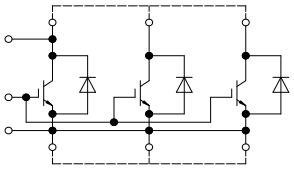
IHM-B 模块 采用第四代沟槽栅/场终止IGBT4和第四代发射极控制二极管
IHM-B module with Trench/Fieldstop IGBT4 and Emitter Controlled 4 diode

初步数据 / Preliminary Data



V_{CES} = 3300V
$I_{C\ nom}$ = 2000A / I_{CRM} = 4000A

潜在应用
- UPS系统
- 中压变流器
- 商业性农用车辆
- 大功率变流器
- 有源前级（能量回馈）
- 牵引变流器
- 电机传动

Potential Applications
- UPS systems
- Medium voltage converters
- Commercial Agriculture Vehicles
- High power converters
- Active frontend (energy recovery)
- Traction drives
- Motor drives

电气特性
- $T_{vj\ op}$ = 150°C
- V_{CEsat} 带正温度系数
- 低 V_{CEsat}
- 低 Qg 和 Cres
- 低开关损耗
- 无与伦比的坚固性
- 沟槽栅IGBT4
- 高电流密度
- 高直流电压稳定性
- 高短路能力

Electrical Features
- $T_{vj\ op}$ = 150°C
- V_{CEsat} with positive temperature coefficient
- Low V_{CEsat}
- Low Qg and Cres
- Low switching losses
- Unbeatable robustness
- Trench IGBT 4
- High current density
- High DC stability
- High short-circuit capability

机械特性
- 封装的 CTI > 600
- 碳化硅铝 (AlSiC) 基板提供更高的温度循环能力
- 符合RoHS
- 绝缘的基板

Mechanical Features
- Package with CTI > 600
- AlSiC base plate for increased thermal cycling capability
- RoHS compliant
- Isolated base plate

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 Collector-emitter voltage	T_{vj} = -40°C T_{vj} = 150°C	V_{CES}		3300 3300	V
连续集电极直流电流 Continuous DC collector current	T_C = 115°C, $T_{vj\,max}$ = 150°C	I_{CDC}		2000	A
集电极重复峰值电流 Repetitive peak collector current	t_P = 1 ms	I_{CRM}		4000	A
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 = 2000 A, V_{GE} = 15 V	$V_{CE\,sat}$		2,20 2,70 2,80	t.b.d.	V V V
栅极阈值电压 Gate threshold voltage	I_C = 94,0 mA, V_{CE} = V_{GE}, T_{vj} = 25°C	V_{GEth}	5,20	5,80	6,40	V
栅极电荷 Gate charge	V_{GE} = -15 / 15 V, V_{CE} = 1800 V	Q_G		40,0		µC
内部栅极电阻 Internal gate resistor	T_{vj} = 25°C	R_{Gint}		0,5		Ω
输入电容 Input capacitance	f = 1000 kHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V	C_{ies}		280		nF
反向传输电容 Reverse transfer capacitance	f = 1000 kHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V	C_{res}		8,00		nF
集电极-发射极截止电流 Collector-emitter cut-off current	V_{CE} = 3300 V, V_{GE} = 0 V, T_{vj} = 25°C	I_{CES}			5,0	mA
栅极-发射极漏电流 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) Turn-on delay time, inductive load	I_C = 2000 A, V_{CE} = 1800 V, V_{GE} = -15 / 15 V, R_{Gon} = 0,5 Ω T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\,on}$		0,54 0,66 0,72		µs µs µs
上升时间(电感负载) Rise time, inductive load	I_C = 2000 A, V_{CE} = 1800 V, V_{GE} = -15 / 15 V, R_{Gon} = 0,5 Ω T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_r		0,22 0,24 0,24		µs µs µs
关断延迟时间(电感负载) Turn-off delay time, inductive load	I_C = 2000 A, V_{CE} = 1800 V, V_{GE} = -15 / 15 V, R_{Goff} = 2,0 Ω T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\,off}$		2,90 3,20 3,30		µs µs µs
下降时间(电感负载) Fall time, inductive load	I_C = 2000 A, V_{CE} = 1800 V, V_{GE} = -15 / 15 V, R_{Goff} = 2,0 Ω T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_f		0,76 1,28 1,58		µs µs µs
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	I_C = 2000 A, V_{CE} = 1800 V, Lσ = 85 nH, di/dt = 7600 A/µs (T_{vj} = 150°C), V_{GE} = -15 / 15 V, R_{Gon} = 0,5 Ω T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{on}		1600 2800 3200		mJ mJ mJ
关断损耗能量 (每脉冲) Turn-off energy loss per pulse	I_C = 2000 A, V_{CE} = 1800 V, Lσ = 85 nH, du/dt = 1800 V/µs (T_{vj} = 150°C), V_{GE} = -15 / 15 V, R_{Goff} = 2,0 Ω T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{off}		2700 3600 3900		mJ mJ mJ
短路数据 SC data	V_{GE} ≤ 15 V, V_{CC} = 2400 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 Thermal resistance, junction to case	每个 IGBT / per IGBT	R_{thJC}			5,50	K/kW
外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个 IGBT / per IGBT λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)	R_{thCH}		4,30		K/kW
在开关状态下温度 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 Repetitive peak reverse voltage	T_{vj} = -40°C T_{vj} = 150°C	V_{RRM}	3300 3300	V
连续正向直流电流 Continuous DC forward current		I_F	2000	A
正向重复峰值电流 Repetitive peak forward current	t_P = 1 ms	I_{FRM}	4000	A
I2t-值 I²t - value	V_R = 0 V, t_P = 10 ms, T_{vj} = 125°C V_R = 0 V, t_P = 10 ms, T_{vj} = 150°C	I²t	1230 1110	kA²s kA²s
最大损耗功率 Maximum power dissipation	T_{vj} = 150°C	P_{RQM}	4200	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 = 2000 A, V_{GE} = 0 V T_{vj} = 25°C I_F = 2000 A, V_{GE} = 0 V T_{vj} = 125°C I_F = 2000 A, V_{GE} = 0 V T_{vj} = 150°C	V_F		2,70 2,35 2,25	t.b.d.	V V V
反向恢复峰值电流 Peak reverse recovery current	I_F = 2000 A, - di_F/dt = 7600 A/µs (T_{vj}=150°C) T_{vj} = 25°C V_R = 1800 V T_{vj} = 125°C V_{GE} = -15 V T_{vj} = 150°C	I_{RM}		2500 2800 2900		A A A
恢复电荷 Recovered charge	I_F = 2000 A, - di_F/dt = 7600 A/µs (T_{vj}=150°C) T_{vj} = 25°C V_R = 1800 V T_{vj} = 125°C V_{GE} = -15 V T_{vj} = 150°C	Q_r		1020 1980 2320		µC µC µC
反向恢复损耗（每脉冲） Reverse recovery energy	I_F = 2000 A, - di_F/dt = 7600 A/µs (T_{vj}=150°C) T_{vj} = 25°C V_R = 1800 V T_{vj} = 125°C V_{GE} = -15 V T_{vj} = 150°C	E_{rec}		1350 2450 2900		mJ mJ mJ
结 - 外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode	R_{thJC}			10,6	K/kW
外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个二极管 / per diode λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)	R_{thCH}		5,10		K/kW
在开关状态下温度 Temperature under switching conditions		$T_{vj\ op}$	-40		150	°C

