IGBT

High speed 5 IGBT in TRENCHSTOP™ 5 technology

IGZ75N65H5

650V IGBT high speed series fifth generation

Data sheet

High speed 5 IGBT in TRENCHSTOP™ 5 technology

Features and Benefits:

High speed H5 technology offering
• Ultra low loss switching thanks to Kelvin emitter pin in combination with TRENCHSTOP™ 5
• 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
• Qualified according to JEDEC for target applications
• Pb-free lead plating; RoHS compliant
• Complete product spectrum and PSpice Models: http://www.infineon.com/igbt/
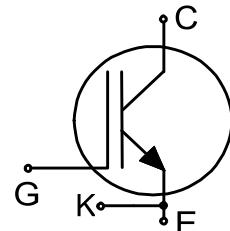
Applications

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

Package pin definition:

• Pin C & backside - collector
• Pin E - emitter
• Pin K - Kelvin emitter
• Pin G - gate

Please note: The emitter and Kelvin emitter pins are not exchangeable. Their exchange might lead to malfunction.

Key Performance and Package Parameters

Type	V_{CE}	I_C	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Marking	Package
IGZ75N65H5	650V	75A	1.65V	175°C	G75EH5	PG-TO247-4

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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} $T_C = 25°C$ $T_C = 100°C$	I_C	119.0 75.0	A
Pulsed collector current, t_p limited by T_{vjmax}[1]	I_{Cpuls}	300.0	A
Turn off safe operating area $V_{CE} \leq 650V$, $T_{vj} \leq 175°C$, $t_p = 1\mu s$[1]	-	300.0	A
Gate-emitter voltage Transient Gate-emitter voltage ($t_p \leq 10\mu s$, D < 0.010)	V_{GE}	±20 ±30	V
Power dissipation $T_C = 25°C$ Power dissipation $T_C = 100°C$	P_{tot}	395.0 197.0	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	$R_{th(j-c)}$		0.38	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}	$V_{GE} = 15.0V$, $I_C = 75.0A$ $T_{vj} = 25°C$ $T_{vj} = 100°C$ $T_{vj} = 150°C$	- - -	1.65 1.82 1.90	2.10 - -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 0.75mA$, $V_{CE} = V_{GE}$	3.2	4.0	4.8	V
Zero gate voltage collector current	I_{CES}	$V_{CE} = 650V$, $V_{GE} = 0V$ $T_{vj} = 25°C$ $T_{vj} = 175°C$	- -	- 850.0	75.0 -	µA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0V$, $V_{GE} = 20V$	-	-	100	nA
Transconductance	g_{fs}	$V_{CE} = 20V$, $I_C = 75.0A$	-	104.0	-	S

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

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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	-	4300	-	pF
Output capacitance	C_{oes}		-	75	-	
Reverse transfer capacitance	C_{res}		-	16	-	
Gate charge	Q_G	V_{CC} = 520V, I_C = 75.0A, V_{GE} = 15V	-	166.0	-	nC
Internal emitter inductance[1] 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 = 37.5A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 10.0Ω, $R_{G(off)}$ = 18.0Ω, $L\sigma$ = 30nH, $C\sigma$ = 25pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery. Diode from IKZ75N65EH5.	-	26	-	ns
Rise time	t_r		-	11	-	ns
Turn-off delay time	$t_{d(off)}$		-	347	-	ns
Fall time	t_f		-	15	-	ns
Turn-on energy	E_{on}		-	0.68	-	mJ
Turn-off energy	E_{off}		-	0.43	-	mJ
Total switching energy	E_{ts}		-	1.11	-	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 = 37.5A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 10.0Ω, $R_{G(off)}$ = 18.0Ω, $L\sigma$ = 30nH, $C\sigma$ = 25pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery. Diode from IKZ75N65EH5.	-	24	-	ns
Rise time	t_r		-	13	-	ns
Turn-off delay time	$t_{d(off)}$		-	400	-	ns
Fall time	t_f		-	15	-	ns
Turn-on energy	E_{on}		-	1.10	-	mJ
Turn-off energy	E_{off}		-	0.48	-	mJ
Total switching energy	E_{ts}		-	1.58	-	mJ

