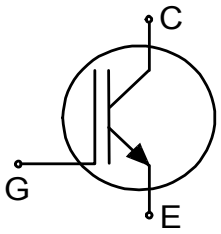
High speed switching series fifth generation

TRENCHSTOP™ 5 high speed soft switching IGBT

Features and Benefits:



High speed S5 technology offering
- High speed smooth switching device for hard & soft switching
- Very Low V_{CEsat}, 1.35V at nominal current
- Plug and play replacement of previous generation IGBTs
- 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

Green

Halogen-Free

RoHS

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°C	T_{vjmax}	Marking	Package
IGB20N65S5	650V	20A	1.35V	175°C	G20ES5	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, $T_{vj} \geq 25°C$	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	 40.0 28.0	A
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	80.0	A
Turn off safe operating area $V_{CE} \leq 650V$, $T_{vj} \leq 175°C$, t_p = 1µs	-	80.0	A
Gate-emitter voltage Transient Gate-emitter voltage ($t_p \leq 10µs$, $D < 0.010$)	V_{GE}	±20 ±30	V
Power dissipation T_c = 25°C Power dissipation T_c = 100°C	P_{tot}	125.0 62.5	W
Operating junction temperature	T_{vj}	-40...+175	°C
Storage temperature	T_{stg}	-55...+150	°C
Soldering temperature, reflow soldering (MSL1 according to JEDEC J-STA-020)		260	°C

Thermal Resistance

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
R_{th} Characteristics						
IGBT thermal resistance, junction - case	$R_{th(j-c)}$		-	-	1.20	K/W
Thermal resistance, min. footprint junction - ambient	$R_{th(j-a)}$		-	-	65	K/W
Thermal resistance, 6cm² Cu on PCB 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 = 20.0A T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	 - - -	 1.35 1.50 1.60	 1.70 - -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C = 0.20mA, 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	 - -	 - 1400	 50 -	µA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0V, V_{GE} = 20V	-	-	100	nA
Transconductance	g_{fs}	V_{CE} = 20V, I_C = 20.0A	-	28.0	-	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	-	1200	-	pF
Output capacitance	C_{oes}		-	24	-	
Reverse transfer capacitance	C_{res}		-	5	-	
Gate charge	Q_G	V_{CC} = 520V, I_C = 20.0A, V_{GE} = 15V	-	48.0	-	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°C						
Turn-on delay time	$t_{d(on)}$	T_{vj} = 25°C, V_{CC} = 400V, I_C = 20.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 20.0Ω, $R_{G(off)}$ = 20.0Ω, Lσ = 30nH, Cσ = 30pF Lσ, Cσ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	13	-	ns
Rise time	t_r		-	14	-	ns
Turn-off delay time	$t_{d(off)}$		-	115	-	ns
Fall time	t_f		-	22	-	ns
Turn-on energy	E_{on}		-	0.36	-	mJ
Turn-off energy	E_{off}		-	0.15	-	mJ
Total switching energy	E_{ts}		-	0.51	-	mJ
Turn-on delay time	$t_{d(on)}$	T_{vj} = 25°C, V_{CC} = 400V, I_C = 10.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 20.0Ω, $R_{G(off)}$ = 20.0Ω, Lσ = 30nH, Cσ = 30pF Lσ, Cσ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	12	-	ns
Rise time	t_r		-	8	-	ns
Turn-off delay time	$t_{d(off)}$		-	129	-	ns
Fall time	t_f		-	22	-	ns
Turn-on energy	E_{on}		-	0.19	-	mJ
Turn-off energy	E_{off}		-	0.08	-	mJ
Total switching energy	E_{ts}		-	0.27	-	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 = 20.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 20.0Ω, $R_{G(off)}$ = 20.0Ω, Lσ = 30nH, Cσ = 30pF Lσ, Cσ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	13	-	ns
Rise time	t_r		-	15	-	ns
Turn-off delay time	$t_{d(off)}$		-	140	-	ns
Fall time	t_f		-	48	-	ns
Turn-on energy	E_{on}		-	0.48	-	mJ
Turn-off energy	E_{off}		-	0.27	-	mJ
Total switching energy	E_{ts}		-	0.75	-	mJ
Turn-on delay time	$t_{d(on)}$	T_{vj} = 150°C, V_{CC} = 400V, I_C = 10.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 20.0Ω, $R_{G(off)}$ = 20.0Ω, Lσ = 30nH, Cσ = 30pF Lσ, Cσ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	11	-	ns
Rise time	t_r		-	9	-	ns
Turn-off delay time	$t_{d(off)}$		-	155	-	ns
Fall time	t_f		-	52	-	ns
Turn-on energy	E_{on}		-	0.26	-	mJ
Turn-off energy	E_{off}		-	0.15	-	mJ
Total switching energy	E_{ts}		-	0.41	-	mJ

