

Induction Heating Series

Reverse conducting IGBT with monolithic body diode

IHY15N120R3

Data sheet

Industrial Power Control

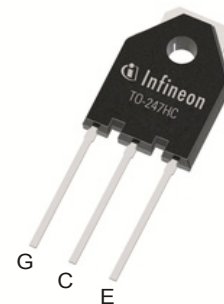
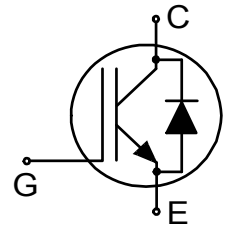
Reverse conducting IGBT with monolithic body diode

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 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



Key Performance and Package Parameters

Type	V_{CE}	I_C	V_{CEsat} , $T_{vj}=25^{\circ}C$	T_{vjmax}	Marking	Package
IHY15N120R3	1200V	15A	1.48V	175°C	H15R1203	PG-TO247HC-3

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Maximum ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	1200	V
DC collector current, limited by T_{vjmax} $T_C = 25^{\circ}C$ $T_C = 100^{\circ}C$	I_C	30.0 15.0	A
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	45.0	A
Turn off safe operating area $V_{CE} \leq 1200V$, $T_{vj} \leq 175^{\circ}C$	-	45.0	A
Diode forward current, limited by T_{vjmax} $T_C = 25^{\circ}C$ $T_C = 100^{\circ}C$	I_F	30.0 15.0	A
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpuls}	45.0	A
Gate-emitter voltage Transient Gate-emitter voltage ($t_p \leq 10\mu s$, $D < 0.010$)	V_{GE}	± 20 ± 25	V
Power dissipation $T_C = 25^{\circ}C$ Power dissipation $T_C = 100^{\circ}C$	P_{tot}	254.0 127.0	W
Operating junction temperature	T_{vj}	-40...+175	$^{\circ}C$
Storage temperature	T_{stg}	-55...+175	$^{\circ}C$
Soldering temperature, wave soldering 1.6 mm (0.063 in.) from case for 10s		260	$^{\circ}C$
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	$R_{th(j-c)}$		0.59	K/W
Diode thermal resistance, junction - case	$R_{th(j-c)}$		0.59	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		55	K/W

Electrical Characteristic, at $T_{vj} = 25^{\circ}\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0V, I_C = 0.50mA$	1200	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	$V_{GE} = 15.0V, I_C = 15.0A$ $T_{vj} = 25^{\circ}C$ $T_{vj} = 125^{\circ}C$ $T_{vj} = 175^{\circ}C$	- - -	1.48 1.70 1.80	1.70 - -	V
Diode forward voltage	V_F	$V_{GE} = 0V, I_F = 15.0A$ $T_{vj} = 25^{\circ}C$ $T_{vj} = 125^{\circ}C$ $T_{vj} = 175^{\circ}C$	- - -	1.55 1.70 1.80	1.75 - -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 0.40mA, V_{CE} = V_{GE}$	5.1	5.8	6.4	V
Zero gate voltage collector current	I_{CES}	$V_{CE} = 1200V, V_{GE} = 0V$ $T_{vj} = 25^{\circ}C$ $T_{vj} = 175^{\circ}C$	- -	- -	100.0 2500.0	μA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0V, V_{GE} = 20V$	-	-	100	nA
Transconductance	g_{fs}	$V_{CE} = 20V, I_C = 15.0A$	-	13.9	-	S
Integrated gate resistor	r_G			none		Ω

Electrical Characteristic, at $T_{vj} = 25^{\circ}\text{C}$, 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	-	1165	-	pF
Output capacitance	C _{oes}		-	40	-	
Reverse transfer capacitance	C _{res}		-	32	-	
Gate charge	Q _G	V _{CC} = 960V, I _C = 15.0A, V _{GE} = 15V	-	165.0	-	nC

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Turn-off delay time	$t_{d(off)}$	$T_{vj} = 25^{\circ}\text{C},$ $V_{CC} = 600V, I_C = 15.0A,$ $V_{GE} = 0.0/15.0V,$ $r_G = 14.6\Omega, L\sigma = 180nH,$ $C\sigma = 39pF$ $L\sigma, C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	300	-	ns
Fall time	t_f		-	46	-	ns
Turn-off energy	E_{off}		-	0.70	-	mJ

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	

IGBT Characteristic, at $T_{vj} = 175^{\circ}\text{C}$

Turn-off delay time	$t_{d(off)}$	$T_{vj} = 175^{\circ}\text{C}$, $V_{CC} = 600\text{V}$, $I_C = 15.0\text{A}$, $V_{GE} = 0.0/15.0\text{V}$, $r_G = 14.6\Omega$, $L\sigma = 180\text{nH}$, $C\sigma = 39\text{pF}$ $L\sigma$, $C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	370	-	ns
Fall time	t_f		-	90	-	ns
Turn-off energy	E_{off}		-	1.25	-	mJ

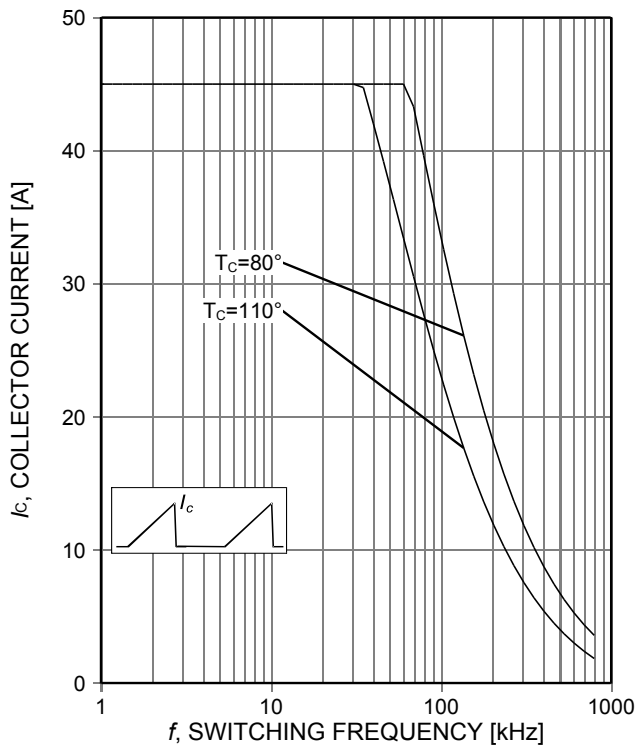


Figure 1. **Collector current as a function of switching frequency**
($T_J \leq 175^\circ\text{C}$, $D=0.5$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $r_G=14,6\Omega$)

