
Introduction of INR18650-25R



SAMSUNG

SAMSUNG SDI

Mar. 2013

Energy Business Division

This material is proprietary to Samsung SDI Co., Ltd. It shall not be used, reproduced, copied, disclosed, transmitted, in whole or in part, without the express written consent of Samsung SDI Co., Ltd.



SAMSUNG SDI

INR18650-25R

- **Specification**
- **Capacity (0.2C vs. 10A)**
- **AC/DC impedance**
- **Capacity & temperature vs. discharge capacity**
- **Energy & avg. voltage at different current**
- **Cycle life**
- **Pulse cycle life**
- **Low temperature voltage profile at 10A**
- **Storage characteristics**
- **Safety test**

Specification

**PROPRIETARY AND
CONFIDENTIAL**

Type		Spec.	Typical INR18650-25R
Chemistry		NCA	NCA
Dimension (mm)	Diameter	18.33 ± 0.07	18.33 ± 0.07
	Height	64.85 ± 0.15	64.85 ± 0.15
Weight (g)		Max. 45.0	43.5
Initial IR (mΩ AC 1kHz)		≤ 18	12.93 ± 2
Initial IR (mΩ DC (10A-1A))		≤ 30	19.23 ± 2
Nominal Voltage (V)		3.6	3.64
Charge Method (100mA cut-off)		CC-CV (4.2±0.05V)	CC-CV (4.2±0.05V)
Charge Time	Standard (min), 0.5C	180min	136
	Rapid (min), 4A	60min	55
Charge Current	Standard current (A)	1.25	1.25
	Max. current (A)	4.0	4.0
Discharge	End voltage (V)	2.5	2.5
	Max. cont. current (A)	20	20
	Max. momentary pulse (A, <1sec)	100	100
Rated discharge Capacity	Standard (mAh) (0.2C)	2,500	2,551
	rated (mAh) (10A)	2,450	2,540

Capacity _ 0.2C vs. 10A

PROPRIETARY AND
CONFIDENTIAL

▪ 0.2C capacity

Cell	Capacity(Ah)	Energy(Wh)	Avg. volt(V)
1	2.563	9.34	3.64
2	2.548	9.28	3.64
3	2.546	9.27	3.64
4	2.548	9.28	3.64
5	2.550	9.29	3.64
Avg.	2.551	9.29	3.64

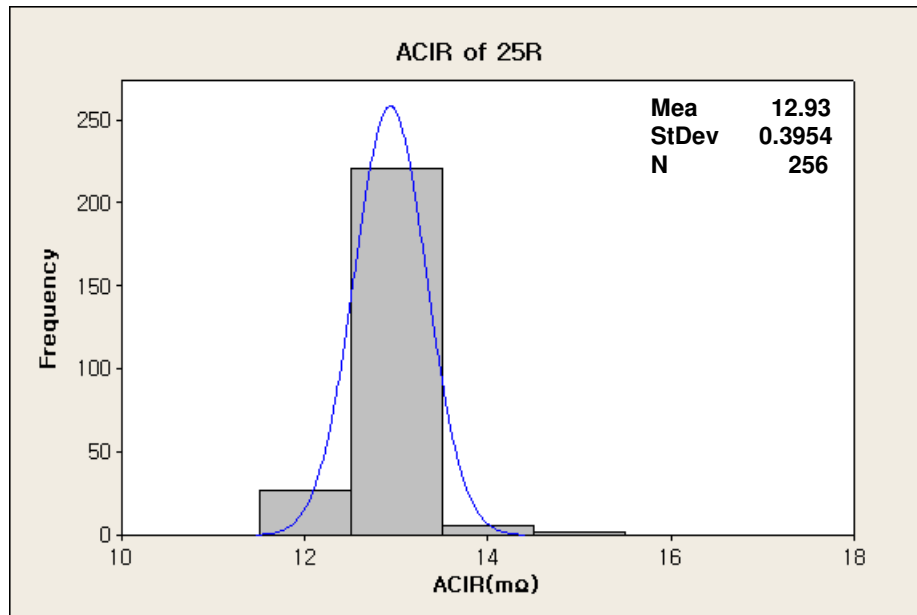
▪ 10A capacity

Cell	Capacity(Ah)	Energy(Wh)	Avg. volt(V)
1	2.539	8.72	3.43
2	2.544	8.73	3.43
3	2.537	8.69	3.42
4	2.540	8.72	3.43
5	2.538	8.72	3.43
Avg.	2.540	8.72	3.43

