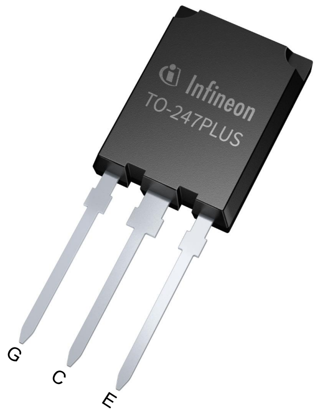
High speed 1200 V TRENCHSTOP™ IGBT 7 Technology co-packed with full rated current, soft-commutating, ultra-fast recovery and low Qrr emitter controlled 7 Rapid diode



Features

- V_{CE} = 1200 V
- I_C = 50 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/

Lead-free
Green
Halogen-free
RoHS

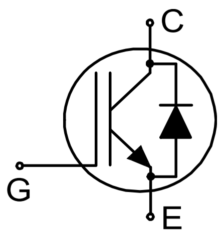
Potential applications

- 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
IKQ50N120CH7	PG-TO247-3-PLUS-NN3.7	K50MCH7

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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
Thermal resistance, junction-ambient	$R_{th(j-a)}$				40	K/W
IGBT thermal resistance, junction-case	$R_{th(j-c)}$			0.29	0.38	K/W
Diode thermal resistance, junction-case	$R_{th(j-c)}$			0.51	0.66	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	71	A
			$T_c = 100$ °C	62	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			200	A
Turn-off safe operating area		$V_{CC} \leq 800$ V, $V_{CE,peak} < 1200$ V, $V_{GE} = 0/15$ V, $R_{Goff} \geq 8$ Ω, $T_{vj} \leq 175$ °C		200	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	398	W
			$T_c = 100$ °C	199	

Table 3 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 50$ 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 = 0.8 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		3500		
Gate-emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = 20 V				100	nA
Transconductance	g_{fs}	I_C = 50 A, V_{CE} = 20 V			89		S
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			6.6		nF
Output capacitance	C_{oes}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			134		pF
Reverse transfer capacitance	C_{res}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			38		pF
Gate charge	Q_G	I_C = 50 A, V_{GE} = 15 V, V_{CC} = 960 V			366		nC
Turn-on delay time	$t_{d(on)}$	V_{CC} = 600 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 8 Ω, $R_{G(off)}$ = 8 Ω	T_{vj} = 25 °C, I_C = 50 A		40		ns
			T_{vj} = 175 °C, I_C = 50 A		38		
Rise time (inductive load)	t_r	V_{CC} = 600 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 8 Ω, $R_{G(off)}$ = 8 Ω	T_{vj} = 25 °C, I_C = 50 A		36		ns
			T_{vj} = 175 °C, I_C = 50 A		34		
Turn-off delay time	$t_{d(off)}$	V_{CC} = 600 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 8 Ω, $R_{G(off)}$ = 8 Ω	T_{vj} = 25 °C, I_C = 50 A		323		ns
			T_{vj} = 175 °C, I_C = 50 A		391		
Fall time (inductive load)	t_f	V_{CC} = 600 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 8 Ω, $R_{G(off)}$ = 8 Ω	T_{vj} = 25 °C, I_C = 50 A		40		ns
			T_{vj} = 175 °C, I_C = 50 A		119		
Turn-on energy	E_{on}	V_{CC} = 600 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 8 Ω, $R_{G(off)}$ = 8 Ω	T_{vj} = 25 °C, I_C = 50 A		2.61		mJ
			T_{vj} = 175 °C, I_C = 50 A		3.96		
Turn-off energy	E_{off}	V_{CC} = 600 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 8 Ω, $R_{G(off)}$ = 8 Ω	T_{vj} = 25 °C, I_C = 50 A		1.1		mJ
			T_{vj} = 175 °C, I_C = 50 A		2.57		

(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, $R_{G(on)}$ = 8 Ω, $R_{G(off)}$ = 8 Ω	T_{vj} = 25 °C, I_C = 50 A		3.71		mJ
			T_{vj} = 175 °C, I_C = 50 A		6.53		
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	limited by bondwire	T_c = 25 °C	66	A
			T_c = 100 °C	51	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}			200	A
Power dissipation	P_{tot}		T_c = 25 °C	226	W
			T_c = 100 °C	113	

Table 5 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode forward voltage	V_F	I_F = 50 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, $R_{G(on)}$ = 8 Ω	T_{vj} = 25 °C, I_F = 50 A		133		ns
			T_{vj} = 175 °C, I_F = 50 A		220		
Diode reverse recovery charge	Q_{rr}	V_R = 600 V, $R_{G(on)}$ = 8 Ω	T_{vj} = 25 °C, I_F = 50 A		1.53		µC
			T_{vj} = 175 °C, I_F = 50 A		4.54		
Diode peak reverse recovery current	I_{rrm}	V_R = 600 V, $R_{G(on)}$ = 8 Ω	T_{vj} = 25 °C, I_F = 50 A		25		A
			T_{vj} = 175 °C, I_F = 50 A		44		

(table continues...)

Table 5 (continued) Characteristic values

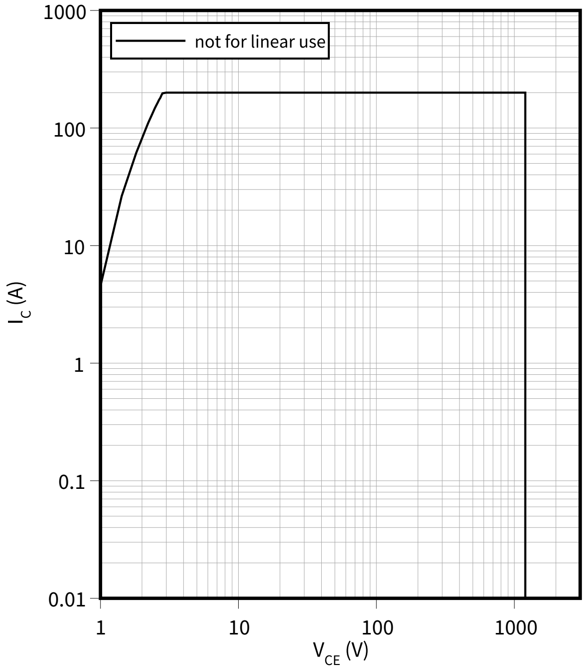
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode peak rate of fall of reverse recovery current	di_{rr}/dt	V_R = 600 V, $R_{G(on)}$ = 8 Ω	T_{vj} = 25 °C, I_F = 50 A		-297		A/µs
			T_{vj} = 175 °C, I_F = 50 A		-283		
Reverse recovery energy	E_{rec}	V_R = 600 V, $R_{G(on)}$ = 8 Ω	T_{vj} = 25 °C, I_F = 50 A		0.46		mJ
			T_{vj} = 175 °C, I_F = 50 A		1.54		
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.*