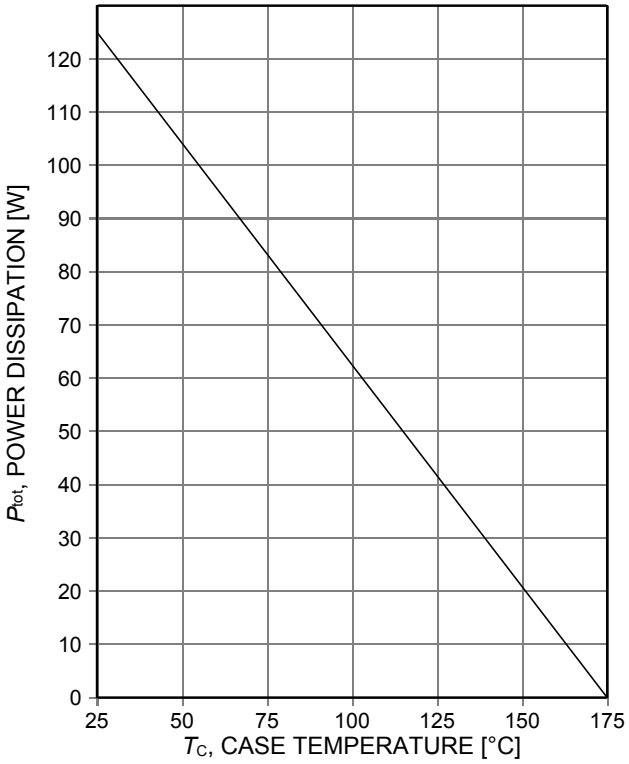


Figure 1. **Power dissipation as a function of case temperature**
(T_{vj}≤175°C)

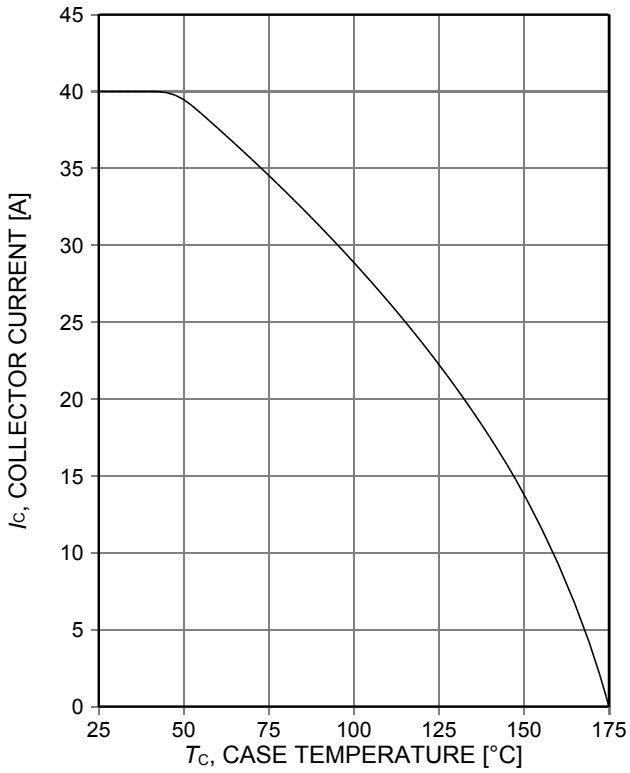


Figure 2. **Collector current as a function of case temperature**
(V_{GE}≥15V, T_{vj}≤175°C)

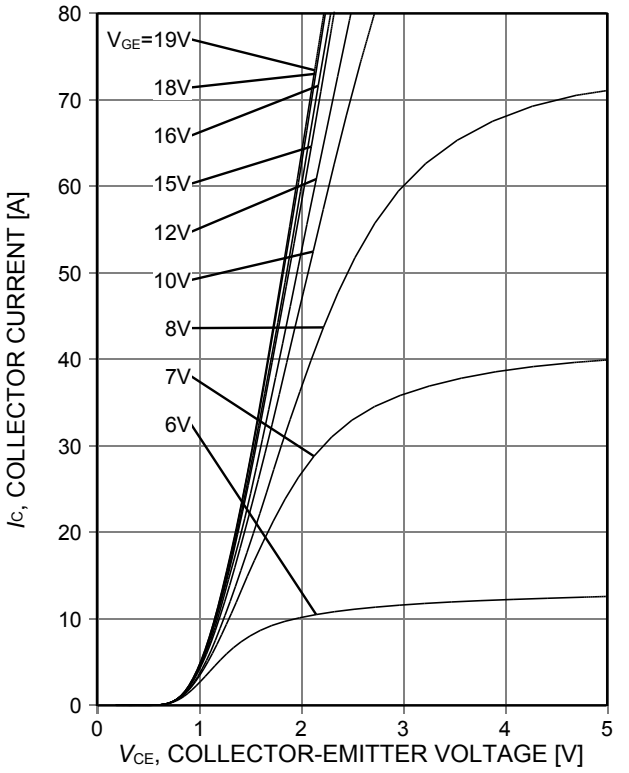


Figure 3. **Typical output characteristic**
(T_{vj}=25°C)

