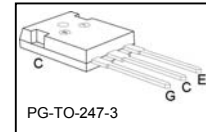
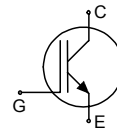


High Speed IGBT in NPT-technology

- 30% lower E_{off} compared to previous generation
- Short circuit withstand time – 10 μ s
- Designed for operation above 30 kHz
- NPT-Technology for 600V applications offers:
 - parallel switching capability
 - moderate E_{off} increase with temperature
 - very tight parameter distribution
- High ruggedness, temperature stable behaviour
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC¹ for target applications
- Complete product spectrum and PSpice Models : <http://www.infineon.com/igbt/>



Type	V_{CE}	I_C	E_{off25}	T_j	Marking	Package
SGW50N60HS	600V	50A	0.88mJ	150°C	G50N60HS	PG-TO-247-3

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	600	V
DC collector current	I_C	100	A
$T_C = 25^\circ\text{C}$		50	
$T_C = 100^\circ\text{C}$		150	
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	150	
Turn off safe operating area	-	150	
$V_{CE} \leq 600\text{V}$, $T_j \leq 150^\circ\text{C}$			
Avalanche energy single pulse	E_{AS}	280	mJ
$I_C = 50\text{A}$, $V_{CC}=50\text{V}$, $R_{GE}=25\Omega$			
start $T_j=25^\circ\text{C}$			
Gate-emitter voltage static	V_{GE}	± 20	V
transient ($t_p < 1\mu\text{s}$, $D < 0.05$)		± 30	
Short circuit withstand time ²⁾	t_{SC}	10	μs
$V_{GE} = 15\text{V}$, $V_{CC} \leq 600\text{V}$, $T_j \leq 150^\circ\text{C}$			
Power dissipation	P_{tot}	416	W
$T_C = 25^\circ\text{C}$			
Operating junction and storage temperature	T_j , T_{stg}	-55...+150	$^\circ\text{C}$
Time limited operating junction temperature for $t < 150\text{h}$	$T_{j(tl)}$	175	
Soldering temperature, 1.6mm (0.063 in.) from case for 10s	-	260	

¹ J-STD-020 and JESD-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}		0.3	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	$V_{(BR)CES}$	$V_{GE}=0V, I_C=500\mu A$	600	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE} = 15V, I_C=50A$				
		$T_J=25^{\circ}C$	-	2.8	3.15	
		$T_J=150^{\circ}C$	-	3.15	-	
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C=1mA, V_{CE}=V_{GE}$	3	4	5	
Zero gate voltage collector current	I_{CES}	$V_{CE}=600V, V_{GE}=0V$				μA
		$T_J=25^{\circ}C$	-	-	40	
		$T_J=150^{\circ}C$	-	-	3000	
Gate-emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V$	-	-	100	nA
Transconductance	g_{fs}	$V_{CE}=20V, I_C=50A$	-	31	-	S

Dynamic Characteristic

Input capacitance	C_{iss}	$V_{CE}=25V, V_{GE}=0V, f=1MHz$	-	2572	-	pF
Output capacitance	C_{oss}		-	245	-	
Reverse transfer capacitance	C_{rss}		-	158	-	
Gate charge	Q_{Gate}	$V_{CC}=480V, I_C=50A, V_{GE}=15V$	-	179	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13	-	nH
Short circuit collector current ¹⁾	$I_{C(SC)}$	$V_{GE}=15V, t_{SC}\leq 10\mu s, V_{CC}\leq 600V, T_j\leq 150^\circ\text{C}$	-	471	-	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	$t_{d(on)}$	$T_j=25^{\circ}\text{C}$, $V_{CC}=400\text{V}$, $I_C=50\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=6.8\Omega$ $L_{\sigma}^{1)}=55\text{nH}$, $C_{\sigma}^{1)}=40\text{pF}$ Energy losses include “tail” and diode reverse recovery ²⁾ .	-	47	-	ns
Rise time	t_r		-	32	-	
Turn-off delay time	$t_{d(off)}$		-	310	-	
Fall time	t_f		-	16	-	
Turn-on energy	E_{on}	Energy losses include “tail” and diode reverse recovery ²⁾ .	-	1.08	-	mJ
Turn-off energy	E_{off}		-	0.88	-	
Total switching energy	E_{ts}		-	1.96	-	

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	$t_{d(on)}$	$T_j=150^{\circ}\text{C}$ $V_{CC}=400\text{V}, I_C=50\text{A},$ $V_{GE}=0/15\text{V},$ $R_G=1.8\Omega$ $L_{\sigma}^{1)}=60\text{nH},$ $C_{\sigma}^{1)}=40\text{pF}$ Energy losses include “tail” and diode reverse recovery ²⁾ .	-	50	-	ns
Rise time	t_r		-	28	-	
Turn-off delay time	$t_{d(off)}$		-	225	-	
Fall time	t_f		-	14	-	
Turn-on energy	E_{on}	Energy losses include “tail” and diode reverse recovery ²⁾ .	-	1	-	mJ
Turn-off energy	E_{off}		-	0.90	-	
Total switching energy	E_{ts}		-	1.9	-	
Turn-on delay time	$t_{d(on)}$	$T_j=150^{\circ}\text{C}$ $V_{CC}=400\text{V}, I_C=50\text{A},$ $V_{GE}=0/15\text{V},$ $R_G=6.8\Omega$ $L_{\sigma}^{1)}=60\text{nH},$ $C_{\sigma}^{1)}=40\text{pF}$ Energy losses include “tail” and diode reverse recovery ²⁾ .	-	48	-	ns
Rise time	t_r		-	31	-	
Turn-off delay time	$t_{d(off)}$		-	350	-	
Fall time	t_f		-	20	-	
Turn-on energy	E_{on}		-	1.5	-	mJ
Turn-off energy	E_{off}		-	1.1	-	
Total switching energy	E_{ts}		-	2.6	-	

