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TEST REPORT
IEC 62133-2
Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications – Part 2: Lithium systems

Report Number.....:	180507030SZN-001
Date of issue.....:	June 05, 2018
Total number of pages .....:	29
Name of Testing Laboratory preparing the Report .....:	**Intertek Testing Services Shenzhen Ltd. Longhua Branch**
Applicant's name .....:	
Address.....:	
Test specification:	
Standard .....:	IEC 62133-2:2017 EN 62133-2: 2017
Test procedure .....:	Test report only
Non-standard test method .....:	N/A
Test Report Form No. .....:	IEC62133_2A
Test Report Form(s) Originator ....:	DEKRA
Master TRF .....:	Dated 2017-08-10

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Test item description ..... :	Lithium ion Battery	
Trade Mark ..... :	N/A	
Manufacturer ..... :	Same as applicant	
Model/Type reference ..... :	18650	
Ratings ..... :	3.7V, 1200mAh, 4.44Wh	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
☐ **CB Testing Laboratory:**	**Intertek Testing Services Shenzhen Ltd. Longhua Branch**	
Testing location/ address ..... :	1F/2F, Building B, QiaoAn Scientific Technology Park, Shangkeng Community, Guanhu Subdistrict, Longhua District, Shenzhen, P.R. China	
Tested by (name, function, signature) ..... :	Frank Li / Assistant Manager	
Approved by (name, function, signature)... :	Maggie Guo / Project Engineer	
☐ **Testing procedure: CTF Stage 1:**		
Testing location/ address ..... :		
Tested by (name, function, signature) ..... :		
Approved by (name, function, signature)... :		
☐ **Testing procedure: CTF Stage 2:**		
Testing location/ address ..... :		
Tested by (name + signature) ..... :		
Witnessed by (name, function, signature) . :		
Approved by (name, function, signature)... :		
☐ **Testing procedure: CTF Stage 3:**		
☐ **Testing procedure: CTF Stage 4:**		
Testing location/ address ..... :		
Tested by (name, function, signature) ..... :		
Witnessed by (name, function, signature) . :		
Approved by (name, function, signature)... :		
Supervised by (name, function, signature) :		

List of Attachments (including a total number of pages in each attachment):
Main report (24 pages)
Appendix 1 (1 page): Circuit diagram and PCB Layout
Appendix 2 (1 page): Information in specification
Appendix 3 (3 page): Photos

Summary of testing:

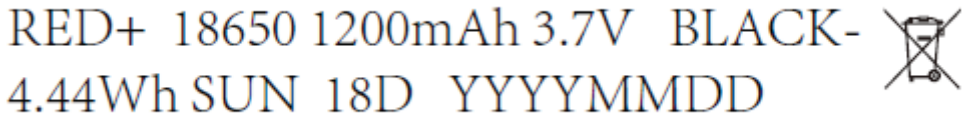
Tests performed (name of test and test clause):	**Testing location:**
7.1 Charging procedures for test purposes 7.2.1 Continuous charging at constant voltage (cells) 7.3.1 External short-circuit (cell) 7.3.2 External short-circuit (battery) 7.3.3 Free fall 7.3.4 Thermal abuse (cells) 7.3.5 Crush (cells) 7.3.6 Over-charging of battery 7.3.7 Forced discharge (cells) 7.3.8.1 Vibration (batteries) 7.3.8.2 Mechanical shock (batteries) 7.3.9 Design Evaluation – Forced internal short circuit	**Intertek Testing Services Shenzhen Ltd. Longhua Branch** 1F/2F, Building B, QiaoAn Scientific Technology Park, Shangkeng Community, Guanhu Subdistrict, Longhua District, Shenzhen, P.R. China

Summary of compliance with National Differences (List of countries addressed):
N/A

☒ The product fulfils the requirements of IEC 62133-2: 2017 and EN 62133-2: 2017.

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.



Silkscreen of battery

Test item particulars.....:	
Classification of installation and use.....:	To be defined in final product
Supply Connection.....:	DC lead wire
Recommend charging method declared by the manufacturer.....:	Charge at constant current 600mA until the voltage reaches 4.2V, then charge at 4.2V till charge current is 24mA.
Discharge current (0,2 It A).....:	240mA
Specified final voltage.....:	3.0V
Upper limit charging voltage per cell.....:	4.25V
Maximum charging current.....:	1200mA
Charging temperature upper limit.....:	45°C
Charging temperature lower limit.....:	0°C
Polymer cell electrolyte type.....:	☐ gel polymer ☐ solid polymer ☒ N/A
Possible test case verdicts:	
- test case does not apply to the test object.....:	N/A
- test object does meet the requirement.....:	P (Pass)
- test object does not meet the requirement.....:	F (Fail)
Testing.....:	
Date of receipt of test item.....:	May 07, 2018
Date (s) of performance of tests.....:	May 07, 2018 to May 16, 2018

General remarks:
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. **Throughout this report a ☐ comma / ☒ point is used as the decimal separator.**
Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided ..... :	☐ **Yes** ☒ **Not applicable**

When differences exist; they shall be identified in the General product information section.
Name and address of factory (ies) ..... :

General product information and other remarks:

The product covered by this report is Li-ion Polymer Battery, consist of 1 cell (model: 18650) which tested with appliance per IEC 62133-2: 2017 in the report.

Product	Cell:18650	Battery:18650
Nominal Capacity (mAh)	1200mAh	1200mAh
Nominal Voltage (V)	3.7V	3.7V
Normal charging voltage (V)	4.2V	4.2V
Normal charging current (mA)	600mA	600mA
Max. charging current (mA)	1200mA	1200mA
End of discharging voltage (V)	3.0V	3.0V
Normal discharging current (mA)	240mA	240mA
Max. discharging current (mA)	1200mA	1200mA
Upper limit charging voltage (V)	4.25V	4.25V
Charging temperature range (°C)	0-45°C	0-45°C

