A New Zero Power Method for Balancing Supercapacitors
SAB™ MOSFETs

- Automatically turns ON and OFF
- Near Zero Leakage turns
- Operating At, Above and Below Threshold Voltage
- Active Always ON
- Fast Dynamic Response
ALD EPAD® Technology

- Patented and Trademarked
- Precision on-chip trimming and calibration technology
- Incorporates Floating-gate MOSFET transistors
- Precision and ultra low operating voltages
- Proven EPAD® manufacturing technology
- 20 Year evolution in technology and manufacturing
- Millions of EPAD® enabled circuits shipped to date
A plug and play PCB solution for automatically balancing supercapacitors

Actual board size
0.6 x 1.6 inches
Benefits of MOSFET Balancing

Scenario 1:
- Power Supply $V_+ = 4.6V$
- If $I_{C1} = I_{C2}$
- $V_{OUT} = V_+ / 2 = 2.30V$
- Each Supercapacitor $= 2.7V$ max. rating

Scenario 2:
- If $I_{C1} > I_{C2}$
- $V_{OUT}$ rises until $I_{C1} = I_{C2}$
- If $V_{C2} = V_{OUT} > 2.7V$, then $C2$ is damaged due to over voltage

Scenario 3:
- If $I_{C2} > I_{C1}$
- $V_{OUT}$ drops until $I_{C1} = I_{C2}$
- If $V_{C1} (V_+ - V_{OUT}) > 2.7V$, $C1$ is damaged due to over-voltage
- Total leakage current equals $I_{C2}$
Benefits of MOSFET Balancing
Two supercapacitors connected in series balanced using a MOSFET chip.
MOSFET vs OPAMP Balancing

ASSUME:
1. CHARGE VOLTAGE OF 4.5 V
2. CELL CAPACITANCE C1 = C2
3. ZERO IS EITHER SLIGHTLY POSITIVE, ZERO, OR SLIGHTLY NEGATIVE POWER BURN.

LEAKAGE CURRENT (mA)

CELL VOLTAGE (V)

SAB MOSFET (CURRENT BALANCING)
CELL 2: 2.45V @ 2.2uA
CELL 1: 2.15V @ 2.2uA
4 Supercaps in Series with 4 SAB MOSFETs

Vcap (V)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

Time Samples (2.85 M sec./33 days)

XV SERIES 300F
ALD910025
+10.0V Power Supply
Change (Delta) Vcap /M sec.

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ALD910025
+10.0V Power Supply
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