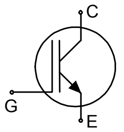
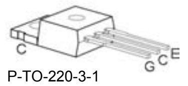
TrenchStop Series

IGP30N60T
IGW30N60T

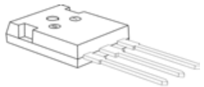
Low Loss IGBT in Trench and Fieldstop technology

- Very low $V_{CE(sat)}$ 1.5 V (typ.)
- Maximum Junction Temperature 175 °C
- Short circuit withstand time – 5µs
- Designed for :
  - Frequency Converters
  - Uninterruptible Power Supply
- Trench and Fieldstop technology for 600 V applications offers :
  - very tight parameter distribution
  - high ruggedness, temperature stable behavior
  - very high switching speed
  - low $V_{CE(sat)}$
- Positive temperature coefficient in $V_{CE(sat)}$
- Low EMI
- Low Gate Charge
- Complete product spectrum and PSpice Models : http://www.infineon.com/igbt/





P-TO-220-3-1
(TO-220AB)



P-TO-247-3-1
(TO-220AC)

Type	V_{CE}	I_C	$V_{CE(sat),Tj=25°C}$	$T_{j,max}$	Marking Code	Package	Ordering Code
IGP30N60T	600V	30A	1.5V	175°C	G30T60	TO-220	Q67040S4722
IGW30N60T	600V	30A	1.5V	175°C	G30T60	TO-247	Q67040S4724

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	600	V
DC collector current, limited by T_{jmax}	I_C		A
T_C = 25°C		60	
T_C = 100°C		30	
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	90	
Turn off safe operating area ($V_{CE} \leq$ 600V, $T_j \leq$ 175°C)	-	90	
Gate-emitter voltage	V_{GE}	±20	V
Short circuit withstand time[1] V_{GE} = 15V, $V_{CC} \leq$ 400V, $T_j \leq$ 150°C	t_{SC}	5	µs
Power dissipation T_C = 25°C	P_{tot}	187	W
Operating junction temperature	T_j	-40...+175	°C
Storage temperature	T_{stg}	-55...+175	
Soldering temperature, 1.6mm (0.063 in.) from case for 10s	-	260	

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[1] 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}		0.80	K/W
Thermal resistance, junction – ambient	R_{thJA}	P-TO-220-3-1 P-TO-247-3-1	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=0.2mA	600	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE} = 15V, I_C=30A				
		T_j=25°C	-	1.5	2.05	
		T_j=175°C	-	1.9	-	
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=0.43mA, V_{CE}=V_{GE}	4.1	4.9	5.7	
Zero gate voltage collector current	I_{CES}	V_{CE}=600V, V_{GE}=0V				µA
		T_j=25°C	-	-	40	
		T_j=175°C	-	-	1000	
Gate-emitter leakage current	I_{GES}	V_{CE}=0V,V_{GE}=20V	-	-	100	nA
Transconductance	g_{fs}	V_{CE}=20V, I_C=30A	-	16.7	-	S
Integrated gate resistor	R_{Gint}			-		Ω

Dynamic Characteristic

Input capacitance	C_{iss}	V_{CE}=25V, V_{GE}=0V, f=1MHz	-	1630	-	pF
Output capacitance	C_{oss}		-	108	-	
Reverse transfer capacitance	C_{rss}		-	50	-	
Gate charge	Q_{Gate}	V_{CC}=480V, I_C=30A V_{GE}=15V	-	167	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E	TO-247-3-1	-	7	-	nH
Short circuit collector current[1]	$I_{C(SC)}$	V_{GE}=15V,t_{SC}≤5µs V_{CC} = 400V, T_j = 150°C	-	275	-	A

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[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=10.6 Ω, L_σ[1]=136nH, C_σ[1]=39pF Energy losses include "tail" and diode reverse recovery. [2]	-	23	-	ns
Rise time	t_r		-	21	-	
Turn-off delay time	$t_{d(off)}$		-	254	-	
Fall time	t_f		-	46	-	
Turn-on energy	E_{on}		-	0.69	-	mJ
Turn-off energy	E_{off}		-	0.77	-	
Total switching energy	E_{ts}		-	1.46	-	

Switching Characteristic, Inductive Load, at T_j=175 °C

Parameter	Symbol	Conditions	Value			Unit
			min.	Typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	T_j=175°C, V_{CC}=400V,I_C=30A, V_{GE}=0/15V, R_G= 10.6 Ω L_σ[1]=136nH, C_σ[1]=39pF Energy losses include "tail" and diode reverse recovery.[2]	-	24	-	ns
Rise time	t_r		-	26	-	
Turn-off delay time	$t_{d(off)}$		-	292	-	
Fall time	t_f		-	90	-	
Turn-on energy	E_{on}		-	1.0	-	mJ
Turn-off energy	E_{off}		-	1.1	-	
Total switching energy	E_{ts}		-	2.1	-	

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

[2] Includes Reverse Recovery Losses from IKW30N60T due to dynamic test circuit in Figure E.

