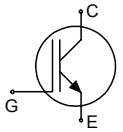
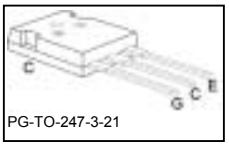
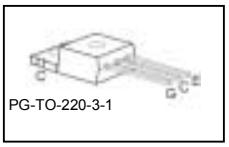
SGP10N60A
SGW10N60A

Fast IGBT in NPT-technology







- 75% lower E_{off} compared to previous generation
  combined with low conduction losses
- Short circuit withstand time – 10 µs
- Designed for:
  - Motor controls
  - Inverter
- NPT-Technology for 600V applications offers:
  - very tight parameter distribution
  - high ruggedness, temperature stable behaviour
  - parallel switching capability
- 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	$V_{CE(sat)}$	T_j	Marking	Package
SGP10N60A	600V	10A	2.3V	150°C	G10N60A	PG-TO-220-3-1
SGW10N60A	600V	10A	2.3V	150°C	G10N60A	PG-TO-247-3-21

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	 20 10.6	A
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	40	
Turn off safe operating area $V_{CE} \le 600V$, $T_j \le 150°C$	-	40	
Gate-emitter voltage	V_{GE}	±20	V
Avalanche energy, single pulse I_C = 10 A, V_{CC} = 50 V, R_{GE} = 25 Ω, start at T_j = 25°C	E_{AS}	70	mJ
Short circuit withstand time[2] V_{GE} = 15V, $V_{CC} \le 600V$, $T_j \le 150°C$	t_{SC}	10	µs
Power dissipation T_C = 25°C	P_{tot}	92	W
Operating junction and storage temperature	T_j , T_{stg}	-55...+150	°C
Soldering temperature, wavesoldering, 1.6mm (0.063 in.) from case for 10s	T_s	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}		1.35	K/W
Thermal resistance, junction – ambient	R_{thJA}	PG-TO-220-3-1 PG-TO-247-3-21	62 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=10A T_j=25°C T_j=150°C	 1.7 -	 2 2.3	 2.4 2.8	
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 1500	µA
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	100	nA
Transconductance	g_{fs}	V_{CE}=20V, I_C=10A	-	6.7	-	S
Dynamic Characteristic						
Input capacitance	C_{iss}	V_{CE}=25V,	-	550	660	pF
Output capacitance	C_{oss}	V_{GE}=0V,	-	62	75	
Reverse transfer capacitance	C_{rss}	f=1MHz	-	42	51	
Gate charge	Q_{Gate}	V_{CC}=480V, I_C=10A V_{GE}=15V	-	52	68	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E	PG-TO-220-3-1 PG-TO-247-3-21	- -	7 13	- -	nH
Short circuit collector current[2)]	$I_{C(SC)}$	V_{GE}=15V, t_{SC}≤10µs V_{CC} ≤ 600V, T_j ≤ 150°C	-	100	-	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}=400V, I_C=10A, V_{GE}=0/15V, R_G=25Ω, L_σ [1)] =180nH, C_σ [1)] =55pF Energy losses include "tail" and diode reverse recovery.	-	28	34	ns
Rise time	t_r		-	12	15	
Turn-off delay time	$t_{d(off)}$		-	178	214	
Fall time	t_f		-	24	29	
Turn-on energy	E_{on}		-	0.15	0.173	mJ
Turn-off energy	E_{off}		-	0.17	0.221	
Total switching energy	E_{ts}		-	0.320	0.394	

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}=400V, I_C=10A, V_{GE}=0/15V, R_G=25Ω L_σ [1)] =180nH, C_σ [1)] =55pF Energy losses include "tail" and diode reverse recovery.	-	28	34	ns
Rise time	t_r		-	12	15	
Turn-off delay time	$t_{d(off)}$		-	198	238	
Fall time	t_f		-	26	32	
Turn-on energy	E_{on}		-	0.260	0.299	mJ
Turn-off energy	E_{off}		-	0.280	0.364	
Total switching energy	E_{ts}		-	0.540	0.663	

[1)] Leakage inductance L_σ and Stray capacity C_σ due to dynamic test circuit in Figure E.

