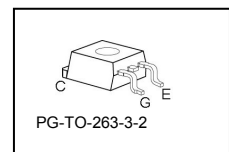
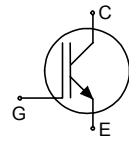


Fast IGBT in NPT-technology

- 75% lower E_{off} compared to previous generation combined with low conduction losses
- Short circuit withstand time – 10 μ s
- 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 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	$V_{CE(sat)}$	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	I_C	20	A
$T_C = 25^\circ\text{C}$		10.6	
$T_C = 100^\circ\text{C}$			
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	40	
Turn off safe operating area	-	40	
$V_{CE} \leq 600\text{V}, T_j \leq 150^\circ\text{C}$			
Gate-emitter voltage	V_{GE}	± 20	V
Avalanche energy, single pulse	E_{AS}	70	mJ
$I_C = 10\text{ A}, V_{CC} = 50\text{ V}, R_{GE} = 25\ \Omega$, start at $T_j = 25^\circ\text{C}$			
Short circuit withstand time ²	t_{SC}	10	μ s
$V_{GE} = 15\text{V}, V_{CC} \leq 600\text{V}, T_j \leq 150^\circ\text{C}$			
Power dissipation	P_{tot}	92	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)		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 $T_j = 25\text{ }^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit	
			min.	Typ.	max.		
Static Characteristic							
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=500\mu A$	600	-	-	V	
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE} = 15V, I_C=10A$	1.7	2	2.4		
		$T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$	-	2.3	2.8		
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C=300\mu A, V_{CE}=V_{GE}$	3	4	5		
Zero gate voltage collector current	I_{CES}	$V_{CE}=600V, V_{GE}=0V$	$T_j=25^\circ\text{C}$	-	-	40	μA
			$T_j=150^\circ\text{C}$	-	-	1500	
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}	$V_{CE}=25V,$ $V_{GE}=0V,$ $f=1\text{MHz}$	-	550	660	pF	
Output capacitance	C_{oss}		-	62	75		
Reverse transfer capacitance	C_{riss}		-	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⁾	$I_{C(SC)}$	$V_{GE}=15V, t_{SC}\leq 10\mu s$ $V_{CC}\leq 600V,$ $T_j\leq 150^\circ\text{C}$	-	100	-	A	

¹⁾ Device on 50mm*50mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70 μ m thick) copper area for collector connection. PCB is vertical without blown air.

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

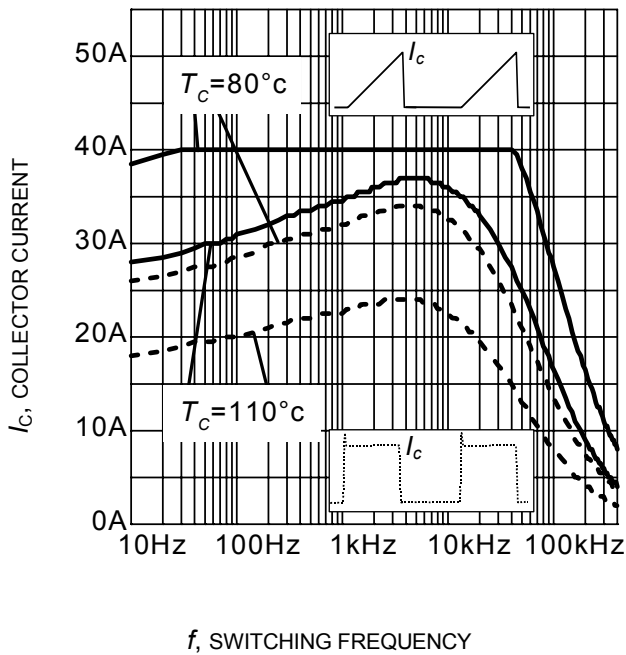
Switching Characteristic, Inductive Load, at $T_j=25\text{ }^\circ\text{C}$

Parameter	Symbol	Conditions	Value			Unit	
			min.	typ.	max.		
IGBT Characteristic							
Turn-on delay time	$t_{d(on)}$	$T_j=25\text{ }^\circ\text{C}$, $V_{CC}=400\text{V}$, $I_C=10\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=25\Omega$, $L_{\sigma}^{(1)}=180\text{nH}$, $C_{\sigma}^{(1)}=55\text{pF}$	-	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}		Energy losses include "tail" and diode reverse recovery.	-	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 $T_j=150\text{ }^\circ\text{C}$