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Clause	Requirement + Test	Result - Remark	Verdict
4	**PARAMETER MEASUREMENT TOLERANCES**		**P**
	Parameter measurement tolerances		P
5	**GENERAL SAFETY CONSIDERATIONS**		**P**
5.1	**General**		P
	Cells and batteries so designed and constructed that they are safe under conditions of both intended use and reasonably foreseeable misuse		P
5.2	**Insulation and wiring**		P
	The insulation resistance between the positive terminal and externally exposed metal surfaces of the battery (excluding electrical contact surfaces) is not less than 5 MΩ	No externally exposed metal surfaces.	N/A
	Insulation resistance (MΩ) ..... :		—
	Internal wiring and insulation are sufficient to withstand maximum anticipated current, voltage and temperature requirements		P
	Orientation of wiring maintains adequate clearance and creepage distances between conductors		P
	Mechanical integrity of internal connections accommodates reasonably foreseeable misuse		P
5.3	**Venting**		P
	Battery cases and cells incorporate a pressure relief mechanism or are constructed so that they relieve excessive internal pressure at a value and rate that will preclude rupture, explosion and self-ignition		P
	Encapsulation used to support cells within an outer casing does not cause the battery to overheat during normal operation nor inhibit pressure relief	To be evaluated in end-product.	N/A
5.4	**Temperature, voltage and current management**	See below	P
	Batteries are designed such that abnormal temperature rise conditions are prevented		P
	Batteries are designed to be within temperature, voltage and current limits specified by the cell manufacturer		P
	Batteries are provided with specifications and charging instructions for equipment manufacturers so that specified chargers are designed to maintain charging within the temperature, voltage and current limits specified	Specification provided.	P
5.5	**Terminal contacts**		P

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Clause	Requirement + Test	Result - Remark	Verdict
	The size and shape of the terminal contacts ensure that they can carry the maximum anticipated current		P
	External terminal contact surfaces are formed from conductive materials with good mechanical strength and corrosion resistance		P
	Terminal contacts are arranged to minimize the risk of short-circuit		P
5.6	**Assembly of cells into batteries**		P
5.6.1	General		N/A
	Each battery have an independent control and protection for current, voltage, temperature and any other parameter required for safety and to maintain the cells within their operating region	Single cell battery	N/A
	This protection may be provided external to the battery such as within the charger or the end devices		N/A
	If protection is external to the battery, the manufacturer of the battery provide this safety relevant information to the external device manufacturer for implementation		N/A
	If there is more than one battery housed in a single battery case, each battery have protective circuitry that can maintain the cells within their operating regions		N/A
	Manufacturers of cells specify current, voltage and temperature limits so that the battery manufacturer/designer may ensure proper design and assembly		N/A
	Batteries that are designed for the selective discharge of a portion of their series connected cells incorporate circuitry to prevent operation of cells outside the limits specified by the cell manufacturer		N/A
	Protective circuit components added as appropriate and consideration given to the end-device application		N/A
	The manufacturer of the battery provide a safety analysis of the battery safety circuitry with a test report including a fault analysis of the protection circuit under both charging and discharging conditions confirming the compliance		N/A
5.6.2	Design recommendation		P
	For the battery consisting of a single cell or a single cellblock, it is recommended that the charging voltage of the cell does not exceed the upper limit of the charging voltage specified in Table 2	The upper limit charging voltage is 4.25V for cell, not exceeding the voltage specified in Table 2.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks, it is recommended that the voltages of any one of the single cells or single cellblocks does not exceed the upper limit of the charging voltage, specified in Table 2, by monitoring the voltage of every single cell or the single cellblocks		N/A
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks, it is recommended that charging is stopped when the upper limit of the charging voltage is exceeded for any one of the single cells or single cellblocks by measuring the voltage of every single cell or the single cellblocks		N/A
	For batteries consisting of series-connected cells or cell blocks, nominal charge voltage not be counted as an overcharge protection		N/A
	For batteries consisting of series-connected cells or cell blocks, cells have closely matched capacities, be of the same design, be of the same chemistry and be from the same manufacturer		N/A
	It is recommended that the cells and cell blocks not discharged beyond the cell manufacturer's specified final voltage		P
	For batteries consisting of series-connected cells or cell blocks, cell balancing circuitry incorporated into the battery management system		N/A
5.6.3	Mechanical protection for cells and components of batteries	No outer case, to be evaluated in end-product	N/A
	Mechanical protection for cells, cell connections and control circuits within the battery provided to prevent damage as a result of intended use and reasonably foreseeable misuse		N/A
	The mechanical protection can be provided by the battery case or it can be provided by the end product enclosure for those batteries intended for building into an end product		N/A
	The battery case and compartments housing cells designed to accommodate cell dimensional tolerances during charging and discharging as recommended by the cell manufacturer		N/A
	For batteries intended for building into a portable end product, testing with the battery installed within the end product considered when conducting mechanical tests		N/A
5.7	**Quality plan**	Not requested by client.	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The manufacturer prepares and implements a quality plan that defines procedures for the inspection of materials, components, cells and batteries and which covers the whole process of producing each type of cell or battery		N/A
5.8	**Battery safety components**		P
	According annex F		P
6	**TYPE TEST AND SAMPLE SIZE**		**P**
	Tests are made with the number of cells or batteries specified in Table 1 using cells or batteries that are not more than six months old	Tests are performed according to specified in Table 1of this standard. The samples are not more than six months old.	P
	Coin cells with resistance ≤ 3 Ω (measured according annex D) are tested according table 1	Not coin cell.	N/A
	Unless otherwise specified, tests are carried out in an ambient temperature of 20 °C ± 5 °C		P
	The safety analysis of 5.6.1 identify those components of the protection circuit that are critical for short-circuit, overcharge and overdischarge protection		P
	When conducting the short-circuit test, consideration given to the simulation of any single fault condition that is likely to occur in the protecting circuit that would affect the short-circuit test		P
7	**SPECIFIC REQUIREMENTS AND TESTS**		**P**
7.1	**Charging procedure for test purposes**		P
7.1.1	First procedure		P
	This charging procedure applies to subclauses other than those specified in 7.1.2		P
	Unless otherwise stated in this document, the charging procedure for test purposes is carried out in an ambient temperature of 20 °C ± 5 °C, using the method declared by the manufacturer		P
	Prior to charging, the battery have been discharged at 20 °C ± 5 °C at a constant current of 0,2 It A down to a specified final voltage		P
7.1.2	Second procedure		P
	This charging procedure applies only to 7.3.1, 7.3.4, 7.3.5, and 7.3.9		P

