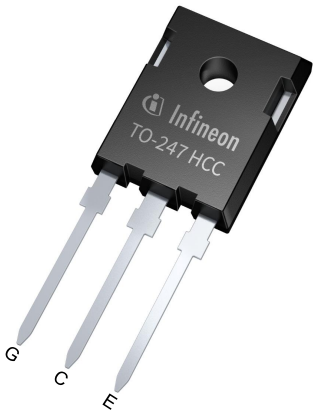
TRENCHSTOP™ 5 WR5 technology in enhanced creepage and clearance package offers improved reliability against package contamination

Features

- V_{CE} = 650 V
- I_C = 30 A
- Pin-to-pin creepage distance > 4.8 mm
- Pin-to-pin clearance distance > 3.4 mm
- Monolithic diode optimized for PFC and welding applications
- Stable temperature behavior
- Very low V_{CEsat} and low E_{off}
- Easy parallel switching capability based on positive temperature coefficient of V_{CEsat}
- Low temperature dependence of V_{CEsat} and E_{sw}
- Product spectrum and PSpice Models: http://www.infineon.com/igbt/



Lead-Free
Green
Halogen-Free
RoHS

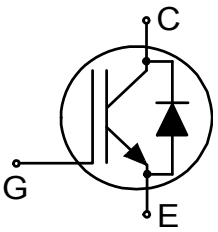
Potential applications

- PFC
- Welding
- ZCS applications

Product validation

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

Description



Type	Package	Marking
IKWH30N65WR5	PG-TO247-3-STD-N4.8	H30EWR5

Table of contents

1 Package

Table 1 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Internal emitter inductance measured 5 mm (0.197 in) from case	L_E			13.0		nH
Storage temperature	T_{stg}		-55		150	°C
Soldering temperature		wave soldering 1.6 mm (0.063 in.) from case for 10 s			260	°C
Mounting torque	M	M3 screw Maximum of mounting process: 3			0.6	Nm
Thermal resistance, junction-ambient	$R_{th(j-a)}$				40	K/W

2 IGBT

Table 2 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CE}	$T_{vj} \geq 25$ °C		650	V
DC collector current, limited by T_{vjmax}	I_C		$T_c = 25$ °C	75	A
			$T_c = 100$ °C	49	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			90	A
Turn-off safe operating area		$V_{CE} \leq 650$ V, $t_p \leq 1$ µs, $T_{vj} \leq 175$ °C		90	A
Gate-emitter voltage	V_{GE}			±20	V
Transient gate-emitter voltage	V_{GE}	$t_p \leq 10$ µs, $D < 0.01$		±30	V
Power dissipation	P_{tot}		$T_c = 25$ °C	190	W
			$T_c = 100$ °C	95	

Table 3 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter breakdown voltage	V_{BRCES}	$I_C = 0.2$ mA, V_{GE}=0 V		650			V
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 30$ A, $V_{GE} = 15$ V	$T_{vj} = 25$ °C		1.4	1.7	V
			$T_{vj} = 175$ °C		1.65		
Gate-emitter threshold voltage	V_{GEth}	$I_C = 0.3$ mA, $V_{CE} = V_{GE}$		3.2	4	4.8	V

(table continues...)

Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Zero gate-voltage collector current	I_{CES}	V_{CE} = 650 V, V_{GE}=0 V	T_{vj} = 25 °C			40	µA
			T_{vj} = 175 °C		0.5		mA
Gate-emitter leakage current	I_{GES}	V_{CE}=0 V, V_{GE} = 20 V				100	nA
Transconductance	g_{fs}	I_C = 30 A, V_{CE} = 20 V			67		S
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE}=0 V, f = 100 kHz			3230		pF
Output capacitance	C_{oes}	V_{CE} = 25 V, V_{GE}=0 V, f = 100 kHz			32		pF
Reverse transfer capacitance	C_{res}	V_{CE} = 25 V, V_{GE}=0 V, f = 100 kHz			13		pF
Gate charge	Q_G	I_C = 30 A, V_{GE} = 15 V, V_{CC} = 520 V			133		nC
Turn-on delay time	t_{don}	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 27 Ω, R_{Goff} = 27 Ω, L_σ = 30 nH, C_σ = 28 pF	T_{vj} = 25 °C, I_C = 30 A		41		ns
			T_{vj} = 175 °C, I_C = 30 A		33		
Rise time (inductive load)	t_r	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 27 Ω, R_{Goff} = 27 Ω, L_σ = 30 nH, C_σ = 28 pF	T_{vj} = 25 °C, I_C = 30 A		20		ns
			T_{vj} = 175 °C, I_C = 30 A		21		
Turn-off delay time	t_{doff}	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 27 Ω, R_{Goff} = 27 Ω, L_σ = 30 nH, C_σ = 28 pF	T_{vj} = 25 °C, I_C = 30 A		398		ns
			T_{vj} = 175 °C, I_C = 30 A		458		
Fall time (inductive load)	t_f	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 27 Ω, R_{Goff} = 27 Ω, L_σ = 30 nH, C_σ = 28 pF	T_{vj} = 25 °C, I_C = 30 A		18		ns
			T_{vj} = 175 °C, I_C = 30 A		18		
Turn-on energy	E_{on}	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 27 Ω, R_{Goff} = 27 Ω, L_σ = 30 nH, C_σ = 28 pF	T_{vj} = 25 °C, I_C = 30 A		0.87		mJ
			T_{vj} = 175 °C, I_C = 30 A		1.04		
Turn-off energy	E_{off}	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 27 Ω, R_{Goff} = 27 Ω, L_σ = 30 nH, C_σ = 28 pF	T_{vj} = 25 °C, I_C = 30 A		0.4		mJ
			T_{vj} = 175 °C, I_C = 30 A		0.7		
Total switching energy	E_{ts}	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 27 Ω, R_{Goff} = 27 Ω, L_σ = 30 nH, C_σ = 28 pF	T_{vj} = 25 °C, I_C = 30 A		1.27		mJ
			T_{vj} = 175 °C, I_C = 30 A		1.74		

(table continues...)

Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
IGBT thermal resistance, junction to case	R_{thjc}				0.8	K/W
Operating junction temperature	T_{vj}		-40		175	°C

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

3 Diode

Table 4 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}	T_{vj} ≥ 25 °C		650	V
Diode forward current, limited by T_{vjmax}	I_F		T_c = 25 °C	23	A
			T_c = 100 °C	13	
Diode pulsed current, limited by T_{vjmax}	I_{Fpulse}			45	A

Table 5 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode forward voltage	V_F	I_F = 12 A	T_{vj} = 25 °C		1.3	1.6	V
			T_{vj} = 175 °C		1.35		
Diode reverse recovery charge	Q_{rr}	V_R = 400 V	T_{vj} = 25 °C, I_F = 15 A, $-di_F/dt$ = 1400 A/µs		1.9		µC
			T_{vj} = 175 °C, I_F = 15 A, $-di_F/dt$ = 1300 A/µs		2.6		
Diode peak reverse recovery current	I_{rrm}	V_R = 400 V	T_{vj} = 25 °C, I_F = 15 A, $-di_F/dt$ = 1400 A/µs		28.6		A
			T_{vj} = 175 °C, I_F = 15 A, $-di_F/dt$ = 1300 A/µs		39		
Diode thermal resistance, junction to case	R_{thjc}					3.3	K/W

(table continues...)

