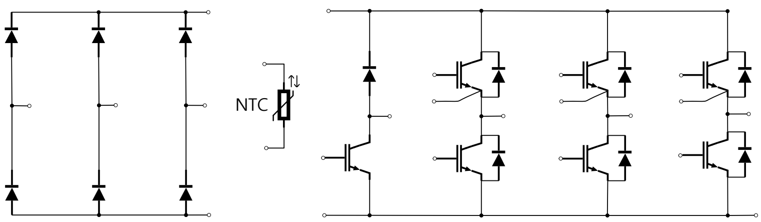
GCP50GX120PIB1

等效电路原理图　　Equivalent Circuit Schematic



50A/1200V

说明

翠展 IGBT 功率模块具有超低的导通损耗以及良好的短路可靠性。

该产品是为了通用逆变器以及不间断电源等应用所设计。

Description

GRECON IGBT Power Module provides ultra low conduction loss as well as short circuit ruggedness. They are designed for the applications such as general inverters and UPS.

典型应用

- 辅助逆变器
- 医疗应用
- 电机传动
- 伺服驱动器

Typical Applications

- Auxiliary Inverters
- Medical Applications
- Motor Drives
- Servo Drives

电气特性

- 低开关损耗
- 最大结温 175℃
- V_{CEsat} 正温度系数
- 低 V_{CEsat}

Electrical Features

- Low Switching Losses
- Maximum junction temperature was 175 ℃
- V_{CEsat} with positive Temperature Coefficient
- Low V_{CEsat}

机械特性

- 高功率循环和温度循环能力
- 铜基板
- 焊接技术
- 标准封装

Mechanical Features

- High Power and Thermal Cycling Capability
- Copper Base Plate
- Solder Contact Technology
- Standard Housing

IGBT,逆变器 / IGBT,Inverter

最大额定值 / Maximum Rated Values

Parameter	Symbol	Conditions	Value	Unit
集电极-发射极电压 Collector-emitter voltage	V_{CES}	T_{vj}=25°C	1200	V
连续集电极直流电流 Continuous DC collector current	$I_{C\ nom}$	T_C=100°C, $T_{vj\ max}$=175°C	50	A
集电极重复峰值电流 Repetitive peak collector current	I_{CRM}	t_p=1ms	100	A
总功率损耗 Total power dissipation	P_{tot}	T_C=25°C, $T_{vj\ max}$=175°C	302	W
栅极-发射极峰值电压 Gate-emitter peak voltage	V_{GES}	T_{vj}=25°C	±20	V

特征值 / Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
栅极阈值电压 Gate threshold voltage	V_{GEth}	V_{GE}=V_{CE}, I_C=1.5mA, T_{vj}=25°C		5.8	6.5	V
栅极-发射极漏电流 Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V, T_{vj}=25 °C			100	nA
集电极-发射极截止电流 Collector-emitter cut-off current	I_{CES}	V_{CE}=1200V, V_{GE}=0V, T_{vj}=25°C			1	mA
集电极-发射极饱和电压 Collector-emitter saturation voltage	$V_{CE\ sat}$	I_C=50A, V_{GE}=15V, T_{vj}=25°C		1.70	2.05	V
		I_C=50A, V_{GE}=15V, T_{vj}=125°C		2.00		
		I_C=50A, V_{GE}=15V, T_{vj}=150°C		2.08		
内部栅极电阻 Internal gate resistance	R_{gint}	T_{vj}=25°C		1.1		Ω
栅极电荷 Gate charge	Q_G	V_{GE}=-8V~+15V，V_{CE}=600V		0.4		uC
输入电容 Input capacitance	C_{ies}	V_{CE}=25V, V_{GE}=0V, f=1MHz, T_{vj}=25°C		6.3		nF
反向传输电容 Reverse transfer capacitance	C_{res}			0.04		

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
开通延迟时间（电感负载） Turn-on delay time , inductive load	$t_{d\ on}$	I_c=50A, V_{CE}=600V R_{gon}=R_{goff}=10Ω V_{GE}=-8V/+15V di/dt_{on}=1000A/us dv/dt_{off}=7000V/us T_{vj}=25°C		51		ns
上升时间（电感负载） Rise time , inductive load	t_r			41		
关断延迟时间（电感负载） Turn-off delay time , inductive load	$t_{d\ off}$			210		
下降时间（电感负载） Fall time , inductive load	t_f			178		
开通损耗能量（每脉冲） Turn-on energy loss per pulse	E_{on}			4.1		mJ
关断损耗能量（每脉冲） Turn-off energy loss per pulse	E_{off}			3.7		
开通延迟时间（电感负载） Turn-on delay time , inductive load	$t_{d\ on}$	I_c=50A, V_{CE}=600V R_{gon}=R_{goff}=10Ω V_{GE}=-8V/+15V di/dt_{on}=950A/us dv/dt_{off}=5800V/us T_{vj}=125°C		51		ns
上升时间（电感负载） Rise time , inductive load	t_r			45		
关断延迟时间（电感负载） Turn-off delay time , inductive load	$t_{d\ off}$			219		
下降时间（电感负载） Fall time , inductive load	t_f			256		
开通损耗能量（每脉冲） Turn-on energy loss per pulse	E_{on}			6.5		mJ
关断损耗能量（每脉冲） Turn-off energy loss per pulse	E_{off}			4.4		
开通延迟时间（电感负载） Turn-on delay time , inductive load	$t_{d\ on}$	I_c=50A, V_{CE}=600V R_{gon}=R_{goff}=10Ω V_{GE}=-8V/+15V di/dt_{on}=900A/us dv/dt_{off}=5800V/us T_{vj}=150°C		52		ns
上升时间（电感负载） Rise time , inductive load	t_r			51		
关断延迟时间（电感负载） Turn-off delay time , inductive load	$t_{d\ off}$			219		
下降时间（电感负载） Fall time , inductive load	t_f			284		
开通损耗能量（每脉冲） Turn-on energy loss per pulse	E_{on}			7.4		mJ
关断损耗能量（每脉冲） Turn-off energy loss per pulse	E_{off}			4.6		

