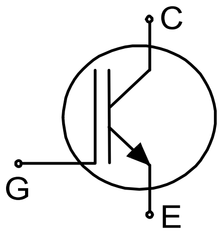
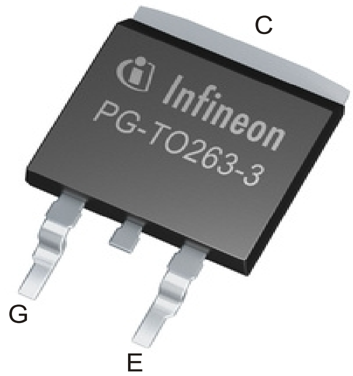
High speed switching series fifth generation

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
- Plug and play replacement of previous generation IGBTs
- 650V breakdown voltage
- Low gate charge Q_G
- Maximum junction temperature 175°C
- Dynamically stress tested
- Qualified according to AEC-Q101
- Green package (RoHS compliant)
- Complete product spectrum and PSpice Models: http://www.infineon.com/igbt/





Applications:

- Off-board charger
- On-board charger
- DC/DC converter
- Power-Factor correction

Package pin definition:

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

Key Performance and Package Parameters

Type	V_{CE}	I_C	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Marking	Package
AIGB50N65H5	650V	50A	1.65V	175°C	AG50EH5	PG-TO263-3

Table of Contents

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	80.0 56.0	A
Pulsed collector current, t_p limited by T_{vjmax}[1)]	I_{Cpuls}	150.0	A
Turn off safe operating area $V_{CE} \leq 650V$, $T_{vj} \leq 175°C$, $t_p = 1µs$[1)]	-	150.0	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}	305.0 152.5	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	$R_{th(j-c)}$		-	-	0.50	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}	$V_{GE} = 15.0V$, $I_C = 50.0A$ $T_{vj} = 25°C$ $T_{vj} = 125°C$ $T_{vj} = 175°C$	- - -	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}	$V_{CE} = 650V$, $V_{GE} = 0V$ $T_{vj} = 25°C$ $T_{vj} = 175°C$	- -	- 1000	40 -	µA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0V$, $V_{GE} = 20V$	-	-	100	nA
Transconductance	g_{fs}	$V_{CE} = 20V$, $I_C = 50.0A$	-	50.0	-	S

[1)] Defined by design. Not subject to production test.

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}		-	65	-	
Reverse transfer capacitance	C_{res}		-	11	-	
Gate charge	Q_G	V_{CC} = 520V, I_C = 50.0A, V_{GE} = 15V	-	115.0	-	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 = 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.	-	22	-	ns
Rise time	t_r		-	16	-	ns
Turn-off delay time	$t_{d(off)}$		-	163	-	ns
Fall time	t_f		-	18	-	ns
Turn-on energy	E_{on}		-	0.55	-	mJ
Turn-off energy	E_{off}		-	0.12	-	mJ
Total switching energy	E_{ts}		-	0.67	-	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		-	6	-	ns
Turn-off delay time	$t_{d(off)}$		-	169	-	ns
Fall time	t_f		-	35	-	ns
Turn-on energy	E_{on}		-	0.13	-	mJ
Turn-off energy	E_{off}		-	0.03	-	mJ
Total switching energy	E_{ts}		-	0.16	-	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.	-	21	-	ns
Rise time	t_r		-	17	-	ns
Turn-off delay time	$t_{d(off)}$		-	182	-	ns
Fall time	t_f		-	17	-	ns
Turn-on energy	E_{on}		-	0.74	-	mJ
Turn-off energy	E_{off}		-	0.16	-	mJ
Total switching energy	E_{ts}		-	0.90	-	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		-	6	-	ns
Turn-off delay time	$t_{d(off)}$		-	200	-	ns
Fall time	t_f		-	34	-	ns
Turn-on energy	E_{on}		-	0.21	-	mJ
Turn-off energy	E_{off}		-	0.05	-	mJ
Total switching energy	E_{ts}		-	0.26	-	mJ

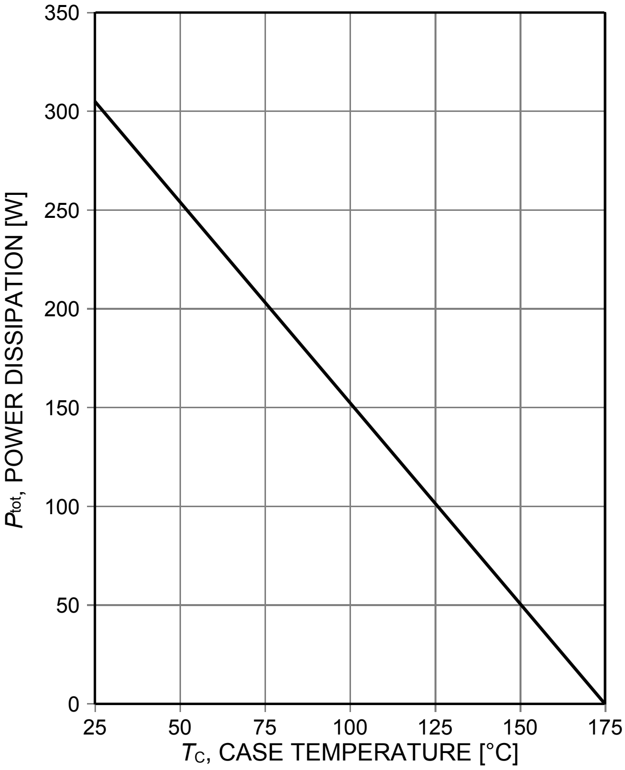


Figure 1. **Power dissipation as a function of case temperature**
(T_{vj}≤175°C)