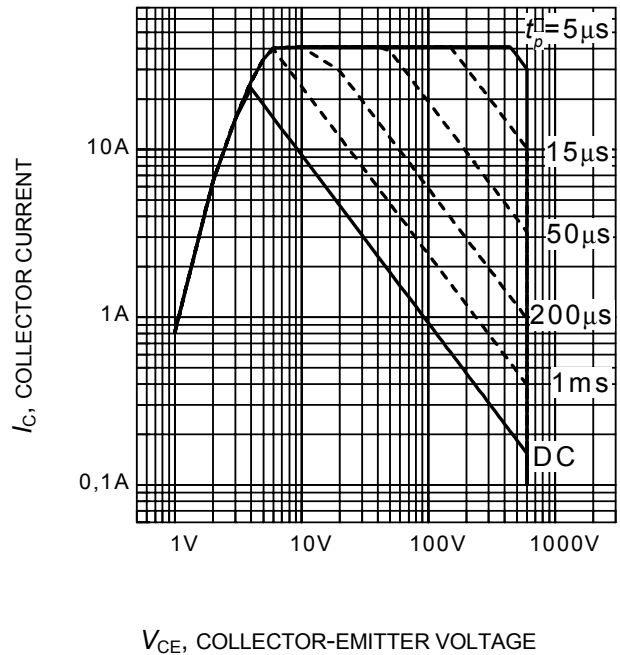
Parameter	Symbol	Conditions	Value			Unit	
			min.	typ.	max.		
IGBT Characteristic							
Turn-on delay time	$t_{d(on)}$	$T_j=150\text{ }^\circ\text{C}$ $V_{CC}=400\text{V}$, $I_C=10\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=25\Omega$ $L_{\sigma}^{(1)}=180\text{nH}$, $C_{\sigma}^{(1)}=55\text{pF}$	-	28	34	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}		Energy losses include "tail" and diode reverse recovery.	-	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.



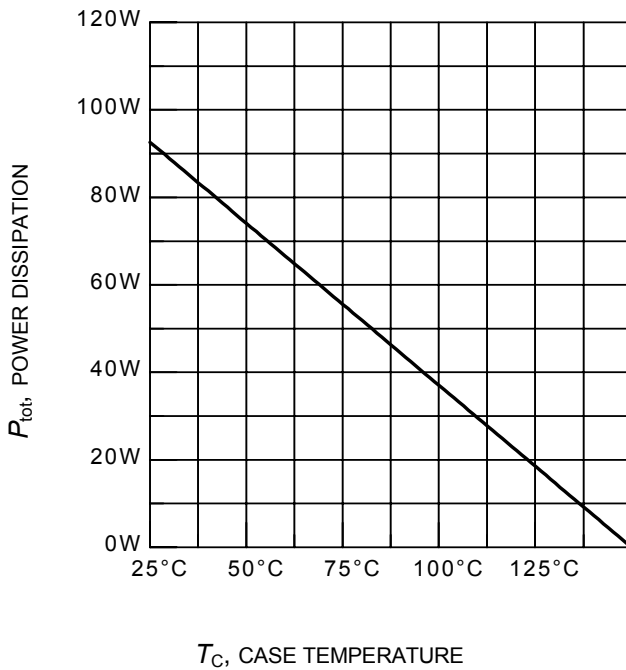
f , SWITCHING FREQUENCY

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



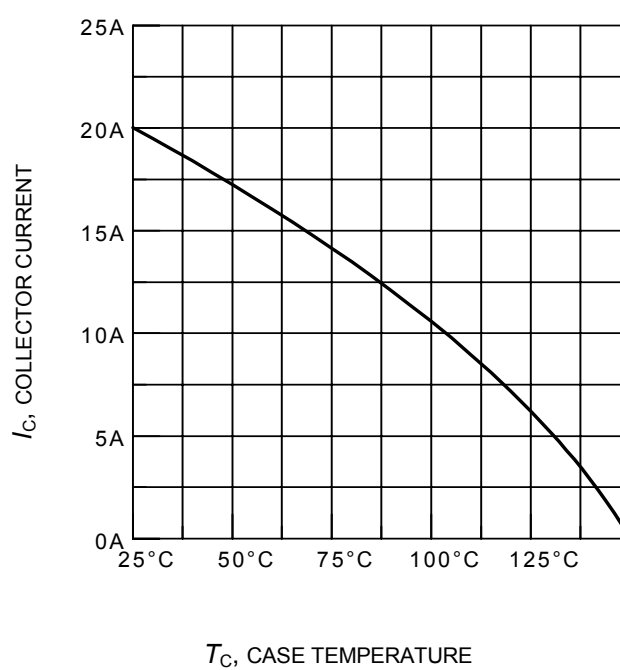
V_{CE} , COLLECTOR-EMITTER VOLTAGE

Figure 2. Safe operating area
 ($D = 0$, $T_C = 25^\circ\text{C}$, $T_j \leq 150^\circ\text{C}$)



T_C , CASE TEMPERATURE

Figure 3. Power dissipation as a function of case temperature
 ($T_j \leq 150^\circ\text{C}$)



