R&D

High-Power High-Energy 4V primary cells for long term applications

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Advanced power sources
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TADIRAN BATTERIES

Outline

Introduction

- Market
- TLM technology

The TLM1550MP cell

- Power and energy capabilities
- Stability during and after long term storage
- Safety

Overview - market

Applications required high-power high-energy power sources for long term usage:

- Telemetry
- E-Call
- Missiles
- Fuses
- Electronic air-born systems (UMV)
- Alarms

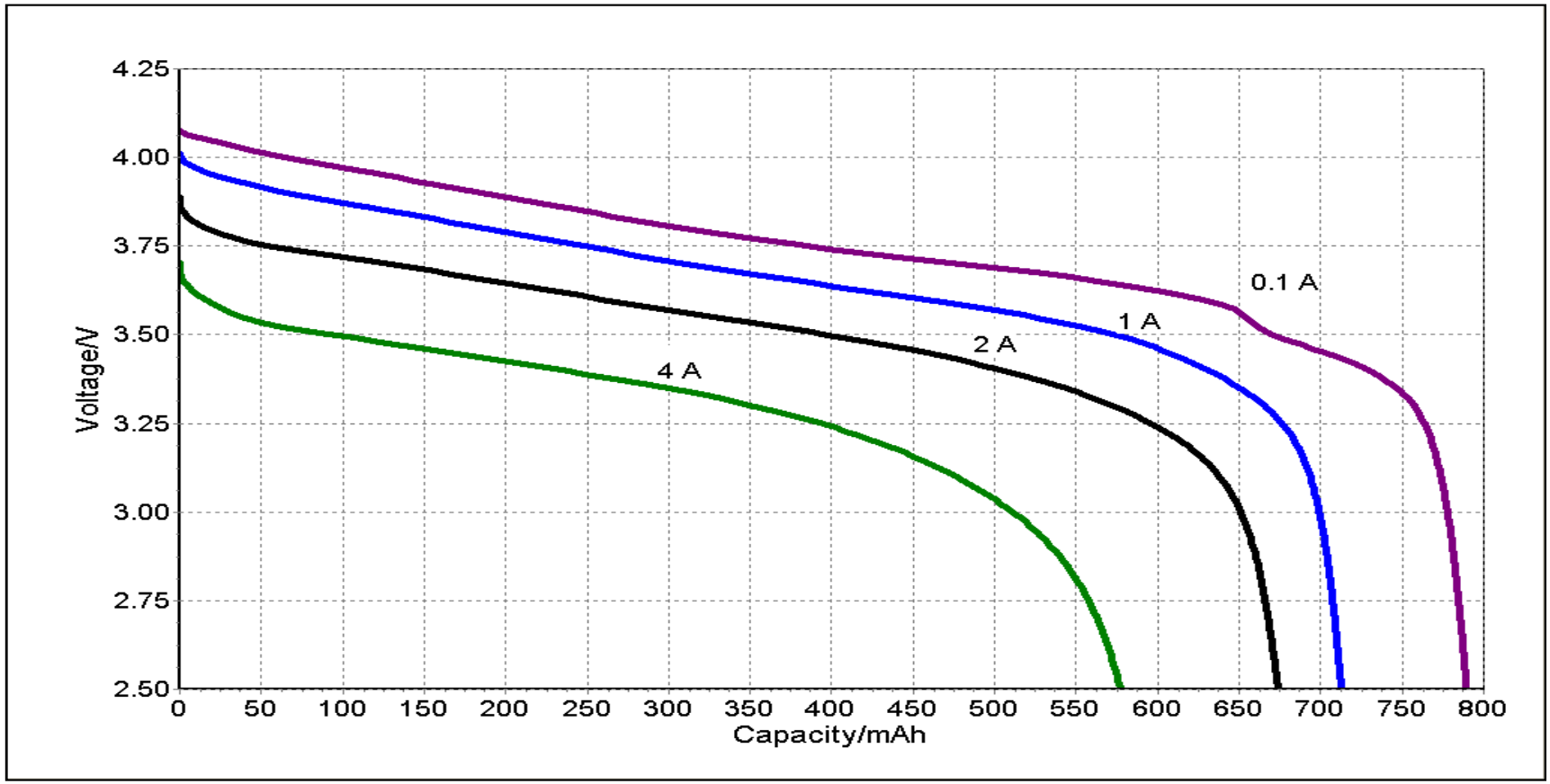
Overview: TLM cells

The TLM series (HP, MP):
Hermetically sealed 4 V primary cells, Li-Ion based technology.

- Electrodes: intercalation compounds.
- Micro-porous separator.
- Electrolyte:$LiPF_6$ dissolve in carbonates mixture.
- 550mAh for TLM1550HP and 800mAh for TLM1550MP

