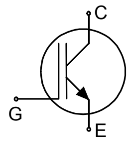
Fast IGBT in NPT-technology



- lower E_{off} compared to previous generation
- Short circuit withstand time – 10 µs
- Designed for:
  - Motor controls
  - Inverter
  - SMPS
- NPT-Technology offers:
  - very tight parameter distribution
  - high ruggedness, temperature stable behaviour
  - parallel switching capability


PG-TO-220-3-1

- Qualified according to JEDEC[1] 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	E_{off}	T_j **M**	**arking**	**Package**
SGP07N120 1200	V	8A	0.7mJ	150°C	GP07N120	PG-TO-220-3-1

Maximum Ratings

Parameter S	**ymbol**	**Value**	**Unit**
Collector-emitter voltage	V_{CE}	1200	V
DC collector current T_C = 25°C T_C = 100°C	I_C	 16.5 7.9	A
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	27	
Turn off safe operating area $V_{CE} \leq$ 1200V, $T_j \leq$ 150°C	-	27	
Gate-emitter voltage	V_{GE}	±20	V
Avalanche energy, single pulse I_C = 8A, V_{CC} = 50V, R_{GE} = 25Ω, start at T_j = 25°C	E_{AS}	40	mJ
Short circuit withstand time[2] V_{GE} = 15V, 100V ≤ $V_{CC} \leq$ 1200V, $T_j \leq$ 150°C	t_{SC}	10	µs
Power dissipation T_C = 25°C	P_{tot}	125 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] 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}		1	K/W
Thermal resistance, junction – ambient	R_{thJA}	PG-TO-220-3-1	62	

Electrical Characteristic, at T_j = 25 °C, unless otherwise specified

Parameter Sy	mbol	Conditions	Value			Unit
			min. ty	p.	max.	
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	V_{GE}=0V, I_C=500µA	1200	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE} = 15V, I_C=8A T_j=25°C T_j=150°C	 2.5 -	 3.1 3.7	 3.6 4.3	
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=350µA, V_{CE}=V_{GE}	3	4	5	
Zero gate voltage collector current	I_{CES}	V_{CE}=1200V, V_{GE}=0V T_j=25°C T_j=150°C	 - -	 - -	 100 400	µA
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	- -		100	nA
Transconductance	g_{fs}	V_{CE}=20V, I_C=8A		6	-	S
Dynamic Characteristic						
Input capacitance	C_{iss}	V_{CE}=25V,	-	720	870	pF
Output capacitance	C_{oss}	V_{GE}=0V,	-	60	75	
Reverse transfer capacitance	C_{rss}	f=1M Hz	- 40		50	
Gate charge	Q_{Gate}	V_{CC}=960V, I_C=8A V_{GE}=15V	- 70		90	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	7	-	nH
Short circuit collector current[2)]	$I_{C(SC)}$	V_{GE}=15V, $t_{SC} \le 10\,\mu s$ 100V $\le V_{CC} \le$ 1200V , $T_j \le$ 150 °C	- 7	5	-	A

[2)] 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, V_{CC}=800V, I_C=8A, V_{GE}=15V/0V, R_G=47Ω, L_σ[1]=180nH, C_σ[1]=40pF Energy losses include "tail" and diode reverse recovery.	-	27	35	ns
Rise time	t_r		-	29	38	
Turn-off delay time	$t_{d(off)}$		-	440	570	
Fall time	t_f		-	21	27	
Turn-on energy	E_{on}		-	0.6	0.8	mJ
Turn-off energy	E_{off}		-	0.4	0.55	
Total switching energy	E_{ts}		-	1.0	1.35	

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, V_{CC}=800V, I_C=8A, V_{GE}=15V/0V, R_G=47Ω, L_σ[1]=180nH, C_σ[1]=40pF Energy losses include "tail" and diode reverse recovery.	-	30	36	ns
Rise time	t_r		-	26	31	
Turn-off delay time	$t_{d(off)}$		-	490	590	
Fall time	t_f		-	30	36	
Turn-on energy	E_{on}		-	1.0	1.2	mJ
Turn-off energy	E_{off}		-	0.7	0.9	
Total switching energy	E_{ts}		-	1.7	2.1	

[1] Leakage inductance L_σ and stray capacity C_σ due to dynamic test circuit in figure E.

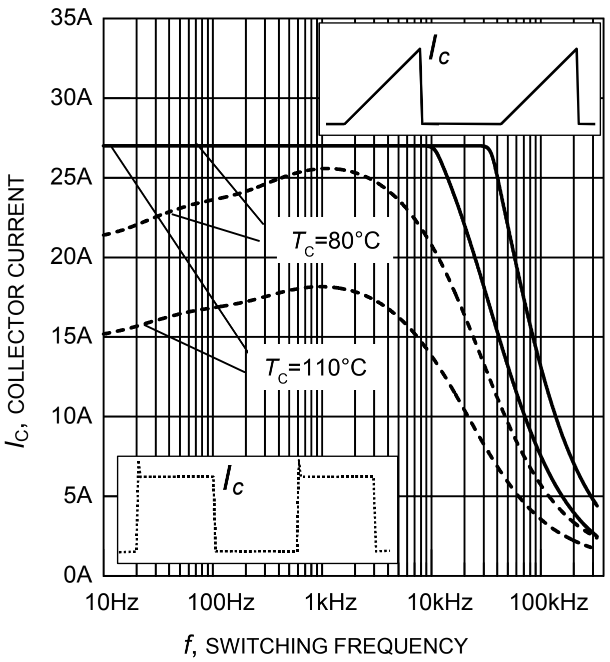


Figure 1. Collector current as a function of switching frequency
($T_j \leq 150°C$, $D = 0.5$, $V_{CE} = 800V$, $V_{GE} = +15V/0V$, $R_G = 47\Omega$)

