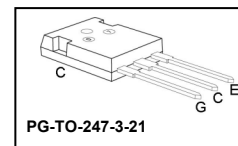
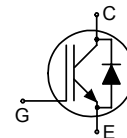


Reverse Conducting IGBT with monolithic body diode

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
- Low EMI
- Qualified according to JEDEC¹ 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), T_j=25°C}	T _{j,max}	Marking	Package
IHW15N120R2	1200V	20A	1.5V	175°C	H15R1202	PG-TO-247-3-21

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V _{CE}	1200	V
DC collector current	I _C	30	A
T _C = 25°C		15	
T _C = 100°C			
Pulsed collector current, t _p limited by T _{j,max}	I _{C,puls}	45	
Turn off safe operating area (V _{CE} ≤ 1200V, T _j ≤ 175°C)	-	45	
Diode forward current	I _F	30	
T _C = 25°C		15	
T _C = 100°C			
Diode pulsed current, t _p limited by T _{j,max}	I _{F,puls}	45	
Diode surge non repetitive current, t _p limited by T _{j,max}	I _{F,SM}	50	
T _C = 25°C, t _p = 10ms, sine halfwave		130	
T _C = 25°C, t _p ≤ 2.5μs, sine halfwave		120	
T _C = 100°C, t _p ≤ 2.5μs, sine halfwave			
Gate-emitter voltage	V _{GE}	±20	V
Transient Gate-emitter voltage (t _p < 5 ms)		±25	
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	
Mounting Torque	M _s	0.6	Nm

¹ LSTD-022 and JEDEC-022

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction – case	R_{thJC}		0.52	K/W
Diode thermal resistance, junction – case	R_{thJCD}		0.47	
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	$V_{(BR)CES}$	$V_{GE}=0V, I_C=500\mu A$	1200	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE} = 15V, I_C=15A$ $T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$ $T_j=175^\circ\text{C}$	-	1.5	1.75	
Diode forward voltage	V_F	$V_{GE}=0V, I_F=15A$ $T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$ $T_j=175^\circ\text{C}$	-	1.45	1.65	
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C=0.4mA, V_{CE}=V_{GE}$	5.1	5.8	6.4	
Zero gate voltage collector current	I_{CES}	$V_{CE}=1200V, V_{GE}=0V$ $T_j=25^\circ\text{C}$ $T_j=175^\circ\text{C}$	-	-	5 2500	μA
Gate-emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V$	-	-	100	
Transconductance	g_{fs}	$V_{CE}=20V, I_C=15A$	-	11.7	-	S
Integrated gate resistor	R_{Gint}			none		Ω

Dynamic Characteristic

Input capacitance	C_{iss}	$V_{CE}=25V,$ $V_{GE}=0V,$ $f=1MHz$	-	1530	-	pF
Output capacitance	C_{oss}		-	49	-	
Reverse transfer capacitance	C_{rss}		-	39	-	
Gate charge	Q_{Gate}	$V_{CC}=960V, I_C=15A$ $V_{GE}=15V$	-	133	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13	-	nH

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

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-off delay time	$t_{d(off)}$	$T_j=25^\circ C,$ $V_{CC}=600V, I_C=15A$ $V_{GE}=0 / 15V,$ $R_G=14.8\Omega,$ $L_{\sigma}^{(2)}=230nH,$ $C_{\sigma}^{(2)}=39pF$	-	282	-	
Fall time	t_f		-	62	-	
Turn-off energy	E_{off}		-	0.9	-	
Total switching energy	E_{ts}		-	0.9	-	

Switching Characteristic, Inductive Load, at $T_j=175^\circ C$

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-off delay time	$t_{d(off)}$	$T_j=175^\circ C$ $V_{CC}=600V, I_C=15A,$ $V_{GE}=0 / 15V,$ $R_G=14.8\Omega,$ $L_{\sigma}=230nH^{(2)},$ $C_{\sigma}=39pF^{(2)}$	-	342	-	
Fall time	t_f		-	90	-	
Turn-off energy	E_{off}		-	1.3	-	
Total switching energy	E_{ts}		-	1.3	-	

²⁾ Leakage inductance L_{σ} and Stray capacity C_{σ} due to dynamic test circuit in Figure E.

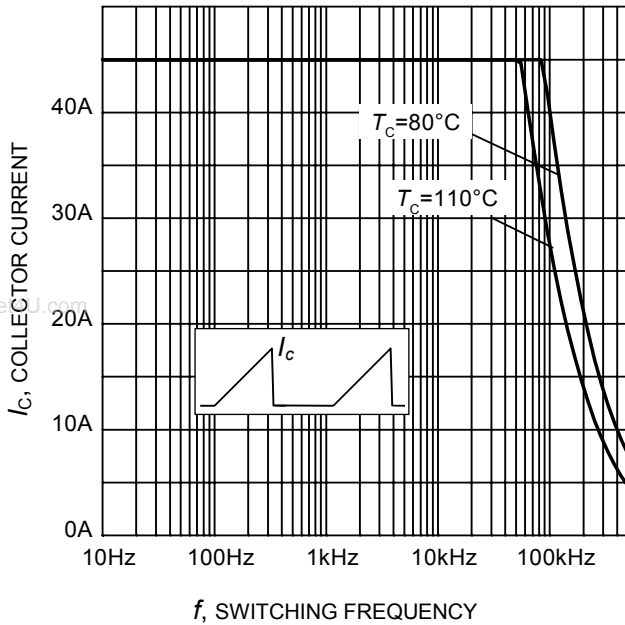


Figure 1. Collector current as a function of switching frequency for hard switching (turn-off)
 ($T_j \leq 175^\circ\text{C}$, $D = 0.5$, $V_{CE} = 600\text{V}$, $V_{GE} = 0/+15\text{V}$, $R_G = 14.8\Omega$)

