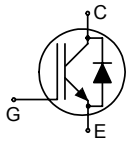
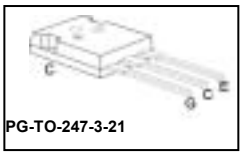
Soft Switching Series

Reverse Conducting IGBT with monolithic body diode

Features:

- Powerful monolithic Body Diode with very low forward voltage
- Body diode clamps negative voltages
- Trench and Fieldstop technology for 1200 V applications offers :
  - very tight parameter distribution
  - high ruggedness, temperature stable behavior
- NPT technology offers easy parallel switching capability due to positive temperature coefficient in $V_{CE(sat)}$
- Low EMI
- Qualified according to JEDEC[1] for target applications
- Pb-free lead plating; RoHS compliant
- Complete product spectrum and PSpice Models : http://www.infineon.com/igbt/





Applications:

- Inductive Cooking
- Soft Switching Applications

Type	V_{CE}	I_C	$V_{CE(sat),Tj=25°C}$	$T_{j,max}$	Marking	Package
IHW20N120R	1200V	20A	1.55V	175°C	H20R120	PG-TO-247-3-21

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	1200	V
DC collector current T_C = 25°C T_C = 100°C	I_C	 40 20	A
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	60	
Turn off safe operating area ($V_{CE} \le 1200V$, $T_j \le 175°C$)	-	60	
Diode forward current T_C = 25°C T_C = 100°C	I_F	 20 13	
Diode pulsed current, t_p limited by T_{jmax}	I_{Fpuls}	30	
Diode surge non repetitive current, t_p limited by T_{jmax} T_C = 25°C, t_p = 10ms, sine halfwave T_C = 25°C, $t_p \le 2.5\mu s$, sine halfwave T_C = 100°C, $t_p \le 2.5\mu s$, sine halfwave	I_{FSM}	 50 130 120	
Gate-emitter voltage Transient Gate-emitter voltage (t_p < 5 ms)	V_{GE}	±20 ±25	V
Power dissipation T_C = 25°C	P_{tot}	357	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	

[1] J-STD-020 and JESD-022

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction – case	R_{thJC}		0.42	K/W
Diode thermal resistance, junction – case	R_{thJCD}		0.66	
Thermal resistance, junction – ambient	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	1200	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE} = 15V, I_C=20A				
		T_j=25°C	-	1.55	1.75	
		T_j=125°C	-	1.75	-	
		T_j=175°C	-	1.85	-	
Diode forward voltage	V_F	V_{GE}=0V, I_F=10A				
		T_j=25°C	-	1.2	1.4	
		T_j=125°C	-	1.2	-	
		T_j=175°C	-	1.2	-	
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=0.7mA, V_{CE}=V_{GE}	5.1	5.8	6.4	
Zero gate voltage collector current	I_{CES}	V_{CE}=1200V, V_{GE}=0V				µA
		T_j=25°C	-	-	5	
		T_j=175°C	-	-	2500	
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	100	nA
Transconductance	g_{fs}	V_{CE}=20V, I_C=20A	-	11.5	-	S
Integrated gate resistor	R_{Gint}			none		Ω

Dynamic Characteristic						
Input capacitance	C_{iss}	V_{CE}=25V,	-	1307	-	pF
Output capacitance	C_{oss}	V_{GE}=0V,	-	76	-	
Reverse transfer capacitance	C_{rss}	f=1MHz	-	14	-	
Gate charge	Q_{Gate}	V_{CC}=960V, I_C=20A V_{GE}=15V	-	113	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13	-	nH

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,	-	57	-	ns
Rise time	t_r	V_{CC}=600V, I_C=20A	-	25	-	
Turn-off delay time	$t_{d(off)}$	V_{GE}=0 /15V,	-	579	-	
Fall time	t_f	R_G=47Ω,	-	68	-	
Turn-on energy	E_{on}	L_σ[2)]=180nH,	-	-	-	mJ
Turn-off energy	E_{off}	C_σ[2)]=39pF	-	1.7	-	
Total switching energy	E_{ts}		-	1.7	-	

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	-	55	-	ns
Rise time	t_r	V_{CC}=600V, I_C=20A,	-	37	-	
Turn-off delay time	$t_{d(off)}$	V_{GE}= 0 /15V,	-	701	-	
Fall time	t_f	R_G= 47Ω,	-	132	-	
Turn-on energy	E_{on}	L_σ=180nH[2)],	-	-	-	mJ
Turn-off energy	E_{off}	C_σ=39pF[2)]	-	2.8	-	
Total switching energy	E_{ts}		-	2.8	-	

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

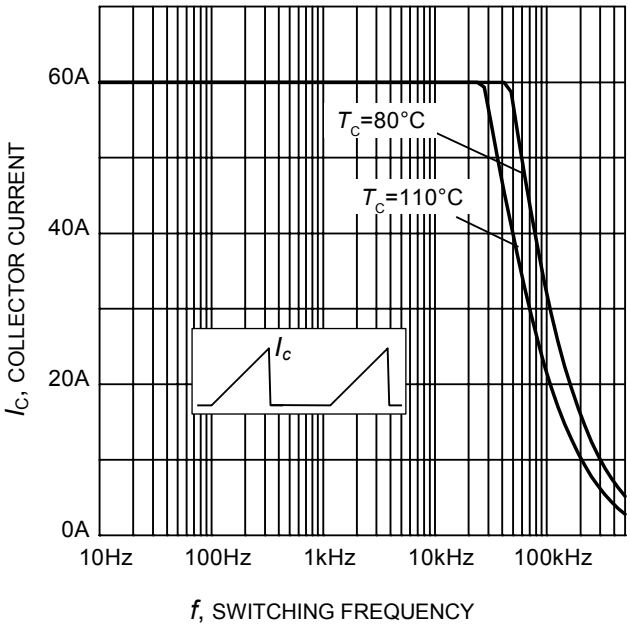


Figure 1. Collector current as a function of switching frequency for hard switching (turn-off)
($T_j \le 175°C$, $D = 0.5$, $V_{CE} = 600V$, $V_{GE} = 0/+14V$, $R_G = 47\Omega$)

