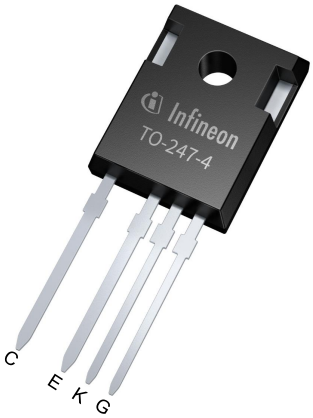
High speed 1200 V TRENCHSTOP™ IGBT 7 Technology co-packed with full rated current, soft-commutating, ultra-fast recovery and low Qrr emitter controlled 7 Rapid diode

Features

- V_{CE} = 1200 V
- I_C = 40 A
- Maximum junction temperature T_{vjmax} = 175°C
- Best-in-class high speed IGBT co-packed with full rated current, low Q_{rr} and soft-commutating high speed diode
- Low saturation voltage V_{CEsat} = 1.7 V at T_{vj} = 25°C
- Optimized for high efficiency in high speed hard switching topologies (2-L inverter, 3-L NPC T-type, ...)
- Easy paralleling capability due to positive temperature coefficient in V_{CEsat}
- Pb-free lead plating; RoHS compliant
- Complete product spectrum and PSpice Models: http://www.infineon.com/igbt/



Halogen-free

Lead-free

Green

RoHS

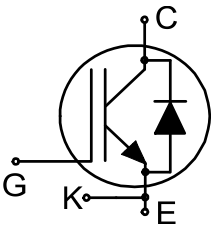
Potential applications

- Industrial UPS
- EV-Charging
- String inverter
- Welding

Product validation

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

Description



Type	Package	Marking
IKZA40N120CH7	PG-TO247-4-STD-NT3.7	K40MCH7

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		nH
Storage temperature	T_{stg}		-55		150	°C
Soldering temperature	T_{sold}	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
IGBT thermal resistance, junction-case	$R_{th(j-c)}$			0.35	0.46	K/W
Diode thermal resistance, junction-case	$R_{th(j-c)}$			0.6	0.78	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		1200	V
DC collector current, limited by T_{vjmax}	I_C	limited by bondwire	$T_c = 25$ °C	95	A
			$T_c = 100$ °C	70	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			160	A
Turn-off safe operating area		$V_{CC} \leq 800$ V, $V_{GE} = 0/15$ V, $R_{Goff} \geq 27\ \Omega$, $T_{vj} \leq 175$ °C		160	A
Gate-emitter voltage	V_{GE}			±20	V
Transient gate-emitter voltage	V_{GE}	$t_p \leq 0.5$ µs, $D < 0.001$		±25	V
Power dissipation	P_{tot}		$T_c = 25$ °C	330	W
			$T_c = 100$ °C	165	

Table 3 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 40$ A, $V_{GE} = 15$ V	$T_{vj} = 25$ °C		1.7	2.15	V
			$T_{vj} = 175$ °C		2		

(table continues...)

Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Gate-emitter threshold voltage	V_{GEth}	I_C = 0.64 mA, V_{CE} = V_{GE}		4.7	5.5	6.2	V
Zero gate-voltage collector current	I_{CES}	V_{CE} = 1200 V, V_{GE} = 0 V	T_{vj} = 25 °C			40	µA
			T_{vj} = 175 °C		2600		
Gate-emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = 20 V				100	nA
Transconductance	g_{fs}	I_C = 40 A, V_{CE} = 20 V			93		S
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			5		nF
Output capacitance	C_{oes}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			108		pF
Reverse transfer capacitance	C_{res}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			30		pF
Gate charge	Q_G	I_C = 40 A, V_{GE} = 15 V, V_{CC} = 960 V			290		nC
Turn-on delay time	$t_{d(on)}$	V_{CC} = 600 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 10 Ω, $R_{G(off)}$ = 10 Ω	T_{vj} = 25 °C, I_C = 40 A		34		ns
			T_{vj} = 175 °C, I_C = 40 A		31		
Rise time (inductive load)	t_r	V_{CC} = 600 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 10 Ω, $R_{G(off)}$ = 10 Ω	T_{vj} = 25 °C, I_C = 40 A		13		ns
			T_{vj} = 175 °C, I_C = 40 A		15		
Turn-off delay time	$t_{d(off)}$	V_{CC} = 600 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 10 Ω, $R_{G(off)}$ = 10 Ω	T_{vj} = 25 °C, I_C = 40 A		360		ns
			T_{vj} = 175 °C, I_C = 40 A		435		
Fall time (inductive load)	t_f	V_{CC} = 600 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 10 Ω, $R_{G(off)}$ = 10 Ω	T_{vj} = 25 °C, I_C = 40 A		40		ns
			T_{vj} = 175 °C, I_C = 40 A		117		
Turn-on energy	E_{on}	V_{CC} = 600 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 10 Ω, $R_{G(off)}$ = 10 Ω	T_{vj} = 25 °C, I_C = 40 A		0.97		mJ
			T_{vj} = 175 °C, I_C = 40 A		1.57		
Turn-off energy	E_{off}	V_{CC} = 600 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 10 Ω, $R_{G(off)}$ = 10 Ω	T_{vj} = 25 °C, I_C = 40 A		1.01		mJ
			T_{vj} = 175 °C, I_C = 40 A		2.1		

(table continues...)

Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Total switching energy	E_{ts}	V_{CC} = 600 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 10 Ω, $R_{G(off)}$ = 10 Ω	T_{vj} = 25 °C, I_C = 40 A		1.98		mJ
			T_{vj} = 175 °C, I_C = 40 A		3.67		
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
Diode forward current, limited by T_{vjmax}	I_F		T_c = 25 °C	66	A
			T_c = 100 °C	42	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}			160	A
Power dissipation	P_{tot}		T_c = 25 °C	192	W
			T_c = 100 °C	96	

Table 5 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode forward voltage	V_F	I_F = 40 A	T_{vj} = 25 °C		2.5	3	V
			T_{vj} = 175 °C		2.3		
Diode reverse recovery time	t_{rr}	V_R = 600 V, $R_{G(on)}$ = 10 Ω	T_{vj} = 25 °C, I_F = 40 A		90		ns
			T_{vj} = 175 °C, I_F = 40 A		170		
Diode reverse recovery charge	Q_{rr}	V_R = 600 V, $R_{G(on)}$ = 10 Ω	T_{vj} = 25 °C, I_F = 40 A		1.51		µC
			T_{vj} = 175 °C, I_F = 40 A		4.39		
Diode peak reverse recovery current	I_{rrm}	V_R = 600 V, $R_{G(on)}$ = 10 Ω	T_{vj} = 25 °C, I_F = 40 A		53		A
			T_{vj} = 175 °C, I_F = 40 A		84		

(table continues...)