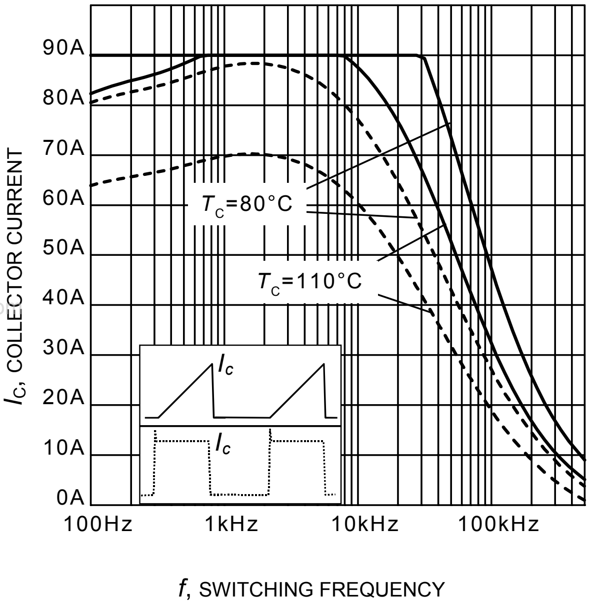


Figure 1. **Collector current as a function of switching frequency**
($T_j \leq 175°C$, $D = 0.5$, $V_{CE} = 400V$, $V_{GE} = 0/+15V$, $R_G = 10\Omega$)

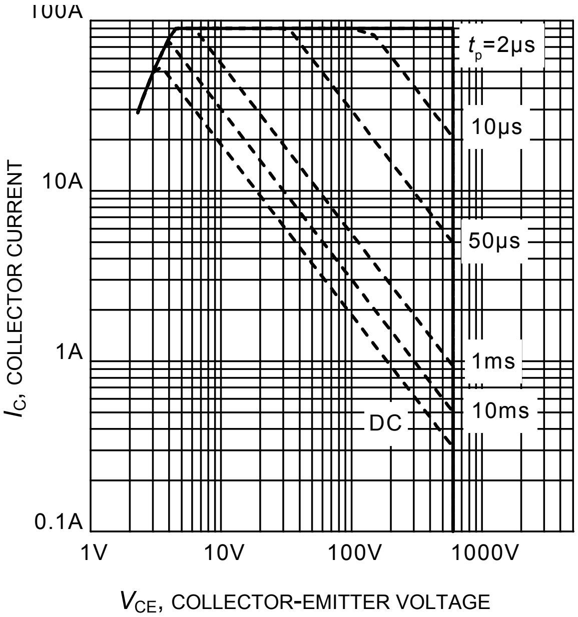


Figure 2. **Safe operating area**
($D = 0$, $T_C = 25°C$, $T_j \leq 175°C$; V_{GE}=15V)

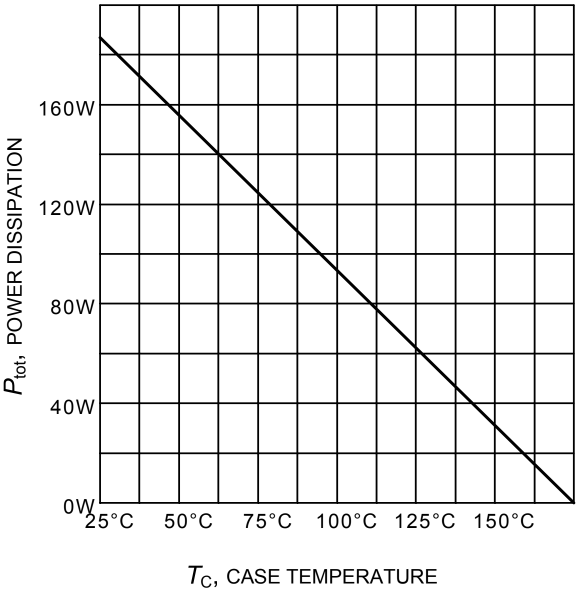


Figure 3. **Power dissipation as a function of case temperature**
($T_j \leq 175°C$)

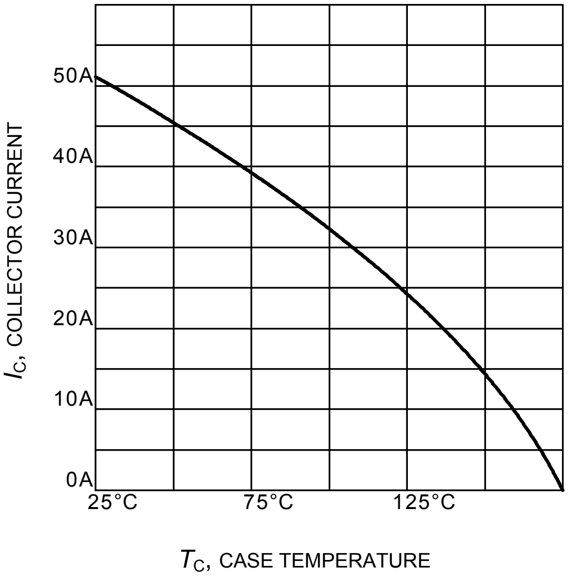


Figure 4. **Collector current as a function of case temperature**
($V_{GE} \geq 15V$, $T_j \leq 175°C$)

