Microtest
微测检测

Test Report

Report No.: MTi170711B021

Date of issue: Jul. 18, 2017

Sample Name:	Li-ion Battery
Model:	503040S
Applicant:	
Address:	

Shenzhen Microtest Co., Ltd.
http://www.mtitest.com

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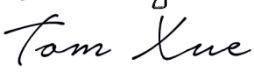
Add: No.102A & 302A, East Block, Hengfang Industrial Park, Xingye Road, Xixiang, Bao'an District, Shenzhen, Guangdong, China.

TEST REPORT

IEC 62133

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

Tested by (printed name and signature)	Nick Yuan	
Reviewed by (printed name and signature)	Iric Yang	
Approved by (printed name and signature)	Tom Xue	

Testing.....:	
Date of receipt of test item.....:	2017-07-06
Date (s) of performance of tests..:	2017-07-06~2017-07-18
Testing laboratory.....:	**Shenzhen Microtest Co., Ltd.**
Address	No.102A & 302A, East Block, Hengfang Industrial Park, Xingye Road, Xixiang, Bao'an District, Shenzhen, Guangdong, China
Test sample description.....:	Li-ion Battery
Trade Mark.....:	N/A
Model.....:	503040S
Ratings.....:	3.7V, 300mAh,1.11Wh
Manufacturer.....:	
Address.....:	
Test specification:	
Standard.....:	IEC 62133: 2012 (Second Edition)
Test procedure.....:	Type test
Non-standard test method.....:	N/A
Test Report Form No.....:	IEC62133B
Test Report Form(s) Originator..:	UL(Demko)
Master TRF.....:	Dated 2013-03

This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
Test items: cl.5.6.2 Design recommendation(Lithium system); cl.8.1 Charging procedure for test purposes (for Cells and Batteries); cl.8.2.1 Continuous charging at constant voltage (Cells); cl.8.2.2 Moulded case stress at high ambient temperature (Batteries) cl.8.3.1 External short circuit (Cells); cl.8.3.2 External short circuit (Batteries); cl.8.3.3 Free fall (Cells and Batteries); cl.8.3.4 Thermal abuse (Cells); cl.8.3.5 Crush (Cells); cl.8.3.6 Over-charging of battery; cl.8.3.7 Forced discharge (Cells); cl.8.3.8 Transport tests (Cells); cl.8.3.9 Design evaluation – Forced internal short circuit (Cells); Tests are made with the number of cells and batteries specified in IEC 62133: 2012 (Second Edition) Table 2.	**Shenzhen Microtest Co., Ltd.** No.102A & 302A, East Block, Hengfang Industrial Park, Xingye Road, Xixiang, Bao'an District, Shenzhen, Guangdong, China

Summary of compliance with National Differences

N/A.

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.

Li-ion Battery
Model: 503040S (1ICP5/30/40)
Nominal Voltage: 3.7V
Capacity: 300mAh, 1.11Wh
Manufacturer :
Date: 2017.07
Made in China
Red wire : +
Black wire : -

Test item particulars ..... :	
Classification of installation and use ..... :	To be defined in final product
Supply connection ..... :	DC lead wire
Recommend charging method declaired by the manufacturer ..... :	Charging the battery with 150mA constant current until 4.20V, then constant voltage until charge current reduces to 3mA at ambient 20°C±5°C.
Discharge current (0,2 I_t A) ..... :	60mA
Specified final voltage ..... :	2.75V
Chemistry ..... :	☐ nickel systems..... ☒ lithium systems
Recommend of charging limit for lithium system	
Upper limit charging voltage per cell ..... :	4.20V
Maximum charging current..... :	300mA
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)

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
"(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.

General product information:

This battery is constructed with one lithium-ion cell, and has overcharge, over-discharge, over current and short-circuits proof circuit.

The main features of the battery are shown as below (clause 8.1.1):

Model	Nominal capacity	Nominal voltage	Nominal Charge Current	Nominal Discharge Current	Maximum Charge Current	Maximum Discharge Current	Maximum Charge Voltage	Cut-off Voltage
503040S	300mAh	3.7V	150mA	150mA	300mA	300mA	4.20V	2.75V

The main features of the battery are shown as below (clause 8.1.2):

Model	Upper limit charge voltage	Taper-off current	Lower charge temperature	Upper charge temperature
503040S	4.20V	15mA	-5°C	45°C

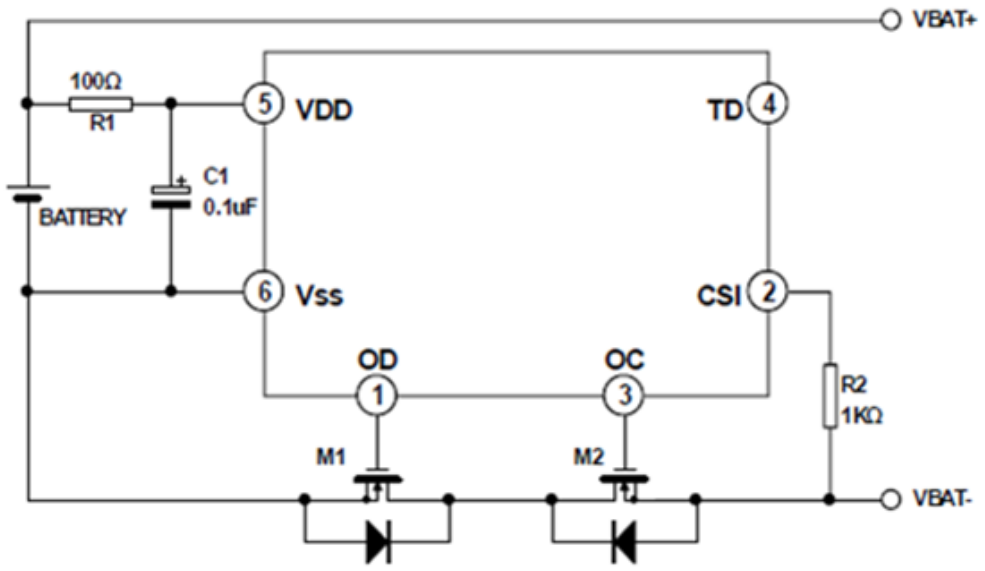
The main features of the cell are shown as below (clause 8.1.1):

