

# IGBT, 逆变器 / IGBT, Inverter

## 最大额定值 / Maximum Rated Values

## 初步数据

## Preliminary Data

|                                                |                                                                                                                              |                             |              |        |
|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------|--------|
| 集电极 - 发射极电压<br>Collector-emitter voltage       | $T_{vj} = 25^{\circ}\text{C}$                                                                                                | $V_{CES}$                   | 1700         | V      |
| 连续集电极直流电流<br>Continuous DC collector current   | $T_C = 80^{\circ}\text{C}, T_{vj\max} = 150^{\circ}\text{C}$<br>$T_C = 25^{\circ}\text{C}, T_{vj\max} = 150^{\circ}\text{C}$ | $I_{C\text{ nom}}$<br>$I_C$ | 1200<br>1900 | A<br>A |
| 集电极重复峰值电流<br>Repetitive peak collector current | $t_P = 1\text{ ms}$                                                                                                          | $I_{CRM}$                   | 2400         | A      |
| 总功率损耗<br>Total power dissipation               | $T_C = 25^{\circ}\text{C}, T_{vj\max} = 150^{\circ}\text{C}$                                                                 | $P_{\text{tot}}$            | 8,95         | kW     |
| 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 | $I_C = 1200\text{ A}, V_{GE} = 15\text{ V}$<br>$I_C = 1200\text{ A}, V_{GE} = 15\text{ V}$                                                                   | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$ | $V_{CE\text{ sat}}$ | 2,00<br>2,40 | 2,45 | V<br>V                         |
| 栅极阈值电压<br>Gate threshold voltage                      | $I_C = 48,0\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$                                                                                         |                                                                 | $V_{GEth}$          | 5,2          | 5,8  | 6,4 V                          |
| 栅极电荷<br>Gate charge                                   | $V_{GE} = -15\text{ V} \dots +15\text{ V}$                                                                                                                   |                                                                 | $Q_G$               | 14,0         |      | $\mu\text{C}$                  |
| 内部栅极电阻<br>Internal gate resistor                      | $T_{vj} = 25^{\circ}\text{C}$                                                                                                                                |                                                                 | $R_{Gint}$          | 1,0          |      | $\Omega$                       |
| 输入电容<br>Input capacitance                             | $f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$                                                                   |                                                                 | $C_{ies}$           | 110          |      | nF                             |
| 反向传输电容<br>Reverse transfer capacitance                | $f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$                                                                   |                                                                 | $C_{res}$           | 3,50         |      | nF                             |
| 集电极-发射极截止电流<br>Collector-emitter cut-off current      | $V_{CE} = 1700\text{ V}, V_{GE} = 0\text{ V}, T_{vj} = 25^{\circ}\text{C}$                                                                                   |                                                                 | $I_{CES}$           |              | 5,0  | mA                             |
| 栅极-发射极漏电流<br>Gate-emitter leakage current             | $V_{CE} = 0\text{ V}, V_{GE} = 20\text{ V}, T_{vj} = 25^{\circ}\text{C}$                                                                                     |                                                                 | $I_{GES}$           |              | 400  | nA                             |
| 开通延迟时间(电感负载)<br>Turn-on delay time, inductive load    | $I_C = 1200\text{ A}, V_{CE} = 900\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Gon} = 1,2\ \Omega$                                                        | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$ | $t_{don}$           | 0,65<br>0,70 |      | $\mu\text{s}$<br>$\mu\text{s}$ |
| 上升时间(电感负载)<br>Rise time, inductive load               | $I_C = 1200\text{ A}, V_{CE} = 900\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Gon} = 1,2\ \Omega$                                                        | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$ | $t_r$               | 0,16<br>0,20 |      | $\mu\text{s}$<br>$\mu\text{s}$ |
| 关断延迟时间(电感负载)<br>Turn-off delay time, inductive load   | $I_C = 1200\text{ A}, V_{CE} = 900\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Goff} = 1,5\ \Omega$                                                       | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$ | $t_{doff}$          | 1,30<br>1,60 |      | $\mu\text{s}$<br>$\mu\text{s}$ |
| 下降时间(电感负载)<br>Fall time, inductive load               | $I_C = 1200\text{ A}, V_{CE} = 900\text{ V}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Goff} = 1,5\ \Omega$                                                       | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$ | $t_f$               | 0,18<br>0,30 |      | $\mu\text{s}$<br>$\mu\text{s}$ |
| 开通损耗能量(每脉冲)<br>Turn-on energy loss per pulse          | $I_C = 1200\text{ A}, V_{CE} = 900\text{ V}, L_S = 50\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Gon} = 1,2\ \Omega$                                    | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$ | $E_{on}$            | 240<br>350   |      | mJ<br>mJ                       |
| 关断损耗能量(每脉冲)<br>Turn-off energy loss per pulse         | $I_C = 1200\text{ A}, V_{CE} = 900\text{ V}, L_S = 50\text{ nH}$<br>$V_{GE} = \pm 15\text{ V}$<br>$R_{Goff} = 1,5\ \Omega$                                   | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$ | $E_{off}$           | 305<br>445   |      | mJ<br>mJ                       |
| 短路数据<br>SC data                                       | $V_{GE} \leq 15\text{ V}, V_{CC} = 1000\text{ V}$<br>$V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$<br>$t_P \leq 10\ \mu\text{s}, T_{vj} = 125^{\circ}\text{C}$ |                                                                 | $I_{SC}$            | 4800         |      | A                              |
| 结 - 外壳热阻<br>Thermal resistance, junction to case      | 每个 IGBT / per IGBT                                                                                                                                           |                                                                 | $R_{thJC}$          |              | 14,0 | K/kW                           |
| 外壳 - 散热器热阻<br>Thermal resistance, case to heatsink    | 每个 IGBT / per IGBT<br>$\lambda_{\text{Paste}} = 1\text{ W/(m}\cdot\text{K)} / \lambda_{\text{grease}} = 1\text{ W/(m}\cdot\text{K)}$                         |                                                                 | $R_{thCH}$          | 12,0         |      | K/kW                           |
| 在开关状态下温度<br>Temperature under switching conditions    |                                                                                                                                                              |                                                                 | $T_{vj\text{ op}}$  | -40          | 125  | $^{\circ}\text{C}$             |

