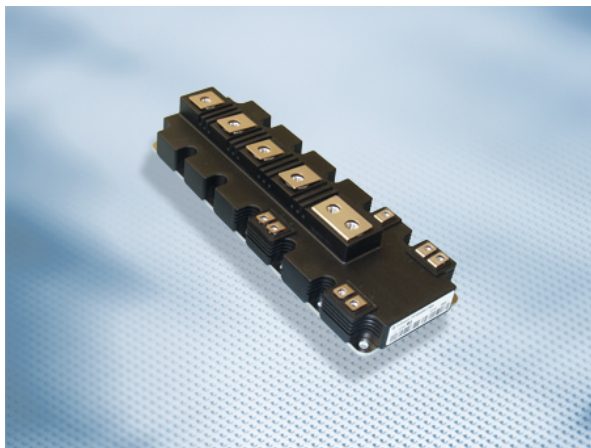


PrimePACK™3 模块 带有温度检测NTC
PrimePACK™3 module and NTC

初步数据 / Preliminary Data



$V_{CES} = 1700V$
 $I_{C\ nom} = 1000A / I_{CRM} = 2000A$

典型应用

- 三电平应用
- 斩波应用
- 辅助逆变器
- 大功率变流器
- 电机传动
- 牵引变流器
- 风力发电机

Typical Applications

- 3-Level-Applications
- Chopper Applications
- Auxiliary Inverters
- High Power Converters
- Motor Drives
- Traction Drives
- Wind Turbines

电气特性

- 提高工作结温 $T_{vj\ op}$
- 高直流电压稳定性
- 高电流密度
- 低开关损耗
- 低 V_{CEsat}
- $T_{vj\ op} = 150^{\circ}C$
- 增大的二极管针对反馈运行模式

Electrical Features

- Extended Operation Temperature $T_{vj\ op}$
- High DC Stability
- High Current Density
- Low Switching Losses
- Low V_{CEsat}
- $T_{vj\ op} = 150^{\circ}C$
- Enlarged Diode for regenerative operation

机械特性

- 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

Mechanical Features

- Package with CTI > 400
- High Creepage and Clearance Distances
- High Power and Thermal Cycling Capability
- High Power Density

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

prepared by: TA	date of publication: 2013-11-05
approved by: MS	revision: 2.1

初步数据
Preliminary Data

IGBT, 斩波器 / IGBT-Chopper
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	$T_C = 100^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	$I_{C\text{nom}}$ I_C	1000 1390	A A
集电极重复峰值电流 Repetitive peak collector current	$t_P = 1\text{ ms}$	I_{CRM}	2000	A
总功率损耗 Total power dissipation	$T_C = 25^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	P_{tot}	6,25	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	$I_C = 1000\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 1000\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 1000\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{sat}}$	2,00 2,35 2,45	2,45 2,80	V V V	
栅极阈值电压 Gate threshold voltage	$I_C = 36,0\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		V_{GEth}	5,2	5,8	6,4	V
栅极电荷 Gate charge	$V_{GE} = -15\text{ V} \dots +15\text{ V}$		Q_G	10,0			μC
内部栅极电阻 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		R_{Gint}	1,8			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}	81,0			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}	2,60			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	$I_C = 1000\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 0,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{don}	0,66 0,70 0,71			μs μs μs
上升时间(电感负载) Rise time, inductive load	$I_C = 1000\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 0,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_r	0,10 0,11 0,12			μs μs μs
关断延迟时间(电感负载) Turn-off delay time, inductive load	$I_C = 1000\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 1,2\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{doff}	1,15 1,30 1,35			μs μs μs
下降时间(电感负载) Fall time, inductive load	$I_C = 1000\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 1,2\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_f	0,25 0,48 0,56			μs μs μs
开通损耗能量(每脉冲) Turn-on energy loss per pulse	$I_C = 1000\text{ A}, V_{CE} = 900\text{ V}, L_S = 30\text{ nH}$ $V_{GE} = \pm 15\text{ V}, di/dt = 8900\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Gon} = 0,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{on}	260 365 415			mJ mJ mJ
关断损耗能量(每脉冲) Turn-off energy loss per pulse	$I_C = 1000\text{ A}, V_{CE} = 900\text{ V}, L_S = 30\text{ nH}$ $V_{GE} = \pm 15\text{ V}, du/dt = 2800\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Goff} = 1,2\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{off}	210 315 345			mJ mJ mJ
短路数据 SC data	$V_{GE} \leq 15\text{ V}, V_{CC} = 1000\text{ V}$ $V_{CE\text{max}} = V_{CES} - L_{SCE} \cdot di/dt$ $t_P \leq 10\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$		I_{SC}	4000			A
结 - 外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		R_{thJC}			24,0	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	$^{\circ}\text{C}$