¹ Leakage inductance L_{σ} and Stray capacity C_{σ} due to test circuit in Figure E.

² Diode used in this test is IDP45E60

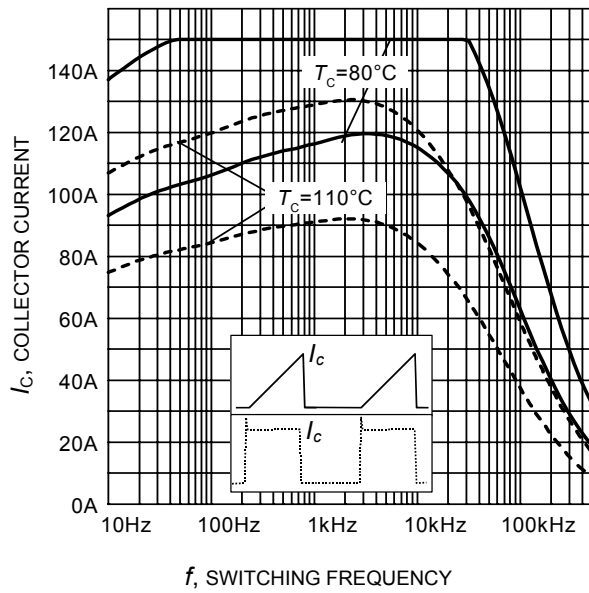


Figure 1. Collector current as a function of switching frequency
 $(T_j \leq 150^\circ\text{C}, D = 0.5, V_{CE} = 400\text{V}, V_{GE} = 0/+15\text{V}, R_G = 6.8\Omega)$

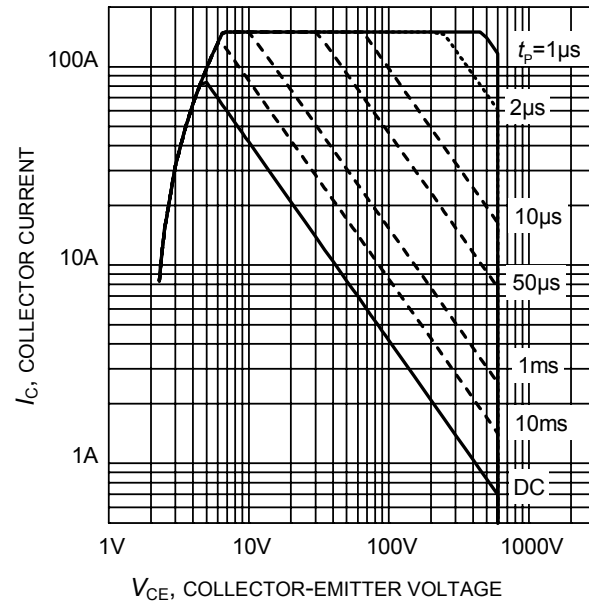


Figure 2. Safe operating area
 $(D = 0, T_C = 25^\circ\text{C}, T_j \leq 150^\circ\text{C}; V_{GE} = 15\text{V})$

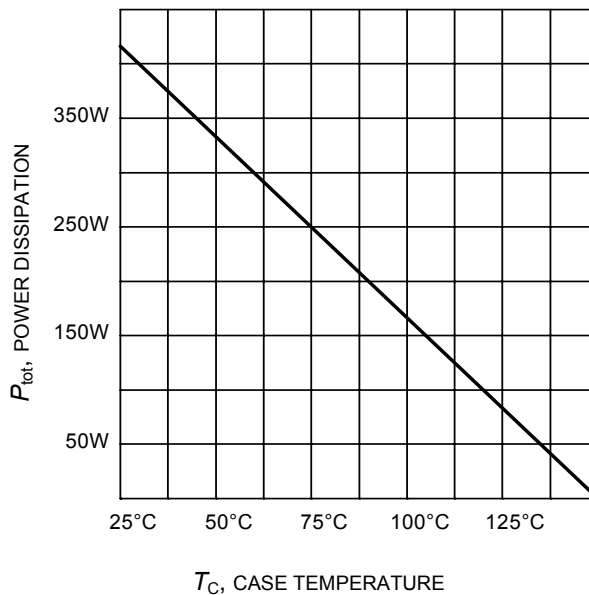


Figure 3. Power dissipation as a function of case temperature
 $(T_j \leq 150^\circ\text{C})$

