

| 关键参数          |      | Key Parameters |   |
|---------------|------|----------------|---|
| $V_{CES}$     |      | 1700           | V |
| $V_{CE(sat)}$ | Typ. | 1.80           | V |
| $I_C$         | Max. | 300            | A |
| $I_{C(RM)}$   | Max. | 600            | A |

| 典型应用      | Typical Applications      |
|-----------|---------------------------|
| ● 风力发电    | Wind Turbines             |
| ● 充电装置    | Power Charging Equipment  |
| ● 无功补偿    | Smart Grid                |
| ● 高可靠性逆变器 | High Reliability Inverter |

| 特点                  | Features                           |
|---------------------|------------------------------------|
| ● 铜基板               | Cu Baseplate                       |
| ● 增强型氧化铝衬板          | Enhanced $Al_2O_3$ Substrates      |
| ● 高热循环能力            | High Thermal Cycling Capability    |
| ● 高浪涌电流             | High Surge Current                 |
| ● 10 $\mu$ s 短路承受能力 | 10 $\mu$ s Short Circuit Withstand |

## 电路结构 Circuit Configuration

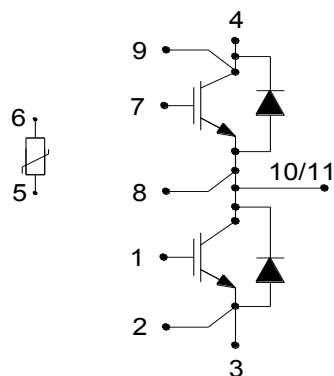


图 1.电路结构

Fig. 1 Circuit configuration

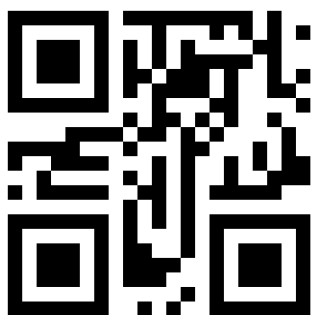
## 模块外形 Module Appearance



图 2. 模块外形

Fig. 2 Module appearance

## 模块标签说明



## Module Label Code Instruction

| 数据位置<br>Data position | 数据内容<br>Content of data       |
|-----------------------|-------------------------------|
| 1--8                  | 模块批次号<br>Module batch number  |
| 9--12                 | 模块序列号<br>Module serial number |
| 13--17                | 模块型号代码<br>Module type code    |

**最大额定值**
**Absolute Maximum Ratings**

| 符号<br>Symbol | 参数名称<br>Parameter                              | 测试条件<br>Test Conditions                                                                                              | 数值<br>Value | 单位<br>Unit            |
|--------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------|-----------------------|
| $V_{CES}$    | 集电极-发射极电压<br>Collector-emitter voltage         | $V_{GE} = 0V, T_C = 25\text{ }^{\circ}\text{C}$                                                                      | 1700        | V                     |
| $V_{GES}$    | 栅极-发射极电压<br>Gate-emitter voltage               | $T_C = 25\text{ }^{\circ}\text{C}$                                                                                   | $\pm 20$    | V                     |
| $I_C$        | 集电极电流<br>Collector-emitter current             | $T_C = 100\text{ }^{\circ}\text{C}, T_{vjmax} = 175\text{ }^{\circ}\text{C}$                                         | 300         | A                     |
| $I_{C(PK)}$  | 集电极峰值电流<br>Peak collector current              | $t_P = 1\text{ms}$                                                                                                   | 600         | A                     |
| $P_{max}$    | 晶体管部分最大损耗<br>Max. transistor power dissipation | $T_{vj} = 175\text{ }^{\circ}\text{C}, T_C = 25\text{ }^{\circ}\text{C}$                                             | 1875        | W                     |
| $\rho_t$     | 二极管 $\rho_t$ 值<br>Diode $\rho_t$               | $V_R = 0V, t_P = 10\text{ms}, T_{vj} = 150\text{ }^{\circ}\text{C}$                                                  | 22          | $\text{kA}^2\text{s}$ |
| $V_{isol}$   | 绝缘电压(模块)<br>Isolation voltage – per module     | 短接所有端子，端子与基板间施加电压<br>(Connected terminals to base plate),<br>AC RMS, 1 min, 50Hz, $T_C = 25\text{ }^{\circ}\text{C}$ | 3400        | V                     |

**热和机械数据**
**Thermal & Mechanical Data**

| 参数<br>Symbol                                 | 说明<br>Explanation              | 值<br>Value | 单位<br>Unit |
|----------------------------------------------|--------------------------------|------------|------------|
| 爬电距离<br>Creepage distance                    | 端子-散热器<br>Terminal to heatsink | 15.0       | mm         |
|                                              | 端子-端子<br>Terminal to terminal  | 13.0       | mm         |
| 绝缘间隙<br>Clearance                            | 端子-散热器<br>Terminal to heatsink | 12.5       | mm         |
|                                              | 端子-端子<br>Terminal to terminal  | 10.0       | mm         |
| 相对漏电起痕指数<br>CTI (Comparative Tracking Index) |                                | >200       |            |

