

带单片体二极管的反向导通 IGBT

特性

- $V_{CE} = 1100\text{ V}$
- $I_C = 30\text{ A}$
- 强大的单片体二极管，具有低正向电压，仅适用于软换向
- 参数分布紧密
- 高稳健性、温度稳定性
- 极低 V_{CESat}
- 由于 V_{CESat} 具有正温度系数，因此易于并联
- 低电磁干扰
- 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

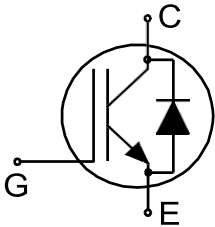
- 电磁炉
- 微波炉
- 电饭煲

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
IHW30N110R5	PG-TO247-3-STD-NN2.5	H30KR5



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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
Diode thermal resistance, junction-case	$R_{th(j-c)}$				0.45	K/W
MOSFET/body diode thermal resistance, junction-case	$R_{th(j-c)}$				0.45	K/W

2 IGBT
 表2 最大额定值

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CE}	$T_{vj} \geq 25\text{ °C}$		1100	V
DC collector current, limited by T_{vjmax}	I_C		$T_c = 25\text{ °C}$	60	A
			$T_c = 100\text{ °C}$	30	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			90	A
Non repetitive peak collector current ¹⁾	I_{CSM}			200	A
Turn-off safe operating area		$V_{CE} \leq 1100\text{ V}, t_p \leq 1\text{ }\mu\text{s}, T_{vj} \leq 175\text{ °C}$		90	A
Gate-emitter voltage	V_{GE}			-20/25	V
Transient gate-emitter voltage	V_{GE}	$t_p \leq 10\text{ }\mu\text{s}, D < 0.01$		30	V
Power dissipation	P_{tot}		$T_c = 25\text{ °C}$	330	W
			$T_c = 100\text{ °C}$	165	

1) 电容器充电饱和电流受 $T_{vjmax} < 175\text{ °C}$ 和 $t_p < 3\text{ }\mu\text{s}$ 限制

表3 特征值

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter breakdown voltage	V_{BRCES}	$I_C = 0.5 \text{ mA}, V_{GE} = 0 \text{ V}$	1100			V
Collector-emitter saturation voltage	V_{CESat}	$I_C = 30 \text{ A}, V_{GE} = 15 \text{ V}$	$T_{vj} = 25^\circ\text{C}$	1.55	1.85	V
			$T_{vj} = 125^\circ\text{C}$	1.8		
			$T_{vj} = 175^\circ\text{C}$	1.9		
Gate-emitter threshold voltage	V_{GETh}	$I_C = 0.75 \text{ mA}, V_{CE} = V_{GE}$	5.1	5.8	6.4	V
Zero gate-voltage collector current	I_{CES}	$V_{CE} = 1100 \text{ V}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25^\circ\text{C}$		100	μA
			$T_{vj} = 175^\circ\text{C}$	630		
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = 20 \text{ V}$			100	nA
Transconductance	g_{fs}	$I_C = 30 \text{ A}, V_{CE} = 20 \text{ V}$		23		S
Input capacitance	C_{ies}	$V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$		1800		pF
Output capacitance	C_{oes}	$V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$		55		pF
Reverse transfer capacitance	C_{res}	$V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$		45		pF
Gate charge	Q_G	$V_{CC} = 880 \text{ V}, I_C = 30 \text{ A}, V_{GE} = 15 \text{ V}$		240		nC
Turn-off delay time	$t_{d(off)}$	$V_{CC} = 600 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 10 \Omega, R_{G(off)} = 10 \Omega, L_\sigma = 175 \text{ nH}, C_\sigma = 40 \text{ pF}$	$T_{vj} = 25^\circ\text{C}, I_C = 30 \text{ A}$	350		ns
			$T_{vj} = 175^\circ\text{C}, I_C = 30 \text{ A}$	400		
Fall time (inductive load)	t_f	$V_{CC} = 600 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 10 \Omega, R_{G(off)} = 10 \Omega, L_\sigma = 175 \text{ nH}, C_\sigma = 40 \text{ pF}$	$T_{vj} = 25^\circ\text{C}, I_C = 30 \text{ A}$	30		ns
			$T_{vj} = 175^\circ\text{C}, I_C = 30 \text{ A}$	120		
Turn-off energy	E_{off}	$V_{CC} = 600 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 10 \Omega, R_{G(off)} = 10 \Omega, L_\sigma = 175 \text{ nH}, C_\sigma = 40 \text{ pF}$	$T_{vj} = 25^\circ\text{C}, I_C = 30 \text{ A}$	1.2		mJ
			$T_{vj} = 175^\circ\text{C}, I_C = 30 \text{ A}$	2.4		
Soft turn-off energy	E_{off}	$V_{GE} = 0/15 \text{ V}, R_{G(on)} = 10 \Omega, R_{G(off)} = 10 \Omega, L_\sigma = 175 \text{ nH}, C_\sigma = 40 \text{ pF}, C_r = 270 \text{ nF}$	$T_{vj} = 25^\circ\text{C}, I_C = 30 \text{ A}$	0.205		mJ
			$T_{vj} = 175^\circ\text{C}, I_C = 30 \text{ A}$	0.49		
Operating junction temperature	T_{vj}		-40		175	$^\circ\text{C}$

注： 电气特性，在 $T_{vj} = 25^\circ\text{C}$ 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
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} \geq 25\text{ °C}$		1100	V
Diode forward current, limited by T_{vjmax}	I_F		$T_c = 25\text{ °C}$	60	A
			$T_c = 100\text{ °C}$	30	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}			90	A

表5 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode forward voltage	V_F	$I_F = 30\text{ A}$	$T_{vj} = 25\text{ °C}$		1.8	2	V
			$T_{vj} = 125\text{ °C}$		2		
			$T_{vj} = 175\text{ °C}$		2.1		
Reverse leakage current	I_R	$V_R = 1100\text{ V}$	$T_{vj} = 25\text{ °C}$			100	μA
			$T_{vj} = 175\text{ °C}$		630		
Operating junction temperature	T_{vj}			-40		175	$^{\circ}\text{C}$

