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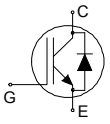
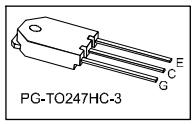
Reverse conducting IGBT with monolithic body diode





RoHS

Halogen-Free

Features:
- Powerful monolithic body diode with low forward voltage designed for soft commutation only
- TrenchStop® technology offering:
  - very tight parameter distribution
  - high ruggedness, temperature stable behavior
  - low V_{CEsat}
  - easy parallel switching capability due to positive temperature coefficient in V_{CEsat}
- Low EMI
- New TO-247HC package offers increased air & creepage distances compared to TO247 package
- Qualified according to JEDEC J-STD-020 and JESD-022 for target applications
- Pb-free lead plating; RoHS compliant
- Halogen free (according to IEC 61249-2-21)
- Complete product spectrum and PSpice Models: http://www.infineon.com/igbt/

Applications:
- Inductive cooking

Type	V_{CE}	I_C	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Marking	Package
IHY20N120R3	1200V	20A	1.48V	175°C	H20R1203	PG-TO247HC-3

Maximum ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	1200	V
DC collector current, limited by T_{vjmax} T_C = 25°C T_C = 100°C	I_C	 40.0 20.0	A
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	60.0	A
Turn off safe operating area $V_{CE} \le 1200V$, $T_{vj} \le 175°C$	-	60.0	A
Diode forward current, limited by T_{vjmax} T_C = 25°C T_C = 100°C	I_F	 40.0 20.0	A
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpuls}	60.0	A
Gate-emitter voltage Transient Gate-emitter voltage (t_p = 10µs, D < 0.010)	V_{GE}	±20 ±25	V
Power dissipation T_C = 25°C Power dissipation T_C = 100°C	P_{tot}	310.0 155.0	W
Operating junction temperature	T_{vj}	-40...+175	°C
Storage temperature	T_{stg}	-55...+175	°C
Soldering temperature, for 10 s (according to JEDEC J-STA-020A)		260	°C
Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction - case	$R_{th(j-c)}$		0.48	K/W
Diode thermal resistance, junction - case	$R_{th(j-c)}$		0.48	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		55	K/W

Electrical Characteristic, at T_{vj} = 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 = 0.50mA	1200	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	V_{GE} = 15.0V, I_C = 20.0A T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	 - - -	 1.48 1.70 1.80	 1.70 - -	V
Diode forward voltage	V_F	V_{GE} = 0V, I_F = 20.0A T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	 - - -	 1.55 1.70 1.80	 1.75 - 	V
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C = 0.50mA, V_{CE} = V_{GE}	5.1	5.8	6.4	V
Zero gate voltage collector current	I_{CES}	V_{CE} = 1200V, V_{GE} = 0V T_{vj} = 25°C T_{vj} = 175°C	 - -	 - -	 100.0 2500.0	µA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0V, V_{GE} = 20V	-	-	100	nA
Transconductance	g_{fs}	V_{CE} = 20V, I_C = 20.0A	-	15.7	-	S
Integrated gate resistor	r_G			none		Ω

Electrical Characteristic, at T_{vj} = 25°C, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Dynamic Characteristic						
Input capacitance	C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	-	1503	-	pF
Output capacitance	C_{oes}		-	50	-	
Reverse transfer capacitance	C_{res}		-	42	-	
Gate charge	Q_G	V_{CC} = 960V, I_C = 20.0A, V_{GE} = 15V	-	211.0	-	nC

Switching Characteristic, Inductive Load, at T_{vj} = 25°C

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-off delay time	$t_{d(off)}$	T_{vj} = 25°C, V_{CC} = 600V, I_C = 20.0A, V_{GE} = 0.0/15.0V, r_G = 15.0Ω, L_σ = 180nH, C_σ = 39pF L_σ, C_σ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	387	-	ns
Fall time	t_f		-	25	-	ns
Turn-off energy	E_{off}		-	0.95	-	mJ

Switching Characteristic, Inductive Load, at T_{vj} = 175°C

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-off delay time	$t_{d(off)}$	T_{vj} = 175°C, V_{CC} = 600V, I_C = 20.0A, V_{GE} = 0.0/15.0V, r_G = 15.0Ω, L_σ = 180nH, C_σ = 39pF L_σ, C_σ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	454	-	ns
Fall time	t_f		-	84	-	ns
Turn-off energy	E_{off}		-	1.65	-	mJ

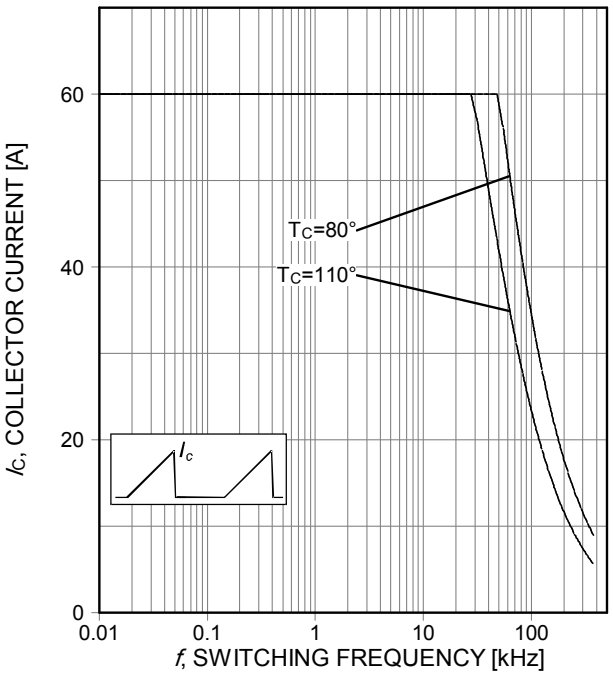


Figure 1. Collector current as a function of switching frequency
(T_j≤175°C, D=0.5, V_{CE}=600V, V_{GE}=15/0V, R_G=15Ω)

