

## IGBT

High speed IGBT in Trench and Fieldstop technology

### IGW30N60H3

600V high speed switching series third generation

## Datasheet

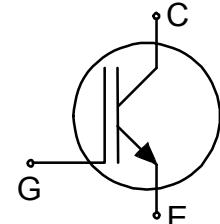
Industrial & Multimarket

## High speed IGBT in Trench and Fieldstop technology

### Features:

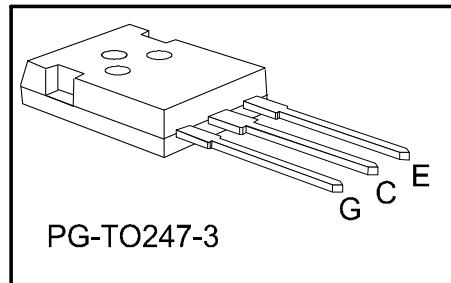
TRENCHSTOP™ technology offering

- very low  $V_{CEsat}$
- low EMI
- Very soft, fast recovery anti-parallel diode
- 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
- converters with high switching frequency



### Key Performance and Package Parameters

Type	$V_{CE}$	$I_C$	$V_{CEsat}, T_{vj}=25^\circ C$	$T_{vjmax}$	Marking	Package
IGW30N60H3	600V	30A	1.95V	175°C	G30H603	PG-T0247-3

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**Maximum ratings**

Parameter	Symbol	Value	Unit
Collector-emitter voltage	$V_{CE}$	600	V
DC collector current, limited by $T_{vj\max}$ $T_C = 25^\circ C$ $T_C = 100^\circ C$	$I_C$	60.0 30.0	A
Pulsed collector current, $t_p$ limited by $T_{vj\max}$	$I_{Cpuls}$	120.0	A
Turn off safe operating area $V_{CE} \leq 600V$ , $T_{vj} \leq 175^\circ C$	-	120.0	A
Gate-emitter voltage	$V_{GE}$	$\pm 20$	V
Short circuit withstand time $V_{GE} = 15.0V$ , $V_{CC} \leq 400V$ Allowed number of short circuits < 1000 Time between short circuits: $\geq 1.0s$ $T_{vj} = 150^\circ C$	$t_{SC}$	5	$\mu s$
Power dissipation $T_C = 25^\circ C$ Power dissipation $T_C = 100^\circ C$	$P_{tot}$	187.0 94.0	W
Operating junction temperature	$T_{vj}$	-40...+175	$^\circ C$
Storage temperature	$T_{stg}$	-55...+150	$^\circ C$
Soldering temperature, wave soldering 1.6 mm (0.063 in.) from case for 10s		260	$^\circ C$
Mounting torque, M3 screw Maximum of mounting processes: 3	$M$	0.6	Nm

**Thermal Resistance**

Parameter	Symbol	Conditions	Max. Value	Unit
<b>Characteristic</b>				
IGBT thermal resistance, junction - case	$R_{th(j-c)}$		0.80	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		40	K/W

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

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>Static Characteristic</b>						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0V$ , $I_C = 2.00mA$	600	-	-	V
Collector-emitter saturation voltage	$V_{CESat}$	$V_{GE} = 15.0V$ , $I_C = 30.0A$ $T_{vj} = 25^\circ C$ $T_{vj} = 125^\circ C$ $T_{vj} = 175^\circ C$	-	1.95 2.30 2.50	2.40 - -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 0.43mA$ , $V_{CE} = V_{GE}$	4.1	5.1	5.7	V
Zero gate voltage collector current	$I_{CES}$	$V_{CE} = 600V$ , $V_{GE} = 0V$ $T_{vj} = 25^\circ C$ $T_{vj} = 175^\circ C$	-	-	40.0 1000.0	$\mu A$
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0V$ , $V_{GE} = 20V$	-	-	100	nA
Transconductance	$g_{fs}$	$V_{CE} = 20V$ , $I_C = 30.0A$	-	16.0	-	S

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

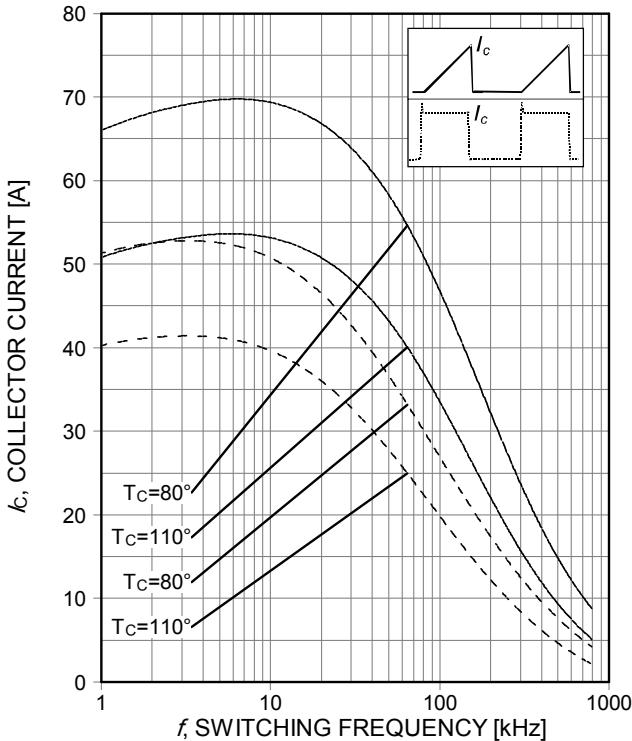
Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>Dynamic Characteristic</b>						
Input capacitance	$C_{ies}$	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$	-	1630	-	pF
Output capacitance	$C_{oes}$		-	107	-	
Reverse transfer capacitance	$C_{res}$		-	50	-	
Gate charge	$Q_G$	$V_{CC} = 480\text{V}, I_C = 30.0\text{A}, V_{GE} = 15\text{V}$	-	165.0	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	$L_E$		-	13.0	-	nH
Short circuit collector current Max. 1000 short circuits Time between short circuits: $\geq 1.0\text{s}$	$I_{C(SC)}$	$V_{GE} = 15.0\text{V}, V_{CC} \leq 400\text{V}, t_{SC} \leq 5\mu\text{s}, T_{vj} = 150^\circ\text{C}$	-	160	-	A

