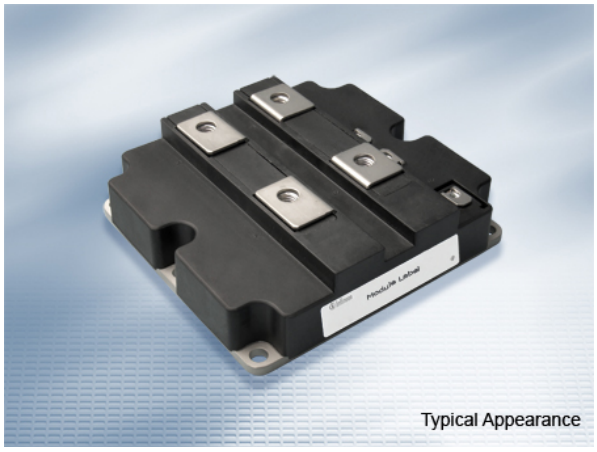
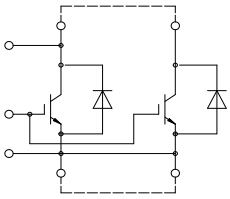
IHM-B 模块 采用软特性的沟槽栅IGBT4
IHM-B module with soft-switching Trench-IGBT4

初步数据 / Preliminary Data



external connection
(to be done)

$V_{CES}$ = 1200V
$I_{C\ nom}$ = 2400A / $I_{CRM}$ = 4800A

潜在应用
- 大功率变流器
- 电机传动
- 风力发电机

**Potential Applications**
- High power converters
- Motor drives
- Wind turbines

电气特性
- 提高工作结温 $T_{vj\ op}$

**Electrical Features**
- Extended operating temperature $T_{vj\ op}$

机械特性
- 4 kV 交流 1分钟 绝缘
- IHM B 封装
- 封装的 CTI > 400
- 高功率密度

**Mechanical Features**
- 4 kV AC 1min insulation
- IHM B housing
- Package with CTI > 400
- High power density

## Module Label Code

**Barcode Code 128**

Sample
00000123456000000000000

**DMX - Code**

| Content of the Code | Digit |
|---|---|
| Module Serial Number | 1 - 5 |
| Module Material Number | 6 - 11 |
| Production Order Number | 12 - 19 |
| Datecode (Production Year) | 20 - 21 |
| Datecode (Production Week) | 22 - 23 |

初步数据
Preliminary Data

## IGBT, 逆变器 / IGBT,Inverter

### 最大额定值 / Maximum Rated Values

| | | | | | |
|---|---|---|---|---|---|
| 集电极 - 发射极电压<br>Collector-emitter voltage | $T_{vj}$ = 25°C | $V_{CES}$ | 1200 | | V |
| 连续集电极直流电流<br>Continuous DC collector current | $T_C$ = 95°C, $T_{vj\,max}$ = 175°C<br>$T_C$ = 25°C, $T_{vj\,max}$ = 175°C | $I_{CDC}$<br>$I_C$ | 2400<br>3460 | | A<br>A |
| 集电极重复峰值电流<br>Repetitive peak collector current | $t_P$ = 1 ms | $I_{CRM}$ | 4800 | | A |
| 栅极 - 发射极峰值电压<br>Gate-emitter peak voltage | | $V_{GES}$ | +/-20 | | V |