T_C , CASE TEMPERATURE

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

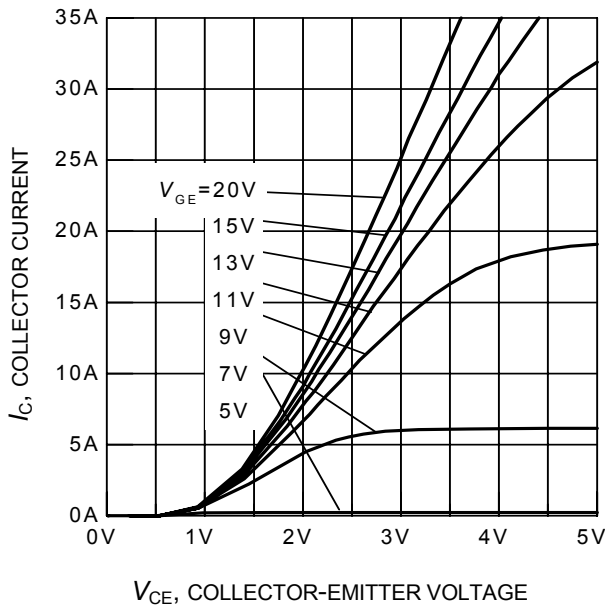


Figure 5. Typical output characteristics
($T_j = 25^\circ\text{C}$)

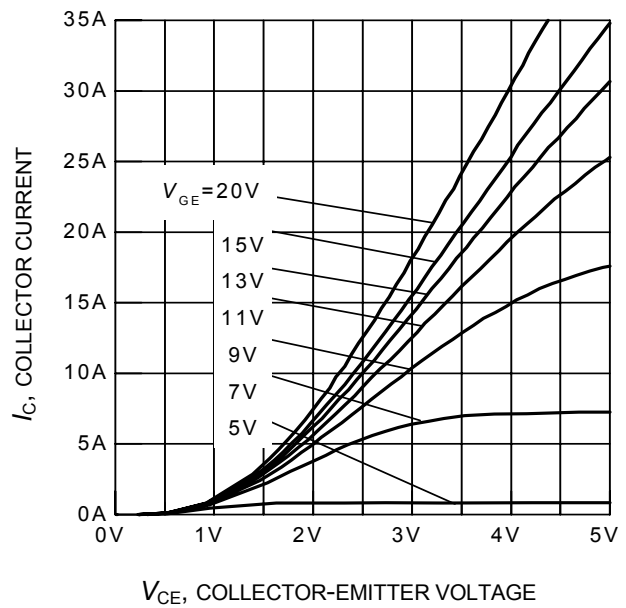


Figure 6. Typical output characteristics
($T_j = 150^\circ\text{C}$)

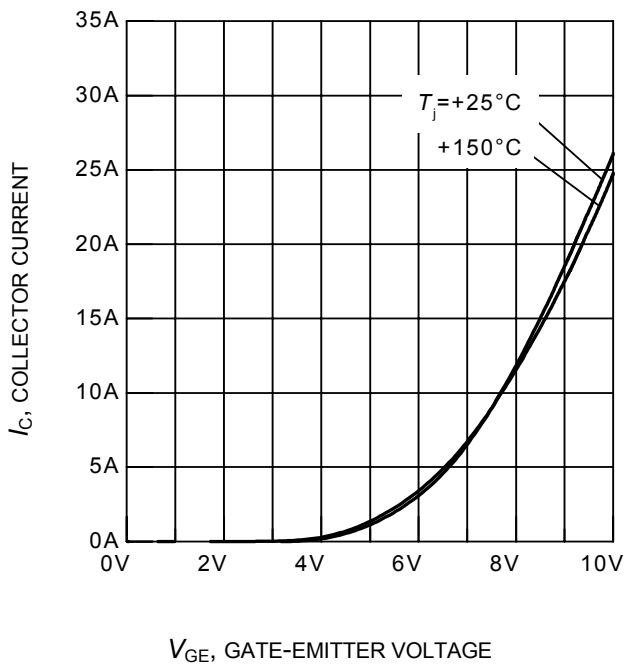


Figure 7. Typical transfer characteristics
($V_{CE} = 10\text{V}$)

