IH-series

Reverse conducting IGBT with monolithic body diode

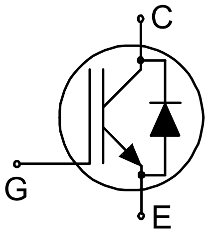
IHY20N135R3

Datasheet

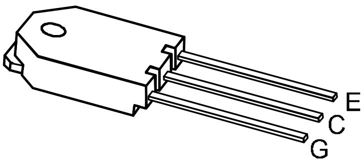
Industrial & Multimarket

Reverse conducting IGBT with monolithic body diode

Features:



- Offers new higher breakdown voltage to 1350V for improved reliability
- 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/



PG-TO247HC-3

Applications:

- Inductive cooking

Key Performance and Package Parameters

Type	V_{CE}	I_C	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Marking	Package
IHY20N135R3	1350V	20A	1.6V	175°C	H20R1353	PG-TO247HC-3

Table of Contents

Description 2
Table of Contents 3
Maximum ratings 4
Thermal Resistance 4
Electrical Characteristics 5
Electrical Characteristics diagrams 7
Package Drawing 13
Testing Conditions 14
Revision History 15
Disclaimer 15

Maximum ratings

Parameter	**Symbol**	**Value**	**Unit**
Collector-emitter voltage	V_{CE}	1350	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 $V_{CE} \le 1350$V, $T_{vj} \le 175$°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, wave soldering 1.6 mm (0.063 in.) from case for 10s		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	1350	-	-	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	- - -	1.60 1.80 1.90	1.80 - -	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	- - -	1.60 1.73 1.80	1.80 -	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} = 1350V, 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	-	14.8	-	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	-	1500	-	pF
Output capacitance	C_{oes}		-	55	-	
Reverse transfer capacitance	C_{res}		-	45	-	
Gate charge	Q_G	V_{CC} = 1080V, I_C = 20.0A, V_{GE} = 15V	-	195.0	-	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 = 175nH, C_σ = 40pF L_σ, C_σ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	335	-	ns
Fall time	t_f		-	50	-	ns
Turn-off energy	E_{off}		-	1.30	-	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 = 175nH, C_σ = 40pF L_σ, C_σ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	405	-	ns
Fall time	t_f		-	100	-	ns
Turn-off energy	E_{off}		-	2.25	-	mJ

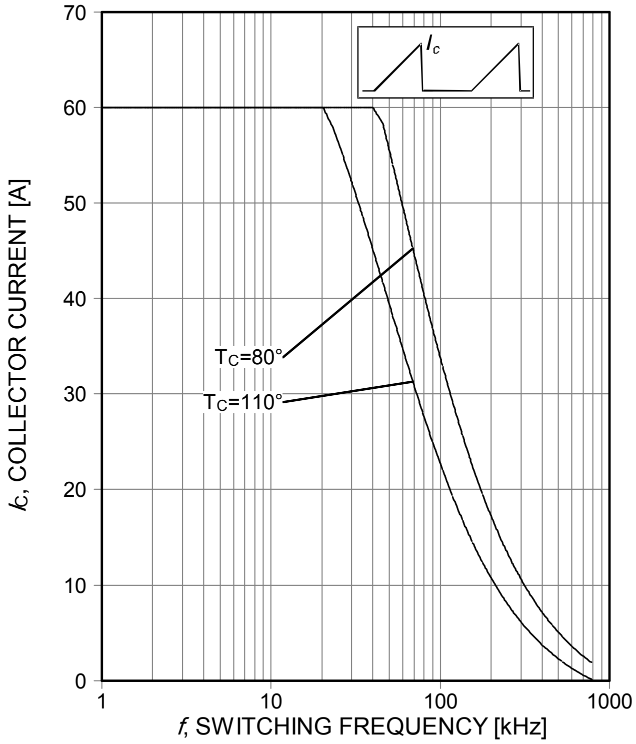


Figure 1. **Collector current as a function of switching frequency**
($T_{vj}\leq175°C$, D=0.5, V_{CE}=600V, V_{GE}=15/0V, r_G=15Ω)

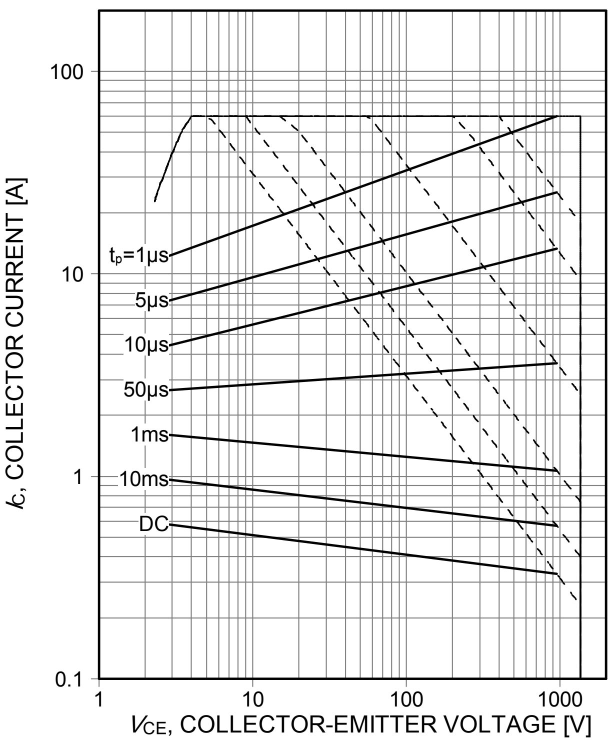


Figure 2. **Forward bias safe operating area**
(D=0, T_C=25°C, $T_{vj}\leq175°C$; V_{GE}=15V)

