



比亚迪
半导体

BGPE40U120P-S

IGBT in advanced TrenchFS Technology with soft and fast recovery anti-parallel diode

具有先进 TrenchFS 技术的 IGBT 且反并联软快恢复二极管

Features

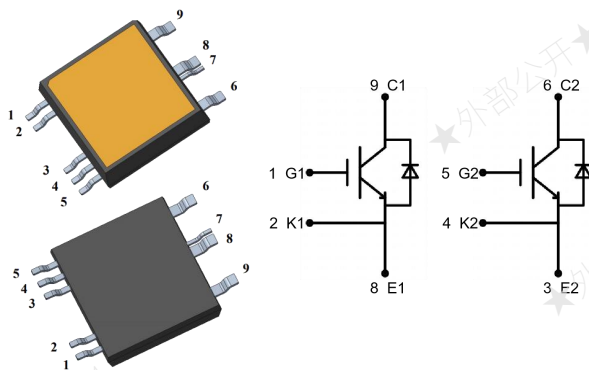
特性

- 1200V TrenchFS technology
1200V沟槽栅场终止技术
- Low saturation voltage
低饱和压降
- Positive temperature coefficient
饱和电压正温度系数
- Short Circuit withstand time-5 μ s
具备 5 μ s 短路承受能力

Applications

应用

- Electric Automotive Air-Condition Compressor
电动汽车空调压缩机
- Electric Automotive PTC Heater
汽车PTC加热
- Inverter
变频器



Ordering Information

订货信息

Type 型号	$V_{CE}[V]$ 集电极-发射极电压	$I_C[A]$ 集电极电流	$V_{CEsat}[V]$ 饱和电压	$T_{jmax}[^{\circ}C]$ 最高结温	Marking 标记	Package 封装
BGPE40U120P-S	1200	40	1.6	175	40U120P-S	SOP9



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Maximum Rated Values

最大额定参数

Parameter 参数	Symbol 符号	Value 值	Unit 单位
Collector-emitter voltage, $T_j \geq 25^\circ\text{C}$ 集电极-发射极电压, $T_j \geq 25^\circ\text{C}$	V_{CE}	1200	V
Collector current, $T_c = 25^\circ\text{C}$ 集电极电流, $T_c = 25^\circ\text{C}$	I_C	80	A
Collector current, $T_c = 100^\circ\text{C}$ 集电极电流, $T_c = 100^\circ\text{C}$	I_C	40	A
Pulsed collector current, t_p limited by T_{jmax} 集电极脉冲电流, 脉宽时间受 T_{jmax} 限制	I_{Cpuls}	160	A
Diode forward current, $T_c = 25^\circ\text{C}$ 二极管正向电流, $T_c = 25^\circ\text{C}$	I_F	80	A
Diode forward current, $T_c = 100^\circ\text{C}$ 二极管正向电流, $T_c = 100^\circ\text{C}$	I_F	40	A
Diode pulsed current 二极管脉冲电流	I_{Fpuls}	160	A
Gate-emitter voltage 栅极-发射极电压	V_{GE}	± 20	V
Short Circuit withstand time ($V_{GE} = 15\text{V}, V_{CC} \leq 800\text{V}, T_j \leq 150^\circ\text{C}$) 短路耐受时间	t_{sc}	5	μs
Total power dissipation, $T_c = 25^\circ\text{C}$ 总耗散功率, $T_c = 25^\circ\text{C}$	P_{tot}	272	W
Operating junction temperature 最高结温	T_{jmax}	175	$^\circ\text{C}$
Operating junction temperature 工作结温	T_{jop}	$-40 \dots +150$	$^\circ\text{C}$
Storage temperature 储存温度	T_{stg}	$-55 \dots +150$	$^\circ\text{C}$
Soldering temperature, 1.6mm from case for 10s 焊接温度	T_{st}	260	$^\circ\text{C}$



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Thermal Resistance

热阻

Parameter 参数	Symbol 符号	Value 值	Unit 单位
IGBT Thermal resistance junction to case IGBT 结-管壳热阻	$R_{th(j-c)}$	0.46	$^{\circ}\text{C}/\text{W}$
Diode Thermal resistance junction to case 二极管结-管壳热阻	$R_{th(j-c)}$	0.78	$^{\circ}\text{C}/\text{W}$
Thermal resistance junction to ambient 结-环境热阻	$R_{th(j-a)}$	40	$^{\circ}\text{C}/\text{W}$

