

IGBT

High speed IGBT in Trench and Fieldstop technology

IGW15N120H3

1200V high speed switching series third generation

Data sheet

High speed IGBT in Trench and Fieldstop technology

Features:

TRENCHSTOP™ technology offering

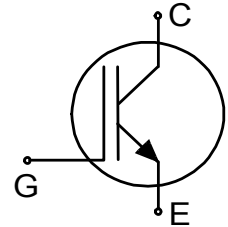
- very low turn-off energy
- low V_{CEsat}
- low EMI
- maximum junction temperature 175°C
- qualified according to JEDEC for target applications
- Pb-free lead plating, halogen-free mould compound, RoHS compliant
- complete product spectrum and PSpice Models:
<http://www.infineon.com/igbt/>

Applications:

- uninterruptible power supplies
- welding converters
- converters with high switching frequency

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} , $T_{vj}=25^{\circ}\text{C}$	T_{vjmax}	Marking	Package
IGW15N120H3	1200V	15A	2.05V	175°C	G15H1203	PG-TO247-3

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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	V_{CE}	1200	V
DC collector current, limited by T_{vjmax} $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	I_C	30.0 15.0	A
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	60.0	A
Turn off safe operating area $V_{CE} \leq 1200\text{V}$, $T_{vj} \leq 175^\circ\text{C}$	-	60.0	A
Gate-emitter voltage	V_{GE}	± 20	V
Short circuit withstand time $V_{GE} = 15.0\text{V}$, $V_{CC} \leq 600\text{V}$ Allowed number of short circuits < 1000 Time between short circuits: $\geq 1.0\text{s}$ $T_{vj} = 175^\circ\text{C}$	t_{SC}	10	μs
Power dissipation $T_C = 25^\circ\text{C}$ Power dissipation $T_C = 100^\circ\text{C}$	P_{tot}	217.0 105.0	W
Operating junction temperature	T_{vj}	$-40 \dots +175$	$^\circ\text{C}$
Storage temperature	T_{stg}	$-55 \dots +150$	$^\circ\text{C}$
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s		260	$^\circ\text{C}$
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	$R_{th(j-c)}$		0.70	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		40	K/W

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

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0V, I_C = 0.50mA$	1200	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	$V_{GE} = 15.0V, I_C = 15.0A$ $T_{vj} = 25^{\circ}C$ $T_{vj} = 125^{\circ}C$ $T_{vj} = 175^{\circ}C$	- - -	2.05 2.50 2.70	2.40 - -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 0.50mA, V_{CE} = V_{GE}$	5.0	5.8	6.5	V
Zero gate voltage collector current	I_{CES}	$V_{CE} = 1200V, V_{GE} = 0V$ $T_{vj} = 25^{\circ}C$ $T_{vj} = 175^{\circ}C$	- -	- -	250.0 2500.0	μA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0V, V_{GE} = 20V$	-	-	600	nA
Transconductance	g_{fs}	$V_{CE} = 20V, I_C = 15.0A$	-	7.5	-	S

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

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Dynamic Characteristic						
Input capacitance	C_{ies}	$V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$	-	875	-	pF
Output capacitance	C_{oes}		-	60	-	
Reverse transfer capacitance	C_{res}		-	45	-	
Gate charge	Q_G	$V_{CC} = 960V, I_C = 15.0A, V_{GE} = 15V$	-	75.0	-	nC
Short circuit collector current Max. 1000 short circuits Time between short circuits: $\geq 1.0s$	$I_{C(SC)}$	$V_{GE} = 15.0V, V_{CC} \leq 600V, t_{SC} \leq 10\mu s, T_{vj} = 175^{\circ}C$	-	52	-	A

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	

IGBT Characteristic, at $T_{vj} = 25^{\circ}\text{C}$

Turn-on delay time	$t_{d(on)}$	$T_{vj} = 25^{\circ}\text{C}, V_{CC} = 600\text{V}, I_C = 15.0\text{A}, V_{GE} = 0.0/15.0\text{V}, R_{G(on)} = 35.0\Omega, R_{G(off)} = 35.0\Omega, L\sigma = 95\text{nH}, C\sigma = 67\text{pF}, L\sigma, C\sigma \text{ from Fig. E}$ Energy losses include "tail" and diode (IKW15N120H3) reverse recovery.	-	21	-	ns
Rise time	t_r		-	34	-	ns
Turn-off delay time	$t_{d(off)}$		-	260	-	ns
Fall time	t_f		-	14	-	ns
Turn-on energy	E_{on}		-	1.10	-	mJ
Turn-off energy	E_{off}		-	0.45	-	mJ
Total switching energy	E_{ts}		-	1.55	-	mJ

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	

IGBT Characteristic, at $T_{vj} = 175^{\circ}\text{C}$

Turn-on delay time	$t_{d(on)}$	$T_{vj} = 175^{\circ}\text{C}, V_{CC} = 600\text{V}, I_C = 15.0\text{A}, V_{GE} = 0.0/15.0\text{V}, R_{G(on)} = 35.0\Omega, R_{G(off)} = 35.0\Omega, L\sigma = 95\text{nH}, C\sigma = 67\text{pF}, L\sigma, C\sigma \text{ from Fig. E}$ Energy losses include "tail" and diode (IKW15N120H3) reverse recovery.	-	19	-	ns
Rise time	t_r		-	30	-	ns
Turn-off delay time	$t_{d(off)}$		-	327	-	ns
Fall time	t_f		-	43	-	ns
Turn-on energy	E_{on}		-	1.60	-	mJ
Turn-off energy	E_{off}		-	0.90	-	mJ
Total switching energy	E_{ts}		-	2.50	-	mJ