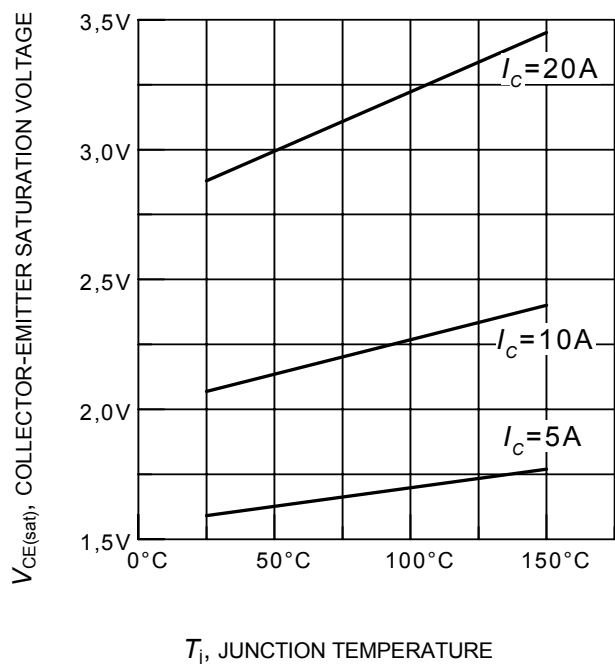
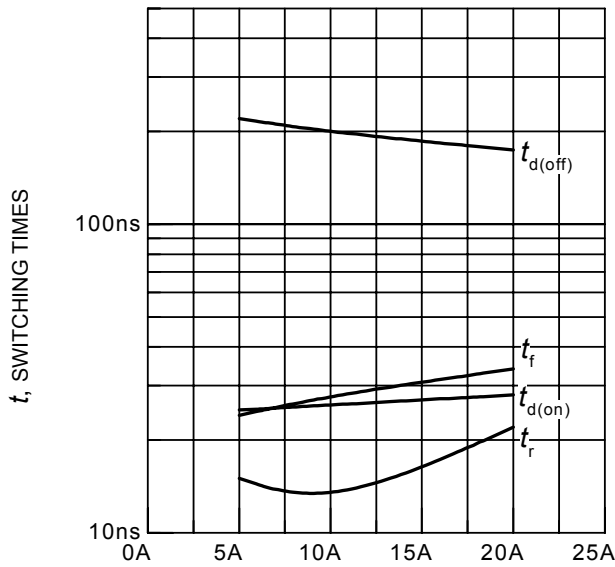


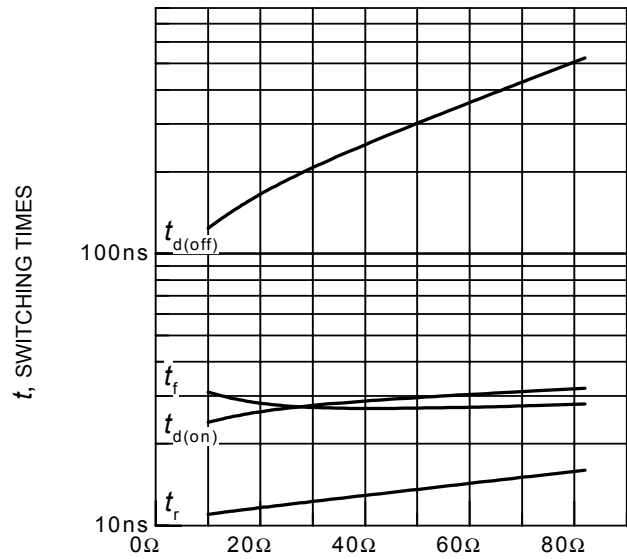
Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
($V_{GE} = 15\text{V}$)



I_C , COLLECTOR CURRENT

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

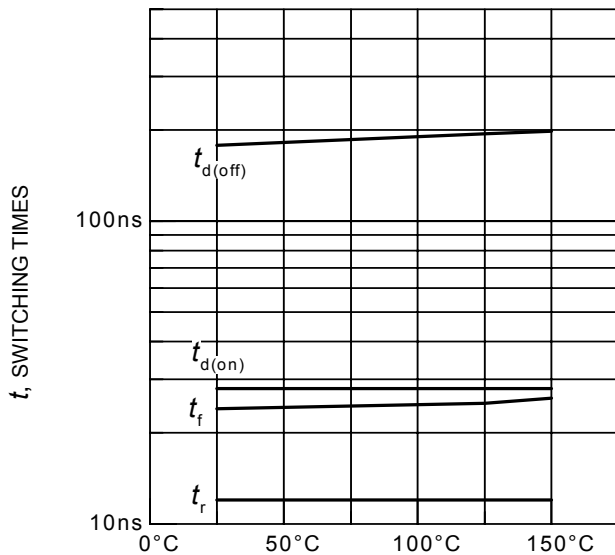
(inductive load, $T_j = 150^\circ\text{C}$, $V_{CE} = 400\text{V}$, $V_{GE} = 0/+15\text{V}$, $R_G = 25\Omega$, Dynamic test circuit in Figure E)



