

Final datasheet

英飞凌高速、低饱和电压 750 V TRENCHSTOP™ IGBT 7 技术，与软恢复和快速恢复的发射极控制 7 二极管共同封装

特性

- $V_{CE} = 750\text{ V}$
- $I_C = 50\text{ A}$
- 低开关损耗
- 极低的集电极-发射极饱和电压 V_{CEsat}
- 带软恢复和快速恢复的反并联二极管
- 平滑切换
- 防潮性
- 针对硬开关、两电平和三电平拓扑进行了优化
- 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
- 储能系统（ESS）

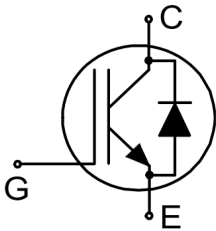
产品验证

- 符合 JEDEC47/20/22 相关测试的工业应用要求

描述

封装引脚定义：

- 引脚 G - 栅极
- 引脚 C & 背面 - 集电极
- 引脚 E - 发射极



Type	Package	Marking
IKWH50N75EH7	PG-TO247-3-U04	K50GEH7

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1 封装

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	$R_{th(j-c)}$			0.46	0.6	K/W
Diode thermal resistance, junction-case	$R_{th(j-c)}$			0.61	0.8	K/W

2 IGBT

表 2 最大额定值

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CE}	$T_{vj} \geq 25\text{ °C}$		750	V
DC collector current, limited by T_{vjmax}	I_C	limited by bondwire	$T_c = 25\text{ °C}$	80	A
			$T_c = 100\text{ °C}$	67	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			200	A
Turn-off safe operating area		$V_{CE} \leq 750\text{ V}$, $t_p \leq 1\text{ }\mu\text{s}$, $T_{vj} \leq 175\text{ °C}$		200	A
Gate-emitter voltage	V_{GE}			± 20	V
Transient gate-emitter voltage	V_{GE}	$t_p \leq 10\text{ }\mu\text{s}$, $D < 0.01$		± 30	V
Power dissipation	P_{tot}		$T_c = 25\text{ °C}$	250	W
			$T_c = 100\text{ °C}$	125	

表 3 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 50\text{ A}$, $V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ °C}$		1.45	1.75	V
			$T_{vj} = 175\text{ °C}$		1.75		
Gate-emitter threshold voltage	V_{GETh}	$I_C = 0.44\text{ mA}$, $V_{CE} = V_{GE}$		3.2	4	4.8	V
Zero gate-voltage collector current	I_{CES}	$V_{CE} = 750\text{ V}$, $V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$			15	μA
			$T_{vj} = 175\text{ °C}$		1500		
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = 20\text{ V}$				100	nA
Transconductance	g_{fs}	$I_C = 50\text{ A}$, $V_{CE} = 20\text{ V}$			65		S
Input capacitance	C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 100\text{ kHz}$			2560		pF
Output capacitance	C_{oes}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 100\text{ kHz}$			79		pF
Reverse transfer capacitance	C_{res}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 100\text{ kHz}$			9.6		pF
Gate charge	Q_G	$V_{CC} = 600\text{ V}$, $I_C = 50\text{ A}$, $V_{GE} = 15\text{ V}$			105		nC
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 10\text{ }\Omega$, $R_{G(off)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ °C}$, $I_C = 50\text{ A}$		18		ns
			$T_{vj} = 175\text{ °C}$, $I_C = 50\text{ A}$		18		
Rise time (inductive load)	t_r	$V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 10\text{ }\Omega$, $R_{G(off)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ °C}$, $I_C = 50\text{ A}$		18		ns
			$T_{vj} = 175\text{ °C}$, $I_C = 50\text{ A}$		19		
Turn-off delay time	$t_{d(off)}$	$V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 10\text{ }\Omega$, $R_{G(off)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ °C}$, $I_C = 50\text{ A}$		141		ns
			$T_{vj} = 175\text{ °C}$, $I_C = 50\text{ A}$		175		
Fall time (inductive load)	t_f	$V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 10\text{ }\Omega$, $R_{G(off)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ °C}$, $I_C = 50\text{ A}$		30		ns
			$T_{vj} = 175\text{ °C}$, $I_C = 50\text{ A}$		72		
Turn-on energy	E_{on}	$V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 10\text{ }\Omega$, $R_{G(off)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ °C}$, $I_C = 50\text{ A}$		1.1		mJ
			$T_{vj} = 175\text{ °C}$, $I_C = 50\text{ A}$		1.5		

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表 3 (续) 特征值

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-off energy	E_{off}	$V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 10\ \Omega$, $R_{G(off)} = 10\ \Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C}$, $I_C = 50\text{ A}$	0.6		mJ
			$T_{vj} = 175\text{ }^{\circ}\text{C}$, $I_C = 50\text{ A}$	1.2		
Total switching energy	E_{ts}	$V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 10\ \Omega$, $R_{G(off)} = 10\ \Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C}$, $I_C = 50\text{ A}$	1.7		mJ
			$T_{vj} = 175\text{ }^{\circ}\text{C}$, $I_C = 50\text{ A}$	2.7		
Operating junction temperature	T_{vj}		-40		175	$^{\circ}\text{C}$

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}		$T_c = 25\text{ }^{\circ}\text{C}$	W
			$T_c = 100\text{ }^{\circ}\text{C}$	

表5 特征值

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Diode forward voltage	V_F	$I_F = 50\text{ A}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	1.65	2	V
			$T_{vj} = 175\text{ }^{\circ}\text{C}$	1.6		
Diode reverse recovery time	t_{rr}	$V_R = 400\text{ V}$, $R_{G(on)} = 10\ \Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C}$, $I_F = 50\text{ A}$	88		ns
			$T_{vj} = 175\text{ }^{\circ}\text{C}$, $I_F = 50\text{ A}$	151		
Diode reverse recovery charge	Q_{rr}	$V_R = 400\text{ V}$, $R_{G(on)} = 10\ \Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C}$, $I_F = 50\text{ A}$	1.5		μC
			$T_{vj} = 175\text{ }^{\circ}\text{C}$, $I_F = 50\text{ A}$	3.4		