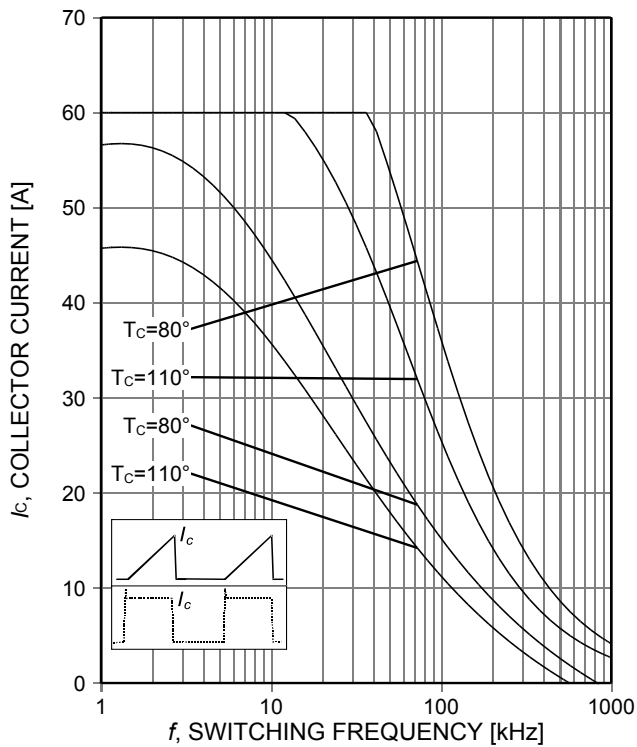


Figure 1. **Collector current as a function of switching frequency**
($T_j \leq 175^\circ\text{C}$, $D=0.5$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $r_{GS}=35\Omega$)

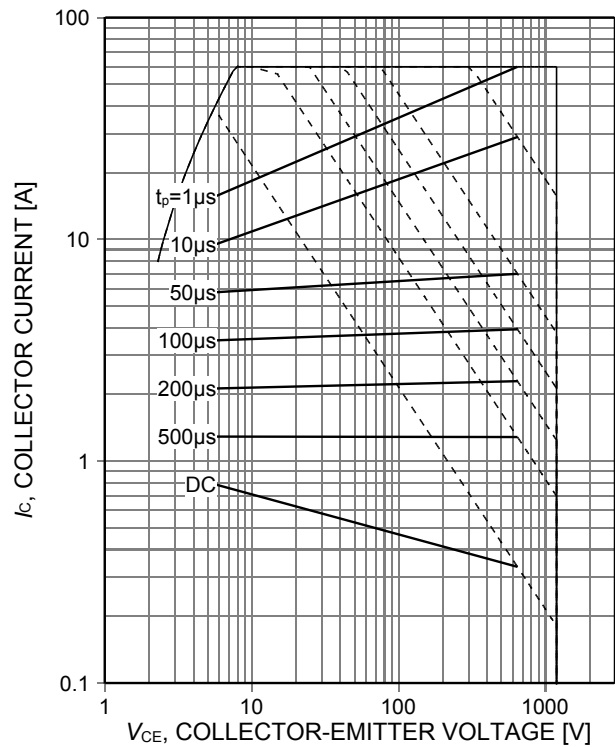


Figure 2. **Forward bias safe operating area**
($D=0$, $T_C=25^\circ\text{C}$, $T_j \leq 175^\circ\text{C}$; $V_{GE}=15\text{V}$)

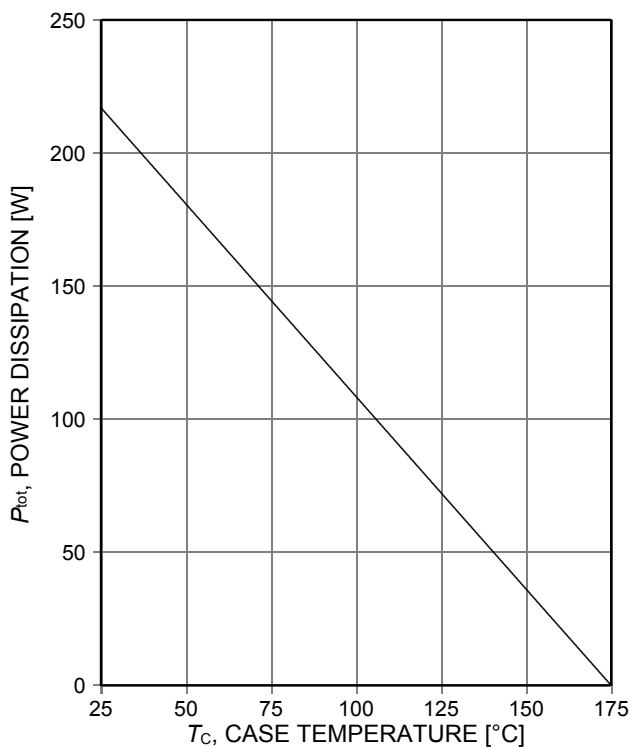


Figure 3. **Power dissipation as a function of case temperature**
($T_j \leq 175^\circ\text{C}$)

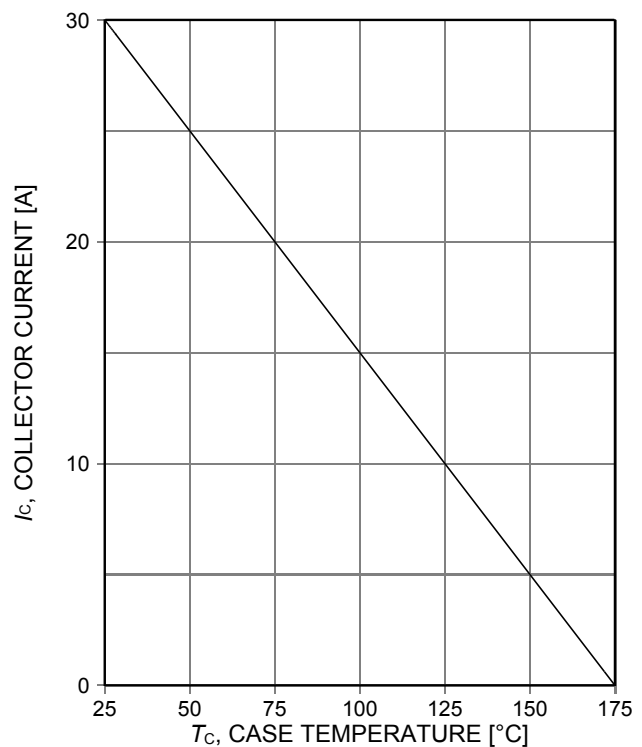


Figure 4. **Collector current as a function of case temperature**
($V_{GE} \geq 15\text{V}$, $T_j \leq 175^\circ\text{C}$)