[1] The internal emitter inductance does not affect the gate control circuitry if bypassed by using the emitter sense pin.
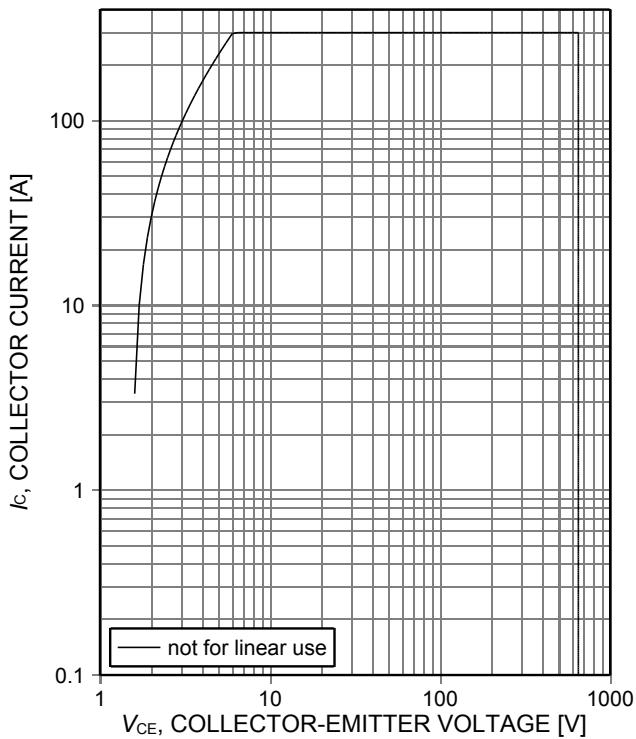
Figure 1. **Forward bias safe operating area**
(D=0, T_C=25°C, T_{vj}≤175°C, V_{GE}=15V, t_p=1µs, I_{Cmax} defined by design - not subject to production test)
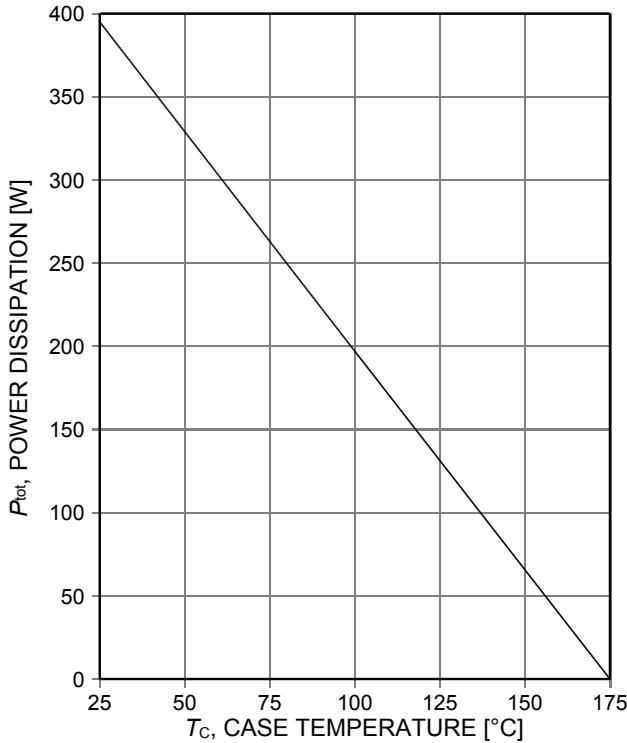
Figure 2. **Power dissipation as a function of case temperature**
(T_{vj}≤175°C)
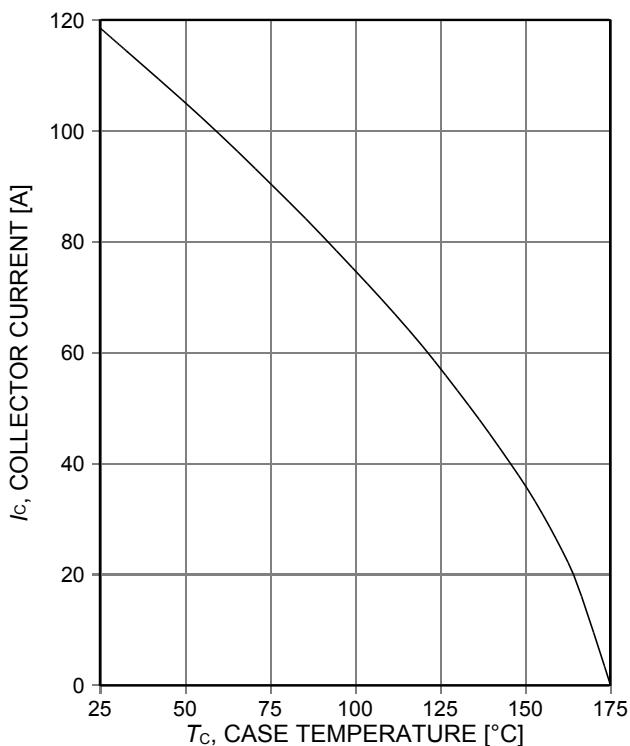
Figure 3. **Collector current as a function of case temperature**
(V_{GE}≥15V, T_{vj}≤175°C)
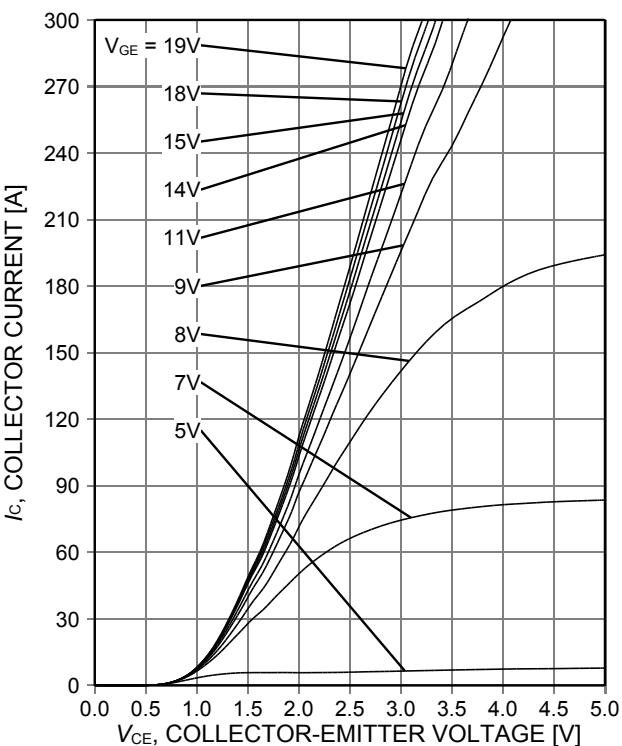
Figure 4. **Typical output characteristic**
(T_{vj}=25°C)
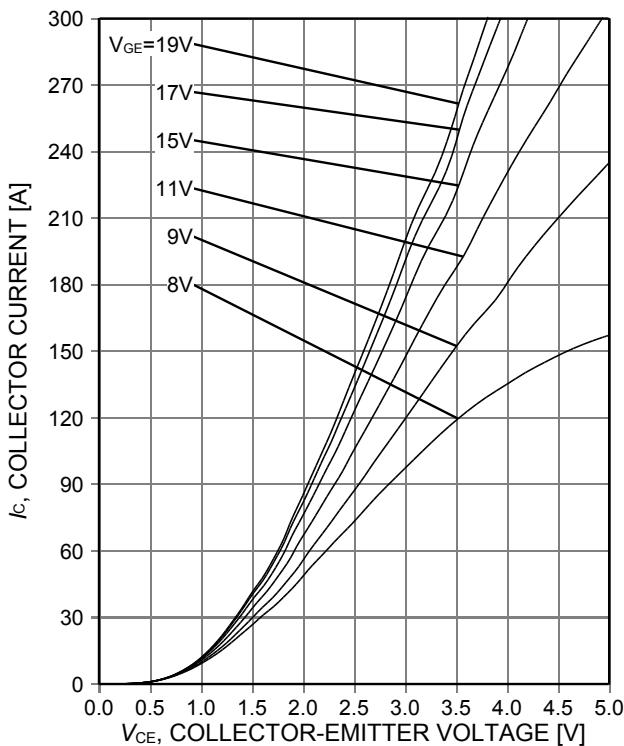
Figure 5. **Typical output characteristic**
(T_{vj}=175°C)
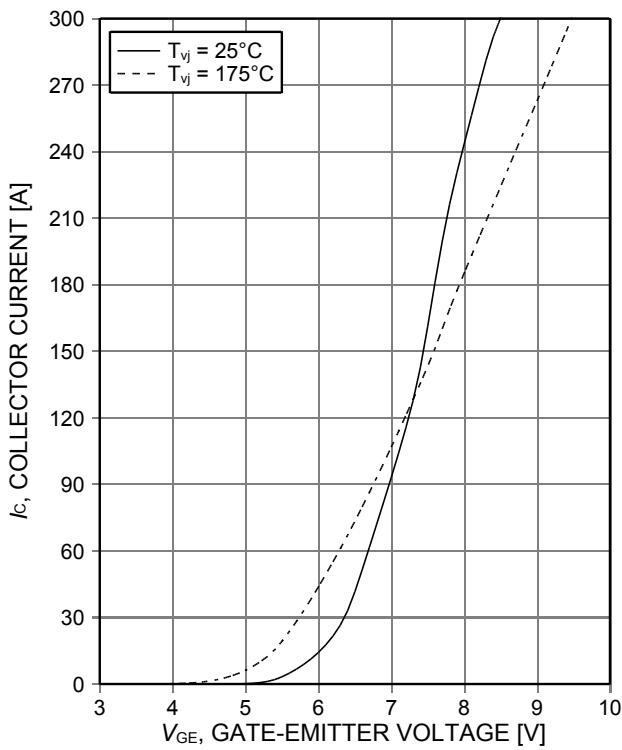
Figure 6. **Typical transfer characteristic**
(V_{CE}=20V)
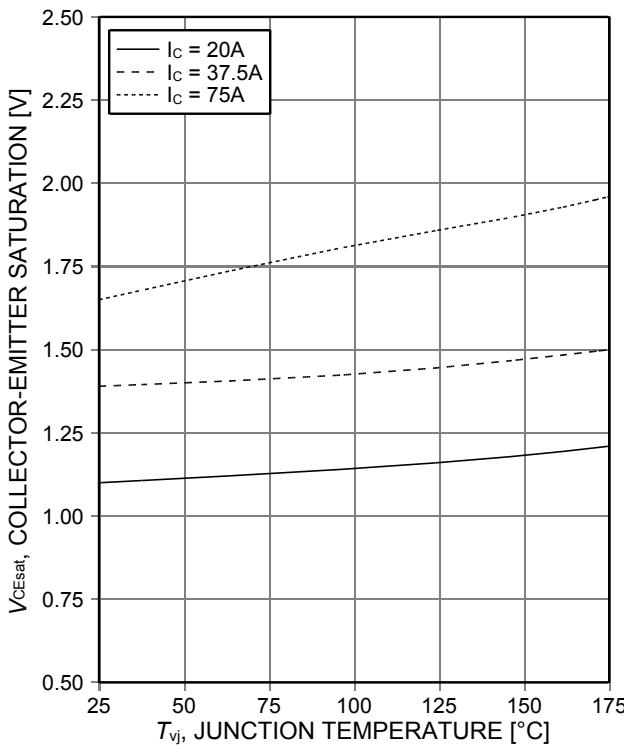
Figure 7. **Typical collector-emitter saturation voltage as a function of junction temperature**
(V_{GE}=15V)
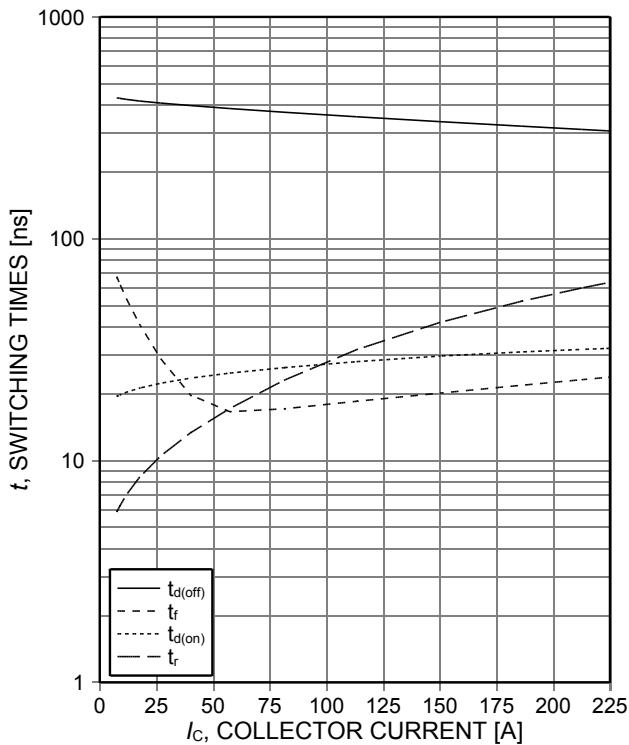
Figure 8. **Typical switching times as a function of collector current**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, $R_{G(on)}$=10Ω, $R_{G(off)}$=18Ω, dynamic test circuit in Figure E)

