

Battery Pack Test Report ***UN38.3***

Customer: Lenovo

Pack Model: SB10K97594

Nominal voltage: 11.4V

Nominal capacity: 42Wh/3.69Ah

Configuration: 3S1P

Customer P/N: ASM p/n=>SB10K97594

FRU p/n=> 01AV437

Celxpert P/N: 921300109

Cell Type: Sony US485490H5K 3690mAh

May 18 . 2017

Approved by _____

Reviewed by _____

Prepared by 单秋梅

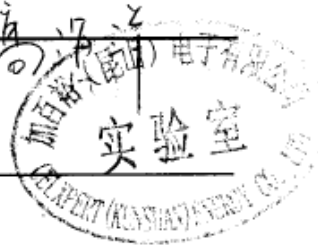
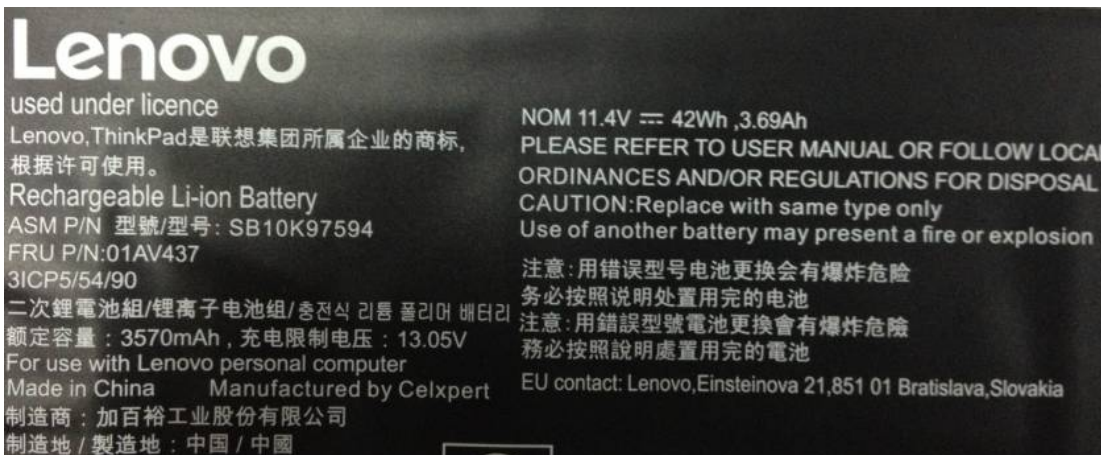
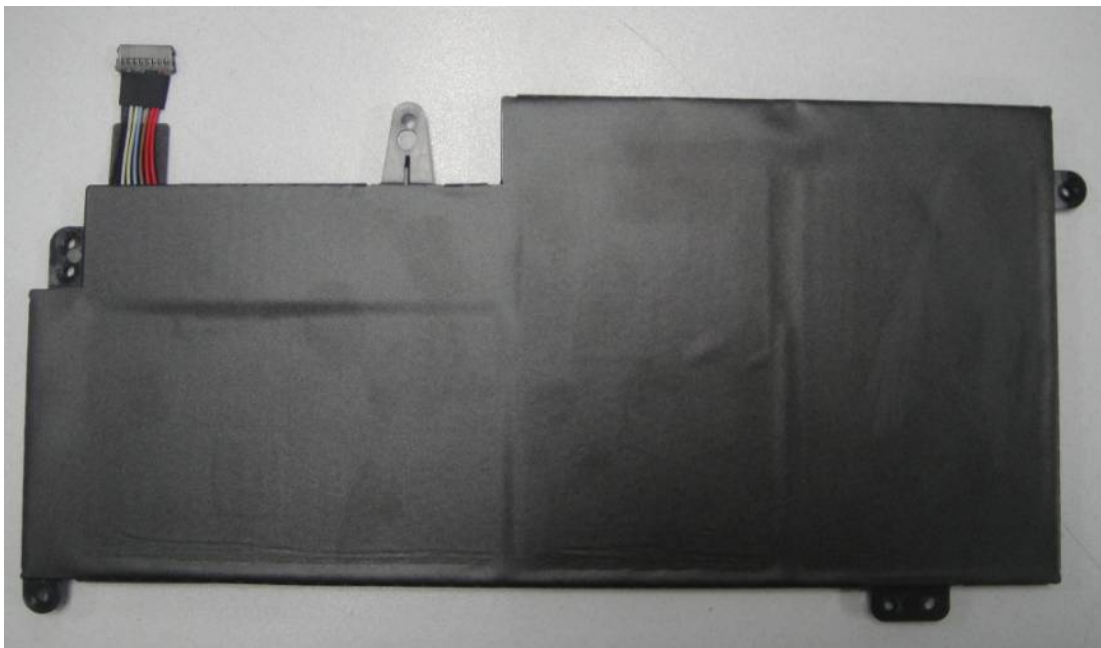


