

## SISD0200ST170i20\_A02

ST-Type phase leg IGBT module

ST 封装半桥 IGBT 模块

 $V_{CE} = 1700\text{ V}$  $I_C = 2 \times 200\text{ A}$ 

- *i20* ultra-low loss fine pattern Trench IGBT chipset  
*i20* 超低损耗精细沟槽栅型 IGBT 芯片组
- Baseplate isolation with efficient  $\text{Al}_2\text{O}_3$  ceramic  
高效  $\text{Al}_2\text{O}_3$  绝缘陶瓷基板
- Cu baseplate for low thermal resistance  
低热阻铜底板
- Industry standard package  
行业标准封装

Maximum ratings<sup>1</sup> 最大额定值<sup>1</sup>

| PARAMETER<br>参数                        | SYMBOL<br>符号 | CONDITIONS<br>工作条件                                                                      | MIN<br>最小值 | MAX<br>最大值       | UNIT<br>单位            |
|----------------------------------------|--------------|-----------------------------------------------------------------------------------------|------------|------------------|-----------------------|
| Collector-emitter voltage<br>集电极-发射极电压 | $V_{CES}$    | $V_{GE} = 0\text{ V}$ , $T_{vj} = 25\text{ °C}$                                         |            | 1700             | V                     |
| DC collector current 集电极直流电流           | $I_C$        | $T_C = 170\text{ °C}$ , $T_{vj} = 175\text{ °C}$                                        |            | 200              | A                     |
| Peak collector current 集电极峰值电流         | $I_{CM}$     | $t_p = 1\text{ ms}$                                                                     |            | 400              | A                     |
| Gate-emitter voltage 栅极-发射极驱动电压        | $V_{GES}$    |                                                                                         | -20        | 20               | V                     |
| Total power dissipation 最大功率损耗         | $P_{tot}$    | $T_C = 25\text{ °C}$ , $T_{vj} = 175\text{ °C}$ , per switch                            |            | 1350             | W                     |
| DC forward current 二极管直流正向电流           | $I_F$        |                                                                                         |            | 200              | A                     |
| Peak forward current 二极管最大脉冲正向电流       | $I_{FRM}$    | $t_p = 1\text{ ms}$                                                                     |            | 400              | A                     |
| Surge current 二极管最大浪涌电流                | $I_{FSM}$    | $V_R = 0\text{ V}$ , $T_{vj} = 150\text{ °C}$ , $t_p = 10\text{ ms}$ ,<br>half-sinewave |            | 915<br>4190      | A<br>A <sup>2</sup> s |
| Isolation voltage 绝缘电压                 | $V_{isol}$   | 1 min, $f = 50\text{ Hz}$                                                               |            | 4000             | V                     |
| Junction operating temperature 运行结温    | $T_{vj(op)}$ |                                                                                         | -40        | 175 <sup>2</sup> | °C                    |
| Case temperature 壳温                    | $T_C$        |                                                                                         | -40        | 150              | °C                    |
| Storage temperature 存储温度               | $T_{stg}$    |                                                                                         | -40        | 125              | °C                    |
| Mounting torques 紧固力矩 <sup>3</sup>     | $M_S$        | Base-heatsink, M6 screws                                                                | 3          | 6                | Nm                    |
|                                        | $M_{t1}$     | Main terminals, M6 screws                                                               | 2.5        | 5                | Nm                    |



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<sup>1</sup> Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747; 根据标准 IEC 60747 要求, 最大额定值表示超过该限值可能会对器件造成损坏

<sup>2</sup>  $T_{vj(op)} > 150\text{ °C}$  allowed for overload conditions, in maximum for 60s and less than 20% of operation time 允许运行的时间不超过 60s, 或者小于运行时间的 20%

<sup>3</sup> For details, please refer to the mounting instructions. 详细信息, 请参考安装说明书