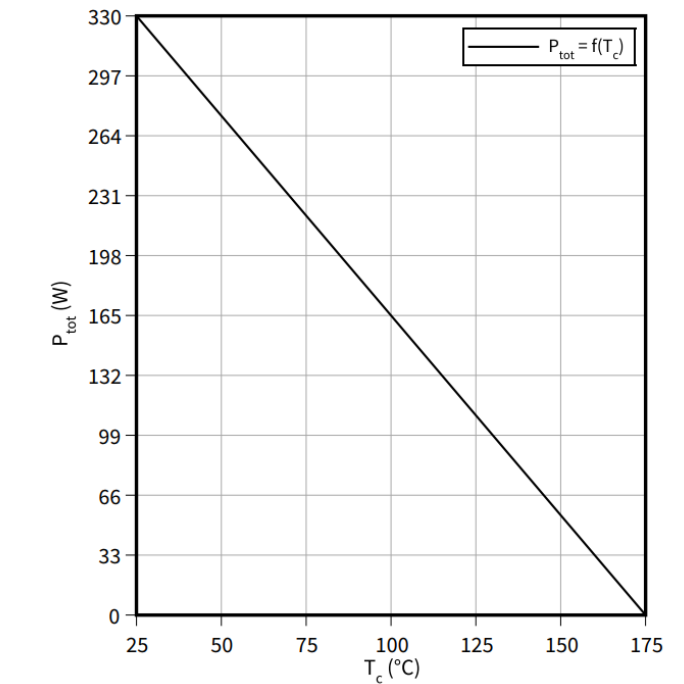
注意：为了获得最佳的使用寿命和可靠性，英飞凌建议运行条件不超过本数据手册中所述最大额定值的80%。

4 特性图

4 特性图

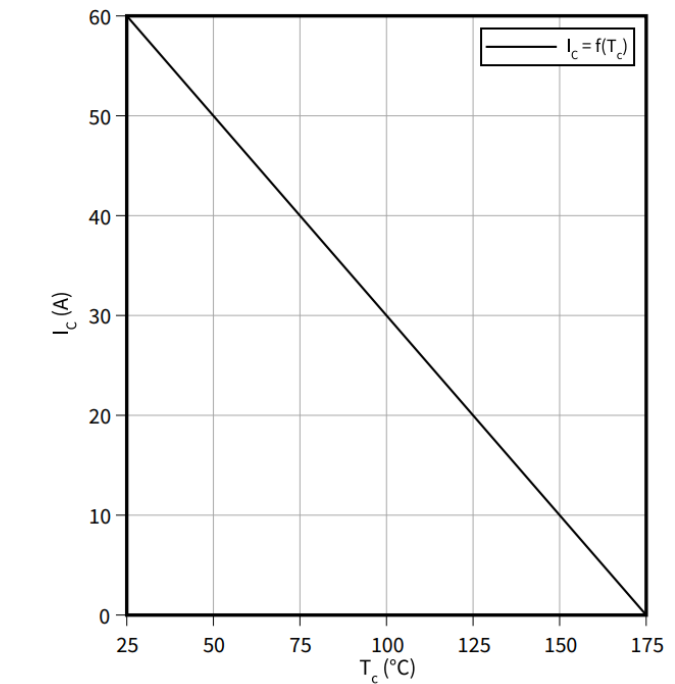
Power dissipation as a function of case temperature

$P_{\text{tot}} = f(T_c)$
 $T_{vj} \leq 175\text{ }^{\circ}\text{C}$



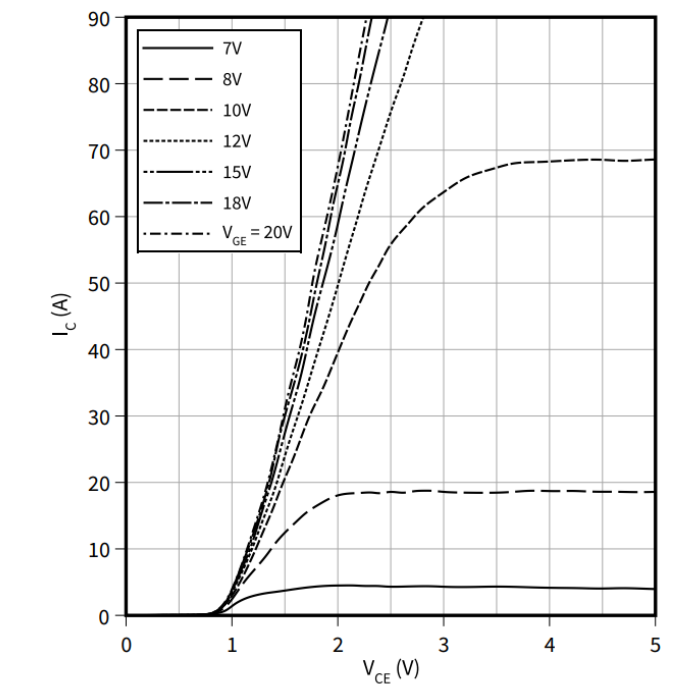
Collector current as a function of case temperature

$I_C = f(T_c)$
 $T_{vj} \leq 175\text{ }^{\circ}\text{C}, V_{GE} \geq 15\text{ V}$



