

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 Q_{rr} 发射极控制 7 快速二极管

特性

- $V_{CE} = 1200\text{ V}$
- $I_C = 50\text{ A}$
- 最高结温 $T_{vjmax} = 175^{\circ}\text{C}$
- 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 $V_{CEsat} = 1.7\text{ V}$ ，测于 $T_{vj} = 25^{\circ}\text{C}$ 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/>



潜在应用

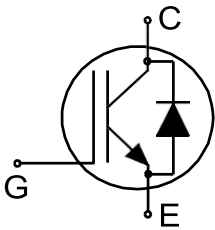
- 工业级不间断电源（UPS）
- 电动汽车充电桩
- 组串式逆变器
- 焊接

- Halogen-free
- Lead-free
- Green
- RoHS

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
IKW50N120CH7	PG-TO247-3-STD-NN2.5	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](http://www.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}	$T_{vj} \geq 25\text{ °C}$		1200	V
DC collector current, limited by T_{vjmax}	I_C	limited by bondwire	$T_c = 25\text{ °C}$	86	A
			$T_c = 100\text{ °C}$	73	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			200	A
Turn-off safe operating area		$V_{CC} \leq 800\text{ V}$, $V_{CE,peak} < 1200\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{Goff} \geq 8\text{ }\Omega$, $T_{vj} \leq 175\text{ °C}$		200	A
Gate-emitter voltage	V_{GE}			± 20	V
Transient gate-emitter voltage	V_{GE}	$t_p \leq 0.5\text{ }\mu\text{s}$, $D < 0.001$		± 25	V
Power dissipation	P_{tot}		$T_c = 25\text{ °C}$	398	W
			$T_c = 100\text{ °C}$	199	

表3 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 50\text{ A}$, $V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ °C}$		1.7	2.15	V
			$T_{vj} = 175\text{ °C}$		2		
Gate-emitter threshold voltage	V_{GETh}	$I_C = 0.8\text{ mA}$, $V_{CE} = V_{GE}$		4.7	5.5	6.2	V
Zero gate-voltage collector current	I_{CES}	$V_{CE} = 1200\text{ V}$, $V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$			40	μA
			$T_{vj} = 175\text{ °C}$		3500		
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = 20\text{ V}$				100	nA
Transconductance	g_{fs}	$I_C = 50\text{ A}$, $V_{CE} = 20\text{ V}$			91		S
Input capacitance	C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 100\text{ kHz}$			6.6		nF
Output capacitance	C_{oes}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 100\text{ kHz}$			133		pF
Reverse transfer capacitance	C_{res}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 100\text{ kHz}$			37		pF
Gate charge	Q_G	$V_{CC} = 960\text{ V}$, $I_C = 50\text{ A}$, $V_{GE} = 15\text{ V}$			375		nC
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 600\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 8\text{ }\Omega$, $R_{G(off)} = 8\text{ }\Omega$	$T_{vj} = 25\text{ °C}$, $I_C = 50\text{ A}$		39		ns
			$T_{vj} = 175\text{ °C}$, $I_C = 50\text{ A}$		37		
Rise time (inductive load)	t_r	$V_{CC} = 600\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 8\text{ }\Omega$, $R_{G(off)} = 8\text{ }\Omega$	$T_{vj} = 25\text{ °C}$, $I_C = 50\text{ A}$		27		ns
			$T_{vj} = 175\text{ °C}$, $I_C = 50\text{ A}$		30		
Turn-off delay time	$t_{d(off)}$	$V_{CC} = 600\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 8\text{ }\Omega$, $R_{G(off)} = 8\text{ }\Omega$	$T_{vj} = 25\text{ °C}$, $I_C = 50\text{ A}$		319		ns
			$T_{vj} = 175\text{ °C}$, $I_C = 50\text{ A}$		387		
Fall time (inductive load)	t_f	$V_{CC} = 600\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 8\text{ }\Omega$, $R_{G(off)} = 8\text{ }\Omega$	$T_{vj} = 25\text{ °C}$, $I_C = 50\text{ A}$		41		ns
			$T_{vj} = 175\text{ °C}$, $I_C = 50\text{ A}$		127		
Turn-on energy	E_{on}	$V_{CC} = 600\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 8\text{ }\Omega$, $R_{G(off)} = 8\text{ }\Omega$	$T_{vj} = 25\text{ °C}$, $I_C = 50\text{ A}$		2.33		mJ
			$T_{vj} = 175\text{ °C}$, $I_C = 50\text{ A}$		3.49		

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3 二极管

表 3 (续) 特征值

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-off energy	E_{off}	$V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V}, R_{G(on)} = 8\ \Omega, R_{G(off)} = 8\ \Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C}, I_C = 50\text{ A}$	1.12		mJ
			$T_{vj} = 175\text{ }^{\circ}\text{C}, I_C = 50\text{ A}$	2.74		
Total switching energy	E_{ts}	$V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V}, R_{G(on)} = 8\ \Omega, R_{G(off)} = 8\ \Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C}, I_C = 50\text{ A}$	3.45		mJ
			$T_{vj} = 175\text{ }^{\circ}\text{C}, I_C = 50\text{ A}$	6.23		
Operating junction temperature	T_{vj}		-40		175	$^{\circ}\text{C}$

注： 电气特性，在 $T_{vj} = 25\text{ }^{\circ}\text{C}$ 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	limited by bondwire	$T_c = 25\text{ }^{\circ}\text{C}$	A
			$T_c = 100\text{ }^{\circ}\text{C}$	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}		200	A
Power dissipation	P_{tot}	$T_c = 25\text{ }^{\circ}\text{C}$	231	W
		$T_c = 100\text{ }^{\circ}\text{C}$	115	

表5 特征值

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Diode forward voltage	V_F	$I_F = 50\text{ A}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	2.5	3	V
			$T_{vj} = 175\text{ }^{\circ}\text{C}$	2.3		
Diode reverse recovery time	t_{rr}	$V_R = 600\text{ V}, R_{G(on)} = 8\ \Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C}, I_F = 50\text{ A}$	116		ns
			$T_{vj} = 175\text{ }^{\circ}\text{C}, I_F = 50\text{ A}$	194		
Diode reverse recovery charge	Q_{rr}	$V_R = 600\text{ V}, R_{G(on)} = 8\ \Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C}, I_F = 50\text{ A}$	1.48		μC
			$T_{vj} = 175\text{ }^{\circ}\text{C}, I_F = 50\text{ A}$	3.71		

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表 5 (续) 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode peak reverse recovery current	I_{rrm}	$V_R = 600 \text{ V}, R_{G(on)} = 8 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}, I_F = 50 \text{ A}$		28		A
			$T_{vj} = 175 \text{ }^\circ\text{C}, I_F = 50 \text{ A}$		41		
Diode peak rate of fall of reverse recovery current	di_{rr}/dt	$V_R = 600 \text{ V}, R_{G(on)} = 8 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}, I_F = 50 \text{ A}$		-383		A/ μs
			$T_{vj} = 150 \text{ }^\circ\text{C}, I_F = 50 \text{ A}$		-323		
Reverse recovery energy	E_{rec}	$V_R = 600 \text{ V}, R_{G(on)} = 8 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}, I_F = 50 \text{ A}$		0.43		mJ
			$T_{vj} = 175 \text{ }^\circ\text{C}, I_F = 50 \text{ A}$		1.22		
Operating junction temperature	T_{vj}			-40		175	$^\circ\text{C}$

