Category: SABFET **CIRCUIT IDEAS FOR DESIGNERS** Schematic no. sabfet_11104.0

Balancing Two 2-Supercap (4 cell) Stacks in Series

Description

Two dual supercapacitor auto balancing (SAB) MOSFET arrays connect across four-supercaps in series, using two separate packages of ALD 9100xx series, with xx equal to the threshold voltage, V_t, in 0.10V increments. At V_t, the I_{DS} ON current for each SAB MOSFET M1 and M2 for each stack is set at 1µA. The I_{DS} ON current of each M1/M2 change exponentially with slight changes in the gate-source voltage, V_{GS}. Each SAB MOSFET M_X behaves like a voltage sensitive resistor (See sabfet_11101.0). At V_{GS} voltages below or above V_t, the SAB MOSFET I_{DS} ON current changes at a rate of approximately 1 decade for every 0.1V change in V_{GS}. When V_{GS} drops low enough, the I_{DS} ON current becomes essentially zero. For example, the ALD910026 has a V_t of 2.60V. If its V_{GS} voltage falls below 2.0V, the I_{DS} current decreases to pA range, which is near zero compared to 1µA.

The voltages across M1/M2 for each stack automatically self-adjust to accommodate different leakage currents for each supercap C1A/C2A/C1B/C2B. V_A settles to approximately ½ (V+), depending upon relative leakage currents of each supercap in both stacks. The currents through M1 and M2 for each stack automatically compensate for different supercap voltages. A higher supercap voltage results in a higher corresponding V_{GS} voltage of M_X connected across it, at a higher I_{DS} ON current, which opposes the tendency for the higher supercap voltage to increase. A lower supercap voltage results in lower I_{DS} ON currents in the corresponding SAB MOSFET until I_{DS} ON ≈ 0. In equilibrium, the total leakage current across both M1/M2 and C1/C2 of each network is approximately equal to the highest leakage current of any one of C1A/C2A/C1B/C2B. Note that the absolute maximum voltage ratings must be observed for each individual SAB MOSFET package at all times.

For full schematic diagram and notes, please register and login at aldinc.com