AC/DC Impedance

PROPRIETARY AND
CONFIDENTIAL

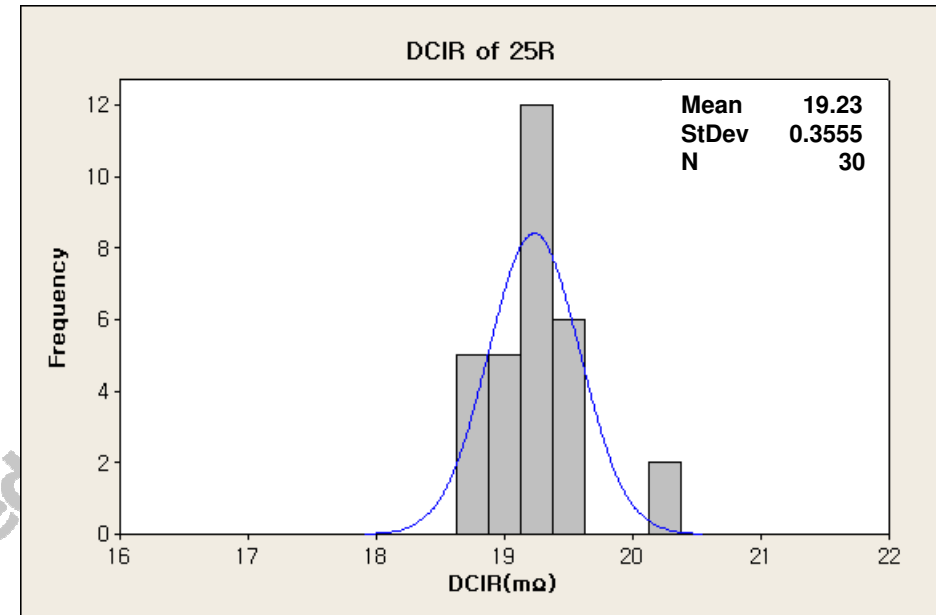
■ AC-IR



AC-IR

$12.93 \pm 2\text{m}\Omega$

■ DC-IR

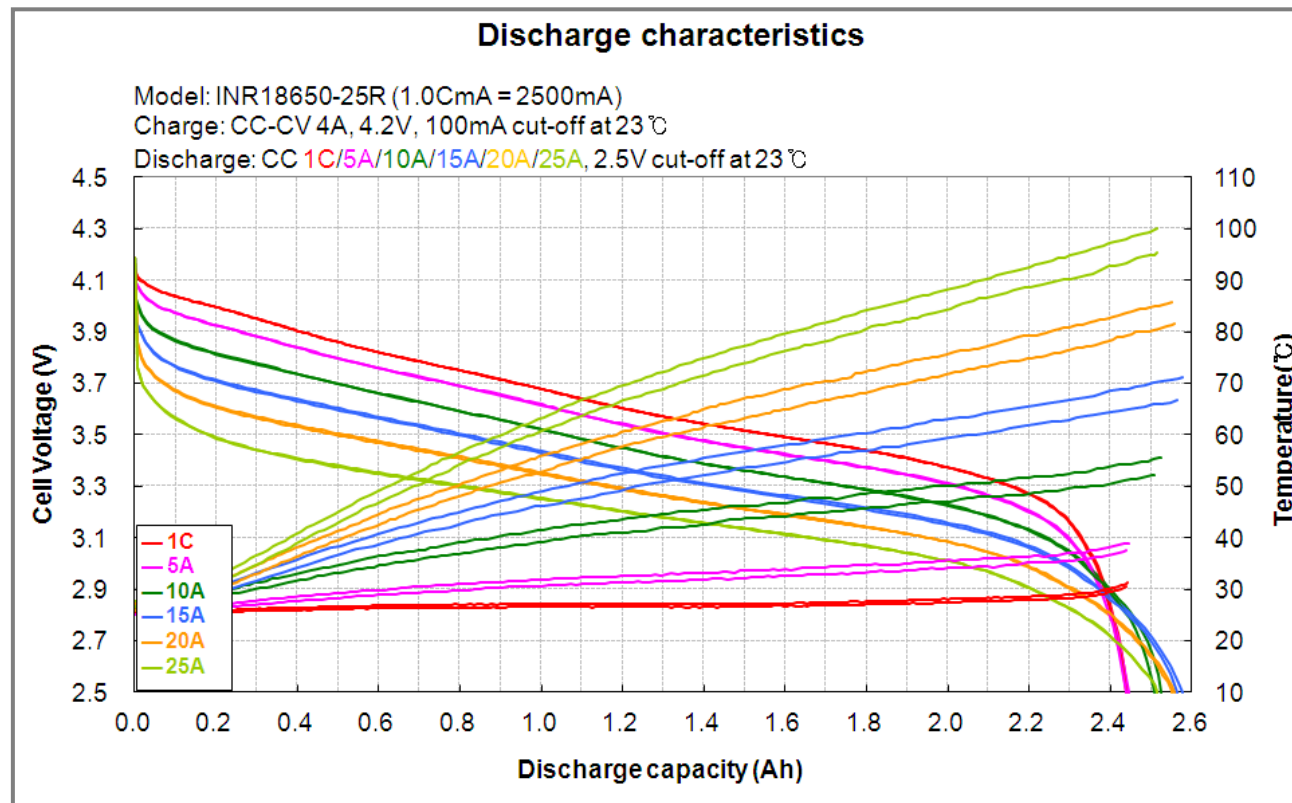


DC-IR

$19.23 \pm 2\text{m}\Omega$

Capacity & Temperature vs. discharge capacity

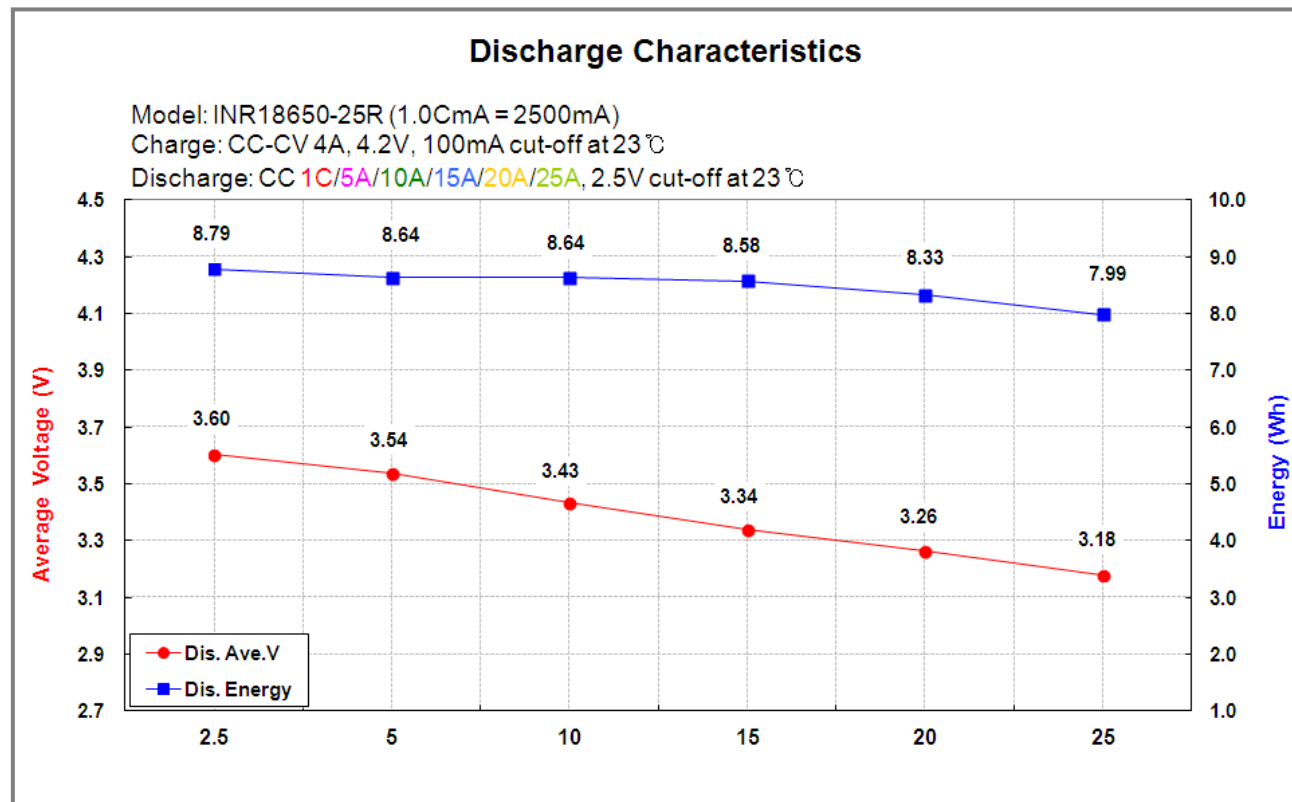
PROPRIETARY AND
CONFIDENTIAL



Discharge current						
	1C	5A	10A	15A	20A	25A
Capa.(Ah)	2.439	2.440	2.517	2.569	2.553	2.514
Temp.(°C)	30.9	38.2	53.9	69.0	83.7	97.8
Time(min.)	58.5	29.3	15.1	10.3	7.66	6.03

Energy & Avg. voltage at different current

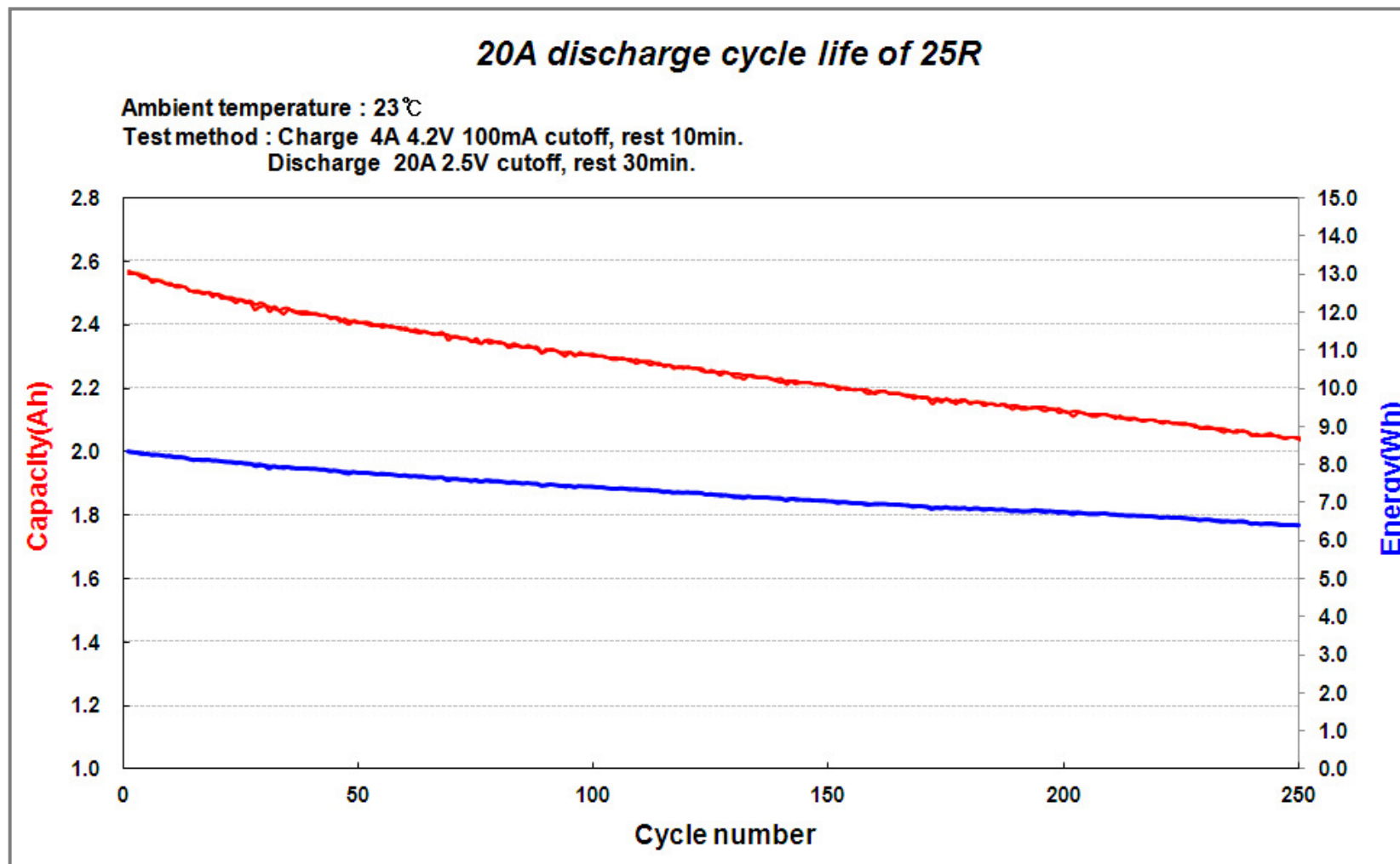
PROPRIETARY AND
CONFIDENTIAL



Discharge current						
	1C	5A	10A	15A	20A	25A
Energy(Wh)	8.79	8.64	8.64	8.58	8.33	7.99
Avg. voltage(V)	3.60	3.54	3.43	3.34	3.26	3.18