**热和机械数据**
**Thermal & Mechanical Data**

| 符号<br>Symbol        | 参数名称<br>Parameter                                            | 测试条件<br>Test Conditions                                                  | 最小值<br>Min. | 典型值<br>Typ. | 最大值<br>Max. | 单位<br>Unit |
|---------------------|--------------------------------------------------------------|--------------------------------------------------------------------------|-------------|-------------|-------------|------------|
| $R_{th(J-C)}$ IGBT  | IGBT 结壳热阻<br>Thermal resistance – IGBT                       |                                                                          |             | 75.4        | 80          | K / kW     |
| $R_{th(J-C)}$ Diode | 二极管结壳热阻<br>Thermal resistance – Diode                        |                                                                          |             | 103.2       | 110         | K / kW     |
| $R_{th(C-H)}$ IGBT  | 接触热阻(IGBT)<br>Thermal resistance – case to heatsink (IGBT)   | 安装力矩 5Nm, 导热脂 1W/m·K<br>Mounting torque 5Nm, with mounting grease 1W/m·K |             | 28          |             | K / kW     |
| $R_{th(C-H)}$ Diode | 接触热阻(Diode)<br>Thermal resistance – case to heatsink (Diode) | 安装力矩 5Nm, 导热脂 1W/m·K<br>Mounting torque 5Nm, with mounting grease 1W/m·K |             | 48          |             | K / kW     |
| $T_{vj\ op}$        | 工作结温<br>Operating junction temperature                       | IGBT 芯片 ( IGBT )                                                         | -40         |             | 150         | °C         |
|                     |                                                              | 二极管芯片( Diode )                                                           | -40         |             | 150         | °C         |
| $T_{stg}$           | 存储温度<br>Storage temperature range                            |                                                                          | -40         |             | 125         | °C         |
| $M$                 | 安装力矩<br>Screw torque                                         | 安装紧固用 - M5<br>Mounting - M5                                              | 3           |             | 6           | Nm         |
|                     |                                                              | 电路互连用 - M6<br>Electrical connections - M6                                | 3           |             | 6           | Nm         |

**热敏电阻数据**
**NTC-Thermistor Data**

| 符号<br>Symbol | 参数名称<br>Parameter                      | 测试条件<br>Test Conditions                                      | 最小值<br>Min. | 典型值<br>Typ. | 最大值<br>Max. | 单位<br>Unit |
|--------------|----------------------------------------|--------------------------------------------------------------|-------------|-------------|-------------|------------|
| $R_{25}$     | 额定电阻值<br>Rated resistance              | $T_C = 25\ ^\circ\text{C}$                                   |             | 5           |             | kΩ         |
| $\Delta R/R$ | $R_{100}$ 偏差<br>Deviation of $R_{100}$ | $T_C = 100\ ^\circ\text{C}$ , $R_{100}=493\Omega$            | -5          |             | 5           | %          |
| $P_{25}$     | 耗散功率<br>Power dissipation              | $T_C = 25\ ^\circ\text{C}$                                   |             |             | 20          | mW         |
| $B_{25/50}$  | $B$ -值<br>$B$ -value                   | $R_2 = R_{25}\exp [B_{25/50}(1/T_2 - 1/(298.15\text{ K}))]$  |             | 3375        |             | K          |
| $B_{25/80}$  | $B$ -值<br>$B$ -value                   | $R_2 = R_{25}\exp [B_{25/80}(1/T_2 - 1/(298.15\text{ K}))]$  |             | 3411        |             | K          |
| $B_{25/100}$ | $B$ -值<br>$B$ -value                   | $R_2 = R_{25}\exp [B_{25/100}(1/T_2 - 1/(298.15\text{ K}))]$ |             | 3433        |             | K          |

**电特性值**
**Electrical Characteristics**

 除非特别声明，否则  $T_C = 25\text{ }^{\circ}\text{C}$ 
 $T_C = 25\text{ }^{\circ}\text{C}$  unless otherwise stated

| 符号<br>Symbol         | 参数名称<br>Parameter                                   | 条件<br>Test Conditions                                                                                                                                                    | 最小值<br>Min. | 典型值<br>Typ. | 最大值<br>Max. | 单位<br>Unit    |
|----------------------|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|---------------|
| $I_{CES}$            | 集电极截止电流<br>Collector cut-off current                | $V_{GE} = 0V, V_{CE} = V_{CES}$                                                                                                                                          |             |             | 1           | mA            |
|                      |                                                     | $V_{GE} = 0V, V_{CE} = V_{CES}, T_{vj} = 125\text{ }^{\circ}\text{C}$                                                                                                    |             |             | 8           | mA            |
|                      |                                                     | $V_{GE} = 0V, V_{CE} = V_{CES}, T_{vj} = 150\text{ }^{\circ}\text{C}$                                                                                                    |             |             | 15          | mA            |
| $I_{GES}$            | 栅极漏电流<br>Gate leakage current                       | $V_{GE} = \pm 20V, V_{CE} = 0V$                                                                                                                                          |             |             | 0.5         | $\mu\text{A}$ |
| $V_{GE(th)}$         | 栅极-发射极阈值电压<br>Gate threshold voltage                | $I_C = 10\text{mA}, V_{GE} = V_{CE}$                                                                                                                                     | 5.60        | 6.10        | 6.70        | V             |
| $V_{CE(sat)}^{(*1)}$ | 集电极-发射极饱和电压<br>Collector-emitter saturation voltage | $V_{GE} = 15V, I_C = 300A$                                                                                                                                               |             | 1.80        | 2.20        | V             |
|                      |                                                     | $V_{GE} = 15V, I_C = 300A, T_{vj} = 125\text{ }^{\circ}\text{C}$                                                                                                         |             | 2.20        |             | V             |
|                      |                                                     | $V_{GE} = 15V, I_C = 300A, T_{vj} = 150\text{ }^{\circ}\text{C}$                                                                                                         |             | 2.30        |             | V             |
| $I_F$                | 二极管正向直流电流<br>Diode forward current                  | DC                                                                                                                                                                       |             | 300         |             | A             |
| $I_{FRM}$            | 二极管正向重复峰值电流<br>Diode peak forward current           | $t_P = 1\text{ms}$                                                                                                                                                       |             | 600         |             | A             |
| $V_F^{(*1)}$         | 二极管正向电压<br>Diode forward voltage                    | $I_F = 300A, V_{GE} = 0V$                                                                                                                                                |             | 1.65        | 2.05        | V             |
|                      |                                                     | $I_F = 300A, V_{GE} = 0V, T_{vj} = 125\text{ }^{\circ}\text{C}$                                                                                                          |             | 1.75        |             | V             |
|                      |                                                     | $I_F = 300A, V_{GE} = 0V, T_{vj} = 150\text{ }^{\circ}\text{C}$                                                                                                          |             | 1.75        |             | V             |
| $I_{SC}$             | 短路电流<br>Short circuit current                       | $T_{vj} = 150\text{ }^{\circ}\text{C}, V_{CC} = 1000V,$<br>$V_{GE} \leq 15V, t_p \leq 10\mu\text{s},$<br>$V_{CE(max)} = V_{CES} - L^{(*2)} \times di/dt,$<br>IEC 60747-9 |             | 1200        |             | A             |

