

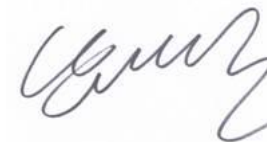
UN38.3 Test Summary



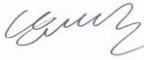
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Description		List of Test Completed	
Cell/Battery Type (Physical Description)	Lithium Ion battery cell (Cylindrical)	Revised edition	Revision 6 Amendment 1
Test Report Number	QDI-190311-C-INR18650MH1	Test 1. Altitude Simulation	Pass
Date of test report	2019.03.11	Test 2. Thermal Test	Pass
Model name	INR18650MH1	Test 3. Vibration	Pass
Nominal voltage (V)	3.70	Test 4. Shock	Pass
Capacity (mAh)	3100	Test 5. External Short Circuit	Pass
Weight (g)	44.324	Test 6. Impact	Pass
Dimensions (mm)	18.40 X 65.20	Test 7. Overcharge	Not applicable
Reference to assembled battery testing requirements	Not applicable	Test 8. Forced Discharge	Pass

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Document Number	QDI-190311-C-INR18650MH1	
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UN38.3 Test Report

- INR18650MH1 (3.70V, 3100mAh) -

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2019. 03. 11

1. UN38.3 Test Condition

Rev.6 Amendment 1

Test item	Test Condition	Requirements	Etc.
Test 1. Altitude Simulation	Storing at (low pressure)11.6kPa for 6hr at 20+/-5°C	<ul style="list-style-type: none"> - After OCV (%) ≥ 90% - No leakage, no venting, no disassembly, no rupture, no fire - Mass loss limit (leakage) <ul style="list-style-type: none"> 1) If M<1g, less than 0.5%, 2) If 1g≤M≤75g, less than 0.2%, 3) If M>75g, less than 0.1% 	<p>T1~T5 : Sequence Tests</p> <pre> graph TD T1[Test 1 Altitude Simulation] --> T2[Test 2 Thermal Test] T2 --> T3[Test 3 Vibration] T3 --> T4[Test 4 Shock] T4 --> T5[Test 5 Ext. Short Circuit] </pre>
Test 2. Thermal Test	[72±2°C,6hr ↔ -40±2°C,6hr, interval max. 30min] x 10cycle Storing at 20±5°C for 24h		
Test 3. Vibration	[7Hz↔200Hz↔7Hz, in 15min] x 12 times x 3 direction 1) sinusoidal waveform with a logarithmic sweep 2) 7Hz 18Hz (maintaining 1gn) app. 50Hz (until 8gn) 200Hz (maintaining 8gn), 1.6mm total excursion		
Test 4. Shock	Half sine shock 1) Peak acceleration - For cells & single cell batteries : 150gn - For batteries (whichever is smaller) : 150gn or $\sqrt{\frac{100850}{Mass(kg)}} gn$ 2) Pulse duration : 6msec 3) 6 direction (±x, y, z) x 3 cycle		
Test 5. External Short Circuit	1) Samples to be heated to 57±4°C in chamber (Measured on external case) 2) Less than 0.1Ω, ext. short-circuit at 57±4°C 3) 1hr continue after returning to 57±4°C		
Test 6. Impact	Φ=15.8±0.1mm bar, 9.1±0.1kg mass, 61±2.5cm height	<ul style="list-style-type: none"> - No disassembly, no fire within 6 hours after the test - Max. Temp ≤ 170°C 	for cylindrical cells (not less than 18mm diameter)
Test 6. Crush	Crushing rate :1.5cm/s, until 13kN±0.78kN or 100mV drop or 50% deformation		for cylindrical cells (less than 18mm diameter) for prismatic, pouch, coin/button cells
Test 7. Overcharge	Current = Manufacturer's recommended max. continuous charge current X 2 Voltage 1.If charge voltage ≤ 18V, V (min.) = 2 x (max. charge voltage) or 22V. 2.If charge voltage > 18V, V (min.) = 1.2 x (max. charge voltage)	<ul style="list-style-type: none"> - No disassembly, no fire within 7 days after the test 	Only for Single Cell Battery / Battery
Test 8. Forced Discharge	Discharge at max. discharge current (connecting in series with 12V DC power supply), Duration time = rated capacity/initial test current	<ul style="list-style-type: none"> - No disassembly, no fire within 7 days after the test 	Resistance of Electric Loader 1/Ω = (max. discharge current) / (12 + Initial OCV)