prepared by: TA	date of publication: 2013-11-05
approved by: MS	revision: 2.1



初步数据
Preliminary Data

Diode-斩波器 / Diode-Chopper
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	1000	A
正向重复峰值电流 Repetitive peak forward current	$t_P = 1\text{ ms}$	I_{FRM}	2000	A
I2t-值 I²t - 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	185	kA²s
			175	kA²s

特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	$I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$		1,70	2,15	V
	$I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 125^{\circ}\text{C}$	V_F	1,70		V
	$I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 150^{\circ}\text{C}$		1,70		V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 1000\text{ A}, -di_F/dt = 8900\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$		1300		A
		$T_{vj} = 125^{\circ}\text{C}$	I_{RM}	1400		A
		$T_{vj} = 150^{\circ}\text{C}$		1450		A
恢复电荷 Recovered charge	$I_F = 1000\text{ A}, -di_F/dt = 8900\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$		285		μC
		$T_{vj} = 125^{\circ}\text{C}$	Q_r	460		μC
		$T_{vj} = 150^{\circ}\text{C}$		520		μC
反向恢复损耗 (每脉冲) Reverse recovery energy	$I_F = 1000\text{ A}, -di_F/dt = 8900\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$		145		mJ
		$T_{vj} = 125^{\circ}\text{C}$	E_{rec}	260		mJ
		$T_{vj} = 150^{\circ}\text{C}$		295		mJ
结 - 外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode	R_{thJC}			35,0	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}		15,0		K/kW
在开关状态下温度 Temperature under switching conditions		$T_{vj\text{ op}}$	-40		150	$^{\circ}\text{C}$

prepared by: TA	date of publication: 2013-11-05
approved by: MS	revision: 2.1

初步数据
Preliminary Data

反向二极管 / Diode, Reverse
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	1000	A
正向重复峰值电流 Repetitive peak forward current	$t_P = 1\text{ ms}$	I_{FRM}	2000	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}	185 175	kA^2s kA^2s

特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	$I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	V_F	1,70 1,70 1,70	2,15	V V V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 1000\text{ A}, -di_F/dt = 8900\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	I_{RM}	1300 1400 1450		A A A
恢复电荷 Recovered charge	$I_F = 1000\text{ A}, -di_F/dt = 8900\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	Q_r	285 460 520		μC μC μC
反向恢复损耗 (每脉冲) Reverse recovery energy	$I_F = 1000\text{ A}, -di_F/dt = 8900\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{rec}	145 260 295		mJ mJ mJ
结 - 外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode		R_{thJC}		35,0	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}	15,0		K/kW
在开关状态下温度 Temperature under switching conditions			$T_{vj op}$	-40	150	$^{\circ}\text{C}$

负温度系数热敏电阻 / NTC-Thermistor

特征值 / Characteristic Values

			min.	typ.	max.	
额定电阻值 Rated resistance	$T_C = 25^{\circ}\text{C}$	R_{25}		5,00		$\text{k}\Omega$
R100 偏差 Deviation of R100	$T_C = 100^{\circ}\text{C}, R_{100} = 493\ \Omega$	$\Delta R/R$	-5		5	%
耗散功率 Power dissipation	$T_C = 25^{\circ}\text{C}$	P_{25}			20,0	mW
B-值 B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15\text{ K}))]$	$B_{25/50}$		3375		K
B-值 B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15\text{ K}))]$	$B_{25/80}$		3411		K
B-值 B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15\text{ K}))]$	$B_{25/100}$		3433		K

