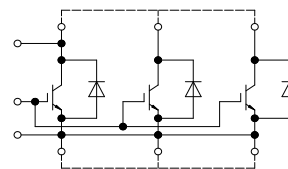


IHM-B 模块 采用第四代沟槽栅/场终止IGBT4和发射极控制二极管
IHM-B module with Trench/Fieldstop IGBT4 and Emitter Controlled diode



external connection
(to be done)

$V_{CES} = 1700V$
 $I_{C\ nom} = 2400A / I_{CRM} = 4800A$

典型应用

- 谐振逆变器应用
- 大功率变流器
- 牵引变流器
- 风力发电机

电气特性

- 提高工作结温 $T_{vj\ op}$
- 低 V_{CEsat}
- $T_{vj\ op} = 150^{\circ}C$

机械特性

- 4 kV 交流 1分钟 绝缘
- 碳化硅铝 (AlSiC) 基板提供更高的温度循环能力
- 封装的 CTI > 400
- 高爬电距离和电气间隙
- 高功率循环和温度循环能力
- 高功率密度
- IHM B 封装

Typical Applications

- Resonant inverter applications
- High power converters
- Traction drives
- Wind turbines

Electrical Features

- Extended operating temperature $T_{vj\ op}$
- Low V_{CEsat}
- $T_{vj\ op} = 150^{\circ}C$

Mechanical Features

- 4 kV AC 1min insulation
- AlSiC base plate for increased thermal cycling capability
- Package with CTI > 400
- High creepage and clearance distances
- High power and thermal cycling capability
- High power density
- IHM B housing

Module Label Code

Barcode Code 128



DMX - Code



Content of the 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

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IGBT, 逆变器 / IGBT, Inverter

最大额定值 / Maximum Rated Values

集电极 - 发射极电压 Collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{CES}	1700	V
连续集电极直流电流 Continuous DC collector current	$T_C = 100^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	$I_{C\text{ nom}}$	2400	A
集电极重复峰值电流 Repetitive peak collector current	$t_P = 1\text{ ms}$	I_{CRM}	4800	A
总功率损耗 Total power dissipation	$T_C = 25^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	P_{tot}	15,5	kW
栅极 - 发射极峰值电压 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 Collector-emitter saturation voltage	$I_C = 2400\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 2400\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 2400\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{ sat}}$	1,90 2,30 2,40	2,25	V V V
栅极阈值电压 Gate threshold voltage	$I_C = 96,0\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		V_{GEth}	5,20	5,80	6,40 V
栅极电荷 Gate charge	$V_{GE} = -15\text{ V} \dots +15\text{ V}$		Q_G	25,0		μC
内部栅极电阻 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		R_{Gint}	0,65		Ω
输入电容 Input capacitance	$f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		C_{ies}	195		nF
反向传输电容 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}	6,30		nF
集电极-发射极截止电流 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 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) Turn-on delay time, inductive load	$I_C = 2400\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 0,82\text{ }\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{don}	0,46 0,50 0,50		μs μs μs
上升时间(电感负载) Rise time, inductive load	$I_C = 2400\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 0,82\text{ }\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_r	0,20 0,20 0,21		μs μs μs
关断延迟时间(电感负载) Turn-off delay time, inductive load	$I_C = 2400\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 0,4\text{ }\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{doff}	1,15 1,30 1,30		μs μs μs
下降时间(电感负载) Fall time, inductive load	$I_C = 2400\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 0,4\text{ }\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_f	0,28 0,46 0,50		μs μs μs
开通损耗能量(每脉冲) Turn-on energy loss per pulse	$I_C = 2400\text{ A}, V_{CE} = 900\text{ V}, L_S = 50\text{ nH}$ $V_{GE} = \pm 15\text{ V}, di/dt = 11500\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Gon} = 0,82\text{ }\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{on}	510 680 740		mJ mJ mJ
关断损耗能量(每脉冲) Turn-off energy loss per pulse	$I_C = 2400\text{ A}, V_{CE} = 900\text{ V}, L_S = 50\text{ nH}$ $V_{GE} = \pm 15\text{ V}, du/dt = 3100\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Goff} = 0,4\text{ }\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{off}	660 870 920		mJ mJ mJ
短路数据 SC data	$V_{GE} \leq 15\text{ V}, V_{CC} = 1000\text{ V}$ $V_{CE\max} = V_{CES} - L_{SCE} \cdot di/dt$ $t_P \leq 10\text{ }\mu\text{s}, T_{vj} = 150^{\circ}\text{C}$		I_{SC}	11000		A
结 - 外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		R_{thJC}		7,74	K/kW
外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个 IGBT / per IGBT $\lambda_{\text{Paste}} = 1\text{ W}/(\text{m}\cdot\text{K}) / \lambda_{\text{grease}} = 1\text{ W}/(\text{m}\cdot\text{K})$		R_{thCH}	10,0		K/kW
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{ op}}$	-40	150	$^{\circ}\text{C}$

