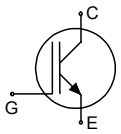
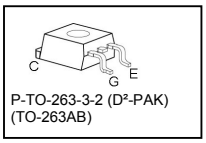
SGB15N60HS

High Speed IGBT in NPT-technology





P-TO-263-3-2 (D²-PAK)
(TO-263AB)

- 30% lower E_{off} compared to previous generation
- Short circuit withstand time – 10 µs
- Designed for operation above 30 kHz
- NPT-Technology for 600V applications offers:
  - parallel switching capability
  - moderate E_{off} increase with temperature
  - very tight parameter distribution
- High ruggedness, temperature stable behaviour
- Qualified according to JEDEC[1] for target applications
- Complete product spectrum and PSpice Models : http://www.infineon.com/igbt/

Type	V_{CE}	I_C	E_{off}	T_j	Marking	Package	Ordering Code
SGB15N60HS	600V	15A	200µJ	150°C	G15N60HS	P-TO-263-3-2	Q67040-S4535

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	 27 15	A
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	60	
Turn off safe operating area $V_{CE} \le 600V$, $T_j \le 150°C$	-	60	
Gate-emitter voltage static transient (t_p<1µs, D<0.05)	V_{GE}	±20 ±30	V
Short circuit withstand time[2)] V_{GE} = 15V, $V_{CC} \le 400V$, $T_j \le 150°C$	t_{SC}	10	µs
Power dissipation T_C = 25°C	P_{tot}	138	W
Operating junction and storage temperature	T_j , T_{stg}	-55...+150	°C
Time limited operating junction temperature for t < 150h	$T_{j(tl)}$	175	
Soldering temperature (reflow soldering, MSL1)	-	220	

[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}		0.9	K/W
Thermal resistance, junction – ambient	R_{thJA}		62	
SMD version, device on PCB[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=15A				
		T_j=25°C		2.8	3.15	
		T_j=150°C		3.5	4.00	
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=400µA, V_{CE}=V_{GE}	3	4	5	
Zero gate voltage collector current	I_{CES}	V_{CE}=600V, V_{GE}=0V				µA
		T_j=25°C	-	-	40	
		T_j=150°C	-	-	2000	
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	100	nA
Transconductance	g_{fs}	V_{CE}=20V, I_C=15A	-	10		S

Dynamic Characteristic

Input capacitance	C_{iss}	V_{CE}=25V,	-	810		pF
Output capacitance	C_{oss}	V_{GE}=0V,	-	83		
Reverse transfer capacitance	C_{rss}	f=1MHz	-	51		
Gate charge	Q_{Gate}	V_{CC}=480V, I_C=15A	-	80		nC
		V_{GE}=15V				
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	-	135		A
		V_{CC} ≤ 400V,				
		T_j ≤ 150°C				

[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=15A, V_{GE}=0/15V, R_G=23Ω L_σ [1)] =60nH, C_σ [1)] =40pF Energy losses include "tail" and diode reverse recovery.	-	13		ns
Rise time	t_r		-	14		
Turn-off delay time	$t_{d(off)}$		-	209		
Fall time	t_f		-	15		
Turn-on energy	E_{on}		-	0.32		mJ
Turn-off energy	E_{off}		-	0.21		
Total switching energy	E_{ts}		-	0.53		

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=15A, V_{GE}=0/15V, R_G= 3.6Ω L_σ [1)] =60nH, C_σ [1)] =40pF Energy losses include "tail" and diode reverse recovery.	-	11		ns
Rise time	t_r		-	6		
Turn-off delay time	$t_{d(off)}$		-	72		
Fall time	t_f		-	26		
Turn-on energy	E_{on}		-	0.38		mJ
Turn-off energy	E_{off}		-	0.20		
Total switching energy	E_{ts}		-	0.58		
Turn-on delay time	$t_{d(on)}$	T_j=150°C V_{CC}=400V, I_C=15A, V_{GE}=0/15V, R_G= 23Ω L_σ [1)] =60nH, C_σ [1)] =40pF Energy losses include "tail" and diode reverse recovery.	-	12		ns
Rise time	t_r		-	15		
Turn-off delay time	$t_{d(off)}$		-	235		
Fall time	t_f		-	17		
Turn-on energy	E_{on}		-	0.48		mJ
Turn-off energy	E_{off}		-	0.30		
Total switching energy	E_{ts}		-	0.78		

