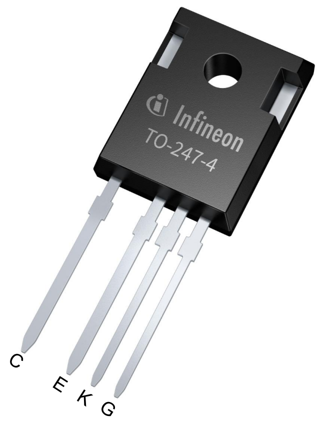
High speed and low saturation voltage 650 V TRENCHSTOP™ IGBT7 technology copacked with soft, fast recovery Emitter Controlled 7 diode

Features

- V_{CE} = 650 V
- I_C = 75 A
- Low switching losses
- Very low collector-emitter saturation voltage V_{CEsat}
- Very soft, fast recovery antiparallel diode
- Smooth switching behavior
- Humidity robustness
- Optimized for hard switching, two- and three-level topologies
- Complete product spectrum and PSpice Models: http://www.infineon.com/igbt/



Potential applications

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

Product validation

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

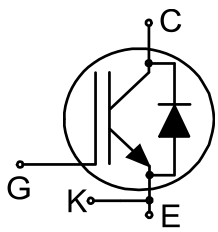
Lead-free

Green

Halogen-free

RoHS

Description



Type	Package	Marking
IKZA75N65EH7	PG-TO247-4-STD-NT3.7	K75EEH7

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	$R_{th(j-c)}$			0.34	0.44	K/W
Diode thermal resistance, junction-case	$R_{th(j-c)}$			0.45	0.58	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	limited by bondwire	$T_c = 25$ °C	80	A
			$T_c = 100$ °C	80	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			300	A
Turn-off safe operating area		$V_{CE} \leq 650$ V, $t_p \leq 1$ µs, $T_{vj} \leq 175$ °C		300	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	338	W
			$T_c = 100$ °C	148	

Table 3 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 75$ A, $V_{GE} = 15$ V	$T_{vj} = 25$ °C		1.4	1.65	V
			$T_{vj} = 175$ °C		1.6		

(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 = 0.66 mA, V_{CE} = V_{GE}		2.9	3.85	4.8	V
Zero gate-voltage collector current	I_{CES}	V_{CE} = 650 V, V_{GE} = 0 V	T_{vj} = 25 °C			25	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 = 75 A, V_{CE} = 20 V			116		S
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			3886		pF
Output capacitance	C_{oes}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			123.7		pF
Reverse transfer capacitance	C_{res}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			16.8		pF
Gate charge	Q_G	V_{CC} = 520 V, I_C = 75 A, V_{GE} = 15 V			152		nC
Turn-on delay time	$t_{d(on)}$	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 10 Ω, $R_{G(off)}$ = 10 Ω	T_{vj} = 25 °C, I_C = 75 A		26		ns
			T_{vj} = 175 °C, I_C = 75 A		24		
Rise time (inductive load)	t_r	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 10 Ω, $R_{G(off)}$ = 10 Ω	T_{vj} = 25 °C, I_C = 75 A		13		ns
			T_{vj} = 175 °C, I_C = 75 A		16		
Turn-off delay time	$t_{d(off)}$	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 10 Ω, $R_{G(off)}$ = 10 Ω	T_{vj} = 25 °C, I_C = 75 A		199		ns
			T_{vj} = 175 °C, I_C = 75 A		223		
Fall time (inductive load)	t_f	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 10 Ω, $R_{G(off)}$ = 10 Ω	T_{vj} = 25 °C, I_C = 75 A		15		ns
			T_{vj} = 175 °C, I_C = 75 A		19		
Turn-on energy	E_{on}	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 10 Ω, $R_{G(off)}$ = 10 Ω	T_{vj} = 25 °C, I_C = 75 A		0.75		mJ
			T_{vj} = 175 °C, I_C = 75 A		1.4		
Turn-off energy	E_{off}	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 10 Ω, $R_{G(off)}$ = 10 Ω	T_{vj} = 25 °C, I_C = 75 A		0.84		mJ
			T_{vj} = 175 °C, I_C = 75 A		1.5		

(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} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 10 Ω, $R_{G(off)}$ = 10 Ω	T_{vj} = 25 °C, I_C = 75 A		1.59		mJ
			T_{vj} = 175 °C, I_C = 75 A		2.9		
Operating junction temperature	T_{vj}			-40		175	°C

3 Diode

Table 4 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Diode forward current, limited by T_{vjmax}	I_F	limited by bondwire	T_c = 25 °C	80	A
			T_c = 100 °C	80	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}			300	A
Power dissipation	P_{tot}		T_c = 25 °C	258	W
			T_c = 100 °C	129	

Table 5 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode forward voltage	V_F	I_F = 75 A	T_{vj} = 25 °C		1.65	2	V
			T_{vj} = 175 °C		1.55		
Diode reverse recovery time	t_{rr}	V_R = 400 V, $R_{G(on)}$ = 10 Ω	T_{vj} = 25 °C, I_F = 75 A		56		ns
			T_{vj} = 175 °C, I_F = 75 A		108		
Diode reverse recovery charge	Q_{rr}	V_R = 400 V, $R_{G(on)}$ = 10 Ω	T_{vj} = 25 °C, I_F = 75 A		1.87		µC
			T_{vj} = 175 °C, I_F = 75 A		4.5		
Diode peak reverse recovery current	I_{rrm}	V_R = 400 V, $R_{G(on)}$ = 10 Ω	T_{vj} = 25 °C, I_F = 75 A		59.4		A
			T_{vj} = 175 °C, I_F = 75 A		86.3		

(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 = 400 V, $R_{G(on)}$ = 10 Ω	T_{vj} = 25 °C, I_F = 75 A		-1620		A/μs
			T_{vj} = 175 °C, I_F = 75 A		-1760		
Reverse recovery energy	E_{rec}	V_R = 400 V, $R_{G(on)}$ = 10 Ω	T_{vj} = 25 °C, I_F = 75 A		0.49		mJ
			T_{vj} = 175 °C, I_F = 75 A		1.17		
Operating junction temperature	T_{vj}			-40		175	°C