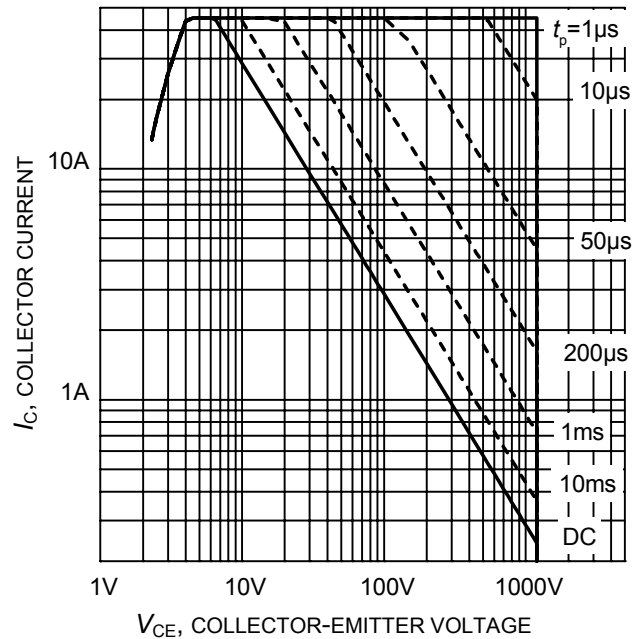


Figure 2. IGBT Safe operating area
 ($D = 0$, $T_C = 25^\circ\text{C}$, $T_j \leq 175^\circ\text{C}$; $V_{GE} = 15\text{V}$)

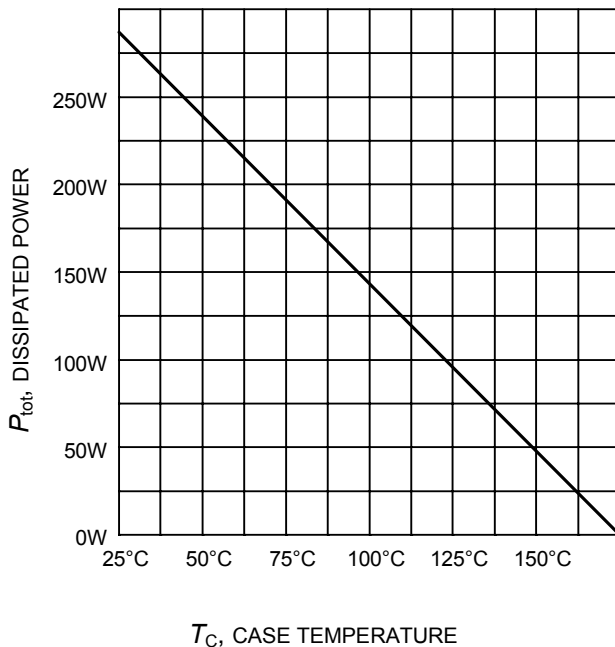


Figure 3. Power dissipation as a function of case temperature
 ($T_j \leq 175^\circ\text{C}$)

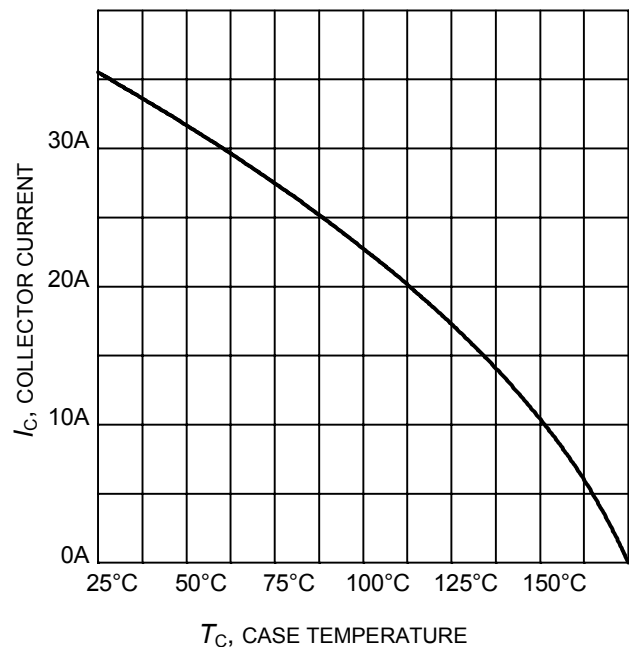


Figure 4. DC Collector current as a function of case temperature
 ($V_{GE} \geq 15\text{V}$, $T_j \leq 175^\circ\text{C}$)

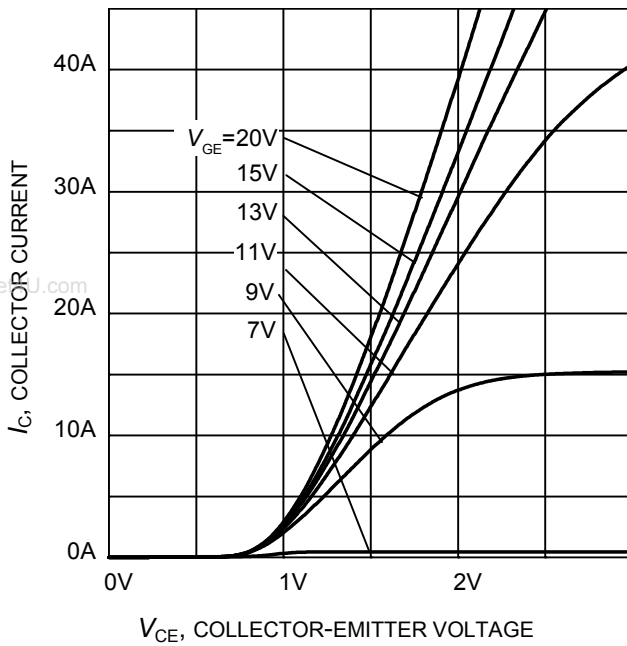


Figure 5. Typical output characteristic
($T_j = 25^\circ\text{C}$)

