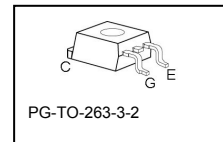
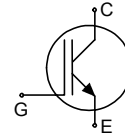


Fast IGBT in NPT-technology

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



- Qualified according to JEDEC¹ 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	Marking	Package
SGB02N120	1200V	2A	0.11mJ	150°C	GB02N120	PG-TO-263-3-2

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	1200	V
DC collector current	I_C	6.2	A
$T_C = 25^\circ\text{C}$		2.8	
$T_C = 100^\circ\text{C}$			
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	9.6	
Turn off safe operating area	-	9.6	
$V_{CE} \leq 1200\text{V}$, $T_j \leq 150^\circ\text{C}$			
Gate-emitter voltage	V_{GE}	± 20	V
Avalanche energy, single pulse	E_{AS}	10	mJ
$I_C = 2\text{A}$, $V_{CC} = 50\text{V}$, $R_{GE} = 25\Omega$, start at $T_j = 25^\circ\text{C}$			
Short circuit withstand time ²	t_{SC}	10	μ s
$V_{GE} = 15\text{V}$, $100\text{V} \leq V_{CC} \leq 1200\text{V}$, $T_j \leq 150^\circ\text{C}$			
Power dissipation	P_{tot}	62	W
$T_C = 25^\circ\text{C}$			
Operating junction and storage temperature	T_j , T_{stg}	-55...+150	$^\circ\text{C}$
Soldering temperature (reflow soldering, MSL1)	T_s	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}		2.0	K/W
Thermal resistance, junction – ambient	R_{thJA}		40	

Electrical Characteristic, at $T_j = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=100\mu A$	1200	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE} = 15V, I_C=2A$ $T_j=25^{\circ}C$ $T_j=150^{\circ}C$	2.5 -	3.1 3.7	3.6 4.3	
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C=100\mu A, V_{CE}=V_{GE}$	3	4	5	
Zero gate voltage collector current	I_{CES}	$V_{CE}=1200V, V_{GE}=0V$ $T_j=25^{\circ}C$ $T_j=150^{\circ}C$	- -	- -	25 100	μA
Gate-emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V$	-	-	100	
Transconductance	g_{fs}	$V_{CE}=20V, I_C=2A$		1.5	-	S
Dynamic Characteristic						
Input capacitance	C_{iss}	$V_{CE}=25V,$	-	205	250	pF
Output capacitance	C_{oss}	$V_{GE}=0V,$	-	20	25	
Reverse transfer capacitance	C_{rss}	$f=1MHz$	-	12	14	
Gate charge	Q_{Gate}	$V_{CC}=960V, I_C=2A$ $V_{GE}=15V$	-	11	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	7	-	nH
Short circuit collector current ²⁾	$I_{C(SC)}$	$V_{GE}=15V, t_{SC}\leq 10\mu s$ $100V\leq V_{CC}\leq 1200V,$ $T_j\leq 150^{\circ}C$	-	24	-	A

²⁾ Allowed number of short circuits: <1000; time between short circuits: >1s.

Switching Characteristic, Inductive Load, at $T_j=25^\circ\text{C}$

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	$T_j=25^{\circ}\text{C}$, $V_{CC}=800\text{V}$, $I_C=2\text{A}$, $V_{GE}=15\text{V}/0\text{V}$, $R_G=91\Omega$, $L_{\sigma}^{(1)}=180\text{nH}$, $C_{\sigma}^{(1)}=40\text{pF}$	-	23	30	ns
Rise time	t_r		-	16	21	
Turn-off delay time	$t_{d(off)}$		-	260	340	
Fall time	t_f		-	61	80	
Turn-on energy	E_{on}	Energy losses include “tail” and diode reverse recovery.	-	0.16	0.21	mJ
Turn-off energy	E_{off}		-	0.06	0.08	
Total switching energy	E_{ts}		-	0.22	0.29	

Switching Characteristic, Inductive Load, at $T_j=150^\circ\text{C}$

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	$T_j=150^{\circ}\text{C}$	-	26	31	ns
Rise time	t_r	$V_{CC}=800\text{V}$,	-	14	17	
Turn-off delay time	$t_{d(off)}$	$I_C=2\text{A}$,	-	290	350	
Fall time	t_f	$V_{GE}=15\text{V}/0\text{V}$,	-	85	102	
Turn-on energy	E_{on}	$R_G=91\Omega$,	-	0.27	0.33	mJ
Turn-off energy	E_{off}	$L_{\sigma}^{(1)}=180\text{nH}$,	-	0.11	0.15	
Total switching energy	E_{ts}	$C_{\sigma}^{(1)}=40\text{pF}$ Energy losses include “tail” and diode reverse recovery.	-	0.38	0.48	

¹⁾ Leakage inductance L_{σ} and stray capacity C_{σ} due to dynamic test circuit in figure E.