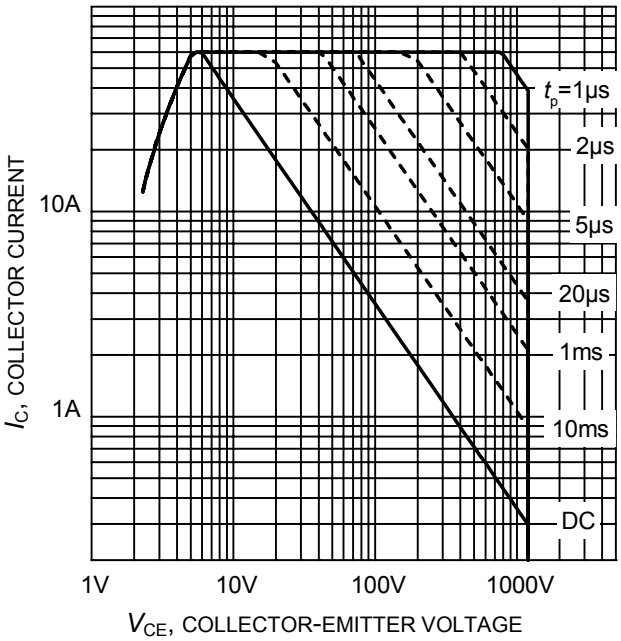


Figure 2. IGBT Safe operating area
($D = 0$, $T_C = 25°C$, $T_j \le 175°C$; $V_{GE}=14V$)

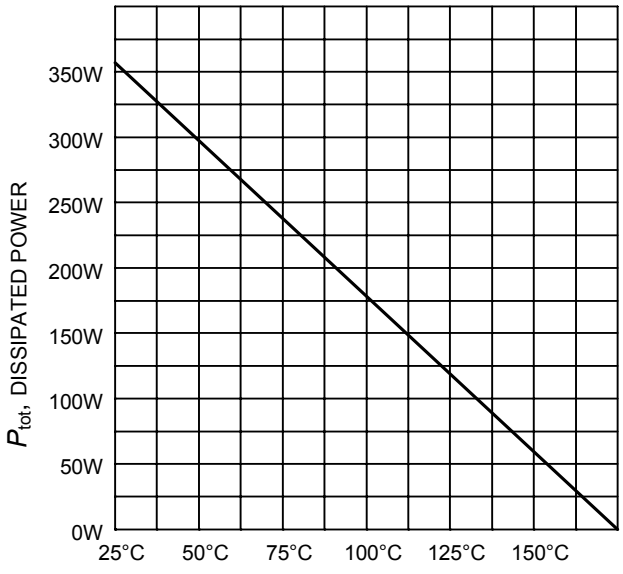


Figure 3. Power dissipation as a function of case temperature
($T_j \le 175°C$)

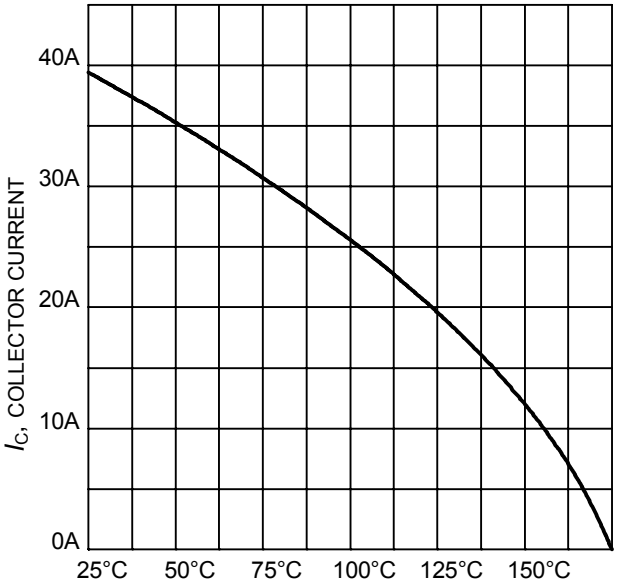


Figure 4. DC Collector current as a function of case temperature
($V_{GE} \ge 14V$, $T_j \le 175°C$)

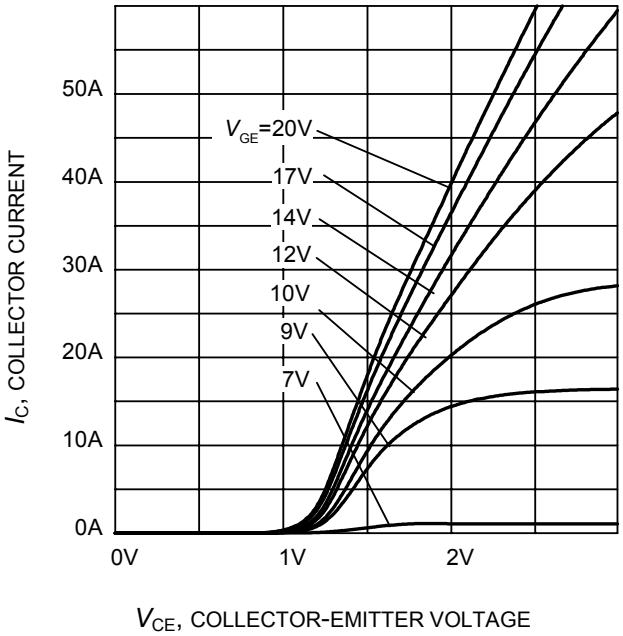


Figure 5. Typical output characteristic
(T_j = 25°C)