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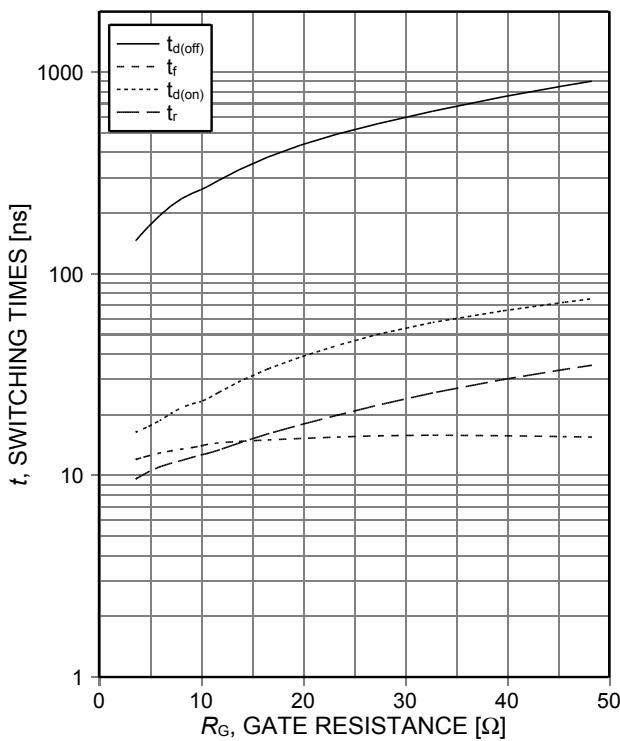
Figure 9. **Typical switching times as a function of gate resistance**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, I_C=37.5A, dynamic test circuit in Figure E)
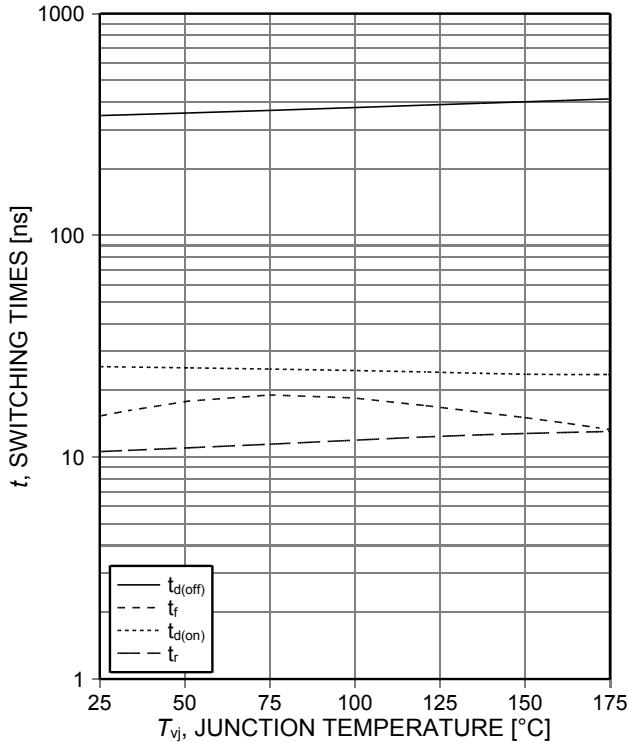
Figure 10. **Typical switching times as a function of junction temperature**
(inductive load, V_{CE}=400V, V_{GE}=0/15V, I_C=37.5A, $R_{G(on)}$=10Ω, $R_{G(off)}$=18Ω, dynamic test circuit in Figure E)
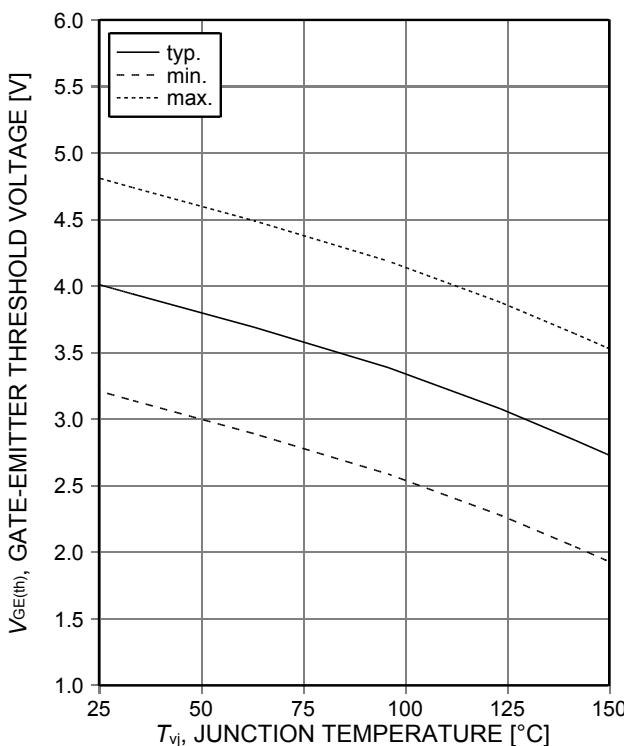
Figure 11. **Gate-emitter threshold voltage as a function of junction temperature**
(I_C=0.75mA)
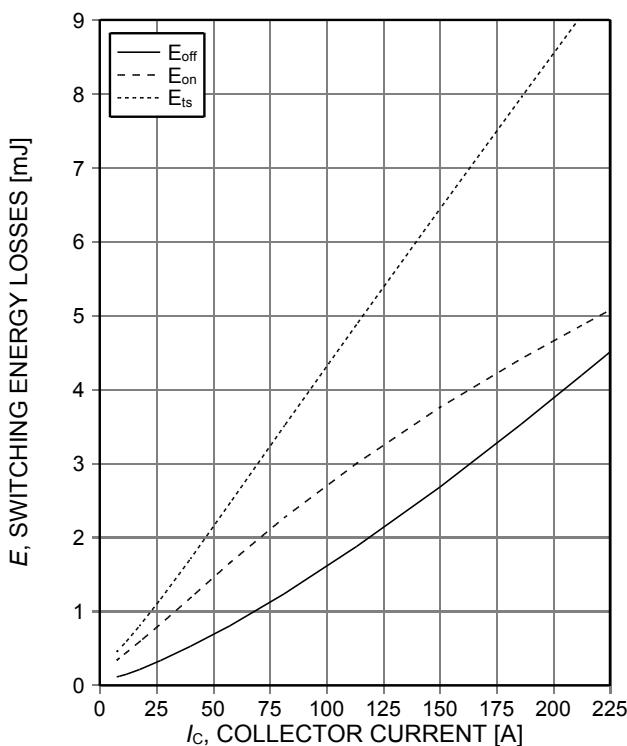
Figure 12. **Typical switching energy losses as a function of collector current**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, $R_{G(on)}$=10Ω, $R_{G(off)}$=18Ω, dynamic test circuit in Figure E)