Table 5 (continued) Characteristic values

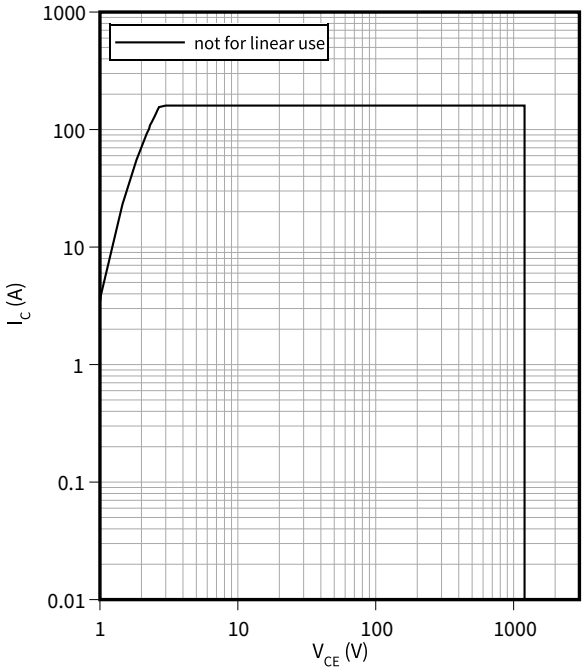
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode peak rate of fall of reverse recovery current	di_{rr}/dt	V_R = 600 V, $R_{G(on)}$ = 10 Ω	T_{vj} = 25 °C, I_F = 40 A		-1560		A/µs
			T_{vj} = 175 °C, I_F = 40 A		-1840		
Reverse recovery energy	E_{rec}	V_R = 600 V, $R_{G(on)}$ = 10 Ω	T_{vj} = 25 °C, I_F = 40 A		0.54		mJ
			T_{vj} = 175 °C, I_F = 40 A		1.82		
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.

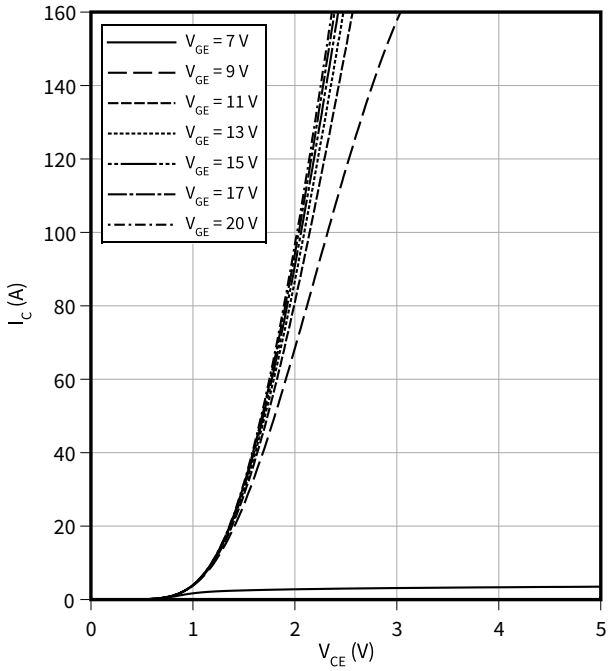
Dynamic test circuit, parasitic inductance L_σ = 30 nH, C_σ = 18 pF

4 Characteristics diagrams

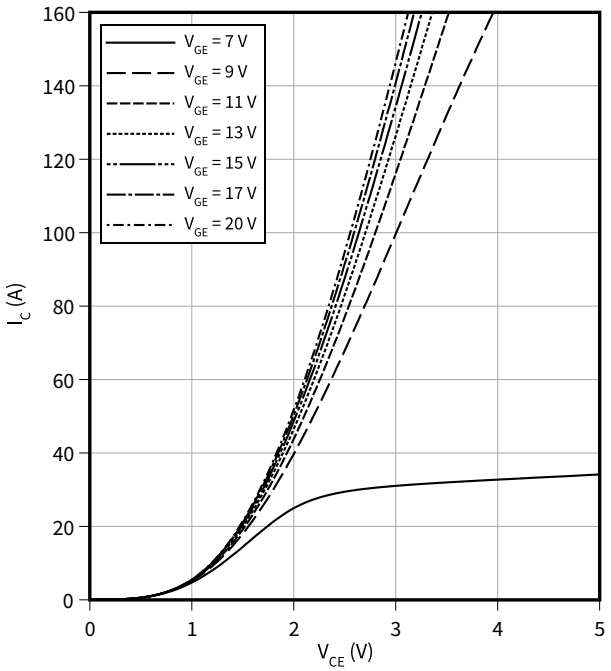
Reverse bias safe operating area
$I_C = f(V_{CE})$
$T_{vj} \leq 175\ °C$, $V_{GE} = 0/15\ V$



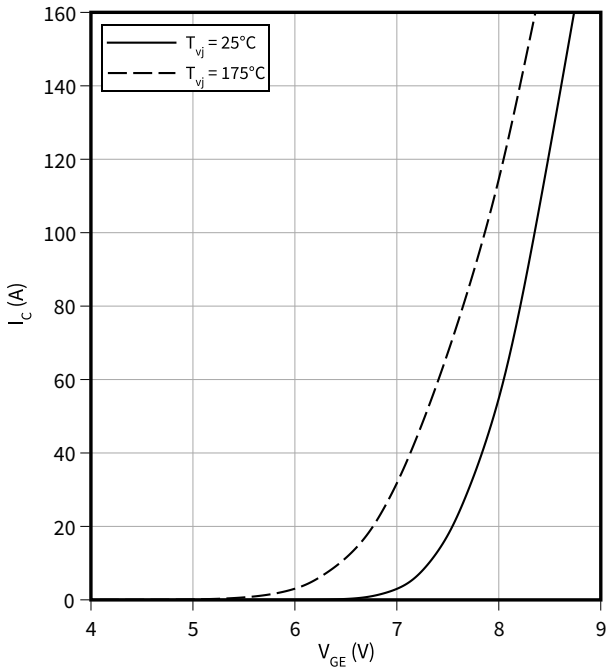
Typical output characteristic
$I_C = f(V_{CE})$
$T_{vj} = 25\ °C$



