V_{CES} = 1200V I_C = 1000A

General Description

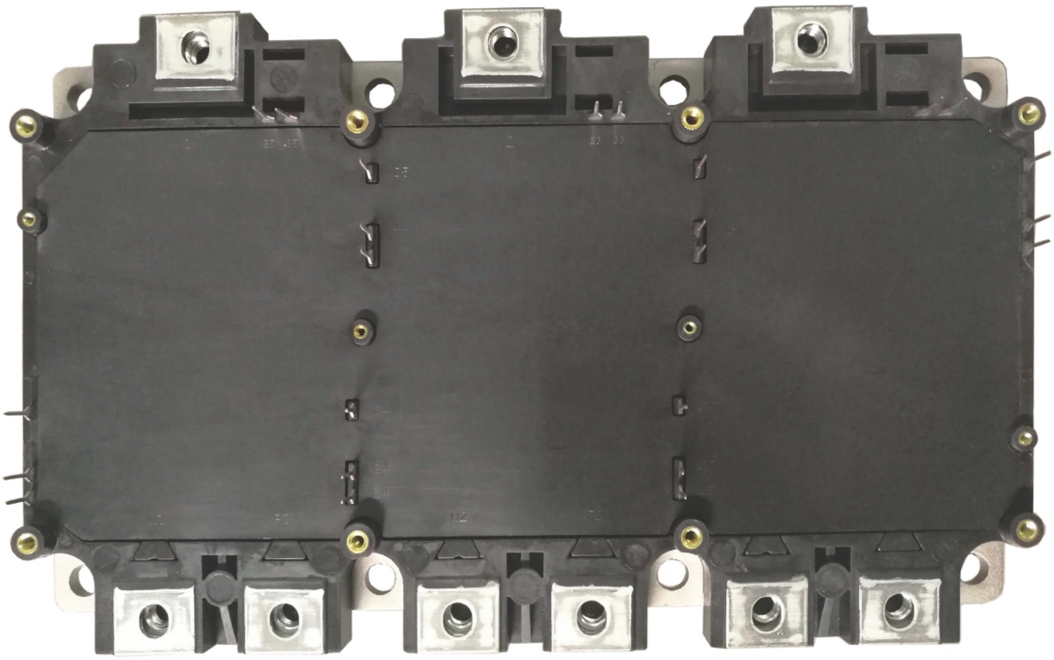
BYD IGBT Power Module BG1000F12D34S4 provides low switching loss as well as high short circuit capability, which introduce the advanced FS IGBT chip and ultra fast & soft recovery anti-parallel FRD to improved connection, it is able to take on a perfect performance in various applications up to 16KHz.
比亚迪IGBT功率模块BG1000F12D34S4提供低损和高短路能力,内含先进的平面栅场终止技术IGBT和超快速软恢复二极管芯片,在不超过16KHZ频率的应用中表现出优良的性能。

Applications

- AC motor control
  交流马达控制
- Inverters
  逆变器
- Servo
  伺服电机
- Maximum applied voltage platform: 750V
  最高支持750电压平台

Features

- Full bridge module
  全桥模块
- High short circuit capability
  高短路能力
- 1200V planar&field stop technology
  1200V 平面栅场终止技术
- Ultra low conduction and switching loss
  低导通和开关损耗
- Including ultra fast & soft recovery anti-parallel FRD
  反并联超快速软恢复二极管



Absolute Maximum Ratings/ 最大额定值

Parameter	Symbol	Conditions		Value	Unit
Collector-emitter voltage 集电极－发射极电压	V_{CES}	V_{GE}=0V	T_{vj}=25℃	1200	V
Continuous collector current 连续集电极直流电流	I_C	—	T_F=25℃	1000	A
	$I_{C\ nom}$	V_{GE}=15V	T_F=65℃ T_{vj}=150℃	530(1)	A
Peak collector current 集电极峰值电流	I_{CRM}	I_{CRM}=2xI_{cnom}	—	1060	A
Gate-emitter voltage 栅极-发射极电压	V_{GES}	—	—	+/-20	V
Short circuit data 短路数据	I_{SC}	V_{CC}=600V,V_{GE}=15V V_{CEM}=V_{CES}-L_{SCE}*di/dt	Tp≤10μs T_j=25℃	3670	A
			Tp≤10μs T_j=125℃	4015	A
Junction temperature 结温	T_{vj}	—	—	-40~175	℃
Storage temperature range 存储温度	T_{stg}	—	—	-40~150	℃
Diode DC forward current 二极管直流正向电流	I_F	—	T_C=25℃	1000	A
Isolation voltage 绝缘电压	V_{isol}	AC,t=1min, f=50Hz	—	3800	V
Total power dissipation 耗散功率	P_{tot}	per switch (IGBT)	T_F= 65℃	1440	W

(1)Other conditions：V_{CC}=600V，f_{SW}=8kHz，△V/△t=8L/min，50% water/50% ethylene glycol

IGBT Characteristics/ IGBT 特性

IGBT	Symbol	Conditions		Min.	Typ.	Max.	Unit
Collector-emitter breakdown voltage 集电极－发射极击穿电压	$V_{(BR)CES}$	V_{GE}=0V, I_C=1mA	T_{vj}=25℃	1200			V
Gate-emitter threshold voltage 栅极-发射极阈值电压	$V_{GE(th)}$	I_C=32mA, V_{CE}=V_{GE}	T_{vj}=25℃	5.0	6.0	7.0	V
Collector-emitter cut-off current 集电极-发射极截止电流	I_{CES}	V_{CE}=1200V, V_{GE}=0V	T_{vj}=25℃	—	—	1.2	mA

Collector-emitter saturation voltage 集电极-发射极饱和电压	$V_{CE(sat)}$	I_C=800A, V_{GE}=15V	T_{vj}=25℃	—	2.05	2.7	V
			T_{vj}=125℃	—	2.15	—	V
			T_{vj}=150℃	—	2.20	—	V
Integrated gate resistor 内部栅极电阻	R_{Gint}	—	T_{vj}=25℃	—	0.65	—	Ω