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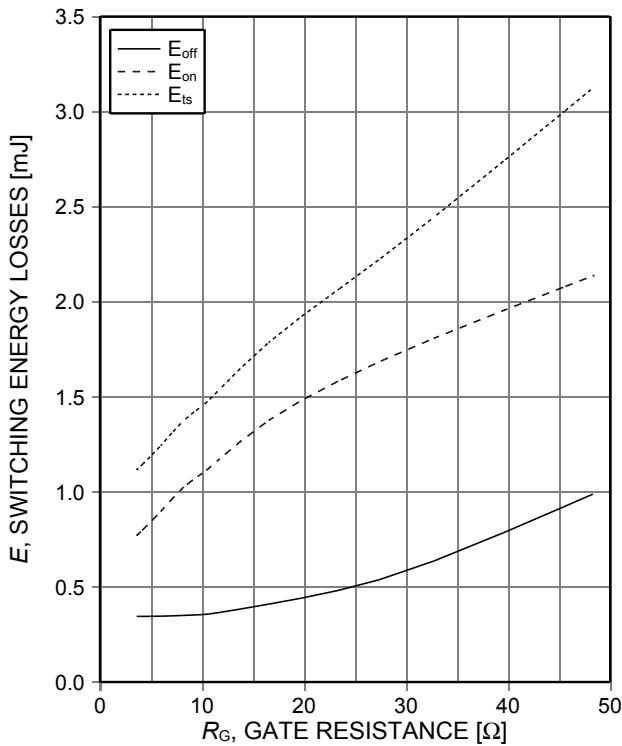
Figure 13. **Typical switching energy losses as a function of gate resistance** (inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, I_C=37.5A, dynamic test circuit in Figure E)
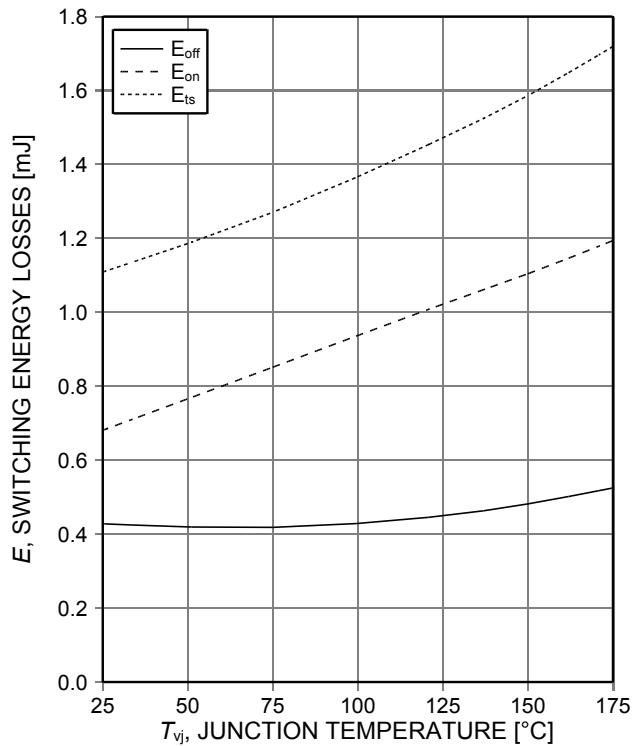