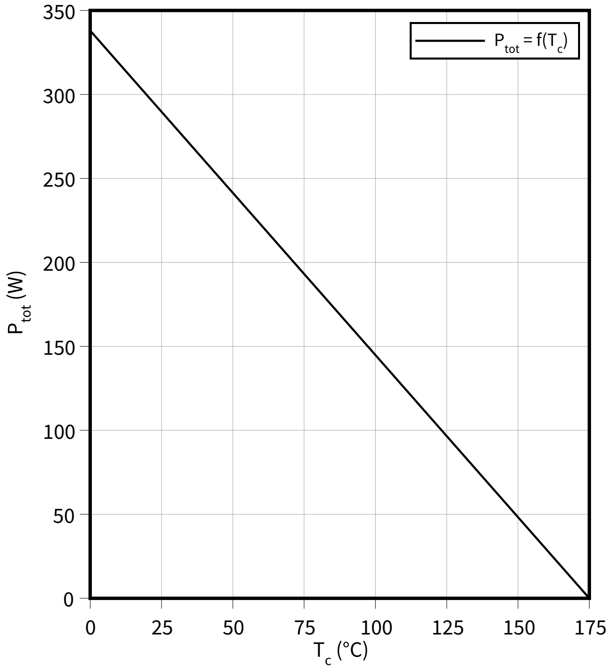
Note: *For optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.*

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

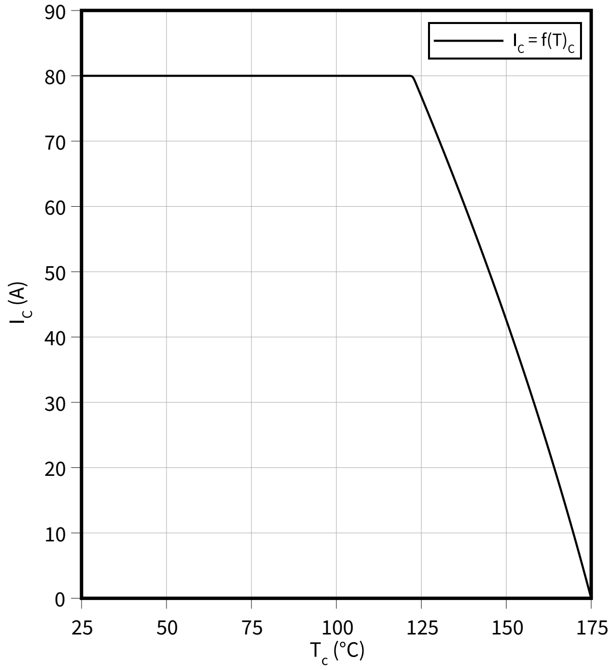
Dynamic test circuit, parasitic inductance L_σ = 8 nH, parasitic capacitor C_σ = 30 pF from Fig. E. Energy losses include “tail” and diode reverse recovery.

4 Characteristics diagrams

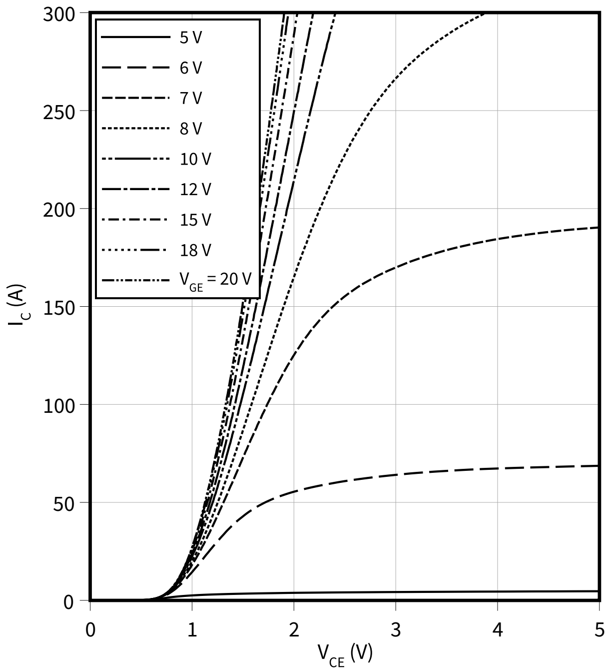
Power dissipation as a function of case temperature
$P_{tot} = f(T_c)$
$T_{vj} \leq 175$ °C



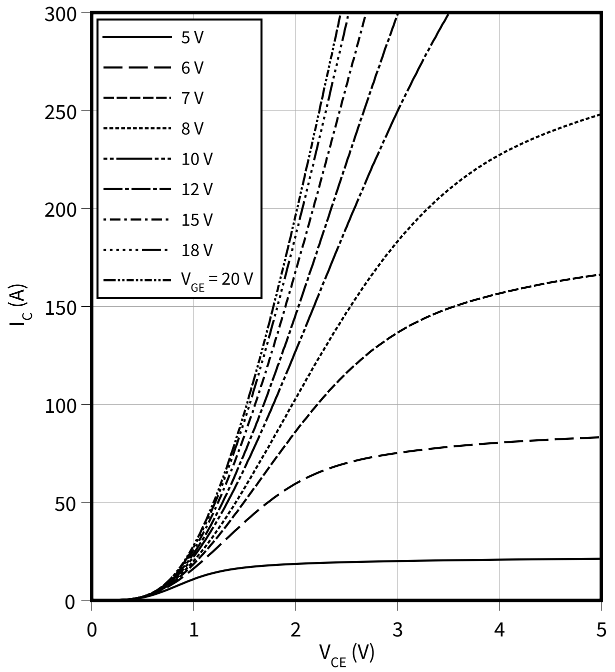
Collector current as a function of case temperature
$I_C = f(T_c)$
$T_{vj} \leq 175$ °C, $V_{GE} \geq 15$ V



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



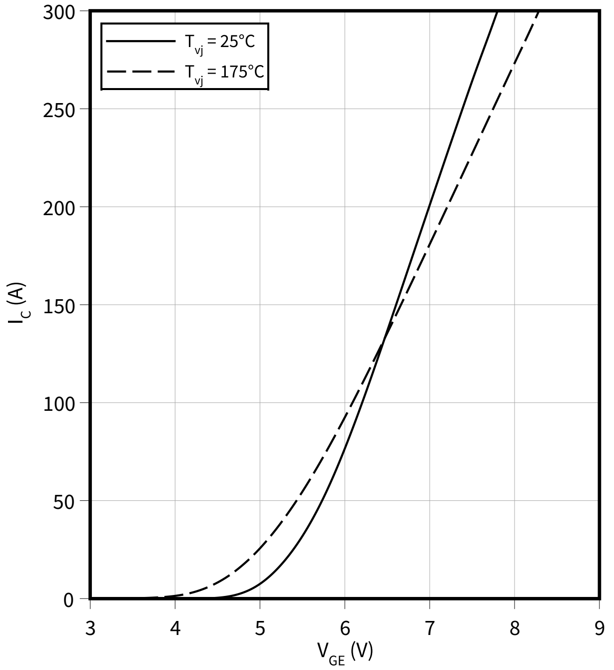
Typical output characteristic
$I_C = f(V_{CE})$
$T_{vj} = 175$ °C