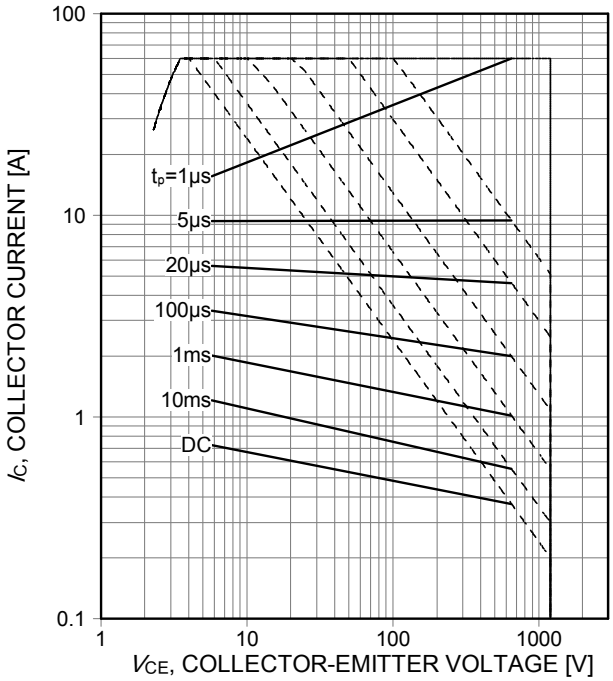


Figure 2. Forward bias safe operating area
(D=0, T_C=25°C, T_j≤175°C; V_{GE}=15V)

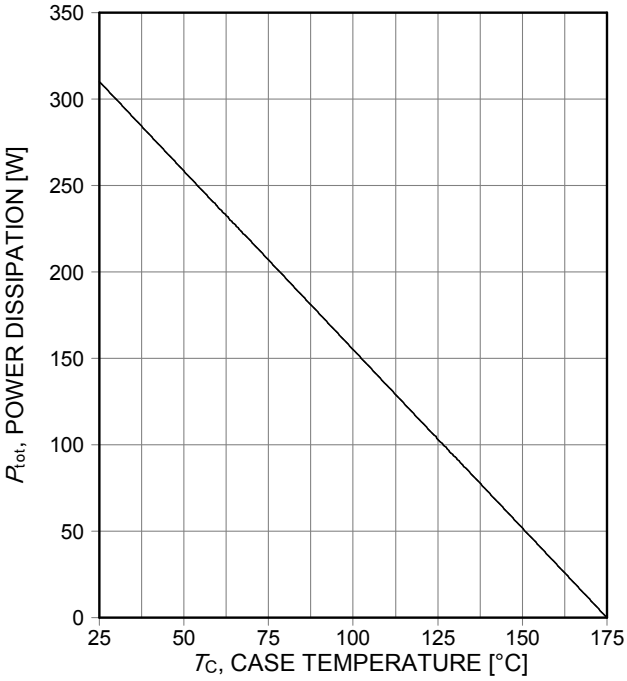


Figure 3. Power dissipation as a function of case temperature
(T_j≤175°C)

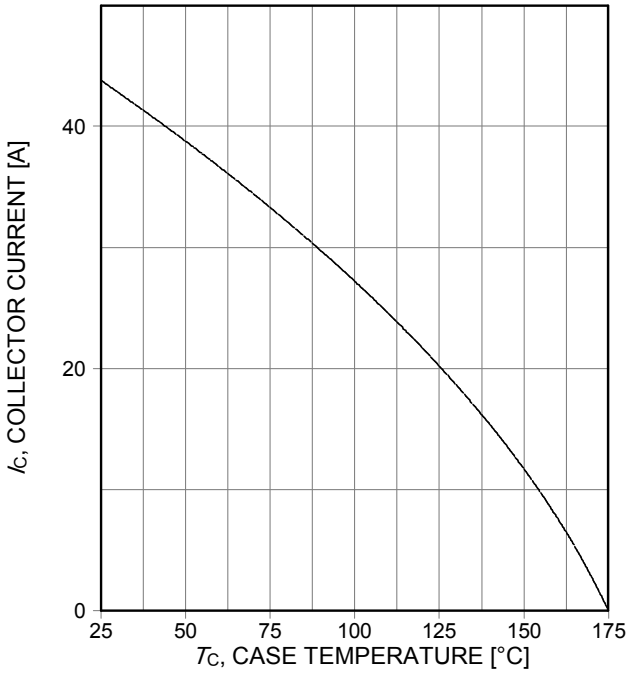


Figure 4. Collector current as a function of case temperature
(V_{GE}≥15V, T_j≤175°C)

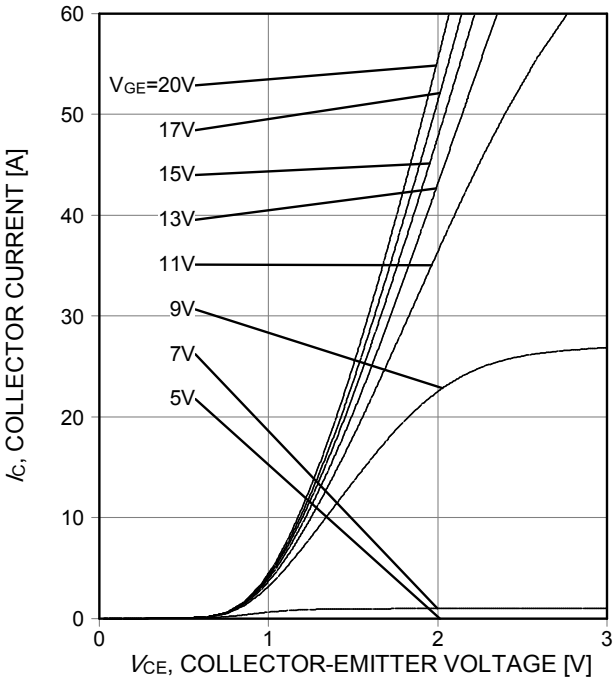


Figure 5. Typical output characteristic
(T_j=25°C)