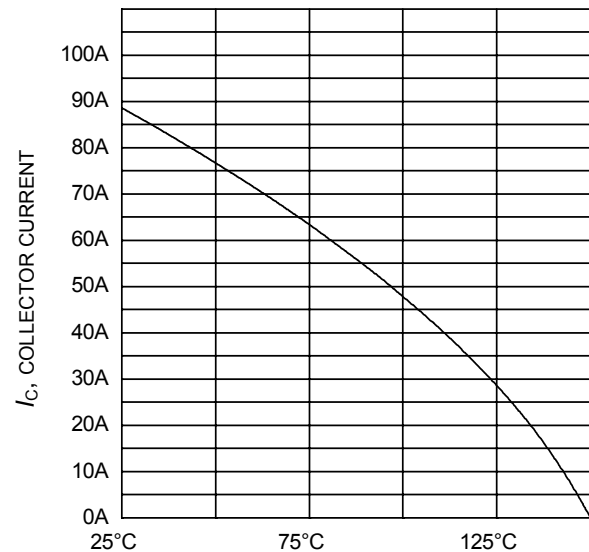


Figure 4. Collector current as a function of case temperature
 $(V_{GE} \leq 15\text{V}, T_j \leq 150^\circ\text{C})$

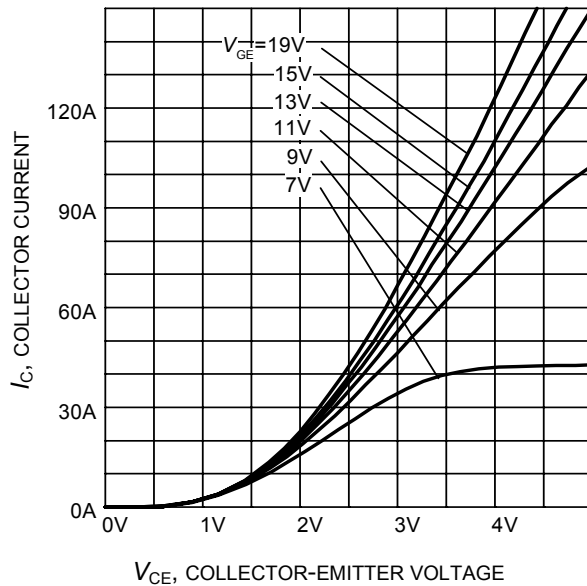


Figure 5. Typical output characteristic
($T_j = 25^\circ\text{C}$)

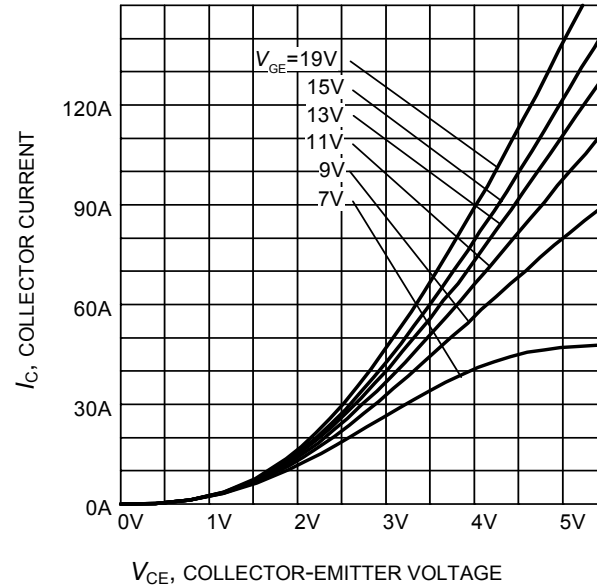


Figure 6. Typical output characteristic
($T_j = 150^\circ\text{C}$)

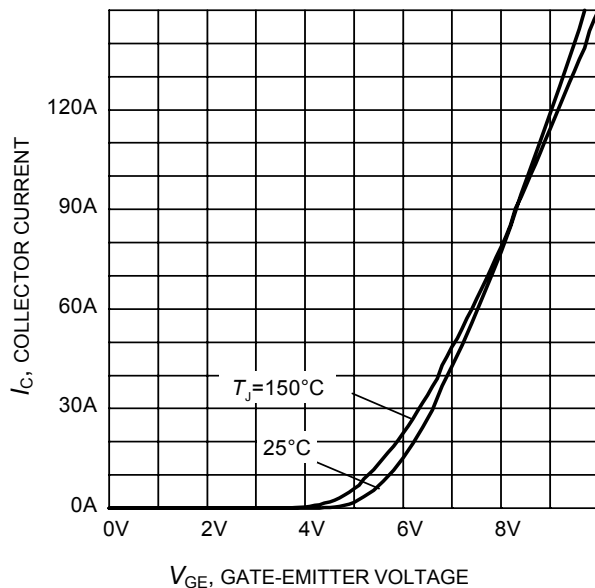


Figure 7. Typical transfer characteristic
($V_{CE} = 10\text{V}$)