IGBT Characteristics/ IGBT 特性

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Gate-emitter leakage current 栅极-发射极漏电流	I_{GES}	V_{GE}=20V, V_{CE}=0V	T_{vj}=25℃	-600	—	+600	nA
Input capacitance 输入电容	C_{ies}	V_{CE}=25V, V_{GE}=0V, f=1MHz	—	—	31.7	—	nF
Reverse transfer capacitance 反向传输电容	C_{res}		—	—	1.4	—	nF
Turn-on delay time 开通延迟时间	$t_{d(on)}$	V_{CC}=600V I_c=800A, R_{Gon}=2.5Ω, R_{Goff}=3.3Ω V_{GEon}=+15V V_{GEoff}=-8V L_S=30nH	T_{vj}=25℃	—	247	—	ns
			T_{vj}=125℃	—	220	—	ns
			T_{vj}=150℃	—	220	—	ns
Rise time 上升时间	t_r		T_{vj}=25℃	—	193	—	ns
			T_{vj}=125℃	—	260	—	ns
			T_{vj}=150℃	—	260	—	ns
Turn-off delay time 关断延迟时间	$t_{d(off)}$		T_{vj}=25℃	—	620	—	ns
			T_{vj}=125℃	—	710		ns
			T_{vj}=150℃	—	730		ns
Fall time 下降时间	t_f		T_{vj}=25℃	—	68	—	ns
			T_{vj}=125℃	—	65	—	ns
			T_{vj}=150℃	—	70	—	ns
Energy dissipation during turn-on time 开通损耗	E_{on}		T_{vj}=25℃	—	160	—	mJ
			T_{vj}=125℃	—	170	—	mJ
			T_{vj}=150℃	—	175	—	mJ
Energy dissipation during turn-off time 关断损耗	E_{off}		T_{vj}=25℃	—	85	—	mJ
			T_{vj}=125℃	—	105	—	mJ
			T_{vj}=150℃	—	113	—	mJ

Diode Characteristics/ 二极管特征值

Forward voltage 正向电压	V_F	I_F=800A	T_{vj}=25	—	1.8	—	V
			T_{vj}=125℃	—	1.7	—	V
			T_{vj}=150℃	—	1.7	—	V

Peak reverse recovery current 反向恢复峰值电流	I_{RR}	I_F=800A, V_R=600V	T_{vj}=25℃	—	145	—	A
			T_{vj}=125℃	—	237	—	A
			T_{vj}=150℃	—	260	—	A
Recovered charge 恢复电荷	Q_r	I_F=800A, V_R=600V	T_{vj}=25℃	—	40	—	uC
			T_{vj}=125℃	—	90	—	uC
			T_{vj}=150℃	—	100	—	uC
Reverse recovery energy 反向恢复能量	E_{rec}		T_{vj}=25℃	—	15	—	mJ
			T_{vj}=125℃	—	33	—	mJ
			T_{vj}=150℃	—	40	—	mJ
Thermal-Mechanical Specifications/ 热力参数							
Parameter	**Symbol**	**Conditions**		**Min.**	**Typ.**	**Max.**	**Unit**
Thermal resistance junction to coolant 结到冷却液热阻	$R_{th(j-f)}$	IGBT，T_F=45℃，△V/△t=8L/min		—	0.059	—	K/W
	$R_{th(j-f)}$	FRD，T_F=45℃，△V/△t=8L/min		—	0.091	—	K/W
Module Characteristics/ 模块特性							
Dimensions 尺寸	L x W x H	Typical , see outline drawing		225×137×34.7			mm
Clearance distance in air 空气间隙	da	according to IEC 60664-1 and EN 50124-1	Term. to base:	—	16.0	—	mm
			Term. to term:	—	11.5	—	
Surface creepage distance 爬电距离	ds	according to IEC 60664-1and EN 50124-1	Term. to base:	22	16.0	—	mm
			Term. to term:	—	12.5	—	
Stray inductance module 模块杂散电感	L_{SCE}	—	—	—	26.51	—	nH
Mass 重量	m	—	—	—	2115	—	g
Pressure drop in cooling circuit 在冷却液中的压差	ΔP	△ v /△ t=12L/min，T=25℃ , cooling fluid=50% water/50% ethylenglycol		—	10	—	KPa
Maximum pressure in cooling circuit 冷却循环中的最大压力	P	—		—	—	250	KPa
Mounting torque 安装扭矩	M	Screw M6-mounting according to valid application note		3.0	—	4.5	Nm
Terminal connection torque 端子连接扭矩	M	Screw M6-mounting according to valid application note		3.0	—	4.5	Nm

NTC-Thermistor Characteristic Values/ 热敏电阻特性						
Rated resistance 额定阻值	R_{25}	T_C=25℃	—	5.0	—	KΩ
Deviation of R100 R100 偏差	△R/R	T_C=100℃，R_{100}=493Ω	-5	—	5	%
Power dissipation 耗散功率	P_{25}	T_C=25℃	—	—	20.0	mW
B-value B-值	$B_{25/50}$	$R_2=R_{25}exp[B_{25/50}(1/T_2-1/(298.15K))]$	—	3375	—	K
B-value B-值	$B_{25/80}$	$R_2=R_{25}exp[B_{25/80}(1/T_2-1/(298.15K))]$	—	3411	—	K
B-value B-值	$B_{25/100}$	$R_2=R_{25}exp[B_{25/100}(1/T_2-1/(298.15K))]$	—	3433	—	K

Thermal and mechanical properties according to IEC 60747 – 15，Specification according to the valid application note 热和机械特性参考 IEC 60747 – 15I_F