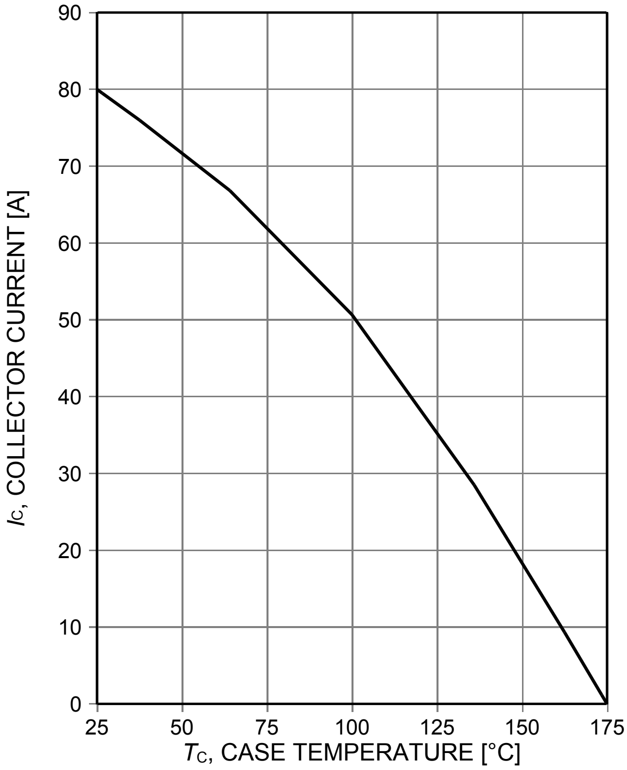


Figure 2. **Collector current as a function of case temperature**
(V_{GE}≥15V, T_{vj}≤175°C)

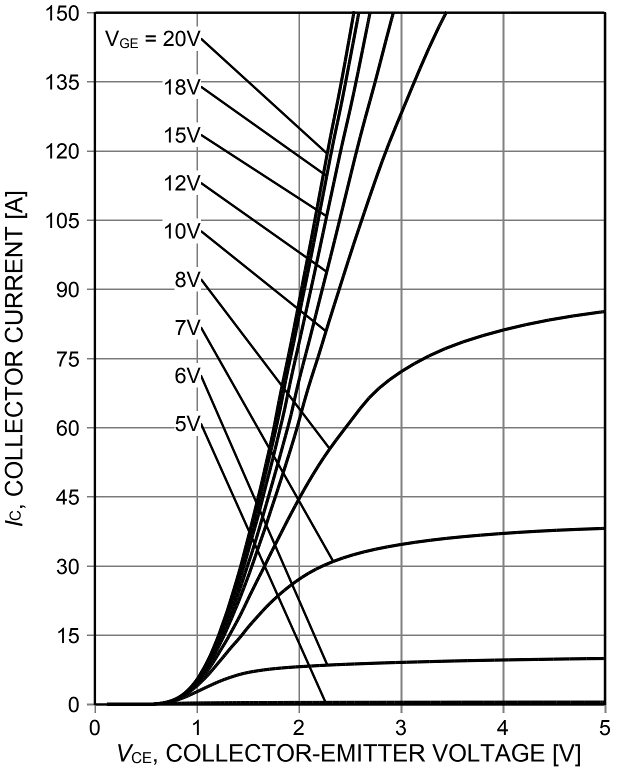


Figure 3. **Typical output characteristic**
(T_{vj}=25°C)

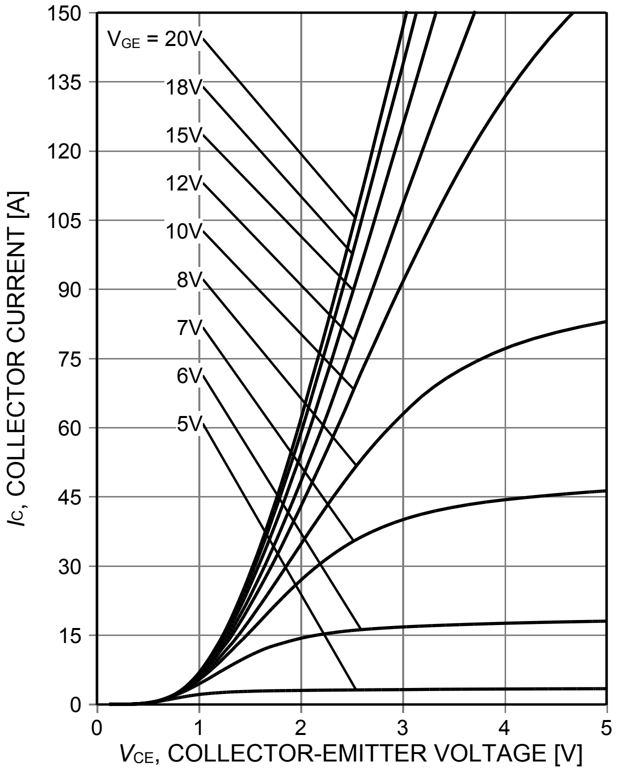


Figure 4. **Typical output characteristic**
(T_{vj}=150°C)