R_G , GATE RESISTOR

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

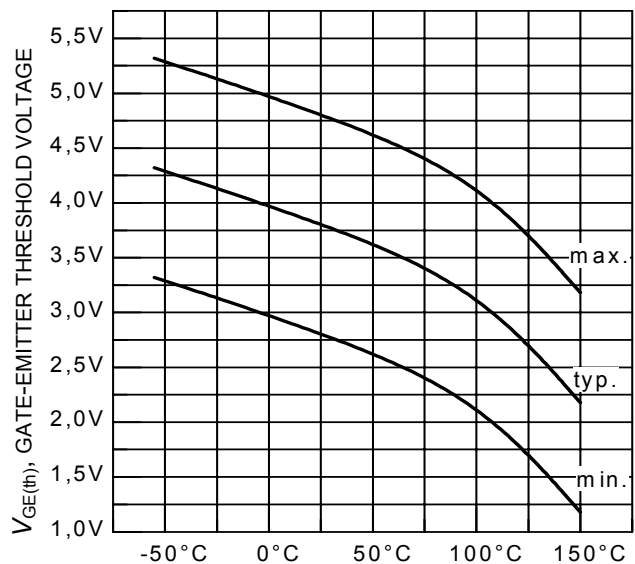
(inductive load, $T_j = 150^\circ\text{C}$, $V_{CE} = 400\text{V}$, $V_{GE} = 0/+15\text{V}$, $I_C = 10\text{A}$, Dynamic test circuit in Figure E)



T_j , JUNCTION TEMPERATURE

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

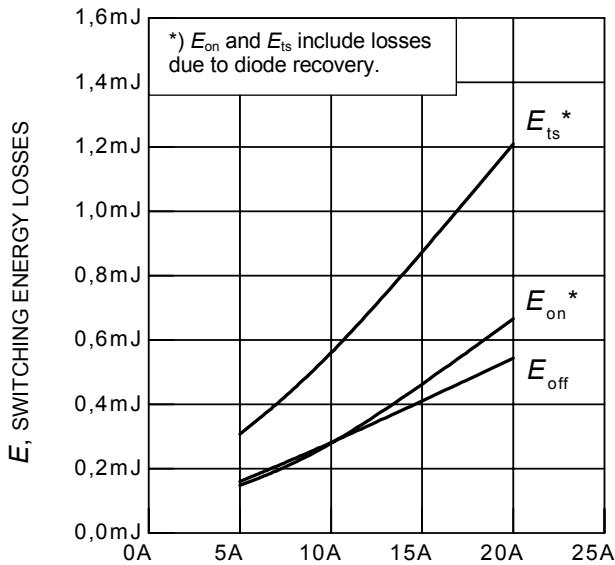
(inductive load, $V_{CE} = 400\text{V}$, $V_{GE} = 0/+15\text{V}$, $I_C = 10\text{A}$, $R_G = 25\Omega$, Dynamic test circuit in Figure E)



T_j , JUNCTION TEMPERATURE

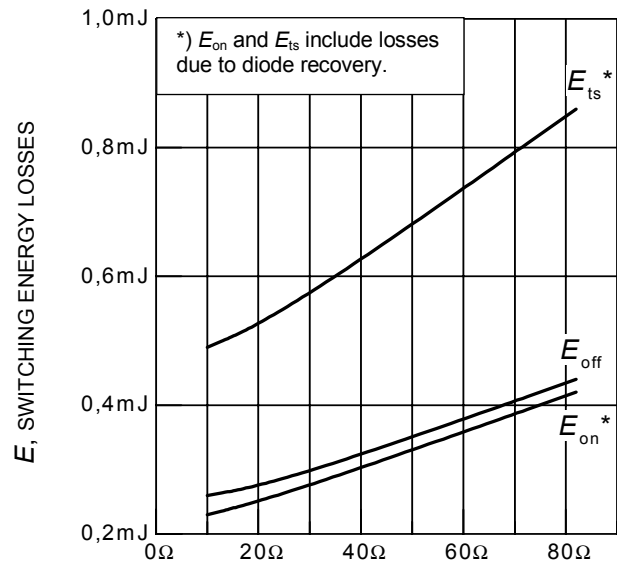
Figure 12. Gate-emitter threshold voltage as a function of junction temperature

