IGBT

TRENCHSTOP^{TM} Performance technology

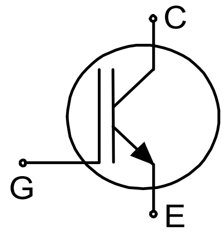
IGW50N60TP

600V IGBT TRENCHSTOP^{TM} Performance series

Data sheet

Industrial Power Control

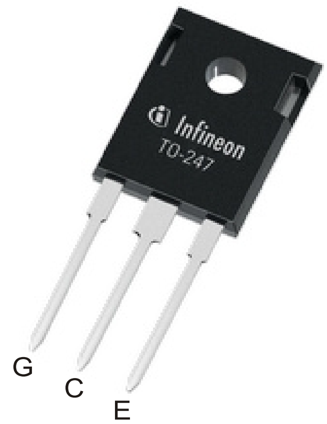
High speed IGBT in Trench and Fieldstop technology



Features:

TRENCHSTOP™ technology offering
- very low V_{CEsat}
- low turn-off losses
- short tail current
- low EMI
- 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:

- drives
- solar inverters
- uninterruptible power supplies
- converters with medium switching frequency

Green

Halogen-Free

RoHS

Key Performance and Package Parameters

Type	V_{CE}	I_C	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Marking	Package
IGW50N60TP	600V	50A	1.6V	175°C	G50DTP	PG-TO247-3

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}	600	V
DC collector current, limited by T_{vjmax} $T_C = 25°C$ value limited by bondwire $T_C = 100°C$	I_C	80.0 61.0	A
Pulsed collector current, t_p limited by T_{vjmax}[1)]	I_{Cpuls}	150.0	A
Turn off safe operating area $V_{CE} \leq 600V$, $T_{vj} \leq 175°C$, $t_p = 1µs$[1)]	-	150.0	A
Gate-emitter voltage	V_{GE}	±20	V
Short circuit withstand time $V_{GE} = 15.0V$, $V_{CC} \leq 400V$ Allowed number of short circuits < 1000 Time between short circuits: ≥ 1.0s $T_{vj} = 150°C$	t_{SC}	5	µs
Power dissipation $T_C = 25°C$ Power dissipation $T_C = 100°C$	P_{tot}	319.2 159.6	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	Value			Unit
			min.	typ.	max.	
R_{th} Characteristics						
IGBT thermal resistance, junction - case	$R_{th(j-c)}$		-	0.36	0.47	K/W

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

Electrical Characteristic, at T_{vj} = 25°C, unless otherwise specified

Parameter	Symbol	Conditions	Value min.	Value typ.	Value max.	Unit
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	V_{GE} = 0V, I_C = 0.20mA	600	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	V_{GE} = 15.0V, I_C = 50.0A T_{vj} = 25°C T_{vj} = 175°C	- -	1.60 1.94	1.80 -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C = 0.80mA, 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°C T_{vj} = 175°C	- -	- -	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	-	78.0	-	S

Electrical Characteristic, at T_{vj} = 25°C, unless otherwise specified

Parameter	Symbol	Conditions	Value min.	Value typ.	Value max.	Unit
Dynamic Characteristic						
Input capacitance	C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	-	1950	-	pF
Output capacitance	C_{oes}		-	83	-	
Reverse transfer capacitance	C_{res}		-	67	-	
Gate charge	Q_G	V_{CC} = 480V, I_C = 50.0A, V_{GE} = 15V	-	249.0	-	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: ≥ 1.0s	$I_{C(SC)}$	V_{GE} = 15.0V, V_{CC} ≤ 400V, t_{SC} ≤ 5µs T_{vj} = 150°C	-	255	-	A

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value min.	Value typ.	Value max.	Unit
IGBT Characteristic, at T_{vj} = 25°C						
Turn-on delay time	$t_{d(on)}$	T_{vj} = 25°C, V_{CC} = 400V, I_C = 50.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 7.0Ω, $R_{G(off)}$ = 7.0Ω, $L\sigma$ = 32nH, $C\sigma$ = 60pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode (IKW50N60DTP) reverse recovery.	-	20	-	ns
Rise time	t_r		-	30	-	ns
Turn-off delay time	$t_{d(off)}$		-	215	-	ns
Fall time	t_f		-	18	-	ns
Turn-on energy	E_{on}		-	1.53	-	mJ
Turn-off energy	E_{off}		-	0.85	-	mJ
Total switching energy	E_{ts}		-	2.38	-	mJ

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic, at T_{vj} = 175°C						
Turn-on delay time	$t_{d(on)}$	T_{vj} = 175°C, V_{CC} = 400V, I_C = 50.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 7.0Ω, $R_{G(off)}$ = 7.0Ω, $L\sigma$ = 32nH, $C\sigma$ = 60pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode (IKW50N60DTP) reverse recovery.	-	21	-	ns
Rise time	t_r		-	34	-	ns
Turn-off delay time	$t_{d(off)}$		-	277	-	ns
Fall time	t_f		-	55	-	ns
Turn-on energy	E_{on}		-	2.25	-	mJ
Turn-off energy	E_{off}		-	1.39	-	mJ
Total switching energy	E_{ts}		-	3.64	-	mJ

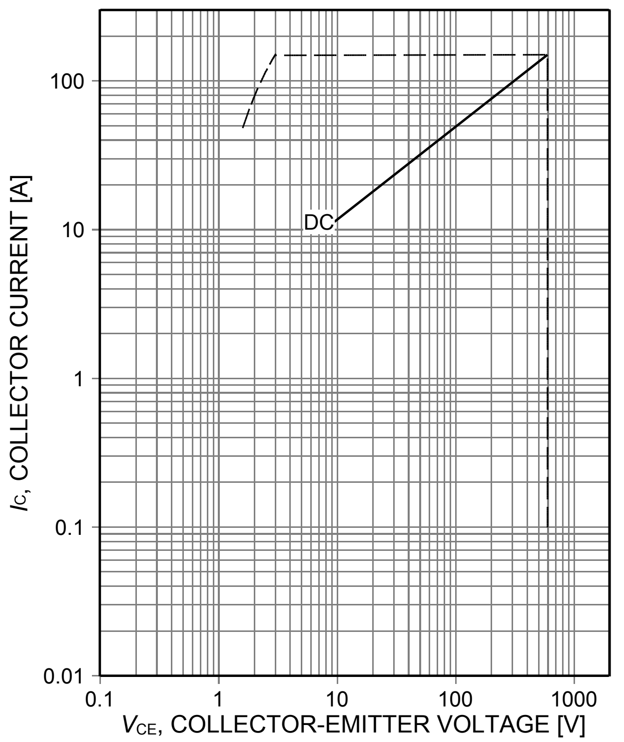


Figure 1. **Forward bias safe operating area**
(D=0, T_C=25°C, T_j≤175°C; V_{GE}=15V)

