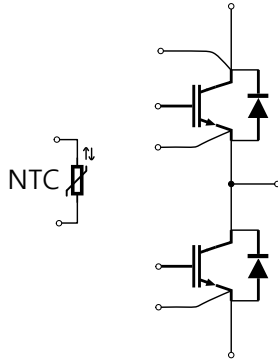


# GCV600GX120HBB3

## 等效电路原理图

### Equivalent Circuit Schematic



600A/1200V

## 说明

翠展 IGBT 功率模块具有超低的导通损耗以及良好的短路可靠性。该产品是为通用逆变器以及不间断电源等应用所设计。

## Description

GRECON IGBT Power Module provides ultra low conduction loss as well as short circuit ruggedness. They are designed for the applications such as general inverters and UPS.

## 典型应用

- 电动汽车
- 大功率变频器
- 风力涡轮机

## Typical Applications

- Automotive Applications
- High power converters
- Wind Turbines

## 电气特性

- 最大结温 175°C
- 正温度系数  $V_{CEsat}$
- 低  $V_{CEsat}$
- 低开关损耗

## Electrical Features

- Maximum junction temperature 175°C
- $V_{CEsat}$  with positive Temperature Coefficient
- Low  $V_{CEsat}$
- Low Switching Losses

## 机械特性

- 高功率循环和温度循环能力
- 铜基板
- 集成 NTC 温度传感器
- 标准封装

## Mechanical Features

- High Power and Thermal Cycling Capability
- Copper Base Plate
- Integrated NTC temperature sensor
- Standard Housing

IGBT,逆变器 / IGBT,Inverter

最大额定值 / Maximum Rated Values

| Parameter                                      | Symbol       | Conditions                                   | Value    | Unit |
|------------------------------------------------|--------------|----------------------------------------------|----------|------|
| 集电极-发射极电压<br>Collector-emitter voltage         | $V_{CES}$    | $T_{vj}=25^{\circ}C$                         | 1200     | V    |
| 集电极电流<br>Implemented collector current         | $I_{CN}$     |                                              | 600      | A    |
| 连续集电极直流电流<br>Continuous DC collector current   | $I_{C\ nom}$ | $T_C=100^{\circ}C, T_{vj\ max}=175^{\circ}C$ | 600      | A    |
| 集电极重复峰值电流<br>Repetitive peak collector current | $I_{CRM}$    | $t_p$ limited by $T_{vj\ max}$               | 1200     | A    |
| 总功率损耗<br>Total power dissipation               | $P_{tot}$    | $T_C=25^{\circ}C, T_{vj\ max}=175^{\circ}C$  | 2679     | W    |
| 栅极-发射极峰值电压<br>Gate-emitter peak voltage        | $V_{GES}$    |                                              | $\pm 20$ | V    |

特征值 / Characteristic Values

| Parameter                                           | Symbol        | Conditions                                               | Value |       |     | Unit     |
|-----------------------------------------------------|---------------|----------------------------------------------------------|-------|-------|-----|----------|
|                                                     |               |                                                          | Min   | Typ   | Max |          |
| 栅极阈值电压<br>Gate threshold voltage                    | $V_{GEth}$    | $V_{GE}=V_{CE}, I_C=23mA,$<br>$T_{vj}=25^{\circ}C$       |       | 6.00  | 6.5 | V        |
| 栅极-发射极漏电流<br>Gate-emitter leakage current           | $I_{GES}$     | $V_{CE}=0V, V_{GE}=20V,$<br>$T_{vj}=25^{\circ}C$         |       |       | 200 | nA       |
| 集电极-发射极截止电流<br>Collector-emitter cut-off current    | $I_{CES}$     | $V_{CE}=1200V, V_{GE}=0V,$<br>$T_{vj}=25^{\circ}C$       |       |       | 1   | mA       |
| 集电极-发射极饱和电压<br>Collector-emitter saturation voltage | $V_{CE\ sat}$ | $I_C=600A, V_{GE}=15V, T_{vj}=25^{\circ}C$               |       | 1.65  |     | V        |
|                                                     |               | $I_C=600A, V_{GE}=15V, T_{vj}=150^{\circ}C$              |       | 2.10  |     |          |
|                                                     |               | $I_C=600A, V_{GE}=15V, T_{vj}=175^{\circ}C$              |       | 2.20  |     |          |
| 内部栅极电阻<br>Internal gate resistance                  | $R_{gint}$    | $T_{vj}=25^{\circ}C$                                     |       | 1.50  |     | $\Omega$ |
| 栅极电荷<br>Gate charge                                 | $Q_G$         | $V_{GE}=-8V\sim +15V, V_{CE}=600V$                       |       | 2.85  |     | $\mu C$  |
| 输入电容<br>Input capacitance                           | $C_{ies}$     | $V_{CE}=25V, V_{GE}=0V, f=1MHz,$<br>$T_{vj}=25^{\circ}C$ |       | 190.5 |     | nF       |
| 输出电容<br>Output capacitance                          | $C_{oes}$     |                                                          |       | 3.25  |     |          |
| 反向传输电容<br>Reverse transfer capacitance              | $C_{res}$     |                                                          |       | 10.1  |     |          |