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Clause	Requirement + Test	Result - Remark	Verdict
	After stabilization for 1 h and 4 h, respectively, at ambient temperature of highest test temperature and lowest test temperature, as specified in Table 2, cells are charged by using the upper limit charging voltage and maximum charging current, until the charging current is reduced to 0,05 It A, using a constant voltage charging method	Charging temperature specified by client is 0-45°C and 45°C and -5°C was used as highest test temperature and lowest test temperature during tests. For Battery and cell: The upper limit charging voltage is 4.25V. The maximum charging current is 1200mA.	P
7.2	**Intended use**		P
7.2.1	Continuous charging at constant voltage (cells)	Test complied.	P
	Fully charged cells are subjected for 7 days to a charge using the charging method for current and standard voltage specified by the cell manufacturer		P
	Results: No fire. No explosion. No leakage.....:	(See appended table 7.2.1)	P
7.2.2	Case stress at high ambient temperature (battery)	No moulded case exists	N/A
	Oven temperature (°C).....:		—
	Results: No physical distortion of the battery case resulting in exposure of internal protective components and cells		N/A
7.3	**Reasonably foreseeable misuse**		P
7.3.1	External short-circuit (cell)	Test complied.	P
	The cells were tested until one of the following occurred:		P
	- 24 hours elapsed; or		N/A
	- The case temperature declined by 20 % of the maximum temperature rise		P
	Results: No fire. No explosion.....:	(See appended table 7.3.1)	P
7.3.2	External short-circuit (battery)	Test complied.	P
	The batteries were tested until one of the following occurred:		P
	- 24 hours elapsed; or		P
	- The case temperature declined by 20 % of the maximum temperature rise		N/A
	In case of rapid decline in short circuit current, the battery pack remained on test for an additional one hour after the current reached a low end steady state condition		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	A single fault in the discharge protection circuit conducted on one to four (depending upon the protection circuit) of the five samples before conducting the short-circuit test		P
	A single fault applies to protective component parts such as MOSFET, fuse, thermostat or positive temperature coefficient (PTC) thermistor		P
	Results: No fire. No explosion..... :	(See appended table 7.3.2)	P
7.3.3	Free fall	Test complied.	P
	Results: No fire. No explosion		P
7.3.4	Thermal abuse (cells)	Test complied.	P
	Oven temperature (°C)..... :	130	—
	Results: No fire. No explosion		P
7.3.5	Crush (cells)	Test complied.	P
	The crushing force was released upon:		P
	- The maximum force of 13 kN ± 0,78 kN has been applied; or		P
	- An abrupt voltage drop of one-third of the original voltage has been obtained		N/A
	Results: No fire. No explosion..... :	(See appended table 7.3.5)	P
7.3.6	Over-charging of battery	Test complied.	P
	The supply voltage which is:		P
	- 1,4 times the upper limit charging voltage presented in Table A.1 (but not to exceed 6,0 V) for single cell/cell block batteries or		P
	- 1,2 times the upper limit charging voltage resented in Table A.1 per cell for series connected multi-cell batteries, and		N/A
	- Sufficient to maintain a current of 2,0 It A throughout the duration of the test or until the supply voltage is reached		P
	Test was continued until the temperature of the outer casing:		P
	- Reached steady state conditions (less than 10 °C change in 30-minute period); or		P
	- Returned to ambient		N/A
	Results: No fire. No explosion..... :	(See appended table 7.3.6)	P
7.3.7	Forced discharge (cells)	Test complied.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	If the discharge voltage reaches the negative value of upper limit charging voltage within the testing duration, the voltage is maintained at the negative value of the upper limit charging voltage by reducing the current for the remainder of the testing duration		N/A
	If the discharge voltage does not reach the negative value of upper limit charging voltage within the testing duration, the test is terminated at the end of the testing duration		P
	Results: No fire. No explosion..... :	(See appended table 7.3.7)	P
7.3.8	Mechanical tests (batteries)	Test complied.	P
7.3.8.1	Vibration		P
	Results: No fire, no explosion, no rupture, no leakage or venting. ..... :	(See appended table 7.3.8.1)	P
7.3.8.2	Mechanical shock		P
	Results: No leakage, no venting, no rupture, no explosion and no fire ..... :	(See appended table 7.3.8.2)	P
7.3.9	Design evaluation – Forced internal short-circuit (cells)		P
	The cells complied with national requirement for ..... :	France, Japan, Republic of Korea and Switzerland	—
	The pressing was stopped upon:		P
	- A voltage drop of 50 mV has been detected; or		N/A
	- The pressing force of 800 N (cylindrical cells) or 400 N (prismatic cells) has been reached	Min 800N applied	P
	Results: No fire ..... :		P
8	**INFORMATION FOR SAFETY**		P
8.1	**General**		P
	Manufacturers of secondary cells ensure that information is provided about current, voltage and temperature limits of their products	Information is given in manufacturer's specifications.	P
	Manufacturers of batteries ensure that equipment manufacturers and, in the case of direct sales, end-users are provided with information to minimize and mitigate hazards	Information is given in manufacturer's specifications.	P
	Systems analyses performed by device manufacturers to ensure that a particular battery design prevents hazards from occurring during use of a product		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	As appropriate, any information relating to hazard avoidance resulting from a system analysis provided to the end user		N/A
	Do not allow children to replace batteries without adult supervision		N/A
8.2	**Small cell and battery safety information**	Built-in battery.	N/A
	The following warning language is to be provided with the information packaged with the small cells and batteries or equipment using them:		N/A
	- Keep small cells and batteries which are considered swallowable out of the reach of children		N/A
	- Swallowing may lead to burns, perforation of soft tissue, and death. Severe burns can occur within 2 h of ingestion		N/A
	- In case of ingestion of a cell or battery, seek medical assistance promptly		N/A
9	**MARKING**		**P**
9.1	**Cell marking**	Battery only	N/A
	Cells marked as specified in IEC 61960, except coin cells		N/A
	Coin cells whose external surface area is too small to accommodate the markings on the cells show the designation and polarity		N/A
	By agreement between the cell manufacturer and the battery and/or end product manufacturer, component cells used in the manufacture of a battery need not be marked		N/A
9.2	**Battery marking**		P
	Batteries marked as specified in IEC 61960, except for coin batteries	Not requested by client.	N/A
	Coin batteries whose external surface area is too small to accommodate the markings on the batteries show the designation and polarity. Batteries also marked with an appropriate caution statement	Not coin battery.	N/A
	Terminals have clear polarity marking on the external surface of the battery	See page 4.	P
	Batteries with keyed external connectors designed for connection to specific end products need not be marked with polarity markings if the design of the external connector prevents reverse polarity connections		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
9.3	**Caution for ingestion of small cells and batteries**		N/A
	Coin cells and batteries identified as small batteries according to 8.2 include a caution statement regarding the hazards of ingestion in accordance with 8.2		N/A
	When small cells and batteries are intended for direct sale in consumer-replaceable applications, caution for ingestion given on the immediate package		N/A
9.4	**Other information**		P
	Storage and disposal instructions	Information is given in manufacturer's specifications.	P
	Recommended charging instructions	Information is given in manufacturer's specifications.	P
10	**PACKAGING AND TRANSPORT**		**P**
	Packaging for coin cells not small enough to fit within the limits of the ingestion gauge of Figure 3	Not coin cell.	N/A
	The materials and packaging design are chosen so as to prevent the development of unintentional electrical conduction, corrosion of the terminals and ingress of environmental contaminants		P
ANNEX A	**CHARGING AND DISCHARGING RANGE OF SECONDARY LITHIUM ION CELLS FOR SAFE USE**		**P**
A.1	**General**		P
A.2	**Safety of lithium ion secondary battery**		P
A.3	**Consideration on charging voltage**		P
A.3.1	General		P
A.3.2	Upper limit charging voltage		P
A.3.2.1	General		P
A.3.2.2	Explanation of safety viewpoint		P
A.3.2.3	Safety requirements, when different upper limit charging voltage is applied	4.25V applied.	N/A
A.4	**Consideration of temperature and charging current**		P
A.4.1	General		P
A.4.2	Recommended temperature range		P
A.4.2.1	General		P