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

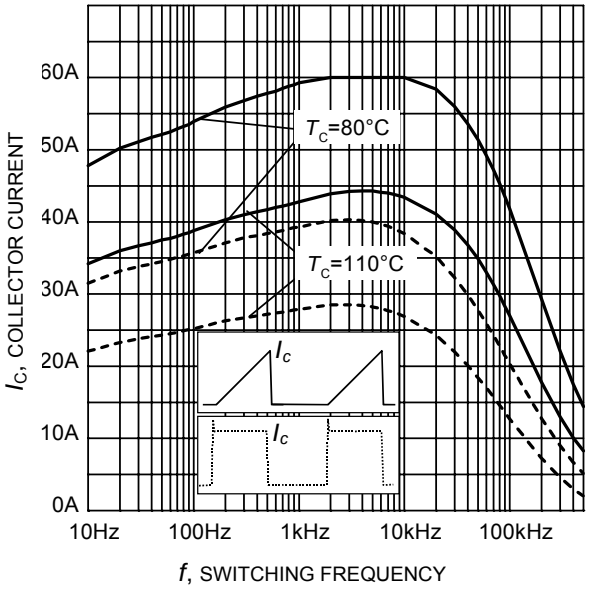


Figure 1. Collector current as a function of switching frequency
($T_j \le 150°C$, $D = 0.5$, $V_{CE} = 400V$, $V_{GE} = 0/+15V$, $R_G = 23\Omega$)

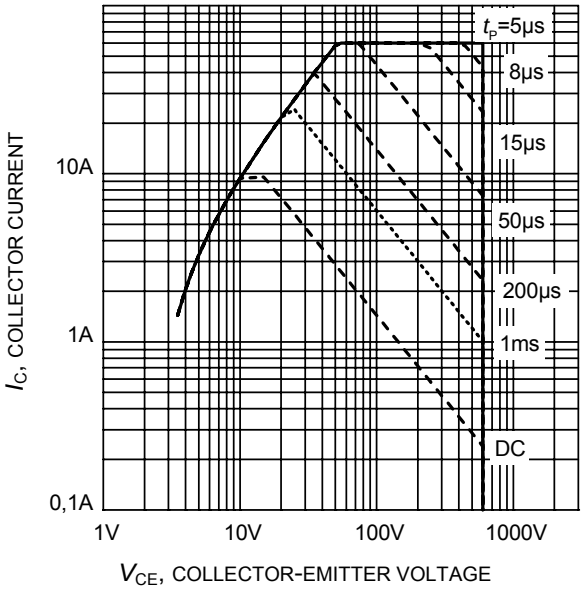


Figure 2. Safe operating area
($D = 0$, $T_C = 25°C$, $T_j \le 150°C$; V_{GE}=15V)

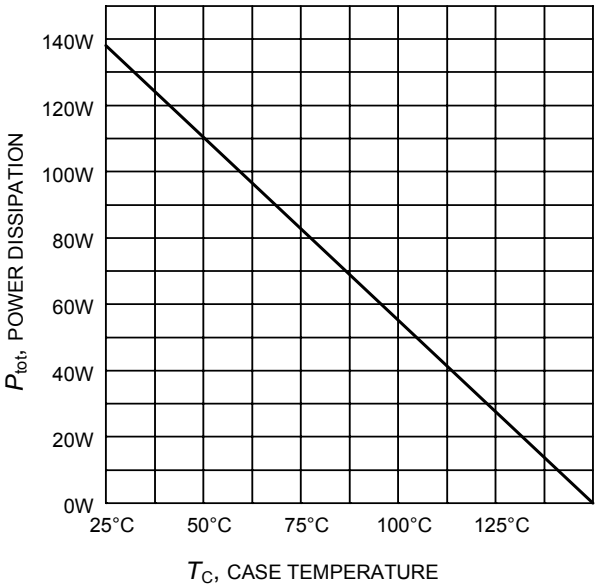


Figure 3. Power dissipation as a function of case temperature
($T_j \le 150°C$)

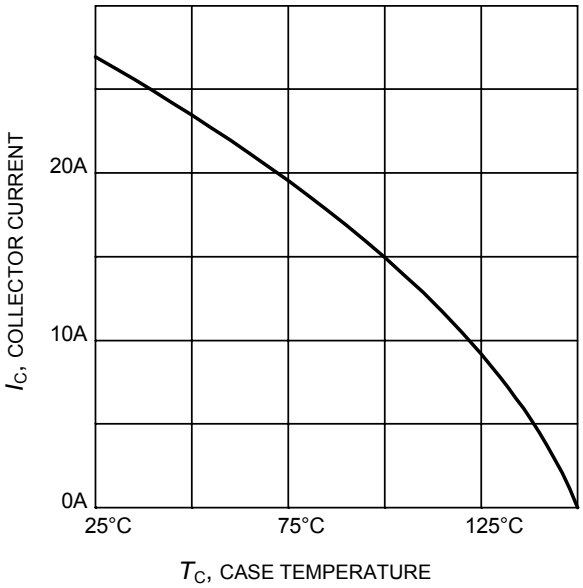


Figure 4. Collector current as a function of case temperature
($V_{GE} \le 15V$, $T_j \le 150°C$)

