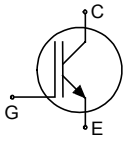
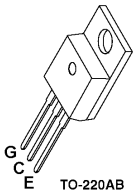
Preliminary Datasheet

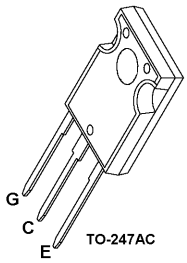
SGP30N60HS
SGW30N60HS

High Speed IGBT in NPT-technology



- 30% lower E_{off} compared to previous generation
  16 µJ/A
- Short circuit withstand time – 10 µs
- NPT-Technology for 600V applications offers:
  - parallel switching capability
  - very tight parameter distribution
  - high ruggedness, temperature stable behaviour





Type	V_{CE}	I_C	$V_{CE(sat)}$	T_j	Package	Ordering Code
SGP30N60HS	600V	30	3.5V	150°C	TO-220AB	Q67040-A4463-A003
SGW30N60HS	600V	30	3.5V	150°C	TO-247AC	Q67040-S4237-A002

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	600	V
DC collector current T_C = 25°C T_C = 100°C	I_C	 41 30	A
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	112	
Turn off safe operating area $V_{CE} \le 600V$, $T_j \le 150°C$	-	112	
Diode pulsed current, t_p limited by T_{jmax}	I_{Fpuls}	112	
Gate-emitter voltage	V_{GE}	±20	V
Short circuit withstand time[1)] V_{GE} = 15V, $V_{CC} \le 600V$, $T_j \le 150°C$	t_{SC}	10	µs
Power dissipation T_C = 25°C	P_{tot}	250	W
Operating junction and storage temperature	T_j , T_{stg}	-55...+150	°C
Soldering temperature, 1.6mm (0.063 in.) from case for 10s	-	260	

[1)] 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}		0.5	K/W
Thermal resistance, junction – ambient	R_{thJA}	TO-247AC	40	

Electrical Characteristic, at T_j = 25 °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=500µA	600	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE} = 15V, I_C=30A T_j=25°C T_j=150°C		 2.9 3.5		
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=300µA, V_{CE}=V_{GE}	3	4	5	
Zero gate voltage collector current	I_{CES}	V_{CE}=600V, V_{GE}=0V T_j=25°C T_j=150°C	 - -	 - -	 40 3000	µA
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	100	nA
Transconductance	g_{fs}	V_{CE}=20V, I_C=30A	-	-	20	S
Dynamic Characteristic						
Input capacitance	C_{iss}	V_{CE}=25V, V_{GE}=0V, f=1MHz	-	1500		pF
Output capacitance	C_{oss}		-	200		
Reverse transfer capacitance	C_{rss}		-	92		
Gate charge	Q_{Gate}	V_{CC}=480V, I_C=30A V_{GE}=15V	-	140		nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E	TO-247AC	-	13		nH
Short circuit collector current[1)]	$I_{C(SC)}$	V_{GE}=15V, t_{SC}≤10µs V_{CC} ≤ 600V, T_j ≤ 150°C	-	220		A

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

Switching Characteristic, Inductive Load, at T_j=25 °C

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	T_j=25°C,	-	16		ns
Rise time	t_r	V_{CC}=400V, I_C=30A,	-	21		
Turn-off delay time	$t_{d(off)}$	V_{GE}=0/15V,	-	106		
Fall time	t_f	R_G=1.8	-	21		
Turn-on energy	E_{on}	Energy losses include “tail” and diode reverse recovery.	-	0.67		mJ
Turn-off energy	E_{off}		-	0.34		
Total switching energy	E_{ts}		-	1.01		
Turn-on delay time	$t_{d(on)}$	T_j=25°C,	-	22		ns
Rise time	t_r	V_{CC}=400V, I_C=30A,	-	30		
Turn-off delay time	$t_{d(off)}$	V_{GE}=0/15V,	-	250		
Fall time	t_f	R_G=11	-	26		
Turn-on energy	E_{on}	Energy losses include “tail” and diode reverse recovery.	-	0.78		mJ
Turn-off energy	E_{off}		-	0.55		
Total switching energy	E_{ts}		-	1.33		

Switching Characteristic, Inductive Load, at T_j=150 °C

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	T_j=150°C	-	17		ns
Rise time	t_r	V_{CC}=400V,	-	19		
Turn-off delay time	$t_{d(off)}$	I_C=30A,	-	122		
Fall time	t_f	V_{GE}=0/15V,	-	29		
Turn-on energy	E_{on}	R_G= 1.8	-	0.90		mJ
Turn-off energy	E_{off}	Energy losses include	-	0.48		
Total switching energy	E_{ts}	“tail” and diode reverse recovery.	-	1.38		
Turn-on delay time	$t_{d(on)}$	T_j=150°C	-	22		ns
Rise time	t_r	V_{CC}=400V,	-	28		
Turn-off delay time	$t_{d(off)}$	I_C=30A,	-	274		
Fall time	t_f	V_{GE}=0/15V,	-	28		
Turn-on energy	E_{on}	R_G= 11	-	1.06		mJ
Turn-off energy	E_{off}	Energy losses include	-	0.70		
Total switching energy	E_{ts}	“tail” and diode reverse recovery.	-	1.76		