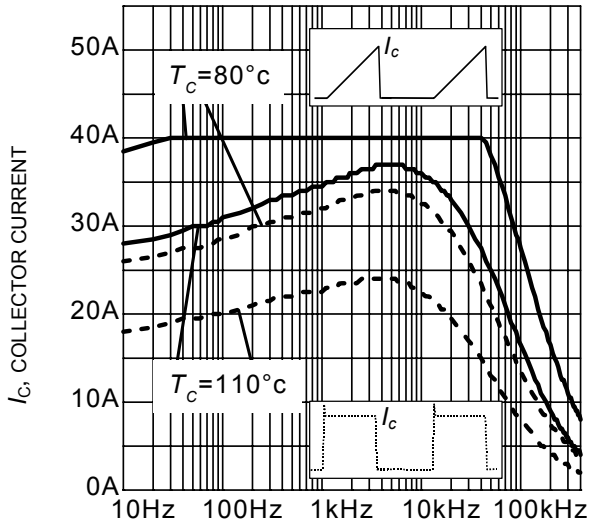


Figure 1. Collector current as a function of switching frequency
($T_j \le 150°C$, $D = 0.5$, $V_{CE} = 400V$, $V_{GE} = 0/+15V$, $R_G = 25\Omega$)

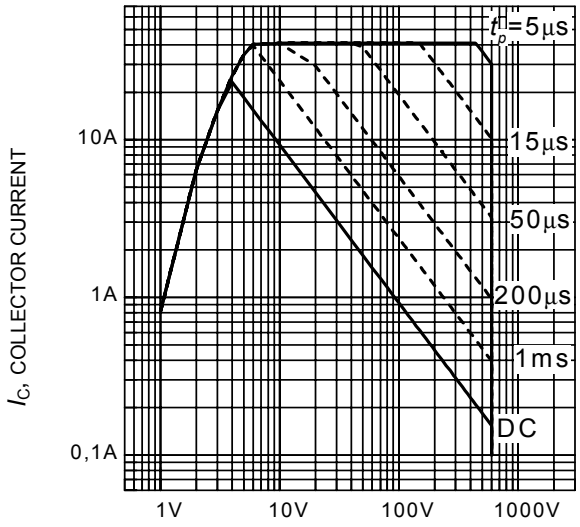


Figure 2. Safe operating area
($D = 0$, $T_C = 25°C$, $T_j \le 150°C$)

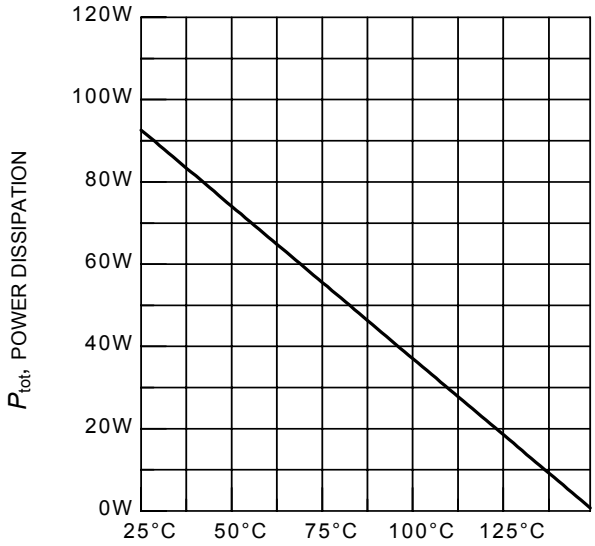


Figure 3. Power dissipation as a function of case temperature
($T_j \le 150°C$)

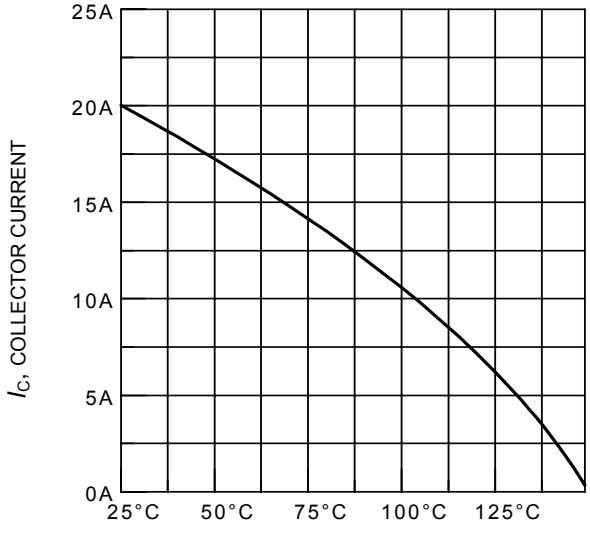


Figure 4. Collector current as a function of case temperature
($V_{GE} \le 15V$, $T_j \le 150°C$)

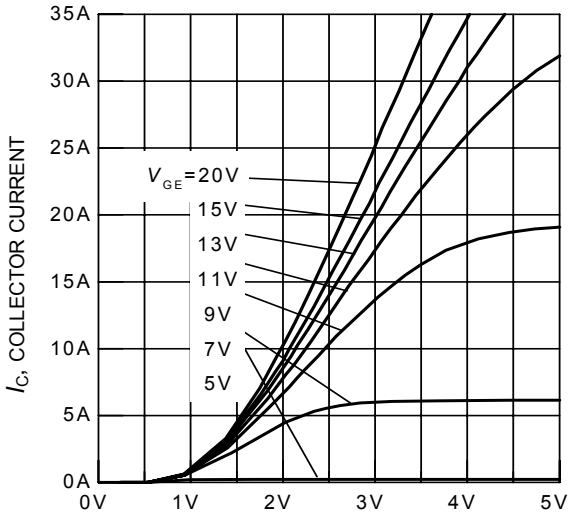


Figure 5. Typical output characteristics
(T_j = 25°C)