Model	Nominal capacity	Nominal voltage	Nominal Charge Current	Nominal Discharge Current	Maximum Charge Current	Maximum Discharge Current	Maximum Charge Voltage	Cut-off Voltage
503040S	300mAh	3.7V	150mA	150mA	300mA	300mA	4.20V	2.75V

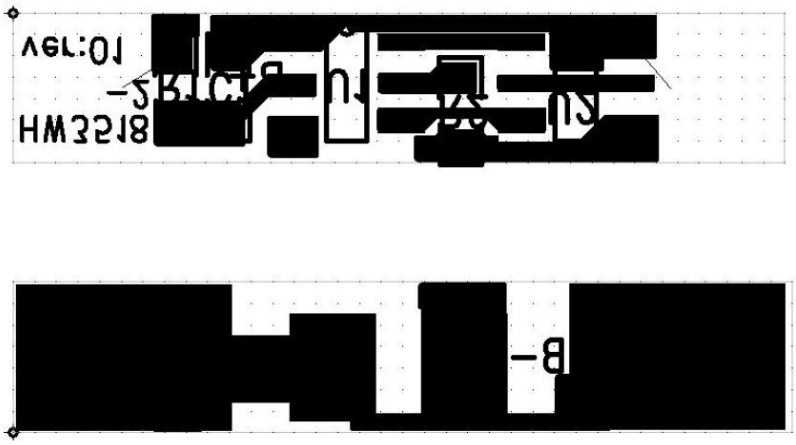
The main features of the cell are shown as below (clause 8.1.2):

Model	Upper limit charge voltage	Taper-off current	Lower charge temperature	Upper charge temperature
503040S	4.20V	15mA	-5°C	45°C

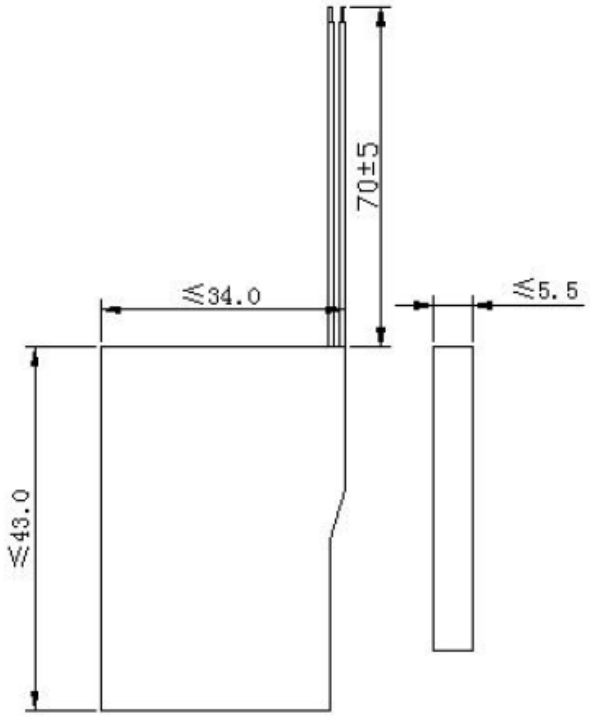
The principle diagram of the PCB:



PCB layout



Construction: (Unit: mm)



Battery

T(max.): W(max.): Hmax.)= 5.5mm:34.0mm:43.0mm

IEC 62133:2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
4	**Parameter measurement tolerances**		P
	Parameter measurement tolerances		P

5	**General safety considerations**		P
5.1	General		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 metal case exists.	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 creepage and clearance 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		N/A
5.4	Temperature/voltage/current management		P
	Batteries are designed such that abnormal temperature rise conditions are prevented	Overcharge, over discharge,over current and short-circuit proof circuit used in this battery. See tests of clause 8.	P
	Batteries are designed to be within temperature, voltage and current limits specified by the cell manufacturer	See above.	P
	Batteries are provided with specifications and charging instructions for equipment manufacturers so that associated chargers are designed to maintain charging within the temperature, voltage and current limits specified	The charging limits specified in the user manual.	P
5.5	Terminal contacts		P
	Terminals have a clear polarity marking on the external surface of the battery	See marking plate	P
	The size and shape of the terminal contacts ensure that they can carry the maximum anticipated current		P

IEC 62133:2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
	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 circuits		P
5.6	Assembly of cells into batteries		N/A
5.6.1	If there is more than one battery housed in a single battery case, cells used in the assembly of each battery have closely matched capacities, be of the same design, be of the same chemistry and be from the same manufacturer	Single cell	N/A
	Each battery has an independent control and protection		N/A
	Manufacturers of cells make recommendations about 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 separate circuitry to prevent the cell reversal caused by uneven discharges		N/A
	Protective circuit components are added as appropriate and consideration given to the end-device application		N/A
	When testing a battery, the manufacturer of the battery provides a test report confirming the compliance according to this standard		N/A
5.6.2	Design recommendation for lithium systems only		P
	For the battery consisting of a single cell or a single cellblock: - Charging voltage of the cell does not exceed the upper limit of the charging voltage specified in Clause 8.1.2, Table 4; or		P
	- Charging voltage of the cell does not exceed the different upper limit of the charging voltage determined through Clause 8.1.2, NOTE 1.		N/A
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks: - The voltages of any one of the single cells or single cellblocks does not exceed the upper limit of the charging voltage, specified in Clause 8.1.2, Table 4, by monitoring the voltage of every single cell or the single cellblocks; or		N/A
	- The voltages of any one of the single cells or single cellblocks does not exceed the different upper limit of the charging voltage, determined through Clause 8.1.2, NOTE 1, by monitoring the voltage of every single cell or the single cellblocks		N/A