❒ Characteristics Diagrams/特性曲线

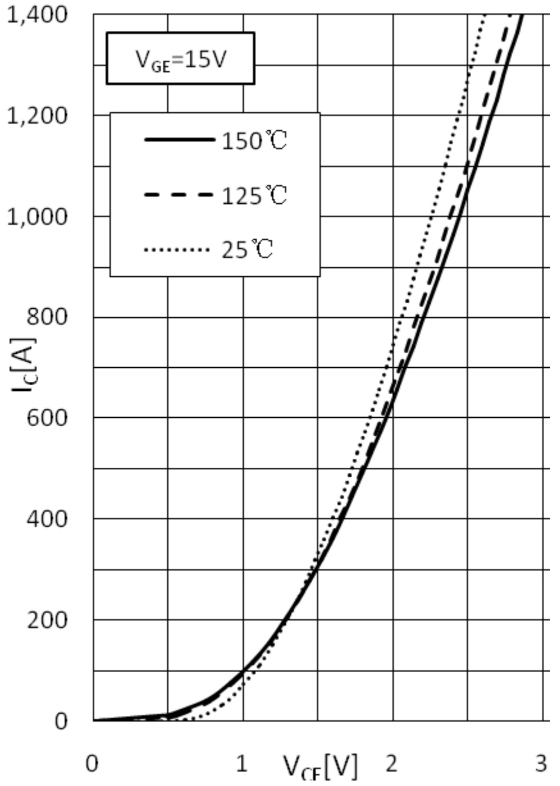


Fig.1:On-state Characteristics
图 1：通态特性

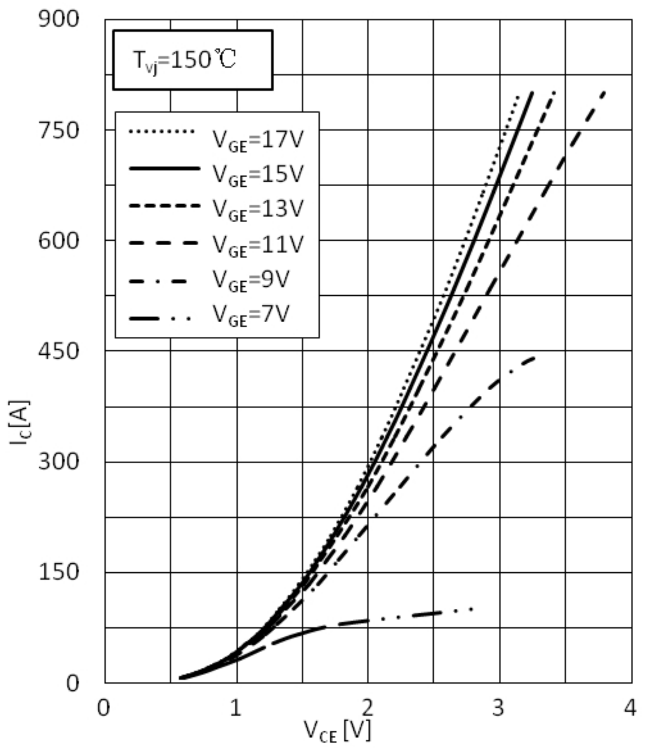


Fig.2:Output characteristics
图 2：输出特性

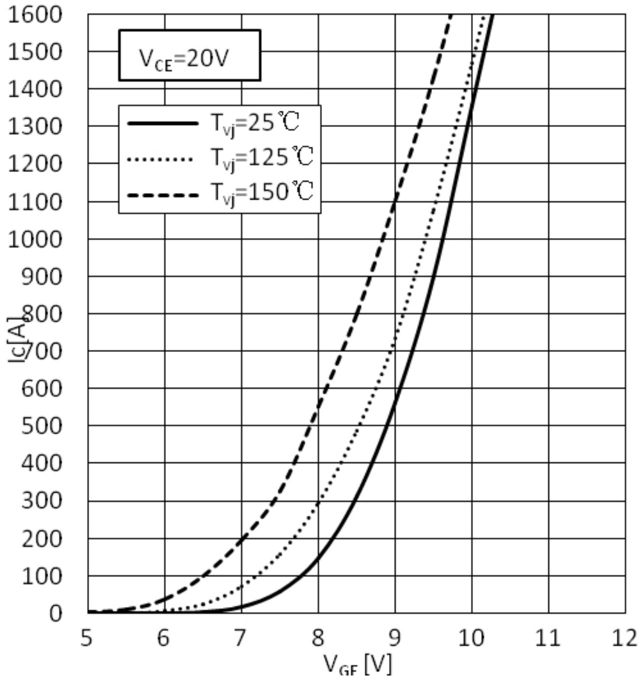


Fig.3: Transfer Characteristics
图 3：传输特性

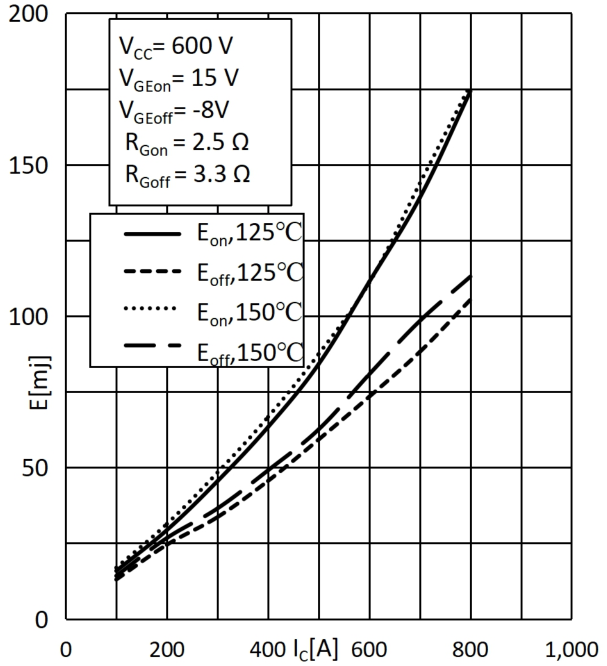


Fig.4: Switching Loss vs. Collector Current
图 4：开关损耗与集电极电流关系