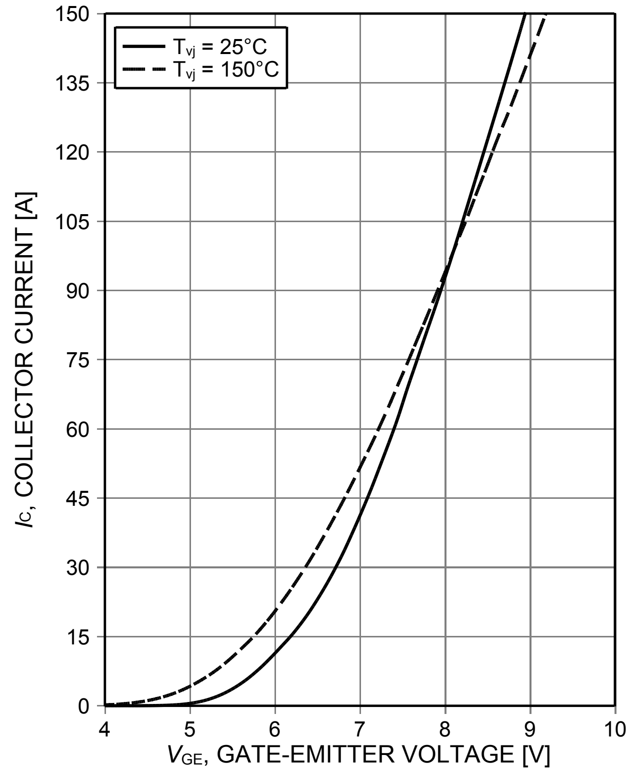


Figure 5. **Typical transfer characteristic**
(V_{CE}=20V)

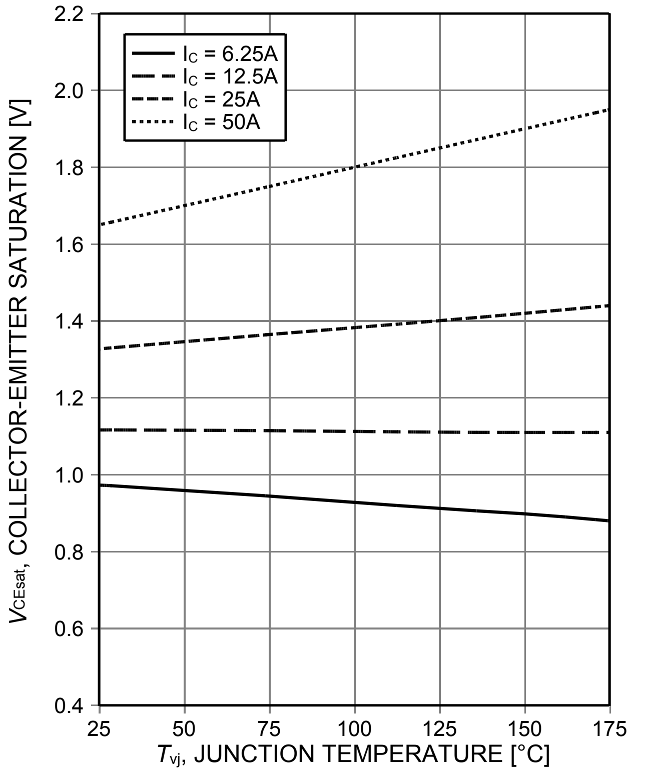


Figure 6. **Typical collector-emitter saturation voltage as a function of junction temperature**
(V_{GE}=15V)

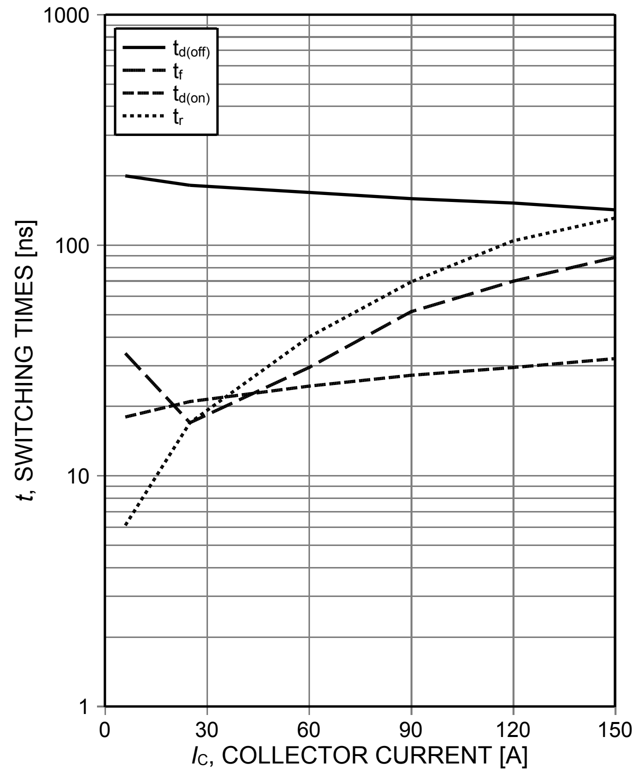


Figure 7. **Typical switching times as a function of collector current**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=15/0V, r_G=12Ω, Dynamic test circuit in Figure E)

