



BGNE40T65SD

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

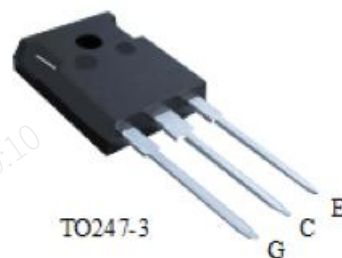
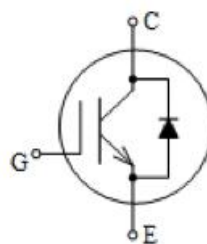
特性

- 650V TrenchFS technology
650V 沟槽栅场终止技术
- Low conduction and switching losses
低导通和开关损耗
- Low gate charge
低栅极电荷

Product validation

产品认证

- Qualified for Automotive Applications. Product Validation according to
本产品为车规级，符合 AEC-Q101 标准要求



Applications

应用

- Electric Automotive Air-Condition Compressor
电动汽车空调压缩机
- Electric Automotive PTC Heater
汽车 PTC 加热器
- 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
BGNE40T65SD	650	40	1.45	175	40T65SD	TO-247-3L



BGNE40T65SD

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}	650	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}	80	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
Total power dissipation, $T_C = 25^\circ\text{C}$ 总耗散功率, $T_C = 25^\circ\text{C}$	P_{tot}	577	W
Maximum 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 5s 焊接温度	T_{st}	260	$^\circ\text{C}$

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	$R_{th(j-c)}$	0.26	$^\circ\text{C/W}$
Diode Thermal resistance junction to case 二极管结-管壳热阻	$R_{th(j-c)}$	0.75	$^\circ\text{C/W}$
Thermal resistance junction to ambient 结-环境热阻	$R_{th(j-a)}$	40	$^\circ\text{C/W}$



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Electrical Characteristic at T_j=25°C (unless otherwise specified)

T_j=25°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	$V_{(BR)CES}$	$V_{GE}=0V, I_C=100\mu A$		650	-	-	V
Collector-emitter saturation voltage 集电极-发射极饱和电压	V_{CEsat}	$V_{GE}=15V, I_C=40A$	$T_j=25^{\circ}C$	-	1.45	1.95	V
			$T_j=150^{\circ}C$	-	1.7	-	V
Diode forward voltage 二极管正向电压	V_F	$V_{GE}=0V, I_F=40A$	$T_j=25^{\circ}C$	-	1.9	2.4	V
			$T_j=150^{\circ}C$	-	1.6	-	V
Gate-emitter threshold voltage 栅极-发射极阈值电压	$V_{GE(th)}$	$I_C=1mA, V_{CE}=V_{GE}$		4.8	5.8	6.8	V
Collector-emitter cut-off current 集电极-发射极截止电流	I_{CES}	$V_{CE}=650V, V_{GE}=0V$		-	-	100	μA
Gate-emitter leakage current 栅极-发射极漏电流	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$		-200	-	200	nA

Dynamic Characteristic

动态特性

Input capacitance 输入电容	C _{ies}	V _{CE} =25V, V _{GE} =0V, f=1MHz	-	3160	-	pF
Output capacitance 输出电容	C _{oes}		-	130	-	pF
Reverse transfer capacitance 反向传输电容	C _{res}		-	17	-	pF
Short circuit current 短路电流	I _{C(sc)}	V _{CE} =400V, V _{GE} =15V, t _{p sc} ≤5μs, T _j =150°C	-	160	-	A



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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	$t_{d(on)}$	$V_{CE}=400\text{V},$ $I_C=40\text{A},$ $V_{GE}=-7.5/15\text{V},$ $R_G=5\Omega,$ $T_j=25^\circ\text{C},$ Energy losses include “tail” and diode reverse recovery.	-	39	-	ns
Rise time 上升时间	t_r		-	83	-	ns
Turn-off delay time 关断延迟时间	$t_{d(off)}$		-	122	-	ns
Fall time 下降时间	t_f		-	103	-	ns
Turn-on energy 开通损耗	E_{on}		-	1.37	-	mJ
Turn-off energy 关断损耗	E_{off}		-	1.23	-	mJ
Total switching energy 总开关损耗	E_{ts}		-	2.6	-	mJ

