Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction – case	R_{thJC}		0.5	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=30A T_j=25°C T_j=150°C		 2.8 3.5	 3.15 4.00	
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=700µA, 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 3000	µA
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	100	nA
Transconductance	g_{fs}	V_{CE}=20V, I_C=30A	-	20	-	S
Dynamic Characteristic						
Input capacitance	C_{iss}	V_{CE}=25V,	-	1500		pF
Output capacitance	C_{oss}	V_{GE}=0V,	-	150		
Reverse transfer capacitance	C_{rss}	f=1MHz	-	92		
Gate charge	Q_{Gate}	V_{CC}=480V, I_C=30A V_{GE}=15V	-	141		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[1)]	$I_{C(SC)}$	V_{GE}=15V, t_{SC}≤10µs V_{CC} ≤ 600V, T_j ≤ 150°C	-	220		A

[1)] 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=30A, V_{GE}=0/15V, R_G=11Ω L_σ [1)] =60nH, C_σ [1)] =40pF Energy losses include "tail" and diode reverse recovery.	-	20		ns
Rise time	t_r		-	21		
Turn-off delay time	$t_{d(off)}$		-	250		
Fall time	t_f		-	25		
Turn-on energy	E_{on}		-	0.60		mJ
Turn-off energy	E_{off}		-	0.55		
Total switching energy	E_{ts}		-	1.15		

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=30A, V_{GE}=0/15V, R_G= 1.8Ω L_σ [1)] =60nH, C_σ [1)] =40pF Energy losses include "tail" and diode reverse recovery.	-	16		ns
Rise time	t_r		-	13		
Turn-off delay time	$t_{d(off)}$		-	122		
Fall time	t_f		-	29		
Turn-on energy	E_{on}		-	0.78		mJ
Turn-off energy	E_{off}		-	0.48		
Total switching energy	E_{ts}		-	1.26		
Turn-on delay time	$t_{d(on)}$	T_j=150°C V_{CC}=400V, I_C=30A, V_{GE}=0/15V, R_G= 11Ω L_σ [1)] =60nH, C_σ [1)] =40pF Energy losses include "tail" and diode reverse recovery.	-	20		ns
Rise time	t_r		-	19		
Turn-off delay time	$t_{d(off)}$		-	274		
Fall time	t_f		-	27		
Turn-on energy	E_{on}		-	0.91		mJ
Turn-off energy	E_{off}		-	0.70		
Total switching energy	E_{ts}		-	1.61		

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

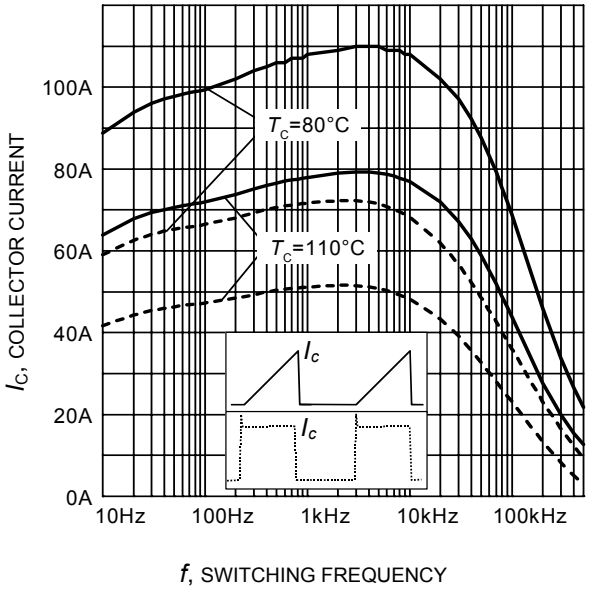


Figure 1. Collector current as a function of switching frequency
($T_j \le 150°C$, $D = 0.5$, $V_{CE} = 400V$, $V_{GE} = 0/+15V$, $R_G = 11\Omega$)

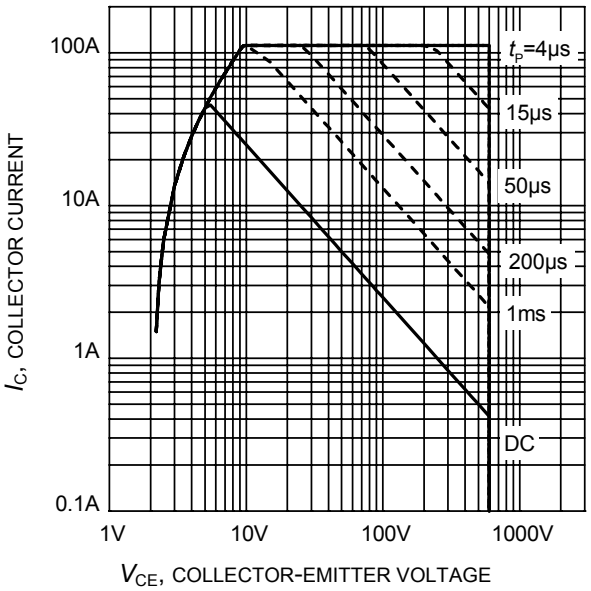


Figure 2. Safe operating area
($D = 0$, $T_C = 25°C$, $T_j \le 150°C$; V_{GE}=15V)

