



BME375B12JA34U1

SiC Power Module/碳化硅功率模块

$$V_{DSS} = 1200V \quad I_D = 375A$$

□ General Description/概述

BYD SiC Power Module BME375B12JA34U1 uses latest double side silver sintering technology and provides low switching loss as well as high short circuit capability, which introduce the advanced SiC mosfet chip, it is able to take on a perfect performance in various applications with switching frequencies in the range of 1-30KHz.

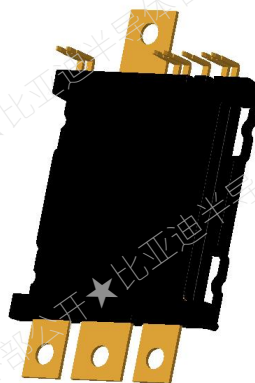
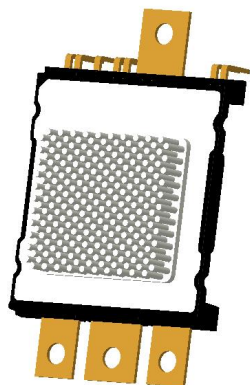
比亚迪碳化硅功率模块BME375B12JA34U1采用最新双面银烧结工艺，具有高导热、低损耗和高短路能力，内含先进的碳化硅mosfet芯片，在1-30KHZ频率的应用中表现出优良的性能。

□ Applications/应用

- Automotive Applications
汽车级应用
- Hybrid Electrical Vehicles (H)EV
混动车
- Motor Drives
电机驱动
- Boost-Buck chopper
升-降压斩波器

□ Features/特性

- The 3rd generation semiconductor material-Silicon Carbide
第三代半导体材料-碳化硅
- Blocking voltage 1200V
阻断电压 1200V
- Low $R_{DS(on)}$
低内阻
- Low Switching Losses
低开关损耗
- Low Q_g and Cr_{ss}
低 Q_g 和 Cr_{ss}
- Low Inductive Design, $L_s \leq 10nH$
低电感设计 $L_s \leq 10nH$
- $T_{vj op} = 175^\circ C$
最大连续工作结温 $175^\circ C$
- Direct Cooled Cu PinFin Base Plate
铜直接冷却底板
- High Performance Si_3N_4 Ceramic
高性能氮化硅陶瓷
- Integrated NTC temperature sensor
集成化 NTC 温度传感器





Parameter 参数	Symbol 符号	Conditions 工作条件	Temperature 结温	Value 值	Unit 单位		
Absolute Maximum Ratings/最大额定值							
Drain-source voltage 漏极-源极间电压	V _{DSS}	V _{GS} <0V	T _{vj} =25℃	1200	V		
DC drain current 连续漏极直流电流	I _{DRM}	V _{GS} =18V, T _{cool} =55℃	T _{vj} =175℃	240	A		
Pulsed drain current 脉冲漏极电流	I _{Dpulse}	t _p =1ms, D=20%, T _{Cool} =55℃	T _{vj} =175℃	480	A		
Gate-source voltage 栅极-源极间电压	V _{GSS}	—	—	+22/-10	V		
Total power dissipation 耗散功率	P _{tot}	—	T _{cool} = 55℃	666	W		
Operating junction temperature 工作结温	T _{vjop}	—	—	-40~+175	℃		
Storage temperature 存储温度	T _{stg}	—	—	-40~+150	℃		
MOSFET Characteristics MOSFET/特性							
Parameter 参数	Symbol 符号	Conditions 工作条件	Temperature 结温	Min. 最小值	Typ. 典型值	Max. 最大值	Unit 单位
Drain-source breakdown voltage 漏极-源极最大阻断电压	V _{(BR)DSS}	V _{GS} =0V	T _{vj} =25℃	1200	—	—	V
			T _{vj} =175℃				
Drain-source on resistance 漏极-源极内阻	R _{DS(on)}	V _{GS} =18V, I _D =180A	T _{vj} =25℃	—	5.3	7.3	mΩ
			T _{vj} =175℃	—	10	—	mΩ
Gate threshold voltage 栅极阈值电压	V _{GS(th)}	I _D =60mA, V _{DS} =V _{GS}	T _{vj} =25℃	1.7	—	5	V
Gate to Source Charge 栅极对源极电量	Q _{GS}	V _{DS} =800V, V _{GS} =-5V/18V, I _D =180A	—	—	123	—	nC
Gate to Drain Charge 栅极对漏极电量	Q _{GD}		—	—	180	—	
Total Gate Charge 总栅极电量	Q _G		—	—	465	—	
Internal gate resistor 内部栅极电阻	R _{G(int)}	—	T _{vj} =25℃	—	3.3	—	Ω