**注意:** 1. (\*1) 表示该参数的测试点为辅助母排端子 (\*1) indicates it is measured at the auxiliary busbar terminal),

**Note:** 2. (\*2) 表示  $L$  是电路杂散电感加上  $L_{sCE}$  (\*2) indicates  $L$  is the circuit stray inductance plus  $L_{sCE}$ ).

**电特性值**
**Electrical Characteristics**

 除非特别声明，否则  $T_C = 25\text{ }^{\circ}\text{C}$ 
 $T_C = 25\text{ }^{\circ}\text{C}$  unless otherwise stated

| 符号<br>Symbol  | 参数名称<br>Parameter                                        | 条件<br>Test Conditions                   | 最小值<br>Min. | 典型值<br>Typ. | 最大值<br>Max. | 单位<br>Unit |
|---------------|----------------------------------------------------------|-----------------------------------------|-------------|-------------|-------------|------------|
| $C_{ies}$     | 输入电容<br>Input capacitance                                | $V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$ |             | 44          |             | nF         |
| $Q_g$         | 栅极电荷<br>Gate charge                                      | $\pm 15V$                               |             | 3.3         |             | $\mu C$    |
| $C_{res}$     | 反向传输电容<br>Reverse transfer capacitance                   | $V_{CE} = 25V, V_{GE} = 0V, f = 100kHz$ |             | 0.35        |             | nF         |
| $L_{sCE}$     | 模块杂散电感<br>Module stray inductance                        |                                         |             | 20          |             | nH         |
| $R_{CC'+EE'}$ | 模块引线电阻，端子-芯片<br>Module lead resistance,<br>terminal-chip |                                         |             | 0.9         |             | m $\Omega$ |
| $R_{Gint}$    | 内部栅极电阻<br>Internal gate resistor                         |                                         |             | 1.6         |             | $\Omega$   |

**电特性值**
**Electrical Characteristics**

| 符号<br>Symbol | 参数名称<br>Parameter                           | 测试条件<br>Test Conditions                                                                                                                                             |                        | 最小值<br>Min. | 典型值<br>Typ. | 最大值<br>Max. | 单位<br>Unit |
|--------------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------|-------------|-------------|------------|
| $t_{d(off)}$ | 关断延迟时间<br>Turn-off delay time               | $I_C = 300A$ ,<br>$V_{CE} = 900V$ ,<br>$V_{GE} = \pm 15V$ ,<br>$R_{G(OFF)} = 2.7\Omega$ ,<br>$L_S = 45nH$ ,<br>$dv/dt = 5800V/\mu s$<br>( $T_{vj} = 150^\circ C$ ). | $T_{vj} = 25^\circ C$  |             | 490         |             | ns         |
|              |                                             |                                                                                                                                                                     | $T_{vj} = 125^\circ C$ |             | 540         |             |            |
|              |                                             |                                                                                                                                                                     | $T_{vj} = 150^\circ C$ |             | 550         |             |            |
| $t_f$        | 下降时间<br>Fall time                           |                                                                                                                                                                     | $T_{vj} = 25^\circ C$  |             | 310         |             | ns         |
|              |                                             |                                                                                                                                                                     | $T_{vj} = 125^\circ C$ |             | 400         |             |            |
|              |                                             |                                                                                                                                                                     | $T_{vj} = 150^\circ C$ |             | 510         |             |            |
| $E_{OFF}$    | 关断损耗<br>Turn-off energy loss                |                                                                                                                                                                     | $T_{vj} = 25^\circ C$  |             | 44          |             | mJ         |
|              |                                             |                                                                                                                                                                     | $T_{vj} = 125^\circ C$ |             | 53          |             |            |
|              |                                             |                                                                                                                                                                     | $T_{vj} = 150^\circ C$ |             | 56          |             |            |
| $t_{d(on)}$  | 开通延迟时间<br>Turn-on delay time                | $T_{vj} = 25^\circ C$                                                                                                                                               |                        | 190         |             | ns          |            |
|              |                                             | $T_{vj} = 125^\circ C$                                                                                                                                              |                        | 200         |             |             |            |
|              |                                             | $T_{vj} = 150^\circ C$                                                                                                                                              |                        | 200         |             |             |            |
| $t_r$        | 上升时间<br>Rise time                           | $T_{vj} = 25^\circ C$                                                                                                                                               |                        | 80          |             | ns          |            |
|              |                                             | $T_{vj} = 125^\circ C$                                                                                                                                              |                        | 90          |             |             |            |
|              |                                             | $T_{vj} = 150^\circ C$                                                                                                                                              |                        | 90          |             |             |            |
| $E_{ON}$     | 开通损耗<br>Turn-on energy loss                 | $T_{vj} = 25^\circ C$                                                                                                                                               |                        | 80          |             | mJ          |            |
|              |                                             | $T_{vj} = 125^\circ C$                                                                                                                                              |                        | 104         |             |             |            |
|              |                                             | $T_{vj} = 150^\circ C$                                                                                                                                              |                        | 115         |             |             |            |
| $Q_{rr}$     | 二极管反向恢复电荷<br>Diode reverse recovery charge  | $T_{vj} = 25^\circ C$                                                                                                                                               |                        | 58          |             | $\mu C$     |            |
|              |                                             | $T_{vj} = 125^\circ C$                                                                                                                                              |                        | 108         |             |             |            |
|              |                                             | $T_{vj} = 150^\circ C$                                                                                                                                              |                        | 128         |             |             |            |
| $I_{rr}$     | 二极管反向恢复电流<br>Diode reverse recovery current | $T_{vj} = 25^\circ C$                                                                                                                                               |                        | 320         |             | A           |            |
|              |                                             | $T_{vj} = 125^\circ C$                                                                                                                                              |                        | 355         |             |             |            |
|              |                                             | $T_{vj} = 150^\circ C$                                                                                                                                              |                        | 365         |             |             |            |
| $E_{rec}$    | 二极管反向恢复损耗<br>Diode reverse recovery energy  | $T_{vj} = 25^\circ C$                                                                                                                                               |                        | 30          |             | mJ          |            |
|              |                                             | $T_{vj} = 125^\circ C$                                                                                                                                              |                        | 55          |             |             |            |
|              |                                             | $T_{vj} = 150^\circ C$                                                                                                                                              |                        | 64          |             |             |            |