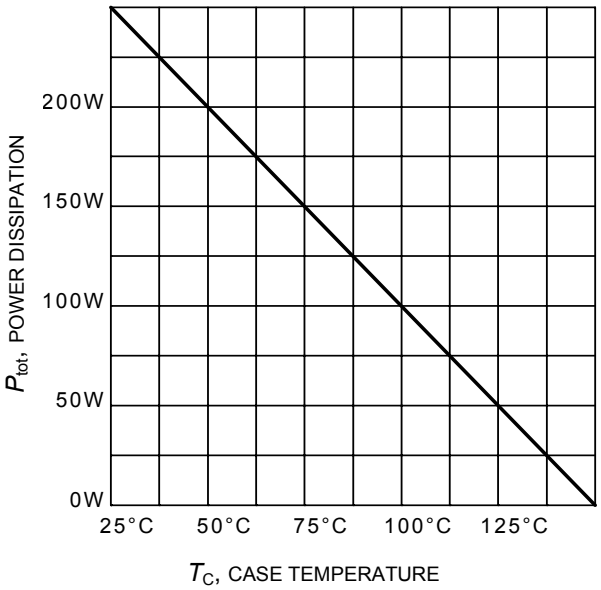


Figure 3. Power dissipation as a function of case temperature
($T_j \le 150°C$)

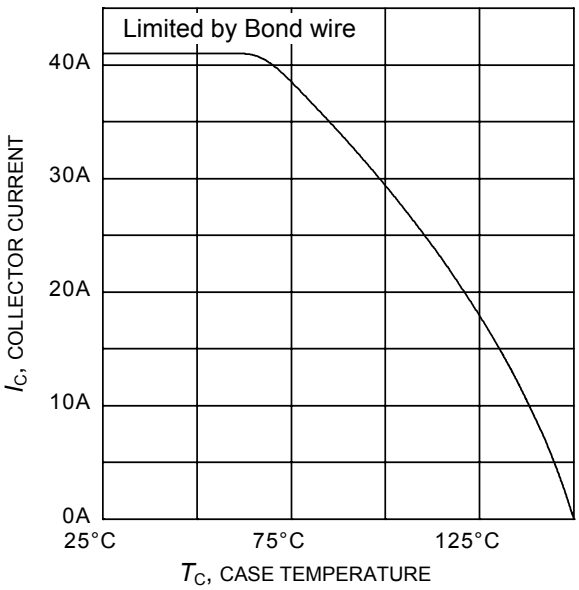


Figure 4. Collector current as a function of case temperature
($V_{GE} \le 15V$, $T_j \le 150°C$)

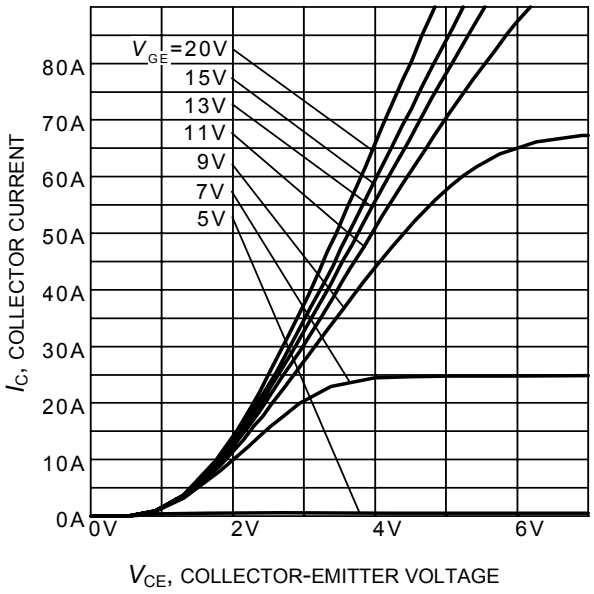


Figure 5. Typical output characteristic
(T_j = 25°C)

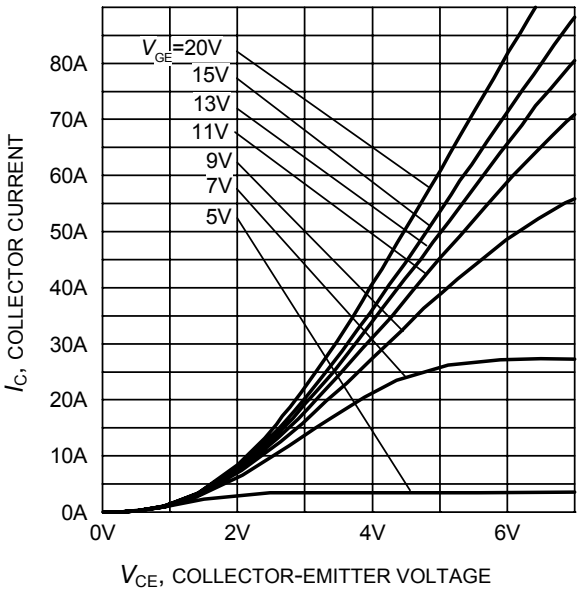


Figure 6. Typical output characteristic
(T_j = 150°C)

