Department of Electronics and Electrical engineering

Submitted by:

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Simulation and PCB Designing of Boost Converter

1. Objective:

The objective of this Project is to study the continuous conduction mode of basic Boost DC-DC converter using MATLAB/SIMULINK and PCB design.

2. Parameters of the DC-DC Converter:

Parameters	Boost
Input Voltage	30 V
Duty Ratio	0.6
Switching Frequency	50kHz
Output Power	300 W
Ripple in Inductor Current	15%
Ripple in Output Voltage	0.1%

3. Boost Converter :

3.1 Circuit Diagram and Theoretical waveforms of boost converter:

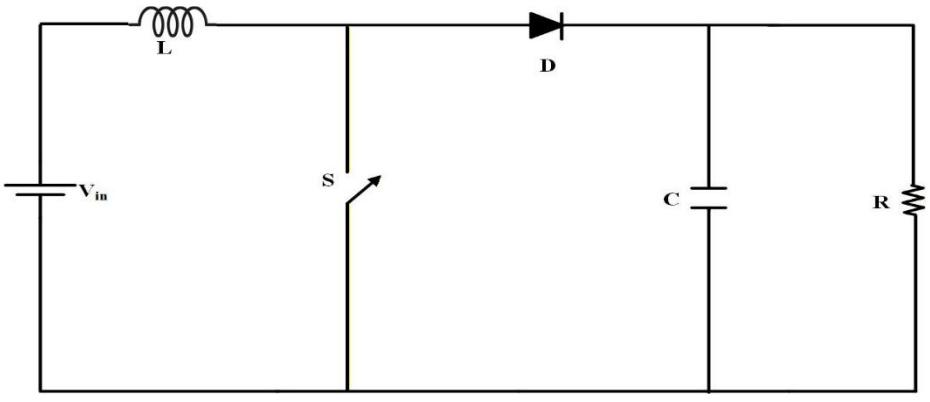
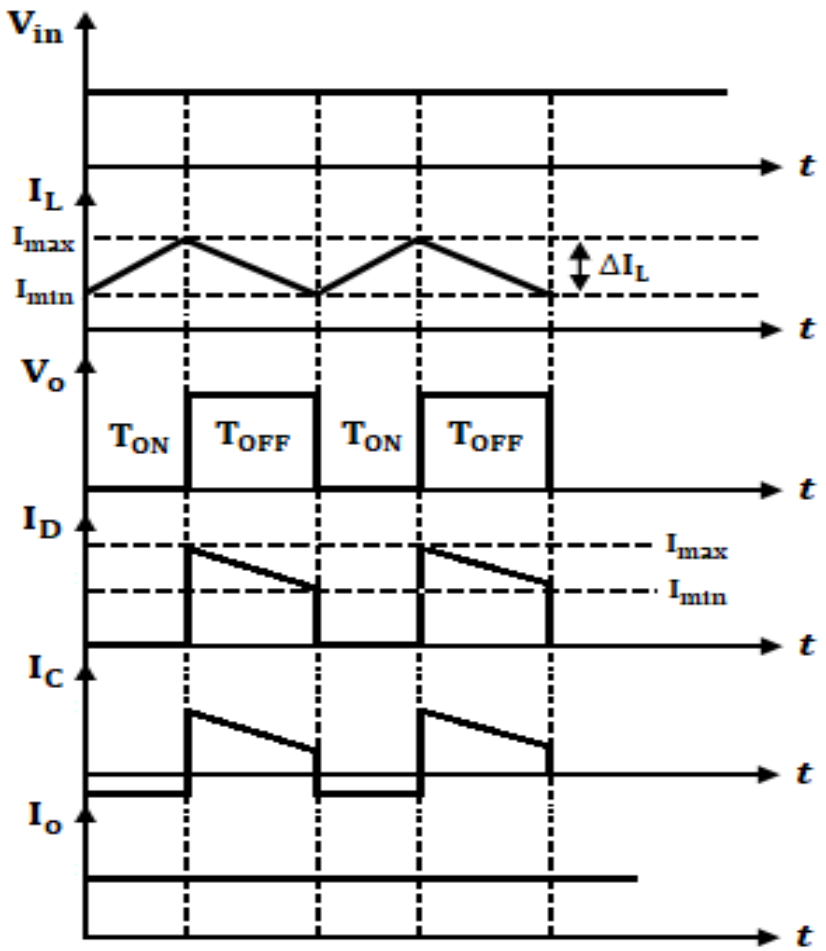


Fig:Boost Converter



Voltage and Current Waveforms of Boost Converter

3.2 Design procedure and final design parameter obtained:

- The value of inductance can be calculated by below expression

$$L = \frac{DV_{in}}{\Delta I_I f_{sw}}$$

The inductance value comes out to be 1.2mH.

