. **Collector current as a function of case temperature**
(V_{GE}≥15V, T_{vj}≤175°C)

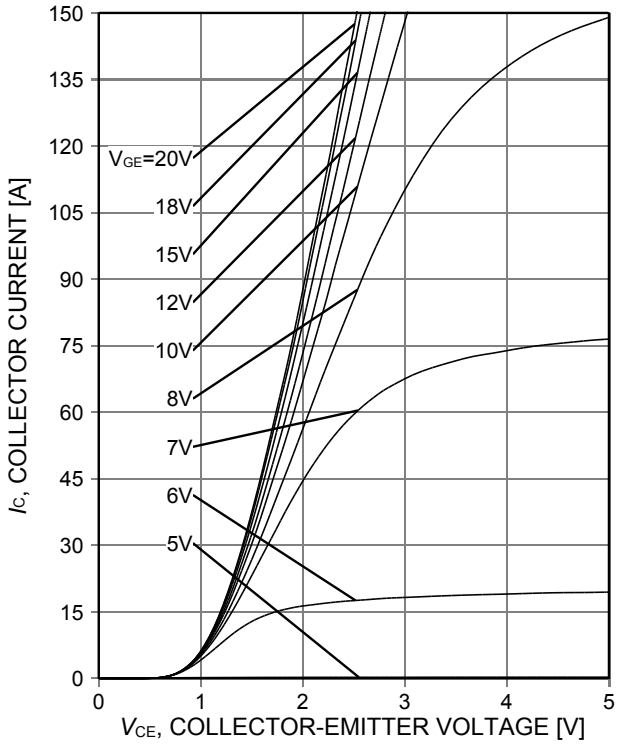


Figure 4. **Typical output characteristic**
(T_{vj}=25°C)

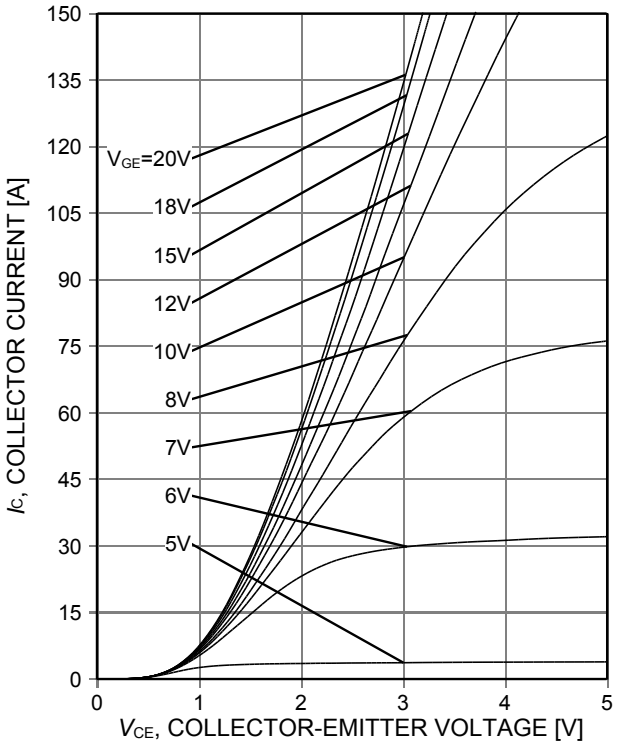


Figure 5. **Typical output characteristic**
(T_{vj}=150°C)