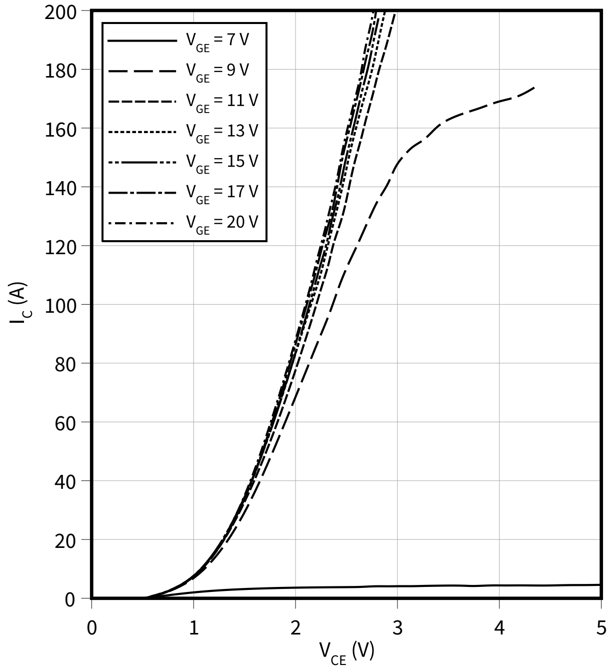
Dynamic test circuit, parasitic inductance L_σ = 30 nH, C_σ = 18 pF

4 Characteristics diagrams

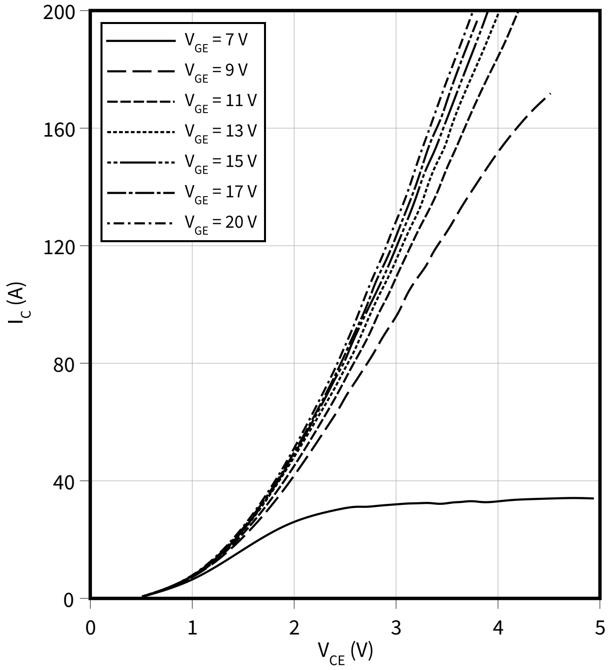
Reverse bias safe operating area
$I_C = f(V_{CE})$, $I_C = f(V_{CE})$
$T_{vj} \le 175\ °C$, $V_{GE} = 0/15\ V$



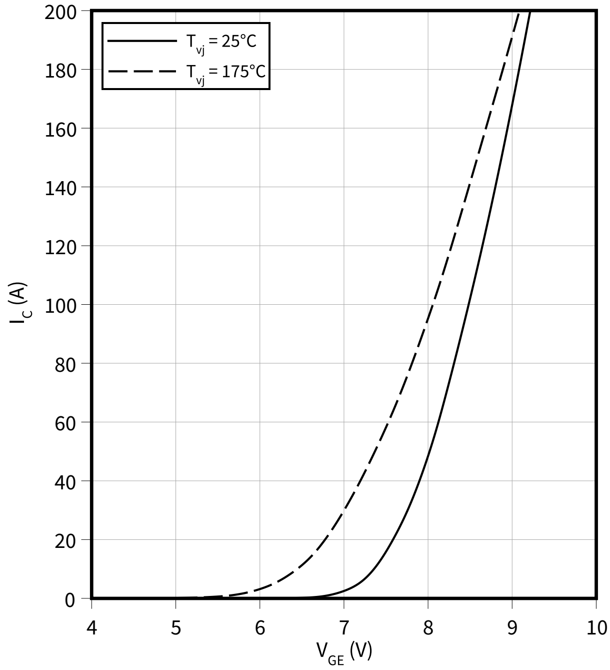
Typical output characteristic
$I_C = f(V_{CE})$
$T_{vj} = 25\ °C$



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



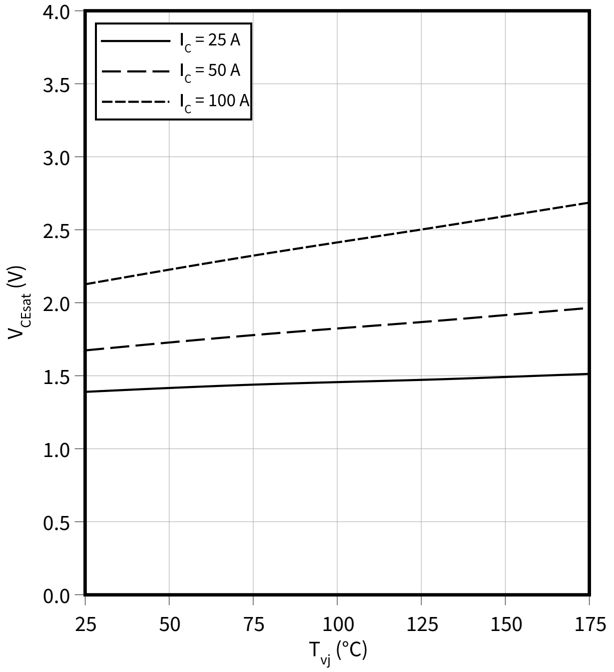
Typical transfer characteristic
$I_C = f(V_{GE})$
$V_{CE} = 20\ V$



