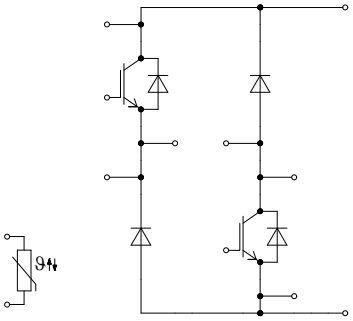
PrimePACK™3+ 模块 采用第四代沟槽栅/场终止IGBT4和发射极控制二极管
PrimePACK™3+ module with Trench/Fieldstop IGBT4 and Emitter Controlled diode





V_{CES} = 1200V
$I_{C\ nom}$ = 900A / I_{CRM} = 1800A

潜在应用
- 商业性农用车辆
- 开关磁阻电机
- 斩波应用
- 电机传动

Potential Applications
- Commercial Agriculture Vehicles
- Switched reluctance drive
- Chopper applications
- Motor drives

电气特性
- $T_{vj\ op}$ = 150°C
- V_{CEsat} 带正温度系数
- 低 V_{CEsat}
- 增大的二极管针对反馈运行模式
- 高电流密度
- 高短路能力

Electrical Features
- $T_{vj\ op}$ = 150°C
- V_{CEsat} with positive temperature coefficient
- Low V_{CEsat}
- Enlarged diode for regenerative operation
- High current density
- High short-circuit capability

机械特性
- 4 kV 交流 1分钟 绝缘
- 封装的 CTI > 400
- 极高的抗震性能
- 符合RoHS
- 集成NTC温度传感器
- 高机械坚固性
- 高爬电距离和电气间隙

Mechanical Features
- 4 kV AC 1min insulation
- Package with CTI > 400
- High vibration resistance
- RoHS compliant
- Integrated NTC temperature sensor
- High mechanical robustness
- High creepage and clearance distances

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

IGBT, 制动-斩波器 / IGBT, Brake-Chopper

最大额定值 / Maximum Rated Values

集电极 - 发射极电压 Collector-emitter voltage	T_{vj} = 25°C	V_{CES}	1200	V
连续集电极直流电流 Continuous DC collector current	T_C = 100°C, $T_{vj\,max}$ = 175°C	I_{CDC}	900	A
集电极重复峰值电流 Repetitive peak collector current	t_P = 1 ms	I_{CRM}	1800	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 = 900 A, V_{GE} = 15 V	$V_{CE\,sat}$		1,70 2,00 2,10	2,05 2,40	V V V
		T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C				
栅极阈值电压 Gate threshold voltage	I_C = 33,0 mA, V_{CE} = V_{GE}, T_{vj} = 25°C	V_{GEth}	5,00	5,80	6,50	V
栅极电荷 Gate charge	V_{GE} = -15 / 15 V	Q_G		6,40		µC
内部栅极电阻 Internal gate resistor	T_{vj} = 25°C	R_{Gint}		1,2		Ω
输入电容 Input capacitance	f = 1000 kHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V	C_{ies}		54,0		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}		2,80		nF
集电极-发射极截止电流 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 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 = 900 A, V_{CE} = 600 V V_{GE} = -15 / 15 V R_{Gon} = 1,2 Ω	$t_{d\,on}$ T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C		0,23 0,26 0,27		µs µs µs
上升时间(电感负载) Rise time, inductive load	I_C = 900 A, V_{CE} = 600 V V_{GE} = -15 / 15 V R_{Gon} = 1,2 Ω	t_r T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C		0,10 0,11 0,11		µs µs µs
关断延迟时间(电感负载) Turn-off delay time, inductive load	I_C = 900 A, V_{CE} = 600 V V_{GE} = -15 / 15 V R_{Goff} = 1,2 Ω	$t_{d\,off}$ T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C		0,60 0,70 0,73		µs µs µs
下降时间(电感负载) Fall time, inductive load	I_C = 900 A, V_{CE} = 600 V V_{GE} = -15 / 15 V R_{Goff} = 1,2 Ω	t_f T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C		0,14 0,16 0,17		µs µs µs
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	I_C = 900 A, V_{CE} = 600 V, Lσ = 45 nH di/dt = 7800 A/µs (T_{vj} = 150°C) V_{GE} = -15 / 15 V, R_{Gon} = 1,2 Ω	E_{on} T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C		53,0 83,0 93,0		mJ mJ mJ
关断损耗能量 (每脉冲) Turn-off energy loss per pulse	I_C = 900 A, V_{CE} = 600 V, Lσ = 45 nH du/dt = 2700 V/µs (T_{vj} = 150°C) V_{GE} = -15 / 15 V, R_{Goff} = 1,2 Ω	E_{off} T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C		140 185 200		mJ mJ mJ
短路数据 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}		3600		A
结 - 外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT	R_{thJC}			29,6	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}		13,9		K/kW
在开关状态下温度 Temperature under switching conditions		$T_{vj\,op}$	-40		150	°C