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



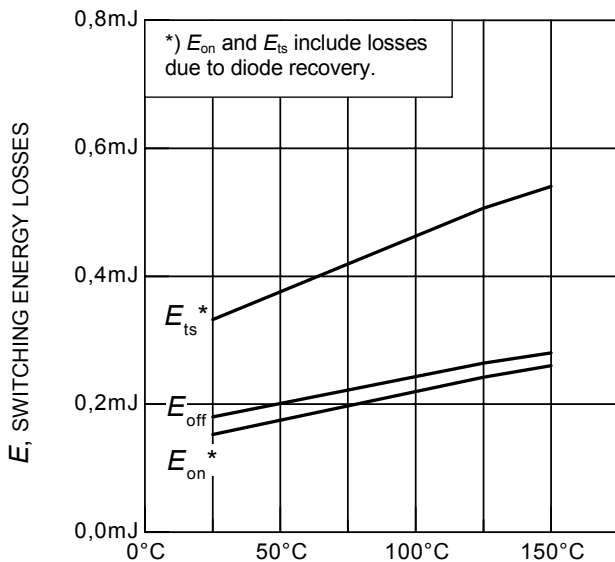
I_C , COLLECTOR CURRENT

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



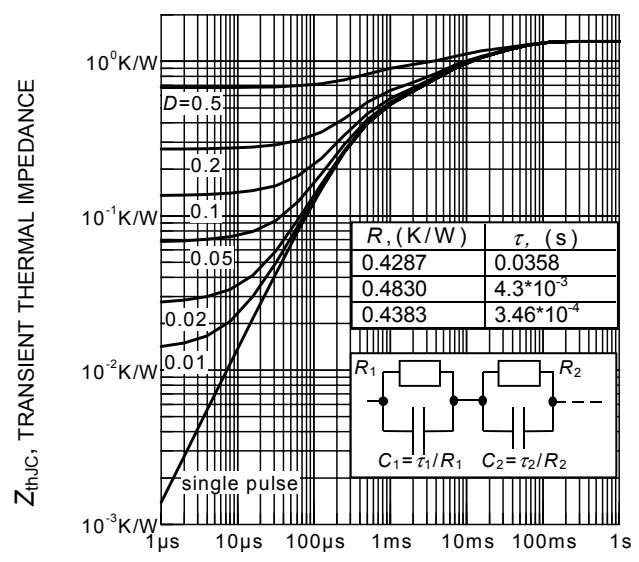
R_G , GATE RESISTOR

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



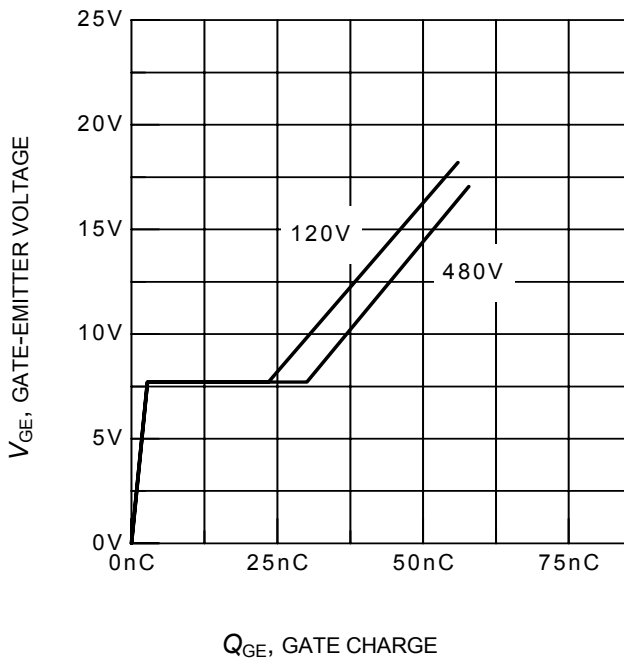
T_j , JUNCTION TEMPERATURE

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

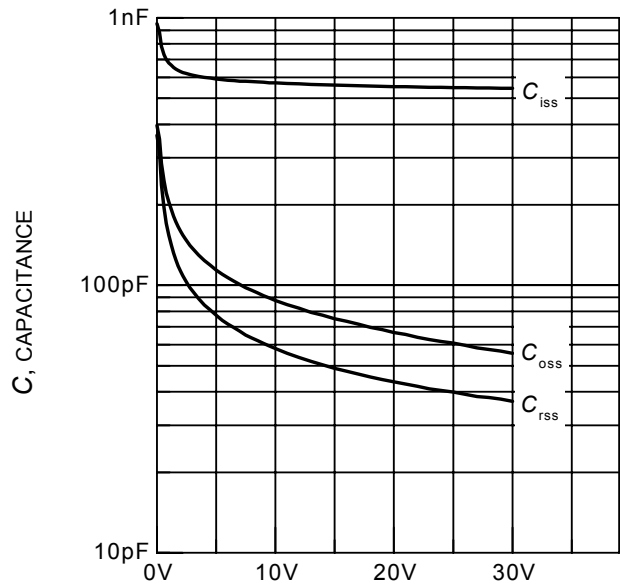


t_p , PULSE WIDTH

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



Q_{GE} , GATE CHARGE
Figure 17. Typical gate charge
 ($I_C = 10A$)