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

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

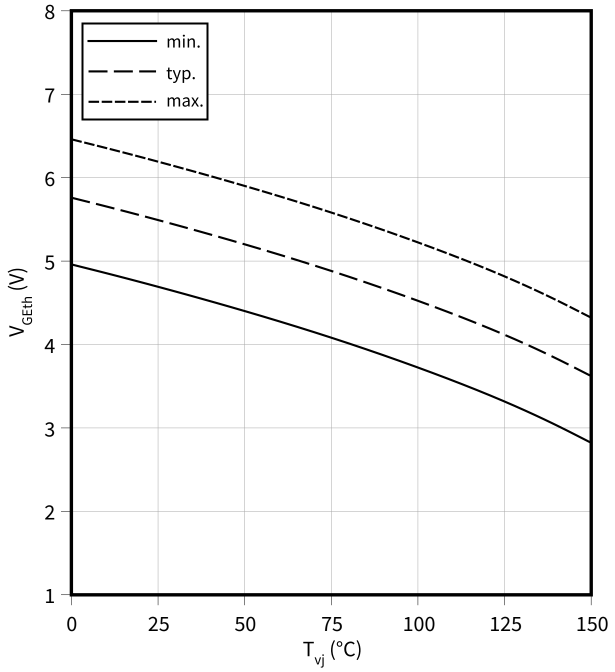
$V_{GE} = 15$ V



Gate-emitter threshold voltage as a function of junction temperature

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

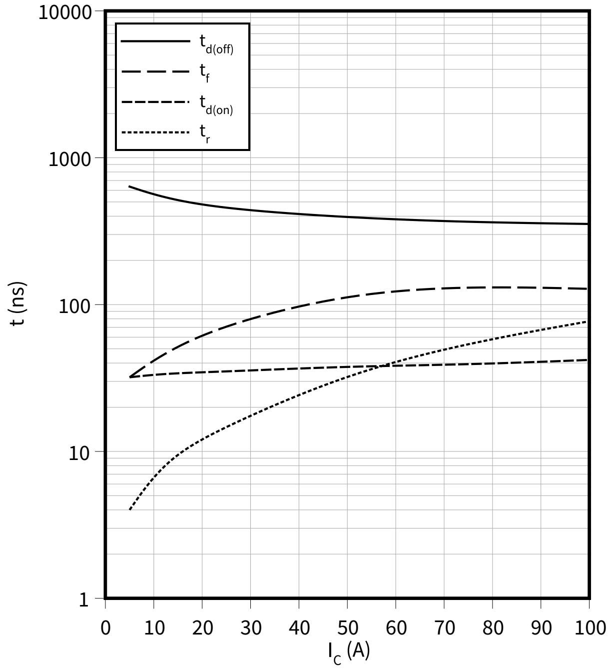
$I_C = 0.8$ mA



Typical switching times as a function of collector current

$t = f(I_C)$

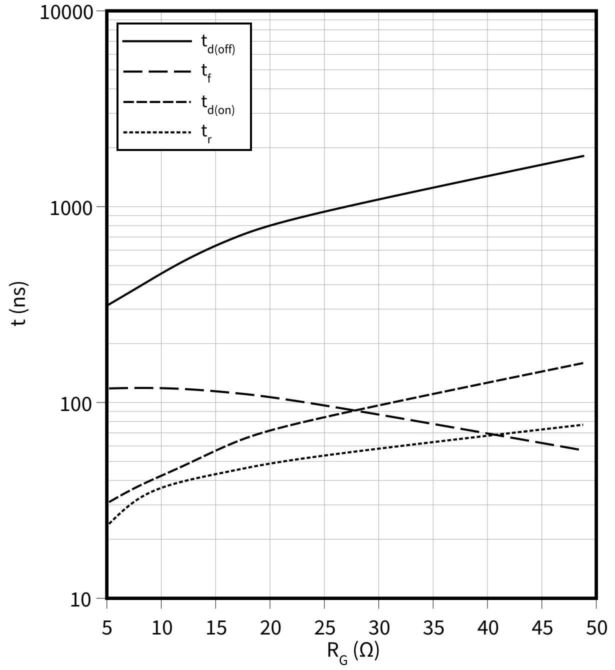
$V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 8\ \Omega$



Typical switching times as a function of gate resistor

$t = f(R_G)$

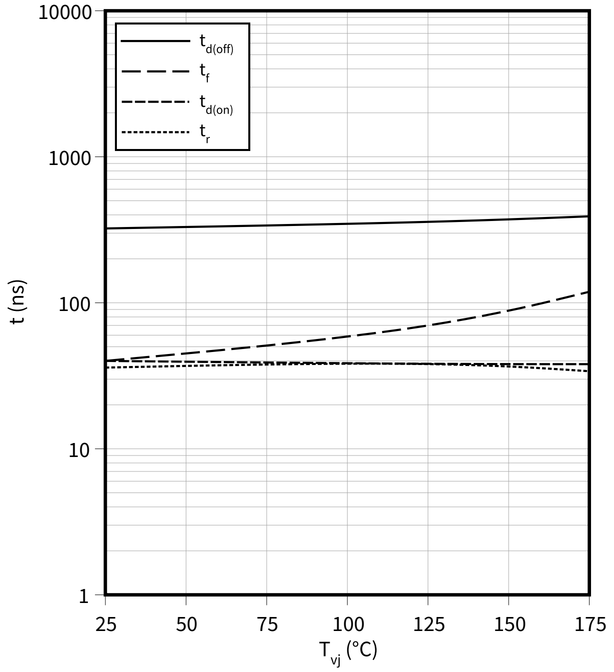
$I_C = 50$ A, $V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

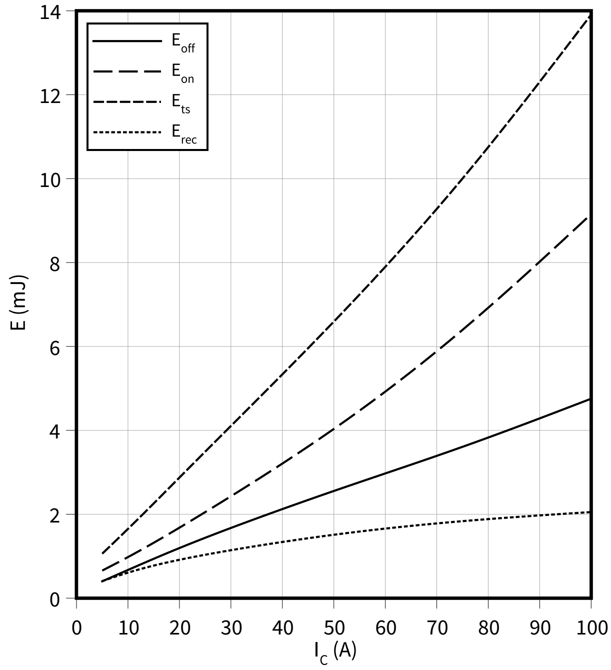
$I_C = 50$ A, $V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_G = 8\ \Omega$