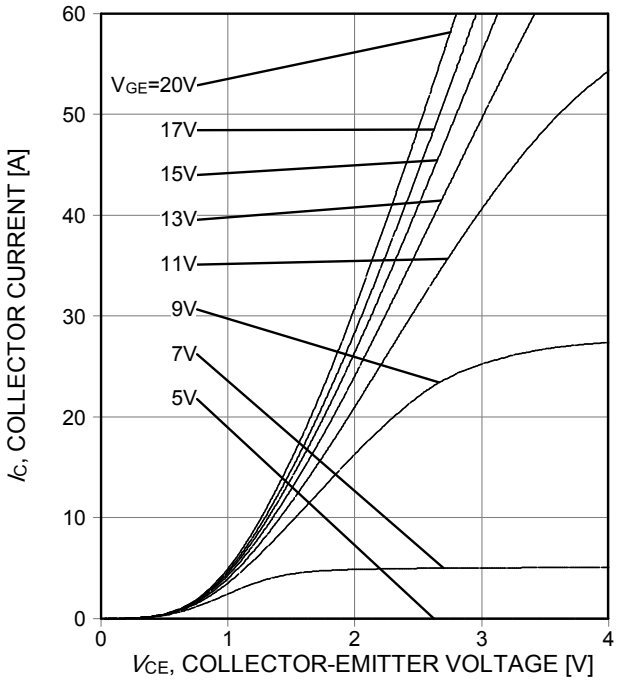


Figure 6. Typical output characteristic
(T_j=175°C)

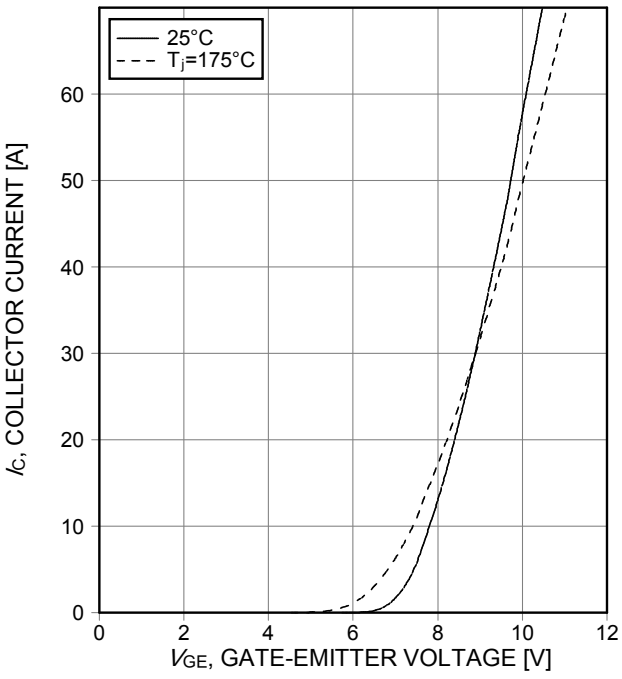


Figure 7. Typical transfer characteristic
(V_{CE}=20V)

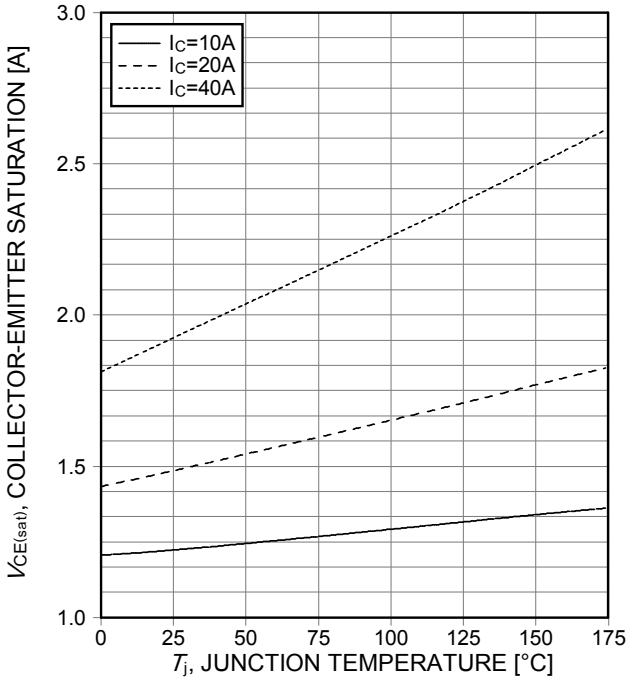


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE}=15V)

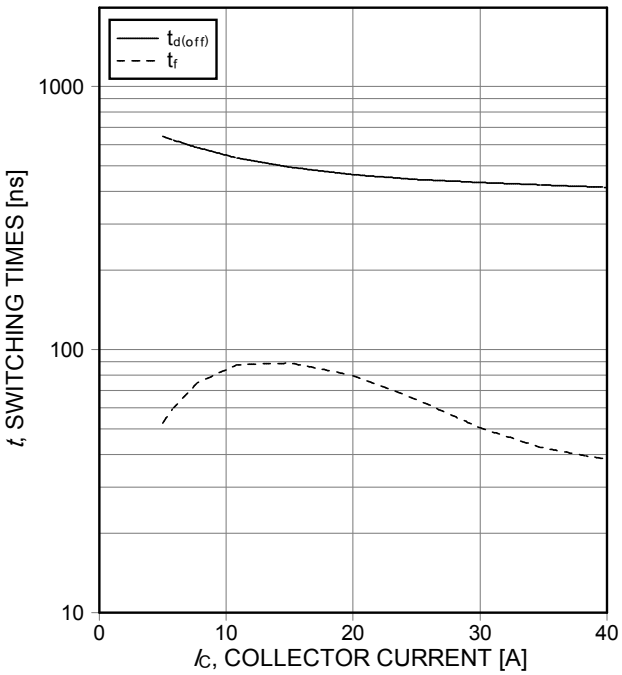


Figure 9. Typical switching times as a function of collector current
(ind. load, T_j=175°C, V_{CE}=600V, V_{GE}=15/0V, R_G=15Ω, test circuit in Fig. E)