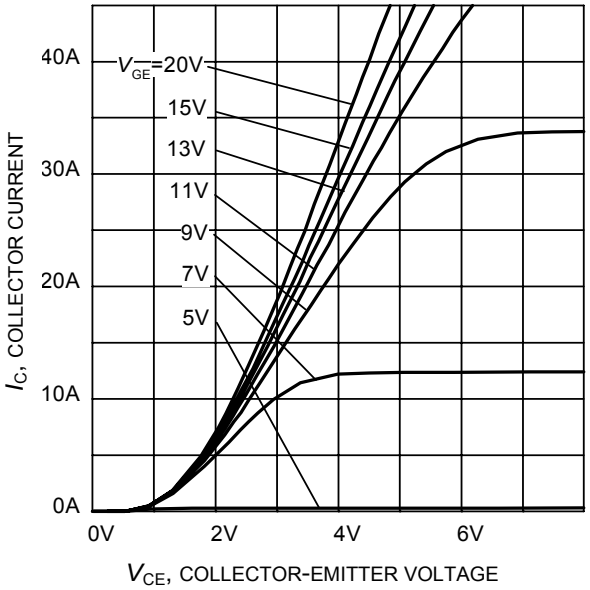


Figure 5. Typical output characteristic
(T_j = 25°C)

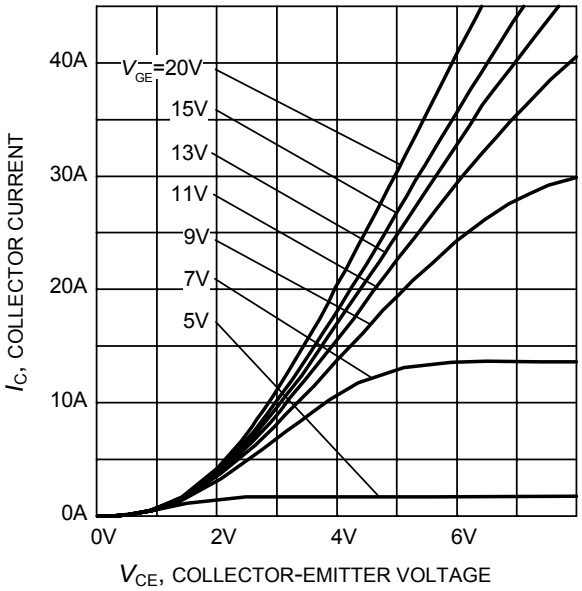


Figure 6. Typical output characteristic
(T_j = 150°C)

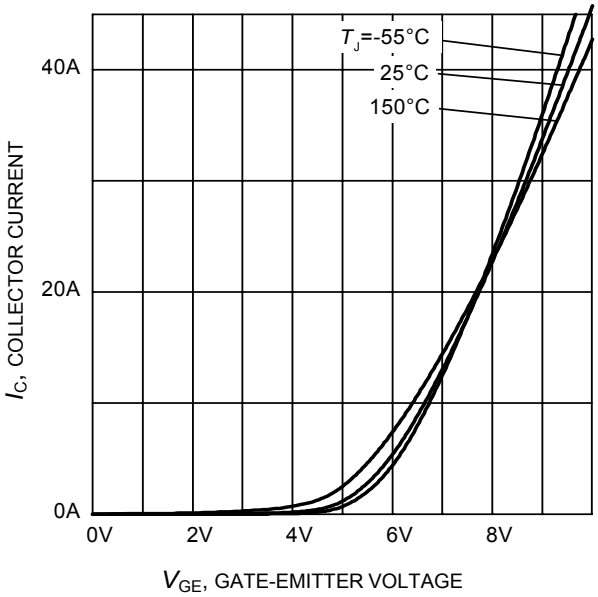


Figure 7. Typical transfer characteristic
(V_{CE}=10V)

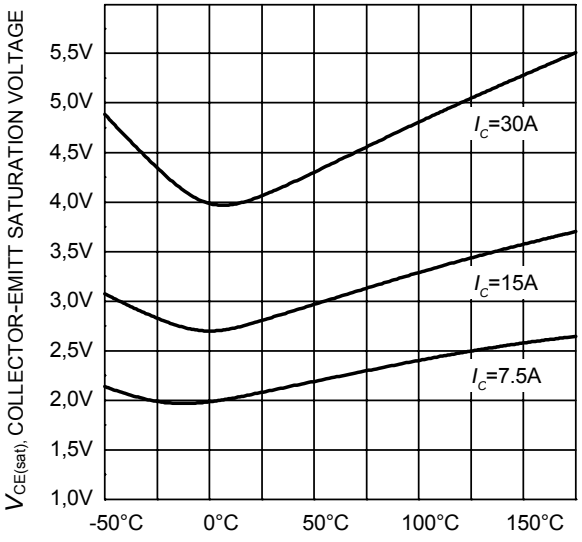


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE} = 15V)

