

深圳市嘉佰达电子科技有限公司

SHENZHEN JIABAIDA ELECTRONICS TECHNOLOGY.CO.,LTD

产 品 规 格 书

Product specification

客户名 (CUSTOMER) :		
产品名 (SAMPLE NAME) :	10~17 串三元 20~120A	
产品型号 (MODEL NAME) :	JBD-SP17S005-三元系列	
呈送日期 (DATE) :	2023-12-25	
版本 (VERSION) :	A.3	
客户签名盖章 (SIGNATURES) :		
编制 (compiler)	审核 (Reviewer)	批准 (Approver)
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修正记录(Correction record)

版本号 Version number	页码 Page number	修订人 Reviser	修订日期 Revision date	修订内容 Revised content	备注 remarks
A.0	全文	张万连	2022.08.02	全新拟制	
A.1	A.1 第 12 页和第 14 页	页刘厚伟	2023.03.13	PCB 升级为 V1.3 版本；常规结构尺寸更新为 104*65mm；串数短接方式更新	
A.2	第 7、13 和第 14 页	2023.08.09	2023.08.09	增加最大持续充放电电流 120A 更新插座实物图	
A.3	第 6 页	吴一凡	2023.12.25	产品充低温保护调整	

1. 产品简介(Product introduction)

JBD-SP17S005 是专门针对 10~17 串锂电池包而设计的软件保护板方案。整套系统采用凹凸的前端采集芯片+蓝牙 MCU 方案，部分参数可以根据客户需求，通过上位机灵活调整。

JBD-SP17S005 is a software protection board scheme specially designed for 10~17 series lithium battery packs. The whole system adopts concave convex front-end acquisition chip + Bluetooth MCU scheme, and some parameters can be flexibly adjusted through the upper computer according to the needs of customers.

2. 功能配置(Configuration)

功能 (Function)	配置 (Configuration)	功能 (Function)	配置(Configuration)
支持串数 (Number of strings supported)	10~17S 可选 (10 to 17 S optional)	485 通讯 (隔离) 485-communication (isolated)	/
持续电流 (Continuous current)	120A 以内可选 (Selectable within 80A)	UART 接口 (隔离) UART interface (isolated)	/
NTC 数量 (Number of NTCs)	1 路内置, 2 路外置 (1 built-in, 2 external)	CAN 通讯 (CAN communication)	/
均衡功能 (Balance Function)	有, 被动均衡 (Yes, passive equilibrium)	232 通讯 (232 Communication)	/
UART 接口(非隔离) UART (non-isolated)	标配 (Standard option)	GPS 模块 (GPS module)	/
开关功能 (Switch function)	选配 (Optional)	加热膜功能 (Heating function)	/
二次保护功能 (Secondary protection function)	/	蓝牙模块 (The bluetooth module)	标配 (Standard option)
电池组并联 (Battery packs in parallel)	不支持 (Not supported)	电池组串联 (Battery packs in series)	不支持 (Not supported)

3. 参数设置(Parameter Setting)

3.1. 基本参数(Basic parameter)

电芯规格 (Cell specifications)		10~17 串三元 (10~17 strings of ternary lithium batteries)
接口类型(Interface type)		充放电同口(Charge and discharge are both at the same port)
充电电压(charging voltage)		4.20V*串数(4.20V*Number of strings)
单体电压范围(Cell voltage range)		2.8~4.25V
持续充电电流(Continuous charging current)		120A 以内可选
持续放电电流(Continuous discharging current)		120A 以内可选
运行功耗(Consumption of running)		≤10mA
休眠功耗(Consumption of sleep)		≤500uA
回路内阻(Circuit resistance)		≤10mR
工作温度(Operating temperature)		-30℃~75℃
保护板结构尺寸(Structure size of PCB)		
尺寸 (size)	20A-60A	102±0.5mm * 65±0.5mm * 12±1mm (长度*宽度*高度) (Length*Width*Height)
	80A	102±0.5mm*65±0.5mm*12±1mm (长度*宽度*高度) (Length*Width*Height)
	120A	102±0.5mm*65±0.5mm*16±1mm (长度*宽度*高度) (Length*Width*Height)

注：测试需在温度 $25\pm 2^{\circ}\text{C}$ ，相对湿度 $65\pm 20\%$ 的环境

Note: Test should be at temperature $25\pm 2^{\circ}\text{C}$, and relative humidity $65\pm 20\%$ of surroundings.