Typical transfer characteristic

$I_C = f(V_{GE})$

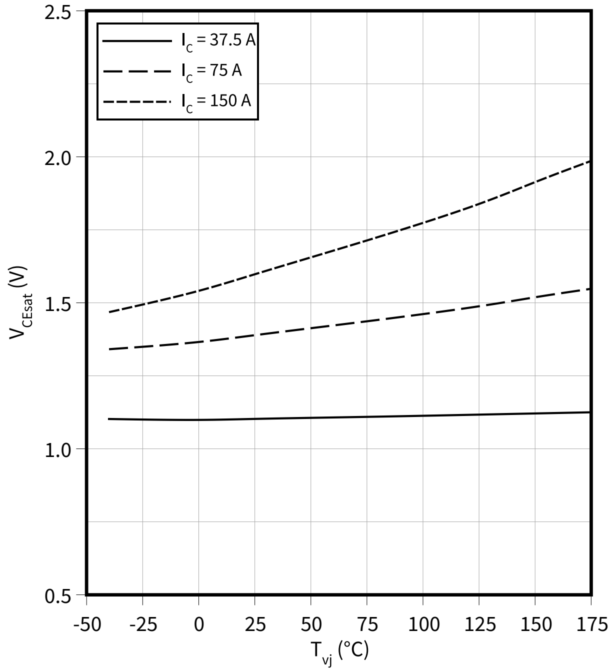
$V_{CE} = 20$ V



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

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

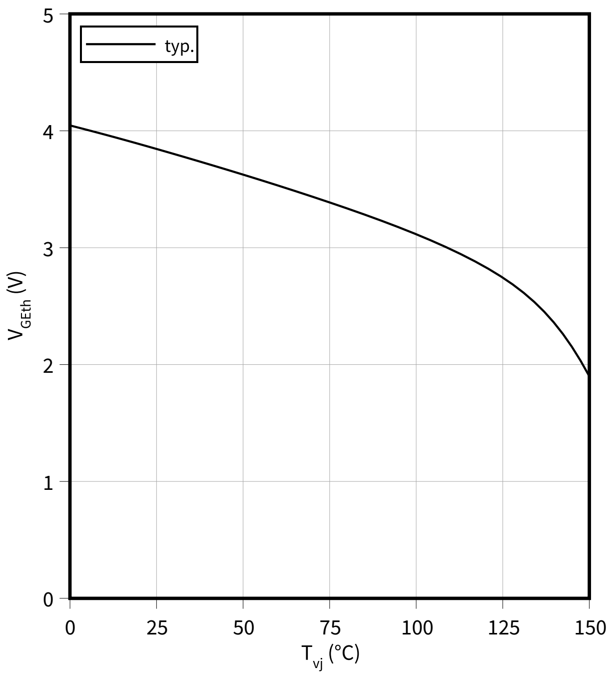
$V_{GE} = 15$ V



Gate-emitter threshold voltage as a function of junction temperature

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

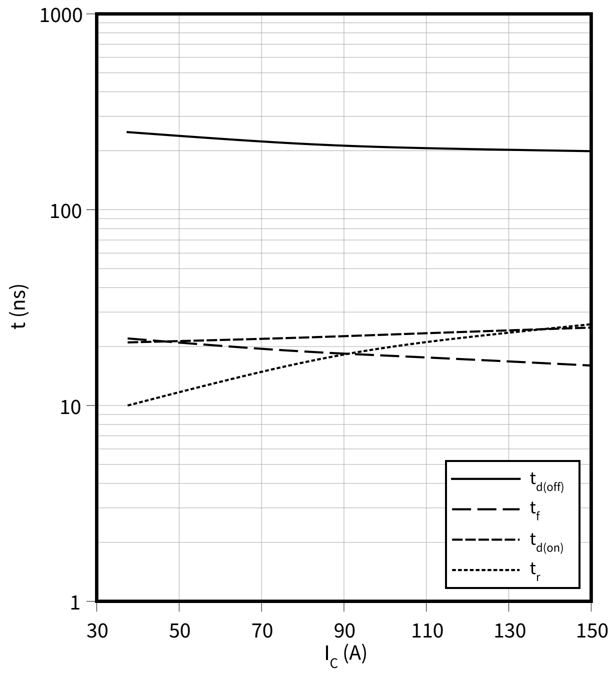
$I_C = 0.66$ mA



Typical switching times as a function of collector current

$t = f(I_C)$

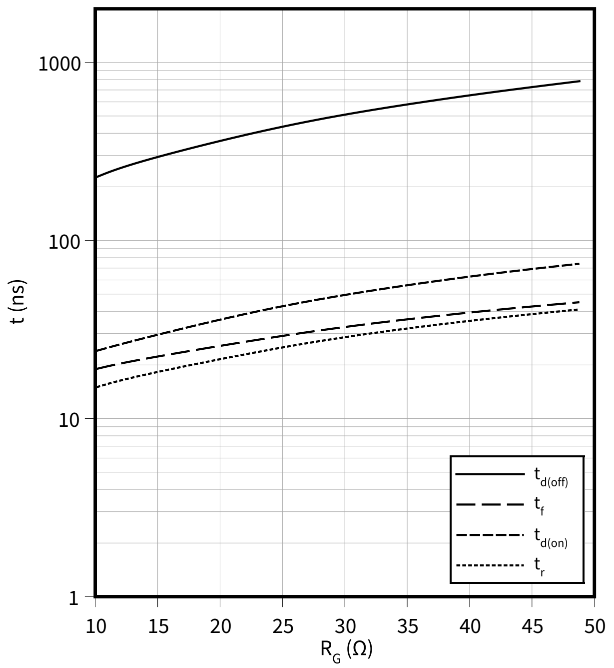
$V_{CC} = 400$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 10\ \Omega$