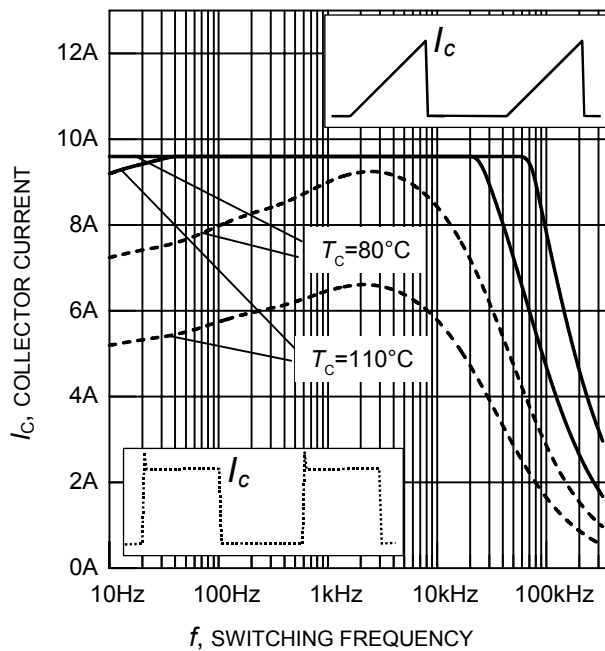


Figure 1. Collector current as a function of switching frequency

($T_j \leq 150^\circ\text{C}$, $D = 0.5$, $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $R_G = 91\Omega$)

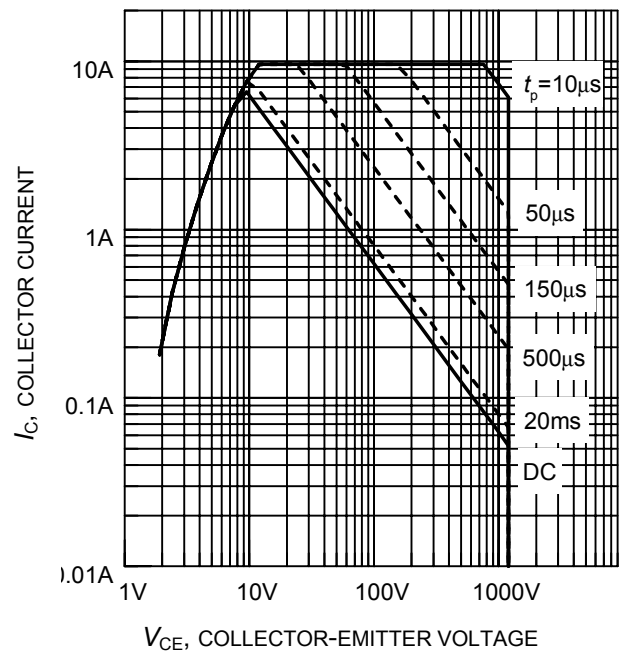


Figure 2. Safe operating area

($D = 0$, $T_C = 25^\circ\text{C}$, $T_j \leq 150^\circ\text{C}$)

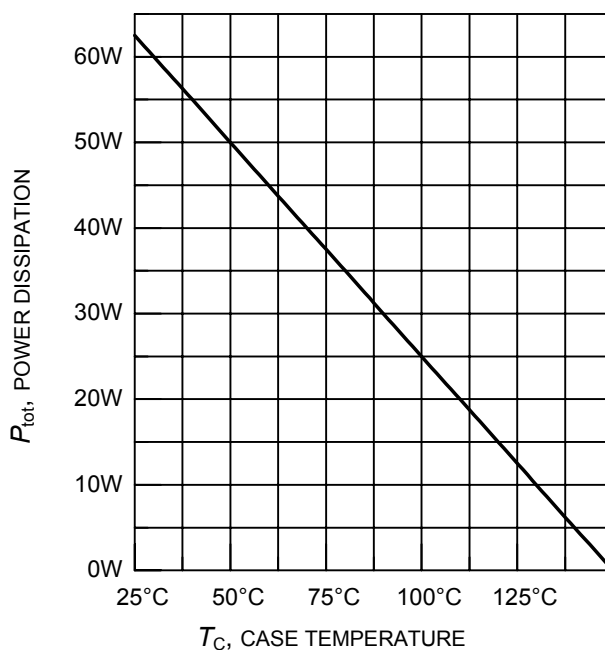


Figure 3. Power dissipation as a function of case temperature

($T_j \leq 150^\circ\text{C}$)

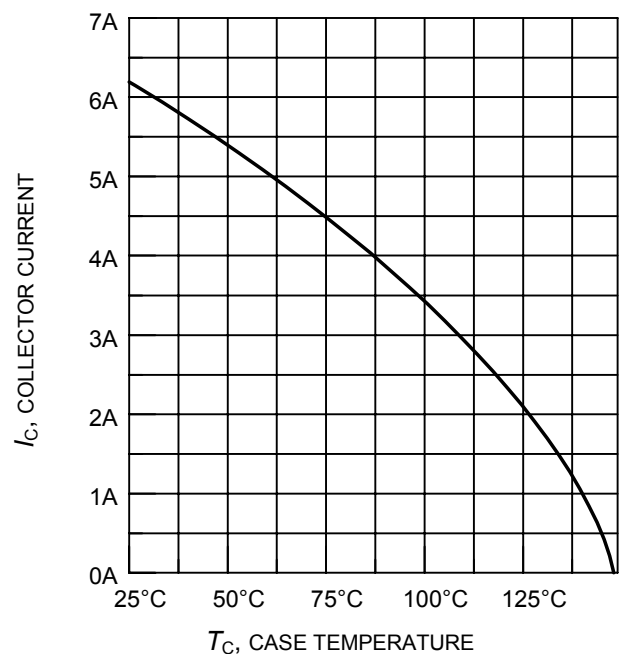


Figure 4. Collector current as a function of case temperature

($V_{GE} \leq 15\text{V}$, $T_j \leq 150^\circ\text{C}$)