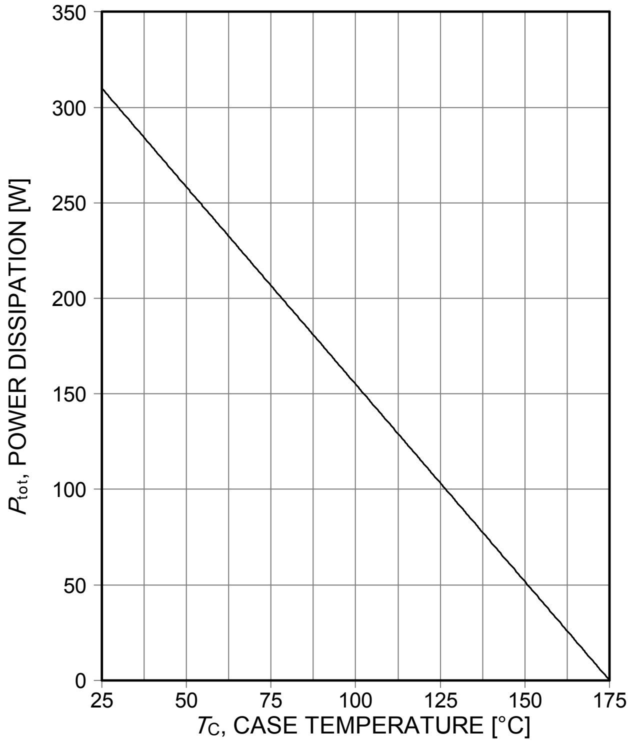


Figure 3. **Power dissipation as a function of case temperature**
($T_{vj}\leq175°C$)

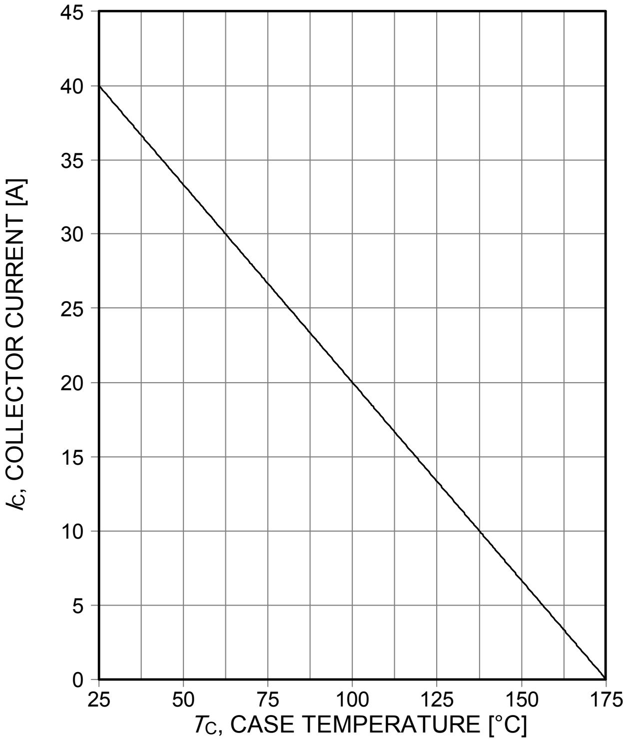


Figure 4. **Collector current as a function of case temperature**
($V_{GE}\geq15V$, $T_{vj}\leq175°C$)

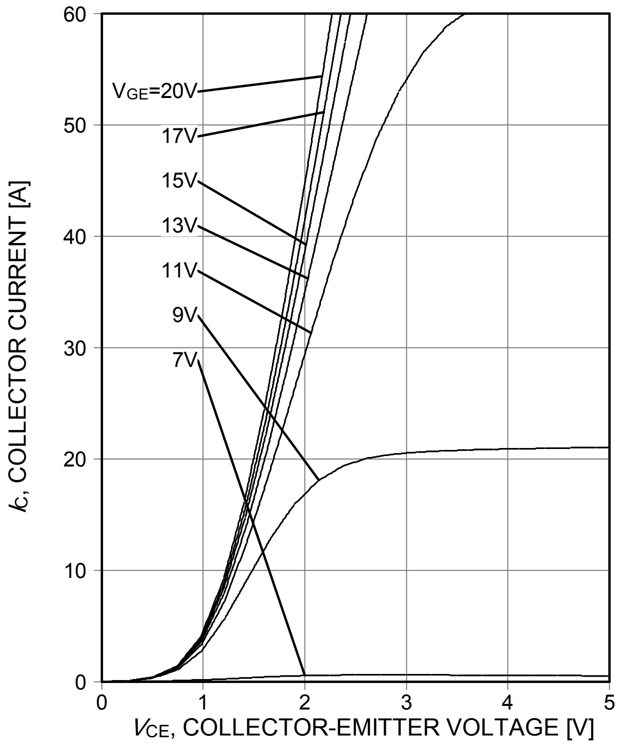


Figure 5. Typical output characteristic
(T_{vj}=25°C)

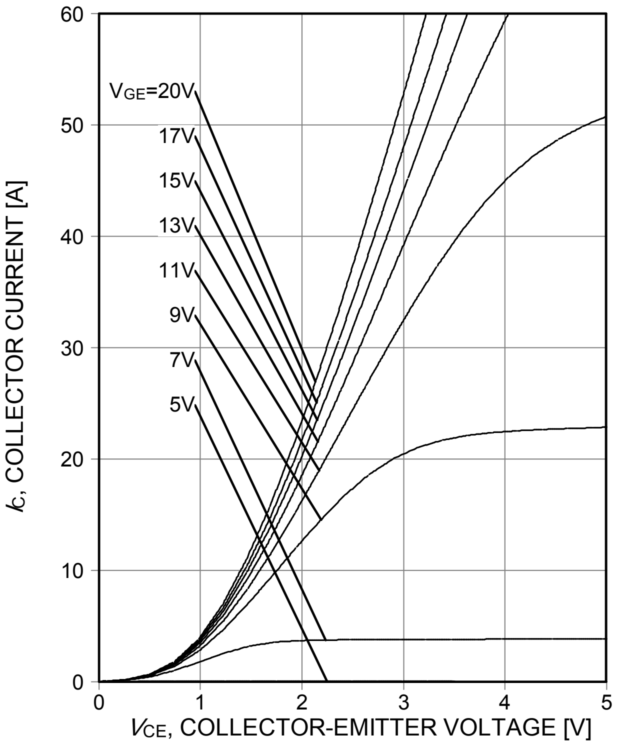


Figure 6. Typical output characteristic
(T_{vj}=175°C)