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 $L_\sigma = 30 \text{ nH}$, $C_\sigma = 18 \text{ pF}$

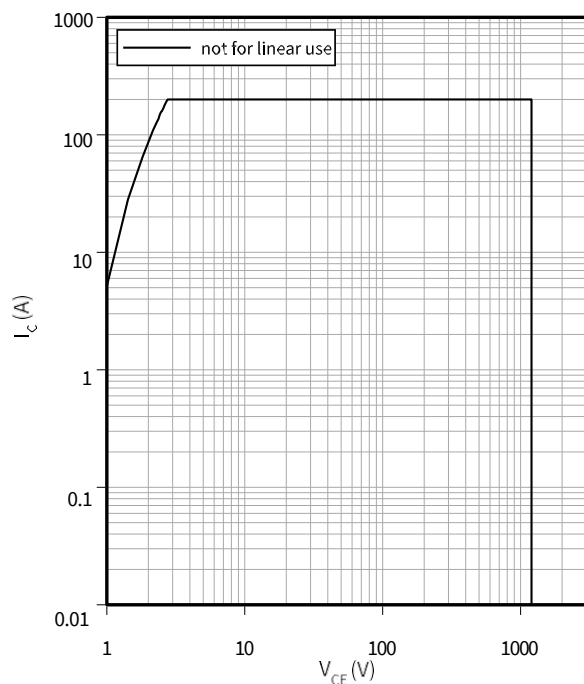
4 特性图

4 特性图

Reverse bias safe operating area

$$I_C = f(V_{CE})$$

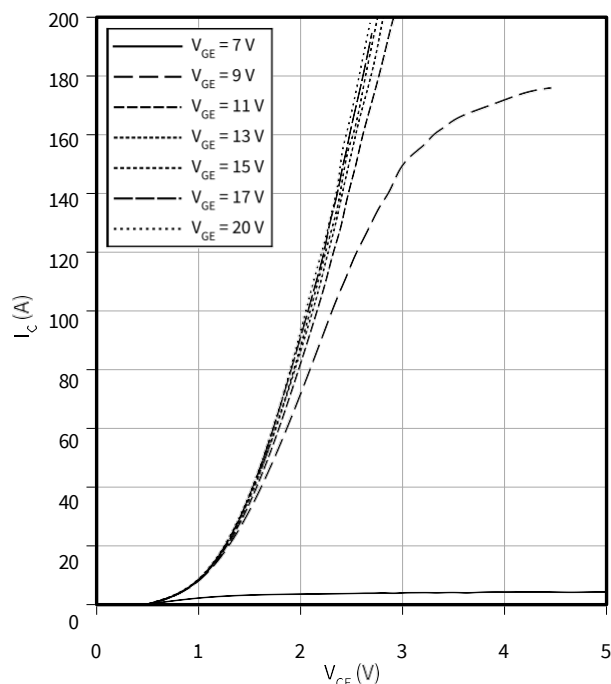
$T_{vj} \leq 175^\circ\text{C}$, $V_{GE} = 0/15\text{ V}$