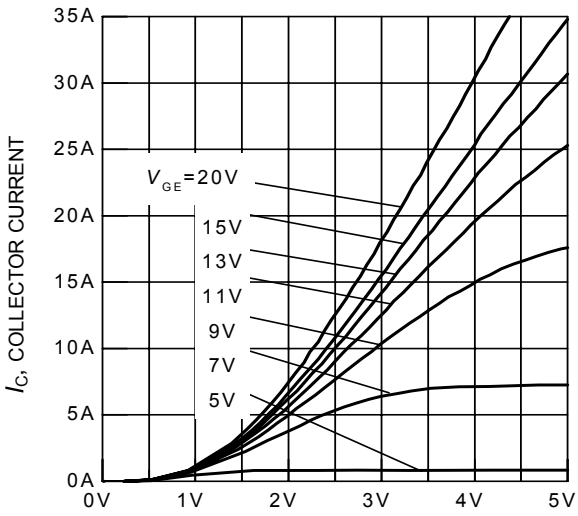


Figure 6. Typical output characteristics
(T_j = 150°C)

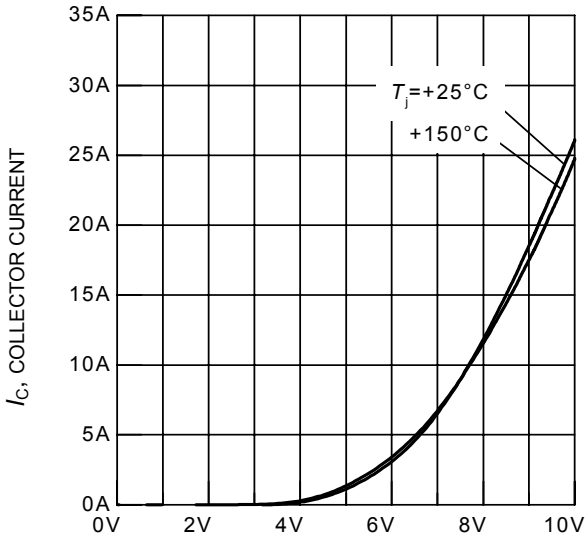


Figure 7. Typical transfer characteristics
(V_{CE} = 10V)

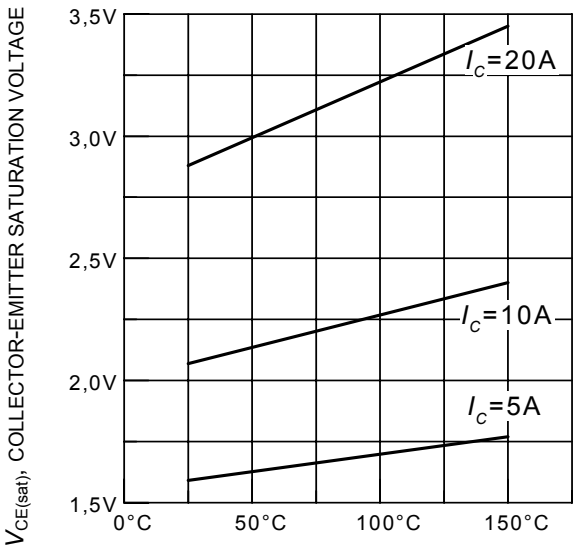


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE} = 15V)

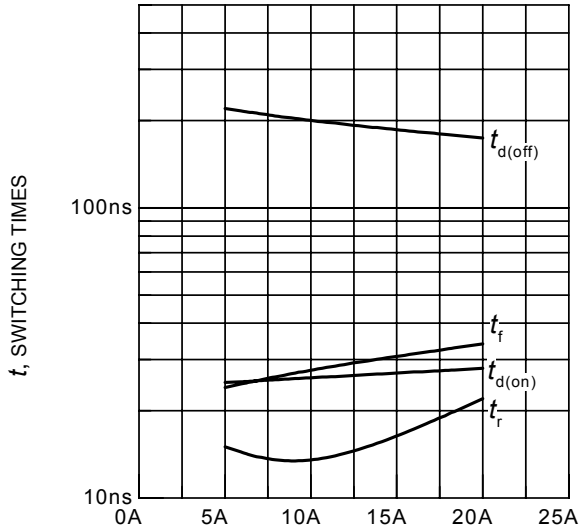


Figure 9. Typical switching times as a function of collector current
(inductive load, T_j = 150°C, V_{CE} = 400V, V_{GE} = 0/+15V, R_G = 25Ω, Dynamic test circuit in Figure E)

