



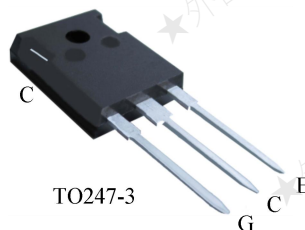
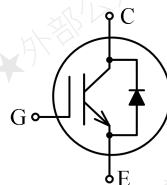
IGBT in advanced Trench FS Technology with soft and fast recovery anti-parallel diode

具有先进 Trench FS 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 saturation voltage  
低饱和压降
- Low gate charge  
低栅极电荷



## 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<br>型号    | $V_{CE}[V]$<br>集电极-发射极<br>电压 | $I_C[A]$<br>集电极电流 | $V_{CEsat}[V]$<br>饱和电压 | $T_{jmax}[^{\circ}C]$<br>最高结温 | Marking<br>标记 | Package<br>封装 |
|---------------|------------------------------|-------------------|------------------------|-------------------------------|---------------|---------------|
| BGNE30V65HD-U | 650                          | 30                | 1.5                    | 175                           | 30V65HD-U     | TO-247-3L     |



**Maximum Rated Values**

**最大额定参数**

| Parameter<br>参数                                                                                  | Symbol<br>符号 | Value<br>值       | Unit<br>单位       |
|--------------------------------------------------------------------------------------------------|--------------|------------------|------------------|
| Collector-emitter voltage, $T_j \geq 25^\circ\text{C}$<br>集电极-发射极电压, $T_j \geq 25^\circ\text{C}$ | $V_{CE}$     | 650              | V                |
| Collector current, $T_c = 25^\circ\text{C}$<br>集电极电流, $T_c = 25^\circ\text{C}$                   | $I_C$        | 60               | A                |
| Collector current, $T_c = 100^\circ\text{C}$<br>集电极电流, $T_c = 100^\circ\text{C}$                 | $I_C$        | 30               | A                |
| Pulsed collector current, $t_p$ limited by $T_{jmax}$<br>集电极脉冲电流, 脉宽时间受 $T_{jmax}$ 限制            | $I_{Cpuls}$  | 120              | A                |
| Diode forward current, $T_c = 25^\circ\text{C}$<br>二极管正向电流, $T_c = 25^\circ\text{C}$             | $I_F$        | 60               | A                |
| Diode forward current, $T_c = 100^\circ\text{C}$<br>二极管正向电流, $T_c = 100^\circ\text{C}$           | $I_F$        | 30               | A                |
| Diode pulsed current<br>二极管脉冲电流                                                                  | $I_{Fpuls}$  | 120              | A                |
| Gate-emitter voltage<br>栅极-发射极电压                                                                 | $V_{GE}$     | $\pm 20$         | V                |
| Total power dissipation, $T_c = 25^\circ\text{C}$<br>总耗散功率, $T_c = 25^\circ\text{C}$             | $P_{tot}$    | 265              | W                |
| Operating junction temperature<br>最高结温                                                           | $T_{jmax}$   | 175              | $^\circ\text{C}$ |
| Operating junction temperature<br>工作结温                                                           | $T_{jop}$    | $-40 \dots +150$ | $^\circ\text{C}$ |
| Storage temperature<br>储存温度                                                                      | $T_{stg}$    | $-40 \dots +150$ | $^\circ\text{C}$ |
| Soldering temperature, 1.6mm from case for 10s<br>焊接温度                                           | $T_{st}$     | 260              | $^\circ\text{C}$ |

**Thermal Resistance**

**热阻**

| Parameter<br>参数                                         | Symbol<br>符号  | Value<br>值 | Unit<br>单位                |
|---------------------------------------------------------|---------------|------------|---------------------------|
| IGBT Thermal resistance junction to case<br>IGBT 结-管壳热阻 | $R_{th(j-c)}$ | 0.47       | $^\circ\text{C}/\text{W}$ |
| Diode Thermal resistance junction to case<br>二极管结-管壳热阻  | $R_{th(j-c)}$ | 1.39       | $^\circ\text{C}/\text{W}$ |
| Thermal resistance junction to ambient<br>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<br>参数 | Symbol<br>符号 | Conditions<br>条件 | Value<br>值      |                 |                 | Unit<br>单位 |
|-----------------|--------------|------------------|-----------------|-----------------|-----------------|------------|
|                 |              |                  | Min.<br>最小<br>值 | Typ.<br>典型<br>值 | Max.<br>最大<br>值 |            |