Anti-Parallel Diode Characteristic

反并联二极管特性

Reverse recovery time 反向恢复时间	t_{rr}	$V_R=400\text{V},$ $I_F=40\text{A},$ $di_F/dt=350\text{A}/\mu\text{s}$ $T_j=25^\circ\text{C},$	-	190	-	ns
Reverse recovery charge 反向恢复电荷	Q_{rr}		-	1.14	-	μC
Peak reverse recovery current 反向恢复峰值电流	I_{rrm}		-	10.4	-	A
Reverse recovered energy 反向恢复损耗	E_{rec}		-	0.33	-	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	$t_{d(on)}$	$V_{CE}=400\text{V},$ $I_C=40\text{A},$ $V_{GE}=-7.5/15\text{V},$ $R_G=5\Omega,$ $T_j=150^{\circ}\text{C},$ Energy losses include “tail” and diode reverse recovery.	-	39	-	ns
Rise time 上升时间	t_r		-	79	-	ns
Turn-off delay time 关断延迟时间	$t_{d(off)}$		-	143	-	ns
Fall time 下降时间	t_f		-	127	-	ns
Turn-on energy 开通损耗	E_{on}		-	1.93	-	mJ
Turn-off energy 关断损耗	E_{off}		-	1.64	-	mJ
Total switching energy 总开关损耗	E_{ts}		-	3.57	-	mJ

Anti-Parallel Diode Characteristic

反并联二极管特性

Reverse recovery time 反向恢复时间	t_{rr}	$V_R=400\text{V},$ $I_F=40\text{A},$ $di_F/dt=350\text{A}/\mu\text{s}$ $T_j=150^{\circ}\text{C}$	-	261	-	ns
Reverse recovery charge 反向恢复电荷	Q_{rr}		-	3.01	-	μC
Peak reverse recovery current 反向恢复峰值电流	I_{rrm}		-	19.1	-	A
Reverse recovered energy 反向恢复损耗	E_{rec}		-	0.91	-	mJ



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Typical Characteristics Diagrams

特性曲线

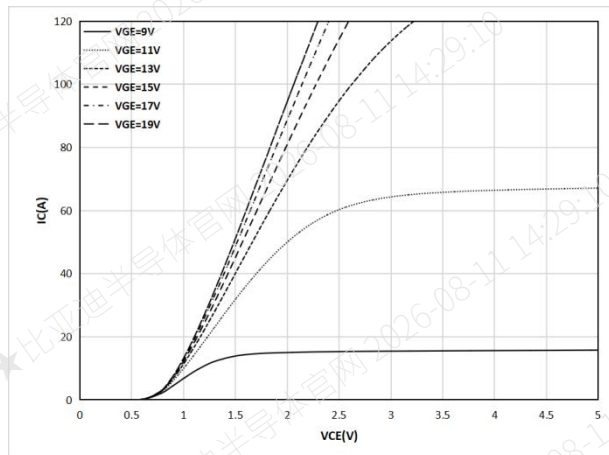


Figure 1. Typical output characteristic ($T_j=25^{\circ}\text{C}$)

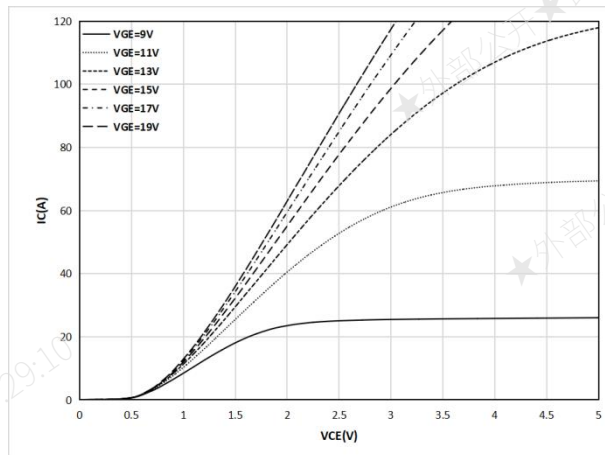


Figure 2. Typical output characteristic ($T_j=150^{\circ}\text{C}$)