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二极管, 逆变器 / Diode, Inverter

最大额定值 / Maximum Rated Values

反向重复峰值电压 Repetitive peak reverse voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{RRM}	1700	V
连续正向直流电流 Continuous DC forward current		I_F	2400	A
正向重复峰值电流 Repetitive peak forward current	$t_P = 1\text{ ms}$	I_{FRM}	4800	A
I^2t -值 I^2t - value	$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	I^2t	1000 940	kA^2s kA^2s
最大损耗功率 Maximum power dissipation	$T_{vj} = 125^{\circ}\text{C}$	P_{RQM}	2400	kW
最小开通时间 Minimum turn-on time		$t_{on\ min}$	10,0	μs

特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	$I_F = 2400\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 2400\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 2400\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	V_F	1,80 1,90 1,95	2,20	V V V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 2400\text{ A}, -di_F/dt = 11500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	I_{RM}	2350 2700 2750		A A A
恢复电荷 Recovered charge	$I_F = 2400\text{ A}, -di_F/dt = 11500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	Q_r	590 1000 1100		μC μC μC
反向恢复损耗 (每脉冲) Reverse recovery energy	$I_F = 2400\text{ A}, -di_F/dt = 11500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{rec}	370 670 760		mJ mJ mJ
结 - 外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode		R_{thJC}		13,1	K/kW
外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个二极管 / per diode $\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$		R_{thCH}	10,5		K/kW
在开关状态下温度 Temperature under switching conditions			$T_{vj\ op}$	-40	150	$^{\circ}\text{C}$

模块 / Module

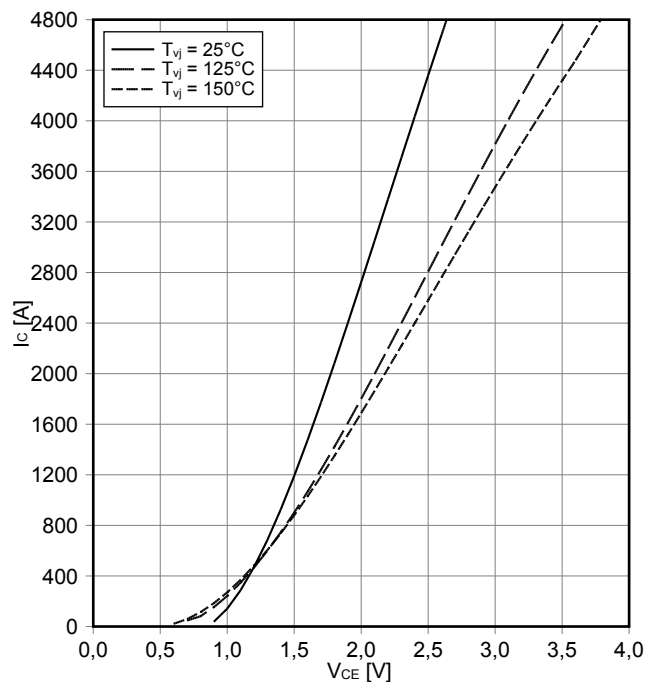
绝缘测试电压 Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V _{ISOL}	4,0	kV
模块基板材料 Material of module baseplate			AlSiC	
爬电距离 Creepage distance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal		32,2 32,2	mm
电气间隙 Clearance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal		19,1 19,1	mm
相对电痕指数 Comperative tracking index		CTI	> 400	
杂散电感,模块 Stray inductance module		L _{sCE}	min. 6,0	typ. max. nH
模块引线电阻,端子-芯片 Module lead resistance, terminals - chip	T _C = 25°C, 每个开关 / per switch	R _{CC'+EE'}	0,10	mΩ
储存温度 Storage temperature		T _{stg}	-40	150 °C
模块安装的安装扭矩 Mounting torque for modul mounting	螺丝 M6 根据相应的应用手册进行安装 Screw M6 - Mounting according to valid application note	M	4,25	5,75 Nm
端子联接扭矩 Terminal connection torque	螺丝 M4 根据相应的应用手册进行安装 Screw M4 - Mounting according to valid application note 螺丝 M8 根据相应的应用手册进行安装 Screw M8 - Mounting according to valid application note	M	1,8 8,0	- - 2,1 10 Nm
重量 Weight		G	1200	g

