

## IGBT Module/IGBT 模块

### Features/特性

- 1200V,200A
  - 采用SPT+技术的低 $V_{CE(sat)}$
- Low  $V_{CE(sat)}$  with SPT+ technology
- 具有正温度系数的 $V_{CE(sat)}$
- $V_{CE(sat)}$  with positive temperature coefficient
- 包括快速软恢复反并联前馈
- Including fast & soft recovery anti-parallel FWD
- 高短路能力 (10us)
- High short circuit capability(10us)
- 低电感模块结构
- Low inductance module structure



IGBT Power Module

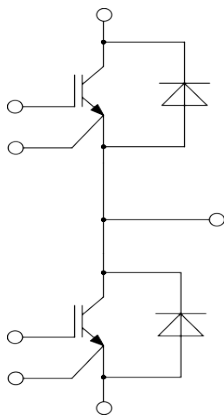
### Mechanical Features/机械特性

绝缘的基板  
Isolated Base Plate  
标准封装  
Standard Housing

### Applications/应用

- 电机驱动逆变器  
Inverter for motor drive
- 交流和直流伺服驱动放大器  
AC and DC servo drive amplifier
- 不间断电源  
UPS (Uninterruptible Power Supplies)
- 光伏储能  
Photovoltaic energy storage

### Equivalent Circuit Schematic/等效电路图



**IGBT-Absolute Maximum Ratings (@  $T_C = 25^\circ\text{C}$  unless otherwise specified)**

| Symbol    | Parameter                                 | Value  | Units |
|-----------|---|--|-------|
| $V_{CES}$ | Collector-Emitter Voltage<br>集电极-发射极电压    | 1200   | V     |
| $V_{GES}$ | Gate-Emitter Peak Voltage<br>栅极-发射极峰值电压   | $\pm 20$   | V     |
| $I_C$     | Continuous Collector Current<br>连续集电极直流电流 | $T_C = 100^\circ\text{C}$<br>200                 | A     |
| $I_{CM}$  | Pulsed Collector Current<br>集电极重复峰值电流     | $t_p = 1\text{ms}$<br>400                        | A     |
| $P_{tot}$ | Total Power Dissipation<br>总功率功耗          | $T_{vj} \text{ max} = 150^\circ\text{C}$<br>1100 | W     |