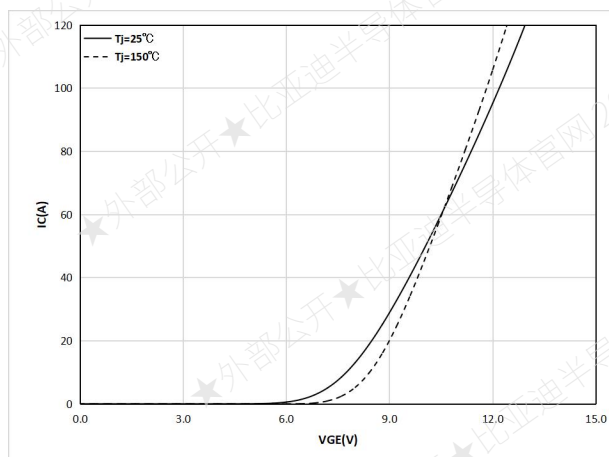


Figure 3. Typical transfer characteristic ($V_{CE}=20\text{V}$)

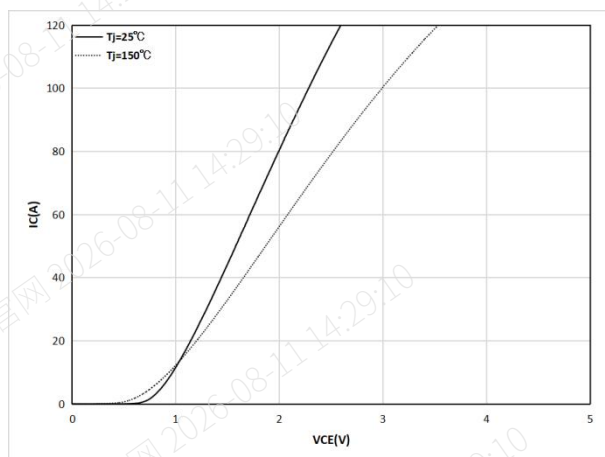


Figure 4. Typical collector current as a function of collector-emitter saturation voltage ($V_{GE}=15\text{V}$)

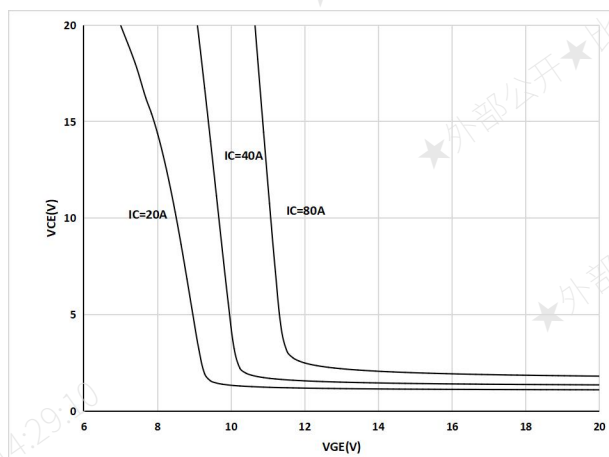


Figure 5. Typical collector-emitter saturation voltage as a function of gate-emitter voltage ($T_j=25^{\circ}\text{C}$)

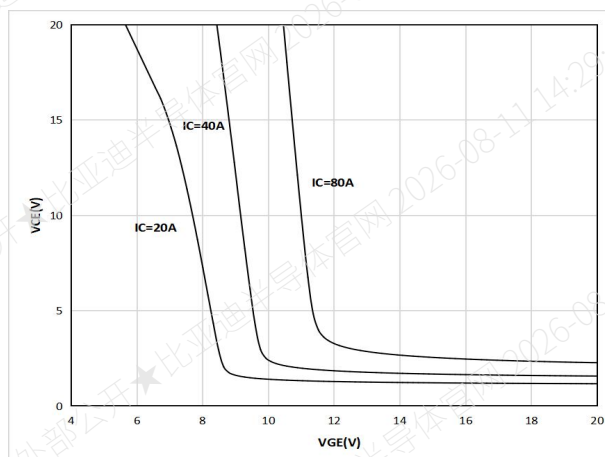


Figure 6. Typical collector-emitter saturation voltage as a function of gate-emitter voltage ($T_j=150^{\circ}\text{C}$)



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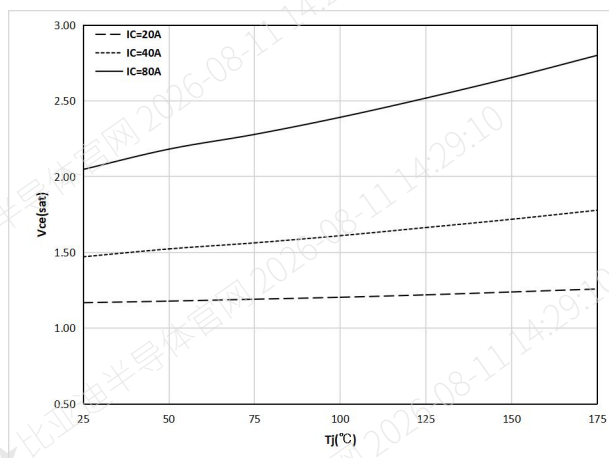