Typical output characteristic
$I_C = f(V_{CE})$
$T_{vj} = 175\ °C$



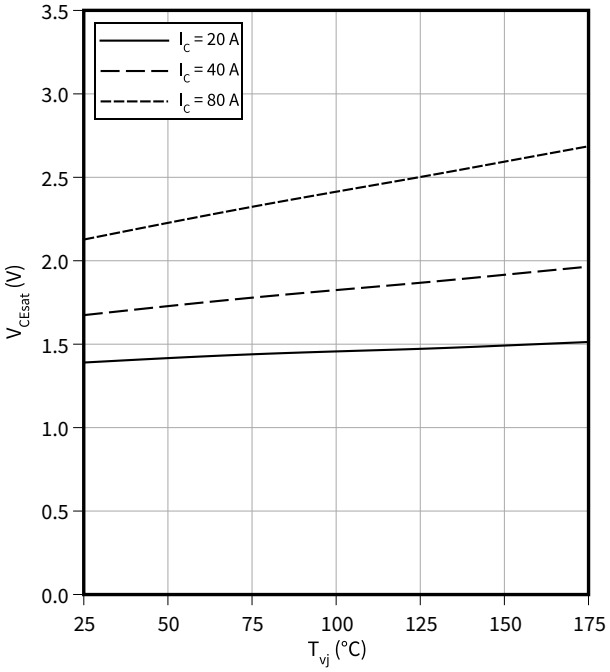
Typical transfer characteristic
$I_C = f(V_{GE})$
$V_{CE} = 20\ V$



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

$V_{CEsat} = f(T_{vj})$

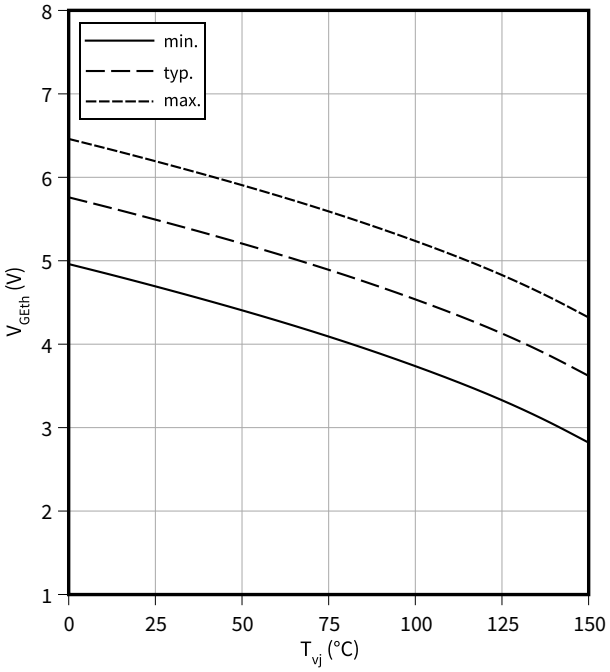
$V_{GE} = 15$ V



Gate-emitter threshold voltage as a function of junction temperature

$V_{GEth} = f(T_{vj})$

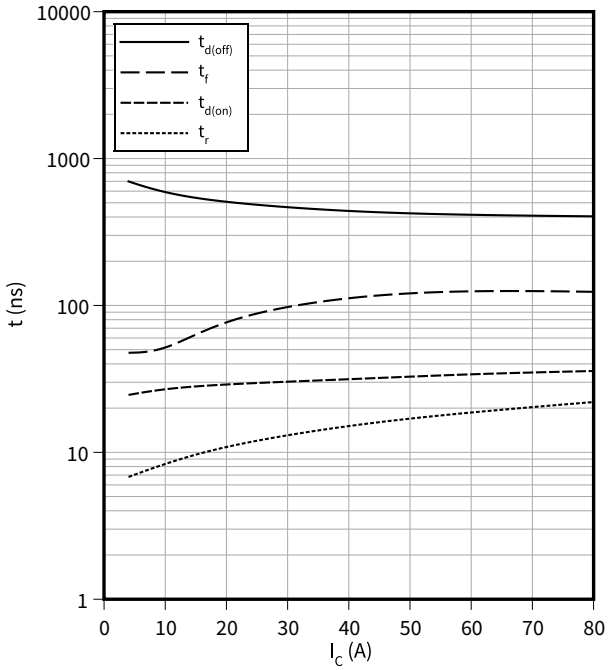
$I_C = 0.85$ mA



Typical switching times as a function of collector current

$t = f(I_C)$

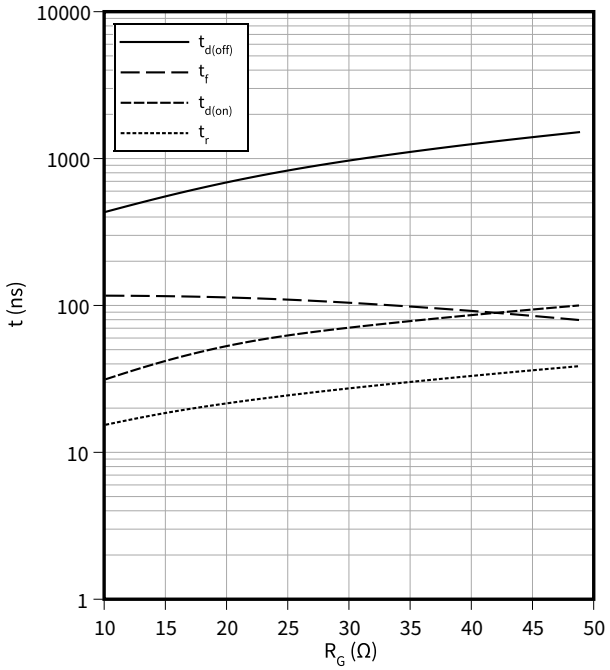
$V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 10\ \Omega$



Typical switching times as a function of gate resistor

$t = f(R_G)$

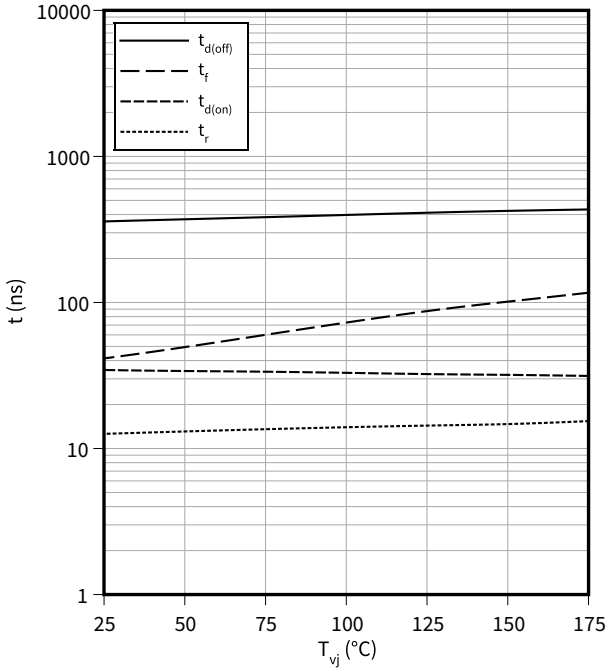
$I_C = 40$ A, $V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