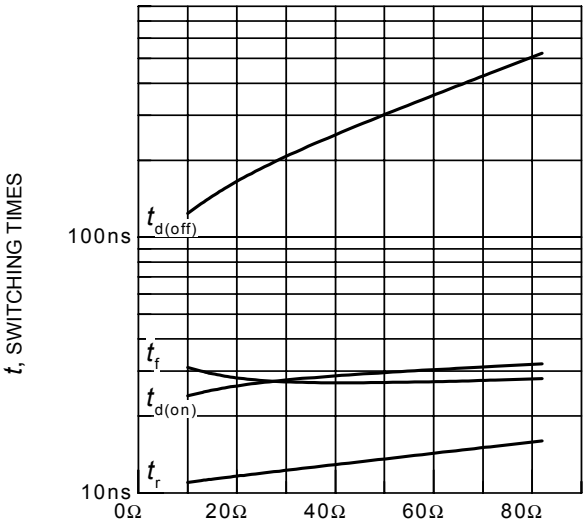


Figure 10. Typical switching times as a function of gate resistor
(inductive load, T_j = 150°C, V_{CE} = 400V, V_{GE} = 0/+15V, I_C = 10A, Dynamic test circuit in Figure E)

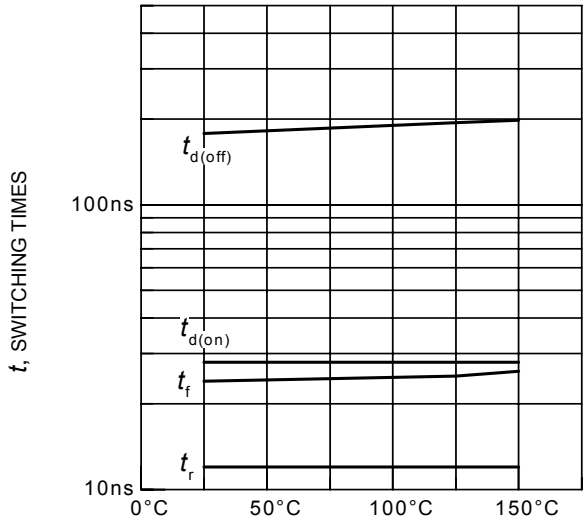


Figure 11. Typical switching times as a function of junction temperature
(inductive load, V_{CE} = 400V, V_{GE} = 0/+15V, I_C = 10A, R_G = 25Ω, Dynamic test circuit in Figure E)

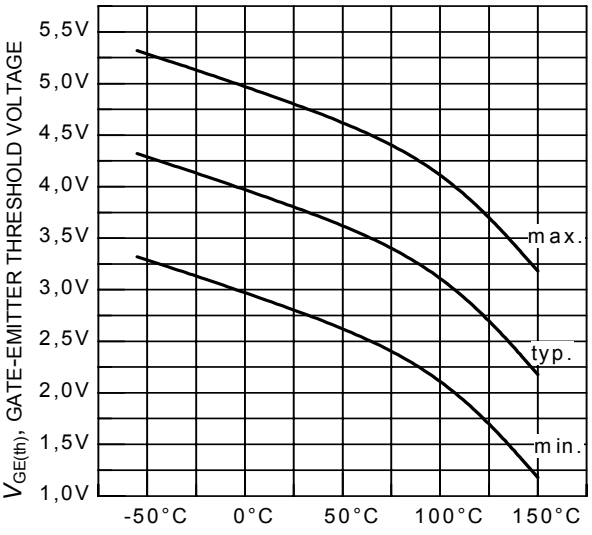


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
(I_C = 0.3mA)

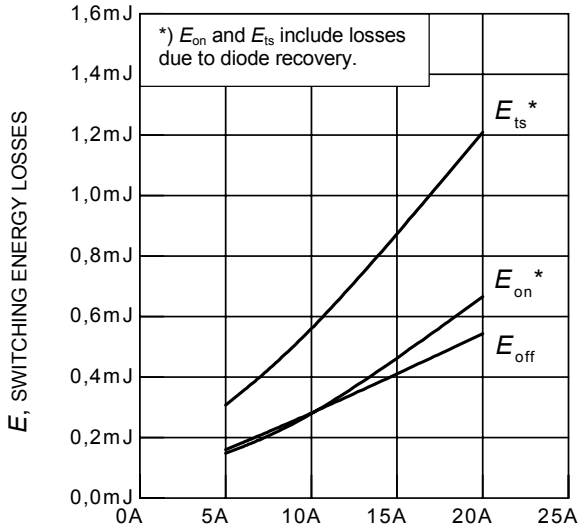


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, T_j = 150°C, V_{CE} = 400V, V_{GE} = 0/+15V, R_G = 25Ω, Dynamic test circuit in Figure E)

