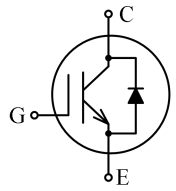
比亚迪
半导体

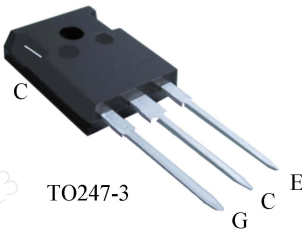
BGNE40T65HD

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 switching losses
  低开关损耗
- Positive temperature coefficient
  饱和电压正温度系数
- Short Circuit withstand time-5μs
  具备5μs短路承受能力





Applications:
应用

- UPS
  不间断电源
- PFC
  功率因数校正
- Welding
  焊机
- Industrial Power Supply
  工业电源

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}[°C] 最高结温	Marking 标记	Package 封装
BGNE40T65HD	650	40	1.85	175	40T65HD	TO-247-3L

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≥25℃ 集电极-发射极电压,T_j≥25℃	V_{CE}	650	V
Collector current,T_C=25℃ 集电极电流，Tc=25℃	I_C	80	A
Collector current,T_C=100℃ 集电极电流，Tc=100℃	I_C	40	
Pulsed collector current，t_p limited by $T_{j\,max}$ 集电极脉冲电流，脉宽时间受 $T_{j\,max}$ 限制	I_{Cpuls}	160	
Diode forward current,T_C=25℃ 二极管正向电流，Tc=25℃	I_F	80	
Diode forward current,T_C=100℃ 二极管正向电流，Tc=100℃	I_F	40	
Diode pulsed current 二极管脉冲电流	I_{Fpuls}	160	
Gate-emitter voltage 栅极-发射极电压	V_{GE}	±20	V
Short Circuit withstand time V_{GE}=15V,V_{CC}≤400V,T_j≤150℃ 短路耐受时间	t_{sc}	5	us
Total power dissipation, T_C=25℃ 总耗散功率，Tc=25℃	P_{tot}	312.5	W
Maximum junction temperature 最高结温	T_{jmax}	175	℃
Operating junction temperature 工作结温	T_{jop}	-40…+150	
Storage temperature 储存温度	T_{stg}	-55…+150	
Soldering temperature,1.6mm from case for 10s 焊接温度	T_{st}	260	
Mounting Torque M3 锁装力矩	Md	0.6	Nm

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	$R_{th(j-c)}$	0.48	℃/W
Diode Thermal resistance junction to case 二极管结-管壳热阻	$R_{th(j-c)}$	0.54	℃/W
Thermal resistance junction to ambient 结-环境热阻	$R_{th(j-a)}$	40	℃/W

Electrical Characteristic at Tj = 25℃ （unless otherwise specified）
Tj=25℃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=100uA		650	-	-	V
Collector-emitter saturation voltage 集电极-发射极饱和电压	Vcesat	V_{GE}=15V, I_C=40A	T_j=25℃	-	1.85	2.2	
			T_j=150℃	-	2.1	-	
Diode forward voltage 二极管正向电压	VF	V_{GE}=0V, I_F=40A	T_j=25℃	-	1.9	2.4	
			T_j=150℃	-	1.6	-	
Gate-emitter threshold voltage 栅极-发射极阈值电压	$V_{GE(th)}$	I_C=1mA, V_{CE}=V_{GE}		5.0	5.8	7.0	
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}=±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		-	5200	-	pF
Output capacitance 输出电容	C_{oes}			-	230	-	

Reverse transfer capacitance 反向传输电容	C_{res}		-	160	-	
Gate charge 门极电量	Q_G	V_{CC}=400V,I_C=40A, V_{GE}=15V	-	238	-	nC
Short circuit current 短路电流	$I_{C(sc)}$	V_{CC}=400V,V_{GE}=15V, tpsc≤5us,T_j=150°C	-	230	-	A

