

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction – case	R_{thJC}		0.45	K/W
Thermal resistance, junction – ambient	R_{thJA}	6cm ² Cu	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	$V_{(BR)CES}$	$V_{GE}=0V, I_C=0.2mA$	600	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE} = 15V, I_C=50A$				
		$T_j=25^{\circ}C$	-	1.5	2.0	
		$T_j=175^{\circ}C$	-	1.9	-	
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C=0.8mA, V_{CE}=V_{GE}$	4.1	4.9	5.7	
Zero gate voltage collector current	I_{CES}	$V_{CE}=600V,$				μA
		$V_{GE}=0V$				
		$T_j=25^{\circ}C$	-	-	40	
		$T_j=175^{\circ}C$	-	-	3500	
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
Integrated gate resistor	R_{Gint}		-			Ω

Dynamic Characteristic

Input capacitance	C_{iss}	$V_{CE}=25V,$ $V_{GE}=0V,$ $f=1MHz$	-	3140	-	pF
Output capacitance	C_{oss}		-	200	-	
Reverse transfer capacitance	C_{rss}		-	93	-	
Gate charge	Q_{Gate}	$V_{CC}=480V, I_C=50A$ $V_{GE}=15V$	-	310	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	7	-	nH
Short circuit collector current ¹⁾	$I_{C(SC)}$	$V_{GE}=15V, t_{SC}\leq 5\mu s$ $V_{CC} = 400V,$ $T_j \leq 150^\circ\text{C}$	-	458.3	-	A

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

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

Parameter	Symbol	Conditions	Value			Unit
			min.	Typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	$T_j=25^{\circ}\text{C}$, $V_{CC}=400\text{V}$, $I_C=50\text{A}$, $V_{GE}=0/15\text{V}$, $r_G=7\Omega$, $L_{\sigma}=103\text{nH}$, $C_{\sigma}=39\text{pF}$ L_{σ} , C_{σ} from Fig. E Energy losses include “tail” and diode reverse recovery.	-	26	-	ns
Rise time	t_r		-	29	-	
Turn-off delay time	$t_{d(off)}$		-	299	-	
Fall time	t_f		-	29	-	
Turn-on energy	E_{on}	Diode from IKW50N60T	-	1.2	-	mJ
Turn-off energy	E_{off}		-	1.4	-	
Total switching energy	E_{ts}		-	2.6	-	

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

Parameter	Symbol	Conditions	Value			Unit
			min.	Typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	$T_j=175^{\circ}\text{C}$, $V_{CC}=400\text{V}$, $I_C=50\text{A}$, $V_{GE}=0/15\text{V}$, $r_G=7\Omega$, $L_{\sigma}=103\text{nH}$, $C_{\sigma}=39\text{pF}$ L_{σ} , C_{σ} from Fig. E Energy losses include “tail” and diode reverse recovery. Diode from IKW50N60T	-	27	-	ns
Rise time	t_r		-	33	-	
Turn-off delay time	$t_{d(off)}$		-	341	-	
Fall time	t_f		-	55	-	
Turn-on energy	E_{on}		-	1.8	-	mJ
Turn-off energy	E_{off}		-	1.8	-	
Total switching energy	E_{ts}		-	3.6	-	

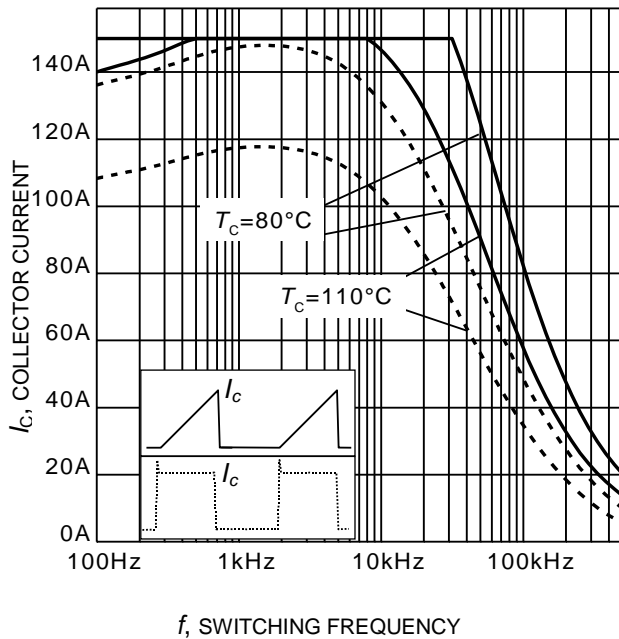


Figure 1. Collector current as a function of switching frequency
 $(T_j \leq 175^\circ\text{C}, D = 0.5, V_{CE} = 400\text{V}, V_{GE} = 0/15\text{V}, r_G = 7\Omega)$