**IGBT Characteristics (@  $T_C = 25^\circ\text{C}$  unless otherwise specified)**

| Symbol               | Parameter  | Conditions   | Min.  | Typ.  | Max.  | Unit          |     |
|----------------------|--|--|---|-------|-------|---------------|-----|
| $V_{CE \text{ sat}}$ | Collector to Emitter Saturation Voltage<br>集电极-发射极饱和电压 | $I_C = 200 \text{ A}, V_{GE} = 15 \text{ V}$   | $T_{vj} = 25^\circ\text{C}$   | 1.8   |       | V             |     |
|                      |  |  | $T_{vj} = 125^\circ\text{C}$  | 2.1   |       |               |     |
| $V_{GE \text{ th}}$  | Gate-Emitter Threshold Voltage<br>栅极阈值电压               | $I_C = 1.0 \text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^\circ\text{C}$                       |   | 5.4   |       | V             |     |
| $I_{CES}$            | Collector-Emitter Cut-off Current<br>集电极-发射极截止电流       | $V_{CE} = 1200 \text{ V}, V_{GE} = 0 \text{ V}, T_{vj} = 25^\circ\text{C}$               |   |       | 5.0   | mA            |     |
| $I_{GES}$            | Gate-emitter Leakage Current<br>栅极-发射极漏电流              | $V_{CE} = 0 \text{ V}, V_{GE} = 20 \text{ V}, T_{vj} = 25^\circ\text{C}$                 |   |       | 400.0 | nA            |     |
| $R_{Gint}$           | Internal Gate Resistor<br>内部栅极电阻                       |  |   | 6.0   |       | $\Omega$      |     |
| $Q_G$                | Gate Charge<br>栅极电荷                                    | $V_{GE} = -15 \dots +15 \text{ V}$   |   | 1.1   |       | $\mu\text{C}$ |     |
| $C_{ies}$            | Input Capacitance<br>输入电容                              | $V_{CE} = 25 \text{ V}, f = 1 \text{ MHz}, V_{GE} = 0 \text{ V}$                         |   | 14    |       | nF            |     |
| $C_{res}$            | Reverse Transfer Capacitance<br>反向传输电容                 |  |   |       | 0.5   |               | nF  |
| $t_{don}$            | Turn-on Delay Time<br>开通延迟时间                           | $V_{CE} = 600 \text{ V}, I_C = 200 \text{ A}, R_G = 5 \Omega, V_{GE} = \pm 15 \text{ V}$ | $T_{vj} = 25^\circ\text{C}$   | 105   |       | nS            |     |
|                      |  |  | $T_{vj} = 125^\circ\text{C}$  | 124   |       |               |     |
| $t_r$                | Rise Time<br>上升时间                                      |  | $T_{vj} = 25^\circ\text{C}$   | 84    |       | nS            |     |
|                      |  |  | $T_{vj} = 125^\circ\text{C}$  | 92    |       |               |     |
| $t_{doff}$           | Turn-off Delay Time<br>关断延迟时间                          |  | $T_{vj} = 25^\circ\text{C}$   | 208   |       | nS            |     |
|                      |  |  | $T_{vj} = 125^\circ\text{C}$  | 261   |       |               |     |
| $t_f$                | Fall Time<br>下降时间                                      |  | $T_{vj} = 25^\circ\text{C}$   | 170   |       | nS            |     |
|                      |  |  | $T_{vj} = 125^\circ\text{C}$  | 177   |       |               |     |
| $E_{on}$             | Turn-On Switching Loss Per Pulse<br>开通损耗能量             |  | $T_{vj} = 25^\circ\text{C}$   | 13    |       | mJ            |     |
|                      |  |  | $T_{vj} = 125^\circ\text{C}$  | 19    |       |               |     |
| $E_{off}$            | Turn-off Energy Loss Per Pulse<br>关断损耗能量               |  | $T_{vj} = 25^\circ\text{C}$   | 35    |       | mJ            |     |
|                      |  |  | $T_{vj} = 125^\circ\text{C}$  | 41    |       |               |     |
| $I_{sc}$             | SC Data<br>短路数据  |  | $V_{GE} = 15 \text{ V}, V_{CC} = 600 \text{ V}, t_p \leq 10 \mu\text{s}$<br>$V_{CEM} \leq 1200 \text{ V}, T_{vj} = 150^\circ\text{C}$ |       | 601   |               | A   |
| $R_{thJC}$           | Thermal Resistance, Junction to Case<br>结-外壳热阻         |  | per IGBT  |       |       | 0.135         | K/W |
| $R_{thCH}$           | Thermal Resistance, Case to Heatsink<br>外壳-散热器热阻       | per IGBT   |   | 0.034 |       | K/W           |     |

**Diode-Absolute Maximum Ratings (@  $T_C = 25^\circ\text{C}$  unless otherwise specified)**

| Symbol    | Parameter                                    | Value                   | Units |
|-----------|--|-------------------------|-------|
| $V_{RRM}$ | Repetitive Peak Reverse Voltage<br>反向重复峰值电压  | 1200                    | V     |
| $I_F$     | Diode Continuous Forward Current<br>连续正向直流电流 | 200                     | A     |
| $I_{FM}$  | Diode Maximum Forward Current<br>正向重复峰值电流    | $t_p=1\text{ms}$<br>400 | A     |

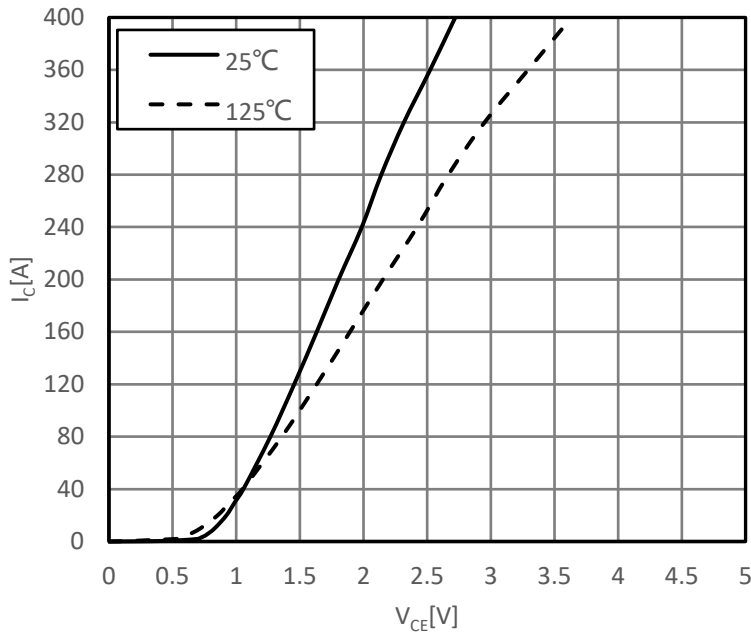
**Diode Characteristics (@  $T_C = 25^\circ\text{C}$  unless otherwise specified)**