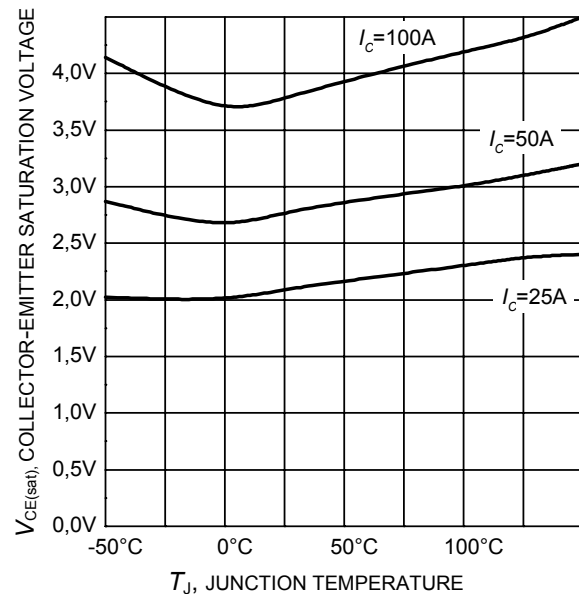


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
($V_{GE} = 15\text{V}$)

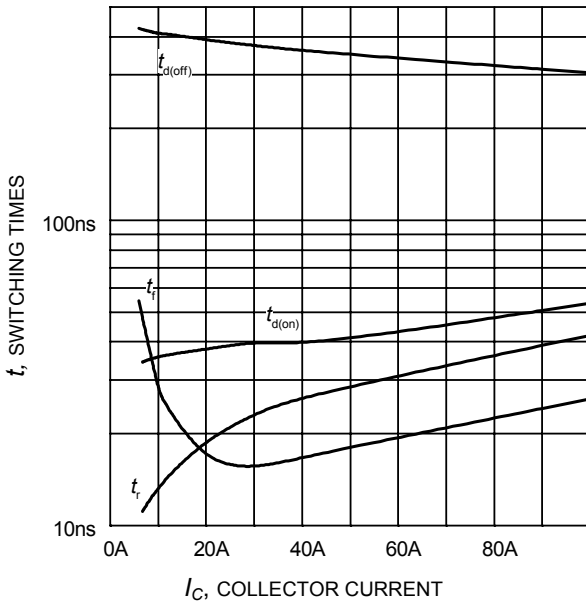


Figure 9. Typical switching times as a function of collector current
(inductive load, $T_J=150^\circ\text{C}$,
 $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=6.8\Omega$,
Dynamic test circuit in Figure E)

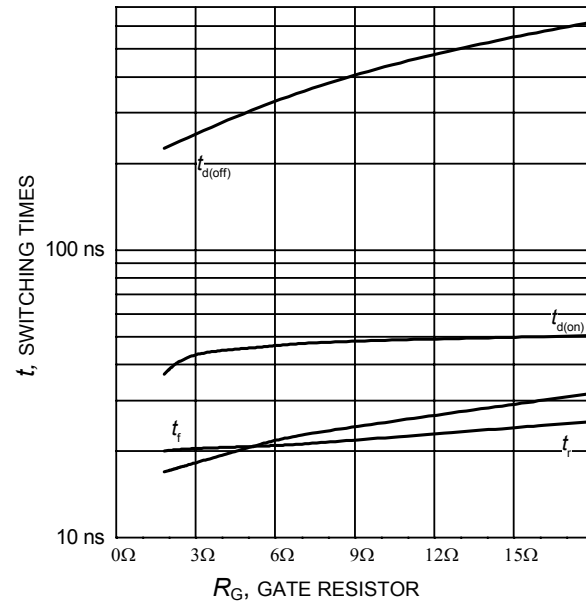


Figure 10. Typical switching times as a function of gate resistor
(inductive load, $T_J=150^\circ\text{C}$,
 $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=50\text{A}$,
Dynamic test circuit in Figure E)

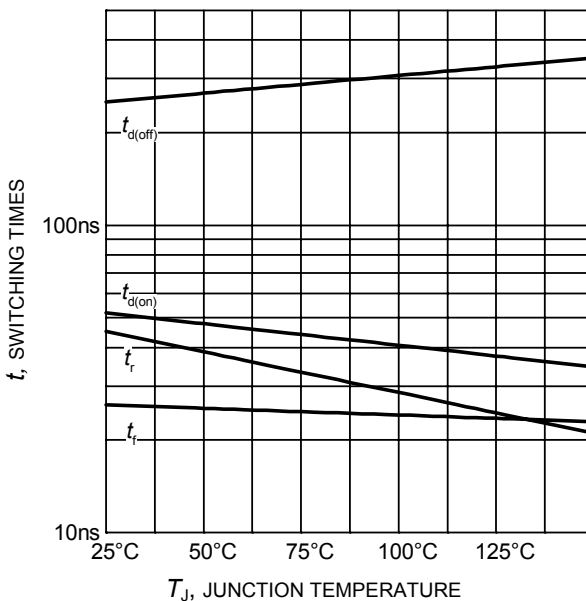


Figure 11. Typical switching times as a function of junction temperature
(inductive load, $V_{CE}=400\text{V}$,
 $V_{GE}=0/15\text{V}$, $I_C=50\text{A}$, $R_G=6.8\Omega$,
Dynamic test circuit in Figure E)