BME375B12JA34U1

Input capacitance 输入电容	C _{iss}	V _{GS} =0V, V _{DS} =1000V, f=1MHz	—	—	10.64	—	nF
Output capacitance 输出电容	C _{oss}		—	—	582.80	—	pF
Reverse transfer capacitance 反向传输电容	C _{rss}		—	—	85.73	—	pF
Gate-source leakage current 栅极-源极漏电流	I _{GSS}	V _{GS} = 20 V, V _{DS} = 0 V	T _{vj} =25℃	—	—	500	nA
Zero Gate Voltage Drain Current 漏极-源极漏电流	I _{DSS}	V _{DS} =1200V, V _{GS} =0V	T _{vj} =25℃	—	—	50	uA
			T _{vj} =175℃	—	—	175	
Turn-on delay time, inductive load 开通延迟时间	t _{d(on)}	V _{DS} =750V I _{DS} =150A, R _{Gon} =6.7Ω , R _{Goff} =6.7Ω , C _{GS} =2.2nF, V _{GSon} =+18V , V _{GSoff} =-5V , L=30 μ H, L _o =20nH,	T _{vj} =25℃	—	73.6	—	ns
			T _{vj} =175℃	—	98.4	—	ns
Rise time, inductive load 上升时间	t _r		T _{vj} =25℃	—	49.5	—	ns
			T _{vj} =175℃	—	92.6	—	ns
Turn-off delay time, inductive load 关断延迟时间	t _{d(off)}		T _{vj} =25℃	—	283.9	—	ns
			T _{vj} =175℃	—	394.8	—	ns
Fall time, inductive load 下降时间	t _f		T _{vj} =25℃	—	43.0	—	ns
			T _{vj} =175℃	—	74.7	—	ns
Energy dissipation during turn-on time 开通损耗	E _{on}		T _{vj} =25℃	—	7.8	—	mJ
			T _{vj} =175℃	—	11.68	—	mJ
Energy dissipation during turn-off time 关断损耗	E _{off}		T _{vj} =25℃	—	8.01	—	mJ
			T _{vj} =175℃	—	11.04	—	mJ
Body Doide/体二极管特性							
Forward voltage 正向电压	V _{SD}	V _{GS} =-5V, I _{SD} =300A	T _{vj} =25	—	5.2	—	V
			T _{vj} =175℃	—	5.1	—	V
Peak reverse recovery current 反向恢复峰值电流	I _{rrm}	V _{DS} =750V I _{DS} =150A,	T _{vj} =25℃	—	56.87	—	A
			T _{vj} =175℃	—	49	—	
Recovered charge 反向恢复电荷	Q _{rr}	R _{Gon} =6.7Ω , R _{Goff} =6.7Ω ,	T _{vj} =25℃	—	1.01	—	uC
			T _{vj} =175℃	—	0.7	—	
Reverse recover time 反向恢复时间	T _{rr}	C _{GS} =2.2nF, V _{GSon} =+18V ,	T _{vj} =25℃	—	12.75	—	ns
			T _{vj} =175℃	—	24.2	—	
Reverse recovery energy 反向恢复损耗	E _{rec}	V _{GSoff} =-5V , di/dt=8KA/us	T _{vj} =25℃	—	0.16	—	mJ
			T _{vj} =175℃	—	0.2	—	
DC reverse drain current 直流反向电流	I _{DR}	V _{GS} =-5V, T _{cool} =55℃	T _{vj} =175℃	—	125	—	A
Peak reverse drain current 最大反向电流	I _{DRM}	V _{GS} =-5V, t _{pulse} =1ms	—	—	250	—	A



BME375B12JA34U1

Thermal Resistance/热阻

Thermal resistance junction to coolant 结-冷却液热阻	$R_{th(j-f)}$	$\Delta v / \Delta t = 8L/min$, $T_{cool} = 55^{\circ}C$, 50%乙二醇, 50%水	—	0.18	—	K/W
--	---------------	---	---	------	---	-----

□ Characteristic Values/典型值

Module Characteristics/模块特性

Dimensions 尺寸	L x W x H	Typical , see outline drawing 标准外观图	110x69x19.8	mm
Isolation voltage 绝缘耐压	V_{isol}	$t=1min, f=50Hz$	3.8	kV
Internal isolation 绝缘层材料	—	Basic insulation 基本绝缘	Si_3N_4	
Clearance distance in air 电气间隙	d_a	according to/ 请参考 IEC 60664-1 & EN 50124-1	Term. to base:	— 9.6 — mm
			Term. to term:	— 4.5 — mm
Surface creepage distance 爬电距离	d_s	according to/ 请参考 IEC 60664-1 & EN 50124-1	Term. to base:	— 9.6 — mm
			Term. to term:	— 7.5 — mm
Mass 重量	m	—	—	310 — g
Pressure drop in cooling circuit 在冷却液中的压差	ΔP	$\Delta v / \Delta t = 12L/min$, $T_{cool} = 25^{\circ}C$, 50%乙二醇, 50%水	—	10 — kPa
Maximum pressure in cooling circuit 冷却循环中的最大压力	P	—	—	250 — kPa
Stray inductance module 杂散电感	L_{sds}	—	—	— 10 nH
Comparative tracking index 相对漏电指数	CTI	—	—	600 — V
Mounting torque 安装扭矩	M	Screw M4-mounting according to valid application manual 参考应用手册使用 M4 螺丝安装	1.8	2.0 2.4 N.m



