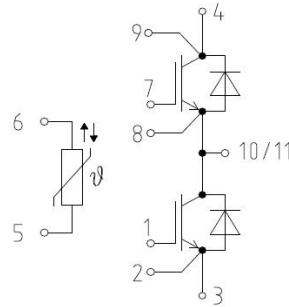


M series package: 1700V450A IGBT module

 Preliminary
Datasheet


等效电路图

Equivalent Circuit Schematic

Features:

- $V_{CES} = 1700V$
- $I_{C\ nom} = 450A / I_{CRM} = 900A$
- High RBSOA capability
- 1700V 450A, $V_{CE(sat)} = 1.55V@25^{\circ}C$
- 1700V 450A, $V_F = 1.70V@25^{\circ}C$
- Low Conduction Losses
- MPT / FS Technology

产品特性:

- 集电极发射极电压达 1700V
- 集电极重复峰值电流达 900A
- 高 RBSOA 能力
- 1700V 450A, $V_{CE(sat)} = 1.55V@25^{\circ}C$
- 1700V 450A, $V_F = 1.70V@25^{\circ}C$
- 低导通损耗
- 微沟槽栅/场终止技术

Typical Applications:

- Static Var Generator
- Middle (High) Voltage Converter
- Wind Turbines
- Motor Drives

典型应用:

- SVG 静止无功发生器
- MVD 中高压级联型变频器
- 风力发电机
- 电机驱动

IGBT, Inverter / IGBT, 逆变部分
Maximum Rated Values / 最大标称参数

| | | | | |
|---|---|--------------------|----------|---|
| Collector-emitter Voltage 集电极-发射极电压 | $T_{vj}=25^{\circ}\text{C}$ | V_{CES} | 1700 | V |
| Implemented collector current 集电极电流 | | $I_{C\text{ nom}}$ | 450 | A |
| Continuous DC collector current 集电极连续直流电流 | $T_C=90^{\circ}\text{C}, T_{vj\text{ max}}=175^{\circ}\text{C}$ | I_C | 450 | A |
| Repetitive Peak collector current 集电极可重复峰值电流 | t_p 受限于 $T_{vj\text{ op}}$ | I_{CRM} | 900 | A |
| Gate-emitter peak voltage 门极-发射极峰值电压 | | V_{GES} | ± 20 | V |

Characteristic Values / 性能参数

| | | | | min. | typ. | max | |
|--|---|---|---------------------|------|------------------------------|-----|---------------|
| Collector-emitter saturation Voltage ¹⁾ 集电极-发射极饱和和压降 | $I_C=450\text{A}, V_{GE}=15\text{V}$ | $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$ | $V_{CE\text{ sat}}$ | - | 1.55 1.72 1.78 1.83 | - | V |
| Gate Threshold Voltage 门极阈值电压 | $V_{CE}=V_{GE}, I_C=9\text{mA}, T_{vj}=25^{\circ}\text{C}$ | | $V_{GE\text{ th}}$ | - | 6.10 | - | V |
| Gate Charge 门极电荷 | $V_{GE}=-15\text{V}/15\text{V}, V_{CE}=600\text{V}$ | | Q_G | - | 4.2 | - | μC |
| Internal Gate Resistor 内置门极电阻 | $T_{vj}=25^{\circ}\text{C}$ | | $R_{G\text{ int}}$ | - | 0.43 | - | Ω |
| Input Capacitance 输入电容 | $f=100\text{kHz}, T_{vj}=25^{\circ}\text{C}, V_{CE}=25\text{V}, V_{GE}=0\text{V}$ | | C_{ies} | - | 45.9 | - | nF |
| Reverse Transfer Capacitance 反向传输电容 | $f=100\text{kHz}, T_{vj}=25^{\circ}\text{C}, V_{CE}=25\text{V}, V_{GE}=0\text{V}$ | | C_{res} | - | 0.16 | - | nF |
| Collector-emitter Cutoff Current 集电极-发射极关断漏电流 | $V_{CE}=1700\text{V}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$ | | I_{CES} | - | - | 1 | mA |
| Gate-emitter Leakage Current 门极-发射极漏电流 | $V_{CE}=0\text{V}, V_{GE}=20\text{V}, T_{vj}=25^{\circ}\text{C}$ | | I_{GES} | - | - | 100 | nA |
| Turn-on Delay Time, Inductive Load 开通延迟时间, 感性负载 | $I_C=450\text{A}, V_{CE}=900\text{V}$ $V_{GE}=-8\text{V}/15\text{V}$ $R_{Gon}=1.5\Omega$ | $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$ | t_{don} | - | 143 149 150 151 | - | ns |
| Rise Time, Inductive Load 上升时间, 感性负载 | $I_C=450\text{A}, V_{CE}=900\text{V}$ $V_{GE}=-8\text{V}/15\text{V}$ $R_{Gon}=1.5\Omega$ | $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$ | t_r | - | 51 63 64 66 | - | ns |
| Turn-off Delay Time, Inductive Load 关断延迟时间, 感性负载 | $I_C=450\text{A}, V_{CE}=900\text{V}$ $V_{GE}=-8\text{V}/15\text{V}$ $R_{Goff}=5\Omega$ | $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$ | t_{doff} | - | 808 874 889 907 | - | ns |
| Fall Time, Inductive Load 下降时间, 感性负载 | $I_C=450\text{A}, V_{CE}=900\text{V}$ $V_{GE}=-8\text{V}/15\text{V}, R_{Goff}=5\Omega$ | $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$ | t_f | - | 438 714 763 848 | - | ns |
| Turn-on energy loss per pulse 开通损耗 | $I_C=450\text{A}, V_{CE}=900\text{V}$ $L_G=30\text{nH}, V_{GE}=-8\text{V}/15\text{V}$ $R_{Gon}=1.5\Omega$ $di/dt=5448\text{A}/\mu\text{s}(T_{vj}=175^{\circ}\text{C})$ | $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$ | E_{on} | - | 105 142 153 162 | - | mJ |