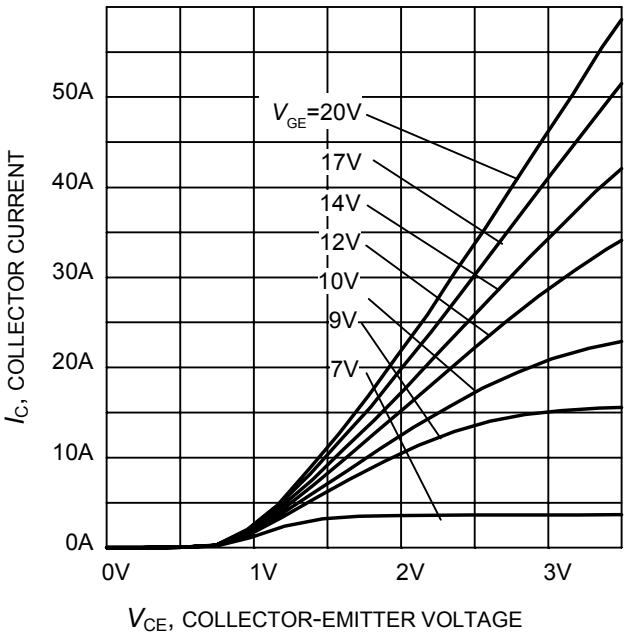


Figure 6. Typical output characteristic
(T_j = 175°C)

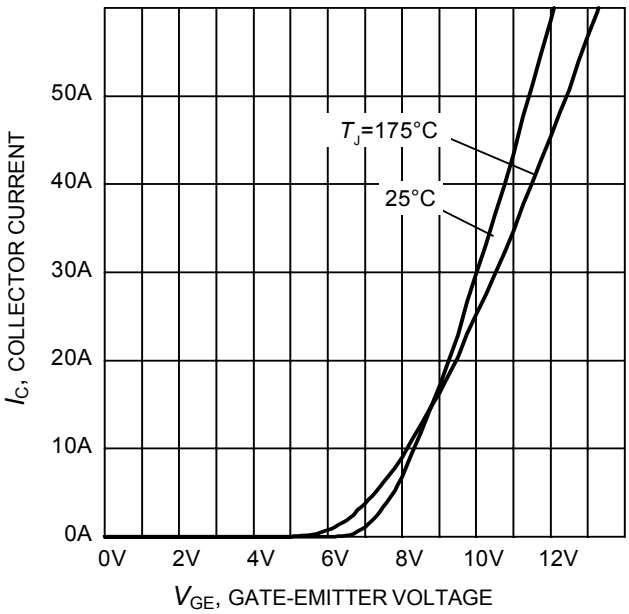


Figure 7. Typical transfer characteristic
(V_{CE}=20V)

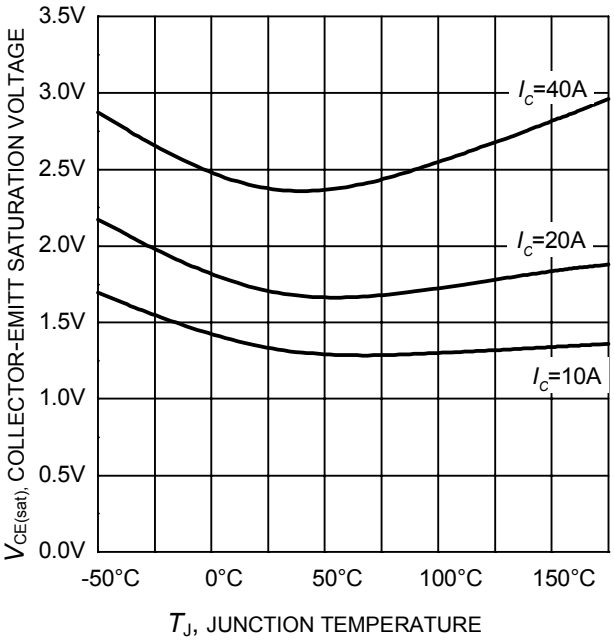


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE} =15V)

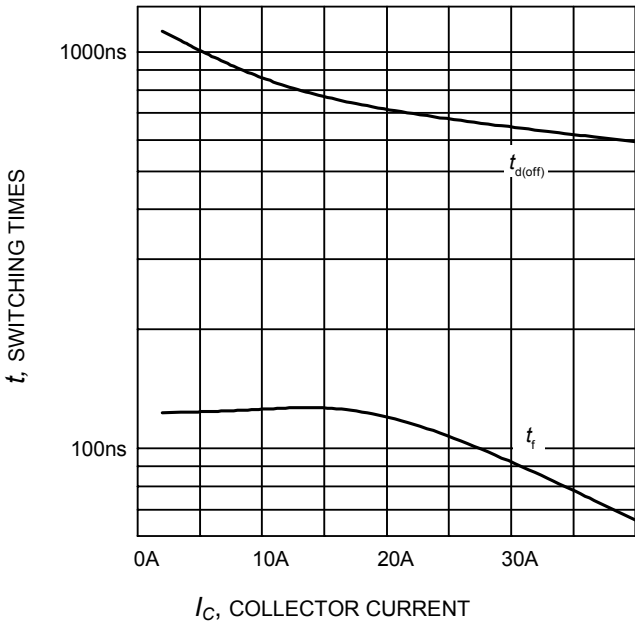


Figure 9. Typical switching times as a function of collector current
(inductive load, T_J=175°C, V_{CE}=600V, V_{GE}=0/15V, R_G=47Ω, Dynamic test circuit in Figure E)