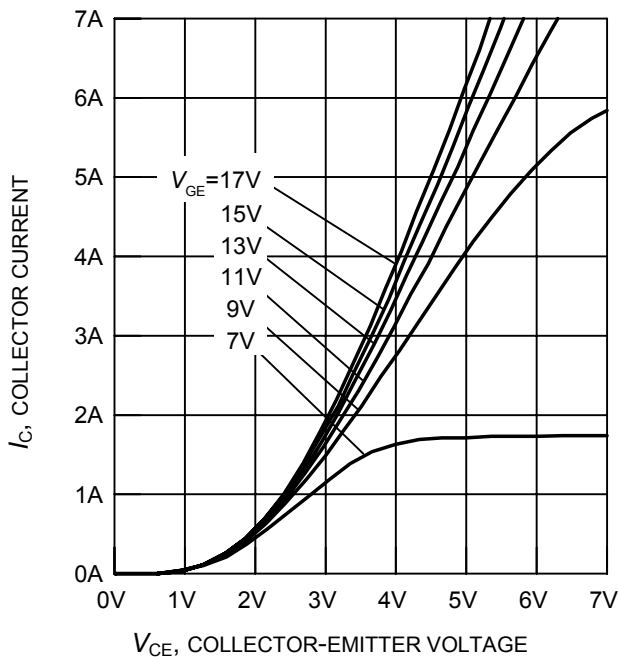


Figure 5. Typical output characteristics
($T_j = 25^\circ\text{C}$)

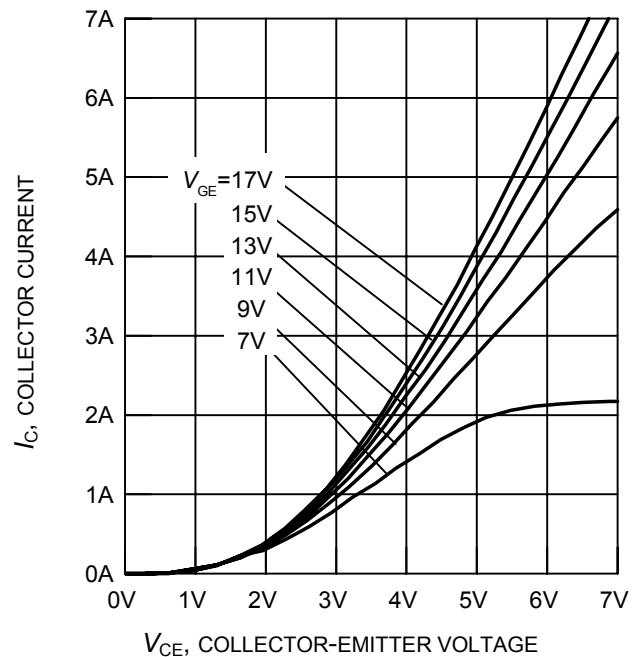


Figure 6. Typical output characteristics
($T_j = 150^\circ\text{C}$)

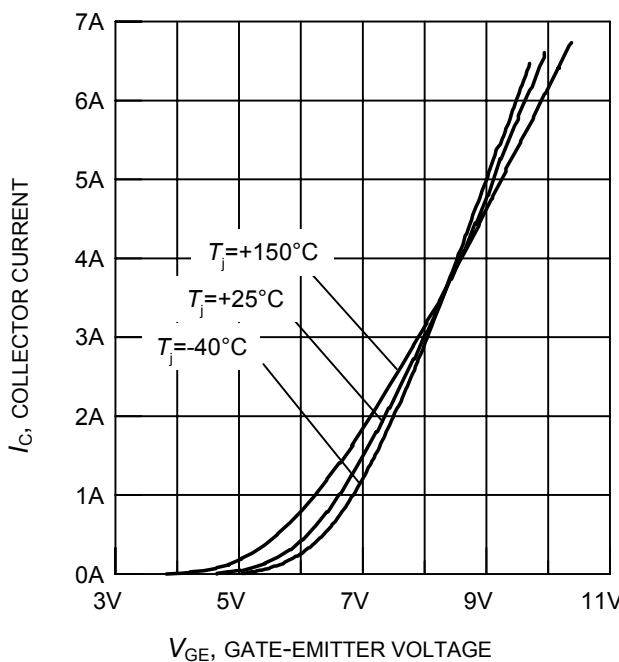


Figure 7. Typical transfer characteristics
($V_{CE} = 20\text{V}$)