Figure 7. Typical collector-emitter saturation voltage as a function of junction temperature ($V_{GE}=15V$)

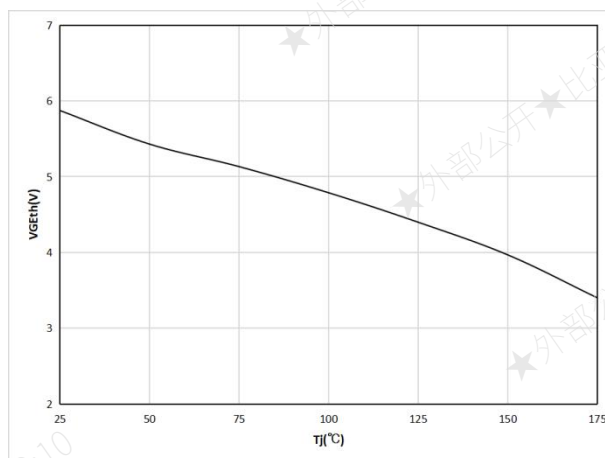


Figure 8. Gate-emitter threshold voltage as a function of junction temperature ($I_C=1mA$)

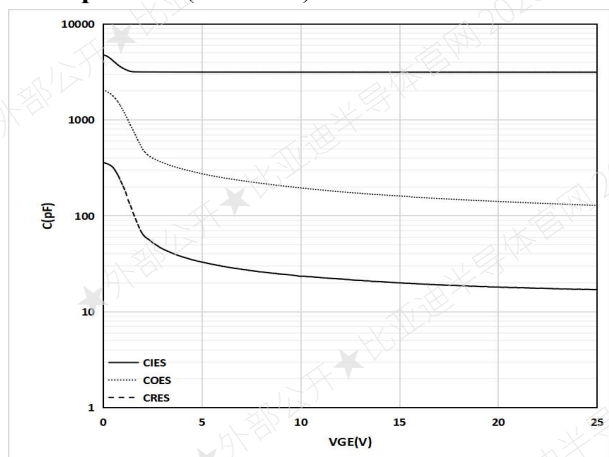


Figure 9. Typical capacitance as a function of collector-emitter voltage ($f=1MHz$, $V_{GE}=0V$)

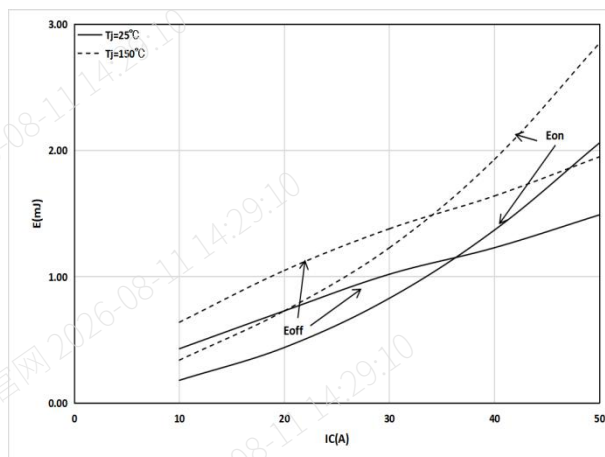


Figure 10. Typical switching energy losses as a function of collector current ($V_{CE}=400V$, $V_{GE}=15V$, $R_G=5\Omega$)

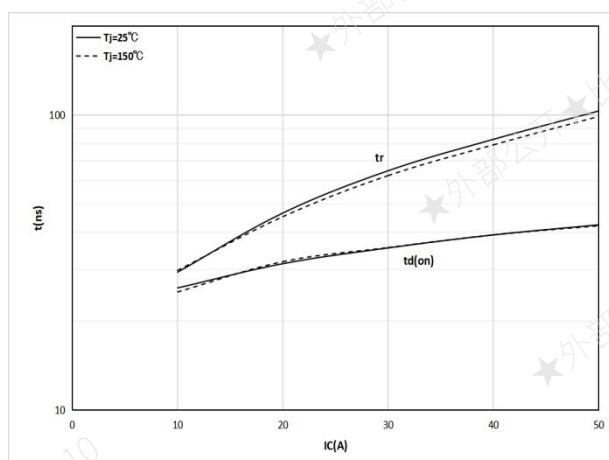


Figure 11. Typical turn-on characteristic as a function of collector current ($V_{CE}=400V$, $V_{GE}=15V$, $R_G=5\Omega$)