| Parameter                                            | Symbol       | Conditions                                                                                                                                               | Value |       |     | Unit |
|------------------------------------------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|-----|------|
|                                                      |              |                                                                                                                                                          | Min   | Typ   | Max |      |
| 开通延迟时间（电感负载）<br>Turn-on delay time , inductive load  | $t_{d\ on}$  | $I_c=600A, V_{CE}=600V$<br>$R_{gon}=R_{goff}=2.0\Omega$<br>$V_{GE}=-8V/+15V$<br>$di/dt_{on}=1700A/us$<br>$dv/dt_{off}=5530V/us$<br>$T_{vj}=25^{\circ}C$  |       | 538.7 |     | ns   |
| 上升时间（电感负载）<br>Rise time , inductive load             | $t_r$        |                                                                                                                                                          |       | 307.3 |     |      |
| 关断延迟时间（电感负载）<br>Turn-off delay time , inductive load | $t_{d\ off}$ |                                                                                                                                                          |       | 951.5 |     |      |
| 下降时间（电感负载）<br>Fall time , inductive load             | $t_f$        |                                                                                                                                                          |       | 144.5 |     |      |
| 开通损耗能量（每脉冲）<br>Turn-on energy loss per pulse         | $E_{on}$     |                                                                                                                                                          |       | 85.5  |     | mJ   |
| 关断损耗能量（每脉冲）<br>Turn-off energy loss per pulse        | $E_{off}$    |                                                                                                                                                          |       | 42.1  |     |      |
| 开通延迟时间（电感负载）<br>Turn-on delay time , inductive load  | $t_{d\ on}$  | $I_c=600A, V_{CE}=600V$<br>$R_{gon}=R_{goff}=2.0\Omega$<br>$V_{GE}=-8V/+15V$<br>$di/dt_{on}=1650A/us$<br>$dv/dt_{off}=4850V/us$<br>$T_{vj}=150^{\circ}C$ |       | 511.6 |     | ns   |
| 上升时间（电感负载）<br>Rise time , inductive load             | $t_r$        |                                                                                                                                                          |       | 328.4 |     |      |
| 关断延迟时间（电感负载）<br>Turn-off delay time , inductive load | $t_{d\ off}$ |                                                                                                                                                          |       | 1022  |     |      |
| 下降时间（电感负载）<br>Fall time , inductive load             | $t_f$        |                                                                                                                                                          |       | 258   |     |      |
| 开通损耗能量（每脉冲）<br>Turn-on energy loss per pulse         | $E_{on}$     |                                                                                                                                                          |       | 150.6 |     | mJ   |
| 关断损耗能量（每脉冲）<br>Turn-off energy loss per pulse        | $E_{off}$    |                                                                                                                                                          |       | 61.1  |     |      |
| 开通延迟时间（电感负载）<br>Turn-on delay time , inductive load  | $t_{d\ on}$  | $I_c=600A, V_{CE}=600V$<br>$R_{gon}=R_{goff}=2.0\Omega$<br>$V_{GE}=-8V/+15V$<br>$di/dt_{on}=1550A/us$<br>$dv/dt_{off}=4600V/us$<br>$T_{vj}=175^{\circ}C$ |       | 495.3 |     | ns   |
| 上升时间（电感负载）<br>Rise time , inductive load             | $t_r$        |                                                                                                                                                          |       | 342.7 |     |      |
| 关断延迟时间（电感负载）<br>Turn-off delay time , inductive load | $t_{d\ off}$ |                                                                                                                                                          |       | 1044  |     |      |
| 下降时间（电感负载）<br>Fall time , inductive load             | $t_f$        |                                                                                                                                                          |       | 304.5 |     |      |
| 开通损耗能量（每脉冲）<br>Turn-on energy loss per pulse         | $E_{on}$     |                                                                                                                                                          |       | 172.4 |     | mJ   |
| 关断损耗能量（每脉冲）<br>Turn-off energy loss per pulse        | $E_{off}$    |                                                                                                                                                          |       | 66.1  |     |      |

| Parameter                                          | Symbol             | Conditions                                                                                                              | Value |      |       | Unit |
|----------------------------------------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------|-------|------|-------|------|
|                                                    |                    |                                                                                                                         | Min   | Typ  | Max   |      |
| 短路数据<br>SC data                                    | I <sub>SC</sub>    | t <sub>p</sub> ≤8us, V <sub>GE</sub> =15V,<br>V <sub>ce</sub> =800V, V <sub>CEM</sub> ≤1200V,<br>T <sub>vj</sub> =150°C |       | 3000 |       | A    |
| 结-壳热阻<br>Thermal resistance, junction to case      | R <sub>thJC</sub>  | 每个 IGBT / per IGBT<br>T <sub>C</sub> =25°C                                                                              |       |      | 0.056 | K/W  |
| 在开关状态下温度<br>Temperature under switching conditions | T <sub>vj op</sub> |                                                                                                                         | -40   |      | 150   | °C   |

二极管,逆变器 / Diode,Inverter

最大额定值 / Maximum Ratings

| Parameter                                   | Symbol    | Conditions                     | Value | Unit |
|---------------------------------------------|-----------|--------------------------------|-------|------|
| 反向重复峰值电压<br>Repetitive peak reverse voltage | $V_{RRM}$ | $T_{vj}=25^{\circ}C$           | 1200  | V    |
| 正向电流<br>Implemented forward current         | $I_{FN}$  |                                | 600   | A    |
| 连续正向直流电流<br>Continuous DC forward current   | $I_F$     |                                | 600   | A    |
| 正向重复峰值电流<br>Repetitive peak forward current | $I_{FRM}$ | $t_p$ limited by $T_{vj\ max}$ | 1200  | A    |

