Resonant Switching Series

Reverse Conducting IGBT with monolithic body diode

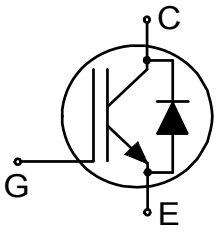
IHW20N120R5

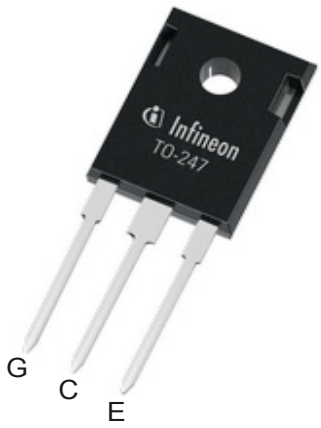
Data sheet

Industrial Power Control

Resonant Switching Series

Reverse Conducting IGBT with monolithic body diode





Features:

• Powerful monolithic body diode with low forward voltage designed for soft commutation
• 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
• 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
• Inverterized microwave ovens
• Resonant converters
• Soft switching applications

Product Validation:

Qualified for industrial applications according to the relevant tests of JEDEC47/20/22

Package pin definition:

• Pin 1 - gate
• Pin 2 & backside - collector
• Pin 3 - emitter

Key Performance and Package Parameters

Type	V_{CE}	I_C	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Marking	Package
IHW20N120R5	1200V	20A	1.55V	175°C	H20MR5	PG-TO247-3

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 16

Maximum Ratings

For optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.

Parameter	Symbol	Value	Unit
Collector-emitter voltage, $T_{vj} \geq 25°C$	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
Non repetitive peak collector current[1)]	I_{CSM}	200	A
Turn off safe operating area $V_{CE} \leq 1200V$, $T_{vj} \leq 175°C$, $t_p = 1µs$	-	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 ($t_p \leq 10µs$, $D < 0.010$)	V_{GE}	±20 ±25	V
Power dissipation $T_c = 25°C$ Power dissipation $T_c = 100°C$	P_{tot}	288.0 144.0	W
Operating junction temperature	T_{vj}	-40...+175	°C
Storage temperature	T_{stg}	-55...+150	°C
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s		260	°C
Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm

Thermal Resistance

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
R_{th} Characteristics						
IGBT thermal resistance, junction - case	$R_{th(j-c)}$		-	-	0.52	K/W
Diode thermal resistance, junction - case	$R_{th(j-c)}$		-	-	0.52	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		-	-	40	K/W

[1)] capacitor charging saturation current limited by $T_{vjmax} < 175°C$ and $t_p < 3µs$

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	 - - -	 1.55 1.75 1.80	 1.75 - -	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 1.75 1.85	 1.85 - -	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	 - -	 - 300	 100 -	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	-	15.2	-	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	-	1340	-	pF
Output capacitance	C_{oes}		-	43	-	
Reverse transfer capacitance	C_{res}		-	34	-	
Gate charge	Q_G	V_{CC} = 1080V, I_C = 20.0A, V_{GE} = 15V	-	170.0	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13.0	-	nH

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic, at T_{vj} = 25°C						
Turn-off delay time	$t_{d(off)}$	T_{vj} = 25°C, V_{CC} = 600V, I_C = 20.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 10.0Ω, $R_{G(off)}$ = 10.0Ω, Lσ = 175nH, Cσ = 40pF Lσ, Cσ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	260	-	ns
Fall time	t_f		-	50	-	ns
Turn-off energy	E_{off}		-	0.75	-	mJ

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic, at T_{vj} = 175°C						
Turn-off delay time	$t_{d(off)}$	T_{vj} = 175°C, V_{CC} = 600V, I_C = 20.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 10.0Ω, $R_{G(off)}$ = 10.0Ω, $L\sigma$ = 175nH, $C\sigma$ = 40pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	350	-	ns
Fall time	t_f		-	90	-	ns
Turn-off energy	E_{off}		-	1.55	-	mJ

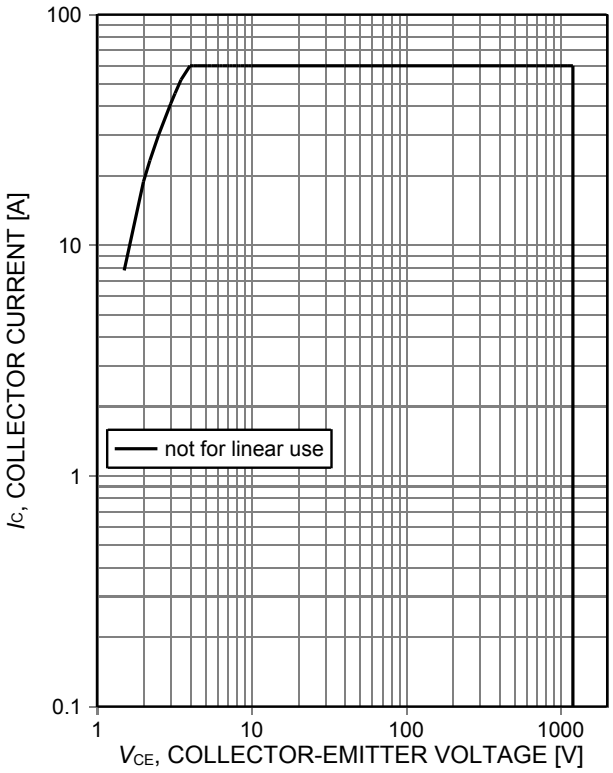


Figure 1. **Forward bias safe operating area**
(D=0, T_C=25°C, T_{vj}≤175°C; V_{GE}=15V, t_p=1µs)