输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$

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

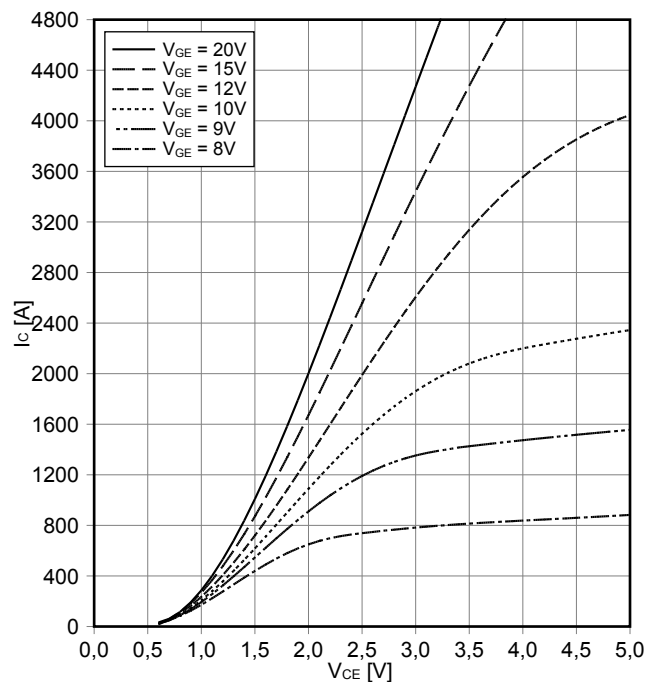


输出特性 IGBT, 逆变器 (典型)

output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$

$T_{vj} = 150^\circ\text{C}$

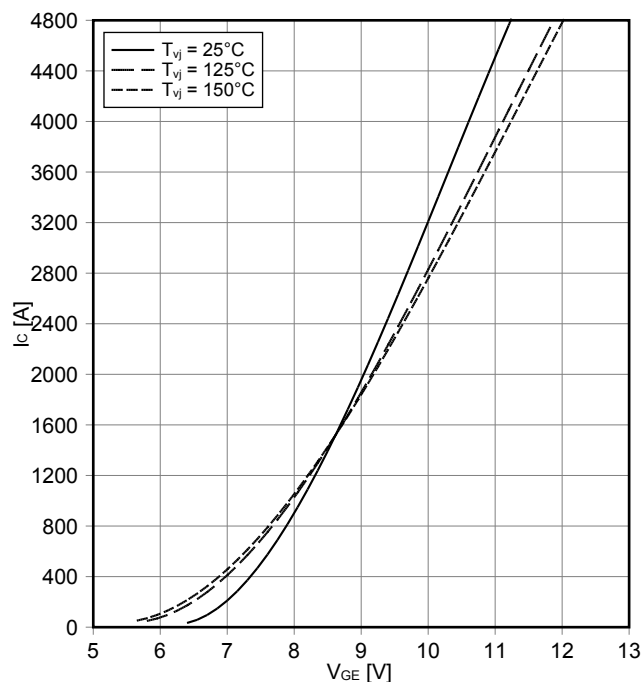


传输特性 IGBT, 逆变器 (典型)

transfer characteristic IGBT, Inverter (typical)

