

英飞凌 TRENCHSTOP™ 5 WR6 技术采用增强型爬电距离和电气间隙封装，提高了抗封装污染的可靠性

特性

- $V_{CE} = 650\text{ V}$
- $I_C = 50\text{ A}$
- 引脚间爬电距离 > 4.8 毫米
- 引脚间电气间隙 > 3.4 毫米
- 针对 PFC 和焊接应用进行优化的集成二极管
- 稳定的温度特性
- 极低的 V_{CEsat} 和低的 E_{off}
- 基于 V_{CEsat} 正温度系提升易于并联的能力
- V_{CEsat} 和 E_{sw} 的低温度依赖性
- 完整的产品范围和 PSpice 模型: <http://www.infineon.com/igbt/>



潜在应用

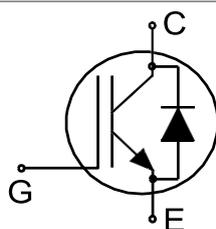
- 功率因数校正
- 焊接
- ZCS应用

产品验证

- 符合 JEDEC47/20/22 相关测试的工业应用要求

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

描述



Type	Package	Marking
IKWH50N65WR6	PG-TO247-3-STD-NN4.8	H50EWR6

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）。

目录

	描述	1
	特性	1
	潜在应用	1
	产品验证	1
	目录	2
1	封装	3
2	IGBT	3
3	二极管	5
4	特征图	7
5	封装外形	14
6	测试条件	15
	修订记录	16
	免责声明	17

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 process: 3			0.6	Nm
Thermal resistance, junction-ambient	$R_{th(j-a)}$				40	K/W
IGBT thermal resistance, junction-case	$R_{th(j-c)}$				0.8	K/W
Diode thermal resistance, junction-case	$R_{th(j-c)}$				3.2	K/W

2 IGBT

表 2 最大额定值

Parameter	Symbol	Note or test condition	Values	Unit
Collector-emitter voltage	V_{CE}	$T_{vj} \geq 25 \text{ °C}$	650	V
DC collector current, limited by T_{vjmax}	I_C	$T_c = 25 \text{ °C}$	85	A
		$T_c = 100 \text{ °C}$	54	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}		150	A
Turn-off safe operating area		$V_{CE} \leq 650 \text{ V}, T_{vj} \leq 175 \text{ °C}$	150	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}	$T_c = 25 \text{ °C}$	205	W
		$T_c = 100 \text{ °C}$	103	

表 3 特征值

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter breakdown voltage	V_{BRCES}	$I_C = 0.2 \text{ mA}, V_{GE} = 0 \text{ V}$	650			V

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表 3 (续) 特征值

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 50\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ °C}$	1.55	1.85	V
			$T_{vj} = 175\text{ °C}$		1.8	
Gate-emitter threshold voltage	V_{GEth}	$I_C = 0.5\text{ mA}, V_{CE} = V_{GE}$	3.2	4	4.8	V
Zero gate-voltage collector current	I_{CES}	$V_{CE} = 650\text{ V}, V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$		40	μA
			$T_{vj} = 175\text{ °C}$		0.5	mA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\text{ V}, V_{GE} = 20\text{ V}$			100	nA
Transconductance	g_{fs}	$I_C = 50\text{ A}, V_{CE} = 20\text{ V}$		100		S
Input capacitance	C_{ies}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$		3510		pF
Output capacitance	C_{oes}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$		34		pF
Reverse transfer capacitance	C_{res}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$		14		pF
Gate charge	Q_G	$I_C = 50\text{ A}, V_{GE} = 15\text{ V}, V_{CC} = 520\text{ V}$		144		nC
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V}, R_{G(on)} = 22\ \Omega, R_{G(off)} = 22\ \Omega, L_\sigma = 30\text{ nH}, C_\sigma = 31\text{ pF}$	$T_{vj} = 25\text{ °C}, I_C = 50\text{ A}$	40		ns
			$T_{vj} = 175\text{ °C}, I_C = 50\text{ A}$		37	
Rise time (inductive load)	t_r	$V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V}, R_{G(on)} = 22\ \Omega, R_{G(off)} = 22\ \Omega, L_\sigma = 30\text{ nH}, C_\sigma = 31\text{ pF}$	$T_{vj} = 25\text{ °C}, I_C = 50\text{ A}$	27		ns
			$T_{vj} = 175\text{ °C}, I_C = 50\text{ A}$		30	
Turn-off delay time	$t_{d(off)}$	$V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V}, R_{G(on)} = 22\ \Omega, R_{G(off)} = 22\ \Omega, L_\sigma = 30\text{ nH}, C_\sigma = 31\text{ pF}$	$T_{vj} = 25\text{ °C}, I_C = 50\text{ A}$	351		ns
			$T_{vj} = 175\text{ °C}, I_C = 50\text{ A}$		394	
Fall time (inductive load)	t_f	$V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V}, R_{G(on)} = 22\ \Omega, R_{G(off)} = 22\ \Omega, L_\sigma = 30\text{ nH}, C_\sigma = 31\text{ pF}$	$T_{vj} = 25\text{ °C}, I_C = 50\text{ A}$	24		ns
			$T_{vj} = 175\text{ °C}, I_C = 50\text{ A}$		18	
Turn-on energy	E_{on}	$V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V}, R_{G(on)} = 22\ \Omega, R_{G(off)} = 22\ \Omega, L_\sigma = 30\text{ nH}, C_\sigma = 31\text{ pF}$	$T_{vj} = 25\text{ °C}, I_C = 50\text{ A}$	1.5		mJ
			$T_{vj} = 175\text{ °C}, I_C = 50\text{ A}$		1.63	

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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}	$V_{\text{CC}} = 400 \text{ V}$, $V_{\text{GE}} = 0/15 \text{ V}$, $R_{\text{G(on)}} = 22 \Omega$, $R_{\text{G(off)}} = 22 \Omega$, $L_{\sigma} = 30 \text{ nH}$, $C_{\sigma} = 31 \text{ pF}$	$T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$, $I_{\text{C}} = 50 \text{ A}$		0.73		mJ
			$T_{\text{vj}} = 175 \text{ }^{\circ}\text{C}$, $I_{\text{C}} = 50 \text{ A}$		1.07		
Total switching energy	E_{ts}	$V_{\text{CC}} = 400 \text{ V}$, $V_{\text{GE}} = 0/15 \text{ V}$, $R_{\text{G(on)}} = 22 \Omega$, $R_{\text{G(off)}} = 22 \Omega$, $L_{\sigma} = 30 \text{ nH}$, $C_{\sigma} = 31 \text{ pF}$	$T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$, $I_{\text{C}} = 50 \text{ A}$		2.23		mJ
			$T_{\text{vj}} = 175 \text{ }^{\circ}\text{C}$, $I_{\text{C}} = 50 \text{ A}$		2.7		
Operating junction temperature	T_{vj}		-40		175	$^{\circ}\text{C}$	

