

	102Ah 1P6SBattery module product specification	Document number: PS-SA31-0030-01 Edition: V0 Condition: SOP
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102Ah 1P6S Battery module product specification

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1 Introduction

1.1 Confidentiality requirement

This document shall be read only by persons directly involved in the project of both parties and shall not be forwarded, reproduced or disclosed any details in the document without the permission of CATL and subject to the relevant confidentiality statements in the development contract.

1.2 Purpose of the document

This document is for ContemporaryAmperexTechnology co., LTD. (CATL) developed by 102 ah1p6s battery module for this specification product specification to describe the basic function and the performance of the product specification interface and communication security features labeling packaging transportation and storage of key parameters, as well as user considerations and related law stated in this document provide products of various specifications, the contract party if there is any inappropriate place, found that should be told that in order to develop better products

CATL reserves the right to update and interpret this document.

1.3 Document Structure

The full text is divided into the following sections:

Part I - Introduction

Part II - Product Overview

Part III - Product Key Parameters

Part IV - Product Composition

Part V- Product Interface

Part VI - Product Technical Requirements

Part VII - Product Configuration Checklist

Part VIII - Labeling, Packaging, Transportation and Storage

Part IX - Notes and Statements

1.4 Definition of terms & abbreviations

1.4.1 Definition of terms

(Battery Cell)	The smallest energy storage unit, a basic electrochemical energy storage device. It consists of a positive electrode, a negative electrode, an electrolyte, a separator, an exhaust valve, and a casing, and is also called a battery cell.
(Battery Module)	Intermediate energy storage unit, a combination of several single-unit circuits and circuit devices (monitoring and protection circuits, electrical and communication interfaces), also called modules, placed in a mechanical electrical unit.
(Nominal Voltage)	The potential difference between the positive and negative electrodes of the battery at 25 °C, 90% RH, 50% SOC.
(Capacity)	The amount of electricity that can be supplied by a fully charged battery under the specified conditions is usually indicated by Ah.
(Energy Capacity)	The amount of power that can be supplied by a fully charged battery under specified conditions is usually expressed in terms of Wh or KWh.
(Nominal Capacity)	After the initial life (BOL) is fully charged according to the specified conditions, the battery is 1C. The minimum capacity that can be provided by rate discharge.
(Unit)	“V” (Volt) (V)) “A” (Ampere) (A)) “Ah” (Ampere-Hour) (Ah)) “Wh” (Watt-Hour) (Wh)) “Ω” (Ohm) (Ω)) “°C” (Degree Celsius) (°C)) “mm” (millimeter) (mm)) “s” (Second) (s)) “Kg” (Kilogram) (Kg)) “Hz” (Hertz) (Hz))

1.4.2 Abbreviations

CATL	ContemporaryAmperexTechnology co., LTD
BMS	Battery Management System
BMU	Battery Management Unit
BOL	Begin of Life
Busbar.	Collecting current
CAN	Controller Area Network
C-CAN	BMU &CMC newsletter CAN
EOL	End of life
FMEA	Failure Model and Effect Analysis

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HV	High Voltage
LV	Low Voltage
OCV	Open Circuit Voltage
S-Box	Switch Box
SOC	State of Charge
SOH	State of Health

1.5 Legal Terms

The product development process considers all relevant technical standards and legal and regulatory requirements, as well as test methods and inspection rules in development contracts. This specification complies with the samples developed at this stage. Any deviation from relevant legal norms has been embodied or described in the text.

2 102Ah 1P6S Battery module information

2.1 Basic Information

∞ Name: 102Ah-355 battery module

∞ Specification: 21.96V / 102Ah

∞ Phase: SOP

2.2 Features & functions

102Ah 1P6S The battery module is an important part of the power battery assembly. Used to provide energy, absorption, and supply to a vehicle's high-voltage electrical system.

Its main features are as follows:

- VDA standard NCM102Ah cell is adopted. Its superior charge-discharge performance can effectively improve the vehicle's dynamic performance, endurance and good environmental adaptability.
- FPC module is adopted to collect the temperature and voltage information of the module, which omits the traditional wire harness collection method, is more simple and convenient, and can effectively use the space, thus having higher energy density and system integration efficiency.

The functional requirements for modules are outlined below:

- (1) Power battery high voltage output function.
- (2) Energy feedback storage function.