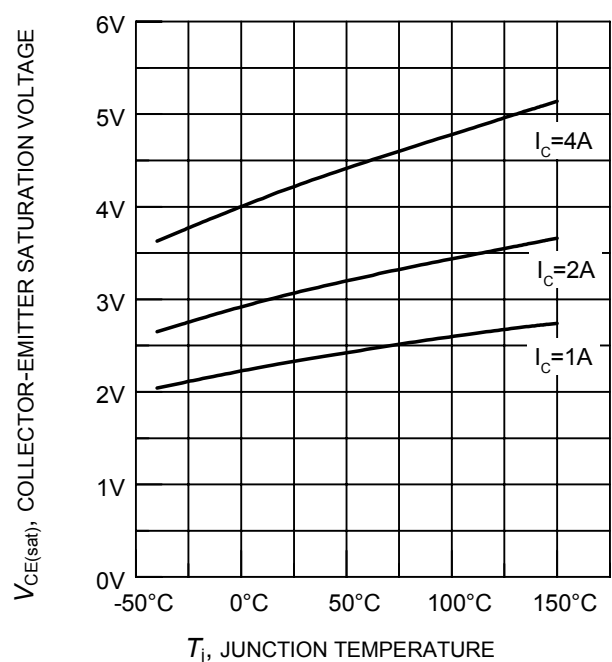


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
($V_{GE} = 15\text{V}$)

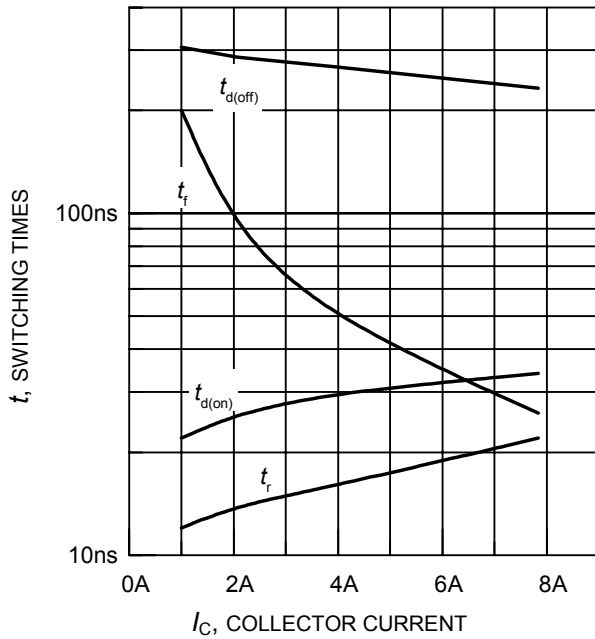


Figure 9. Typical switching times as a function of collector current

(inductive load, $T_j = 150^\circ\text{C}$,
 $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $R_G = 91\Omega$,
dynamic test circuit in Fig.E)

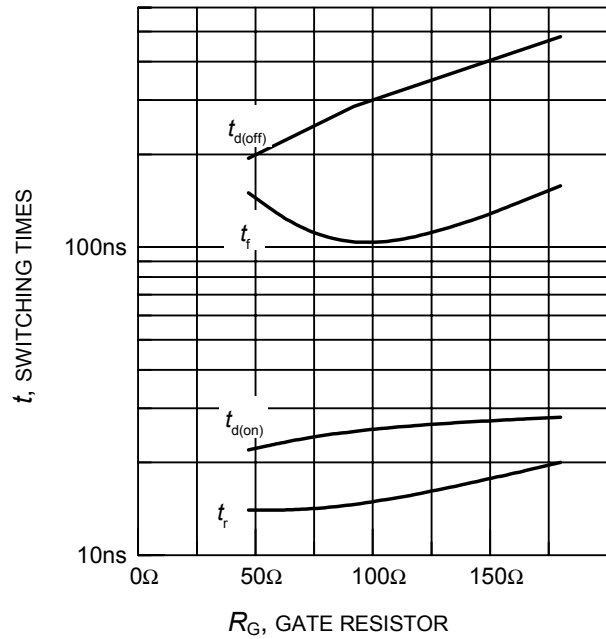


Figure 10. Typical switching times as a function of gate resistor

(inductive load, $T_j = 150^\circ\text{C}$,
 $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $I_C = 2\text{A}$,
dynamic test circuit in Fig.E)

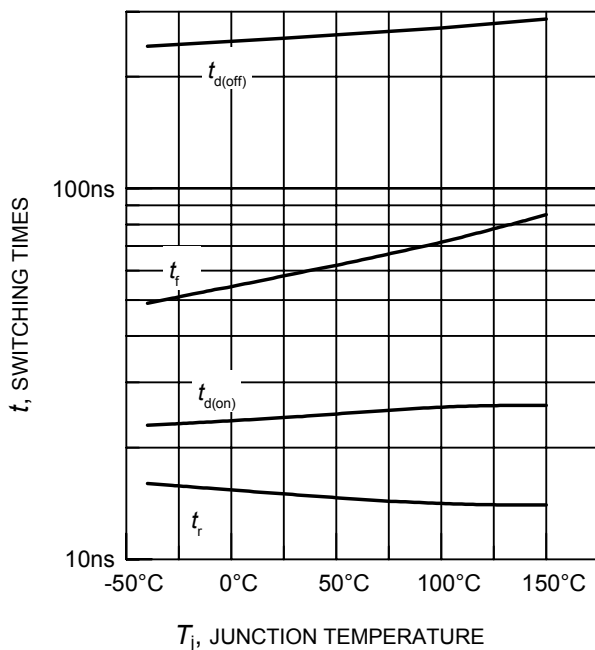


Figure 11. Typical switching times as a function of junction temperature

(inductive load, $V_{CE} = 800\text{V}$,
 $V_{GE} = +15\text{V}/0\text{V}$, $I_C = 2\text{A}$, $R_G = 91\Omega$,
dynamic test circuit in Fig.E)