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表 5 (续) 特征值

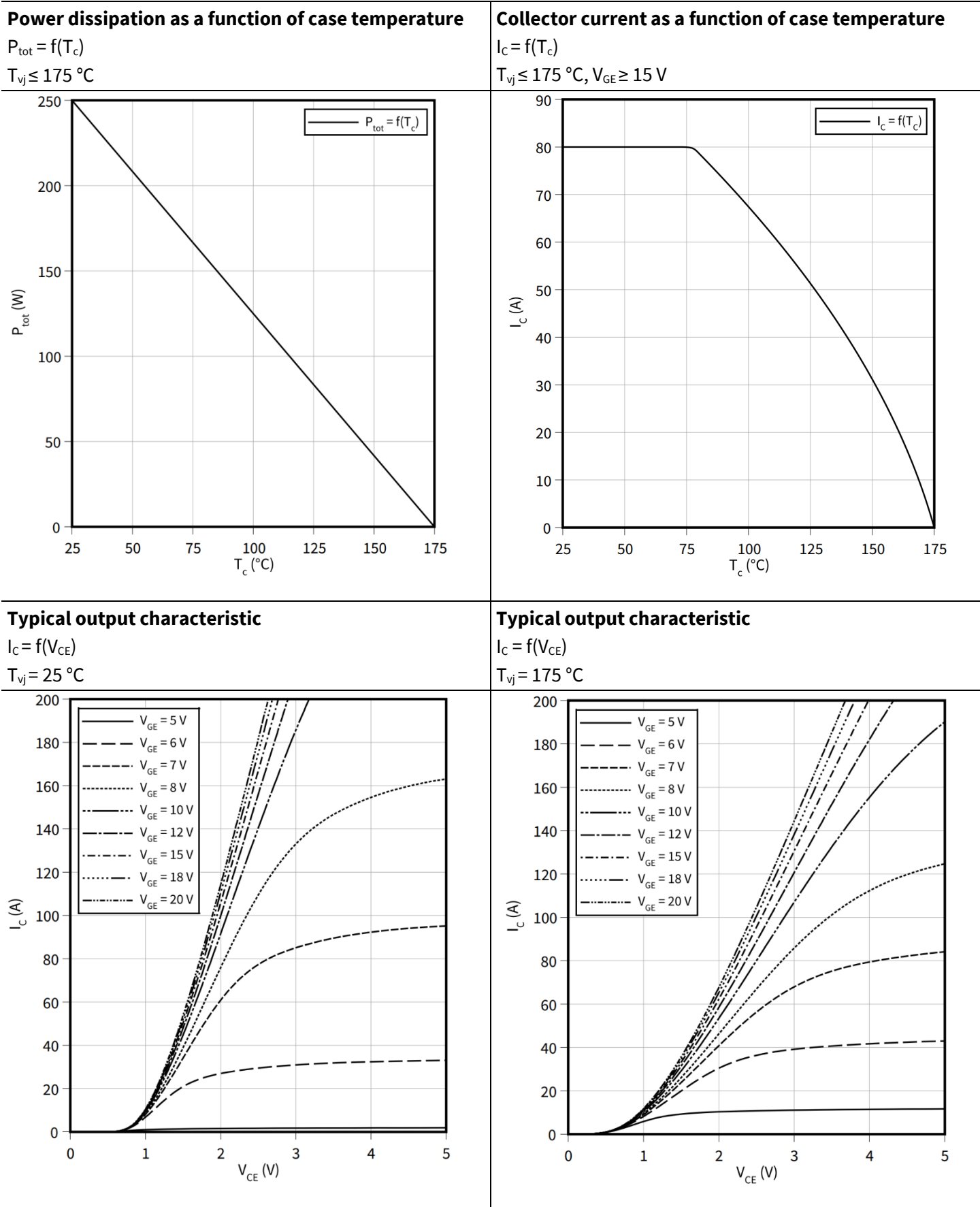
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode peak reverse recovery current	I_{rrm}	$V_R = 400\text{ V}, R_{G(on)} = 10\ \Omega$	$T_{vj} = 25\text{ °C}, I_F = 50\text{ A}$		28.8		A
			$T_{vj} = 175\text{ °C}, I_F = 50\text{ A}$		42.8		
Diode peak rate of fall of reverse recovery current	di_{rr}/dt	$V_R = 400\text{ V}, R_{G(on)} = 10\ \Omega$	$T_{vj} = 25\text{ °C}, I_F = 50\text{ A}$		-470		A/ μs
			$T_{vj} = 175\text{ °C}, I_F = 50\text{ A}$		-380		
Reverse recovery energy	E_{rec}	$V_R = 400\text{ V}, R_{G(on)} = 10\ \Omega$	$T_{vj} = 25\text{ °C}, I_F = 50\text{ A}$		0.35		mJ
			$T_{vj} = 175\text{ °C}, I_F = 50\text{ A}$		0.91		
Operating junction temperature	T_{vj}			-40		175	°C

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

除非另有规定，电气特性均在 $T_{vj} = 25\text{ °C}$ 的条件下测得。

动态测试电路，寄生电感 $L_\sigma = 8\text{ nH}$ ，寄生电容 $C_\sigma = 30\text{ pF}$ ，如图 E 所示。能量损耗包括“拖尾”和二极管反向恢复。