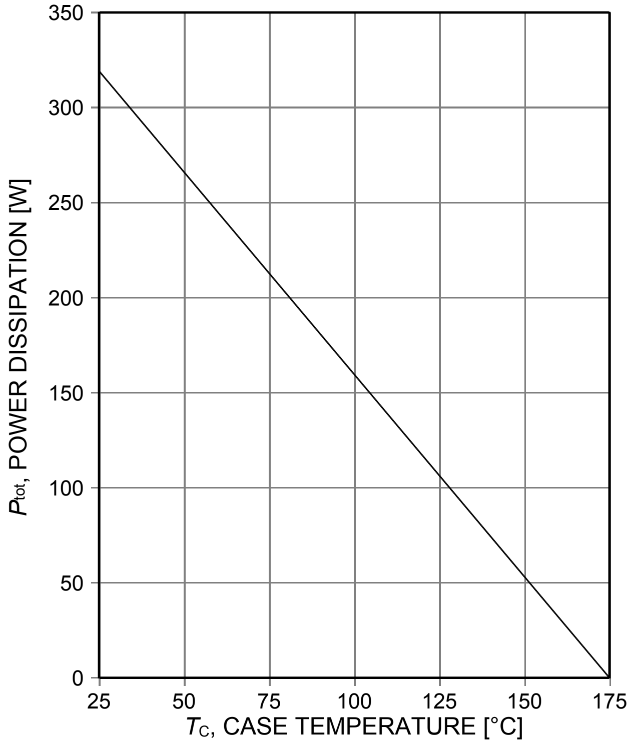


Figure 2. **Power dissipation as a function of case temperature**
(T_j≤175°C)

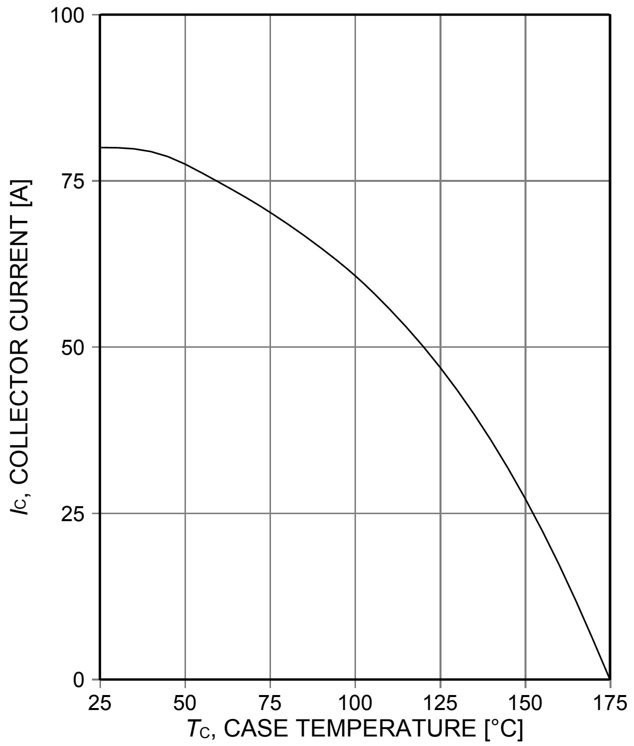


Figure 3. **Collector current as a function of case temperature**
(V_{GE}≥15V, T_j≤175°C)

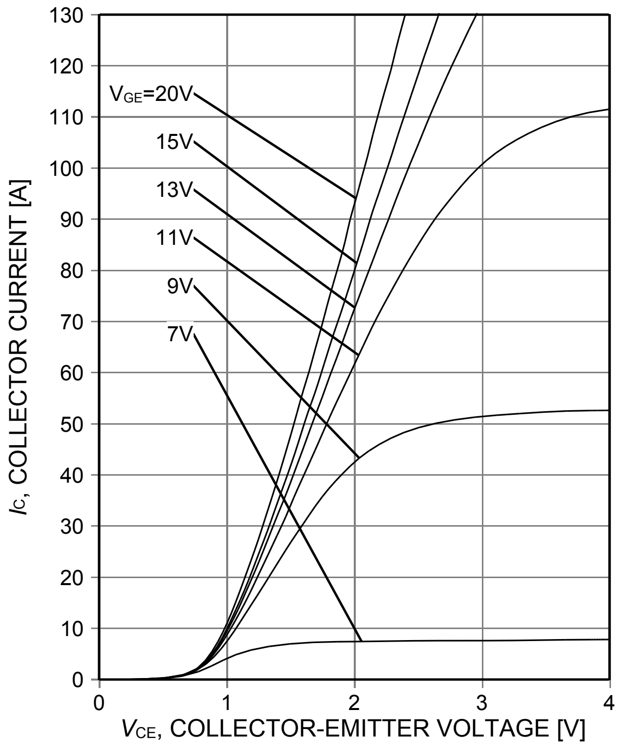


Figure 4. **Typical output characteristic**
(T_j=25°C)