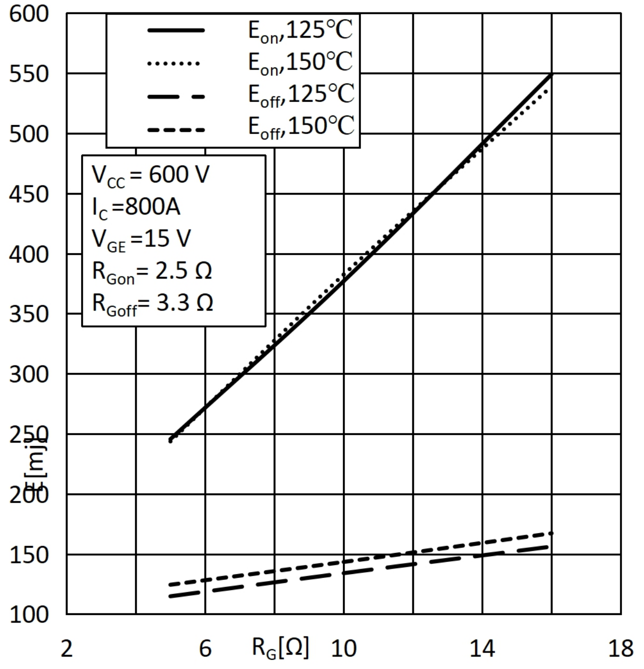


Fig.5: Switching Loss vs. Gate Resistor

图 5：开关损耗与门极电阻关系

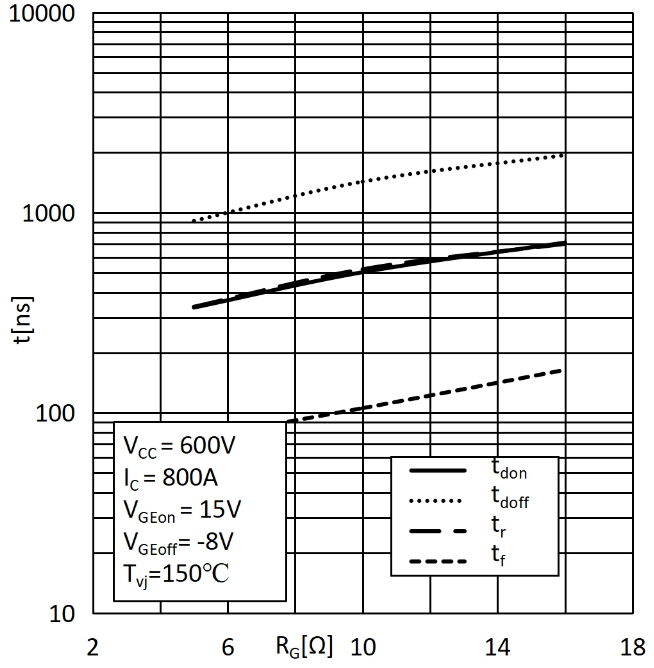


Fig.6: Switching Times vs. Gate Resistor

图 6：开关时间与门极电阻关系

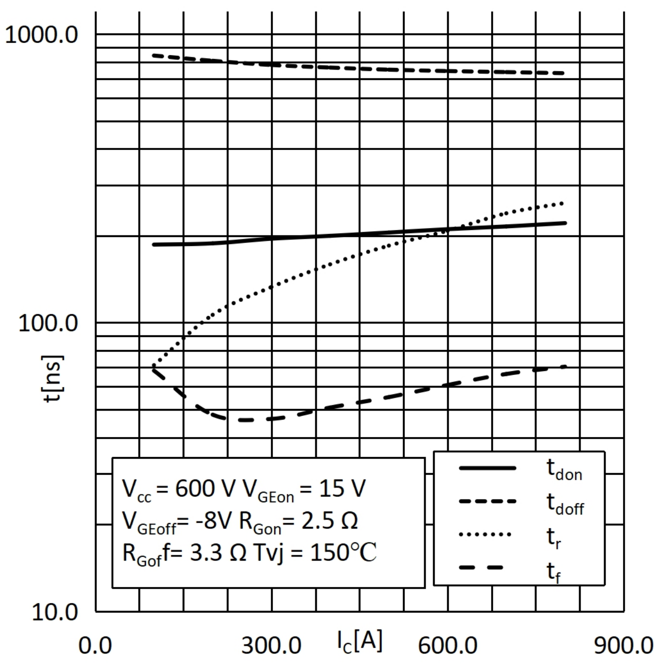


Fig.7: Switching Times vs. I_C

图 7：开关时间与集电极电流关系

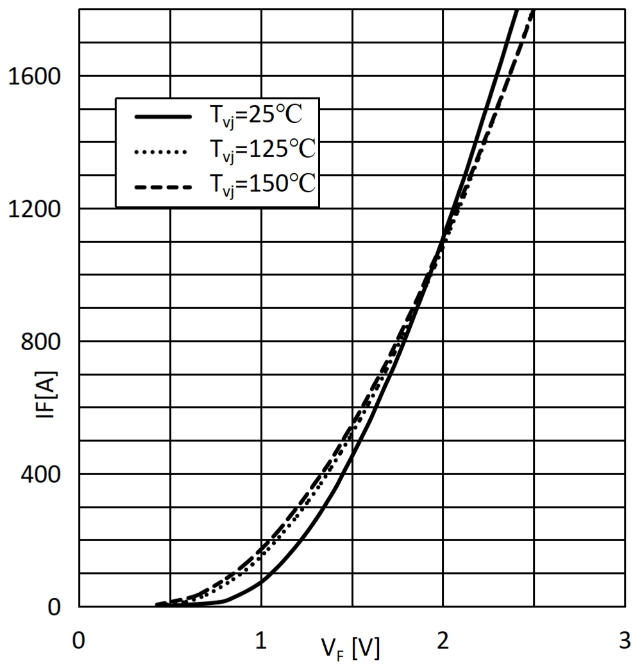


Fig.8: Forward characteristic

图 8：正向特性

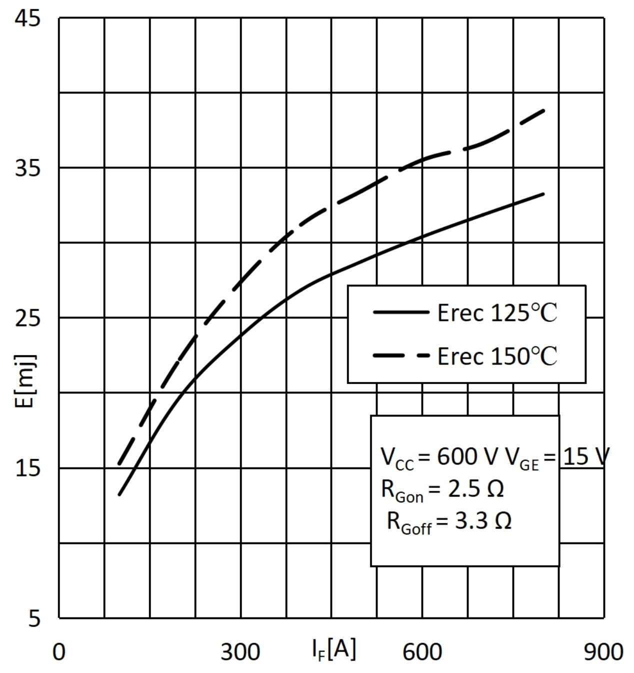