3.2. 主要参数(Main parameter)

	项目(Project)	规格(Specification)			单位(Unit)
		最小值 MIN	典型值 TYP	最大值 MAX	
过压和欠压保护 (Overvoltage and undervoltage protection)	过充保护电压(Overvoltage)	4.22	4.25	4.28	V
	过充保护延时(Overvoltage delay)	1000	2000	3000	mS
	过充保护释放(Overvoltage release)	4.10	4.15	4.20	V
	过放保护电压(Undervoltage)	2.70	2.80	2.90	V
	过放保护延时(Undervoltage delay)	1000	2000	3000	mS
	过放保护释放(Undervoltage release)	2.90	3.00	3.10	V
	过放保护释放条件(Undervoltage release conditions)	60S 内电压自恢复或者充电恢复 (Voltage self recovery or charging recovery within 60s)			
充电过流保护 (Overcurrent Charge)	充电过流保护值 (Overcurrent Charge protection value)	见下面过流保护值配置表 (See the configuration table of overcurrent protection value below)			
	充电过流延时 (Overcurrent Charge delay)	7	10	13	S
	充电过流释放条件 (Charge over current release conditions)	延时 32S 后自动恢复 (Automatic recover after a delay of 32S)			
放电过流保护 (Overcurrent Discharge)	一级放电过流保护值 (1th Overcurrent Discharge)	见下面过流保护值配置表 (See the configuration table of overcurrent protection value below)			
	一级放电过流保护延迟 (1th Overcurrent Discharge delay)	7	10	13	S
	二级放电过流保护电流值 (2th Overcurrent Discharge)	见下面过流保护值配置表 (See the configuration table of overcurrent protection value below)			
	二级放电过流 2 保护延迟 (2th Overcurrent Discharge delay)	200	500	800	mS
	放电过流保护恢复条件 (Overcurrent Discharge release)	延时 32S 后自动恢复 (Automatic recover after a delay of 32S)			
短路保护 (Short Circuit Discharge)	短路保护电流 (Short circuit protection current)	见下面过流保护值配置表 (See the configuration table of overcurrent protection value below)			
	短路保护延迟时间 (Short circuit protection delay time)	--	400	800	uS
	短路保护恢复 (Short circuit protection recovery)	断开负载后延时 5S 恢复 (Recover after 5S delay after disconnecting the load)			
	短路说明: 短路电流小于最小值或高于最大值可能会造成短路保护失效, 短路电流超过2000A, 不保证有短路保护, 也不建议做短路保护测试。 (Short-circuit description: The short-circuit current is less than the minimum value or higher than the maximum value, which may cause the short-circuit protection to fail, and the short-circuit current exceeds 2000A, short-circuit protection is not guaranteed, and short-circuit protection testing is not recommended.)				

充电高温保护 Overtemperature Charge	温度保护值 (Temperature protection value)	60	65	70	°C
	温度保护释放值 (Temperature protection release value)	50	55	60	°C
充电低温保护 Undertemperature Charge	温度保护值 (Temperature protection value)	-35	-30	-25	°C
	温度保护释放值 (Temperature protection release value)	-30	-25	-20	°C
放电高温保护 Overtemperature Discharge	温度保护值 (Temperature protection value)	70	75	80	°C
	温度保护释放值 (Temperature protection release value)	60	65	70	°C
放电低温保护 Undertemperature Discharge	温度保护值 (Temperature protection value)	-35	-30	-25	°C
	温度保护释放值 (Temperature protection release value)	-30	-25	-20	°C
FET 高温保护(内置) high temperature protection of FET(Built-in)	温度保护值 (Temperature protection value)	85	90	95	°C
	温度保护释放值 (Temperature protection release value)	65	70	75	°C
均衡功能 (Balance Function)	均衡开启电压 (Equalization turn-on voltage)	3.85	3.90	3.95	V
	开启压差 (Turn on differential pressure)		15		mv
	均衡电流 (Balance current)	30	60	90	mA
	均衡模式 (Balance model)	充电均衡\静态均衡 (Charge equalization Static equalization)			
	均衡类型 (Balance type)	分时均衡\脉冲均衡 (Time-sharing/pulse equalization)			

注：测试需在温度 $25 \pm 2^{\circ}\text{C}$ ，相对湿度 $65 \pm 20\%$ 的环境。

Note: Test should be at temperature $25 \pm 2^{\circ}\text{C}$, and relative humidity $65 \pm 20\%$ of surroundings.

补充说明：本保护板所有单节电压大于均衡开启电压后，会关闭所有均衡，解决了均衡电池在充电末端一直发热的问题。

Supplementary note: after the voltage of all single sections of the protection board is greater than the equalizing opening voltage, all equalizing will be turned off, which solves the problem that the equalizing battery is always hot at the charging end.

