英飞凌高速 1200 V TRENCHSTOP™ IGBT 7 技术，集成全额定电流、软换向、超快速恢复和低 Qrr 发射极控制 7 快速二极管

特性

- V_{CE} = 1200 V
- I_C = 50 A
- 最高结温 T_{vjmax} = 175°C
- 一流的高速 IGBT，集成全额定电流、低 Q_{rr}和软换向高速二极管
- 低饱和电压 V_{CEsat} = 1.7 V，测于 T_{vj} = 25°C时
- 针对高速硬开关拓扑（2-L 逆变器、3-L NPC T 型等）进行了优化，提高了效率
- 由于 V_{CEsat}具有正温度系数，因此易于并联
- 无铅镀层；符合RoHS标准
- 完整的产品品类和 PSpice 模型： http://www.infineon.com/igbt/

Halogen-free
Lead-free
Green
RoHS

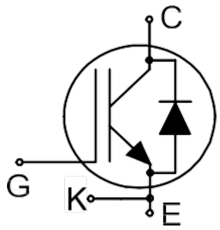
潜在应用

- 工业级不间断电源（UPS）
- 电动汽车充电桩
- 组串式逆变器
- 焊接

产品验证

- 符合JEDEC47/20/22相关测试的工业应用要求

描述



Type	Package	Marking
IKZA50N120CH7	PG-TO247-4-STD-NT3.7	K50MCH7

本数据手册的原文使用英文撰写。为方便起见，英飞凌提供了译文；由于翻译过程中可能使用了自动化工具，英飞凌不保证译文的准确性。为确认准确性，请务必访问 infineon.com 参考最新的英文版本（控制文档）。

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1 封装

表 1 特征值

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 processes: 3			0.6	Nm
Thermal resistance, junction-ambient	$R_{th(j-a)}$				40	K/W
IGBT thermal resistance, junction-case	$R_{th(j-c)}$			0.29	0.38	K/W
Diode thermal resistance, junction-case	$R_{th(j-c)}$			0.5	0.65	K/W

2 IGBT

表2 最大额定值

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	100	A
			$T_c = 100$ °C	82	
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, $R_{Goff} \geq 23$ 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	

表3 特征值

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		
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			98		S
Input capacitance	C_{ies}	$V_{CE} = 25$ V, $V_{GE} = 0$ V, $f = 100$ kHz			6.7		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			372		nC
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_{G(on)} = 8\ \Omega$, $R_{G(off)} = 8\ \Omega$	$T_{vj} = 25$ °C, $I_C = 50$ A		39		ns
			$T_{vj} = 175$ °C, $I_C = 50$ A		36		
Rise time (inductive load)	t_r	$V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_{G(on)} = 8\ \Omega$, $R_{G(off)} = 8\ \Omega$	$T_{vj} = 25$ °C, $I_C = 50$ A		13		ns
			$T_{vj} = 175$ °C, $I_C = 50$ A		15		
Turn-off delay time	$t_{d(off)}$	$V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_{G(on)} = 8\ \Omega$, $R_{G(off)} = 8\ \Omega$	$T_{vj} = 25$ °C, $I_C = 50$ A		333		ns
			$T_{vj} = 175$ °C, $I_C = 50$ A		411		
Fall time (inductive load)	t_f	$V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_{G(on)} = 8\ \Omega$, $R_{G(off)} = 8\ \Omega$	$T_{vj} = 25$ °C, $I_C = 50$ A		50		ns
			$T_{vj} = 175$ °C, $I_C = 50$ A		143		
Turn-on energy	E_{on}	$V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_{G(on)} = 8\ \Omega$, $R_{G(off)} = 8\ \Omega$	$T_{vj} = 25$ °C, $I_C = 50$ A		1.05		mJ
			$T_{vj} = 175$ °C, $I_C = 50$ A		1.62		

（表格续下页……）

表 3 （续） 特征值

Parameter	Symbol	Note or test condition		Values Min.	Values Typ.	Values Max.	Unit
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		1.4		mJ
			T_{vj} = 175 °C, I_C = 50 A		2.96		
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		2.45		mJ
			T_{vj} = 175 °C, I_C = 50 A		4.58		
Operating junction temperature	T_{vj}			-40		175	°C

注： 电气特性，在 T_{vj} = 25°C 条件下测得，除非另有规定。

3 二极管

表4 最大额定值

Parameter	Symbol	Note or test condition		Values	Unit
Diode forward current, limited by T_{vjmax}	I_F		T_c = 25 °C	81	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	232	W
			T_c = 100 °C	115	

表5 特征值

Parameter	Symbol	Note or test condition		Values Min.	Values Typ.	Values Max.	Unit
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		96		ns
			T_{vj} = 175 °C, I_F = 50 A		168		
Diode reverse recovery charge	Q_{rr}	V_R = 600 V, $R_{G(on)}$ = 8 Ω	T_{vj} = 25 °C, I_F = 50 A		1.74		µC
			T_{vj} = 175 °C, I_F = 50 A		4.63		

（表格续下页……）

表 5 （续） 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode peak reverse recovery current	I_{rrm}	V_R = 600 V, $R_{G(on)}$ = 8 Ω	T_{vj} = 25 °C, I_F = 50 A		58		A
			T_{vj} = 175 °C, I_F = 50 A		95		
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		-1830		A/µs
			T_{vj} = 150 °C, I_F = 50 A		-2520		
Reverse recovery energy	E_{rec}	V_R = 600 V, $R_{G(on)}$ = 8 Ω	T_{vj} = 25 °C, I_F = 50 A		0.72		mJ
			T_{vj} = 175 °C, I_F = 50 A		1.86		
Operating junction temperature	T_{vj}			-40		175	°C

