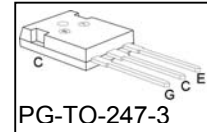
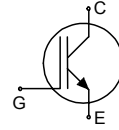


Low Loss IGBT in TrenchStop® and Fieldstop technology

- Approx. 1.0V reduced $V_{CE(sat)}$ compared to BUP313
- Short circuit withstand time – 10 μ s
- 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 JEDEC¹ 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	$V_{CE(sat)}, T_J=25^\circ\text{C}$	$T_{j,max}$	Marking Code	Package
IGW15T120	1200V	15A	1.7V	150°C	G15T120	PG-TO-247-3

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	1200	V
DC collector current	I_C	30	A
$T_C = 25^\circ\text{C}$		15	
$T_C = 100^\circ\text{C}$		15	
Pulsed collector current, t_p limited by $T_{j,max}$	$I_{C,puls}$	45	
Turn off safe operating area	-	45	
$V_{CE} \leq 1200\text{V}, T_J \leq 150^\circ\text{C}$			
Gate-emitter voltage	V_{GE}	± 20	V
Short circuit withstand time ²⁾	t_{SC}	10	μs
$V_{GE} = 15\text{V}, V_{CC} \leq 1200\text{V}, T_J \leq 150^\circ\text{C}$			
Power dissipation	P_{tot}	110	W
$T_C = 25^\circ\text{C}$			
Operating junction temperature	T_j	-40...+150	$^\circ\text{C}$
Storage temperature	T_{stg}	-55...+150	
Soldering temperature, 1.6mm (0.063 in.) from case for 10s	-	260	

¹ J-STD-020 and JEDEC-022

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

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction – case	R_{thJC}		1.1	K/W
Thermal resistance, junction – ambient	R_{thJA}		40	

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

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=0.5mA$	1200	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE} = 15V, I_C=15A$ $T_J=25^{\circ}C$ $T_J=125^{\circ}C$ $T_J=150^{\circ}C$	- - -	1.7 2.0 2.2	2.2 - -	
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C=0.6mA, V_{CE}=V_{GE}$	5.0	5.8	6.5	
Zero gate voltage collector current	I_{CES}	$V_{CE}=1200V, V_{GE}=0V$ $T_J=25^{\circ}C$ $T_J=150^{\circ}C$	- -	- -	0.2 2.0	
Gate-emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V$	-	-	100	nA
Transconductance	g_{fs}	$V_{CE}=20V, I_C=15A$	-	10	-	S
Integrated gate resistor	R_{Gint}		none			Ω

Dynamic Characteristic

Input capacitance	C_{iss}	$V_{CE}=25V, V_{GE}=0V, f=1MHz$	-	1100	-	pF
Output capacitance	C_{oss}		-	100	-	
Reverse transfer capacitance	C_{rss}		-	50	-	
Gate charge	Q_{Gate}	$V_{CC}=960V, I_C=15A, V_{GE}=15V$	-	85	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13	-	nH
Short circuit collector current ¹⁾	$I_{C(SC)}$	$V_{GE}=15V, t_{SC}\leq 10\mu s, V_{CC}=600V, T_j=25^\circ\text{C}$	-	90	-	A

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

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

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	$T_j=25^{\circ}\text{C}$, $V_{CC}=600\text{V}$, $I_C=15\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=56\Omega$, $L_{\sigma}^{2)}=180\text{nH}$, $C_{\sigma}^{2)}=39\text{pF}$ Energy losses include “tail” and diode reverse recovery.	-	50	-	ns
Rise time	t_r		-	30	-	
Turn-off delay time	$t_{d(off)}$		-	520	-	
Fall time	t_f		-	60	-	
Turn-on energy	E_{on}		-	1.3	-	mJ
Turn-off energy	E_{off}		-	1.4	-	
Total switching energy	E_{ts}		-	2.7	-	

Switching Characteristic, Inductive Load, at $T_j=150^\circ\text{C}$

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	$T_J=150^{\circ}\text{C}$, $V_{CC}=600\text{V}$, $I_C=15\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=56\Omega$ $L_{\sigma}^{2)}=180\text{nH}$, $C_{\sigma}^{2)}=39\text{pF}$	-	50	-	ns
Rise time	t_r		-	35	-	
Turn-off delay time	$t_{d(off)}$		-	600	-	
Fall time	t_f		-	120	-	
Turn-on energy	E_{on}	Energy losses include “tail” and diode reverse recovery.	-	2.0	-	mJ
Turn-off energy	E_{off}		-	2.1	-	
Total switching energy	E_{ts}		-	4.1	-	

²⁾ Leakage inductance L_{σ} and Stray capacity C_{σ} due to dynamic test circuit in Figure E.