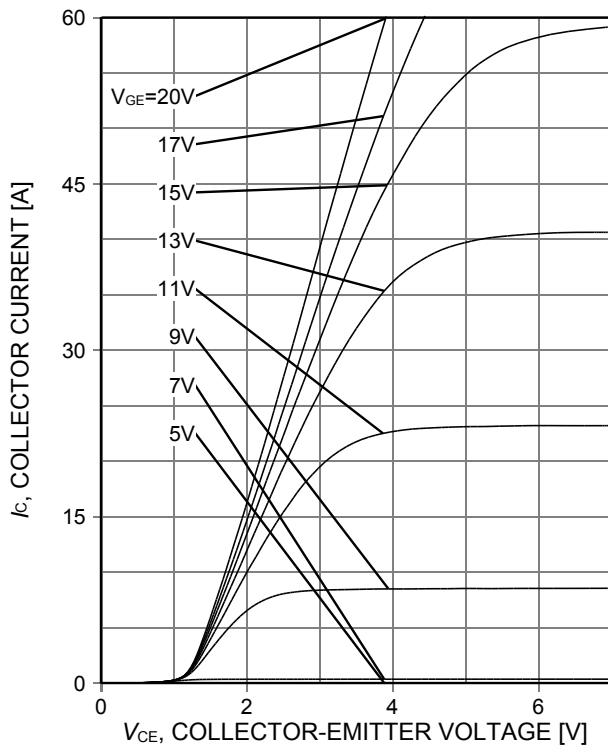


Figure 5. **Typical output characteristic**
($T_j=25^\circ\text{C}$)

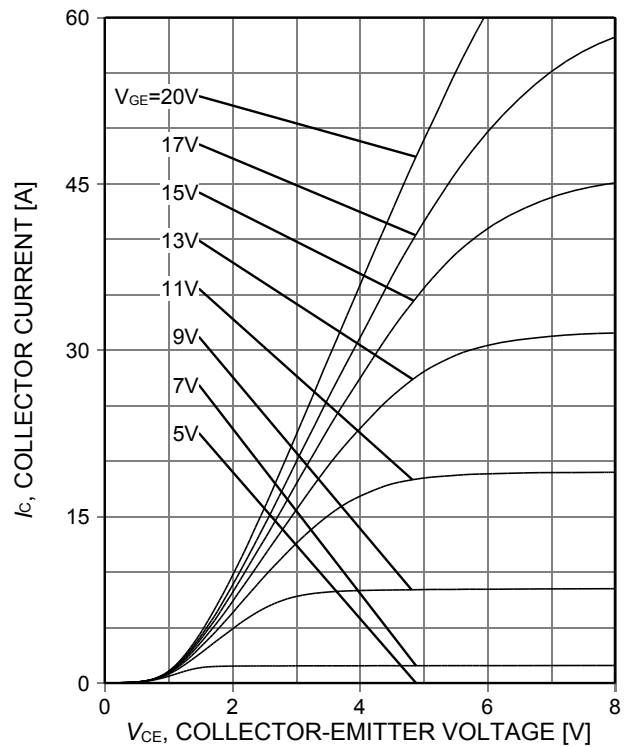


Figure 6. **Typical output characteristic**
($T_j=175^\circ\text{C}$)

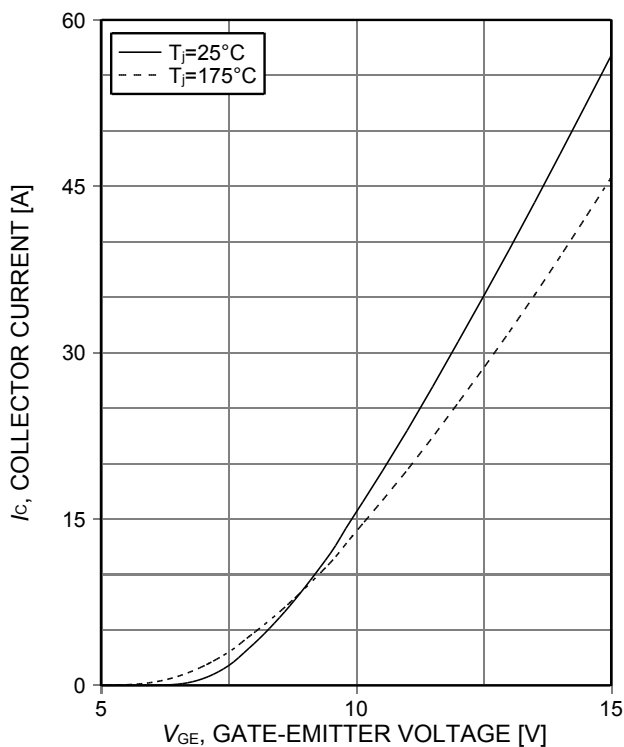


Figure 7. **Typical transfer characteristic**
($V_{CE}=20\text{V}$)

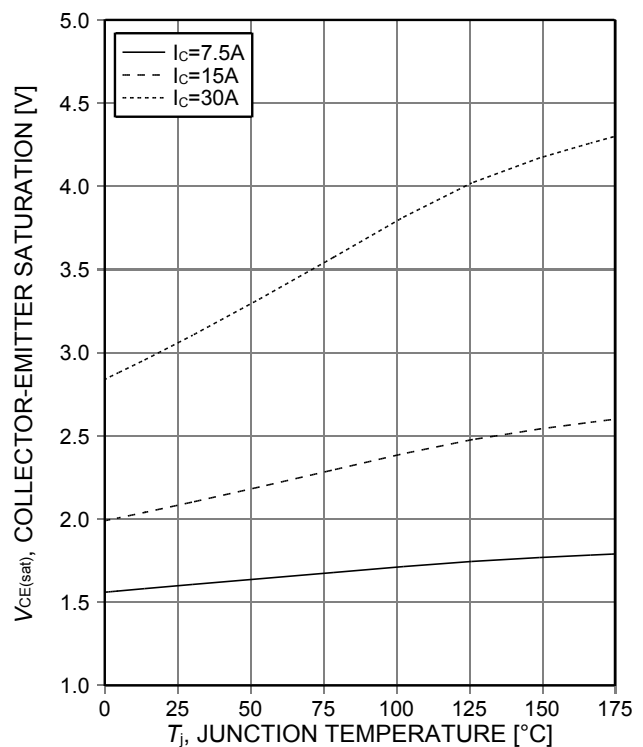


Figure 8. **Typical collector-emitter saturation voltage as a function of junction temperature**
($V_{GE}=15\text{V}$)