NTC-Thermistor Characteristic Values/热敏电阻特性

Rated resistance 额定阻值	R_{25}	$T_C=25^{\circ}\text{C}$	—	5.0	—	k Ω
Deviation of R100 R100 偏差	$\Delta R/R$	$T_C=100^{\circ}\text{C}$, $R_{100}=493\Omega$	-5	—	5	%
Power dissipation 耗散功率	P_{25}	$T_C=25^{\circ}\text{C}$	—	—	20.0	mW
B-Value B-值	$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$	—	3375	—	K
B-value B-值	$B_{25/80}$	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15\text{K}))]$	—	3411	—	K
B-value B-值	$B_{25/100}$	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15\text{K}))]$	—	3433	—	K

Thermal and mechanical properties according to IEC 60747-15.

Specification according to the valid application note.

热和机械特性请参考 IEC 60747-15。

规格书根据实际应用撰写。

□ Characterization Curves/特性曲线

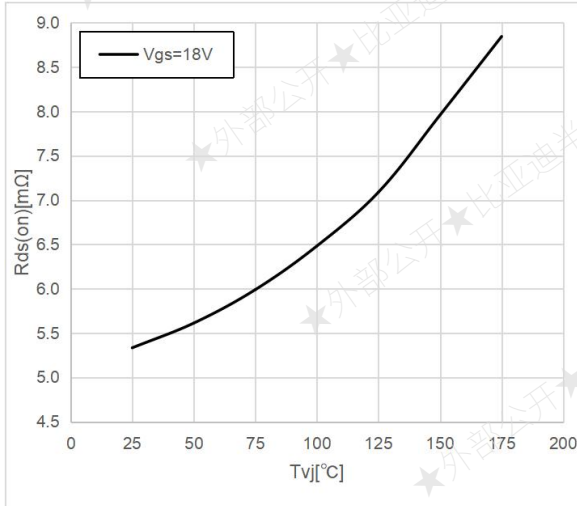


Fig.1 Drain-source On Resistance vs. Junction Temperature

图1：内阻和结温的关系

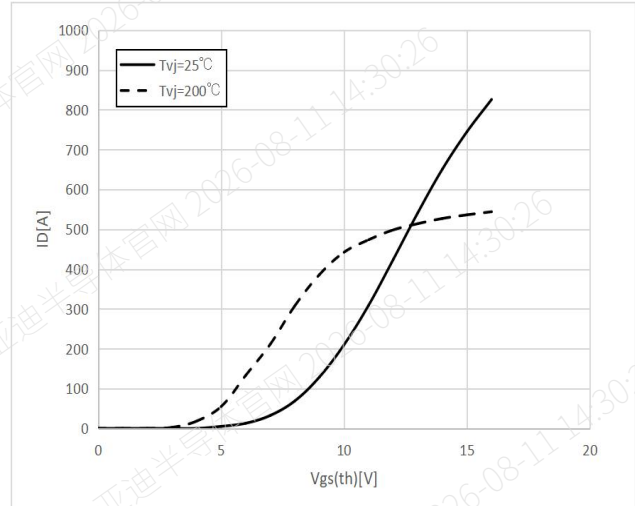


Fig.2 Transfer Characteristic MOSFET (typical)

