PRODUCT SPECIFICATION

Rechargeable Polymer Lithium Ion Battery

Customer: _____.

Battery Model Number: SG503759-3S1P .

Application: _____.

Date: 2011 / 01 / 28 .

Doc.No: 11012801-(V1.1) .

Approved	Checked	Prepared
John Zeng	John Zeng	David Guo

SOTO BATTERY TECHNOLOGY CO., LTD
ADD: 46# Xinfeng Road, Potoubei Industry Park, Longgang District, Shenzhen 518172, CHINA
TEL : 0086 755 84535976 FAX : 0086 755 28436910
http:// www.soto-battery.com E-mail: sales@soto-battery.com

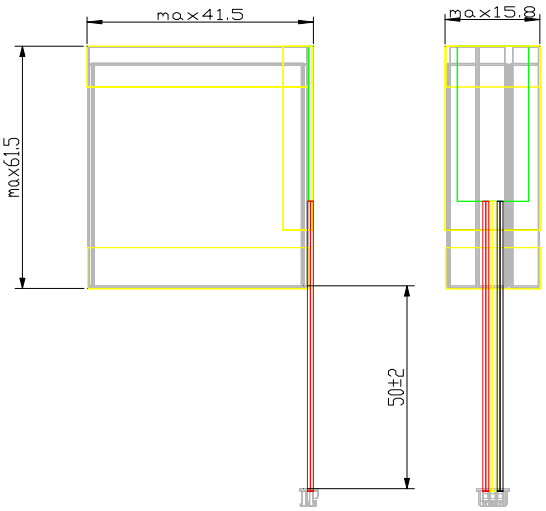
Content

1. SCOPE

This specification is applied to Lithium Ion Battery Pack Manufactured by SOTO Battery Technology Co., Ltd.

2. PRODUCT NAME AND TYPE

Product name：Lithium Polymer Battery
Product Model：SG503759-3S1P
Initial Dimension:



Item	Content	Specifications(mm)
T	Thickness	15.8 max
W	Width	41.5 max
L 1	Length	61.5 max
L 2	Wire length	50±2 mm

NO	Item	Model	Specification	Remark
1	Cell	SG503759	1300mAh	3PCS
2	PCM	TBD	Over Voltage Protect: 4.25±0.025V Over Discharge Protect: 2.0±0.05V	1PCS
3	Wire	AWG#26	Outer Diameter:1.0± 0.1mm	1PCS
4	Connector	JST-PHR-3P	Pin1:Red(+);Pin2:Yellow(NTC);Pin3:Black(-)	1PCS

3. PRODUCT SPECIFICATION

Item		Rating	Note
3.1 Typical Capacity		1300 mAh	0.2C discharge
3.2 Minimum Capacity		1230 mAh	0.2C discharge
3.3 Nominal Voltage		11.1 V	
3.4 End Voltage		8.25 V	3.0V/cell
3.5 Charging Current (Std.)		0.2CA=（260 mA）	Ambient temperature 0~+45℃
3.6 Charging Current (Max.)		1CA=（1300 mA）	Ambient temperature 0~+45℃
3.7 Charging Voltage		12.6 V	
3.8 Charging Time (Std.)		6~7.0 hours	
3.9 Charging Time (Max.)		2~3.0 hours	
3.10 Discharging Current (Std.)		0.2CA=（260 mA）	Ambient temperature -20~+60℃
3.11 Discharging Current (Max.)		1CA=（1300 mA）	Ambient temperature -20~+60℃
3.12 Internal Resistance(25℃)		<200 mΩ	AC Impedance 1KHz
3.13 Weight		72±7 g	Battery pack
3.14 Temperature range for storage	Within 1 month	-20~+60℃	Percentage of recoverable capacity 80 %
	Within 3 month	-20~+45℃	
	Within 1 year	-20~+20℃	
3.15 Storage Humidity	≤75% RH		
3.17 Appearance	Without distortion and leakage		
3.18 Standard testing condition	Temperature: 23±5℃. Humidity: ≤75%RH. Atmospheric Pressure: 86-106 Kpa		

4. GENERAL PERFORMANCE

4.1 Testing standard.

(1).Percentage of recoverable capacity

=(discharging time after storage / discharging time Initial)×100%

(2).Discharging time is estimated by the discharge at 0.2CA to end voltage 3.0V after fully charged according to specification at approximately 25℃.

