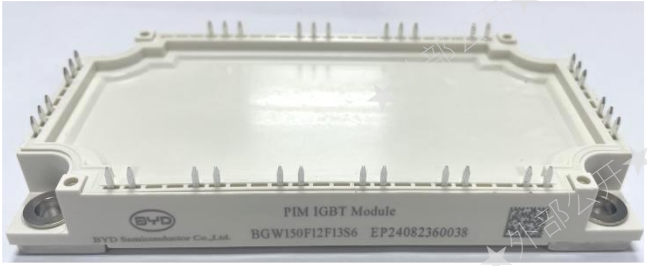
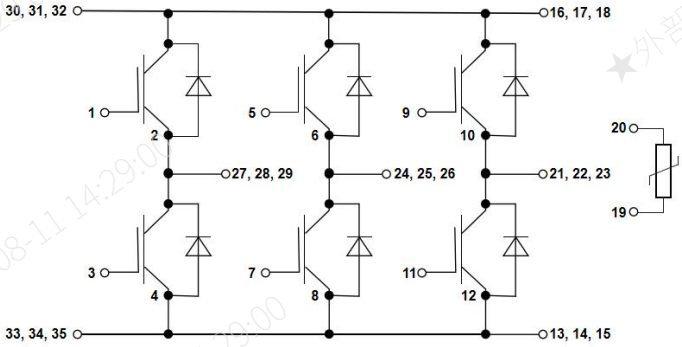
❒ General Description

This IGBT module, which adopts general packaging, provides low switching losses characteristic as well as high power and thermal cycling capability, which introduce the advanced IGBT chip/FRD and improved connection.





❒ 概述

这款 IGBT 模块采用了标准封装，使用高性能的 IGBT 芯片和 FRD 芯片和优化的电气连接，具有低开关损耗和高功率循环和温度循环能力。

❒ Key Features

- Full-bridge module
- High short circuit withstabd capability
- Ultra low conduction and switching loss
- Integrated NTC temperature sensor
- Copper Base Plate

❒ 关键特性

- 全桥模块
- 高短路耐量
- 低导通和开关损耗
- 集成温度传感器
- 铜基板

❒ Applications

- Automotive Application
- AC Motor Control
- Motion/Servo Control
- Power supply

❒ 应用

- 交流马达控制
- 逆变器
- 光伏领域
- 汽车领域

❒ IGBT/IGBT

● Maximum Rated Values/最大额定值

Parameter	Symbol	Conditions	Values	Units
Collector-emitter voltage 集电极-发射极电压	V_{CES}	T_{vj}=25℃, V_{GE}=0V	1200	V
Continuous collector current 连续集电极直流电流	I_C	T_c=80℃, T_{vj}=150℃	150	A
Gate-emitter voltage 栅极-发射极电压	V_{GES}	T_{vj}=25℃	±20	V
Peak collector current 集电极峰值电流	I_{CRM}	Pluse，t_p=1ms, T_{vj}=25℃	300	A
Total power dissipation 总耗散功率	P_{tot}	T_c=25℃, T_{vj}=150℃	625	W

● Characteristics Values/特征值

Parameter	Symbol	Conditions	Values			Units
			Min.	Typ.	Max.	
Collector-Emitter Saturation Voltage 集电极-发射极饱和电压	V_{CEsat}	I_C=150A,V_{GE}=15V,T_{vj}=25℃	1.3	-	2.2	V
		I_C=150A,V_{GE}=15V,T_{vj}=150℃	-	1.8	-	V
Gate-emitter threshold voltage 栅极-发射极阈值电压	V_{GEth}	V_{CE}=V_{GE},I_C=6mA,T_{vj}=25℃	5.0	6.0	7.0	V
Gate charge 栅极电荷	Q_G	V_{GE}=-8V…+15V	-	0.81	-	uC
Internal gate resistor 内部栅极电阻	R_{gint}	T_{vj}=25℃	-	2.5	-	Ω
SC data 短路数据	I_{SC}	V_{GE} = 15 V, V_{CC} = 750 V V_{CEmax} = V_{CES} - L_{sCE} ·di/dt T_P≤ 10 μs，T_j=25℃	-	900	-	A
Input capacitance 输入电容	C_{ies}	T_{vj}=25℃,f=1MHz, V_{GE}=0V, V_{CE}=25V	-	12.5	-	nF
Reverse transfer capacitance 反向传输电容	C_{res}		-	102	-	pF
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℃	-	-	100	μA
Gate-emitter leakage current 栅极-发射极漏电流	I_{GES}	V_{CE}=0V,V_{GE}=20V,T_{vj}=25℃	-	-	200	nA

Parameter	Symbol	Conditions		Values			Units
				Min.	Typ.	Max.	
Turn-on delay time 开通延迟时间	$t_{d\ on}$	I_C = 150 A, V_{CE} = 650 V V_{GE} = -8V…+15 V R_{Gon}/ R_{Goff}= 2.5/5.0Ω, L_s = 50nH	T_{vj}=25℃	-	108	-	ns
			T_{vj}=150℃	-	117	-	ns
Rise time 上升时间	t_r		T_{vj}=25℃	-	40	-	ns
			T_{vj}=150℃	-	50	-	ns
Turn-off delay time, 关断延迟时间	$t_{d\ off}$		T_{vj}=25℃	-	307	-	ns
			T_{vj}=150℃	-	375	-	ns
Fall time 下降时间	t_f		T_{vj}=25℃	-	265	-	ns
			T_{vj}=150℃	-	400	-	ns
Turn-on energy loss 开通损耗	E_{on}		T_{vj}=25℃	-	8	-	mJ
			T_{vj}=150℃	-	12	-	mJ
Turn-off energy loss 关断损耗	E_{off}		T_{vj}=25℃	-	15	-	mJ
			T_{vj}=150℃	-	22	-	mJ