Figure photo of the pack



1. UN38.3 Test Report

Test Period	2016/07/01~2016/07/28		Test Spec.	ST/SG/AC.10/11/Rev.5 Amend.2	
Parts Name	Battery Pack	Application	NB	Quantity	Pack 16PCS/Cell 25pcs

1.1 Test Summary

Item	Test Item	Test Result	Details
T1	Altitude simulation test (UN38.3-1)	Pass	Page 9
T2	Thermal test (UN38.3-2)	Pass	Page 10
T3	Vibration test (UN38.3-3)	Pass	Page 11
T4	Shock test (UN38.3-4)	Pass	Page 12
T5	Short Circuit test (UN38.3-5)	Pass	Page 13
T6	Crush Test (UN38.3-6)	Pass	Page 13
T7	Overcharge test (UN38.3-7)	Pass	Page 14
T8	Forced discharge test (UN38.3-8)	Pass	Page 15

The battery pack passes UN38.3 test.

1.2 Test sample list

No.	Pack S/N	Test item	No.	Cell Num.	Test item
1	Sample No:1/16	38.3.1~5	1	Sony US485490H5K 3690mAh	38.3.6
2	Sample No:2/16	38.3.1~5	2	Sony US485490H5K 3690mAh	38.3.6
3	Sample No:3/16	38.3.1~5	3	Sony US485490H5K 3690mAh	38.3.6
4	Sample No:4/16	38.3.1~5	4	Sony US485490H5K 3690mAh	38.3.6
5	Sample No:5/16	38.3.1~5	5	Sony US485490H5K 3690mAh	38.3.6
6	Sample No:6/16	38.3.1~5	6	Sony US485490H5K 3690mAh	38.3.8
7	Sample No:7/16	38.3.1~5	7	Sony US485490H5K 3690mAh	38.3.8
8	Sample No:8/16	38.3.1~5	8	Sony US485490H5K 3690mAh	38.3.8
9	Sample No:9/16	38.3.7	9	Sony US485490H5K 3690mAh	38.3.8
10	Sample No:10/16	38.3.7	10	Sony US485490H5K 3690mAh	38.3.8
11	Sample No:11/16	38.3.7	11	Sony US485490H5K 3690mAh	38.3.8
12	Sample No:12/16	38.3.7	12	Sony US485490H5K 3690mAh	38.3.8
13	Sample No:13/16	38.3.7	13	Sony US485490H5K 3690mAh	38.3.8
14	Sample No:14/16	38.3.7	14	Sony US485490H5K 3690mAh	38.3.8
15	Sample No:15/16	38.3.7	15	Sony US485490H5K 3690mAh	38.3.8
16	Sample No:16/16	38.3.7	16	Sony US485490H5K 3690mAh	38.3.8
			17	Sony US485490H5K 3690mAh	38.3.8
			18	Sony US485490H5K 3690mAh	38.3.8
			19	Sony US485490H5K 3690mAh	38.3.8
			20	Sony US485490H5K 3690mAh	38.3.8
			21	Sony US485490H5K 3690mAh	38.3.8
			22	Sony US485490H5K 3690mAh	38.3.8
			23	Sony US485490H5K 3690mAh	38.3.8
			24	Sony US485490H5K 3690mAh	38.3.8
			25	Sony US485490H5K 3690mAh	38.3.8