## IGBT<sup>4</sup>

| PARAMETER<br>参数                                                  | SYMBOL<br>符号         | CONDITIONS<br>工作条件                                                                                                                              |                          | MIN<br>最小值 | TYP<br>典型 | MAX<br>最大值 | UNIT<br>单位 |
|------------------------------------------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------|-----------|------------|------------|
| Collector(-emitter) breakdown voltage 集电极-发射极击穿电压                | V <sub>(BR)CES</sub> | V <sub>GE</sub> = 0 V, I <sub>C</sub> = 10 mA, T <sub>vj</sub> = 25°C                                                                           |                          | 1700       |           |            | V          |
| Collector-emitter saturation voltage <sup>5</sup><br>集电极-发射极饱和电压 | V <sub>CE sat</sub>  | I <sub>C</sub> = 200 A, V <sub>GE</sub> = 15 V                                                                                                  | T <sub>vj</sub> = 25 °C  |            | 1.65      | 2.0        | V          |
|                                                                  |                      |                                                                                                                                                 | T <sub>vj</sub> = 125 °C |            | 1.85      |            | V          |
|                                                                  |                      |                                                                                                                                                 | T <sub>vj</sub> = 175 °C |            | 2.05      |            | V          |
| Collector cut-off current<br>集电极截止电流                             | I <sub>CES</sub>     | V <sub>CE</sub> = 1700 V, V <sub>GE</sub> = 0 V                                                                                                 | T <sub>vj</sub> = 25 °C  |            |           | 1          | mA         |
|                                                                  |                      |                                                                                                                                                 | T <sub>vj</sub> = 125 °C |            | 0.25      |            | mA         |
|                                                                  |                      |                                                                                                                                                 | T <sub>vj</sub> = 175 °C |            | 4.5       |            | mA         |
| Gate leakage current 栅极漏电流                                       | I <sub>GES</sub>     | V <sub>CE</sub> = 0 V, V <sub>GE</sub> = ±20 V                                                                                                  |                          | -0.5       |           | 0.5        | μA         |
| Gate-emitter threshold voltage<br>栅极-发射极阈值电压                     | V <sub>GE(th)</sub>  | I <sub>C</sub> = 10mA, V <sub>CE</sub> = V <sub>GE</sub> , T <sub>vj</sub> = 25°C                                                               |                          | 5          | 6.15      | 7.5        | V          |
| Gate charge 栅极电荷                                                 | Q <sub>G</sub>       | I <sub>C</sub> = 200 A, V <sub>CE</sub> = 900 V, V <sub>GE</sub> = -15 V .. 15 V                                                                |                          |            | 1.5       |            | μC         |
| Input capacitance 输入电容                                           | C <sub>ies</sub>     | V <sub>CE</sub> = 25 V, V <sub>GE</sub> = 0 V, f = 100kHz, T <sub>vj</sub> = 25 °C                                                              |                          |            | 16.2      |            | nF         |
| Output capacitance 输出电容                                          | C <sub>oes</sub>     |                                                                                                                                                 |                          |            | 1.04      |            |            |
| Reverse transfer capacitance<br>反向传输电容                           | C <sub>res</sub>     |                                                                                                                                                 |                          |            | 0.48      |            |            |
| Internal gate resistor 栅极内阻                                      | R <sub>Gint</sub>    | Per switch                                                                                                                                      |                          |            | 4.2       |            | Ω          |
| Turn-on delay time<br>开通延迟                                       | t <sub>d(on)</sub>   | V <sub>CC</sub> = 900 V, I <sub>C</sub> = 200 A,<br>R <sub>Gon</sub> = 4 Ω, V <sub>GE</sub> = ± 15 V,<br>L <sub>S</sub> = 35 nH, inductive load | T <sub>vj</sub> = 25 °C  |            | 110       |            | ns         |
|                                                                  |                      |                                                                                                                                                 | T <sub>vj</sub> = 125 °C |            | 135       |            |            |
|                                                                  |                      |                                                                                                                                                 | T <sub>vj</sub> = 175 °C |            | 154       |            |            |
| Rise time<br>上升时间                                                | t <sub>r</sub>       |                                                                                                                                                 | T <sub>vj</sub> = 25 °C  |            | 29        |            |            |
|                                                                  |                      |                                                                                                                                                 | T <sub>vj</sub> = 125 °C |            | 32        |            |            |
|                                                                  |                      |                                                                                                                                                 | T <sub>vj</sub> = 175 °C |            | 33        |            |            |
| Turn-off delay time<br>关断延迟                                      | t <sub>d(off)</sub>  | V <sub>CC</sub> = 900 V, I <sub>C</sub> = 200 A,<br>R <sub>G</sub> = 4.5 Ω, V <sub>GE</sub> = ± 15 V,<br>L <sub>S</sub> = 35 nH, inductive load | T <sub>vj</sub> = 25 °C  |            | 486       |            | ns         |
|                                                                  |                      |                                                                                                                                                 | T <sub>vj</sub> = 125 °C |            | 559       |            |            |
|                                                                  |                      |                                                                                                                                                 | T <sub>vj</sub> = 175 °C |            | 579       |            |            |
| Fall time<br>下降时间                                                | t <sub>f</sub>       |                                                                                                                                                 | T <sub>vj</sub> = 25 °C  |            | 382       |            |            |
|                                                                  |                      |                                                                                                                                                 | T <sub>vj</sub> = 125 °C |            | 578       |            |            |
|                                                                  |                      |                                                                                                                                                 | T <sub>vj</sub> = 175 °C |            | 604       |            |            |
| Turn-on switching energy<br>开通损耗                                 | E <sub>on</sub>      | V <sub>CC</sub> = 900 V, I <sub>C</sub> = 200 A,<br>R <sub>G</sub> = 4 Ω, V <sub>GE</sub> = ± 15 V,<br>L <sub>S</sub> = 35 nH, inductive load   | T <sub>vj</sub> = 25 °C  |            | 48        |            | mJ         |
|                                                                  |                      |                                                                                                                                                 | T <sub>vj</sub> = 125 °C |            | 66        |            |            |
|                                                                  |                      |                                                                                                                                                 | T <sub>vj</sub> = 175 °C |            | 74        |            |            |
| Turn-off switching energy<br>关断损耗                                | E <sub>off</sub>     | V <sub>CC</sub> = 900 V, I <sub>C</sub> = 200 A,<br>R <sub>G</sub> = 4.5 Ω, V <sub>GE</sub> = ± 15 V,<br>L <sub>S</sub> = 35 nH, inductive load | T <sub>vj</sub> = 25 °C  |            | 38        |            |            |
|                                                                  |                      |                                                                                                                                                 | T <sub>vj</sub> = 125 °C |            | 51        |            |            |
|                                                                  |                      |                                                                                                                                                 | T <sub>vj</sub> = 175 °C |            | 55        |            |            |
| Short circuit current<br>短路电流                                    | I <sub>SC</sub>      | t <sub>PCS</sub> ≤ 10 μs, V <sub>GE</sub> = 15 V, T <sub>vj</sub> = 175 °C,<br>V <sub>CC</sub> = 1250 V, V <sub>CEM</sub> Chip ≤ 1700 V         |                          |            | 918       |            | A          |

<sup>4</sup> Characteristic values according to IEC 60747-9

<sup>5</sup> Collector-emitter saturation voltage is given at chip-level 集电极-发射极饱和电压