二极管，制动-斩波器 / Diode, Brake-Chopper

最大额定值 / Maximum Rated Values

反向重复峰值电压 Repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	1200	V
连续正向直流电流 Continuous DC forward current		I_F	900	A
正向重复峰值电流 Repetitive peak forward current	t_P = 1 ms	I_{FRM}	1800	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	91,0 88,0	kA²s kA²s

特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	I_F = 900 A, V_{GE} = 0 V I_F = 900 A, V_{GE} = 0 V I_F = 900 A, V_{GE} = 0 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	V_F		1,65 1,55 1,50	2,15 2,00	V V V
反向恢复峰值电流 Peak reverse recovery current	I_F = 900 A, - di_F/dt = 7800 A/µs (T_{vj}=150°C) V_R = 600 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	I_{RM}		560 750 800		A A A
恢复电荷 Recovered charge	I_F = 900 A, - di_F/dt = 7800 A/µs (T_{vj}=150°C) V_R = 600 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	Q_r		89,0 180 210		µC µC µC
反向恢复损耗（每脉冲） Reverse recovery energy	I_F = 900 A, - di_F/dt = 7800 A/µs (T_{vj}=150°C) V_R = 600 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{rec}		43,0 87,0 100		mJ mJ mJ
结 - 外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode		R_{thJC}			44,2	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}		12,4		K/kW
在开关状态下温度 Temperature under switching conditions			$T_{vj\,op}$	-40		150	°C

二極體, 反轉 / 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°C	V_{RRM}	1200	V
连续正向直流电流 Continuous DC forward current		I_F	150	A
正向重复峰值电流 Repetitive peak forward current	t_P = 1 ms	I_{FRM}	300	A
I2t-值 I²t - value	V_R = 0 V, t_P = 10 ms, T_{vj} = 125°C	I²t	0,17	kA²s

特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	I_F = 150 A, V_{GE} = 0 V I_F = 150 A, V_{GE} = 0 V	T_{vj} = 25°C T_{vj} = 125°C	V_F		1,65 1,65	2,15	V V
结 - 外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode		R_{thJC}			225	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}		120		K/kW
在开关状态下温度 Temperature under switching conditions			$T_{vj\,op}$	-40		150	°C

负温度系数热敏电阻 / NTC-Thermistor

特征值 / Characteristic Values

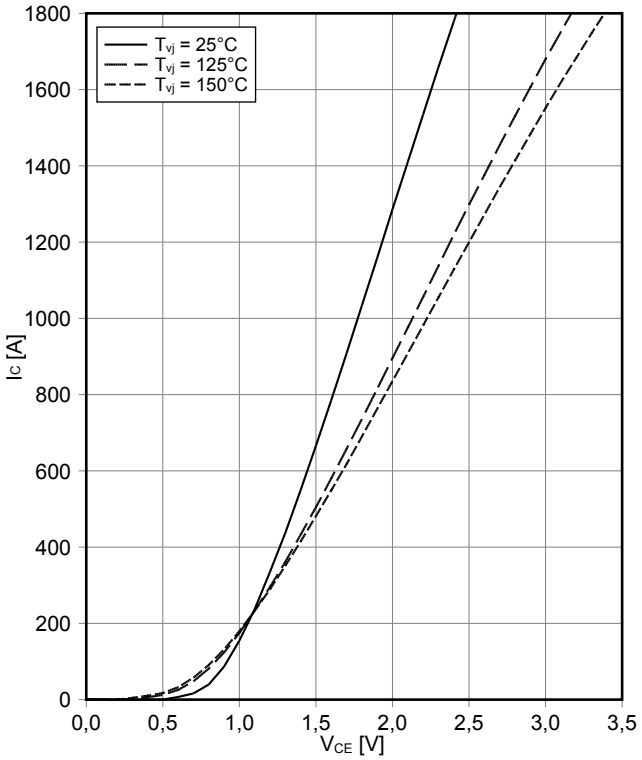
			min.	typ.	max.	
额定电阻值 Rated resistance	T_{NTC} = 25°C	R_{25}		5,00		kΩ
R100 偏差 Deviation of R100	T_{NTC} = 100°C, R_{100} = 493 Ω	ΔR/R	-5		5	%
耗散功率 Power dissipation	T_{NTC} = 25°C	P_{25}			20,0	mW
B-值 B-value	$R_2 = R_{25}$ exp [$B_{25/50}(1/T_2 - 1/(298,15\ K))$]	$B_{25/50}$		3375		K
B-值 B-value	$R_2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