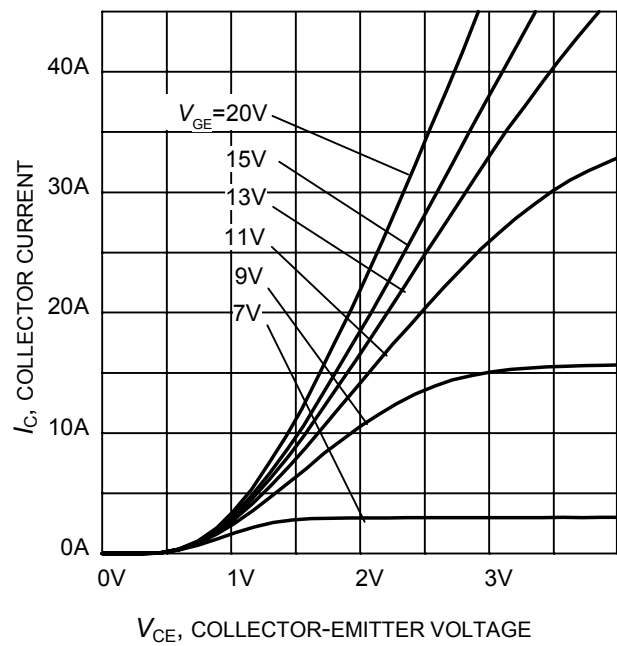


Figure 6. Typical output characteristic
($T_j = 175^\circ\text{C}$)

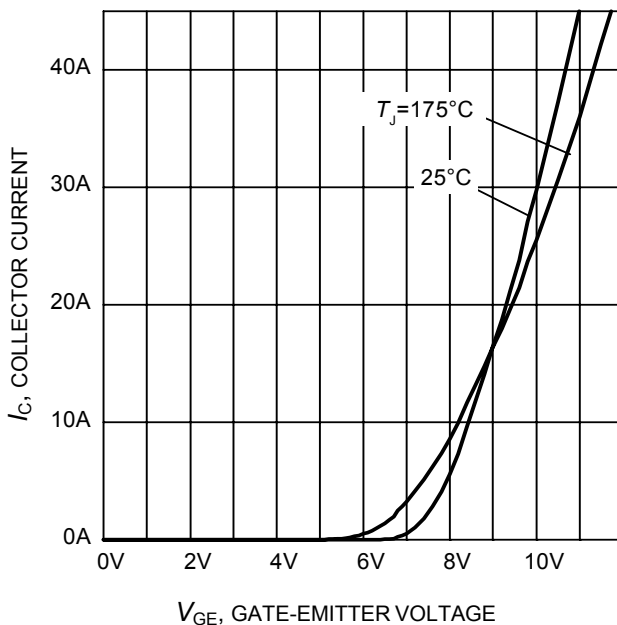


Figure 7. Typical transfer characteristic
($V_{CE} = 20\text{V}$)

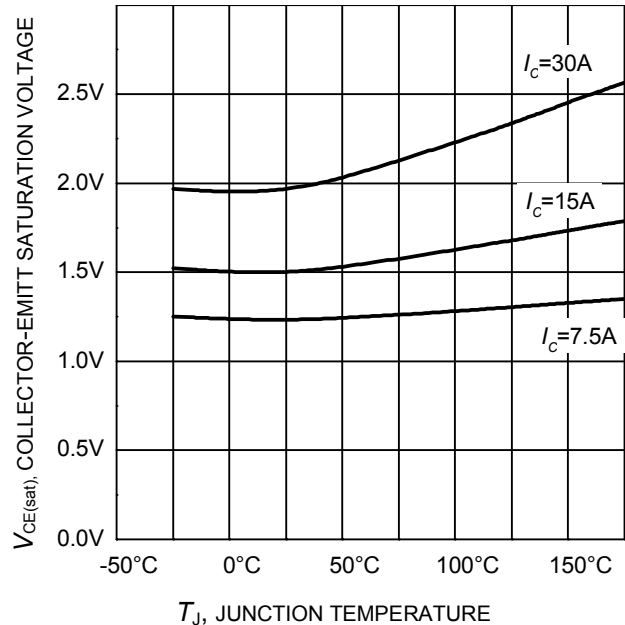


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
($V_{GE} = 15\text{V}$)