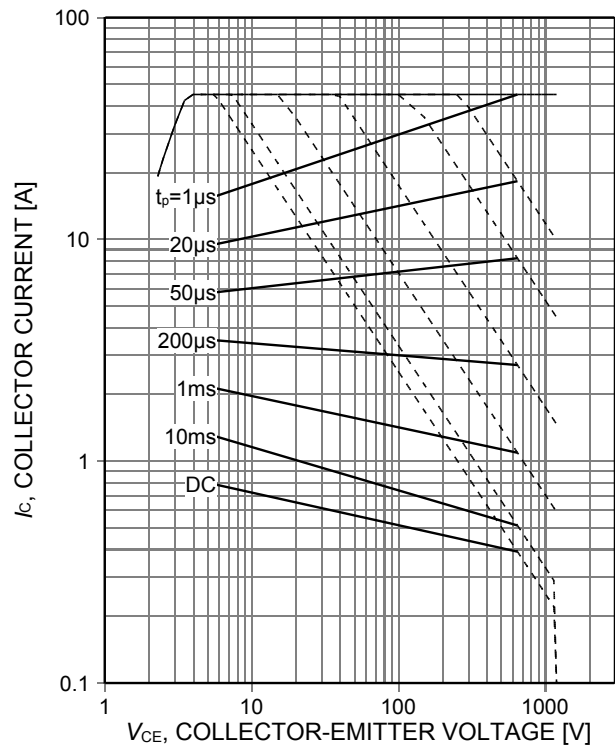


Figure 2. **Forward bias safe operating area**
($D=0$, $T_C=25^\circ\text{C}$, $T_J \leq 175^\circ\text{C}$; $V_{GE}=15\text{V}$)

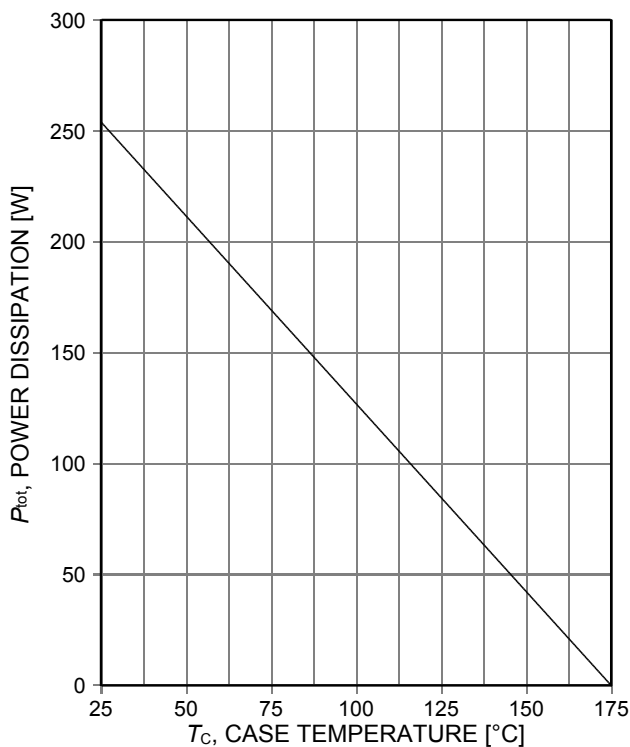


Figure 3. **Power dissipation as a function of case temperature**
($T_J \leq 175^\circ\text{C}$)

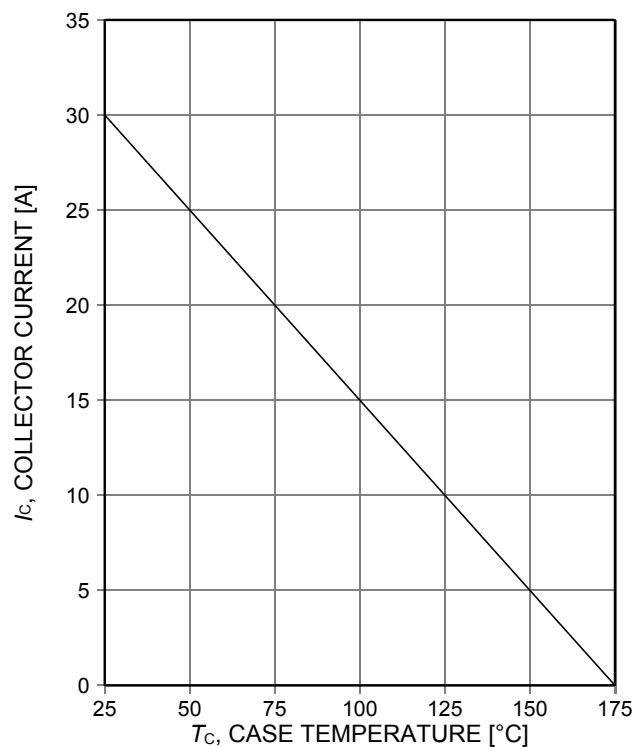


Figure 4. **Collector current as a function of case temperature**
($V_{GE} \geq 15\text{V}$, $T_J \leq 175^\circ\text{C}$)

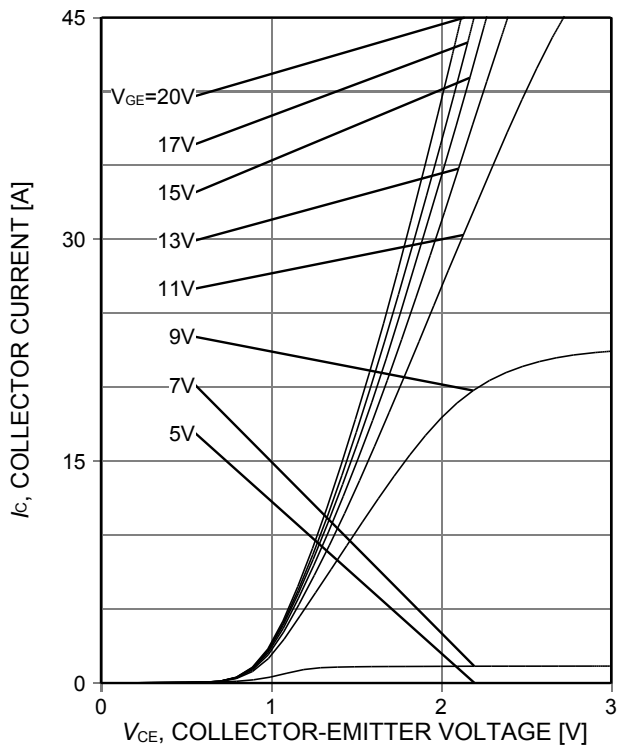


Figure 5. **Typical output characteristic**
($T_j=25^\circ\text{C}$)