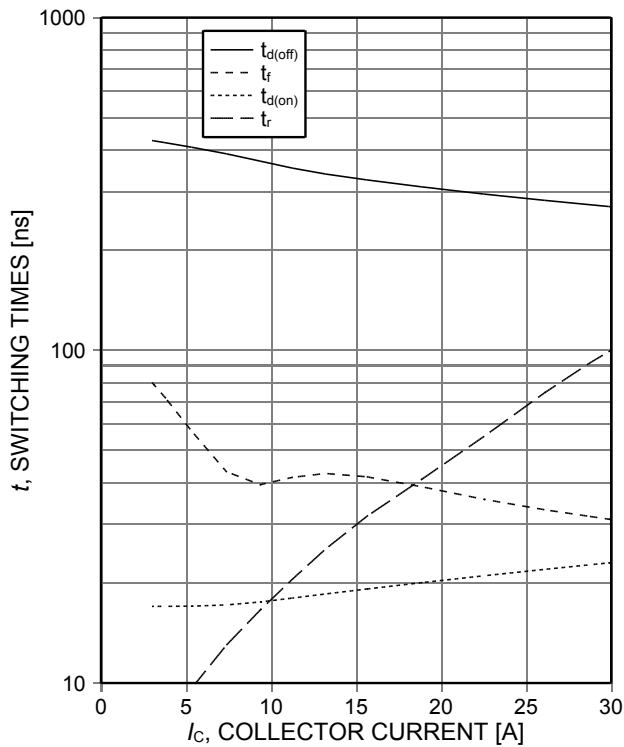


Figure 9. **Typical switching times as a function of collector current**
(ind. load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $r_G=35\Omega$, test circuit in Fig. E)

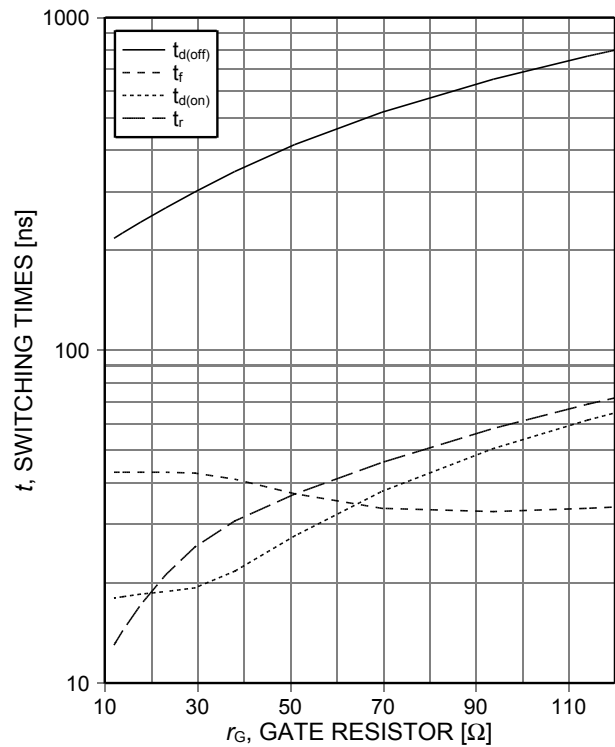


Figure 10. **Typical switching times as a function of gate resistor**
(ind. load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=15\text{A}$, test circuit in Fig. E)

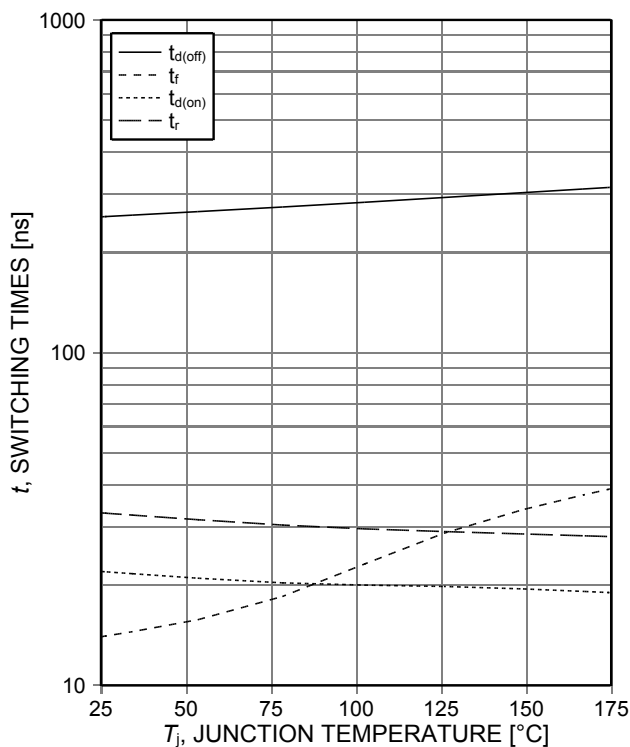


Figure 11. **Typical switching times as a function of junction temperature**
(ind. load, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=15\text{A}$, $r_G=35\Omega$, test circuit in Fig. E)