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
短路数据 SC data	I_{SC}	t_p≤10us, V_{GE}=15V, V_{cc}=800V, V_{CEM}≤1200V, T_{vj}=25°C		194		A
		t_p≤8us, V_{GE}=15V, V_{cc}=800V, V_{CEM}≤1200V, T_{vj}=150°C		182		A
结-外壳热阻 Thermal resistance,junction to case	R_{thJC}	每个 IGBT / per IGBT			0.498	K/W
外壳-散热器热阻 Thermal resistance,case to heatsink	R_{thCH}	每个 IGBT / per IGBT λ_{grease}=1W/(m • K)		0.264		K/W
在开关状态下温度 Temperature under switching conditions	$T_{vj\ op}$		-40		150	°C

二极管,逆变器 / Diode,Inverter

最大额定值 / Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
反向重复峰值电压 Repetitive peak reverse voltage	V_{RRM}	T_{vj}=25 °C	1200	V
连续正向直流电流 Continuous DC forward current	I_F		50	A
正向重复峰值电流 Repetitive peak forward current	I_{FRM}	t_p=1ms	100	A
I^2t-值 I^2t-value	I^2t	V_R = 0 V, t_p = 8.3 ms, T_{vj} = 25°C	664	A^2s

特征值 / Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
正向电压 Forward voltage	V_F	I_F=50A, V_{GE}=0V, T_{vj}=25°C		2.19	2.40	V
		I_F=50A, V_{GE}=0V, T_{vj}=125°C		1.94		
		I_F=50A, V_{GE}=0V, T_{vj}=150°C		1.88		
恢复电荷 Recovered charge	Q_{rr}	I_F=50A, V_R=600V -di_F/dt=1000A/us T_{vj}=25°C		5.1		uC
反向恢复峰值电流 Peak reverse recovery current	I_{RM}			40		A
反向恢复损耗（每脉冲） Reverse recovery energy	E_{rec}			2.0		mJ
恢复电荷 Recovered charge	Q_{rr}	I_F=50A, V_R=600V -di_F/dt=850A/us T_{vj}=125°C		10.7		uC
反向恢复峰值电流 Peak reverse recovery current	I_{RM}			54		A
反向恢复损耗（每脉冲） Reverse recovery energy	E_{rec}			4.1		mJ
恢复电荷 Recovered charge	Q_{rr}	I_F=50A, V_R=600V -di_F/dt=800A/us T_{vj}=150°C		12.0		uC
反向恢复峰值电流 Peak reverse recovery current	I_{RM}			55		A
反向恢复损耗（每脉冲） Reverse recovery energy	E_{rec}			4.5		mJ

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
结-外壳热阻 Thermal resistance,junction to case	R_{thJC}	每个二极管 / per diode			0.833	K/W
外壳-散热器热阻 Thermal resistance,case to heatsink	R_{thCH}	每个二极管 / per diode λ_{grease}=1W/(m・K)		0.443		K/W
在开关状态下温度 Temperature under switching conditions	$T_{vj\ op}$		-40		150	℃

二极管,整流器 / Diode,Rectifier

最大额定值 / Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
反向重复峰值电压 Repetitive peak reverse voltage	V_{RRM}	T_{vj}=25 °C	1600	V
最大正向均方根电流（每芯片） Maximum RMS forward current per chip	I_{FRMSM}		50	A
正向浪涌电流 Surge forward current	I_{FSM}	t_P=10ms, T_{vj}=25 °C	420	A
I^2t-值 I^2t-value	I^2t	t_P=10ms, T_{vj}=25 °C	882	A^2s

特征值 / Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
正向电压 Forward voltage	V_F	I_F=50A, T_{vj}=25°C		1.1	1.2	V
反向电流 Reverse current	I_{RM}	V_R=V_{RRM} ,T_{vj}=25°C			50	uA
结-外壳热阻 Thermal resistance,junction to case	R_{thJC}	每个二极管 / per diode			0.558	K/W
外壳-散热器热阻 Thermal resistance,case to heatsink	R_{thCH}	每个二极管 / per diode λ_{grease}=1W/(m • K)		0.296		K/W
在开关状态下温度 Temperature under switching conditions	$T_{vj\ op}$		-40		150	°C

IGBT,制动-斩波器 / IGBT,Brake-Chopper

最大额定值 / Maximum Rated Values

Parameter	Symbol	Conditions	Value	Unit
集电极-发射极电压 Collector-emitter voltage	V_{CES}	T_{vj}=25°C	1200	V
连续集电极直流电流 Continuous DC collector current	$I_{C\ nom}$	T_C=100°C, $T_{vj\ max}$=175°C	25	A
集电极重复峰值电流 Repetitive peak collector current	I_{CRM}	t_p=1ms	50	A
总功率损耗 Total power dissipation	P_{tot}	T_C=25°C, $T_{vj\ max}$=175°C	231	W
栅极-发射极峰值电压 Gate-emitter peak voltage	V_{GES}	T_{vj}=25°C	±20	V