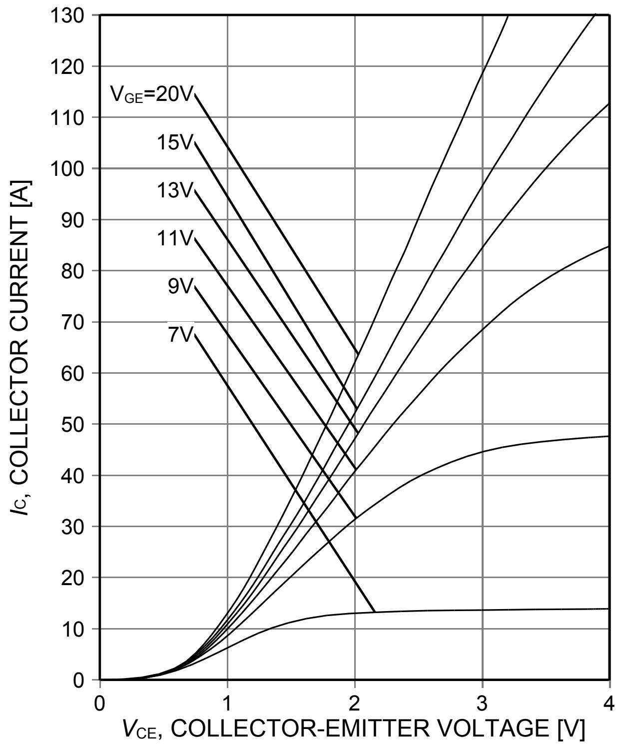


Figure 5. **Typical output characteristic**
(T_j=175°C)

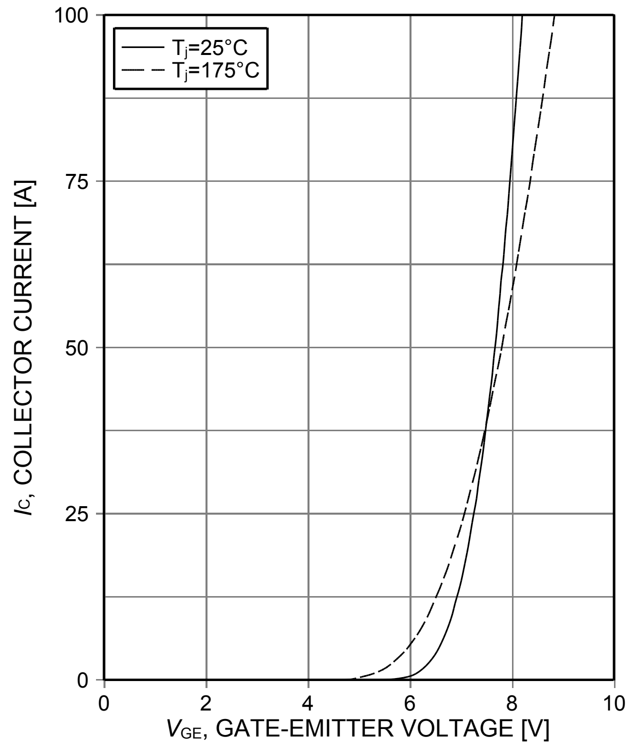


Figure 6. **Typical transfer characteristic**
(V_{CE}=20V)

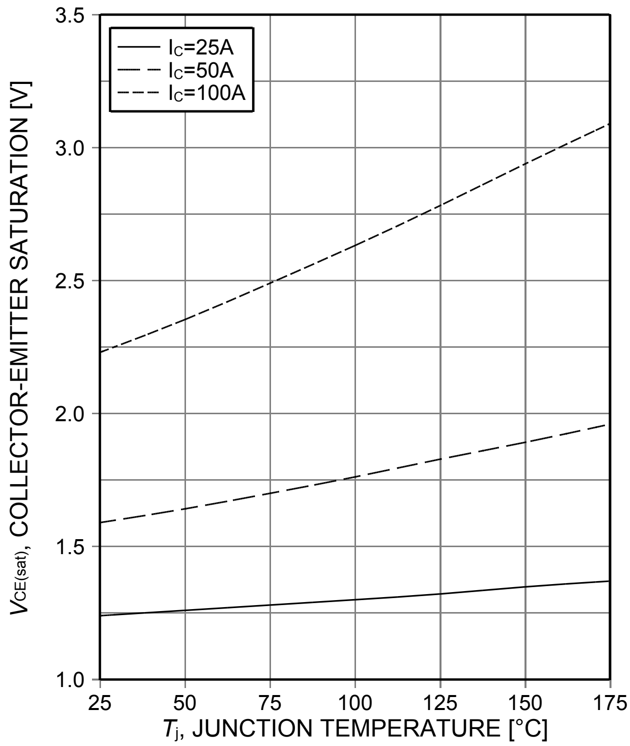


Figure 7. **Typical collector-emitter saturation voltage as a function of junction temperature**
(V_{GE}=15V)

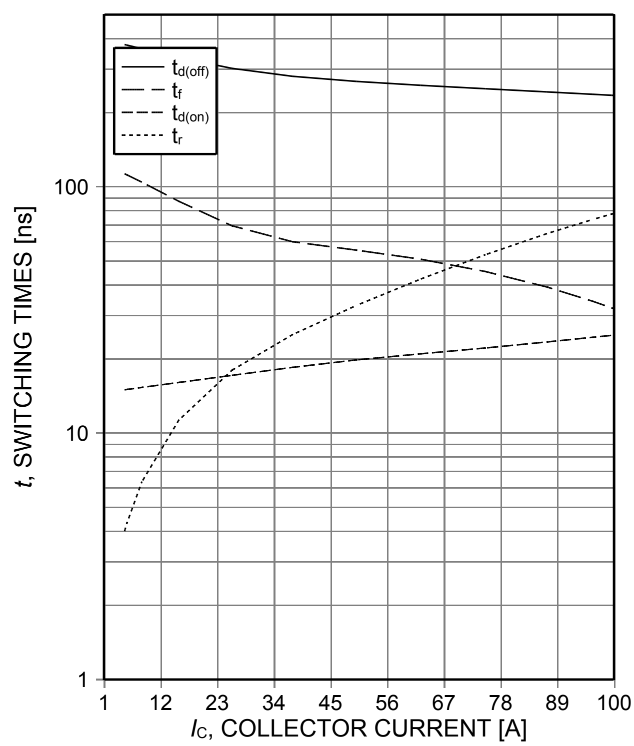


Figure 8. **Typical switching times as a function of collector current**
(ind. load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, r_G=7Ω, test circuit in Fig. E)