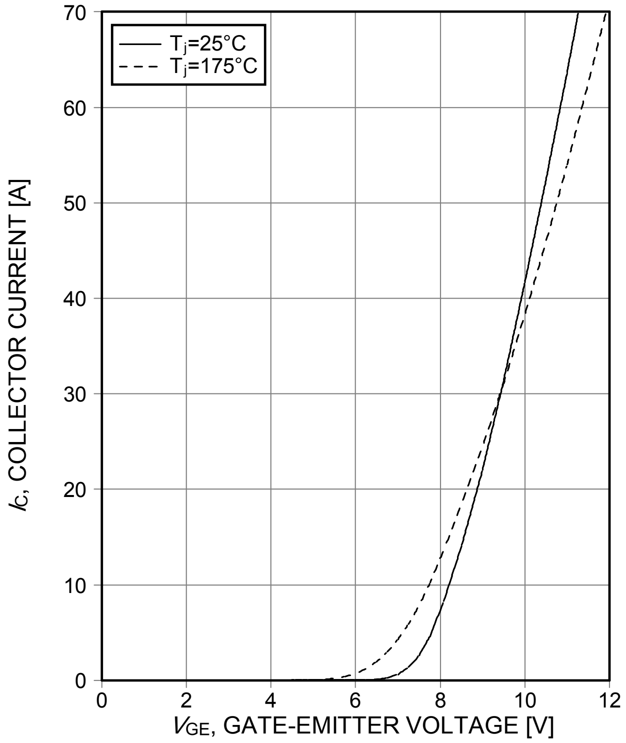


Figure 7. Typical transfer characteristic
(V_{CE}=20V)

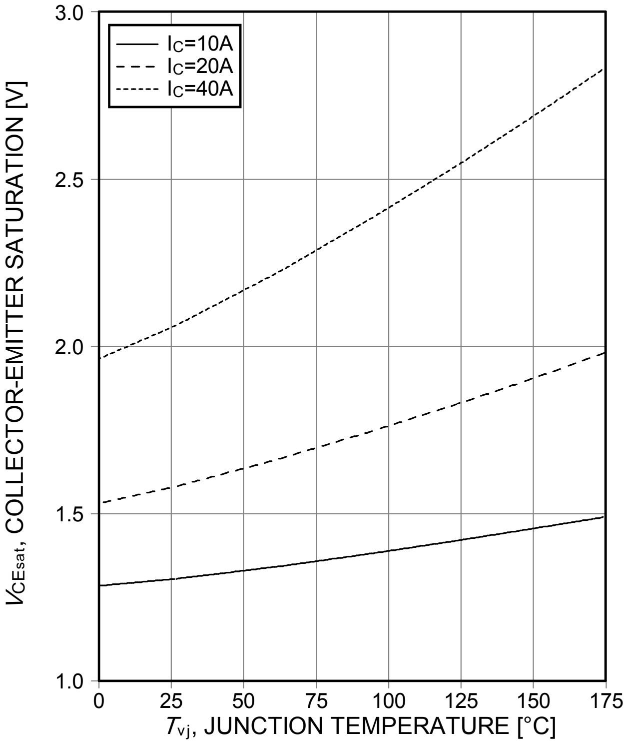


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE}=15V)

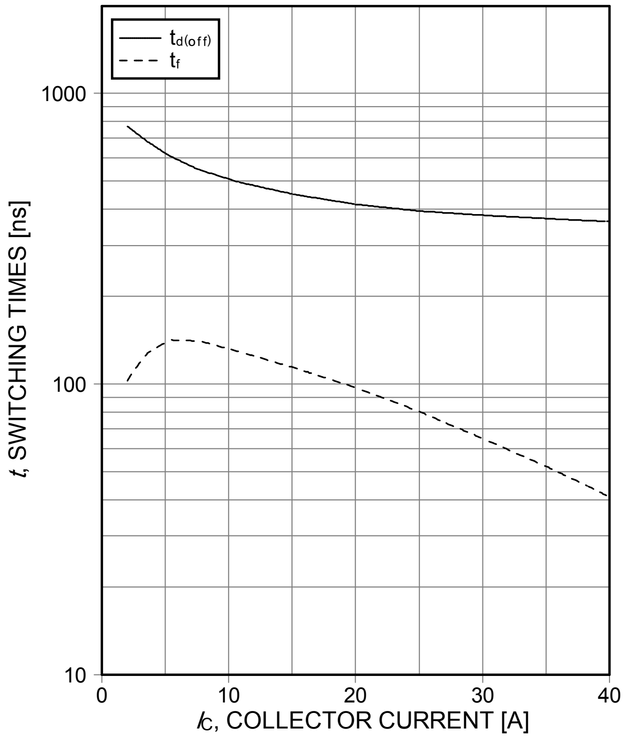


Figure 9. Typical switching times as a function of collector current
(inductive load, T_{vj}=175°C, V_{CE}=600V, V_{GE}=15/0V, r_G=15Ω, Dynamic test circuit in Figure E)

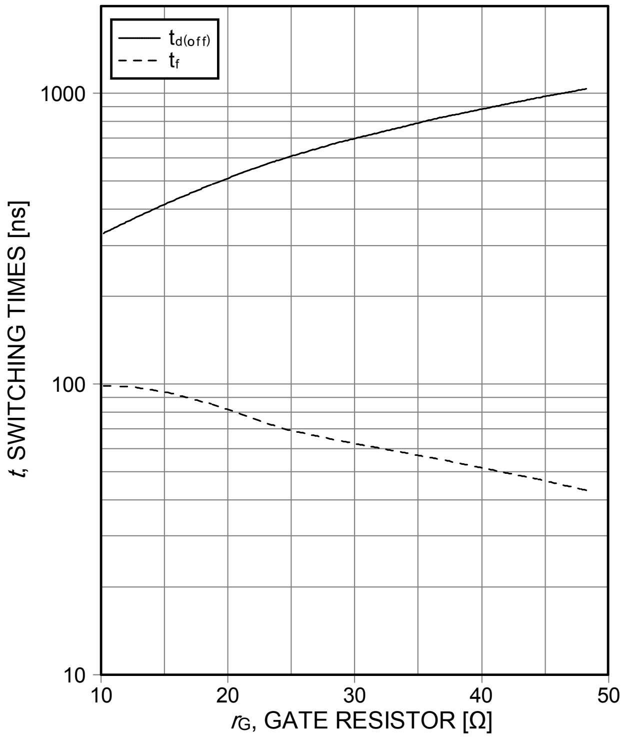


Figure 10. Typical switching times as a function of gate resistor
(inductive load, T_{vj}=175°C, V_{CE}=600V, V_{GE}=15/0V, I_C=20A,Dynamic test circuit in Figure E)