| | | | | | | | |
|--|--|---|-------------|-----|--------------------------|-----|------------|
| Turn-off energy loss per pulse 关断损耗 | $I_C=450A, V_{CE}=900V$ $L_G=30nH, V_{GE}=-8V/15V$ $R_{Goff}=5\Omega$ $du/dt=4762V/\mu s(T_{vj}=175^\circ C)$ | $T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$ $T_{vj}=175^\circ C$ | E_{off} | - | 114 158 170 178 | - | mJ |
| SC Data 短路耐量 | $V_{GE}=-8V/15V$ $V_{CC}=1000V$ | $t_p \leq 8\mu s, T_{vj}=150^\circ C$ $t_p \leq 6\mu s, T_{vj}=175^\circ C$ | I_{sc} | - | 1900 1800 | - | A |
| Thermal Resistance, Junction to Case 结-外壳热阻 | Per IGBT/单个 IGBT | | R_{thJC} | - | 0.060 | - | K/W |
| Thermal Resistance, Case to Heatsink 外壳-散热器热阻 | Per IGBT/单个 IGBT $\lambda_{grease}=1W/(m \cdot K)$ | | R_{thCH} | - | 0.037 | - | K/W |
| Temperature under switching conditions 工作温度 | | | $T_{vj op}$ | -40 | - | 175 | $^\circ C$ |

Diode, Inverter / 二极管, 逆变部分

Maximum Rated Values / 最大标称参数

| | | | | |
|--|---------------------|------------|------|---|
| Repetitive peak reverse voltage 可重复反向峰值电压 | $T_{vj}=25^\circ C$ | V_{RRM} | 1700 | V |
| Continuous DC Forward Current 可连续正向直流电流 | | I_{Fnom} | 450 | A |
| Repetitive Peak Forward Current 可重复正向峰值电流 | $t_p=1ms$ | I_{FRM} | 900 | A |

Characteristic Values / 性能参数

| | | | min. | typ. | max | | |
|--|--|---|-------------|------|------------------------------|-----|------------|
| Forward Voltage ¹⁾ 正向通态压降 | $I_F=450A, V_{GE}=0V$ | $T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$ $T_{vj}=175^\circ C$ | V_F | - | 1.70 1.90 1.95 2.00 | - | V |
| Peak Reverse Recovery Current 反向恢复峰值电流 | $I_F=450A, V_R=900V$ $-di_F/dt=5556A/\mu s(T_{vj}=175^\circ C)$ $V_{GE}=-8V$ | $T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$ $T_{vj}=175^\circ C$ | I_{RM} | - | 662 678 686 678 | - | A |
| Recovery Charge 反向恢复电荷 | $I_F=450A, V_R=900V$ $-di_F/dt=5556A/\mu s(T_{vj}=175^\circ C)$ $V_{GE}=-8V$ | $T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$ $T_{vj}=175^\circ C$ | Q_R | - | 79 114 125 135 | - | μC |
| Reverse Recovery Energy 反向恢复损耗 | $I_F=450A, V_R=900V$ $-di_F/dt=5556A/\mu s(T_{vj}=175^\circ C)$ $V_{GE}=-8V$ | $T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$ $T_{vj}=175^\circ C$ | E_{rec} | - | 36 59 66 71 | - | mJ |
| Thermal Resistance, Junction to Case 结-壳热阻 | Per FRD/单个 FRD | | R_{thJC} | - | 0.078 | - | K/W |
| Thermal Resistance, Case to Heatsink 外壳-散热器热阻 | Per IGBT/单个 IGBT $\lambda_{grease}=1W/(m \cdot K)$ | | R_{thCH} | - | 0.048 | - | K/W |
| Temperature under switching conditions 工作温度 | | | $T_{vj op}$ | -40 | - | 175 | $^\circ C$ |