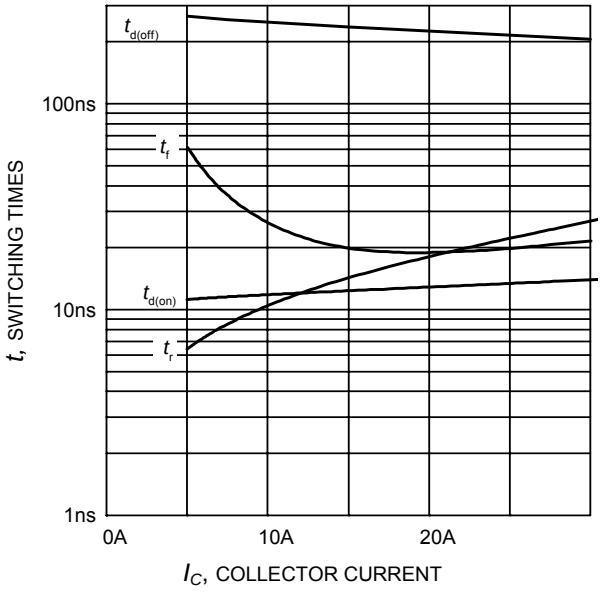


Figure 9. Typical switching times as a function of collector current
(inductive load, T_J=150°C, V_{CE}=400V, V_{GE}=0/15V, R_G=23Ω, Dynamic test circuit in Figure E)

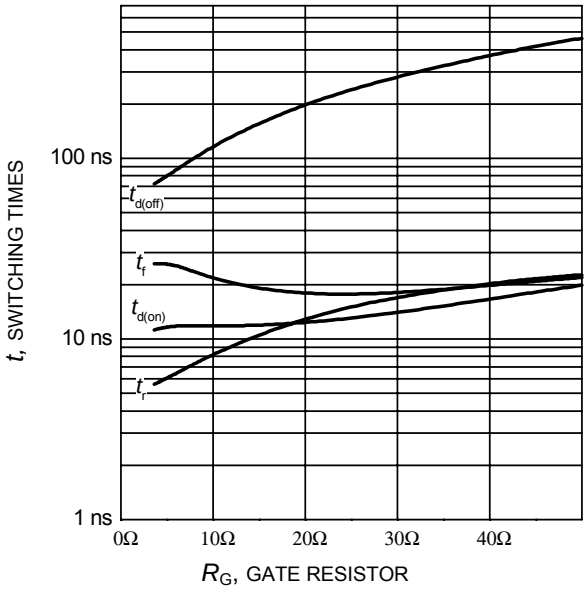


Figure 10. Typical switching times as a function of gate resistor
(inductive load, T_J=150°C, V_{CE}=400V, V_{GE}=0/15V, I_C=15A, Dynamic test circuit in Figure E)

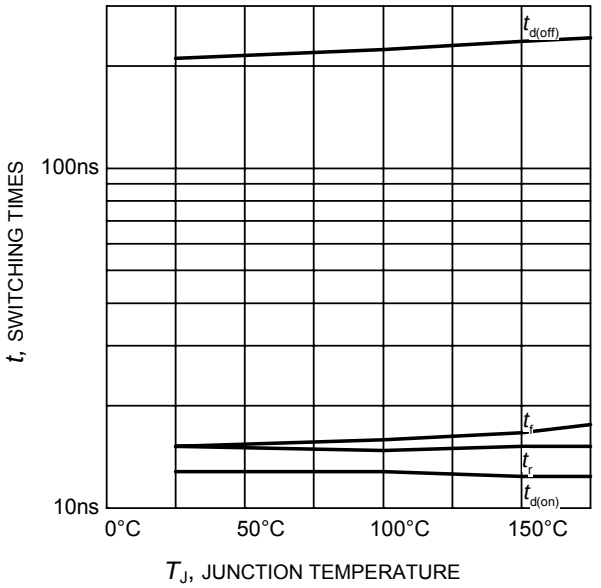


Figure 11. Typical switching times as a function of junction temperature
(inductive load, V_{CE}=400V, V_{GE}=0/15V, I_C=15A, R_G=23Ω, Dynamic test circuit in Figure E)