特征值 / Characteristic Values

| Parameter                                          | Symbol       | Conditions                                                           | Value |       |       | Unit        |
|----------------------------------------------------|--------------|----------------------------------------------------------------------|-------|-------|-------|-------------|
|                                                    |              |                                                                      | Min   | Typ   | Max   |             |
| 正向电压<br>Forward voltage                            | $V_F$        | $I_F=600A, V_{GE}=0V, T_{vj}=25^{\circ}C$                            |       | 2.25  |       | V           |
|                                                    |              | $I_F=600A, V_{GE}=0V, T_{vj}=150^{\circ}C$                           |       | 1.95  |       |             |
|                                                    |              | $I_F=600A, V_{GE}=0V, T_{vj}=175^{\circ}C$                           |       | 1.89  |       |             |
| 恢复电荷<br>Recovered charge                           | $Q_{rr}$     | $I_F=600A, V_R=600V$<br>$-di_F/dt=6850A/us$<br>$T_{vj}=25^{\circ}C$  |       | 39.5  |       | $\mu C$     |
| 反向恢复峰值电流<br>Peak reverse recovery current          | $I_{RRM}$    |                                                                      |       | 89.8  |       | A           |
| 反向恢复损耗（每脉冲）<br>Reverse recovery energy             | $E_{rec}$    |                                                                      |       | 8.9   |       | mJ          |
| 恢复电荷<br>Recovered charge                           | $Q_{rr}$     | $I_F=600A, V_R=600V$<br>$-di_F/dt=5600A/us$<br>$T_{vj}=150^{\circ}C$ |       | 140.6 |       | $\mu C$     |
| 反向恢复峰值电流<br>Peak reverse recovery current          | $I_{RRM}$    |                                                                      |       | 195.9 |       | A           |
| 反向恢复损耗（每脉冲）<br>Reverse recovery energy             | $E_{rec}$    |                                                                      |       | 46.5  |       | mJ          |
| 恢复电荷<br>Recovered charge                           | $Q_{rr}$     | $I_F=600A, V_R=600V$<br>$-di_F/dt=5350A/us$<br>$T_{vj}=175^{\circ}C$ |       | 175.6 |       | $\mu C$     |
| 反向恢复峰值电流<br>Peak reverse recovery current          | $I_{RRM}$    |                                                                      |       | 225.0 |       | A           |
| 反向恢复损耗（每脉冲）<br>Reverse recovery energy             | $E_{rec}$    |                                                                      |       | 57.2  |       | mJ          |
| 结-壳热阻<br>Thermal resistance,junction to case       | $R_{thJC}$   | 每个二极管 / per Diode<br>$T_C=25^{\circ}C$                               |       |       | 0.088 | K/W         |
| 在开关状态下温度<br>Temperature under switching conditions | $T_{vj\ op}$ |                                                                      | -40   |       | 150   | $^{\circ}C$ |

负温度系数热敏电阻 / NTC-Thermistor

特征值 / Characteristic Values

| Parameter                    | Symbol             | Conditions                                      | Value |      |     | Unit |
|------------------------------|--------------------|-------------------------------------------------|-------|------|-----|------|
|                              |                    |                                                 | Min   | Typ  | Max |      |
| 额定电阻值<br>Rated resistance    | R <sub>25</sub>    |                                                 |       | 5    |     | kΩ   |
| R100 偏差<br>Deviation of R100 | ΔR/R               | T <sub>c</sub> =100°C, R <sub>100</sub> =493.3Ω | -5    |      | 5   | %    |
| 耗散功率<br>Power dissipation    | P <sub>25</sub>    |                                                 |       |      | 20  | mW   |
| B-值<br>B-value               | B <sub>25/50</sub> | $R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$  |       | 3380 |     | K    |