## Diode<sup>6</sup>

| PARAMETER<br>参数                              | SYMBOL<br>符号     | CONDITIONS<br>工作条件                                                                                                                                                          |                          | MIN<br>最小值 | TYP<br>典型 | MAX<br>最大值 | UNIT<br>单位 |
|----------------------------------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------|-----------|------------|------------|
| Forward voltage <sup>7</sup><br>正向压降         | V <sub>F</sub>   | I <sub>F</sub> = 200 A                                                                                                                                                      | T <sub>Vj</sub> = 25 °C  |            | 1.7       | 2.1        | V          |
|                                              |                  |                                                                                                                                                                             | T <sub>Vj</sub> = 125 °C |            | 1.85      |            | V          |
|                                              |                  |                                                                                                                                                                             | T <sub>Vj</sub> = 175 °C |            | 1.95      |            | V          |
| Peak reverse<br>recovery current<br>反向恢复电流峰值 | I <sub>RM</sub>  | V <sub>R</sub> = 900 V, I <sub>F</sub> = 200 A,<br>di/dt = 7184 A/μs (175 °C),<br>R <sub>G</sub> = 4 Ω, V <sub>GE</sub> = ± 15 V,<br>L <sub>S</sub> = 35 nH, inductive load | T <sub>Vj</sub> = 25 °C  |            | 293       |            | A          |
|                                              |                  |                                                                                                                                                                             | T <sub>Vj</sub> = 125 °C |            | 299       |            | A          |
|                                              |                  |                                                                                                                                                                             | T <sub>Vj</sub> = 175 °C |            | 297       |            | A          |
| Recovery charge<br>恢复电荷                      | Q <sub>r</sub>   |                                                                                                                                                                             | T <sub>Vj</sub> = 25 °C  |            | 56        |            | μC         |
|                                              |                  |                                                                                                                                                                             | T <sub>Vj</sub> = 125 °C |            | 86        |            | μC         |
|                                              |                  |                                                                                                                                                                             | T <sub>Vj</sub> = 175 °C |            | 97        |            | μC         |
| Reverse recovery time<br>反向恢复时间              | t <sub>rr</sub>  |                                                                                                                                                                             | T <sub>Vj</sub> = 25 °C  |            | 696       |            | ns         |
|                                              |                  |                                                                                                                                                                             | T <sub>Vj</sub> = 125 °C |            | 1107      |            | ns         |
|                                              |                  |                                                                                                                                                                             | T <sub>Vj</sub> = 175 °C |            | 1318      |            | ns         |
| Reverse recovery energy<br>反向恢复能量            | E <sub>rec</sub> |                                                                                                                                                                             | T <sub>Vj</sub> = 25 °C  |            | 28        |            | mJ         |
|                                              |                  |                                                                                                                                                                             | T <sub>Vj</sub> = 125 °C |            | 47        |            | mJ         |
|                                              |                  |                                                                                                                                                                             | T <sub>Vj</sub> = 175 °C |            | 54        |            | mJ         |

## Package properties 封装特性<sup>8</sup>

| PARAMETER<br>参数                                          | SYMBOL<br>符号              | CONDITIONS<br>工作条件                             |                          | MIN<br>最小值 | TYP<br>典型 | MAX<br>最大值 | UNIT<br>单位 |
|----------------------------------------------------------|---------------------------|------------------------------------------------|--------------------------|------------|-----------|------------|------------|
| IGBT thermal resistance<br>junction to case IGBT 结-壳热阻   | R <sub>th(j-c)IGBT</sub>  | Per switch                                     |                          |            |           | 0.108      | K/W        |
| Diode thermal resistance<br>junction to case 二极管结-壳热阻    | R <sub>th(j-c)Diode</sub> |                                                |                          |            |           | 0.175      | K/W        |
| IGBT thermal resistance case<br>to heatsink IGBT 壳到散热器热阻 | R <sub>th(c-s)IGBT</sub>  | IGBT per switch, lambda<br>grease = 1 W/m x K  |                          |            | 0.039     |            | K/W        |
| Diode thermal resistance<br>case to heatsink 二极管壳到散热器热阻  | R <sub>th(c-s)Diode</sub> | diode per switch, lambda<br>grease = 1 W/m x K |                          |            | 0.045     |            | K/W        |
| Comparative tracking index<br>相对漏电起痕指数                   | CTI                       |                                                |                          | >400       |           |            |            |
| Module stray inductance<br>模块自身杂散电感                      | L <sub>s CE</sub>         | Per switch                                     |                          |            | 20        |            | nH         |
| Resistance, terminal chip<br>端子到芯片之间的阻抗                  | R <sub>CC+EE'</sub>       | Per switch                                     | T <sub>Vj</sub> = 25 °C  |            | 0.7       |            | mΩ         |
|                                                          |                           |                                                | T <sub>Vj</sub> = 125 °C |            |           |            |            |
|                                                          |                           |                                                | T <sub>Vj</sub> = 175 °C |            |           |            |            |

