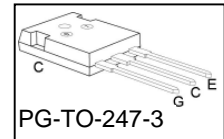
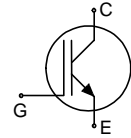


## Low Loss IGBT in TrenchStop® and Fieldstop technology

- Short circuit withstand time – 10µs
- Designed for :
  - Frequency Converters
  - Uninterrupted Power Supply
- TrenchStop® and Fieldstop technology for 1200 V applications offers :
  - very tight parameter distribution
  - high ruggedness, temperature stable behavior
- NPT technology offers easy parallel switching capability due to positive temperature coefficient in  $V_{CE(sat)}$
- Low EMI
- Low Gate Charge
- Qualified according to JEDEC<sup>1</sup> for target applications
- Pb-free lead plating; RoHS compliant
- Complete product spectrum and PSpice Models : <http://www.infineon.com/igbt/>



Type	$V_{CE}$	$I_C$	$V_{CE(sat), T_j=25^\circ C}$	$T_{j,max}$	Marking Code	Package
IGW40T120	1200V	40A	1.7V	150°C	G40T120	PG-TO-247-3

**Maximum Ratings**

Parameter	Symbol	Value	Unit
Collector-emitter voltage	$V_{CE}$	1200	V
DC collector current	$I_C$		A
$T_C = 25^\circ C$		75	
$T_C = 100^\circ C$		40	
Pulsed collector current, $t_p$ limited by $T_{j,max}$	$I_{C,puls}$	105	
Turn off safe operating area	-	105	
$V_{CE} \leq 1200V, T_j \leq 150^\circ C$			
Gate-emitter voltage	$V_{GE}$	$\pm 20$	V
Short circuit withstand time <sup>2)</sup>	$t_{SC}$	10	µs
$V_{GE} = 15V, V_{CC} \leq 1200V, T_j \leq 150^\circ C$			
Power dissipation	$P_{tot}$	270	W
$T_C = 25^\circ C$			
Operating junction temperature	$T_j$	-40...+150	°C
Storage temperature	$T_{stg}$	-55...+150	
Soldering temperature, 1.6mm (0.063 in.) from case for 10s	-	260	

<sup>1</sup> J-STD-020 and JESD-022

<sup>2)</sup> Allowed number of short circuits: <1000; time between short circuits: >1s.

**Thermal Resistance**

Parameter	Symbol	Conditions	Max. Value	Unit
<b>Characteristic</b>				
IGBT thermal resistance, junction – case	$R_{thJC}$		0.45	K/W
Thermal resistance, junction – ambient	$R_{thJA}$		40	

**Electrical Characteristic, at  $T_j = 25\text{ °C}$ , unless otherwise specified**

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>Static Characteristic</b>						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=1.5mA$	1200	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE} = 15V, I_C=40A$ $T_j=25\text{ °C}$	-	1.7	2.3	
			$T_j=125\text{ °C}$	-	2.1	
			$T_j=150\text{ °C}$	-	2.3	-
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C=1.5mA, V_{CE}=V_{GE}$	5.0	5.8	6.5	
Zero gate voltage collector current	$I_{CES}$	$V_{CE}=1200V,$ $V_{GE}=0V$ $T_j=25\text{ °C}$	-	-	0.4	mA
			$T_j=150\text{ °C}$	-	-	
Gate-emitter leakage current	$I_{GES}$	$V_{CE}=0V, V_{GE}=20V$	-	-	600	nA
Transconductance	$g_{fs}$	$V_{CE}=20V, I_C=40A$	-	21	-	S
Integrated gate resistor	$R_{Gint}$			6		$\Omega$

**Dynamic Characteristic**

Input capacitance	$C_{iss}$	$V_{CE}=25V,$ $V_{GE}=0V,$ $f=1MHz$	-	2500	-	pF
Output capacitance	$C_{oss}$		-	130	-	
Reverse transfer capacitance	$C_{rss}$		-	110	-	
Gate charge	$Q_{Gate}$	$V_{CC}=960V, I_C=40A$ $V_{GE}=15V$	-	203	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	$L_E$		-	13	-	nH
Short circuit collector current <sup>1)</sup>	$I_{C(SC)}$	$V_{GE}=15V, t_{SC} \leq 10\mu s$ $V_{CC} = 600V,$ $T_j = 25^\circ C$	-	210	-	A

**Switching Characteristic, Inductive Load, at  $T_j=25^\circ C$** 

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	

**IGBT Characteristic**

Turn-on delay time	$t_{d(on)}$	$T_j=25^\circ C,$ $V_{CC}=600V, I_C=40A,$ $V_{GE}=0/15V,$ $R_G=15\Omega,$ $L_\sigma^{2)}=180nH,$ $C_\sigma^{2)}=39pF$ Energy losses include "tail" and diode reverse recovery.	-	48	-	ns
Rise time	$t_r$		-	34	-	
Turn-off delay time	$t_{d(off)}$		-	480	-	
Fall time	$t_f$		-	70	-	mJ
Turn-on energy	$E_{on}$		-	3.3	-	
Turn-off energy	$E_{off}$		-	3.2	-	
Total switching energy	$E_{ts}$		-	6.5	-	

**Switching Characteristic, Inductive Load, at  $T_j=150^\circ C$** 

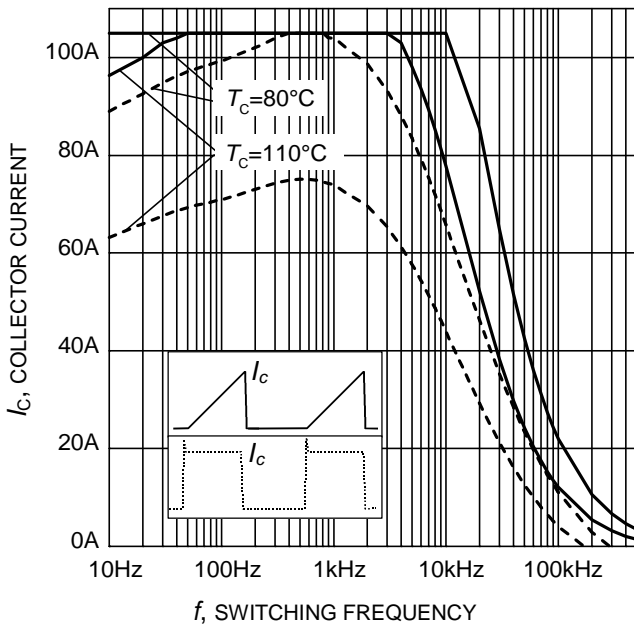
Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	