3. 3. 过流保护值配置表(Overcurrent protection value configuration table)

持续电流 (Continuous current)	充电过流保护值 (Charge over current protection value)	一级放电过流保护值 (The first discharge over current protection value)	二级放电过流保护值 (The second discharge over current protection value)	短路保护值 (Short circuit protection value)
20A	30±5A	30±5A	75±15A	300±60A
40A	50±5A	50±5A	125±25A	500±100A
50A	60±5A	60±5A	175±35A	700±140A
60A	70±5A	70±5A	225±45A	900±180A
80A	90±5A	90±5A	275±55A	1200±240A
120	130±5A	130±5A	450±80A	1600±300A

4. 功能说明(Function Description)

4.1. 过充保护和恢复(Overcharge protection and recovery)

4.1.1. 单体过充保护及恢复(Monomer overcharge protection and recovery)

当任意一节电芯电压高于单体过充电压设定值，并且持续时间达到单体过充延时，系统进入过 充保护状态，关闭充电 MOS，不能对电池充电。

单体过充保护后，当所有单体电压降到单体过充恢复值以下时，解除过充保护状态。也可放电 解除。

When the voltage of any cell is higher than the set value of the monomer overcharge voltage, and the duration reaches the monomer overcharge delay, the system enters the overcharge protection state, turns off the charging MOS, and cannot charge the battery.

After the monomer overcharge protection, when the voltage of all the monomer drops below the recovery value of the monomer overcharge, the overcharge protection state is lifted. It is also possible to discharge and release.

4.1.2. 总体过充保护及恢复(Overall overcharge protection and recovery)

当总体电压高于总体过压设定值，并且持续时间达到总体过充延时，系统进入过充保护状态， 关闭充电 MOS，不能对电池充电。 当总体电压降到总电压过压保护恢复值以下时，解除过充保护状态，也可放解除。

When the overall voltage is higher than the overall overvoltage setting value and the duration reaches the overall overcharge delay, the system enters the overcharge protection state, turns off the charging MOS, and cannot charge the battery. When the overall voltage drops below the total voltage overvoltage protection recovery value, the overcharge protection state can be lifted, and the discharge can also be released.

4.2. 过放保护和恢复(Over-discharge protection and recovery)

4.2.1. 单体过放保护及恢复(Monomer overdisplay protection and recovery)

当最低节电压低于单体过放电压设定值，并且持续时间达到单体过放延时，系统进入过放保护状态，关闭放电 MOS，不能对电池放电。

发生单体过放保护后，对电池组充电可以解除过放保护状态。

When the minimum saving voltage is lower than the set value of the monomer overdischarge voltage, and the

duration reaches the monomer overdischarge delay, the system enters the overdischarge protection state, turns off the discharge MOS, and cannot discharge the battery.

After the occurrence of monomer over-discharge protection, the over-discharge protection state can be released by charging the battery pack.

4.2.2. 总体过放保护及恢复(Overall over-discharge protection and recovery)

当总体电压低于总体过放电压设定值，并且持续时间达到总体过放延时，系统进入过放保护状态，关闭放电 MOS，不能对电池放电。

发生总体过放保护后，对电池组充电可以解除过放保护状态。

When the overall voltage is lower than the overall overdischarge voltage setting, and the duration reaches the overall overdischarge delay, the system enters the overdischarge protection state, turns off the discharge MOS, and cannot discharge the battery.

After overall over-discharge protection occurs, charging the battery pack can release the over-discharge protection state.

4.3. 充电过流保护和恢复(Charging overcurrent protection and recovery)

当充电电流超过充电过流保护电流且持续的时间达到过流检测延迟时间，系统进入到充电过流保护状态，不能对电池进行充电。发生充电过流保护后延时自动恢复，如需不要自动恢复可将对应的释放时间设长；放电也可以解除充电过流状态。

When the charging current exceeds the charging overcurrent protection current and the duration reaches the overcurrent detection delay time, the system enters the charging overcurrent protection state and the battery cannot be charged. Automatic recovery after the delay of charging overcurrent protection, if you need not automatic recovery, you can set the corresponding release time to a long time; Discharge can also remove the charging overcurrent state.

4.4. 放电过流保护和恢复(Discharge overcurrent protection and recovery)

当放电电流超过放电过流保护电流且持续的时间达到过流检测延迟时间，系统进入到放电过流保护状态，关闭放电 MOS。发生放电过流后延时自动恢复，如需不要自动恢复可将对应的释放时间设长。充电也可以解除放电过流状态。放电有两级过流保护功能，对不同的电流值具有不同的响应速度，更加可靠地保护电池。

When the charging current exceeds the charging overcurrent protection current and the duration reaches the overcurrent detection delay time, the system enters the charging overcurrent protection state and the battery cannot be charged. Automatic recovery after the delay of charging overcurrent protection, if you need not automatic recovery, you can set the corresponding release time to a long time; Discharge can also remove the charging overcurrent state.