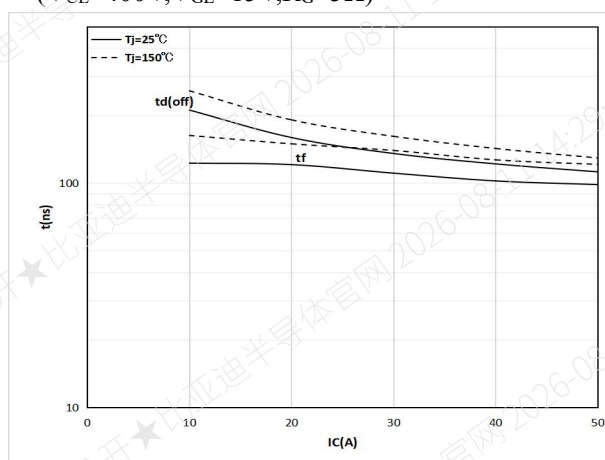


Figure 12. Typical turn-off characteristic as a function of collector current ($V_{CE}=400V$, $V_{GE}=15V$, $R_G=5\Omega$)



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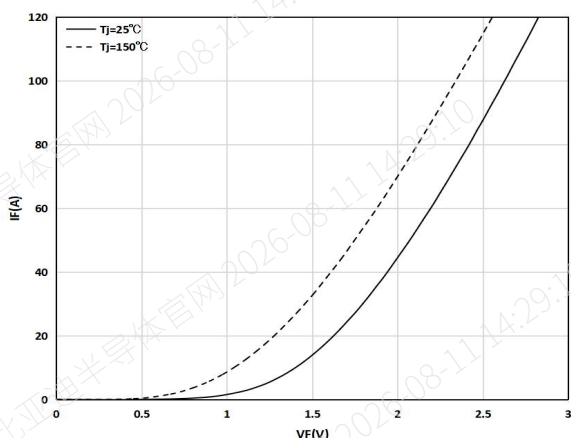