4 特性图

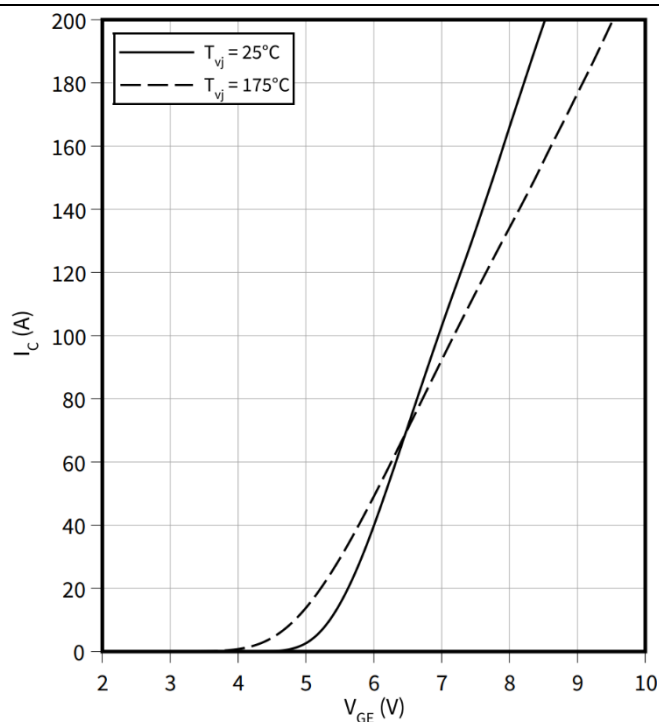


4 特性图

Typical transfer characteristic

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

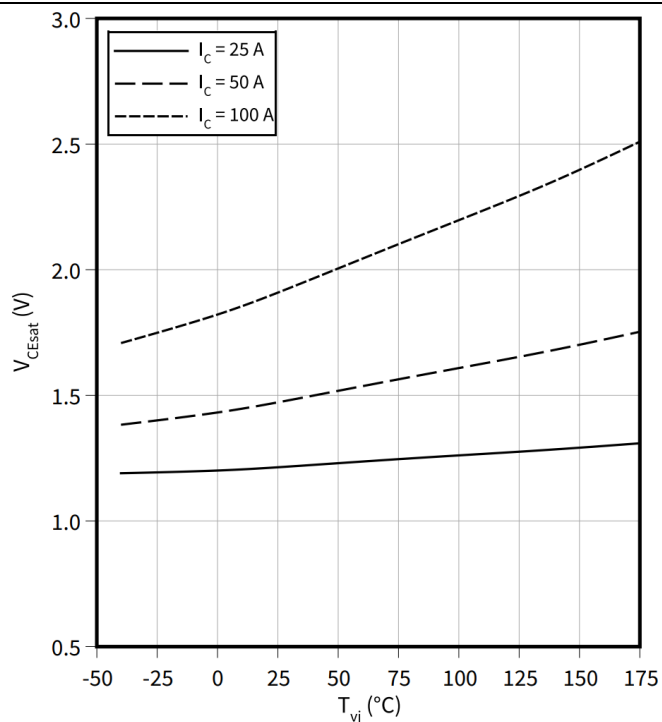
$$V_{CE} = 20 \text{ V}$$



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

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

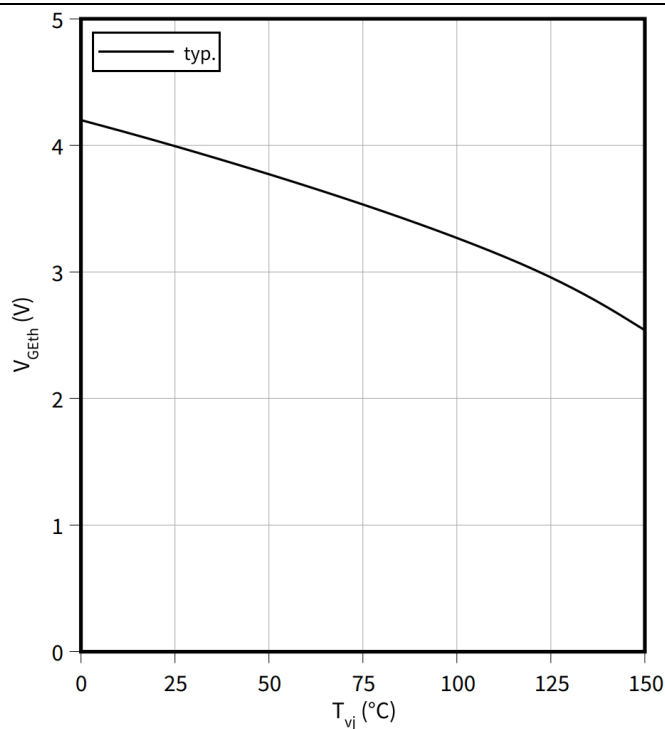
$$V_{GE} = 15 \text{ V}$$



Gate-emitter threshold voltage as a function of junction temperature

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

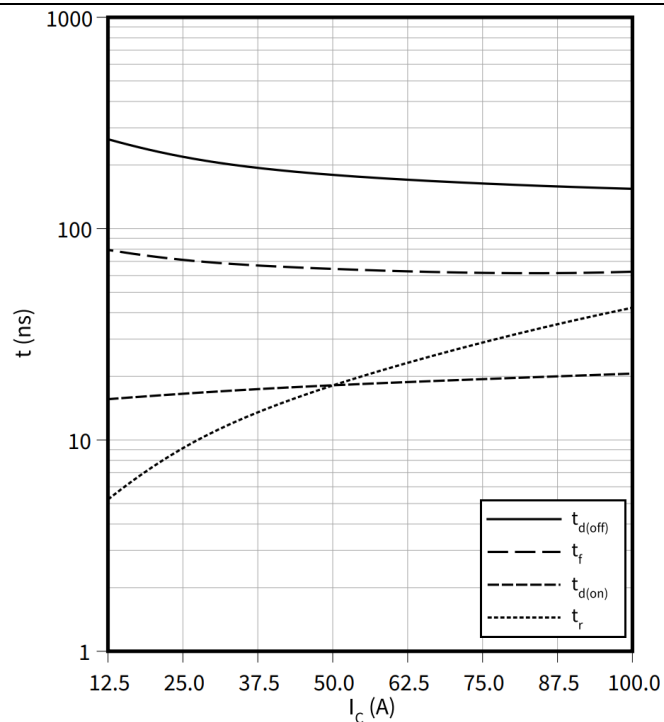
$$I_C = 0.44 \text{ mA}$$



Typical switching times as a function of collector current

$$t = f(I_C)$$

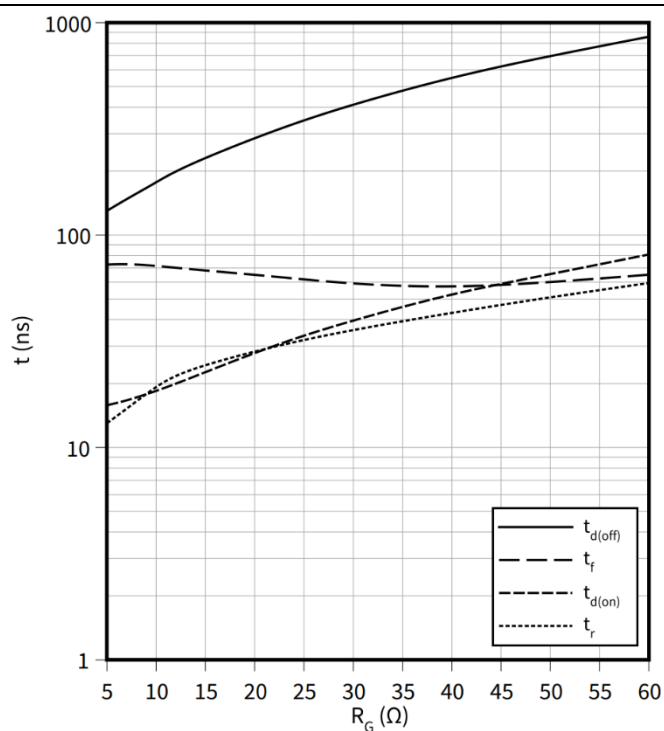
$$V_{CC} = 400 \text{ V}, T_{vj} = 175^\circ\text{C}, V_{GE} = 0/15 \text{ V}, R_G = 10 \Omega$$