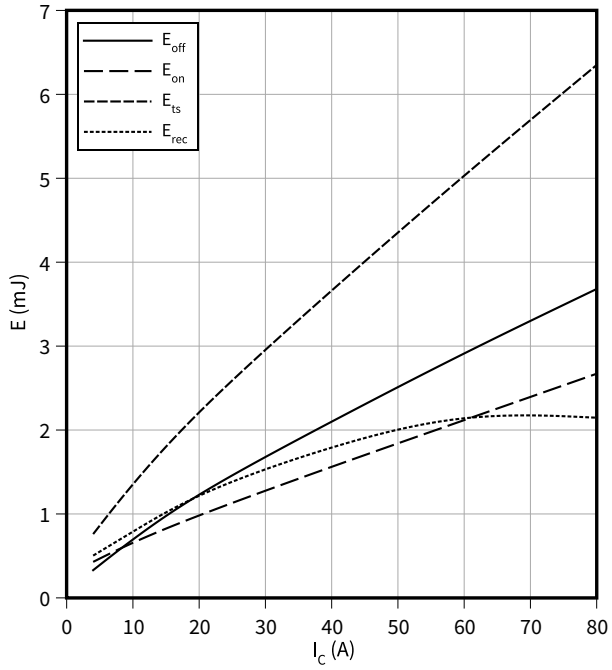
$I_C = 40$ A, $V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_G = 10\ \Omega$



Typical switching energy losses as a function of collector current

$E = f(I_C)$

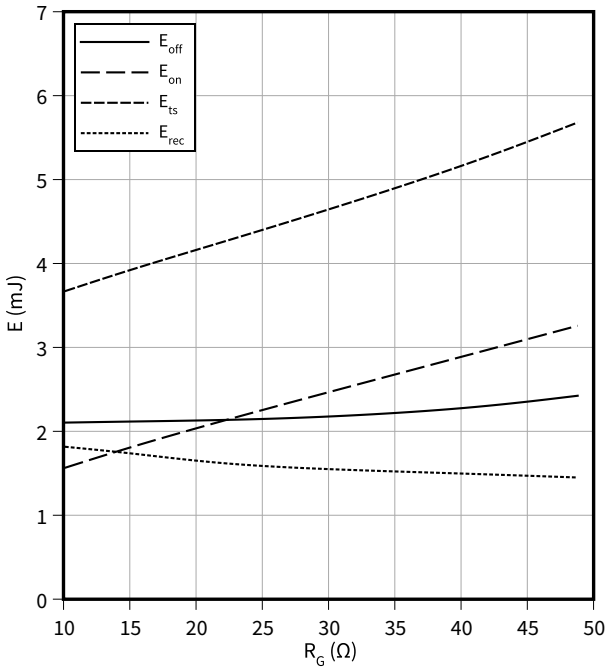
$V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 10\ \Omega$



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

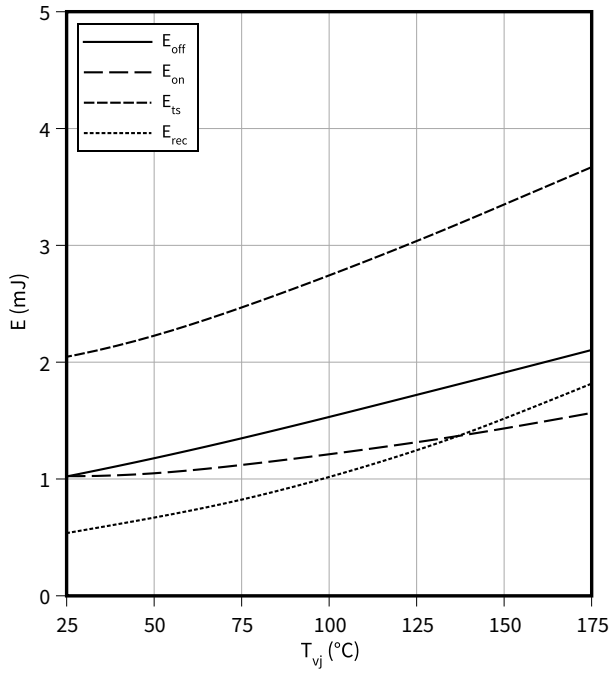
$I_C = 40$ A, $V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V



Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

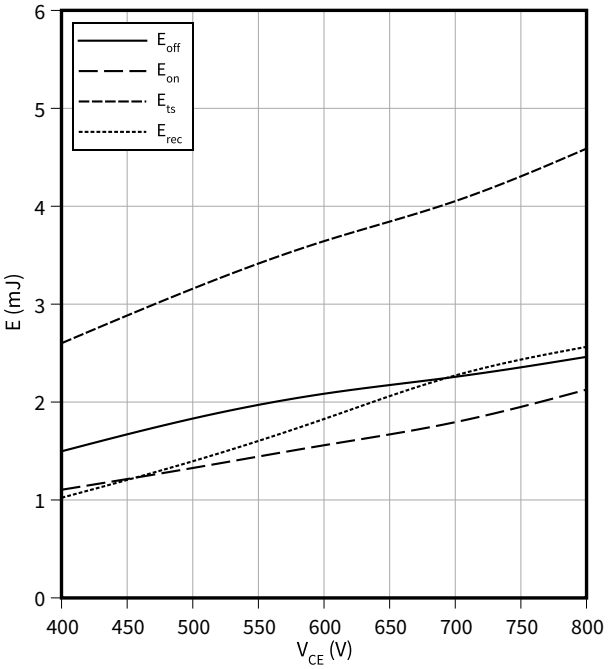
$I_C = 40$ A, $V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_G = 10\ \Omega$



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

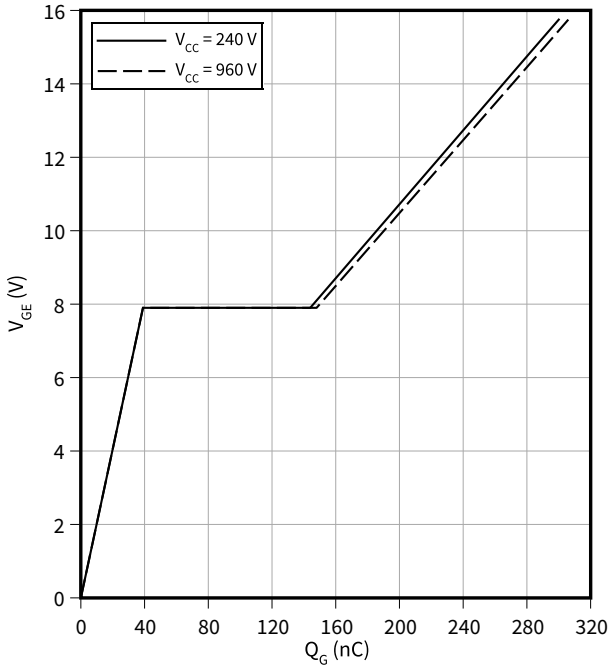
$I_C = 40\ A$, $T_{vj} = 175\ °C$, $V_{GE} = 0/15\ V$, $R_G = 10\ \Omega$



