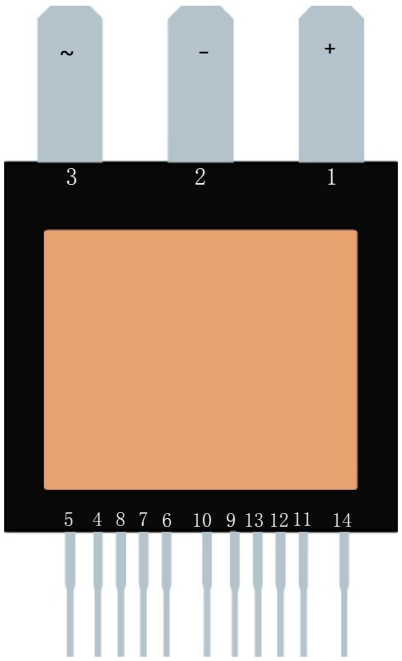
❒ 总体描述 / General Description

BG200B12LD1 是一款紧凑型双面冷却 IGBT 半桥模块，能有效的提升电动机的功率密度；另外，模块集成了电流与温度检测功能，可更快的响应以实现所需保护；

BG200B12LD1 is a very compact half-bridge IGBT module with double-sided cooling. Because of the heat dissipation on both sides, it is more efficient than the normal single-side cooling module, which is beneficial to improve the power density of the motor controller. The module of IGBT chip integrates the function of current and temperature monitoring, which can achieve a current and temperature monitoring in the chip level, and its response is faster than traditional way. When the abnormal situation, can be very instant protection measures, to ensure the stability and reliability of the product. The module is very suitable for such a bad application situation like the new energy vehicle.



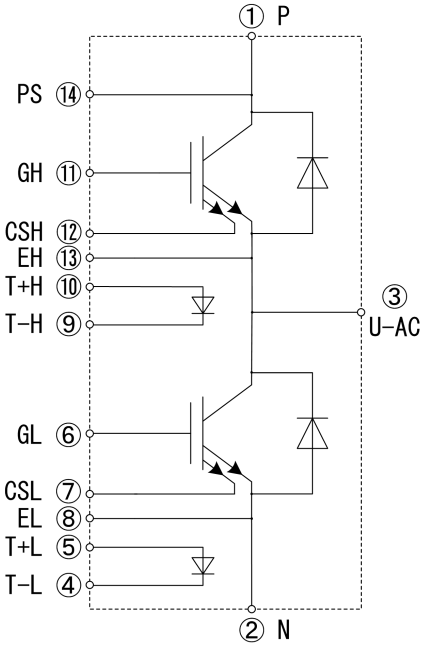
V_{ces}=1200V,I_c=200A

❒ 关键特性 / Key Features

- 优良的散热性能
- 小寄生电感、表面绝缘
- 集成温度检测、电流检测
- 低功率损耗、高工作频率利于高功率密度设计
- Superior thermal performance
- Low inductance design with module cooling surfaces electrically isolated
- Integrated temperature and current sense
- Low power loss and high working frequency Is provided to suit high power density application.

❒ 典型应用 / Typical Applications

- 电动车控制器
- 高功率密度马达驱动器
- Main inverter and generator for hybrid and electric vehicle
- High power density motor drives



❒ IGBT，逆变器/ IGBT, Inverter

● 最大额定值 / Maximum Rated Values

Items	Conditions	Symbol	Values	Units
集电极-发射极电压 Collector-emitter voltage	T_j=25℃	V_{CES}	1200	V
栅极-发射极电压 Gate-emitter voltage	T_j=25℃	V_{GES}	±20	V
集电极电流 Collector current	T_f=25℃,T_j=150℃,I_{DC}	I_{C_nom}	260	A
	T_f=60℃,T_j=150℃,I_{DC}	I_C	200	A
集电极重复峰值电流 Repetitive peak collector current	Pluse,t_p=1ms, T_j=25℃	I_{CRM}	400	A
总功率损耗 Total power dissipation	T_C=100℃,T_{jopmax}=150℃	P_{tot}	1200	W