4.5. 温度保护和恢复(Temperature protection and recovery)

4.5.1. 充放电高温保护及恢复(Charge and discharge high temperature protection and recovery)

当充放电时 NTC 检测电芯表面的温度高于设定的高温保护温度时，管理系统进入高温保护状态，充电或放电 MOSFET 关闭，在该状态不能对电池包充电或放电。

当电芯表面的温度下降到高温恢复设定值时，管理系统从高温状态恢复，重新导通充放电 MOS。

When the temperature on the surface of the battery cell detected by NTC is higher than the set high temperature protection temperature when charging and discharging, the management system enters a high temperature protection state, and the charging or discharging MOSFET is turned off, and the battery pack cannot be charged or discharged in this state.

When the temperature on the surface of the cell drops to the high temperature recovery setpoint, the management system recovers from the high temperature state and re-conducts the charge-discharge MOS.

4.5.2. 充放电低温保护和恢复(Charge-discharge cryogenic protection and recovery)

当充放电时 NTC 检测电芯表面的温度低于设定的低温保护温度时，管理系统进入低温保护状态，充电或放电 MOSFET 关闭，在该状态不能对电池包充电或放电。

当电芯表面的温度上升到低温恢复设定值时，管理系统从低温状态恢复，重新导通充放电 MOS。

When the temperature on the surface of the NTC detection cell is lower than the set cryogenic protection temperature when charging and discharging, the management system enters a cryogenic protection state, and the charging or discharging MOSFET is turned off, and the battery pack cannot be charged or discharged in this state.

When the temperature on the surface of the cell rises to the low temperature recovery setpoint, the management system recovers from the low temperature state and re-conducts the charge-discharge MOS.

4.5.3 静态（无充放电）时，如果温度上升或降低至保护板，保护板不会做出任何保护动作，直到系统检测到有电流时，再做出对应的保护动作。

4.5.3. When static (no charge and discharge), if the temperature rises or decreases to the protection plate, the protection plate will not make any protective action until the system detects that there is a current, and then make the corresponding protection action.

4.6. 均衡功能(Equalization function)

管理系统采用电阻旁路的方式进行电芯均衡，充电过程中电池组最高节单体电芯电压达到设定的均衡启动电压值，且电池组单体电芯最低电压与最高电压压差大于设定值时，达到条件的电芯均衡功能开启，相邻的两路均衡不能同时开启。

当电芯压差小于设定值或者电芯电压小于均衡开启电压时均衡停止。可设置充电均衡模式和静态均衡模式。

The management system adopts the method of resistance bypass for cell balancing, and the maximum cell voltage of the battery pack reaches the set equilibrium starting voltage value during the charging process, and when the minimum voltage and maximum voltage difference between the battery cell and the maximum voltage are greater than the set value, the cell balance function that reaches the condition is turned on, and the adjacent two-way equalization cannot be opened at the same time.

Equalization stops when the cell dropout is less than the set value or the cell voltage is less than the equalization on voltage. Charge equalization mode and static equalization mode can be set.

4.7. 容量计算(Capacity calculations)

可以通过对电流、时间积分的方式精准地进行电池组的 SOC 计算。电池组满容量、及循环容量可以通过上位机进行设置，在进行完整充放电循环后容量可自动更新。具有充放电循环次数计算功能，当电池组累积放电容量达到设定

循环容量时，循环次数增加一次。

注：新装电池请根据电池容量设定标称容量和循环容量，并进行一次容量学习，否则可能出现容量不准问题。容量学习操作：先充满电至过压保护，然后放空电至欠压保护，再充一次电即可。

The SOC calculation of the battery pack can be accurately performed by integrating current and time. The full capacity and cycle capacity of the battery pack can be set by the host computer, and the capacity can be automatically updated after a complete charge and discharge cycle. It has the function of calculating the number of charge and discharge cycles, and when the accumulated discharge capacity of the battery pack reaches the set cycle capacity, the number of cycles is increased once.

Note: Please set the nominal capacity and cycle capacity according to the battery capacity, and carry out a capacity learning, otherwise the capacity may be inaccurate. Capacity learning operation: first full charge to overvoltage protection, then discharge to undervoltage protection, and then charge again.