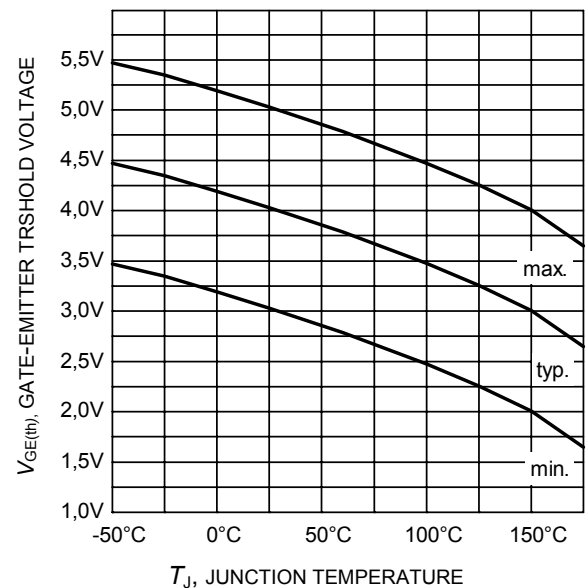


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
($I_C = 1\text{mA}$)

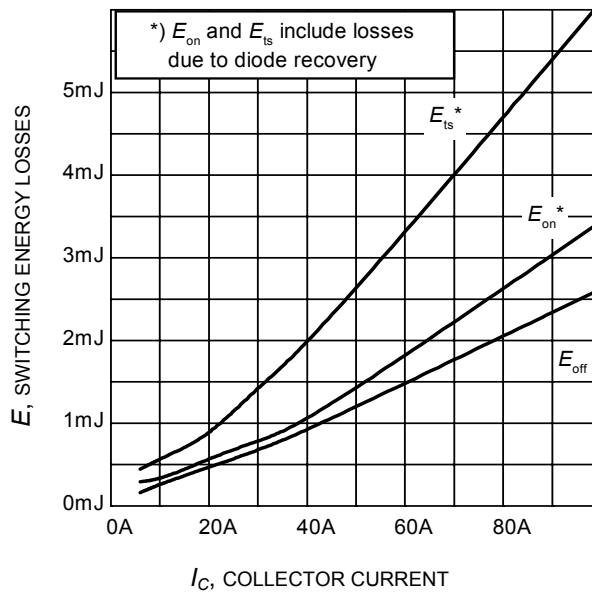


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, $T_J=150^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=6.8\Omega$, Dynamic test circuit in Figure E)

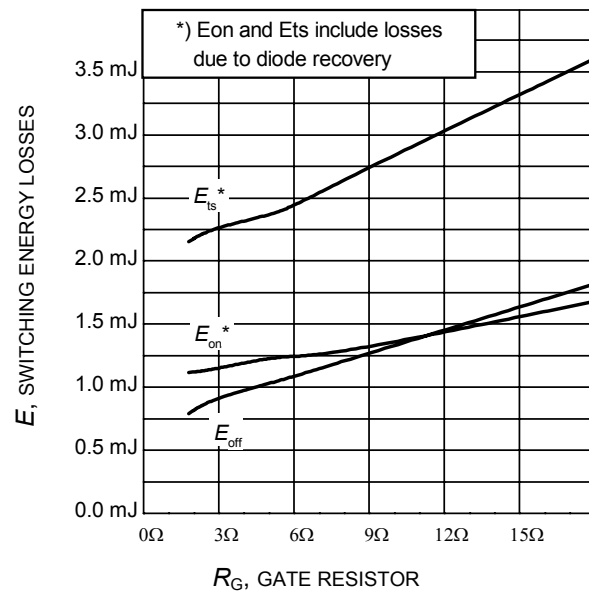


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, $T_J=150^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=50\text{A}$, Dynamic test circuit in Figure E)

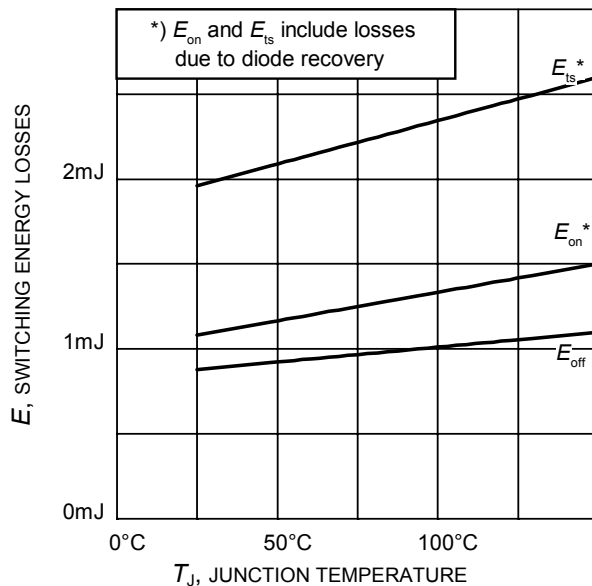


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=50\text{A}$, $R_G=6.8\Omega$, Dynamic test circuit in Figure E)