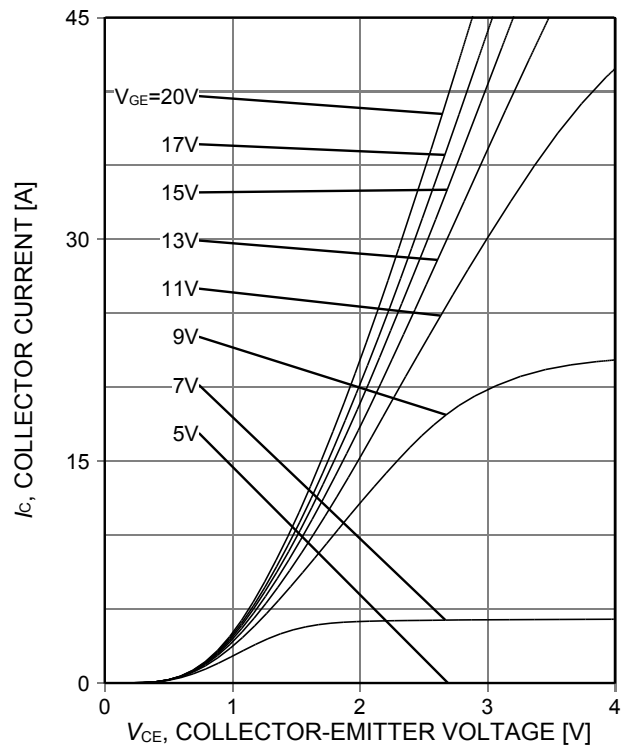


Figure 6. **Typical output characteristic**
($T_j=175^\circ\text{C}$)

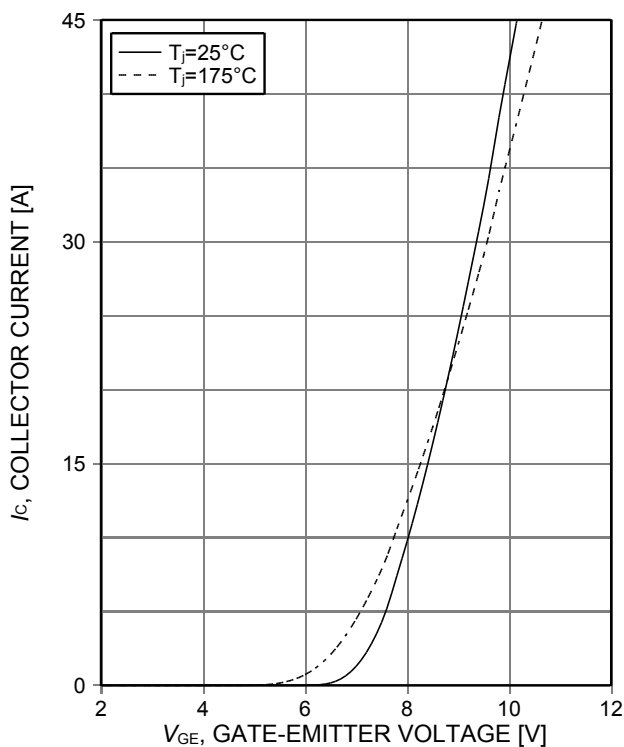


Figure 7. **Typical transfer characteristic**
($V_{CE}=20\text{V}$)

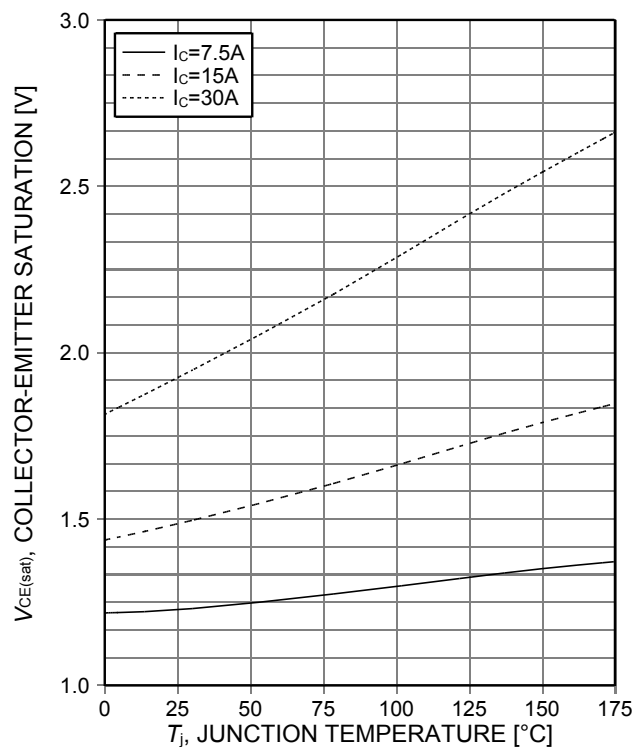


Figure 8. **Typical collector-emitter saturation voltage as a function of junction temperature**
($V_{GE}=15\text{V}$)

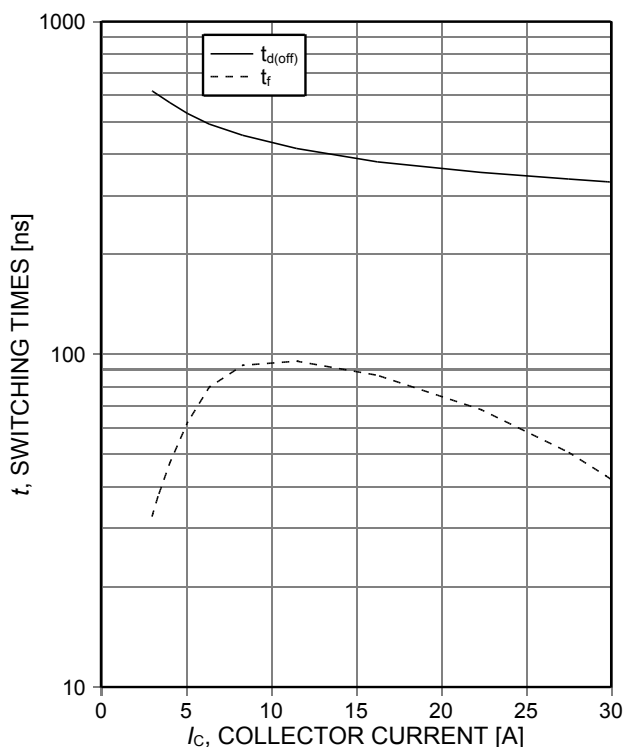


Figure 9. **Typical switching times as a function of collector current**
(ind. load, $T_J=175^{\circ}\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $r_G=14,6\Omega$, test circuit in Fig. E)