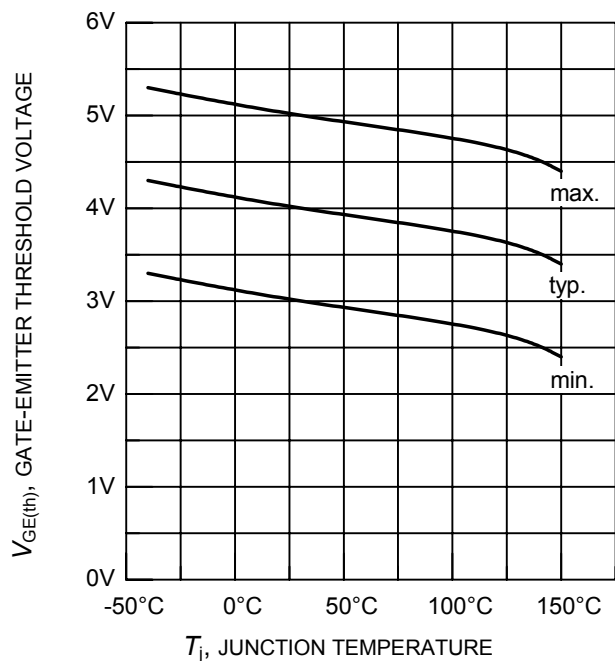


Figure 12. Gate-emitter threshold voltage as a function of junction temperature

($I_C = 0.3\text{mA}$)

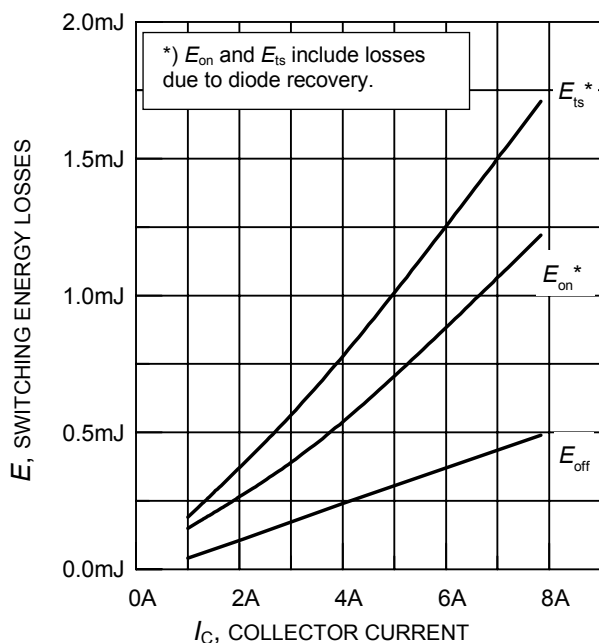


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, $T_j = 150^\circ\text{C}$,
 $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $R_G = 91\Omega$,
dynamic test circuit in Fig.E)

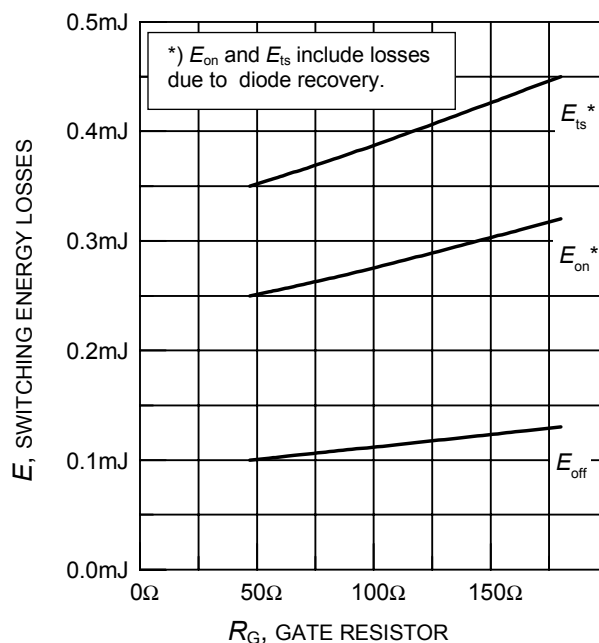


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, $T_j = 150^\circ\text{C}$,
 $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $I_C = 2\text{A}$,
dynamic test circuit in Fig.E)

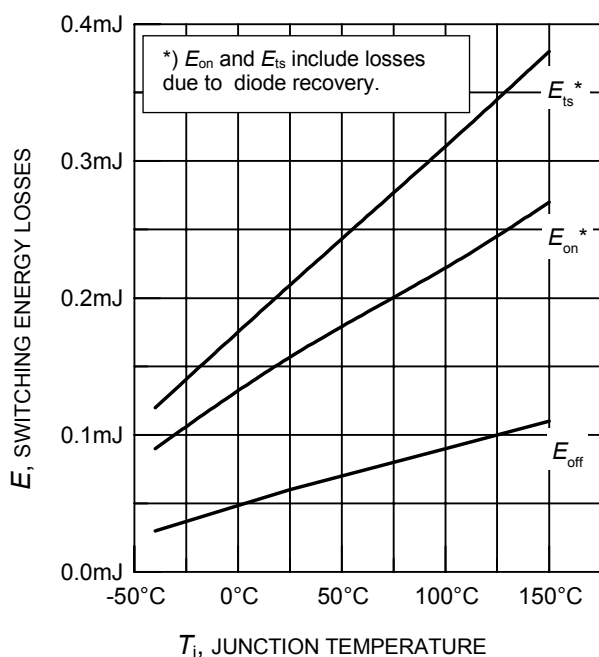


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, $V_{CE} = 800\text{V}$,
 $V_{GE} = +15\text{V}/0\text{V}$, $I_C = 2\text{A}$, $R_G = 91\Omega$,
dynamic test circuit in Fig.E)