Figure 13. Typical diode forward current as a function of forward voltage

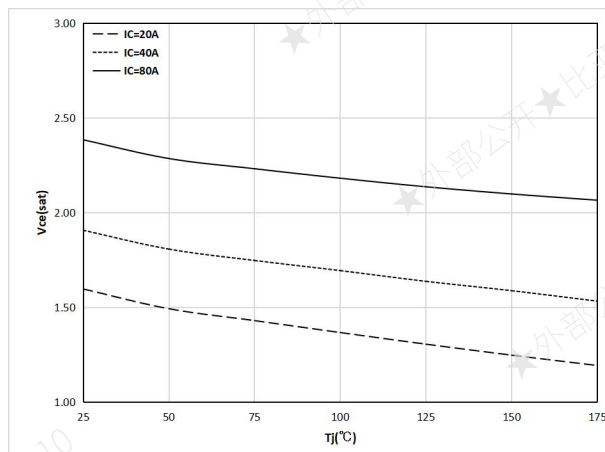


Figure 14. Typical diode forward voltage as a function of junction temperature

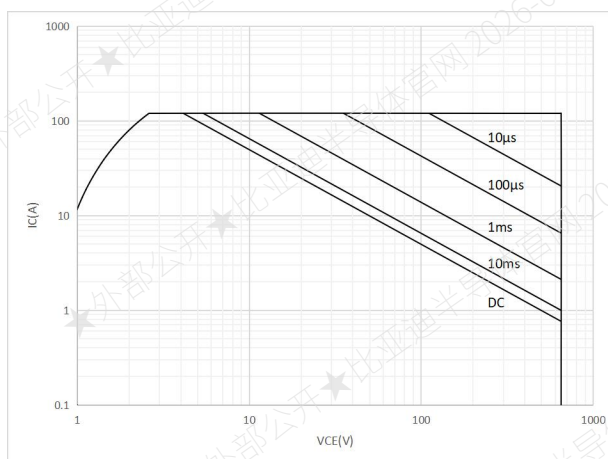


Figure 15. Forward bias safe operating area

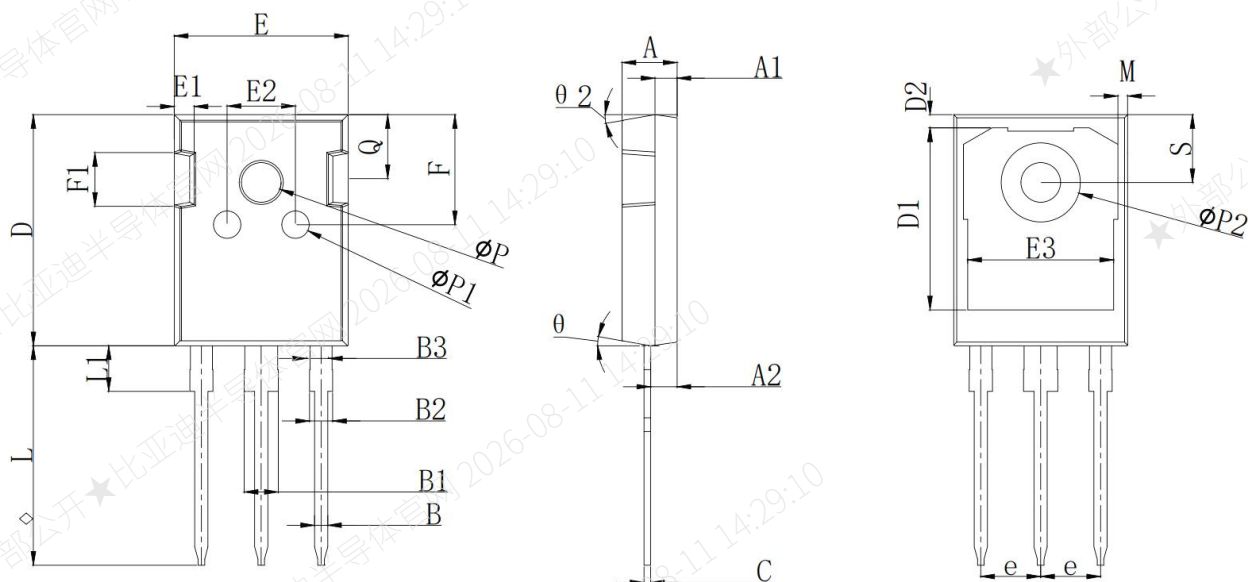
($D=0$, $T_c=25^\circ\text{C}$, $T_j \leq 150^\circ\text{C}$, $V_{GE}=15\text{V}$, pulse width limited by T_{jmax})



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TO-247-3L Outline Dimensions:

TO-247-3L 外形尺寸



Common Dimensions (Units:Millimeter)

Symbol	Min.	Max.	Symbol	Min.	Max.
A	4.85	5.15	E3	13.06	14.22
A1	1.90	2.10	F	8.76	10.20
A2	2.20	2.60	F1	4.00	5.30
B	1.00	1.40	e	5.39	5.49
B1	2.80	3.25	L	19.72	21.00
B2	1.80	2.20	L1	3.90	4.80
B3	1.80	2.10	φP	3.50	3.70
C	0.50	0.70	φP1	2.40	3.10
D	20.30	21.10	φP2	7.10	7.30
D1	16.35	16.75	Q	5.40	5.98
D2	0.85	1.32	S	5.98	6.27
E	15.45	15.90	θ	1°	11°
E1	1.20	2.60	θ2	9°	23°
E2	6.10	8.20			

Note: The mold may vary little from different packaging plants, please refer to the actual product.

备注：因各封装厂的模具存在细微差异，请以实物的尺寸为准。

Packing

包装

Packing 包装	pcs/tube 个/料管	tube/inner box 料管/内盒	inner box/carton 内盒/箱	pcs/carton 个/箱
Tube	30	12	6	2160



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- **Warranty Period:** Unless otherwise agreed in the COOPERATION AGREEMENT or other WRITTEN DOCUMENTS, the Warranty Period for products specified in this specification shall be one year from the date of purchase if the products are properly preserved.

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。

- Our Company is committed to enhancing product quality and stability. This specification serves solely to delineate technical product details.

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