❒ FRD/二极管

● Maximum Rated Values/最大额定值

Parameter	Symbol	Conditions	Values	Units
Repetitive peak reverse voltage 反向重复峰值电压	V_{RRM}	T_{vj}=25℃	1200	V
Diode DC forward current 二极管直流正向电流	I_F	T_C=25℃	160	A
Repetitive peak forward current 正向重复峰值电流	I_{FRM}	t_p=1ms,T_{vj}=25℃	320	A
I^2t -value I^2t -值	I^2t	V_R=0V,t_p=10ms,T_{vj}=150℃	3000	A^2s

● Characteristics Values/特征值

Parameter	Symbol	Conditions		Values			Units
				Min.	Typ.	Max.	
Forward voltage 正向电压	V_F	I_F=160A, V_{GE}=0V	T_{vj}=25℃	1.5	2.0	2.5	V
			T_{vj}=150℃	-	2.0	-	V
Peak reverse recovery current 反向恢复峰值电流	I_{RM}	I_F=150 A, V_R = 650 V, V_{GE}=-8V…+15V, Ls=50nH	T_{vj}=25℃	-	145	-	A
			T_{vj}=150℃	-	155	-	A
Recovered charge 恢复电荷	Q_r		T_{vj}=25℃	-	16	-	uC
			T_{vj}=150℃	-	30	-	uC
Reverse recovery energy 反向恢复损耗	E_{rec}		T_{vj}=25℃	-	8	-	mJ
			T_{vj}=150℃	-	15	-	mJ

❒ Module/模块

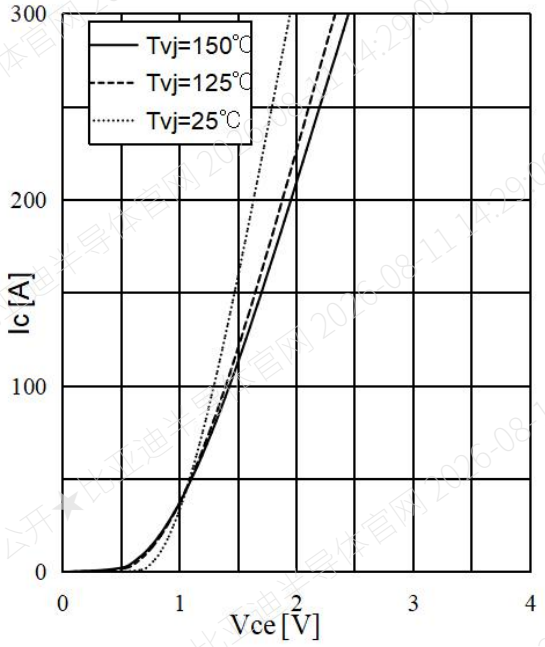
Parameter	Symbol	Conditions	Values			Units
			Min.	Typ.	Max.	
Maximum junction temperature 最大结温	T_{vjmax}	-	-	-	150	℃
Temperature under switching conditions 开关状态下温度	T_{vjop}	-	-40	-	150	℃
Storage temperature 储存温度	T_{stg}	-	-40	-	150	℃
IGBT, thermal resistance, junction to case 结-外壳热阻	$R_{thjc\ IGBT}$	per IGBT 每个 IGBT	-	0.200	0.2084	K/W
IGBT, thermal resistance, case to heatsink 外壳-散热器热阻	$R_{thch\ IGBT}$	per IGBT/每个 IGBT λ paste=1W(m.K) / λ grease=1W(m.K)	-	0.032	-	K/W
Diode, thermal resistance, junction to case 结-外壳热阻	$R_{thjc\ Diode}$	per diode 每个二极管	-	0.28	0.3286	K/W
Diode, thermal resistance, case to heatsink 外壳-散热器热阻	$R_{thch\ Diode}$	per diode/每个二极管 λ paste=1W(m.K) / λ grease=1W(m.K)	-	0.04	-	K/W
Module, thermal resistance, case to heatsink 外壳-散热器热阻	$R_{thch\ Module}$	per module/每个模块 λ paste=1W(m.K) / λ grease=1W(m.K)	-	0.009	-	K/W

Parameter	Symbol	Conditions	Values			Units
			Min.	Typ.	Max.	
Stray inductance module 模块杂散电感	L_{sCE}	-	-	22	-	nH
Module lead resistance, terminals - chip 模块引线电阻,端子-芯片	$R_{CC'+EE'}$	T_{vj}=25℃，per switch	-	1.8	-	mΩ
Isolation test voltage 绝缘测试电压	V_{isol}	AC: 3800~3850V, 升压 5S 持续 30S，下降 5S, 漏电≤ 2.0mA； DC: 3800~3850V, 升压 3S 持续 10S，下降 3S, 漏电≤0.05mA；	3.8	-	-	kV
Weight 重量	G	-	-	310	-	g
Creepage distance 爬电距离	ds	Terminal to terminal 端子到端子	-	10.0	-	mm
		Terminal to base 端子到基板	-	12.0	-	
Clearance distance in air 空气间隙	da	Terminal to terminal 端子到端子	-	10.0	-	
		Terminal to base 端子到基板	-	7.5	-	
Mounting torque for module mounting 模块的安装扭距	M_1	Screw M5 M5 螺栓	3	-	6	N.m
Internal isolation 内部绝缘	-	ceramics 陶瓷	Al_2O_3			-
Material of module baseplate 模块基板材料	-	-	Cu			-
Dimensions 尺寸	L x W x H	-	122×62×20.5			mm
Comparative tracking index 相对电痕指数	CTI	-	>200			-