图2：MOSFET转移特性

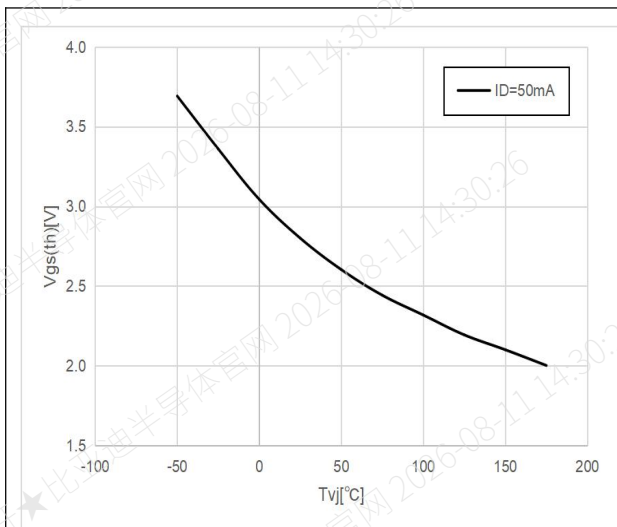


Fig.3 Gate Threshold Voltage vs. Junction Temperature

图3：栅极阈值电压和结温的关系

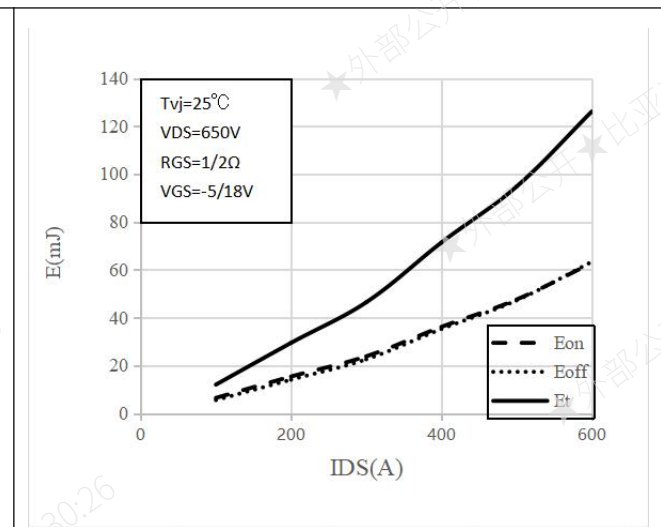


Fig.4 Switching Loss vs. Drain Current

图4：开关损耗和漏极电流关系

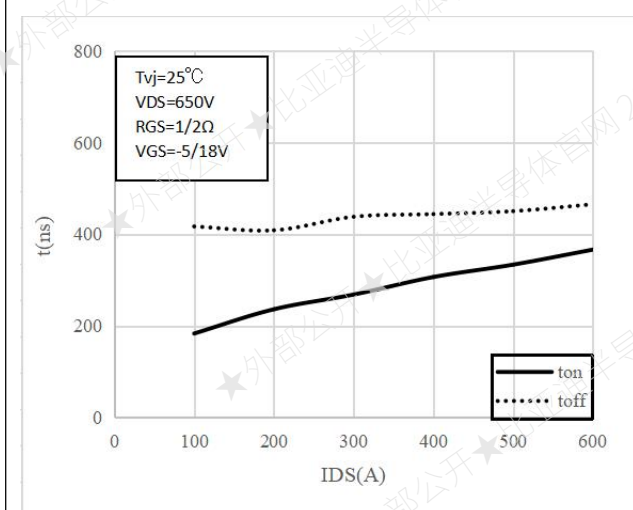


Fig.5 Switching Time vs. Drain Current

图5：开关时间和漏极电流关系

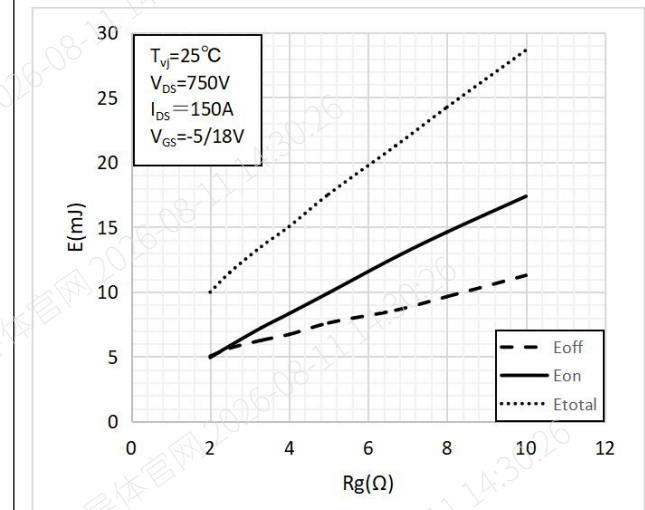