注： 电气特性，在 $T_{\text{vj}} = 25^{\circ}\text{C}$ 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}	$T_{\text{vj}} \geq 25 \text{ }^{\circ}\text{C}$	650	V	
Diode forward current, limited by T_{vjmax}	I_{F}		$T_{\text{C}} = 25 \text{ }^{\circ}\text{C}$	24	A
			$T_{\text{C}} = 100 \text{ }^{\circ}\text{C}$	14	
Diode pulsed current, t_{p} limited by T_{vjmax}	I_{Fpulse}		50	A	

表5 特征值

Parameter	Symbol	Note or test condition	Values			Unit	
			Min.	Typ.	Max.		
Diode forward voltage	V_{F}	$I_{\text{F}} = 12.5 \text{ A}$	$T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$		1.3	1.6	V
			$T_{\text{vj}} = 175 \text{ }^{\circ}\text{C}$		1.3		
Diode reverse recovery time	t_{rr}	$V_{\text{R}} = 400 \text{ V}$	$T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$, $I_{\text{F}} = 25 \text{ A}$, $-di_{\text{F}}/dt = 1500 \text{ A}/\mu\text{s}$		87		ns
			$T_{\text{vj}} = 175 \text{ }^{\circ}\text{C}$, $I_{\text{F}} = 25 \text{ A}$, $-di_{\text{F}}/dt = 1400 \text{ A}/\mu\text{s}$		110		

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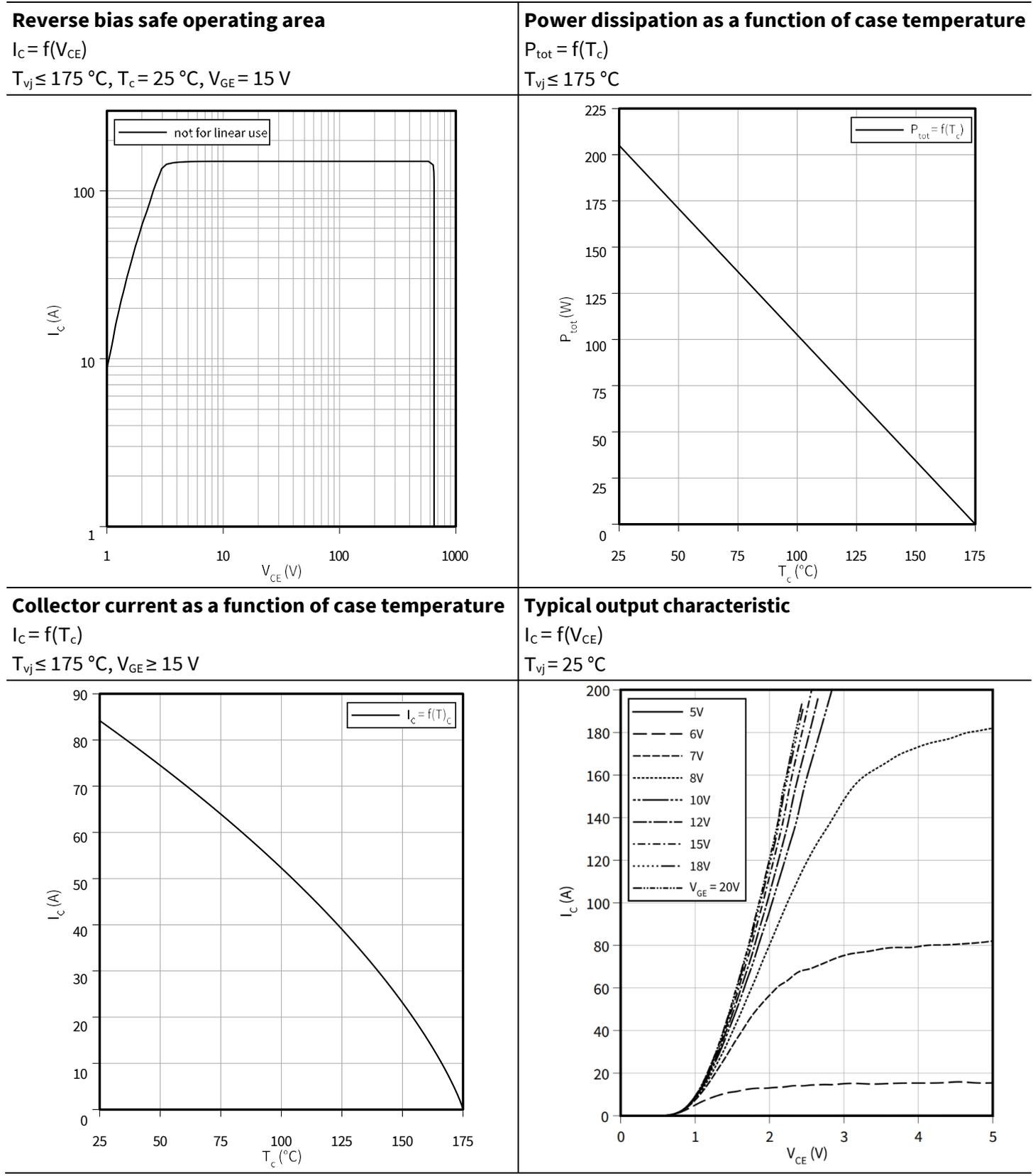
表 5 (续) 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode reverse recovery charge	Q_{rr}	$V_R = 400\text{ V}$	$T_{vj} = 25\text{ °C}$, $I_F = 25\text{ A}$, $-di_F/dt = 1500\text{ A}/\mu\text{s}$		1.7		μC
			$T_{vj} = 175\text{ °C}$, $I_F = 25\text{ A}$, $-di_F/dt = 1400\text{ A}/\mu\text{s}$		3		
Diode peak reverse recovery current	I_{rrm}	$V_R = 400\text{ V}$	$T_{vj} = 25\text{ °C}$, $I_F = 25\text{ A}$, $-di_F/dt = 1500\text{ A}/\mu\text{s}$		28.4		A
			$T_{vj} = 175\text{ °C}$, $I_F = 25\text{ A}$, $-di_F/dt = 1400\text{ A}/\mu\text{s}$		42.2		
Diode peak rate of fall of reverse recovery current	di_{rr}/dt	$V_R = 400\text{ V}$	$T_{vj} = 25\text{ °C}$, $I_F = 25\text{ A}$, $-di_F/dt = 1500\text{ A}/\mu\text{s}$		389		$\text{A}/\mu\text{s}$
			$T_{vj} = 175\text{ °C}$, $I_F = 25\text{ A}$, $-di_F/dt = 1400\text{ A}/\mu\text{s}$		852		
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