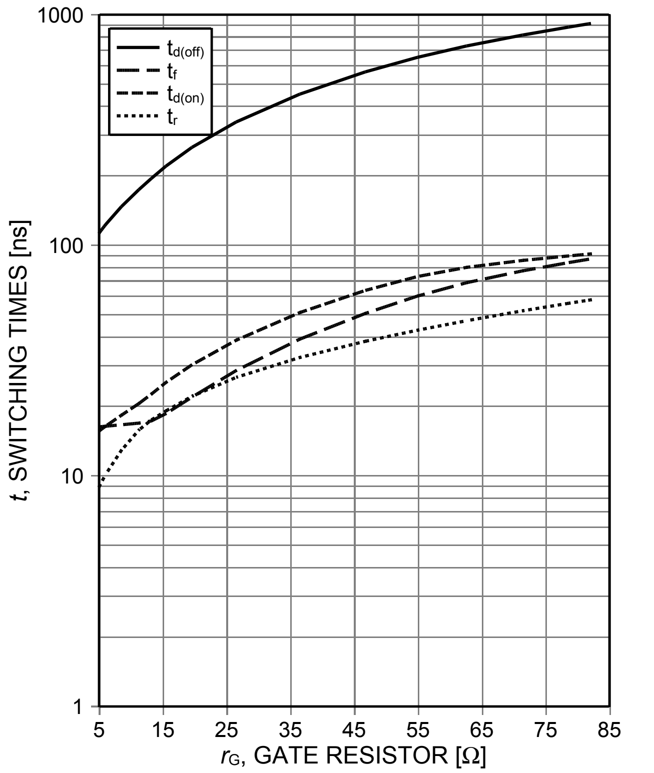


Figure 8. **Typical switching times as a function of gate resistor**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=15/0V, I_C=25A,Dynamic test circuit in Figure E)

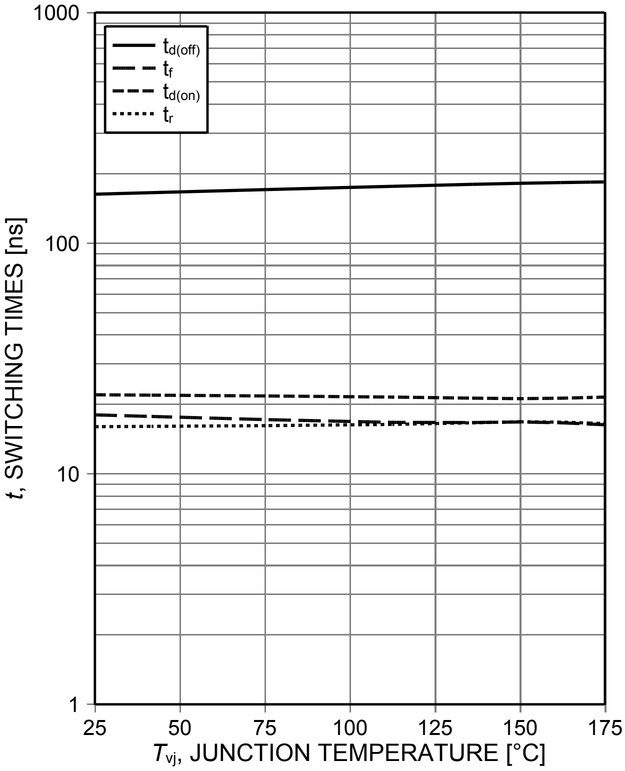


Figure 9. **Typical switching times as a function of junction temperature**
(inductive load, V_{CE}=400V, V_{GE}=15/0V, I_C=25A, r_G=12Ω,Dynamic test circuit in Figure E)

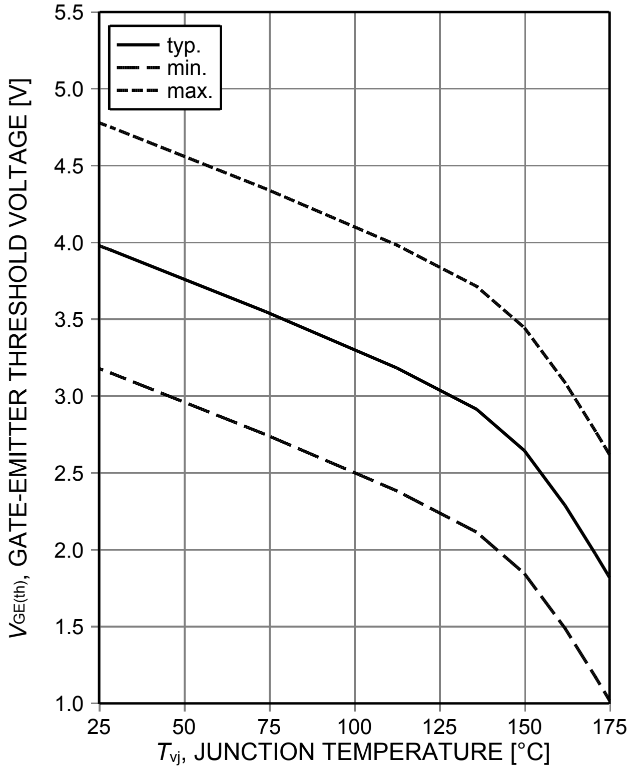


Figure 10. **Gate-emitter threshold voltage as a function of junction temperature**
(I_C=0.5mA)