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Clause	Requirement + Test	Result - Remark	Verdict
A.4.2.2	Safety consideration when a different recommended temperature range is applied	Charing temperature range declared by client is 0-45°C.	P
A.4.3	High temperature range	Not high than 45°C.	N/A
A.4.3.1	General		N/A
A.4.3.2	Explanation of safety viewpoint		N/A
A.4.3.3	Safety considerations when specifying charging conditions in the high temperature range		N/A
A.4.3.4	Safety considerations when specifying a new upper limit in the high temperature range		N/A
A.4.4	Low temperature range	-5°C applied.	P
A.4.4.1	General		P
A.4.4.2	Explanation of safety viewpoint		P
A.4.4.3	Safety considerations, when specifying charging conditions in the low temperature range		P
A.4.4.4	Safety considerations when specifying a new lower limit in the low temperature range		P
A.4.5	Scope of the application of charging current		P
A.4.6	Consideration of discharge		P
A.4.6.1	General		P
A.4.6.2	Final discharge voltage and explanation of safety viewpoint		P
A.4.6.3	Discharge current and temperature range		P
A.4.6.4	Scope of application of the discharging current		P
A.5	**Sample preparation**		P
A.5.1	General		P
A.5.2	Insertion procedure for nickel particle to generate internal short		P
A.5.3	Disassembly of charged cell		P
A.5.4	Shape of nickel particle		P
A.5.5	Insertion of nickel particle in cylindrical cell		P
A.5.5.1	Insertion of nickel particle in winding core		P
A.5.5.2	Marking the position of the nickel particle on both ends of the winding core of the separator		P
A.5.6	Insertion of nickel particle in prismatic cell		N/A
A.6	**Experimental procedure of the forced internal short-circuit test**		P
A.6.1	Material and tools for preparation of nickel particle		P

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Clause	Requirement + Test	Result - Remark	Verdict
A.6.2	Example of a nickel particle preparation procedure		P
A.6.3	Positioning (or placement) of a nickel particle		P
A.6.4	Damaged separator precaution		P
A.6.5	Caution for rewinding separator and electrode		P
A.6.6	Insulation film for preventing short-circuit		P
A.6.7	Caution when disassembling a cell		P
A.6.8	Protective equipment for safety		P
A.6.9	Caution in the case of fire during disassembling		P
A.6.10	Caution for the disassembling process and pressing the electrode core		P
A.6.11	Recommended specifications for the pressing device		P
ANNEX B	**RECOMMENDATIONS TO EQUIPMENT MANUFACTURERS AND BATTERY ASSEMBLERS**		**P**
ANNEX C	**RECOMMENDATIONS TO THE END-USERS**		**N/A**
ANNEX D	**MEASUREMENT OF THE INTERNAL AC RESISTANCE FOR COIN CELLS**		**N/A**
D.1	**General**		N/A
D.2	**Method**		N/A
	A sample size of three coin cells is required for this measurement..... :		N/A
	Coin cells with an internal resistance of less than or equal to 3 Ω are subjected to the testing according to Clause 6 and Table 1		N/A
	Coin cells with an internal resistance greater than 3 Ω require no further testing		N/A
ANNEX E	**PACKAGING AND TRANSPORT**		**P**
ANNEX F	**COMPONENT STANDARDS REFERENCES**		**P**

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

	TABLE: Critical components information				P
Object / part No.	**Manufacturer / trademark**	**Type / model**	**Technical data**	**Standard**	**Mark(s) of conformity[1)]**
PCB	SHENZHEN LITONGWEI TECHNOLOGY CO., LTD	Z306	V-0 ,130°C	UL 94	UL E498321
PCB (Alternative)	SHENZHEN MANKUN ELECTRONICS CO LTD	MK-D	V-0 ,130°C	UL 94	UL E248237
PCB (Alternative)	Interchangeable	Interchangeable	V-0, 130°C	UL 94	UL
Protect IC (U1)	DEPUWEI	DW01	Over-charge protection voltage: 4.28V over-discharge protection voltage: 2.4V	--	Test with appliance
MOSFET (Q1, Q2)	DEPUWEI	8205A	Id: 6A Vds: 20V	--	Tested with appliance
Wiring	ALPHA WIRE CO	1007	80°C, 300Vac	UL 758	UL E341631
Wiring (Alternative)	DONGGUAN ZHIHE ELECTRICAL CABLE TECH CO LTD	1007	80°C, 300Vac	UL 758	UL E258239
Wiring (Alternative)	Interchangeable	Interchangeable	min.80°C, min 300Vac,	UL 758	UL
Cell (1S1P)	Shenzhen Sunbang Technology Co., Ltd	18650	3.7V, 1200mAh	IEC 62133-2: 2017	Tested with appliance
-Electrolyte	Henan famwright new energy technology co.,LTD	HL-02	EC+EMC+DMC+DEC+PC+VC	--	--
-Separator	Foshan Donghang OPTIC-ELECTRIC Technology Co., Ltd	16μm	240*16*0.016mm, shutdown temperature 130°C	--	--

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

-Negative electrode	Shenzhen Top Energy Co., Lth	Cu foil	Graphite, CMC, LA-133, Distilled Water, Conductive Additive, 112mm*214mm*0.128nn	--	--
-Positive electrode	Shenzhen Top Energy Co., Lth	Al foil	$LiCoO_2$, PVDF, Conductive additive, 105mm*13mm*0.129mm	--	--
Supplementary information: 1) Provided evidence ensures the agreed level of compliance. See OD-CB2039.					