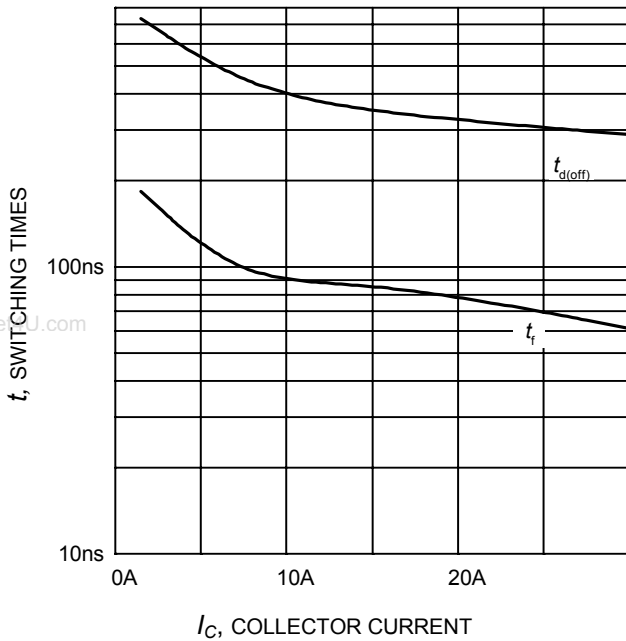


Figure 9. Typical switching times as a function of collector current
 (inductive load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=14.8\Omega$, Dynamic test circuit in Figure E)

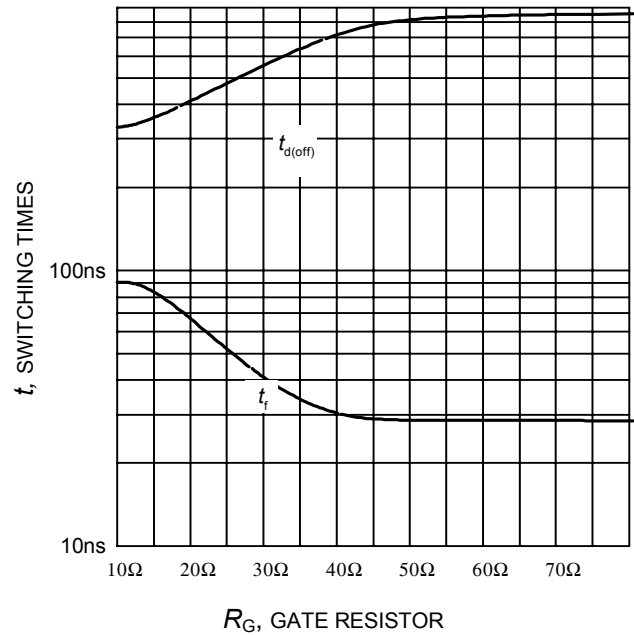


Figure 10. Typical switching times as a function of gate resistor
 (inductive load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=15\text{A}$, Dynamic test circuit in Figure E)

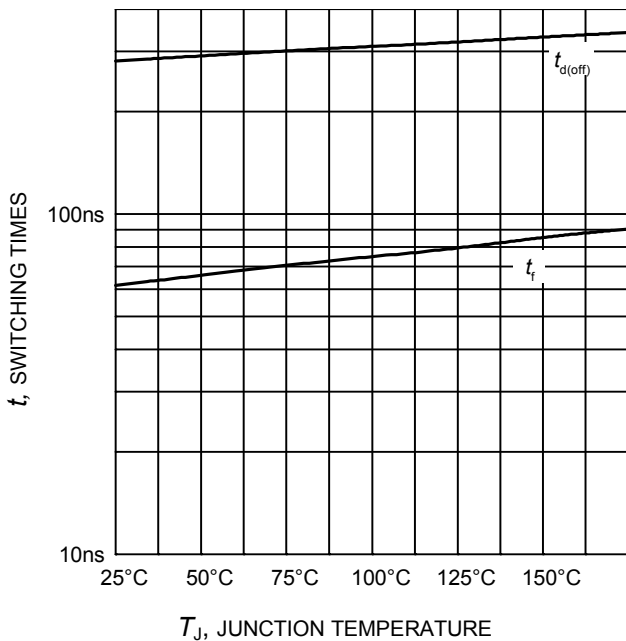


Figure 11. Typical switching times as a function of junction temperature
 (inductive load, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=15\text{A}$, $R_G=14.8\Omega$, Dynamic test circuit in Figure E)

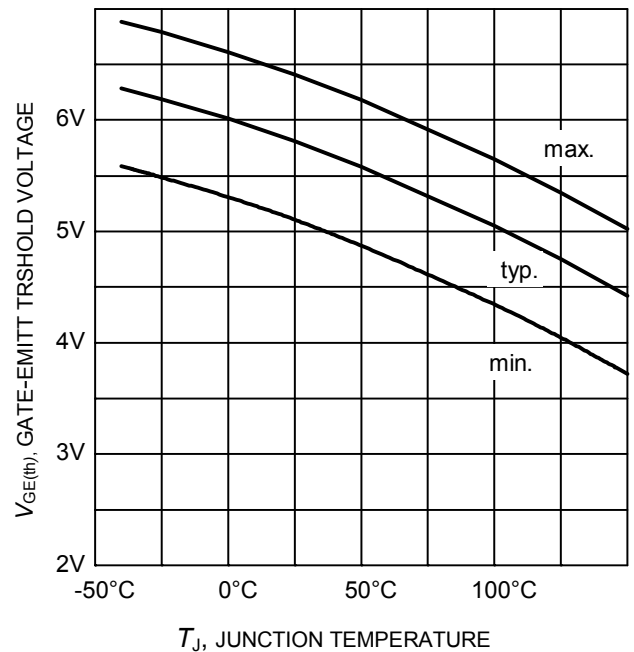


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
 ($I_C = 0.4\text{mA}$)