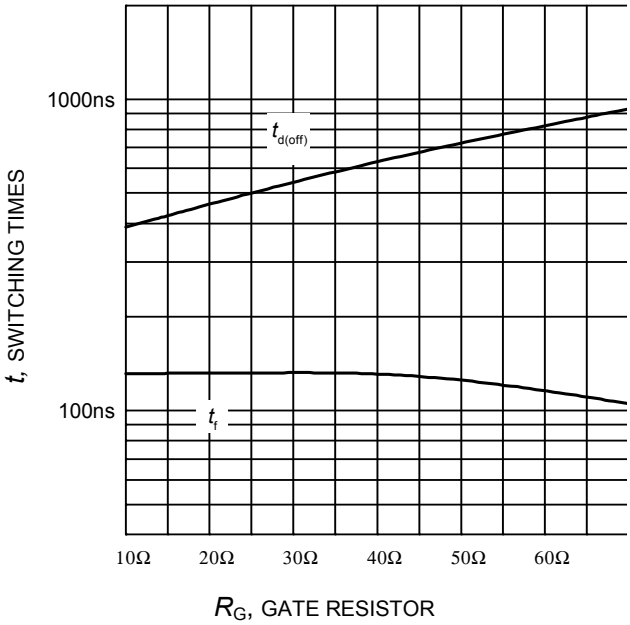


Figure 10. Typical switching times as a function of gate resistor
(inductive load, T_J=175°C, V_{CE}=600V, V_{GE}=0/15V, I_C=20A, Dynamic test circuit in Figure E)

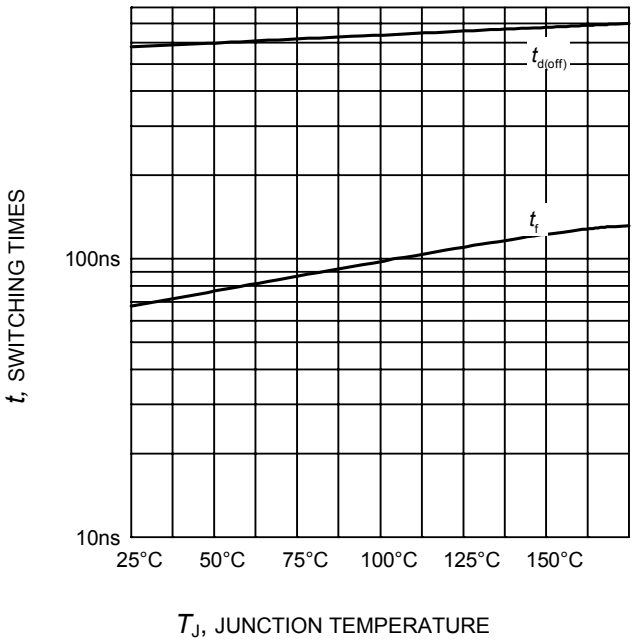


Figure 11. Typical switching times as a function of junction temperature
(inductive load, V_{CE}=600V, V_{GE}=0/15V, I_C=20A, R_G=47Ω, Dynamic test circuit in Figure E)

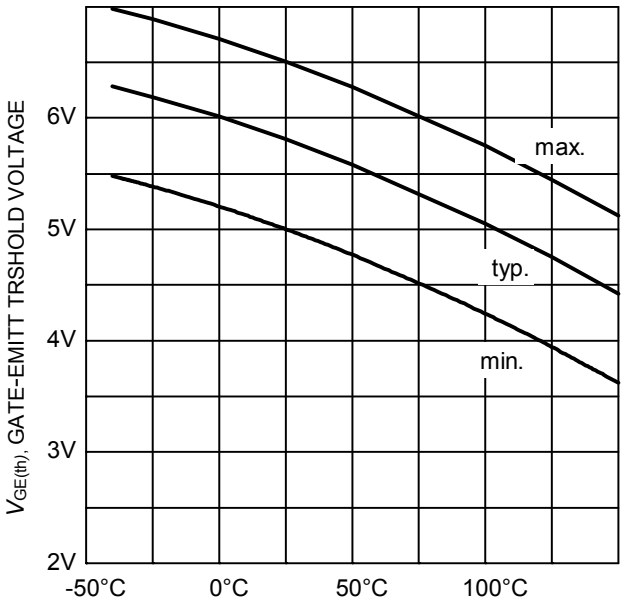


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
(I_C = 0.7mA)

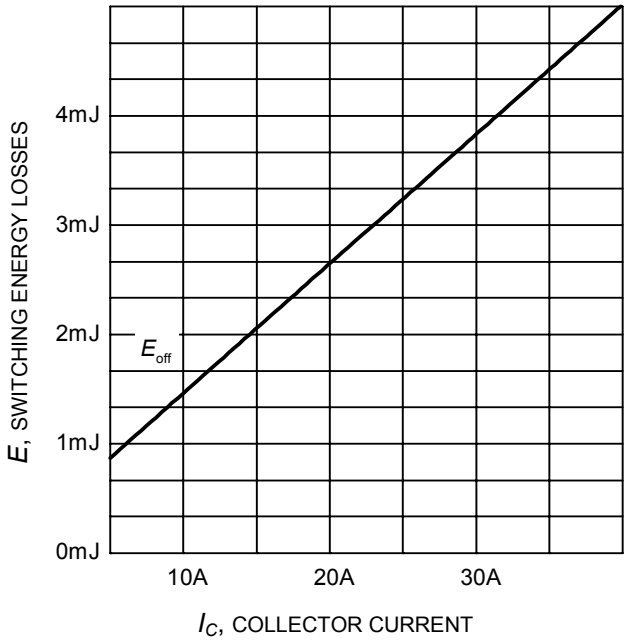


Figure 13. Typical turn-off energy as a function of collector current
(inductive load, T_J=175°C, V_{CE}=600V, V_{GE}=0/15V, R_G=29Ω, Dynamic test circuit in Figure E)