<sup>6</sup> Characteristic values according to IEC 60747-2

<sup>7</sup> Forward voltage is given at chip-level 正向压降是芯片两端的电压值。

<sup>8</sup> Package and mechanical properties according to IEC 60747-15

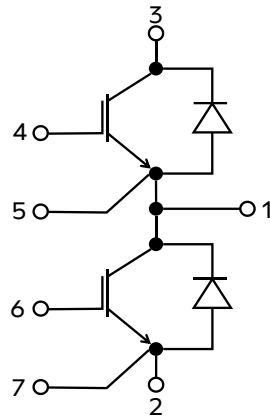


## Mechanical properties 机械特性<sup>9</sup>

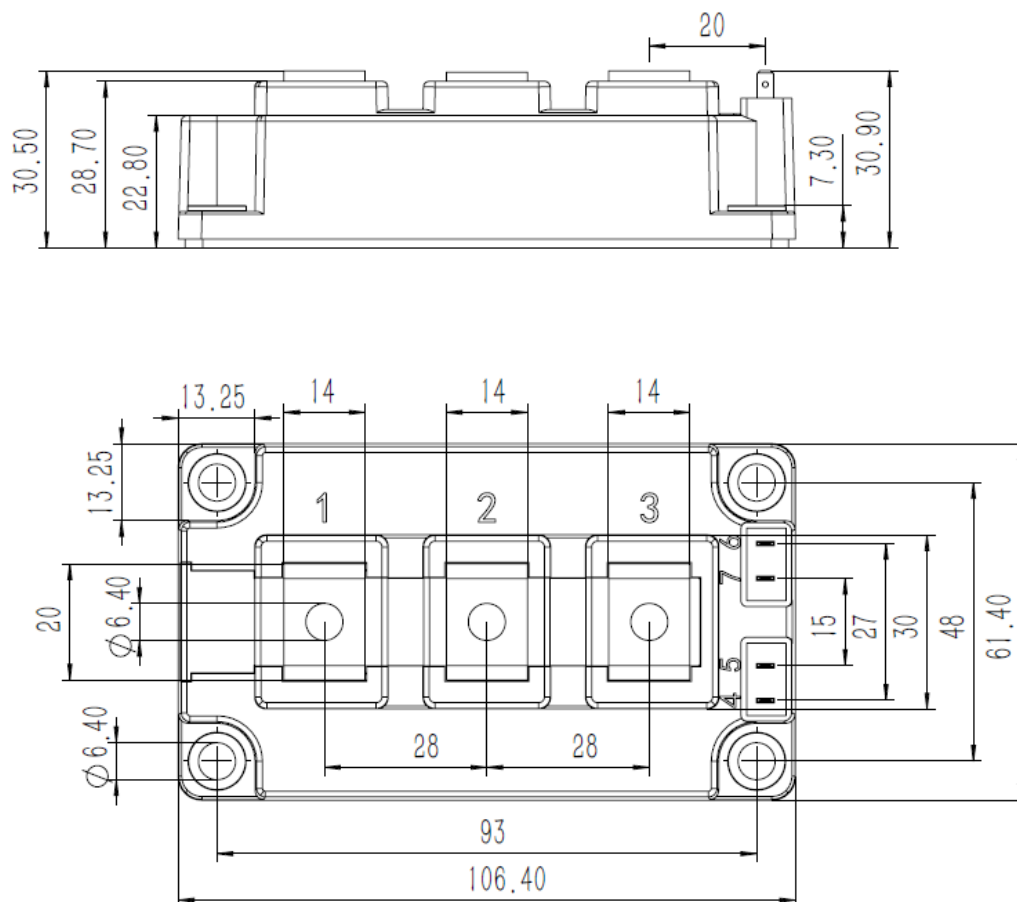
| PARAMETER<br>参数                   | SYMBOL<br>符号 | CONDITIONS<br>工作条件                                                             |                                   | MIN<br>最小值      | TYP<br>典型 | MAX<br>最大值 | UNIT<br>单位      |
|-----------------------------------|--------------|--------------------------------------------------------------------------------|-----------------------------------|-----------------|-----------|------------|-----------------|
| Dimensions                        | L x W x H    | Typical                                                                        |                                   | 106 x 62 x 30.9 |           |            | mm <sup>3</sup> |
| Clearance distance in air<br>电气间隙 | da           | According to IEC 60664-1<br>and EN 50124-1<br>参考标准 IEC 60664-1 和 EN<br>50124-1 | Terminal<br>to base:<br>端子到基板     |                 | 23        |            | mm              |
|                                   |              |                                                                                | Terminal<br>to terminal:<br>端子到端子 |                 | 11        |            |                 |
| Surface creepage distance<br>爬电距离 | ds           |                                                                                | Terminal<br>to base:<br>端子到基板     |                 | 29        |            | mm              |
|                                   |              |                                                                                | Terminal<br>to terminal:<br>端子到端子 |                 | 23        |            |                 |
| Mass 重量                           | m            |                                                                                |                                   |                 | 310       |            | g               |

<sup>9</sup> Package and mechanical properties according to IEC 60747-15

## Electrical configuration 电气图



### Outline drawing 外形图



This is an electrostatic sensitive device, please observe the international standard. 本产品对静电特别敏感。  
This product has been designed and qualified for Industrial Level. 本产品的设计符合工业级标准。