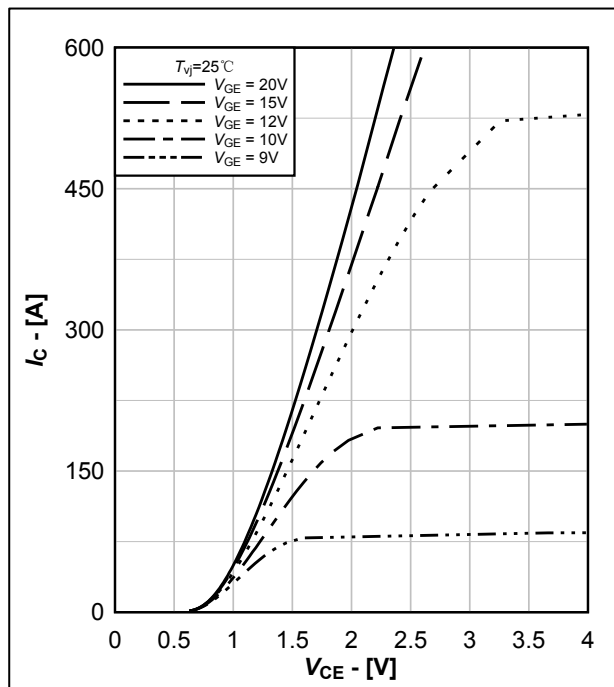

图 3. IGBT 输出特性典型曲线,  $I_C = f(V_{CE})$ 

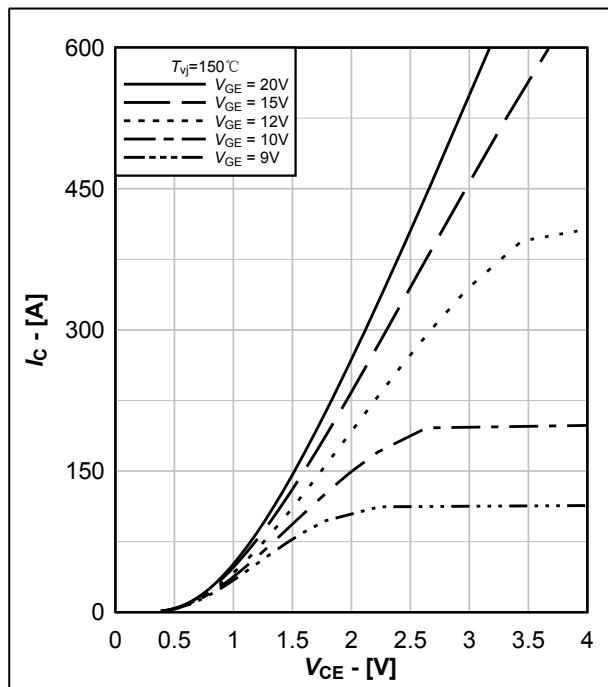
Fig.3 Typical IGBT output characteristic,  $I_C = f(V_{CE})$ 

图 4. IGBT 输出特性典型曲线,  $I_C = f(V_{CE})$ 

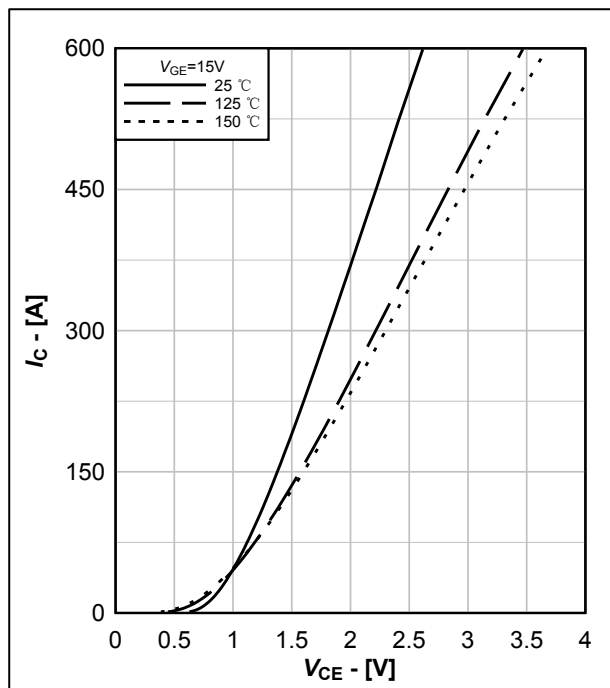
Fig.4 Typical IGBT output characteristic,  $I_C = f(V_{CE})$ 

