SMI-48100A1F6 LFP Battery System Specification

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Summary of file changes：

Date	Version	Revision Note	Reviser	Verifier
2022-01-24	A0	The new artificial	JunJun Feng	Junjun Wang

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Contents

SMI-48100A1F6 Specification

Keyword：Battery module

Abstract：In this paper, technical requirements and performance indexes of SMI-48100A1F6 battery module are defined to provide a basis for development and test。

Definition：

No	Item	Description	Remark
1	BMS	Battery Management System	
2	DOD	Depth of Discharge	
3	SOC	Status of Charge	
4	LED	LED	

1、 Introduction and Scope

1.1 Introduction

This product is used to supply the backup power for communication equipment when the main power is cut off, ensuring normal service operation and improving power supply reliability.

It uses the LiFePO4 battery cell, nominal capacity is 100Ah, nominal output DC is 48V. The battery has built-in BMS, with completed charge/discharge management, SOC estimation and calibration, battery equilibrium management, alarm field indication and reporting functions, etc., providing RS485 interface.

If single battery module capacity is not meeting the requirement, it support multi-batteries parallel at the max.16. Battery is external with LED to display the operated status.

1.2 Scope

This document describes the SMI-48100A1F6 battery module in items of basic functions, performance indicators, technical indicators, protection function parameters and other technical requirements.

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1.3 Design standard

The design and test of this product refer to the following standards:

1） IEC 62619 Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications

2） UN38.3 Li-Ion Battery Transportation Safety Testing Requirement

3）GB/T 4208-2008 Enclosure Protection Class

4）YD/T 1051-2018 General technical requirements for power supply system of communication bureau (station)

5)YD/T 2344.1-2011 Lithium iron phosphate battery pack for communication Part 1: Integrated