### 特征值 / Characteristic Values

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| 集电极 - 发射极饱和电压<br>Collector-emitter saturation voltage | $I_C$ = 2400 A, $V_{GE}$ = 15 V<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $V_{CE\,sat}$ | | 1,70<br>2,00<br>2,10 | 2,05 | V<br>V<br>V |
| 栅极阈值电压<br>Gate threshold voltage | $I_C$ = 91,2 mA, $V_{CE}$ = $V_{GE}$, $T_{vj}$ = 25°C | $V_{GEth}$ | 5,10 | 5,80 | 6,50 | V |
| 栅极电荷<br>Gate charge | $V_{GE}$ = -15 / 15 V | $Q_G$ | | 18,5 | | µC |
| 内部栅极电阻<br>Internal gate resistor | $T_{vj}$ = 25°C | $R_{Gint}$ | | 0,81 | | Ω |
| 输入电容<br>Input capacitance | f = 1000 kHz, $T_{vj}$ = 25°C, $V_{CE}$ = 25 V, $V_{GE}$ = 0 V | $C_{ies}$ | | 150 | | nF |
| 反向传输电容<br>Reverse transfer capacitance | f = 1000 kHz, $T_{vj}$ = 25°C, $V_{CE}$ = 25 V, $V_{GE}$ = 0 V | $C_{res}$ | | 8,30 | | nF |
| 集电极-发射极截止电流<br>Collector-emitter cut-off current | $V_{CE}$ = 1200 V, $V_{GE}$ = 0 V, $T_{vj}$ = 25°C | $I_{CES}$ | | | 5,0 | mA |
| 栅极-发射极漏电流<br>Gate-emitter leakage current | $V_{CE}$ = 0 V, $V_{GE}$ = 20 V, $T_{vj}$ = 25°C | $I_{GES}$ | | | 400 | nA |
| 开通延迟时间(电感负载)<br>Turn-on delay time, inductive load | $I_C$ = 2400 A, $V_{CE}$ = 600 V, $V_{GE}$ = -15 / 15 V, $R_{Gon}$ = 1,6 Ω<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_{d\,on}$ | | 0,50<br>0,54<br>0,55 | | µs<br>µs<br>µs |
| 上升时间(电感负载)<br>Rise time, inductive load | $I_C$ = 2400 A, $V_{CE}$ = 600 V, $V_{GE}$ = -15 / 15 V, $R_{Gon}$ = 1,6 Ω<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_r$ | | 0,33<br>0,33<br>0,33 | | µs<br>µs<br>µs |
| 关断延迟时间(电感负载)<br>Turn-off delay time, inductive load | $I_C$ = 2400 A, $V_{CE}$ = 600 V, $V_{GE}$ = -15 / 15 V, $R_{Goff}$ = 0,3 Ω<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_{d\,off}$ | | 1,05<br>1,15<br>1,20 | | µs<br>µs<br>µs |
| 下降时间(电感负载)<br>Fall time, inductive load | $I_C$ = 2400 A, $V_{CE}$ = 600 V, $V_{GE}$ = -15 / 15 V, $R_{Goff}$ = 0,3 Ω<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $t_f$ | | 0,20<br>0,23<br>0,24 | | µs<br>µs<br>µs |
| 开通损耗能量 (每脉冲)<br>Turn-on energy loss per pulse | $I_C$ = 2400 A, $V_{CE}$ = 600 V, Lσ = 54 nH, di/dt = 6250 A/µs ($T_{vj}$ = 150°C), $V_{GE}$ = -15 / 15 V, $R_{Gon}$ = 1,6 Ω<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{on}$ | | 365<br>460<br>505 | | mJ<br>mJ<br>mJ |
| 关断损耗能量 (每脉冲 )<br>Turn-off energy loss per pulse | $I_C$ = 2400 A, $V_{CE}$ = 600 V, Lσ = 54 nH, du/dt = 2400 V/µs ($T_{vj}$ = 150°C), $V_{GE}$ = -15 / 15 V, $R_{Goff}$ = 0,3 Ω<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 125°C<br>$T_{vj}$ = 150°C | $E_{off}$ | | 450<br>560<br>595 | | mJ<br>mJ<br>mJ |
| 短路数据<br>SC data | $V_{GE}$ ≤ 15 V, $V_{CC}$ = 800 V, $V_{CEmax}$ = $V_{CES}$ -$L_{sCE}$ ·di/dt, $t_P$ ≤ 10 µs, $T_{vj}$ = 150°C | $I_{SC}$ | | 9600 | | A |
| 结 - 外壳热阻<br>Thermal resistance, junction to case | 每个 IGBT / per IGBT | $R_{thJC}$ | | | 12,0 | K/kW |
| 外壳 - 散热器热阻<br>Thermal resistance, case to heatsink | 每个 IGBT / per IGBT<br>$\lambda_{Paste}$ = 1 W/(m·K) / $\lambda_{grease}$ = 1 W/(m·K) | $R_{thCH}$ | | 9,75 | | K/kW |
| 在开关状态下温度<br>Temperature under switching conditions | | $T_{vj\,op}$ | -40 | | 150 | °C |

初步数据
Preliminary Data

## 二极管,逆变器 / Diode, Inverter

### 最大额定值 / Maximum Rated Values

| | | | | |
|---|---|---|---|---|
| 反向重复峰值电压<br>Repetitive peak reverse voltage | $T_{vj}$ = 25°C | $V_{RRM}$ | 1200 | V |
| 连续正向直流电流<br>Continuous DC forward current | | $I_F$ | 2400 | A |
| 正向重复峰值电流<br>Repetitive peak forward current | $t_P$ = 1 ms | $I_{FRM}$ | 4800 | A |
| I2t-值<br>I²t - value | $V_R$ = 0 V, $t_P$ = 10 ms, $T_{vj}$ = 125°C<br>$V_R$ = 0 V, $t_P$ = 10 ms, $T_{vj}$ = 150°C | I²t | 615<br>595 | kA²s<br>kA²s |