根据应用手册标定

Specification according to the valid application note.

prepared by: TA	date of publication: 2013-11-05
approved by: MS	revision: 2.1



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}	4,0		kV
模块基板材料 Material of module baseplate			Cu		
内部绝缘 Internal isolation	基本绝缘 (class 1, IEC 61140) basic insulation (class 1, IEC 61140)		Al ₂ O ₃		
爬电距离 Creepage distance	端子- 散热片 / terminal to heatsink 端子- 端子 / terminal to terminal		33,0 33,0		mm
电气间隙 Clearance	端子- 散热片 / terminal to heatsink 端子- 端子 / terminal to terminal		19,0 19,0		mm
相对电痕指数 Comperative tracking index		CTI	> 400		
			min.	typ.	max.
杂散电感, 模块 Stray inductance module		L _{sCE}		10	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'}		0,20	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 M5 根据相应的应用手册进行安装 Screw M5 - Mounting according to valid application note	M	3,00	-	6,00 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

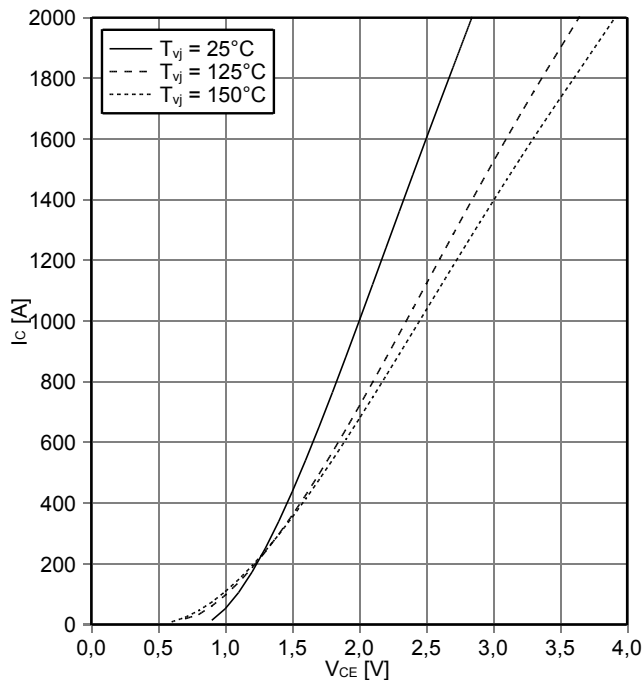
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初步数据
Preliminary Data

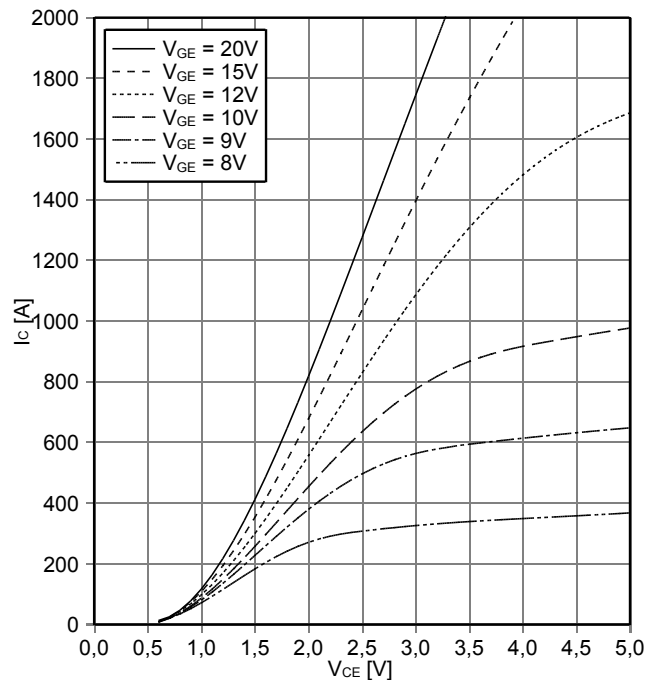
输出特性 IGBT, 斩波器 (典型)
output characteristic IGBT-Chopper (typical)