Fig.9: Reverse recovery Energy vs IF.
图 9：反向恢复损耗与正向电流的关系

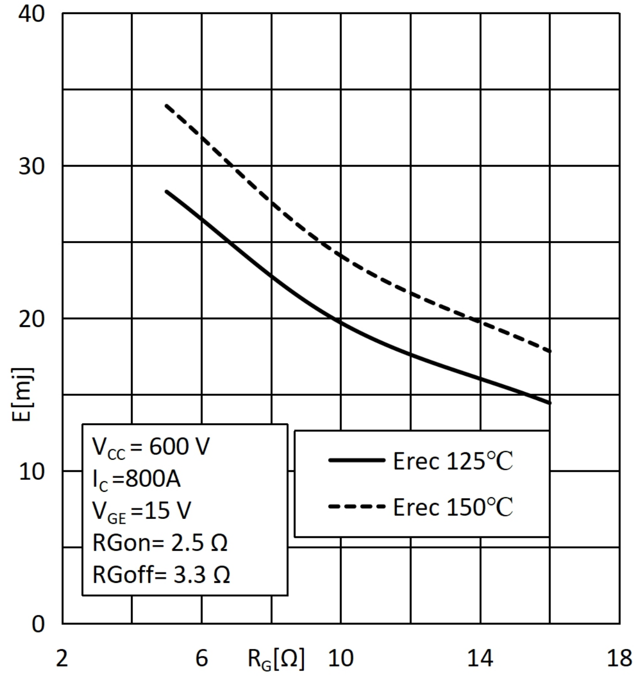


Fig.10: Reverse recovery Energy vs. Gate Resistor
图 10：反向恢复损耗与门极电阻关系

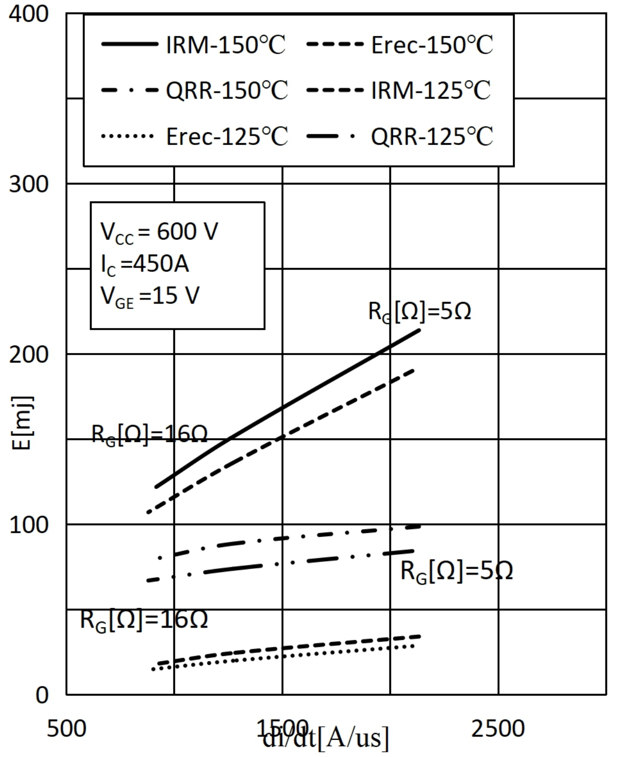


Fig.11: Reverse Recovery Characteristics vs. di/dt
图 11：反向恢复与正向电流关系

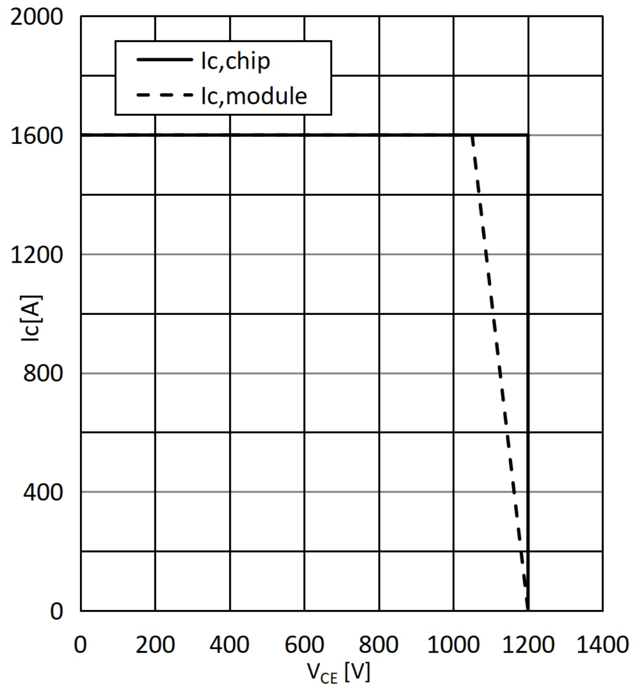


Fig.12: Reverse Bias Safe Operating Area
图 12：反偏安全工作区