Electrical Characteristic at $T_j=25^{\circ}\text{C}$ (unless otherwise specified)

$T_j=25^{\circ}\text{C}$ 时电学特性（除非特别声明）

Parameter 参数	Symbol 符号	Conditions 条件	Value 值			Unit 单位
			Min. 最小值	Typ. 典型值	Max. 最大值	

Static Characteristic

静态特性

Collector-emitter breakdown voltage 集电极-发射极击穿电压	$V_{(BR)CES}$	$V_{GE}=0V, I_C=1mA$		1200	-	-	V
Collector-emitter saturation voltage 集电极-发射极饱和电压	V_{CEsat}	$V_{GE}=15V, I_C=40A$	$T_j=25^{\circ}C$	-	1.6	2.1	V
			$T_j=150^{\circ}C$	-	1.9	-	V
Diode forward voltage 二极管正向电压	V_F	$V_{GE}=0V, I_F=40A$	$T_j=25^{\circ}C$	-	2.3	2.9	V
			$T_j=150^{\circ}C$	-	2.4	-	V
Gate-emitter threshold voltage 栅极-发射极阈值电压	$V_{GE(th)}$	$I_C=1.6mA, V_{CE}=V_{GE}$		5	5.8	7	V
Collector-emitter cut-off current 集电极-发射极截止电流	I_{CES}	$V_{CE}=1200V, V_{GE}=0V$		-	-	100	μA
Gate-emitter leakage current 栅极-发射极漏电流	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$		-	-	100	nA

Dynamic Characteristic

动态特性

Input capacitance 输入电容	C_{ies}	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$	-	4125	-	pF
Output capacitance 输出电容	C_{oes}		-	108	-	pF
Reverse transfer capacitance 反向传输电容	C_{res}		-	15	-	pF
Gate charge 门极电阻	R_G	$V_{GE}=15\text{V}, V_{CE}=0\text{V}, f=1\text{MHz}$	-	2.0	-	Ω



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Switching Characteristic at $T_j=25^\circ\text{C}$ (Inductive Load)

$T_j=25^\circ\text{C}$ 时开关特性（感性负载）

Parameter 参数	Symbol 符号	Conditions 条件	Value 值			Unit 单位
			Min. 最小值	Typ. 典型值	Max. 最大值	
IGBT Characteristic IGBT 特性						
Turn-on delay time 开通延迟时间	t _{d(on)}	V _{CE} =600V, I _C =40A, V _{GE} =15V, R _G =10Ω, T _j =25℃, Energy losses include “tail” and diode reverse recovery.	-	163.2	-	ns
Rise time 上升时间	t _r		-	76.4	-	ns
Turn-off delay time 关断延迟时间	t _{d(off)}		-	83.3	-	ns
Fall time 下降时间	t _f		-	158.9	-	ns
Turn-on energy 开通损耗	E _{on}		-	3.82	-	mJ
Turn-off energy 关断损耗	E _{off}		-	2.92	-	mJ
Total switching energy 总开关损耗	E _{ts}		-	6.74	-	mJ

Anti-Parallel Diode Characteristic

反并联二极管特性

Reverse recovery time 反向恢复时间	t_{rr}	$V_R=600\text{V},$ $I_F=40\text{A},$ $di_F/dt=510\text{A}/\mu\text{s}$ $T_j=25^\circ\text{C},$	-	796	-	ns
Reverse recovery charge 反向恢复电荷	Q_{rr}		-	2.72	-	μC
Peak reverse recovery current 反向恢复峰值电流	I_{rrm}		-	16.4	-	A
Reverse recovered energy 反向恢复损耗	E_{rec}		-	1.16	-	mJ



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Switching Characteristic at $T_j=150^{\circ}\text{C}$ (Inductive Load)