prepared by: WB

date of publication: 2013-11-25

approved by: PL

revision: 2.1

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 | $T_{vj} = 25^{\circ}\text{C}$                                          | $V_{RRM}$ | 1700 | V                     |
| 连续正向直流电流<br>Continuous DC forward current   |                                                                        | $I_F$     | 1200 | A                     |
| 正向重复峰值电流<br>Repetitive peak forward current | $t_P = 1 \text{ ms}$                                                   | $I_{FRM}$ | 2400 | A                     |
| $I_{2t}$ -值<br>$I_{2t}$ - value             | $V_R = 0 \text{ V}, t_P = 10 \text{ ms}, T_{vj} = 125^{\circ}\text{C}$ | $I_{2t}$  | 405  | $\text{kA}^2\text{s}$ |

特征值 / Characteristic Values

|                                                    |                                                                                                                                                       |                                                                 | min.                | typ.         | max. |                                |
|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|---------------------|--------------|------|--------------------------------|
| 正向电压<br>Forward voltage                            | $I_F = 1200 \text{ A}, V_{GE} = 0 \text{ V}$<br>$I_F = 1200 \text{ A}, V_{GE} = 0 \text{ V}$                                                          | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$ | $V_F$               | 1,60<br>1,70 | 2,00 | V<br>V                         |
| 反向恢复峰值电流<br>Peak reverse recovery current          | $I_F = 1200 \text{ A}, -di_F/dt = 7000 \text{ A}/\mu\text{s} (T_{vj}=125^{\circ}\text{C})$<br>$V_R = 900 \text{ V}$<br>$V_{GE} = -15 \text{ V}$       | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$ | $I_{RM}$            | 1400<br>1500 |      | A<br>A                         |
| 恢复电荷<br>Recovered charge                           | $I_F = 1200 \text{ A}, -di_F/dt = 7000 \text{ A}/\mu\text{s} (T_{vj}=125^{\circ}\text{C})$<br>$V_R = 900 \text{ V}$<br>$V_{GE} = -15 \text{ V}$       | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$ | $Q_r$               | 355<br>595   |      | $\mu\text{C}$<br>$\mu\text{C}$ |
| 反向恢复损耗 (每脉冲)<br>Reverse recovery energy            | $I_F = 1200 \text{ A}, -di_F/dt = 7000 \text{ A}/\mu\text{s} (T_{vj}=125^{\circ}\text{C})$<br>$V_R = 900 \text{ V}$<br>$V_{GE} = -15 \text{ V}$       | $T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$ | $E_{rec}$           | 235<br>420   |      | mJ<br>mJ                       |
| 结 - 外壳热阻<br>Thermal resistance, junction to case   | 每个二极管 / per diode                                                                                                                                     |                                                                 | $R_{thJC}$          |              | 27,0 | K/kW                           |
| 外壳 - 散热器热阻<br>Thermal resistance, case to heatsink | 每个二极管 / per diode<br>$\lambda_{\text{Paste}} = 1 \text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{\text{grease}} = 1 \text{ W}/(\text{m}\cdot\text{K})$ |                                                                 | $R_{thCH}$          | 23,0         |      | K/kW                           |
| 在开关状态下温度<br>Temperature under switching conditions |                                                                                                                                                       |                                                                 | $T_{vj \text{ op}}$ | -40          | 125  | $^{\circ}\text{C}$             |