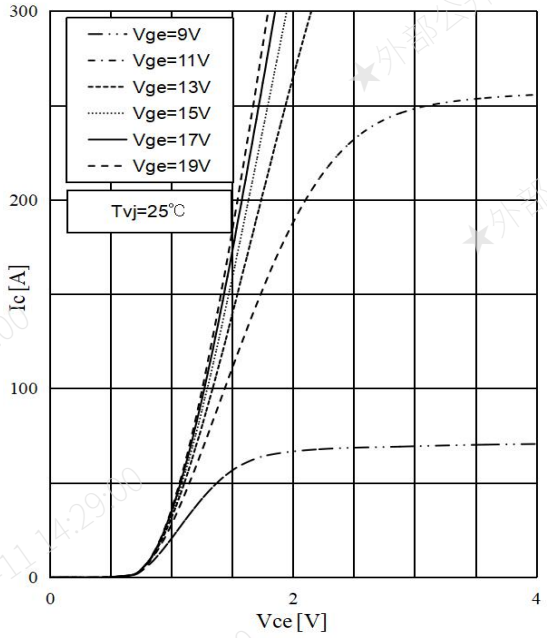
❒ NTC-Thermistor/负温度系数热敏电阻

Parameter	Symbol	Conditions	Values			Units
			Min.	Typ.	Max.	
Rated resistance 额定电阻值	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	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

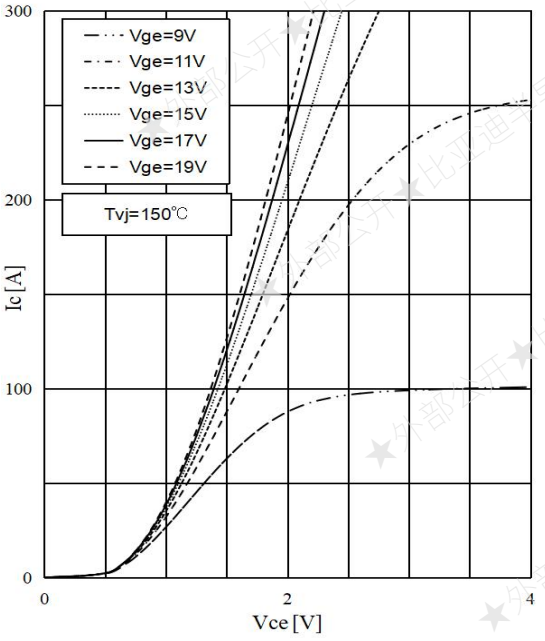
❒ Characteristics Diagrams/特性曲线



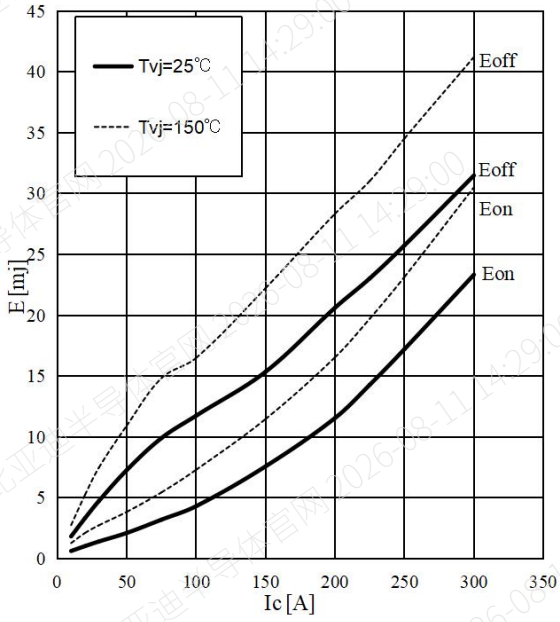
V_{GE} = 15V, I_C = f (V_{CE}) Fig.1: Output Characteristics
图 1：通态特性



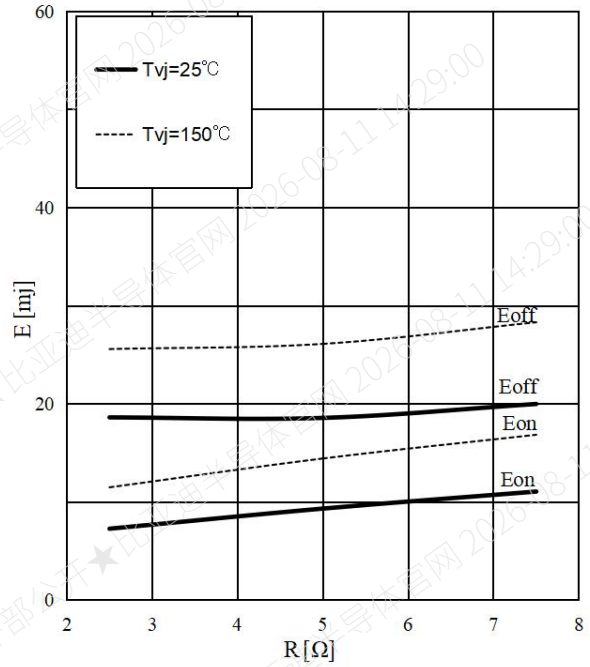
T_{vj} = 25℃ Fig.2:Output characteristics
图 2：输出特性