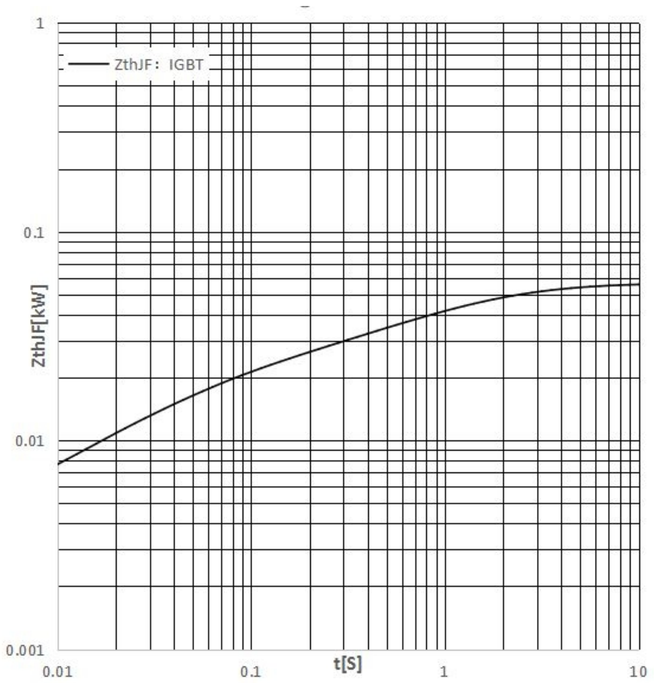


Fig.13: Typ. transient thermal impedance(IGBT)Z_{thJF} IGBT(K/W)

图 13：典型的瞬态热阻抗(IGBT) Z_{thJF} IGBT(K/W)

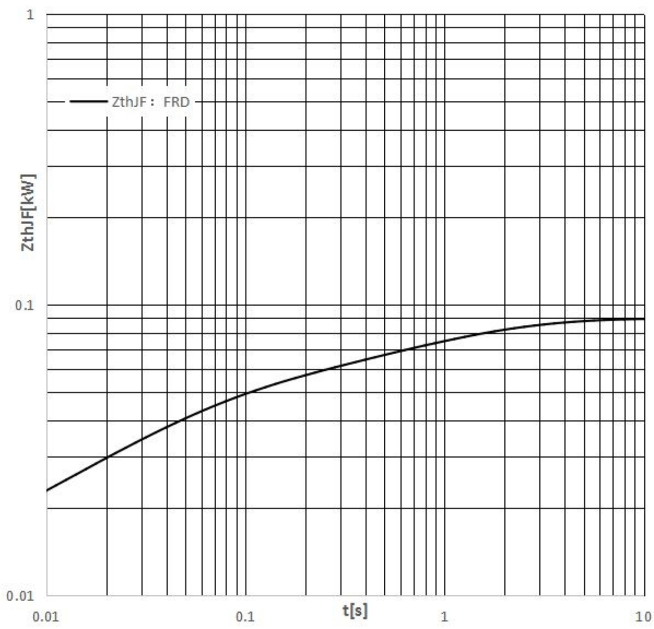


Fig.14: Typ. transient thermal impedance(FRD)Z_{thJF} FRD(K/W)

图 14：典型的瞬态热阻抗(FRD)Z_{thJF} FRD(K/W)

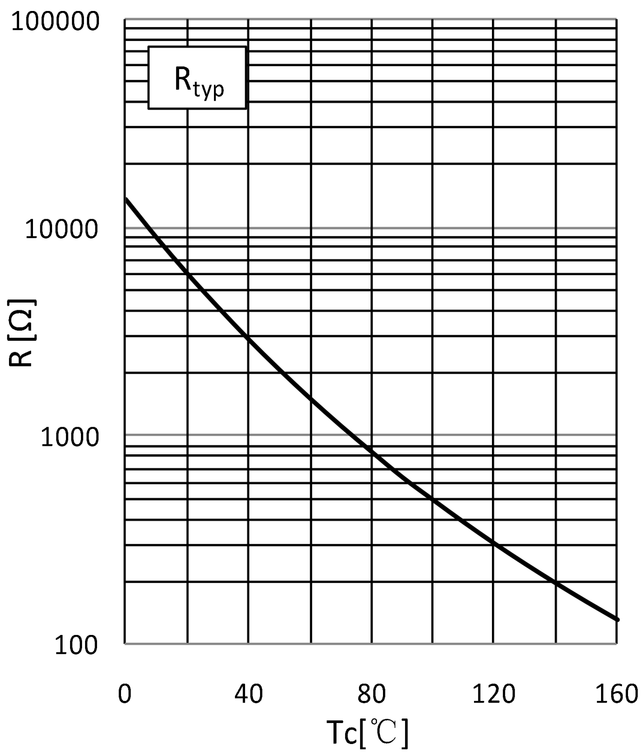
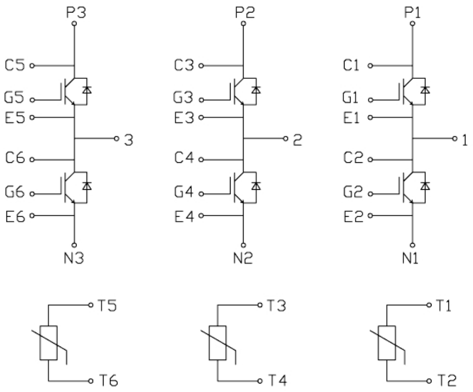
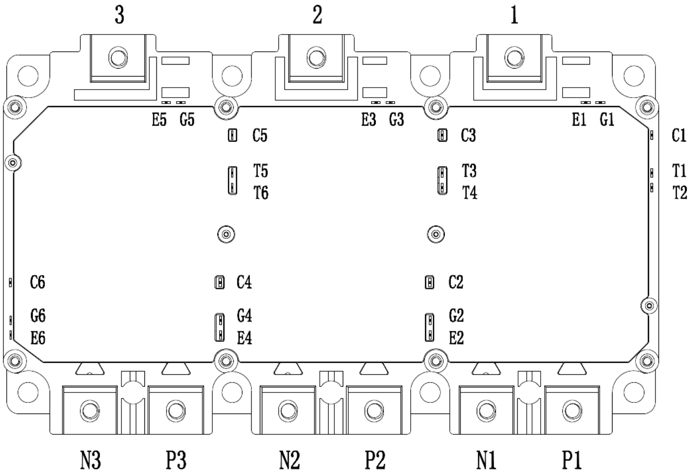