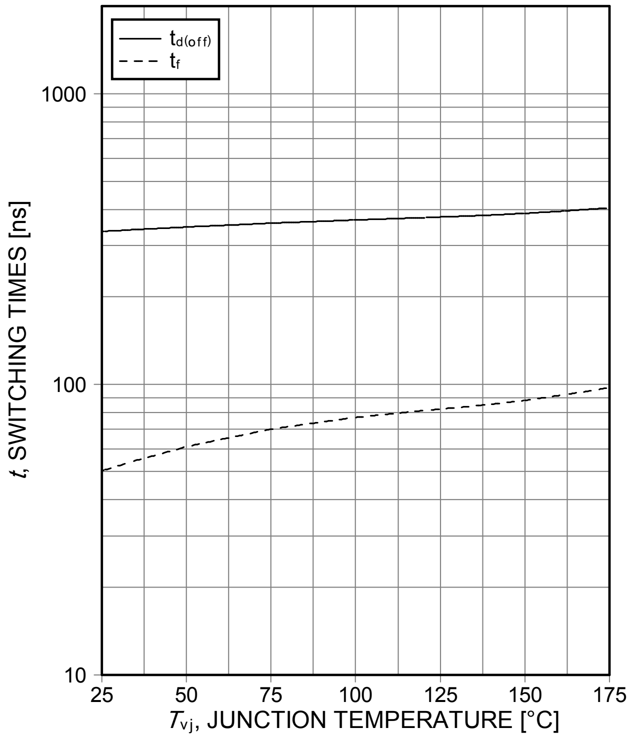


Figure 11. Typical switching times as a function of junction temperature
(inductive load, V_{CE}=600V, V_{GE}=15/0V, I_C=20A, r_G=15Ω,Dynamic test circuit in Figure E)

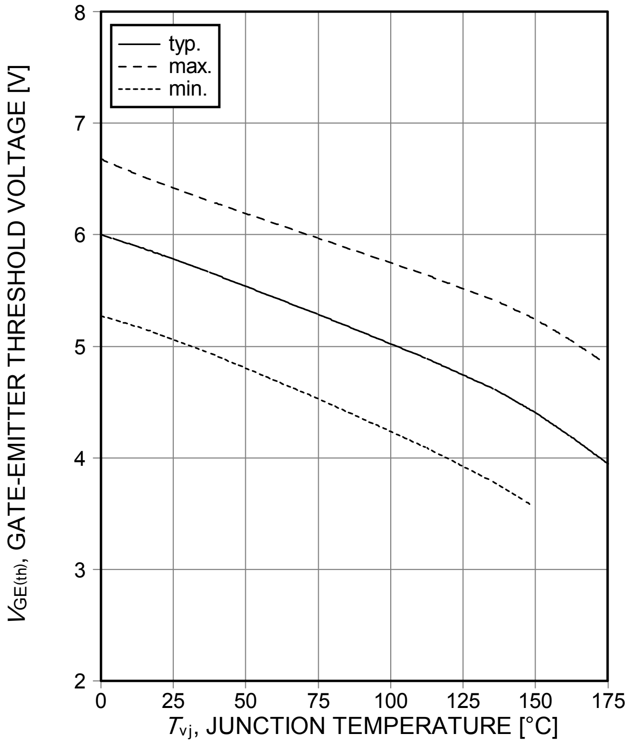


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
(I_C=0.5mA)

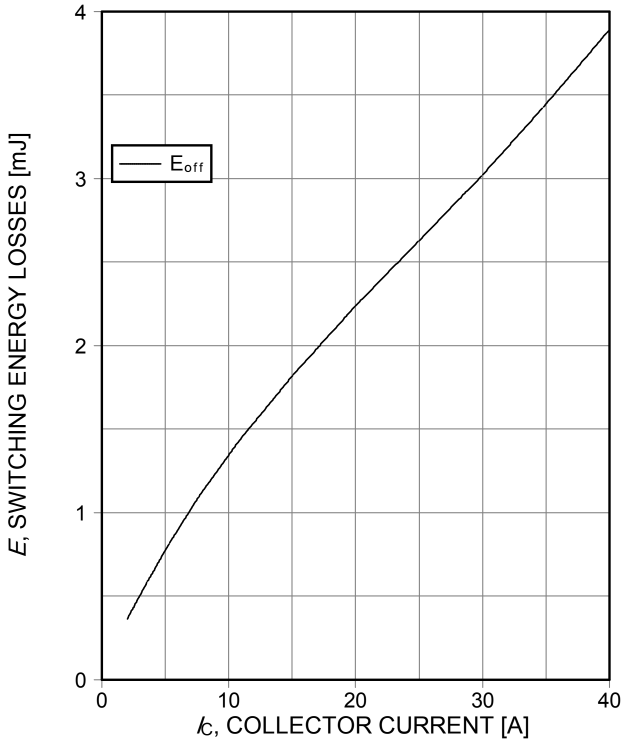


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, T_{vj}=175°C, V_{CE}=600V, V_{GE}=15/0V, r_G=15Ω,Dynamic test circuit in Figure E)

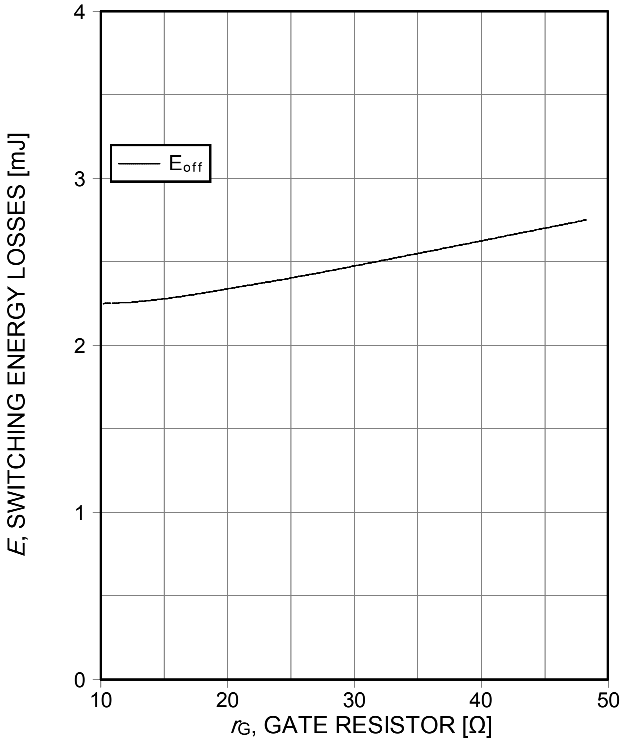


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, T_{vj}=175°C, V_{CE}=600V, V_{GE}=15/0V, I_C=20A, Dynamic test circuit in Figure E)