**Switching Characteristic, Inductive Load, at  $T_{vj} = 25^\circ\text{C}$** 

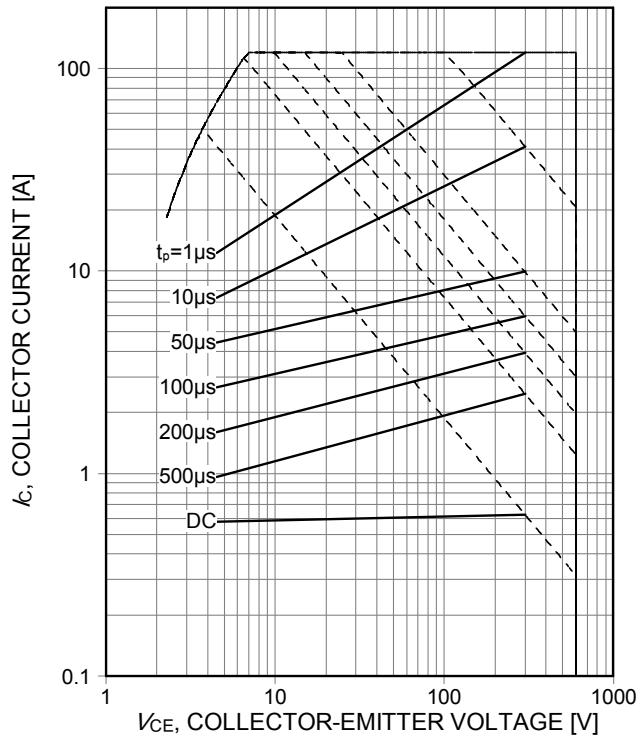
Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>IGBT Characteristic</b>						
Turn-on delay time	$t_{d(on)}$	$T_{vj} = 25^\circ\text{C}, V_{CC} = 400\text{V}, I_C = 30.0\text{A}, V_{GE} = 0.0/15.0\text{V}, r_G = 10.5\Omega, L_\sigma = 95\text{nH}, C_\sigma = 67\text{pF}$ $L_\sigma, C_\sigma$ from Fig. E Energy losses include "tail" and diode (IKW30N60H3) reverse recovery.	-	21	-	ns
Rise time	$t_r$		-	33	-	ns
Turn-off delay time	$t_{d(off)}$		-	207	-	ns
Fall time	$t_f$		-	22	-	ns
Turn-on energy	$E_{on}$		-	0.94	-	mJ
Turn-off energy	$E_{off}$		-	0.44	-	mJ
Total switching energy	$E_{ts}$		-	1.38	-	mJ

**Switching Characteristic, Inductive Load, at  $T_{vj} = 175^\circ\text{C}$** 

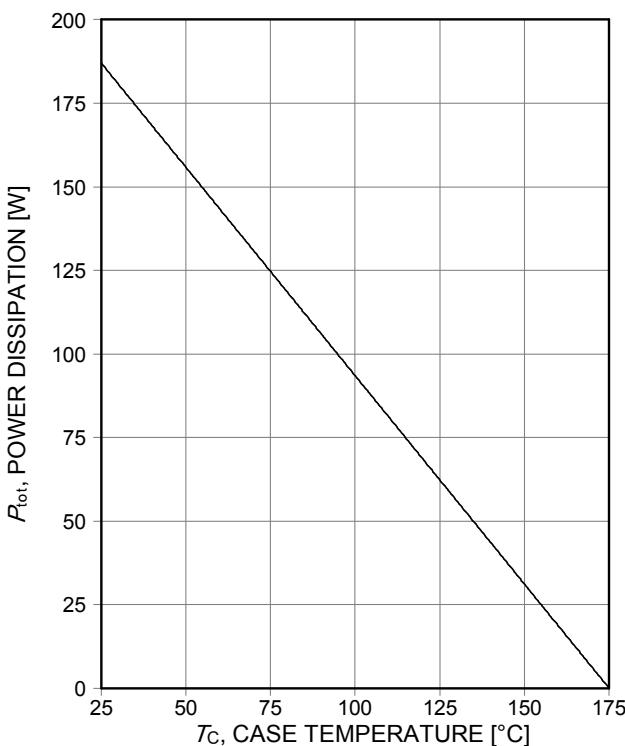
Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>IGBT Characteristic</b>						
Turn-on delay time	$t_{d(on)}$	$T_{vj} = 175^\circ\text{C}, V_{CC} = 400\text{V}, I_C = 30.0\text{A}, V_{GE} = 0.0/15.0\text{V}, r_G = 10.5\Omega, L_\sigma = 95\text{nH}, C_\sigma = 67\text{pF}$ $L_\sigma, C_\sigma$ from Fig. E Energy losses include "tail" and diode (IKW30N60H3) reverse recovery.	-	20	-	ns
Rise time	$t_r$		-	30	-	ns
Turn-off delay time	$t_{d(off)}$		-	239	-	ns
Fall time	$t_f$		-	23	-	ns
Turn-on energy	$E_{on}$		-	1.12	-	mJ
Turn-off energy	$E_{off}$		-	0.60	-	mJ
Total switching energy	$E_{ts}$		-	1.72	-	mJ



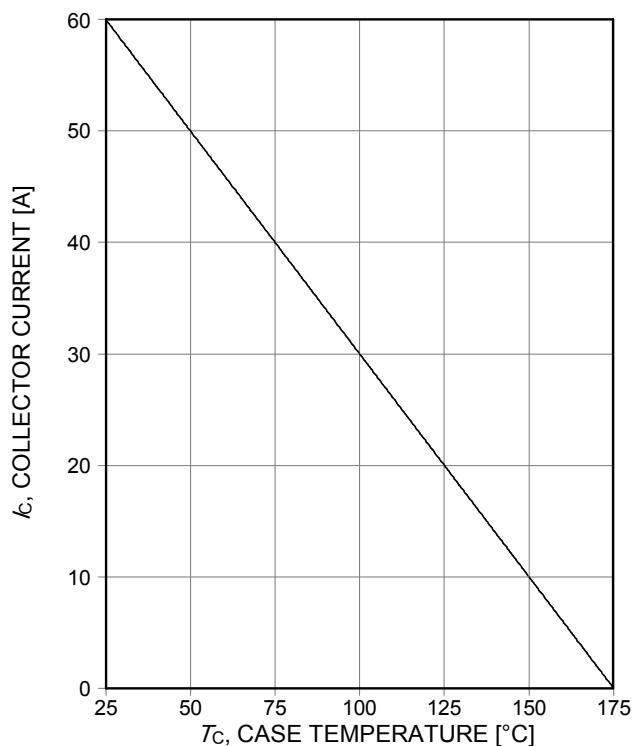
**Figure 1. Collector current as a function of switching frequency**  
 $(T_j \leq 175^\circ\text{C}, D=0.5, V_{CE}=400\text{V}, V_{GE}=15/0\text{V}, R_G=10.5\Omega)$