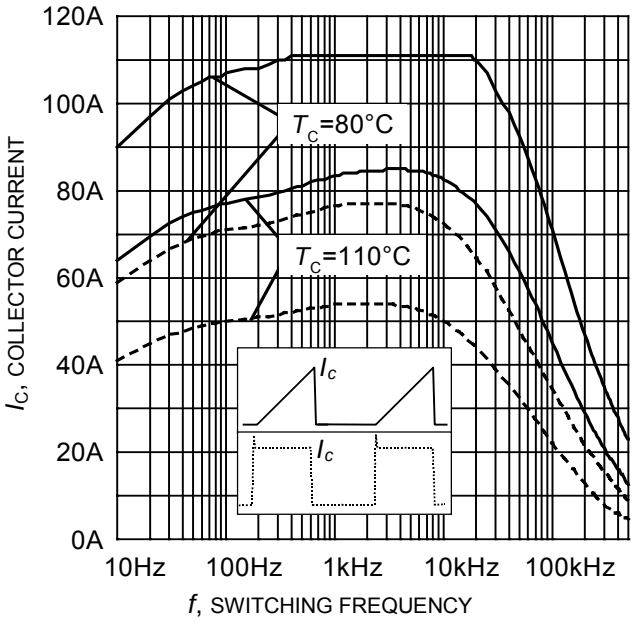


Figure 1. Collector current as a function of switching frequency
($T_j \le 150°C$, $D = 0.5$, $V_{CE} = 400V$, $V_{GE} = 0/+15V$, $R_G = 11\Omega$)

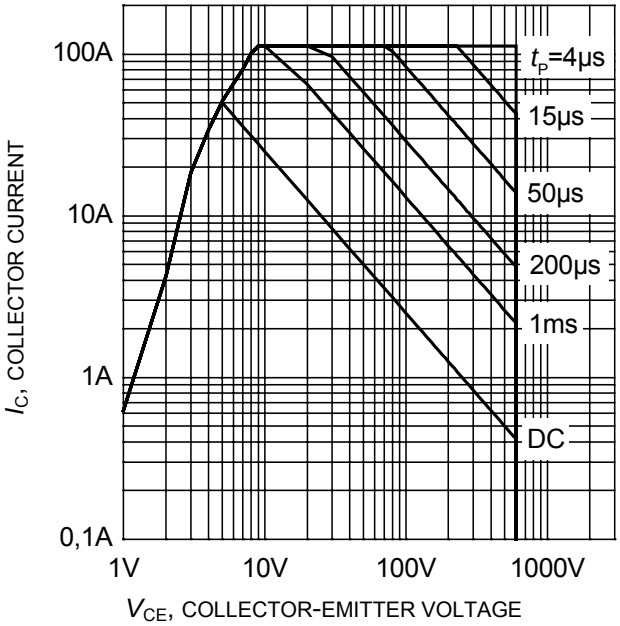


Figure 2. Safe operating area
($D = 0$, $T_C = 25°C$, $T_j \le 150°C$; V_{GE}=15V)

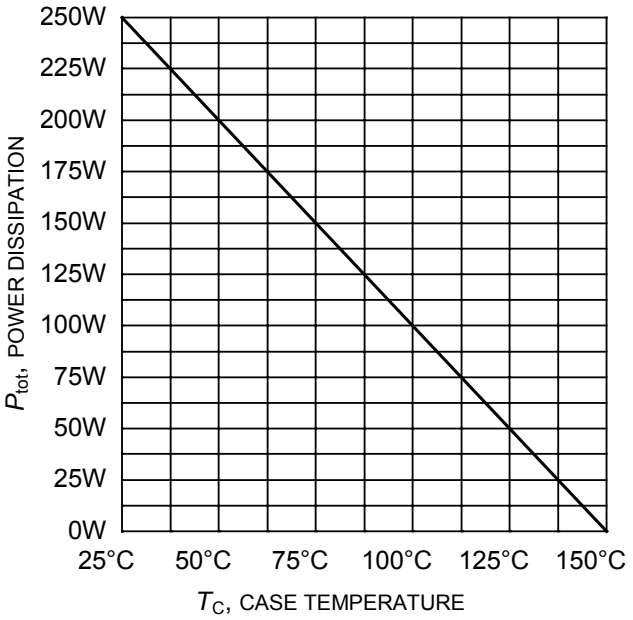


Figure 3. Power dissipation as a function of case temperature
($T_j \le 150°C$)

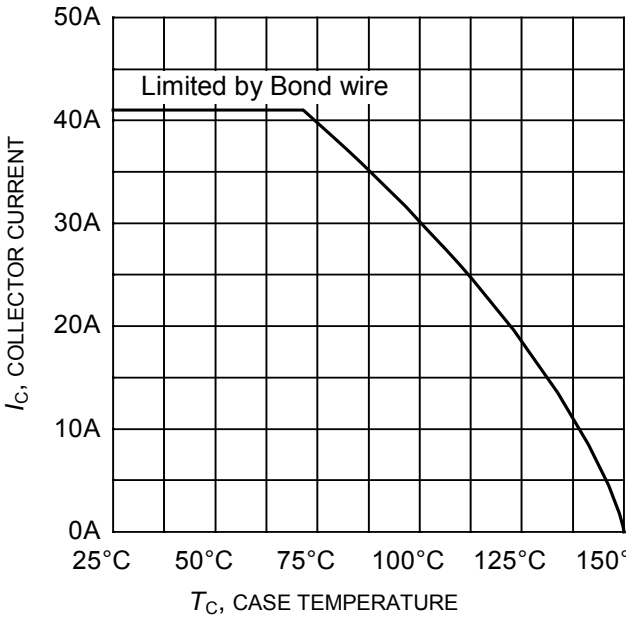


Figure 4. Collector current as a function of case temperature
($V_{GE} \le 15V$, $T_j \le 150°C$)