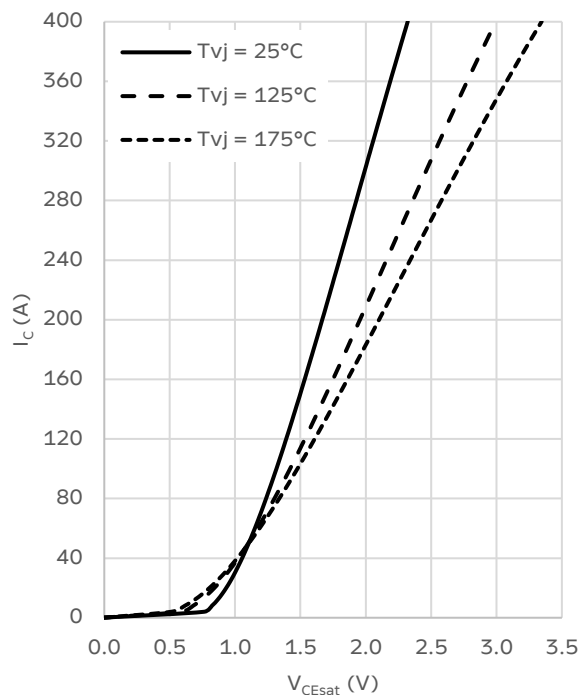
## Characteristics 特性曲线

### IGBT on-state characteristics (typical)

#### IGBT 通态特性曲线 (典型)

$$I_C = f(V_{CE})$$

$$V_{GE} = 15 \text{ V}$$

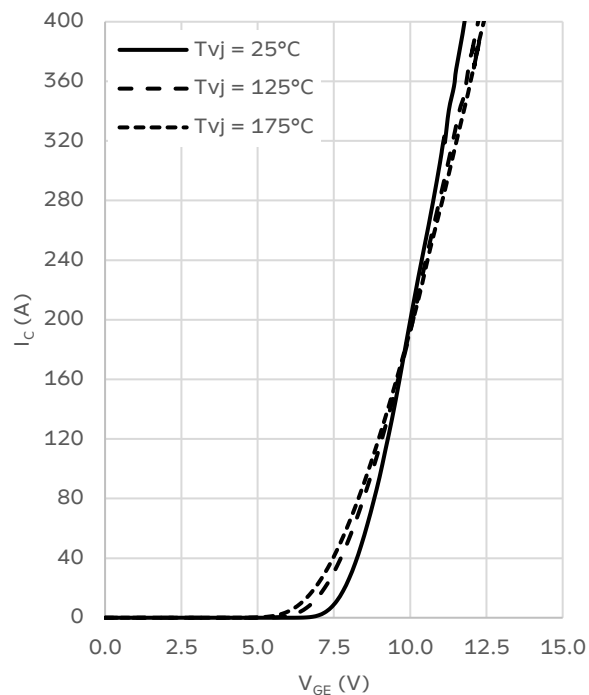


### IGBT transfer characteristics (typical)

#### IGBT 转移特性曲线 (典型)

$$I_C = f(V_{GE})$$

$$V_{CE} = 20 \text{ V}$$

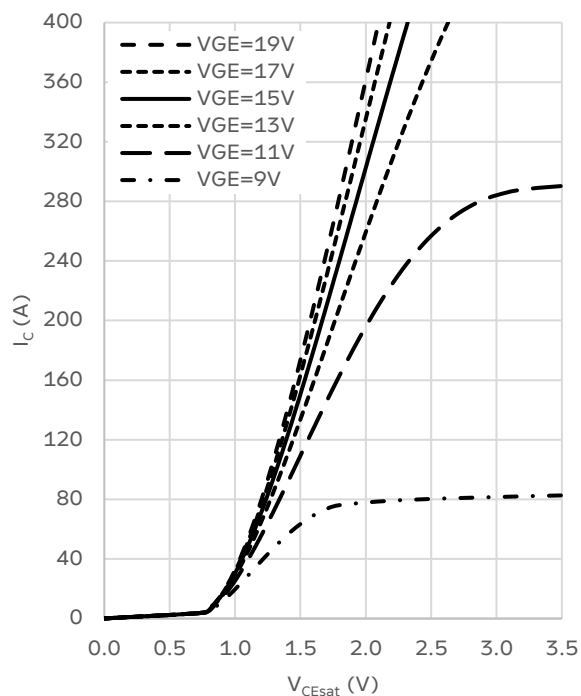


### IGBT output characteristics (typical)

#### IGBT 输出特性曲线 (典型)

$$I_C = f(V_{CE})$$

$$T_{vj} = 25^\circ\text{C}$$

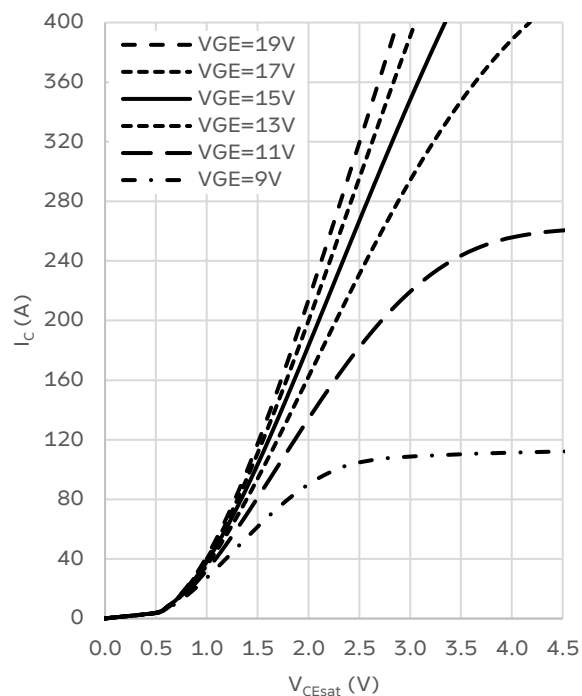


### IGBT output characteristics (typical)

#### IGBT 输出特性曲线 (典型)

$$I_C = f(V_{CE})$$

$$T_{vj} = 175^\circ\text{C}$$

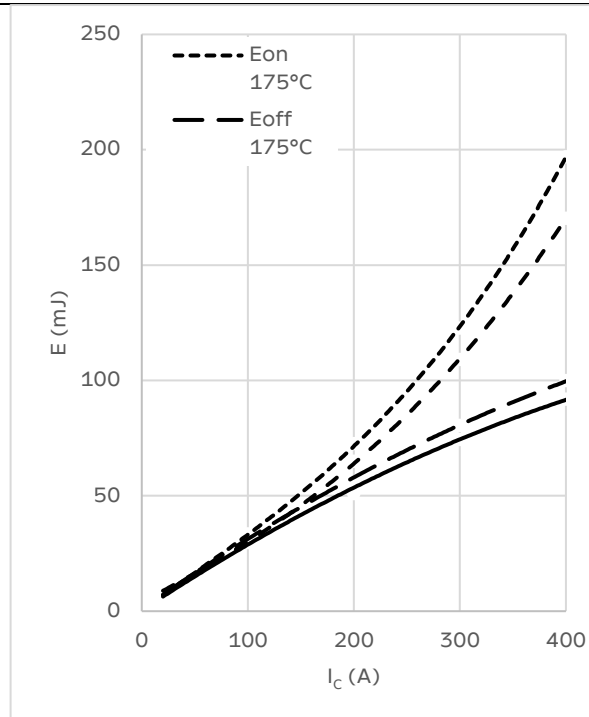


### IGBT switching losses (typical)

#### IGBT 开关损耗曲线 (典型)

$E = f(I_{CE})$

$V_{CE} = 900 \text{ V}$ ,  $R_{Gon} = 4 \text{ } \Omega$ ,  $R_{Goff} = 4.5 \text{ } \Omega$ ,  $V_{GE} = -15/+15 \text{ V}$

