

# Capacitor Management System

REV	Date	Description	BY
V0	Oct. 11. 2016	First version	YH Yoo
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# The Importance of Balancing

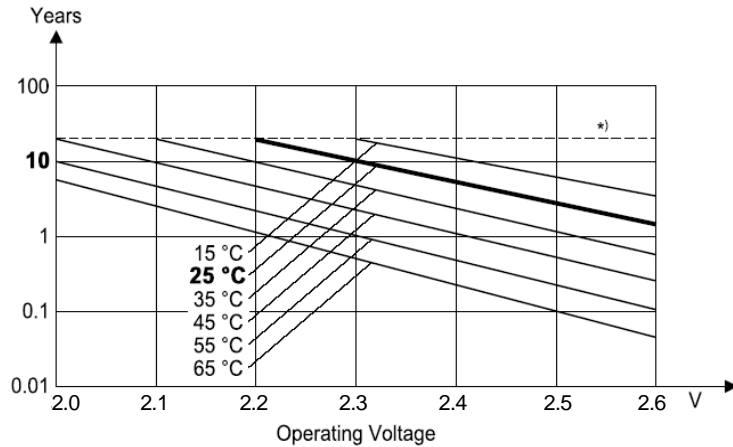


Fig.1 Ultracapacitor Load Life (vs. Temperature & Voltage)

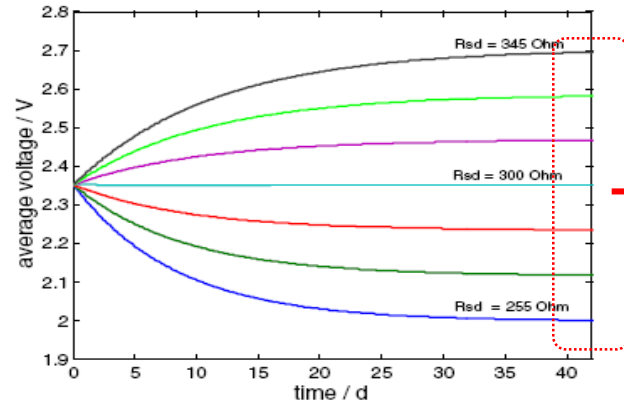


Fig.2 Ultracapacitor self discharge

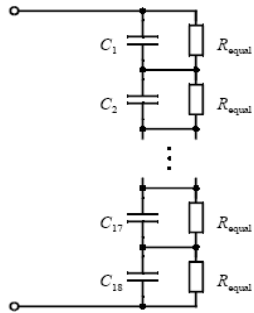
The service life of whole module decreases.

- The Service Life of Ultracapacitor depends on **temperature & cell voltage**.
- The charging voltage discrepancies between cells deteriorate the expected service life.
- And so series connected ultracapacitors should be balanced by several methods ;
  - 1) The capacitance differences of series connected cells should be small.
  - 2) Proper balancing circuit at each cell is needed.

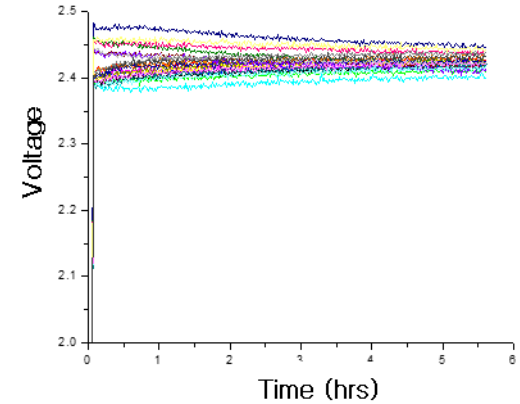
\*reference, "Analysis and Evaluation of Charge Balancing Circuits on Performance, Reliability and Lifetime of Supercapacitor Systems" 2003 IEEE Aachen University and Ford Research Aachen, Dirk Linzen

# How to balancing

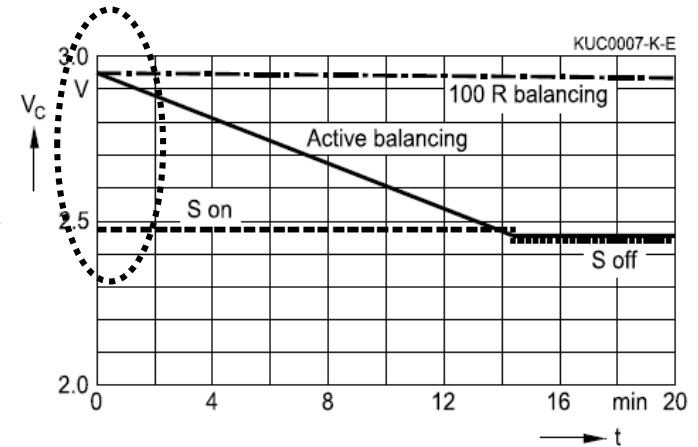
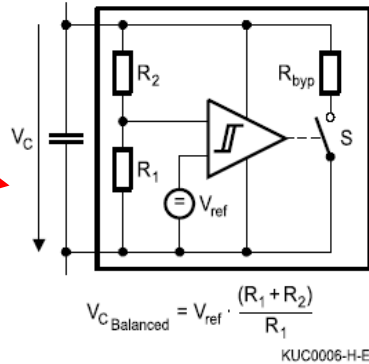
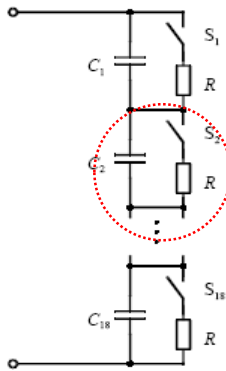
## Passive Balancing