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.2.1	TABLE: Continuous charging at constant voltage (cells)			P
Sample no.	**Recommended charging voltage Vc (Vdc)**	**Recommended charging current I_{rec} (A)**	**OCV before test (Vdc)**	**Results**
001	4.20	0.60	4.171	Pass
002	4.20	0.60	4.173	Pass
003	4.20	0.60	4.177	Pass
004	4.20	0.60	4.175	Pass
005	4.20	0.60	4.177	Pass

Supplementary information:
- No fire or explosion
- No leakage
- The ambient temperature is 21.3°C

7.3.1	TABLE: External short-circuit (cell)				P
Sample no.	**Ambient T (°C)**	**OCV before test (Vdc)**	**Resistance of circuit (mΩ)**	**Maximum case temperature rise ΔT (K)**	**Results**
Samples charged at charging temperature upper limit[1)]					
006	54.1	4.172	80	85.7	Pass
007	54.1	4.173	72	64.0	Pass
008	54.1	4.171	80	63.3	Pass
009	54.1	4.175	81	68.3	Pass
010	54.1	4.177	72	74.5	Pass
Samples charged at charging temperature lower limit[2)]					
011	54.1	4.168	72	74.1	Pass
012	54.1	4.169	81	50.1	Pass
013	54.1	4.170	80	83.6	Pass
014	54.1	4.163	80	69.0	Pass
015	54.1	4.165	72	59.4	Pass

Supplementary information:
- No fire or explosion
1) Cells charged at 45°C
2) Cells charged at -5°C

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.2	TABLE: External short-circuit (battery)					P
Sample no.	**Ambient T (°C)**	**OCV before test (Vdc)**	**Resistance of circuit (mΩ)**	**Maximum case temperature rise ΔT (K)**	**Component single fault condition**	**Results**
016	22.3	4.181	82	2.6	Normal	Pass
017	22.3	4.183	81	1.8	Q1 Pin 7-8 S-C	Pass
018	22.3	4.179	81	2.4	Q1 Pin 7-8 S-C	Pass
019	22.3	4.177	72	1.6	Q1 Pin 7-8 S-C	Pass
020	22.3	4.178	72	2.4	Q1 Pin 7-8 S-C	Pass

Supplementary information:
- No fire or explosion

7.3.5	TABLE: Crush (cells)			P
Sample no.	**OCV before test (Vdc)**	**OCV at removal of crushing force (Vdc)**	**Maximum force applied to the cell during crush (kN)**	**Results**
Samples charged at charging temperature upper limit[1)]				
034	4.171	4.112	12.72	Pass
035	4.173	4.163	12.85	Pass
036	4.171	4.121	12.95	Pass
037	4.177	0.000	12.84	Pass
038	4.171	4.131	12.78	Pass
Samples charged at charging temperature lower limit[2)]				
039	4.163	4.121	12.79	Pass
040	4.161	4.153	12.82	Pass
041	4.161	4.151	12.73	Pass
042	4.162	4.158	12.95	Pass
043	4.164	4.160	12.82	Pass

Supplementary information:
- No fire or explosion

1) Cells charged at 45°C
2) Cells charged at -5°C

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.6	TABLE: Over-charging of battery				P
Constant charging current (A) ..... :		2.4			—
Supply voltage (Vdc) ..... :		6.0			—
Sample no.	**OCV before charging (Vdc)**	**Total charging time (minute)**	**Maximum outer case temperature (°C)**	**Results**	
044	3.211	90	30.6	Pass	
045	3.198	90	26.4	Pass	
046	3.203	90	30.7	Pass	
047	3.205	90	29.5	Pass	
048	3.197	90	24.3	Pass	

Supplementary information:
- No fire or explosion
- The ambient temperature is 22.1°C

7.3.7	TABLE: Forced discharge (cells)			P
Sample no.	**OCV before application of reverse charge (Vdc)**	**Measured reverse charge I_t (A)**	**Lower limit discharge voltage (Vdc)**	**Results**
049	3.412	1.2	-4.25	Pass
050	3.413	1.2	-4.25	Pass
051	3.417	1.2	-4.25	Pass
052	3.415	1.2	-4.25	Pass
053	3.412	1.2	-4.25	Pass

Supplementary information:
- No fire or explosion
- The ambient temperature is 21.5°C

7.3.8.1	TABLE: Vibration				P
Sample no.	**OCV before test (Vdc)**	**OCV after test (Vdc)**	**Mass before test (g)**	**Mass after test (g)**	**Results**
054	4.173	4.171	38.692	38.688	Pass
055	4.174	4.172	38.678	38.676	Pass
056	4.177	4.175	38.688	38.685	Pass

Supplementary information:
- No fire or explosion
- The ambient temperature is 23.1°C

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.8.2	TABLE: Mechanical shock				P
Sample no.	**OCV before test (Vdc)**	**OCV after test (Vdc)**	**Mass before test (g)**	**Mass after test (g)**	**Results**
057	4.175	4.171	38.701	38.698	Pass
058	4.174	4.172	38.711	38.708	Pass
059	4.174	4.171	38.687	38.685	Pass

Supplementary information:
- No fire or explosion
- The ambient temperature is 23.1°C

7.3.9	TABLE: Forced internal short circuit (cells)				P
Sample no.	**Chamber ambient T (°C)**	**OCV before test (Vdc)**	**Particle location [1)]**	**Maximum applied pressure (N)/ Drop voltage mV)**	**Results**
Samples charged at charging temperature upper limit[1)]					
060	50	4.145	1	800.5	P
061	50	4.151	1	800.3	P
062	50	4.166	1	800.3	P
063	50	4.155	2	800.3	P
064	50	4.161	2	800.5	P
Samples charged at charging temperature lower limit[2)]					
065	5	4.133	2	800.6	P
066	5	4.135	1	800.2	P
067	5	4.131	1	800.3	P
068	5	4.130	2	800.5	P
069	5	4.128	1	800.5	P

Supplementary information:

1) Identify one of the following:
1: Nickel particle inserted between positive and negative (active material) coated area.
2: Nickel particle inserted between positive aluminium foil and negative active material coated area.
- No fire or explosion
1) Cells charged at 45°C
2) Cells charged at -5°C

