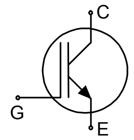
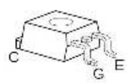
Fast IGBT in NPT-technology



- 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/



PG-TO-263-3-2

Type	V_{CE}	I_C	$V_{CE(sat)}$	T_j	Marking	Package
SGB10N60A	600V	10A	2.3V	150°C	G10N60A	PG-TO-263-3-2

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 $V_{CE} \leq 600V$, $T_j \leq 150°C$	-	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, $V_{CC} \leq 600V$, $T_j \leq 150°C$	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 (reflow soldering MSL1)		245	

[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[1)]	R_{thJA}		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		-	7	-	nH
Short circuit collector current[2)]	$I_{C(SC)}$	V_{GE}=15V, t_{SC}≤10µs V_{CC} ≤ 600V, T_j ≤ 150°C	-	100	-	A

[1)] Device on 50mm*50mm*1.5mm epoxy PCB FR4 with 6cm^2 (one layer, 70µm thick) copper area for collector connection. PCB is vertical without blown air.
[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.

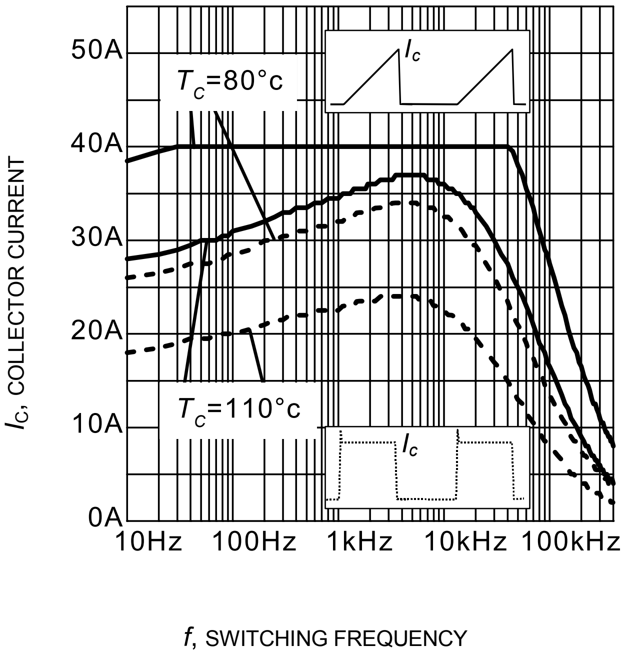


Figure 1. Collector current as a function of switching frequency
($T_j \leq 150°C$, D = 0.5, V_{CE} = 400V, V_{GE} = 0/+15V, R_G = 25Ω)

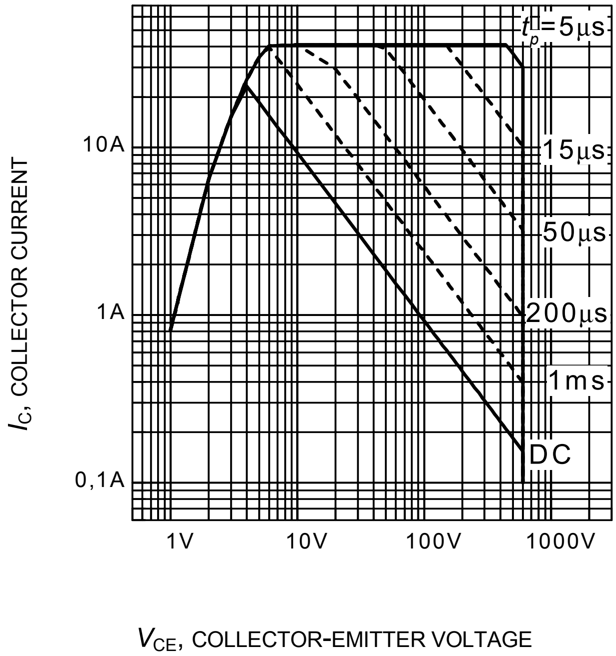


Figure 2. Safe operating area
(D = 0, T_C = 25°C, $T_j \leq 150°C$)

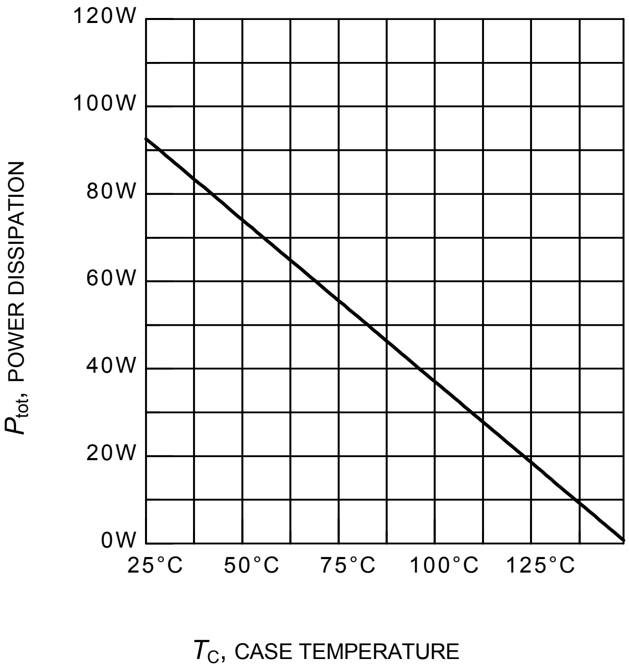


Figure 3. Power dissipation as a function of case temperature
($T_j \leq 150°C$)