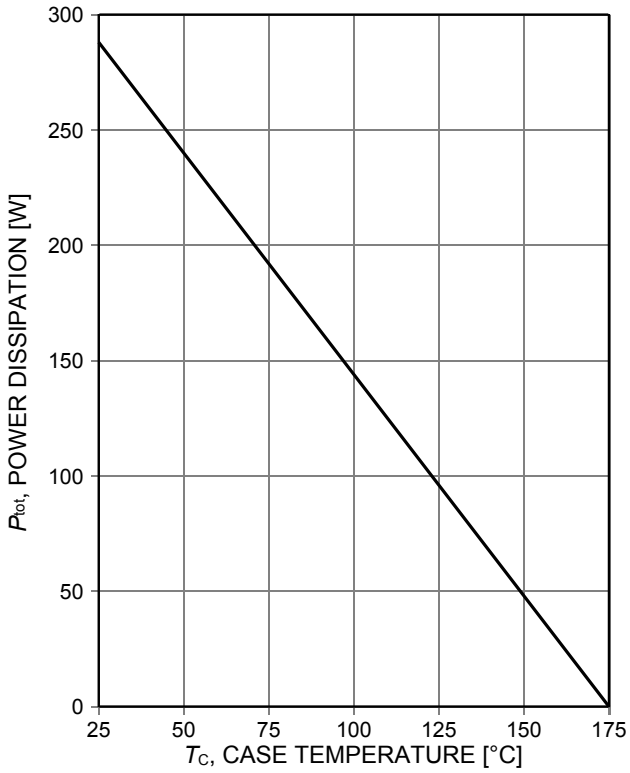


Figure 2. **Power dissipation as a function of case temperature**
(T_{vj}≤175°C)

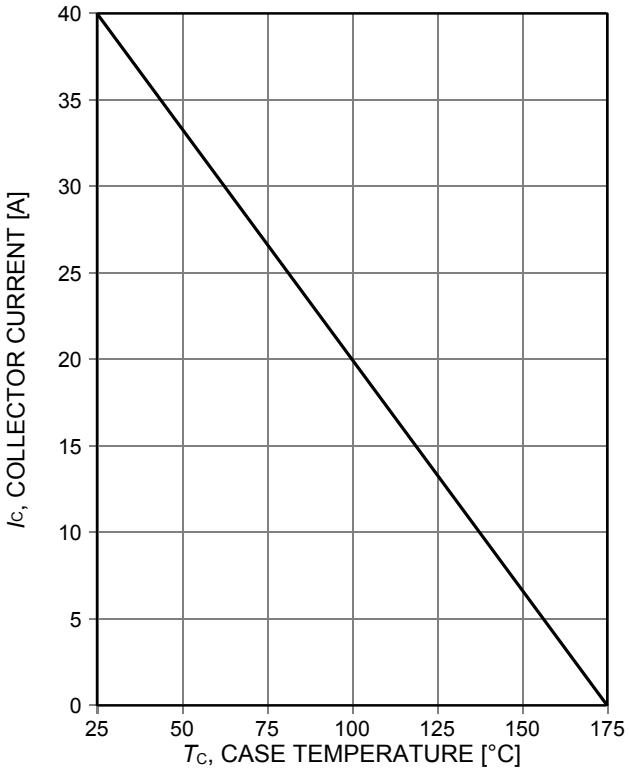


Figure 3. **Collector current as a function of case temperature**
(V_{GE}≥15V, T_{vj}≤175°C)

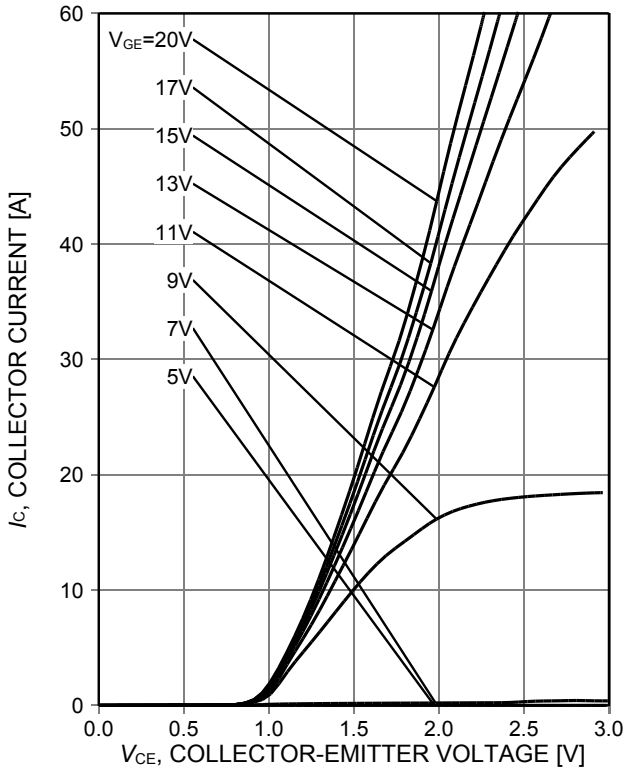


Figure 4. **Typical output characteristic**
(T_{vj}=25°C)

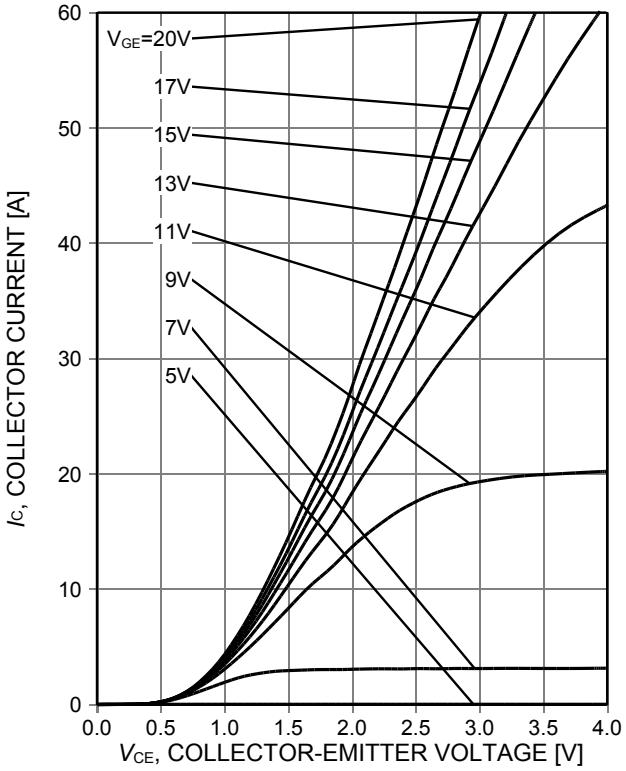


Figure 5. **Typical output characteristic** (T_{vj}=175°C)