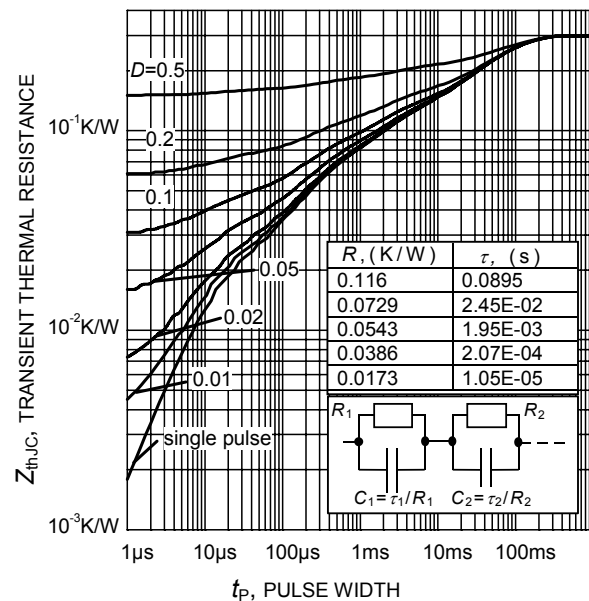


Figure 16. IGBT transient thermal resistance
($D = t_p / T$)

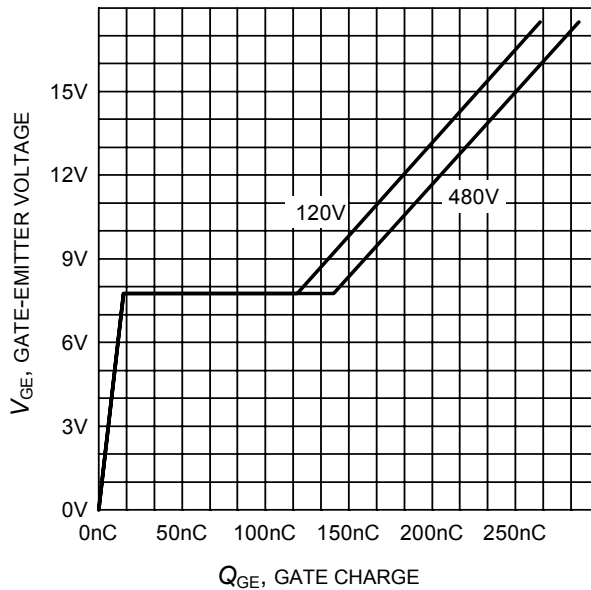


Figure 17. Typical gate charge
($I_C = 50\text{ A}$)

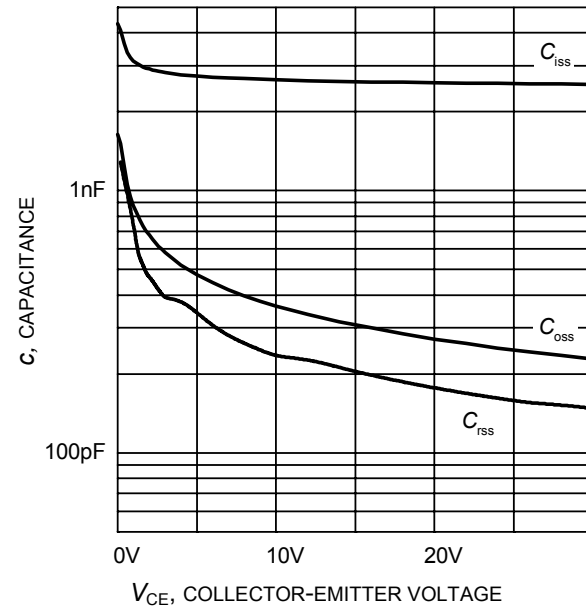


Figure 18. Typical capacitance as a function of collector-emitter voltage
($V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$)

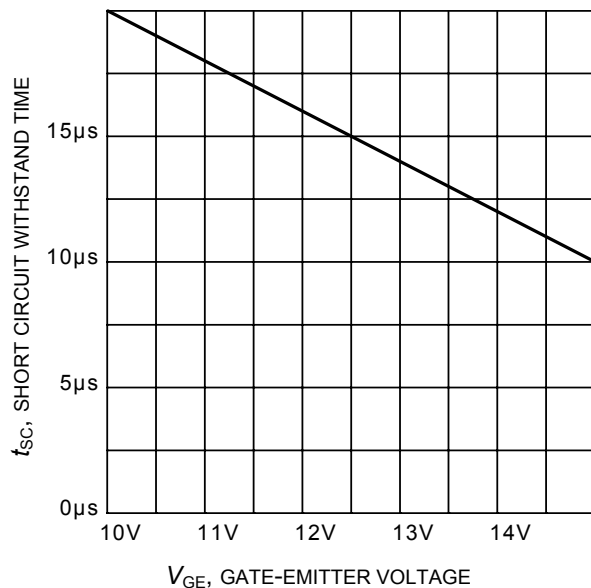


Figure 19. Short circuit withstand time as a function of gate-emitter voltage
($V_{CE} = 600\text{ V}$, start at $T_J = 25^\circ\text{C}$)

