

# Boost ZVS Converter

## Project File

boost-zvs.sqproj

## Introduction

The basic boost topology is modified to attain zero voltage transition across the switch. The resonant l-c circuit is introduced to create the zero voltage condition. The resonant capacitor produces a zero voltage across the switch at which instant the switch can be turned in or off. The output current can be assumed to be a constant during the high frequency resonant cycle. The details of the ZVS converter can be found from [1].

The ratio of output voltage to input voltage is given by

$$\frac{V_o}{V_{in}} = \frac{1}{1-D} = \frac{I_{in}}{I_o} \quad (1)$$

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.

## Simulation Example

The simulation example consists of a ZVS boost PWM dc-dc converter as shown in Figure ???. In the present example, the input voltage is kept at 10V. The Load resistance is kept at  $30\Omega$ . The output filter capacitor is chosen as  $100\mu\text{F}$ . The boost inductor is selected as  $l_s = 2\text{mH}$ . The resonant components are selected as :  $l_r = 56.83\mu\text{H}$  and  $c_r = 10\text{nF}$ , corresponds to the resonant frequency of around 211kHz. The switching frequency is selected as 120kHz.

The switch is controlled by a signal “gce clock”. The output can be controlled by changing the *duty* cycle parameter for the clock. The switch and diode are ideal switch and diode, respectively.

## 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 output load current, resonant inductor current and

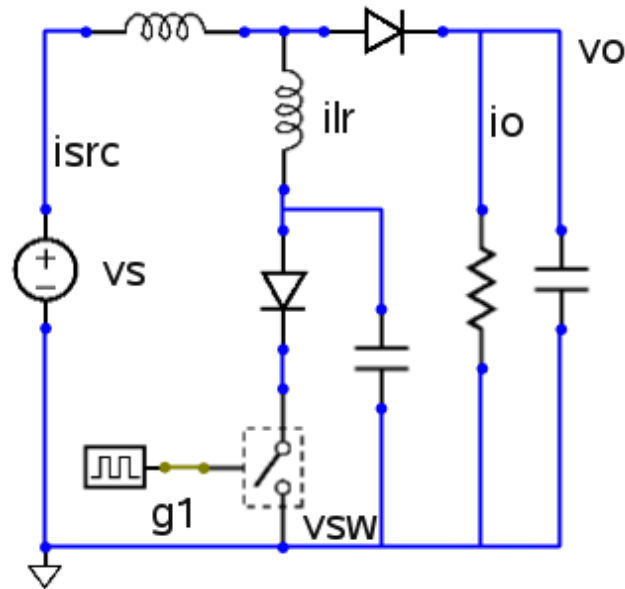


Figure 1: The Schematic circuit for the ZVS boost converter

the source current. The third plot shows the input voltage, output voltage and the switch voltage for 64% duty cycle. All the plots are steady-state and plotted for two cycles with reference to time.

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. See the effect of change in the frequency
3. See the effect of change in inductor on the boundary conditions for discontinuous current conduction.
4. See the effect of change in output filter capacitance value.
5. See the effect of change in the resonant components on the ZVS and the switch voltage peak value.
6. Find the boundary conditions for ZVS operation and verify them by simulation with appropriate parameter values.

## References

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

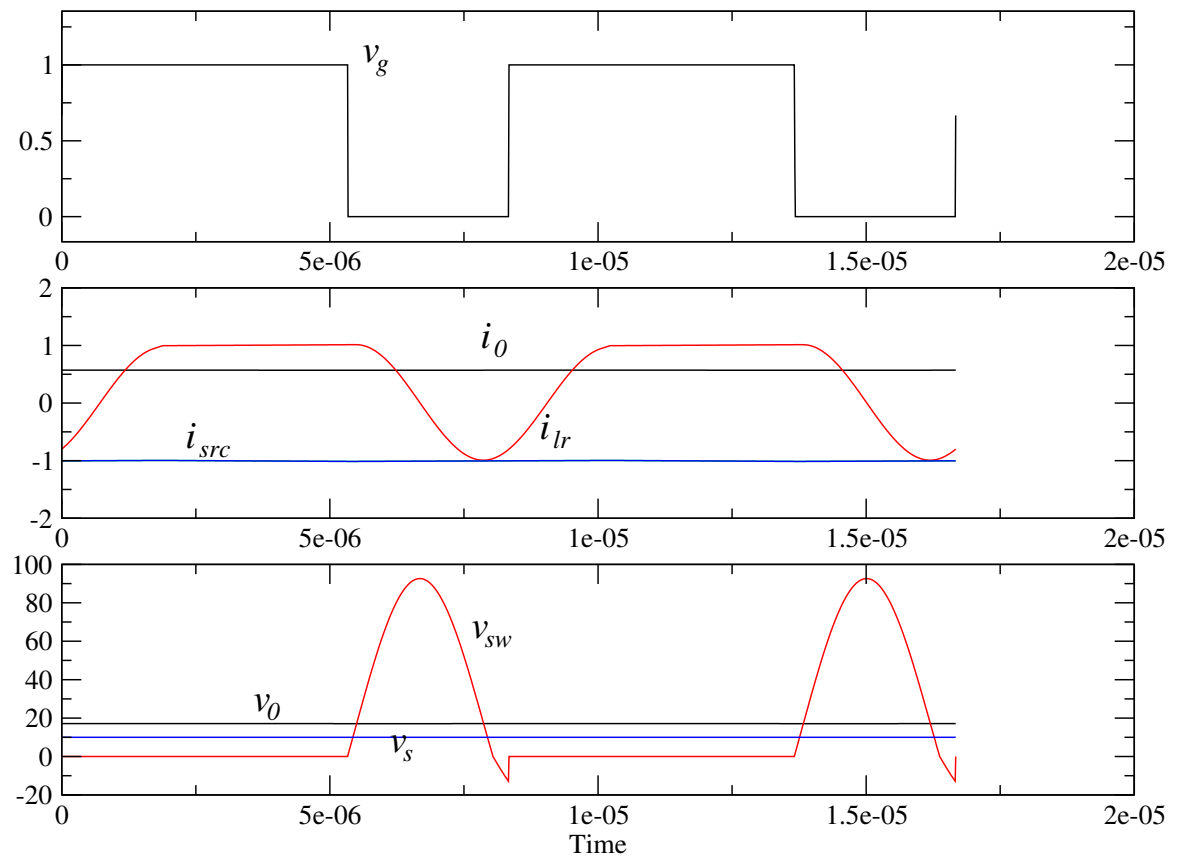


Figure 2: Simulation Plots for ZVS boost converter