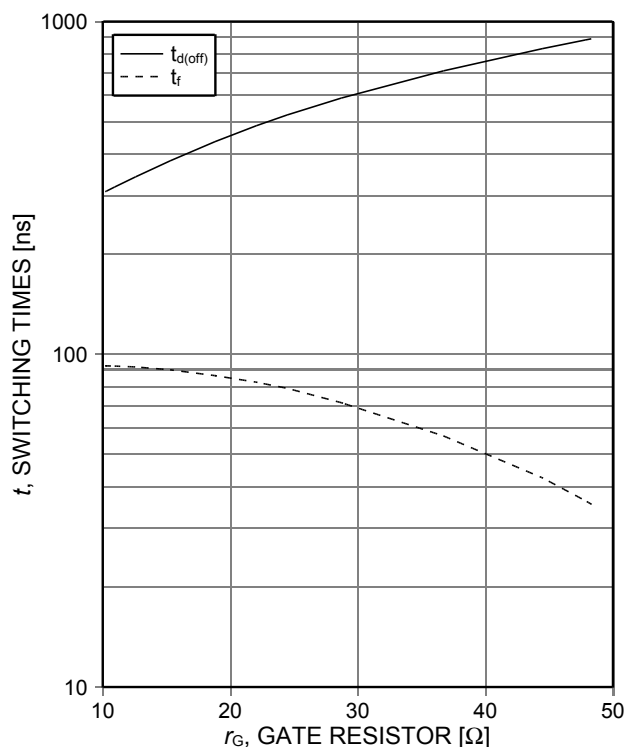


Figure 10. **Typical switching times as a function of gate resistor**
(ind. load, $T_J=175^{\circ}\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=15\text{A}$, test circuit in Fig. E)

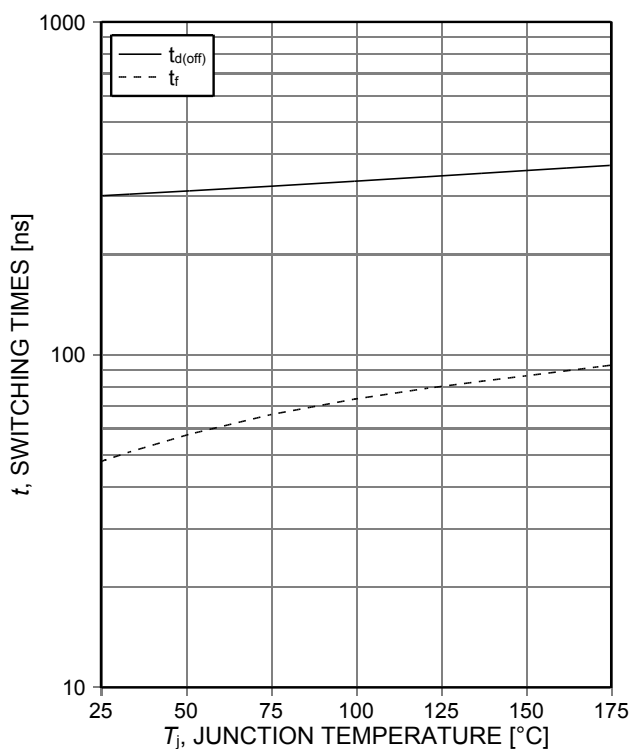


Figure 11. **Typical switching times as a function of junction temperature**
(ind. load, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=15\text{A}$, $r_G=14,6\Omega$, test circuit in Fig. E)

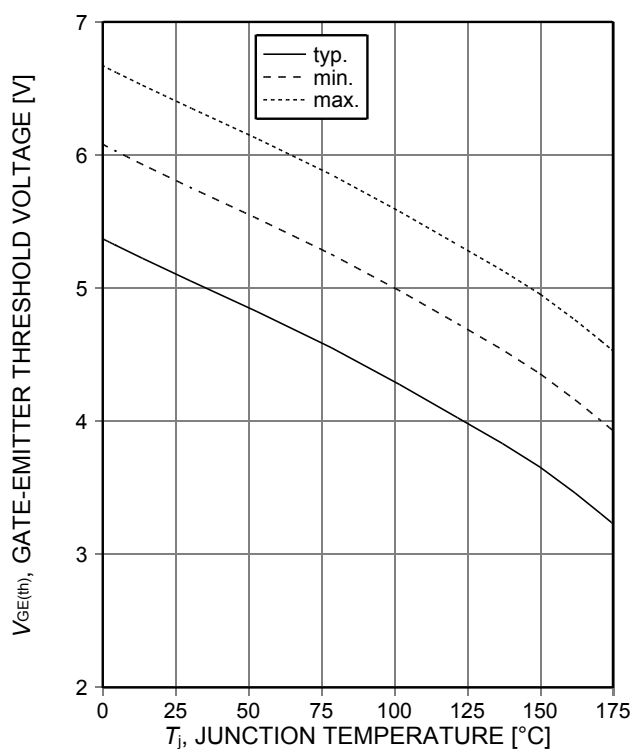


Figure 12. **Gate-emitter threshold voltage as a function of junction temperature**
($I_C=0.4\text{mA}$)