注意：为了获得最佳的使用寿命和可靠性，英飞凌建议运行条件不超过本数据手册中所述最大额定值的80%。

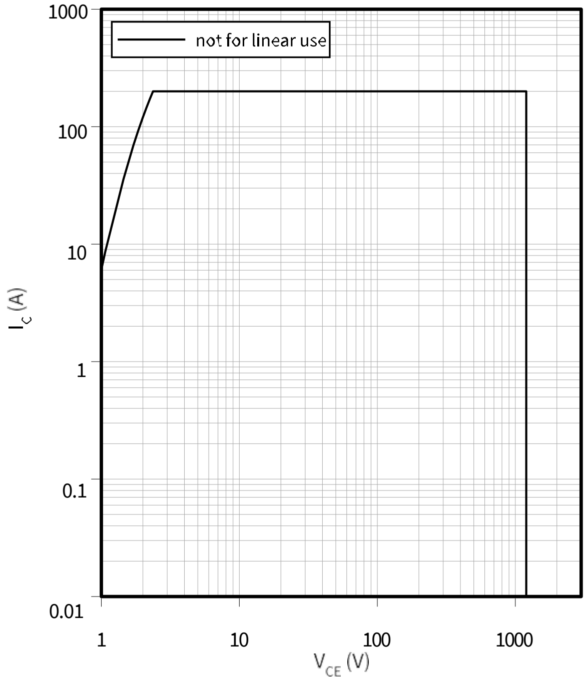
动态测试电路，寄生电感 L_σ = 30 nH, C_σ = 18 pF

4 特性图

Reverse bias safe operating area

$I_C = f(V_{CE})$

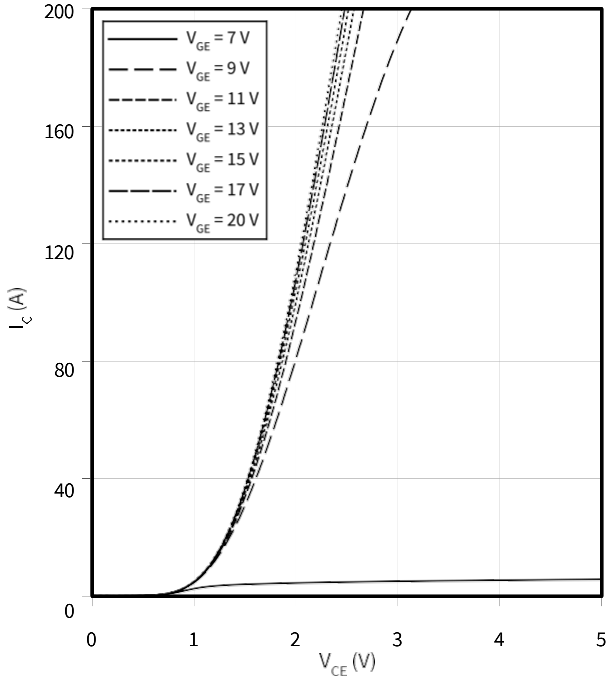
$T_{vj} \leq 175$ °C, $V_{GE} = 0/15$ V



Typical output characteristic

$I_C = f(V_{CE})$

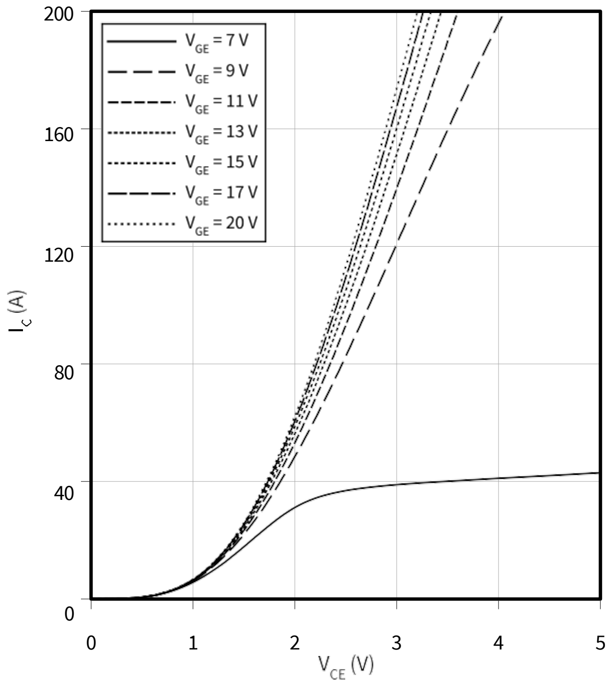
$T_{vj} = 25$ °C



Typical output characteristic

$I_C = f(V_{CE})$

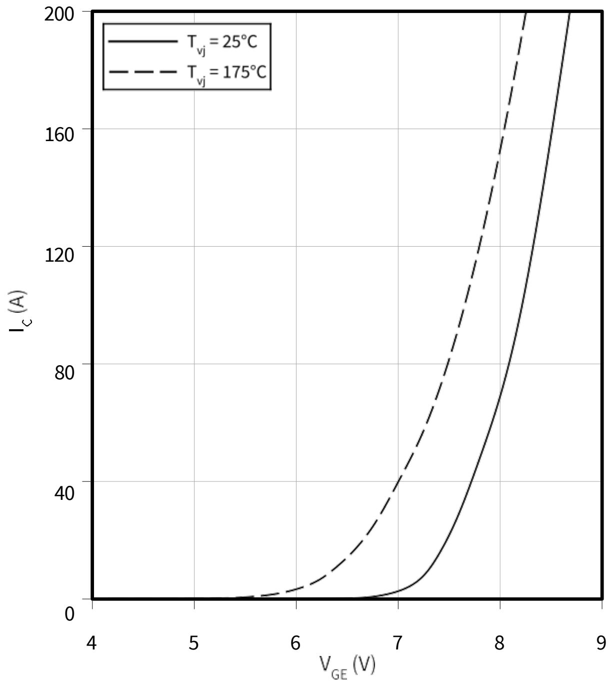
$T_{vj} = 175$ °C



Typical transfer characteristic

$I_C = f(V_{GE})$

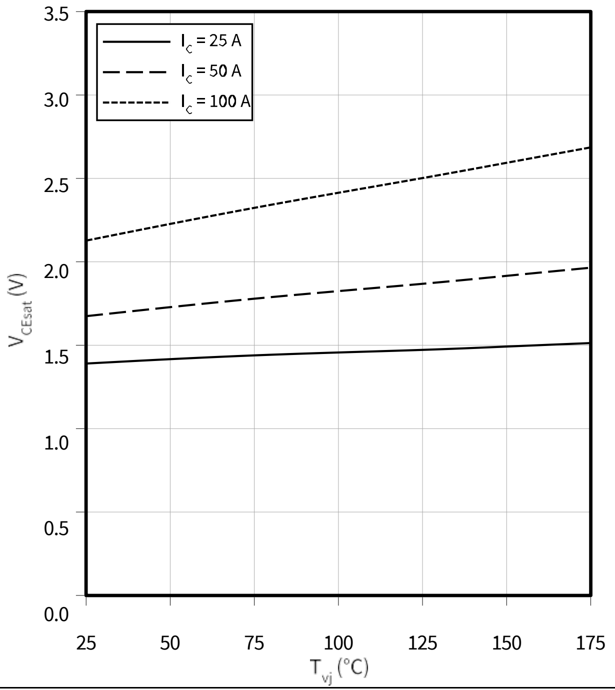
$V_{CE} = 20$ V



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