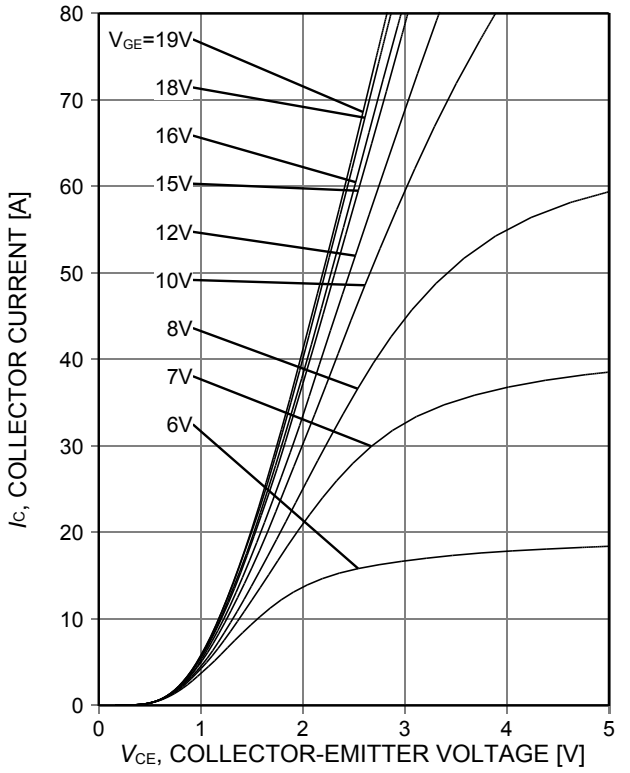


Figure 4. **Typical output characteristic**
(T_{vj}=175°C)

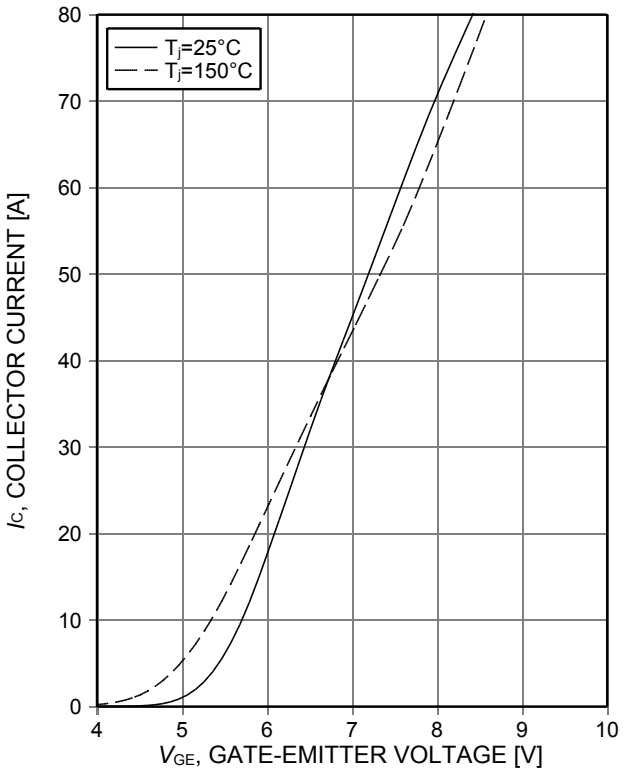


Figure 5. **Typical transfer characteristic** (V_{CE}=20V)

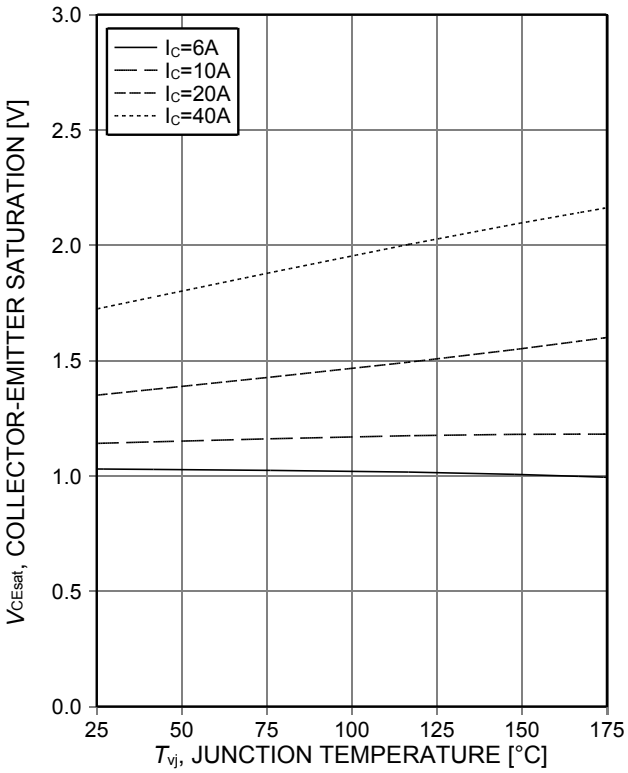


Figure 6. **Typical collector-emitter saturation voltage as a function of junction temperature** (V_{GE}=15V)

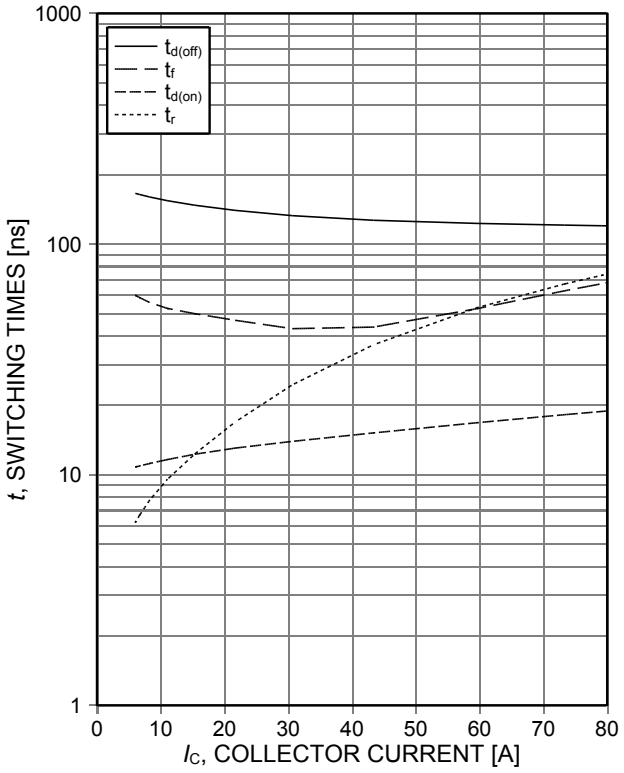


Figure 7. **Typical switching times as a function of collector current** (inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, R_G=20Ω, Dynamic test circuit in Figure E)