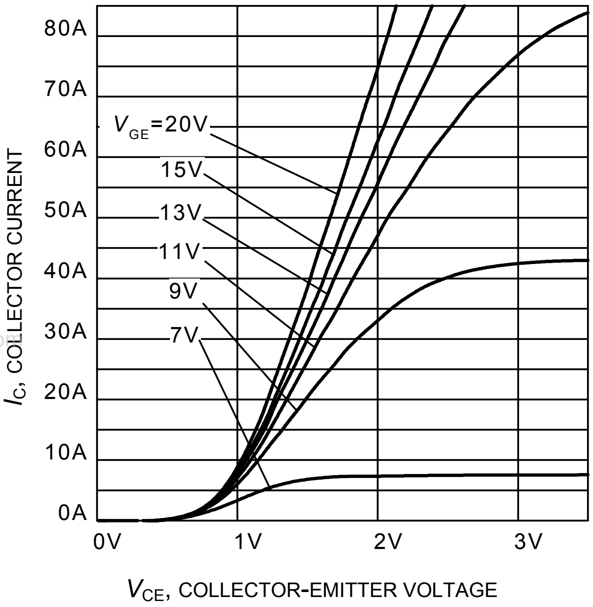


Figure 5. Typical output characteristic
(T_j = 25°C)

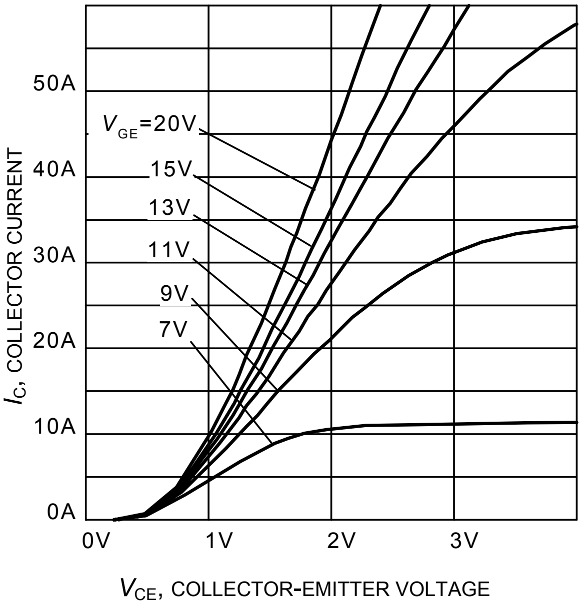


Figure 6. Typical output characteristic
(T_j = 175°C)

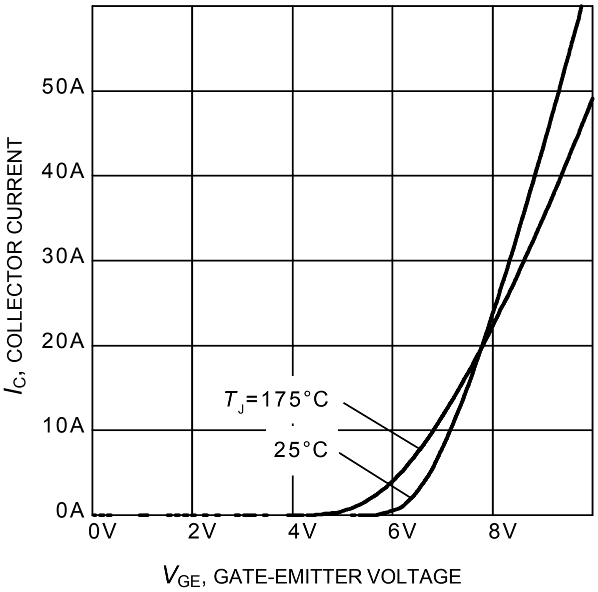


Figure 7. Typical transfer characteristic
(V_{CE}=20V)

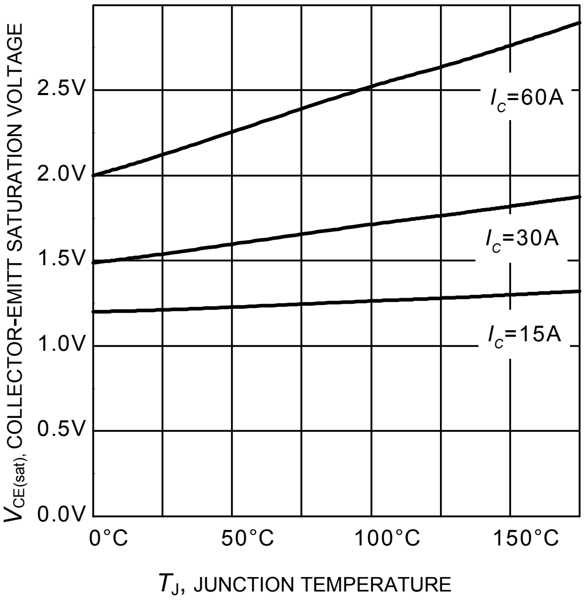


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE} = 15V)