**Static Characteristic**

**静态特性**

|                                                     |               |                               |                    |      |     |     |         |
|-----------------------------------------------------|---------------|-------------------------------|--------------------|------|-----|-----|---------|
| Collector-emitter breakdown voltage<br>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<br>集电极-发射极饱和电压 | $V_{CEsat}$   | $V_{GE}=15V, I_C=30A$         | $T_j=25^{\circ}C$  | -    | 1.5 | 2.1 | V       |
|                                                     |               |                               | $T_j=150^{\circ}C$ | -    | 1.9 | -   | V       |
| Diode forward voltage<br>二极管正向电压                    | $V_F$         | $V_{GE}=0V, I_F=30A$          | $T_j=25^{\circ}C$  | -    | 1.8 | 2.2 | V       |
|                                                     |               |                               | $T_j=150^{\circ}C$ | -    | 1.7 | -   | V       |
| Gate-emitter threshold voltage<br>栅极-发射极阈值电压        | $V_{GE(th)}$  | $I_C=300\mu A, V_{CE}=V_{GE}$ |                    | 4    | 4.6 | 6   | V       |
| Collector-emitter cut-off current<br>集电极-发射极截止电流    | $I_{CES}$     | $V_{CE}=650V, V_{GE}=0V$      |                    | -    | -   | 100 | $\mu A$ |
| Gate-emitter leakage current<br>栅极-发射极漏电流           | $I_{GES}$     | $V_{CE}=0V, V_{GE}=\pm 20V$   |                    | -100 | -   | 100 | nA      |

**Dynamic Characteristic**

**动态特性**

|                                        |           |                                                  |   |      |   |          |
|----------------------------------------|-----------|--------------------------------------------------|---|------|---|----------|
| Input capacitance<br>输入电容              | $C_{ies}$ | $V_{CE}=25V,$<br>$V_{GE}=0V,$<br>$f=1\text{MHz}$ | - | 1400 | - | pF       |
| Output capacitance<br>输出电容             | $C_{oes}$ |                                                  | - | 82   | - | pF       |
| Reverse transfer capacitance<br>反向传输电容 | $C_{res}$ |                                                  | - | 15   | - | pF       |
| Gate charge<br>门极电阻                    | $R_G$     | $V_{GE}=0V,$<br>$V_{CE}=0V,$<br>$f=1\text{MHz}$  | - | 4.4  | - | $\Omega$ |



**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<br>参数 | Symbol<br>符号 | Conditions<br>条件 | Value<br>值      |                 |                 | Unit<br>单位 |
|-----------------|--------------|------------------|-----------------|-----------------|-----------------|------------|
|                 |              |                  | Min.<br>最小<br>值 | Typ.<br>典型<br>值 | Max.<br>最大<br>值 |            |

**IGBT Characteristic**

**IGBT 特性**

|                                 |              |                                                                                                                                                                        |   |      |   |    |
|---------------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|---|----|
| Turn-on delay time<br>开通延迟时间    | $t_{d(on)}$  | $V_{CE}=400V$ ,<br>$I_C=30A$ ,<br>$V_{GE}=15V$ ,<br>$R_G=10\Omega$ ,<br>$T_j=25^\circ\text{C}$ ,<br><br>Energy losses include<br>"tail" and diode<br>reverse recovery. | - | 23   | - | ns |
| Rise time<br>上升时间               | $t_r$        |                                                                                                                                                                        | - | 48   | - | ns |
| Turn-off delay time<br>关断延迟时间   | $t_{d(off)}$ |                                                                                                                                                                        | - | 91   | - | ns |
| Fall time<br>下降时间               | $t_f$        |                                                                                                                                                                        | - | 18   | - | ns |
| Turn-on energy<br>开通损耗          | $E_{on}$     |                                                                                                                                                                        | - | 0.72 | - | mJ |
| Turn-off energy<br>关断损耗         | $E_{off}$    |                                                                                                                                                                        | - | 0.40 | - | mJ |
| Total switching energy<br>总开关损耗 | $E_{ts}$     |                                                                                                                                                                        | - | 1.12 | - | mJ |