4.8. 休眠功能(Sleep function)

保护板处于静态时（无通讯，无电流，无均衡及过压保护。）延时 1 分钟后，进入休眠状态，进入此状态后，保护板仅降低检测电压电流的频率和自身功耗。通讯、拨开关、充放电可以自动退出休眠模式。

When the protection board is at rest (no communication, no current, no equalization and overvoltage protection. After a delay of 1 minute, it enters a sleep state, and after entering this state, the protection board only reduces the frequency of the sense voltage current and its own power consumption. Communication, toggle switch, charge and discharge can automatically exit sleep mode.

4.9. 通讯功能(Communication function)

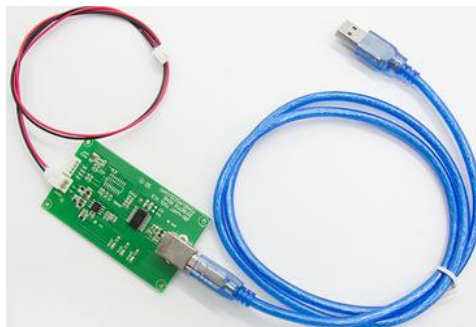
保护板可通过通讯盒与电脑连接，通讯格式 9600, 8, N, 1 上位机接收保护板数据：

The protection board can be connected to the computer through the communication box, and the communication format 9600, 8, N, 1 host computer receives the protection board data:



UART 通讯盒

(UART communication box)



RS485 通讯盒

(RS485 communication box)



蓝牙模块

(Bluetooth module)

注：上述三种工具都需要另行购买。

连接方式为：在电脑端安装我司通讯盒专用驱动程序后，将通讯盒的 USB 端插在电脑的 USB 端口，另一头接在已

经接好电池的保护板对应接口。打开上位机，点通讯口设置，选择通讯盒对应的 CMO 口，其他选项不用动，确认后点击开始，即可读取保护内数据。如需更改保护板参数，一定要先在参数页面点击读取参数后，再来更改参数。

Note: All three of the above tools need to be purchased separately.

The connection method is: after installing the special driver for our communication box on the computer side, insert the USB end of the communication box into the USB port of the computer, and connect the other end to the corresponding interface of the protective board that has been connected to the battery. Open the host computer, click the communication port settings, select the CMO port corresponding to the communication box, other options do not move, after confirmation, click Start, you can read the protected data. If you need to change the parameters of the protection plate, **you must first click Read Parameters on the Parameters page before changing the parameters.**

5. 主要物料(main material)

序号 (Number)	物料名称 (Name of Material)	生产厂家 (Manufacturer)	数量 (Quantity)
1	IC\TL8250F512ET32\TQFN32	泰凌微	1PCS
2	OZ3717	凹凸	1PCS
3	PCB-JBD-SP17S005	JBD	1PCS
配件(Accessories)			
1			
2			
3			

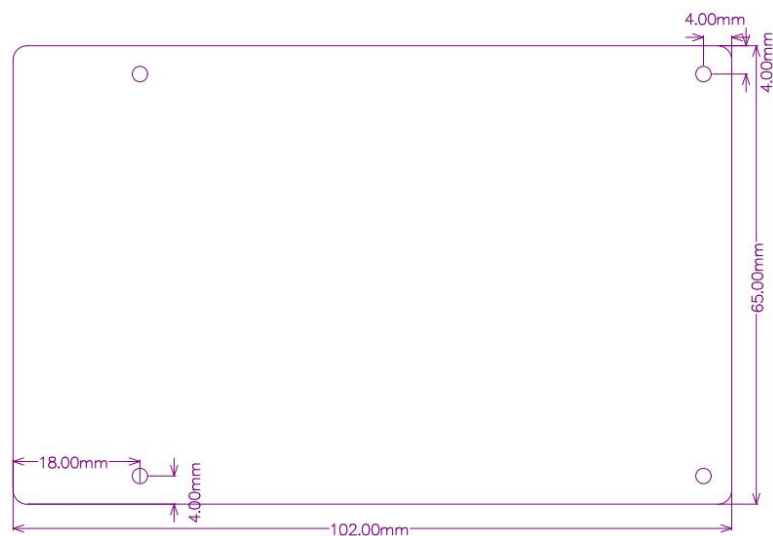
注：以上物料可能用同等规格参数或者更好的规格参数的物料替代，如有认证需求不允许更换物料，需要通知我司业务重新送样，受控规格书，最终解释权归嘉佰达所有。

Note: The above materials may be replaced by materials with the same specifications or better specifications. If there are certification requirements, the replacement of materials is not allowed, and we need to notify our business to send samples again. The controlled specifications, the final interpretation right belongs to Jiabaida.