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

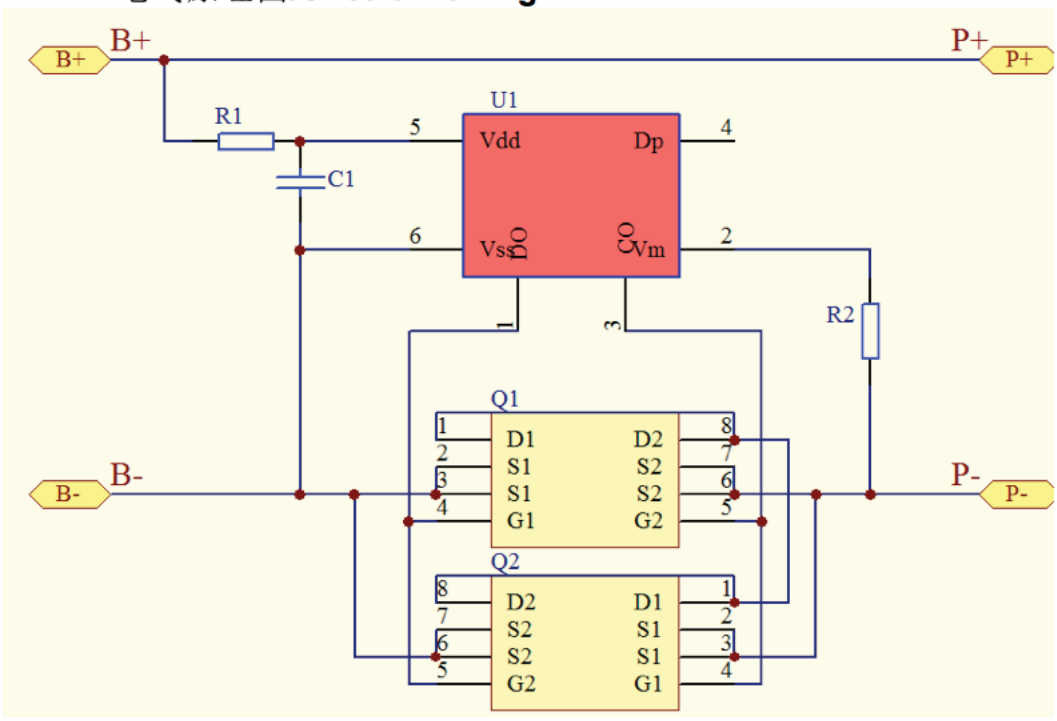
D.2	TABLE: Internal AC resistance for coin cells			N/A
Sample no.	**Ambient T (°C)**	**Store time (h)**	**Resistance Rac (Ω)**	**Results [1)]**

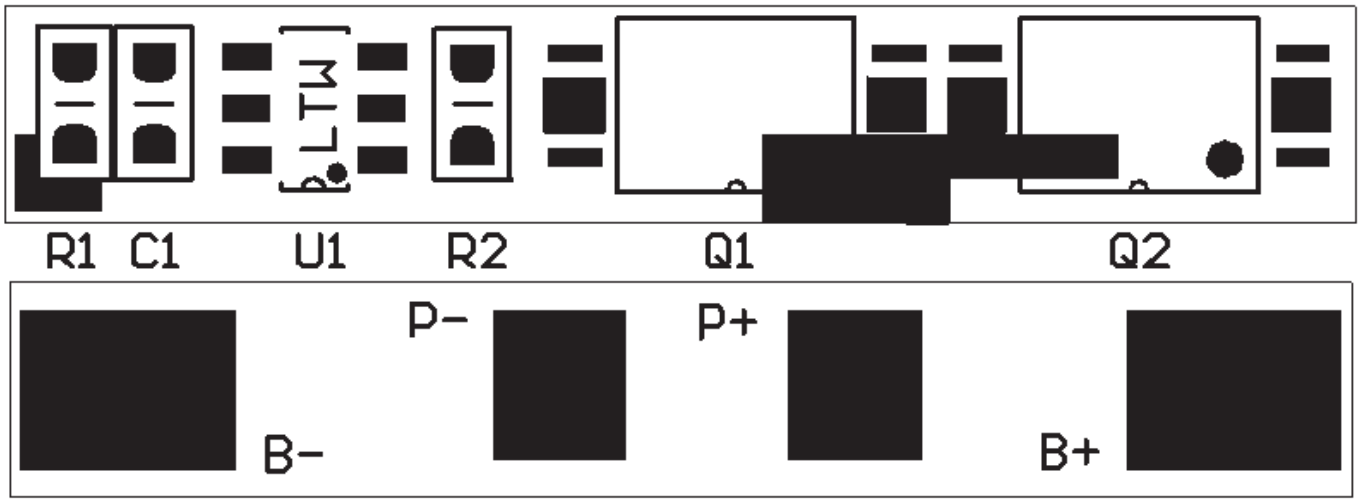
Supplementary information:

[1)] Coin cells with internal resistance less than or equal to 3 Ω, see test result on corresponding tables

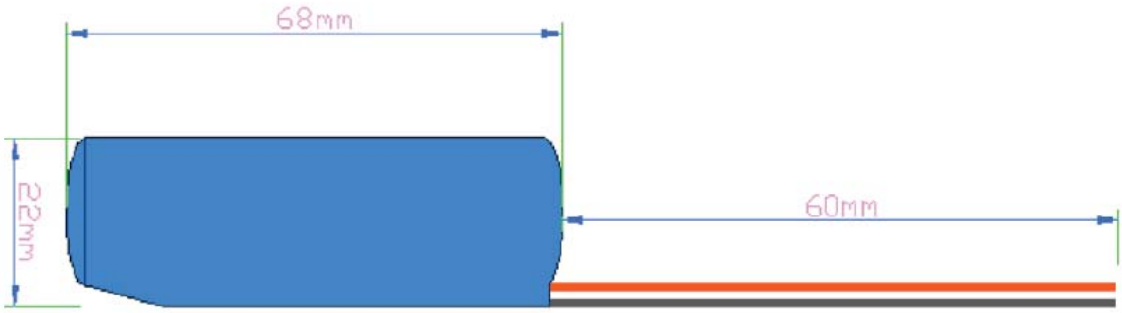
Appendix 1: Circuit diagram and PCB Layout