Typical switching times as a function of gate resistor

$t = f(R_G)$

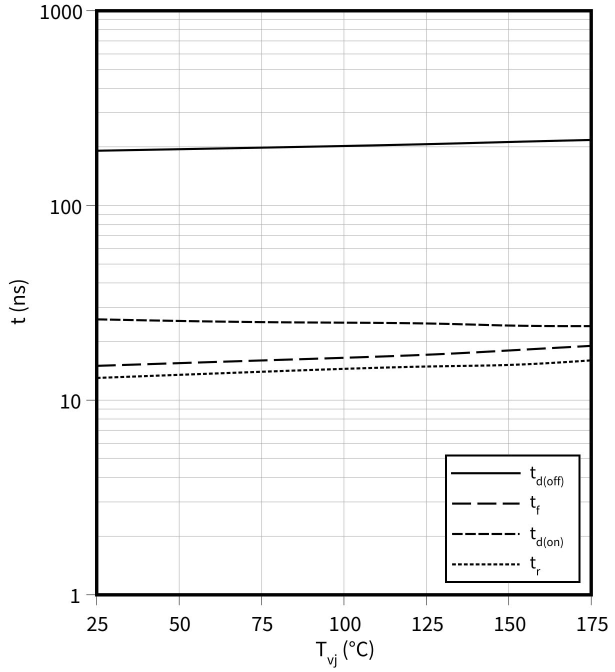
$I_C = 75$ A, $V_{CC} = 400$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

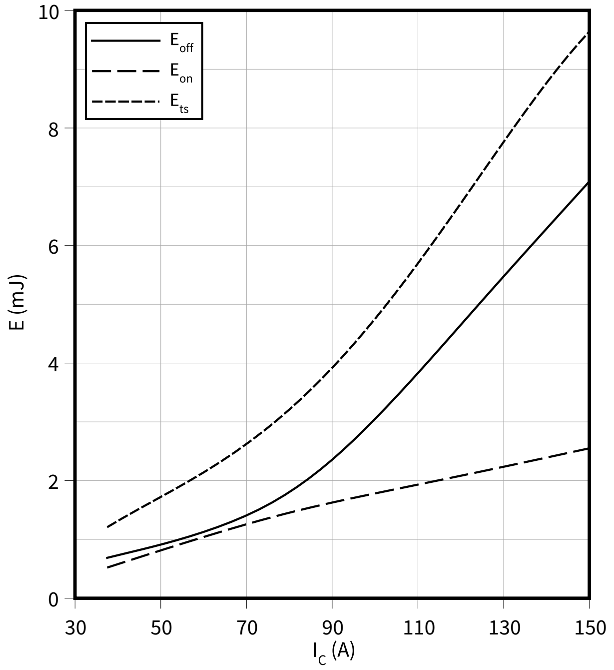
$I_C = 75$ A, $V_{CC} = 400$ V, $V_{GE} = 0/15$ V, $R_G = 10$ Ω



Typical switching energy losses as a function of collector current

$E = f(I_C)$

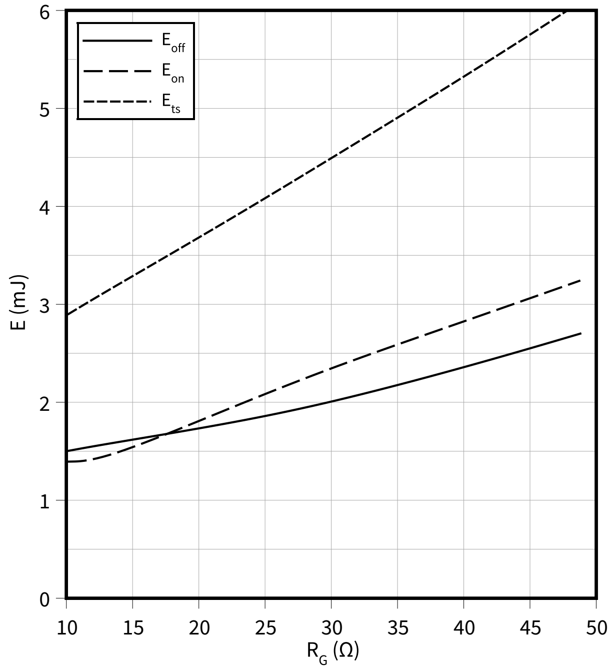
$V_{CC} = 400$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 10$ Ω

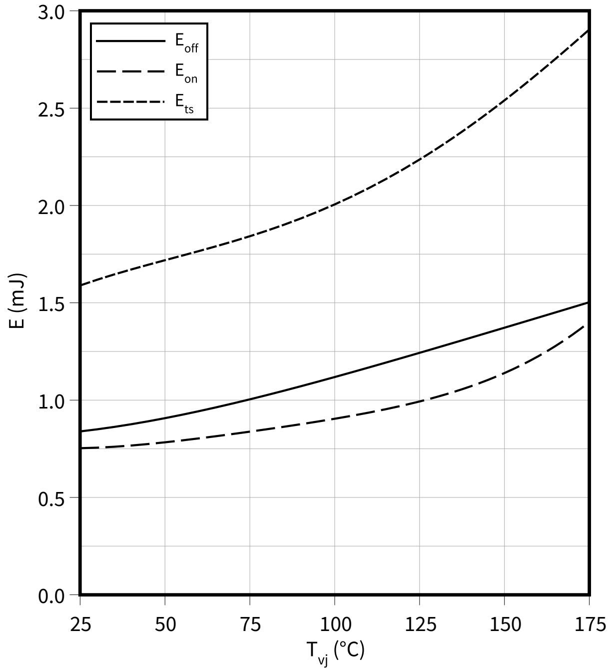
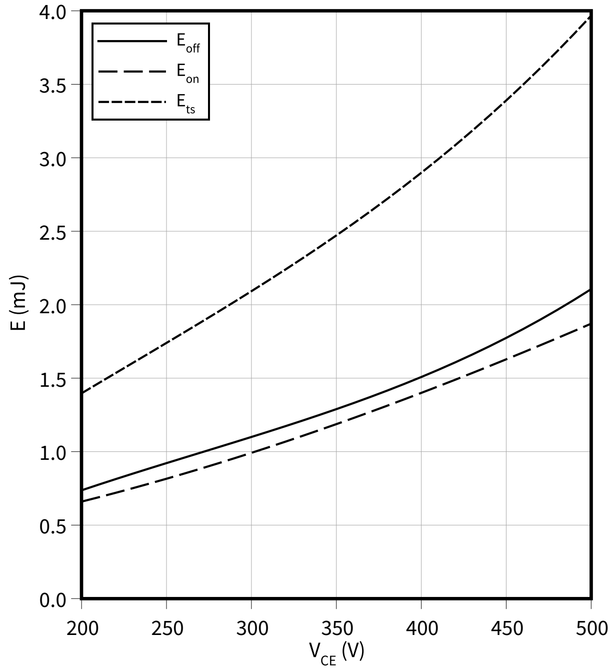