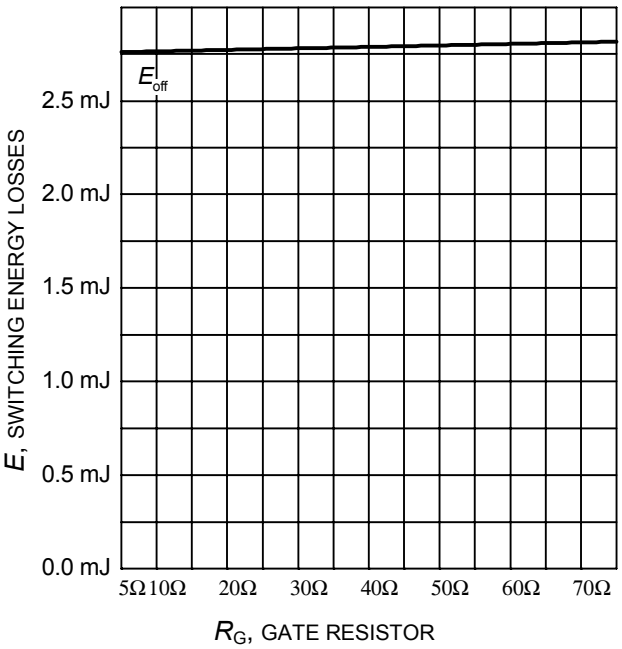


Figure 14. Typical turn-off energy as a function of gate resistor
(inductive load, T_J=175°C, V_{CE}=600V, V_{GE}=0/15V, I_C=20A, Dynamic test circuit in Figure E)

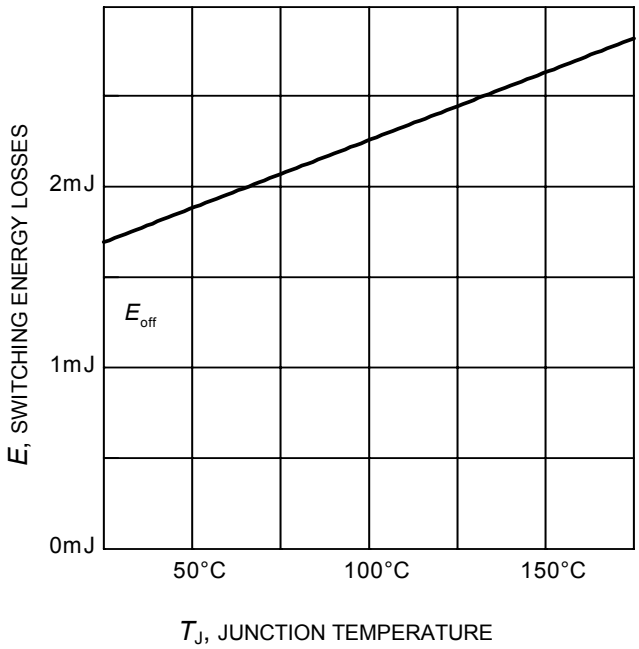


Figure 15. Typical turn-off energy as a function of junction temperature
(inductive load, V_{CE}=600V, V_{GE}=0/15V, I_C=20A, R_G=29Ω, Dynamic test circuit in Figure E)

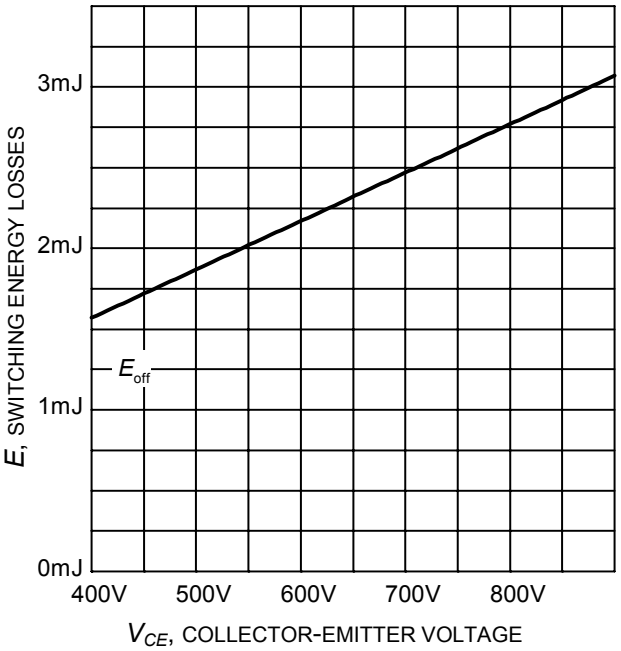


Figure 16. Typical turn-off energy as a function of collector emitter voltage
(inductive load, T_J=175°C, V_{GE}=0/15V, I_C=20A, R_G=29Ω, Dynamic test circuit in Figure E)