6. 示意图及尺寸(Schematic and Dimensions)

6.1. 尺寸及安装点标注图(Dimensions and installation point drawing)

6.1.1. 常规结构尺寸

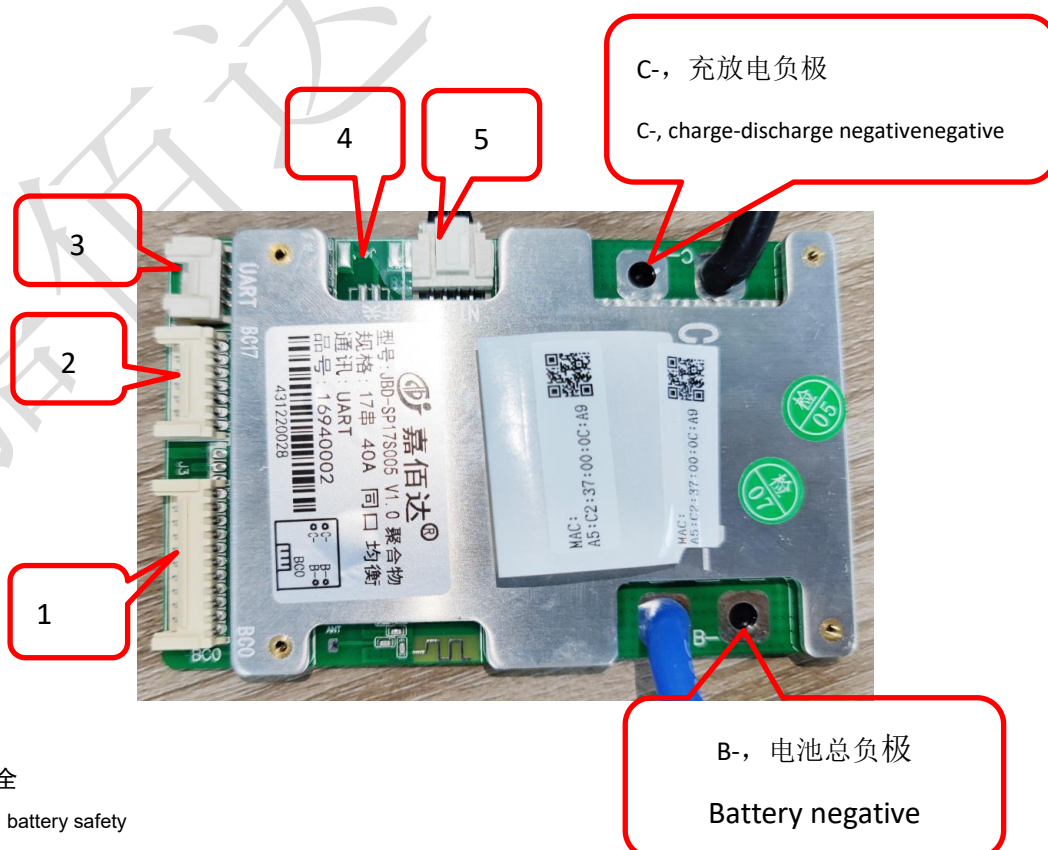


General structure size

7. 信号口定义(Signal port definition)

7.1. 示意图标注接口标号 (图片为接线示意图, 外形请以实物为准)

Schematic marking the interface label (refer to the following figure)



标号 (Label)	位号 (Tag number)	接插件功能 (Connector)	接插件示意图 (Schematic diagram)	PIN	PIN 功能定义 (Pin function)	备注 (Note)
1	J1 (HY2.0-11P) (带卡扣)	电压检测插座 (17 串连接方式) Voltage detection socket (17series connection mode)		1	接最低节电芯负极 Connect to Negative Side of Cell 1.	BC0
				2	接第 1 节电芯正极 Connect to Positive Side of Cell 1	BC1
				3	接第 2 节电芯正极 Connect to Positive Side of Cell 2	BC2
				4	接第 3 节电芯正极 Connect to Positive Side of Cell 3	BC3
				5	接第 4 节电芯正极 Connect to Positive Side of Cell 4	BC4
				6	接第 5 节电芯正极 Connect to Positive Side of Cell 5	BC5
				7	接第 6 节电芯正极 Connect to Positive Side of Cell 6	BC6
				8	接第 7 节电芯正极 Connect to Positive Side of Cell 7	BC7
				9	接第 8 节电芯正极 Connect to Positive Side of Cell 8	BC8
				10	接第 9 节电芯正极 Connect to Positive Side of Cell 9	BC9
				11	接第 10 节电芯正极 Connect to Positive Side of Cell 10	BC10
2	J2 (HY2.0-7P) (带卡扣)	电压检测插座 (17 串连接方式) Voltage detection socket (17series connection mode)		1	接第 11 节电芯正极 Connect to Positive Side of Cell 11	BC11
				2	接第 12 节电芯正极 Connect to Positive Side of Cell 12	BC12
				3	接第 13 节电芯正极 Connect to Positive Side of Cell 13	BC13
				4	接第 14 节电芯正极 Connect to Positive Side of Cell 14	BC14
				5	接第 15 节电芯正极 Connect to Positive Side of Cell 15	BC15
				6	接第 16 节电芯正极 Connect to Positive Side of Cell 16	BC16
				7	接第 17 节电芯正极 Connect to Positive Side of Cell 17	BC17