● 特征值 / Characteristics Values

Items	Conditions	Symbol	Values			Units
			Min.	Typ.	Max.	
集电极-发射极击穿电压 Collector-emitter Break-down voltage	T_j=25℃, V_{GE}=0V, I_C=100uA	V_{BRCES}	1220	-	-	V
集电极-发射极饱和压降 Collector-Emitter Saturation Voltage	I_C=200A,V_{GE}=15V,T_j=25℃	$V_{CE(sat)}$	-	1.7	2.1	V
	I_C=200A,V_{GE}=15V,T_j=125℃		-	1.94	-	V
	I_C=200A,V_{GE}=15V,T_j=150℃		-	2.0	-	V
阈值电压 Gate threshold voltage	V_{CE}=V_{GE},I_C=100mA,T_j=25℃	$V_{GE(th)}$	5.5	6.2	6.9	V
栅极电荷 Gate charge	V_{GE}=-10V…+20V	Q_G	-	1.4	-	uC
内置栅极电阻 Internal gate resistance	Per switch, T_j=25℃	R_{gint}	-	1	-	Ω
输入电容 Input capacitance	T_j=25℃,f=1MHz V_{GE}=0V, V_{CE}=10V	C_{ies}	-	18.5	22.0	nF
反向传输电容 Reverse capacitance		C_{res}	-	-	1.3	nF
输出电容 Output capacitance		C_{oes}	-	-	2.0	nF
集电极-发射极截止电流 Collector-emitter cut-off current	V_{CE}=1200V,V_{GE}=0V,T_j=25℃	I_{CES}	-	-	100	uA
栅极-发射极漏电流	V_{CE}=0V,V_{GE}=20V,T_j=25℃	I_{GES}	-	-	600	nA

Gate-emitter leakage current							
开通延迟 Turn-on delay time	I_C =200 A V_{CE} =600 V V_{GE}=-8V…+15 V R_G =3.3Ω L_s=65nH Per pulse（每脉冲） inductive load （感性负载）	T_j=25℃	t_{d_on}	-	175	-	nS
		T_j=125℃		-	175	-	nS
		T_j=150℃		-	175	-	nS
上升时间 Rise time		T_j=25℃	t_r	-	58	-	nS
		T_j=125℃		-	61	-	nS
		T_j=150℃		-	64	-	nS
关断延迟 Turn-off delay time		T_j=25℃	t_{d_off}	-	370	-	nS
		T_j=125℃		-	420	-	nS
		T_j=150℃		-	430	-	nS
下降时间 Fall time		T_j=25℃	t_f	-	320	-	nS
		T_j=125℃		-	410	-	nS
		T_j=150℃		-	433	-	nS
开通损耗 Turn-on energy loss		T_j=25℃	E_{on}		9.5		mJ
		T_j=125℃		-	13.0	-	mJ
		T_j=150℃		-	14.0	-	mJ
关断损耗 Turn-off energy loss		T_j=25℃	E_{off}	-	22.0	-	mJ
		T_j=125℃		-	28.0	-	mJ
		T_j=150℃		-	29.0	-	mJ
短路数据 SC data	V_{GE}=15V V_{CE}=800V t_p=3uS Rg=5Ω/93Ω	T_j=150℃	I_{sc}	-	2950	-	A
E-e 电流比例 The ratio of terminal_E to Auxiliary terminal _e	V_{GE}=15V,I_C=260A, R_e=16.7Ω	T_j=25℃	$\gamma_{E/e}$	-	14400	-	-
		T_j=125℃		-	13400	-	-
		T_j=150℃		-	13100	-	-
温度二极管电压 voltage of temperature diode	I_D=200uA	T_j=25℃	$V_{f\_temp\ diode}$	-	2.015	-	V
		T_j=125℃		-	1.624	-	V
		T_j=150℃		-	1.524	-	V

FRD，快恢复二极管 / FRD, Diode

● 最大额定值 / Maximum Rated Values

Items	Conditions	Symbol	Values	Units
反向重复峰值电压 Repetitive peak reverse voltage	T_j=25℃	V_{RRM}	1200	V
连续正向直流电流 Continuous Forward current	T_j=25℃	I_F	200	A
正向重复峰值电流 Repetitive peak forward current	Pluse,t_p=1ms	I_{FRM}	400	A