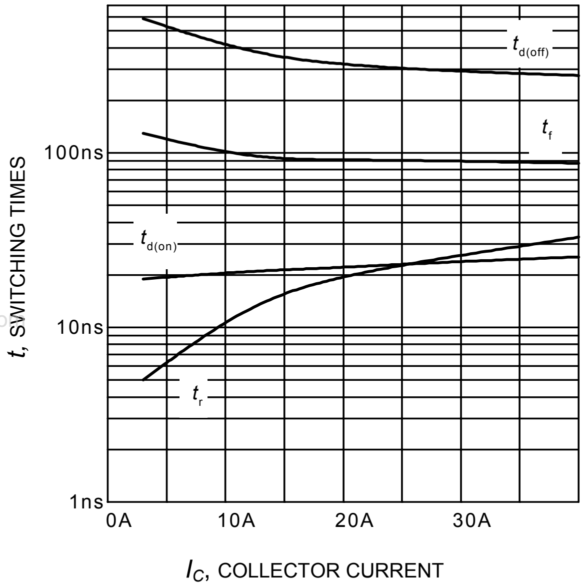


Figure 9. Typical switching times as a function of collector current
(inductive load, T_J=175°C, V_{CE} = 400V, V_{GE} = 0/15V, R_G = 10Ω, Dynamic test circuit in Figure E)

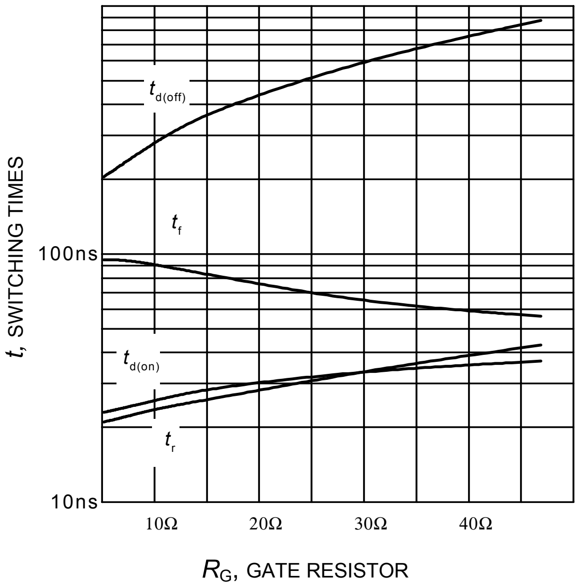


Figure 10. Typical switching times as a function of gate resistor
(inductive load, T_J = 175°C, V_{CE}= 400V, V_{GE} = 0/15V, I_C = 30A, Dynamic test circuit in Figure E)

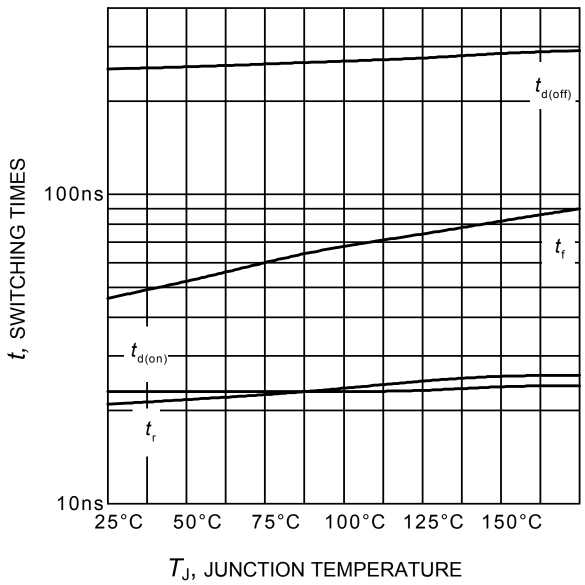


Figure 11. Typical switching times as a function of junction temperature
(inductive load, V_{CE} = 400V, V_{GE} = 0/15V, I_C = 30A, R_G=10Ω, Dynamic test circuit in Figure E)

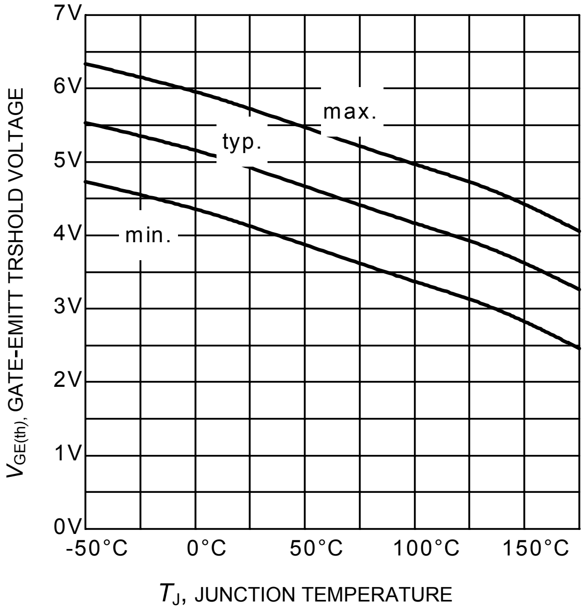


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
(I_C = 0.43mA)

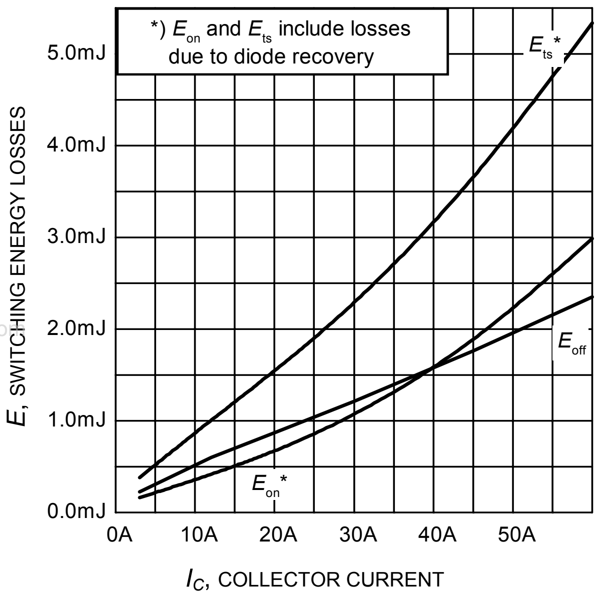


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, T_J = 175°C, V_{CE} = 400V, V_{GE} = 0/15V, R_G = 10Ω, Dynamic test circuit in Figure E)

