Renata SA, Switzerland

Engineering Specification

Model No. : AHB390831PR

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PREPARED BY	CHECKED BY	SALES & MARKETING DIV.	QUALITY ASSURANCE DIV.	APPROVED BY
Y.H. Fang	Kuan Mu	Emily Lu	Kevin Wang	Kevin Wang
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1. Preface

The purpose of this engineering specification is to provide technical information for the rechargeable Lithium-ion polymer battery pack AHB390831PR, manufactured and supplied by SYNergy ScienTech Corporation.

2. Description and Model

2.1 Description	Rechargeable Lithium-ion Polymer Battery Pack
2.2 Model	AHB390831PR

3. Specifications

3.1 Typical Capacity	85mAh (at 0.2C rate discharge process after standard charge)
3.2 Minimum Capacity	80mAh (at 0.2C rate discharge process after standard charge)
3.3 Charging Voltage	4.2V
3.4 Average working Voltage	3.7V at 0.2C rate
3.5 Standard Charge	Constant current 0.5C Constant voltage 4.2V 0.05C cut-off
3.6 Fast Charge	Constant current 1.0C Constant voltage 4.2V 0.05C cut-off
3.7 Discharge Cut-off Voltage	3.0V
3.8 Max. Discharge Current	2.0C (for non-continuous discharge mode) 1.0C (for continuous discharge mode)
3.9 Max. Charge Current	1C
3.10 Cycle Life	500 cycles, more than 80% at 0.5C rate discharge
3.11 Temperature range of operation	
Standard Charge	0℃ to 45℃
Discharge	-20℃ to 60℃
3.12 Weight of Battery Pack	Approx. 2.8 g
3.13 Initial Internal Impedance	≤ 530mΩ (30% SOC)
3.14 Storage	At 30% SOC and specified temp, recoverable capacities in % vs time. -20℃ to 25℃ (12 months, ≧85%) 25℃ to 45℃ (3 months, ≧80%)
3.15 Recharging Necessity	To prevent over-discharge at long storage time, the battery pack shall be charged within 3 months after shipment.

4. Outline Dimension

See attached drawing for AHB390831PR (Fig. 1). The thickness is the maximum thickness after 500 cycles.

5. Appearance

Free from deformation, damage, noticeable scratch, flaw, rust, discoloration or electrolyte leakage.

6. Cell Marking

The cells will be marked on the front side with DAILY date code which should be consistent with the cell manufacturing date. The marking should consist of three lines. The first line indicates the AHB model number. The second line indicates the manufacturing date, lot number and the serial number in that lot. The third line indicates the energy carried in watt hour.

Example: 2D CODE -AHB390831N Model AHB390831N1
YMDDLN-xxxx 2D code information
0.30Wh Minimum Capacity

-: indicates the negative terminal. The position of "-" should be near the negative lead.
Y: 2-2022, 3-2023, 4-2024,…..
M: 1-Jan., 2-Feb., …, A-October, B-November, C-December,
DD: 01-1st day of the month, 02-2nd day of the month, and
LN: 012: lot number of cells to be produced.
xxxx: serial number, four digits.

7. Standard Test Condition

7.1 Environmental Conditions

Unless otherwise specified, all tests shall be conducted within one month of delivery at the temperature 23±5℃ and the relative humidity 65±20%.

7.2 Test Equipments

(1) Ammeter and voltmeter
The ammeter and voltmeter shall have an accuracy of ± 0.1mA and ± 0.1mV, respectively.

(2) Slide caliper
The slide caliper shall meet with JIS B7507 standard（slide caliper）and have a scale of 0.01 mm.

(3) Impedance meter
The impedance meter shall be operated at 1 kHz.

8. RoHS compliance is for all parts.

9. Test Procedure and its Standard

Item	Measuring Procedure	Standard
9.1 Appearance	Visual	No Defects and Leakage
9.2 Dimension	Caliper for dimension	As item 4
9.3 Weight	Balance	As item 3.12
9.4 Initial Open Circuit Voltage	Voltmeter	3.6~3.8V
9.5 Initial Internal Impedance	Measure the AC impedance at 1kHz	≤ 530mΩ (30% SOC)
9.6 Discharge Capacity	After standard charge, discharge at 0.2C until final discharge voltage of 3.0V and measure the capacity	≧80mAh (min.)
9.7 Maximum Discharge Current	Until final discharge end voltage of 3.0V	1.0C