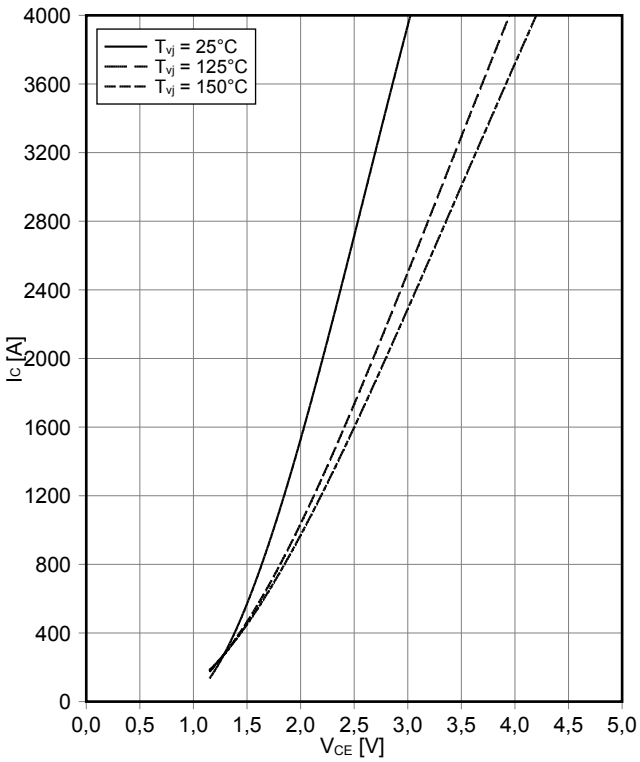
初步数据
Preliminary Data

模块 / Module

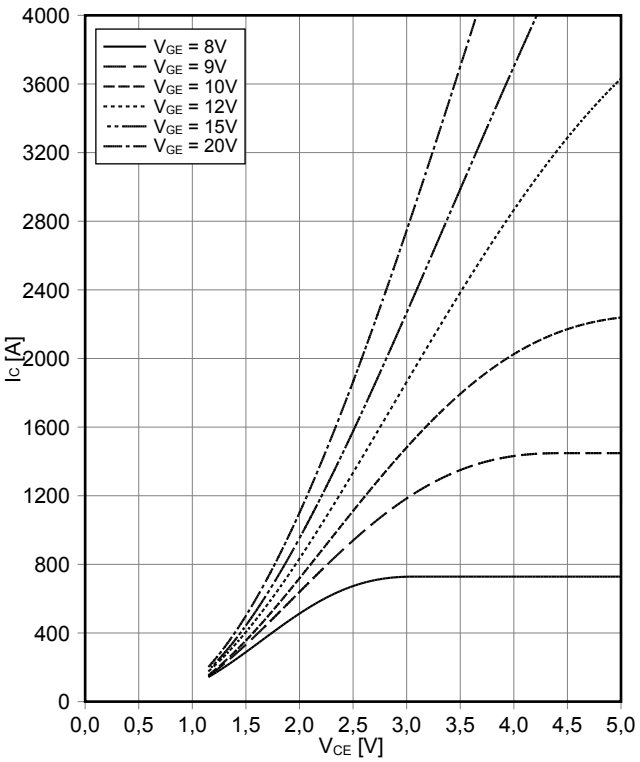
绝缘测试电压 Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V_{ISOL}		6,0		kV
局部放电停止电压 Partial discharge extinction voltage	RMS, f = 50 Hz, $Q_{PD} \leq$ 10 pC	V_{ISOL}		2,6		kV
DC 稳定性 DC stability	T_{vj} = 25°C, 100 fit	$V_{CE\ D}$		2100		V
模块基板材料 Material of module baseplate				AlSiC		
爬电距离 Creepage distance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal			32,2		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		mm
相对电痕指数 Comperative tracking index		CTI		> 600		
			min.	typ.	max.	
杂散电感,模块 Stray inductance module		L_{sCE}		6,0		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	$R_{CC'+EE'}$ $R_{AA'+CC'}$		0,095 0,08		mΩ
储存温度 Storage temperature		T_{stg}	-40		150	°C
模块安装的安装扭距 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
端子联接扭距 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 Nm
重量 Weight		G		1200		g