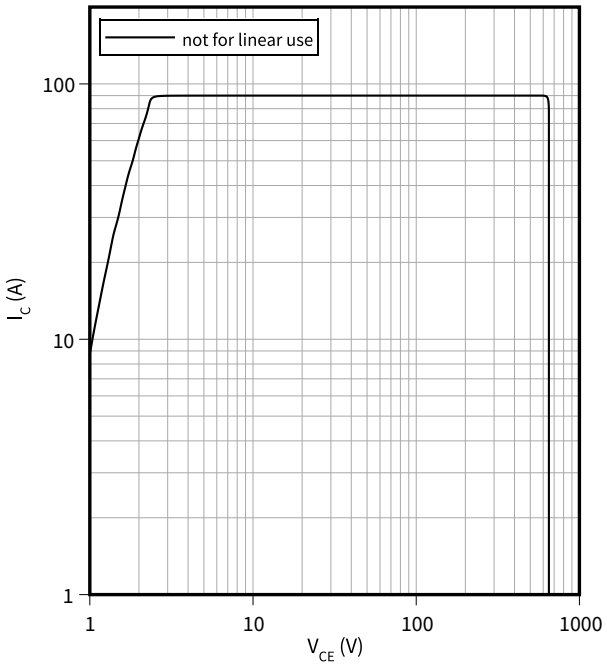
Table 5 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Operating junction temperature	T_{vj}		-40		175	°C

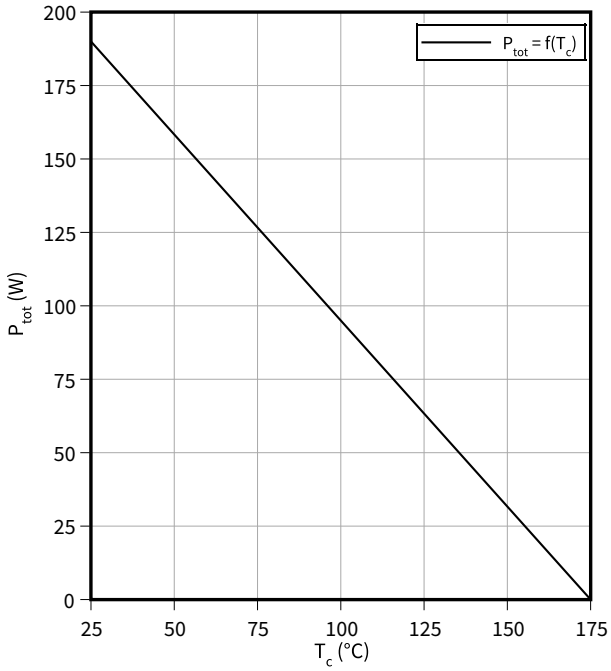
Note: For optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.

4 Characteristics diagrams

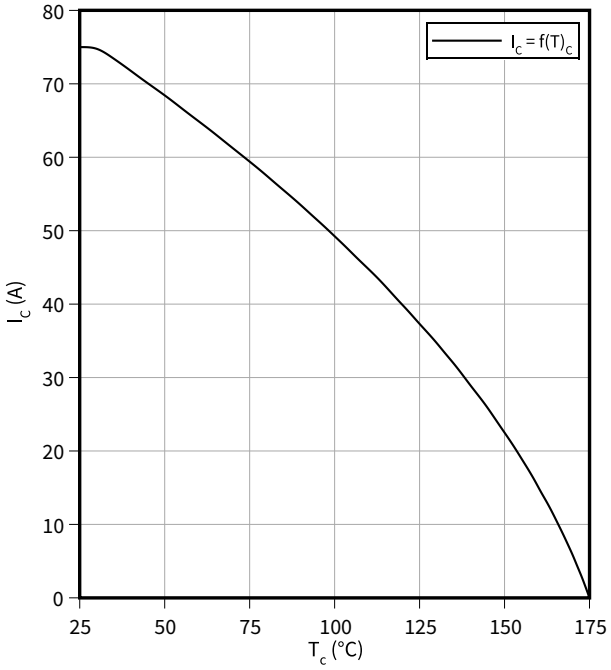
Reverse bias safe operating area
$I_C = f(V_{CE})$
$t_p = 1\ \mu s$, D = 0 , $T_{vj} \leq 175\ °C$, $T_c = 25\ °C$, $V_{GE} = 15\ V$



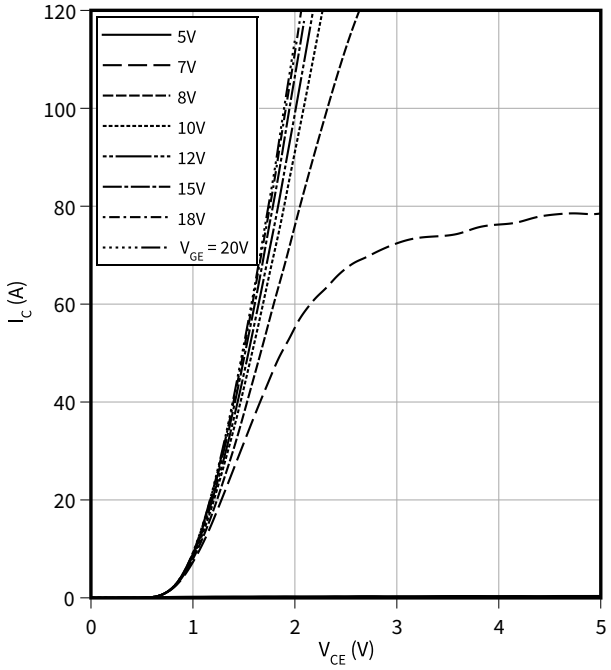
Power dissipation as a function of case temperature
$P_{tot} = f(T_c)$
$T_{vj} \leq 175\ °C$



Collector current as a function of case temperature
$I_C = f(T_c)$
$T_{vj} \leq 175\ °C$, $V_{GE} \geq 15\ V$



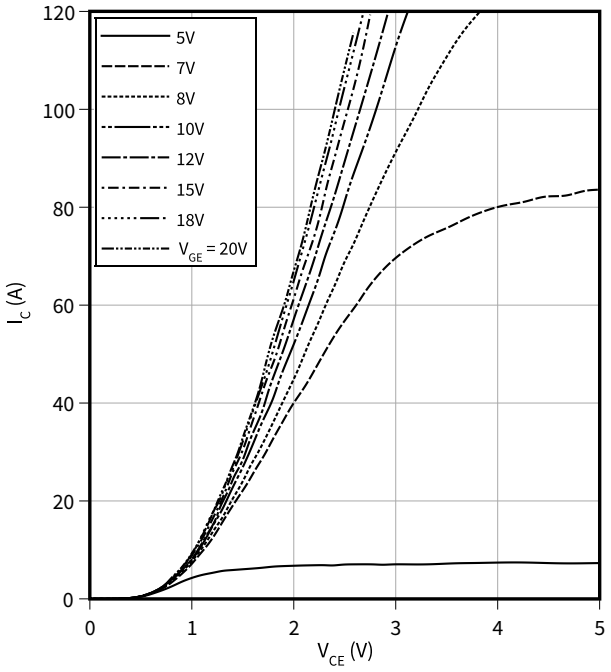
Typical output characteristic
$I_C = f(V_{CE})$
$T_{vj} = 25\ °C$