Typical switching energy losses as a function of collector current

$E = f(I_C)$

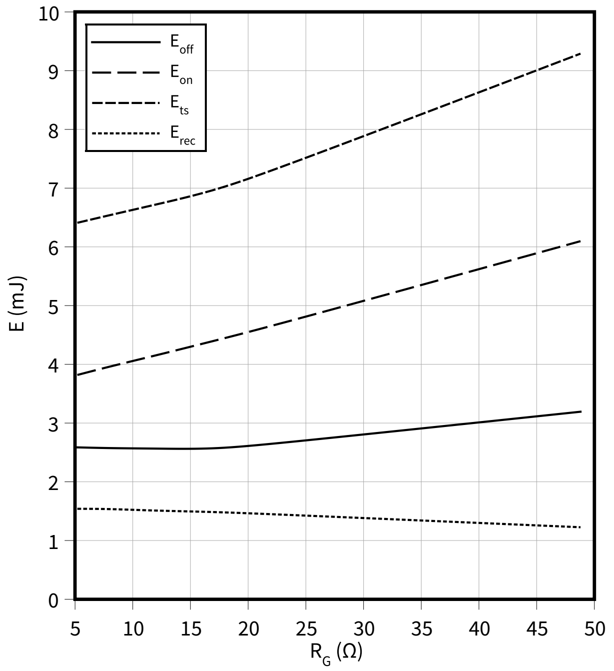
$V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 8\ \Omega$



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

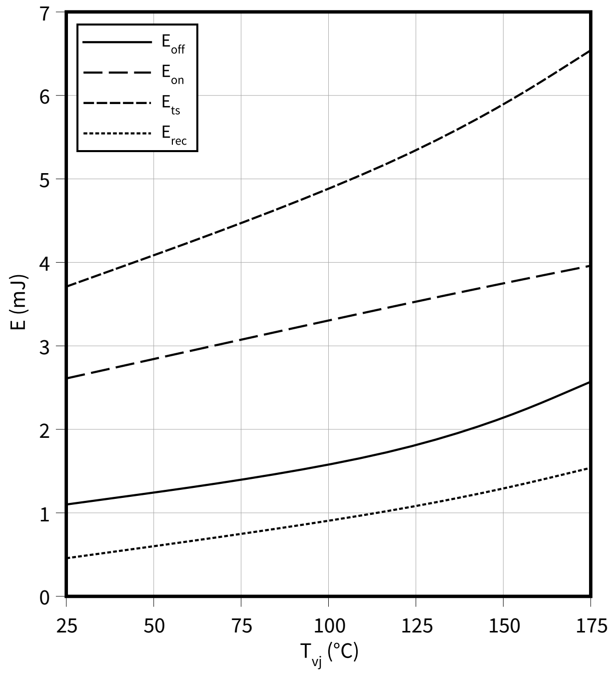
$I_C = 50$ A, $V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V



Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

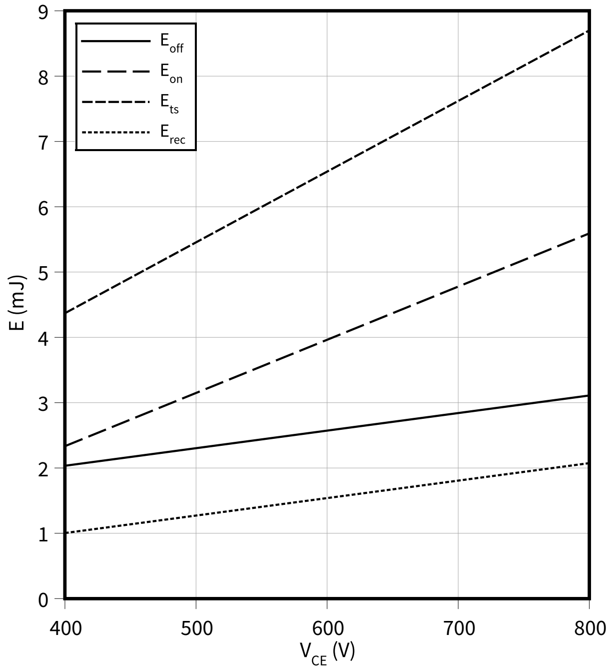
$I_C = 50$ A, $V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_G = 8\ \Omega$



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

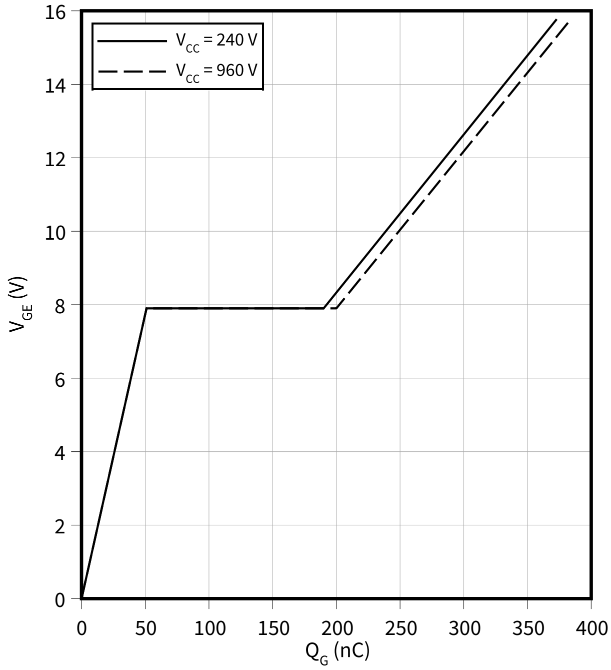
$I_C = 50$ A, $V_{GE} = 0/15$ V, $T_{vj} = 175$ °C, $R_G = 8\ \Omega$