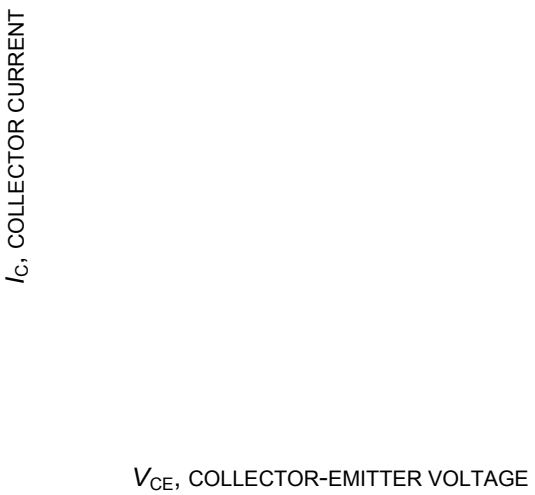


Figure 5. Typical output characteristic
(T_j = 25°C)

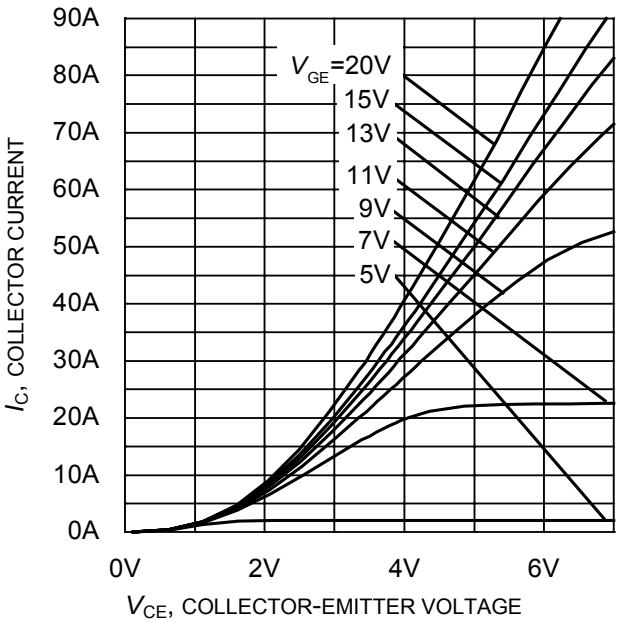


Figure 6. Typical output characteristic
(T_j = 150°C)

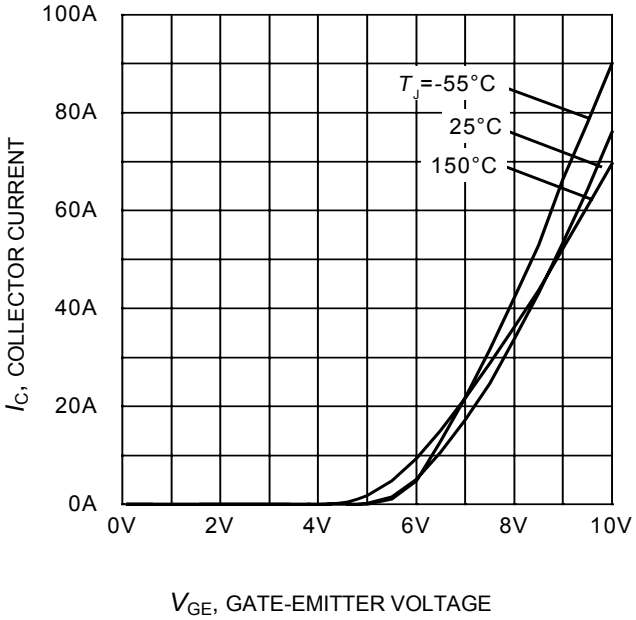


Figure 7. Typical transfer characteristic
(V_{GE}=10V)

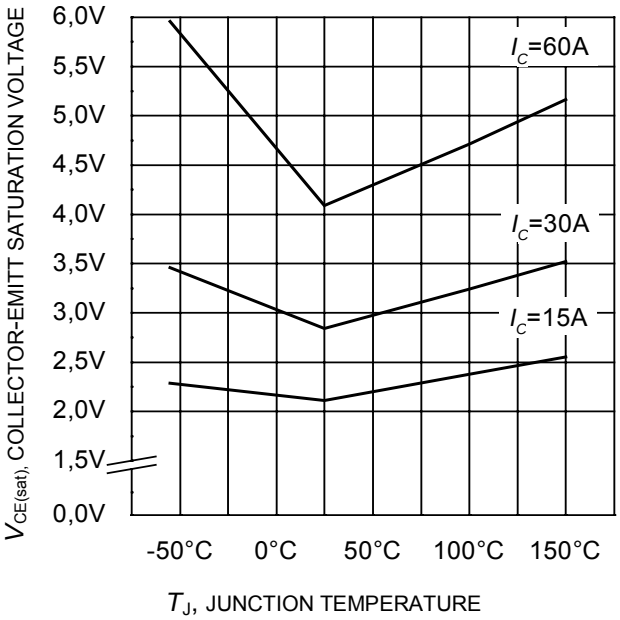


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE} = 15V)