Typical output characteristic

$$I_C = f(V_{CE})$$

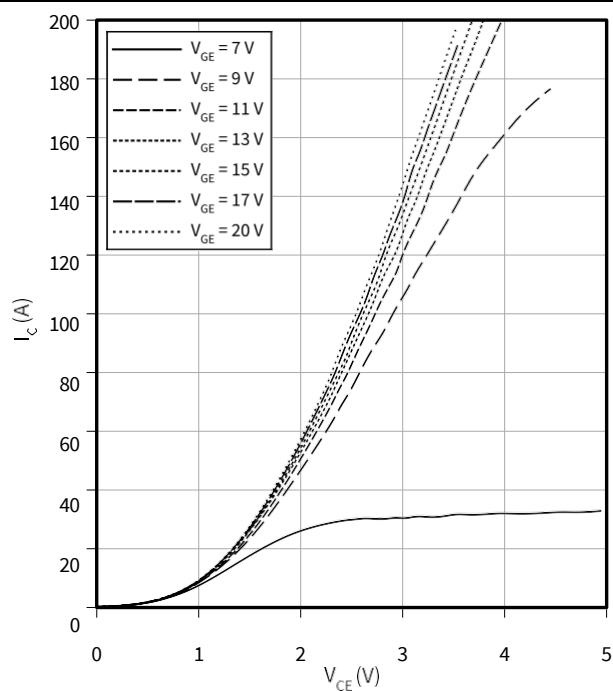
$T_{vj} = 25^\circ\text{C}$



Typical output characteristic

$$I_C = f(V_{CE})$$

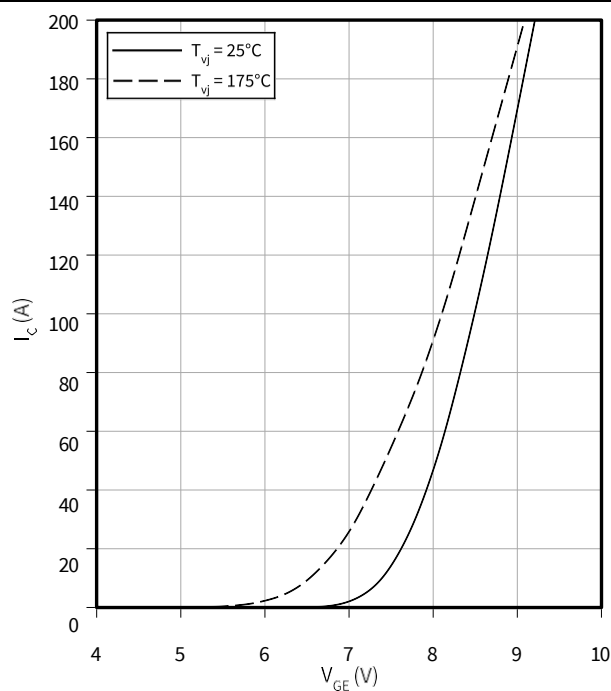
$T_{vj} = 175^\circ\text{C}$



Typical transfer characteristic

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

$V_{CE} = 20\text{ V}$

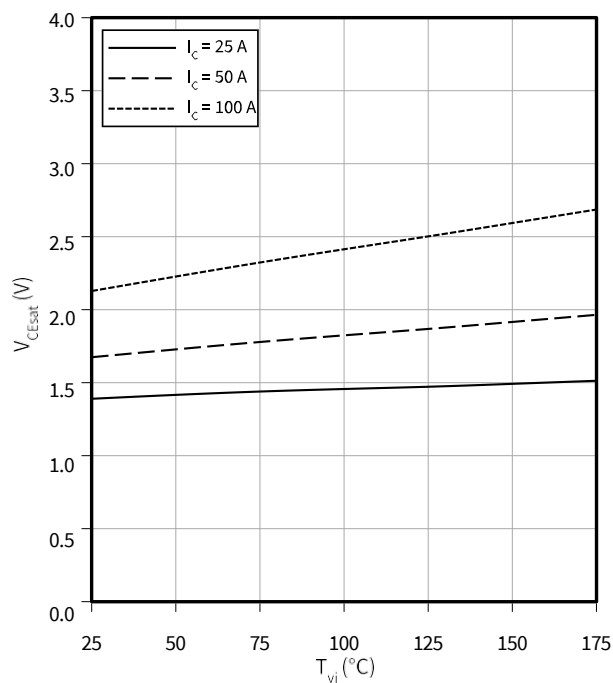


4 特性图

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

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

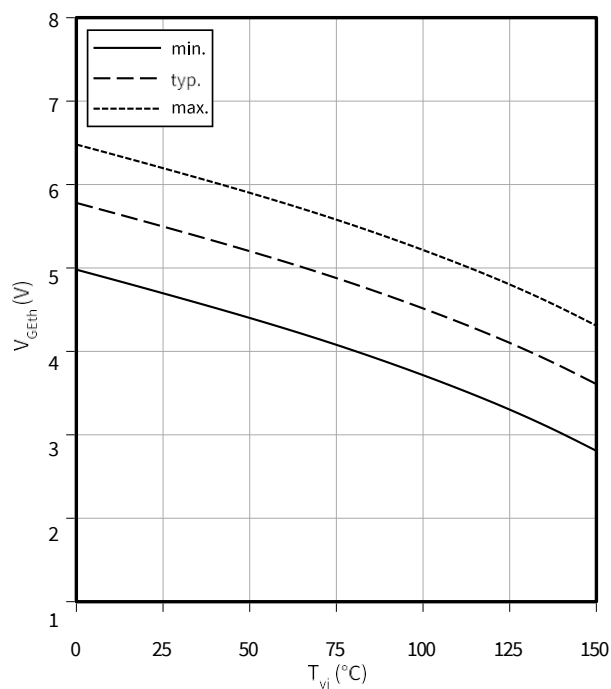
$$V_{GE} = 15 \text{ V}$$



Gate-emitter threshold voltage as a function of junction temperature

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

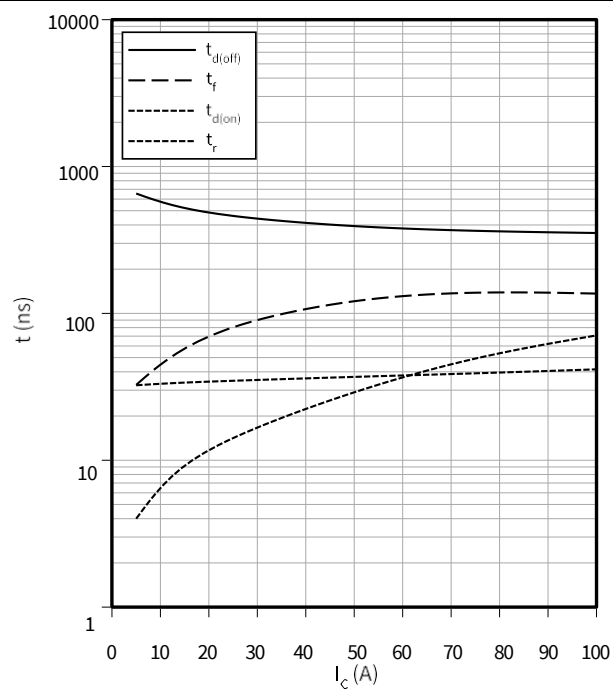
$$I_C = 0.85 \text{ mA}$$



Typical switching times as a function of collector current

$$t = f(I_C)$$

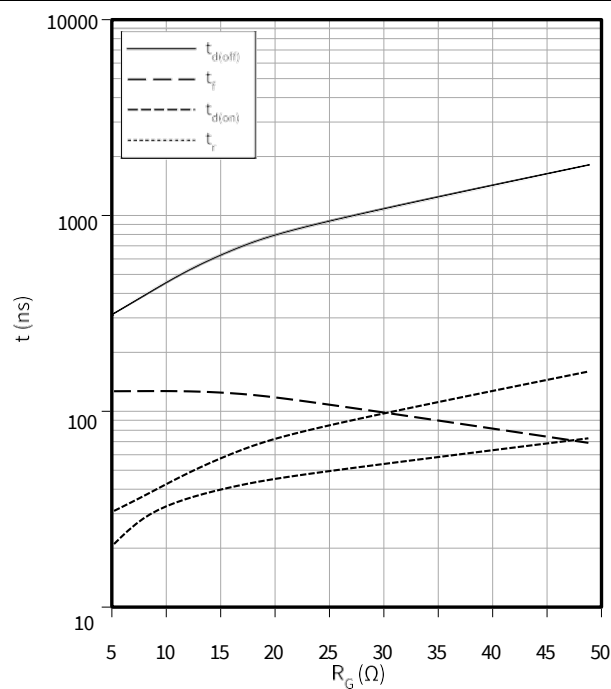
$$V_{CC} = 600 \text{ V}, T_{vj} = 175 \text{ °C}, V_{GE} = 0/15 \text{ V}, R_G = 8 \text{ } \Omega$$