Typical gate charge

$V_{GE} = f(Q_G)$

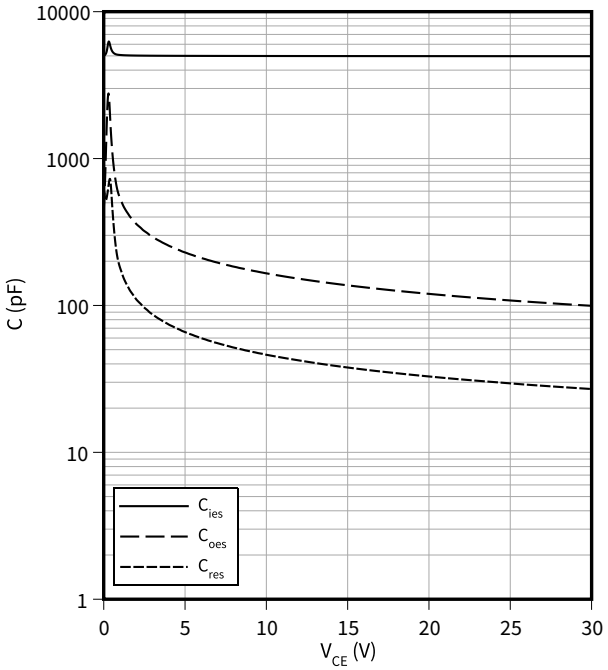
$I_C = 40\ A$



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

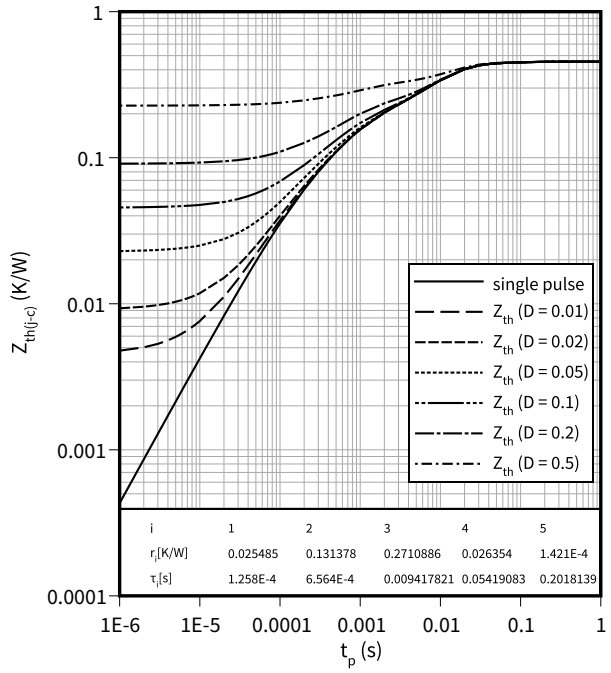
$f = 100\ kHz$, $V_{GE} = 0\ V$



IGBT transient thermal impedance as a function of pulse width

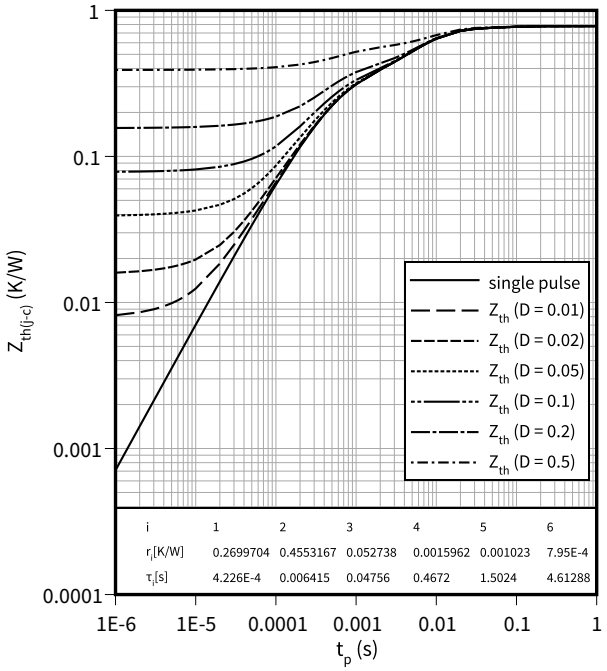
$Z_{th(j-c)} = f(t_p)$

$D = t_p/T$



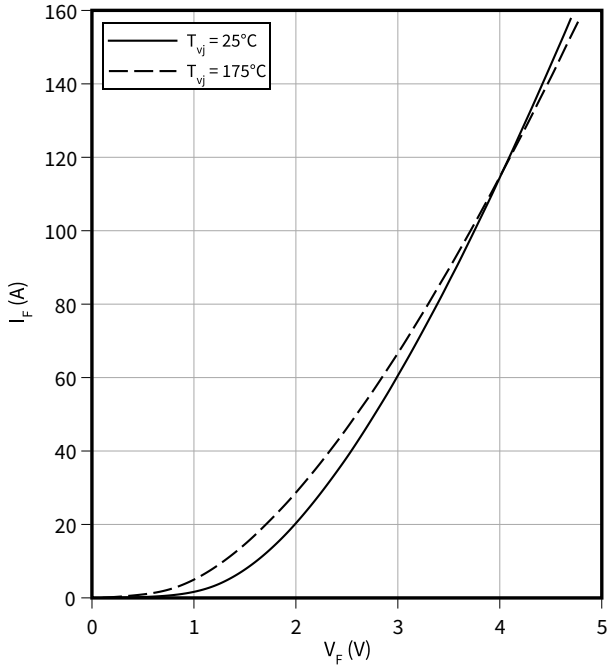
Diode transient thermal impedance as a function of pulse width

$Z_{th(j-c)} = f(t_p)$
$D = t_p/T$



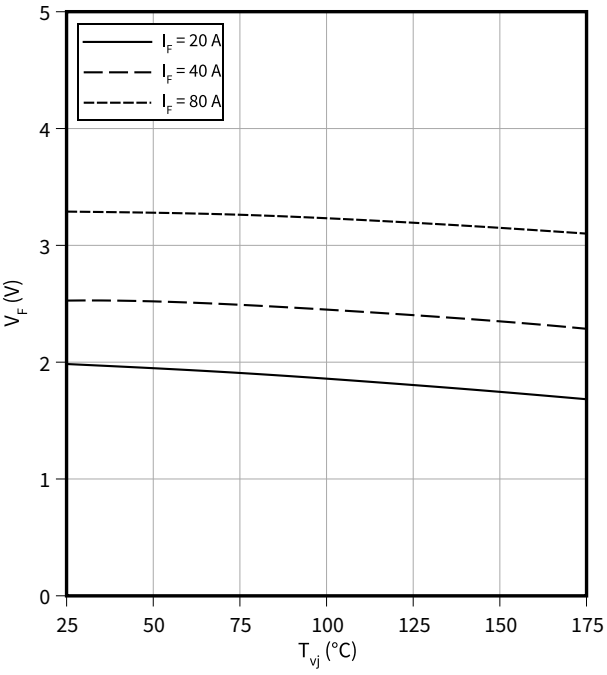
Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