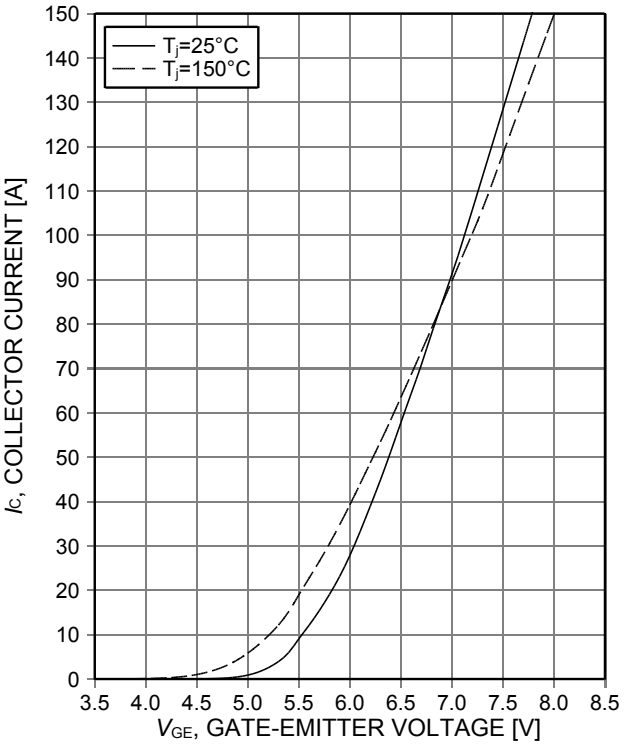


Figure 6. **Typical transfer characteristic**
(V_{CE}=20V)

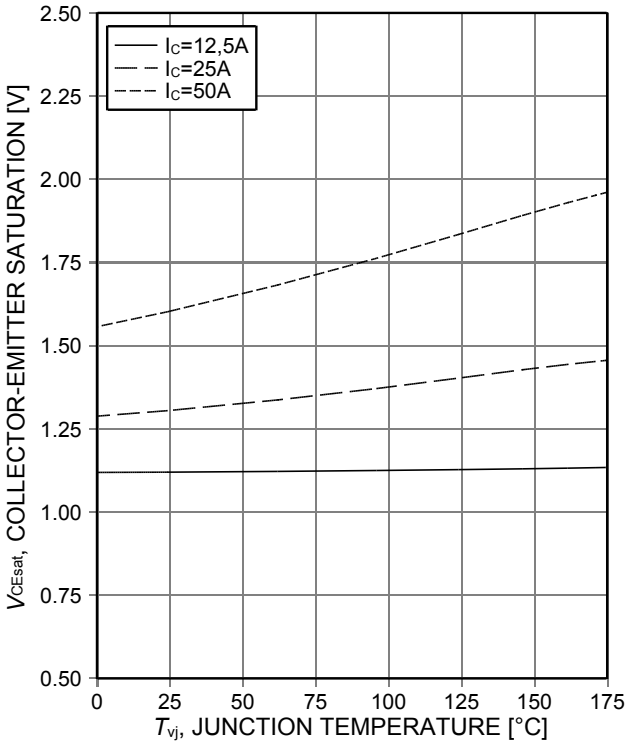


Figure 7. **Typical collector-emitter saturation voltage as a function of junction temperature**
(V_{GE}=15V)

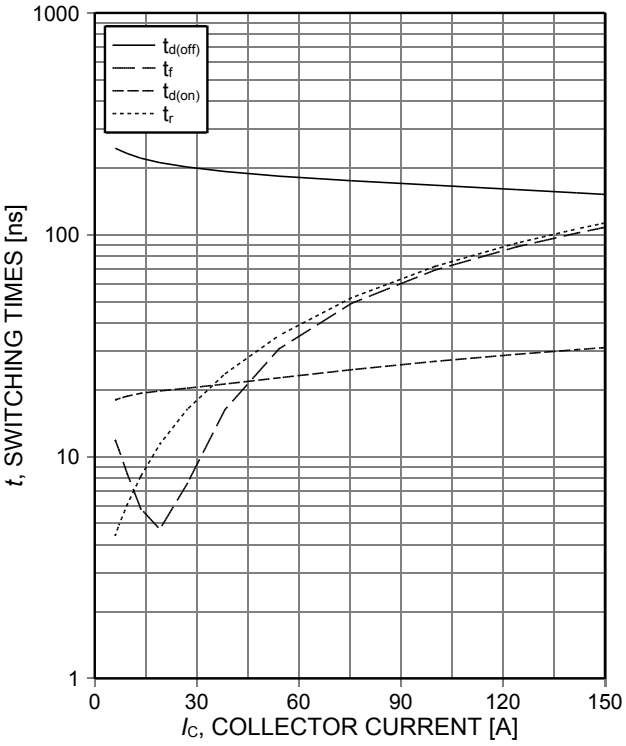


Figure 8. **Typical switching times as a function of collector current**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=15/0V, r_G=12Ω, Dynamic test circuit in Figure E)