IEC 62133:2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks: - Charging is stopped when the upper limit of the charging voltage, specified in Clause 8.1.2, Table 4, is exceeded for any one of the single cells or single cellblocks by measuring the voltage of every single cell or the single cellblocks; or		N/A
	- Charging is stopped when the upper limit of the different charging voltage, determined through Clause 8.1.2, NOTE 1, 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
5.7	Quality plan		P
	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	The manufacturer has ISO 9001 certification.	P

6	**Type test conditions**		P
	Tests were made with the number of cells or batteries specified in Table 1 for nickel-cadmium and nickel-metal hydride systems and Table 2 for lithium systems, using cells or batteries that are not more than six months old	Complied. Tabel 2 for Lithium system.	P
	Unless noted otherwise in the test methods, testing was conducted in an ambient of 20°C ± 5°C.	Tests are carried out at 20°C ± 5°C.	P

7	**Specific requirements and tests (nickel systems)**		N/A
7.1	Charging procedure for test purposes	Lithium systems.	N/A
7.2	Intended use		N/A
7.2.1	Continuous low-rate charging (cells)		N/A
	Results: No fire. No explosion		N/A
7.2.2	Vibration		N/A
	Results: No fire. No explosion. No leakage		N/A
7.2.3	Moulded case stress at high ambient temperature		N/A
	Oven temperature (°C).....:		—
	Results: No physical distortion of the battery casing resulting in exposure if internal components		N/A
7.2.4	Temperature cycling		N/A
	Results: No fire. No explosion. No leakage.		N/A
7.3	Reasonably foreseeable misuse		N/A
7.3.1	Incorrect installation cell		N/A

IEC 62133:2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
	The test was carried out using: - Four fully charged cells of the same brand, type, size and age connected in series, with one of them reversed; or		N/A
	- A stabilized dc power supply.		N/A
	Results: No fire. No explosion..... :		N/A
7.3.2	External short circuit		N/A
	The cells or batteries were tested until one of the following occurred: - 24 hours elapsed; or		N/A
	- The case temperature declined by 20% of the maximum temperature rise		N/A
	Results: No fire. No explosion..... :		N/A
7.3.3	Free fall		N/A
	Results: No fire. No explosion.		N/A
7.3.4	Mechanical shock (crash hazard)		N/A
	Results: No fire. No explosion. No leakage.		N/A
7.3.5	Thermal abuse		N/A
	Oven temperature (°C)..... :		—
	Results: No fire. No explosion.		N/A
7.3.6	Crushing of cells		N/A
	The crushing force was released upon: - The maximum force of 13 kN ± 1 kN has been applied; or		N/A
	- An abrupt voltage drop of one-third of the original voltage has been obtained		N/A
	The cell is prismatic type and a second set of samples was tested, rotated 90° around longitudinal axis compared to the first set		N/A
	Results: No fire. No explosion..... :		N/A
7.3.7	Low pressure		N/A
	Chamber pressure (kPa)..... :		—
	Results: No fire. No explosion. No leakage.		N/A
7.3.8	Overcharge		N/A
	Results: No fire. No explosion..... :		N/A
7.3.9	Forced discharge		N/A
	Results: No fire. No explosion..... :		N/A

IEC 62133:2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
8	**Specific requirements and tests (lithium systems)**		**P**
8.1	Charging procedures for test purposes		P
8.1.1	First procedure: This charging procedure applied to tests other than those specified in 8.1.2	.	P
8.1.2	Second procedure: This charging procedure applied to the tests of 8.3.1, 8.3.2, 8.3.4, 8.3.5, and 8.3.9		P
	If a cell's specified upper and/or lower charging temperature exceeds values for the upper and/or lower limit test temperatures of Table 4, the cells were charged at the specified values plus 5 °C for the upper limit and minus 5 °C for the lower limit	The upper charging temperature is 45°C and the lower charging temperature is 10°C in specification..	P
	A valid rationale was provided to ensure the safety of the cell (see Figure A.1) ..... :	See the test result.	P
	For a different upper limit charging voltage (i.e. other than for lithium cobalt oxide systems at 4,25 V), the applied upper limit charging voltage and upper limit charging temperatures were adjusted accordingly	Lithium cobalt oxide systems only.	N/A
	A valid rationale was provided to ensure the safety of the cell (see Figure A.1) ..... :		N/A
8.2	Intended use		P
8.2.1	Continuous charging at constant voltage (cells)	Tested complied.	P
	Results: No fire. No explosion..... :	See Table 8.2.1	P
8.2.2	Moulded case stress at high ambient temperature (battery)	No moulded case exists.	N/A
	Oven temperature (°C)..... :		—
	Results: No physical distortion of the battery casing resulting in exposure if internal components		N/A
8.3	Reasonably foreseeable misuse		P
8.3.1	External short circuit (cell)		P
	The cells were tested until one of the following occurred: - 24 hours elapsed; or		N/A
	- The case temperature declined by 20% of the maximum temperature rise		P
	Results: No fire. No explosion..... :	See Table 8.3.1	P
8.3.2	External short circuit (battery)		P
	The cells were tested until one of the following occurred: - 24 hours elapsed; or	Protection circuit were used.	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