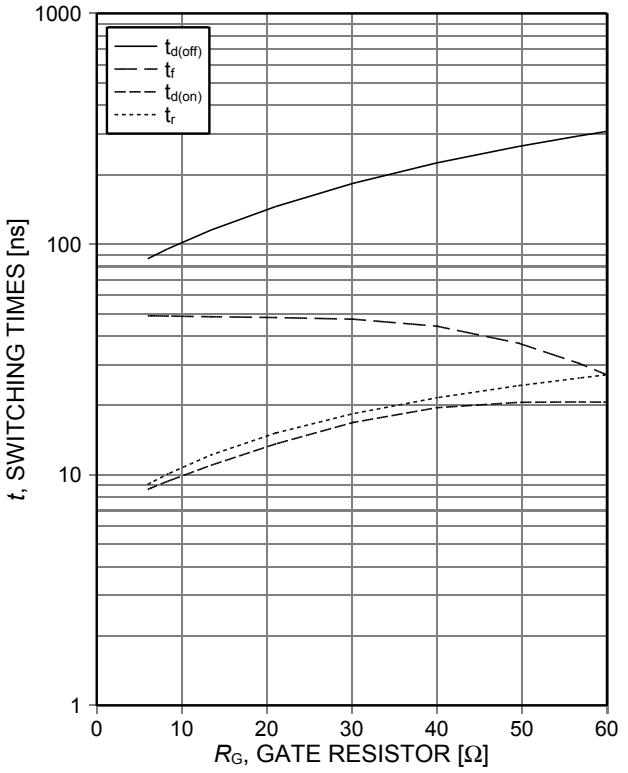


Figure 8. **Typical switching times as a function of gate resistor** (inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, I_C=20A, Dynamic test circuit in Figure E)

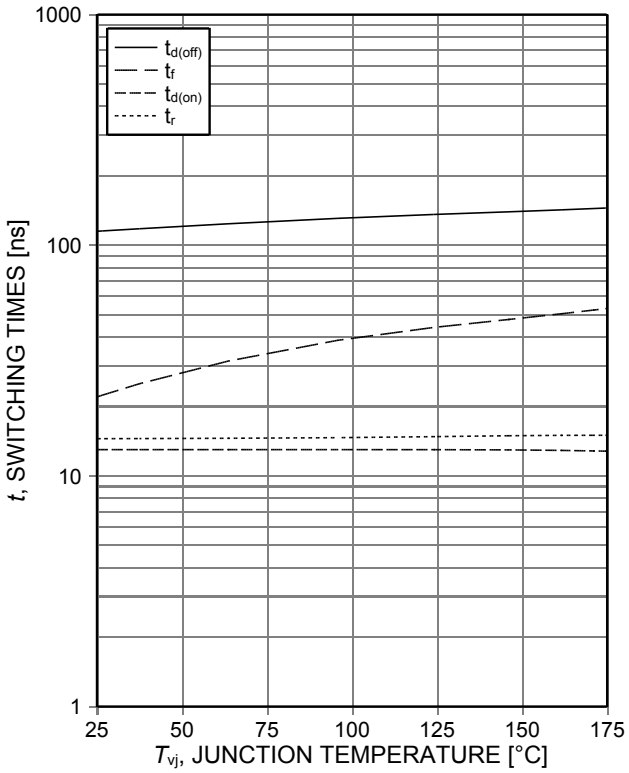


Figure 9. **Typical switching times as a function of junction temperature**
(inductive load, V_{CE}=400V, V_{GE}=0/15V, I_C=20A, R_G=20Ω, Dynamic test circuit in Figure E)

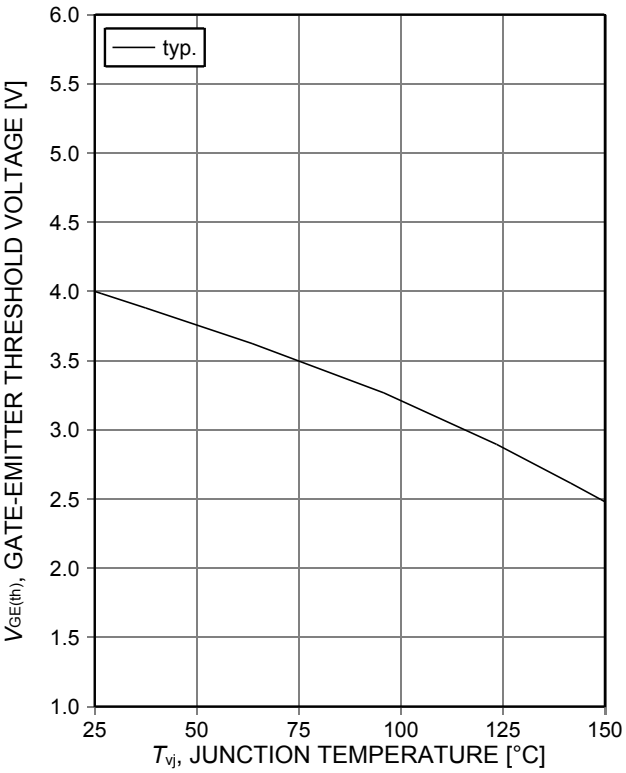


Figure 10. **Gate-emitter threshold voltage as a function of junction temperature**
(I_C=0.2mA)