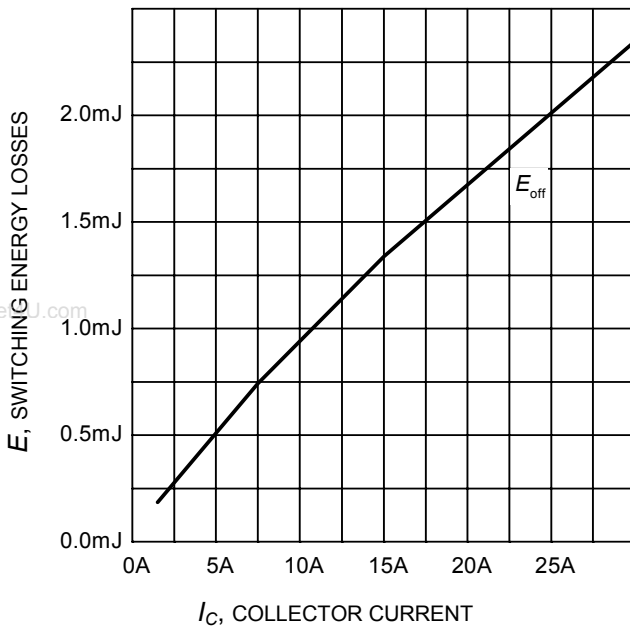


Figure 13. Typical turn-off energy as a function of collector current
 (inductive load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=14.8\Omega$, Dynamic test circuit in Figure E)

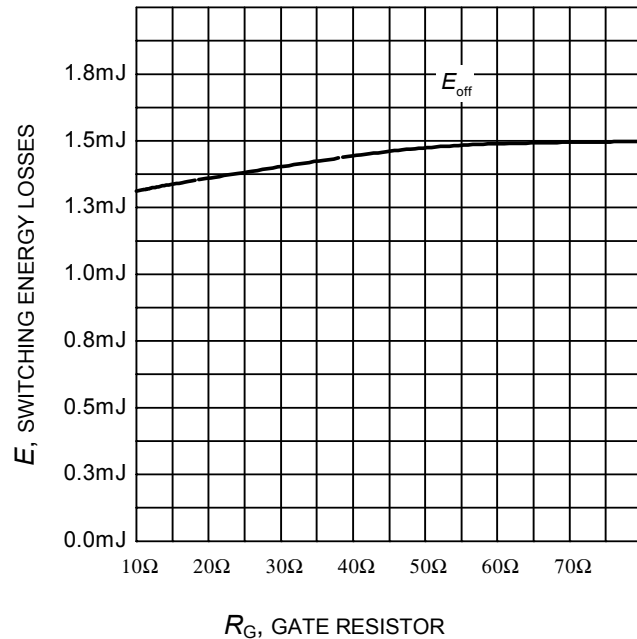


Figure 14. Typical turn-off energy as a function of gate resistor
 (inductive load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=15\text{A}$, Dynamic test circuit in Figure E)

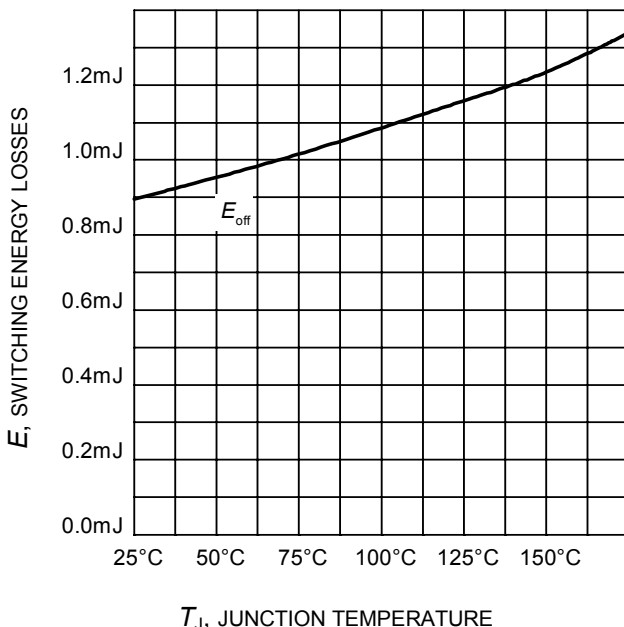


Figure 15. Typical turn-off energy as a function of junction temperature
 (inductive load, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=15\text{A}$, $R_G=14.8\Omega$, Dynamic test circuit in Figure E)

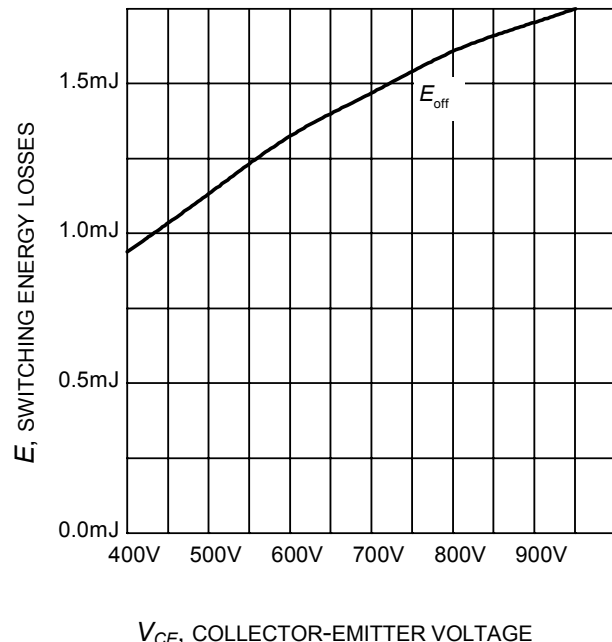


Figure 16. Typical turn-off energy as a function of collector emitter voltage
 (inductive load, $T_J=175^\circ\text{C}$, $V_{GE}=0/15\text{V}$, $I_C=15\text{A}$, $R_G=14.8\Omega$, Dynamic test circuit in Figure E)