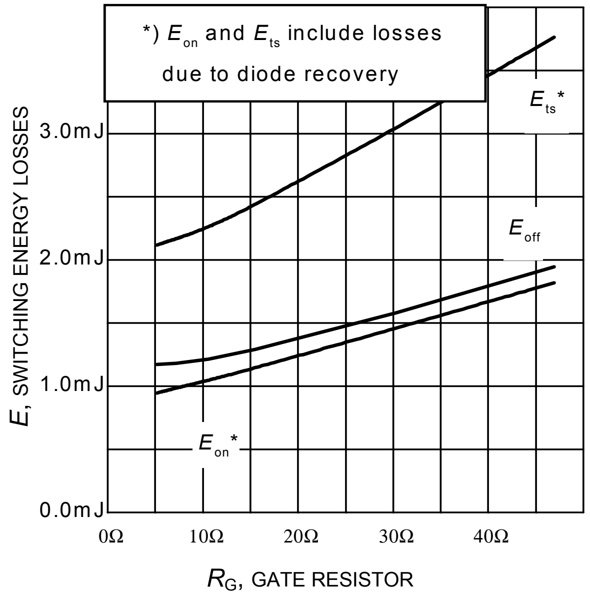


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, T_J = 175°C, V_{CE} = 400V, V_{GE} = 0/15V, I_C = 30A, Dynamic test circuit in Figure E)

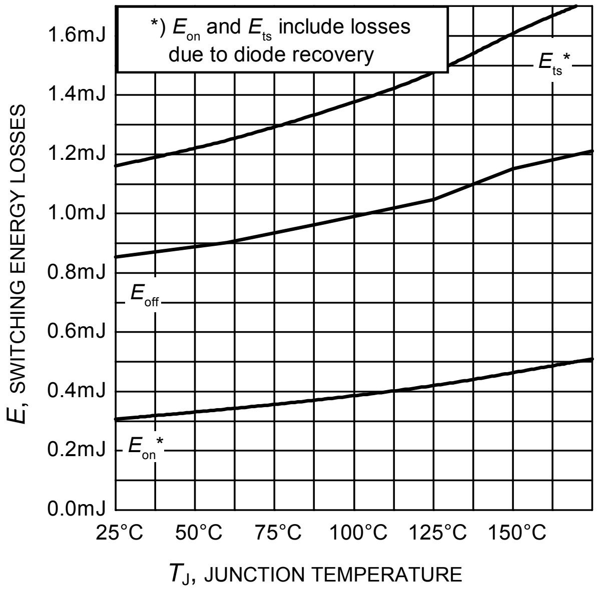


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE} = 400V, V_{GE} = 0/15V, I_C = 30A, R_G = 10Ω, Dynamic test circuit in Figure E)

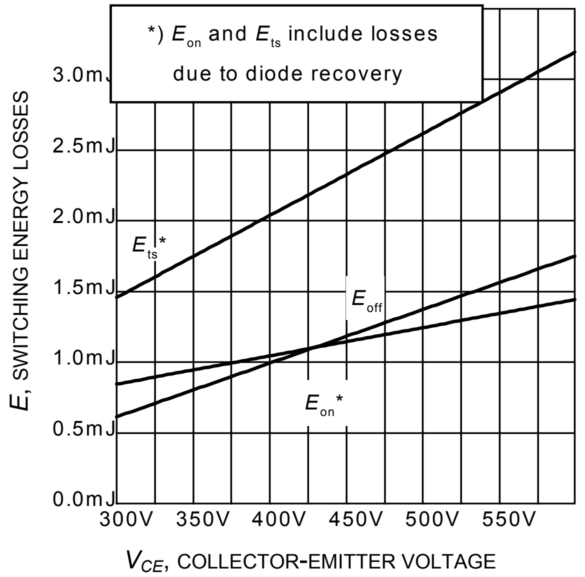


Figure 16. Typical switching energy losses as a function of collector emitter voltage
(inductive load, T_J = 175°C, V_{GE} = 0/15V, I_C = 30A, R_G = 10Ω, Dynamic test circuit in Figure E)

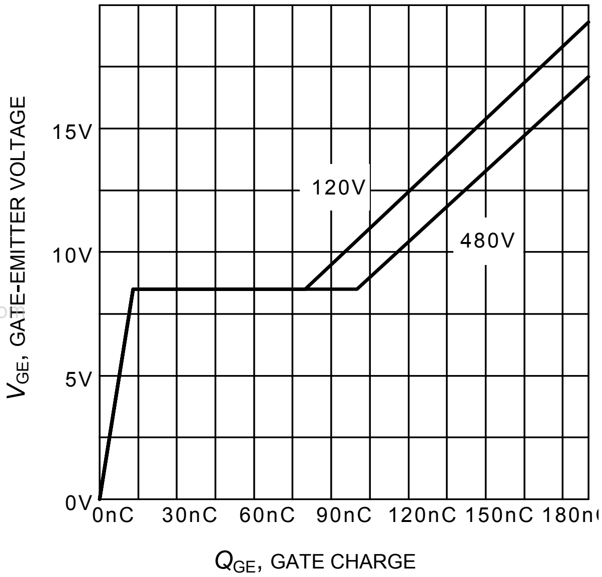


Figure 17. Typical gate charge
(I_C=30 A)