图 5. IGBT 输出特性典型曲线,  $I_C = f(V_{CE})$ 

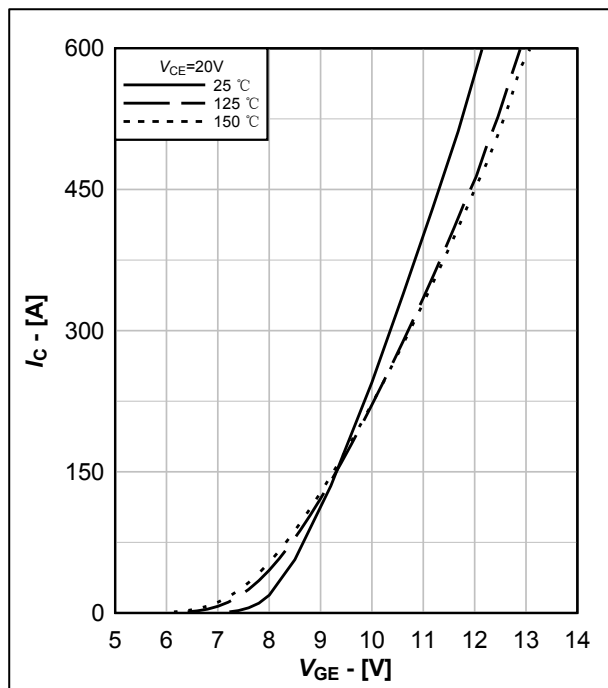
Fig.5 Typical IGBT output characteristic,  $I_C = f(V_{CE})$ 

图 6. IGBT 传输特性典型曲线,  $I_C = f(V_{GE})$ 

Fig.6 Typical IGBT transfer characteristic,  $I_C = f(V_{GE})$

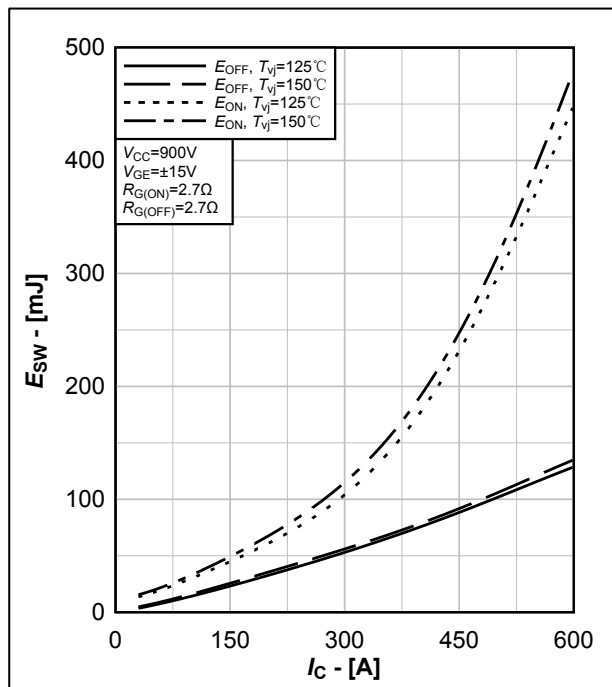

 图 7. IGBT 开关损耗典型曲线,  $E_{on}=f(I_C)$ ,  $E_{off}=f(I_C)$ 

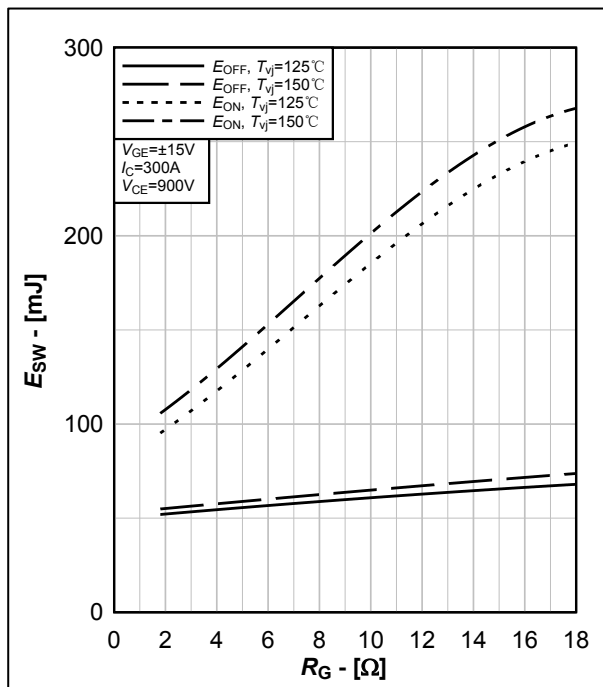
 Fig.7 Typical IGBT switching energy,  $E_{on}=f(I_C)$ ,  $E_{off}=f(I_C)$ 