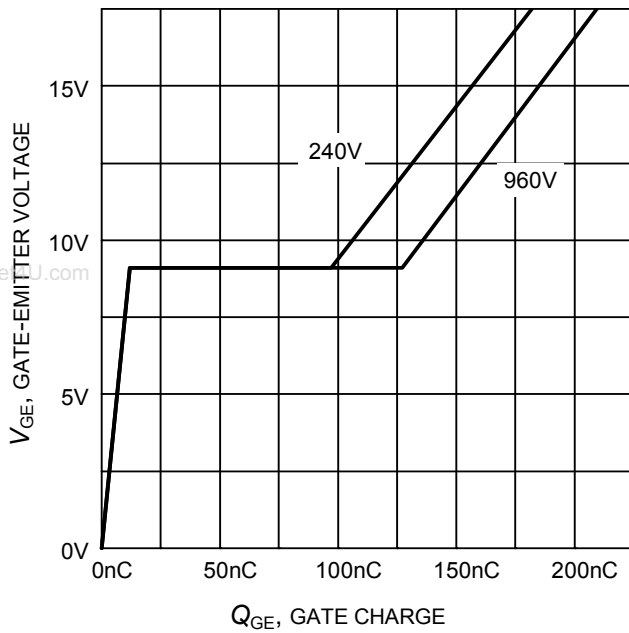


Figure 17. Typical gate charge
($I_C=15\text{ A}$)

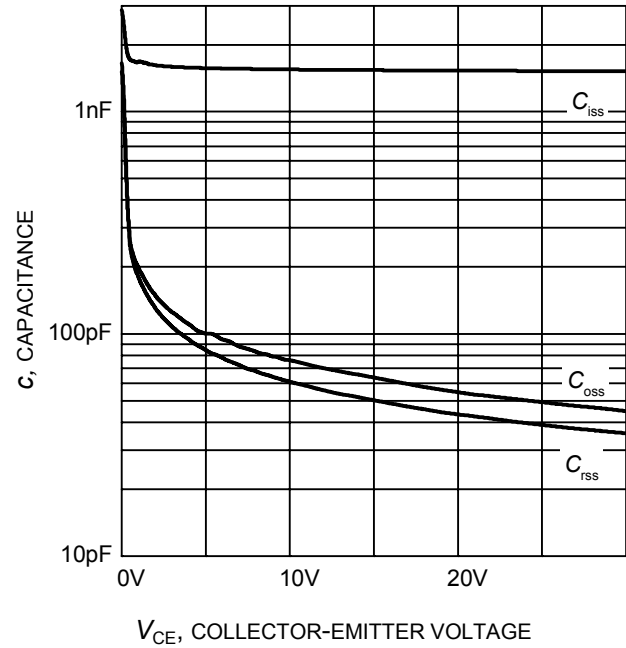


Figure 18. Typical capacitance as a function of collector-emitter voltage
($V_{GE}=0\text{V}$, $f = 1\text{ MHz}$)

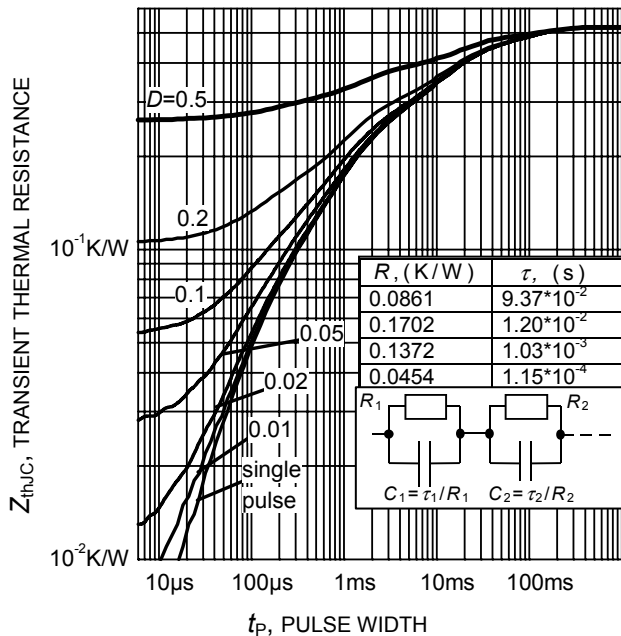


Figure 19. IGBT transient thermal resistance
($D = t_p / T$)

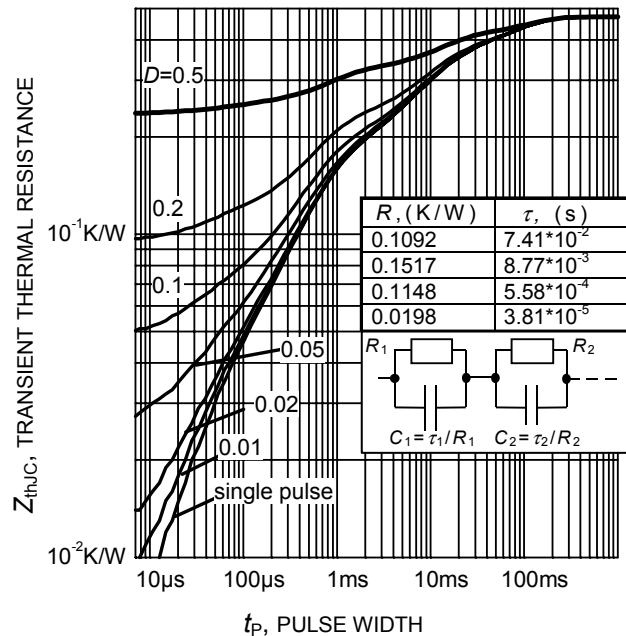


Figure 20. Typical Diode transient thermal impedance as a function of pulse width
($D=t_p/T$)