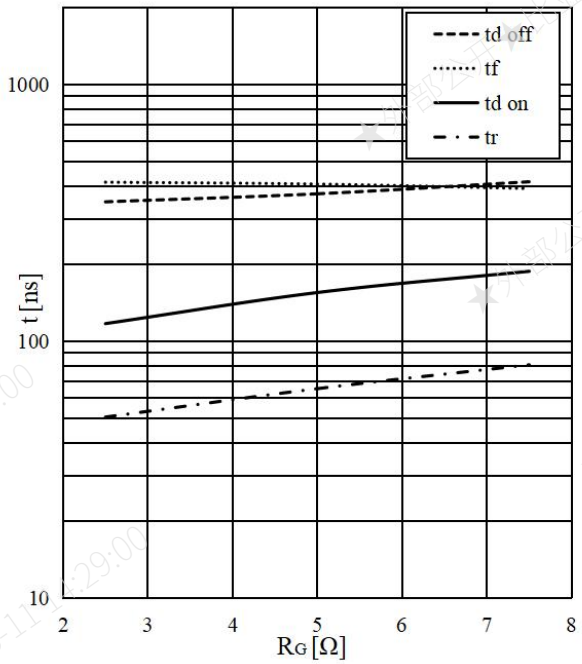
T_{vj} = 150℃ Fig.3: Transfer Characteristics
图 3：输出特性



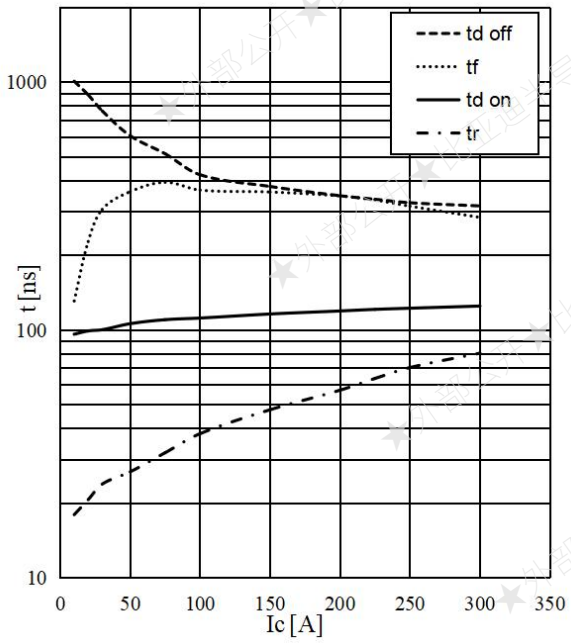
V_{GE} = 15 V, R_{Gon} = 2.5 Ω, R_{Goff} = 5 Ω, V_{CE} = 650 V
Fig.4: Switching Loss vs. Collector Current
图 4：开关损耗与集电极电流关系



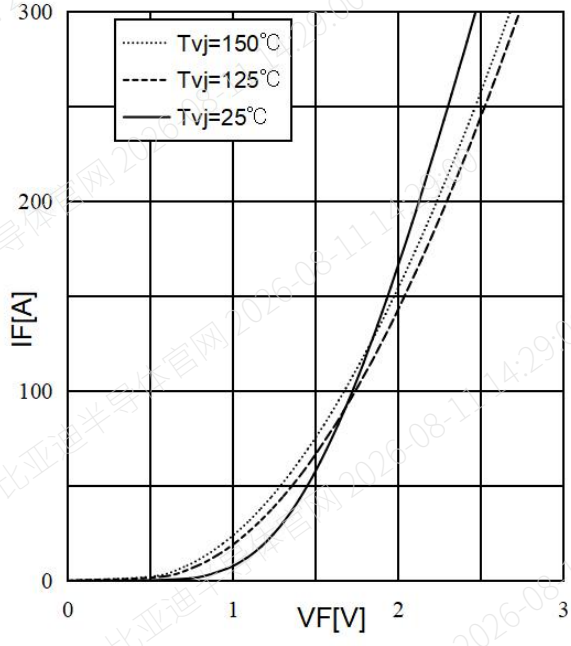
V_{GE} = 15 V, I_C = 150 A, V_{CE} = 650 V
Fig.5: Switching Loss vs. Gate Resistor
图 5：开关损耗与门极电阻关系