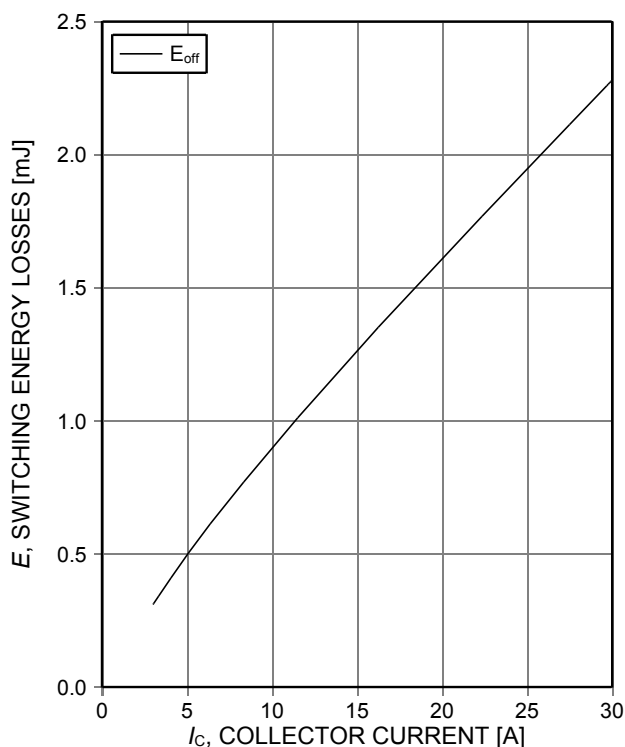


Figure 13. **Typical switching energy losses as a function of collector current**
(ind. load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $r_G=14,6\Omega$, test circuit in Fig. E)

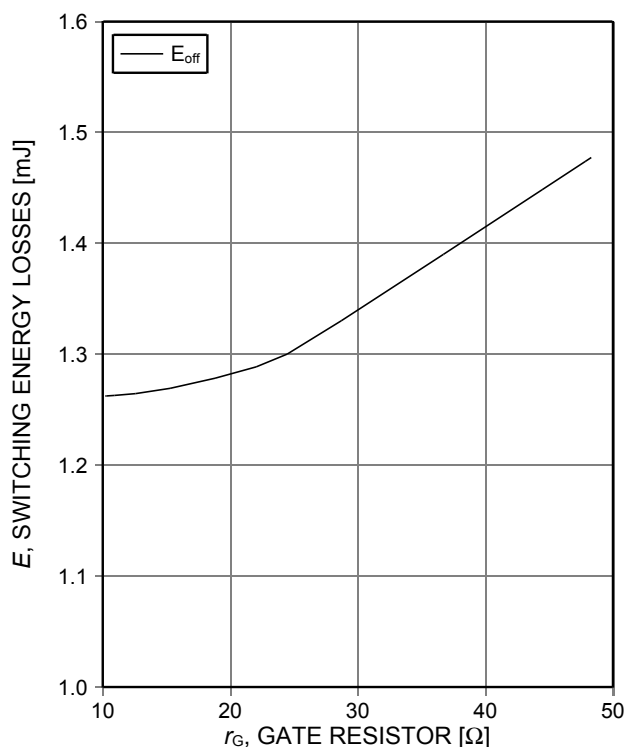


Figure 14. **Typical switching energy losses as a function of gate resistor**
(ind. load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=15\text{A}$, test circuit in Fig. E)

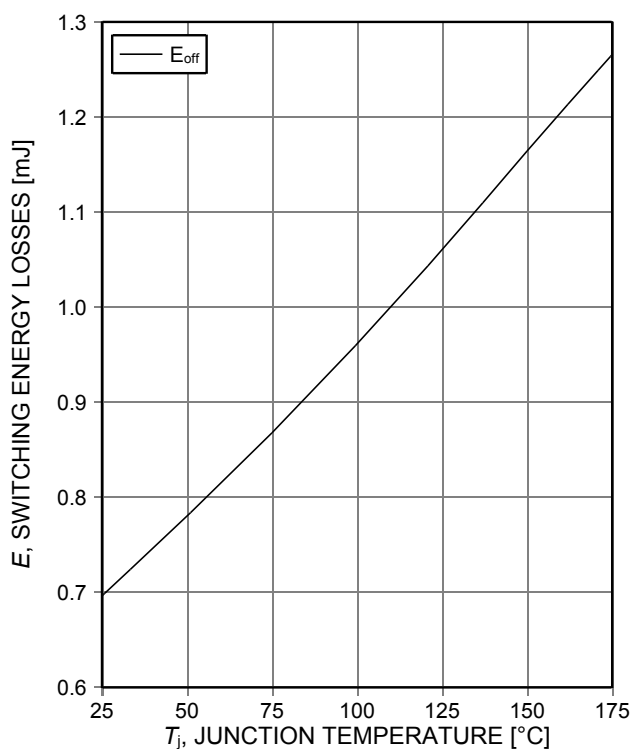


Figure 15. **Typical switching energy losses as a function of junction temperature**
(ind load, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=15\text{A}$, $r_G=14,6\Omega$, test circuit in Fig. E)

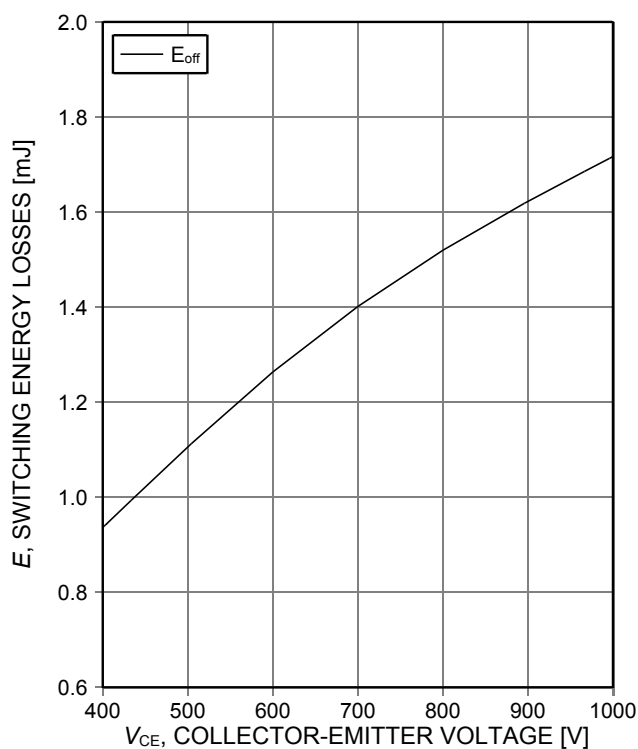


Figure 16. **Typical switching energy losses as a function of collector-emitter voltage**
(ind. load, $T_J=175^\circ\text{C}$, $V_{GE}=15/0\text{V}$, $I_C=15\text{A}$, $r_G=14,6\Omega$, test circuit in Fig. E)