$T_j=150^{\circ}\text{C}$ 时开关特性（感性负载）

Parameter 参数	Symbol 符号	Conditions 条件	Value 值			Unit 单位
			Min. 最小 值	Typ. 典型 值	Max. 最大 值	
IGBT Characteristic IGBT 特性						
Turn-on delay time 开通延迟时间	t _{d(on)}	V _{CE} =600V, I _C =40A, V _{GE} =15V, R _G =10Ω, T _j =150°C, Energy losses include “tail” and diode reverse recovery.	-	217.8	-	ns
Rise time 上升时间	t _r		-	95.8	-	ns
Turn-off delay time 关断延迟时间	t _{d(off)}		-	218.5	-	ns
Fall time 下降时间	t _f		-	158.9	-	ns
Turn-on energy 开通损耗	E _{on}		-	5.75	-	mJ
Turn-off energy 关断损耗	E _{off}		-	3.2	-	mJ
Total switching energy 总开关损耗	E _{ts}		-	8.95	-	mJ

Anti-Parallel Diode Characteristic

反并联二极管特性

Reverse recovery time 反向恢复时间	t_{rr}	$V_R=600\text{V},$ $I_F=40\text{A},$ $di_F/dt=510\text{A}/\mu\text{s}$ $T_j=150^{\circ}\text{C}$	-	1068.3	-	ns
Reverse recovery charge 反向恢复电荷	Q_{rr}		-	4.67	-	μC
Peak reverse recovery current 反向恢复峰值电流	I_{rrm}		-	20.7	-	A
Reverse recovered energy 反向恢复损耗	E_{rec}		-	2.24	-	mJ



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Typical Characteristics Diagrams

特性曲线

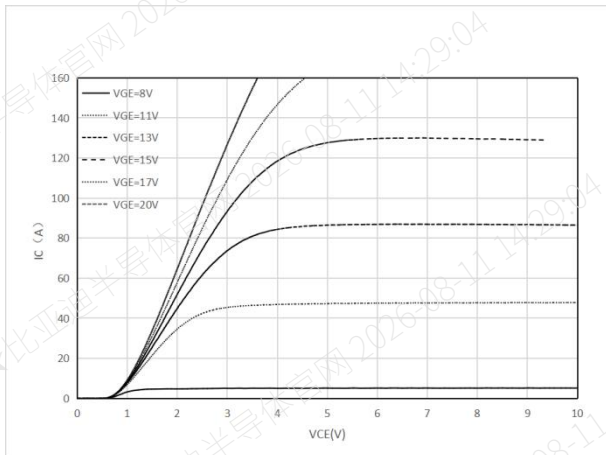


Figure 1. Typical output characteristic ($T_j=25^{\circ}\text{C}$)

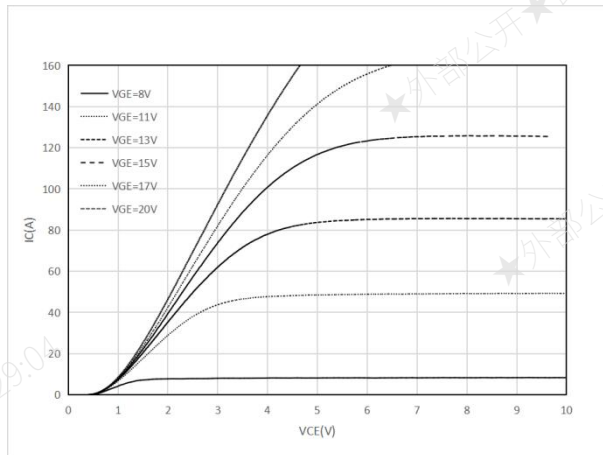


Figure 2. Typical output characteristic ($T_j=150^{\circ}\text{C}$)

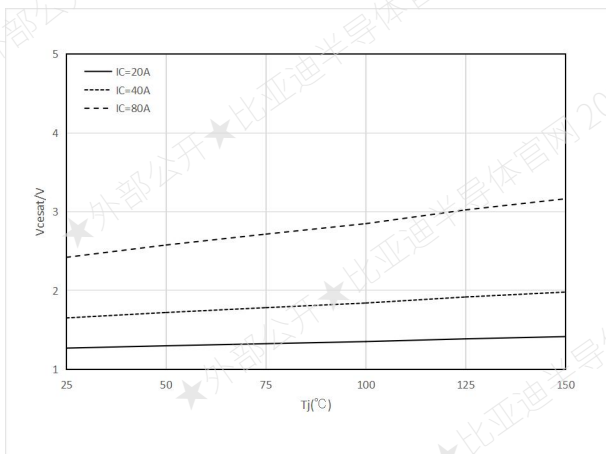


Figure 3. Typical collector-emitter saturation voltage as a function of junction temperature ($V_{GE}=15\text{V}$)