Typical switching times as a function of gate resistor

$$t = f(R_G)$$

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

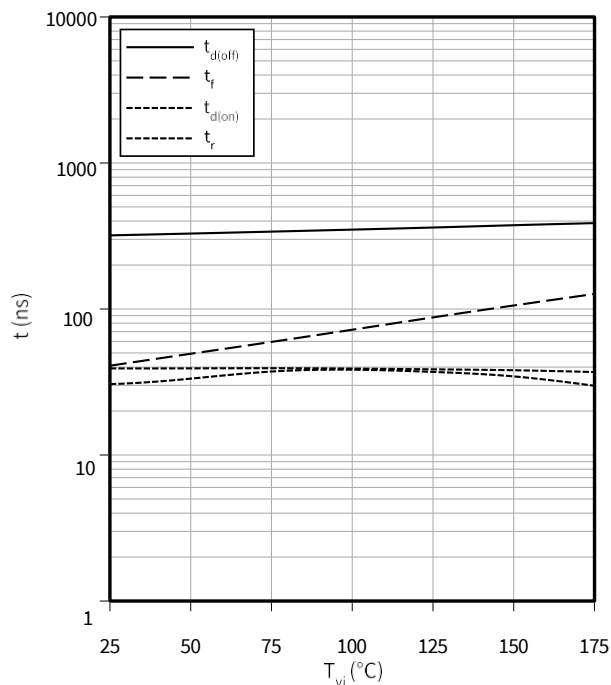


4 特性图

Typical switching times as a function of junction temperature

$$t = f(T_{vj})$$

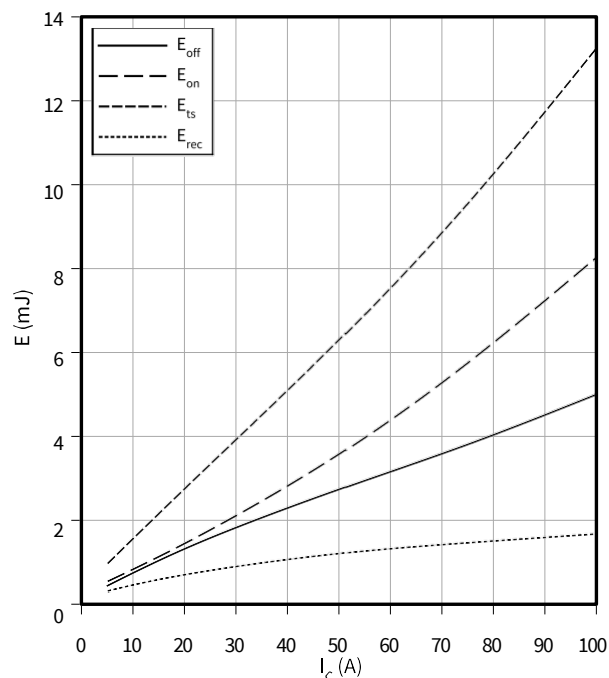
$I_C = 50 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = 0/15 \text{ V}$, $R_G = 8 \Omega$



Typical switching energy losses as a function of collector current

$$E = f(I_C)$$

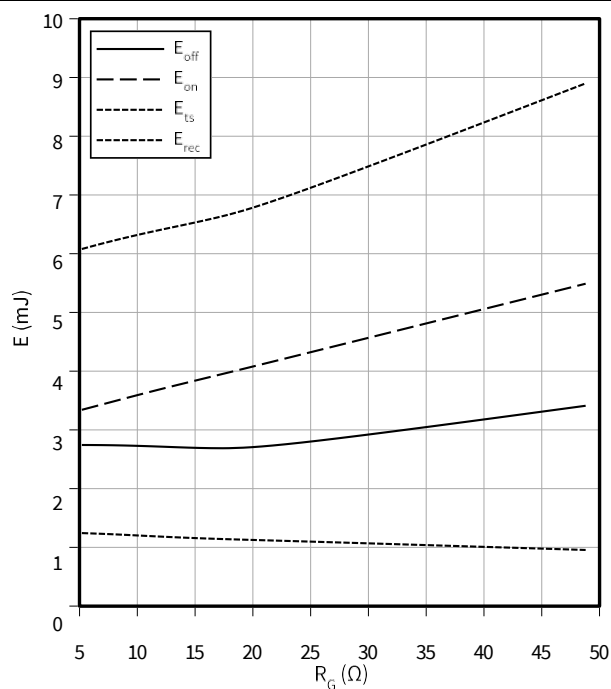
$V_{CC} = 600 \text{ V}$, $T_{vj} = 175 \text{ }^{\circ}\text{C}$, $V_{GE} = 0/15 \text{ V}$, $R_G = 8 \Omega$



Typical switching energy losses as a function of gate resistor

$$E = f(R_G)$$

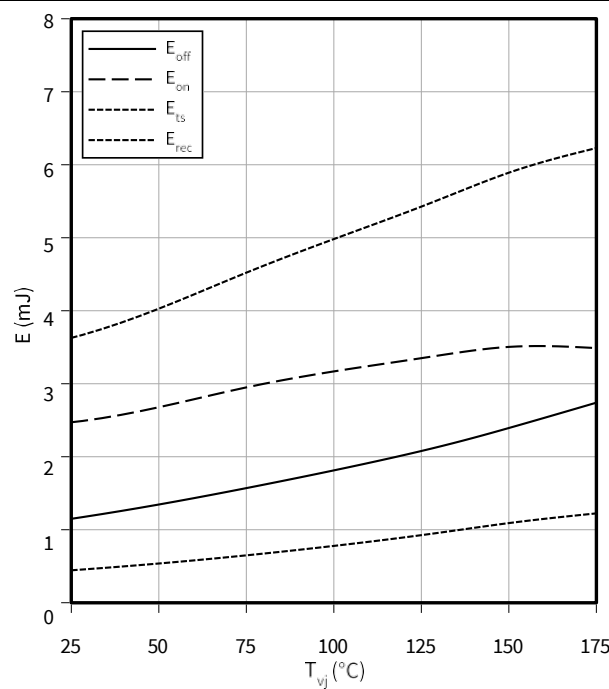
$I_C = 50 \text{ A}$, $V_{CC} = 600 \text{ V}$, $T_{vj} = 175 \text{ }^{\circ}\text{C}$, $V_{GE} = 0/15 \text{ V}$



Typical switching energy losses as a function of junction temperature

$$E = f(T_{vj})$$

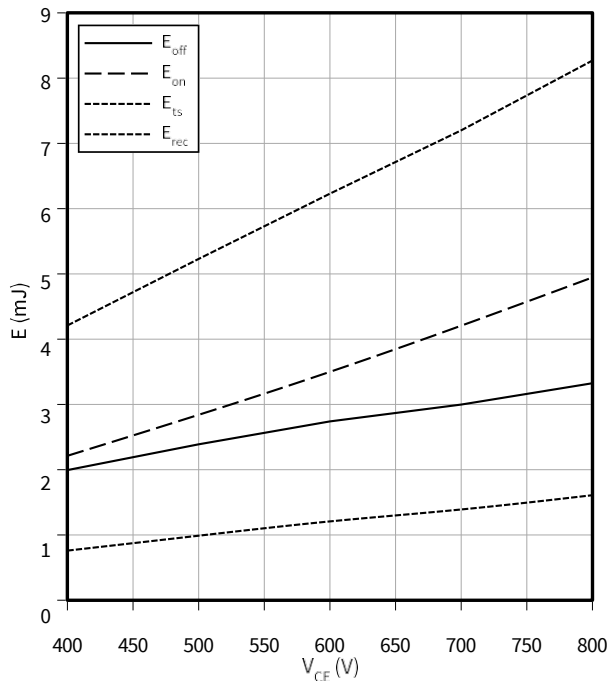
$I_C = 50 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = 0/15 \text{ V}$, $R_G = 8 \Omega$