### 特征值 / Characteristic Values

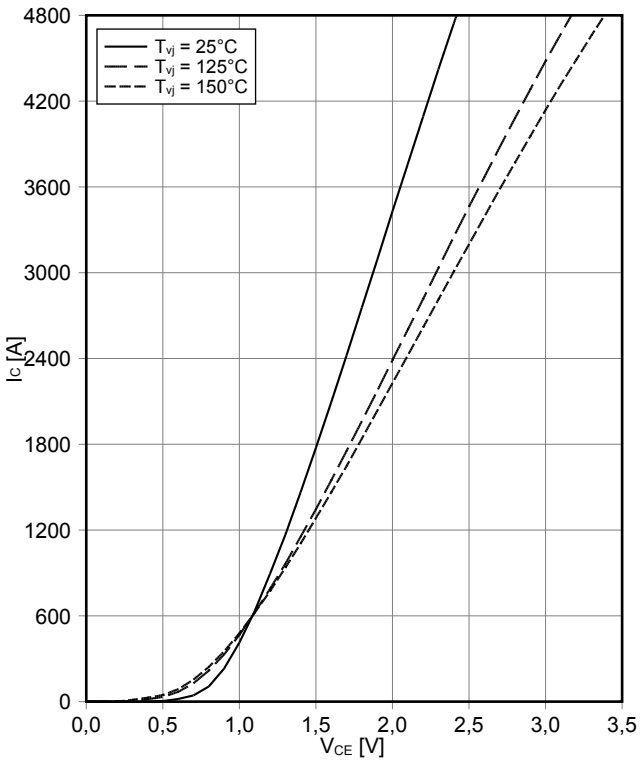
| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| 正向电压<br>Forward voltage | $I_F$ = 2400 A, $V_{GE}$ = 0 V $T_{vj}$ = 25°C<br>$I_F$ = 2400 A, $V_{GE}$ = 0 V $T_{vj}$ = 125°C<br>$I_F$ = 2400 A, $V_{GE}$ = 0 V $T_{vj}$ = 150°C | $V_F$ | | 1,80<br>1,75<br>1,70 | 2,35 | V<br>V<br>V |
| 反向恢复峰值电流<br>Peak reverse recovery current | $I_F$ = 2400 A, - $di_F/dt$ = 6250 A/µs ($T_{vj}$=150°C) $T_{vj}$ = 25°C<br>$V_R$ = 600 V $T_{vj}$ = 125°C<br>$V_{GE}$ = -15 V $T_{vj}$ = 150°C | $I_{RM}$ | | 805<br>1150<br>1200 | | A<br>A<br>A |
| 恢复电荷<br>Recovered charge | $I_F$ = 2400 A, - $di_F/dt$ = 6250 A/µs ($T_{vj}$=150°C) $T_{vj}$ = 25°C<br>$V_R$ = 600 V $T_{vj}$ = 125°C<br>$V_{GE}$ = -15 V $T_{vj}$ = 150°C | $Q_r$ | | 245<br>430<br>490 | | µC<br>µC<br>µC |
| 反向恢复损耗（每脉冲）<br>Reverse recovery energy | $I_F$ = 2400 A, - $di_F/dt$ = 6250 A/µs ($T_{vj}$=150°C) $T_{vj}$ = 25°C<br>$V_R$ = 600 V $T_{vj}$ = 125°C<br>$V_{GE}$ = -15 V $T_{vj}$ = 150°C | $E_{rec}$ | | 105<br>185<br>210 | | mJ<br>mJ<br>mJ |
| 结 - 外壳热阻<br>Thermal resistance, junction to case | 每个二极管 / per diode | $R_{thJC}$ | | | 20,0 | K/kW |
| 外壳 - 散热器热阻<br>Thermal resistance, case to heatsink | 每个二极管 / per diode<br>$\lambda_{Paste}$ = 1 W/(m·K) / $\lambda_{grease}$ = 1 W/(m·K) | $R_{thCH}$ | | 11,0 | | K/kW |
| 在开关状态下温度<br>Temperature under switching conditions | | $T_{vj\,op}$ | -40 | | 150 | °C |