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



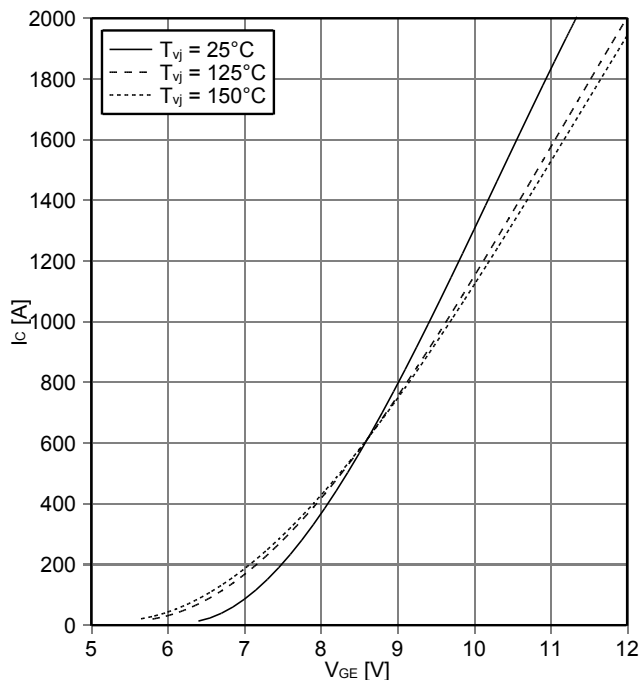
输出特性 IGBT, 斩波器 (典型)
output characteristic IGBT-Chopper (typical)

$I_C = f(V_{CE})$
 $T_{vj} = 150^\circ\text{C}$



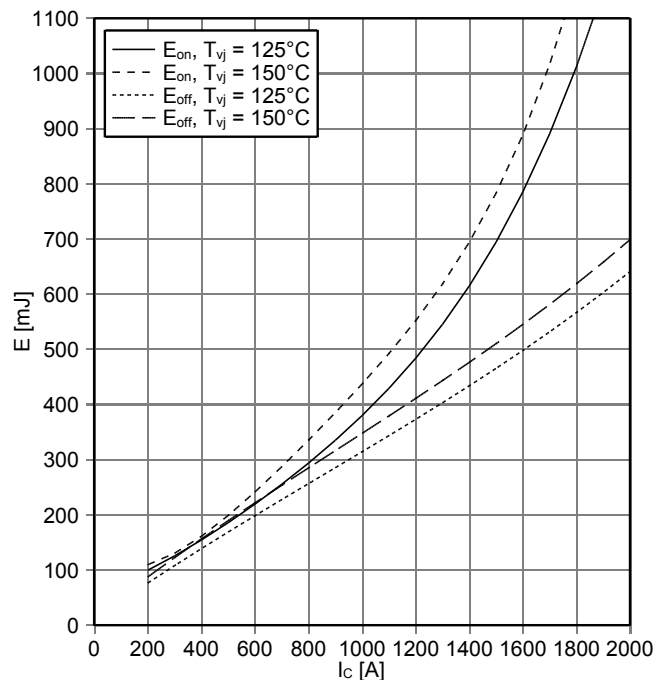
传输特性 IGBT, 斩波器 (典型)
transfer characteristic IGBT-Chopper (typical)

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



开关损耗 IGBT, 斩波器 (典型)
switching losses IGBT-Chopper (typical)

$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
 $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 0.3\ \Omega$, $R_{Goff} = 1.2\ \Omega$, $V_{CE} = 900\text{ V}$