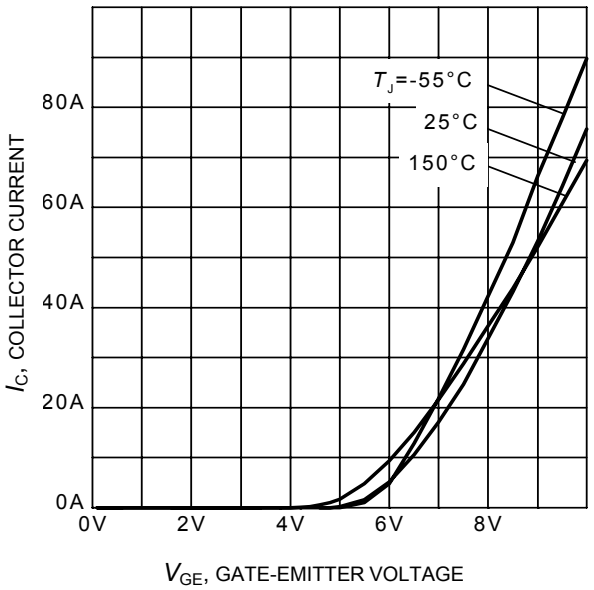


Figure 7. Typical transfer characteristic
(V_{CE}=10V)

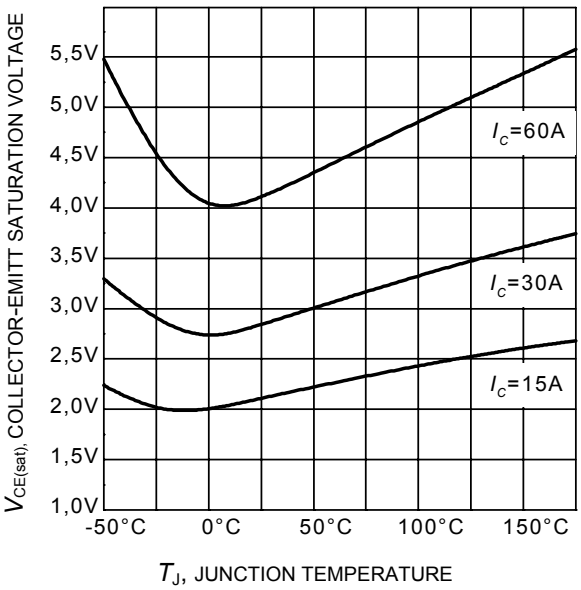


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE} = 15V)

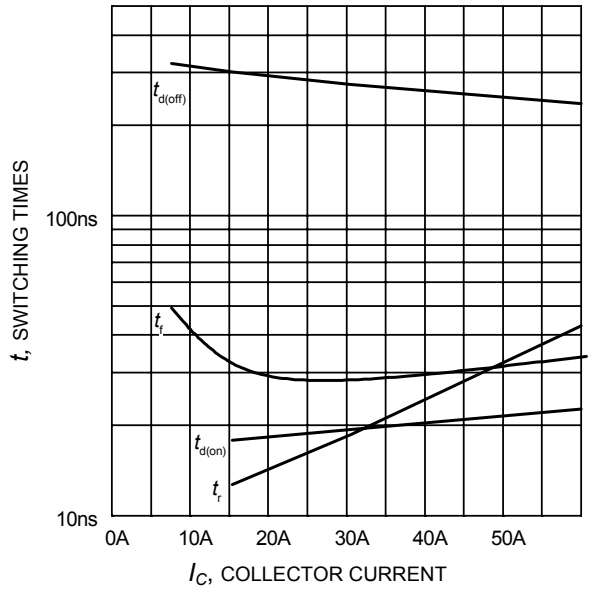


Figure 9. Typical switching times as a function of collector current
(inductive load, T_J=150°C, V_{CE}=400V, V_{GE}=0/15V, R_G=11Ω, Dynamic test circuit in Figure E)

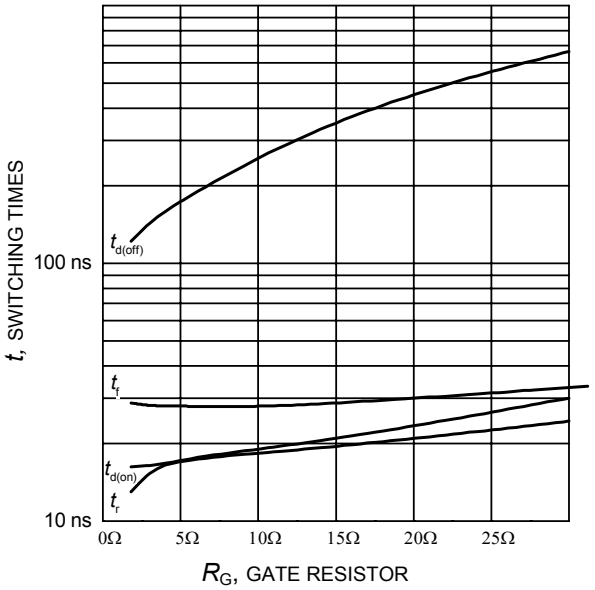


Figure 10. Typical switching times as a function of gate resistor
(inductive load, T_J=150°C, V_{CE}=400V, V_{GE}=0/15V, I_C=30A, Dynamic test circuit in Figure E)