1.3 Test result

Item	Test Item	Test specification	Judge criteria	Sample(s)				
T1	Altitude Simulation (UN38.3-1)	1-1. 4 batteries are standard charged. 4 batteries are 1C cycled 50 times, ending in fully charged state. All batteries weight is measured. The charged batteries voltage are measured and recorded. 1-2. Batteries shall be stored at a pressure of 11.6Kpa or less for at least six hours at ambient temperature 20+/-5 °C. 1-3. Vacuum is released. All cells weight is measured. The charged cell voltage are measured and recorded.	No mass loss (<0.1%), no leakage, no venting, no disassembly, no rupture and no fire. Battery voltage drop < 10%.	4 packs are standard charged (Pack#1~4) 4 packs 50 cycled ending in fully charged states (Pack#5~8)				
Test Period	Start: 2016/07/01 End:2016/07/01							
Test Equipment	數位電表 Q153, 電子天平 Q090, 真空烘箱 Q146							
Major Problem	-							
Warning Point	-							
Recommendation	The battery packs pass the test.							
Raw Data	Altitude Simulation Test on Charged Packs							
	No.	Before		After		voltage residue	mass loss	other event
		OCV (V)	Weight (g)	OCV (V)	Weight (g)	Volt (%)	Weight (%)	
	1	12.972	197.11	12.970	197.10	99.98%	0.00%	O
	2	12.964	197.14	12.963	197.13	99.99%	0.00%	O
	3	12.969	197.18	12.968	197.17	99.99%	0.00%	O
	4	12.975	197.16	12.972	197.15	99.98%	0.00%	O
	5	12.924	197.07	12.922	197.06	99.98%	0.00%	O
	6	12.936	197.13	12.933	197.12	99.98%	0.00%	O
	7	12.933	197.15	12.932	197.14	99.99%	0.00%	O
8	12.928	197.09	12.924	197.08	99.97%	0.00%	O	
Note: L-Leakage ; V-Venting ; D-Disassembly ; R-Rupture ; F-Fire								
O-No Leakage , No Venting , No Disassembly , No Rupture , No Fire								

Item	Test Item	Test specification	Judge criteria	Sample(s)				
T2	Thermal test (UN38.3-2)	2-1. Packs are stored for 6 hours at $72\pm 2^{\circ}\text{C}$, followed by storage for 6 hours at $-40\pm 2^{\circ}\text{C}$. The maximum time interval between test temperature extremes is 30 minutes. 2-2.Repeat 2-1 for 10 times. Then store the packs at ambient for 24 hours. All packs weight are measured. The charged battery voltage are measured and recorded.	No mass loss (<0.1%), no leakage, no venting, no disassembly, no rupture and no fire. Battery voltage drop < 10%.	4 packs are standard charged (Pack#1~4) 4 packs 50 cycled ending in fully charged states (Pack#5~8)				
Test Period		Start: 2016/07/05 End:2016/07/11						
Test Equipment		數位電表 Q153, 電子天平 Q090, 冷熱衝擊機 Q0446						
Major Problem		-						
Warning Point		-						
Recommendation		The packs pass the test.						
Raw Data	Thermal Test on Charged Packs							
	No.	Before		After		voltage residue	mass loss	other event
		OCV (V)	Weight (g)	OCV (V)	Weight (g)			
	1	12.970	197.10	12.901	197.08	99.47%	0.01%	O
	2	12.963	197.13	12.887	197.09	99.41%	0.02%	O
	3	12.968	197.17	12.893	197.15	99.42%	0.01%	O
	4	12.972	197.15	12.898	197.13	99.43%	0.01%	O
	5	12.922	197.06	12.851	197.03	99.45%	0.02%	O
	6	12.933	197.12	12.858	197.09	99.42%	0.02%	O
	7	12.932	197.14	12.864	197.12	99.47%	0.01%	O
8	12.924	197.08	12.849	197.05	99.42%	0.01%	O	
Note: L-Leakage ; V-Venting ; D-Disassembly ; R-Rupture ; F-Fire								
O-No Leakage , No Venting , No Disassembly , No Rupture , No Fire								