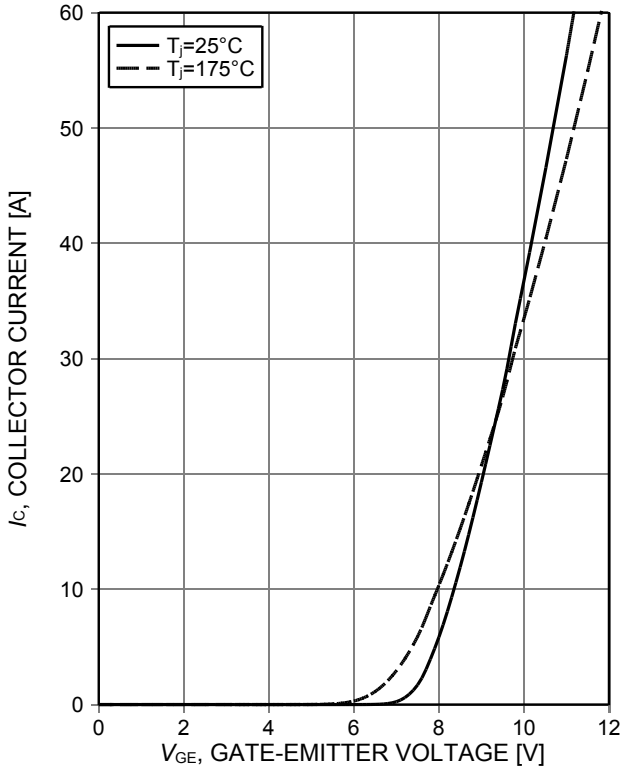


Figure 6. **Typical transfer characteristic** (V_{CE}=20V)

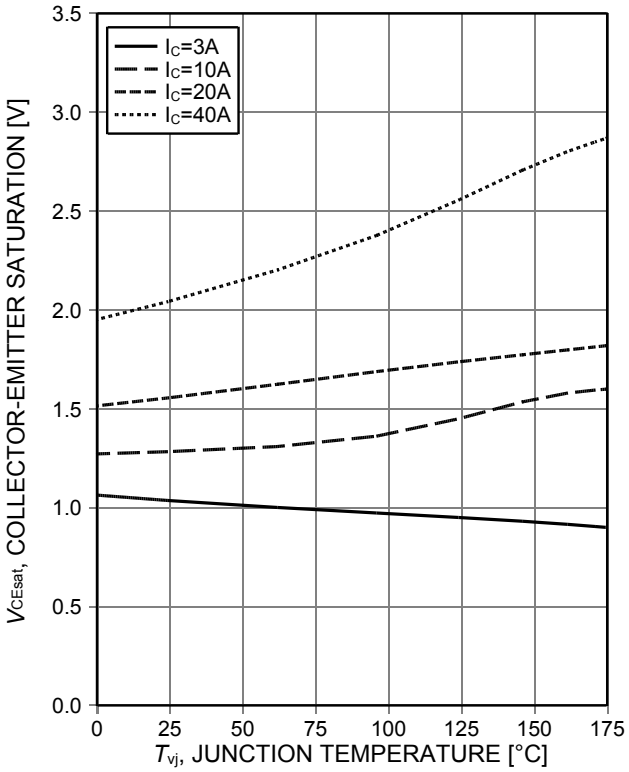


Figure 7. **Typical collector-emitter saturation voltage as a function of junction temperature** (V_{GE}=15V)

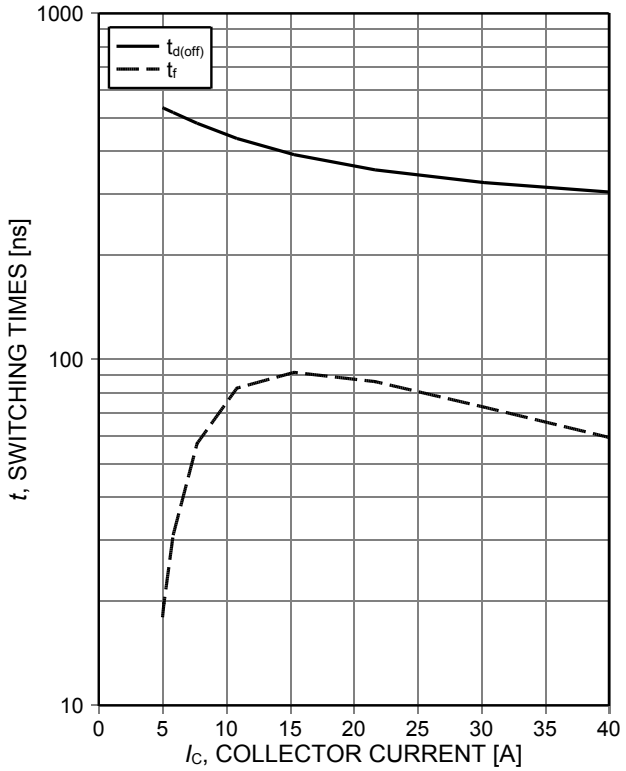


Figure 8. **Typical switching times as a function of collector current** (inductive load, T_{vj}=175°C, V_{CE}=600V, V_{GE}=0/15V, $R_{G(on)}$=10Ω, $R_{G(off)}$=10Ω, dynamic test circuit in Figure E)

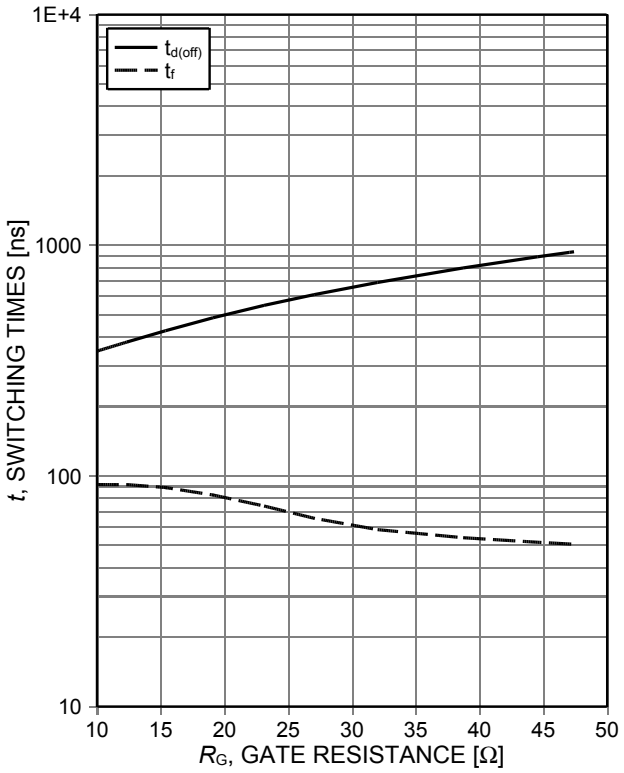


Figure 9. **Typical switching times as a function of gate resistance**
(inductive load, T_{vj}=175°C, V_{CE}=600V, V_{GE}=0/15V, I_C=20A, dynamic test circuit in Figure E)