Figure 14. **Typical switching energy losses as a function of junction temperature** (inductive load, V_{CE}=400V, V_{GE}=0/15V, I_C=37.5A, $R_{G(on)}$=10Ω, $R_{G(off)}$=18Ω, dynamic test circuit in Figure E)
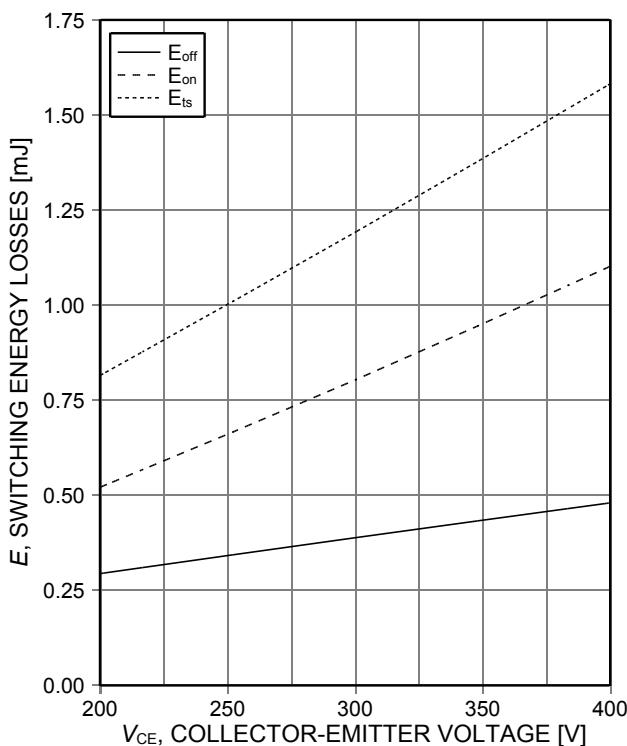

