

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

Customer: Lenovo

Pack Model: L18C4PF0

Nominal voltage: 15.36V

Nominal capacity: 2964mAh/45Wh

Configuration: 4S1P

Customer P/N: 5B10S73501

Celxpert P/N: 921300203

Cell Type: Coslight CA4041B0G 2964mAh

Dec.05.2018

Approved by _____) (高海峰

Reviewed by _____

Prepared by 单秋梅



1. Figure photo of the pack.



Lenovo

Lenovo is the trademark of Lenovo, used under license.
 Lenovo 是联想集团所属企业的商标, 根据许可使用。

Model name 型号/型號: L18C4PF0
 41CP4/41/110
 15.36V == Typical Capacity 2964mAh / 45Wh, Rated Capacity 2865mAh / 44Wh
 额定容量: 2865mAh 充电限制电压(limited charging voltage): 17.6V
 For use with Lenovo personal computer
 制造商: 加百裕工业股份有限公司
 Manufactured By Celxpert(Kunshan)Energy Co., Ltd.
 Rechargeable Li-Ion Battery / 锂离子电池组
 Made in China 制造地: 中国

PS:此報告僅針對送檢樣品有效

The test report is valid for the tested samples only.

2. UN38.3 Test Report

Test Period	2018/06/11~2018/06/27		Test Spec.	ST/SG/AC.10/11/Rev.6/Amend.1	
Parts Name	Battery Pack	Application	NB	Quantity	Pack 16PCS/Cell 30pcs

2.1 Test Summary

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

2.2 Test sample list

No.	Pack S/N	Test item	No.	Cell Num.	Test item
1	Sample No:1/16	38.3.1~5	1	Coslight CA4041B0G 2865mAh	38.3.6
2	Sample No:2/16	38.3.1~5	2	Coslight CA4041B0G 2865mAh	38.3.6
3	Sample No:3/16	38.3.1~5	3	Coslight CA4041B0G 2865mAh	38.3.6
4	Sample No:4/16	38.3.1~5	4	Coslight CA4041B0G 2865mAh	38.3.6
5	Sample No:5/16	38.3.1~5	5	Coslight CA4041B0G 2865mAh	38.3.6
6	Sample No:6/16	38.3.1~5	6	Coslight CA4041B0G 2865mAh	38.3.6
7	Sample No:7/16	38.3.1~5	7	Coslight CA4041B0G 2865mAh	38.3.6
8	Sample No:8/16	38.3.1~5	8	Coslight CA4041B0G 2865mAh	38.3.6
9	Sample No:9/16	38.3.7	9	Coslight CA4041B0G 2865mAh	38.3.6
10	Sample No:10/16	38.3.7	10	Coslight CA4041B0G 2865mAh	38.3.6
11	Sample No:11/16	38.3.7	11	Coslight CA4041B0G 2865mAh	38.3.8
12	Sample No:12/16	38.3.7	12	Coslight CA4041B0G 2865mAh	38.3.8
13	Sample No:13/16	38.3.7	13	Coslight CA4041B0G 2865mAh	38.3.8
14	Sample No:14/16	38.3.7	14	Coslight CA4041B0G 2865mAh	38.3.8
15	Sample No:15/16	38.3.7	15	Coslight CA4041B0G 2865mAh	38.3.8
16	Sample No:16/16	38.3.7	16	Coslight CA4041B0G 2865mAh	38.3.8
			17	Coslight CA4041B0G 2865mAh	38.3.8
			18	Coslight CA4041B0G 2865mAh	38.3.8
			19	Coslight CA4041B0G 2865mAh	38.3.8
			20	Coslight CA4041B0G 2865mAh	38.3.8
			21	Coslight CA4041B0G 2865mAh	38.3.8
			22	Coslight CA4041B0G 2865mAh	38.3.8
			23	Coslight CA4041B0G 2865mAh	38.3.8
			24	Coslight CA4041B0G 2865mAh	38.3.8
			25	Coslight CA4041B0G 2865mAh	38.3.8
			26	Coslight CA4041B0G 2865mAh	38.3.8
			27	Coslight CA4041B0G 2865mAh	38.3.8
			28	Coslight CA4041B0G 2865mAh	38.3.8
			29	Coslight CA4041B0G 2865mAh	38.3.8
			30	Coslight CA4041B0G 2865mAh	38.3.8