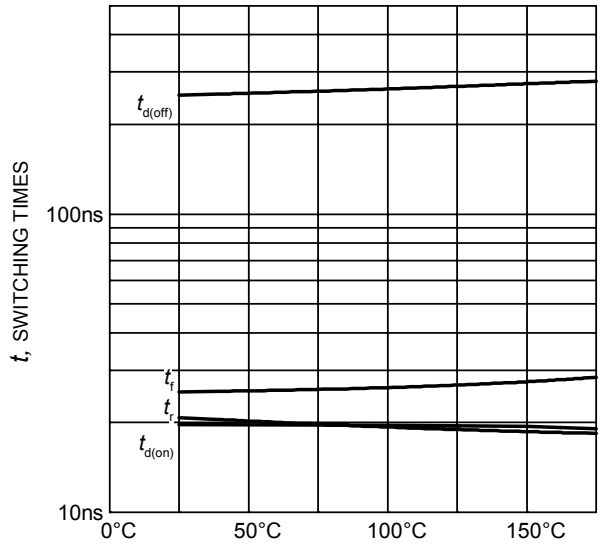


Figure 11. Typical switching times as a function of junction temperature
(inductive load, V_{CE}=400V, V_{GE}=0/15V, I_C=30A, R_G=11Ω, Dynamic test circuit in Figure E)

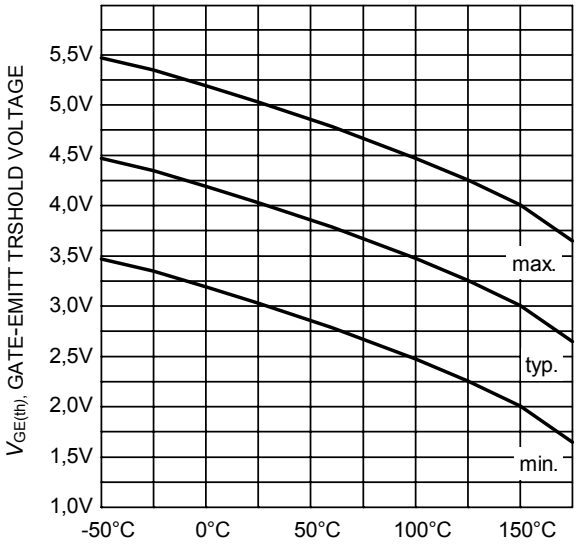


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
(I_C = 0.7mA)

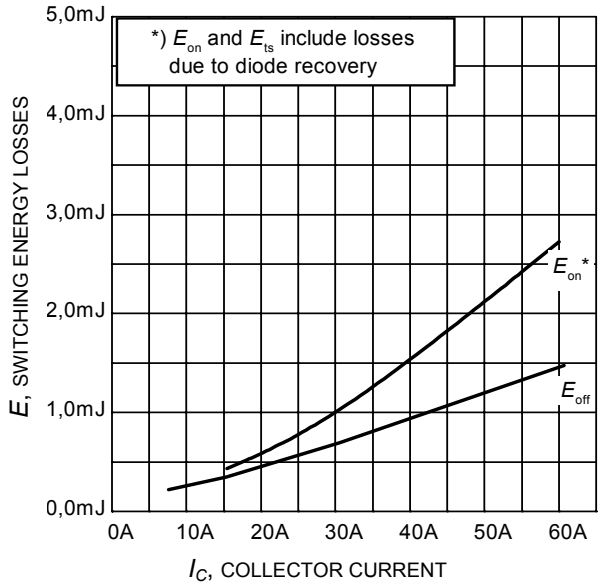


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, T_J=150°C, V_{CE}=400V, V_{GE}=0/15V, R_G=11Ω, Dynamic test circuit in Figure E)