$I_C = f(V_{GE})$

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

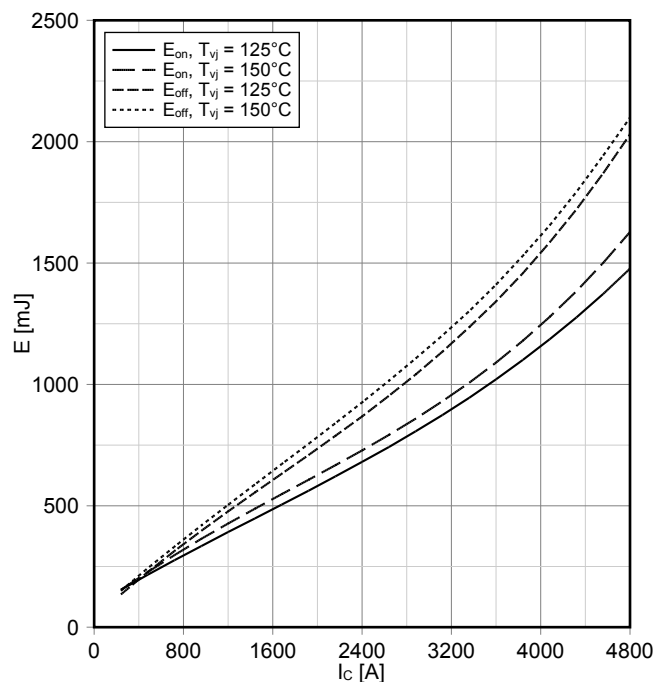


开关损耗 IGBT, 逆变器 (典型)

switching losses IGBT, Inverter (typical)

$E_{on} = f(I_C)$, $E_{off} = f(I_C)$

$V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 0.82\ \Omega$, $R_{Goff} = 0.4\ \Omega$, $V_{CE} = 900\text{ V}$



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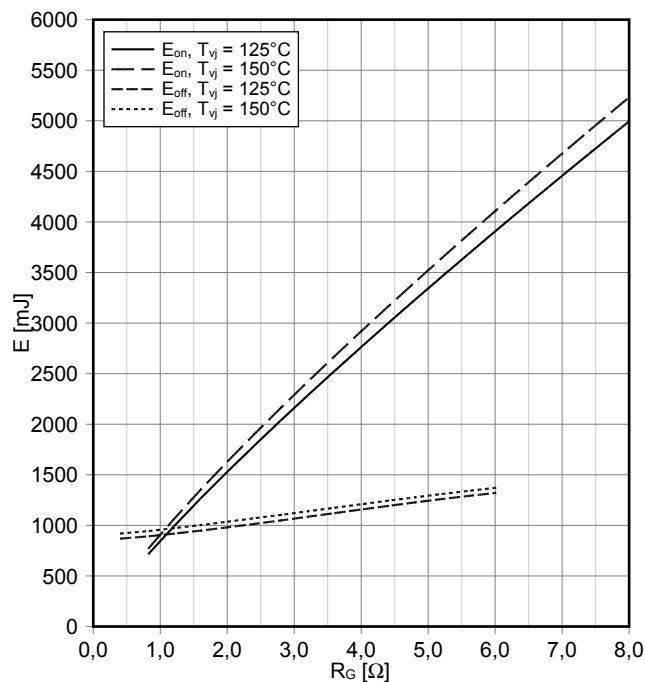
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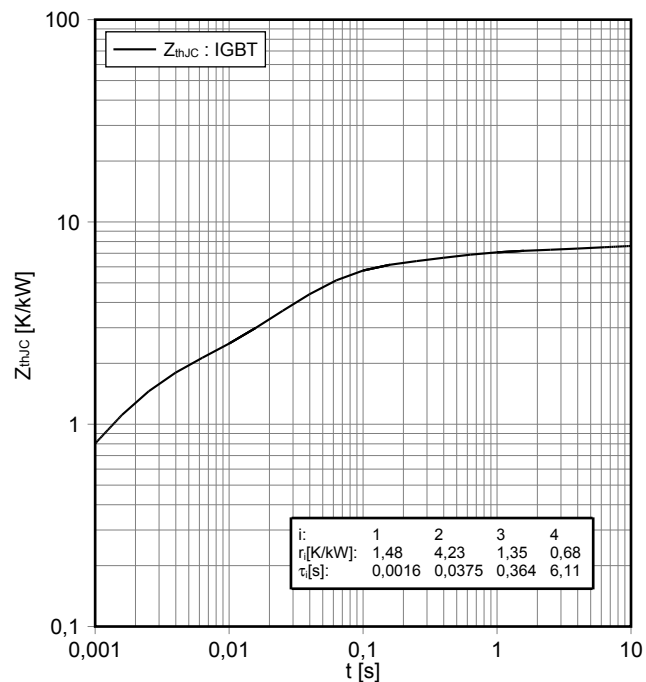
revision: V3.1