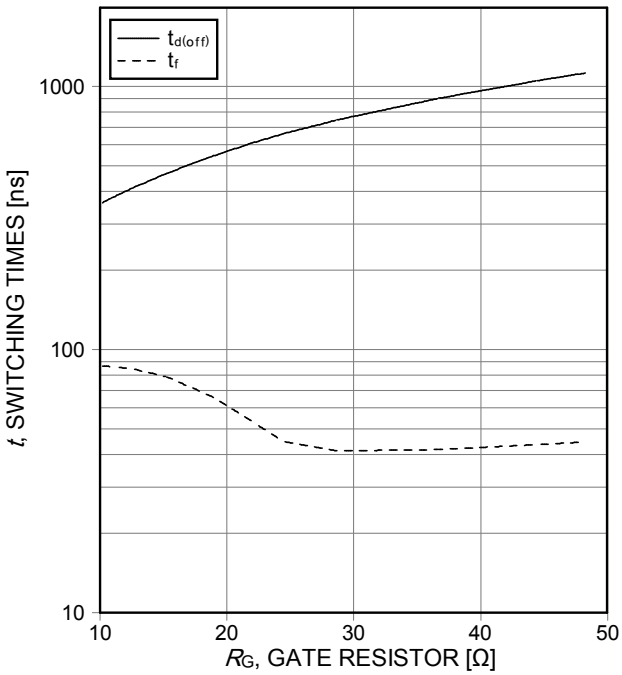


Figure 10. Typical switching times as a function of gate resistor
(ind. load, T_j=175°C, V_{CE}=600V, V_{GE}=15/0V, I_C=20A, test circuit in Fig. E)

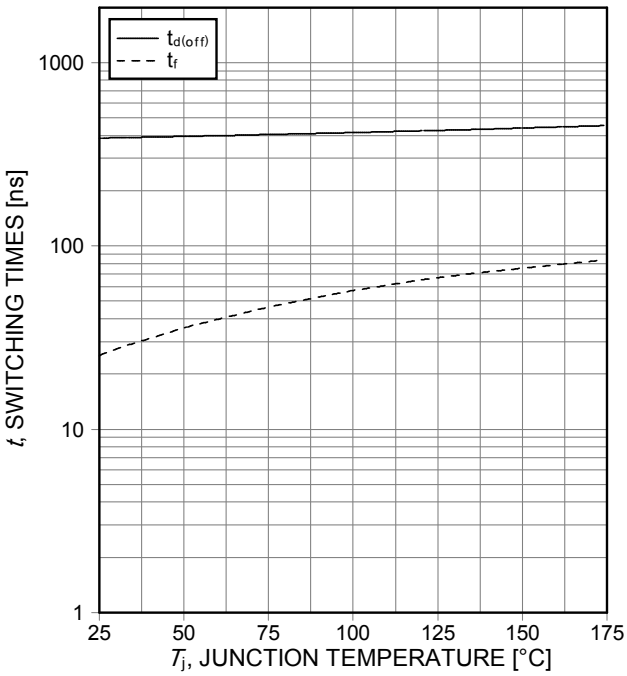


Figure 11. Typical switching times as a function of junction temperature
(ind. load, V_{CE}=600V, V_{GE}=15/0V, I_C=20A, R_G=15Ω, test circuit in Fig. E)

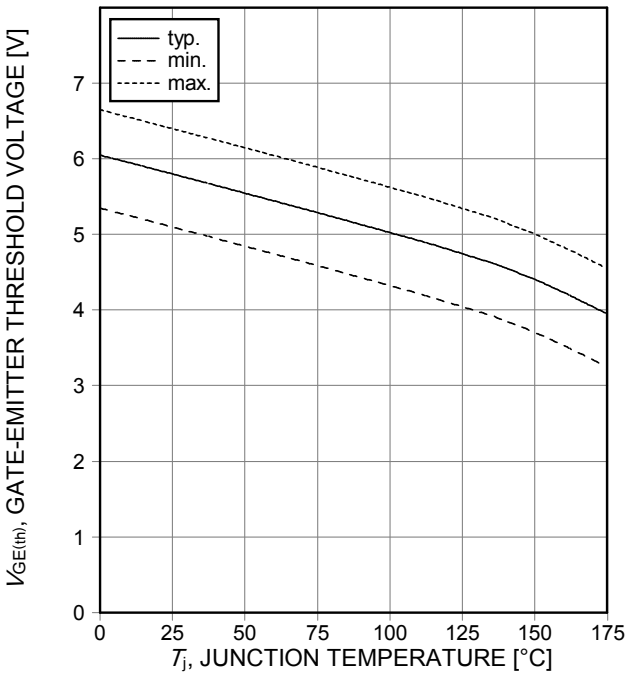


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
(I_C=0.5mA)

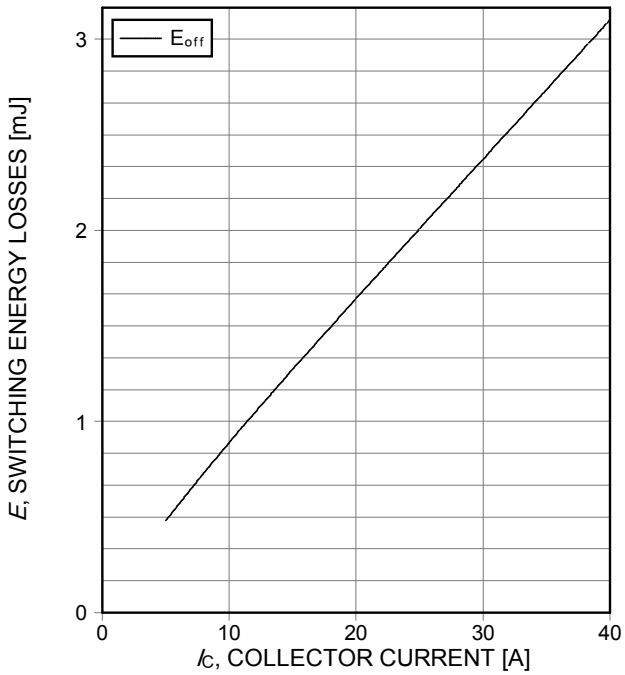


Figure 13. Typical switching energy losses as a function of collector current
(ind. load, T_j=175°C, V_{CE}=600V, V_{GE}=15/0V, R_G=15Ω, test circuit in Fig. E)