Fig.6 Switching Loss vs. Gate Resistor

图6：开关损耗和栅极电阻关系

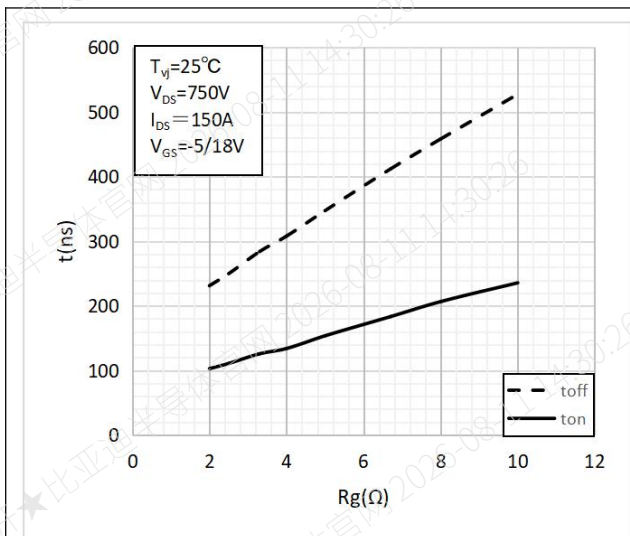


Fig.7 Switching Time vs. Gate Resistor

图7：开关时间和栅极电阻关系

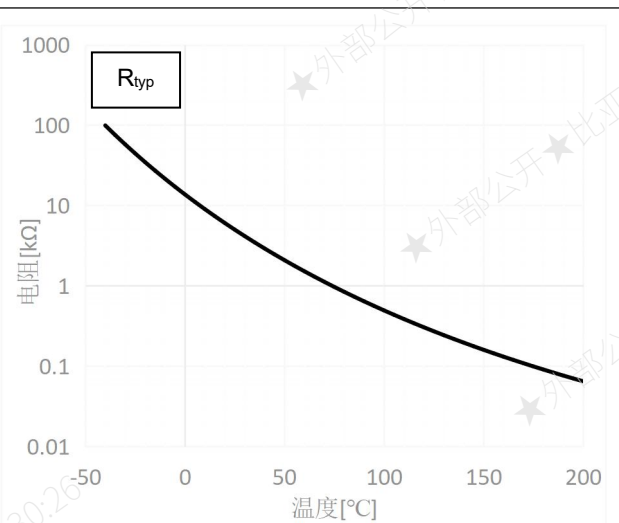


Fig.8 Typ. NTC-Temperature Characteristics

图8：典型NTC热特性

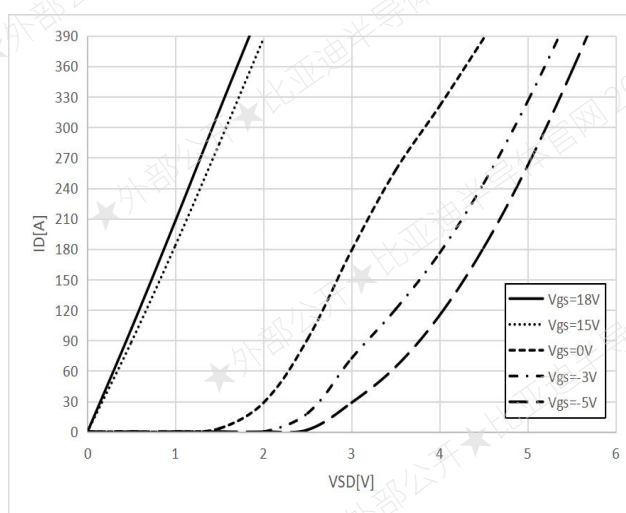


Fig 9 Body Diode Forward Current vs. Forward Voltage

$T_{vj}=25^{\circ}\text{C}$

图9：体二极管正向电流和正向压降的关系，结温25°C