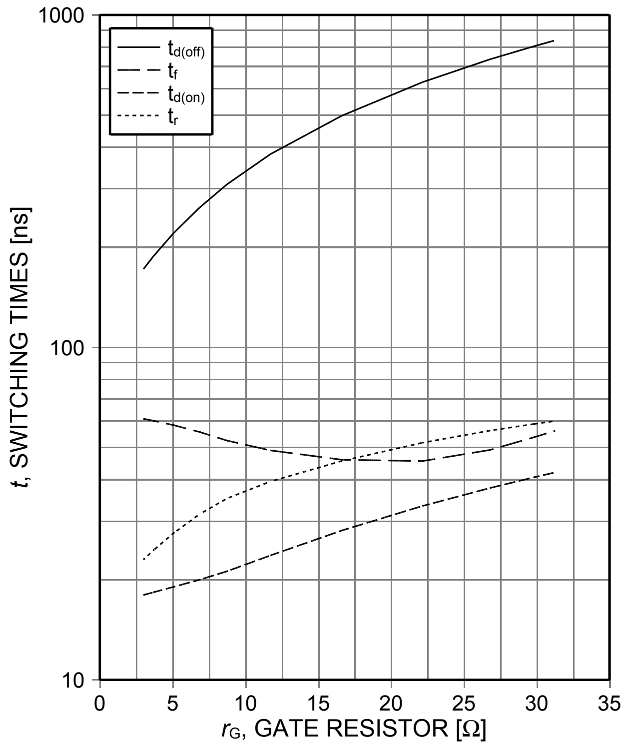


Figure 9. **Typical switching times as a function of gate resistor**
(ind. load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, I_C=50A, test circuit in Fig. E)

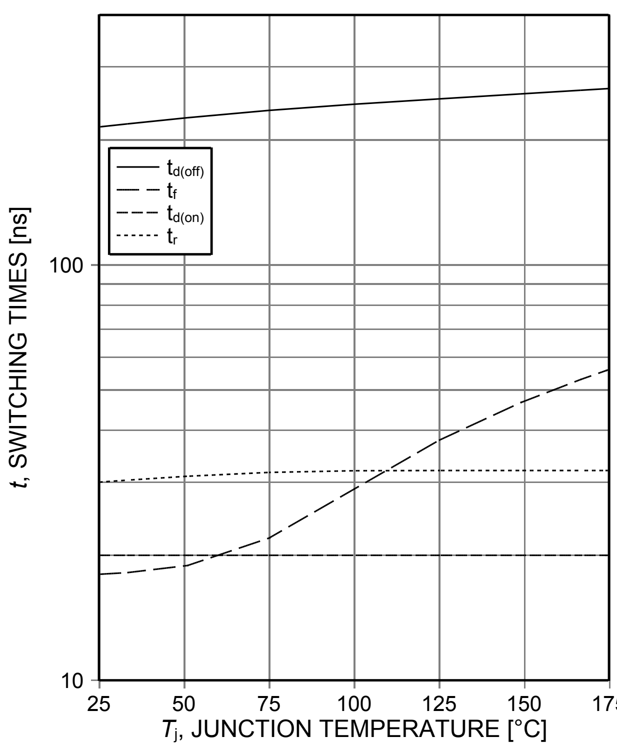


Figure 10. **Typical switching times as a function of junction temperature**
(ind. load, V_{CE}=400V, V_{GE}=15/0V, I_C=50A, r_G=7Ω, test circuit in Fig. E)

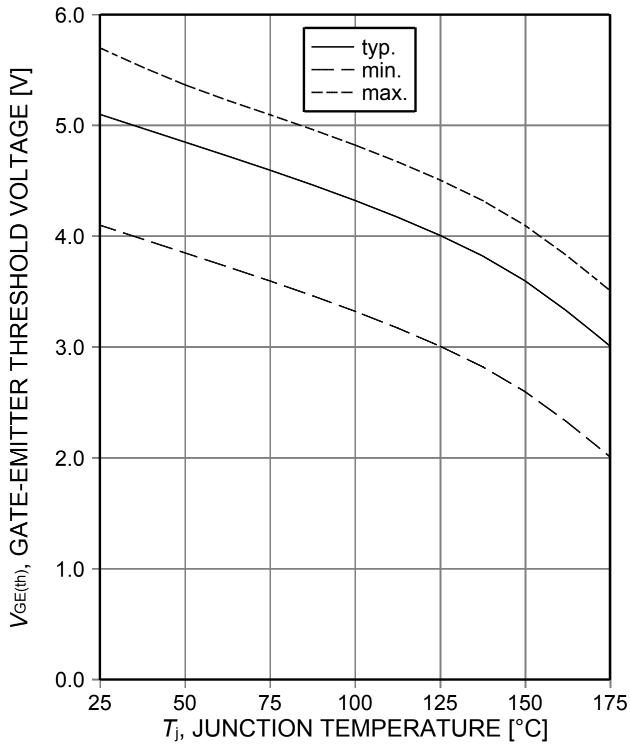


Figure 11. **Gate-emitter threshold voltage as a function of junction temperature**
(I_C=0,8mA)

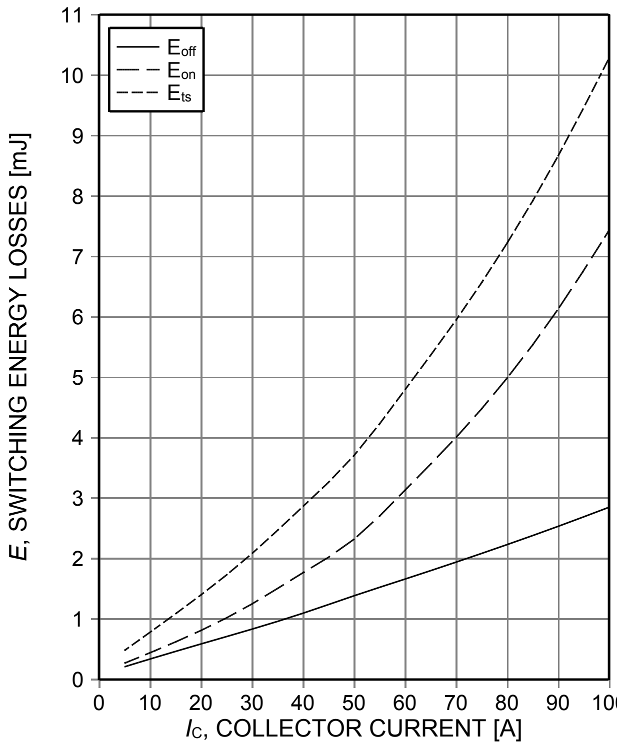


Figure 12. **Typical switching energy losses as a function of collector current**
(ind. load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, r_G=7Ω, test circuit in Fig. E)