battery pack

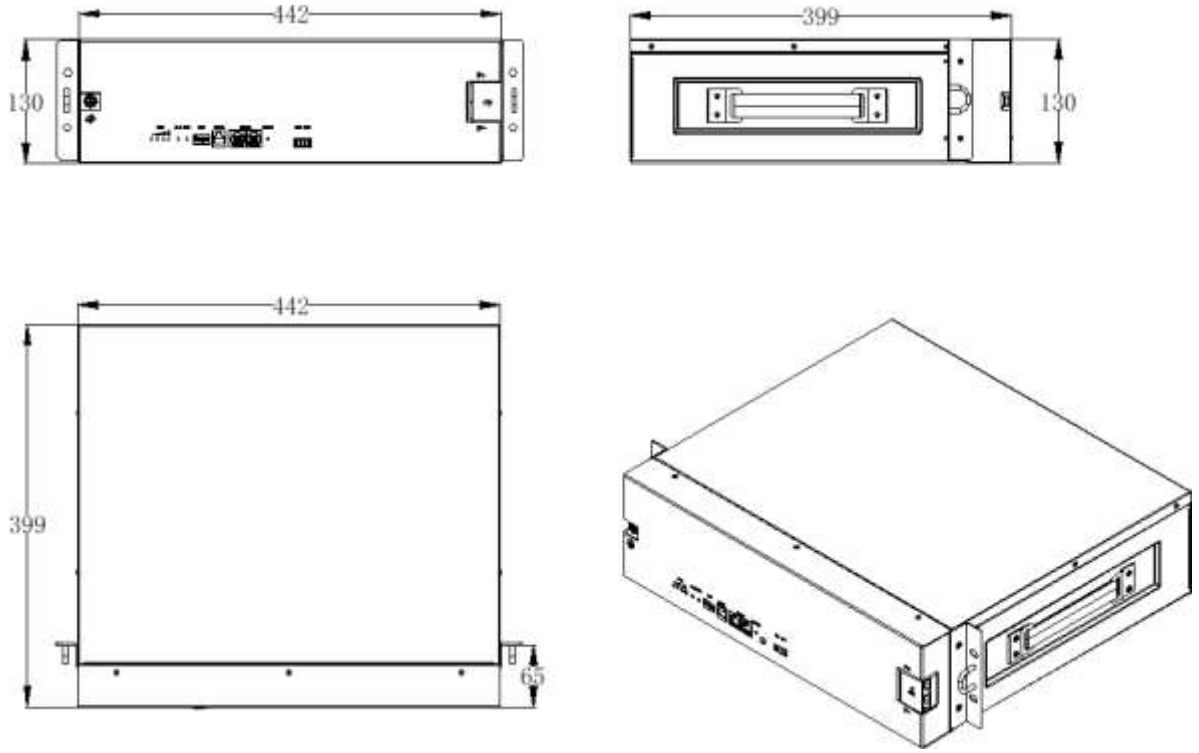
2、 Basic Performance

2.1 Battery Module Basic Performance

No.	Item	Parameter	Remark
1	Rated Voltage	48V	Technology LFP
2	Rated capaciy	100Ah	25°C/0.2C Charge/0.2C Discharge
3	Combination Method	1P15S	15 cells, Laser welding
4	Max Continuous Charge Current	100A（1C）	
5	Max Continuous Discharge Current	100A（1C）	
6	Internal resistance	About 20mΩ	at 25÷45 deg C when battery pack fully charged
7	Cut-off discharge voltage	43.2V	Battery module：43.2V Cell：≥ 2.7V. Whichever comes first
8	Battery Dimension	442mm*399mm*130mm（3U），19-inch rack	W*D*H（Without handle and hanging ear）
9	Work Temperature (Charge)	0~55℃	
10	Work Temperature （Discharge）	-20~60℃	
11	Storage Temperature	-20~45℃	Short time（within 1 month）
		15~35℃	Long time（within 6 month）
12	Operating Relative Humidity	5%~95%RH,	No condensation
13	Storage Relative Humidity	5%~95%RH	No condensation
14	Weight	About 40 kg	(±1kg)
15	Design Life	≥10years	20-25 deg C
16	IP code	≥IP20	
17	Vibration resistant	Work normally after vibration test: Amplitude: 0.8mm. Vibration frequency: Change	

			with rate 1Hz/min from 10Hz-50Hz in at least 90mins. Direction: three mutually perpendicular directions.	
18	External port	Battery terminals	Fit with cable lug SC25-8.	Have protection cap
		Communication	2*RS485+RS232	
19	Cycle life (80%Crt End of Life (EoL)		4000 cycles @0.5C, 25℃, 80%DOD	
			1500 cycles @0.5C, 45℃, 80%DOD	
20	The maximum battery pack can work in parrallel		16 batteries with discharge capacity	

Product size chart（unit:mm）：



Picture1:Battery box structure size chart

2.2 Electrical Parameter

No.	Item	Parameter	Remark
1	Fully charging voltage (VDC)	52.5-55V	
2	Maximum charge current (A)	1 Ctr	
3	Maximum discharge current (A)	1 Ctr	
4	Control and self-limit the battery charging current when charging current exceed allowed value	10±1 A	Limit value in range
5	Capacity at 0.2Crt discharge rate, 100%DOD (Ah), 25 deg C	≥ 100%Crt	
6	Capacity at 1.0Crt discharge rate, 100%DOD (Ah) 25 deg C	≥ 95%Crt	
7	The difference among the max capacity value, min capacity value and mean value of all cells in the battery module must in range:	Range ±1%	of mean value
8	The deviation of voltage between maximum and minimum cell compare when battery pack is fully discharged at 0.2Crt mode,100%DOD	≤ 0.3V	

9	The difference among the max internal resistant value, min internal resistant value and mean value of all cells in the battery module must in range:	±15%	of mean value
10	The deviation of open circuit voltage between maximum and minimum cell when battery pack is fully charged	≤ 0.05V	
11	Charge/discharge efficiency in Wh (round trip efficiency) at 0.2Crt charge and discharge current	≥ 95%	
12	Cell temperature rise during 5 continouos cycles at 0.5Crt, 50 deg C	≤ 25 deg C	
13	New lithium batteries operate in parallel with old lithium batteries (from 2 to 14 batteries, different SOH, manufacturers but same technology and number of cells)	Do not affect quality and warranty conditions	It supports mix working different SOC, but SOC difference should be ＜3%;