**Anti-Parallel Diode Characteristic**

**反并联二极管特性**

|                                           |           |                                                         |   |      |   |               |
|-------------------------------------------|-----------|---------------------------------------------------------|---|------|---|---------------|
| Reverse recovery time<br>反向恢复时间           | $t_{rr}$  | $V_R=400V$ ,<br>$I_F=30A$ ,<br>$T_j=25^\circ\text{C}$ , | - | 102  | - | ns            |
| Reverse recovery charge<br>反向恢复电荷         | $Q_{rr}$  |                                                         | - | 0.63 | - | $\mu\text{C}$ |
| Peak reverse recovery current<br>反向恢复峰值电流 | $I_{rrm}$ |                                                         | - | 10.6 | - | A             |
| Reverse recovered energy<br>反向恢复损耗        | $E_{rec}$ |                                                         | - | 0.16 | - | mJ            |



**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<br>参数 | Symbol<br>符号 | Conditions<br>条件 | Value<br>值      |                 |                 | Unit<br>单位 |
|-----------------|--------------|------------------|-----------------|-----------------|-----------------|------------|
|                 |              |                  | Min.<br>最小<br>值 | Typ.<br>典型<br>值 | Max.<br>最大<br>值 |            |

**IGBT Characteristic**

**IGBT 特性**

|                                 |              |                                                                                                                                                                                       |   |      |   |    |
|---------------------------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|---|----|
| Turn-on delay time<br>开通延迟时间    | $t_{d(on)}$  | $V_{CE}=400\text{V},$<br>$I_C=30\text{A},$<br>$V_{GE}=15\text{V},$<br>$R_G=10\Omega,$<br>$T_j=150^{\circ}\text{C},$<br>Energy losses include<br>“tail” and diode<br>reverse recovery. | - | 23   | - | ns |
| Rise time<br>上升时间               | $t_r$        |                                                                                                                                                                                       | - | 48   | - | ns |
| Turn-off delay time<br>关断延迟时间   | $t_{d(off)}$ |                                                                                                                                                                                       | - | 105  | - | ns |
| Fall time<br>下降时间               | $t_f$        |                                                                                                                                                                                       | - | 53   | - | ns |
| Turn-on energy<br>开通损耗          | $E_{on}$     |                                                                                                                                                                                       | - | 1.03 | - | mJ |
| Turn-off energy<br>关断损耗         | $E_{off}$    |                                                                                                                                                                                       | - | 0.55 | - | mJ |
| Total switching energy<br>总开关损耗 | $E_{ts}$     |                                                                                                                                                                                       | - | 1.58 | - | mJ |

**Anti-Parallel Diode Characteristic**

**反并联二极管特性**

|                                           |           |                                                                      |   |      |   |               |
|-------------------------------------------|-----------|----------------------------------------------------------------------|---|------|---|---------------|
| Reverse recovery time<br>反向恢复时间           | $t_{rr}$  | $V_R=400\text{V},$<br>$I_F=30\text{A},$<br>$T_j=150^{\circ}\text{C}$ | - | 276  | - | ns            |
| Reverse recovery charge<br>反向恢复电荷         | $Q_{rr}$  |                                                                      | - | 1.90 | - | $\mu\text{C}$ |
| Peak reverse recovery current<br>反向恢复峰值电流 | $I_{rrm}$ |                                                                      | - | 17.9 | - | A             |
| Reverse recovered energy<br>反向恢复损耗        | $E_{rec}$ |                                                                      | - | 0.57 | - | mJ            |