## 模块 / Module

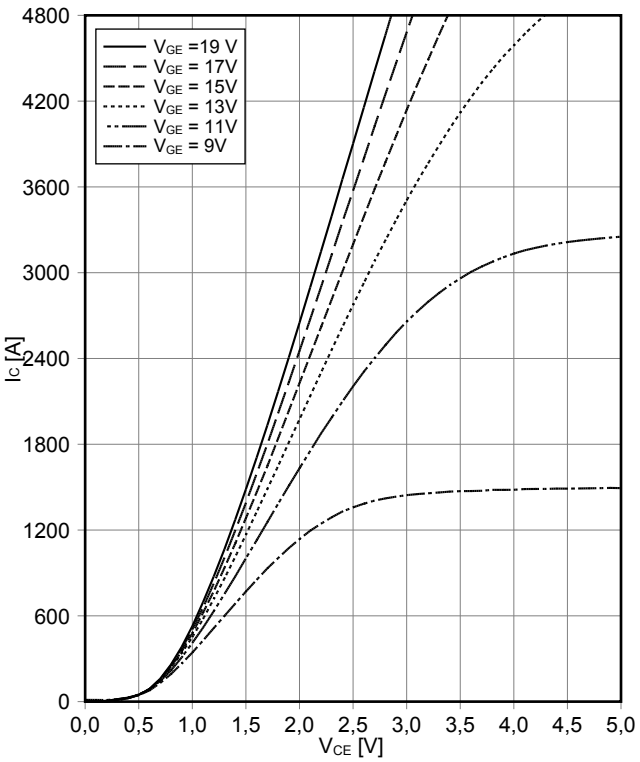
| | | | | | | |
|---|---|---|---|---|---|---|
| 绝缘测试电压<br>Isolation test voltage | RMS, f = 50 Hz, t = 1 min. | $V_{ISOL}$ | | 4,0 | | kV |
| 模块基板材料<br>Material of module baseplate | | | | Cu | | |
| 内部绝缘<br>Internal isolation | 基本绝缘 (class 1, IEC 61140)<br>basic insulation (class 1, IEC 61140) | | | $Al_2O_3$ | | |
| 爬电距离<br>Creepage distance | 端子至散热器 / terminal to heatsink<br>端子至端子 / terminal to terminal | | | 32,0<br>32,0 | | mm |
| 电气间隙<br>Clearance | 端子至散热器 / terminal to heatsink<br>端子至端子 / terminal to terminal | | | 19,0<br>19,0 | | mm |
| 相对电痕指数<br>Comperative tracking index | | CTI | | > 400 | | |
| | | | min. | typ. | max. | |
| 杂散电感,模块<br>Stray inductance module | | $L_{sCE}$ | | 9,0 | | nH |
| 模块引线电阻,端子-芯片<br>Module lead resistance, terminals - chip | $T_C$ = 25°C, 每个开关 / per switch | $R_{CC'+EE'}$ | | 0,13 | | mΩ |
| 储存温度<br>Storage temperature | | $T_{stg}$ | -40 | | 150 | °C |
| 模块安装的安装扭距<br>Mounting torque for modul mounting | 螺丝 M6 根据相应的应用手册进行安装<br>Screw M6 - Mounting according to valid application note | M | 4,25 | | 5,75 | Nm |
| 端子联接扭距<br>Terminal connection torque | 螺丝 M4 根据相应的应用手册进行安装<br>Screw M4 - Mounting according to valid application note<br>螺丝 M8 根据相应的应用手册进行安装<br>Screw M8 - Mounting according to valid application note | M | 1,7<br><br>8,0 | -<br><br>- | 2,1<br><br>10 | Nm<br><br>Nm |
| 重量<br>Weight | | G | | 1300 | | g |

初步数据
Preliminary Data

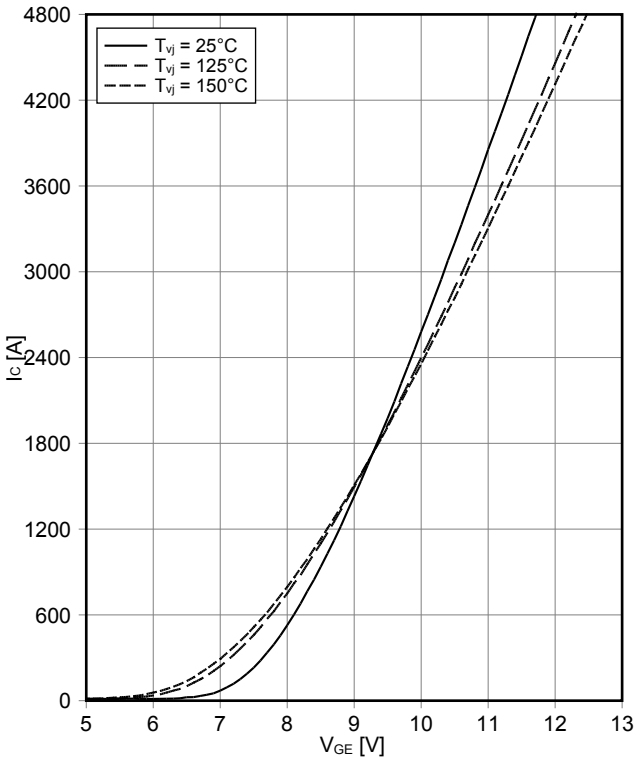
输出特性 IGBT, 逆变器 （典型)
**output characteristic IGBT,Inverter (typical)**
$I_C = f(V_{CE})$
$V_{GE}$ = 15 V