Item	Test Item	Test specification	Judge criteria	Sample(s)				
T3	Vibration test (UN38.3-3)	3-1. Packs are firmly secured to the platform of the vibration machine without distorting the packs in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of 3 mutually perpendicular to the terminal face. 3-2. The logarithmic frequency sweep is as follows: 7-18 Hz → 1gn 18-50 Hz → 0.8mm amplitude 50-200 Hz → 8gn 3-3. All packs weight are measured. The charged packs voltage are measured and recorded.	No mass loss (<0.1%), no leakage, no venting, no disassembly, no rupture and no fire. Battery voltage drop < 10%.	4 packs are standard charged (Pack#1~4) 4 packs 50 cycled ending in fully charged states (Pack#5~8)				
Test Period	Start: 2016/07/18 End:2016/07/19							
Test Equipment	數位電表 Q153, 電子天平 Q090, 振動測試機 Q300							
Major Problem	-							
Warning Point	-							
Recommendation	The packs pass the test.							
Raw Data	Vibration Test on Charged Packs							
	No.	Before		After		voltage residue	mass loss	other event
		OCV (V)	Weight (g)	OCV (V)	Weight (g)	Volt (%)	Weight (%)	
	1	12.901	197.08	12.894	197.05	99.95%	0.01%	O
	2	12.887	197.09	12.880	197.07	99.95%	0.01%	O
	3	12.893	197.15	12.885	197.13	99.94%	0.01%	O
	4	12.898	197.13	12.890	197.11	99.94%	0.01%	O
	5	12.851	197.03	12.843	197.01	99.94%	0.01%	O
	6	12.858	197.09	12.852	197.06	99.95%	0.01%	O
	7	12.864	197.12	12.855	197.09	99.93%	0.01%	O
8	12.849	197.05	12.842	197.03	99.95%	0.01%	O	
Note: L-Leakage ; V-Venting ; D-Disassembly ; R-Rupture ; F-Fire								
O-No Leakage , No Venting , No Disassembly , No Rupture , No Fire								

Item	Test Item	Test specification	Judge criteria	Sample(s)				
T4	Shock test (UN38.3-4)	4-1. Packs shall be secured to the testing machine by means of a rigid mount, which will support all mounting surfaces. 4-2. Packs shall be subjected to a half-sine shock of peak acceleration 150gn and pulse duration of 6 milliseconds. Each pack shall be subjected to 3 shocks in the positive direction followed by three shocks in the negative direction of three mutually perpendicularly mounting positions of the pack for a total of 18 shocks. 4-3. All batteries weight are measured. The charged cell voltage are measured and recorded.	No mass loss (<0.1%), no leakage, no venting, no disassembly, no rupture and no fire. Battery voltage drop < 10%.	4 packs are standard charged (Pack#1~4) 4 packs 50 cycled ending in fully charged states (Pack#5~8)				
Test Period	Start: 2016/07/21 End:2016/07/21							
Test Equipment	數位電表 Q153, 電子天平 Q090, 衝擊測試機 Q154							
Major Problem	-							
Warning Point	-							
Recommendation	The packs pass the test.							
Raw Data	Shock Test on Charged Packs							
	No.	Before		After		voltage residue	mass loss	other event
		OCV (V)	Weight (g)	OCV (V)	Weight (g)	Volt (%)	Weight (%)	
	1	12.894	197.05	12.888	197.04	99.95%	0.00%	O
	2	12.880	197.07	12.875	197.06	99.96%	0.00%	O
	3	12.885	197.13	12.880	197.12	99.96%	0.00%	O
	4	12.890	197.11	12.884	197.10	99.95%	0.00%	O
	5	12.843	197.01	12.839	197.00	99.97%	0.00%	O
	6	12.852	197.06	12.845	197.05	99.95%	0.00%	O
	7	12.855	197.09	12.849	197.08	99.95%	0.00%	O
8	12.842	197.03	12.837	197.02	99.96%	0.00%	O	
Note: L-Leakage ; V-Venting ; D-Disassembly ; R-Rupture ; F-Fire								
O-No Leakage , No Venting , No Disassembly , No Rupture , No Fire								