## Typical Characteristics Diagrams

### 特性曲线

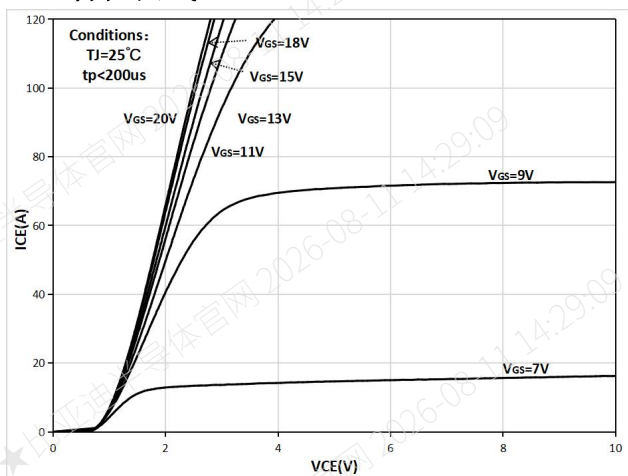


Figure 1. Typical output characteristic ( $T_j=25^\circ\text{C}$ )

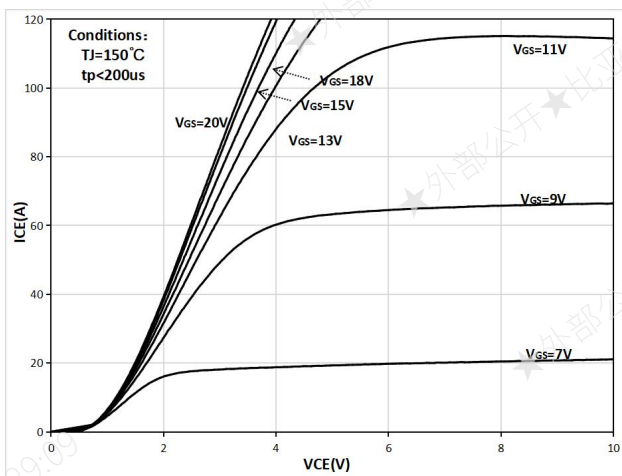


Figure 2. Typical output characteristic ( $T_j=150^\circ\text{C}$ )

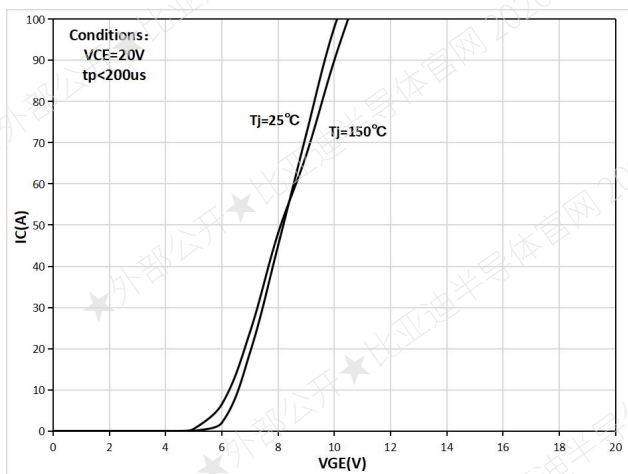


Figure 3. Typical transfer characteristic ( $V_{CE}=20\text{V}$ )

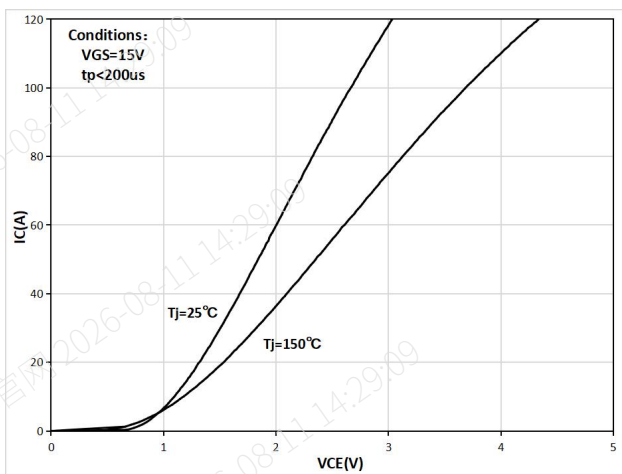


Figure 4. Typical collector current as a function of collector-emitter saturation voltage ( $V_{GE}=15\text{V}$ )

