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A SWITCHED-CAPACITOR-BASED SERIAL DC-DC CONVERTER USING CLEAN ENERGY POWER SUPPLIES

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Abstract. *Aimed at mobile back-lighting applications, a switched-capacitor-based serial DC-DC converter is proposed in this paper. By using battery energy and solar energy, the proposed converter generates the stepped-up voltage to drive white LEDs. Unlike conventional multiple-input parallel converters, the output voltage of the proposed converter is generated by adding the output voltage of the SC-based circuit to the voltage of solar-cells. For this reason, the proposed converter can realize not only small hardware-cost but also wide input-range. Concretely, in comparison with the conventional parallel converter using 1.5 × step-up SC converters, the proposed converter can achieve 20% reduction of hardware cost and 16% extension of input range. The characteristics of the proposed converter are clarified by theoretical analyses. Furthermore, SPICE simulations and experiments show the validity of circuit design, where theoretical results correspond well with simulation results. For this reason, derived theoretical formulas can provide basic information to design serial SC DC-DC converters. The proposed converter will be useful as a LED driver circuit for display back-lighting.*
Keywords: Power converters, DC-DC converters, Switched-capacitor circuits, Charge pumps, Clean energy power supplies, Solar cells

1. **Introduction.** As one of the most ideal back-light solutions, white LEDs have been used for small color displays in portable devices. To drive white LEDs, switched-capacitor (SC) DC-DC converters [1-17] have been employed, because capacitor-based converters can be designed without magnetic elements. Although the power efficiency of capacitor-based converters is inferior to that of inductor-based converters such as buck converters,