9.8 Charge/Discharge Cycle Life	0.5C	Charge: CC- 0.5C, CV-4.2V, Cut-off current: 0.05C Discharge: 0.5C to 3.0V	Discharge capacity should be ≧80% of 1st cycle capacity @ 500th cycle. Rest for 10 minutes between each charge/discharge step.
9.9 Leakage Proof	The fully charged battery shall be stored at 65±3℃ and relative humidity 95±5% for 7 days.		No leakage.
9.10 Temperature Characteristics	1)Charge:CC/CV,CC-0.5C,CV-4.2V Cut-off 0.05C at 23±3℃. 2)Discharge: 0.5C to 3.0V at -10±3℃ and ～60±3℃, respectively. Hold for 1 hour after standard charging.		Discharge capacities should be ≧60% for -10±3℃ and ≧95% for 60±3℃.
9.11 Self Discharge (for cell only)	Capacity after 30days storage, measured under the same conditions as 23±5℃ and relative humidity 65±20% environmental test conditions. Data is collected by fully charging the battery, measuring the initial capacity (discharging), recharging the battery, storing the battery, and then measuring the residual capacity after storing.		Residual capacity ≧72mAh

10. PCM（Protection Circuit Module）SPECIFICATIONS： (Fig.2)

10.1 Operating input voltage	1.5 – 10V
10.2 Current consumption (Operation)	≦ 5.5 μA
10.3 Current consumption (Power down)	≦ 0.2 μA
10.4 Over-charge threshold voltage	4.28V ± 25mV
10.5 Charge Current Protection	1.2 ~ 5.3 A
10.6 Over-discharge Threshold voltage	2.8V ± 50mV
10.7 Discharge Current Protection	0.6 ~ 2.0 A
10.8 On-State Resistance (V_B = 3.7V)	≦ 75 mΩ
10.9 Dimensions	7.1 × 3.6 × 2.0 mm
10.10 0V battery charge function	Available

11. Safety Criteria for Acceptance

Item	State	Test method	Specification
External Short-circuit Test	Fully Charged	Cell terminals are short-circuited for 6 hours or longer with a resistance of 80±20mΩ or less. Tests are to be conducted at 20±5℃ room temperature and 55±5℃.	NO EXPLOSION or FIRE.
Forced-Discharge Test	Fully Charged	Cell is discharged at a current of 1C rate for 1.5 hours.	NO EXPLOSION or FIRE.
Heating Test	Fully Charged	The temperature of the oven is to be raised at a rate of 5±2℃/min. to a temperature of 130±2℃, and remains for 30 minutes at this temperature.	NO EXPLOSION or FIRE.
Crush Test	Fully Charged	Crush between two flat plates. Applied force is about 13kN.	NO EXPLOSION or FIRE.
Impact Test	Fully Charged	Impact between bar (15.8mm diameter) and 9.1 Kg falling material (at a height of 61 cm). Bar is laid across the center of the test sample.	NO EXPLOSION or FIRE.
Drop Test	Fully Charged	Drop a fully charged cell onto a concrete floor from the height of 1.0 meters for 3 times.	NO EXPLOSION or FIRE.
Vibration Test	Fully Charged	Vibrate the cell in tri-axial directions each for 90~100 min. in conditions of frequency 10 ~ 55 Hz with amplitude 0.8 mm.	NO EXPLOSION or FIRE.
Abnormal Charge Test	Fully Discharged	Charging the battery by 3C and 4.4 V for 7 hrs.	NO EXPLOSION or FIRE.

12. Battery Pack Safety Criteria

Item	State	Test method	Specification
Overcharge Test	Fully Discharged	- Fully charge battery pack Settings: CVC mode: 4.2V, set charging current (0.8C), cut-off by taper current (or end Current) 0.02C. - Continuously charge battery pack Settings: CVC mode: 4.6V, set charging current (0.2C). As the pack enters into protection mode, the charging current become to zero.	Test passed according to test method.
Over Current Protection	Fully Charged	For the battery pack, set a load of 400mA to check if the pack would not be protected.	Test passed according to test method.
Over-Discharge Test	Fully Charged	- Fully charge battery pack Settings: CCD mode set discharging current (0.5C), cut-off voltage (or end voltage) 3.0V. - Continuously discharge battery pack Settings: CCD mode set discharging current (0.2C). End voltage 2.0V. As the pack enters into protection mode, the discharging current become to zero.	Test passed according to test method.
Short Circuit	Fully Charged	Fully charge battery pack, short +ve & -ve terminal directly. If protected, pack would not be discharged. Then charge by small current, it would be resumed accordingly.	Test passed according to test method.

13. Charge State of Battery Before Shipment

The battery is charged to 30 % of minimum capacity. Voltage is 3.6V~3.8V.