初步数据  
Preliminary Data

模块 / Module

|                                                          |                                                                                                                                                                  |                      |              |                |
|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------|----------------|
| 绝缘测试电压<br>Isolation test voltage                         | RMS, f = 50 Hz, t = 1 min.                                                                                                                                       | V <sub>ISOL</sub>    | 4,0          | kV             |
| 模块基板材料<br>Material of module baseplate                   |                                                                                                                                                                  |                      | AlSiC        |                |
| 内部绝缘<br>Internal isolation                               | 基本绝缘 (class 1, IEC 61140)<br>basic insulation (class 1, IEC 61140)                                                                                               |                      | AlN          |                |
| 爬电距离<br>Creepage distance                                | 端子- 散热片 / terminal to heatsink<br>端子- 端子 / terminal to terminal                                                                                                  |                      | 32,2<br>32,2 | mm             |
| 电气间隙<br>Clearance                                        | 端子- 散热片 / terminal to heatsink<br>端子- 端子 / terminal to terminal                                                                                                  |                      | 19,1<br>19,1 | mm             |
| 相对电痕指数<br>Comperative tracking index                     |                                                                                                                                                                  | CTI                  | > 400        |                |
|                                                          |                                                                                                                                                                  |                      |              |                |
| 外壳 - 散热器热阻<br>Thermal resistance, case to heatsink       | 每个模块 / per module<br>$\lambda_{\text{Paste}} = 1 \text{ W/(m}\cdot\text{K)} / \lambda_{\text{grease}} = 1 \text{ W/(m}\cdot\text{K)}$                            | R <sub>thCH</sub>    | min. 8,00    | typ. max. K/kW |
| 杂散电感,模块<br>Stray inductance module                       |                                                                                                                                                                  | L <sub>sCE</sub>     | 12           | nH             |
| 模块引线电阻,端子-芯片<br>Module lead resistance, terminals - chip | T <sub>C</sub> = 25°C, 每个开关 / per switch                                                                                                                         | R <sub>CC'+EE'</sub> | 0,19         | mΩ             |
| 储存温度<br>Storage temperature                              |                                                                                                                                                                  | T <sub>stg</sub>     | -40          | 125 °C         |
| 模块安装的安装扭矩<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      |
| 端子联接扭矩<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                    | 1,8<br>8,0   | - 2,1<br>10 Nm |
| 重量<br>Weight                                             |                                                                                                                                                                  | G                    | 1050         | g              |

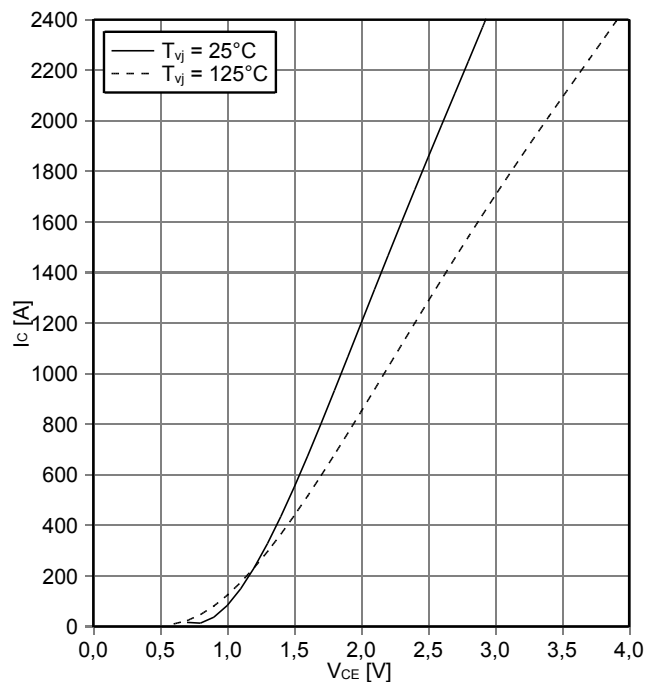
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| prepared by: WB | date of publication: 2013-11-25 |
| approved by: PL | revision: 2.1                   |