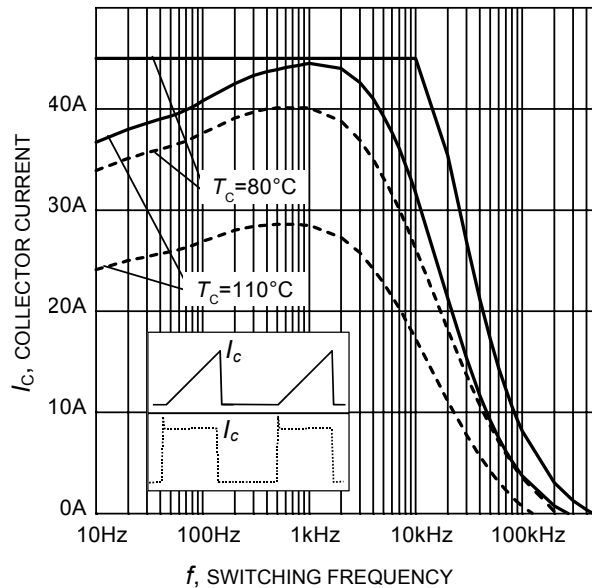


Figure 1. Collector current as a function of switching frequency
 $(T_j \leq 150^\circ\text{C}, D = 0.5, V_{CE} = 600\text{V}, V_{GE} = 0/+15\text{V}, R_G = 56\Omega)$

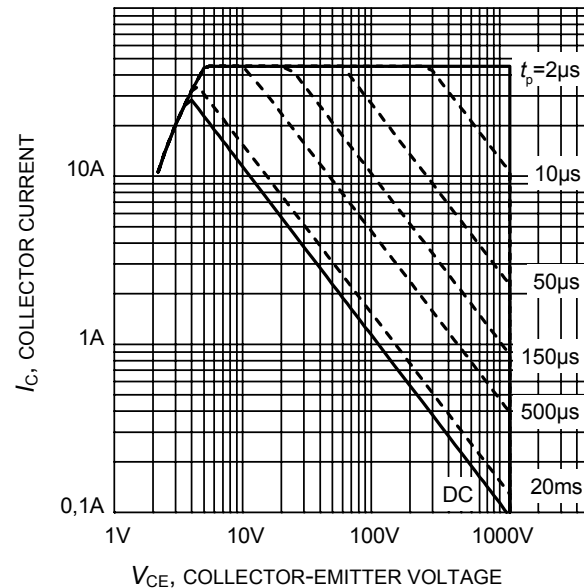


Figure 2. Safe operating area
 $(D = 0, T_C = 25^\circ\text{C}, T_j \leq 150^\circ\text{C}; V_{GE} = 15\text{V})$

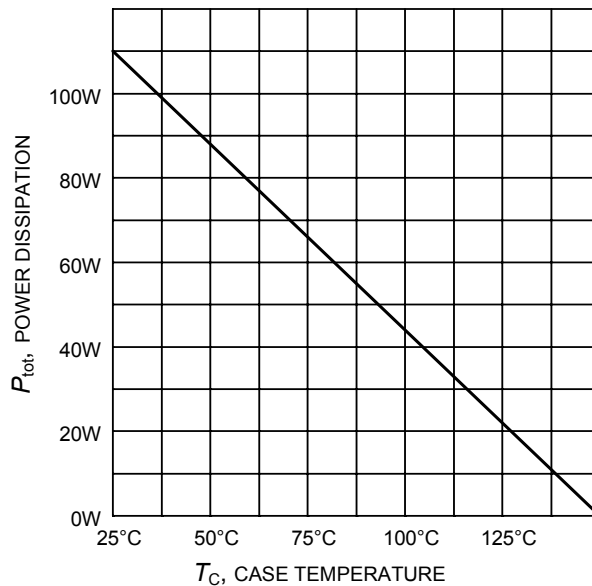


Figure 3. Power dissipation as a function of case temperature
 $(T_j \leq 150^\circ\text{C})$

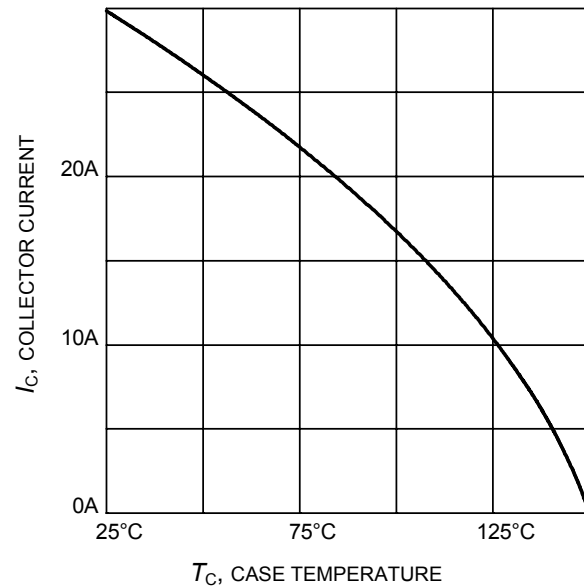


Figure 4. Collector current as a function of case temperature
 $(V_{GE} \geq 15\text{V}, T_j \leq 150^\circ\text{C})$

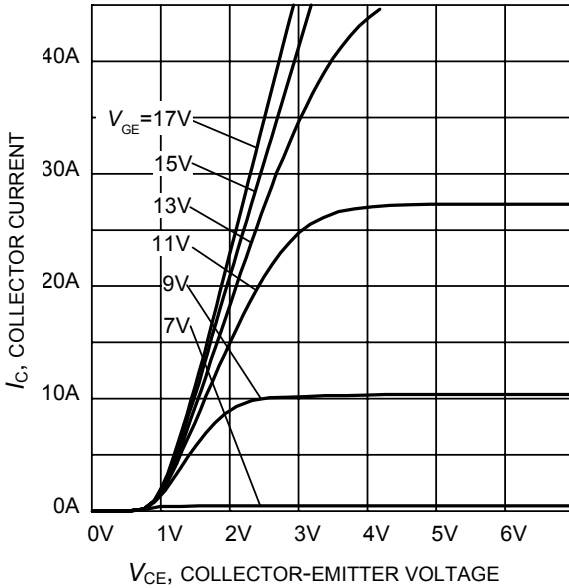


Figure 5. Typical output characteristic
($T_j = 25^\circ\text{C}$)