特征值 / Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
栅极阈值电压 Gate threshold voltage	V_{GEth}	V_{GE}=V_{CE}, I_C=1.5mA, T_{vj}=25°C		6.5	7.1	V
栅极-发射极漏电流 Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V, T_{vj}=25 °C			100	nA
集电极-发射极截止电流 Collector-emitter cut-off current	I_{CES}	V_{CE}=1200V, V_{GE}=0V, T_{vj}=25°C			1	mA
集电极-发射极饱和电压 Collector-emitter saturation voltage	$V_{CE\ sat}$	I_C=25A, V_{GE}=15V, T_{vj}=25°C		1.68	1.90	V
		I_C=25A, V_{GE}=15V, T_{vj}=125°C		1.98		
		I_C=25A, V_{GE}=15V, T_{vj}=150°C		2.06		
内部栅极电阻 Internal gate resistance	R_{gint}	T_{vj}=25°C		1.44		Ω
栅极电荷 Gate charge	Q_G	V_{GE}=-8V~+15V，V_{CE}=600V		0.2		uC
输入电容 Input capacitance	C_{ies}	V_{CE}=25V, V_{GE}=0V, f=1MHz, T_{vj}=25°C		3.83		nF
反向传输电容 Reverse transfer capacitance	C_{res}			0.02		

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
开通延迟时间（电感负载） Turn-on delay time , inductive load	$t_{d\ on}$	I_c=25A, V_{CE}=600V R_{gon}=R_{goff}=30Ω V_{GE}=-8V/+15V T_{vj}=25°C		94		ns
上升时间（电感负载） Rise time , inductive load	t_r			46		
关断延迟时间（电感负载） Turn-off delay time , inductive load	$t_{d\ off}$			211		
下降时间（电感负载） Fall time , inductive load	t_f			178		
开通损耗能量（每脉冲） Turn-on energy loss per pulse	E_{on}			1.6		mJ
关断损耗能量（每脉冲） Turn-off energy loss per pulse	E_{off}			1.8		
开通延迟时间（电感负载） Turn-on delay time , inductive load	$t_{d\ on}$	I_c=25A, V_{CE}=600V R_{gon}=R_{goff}=30Ω V_{GE}=-8V/+15V T_{vj}=125°C		83		ns
上升时间（电感负载） Rise time , inductive load	t_r			54		
关断延迟时间（电感负载） Turn-off delay time , inductive load	$t_{d\ off}$			219		
下降时间（电感负载） Fall time , inductive load	t_f			256		
开通损耗能量（每脉冲） Turn-on energy loss per pulse	E_{on}			2.5		mJ
关断损耗能量（每脉冲） Turn-off energy loss per pulse	E_{off}			2.0		
开通延迟时间（电感负载） Turn-on delay time , inductive load	$t_{d\ on}$	I_c=25A, V_{CE}=600V R_{gon}=R_{goff}=30Ω V_{GE}=-8V/+15V T_{vj}=150°C		84		ns
上升时间（电感负载） Rise time , inductive load	t_r			54		
关断延迟时间（电感负载） Turn-off delay time , inductive load	$t_{d\ off}$			220		
下降时间（电感负载） Fall time , inductive load	t_f			285		
开通损耗能量（每脉冲） Turn-on energy loss per pulse	E_{on}			2.6		mJ
关断损耗能量（每脉冲） Turn-off energy loss per pulse	E_{off}			2.2		

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
短路数据 SC data	I_{SC}	t_p≤10us, V_{GE}=15V, V_{cc}=800V, V_{CEM}≤1200V, T_{vj}=25°C		105		A
		t_p≤8us, V_{GE}=15V, V_{cc}=800V, V_{CEM}≤1200V, T_{vj}=150°C		90		A
结-外壳热阻 Thermal resistance,junction to case	R_{thJC}	每个 IGBT / per IGBT			0.649	K/W
外壳-散热器热阻 Thermal resistance,case to heatsink	R_{thCH}	每个 IGBT / per IGBT λ_{grease}=1W/(m・K)		0.345		K/W
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 Ratings

Parameter	Symbol	Conditions	Value	Unit
反向重复峰值电压 Repetitive peak reverse voltage	V_{RRM}	T_{vj}=25 °C	1200	V
连续正向直流电流 Continuous DC forward current	I_F		15	A
正向重复峰值电流 Repetitive peak forward current	I_{FRM}	t_p=1ms	30	A
I^2t-值 I^2t-value	I^2t	V_R = 0 V, t_p = 10 ms, T_{vj} = 25°C	200	A^2s