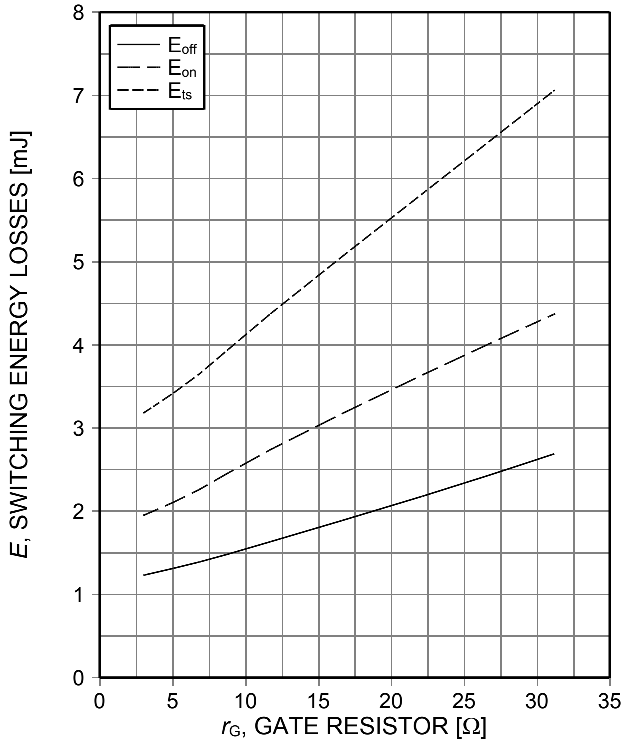


Figure 13. **Typical switching energy losses as a function of gate resistor**
(ind. load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, I_C=50A, test circuit in Fig. E)

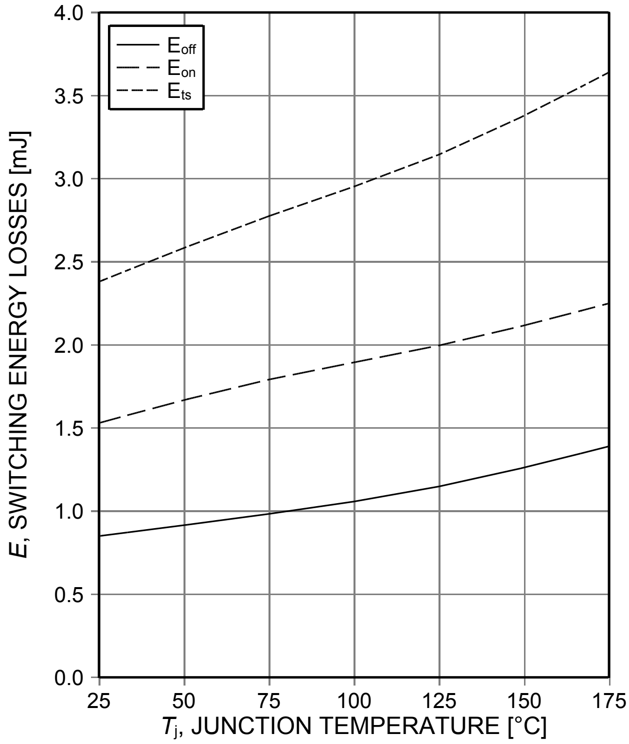


Figure 14. **Typical switching energy losses as a function of junction temperature**
(ind load, V_{CE}=400V, V_{GE}=15/0V, I_C=50A, r_G=7Ω, test circuit in Fig. E)

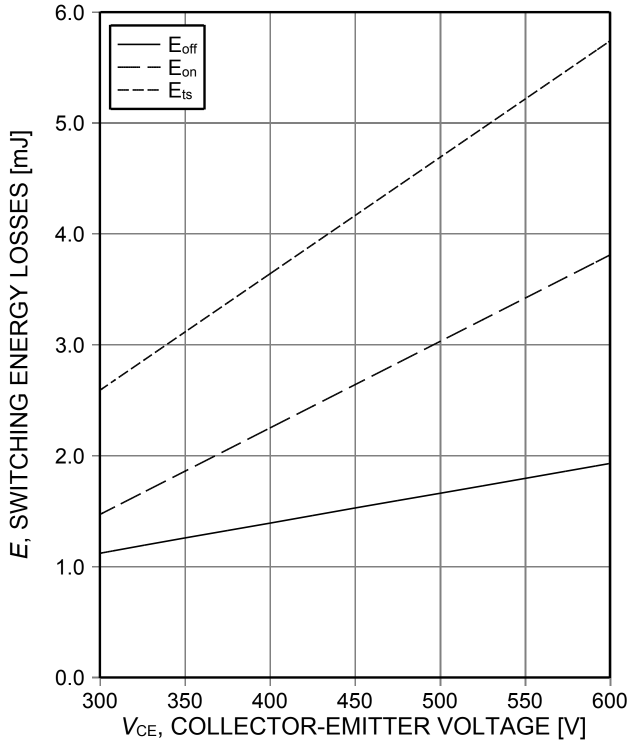


Figure 15. **Typical switching energy losses as a function of collector emitter voltage**
(ind. load, T_j=175°C, V_{GE}=15/0V, I_C=50A, r_G=7Ω, test circuit in Fig. E)

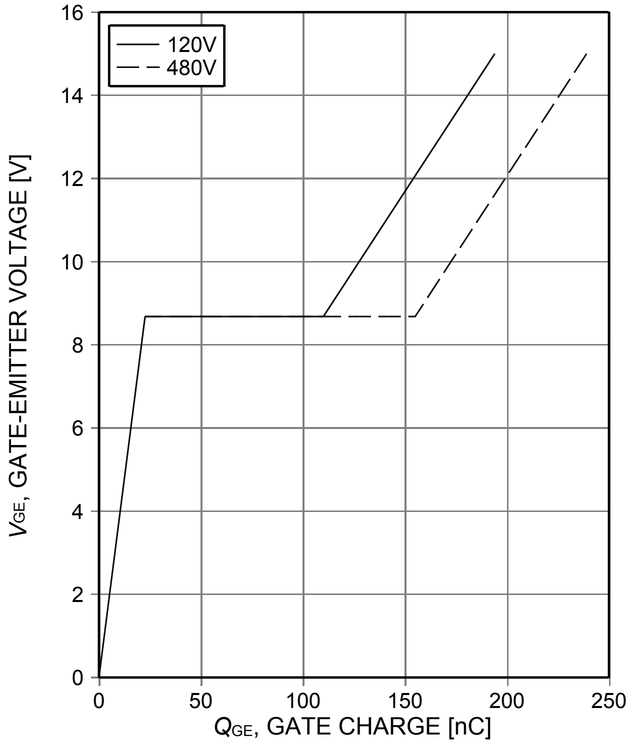


Figure 16. **Typical gate charge**
(I_C=50A)