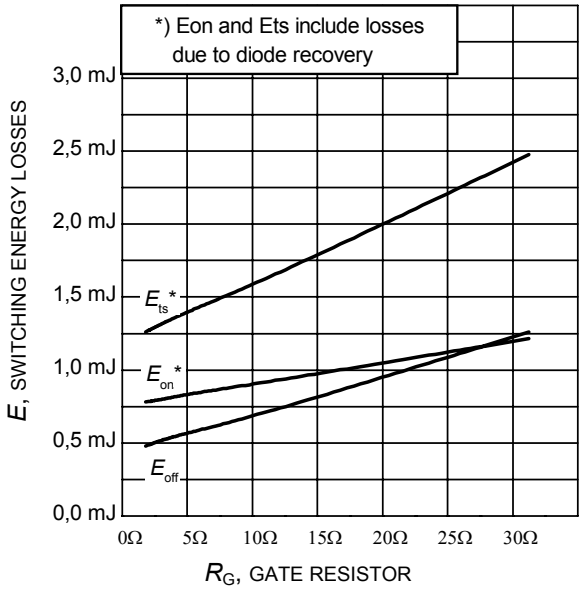


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, T_J=150°C, V_{CE}=400V, V_{GE}=0/15V, I_C=30A, Dynamic test circuit in Figure E)

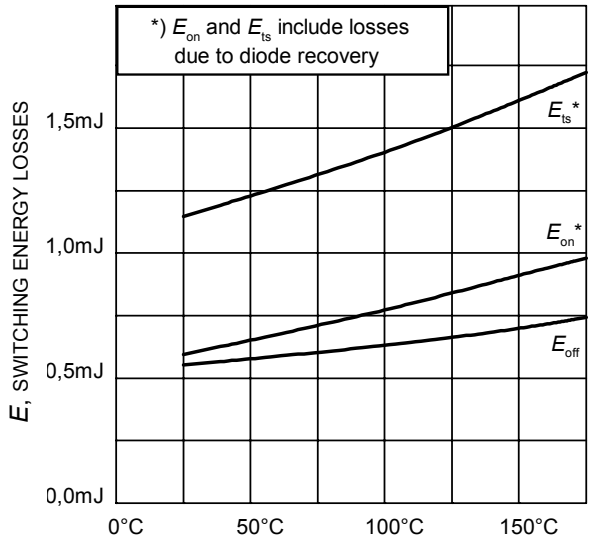


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE}=400V, V_{GE}=0/15V, I_C=30A, R_G=11Ω, Dynamic test circuit in Figure E)

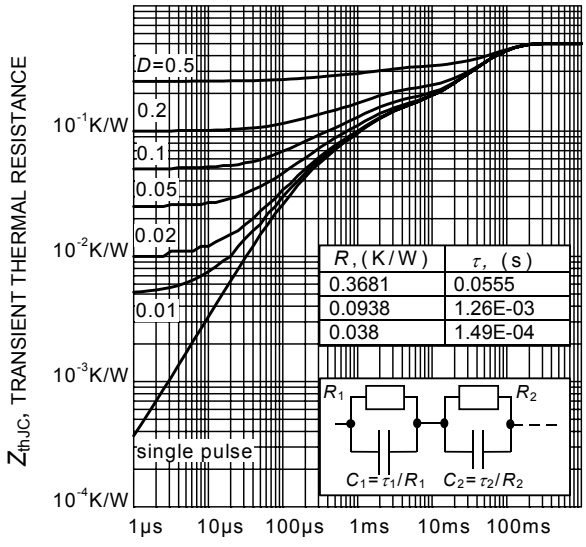


Figure 16. IGBT transient thermal resistance
($D = t_p / T$)

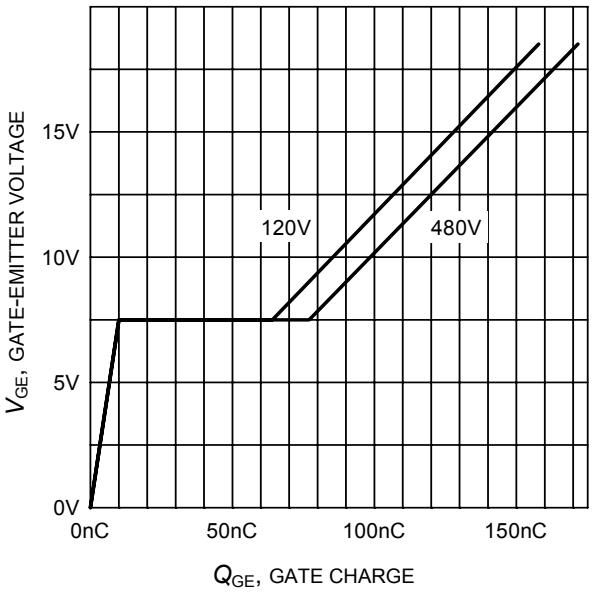


Figure 17. Typical gate charge
(I_C=30 A)

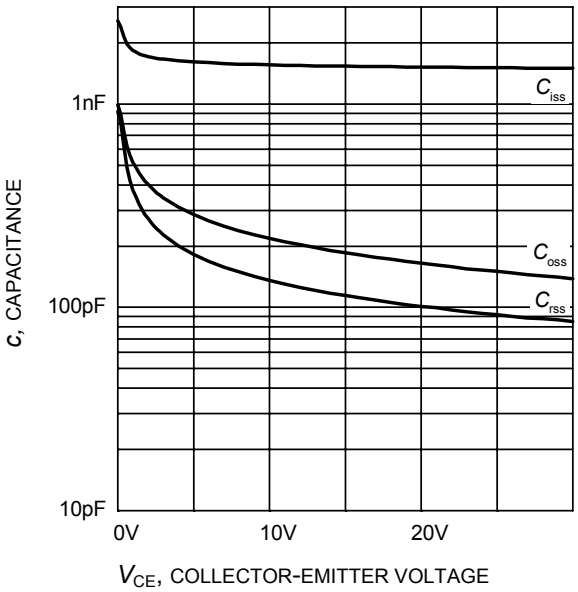


Figure 18. Typical capacitance as a function of collector-emitter voltage
(V_{GE}=0V, *f* = 1 MHz)

