

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

Customer: Lenovo

Pack Model: L12C3A01

Nominal voltage: 10.8V dc

Nominal capacity: 2200mAh/24Wh

Configuration: 3S1P

Customer P/N: 121-500169/121-500187

Celxpert P/N: 921300032 / 921300033

Cell Type: LG S3 2200mAh

Jan. 27, 2018

Approved by _____

Reviewed by _____

Prepared by _____

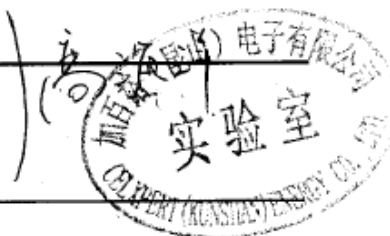


Figure photo of the pack.



1. UN38.3 Test Report

Test Period	2013/01/09 ~2013/01/21		Test Spec.	ST/SG/AC.10/11/Rev.5	
Parts Name	Battery Pack	Application	NB	Quantity	16PCS

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	Impact Test (UN38.3-6)	Pass	Page 13
T7	Overcharge test (UN38.3-7)	Pass	Page 14

The battery pack passes UN38.3 test.

1.2 Test sample list

N o.	Pack S/N	Test item	N o.	Cell Num.	Test item
1	Sample No:1/16	38.3.1~5	1	H3634100058	38.3.6
2	Sample No:2/16	38.3.1~5	2	H3634100120	38.3.6
3	Sample No:3/16	38.3.1~5	3	H3634100505	38.3.6
4	Sample No:4/16	38.3.1~5	4	H3634101736	38.3.6
5	Sample No:5/16	38.3.1~5	5	H3634100203	38.3.6
6	Sample No:6/16	38.3.1~5	6		
7	Sample No:7/16	38.3.1~5	7		
8	Sample No:8/16	38.3.1~5	8		
9	Sample No:9/16	38.3.7	9		
10	Sample No:10/16	38.3.7	10		
11	Sample No:11/16	38.3.7			
12	Sample No:12/16	38.3.7			
13	Sample No:13/16	38.3.7			
14	Sample No:14/16	38.3.7			
15	Sample No:15/16	38.3.7			
16	Sample No:16/16	38.3.7			

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%. Battery resistance change < ±10%.	4 packs are standard charged (Pack#1~4) 4 packs 50 cycled ending in fully charged states (Pack#5~8)							
Test Period	Start: 2013/01/09 End: 2013/01/09										
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										
		Before			After			Difference			
	No.	OCV (V)	Resistance (mΩ)	Weight (g)	OCV (V)	Resistance (mΩ)	Weight (g)	Volt (%)	Resistance (%)	Weight (%)	Result
	1	12.5360	181.00	170.93	12.4920	180.00	170.92	0.35%	0.55%	0.01%	Pass
	2	12.5380	178.00	170.32	12.4930	178.00	170.33	0.36%	0.00%	0.01%	Pass
	3	12.5370	182.00	170.09	12.4880	181.00	170.07	0.39%	0.55%	0.01%	Pass
	4	12.5240	185.00	170.11	12.4760	184.00	170.10	0.38%	0.54%	0.01%	Pass
	5	12.5280	177.00	170.17	12.4820	178.00	170.20	0.37%	0.56%	0.02%	Pass
	6	12.5310	174.00	170.23	12.4920	173.00	170.21	0.31%	0.57%	0.01%	Pass
	7	12.5320	176.00	170.03	12.4870	175.00	170.02	0.36%	0.57%	0.01%	Pass
8	12.5260	183.00	170.18	12.4930	181.00	170.16	0.26%	1.09%	0.01%	Pass	

Item	Test Item	Test specification	Judge criteria	Sample(s)								
T2	Thermal test (UN38.3-2)	2-1. Packs are stored for 6 hours at 75±2°C, followed by storage for 6 hours at -40±2°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%. Battery resistance change < ±10%.	4 packs are standard charged (Pack#1~4) 4 packs 50 cycled ending in fully charged states (Pack#5~8)								
Test Period		Start: 2013/01/10 End: 2013/01/15										
Test Equipment		數位電表 Q153, 電子天平 Q090, 冷熱衝擊機 Q336										
Major Problem		-										
Warning Point		-										
Recommendation		The packs pass the test.										
Raw Data		Thermal Test on Charged Packs										
		No.	Before			After			Difference			Result
			OCV (V)	Resistance (mΩ)	Weight (g)	OCV (V)	Resistance (mΩ)	Weight (g)	Volt (%)	Resistance (%)	Weight (%)	
		1	12.4920	180.00	170.92	12.3960	181.00	170.93	0.77%	0.56%	0.01%	Pass
		2	12.4930	178.00	170.33	12.3870	177.00	170.31	0.85%	0.56%	0.01%	Pass
		3	12.4880	181.00	170.07	12.3600	182.00	170.05	1.02%	0.55%	0.01%	Pass
		4	12.4760	184.00	170.10	12.3780	184.00	170.09	0.79%	0.00%	0.01%	Pass
		5	12.4820	178.00	170.20	12.3880	178.00	170.21	0.75%	0.00%	0.01%	Pass
		6	12.4920	173.00	170.21	12.3910	174.00	170.22	0.81%	0.58%	0.01%	Pass
		7	12.4870	175.00	170.02	12.3980	175.00	170.03	0.71%	0.00%	0.01%	Pass
8	12.4930	181.00	170.16	12.3880	182.00	170.15	0.84%	0.55%	0.01%	Pass		