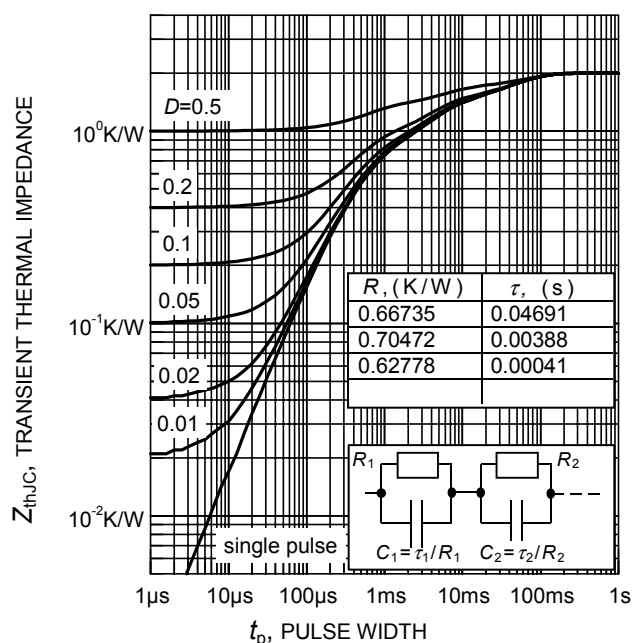


Figure 16. IGBT transient thermal impedance as a function of pulse width
($D = t_p / T$)

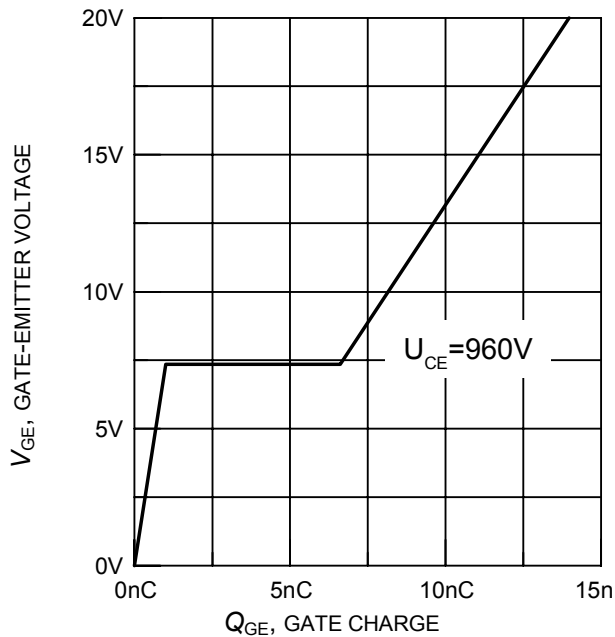


Figure 17. Typical gate charge
($I_C = 2A$)

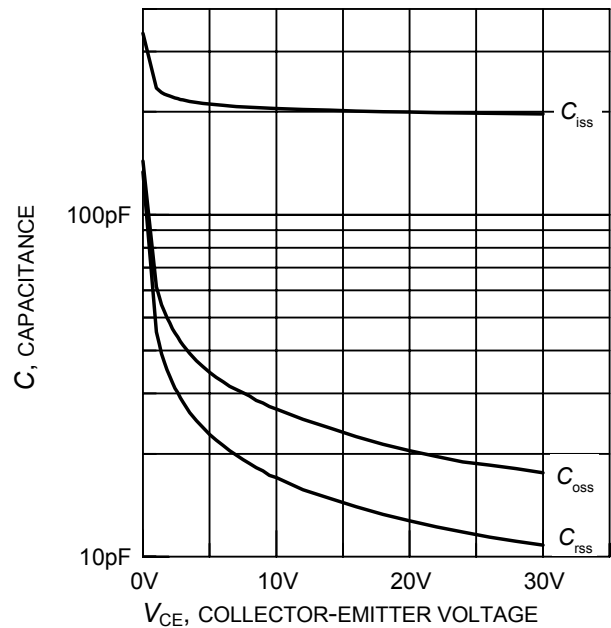


Figure 18. Typical capacitance as a function of collector-emitter voltage
($V_{GE} = 0V$, $f = 1MHz$)