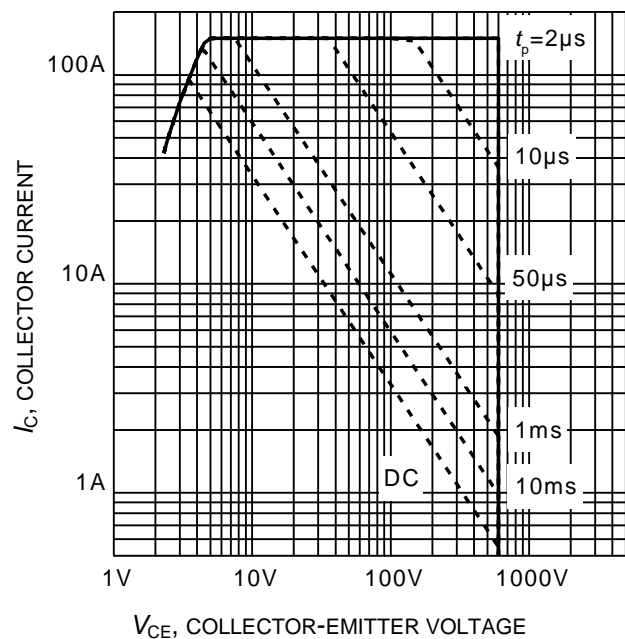


Figure 2. Safe operating area
 $(D = 0, T_c = 25^\circ\text{C}, T_j \leq 175^\circ\text{C}; V_{GE} = 0/15\text{V})$

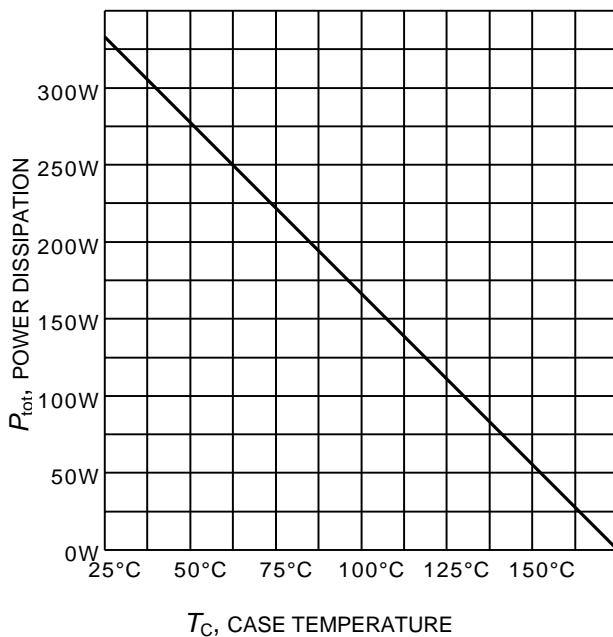


Figure 3. Power dissipation as a function of case temperature
 $(T_j \leq 175^\circ\text{C})$

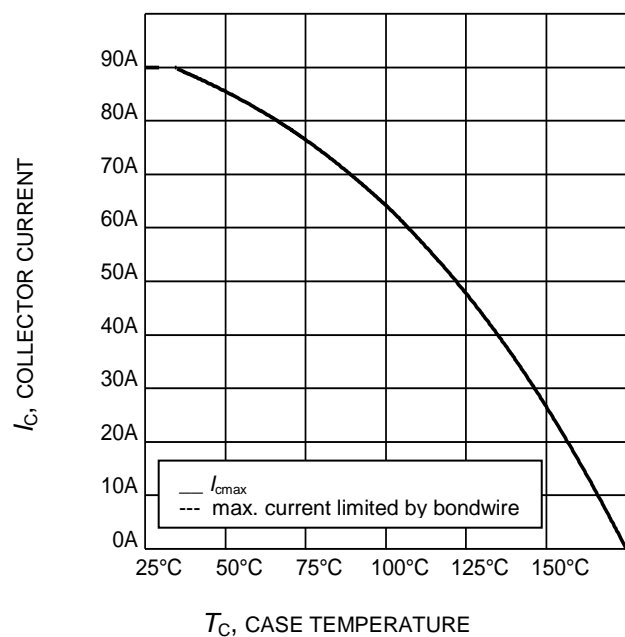


Figure 4. Collector current as a function of case temperature
 $(V_{GE} \geq 15\text{V}, T_j \leq 175^\circ\text{C})$

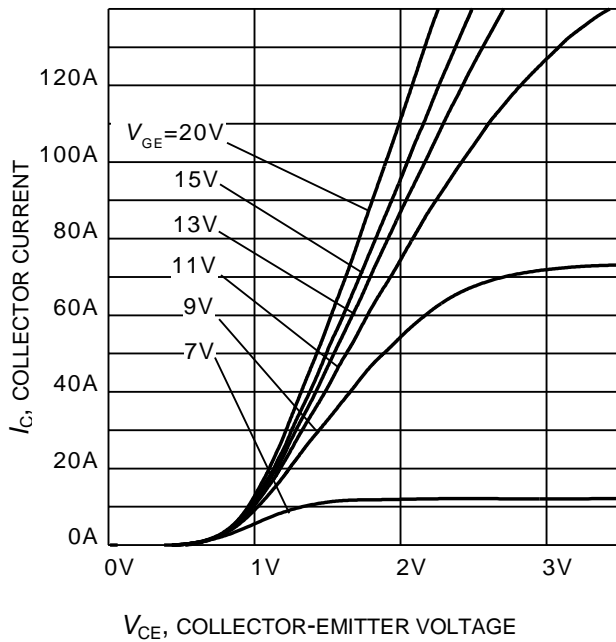


Figure 5. Typical output characteristic
($T_j = 25^\circ\text{C}$)