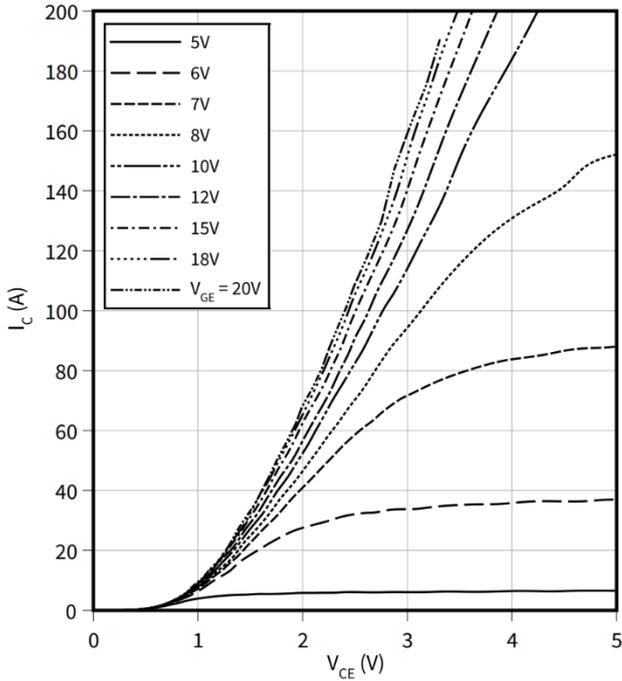


4 特性图

Typical output characteristic

$I_C = f(V_{CE})$

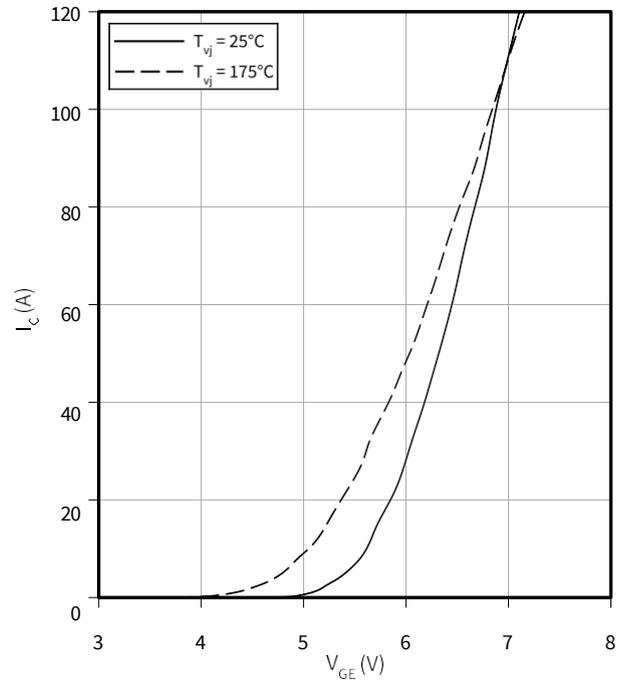
$T_{vj} = 175\text{ }^\circ\text{C}$



Typical transfer characteristic

$I_C = f(V_{GE})$

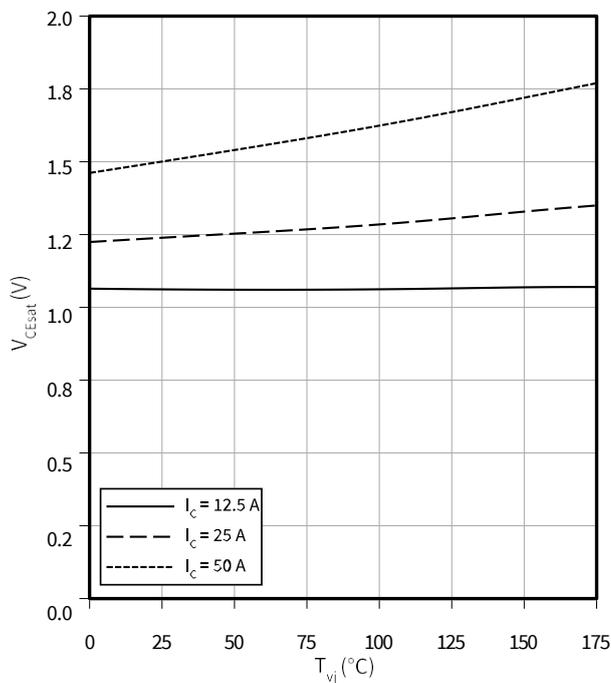
$V_{CE} = 20\text{ V}$



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

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

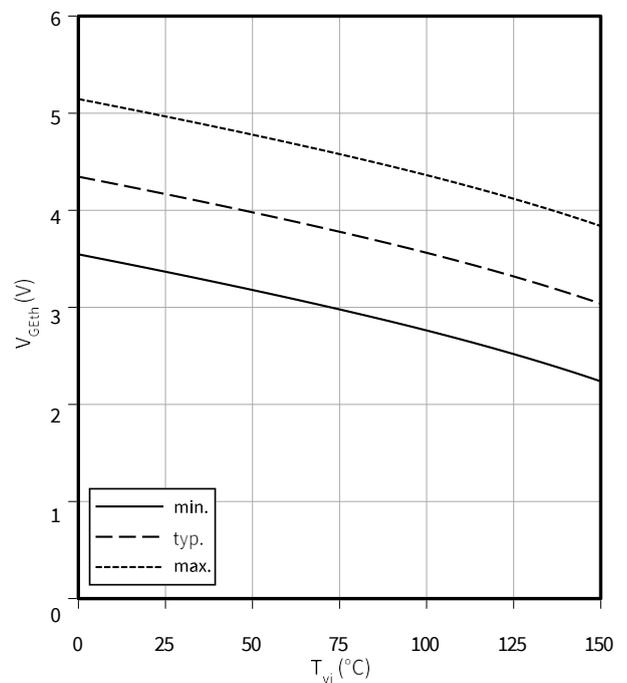
$V_{GE} = 15\text{ V}$



Gate-emitter threshold voltage as a function of junction temperature

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

$I_C = 0.5\text{ mA}$

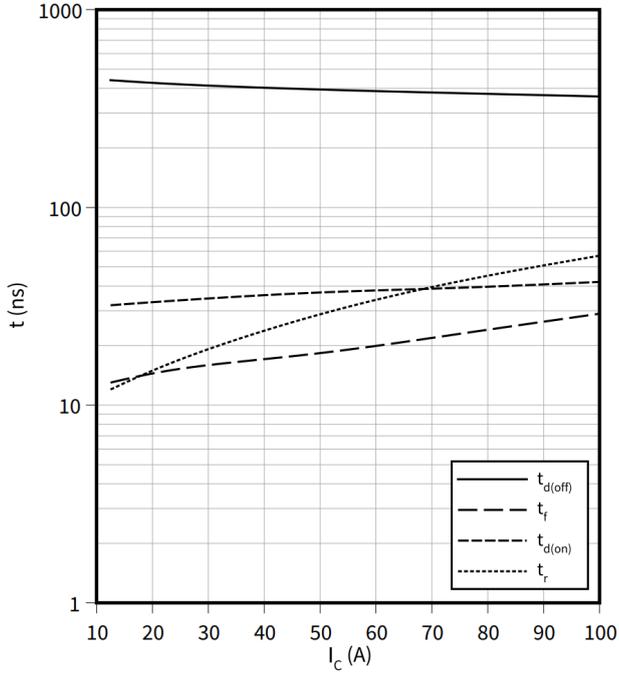


4 特性图

Typical switching times as a function of collector current

$t = f(I_C)$

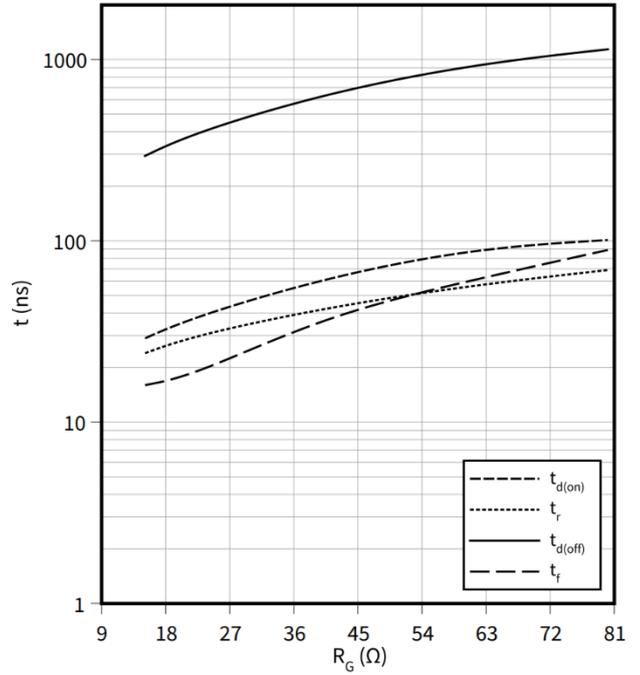
$V_{CC} = 400\text{ V}$, $T_{vj} = 175\text{ }^\circ\text{C}$, $V_{GE} = 0/15\text{ V}$, $R_G = 22\ \Omega$