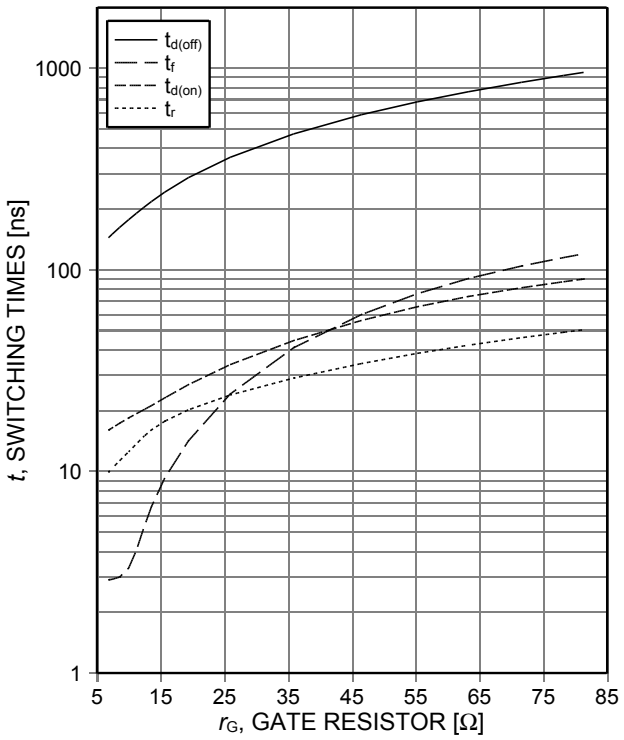


Figure 9. **Typical switching times as a function of gate resistor**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=15/0V, I_C=25A,Dynamic test circuit in Figure E)

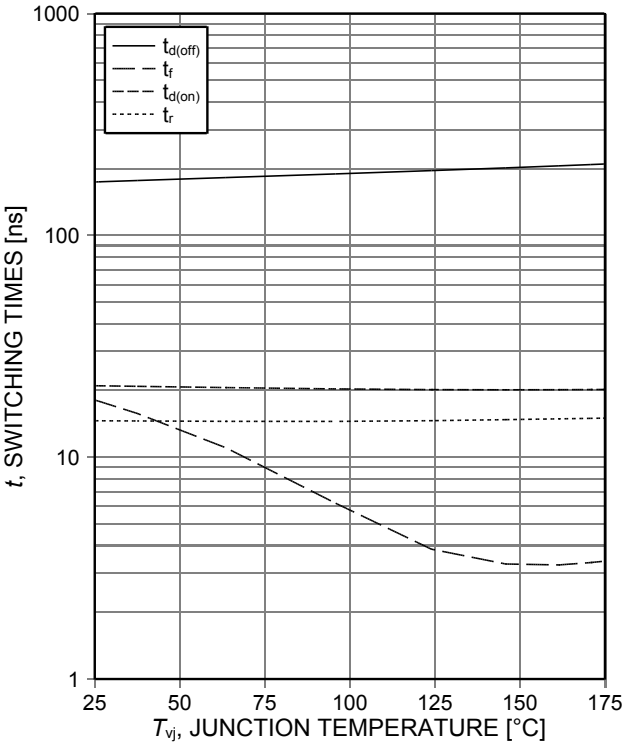


Figure 10. **Typical switching times as a function of junction temperature**
(inductive load, V_{CE}=400V, V_{GE}=15/0V, I_C=25A, r_G=12Ω,Dynamic test circuit in Figure E)

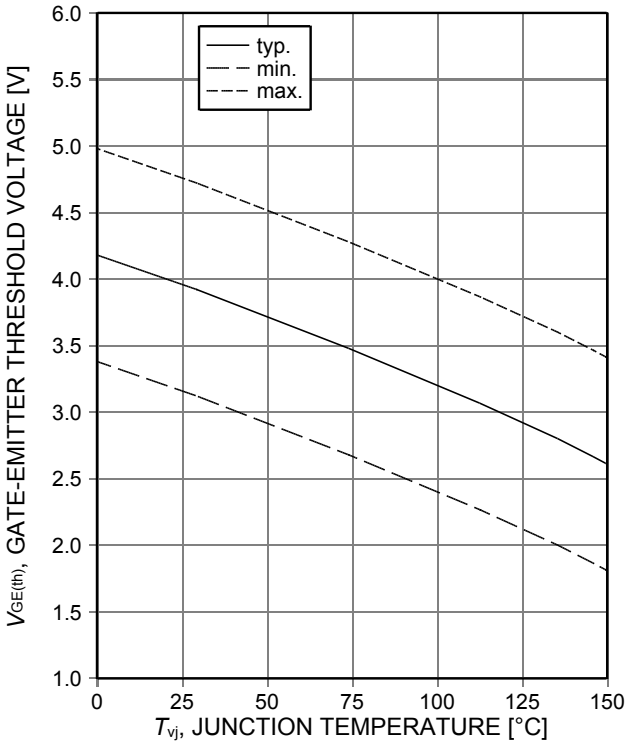


Figure 11. **Gate-emitter threshold voltage as a function of junction temperature**
(I_C=0.5mA)