初步数据  
Preliminary Data

输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

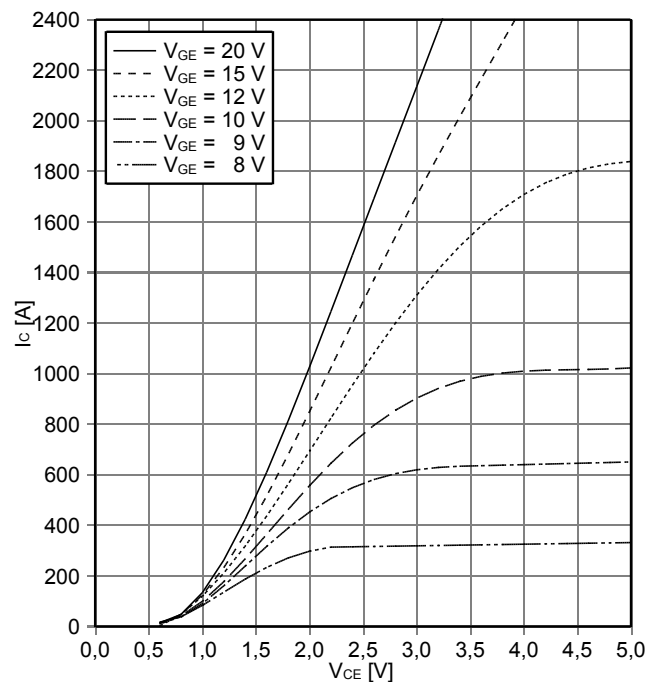
$I_C = f(V_{CE})$   
 $V_{GE} = 15\text{ V}$



输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

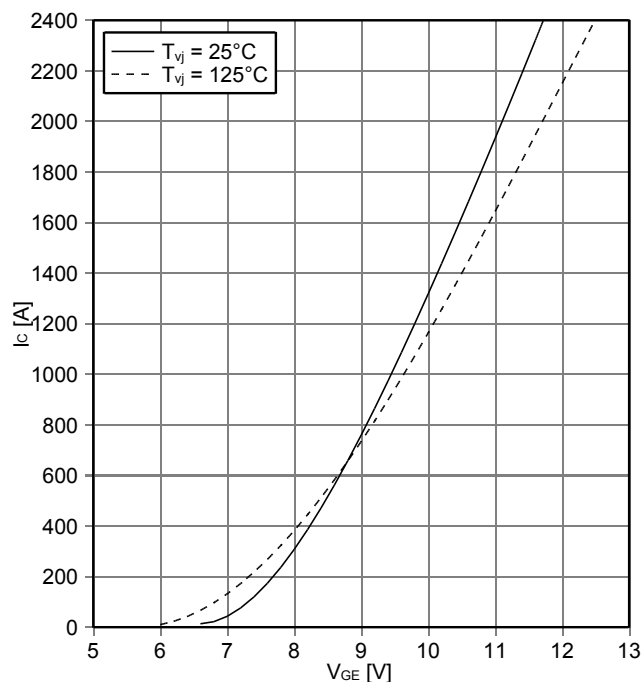
$I_C = f(V_{CE})$   
 $T_{vj} = 125^\circ\text{C}$



传输特性 IGBT, 逆变器 (典型)

transfer characteristic IGBT, Inverter (typical)

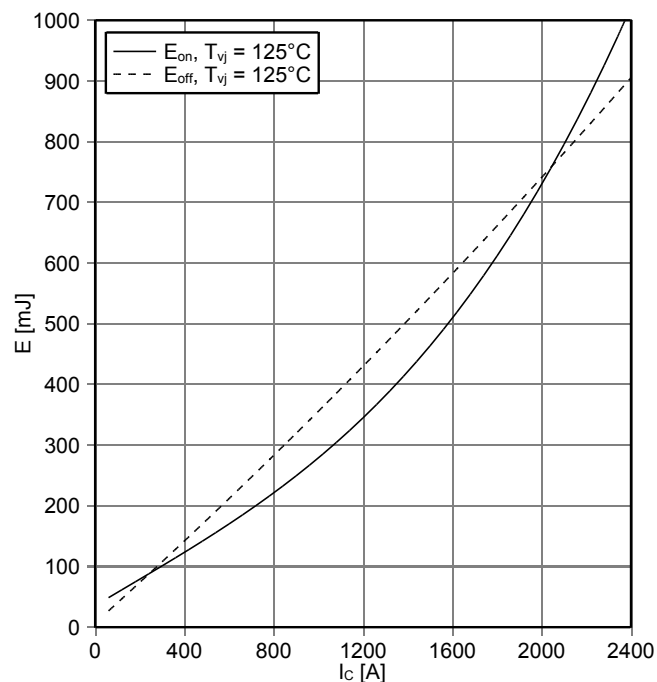
$I_C = f(V_{GE})$   
 $V_{CE} = 20\text{ V}$