初步数据
Preliminary Data

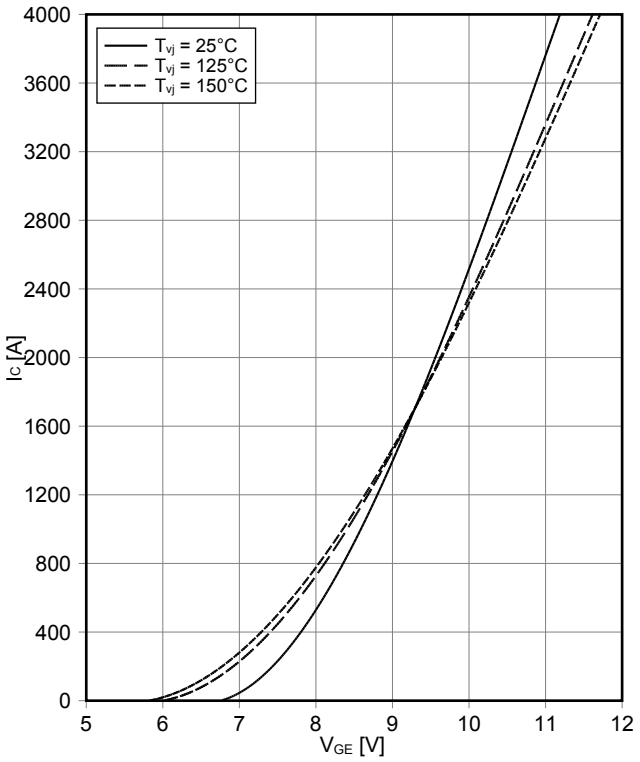
输出特性 IGBT, 逆变器 （典型)
output characteristic IGBT,Inverter (typical)
$I_C = f(V_{CE})$
V_{GE} = 15 V



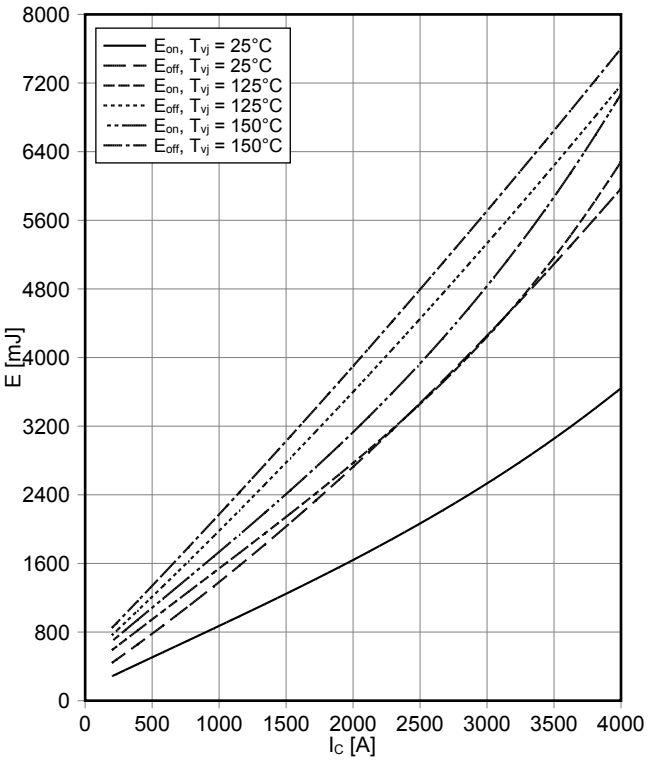
输出特性 IGBT, 逆变器 （典型)
output characteristic IGBT,Inverter (typical)
$I_C = f(V_{CE})$
T_{vj} = 150°C