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

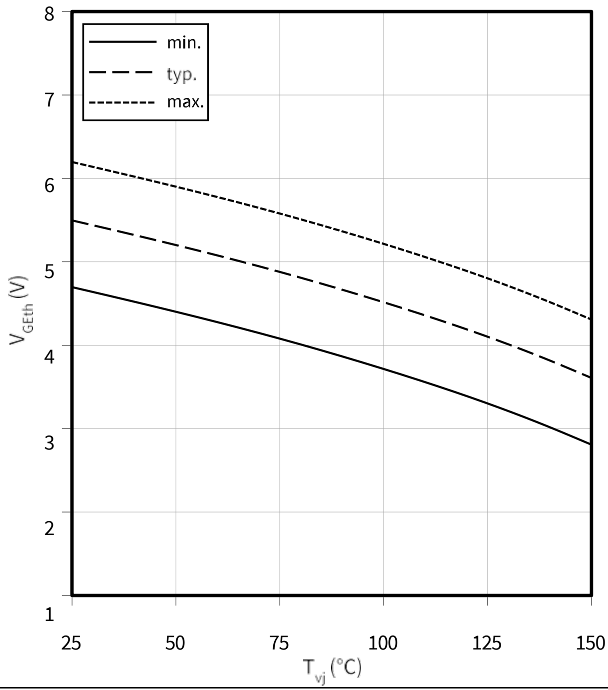
$V_{GE} = 15$ V



Gate-emitter threshold voltage as a function of junction temperature

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

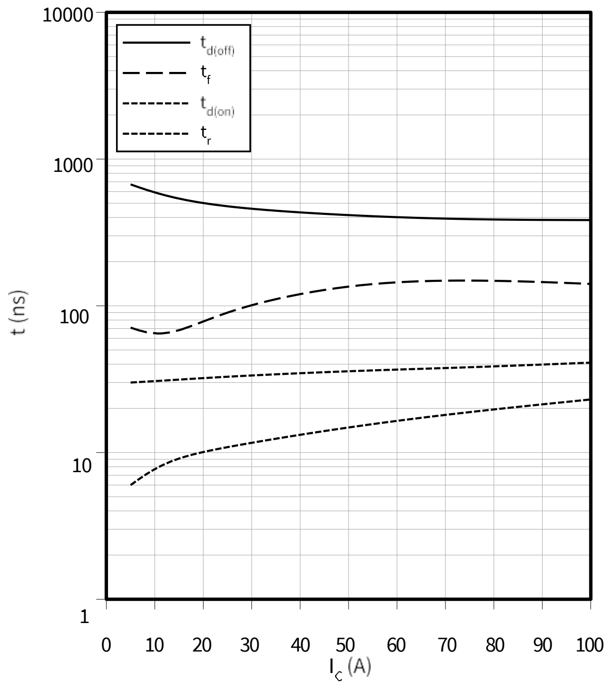
$I_C = 0.8$ mA



Typical switching times as a function of collector current

$t = f(I_C)$

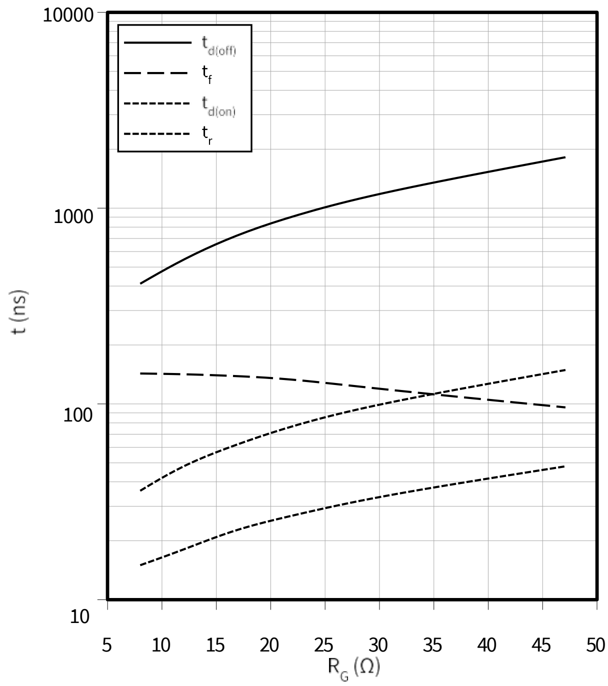
$T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $V_{CC} = 600$ V, $R_G = 8\ \Omega$



Typical switching times as a function of gate resistor

$t = f(R_G)$

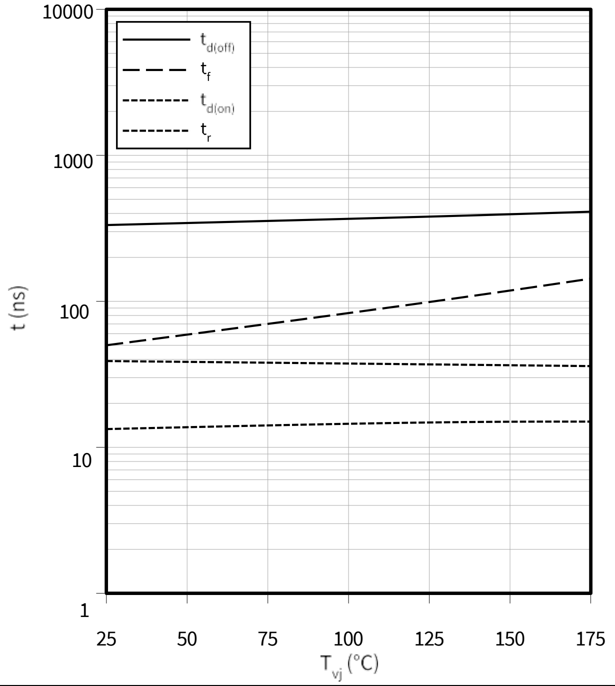
$I_C = 50$ A, $V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