开关损耗 IGBT, 逆变器 (典型)

switching losses IGBT, Inverter (typical)

$E_{on} = f(I_C)$ ,  $E_{off} = f(I_C)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Gon} = 1.2\ \Omega$ ,  $R_{Goff} = 1.5\ \Omega$ ,  $V_{CE} = 900\text{ V}$



prepared by: WB

date of publication: 2013-11-25

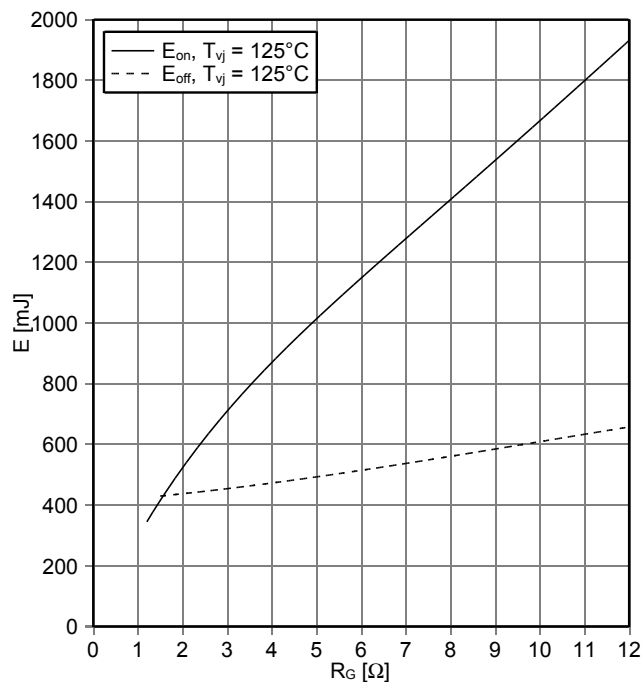
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revision: 2.1

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Preliminary Data

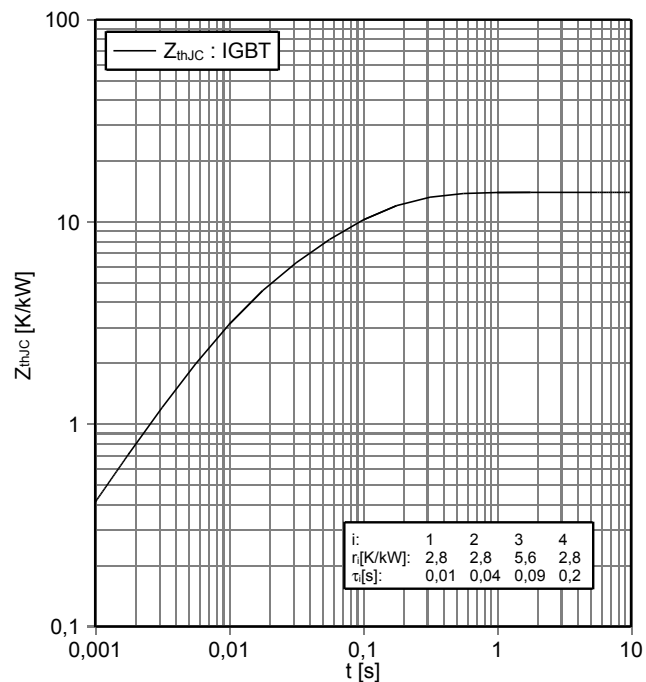
开关损耗 IGBT, 逆变器 (典型)  
switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G)$ ,  $E_{off} = f(R_G)$   
 $V_{GE} = \pm 15 \text{ V}$ ,  $I_C = 1200 \text{ A}$ ,  $V_{CE} = 900 \text{ V}$