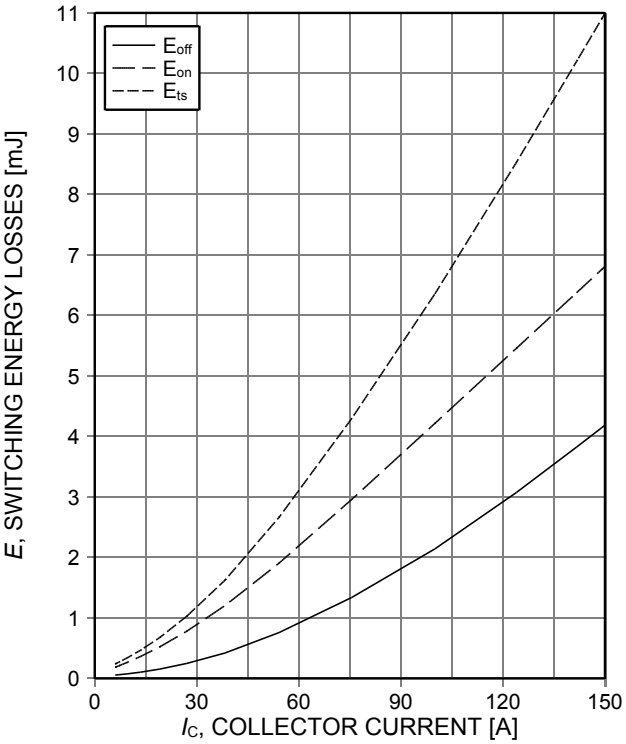


Figure 12. **Typical switching energy losses as a function of collector current**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=15/0V, r_G=12Ω,Dynamic test circuit in Figure E)

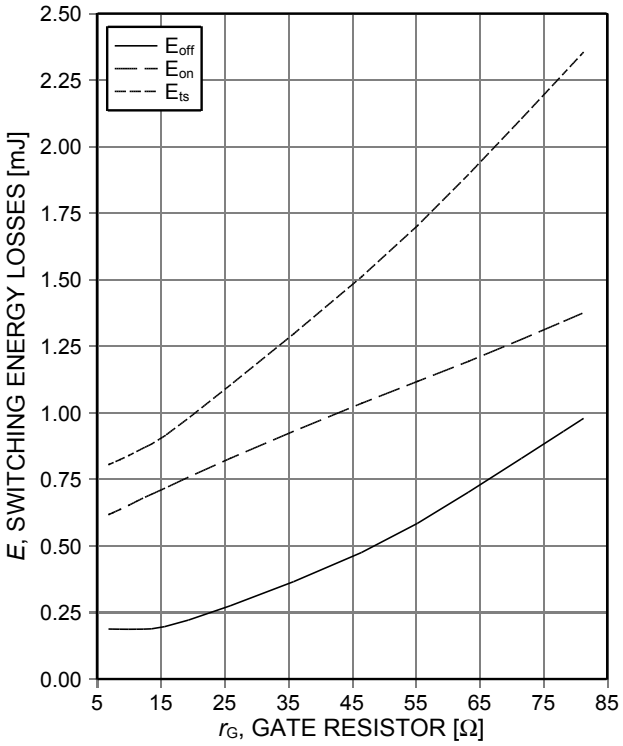


Figure 13. **Typical switching energy losses as a function of gate resistor** (inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=15/0V, I_C=25A, Dynamic test circuit in Figure E)