4.1 电气原理图/Circuit Drawing



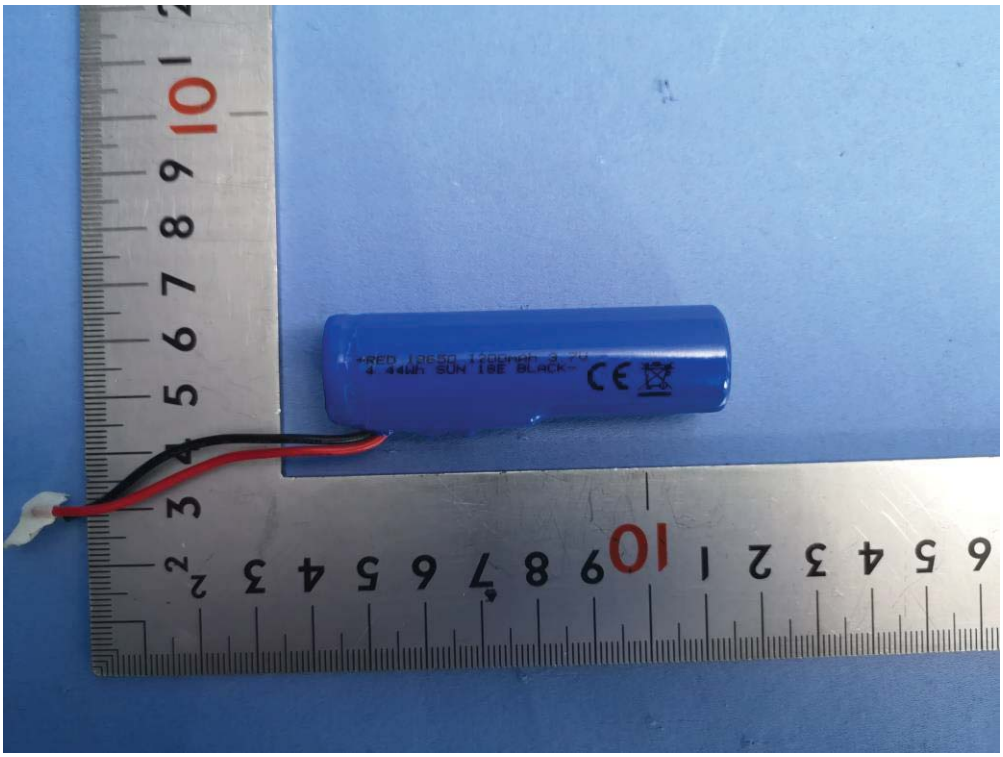


Appendix 2: Information in specification

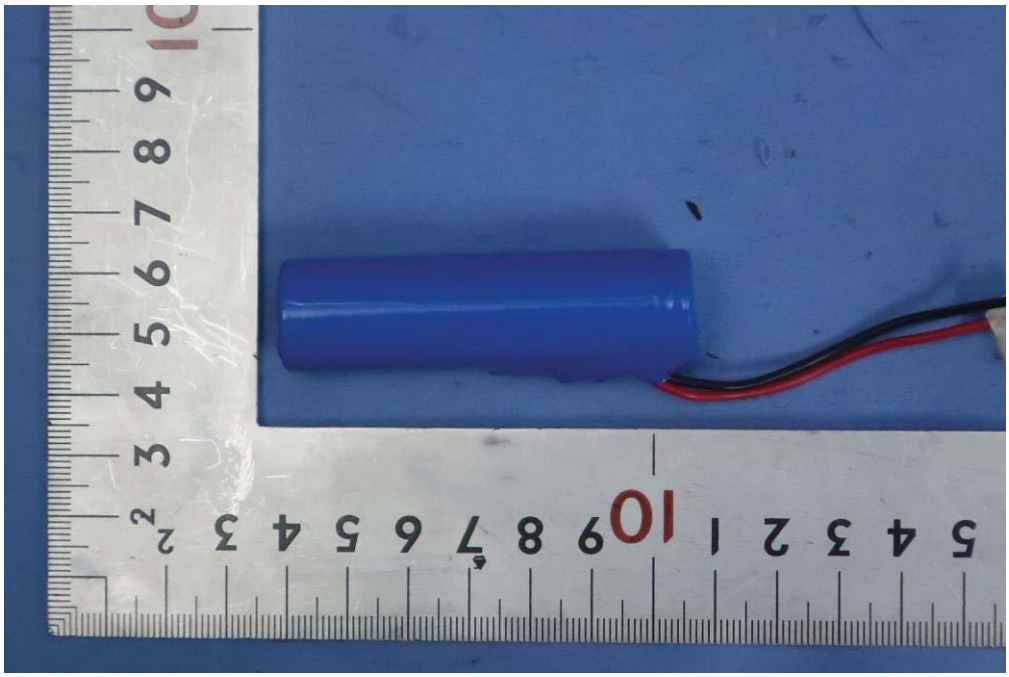


unit（mm）			
L（长）	Max：68mm	（直径）	MAX ：22mm
Wire	UL1007 AWG22#	Connector	外露线长：100±5mm
PCM	IC:DW01+2*8205(MOS)	喷码内容	- 18650 4.44Wh + 3.7V 1200mAh 02