根据应用手册标定
Specification according to the valid application note.

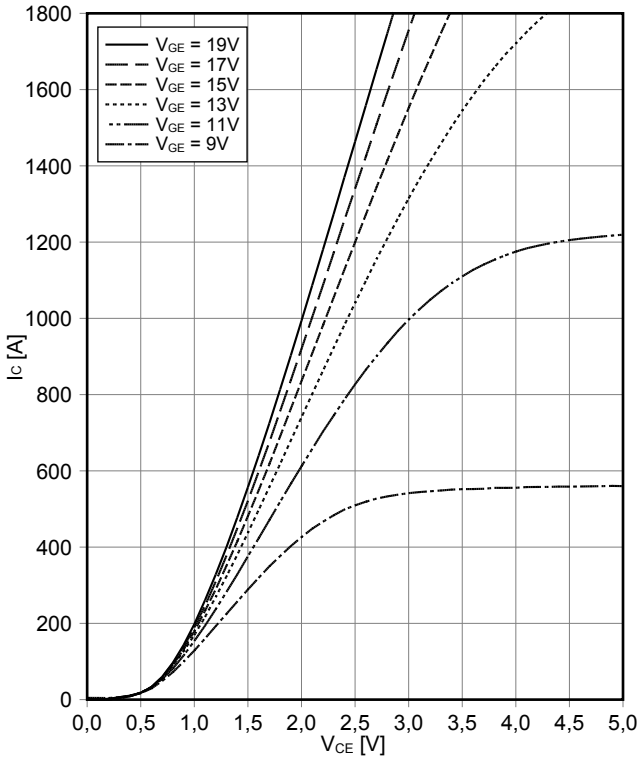
模块 / Module

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_2O_3		
爬电距离 Creepage distance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal			33,0 33,0		mm
电气间隙 Clearance	端子至散热器 / terminal to heatsink 端子至端子 / 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	$R_{CC'+EE'}$		0,23		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 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		1400		g

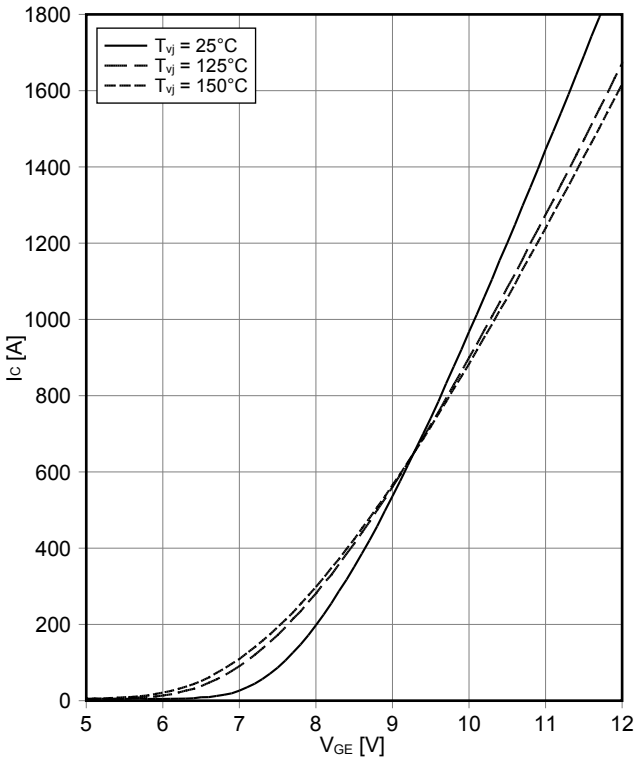
输出特性 IGBT, 制动-斩波器 （典型）
output characteristic IGBT, Brake-Chopper (typical)
$I_C = f(V_{CE})$
V_{GE} = 15 V



