

# Series Connected Super Capacitor and Li-Ion Capacitor Cells: Active Voltage Equalization

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**Abstract:** Energy storage package usually consists of multiple cells. The associated cell equalization is important for cell package design. An innovative and efficient switched-capacitor balancing circuit is proposed in this paper to achieve cell voltage balancing for a package of hybrid energy sources. The key feature is that the balancing is not just restricted to equal cell voltage but is extended to different cell combinations that will be beneficial for non-sorted cell packages, for different types of Li-ion cells, and for other applications, such as second-life retired batteries. The topology and operation process of each switching state for this voltage equalizer are analyzed in detail. The mathematical derivation, software simulation, and laboratory experiment are conducted to verify the feasibility of this model. This proposed voltage equalizer is especially useful with the increasing establishment of hybrid systems, which take advantages of different types of energy sources or energy storage devices.

**Keywords:** Voltage Balancing, Hybrid Energy Sources, Super Capacitors.

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