| Symbol     | Parameter                                       | Conditions  | Min.                       | Typ. | Max. | Unit          |
|------------|---|---|----------------------------|------|------|---------------|
| $V_F$      | Diode Forward Voltage<br>正向电压                   | $I_C = 200\text{ A}$  | $T_{vj}=25^\circ\text{C}$  |      | 1.8  | V             |
|            |   |   | $T_{vj}=125^\circ\text{C}$ |      | 1.9  |               |
| $Q_r$      | Recovered Charge<br>恢复电荷                        | $I_F = 200\text{ A}, V_R = 600\text{ V},$<br>$-diF/dt = 1900\text{ A}/\mu\text{s},$<br>$R_G = 5\ \Omega, V_{GE} = -15\text{ V}$ | $T_{vj}=25^\circ\text{C}$  |      | 20.2 | $\mu\text{C}$ |
|            |   |   | $T_{vj}=125^\circ\text{C}$ |      | 31   |               |
| $I_{rm}$   | Peak Reverse Recovery Current<br>反向恢复峰值电流       | $I_F = 200\text{ A}, V_R = 600\text{ V},$<br>$-diF/dt = 1900\text{ A}/\mu\text{s},$<br>$R_G = 5\ \Omega, V_{GE} = -15\text{ V}$ | $T_{vj}=25^\circ\text{C}$  |      | 120  | A             |
|            |   |   | $T_{vj}=125^\circ\text{C}$ |      | 118  |               |
| $t_{rr}$   | Reverse Recovery Time<br>反向恢复时间                 | $I_F = 200\text{ A}, V_R = 600\text{ V},$<br>$-diF/dt = 1900\text{ A}/\mu\text{s},$<br>$R_G = 5\ \Omega, V_{GE} = -15\text{ V}$ | $T_{vj}=25^\circ\text{C}$  |      | 333  | nS            |
|            |   |   | $T_{vj}=125^\circ\text{C}$ |      | 524  |               |
| $E_{rec}$  | Reverse Recovery Energy<br>反向恢复损耗               | $I_F = 200\text{ A}, V_R = 600\text{ V},$<br>$-diF/dt = 1900\text{ A}/\mu\text{s},$<br>$R_G = 5\ \Omega, V_{GE} = -15\text{ V}$ | $T_{vj}=25^\circ\text{C}$  |      | 7.3  | mJ            |
|            |   |   | $T_{vj}=125^\circ\text{C}$ |      | 11.2 |               |
| $R_{thJC}$ | Thermal Resistance, Junction to Case<br>结-外壳热阻  | per Diode   |                            | 0.2  |      | K/W           |
| $R_{thCH}$ | Thermal Resistance, Case to Heatsink<br>结-散热器热阻 | per Diode   |                            | 0.1  |      | K/W           |