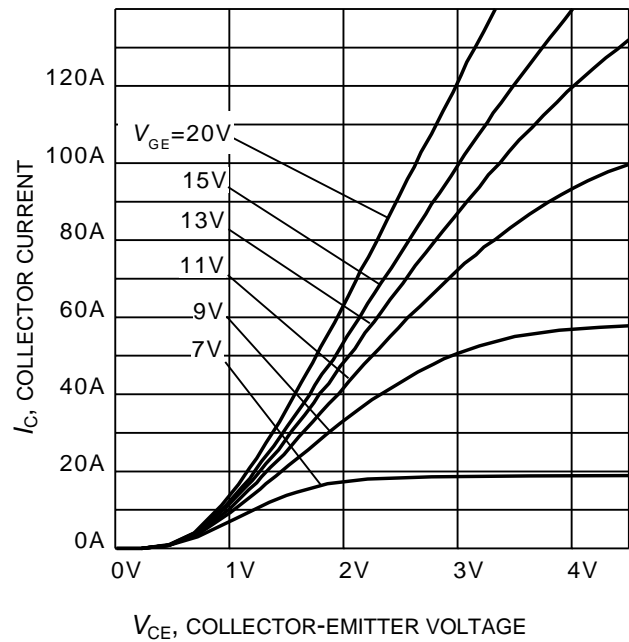


Figure 6. Typical output characteristic
($T_j = 175^\circ\text{C}$)

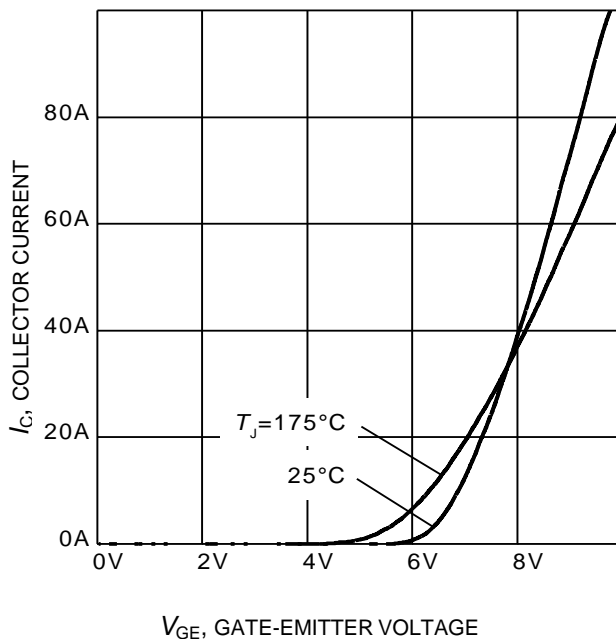


Figure 7. Typical transfer characteristic
($V_{ce} = 20\text{V}$)

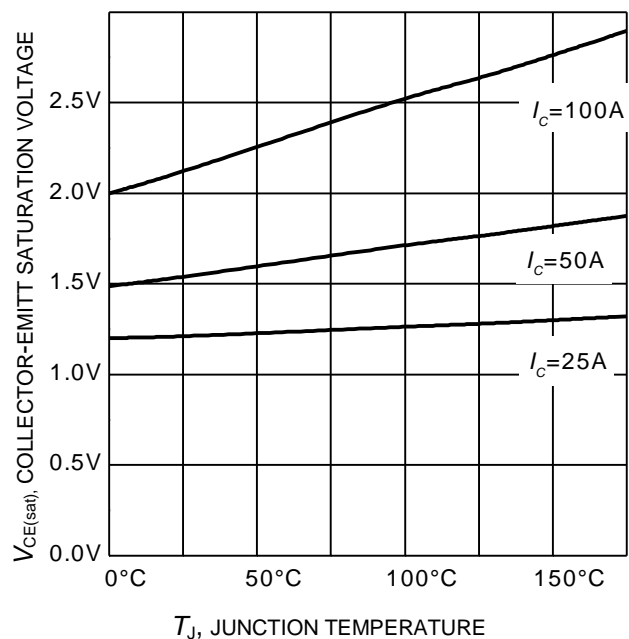
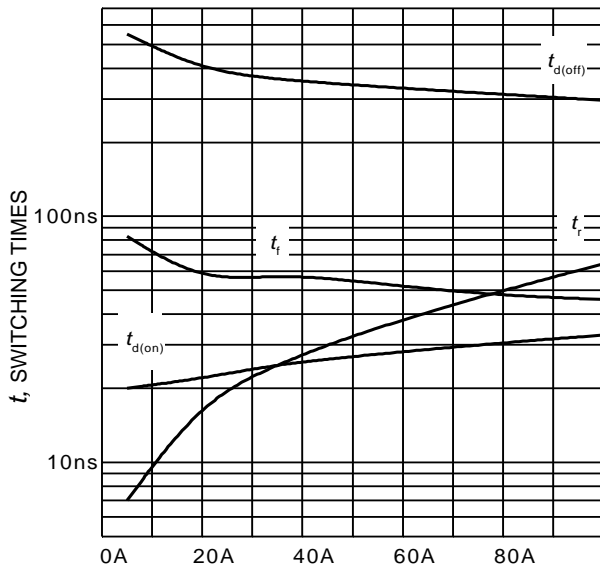
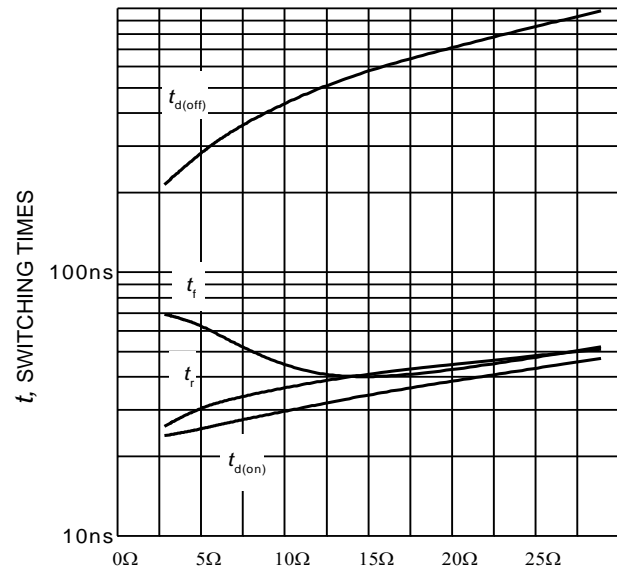