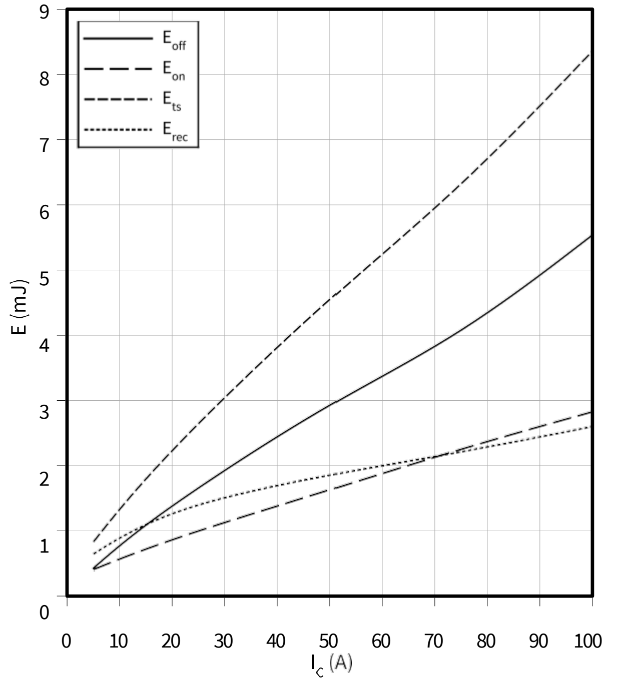
$I_C = 50$ A, $V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_G = 8\ \Omega$



Typical switching energy losses as a function of collector current

$E = f(I_C)$

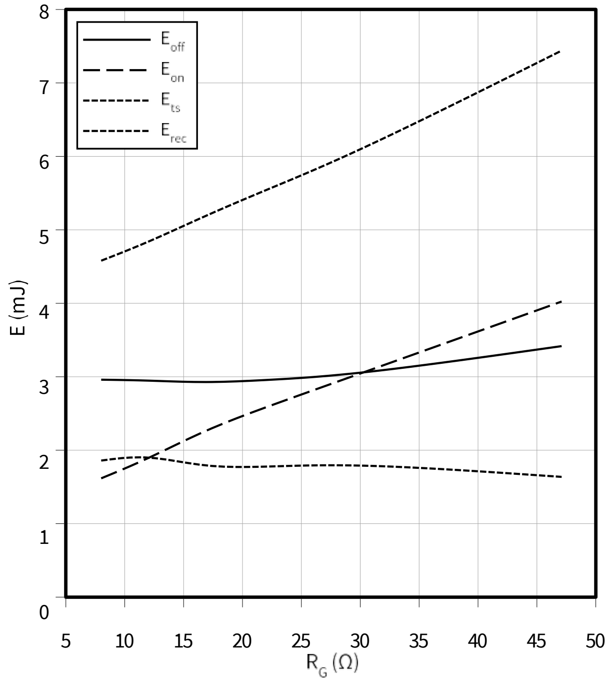
$V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 8\ \Omega$



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

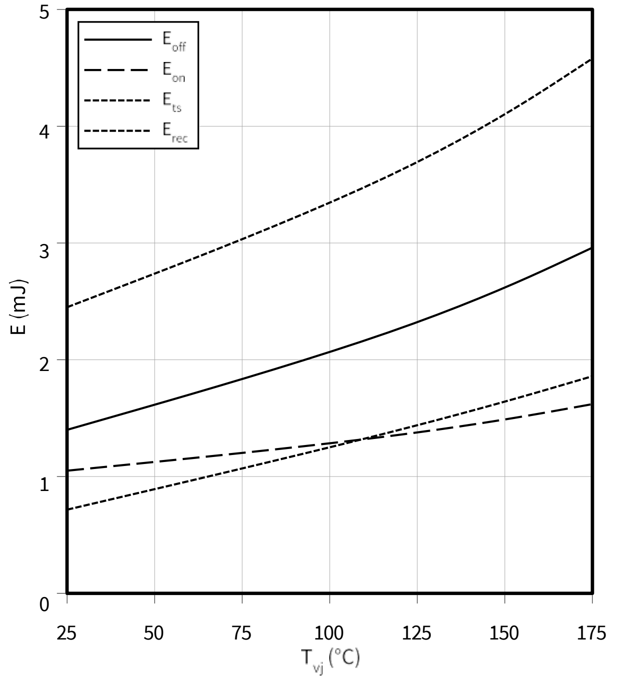
$I_C = 50$ A, $V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V



Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

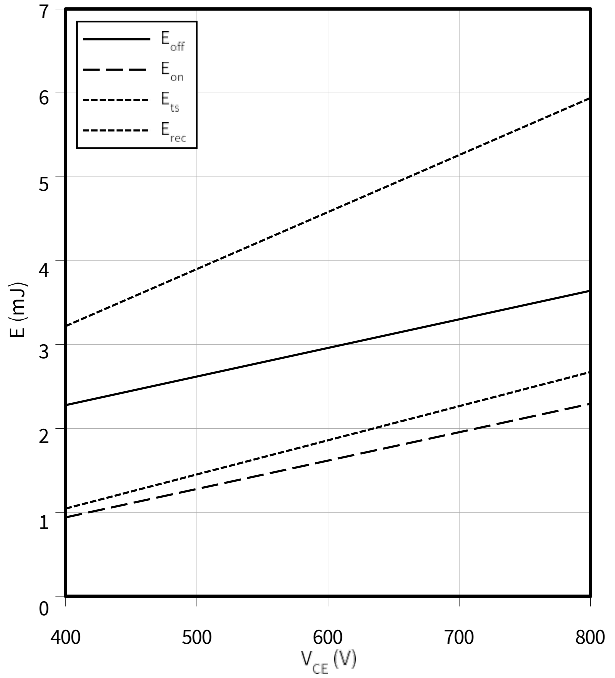
$I_C = 50$ A, $V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_G = 8\ \Omega$



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

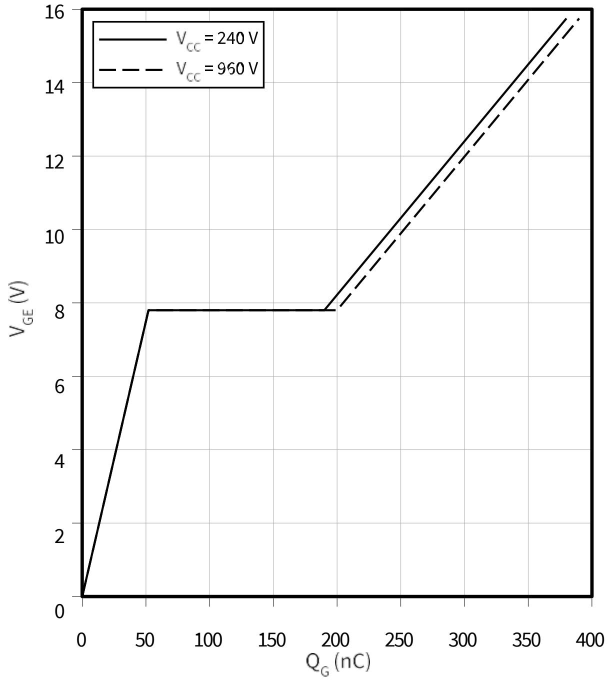
$I_C = 50$ A, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 8\ \Omega$