**IGBT Characteristic**

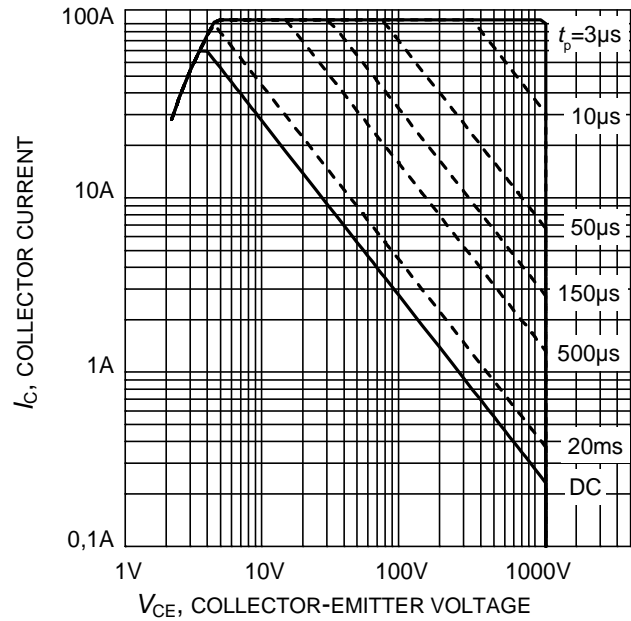
Turn-on delay time	$t_{d(on)}$	$T_j=150^\circ C$ $V_{CC}=600V, I_C=40A,$ $V_{GE}=0/15V,$ $R_G=15\Omega,$ $L_\sigma^{2)}=180nH,$ $C_\sigma^{2)}=39pF$ Energy losses include "tail" and diode reverse recovery.	-	52	-	ns
Rise time	$t_r$		-	40	-	
Turn-off delay time	$t_{d(off)}$		-	580	-	
Fall time	$t_f$		-	120	-	mJ
Turn-on energy	$E_{on}$		-	5.0	-	
Turn-off energy	$E_{off}$		-	5.4	-	
Total switching energy	$E_{ts}$		-	10.4	-	

<sup>1)</sup> Allowed number of short circuits: <1000; time between short circuits: >1s.

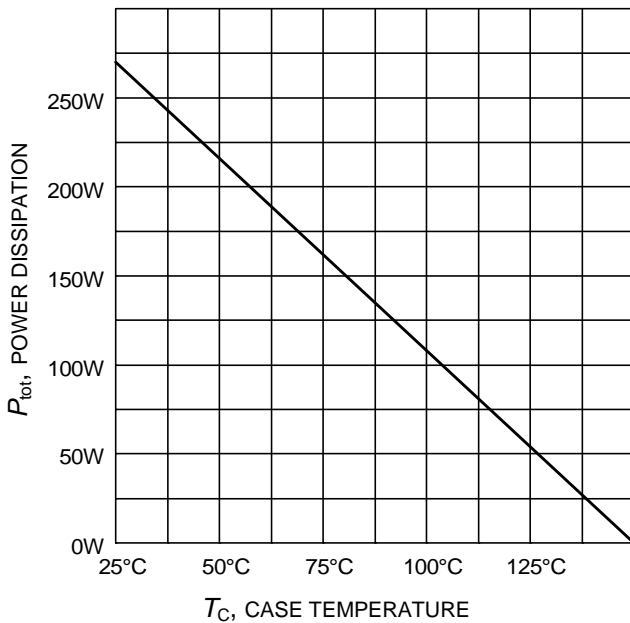
<sup>2)</sup> Leakage inductance  $L_\sigma$  and Stray capacity  $C_\sigma$  due to dynamic test circuit in Figure E.



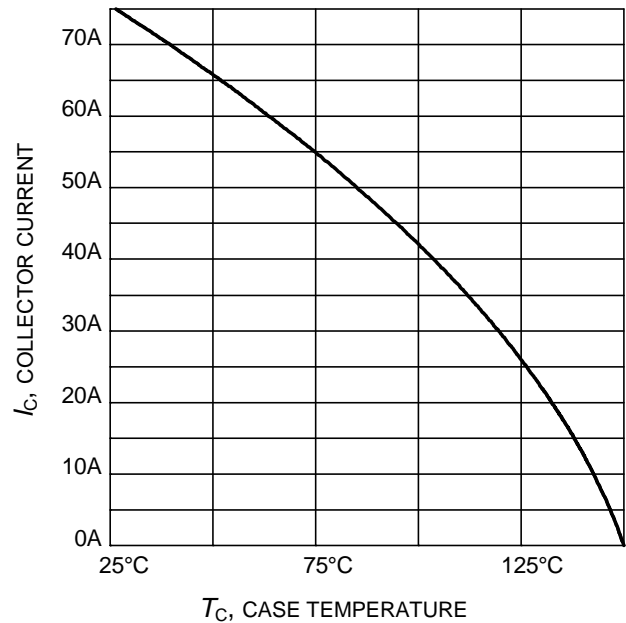
**Figure 1. Collector current as a function of switching frequency**  
 ( $T_j \leq 150^\circ\text{C}$ ,  $D = 0.5$ ,  $V_{CE} = 600\text{V}$ ,  
 $V_{GE} = 0/+15\text{V}$ ,  $R_G = 15\Omega$ )



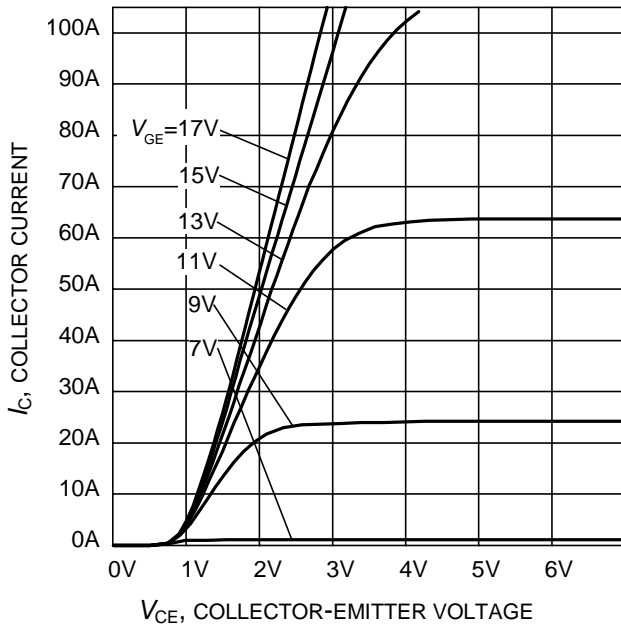
**Figure 2. Safe operating area**  
 ( $D = 0$ ,  $T_C = 25^\circ\text{C}$ ,  
 $T_j \leq 150^\circ\text{C}$ ;  $V_{GE} = 15\text{V}$ )