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
($V_{ge} = 15\text{V}$)



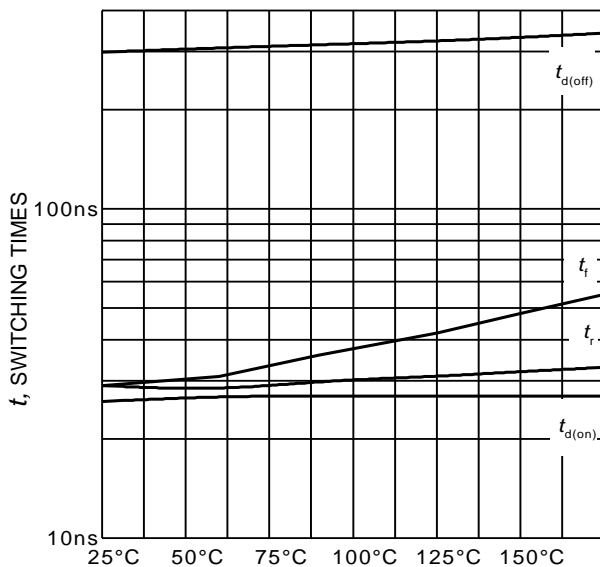
I_C , COLLECTOR CURRENT

Figure 9. Typical switching times as a function of collector current
(inductive load, $T_J=175^\circ\text{C}$,
 $V_{CE} = 400\text{V}$, $V_{GE} = 0/15\text{V}$, $r_G = 7\Omega$,
Dynamic test circuit in Figure E)



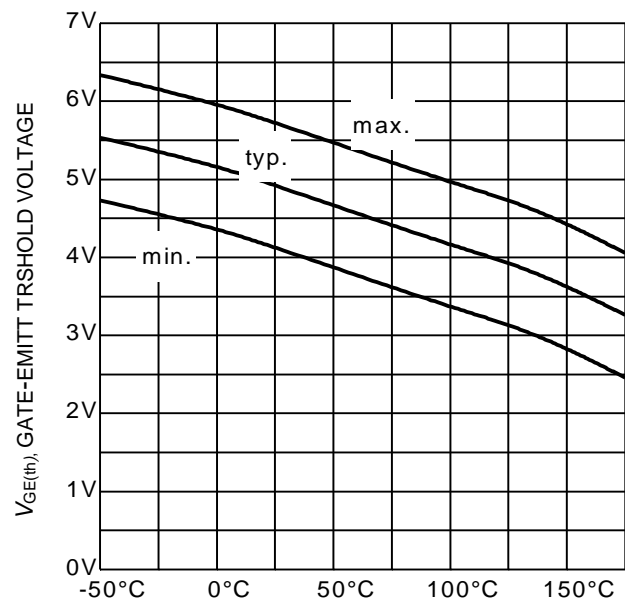
R_G , GATE RESISTOR

Figure 10. Typical switching times as a function of gate resistor
(inductive load, $T_J = 175^\circ\text{C}$,
 $V_{CE} = 400\text{V}$, $V_{GE} = 0/15\text{V}$, $I_C = 50\text{A}$,
Dynamic test circuit in Figure E)



T_J , JUNCTION TEMPERATURE

Figure 11. Typical switching times as a function of junction temperature
(inductive load, $V_{CE} = 400\text{V}$,
 $V_{GE} = 0/15\text{V}$, $I_C = 50\text{A}$, $r_G = 7\Omega$,
Dynamic test circuit in Figure E)



T_J , JUNCTION TEMPERATURE

Figure 12. Gate-emitter threshold voltage as a function of junction temperature
($I_C = 0.8\text{mA}$)

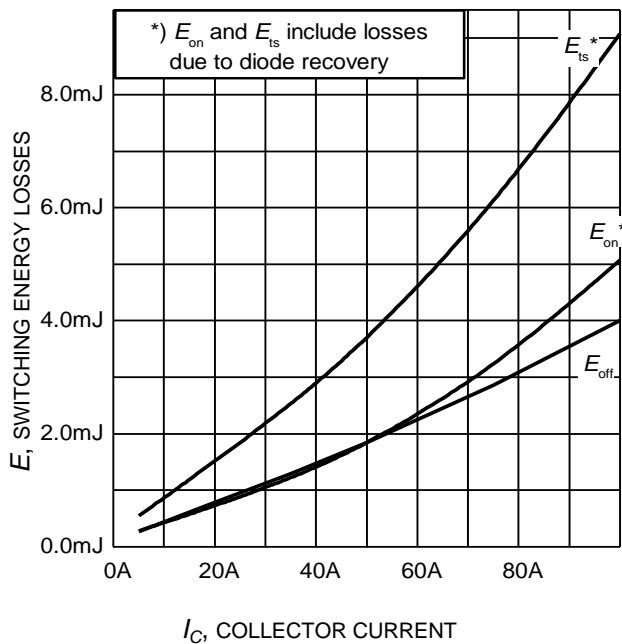


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, $T_J = 175^\circ\text{C}$, $V_{CE} = 400\text{V}$, $V_{GE} = 0/15\text{V}$, $r_G = 7\Omega$, Dynamic test circuit in Figure E)