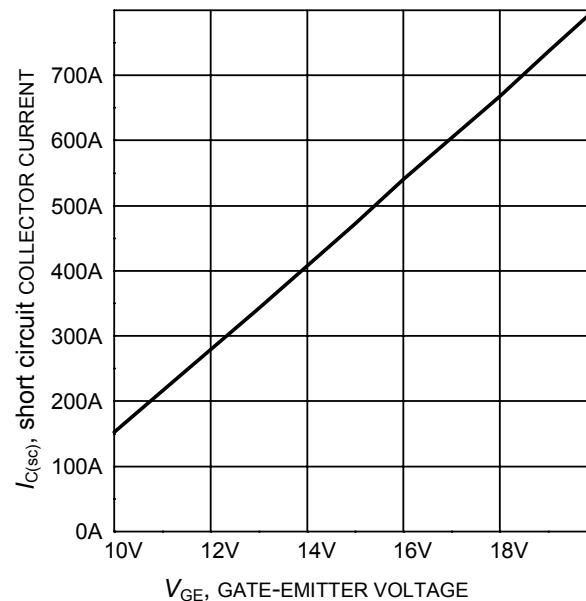
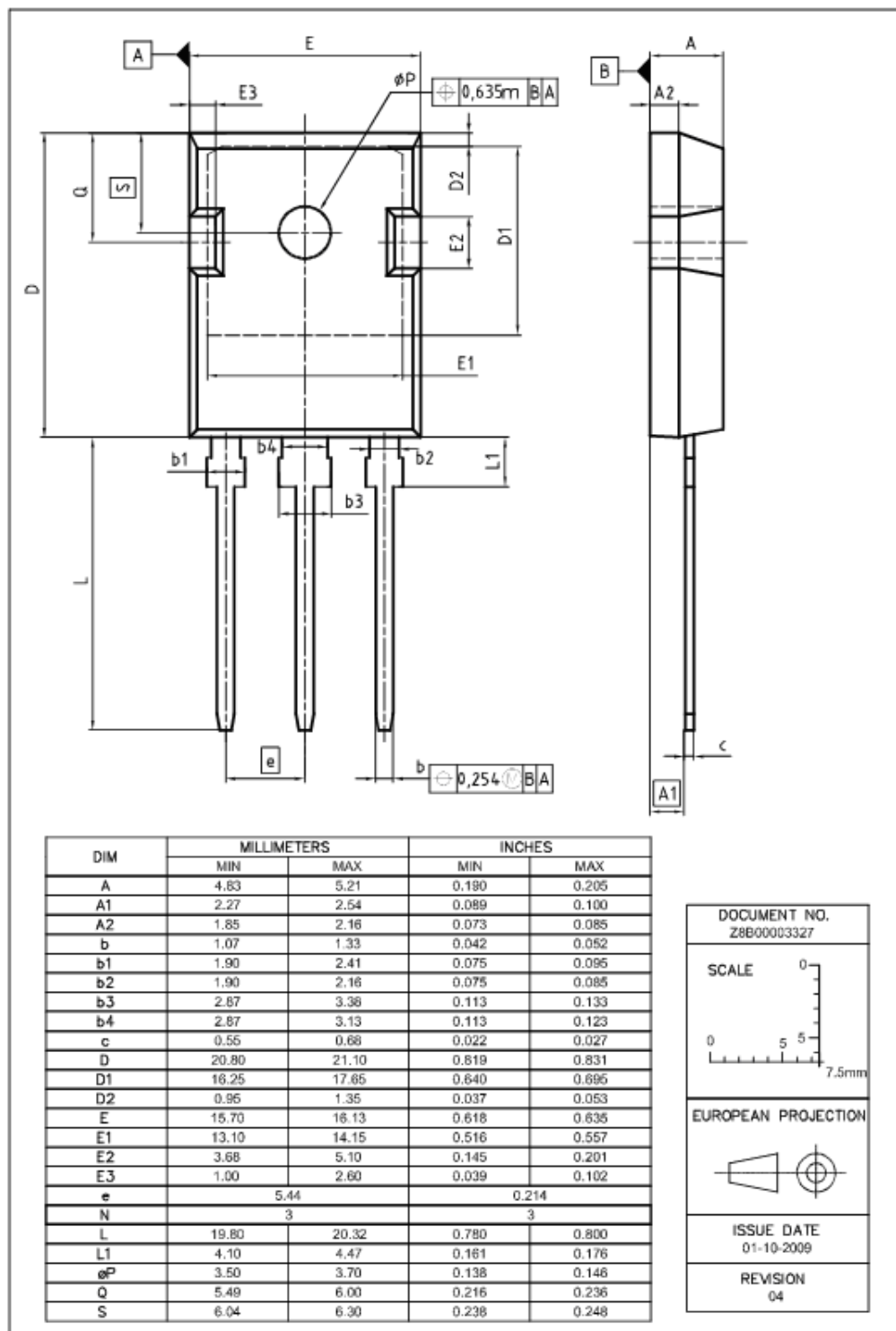