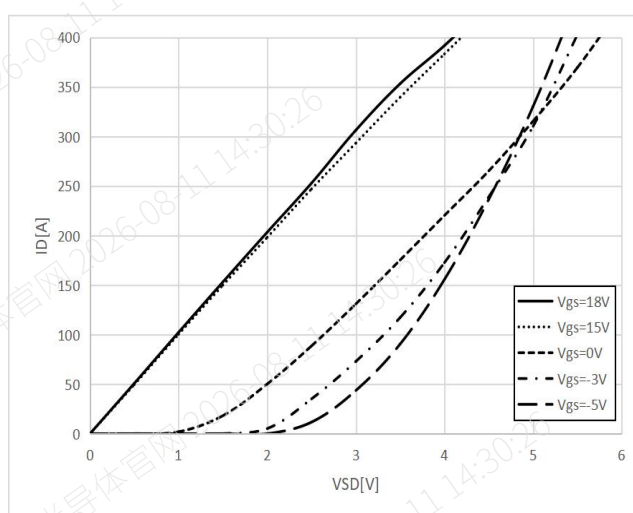


Fig 10 Body Diode Forward Current vs. Forward Voltage

$T_{vj}=200^{\circ}\text{C}$

图10：体二极管正向电流和正向压降关系，结温200°C

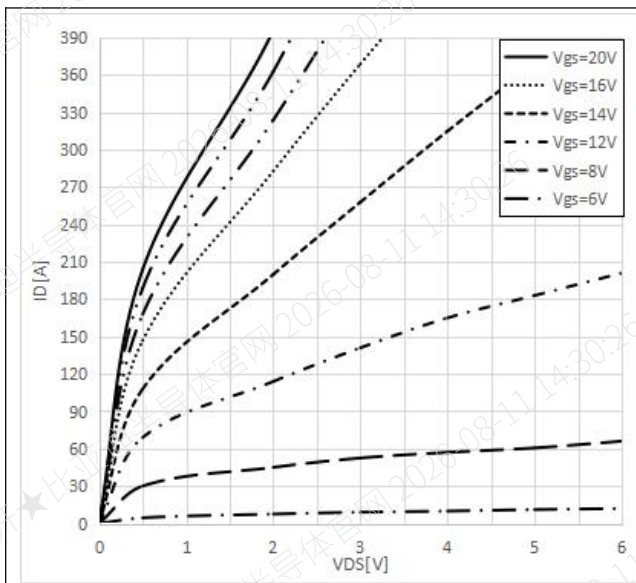


Fig 11 Forward Current vs. Forward Voltage $T_{vj}=25^{\circ}\text{C}$

图11: 正向电流和正向压降关系, 结温 25°C

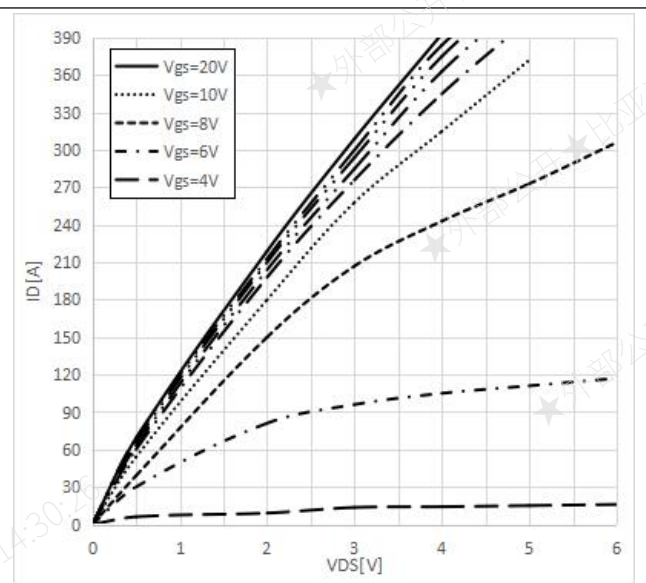
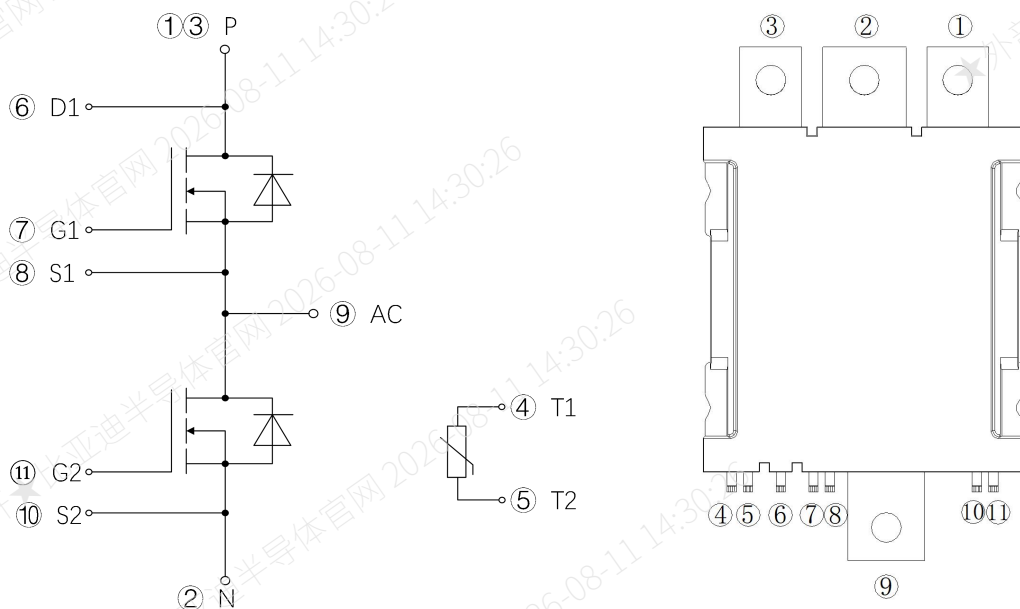