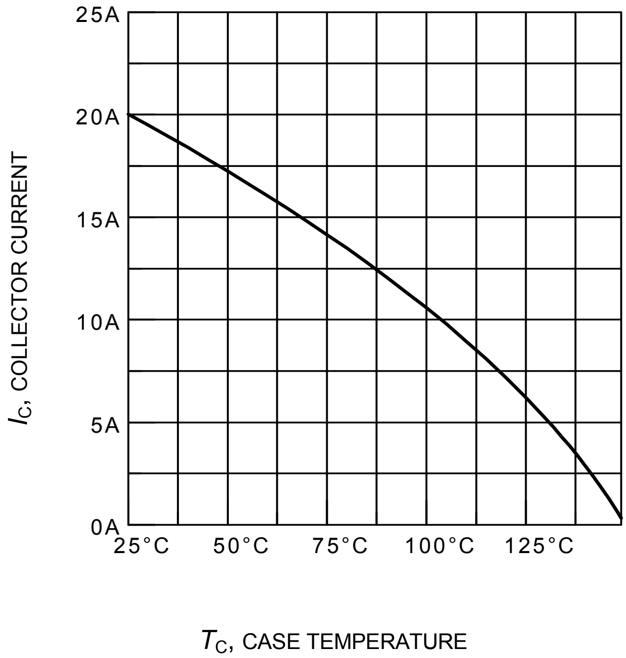
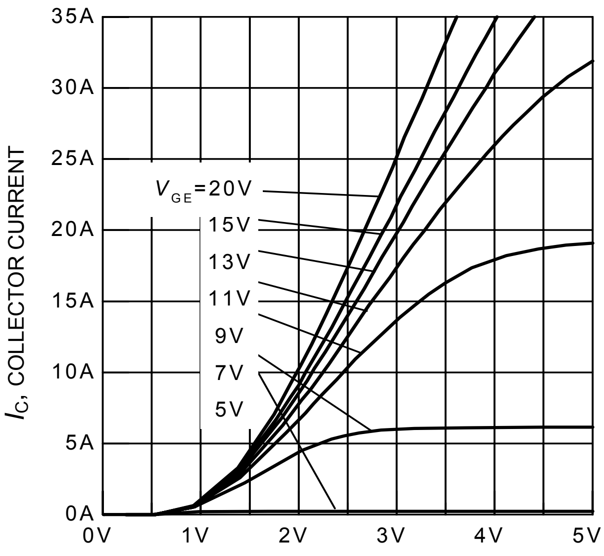
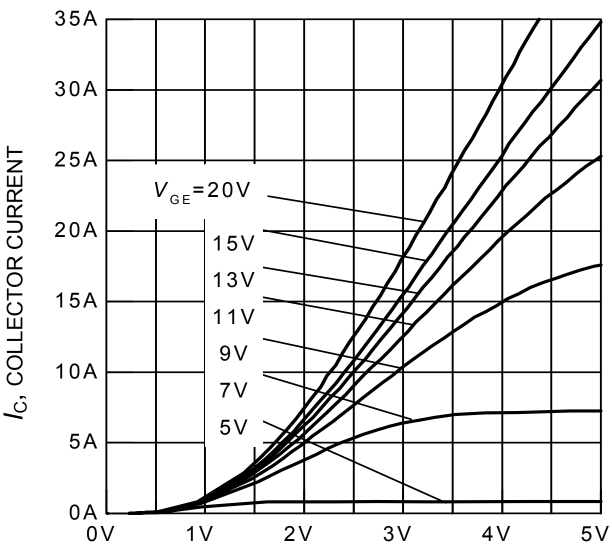


Figure 4. Collector current as a function of case temperature
($V_{GE} \leq 15V$, $T_j \leq 150°C$)