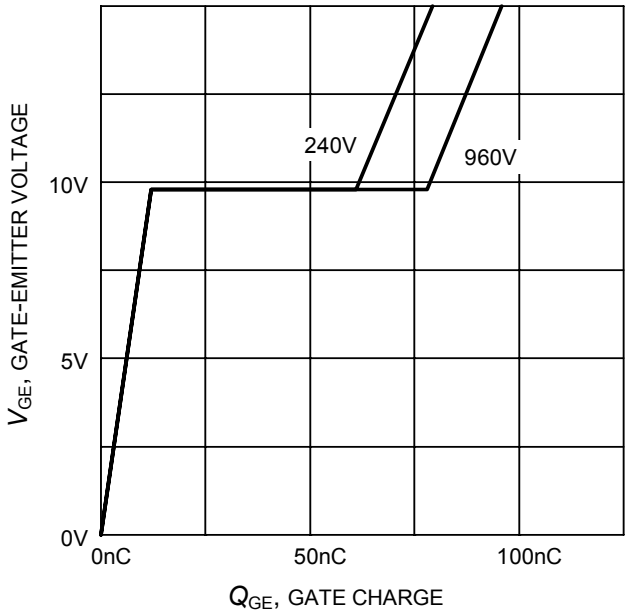


Figure 17. Typical gate charge
(I_C=20 A)

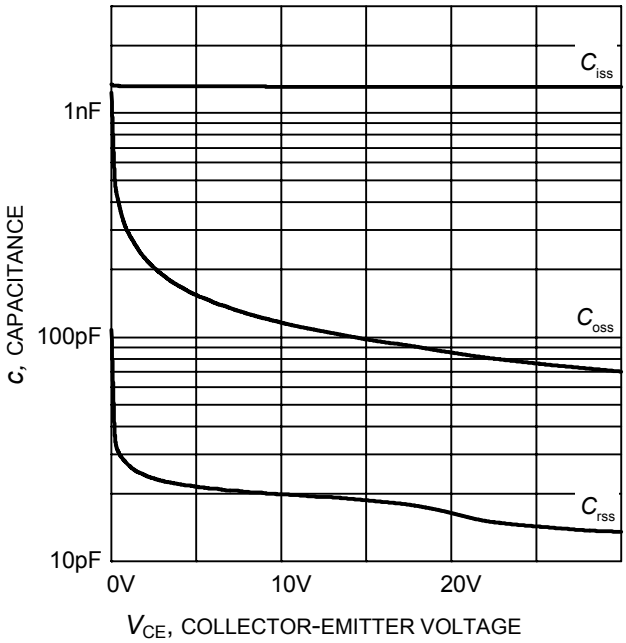


Figure 18. Typical capacitance as a function of collector-emitter voltage
(V_{GE}=0V, f = 1 MHz)

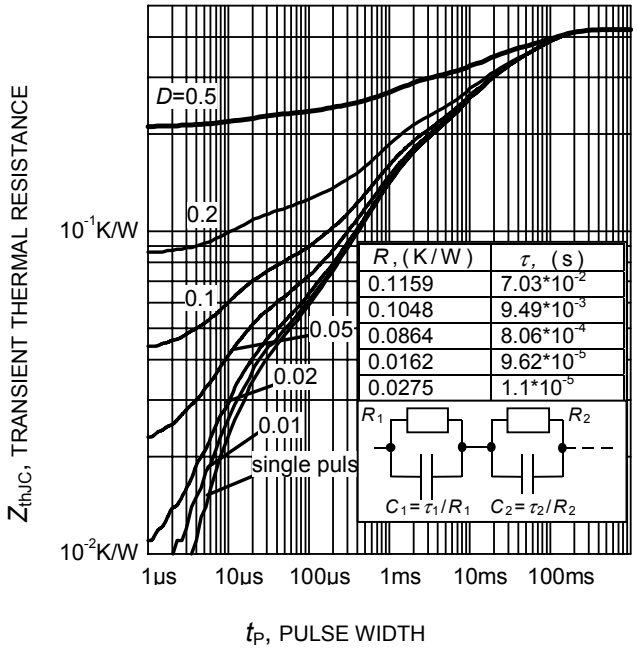


Figure 19. IGBT transient thermal resistance
($D = t_p / T$)

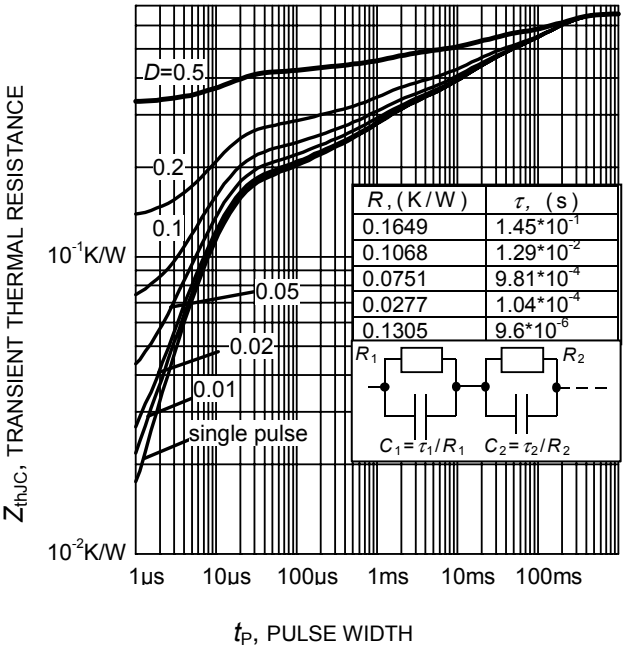


Figure 20. Typical Diode transient thermal impedance as a function of pulse width
(D=t_P/T)