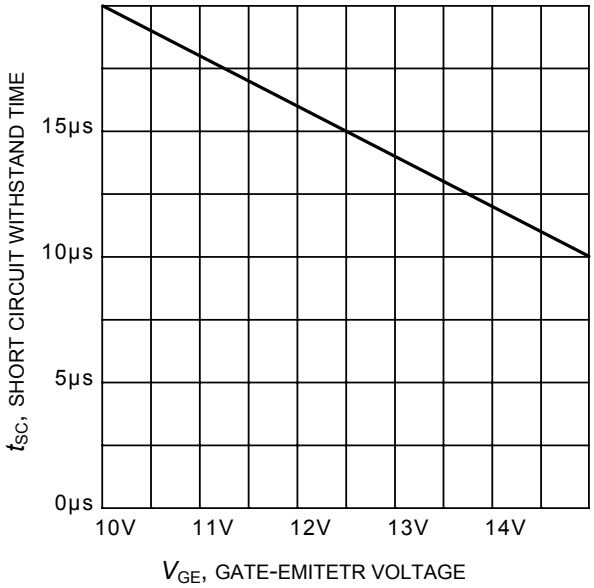


Figure 19. Short circuit withstand time as a function of gate-emitter voltage
(V_{CE}=600V, start at T_J=25°C)

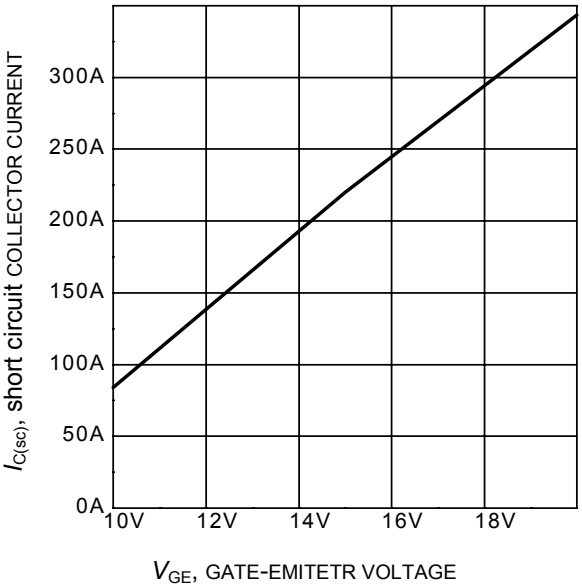
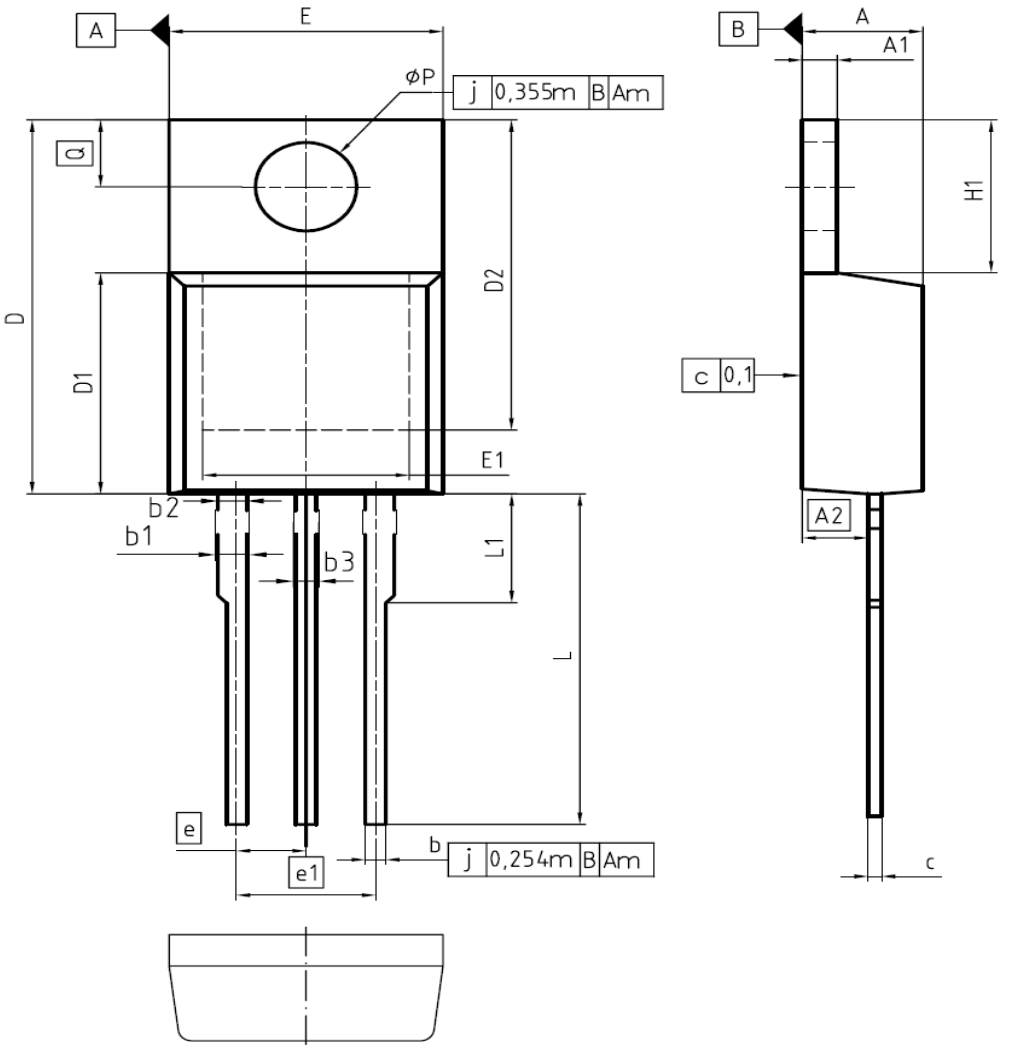