Typical switching times as a function of gate resistor

$t = f(R_G)$

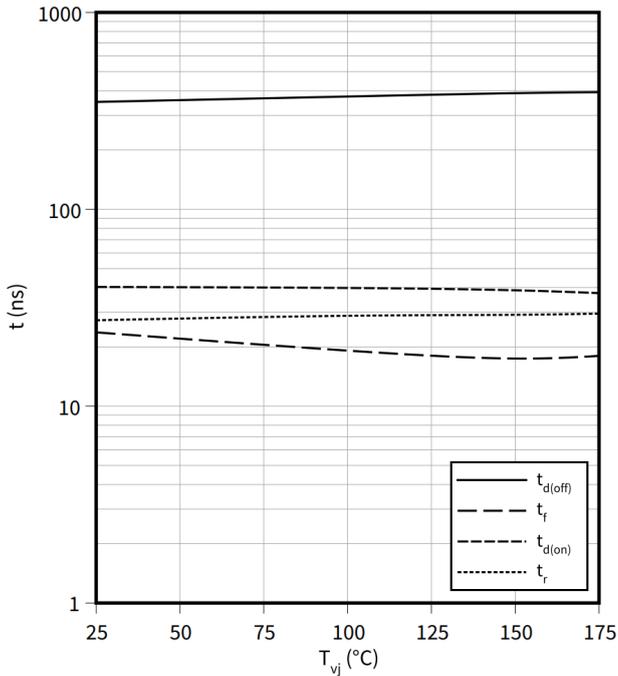
$I_C = 50\text{ A}$, $V_{CC} = 400\text{ V}$, $T_{vj} = 175\text{ }^\circ\text{C}$, $V_{GE} = 0/15\text{ V}$



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

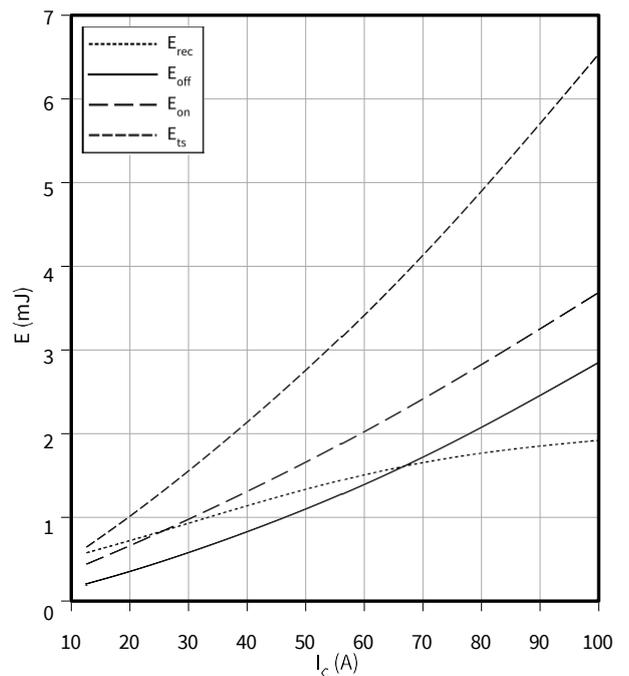
$I_C = 50\text{ A}$, $V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_G = 22\ \Omega$



Typical switching energy losses as a function of collector current

$E = f(I_C)$

$V_{CC} = 400\text{ V}$, $T_{vj} = 175\text{ }^\circ\text{C}$, $V_{GE} = 0/15\text{ V}$, $R_G = 22\ \Omega$

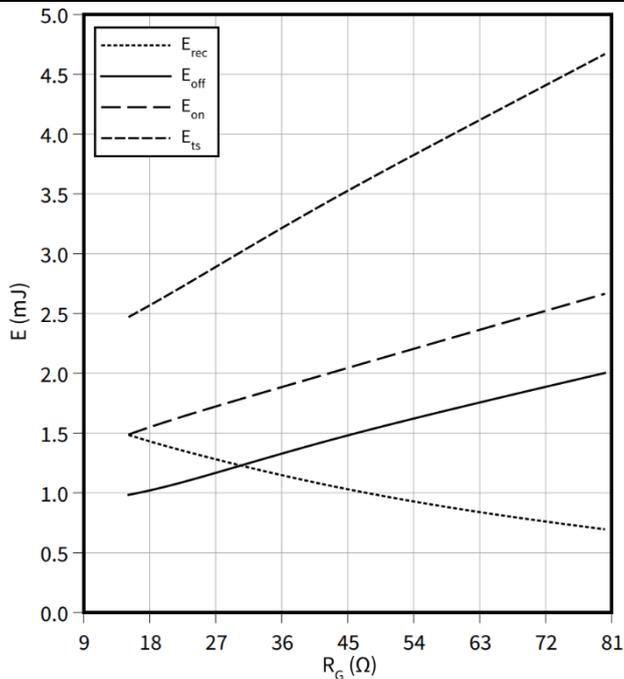


4 特性图

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

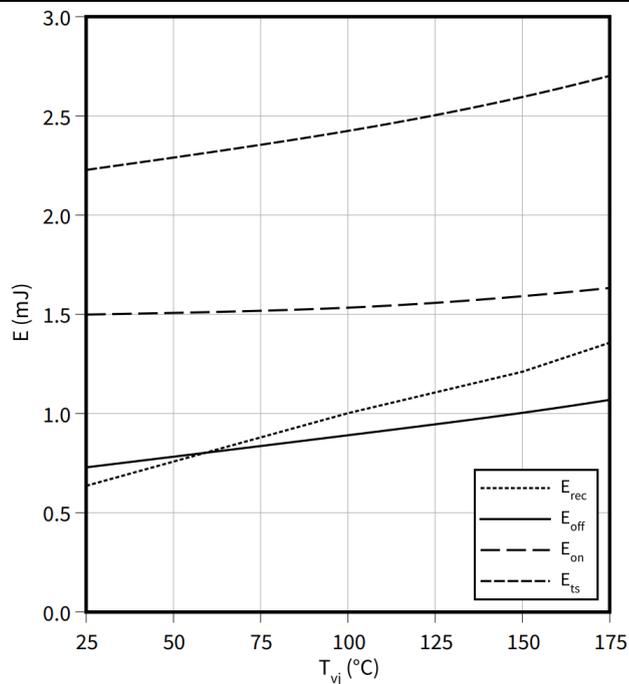
$I_C = 50\text{ A}$, $V_{CC} = 400\text{ V}$, $T_{vj} = 175\text{ }^\circ\text{C}$, $V_{GE} = 0/15\text{ V}$



Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

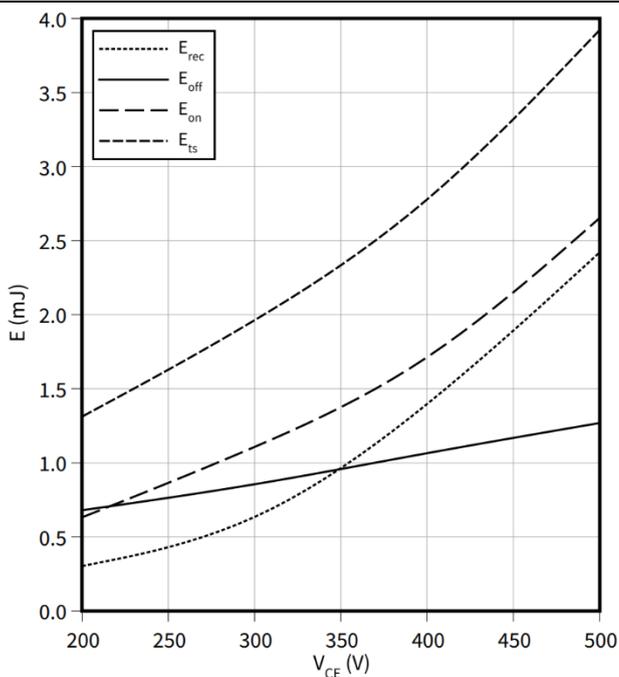
$I_C = 50\text{ A}$, $V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_G = 22\text{ } \Omega$



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

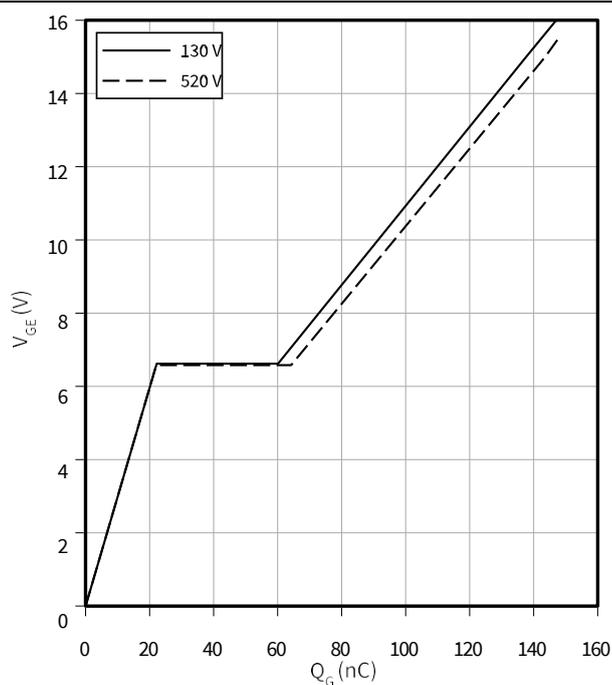
$I_C = 50\text{ A}$, $T_{vj} = 175\text{ }^\circ\text{C}$, $V_{GE} = 0/15\text{ V}$, $R_G = 22\text{ } \Omega$



Typical gate charge

$V_{GE} = f(Q_G)$

$I_C = 50\text{ A}$

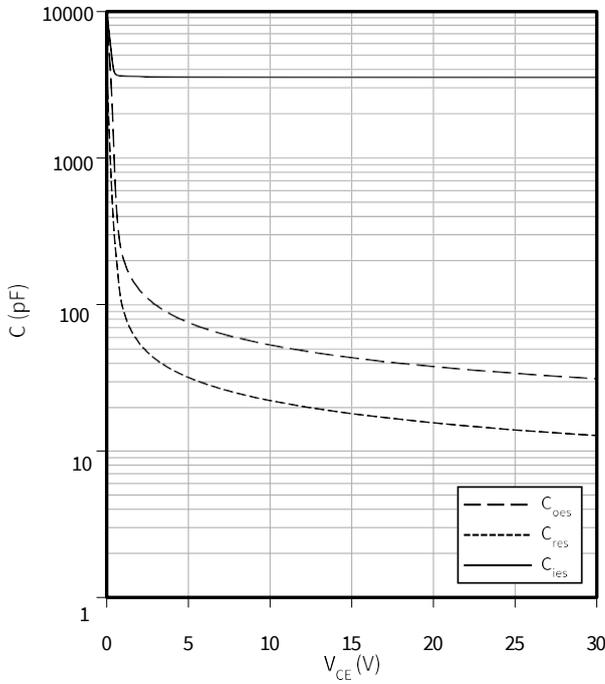


4 特性图

Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

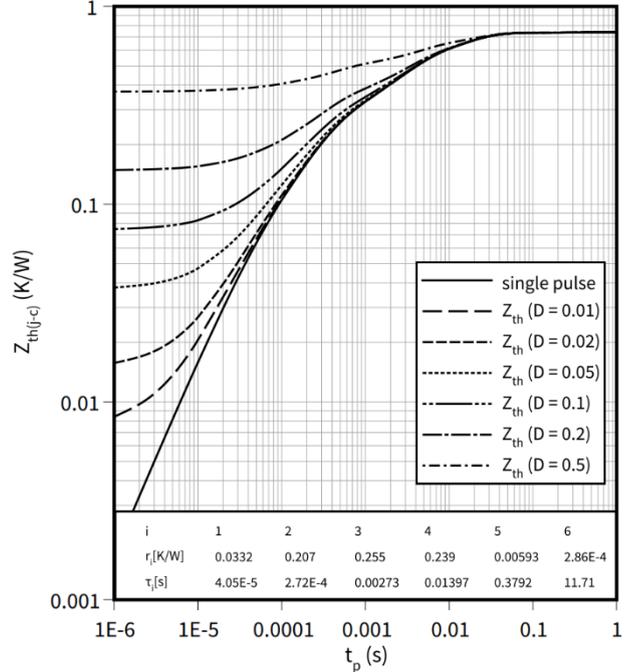
$f = 100 \text{ kHz}, V_{GE} = 0 \text{ V}$