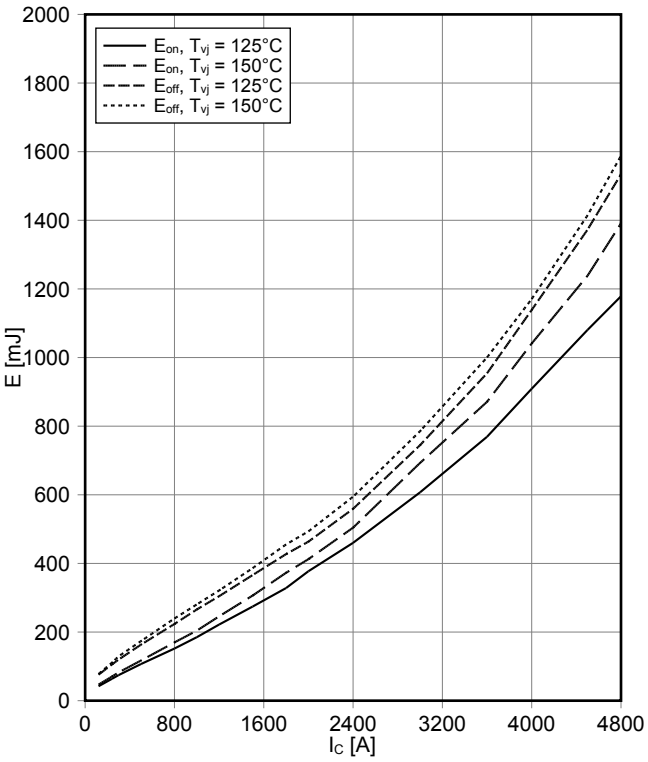

输出特性 IGBT, 逆变器 （典型)
**output characteristic IGBT,Inverter (typical)**
$I_C = f(V_{CE})$
$T_{vj}$ = 150°C




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

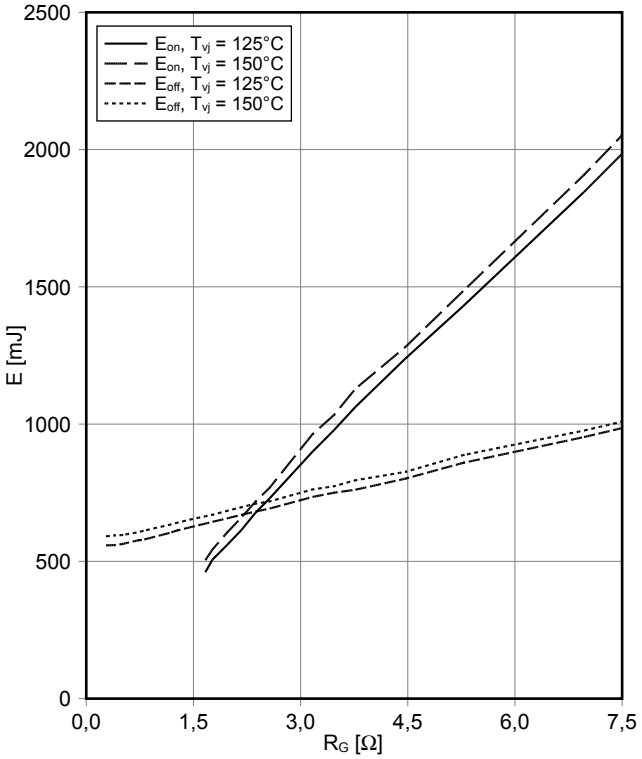



开关损耗 IGBT, 逆变器 （典型)
**switching losses IGBT,Inverter (typical)**
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
$V_{GE}$ = ±15 V, $R_{Gon}$ = 1.6 Ω, $R_{Goff}$ = 0.3 Ω, $V_{CE}$ = 600 V