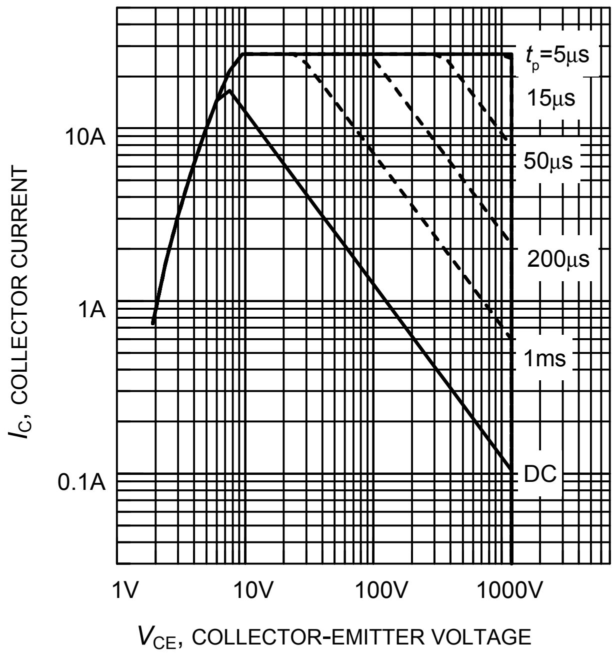


Figure 2. Safe operating area
($D = 0$, $T_C = 25°C$, $T_j \leq 150°C$)

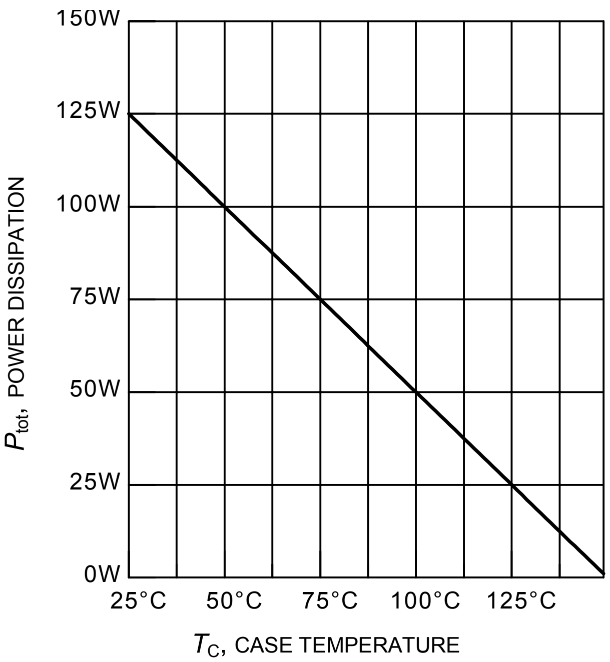


Figure 3. Power dissipation as a function of case temperature
($T_j \leq 150°C$)

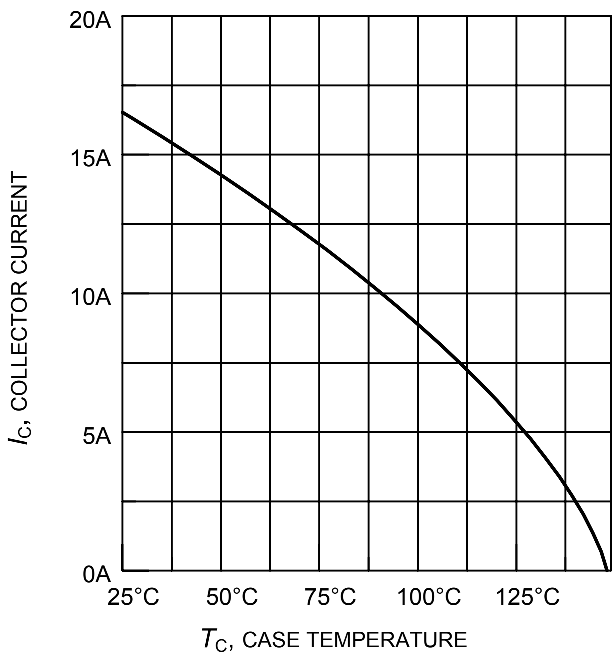


Figure 4. Collector current as a function of case temperature
($V_{GE} \leq 15V$, $T_j \leq 150°C$)

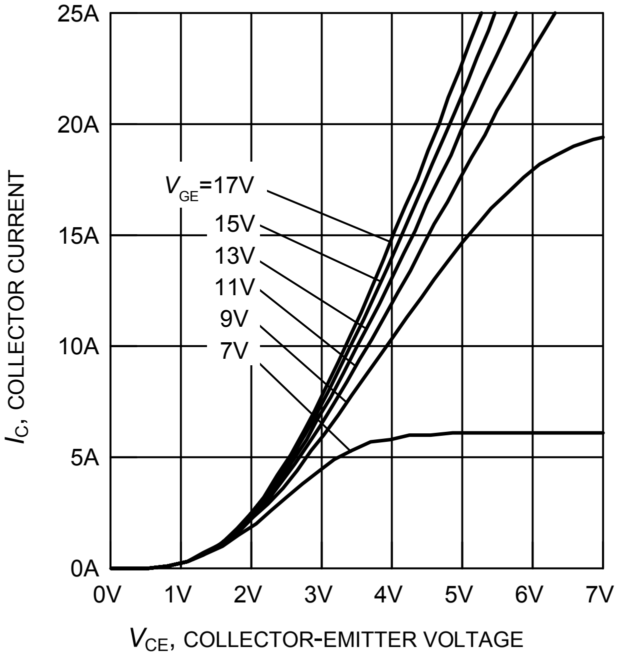


Figure 5. Typical output characteristics
(T_j = 25°C)