Switching Characteristic at T_j=25°C（Inductive Load）

T_j=25°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	$t_{d(on)}$	T_j=25°C， V_{CC}=400V, I_C=40A, V_{GE}=-7.5/15V, R_G=10Ω, Energy losses include "tail" and diode reverse recovery.	-	100	-	ns
Rise time 上升时间	t_r		-	90	-	
Turn-off delay time 关断延迟时间	$t_{d(off)}$		-	115	-	
Fall time 下降时间	t_f		-	25	-	
Turn-on energy 开通损耗	E_{on}		-	0.58	-	mJ
Turn-off energy 关断损耗	E_{off}		-	0.38	-	
Total switching energy 总开关损耗	E_{ts}		-	0.96	-	
Anti-Parallel Diode Characteristic **反并联二极管特性**						
Reverse recovery time 反向恢复时间	t_{rr}	T_j=25°C, V_R=400V, I_F=40A, diF/dt=1000A/μs	-	55	-	ns
Recovered charge 恢复电荷	Q_r		-	1.8	-	μC
Peak reverse recovery current 反向恢复峰值电流	I_{RM}		-	7	-	A
Reverse recovered energy 反向恢复损耗	E_{rec}		-	0.07	-	mJ

Switching Characteristic at T_j=150℃（Inductive Load）
T_j=150℃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	$t_{d(on)}$	T_j=150℃, V_{CC}=400V, I_C=40A, V_{GE}=-7.5/15V, R_G=10Ω, Energy losses include "tail" and diode reverse recovery.	-	100	-	ns
Rise time 上升时间	t_r		-	80	-	
Turn-off delay time 关断延迟时间	$t_{d(off)}$		-	135	-	
Fall time 下降时间	t_f		-	65	-	
Turn-on energy 开通损耗	E_{on}		-	0.83	-	mJ
Turn-off energy 关断损耗	E_{off}		-	0.48	-	
Total switching energy 总开关损耗	E_{ts}		-	1.31	-	
Anti-Parallel Diode Characteristic **反并联二极管特性**						
Reverse recovery time 反向恢复时间	t_{rr}	T_j=150℃, V_R=400V, I_F=40A, diF/dt=1000A/μs	-	130	-	ns
Recovered charge 恢复电荷	Q_r		-	2.1	-	μC
Peak reverse recovery current 反向恢复峰值电流	I_{RM}		-	12	-	A
Reverse recovered energy 反向恢复损耗	E_{rec}		-	0.11	-	mJ

ELECTRICAL CHARACTERISTICS
特性曲线

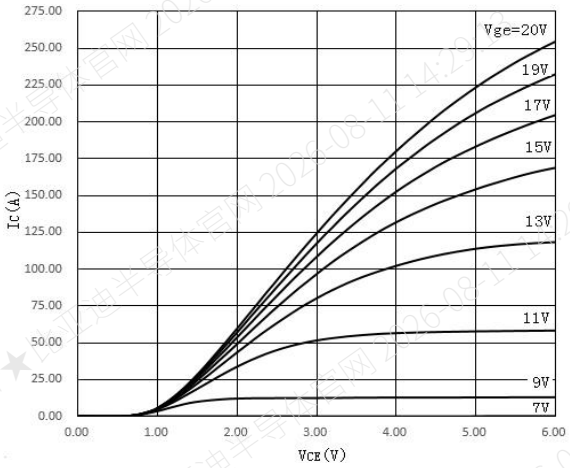


Figure 1. Typical output characteristic(T_j=25℃)

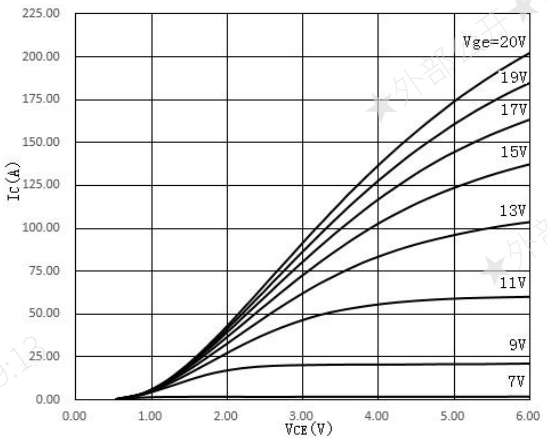


Figure 2. Typical output characteristic(T_j=150℃)