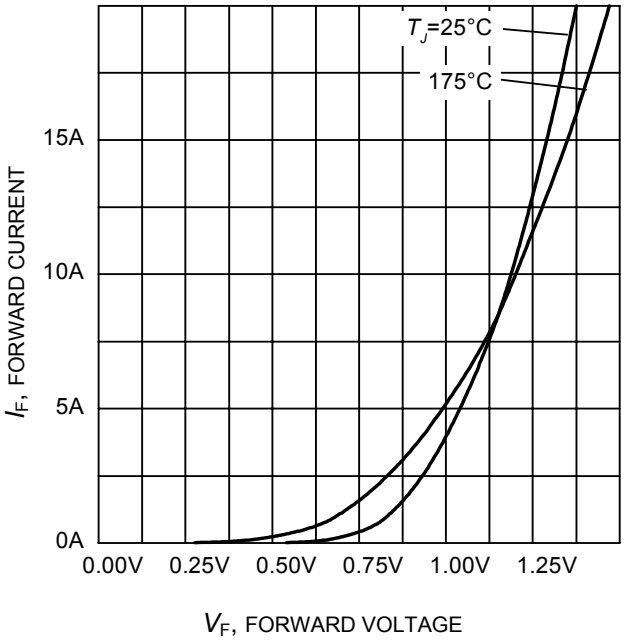


Figure 21. Typical diode forward current as a function of forward voltage

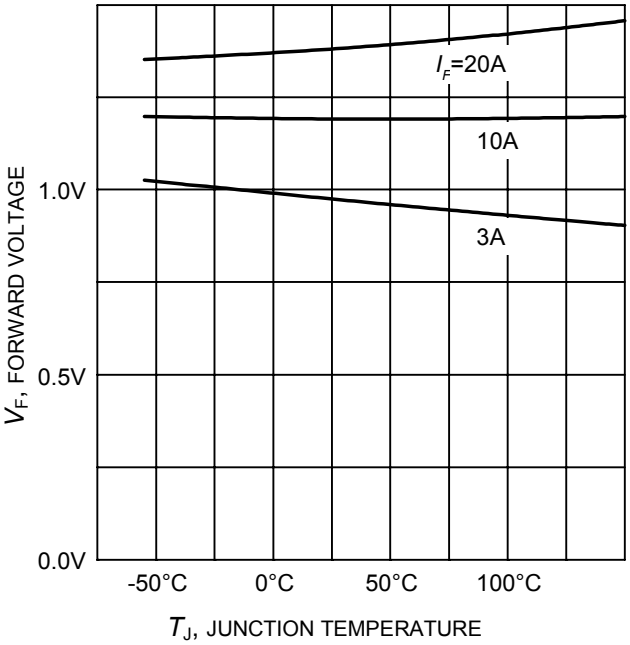


Figure 22. Typical diode forward voltage as a function of junction temperature

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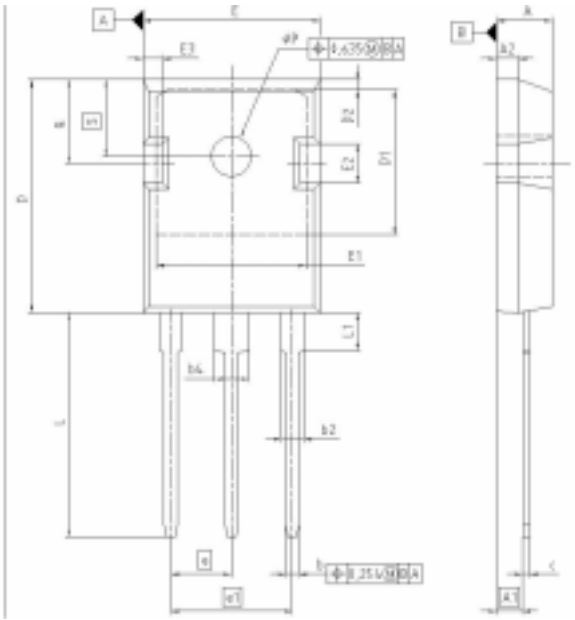

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.965	5.157	0.195	0.203
A1	2.273	2.527	0.089	0.099
A2	1.853	2.107	0.073	0.083
b	1.073	1.327	0.042	0.052
b2	1.903	2.386	0.075	0.094
b4	2.870	3.454	0.113	0.136
c	0.549	0.752	0.022	0.030
D	20.823	21.077	0.820	0.830
D1	17.323	17.831	0.682	0.702
D2	1.083	1.317	0.043	0.052
E	15.773	16.027	0.621	0.631
E1	13.893	14.147	0.547	0.557
E2	3.683	3.937	0.145	0.155
E3	1.663	1.937	0.065	0.076
e	5.450		0.215	
e1	10.900		0.430	
N	3		3	
L	20.053	20.307	0.789	0.799
L1	4.166	4.472	0.164	0.176
øP	3.558	3.661	0.140	0.144
Q	5.490	5.747	0.216	0.226
S	6.043	6.297	0.238	0.248