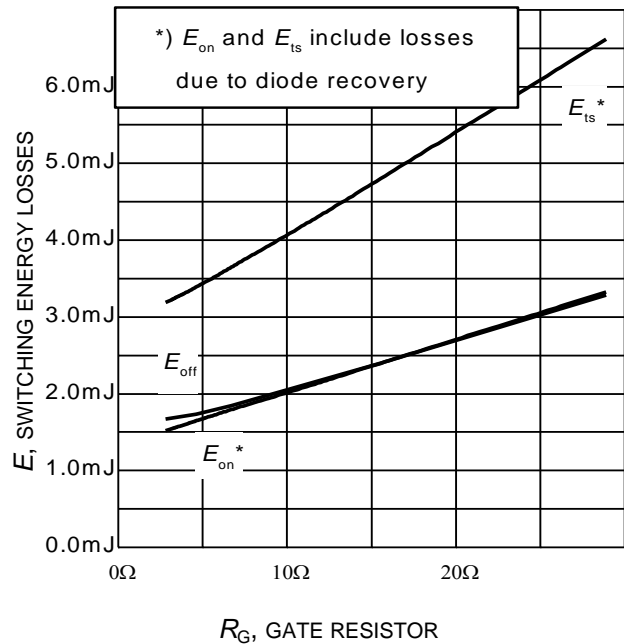


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, $T_J = 175^\circ\text{C}$, $V_{CE} = 400\text{V}$, $V_{GE} = 0/15\text{V}$, $I_C = 50\text{A}$, Dynamic test circuit in Figure E)

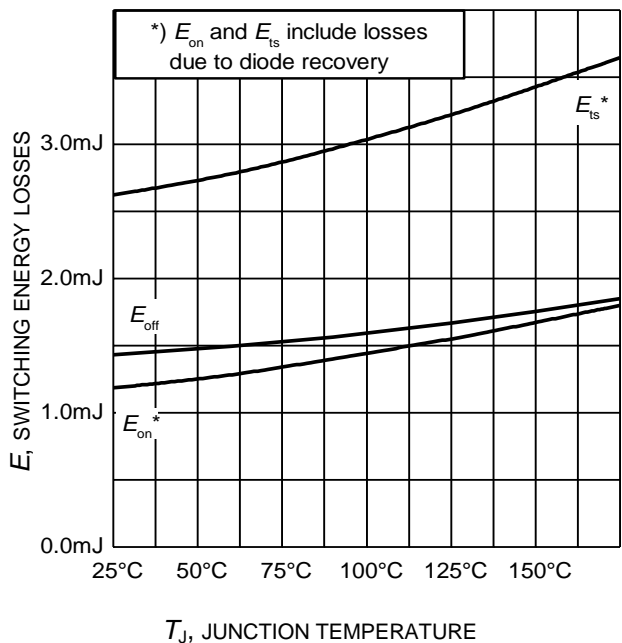


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, $V_{CE} = 400\text{V}$, $V_{GE} = 0/15\text{V}$, $I_C = 50\text{A}$, $r_G = 7\Omega$, Dynamic test circuit in Figure E)

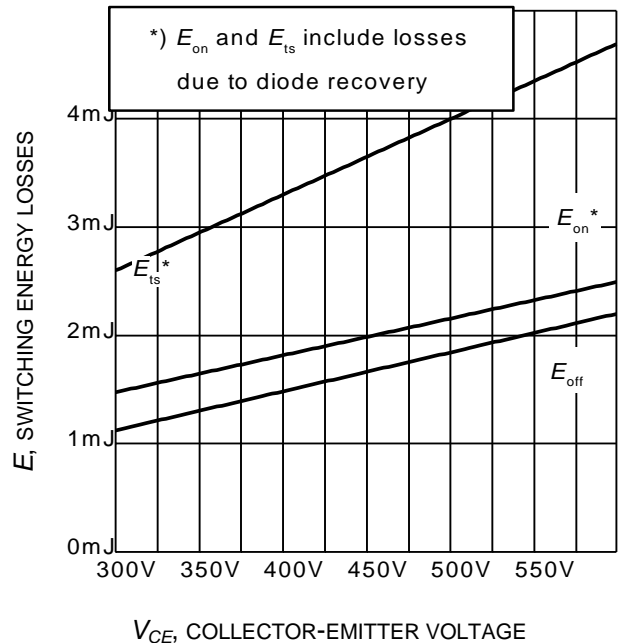


Figure 16. Typical switching energy losses as a function of collector emitter voltage
(inductive load, $T_J = 175^\circ\text{C}$, $V_{GE} = 0/15\text{V}$, $I_C = 50\text{A}$, $r_G = 7\Omega$, Dynamic test circuit in Figure E)