 图 8. IGBT 开关损耗典型曲线,  $E_{on}=f(R_G)$ ,  $E_{off}=f(R_G)$ 

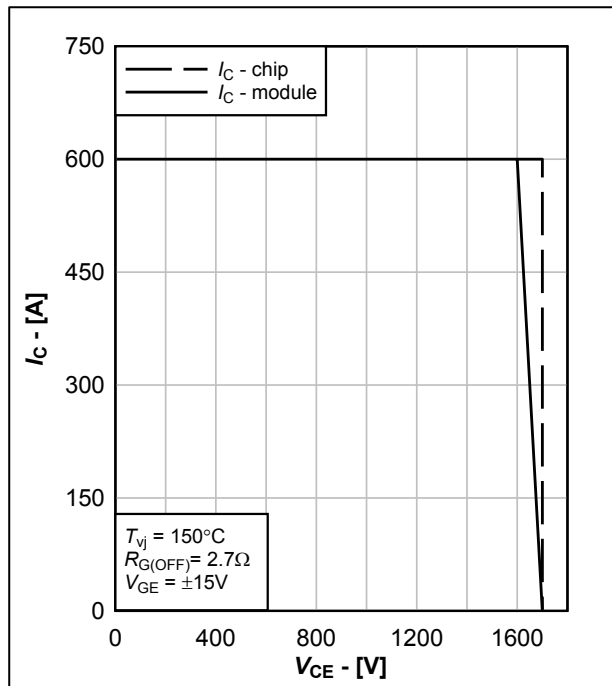
 Fig.8 Typical IGBT switching energy,  $E_{on}=f(R_G)$ ,  $E_{off}=f(R_G)$ 

 图 9. IGBT 反偏安全工作区,  $I_C=f(V_{CE})$ 

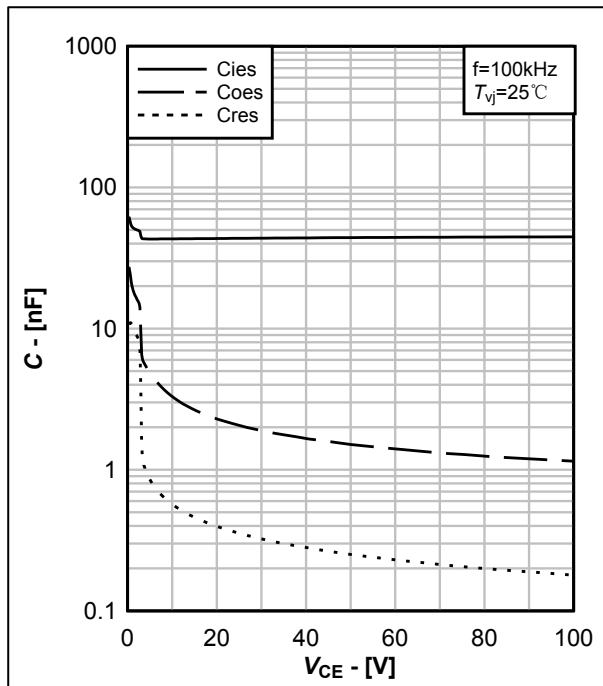
 Fig.9 Reverse bias safe operating area of IGBT,  $I_C=f(V_{CE})$ 

 图 10. 电容特性典型曲线,  $C=f(V_{CE})$ 

 Fig.10 Typical capacity characteristic,  $C=f(V_{CE})$

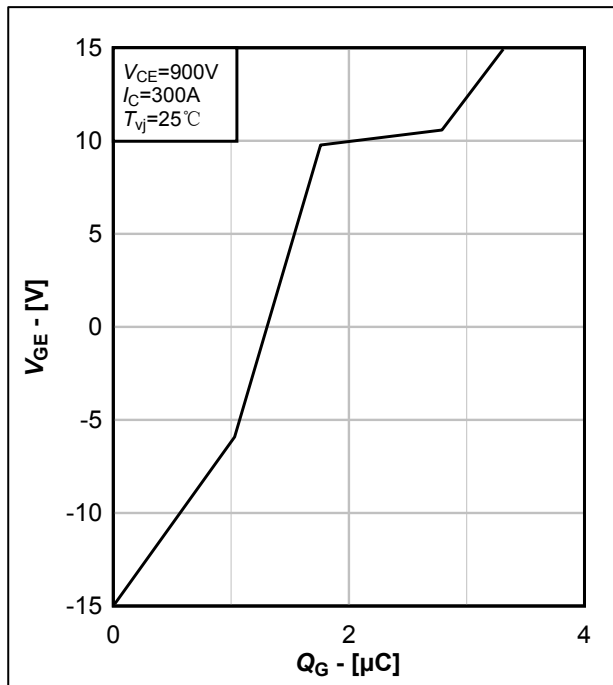

 图 11. 栅极电荷特性典型曲线,  $V_{GE} = f(Q_G)$ 

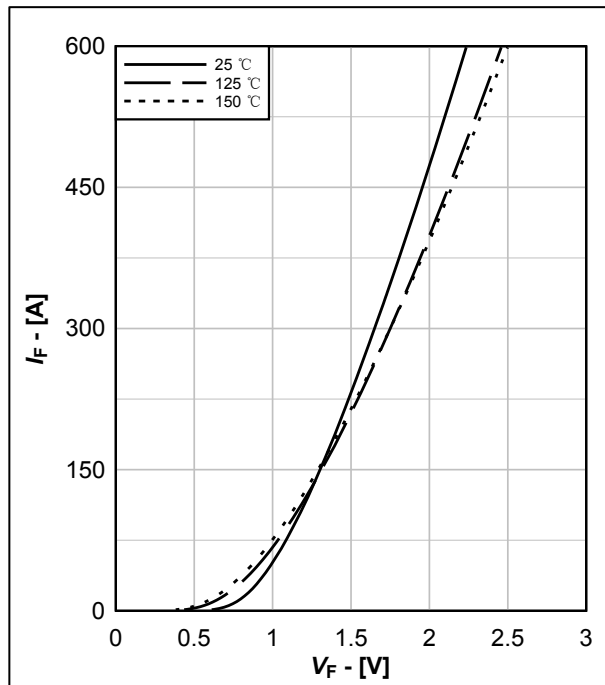
 Fig.11 Typical gate charge characteristic,  $V_{GE} = f(Q_G)$ 