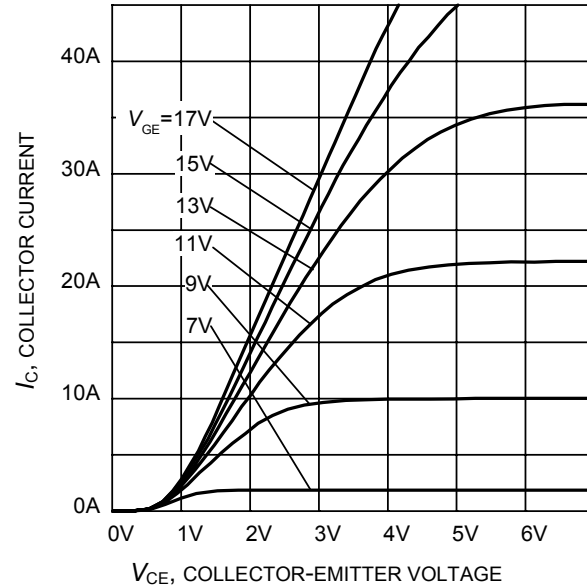


Figure 6. Typical output characteristic
($T_j = 150^\circ\text{C}$)

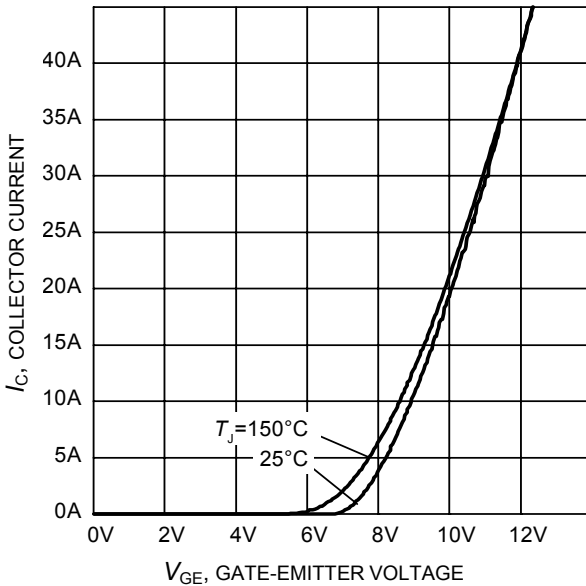


Figure 7. Typical transfer characteristic
($V_{ce} = 20\text{V}$)

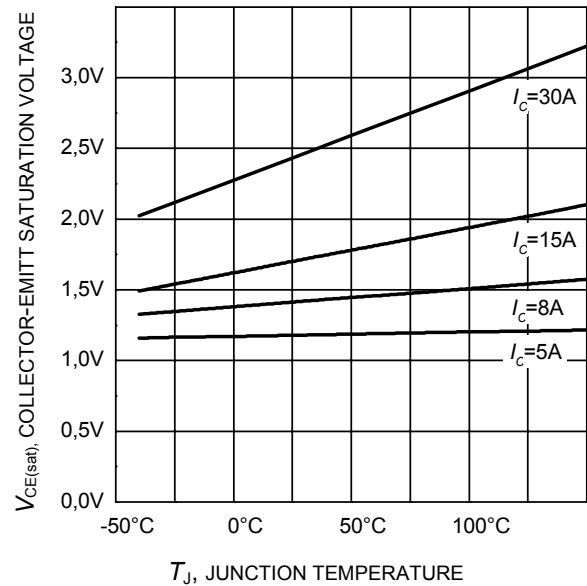


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
($V_{ge} = 15\text{V}$)

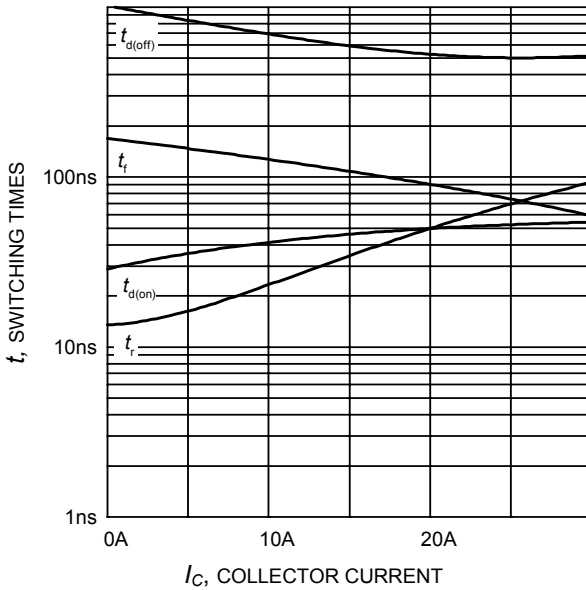


Figure 9. Typical switching times as a function of collector current
(inductive load, $T_J = 150^\circ\text{C}$,
 $V_{CE} = 600\text{V}$, $V_{GE} = 0/15\text{V}$, $R_G = 56\Omega$,
Dynamic test circuit in Figure E)