IEC 62133:2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
	Results: No fire. No explosion..... :	See Table 8.3.2	P
8.3.3	Free fall	Fully charged cells and batteries were dropped three times from a height of 1.0 m onto a concrete floor.	P
	Results: No fire. No explosion.		P
8.3.4	Thermal abuse (cells)		P
	The cells were held at 130°C ± 2°C for: 10 minutes; or		P
	- 30 minutes for large cells (gross mass of more than 500 g as defined in IEC 62281)		N/A
	Oven temperature (°C)..... :	130°C	--
	Gross mass of cell (g) ..... :		--
	Results: No fire. No explosion.	No fire. No explosion.	P
8.3.5	Crush (cells)		P
	The crushing force was released upon: - The maximum force of 13 kN ± 1 kN has been applied; or	Tested complied.	P
	- An abrupt voltage drop of one-third of the original voltage has been obtained; or	No voltage drop was noticed	N/A
	- 10% of deformation has occurred compared to the initial dimension	No deformation was noticed	N/A
	Results: No fire. No explosion..... :	See Table 8.3.5	P
8.3.6	Over-charging of battery		P
	Test was continued until the temperature of the outer casing: - 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 Table 8.3.6	P
8.3.7	Forced discharge (cells)		P
	Results: No fire. No explosion..... :	See Table 8.3.7	P
8.3.8	Transport tests		N/A
	Manufacturer's documentation provided to show compliance with UN Recommendations on Transport of Dangerous Goods		N/A
8.3.9	Design evaluation – Forced internal short circuit (cells)		P
	The cells complied with national requirement for..... :	France, Japan, Korea and Switzerland.	—
	The pressing was stopped upon: - A voltage drop of 50 mV has been detected; or	>50 mV	P
	- The pressing force of 800 N (cylindrical cells) or 400 N (prismatic cells) has been reached		N/A

IEC 62133:2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
	Results: No fire ..... :	See Table 8.3.9	P

9	**Information for safety**		P
	The manufacturer of secondary cells ensures that information is provided about current, voltage and temperature limits of their products.	Information for safety mentioned in manufacturer's specifications.	P
	The manufacturer of batteries ensures that equipment manufacturers and, in the case of direct sales, end-users are provided with information to minimize and mitigate hazards.	Information for safety mentioned 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
	As appropriate, information relating to hazard avoidance resulting from a system analysis is provided to the end user..... :		N/A

10	**Marking**		P
10.1	Cell marking		N/A
	Cells marked as specified in the applicable cell standards: IEC 61951-1, IEC 61951-2 or IEC 61960.	The final product is battery.	N/A
10.2	Battery marking		P
	Batteries marked in accordance with the requirements for the cells from which they are assembled.	See marking plate	P
	Batteries marked with an appropriate caution statement.		N/A
10.3	Other information		P
	Storage and disposal instructions marked on or supplied with the battery.	Information for disposal instructions mentioned in manufacturer's specifications.	P
	Recommended charging instructions marked on or supplied with the battery.	Information for recommended charging instructions mentioned in manufacturer's specifications.	P
11	**Packaging**		**P**
	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 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		N/A
A.3.2.3	Safety requirements, when different upper limit charging voltage is applied	The upper limit charging voltage is 4.25V in specification.	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
A.4.2.2	Safety consideration when a different recommended temperature range is applied	Charging temperature declared by client is: -5-45°C.	P
A.4.3	High temperature range	The upper charging temperature is 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 high temperature range		N/A
A.4.3.4	Safety consideration when specifying new upper limit in high temperature range		N/A
A.4.4	Low temperature range	The lower charging temperature is -5°C.	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 low temperature range		P
A.4.4.4	Safety considerations when specifying a new lower limit in the low temperature range	-5°C applied.	P
A.4.5	Scope of the application of charging 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
	The insertion procedure carried out at 20°C±5°C and under -25 °C of dew point		P
A.5.3	Disassembly of charged cell		P
A.5.4	Shape of nickel particle		P

A.5.5	Insertion of nickel particle to cylindrical cell		N/A
A.5.5.1	Insertion of nickel particle to winding core		N/A
A.5.5.2	Mark the position of nickel particle on the both end of winding core of the separator		N/A
A.5.6	Insertion of nickel particle to prismatic cell		P

	TABLE: Critical components information				P
Object/part no.	**Manufacturer/ trademark**	**Type/model**	**Technical data**	**Standard**	**Mark(s) of conformity [1)]**
PCB	MEIYADI	XBL-18-6H	V-0, 130ºC; 0.6*3.5*18mm	--	UL approved
Protective IC (U1)	Shenzhen Developer Microelectronics CO., LTD.	DW01	Overcharge detection Voltage:4.3V±0.05V Over discharge detection voltage:2.4V±0.1V Over Current: 1-2.5A	--	--
MOSFET (U2)	Shenzhen Developer Microelectronics CO., LTD.	8205A	V_{DS}= 20V V_{GS}=±12V ID= 5.0A T_J,$T_{STG:}$ -55 To 150℃	--	--
Cell	ShenZhen ChuangXingYuan Technology Co., Ltd.	503040S	3.7V ,300mA	IEC62133: 2012	Tested with appliance
-Separator	--	--	PE/ Shut down temperature: 130°C	--	--
-Electrolyte	--	--	LiFP6 dissolved in organic solvent (EC+ DMC)	--	--
-Positive electrode	--	--	$LiCoO_2$, PVDF, NMP, Conductive Additive	--	--
-Negative electrode	--	--	Graphite, CMC, SBR, Distilled Water, Conductive Additive,	--	--

Supplementary information:

[1)] Provided evidence ensures the agreed level of compliance.