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

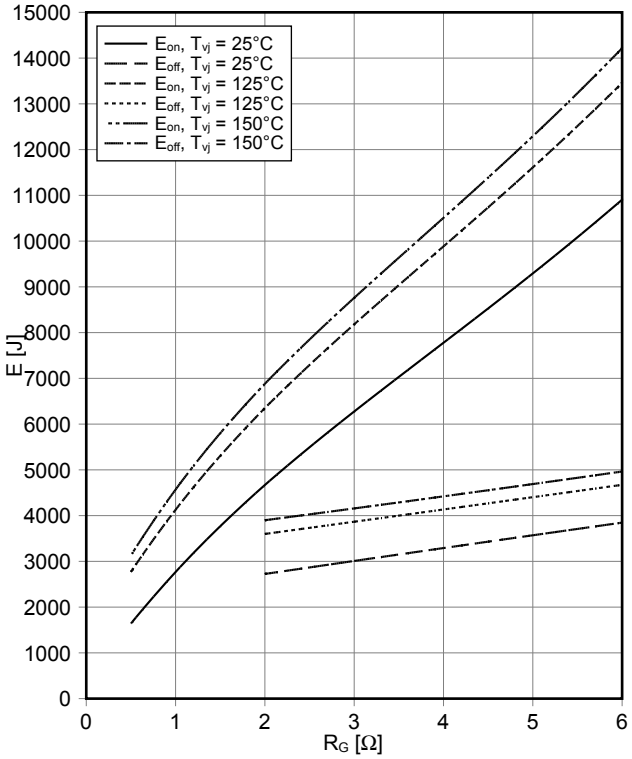


开关损耗 IGBT, 逆变器 （典型)
switching losses IGBT,Inverter (typical)
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
V_{GE} = ±15 V, R_{Gon} = 0.5 Ω, R_{Goff} = 2 Ω, V_{CE} = 1800 V

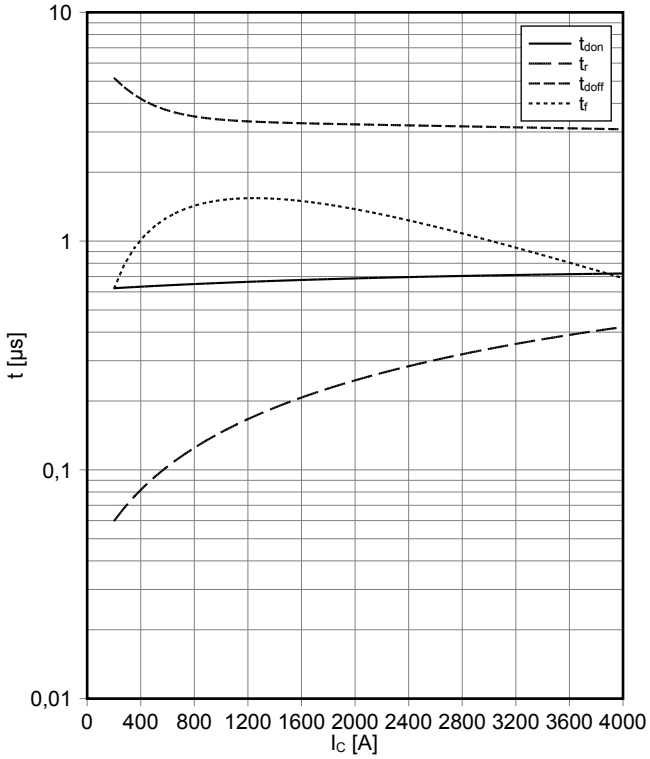


初步数据
Preliminary Data

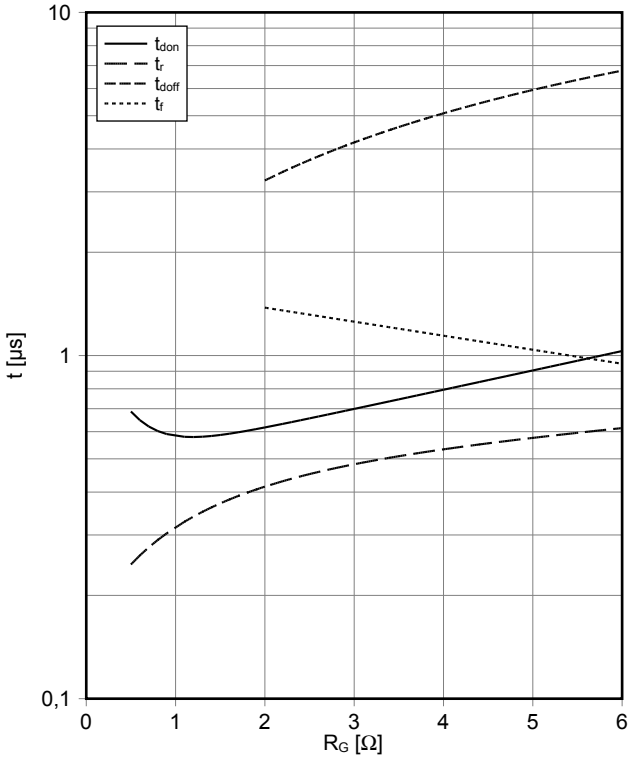
开关损耗 IGBT, 逆变器 （典型）
switching losses IGBT,Inverter (typical)
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
V_{GE} = ±15 V, I_C = 2000 A, V_{CE} = 1800 V