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

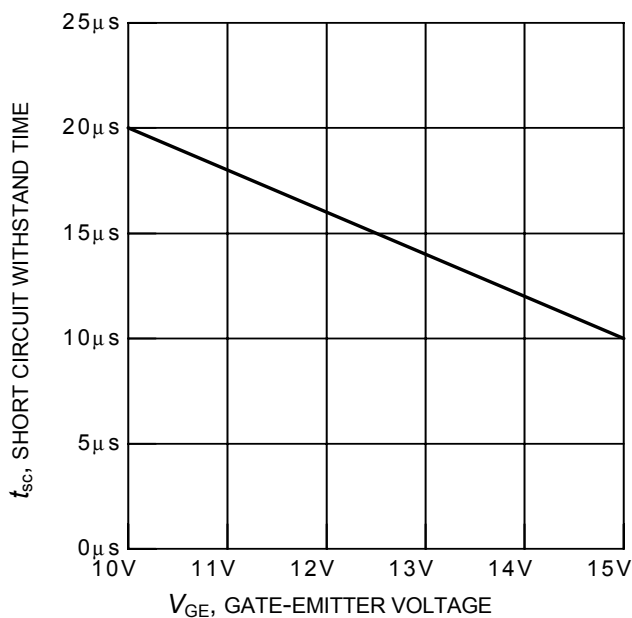


Figure 19. Short circuit withstand time as a function of gate-emitter voltage
 ($V_{CE} = 600V, \text{start at } T_j = 25^\circ C$)

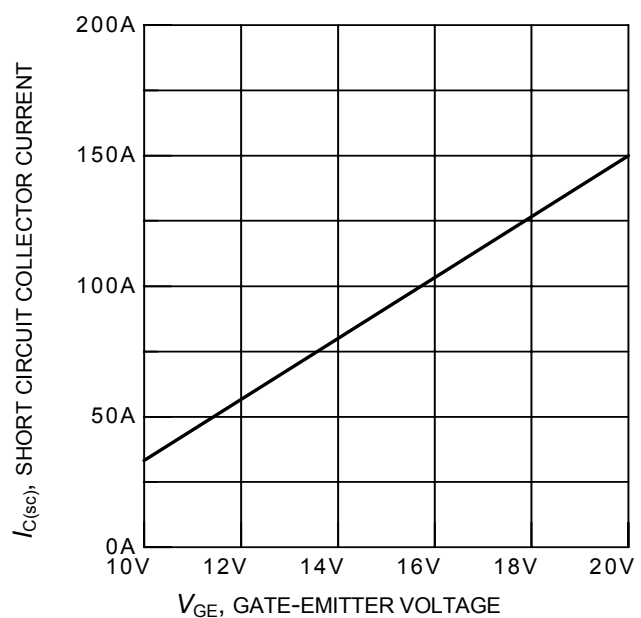
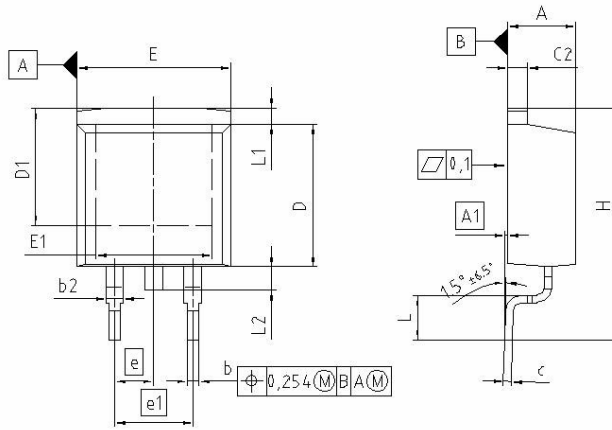
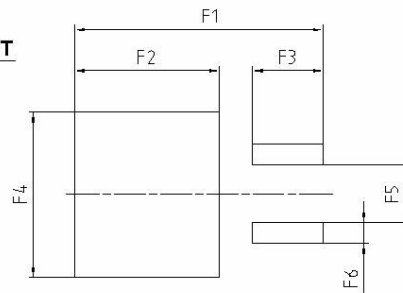


Figure 20. Typical short circuit collector current as a function of gate-emitter voltage
 ($V_{CE} \leq 600V, T_j = 150^\circ C$)

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	0.850	0.850	0.026	0.033
b2	0.950	1.321	0.037	0.052
c	0.330	0.850	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