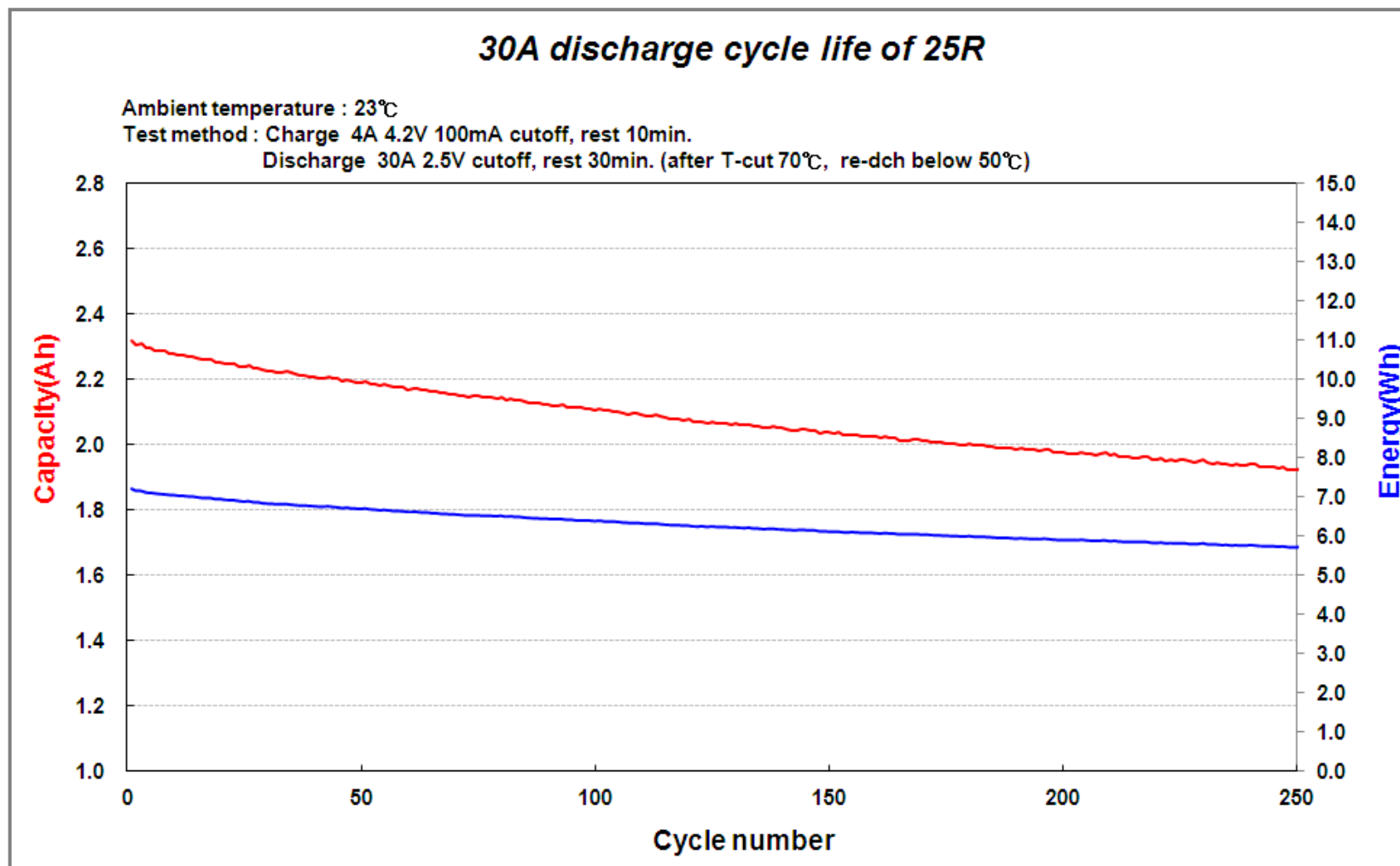
Cycle life _ 20A cycle

PROPRIETARY AND
CONFIDENTIAL



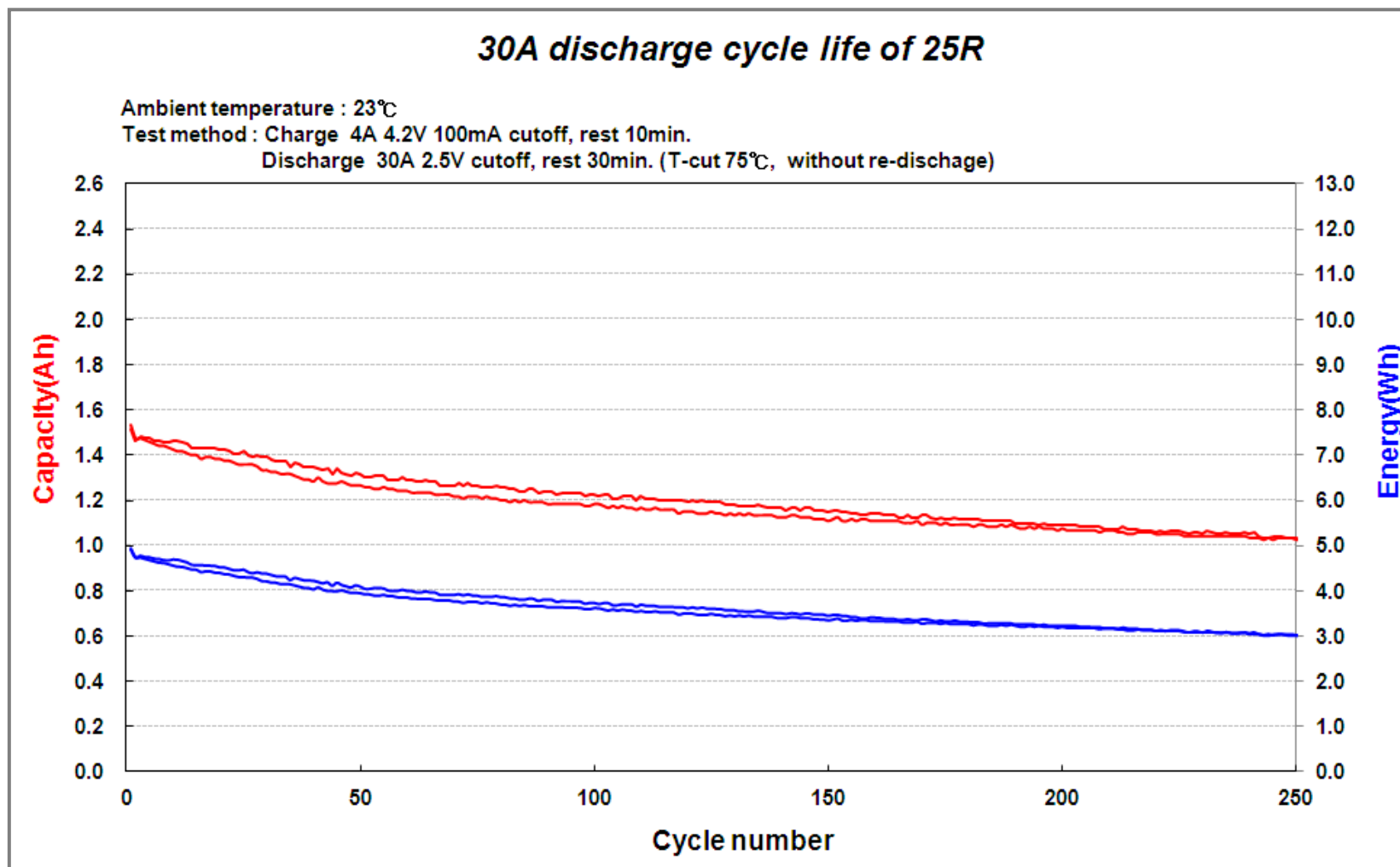
Cycle life _ 30A cycle(70℃ T-cut)