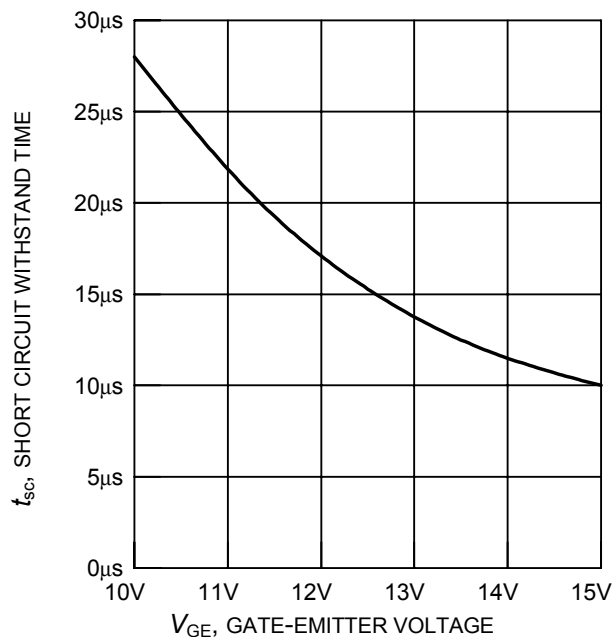


Figure 19. Short circuit withstand time as a function of gate-emitter voltage
($V_{CE} = 1200V$, start at $T_j = 25^\circ C$)

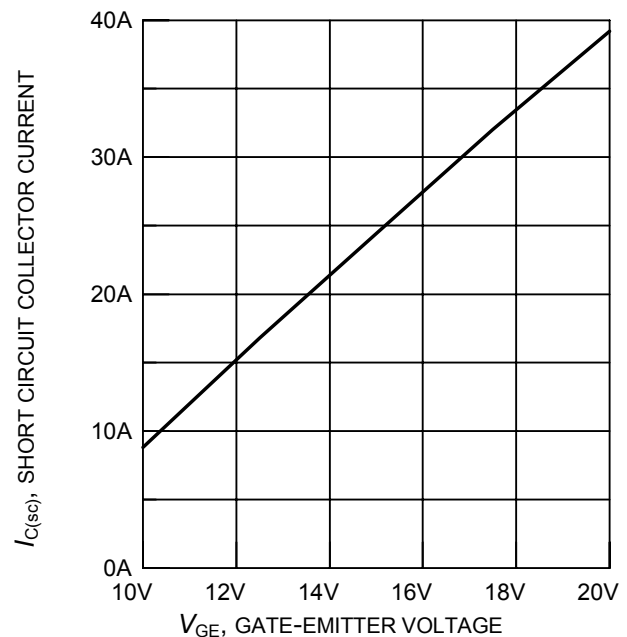
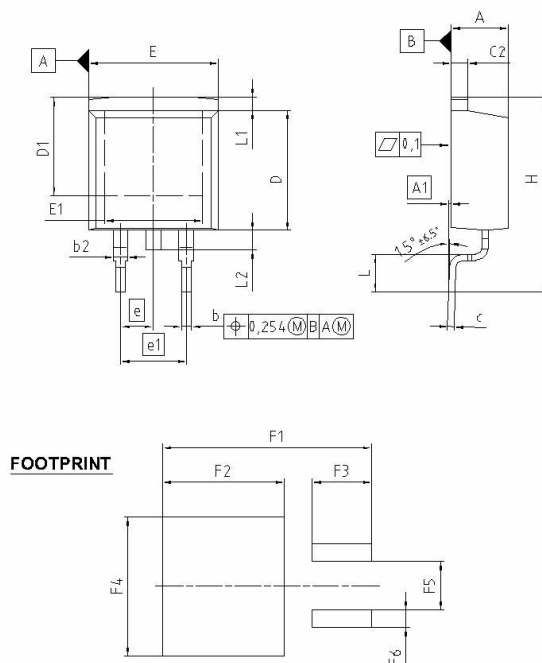
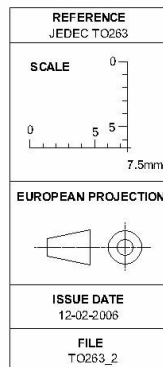


Figure 20. Typical short circuit collector current as a function of gate-emitter voltage
($100V \leq V_{CE} \leq 1200V$, $T_C = 25^\circ C$, $T_j \leq 150^\circ C$)

PG-T0263-3-2



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	0.850	0.850	0.033	0.033
b2	0.950	1.321	0.037	0.052
c	0.330	0.850	0.013	0.033
c2	0.170	1.400	0.006	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