7.2.1	TABLE: Continuous low rate charge (cells)				N/A
Model	**Recommended charging method, (CC, CV, or CC/CV)**	**Recommended charging voltage V_c, (Vdc)**	**Recommended charging current I_{rec}, (A)**	**OCV at start of test, (Vdc)**	**Results**
Supplementary information: A-No fire or explosion, B-No leakage, C-Leage, D-Fire, E-Explosion, F-Bulge, G-Others (please explain)					

7.2.2	TABLE: Vibration	N/A
Model	**OCV at start of test, (Vdc)**	**Results**
Supplementary information: A-No fire or explosion, B-No leakage, C-Leage, D-Fire, E-Explosion, F-Bulge, G-Others (please explain)		

7.3.1	TABLE: Incorrect installation (cells)	N/A
Model	**OCV of reversed cell, (Vdc)**	**Results**
Supplementary information: A-No fire or explosion, B-No leakage, C-Leage, D-Fire, E-Explosion, F-Bulge, G-Others (please explain)		

7.3.2	TABLE: External short circuit				N/A
Model	**Ambient (at 20°C ± 5°C or 55°C ± 5°C)**	**OCV at start of test, (Vdc)**	**Resistance of circuit, (Ω)**	**Maximum case temperature rise ΔT, (°C)**	**Results**
Supplementary information: A-No fire or explosion, B-No leakage, C-Leage, D-Fire, E-Explosion, F-Bulge, G-Others (please explain)					

7.3.6	TABLE: Crush		N/A
Model	**OCV at start of test, (Vdc)**	**OCV at removal of crushing force, (Vdc)**	**Results**
Supplementary information: A-No fire or explosion, B-No leakage, C-Leage, D-Fire, E-Explosion, F-Bulge, G-Others (please explain)			

7.3.8	TABLE: Overcharge			N/A
Model	**OCV prior to charging, (Vdc)**	**Maximum charge current, (A)**	**Time for charging, (hours)**	**Results**
Supplementary information: A-No fire or explosion, B-No leakage, C-Leage, D-Fire, E-Explosion, F-Bulge, G-Others (please explain)				

7.3.9	TABLE: Forced discharge (cells)			N/A
Model	**OCV before application of reverse charge, (Vdc)**	**Measured reverse charge I_t, (A)**	**Time for reversed charge, (minutes)**	**Results**

Supplementary information:

A-No fire or explosion, B-No leakage, C-Leage, D-Fire, E-Explosion, F-Bulge, G-Others (please explain)

8.2.1	TABLE: Continuous charging at constant voltage (cells)			P
Model	**Recommended charging voltage V_c, (Vdc)**	**Recommended charging current I_{rec}, (mA)**	**OCV at start of test, (Vdc)**	**Results**
C1	4.20	150	4.19	A,B
C2	4.20	150	4.18	A,B
C3	4.20	150	4.18	A,B
C4	4.20	150	4.19	A,B
C5	4.20	150	4.18	A,B

Supplementary information:

A-No fire or explosion, B-No leakage, C-Leage, D-Fire, E-Explosion, F-Bulge, G-Others (please explain)

8.3.1	TABLE: External short circuit (cell)				P
Model	**Ambient, (°C)**	**OCV at start of test, (Vdc)**	**Resistance of circuit, (mΩ)**	**Maximum case temperature (°C)**	**Results**
Samples charged at charging temperature upper limit (45°C)					
C6	24.6	4.13	85.2	124.0	A
C7	24.6	4.12	83.9	132.8	A
C8	24.6	4.13	78.5	126.1	A
C9	24.6	4.13	83.1	136.1	A
C10	24.6	4.12	87.4	124.5	A
Samples charged at charging temperature lower limit (-5°C)					
C11	24.7	4.07	82.6	127.8	A
C12	24.7	4.07	84.3	135.1	A
C13	24.7	4.08	81.7	133.4	A
C14	24.7	4.06	82.1	129.3	A
C15	24.7	4.08	89.6	126.2	A
Supplementary information: A-No fire or explosion, B-No leakage, C-Leage, D-Fire, E-Explosion, F-Bulge, G-Others (please explain)					

8.3.2	TABLE: External short circuit (battery)				P
Model	**Ambient, (°C)**	**OCV at start of test, (Vdc)**	**Resistance of circuit, (mΩ)**	**Maximum case temperature (°C)**	**Results**
Samples charged at charging temperature upper limit (45°C)					
B1	55.1	4.14	84.5	55.3	A
B2	55.1	4.13	86.0	55.2	A
B3	55.1	4.14	80.4	55.3	A
B4	55.1	4.14	81.7	55.2	A
B5	55.1	4.13	79.3	55.3	A
Samples charged at charging temperature lower limit (-5°C)					
B6	55.1	4.06	81.4	55.2	A
B7	55.1	4.07	86.2	55.3	A
B8	55.1	4.06	83.4	55.3	A
B9	55.1	4.06	84.3	55.4	A
B10	55.1	4.07	79.4	55.3	A
Supplementary information: A-No fire or explosion, B-No leakage, C-Leage, D-Fire, E-Explosion, F-Bulge, G-Others (please explain)					

8.3.5	TABLE: Crush				P
Model	**OCV at start of test, (Vdc)**	**OCV at removal of crushing force, (Vdc)**	**Width/ diameter of cell before crush, (mm)**	**Required deformation for crush, (mm)**	**Results**
Samples charged at charging temperature upper limit (45°C)					
C29	4.14	4.14	--	--	A
C30	4.14	4.14	--	--	A
C31	4.14	4.14	--	--	A
C32	4.14	4.14	--	--	A
C33	4.15	4.15	--	--	A
Samples charged at charging temperature lower limit (-5°C)					
C34	4.08	4.08	--	--	A
C35	4.07	4.07	--	--	A
C36	4.07	4.07	--	--	A
C37	4.07	4.07	--	--	A
C38	4.06	4.06	--	--	A

Note:
A 13kN force applied at the wide side of prismatic cells.