3、 BMS(Battery Management System)

3.1 Bacic Performance of BMS

No.	Item	Parameter	Remark
1	Voltage Sampling	15pcs	
2	Communication protocol	Modbus RTU - RS485	
3	Monitor all parameters of battery	Voltage of each module, each cell, current, temperature of cell, BMS, environment, SOC, SOH, cycle count, the accumulated discharge capacity (Ah) or energy (Wh)	
4	Measure and store the accumulated discharge capacity (Ah) or energy (Wh) in whole battery life	Error: ≤ 5%	
5	Measure and monitor the State of Charge (SOC)	Error ≤ 5%	
6	Measure and monitor the State of Health (SOH)	Error ≤ 10%	
7	Measure and monitor the voltage of each cell and battery pack	Error: ≤ 0.5 %	
8	Measure and monitor the current of battery pack	Error: ≤ 2%	

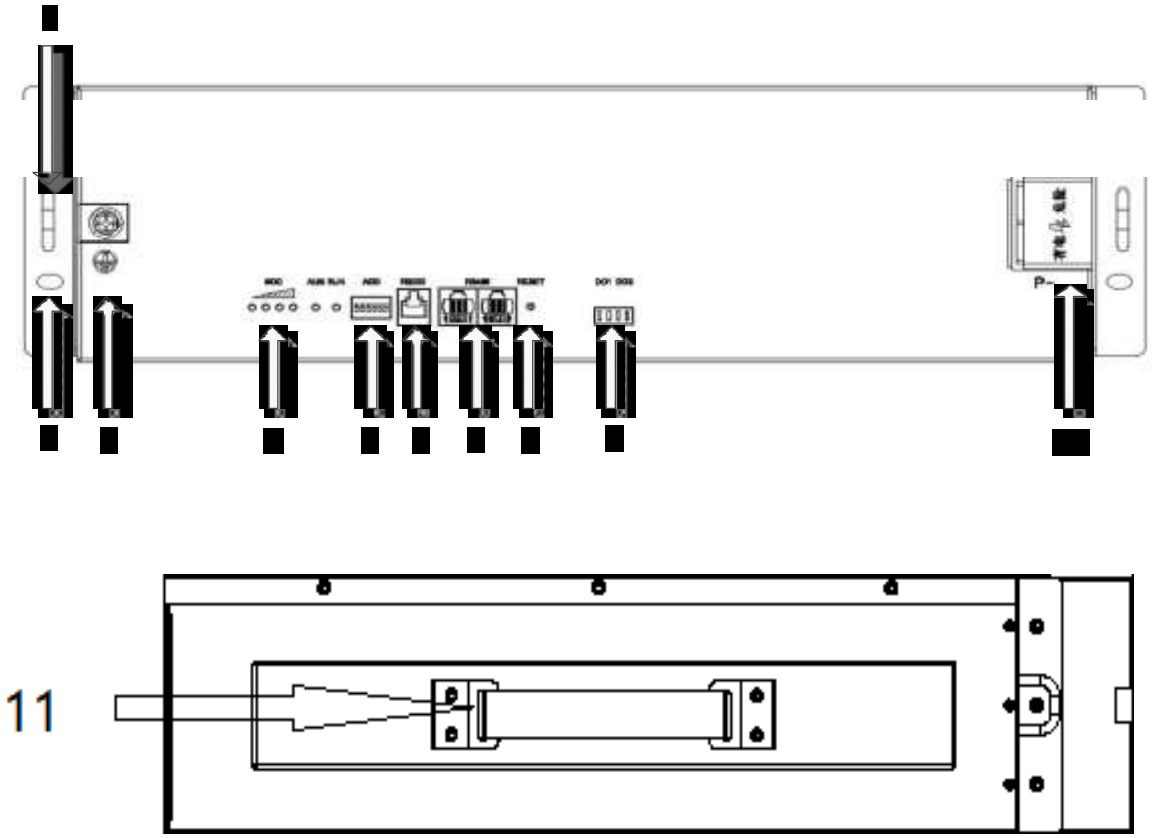
9	Display voltage of battery on BMS software	Resolution volatage for cell: ≤ 1mV Resolution voltage for pack: ≤ 10mV	
10	Measure and monitor the temperature of cells, BMS and working environment temperature of battery	Error: ≤ 3 deg C	Temperature sampling range: -40~125℃
11	Count the number of discharge cycles	Discharge capacity is 80% capactiy, count 1 cycle.	
12	Record history events of battery (alarm, protect funtions)	≥ 200 events and data of events can be exported by the unique BMS softare	
13	Connect to 1 battery to get instantaneous data of all other batteries module in the string	Can take data of 16 batteries	
14	External Communication	RS485、RS232	
15	Equilibrium management	Passive equalization	Passive equalization after full charge
		Equilibrium start voltage difference:50mV	
		Equilibrium start voltage:3400mV	
16	System management	Battery data sampling, uploading at real time.	
17	BMS protection function when:	Cell, battery overvoltage (when charging) & undervoltage (when discharging)	
		High/ low temperature of cells, BMS and environment	
		Over discharge current protection	
		Short circuit protection	
		Reverse polarity protection when battery is actived	