特征值 / Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
正向电压 Forward voltage	V_F	I_F=15A, V_{GE}=0V, T_{vj}=25°C		2.10	2.40	V
		I_F=15A, V_{GE}=0V, T_{vj}=125°C		1.80		
		I_F=15A, V_{GE}=0V, T_{vj}=150°C		1.75		
恢复电荷 Recovered charge	Q_{rr}	I_F=15A, V_R=600V -di_F/dt=550A/us T_{vj}=25°C		1.2		uC
反向恢复峰值电流 Peak reverse recovery current	I_{RM}			15		A
反向恢复损耗（每脉冲） Reverse recovery energy	E_{rec}			0.5		mJ
恢复电荷 Recovered charge	Q_{rr}	I_F=15A, V_R=600V -di_F/dt=500A/us T_{vj}=125°C		3.1		uC
反向恢复峰值电流 Peak reverse recovery current	I_{RM}			33		A
反向恢复损耗（每脉冲） Reverse recovery energy	E_{rec}			1.1		mJ
恢复电荷 Recovered charge	Q_{rr}	I_F=15A, V_R=600V -di_F/dt=500A/us T_{vj}=150°C		3.5		uC
反向恢复峰值电流 Peak reverse recovery current	I_{RM}			24		A
反向恢复损耗（每脉冲） Reverse recovery energy	E_{rec}			1.2		mJ

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
结-外壳热阻 Thermal resistance,junction to case	R_{thJC}	每个二极管 / per diode			1.605	K/W
外壳-散热器热阻 Thermal resistance,case to heatsink	R_{thCH}	每个二极管 / per diode λ_{grease}=1W/(m・K)		0.852		K/W
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

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
额定电阻值 Rated resistance	R_{25}			5		kΩ
R100 偏差 Deviation of R100	ΔR/R	T_c=100°C, R_{100}=493.3Ω	-5		5	%
耗散功率 Power dissipation	P_{25}				20	mW
B-值 B-value	$B_{25/50}$	$R_2=R_{25exp}[B_{25/50}(1/T_2-1/(298.15K))]$		3380		K

模块 / Module

特征值（除非另有说明，否则 T_c=25°C）

Characteristic Values (T_c=25°C unless otherwise specified)

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
绝缘电压 Isolation voltage	V_{isol}	RMS,t=1min, f=50Hz	2500			V
最大结温 Maximum junction temperature	T_{jmax}				175	°C
在开关状态下温度 Operating junction temperature	$T_{vj\ op}$		-40		150	°C
储存温度 Storage temperature	T_{stg}		-40		125	°C
杂散电感（模块） Stray inductance module	L_{CE}			60		nH
外壳-散热器热阻 Thermal resistance,case to heatsink	R_{thCH}	每个模块 / per module λ_{grease}=1W/(m·K)		0.02		K/W
模块安装扭矩 Mounting torque for module mounting	M	M5 螺丝（底板到散热器） Screw M5 baseplate to heatsink	3.0		6.0	N.m
模块重量 / Weight of module	G			170		g

电气特性（曲线）/ Electrical Characteristics (curves)