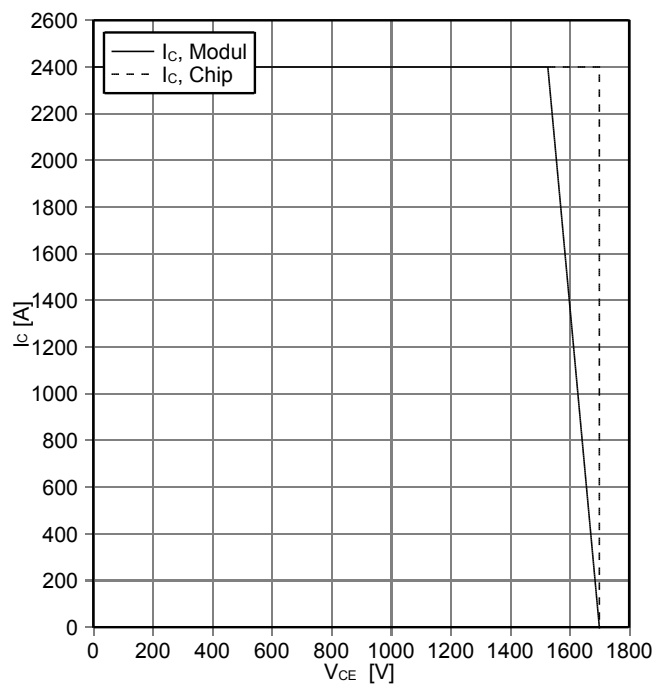
瞬态热阻抗 IGBT, 逆变器  
transient thermal impedance IGBT, Inverter

$Z_{thJC} = f(t)$



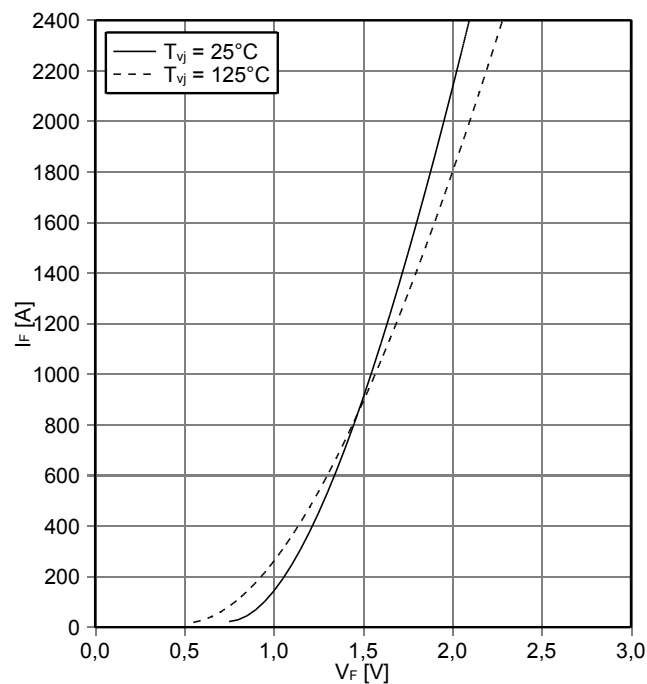
反偏安全工作区 IGBT, 逆变器 (RBSOA)  
reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$   
 $V_{GE} = \pm 15 \text{ V}$ ,  $R_{Goff} = 1.5 \Omega$ ,  $T_{vj} = 125^\circ\text{C}$



正向偏压特性 二极管, 逆变器 (典型)  
forward characteristic of Diode, Inverter (typical)

$I_F = f(V_F)$



prepared by: WB

date of publication: 2013-11-25

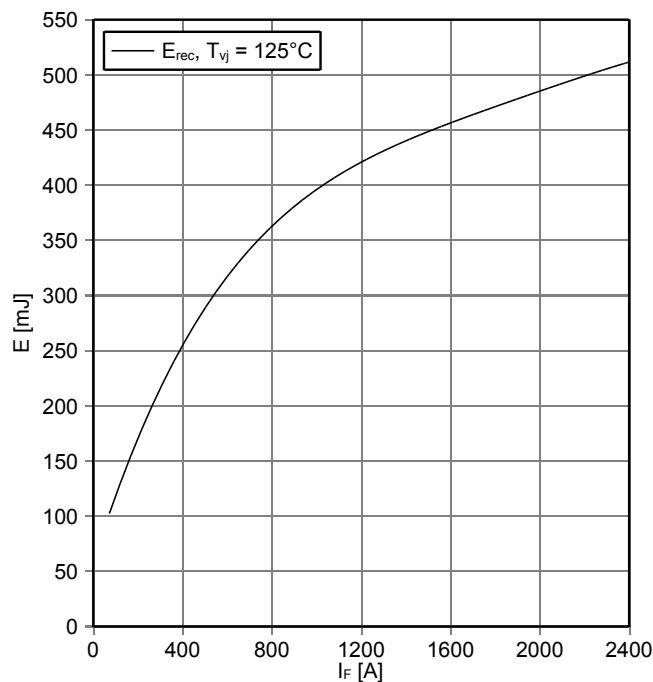
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revision: 2.1