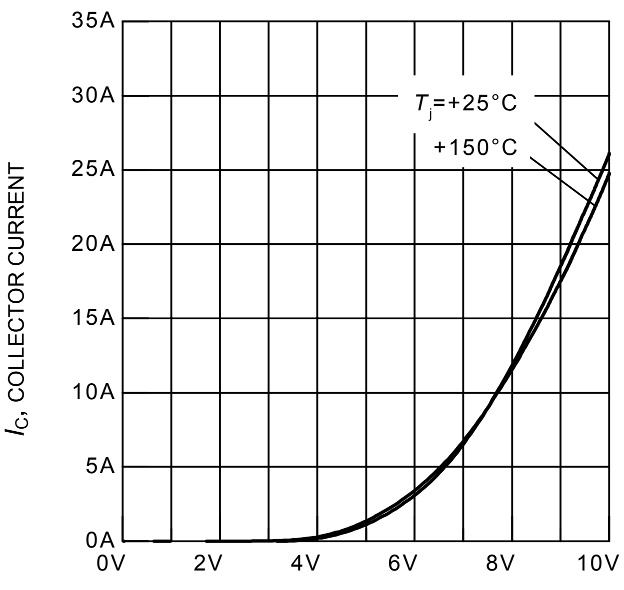
V_{CE}, COLLECTOR-EMITTER VOLTAGE

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



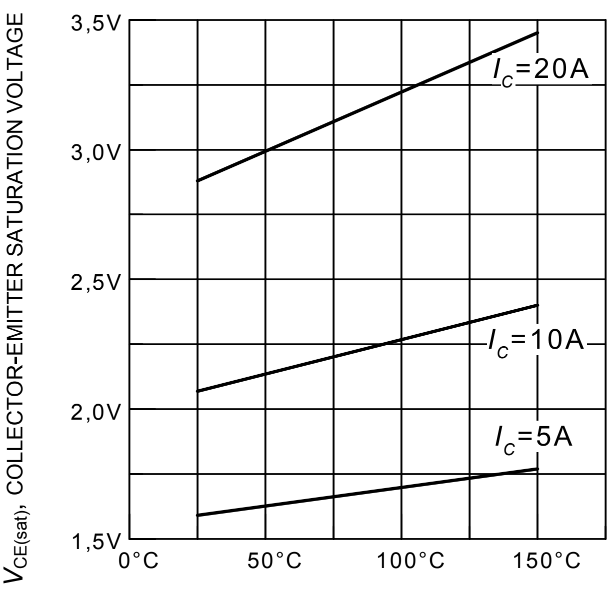
V_{CE}, COLLECTOR-EMITTER VOLTAGE

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



V_{GE}, GATE-EMITTER VOLTAGE

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



T_j, JUNCTION TEMPERATURE

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

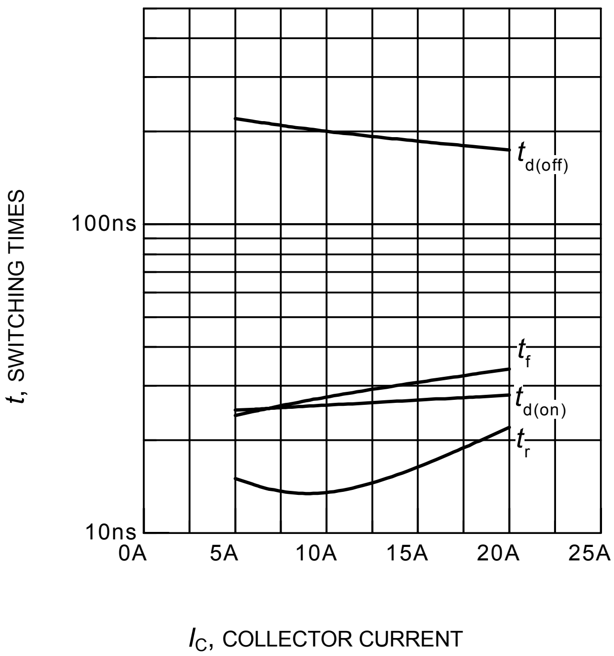


Figure 9. Typical switching times as a function of collector current
(inductive load, T_j = 150°C, V_{CE} = 400V, V_{GE} = 0/+15V, R_G = 25Ω, Dynamic test circuit in Figure E)

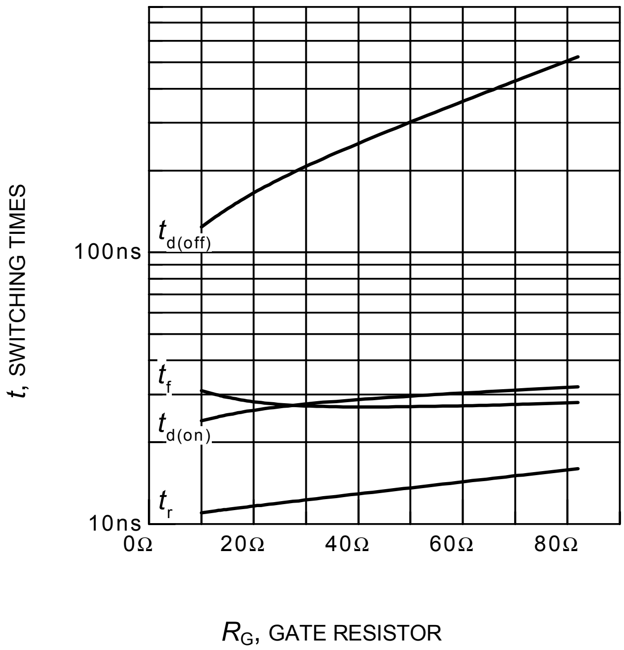


Figure 10. Typical switching times as a function of gate resistor
(inductive load, T_j = 150°C, V_{CE} = 400V, V_{GE} = 0/+15V, I_C = 10A, Dynamic test circuit in Figure E)