- The value of capacitance can be calculated by

$$C = \frac{I_O}{\Delta V_o f_{sw}}$$

The value of capacitance comes out to be 640 μF.

- For continuous conduction mode output voltage can be found out by

$$V_O = \frac{DV_{in}}{1-D}$$

$$R = \frac{V_O}{I_O}$$

The value of output voltage and load resistance comes out to be 75 V and 18.75 Ω respectively.

- Using blocks from simscape/electrical/specialized power system/power electronics Boost converter is simulated with a discrete solver setting.

3.3 MatLab/Simulink Simulation:

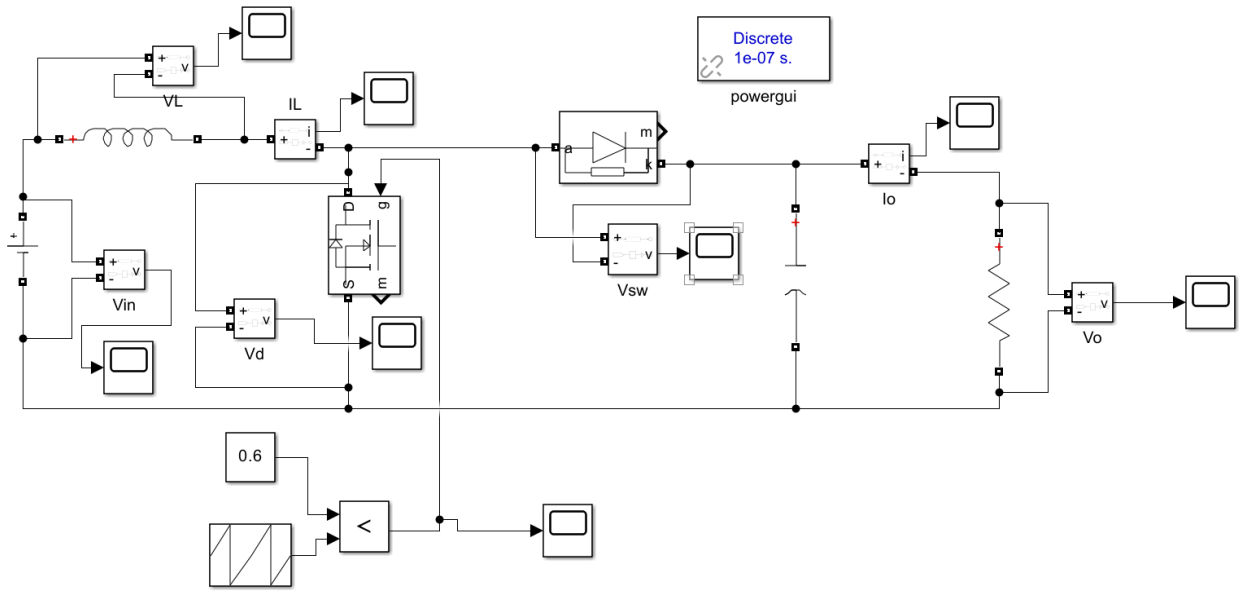
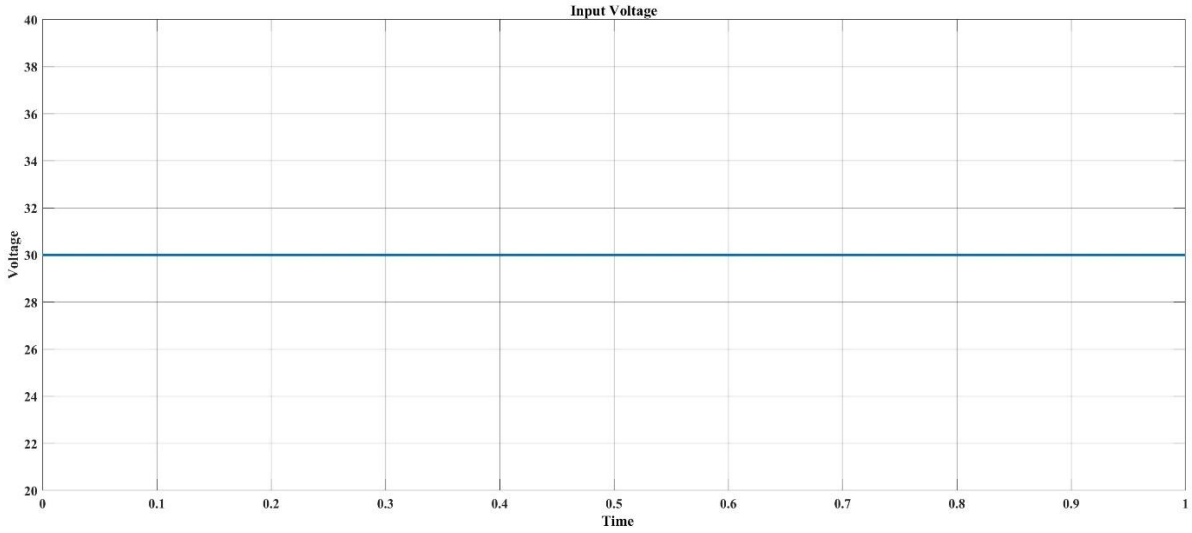