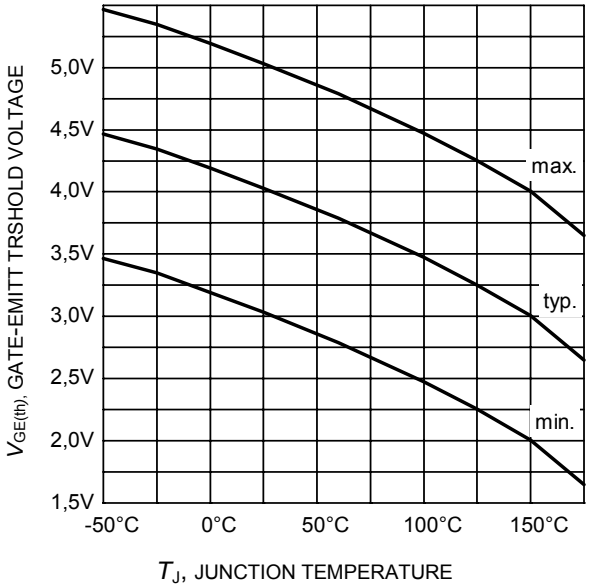


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
(I_C = 0.5mA)

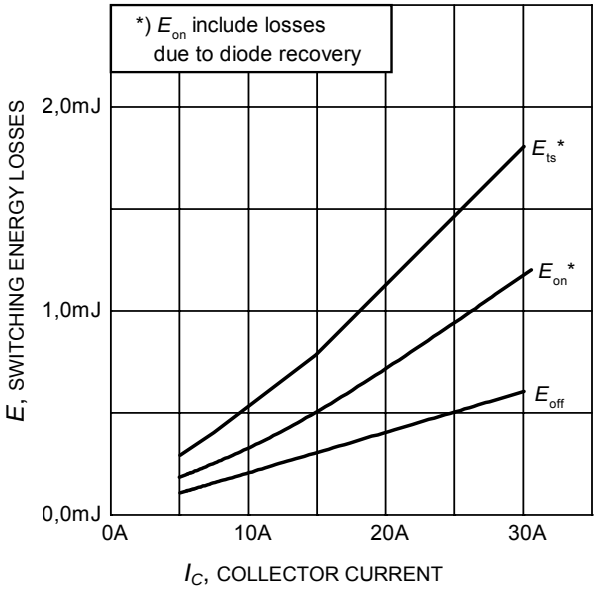


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, T_J=150°C, V_{CE}=400V, V_{GE}=0/15V, R_G=23Ω, Dynamic test circuit in Figure E)

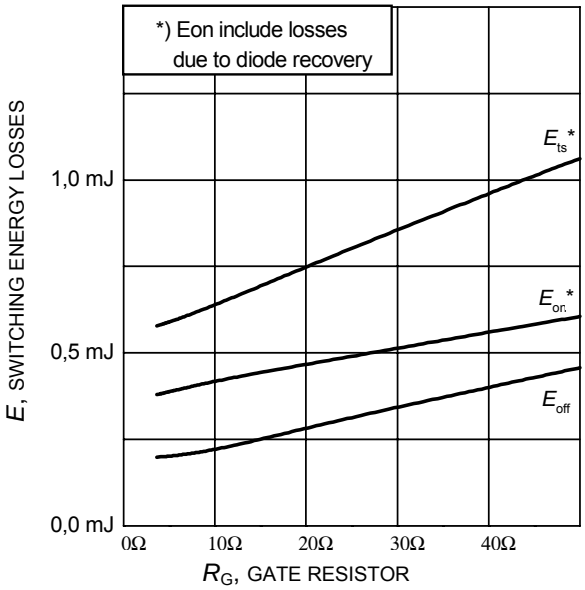


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, T_J=150°C, V_{CE}=400V, V_{GE}=0/15V, I_C=15A, Dynamic test circuit in Figure E)

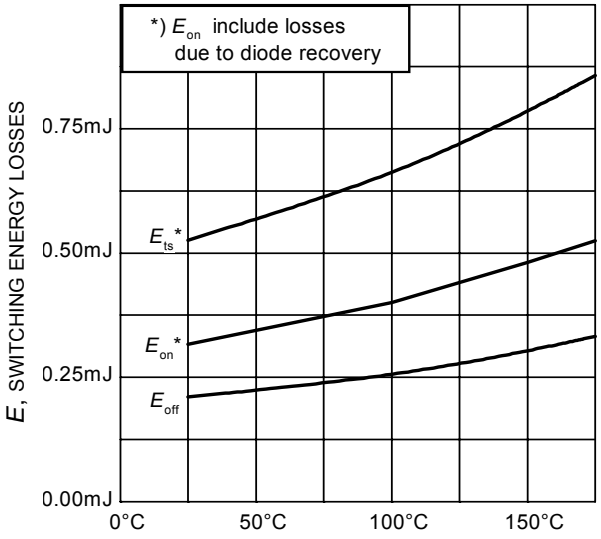


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE}=400V, V_{GE}=0/15V, I_C=20A, R_G=23Ω, Dynamic test circuit in Figure E)