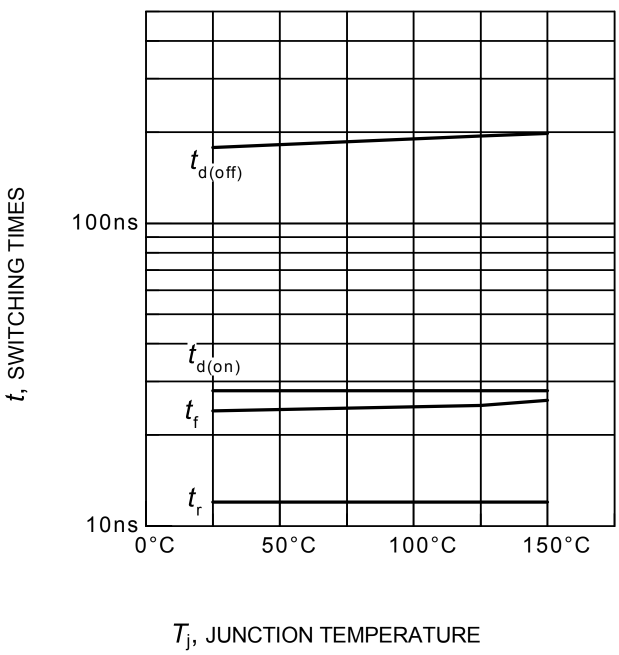


Figure 11. Typical switching times as a function of junction temperature
(inductive load, V_{CE} = 400V, V_{GE} = 0/+15V, I_C = 10A, R_G = 25Ω, Dynamic test circuit in Figure E)

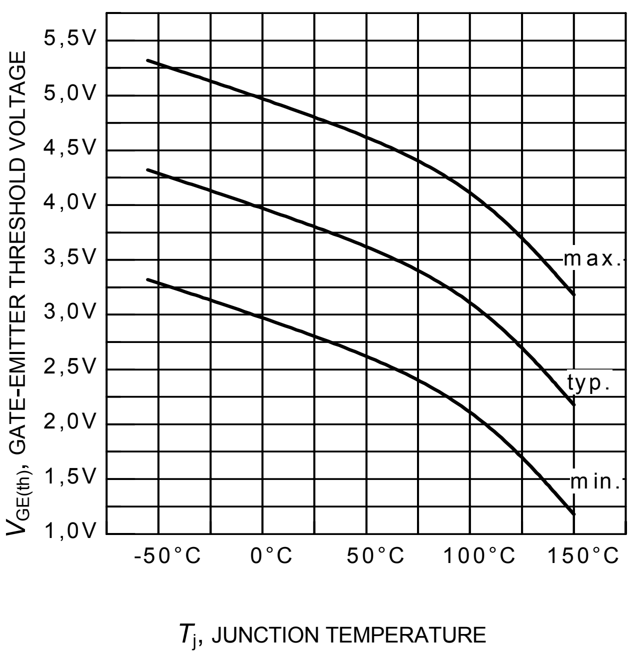


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
(I_C = 0.3mA)

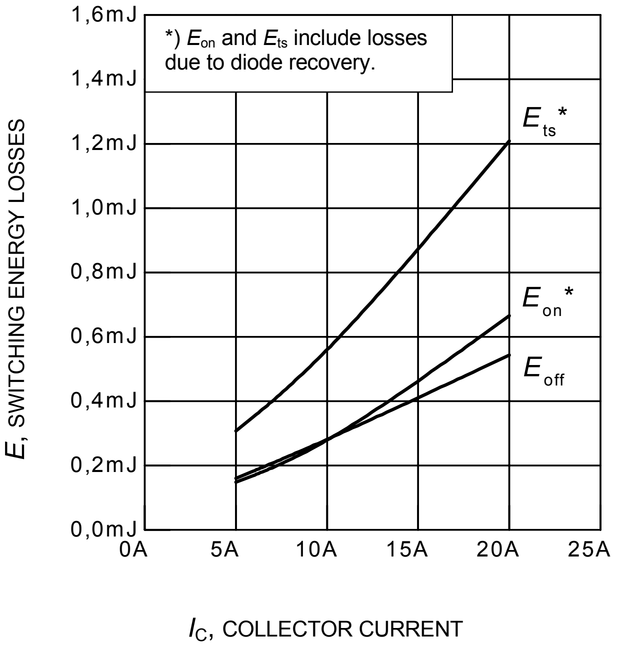


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, T_j = 150°C, V_{CE} = 400V, V_{GE} = 0/+15V, R_G = 25Ω, Dynamic test circuit in Figure E)