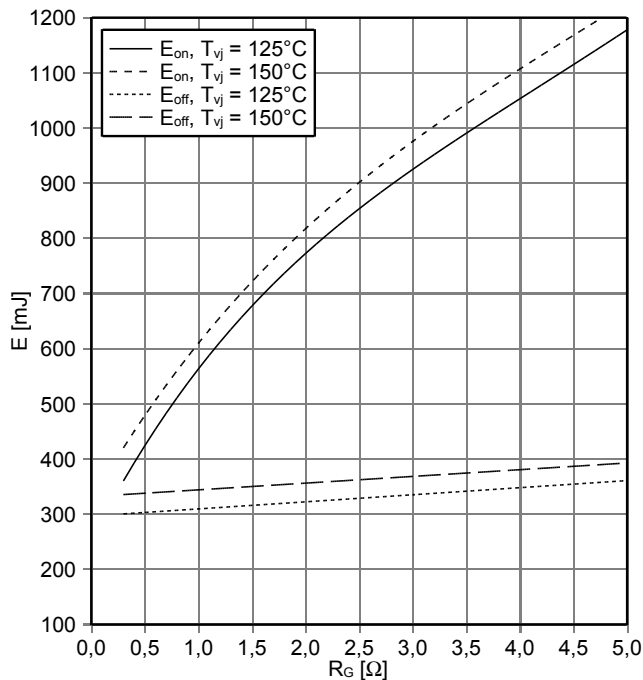
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approved by: MS	revision: 2.1



初步数据
Preliminary Data

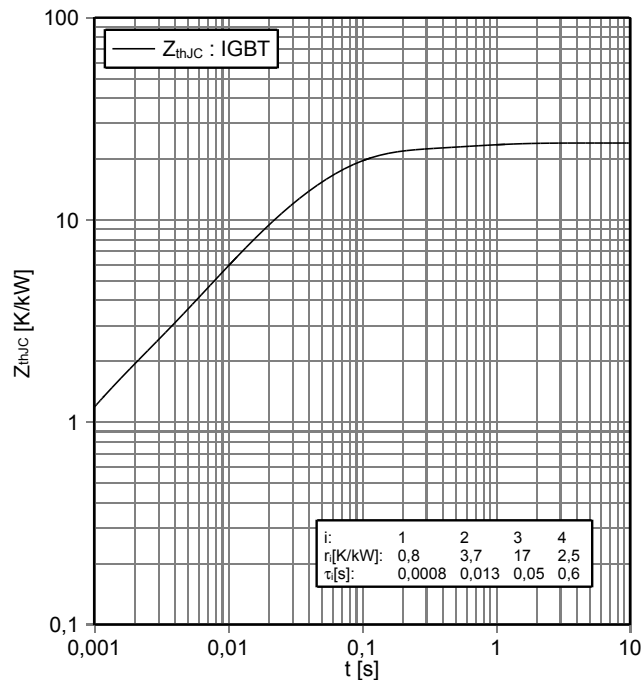
开关损耗 IGBT, 斩波器 (典型)
switching losses IGBT-Chopper (typical)

$E_{on} = f(R_G), E_{off} = f(R_G)$
 $V_{GE} = \pm 15 V, I_C = 1000 A, V_{CE} = 900 V$



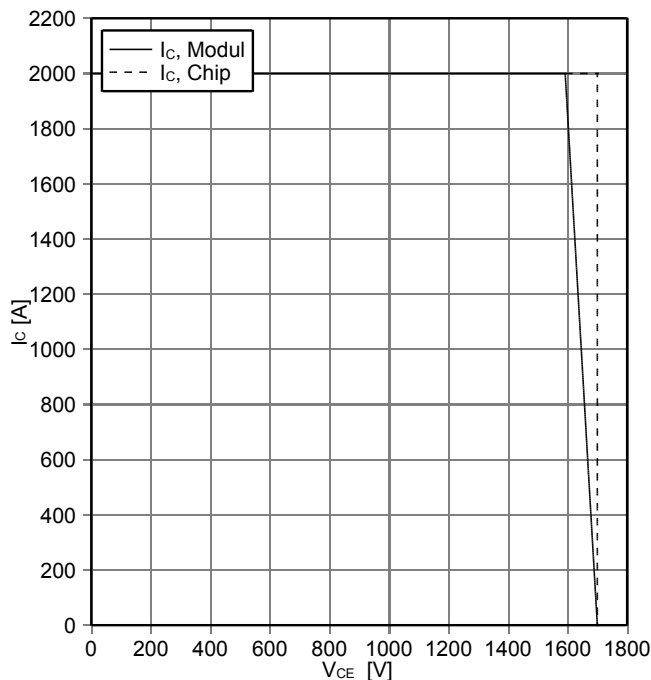
瞬态热阻抗 IGBT, 斩波器
transient thermal impedance IGBT-Chopper