NTC-Thermistor/ NTC-热敏电阻
Characteristic Values / 性能参数

| | | | min. | typ. | max | |
|-------------------------------|--|--------------|------|------|-----|------------|
| Rated Resistance 标称电阻 | $T_{NTC}=25^{\circ}C$ | R_{25} | - | 5 | - | K Ω |
| Deviation of R100 R100 偏移值 | $T_{NTC}=100^{\circ}C$, $R_{100}=465\Omega$ | $\Delta R/R$ | -5 | - | 5 | % |
| Power Dissipation 功率耗散 | $T_{NTC}=25^{\circ}C$ | P_{25} | - | - | 20 | mW |
| B-Value B 值 | $R_2=R_{25} \exp[B_{25/50}(1/T_2-1/(298.15K))]$ | $B_{25/50}$ | - | 3375 | - | K |
| | $R_2=R_{25} \exp[B_{25/80}(1/T_2-1/(298.15K))]$ | $B_{25/80}$ | - | 3414 | - | K |
| | $R_2=R_{25} \exp[B_{25/100}(1/T_2-1/(298.15K))]$ | $B_{25/100}$ | - | 3436 | - | K |

Module / 模块

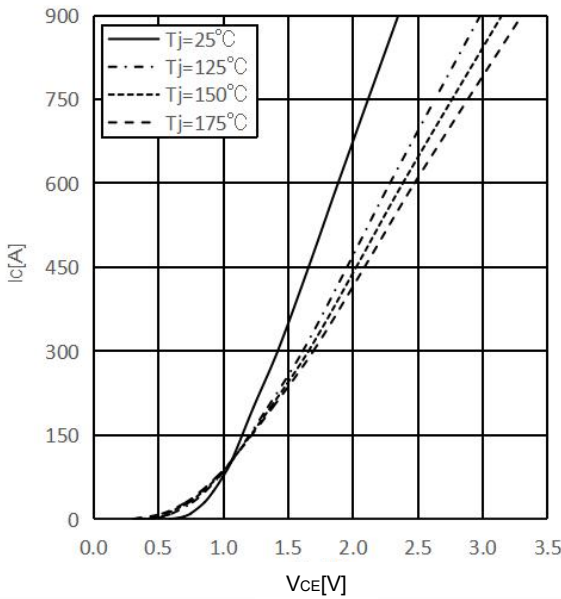
| | | | | | | |
|---|----------------------|-----------------|--|------|--|----|
| Isolation Test Voltage 绝缘测试电压 | RMS, f=50Hz, t=1min | V_{ISOL} | | 3.4 | | kV |
| Isolation Test Voltage of NTC NTC 绝缘测试电压 | RMS, f=50Hz, t=1min | $V_{ISOL(NTC)}$ | | 3.4 | | kV |
| Material of Module Baseplate 模块底板材料 | | | | Cu | | |
| Internal Isolation 内部绝缘 | | | | ZTA | | |
| Creepage Distance 爬电距离 | Terminal to heatsink | | | 15 | | mm |
| | Terminal to terminal | | | 12.1 | | |
| Clearance 电气间隙 | Terminal to heatsink | | | 12.5 | | mm |
| | Terminal to terminal | | | 10 | | |
| Comparative Tracking Index 相对漏电起痕指数 | | CTI | | >200 | | |

| | | | min. | typ. | max. | |
|--|--------------------------------|---------------|------|------|------|-------------|
| Stray Inductance Module 模块杂散电感 | | L_{sCE} | - | 20 | - | nH |
| Module Lead Resistance, Terminals-Chip 模块引脚电阻, 端子-芯片 | $T_C=25^{\circ}C$, Per Switch | $R_{CC'+EE'}$ | - | 0.8 | - | m Ω |
| Storage Temperature 贮存温度 | | T_{stg} | -40 | - | 125 | $^{\circ}C$ |
| Mounting Torque for Module Mounting 模块安装力矩 | Screw M5 / M5 螺丝 | M | 3.0 | - | 6.0 | Nm |
| Mounting Torque for Terminal Mounting 功率端子安装力矩 | Screw M6 / M6 螺丝 | M | 3.0 | - | 6.0 | Nm |
| Weight 重量 | | G | - | 345 | | g |

