Design of Mixed Signal based Buck-Converter using eSim

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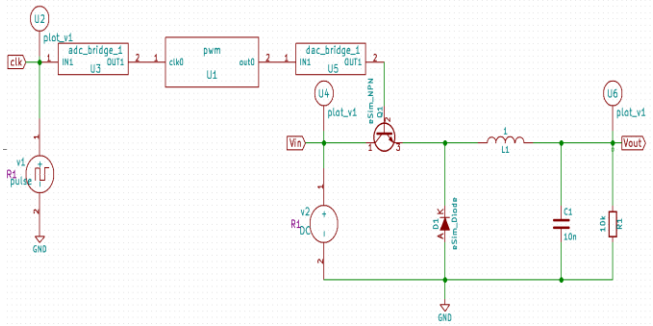
***Abstract*—This paper presents design of switch mode power supply (SMPS) based on mixed signal on buck converter to step down the input voltage. The step-down converter presented here offers a good efficiency performance. The proposed converter is designed in eSim tool.**

I. Introduction

A step-down converter is also known as buck converter, as the name suggests it steps down the input voltage to lower voltage, since the power is always conserved therefore the current in the output is higher than the input current and thus power is conserved. A typical step-down converter consists of a switch (transistor) and a diode as a semiconductor device, and storing element: inductor and a capacitor, the former is used to store electrical energy in the form of magnetic energy and the later is to smooth the output voltage i.e., to filter out the ripple. The working principle of the step-down converter can be explained as follows-

When the transistor is ON state, current starts flowing through the inductor stores electric energy by generating magnetic field around it and since capacitor therefore, charge will be stored and the voltage across it will appear across the load.

When the transistor is turned OFF, inductor will pump out its stored energy tand current will start flowing[2].The current will flow until the stored energy in the inductor collapsed during this period diode will be in forward bias and thus allow current to flow through it. Using Verilog the PWM signal can be generated to drive the gate of the transistor, thus a mixed signal design can be accomplished easily.



II. Schematic Diagram

fig1: circuit diagram of buck converter in eSim

III. Simulation

Ngspice Plots

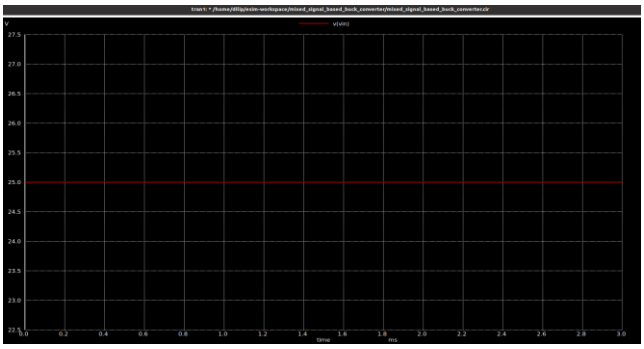


fig2: input voltage

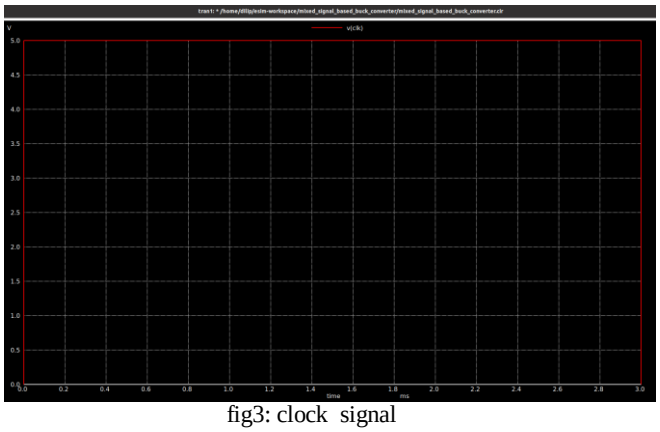


fig3: clock signal

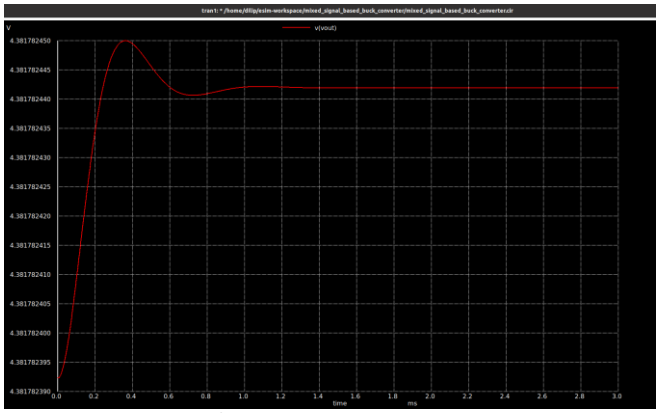


fig4: output voltage

IV. Conclusion

Thus, a mixed signal based buck converter is designed and simulated using eSim tool and appropriate waveform is generated.

V. Refrences

[1] S. Masri, N. Mohamad and M. H. M. Hariri, "Design and development of DC-DC buck converter for photovoltaic application," 2012 International Conference on Power Engineering and Renewable Energy (ICPERE), 2012, pp. 1-5, doi: 10.1109/ICPERE.2012.6287236.

[2] Electronicscoach, "What is buck converter?" https://electronicscoach.com/buck-converter.html [accessed April. 14 2022]]