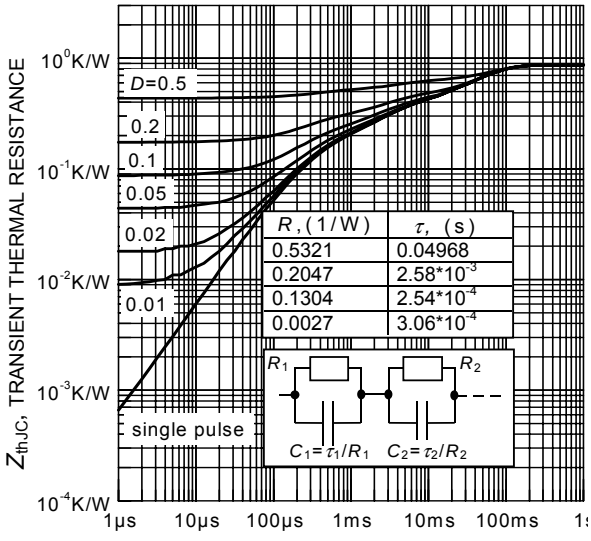


Figure 16. IGBT transient thermal resistance
($D = t_p / T$)

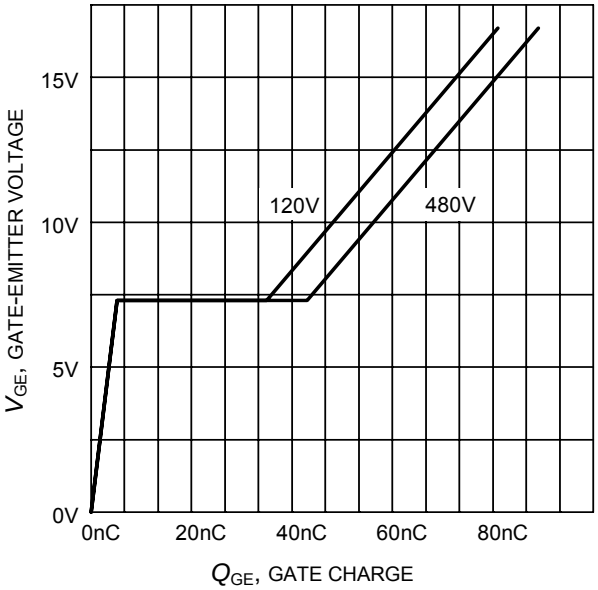


Figure 17. Typical gate charge
(I_C=15 A)

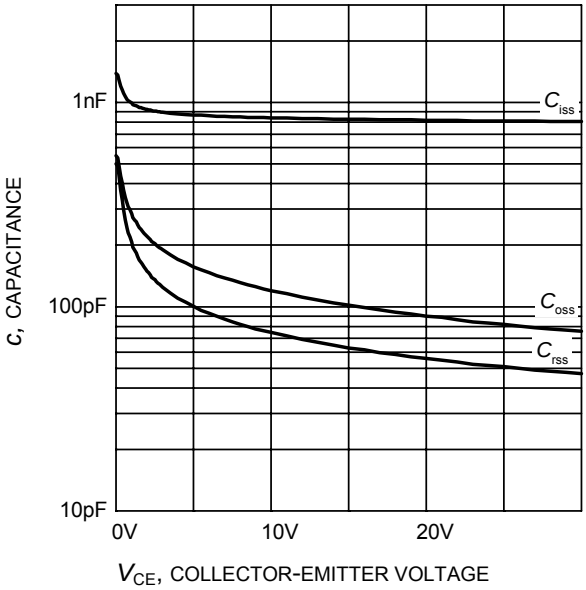


Figure 18. Typical capacitance as a function of collector-emitter voltage
(V_{GE}=0V, f = 1 MHz)

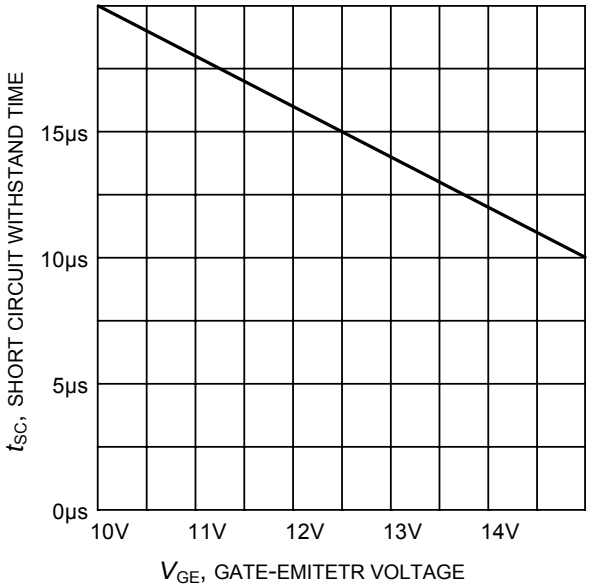


Figure 19. Short circuit withstand time as a function of gate-emitter voltage
(V_{CE}=600V, start at T_J=25°C)