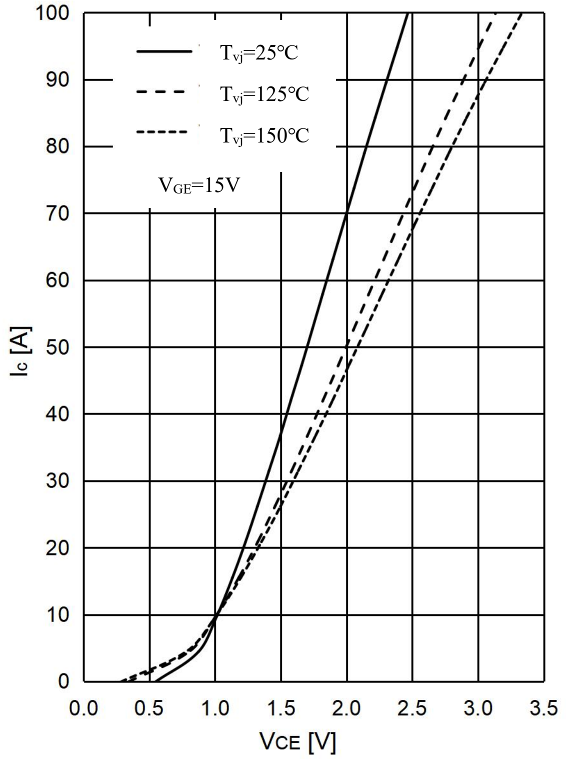


图 1 . IGBT 输出特性,逆变器

Fig 1. IGBT Output Characteristic,Inverter

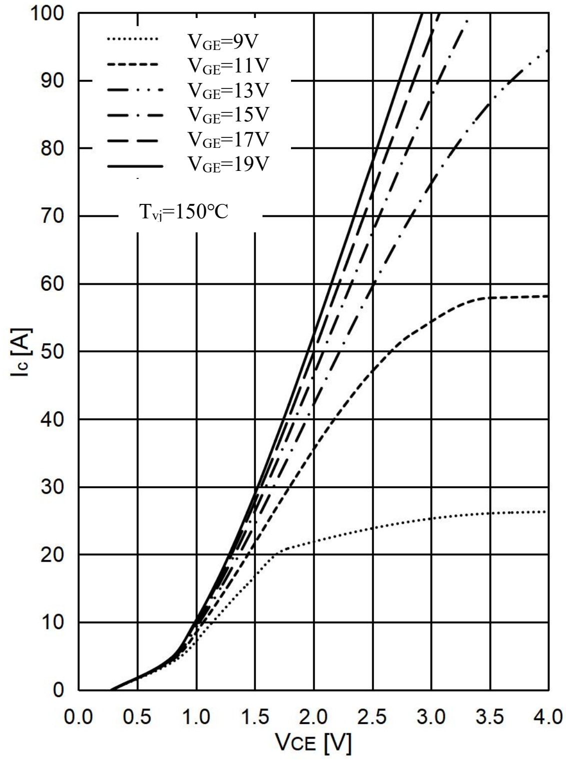


图 2 . IGBT 输出特性,逆变器

Fig 2. IGBT Output Characteristic,Inverter

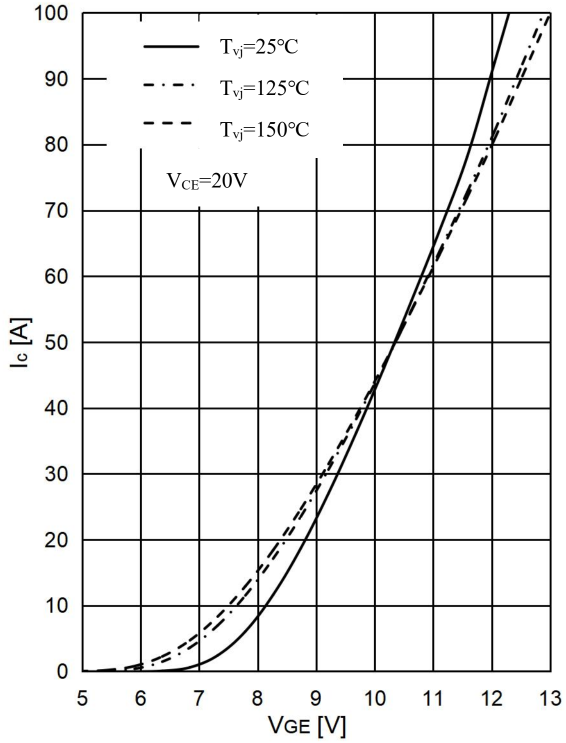


图 3 . IGBT 转移特性,逆变器

Fig 3. IGBT Transfer Characteristic,Inverter

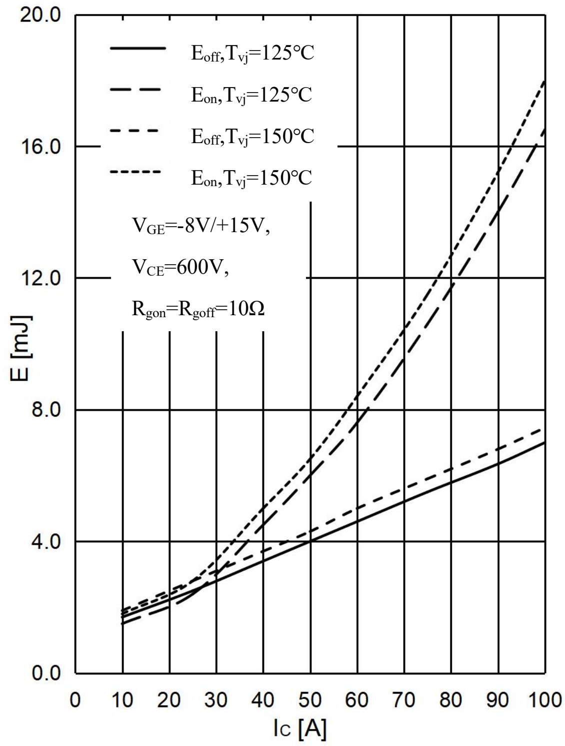


图 4 . IGBT 开关损耗-集电极电流,逆变器

Fig 4. IGBT Switching Loss E_{on} & E_{off} vs. I_C,Inverter