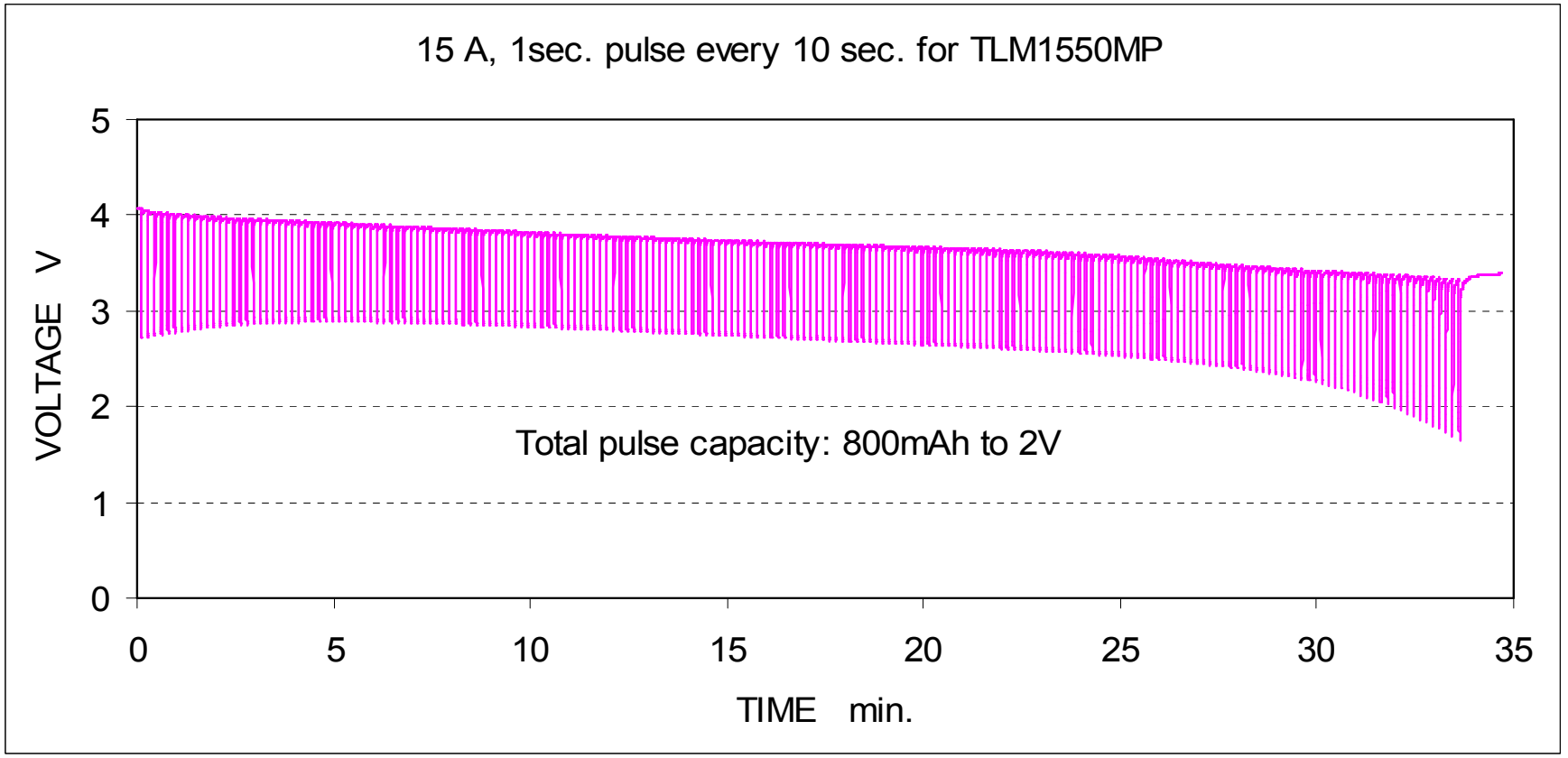
TLM 1550MP – Performance

Discharge capabilities for TLM1550MP at RT



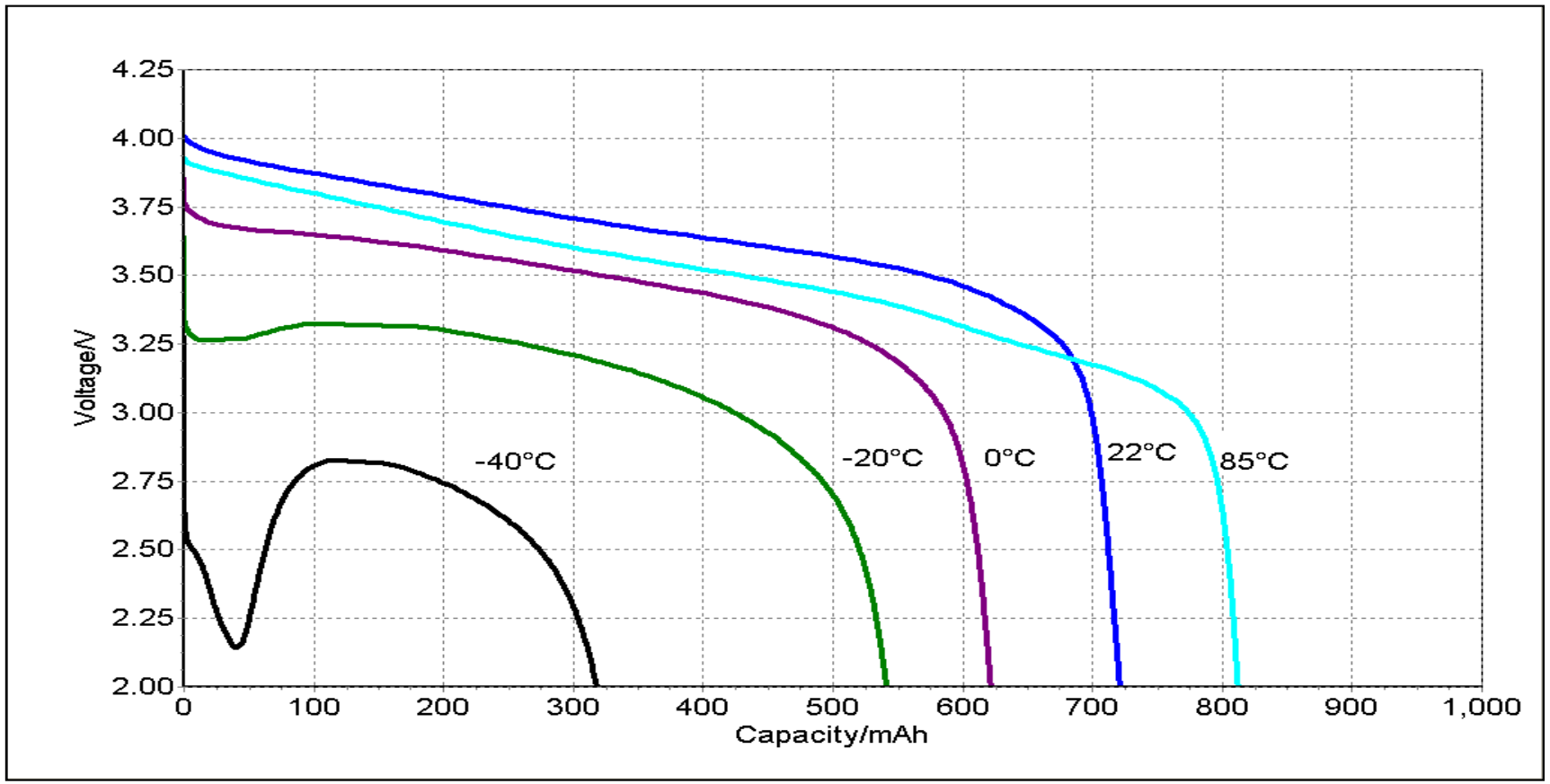
TLM 1550MP – Performance

Pulse capabilities for TLM1550MP at RT



TLM 1550MP – Performance

Discharge capabilities for TLM1550MP at 1 A



Performance after long term storage

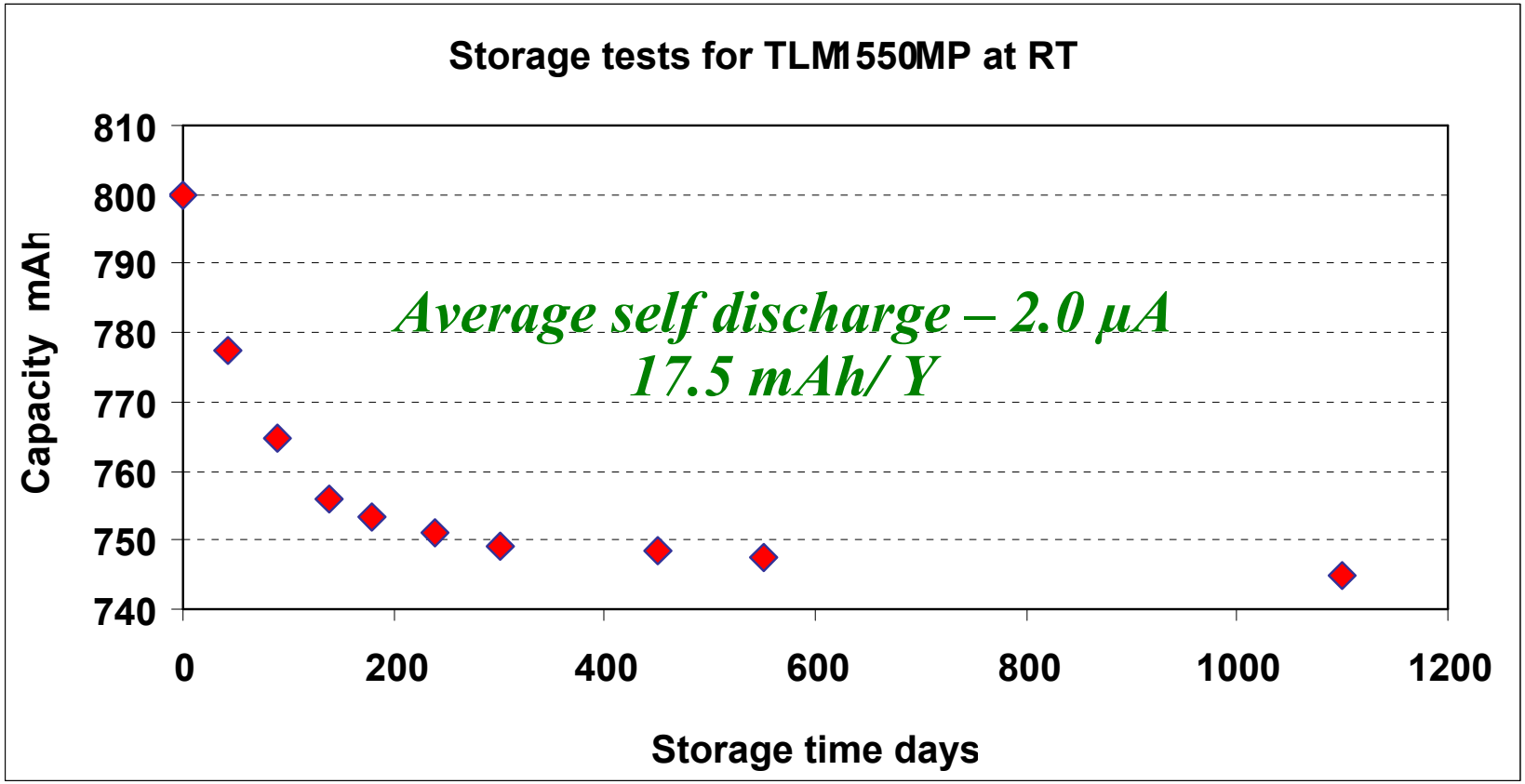