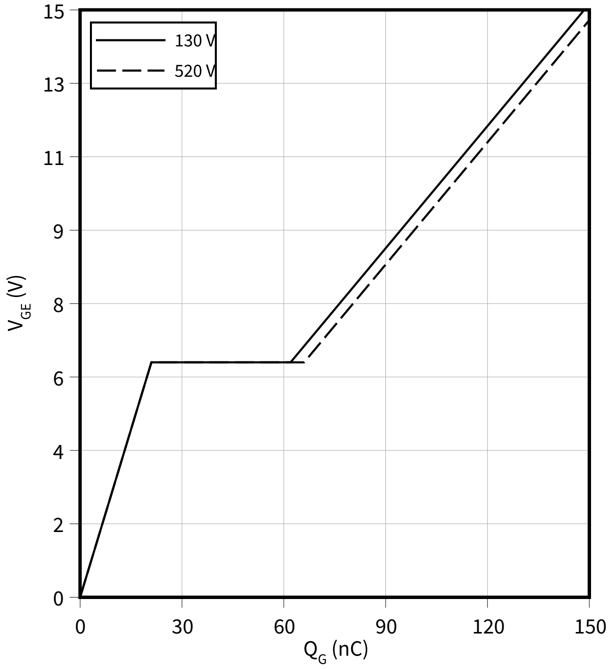
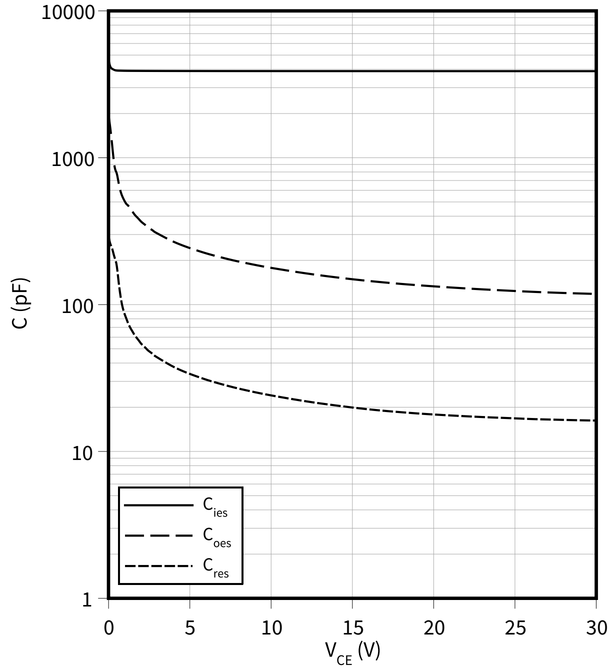
Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

$I_C = 75$ A, $V_{CC} = 400$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V

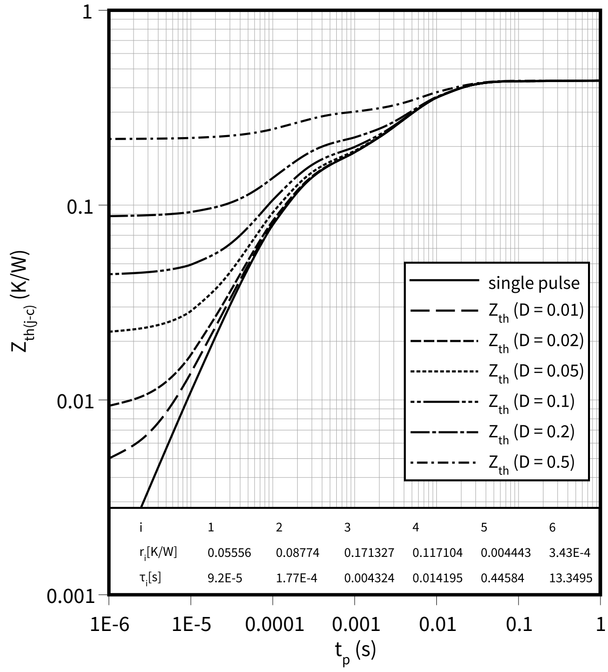


Typical switching energy losses as a function of junction temperature $E = f(T_{vj})$ I_C = 75 A, V_{CC} = 400 V, V_{GE} = 0/15 V, R_G = 10 Ω	**Typical switching energy losses as a function of collector emitter voltage** $E = f(V_{CE})$ I_C = 75 A, T_{vj} = 175 °C, V_{GE} = 0/15 V, R_G = 10 Ω
	

Typical gate charge $V_{GE} = f(Q_G)$ I_C = 75 A	**Typical capacitance as a function of collector-emitter voltage** $C = f(V_{CE})$ f = 100 kHz, V_{GE} = 0 V
	

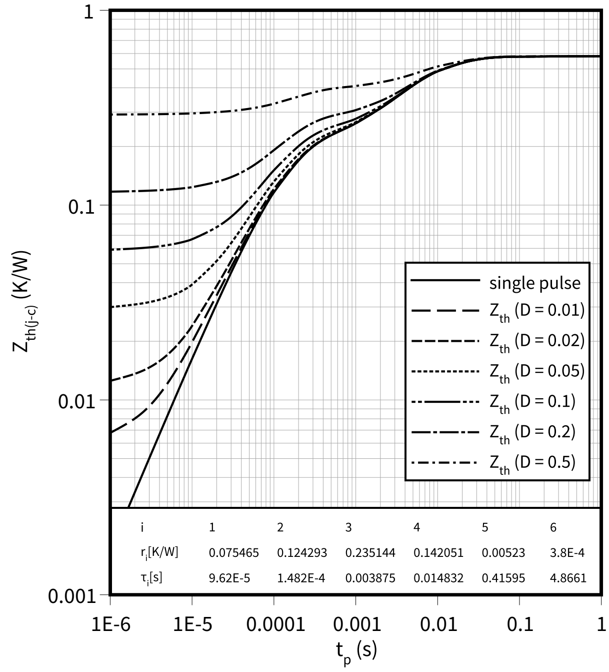
IGBT transient thermal impedance as a function of pulse width