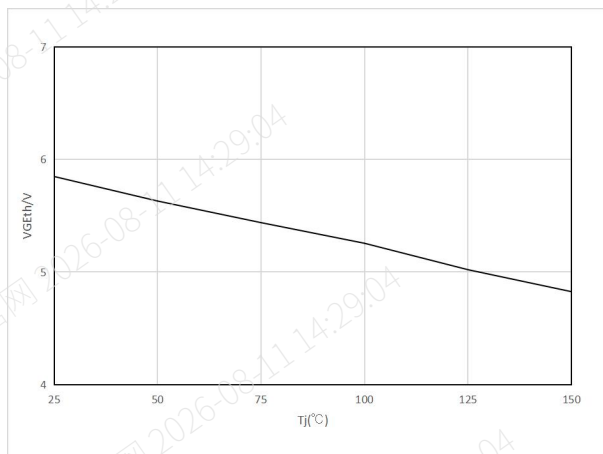


Figure 4. Gate-emitter threshold voltage as a function of junction temperature ($I_c=1.6\text{mA}$)

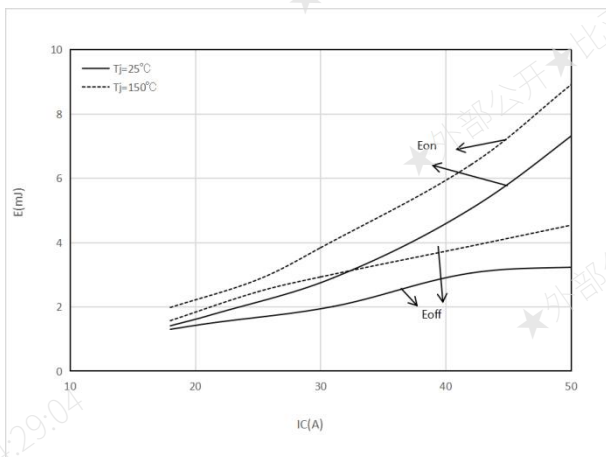


Figure 5. Typical switching energy losses as a function of collector current ($V_{CE}=600\text{V}$, $V_{GE}=15\text{V}$, $R_G=10\Omega$)

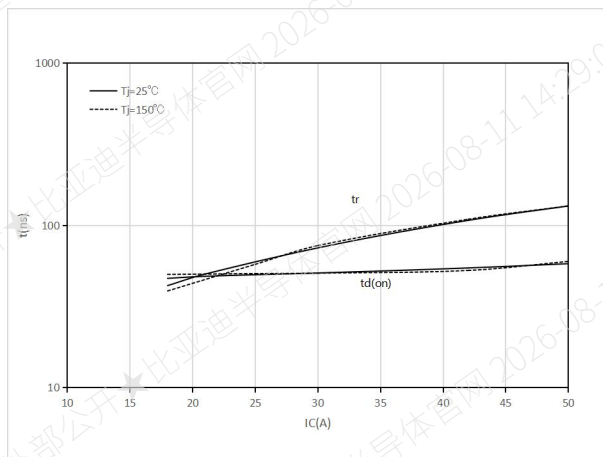


Figure 6. Typical turn-on characteristic as a function of collector current ($V_{CE}=600\text{V}$, $V_{GE}=15\text{V}$, $R_G=10\Omega$)



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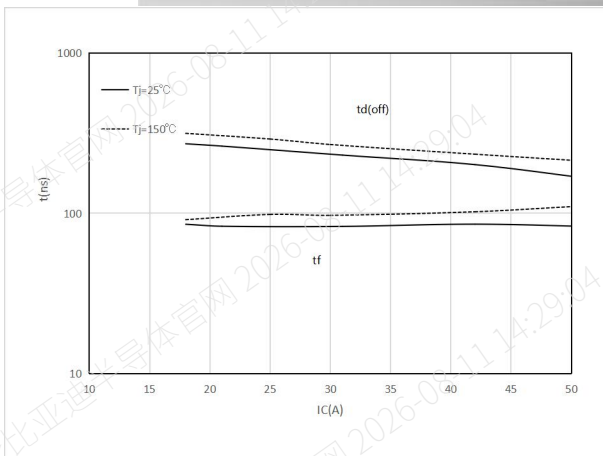