- Self discharge
- Impedance growth

Self discharge

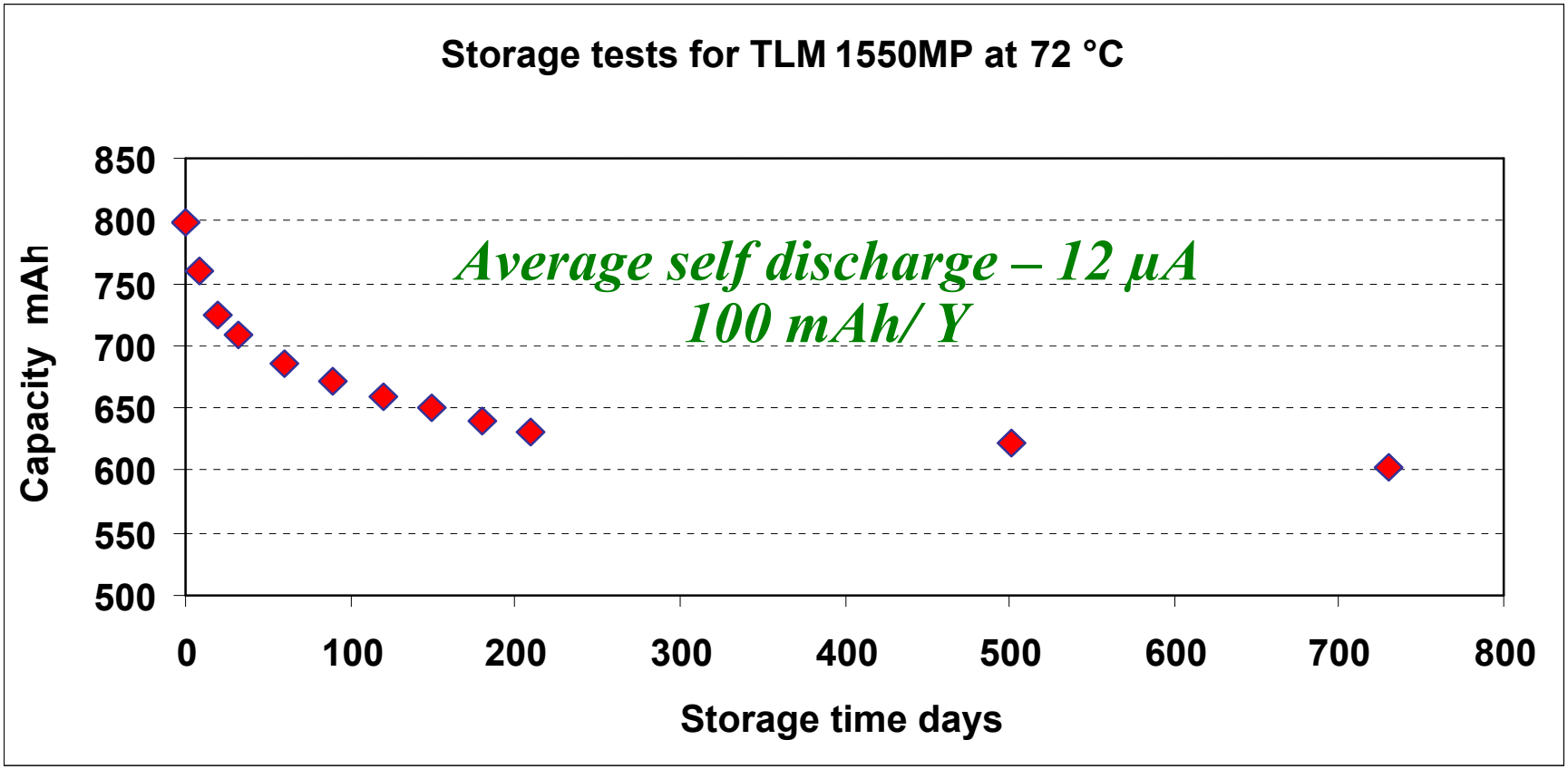
Self discharge measurements:

- Long term storage at RT and at elevated temperatures: capacity determination by OCV/Capacity curve and direct low rate discharge.
- Long term discharge at RT and at elevated temperatures.
- Microcalorimetry.