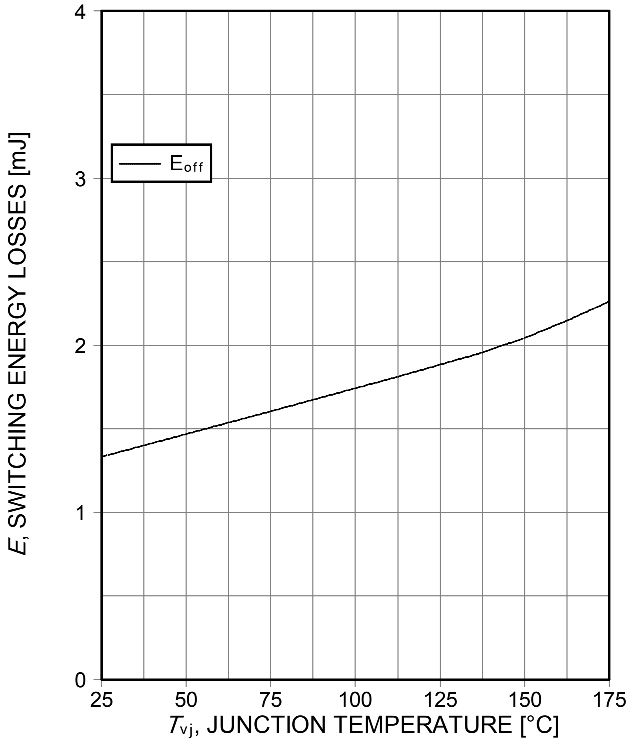


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE}=600V, V_{GE}=15/0V, I_C=20A, r_G=15Ω,Dynamic test circuit in Figure E)

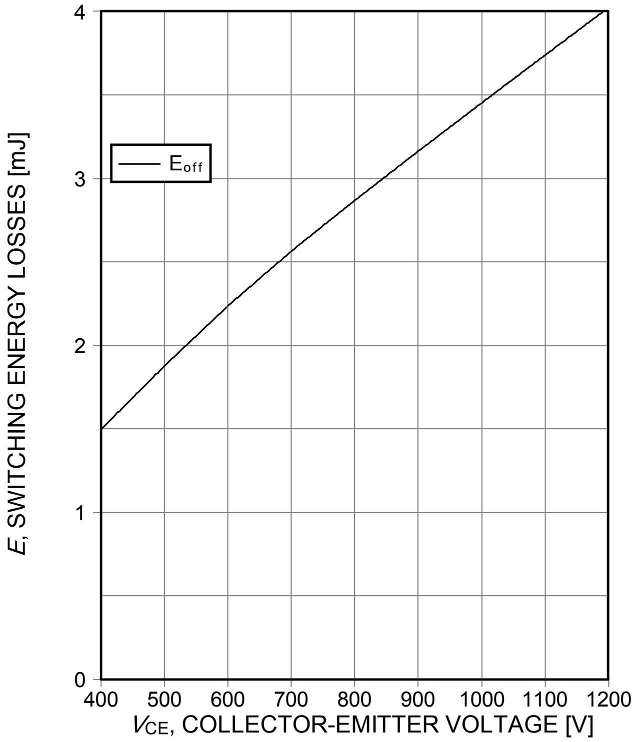


Figure 16. Typical switching energy losses as a function of collector emitter voltage
(inductive load, T_{vj}=175°C, V_{GE}=15/0V, I_C=20A, r_G=15Ω,Dynamic test circuit in Figure E)

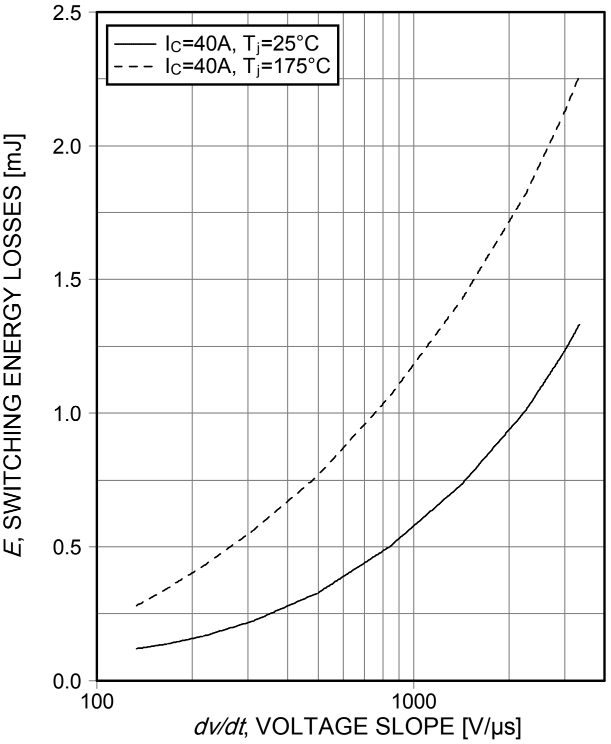


Figure 17. Typical turn off switching energy loss for soft switching
(inductive load, T_{vj}=175°C, V_{GE}=15/0V, I_C=20A, r_G=15Ω,Dynamic test circuit in Figure E)

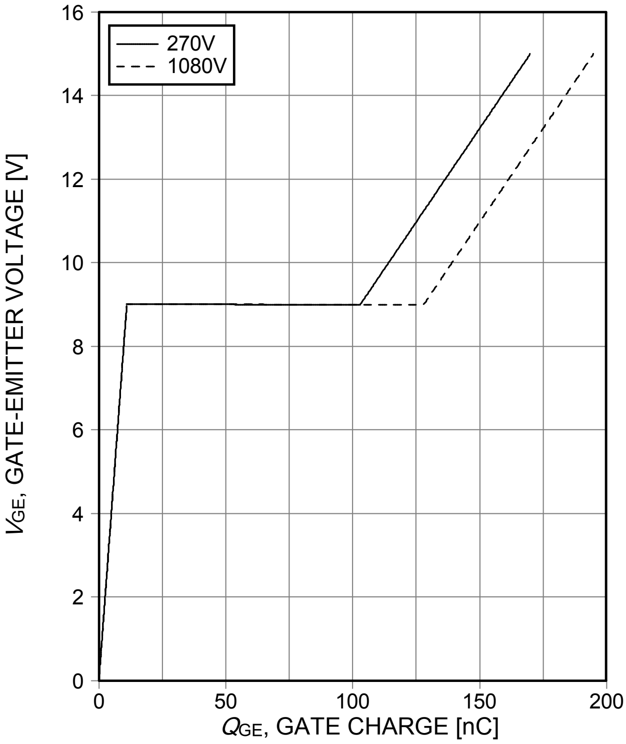


Figure 18. Typical gate charge
(I_C=20A)