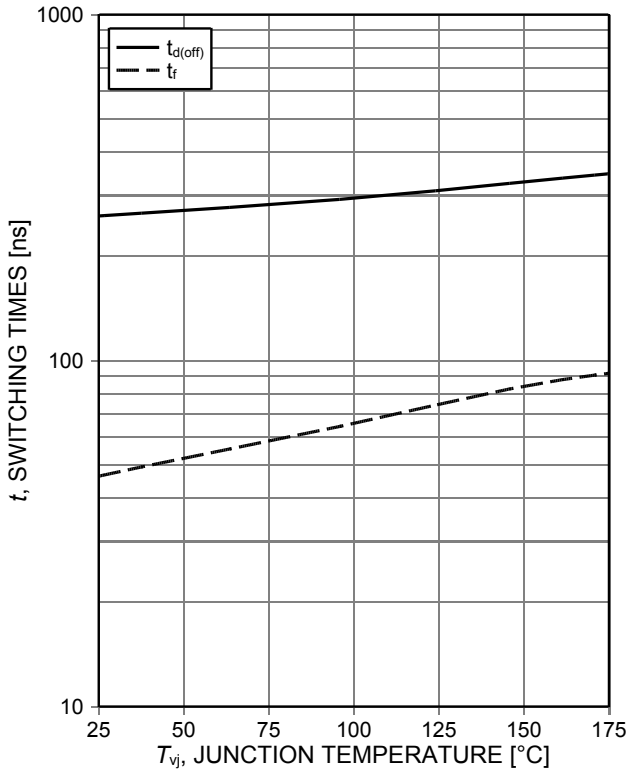


Figure 10. **Typical switching times as a function of junction temperature**
(inductive load, V_{CE}=600V, V_{GE}=0/15V, I_C=20A, $R_{G(on)}$=10Ω, $R_{G(off)}$=10Ω, dynamic test circuit in Figure E)

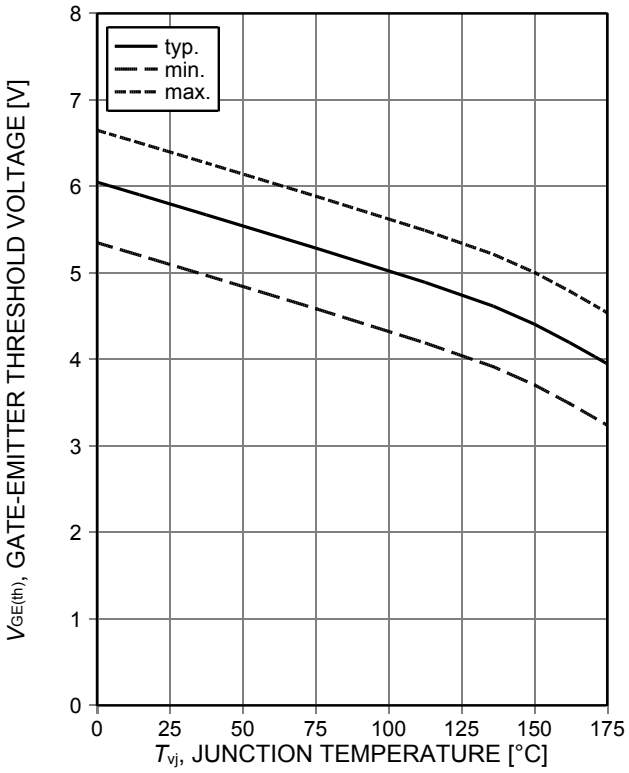


Figure 11. **Gate-emitter threshold voltage as a function of junction temperature**
(I_C=0.5mA, min / max values verified by chip design)

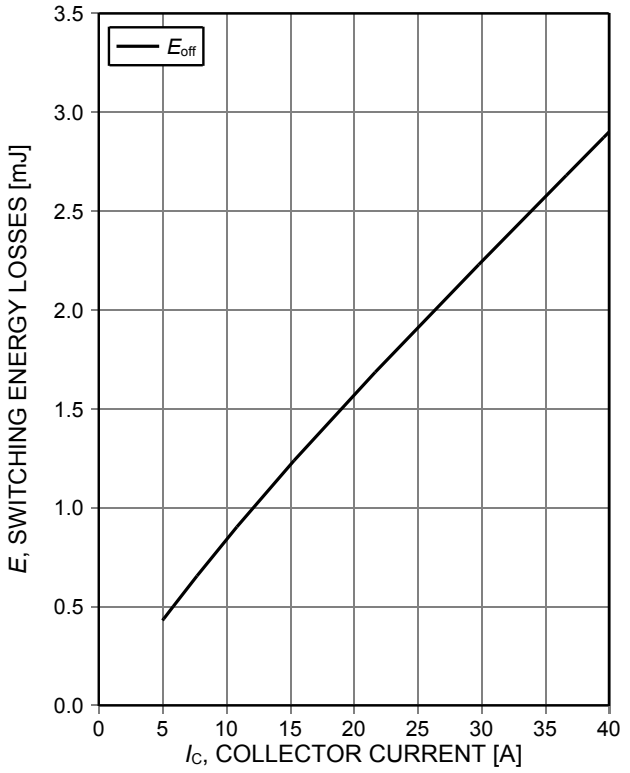


Figure 12. **Typical switching energy losses as a function of collector current**
(inductive load, T_{vj}=175°C, V_{CE}=600V, V_{GE}=0/15V, $R_{G(on)}$=10Ω, $R_{G(off)}$=10Ω, dynamic test circuit in Figure E)