$Z_{thJC} = f(t)$



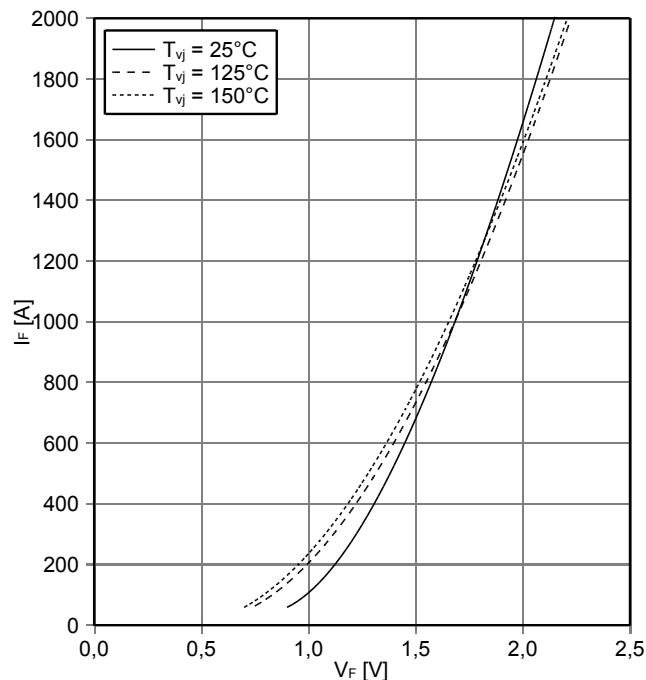
反偏安全工作区 IGBT, 斩波器 (RBSOA)
reverse bias safe operating area IGBT-Chopper (RBSOA)

$I_C = f(V_{CE})$
 $V_{GE} = \pm 15 V, R_{Goff} = 1.2 \Omega, T_{vj} = 150^\circ C$



正向偏压特性 Diode-斩波器 (典型)
forward characteristic of Diode-Chopper (typical)

$I_F = f(V_F)$



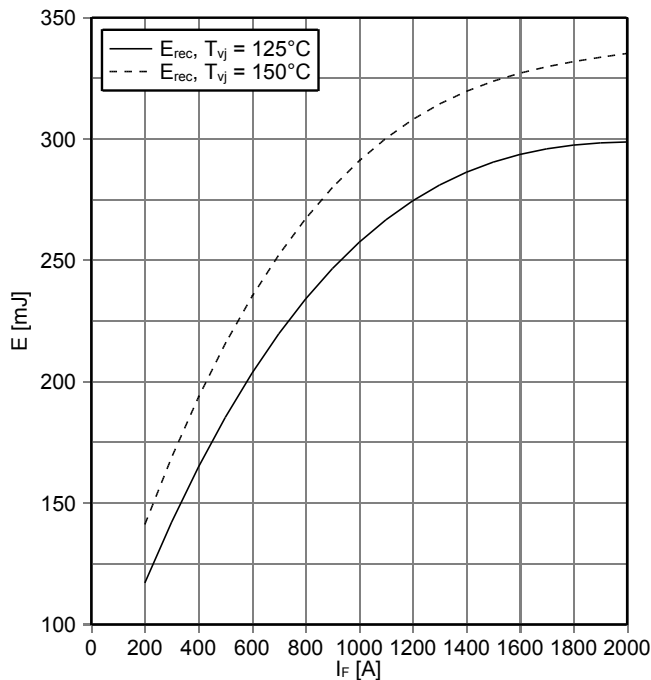
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初步数据
Preliminary Data