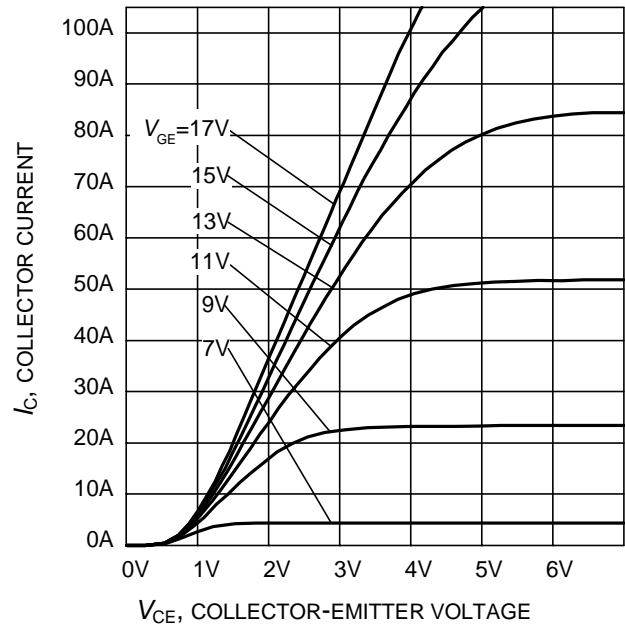
**Figure 3. Power dissipation as a function of case temperature**  
 ( $T_j \leq 150^\circ\text{C}$ )



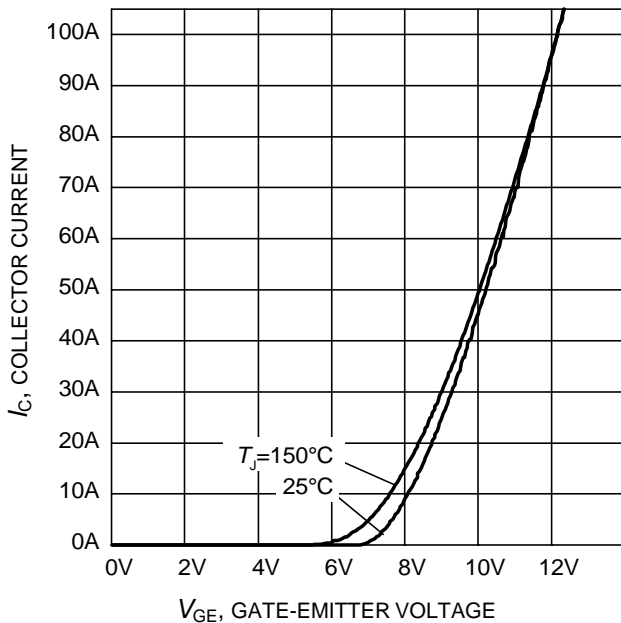
**Figure 4. Collector current as a function of case temperature**  
 ( $V_{GE} \geq 15\text{V}$ ,  $T_j \leq 150^\circ\text{C}$ )



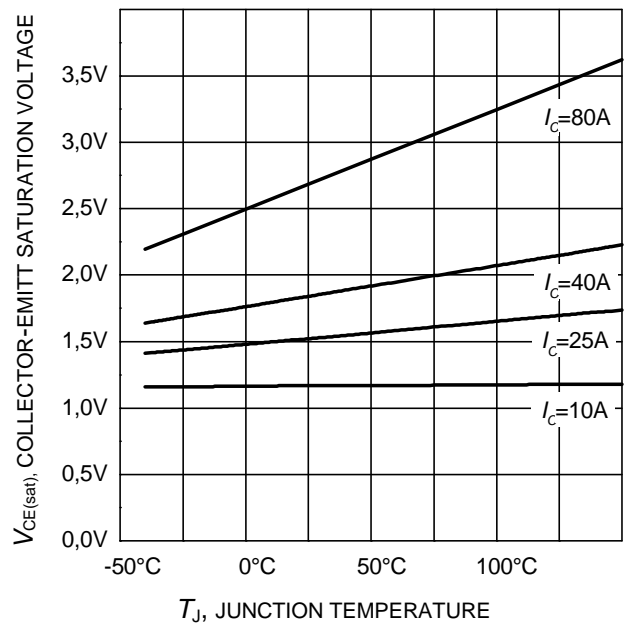
**Figure 5. Typical output characteristic**  
( $T_j = 25^\circ\text{C}$ )



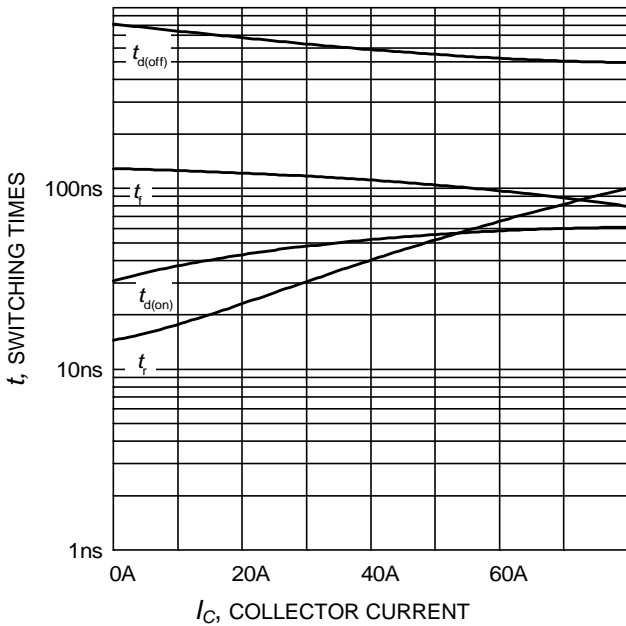
**Figure 6. Typical output characteristic**  
( $T_j = 150^\circ\text{C}$ )