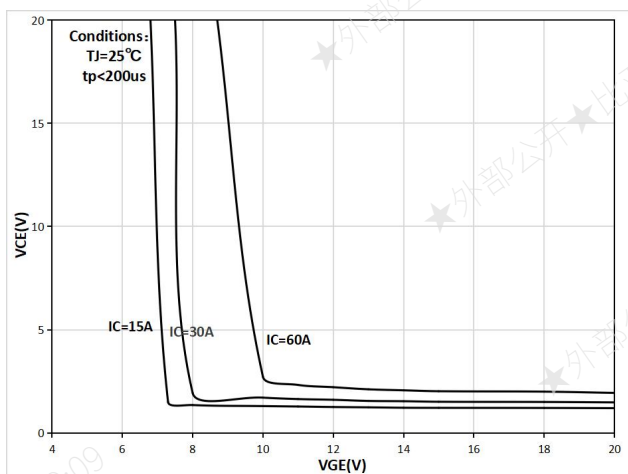


Figure 5. Typical collector-emitter saturation voltage as a function of gate-emitter voltage ( $T_j=25^\circ\text{C}$ )

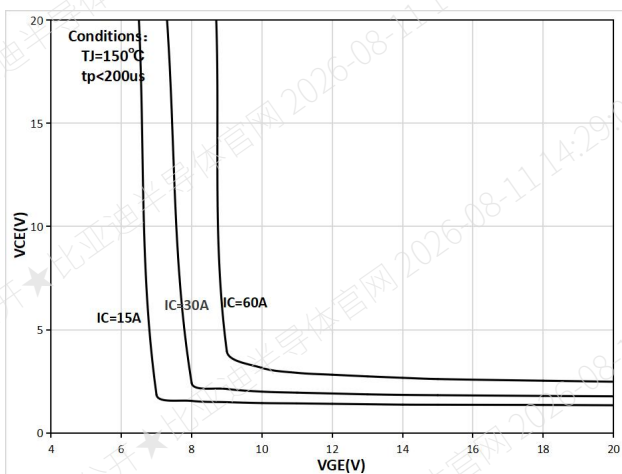


Figure 6. Typical collector-emitter saturation voltage as a function of gate-emitter voltage ( $T_j=150^\circ\text{C}$ )

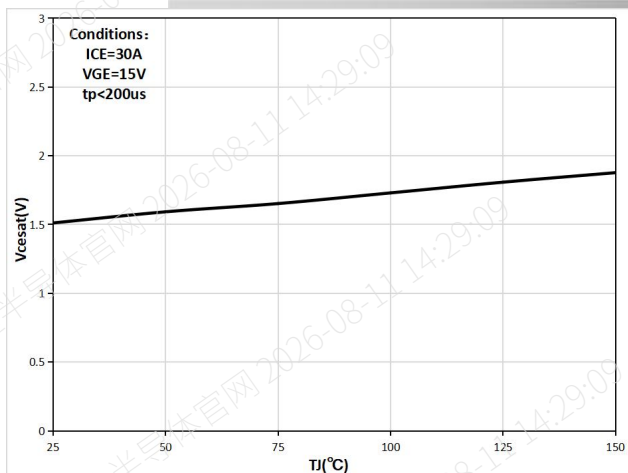


Figure 7. Typical collector-emitter saturation voltage as a function of junction temperature ( $V_{GE}=15V$ )