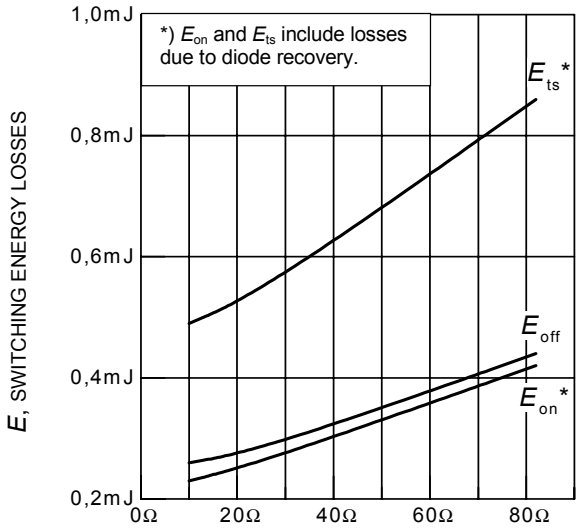


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, T_j = 150°C, V_{CE} = 400V, V_{GE} = 0/+15V, I_C = 10A, Dynamic test circuit in Figure E)

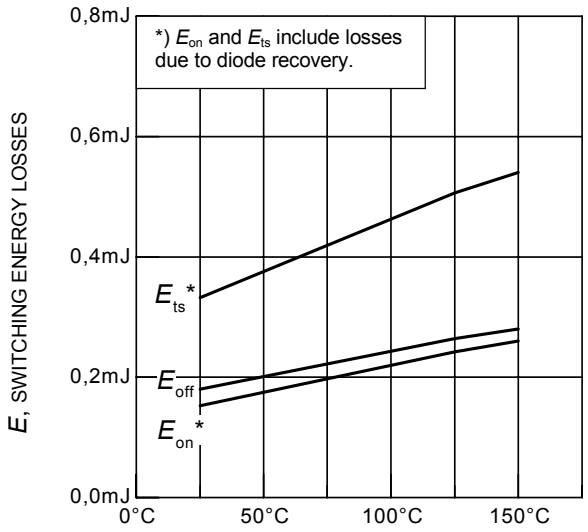


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE} = 400V, V_{GE} = 0/+15V, I_C = 10A, R_G = 25Ω, Dynamic test circuit in Figure E)

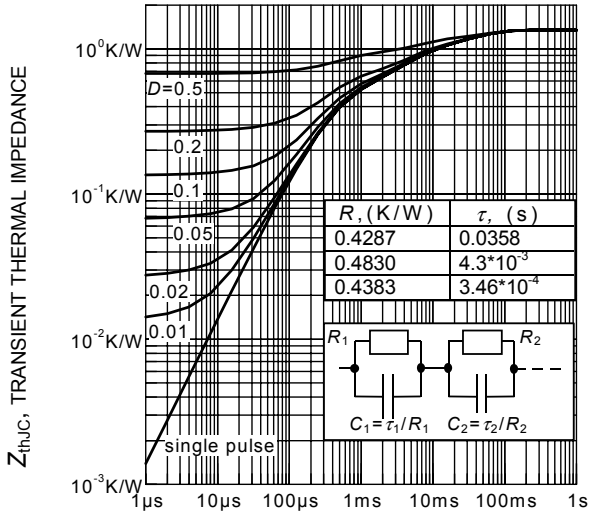


Figure 16. IGBT transient thermal impedance as a function of pulse width
($D = t_p / T$)

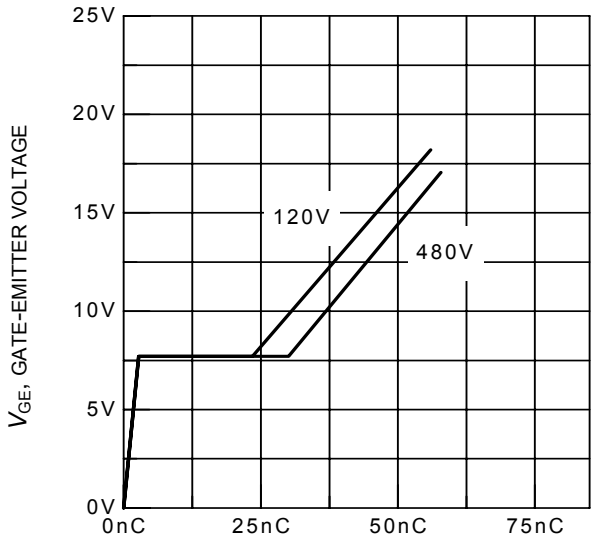


Figure 17. Typical gate charge
(I_C = 10A)