初步数据  
Preliminary Data

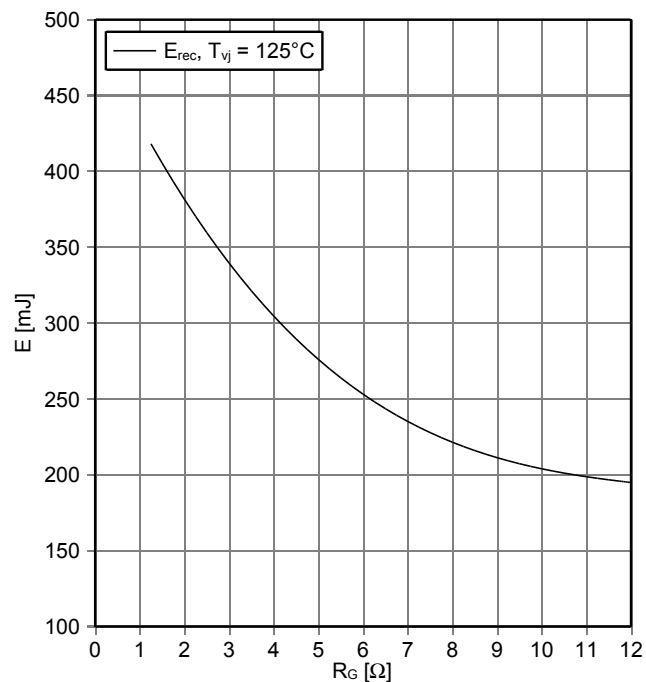
开关损耗 二极管,逆变器 (典型)  
switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$   
 $R_{Gon} = 1.2 \Omega$ ,  $V_{CE} = 900 V$



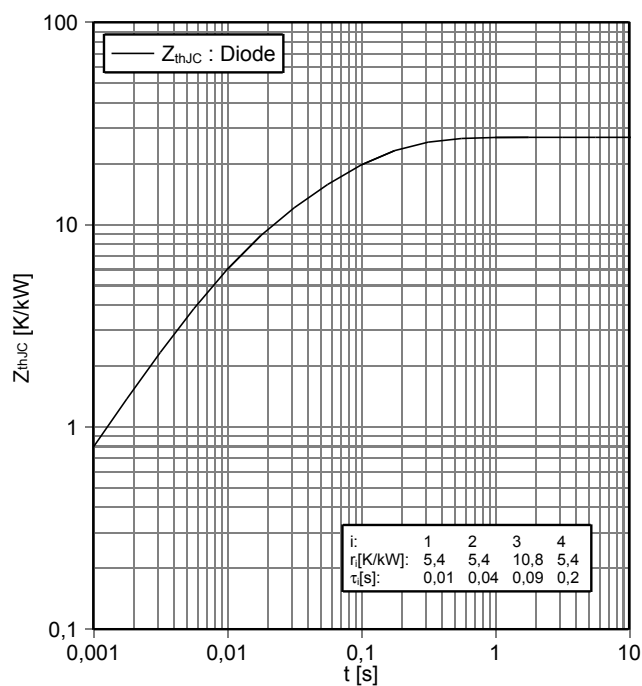
开关损耗 二极管,逆变器 (典型)  
switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$   
 $I_F = 1200 A$ ,  $V_{CE} = 900 V$