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

$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
 $V_{GE} = \pm 15 \text{ V}$, $I_C = 2400 \text{ A}$, $V_{CE} = 900 \text{ V}$

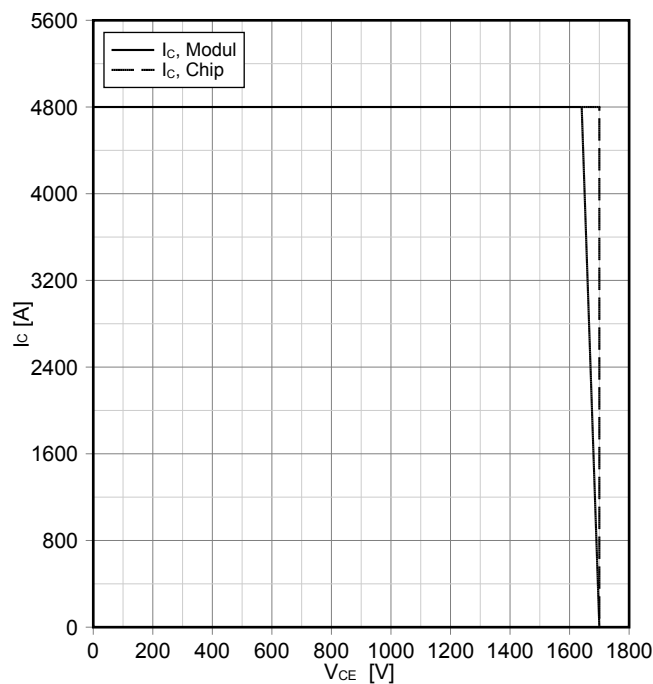


瞬态热阻抗 IGBT, 逆变器
transient thermal impedance IGBT, Inverter
 $Z_{thJC} = f(t)$

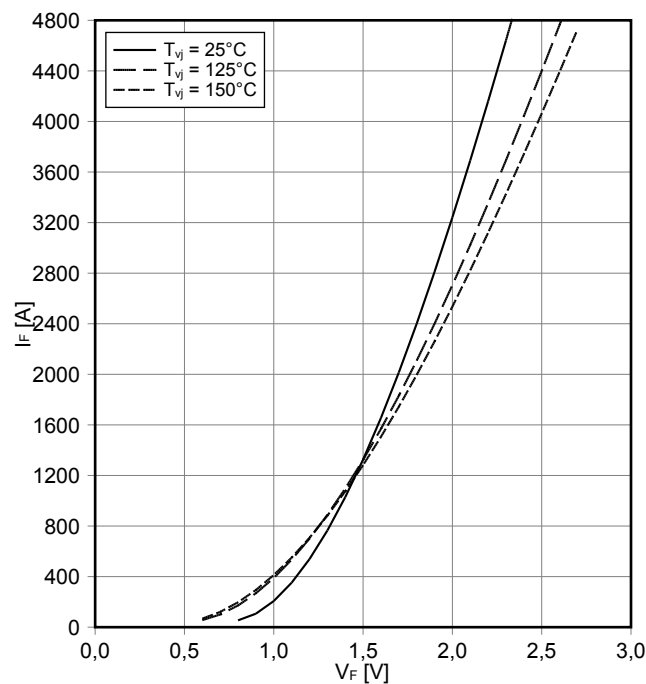


反偏安全工作区 IGBT, 逆变器 (RBSOA)
reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$