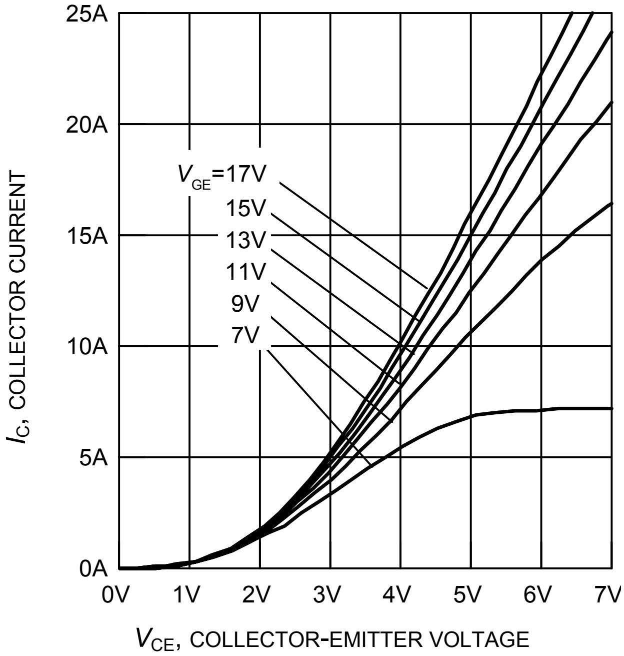


Figure 6. Typical output characteristics
(T_j = 150°C)

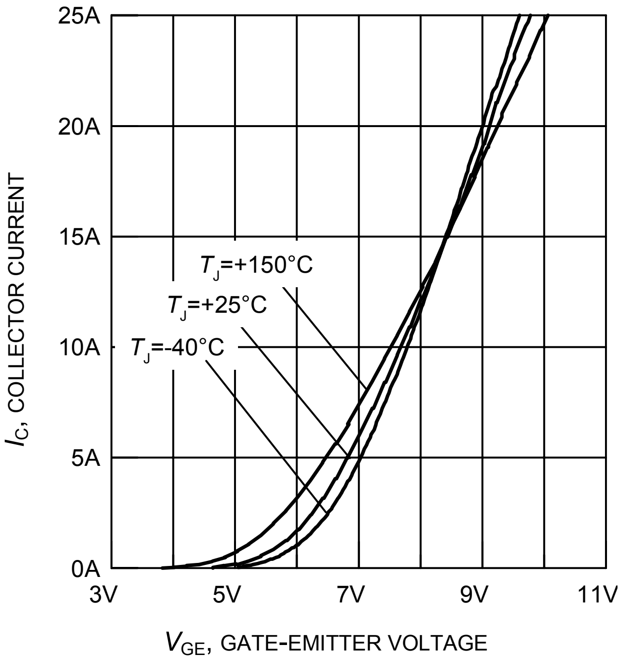


Figure 7. Typical transfer characteristics
(V_{CE} = 20V)

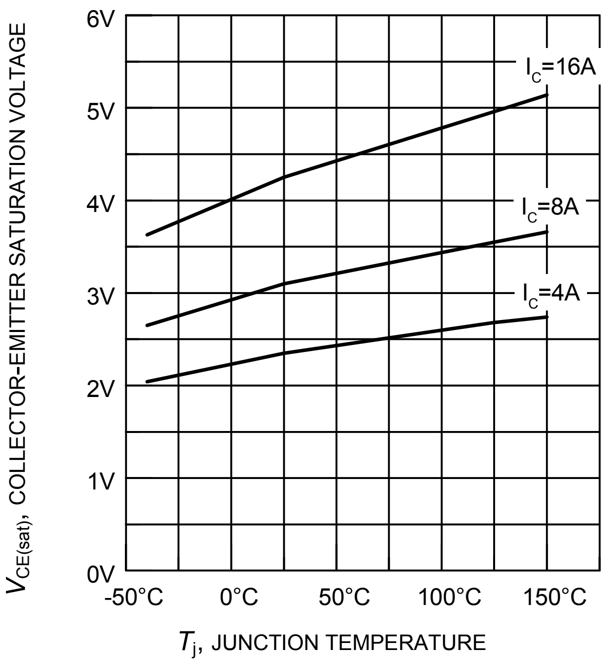


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE} = 15V)

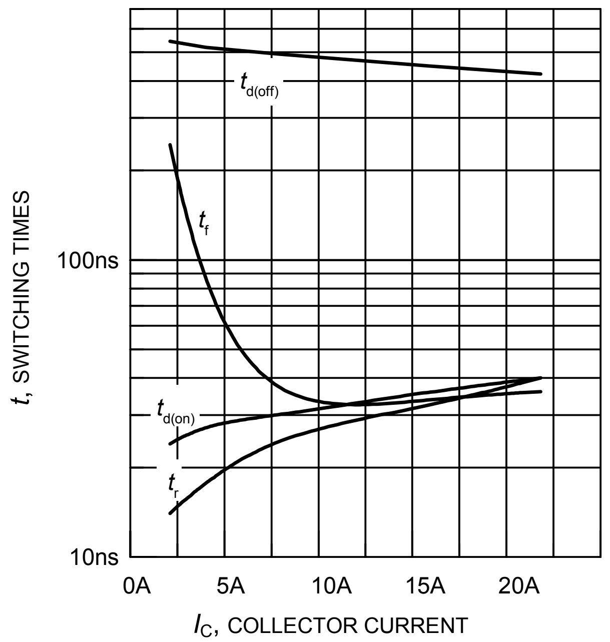


Figure 9. Typical switching times as a function of collector current
(inductive load, T_j = 150°C,
V_{CE} = 800V, V_{GE} = +15V/0V, R_G = 47Ω,
dynamic test circuit in Fig.E)