PROPRIETARY AND
CONFIDENTIAL



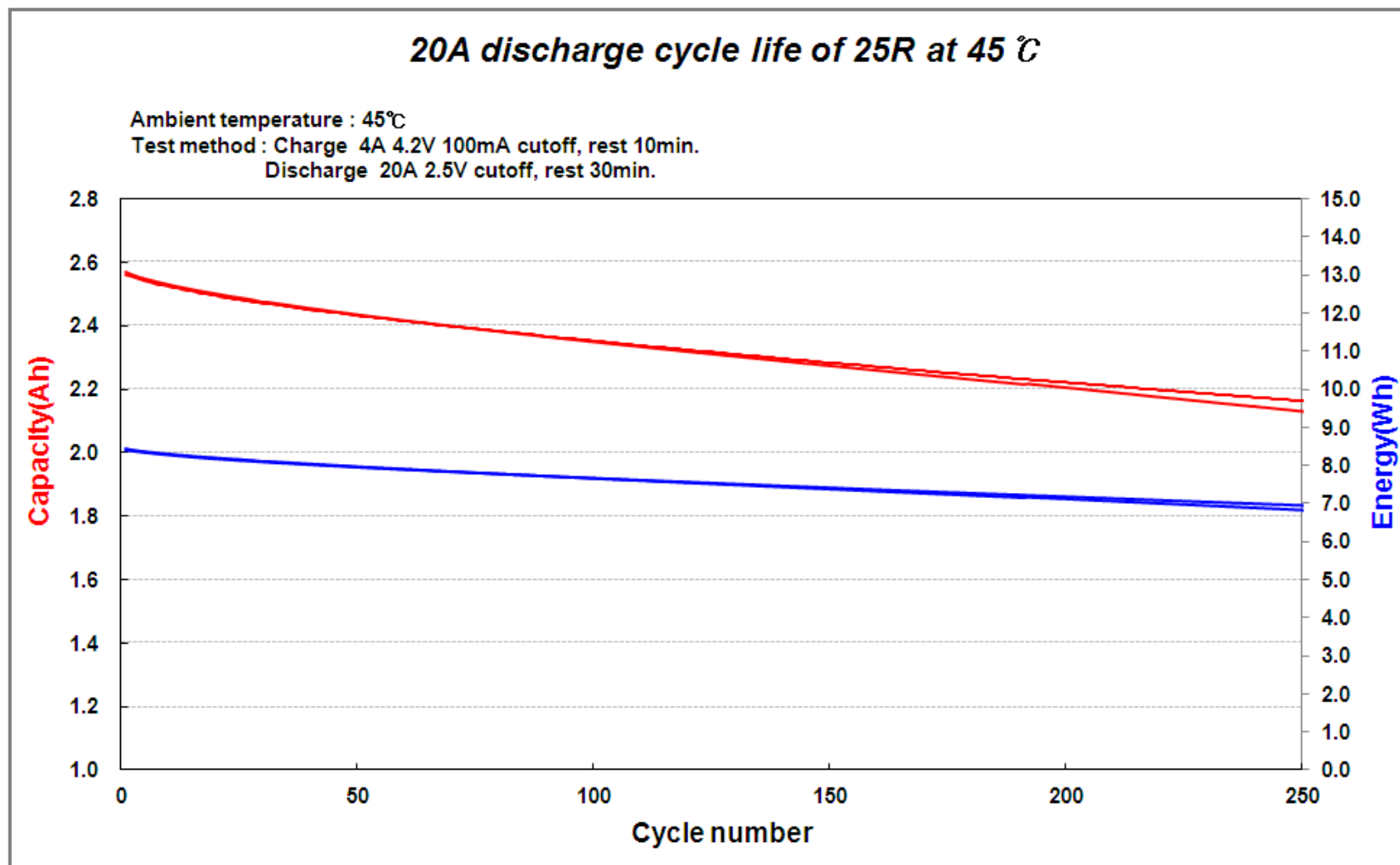
Cycle life _ 30A cycle(75°C T-cut)