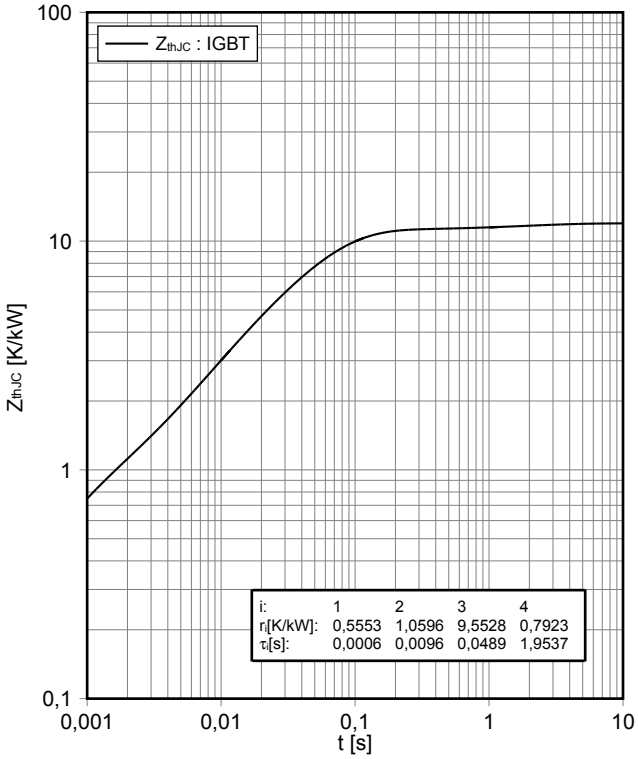


初步数据
Preliminary Data

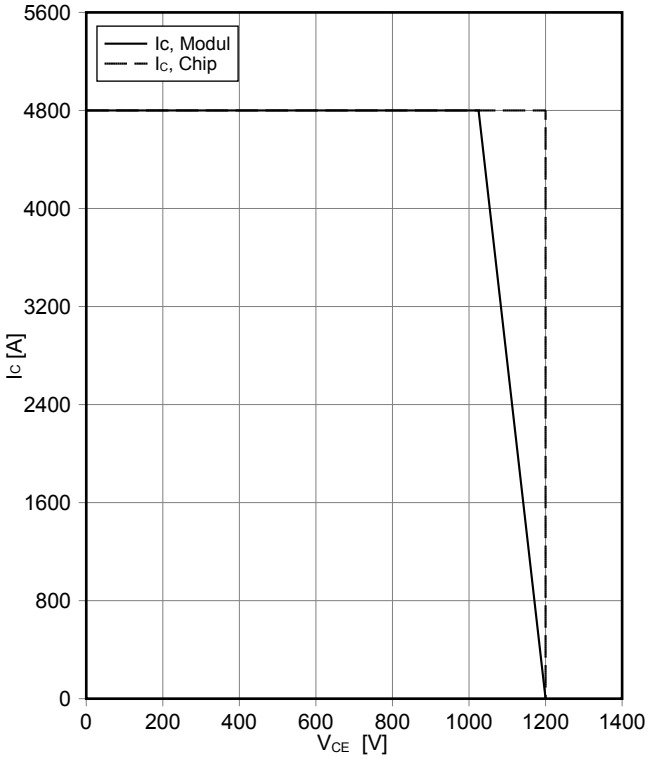
开关损耗 IGBT, 逆变器（典型）
**switching losses IGBT,Inverter (typical)**
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
$V_{GE}$ = ±15 V, $I_C$ = 2400 A, $V_{CE}$ = 600 V



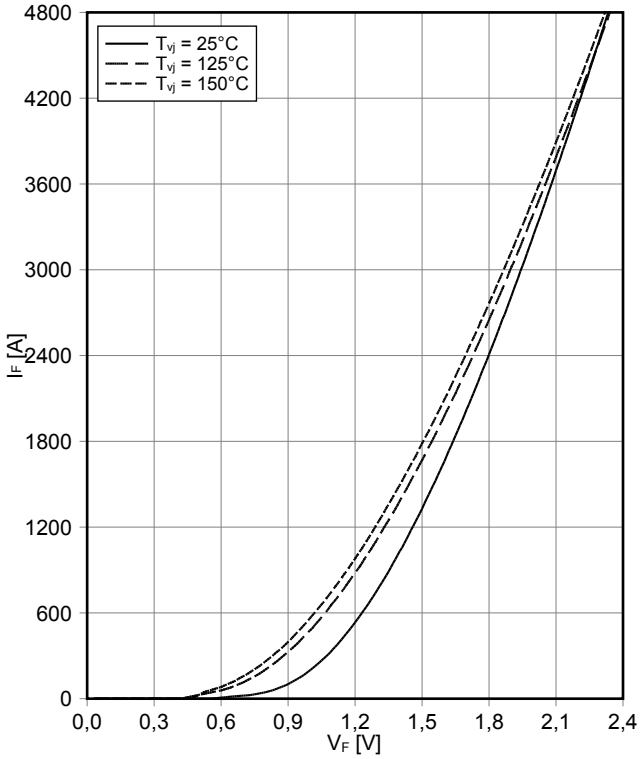

瞬态热阻抗 IGBT, 逆变器
**transient thermal impedance IGBT,Inverter**
$Z_{thJC} = f(t)$




反偏安全工作区 IGBT, 逆变器（RBSOA）
**reverse bias safe operating area IGBT,Inverter (RBSOA)**
$I_C = f(V_{CE})$
$V_{GE}$ = ±15 V, $R_{Goff}$ = 0.3 Ω, $T_{vj}$ = 150°C