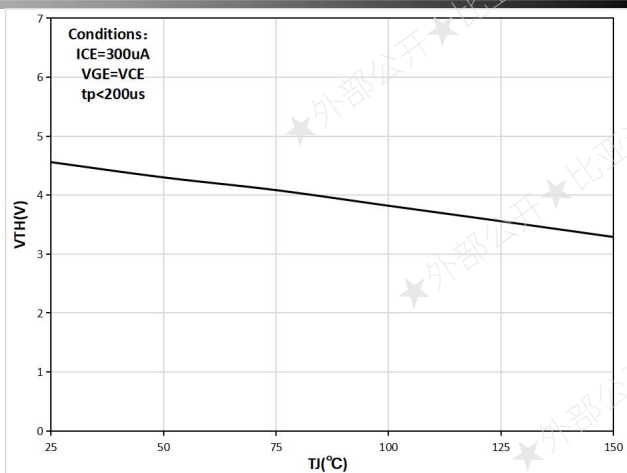


Figure 8. Gate-emitter threshold voltage as a function of junction temperature

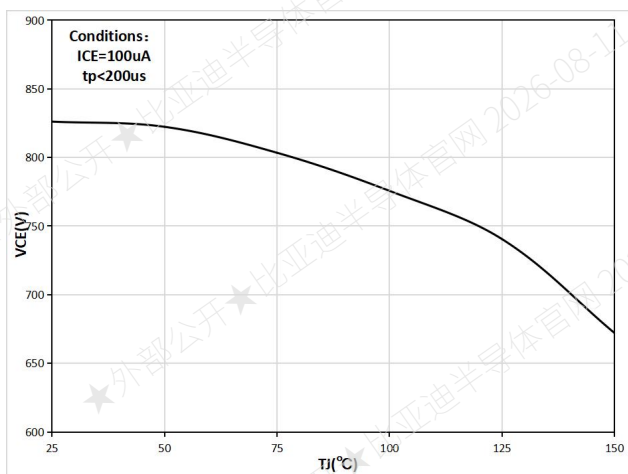


Figure 9. Collector-Emitter breakdown voltage as a function junction temperature ( $I_C=100uA$ )

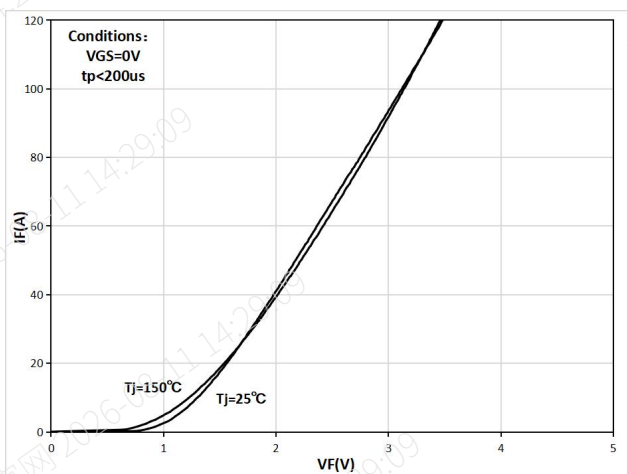


Figure 10. Typical diode forward current as a function of forward voltage

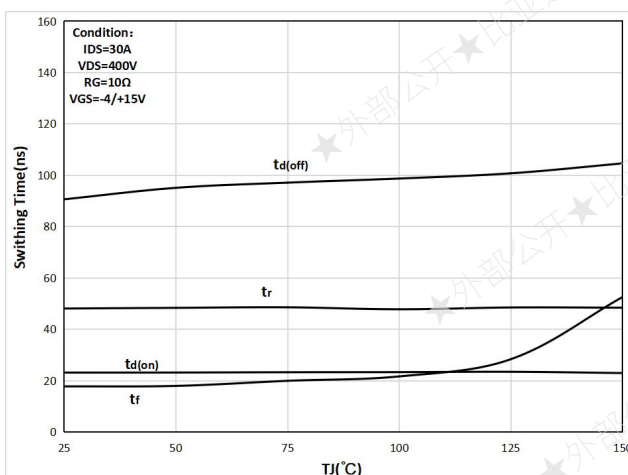


Figure 11. Typical switching time as a function of junction temperature  
( $V_{CE}=400V, I_C=30A, V_{GE}=15V, R_G=10\Omega$ )

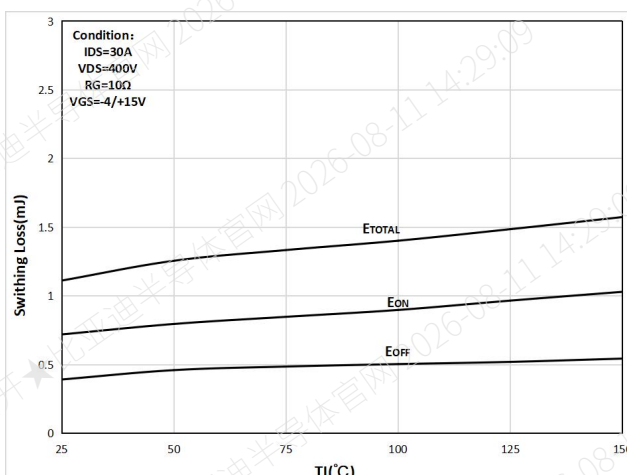


Figure 12. Typical switching energy losses as a function of junction temperature  
( $V_{CE}=400V, I_C=30A, V_{GE}=15V, R_G=10\Omega$ )