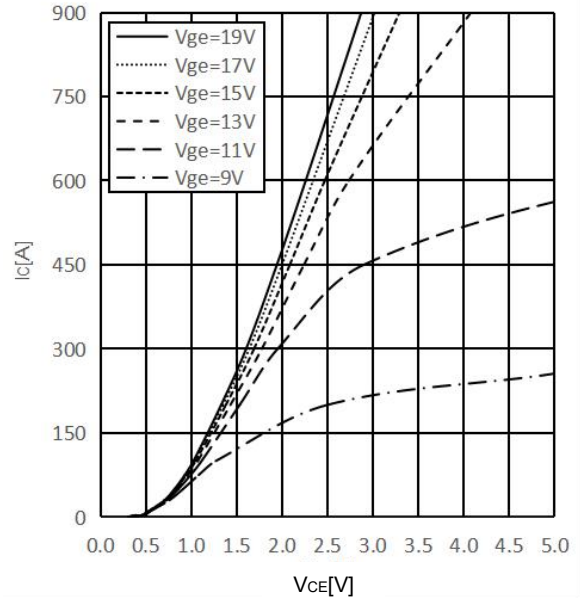
- 1) Terminal impedance is not included.
不包含端子阻抗。

Circuit Diagram / 曲线图

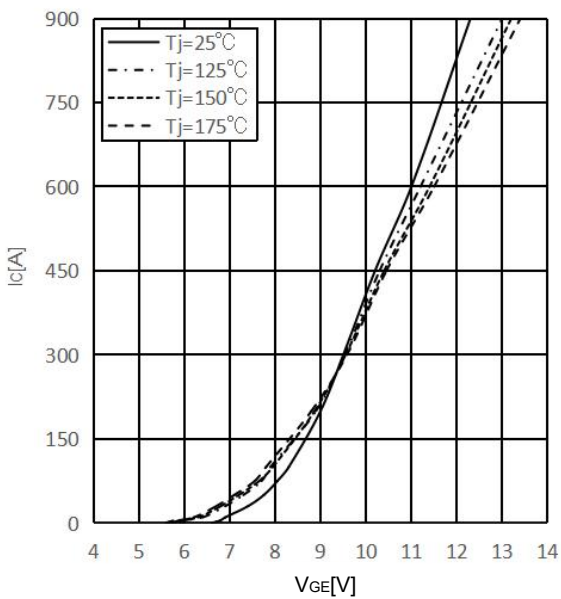
Output characteristic IGBT, Inverter (typical), Inclusive R_{CC+EE}
 IGBT 输出特性, 逆变 (典型值), 包含 R_{CC+EE}
 $I_C = f(V_{CE}), V_{GE} = 15V$



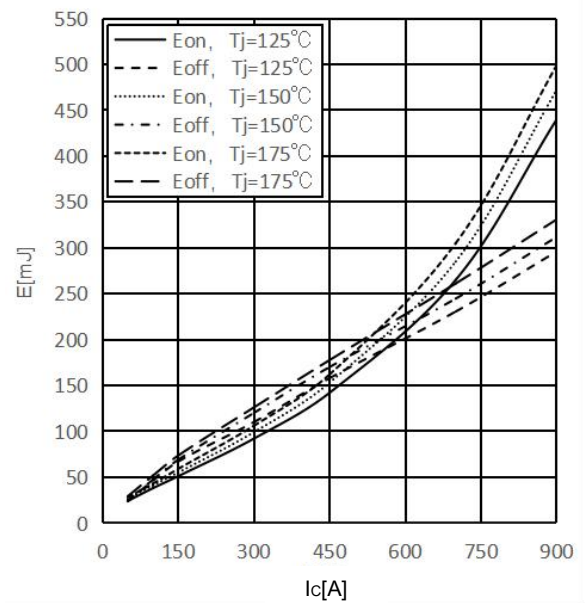
Output characteristic IGBT, Inverter (typical), Inclusive R_{CC+EE}
 IGBT 输出特性, 逆变 (典型值), 包含 R_{CC+EE}
 $I_C = f(V_{CE}), T_j = 175^\circ C$



Transfer characteristic IGBT, Inverter (typical), Inclusive R_{CC+EE}
 IGBT 传输特性, 逆变 (典型值), 包含 R_{CC+EE}
 $I_C = f(V_{GE}), V_{CE} = 20V$