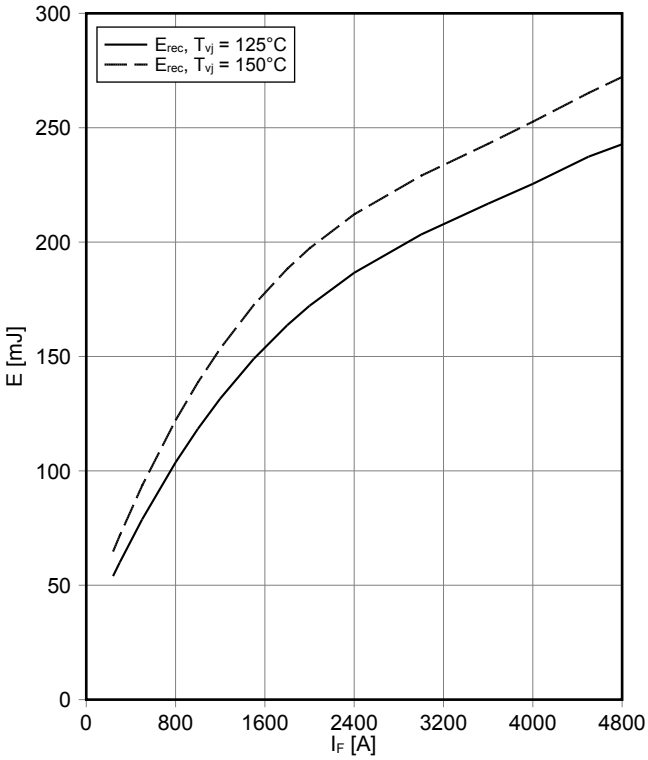



正向偏压特性 二极管,逆变器（典型）
**forward characteristic of Diode, Inverter (typical)**
$I_F = f(V_F)$

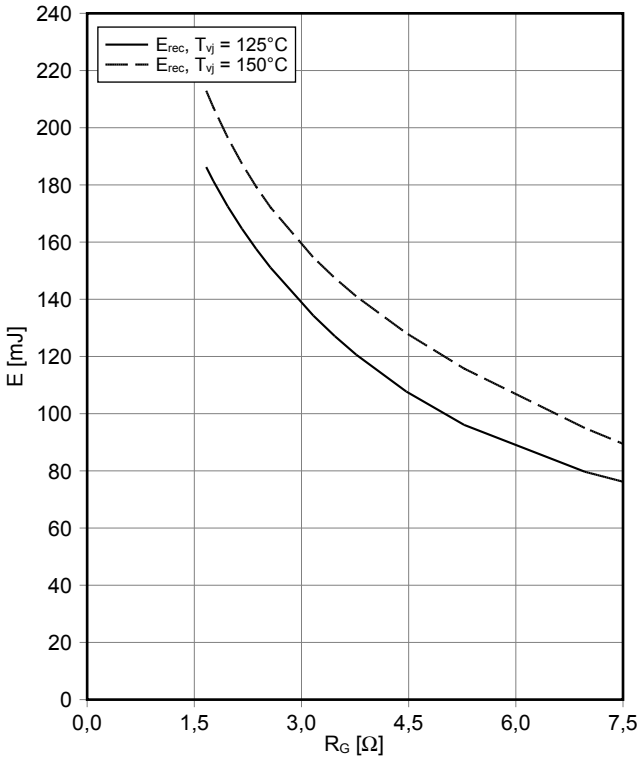


初步数据
Preliminary Data

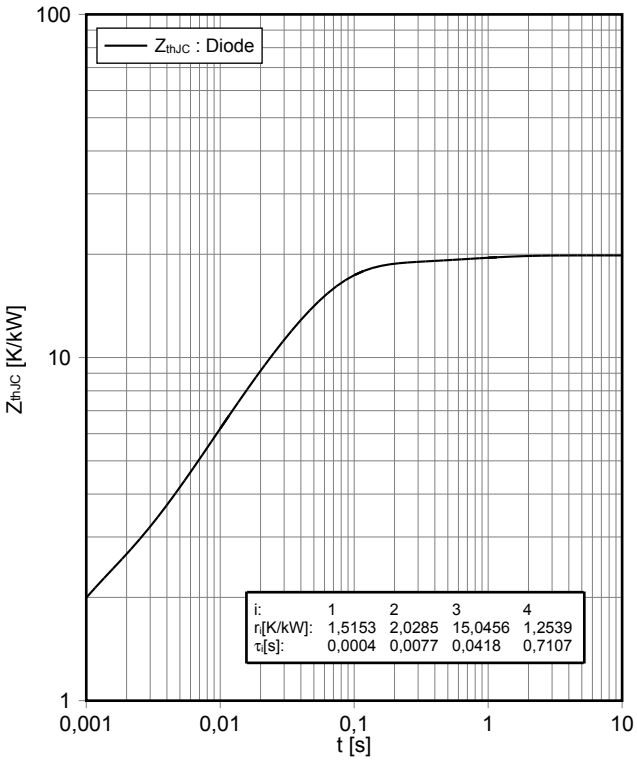
开关损耗 二极管,逆变器 （典型）
**switching losses Diode, Inverter (typical)**
$E_{rec} = f(I_F)$
$R_{Gon} = 1.6\ \Omega$, $V_{CE} = 600\ V$