Supplementary information:

A-No fire or explosion, B-No leakage, C-Leage, D-Fire, E-Explosion, F-Bulge, G-Others (please explain)

8.3.6	TABLE: Over-charging of battery			P
Constant charging current (A) ..... :		**0.6**		—
Supply voltage (Vdc) ..... :		**5.0**		—
Model	**OCV before charging, (Vdc)**	**Resistance of circuit, (mΩ)**	**Maximum outer casing temperature, (°C)**	**Results**
B14	3.38	18.7	26.9	A
B15	3.38	18.2	26.1	A
B16	3.37	19.2	26.3	A
B17	3.38	19.4	26.7	A
B18	3.39	19.1	26.6	A

Supplementary information:

A-No fire or explosion, B-No leakage, C-Leage, D-Fire, E-Explosion, F-Bulge, G-Others (please explain)

8.3.7	TABLE: Forced discharge (cells)			P
Model	**OCV before application of reverse charge, (Vdc)**	**Measured Reverse charge I_t, (mA)**	**Time for reversed charge, (minutes)**	**Results**
C34	3.38	300	90	A
C35	3.38	300	90	A
C36	3.38	300	90	A
C37	3.38	300	90	A
C38	3.37	300	90	A

Supplementary information:

A-No fire or explosion, B-No leakage, C-Leage, D-Fire, E-Explosion, F-Bulge, G-Others (please explain)

8.3.9	TABLE: Forced internal short circuit (cells)					P
Model	**Chamber ambient, (°C)**	**OCV at start of test, (Vdc)**	**Particle location [1)]**	**Maximum applied pressure, (N)**	**Voltage drop, (mV)**	**Results**
C39	45	4.13	1	56	>50	A
C40	45	4.13	1	62	>50	A
C41	45	4.14	1	58	>50	A
C42	45	4.13	2	71	>50	A
C43	45	4.12	2	69	>50	A
C44	10	4.04	1	67	>50	A
C45	10	4.04	1	56	>50	A
C46	10	4.05	1	54	>50	A
C47	10	4.05	2	63	>50	A
C48	10	4.04	2	72	>50	A

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.

A-No fire, D-Fire, G-Others (please explain)

Photos of The Sample

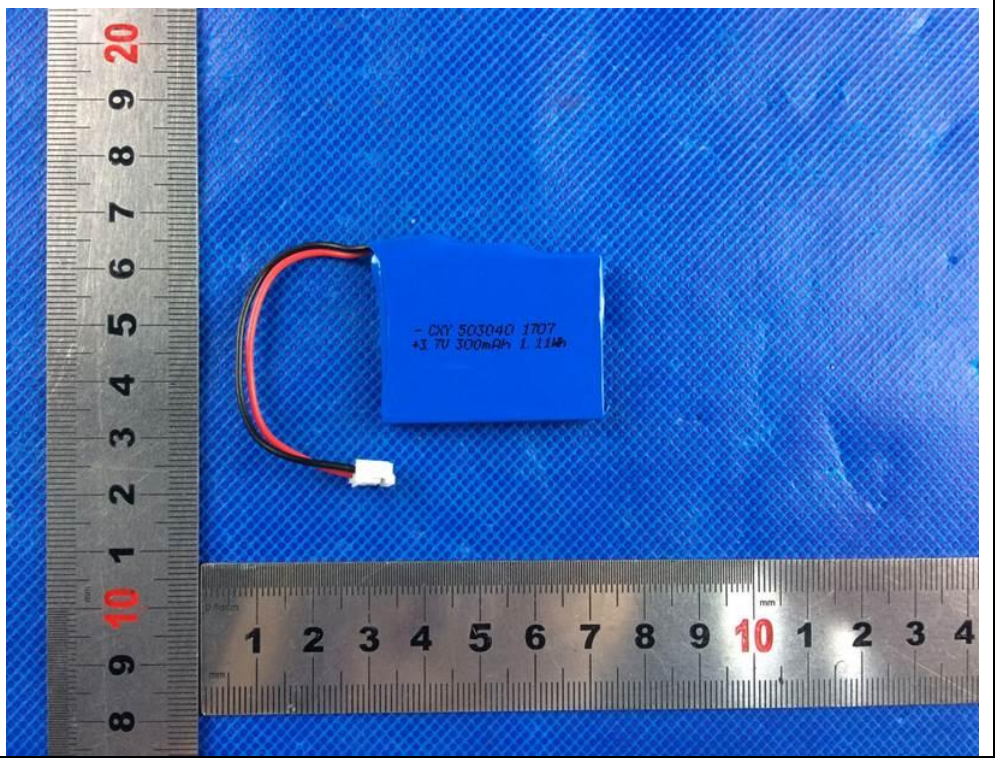
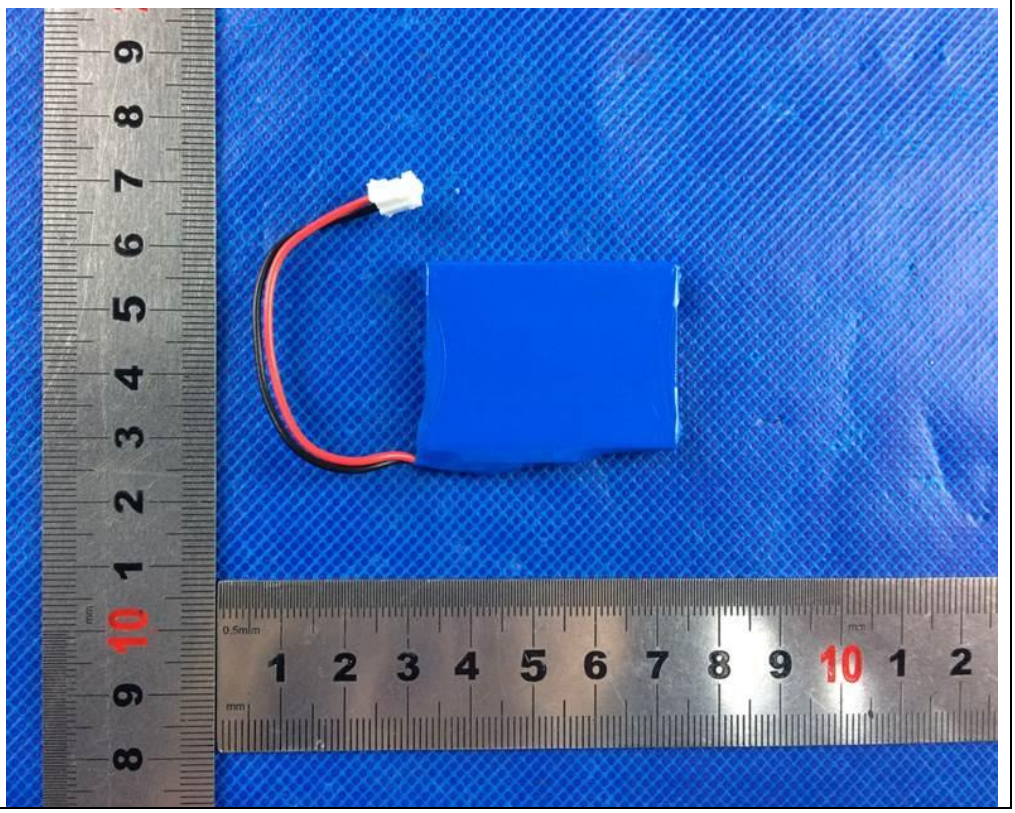
Photo 1 **[√] General view of battery**	
Photo 2 **[√] General view of battery**	