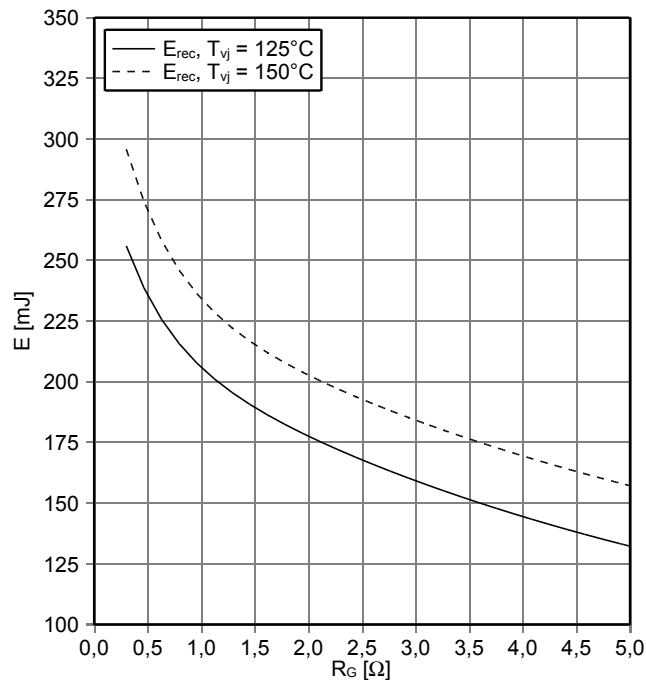
开关损耗 Diode-斩波器 (典型)
switching losses Diode-Chopper (typical)

$E_{rec} = f(I_F)$
 $R_{Gon} = 0.3 \Omega, V_{CE} = 900 V$



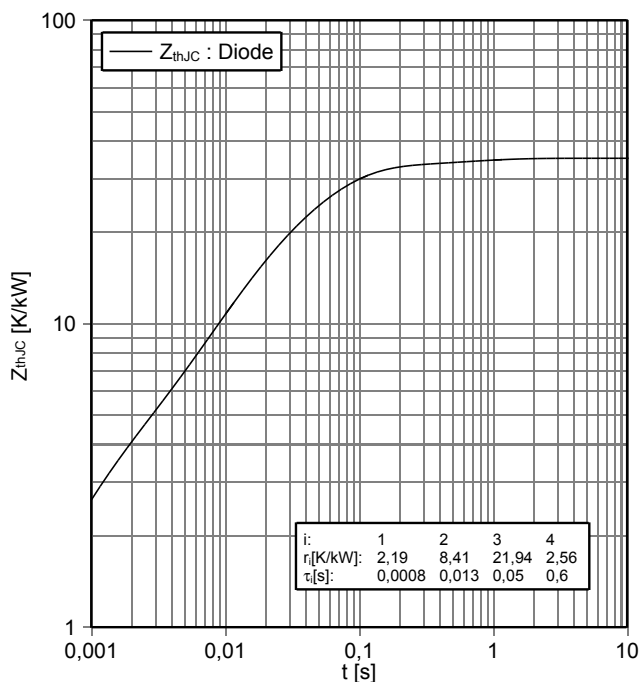
开关损耗 Diode-斩波器 (典型)
switching losses Diode-Chopper (typical)

$E_{rec} = f(R_G)$
 $I_F = 1000 A, V_{CE} = 900 V$



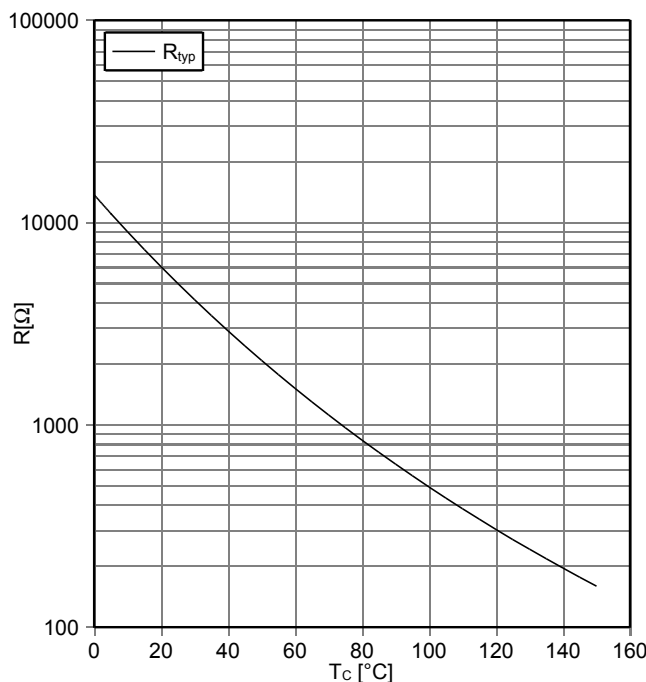
瞬态热阻抗 Diode-斩波器
transient thermal impedance Diode-Chopper