Typical gate charge

$V_{GE} = f(Q_G)$

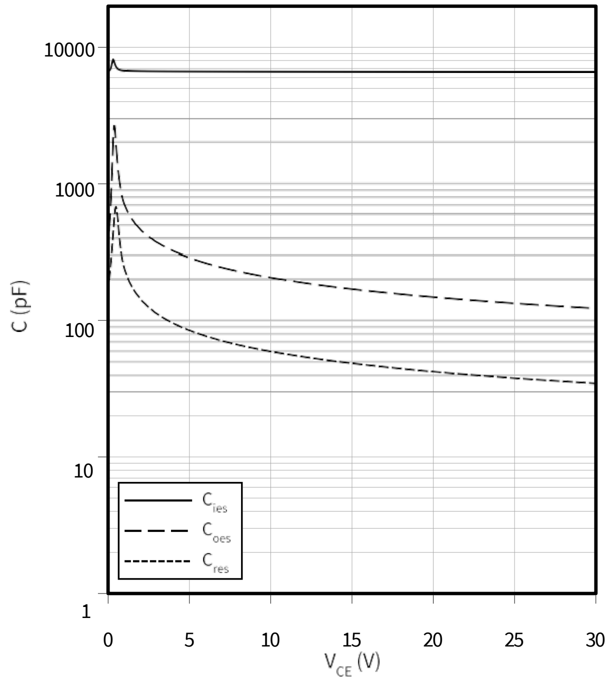
$I_C = 50$ A



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

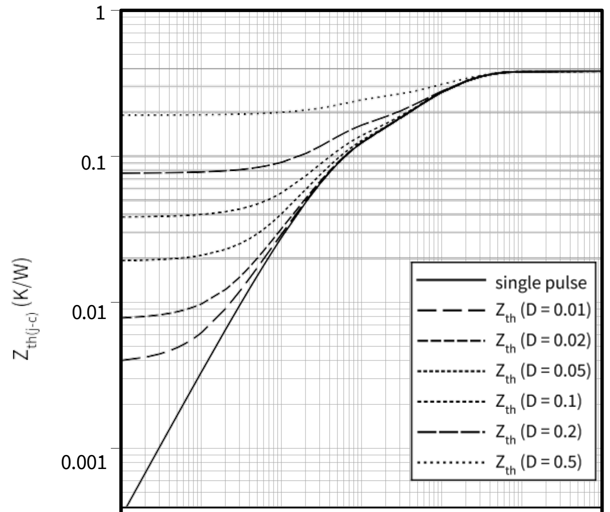
$f = 100$ kHz, $V_{GE} = 0$ V



IGBT transient thermal impedance as a function of pulse width

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

$D = t_p/T$

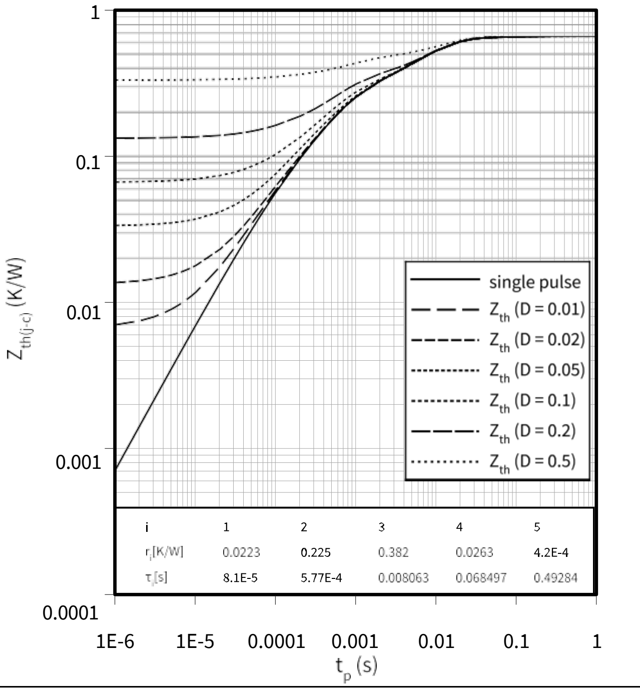


i	1	2	3	4	5	6
r_i[K/W]	0.00357	0.094536	0.1082	0.1699	0.004854	8.58E-4
τ_i[s]	5.49E-5	3.856E-4	0.00416	0.01609	0.258895	6.60288