Typical gate charge

$V_{GE} = f(Q_G)$

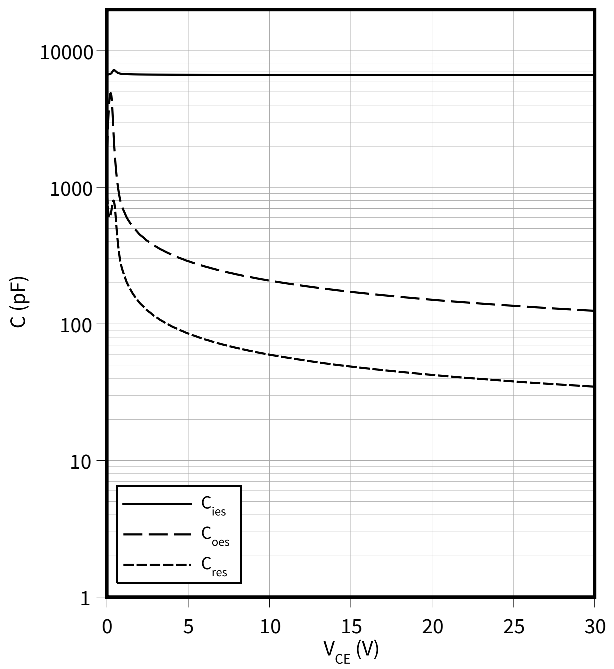
$I_C = 50$ A



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

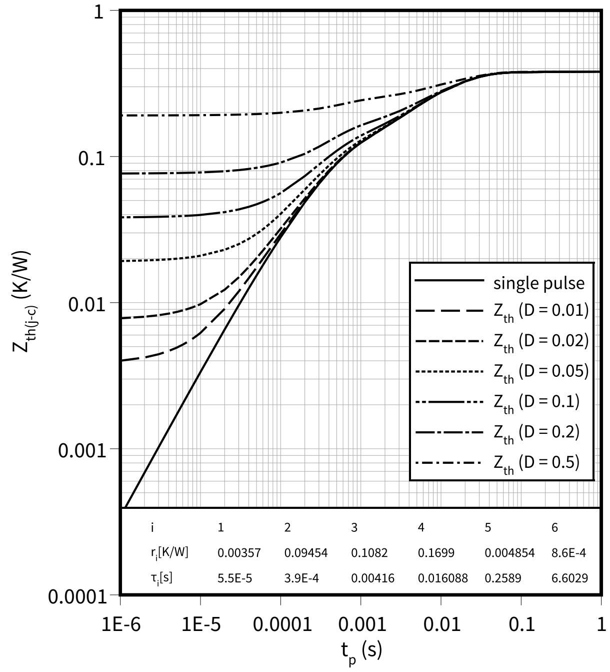
$f = 100$ kHz, $V_{GE} = 0$ V



IGBT transient thermal impedance as a function of pulse width

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

$D = t_p/T$

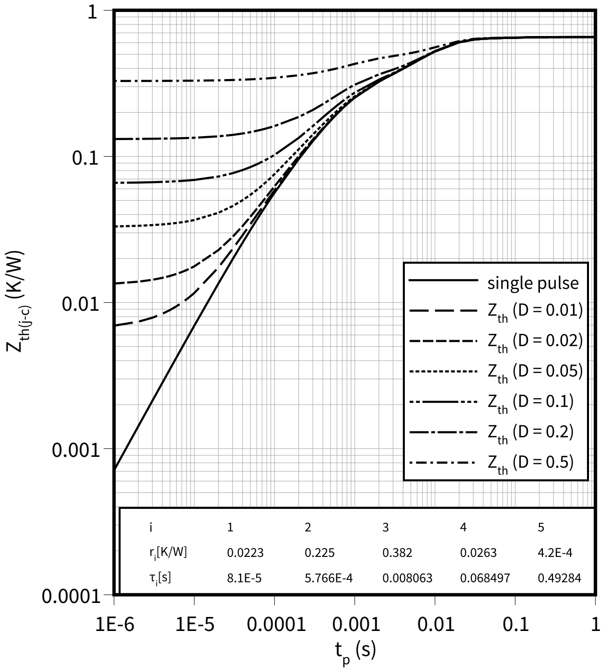


i	1	2	3	4	5	6
r_i[K/W]	0.00357	0.09454	0.1082	0.1699	0.004854	8.6E-4
τ_i[s]	5.5E-5	3.9E-4	0.00416	0.016088	0.2589	6.6029

Diode transient thermal impedance as a function of pulse width

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

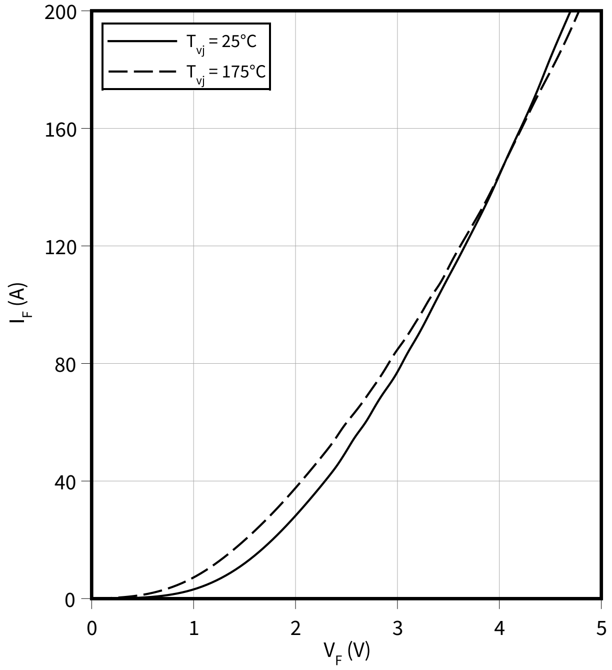
$D = t_p/T$



i	1	2	3	4	5
r_i[K/W]	0.0223	0.225	0.382	0.0263	4.2E-4
τ_i[s]	8.1E-5	5.766E-4	0.008063	0.068497	0.49284