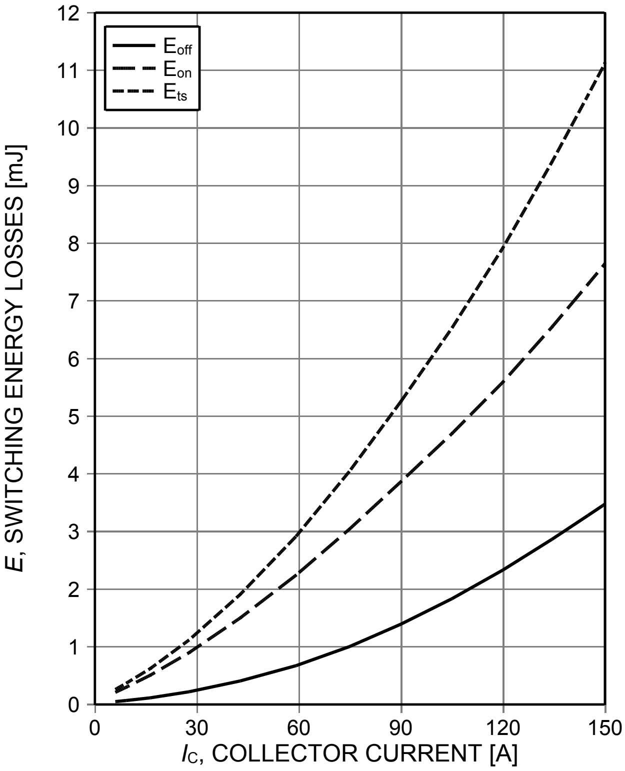


Figure 11. **Typical switching energy losses as a function of collector current**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=15/0V, r_G=12Ω,Dynamic test circuit in Figure E)

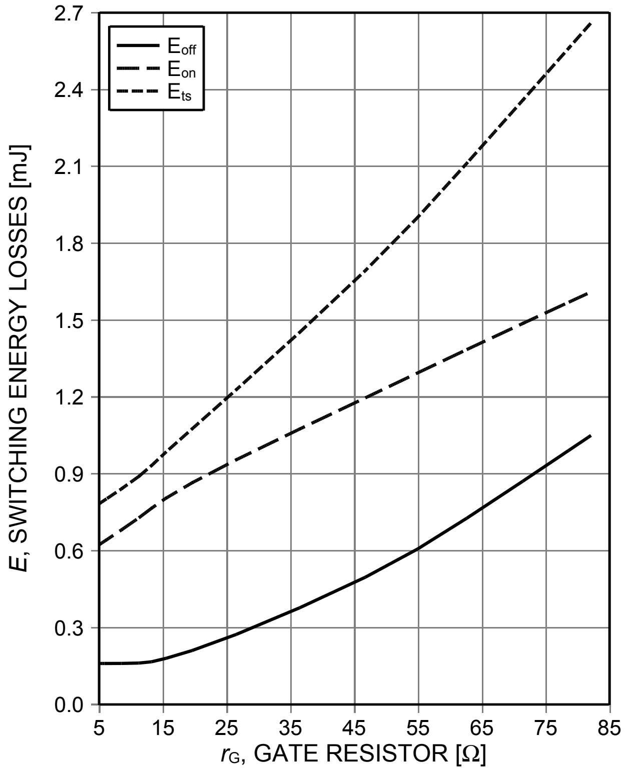


Figure 12. **Typical switching energy losses as a function of gate resistor**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=15/0V, I_C=25A, Dynamic test circuit in Figure E)

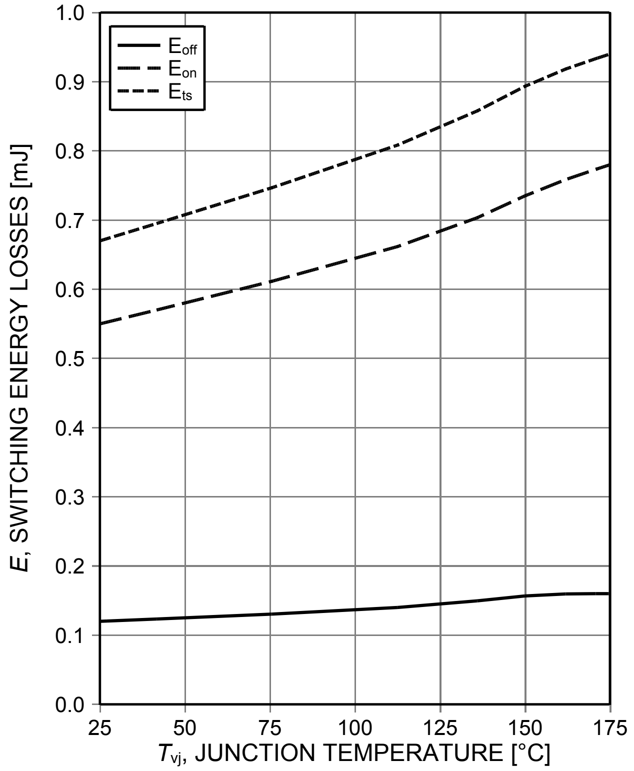


Figure 13. **Typical switching energy losses as a function of junction temperature**
(inductive load, V_{CE}=400V, V_{GE}=15/0V, I_C=25A, r_G=12Ω,Dynamic test circuit in Figure E)