IGBT transient thermal impedance as a function of pulse width

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

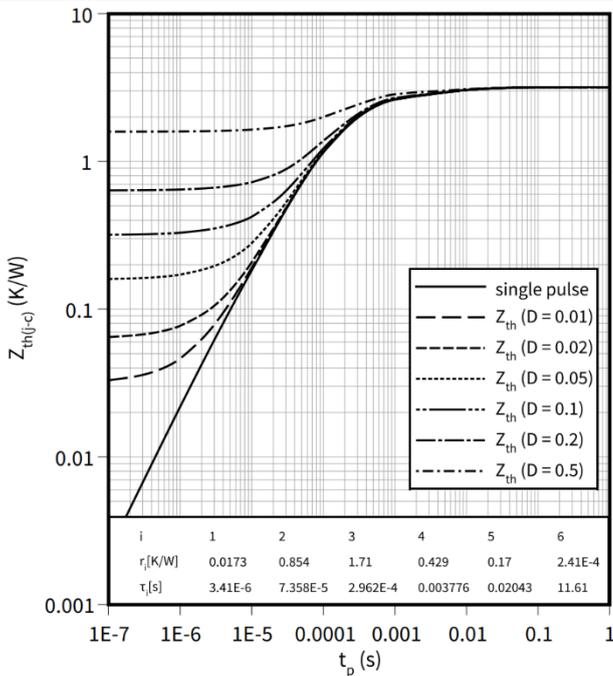
$D = t_p/T$



Diode transient thermal impedance as a function of pulse width

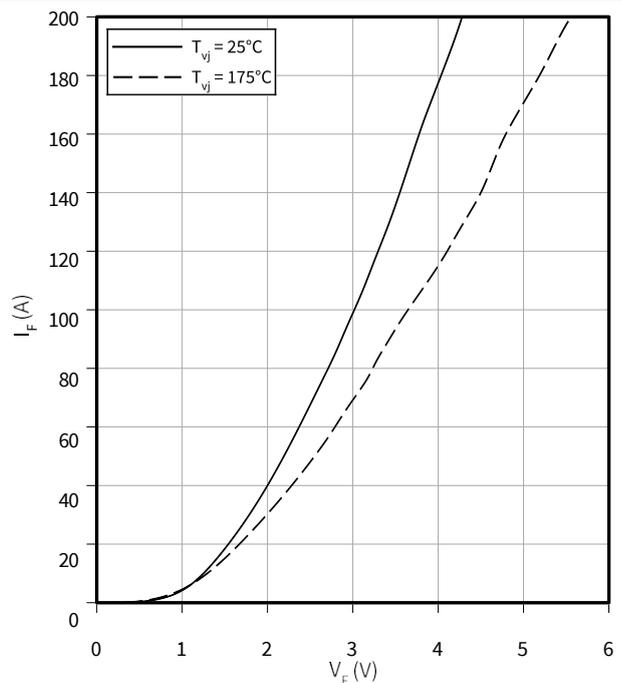
$Z_{th(j-c)} = f(t_p)$

$D = t_p/T$



Typical diode forward current as a function of forward voltage

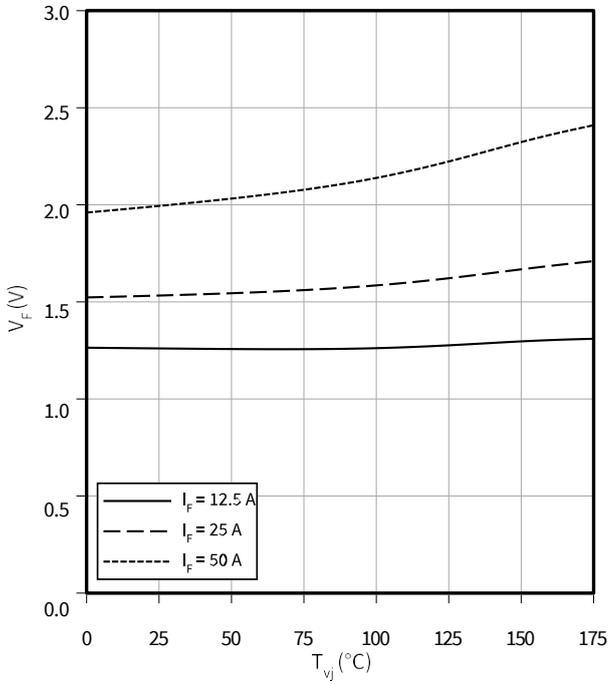
$I_F = f(V_F)$



4 特性图

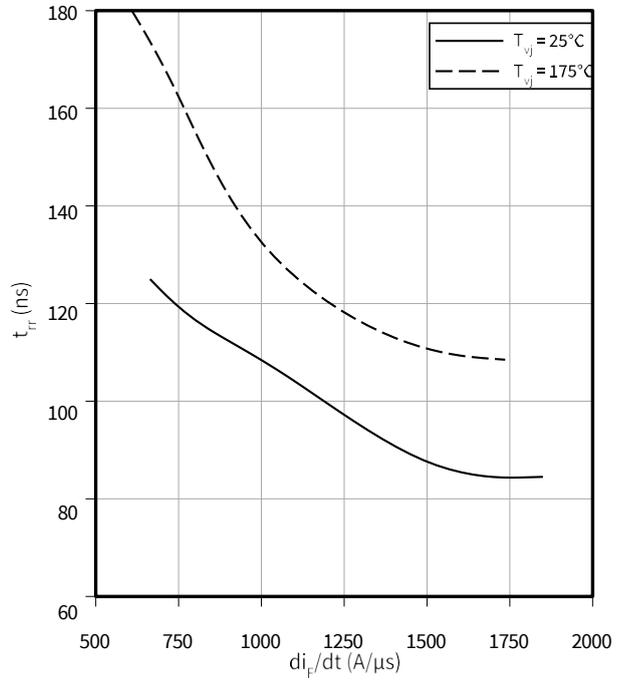
Typical diode forward voltage as a function of junction temperature

$V_F = f(T_{vj})$



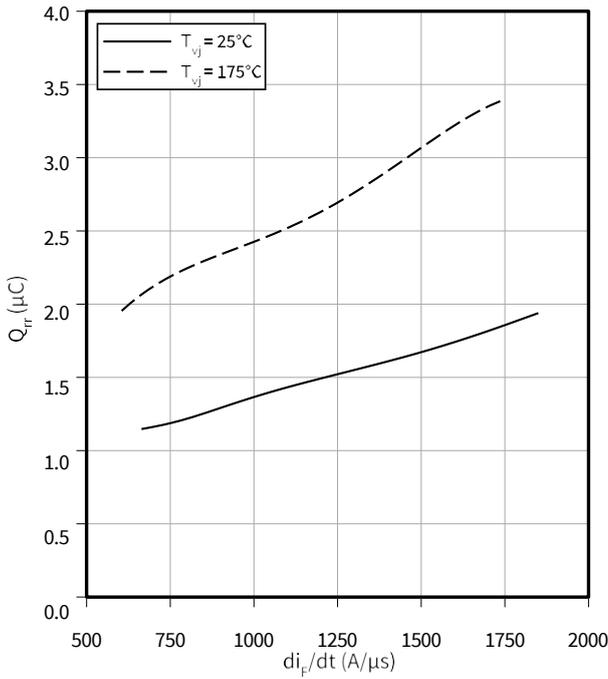
Typical reverse recovery time as a function of diode current slope