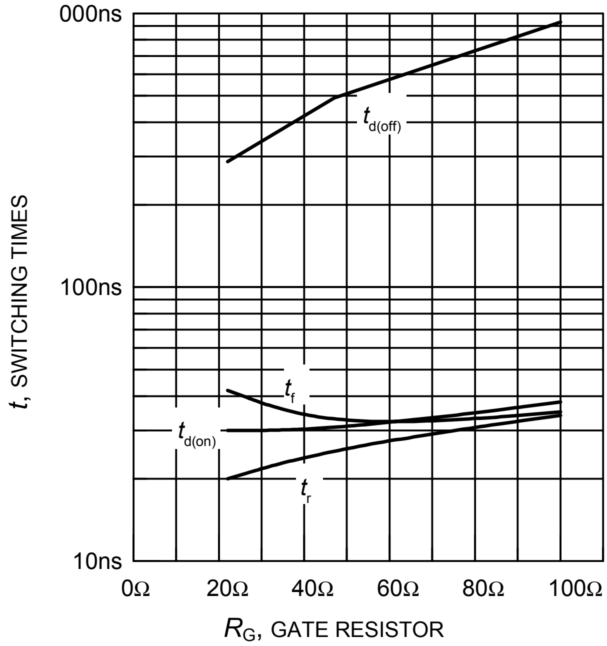


Figure 10. Typical switching times as a function of gate resistor
(inductive load, T_j = 150°C,
V_{CE} = 800V, V_{GE} = +15V/0V, I_C = 8A,
dynamic test circuit in Fig.E)

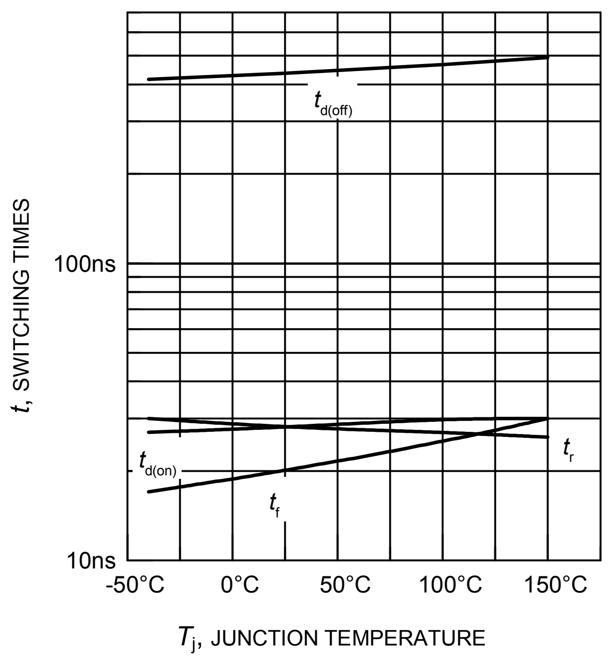


Figure 11. Typical switching times as a function of junction temperature
(inductive load, V_{CE} = 800V,
V_{GE} = +15V/0V, I_C = 8A, R_G = 47Ω,
dynamic test circuit in Fig.E)

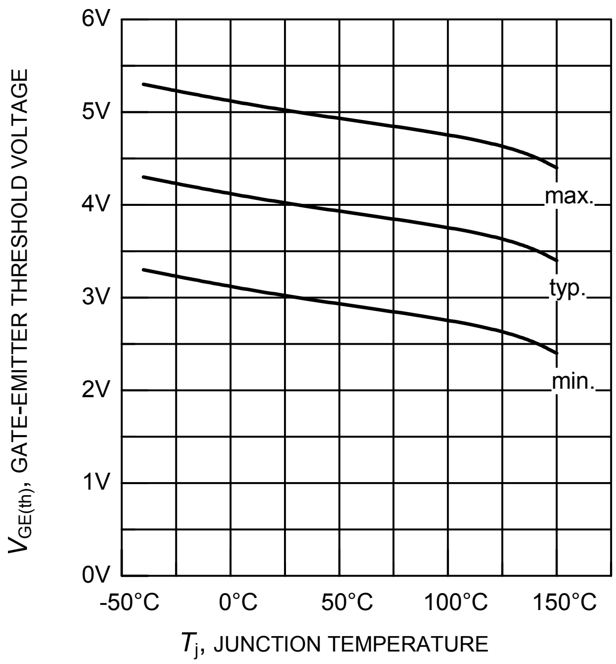


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
(I_C = 0.3mA)