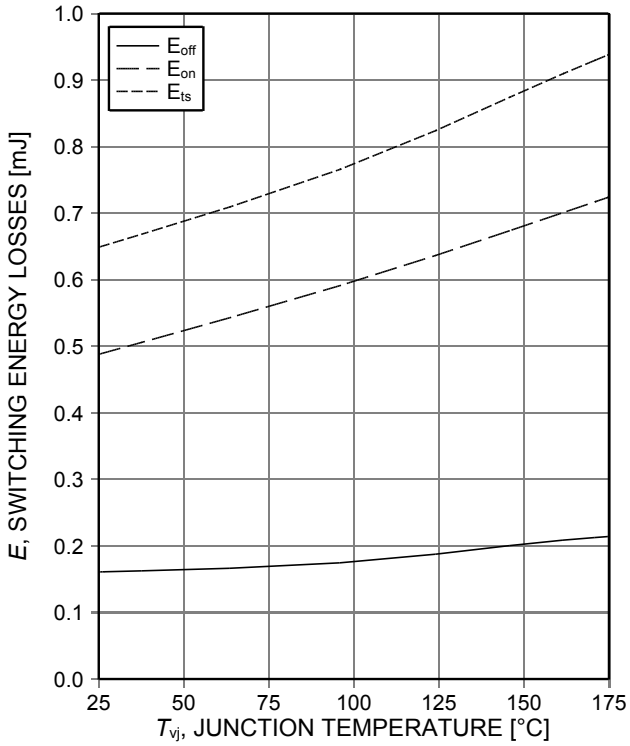


Figure 14. **Typical switching energy losses as a function of junction temperature** (inductive load, V_{CE}=400V, V_{GE}=15/0V, I_C=25A, r_G=12Ω,Dynamic test circuit in Figure E)

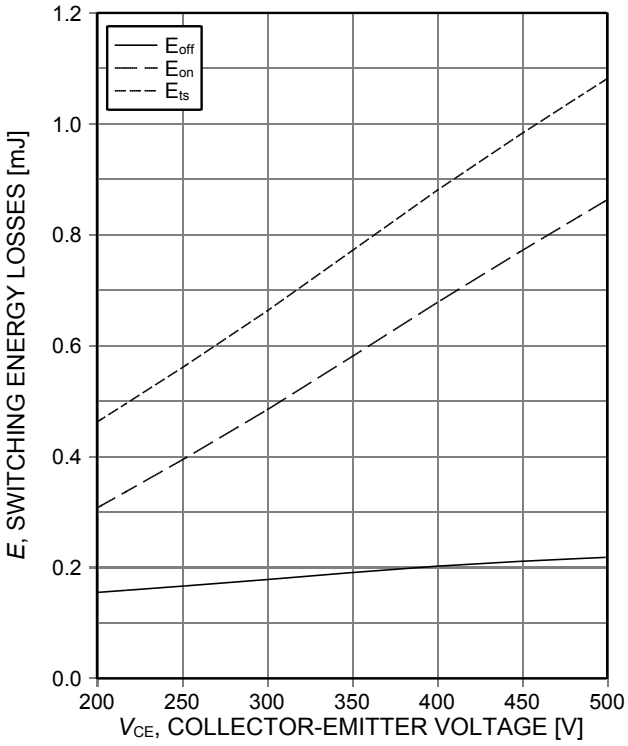


Figure 15. **Typical switching energy losses as a function of collector emitter voltage** (inductive load, T_{vj}=150°C, V_{GE}=15/0V, I_C=25A, r_G=12Ω,Dynamic test circuit in Figure E)

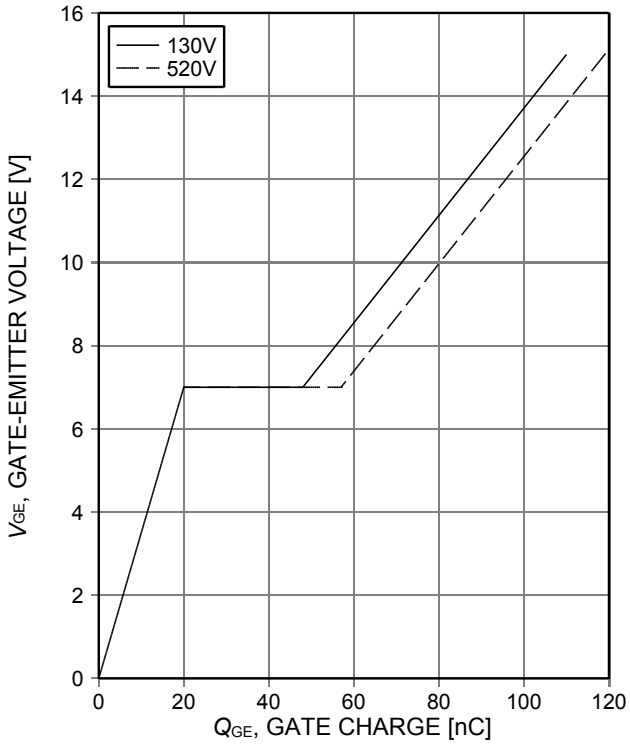


Figure 16. **Typical gate charge** (I_C=50A)