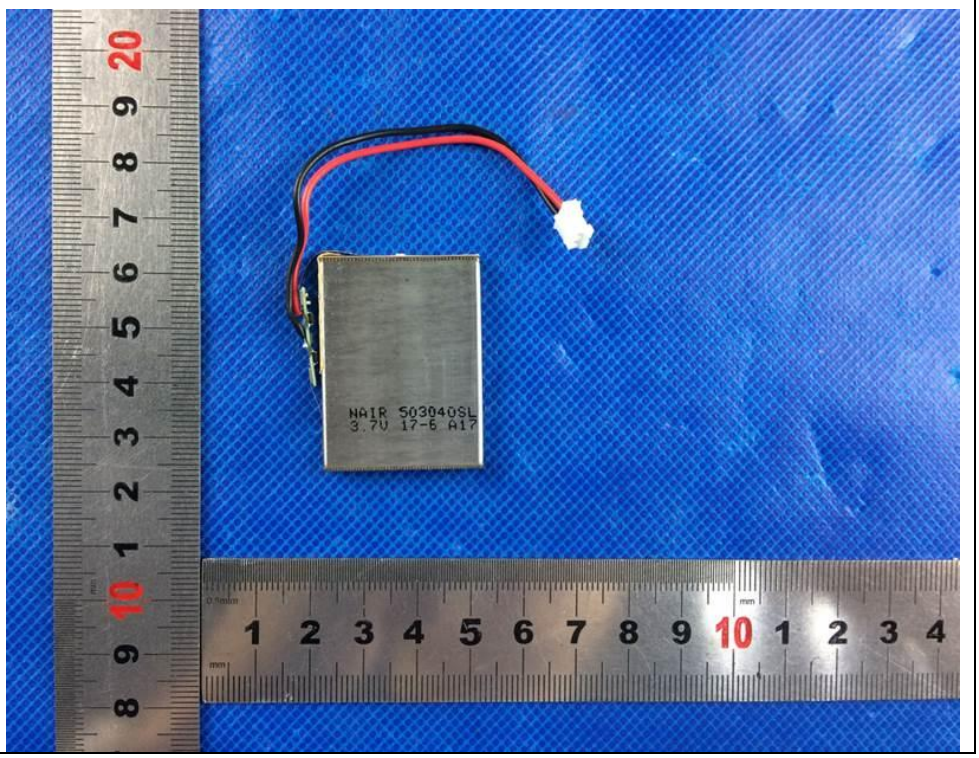
Photo 3 **[√] General view of battery**	

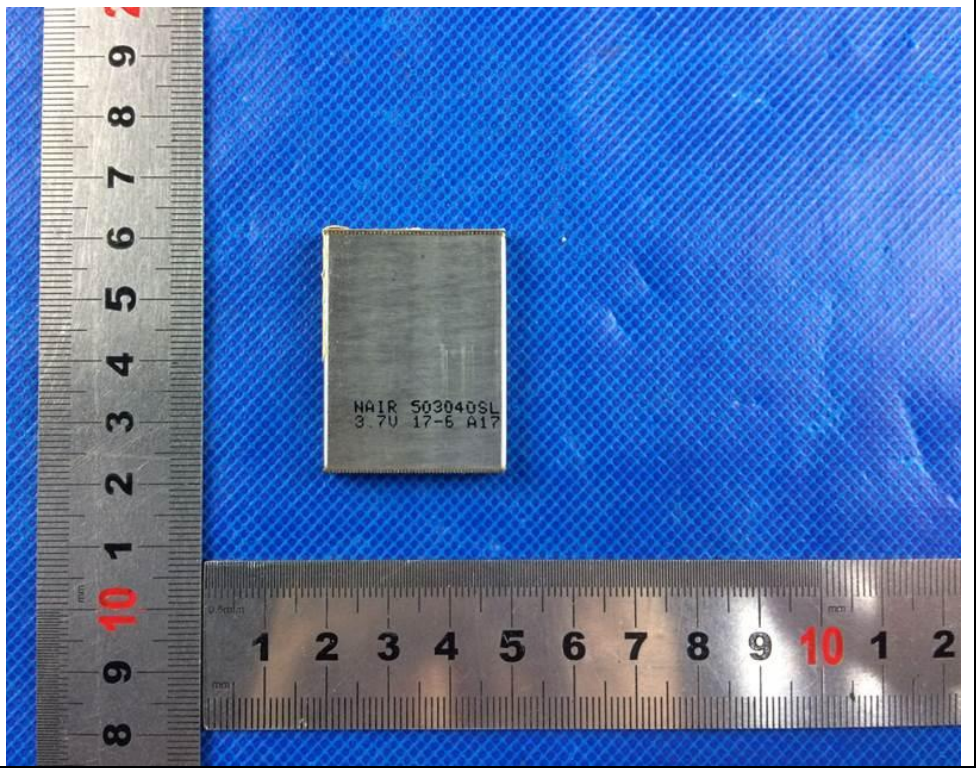
Photo 4 **[√] General view of cell**	