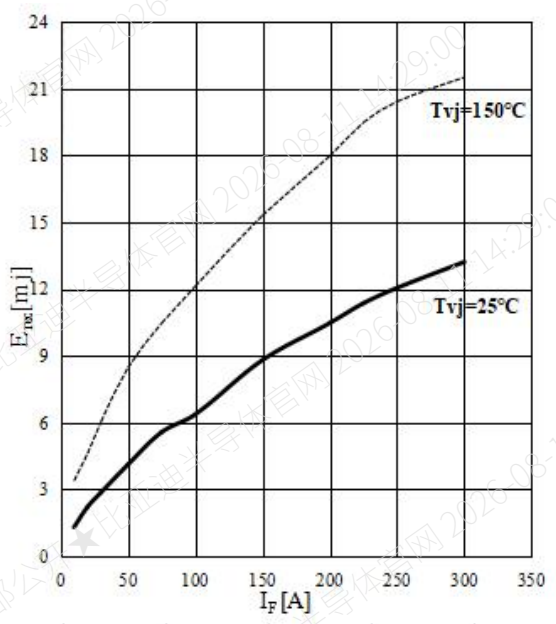
V_{CC} = 650 V, I_C = 150 A, V_{GE} = -8/15 V, T_{vj} = 150℃
Fig.6: Switching Times vs. Gate Resistor
图 6：开关时间与门极电阻关系



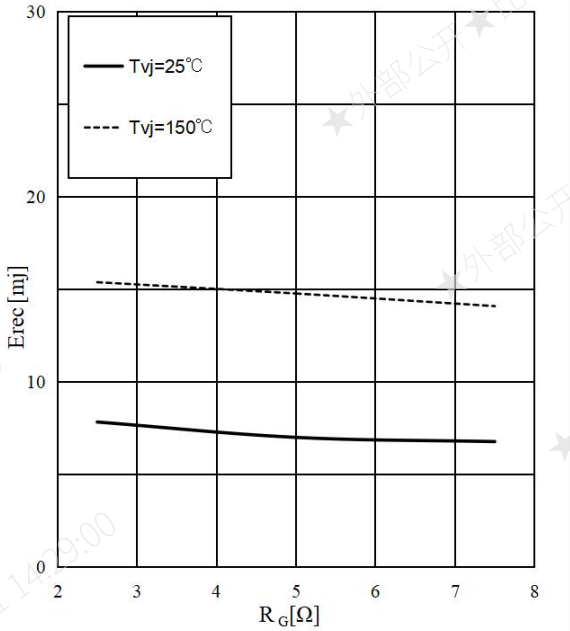
V_{cc} = 650 V, V_{GE} = 15 V, $R_{G\ on/off}$ = 2.5/5.0 Ω, T_{vj} = 150℃
Fig.7: Switching Times vs. I_C
图 7：开关时间与集电极电流关系



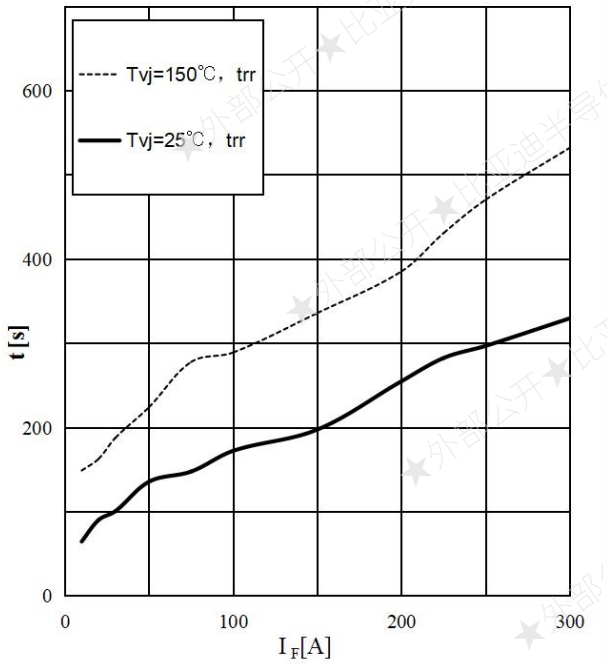
$I_F = f(V_F)$
Fig.8: Forward characteristic
图 8：正向特性



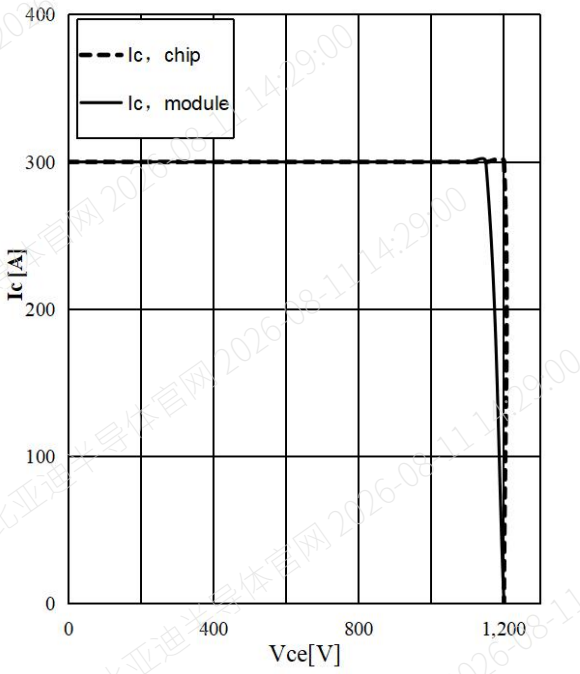
R_{Gon} = 2.5 Ω , V_{CE} = 650 V
Fig.9: Reverse recovery Energy
图 9：反向恢复损耗