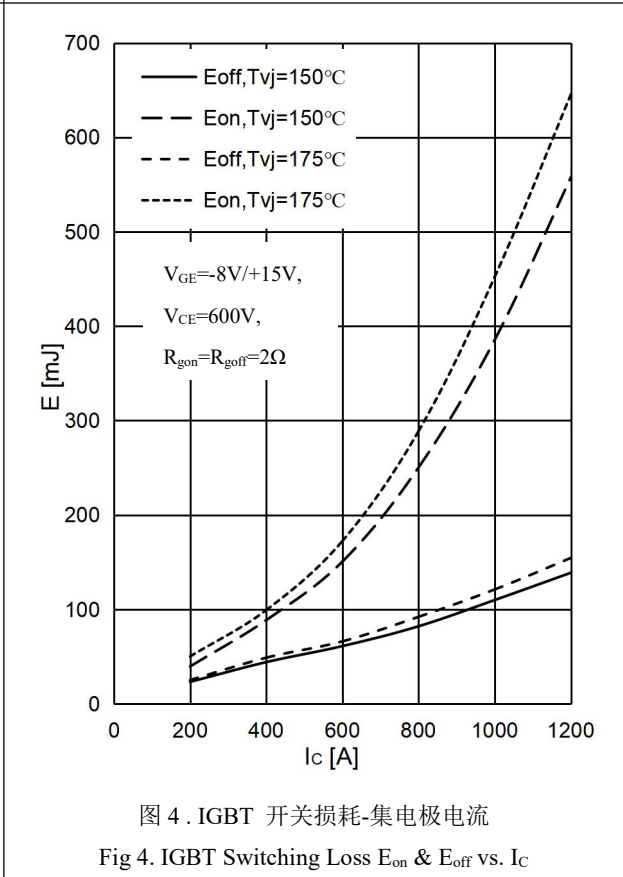
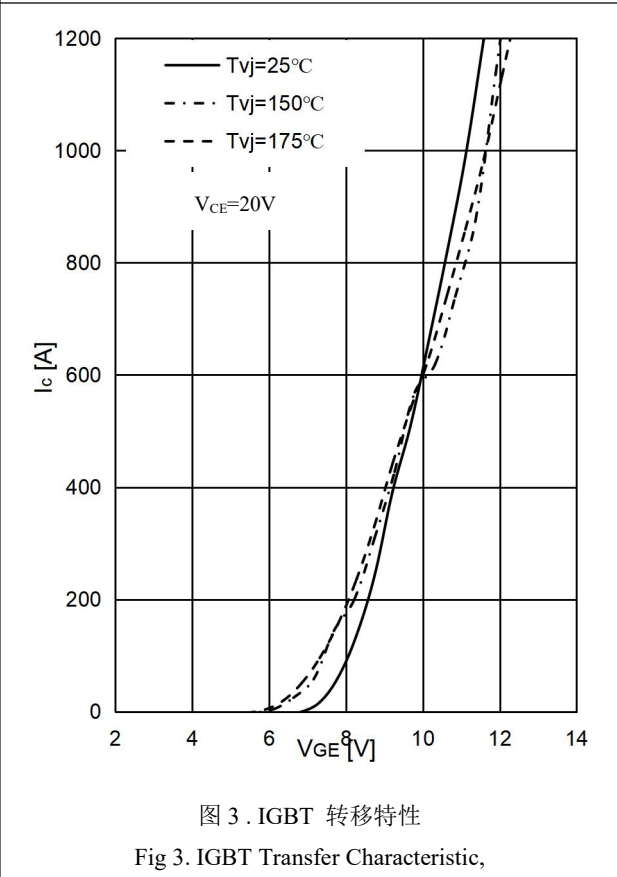
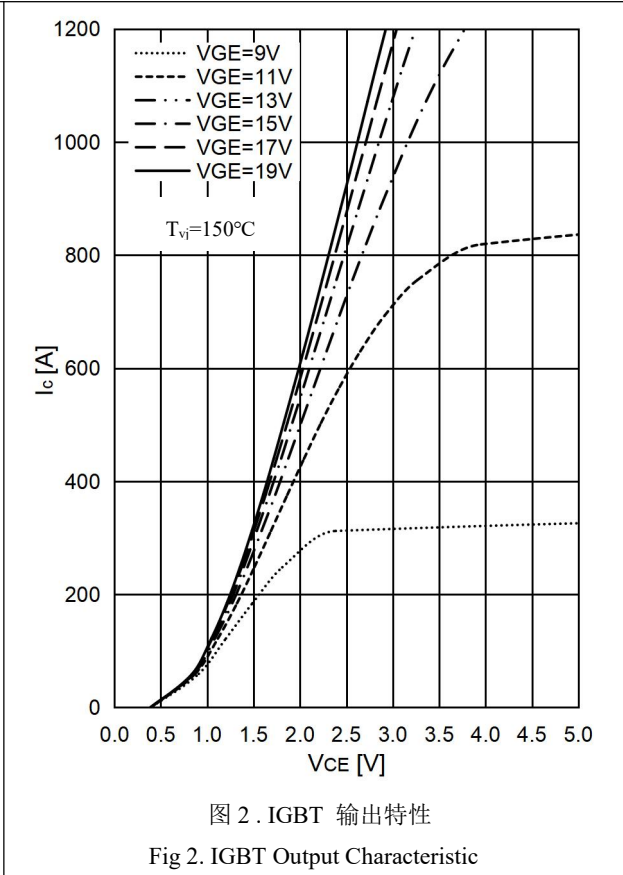
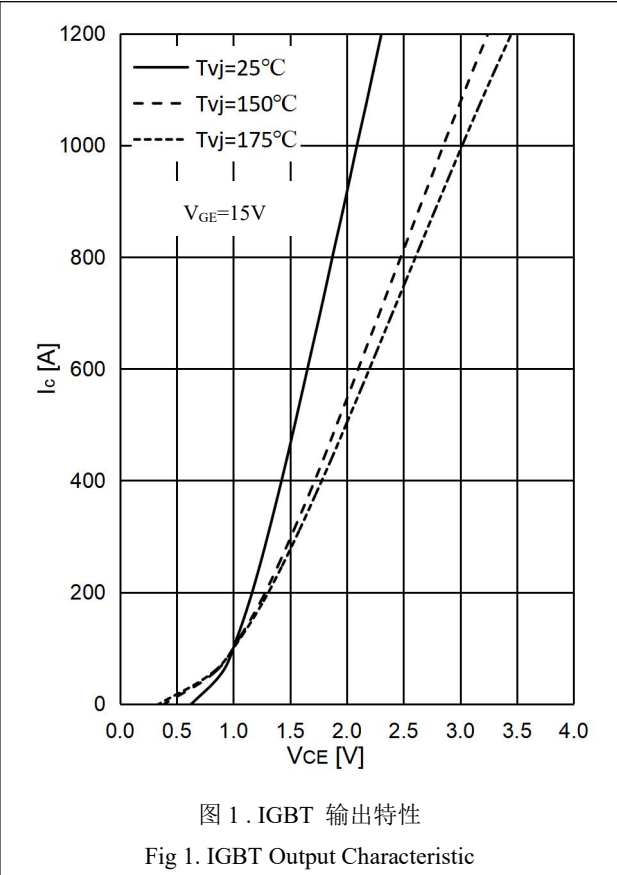
模块 / Module