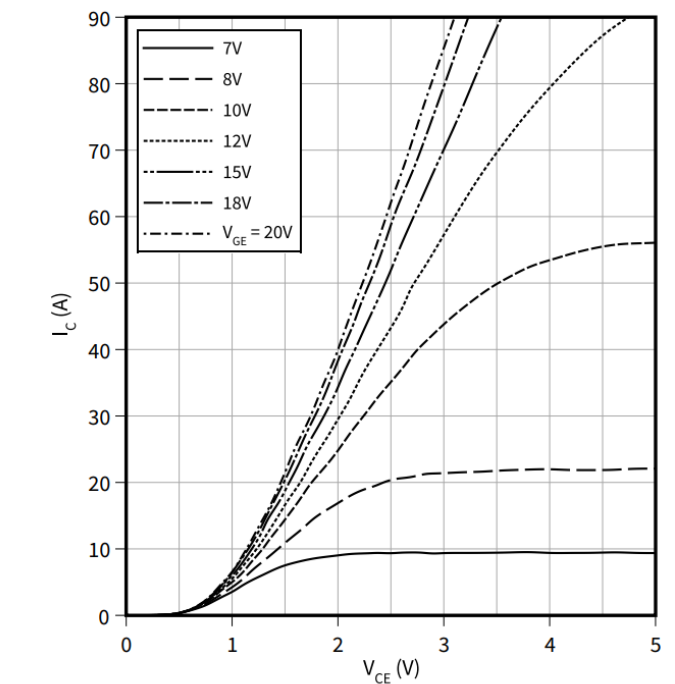
Typical output characteristic

$I_C = f(V_{CE})$
 $T_{vj} = 25\text{ }^{\circ}\text{C}$



Typical output characteristic

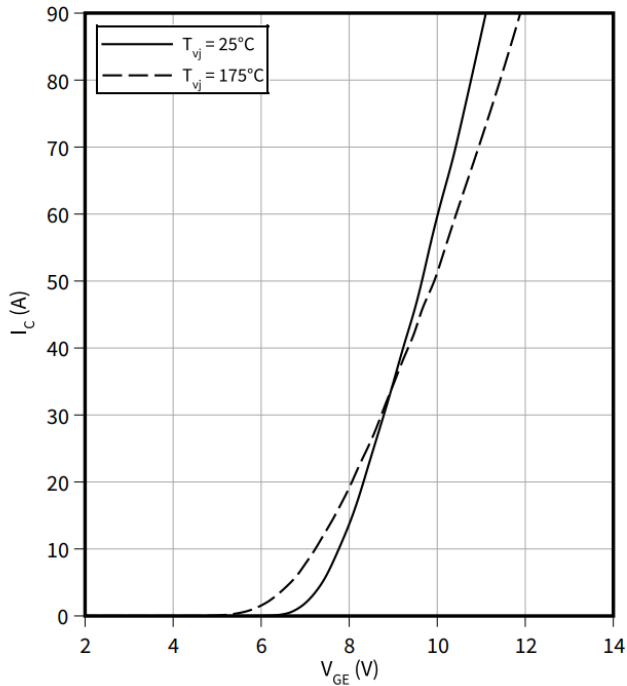
$I_C = f(V_{CE})$
 $T_{vj} = 175\text{ }^{\circ}\text{C}$



4 特性图

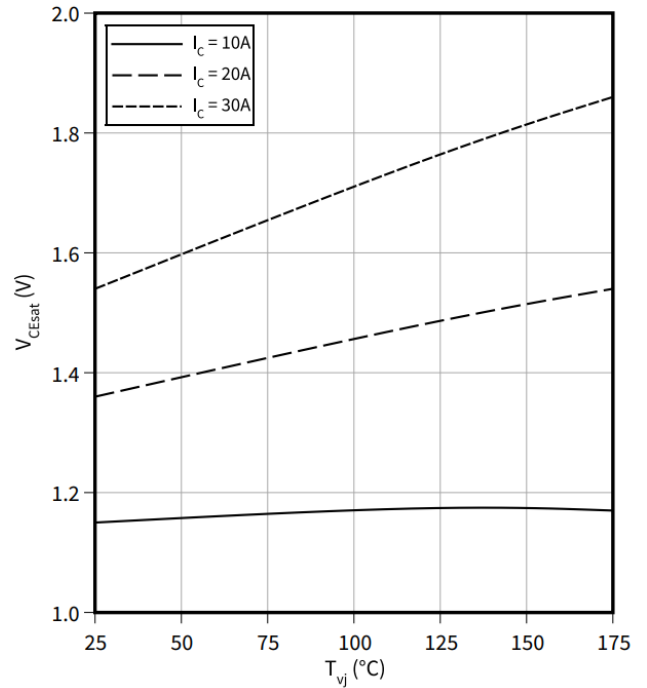
Typical transfer characteristic

$I_C = f(V_{GE})$
 $V_{CE} = 20 \text{ V}$



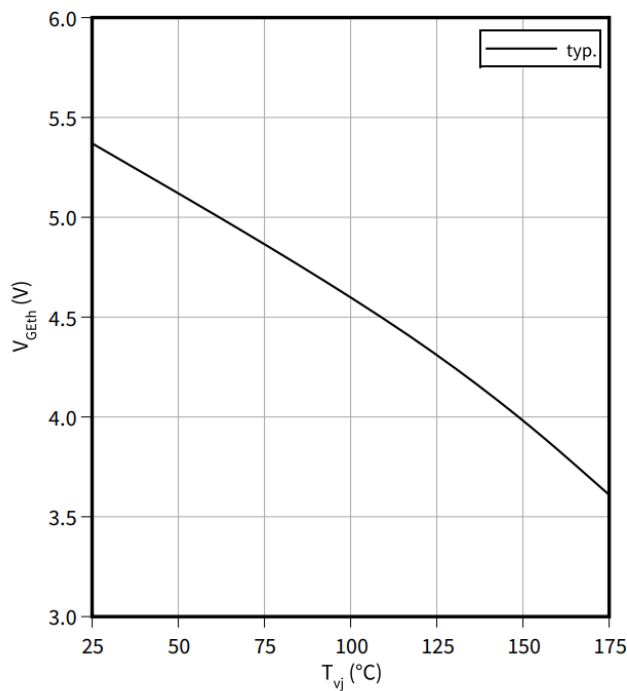
Typical collector-emitter saturation voltage as a function of junction temperature

$V_{CEsat} = f(T_{vj})$
 $V_{GE} = 15 \text{ V}$



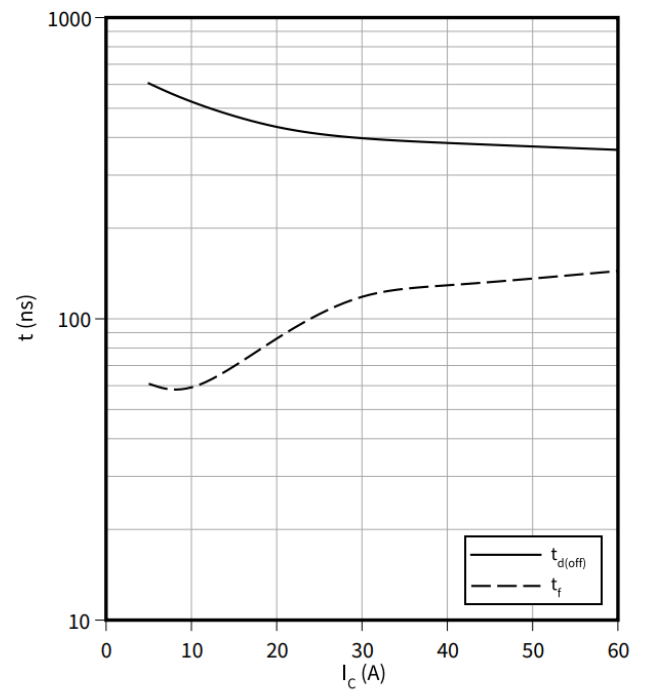
Gate-emitter threshold voltage as a function of junction temperature