Figure 20. Typical short circuit collector current as a function of gate-emitter voltage
($V_{CE} \leq 600\text{ V}$, $T_J \leq 150^\circ\text{C}$)

TO247-3



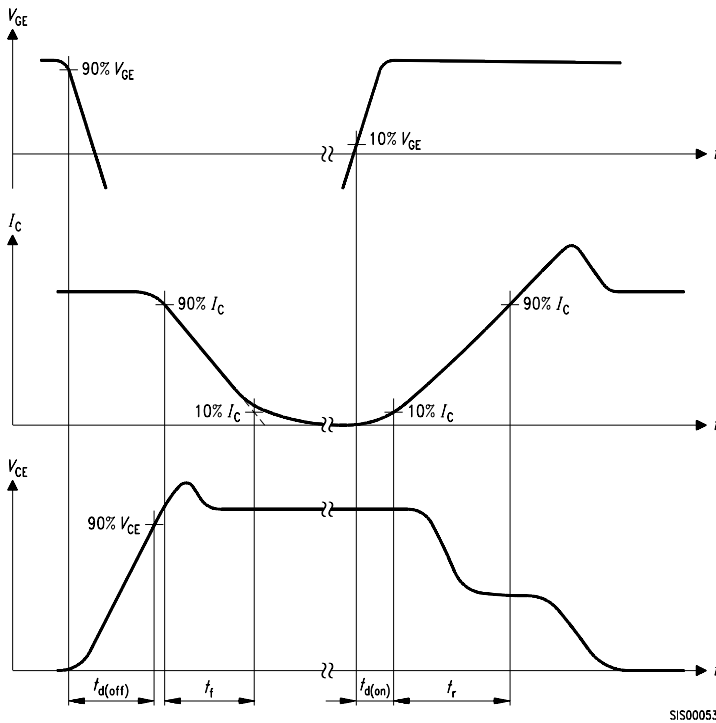


Figure A. Definition of switching times

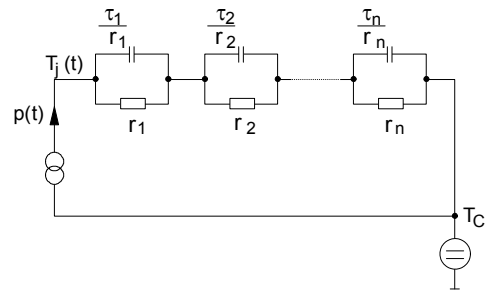


Figure D. Thermal equivalent circuit

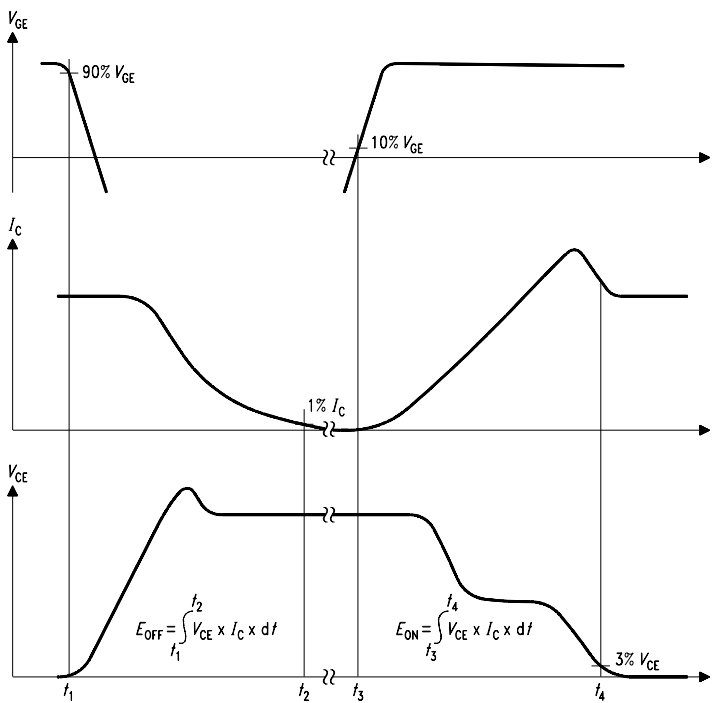


Figure B. Definition of switching losses

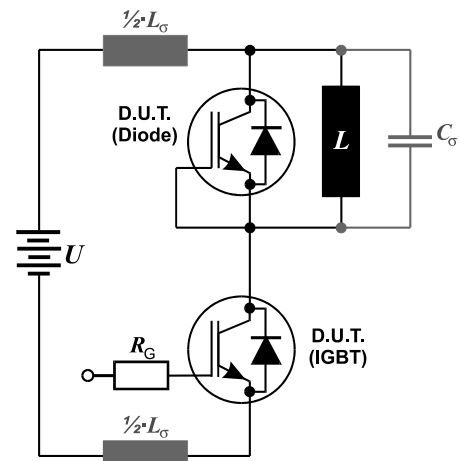


Figure E. Dynamic test circuit
Leakage inductance $L_\sigma = 55\text{nH}$
and Stray capacity $C_\sigma = 40\text{pF}$.

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