4 特性图

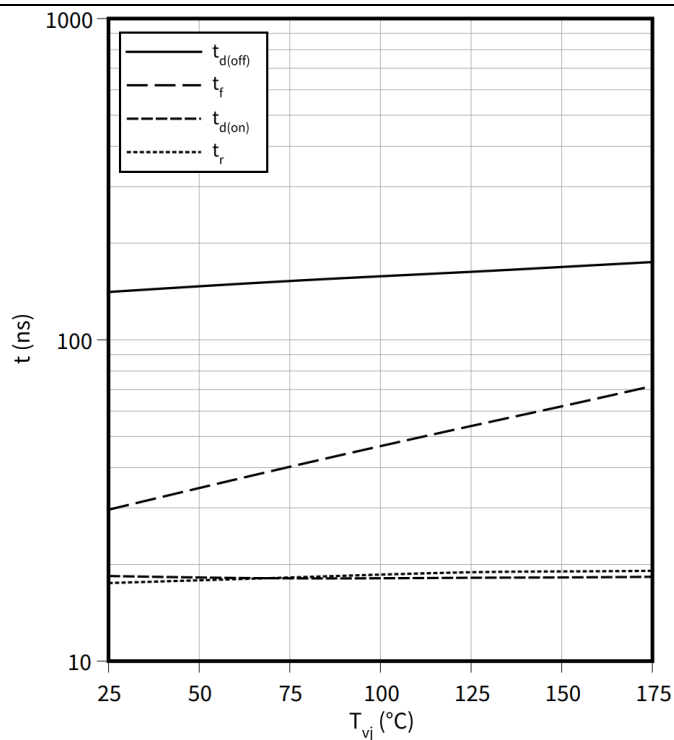
Typical switching times as a function of gate resistor

$$t = f(R_G)$$

 $I_C = 50 \text{ A}, V_{CC} = 400 \text{ V}, T_{vj} = 175 \text{ }^{\circ}\text{C}, V_{GE} = 0/15 \text{ V}$


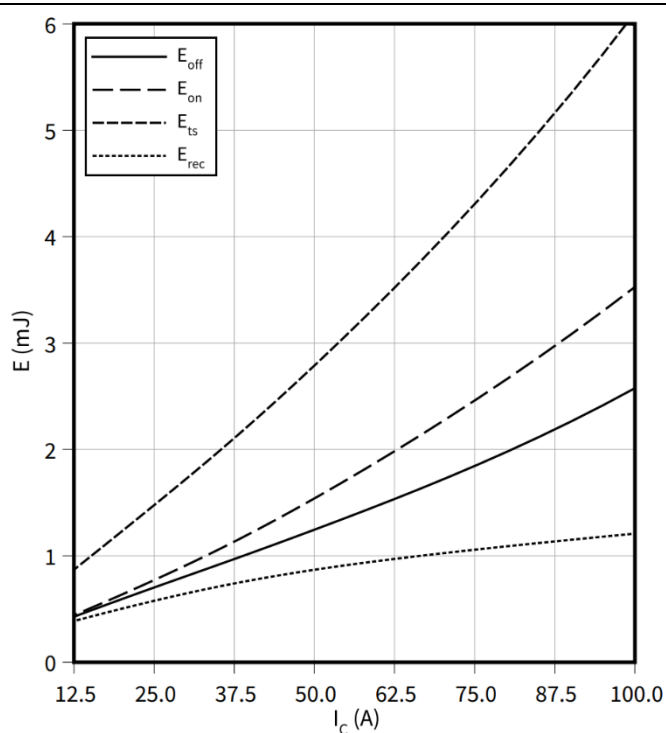
Typical switching times as a function of junction temperature

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

 $I_C = 50 \text{ A}, V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_G = 10 \text{ } \Omega$


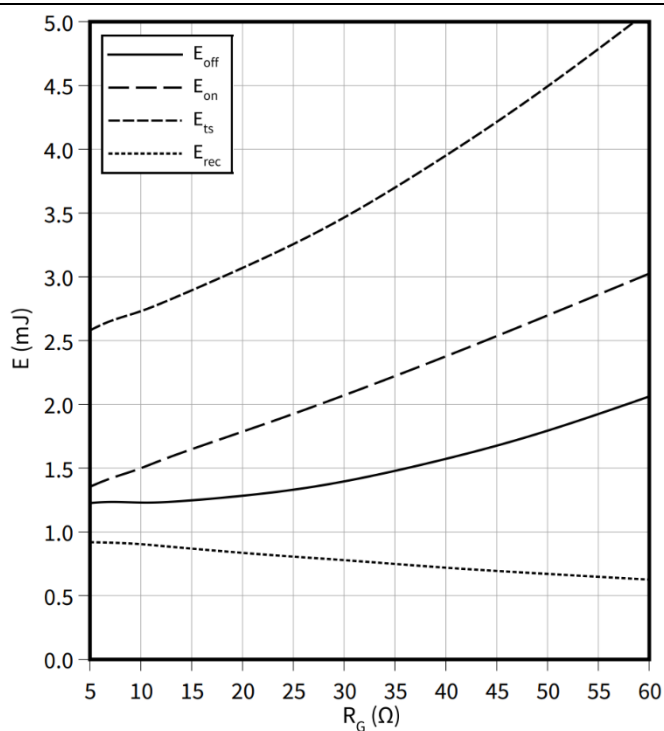
Typical switching energy losses as a function of collector current

$$E = f(I_C)$$

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


Typical switching energy losses as a function of gate resistor

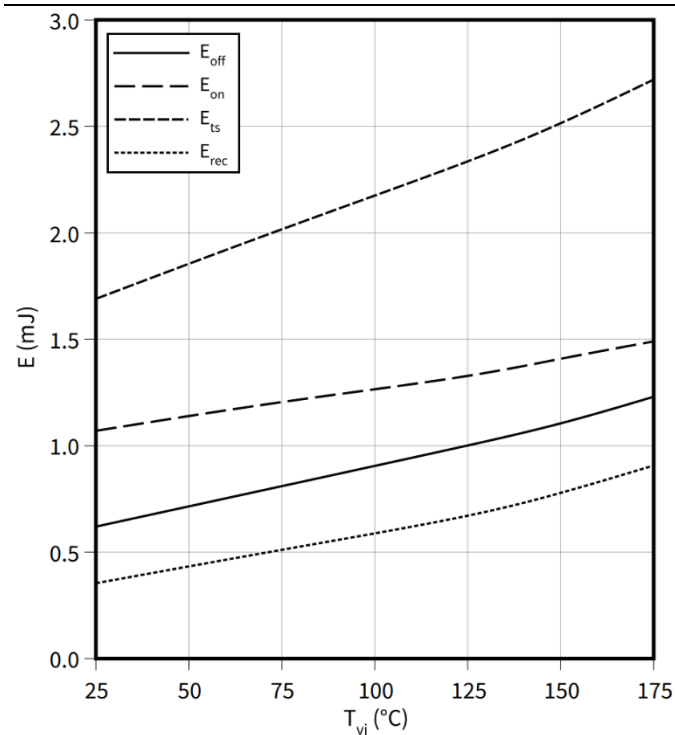
$$E = f(R_G)$$

 $I_C = 50 \text{ A}, V_{CC} = 400 \text{ V}, T_{vj} = 175 \text{ }^{\circ}\text{C}, V_{GE} = 0/15 \text{ V}$