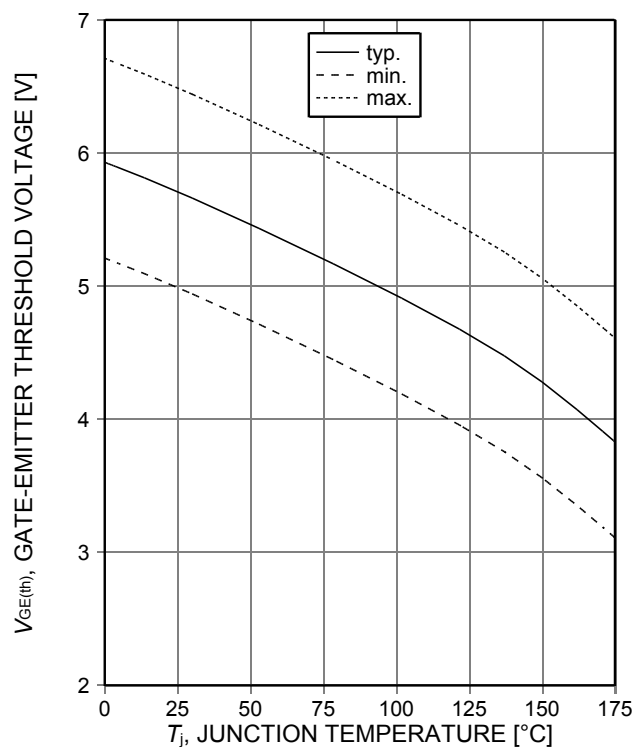


Figure 12. **Gate-emitter threshold voltage as a function of junction temperature**
($I_C=0.5\text{mA}$)

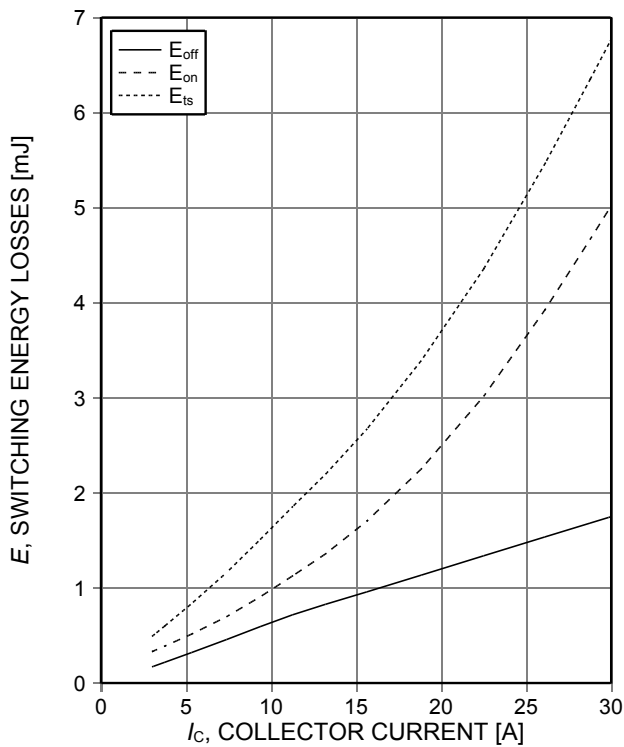


Figure 13. **Typical switching energy losses as a function of collector current**
(ind. load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $r_G=35\Omega$, test circuit in Fig. E)

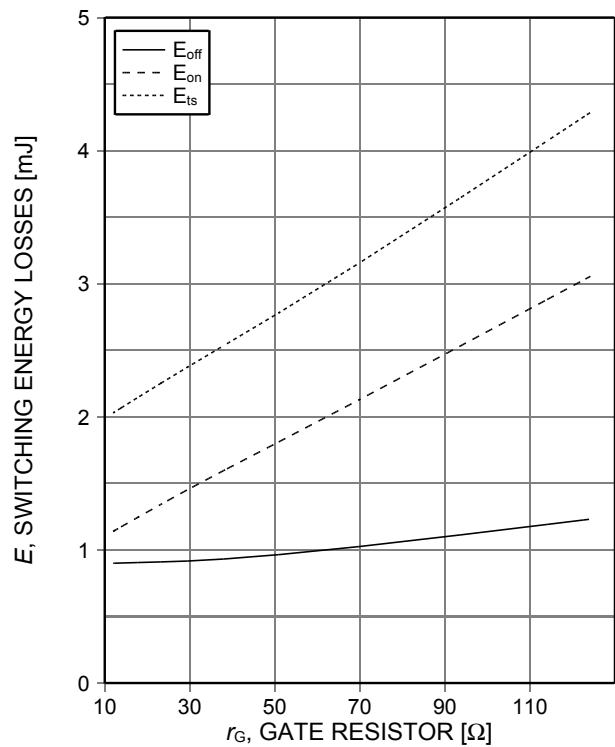


Figure 14. **Typical switching energy losses as a function of gate resistor**
(ind. load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=15\text{A}$, test circuit in Fig. E)

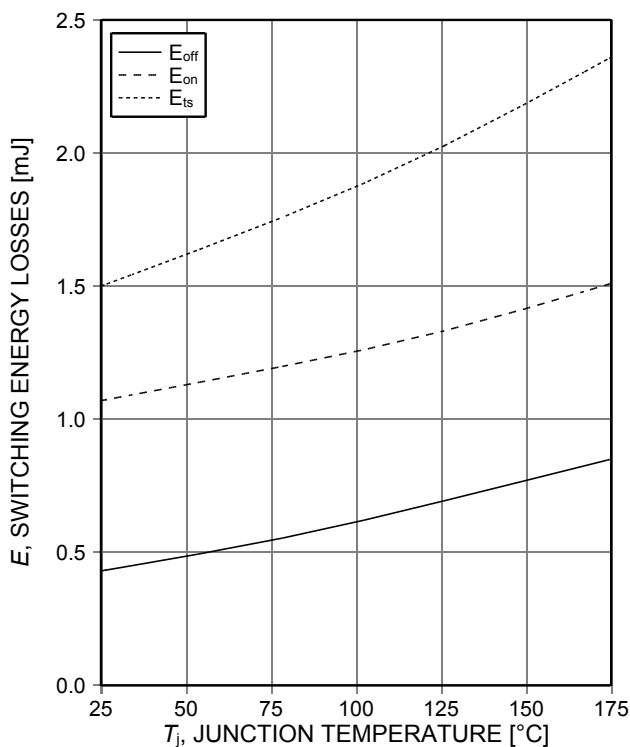


Figure 15. **Typical switching energy losses as a function of junction temperature**
(ind load, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=15\text{A}$, $r_G=35\Omega$, test circuit in Fig. E)