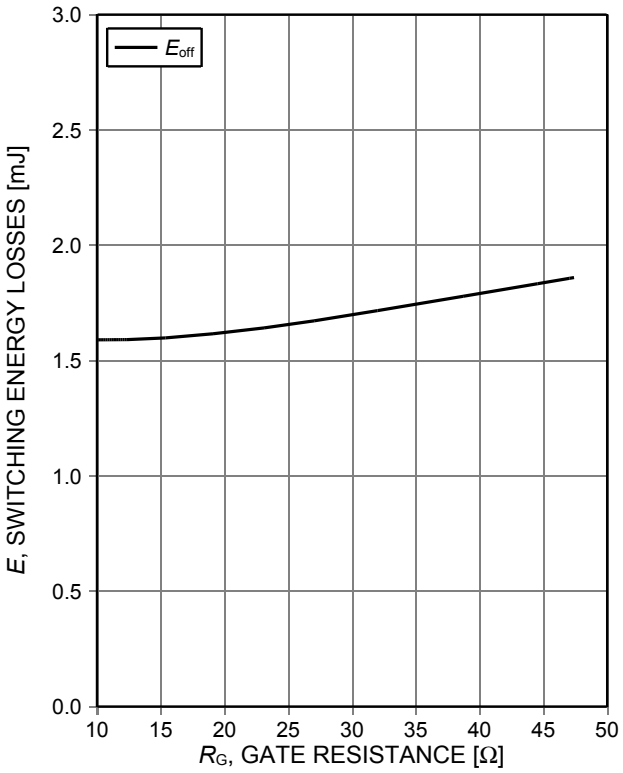


Figure 13. **Typical switching energy losses as a function of gate resistance** (inductive load, T_{vj}=175°C, V_{CE}=600V, V_{GE}=0/15V, I_C=20A, dynamic test circuit in Figure E)

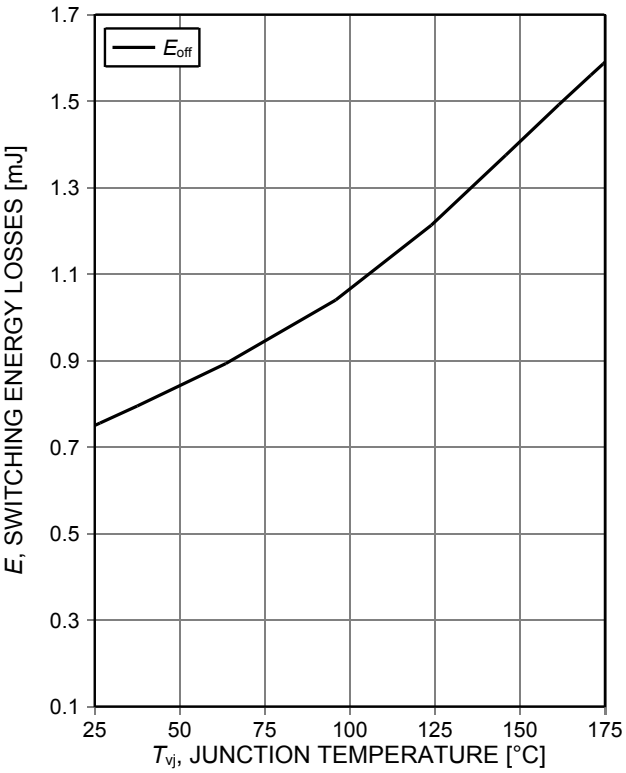


Figure 14. **Typical switching energy losses as a function of junction temperature** (inductive load, V_{CE}=600V, V_{GE}=0/15V, I_C=20A, $R_{G(on)}$=10Ω, $R_{G(off)}$=10Ω, dynamic test circuit in Figure E)

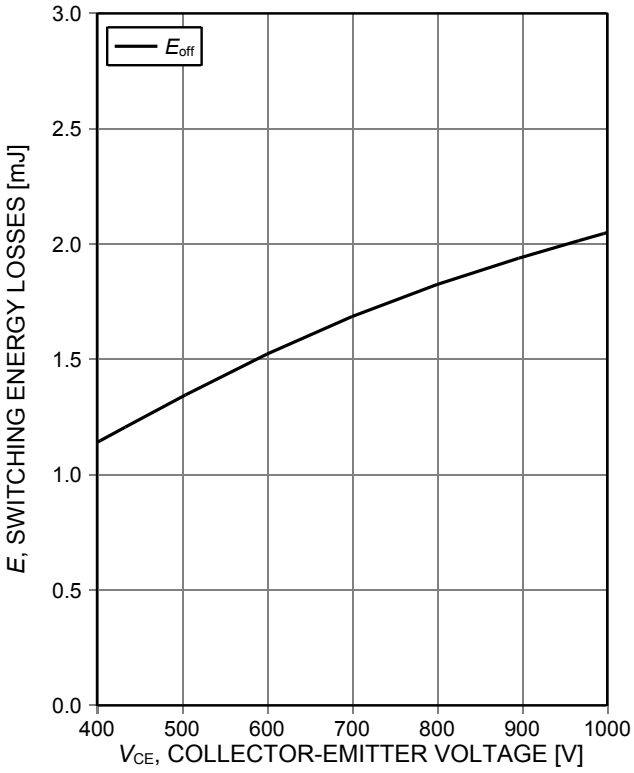


Figure 15. **Typical switching energy losses as a function of collector emitter voltage** (inductive load, T_{vj}=175°C, V_{GE}=0/15V, I_C=20A, $R_{G(on)}$=10Ω, $R_{G(off)}$=10Ω, dynamic test circuit in Figure E)