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



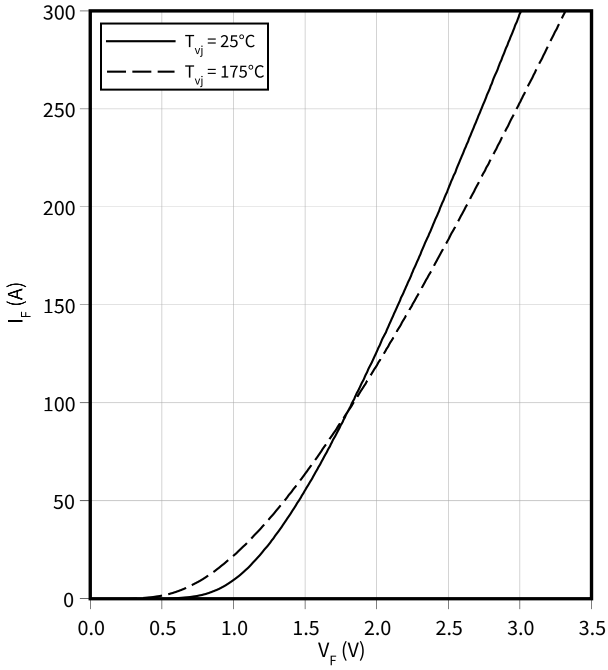
Diode transient thermal impedance as a function of pulse width

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



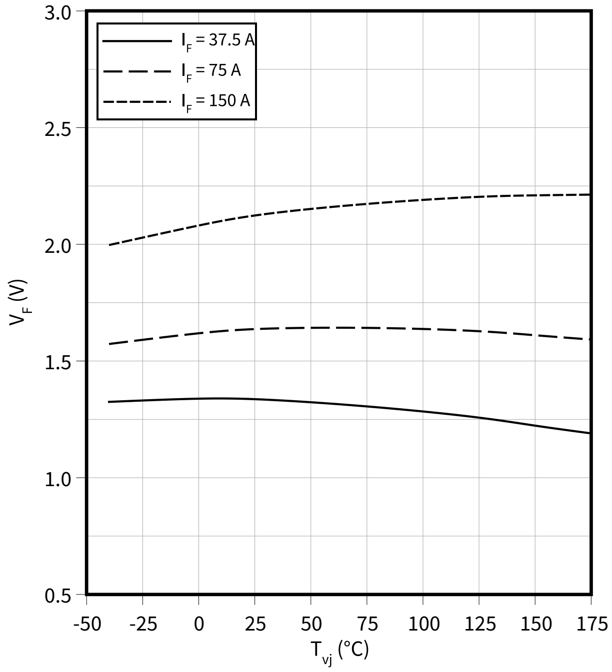
Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$

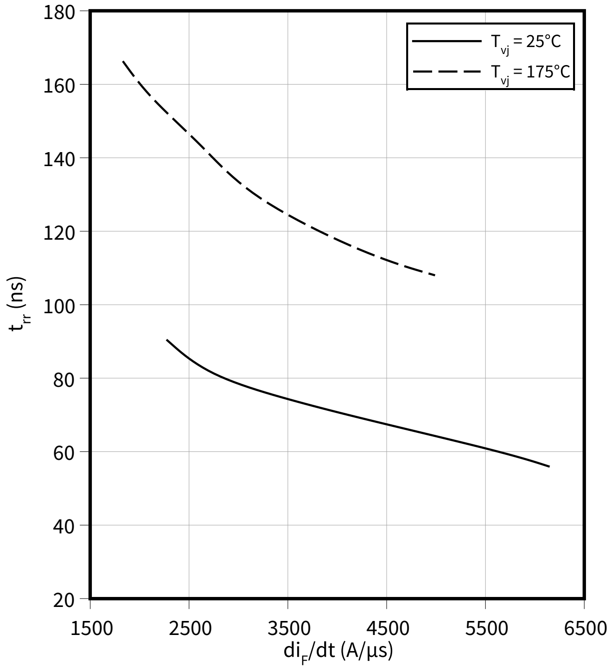


Typical diode forward voltage as a function of junction temperature

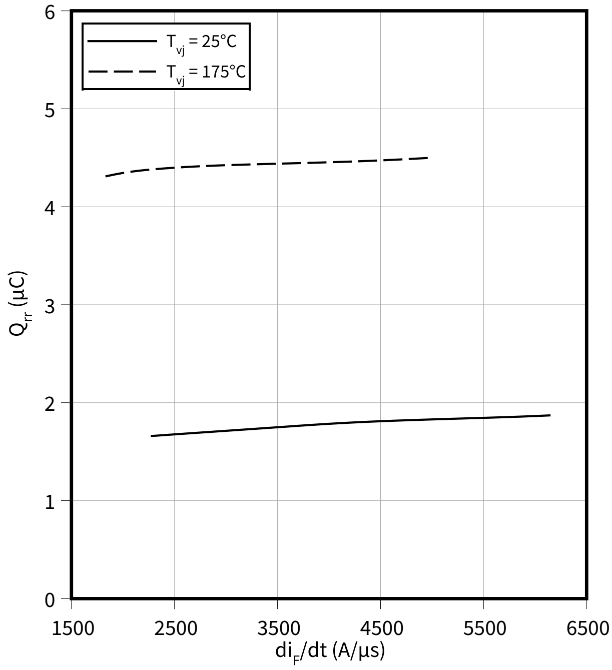
$V_F = f(T_{vj})$



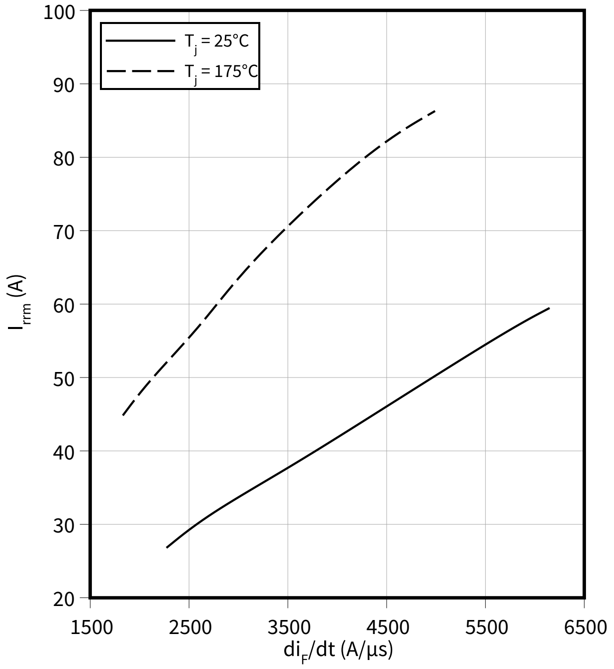
Typical reverse recovery time as a function of diode current slope
$t_{rr} = f(di_F/dt)$
$V_R = 400$ V, $I_F = 75$ A