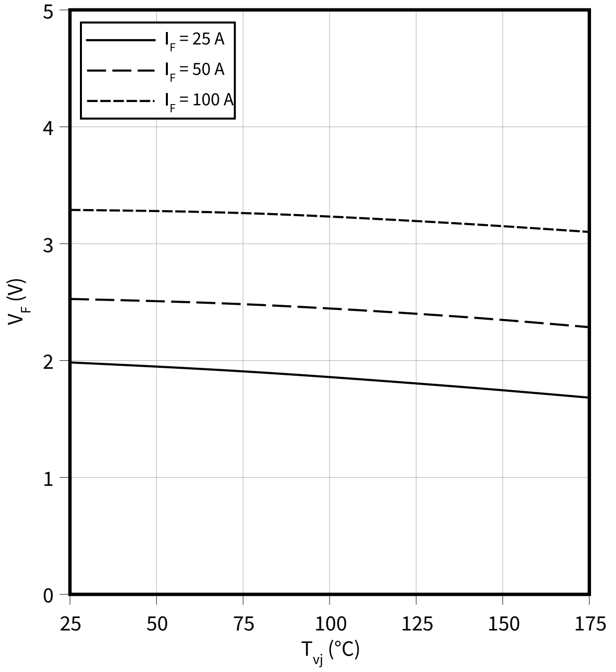
Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