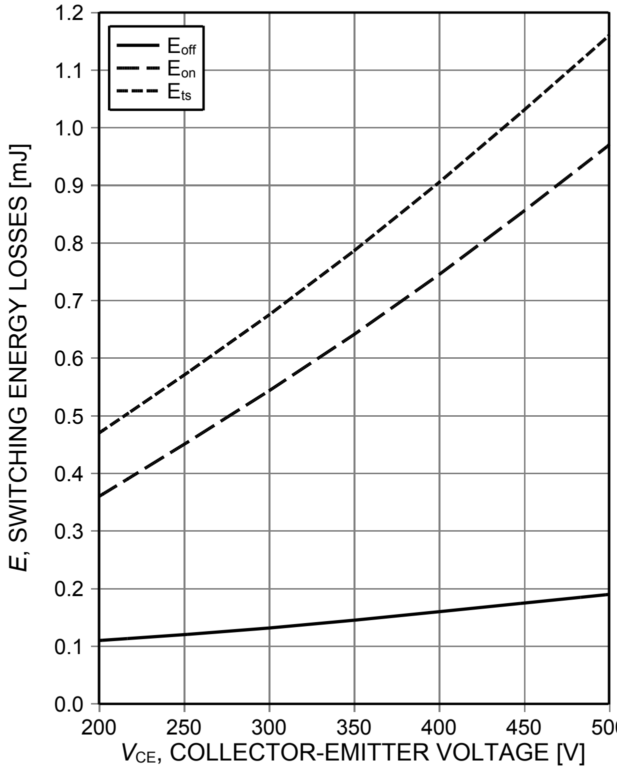


Figure 14. **Typical switching energy losses as a function of collector emitter voltage**
(inductive load, T_{vj}=150°C, V_{GE}=15/0V, I_C=25A, r_G=12Ω,Dynamic test circuit in Figure E)

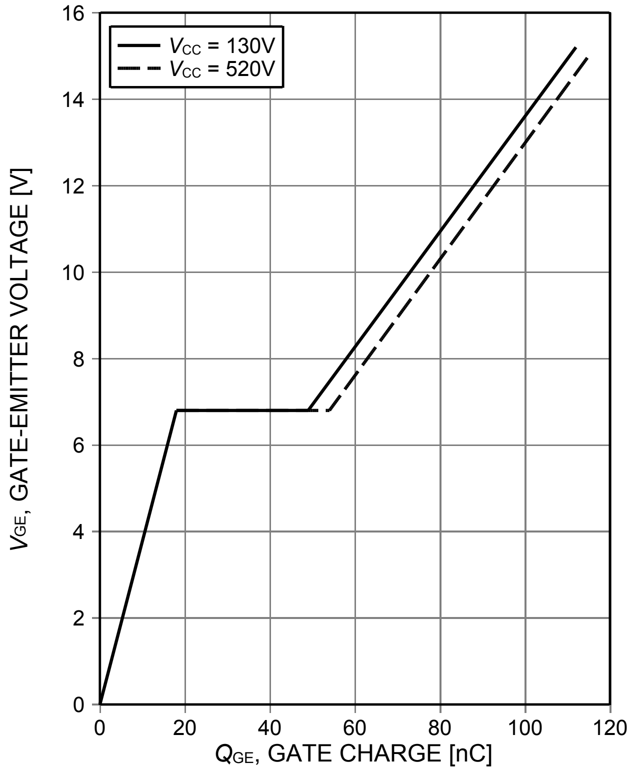


Figure 15. **Typical gate charge**
(I_C=50A)

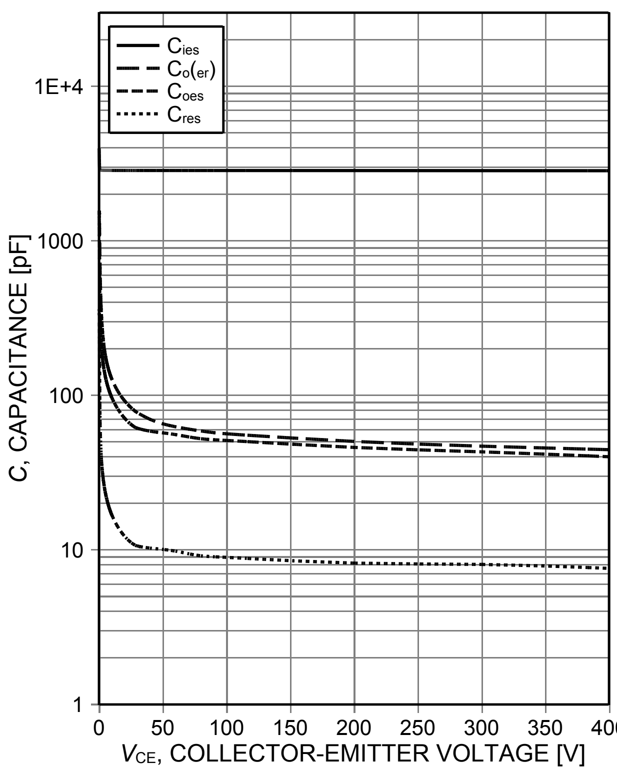


Figure 16. **Typical capacitance as a function of collector-emitter voltage**
(V_{GE}=0V, f=1MHz)