Item	Test Item	Test specification	Judge criteria	Sample(s)
T5	Short Circuit Test (UN38.3-5)	5-1.Packs are placed in to a 55±2°C oven, and exterior packs temperature are monitored 5-2.When packs exterior reach 55±2°C, they are shorted by connecting terminals with a copper wire of resistance less than 100m Ohm. 5-4. The short was continued for more than 1hour or the cell temperature return to 55°C. The packs are observed for a further 6 hours.	No rupture, no disassembly, no explosion, no fire, no smoke. Packs exterior peak temperature <170°C.	4 packs are standard charged (Pack#1~4) 4 packs 50 cycled ending in fully charged states (Pack#5~8)
Test Period		Start: 2016/07/25 End:2016/07/28		
Test Equipment		數位電表 Q153, 資料收集器 Q075, 烘箱 Q171		
Recommendation		The packs pass the test.		
Raw Data		Short Circuit Test on Charged Packs		
		No.	Max. Temp.(°C)	Other event
		1	56.07	O
		2	55.57	O
		3	56.12	O
		4	55.25	O
5	55.91	O		
6	55.43	O		
7	55.28	O		
8	56.03	O		
		Note: D-Disassembly ; R-Rupture ; F-Fire		
		O- No Disassembly , No Rupture , No Fire		
Item	Test Item	Test specification	Judge criteria	Sample(s)
T6	Crush test/ Impact test (UN38.3-6)	6-1.Cell's diameter > 20mm, Execution impact test. (A 9.1 Kg mass is to be dropped from a height of 61±2.5cm onto the sample.) 6-2.Cell's diameter < 20mm, Execution crush test (The cells are crushed with a 13 KN with the crush tester. Once the force is obtained it is to be released.)	External temperature of cell does not exceed 170°C and there is no disassembly and no fire within 6 hours of the test.	5 cells are 50% charged (Cell #1~5)
Test Period		Start: 2016/07/11 End:2016/07/11		
Test Equipment		數位電表 Q153, 資料收集器 Q152, 擠壓試驗機 Q437/撞擊測試機 Q231		
Recommendation		The Cells pass the test.		
Raw Data		Crush Test on 50% Charged Cells		
		No.	Max. Temp.(°C)	Other event
		1	20.75	O
		2	20.64	O
		3	19.74	O
		4	21.14	O
5	20.69	O		
		Note: D-Disassembly ; F-Fire / O-No Disassembly , No Fire		