3.2 Protection Parameter of BMS

No.	Item	Description	Value	Unit	Remark
1	Over Charge Parameter	Cell Overcharge Warning Voltage	3.6	V	Adjustable
		Cell Overcharge Protection Voltage	3.7	V	Adjustable
		Battery Module Overcharge Warning Voltage	52.5	V	Adjustable
		Battery Module Overcharge Protection Voltage	55	V	Adjustable
2	Over Discharge Parameter	Cell Over Discharge Warning Voltage	2.8	V	Adjustable
		Cell Over Discharge Protection Voltage	2.7	V	Adjustable
		Battery Module Over Discharge Warning Voltage	45	V	Adjustable
		Battery Module Over Discharge Protection Voltage	43.2	V	Adjustable
3	Over-charge Current Parameter	Over-charge Current Warning	102	A	Adjustable
		Over-charge Current Protection	105	A	Adjustable
4	Over-discharge Current Parameter	Over-discharge Current Warning	105	A	Adjustable
		General Over-discharge Current Protection	110	A	Adjustable
		Severe Over-discharge Current Protection	130	A	Adjustable

5	Temperature Protection	Charging Temperature	High Temperature Warning	55	℃	Adjustable
			Low Temperature Warning	5	℃	Adjustable
			High Temperature Protection	60	℃	Adjustable
			Low Temperature Protection	0	℃	Adjustable
		Discharging Temperature	High Temperature Warning	60	℃	Adjustable
			Low Temperature Warning	-10	℃	Adjustable
			High Temperature Protection	65	℃	Adjustable
			Low Temperature Protection	-20	℃	Adjustable

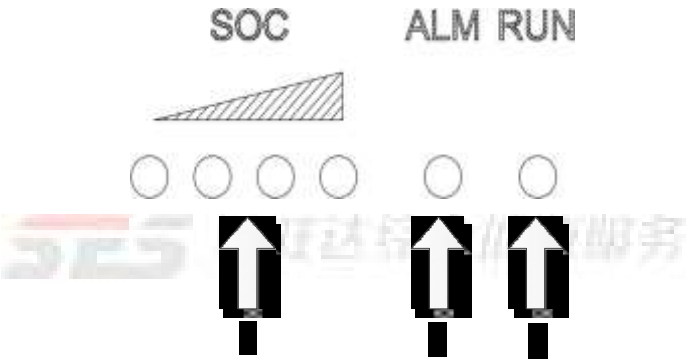
3.3 Operation Panel



No.	Item	Function	Remark
1	Handle	Pull or push the battery box out of the cabinet	
2	Mounting hole	Mounting hole when battery module putting into the rack	
3	Ground hole	Ground hole	