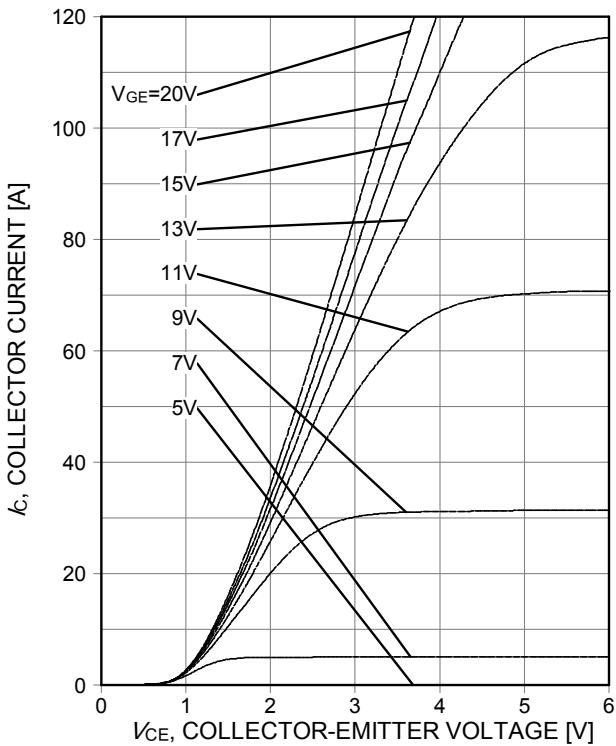
**Figure 2. Forward bias safe operating area**  
 $(D=0, T_C=25^\circ\text{C}, T_j \leq 175^\circ\text{C}; V_{GE}=15\text{V})$



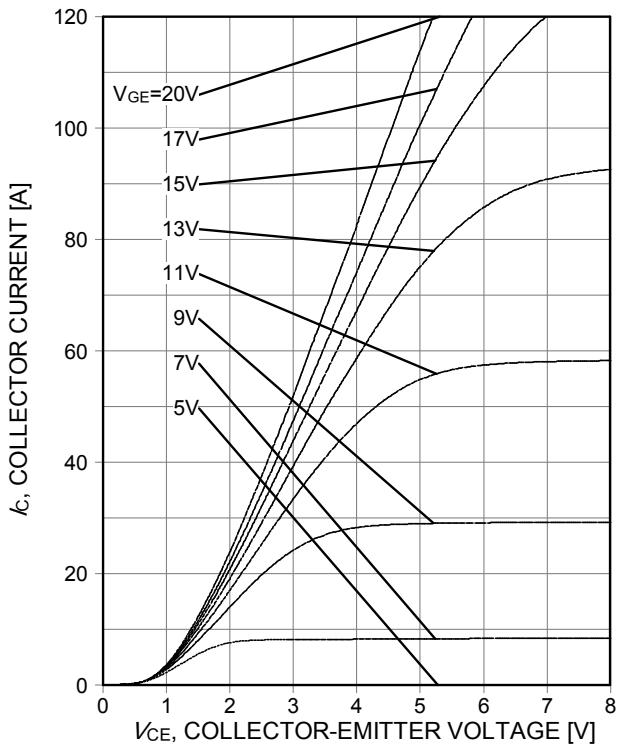
**Figure 3. Power dissipation as a function of case temperature**  
 $(T_j \leq 175^\circ\text{C})$



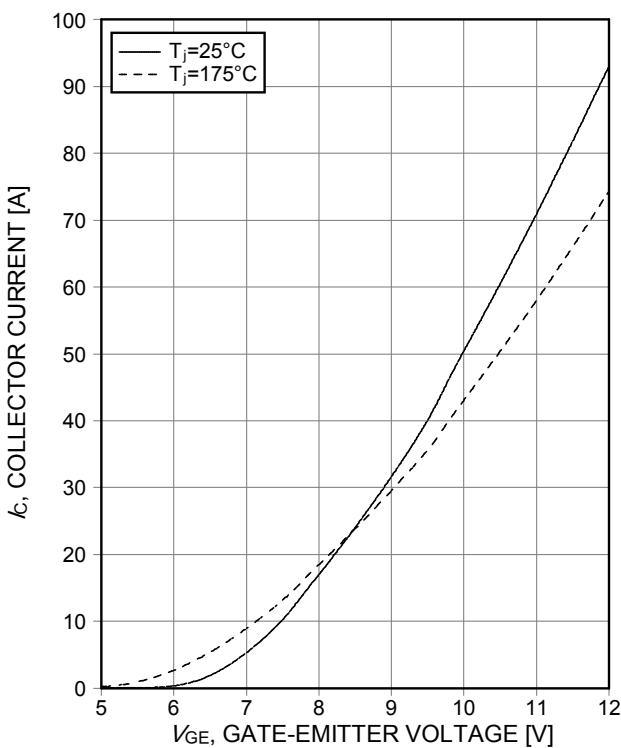
**Figure 4. Collector current as a function of case temperature**  
 $(V_{GE} \geq 15\text{V}, T_j \leq 175^\circ\text{C})$



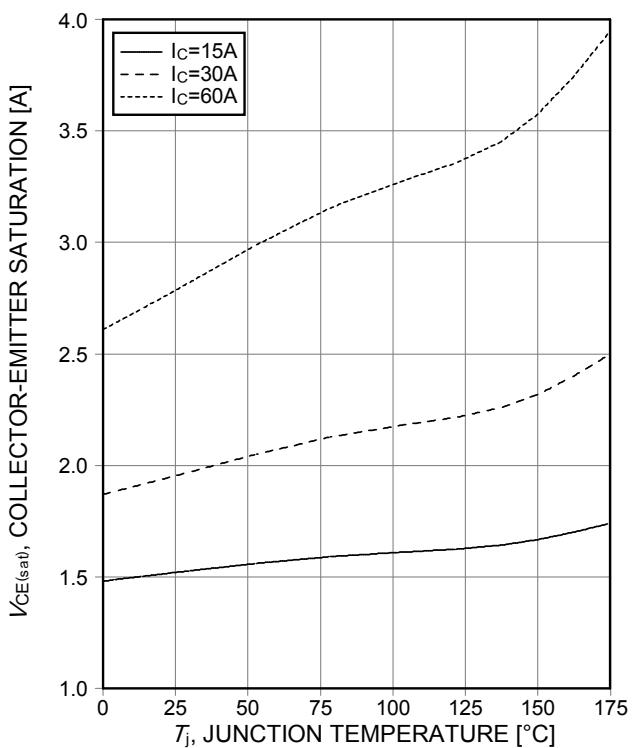
**Figure 5. Typical output characteristic**  
( $T_j=25^\circ\text{C}$ )