特征值（除非另有说明，否则 T<sub>c</sub>=25°C）

Characteristic Values (T<sub>c</sub>=25°C unless otherwise specified)

| Parameter                                             | Symbol               | Conditions                                      | Value |      |     | Unit |
|-------------------------------------------------------|----------------------|-------------------------------------------------|-------|------|-----|------|
|                                                       |                      |                                                 | Min   | Typ  | Max |      |
| 绝缘电压<br>Isolation voltage                             | V <sub>isol</sub>    | RMS,t=1min, f=50Hz                              | 2500  |      |     | V    |
| 最大结温<br>Maximum junction temperature                  | T <sub>Jmax</sub>    |                                                 |       |      | 175 | °C   |
| 在开关状态下温度<br>Operating junction temperature            | T <sub>vj op</sub>   |                                                 | -40   |      | 150 | °C   |
| 储存温度<br>Storage temperature                           | T <sub>stg</sub>     |                                                 | -40   |      | 125 | °C   |
| 杂散电感（模块）<br>Stray inductance module                   | L <sub>CE</sub>      |                                                 |       | 20   |     | nH   |
| 模块引线电阻,端子-芯片<br>Module lead resistance,terminals-chip | R <sub>CC'+EE'</sub> | T <sub>c</sub> =25°C, 每个开关/per switch           |       | 1.00 |     | mΩ   |
| 模块安装扭矩<br>Mounting torque for module mounting         | M                    | M5 螺丝（底板到散热器）<br>Screw M5 baseplate to heatsink | 3.0   |      | 6.0 | N.m  |
|                                                       |                      | M6 螺丝(端子连接)<br>Screw M6 to terminal             |       |      |     |      |
| 模块重量 / Weight of module                               | G                    |                                                 |       | 350  |     | g    |

电气特性（曲线） / Electrical Characteristics (curves)