$V_{GEth} = f(T_{vj})$
 $I_C = 0.75 \text{ mA}$



Typical switching times as a function of collector current

$t = f(I_C)$
 $V_{CC} = 600 \text{ V}$, $T_{vj} = 175^\circ\text{C}$, $V_{GE} = 0/15 \text{ V}$, $R_G = 10 \Omega$

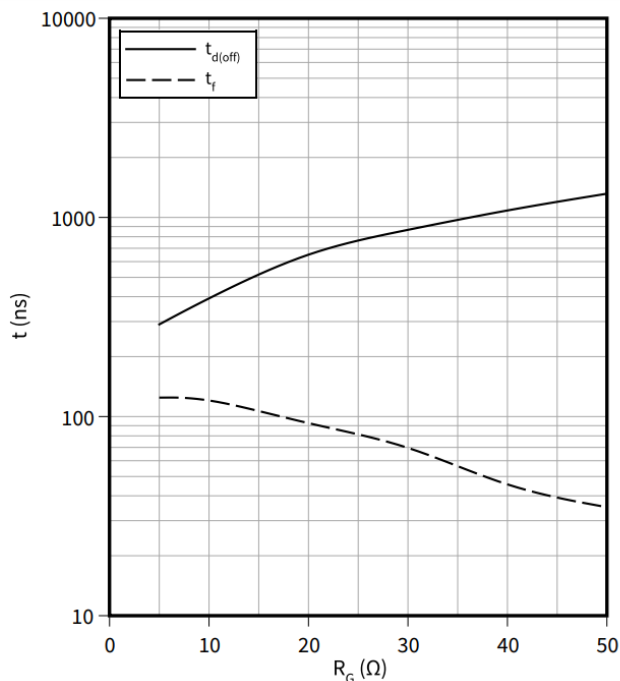


4 特性图

Typical switching times as a function of gate resistor

$$t = f(R_G)$$

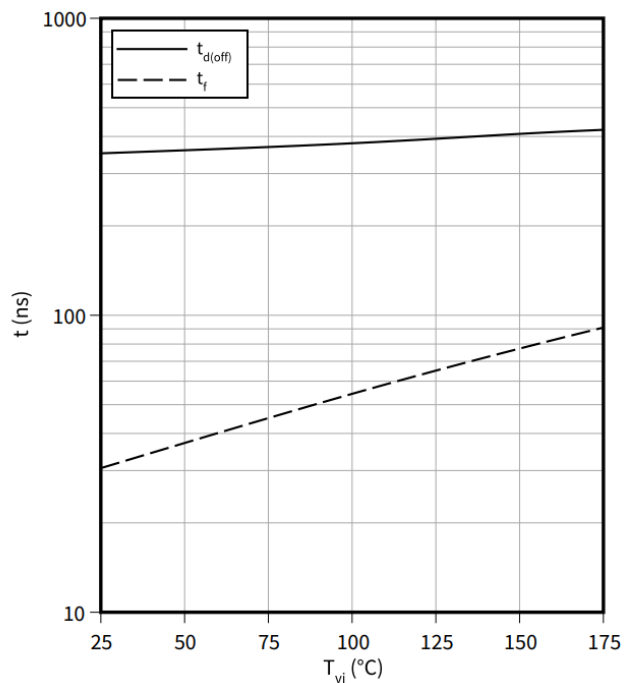
$I_C = 30 \text{ A}$, $V_{CC} = 600 \text{ V}$, $T_{vj} = 175 \text{ }^\circ\text{C}$, $V_{GE} = 0/15 \text{ V}$



Typical switching times as a function of junction temperature

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

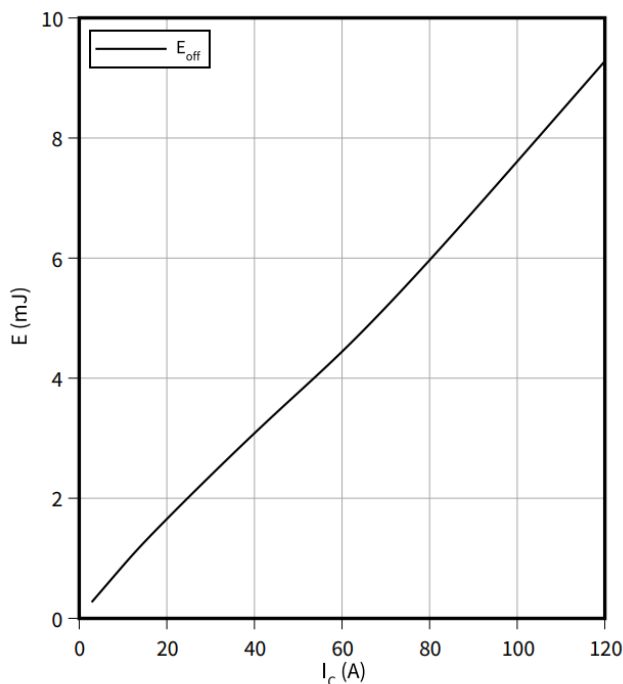
$I_C = 30 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = 0/15 \text{ V}$, $R_G = 10 \text{ }\Omega$