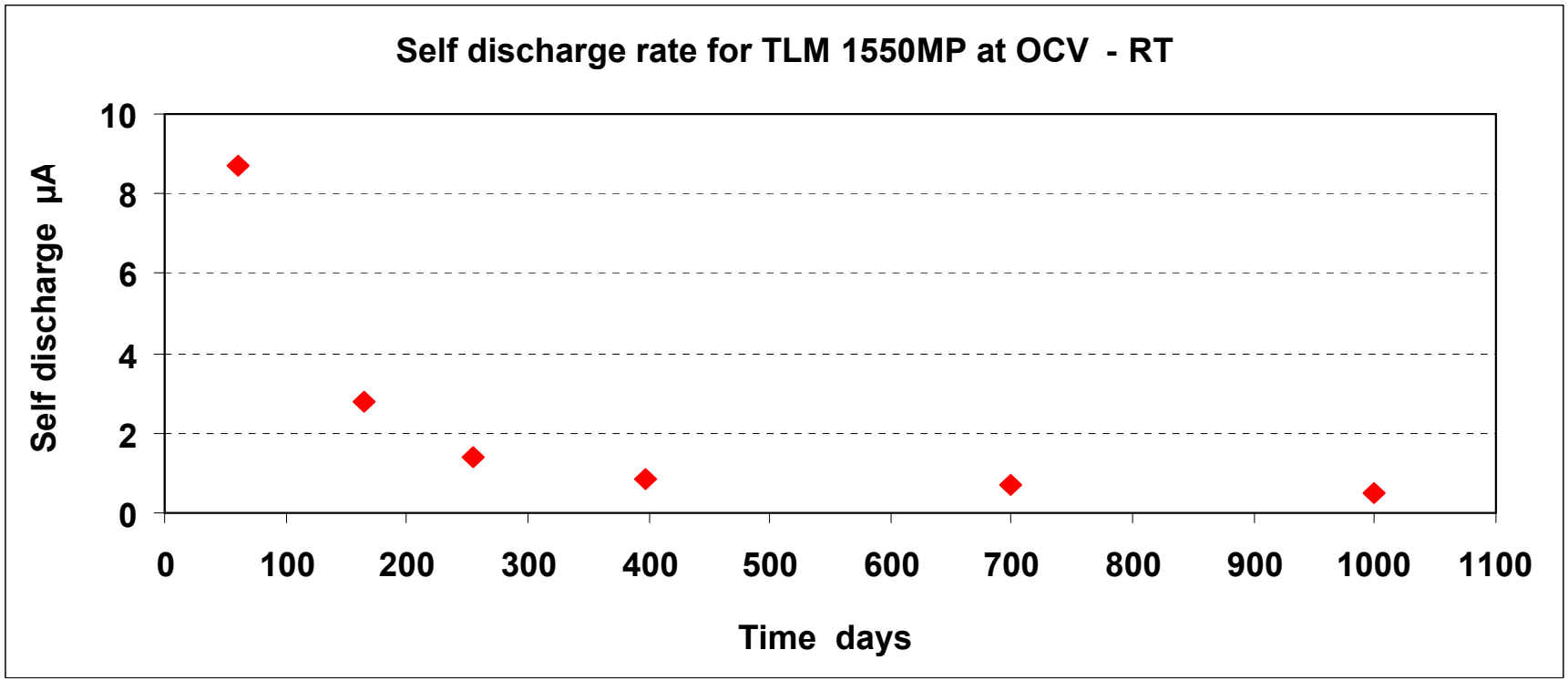
TLM 1550MP – Self discharge



TLM 1550MP – Self discharge

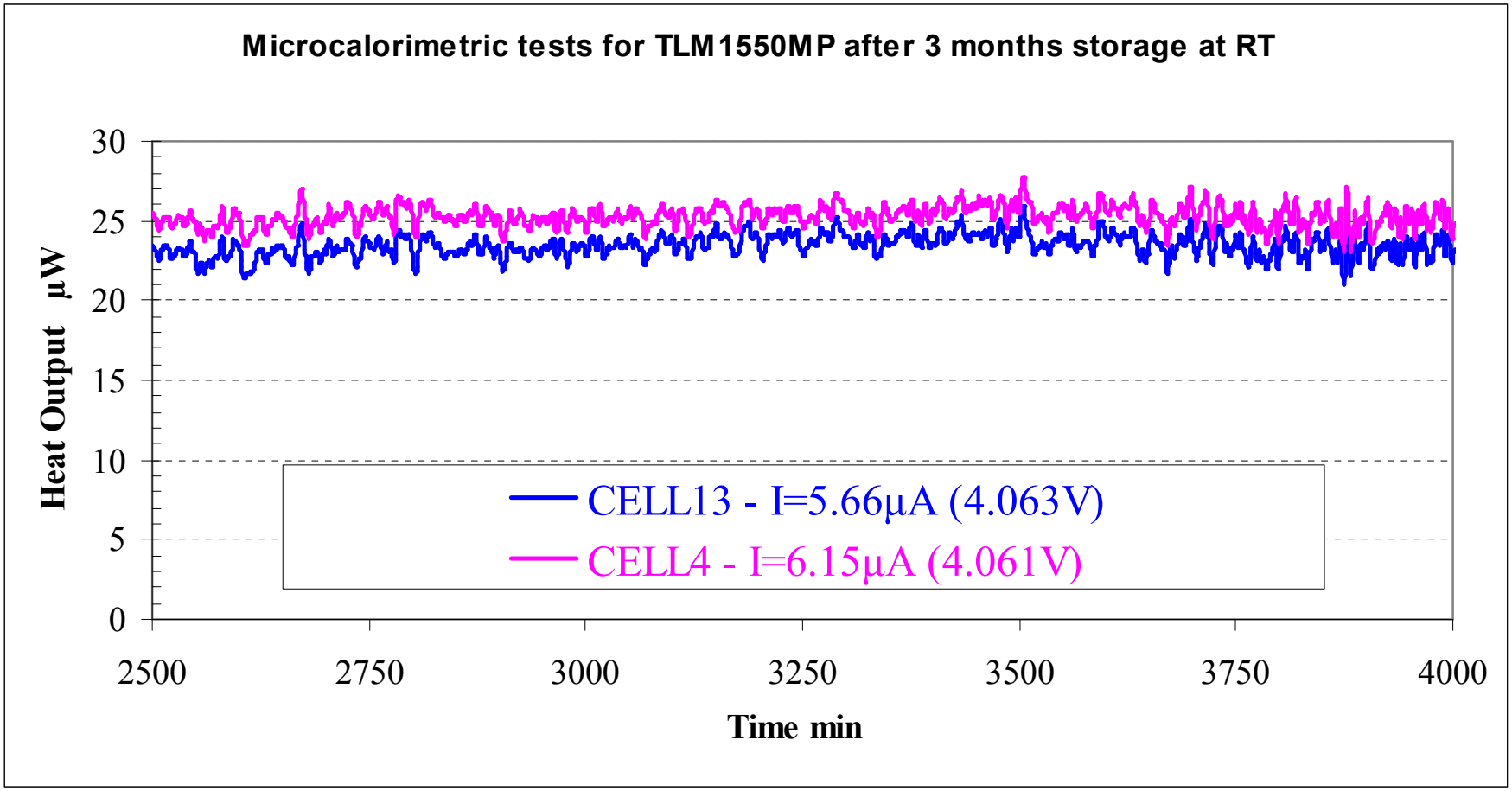


TLM 1550MP – Self discharge

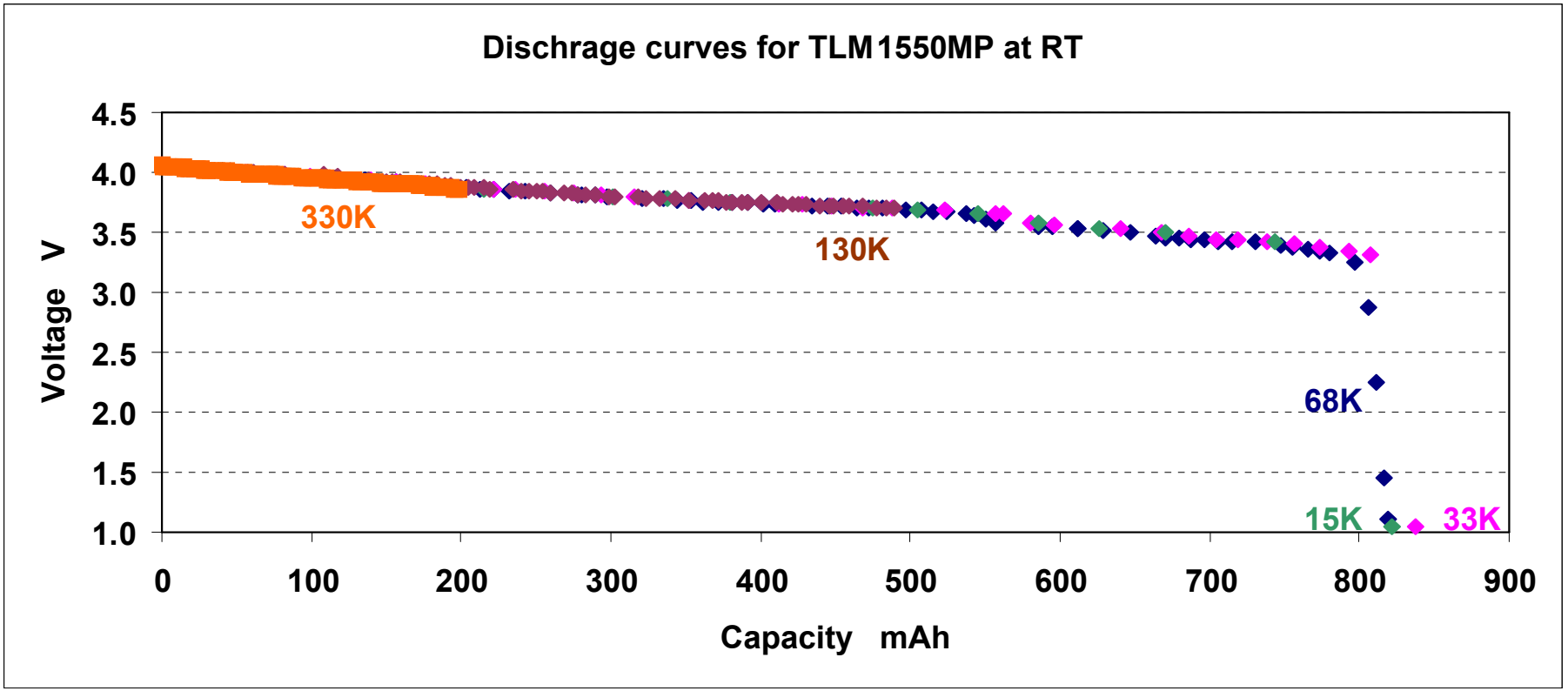


During the first 100 d the average self discharge is about 9 µA.
The value of self discharge is decreasing to about 0.5 µA after 1000d