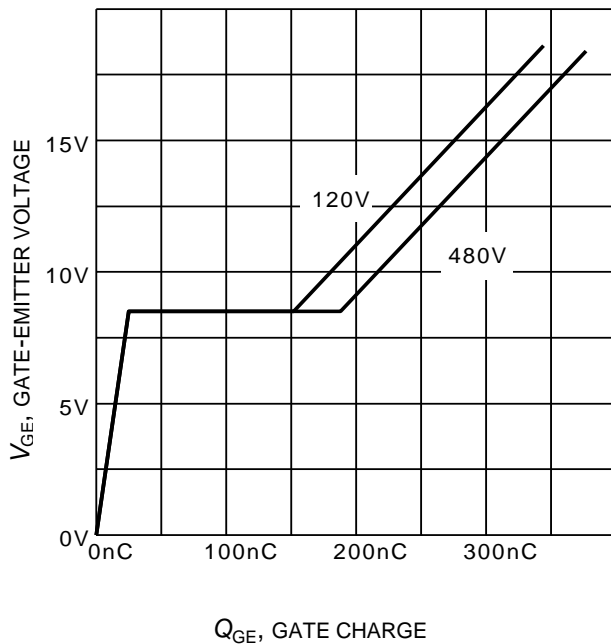


Figure 17. Typical gate charge
($I_C=50\text{ A}$)

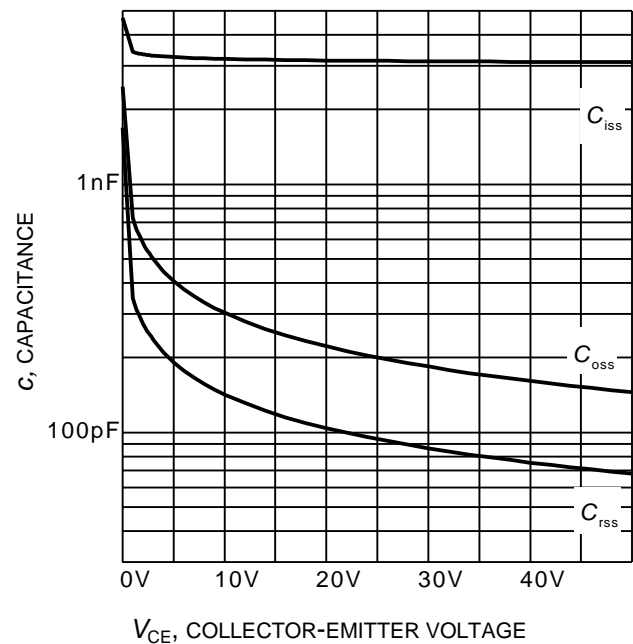


Figure 18. Typical capacitance as a function of collector-emitter voltage
($V_{GE}=0\text{V}$, $f=1\text{ MHz}$)

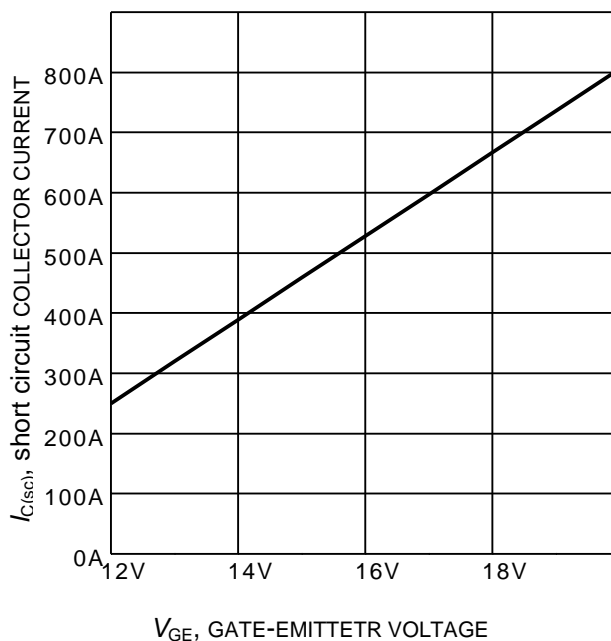


Figure 19. Typical short circuit collector current as a function of gate-emitter voltage
($V_{CE} \leq 400\text{V}$, $T_J \leq 150^\circ\text{C}$)

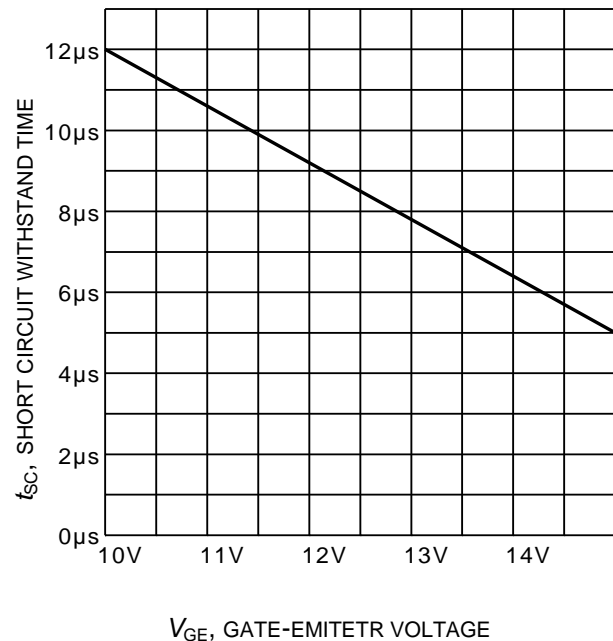


Figure 20. Short circuit withstand time as a function of gate-emitter voltage
($V_{CE}=400\text{V}$, start at $T_J=25^\circ\text{C}$, $T_{Jmax}<150^\circ\text{C}$)