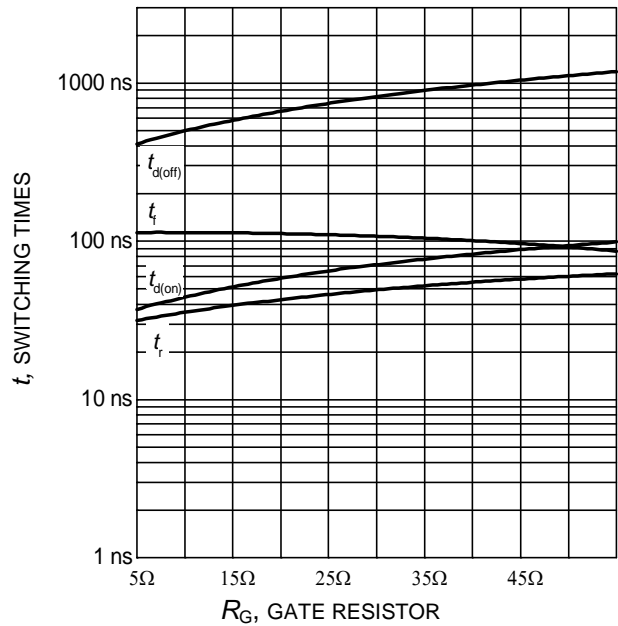
**Figure 7. Typical transfer characteristic**  
( $V_{CE} = 20\text{V}$ )



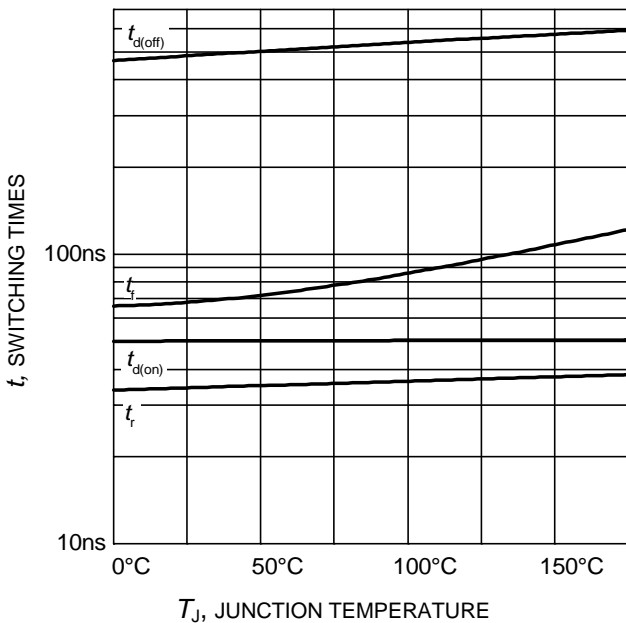
**Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature**  
( $V_{GE} = 15\text{V}$ )



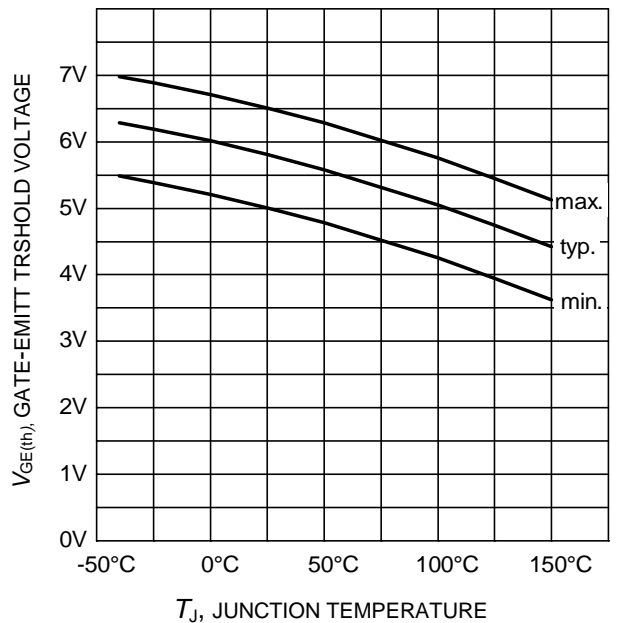
**Figure 9. Typical switching times as a function of collector current**  
 (inductive load,  $T_J=150^{\circ}\text{C}$ ,  $V_{CE}=600\text{V}$ ,  $V_{GE}=0/15\text{V}$ ,  $R_G=15\Omega$ , Dynamic test circuit in Figure E)



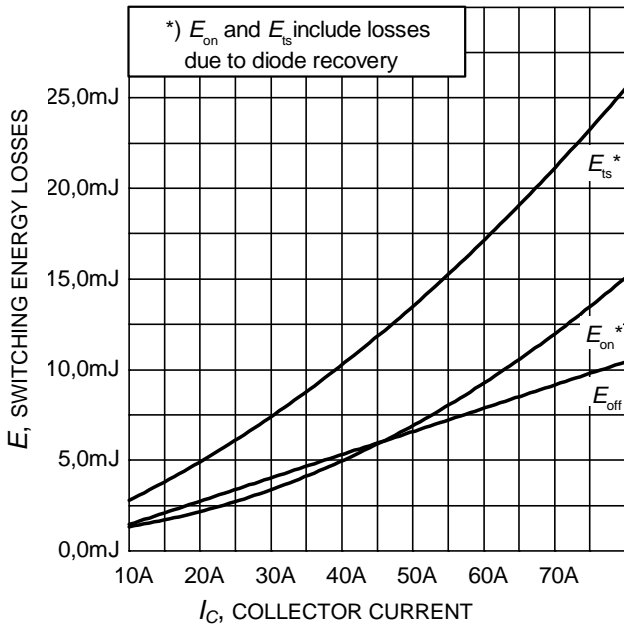
**Figure 10. Typical switching times as a function of gate resistor**  
 (inductive load,  $T_J=150^{\circ}\text{C}$ ,  $V_{CE}=600\text{V}$ ,  $V_{GE}=0/15\text{V}$ ,  $I_C=40\text{A}$ , Dynamic test circuit in Figure E)