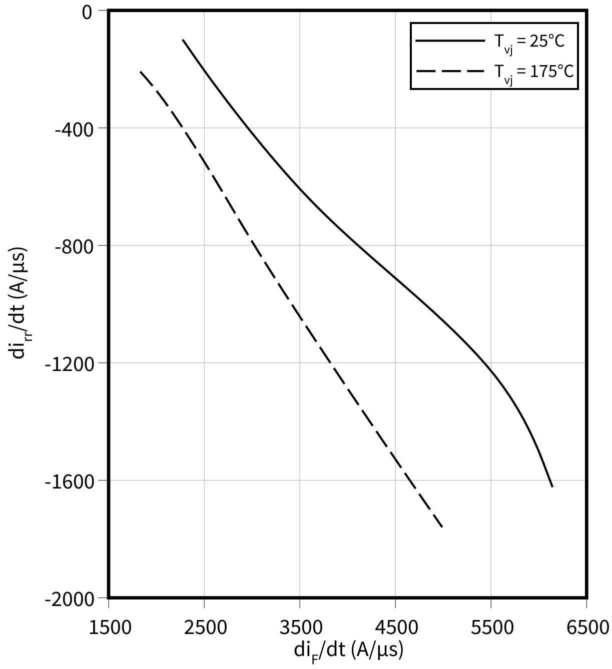
Typical reverse recovery charge as a function of diode current slope
$Q_{rr} = f(di_F/dt)$
$V_R = 400$ V, $I_F = 75$ A



Typical reverse recovery current as a function of diode current slope
$I_{rrm} = f(di_F/dt)$
$V_R = 400$ V, $I_F = 75$ A



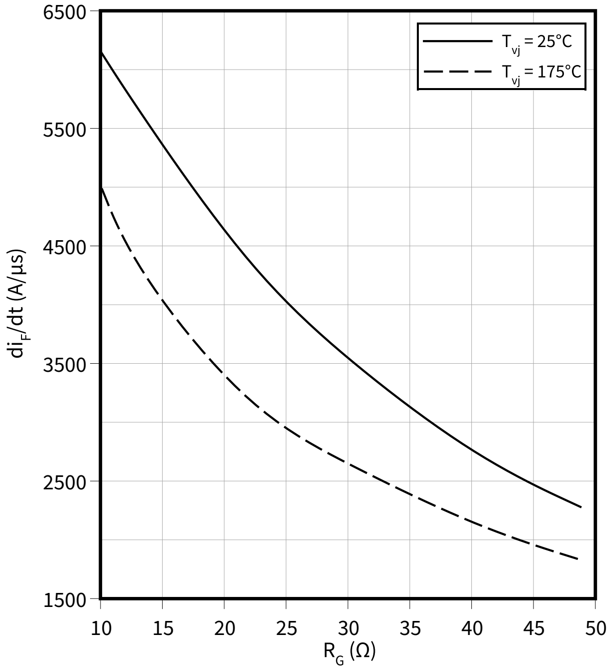
Typical diode peak rate of fall of reverse recovery current as a function of diode current slope
$di_{rr}/dt = f(di_F/dt)$
$V_R = 400$ V, $I_F = 75$ A