Fig 12 Forward Current vs. Forward Voltage $T_{vj}=200^{\circ}\text{C}$

图12: 正向电流和正向压降关系, 结温 200°C

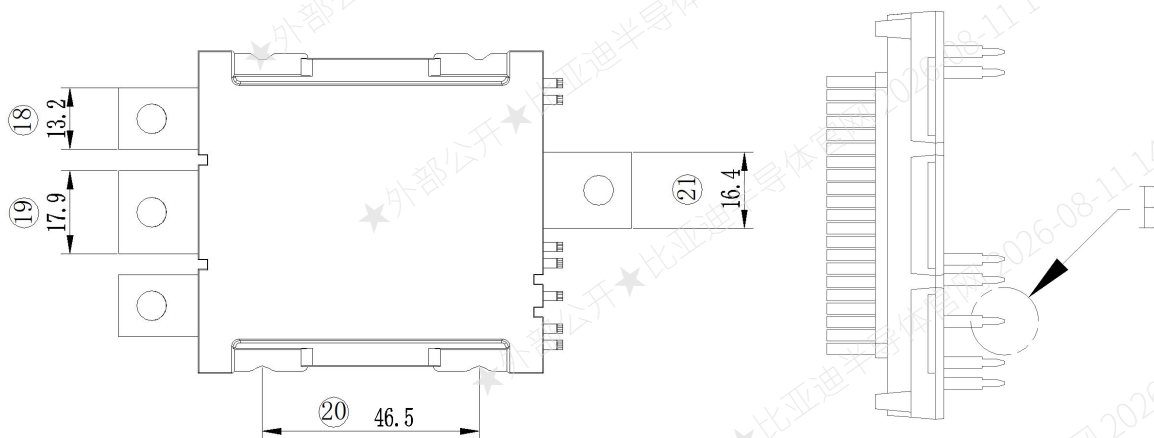


□ Circuit Diagram/电路图



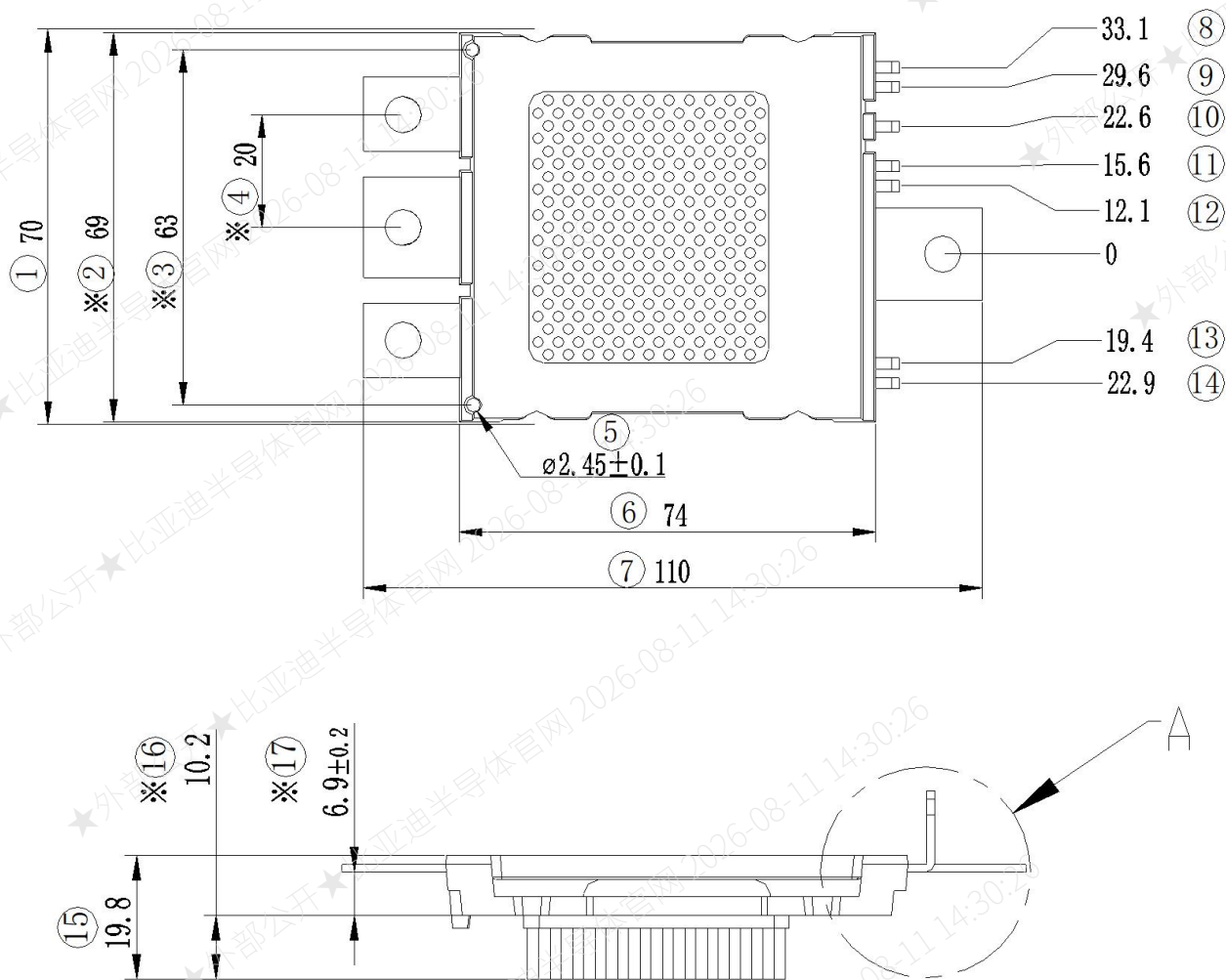
注：图中二极管为 MOSFET 体二极管。

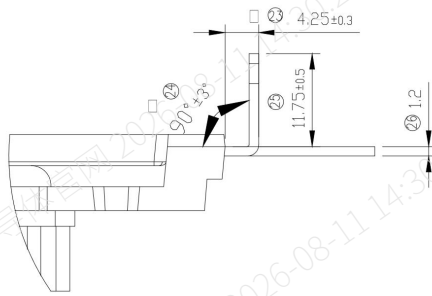
□ Package Outlines/封装轮廓图



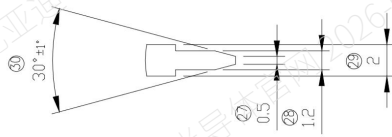


BME375B12JA34U1





Detail A Proportion 2:1



Detail B Proportion 2:1

❑ Attached (recommended torque and screw)/安装（推荐扭矩和螺丝）:

Recommend Mounting Torque(M4): 1.8-2.4 N·m

推荐安装扭矩(M4)扭矩:1.8-2.4 N·m

❑ Attention

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.

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.

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.



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.

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.

Anti-electrostatic Measures:

- Following precautions should be taken during the period with the gate to prevent electrostatic breakdown of the device.
 - * 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.

❑ RESTRICTIONS ON PRODUCT USE

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 BYD 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 BYD products are used within specified operating ranges as set forth in the most recent BYD products specifications.

❑ 注意:

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，并根据指导来使用比亚迪功率器件。

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。

贮存：

- 贮存地点温度与湿度应分别控制在5~35°C和45~75%湿度。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。

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。

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。

防静电措施：

- 带栅极器件应采取以下预防措施防止静电击穿器件：
 - * 栅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。防静电地板可以抑制电荷生成并快速耗散。
 - * 不要使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。

□ 产品使用须知

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，半导体器件一般会因为其固有的对电荷敏感性和易受物理应力损坏的特点，而发生故障和失效。当用户购买BYD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来防止任何事故，火灾或继而引起的危害公共安全的隐患，包括设计的裕量，防火措施，故障预防等。请改善您的设计，确保BYD的产品在额定范围内使用并参考最新的BYD产品规格书。



免责声明 | DISCLAIMER

- 本公司致力于提高产品质量与稳定性。本规格书之目的，仅在于陈述产品相关技术信息。
Our company is committed to enhancing product quality and stability. This specification serves solely to delineate technical product details.