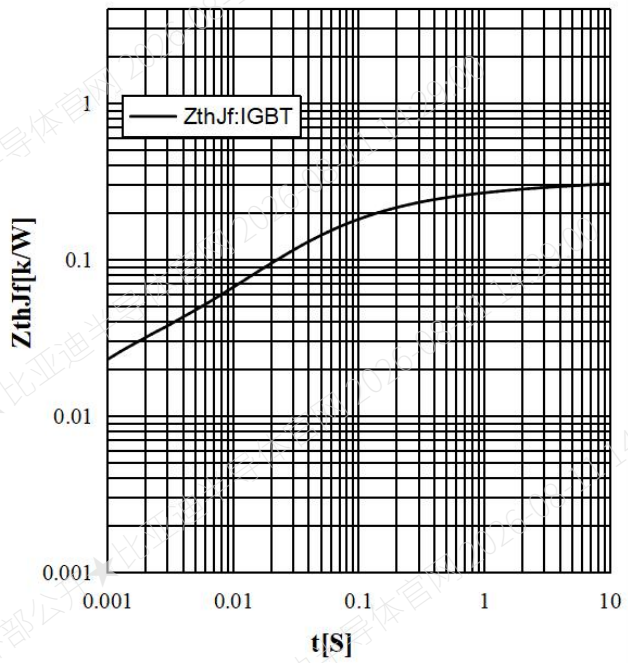
V_{cc} = 650 V, V_{GE} = 15 V, IF= 150 A
Fig.10: Reverse recovery Energy vs. Gate Resistor
图 10：反向恢复损耗与门极电阻关系



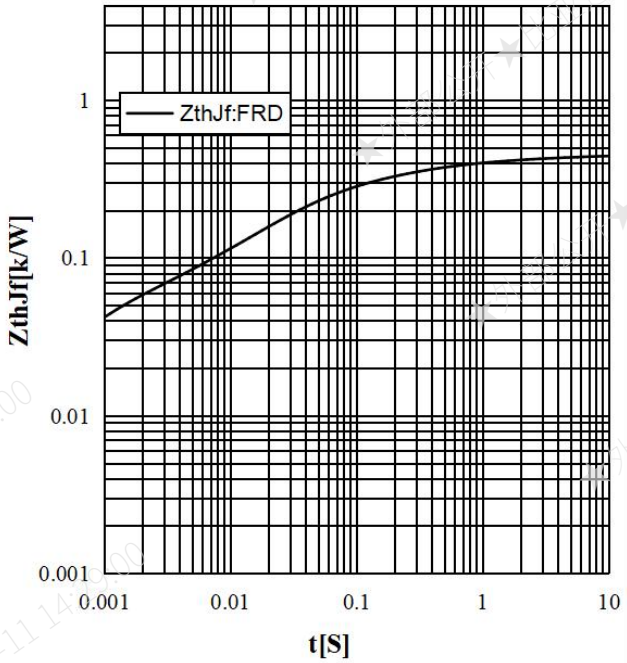
V_{cc} = 650 V, V_{GE} = 15 V, $R_{G\ on/off}$ = 2.5/5.0 Ω
Fig.11: Reverse Recovery Times vs. IF
图 11：反向恢复时间与正向电流关系



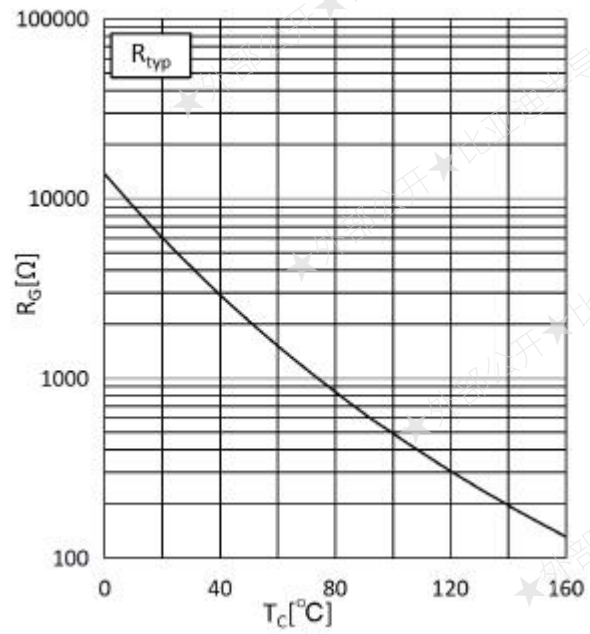
V_{cc} = 650 V, V_{GE} = 15 V, $R_{G\ on/off}$ = 2.5/5.0 Ω, T_{vj} = 150℃
Fig.12: Reverse Bias Safe Operating Area
图 12：反偏安全工作区



$Z_{thJF} = f(t)$
Fig.13: Typy. transient thermal impedance
图 13：典型的瞬态热阻抗 Z_{thJF}