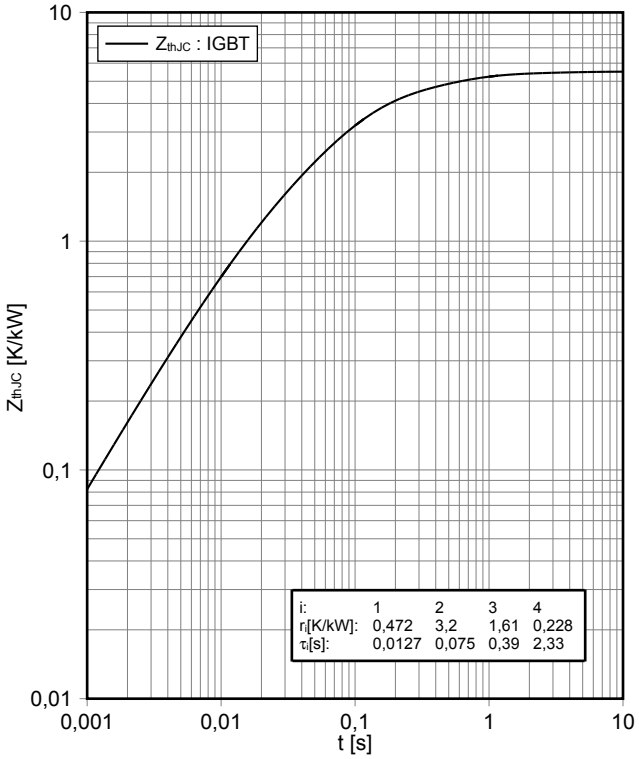
??? IGBT, 逆变器 （典型）
switching times IGBT,Inverter (typical)
$t_{don} = f(I_C)$, $t_r = f(I_C)$, $t_{doff} = f(I_C)$, $t_r = f(I_C)$, $t_{doff} = f(I_C)$, $t_f = f(I_C)$
V_{GE} = ±15 V, R_{Gon} = 0.5 Ω, R_{Goff} = 2 Ω, V_{CE} = 1800 V, T_{vj} = 125°C



??? IGBT, 逆变器 （典型）
switching times IGBT,Inverter (typical)
$t_{don} = f(R_G)$, $t_r = f(R_G)$, $t_{doff} = f(R_G)$, $t_r = f(R_G)$, $t_{doff} = f(R_G)$, $t_f = f(R_G)$
V_{GE} = ±15 V, I_C = 2000 A, V_{CE} = 1800 V, T_{vj} = 125°C