This measuring test should be performed within one month after shipment from our factory.

14. Handling Precautions

AHB battery pack shall have enough protection for AHB cell from the specification of electrical, mechanical and environmental characteristics. For use of this battery, must follow as specified below. Other than UL1642 or above PACK safety requirement conditions listed may cause major burst, fire, some smokes and it would cause severe performance failure and unsafe for use. Please be sure to follow instructions carefully.

DANGERS:

(1) Don't disassemble or modify the battery.

The battery has safety function and protection circuit to avoid the danger. AHB cell is packaged by Aluminum laminated plastic film which is easy to be damaged by sharp edge such as pin, needle, edge of devices like nickel tabs, etc. If they have serious damage, electrolyte leakage, short-circuit between positive and negative tabs, etc. It would cause the generation, smoke, rupture, or flaming with mishandling.

(2) Don't incinerate or heat the battery

Don't use or leave battery nearby fire, stove or heated place (more than 130℃). These occur the melting of insulator, damage of safety function, or ignition on electrolyte. In case that separator made of polymer is melted by high temperature, the internal short-circuit occurs in individual cells and then it would cause the generating, smoke, rupture or flaming.

(3) Don't use any damage battery

Do not use the battery that are dented or bent on their edge part. AHB batteries are possible to be damaged by strong mechanical shock and it would cause wire break, short-circuit inside the cell, leakage of electrolyte, etc.

(4) Don't use battery nearby the high temperature place or under the blazing sun.

AHB batteries have possibility to be degraded its performance such as capacity, thickness increase, impendence, etc. The battery will be charged at the abnormal chemical reaction occurs in the high temperature place. The thickness change may lead to stressing on battery case/ device, wiring or cell which may have possibility to lead to damage performance.

(5) Don't use the unspecified charger.

If the battery is charged with unspecified condition (under high temperature over the regulated value, excessive high voltage or current over regulated value, or remodeled charger with PCM failed or disassemble), there are causes that it will be overcharged or the abnormal chemical reaction will occur in cells. It causes the gas generating, smoke, rupture or flaming.

(6) Don’t drive a nail into a battery, strike it by hammer, or tread it.
As the battery might be broken or deformed and then it will be short-circuited, it would cause the generating, smoke, rupture or flaming.

(7) Don’t give battery impact or fling it
If the protection circuit assembled in the battery is broken, the battery will be charged at abnormal voltage or current and abnormal chemical reaction will occur. It may cause the generating, smoke, rupture or flaming.

(8) Don’t make the direct ultrasonic wave power to the battery or soldering near the battery
It may cause serious damage to the batteries. Soldering near the battery may cause damage of the components, such as separator and insulator, are melted by heat, it would cause the gas generating, smoke, rupture or flaming.

(9) Don’t reverse polarity (and terminals)
If the protection circuit assembled in the battery is broken. On charging, the battery is reversed-charged and abnormal chemical reaction occurs. And also, there may be case that unexpected large current flows on discharging. There causes the generating, smoke, rupture or flaming.

(10) Don’t reverse-charge or reverse-connect
The battery has polarity. In case the battery is not connected with charger or equipment smoothly do not force them to connect and do check polarity of battery. If the battery is connected to opposite polarity with charger. It will be reverse-charged and abnormal chemical reaction will occur. If the protection circuit assembled in the battery is broken, it would cause the generating, swelling, smoke, rupture or flaming.

(11) Any components or conductive metals from devices must be insulated and averted to contact the edges of pouch cell.

(12) Don’t connect battery to the plug socket or car-cigarette-plug
Added high voltage to the battery, if the protection circuit assembled in the battery is broken, the excessive current will flow in it and then it may cause the generating, swelling, smoke, rupture or flaming.

(13) Don’t use battery for another equipment
If the battery is used for unspecified equipment, it will deteriorate its performance and cycle-life.

(14) Don’t touch a leaked battery directly
In case the leaked electrolyte gets into eyes, wash them with fresh water as soon as possible without rubbing eyes. And then, see a doctor immediately. If leave damaged eyes undone, it will cause eye-trouble.

WARNINGS:

(1) Keep the battery away from babies

Keep the little battery out of the reach of babies in order to avoid troubles by swallowing. In case of swallowing the battery, see a doctor immediately.

(2) Don't get into a microwave or a high pressure container

Because of sudden heat or damage of sealing condition of battery, it may cause the generating, smoke, rupture or flaming.

(3) Don't use a leaked battery nearby fire

If the liquid leaks from the battery (or the battery gives out bad smell), let the battery leave from flammable objects immediately. Unless do that, the electrolyte leaked from battery may catch fire and it would cause the smoke, flaming or rupture of it.