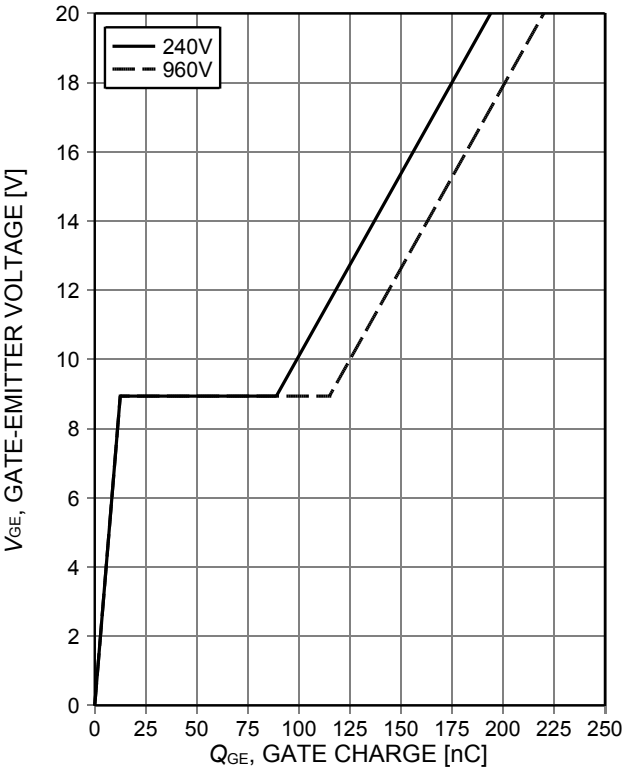


Figure 16. **Typical gate charge** (I_C=20A)

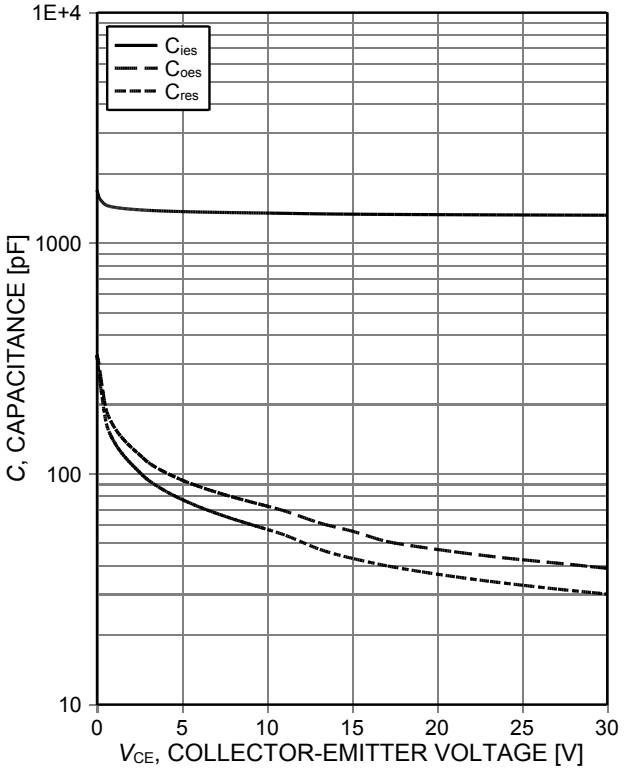


Figure 17. **Typical capacitance as a function of collector-emitter voltage**
(V_{GE}=0V, f=1MHz)

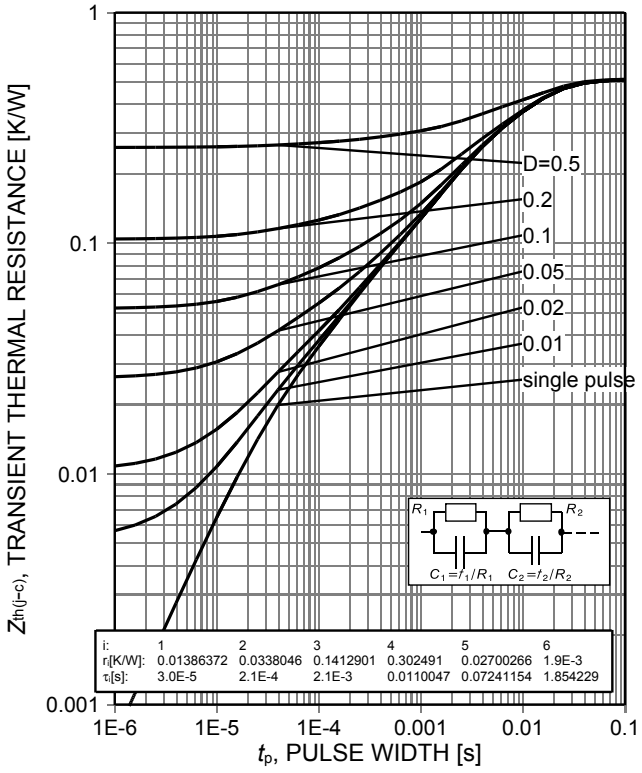


Figure 18. **IGBT transient thermal resistance**
($D=t_p/T$)

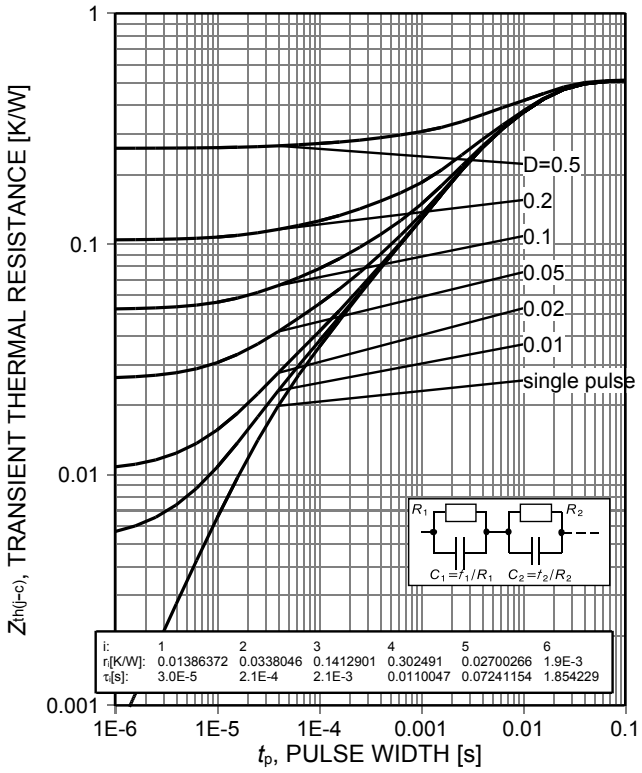


Figure 19. **Diode transient thermal impedance as a function of pulse width**
($D=t_p/T$)

