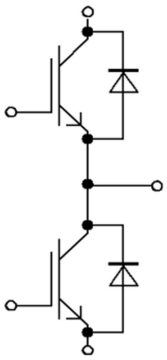
K package: 1200V 600A IGBT module



Equivalent Circuit Schematic

Features:

- 1200V 600A,$VCE_{(sat)}$ = 1.55V @25℃
- Trench/FS Technology
- Low Losses
- High RBSOA capability
- Low reverse-recovery losses

产品特性:

- 1200V 600A,$VCE_{(sat)}$ = 1.55V@25℃
- 沟槽栅/场终止技术
- 低损耗
- 高 RBSOA 能力
- 低反向恢复损耗

Typical Applications：

- High Power Converters
- Motor Drives
- Uninterrupted Power Supply
- Photovoltaic

典型应用：

- 大功率变流器
- 电机传动
- 不间断电源
- 光伏

IGBT, Inverter / IGBT，逆变部分
Maximum Rated Values / 最大标称参数

Collector-emitter Voltage 集电极-发射极电压	T_{vj}=25℃	V_{CES}	1200	V
Continuous DC collector current 集电极连续直流电流		$I_{C\ nom}$	600	A
	T_C=80℃, T_{vjmax}=175℃	I_C	715	A
Repetitive Peak collector current 集电极可重复峰值电流	I_{CRM}=2×I_{Cnom}	I_{CRM}	1200	A
Total power dissipation 总功率损耗	T_C=25℃, T_{vjmax}=175℃	P_{tot}	2640	W
Gate-emitter peak voltage 门极-发射极峰值电压		V_{GES}	±20	V

Characteristic Values / 性能参数

			min.	typ.	max.	
Collector-emitter saturation Voltage[1)] 集电极-发射极饱和压降	I_C=600A, V_{GE}=15V I_C=600A, V_{GE}=15V I_C=600A, V_{GE}=15V I_C=600A, V_{GE}=15V	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	V_{CEsat}		1.55 1.70 1.85 1.90	1.70	V
Gate Threshold Voltage 门极阈值电压	V_{CE}= V_{GE}, I_C=22.8mA, T_{vj}=25℃		V_{GEth}	5.0	6.0	7.0	V
Gate Charge 门极电荷	V_{GE} =-8V/15V, V_{CE}=600V	T_{vj}=25℃	Q_G		5.6		uC
Internal Gate Resistor 内置门极电阻	T_{vj}=25℃		R_{Gint}		0.45		Ω
Input Capacitance 输入电容	V_{CE} = 25V, V_{GE} = 0V f = 100KHz, T_{vj}= 25℃		C_{ies}		143		nF
Reverse Transfer Capacitance 反向传输电容			C_{res}		0.35		nF
Collector-emitter Cutoff Current 集电极-发射极关断漏电流	V_{CE}=1200V, V_{GE}=0V,	T_{vj}=25℃	I_{CES}			100	uA
Gate-emitter Leakage Current 门极-发射极漏电流	V_{CE}=0V, V_{GE}=±20V,	T_{vj}=25℃	I_{GES}			±100	nA
Turn-on Delay Time, Inductive Load 开通延迟时间，感性负载	I_C=600A, V_{CE}=600V V_{GE}= 15V/-8V R_{Gon}=1.5Ω	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	t_{don}		400 415 415 415		ns
Rise Time, Inductive Load 上升时间，感性负载	I_C=600A, V_{CE}=600V V_{GE}= 15V/-8V R_{Gon}=1.5Ω	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	t_r		90 105 110 115		ns
Turn-off Delay Time, Inductive Load 关断延迟时间，感性负载	I_C=600A, V_{CE}=600V V_{GE}=15V/-8V R_{Goff}=4.7Ω	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	t_{doff}		1100 1210 1225 1240		ns
Fall Time, Inductive Load 下降时间，感性负载	I_C=600A, V_{CE}=600V V_{GE}= 15V/-8V R_{Goff}=4.7Ω	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	t_f		80 110 120 135		ns