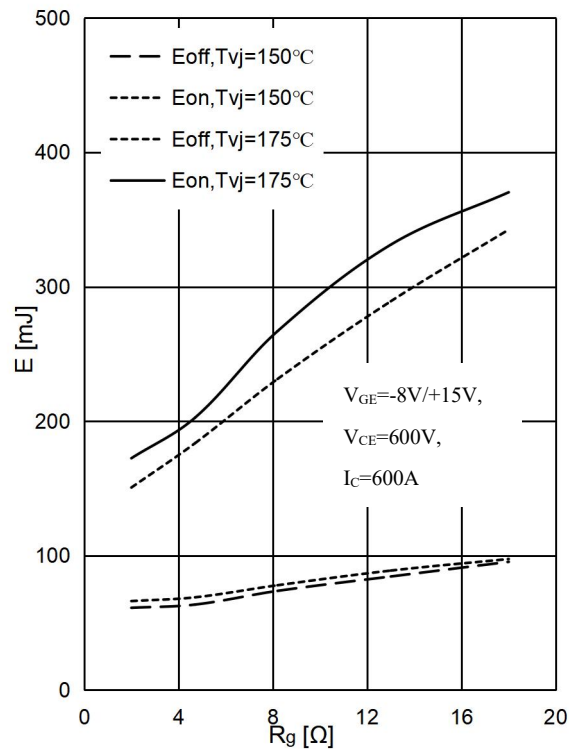


图 5 . IGBT 开关损耗-栅极电阻

Fig 5. IGBT Switching Loss  $E_{on}$  &  $E_{off}$  vs.  $R_G$ ,

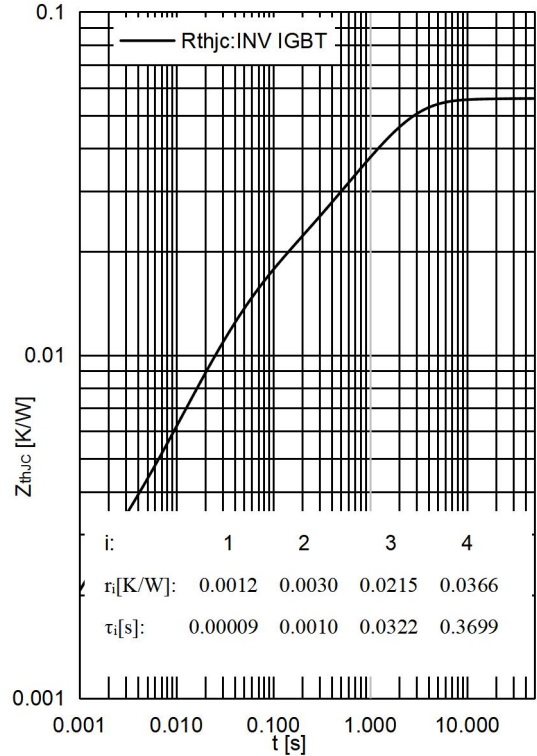


图 6 . IGBT 瞬态热阻抗

Fig 6. IGBT Transient thermal impedance

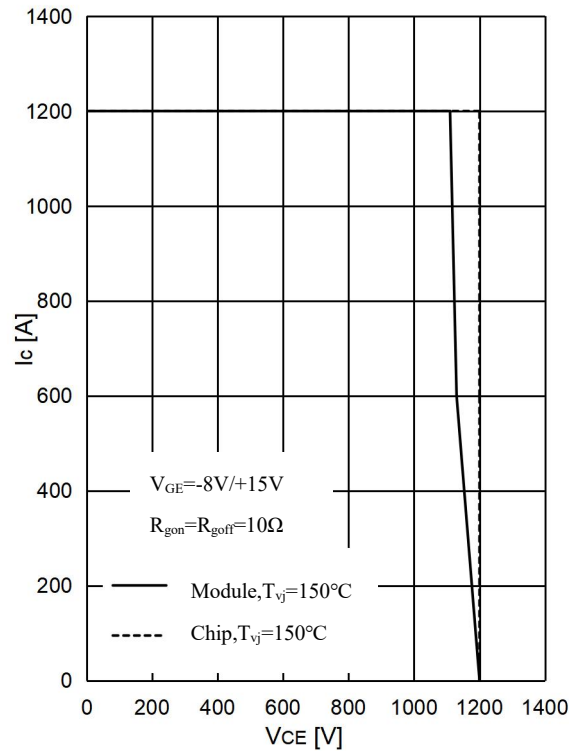


图 7 . IGBT 反偏安全工作区

Fig 7. IGBT RBSOA

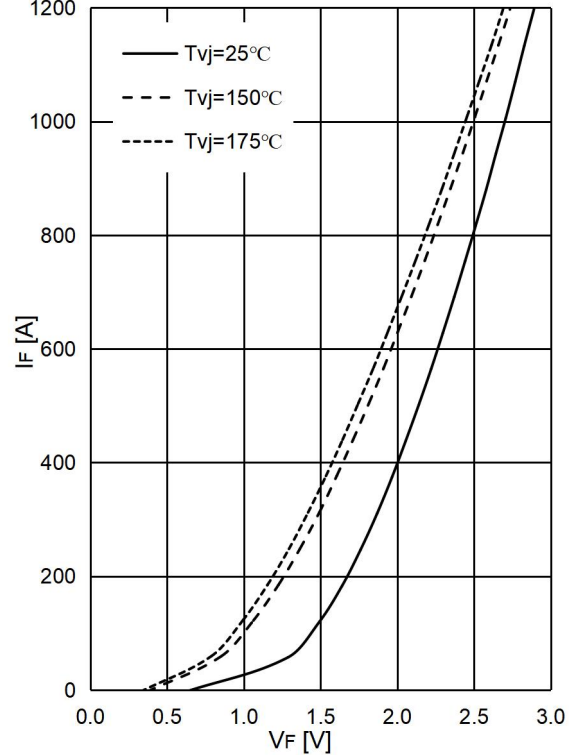


图 8 . 二极管 正向偏压特性

Fig 8. Diode Forward characteristic

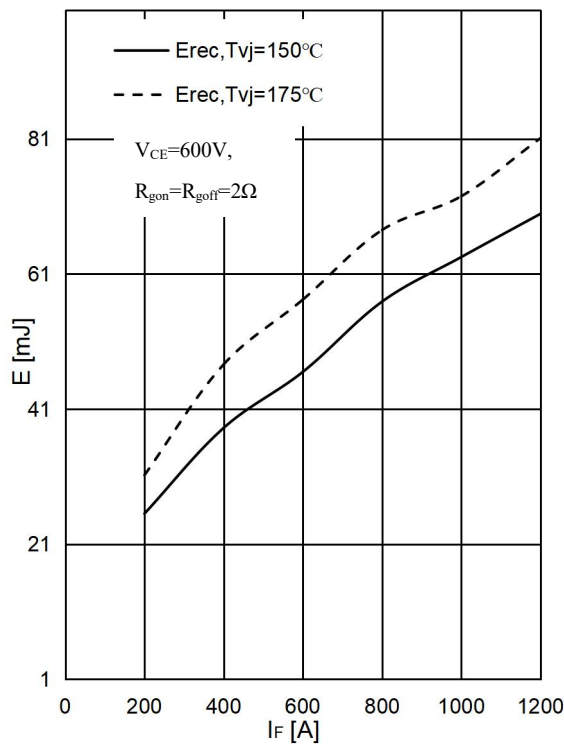