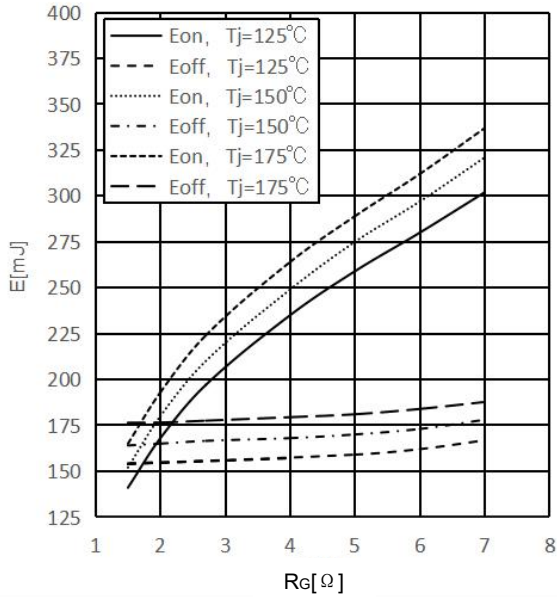


Switching losses IGBT, Inverter (typical), Inclusive R_{CC+EE}
 IGBT 开关损耗, 逆变 (典型值), 包含 R_{CC+EE}
 $E = f(I_C), V_{GE} = +15V/-8V,$
 $R_{Gon} = 1.5\Omega, R_{Goff} = 5\Omega, V_{CE} = 900V$



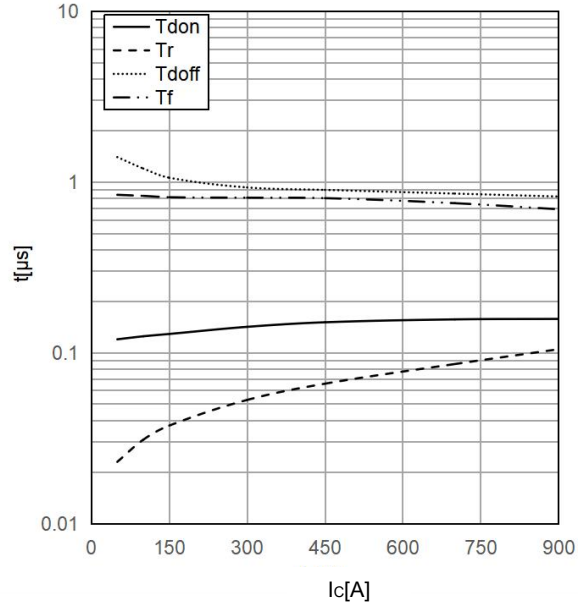
Switching losses IGBT, Inverter (typical), Inclusive R_{CC+EE}

IGBT 开关损耗, 逆变 (典型值), 包含 R_{CC+EE}
 $E=f(R_G)$, $V_{GE}=+15V/-8V$, $I_C=450A$, $V_{CE}=900V$



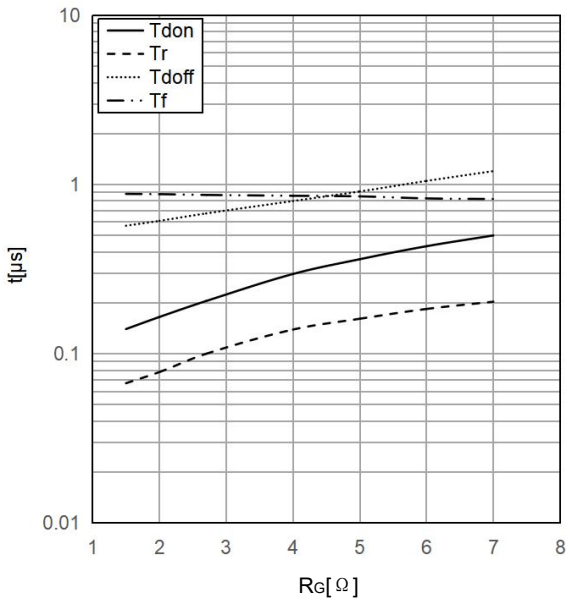
Switching times IGBT, Inverter (typical)

IGBT 开关时间, 逆变 (典型值)
 $t_{don}=f(I_C)$, $t_r=f(I_C)$, $V_{GE}=+15V/-8V$, $V_{CE}=900V$
 $R_{Gon}=1.5\Omega$, $R_{Goff}=5\Omega$, $T_j=175^\circ C$