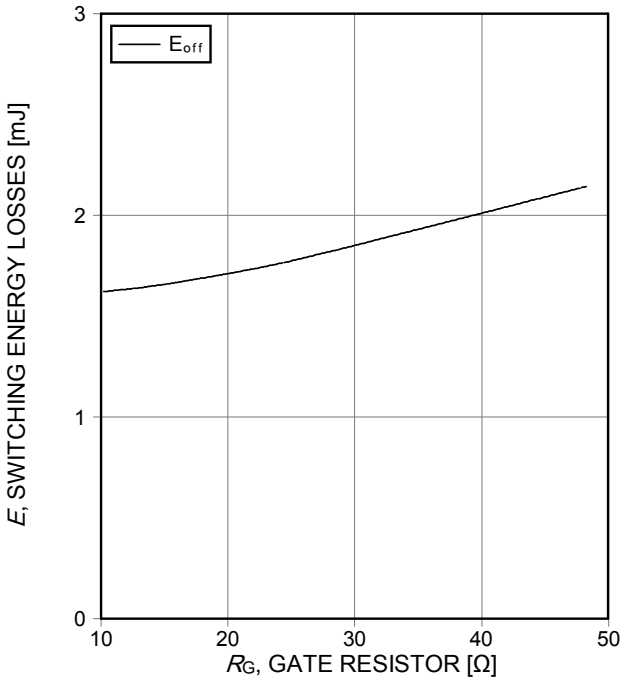


Figure 14. Typical switching energy losses as a function of gate resistor
(ind. load, T_j=175°C, V_{CE}=600V, V_{GE}=15/0V, test circuit in Fig. E)

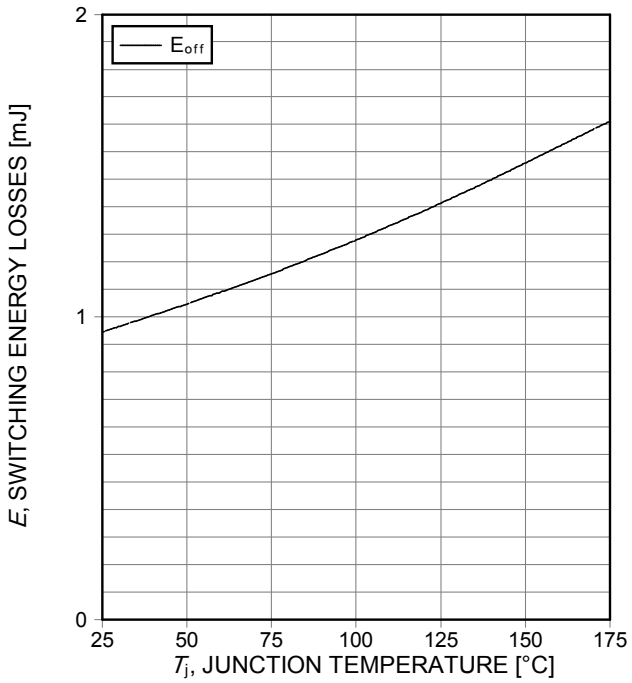


Figure 15. Typical switching energy losses as a function of junction temperature
(ind load, V_{CE}=600V, V_{GE}=15/0V, I_C=20A, R_G=15Ω, test circuit in Fig. E)

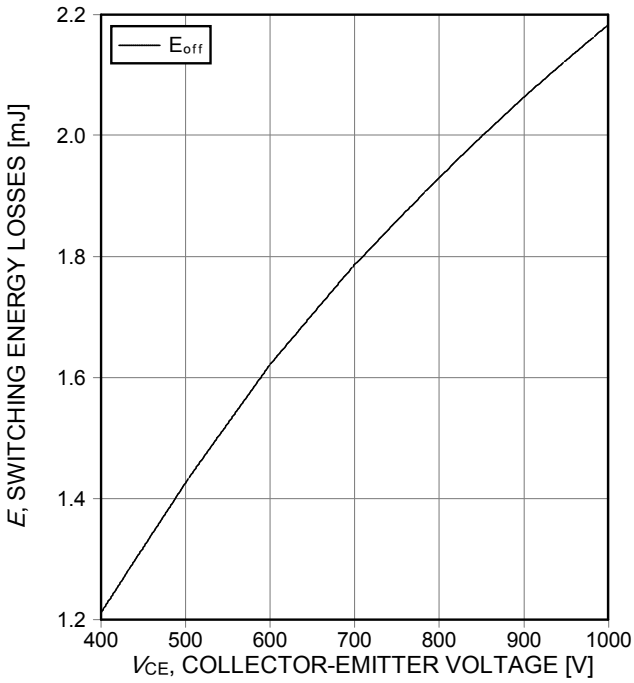


Figure 16. Typical switching energy losses as a function of collector emitter voltage
(ind. load, T_j=175°C, V_{GE}=15/0V, I_C=20A, R_G=15Ω, test circuit in Fig. E)