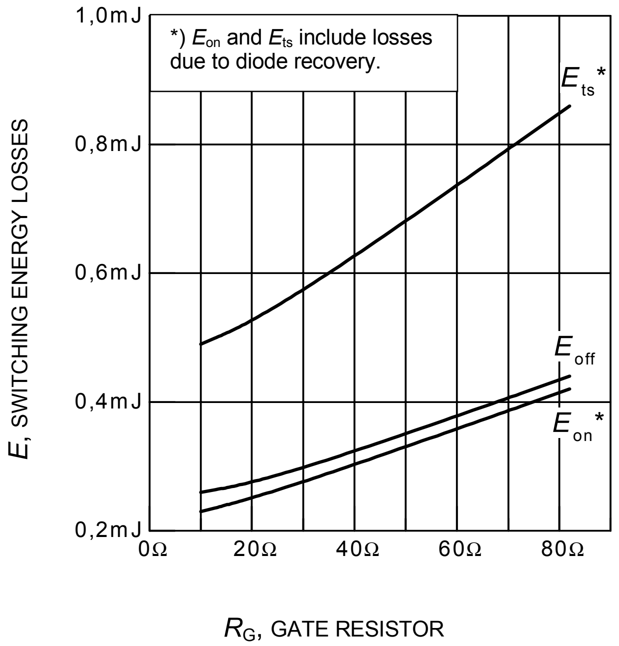


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, T_j = 150°C, V_{CE} = 400V, V_{GE} = 0/+15V, I_C = 10A, Dynamic test circuit in Figure E)

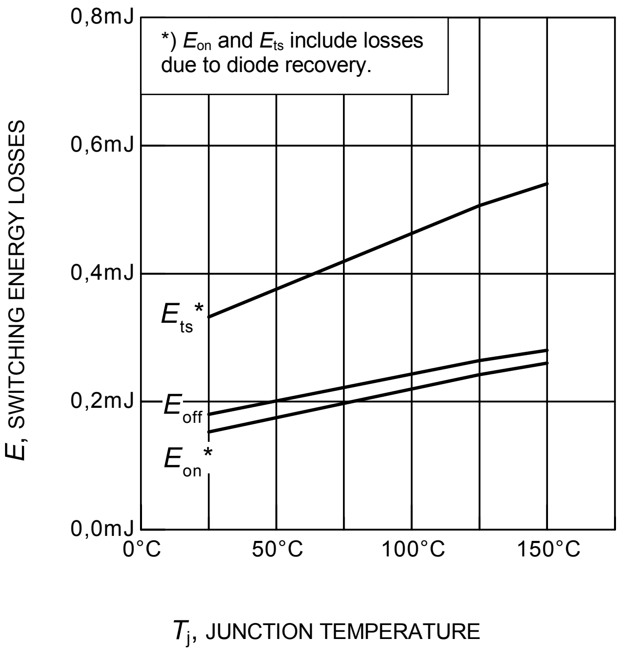


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE} = 400V, V_{GE} = 0/+15V, I_C = 10A, R_G = 25Ω, Dynamic test circuit in Figure E)

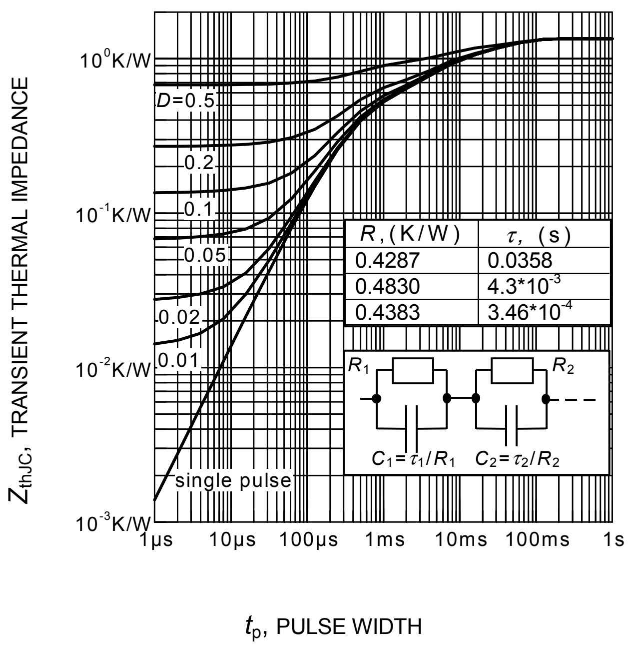


Figure 16. IGBT transient thermal impedance as a function of pulse width
(D = t_p / T)