3	J5 (HY2.0) (带卡扣)	通讯接口 (Communication interface)		1	GND GPS 接口地线 GND GPS interface ground	
				2	RXD 保护板数据接收 RXD shield data reception	
				3	TXD 保护板数据发送 TXD shield data is sent	
				4	NC	
4	J4 (HY2.0)	开关接口 (Switch interface)		1	SW+	
				2	SW-	
5	J7 (HY2.0) (带卡扣)	外置温度探头 接口 (External temperature probe interface)		1	NTC1 温度探头接口 NTC1 temperature probe interface	
				2	NTC1 温度探头接口 NTC1 temperature probe interface	
				3	NTC2 温度探头接口 NTC2 temperature probe interface	
				4	NTC2 温度探头接口 NTC2 temperature probe interface	

7.2 10~16S 接线 (10 ~ 16s wiring)

17S	无短接	
16S	BC15 和 BC16 短接一起接第 15 串正极	
15S	BC14 和 BC16 短接一起接第 14 串正极	
14S	BC13 和 BC16 短接一起接第 13 串正极	
13S	BC12 和 BC16 短接一起接第 12 串正极	
12S	BC11 和 BC16 短接一起接第 11 串正极	
11S	BC10 和 BC16 短接一起接第 10 串正极	
10S	BC9 和 BC16 短接一起接第 9 串正极	

注：10S 和 11S 的 J2-2PIN 插座焊在 BC16 和 BC17 两个插孔位置。

Note: The J2-2PIN receptacles of the 10S and 11S are welded at the bc16 and BC17 jack positions.

7.3 串数自动识别说明(The number of strings is automatically recognized)

7.3.1 排线插入顺序：先插上高端排线，再插上低端的排线，若先插上低端排线，在 5 秒内没有插上高端排线，则保护板无法识别到高端串数的电压，只有能识别到低端串数的电压，此时则需要重新拔插排线。

7.3.1 Line insertion order: first plug in the high-end cable, and then plug in the low-end cable, if the low-end line is inserted first, the high-end cable is not inserted within 5 seconds, the protection board can not recognize the voltage of the high-end string, only the voltage of the low-end string can be recognized, at this time you need to reseal the cable.

8. 环境适用性(Environmental suitability)

8.1. 工作环境(The environment of working)

- BMS 保护板允许在下列条件下正常工作：
- 环境温度：-30℃ ~+75℃；
- 相对湿度：5% ~ 90%；
- 大气压力：86kPa~106 kPa；

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- BMS The protective plate allows normal operation under the following conditions:
 - Ambient temperature: -30℃ ~+75℃;
 - Relative humidity: 5% ~ 90%;
 - Atmospheric pressure: 86kPa~106kPa;

8.2. 存储环境 (The environment of storage)

BMS 保护板应存储在环境温度为-5° C~+40° C、相对湿度不大于 70%、清洁通风良好的库房内，空气中不得含有腐蚀性气体及影响电气绝缘的介质，不得受任何机械冲击或重压。不受阳光直射，与热源(暖气设备等)之间的距离不得少于 2m。在以上存储条件下，BMS 保护板可存放一年。

BMS The protection board should be stored in a clean and well-ventilated warehouse with an ambient temperature of -5°C~+40°C, a relative humidity of not more than 70%, and the air must not contain corrosive gases and media that affect electrical insulation, and must not be affected by any mechanical Shock or heavy pressure. Not subject to direct sunlight, and the distance from the heat source (heating equipment, etc.) should not be less than 2m. Under the above storage conditions, the BMS protection board can be stored for one year.