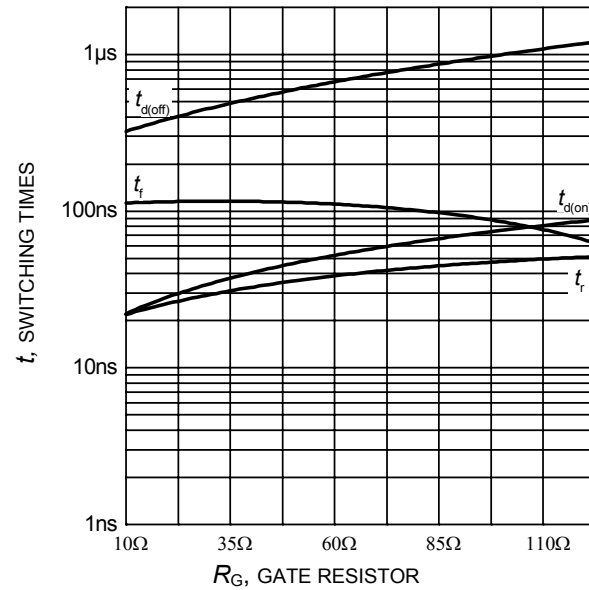


Figure 10. Typical switching times as a function of gate resistor
(inductive load, $T_J = 150^\circ\text{C}$,
 $V_{CE} = 600\text{V}$, $V_{GE} = 0/15\text{V}$, $I_C = 15\text{A}$,
Dynamic test circuit in Figure E)

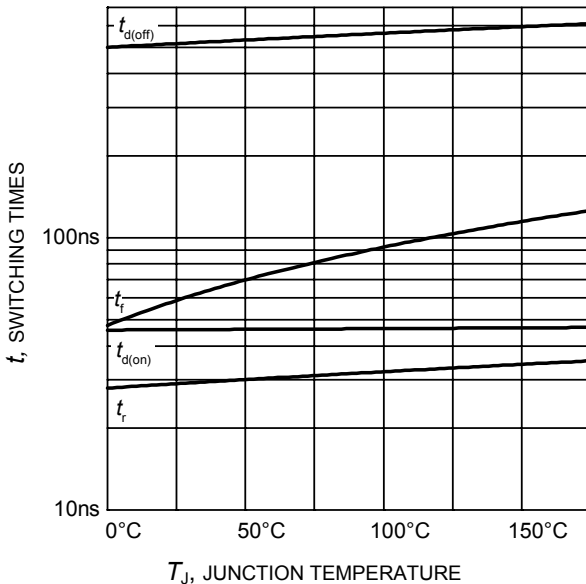


Figure 11. Typical switching times as a function of junction temperature
(inductive load, $V_{CE} = 600\text{V}$,
 $V_{GE} = 0/15\text{V}$, $I_C = 15\text{A}$, $R_G = 56\Omega$,
Dynamic test circuit in Figure E)

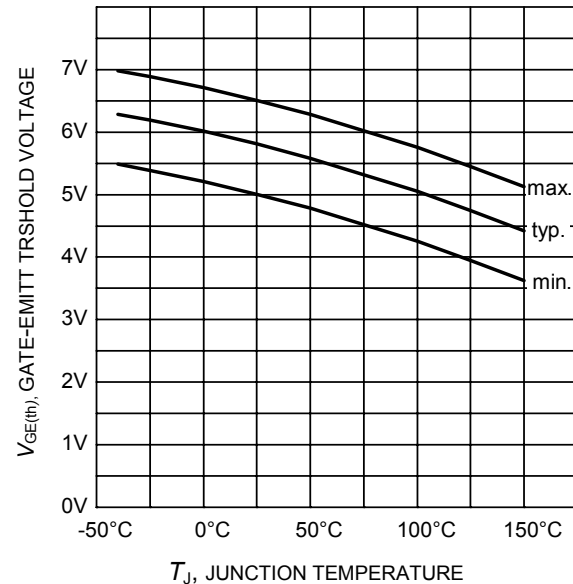


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
($I_C = 0.6\text{mA}$)

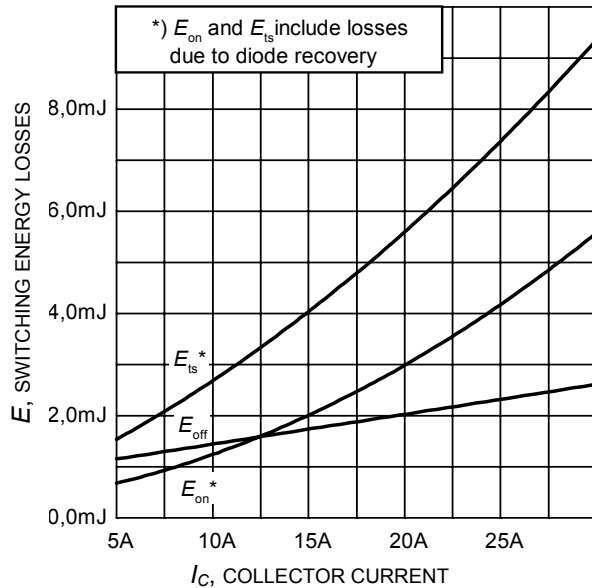


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, $T_J=150^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=56\Omega$, Dynamic test circuit in Figure E)