Diode transient thermal impedance as a function of pulse width

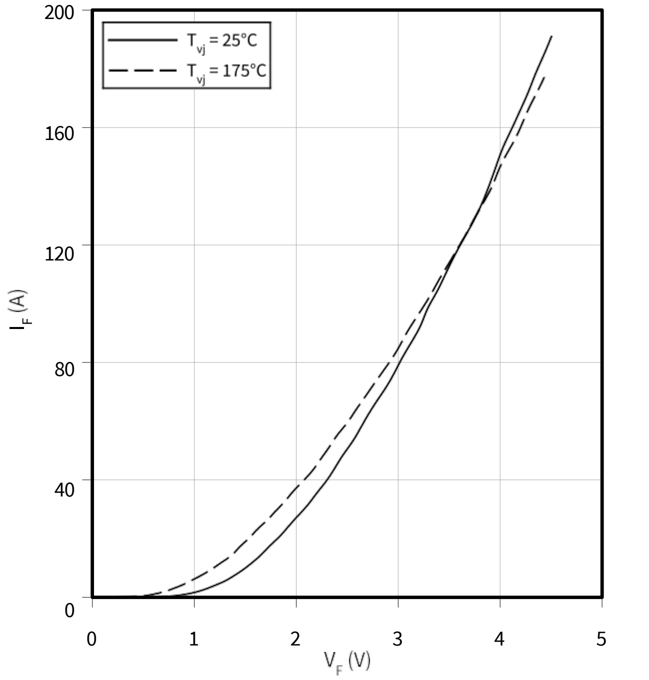
$Z_{th(j-c)} = f(t_p)$

$D = t_p/T$



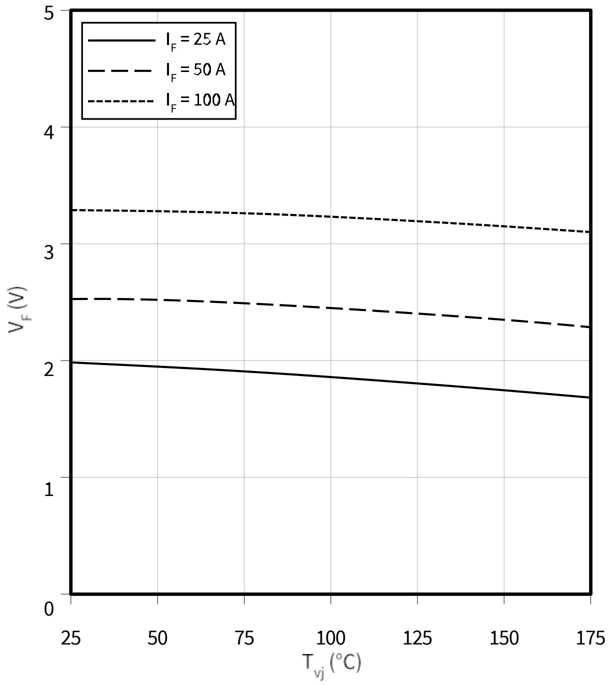
Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