Typical switching energy losses as a function of collector current

$$E = f(I_C)$$

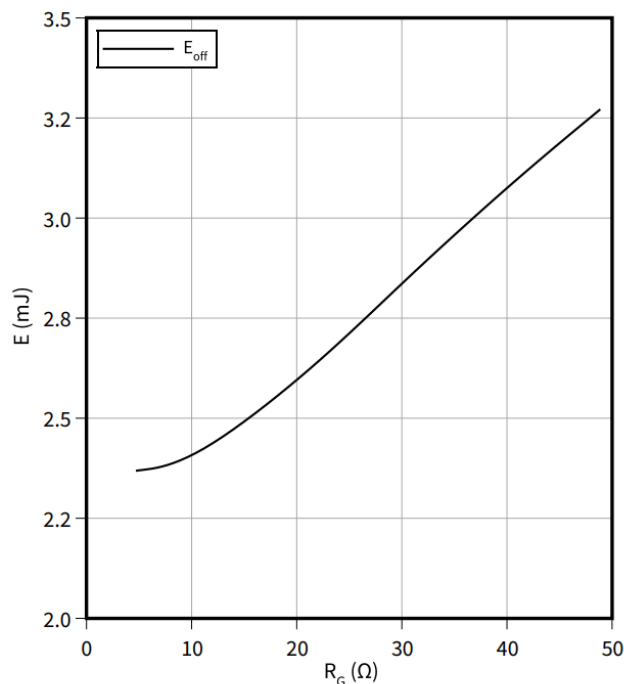
$V_{CC} = 600 \text{ V}$, $T_{vj} = 175 \text{ }^\circ\text{C}$, $V_{GE} = 0/15 \text{ V}$, $R_G = 10 \text{ }\Omega$



Typical switching energy losses as a function of gate resistor

$$E = f(R_G)$$

$I_C = 30 \text{ A}$, $V_{CC} = 600 \text{ V}$, $T_{vj} = 175 \text{ }^\circ\text{C}$, $V_{GE} = 0/15 \text{ V}$

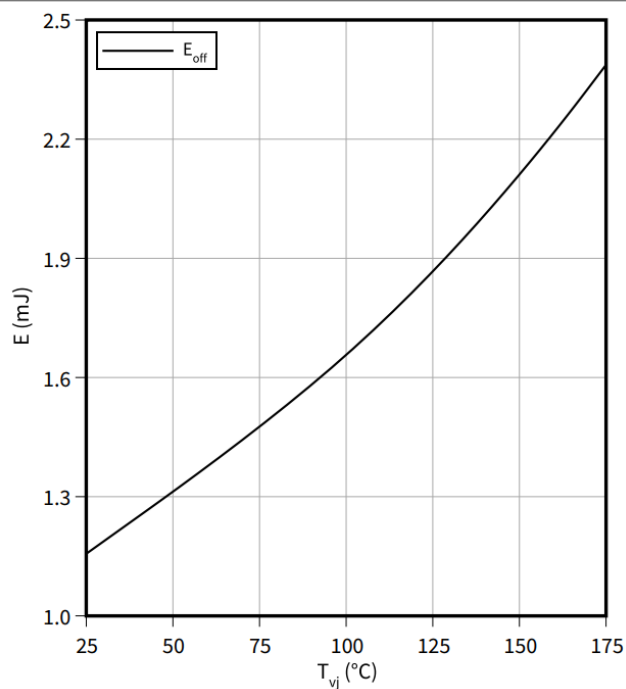


4 特性图

Typical switching energy losses as a function of junction temperature

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

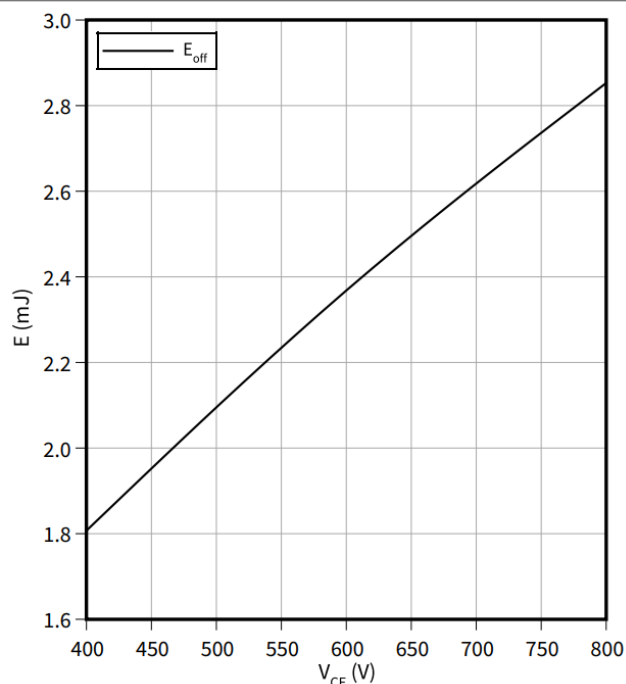
$I_C = 30\text{ A}$, $V_{CC} = 600\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_G = 10\ \Omega$



Typical switching energy losses as a function of collector emitter voltage

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

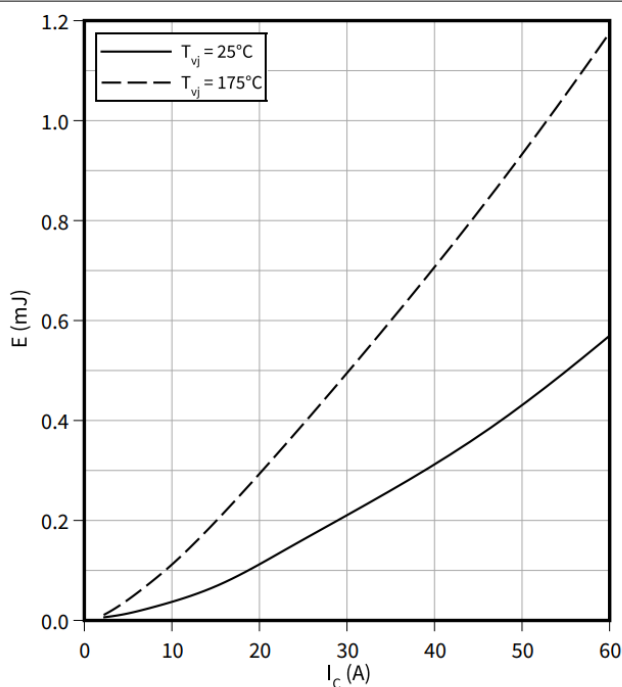
$I_C = 30\text{ A}$, $T_{vj} = 175\text{ °C}$, $V_{GE} = 0/15\text{ V}$, $R_G = 10\ \Omega$