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	17.35	182.64	17.348	182.63	99.99%	0.00%	O
	2	17.36	182.49	17.359	182.48	99.99%	0.00%	O
	3	17.35	182.75	17.349	182.74	99.99%	0.00%	O
	4	17.34	182.36	17.337	182.35	99.98%	0.00%	O
	5	17.21	182.59	17.208	182.58	99.99%	0.00%	O
	6	17.23	182.76	17.227	182.75	99.98%	0.00%	O
	7	17.22	182.47	17.219	182.46	99.99%	0.00%	O
8	17.24	182.56	17.236	182.55	99.98%	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±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%.	4 packs are first cycle in fully charged (Pack#1~4) 4 packs are 25 times cycled ending in fully charged state (Pack #5~8)		
Test Period		Start: 2018/06/12			End: 2018/06/18			
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)	Volt (%)	Weight (%)	
	1	17.348	182.63	17.279	182.61	99.60%	0.01%	O
	2	17.359	182.48	17.283	182.46	99.56%	0.01%	O
	3	17.349	182.74	17.274	182.72	99.57%	0.01%	O
	4	17.337	182.35	17.263	182.34	99.57%	0.01%	O
	5	17.208	182.58	17.137	182.56	99.59%	0.01%	O
	6	17.227	182.75	17.152	182.73	99.56%	0.01%	O
	7	17.219	182.46	17.151	182.44	99.61%	0.01%	O
8	17.236	182.55	17.161	182.53	99.56%	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 first cycle in fully charged (Pack#1~4) 4 packs are 25 times cycled ending in fully charged state (Pack #5~8)		
Test Period		Start: 2018/06/19			End: 2018/06/20			
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	17.279	182.61	17.272	182.59	99.96%	0.01%	O
	2	17.283	182.46	17.276	182.44	99.96%	0.01%	O
	3	17.274	182.72	17.266	182.71	99.95%	0.01%	O
	4	17.263	182.34	17.255	182.32	99.95%	0.01%	O
	5	17.137	182.56	17.129	182.54	99.95%	0.01%	O
	6	17.152	182.73	17.146	182.71	99.97%	0.01%	O
	7	17.151	182.44	17.142	182.41	99.95%	0.01%	O
8	17.161	182.53	17.154	182.51	99.96%	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)	<p>4-1. Packs shall be secured to the testing machine by means of a rigid mount, which will support all mounting surfaces.</p> <p>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.</p> <p>4-3. All batteries weight are measured. The charged cell voltage are measured and recorded.</p>			<p>No mass loss (<0.1%), no leakage, no venting, no disassembly, no rupture and no fire.</p> <p>Battery voltage drop < 10%.</p>	<p>4 packs are first cycle in fully charged (Pack#1~4)</p> <p>4 packs are 25 times cycled ending in fully charged state (Pack #5~8)</p>		
Test Period		Start: 2018/06/22			End: 2018/06/22			
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	17.272	182.59	17.266	182.59	99.97%	0.00%	O
	2	17.276	182.44	17.271	182.43	99.97%	0.00%	O
	3	17.266	182.71	17.261	182.70	99.97%	0.00%	O
	4	17.255	182.32	17.249	182.31	99.97%	0.00%	O
	5	17.129	182.54	17.125	182.53	99.98%	0.00%	O
	6	17.146	182.71	17.139	182.70	99.96%	0.00%	O
	7	17.142	182.41	17.136	182.41	99.96%	0.00%	O
8	17.154	182.51	17.149	182.50	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)	
T5	Short Circuit Test (UN38.3-5)	5-1.Packs are placed in to a (57±4) °C oven, and exterior packs temperature are monitored 5-2.When packs exterior reach (57±4)°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 57°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 first cycle in fully charged (Pack#1~4) 4 packs are 25 times cycled ending in fully charged state (Pack #5~8)	
Test Period		Start: 2018/06/25			End: 2018/06/27			
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	54.26	O			
		2	55.36	O			
		3	56.49	O			
		4	55.38	O			
		5	55.75	O			
		6	56.49	O			
		7	55.29	O			
		8	56.48	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	Impact test (UN38.3-6)	6-1.Cell's diameter > 18mm, Execution impact test. (A 9.1 Kg mass is to be dropped from a height of (61±2.5)cm onto the sample.) 6-2.Cell's diameter < 18mm, 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 first cycle in charged states to 50%. (Pack#1~5) 5 cells are after 25 cycles ending in charged states to 50%. (Pack #6~10)			
Test Period		Start: 2018/06/11 End: 2018/06/11					
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	No.	Max. Temp.(°C)	Other event
		1	21.36	O	6	21.46	O
		2	22.35	O	7	22.58	O
		3	21.46	O	8	21.47	O
		4	21.58	O	9	21.59	O
		5	22.49	O	10	21.56	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 of the test.	4 packs are first cycle in fully charged (Pack#9~12) 4 packs are 25 times cycled ending in fully charged state (Pack #13~16)			
Test Period		Start: 2018/06/13 End: 2018/06/15					

Test Equipment	數位電表 Q153, 資料收集器 Q078, 電源供應器 Q148/Q150/Q0236			
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	5.9	21.36
	10			21.49
	11			20.36
	12			20.48
	13			21.57
	14			21.46
	15			20.25
	16			20.15
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#11~20) 10 cells are after 25 cycles ending in fully discharged states (Pack #21~30)
Test Period	Start: 2018/06/18		End: 2018/06/19	
Test Equipment	數位電表 Q153, 資料收集器 Q160, 電源供應器 Q0474/Q0475/Q0476			

Major Problem	-					
Warning Point	-					
Recommendation	The packs pass the test.					
Raw Data	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
	11	51.26	0	21	51.26	0
	12	54.60	0	22	54.26	0
	13	58.36	0	23	53.28	0
	14	48.49	0	24	52.25	0
	15	47.26	0	25	54.86	0
	16	51.26	0	26	53.26	0
	17	50.24	0	27	51.76	0
	18	49.36	0	28	50.16	0
	19	48.26	0	29	52.48	0
	20	46.28	0	30	52.76	0