4. 2. Battery Cell Performance Criteria

Before proceed the following tests, the cells should be discharged at 0.2C to 3.0V cutoff. Unless otherwise stated, tests should be done within one month of delivery under the following conditions:

Ambient temperature:20℃±5℃

Relative Humidity: 65±20%

Note Standard Charge/Discharge Conditions:

Charge: 0.2CCharge to 4.2V/cell,0.01C cut off

Discharge: 0.2C Discharge to 3.0 V/cell

No.	Item	Test methods and condition	Criteria
4.1	0.2C Capacity	After standard charging, rest battery for 10min, then discharging at 0.2C to voltage 3.0V, recording the discharging time.	≥95%
4.2	Rate Discharge	Standard Charge/rest 5min discharge at 1C to 3.0V	≥90%
4.3	Cycle life	Constant current 0.2C charge to 4.2V, then constant voltage charge to current declines to 0.01C, rest 10min，constant current 0.2C discharge to 3.0V，rest 10min. Repeat above steps till continuously discharging capacity Higher than 80% of the Initial Capacities of the Cells	≥500 times
4.4	Capability of keeping electricity	20±5℃, After standard charging, rest the battery 28days, discharging at 0.2C to voltage 3.0V, recording the discharging time.	≥85% First capacity

5. ENVIRONMENT PERFORMANCE

No.	Item	Test methods and condition	Criteria
5.1	Discharge at high temperature	After standard charging, rest the cells 2h at 50±2℃, then discharging at 0.2C to voltage 3.0V	No fire, no explosion
5.2	Discharge at	After standard charging, rest the cells for 16h at	No fire, no

	low temperature	-10±2℃, then discharging at 0.2C to voltage 3.0V, recording the discharging time.	explosion

6. SAFE CHARACTERISTICS

Safe characteristic testing must be with protective equipment.

No.	Item	Test methods and condition	Criteria
6.1	External Short Circuit	After standard charge, short-circuit the cell at 20℃±5℃ until the cell temperature returns to ambient temperature.(cross section of the wire or connector should be more than 0.75mm^2)	No fire, no explosion
6.2	Free falling(drop)	Standard charge, and then leave for 2hrs,check battery before / after drop Height: 50 cm Thickness of wooden board: 30mm Direction is not specified Test for 3 times	No fire, no explosion
6.3	Thermal shock	Put the cells in the oven. The temperature of the oven is to be raised at 5±2℃ per minute to a temperature of 130±2℃ and remains 10 minutes.	No fire, no explosion