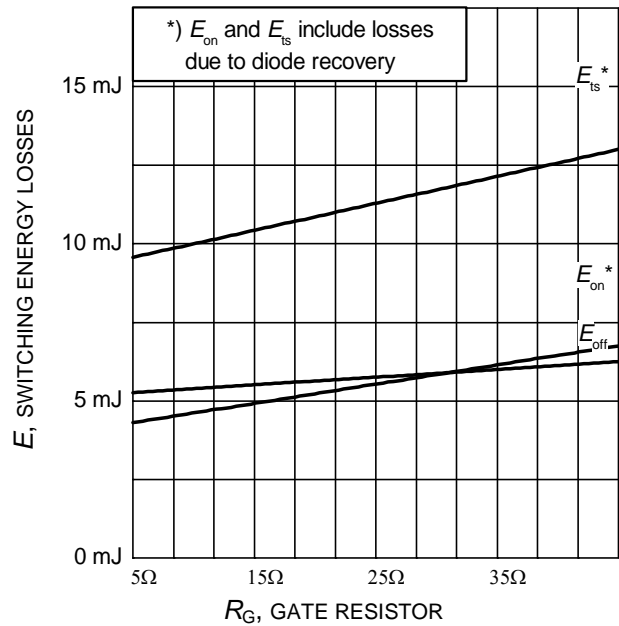
**Figure 11. Typical switching times as a function of junction temperature**  
 (inductive load,  $V_{CE}=600\text{V}$ ,  $V_{GE}=0/15\text{V}$ ,  $I_C=40\text{A}$ ,  $R_G=15\Omega$ , Dynamic test circuit in Figure E)



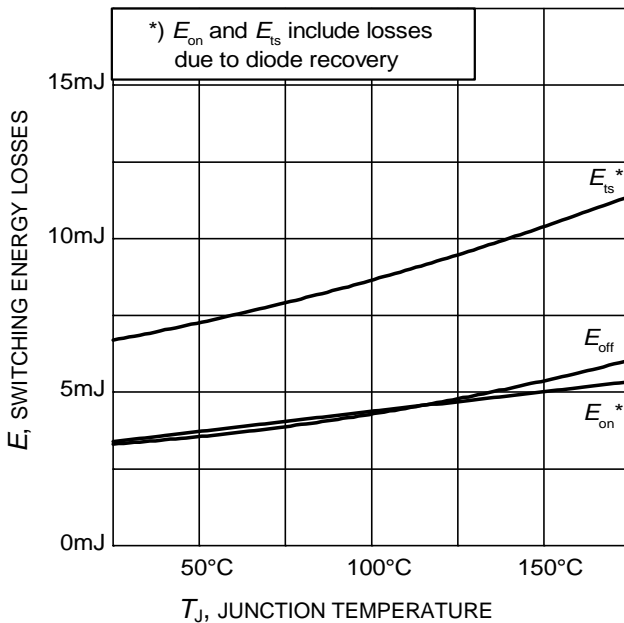
**Figure 12. Gate-emitter threshold voltage as a function of junction temperature**  
 ( $I_C = 1.5\text{mA}$ )



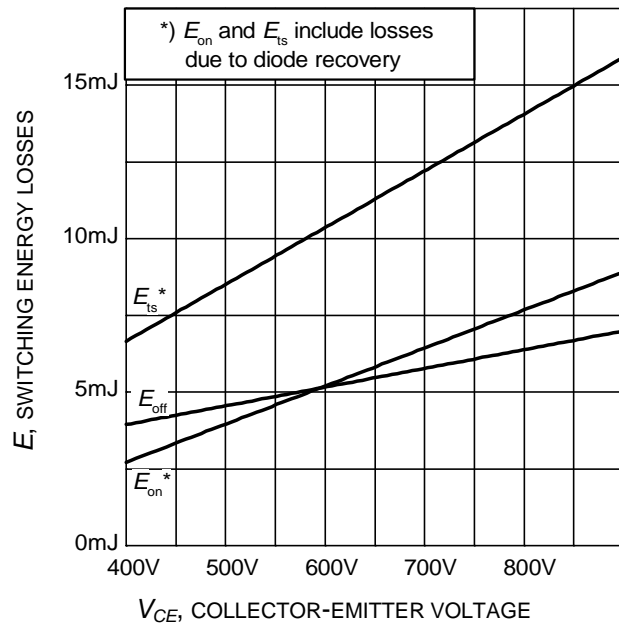
**Figure 13. Typical switching energy losses as a function of collector current**  
 (inductive load,  $T_J=150^\circ\text{C}$ ,  $V_{CE}=600\text{V}$ ,  $V_{GE}=0/15\text{V}$ ,  $R_G=15\Omega$ , Dynamic test circuit in Figure E)



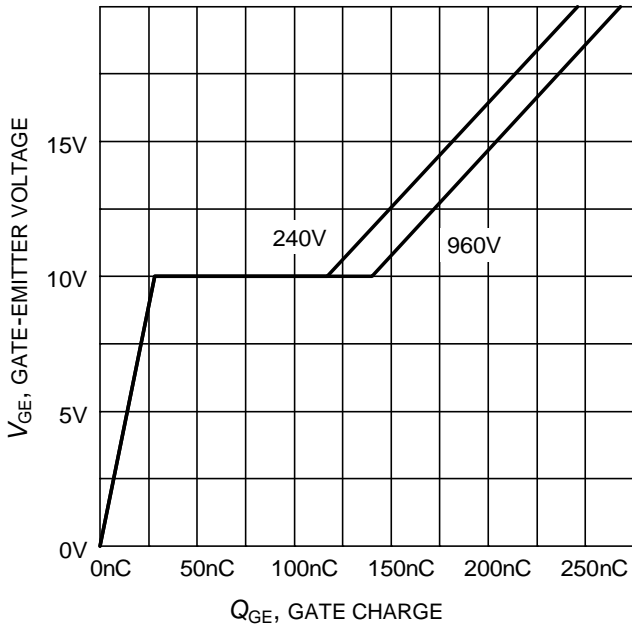
**Figure 14. Typical switching energy losses as a function of gate resistor**  
 (inductive load,  $T_J=150^\circ\text{C}$ ,  $V_{CE}=600\text{V}$ ,  $V_{GE}=0/15\text{V}$ ,  $I_C=40\text{A}$ , Dynamic test circuit in Figure E)