Typical turn off switching energy loss for soft switching

$$E = f(I_C)$$

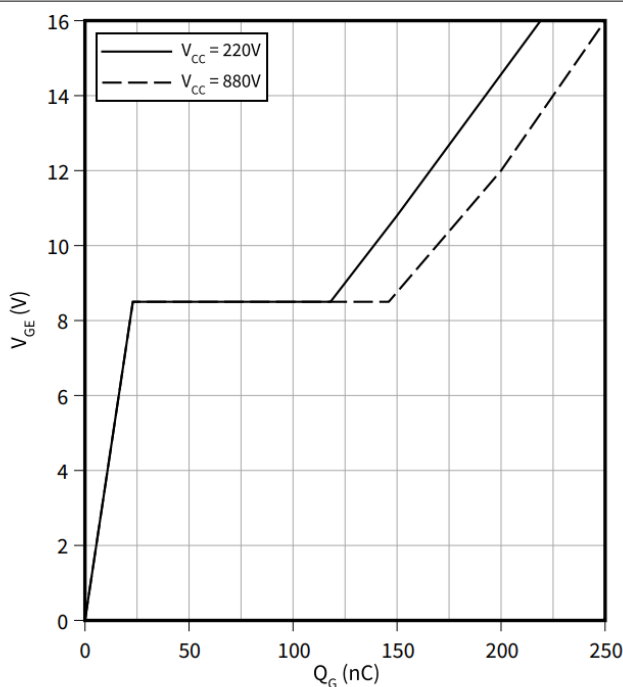
$V_{GE} = 0/15\text{ V}$, $C_r = 270\text{ nF}$, $R_G = 10\ \Omega$



Typical gate charge

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

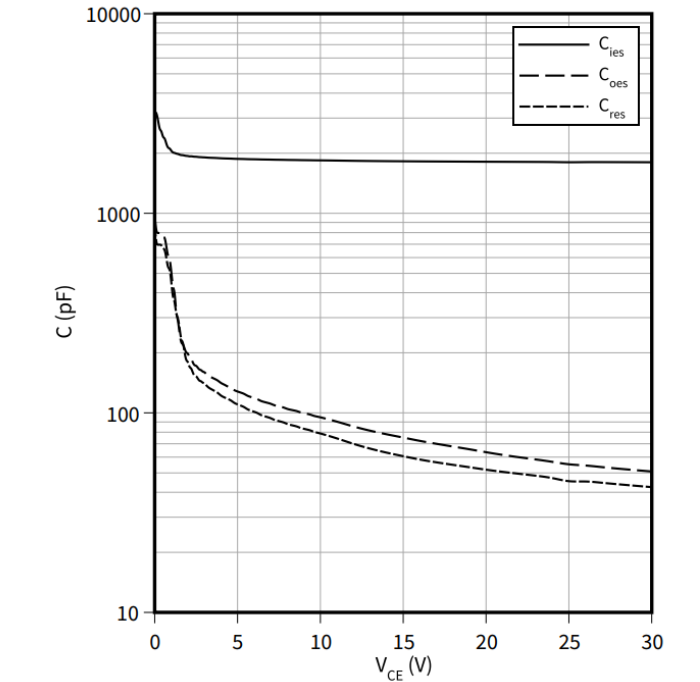
$I_C = 30\text{ A}$



4 特性图

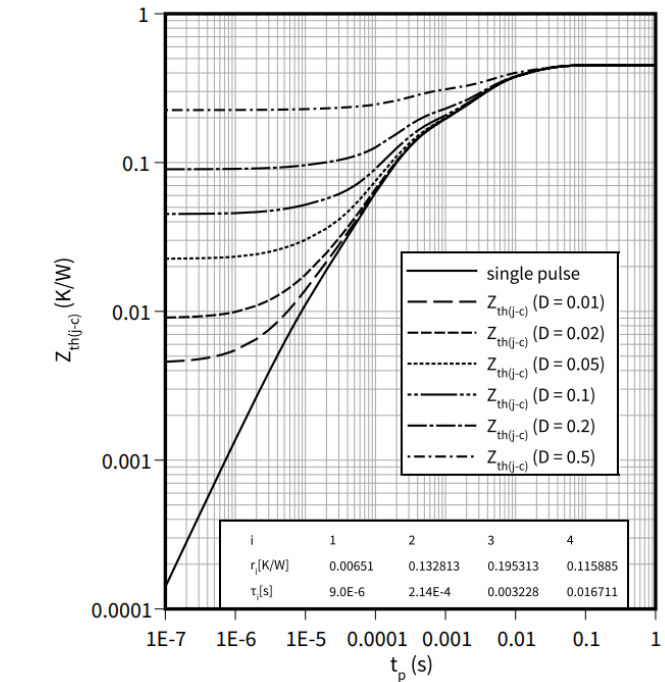
Typical capacitance as a function of collector-emitter voltage

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



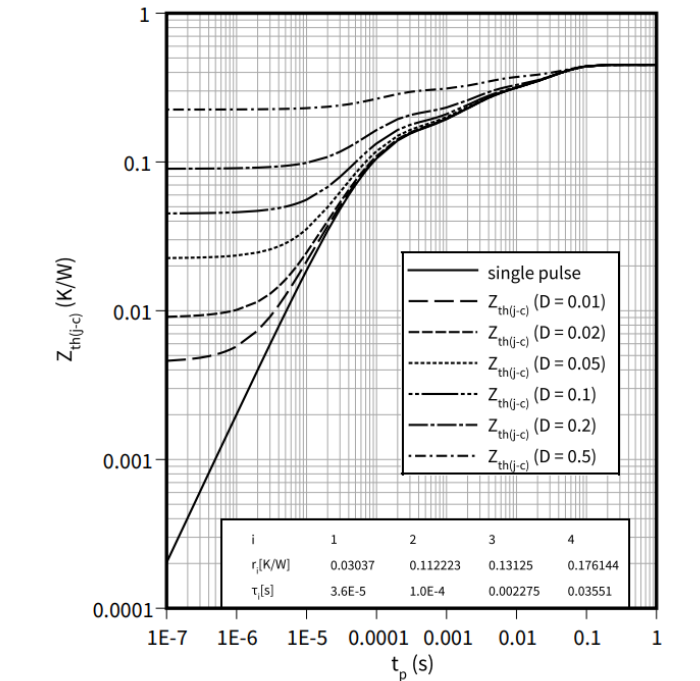
IGBT transient thermal impedance as a function of pulse width