Figure 15. **Typical switching energy losses as a function of collector emitter voltage** (inductive load, T_{vj}=150°C, V_{GE}=0/15V, I_C=37.5A, $R_{G(on)}$=10Ω, $R_{G(off)}$=18Ω, dynamic test circuit in Figure E)
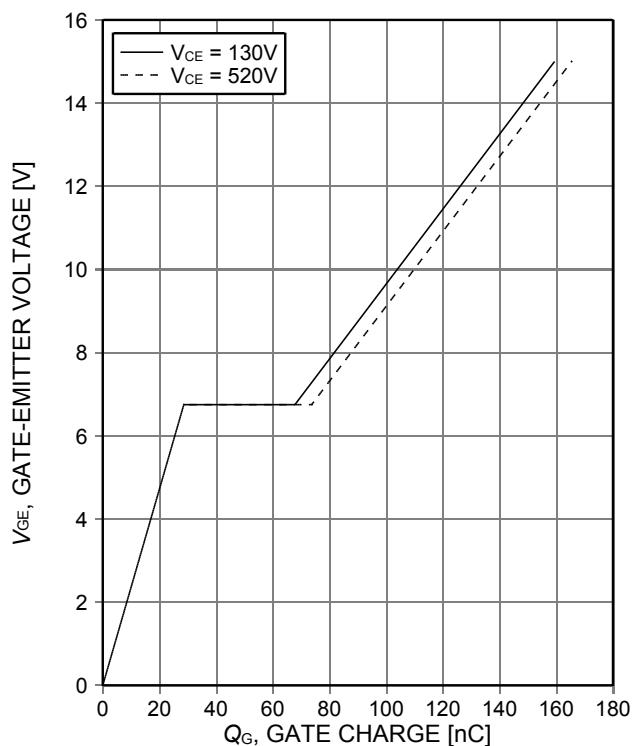
Figure 16. **Typical gate charge** (I_C=75A)

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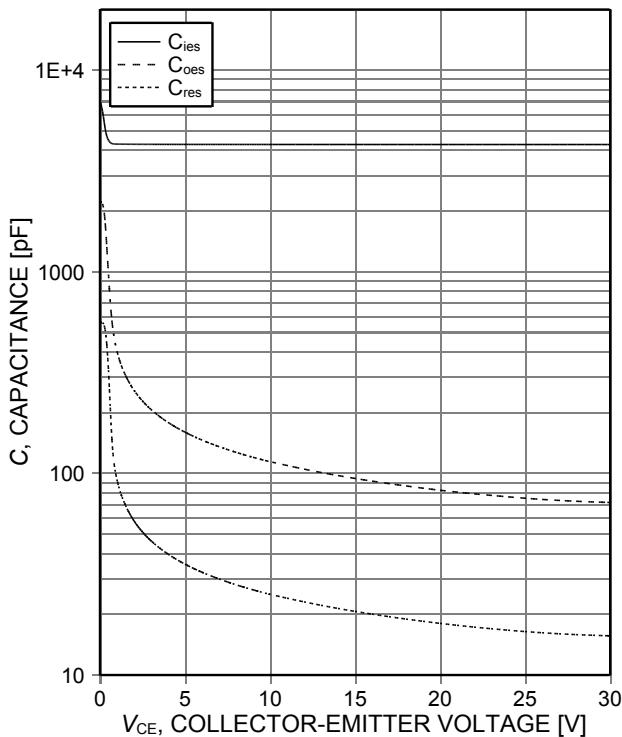
Figure 17. **Typical capacitance as a function of collector-emitter voltage**
(V_{GE}=0V, f=1MHz)
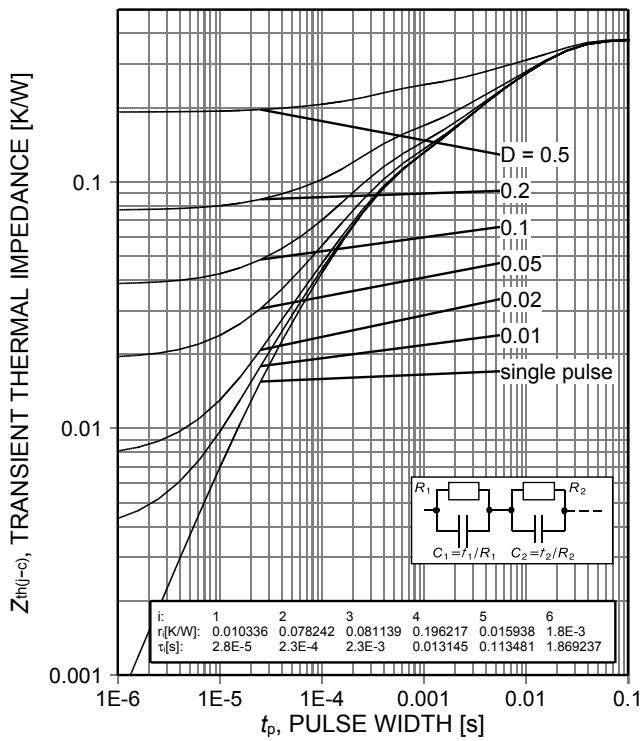
Figure 18. **IGBT transient thermal impedance**
($D=t_p$/T)