 图 12. FRD 输出特性典型曲线,  $I_F = f(V_F)$ 

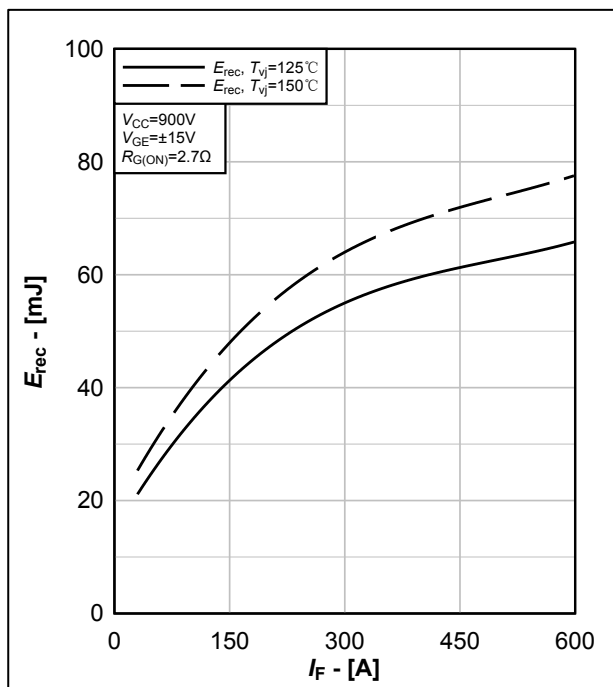
 Fig.12 Typical FRD output characteristic,  $I_F = f(V_F)$ 

 图 13. FRD 反向恢复损耗典型曲线,  $E_{rec} = f(I_F)$ 

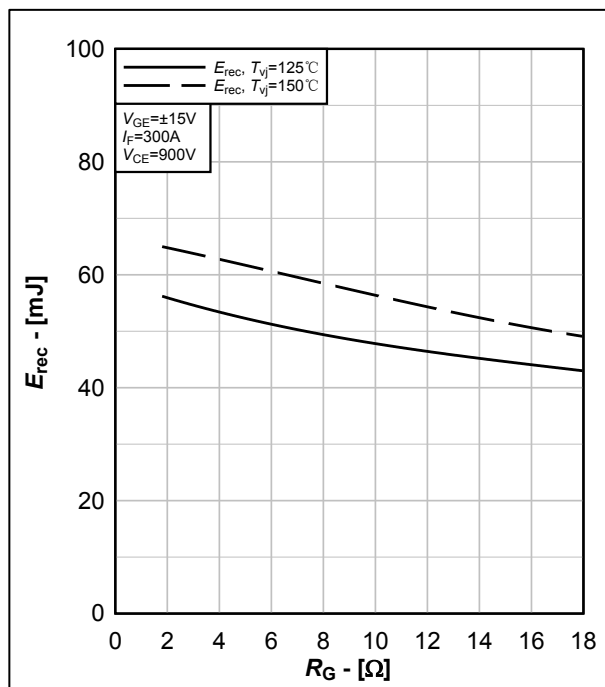
 Fig.13 Typical FRD switching loss  $E_{rec}$ ,  $E_{rec} = f(I_F)$ 