4 特性图

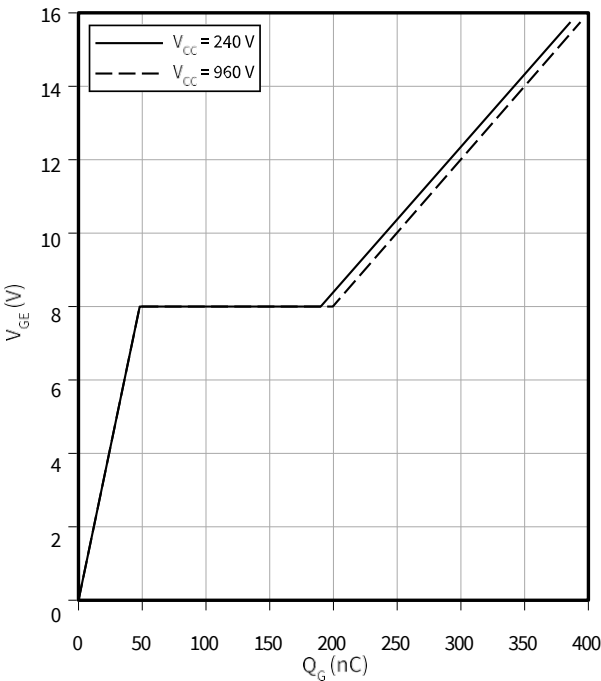
Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$
 $I_C = 50\text{ A}$, $T_{vj} = 175\text{ }^{\circ}\text{C}$, $V_{GE} = 0/15\text{ V}$, $R_G = 8\text{ }\Omega$



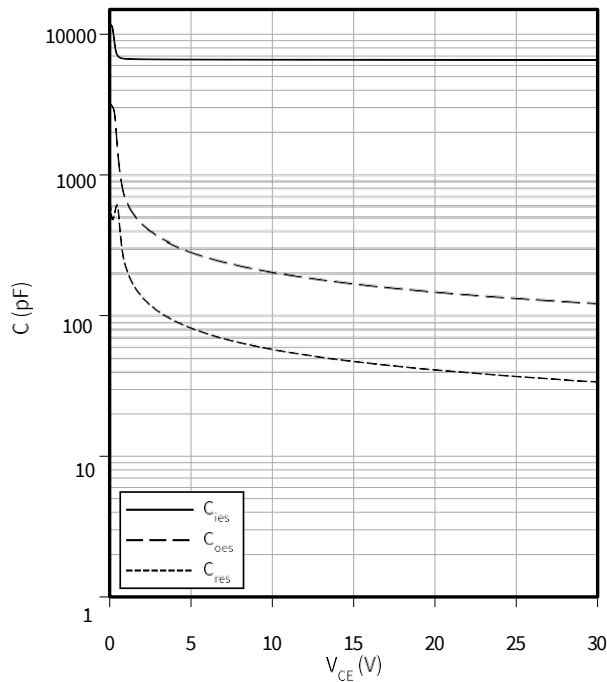
Typical gate charge

$V_{GE} = f(Q_G)$
 $I_C = 50\text{ A}$



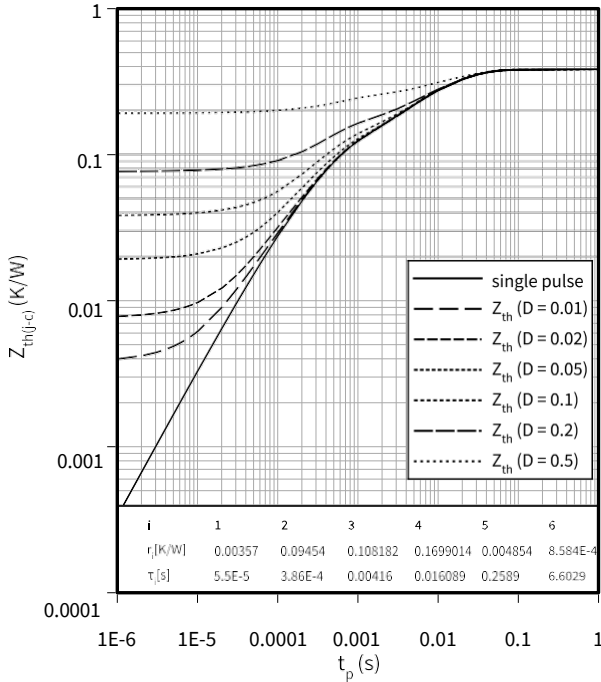
Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$
 $f = 100\text{ kHz}$, $V_{GE} = 0\text{ V}$