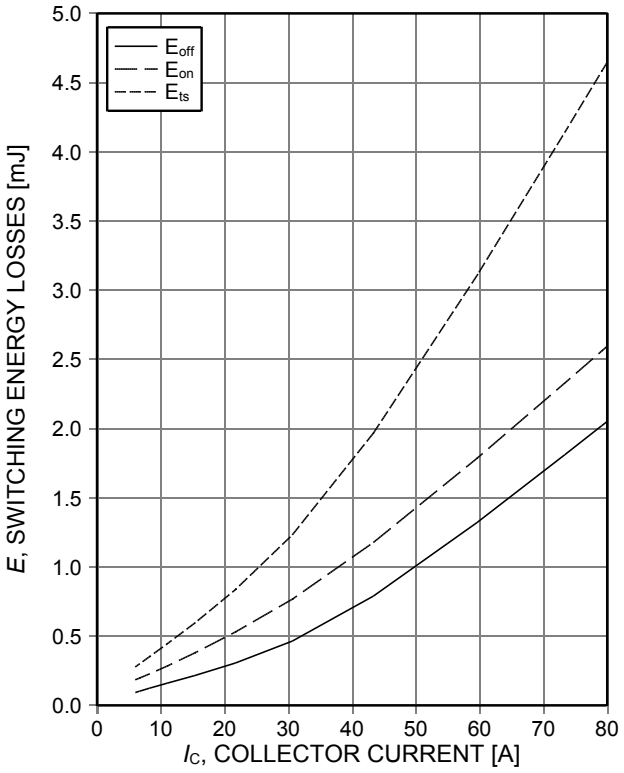


Figure 11. **Typical switching energy losses as a function of collector current**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, R_G=20Ω, Dynamic test circuit in Figure E)

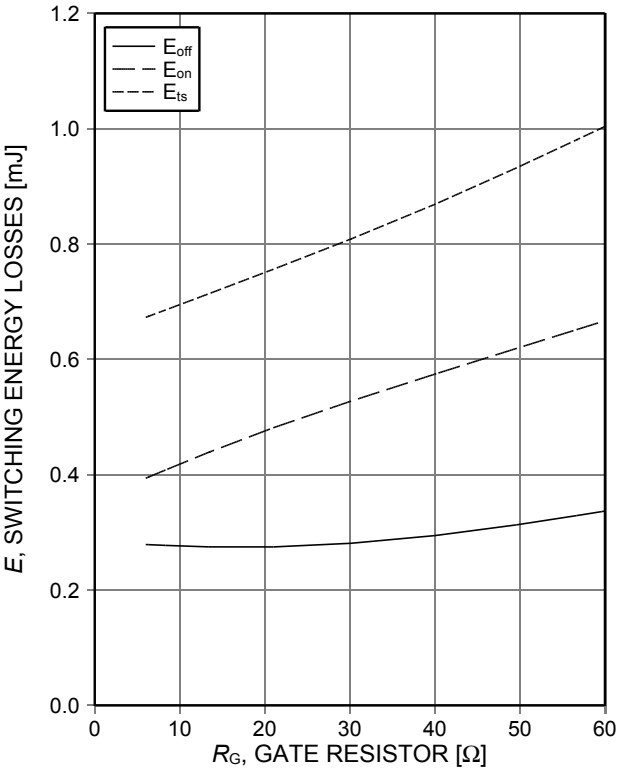


Figure 12. **Typical switching energy losses as a function of gate resistor**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, I_C=20A, Dynamic test circuit in Figure E)

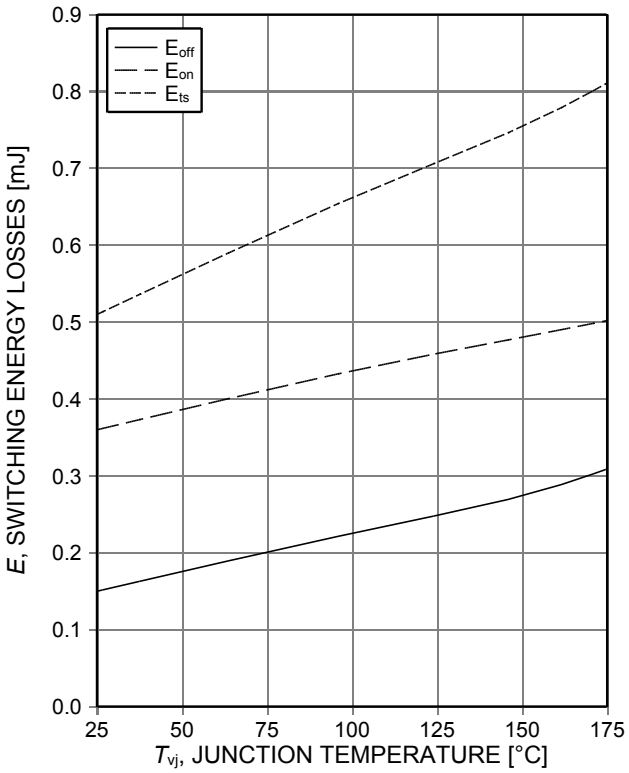


Figure 13. **Typical switching energy losses as a function of junction temperature** (inductive load, V_{CE}=400V, V_{GE}=0/15V, I_C=20A, R_G=20Ω, Dynamic test circuit in Figure E)