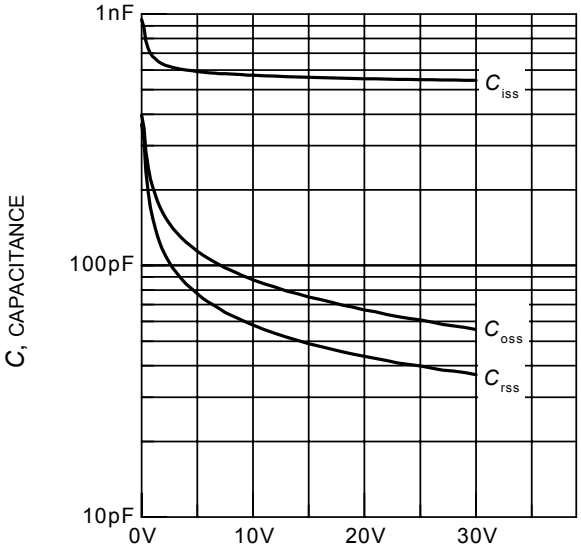


Figure 18. Typical capacitance as a function of collector-emitter voltage
(V_{GE} = 0V, f = 1MHz)

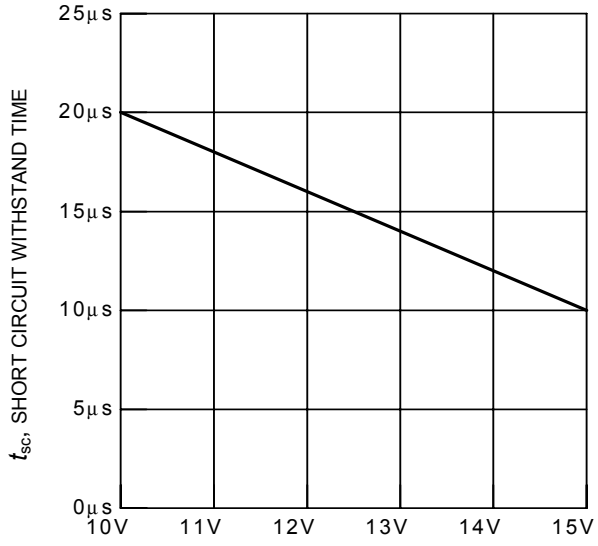


Figure 19. Short circuit withstand time as a function of gate-emitter voltage
(V_{CE} = 600V, start at T_j = 25°C)

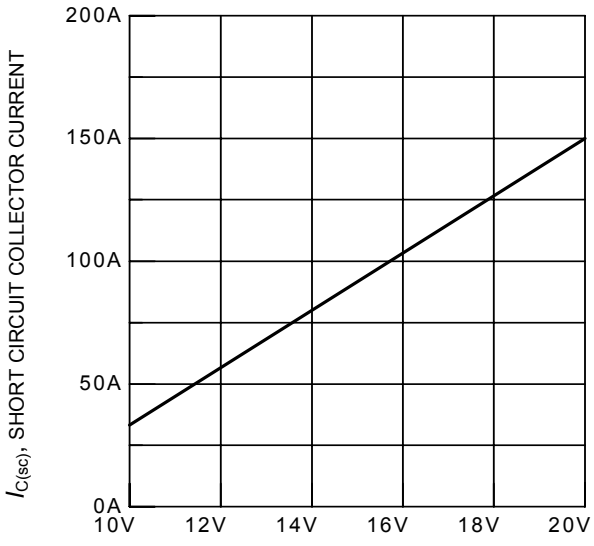
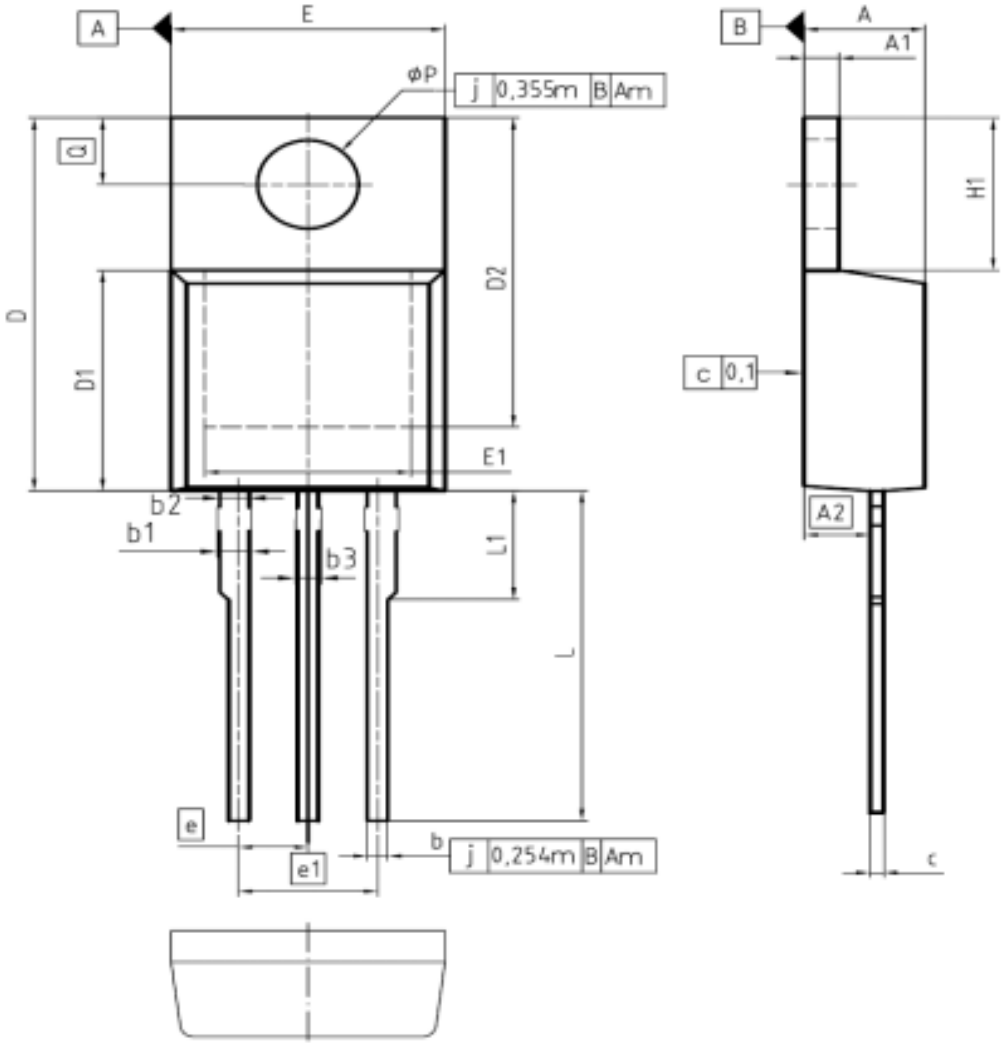