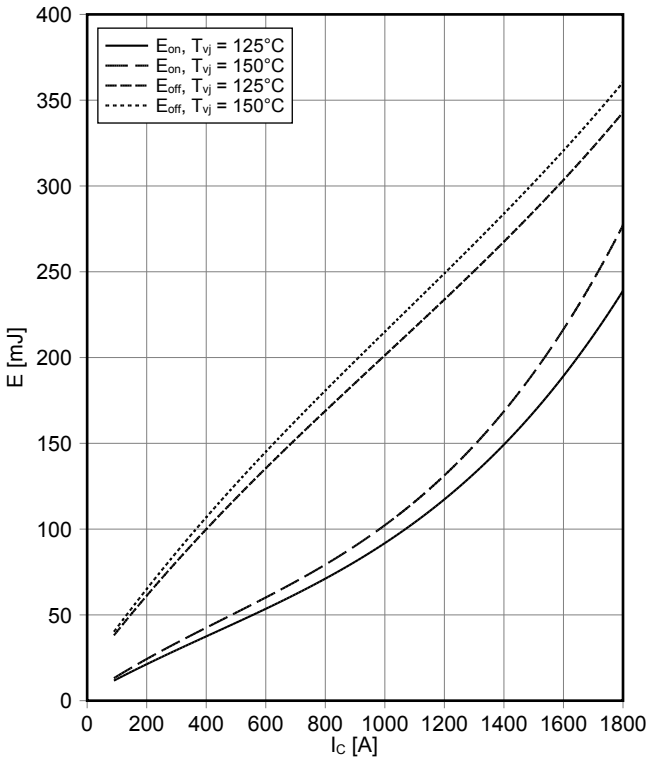
输出特性 IGBT, 制动-斩波器 （典型）
output characteristic IGBT, Brake-Chopper (typical)
$I_C = f(V_{CE})$
T_{vj} = 150°C



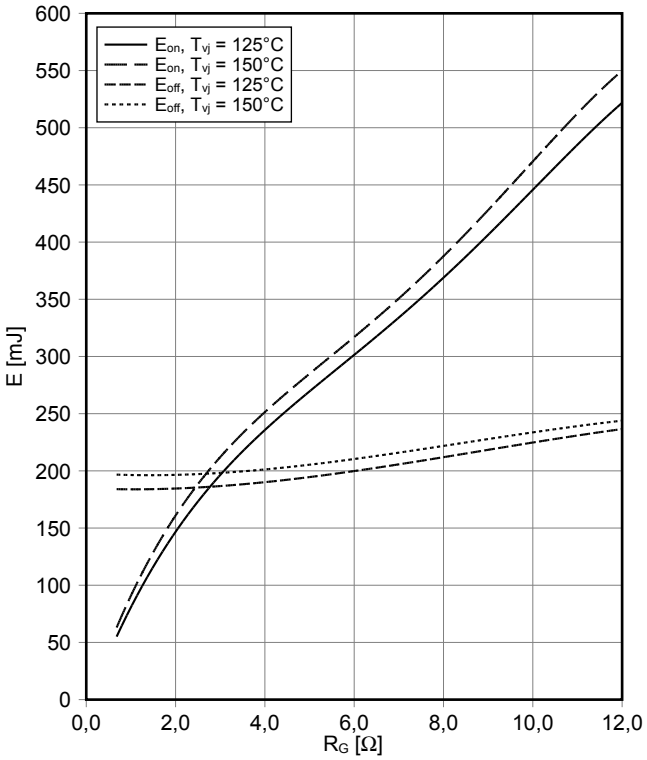
传输特性 IGBT, 制动-斩波器 (典型)
transfer characteristic IGBT, Brake-Chopper (typical)
$I_C = f(V_{GE})$
V_{CE} = 20 V