4 Characteristics diagrams

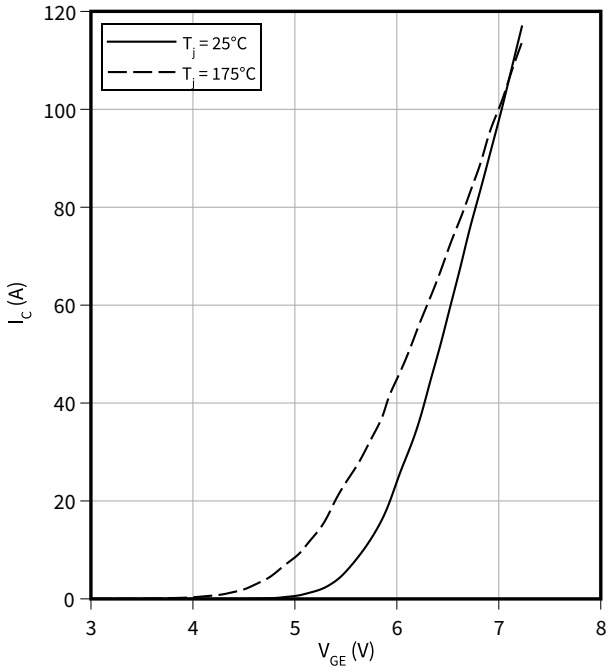
Typical output characteristic

$I_C = f(V_{CE})$
$T_{vj} = 175\ °C$



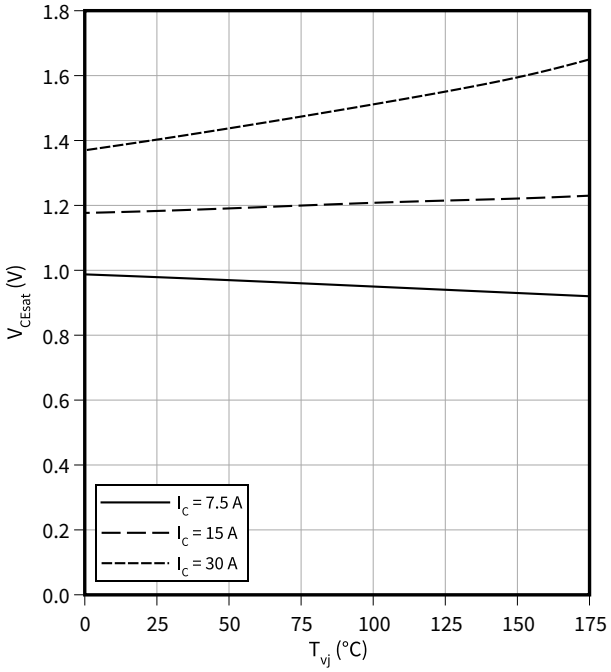
Typical transfer characteristic

$I_C = f(V_{GE})$
$V_{CE} = 20\ V$



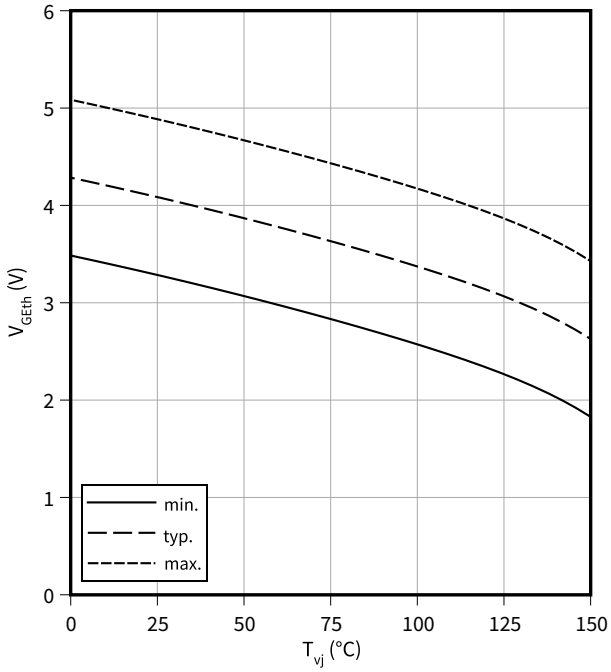
Typical collector-emitter saturation voltage as a function of junction temperature

$V_{CEsat} = f(T_{vj})$
$V_{GE} = 15\ V$



Gate-emitter threshold voltage as a function of junction temperature

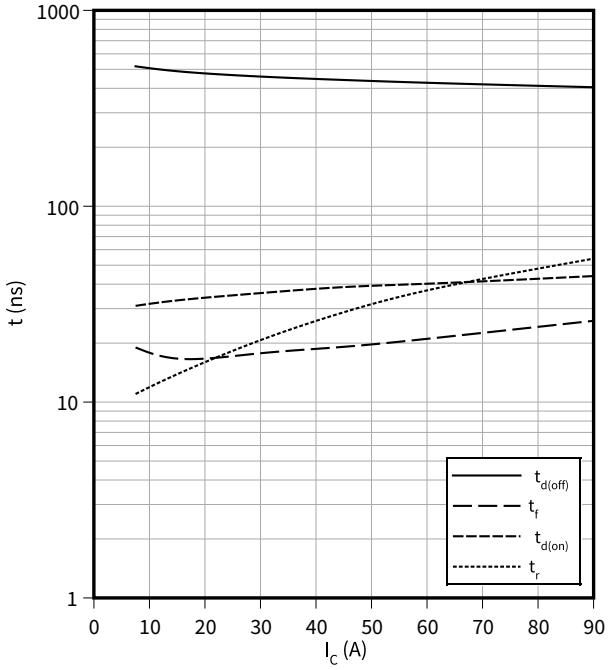
$V_{GEth} = f(T_{vj})$
$I_C = 0.2\ mA$



Typical switching times as a function of collector current

$t = f(I_C)$

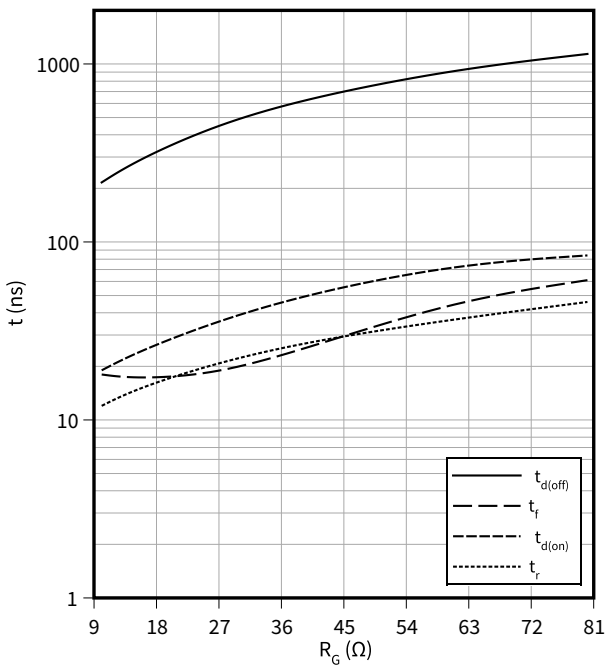
V_{CC} = 400 V, T_{vj} = 175 °C, V_{GE} = 0/15 V, R_G = 27 Ω