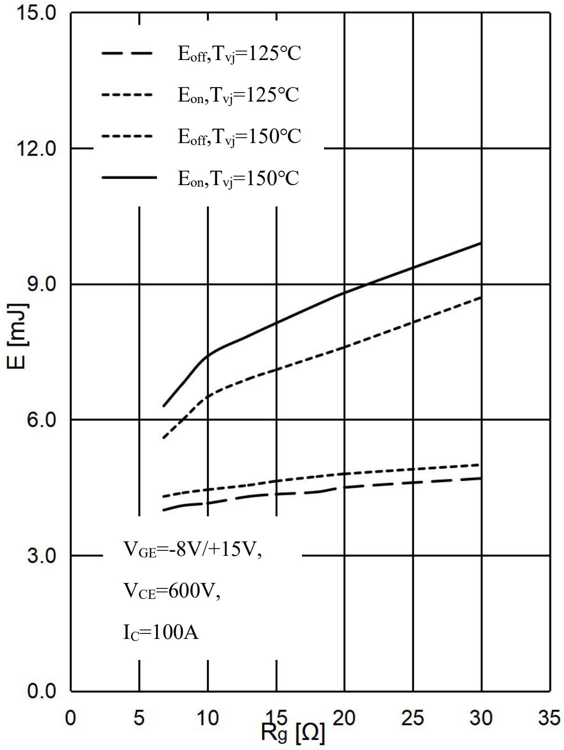


图 5 . IGBT 开关损耗-栅极电阻,逆变器

Fig 5. IGBT Switching Loss E_{on} & E_{off} vs. R_G,Inverter

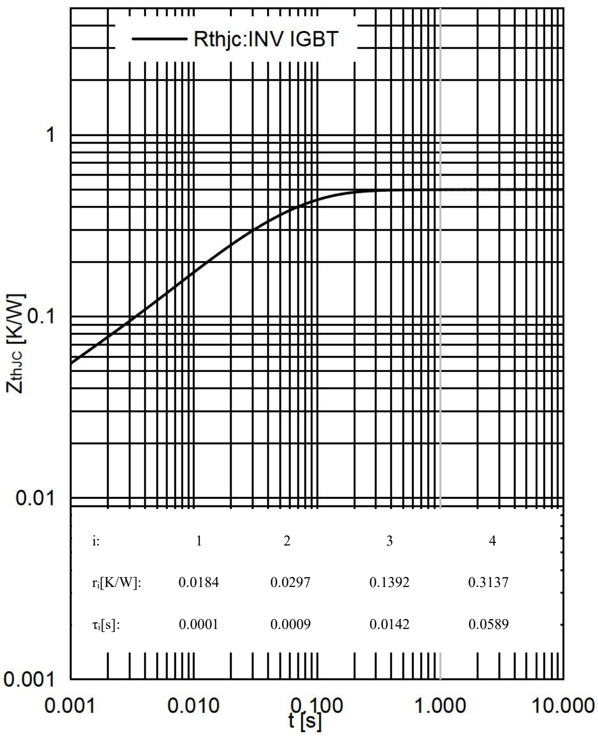


图 6 . IGBT 瞬态热阻抗,逆变器

Fig 6. IGBT Transient thermal impedance,Inverter

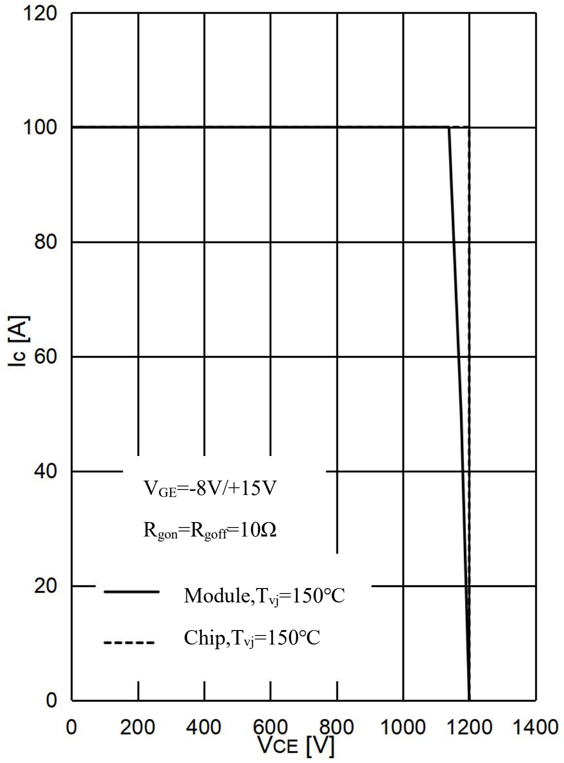


图 7 . IGBT 反偏安全工作区,逆变器

Fig 7. IGBT RBSOA,Inverter

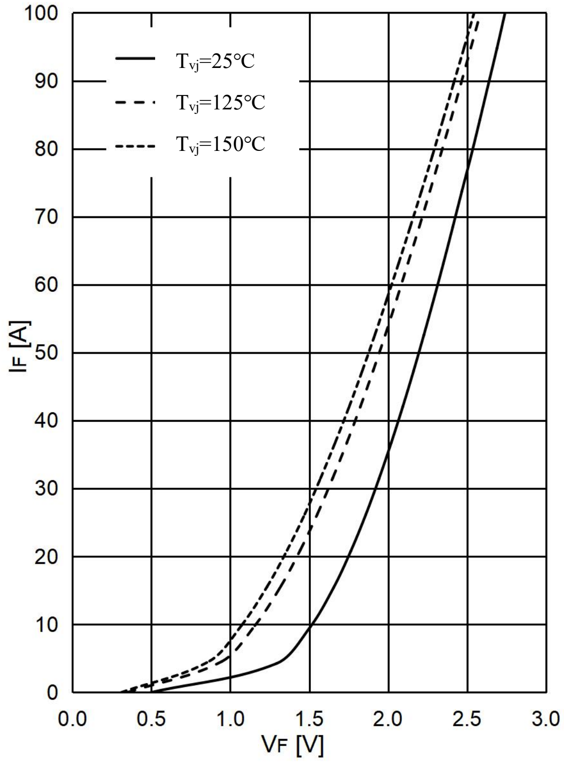


图 8 . 二极管 正向偏压特性,逆变器

Fig 8. Diode Forward characteristic,Inverter