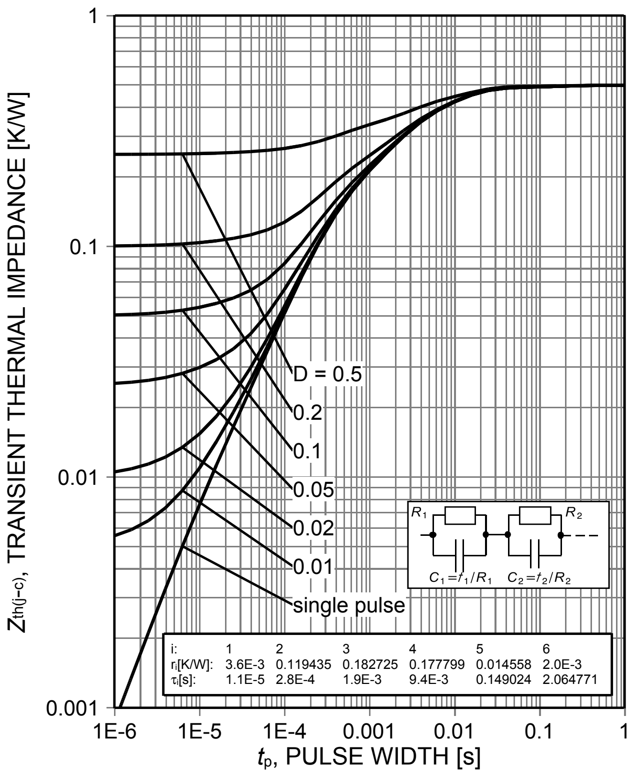
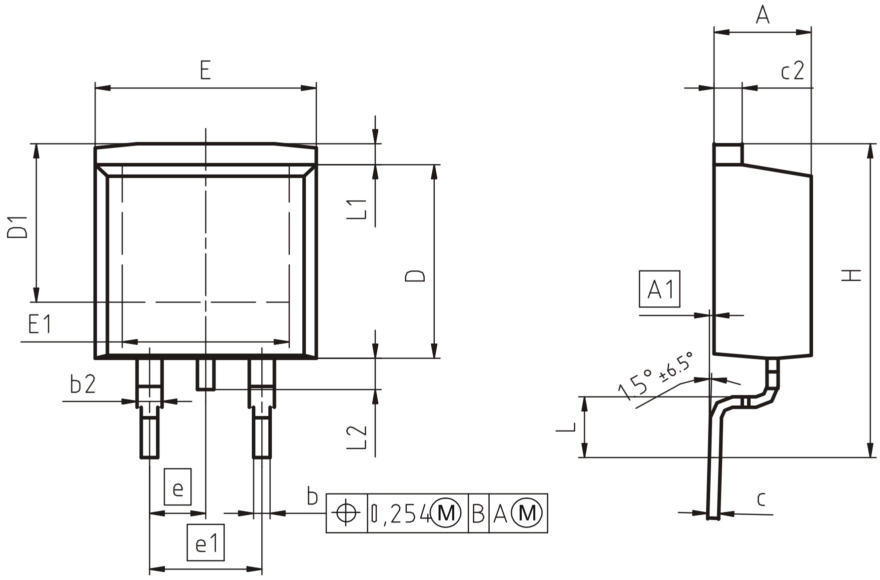
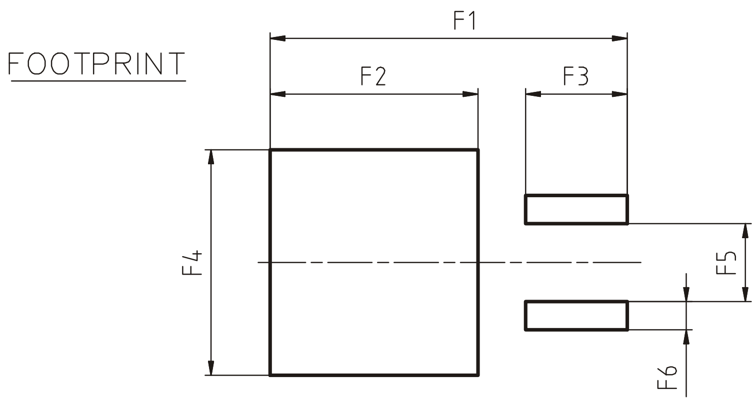


Figure 17. **IGBT transient thermal impedance** (D=t_p/T)

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

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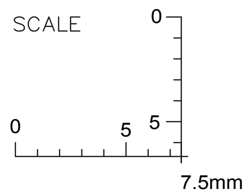
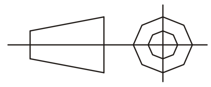
SCALE