Appendix 3: Photos

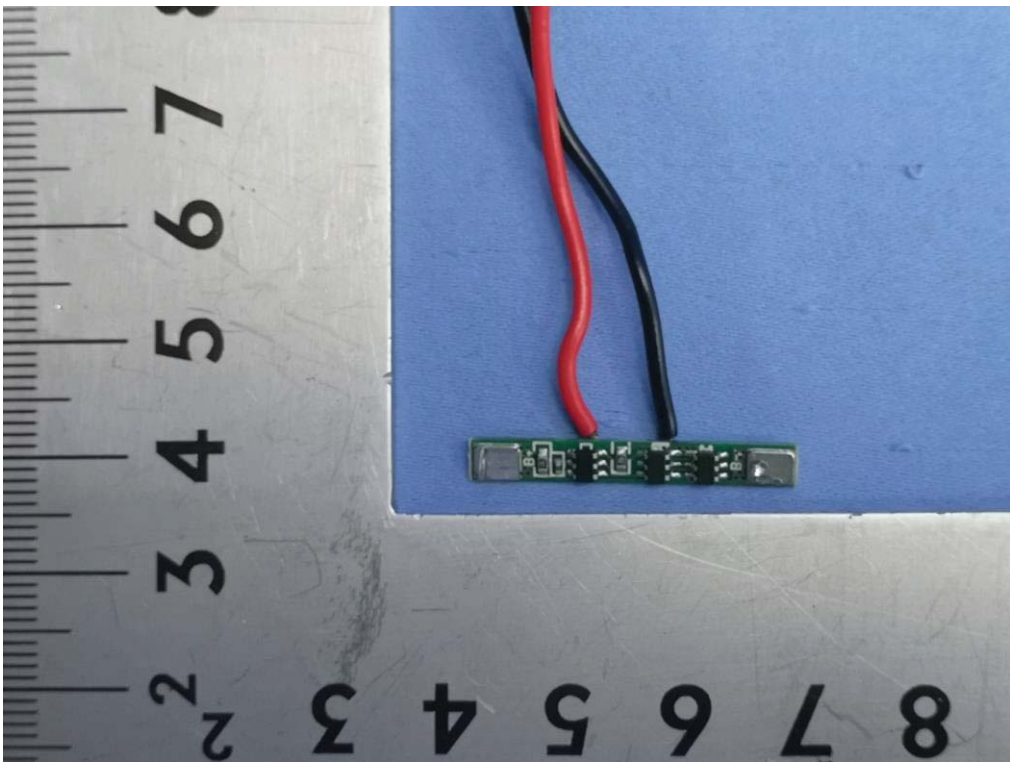


Front view of Battery Pack

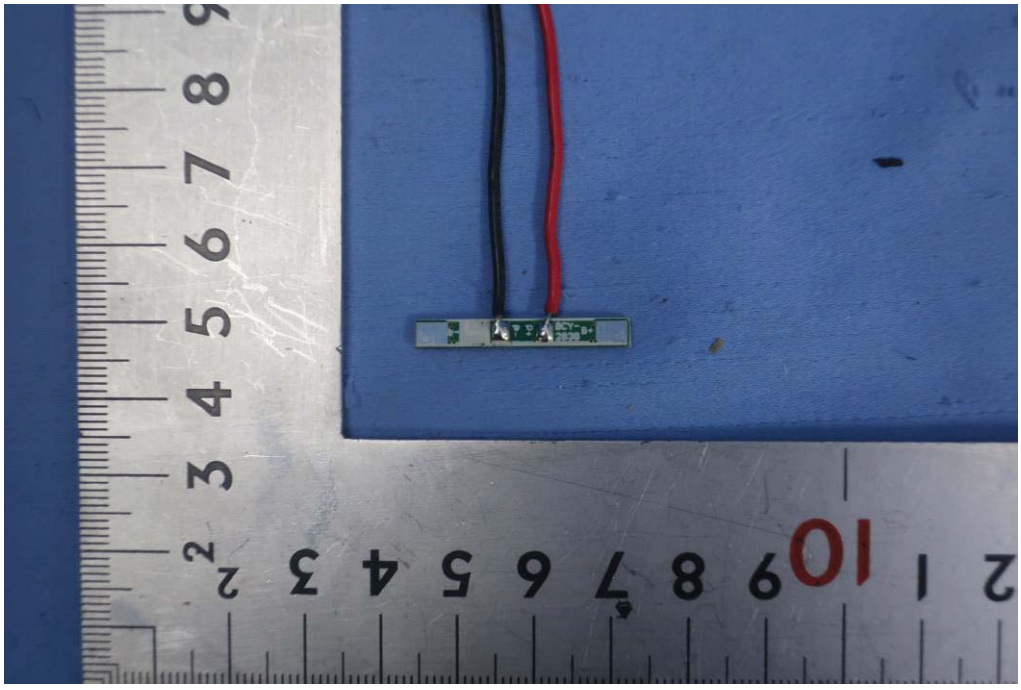


Back view of Battery Pack

Appendix 3: Photos

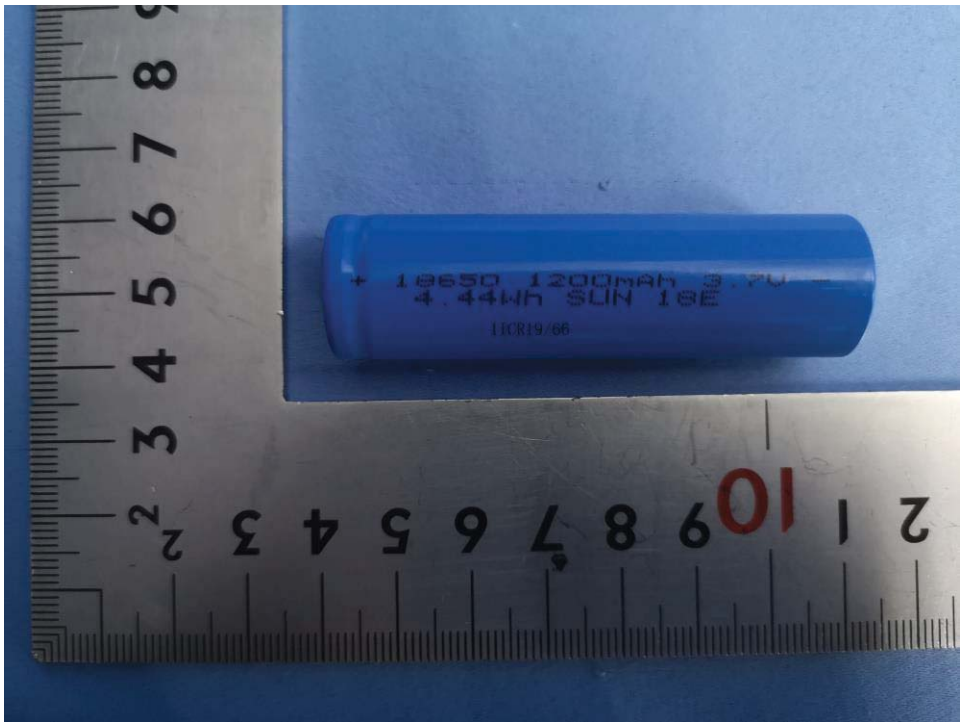


Component side of PCM

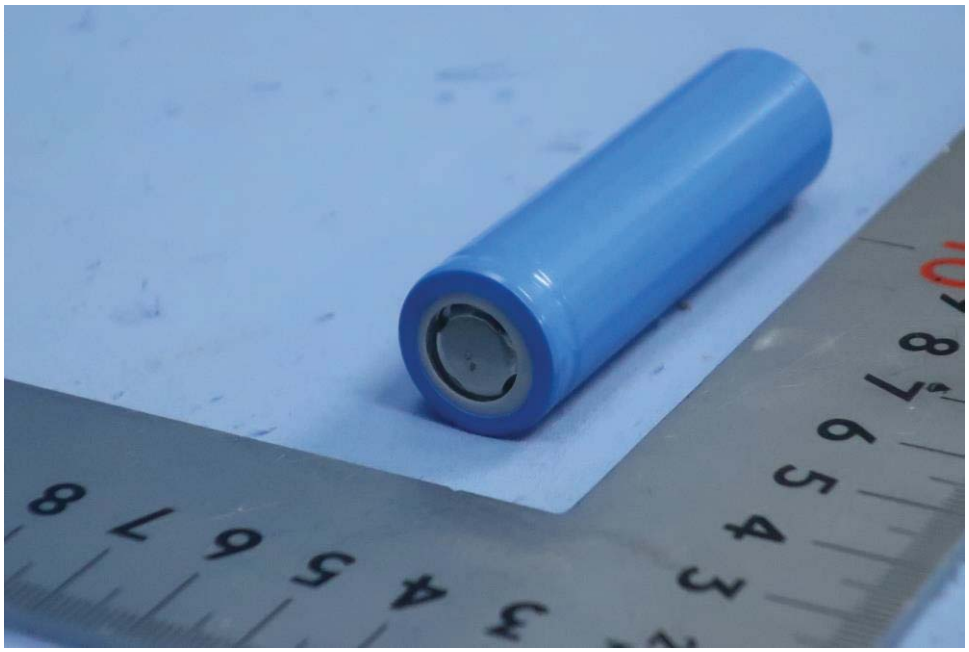


Soldering side of PCM

Appendix 3: Photos



Front view of cell



Top view of cell

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The End of Report