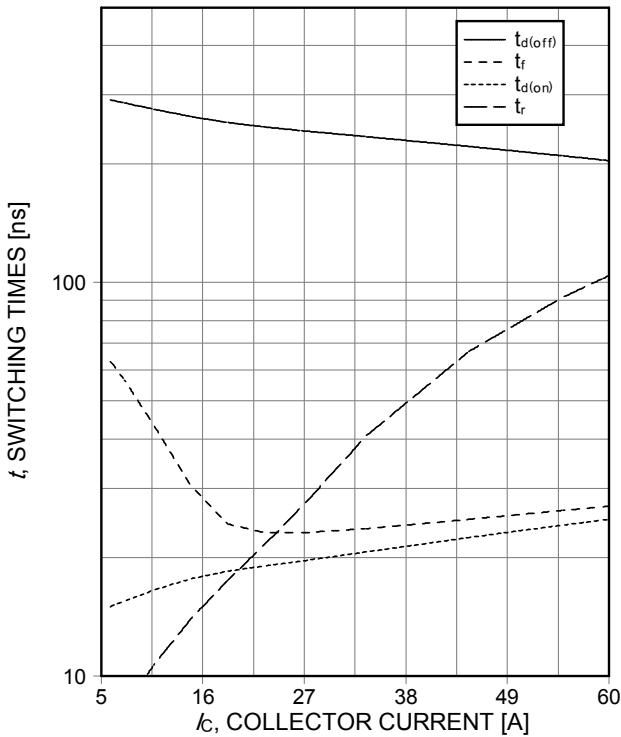
**Figure 6. Typical output characteristic**  
( $T_j=175^\circ\text{C}$ )



**Figure 7. Typical transfer characteristic**  
( $V_{CE}=20\text{V}$ )

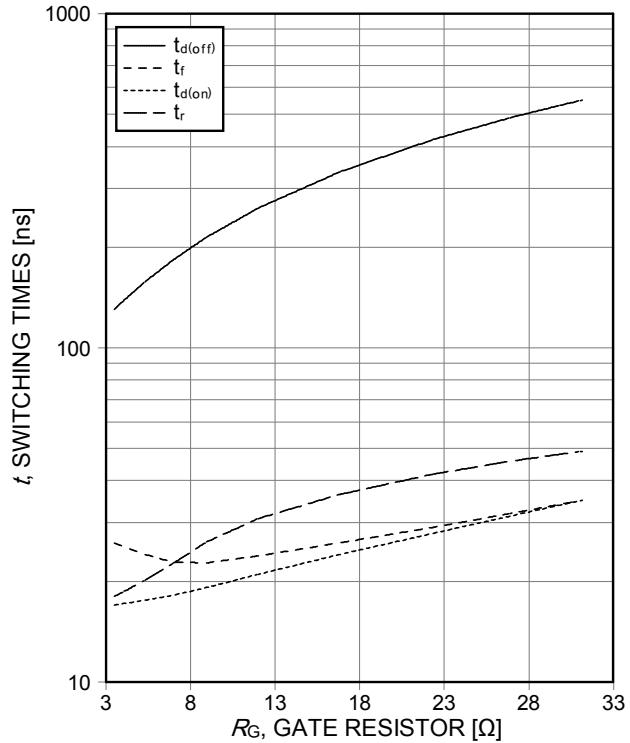


**Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature**  
( $V_{GE}=15\text{V}$ )



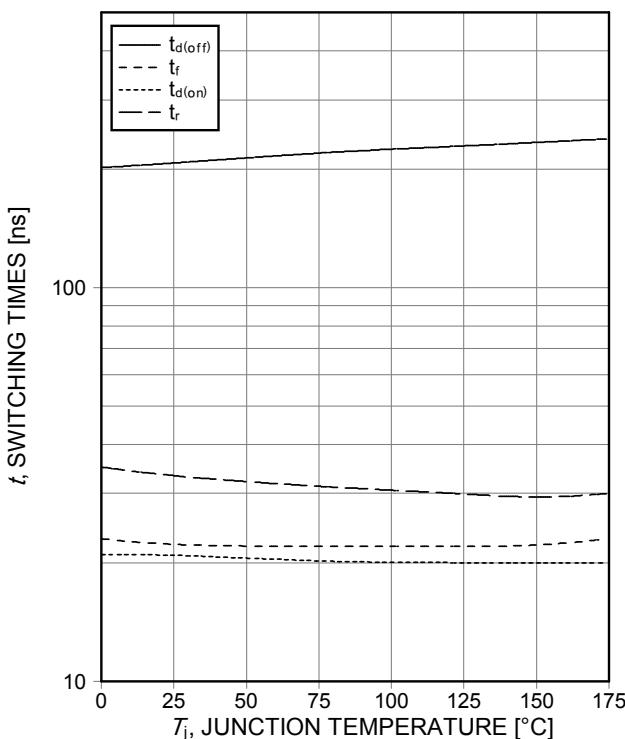
**Figure 9. Typical switching times as a function of collector current**

(ind. load,  $T_j=175^\circ\text{C}$ ,  $V_{CE}=400\text{V}$ ,  $V_{GE}=15/0\text{V}$ ,  $R_G=10,5\Omega$ , test circuit in Fig. E)



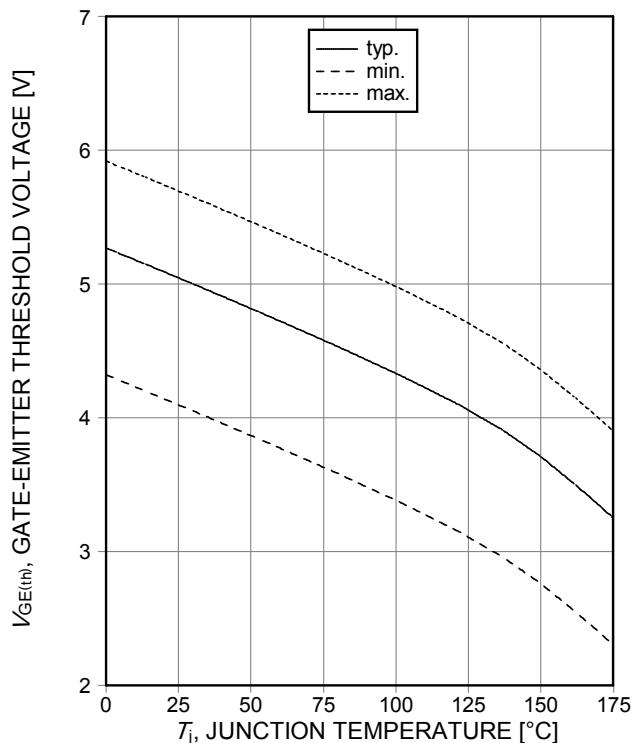
**Figure 10. Typical switching times as a function of gate resistor**