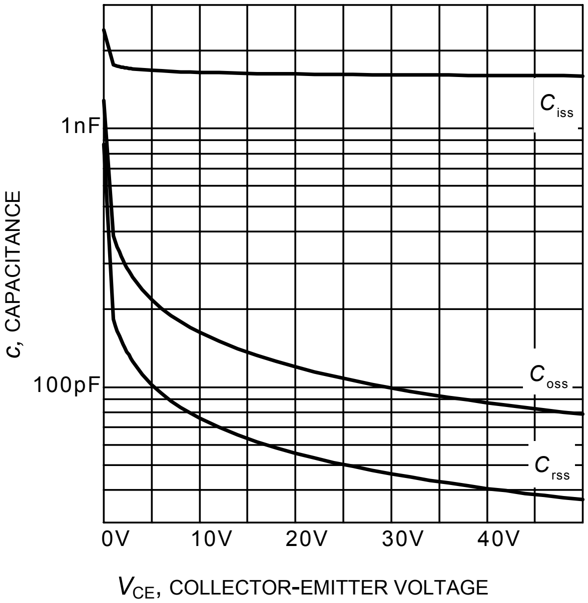


Figure 18. Typical capacitance as a function of collector-emitter voltage
(V_{GE}=0V, f = 1 MHz)

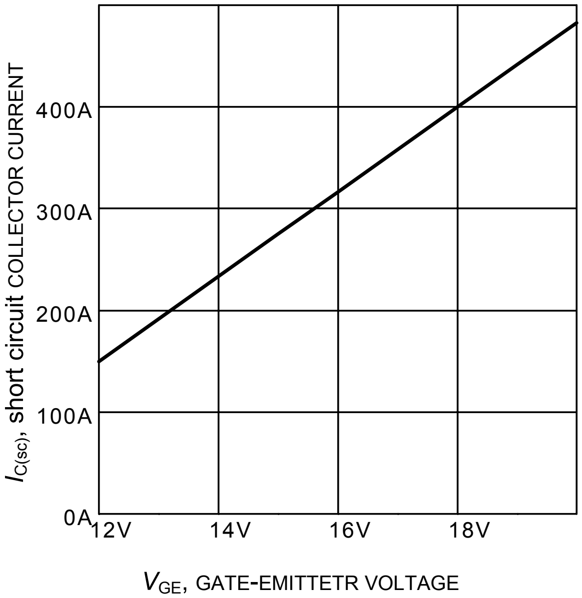


Figure 19. Typical short circuit collector current as a function of gate-emitter voltage
($V_{CE} \leq 400$V, $T_j \leq 150$°C)

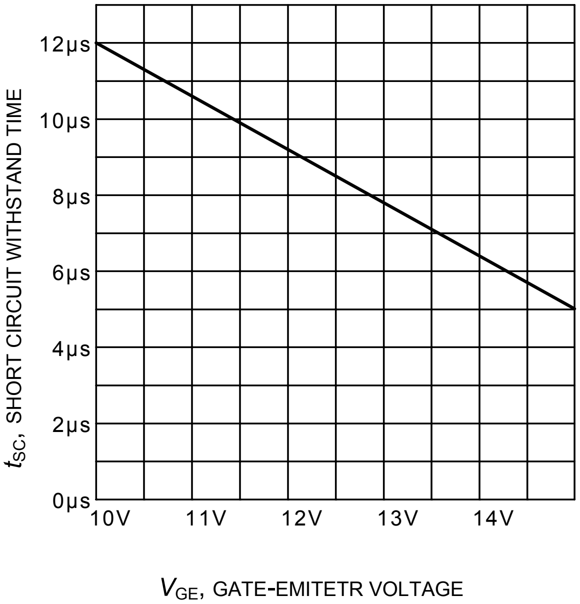
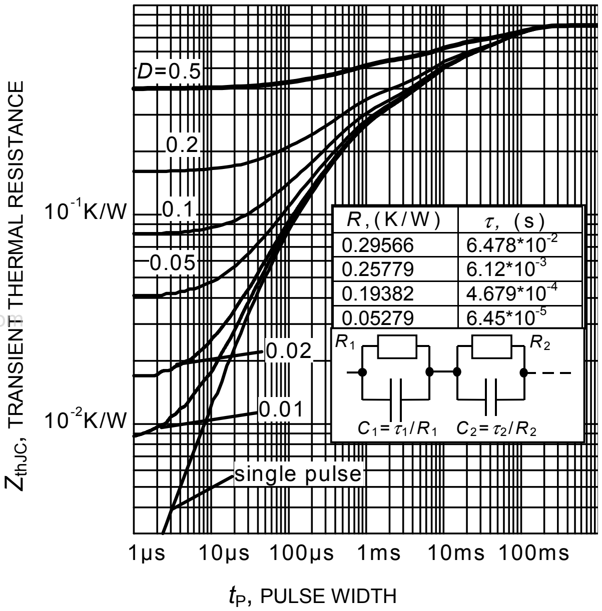