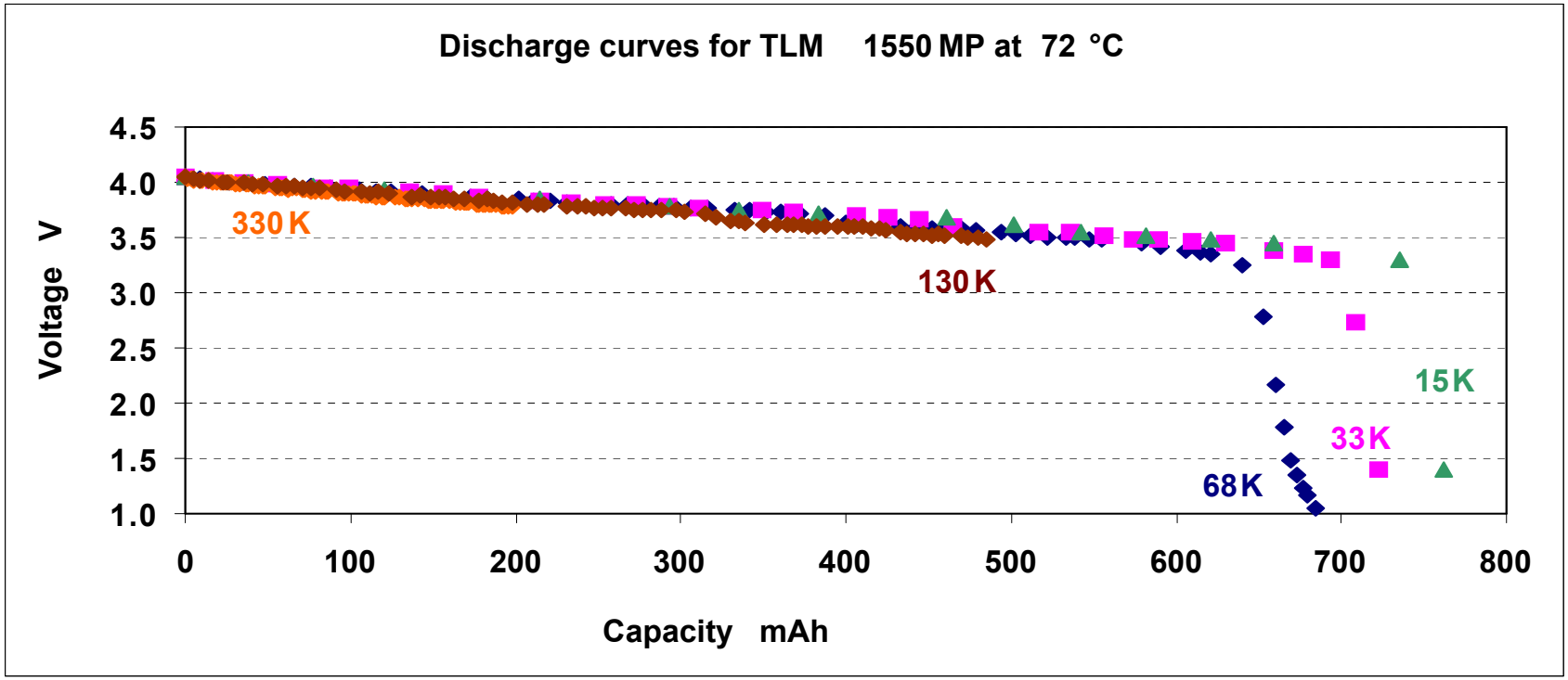
TLM 1550MP – Self discharge



TLM 1550MP – Self discharge



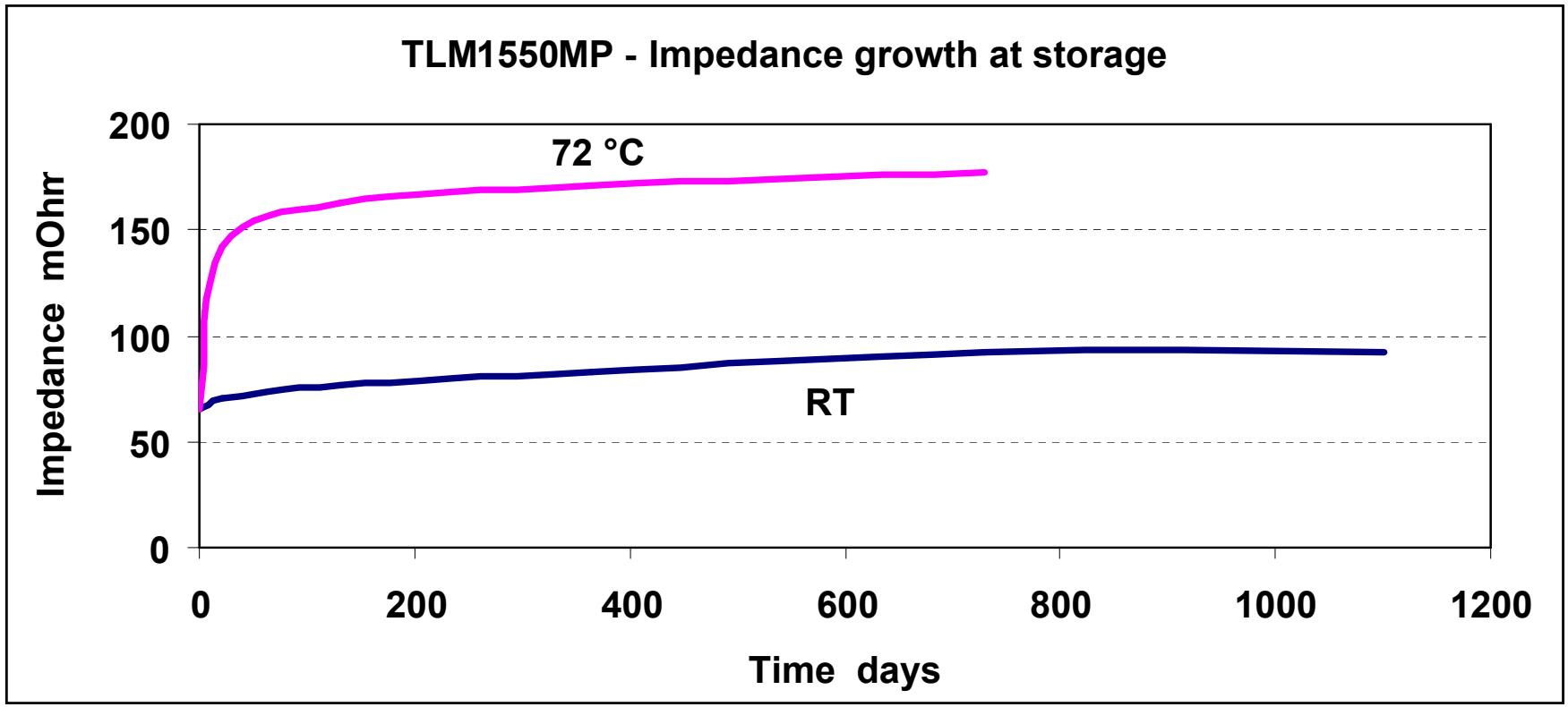
TLM 1550MP – Self discharge



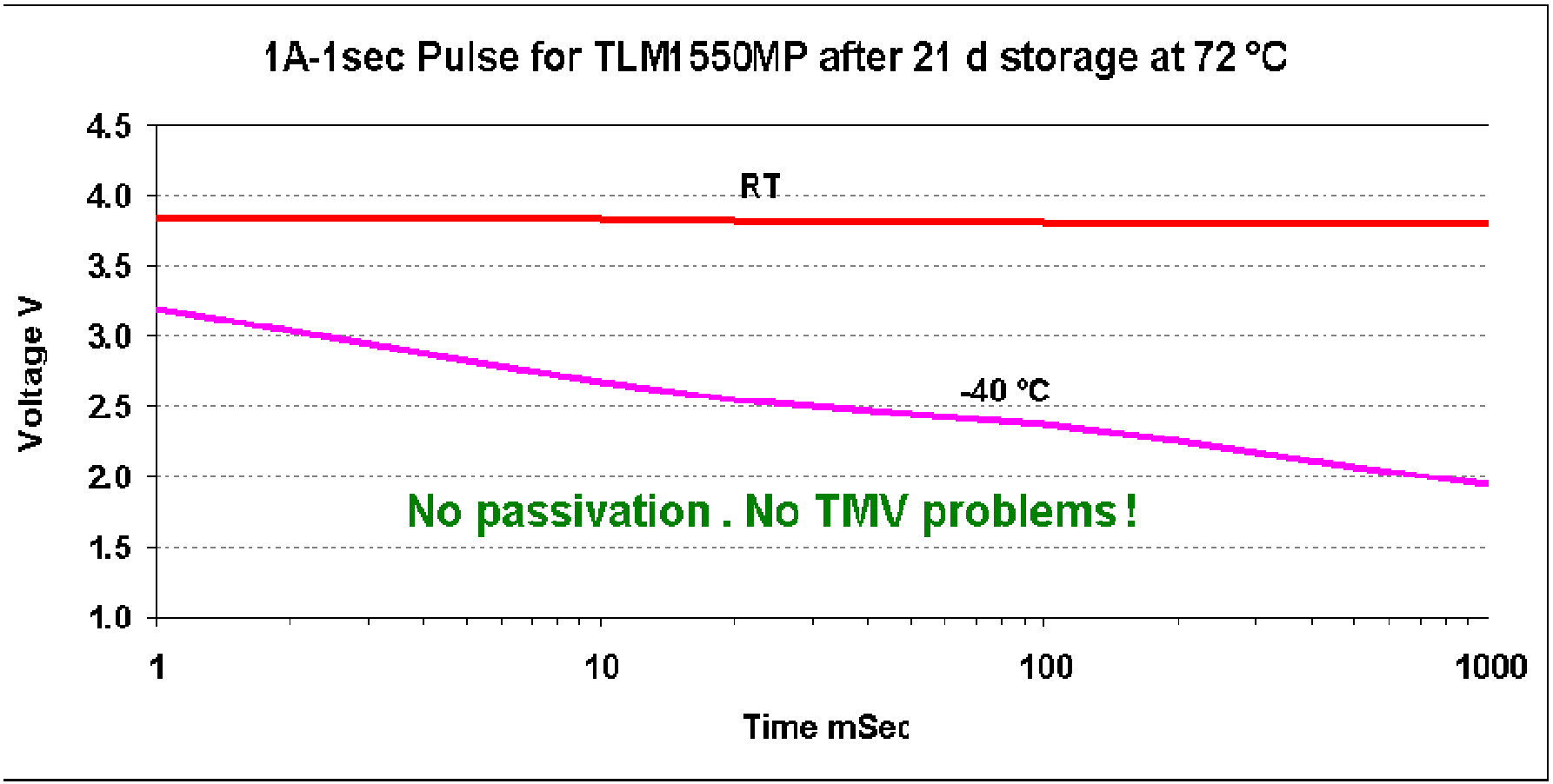
15K: 250µA, 770mAh, 4.25 M.
33K: 115µA, 725mAh, 8.6 M.
68K: 55µA, 690mAh, 17.2 M.

