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Design of an Average-Current-Mode Non-Inverting Buck-Boost DC-DC Converter with Reduced Switching and Conduction Losses

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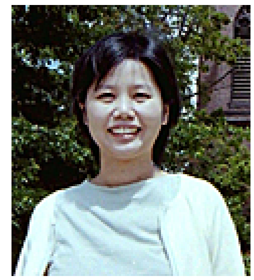

Due to the growth of consumer electronics market, there are more and more studies in energy saving to prolong service life of electronic products. Because the output voltage of batteries decreases with time (e.g., Li-ion: 2.7–4.2 V), it may be higher or lower than the required supply voltage (e.g., 3.3V). To use the entire battery output voltage range, a non-inverting buck-boost dc-dc converter is a good choice. This work adopted an improved switching scheme for power transistors, which can reduce the conduction losses by reducing the average current on the inductor and can also reduce the switching losses. The overall efficiency of the converter is then improved. Furthermore, this work proposed the scheme to adopt the average current mode control in the non-inverting buck-boost dc-dc converter, and it can get both better system noise immunity and fast transient response. The die area of this chip is 2.14×1.92mm^2, which was fabricated by using TSMC 0.35μm 2P4M 3.3V/5V mixed-signal polycide process. The input voltage of the converter may range from 2.3 V to 5 V, and its output voltage is set to 3.3V. Its maximal load current is 400 mA load current, and its maximal measured efficiency is 92.01%.

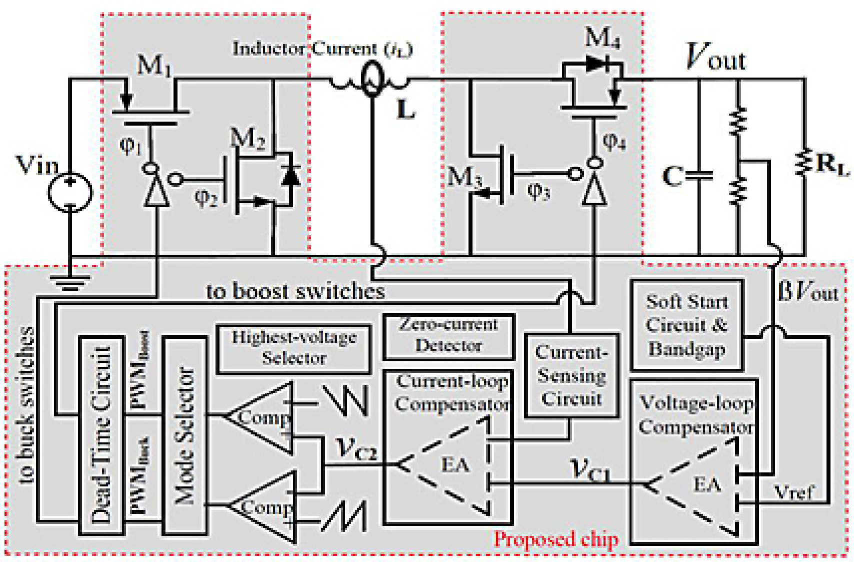

Fig. 1 Block diagram of the proposed average-current-mode non-inverting buck-boost converter

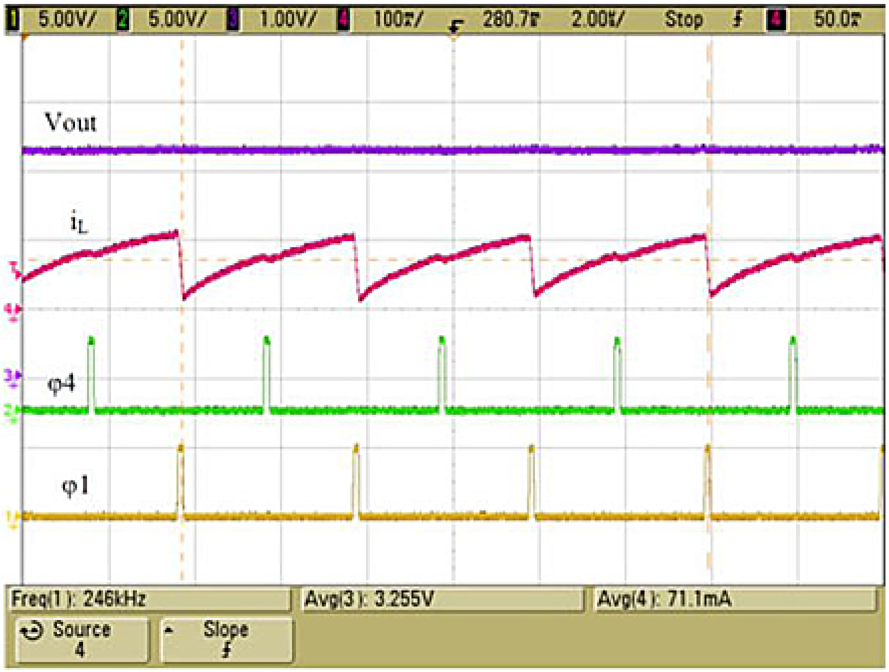

Fig. 2 Measured waveforms with V_{in}=3.5 V, V_{out}=3.3 V, and I_{LOAD}=70 mA