PG-TO247-4
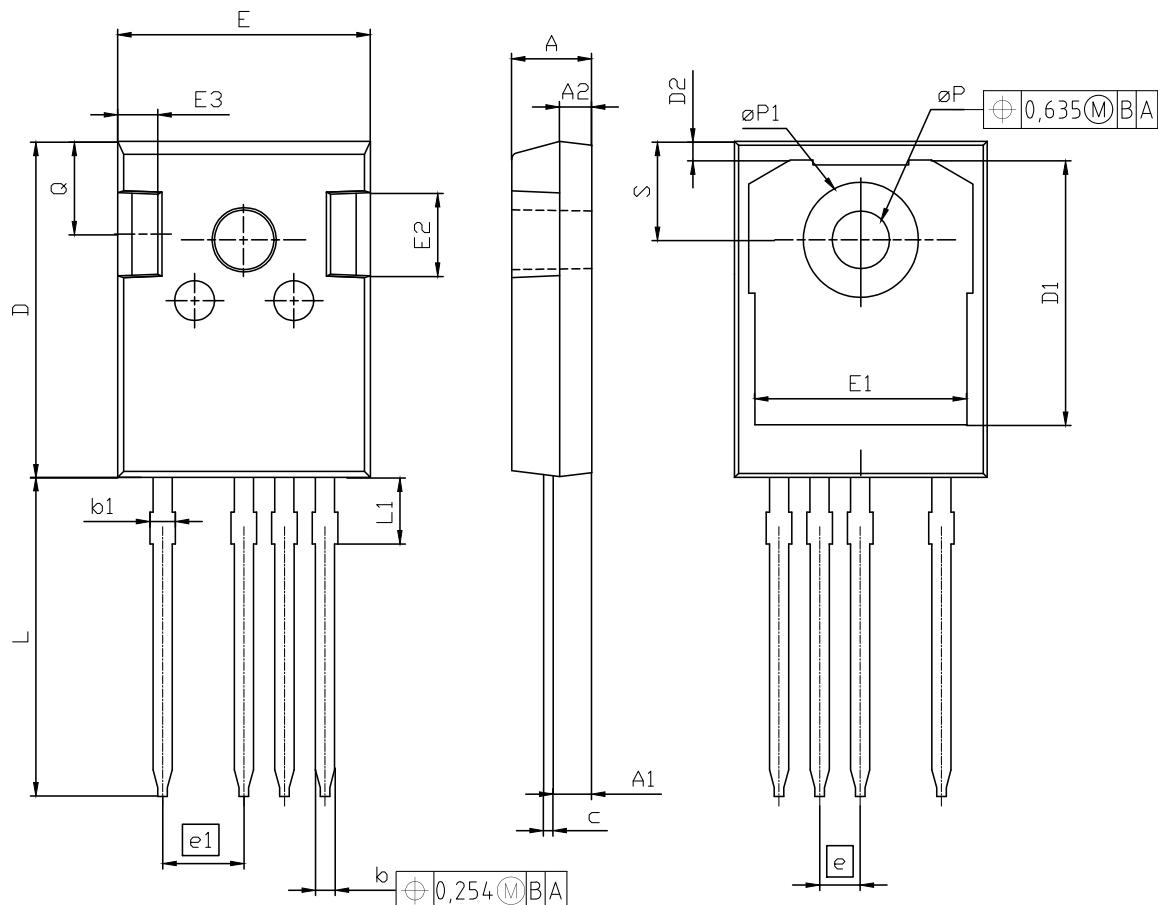
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.29	2.54	0.090	0.100
A2	1.90	2.16	0.075	0.085
b	1.07	1.33	0.042	0.052
b1	1.10	1.70	0.043	0.067
c	0.50	0.70	0.020	0.028
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	0.640	0.695
D2	0.95	1.35	0.037	0.053
E	15.70	16.13	0.618	0.635
E1	13.10	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	2.54 (BSC)		0.100 (BSC)	
e1	5.08		0.200	
N	4		4	
L	19.72	20.32	0.776	0.800
L1	4.02	4.40	0.158	0.173
øP	3.50	3.70	0.138	0.146
øP1	7.00	7.40	0.276	0.291
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