PROPRIETARY AND
CONFIDENTIAL



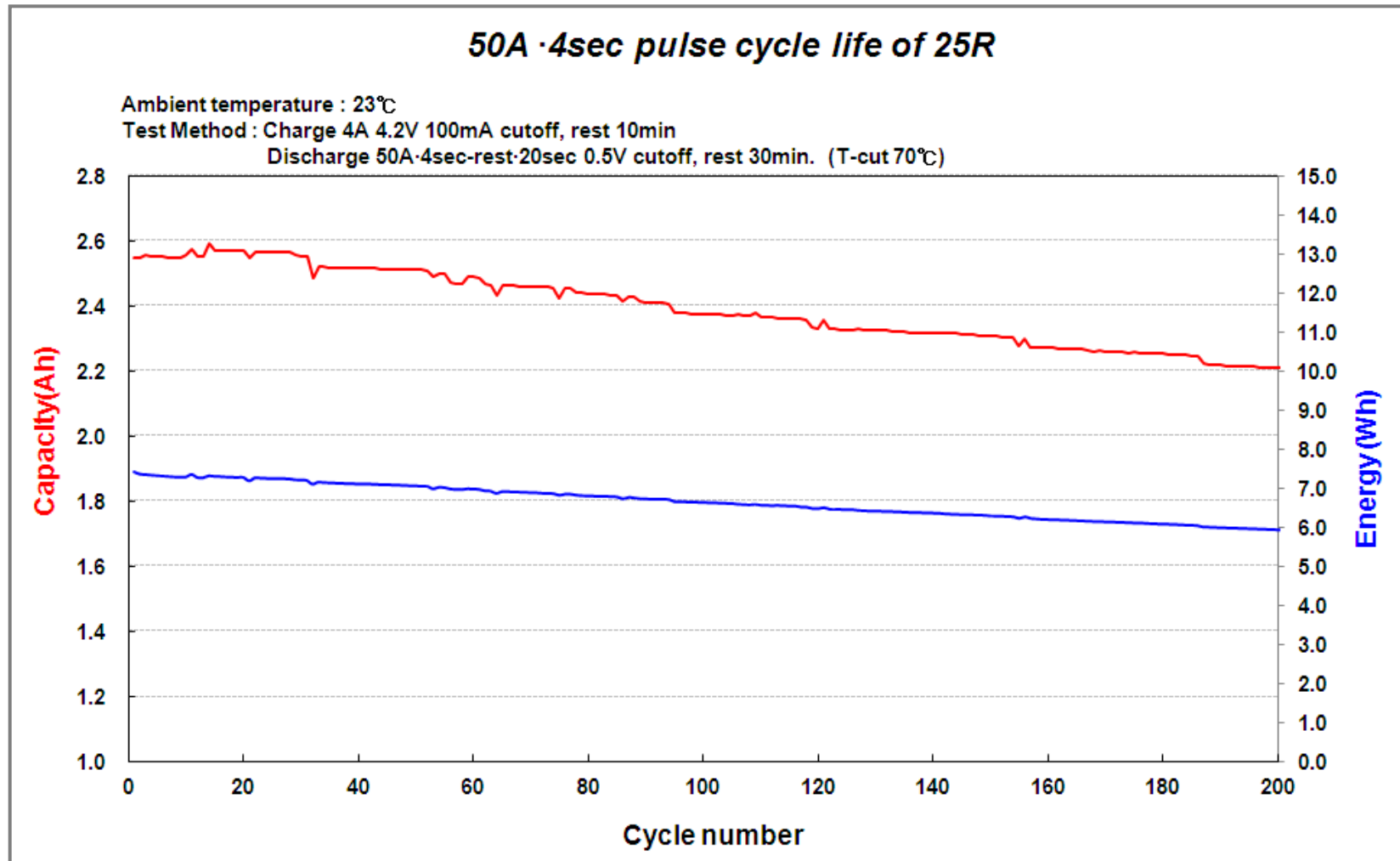
Cycle life _ 20A cycle at 45℃

PROPRIETARY AND
CONFIDENTIAL



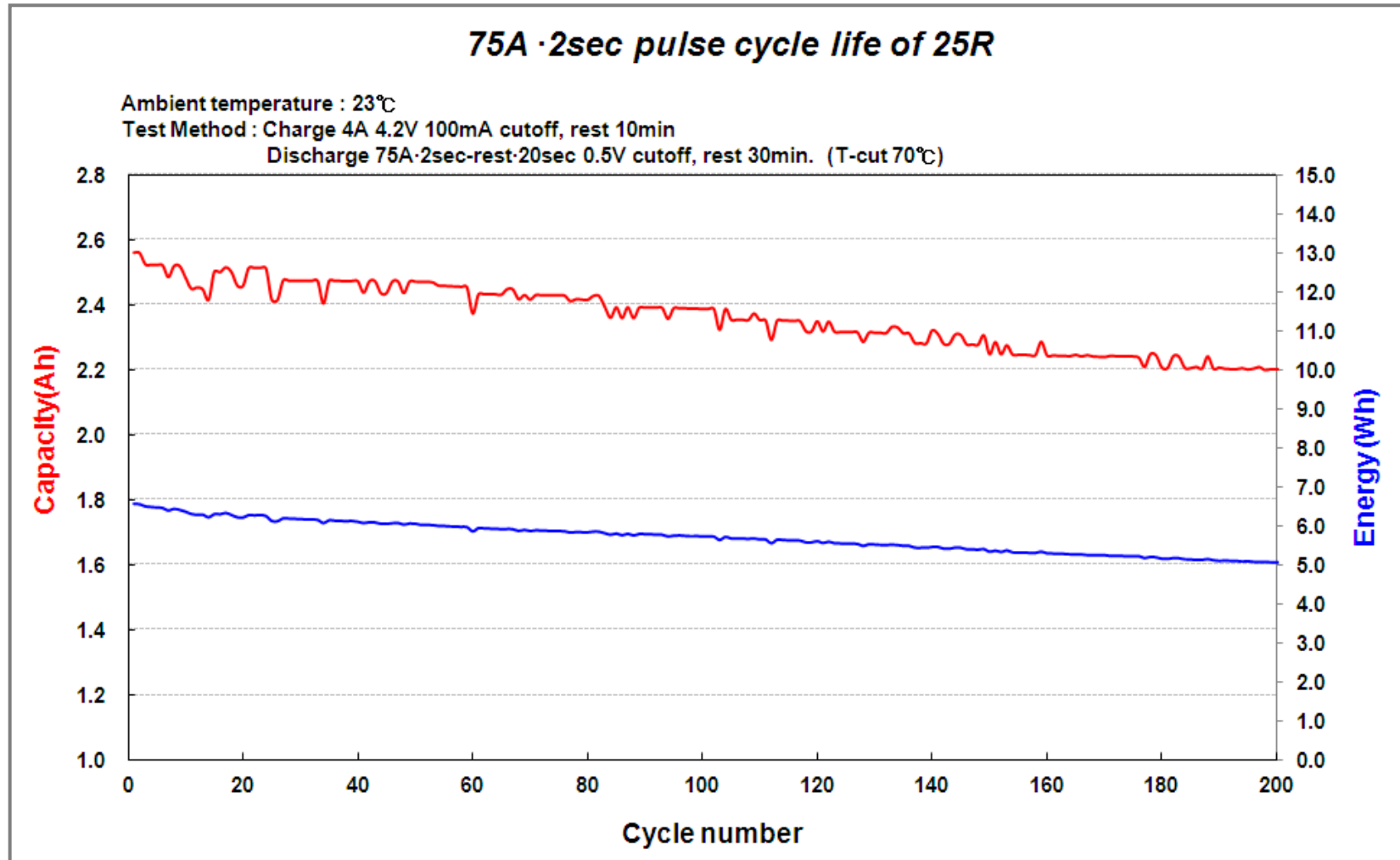
Pulse cycle life _ 50A 4sec pulse

PROPRIETARY AND
CONFIDENTIAL



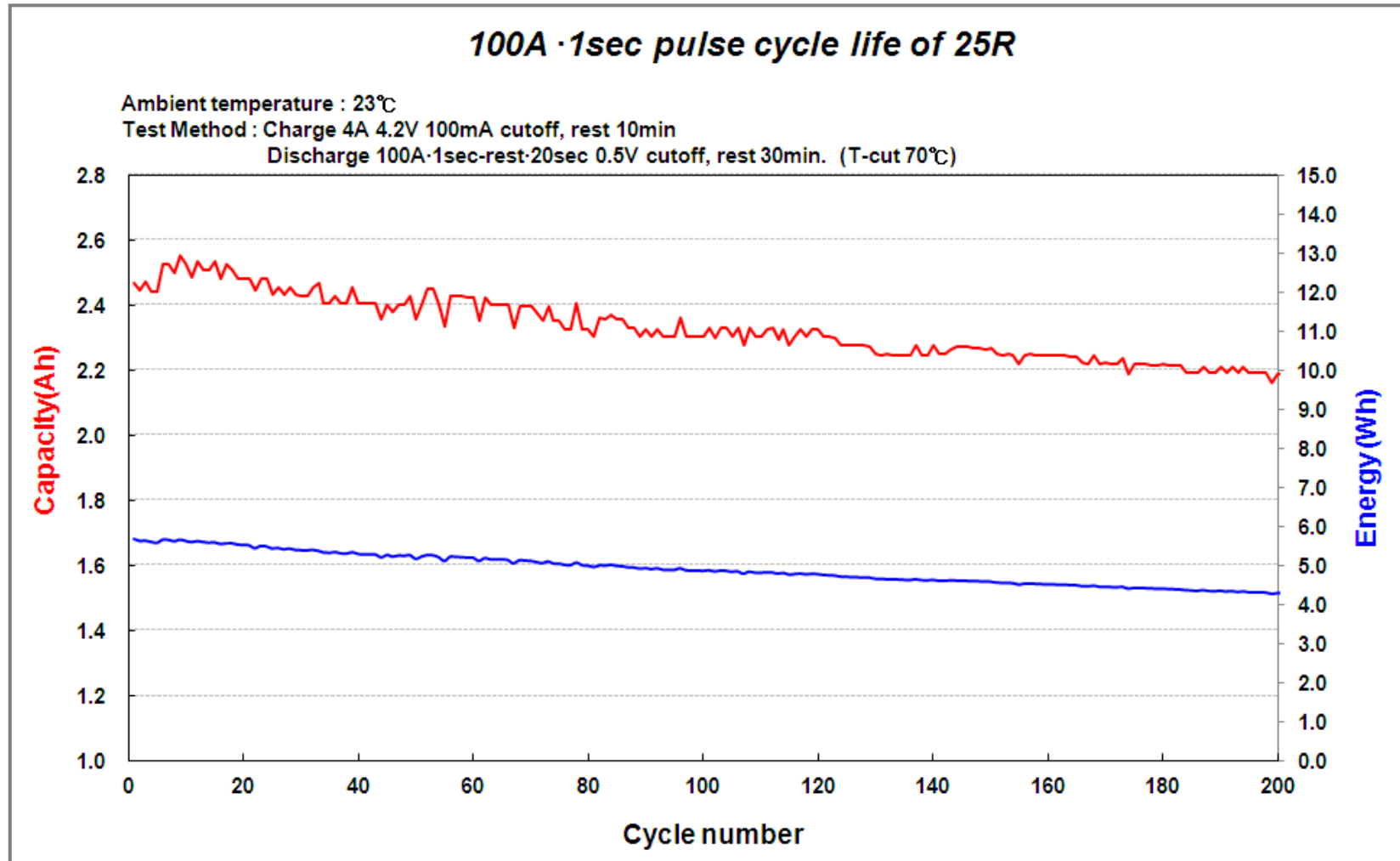
Pulse cycle life _ 75A 2sec pulse

PROPRIETARY AND
CONFIDENTIAL



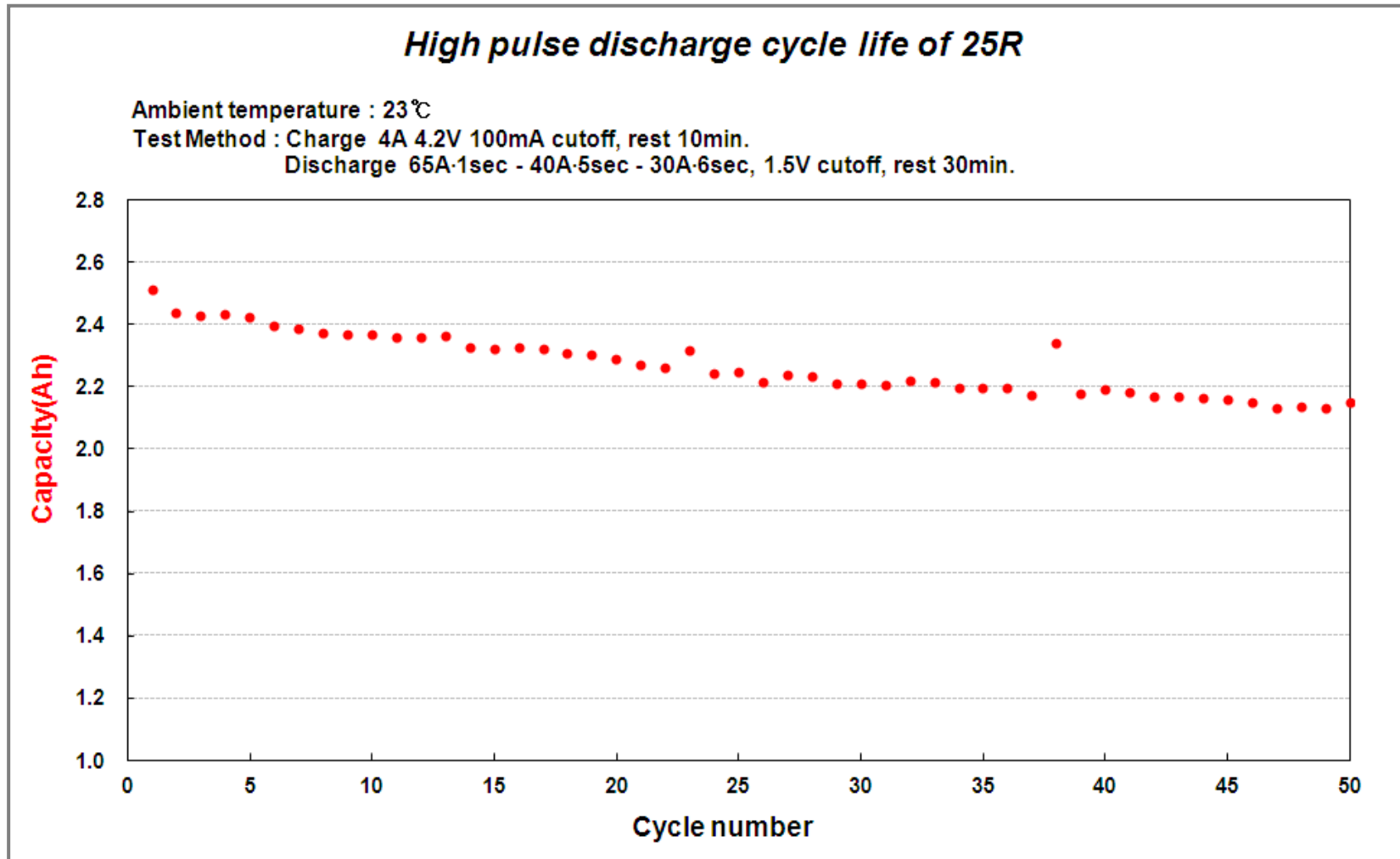
Pulse cycle life _ 100A 1sec pulse

PROPRIETARY AND
CONFIDENTIAL



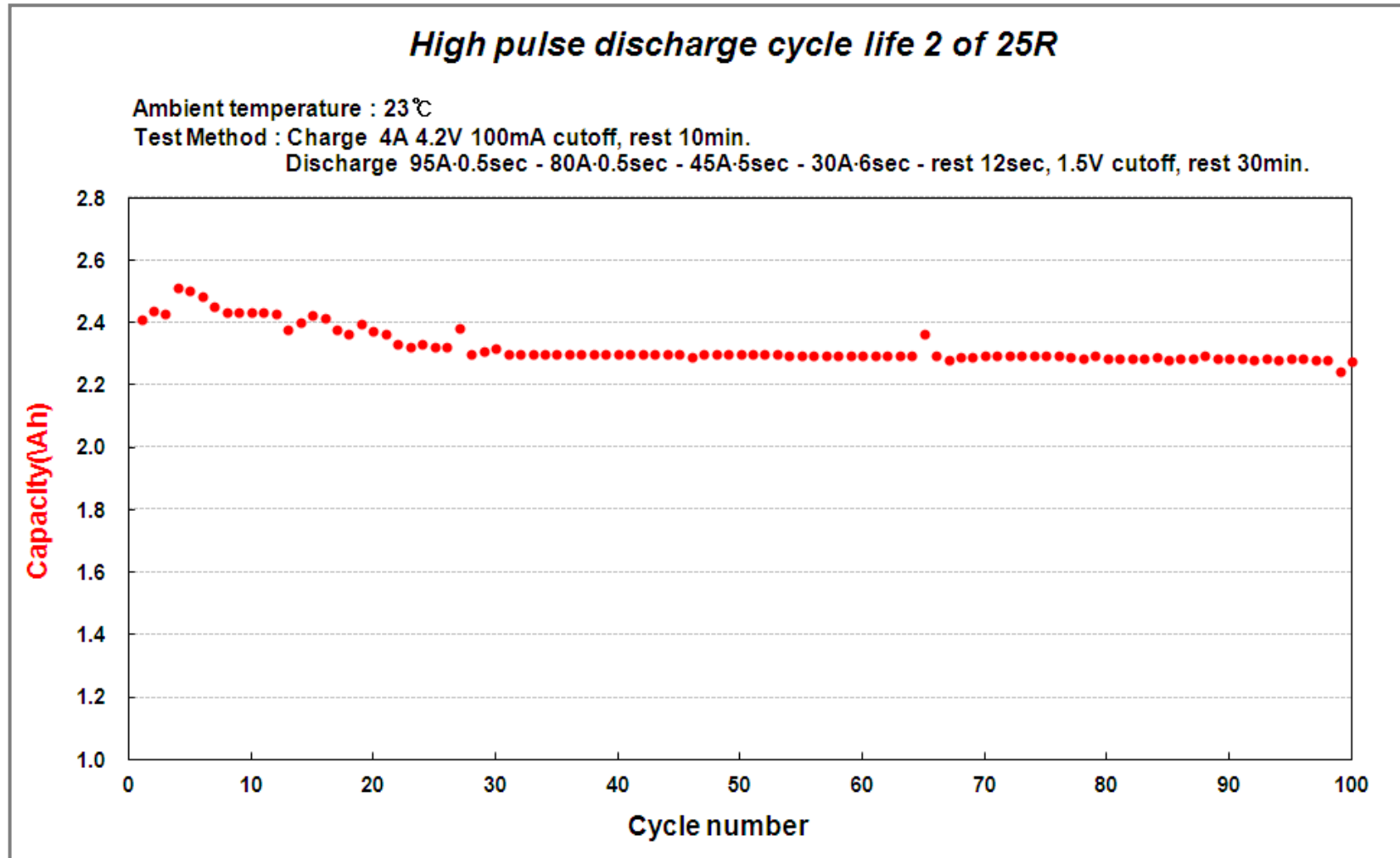