Typical diode forward voltage as a function of junction temperature

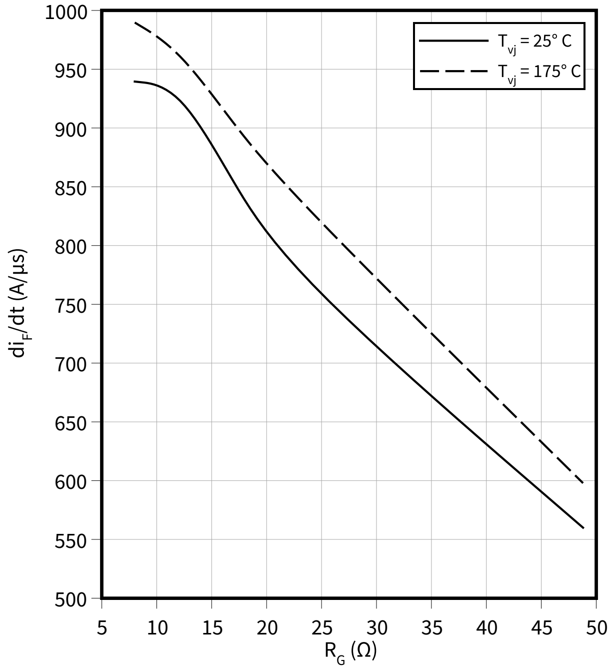
$V_F = f(T_{vj})$



Typical diode current slope as a function of gate resistor

$di_F/dt = f(R_G)$

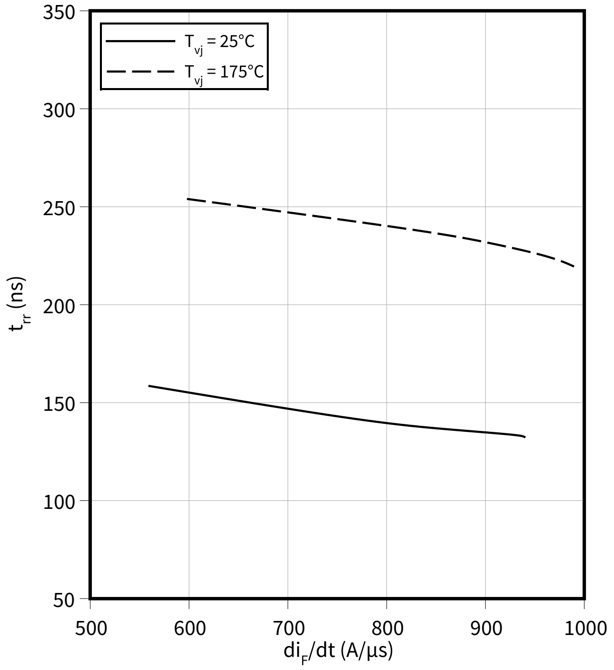
$V_R = 600$ V, $I_F = 50$ A



Typical reverse recovery time as a function of diode current slope

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

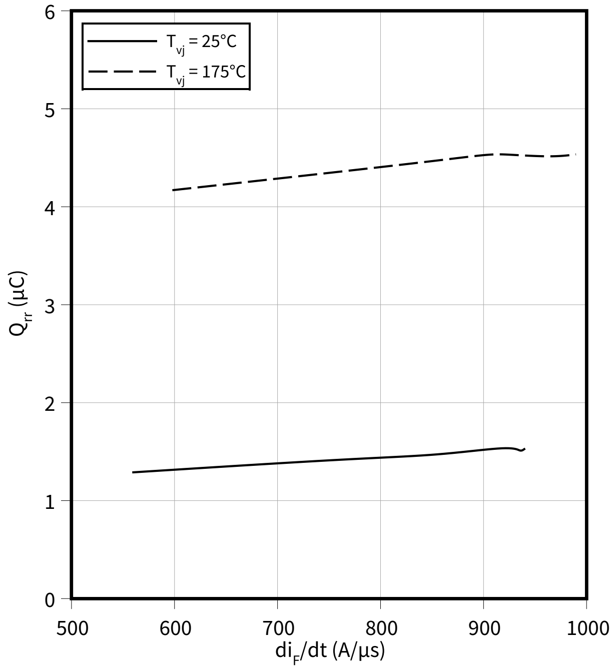
$V_R = 600$ V, $I_F = 50$ A



Typical reverse recovery charge as a function of diode current slope

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

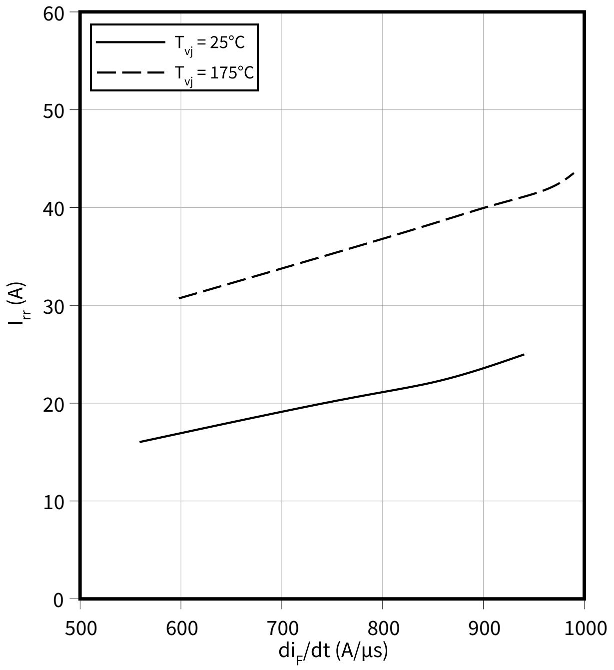
$V_R = 600$ V, $I_F = 50$ A



Typical reverse recovery current as a function of diode current slope

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

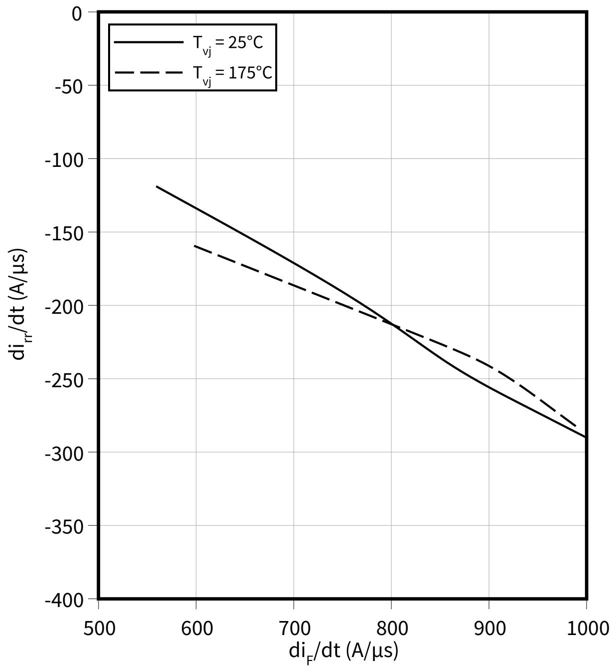
$V_R = 600$ V, $I_F = 50$ A



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

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

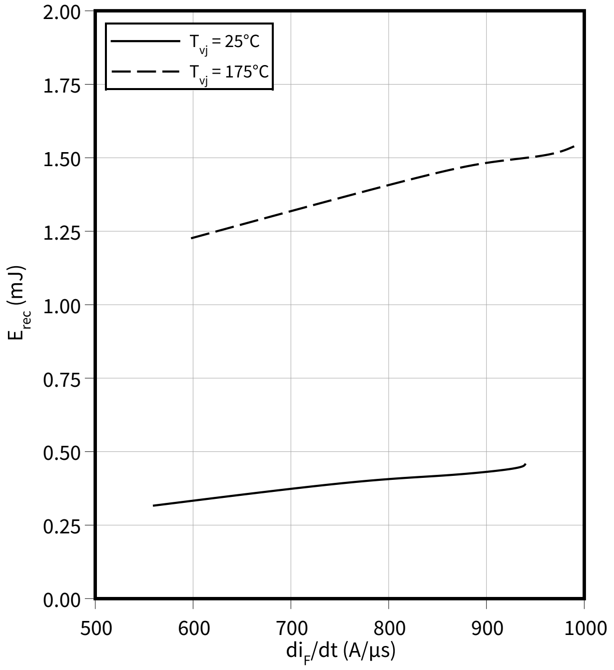
$V_R = 600$ V, $I_F = 50$ A



Typical reverse energy losses as a function of diode current slope

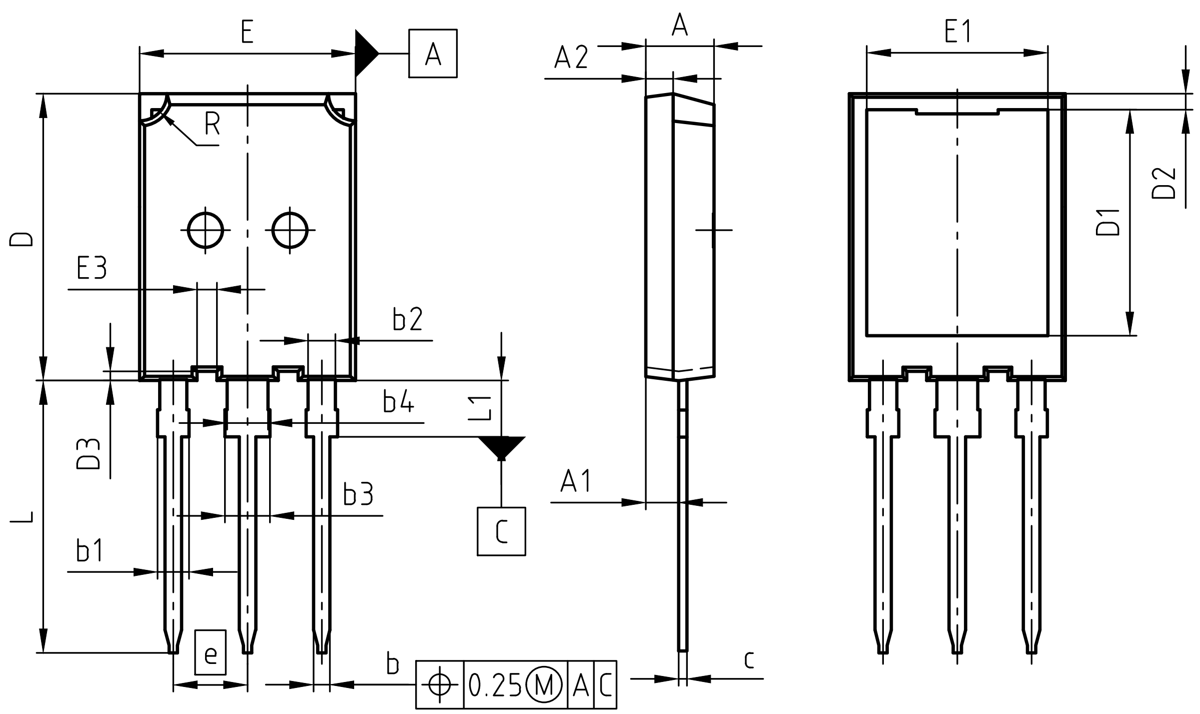
$E_{rec} = f(di_F/dt)$

$V_R = 600$ V, $I_F = 50$ A



5 Package outlines

PG-TO247-3-PLUS-NN3.7



PACKAGE - GROUP NUMBER:	PG-TO247-3-U01	
DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	4.90	5.10
A1	2.31	2.51
A2	1.90	2.10
b	1.16	1.26
b1	1.96	2.06
b2	2.77	3.38
b3	2.96	3.25
b4	2.96	3.06
c	0.59	0.66
D	20.90	21.10
D1	16.25	16.85
D2	1.05	1.35
D3	0.58	0.78
E	15.70	16.90
E1	13.10	13.50
E3	1.35	1.55
e	5.44 (BSC)	
N	3	
L	19.80	20.10
L1	3.90	4.30
R	1.90	2.10