Typical switching times as a function of gate resistor

$t = f(R_G)$

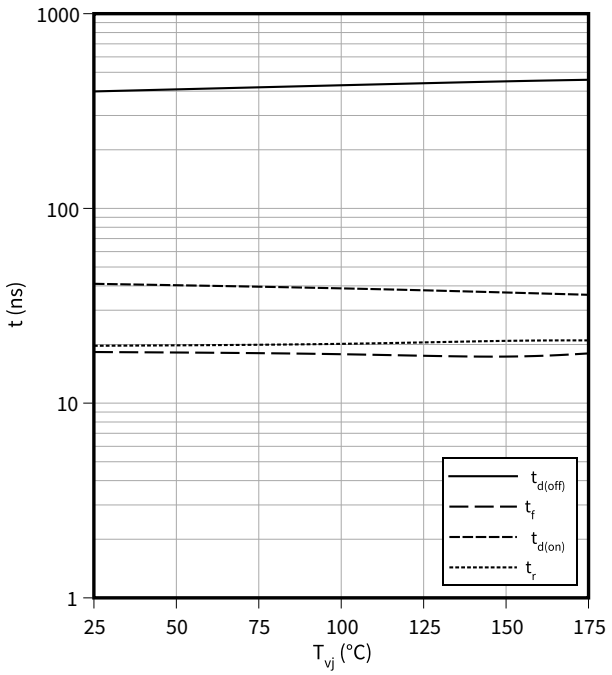
I_C = 30 A, V_{CC} = 400 V, T_{vj} = 175 °C, V_{GE} = 0/15 V



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

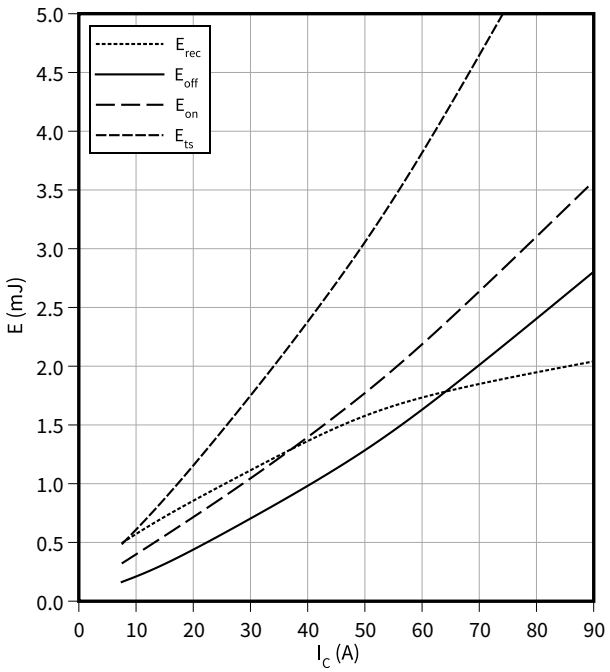
I_C = 30 A, V_{CC} = 400 V, V_{GE} = 0/15 V, R_G = 27 Ω



Typical switching energy losses as a function of collector current

$E = f(I_C)$

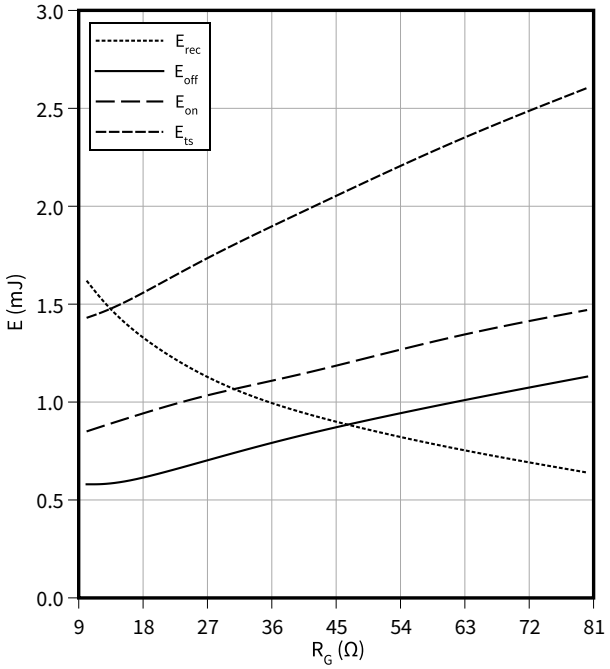
V_{CC} = 400 V, T_{vj} = 175 °C, V_{GE} = 0/15 V, R_G = 27 Ω



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

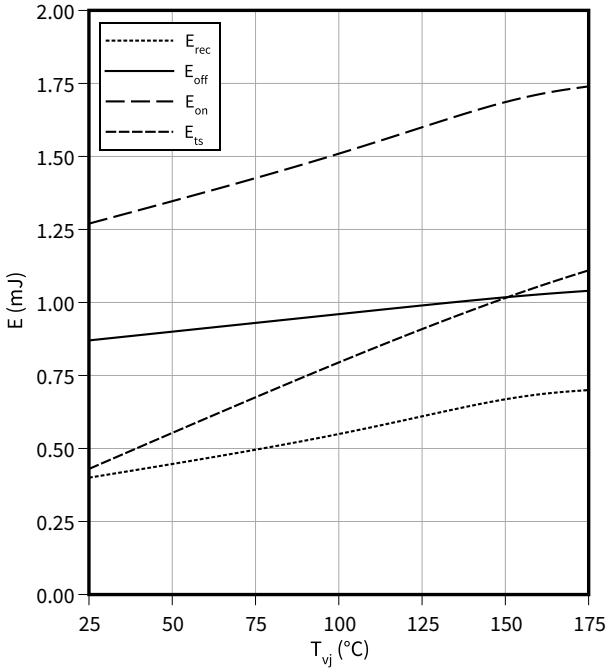
$I_C = 30\ A, V_{CC} = 400\ V, T_{vj} = 175\ °C, V_{GE} = 0/15\ V$



Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

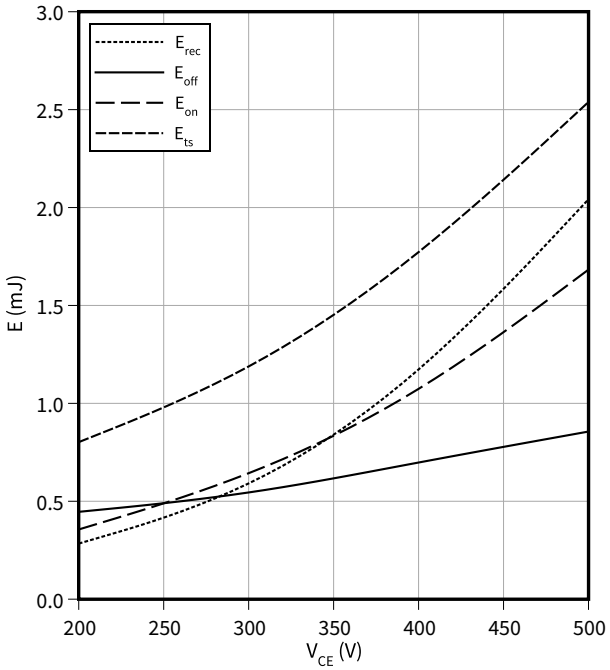
$I_C = 30\ A, V_{CC} = 400\ V, V_{GE} = 0/15\ V, R_G = 27\ Ω$



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

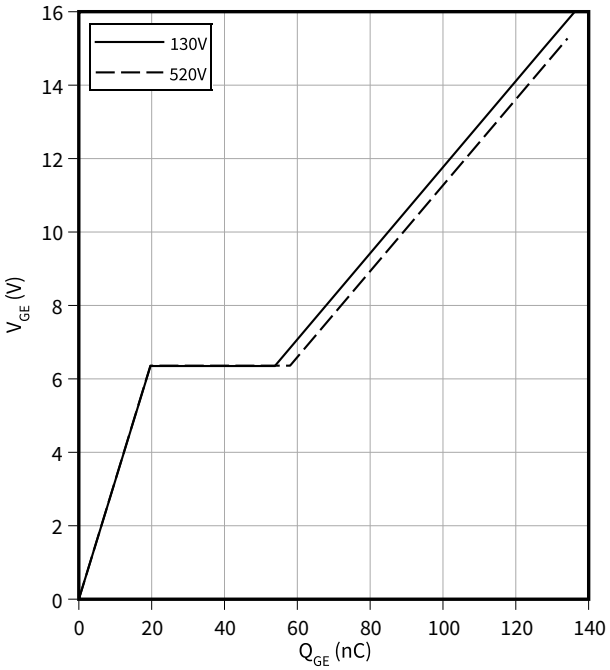
$I_C = 30\ A, T_{vj} = 175\ °C, V_{GE} = 0/15\ V, R_G = 27\ Ω$