- The long term charging decreases the voltage differences of cells.



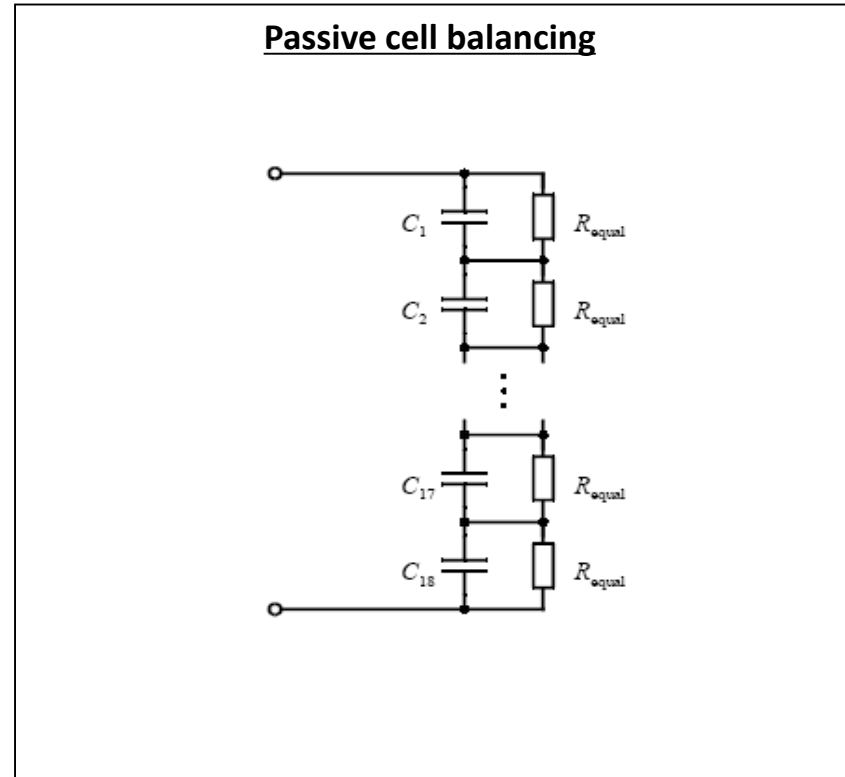
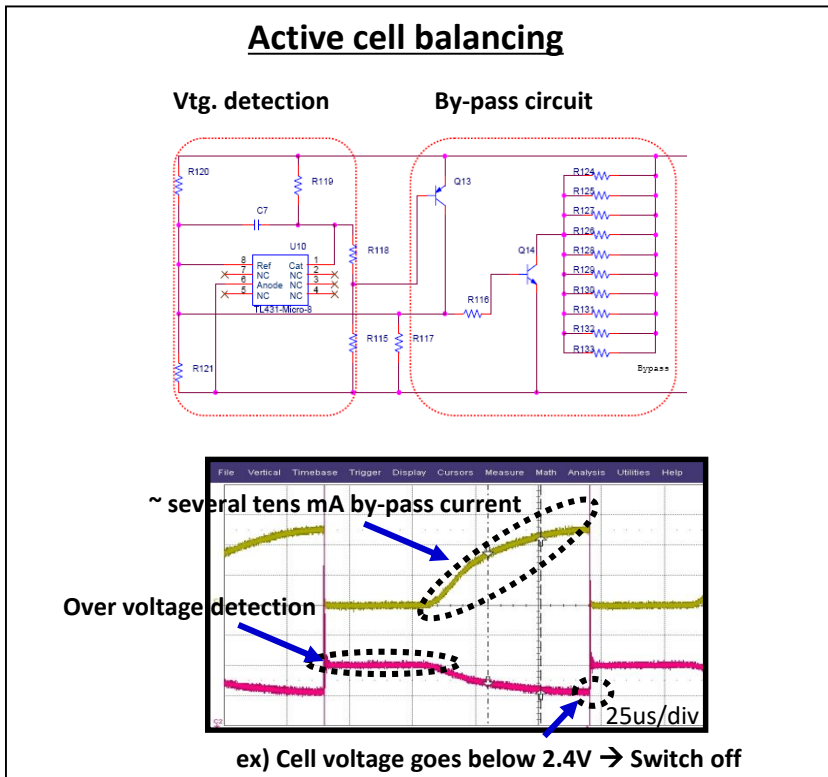
## Active Balancing