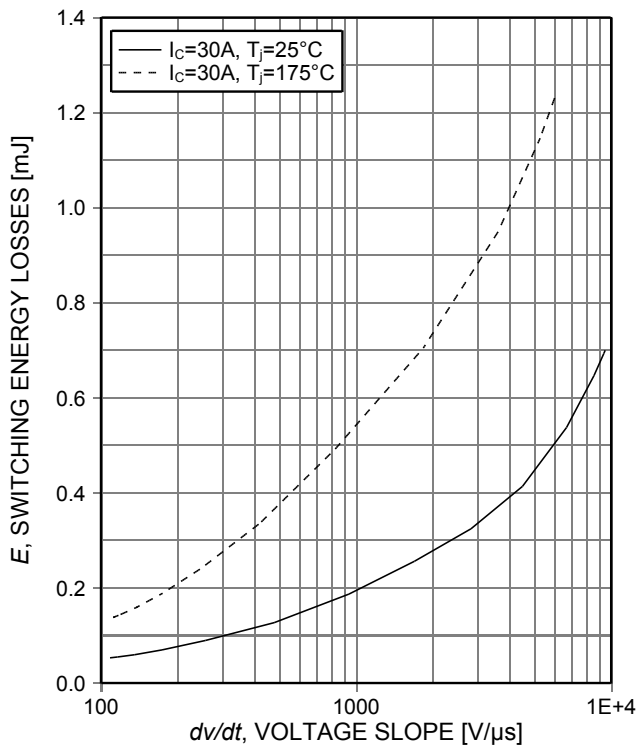


Figure 17. **Typical turn off switching energy loss for soft switching**
(ind load, $V_{CE}=600V$, $V_{GE}=15/0V$, $I_C=15A$, $R_G=14,6\Omega$, Dynamic test circuit in Fig. E)

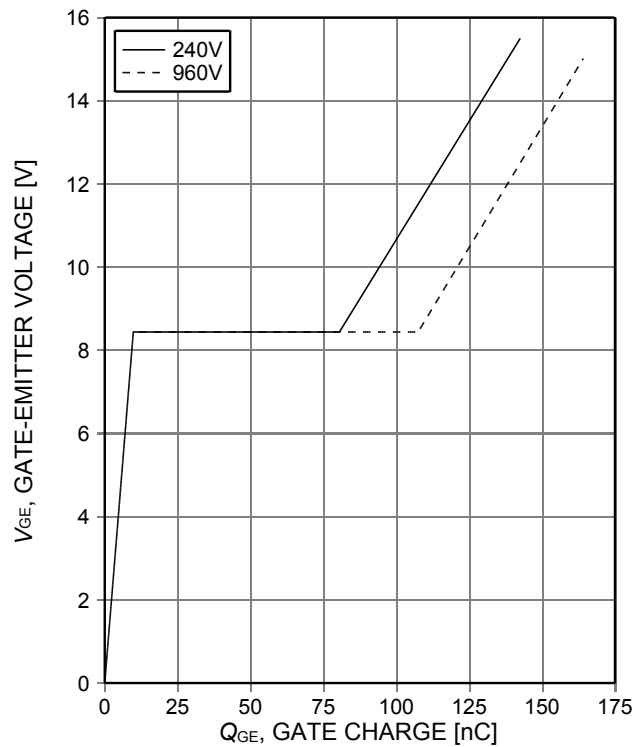


Figure 18. **Typical gate charge**
($I_C=15A$)

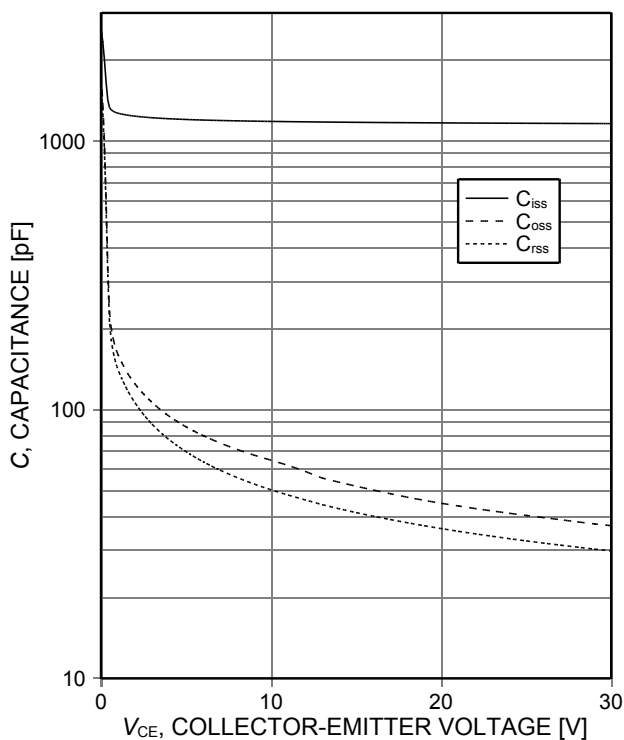


Figure 19. **Typical capacitance as a function of collector-emitter voltage**
($V_{GE}=0V$, $f=1MHz$)

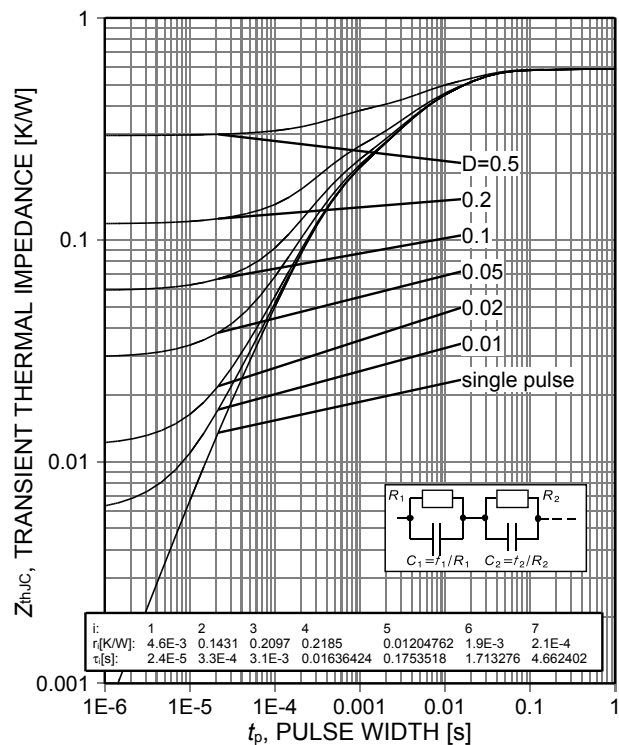


Figure 20. **IGBT transient thermal impedance**
($D=t_p/T$)