IGBT transient thermal impedance as a function of pulse width

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

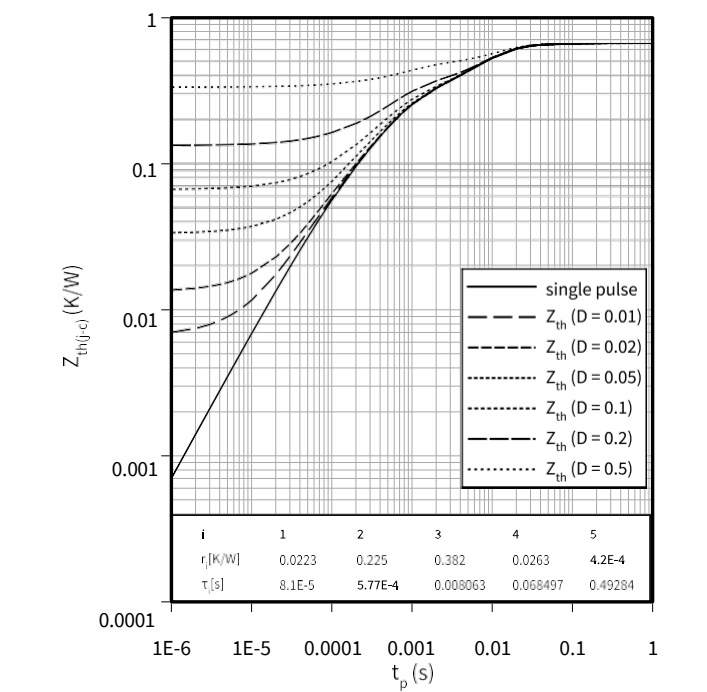


4 特性图

Diode transient thermal impedance as a function of pulse width

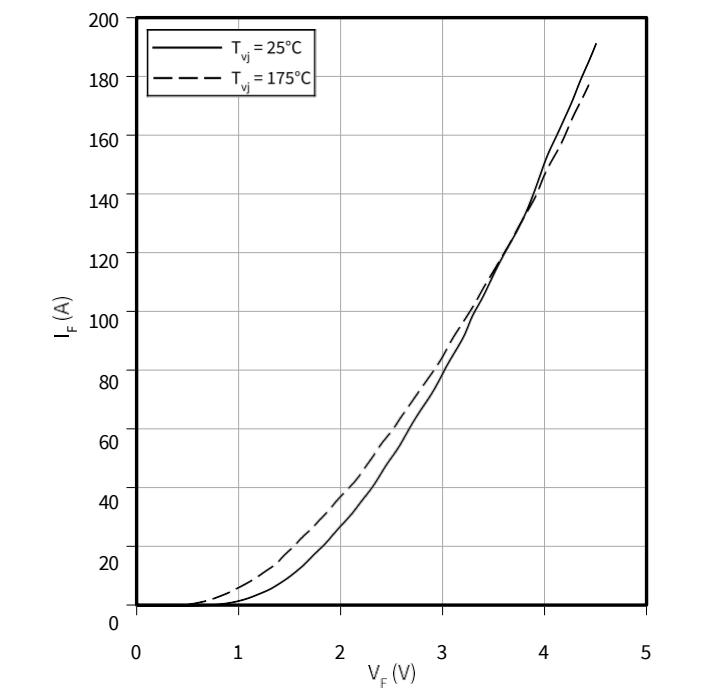
$$Z_{th(j-c)} = f(t_p)$$

$$D = t_p/T$$



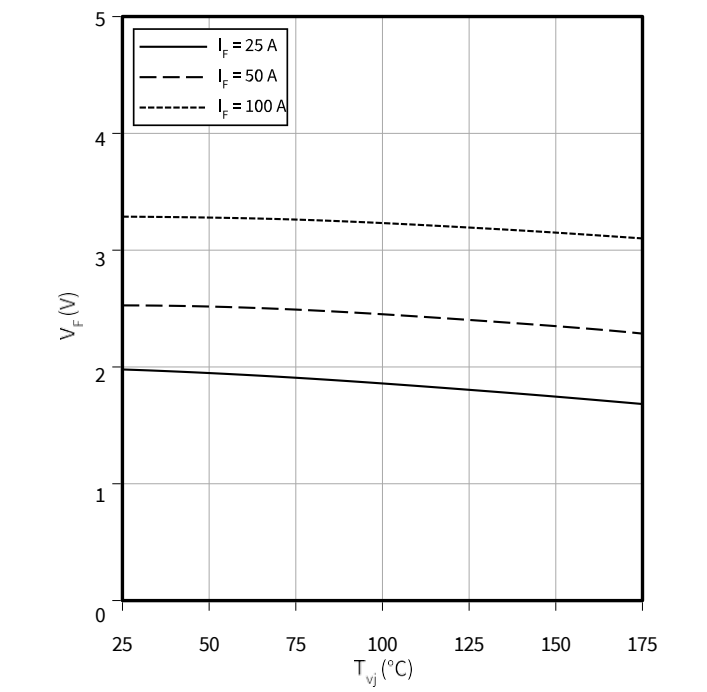
Typical diode forward current as a function of forward voltage

$$I_F = f(V_F)$$



Typical diode forward voltage as a function of junction temperature

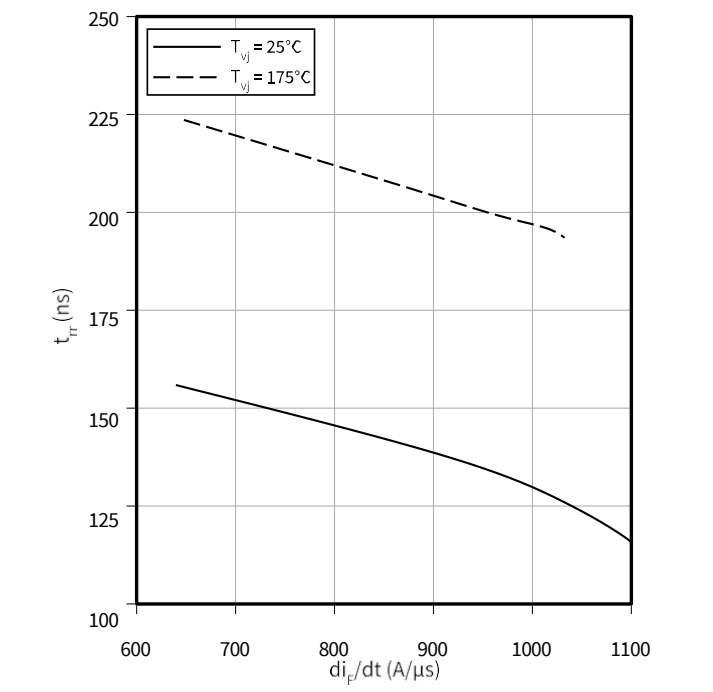
$$V_F = f(T_{vj})$$



Typical reverse recovery time as a function of diode current slope

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

$$V_R = 600\text{ V}, I_F = 50\text{ A}$$

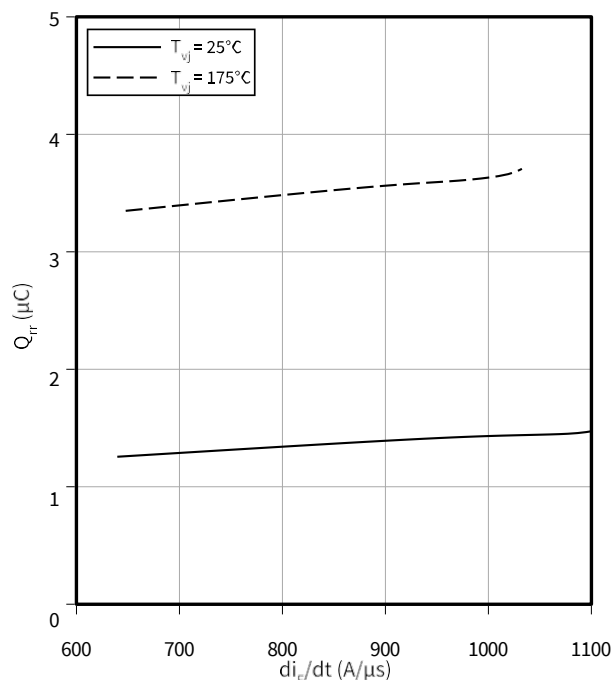


4 特性图

Typical reverse recovery charge as a function of diode current slope

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

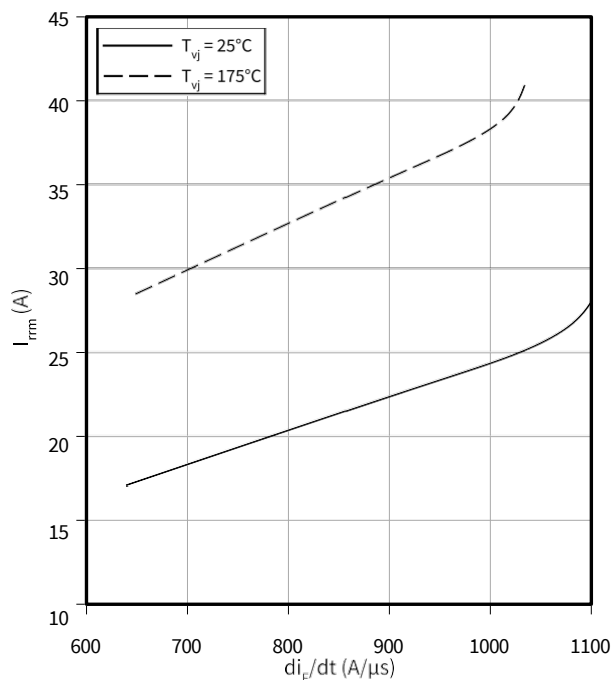
$V_R = 600 \text{ V}$, $I_F = 50 \text{ A}$