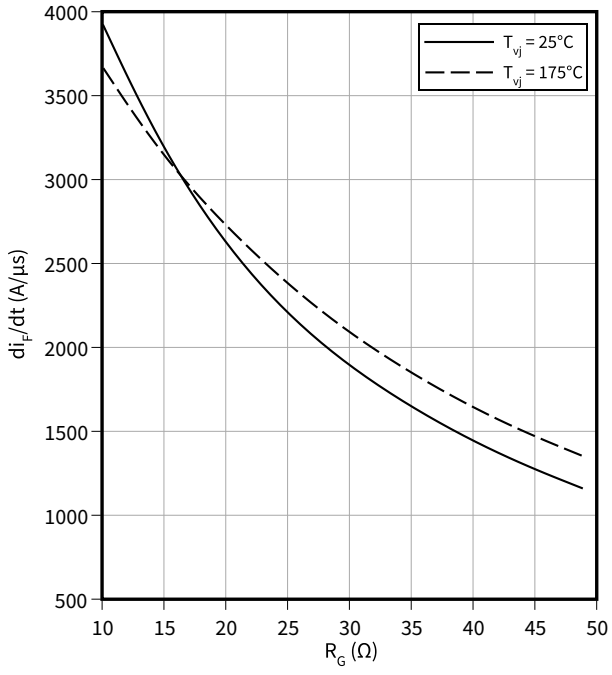
Typical diode forward voltage as a function of junction temperature

$V_F = f(T_{vj})$



Typical diode current slope as a function of gate resistor

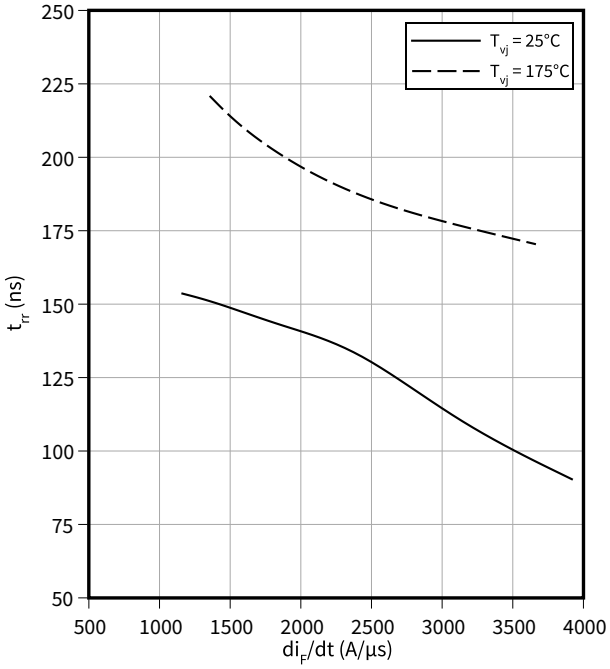
$di_F/dt = f(R_G)$
$V_R = 600$ V, $I_F = 40$ A



