



BME1400B15JE34U5N

SiC Power Module/碳化硅功率模块

$$V_{DSS} = 1500V \quad I_D = 1400A$$

□ General Description/概述

BYD SiC Power Module BME1400B15JE34U5N uses latest Double sided 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 BME1400B15JE34U5N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
- Maximum applied voltage platform: 900V
最高支持1000V电压平台

□ Features/特性

- The 3rd generation semiconductor material-Silicon Carbide
第三代半导体材料-碳化硅
- Blocking voltage 1500V
阻断电压 1500V
- 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 °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



**BME1400B15JE34U5N****□ Characteristic Values/典型值**

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}	$V_{GS} < 0V$	$T_{vj} = 25^{\circ}C$	1500	V
DC drain current 连续漏极直流电流	I_{DRM}	$V_{GS} = 18V$, $T_{cool} = 55^{\circ}C$	$T_{vj} = 175^{\circ}C$	-	A
Pulsed drain current 脉冲漏极电流	I_{Dpulse}	$t_P = 1ms$, $D = 20\%$, $T_{Cool} = 55^{\circ}C$	$T_{vj} = 175^{\circ}C$	-	A
Gate-source voltage 栅极-源极间电压	V_{GSS}	—	—	-10/20	V
Total power dissipation 耗散功率	P_{tot}	—	$T_{cool} = 55^{\circ}C$	1675	W
Operating junction temperature 工作结温	T_{vj}	—	—	-55~+175	$^{\circ}C$
Storage temperature 存储温度	T_{stg}	—	—	-40~+150	$^{\circ}C$

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	$V_{(BR)DSS}$	$V_{GS} = 0V$	$T_{vj} = 25^{\circ}C$	1500	—	—	V
			$T_{vj} = 175^{\circ}C$				
Drain-source on resistance 漏极-源极内阻	$R_{DS(on)}$	$V_{GS} = 18V$, $I_D = 600A$	$T_{vj} = 25^{\circ}C$	—	2.5	—	m Ω
			$T_{vj} = 175^{\circ}C$	—	—	—	m Ω
Gate threshold voltage 栅极阈值电压	$V_{GS(th)}$	$I_D = 100mA$, $V_{DS} = V_{GS}$	$T_{vj} = 25^{\circ}C$	2.0	—	4	V
			$T_{vj} = 175^{\circ}C$	—	—	—	V
Gate to Source Charge 栅极对源极电量	Q_{GS}	$V_{DS} = 800V$, $V_{GS} = -4V/18V$, $I_D = 800A$	—	—	—	—	nC
Gate to Drain Charge 栅极对漏极电量	Q_{GD}		—	—	—	—	
Total Gate Charge 总栅极电量	Q_G		—	—	—	—	