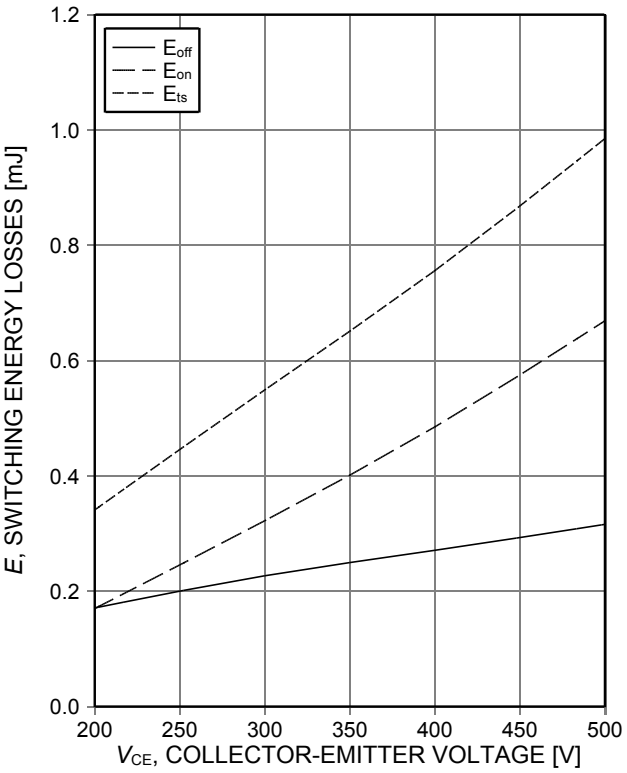


Figure 14. **Typical switching energy losses as a function of collector emitter voltage** (inductive load, T_{vj}=150°C, V_{GE}=0/15V, I_C=20A, R_G=20Ω, Dynamic test circuit in Figure E)

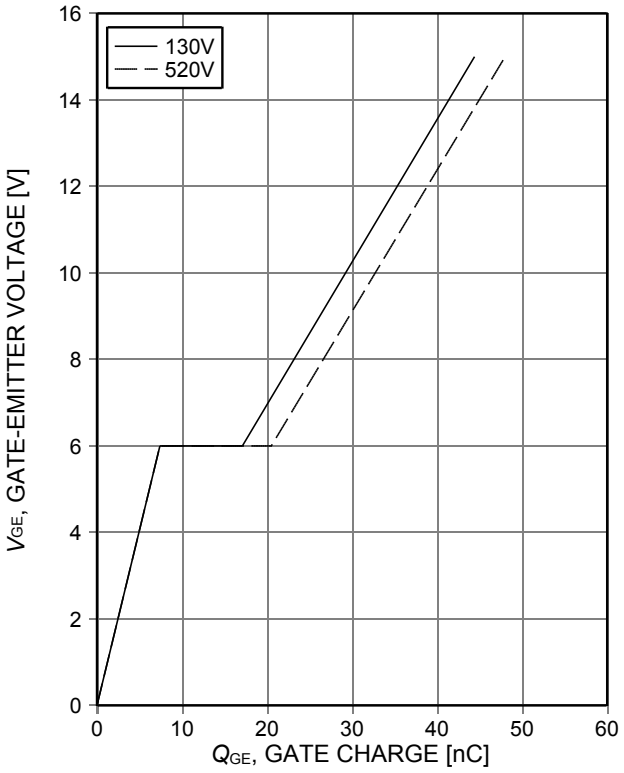


Figure 15. **Typical gate charge** (I_C=20A)

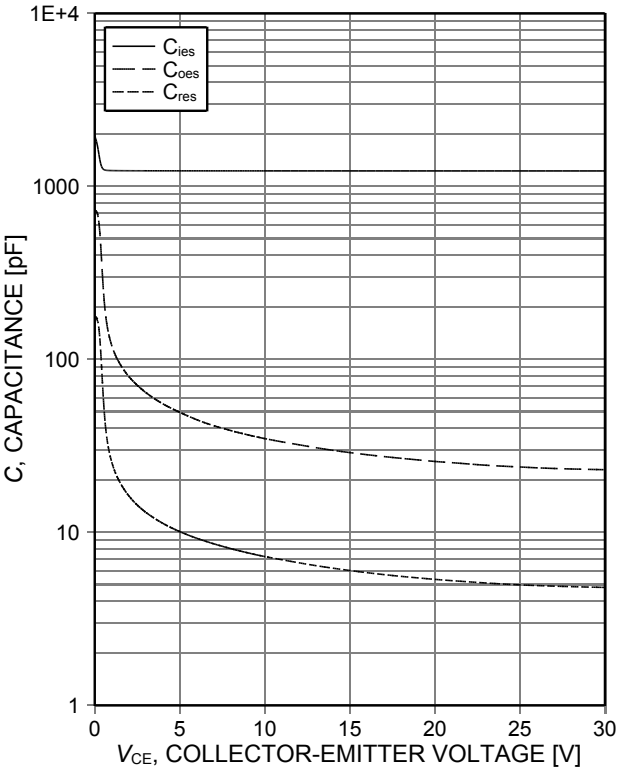


Figure 16. **Typical capacitance as a function of collector-emitter voltage** (V_{GE}=0V, f=1MHz)