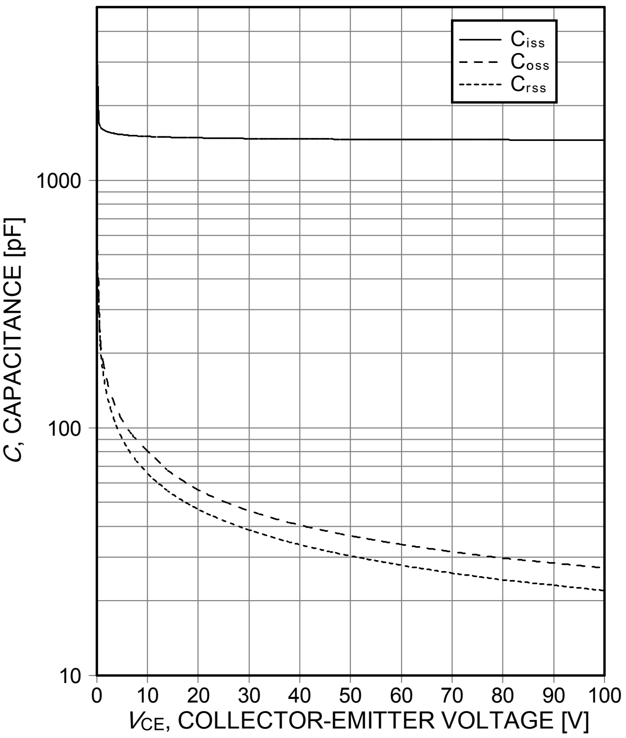
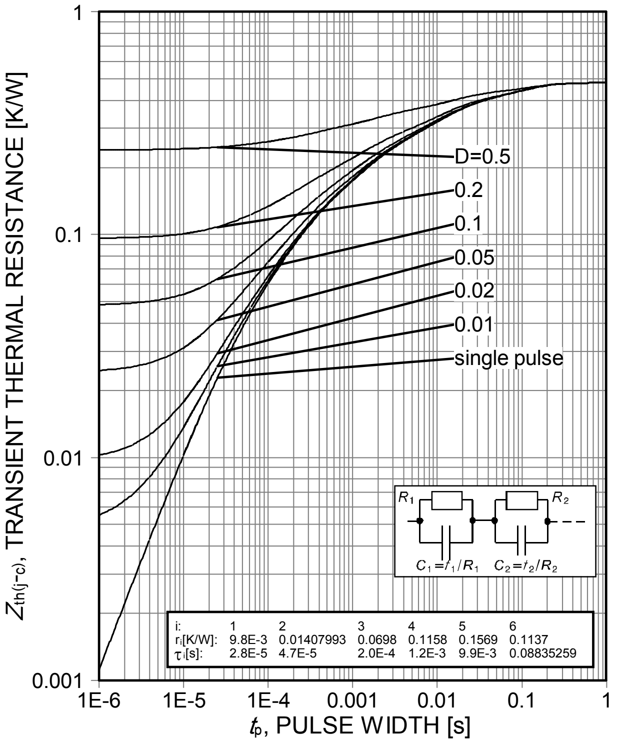
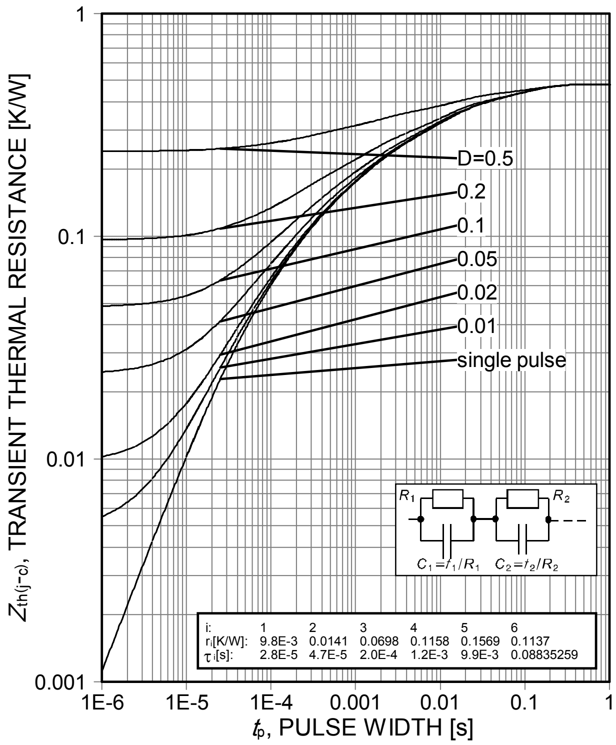


Figure 19. Typical capacitance as a function of collector-emitter voltage
(V_{GE}=0V, f=1MHz)



i:	1	2	3	4	5	6
r_i[K/W]:	9.8E-3	0.01407993	0.0698	0.1158	0.1569	0.1137
τ_i[s]:	2.8E-5	4.7E-5	2.0E-4	1.2E-3	9.9E-3	0.08835259

Figure 20. IGBT transient thermal resistance
(D=t_p/T)



i:	1	2	3	4	5	6
r_i[K/W]:	9.8E-3	0.0141	0.0698	0.1158	0.1569	0.1137
τ_i[s]:	2.8E-5	4.7E-5	2.0E-4	1.2E-3	9.9E-3	0.08835259