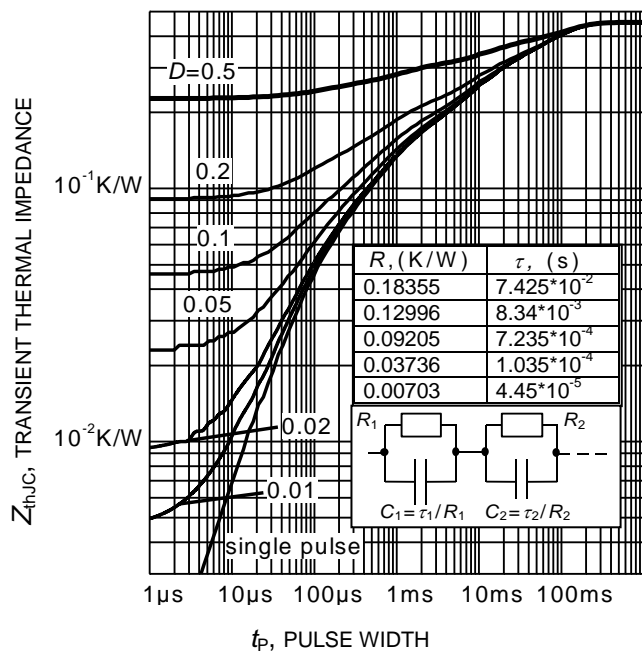
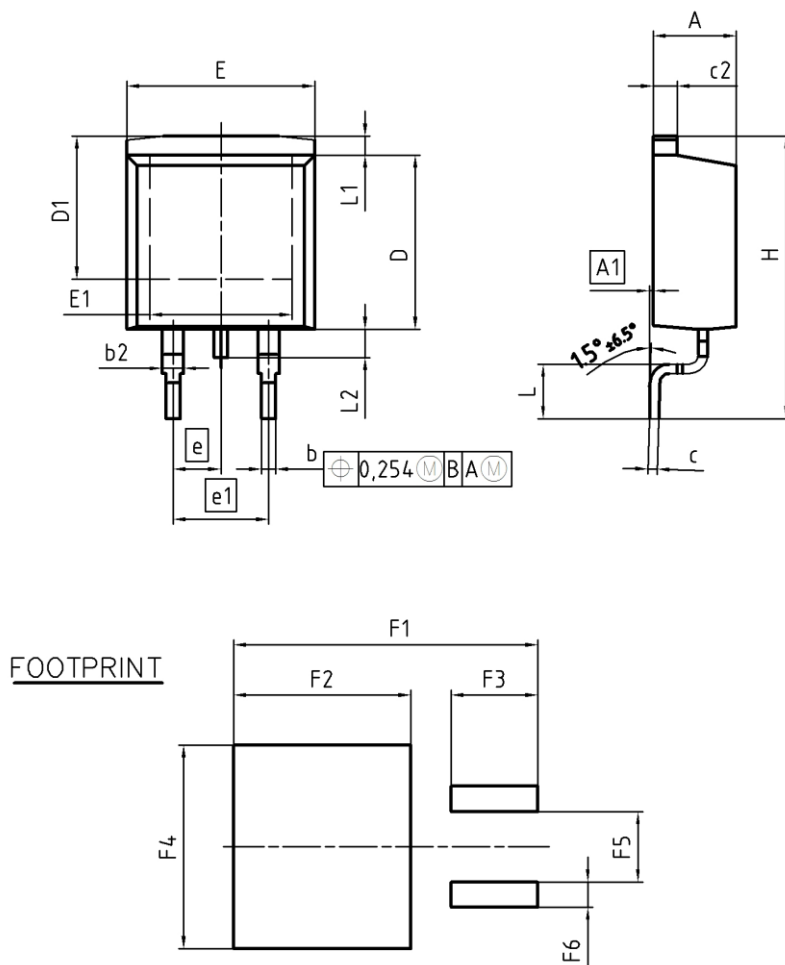
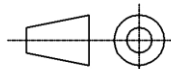


Figure 21. IGBT transient thermal impedance
 $(D = t_p / T)$

PG-TO263-3



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	0.00	0.25	0.000	0.010
b	0.65	0.85	0.026	0.033
b2	0.95	1.15	0.037	0.045
c	0.33	0.65	0.013	0.026
c2	1.17	1.40	0.046	0.055
D	8.51	9.45	0.335	0.372
D1	7.10	7.90	0.280	0.311
E	9.80	10.31	0.386	0.406
E1	6.50	8.60	0.256	0.339
e	2.54		0.100	
e1	5.08		0.200	
N	2		2	
H	14.61	15.88	0.575	0.625
L	2.29	3.00	0.090	0.118
L1	0.70	1.60	0.028	0.063
L2	1.00	1.78	0.039	0.070
F1	16.05	16.25	0.632	0.640
F2	9.30	9.50	0.366	0.374
F3	4.50	4.70	0.177	0.185
F4	10.70	10.90	0.421	0.429
F5	3.65	3.85	0.144	0.152
F6	1.25	1.45	0.049	0.057