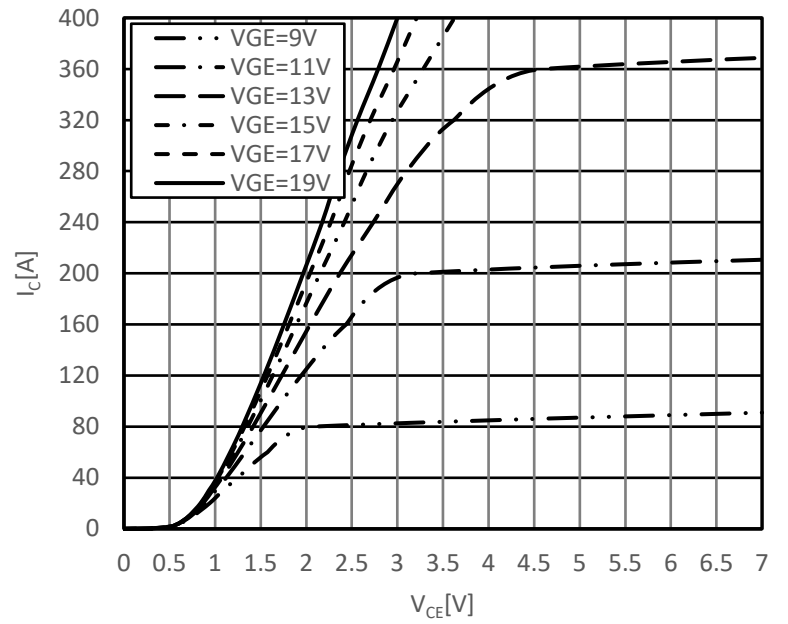
## Module

| Symbol              | Parameter                                       | Conditions                | Min. | Typ. | Max. | Unit |
|---------------------|---|---------------------------|------|------|------|------|
| V <sub>ISOL</sub>   | Isolation Test Voltage<br>绝缘测试电压                | RMS, f = 50 Hz, t = 1 min | 2500 |      |      | V    |
| T <sub>vj max</sub> | Maximum Junction Temperature<br>最大结温            |                           |      |      | 150  | °C   |
| T <sub>vj op</sub>  | Operating Junction Temperature<br>工作结温          |                           | -40  |      | 150  | °C   |
| T <sub>STG</sub>    | Storage Temperature Range<br>储存温度               |                           | -40  |      | 125  | °C   |
| R <sub>thCH</sub>   | Case to Heatsink<br>外壳-散热器热阻                    | per Module                |      | 0.01 |      | K/W  |
| Ms                  | Mounting Torque For Modul Mounting<br>模块安装的安装扭矩 | Recommended(M6)           | 3    |      | 6    | Nm   |
| Mt                  | Terminal Connection Torque<br>端子连接扭矩            | Recommended(M5)           | 2.5  |      | 5    | Nm   |
| G                   | Weight<br>重量                                    |                           |      | 322  |      | g    |

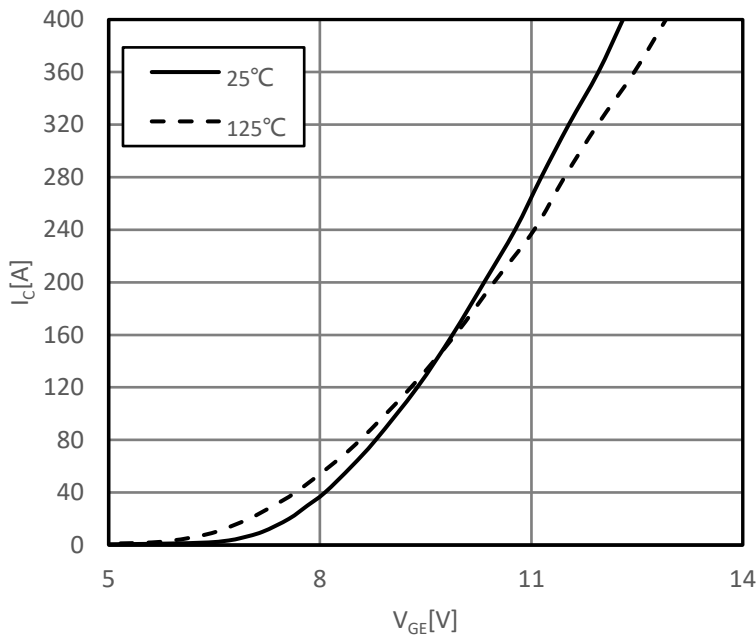
输出特性IGBT,逆变器 (典型)  
output characteristic IGBT,Inverter (typical)  
 $I_C=f(V_{CE})$   
 $V_{GE}=15V$



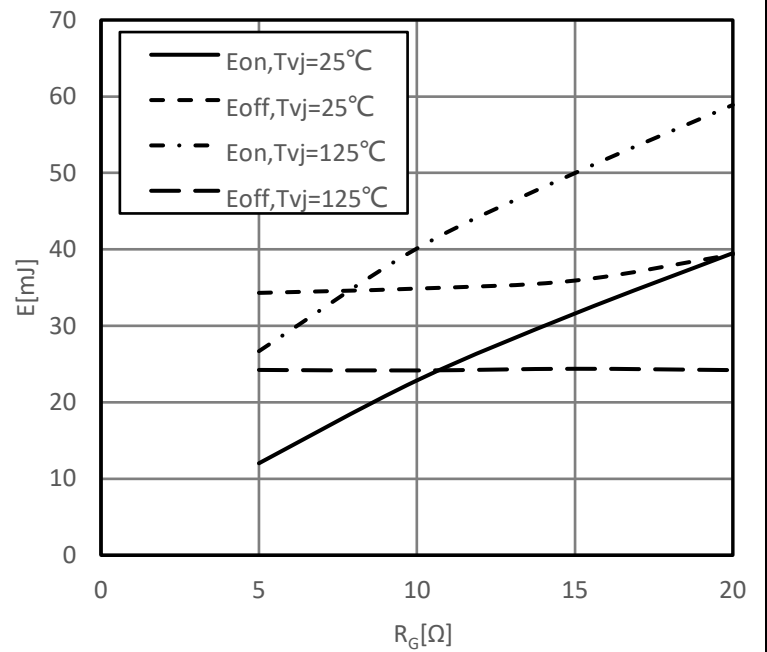
输出特性IGBT,逆变器 (典型)  
output characteristic IGBT,Inverter (typical)  
 $I_C=f(V_{CE})$   
 $T_{vj}=125^\circ C$