High pulse cycle life

PROPRIETARY AND
CONFIDENTIAL



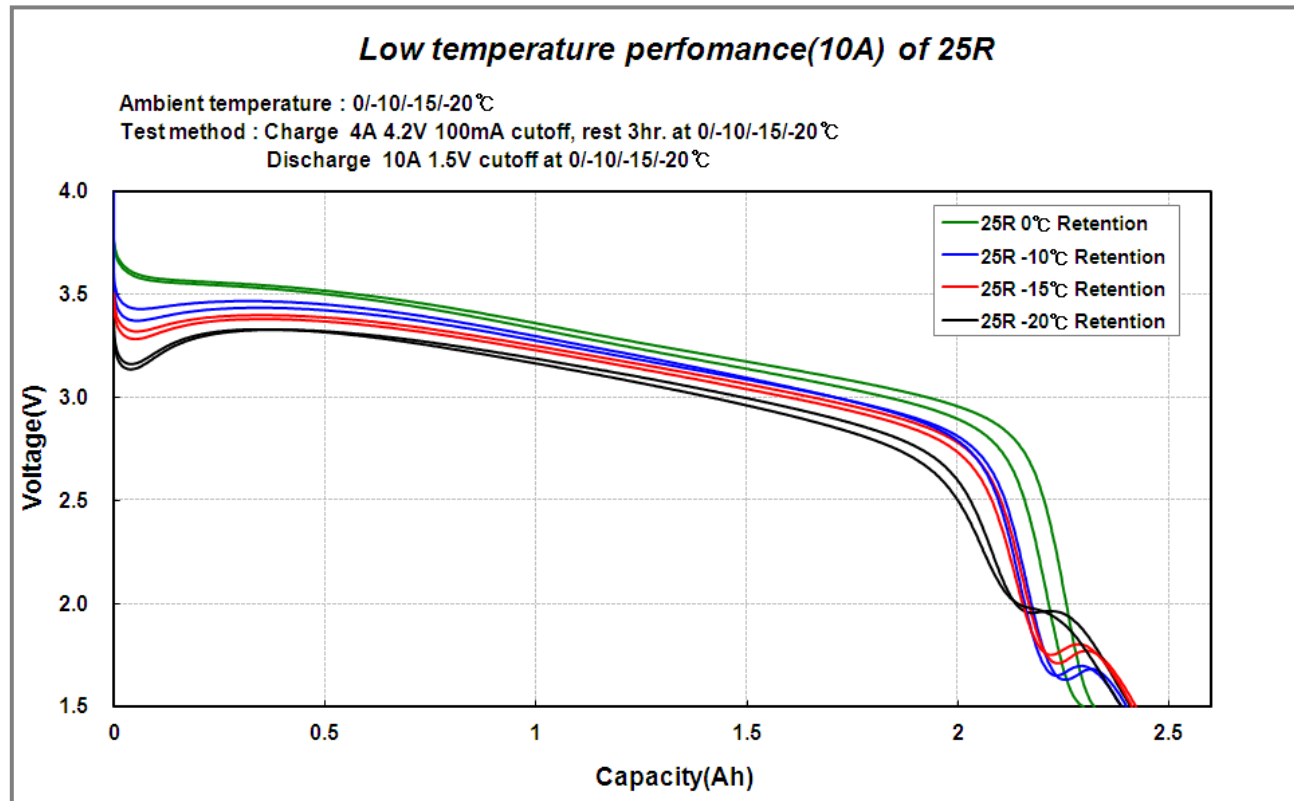
High pulse cycle life 2

PROPRIETARY AND
CONFIDENTIAL



Low temperature discharge (10A)

PROPRIETARY AND
CONFIDENTIAL

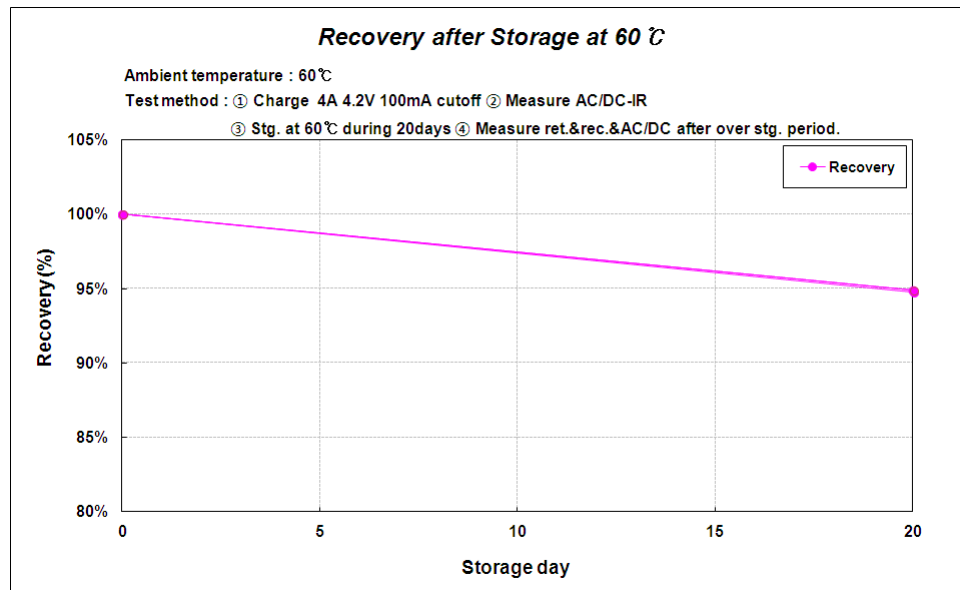


	0 ℃		-10 ℃		-15 ℃		-20 ℃	
	Capacity(Ah)	Capa.(%)	Capacity(Ah)	Capa.(%)	Capacity(Ah)	Capa.(%)	Capacity(Ah)	Capa.(%)
10A	2.323	92.9	2.398	95.9	2.413	96.5	2.407	96.3
	2.298	91.9	2.385	95.4	2.421	96.8	2.386	95.4
Avg.	2.310	92.4	2.392	95.7	2.417	96.7	2.397	95.9