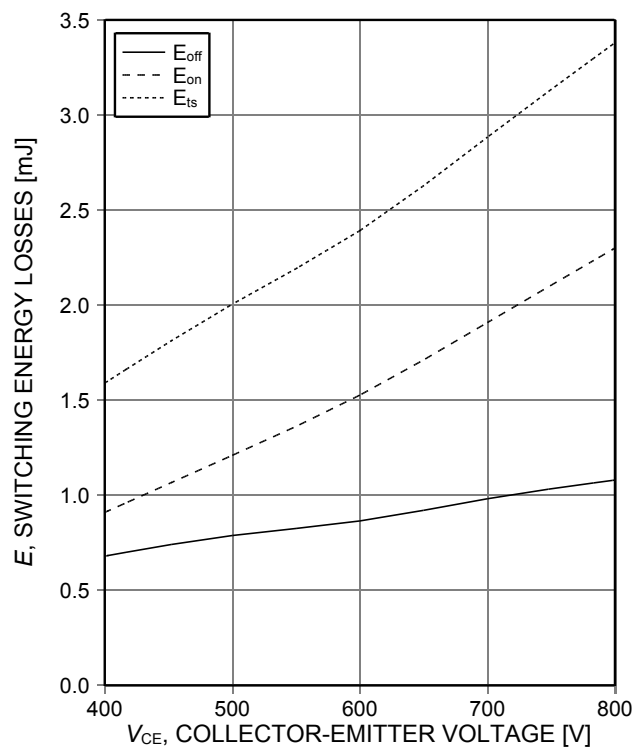


Figure 16. **Typical switching energy losses as a function of collector emitter voltage**
(ind. load, $T_J=175^\circ\text{C}$, $V_{GE}=15/0\text{V}$, $I_C=15\text{A}$, $r_G=35\Omega$, test circuit in Fig. E)

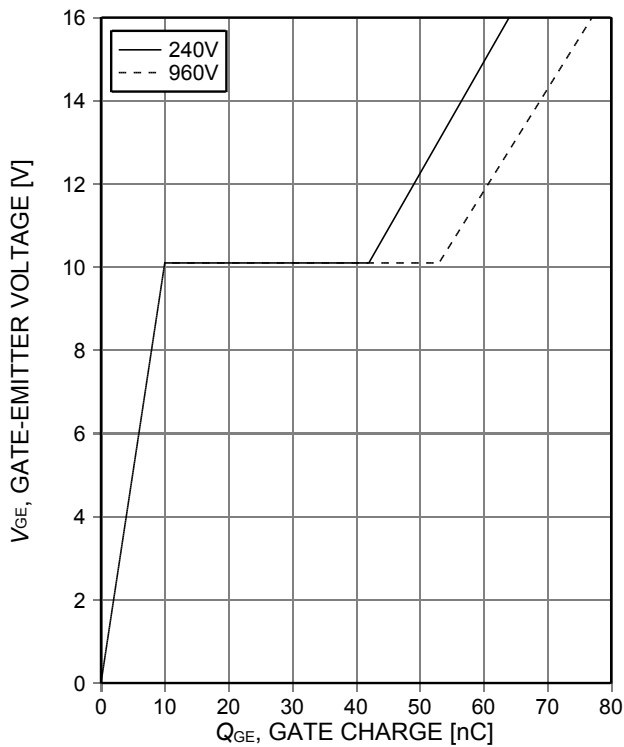


Figure 17. **Typical gate charge**
($I_C=15A$)

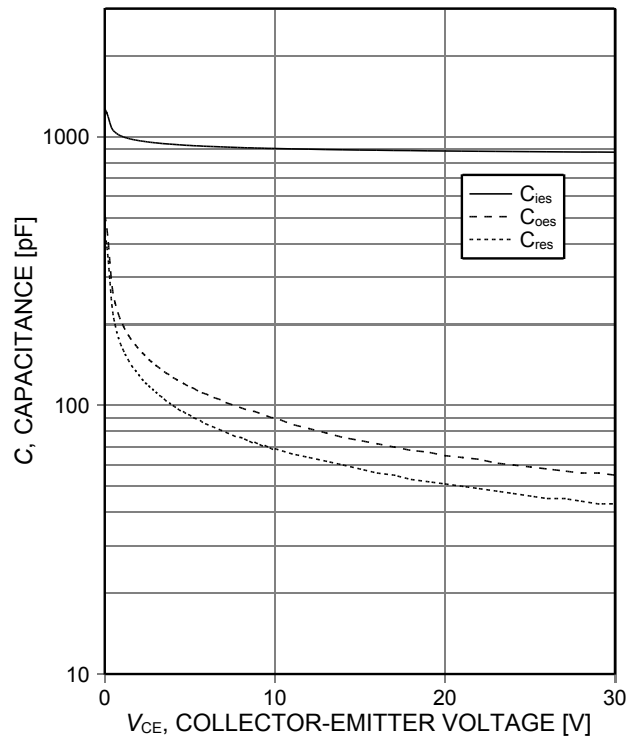


Figure 18. **Typical capacitance as a function of collector-emitter voltage**
($V_{GE}=0V$, $f=1MHz$)

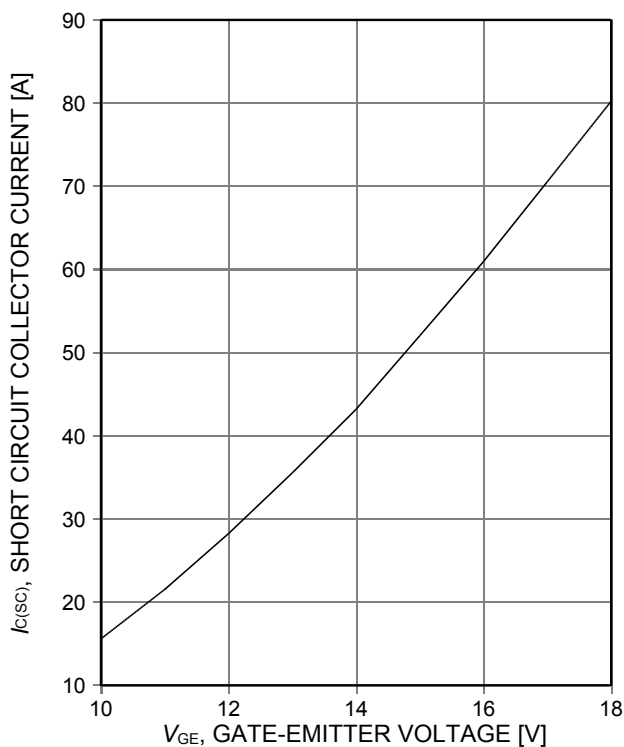


Figure 19. **Typical short circuit collector current as a function of gate-emitter voltage**
($V_{CE} \leq 600V$, start at $T_J=25^\circ C$)