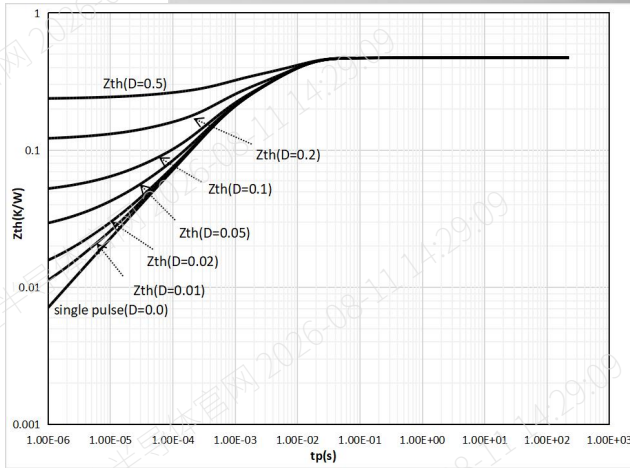


Figure 13.IGBT Transient thermal impedance as a function of pulse width( $D=t_p/T$ )

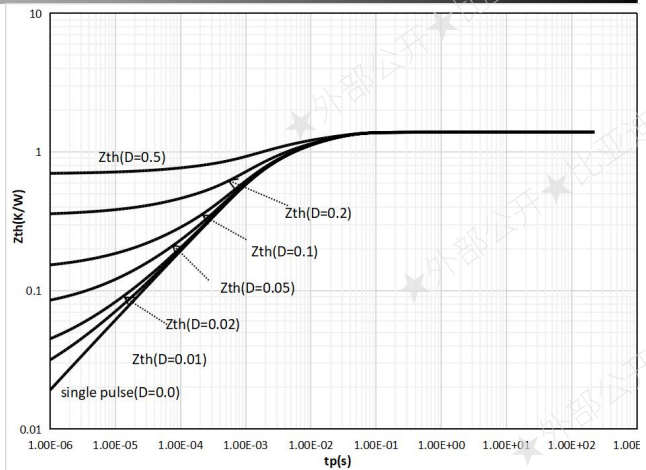
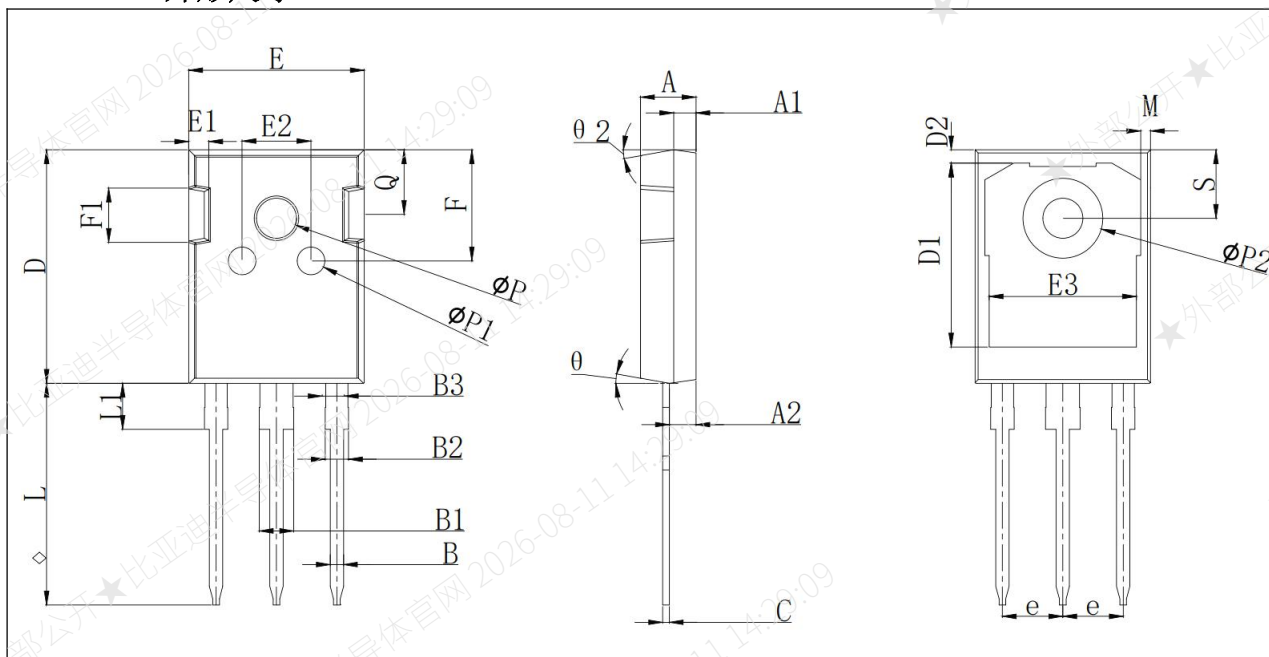