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%. Battery resistance change < ±10%	4 packs are standard charged (Pack#1~4) 4 packs 50 cycled ending in fully charged states (Pack#5~8)								
Test Period		Start: 2013/01/16 End: 2013/01/17										
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										
			Before			After			Difference			
		No.	OCV (V)	Resistance (mΩ)	Weight (g)	OCV (V)	Resistance (mΩ)	Weight (g)	Volt (%)	Resistance (%)	Weight (%)	Result
		1	12.3960	181.00	170.93	12.3430	182.00	170.92	0.43%	0.55%	0.01%	Pass
		2	12.3870	177.00	170.31	12.3540	178.00	170.32	0.27%	0.56%	0.01%	Pass
		3	12.3600	182.00	170.05	12.3570	182.00	170.04	0.02%	0.00%	0.01%	Pass
		4	12.3780	184.00	170.09	12.3450	184.00	170.08	0.27%	0.00%	0.01%	Pass
		5	12.3880	178.00	170.21	12.3550	179.00	170.22	0.27%	0.56%	0.01%	Pass
		6	12.3910	174.00	170.22	12.3680	175.00	170.21	0.19%	0.57%	0.01%	Pass
		7	12.3980	175.00	170.03	12.3660	176.00	170.02	0.26%	0.57%	0.01%	Pass
8	12.3880	182.00	170.15	12.3660	181.00	170.14	0.18%	0.55%	0.01%	Pass		

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%. Battery resistance change < ±10%.	4 packs are standard charged (Pack#1~4) 4 packs 50 cycled ending in fully charged states (Pack#5~8)								
Test Period		Start: 2013/01/17 End: 2013/01/17										
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										
			Before			After			Difference			
		No.	OCV (V)	Resistance (mΩ)	Weight (g)	OCV (V)	Resistance (mΩ)	Weight (g)	Volt (%)	Resistance (%)	Weight (%)	Result
		1	12.3430	182.00	170.92	12.3230	182.00	170.91	0.16%	0.00%	0.01%	Pass
		2	12.3540	178.00	170.32	12.3330	178.00	170.33	0.17%	0.00%	0.01%	Pass
		3	12.3570	182.00	170.04	12.3260	183.00	170.03	0.25%	0.55%	0.01%	Pass
		4	12.3450	184.00	170.08	12.3340	184.00	170.06	0.09%	0.00%	0.01%	Pass
		5	12.3550	179.00	170.22	12.3340	180.00	170.21	0.17%	0.56%	0.01%	Pass
		6	12.3680	175.00	170.21	12.3570	175.00	170.20	0.09%	0.00%	0.01%	Pass
		7	12.3660	176.00	170.02	12.3520	177.00	170.03	0.11%	0.57%	0.01%	Pass
8	12.3660	181.00	170.14	12.3510	182.00	170.13	0.12%	0.55%	0.01%	Pass		

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: 2013/01/18 End: 2013/01/21		
Test Equipment		數位電表 Q153, 資料收集器 Q078, 烘箱 Q171		
Recommendation		The packs pass the test.		
Raw Data	Short Circuit Test on Charged Packs			
	No.	Max. Temp.(°C)	Visual	Result
	1	56.14	OK	Pass
	2	55.36	OK	Pass
	3	54.27	OK	Pass
	4	55.82	OK	Pass
	5	56.07	OK	Pass
	6	53.54	OK	Pass
	7	55.92	OK	Pass
	8	55.73	OK	Pass
Item	Test Item	Test specification	Judge criteria	Sample(s)
T6	Impact test (UN38.3-6)	6-1. The test sample is to be placed on a flat surface. A 15.8mm diameter bar is to be placed across the center of the sample. A 9.1 Kg mass is to be dropped from a height of 61±2.5cm onto the sample. 6-2. A cylindrical or prismatic cell is to be impacted with its longitudinal axis parallel to the flat surface.	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) For prismatic cell, The amount double
Test Period		Start: 2013/01/08 End: 2013/01/08		
Test Equipment		數位電表 Q153, 資料收集器 Q160, 撞擊試驗機 Q231		
Recommendation		The Cells pass the test.		
Raw Data	Impact Test on 50% Charged Cells			
	No.	Max. Temp.(°C)	Visual	Result
	1	78.33	OK	Pass
	2	59.62	OK	Pass
	3	46.78	OK	Pass
	4	62.31	OK	Pass
	5	57.11	OK	Pass

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 of 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: 2013/01/13 End: 2013/01/21				
Test Equipment		數位電表 Q153, 資料收集器 Q151, 電源供應器 Q147				
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)	Visual	Result
	9	22.0 V	4.4 A	25.64	OK	Pass
	10			26.34	OK	Pass
	11			24.15	OK	Pass
	12			24.95	OK	Pass
	13			25.09	OK	Pass
	14			25.68	OK	Pass
	15			25.71	OK	Pass
	16			26.10	OK	Pass