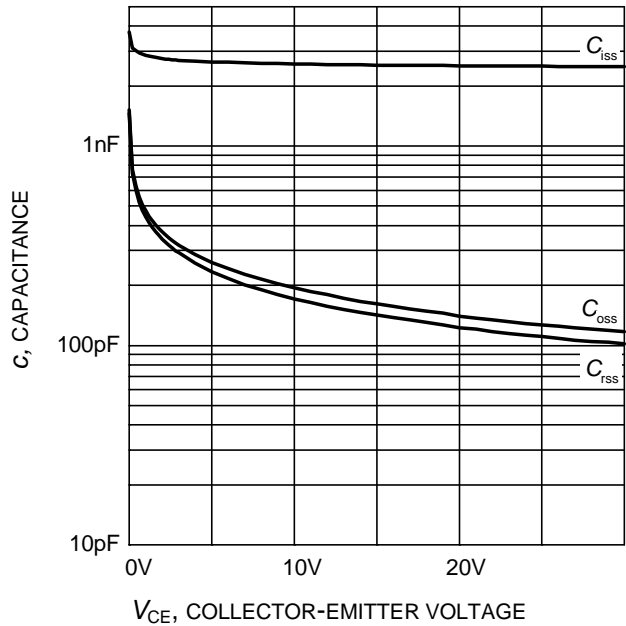
**Figure 15. Typical switching energy losses as a function of junction temperature**  
 (inductive load,  $V_{CE}=600\text{V}$ ,  $V_{GE}=0/15\text{V}$ ,  $I_C=40\text{A}$ ,  $R_G=15\Omega$ , Dynamic test circuit in Figure E)



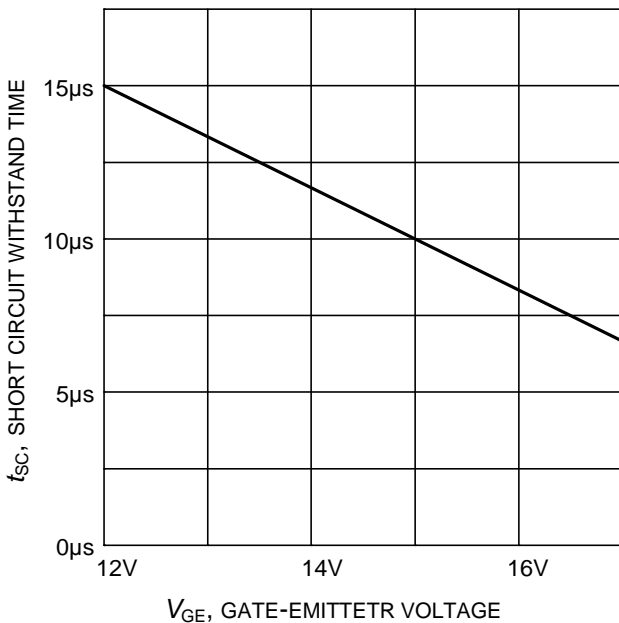
**Figure 16. Typical switching energy losses as a function of collector emitter voltage**  
 (inductive load,  $T_J=150^\circ\text{C}$ ,  $V_{GE}=0/15\text{V}$ ,  $I_C=40\text{A}$ ,  $R_G=15\Omega$ , Dynamic test circuit in Figure E)



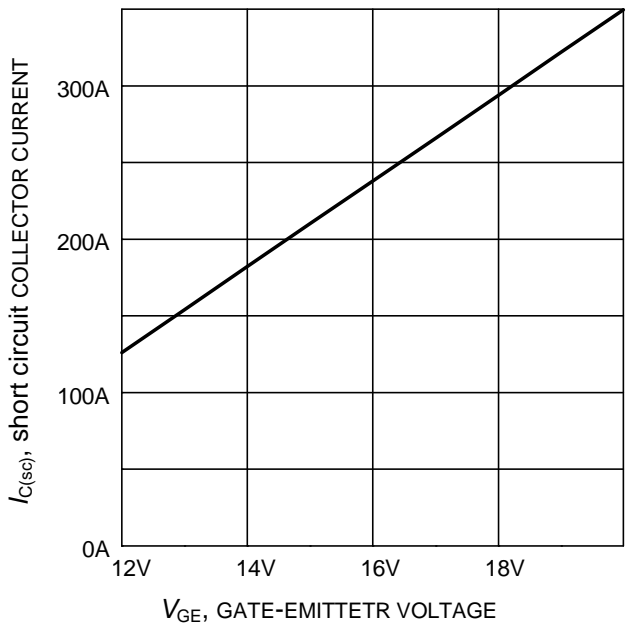
**Figure 17. Typical gate charge**  
( $I_C=40\text{ A}$ )



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

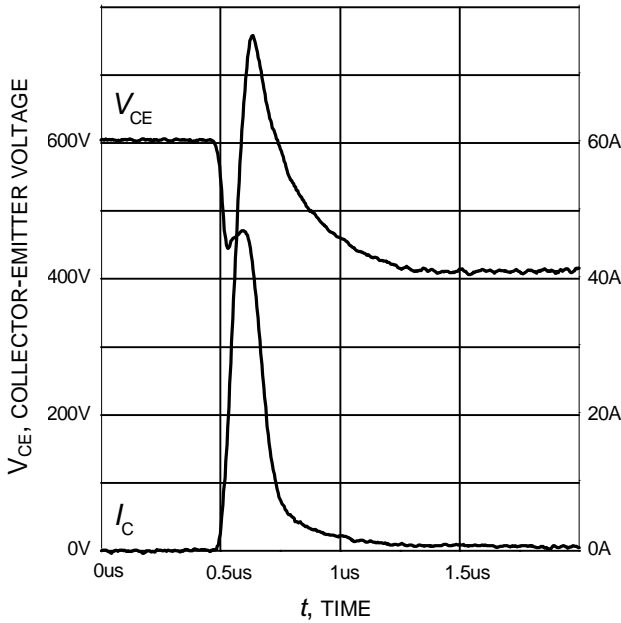


**Figure 19. Short circuit withstand time as a function of gate-emitter voltage**  
( $V_{CE}=600\text{V}$ , start at  $T_j=25^\circ\text{C}$ )