Turn-on energy loss per pulse 开通损耗	I_C=600A, V_{CE}=600V L_σ=40nH, V_{GE}= 15V/-8V R_{Gon}=1.5Ω , di/dt = 4300 A/μs (T_{vj}=175℃)	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	E_{on}		48.0 71.0 78.0 82.0		mJ
Turn-off energy loss per pulse 关断损耗	I_C=600A, V_{CE}=600V L_σ=40nH, R_{Goff}=4.7Ω V_{GE}= 15V/-8V, dv/dt = 4700 V/μs (T_{vj}=175℃)	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	E_{off}		66.5 81.5 85.0 92.0		mJ
SC Data 短路耐量	V_{CE}=600V, V_{GE} =15V/-8V, T_{vj}=150℃		t_{psc}	8			μs
Thermal Resistance, Junction to Case 结-壳热阻	Per IGBT/单个 IGBT		R_{thJC}		0.056		K/W
Temperature under switching conditions[2)] 工作温度			$T_{vj\,op}$	-40		175	℃

Diode, Inverter / 二极管，逆变部分

Maximum Rated Values / 最大标称参数

Repetitive peak reverse voltage 可重复反向峰值电压	T_{vj}=25℃	V_{RRM}	1200		V
Continuous DC Forward Current 可连续正向直流电流		I_F	600		A
Repetitive Peak Forward Current 可重复正向峰值电流	I_{CRM}=2×I_{Fnom}	I_{FRM}	1200		A

Characteristic Values / 性能参数

				min.	typ.	max.	
Forward Voltage[1)] 正向通态压降	I_F=600A, V_{GE}=0V I_F=600A, V_{GE}=0V I_F=600A, V_{GE}=0V I_F=600A, V_{GE}=0V	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	V_F		1.90 1.85 1.85 1.70	2.40	V
Peak Reverse Recovery Current 反向恢复峰值电流	I_F=600A, V_R=600V -di$_F$/dt=4000A/us, (T_{vj}=175℃) V_{GE}=-8V	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	I_{RM}		290 330 345 375		A
Recovery Charge 反向恢复电荷	I_F=600A, V_R=600V -di$_F$/dt=4000A/us, (T_{vj}=175℃) V_{GE}=-8V	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	Q_R		27.3 63.5 75.5 87.0		uC
Reverse Recovery Energy 反向恢复损耗	I_F=600A, V_R=600V -di$_F$/dt=4000A/us, (T_{vj}=175℃) V_{GE}=-8V	T_{vj}=25℃ T_{vj}=125℃ T_{vj}=150℃ T_{vj}=175℃	E_{rec}		12.5 25.5 31.0 39.0		mJ
Thermal Resistance, Junction to Case 结-壳热阻	Per Diode /单个 Diode		R_{thJC}		0.082		K/W
Temperature under switching conditions[2)] 工作温度			$T_{vj\,op}$	-40		175	℃

Module / 模块

Isolation Test Voltage 绝缘测试电压	RMS, f=50Hz, t=1min	V_{ISOL}	3.0	KV
Material of Module Baseplate 模块底板材料			Cu	
Internal Isolation 内部绝缘	基本绝缘（class 1, IEC 61140） Basic insulation (class1,IEC 61140		Al_2O_3	
Creepage Distance 爬电距离	端子-散热片 terminal to heatsink 端子-端子 terminal to terminal		29.0 23.0	mm
Clearance 电气间隙	端子-散热片 terminal to heatsink 端子-端子 terminal to terminal		23.0 11.0	mm
Comparative Tracking Index 相对漏电起痕指数		CTI	>400	

			min.	typ.	max.	
Stray Inductance Module 模块杂散电感		L_{sCE}		20		nH
Module Lead Resistance, Terminals-Chip 模块引脚电阻，端子-芯片	T_C =25°C,每个开关 per switch	$R_{CC'+EE'}$		0.50		mΩ
Storage Temperature 贮存温度		T_{stg}	-40		125	℃
Modul Mounting torque 模块安装扭距	M5	M	4.0		6.0	Nm
Terminal Mounting torque 端子安装扭距	M6	M	2.5		5.0	Nm
Weight 重量		G		320		g

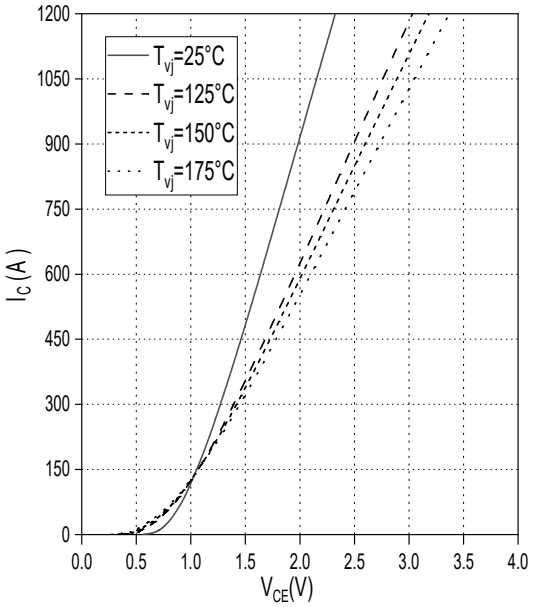
注： 1）Terminal impedance is not included.