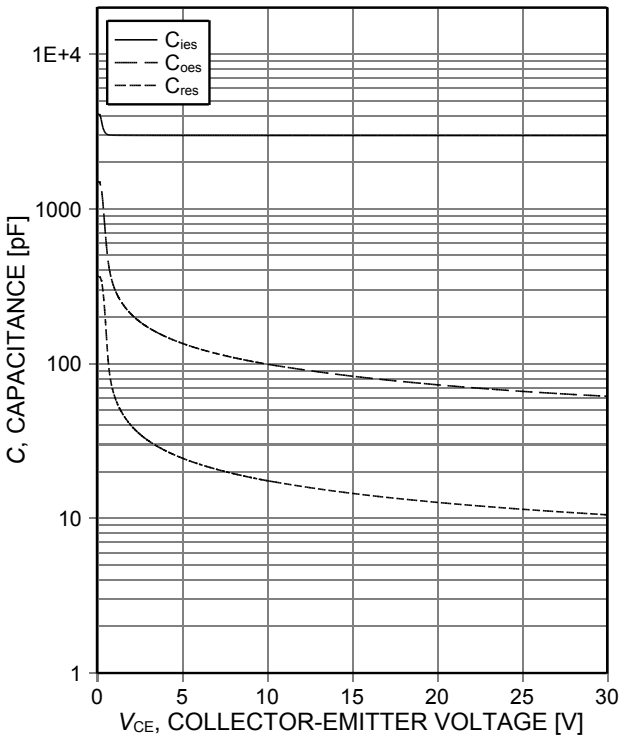


Figure 17. **Typical capacitance as a function of collector-emitter voltage**
(V_{GE}=0V, f=1MHz)