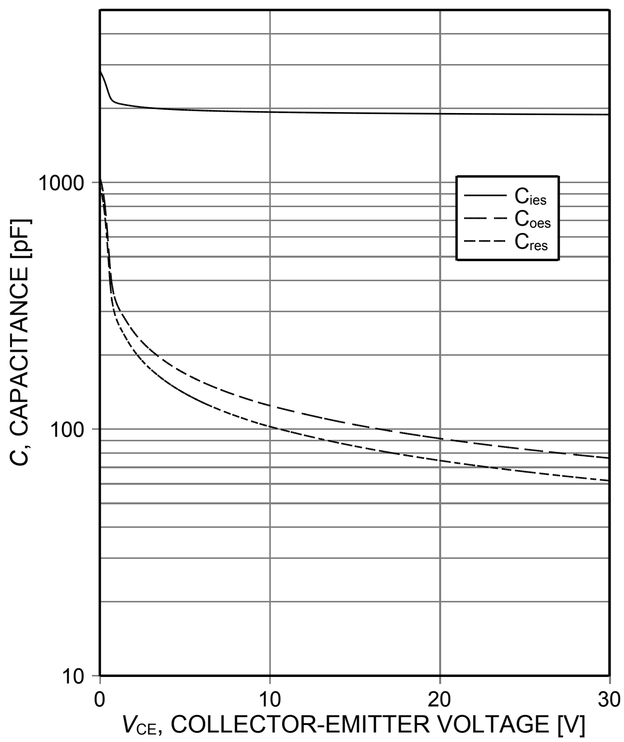


Figure 17. **Typical capacitance as a function of collector-emitter voltage**
(V_{GE}=0V, f=1MHz)

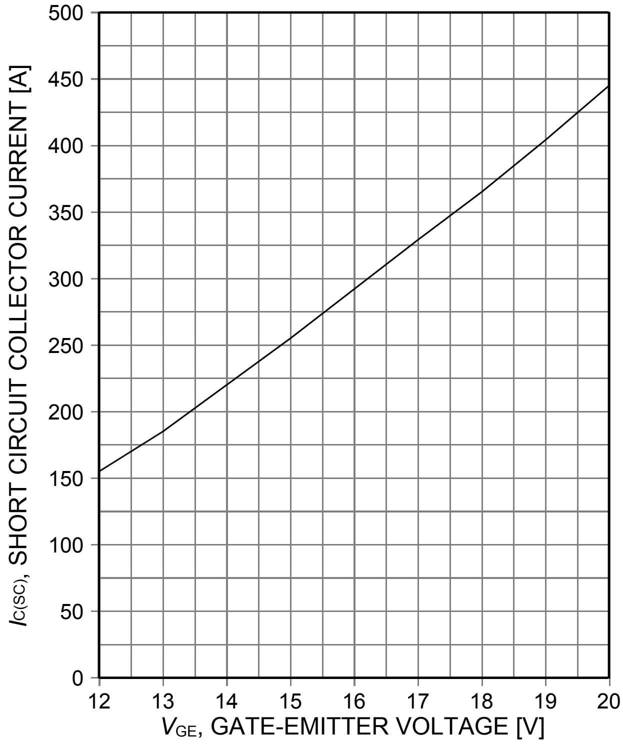


Figure 18. **Typical short circuit collector current as a function of gate-emitter voltage**
(V_{CE}≤400V, start at T_j=150°C)

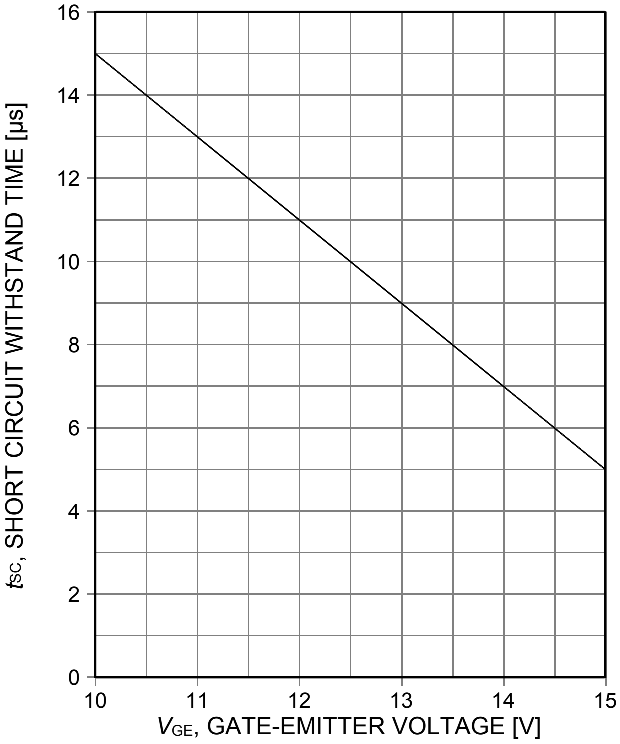


Figure 19. **Short circuit withstand time as a function of gate-emitter voltage**
(V_{CE}≤400V, start at T_j≤150°C)