开关损耗 二极管,逆变器 （典型）
**switching losses Diode, Inverter (typical)**
$E_{rec} = f(R_G)$
$I_F = 2400\ A$, $V_{CE} = 600\ V$

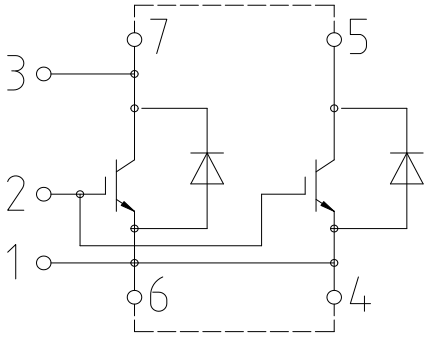



瞬态热阻抗 二极管,逆变器
**transient thermal impedance Diode, Inverter**
$Z_{thJC} = f(t)$



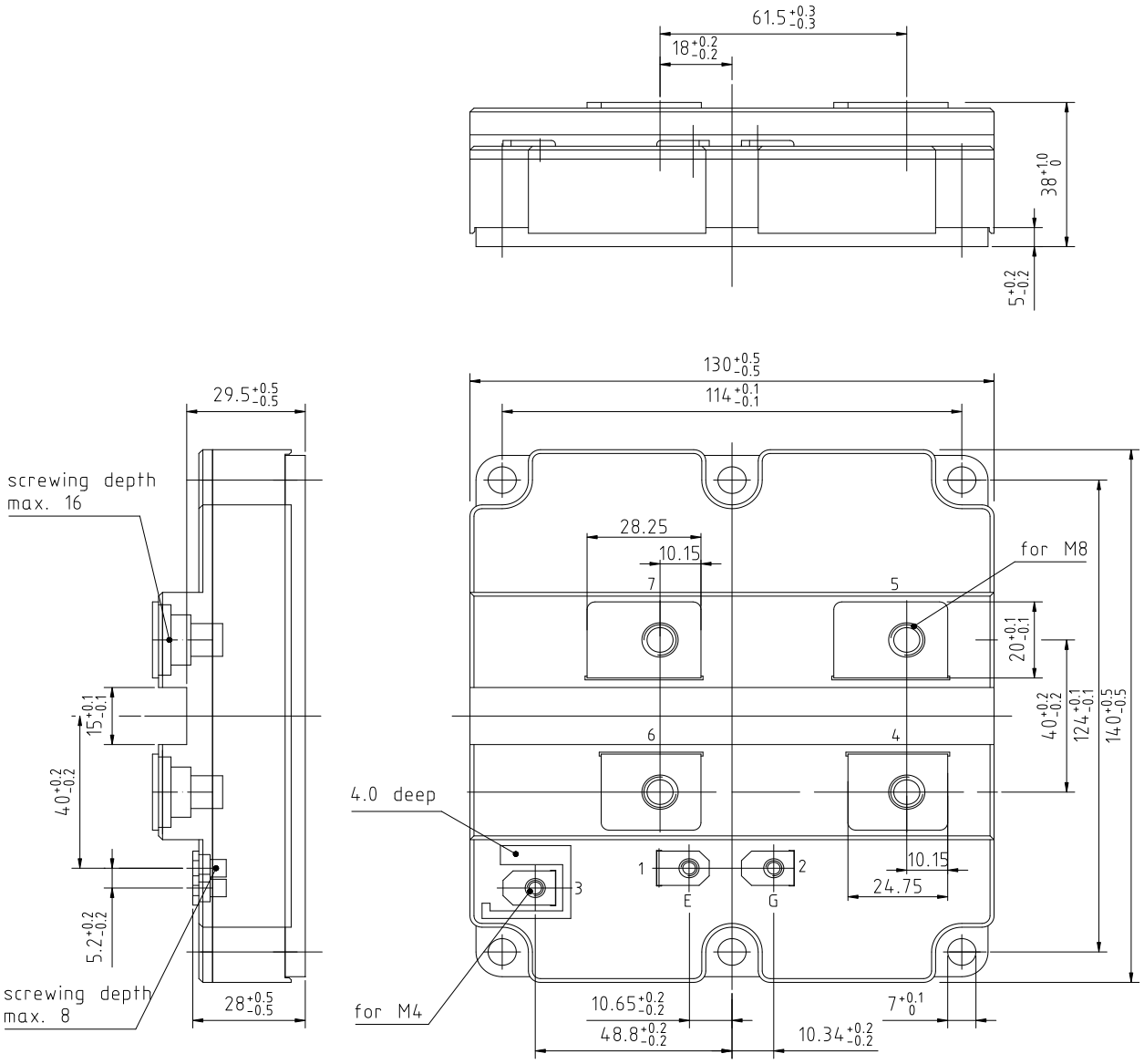
初步数据
Preliminary Data

## 接线图 / Circuit diagram




external connection
(to be done)

## 封装尺寸 / Package outlines



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