(4) Don't use an abnormal battery, such as leakage, swelling, deformation, etc.

In case the battery has bad smell, it generates, its color change or it is warped in using (includes charging and storage), let it take out from equipment or charger and do not use it. If an abnormal battery is used, it may generate bad performance or damage the device or pack.

(5) Don't store the battery at high voltage and/or high temperature environment which may cause the loss of battery performances and safety features.

(6) Notice for Assembling Battery Pack: Tab connection;

Ultrasonic welding or spot welding is recommended to connect battery with PCM or other parts. If the manual solder method is applied to connect the tab with PCM, notices shown below are very important to ensure battery performance.

A. The solder iron should be well controlled with a moderate temperature and safe ESD.
B. The soldering temperature should not be exceeded 350^{o}C.
C. The soldering time should not be longer than 3 sec.
D. The soldering time should not be exceeded over 4 times and leave the battery tab to be cooling down before next soldering. Directly heating cell body is strictly prohibited because battery may be damaged via a heating above approx.100^{o}C.

CAUTIONS:

(1) Don’t use or leave the battery under the blazing sun (or in heated car by sunshine)
The battery may smoke, heat or flame. And also, it might cause the deterioration of battery’s characteristics or cycle life.

(2) Static Electricity
The battery has the protection circuit to avoid the danger. Do not use nearby the place where generates static electricity (more than 100V) which gives damage to the protection circuit. If the protection circuit were broken under abnormal handling, the battery would generate, smoke, rupture or flame.

(3) Manual
Please read the manual before using the battery and let it keep after reading. And also, please read it necessary.

(4) Charging Method
Please read the manual of specific charger about charging method.

(5) First time use
When the battery has rust, bad smell or something abnormal at first-time-using, do not use the equipment and go to the shop which it was bought.

DISPOSAL METHOD

(1) The disposal of battery should be in accordance with local, state or national legislation.

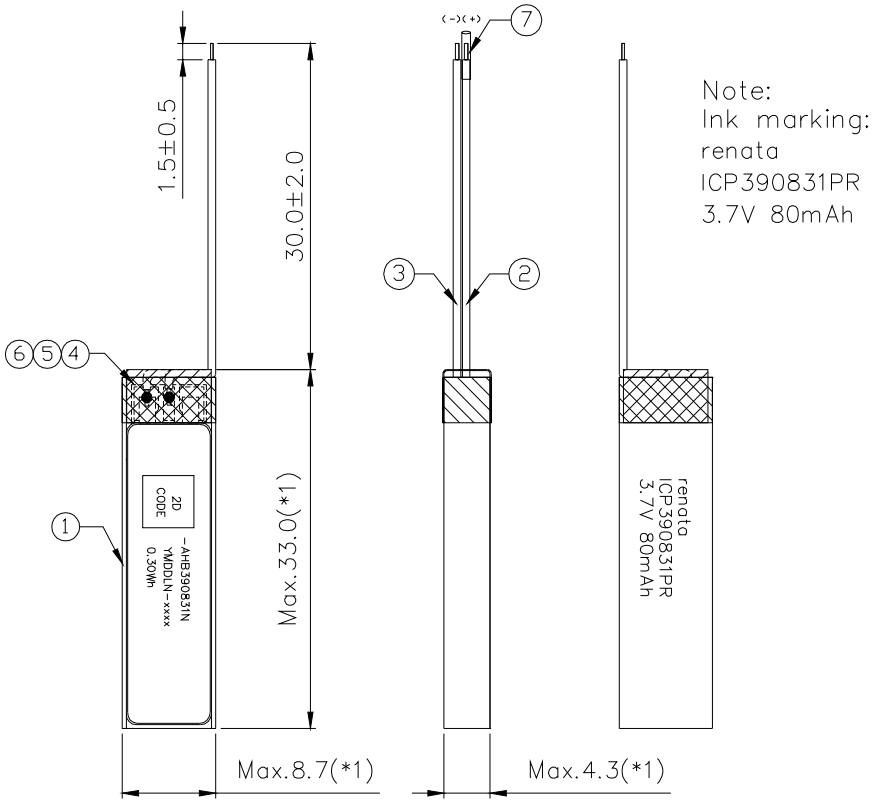
(2) According to terms 7.3 of the Regulation, it is not necessary for a manufacturer or importer to provide measures to ensure that SVHC substances are not exposed to humans or the environment. If the articles are used under normal or reasonably foreseeable circumstances (including disposal) they do not need to fulfill the responsibilities of EU REACH Regulation 7.2 terms, but they should provide the appropriate instructions with the recipients of article.