图 9 . 二极管 开关损耗-正向电流  
Fig 9. Diode Switching Loss  $E_{rec}$  vs.  $I_F$

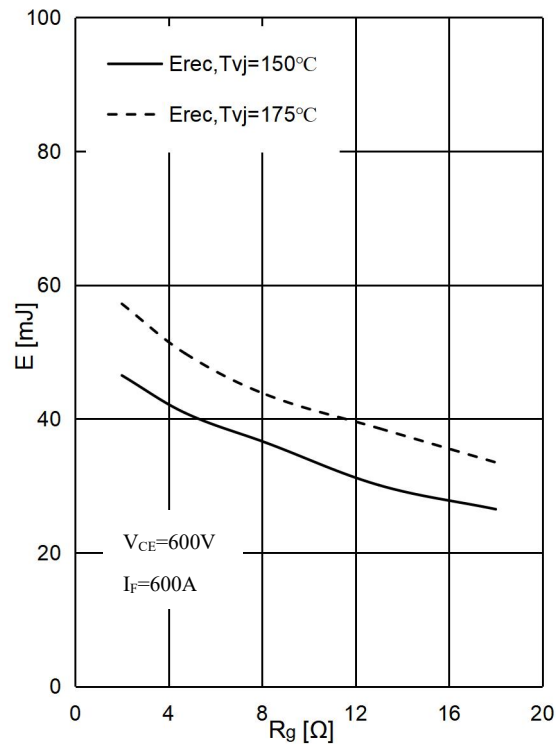


图 10 . 二极管 开关损耗-栅极电阻,  
Fig 10. Diode Switching Loss  $E_{rec}$  vs.  $R_G$

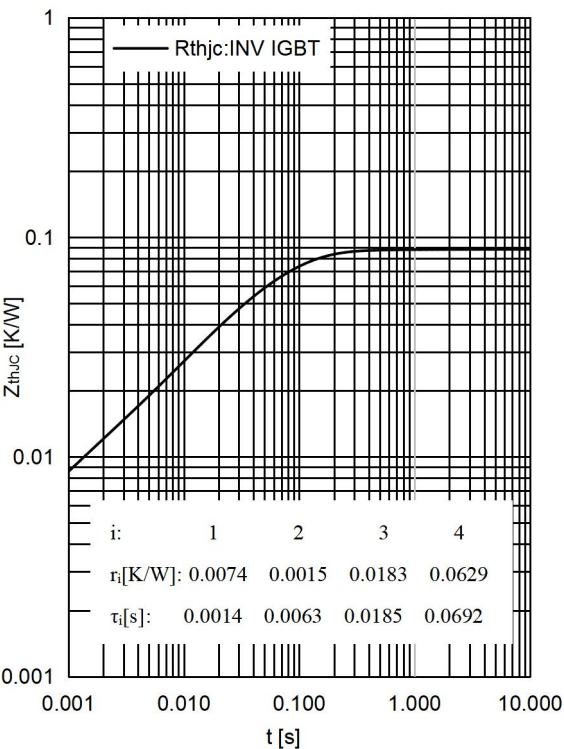


图 11 . 二极管 瞬态热阻抗  
Fig 11. Diode Transient thermal impedance

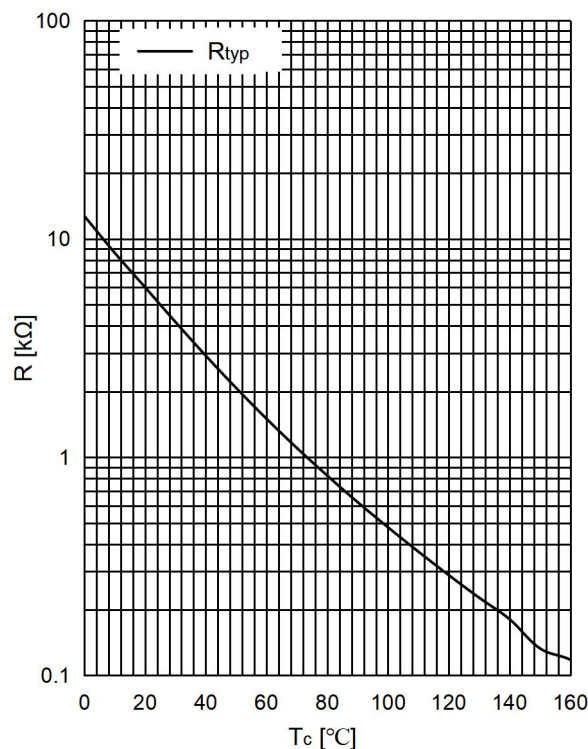
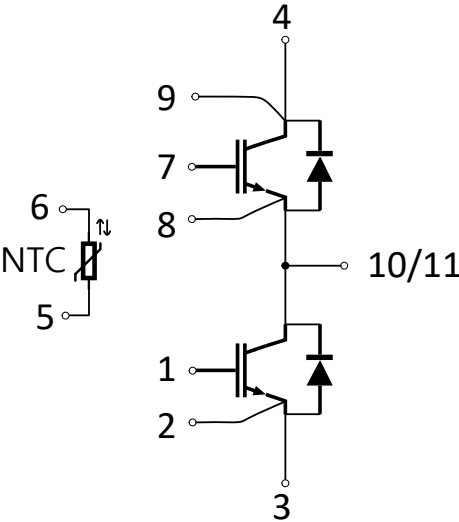
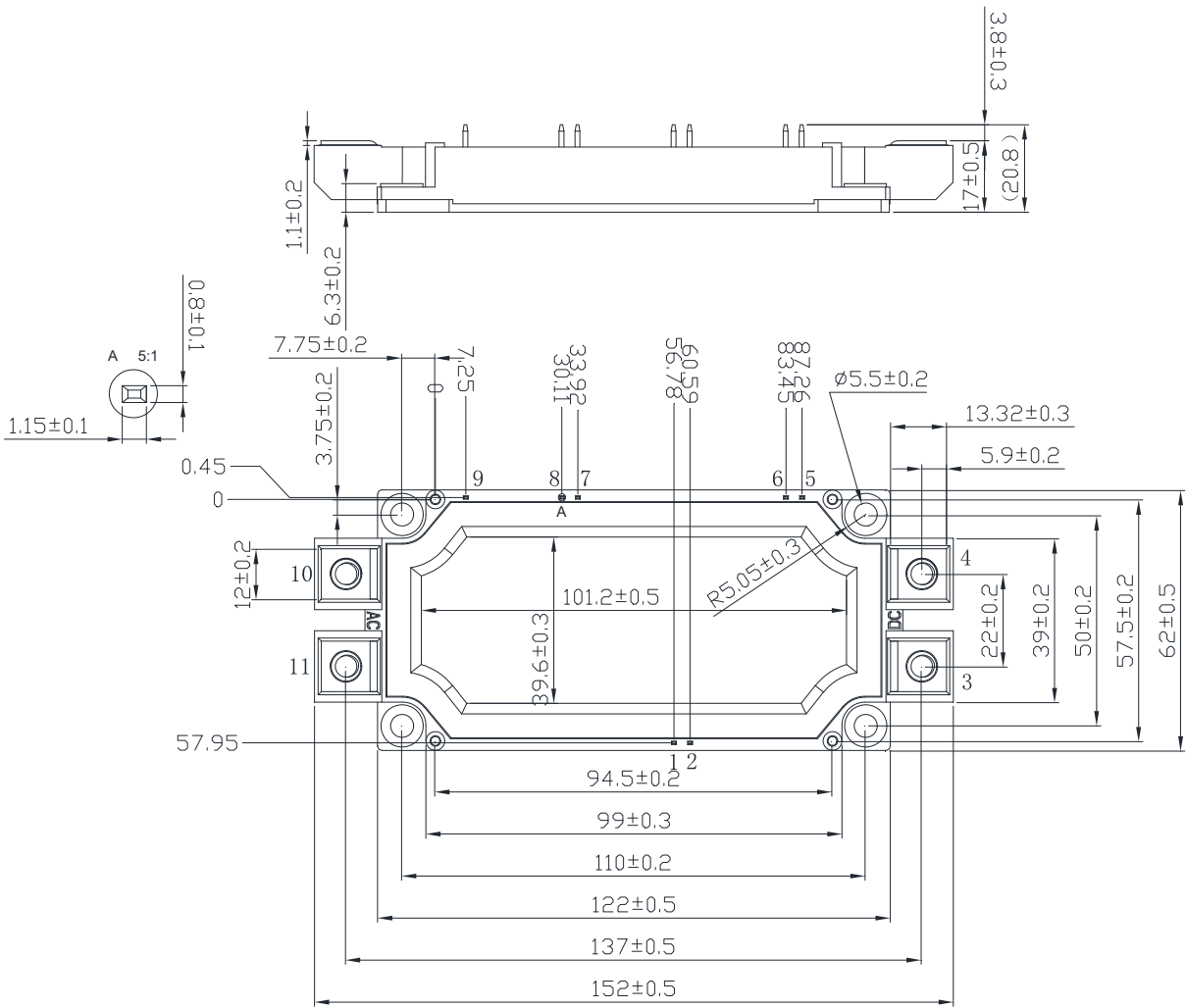