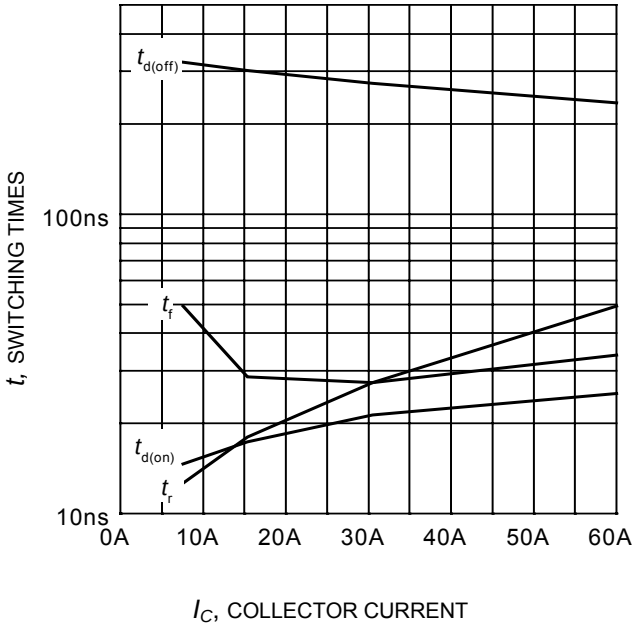


Figure 9. Typical switching times as a function of collector current
(inductive load, T_J=150°C, V_{CE}=400V, VGE=0/15V, R_G=11Ω)

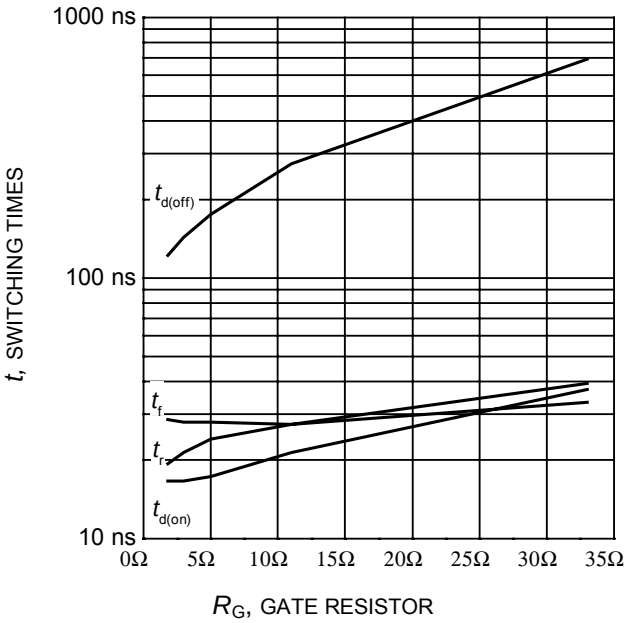


Figure 10. Typical switching times as a function of gate resistor
(inductive load, T_J=150°C, V_{CE}=400V, VGE=0/15V, I_C=30A)

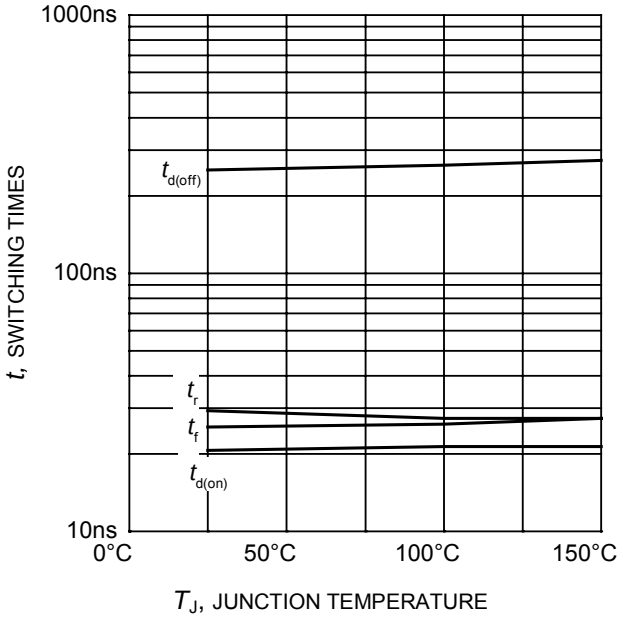


Figure 11. Typical switching times as a function of junction temperature
(inductive load, V_{CE}=400V, VGE=0/15V, I_C=20A, R_G=11Ω)