$Z_{thJC} = f(t)$



负温度系数热敏电阻 温度特性
NTC-Thermistor-temperature characteristic (typical)

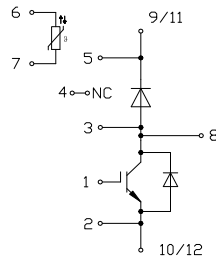
$R = f(T)$



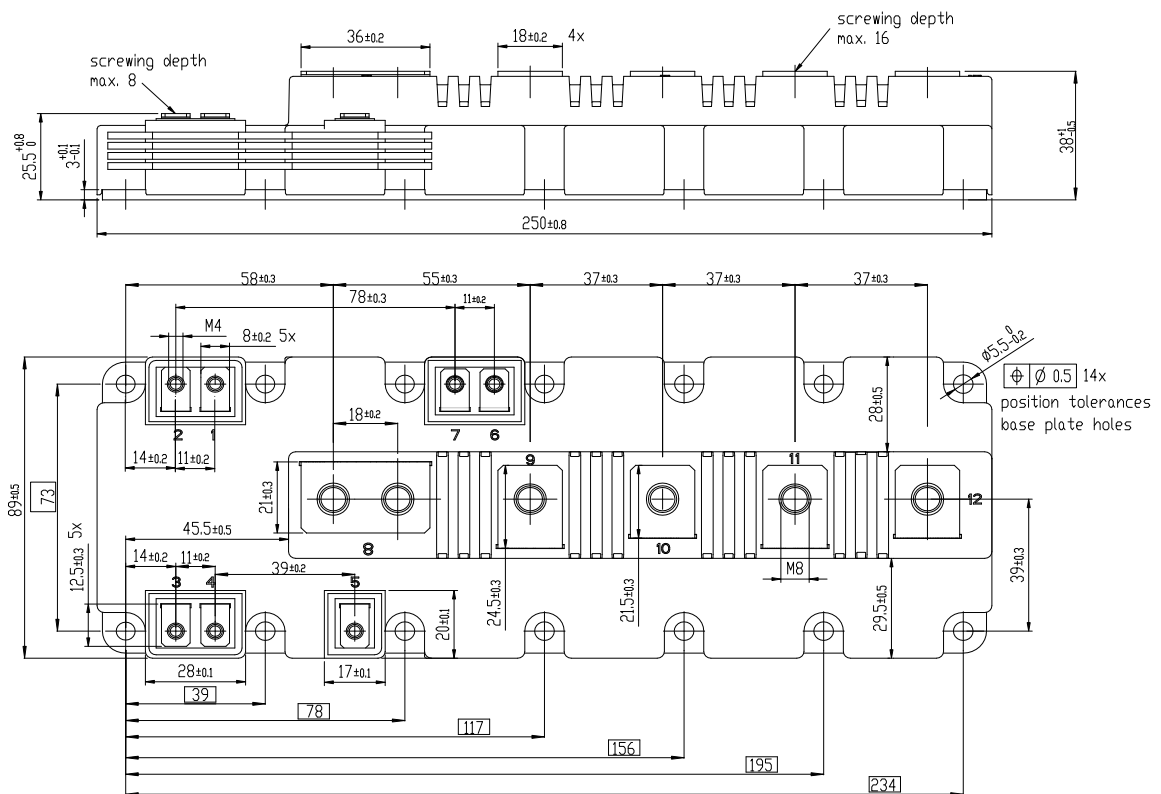
prepared by: TA	date of publication: 2013-11-05
approved by: MS	revision: 2.1

初步数据
Preliminary Data

接线图 / circuit_diagram_headline



封装尺寸 / package outlines



prepared by: TA	date of publication: 2013-11-05
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**初步数据
Preliminary Data**

使用条件和条款

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approved by: MS	revision: 2.1

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