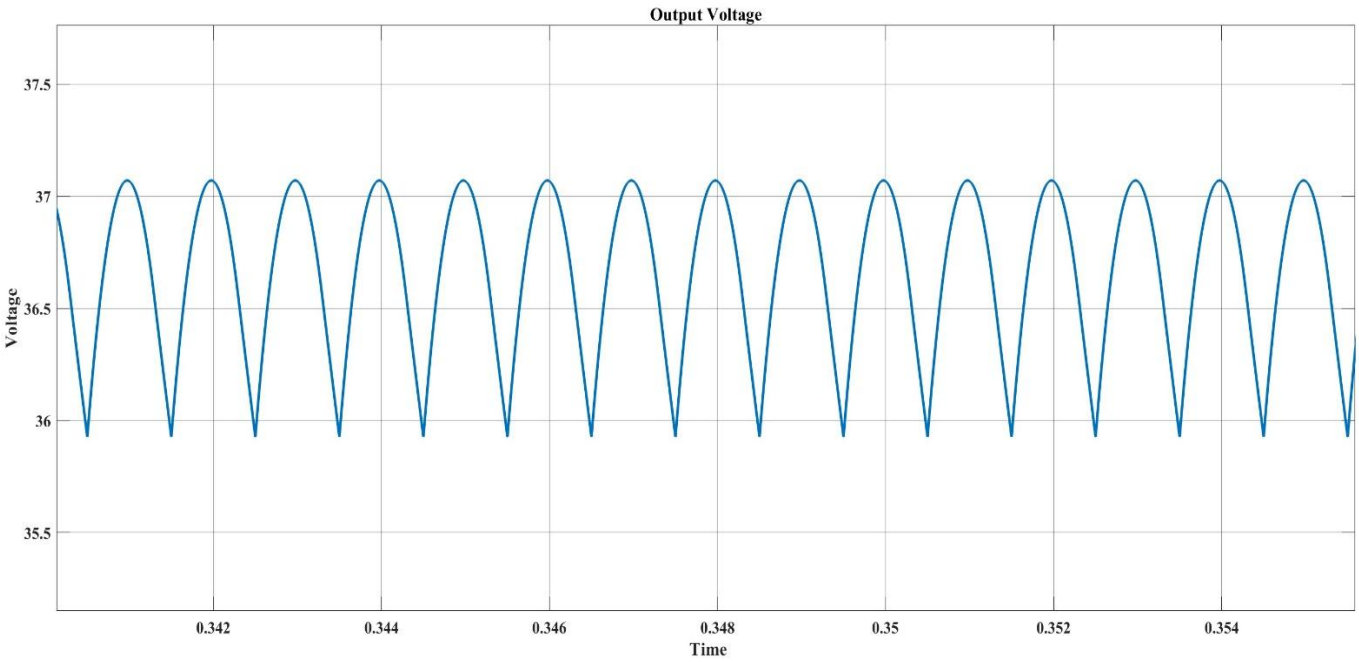
Fig. Boost Converter

3.4 Simulated Waveforms:

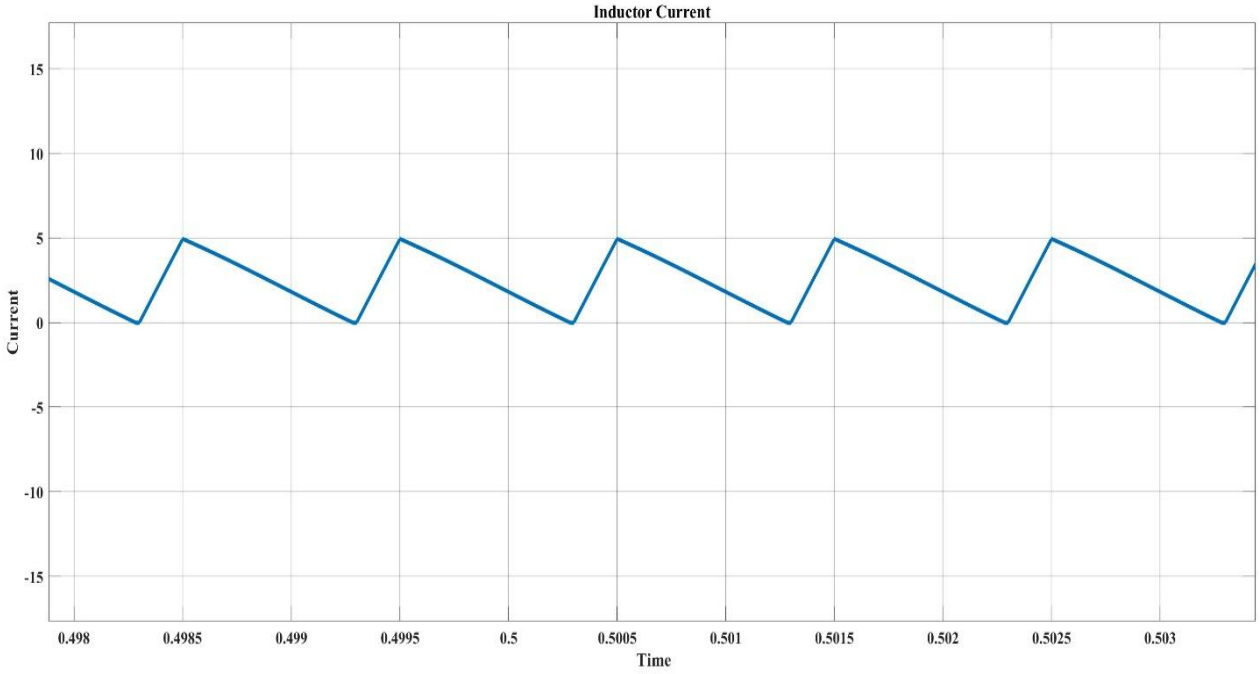
I. Input Voltage :



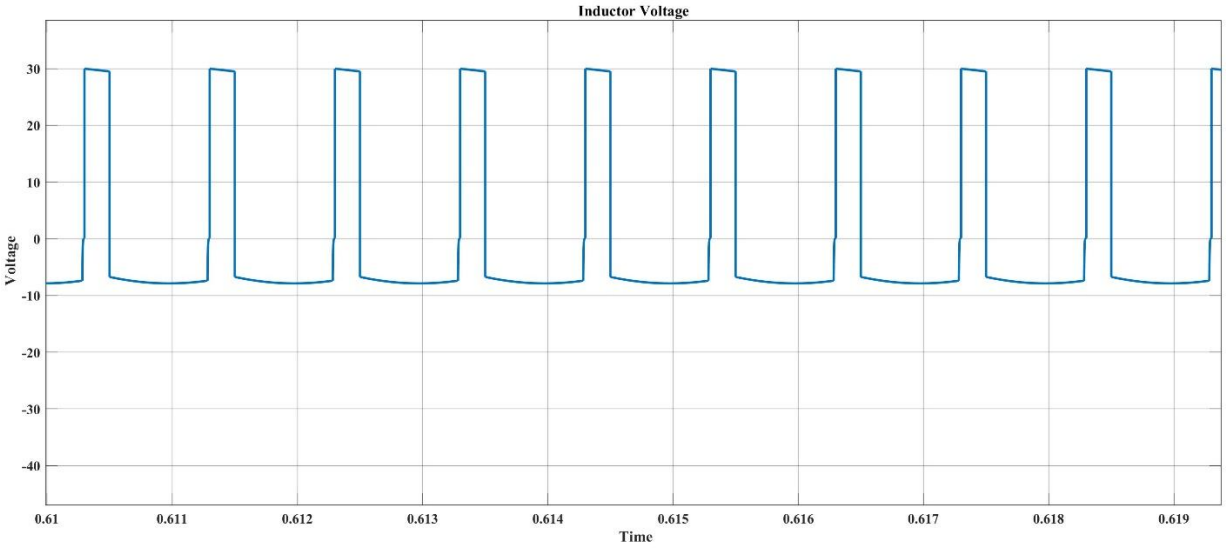
II. Output Voltage :