 $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 0.4 \Omega$, $T_{vj} = 150^\circ\text{C}$



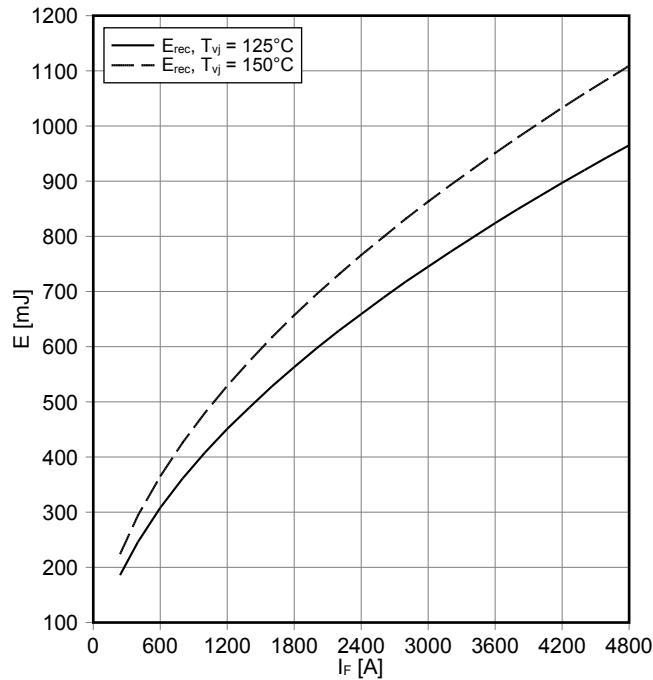
正向偏压特性 二极管, 逆变器 (典型)
forward characteristic of Diode, Inverter (typical)
 $I_F = f(V_F)$



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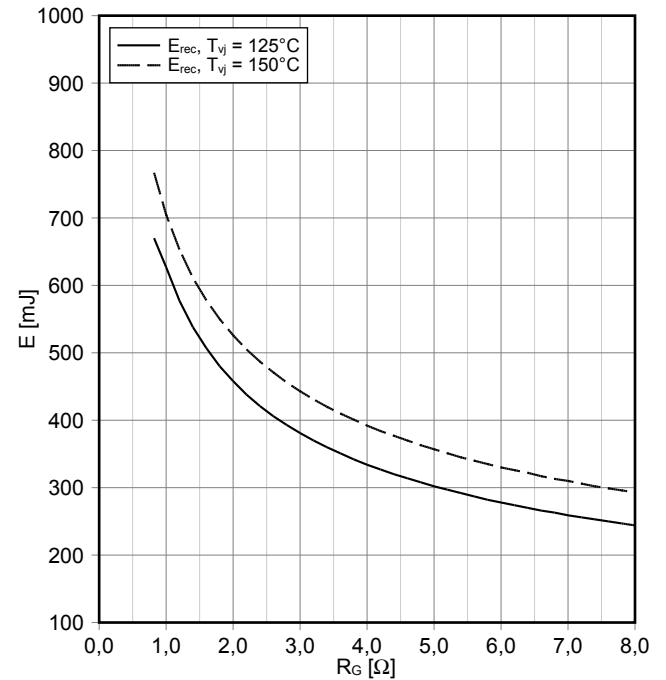
开关损耗 二极管, 逆变器 (典型)
switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$
 $R_{Gon} = 0.82 \Omega$, $V_{CE} = 900 V$