Figure 20. Typical short circuit collector current as a function of gate-emitter voltage
($V_{CE} \le 600V$, $T_j \le 150°C$)

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

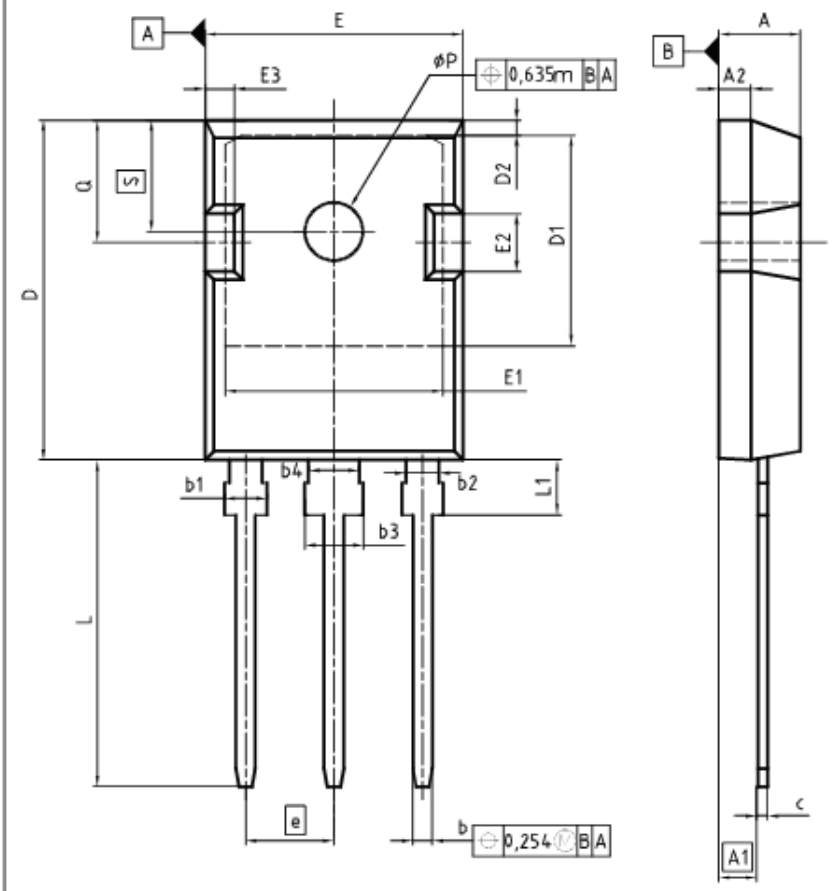
SCALE 0 2.5 0 2.5 5mm

EUROPEAN PROJECTION

ISSUE DATE
23-08-2007

REVISION
05

TO247-3



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.27	2.54	0.089	0.100
A2	1.85	2.16	0.073	0.085
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	0.640	0.695
D2	0.95	1.35	0.037	0.053
E	15.70	16.13	0.618	0.635
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.00	2.60	0.039	0.102
e	5.44		0.214	
N	3		3	
L	19.80	20.32	0.780	0.800
L1	4.10	4.47	0.161	0.176
øP	3.50	3.70	0.138	0.146
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