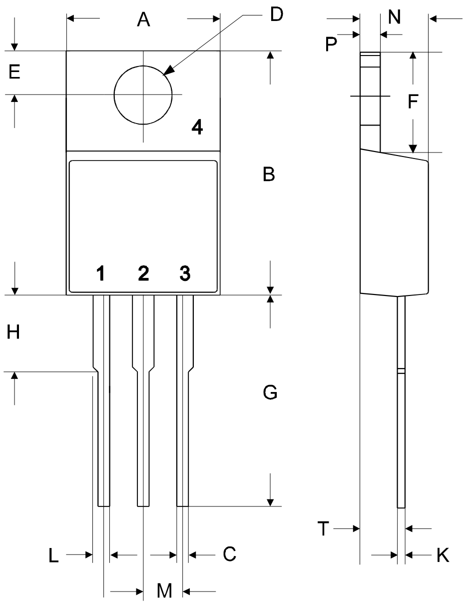
Figure 20. Short circuit withstand time as a function of gate-emitter voltage
(V_{CE}=600V, start at T_J=25°C, T_{Jmax}<150°C)



R,(K/W)	τ, (s)
0.29566	$6.478*10^{-2}$
0.25779	$6.12*10^{-3}$
0.19382	$4.679*10^{-4}$
0.05279	$6.45*10^{-5}$

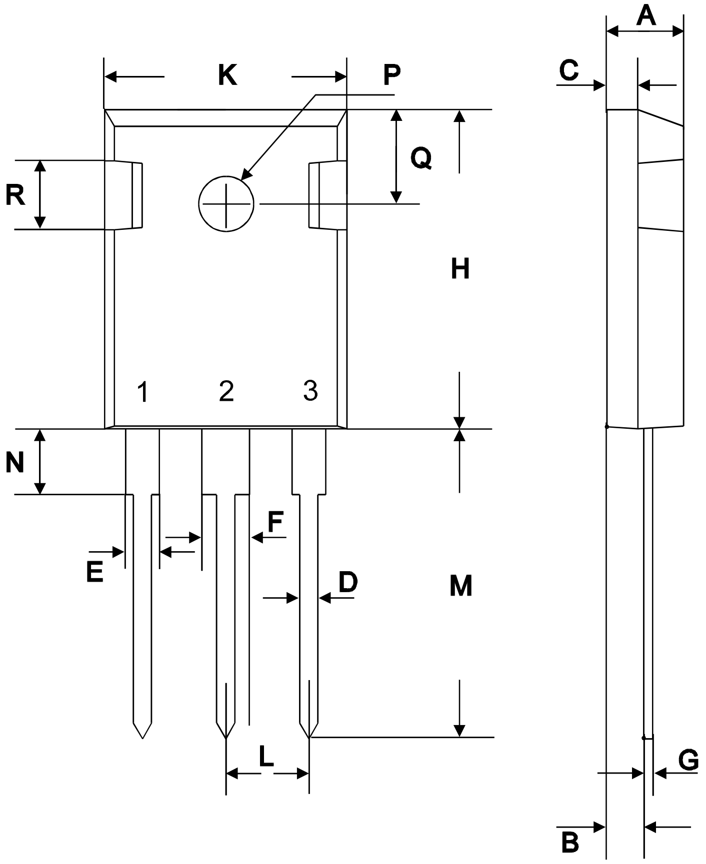
Figure 21. IGBT transient thermal resistance
($D = t_p / T$)

TO-220AB



symbol	Dimensions			
	[mm]		[inch]	
	min	max	min	max
A	9.70	10.30	0.3819	0.4055
B	14.88	15.95	0.5858	0.6280
C	0.65	0.86	0.0256	0.0339
D	3.55	3.7	0.1398	0.1457
E	2.60	3.00	0.1024	0.1181
F	6.00	6.80	0.2362	0.2677
G	13.00	14.00	0.5118	0.5512
H	4.35	4.75	0.1713	0.1870
K	0.38	0.65	0.0150	0.0256
L	0.95	1.32	0.0374	0.0520
M	2.54 typ.		0.1 typ.	
N	4.30	4.50	0.1693	0.1772
P	1.17	1.40	0.0461	0.0551
T	2.30	2.72	0.0906	0.1071

TO-247AC



symbol	dimensions			
	[mm]		[inch]	
	min	max	min	max
A	4.78	5.28	0.1882	0.2079
B	2.29	2.51	0.0902	0.0988
C	1.78	2.29	0.0701	0.0902
D	1.09	1.32	0.0429	0.0520
E	1.73	2.06	0.0681	0.0811
F	2.67	3.18	0.1051	0.1252
G	0.76 max		0.0299 max	
H	20.80	21.16	0.8189	0.8331
K	15.65	16.15	0.6161	0.6358
L	5.21	5.72	0.2051	0.2252
M	19.81	20.68	0.7799	0.8142
N	3.560	4.930	0.1402	0.1941
∅P	3.61		0.1421	
Q	6.12	6.22	0.2409	0.2449