3 Module key parameters

Electrical performance parameters are as follows

102Ah 1P6S Battery module product specification

Item		Unit	Battery Module
Nominal Voltage		V	21.96V(25°C, 1C)
			22.2V(25°C, 1/3C)
MIN Capacity		Ah	≥100Ah (25°C, 1C)
			≥102Ah (25°C, 1/3C)
Allowable operating voltage	55°C≥T>0°C	V	16.8V~25.8V
	0°C≥T>-20°C	V	15V~25.8V
	-20°C≥T>0°C	V	12.6V~25.8V
capability (1/3C, 2.8V~4.3V, 25°C)		Wh	≥2264.4Wh
capability (1C, 2.8V~4.3V, 25°C)			≥2196Wh
MAX Continuous charging current (≤80%SOC) :		A	100A
MAX Continuous encharging current		A	150A
Efficiency (@25°C, 1C charged to 4.3V, 0.05C is charged to the single-cell voltage 4.3V, after standing to the target temperature, 1C discharge)	-30°C	%	80%
	-20°C		85%
	-10°C		87%
	0°C		92%
	10°C		94%
	25°C		100%
	50°C		103%
Module self-discharge rate (出厂 60%SOC@25°C)		%	The first month: <3% The second month: <2% The third month: <2%
Battery Module Maximum SOC Running Window		%	5%~97%
Battery module operating temperature range	Charge	°C	-20°C~55°C
	Discharge		-30°C~55°C
Battery module storage temperature range		°C	-40°C~65°C
Battery module operating humidity range		%RH	2%~65%
Battery module working altitude range		m	-150m~5000m
Module cycle life		Cycles	≥1500 (0.5C/1C, 5%~97%DOD, 25°C)
total weight		kg	(11.200±0.300) kg
Dimensions		mm	355*151.5*108.5mm

4 102Ah 1P6S Battery module composition

4.1 The structural composition of modules

Module is composed of six batteries in series, from the battery module (powder batteries, and the side panel welding fixed end plate. Batteries, the connection between the aluminum with low impedance and high intensity of laser welding, voltage sampling FPC (nickel) with laser pulse spot welding, high efficiency, welding is firm, good quality and good performance of thermal conductivity. The whole module without bolt connection. FPC on CCS, low pressure connector on FPC, located in the anode side module.



Figure 1 102Ah 1P6S Schematic diagram of battery module product

4.2 Modular structure

Module is mainly composed of the following parts: the batteries battery module end plate and a pole ear protection battery module side panel and wiring harness insulation membrane isolation plate cover module output extremely Busbar protection cover parts. Such as battery module, simple structure, fewer parts, high reliability, using laser welding, the welding stability, low internal resistance, light weight, high energy density.

4.3 Cell

1P6S102Ah The module USES a ternary lithium ion cell 3.66V/102Ah. The key parameters of the single cell are shown in the table below:

Number	parameter	Norm	Remark
1	Size	52.2mm (L) *148.9mm (W) *100.3mm (H)	Height without pole
2	Capacity	103.0Ah (C _{nom})	25°C, 1/3C
		100.0Ah (C _{nom})	25°C, 1C
3	Nominal Voltage	3.66V	
4	Operating voltage range (work refers to charging or discharging current ≥ 1A)	2.8V -4.3V	T>0°C
		2.5V -4.3V	-20°C <T≤0°C
		2.1V-4.3V	T≤-20°C
5	Continuous working temperature	10~45°C	
	Other	-30 ~ 10°C, 45 ~ 60°C	Impact on life

The overall structure of the cell is shown in figure 2:



Figure 2 Schematic diagram of cell structure

5 Module interface

5.1 High voltage interface

The module's external output high-voltage connection includes the total positive output pole and the total negative output pole, as shown in figure 5 below. M6*12 bolts with strength rating not less than 8.8 are required for locking.

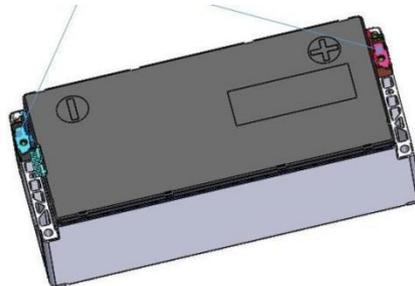


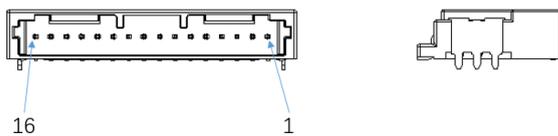
Figure 3 102Ah 1P6S Schematic diagram of the output pole of the battery module

5.2 Low voltage interface

The battery system has a low voltage interface to interface with the BMU, as follows:

The module has a total of 1 low-voltage interface. On the total negative output side of the module, the plug-in is inserted and removed more than 20 times. When performing low-voltage electrical connection, the corresponding connector is required to match, and check whether the low-voltage connector is Clean, oily, etc., to ensure that no metal powder falls into the connector. After inserting the plug of the harness end low voltage connector, check that the plug of the plug is stuck.