不包含端子阻抗。

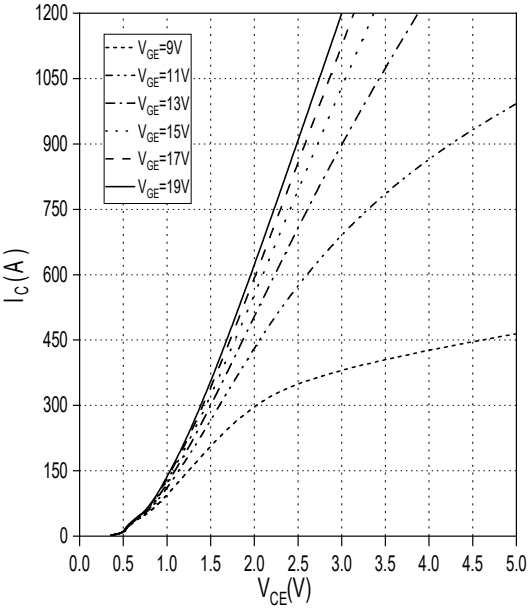
2）Tvj op > 150 °C is only allowed for operation at overload conditions

Tvj op > 150 °C 仅允许在过载条件下运行。

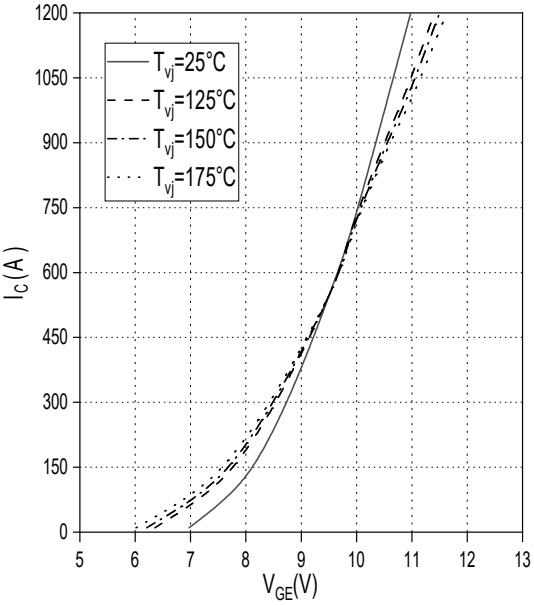
输出特性 IGBT,逆变器(典型值)
Output characteristic IGBT Inverter (typical)
$I_C = f(V_{CE})$,
V_{GE} = 15V



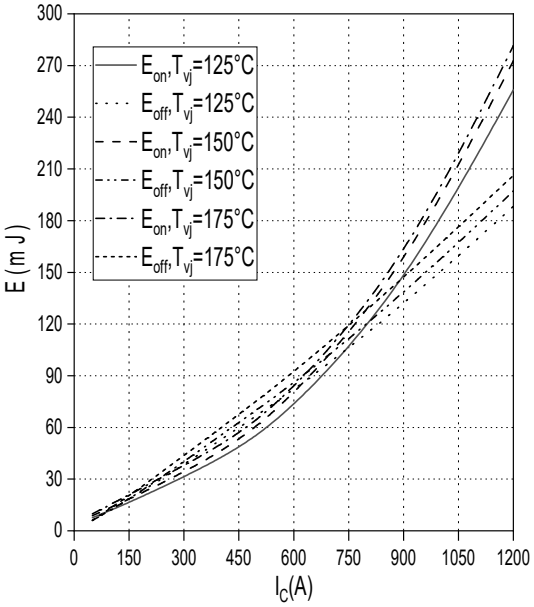
输出特性 IGBT, 逆变器(典型值)
output characteristic IGBT Inverter (typical)
$I_C = f(V_{CE})$,
T_{vj} = 175℃