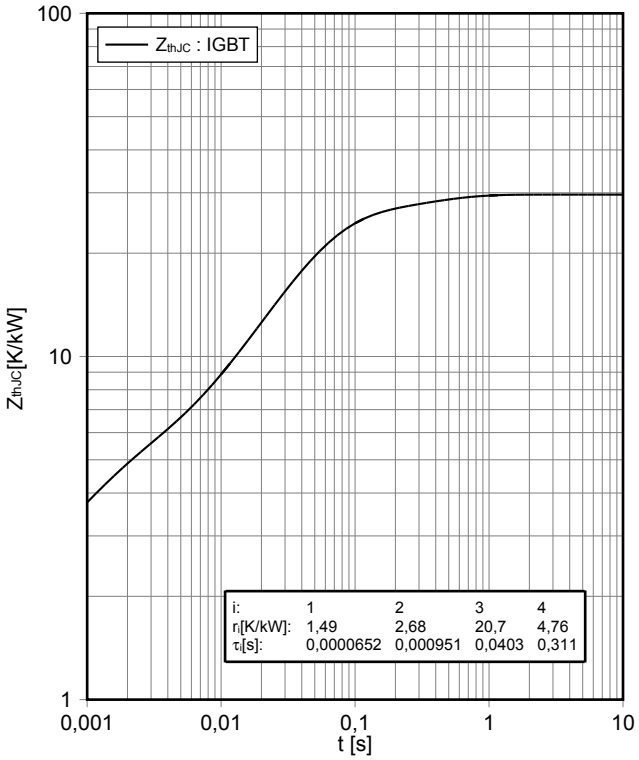
开关损耗 IGBT, 制动-斩波器 （典型）
switching losses IGBT, Brake-Chopper (typical)
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
V_{GE} = ±15 V, R_{Gon} = 1.2 Ω, R_{Goff} = 1.2 Ω, V_{CE} = 600 V



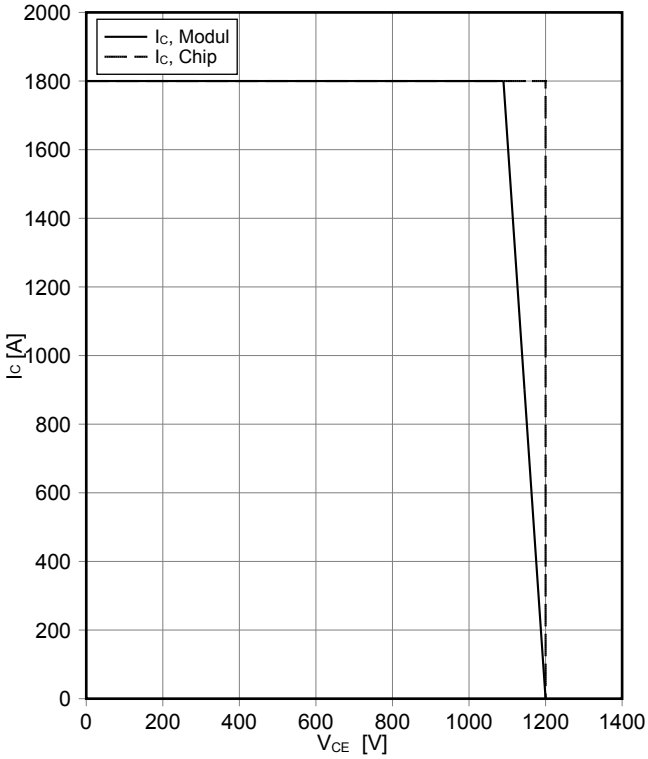
开关损耗 IGBT, 制动-斩波器 （典型)
switching losses IGBT, Brake-Chopper (typical)
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
V_{GE} = ±15 V, I_C = 900 A, V_{CE} = 600 V



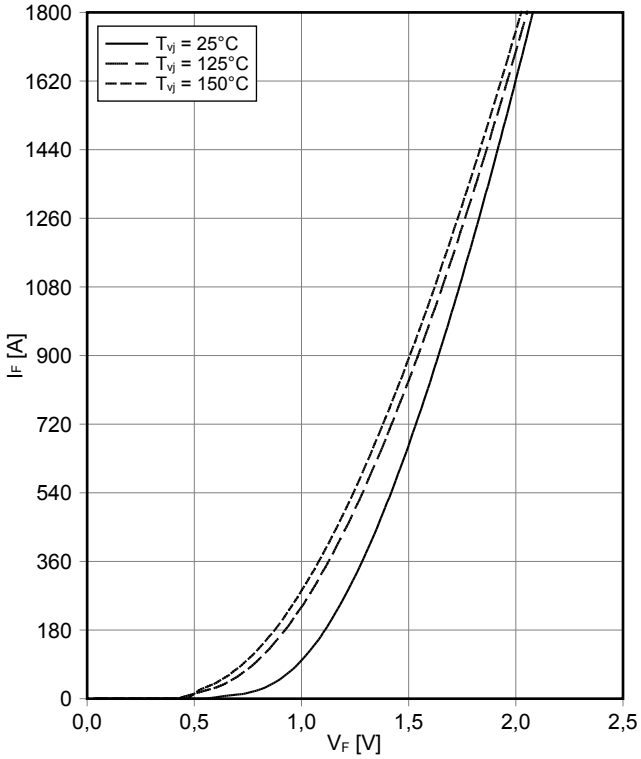
瞬态热阻抗 IGBT, 制动-斩波器
transient thermal impedance IGBT, Brake-Chopper
$Z_{thJC} = f(t)$