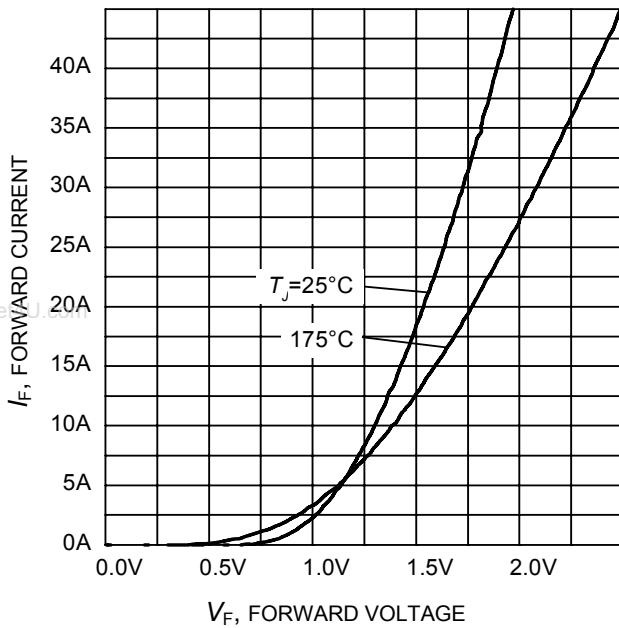


Figure 21. Typical diode forward current as a function of forward voltage

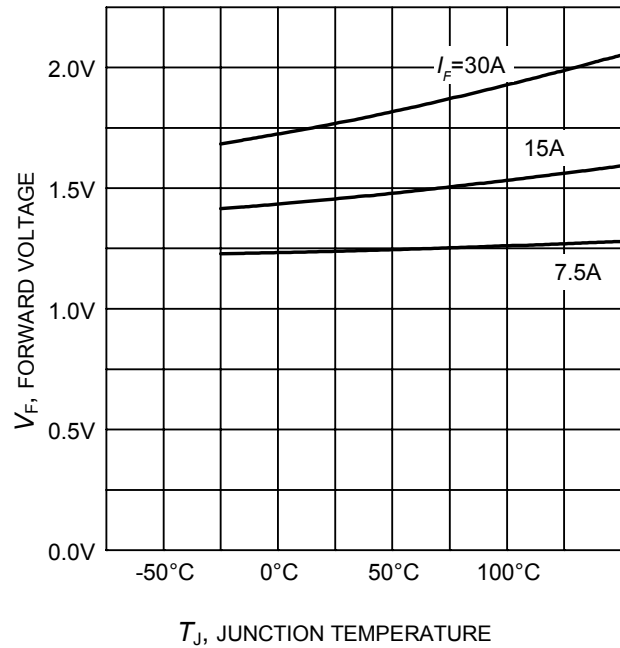
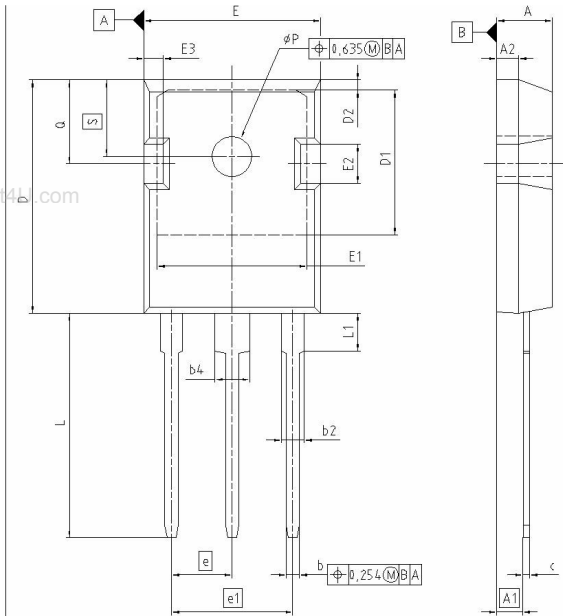


Figure 22. Typical diode forward voltage as a function of junction temperature

PG-TO247-3-21



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.903	5.157	0.193	0.203
A1	2.273	2.527	0.092	0.096
A2	1.853	2.107	0.075	0.081
b	1.073	1.327	0.047	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	0.024	0.030
D	20.823	21.077	0.820	0.830
D1	17.323	17.831	0.682	0.702
D2	1.063	1.317	0.042	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	1.683	1.937	0.066	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	4.168	4.472	0.164	0.176
pP	3.559	3.661	0.140	0.144
Q	5.493	5.747	0.216	0.226
S	6.043	6.297	0.238	0.248