4 特性图

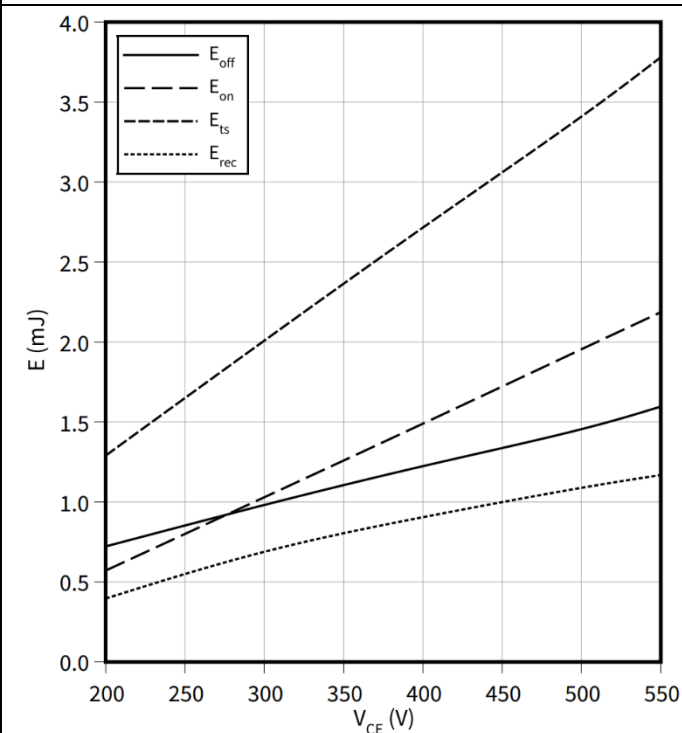
Typical switching energy losses as a function of junction temperature

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

 $I_C = 50 \text{ A}, V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_G = 10 \Omega$


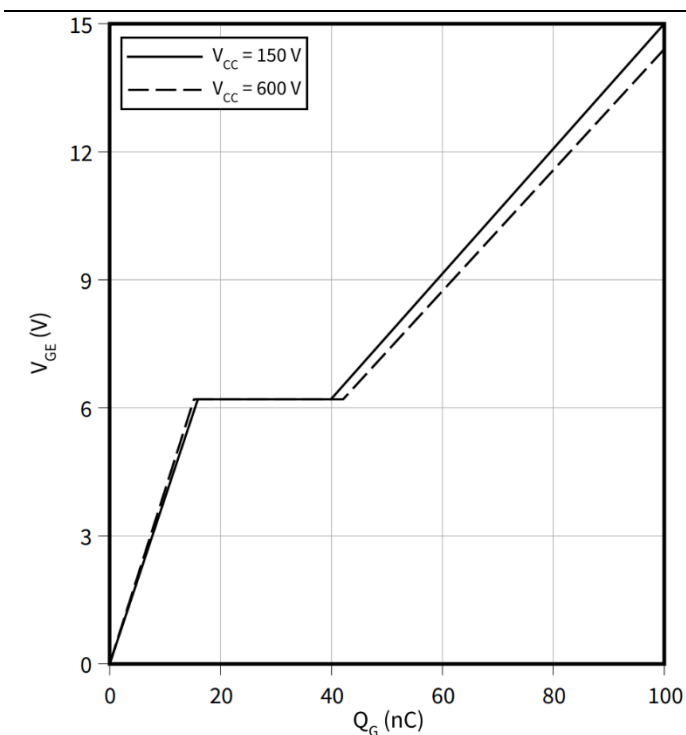
Typical switching energy losses as a function of collector emitter voltage

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

 $I_C = 50 \text{ A}, T_{vj} = 175 \text{ °C}, V_{GE} = 0/15 \text{ V}, R_G = 10 \Omega$