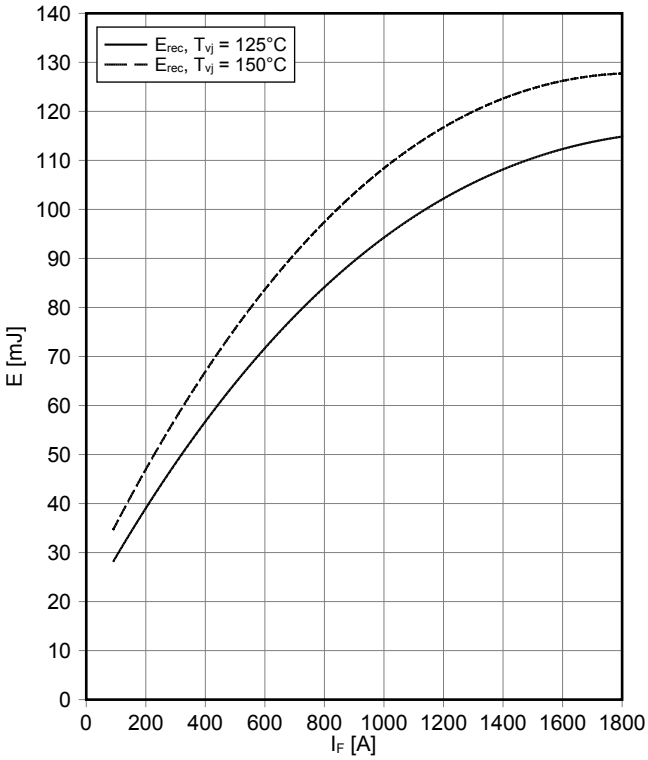
反偏安全工作区 IGBT, 制动-斩波器 （RBSOA）
reverse bias safe operating area IGBT, Brake-Chopper (RBSOA)
$I_C = f(V_{CE})$
V_{GE} = ±15 V, R_{Goff} = 1.2 Ω, T_{vj} = 150°C



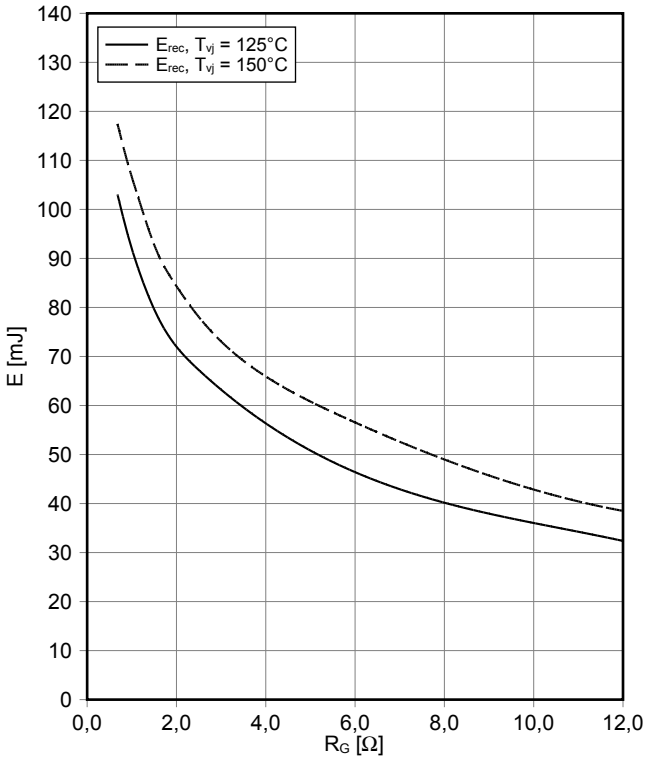
正向偏压特性 二极管，制动-斩波器 （典型)
forward characteristic of Diode, Brake-Chopper (typical)
$I_F = f(V_F)$