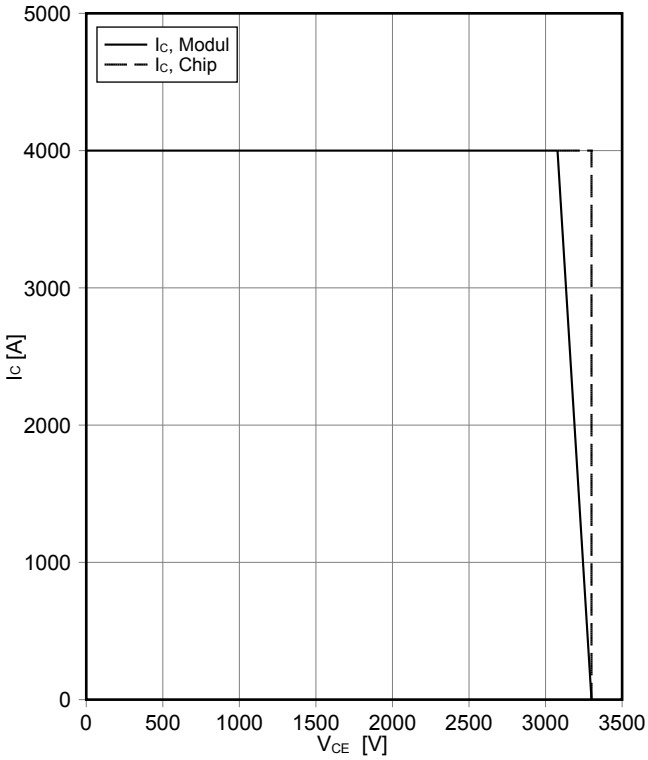


瞬态热阻抗 IGBT, 逆变器
transient thermal impedance IGBT,Inverter
$Z_{thJC} = f(t)$

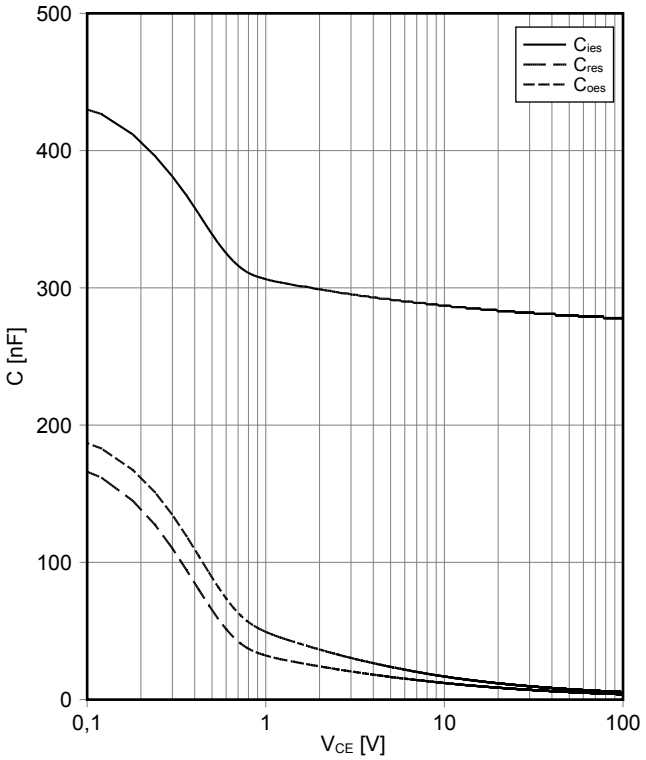


初步数据
Preliminary Data

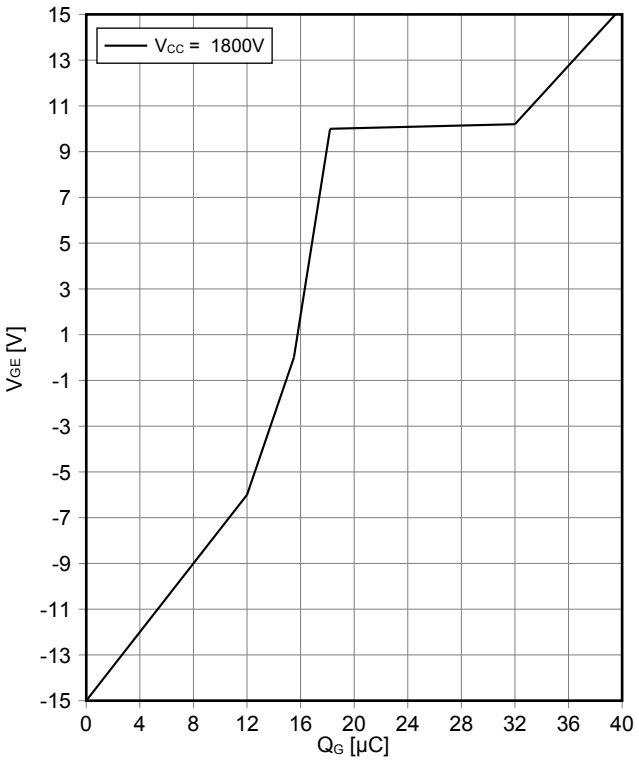
反偏安全工作区 IGBT, 逆变器（RBSOA）
reverse bias safe operating area IGBT,Inverter (RBSOA)
$I_C = f(V_{CE})$
V_{GE} = ±15 V, R_{Goff} = 2 Ω, T_{vj} = 150°C



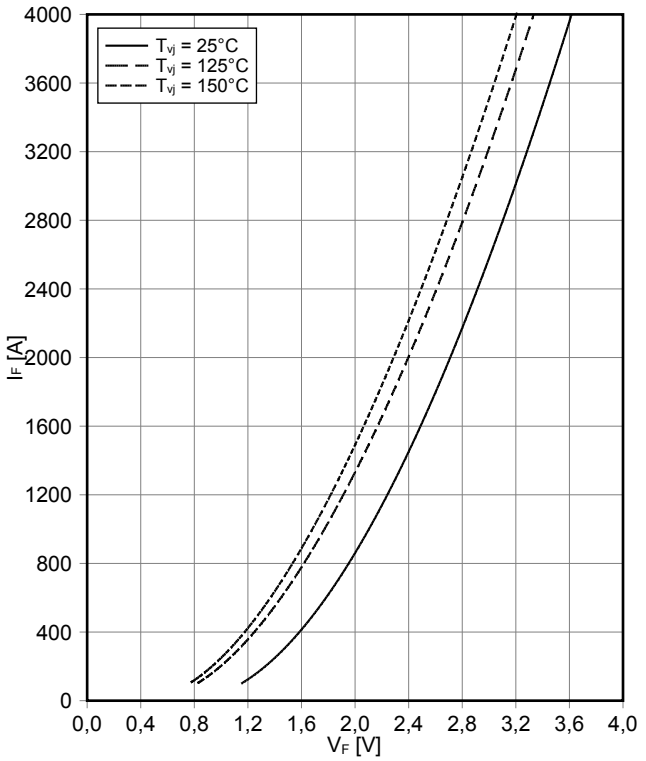
电容特性 IGBT, 逆变器（典型）
capacity characteristic IGBT,Inverter (typical)
$C = f(V_{CE})$
V_{GE} = 0 V, T_{vj} = 25°C, f = 100kHz



栅极电荷特性 IGBT, 逆变器（典型）
gate charge characteristic IGBT,Inverter (typical)
$V_{GE} = f(Q_G)$
I_C = 2000 A, T_{vj} = 25°C

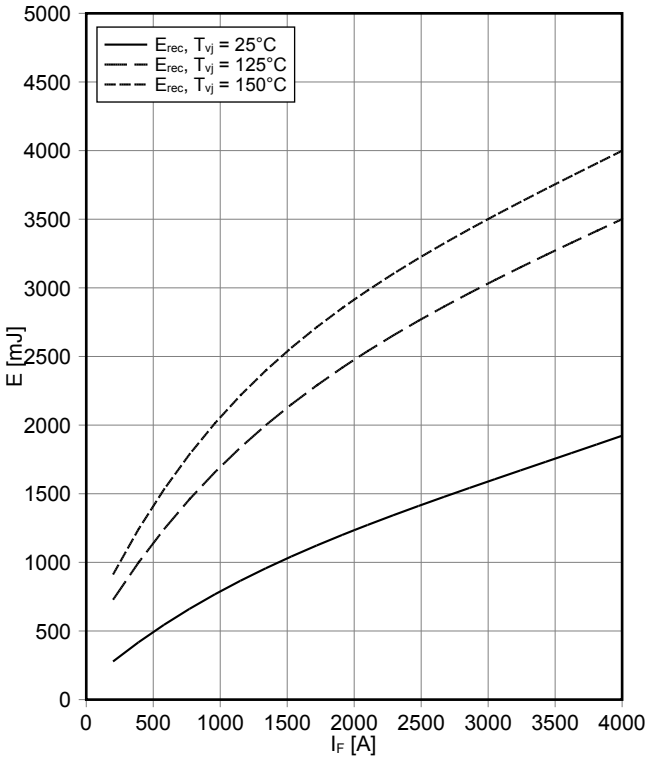


正向偏压特性 二极管,逆变器（典型）
forward characteristic of Diode, Inverter (typical)
$I_F = f(V_F)$