- 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，本公司不承诺规格书中所列信息准确性及产品适配、适销性。规格书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。

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 the specifications, nor the fitness for a particular purpose or merchantability of the products. The information in the specifications shall not be construed as a guarantee or commitment regarding product functionality, condition, or quality.

- 规格书所载内容，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；本公司对规格书所列产品知识产权的承诺，仅限于与用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，禁止用户对产品进行任何形式的拆解和逆向工程分析。

The content contained in this specification shall not be construed as any express, implied, or otherwise grant and/or license to patents, trademarks, copyrights, or other intellectual property rights owned by the Company or third parties. The Company's commitments regarding product intellectual property are strictly limited to the terms expressly stated in SEPARATE WRITTEN AGREEMENTS with Customers. Reverse-engineering, disassembly, or any form of analysis of the product is strictly prohibited without the Company's prior written consent.

- 任何超出规格书中建议存储条件、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。当用户在使用产品时，应根据最新规格书上规定的操作步骤或示明条件进行使用或测试。用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、或实际应用中验证规格书所述的任何功能，以确保实际使用场景适用性、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。建议用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。

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 the specifications 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.

- 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。用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规格书明确条件下合法、合理使用，否则造成损失与伤害的，本公司概不负责。

This product shall not be used in any equipment 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.

- 本规格书表明信息，均为发布时本公司尽合理努力整理并记录的产品最新信息。为提供更加准确的信息，本公司保留对规格书不定期勘误修改及版本更新的权利。用户在使用或参阅时，请使用最新版本。

The information presented in this specification constitutes the latest product details compiled and recorded by the Company with reasonable efforts at the time of publication. To ensure greater accuracy, the 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.

- 本规格书以中英文双语书就，如有不同之处，以中文内容为准。

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.