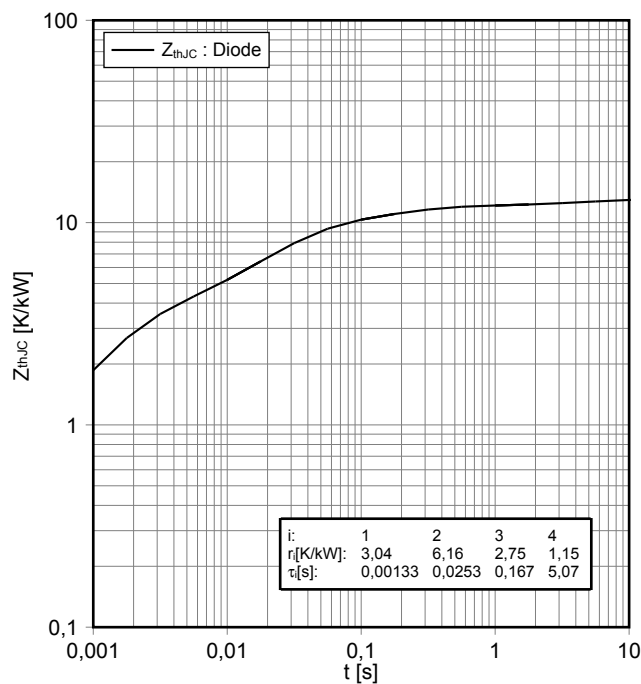
开关损耗 二极管, 逆变器 (典型)
switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$
 $I_F = 2400 A$, $V_{CE} = 900 V$



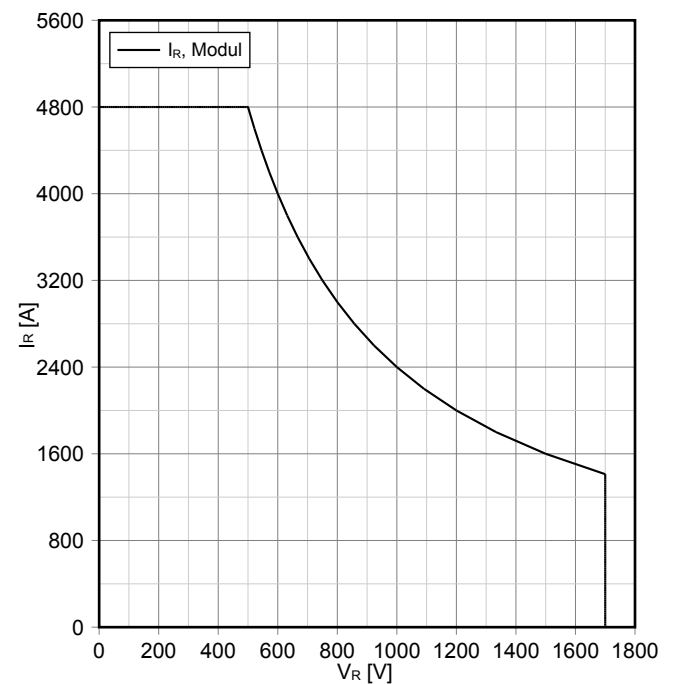
瞬态热阻抗 二极管, 逆变器
transient thermal impedance Diode, Inverter