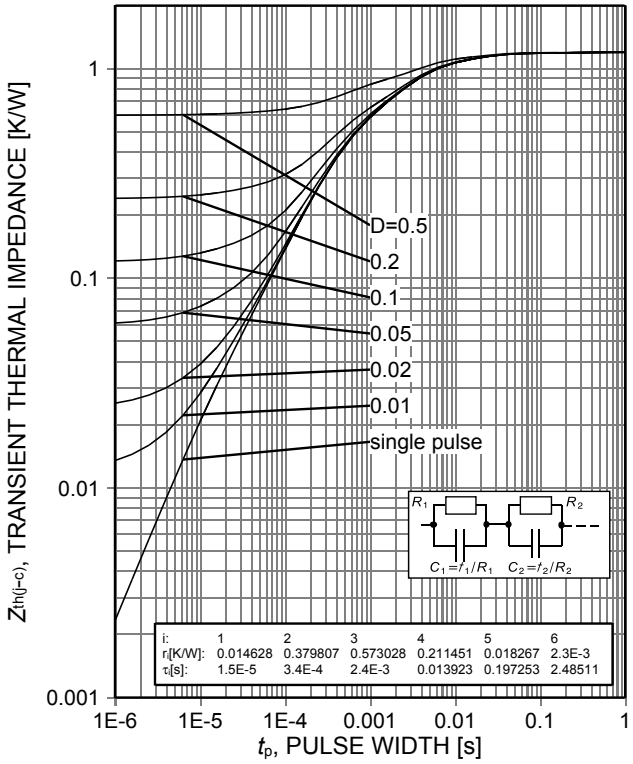
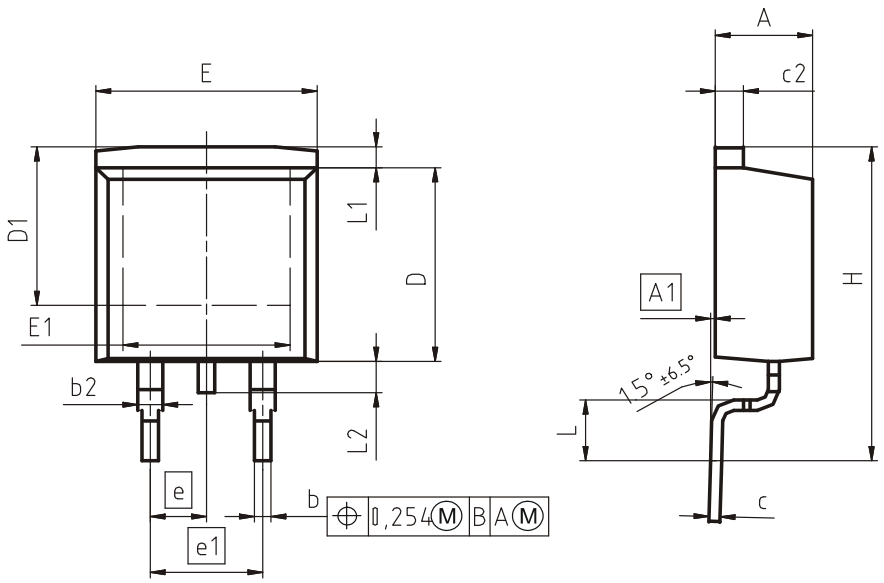
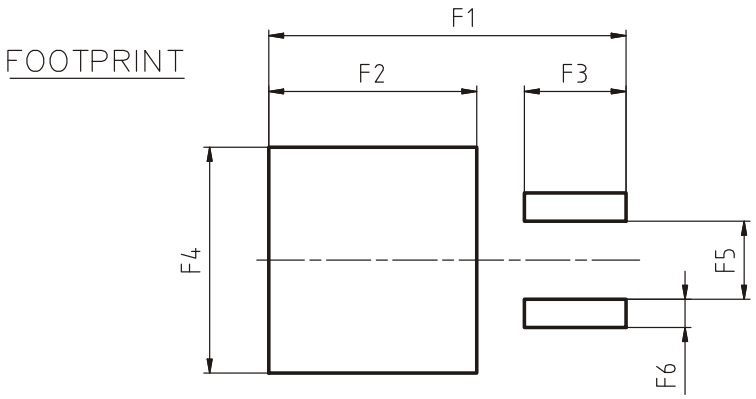


Figure 17. **IGBT transient thermal impedance** ($D=t_p/T$)

Package Drawing PG-TO263-3



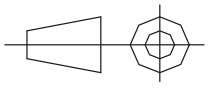


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	0.00	0.25	0.000	0.010
b	0.65	0.85	0.026	0.033
b2	0.95	1.15	0.037	0.045
c	0.33	0.65	0.013	0.026
c2	1.17	1.40	0.046	0.055
D	8.51	9.45	0.335	0.372
D1	7.10	7.90	0.280	0.311
E	9.80	10.31	0.386	0.406
E1	6.50	8.60	0.256	0.339
e	2.54		0.100	
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