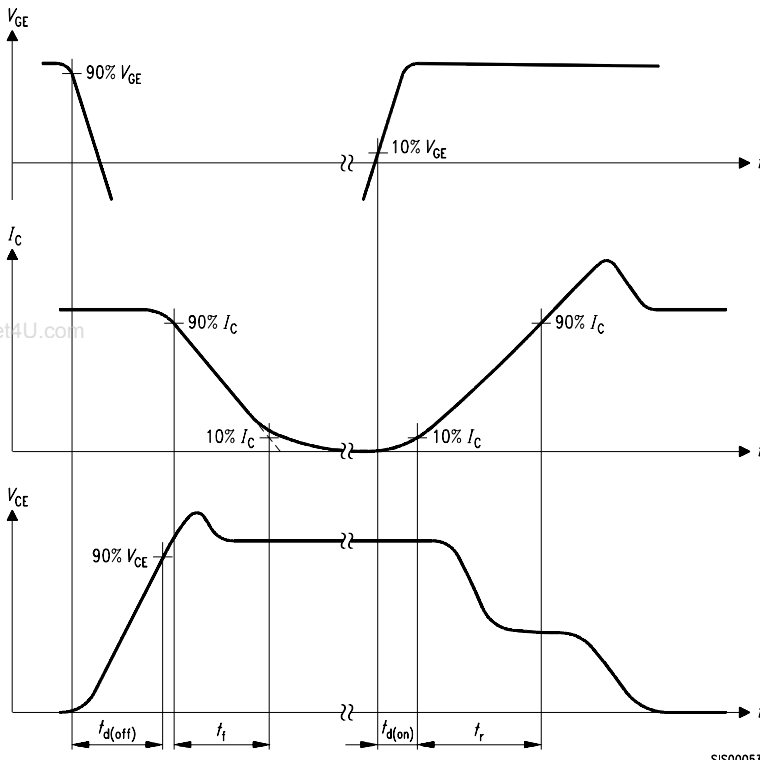


Figure A. Definition of switching times

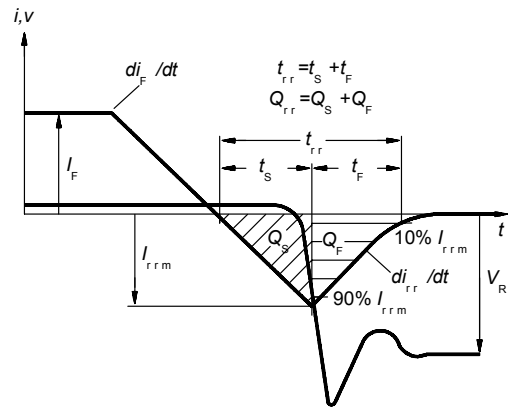


Figure C. Definition of diodes switching characteristics

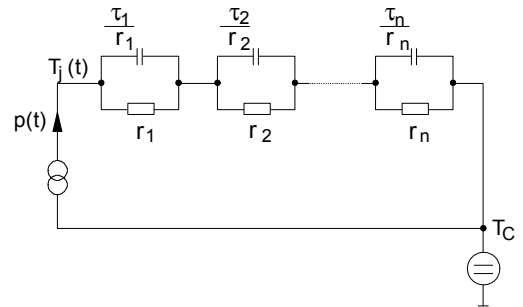


Figure D. Thermal equivalent circuit

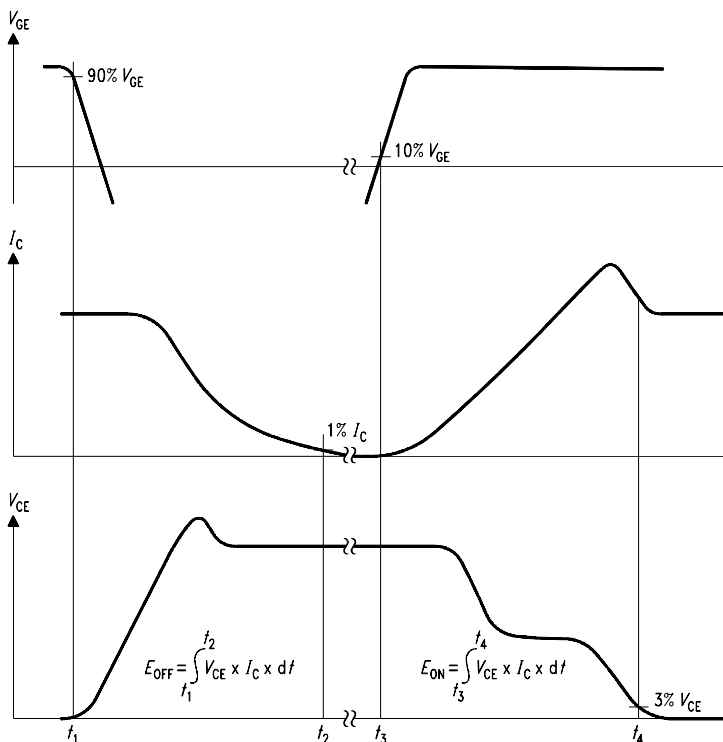


Figure B. Definition of switching losses

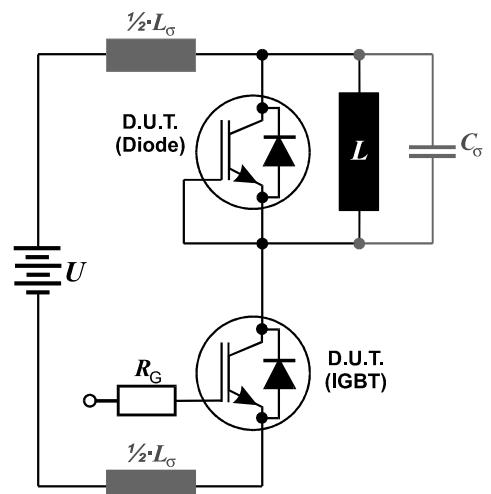


Figure E. Dynamic test circuit
Leakage inductance $L_{\sigma} = 180\text{nH}$
and Stray capacity $C_{\sigma} = 39\text{pF}$.

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