Typical diode current slope as a function of gate resistor

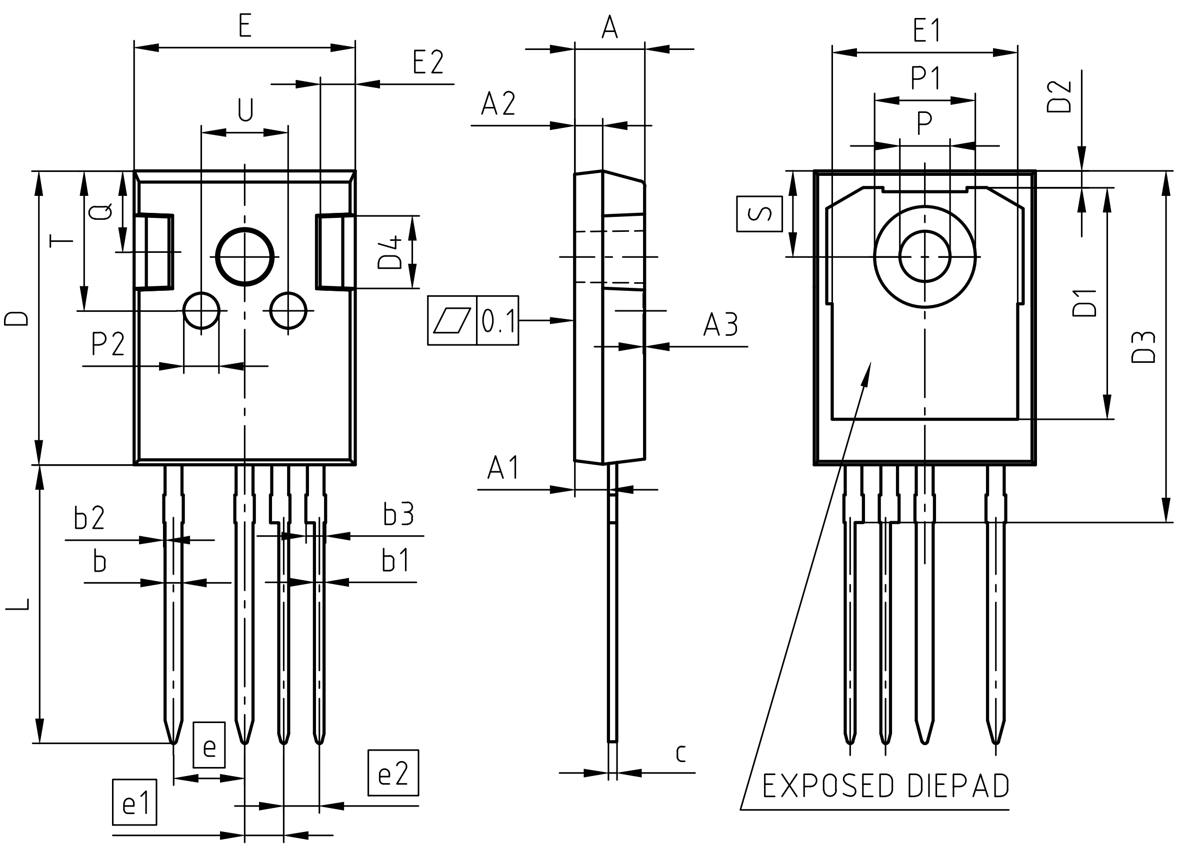
$di_F/dt = f(R_G)$

$V_R = 400$ V, $I_F = 75$ 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

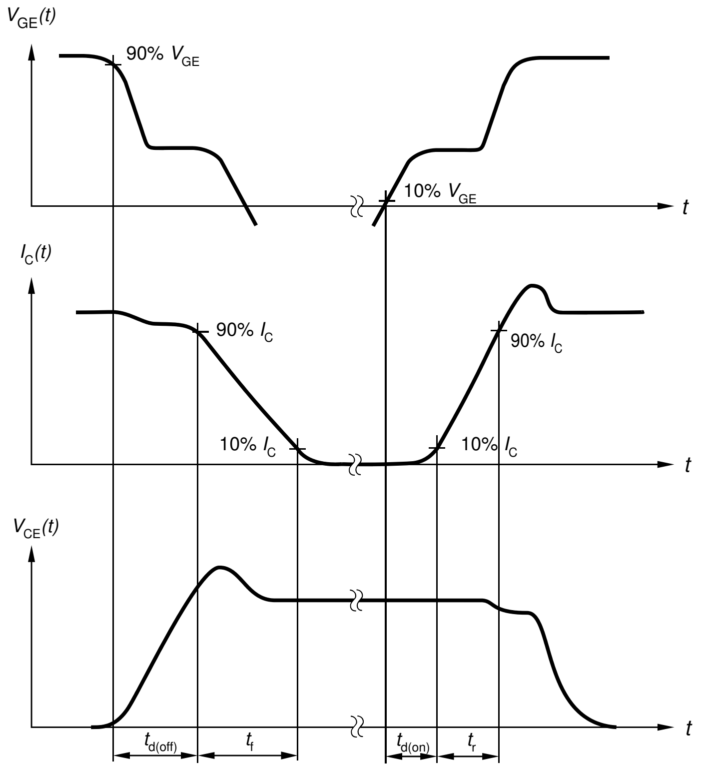


Figure A. **Definition of switching times**

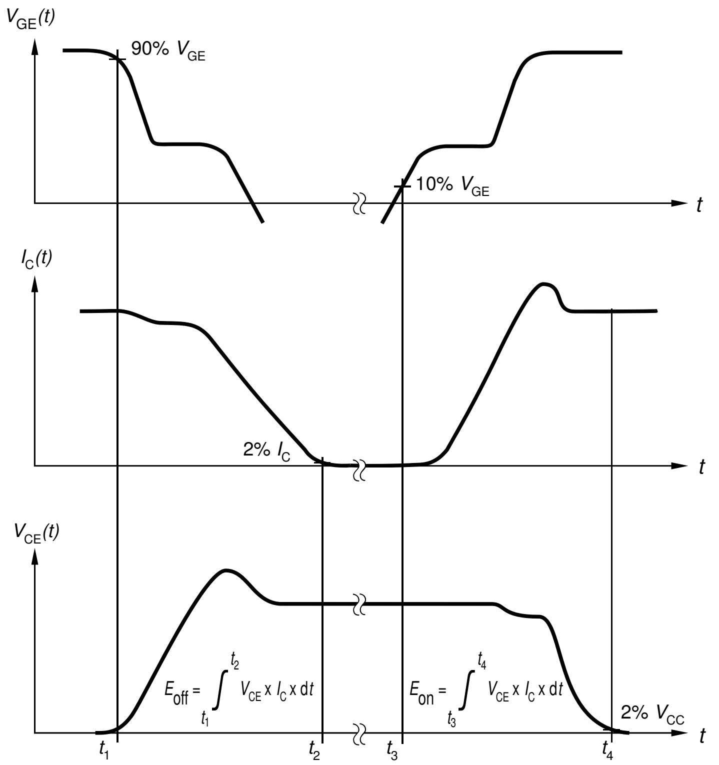


Figure B. **Definition of switching losses**

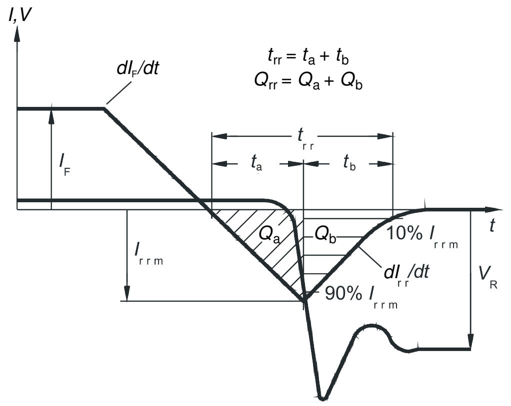


Figure C. **Definition of diode switching characteristics**

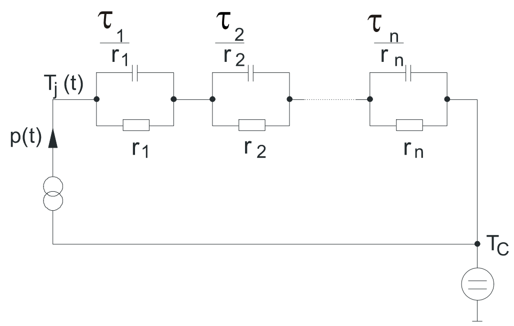


Figure D. **Thermal equivalent circuit**

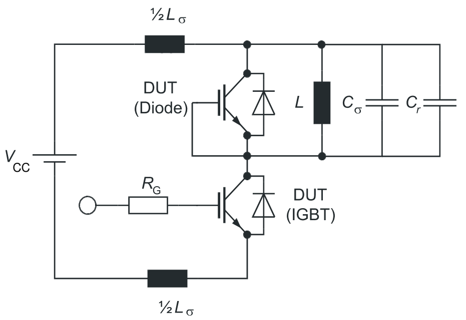


Figure E. **Dynamic test circuit**
Parasitic inductance L_{σ},
parasitic capacitor C_{σ},
relief capacitor C_{r},
(only for ZVT switching)

Figure 2

Revision history

Document revision	Date of release	Description of changes
1.00	2023-04-27	Final datasheet

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