Typical gate charge

$V_{GE} = f(Q_{GE})$

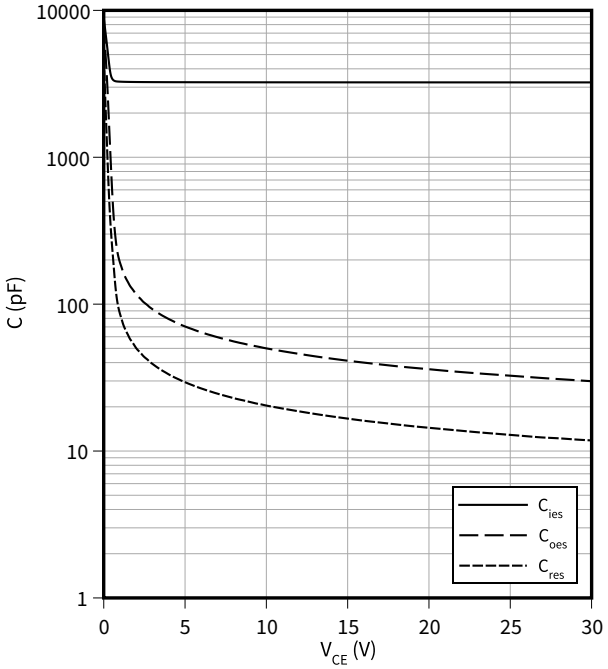
$I_C = 30\ A$



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

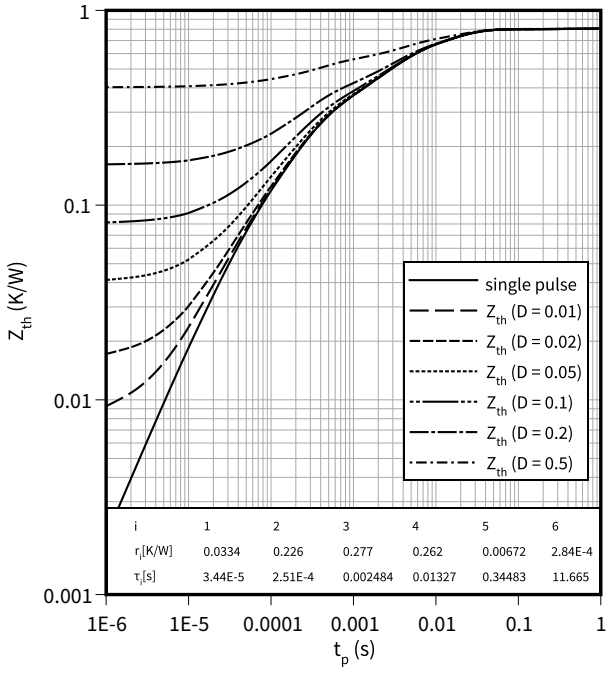
$V_{GE} = 0\ V$, $f = 100\ kHz$



IGBT transient thermal impedance as a function of pulse width

$Z_{th} = f(t_p)$

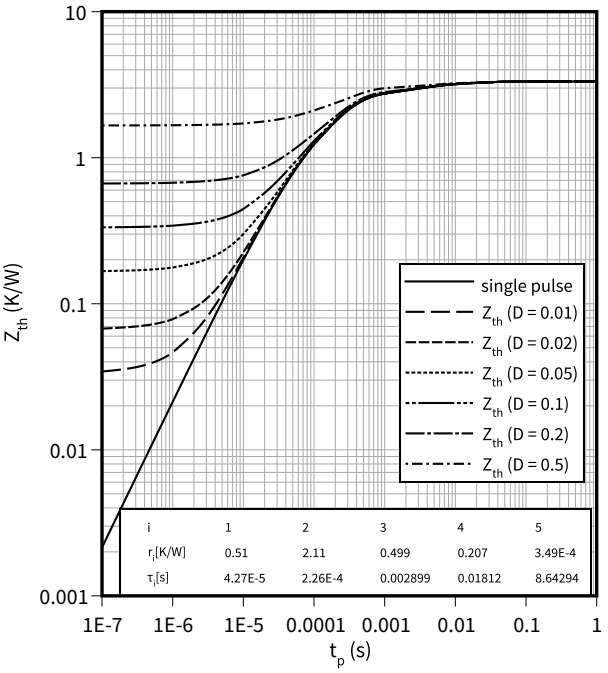
$D = t_p/T$



Diode transient thermal impedance as a function of pulse width

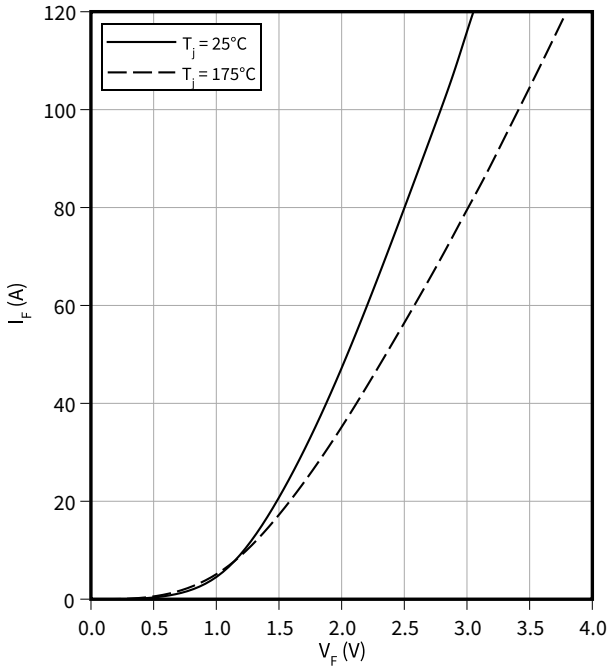
$Z_{th} = f(t_p)$

$D = t_p/T$



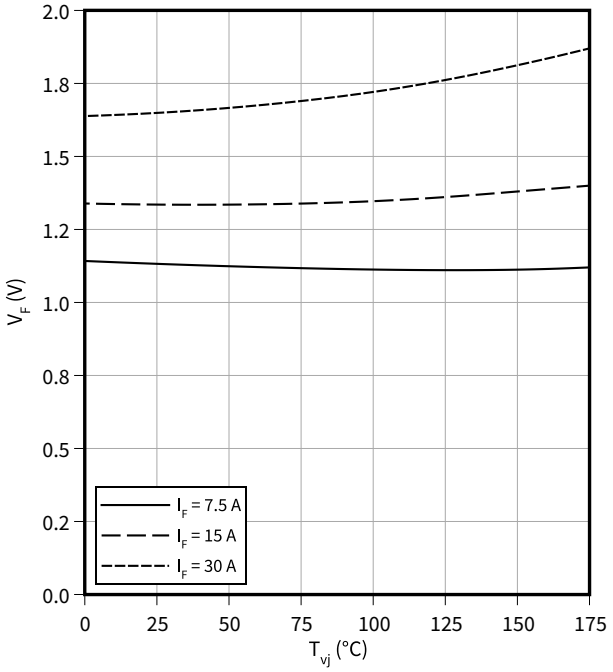
Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



Typical diode forward voltage as a function of junction temperature

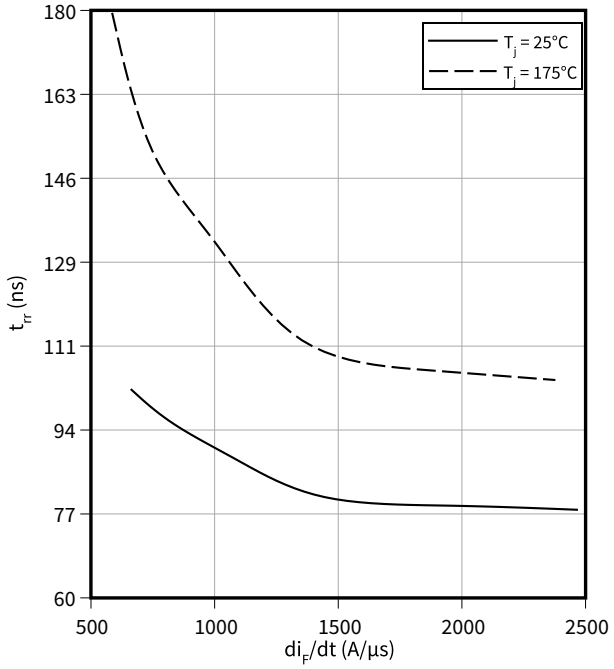
$V_F = f(T_{vj})$



Typical reverse recovery time as a function of diode current slope

$t_{rr} = f(di_F/dt)$

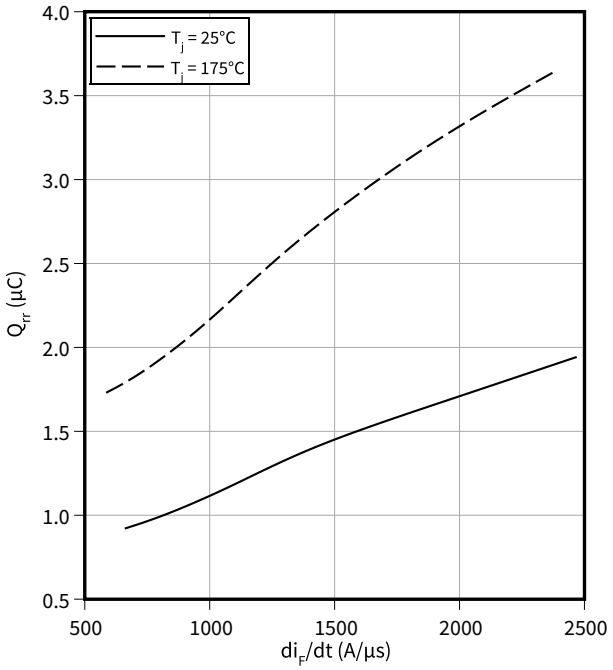
$V_R = 400\ V$, $I_F = 15\ A$



Typical reverse recovery charge as a function of diode current slope

$Q_{rr} = f(di_F/dt)$

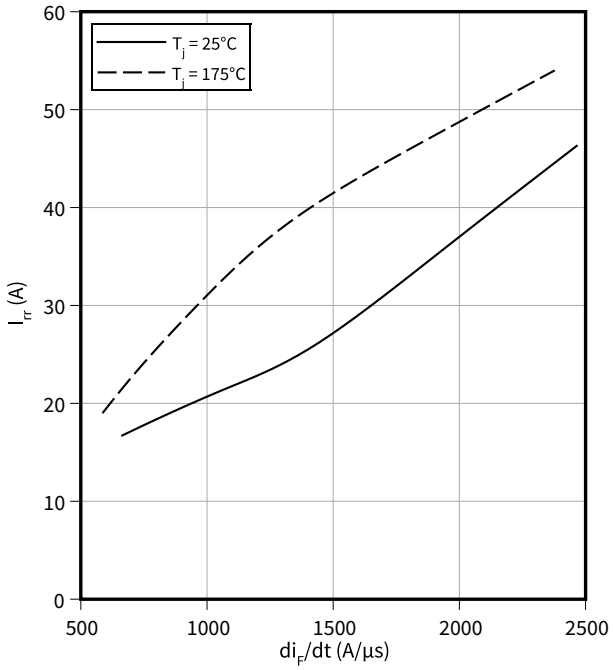
$V_R = 400\ V$, $I_F = 15\ A$



Typical reverse recovery current as a function of diode current slope

$I_{rr} = f(di_F/dt)$

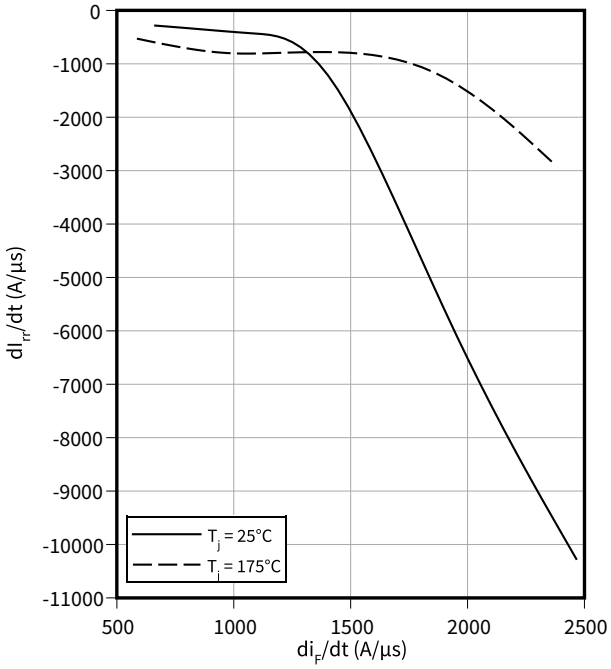
$V_R = 400\ V$, $I_F = 15\ A$



Typical diode peak rate of fall of reverse recovery current as a function of diode current slope