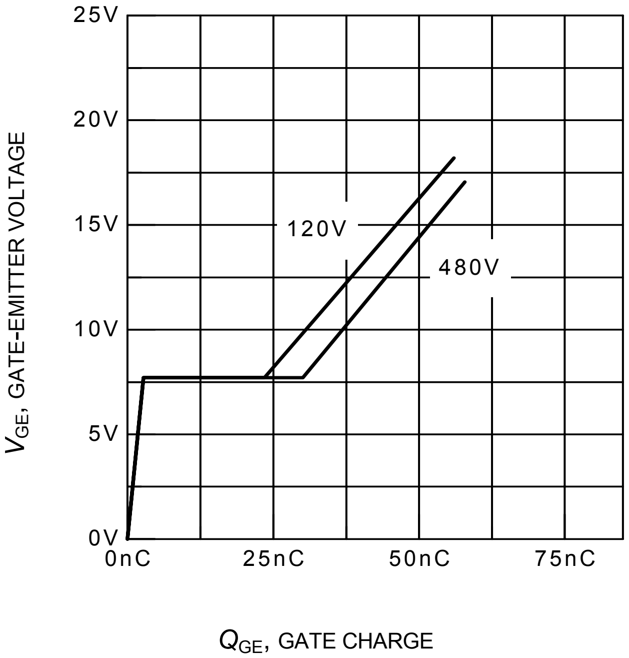


Figure 17. Typical gate charge
(I_C = 10A)

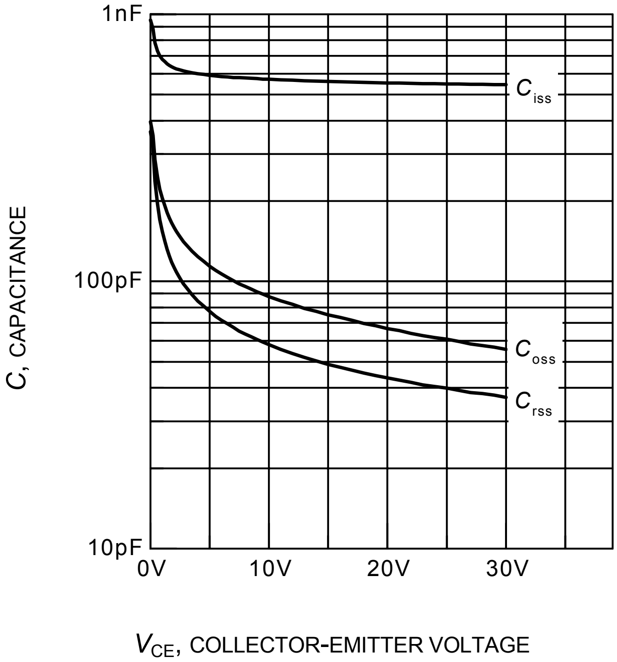


Figure 18. Typical capacitance as a function of collector-emitter voltage
(V_{GE} = 0V, f = 1MHz)

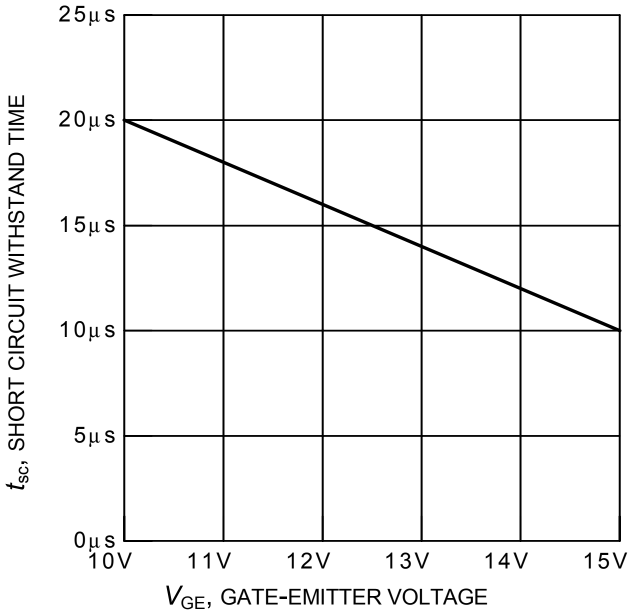


Figure 19. Short circuit withstand time as a function of gate-emitter voltage
(V_{CE} = 600V, start at T_j = 25°C)