图 12 . 负温度系数热敏电阻 温度特性  
Fig 12. NTC-Thermistor-temperature characteristic

电路图 / Circuit Diagram



封装尺寸 / Package Dimensions



## 使用条件和条款:

本产品规格书中提供的一部分产品数据是产品的典型值，实际出厂测试的产品数据可能与典型值略有偏离，但我公司保证这些偏离不会影响产品的正常使用。如果产品信息发生变更，我公司会及时修订产品规格书，请随时关注我公司网站发布的产品手册信息。如果您有超出规格书所提供的产品信息的要求或者对我们的产品针对的特殊应用有疑虑的话，请联系我们负责您的销售部门(详情请查询[www.grecon-semi.com](http://www.grecon-semi.com))。对那些特别感兴趣的问题我们将提供相应的应用手册。由于技术需要，我们的产品可能含有危险物质。如果需要查询类似问题请联系我们负责您的销售部门。产品使用过程中，如有超出产品数据手册中所定义的产品极限温度、电压、电流或安全工作区范围的情况，我公司无法保证产品的应用可靠性。产品在使用时，严禁触碰。产品断电后，在确保无电荷残留、产品已冷却后，才可以在有静电防护措施的情况下触碰产品。如果您想将我们的产品用于航天，健康，危及生命或者生命维持等应用，请申明。

请注意，对这类应用我们强烈建议：

- 执行风险和质量评估；
- 签订质量协议；
- 进行规定的测试和产品出厂检查，我们可以根据测试的实际情况供货；

如果有必要，请根据实际需要将类似的说明给您的客户。我们将保留产品规格书的修改权。

## Terms & Conditions of usage

Some product data in the datasheet of this product are the typical values, the actual factory testing data may deviate slightly from typical values, but our company guarantees that these deviations will not affect the normal use of the product. If the product information changes, our company will promptly amend the datasheet, please keeps your attention to product information changing in our company website. Should you require product information in excess of the data given in this product data sheet or which concerns the specific application of our product, please contact the sales office, which is responsible for you (see [www.grecon-semi.com](http://www.grecon-semi.com)). For those that are specifically interested we may provide application notes. Due to technical requirements our product may contain dangerous substances. For information on the types in question please contact the sales office, which is responsible for you. During the application, if the working conditions are beyond the limitation of temperature, voltage, current or safe operating area of the product defined in the product datasheet, our company cannot guarantee the reliability of the product. When the products are in use, it is strictly prohibited to touch. After power off, to ensure that there is no residual charge and the products have been cooled before they can be touched. And all operations must be under ESD protection measures.

Should you intend to use the Product in aviation applications, in health or live endangering or life support applications, please notify. Please note, that for any such applications we urgently recommend:

- to perform joint Risk and Quality Assessments;
- the conclusion of Quality Agreements;
- to establish joint measures of an ongoing product survey, and that we may make delivery depended on the realization of any such measures.

If and to the extent necessary, please forward equivalent notices to your customers. Changes of this product data sheet are reserved.