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



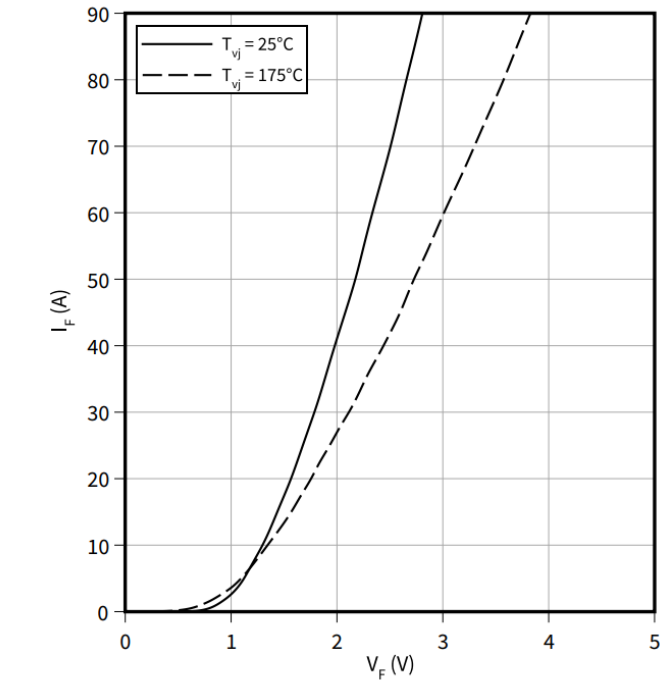
Diode transient thermal impedance as a function of pulse width