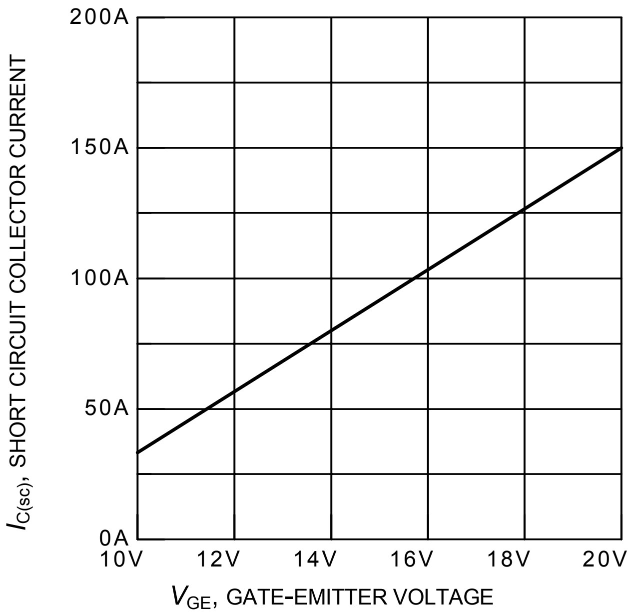
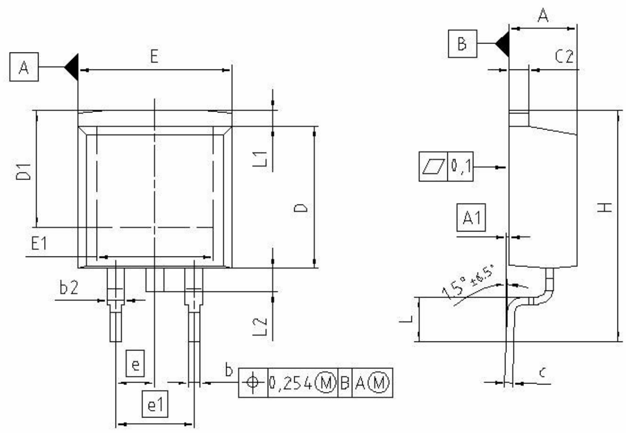
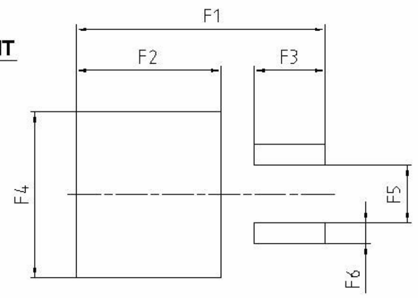


Figure 20. Typical short circuit collector current as a function of gate-emitter voltage
($V_{CE} \leq$ 600V, T_j = 150°C)

PG-TO263-3-2



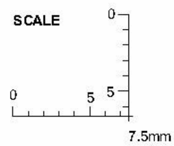
FOOTPRINT



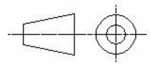
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.300	4.572	0.169	0.180
A1	0.000	0.254	0.000	0.010
b	0.650	0.850	0.026	0.033
b2	0.950	1.321	0.037	0.052
c	0.330	0.650	0.013	0.026
c2	0.170	1.400	0.046	0.055
D	8.509	9.450	0.335	0.372
D1	7.100	-	0.280	-
E	9.800	10.312	0.386	0.406
E1	6.500		0.256	
e	2.540		0.100	
e1	5.080		0.200	
N	2		2	
H	14.605	15.875	0.575	0.625
L	2.200	3.000	0.087	0.118
L1	-	1.600	-	0.063
L2	1.000	1.778	0.039	0.070
F1	16.050	16.250	0.632	0.640
F2	9.300	9.500	0.366	0.374
F3	4.500	4.700	0.177	0.185
F4	10.700	10.900	0.421	0.429
F5	3.630	3.830	0.143	0.151
F6	1.100	1.300	0.043	0.051