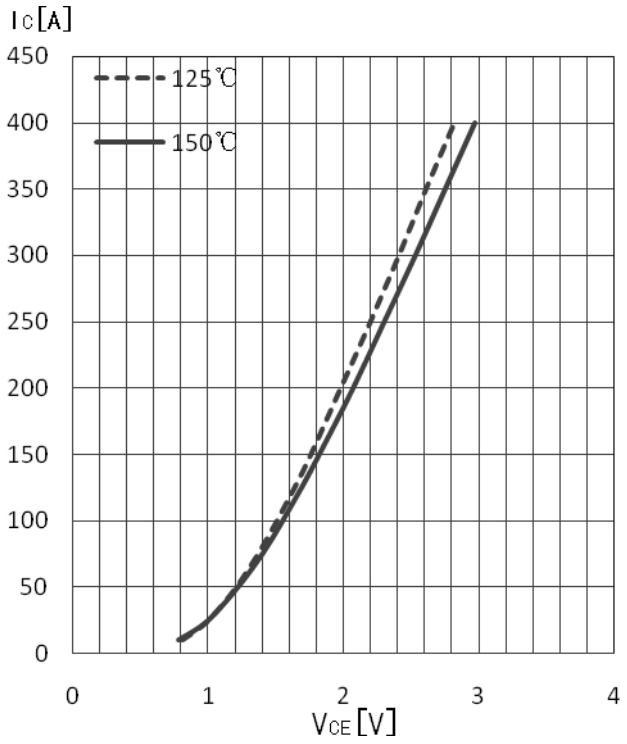
● 特征值 / Characteristics Values

Items	Conditions		Symbol	Values			Unit
				Min.	Typ.	Max.	s
正向压降 Forward voltage	I_F=200A V_{GE}=0V	T_j=25˚C	V_F	-	2.4	2.7	V
		T_j=125˚C		-	2.6	-	V
		T_j=150˚C		-	2.7		V
反向恢复峰值电流 Peak reverse recovery current	I_F= 200 A V_R = 600 V V_{GE}=-8V…+15V R_G=3.3Ω L_s=50nH Per pulse（每脉冲） inductive load （感性负载）	T_j=25˚C	I_{RM}	-	160.0	-	A
		T_j=125˚C		-	185.0	-	A
		T_j=150˚C		-	200.0	-	A
反向恢复电荷 Recovered charge		T_j=25˚C	Q_r	-	14.0	-	uC
		T_j=125˚C		-	26.0	-	uC
		T_j=150˚C		-	29.0	-	uC
反向恢复损耗 Reverse recovery energy		T_j=25˚C	E_{rec}	-	6.0	-	mJ
		T_j=125˚C		-	11.0	-	mJ
		T_j=150˚C		-	14.0	-	mJ
反向恢复时间 Reverse recovery time		T_j=25˚C	t_{rr}	-	340	-	nS
		T_j=125˚C		-	700	-	nS
		T_j=150˚C		-	770	-	nS

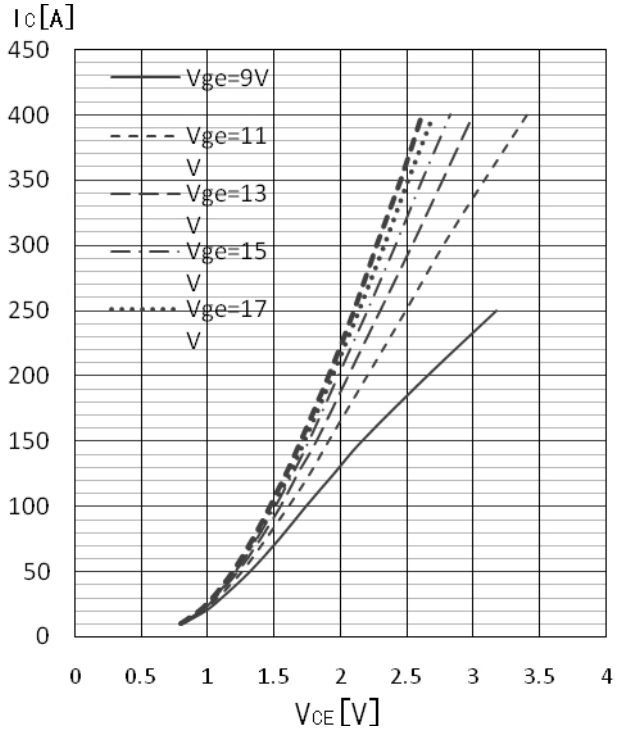
❒ 模块 / Module

Items	Conditions	Symbol	Values			Units
			Min.	Typ.	Max.	
最高结温 Maximum junction temperature	-	T_{jmax}	-	-	175	℃
最高允许工作结温 Temperature under switching conditions	-	T_{jop}	-	-	150	℃
储存温度 Storage temperature	-	T_{stg}	-40	-	125	℃
结-外壳热阻 IGBT IGBT, thermal resistance, junction to case, per IGBT	Cooling fluid:50%water+50% ethylenglycol,10L/min	R_{thjc_IGBT}	-	0.042	-	K/W
结-外壳热阻 FRD Diode, thermal resistance, junction to case, per FRD		R_{thjc_Diode}	-	0.050	-	K/W
杂散电感 Stray inductance	F=10KHz,V=1.0V	L_{S_CE}	-	36	-	nH
绝缘耐压 Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V_{isol}	2.5	-	-	KV
重量 Weight	-	G	59	61	63	g
基板平面度 Flatness of base plate	On the centerline X, Y	e_c	50	75	100	Um
爬电距离 Creepage distance	Terminal to terminal（端子-端子）	-	10	-	-	Mm
电器间隙 Clearance	Terminal to terminal（端子-端子）	-	10	-	-	Mm
耐受压力 withstand the pressure	-	-	-	-	1500	N
内部绝缘介质 Internal isolation		-	Al_2O_3+AlN			-
相对电痕指数 Comparative tracking index	-	CTI	≥600			-