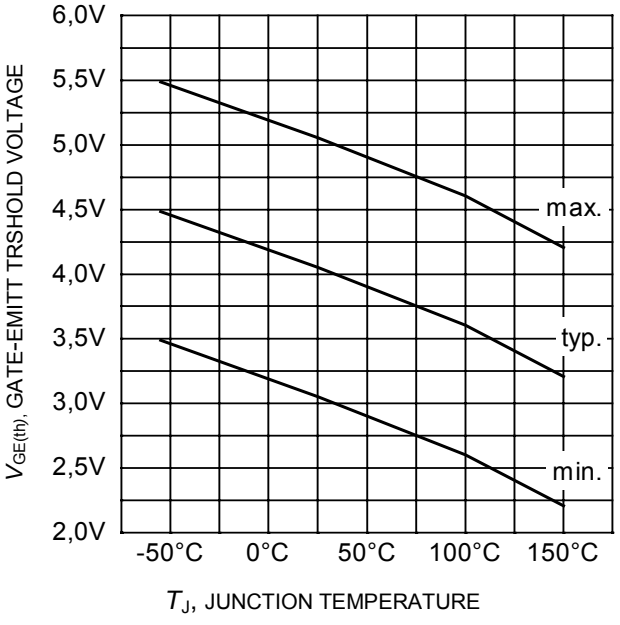


Figure 12. Collector current as a function of case temperature
(V_{GE} ≤ 15V, T_j ≤ 150°C)

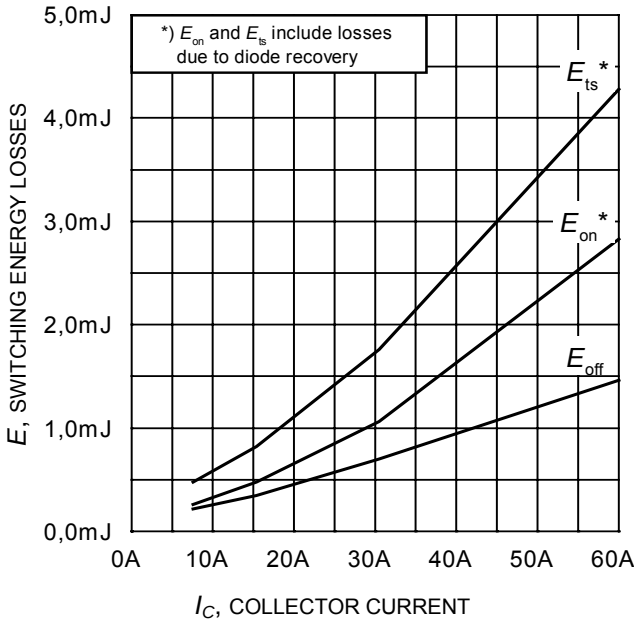


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, T_J=150°C, V_{CE}=400V, VGE=0/15V, R_G=11Ω)

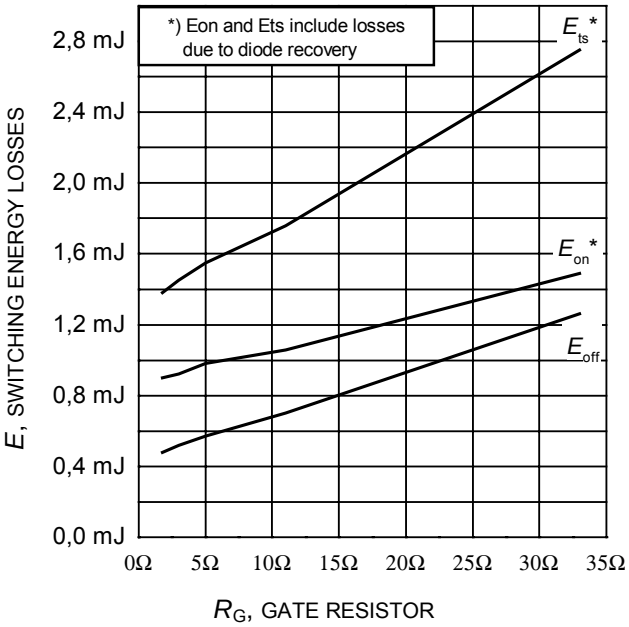


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, T_J=150°C, V_{CE}=400V, VGE=0/15V, I_C=30A

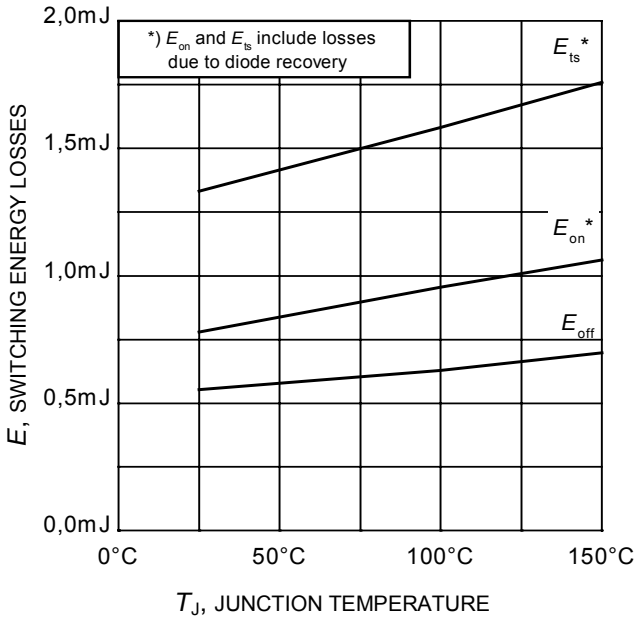


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE}=400V, VGE=0/15V, I_C=30A, R_G=11Ω)