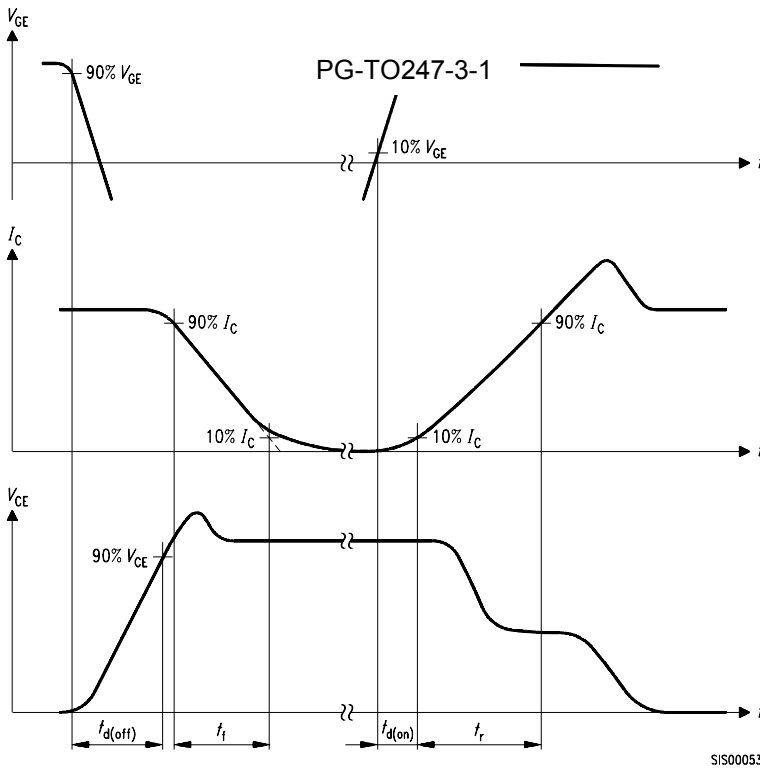


Figure A. Definition of switching times

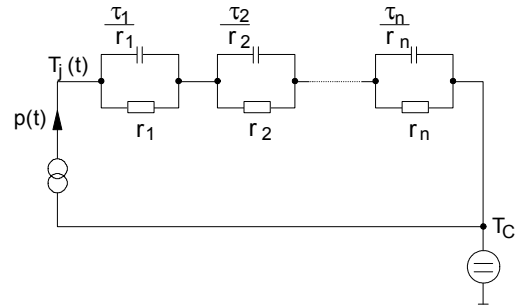


Figure D. Thermal equivalent circuit

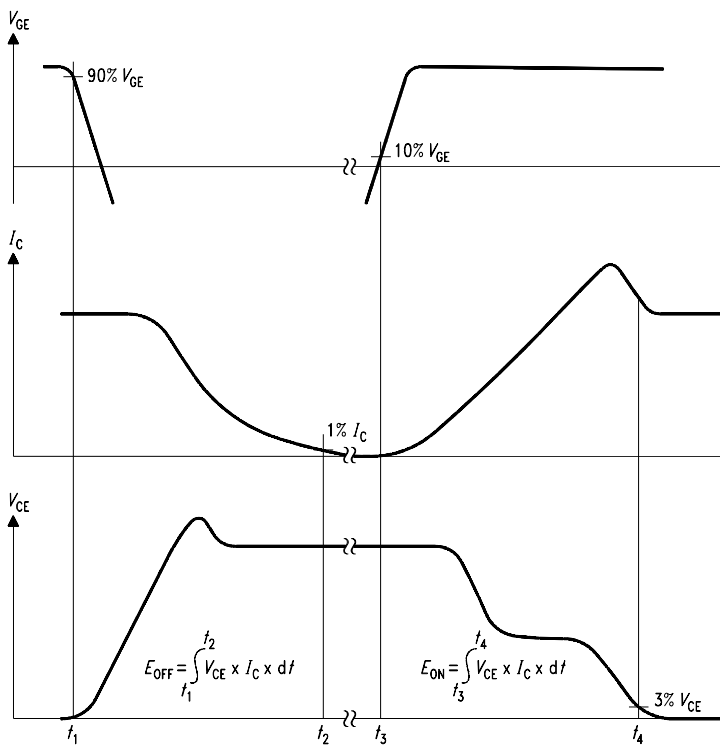


Figure B. Definition of switching losses

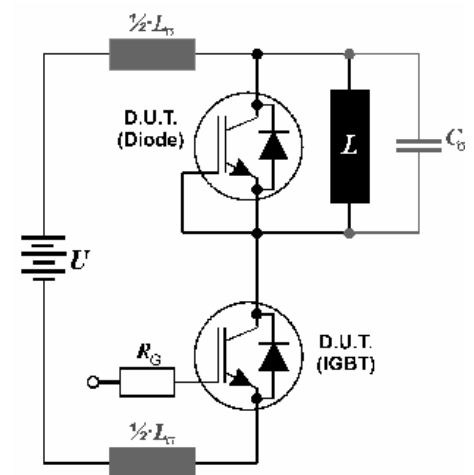


Figure E. Dynamic test circuit
Leakage inductance $L_{\sigma} = 180\text{nH}$
and Stray capacity $C_{\sigma} = 55\text{pF}$.

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