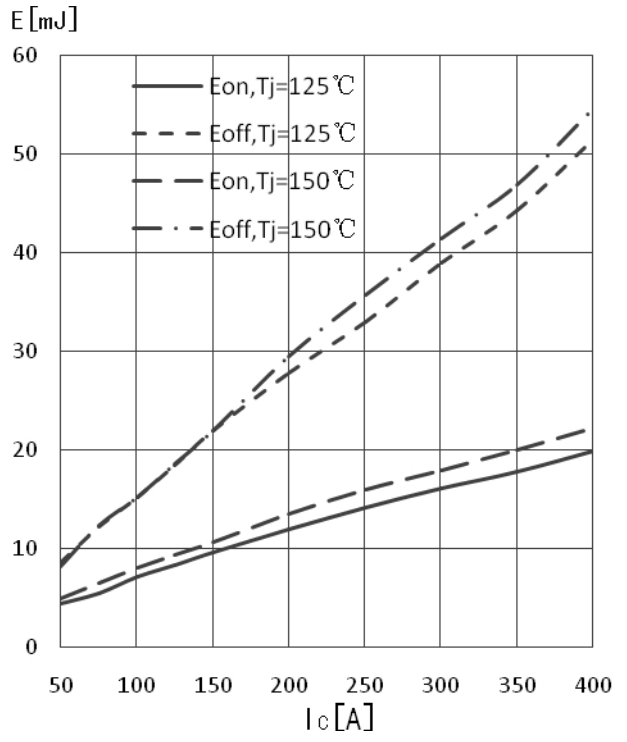
❒ 特性曲线 / Characteristics Diagrams



输出特性 /output characteristic IGBT

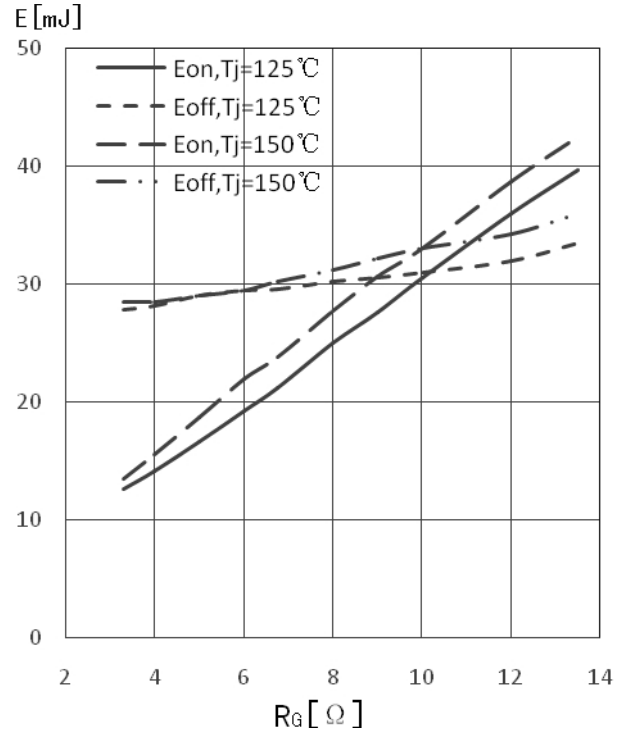


输出特性 / output characteristic IGBT



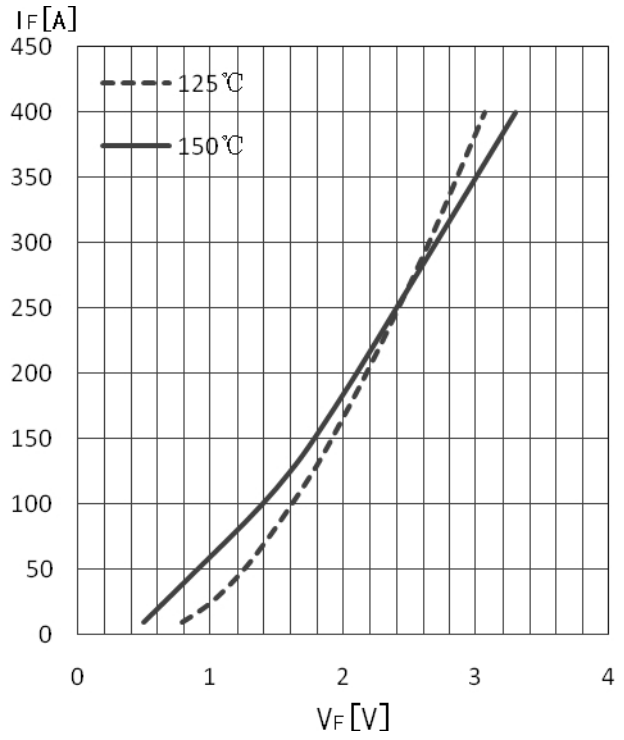
开关损耗与集电极电流/Switching Loss vs.Collector current