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

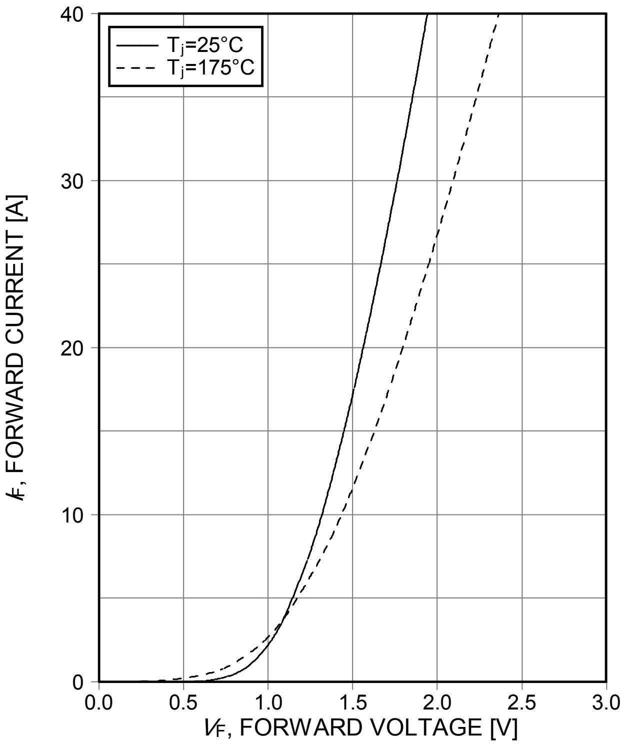


Figure 22. Typical diode forward current as a function of forward voltage

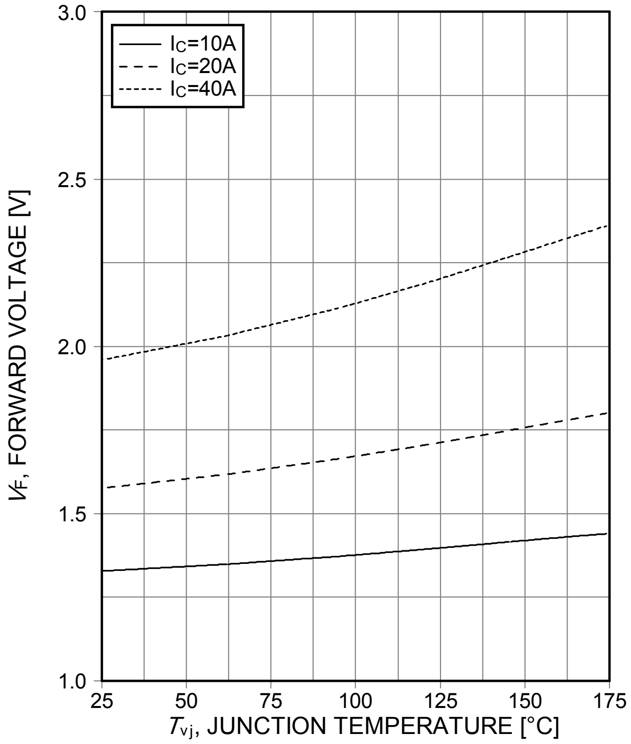
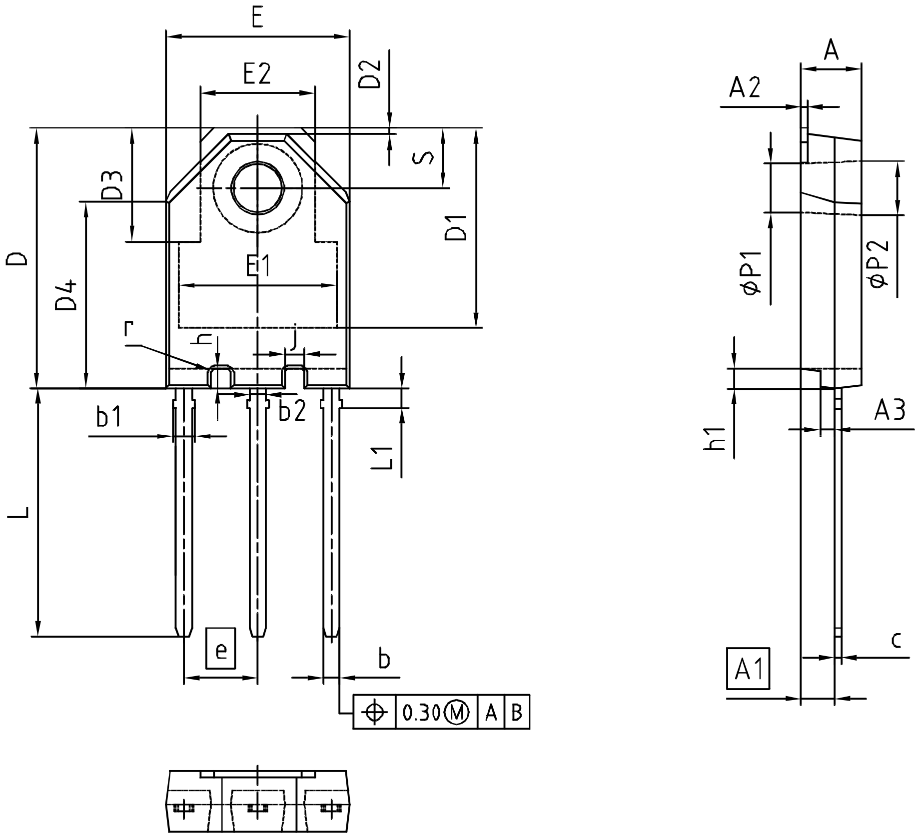