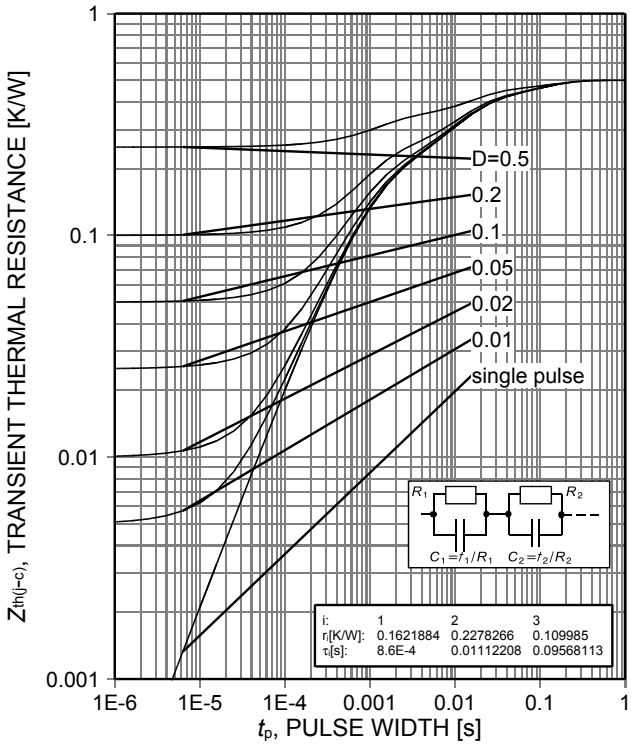
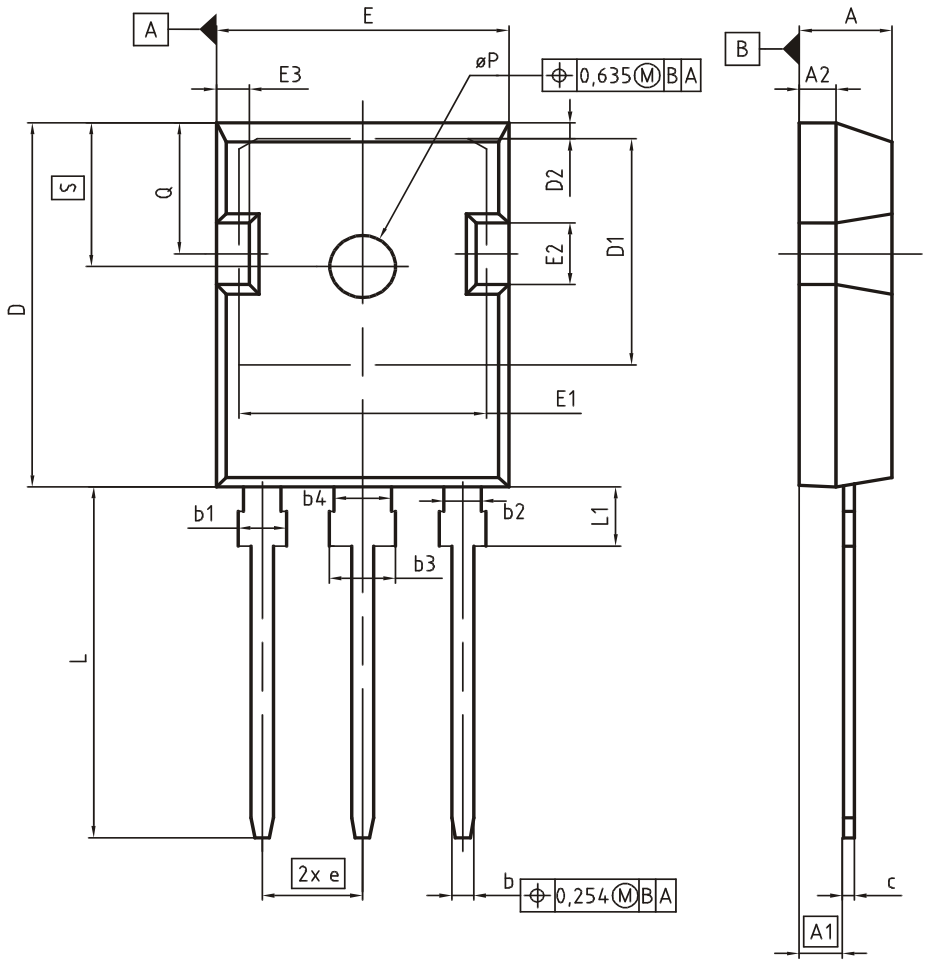


Figure 18. **IGBT transient thermal resistance**
($D=t_p/T$)