DOCUMENT NO.
Z8B00003327

SCALE 0 5 5 7.5mm

EUROPEAN PROJECTION

ISSUE DATE
01-10-2009

REVISION
04

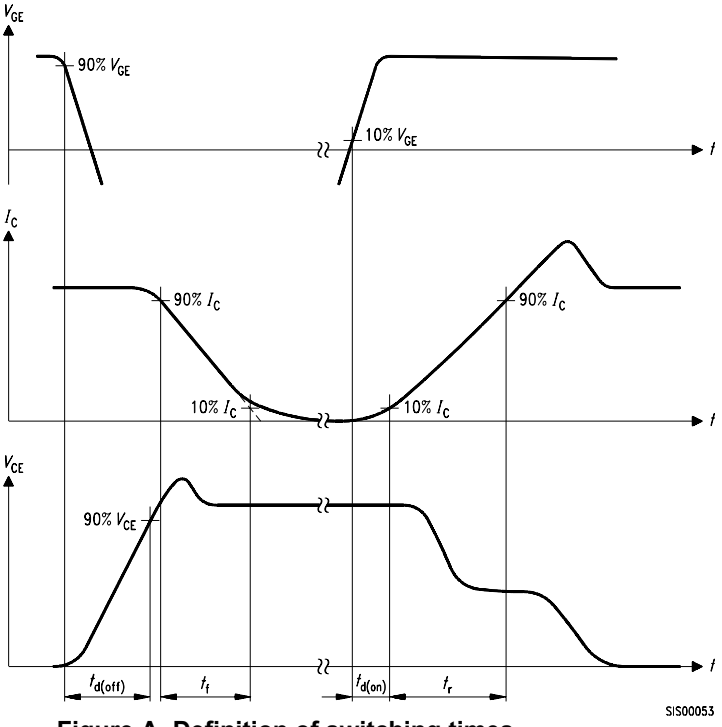


Figure A. Definition of switching times

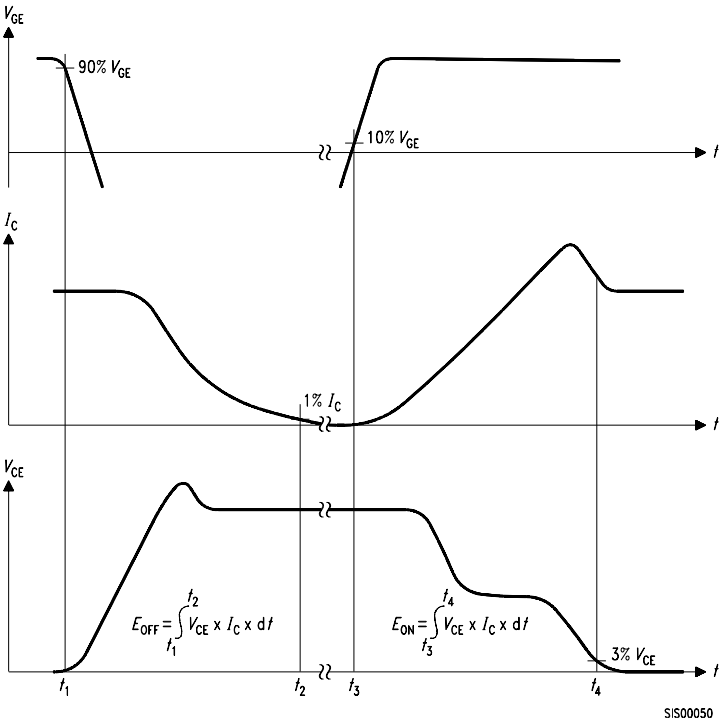


Figure B. Definition of switching losses

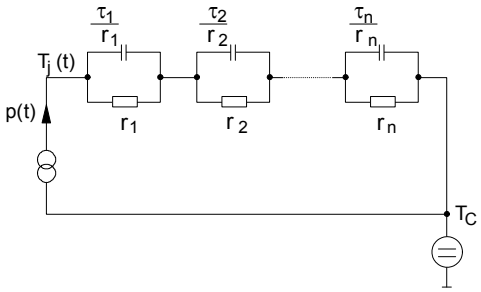


Figure D. Thermal equivalent circuit

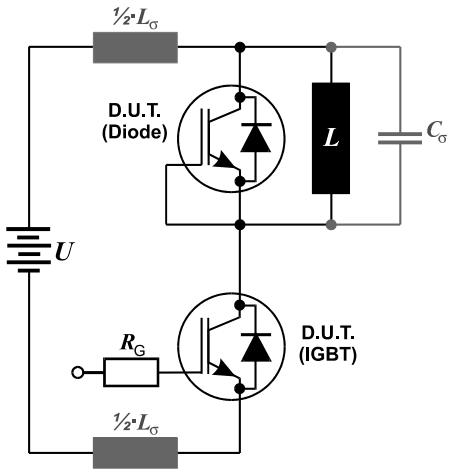


Figure E. Dynamic test circuit
Leakage inductance L_σ =60nH
and Stray capacity C_σ =40pF.

Published by
Infineon Technologies AG
81726 Munich, Germany

Legal Disclaimer

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics. 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 the 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 the nearest Infineon Technologies Office. Infineon Technologies components may be used in life-support devices or systems only 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.