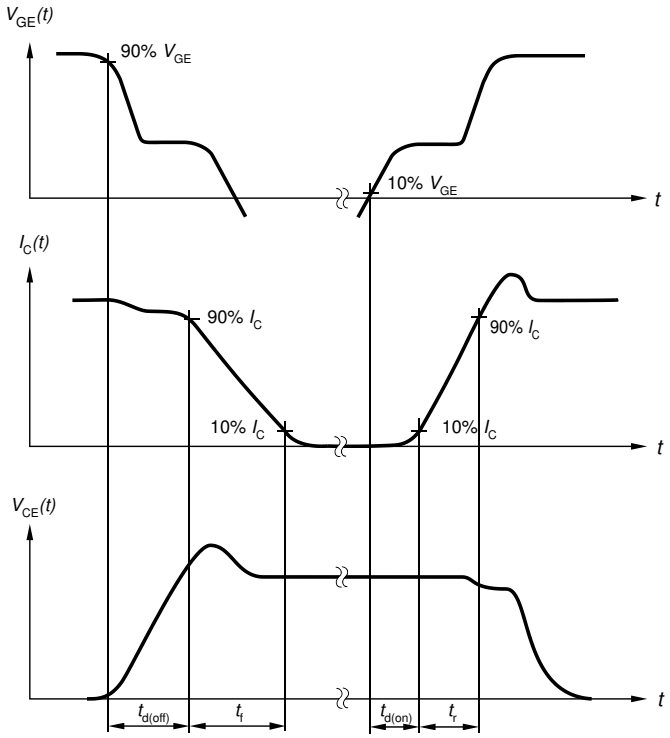


Figure A. **Definition of switching times**

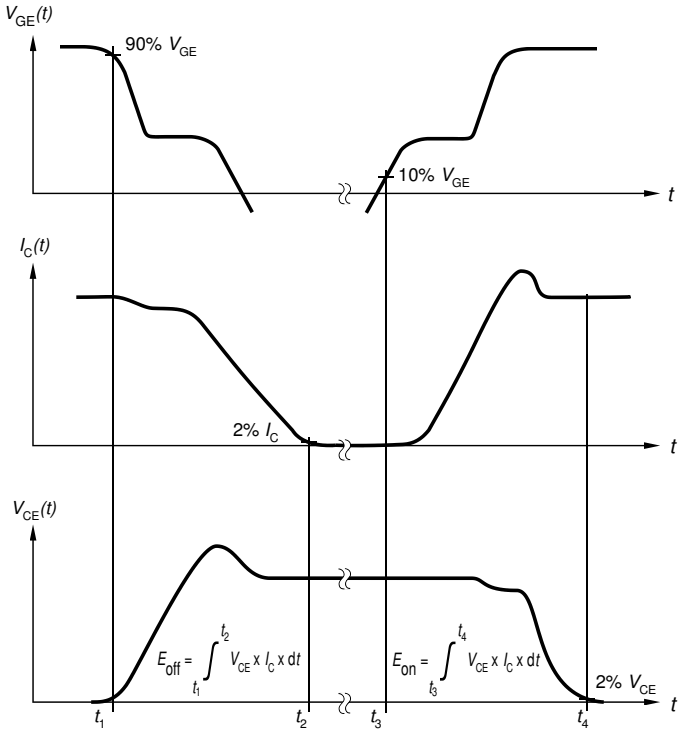


Figure B. **Definition of switching losses**

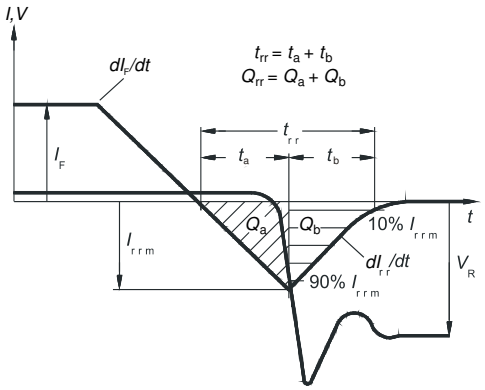


Figure C. **Definition of diode switching characteristics**

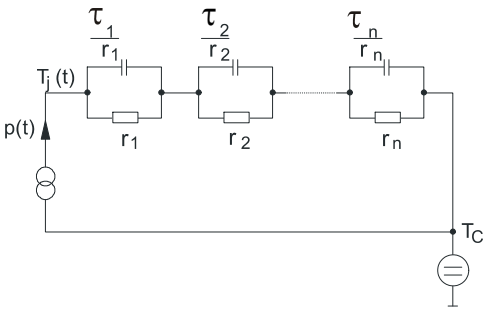


Figure D. **Thermal equivalent circuit**

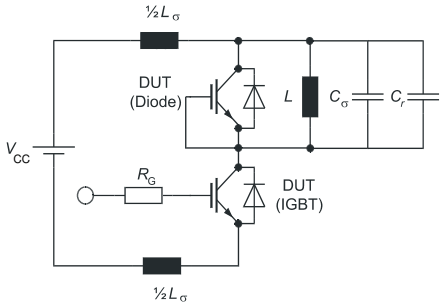


Figure E. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r,
(only for ZVT switching)

Revision History

IGB20N65S5

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.