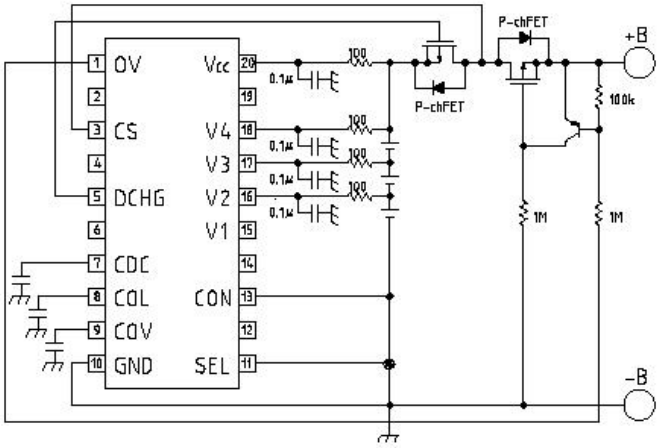
7. BATTERY PROTECTION

7.1 PCM Standard

Item	Symbol	Content	Criterion
Over charge Protection	VDET1	Over charge detection voltage	4.25±0.05V
	tVDET1	Over charge detection delay time	1.0～1.4S
	VREL1	Over charge release voltage	4.05±0.05V
Over discharge protection	VDET2	Over discharge detection voltage	2.0±0.1V
	tVDET2	Over discharge detection delay time	100-500mS
	VREL2	Over discharge release voltage	2.8±0.15V
Over current protection	VDET3	Over current detection voltage	0.15±0.015V
	Imax_-C	Over current detection current	20.0～24.0A
	tVDET3	Detection delay time	5～15mS
		Release condition	Cut load

Short protection		Detection condition	Exterior short circuit
	TSHORT	Detection delay time	220～380uS
		Release condition	Cut short circuit
Interior resistance	RSS	Main loop electrify resistance	V_C=4.2V；R_{SS}≤60mΩ
Current consumption	IDD	Current consume in normal operation	55μA Type 110μA Max

7.2 Schematic diagram



7.3 Parts list

NO.	Location	Part name	Specification	Pack type	Q'ty	Maker/Remark
1	U1	Battery protection IC	MM1414H	TSOP-20-2	1	MITSUMI
2	U2,U3	Silicon MOSFET	AO4407	SO-8	2	AOS
3	Q1	三极管	3906	SOT-23	1	
4	R7,R9	Resistance	SMD 1MΩ±5%	0603	2	YAGEO
5	R8	Resistance	SMD 100KΩ±5%	0603	1	YAGEO
6	R4S	Resistance	SMD 0Ω±5%	0603	1	YAGEO
7	R1,R2,R3,R4 R5,R6	Resistance	SMD 100Ω±5%	0603	6	YAGEO
8	C1,C2,C3,C4 C5	Capacitance	SMD 0.1μF	0603	5	YAGEO
9	C6,C8	Capacitance	SMD 0.01μF	0603	2	YAGEO
10	C7	Capacitance	SMD 680PF	0603	1	YAGEO
11	PCB	Print circuit board	38*12*0.8mm		1	AS

8. SHIPMENT

Cells shall be shipped in 30% state of charge.

9. PERIOD OF WARRANTY

The period of warranty is one year from the date of shipment. SOTO guarantees to give a replacement in case of battery with defects proven due to manufacturing process instead of the customer abuse and misuse.

10. LIABILITIES

- ✧ The customer is requested to contact SOTO in advance, if and when the customer needs other applications or operating conditions than those described in this document. Additional experimentation may be required to verify performance and safety under such conditions.
- ✧ SOTO will take no responsibility for any accident when the battery is used under other conditions than those described in this Document.
- ✧ SOTO will inform, in a written form, the customer of improvement(s) regarding proper use and handing of the battery, if it is deemed necessary.
- ✧ Any matters that this specification does not cover should be conferred between the customer and SOTO

11. WARNINGS

- ✧ Load circuit may cause voltage and current, and the voltage or current may add to pack, the voltage or current must be controlled as lower than RWV and RWI, larger voltage or current may damage the PCM of pack.
- ✧ To prevent the possibility of the pack from leaking, heating, fire .please observe the following precautions:
- ✧ The soft aluminum packing foil is very easily damaged by sharp edge parts such as Ni-tabs, pins and needles .Do not strike at pack with any sharp edge parts.
- ✧ Do not immerse the pack in water and seawater.
- ✧ Do not use and leave the pack near a heat source as fire or heater.
- ✧ When recharging, use the battery charger specifically for that purpose.
- ✧ Do not reverse the positive and negative terminals.
- ✧ Do not connect the pack to an electrical outlet.
- ✧ Do not discard the pack in fire or heat it.
- ✧ Do not short-circuit the pack by directly connecting the positive and negative terminal with metal object such as wire.
- ✧ Do not transport and store the battery together with metal objects such as necklaces, hairpins etc.
- ✧ Do not strike or throw the pack.
- ✧ Do not directly solder the battery pack or cell（except the cable and tab）and pierce the battery with a nail or other sharp object.