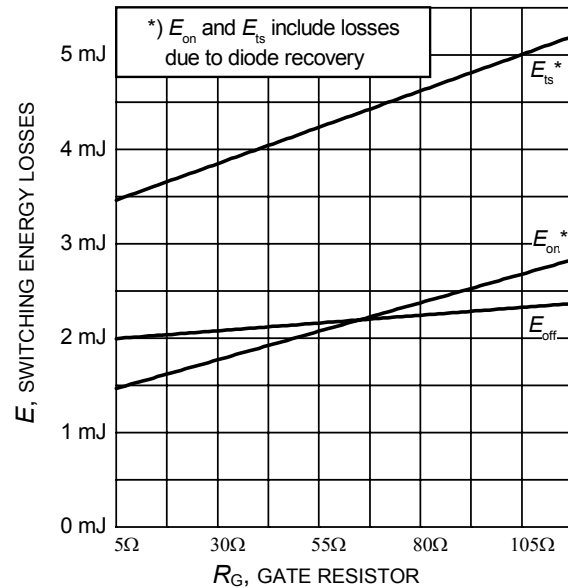


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, $T_J=150^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=15\text{A}$, Dynamic test circuit in Figure E)

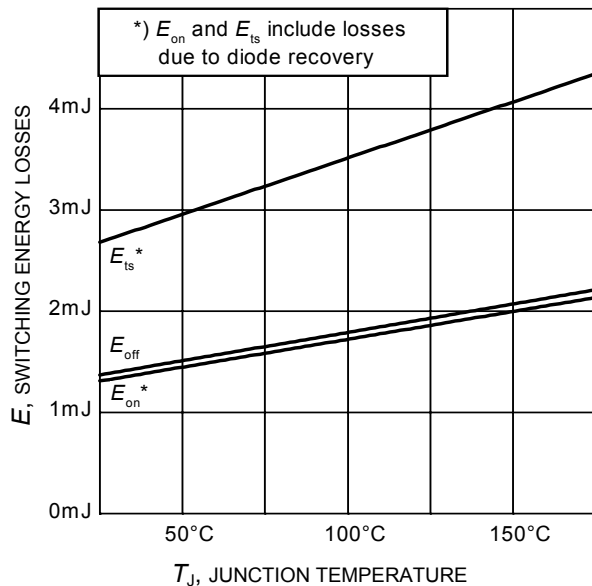


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=15\text{A}$, $R_G=56\Omega$, Dynamic test circuit in Figure E)

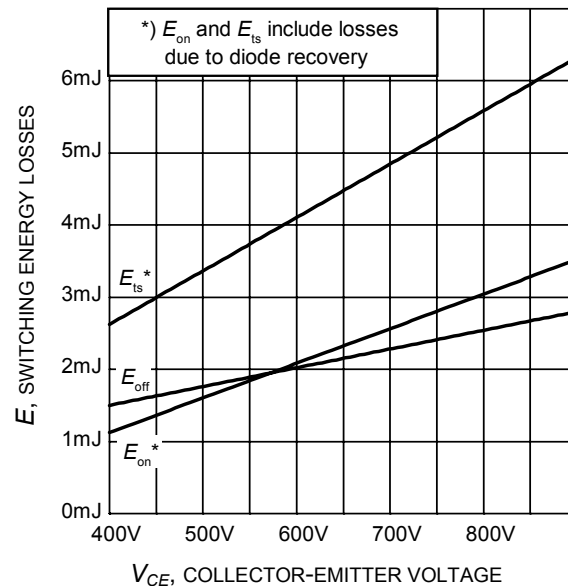


Figure 16. Typical switching energy losses as a function of collector emitter voltage
(inductive load, $T_J=150^\circ\text{C}$, $V_{GE}=0/15\text{V}$, $I_C=15\text{A}$, $R_G=56\Omega$, Dynamic test circuit in Figure E)

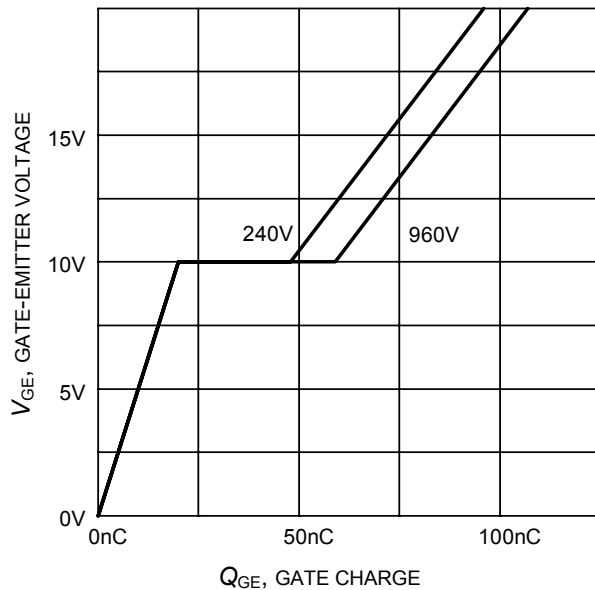


Figure 17. Typical gate charge
($I_C = 15\text{ A}$)