IGBT/ V_{CE}=600V ,V_{GE}=-8V…+15V,R_{ON}=R_{OFF}=3.3Ω

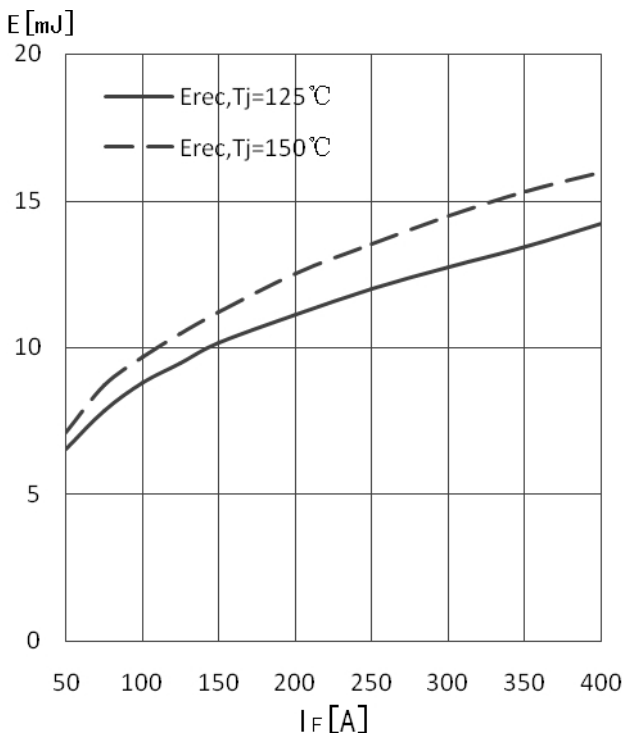


开关损耗与门极电阻/Switching Loss vs.Gate Resistor

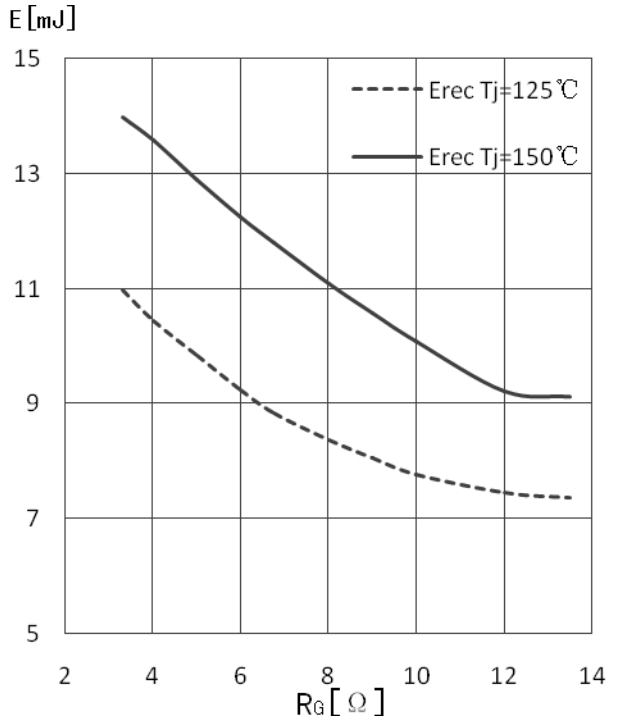
IGBT/ VCE=600V, IC=200A , VGE=-8V…+15V



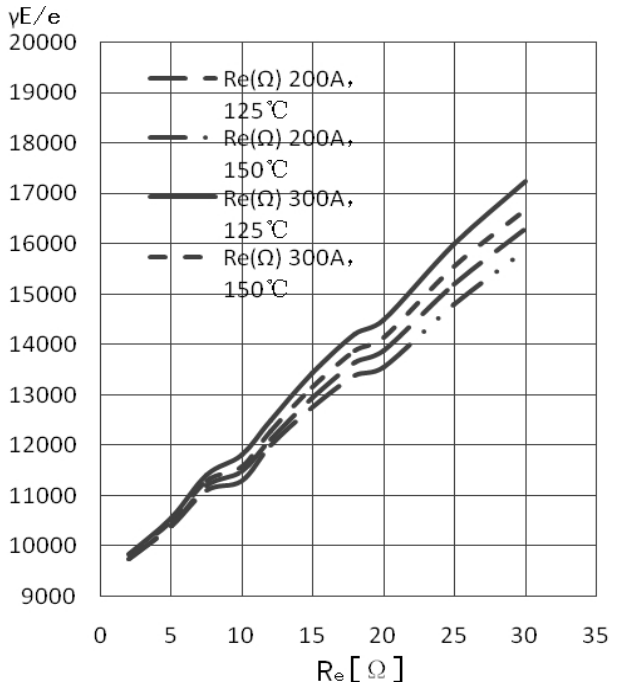
输出特性 / output characteristic FRD



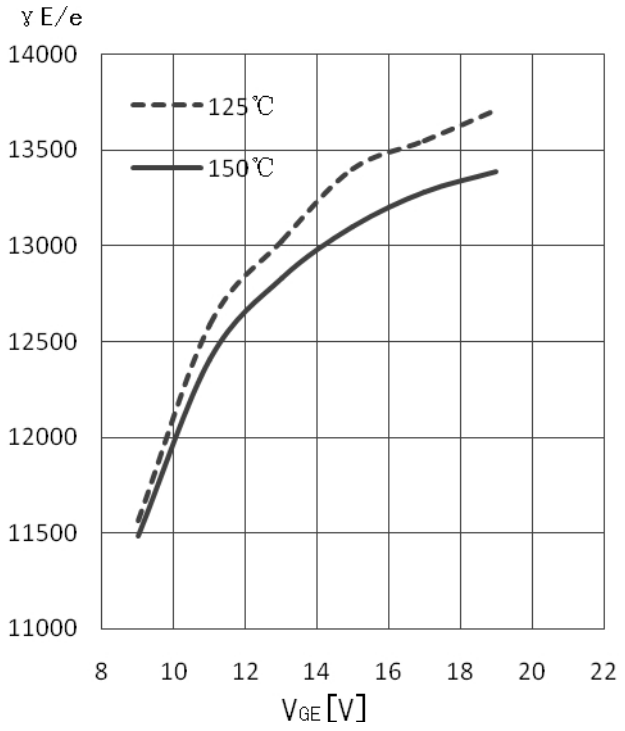
开关损耗/ Switching Loss FRD
VCE=600V ,RON=ROFF=3.3Ω