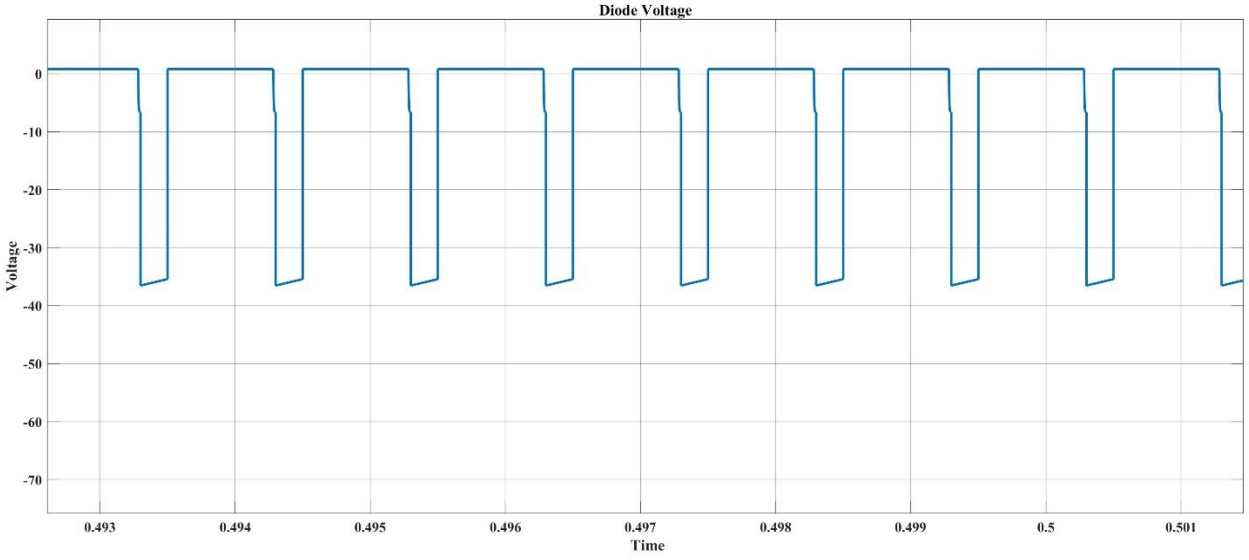
III. Inductor Current



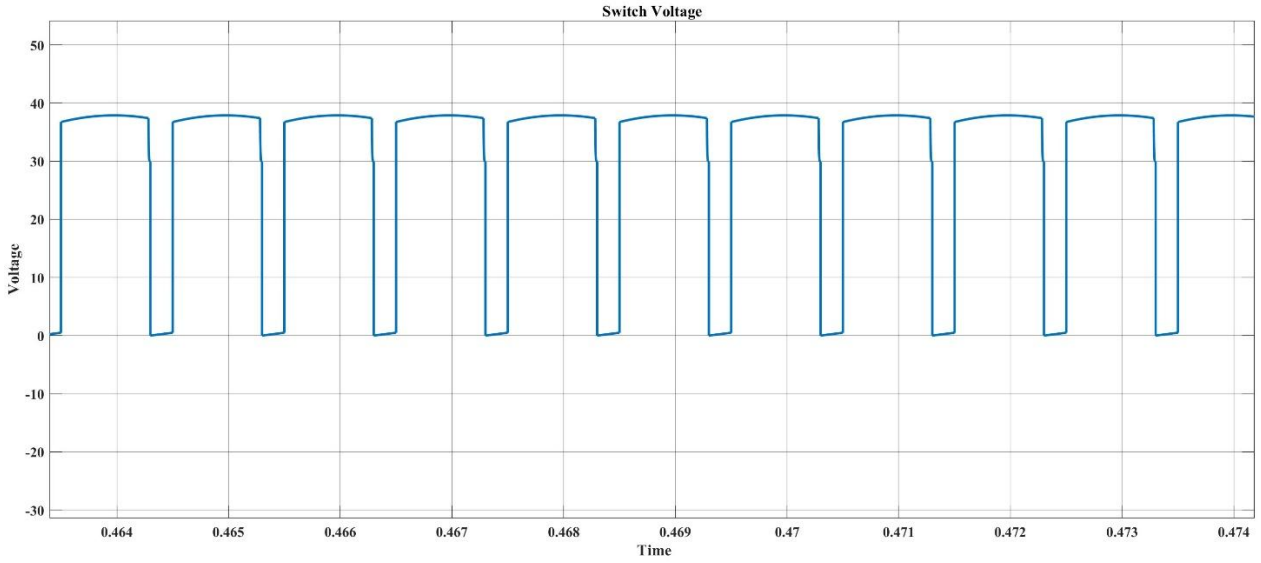