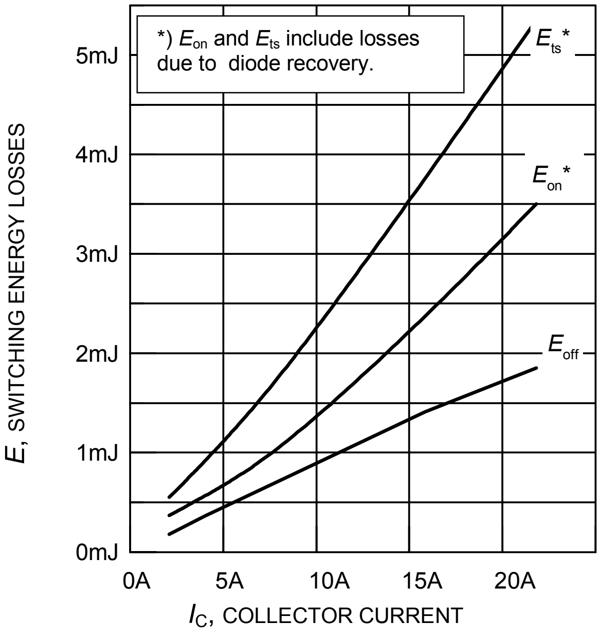


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, T_j = 150°C, V_{CE} = 800V, V_{GE} = +15V/0V, R_G = 47Ω, dynamic test circuit in Fig.E)

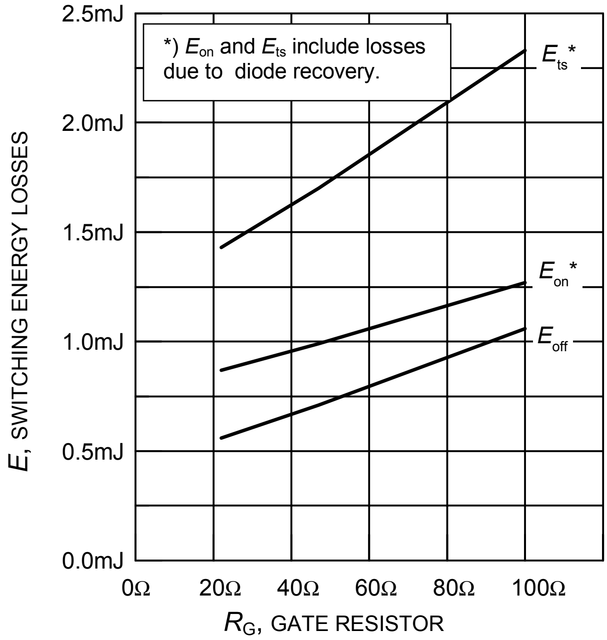


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, T_j = 150°C, V_{CE} = 800V, V_{GE} = +15V/0V, I_C = 8A, dynamic test circuit in Fig.E)

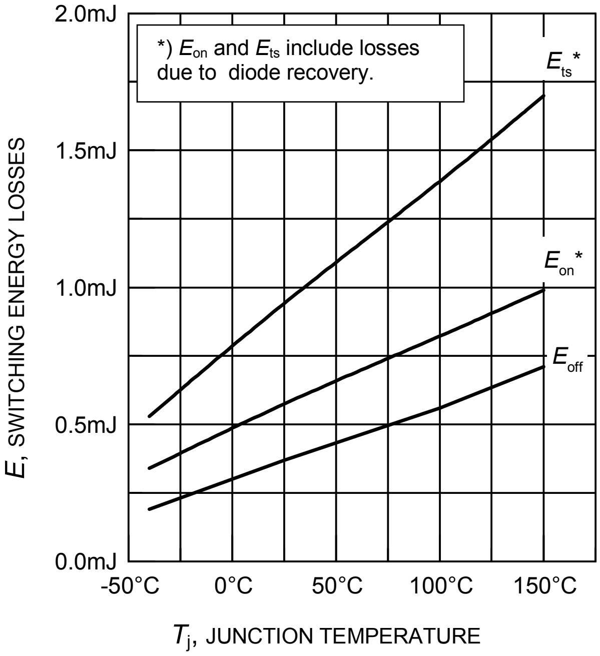
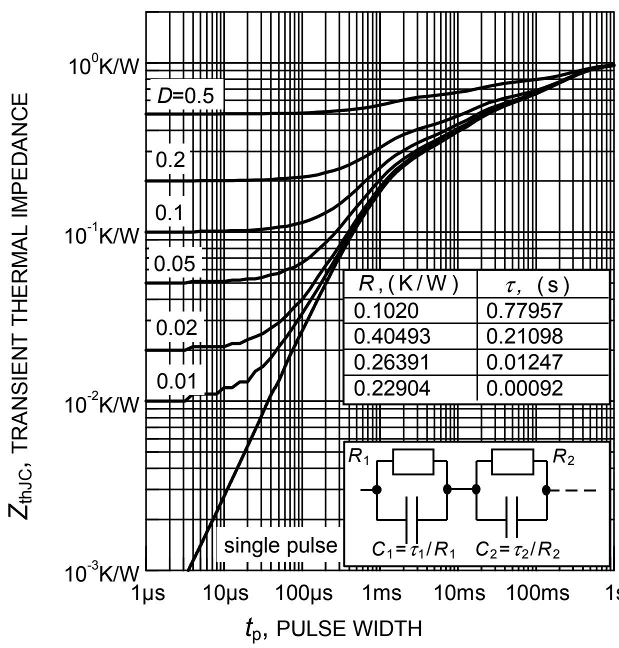


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE} = 800V, V_{GE} = +15V/0V, I_C = 8A, R_G = 47Ω, dynamic test circuit in Fig.E)



R, (K/W)	τ, (s)
0.1020	0.77957
0.40493	0.21098
0.26391	0.01247
0.22904	0.00092

Figure 16. IGBT transient thermal impedance as a function of pulse width
($D = t_p / T$)