Figure 14.Diode Transient thermal impedance as a function of pulse width( $D=t_p/T$ )



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  | $\phi P$   | 3.50  | 3.70  |
| C      | 0.50  | 0.70  | $\phi P1$  | 2.40  | 3.10  |
| D      | 20.30 | 21.10 | $\phi P2$  | 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 | $\theta$   | 1°    | 11°   |
| E1     | 1.20  | 2.60  | $\theta 2$ | 9°    | 23°   |
| E2     | 6.10  | 8.20  |            |       |       |

Note: Please note that molds can vary between packaging plants. For definitive specifications, please refer to the physical 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<br>包装 | pcs/tube<br>个/料管 | tube/inner box<br>料管/内盒 | inner box/carton<br>内盒/箱 | pcs/carton<br>个/箱 |
|---------------|------------------|-------------------------|--------------------------|-------------------|
| 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:  $20\pm 5^{\circ}\text{C}$ ; 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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- **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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prevention, to design and maintain a safe and stable system environment. Customers must verify all functionalities described in this specification before or during actual application to ensure product suitability, safety (preventing potential accidents, fires, or public harm etc.), and reliability. It is recommended that Customers consult our company prior to testing to confirm whether the product information adequately covers the application requirements.

任何超出本文件中建议存储条件、使用条件及绝对最大额定参数条件（或部分明确值）使用，造成的产品损坏或连带事故发生，本公司不承担相关责任。当客户在使用产品时，应根据最新版本文件上规定的操作步骤或说明条件进行使用或测试。客户有责任遵从安全规则（包括冗余设计、防火措施、故障预防等）设计安全及稳定的系统环境，在实际应用前、或实际应用中验证本文件所述的任何功能，以确保适用性、安全性（预防可能发生的任何事故、火灾或社会伤害等）及可靠性。建议客户在测试前可咨询本公司，以验证产品信息是否可以涵盖应用需求。

- **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.**

本产品不能且禁止应用在一些需要更高稳定性及质量的特殊设备上，以免导致人员伤亡等意外发生，包括原子能控制设备，飞机及航空器件，船舶、轨道等运输设备，交通信号设备，燃烧控制设备，医药设备以及所有安全性设备等。客户应通过本公司或经本公司授权的渠道购买正品，并应在法律约束范围内及本文件明确条件下合法、合理使用，否则造成损失与伤害的，本公司概不负责。

- The information presented in this specification constitutes the latest product details compiled and recorded by our Company with reasonable efforts at the time of publication. To ensure greater accuracy, our Company reserves the right to make periodic corrections, modifications, and version updates to this specification without prior notice. Customers should always refer to the latest version when using or consulting this document.

本文件示明信息，均为发布时本公司尽合理努力整理并记录的产品最新信息。为提供更加准确的信息，本公司保留对本文件不定期勘误修改及版本更新的权利。客户在使用或参阅时，请使用最新版本。

- 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。