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Internal gate resistor 内部栅极电阻	$R_{G(int)}$	—	$T_{vj}=25^{\circ}\text{C}$	—	1.5	—	Ω
Input capacitance 输入电容	C_{iss}	$V_{GS}=0V,$ $V_{DS}=1000V,$ $f=100kHz$	—	—	—	—	nF
Output capacitance 输出电容	C_{oss}		—	—	—	—	pF
Reverse transfer capacitance 反向传输电容	C_{rss}		—	—	—	—	pF
Gate-source leakage current 栅极-源极漏电流	I_{GSS}	$V_{GS} = 20V,$ $V_{DS} = 0\text{ V}$	$T_{vj}=25^{\circ}\text{C}$	—	—	100	nA
Zero Gate Voltage Drain Current 漏极-源极漏电流	I_{DSS}	$V_{DS}=1200V,$ $V_{GS}=0V$	$T_{vj}=25^{\circ}\text{C}$	—	—	100	μA
Turn-on delay time, inductive load 开通延迟时间	$t_{d(on)}$	$V_{DS}=870V$ $I_{DS}=850A,$ $R_{Gon}=2.5\Omega$, $R_{Goff}=7.67\Omega$, $C_{GS}=2.2nF,$ $V_{GSon}=+18V$, $V_{GSoff}=-5V$, $L=30\text{ }\mu\text{ H},$ $L_{\circ}=15nH,$	$T_{vj}=25^{\circ}\text{C}$	—	168.7	—	ns
			$T_{vj}=175^{\circ}\text{C}$	—	—	—	ns
Rise time, inductive load 上升时间	t_r		$T_{vj}=25^{\circ}\text{C}$	—	109.8	—	ns
			$T_{vj}=175^{\circ}\text{C}$	—	—	—	ns
Turn-off delay time, inductive load 关断延迟时间	$t_{d(off)}$		$T_{vj}=25^{\circ}\text{C}$	—	381.1	—	ns
			$T_{vj}=175^{\circ}\text{C}$	—	—	—	ns
Fall time, inductive load 下降时间	t_f		$T_{vj}=25^{\circ}\text{C}$	—	98.6	—	ns
			$T_{vj}=175^{\circ}\text{C}$	—	—	—	ns
Energy dissipation during turn-on time 开通损耗	E_{on}		$T_{vj}=25^{\circ}\text{C}$	—	49.4	—	mJ
			$T_{vj}=175^{\circ}\text{C}$	—	—	—	mJ
Energy dissipation during turn-off time 关断损耗	E_{off}	$T_{vj}=25^{\circ}\text{C}$	—	62.4	—	mJ	
		$T_{vj}=175^{\circ}\text{C}$	—	—	—	mJ	
Body Doide/体二极管特性							
Forward voltage 正向电压	V_{SD}	$V_{GS}=0V,$ $I_{SD}=600A$	$T_{vj}=25$	—	3.6	—	V
			$T_{vj}=175^{\circ}\text{C}$	—	—	—	V
Peak reverse recovery current 反向恢复峰值电流	I_{rrm}		$T_{vj}=25^{\circ}\text{C}$	—	89.3	—	A
			$T_{vj}=175^{\circ}\text{C}$	—	—	—	



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Recovered charge 反向恢复电荷	Q_{rr}	$V_{DS}=870V$ $I_{DS}=850A$, $R_{Gon}=2.5\Omega$, $R_{Goff}=7.67\Omega$, $C_{GS}=2.2nF$, $V_{GSon}=+2.5V$, $V_{GSoff}=-5V$, $di/dt=6kA/us$	$T_{vj}=25^{\circ}C$	—	1.78	—	uC
Reverse recover time 反向恢复时间	T_{rr}		$T_{vj}=175^{\circ}C$	—	—	—	ns
Reverse recovery energy 反向恢复损耗	E_{rec}		$T_{vj}=25^{\circ}C$	—	31.8	—	ns
			$T_{vj}=175^{\circ}C$	—	—	—	mJ
DC reverse drain current 直流反向电流	I_{DR}	$V_{GS}=-5V$, $T_{cool}=55^{\circ}C$	$T_{vj}=175^{\circ}C$	—	—	—	A
Peak reverse drain current 最大反向电流	I_{DRM}	$V_{GS}=-5V$, $t_{pulse}=1ms$	—	—	—	—	A
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	—	—	0.0716	—	K/W
Module Characteristics/模块特性							
Dimensions 尺寸	L x W x H	Typical, see outline drawing 标准外观图	74×70×19.8			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 空气间隙	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



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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 note 参考规格书使用 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.