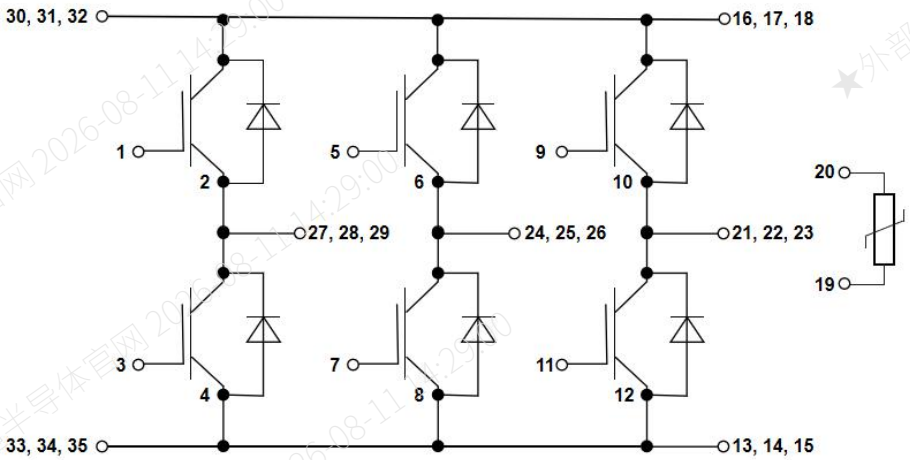


$Z_{thJF} = f(t)$
Fig.14: Typ. transient thermal impedance
图 14：典型的瞬态热阻抗 Z_{thJF}

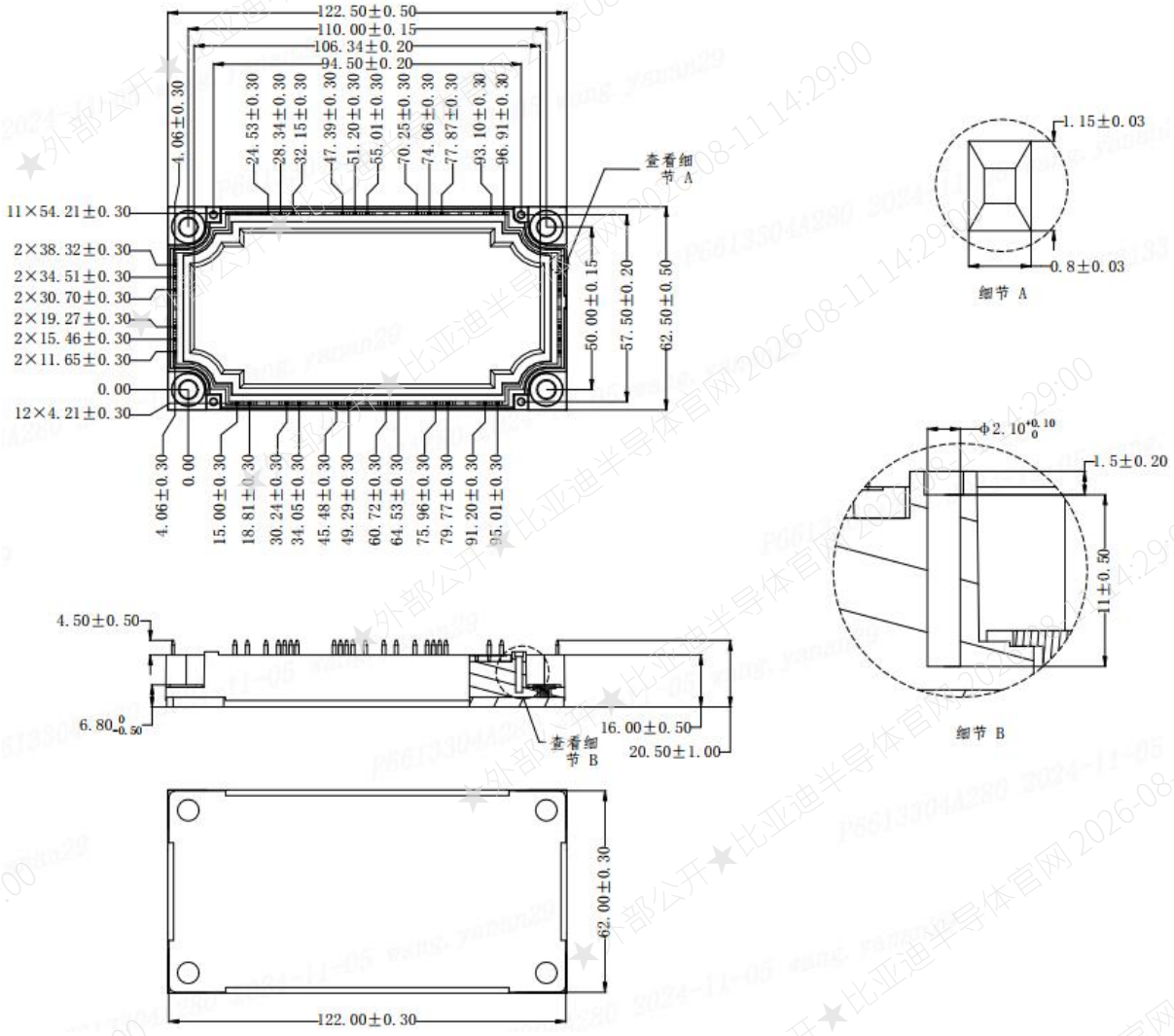


R = f (T)
Fig.15:Typ. NTC-Temperature Characteristics
图 15：典型的 NTC 电阻-温度特性

Circuit Diagram/接线图



❒ Package outlines/封装尺寸



❒ Attention/警示

Correct and Safety Use of Power Module:

功率模块安全正确的使用方法：

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.
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:

运输过程：

•Tossing or dropping of a carton may damage devices inside.
包装箱颠簸或坠落可能导致内部器件损毁。

• Devices exposed to moisture may result in failure. Special care should be taken during rainy or snowy weather to implement protective measures preventing the device from getting wet.
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:

存储：

The temperature and humidity of the storage place should be 5~35°C and 30~75% 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.
贮存地点温度与湿度应分别控制在5~35°C和30~75%。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:

长期存储：

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, please inspect them to ensure there are no scratches, dust, rust, or other defects on the surface.
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:

应用环境

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.
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。

Silicone modules are not suitable for flip-chip applications.
硅胶模块，不适合用于倒装。

Anti-electrostatic Measures:

防静电措施：

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

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。

• Precautions against the device rupture caused by static electricity.