开关损耗与门极电阻/ Switching Loss vs. Gate Resistor FRD
VCE=600V，IC=200A ,VGE=-8V…+15V

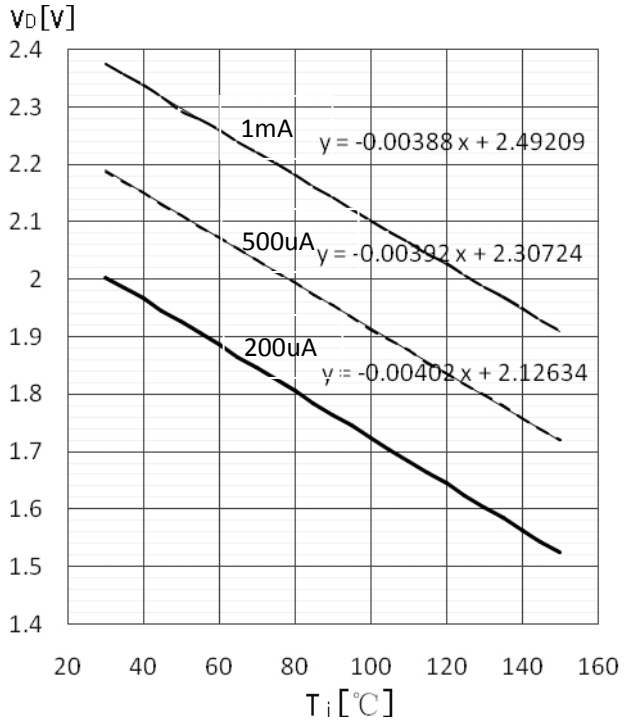


放大倍数与检测电阻/Magnify Multiple vs. Sense Resistor VGE=-8V…+15V

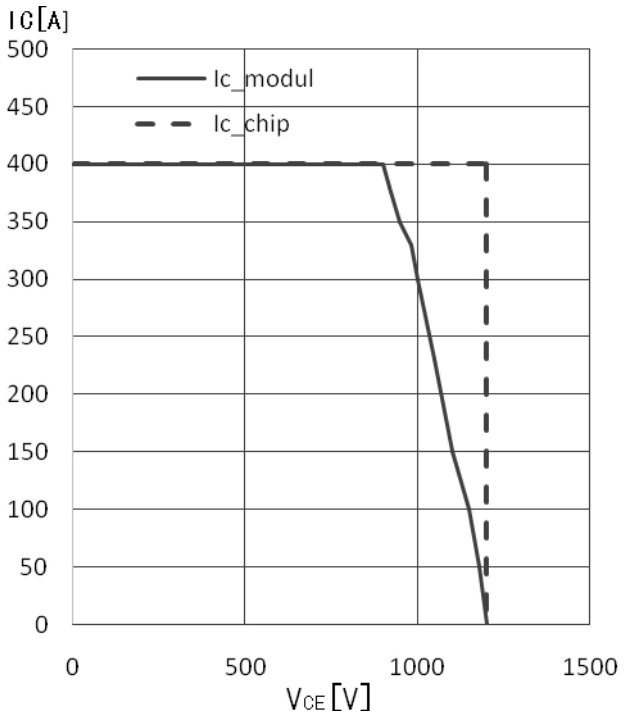


放大倍数与门极电压/Magnify Multiple vs. Gate Voltage

I_C=200A R=18Ω V_{GE}=-8V…+15V

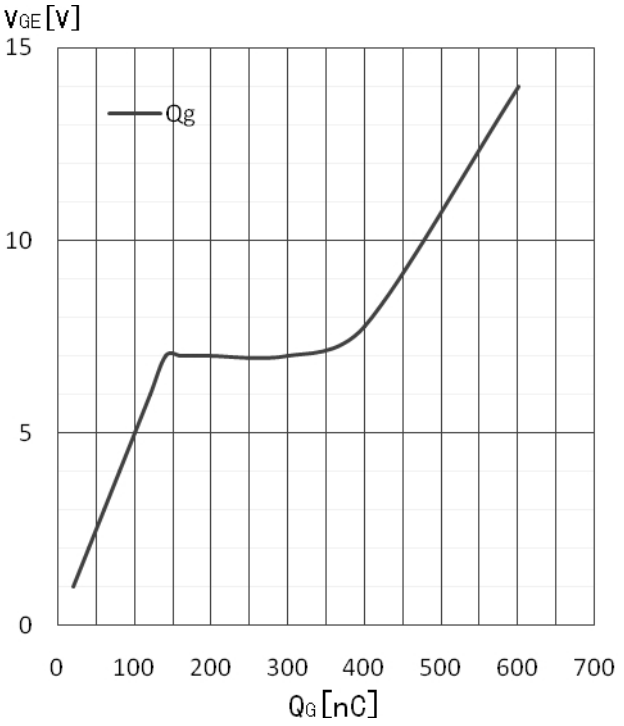


温度传感 / Temperature sensor



反偏安全工作区/ Reverse Bias Safe Operating Area

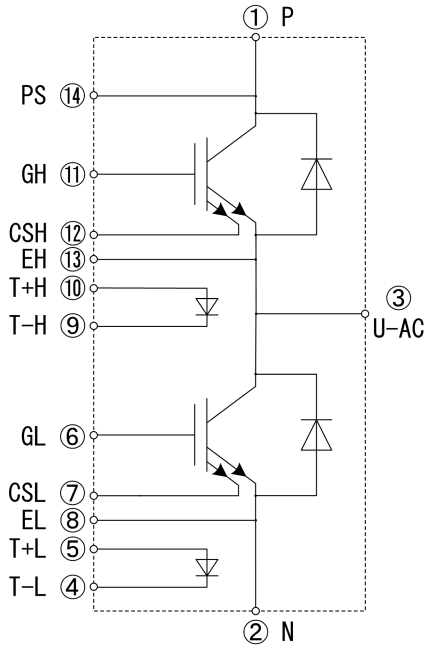
V_{GE}=-8V…+15V



门极电荷/Gate Charge

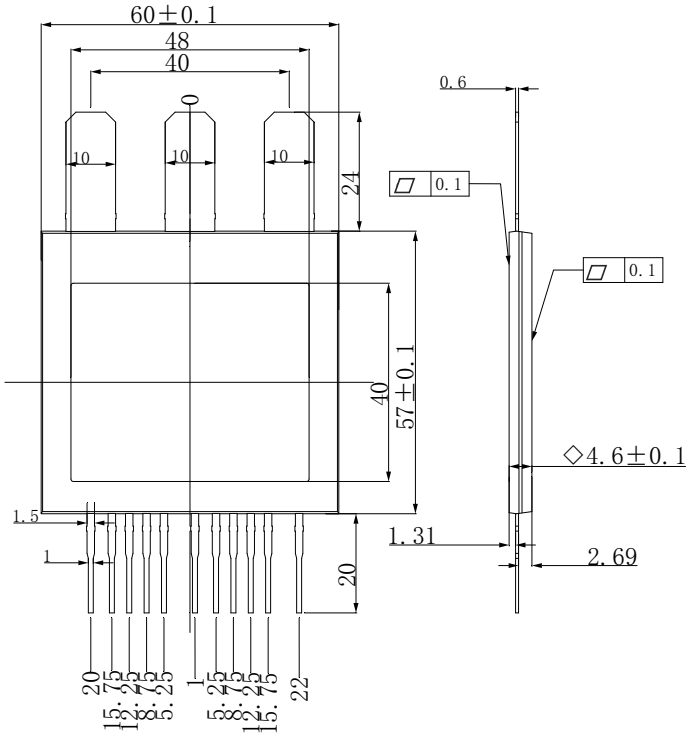
VGE=-8V…+15V

❒ 拓扑图 / Circuit_ Diagram_headline



(1) 电源正极 / P-POSITIVE Power
(2)电源负极 / N-NEGATIVE Power
(3)交流输出 / U-AC OUTPUT
(4)下桥温度二极管阴极 / T-L-Temp Output Low
(5)下桥温度二极管阳极 / T+L-Temp Input Low
(6)下桥门极 / GL-Gate Low
(7)下桥电流传感 / CSL-Current Sensor Low
(8)下桥发射极 / EL-Emitter Low
(9)上桥温度二极管阴极 / T-H-Temp Output High
(10)上桥温度二极管阳极 / T+H-Temp Input High
(11)上桥门极 / GH-Gate High
(12)上桥电流传感 / CSH-Current Senor High
(13)上桥发射极 / EH-Emitter High
(14)上桥集电极 / PS-Collector

❒ 封装尺寸 / Package outlines



注意事项 / Attention

正确、安全使用功率模块