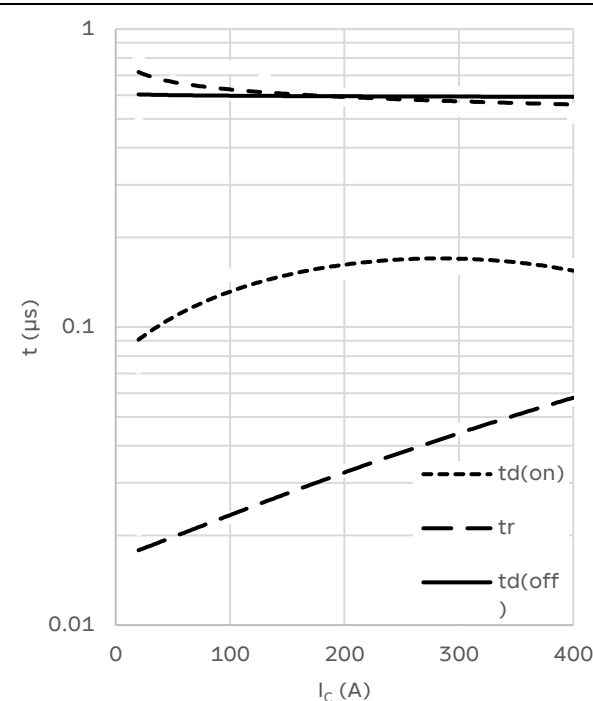


### IGBT switching times (typical)

#### IGBT 开关时间曲线 (典型)

$t = f(I_{CE})$ ,  $T_{vj} = 175^\circ\text{C}$

$V_{CE} = 900 \text{ V}$ ,  $R_{Gon} = 4 \text{ } \Omega$ ,  $R_{Goff} = 4.5 \text{ } \Omega$ ,  $V_{GE} = -15/+15 \text{ V}$

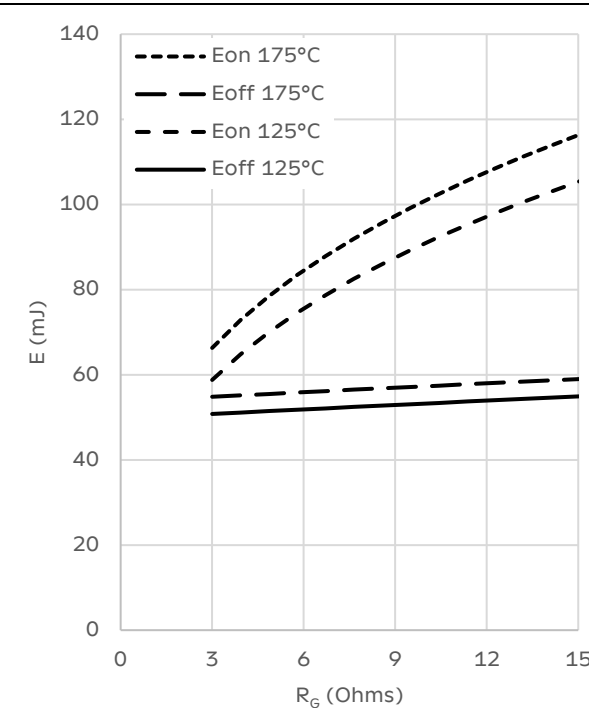


### IGBT switching losses (typical)

#### IGBT 开关损耗曲线 (典型)

$E = f(R_G)$

$V_{CE} = 900 \text{ V}$ ,  $I_C = 200 \text{ A}$ ,  $V_{GE} = -15/+15 \text{ V}$

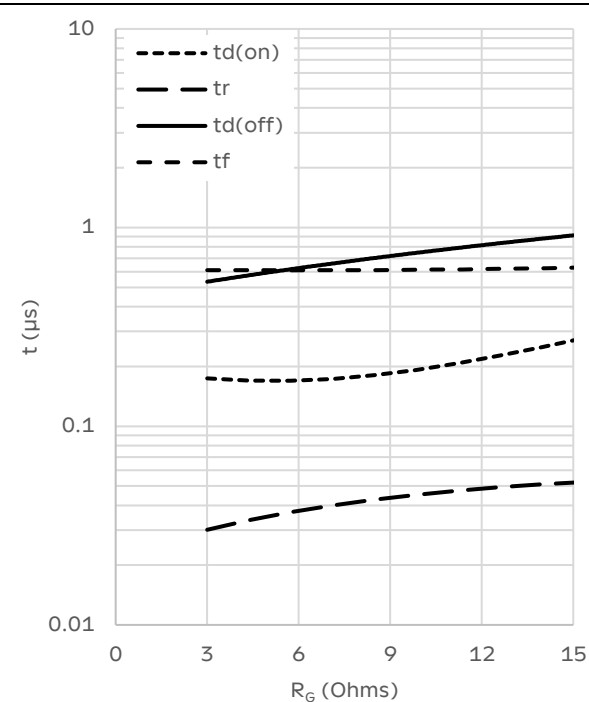


### IGBT switching times (typical)

#### IGBT 开关时间曲线 (典型)

$t = f(R_G)$ ,  $T_{vj} = 175^\circ\text{C}$

$V_{CE} = 900 \text{ V}$ ,  $I_C = 200 \text{ A}$ ,  $V_{GE} = -15/+15 \text{ V}$