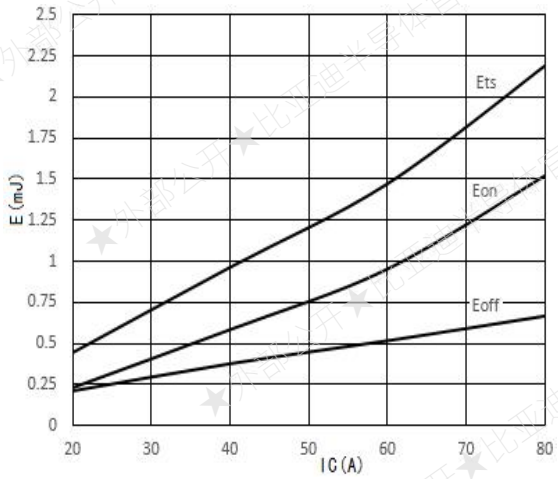


Figure 3. Switching energy vs I_C
(T_j=25℃,V_{GE}=15V,V_{CE}=400V,R_g=10Ω)

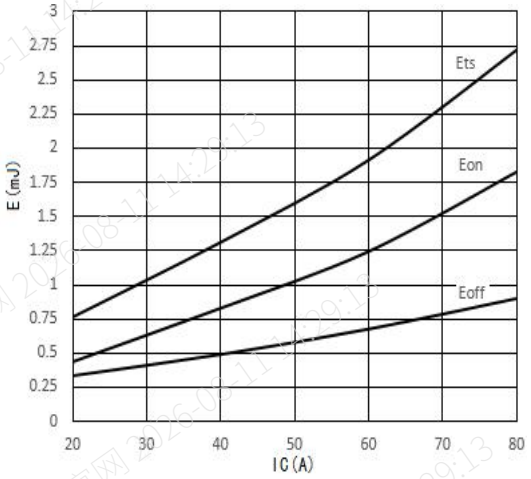


Figure 4. Switching energy vs I_C
(T_j=150℃,V_{GE}=15V,V_{CE}=400V,R_g=10Ω)

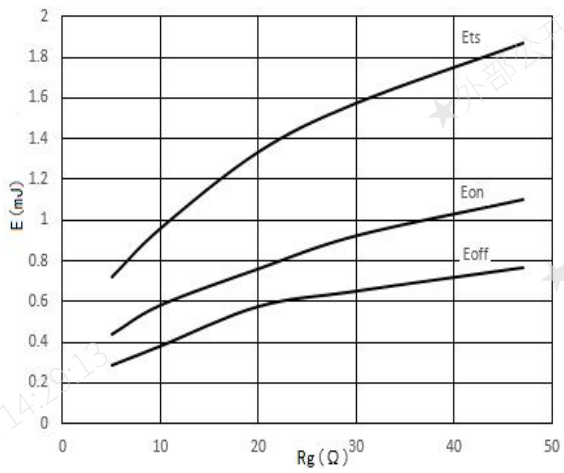


Figure 5. Switching energy losses vs R_g
(T_j=25℃,VCE=400V,VGE=15V,Ic=40A)

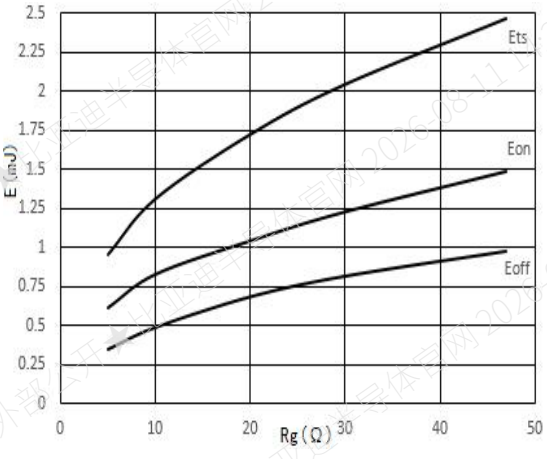


Figure 6. Switching energy losses vs R_g
(T_j=150℃, V_{CE}=400V,V_{GE}=15V,I_C=40A)

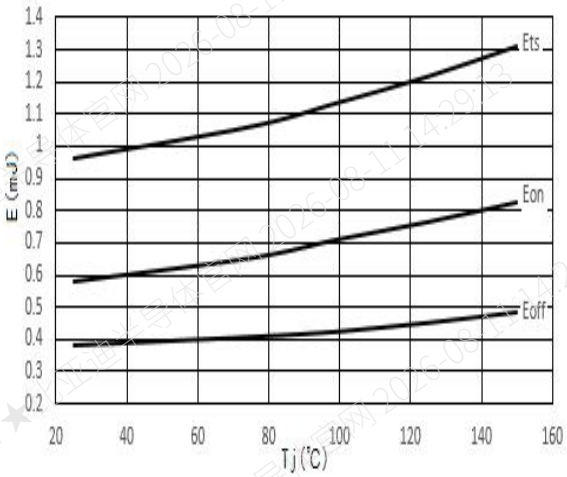


Figure 7. Switching energy losses vs T_j
(V_{CE}=400V,V_{GE}=15V,I_C=40A,R_G=10Ω)