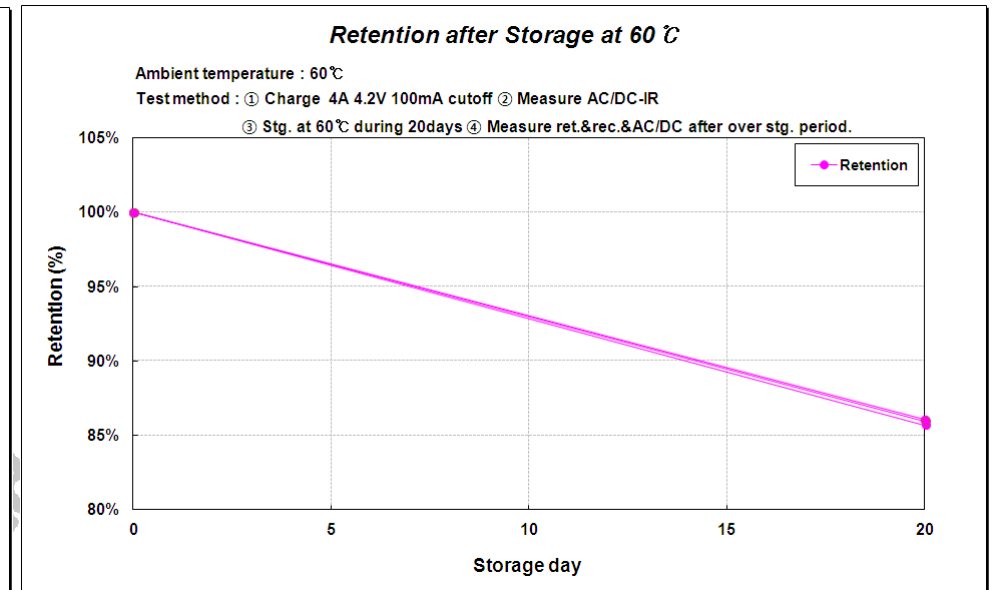
Storage at 60℃

PROPRIETARY AND
CONFIDENTIAL

Recovery



Retention



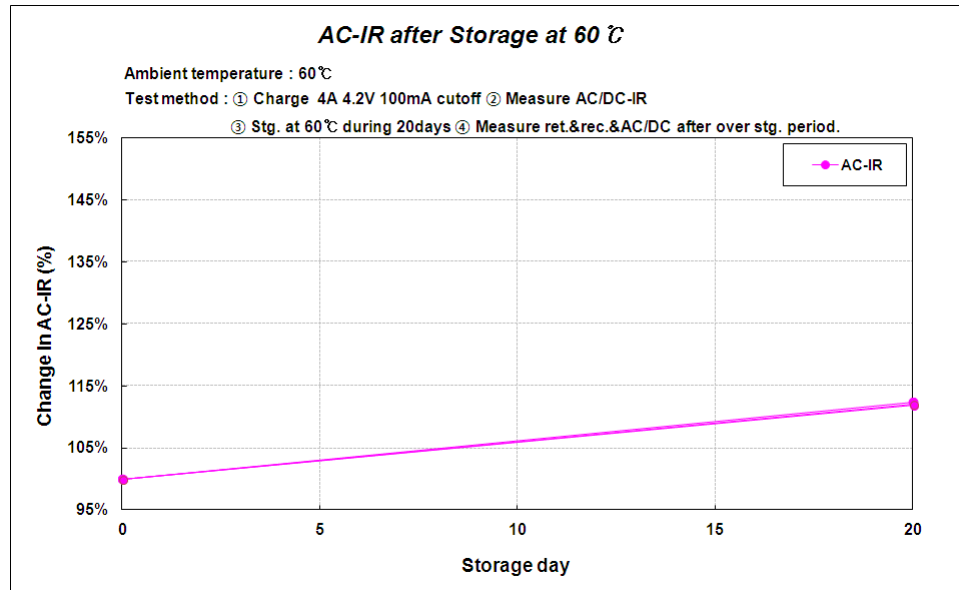
Storage at 60℃

storage day	initial			after storage				Ratio(%)			
	ACIR	DCIR	Capacity	ACIR	DCIR	Retention	Recovery	ACIR	DCIR	Retention	Recovery
20	12.8	19.0	2.563	14.3	23.6	2.203	2.431	112.1	123.9	85.9	94.8
50	Test is ongoing										

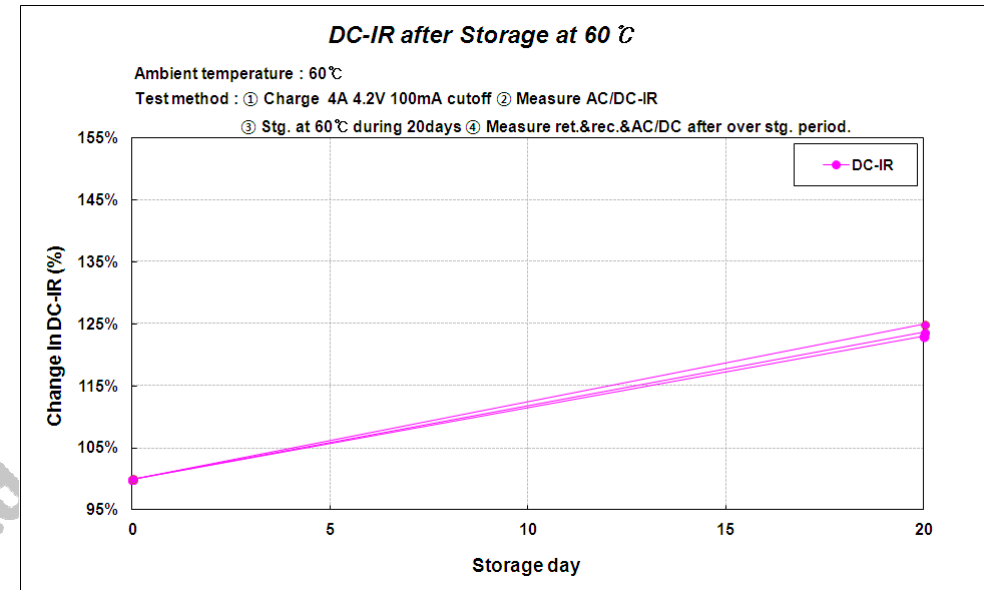
Storage at 60°C

PROPRIETARY AND
CONFIDENTIAL

■ AC-IR



■ DC-IR



Storage at 60°C

storage day	initial			after storage				Ratio(%)			
	ACIR	DCIR	Capacity	ACIR	DCIR	Retention	Recovery	ACIR	DCIR	Retention	Recovery
20	12.8	19.0	2.563	14.3	23.6	2.203	2.431	112.1	123.9	85.9	94.8
50	Test is ongoing										

Safety test

PROPRIETARY AND
CONFIDENTIAL

Test item			Spec.	Results		OK/NG	Remark
				Results	Max. temp.		
Electrical Abuse	Overcharge	20A 20V(UL)	L1	3L1	115.6	OK	
	Short circuit	80mΩ at 23℃ (UL)	L1	3L0	82.7	OK	
		80mΩ at 60℃ (UL)	L1	3L0	102.4	OK	
Mechanical Abuse	Impact	UL	L1	5L0	22.6	OK	
	Crush	UL	L1	5L0	23.9	OK	
Thermal Abuse	Hot oven	130℃ (UL)	L1	5L1	135.4	OK	