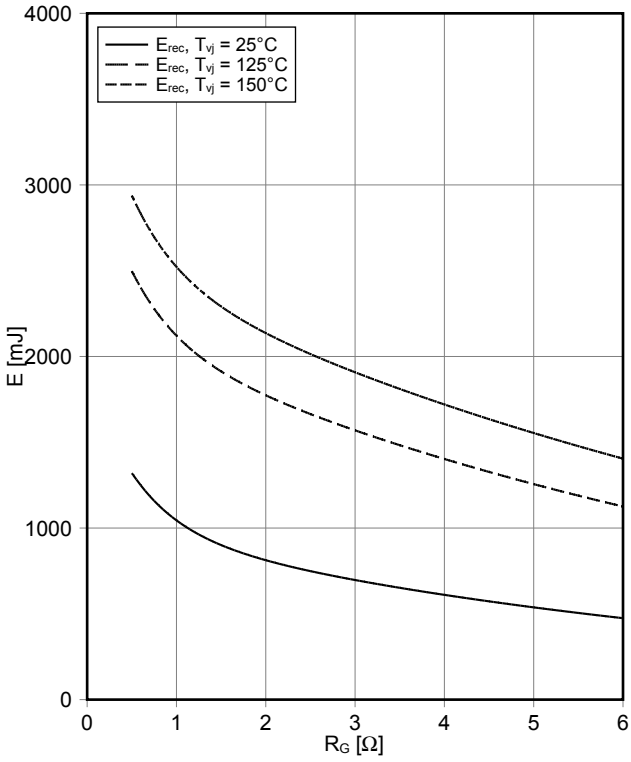


初步数据
Preliminary Data

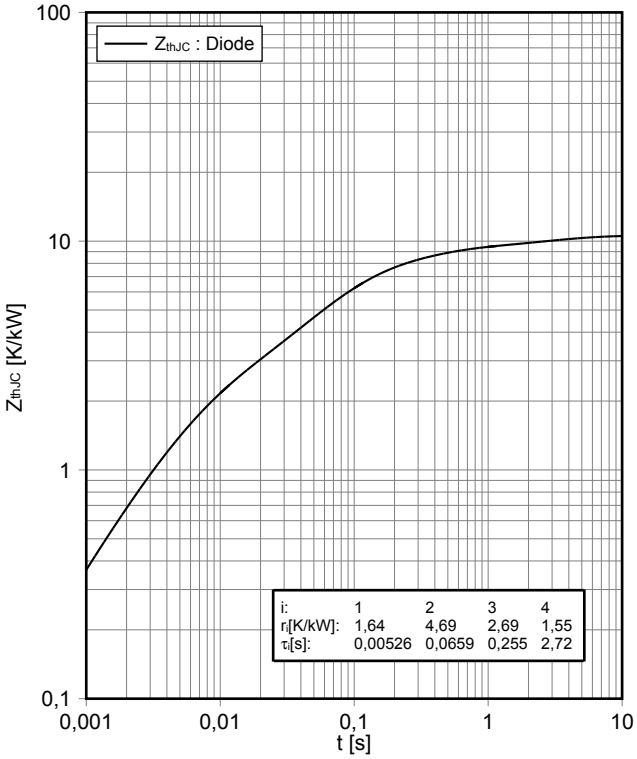
开关损耗 二极管,逆变器 （典型）
switching losses Diode, Inverter (typical)
$E_{rec} = f(I_F)$
$R_{Gon} = 0.5\ \Omega$, $V_{CE} = 1800$ V



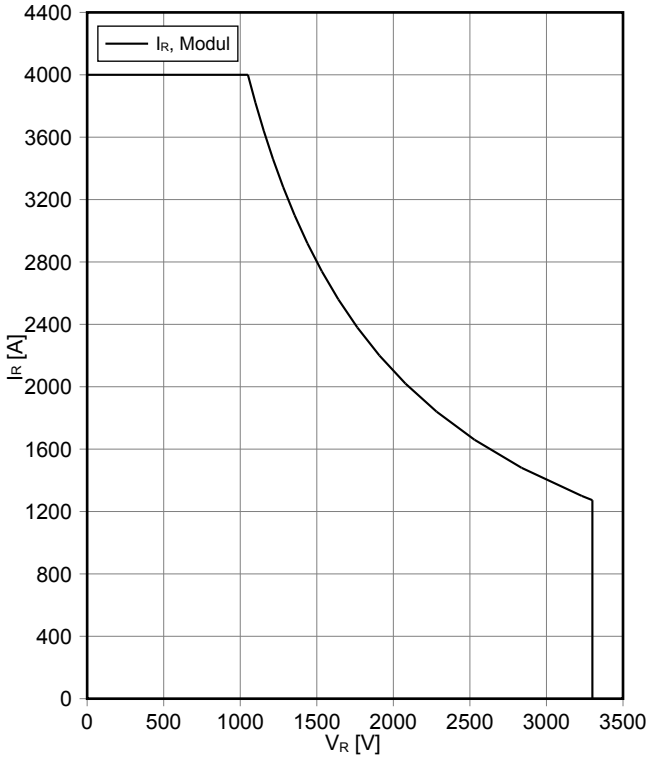
开关损耗 二极管,逆变器 （典型）
switching losses Diode, Inverter (typical)
$E_{rec} = f(R_G)$
$I_F = 2000$ A, $V_{CE} = 1800$ V