Figure 23. Typical diode forward voltage as a function of junction temperature

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

DOCUMENT NO.
Z8B00151733

SCALE 0 2.5 5mm

EUROPEAN PROJECTION

ISSUE DATE
11-03-2009

REVISION
01

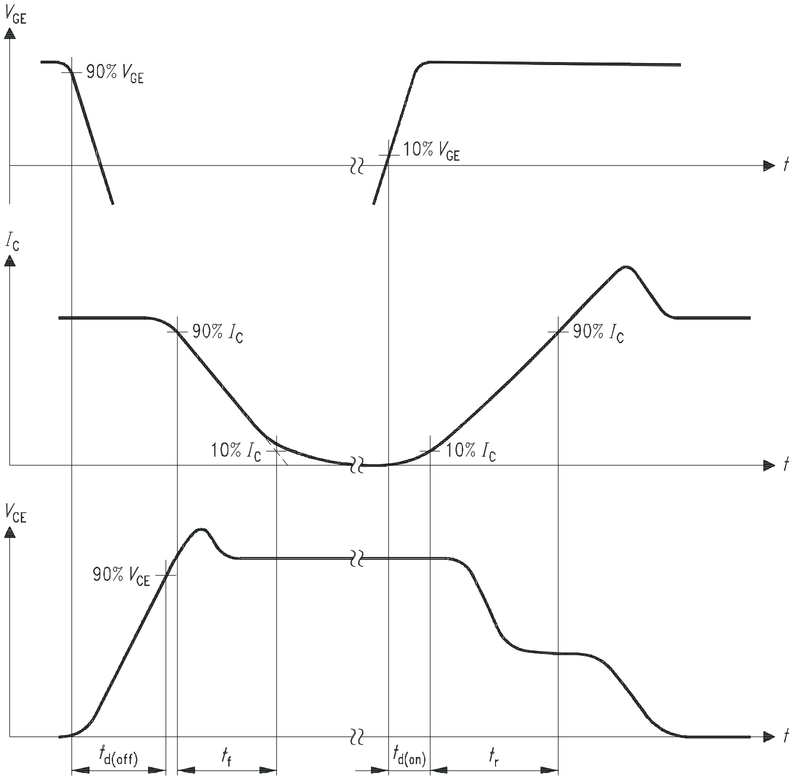


Figure A. Definition of switching times

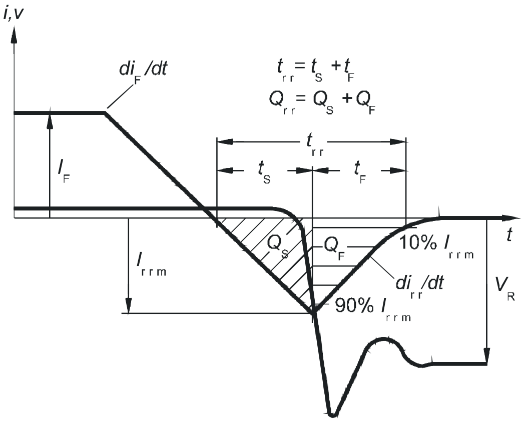


Figure C. Definition of diodes switching characteristics

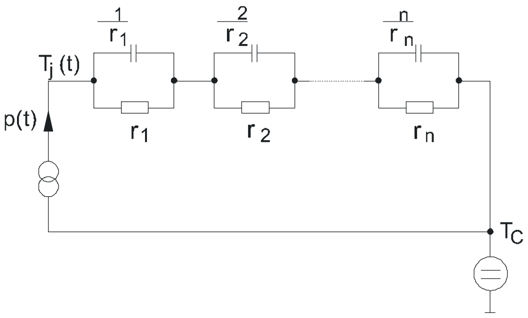


Figure D. Thermal equivalent circuit

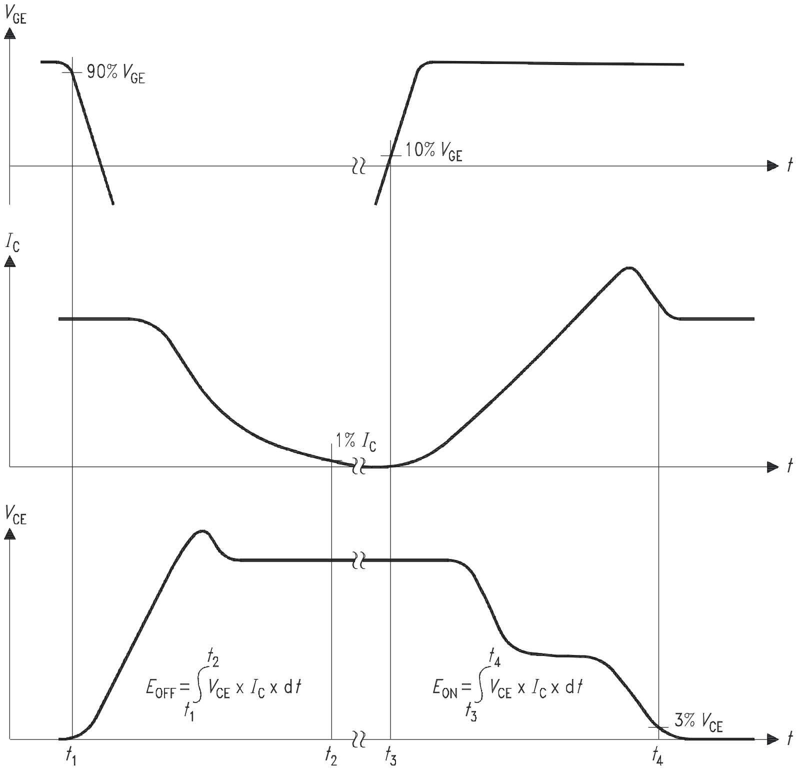


Figure B. Definition of switching losses

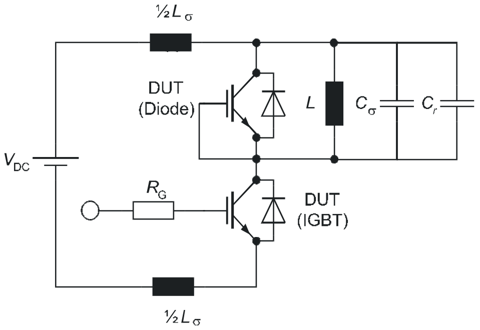


Figure E. Dynamic test circuit

Parasitic inductance L_σ,
Parasitic capacitor C_σ,
Relief capacitor C_r
(only for ZVT switching)

Revision History

IHY20N135R3

Revision: 2010-07-13, Rev. 2.1

Previous Revision

Revision	Date	Subjects (major changes since last revision)
0.1	2010-01-11	-
1.1	2010-02-04	-
2.1	-	Cover sheet, features list

We Listen to Your Comments
Any information within this document that you feel is wrong, unclear or missing at all ?
Your feedback will help us to continuously improve the quality of this document.
Please send your proposal (including a reference to this document) to: erratum@infineon.com

Published by
Infineon Technologies AG
81726 Munich, Germany
81726 München, Germany

Information
For further information on technology, delivery terms and conditions and prices, please contact the nearest Infineon Technologies Office (www.infineon.com).

Warnings
Due to technical requirements, components may contain dangerous substances. For information on the types in question, please contact the nearest Infineon Technologies Office. Infineon Technologies components may be used in life-support devices or systems only with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.