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



Typical diode forward current as a function of forward voltage

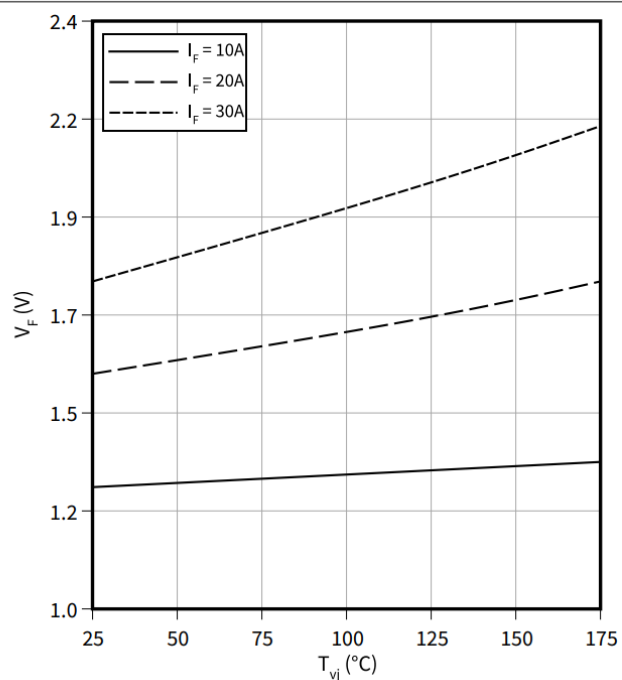
$I_F = f(V_F)$



4 特性图

Typical diode forward voltage as a function of junction temperature

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



5 封装外形

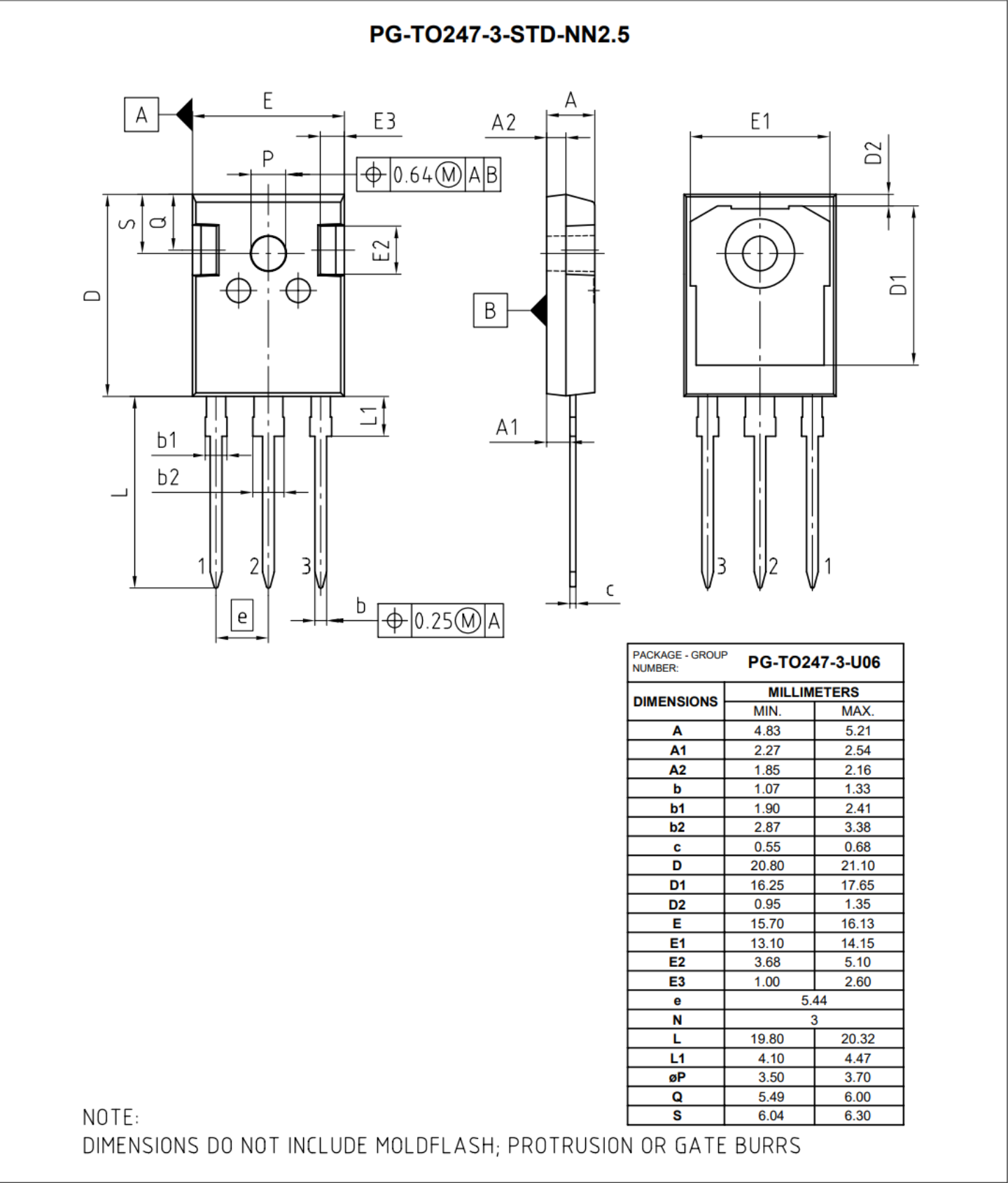


图 1

6 测试条件

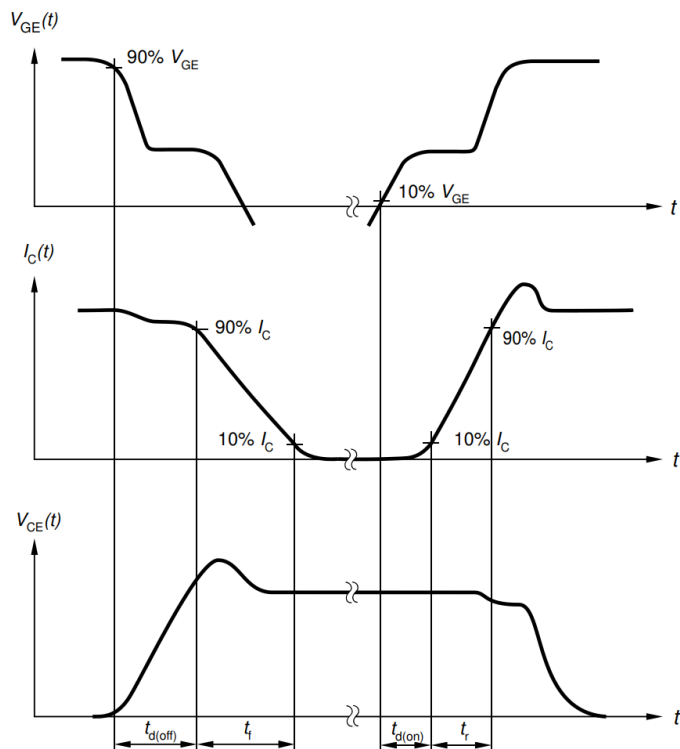


Figure A. Definition of switching times

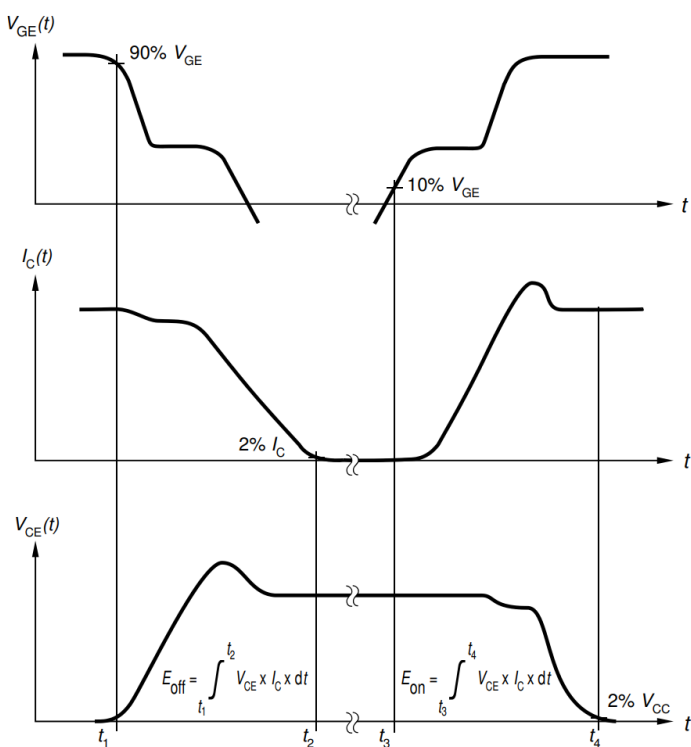


Figure B. Definition of switching losses

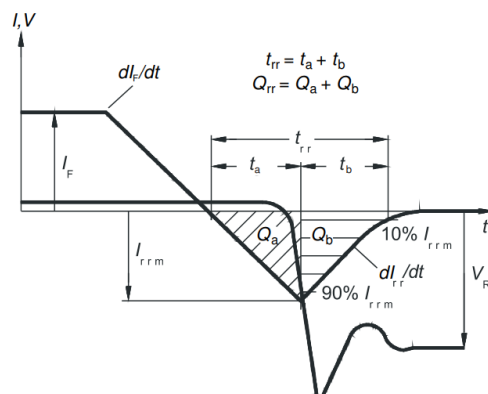


Figure C. Definition of diode switching characteristics

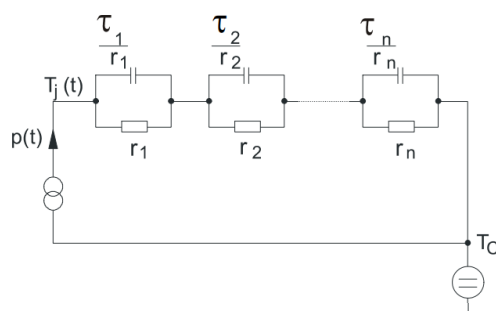


Figure D. Thermal equivalent circuit

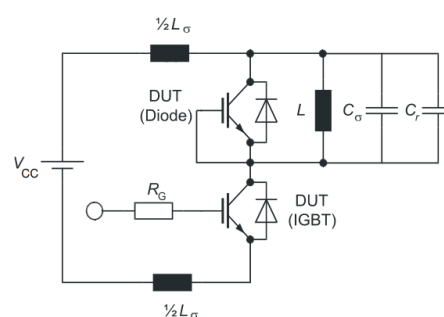


Figure E. Dynamic test circuit
 Parasitic inductance L_σ ,
 parasitic capacitor C_σ ,
 relief capacitor C_r ,
 (only for ZVT switching)

修订记录

Document revision	Date of release	Description of changes
1.00	2022-05-18	Final datasheet
1.10	2023-06-06	Table 3 on page 4 updated Figures on page 9 updated Editorial changes



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