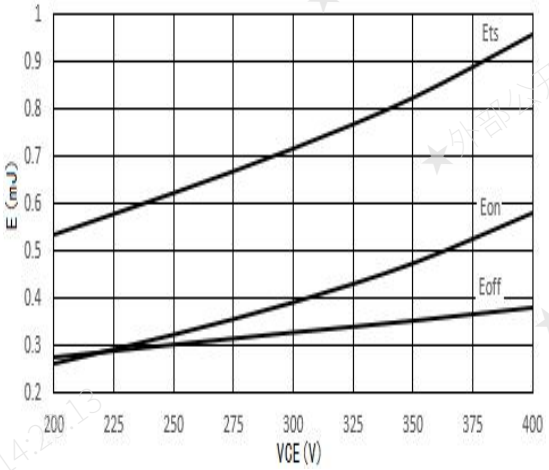


Figure 8. Switching energy losses vs V_{CE}
(T_j=25℃,V_{GE}=15V,I_C=40A,R_g=10Ω)

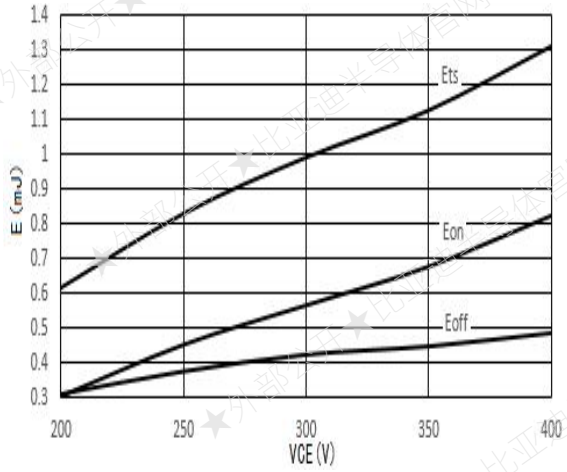


Figure 9. Switching energy losses vs V_{CE}
(T_j=150℃, V_{GE}=15V,I_C=40A,R_g=10Ω)

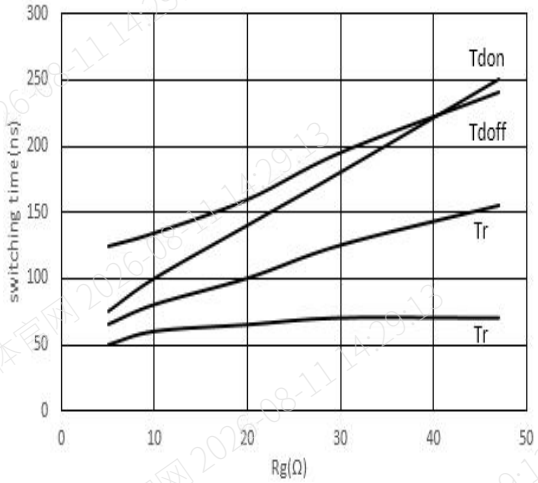


Figure 10. Switching times vs R_g
(T_j=150℃,V_{CE}=400V,V_{GE}=15V,I_C=40A)