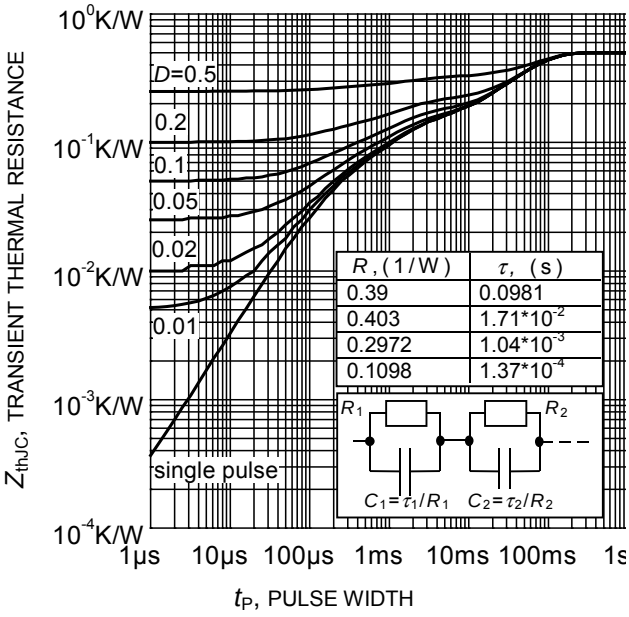


Figure 16. IGBT transient thermal resistance
($D = t_p / T$)

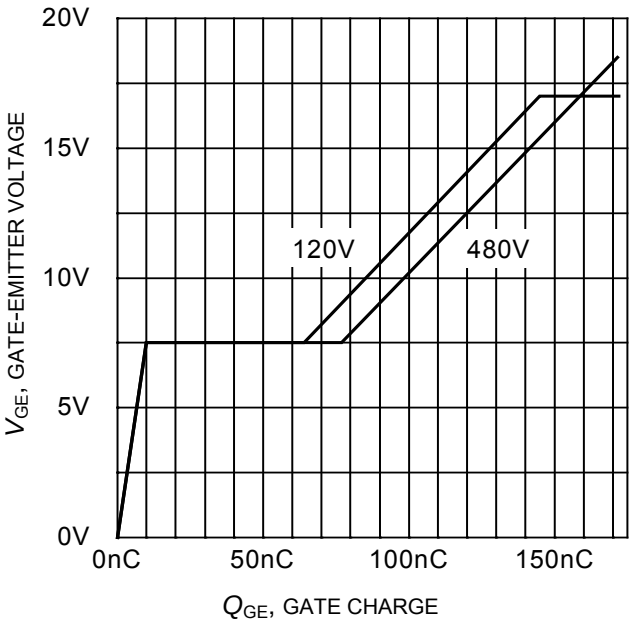


Figure 17. Typical gate charge
(I_C=30 A)

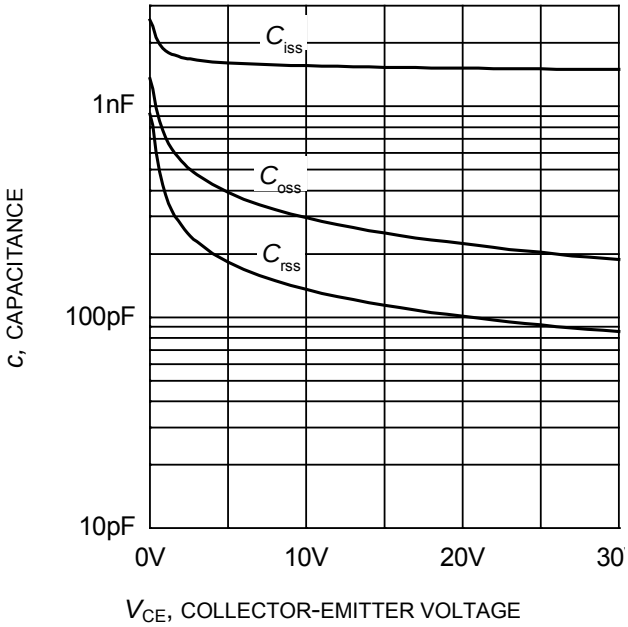
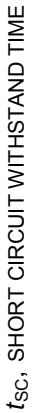


Figure 18. Typical capacitance as a function of collector-emitter voltage
(V_{GE}=0V, f = 1 MHz)