REFERENCE
JEDEC TO263

SCALE



EUROPEAN PROJECTION



ISSUE DATE
12-02-2006

FILE
TO263_2

PG-TO247-3-1

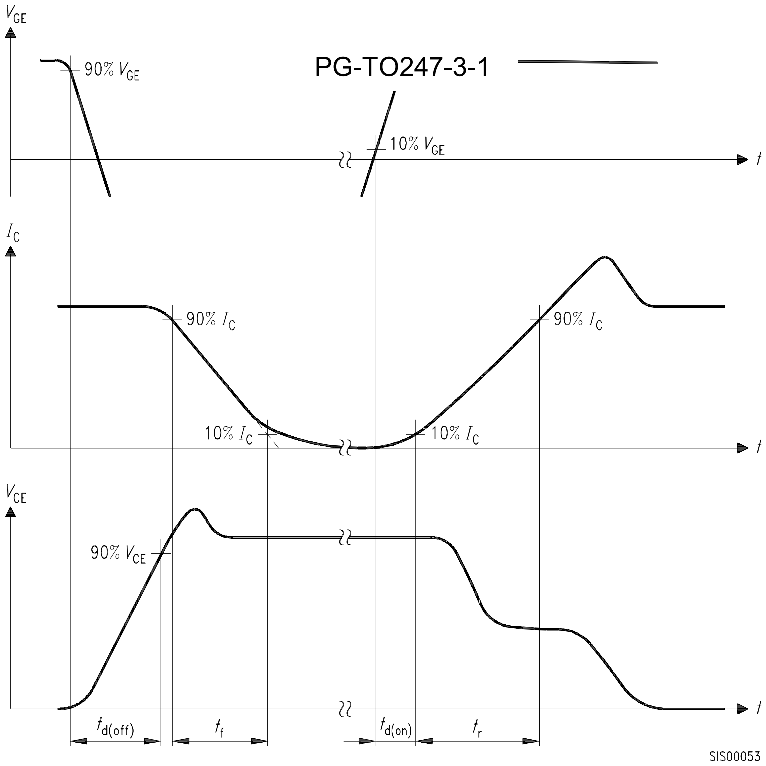


Figure A. Definition of switching times

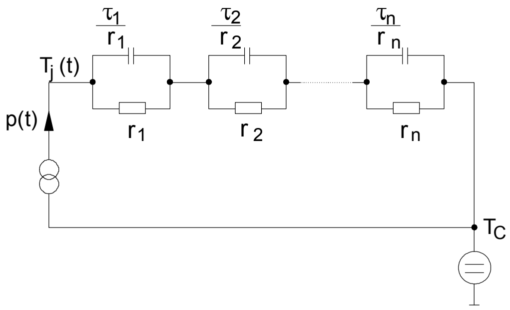


Figure D. Thermal equivalent circuit

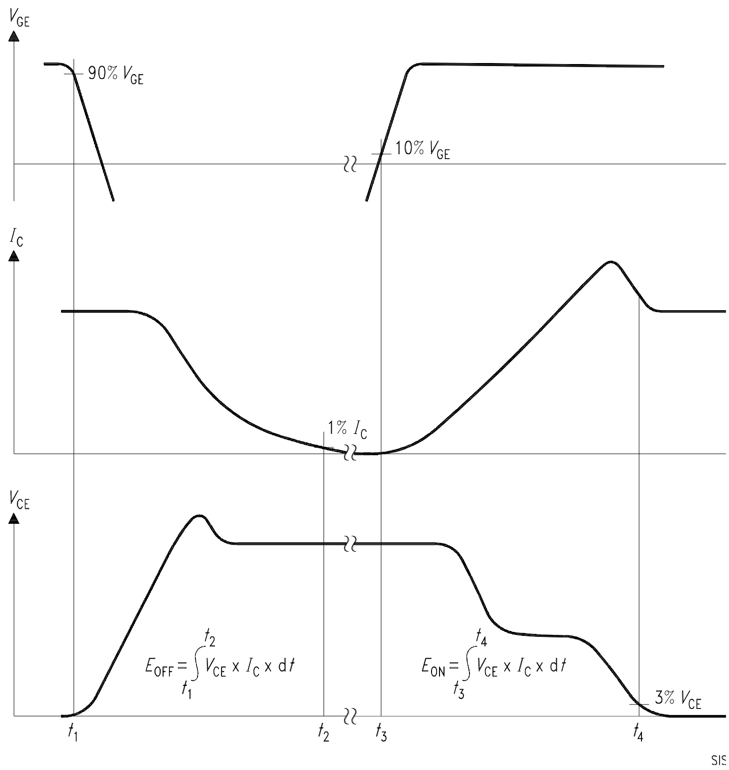


Figure B. Definition of switching losses

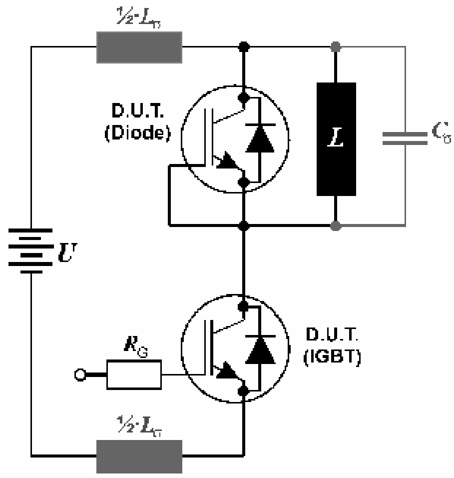


Figure E. Dynamic test circuit
Leakage inductance L_σ =180nH
and Stray capacity C_σ =55pF.

Edition 2006-01

Published by
Infineon Technologies AG
81726 München, Germany

Attention please!

The information given in this data sheet shall in no event be regarded as a guarantee of conditions or characteristics (“Beschaffenheitsgarantie”). With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

Information

For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office (**www.infineon.com**).

Warnings

Due to technical requirements components may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies Office.

Infineon Technologies Components may only be used in life-support devices or systems with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.