瞬态热阻抗 二极管,逆变器  
transient thermal impedance Diode, Inverter

$Z_{thJC} = f(t)$



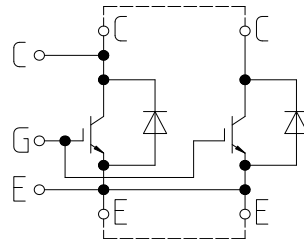
prepared by: WB

date of publication: 2013-11-25

approved by: PL

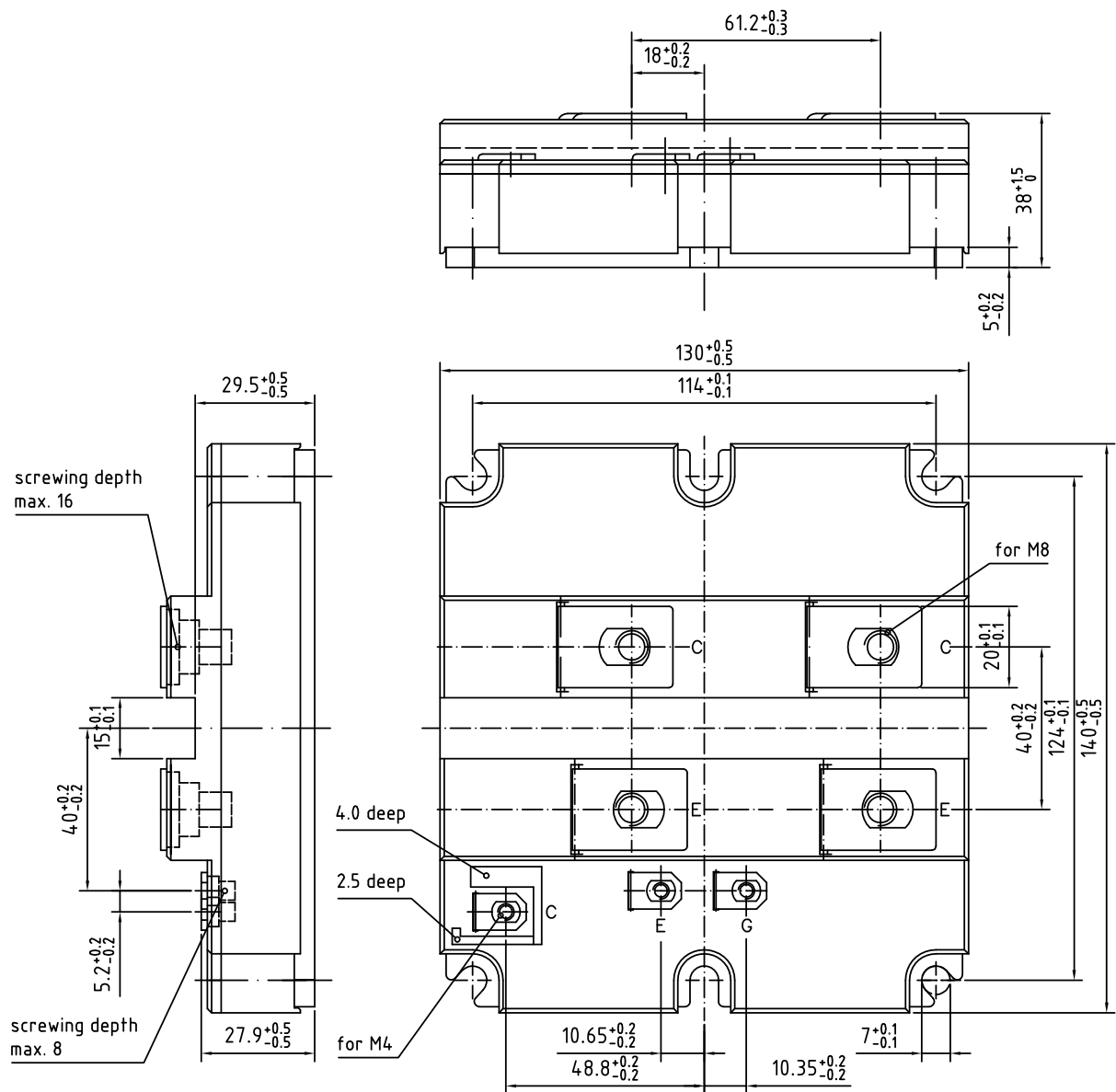
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接线图 / circuit\_diagram\_headline



external connection  
to be done

封装尺寸 / package outlines



|                 |                                 |
|-----------------|---------------------------------|
| prepared by: WB | date of publication: 2013-11-25 |
| approved by: PL | revision: 2.1                   |

### 初步数据 Preliminary Data

#### 使用条件和条款

##### 使用条件和条款

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-得到质量协议的结论

-建立联合的测试和出厂产品检查，我们可以根据测试的实际情况供货

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- to perform joint Risk and Quality Assessments;

- the conclusion of Quality Agreements;

- to establish joint measures of an ongoing product survey, and that we may make delivery depended on the realization of any such measures.

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prepared by: WB

date of publication: 2013-11-25

approved by: PL

revision: 2.1

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