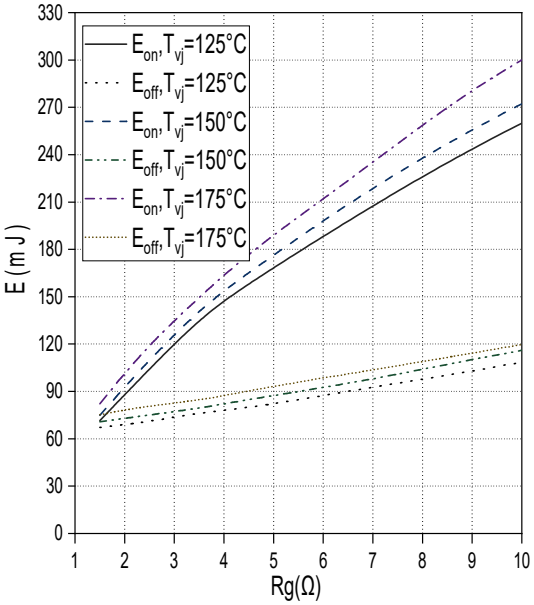
传输特性 IGBT, 逆变器 (典型值)
Transfer characteristic IGBT, Inverter (typical)
$I_C = f(V_{GE})$,
V_{CE} = 20V



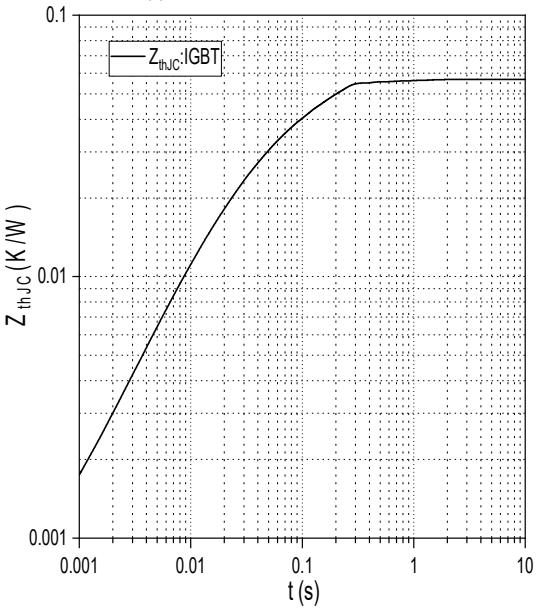
开关损耗 IGBT ,逆变器（典型值)
switching losses IGBT , Inverter (typical)
$E_{on} = f(I_C)$,$E_{off} = f(I_C)$, V_{GE} = 15V/-8V,
R_{Gon} = 1.5Ω,R_{Goff} = 4.7Ω,V_{CE} = 600V



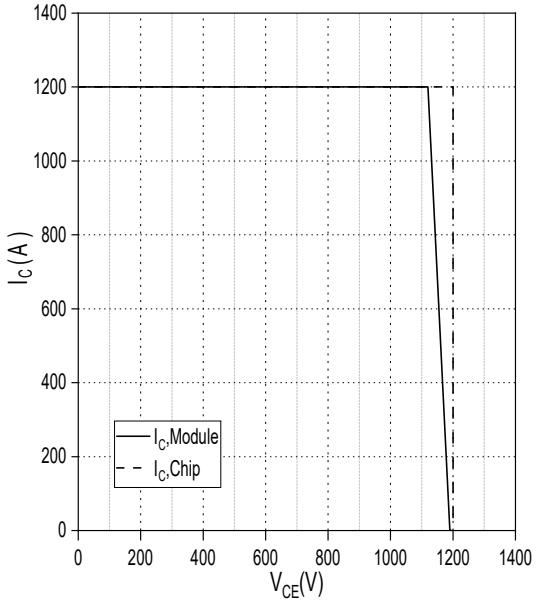
开关损耗 IGBT, 逆变器（典型值）
Switching losses IGBT, Inverter (typical)
V_{GE} = 15V/-8V,I_C = 600A,V_{CE} = 600V