Level 0
•No change

Level 1
•Leak

Level 2
•Smoke, < 200℃

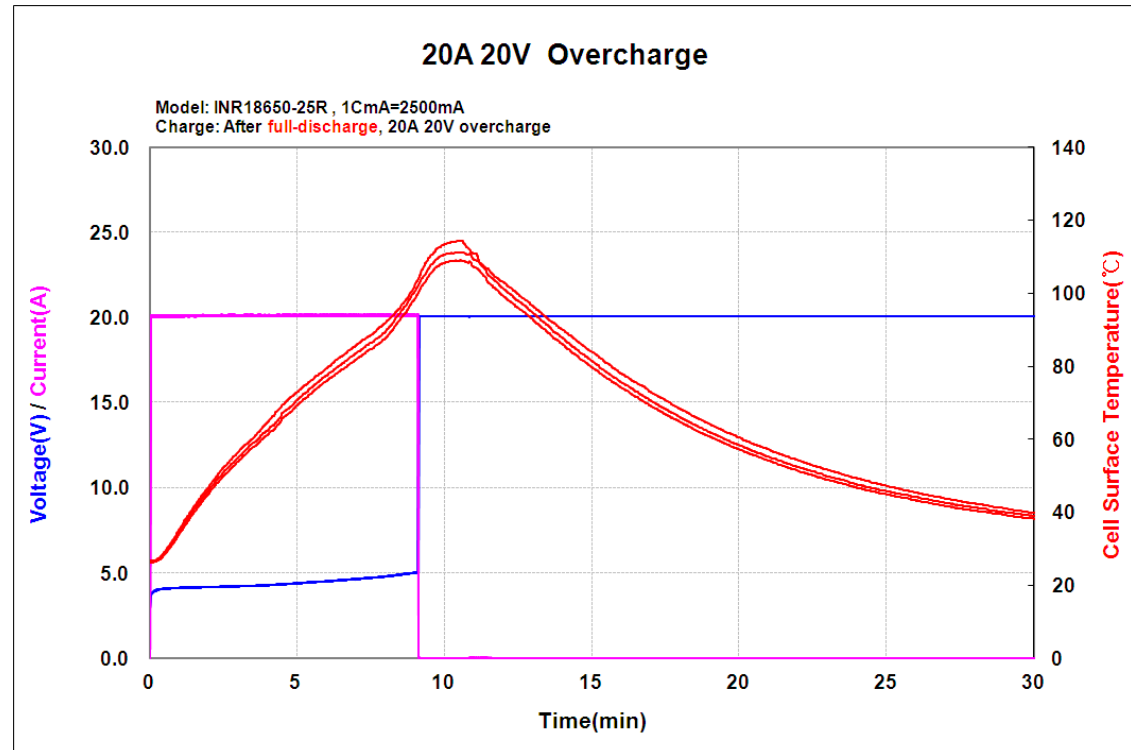
Level 3
•Smoke, > 200℃

Level 4
•Fire

Level 5
•Explosion

Safety test _ Overcharge

PROPRIETARY AND
CONFIDENTIAL

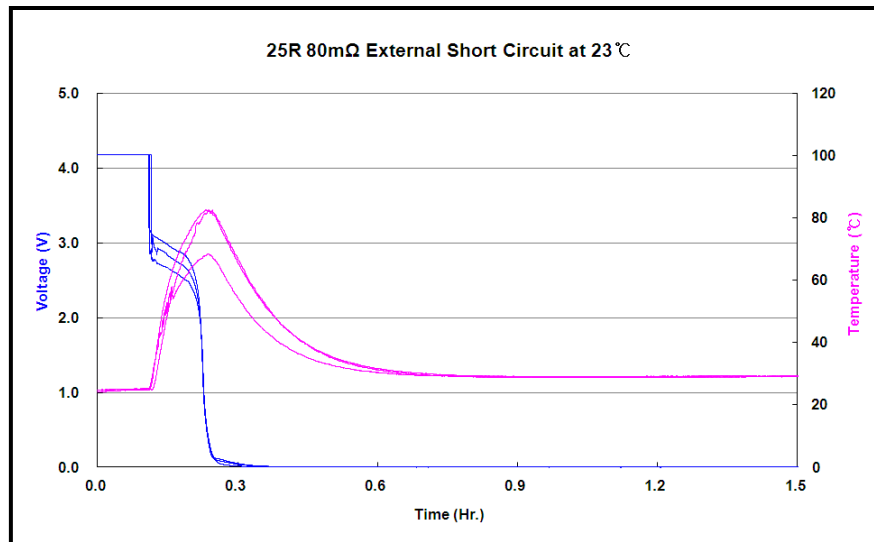


Cell	Results	CID open time	Max. temp.
1	L1 / OK	9.10	111.3
2	L1 / OK	9.08	109.1
3	L1 / OK	9.12	115.6
Avg.		9.10	112.0

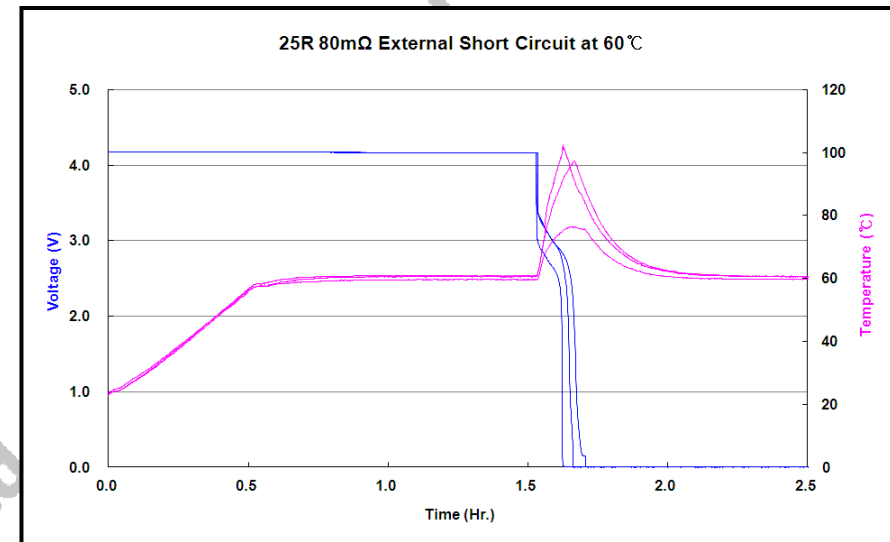
Safety test _ Short circuit (80mΩ)

PROPRIETARY AND
CONFIDENTIAL

■ 80mΩ at 23 °C



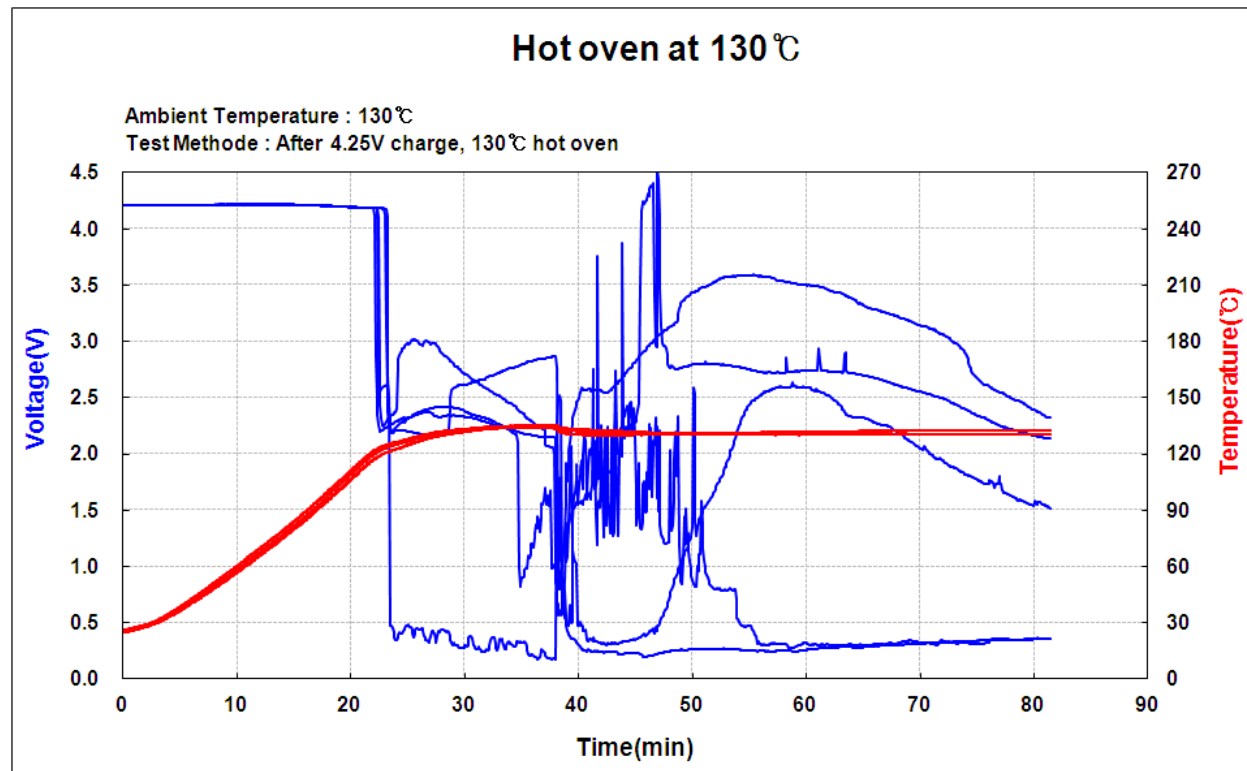
■ 80mΩ at 60 °C



Cell	Results	Max. temp.	Cell	Results	Max. temp.
1	L0 / OK	68.4	1	L0 / OK	97.2
2	L0 / OK	82.7	2	L0 / OK	102.4
3	L0 / OK	82.6	3	L0 / OK	79.5
Avg.		77.9	Avg.		92.0

Safety test _ Hot oven(130℃)

PROPRIETARY AND
CONFIDENTIAL



Cell	Results	Max. temp.
1	L1 / OK	134.8
2	L1 / OK	135.4
3	L1 / OK	134.0
4	L1 / OK	135.2
5	L1 / OK	134.6
Avg.		134.8

Safety test _ Impact & Crush

PROPRIETARY AND
CONFIDENTIAL

▪ Impact



▪ Crush



Cell	Results	Max. temp.	Cell	Results	Max. temp.
1	L0 / OK	22.5	1	L0 / OK	22.7
2	L0 / OK	22.4	2	L0 / OK	22.9
3	L0 / OK	22.2	3	L0 / OK	22.7
4	L0 / OK	21.9	4	L0 / OK	22.5
5	L0 / OK	22.6	5	L0 / OK	23.9
Avg.		22.3	Avg.		22.9

- Thank you -

SAMSUNG

SAMSUNG SDI