Typical reverse recovery time as a function of diode current slope

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

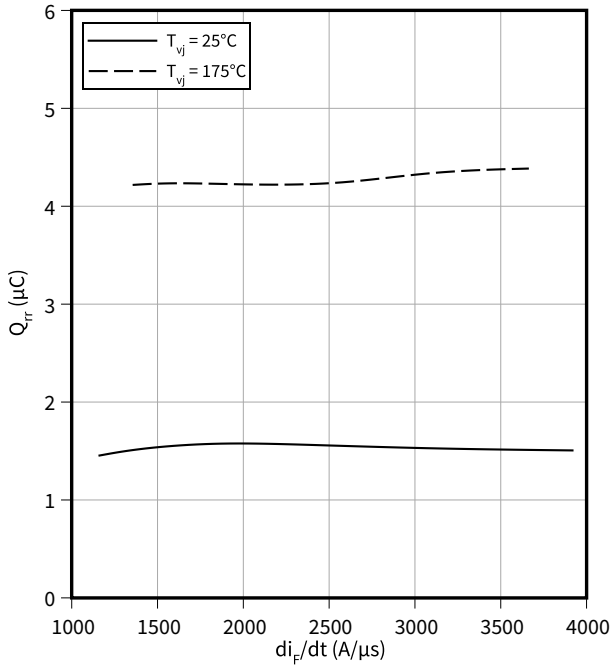
$V_R = 600\ V$, $I_F = 40\ A$



Typical reverse recovery charge as a function of diode current slope

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

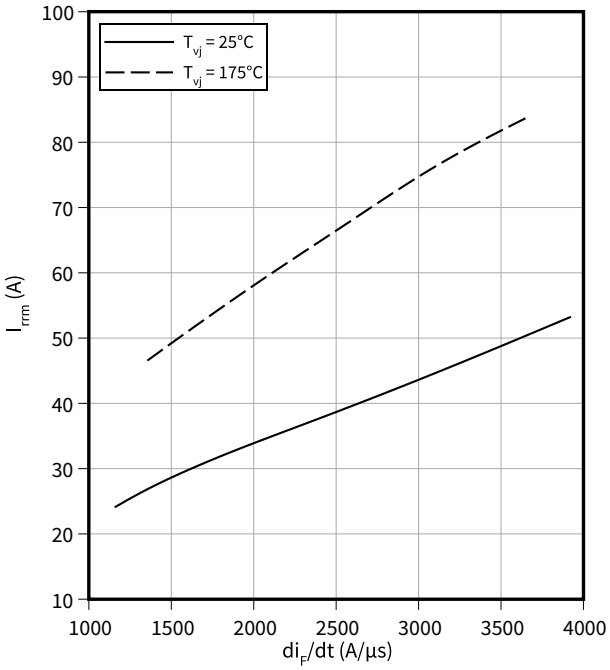
$V_R = 600\ V$, $I_F = 40\ A$



Typical reverse recovery current as a function of diode current slope

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

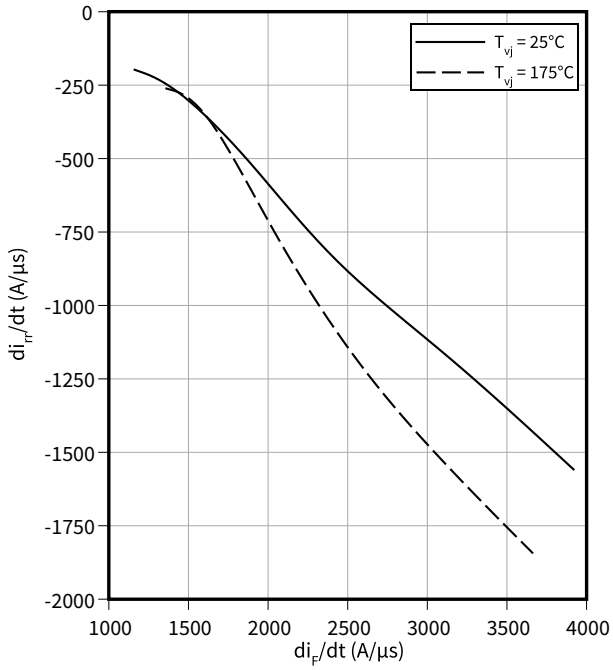
$V_R = 600\ V$, $I_F = 40\ A$



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

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

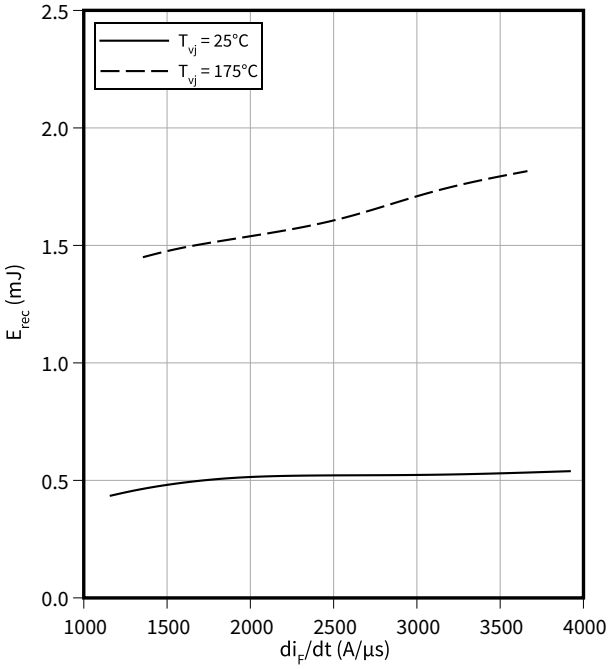
$V_R = 600\ V$, $I_F = 40\ A$



Typical reverse energy losses as a function of diode current slope

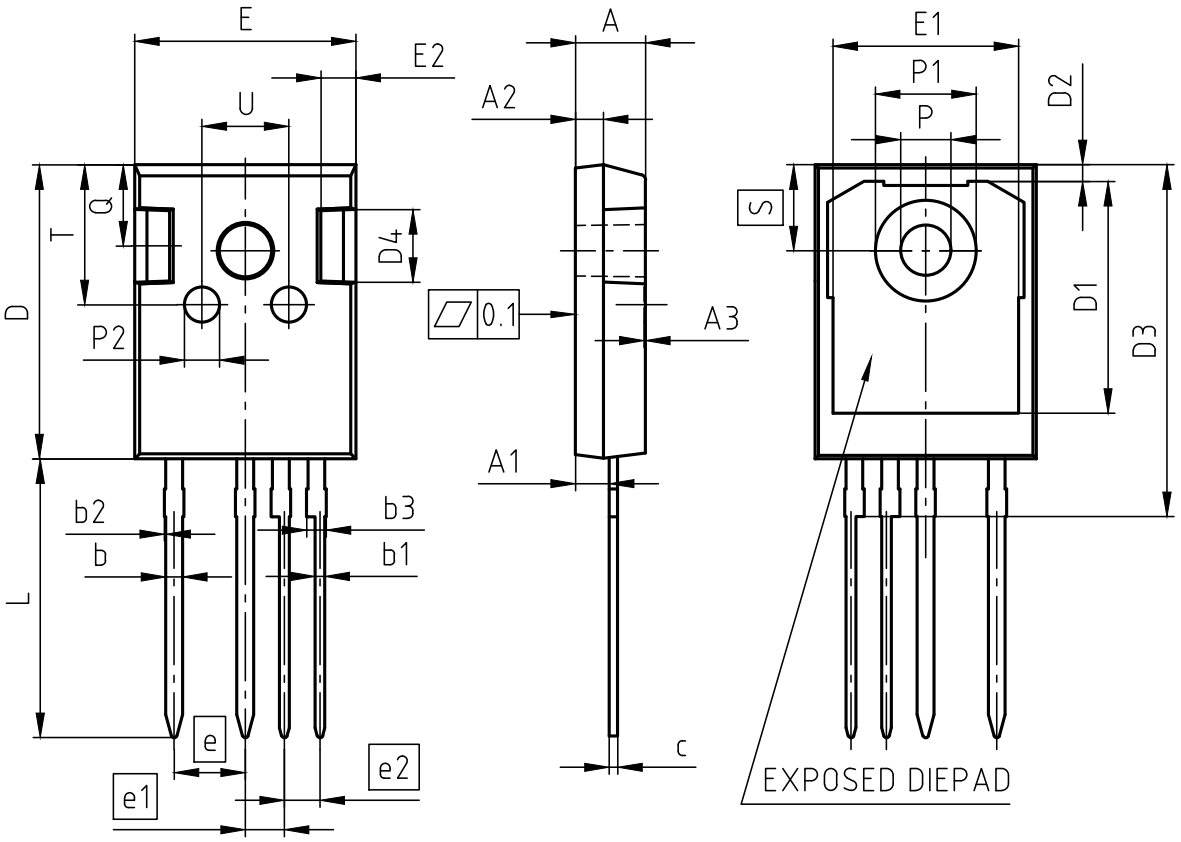
$E_{rec} = f(di_F/dt)$

$V_R = 600$ V, $I_F = 40$ A



5 Package outlines

PG-TO247-4-STD-NT3.7



NOTES:
ALL DIMENSIONS DO NOT INCLUDE MOLD FLASH
OR PROTRUSIONS.