} ***8.5µA***

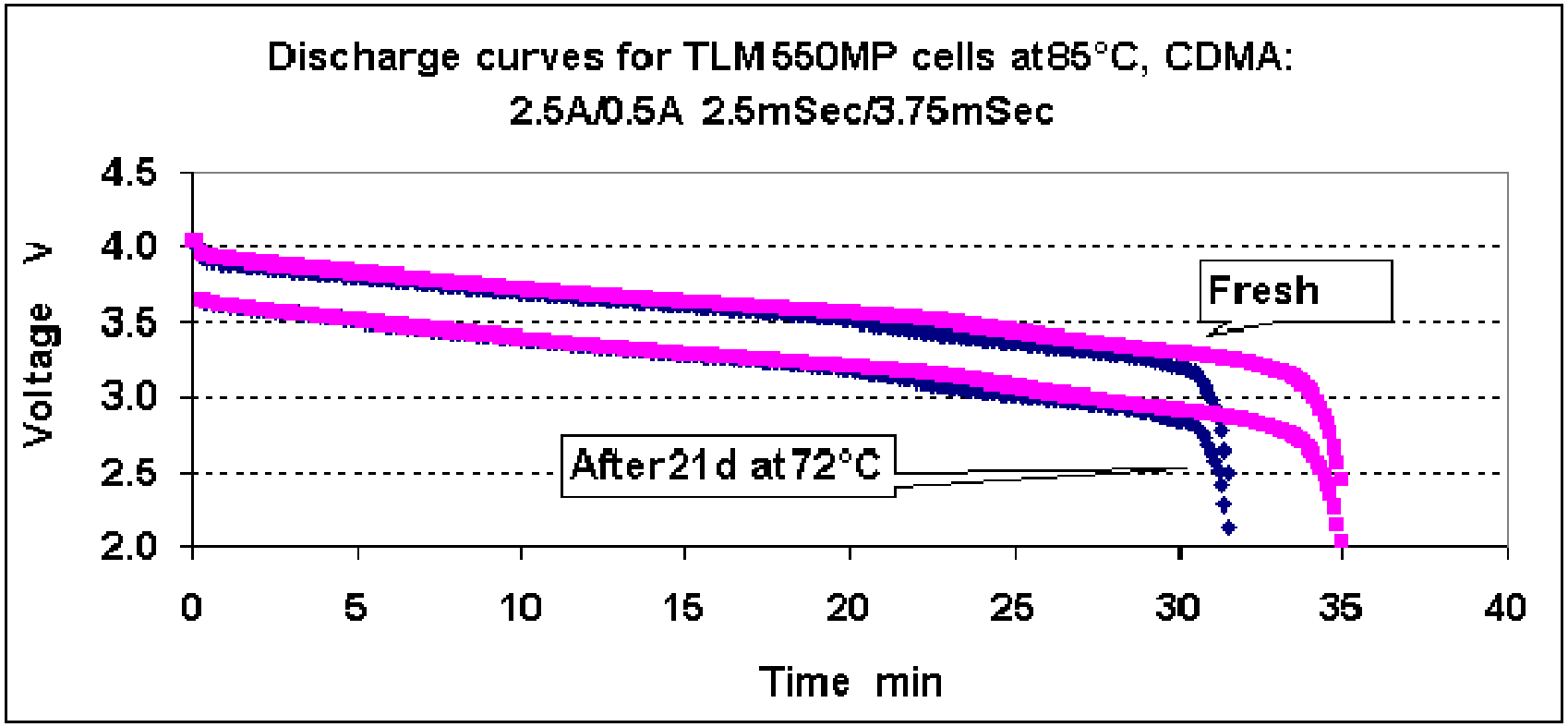
TLM 1550MP – Impedance growth



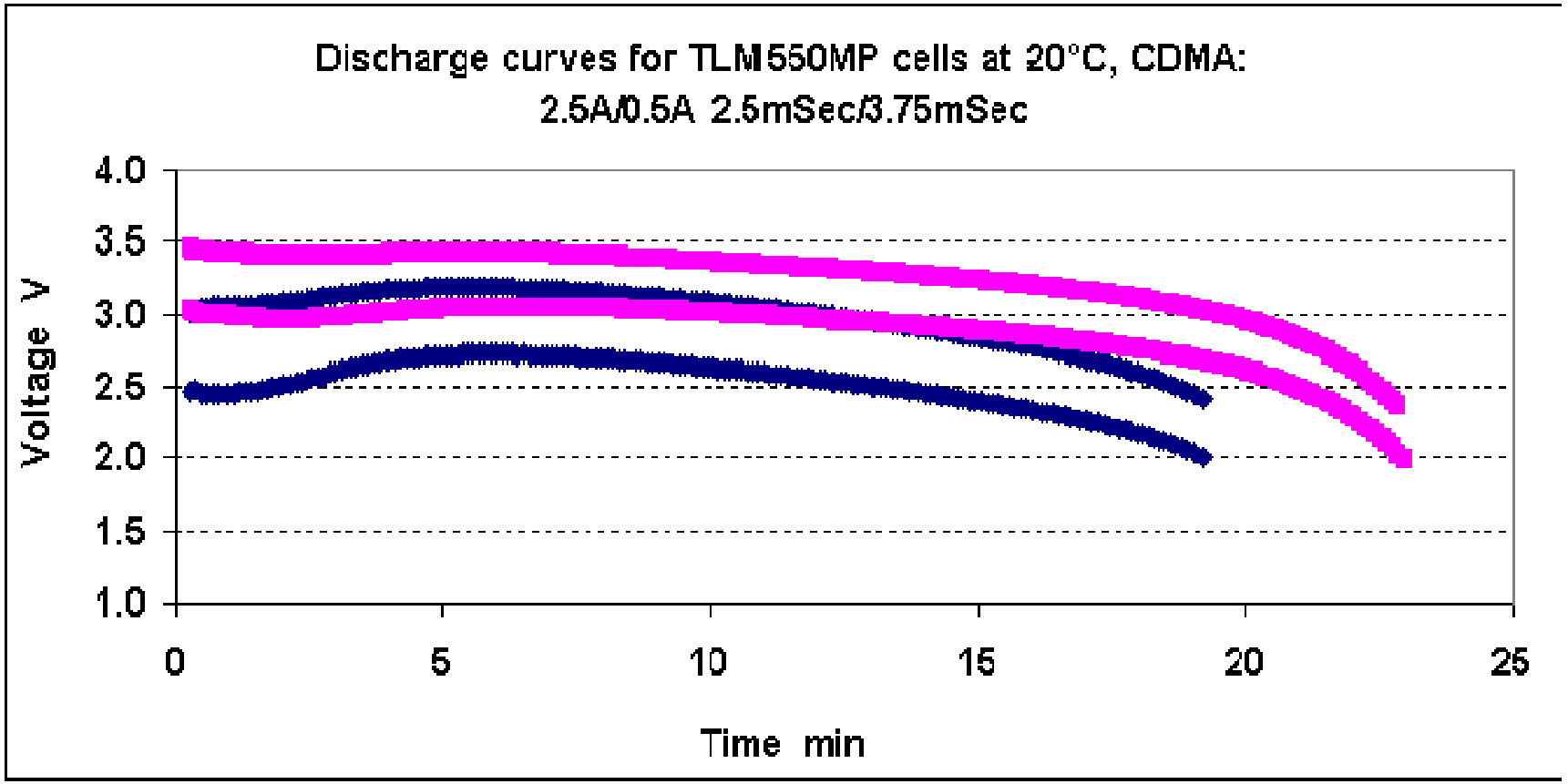
TLM 1550MP – Impedance growth



TLM 1550MP – Impedance growth



TLM 1550MP – Impedance growth



Summary: Safety Tests

The TLM1550MP cells passed successfully the following tests:

- Short circuit @ RT, 55°C.
- Oven to at least 150°C.
- Impact.
- Crush (UL1642).
- Over charge up to 4A, 200%.
- Over discharge up to 4A, 300%.

Summary: TLM1550MP

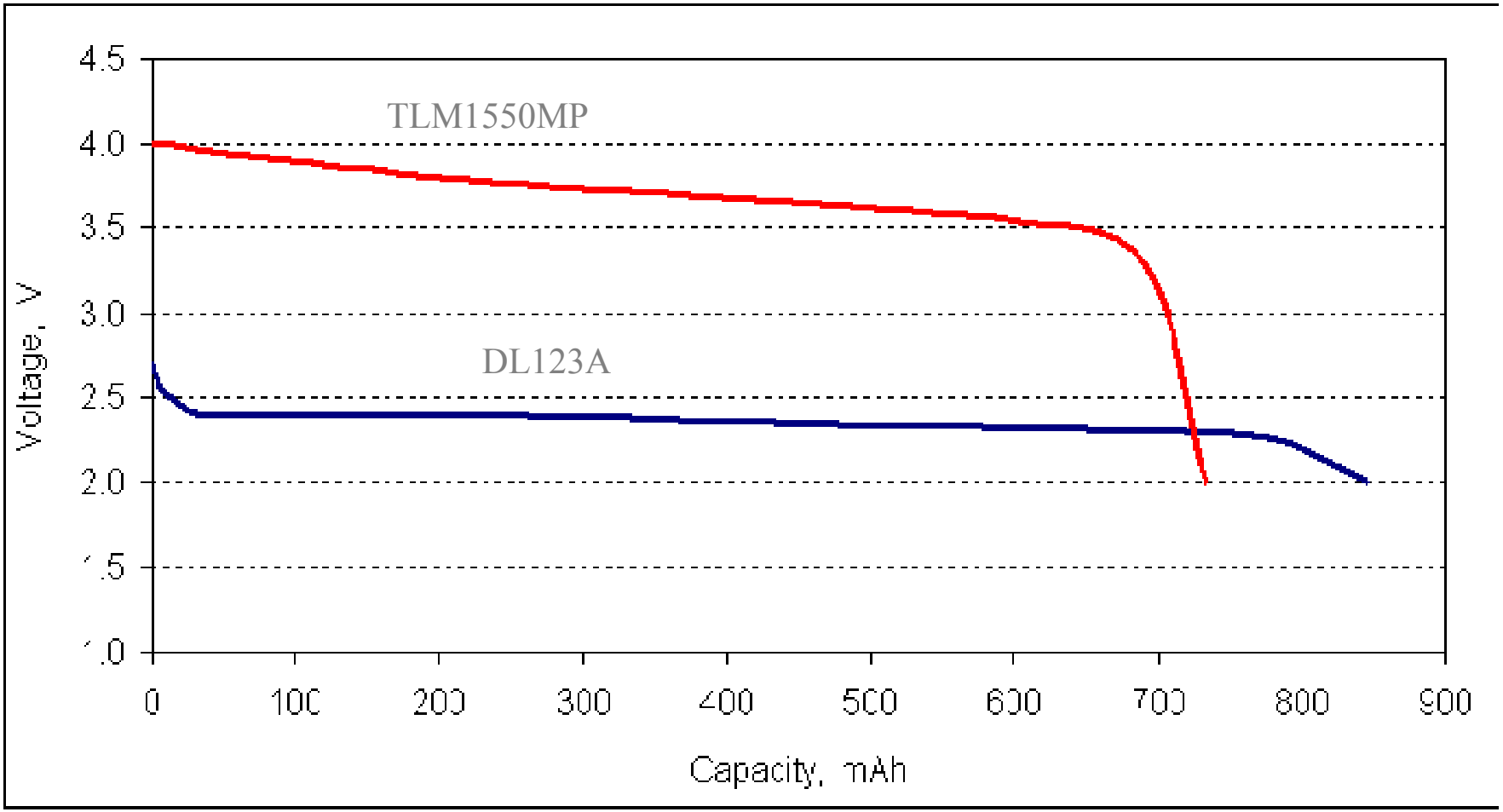
- Operating voltage: 4 to 3 V
- Available capacity: up to 800 mAh .
- Maximum continuous current: 4 A.
- Maximum pulse current : 15 A .
- Wide operating temperature range: -40 to 85 ^{o}C.
- Free from passivation and TMV problems.
- Simple remaining capacity measurement.
- Low self discharge under OCV and bc current conditions: <2µA at RT.
- Stability of power and energy after long term storage.
- Safety: stands for UN regulations.
- Stable to high G shock accelerations ~ tens thousands G's.