15. History of Revision

REV.	ISSUE	CONTENT OF AMENDMENT	PRE.	CHK.	APP.
0.0	Nov. 03, 2017	1st Edition	YHF	KM	KW
1.0	Oct. 01, 2021	2nd Edition	YHF	KM	KW
2.0	May 04, 2022	3rd Edition	YHF	KM	KW
3.0	May 05, 2022	4th Edition	YHF	KM	KW
End					

NO.	PART NAME	DESCRIPTION	QTY.	UM	NOTE
1	Battery	AHB390831N	1	EA	Polymer
2	Red Wire	POS.POLE UL3302,AWG30	1	EA	(+)
3	Black Wire	NEG.POLE UL3302,AWG30	1	EA	(−)
4	SYN0603−28NXHSO or Same Spec	CIRCUIT PROTECTION	1	EA	PCM
5	Insulating Tape	FOR PROTECTION CELL	2	EA	Nomex
6	Insulating Tape	FOR INSULATING	2	EA	PI
7	Insulating Tube	FOR INSULATING +/−	1	EA	(+)

■HSF reference W−Y001
■Halogen Free reference W−0080
□Other:



(*1) Measure between two parallel plates with caliper after 500 cycles.

Fig.1

Part list:

Item	Ref	Part name	Number	Qty	Marker
1	R1	RES	RC0201JR-07220RL/ 0201/220Ω/±5%/1/20W	1	YAGEO or Same Spec
2	R2	RES	RC0201JR-072KL/ 0201/2KΩ/±5%/1/20W	1	YAGEO or Same Spec
3	C1	CAP	CC0201KRX5R6BB104/ 0201/0.1μF/±10%/ X5R/10V	1	YAGEO or Same Spec
			GRM033R61A104KE15D/ 0201/X5R/0.1μF/±10%/ 10V		MURATA or Same Spec
4	U1	CONTROL IC	S-8211CAY-I6TIU/ SNT-6A	1	ABLIC
5	U2	MOSFET	FKCS8252E/ Dual-N/WLCSP	1	FETek
			PWEF8252/ N-channel/CSP		POTENS
6	--	PCB	SW0703-28HF-B	1	ASSUNNY or Same Spec

Circuit diagram:

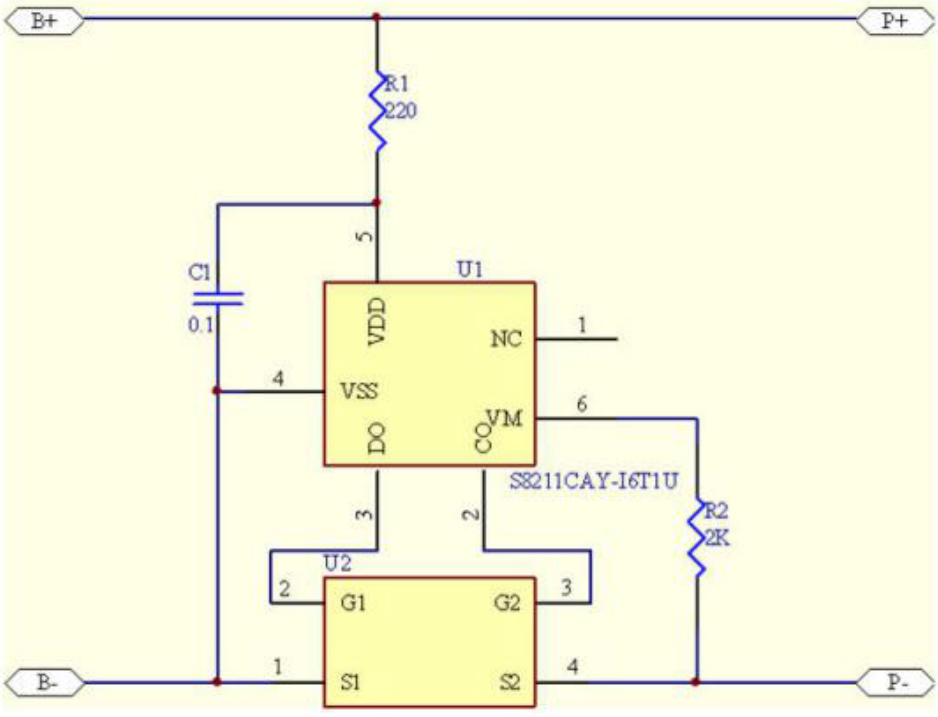


Fig.2