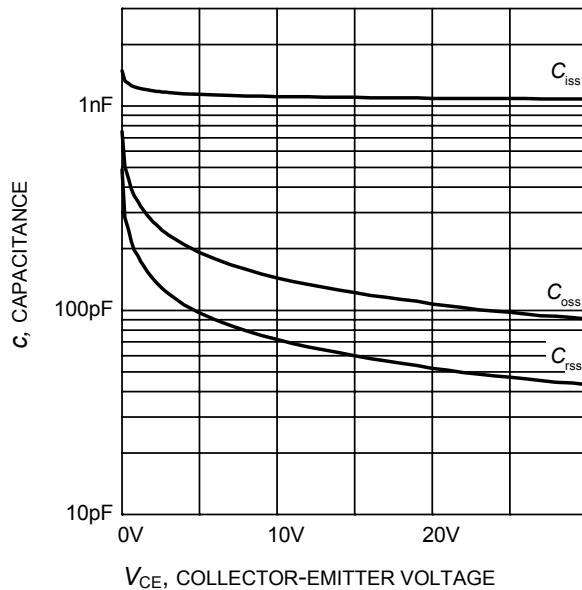


Figure 18. Typical capacitance as a function of collector-emitter voltage
($V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$)

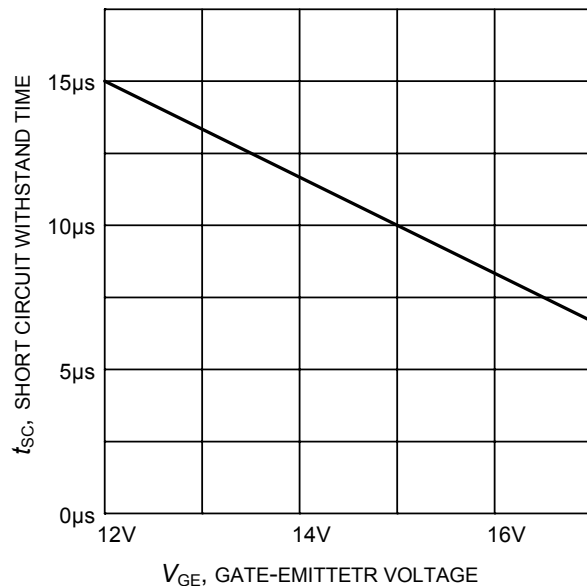


Figure 19. Short circuit withstand time as a function of gate-emitter voltage
($V_{CE} = 600\text{ V}$, start at $T_J = 25^\circ\text{C}$)

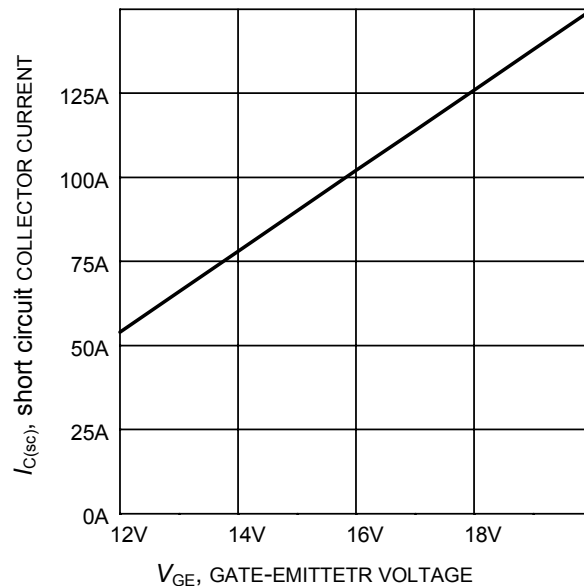


Figure 20. Typical short circuit collector current as a function of gate-emitter voltage
($V_{CE} \leq 600\text{ V}$, $T_J \leq 150^\circ\text{C}$)

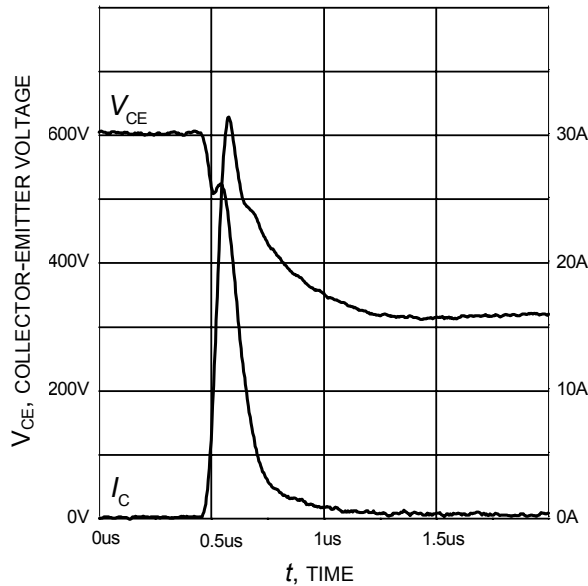


Figure 21. Typical turn on behavior
 $(V_{GE}=0/15V, R_G=56\Omega, T_j = 150^\circ C,$
 Dynamic test circuit in Figure E)