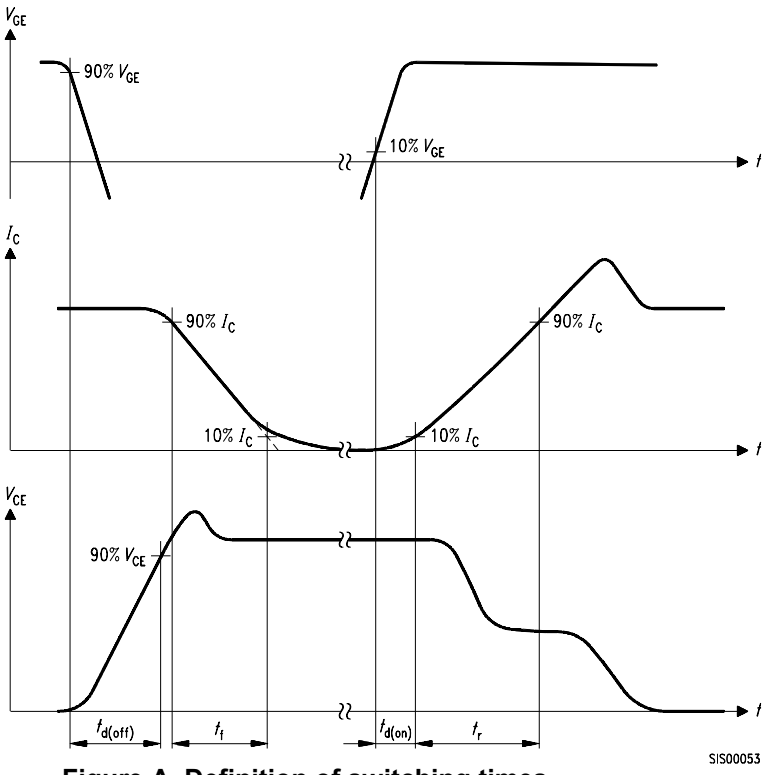

Figure A. Definition of switching times

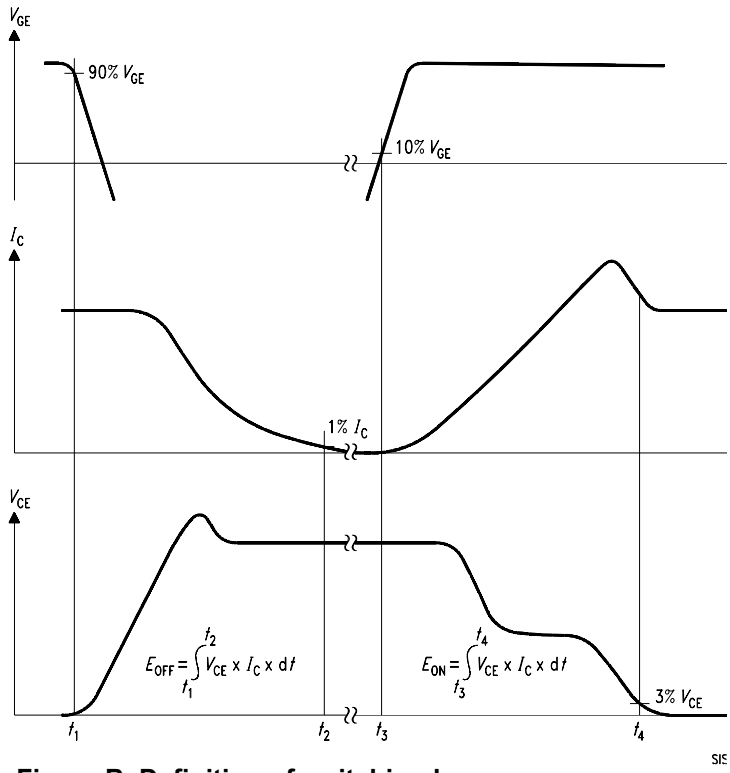

Figure B. Definition of switching losses

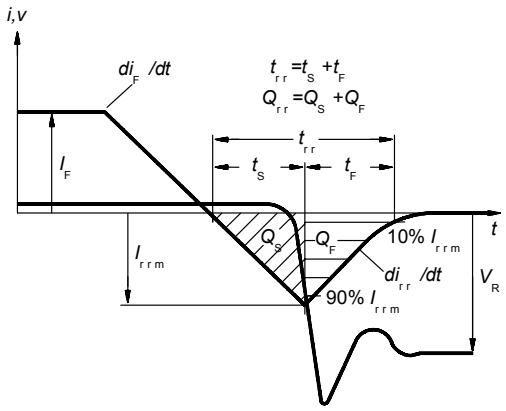

Figure C. Definition of diodes switching characteristics

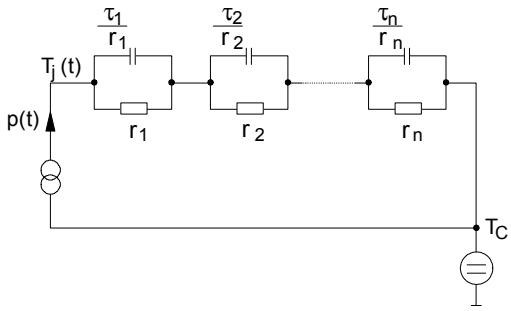

Figure D. Thermal equivalent circuit

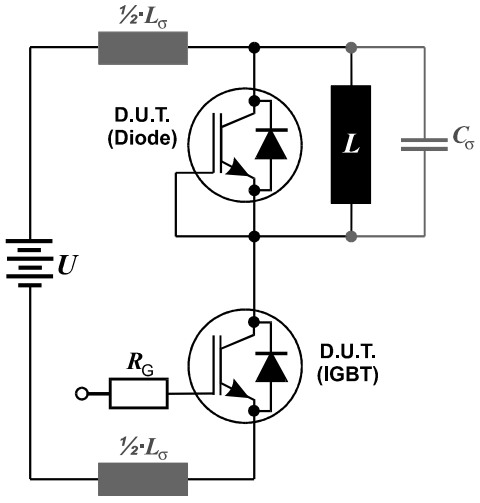

Figure E. Dynamic test circuit
Leakage inductance L_σ =180nH
and Stray capacity C_σ =39pF.

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