(ind. load,  $T_j=175^\circ\text{C}$ ,  $V_{CE}=400\text{V}$ ,  $V_{GE}=15/0\text{V}$ ,  $I_c=30\text{A}$ , test circuit in Fig. E)



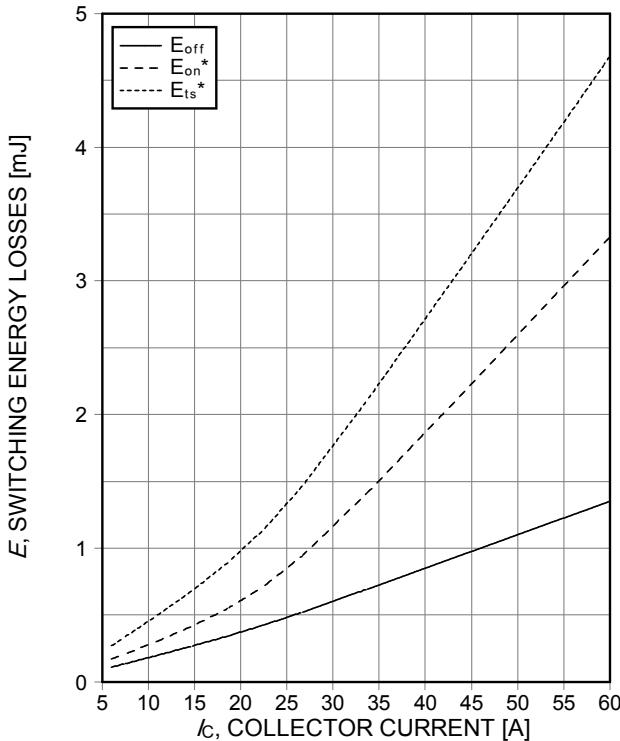
**Figure 11. Typical switching times as a function of junction temperature**

(ind. load,  $V_{CE}=400\text{V}$ ,  $V_{GE}=15/0\text{V}$ ,  $I_c=30\text{A}$ ,  $R_G=10,5\Omega$ , test circuit in Fig. E)

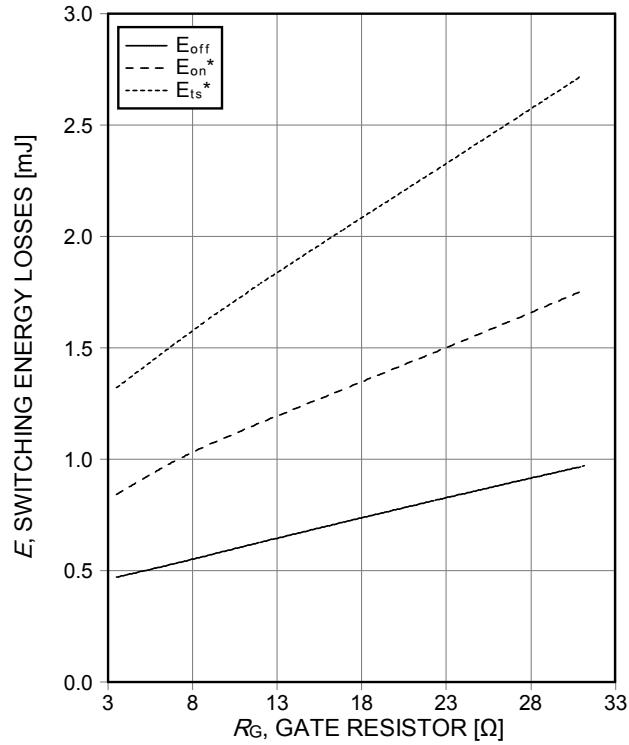


**Figure 12. Gate-emitter threshold voltage as a function of junction temperature**

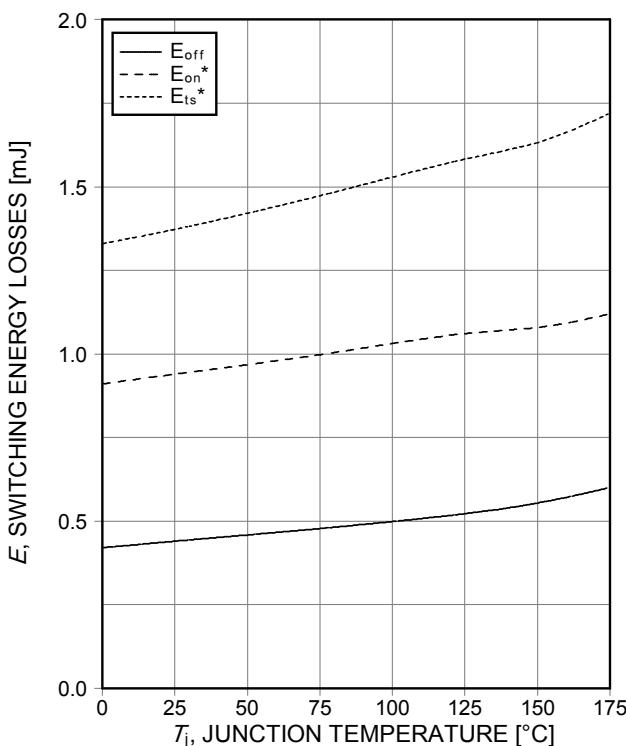
( $I_c=0.43\text{mA}$ )



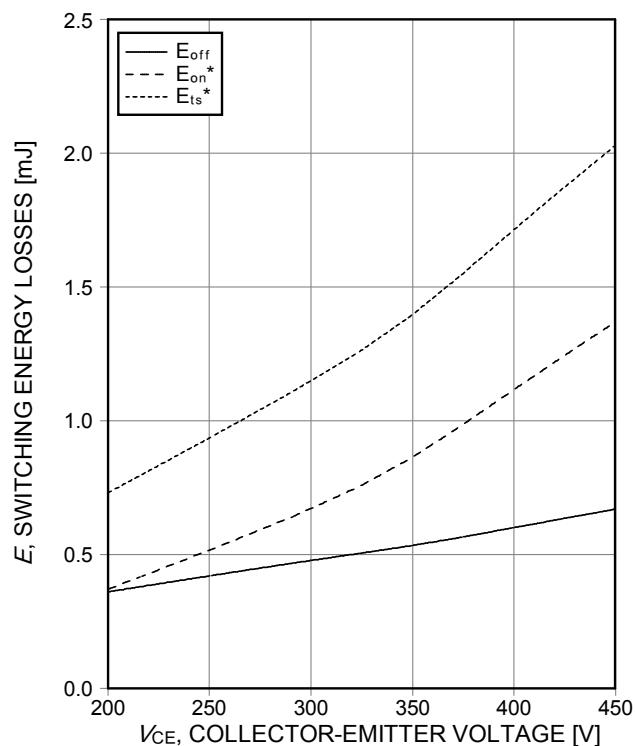
**Figure 13.** Typical switching energy losses as a function of collector current  
(ind. load,  $T_j=175^\circ\text{C}$ ,  $V_{CE}=400\text{V}$ ,  $V_{GE}=15/0\text{V}$ ,  $R_G=10,5\Omega$ , test circuit in Fig. E)