 图 14. FRD 反向恢复损耗典型曲线,  $E_{rec} = f(R_G)$ 

 Fig.14 Typical FRD switching loss  $E_{rec}$ ,  $E_{rec} = f(R_G)$

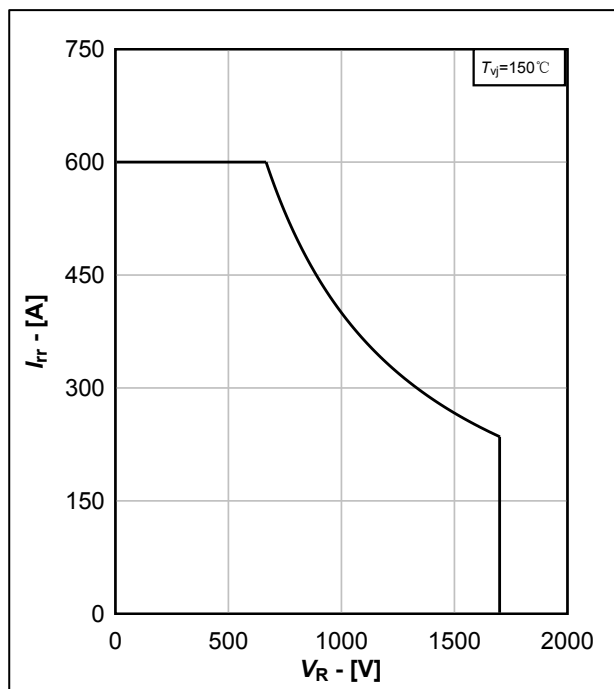

 图 15. FRD 反偏安全工作区,  $I_{rr} = f(V_R)$ 

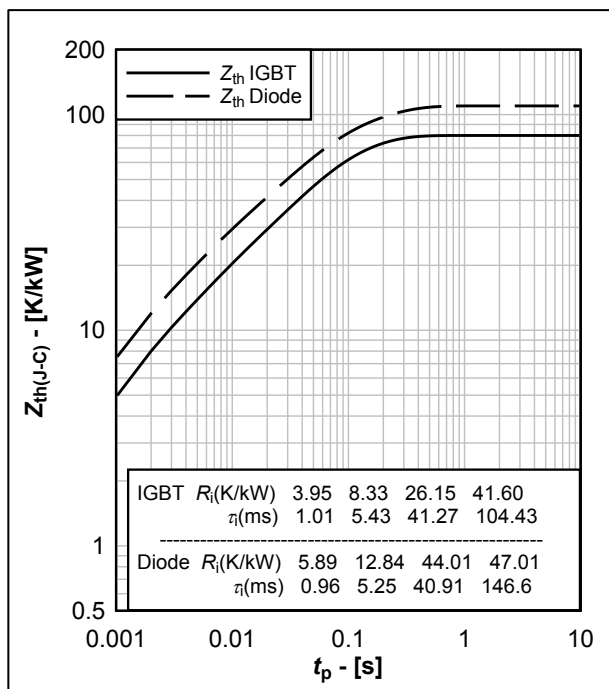
 Fig.15 Reverse bias safe operating area of FRD,  $I_{rr} = f(V_R)$ 

 图 16. 瞬态热阻抗曲线,  $Z_{th(j-c)} = f(t_p)$ 

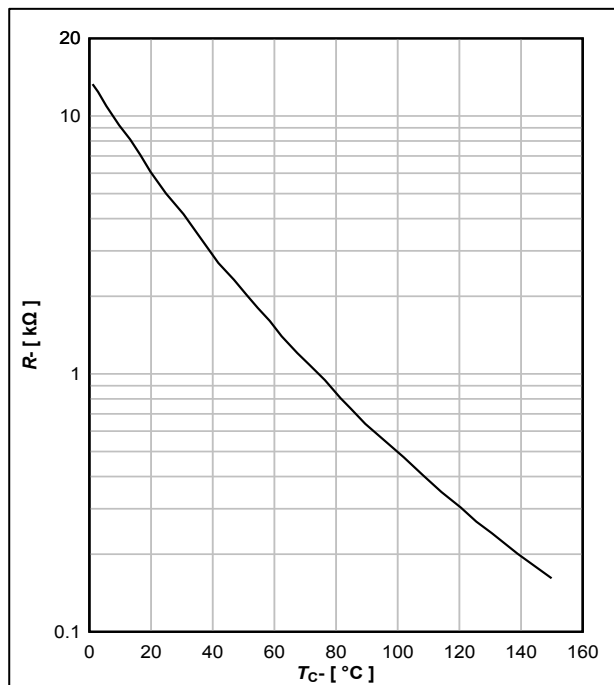
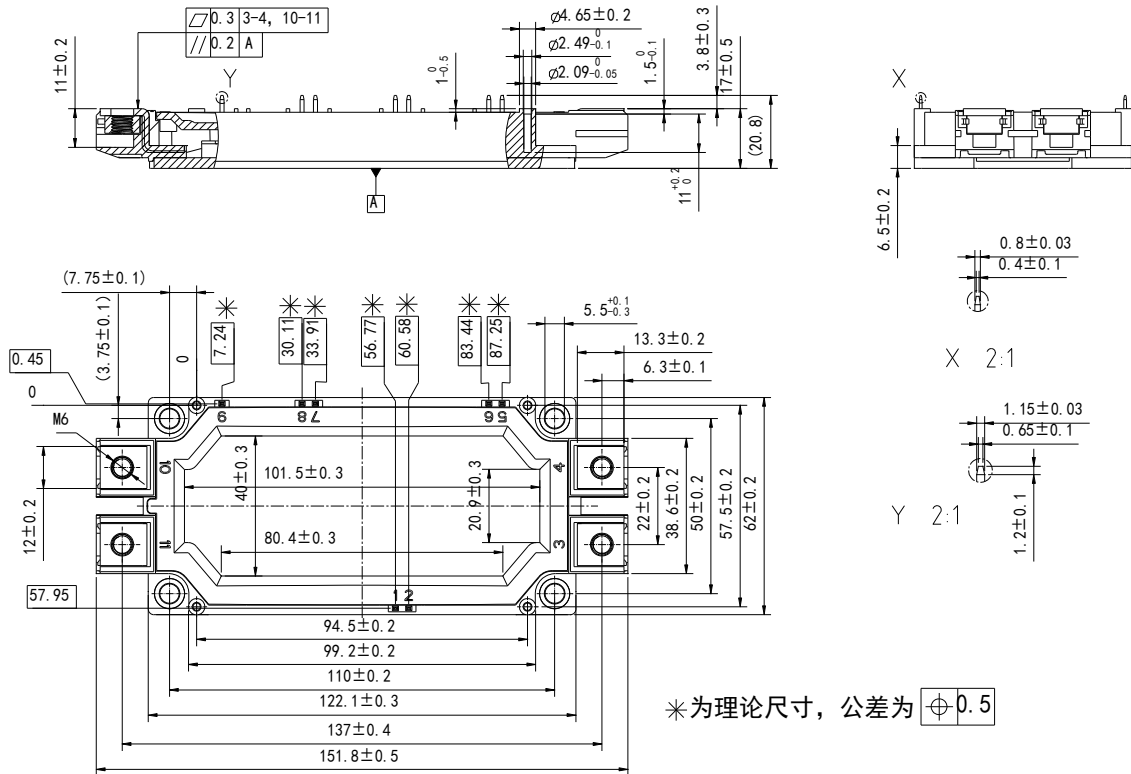
 Fig.16 Transient thermal impedance,  $Z_{th(j-c)} = f(t_p)$ 

 图 17. 热敏电阻典型特性曲线,  $R = f(T_c)$ 

 Fig.17 Typical NTC thermistor characteristic,  $R = f(T_c)$



重量 Weight: 345g

模块外观类型 Module outline code: M1

图 18. 模块外观尺寸

Fig. 18 Module outlines

株洲中车时代半导体有限公司

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