12. CAUTIONS

- ✧ To ensure proper use of the battery please read the manual carefully before using it. Handling
- ✧ Do not expose to, dispose of the battery in fire.
- ✧ Do not put the battery in a charger or equipment with wrong terminals connected.
- ✧ Avoid shorting the battery.
- ✧ Avoid excessive physical shock or vibration.
- ✧ Do not disassemble or deform the battery.
- ✧ Do not immerse in water.
- ✧ Do not use the battery mixed with other different make, type, or model batteries.
- ✧ Keep out of the reach of children.
- ✧ Battery must be charged in appropriate charger only.
- ✧ Never use a modified or damaged charger.
- ✧ Do not leave battery in charger over 24 hours.
- ✧ Store the battery in a cool, dry and well-ventilated area.
- ✧ Regulations vary for different countries. Dispose of in accordance with local regulations.

13. HANDLING OF CELLS

- ✧ Soft Aluminum foil Easily damaged by sharp edge parts such as pins and needles, Ni-tabs, comparing with metal-can-cased LIB. Don't strike battery with any sharp edge parts. Trim your nail or wear glove before taking battery. Clean worktable to make sure no any sharp particle.
- ✧ Sealed edge may be damaged by heat above 100°C, bend or fold sealed edge.
- ✧ Prohibition short circuit: Never make short pack circuit. It generates very high current which causes heating of the cells and may cause electrolyte leakage, gassing or explosion that are very dangerous. The LIP tabs may be easily short-circuited by putting them on conductive surface. Such outer short circuit may lead to heat generation and damage of the cell.
- ✧ Mechanical shock: LIP cells have less mechanical endurance than metal-can-cased LIB. Falling, hitting, bending, etc. may cause degradation of LIP characteristics
- ✧ Charging current：Cannot surpass the biggest charging current which in this specification book stipulated.
- ✧ Charging voltage：Does not have to surpass the highest amount which in this specification book stipulated to decide the voltage.
- ✧ Charge temperature：The battery must carry on the charge in the ambient temperature scope which this specification book stipulated.
- ✧ Uses the constant electric current and the constant voltage way charge, the prohibition reverse charges.
- ✧ If the battery positive electrode and the cathode meet instead, can damage the battery.
- ✧ The cell shall be discharged at less than the maximum discharge current specified in the Product Specification. High discharging current may reduce the discharging capacity significantly or cause over-heat.
- ✧ The battery discharge must carry on in the ambient temperature scope which this specification book stipulated.
- ✧ Over-discharges

  It should be noted that the cell would be at over-discharged state by its self-discharge characteristics in case the cell is not used for long time. In order to prevent over-discharging, the cell shall be charged

periodically to maintain between 3.6V and 3.9V.Over-discharging may causes loss of cell performance, characteristics, or battery functions. The charger shall be equipped with a device to prevent further discharging exceeding a cut-off voyage specified in the Product Specification. Also the charger shall be equipped with a device to control the recharging procedures as follows:

The cell battery pack shall start with a low current (0.01C) for 15-30 minutes, i.e.-charging, before rapid charging starts. The rapid charging shall be started after the (individual) cell voltage has been reached above 3V within 15-30 minutes that can be determined with the use of an appropriate timer for pre-charging. In case the (individual) cell voltage does not rise to 3V within the pre-charging time, then the charger shall have functions to stop further charging and display the cell/pack is at abnormal state.

✧ Storing the Batteries

If the cell has to be storied for a long time (Over 1 months),the environmental condition should be;

Temperature: 23±5℃ Humidity: 65±20%RH, The voltage for a long time storage shall be 3.6V~3.9V range.

Because batteries utilize a chemical reaction, battery performance will deteriorate over time even if stored for a long period of time without being used. In addition, if the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged by electrolyte leakage. If the batteries cannot maintain a charge for long periods of time, even when they are charged correctly, this may indicate it is time to change the battery.