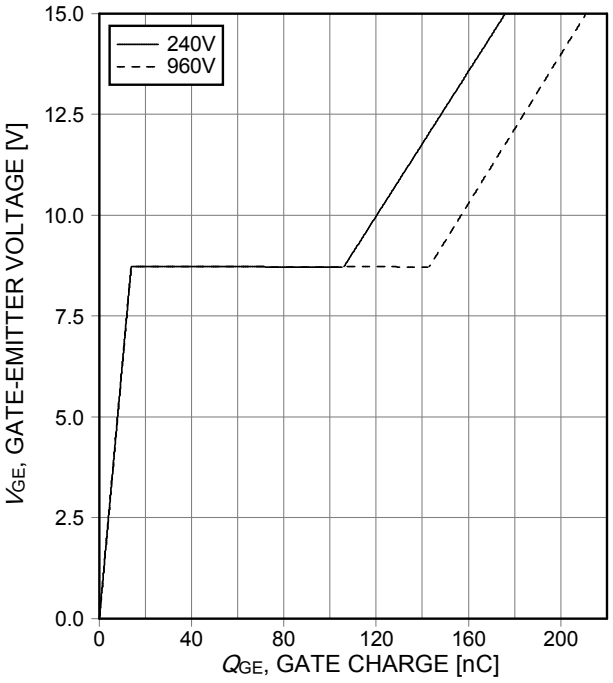


Figure 17. Typical gate charge
(I_C=20A)

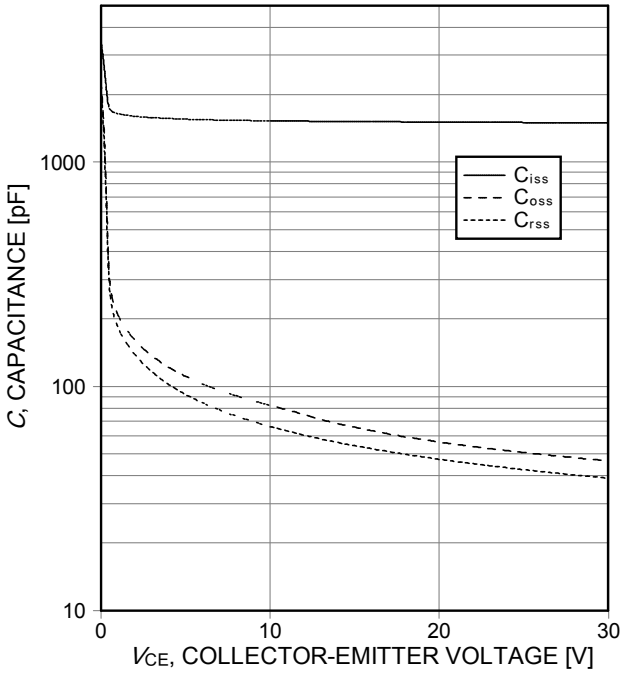


Figure 18. Typical capacitance as a function of collector-emitter voltage
(V_{GE}=0V, f=1MHz)

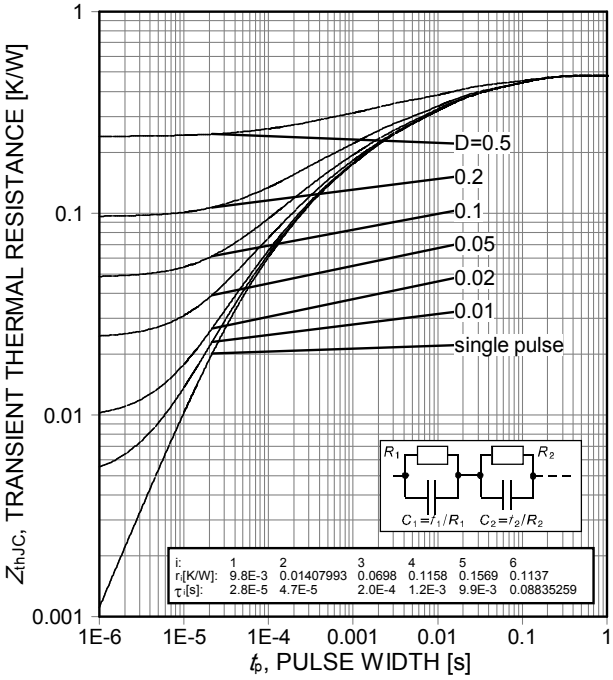


Figure 19. IGBT transient thermal resistance
($D=t_p/T$)

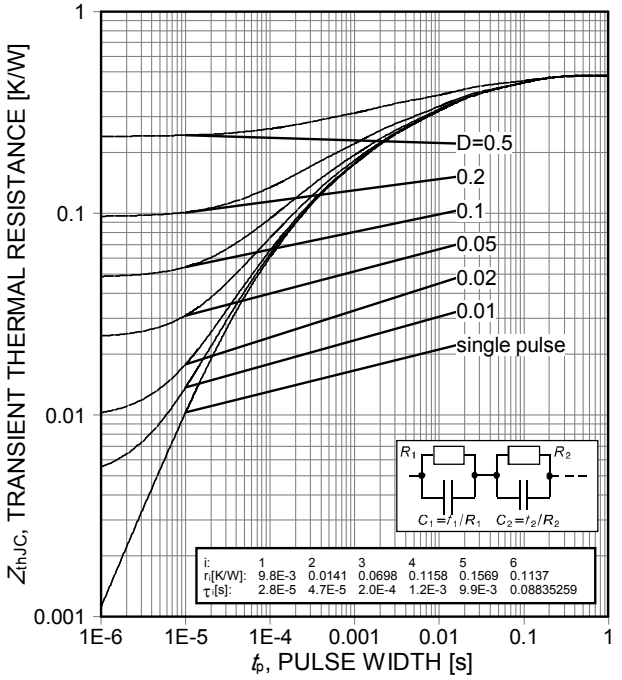


Figure 20. Diode transient thermal impedance as a function of pulse width
($D=t_p/T$)