EUROPEAN PROJECTION



ISSUE DATE
30-08-2007

REVISION
01

Testing Conditions

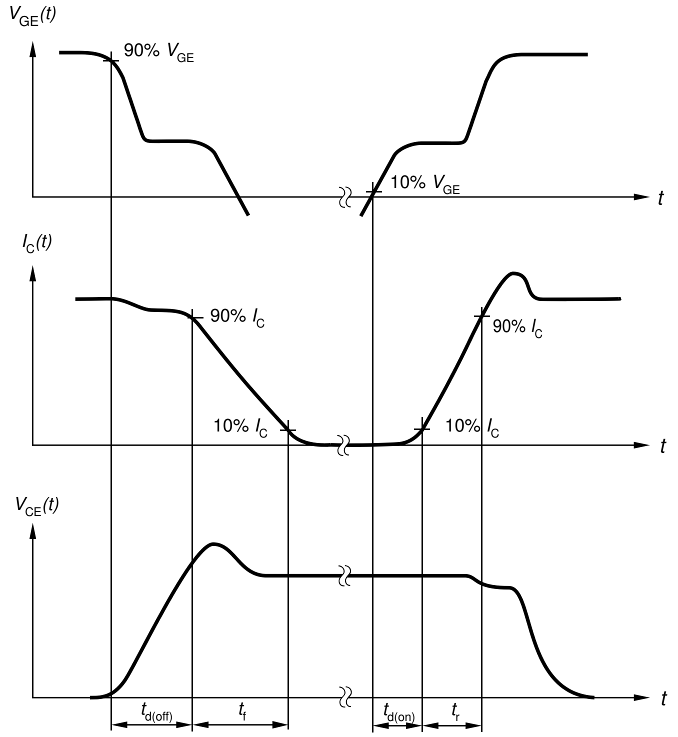


Figure A. **Definition of switching times**

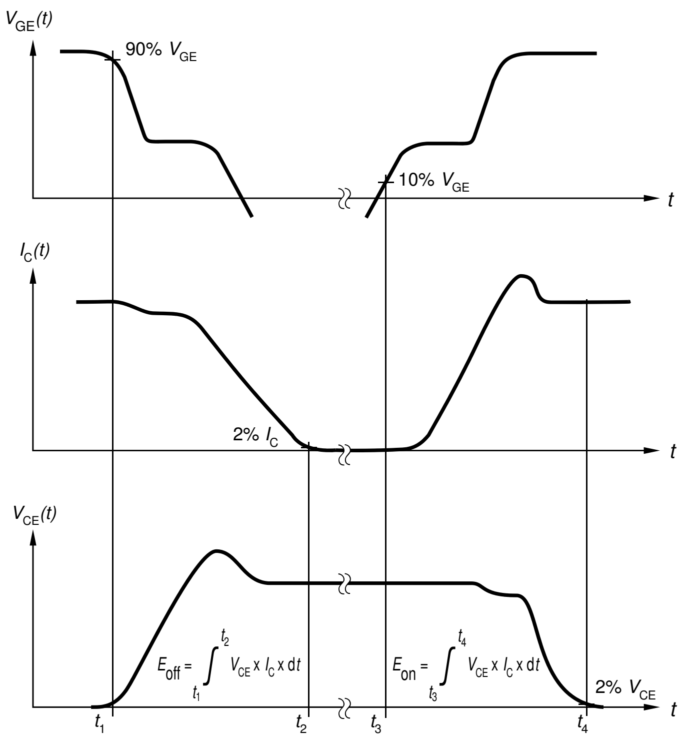


Figure B. **Definition of switching losses**

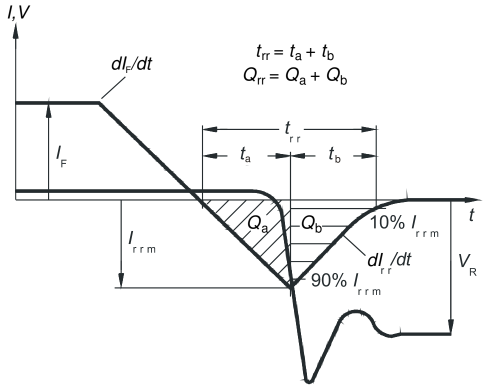


Figure C. **Definition of diode switching characteristics**

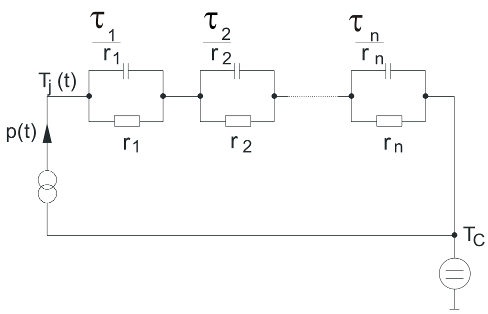


Figure D. **Thermal equivalent circuit**

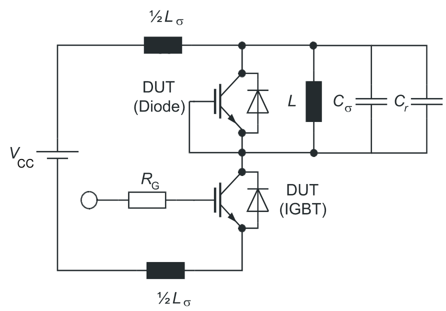


Figure E. **Dynamic test circuit**
Parasitic inductance L_{σ},
parasitic capacitor C_{σ},
relief capacitor C_r,
(only for ZVT switching)

Revision History

AIGB50N65H5

Revision: 2019-10-19, Rev. 2.1

Previous Revision		
Revision	Date	Subjects (major changes since last revision)
2.1	2019-10-19	Final Datasheet

Trademarks

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Published by
Infineon Technologies AG
81726 München, Germany