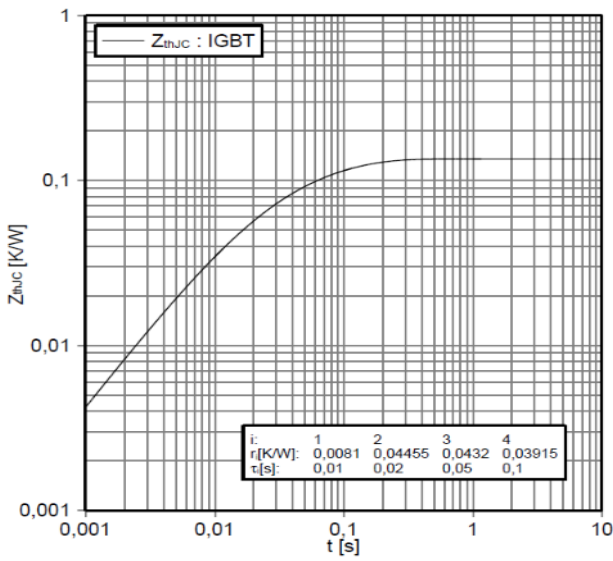
传输特性IGBT,逆变器(典型)  
transfer characteristic IGBT,Inverter(typical)  
 $I_C=f(V_{GE})$   
 $V_{CE}=20V$



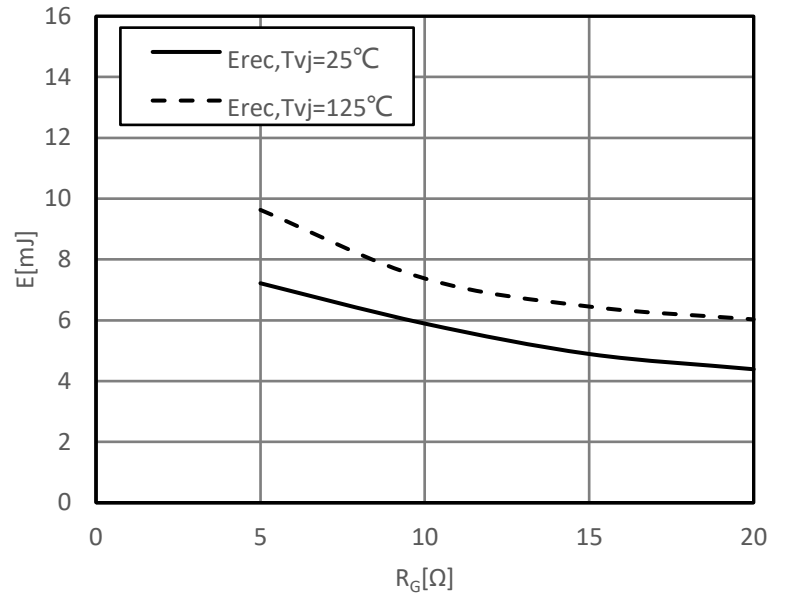
开关损耗IGBT,逆变器 (典型)  
switching losses IGBT,Inverter(typical)  
 $E_{on}=f(R_G), E_{off}=f(R_G)$   
 $V_{GE}=\pm 15V, I_C=200A, V_{CE}=600V$