Figure 20. Typical short circuit collector current as a function of gate-emitter voltage
($V_{CE} \le$ 600V, T_j = 150°C)

PG-TO220-3-1



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

DOCUMENT NO.
Z8B00003318

SCALE 0 2.5 0 2.5 5mm

EUROPEAN PROJECTION

ISSUE DATE
23-08-2007

REVISION
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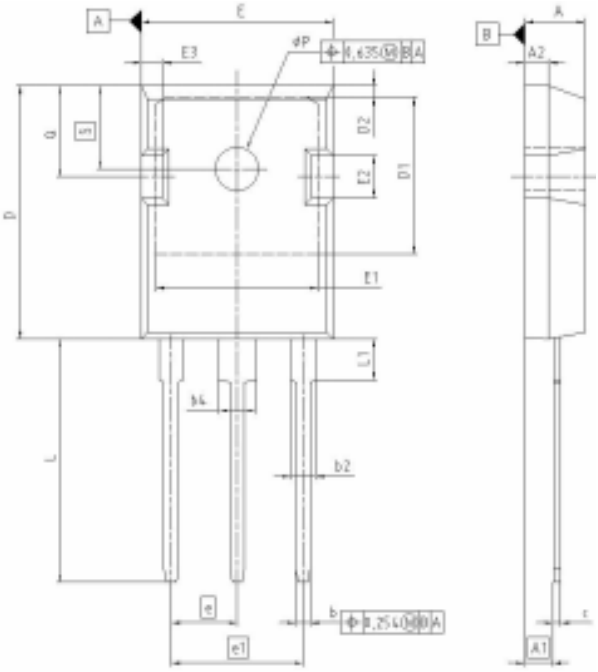
PG-TO247-3-21



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.900	5.157	0.193	0.203
A1	2.275	2.527	0.090	0.099
A2	1.853	2.107	0.073	0.083
b	1.073	1.327	0.042	0.052
b2	1.903	2.386	0.075	0.094
b4	2.870	3.454	0.113	0.136
c	0.549	0.752	0.022	0.030
D	20.823	21.077	0.820	0.830
D1	17.323	17.831	0.682	0.702
D2	1.063	1.317	0.042	0.052
E	15.773	16.027	0.621	0.631
E1	13.893	14.147	0.547	0.557
E2	3.683	3.937	0.145	0.155
E3	1.903	1.937	0.075	0.076
e	5.450		0.215	
e1	10.900		0.430	
N	3		3	
L	20.053	20.307	0.789	0.799
L1	4.166	4.472	0.164	0.176
øP	3.559	3.661	0.140	0.144
Q	5.495	5.747	0.216	0.226
S	6.043	6.297	0.238	0.248