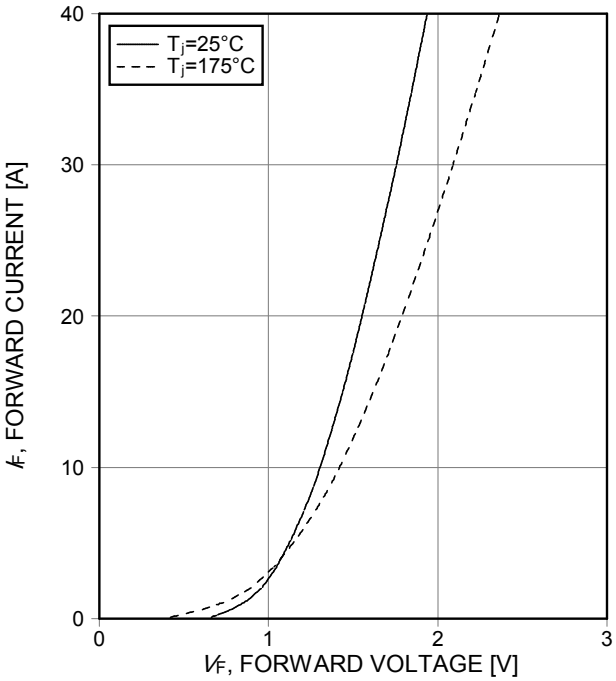


Figure 21. Typical diode forward current as a function of forward voltage

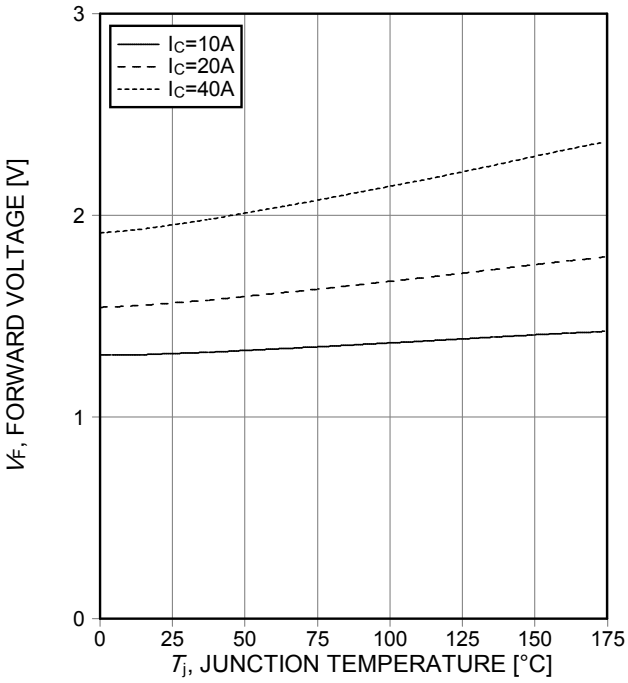
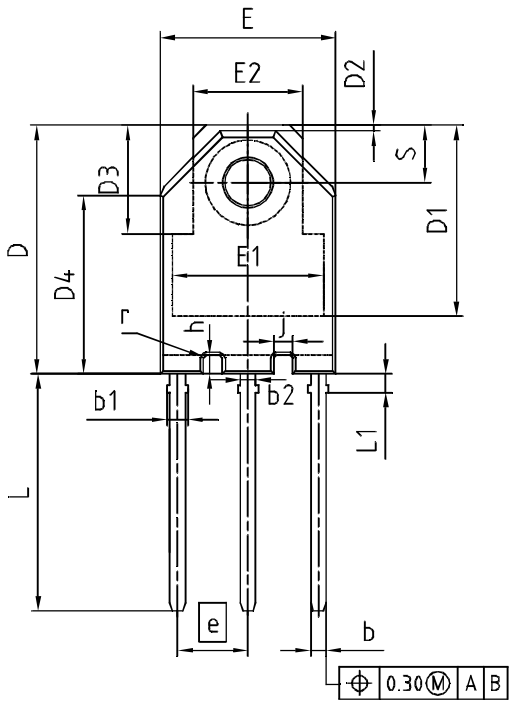
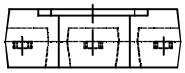


Figure 22. Typical diode forward voltage as a function of junction temperature

PG-TO247HC-3 (PG-TOHC-3)



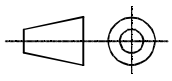


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.40	4.60	0.173	0.181
A1	2.40	2.60	0.094	0.102
A2	0.40	0.60	0.016	0.024
A3	0.95	1.15	0.037	0.045
b	1.10	1.30	0.043	0.051
b1	1.50	1.70	0.059	0.067
b2	1.10	1.30	0.043	0.051
c	0.40	0.60	0.016	0.024
D	19.05	19.45	0.750	0.766
D1	14.69	14.89	0.578	0.586
D2	0.35	0.55	0.014	0.022
D3	8.30	8.50	0.327	0.335
D4	13.51	14.11	0.532	0.556
E	13.40	13.80	0.528	0.543
E1	11.60	11.80	0.457	0.465
E2	8.30	8.70	0.327	0.343
e	5.45		0.215	
N	3		3	
L	18.05	18.65	0.711	0.734
L1	1.35	1.55	0.053	0.061
øP1	3.51	3.71	0.138	0.146
øP2	4.00	4.10	0.157	0.161
S	4.35	4.55	0.171	0.179
j	1.35	1.55	0.053	0.061
h	1.35	1.55	0.053	0.061
r	max 0.2		max 0.008	
h1	1.35	1.55	0.053	0.061