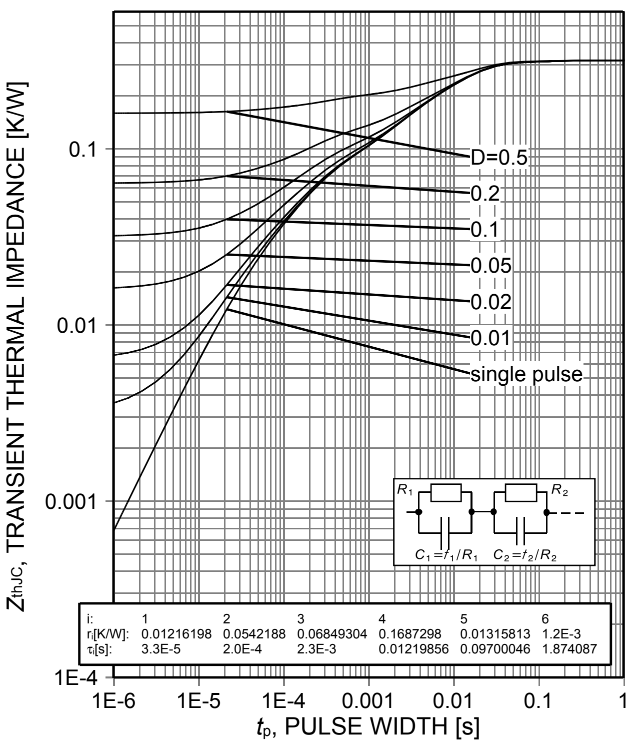
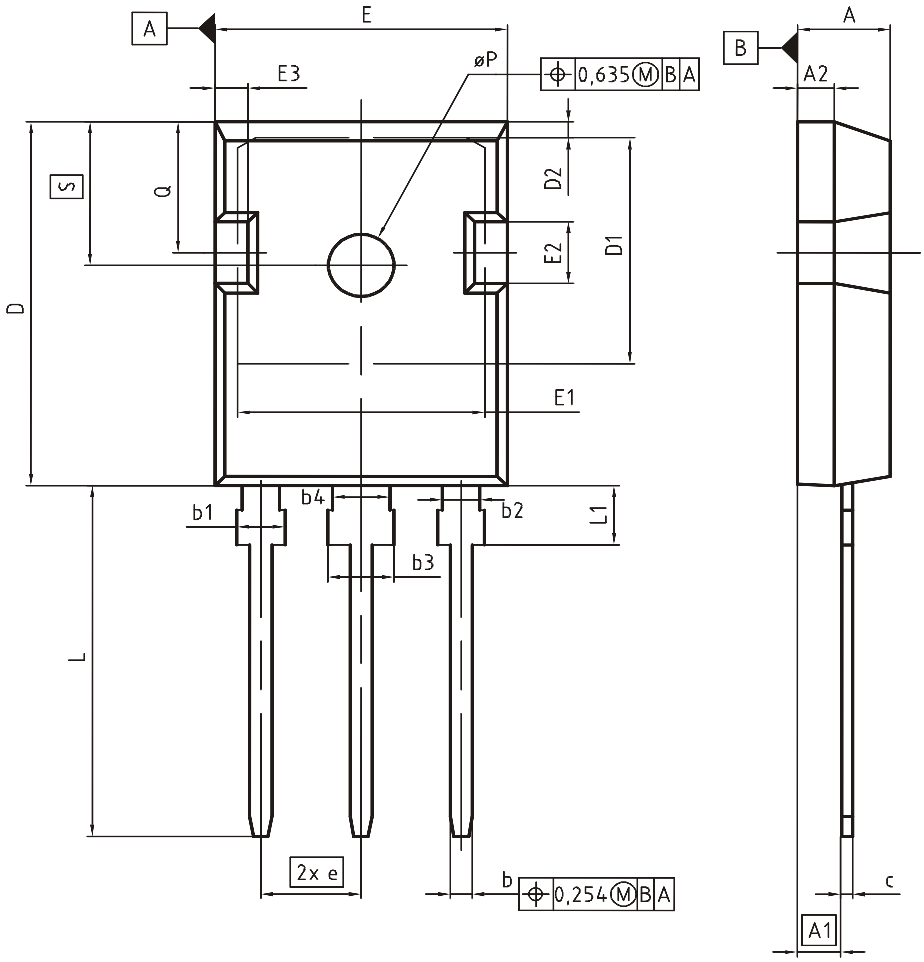


Figure 20. **Typical IGBT transient thermal impedance**
(D=t_p/T)

Package Drawing PG-TO247-3



<table>
<tr><th rowspan="2">DIM</th><th colspan="2">MILLIMETERS</th><th colspan="2">INCHES</th></tr>
<tr><th>MIN</th><th>MAX</th><th>MIN</th><th>MAX</th></tr>
<tr><td>A</td><td>4.83</td><td>5.21</td><td>0.190</td><td>0.205</td></tr>
<tr><td>A1</td><td>2.27</td><td>2.54</td><td>0.089</td><td>0.100</td></tr>
<tr><td>A2</td><td>1.85</td><td>2.16</td><td>0.073</td><td>0.085</td></tr>
<tr><td>b</td><td>1.07</td><td>1.33</td><td>0.042</td><td>0.052</td></tr>
<tr><td>b1</td><td>1.90</td><td>2.41</td><td>0.075</td><td>0.095</td></tr>
<tr><td>b2</td><td>1.90</td><td>2.16</td><td>0.075</td><td>0.085</td></tr>
<tr><td>b3</td><td>2.87</td><td>3.38</td><td>0.113</td><td>0.133</td></tr>
<tr><td>b4</td><td>2.87</td><td>3.13</td><td>0.113</td><td>0.123</td></tr>
<tr><td>c</td><td>0.55</td><td>0.68</td><td>0.022</td><td>0.027</td></tr>
<tr><td>D</td><td>20.80</td><td>21.10</td><td>0.819</td><td>0.831</td></tr>
<tr><td>D1</td><td>16.25</td><td>17.65</td><td>0.640</td><td>0.695</td></tr>
<tr><td>D2</td><td>0.95</td><td>1.35</td><td>0.037</td><td>0.053</td></tr>
<tr><td>E</td><td>15.70</td><td>16.13</td><td>0.618</td><td>0.635</td></tr>
<tr><td>E1</td><td>13.10</td><td>14.15</td><td>0.516</td><td>0.557</td></tr>
<tr><td>E2</td><td>3.68</td><td>5.10</td><td>0.145</td><td>0.201</td></tr>
<tr><td>E3</td><td>1.00</td><td>2.60</td><td>0.039</td><td>0.102</td></tr>
<tr><td>e</td><td colspan="2">5.44 (BSC)</td><td colspan="2">0.214 (BSC)</td></tr>
<tr><td>N</td><td colspan="2">3</td><td colspan="2">3</td></tr>
<tr><td>L</td><td>19.80</td><td>20.32</td><td>0.780</td><td>0.800</td></tr>
<tr><td>L1</td><td>4.10</td><td>4.47</td><td>0.161</td><td>0.176</td></tr>
<tr><td>øP</td><td>3.50</td><td>3.70</td><td>0.138</td><td>0.146</td></tr>
<tr><td>Q</td><td>5.49</td><td>6.00</td><td>0.216</td><td>0.236</td></tr>
<tr><td>S</td><td>6.04</td><td>6.30</td><td>0.238</td><td>0.248</td></tr>
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DOCUMENT NO.
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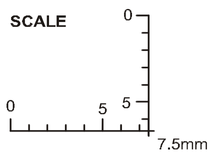
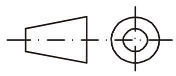
SCALE