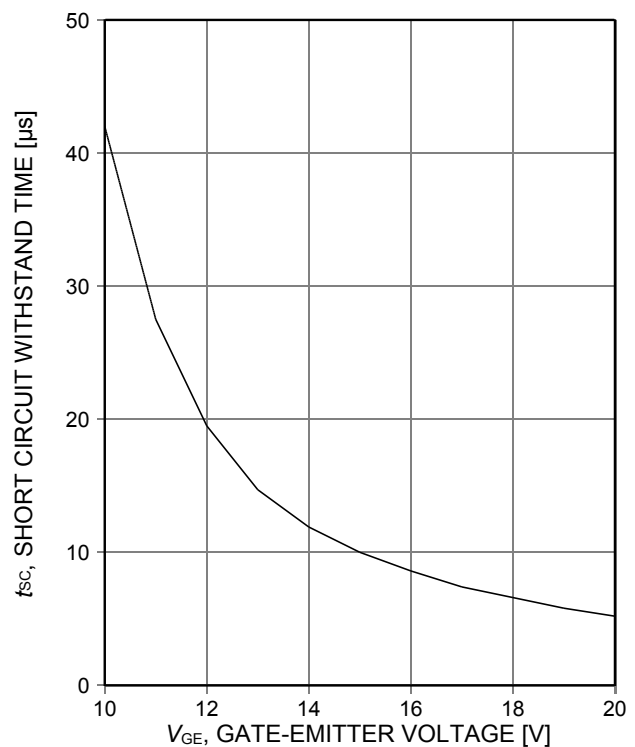


Figure 20. **Short circuit withstand time as a function of gate-emitter voltage**
($V_{CE} \leq 600V$, start at $T_J \leq 150^\circ C$)

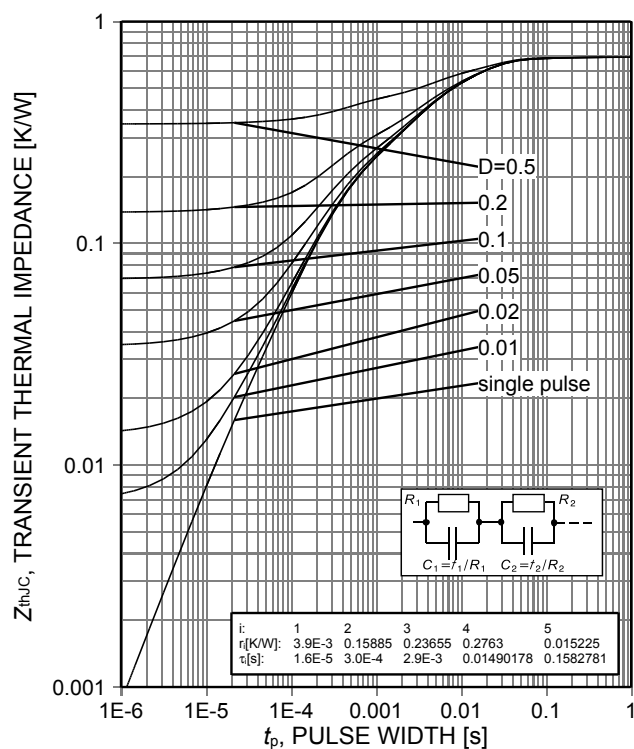
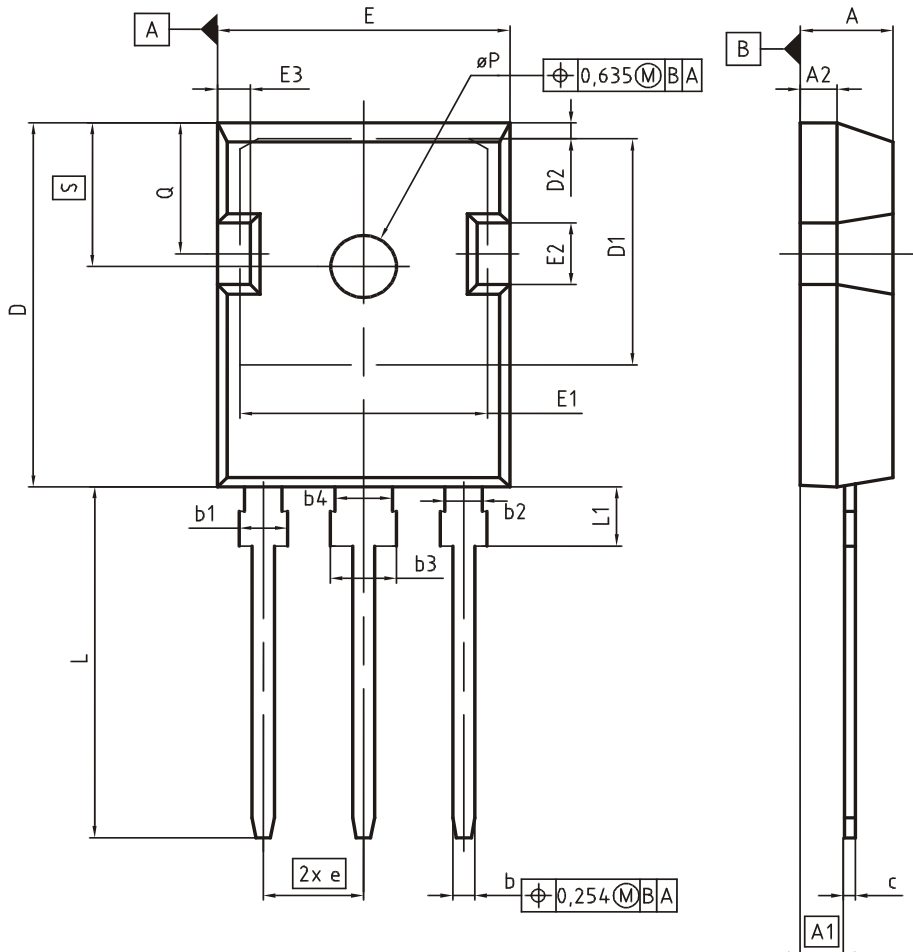
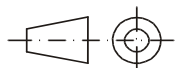