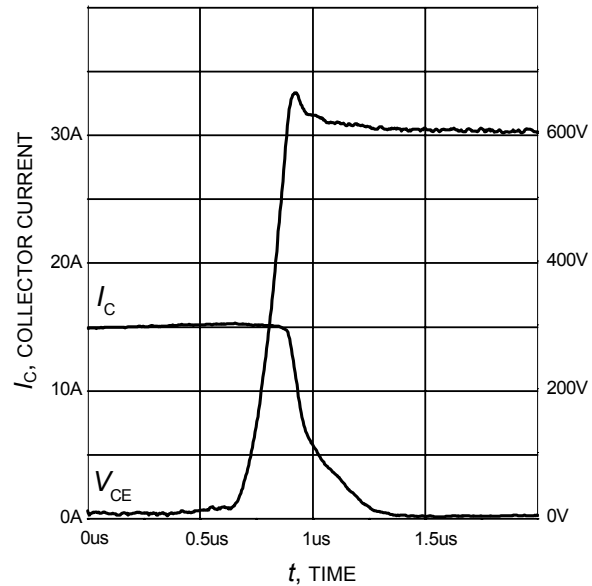


Figure 22. Typical turn off behavior
 $(V_{GE}=15/0V, R_G=56\Omega, T_j = 150^\circ C,$
 Dynamic test circuit in Figure E)

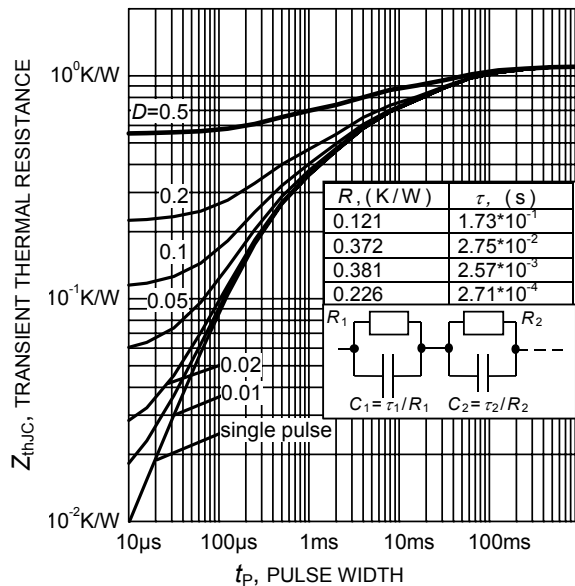
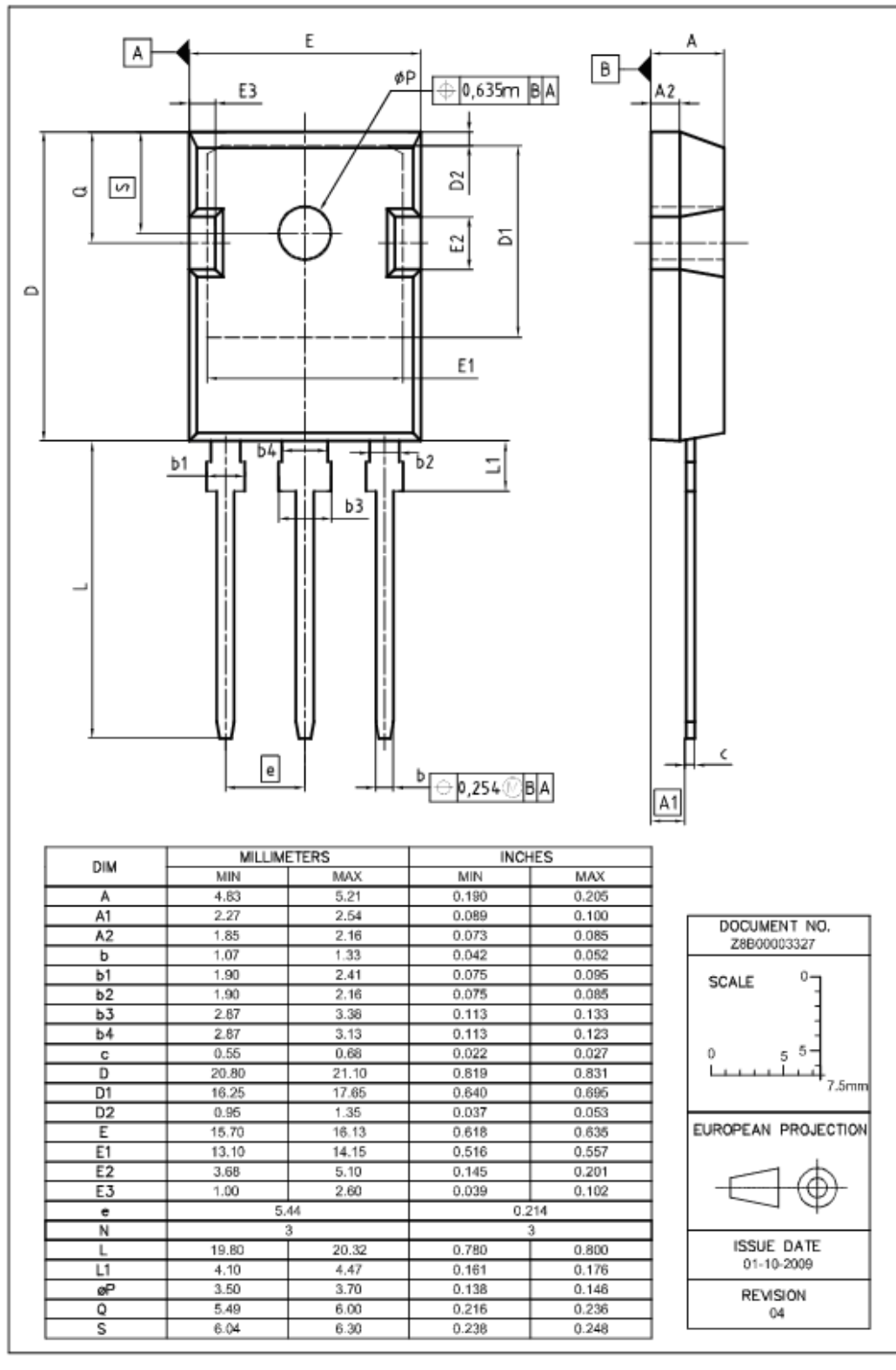