不当操作（比如电、机械应力等）可能引起功率模块损坏；请注意按照以下描述及使用比亚迪模块指引操作；

运输

包装盒的摇动或掉落可能会损坏里面的模块；如果模块被水打湿，可能会发生故障，尤其要注意雨雪天防止模块被打湿；

储存

贮存温度范围-40℃-125℃，湿度 45-75%，如果贮存条件远高于或低于标准，可能会降低模块的性能；

长时间储存

当模块贮存超过一年时，场地必须实施除湿措施，要使用贮存长时间之后的模块时，一定要检查模块是否有灰尘、铁锈等；

运行环境

模块不能暴露于水、有机溶剂、腐蚀性气体、腐蚀剂等，否则容易引起事故；

静电防护措施

以下预防措施对于模块静电防护来说是很有必要的：

人体静电或超过栅极到发射极耐压的应用都有可能导致模块损坏；电流检测和温度检测也容易过压损坏；静电防护的基础措施是内在抑制和快速泄放；

对静电敏感的器皿不能被用来做运输或贮存；

模块使用之前信号端子到发射极应使用碳纤维布或类似产品始终保持短路状态，不能用手接触信号端子；

去掉碳纤维布或类似物后，用导体将地面设备和人体周围的大地覆盖起来是很有必要的；

使用的烙铁一定要接地；

Correct and Safety Use of the 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.

During Transit:

Tossing or dropping of a carton may damage modules inside.

If a module gets wet with water, malfunctioning and failure may be resulted. Special care should be taken during rain or snow to prevent the modules from getting wet.

Storage:

The temperature and humidity of the storage place should be -40℃~125°C and 45~75% respectively. The performance and reliability of modules may be jeopardized if modules are stored in an environment far above or below the range indicated above.

Prolonged Storage:

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

Operating Environment:

Modules 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.

Anti-electrostatic Measures:

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

Precautions against the modules 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 modules. 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.

限制应用 / Restrictions on Product Use

- 本资料内容随产品的改进，可能会有未经预告之修改，本公司拥有优先修改权。
- 尽管本公司一向致力于提高产品质量和可靠性，但是半导体产品有可能按某种概率发生故障或错误工作，为防止因故障或错误工作而产生人身事故，火灾事故，社会性损害等，请充分留意冗余设计、火灾蔓延对策设计、防止错误动作设计等安全设计。
- 本文所列比亚迪产品仅可应用于计算机、个人设备、办公设备、测量设备、工业机器臂、家用电器等通用电气设备中，不可用于对精度、可靠性要求极高的设备中，也不可应用于会造成人身伤亡的设备中，不可用设备包括但不限于原子能控制器、航空航天设备、医疗设备与其他安环设备，对产品不恰当的使用将由使用者承担可能存在的风险。

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- 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.
- The products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office 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 products listed in this document shall be made at the customer’s own risk.