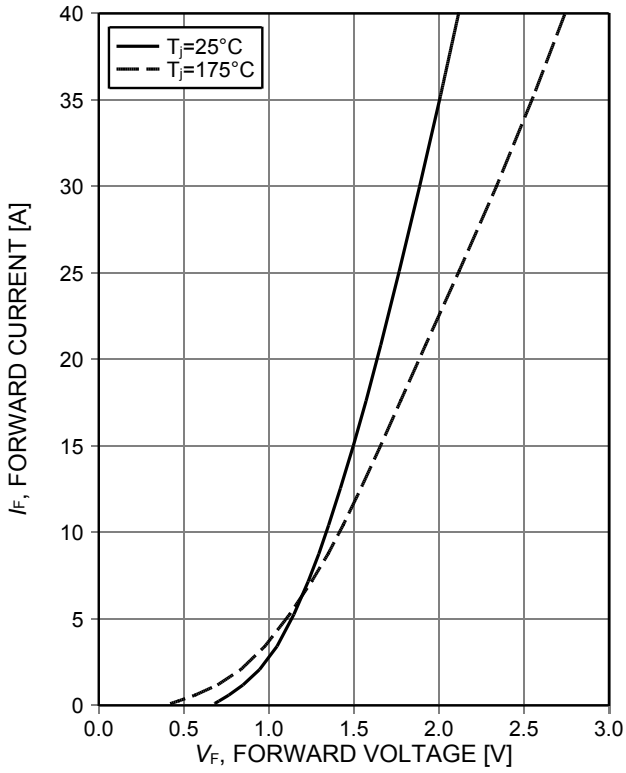


Figure 20. **Typical diode forward current as a function of forward voltage**

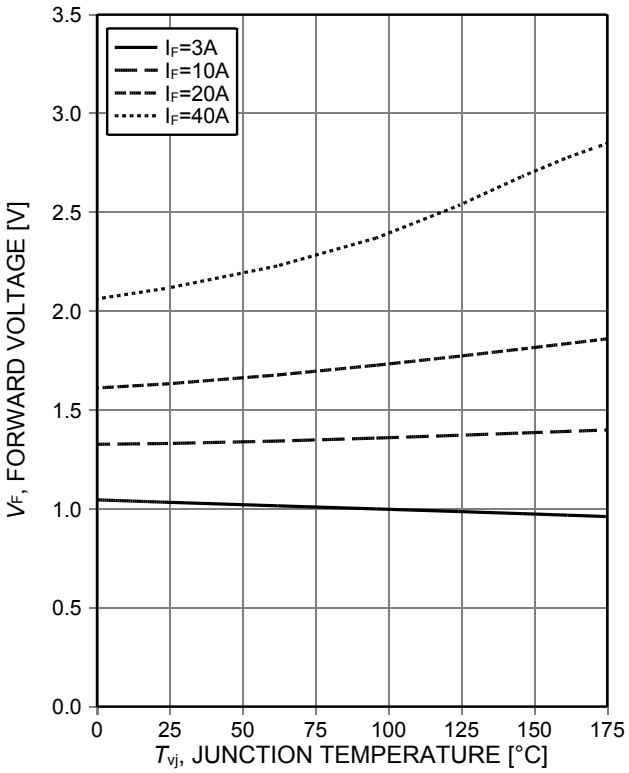
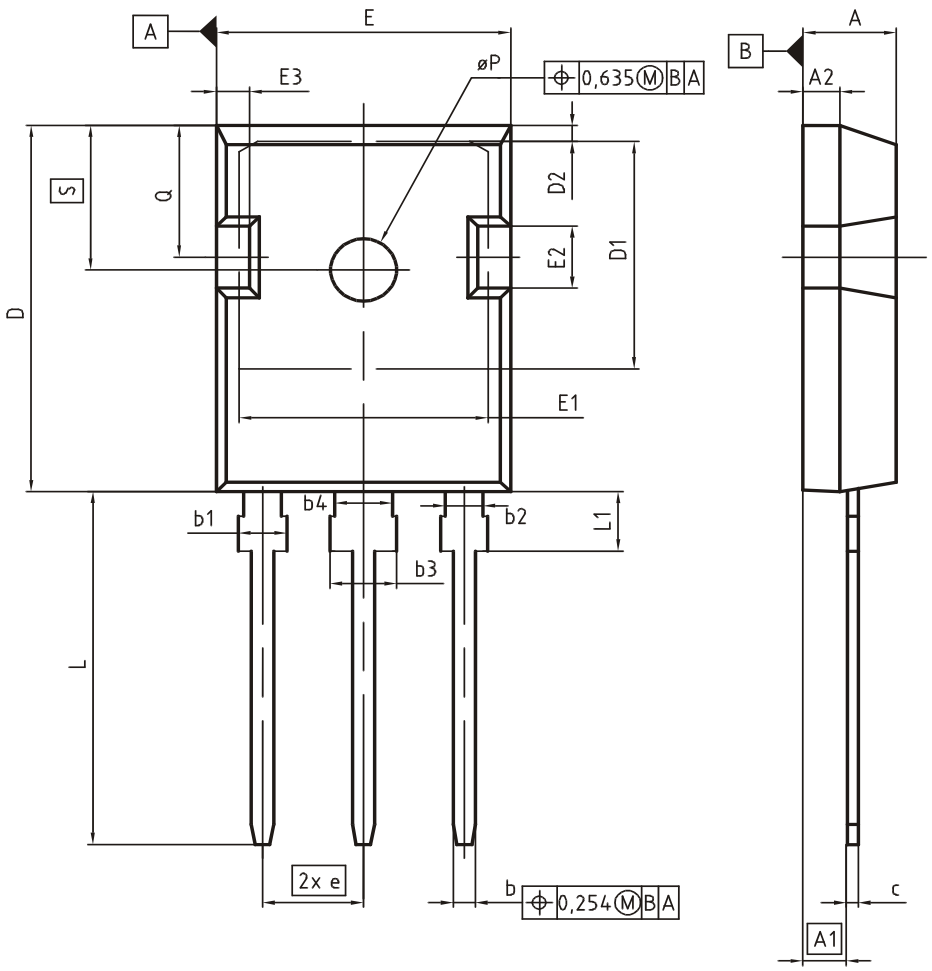


Figure 21. **Typical diode forward voltage as a function of junction temperature**