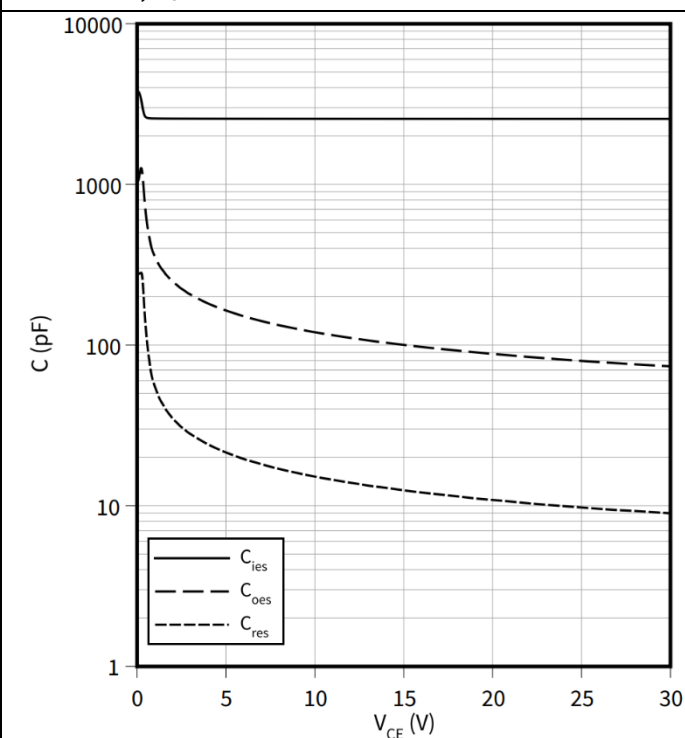
Typical gate charge

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

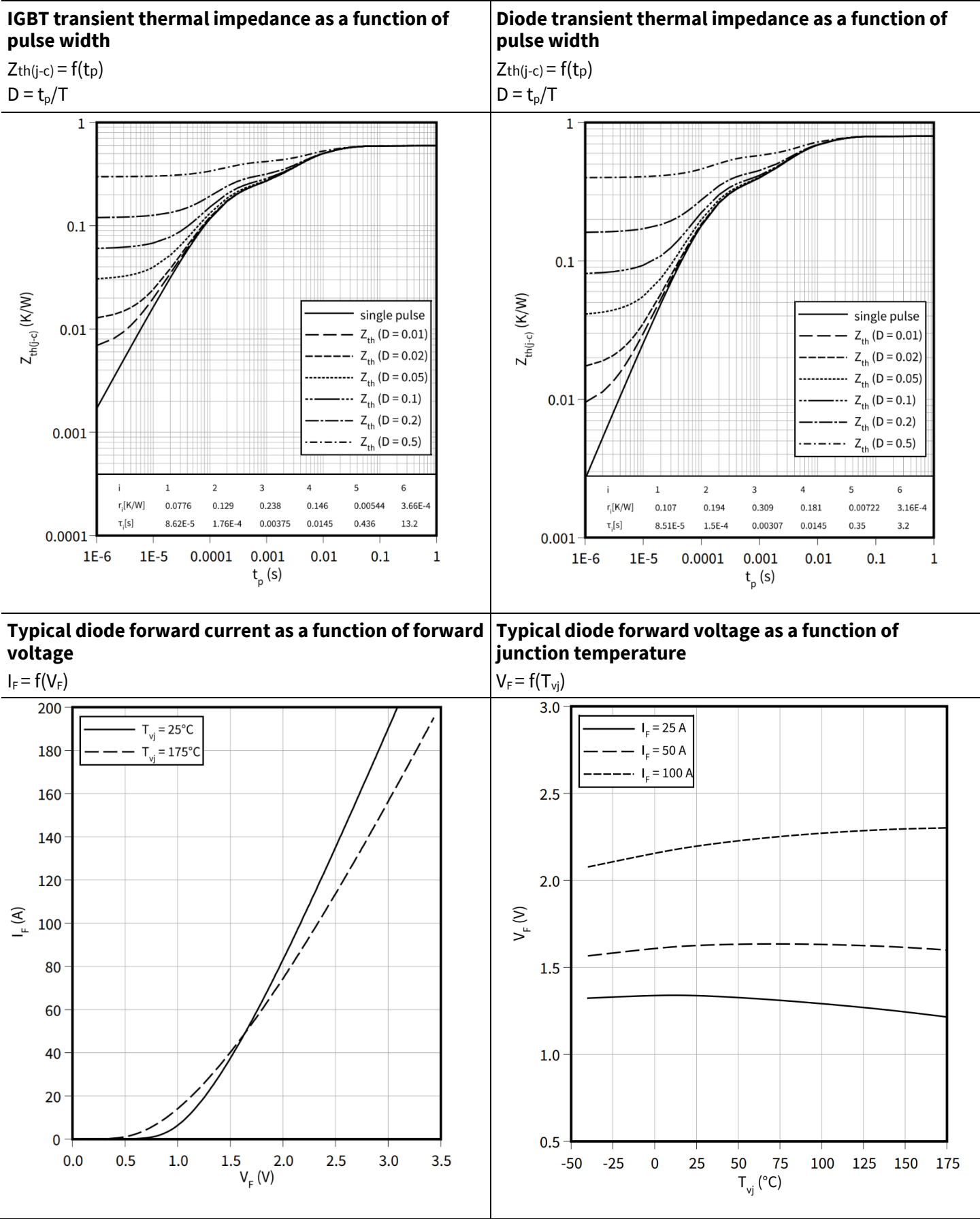
 $I_C = 50 \text{ A}$


Typical capacitance as a function of collector-emitter voltage

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

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


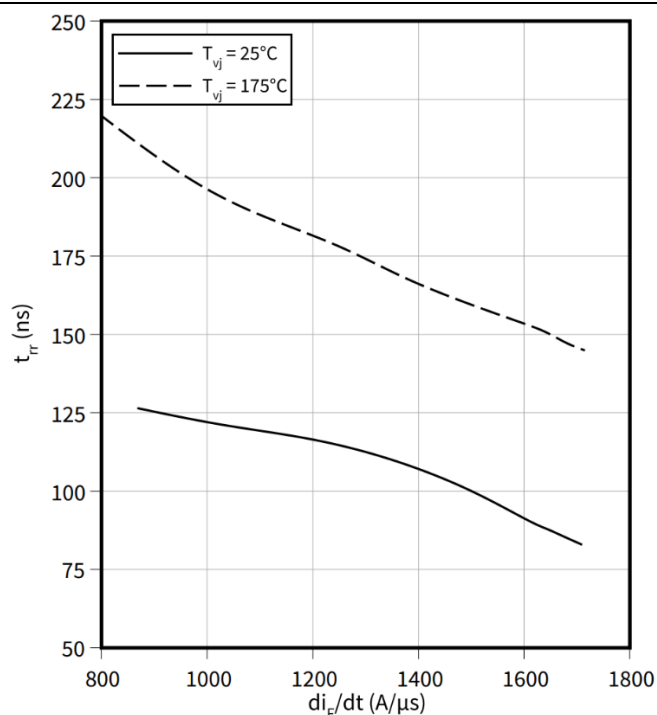
4 特性图



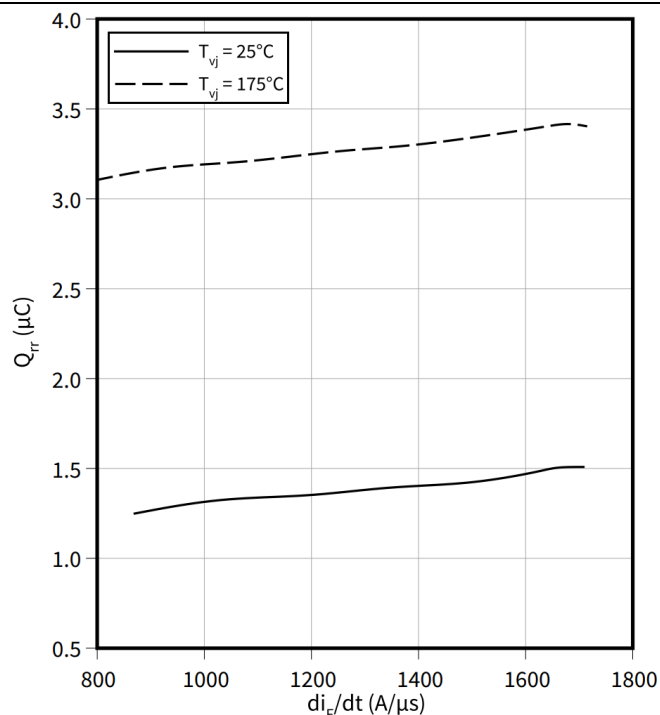
4 特性图

Typical reverse recovery time as a function of diode current slope

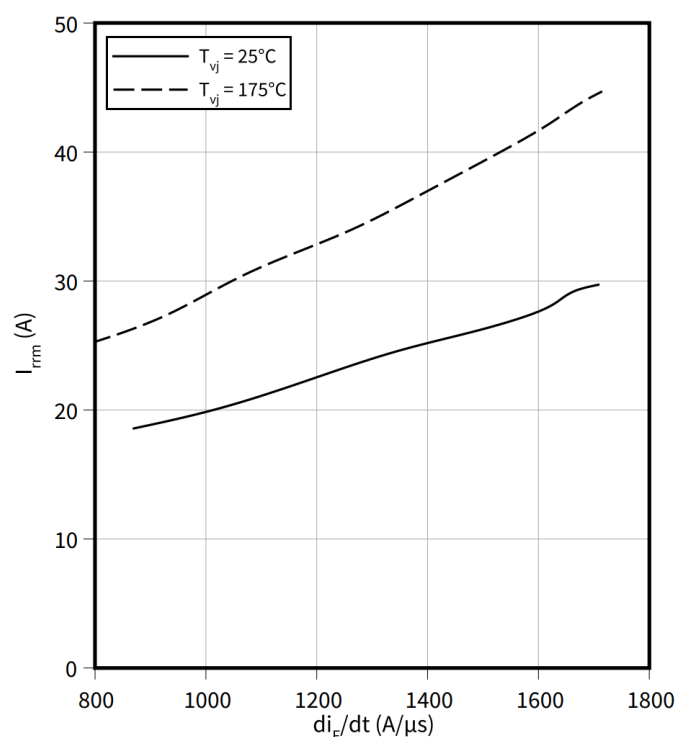
$$t_{rr} = f(di_F/dt)$$

 $V_R = 400 \text{ V}, I_F = 50 \text{ A}$
**Typical reverse recovery charge as a function of diode current slope**