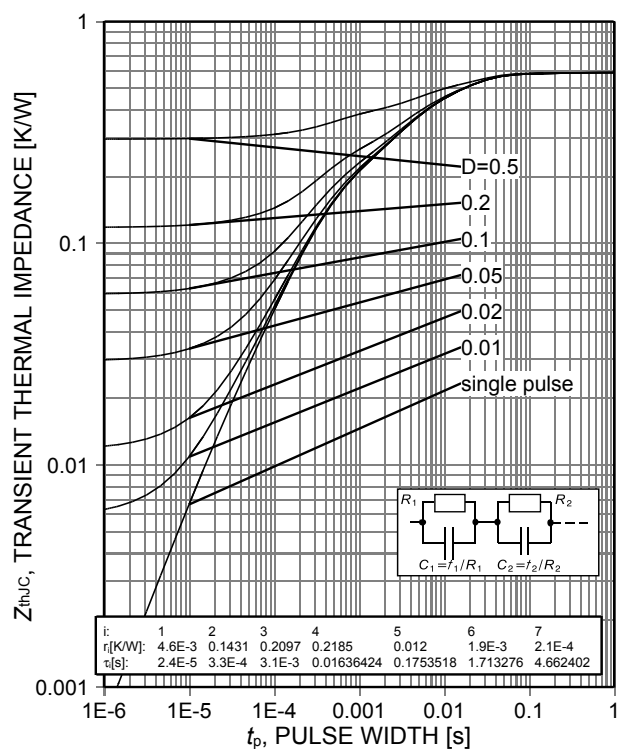


Figure 21. Diode transient thermal impedance as a function of pulse width ($D=t_p/T$)

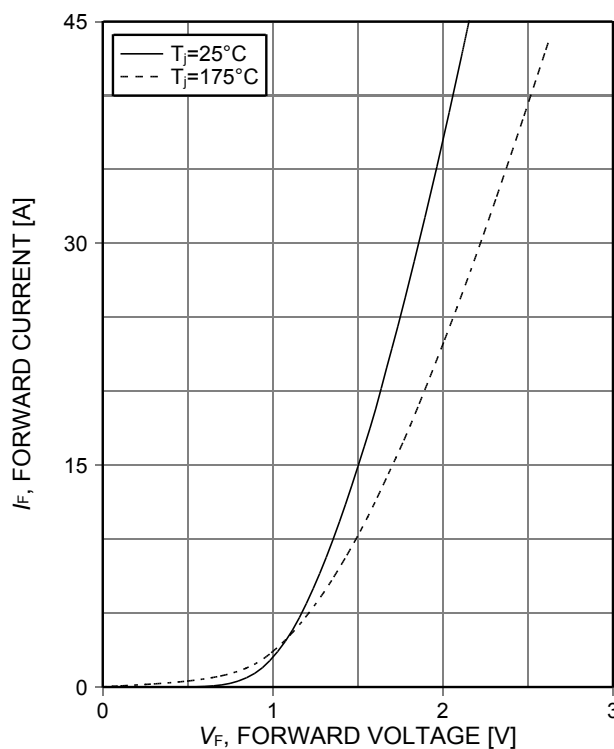


Figure 22. Typical diode forward current as a function of forward voltage

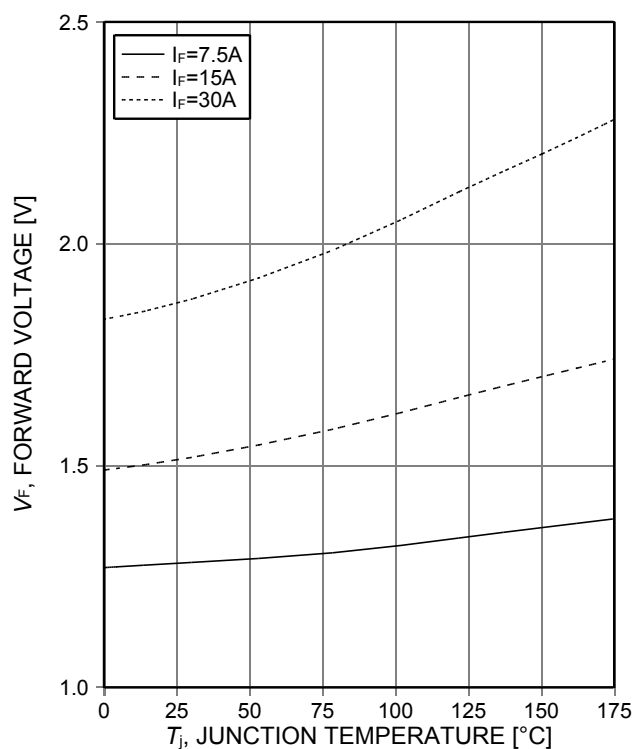
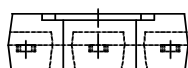
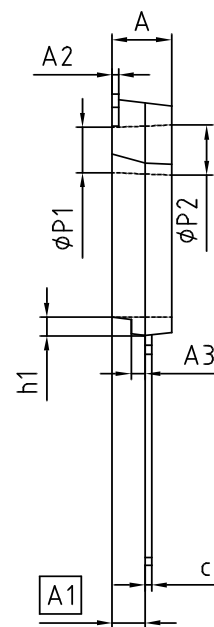
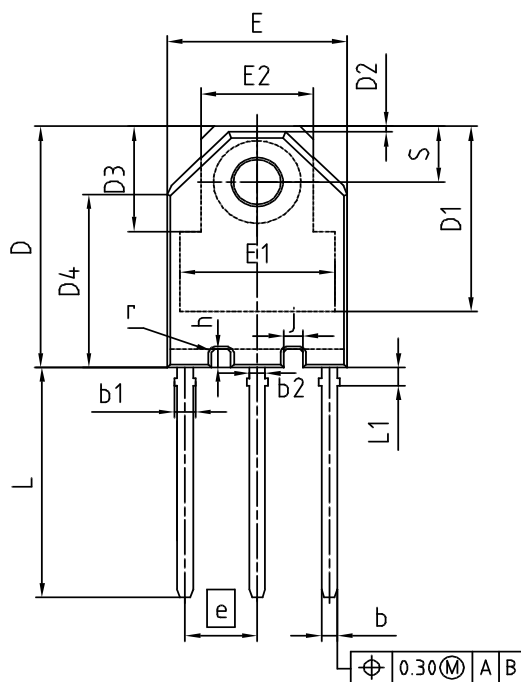