Figure 21. IGBT transient thermal impedance
($D=t_p/T$)

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 7.5mm
EUROPEAN PROJECTION 
ISSUE DATE 09-07-2010
REVISION 05

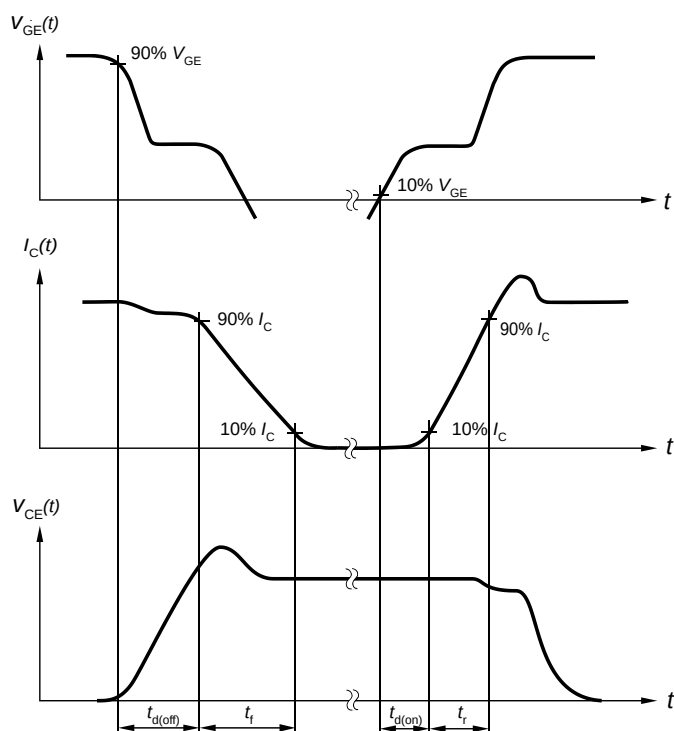


Figure A. Definition of switching times

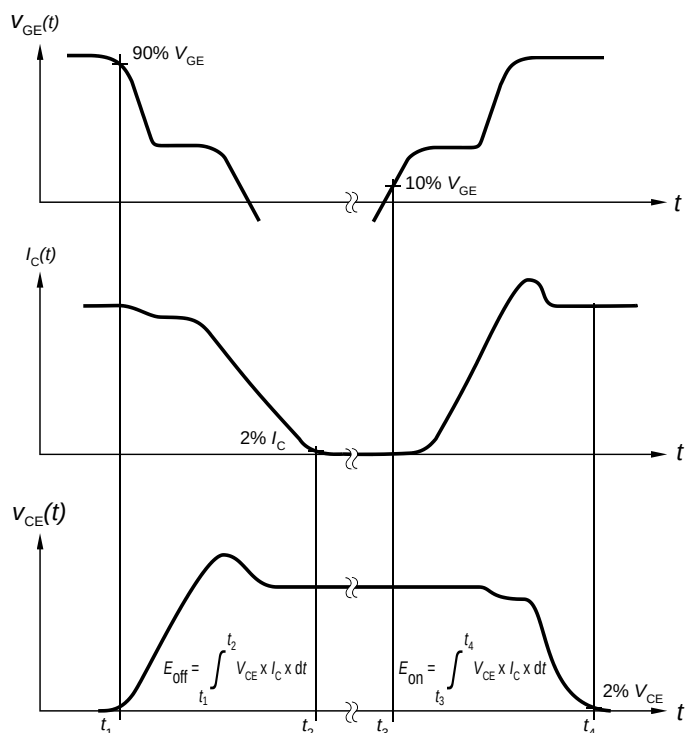


Figure B. Definition of switching losses

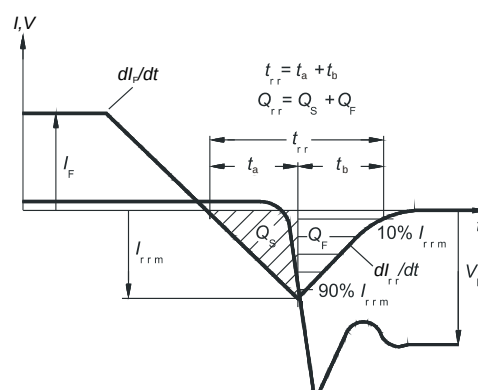


Figure C. Definition of diode switching characteristics

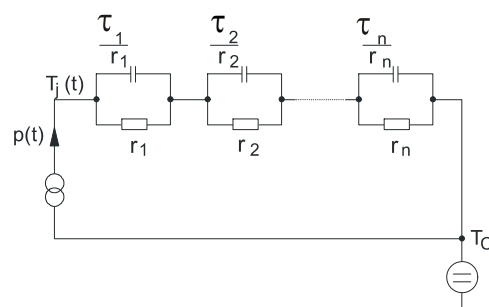


Figure D. Thermal equivalent circuit

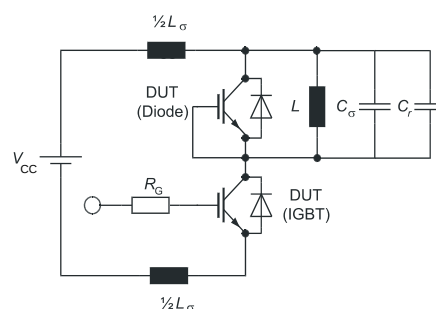


Figure E. **Dynamic test circuit**
Parasitic inductance L_{σ} ,
parasitic capacitor L_{σ} ,
relief capacitor C_r ,
(only for ZVT switching)

Revision History

IGW15N120H3

Revision: 2014-12-01, Rev. 2.1

Previous Revision

Revision	Date	Subjects (major changes since last revision)
1.1	2009-11-27	-
2.1	2014-12-01	Final data sheet

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