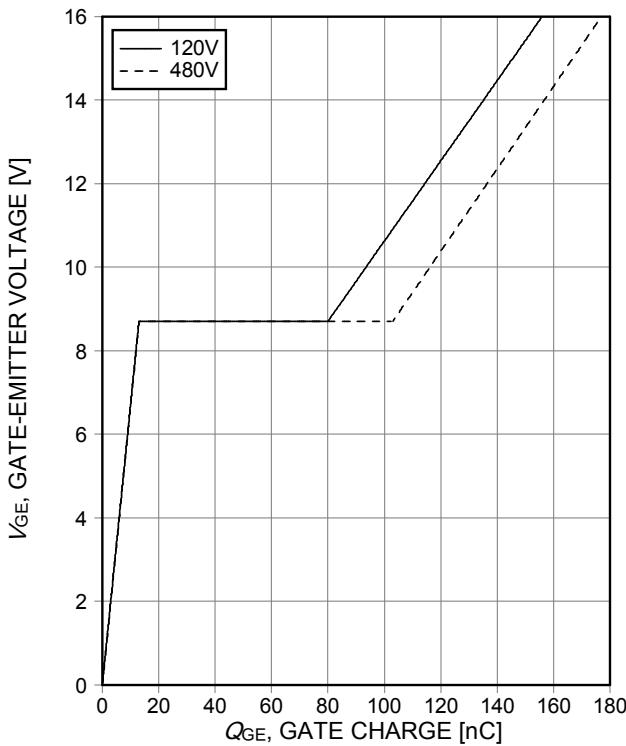
**Figure 14.** Typical switching energy losses as a function of gate resistor  
(ind. load,  $T_j=175^\circ\text{C}$ ,  $V_{CE}=400\text{V}$ ,  $V_{GE}=15/0\text{V}$ ,  $I_C=30\text{A}$ , test circuit in Fig. E)



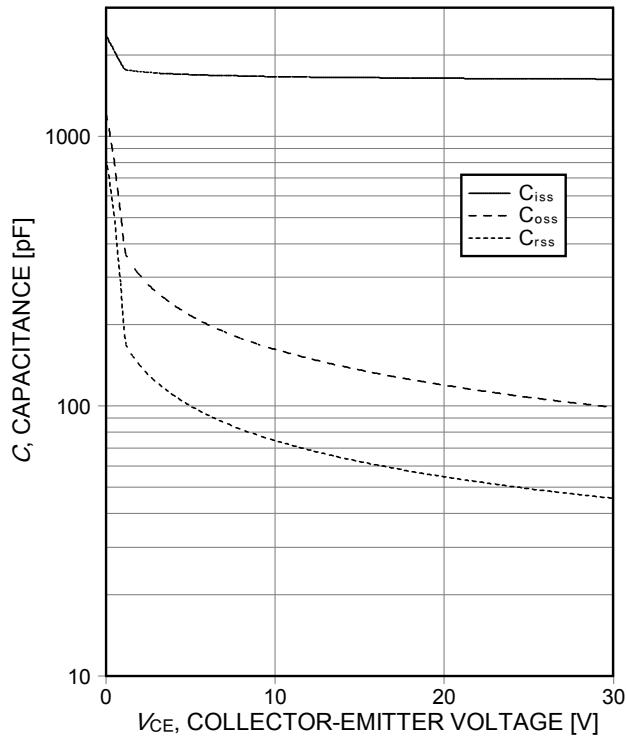
**Figure 15.** Typical switching energy losses as a function of junction temperature  
(ind. load,  $V_{CE}=400\text{V}$ ,  $V_{GE}=15/0\text{V}$ ,  $I_C=30\text{A}$ ,  $R_G=10,5\Omega$ , test circuit in Fig. E)



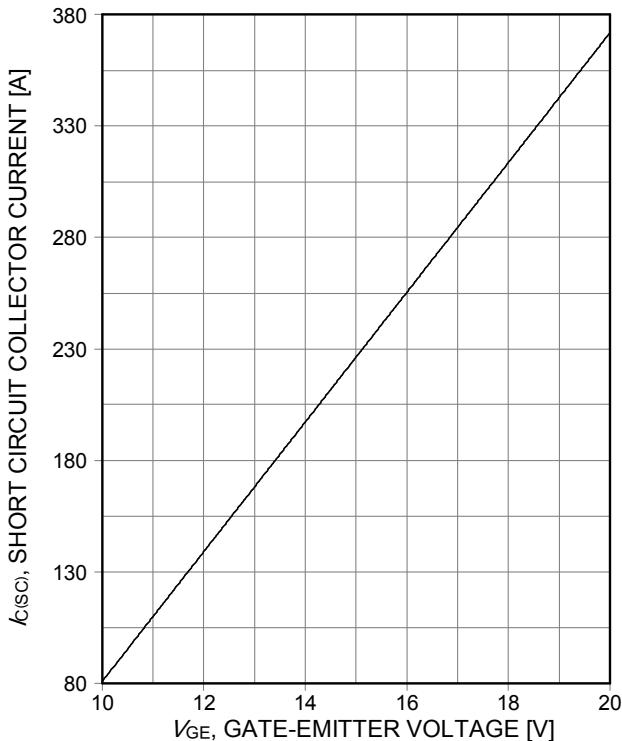
**Figure 16.** Typical switching energy losses as a function of collector-emitter voltage  
(ind. load,  $T_j=175^\circ\text{C}$ ,  $V_{GE}=15/0\text{V}$ ,  $I_C=30\text{A}$ ,  $R_G=10,5\Omega$ , test circuit in Fig. E)