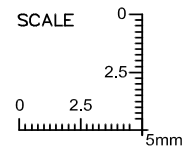
Figure 23. Typical diode forward voltage as a function of junction temperature

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

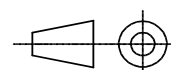


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.40	4.60	0.173	0.181
A1	2.40	2.60	0.094	0.102
A2	0.40	0.60	0.016	0.024
A3	0.95	1.15	0.037	0.045
b	1.10	1.30	0.043	0.051
b1	1.50	1.70	0.059	0.067
b2	1.10	1.30	0.043	0.051
c	0.40	0.60	0.016	0.024
D	19.05	19.45	0.750	0.766
D1	14.69	14.89	0.578	0.586
D2	0.35	0.55	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

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Z8B00151733



EUROPEAN PROJECTION



ISSUE DATE
11-03-2009

REVISION
01

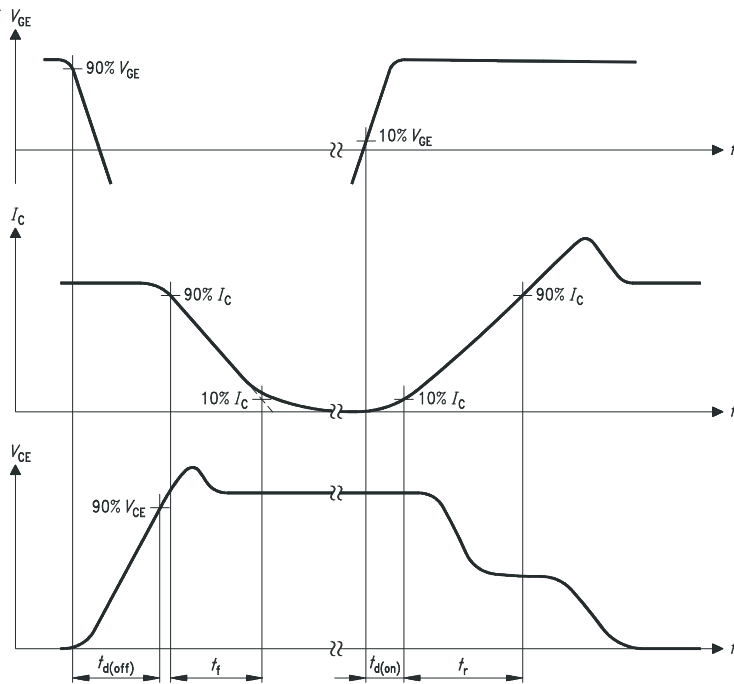


Figure A. Definition of switching times

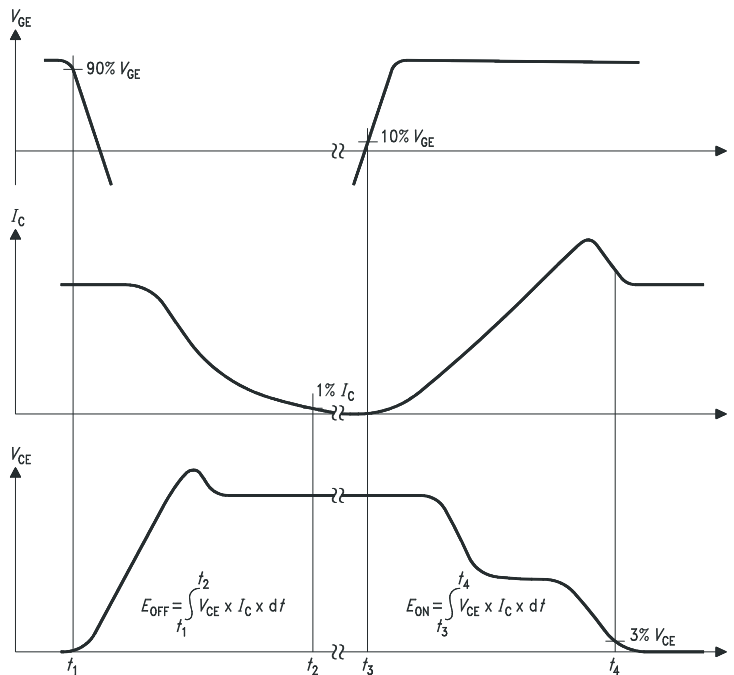


Figure B. Definition of switching losses

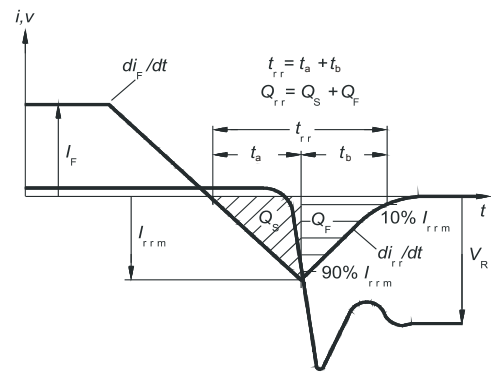


Figure C. Definition of diodes switching characteristics

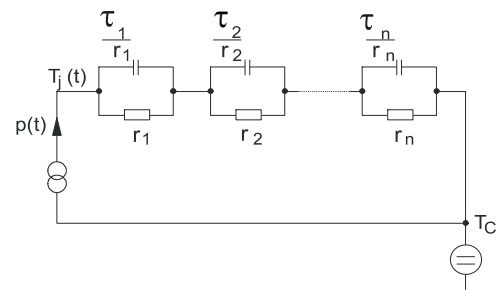


Figure D. Thermal equivalent circuit

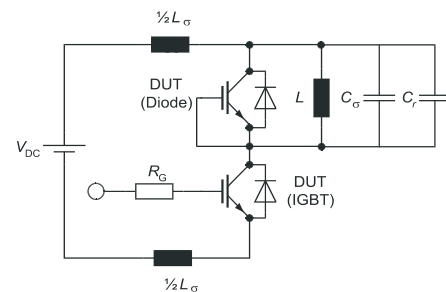


Figure E. Dynamic test circuit
Parasitic inductance L_σ ,
Parasitic capacitor C_σ ,
Relief capacitor C_r
(only for ZVT switching)

Revision History

IHY15N120R3

Revision: 2013-02-12, Rev. 2.3

Previous Revision

Revision	Date	Subjects (major changes since last revision)
1.1	2009-07-10	-
1.2	2009-07-11	-
1.3	2009-10-30	-
1.4	2009-10-30	-
2.1	2009-11-25	-
2.2	2010-07-13	Cover sheet, features list
2.3	2013-02-12	Layout change

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