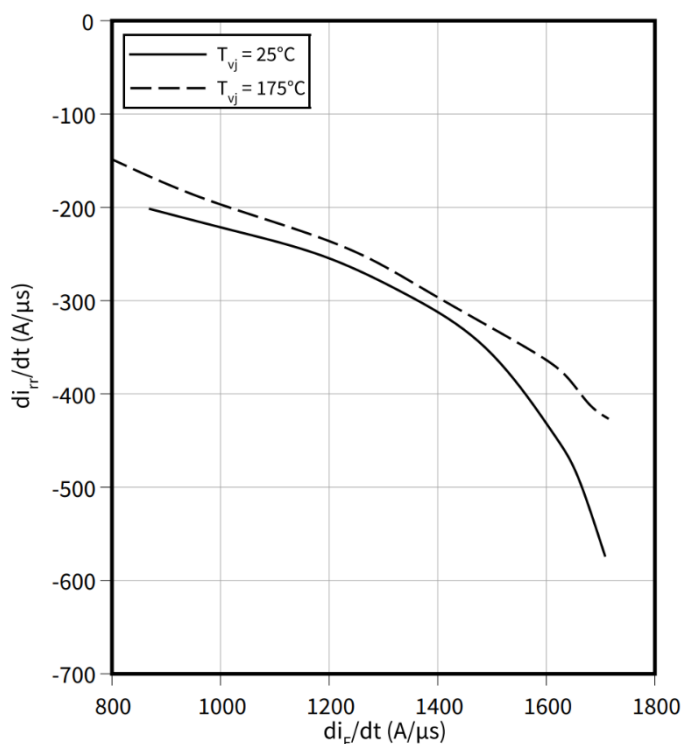
$$Q_{rr} = f(di_F/dt)$$

 $V_R = 400 \text{ V}, I_F = 50 \text{ A}$
**Typical reverse recovery current as a function of diode current slope**

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

 $V_R = 400 \text{ V}, I_F = 50 \text{ A}$
**Typical diode peak rate of fall of reverse recovery current as a function of diode current slope**

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

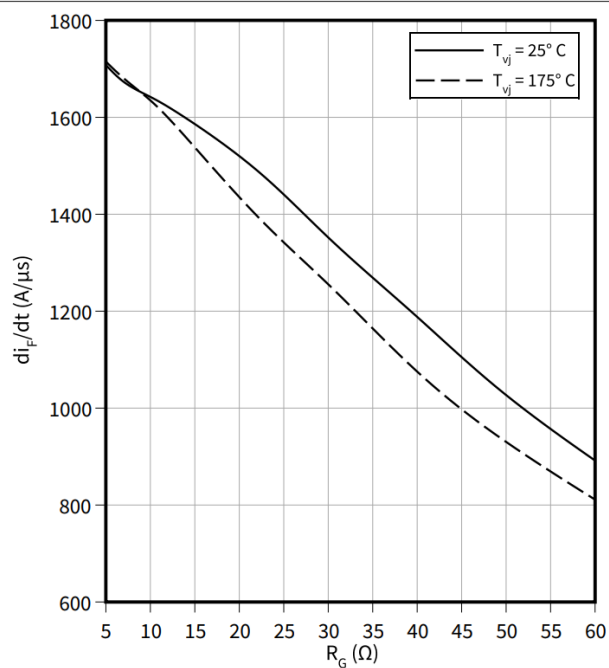
 $= 400 \text{ V}, I_F = 50 \text{ A}$


4 特性图

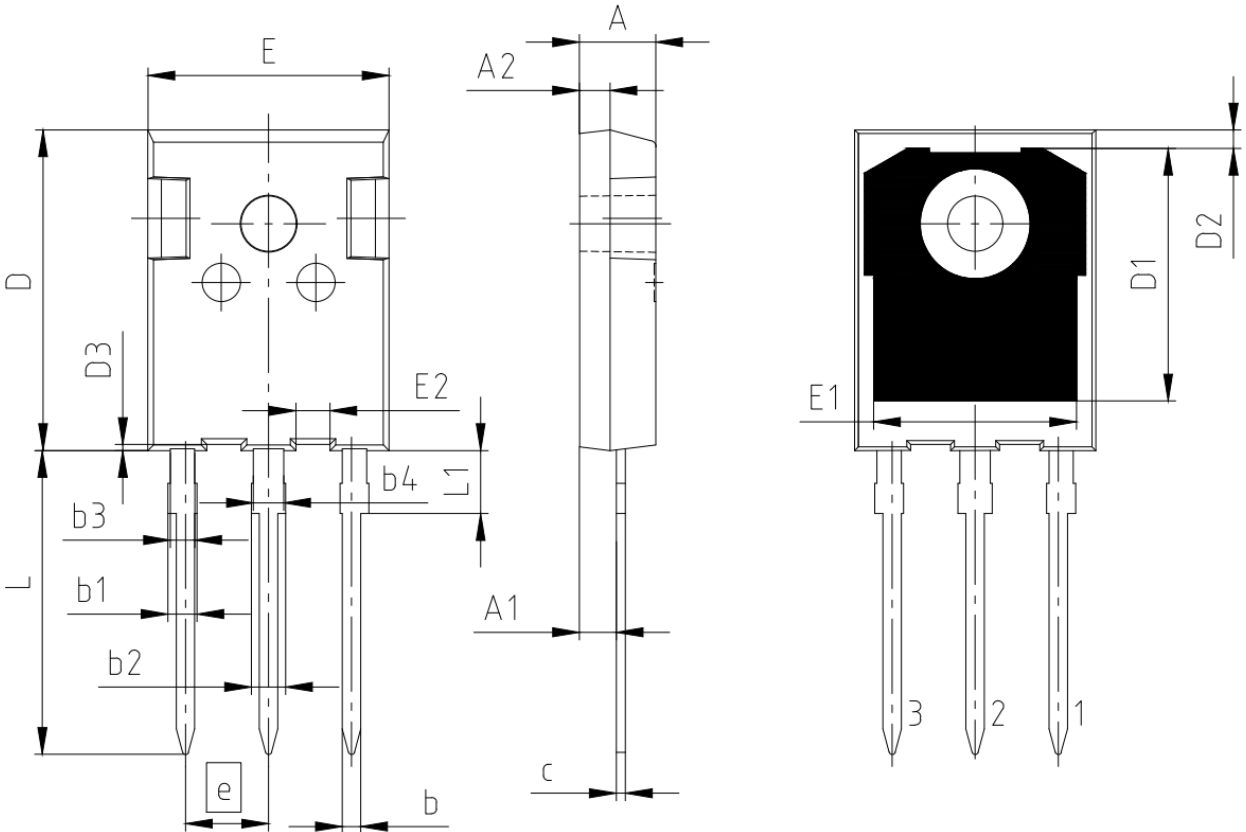
Typical diode current slope as a function of gate resistor

$$di_F/dt = f(R_G)$$

$V_R = 400 \text{ V}$, $I_F = 50 \text{ A}$



5 封装外形



PACKAGE - GROUP NUMBER: PG-TO247-3-U04		
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		1.90
b2		2.30
b3	1.55	1.65
b4	1.96	2.06
c	0.59	0.66
D	20.90	21.10
D1	16.25	16.85
D2	1.05	1.35
D3	0.55	0.65
E	15.70	15.90
E1	13.10	13.50
E2	2.14	2.34
e	5.44	
N	3	
L	19.80	20.10
L1	3.95	4.30