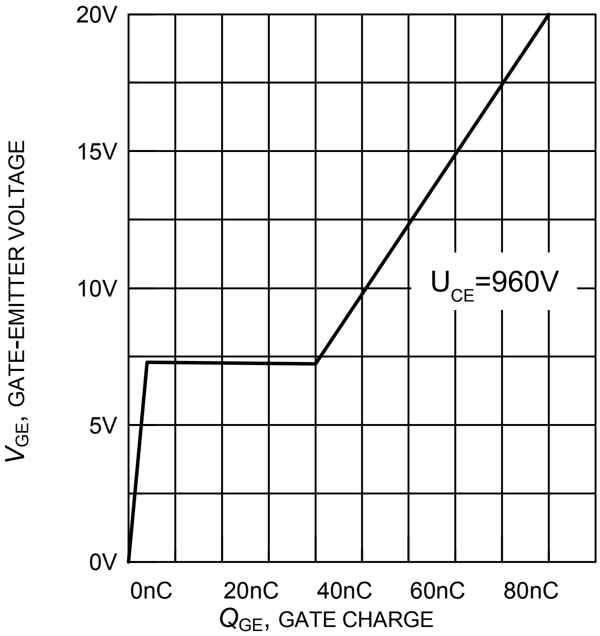


Figure 17. Typical gate charge
(I_C = 8A)

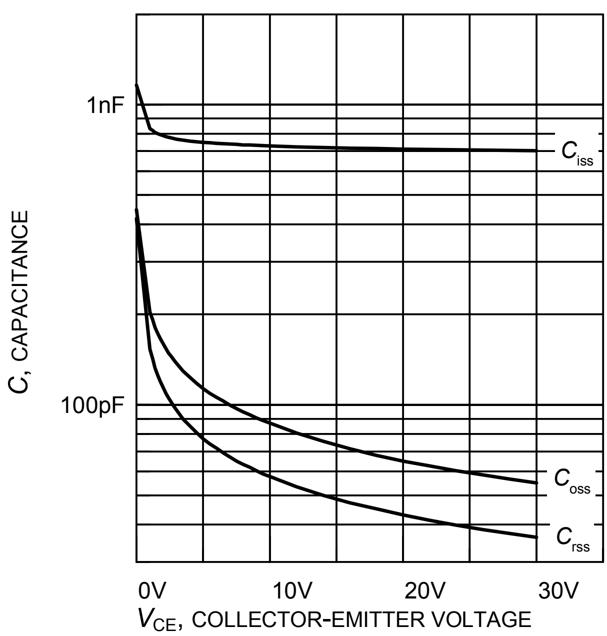


Figure 18. Typical capacitance as a function of collector-emitter voltage
(V_{GE} = 0V, f = 1MHz)

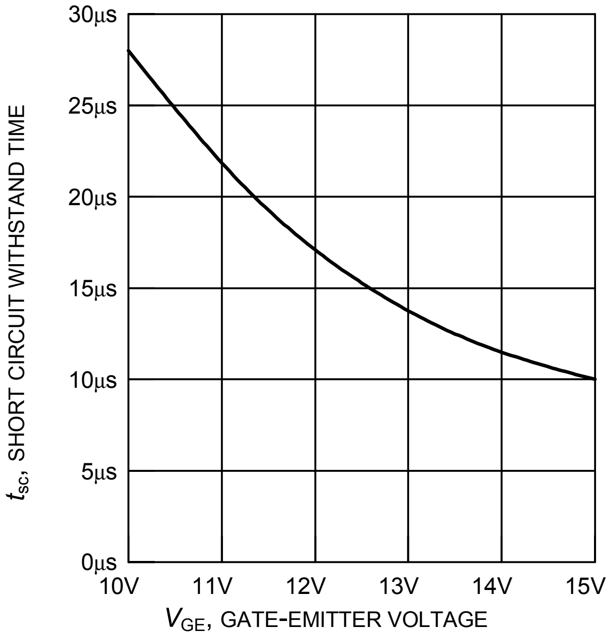


Figure 19. Short circuit withstand time as a function of gate-emitter voltage
(V_{CE} = 1200V, start at T_j = 25°C)

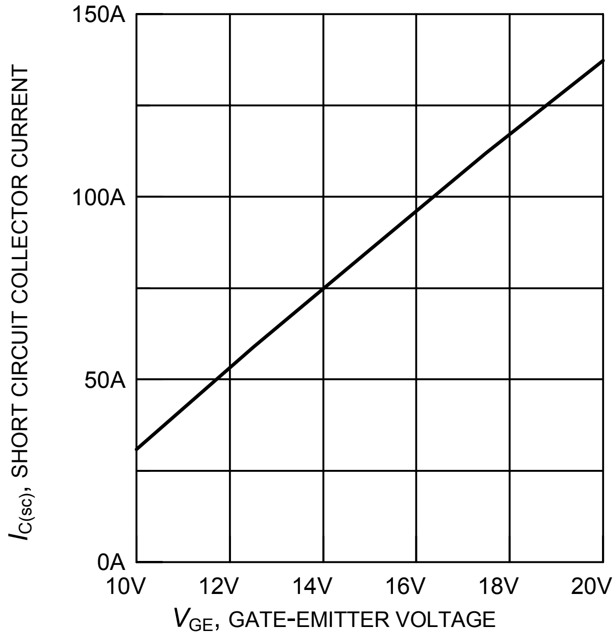


Figure 20. Typical short circuit collector current as a function of gate-emitter voltage
(100V ≤ V_{CE} ≤ 1200V, T_C = 25°C, T_j ≤ 150°C)