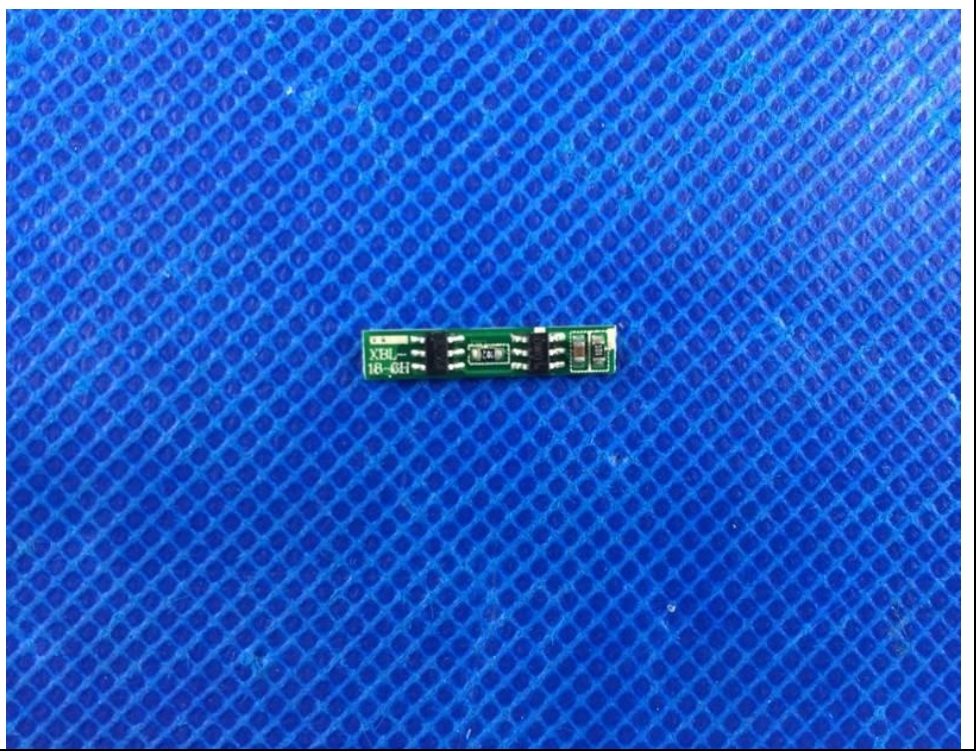
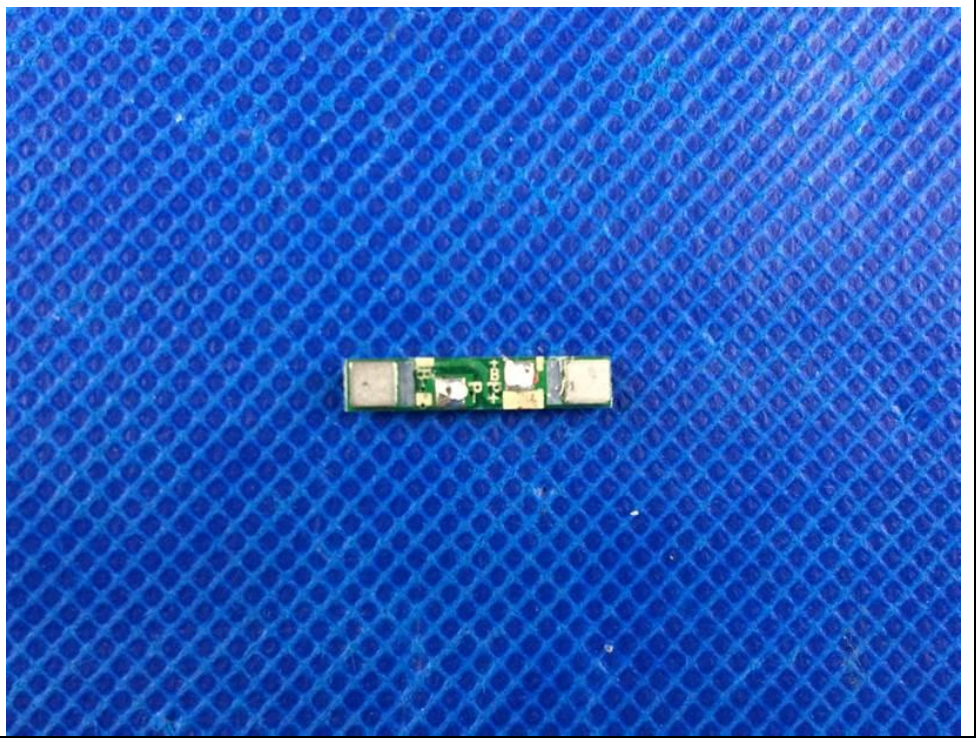
Photo 5 [√] Component view of PCB	

Photo 6 [√] Trace view of PCB	

****** End of Report ******