EUROPEAN PROJECTION



ISSUE DATE
09-07-2010

REVISION
05

Testing Conditions

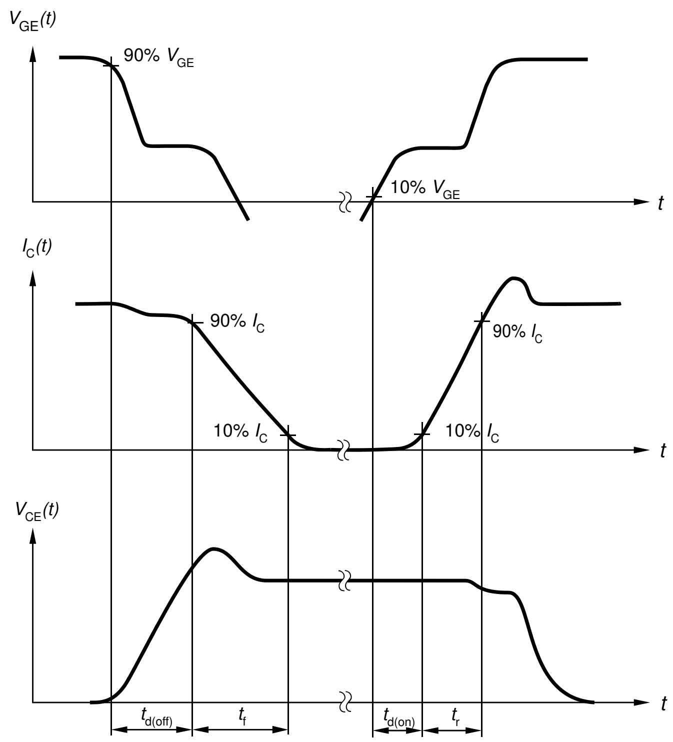


Figure A. **Definition of switching times**

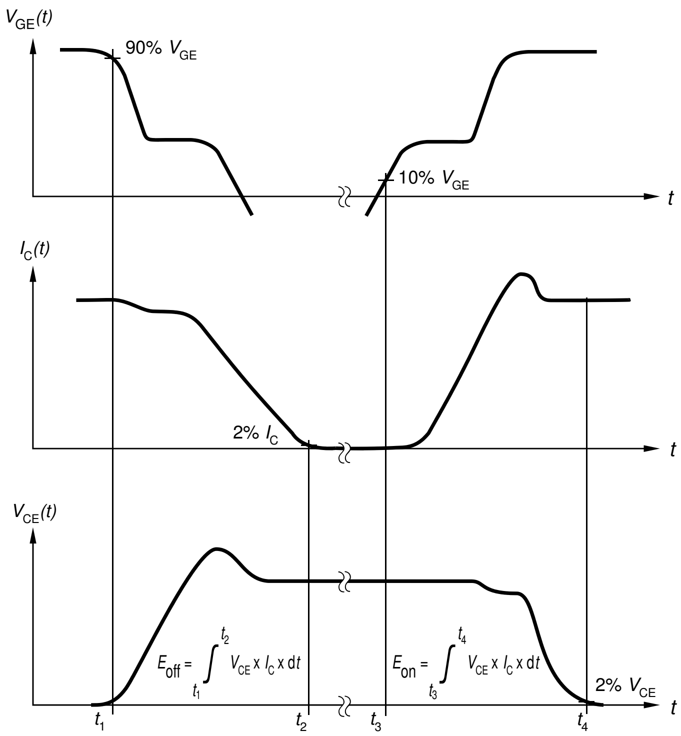


Figure B. **Definition of switching losses**

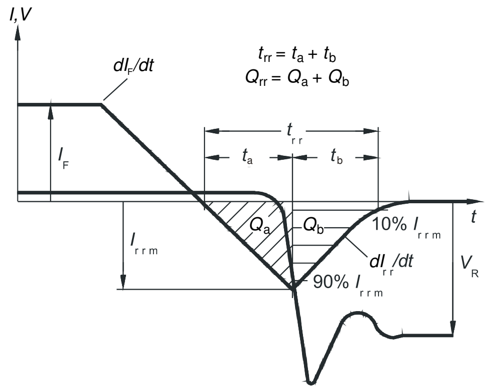


Figure C. **Definition of diode switching characteristics**

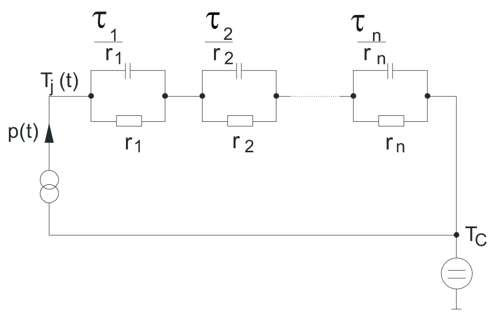


Figure D. **Thermal equivalent circuit**

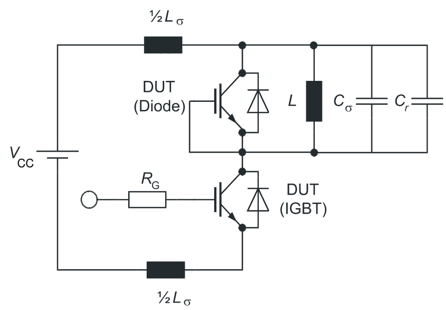


Figure E. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r,
(only for ZVT switching)