DOCUMENT NO.
Z8B00168124

SCALE

7.5mm

EUROPEAN PROJECTION

ISSUE DATE
29-01-2013

REVISION
1
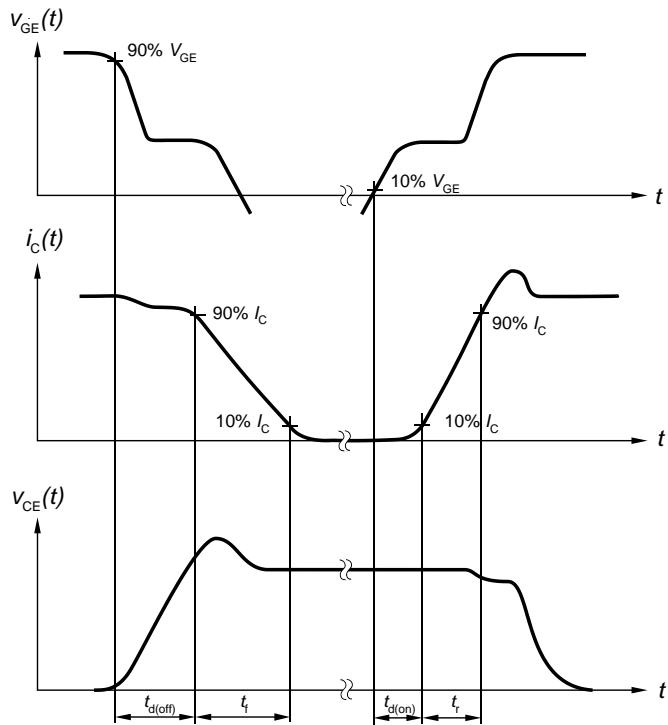
**Figure A. Definition of switching times**

$$E_{off} = \int_{t_1}^{t_2} V_{CE} \times I_C \times dt$$

$$E_{on} = \int_{t_3}^{t_4} V_{CE} \times I_C \times dt$$
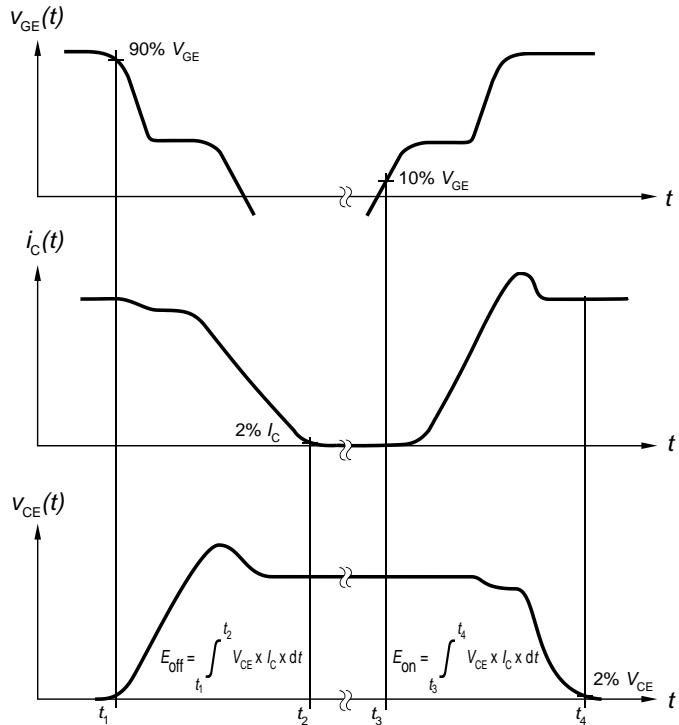
Figure B. Definition of switching losses

$$t_{rr} = t_a + t_b$$
$$Q_{rr} = Q_S + Q_F$$
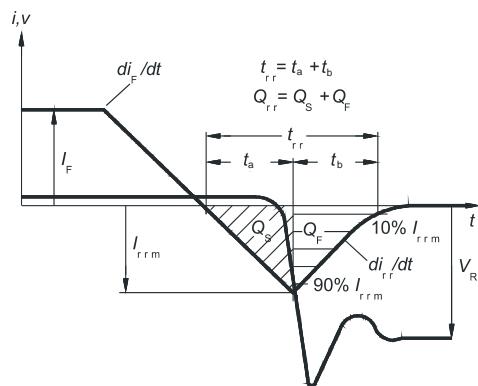
**Figure C. Definition of diodes switching characteristics**
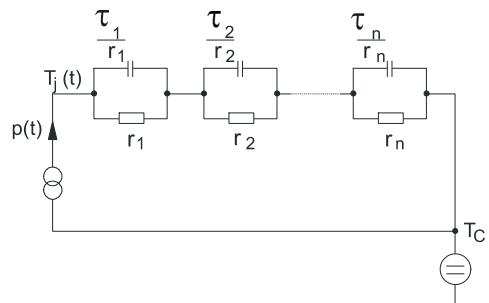

Figure D. Thermal equivalent circuit
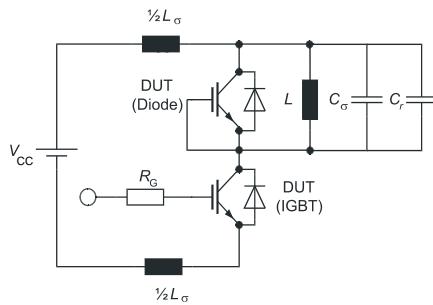
Figure E. Dynamic test circuit
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r
(only for ZVT switching)