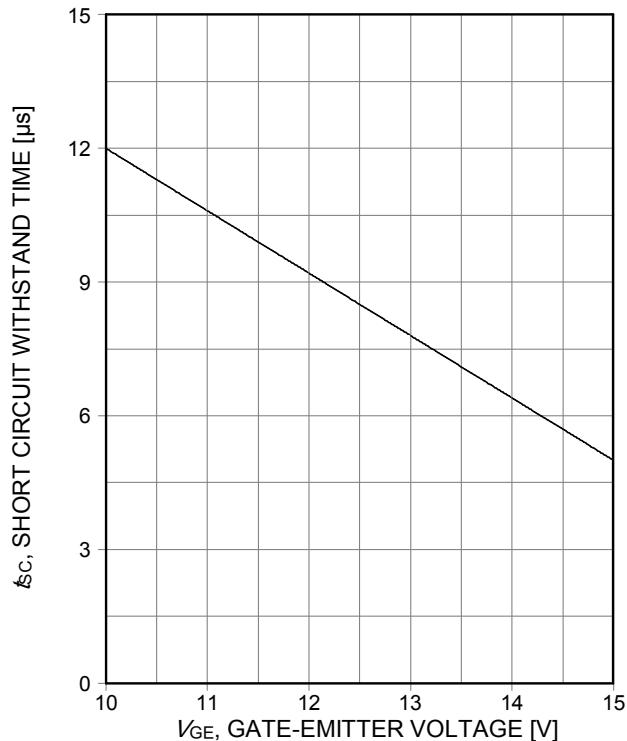
**Figure 17.** Typical gate charge  
( $I_c=30A$ )



**Figure 18.** Typical capacitance as a function of collector-emitter voltage  
( $V_{GE}=0V$ ,  $f=1MHz$ )



**Figure 19.** Typical short circuit collector current as a function of gate-emitter voltage  
( $V_{CE}\leq 400V$ , start at  $T_j=25^\circ C$ )



**Figure 20.** Short circuit withstand time as a function of gate-emitter voltage  
( $V_{CE}\leq 400V$ , start at  $T_j\leq 150^\circ C$ )

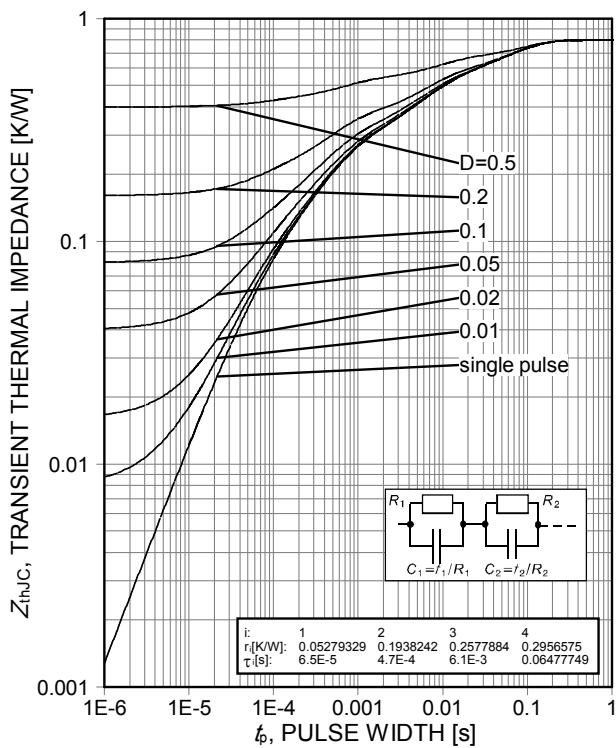
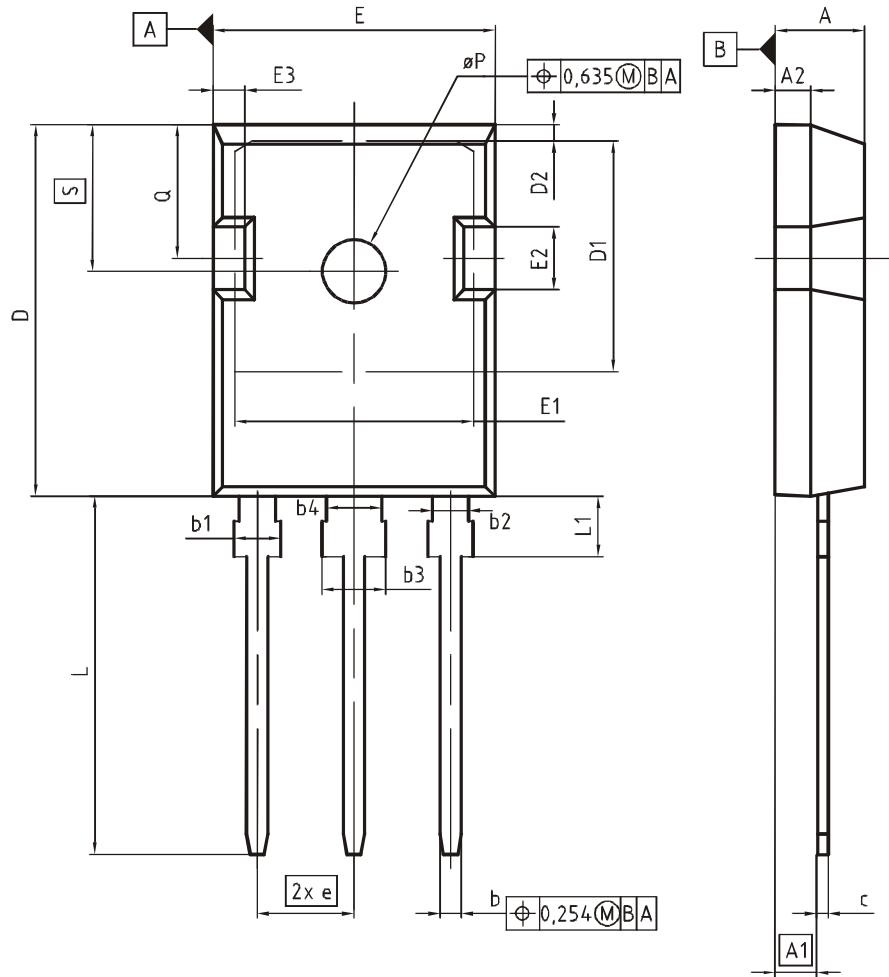


Figure 21. IGBT transient thermal impedance  
( $D=t_p/T$ )