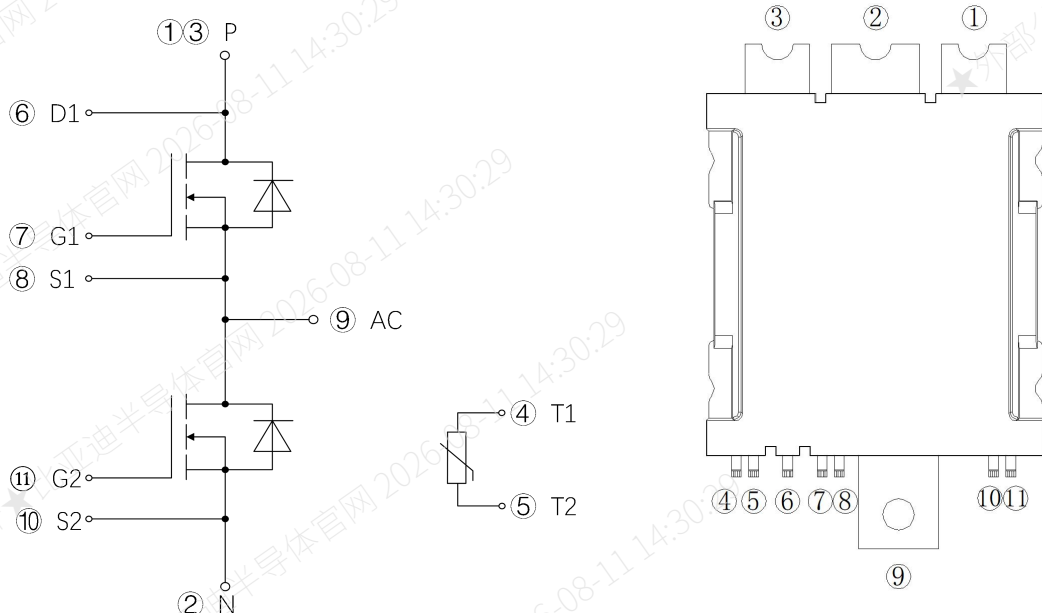
热和机械特性请参考 IEC 60747-15。

规格书根据实际应用撰写。



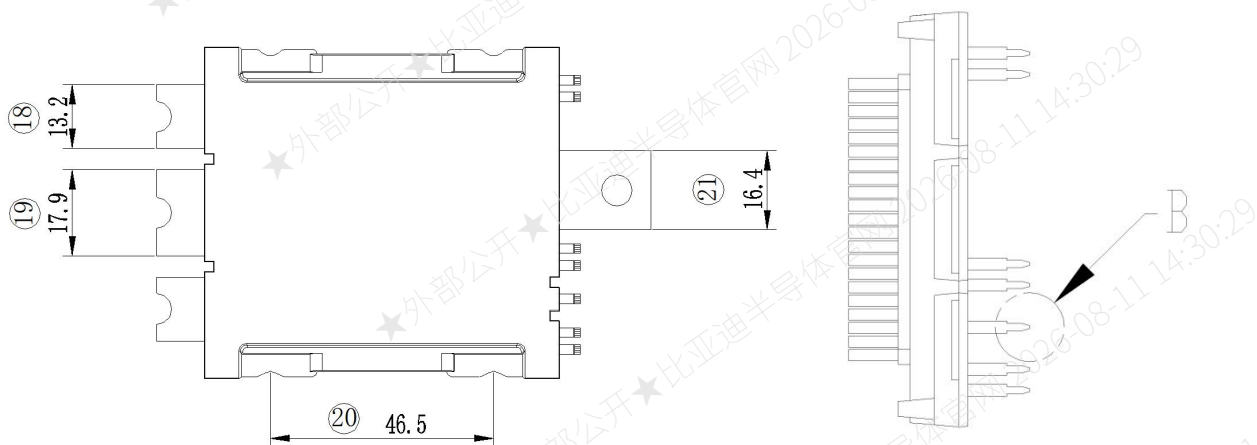
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□ Circuit Diagram/电路图