DOCUMENT NO.
Z8B00151733

SCALE 0 2.5 0 2.5 5mm

EUROPEAN PROJECTION



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01

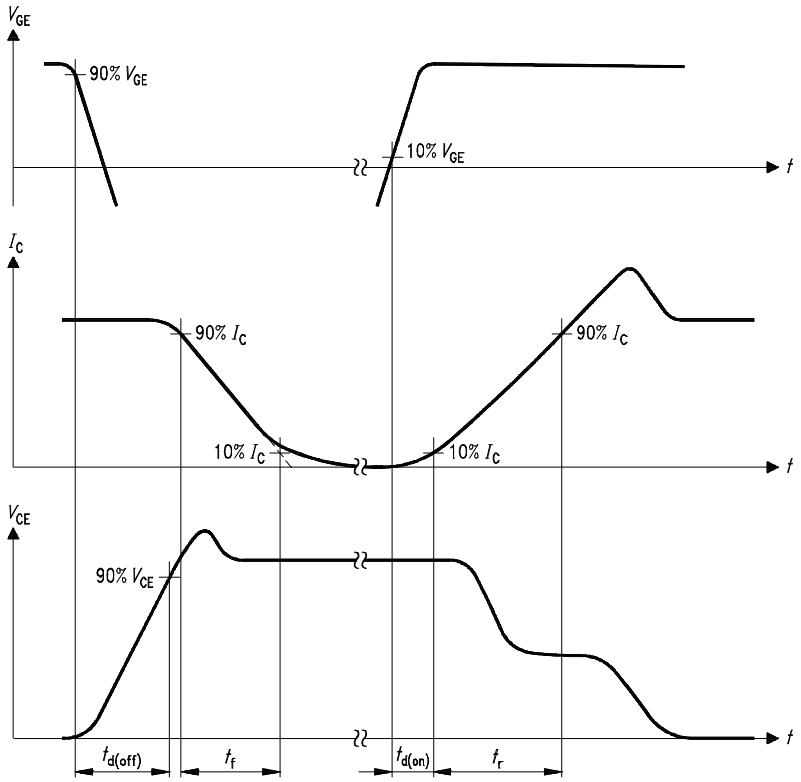

Figure A. Definition of switching times

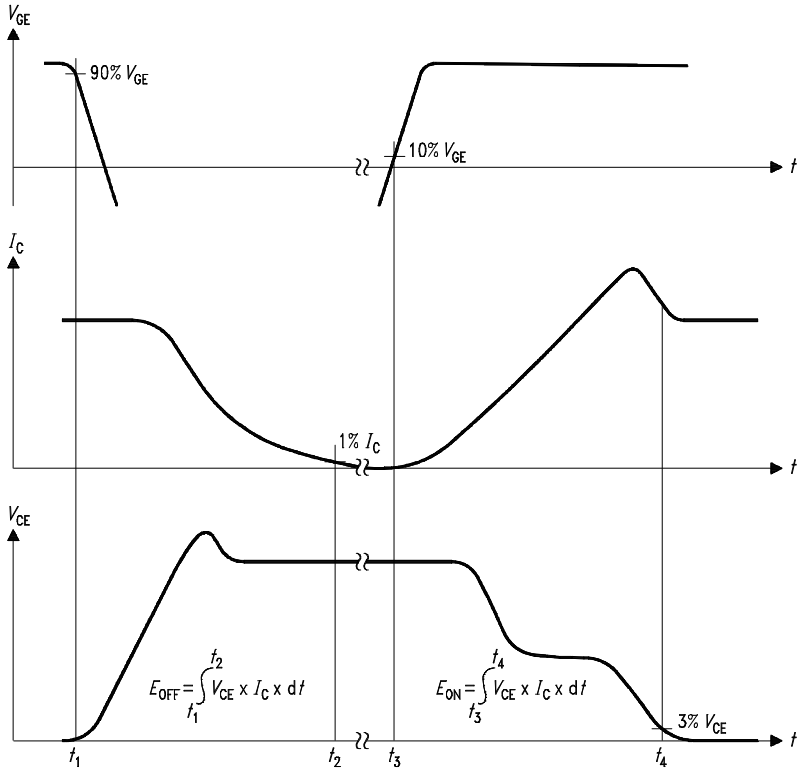

Figure B. Definition of switching losses

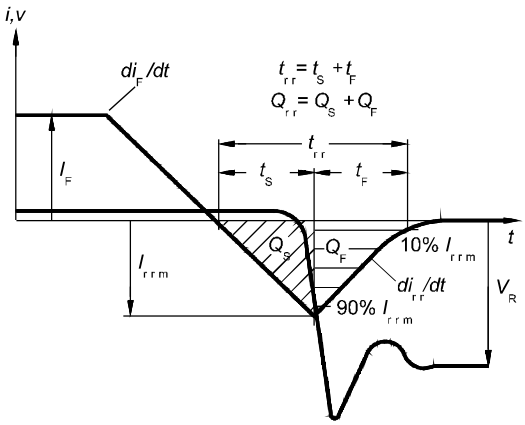

Figure C. Definition of diodes switching characteristics

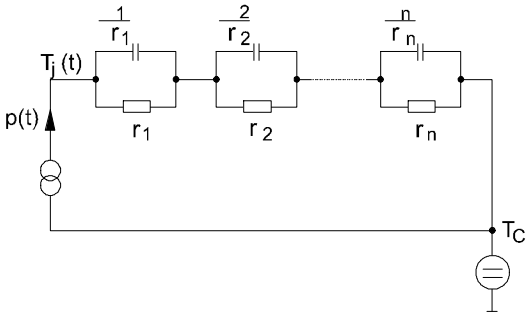

Figure D. Thermal equivalent circuit

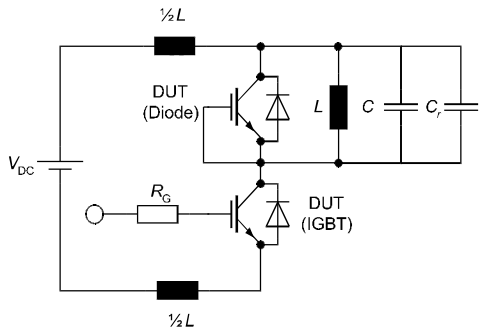

Figure E. Dynamic test circuit
Leakage inductance L= 180nH,
Stray capacitor C_σ = 40pF,
Relief capacitor C_r = 1nF
(only for ZVT switching)

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