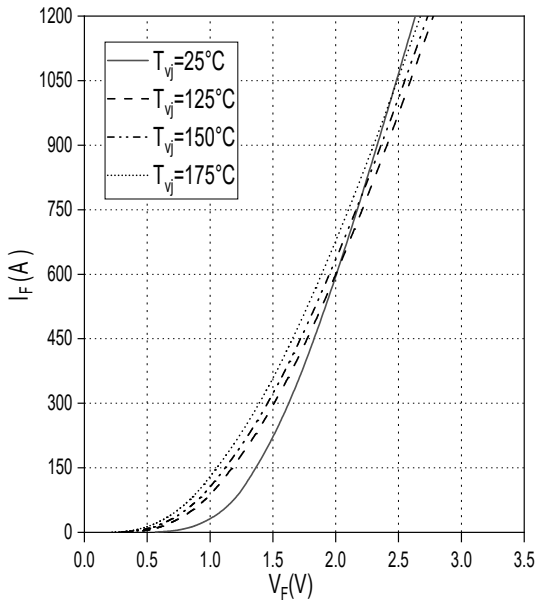
瞬态热阻抗 IGBT,逆变器
transient thermal impedance IGBT , Inverter
Z_{thJC} = f(t)



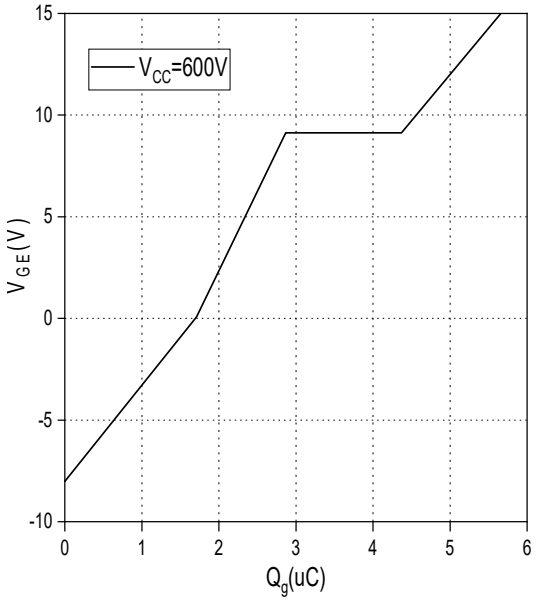
反偏安全工作区 IGBT,逆变器(RBSOA)
Reverse bias safe operating area IGBT, Inverter (RBSOA) I_C = f(V_{CE}),
V_{GE} = 15V/-8V,R_{Goff} = 4.7Ω,T_{vj} = 175°C



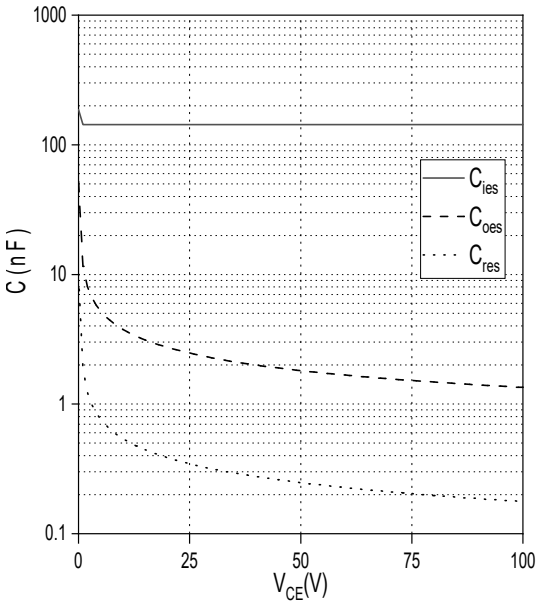
正向偏压特性二极管,逆变器（典型值)
forward characteristic of Diode, Inverter (typical)
I_F = f(V_F)



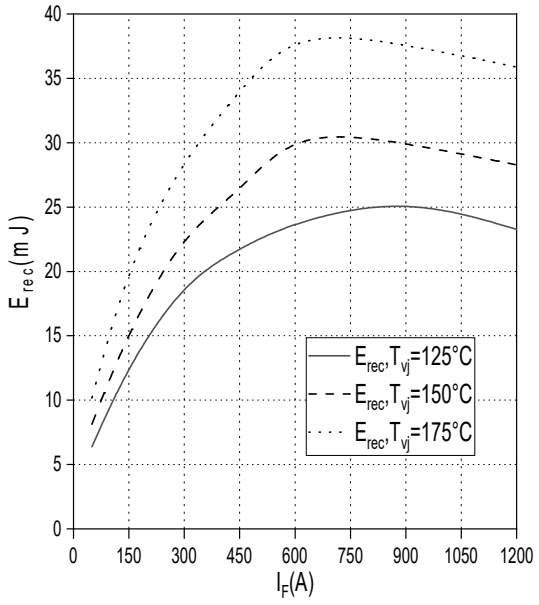
栅极电荷特性, IGBT, 逆变器（典型)
Gate charge characteristic, IGBT, Inverter (typical)
$V_{GE} = f(Q_g)$
I_C = 600A, Tvj = 25 °C