Figure 23. IGBT transient thermal resistance
 $(D = t_p / T)$

T0247-3



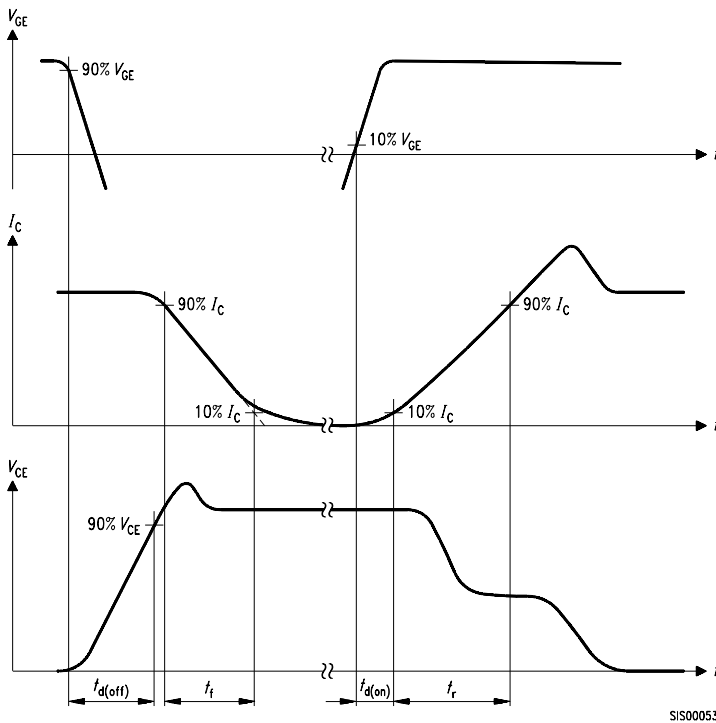


Figure A. Definition of switching times

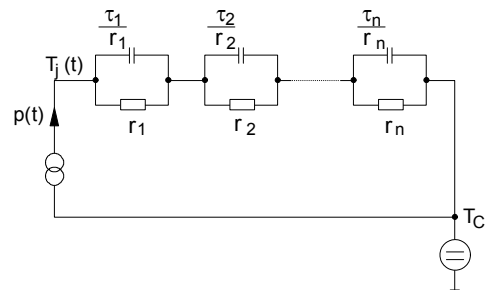


Figure D. Thermal equivalent circuit

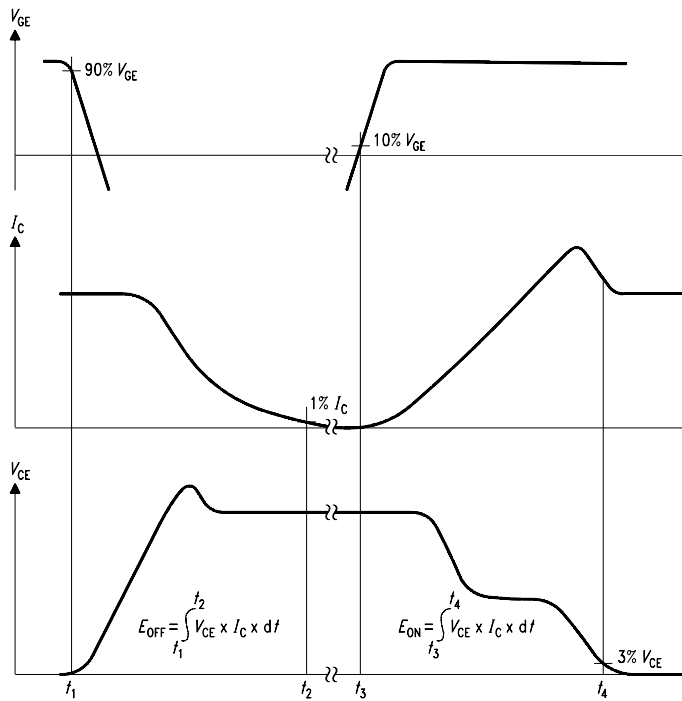


Figure B. Definition of switching losses

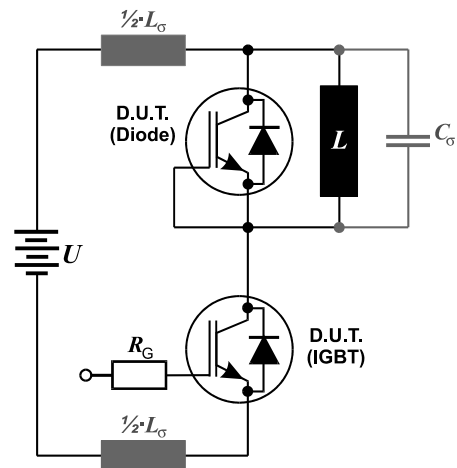


Figure E. Dynamic test circuit
Leakage inductance $L_\sigma = 180\text{nH}$
and Stray capacity $C_\sigma = 39\text{pF}$.

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