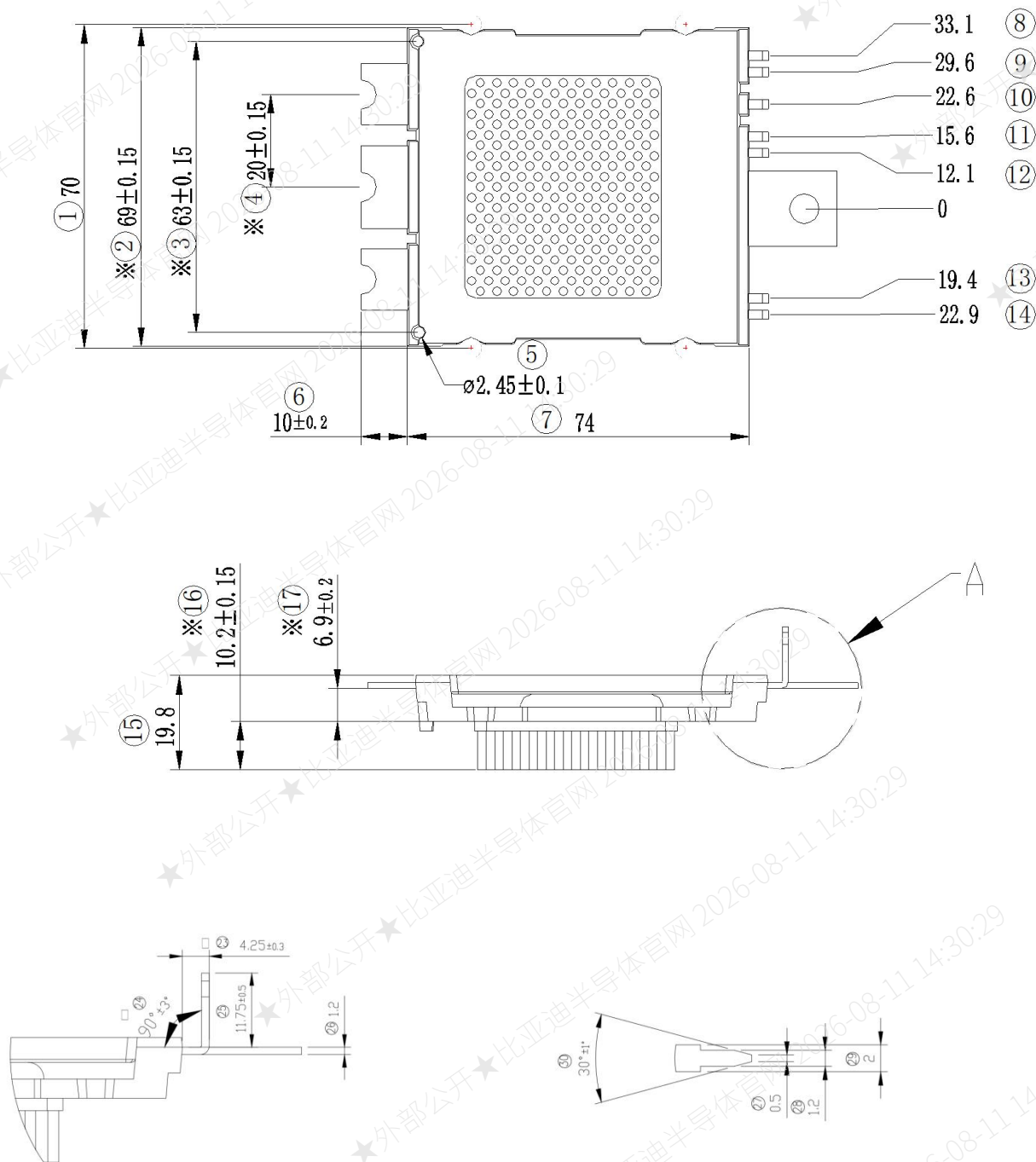
注：图中二极管为 MOSFET 体二极管。

□ Package Outlines/封装轮廓图





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Detail A Proportion 2:1

Detail B Proportion 2:1



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□ 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 for gated devices to prevent static buildup which could damage the devices.
- 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.



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- 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.

□ 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,并根据指导来使用使用比亚迪IGBT模块。

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 $5\sim 35^{\circ}\text{C}$ 和 $45\sim 75\%$ 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来防止可以损毁器件的静电生成。
- 预防措施可以防止静电击穿器件:
- 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。



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DISCLAIMER 免责声明

- Warranty period: Unless otherwise agreed in the cooperation agreement or other written documents, the warranty period for the products described in this specification is one year from the date of purchase, provided that the products are properly stored.

Special instructions: Storage temperature: $20 \pm 5^{\circ}\text{C}$; Relative humidity: 30%-60%; The product should be placed in a place away from light and vibration to avoid shock.

质保期: 除双方在合作协议或其他书面文件中另行约定外, 产品妥当保存的情况下自购买之日起, 本规格书所述产品质保期为一年。

特殊说明: 储存温度: $20 \pm 5^{\circ}\text{C}$; 相对湿度: 30%-60%; 产品应放置于避光地方, 避免震动。

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