V_{GE}, GATE-EMITETR VOLTAGE

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

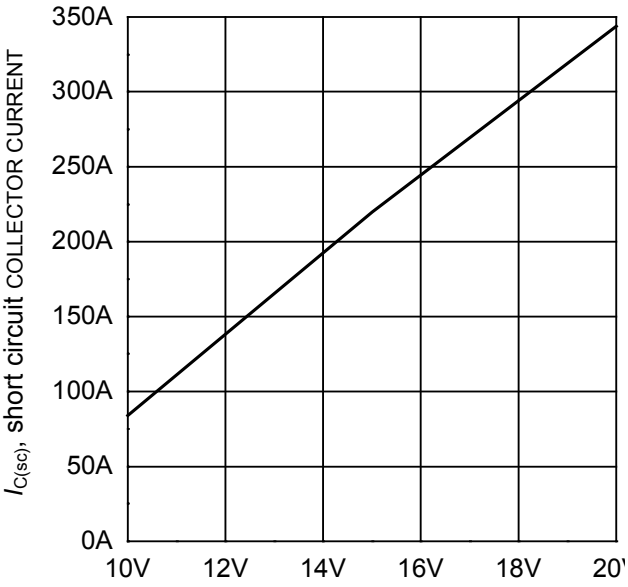
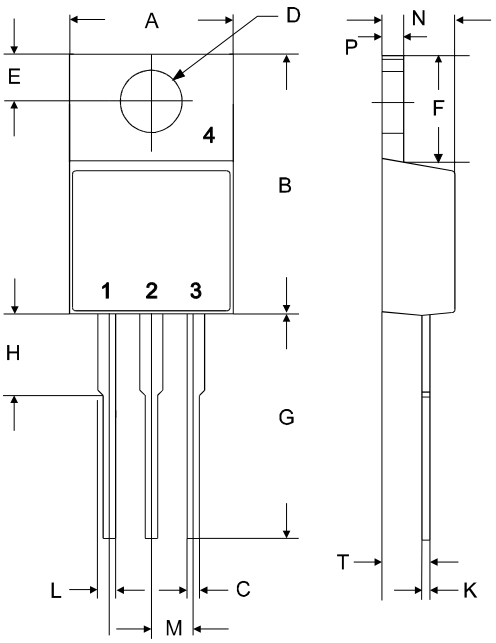


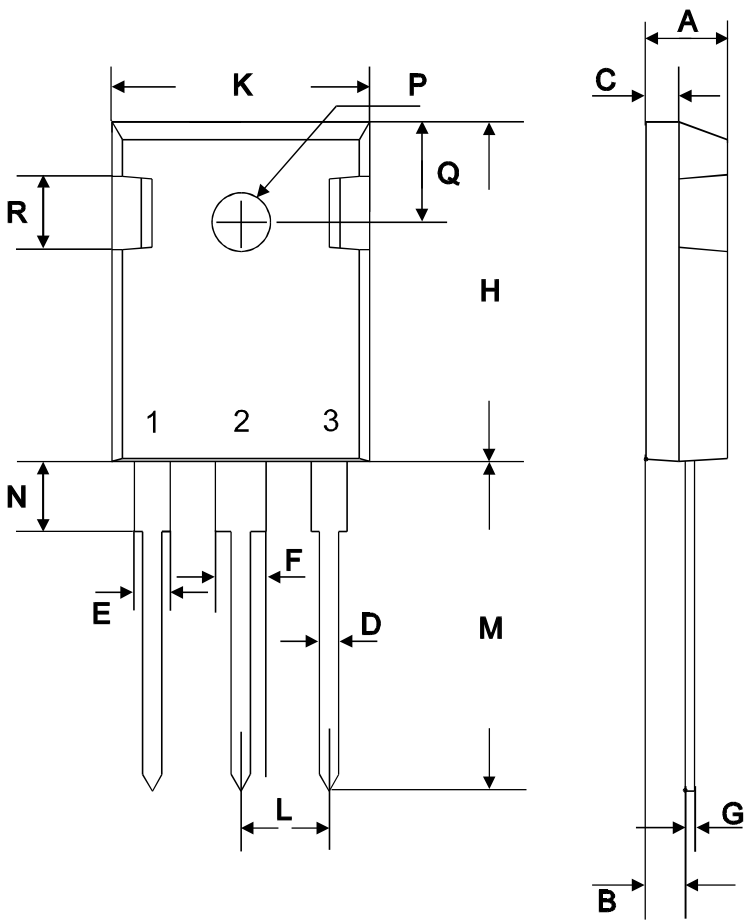
Figure 20. Typical short circuit collector current as a function of gate-emitter voltage
($V_{CE} \le 600V$, $T_j \le 150°C$)

TO-220AB



symbol	dimensions			
	[mm]		[inch]	
	min	max	min	max
A	9.70	10.30	0.3819	0.4055
B	14.88	15.95	0.5858	0.6280
C	0.65	0.86	0.0256	0.0339
D	3.55	3.89	0.1398	0.1531
E	2.60	3.00	0.1024	0.1181
F	6.00	6.80	0.2362	0.2677
G	13.00	14.00	0.5118	0.5512
H	4.35	4.75	0.1713	0.1870
K	0.38	0.65	0.0150	0.0256
L	0.95	1.32	0.0374	0.0520
M	2.54 typ.		0.1 typ.	
N	4.30	4.50	0.1693	0.1772
P	1.17	1.40	0.0461	0.0551
T	2.30	2.72	0.0906	0.1071

TO-247AC



symbol	dimensions			
	[mm]		[inch]	
	min	max	min	max
A	4.78	5.28	0.1882	0.2079
B	2.29	2.51	0.0902	0.0988
C	1.78	2.29	0.0701	0.0902
D	1.09	1.32	0.0429	0.0520
E	1.73	2.06	0.0681	0.0811
F	2.67	3.18	0.1051	0.1252
G	0.76 max		0.0299 max	
H	20.80	21.16	0.8189	0.8331
K	15.65	16.15	0.6161	0.6358
L	5.21	5.72	0.2051	0.2252
M	19.81	20.68	0.7799	0.8142
N	3.560	4.930	0.1402	0.1941
∅P	3.61		0.1421	
Q	6.12	6.22	0.2409	0.2449