PACKAGE - GROUP NUMBER:	PG-TO247-4-U02				
DIMENSIONS	MILLIMETERS		DIMENSIONS	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	4.90	5.10	E	15.70	15.90
A1	2.31	2.51	E1	13.10	13.50
A2	1.90	2.10	E2	2.40	2.60
A3	0.05	0.25	e	5.08	
b	1.10	1.30	e1	2.79	
b1	0.65	0.79	e2	2.54	
b2	---	0.20	N	4	
b3	1.34	1.44	L	19.80	20.10
c	0.58	0.66	øP	3.50	3.70
D	20.90	21.10	øP1	7.00	7.40
D1	16.25	16.85	øP2	2.40	2.60
D2	1.05	1.35	Q	5.60	6.00
D3	24.97	25.27	S	6.15	
D4	4.90	5.10	T	9.80	10.20
			U	6.00	6.40

Figure 1

6 Testing conditions

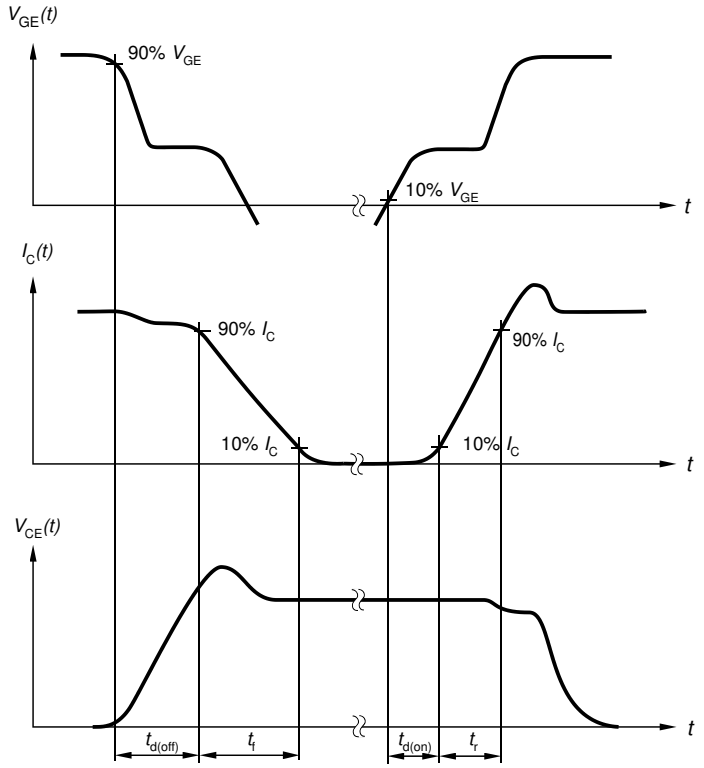


Figure A. **Definition of switching times**

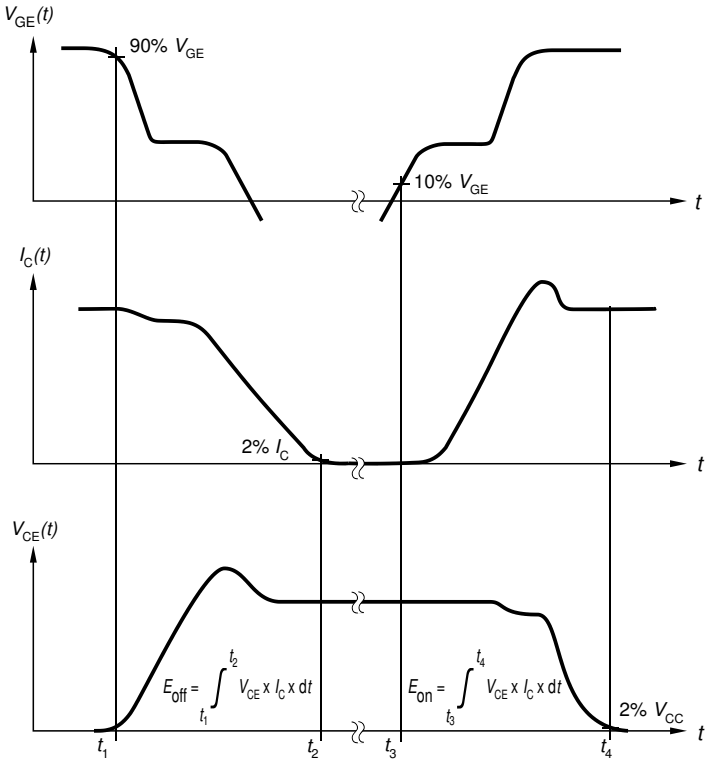


Figure B. **Definition of switching losses**

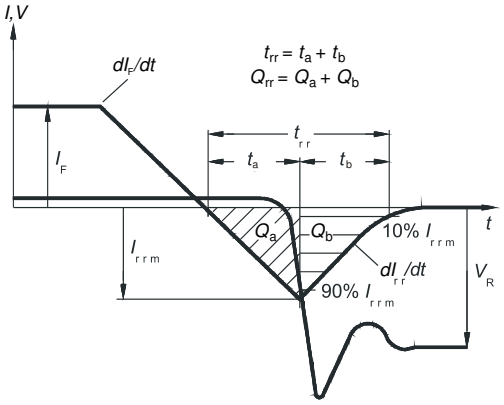


Figure C. **Definition of diode switching characteristics**

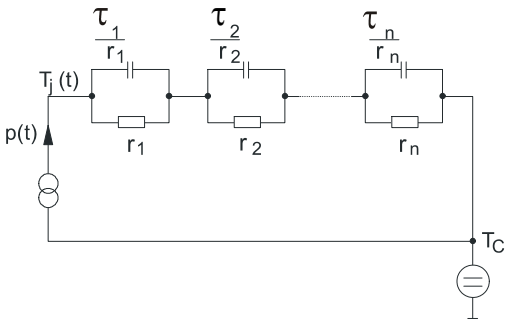


Figure D. **Thermal equivalent circuit**

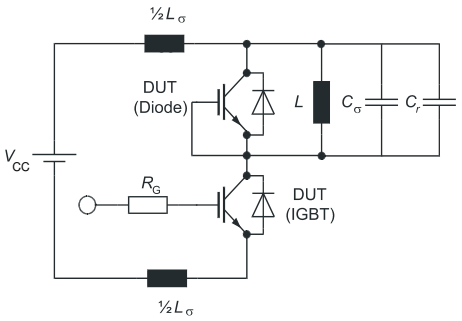


Figure E. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r,
(only for ZVT switching)

Figure 2

Revision history

Document revision	Date of release	Description of changes
0.10	2022-05-02	Target datasheet
0.20	2022-05-31	Editorial changes
1.00	2022-10-06	Final datasheet
1.10	2022-11-09	Correction of diagrams "Typical output characteristic" Correction of diagram "Typical collector-emitter saturation voltage as a function of junction temperature" Correction of diagram “Typical transfer characteristic” Correction of diagram “IGBT transient thermal impedance as a function of pulse width” Correction of diagram “Diode transient thermal impedance as a function of pulse width” Correction of diagram "Typical diode forward voltage as a function of junction temperature"
1.20	2022-11-23	Update of potential applications

Trademarks

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

Edition 2022-11-23

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-ABB253-005

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:
IKZA40N120CH7XKSA1