Package Drawing PG-TO247-3



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

DOCUMENT NO.	Z8B00003327
SCALE	0 5 5 7.5mm
EUROPEAN PROJECTION	
ISSUE DATE	09-07-2010
REVISION	05

Testing Conditions

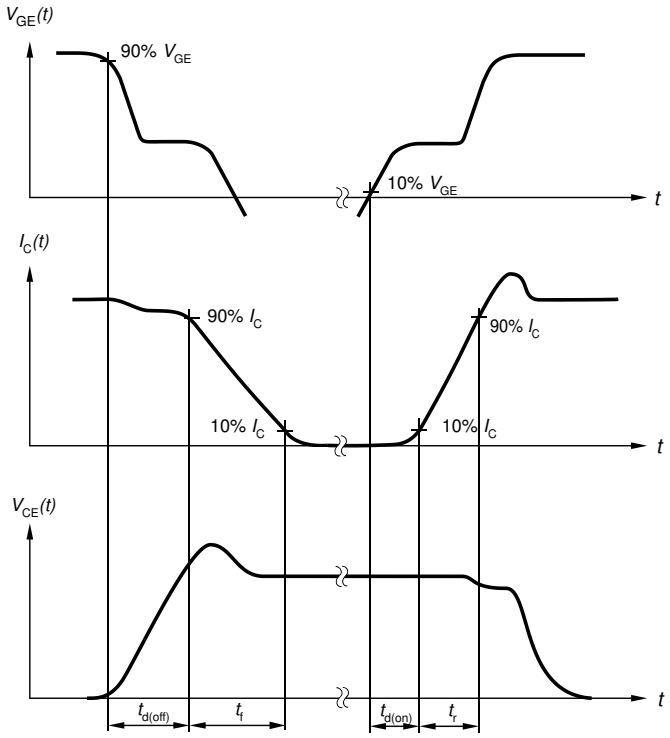


Figure A. **Definition of switching times**

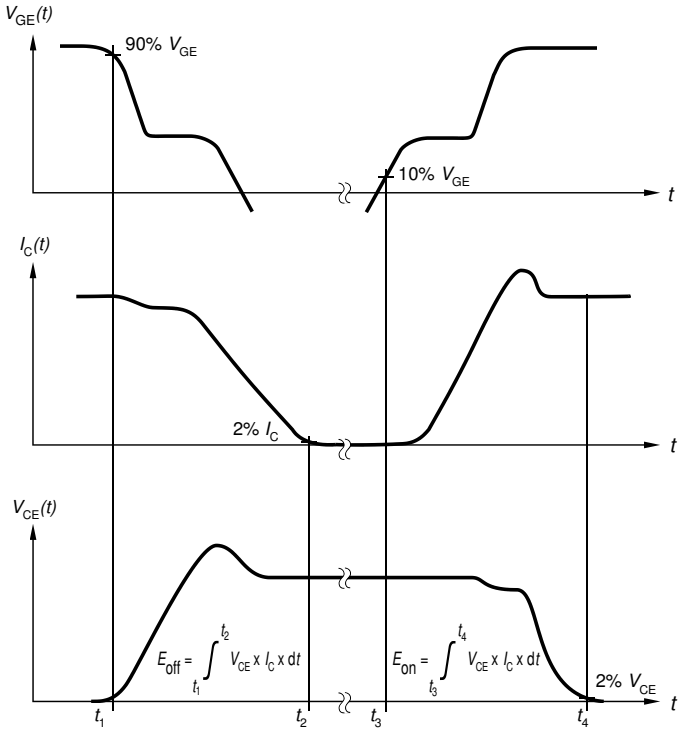


Figure B. **Definition of switching losses**

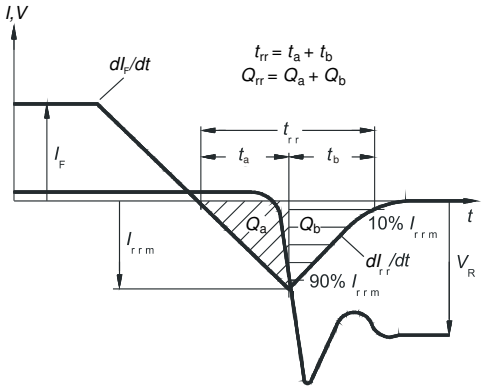


Figure C. **Definition of diode switching characteristics**

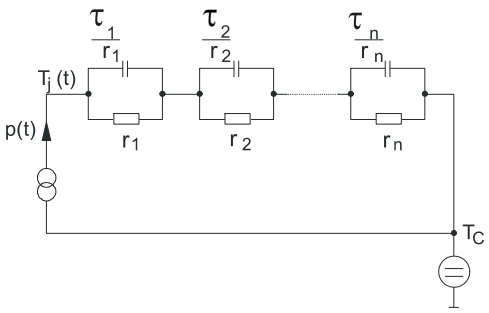


Figure D. **Thermal equivalent circuit**

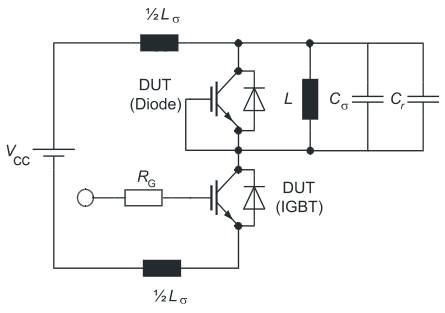


Figure E. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r,
(only for ZVT switching)

Revision History

IGW50N65F5

Revision: 2015-05-04, Rev. 2.1

Previous Revision

Revision	Date	Subjects (major changes since last revision)
1.1	2012-11-09	Preliminary data sheet
1.2	2013-12-16	New Marking Pattern
2.1	2015-05-04	Final data sheet

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 Munich, Germany
81726 München, Germany
© 2015 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. With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, 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.

Information
For further information on technology, delivery terms and conditions and prices, please contact the 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.