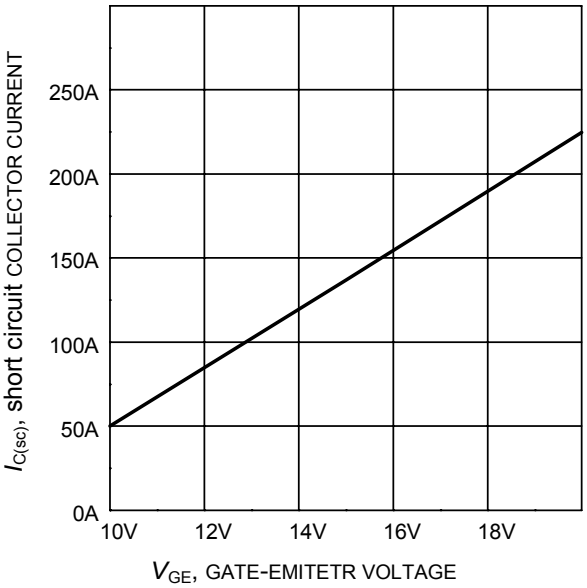
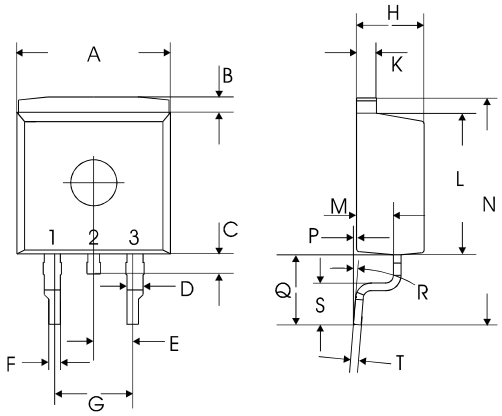
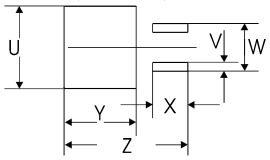


Figure 20. Typical short circuit collector current as a function of gate-emitter voltage
($V_{CE} \le 400V$, $T_j \le 150°C$)

P-TO263-3-2



Footprint
(dif. scale)



symbol	dimensions			
	[mm]		[inch]	
	min	max	min	max
A	9.80	10.20	0.3858	0.4016
B	0.70	1.30	0.0276	0.0512
C	1.00	1.60	0.0394	0.0630
D	1.03	1.07	0.0406	0.0421
E	2.54 typ.		0.1 typ.	
F	0.65	0.85	0.0256	0.0335
G	5.08 typ.		0.2 typ.	
H	4.30	4.50	0.1693	0.1772
K	1.17	1.37	0.0461	0.0539
L	9.05	9.45	0.3563	0.3720
M	2.30	2.50	0.0906	0.0984
N	15 typ.		0.5906 typ.	
P	0.00	0.20	0.0000	0.0079
Q	4.20	5.20	0.1654	0.2047
R	8° max		8° max	
S	2.40	3.00	0.0945	0.1181
T	0.40	0.60	0.0157	0.0236
U	10.80		0.4252	
V	1.15		0.0453	
W	6.23		0.2453	
X	4.60		0.1811	
Y	9.40		0.3701	
Z	16.15		0.6358	