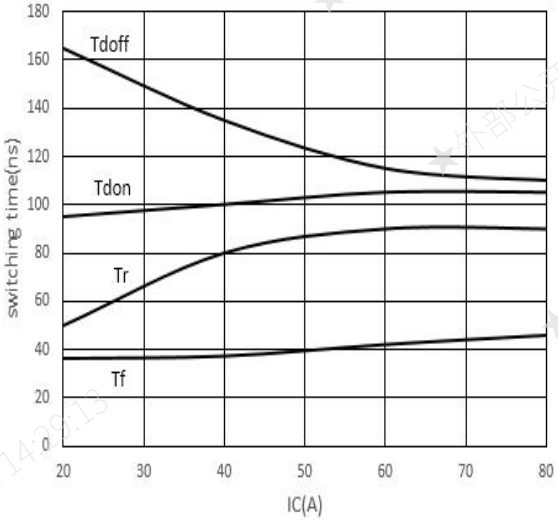
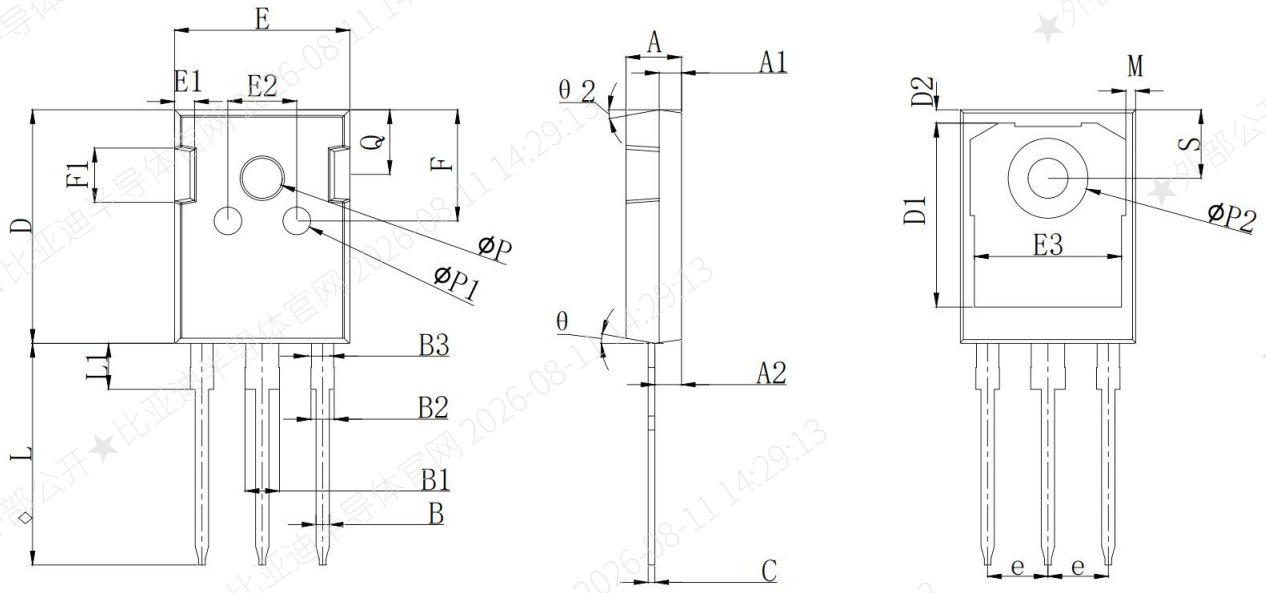


Figure 11. Switching times vs I_C
(T_j=150℃,V_{CE}=400V,V_{GE}=15V,R_g=10Ω)

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	θ 2	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	pcs/tube	tube/ inner box	inner box/ carton	pcs/carton
Tube	30	12	6	2160

DISCLAIMER 免责声明

- 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±5℃; 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期一年。
  特殊说明：储存温度：20±5℃；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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- **Notwithstanding the Company's reasonable efforts and due diligence, the sensitive nature of the products and variations in testing environments and systems may result in a certain failure rate, including potential malfunctions or failures under specific conditions. Consequently, the Company does not warrant the accuracy of the information contained in this specification, nor the fitness for a particular purpose or merchantability of the products. The information in this specification shall not be construed as a guarantee or commitment regarding product functionality, condition, or quality.**
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- **This product shall not be used in any equipment or applications requiring higher reliability or quality standards where failure could result in personal injury, death, or catastrophic events, including but not limited to nuclear control systems, aircraft/aviation components, maritime/rail transport equipment, traffic signaling devices, combustion control systems, medical equipment, or other safety-critical applications. Customers must procure genuine products exclusively through the Company or authorized channels, and utilize them strictly within legally permitted boundaries and under conditions expressly defined in this specification. The Company disclaims all liability for losses, damages, or injuries arising from non-compliance with these requirements.**

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- This specification is written in both Chinese and English, and in case of any conflict between the Chinese and English versions, the Chinese version shall prevail.

  本文件以中英文双语书就，如有不同之处，以中文内容为准。