$dI_{rr}/dt = f(di_F/dt)$

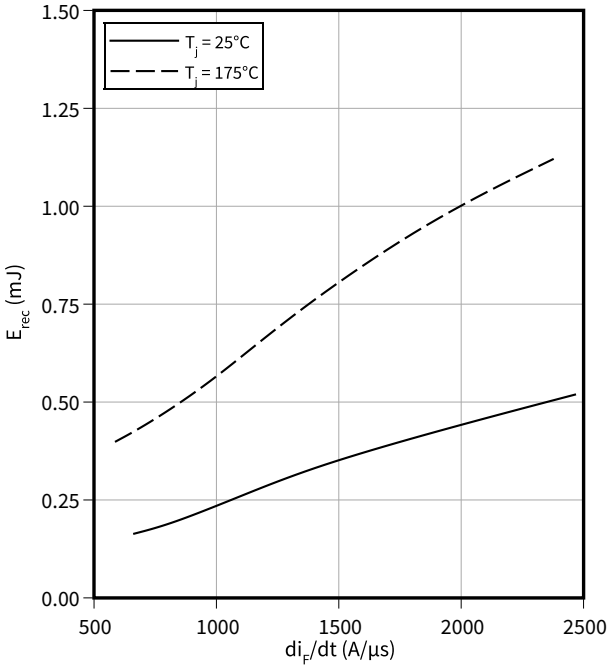
$V_R = 400\ V$, $I_F = 15\ A$



Typical reverse energy losses as a function of diode current slope

$E_{rec} = f(di_F/dt)$

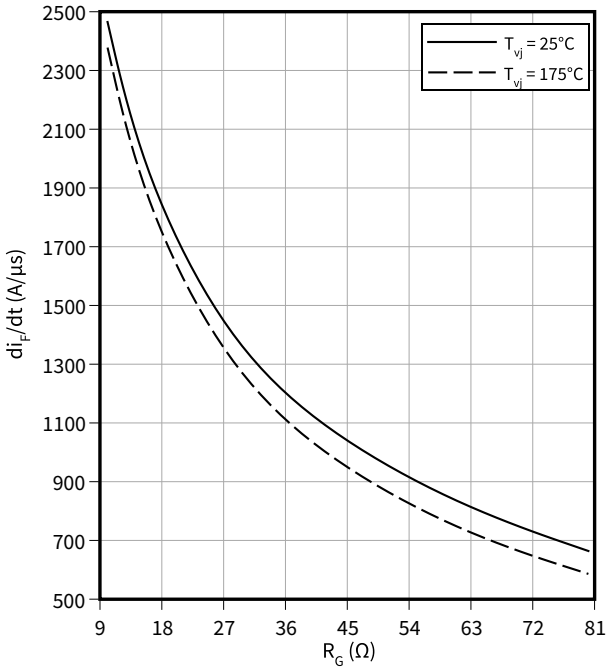
$V_R = 400\ V$, $I_F = 15\ A$



Typical diode current slope as a function of gate resistor

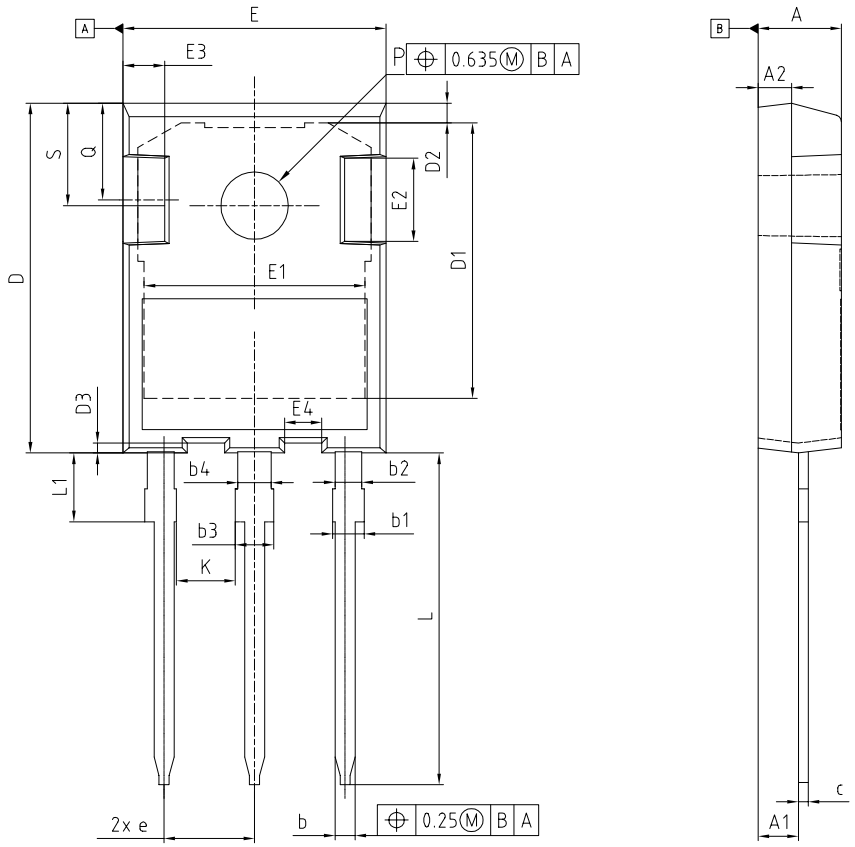
$di_F/dt = f(R_G)$

$V_R = 400\ V$, $I_F = 15\ A$



5 Package outlines

PG-TO247-3-STD-N4.8



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	1.48	2.02	0.058	0.080
b2	1.48	1.72	0.058	0.068
b3	1.84	2.42	0.072	0.095
b4	1.84	2.18	0.072	0.086
c	0.55	0.68	0.022	0.027
D	20.80	21.10	0.819	0.831
D1	16.25	16.85	0.640	0.663
D2	0.95	1.35	0.037	0.053
D3	0.55	0.65	0.022	0.026
E	15.70	15.90	0.618	0.626
E1	13.10	14.15	0.516	0.557
E2	4.90	5.10	0.193	0.201
E3	1.00	2.60	0.039	0.102
E4	3.44	3.76	0.135	0.148
e	5.44 (BSC)		0.214 (BSC)	
K	3.4	–	0.134	–
L	19.80	20.32	0.780	0.800
L1	3.95	4.30	0.156	0.169
øP	3.50	3.70	0.138	0.146
Q	5.6	6.00	0.220	0.236
S	5.95	6.35	0.234	0.250
N	3		3	