$Z_{thJC} = f(t)$

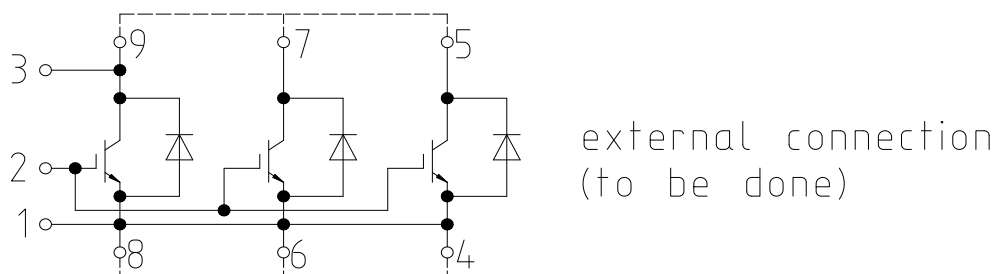


安全工作区 二极管, 逆变器 (SOA)
safe operation area Diode, Inverter (SOA)

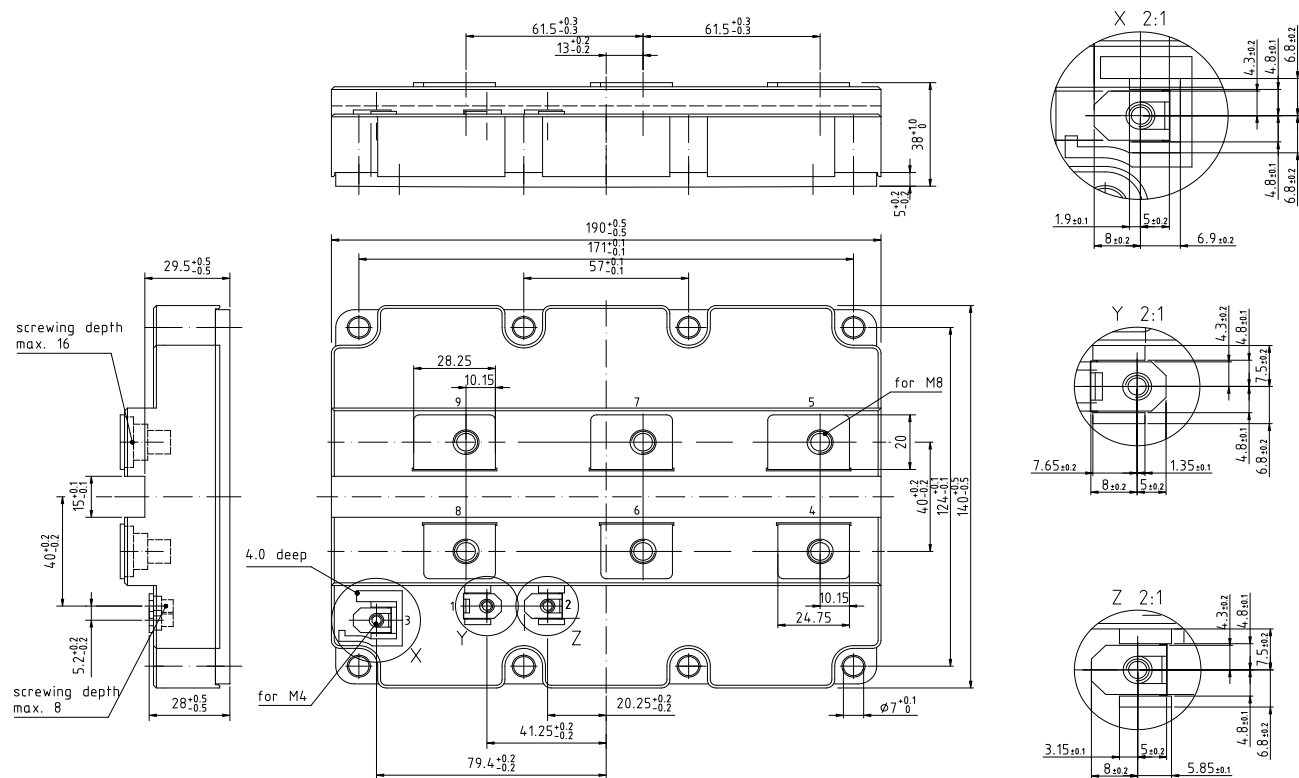
$I_R = f(V_R)$
 $T_{vj} = 150^\circ C$



接线图 / Circuit diagram



封装尺寸 / Package outlines



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