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

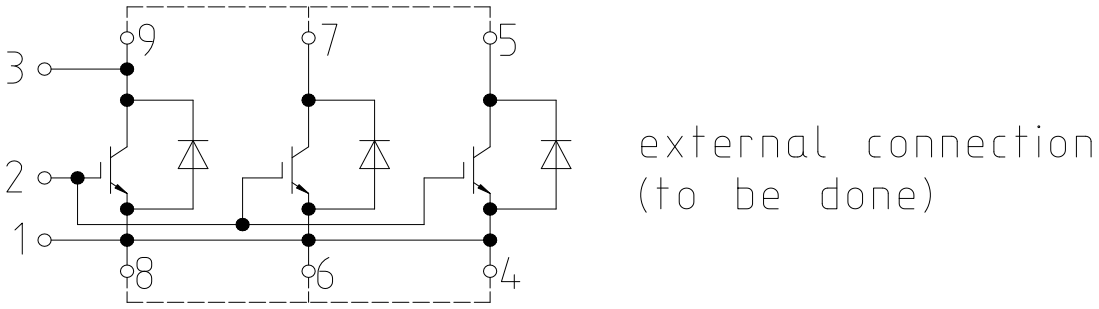


安全工作区 二极管,逆变器 (SOA)
safe operation area Diode, Inverter (SOA)
$I_R = f(V_R)$
$T_{vj} = 150$°C

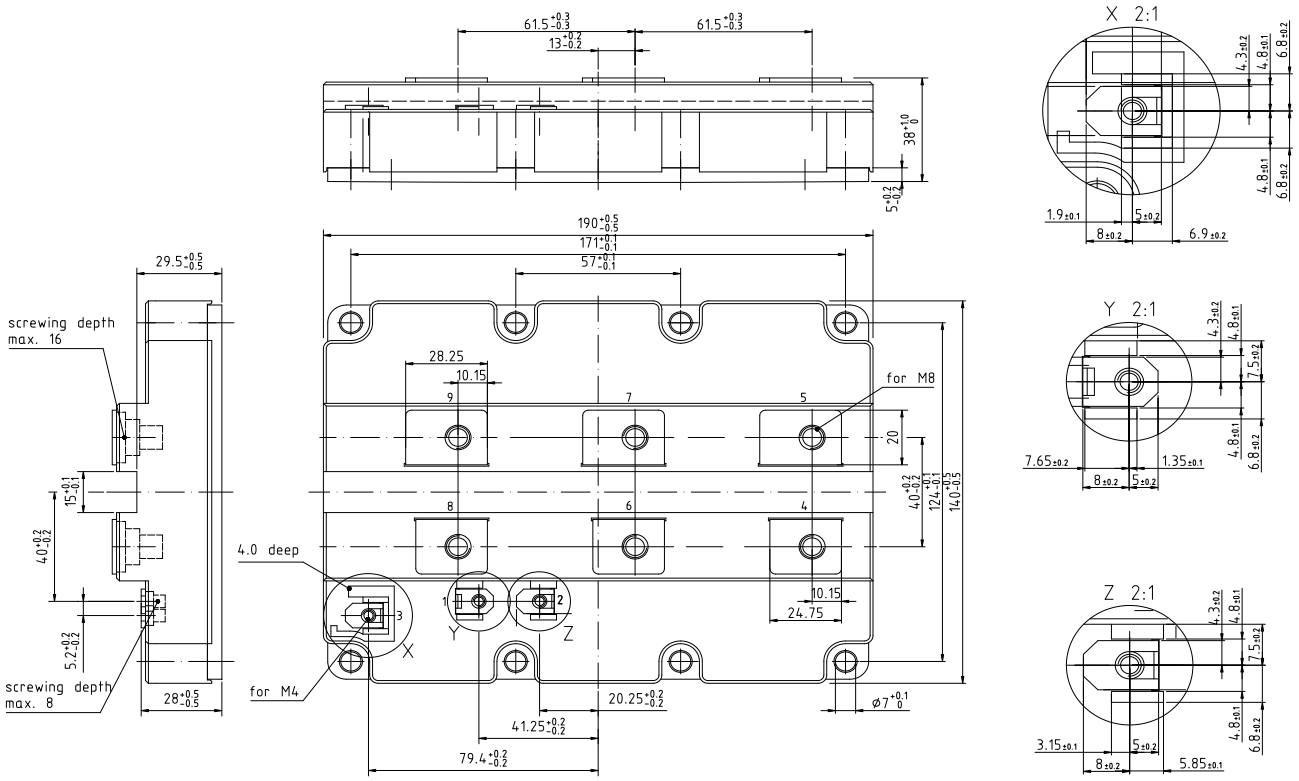


初步数据
Preliminary Data

接线图 / Circuit diagram



封装尺寸 / Package outlines



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