$t_{rr} = f(di_F/dt)$
 $V_R = 400$ V, $I_F = 25$ A



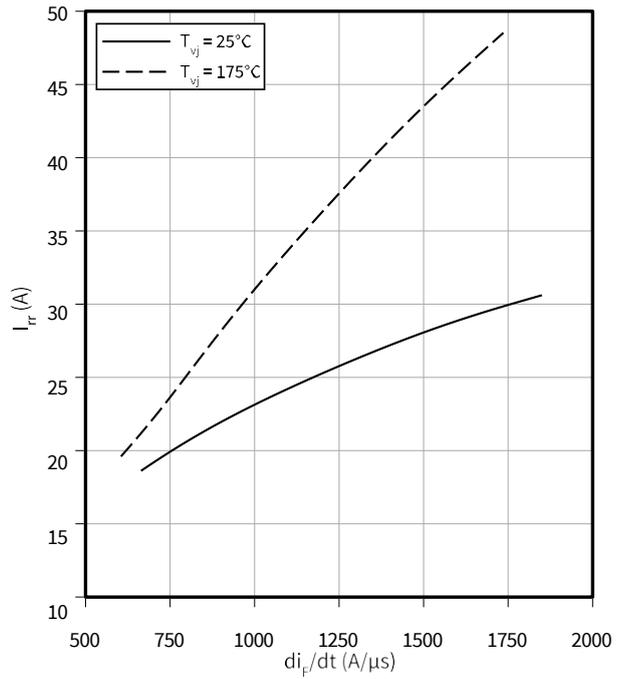
Typical reverse recovery charge as a function of diode current slope