Connector model: Hirose ZG05L2-16P-1.8H



Hirose ZG05L2-16P-1.8H Connector:

PIN Numbering	Definition	Function
1	V1	First anode
2	NTCI+	Temperature sampling
3	NTCI-	Temperature sampling
4	V3	Third anode
5	NTC2+	Temperature sampling
6	NTC2-	Temperature sampling
7	V5	fifth anode
8	V6	sixth anode
9	POWER	Anode
10	V4	Forth anode
11	V2	Second anode
12	V0	Earthing
13	GND	Earthing
14	/	/
15	/	/
16	/	/

5.3 Fixed interface

Module in the installation of the Pack number of fixed point for a total of four (as shown in figure 4). Requires selecting strength grade is not less than 10.9 -magnitude M6 bolts (screw length should be determined according to the Pack design) for locking, the installation of the bolt 12 n · m torque requirements, and the moment in the process of vibration attenuation of no less than 70% by adopting the way of logo or recheck all bolt locking.



Figure 4 102Ah 1P6S Schematic diagram of fixed point for battery module installation

5.4 Heat exchange interface

There is a heat exchange interface at the bottom of the module (as shown in figure 5) to place a thermal pad, and the cell flatness is required to be 0.4mm.

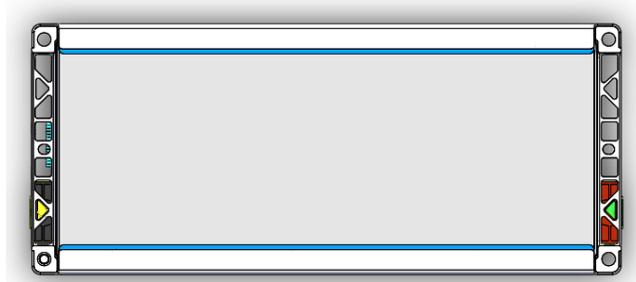
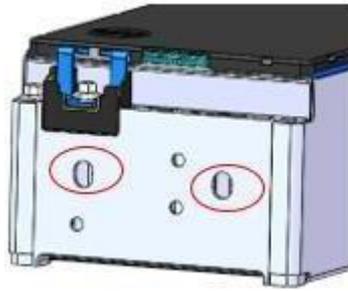


Figure5 102Ah 1P6S Heat exchange interface at bottom of battery module

5.5 Hoisting interface

Two lifting holes are designed on the end plates on both sides of the module to facilitate assembly and transportation of the module on the Pack line. Meanwhile, fixed holes of wire harness should be reserved.



5.6 Module performance test validation

5.7 Module test conditions

Number	Test item	Test standard
1	Fall	GB/T31485-2015
2	Overcharge	GB/T31485-2015
3	Overdischarge	GB/T31485-2015
4	Squeeze	GB/T31485-2015
5	Bottom ball test	Customize
6	Bottom bearing capacity test	Customize
7	Creep test	Customize
8	Seawater immersion test	GB/T31485-2015
9	Heating test	GB/T31485-2015
10	Acupuncture test	GB/T31485-2015
11	Insulation resistance test	GB/T 18384.1-2015
12	Withstand voltage test	GB/T 18384.3-2015
13	Positive and negative column strength test	Customize

14	Sampling plug-in test	Customize
15	Vibration	GB/T31467.3-2015(7.1.2)&Customize
16	Mechanical shock test 1 (collision safety requirements)	GB/T31467.3-2015
17	Mechanical shock test 2	GB/T31467.3-2015
18	Mechanical shock test 3	UN38.3
19	Low air pressure test	GB/T31485-2015
20	Damp heat cycle test	GB/T31467.3-2015
21	Module temperature rise test	Customize
22	Nominal capacity test	GB/T31486-2015
23	Different temperature capacity and energy tests	GB/T31486-2015
24	Energy test at room temperature	GB/T31486-2015
25	NEDC normal temperature discharge energy test	Customize
26	Pulse power test	GB/T31486-2015
27	Current test	Customize

5.8 Module configuration list

Number	Item	Details	Remark
1	3D data		
2	2D drawing		

6 Marking, packaging, transportation and storage

6.1 Marking

The module and the packaging box are pasted or sprayed with some basic product information labels, which are mainly used to identify products, quality and quantity



characteristics and usage methods, including the labels of modules (as shown in figure 6).