Figure 7. Typical turn-off characteristic as a function of collector current
($V_{CE}=600\text{V}$, $V_{GE}=15\text{V}$, $R_G=10\Omega$)

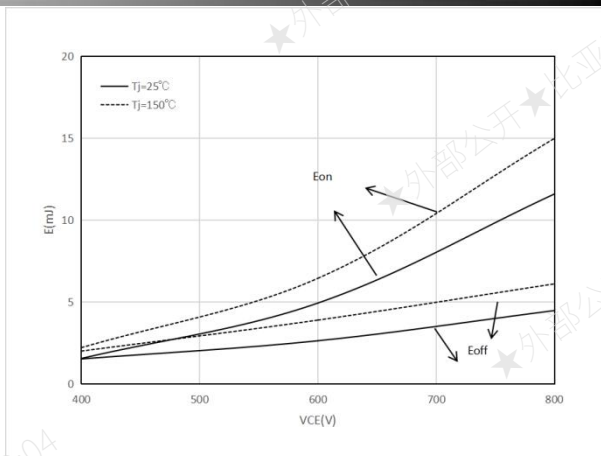


Figure 8. Typical switching energy losses as a function of collector emitter voltage
($I_C=40\text{A}$, $V_{GE}=15\text{V}$, $R_G=10\Omega$)

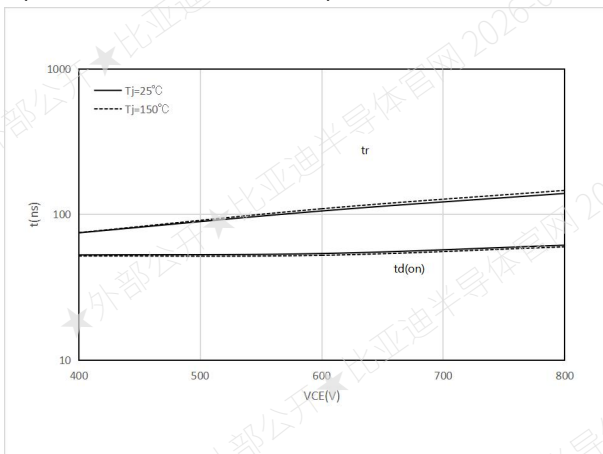


Figure 9. Typical turn-on characteristic as a function of collector emitter voltage
($I_C=40\text{A}$, $V_{GE}=15\text{V}$, $R_G=10\Omega$)

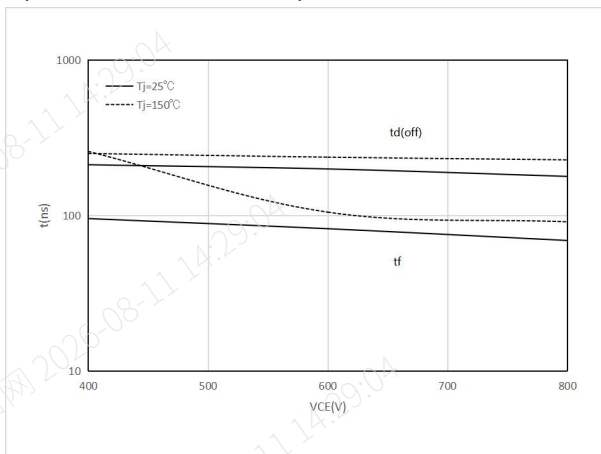


Figure 10. Typical turn-off characteristic as a function of collector emitter voltage
($I_C=40\text{A}$, $V_{GE}=15\text{V}$, $R_G=10\Omega$)