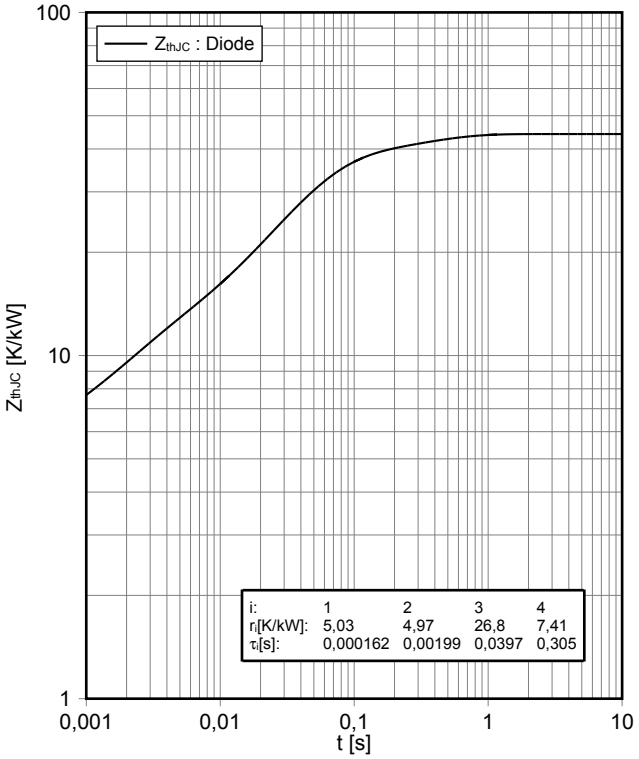
开关损耗 二极管，制动-斩波器 （典型）
switching losses Diode, Brake-Chopper (typical)
$E_{rec} = f(I_F)$
$R_{Gon} = 1.2\ \Omega$, $V_{CE} = 600\ V$



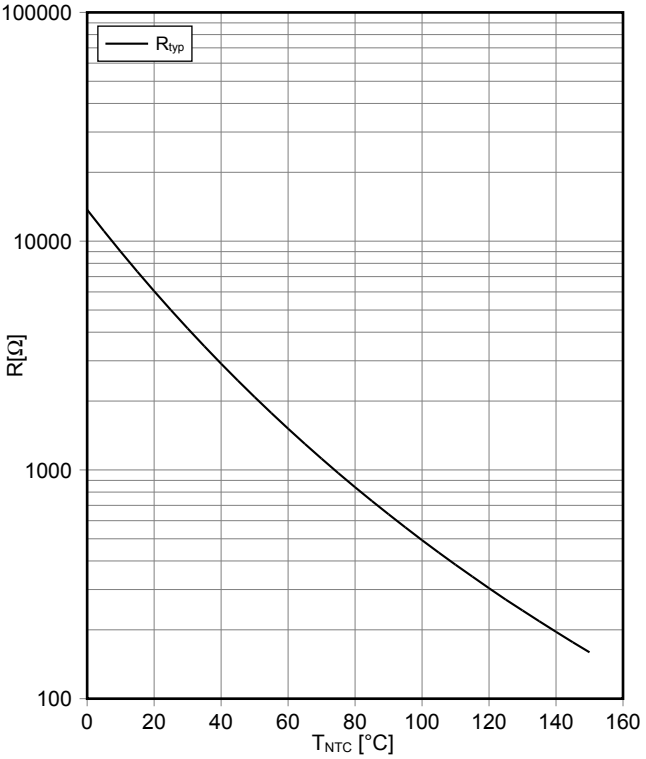
开关损耗 二极管，制动-斩波器 （典型）
switching losses Diode, Brake-Chopper (typical)
$E_{rec} = f(R_G)$
$I_F = 900\ A$, $V_{CE} = 600\ V$