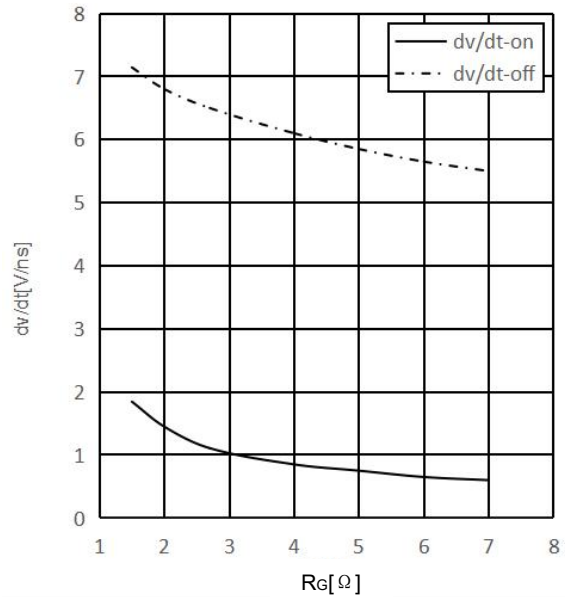
Switching times IGBT, Inverter (typical)

IGBT 开关时间, 逆变 (典型值)
 $t_{don}=f(R_G)$, $t_r=f(R_G)$, $V_{GE}=+15V/-8V$,
 $I_C=450A$, $V_{CE}=900V$, $T_j=175^\circ C$

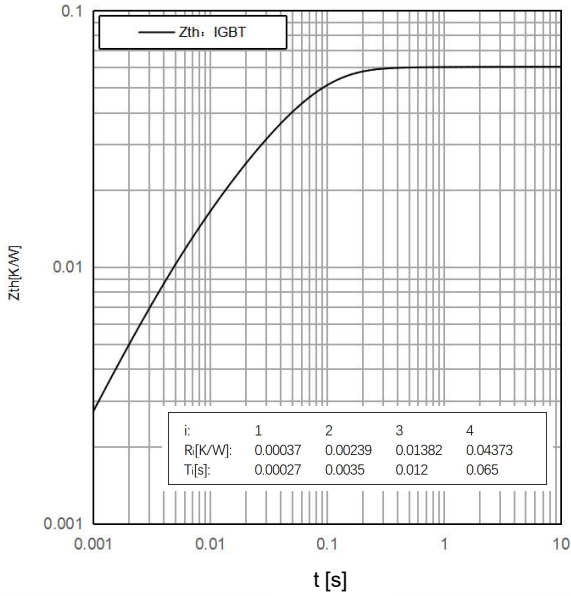


IGBT, Inverter (typical)

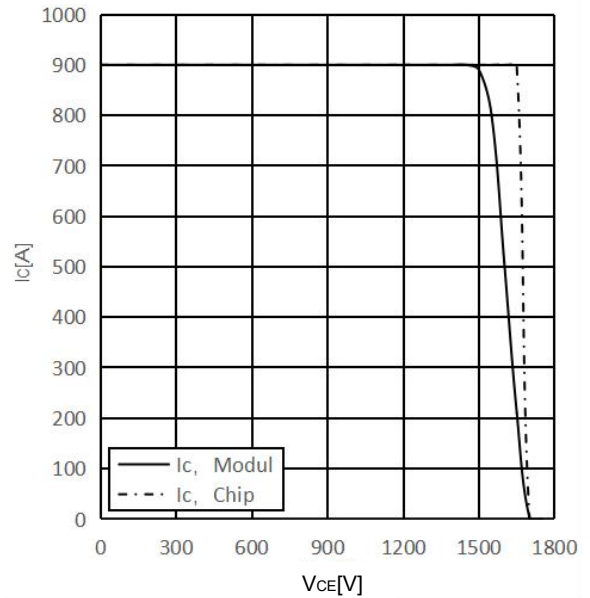
IGBT 电压变化斜率, 逆变 (典型值)
 $dv/dt=f(R_G)$, $V_{GE}=+15V/-8V$,
 $I_C=450A$, $V_{CE}=900V$, $T_j=25^\circ C$



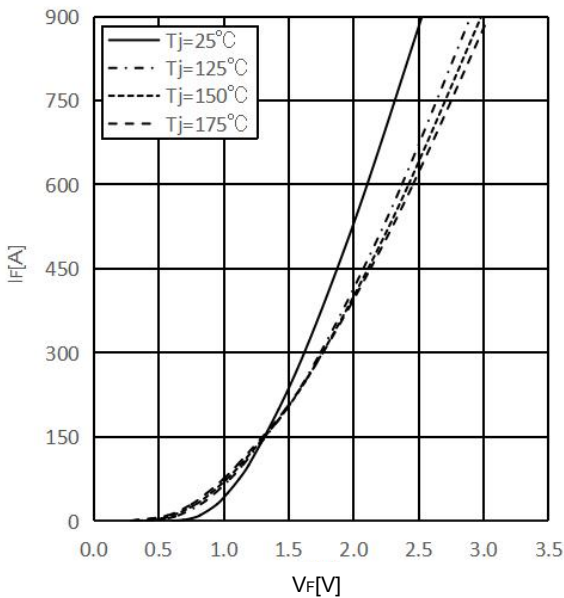
Transient thermal impedance IGBT, Inverter
IGBT 瞬态热阻, 逆变
 $Z_{thJC}=f(t)$