Figure6 102Ah 1P6S Marking of battery modules

6.2 Packing

When the module is delivered separately, it shall be installed in a special packing box, packed with EPS, equipped with desiccant, wrapped with stretch film, tightened with packing belt, and protected by corner guard. The following documents shall be attached to the packing box:

- Packing list
- Product shipment report

6.3 Transportation

When the module leaves the factory, it is generally at about 60%SOC. During the transportation, it should be protected from severe vibration and impact, sunshine and rain, and not upside down to ensure no short circuit.

6.4 Storage

At room temperature, the SOC of the product is generally between 30-60%. The requirements for the product storage environment are as follows:

- Storage temperature: -10 °C ~ 40 °C, it is recommended to store at room temperature 5 °C ~ 30 °C ;
- Storage humidity: When the humidity does not exceed 98% RH, it is recommended to store in the range of 10%~85%RH;
- Storage environment: The product should be stored in a clean, ventilated and cool environment, avoiding direct sunlight, high temperature, corrosive gas, severe vibration, mechanical shock and heavy pressure; away from heat source; altitude is less than 5000m.
- Before leaving the factory, standard charging (1C) to 60% SOC at normal temperature, and then leaving the factory

7 Notes and statements

7.1 Notes

At room temperature, the SOC of the product is generally between 30-60%. The requirements for the product storage environment are as follows.

- It is prohibited to store or use the product at high temperature, and it must be kept away from the heat source. These environments above the safe temperature range will lead to a significant decrease in the performance and life of the product, and even cause serious consequences such as combustion explosion;
- Do not store and use in the environment with high static electricity or high electromagnetic radiation. Otherwise, the electronic devices in the product will be damaged, which may lead to safety hazards;
- Do not get wet or even soak in water. Otherwise, the product may lose its function of internal short circuit or abnormal chemical reaction and cause fire, smoke, explosion and other accidents;
- If smoke, heat, discoloration or deformation are found, or if any abnormal phenomena occur in the use of storage, transportation and services, the professional department should be contacted immediately to further observe and control the risk;
- Non-professional installation, maintenance, repair and disassembly are prohibited, unless it is

- the maintenance operation of professional technician;
- It is prohibited to dispose of waste products in fires or hot furnaces. Waste batteries should be recycled and recycled by professional institutions or organizations
- Do not press heavy objects on the product or stack them on top of each other.

7.2 Statement

Before you use this product, make sure you have read and fully received the following information:

- CATL shall not be liable for any loss of personnel or property resulting from any breach of the terms and conditions of use specified in this document;
- This product in the installation, storage, transportation, use, maintenance and repair process, there are potential risks and hazards, please according to the corresponding requirements for operation;
- The user shall establish the correct rules for the service and maintenance of the product, and CATL shall provide the necessary technical support;
- CATL reserves the right to interpret all problems with this product. If you have any questions or objections, please contact CATL professional.

7.3 Specification for safe use of modules

CATL shall not be liable for any loss of personnel or property resulting from any violation of the conditions of use and scope of work;

- Module connection

The module has two interfaces: the positive and negative poles of the power supply and the communication interface. All interfaces are built-in. Since the system works in a high-voltage and high-current working environment, the safety and reliability of the connection are basic requirements:

- a) Connect the wires to meet the maximum continuous charge and discharge current usage requirements;
- b) Each connector must be safe and reliable, to ensure that there will be no loose,

virtual contact problems, close to zero contact resistance, the connector must have corrosion resistance, wear resistance, anti-seismic function;

- c) All connections must meet the relevant national standards to prevent all forms of arcing;
- d) The connection between the internal batteries must have anti-vibration and anti-loose devices. The temperature, voltage and current sensors must also be safe and reliable to prevent loosening, aging and extrusion. It is strictly forbidden to expose any metal in the sensing line;
- e) guard against any form of short circuit during the connection process;
- f) It is strictly forbidden for the operator to operate without the protective equipment;
- g) All connections must be carried out under clear direction, and any form of guessing and ambiguous attempting is prohibited.
- h) The key points of the connection are: to ensure that the connection is correct, reliable (not loose), good contact (no contact resistance), no short circuit;
- i) After the connection is completed, it must be measured and confirmed point by point;
- j) All connection points must ensure that they are not in contact with or shorted to the outer box or other components;
- k) There are other uncertain factors that need to be consulted by a professional before they can be implemented.