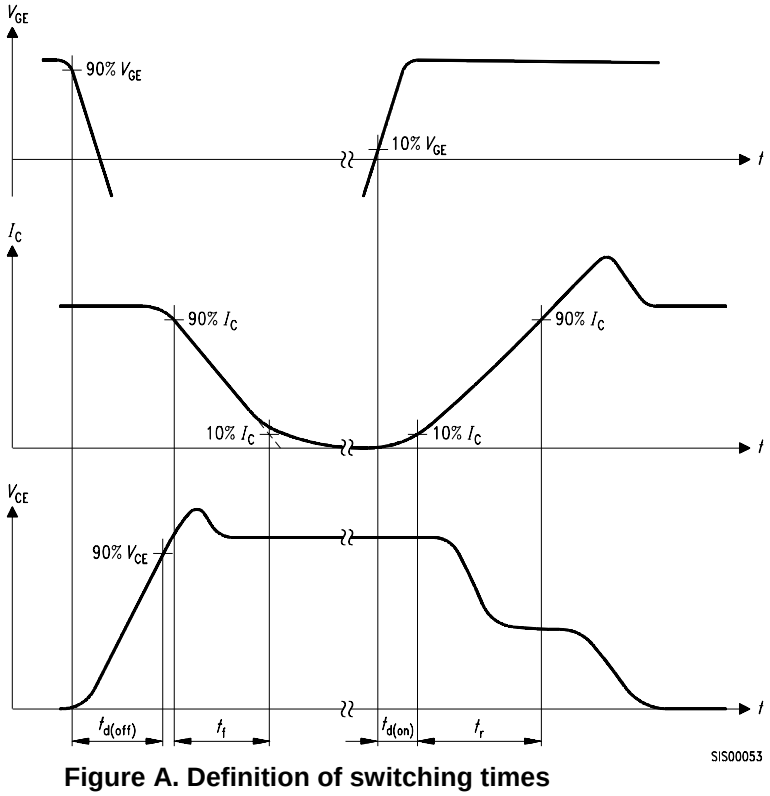


Figure A. Definition of switching times

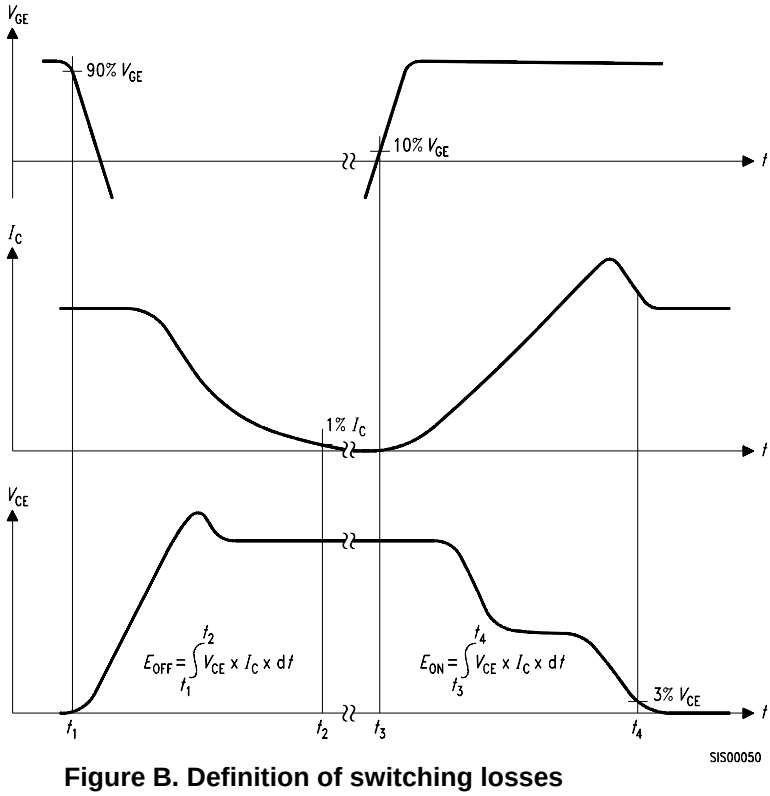


Figure B. Definition of switching losses

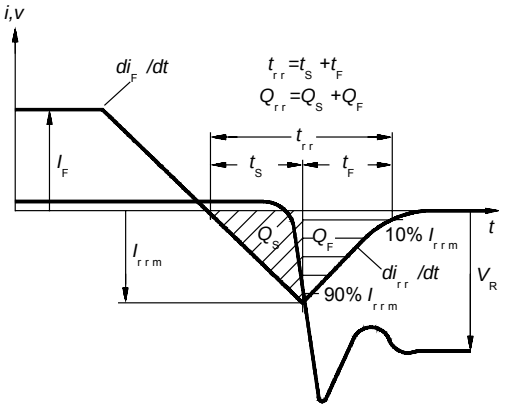


Figure C. Definition of diodes switching characteristics

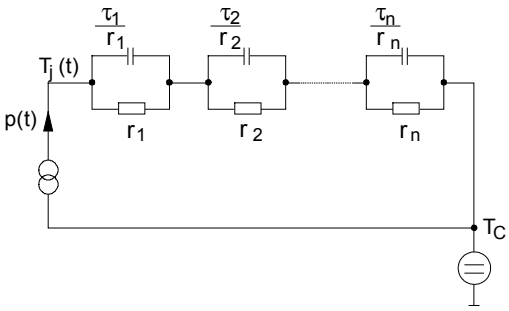


Figure D. Thermal equivalent circuit

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