IV. Voltage across inductor



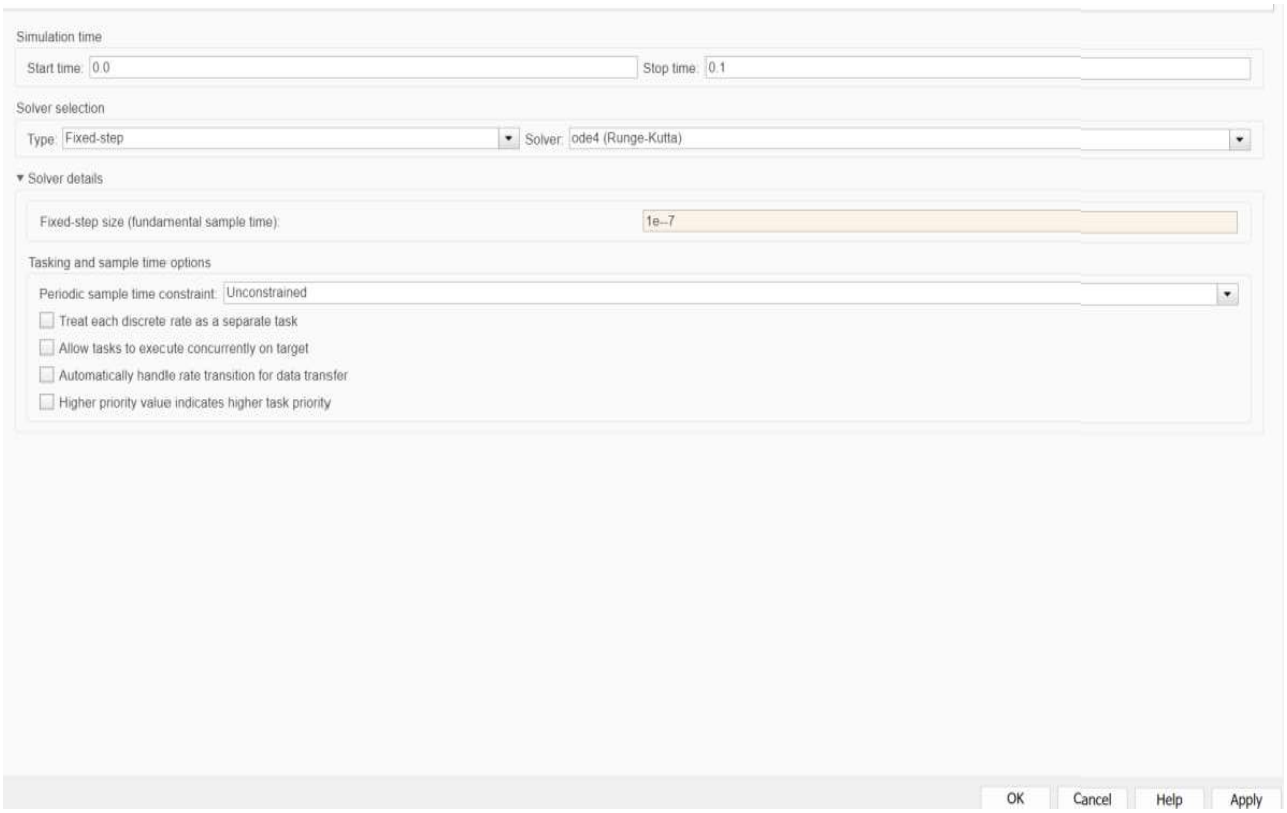
V. Voltage across Diode :