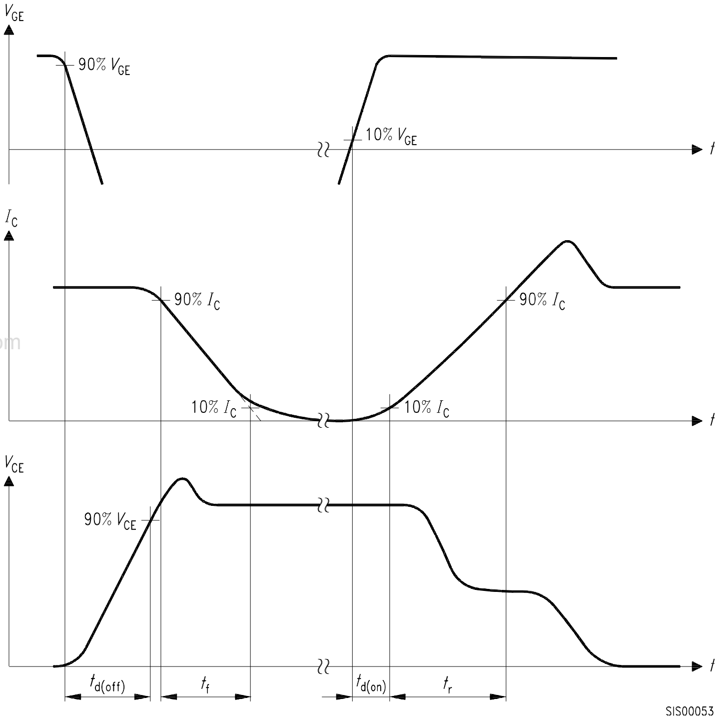


Figure A. Definition of switching times

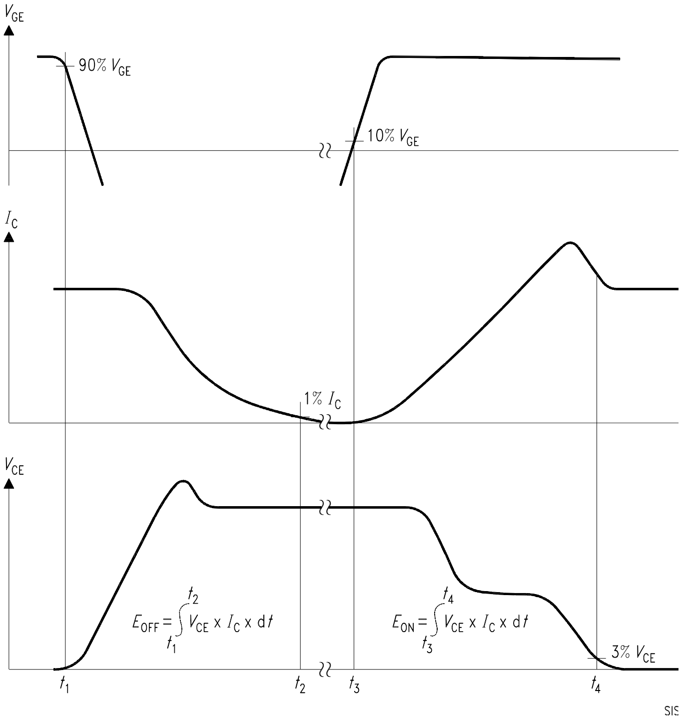


Figure B. Definition of switching losses

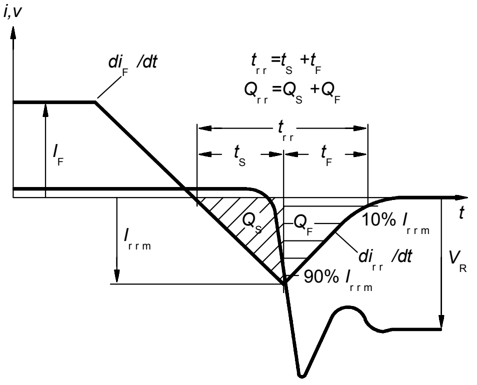


Figure C. Definition of diodes switching characteristics

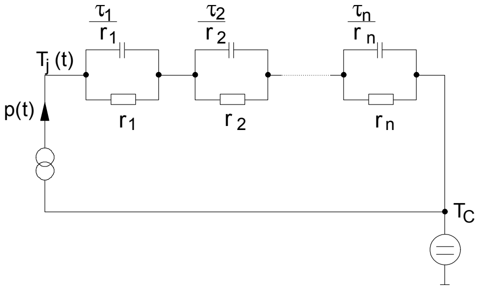


Figure D. Thermal equivalent circuit

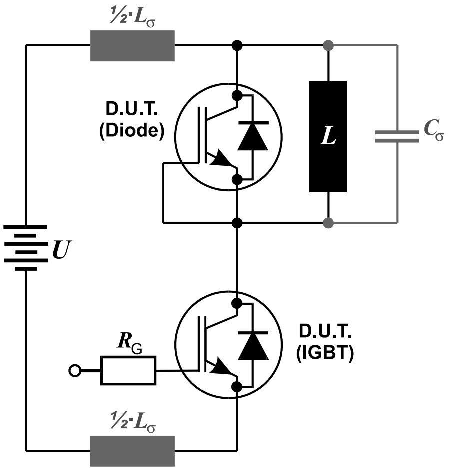


Figure E. Dynamic test circuit

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