Flyback Converter

Project File

flyback.sqproj

Introduction

Flyback converters are derived from the buck-boost converter circuit. However, in the most practical conditions it is used as a step down converter. The highh frequency isolation transformer is an essential component. The main applications of this circuit are in regulated dc power supplies, where isolation between input and output is the most important specification. Both single switch and dubble switch topologies are possible, the selection depends on the amount of power handled by the converter. The output voltage is controlled by controlling the switch-duty cycle. The ratio of output voltage to input voltage is given by:

$$\frac{V_o}{V_{in}} = \frac{N_2}{N_1} \cdot \frac{D}{1-D} = \frac{I_{in}}{1_o} \tag{1}$$

Where, V_o and V_{in} are the output and input voltages, respectively. The term I_o and I_{in} are the output and input currents, respectively. The term D is the duty ratio and defined as the ratio of the on time of the switch to the total switching period.

This shows the output voltage to be hgher or lower than the input voltage, based on the duty-ratio D.

Simulation Example

The simulation example consists of a simple boost PWM dc-dc converter as shown in Figure 1. In the present example, the input voltage is kept at 25V. The Load resistance is kept at 30Ω. The output filter capacitor is chosen as 220μF. The switch is controlled by a signal "gce clock". The output can be controlled by changing the $d$uty cycle parameter for the clock. The transformer specs. are primary turns: n_1=48, secondary turns: n_2 and magnetiZing inductance as 400μH. The switch, diode and the two winding transformer are ideal elements.

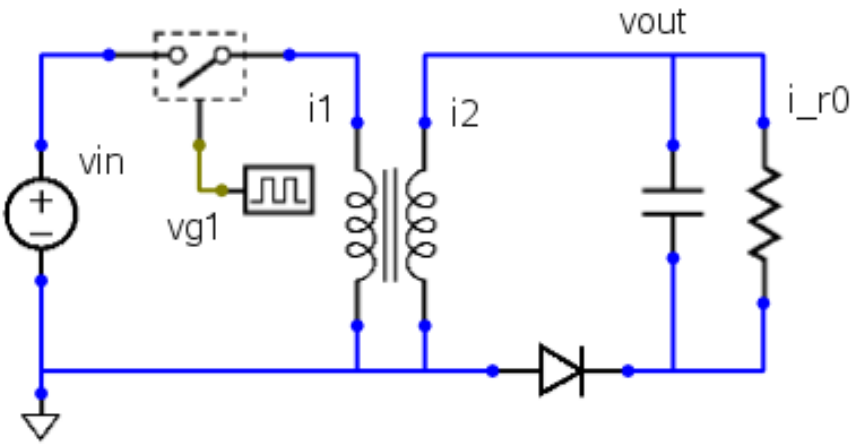

Figure 1: The Schematic circuit for the flyback converter

Sample Plots

The sample simulation plots are shown in Fig. 2. Here, the first upper plot shows the gate driver pulse. The second plot shows the input and output voltages. The third plot shows the primary and secondary currents of the transformer and the output resistance current for the two switching cycles with reference to time in steady state.

Few sample exercises are given here to get the complete understanding of the topic.

Exercises

1. Change the duty cycle, re-run the simulation and verify output voltage
2. Examine the effect of change in transformer turns ratio and the magnetizing inductance
3. See the effect of change in the frequency
4. See the effect of change in inductor/duty cycle on the boundary conditions for discontinuose current conduction.
5. See the effect of change in output filter capacitance value
6. Modify the circuit for two switch topology and study the different circuit waveforms.

References

[1] Ned Mohan, T.M.Undeland and W.P. Robbins, *Power Electronics: Converter, Applications and Devices*, Second Edition, John Wiley and Sons, 1995

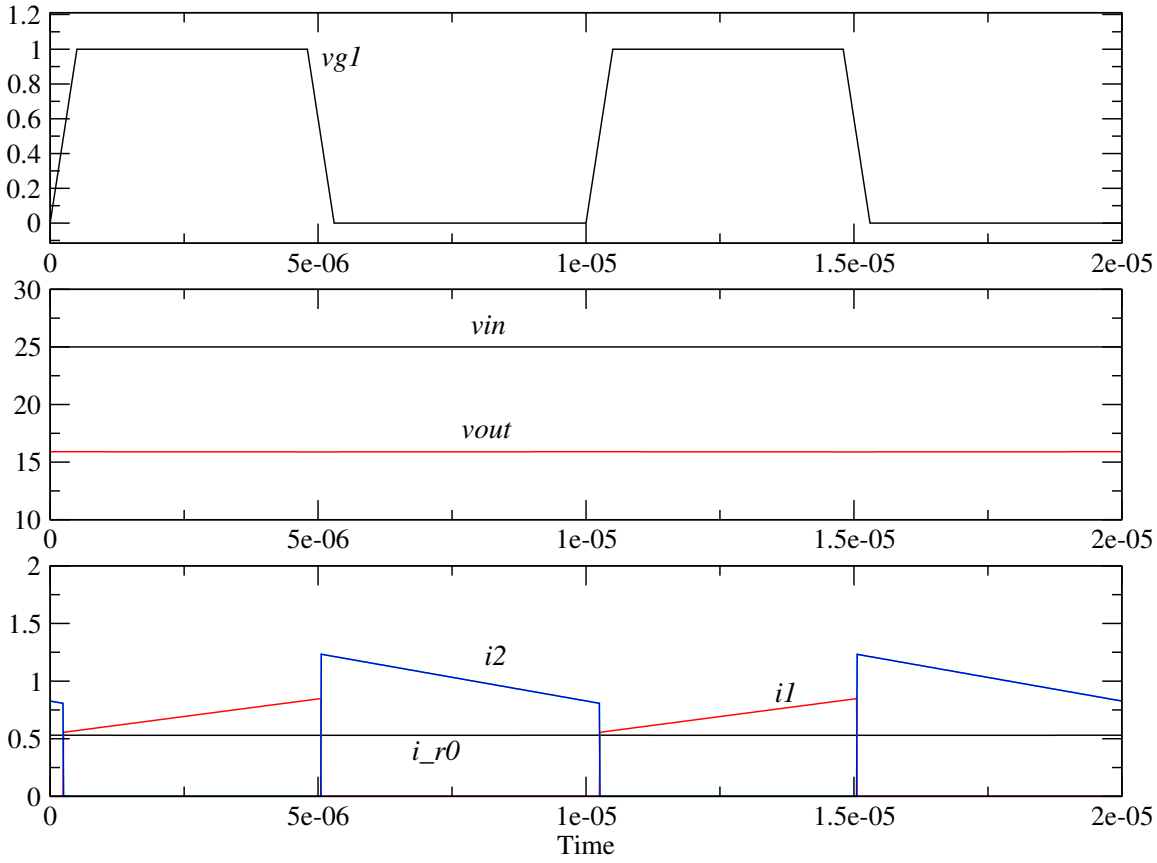

Figure 2: Simulation Plots for flyback Converter