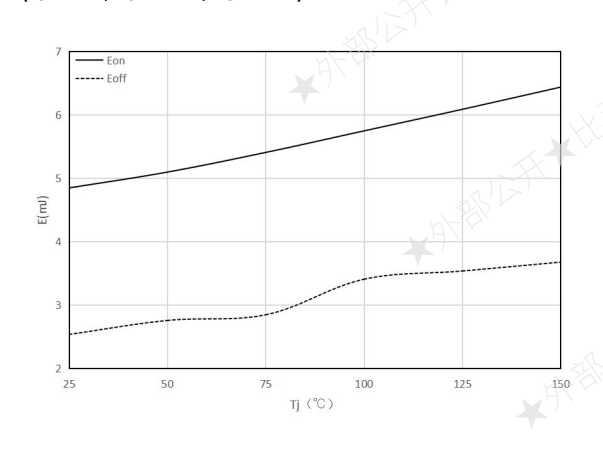


Figure 11. Typical switching energy losses as a function of junction temperature
($V_{CE}=600\text{V}$, $I_C=40\text{A}$, $V_{GE}=15\text{V}$, $R_G=10\Omega$)

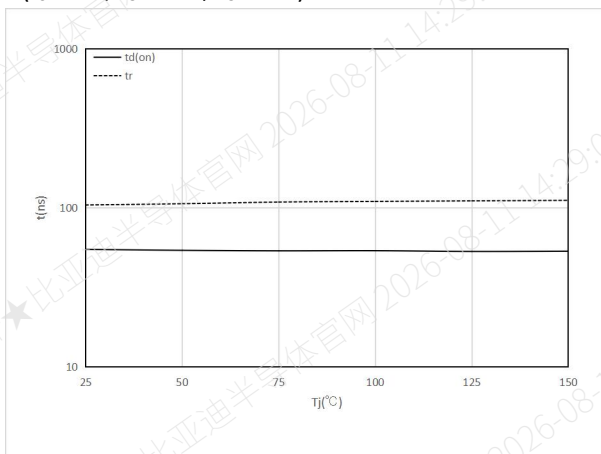


Figure 12. Typical turn-on characteristic as a function of junction temperature
($V_{CE}=600\text{V}$, $I_C=40\text{A}$, $V_{GE}=15\text{V}$, $R_G=10\Omega$)



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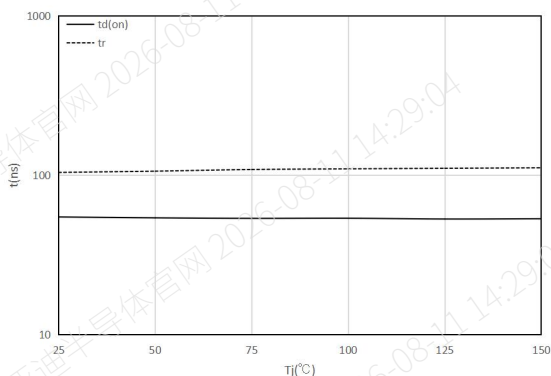


Figure 13. Typical turn-off characteristic as a function of junction temperature
($V_{CE}=600V$, $I_C=40A$, $V_{GE}=15V$, $R_G=10\Omega$)

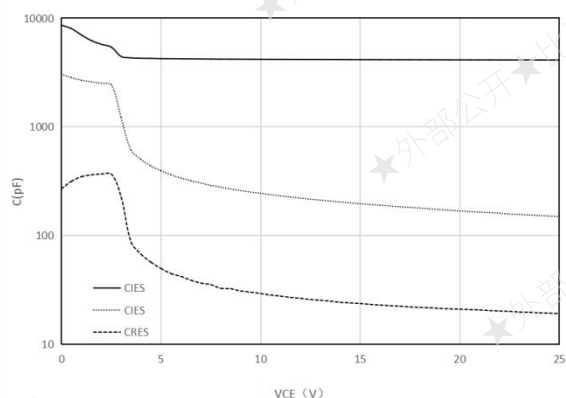


Figure 14. Typical capacitance as a function of collector-emitter voltage ($f=1MHz$, $V_{GE}=0V$)