NOTE:
DIMENSIONS DO NOT INCLUDE MOLDFLASH; PROTRUSION OR GATE BURRS

Figure 1

6 Testing conditions

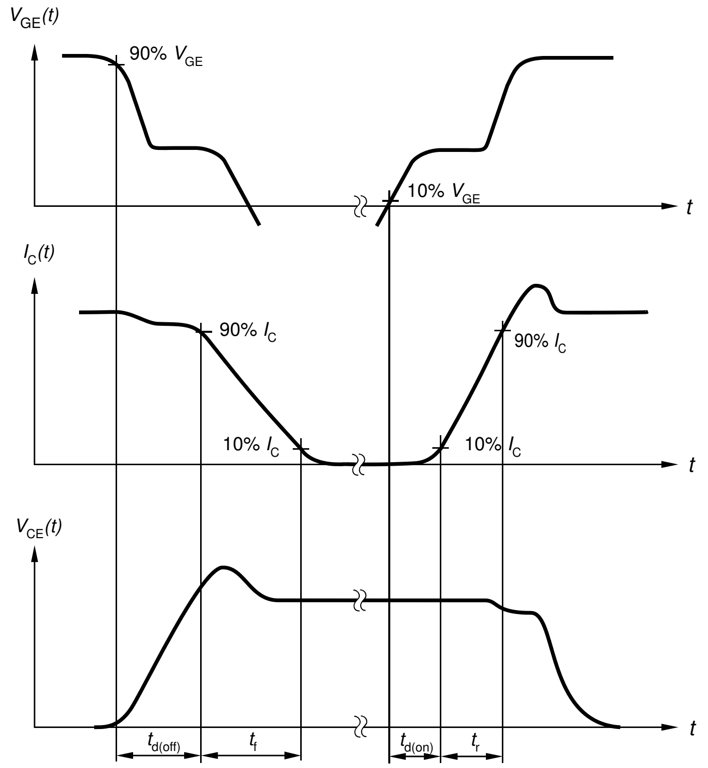


Figure A. **Definition of switching times**

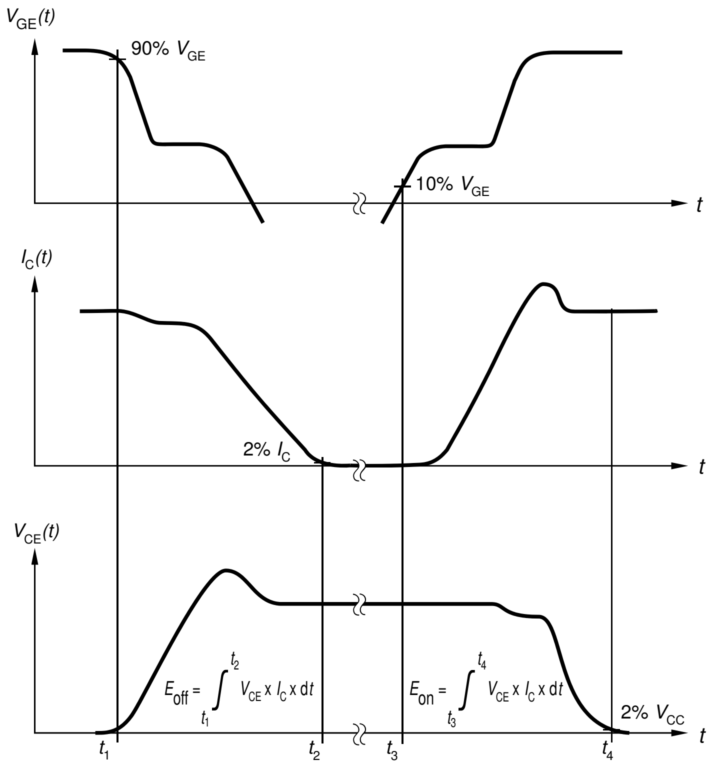


Figure B. **Definition of switching losses**

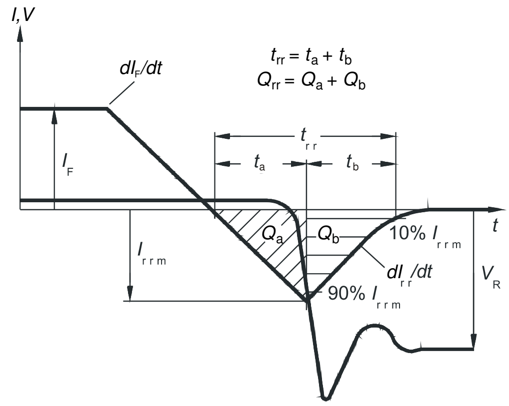


Figure C. **Definition of diode switching characteristics**

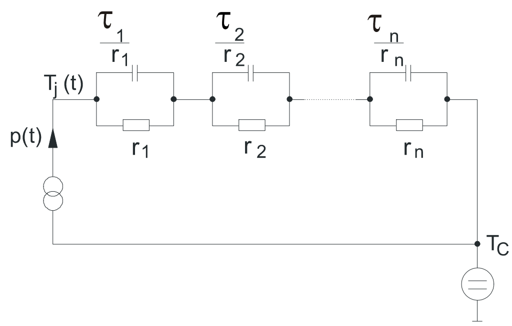


Figure D. **Thermal equivalent circuit**

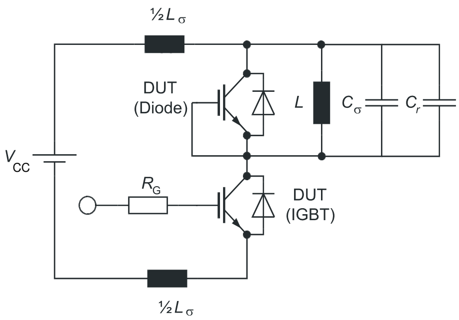


Figure E. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r,
(only for ZVT switching)

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	2022-11-29	Final datasheet

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