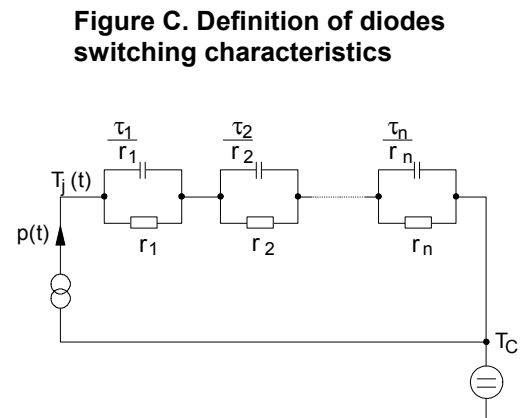
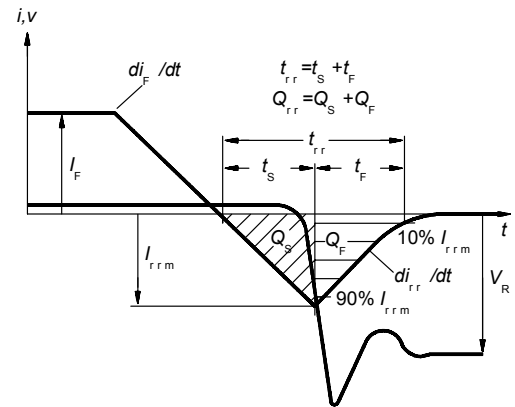
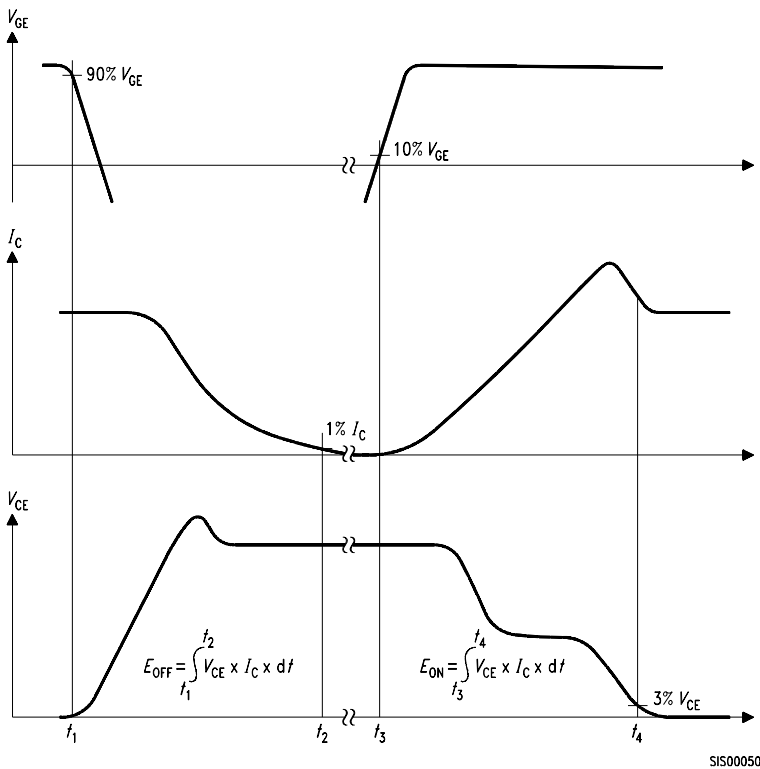
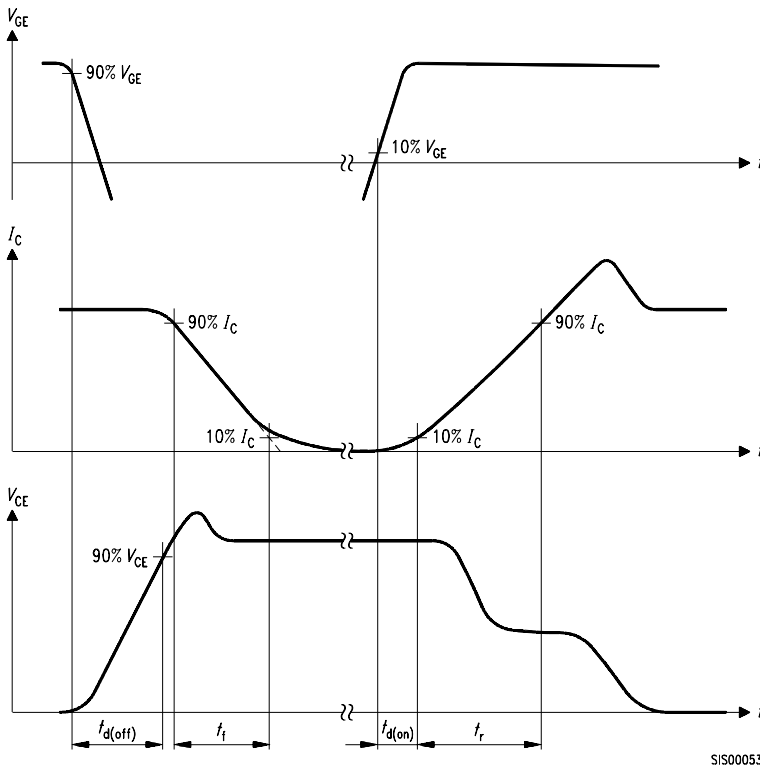


Figure D. Thermal equivalent circuit

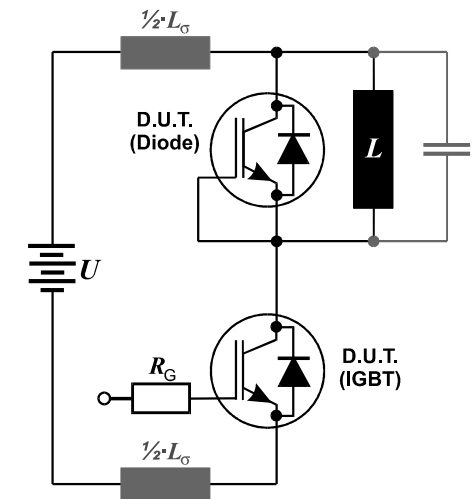


Figure E. Dynamic test circuit
Leakage inductance $L_\sigma = 180\text{nH}$, and stray capacity $C_\sigma = 40\text{pF}$.

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