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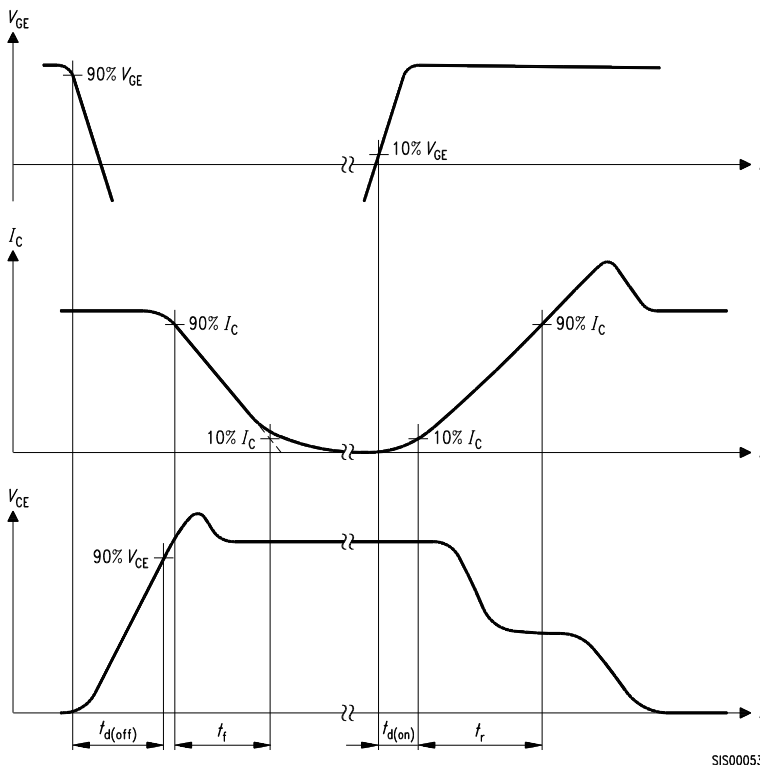


Figure A. Definition of switching times

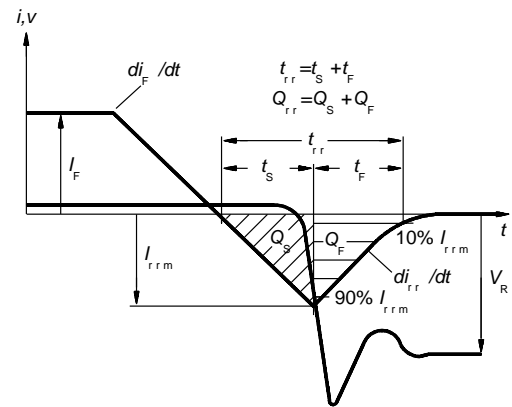


Figure C. Definition of diodes switching characteristics

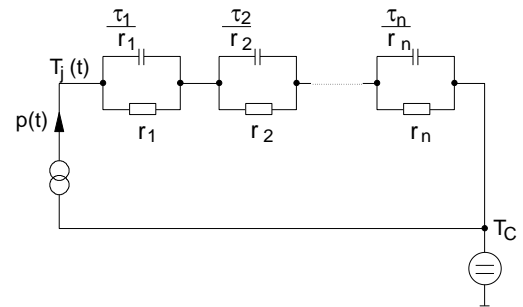


Figure D. Thermal equivalent circuit

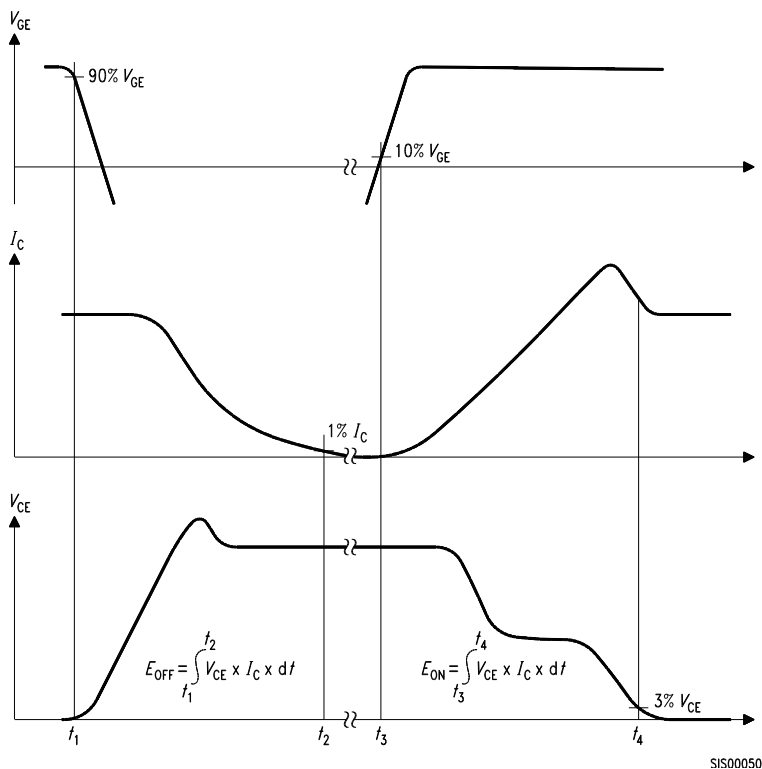


Figure B. Definition of switching losses

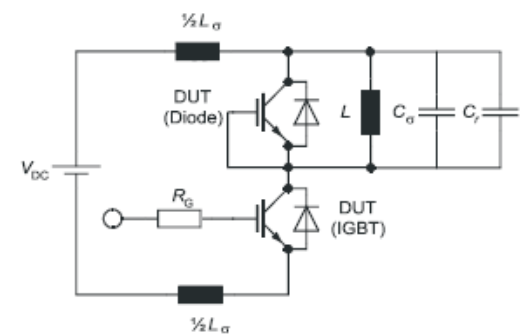


Figure E. Dynamic test circuit
Parasitic inductance L_σ ,
Parasitic capacitor C_σ ,
Relief capacitor C_r
(only for ZVT switching)

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