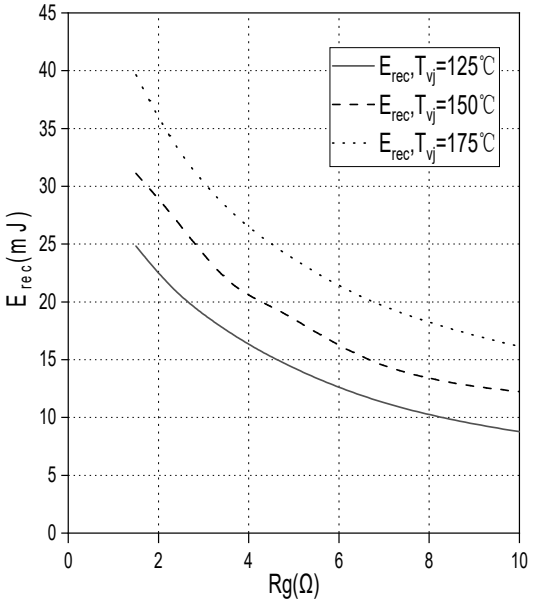
电容特性, IGBT, 逆变器 (典型)
Capacity characteristic, IGBT, Inverter (typical)
C = f(VCE)
f = 100kHz, V_{GE} = 0 V, Tvj = 25 °C



开关损耗 二极管,逆变器（典型值)
Switching losses Diode, Inverter (typical)
$E_{rec} = f(I_F)$
R_{Gon} = 1.5Ω,V_{CE} = 600V



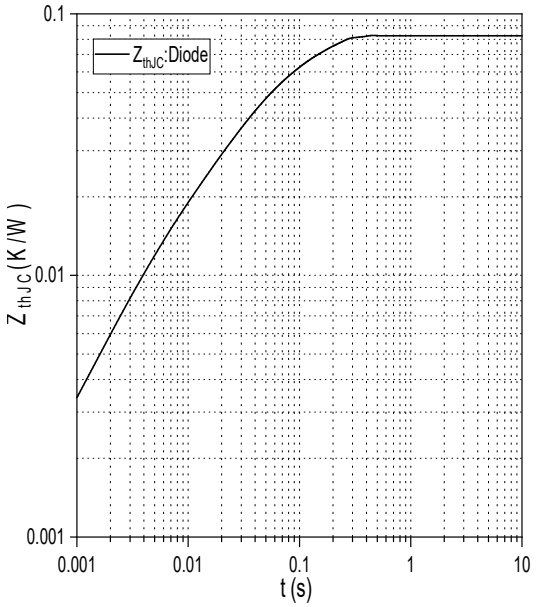
二极管,逆变器（典型值)
switching losses Diode, Inverter (typical)
$E_{rec} = f(R_G)$
I_F = 600A,V_{CE} = 600V



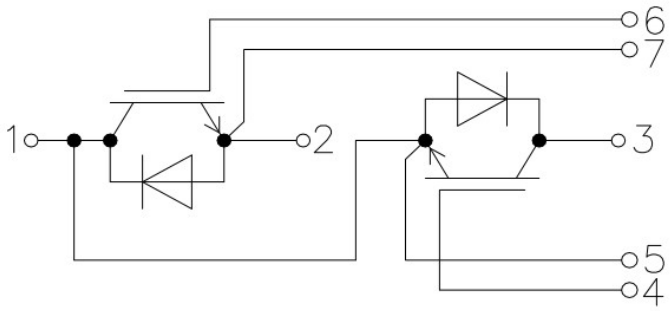
瞬态热阻抗 二极管,逆变器

transient thermal impedance Diode , Inverter

$Z_{thJC} = f(t)$



Internal Circuit:



Package Dimension
Dimensions in Millimeters