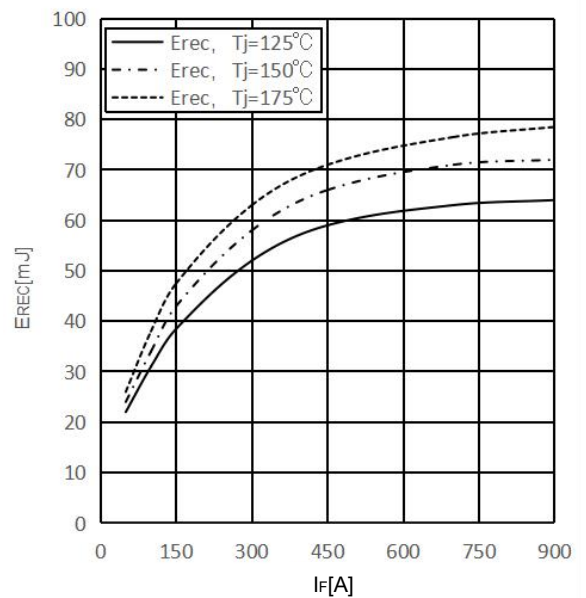
Reverse bias safe operating area IGBT, Inverter(RBSOA)
IGBT 反向安全工作区, 逆变(RBSOA)
 $I_C=f(V_{CE}), V_{GE}=+15V/-8V, R_{Goff}=5\Omega, T_j=175^\circ\text{C}$



Forward characteristic FRD, Inverter(typical), Inclusive $R_{CC'+EE'}$
FRD 正向特性, 逆变 (典型值), 包含 $R_{CC'+EE'}$
 $I_F=f(V_F)$

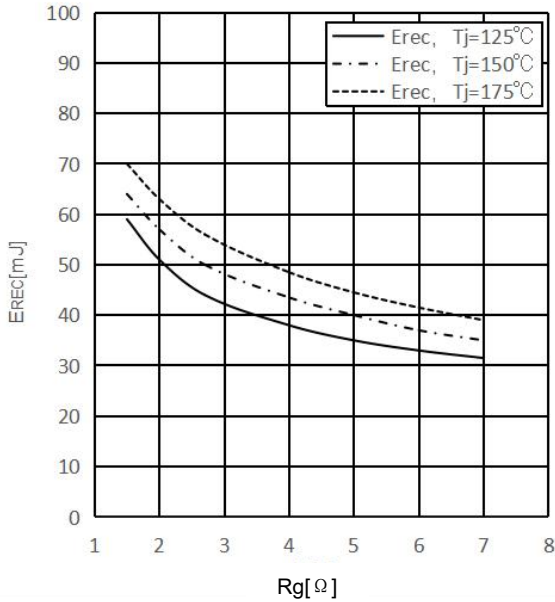


Switching Losses FRD, Inverter (typical), Inclusive $R_{CC'+EE'}$
FRD 开关损耗, 逆变 (典型值), 包含 $R_{CC'+EE'}$
 $E_{rec}=f(I_F), R_{Gon}=5\Omega, V_{CE}=900V$



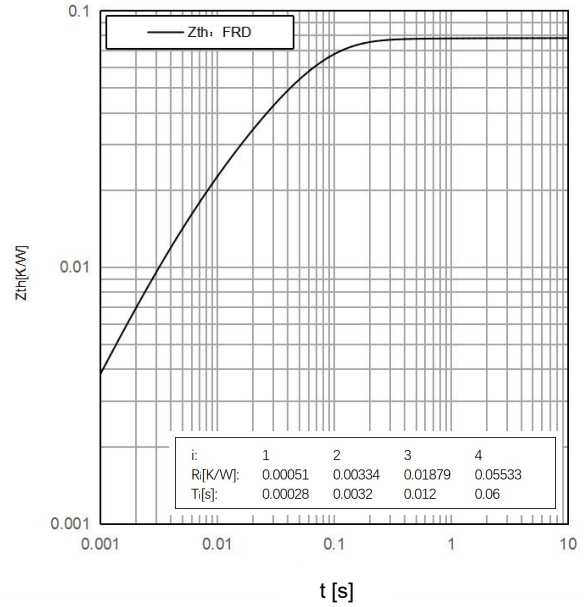
Switching Losses FRD, Inverter(typical), Inclusive R_{CC+EE}

