High Efficiency Dc-Dc Buck Boost Converter

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Abstract

This paper introduces you to contemporary VLSI technology's high-efficiency buck and boost converters. A MOSFET switch, two inductors, two diodes, and a capacitor make up the circuit. The circuit is built-in Esim and simulated with a ngspice application using sky130 models by editing the netlist. The offered DC-DC buck-boost converter's output voltage is primarily lower than the input voltage. By managing both switching frequency and load fluctuation, the circuit is built utilizing buck-boost topology into buck topology, resulting in improved efficiency. The circuit is optimized for switching frequency, has an off-chip capacitor, and employs switching and conduction loss reduction methods.

1 Circuit Details

The circuit is made by joining two converters, a buck converter, and a boost converter. Buck converter is a DC to DC power converter which steps down the voltage from its input to its output. Boost converter works exactly opposite to buck converter; it steps up the voltage from its input to its output. The circuit works on both principles of the buck converter and boost converter. The designed circuit is a combination buck and boost converter parallelly, therefore, we have to connect inductor L2 and diode D2 in the circuit. The proposed DC-DC buck-boost converter will produce negative output voltage with a low duty cycle and produce high voltage gain. The MOSFET present here worked as a high-frequency switch. Inductor L1 stores energy when the MOSFET switch is closed and supplies it to load and capacitor when the MOSFET switch is open. To store energy to transfer to output and filter it to get smooth voltage is the function of the capacitor. The proposed converter is arranged by 5V input DC source for superior efficiency, a MOSFET switch which is considered as a switching device where the switching has been set to 20KHz, as well as inductors L1 & L2 set at 35mH, load resistance RL at 50Ω and output filter capacitor CL at 1.1μF. The output voltage of the proposed DC-DC buck-boost converter is controlled by altering its MOSFET switch. DC-DC Buck-Boost converters can be developed by architecture improvement and by lowering parasitic resistance and capacitance.

2 Implemented Circuit

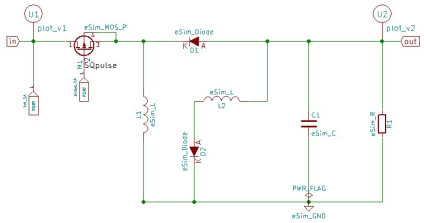

Figure 1: Implemented circuit diagram.

3 Implemented Waveforms

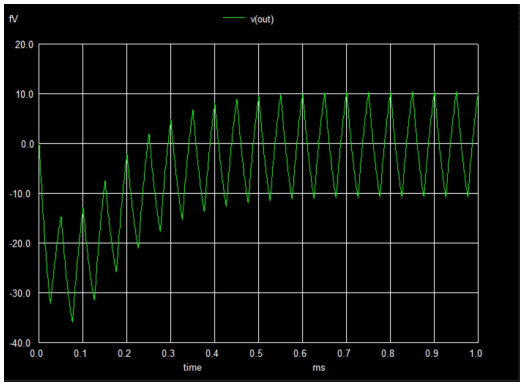

Figure 2: Implemented waveform.

References

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[2] P. D. M. A. H. M. S. H. Sairatun Nesa Soheli, Dr. Golam Sarowar. Design and analysis of a dc -dc buck boost converter to achieve high efficiency and low voltage gain by using buck boost topology into buck topology. . https://ieeexplore.ieee.org/document/8643001.