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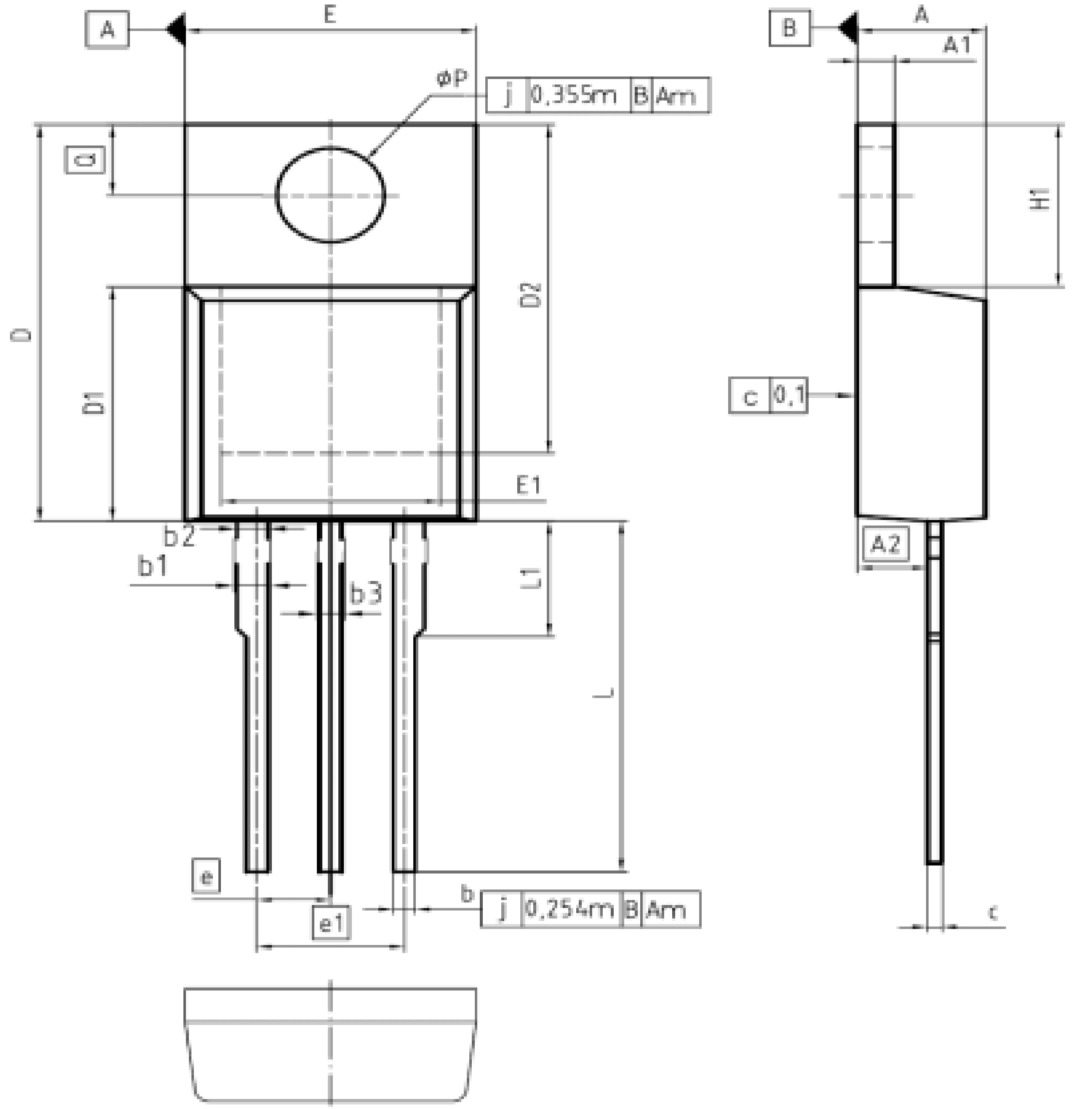

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	1.17	1.40	0.046	0.055
A2	2.15	2.72	0.085	0.107
b	0.65	0.86	0.026	0.034
b1	0.95	1.40	0.037	0.055
b2	0.95	1.15	0.037	0.045
b3	0.65	1.15	0.026	0.045
c	0.33	0.60	0.013	0.024
D	14.81	15.95	0.583	0.628
D1	8.51	9.45	0.335	0.372
D2	12.19	13.10	0.480	0.516
E	9.70	10.36	0.382	0.408
E1	6.50	8.60	0.256	0.339
e	2.54		0.100	
e1	5.08		0.200	
N	3		3	
H1	5.90	6.90	0.232	0.272
L	13.00	14.00	0.512	0.551
L1	-	4.80	-	0.189
øP	3.60	3.89	0.142	0.153
Q	2.60	3.00	0.102	0.118