R&D

Thank You

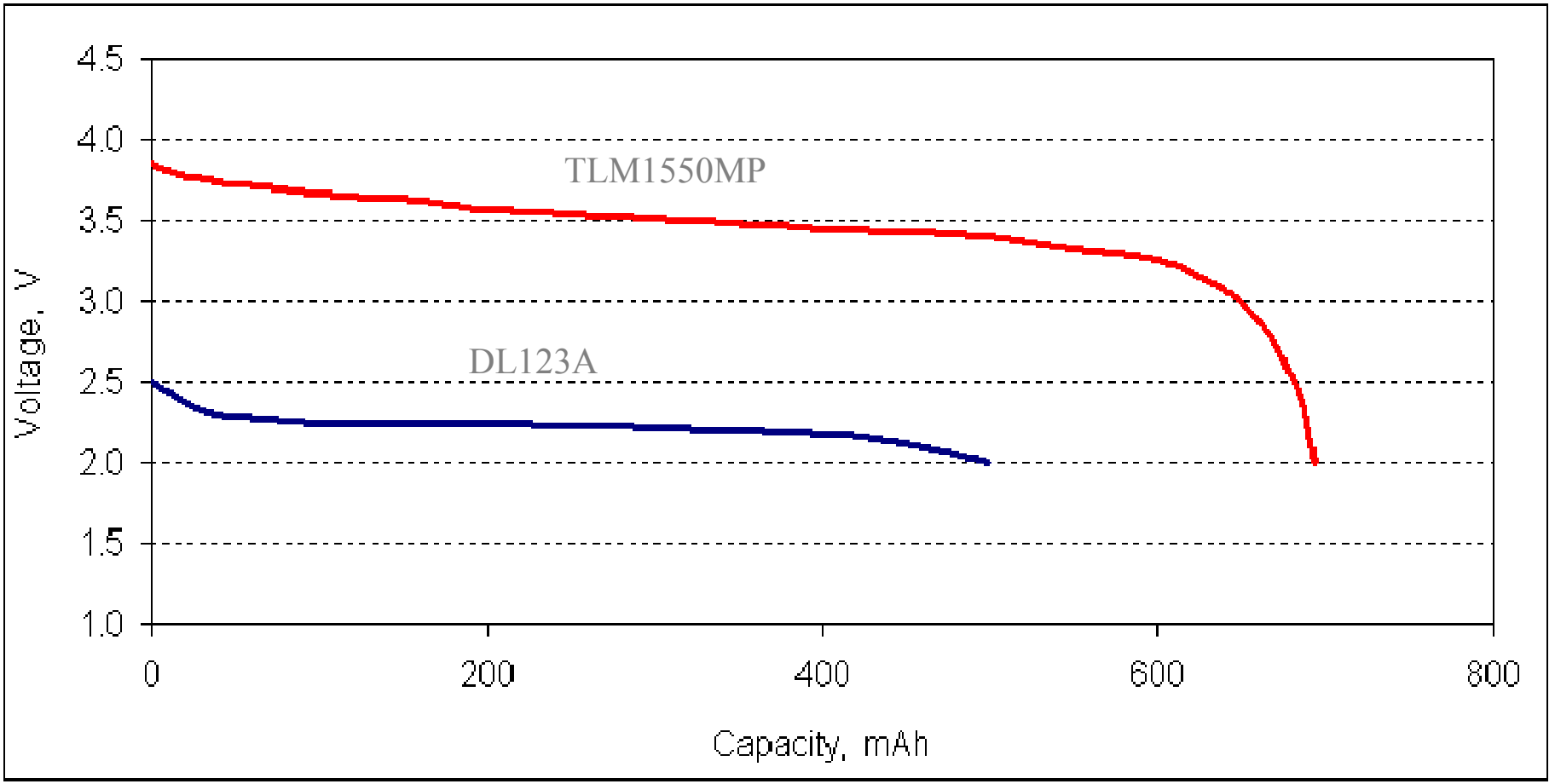
TLM1550MP vs. DL123A

Discharge curves at 1A, RT



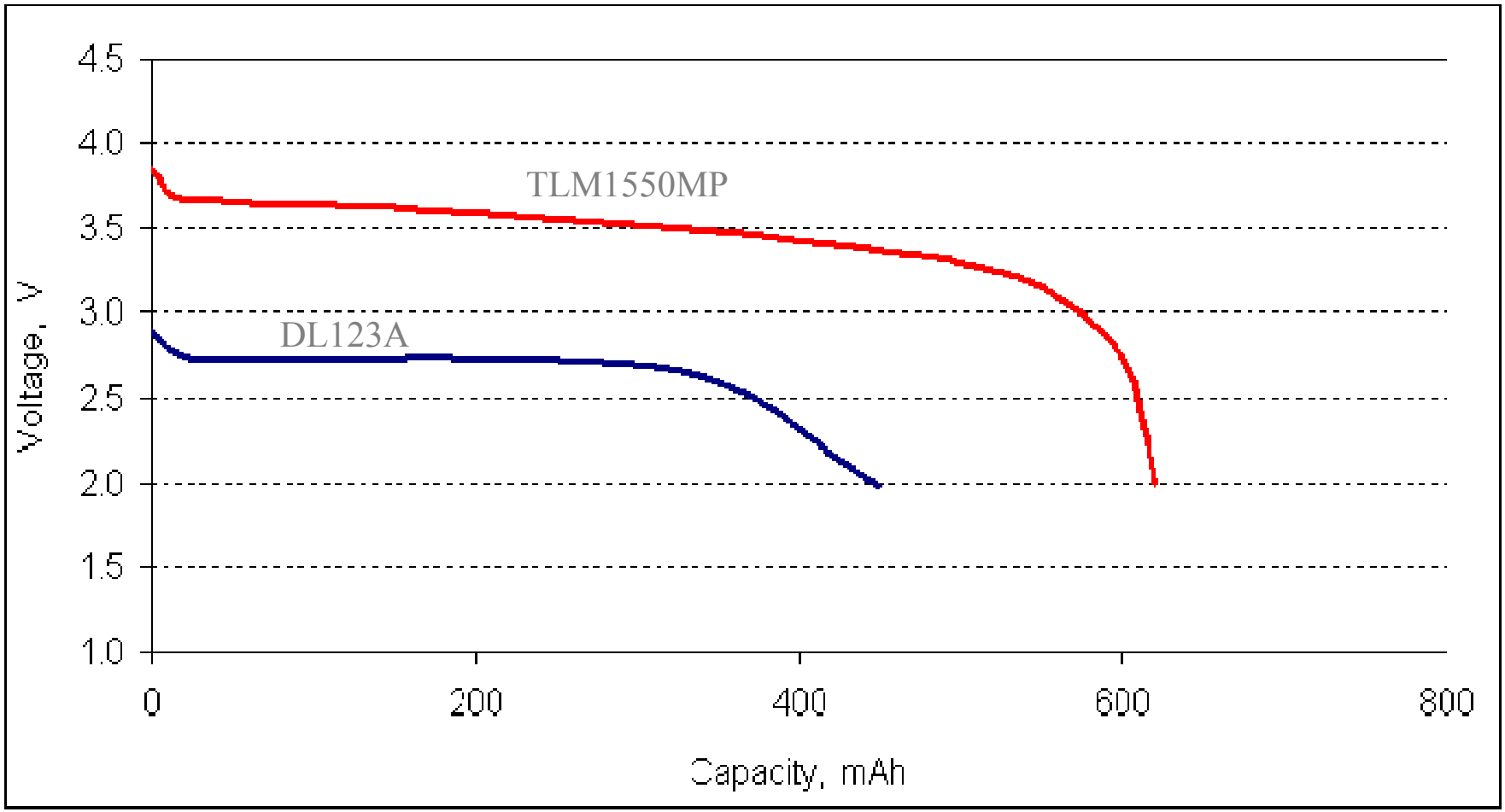
TLM1550MP vs. DL123A

Discharge curves at 2A, RT



TLM1550MP vs. DL123A

Discharge curves at 1A, 0°C



TLM1550MP vs. DL123A

Discharge curves at 1A, -20°C