\*reference, "Analysis and Evaluation of Charge Balancing Circuits on Performance, Reliability and Lifetime of Supercapacitor Systems" 2003 IEEE Aachen University and Ford Research Aachen, Dirk Linzen

# Balancing for application

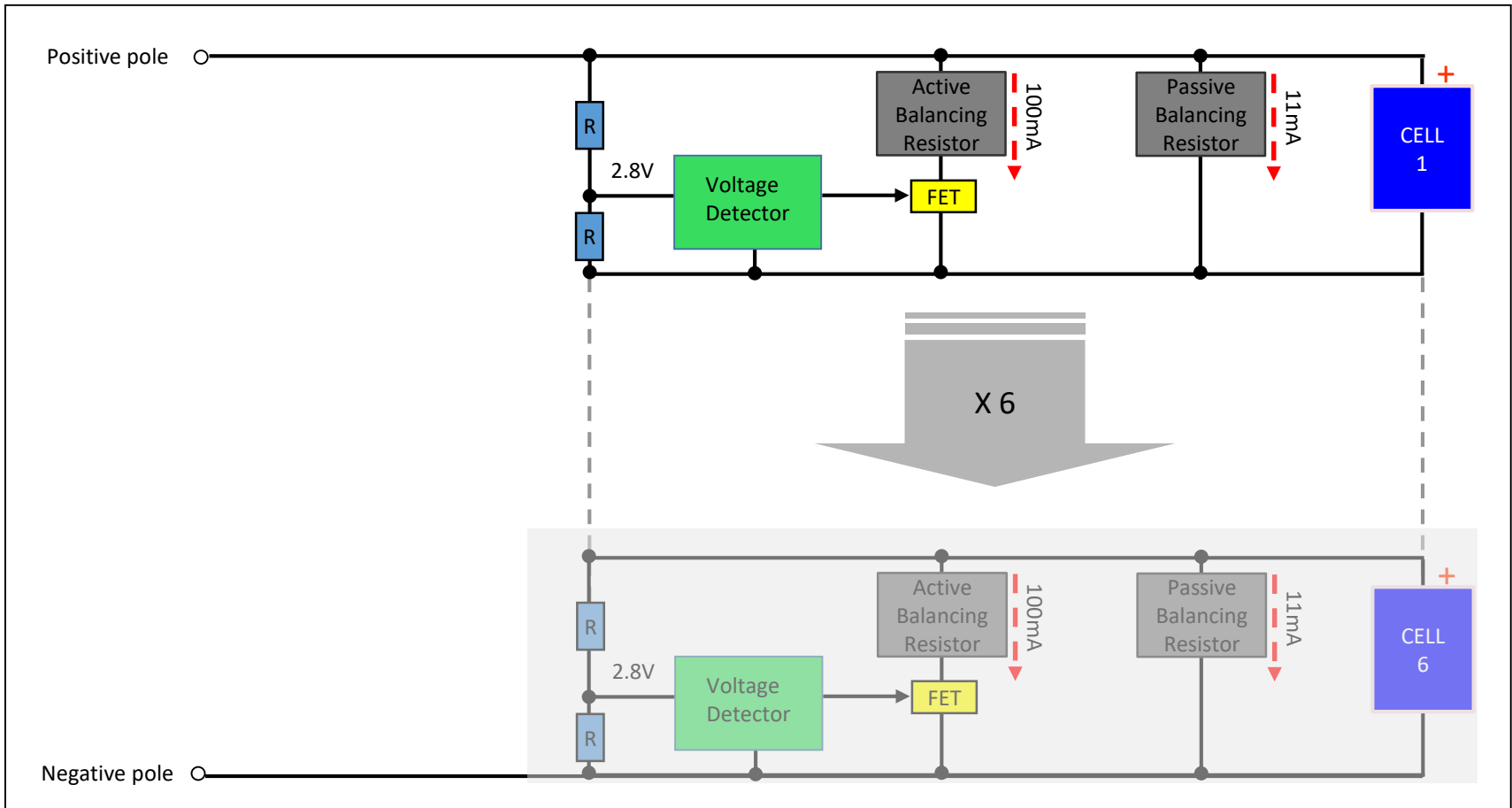
- **Active cell balancing : Over voltage protection + Cell balancing resistor**
  - High Duty Cycle Applications and Application that full-time discharge is impossible by passive resistance.
- **Passive cell balancing : cell balancing resistor**
  - Back up power Applications (ex. UPS)



\*reference, "Analysis and Evaluation of Charge Balancing Circuits on Performance, Reliability and Lifetime of Supercapacitor Systems" 2003 IEEE Aachen University and Ford Research Aachen, Dirk Linzen

# Balancing Diagram

## ❖ Balancing Diagram of LSUM 016R8L 0058F EA



\* Active balancing turn on voltage, Discharge current and Passive balancing can be applicable as requested by customer