4	Status indicator	Battery module capacity and faulty display	
5	ADD	Battery module address setting switch	
6	RS232	RS232 communication port	RJ11
7	RS485	RS485 communication port	RJ45
8	RESET	Reset	
9	DO1/DO2	Dry contact	
10	Output terminal	Battery module power output port	
11	Handle	Handle of battery module	

3.4 Status Display Introduction



NO	Item	Function
1	SOC	Capacity indicator
2	ALM	Faulty indicator
3	RUN	Operated indicator

3.4.1 Capacity indicator

Status		Charge				Discharge			
Capacity indicator		L4●	L3●	L2●	L1●	L4●	L3●	L2●	L1●
Capacity（%）	0～25%	off	off	off	flash2	off	off	off	on
	25～50%	off	off	flash2	on	off	off	on	on
	50～75%	off	flash2	on	on	off	on	on	on
	75～100%	flash2	on	on	on	on	on	on	on
Operated indicator●		on				Flash（flash 3）			

3.4.2 Status indicator

Status	Normal/Alarm/ Protection	RUN	ALM	Capacity LED				Remark
		●	●	●	●	●	●	
Power off	Sleep	off	off	off	off	off	off	All off
Standby	Normal	flash1	off	Indicate according to capacity				Standby status
	Alarm	flash1	flash3					Module low voltage
Charge	Normal	on	off	Indicate according to electricity (The maximum capacity indicator LED flashes 2)				The maximum capacity indicator LED flash（flash2）, Overcharge alarm, ALM LED do not flash
	Alarm	on	flash3					
	Overcharge protection	on	off	on	on	on	on	If there is no mains power, the indicator is in standby mode
	Temperature, overcurrent and failure protection	off	on	off	off	off	off	Stop charge
Discharge	Normal	flash3	off	Indicate according to capacity				
	Alarm	flash3	flash3					
	Under voltage protection	off	off	off	off	off	off	Stop discharge
	Temperature, overcurrent short circuit, reverse connection and failure protection	off	on	off	off	off	off	Stop discharge
Failure		off	on	off	off	off	off	Stop charge, discharge

3.4.3 LED flash instruction

Flash way	on	off
Flash1	0.25s	3.75s

Flash2	0.5s	0.5s
Flash3	0.5s	1.5s

4、 Safety Performance

No.	Item	Standard	Test Method
1	Over Charge Test	No fire, No explosion	After standard charge, hold for 10mins; then charge at constant current of 1C to 5V.。
2	Over Discharge Test	No fire, No explosion	After standard charge, hold for 10mins; then discharge at constant current of 0.3C to 0V.
3	Vibration test	1. After the sample test is completed, the open circuit voltage is not less than 90% of the value before the test. 2. The sample has no leakage, no smoke, no rupture, no decomposition, no fire	1. The battery is firmly fixed on the vibration platform of the vibration equipment; 2. Increase from 7Hz to 200Hz, and then decrease back to 7Hz as a cycle, and one cycle lasts for 15 minutes. Circulate the sample 12 times in three mutually perpendicular directions for a total of 3 hours. One of the vibration directions must be perpendicular to the polar plane of the sample; 3. The logarithmic sweep frequency is: from 7Hz to maintain a maximum acceleration of 1gn until the frequency is 18Hz, then keep the amplitude at 0.8mm (total offset 1.6mm) and increase the frequency until the maximum acceleration reaches 8gn (frequency is about 25Hz), Keep the maximum acceleration at 8gn until the frequency increases to 200Hz;
4	Drop Test	No fire, No explosion	After the standard is fully charged, drop the battery product freely from a height of 1.5m onto the board, twice on each side
5	Short Test	No fire, No explosion	After standard charge,, under 20℃±5℃ ambient temperature for 1h。Then put the battery by external short circuit for 10 min, the outside line resistance should be less than 10 mΩ.
6	Impact Test	1. After test OCV is more than 90% before the test 2. No fire, No explosion	The battery pack is fastened to the test device with a hard bracket that supports all mounting surfaces of each test battery pack. Must withstand the maximum acceleration of 150g and pulse duration of 6ms half sine wave impact.3 times impact in X,Y,Z direction (positive and negative),Total 18 times