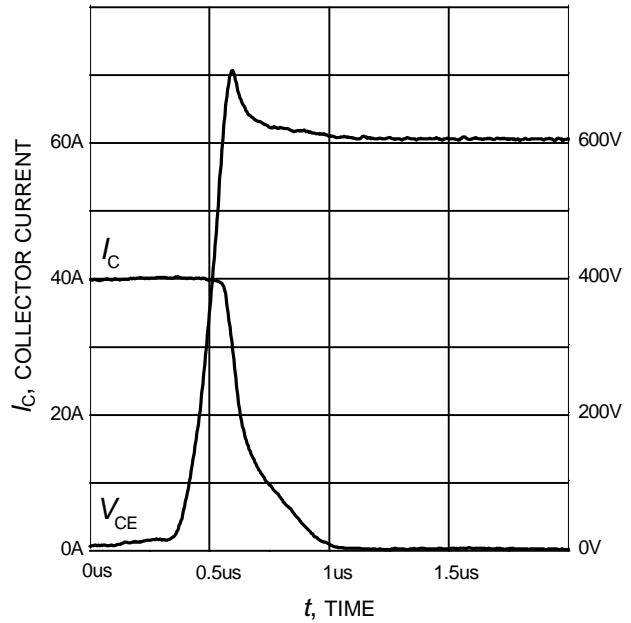


**Figure 20. Typical short circuit collector current as a function of gate-emitter voltage**  
( $V_{CE} \leq 600\text{V}$ ,  $T_j \leq 150^\circ\text{C}$ )

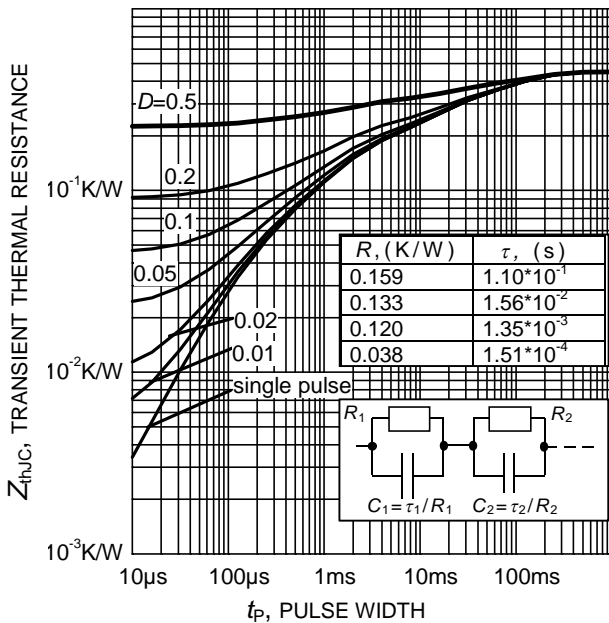




**Figure 21. Typical turn on behavior**  
 ( $V_{GE}=0/15V$ ,  $R_G=15\Omega$ ,  $T_j = 150^\circ C$ ,  
 Dynamic test circuit in Figure E)

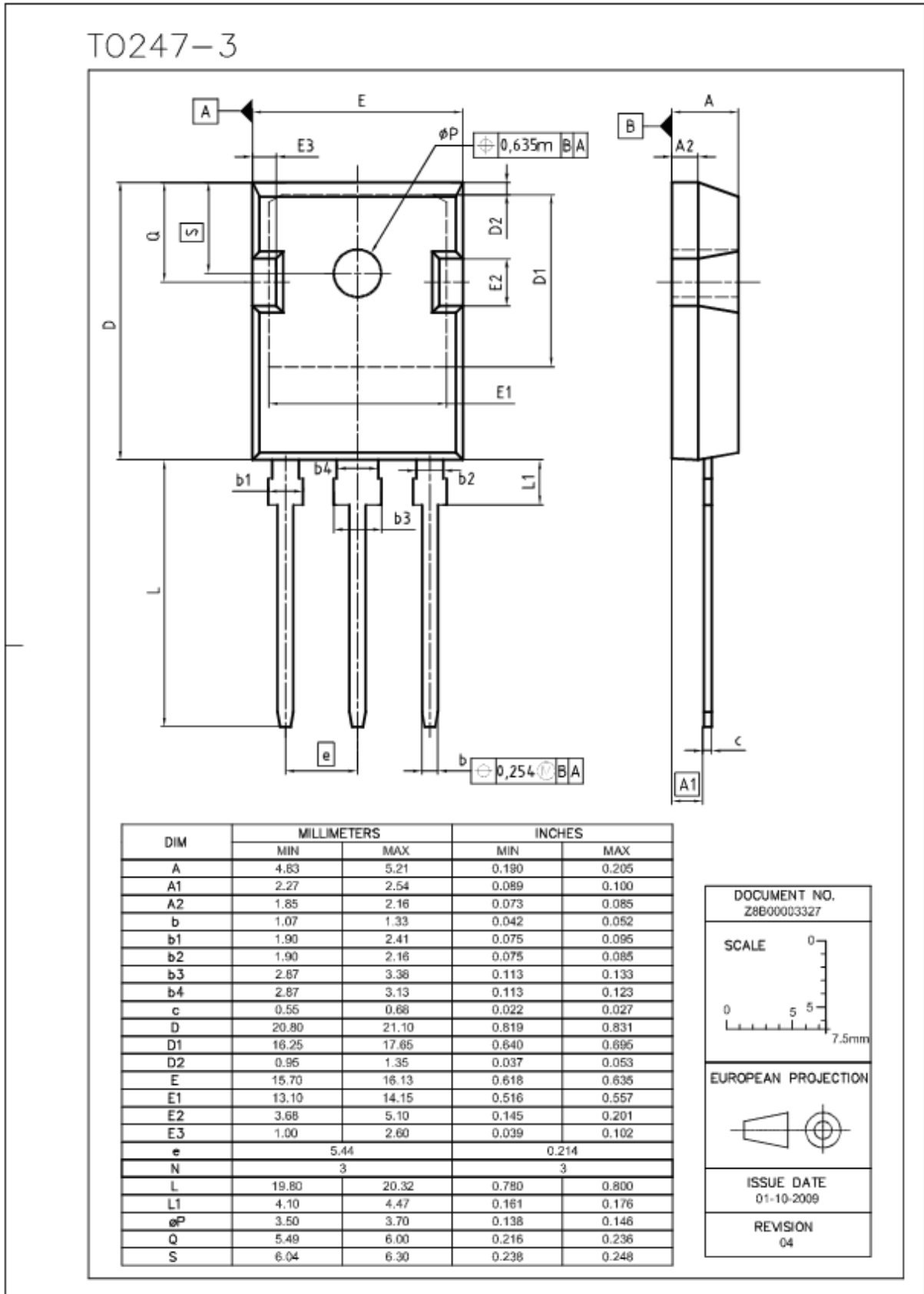


**Figure 22. Typical turn off behavior**  
 ( $V_{GE}=15/0V$ ,  $R_G=15\Omega$ ,  $T_j = 150^\circ C$ ,  
 Dynamic test circuit in Figure E)