Typical reverse recovery current as a function of diode current slope

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

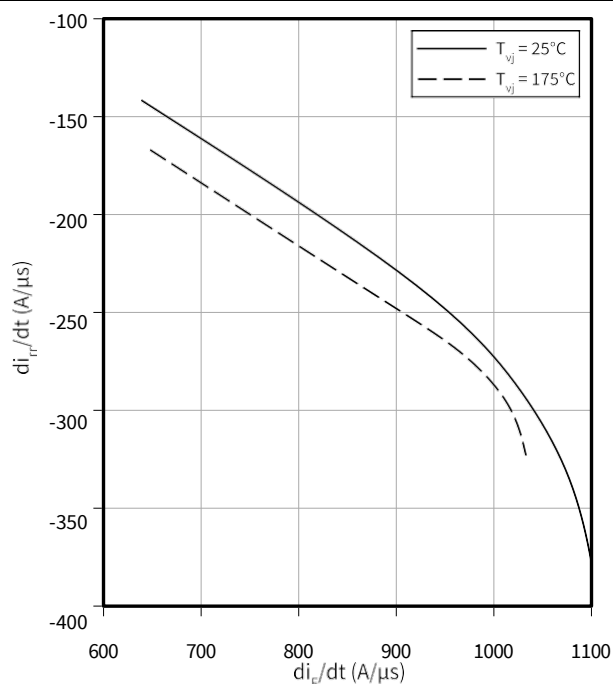
$V_R = 600 \text{ V}$, $I_F = 50 \text{ A}$



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

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

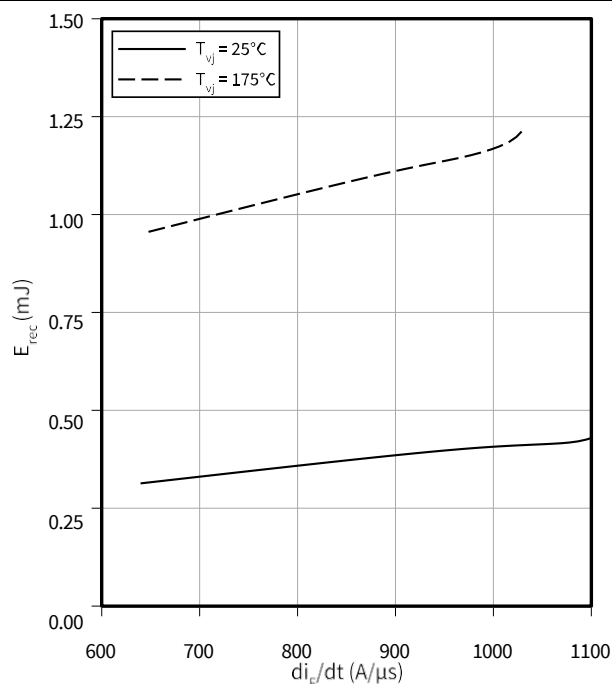
$V_R = 600 \text{ V}$, $I_F = 50 \text{ A}$



Typical reverse energy losses as a function of diode current slope

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

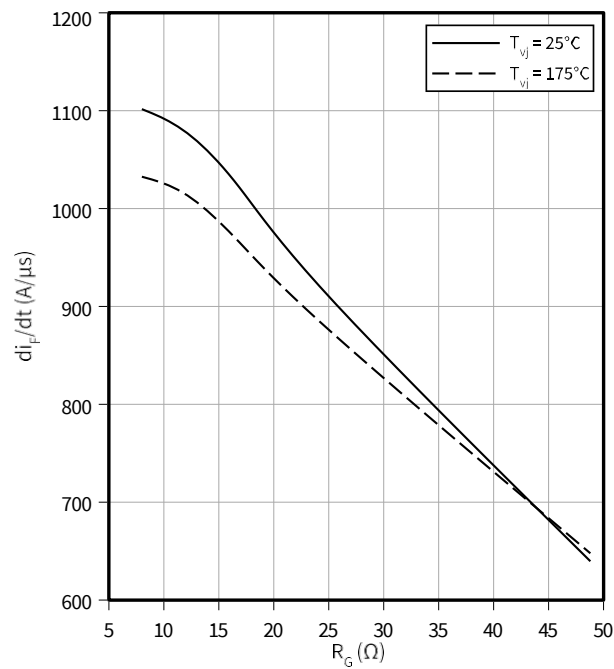
$V_R = 600 \text{ V}$, $I_F = 50 \text{ A}$