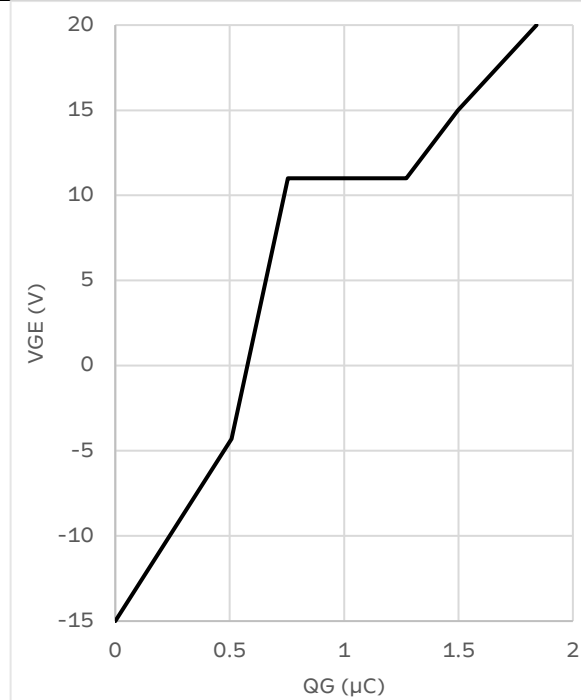


#### IGBT gate charge (typical)

IGBT 门极电荷 (典型)

$V_{GE} = f(Q_G)$ ,  $T_{vj} = 25\text{ °C}$

$V_{CE} = 900\text{ V}$ ,  $I_C = 200\text{ A}$

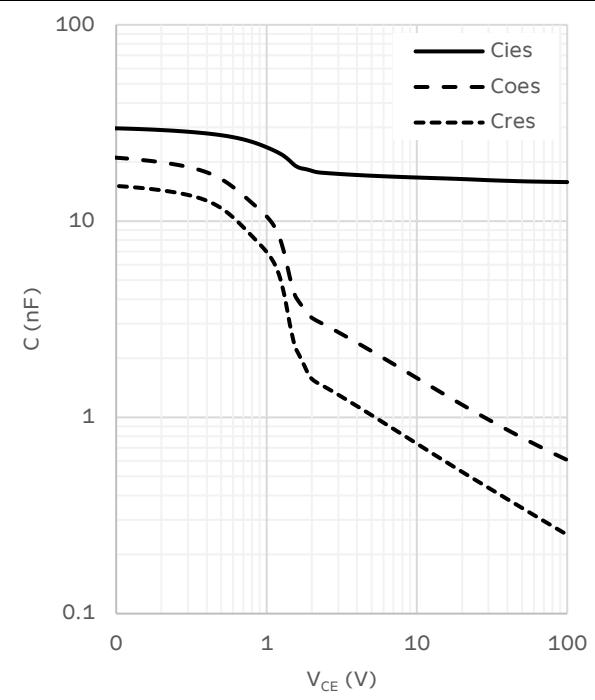


#### Capacitance characteristics (typical)

电容特性曲线 (典型)

$C = f(V_{CE})$ ,  $T_{vj} = 25\text{ °C}$

$f = 100\text{ kHz}$ ,  $V_{GE} = 0\text{ V}$

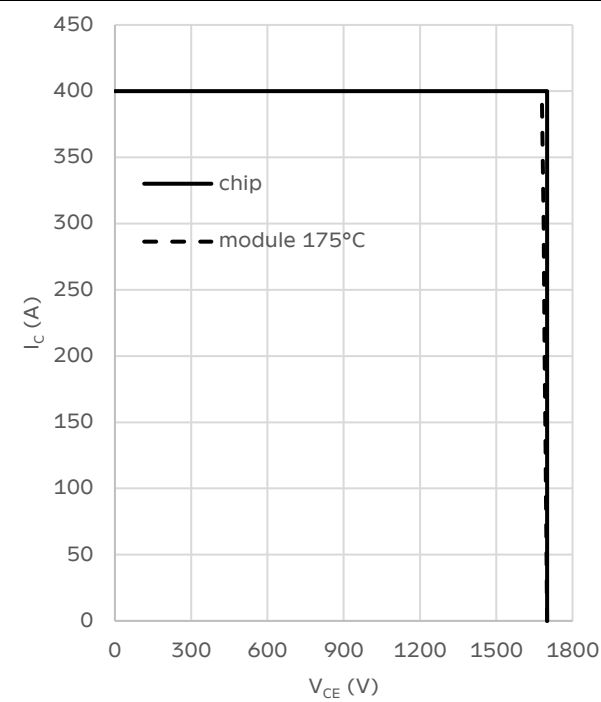


#### IGBT RBSOA

IGBT 反偏安全工作区域

$I_C = f(V_{CEM})$

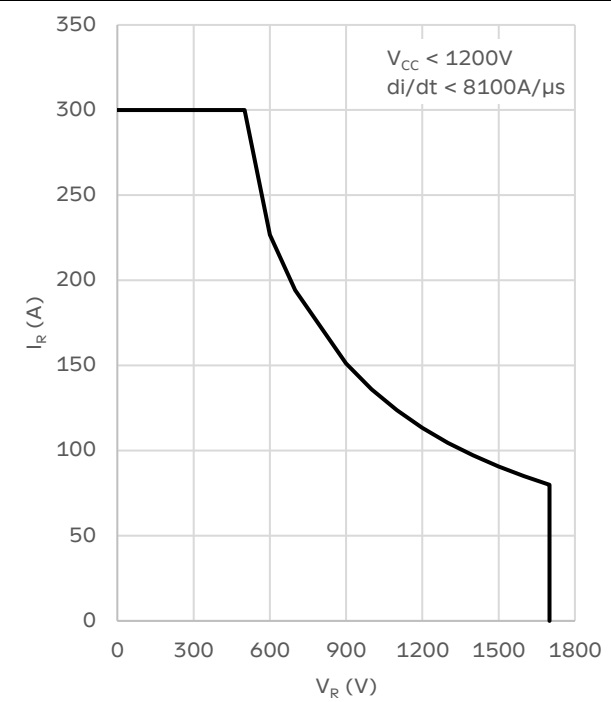
$R_{Goff} = 4.5\text{ }\Omega$ ,  $V_{GE} = \pm 15\text{ V}$