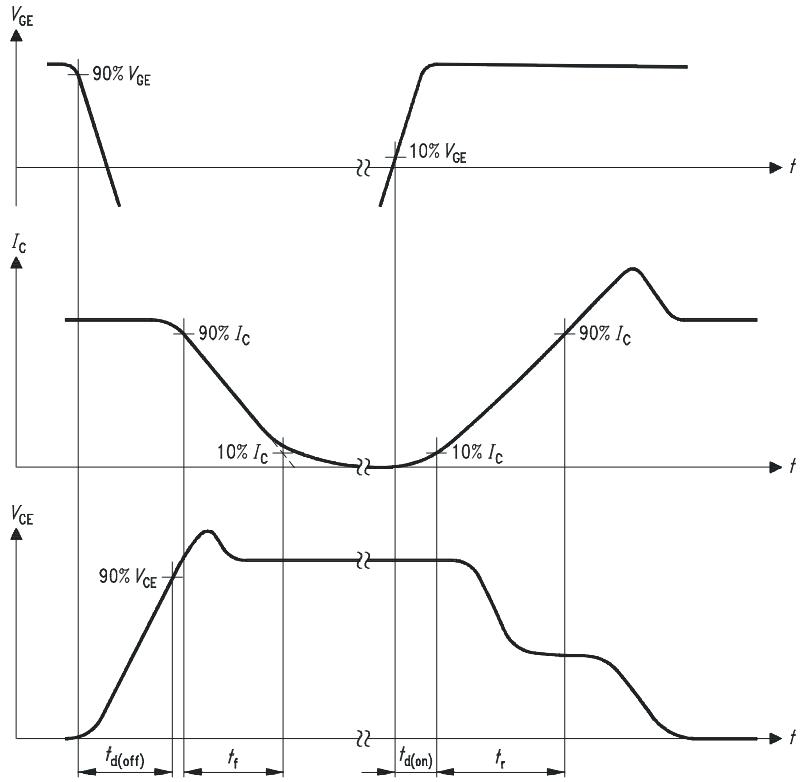
## PG-T0247-3



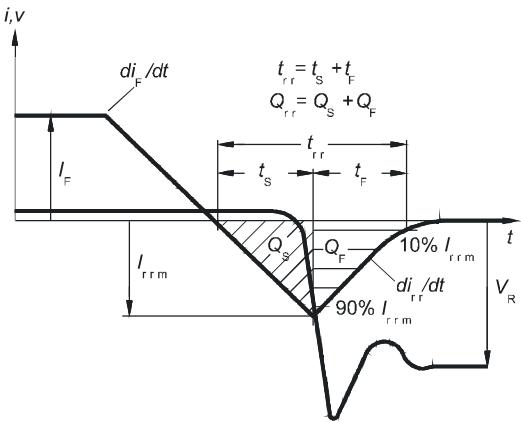
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.27	2.54	0.089	0.100
A2	1.85	2.16	0.073	0.085
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	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
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EUROPEAN PROJECTION	
ISSUE DATE	09-07-2010
REVISION	05

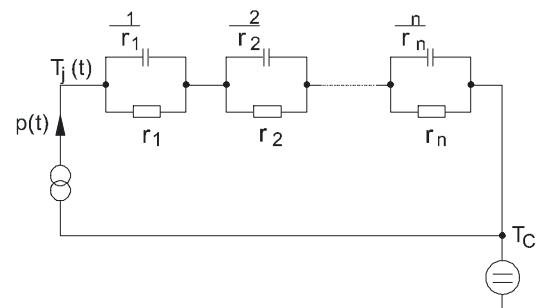
## High speed switching series third generation



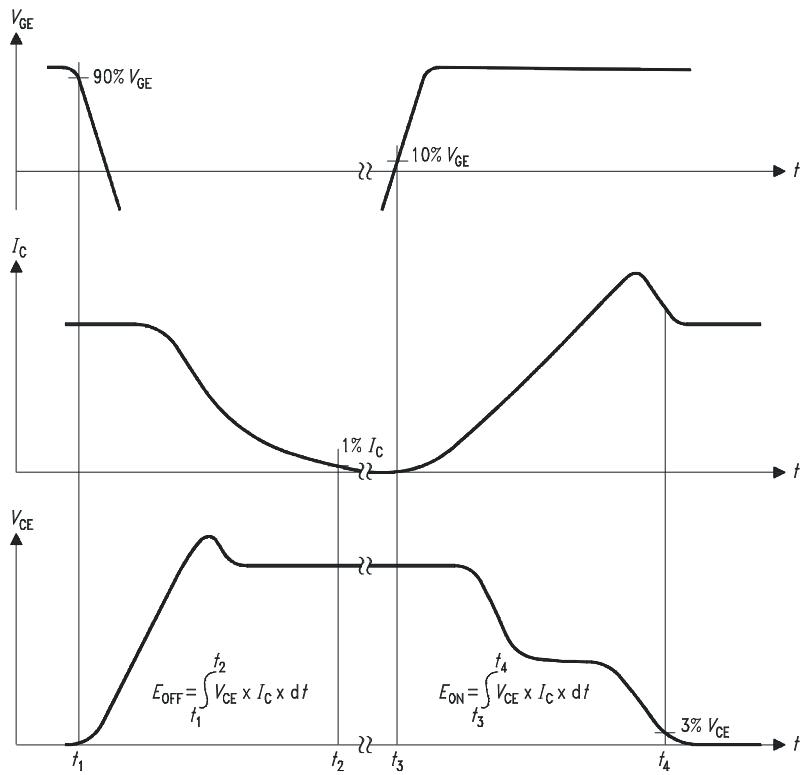
**Figure A. Definition of switching times**



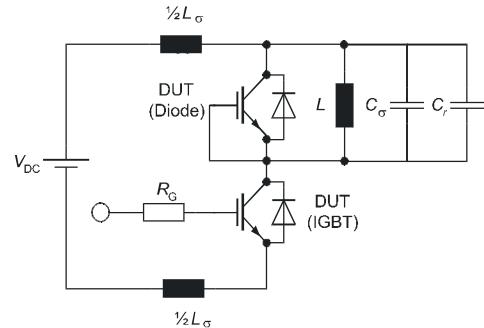
**Figure C. Definition of diodes switching characteristics**



**Figure D. Thermal equivalent circuit**



**Figure B. Definition of switching losses**



**Figure E. Dynamic test circuit**

Parasitic inductance  $L_\sigma$ ,  
Parasitic capacitor  $C_\sigma$ ,  
Relief capacitor  $C_r$   
(only for ZVT switching)

**Revision History**

IGW30N60H3

**Revision: 2010-07-26, Rev. 1.1****Previous Revision**

Revision	Date	Subjects (major changes since last revision)
1.1	-	Preliminary datasheet

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Please send your proposal (including a reference to this document) to: erratum@infineon.com

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**Стандарт  
Электрон  
Связь**

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Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

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Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

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