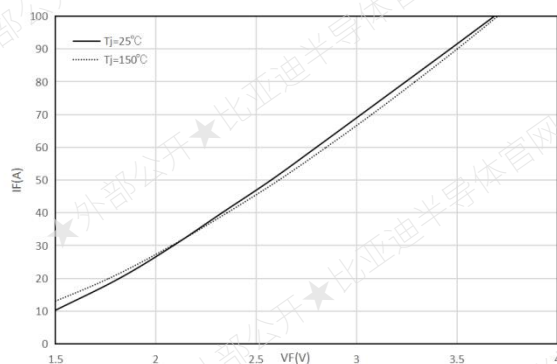


Figure 15. Typical diode forward current as a function of forward voltage

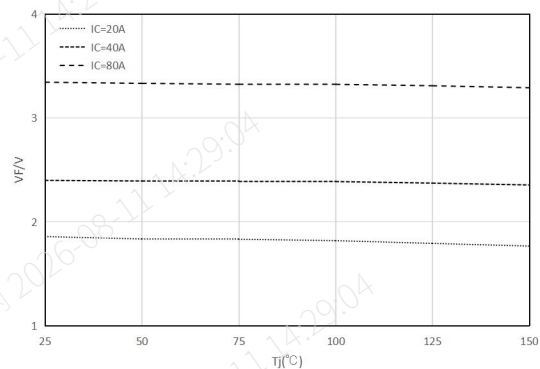


Figure 16. Typical diode forward current as a function of junction temperature

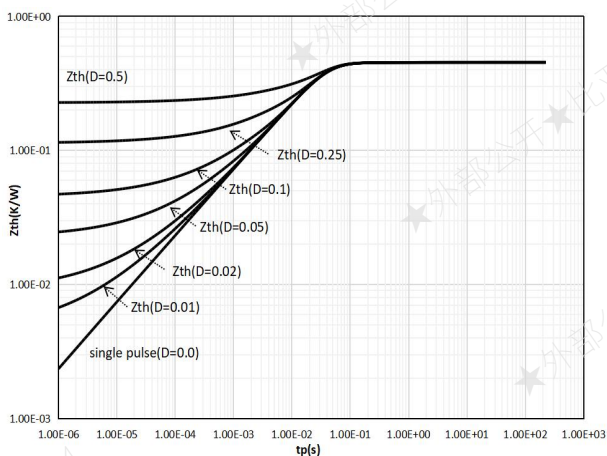


Figure 17. IGBT Transient thermal impedance as a function of pulse width ($D=tp/T$)

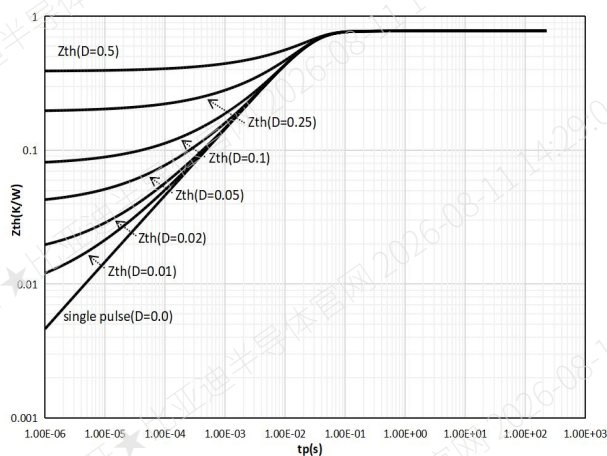


Figure 18. Diode Transient thermal impedance as a function of pulse width ($D=tp/T$)



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SOP Packing Outline Dimensions: SOP 封装外形尺寸

Dim.	Mechanical Dimensions /mm	
	MIN	MAX
A	5.40	5.60
A1	0.05	0.25
A2	3.90	4.10
b	0.90	1.10
b1	1.90	2.10
b2	0.50	0.70
c	0.45	0.60
D	24.80	25.20
D1	21.00 TYP	
E	32.40	33.00
E1	22.80	23.20
E2	19.00 TYP	
e1	2.65	2.85
e2	10.65	10.85
e3	8.50	8.70
e4	7.00	7.20
e5	2.20	2.40
L	1.05	1.45



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Special instructions: Storage Temperature: $20\pm 5^{\circ}\text{C}$; Relative Humidity: 30%-60%; The product should be stored in a place away from direct light and vibration.

质保期: 除双方在合作协议或其他书面文件中另行约定外, 产品妥当保存的情况下自购买之日起, 本规格书所述产品质保期为一年。

特殊说明: 储存温度: $20\pm 5^{\circ}\text{C}$; 相对湿度: 30%-60%; 产品应放置于避光地方, 避免震动。

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