5、 Storage Requirement

		Requirement
Storage Temperature	Less than 1 month	-20~45℃
	Less than 6 month	15~35℃
Humidity		5%-95%RH. No condensation
Storage SOC		40~60%SOC, Power supply shall be supplemented every 6 months
Other Requirement		It should be protected from direct sunlight and no less than 2m away from heat source. When stored, the battery module shall not be inverted, and avoid mechanical shock and pressure. Please not touch power terminal directly. Do not short circuit the positive and negative terminals.

6、 Delivery Requirement

No.	Item	Parameter	Remark
1	Capacity	≥100Ah	0.2C@25 degC
2	Rated Voltage	48V	Battery Module Rated Voltage
3	Battery Weight	About 39kg	(±1kg)
4	Self Discharge	≤3%/month	At 25℃, Self-discharge rate of battery module (%/month)
5	Delivery capacity requirements	45%±5%SOC	Can be agreed according to customer's special needs

7、 Requirements for identification, packaging and transportation

7.1 Identification

A. each battery pack should have the following signs: product name, model, chemical type of battery used, nominal voltage, rated capacity, charging limit voltage, implementation standard number, positive and negative polarity, manufacturing date or batch number, manufacturing Factory name, trademark and cautionary instructions, which allow the execution of the standard number, site, zip code and contact telephone number to be printed in the package or instruction

manual.

B. All marks should be clear and complete, paste firmly, flat, non-foaming, clearly identifiable, and cannot be filled in manually.

C. The information of the product body and the production serial number and model date of the package must be consistent.

7.2 Packaging

A. Each battery pack should be individually packaged, and the outer packaging box should be intact without damage, and should be accompanied by product instruction manual, certificate of conformity, packing list, etc.

B. Packaging and filling materials (such as foam, plastic bags, etc.) are clean and free of dirt, and isolation materials can prevent direct extrusion between controllers.

C. The packaging should be moisture and vibration proof and meet the requirements of GB/T 3873.

D. The packaged product should be placed in a dry, dust-proof, moisture-proof packaging box.

E. The product name, model, quantity, gross weight, manufacturer, and date of manufacture should be marked on the outside of the package. There should be necessary signs such as “careful handling”, “fear of wetness”, “upward”, “fear of fire”, etc. The graphic logo should meet the requirements of GB/T 191.

F. The packaging complies with the performance inspection of SN0449.2-1995 Marine Export Dangerous Goods Packaging Inspection Regulations.

G. Document and accessories

- User manual
- Positive and negative cable with cable lugs for 1 battery: Length: ≥ 70cm,
- Rubber or foam base for batteries stacking: Thickness: ≥ 1cm Quantity: ≥ 4 pcs/battery.
- RJ45 connector: ≥ 2 pcs/battery.
- Prefabricated LAN cable with connectors to connect between battery modules: Length: ≥ 2m/battery.

H. Vibration resistant

Work normally after vibration test: Amplitude: 0.8mm. Vibration frequency: Change with rate 1Hz/min from 10Hz-50Hz in at least 90mins. Direction: three mutually perpendicular directions.

7.3 Transportation

The battery pack should be packed in boxes for transportation. During transportation, it should be protected from severe vibration, impact or extrusion to prevent sun and rain. It can be transported by vehicles, trains, ships, airplanes and other means of transportation.

Lithium-ion battery products are generally not allowed to be transported by airplane. Under special circumstances, when they need to be transported by airplane, they need to be certified in accordance with UN38.3.

7.4 Recovery

Dispose battery in accordance with local regulations.