#### Diode SOA

Diode 反偏安全工作区域

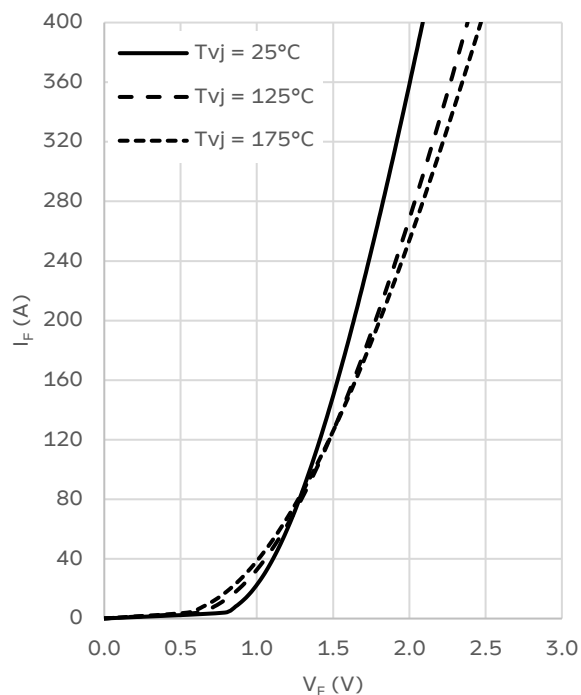
$T_{vj} \leq 175\text{ °C}$



#### Diode forward characteristic (typical)

二极管正向特性 (典型)

$$I_F = f(V_F)$$

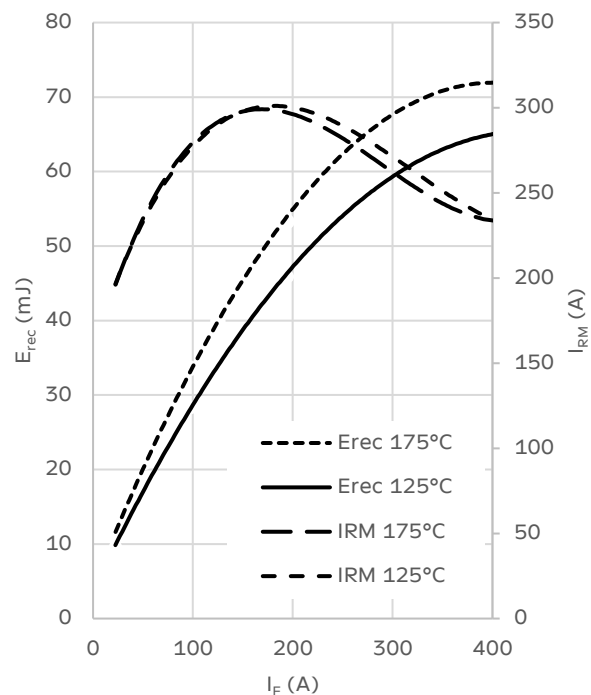


#### Diode switching characteristics (typical)

二极管开关特性 (典型)

$$E_{rec} = f(I_F), I_{RM} = f(I_F)$$

$$V_{DC} = 900 \text{ V}, R_{Gon} = 4 \text{ } \Omega \text{ (IGBT)}, V_{GE} = -15/+15 \text{ V (IGBT)}$$

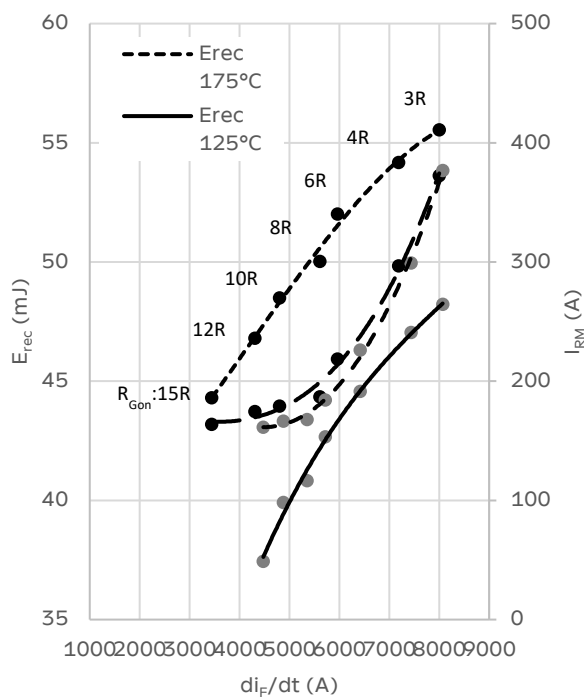


#### Diode switching characteristics (typical)

二极管开关特性 (典型)

$$E_{rec} = f(di/dt), I_{RM} = f(di/dt)$$

$$V_{DC} = 900 \text{ V}, I_F = 200 \text{ A}, V_{GE} = -15/+15 \text{ V (IGBT)}$$



#### Thermal impedance (typical)

热阻抗 (典型)

$$Z_{th(j-c)} = f(t)$$