Package Drawing PG-TO247-3



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.27	2.54	0.089	0.100
A2	1.85	2.16	0.073	0.085
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	0.640	0.695
D2	0.95	1.35	0.037	0.053
E	15.70	16.13	0.618	0.635
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.00	2.60	0.039	0.102
e	5.44 (BSC)		0.214 (BSC)	
N	3		3	
L	19.80	20.32	0.780	0.800
L1	4.10	4.47	0.161	0.176
øP	3.50	3.70	0.138	0.146
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

DOCUMENT NO.	Z8B00003327
SCALE	0 5 5 7.5mm
EUROPEAN PROJECTION	
ISSUE DATE	09-07-2010
REVISION	05

Testing Conditions

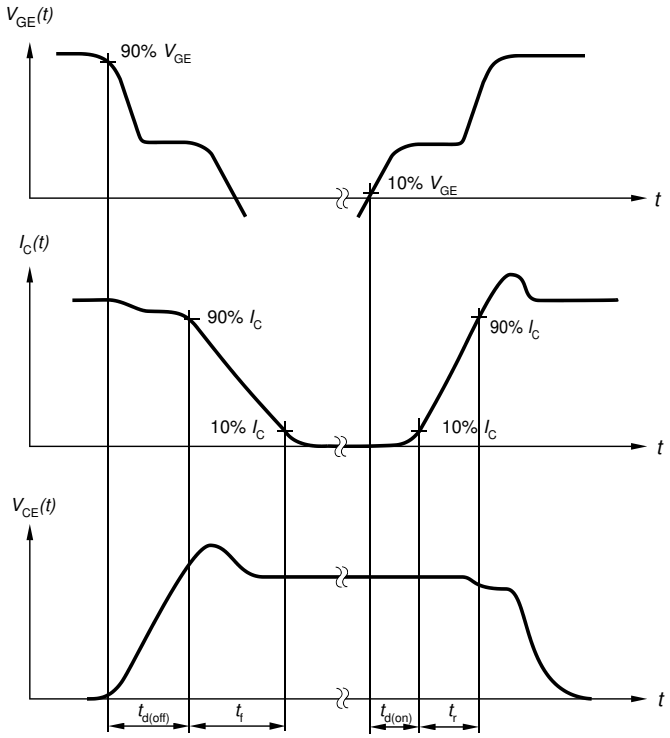


Figure A. **Definition of switching times**

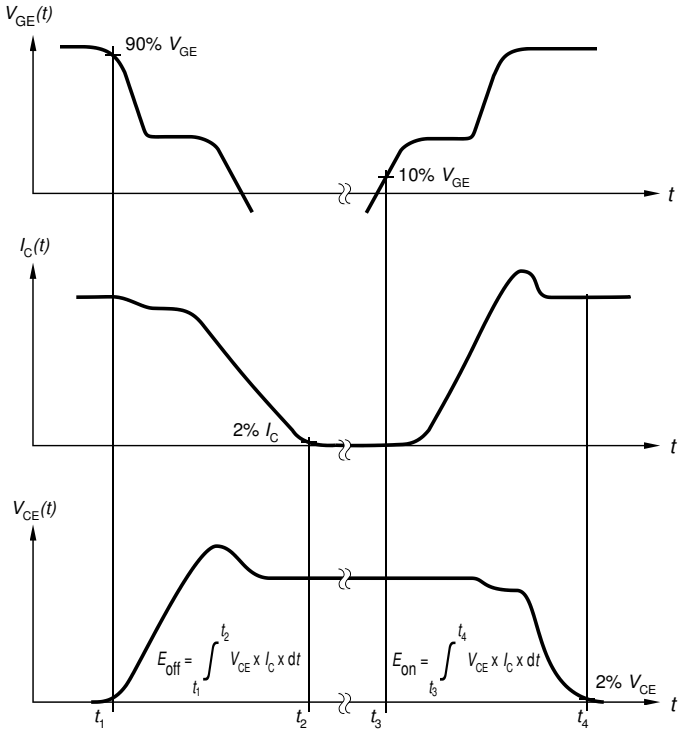


Figure B. **Definition of switching losses**

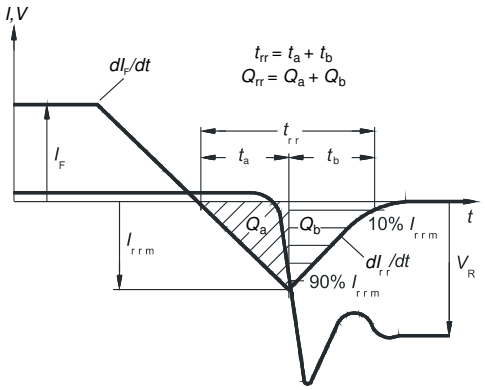


Figure C. **Definition of diode switching characteristics**

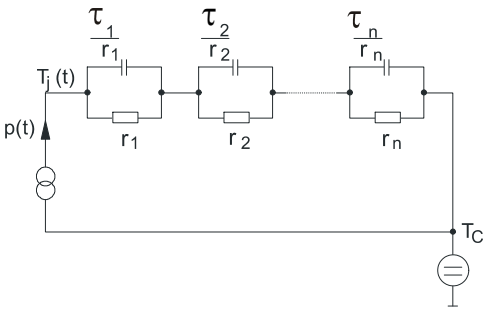


Figure D. **Thermal equivalent circuit**

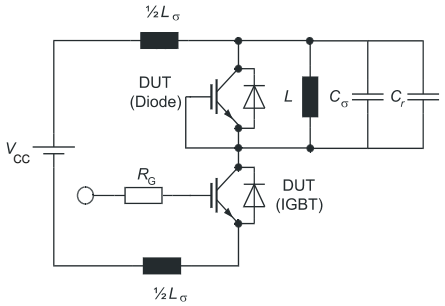


Figure E. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r,
(only for ZVT switching)

Revision History

IHW20N120R5

Revision: 2019-09-19, Rev. 2.2

Previous Revision

Revision	Date	Subjects (major changes since last revision)
1.1	2014-04-17	Preliminary data sheet
2.1	2015-01-26	Final data sheet
2.2	2019-09-19	additional parameter in maximum ratings table: non repetitive peak collector current

Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Published by
Infineon Technologies AG
81726 München, Germany
© Infineon Technologies AG 2019.
All Rights Reserved.

Important Notice
The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie"). With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

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

Please note that this product is not qualified according to the AEC Q100 or AEC Q101 documents of the Automotive Electronics Council.

Warnings
Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.