Typical diode forward voltage as a function of junction temperature

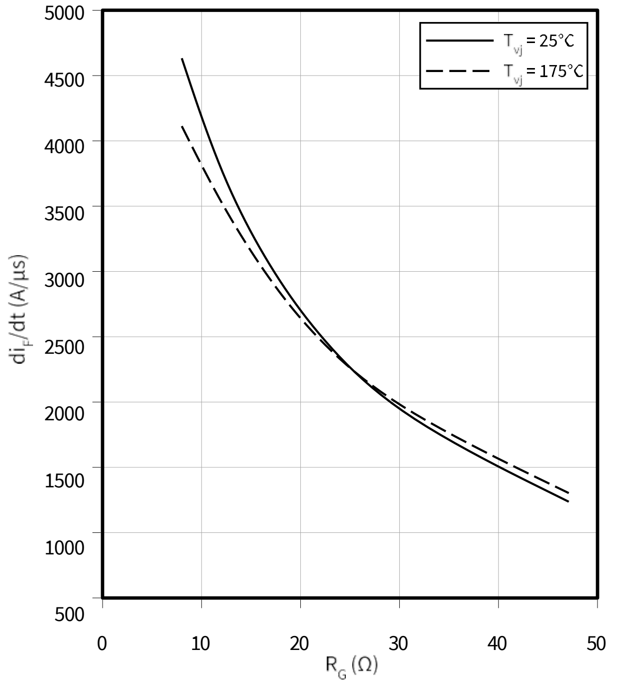
$V_F = f(T_{vj})$



Typical diode current slope as a function of gate resistor

$di_F/dt = f(R_G)$

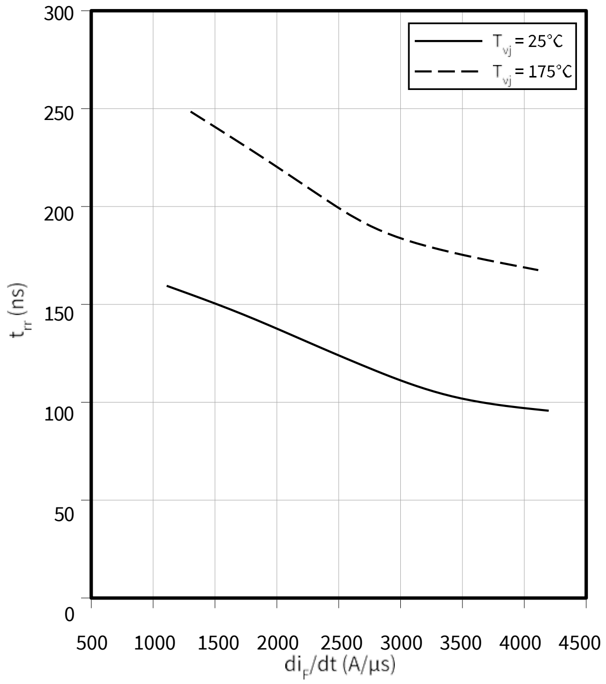
$V_R = 600$ V, $I_F = 50$ A



Typical reverse recovery time as a function of diode current slope

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

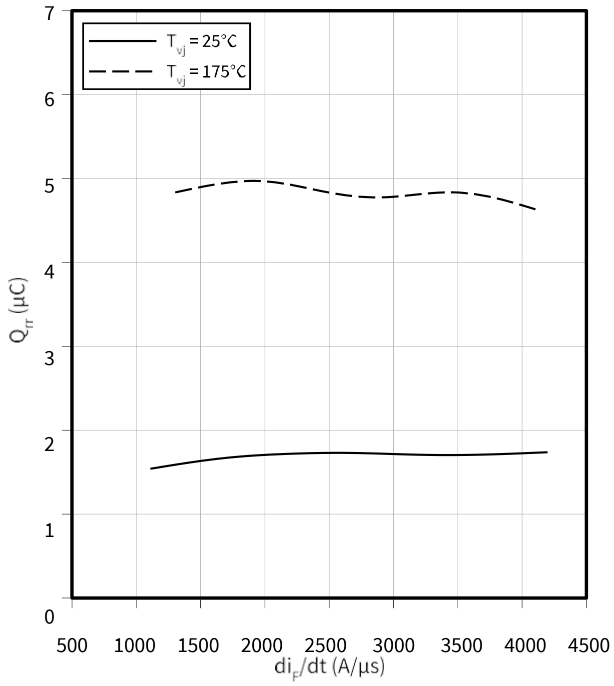
$V_R = 600$ V, $I_F = 50$ A



Typical reverse recovery charge as a function of diode current slope

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

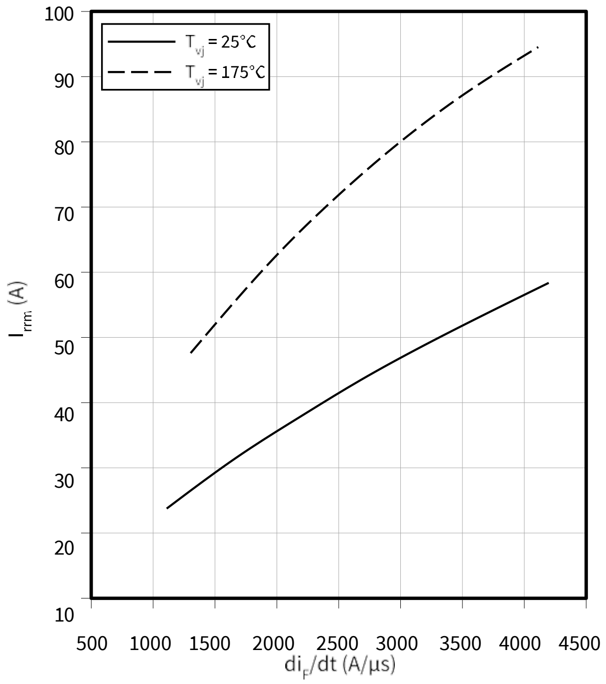
$V_R = 600$ V, $I_F = 50$ A



Typical reverse recovery current as a function of diode current slope

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

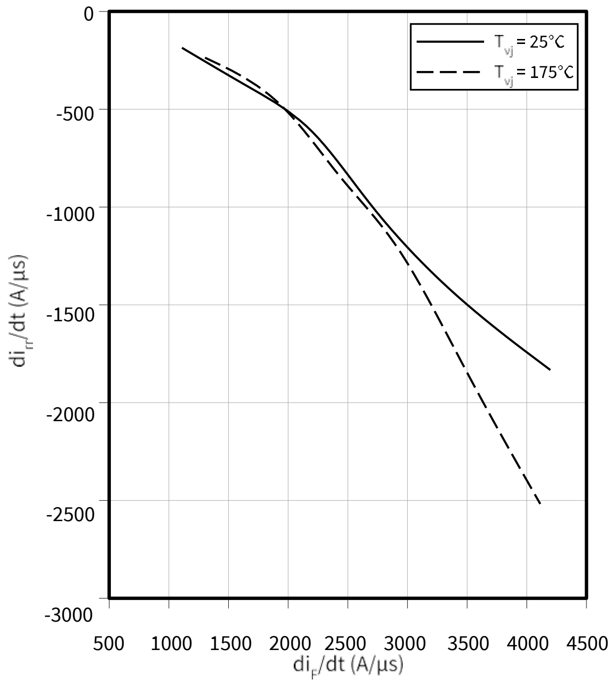
$V_R = 600$ V, $I_F = 50$ A



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

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

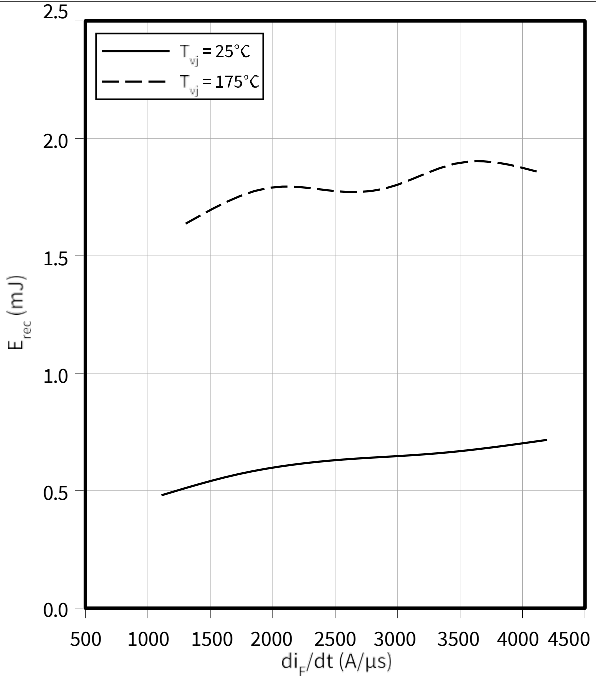
$V_R = 600$ V, $I_F = 50$ A



典型反向损耗随二极管电流斜率变化关系

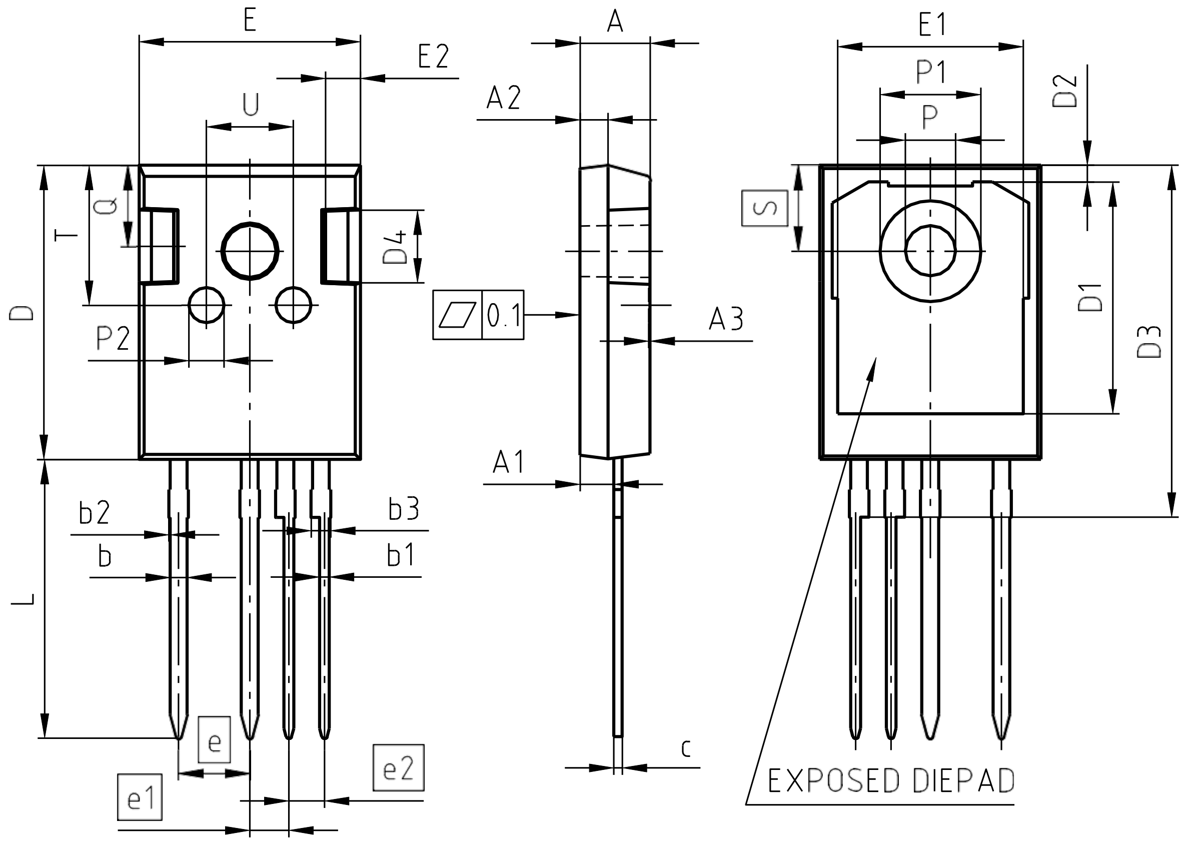
$E_{rec} = f(di_F/dt)$

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



5 封装外形

PG-TO247-4-STD-NT3.7

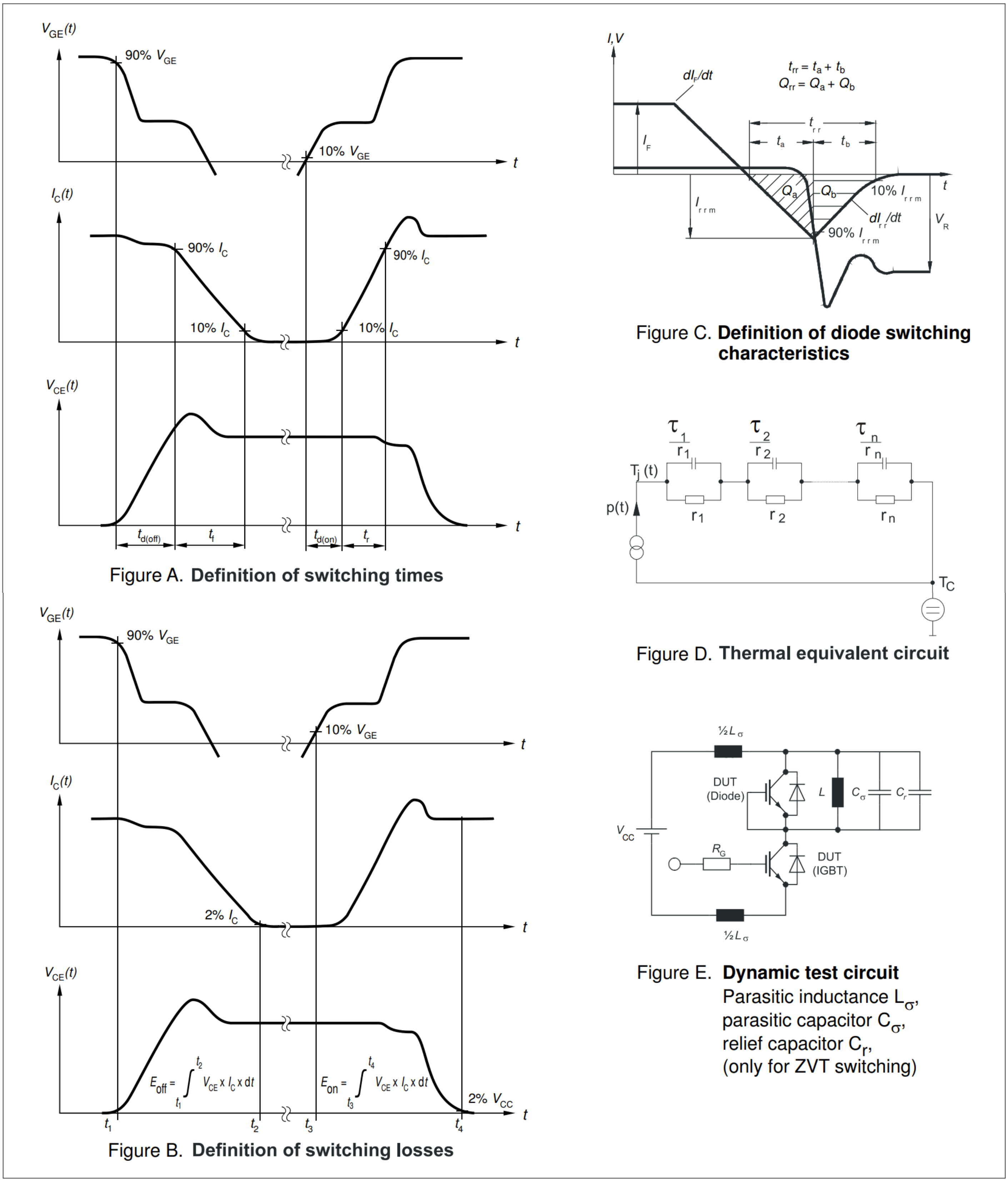