Item	Test Item	Test specification	Judge criteria	Sample(s)
T7	Overcharge test (UN38.3-7)	7-1. The charge current shall be twice the Spec's recommended maximum continuous charge current. 7-2. The minimum voltage of the test shall be as follows: (a) When the Spec's recommended charge voltage is not more than 18V, the minimum voltage of the test shall be the lesser of two times the maximum charge voltage of the battery or 22V. (b) When the Spec's recommended charge voltage is more than 18V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage. 7-3. Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.	No disassembly, no fire within seven days after the test.	4 packs are fully charged (Pack#9~12) 4 packs are 50 times cycled ending in fully charged state (Pack #13~16)
Test Period	Start: 2016/07/22 End:2016/07/26			
Test Equipment	數位電表 Q153, 資料收集器 Q078, 電源供應器 Q148/Q149/Q150			
Major Problem	-			
Warning Point	-			
Recommendation	The packs pass the test.			
Raw Data	Overcharge Test on Charged Packs			
	No.	Charge Voltage(V)	Charge Current(A)	Max. Temp.(°C)
	9	22.0 V	5.3	22.13
	10			21.21
	11			22.04
	12			21.62
	13			22.23
	14			20.27
	15			20.86
	16			21.17
Note: D-Disassembly ; F-Fire / O-No Disassembly ,No Fire				

Item	Test Item	Test specification	Judge criteria	Sample(s)																																																																									
T8	Forced discharge test (UN38.3-8)	Cell shall be forced discharged at ambient temperature by connecting it in series with a 12 V D.C. power supply at an initial current equal to the maximum discharge current Specified by the manufacturer.	No disassembly, no fire within seven days after the test.	10 cells are first cycle in fully discharged states (Pack#6~15) 10 cells are after 50 cycles ending in fully discharged states (Pack #16~25)																																																																									
Test Period	Start: 2016/07/18 End:2016/07/19																																																																												
Test Equipment	數位電表 Q153, 資料收集器 Q160, 電源供應器 Q147/Q236/Q237																																																																												
Major Problem	-																																																																												
Warning Point	-																																																																												
Recommendation	The packs pass the test.																																																																												
Raw Data	<table border="1"> <thead> <tr> <th colspan="3">Forced discharge are first cycle in fully discharged</th> <th colspan="3">Forced discharge are after 50 cycles ending in fully discharged</th> </tr> <tr> <th>No.</th> <th>Max. Temp.(°C)</th> <th>Other event</th> <th>No.</th> <th>Max. Temp.(°C)</th> <th>Other event</th> </tr> </thead> <tbody> <tr><td>6</td><td>72.13</td><td>0</td><td>16</td><td>60.32</td><td>0</td></tr> <tr><td>7</td><td>60.38</td><td>0</td><td>17</td><td>57.14</td><td>0</td></tr> <tr><td>8</td><td>64.92</td><td>0</td><td>18</td><td>57.78</td><td>0</td></tr> <tr><td>9</td><td>54.87</td><td>0</td><td>19</td><td>59.47</td><td>0</td></tr> <tr><td>10</td><td>65.84</td><td>0</td><td>20</td><td>53.82</td><td>0</td></tr> <tr><td>11</td><td>45.57</td><td>0</td><td>21</td><td>49.98</td><td>0</td></tr> <tr><td>12</td><td>54.69</td><td>0</td><td>22</td><td>48.52</td><td>0</td></tr> <tr><td>13</td><td>63.70</td><td>0</td><td>23</td><td>56.17</td><td>0</td></tr> <tr><td>14</td><td>67.44</td><td>0</td><td>24</td><td>54.27</td><td>0</td></tr> <tr><td>15</td><td>53.94</td><td>0</td><td>25</td><td>59.29</td><td>0</td></tr> </tbody> </table>					Forced discharge are first cycle in fully discharged			Forced discharge are after 50 cycles ending in fully discharged			No.	Max. Temp.(°C)	Other event	No.	Max. Temp.(°C)	Other event	6	72.13	0	16	60.32	0	7	60.38	0	17	57.14	0	8	64.92	0	18	57.78	0	9	54.87	0	19	59.47	0	10	65.84	0	20	53.82	0	11	45.57	0	21	49.98	0	12	54.69	0	22	48.52	0	13	63.70	0	23	56.17	0	14	67.44	0	24	54.27	0	15	53.94	0	25	59.29	0
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	14	67.44	0	24	54.27	0																																																																							
	15	53.94	0	25	59.29	0																																																																							
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