Fig.15:Typ. NTC-Temperature Characteristics

图 15：典型的 NTC 电阻-温度特性

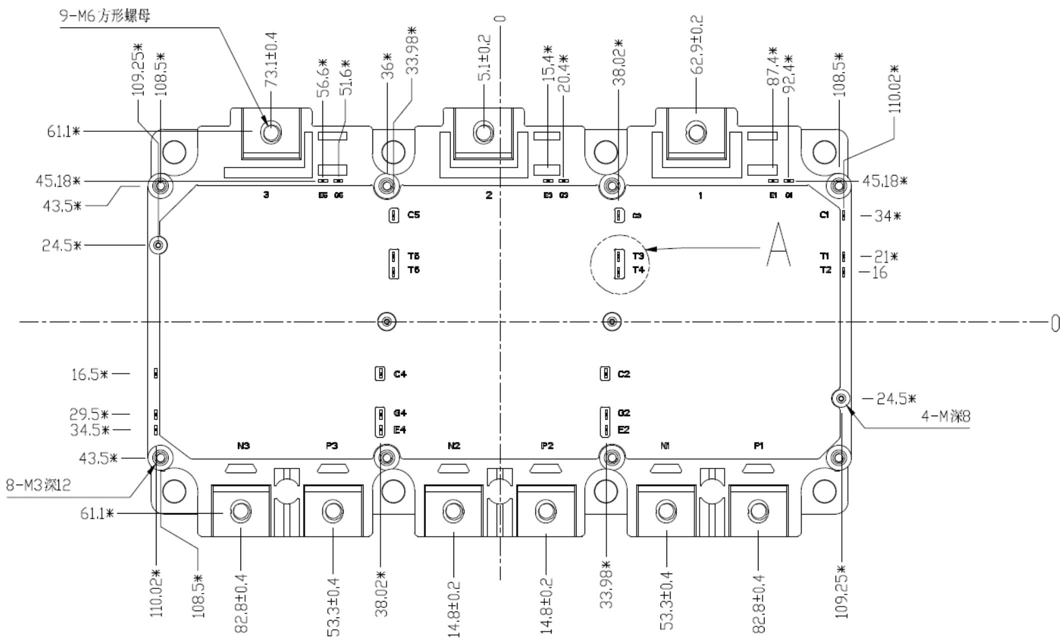
❒ Circuit Diagram/接线图

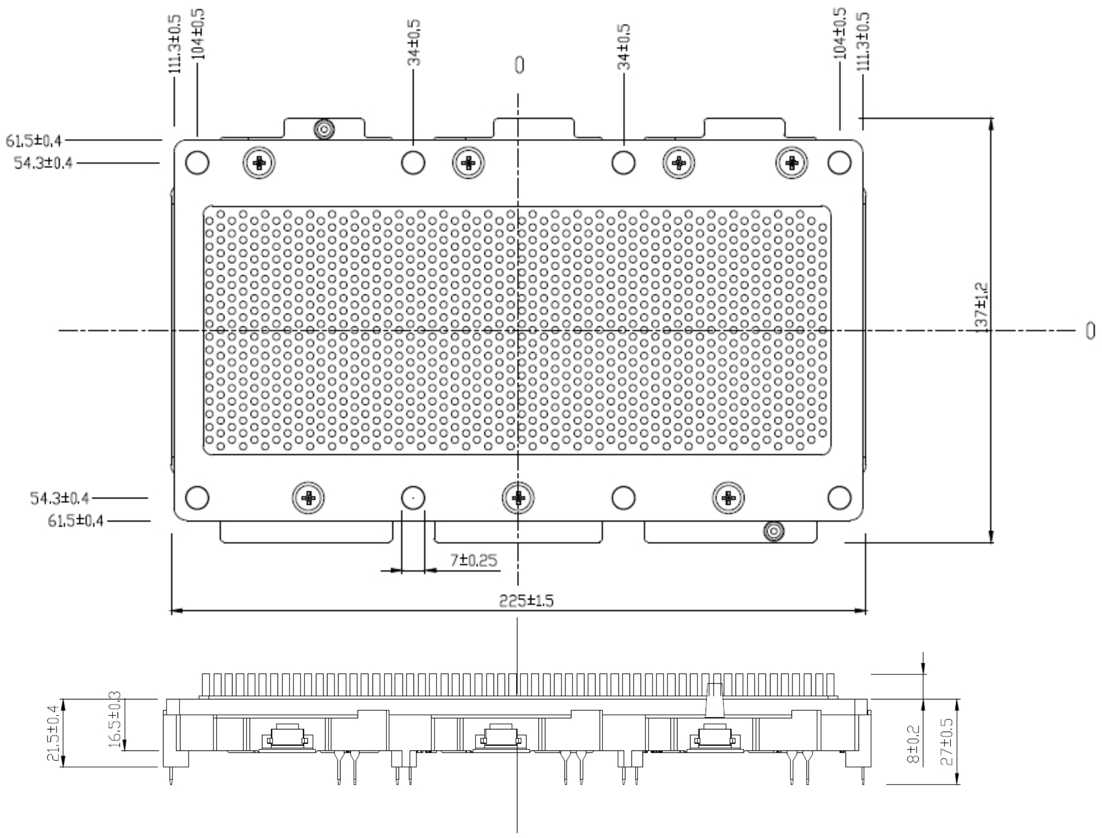




❒ Package outlines/封装尺寸

带*号尺寸为Φ±0.3





❒ Attached (recommended torque and screw)/附（推荐扭矩与螺钉）

Terminal Torque(M6): pre-tightening torque 0.5 N.m and final torque 3.0-4.5 N·m

端子扭矩(M6)预紧扭矩0.5 N.m, 最终扭矩3.0-4.5 N·m

Mounting Torque(M3):0.5-1.0 N·m

安装扭矩(M3): 0.5-1.0 N·m

For the 1.0mm thickness shielding plate mounting, we suggest you use the M2x5 screws

对于1.0mm厚度的屏蔽板安装, 建议使用M2X5的螺钉。

❒ Attention/注意事项

Correct and Safety Use of Power Module

Unsuitable operation (such as electrical, mechanical stress and so on) may lead to damage of power modules.

Please pay attention to the following descriptions and use BYD's IGBT modules according to the guidance.

功率模块安全正确的使用方法:

不当的操作（如电应力、机械应力等）可能导致模块损毁。请注意以下介绍，并根据指导来使用使用比亚迪IGBT模块。

During Transit:

• Tossing or dropping of a carton may damage devices inside.

• If a device gets wet with water, malfunctioning and failure may result. Special care should be taken during rain or snow to prevent the devices from getting wet.

运输过程中:

• 包装箱颠簸或坠落可能导致内部器件损毁。

• 器件遇水受潮将导致故障失效。在雨雪天气尤其要注意保护器件防止淋湿。

Storage:

• The temperature and humidity of the storage place should be 5~35°C and 45~75% respectively. The performance and reliability of devices may be jeopardized if devices are stored in an environment far above or below the range indicated above.

贮存：

• 贮存地点温度与湿度应分别控制在5~35°C和45~75%。如果贮存环境远高于或低于指示的变化范围，将危害器件的性能与可靠性。

Prolonged Storage:

• When storing devices more than one year, dehumidifying measures should be provided for the storage place. When using devices after a long period of storage, make sure to check the exterior of the devices is free from scratches, dirt, rust, and so on.

长期贮存：

• 当存储器件时间超过一年，贮存地点应当采取去湿措施。器件经过长期存放使用时，检查器件确保外观没有刮伤，灰尘，锈迹等。

Operating Environment:

• Devices should not be exposed to water, organic solvents, corrosive gases, explosive gases, fine particles, or corrosive agents, since any of those can lead to a serious accident.

应用环境：

• 器件不应当暴露在水，有机溶剂，腐蚀性气体、易燃易爆性气体，微尘，腐蚀性药剂中，上述任何一种情况都会导致严重事故。

Anti-electrostatic Measures:

• Following precautions should be taken for gated devices to prevent static buildup which could damage the devices.

(1) Precautions against the device rupture caused by static electricity