9. 包装运输(Packing and shipping)

9.1. 标志(Logo)

BMS 保护板应有下列清晰耐久标志：

- 产品名称、型号
- 电芯型号
- 出厂日期及编号
- The following marks should be clearly display on this product:
- Name and model of product
- Model of battery cell
- Manufacture date and number

9.2. 包装(Package)

● 包装应符合防潮、防振动的要求，包装箱应牢固可靠，箱内应衬有防潮材料，产品在箱内不应窜动。

- 外部纸箱包装箱，单板防静电袋加气泡袋包装；

● The packaging should meet the requirements of moisture-proof and anti-vibration, the packing box should be firm and reliable, the inside of the box should be lined with moisture-proof material, and the product should not move in the box.

- External carton box, veneer anti-static bag plus bubble bag packaging;

9.3. 运输(transportation)

● 在运输中，产品不得受剧烈机械冲撞、暴晒、雨淋、化学腐蚀性物品及有害气体侵蚀；5.3.2 在装卸过程中，产品轻搬轻放，严禁摔掷、重压。

- 包装箱码放高度小于 5 层。

● During transportation, the product shall not be subject to severe mechanical impact, exposure to the sun, rain, chemical corrosive substances and harmful gases; 5.3.2 During the loading and unloading process, the product should be handled with care, and it is strictly forbidden to throw or press it.

- The height of the packing boxes shall be less than 5 layers.

10. 注意事项(Precautions)

1. 本电池管理系统常规是不能串联使用的。
2. 多个使用本管理系统的电池包并联时，应确保并联之前各电池包的最大压差低于 3V。
3. 多个使用本管理系统的电池包并联使用时，适配器总的充电冲击电流可能施加到单个电池包上，应确保适配器总的充电冲击电流不超过单个管理系统充电冲击电流的最大值。
4. 本管理系统的短路保护功能适用于多种应用情景，但并不能保证可以在任意条件下短路。当电池包和短路回路的内阻值总和低于 $40\text{m}\Omega$ 、电池组容量超出额定值 20%、短路电流超过 1800A、短路回路的电感非常大或者短路的导线总长度非常长时，请自行测试确定是否可以使用本管理系统。
5. 焊接电池引线时，一定不可有错接或反接。如果确实已接错，这块电路板可能已损坏，需要重新测试合格后才可使用。
6. 装配时管理系统不要直接接触到电芯表面，以免损坏电路板。装配要牢固可靠。
7. 使用中注意引线头、烙铁、焊锡等不要碰到电路板上的元器件，否则有可能损坏本电路板。焊接本电路板请不要使用膏状助焊剂，否则有可能导致本电路板工作不正常。
8. 使用过程要注意防静电、防潮、防水等。
9. 使用过程中请遵循设计参数及使用条件，不得超过本规格书中的值，否则有可能损坏管理系统。
10. 将电池组和管理系统组合好以后，初次上电如发现无电压输出或充不进电，请检查接线是否正确。
11. 本规格书中的参数、功能和外形仅供参考，以保护板实物为准。

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- 1) This battery management system cannot be used in series in general
 - 2) When multiple battery packs using this management system are connected in parallel, make sure that the maximum voltage difference of each battery pack is lower than 3V before parallel connection.
 - 3) When multiple battery packs using this management system are used in parallel, the total charging inrush current of the adapter may be applied to a single battery pack. It should be ensured that the total charging inrush current of the adapter does not exceed the maximum charging inrush current of a single management system.
 - 4) The short-circuit protection function of this management system is suitable for a variety of application scenarios, but it does not guarantee that it can be short-circuited under any conditions. When the total internal resistance of the battery pack and the

short-circuit loop is lower than $40\text{m}\Omega$, the capacity of the battery pack exceeds the rated value by 20%, the short-circuit current exceeds 1800A, the inductance of the short-circuit loop is very large, or the total length of the short-circuit wire is very long, please test yourself to determine whether This management system can be used.

5) When soldering the battery leads, there must be no wrong or reverse connection. If it is indeed connected incorrectly, the circuit board may be damaged and needs to be re-tested before it can be used.

6) When assembling, the management system should not directly touch the surface of the cell to avoid damage to the circuit board. Assembly should be firm and reliable.

7) During use, be careful not to touch the components on the circuit board such as lead tips, soldering iron, solder, etc., otherwise the circuit board may be damaged. Please do not use paste flux when soldering this circuit board, otherwise it may cause this circuit board to work abnormally.

8) During use, pay attention to anti-static, moisture-proof, waterproof, etc.

9) During use, please follow the design parameters and conditions of use, and must not exceed the values in this specification, otherwise the management system may be damaged.

10) After the battery pack and the management system are combined, please check whether the wiring is correct if you find that there is no voltage output or charging fails when the battery is powered on for the first time.

11) The parameters, functions and appearances in this specification are for reference only, and the actual protection board shall prevail.