NOTES:
ALL DIMENSIONS DO NOT INCLUDE MOLD FLASH
OR PROTRUSIONS.

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

图 1

6 测试条件



$V_{GE}(t)$
90% V_{GE}
10% V_{GE}
$I_C(t)$
90% I_C
10% I_C
$V_{CE}(t)$
$t_{d(off)}$
t_f
$t_{d(on)}$
t_r
t
Figure A. **Definition of switching times**
2% I_C
$E_{off} = \int_{t_1}^{t_2} V_{CE} \times I_C \times dt$
$E_{on} = \int_{t_3}^{t_4} V_{CE} \times I_C \times dt$
2% V_{CC}
t_1
t_2
t_3
t_4
Figure B. **Definition of switching losses**
I,V
dI_F/dt
$t_{rr} = t_a + t_b$
$Q_{rr} = Q_a + Q_b$
t_{rr}
t_a
t_b
I_F
I_{rrm}
Q_a
Q_b
10% I_{rrm}
dI_{rr}/dt
90% I_{rrm}
V_R
Figure C. **Definition of diode switching characteristics**
τ_1
τ_2
τ_n
r_1
r_2
r_n
T_j (t)
p(t)
T_C
Figure D. **Thermal equivalent circuit**
½L_σ
DUT (Diode)
L
C_σ
C_r
V_{CC}
R_G
DUT (IGBT)
Figure E. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r,
(only for ZVT switching)

图 2

修订记录

Document revision	Date of release	Description of changes
0.10	2022-05-02	Target datasheet
0.20	2022-06-01	Editorial changes
1.00	2022-11-09	Final datasheet
1.10	2022-11-23	Update of potential applications
1.20	2023-01-19	Correction of E_{on} at 25°C on page 4 Adaption of graph E = f(T_{vj}) on page 9

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