预防措施可以防止静电击穿器件。

• 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.

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。

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

不要用易受静电影响的容器运输或贮存器件。

• 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.

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。

• During the installation process, it is necessary to always maintain the equipment and the operator's body in contact with the ground after removing carbon fiber cloth or similar materials. It is advisable to cover the workstation and its surrounding floor with conductive mats and ground them.

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。

• Use soldering irons with grounded tips.

使用接地的烙铁头。

❒ DISCLAIMER /免责声明

- Warranty Period：Unless otherwise agreed in the COOPERATION AGREEMENT or other WRITTEN DOCUMENTS, the Warranty Period for products specified in this specification shall be 12 months from the date of shipment.

  质保期：除双方在合作协议或其他书面文件中另行约定外，本文件所述产品质保期为自出厂起 12 个月。

- Our Company is committed to enhancing product quality and stability. This specification serves solely to delineate technical product details.

  本公司致力于提高产品质量与稳定性。本文件之目的，仅在于陈述产品相关技术信息。

- **Notwithstanding the Company's reasonable efforts and due diligence, the sensitive nature of the products and variations in testing environments and systems may result in a certain failure rate, including potential malfunctions or failures under specific conditions. Consequently, the Company does not warrant the accuracy of the information contained in this specification, nor the fitness for a particular purpose or merchantability of the products. The information in this specification shall not be construed as a guarantee or commitment regarding product functionality, condition, or quality.**

  尽管本公司已尽合理努力及注意，但由于产品本身敏感特性以及测试环境、系统的差异，存在一定的故障发生率以及可能在某些情况下出现故障或失效。因此，本公司不承诺本文件中所列信息准确性及产品适配、适销性。本文件所载信息不应被视为本公司对产品功能、条件或质量的保证与承诺。

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  本文件所载内容，不应视为对本公司或他人所有的专利、商标（标识）及版权等知识产权做出的任何明示、默示或其他方式的转让及/或许可；本公司对本文件所列产品知识产权的承诺，仅限于与客户另行达成书面合作约定中示明的内容。未经本公司书面许可，禁止客户对产品进行任何形式的拆解和逆向工程分析。

- **The Company shall not be held liable for any product damage or consequential incidents resulting from usage beyond the recommended storage conditions, operating parameters, or absolute maximum ratings (or other explicitly stated limits) specified in this specification. Customers must strictly adhere to the operational procedures and conditions outlined in the latest version of the specification when utilizing or testing the product. Customers are responsible for complying with safety standards, including but not limited to redundant design, fire prevention measures, and fault prevention, to design and maintain a safe and stable system environment. Customers must verify all functionalities described in this specification before or during actual**

application to ensure product suitability, safety (preventing potential accidents, fires, or public harm etc.), and reliability. It is recommended that Customers consult our company prior to testing to confirm whether the product information adequately covers the application requirements.

任何超出本文件中建议存储条件、使用条件及绝对最大额定参数条件（或部分明确值）使用，造成的产品损坏或连带事故发生，本公司不承担相关责任。当客户在使用产品时，应根据最新版本文件上规定的操作步骤或示明条件进行使用或测试。客户有责任遵从安全规则（包括冗余设计、防火措施、故障预防等）设计安全及稳定的系统环境，在实际应用前、或实际应用中验证本文件所述的任何功能，以确保适用性、安全性（预防可能发生的任何事故、火灾或社会伤害等）及可靠性。建议客户在测试前可咨询本公司，以验证产品信息是否可以涵盖应用需求。

- **This product shall not be used in any equipment or applications requiring higher reliability or quality standards where failure could result in personal injury, death, or catastrophic events, including but not limited to nuclear control systems, aircraft/aviation components, maritime/rail transport equipment, traffic signaling devices, combustion control systems, medical equipment, or other safety-critical applications. Customers must procure genuine products exclusively through the Company or authorized channels, and utilize them strictly within legally permitted boundaries and under conditions expressly defined in this specification. The Company disclaims all liability for losses, damages, or injuries arising from non-compliance with these requirements.**

  本产品不能且禁止应用在一些需要更高稳定性及质量的特殊设备上，以免导致人员伤亡等意外发生，包括原子能控制设备，飞机及航空器件，船舶、轨道等运输设备，交通信号设备，燃烧控制设备，医药设备以及所有安全性设备等。客户应通过本公司或经本公司授权的渠道购买正品，并应在法律约束范围内及本文件明确条件下合法、合理使用，否则造成损失与伤害的，本公司概不负责。

- The information presented in this specification constitutes the latest product details compiled and recorded by our Company with reasonable efforts at the time of publication. To ensure greater accuracy, our Company reserves the right to make periodic corrections, modifications, and version updates to this specification without prior notice. Customers should always refer to the latest version when using or consulting this document.

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- This specification is written in both Chinese and English, and in case of any conflict between the Chinese and English versions, the Chinese version shall prevail.

  本文件以中英文双语书就，如有不同之处，以中文内容为准。