2-1. T1-T4 Test Result

Before			Altitude (T1)					Thermal (T2)					Vibration (T3)					Shock (T4)				
NO.	OCV	Mass (g)	After OCV (V)	Mass (g)	After OCV(%)	Mass Loss(%)	Result	After OCV (V)	Mass (g)	After OCV(%)	Mass Loss(%)	Result	After OCV (V)	Mass (g)	After OCV(%)	Mass Loss(%)	Result	After OCV (V)	Mass (g)	After OCV(%)	Mass Loss(%)	Result

A. 1st cycle fully charged state

1	4.150	44.210	4.149	44.209	99.98	0.002	Pass	4.111	44.206	99.08	0.007	Pass	4.110	44.205	99.98	0.002	Pass	4.109	44.204	99.98	0.002	Pass
2	4.150	44.324	4.149	44.322	99.98	0.005	Pass	4.111	44.320	99.08	0.005	Pass	4.110	44.318	99.98	0.005	Pass	4.109	44.316	99.98	0.005	Pass
3	4.149	44.120	4.147	44.120	99.95	0.000	Pass	4.111	44.118	99.13	0.005	Pass	4.110	44.117	99.98	0.002	Pass	4.110	44.117	100.00	0.000	Pass
4	4.150	44.141	4.149	44.140	99.98	0.002	Pass	4.112	44.139	99.11	0.002	Pass	4.110	44.137	99.95	0.005	Pass	4.110	44.136	100.00	0.002	Pass
5	4.150	44.294	4.149	44.292	99.98	0.005	Pass	4.112	44.290	99.11	0.005	Pass	4.111	44.287	99.98	0.007	Pass	4.111	44.287	100.00	0.000	Pass

B. 25th cycle fully charged state

6	4.158	44.080	4.157	44.079	99.98	0.002	Pass	4.112	44.078	98.92	0.002	Pass	4.111	44.075	99.98	0.007	Pass	4.111	44.074	100.00	0.002	Pass
7	4.159	44.039	4.158	44.037	99.98	0.005	Pass	4.113	44.035	98.92	0.005	Pass	4.111	44.034	99.95	0.002	Pass	4.111	44.032	100.00	0.005	Pass
8	4.160	44.151	4.159	44.150	99.98	0.002	Pass	4.113	44.148	98.89	0.005	Pass	4.112	44.146	99.98	0.005	Pass	4.111	44.145	99.98	0.002	Pass
9	4.162	44.187	4.161	44.185	99.98	0.005	Pass	4.114	44.183	98.87	0.005	Pass	4.114	44.181	100.00	0.005	Pass	4.114	44.179	100.00	0.005	Pass
10	4.161	44.320	4.160	44.319	99.98	0.002	Pass	4.114	44.317	98.89	0.005	Pass	4.113	44.316	99.98	0.002	Pass	4.113	44.315	100.00	0.002	Pass

2-2. T5/T6/T8 Test Result

EXT. Short Circuit (T5)			
NO.	Initial OCV(V)	Max. Temp (°C)	Result

A. 1st cycle fully charged state

1	4.109	110.28	Pass
2	4.109	109.42	Pass
3	4.110	113.26	Pass
4	4.110	110.60	Pass
5	4.111	116.70	Pass

B. 25th cycle fully charged state

6	4.111	112.21	Pass
7	4.111	120.39	Pass
8	4.111	109.76	Pass
9	4.114	123.90	Pass
10	4.113	122.92	Pass

Impact (T6)			
NO.	Initial OCV(V)	Max. Temp (°C)	Result

A. 1st cycle 50% charged state

11	3.713	101.95	Pass
12	3.716	94.66	Pass
13	3.714	112.30	Pass
14	3.715	105.32	Pass
15	3.714	119.29	Pass

B. 25th cycle 50% charged state

16	3.731	121.14	Pass
17	3.735	122.11	Pass
18	3.729	121.13	Pass
19	3.730	120.73	Pass
20	3.732	113.73	Pass

Forced Discharge (T8)							
NO.	Initial OCV(V)	Max. Temp (°C)	Result	NO.	Initial OCV(V)	Max. Temp (°C)	Result

A. 1st cycle fully discharged state

21	3.140	45.29	Pass
22	3.148	47.52	Pass
23	3.129	38.42	Pass
24	3.133	40.84	Pass
25	3.133	36.06	Pass
26	3.151	38.77	Pass
27	3.140	39.92	Pass
28	3.145	38.77	Pass
29	3.163	38.74	Pass
30	3.149	41.81	Pass

B. 25th cycle fully discharged state

31	3.200	46.76	Pass
32	3.184	49.74	Pass
33	3.191	41.41	Pass
34	3.193	44.64	Pass
35	3.191	37.56	Pass
36	3.182	43.85	Pass
37	3.189	41.83	Pass
38	3.192	44.51	Pass
39	3.188	39.28	Pass
40	3.195	43.65	Pass

3. Sample Image