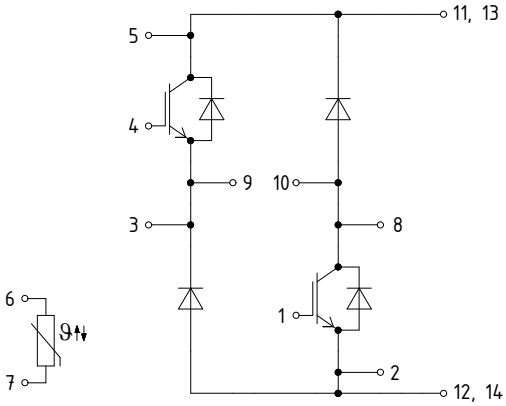
瞬态热阻抗 二极管，制动-斩波器
transient thermal impedance Diode, Brake-Chopper
$Z_{thJC} = f(t)$



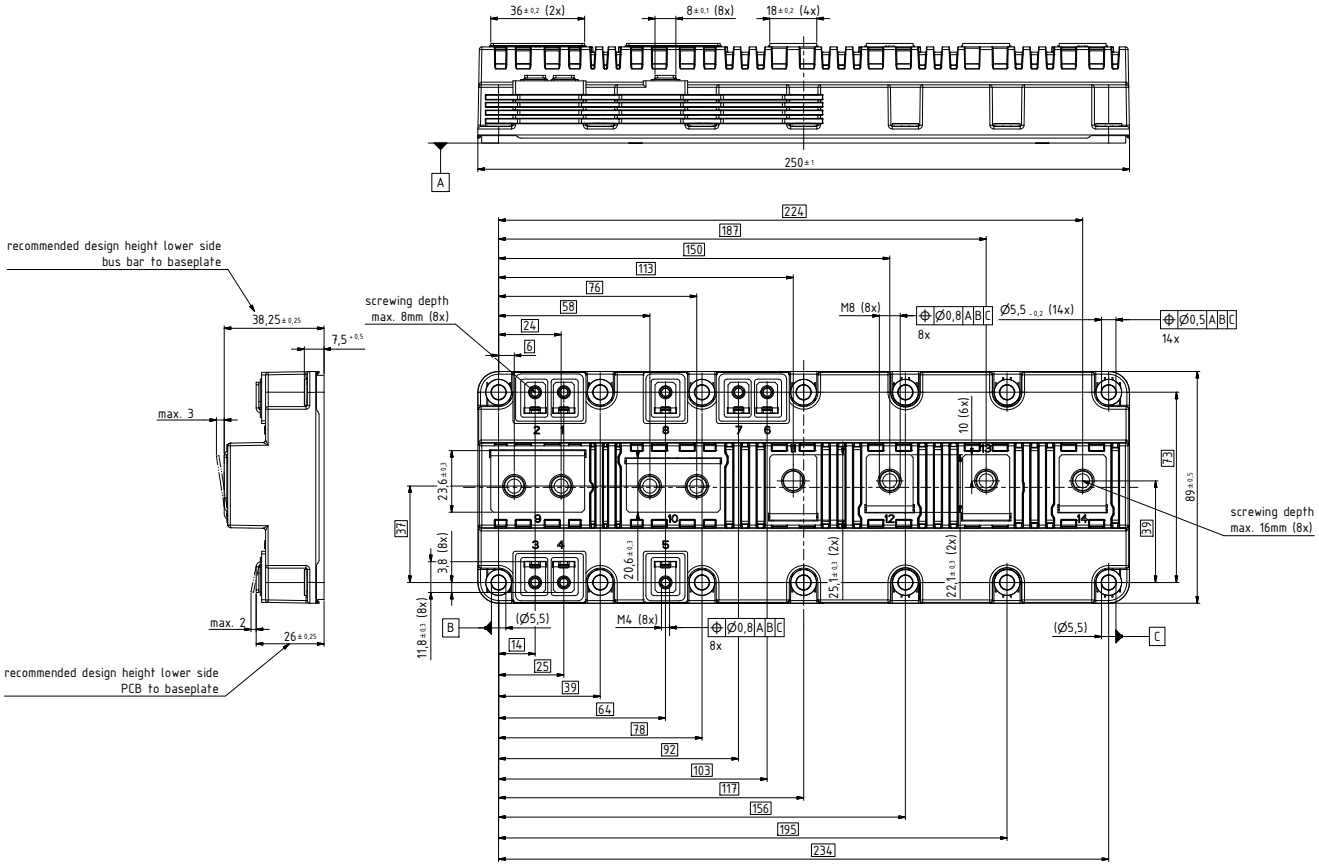
负温度系数热敏电阻 温度特性
NTC-Thermistor-temperature characteristic (typical)
R = f (T)



接线图 / Circuit diagram



封装尺寸 / Package outlines



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