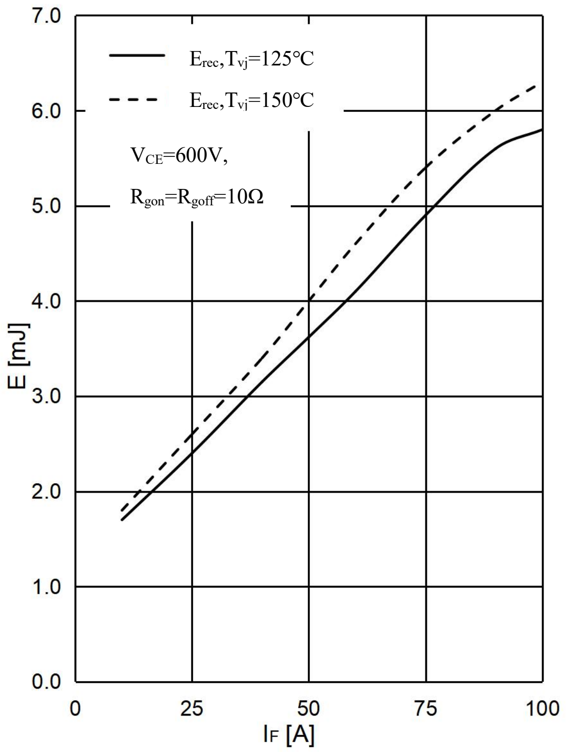


图 9．二极管 开关损耗-正向电流,逆变器

Fig 9. Diode Switching Loss E_{rec} vs. I_F,Inverter

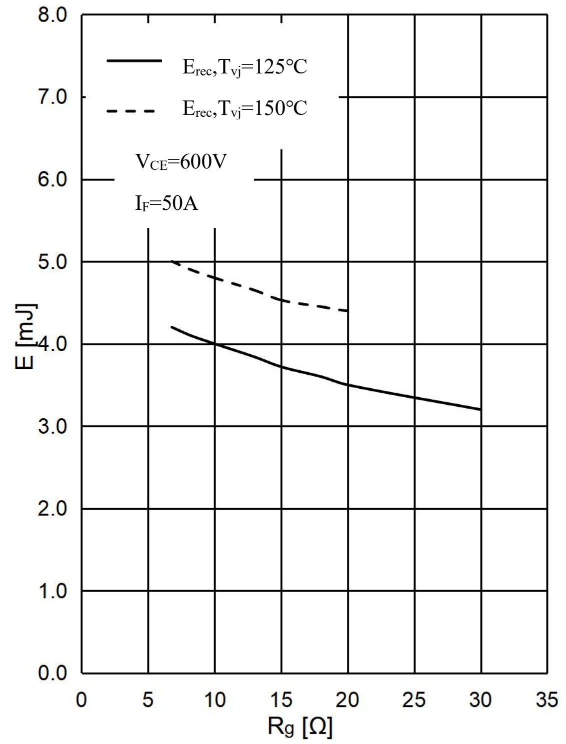


图 10．二极管 开关损耗-栅极电阻,逆变器

Fig 10. Diode Switching Loss E_{rec} vs. R_G,Inverter

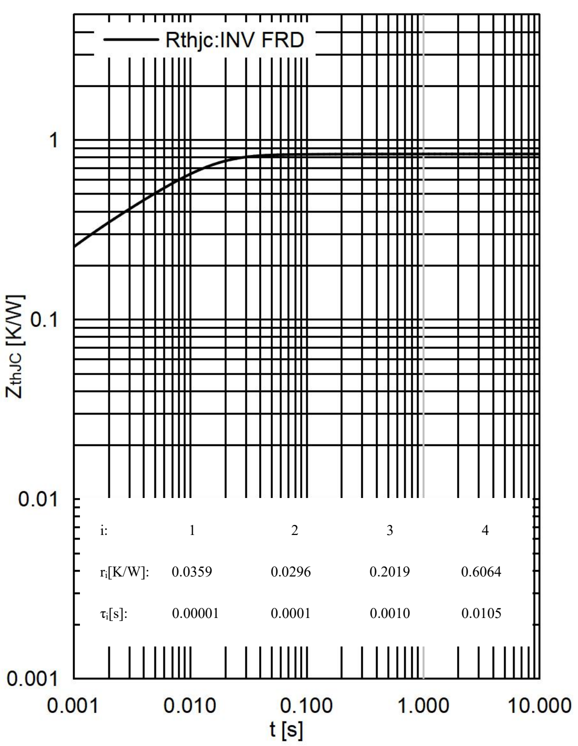


图 11．二极管 瞬态热阻抗,逆变器

Fig 11. Diode Transient thermal impedance,Inverter

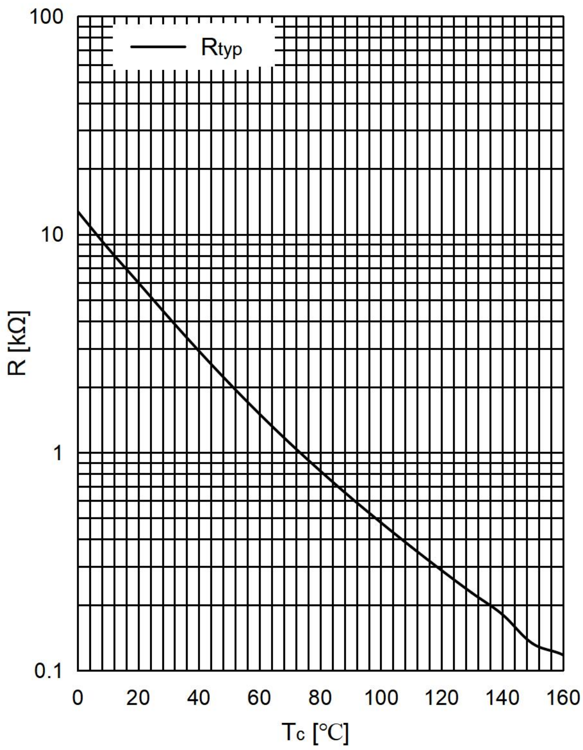
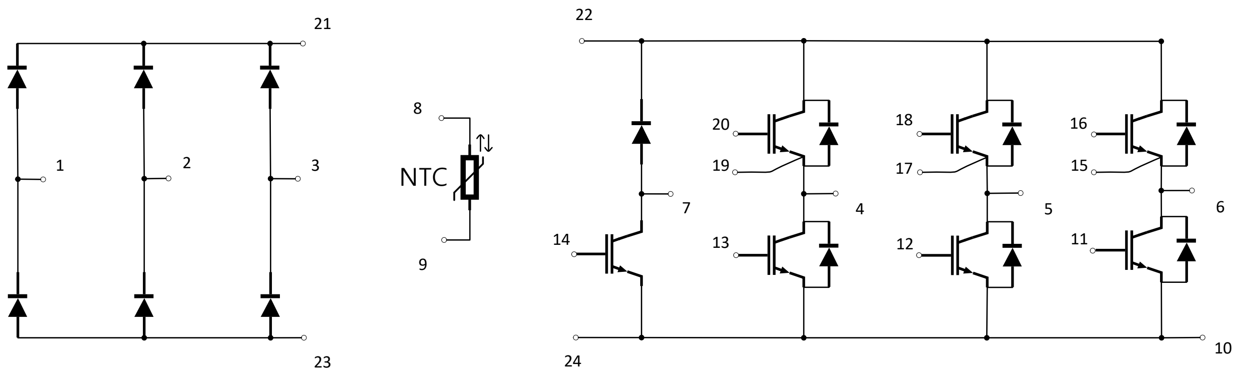