4 特性图

Typical diode current slope as a function of gate resistor

$di_F/dt = f(R_G)$
 $V_R = 600\text{ V}, I_F = 50\text{ A}$



5 封装外形

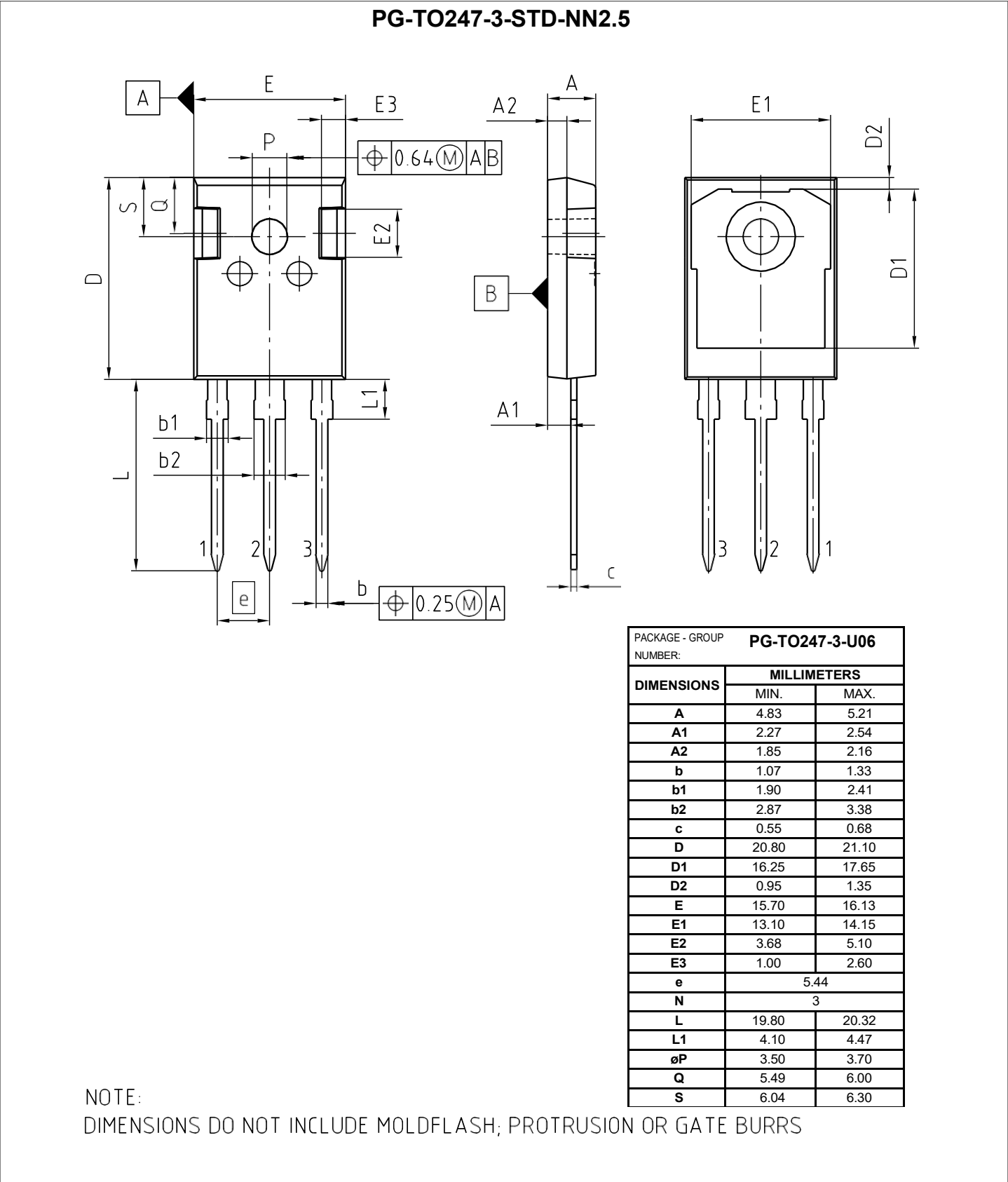


图 1

6 测试条件

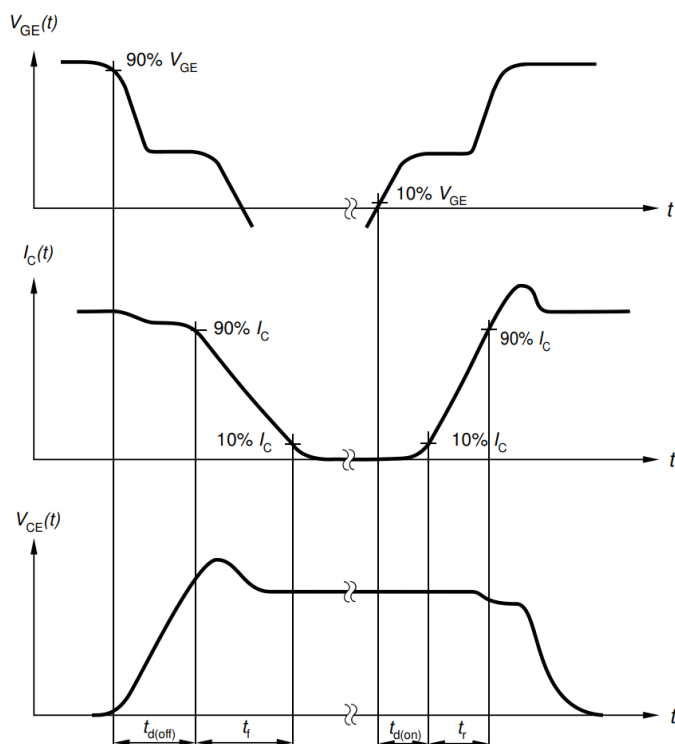


Figure A. Definition of switching times

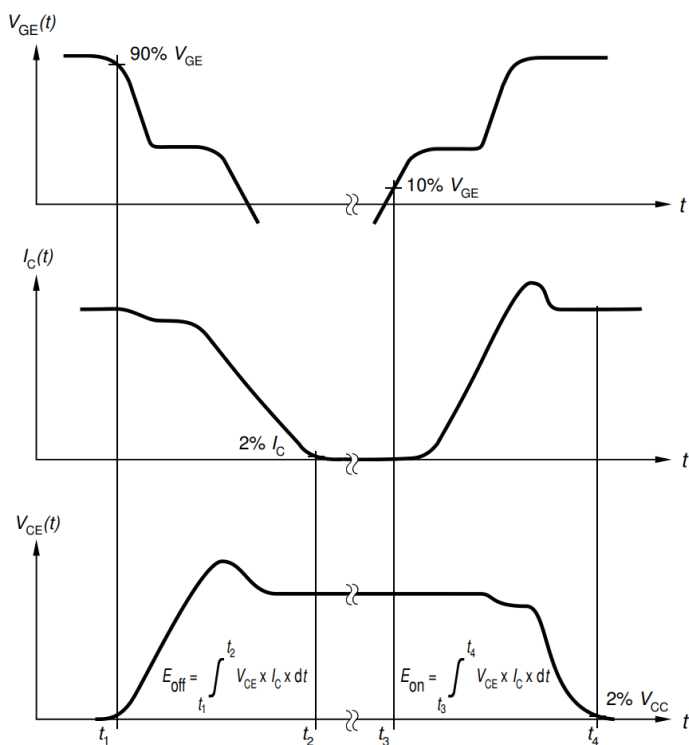


Figure B. Definition of switching losses

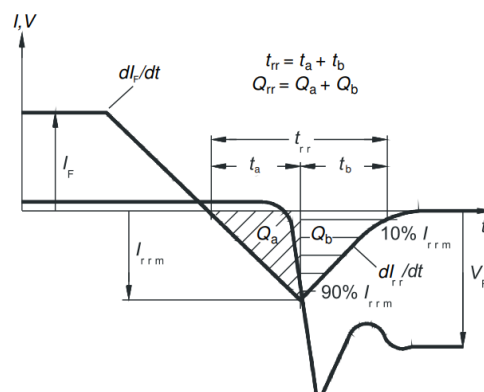


Figure C. Definition of diode switching characteristics

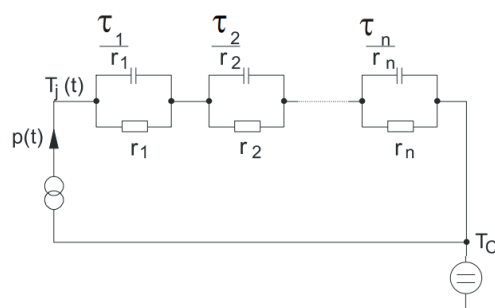


Figure D. Thermal equivalent circuit

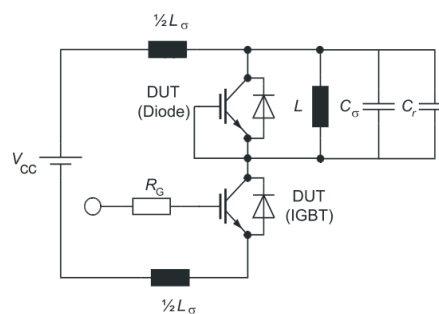


Figure E. Dynamic test circuit
 Parasitic inductance L_{σ} ,
 parasitic capacitor C_{σ} ,
 relief capacitor C_r ,
 (only for ZVT switching)

修订记录

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Document revision	Date of release	Description of changes
0.10	2022-05-02	Target datasheet
0.20	2022-05-19	Editorial changes
0.30	2022-06-01	Editorial changes
1.00	2022-11-02	Final datasheet
1.10	2022-11-25	Update of potential applications
1.20	2023-07-21	Figures on page 10 updated Editorial changes



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