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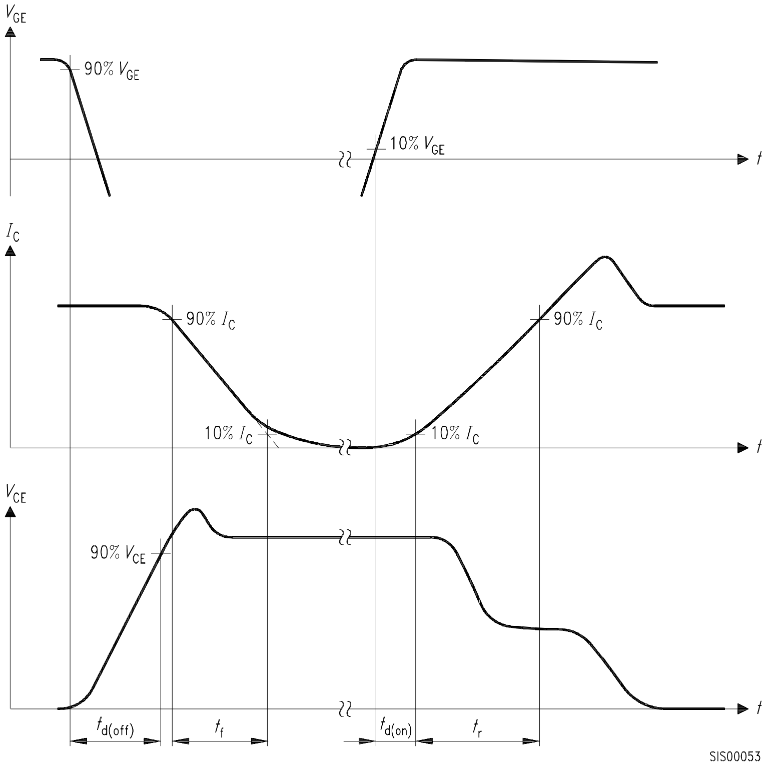

Figure A. Definition of switching times

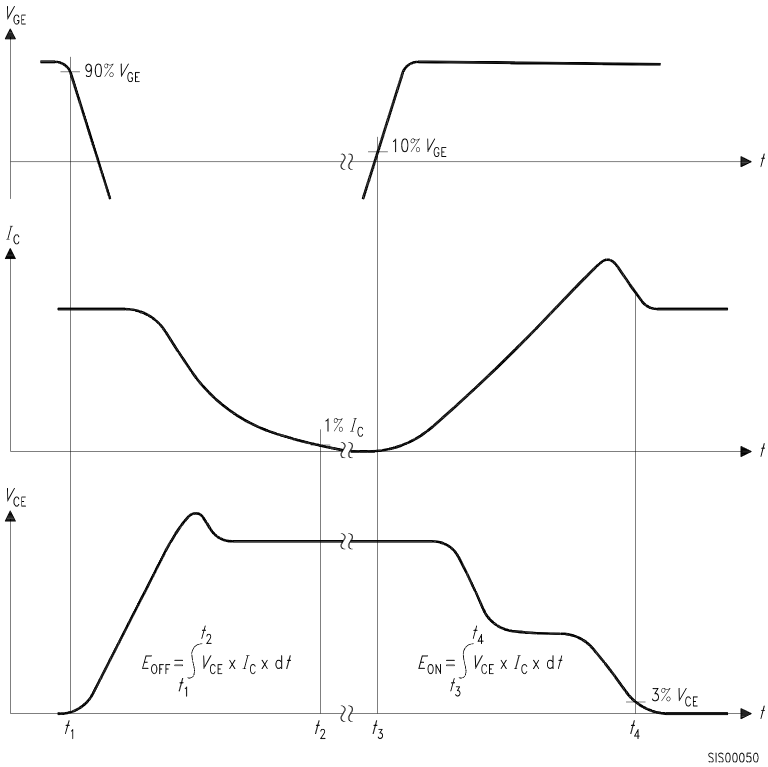

Figure B. Definition of switching losses

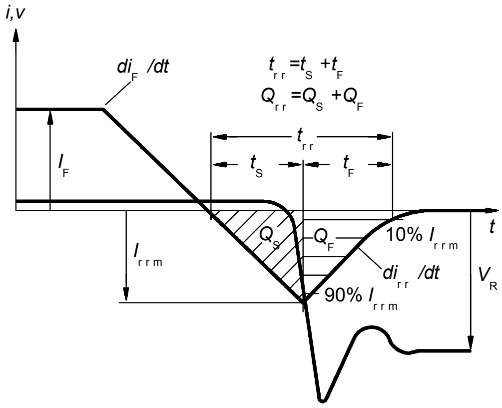

Figure C. Definition of diodes switching characteristics

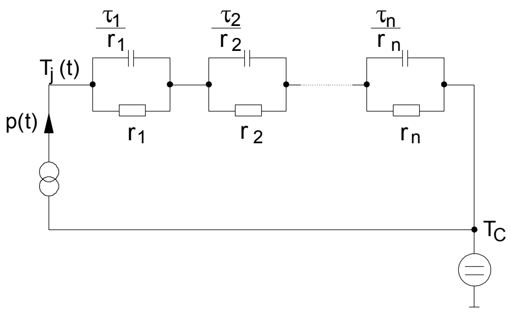

Figure D. Thermal equivalent circuit

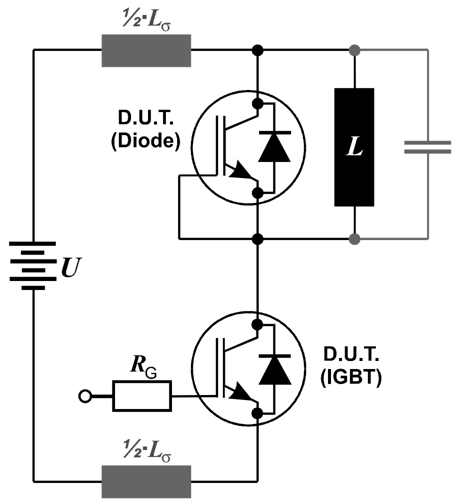

Figure E. Dynamic test circuit
Leakage inductance L_σ=180nH,
and stray capacity C_σ =40pF.

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