Static electricity of human bodies and cartons and/or excessive voltage applied across the gate to emitter may damage and rupture devices. Sense-emitter and temperature-sensor are also vulnerable to excessive voltage. The basis of anti-electrostatic is suppression of build-up and quick dissipation of the charged electricity.

* Containers that are susceptible to static electricity should not be used for transit or for storage.

* Signal terminals to emitter should be always shorted with a carbon cloth or the like until right before a module is used. Never touch the signal terminals with bare hands.

* Always ground the equipment and your body during installation (after removing a carbon cloth or the like. It is advisable to cover the workstation and its surrounding floor with conductive mats and ground them.

* Use soldering irons with grounded tips.

防静电措施：

•带栅极器件应采取以下预警来防止可以损毁器件的静电生成。

(1) 预防措施可以防止静电击穿器件。

*门极与发射极间产生的人体静电、包装箱静电和过电压将损毁或击穿器件。采样发射极和温度传感器同样容易受到过压损毁。防静电底板可以抑制电荷生成并快速耗散。

* 不要用易受静电影响的容器运输或贮存器件。

* 发射极信号端子应一直用碳纤维布或类似物短接直到模块使用前。任何情况下不要徒手碰触信号端子。

*安装过程中始终保持设备和你的身体接地(移除碳纤维布或类似物后)。用导电垫覆盖工作地点及周围地板并使其接地。

* 使用接地的烙铁头。

❒ Restrictions on Product Use/产品应用的限制

The information contained herein is subject to change without notice.
此处包含的信息如有变更,不另通知。
BYD Semiconductor Company Limited exerts the greatest possible effort to ensure high quality and reliability. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing products, to comply with the standards of safety in making a safe design for the entire system, including redundancy, fire-prevention measures, and malfunction prevention, to prevent any accidents, fires, or community damage that may ensue. In developing your designs, please ensure that products are used within specified operating ranges as set forth in the most recent products specifications.

比亚迪半导体股份有限公司致力于产品的高性能和高可靠性。然而,因为半导体器件固有的电敏感和较弱的抗物理压力能力,模块容易因此导致失效。当用户购买的产品时,用户有责任按照安全标准来为整个系统做出安全的设计,包括冗余度、防火、失效预防、来预防任何可能发生的事故、火灾或者可能引起的社区危害。请改善您的设计,确保的产品在额定范围内使用并参考最新的产品规格书。

The products listed in this document are intended for usage in general electronics applications (personal equipment, measuring equipment, industrial robotics, domestic appliances, etc. These products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury (“Unintended Usage”). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of BME products listed in this document shall be made at the customer’s own risk.

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