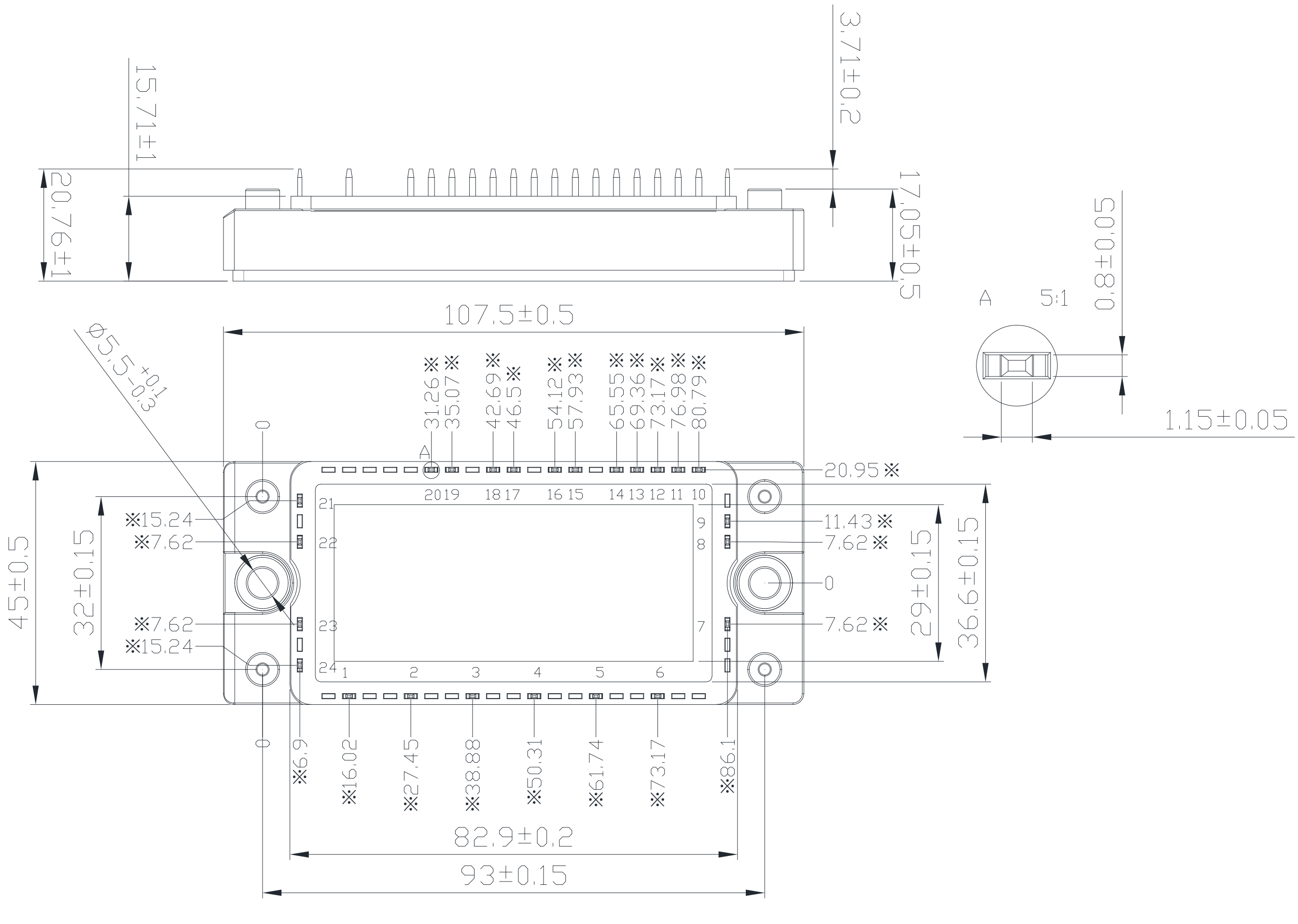
图 12．负温度系数热敏电阻 温度特性

Fig 12. NTC-Thermistor-temperature characteristic

电路图 / Circuit Diagram



封装尺寸 / Package Dimensions



※: All dimensions with a tolerance of ⌖ Ø0.4

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