FRD 开关损耗, 逆变 (典型值), 包含 R_{CC+EE}
 $E_{rec}=f(R_g)$



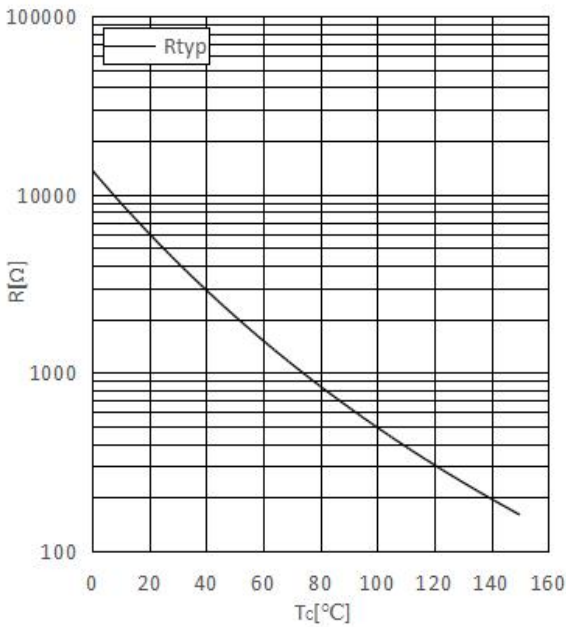
Transient thermal impedance FRD, Inverter

FRD 瞬态热阻, 逆变
 $Z_{thJC}=f(t)$

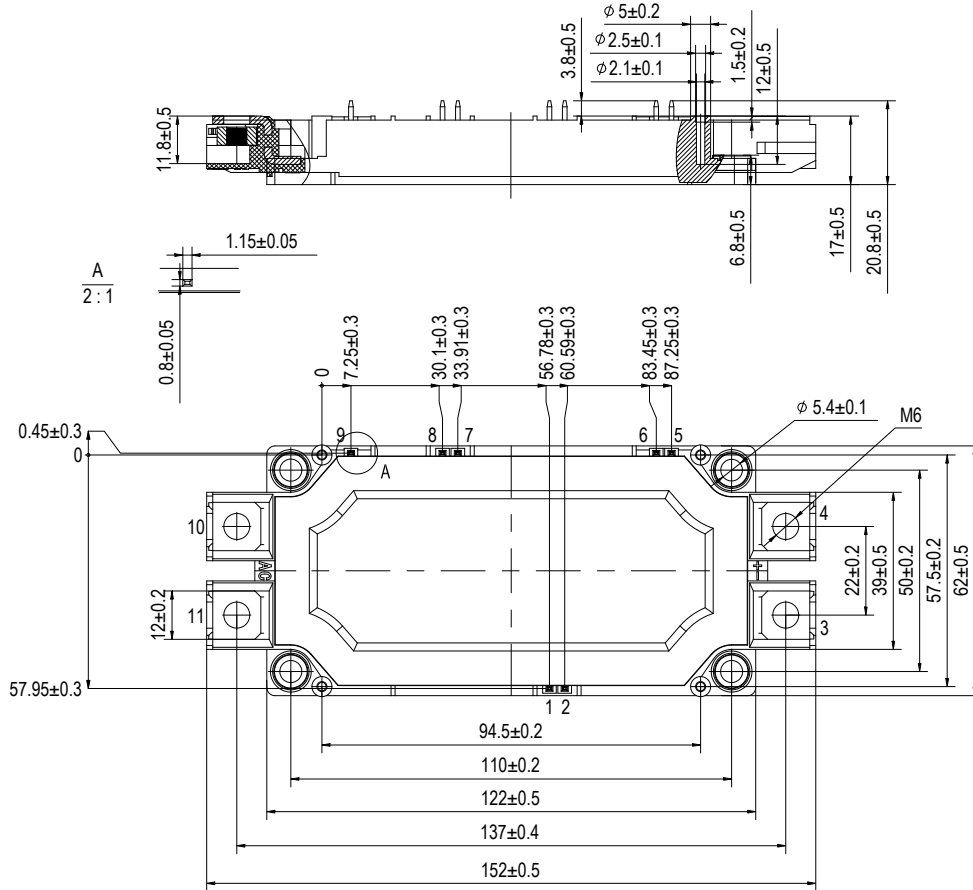


NTC Thermistor temperature characteristic (typical)

NTC 热敏电阻
 $R=f(T)$



Package Dimension / 封装尺寸
Dimensions in Millimeters / 毫米为单位



Internal Circuit / 内部电路