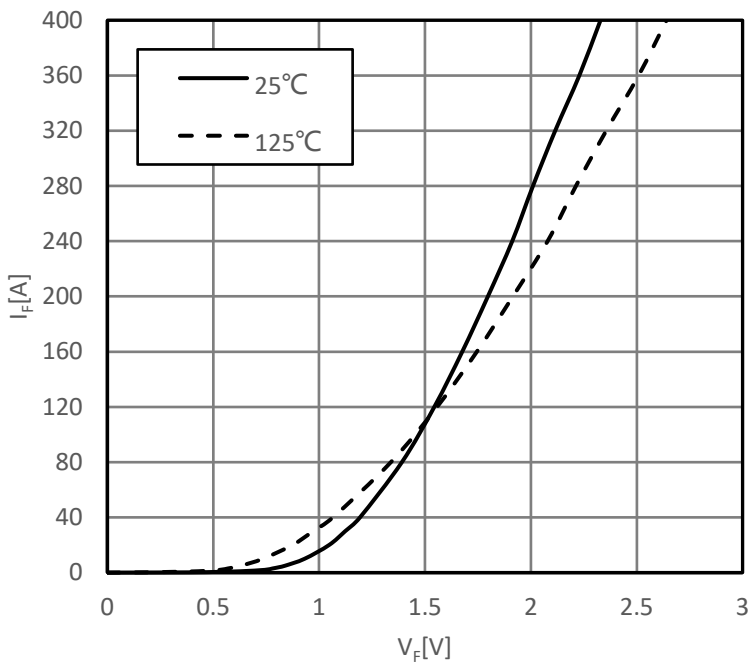
瞬态热阻抗IGBT,逆变器  
transient thermal impedance IGBT, Inverter  
 $Z_{thJC}=f(t)$



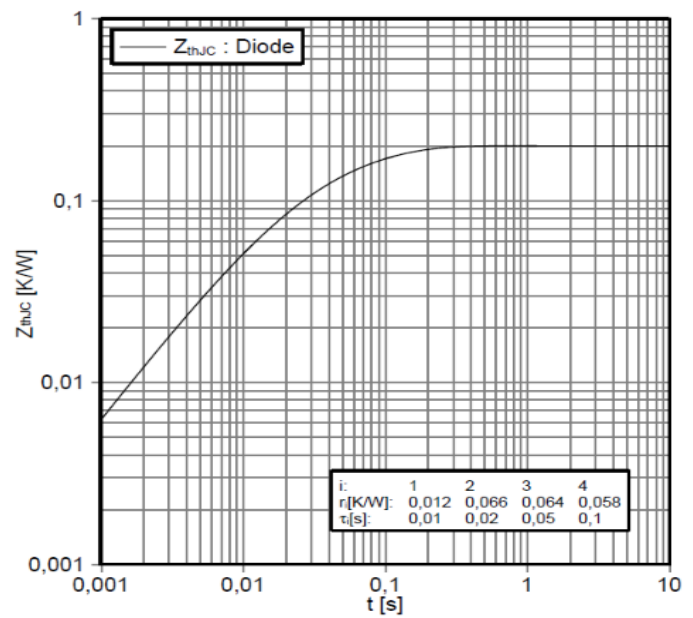
开关损耗二极管,逆变器 (典型)  
switching losses Diode, Inverter (typical)  
 $E_{rec}=f(R_G)$   
 $I_F=200A, V_{CE}=600V$



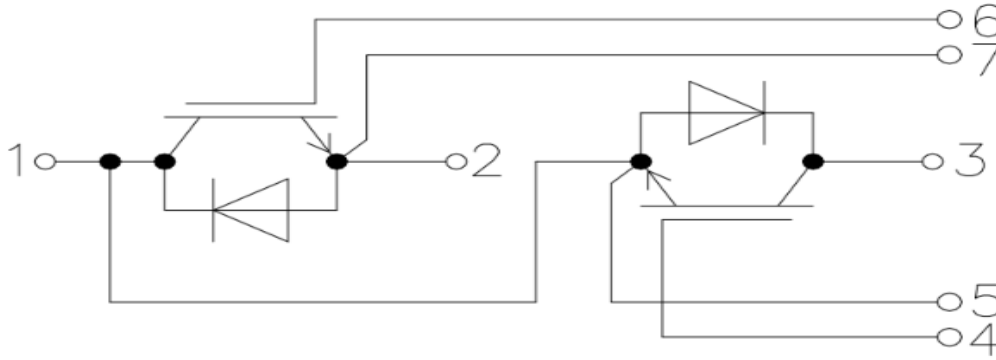
正向偏压特性二极管,逆变器 (典型)  
forward characteristic of Diode, Inverter (typical)  
 $I_F=f(V_F)$



瞬态热阻抗二极管,逆变器  
transient thermal impedance Diode, Inverter  
 $Z_{thJC}=f(t)$



## 接线图/circuit\_diagram\_headline



## 封装尺寸/package outlines