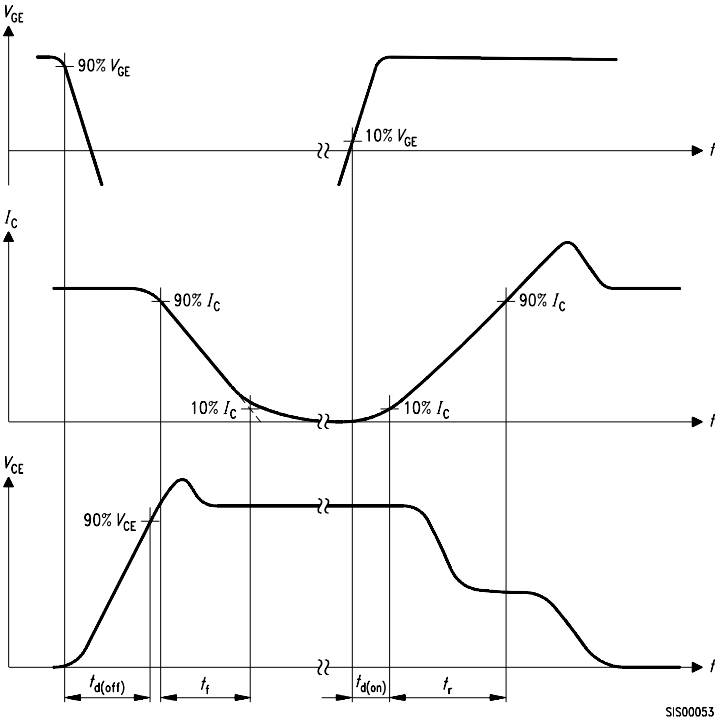


Figure A. Definition of switching times

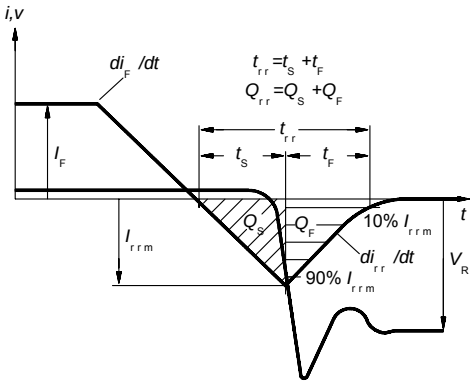


Figure C. Definition of diodes switching characteristics

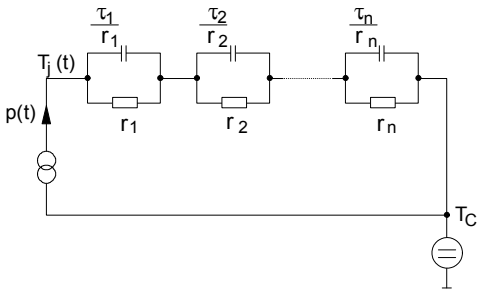


Figure D. Thermal equivalent circuit

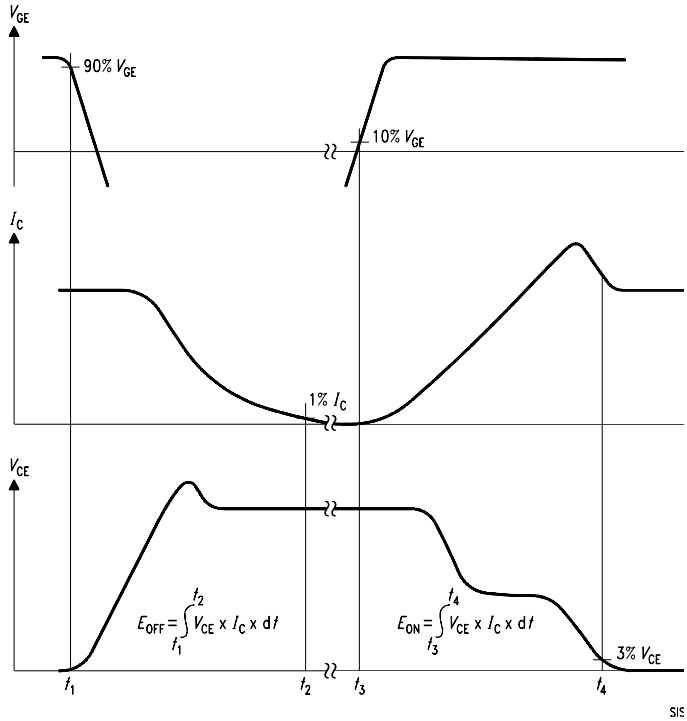


Figure B. Definition of switching losses

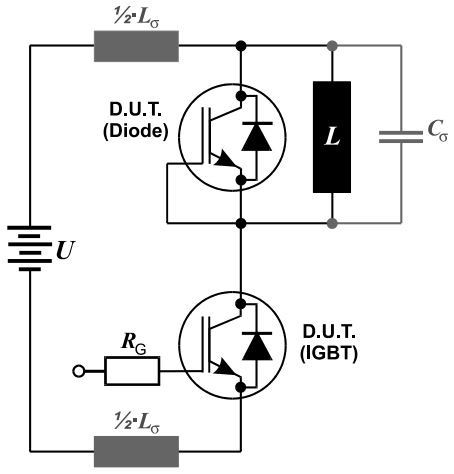


Figure E. Dynamic test circuit
Leakage inductance L_σ =60nH
and Stray capacity C_σ =40pF.

Infineon Technologies AG,
Bereich Kommunikation
St.-Martin-Strasse 53,
D-81541 München

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