图 1

6 测试条件

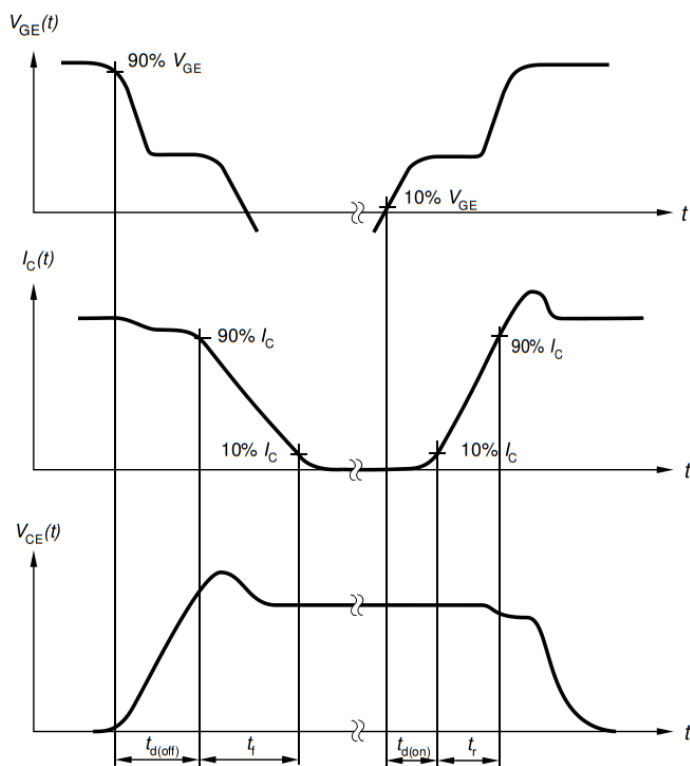


Figure A. Definition of switching times

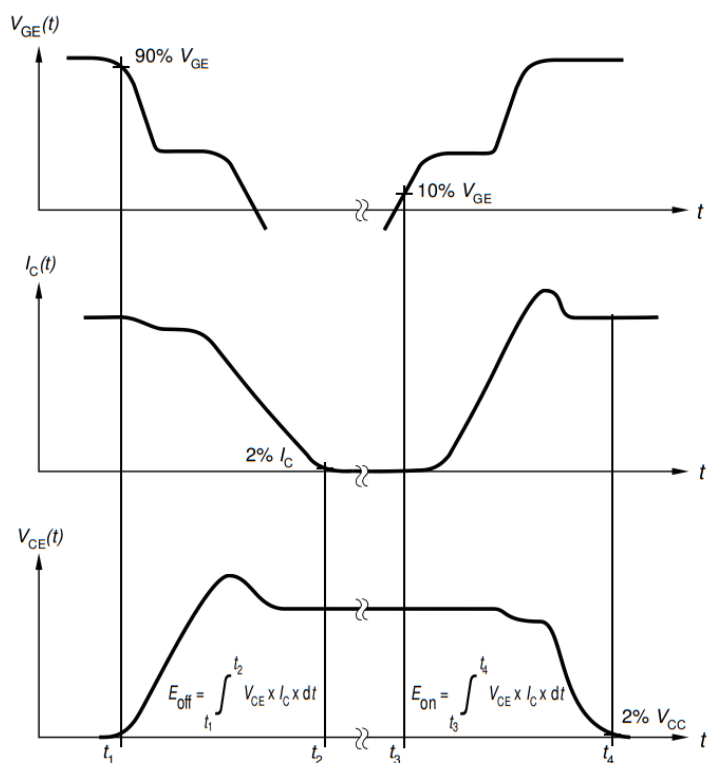


Figure B. Definition of switching losses

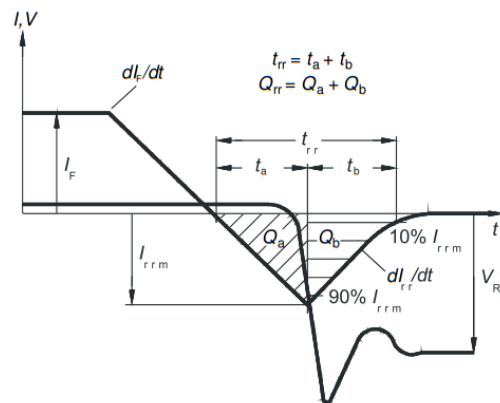


Figure C. Definition of diode switching characteristics

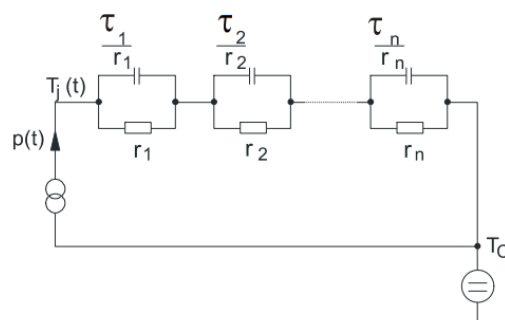


Figure D. Thermal equivalent circuit

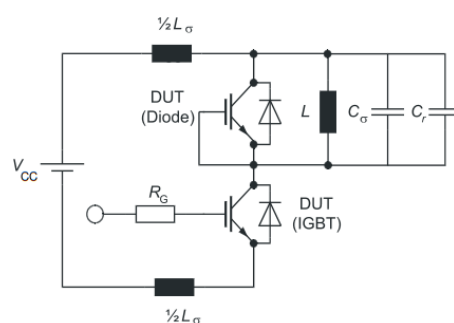


Figure E. **Dynamic test circuit**
 Parasitic inductance L_σ ,
 parasitic capacitor C_σ ,
 relief capacitor C_r ,
 (only for ZVT switching)



修订记录

修订记录

Document revision	Date of release	Description of changes
0.10	2025-03-19	Preliminary datasheet
1.00	2025-07-31	Final datasheet

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