**Figure 23. IGBT transient thermal resistance**  
 ( $D = t_p / T$ )

PG-TO247-3



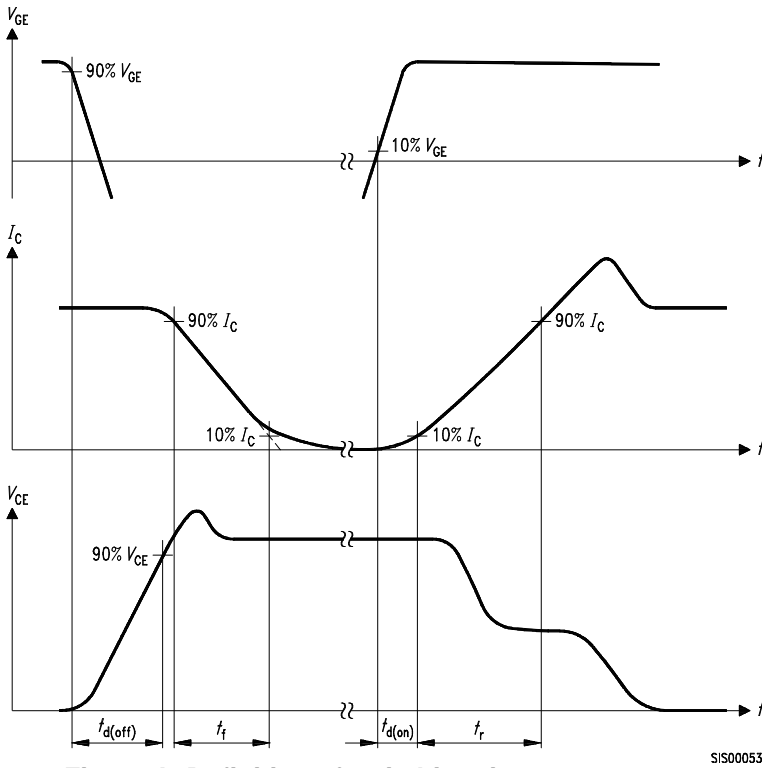


Figure A. Definition of switching times

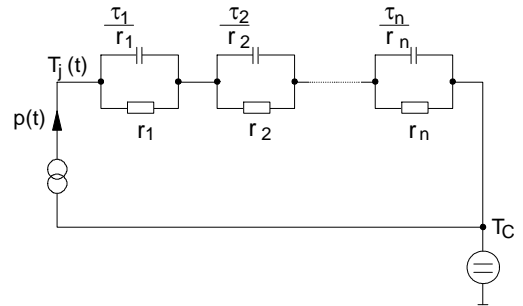


Figure D. Thermal equivalent circuit

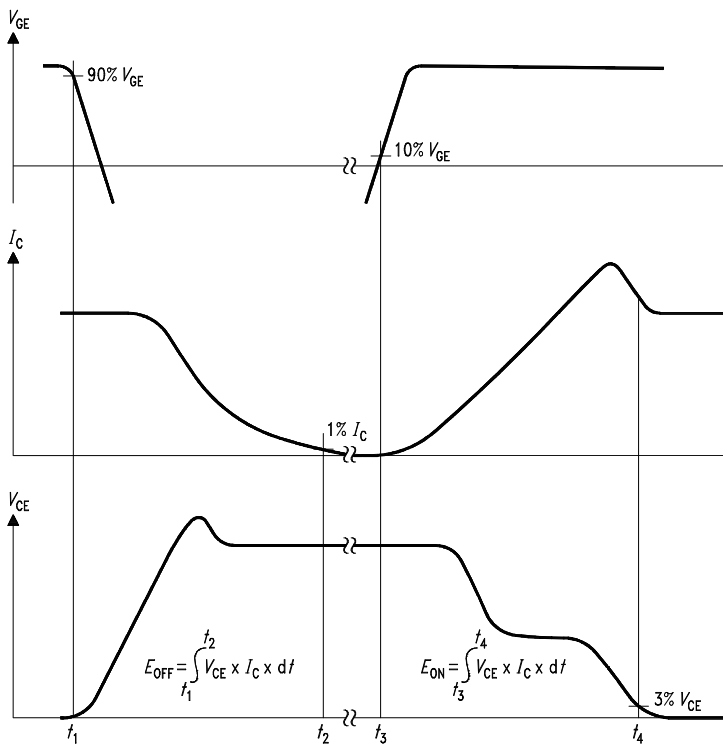


Figure B. Definition of switching losses

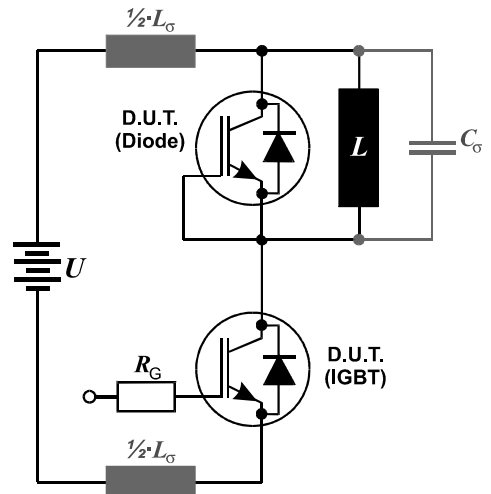


Figure E. Dynamic test circuit  
Leakage inductance  $L_{\sigma} = 180\text{nH}$   
and Stray capacity  $C_{\sigma} = 39\text{pF}$ .



TrenchStop® Series

IGW40T120

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**Edition 2006-01**

**Published by  
Infineon Technologies AG  
81726 München, Germany**

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