DOCUMENT NO.
Z8B00205969

SCALE 3:1
0 1 2 3mm

EUROPEAN PROJECTION

ISSUE DATE
31.03.2022

REVISION
1

Figure 1

6 Testing conditions

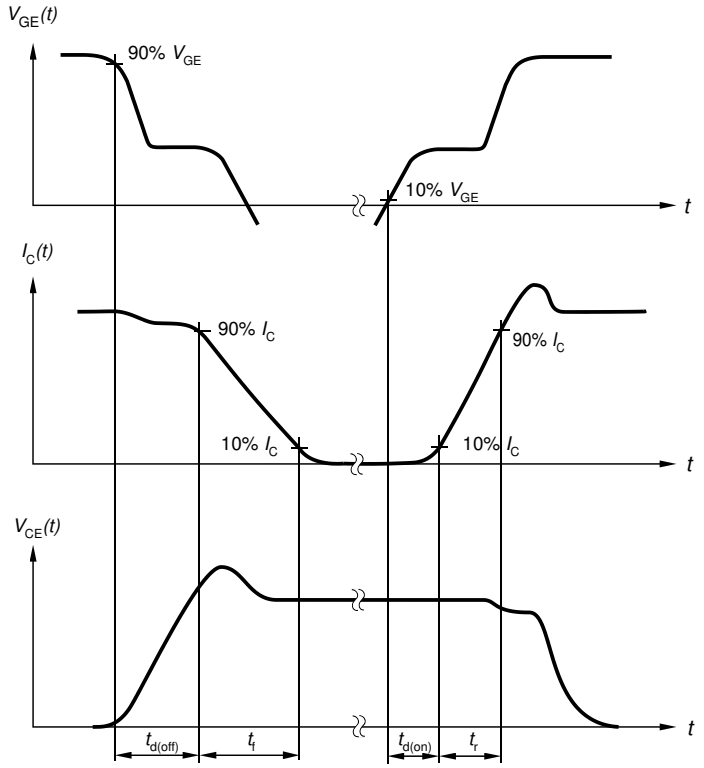


Figure A. **Definition of switching times**

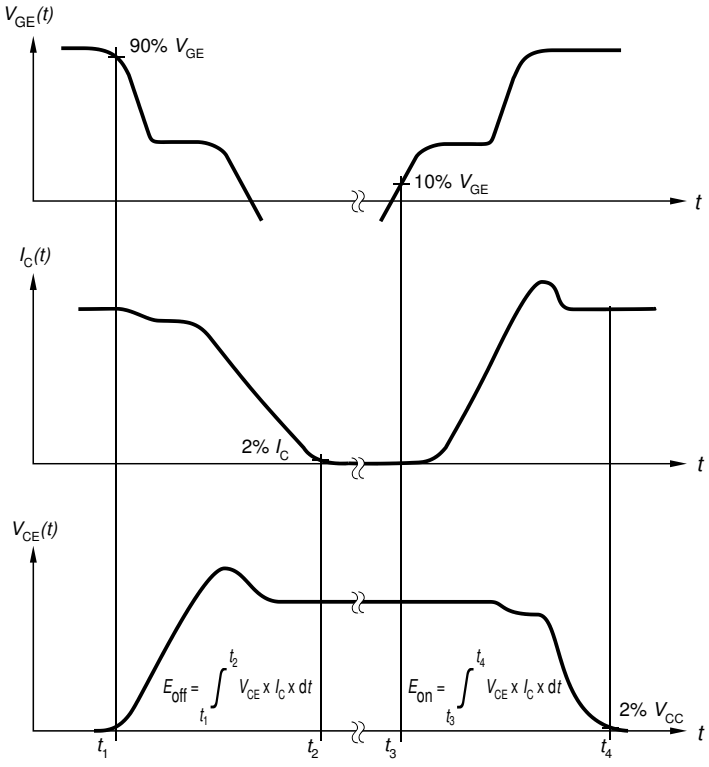


Figure B. **Definition of switching losses**

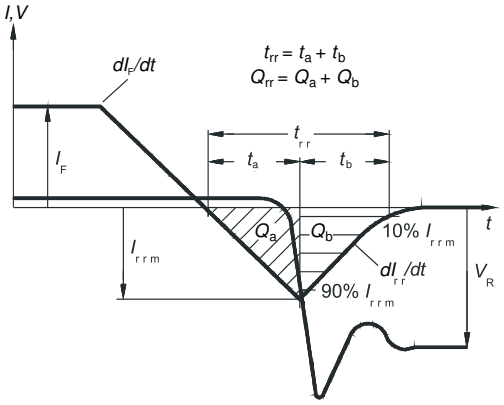


Figure C. **Definition of diode switching characteristics**

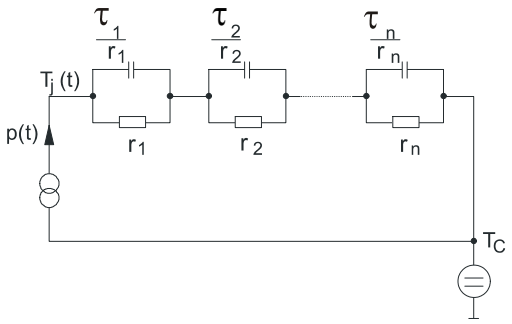


Figure D. **Thermal equivalent circuit**

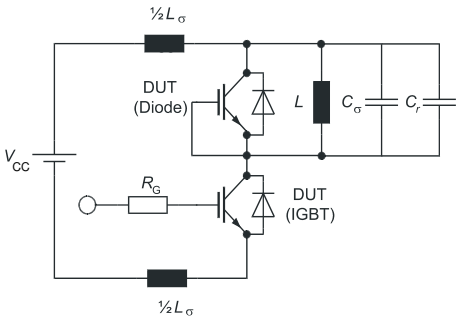


Figure E. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r,
(only for ZVT switching)

Figure 2

Revision history

Document revision	Date of release	Description of changes
1.00	2021-05-17	Final datasheet
1.10	2021-05-18	Update of diagram E = f(Tvj)
1.20	2021-06-29	Update of diagram E = f(T_{vj})
1.30	2022-04-05	Update of “DC collector current, limited by T_{vjmax}” in table “Maximum rated values”, for 25°C and 100°C Transient gate-emitter voltage V_{GE} in table “Maximum rated values” of IGBT changed to ±30V Update of diagram “Collector current as a function of case temperature”, $I_C = f(T_c)$ "Forward bias safe operating area” diagram renamed to “Reverse bias safe operating area” Correction of package outline dimensions Change package name to marketing name

Trademarks

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

Edition 2022-04-05

Published by

Infineon Technologies AG

81726 Munich, Germany

Do you have a question about any aspect of this document?

Email: erratum@infineon.com

Document reference
IFX-ABA903-004

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.

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.

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Infineon:
IKWH30N65WR5XKSA1