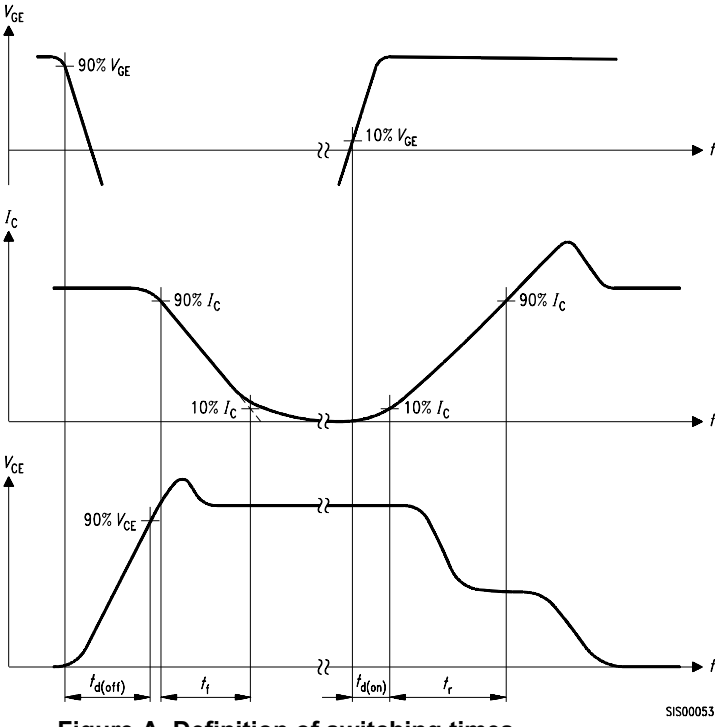


Figure A. Definition of switching times

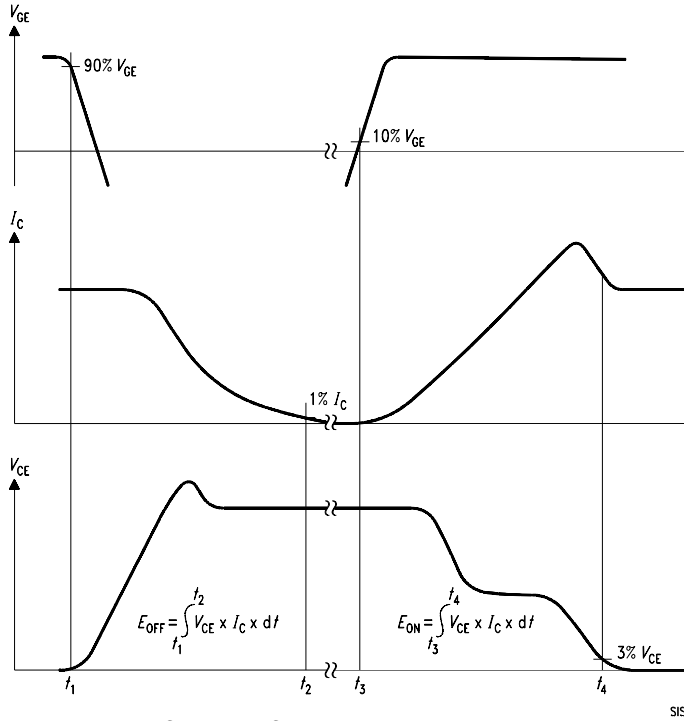


Figure B. Definition of switching losses

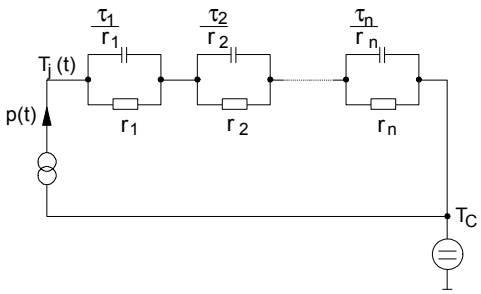


Figure D. Thermal equivalent circuit

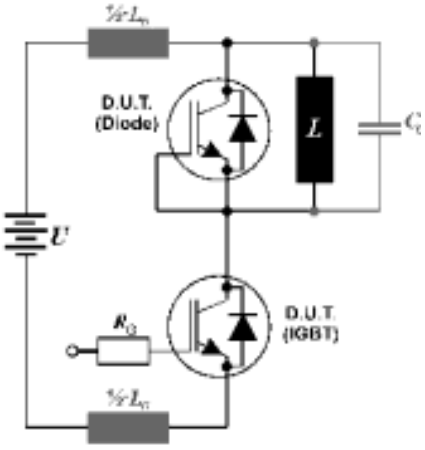


Figure E. Dynamic test circuit
Leakage inductance L_σ =180nH
and Stray capacity C_σ =55pF.

Edition 2006-01

Published by
Infineon Technologies AG
81726 München, Germany

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