$Q_{rr} = f(di_F/dt)$
 $V_R = 400$ V, $I_F = 25$ A



Typical reverse recovery current as a function of diode current slope

$I_{rrm} = f(di_F/dt)$
 $V_R = 400$ V, $I_F = 25$ A

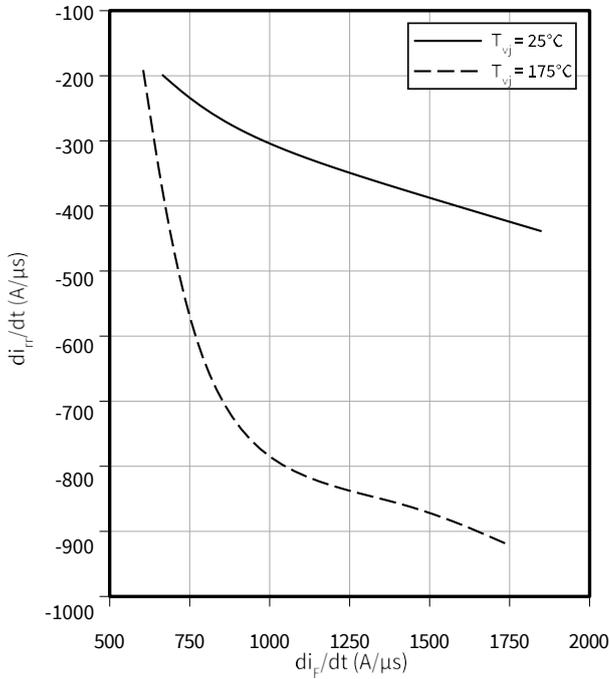


4 特性图

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

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

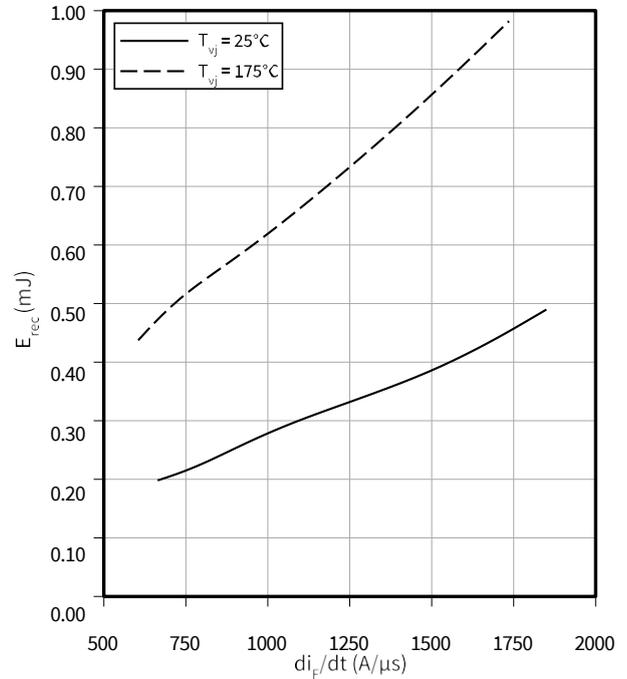
$V_R = 400\text{ V}, I_F = 25\text{ A}$



Typical reverse energy losses as a function of diode current slope

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

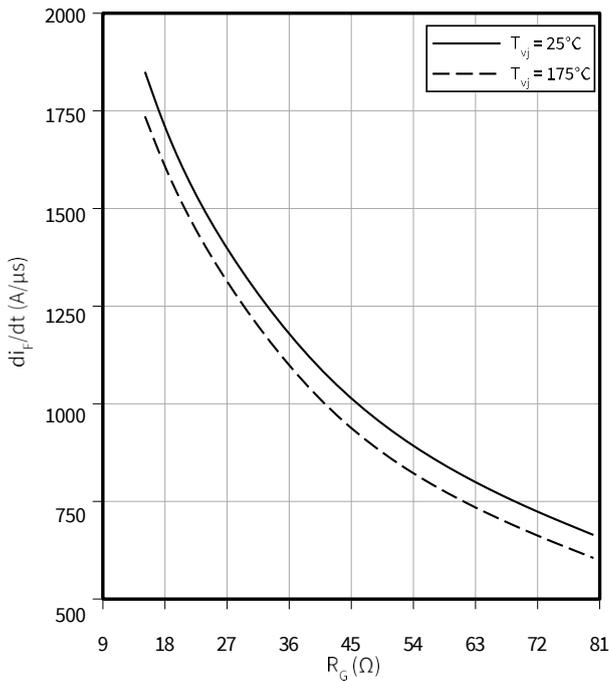
$V_R = 400\text{ V}, I_F = 25\text{ A}$



Typical diode current slope as a function of gate resistor

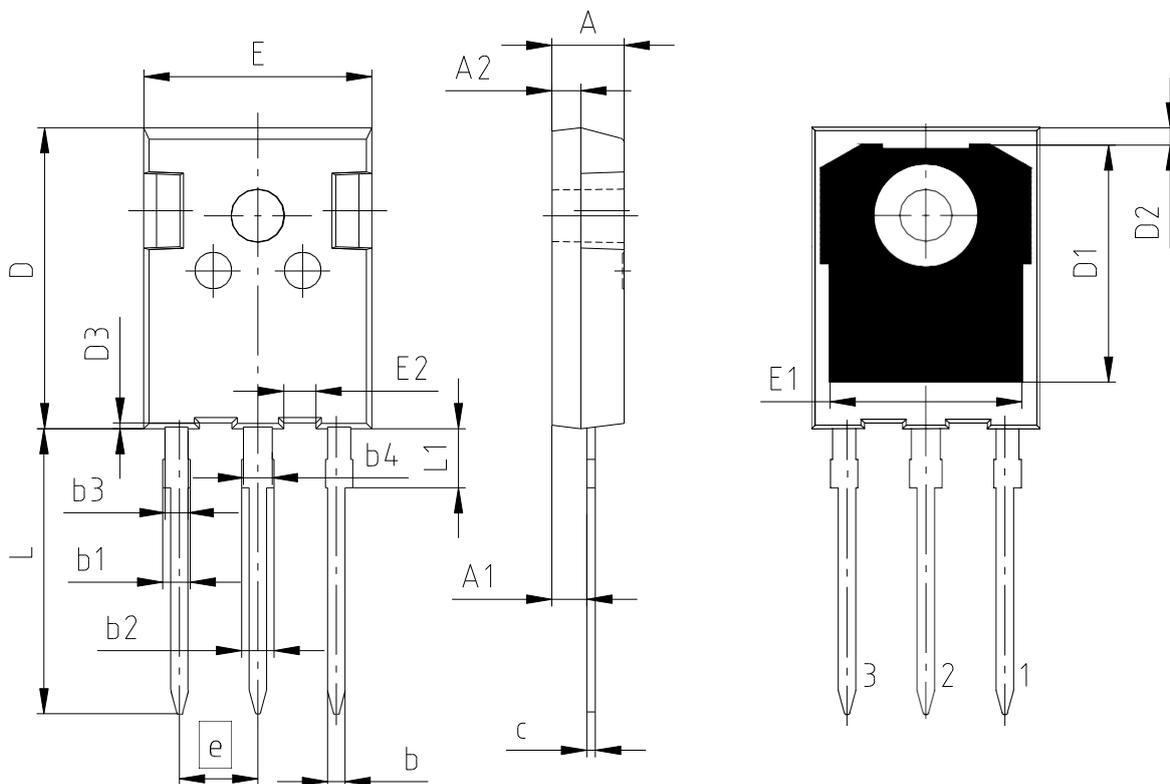
$di_F/dt = f(R_G)$

$V_R = 400\text{ V}, I_F = 25\text{ A}$



5 封装外形

PG-TO247-3-STD-NN4.8



PACKAGE - GROUP PG-TO247-3-U04		
NUMBER:		
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

6 测试条件

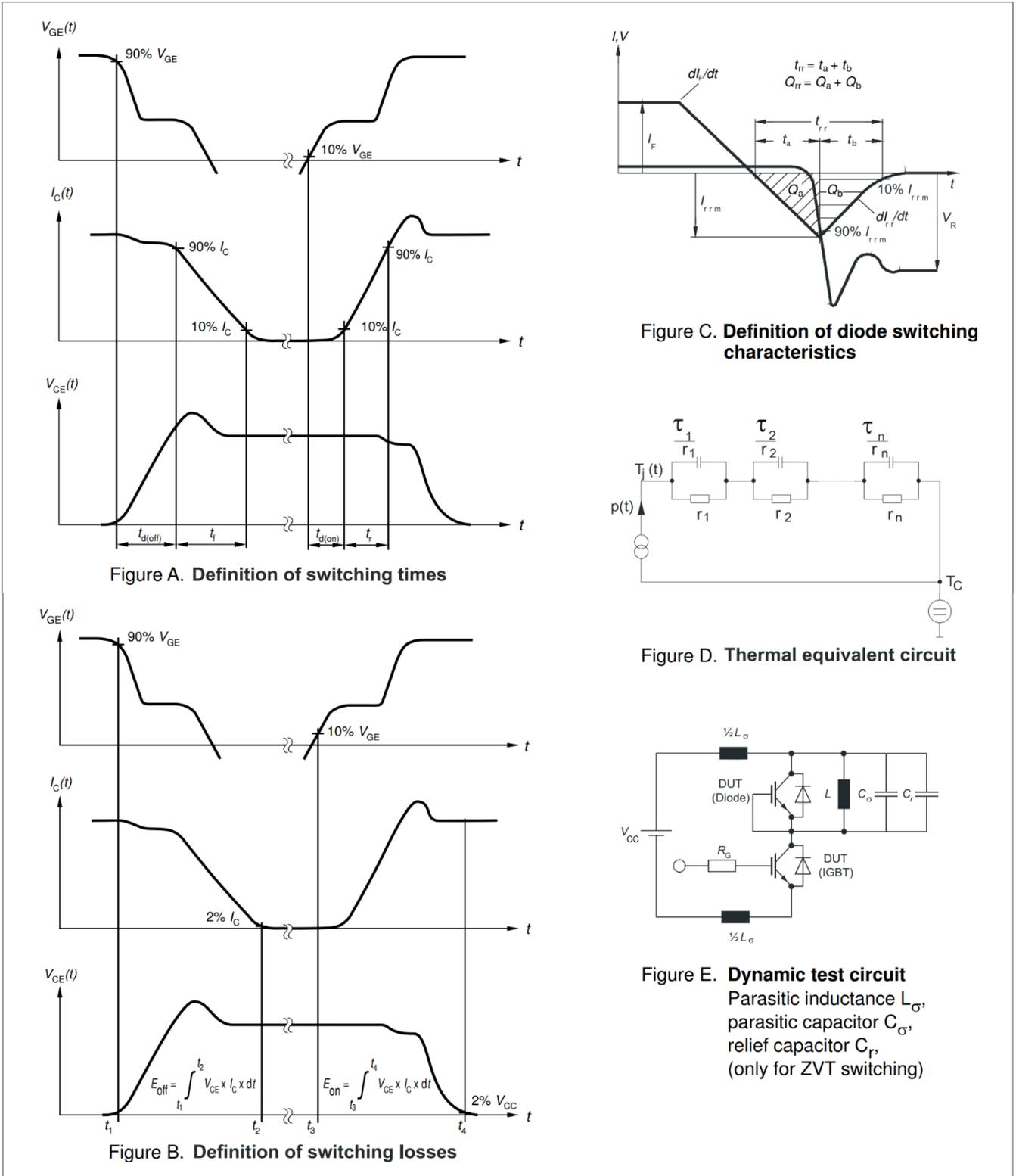


图 2

修订记录

Document revision	Date of release	Description of changes
1.00	2021-05-20	Initial version
1.10	2022-12-06	<p>Update of “DC collector current, limited by T_{vjmax}” in table “Maximum rated values”, for 25°C and 100°C</p> <p>Transient gate-emitter voltage V_{GE} in table “Maximum rated values” of IGBT changed to $\pm 30V$</p> <p>Update of diagram “Collector current as a function of case temperature”, $I_C = f(T_c)$</p> <p>“Forward bias safe operating area” diagram renamed to “Reverse bias safe operating area”</p> <p>Correction of package outline dimensions</p> <p>Change package name to marketing name</p> <p>Editorial changes</p>



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