2) Moisture proof and waterproof

The battery pack is a high-voltage energy storage device with many high-voltage output ports and single-cell batteries. Liquid entering the battery pack may cause short-circuit, leakage, and corrosion of the battery and connector. Therefore, the battery pack must not be soaked by various liquids. The humid air does not enter the battery pack. The battery pack must not be exposed to the sun and rain. If the battery pack is soaked or exposed to rain, it needs immediate maintenance. The battery pack installation space must fully consider the waterproof function.

3) Environmental insulation

The battery pack must be kept in the optimum operating temperature range, which can greatly extend the battery life and improve the safety of the battery. The temperature limit should be sufficient to meet the various definitions in the specification. The space in which the battery pack is installed should be kept ventilated and heat-insulated. It is strictly forbidden to direct sunlight or heat directly to the battery under the sun or directly radiate heat to the outside

in the cold winter.

4) Shockproof collision

The internal battery of the battery pack is connected in series and equipped with various components and sensing devices. The battery pack must be installed firmly and reliably without any looseness and shaking. It is forbidden to reverse or tilt the battery pack. At the same time, the shock absorber cushion must be installed at the bottom of the battery pack to prevent the battery pack from swinging sharply during use and affect the reliability of the battery connection. The periphery of the battery pack installation space must have sufficient strength anti-collision protection device to ensure that the general collision will not directly damage the battery pack and the battery, resulting in battery outlet safety accidents (direct short circuit, overheating, combustion, etc.)

5) High voltage insulation

All power connections in the battery pack must ensure adequate insulation protection to ensure that the battery's positive and negative terminals do not touch the outer box under any circumstances, causing leakage and short circuit. At any time, it is absolutely necessary to ensure that the positive and negative terminals of the battery system will not be directly short-circuited, otherwise it may cause major safety and electric shock.

6) Accident handling

After the battery unit is abnormal and accidents, it should promptly take correct and effective treatment measures to eliminate further damage and increase losses:

- a) Overheating: Under normal circumstances, when the battery pack battery is overheated, the battery pack cooling system will automatically dissipate heat to cool the battery pack to the optimal operating temperature range; when the battery pack fails to cool down to the target temperature or battery pack within the specified time When the temperature exceeds the safe upper limit, the management system will give a warning and request to stop using it immediately. In this case, stop using the battery immediately, and notify the relevant technicians to conduct a comprehensive inspection, and then continue to use it after troubleshooting.
- b) Leakage: If the battery pack is found to be leaking during use, the personnel in the energy storage room must be evacuated immediately, and the relevant technical personnel should be notified immediately to handle the problem. It is strictly forbidden to work with the battery and forcibly continue to use it.
- c) Over-discharge: When the battery pack is used up, the overall voltage is too low or some battery voltage is lower than its normal working voltage range,

the management system will give a warning and request to stop using the battery immediately. At this time, stop the battery immediately. Discharge, start charging the battery. It is forbidden to force the battery to continue to discharge at this time, which will damage the performance of the battery. In severe cases, the battery may be permanently damaged and cannot be used any more.

- d) Short circuit: battery pack short circuit caused by various reasons, you must immediately evacuate the personnel in the energy storage room, cut off the relevant power and electrical equipment (if possible), immediately disconnect the battery from the system, and immediately notify the relevant technical personnel. On-site maintenance troubleshooting, batteries that have been severely short-circuited will not be re-used, and must be thoroughly tested by the manufacturer before deciding whether to continue maintenance.
- e) Combustion: battery pack burning accidents caused by various reasons, personnel must be evacuated immediately, and no unrelated persons should be allowed to approach the product within the safe range (because of the possibility of explosion hazard), special fire extinguishers should be used to extinguish the fire by professional personnel. After that, the person wearing the necessary protective equipment first cuts off the power connection line, and the battery pack application resistor is fully discharged (voltage to 0V) before the battery pack can be removed for subsequent operation analysis.
- f) The battery pack is collided: For various reasons, if the battery pack is bumped, deformed or foreign matter is pierced, immediately disconnect the battery power cable and notify the professional technician to attend the site. If the battery needs to be removed, the battery should be fully discharged by the person wearing the necessary protective equipment before disassembly.

Other accidents: Due to other accidents, when the battery system needs to be repaired or removed, the battery line should be disconnected first to ensure that the battery will not be short-circuited. Remove the battery pack to ensure that the battery pack will not be bumped, dropped, inverted, etc. The situation is damaged.

If this happens, please refer to the above rules for processing.