VI. Voltage across switch:



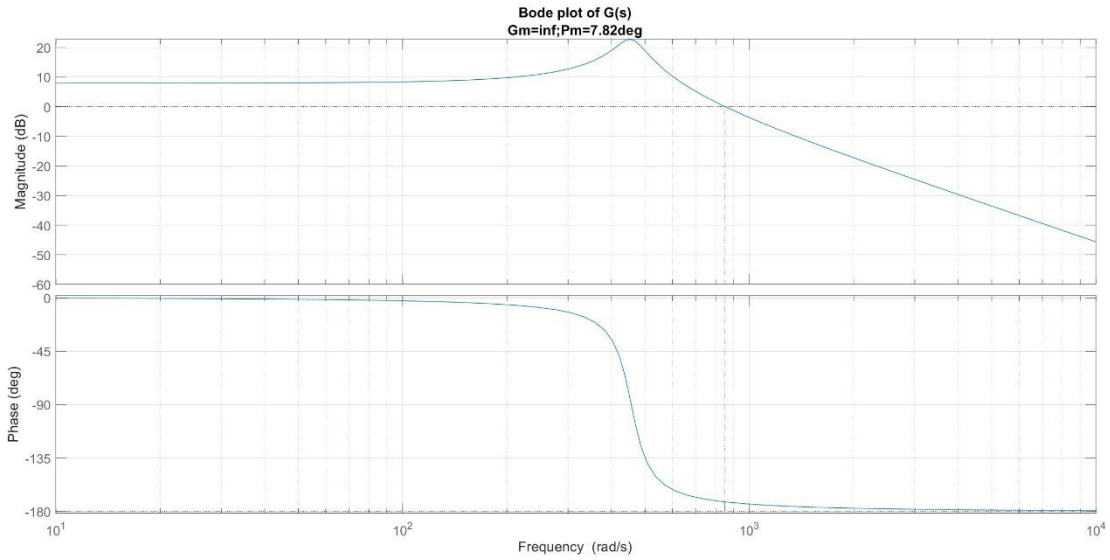
3.5 Simulation Configuration Parameters:

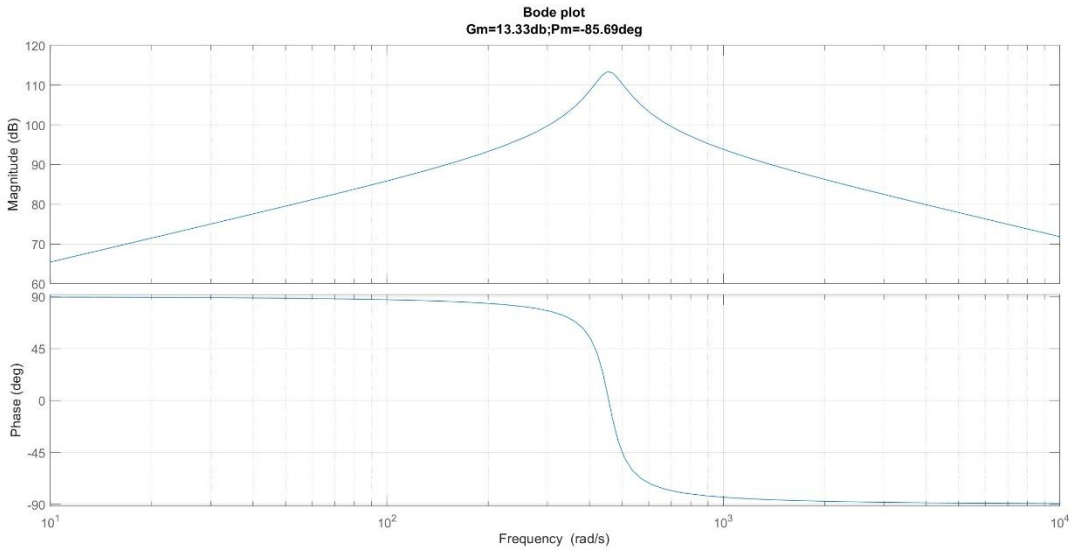


3.6 MatLab Code for Boost Converter:

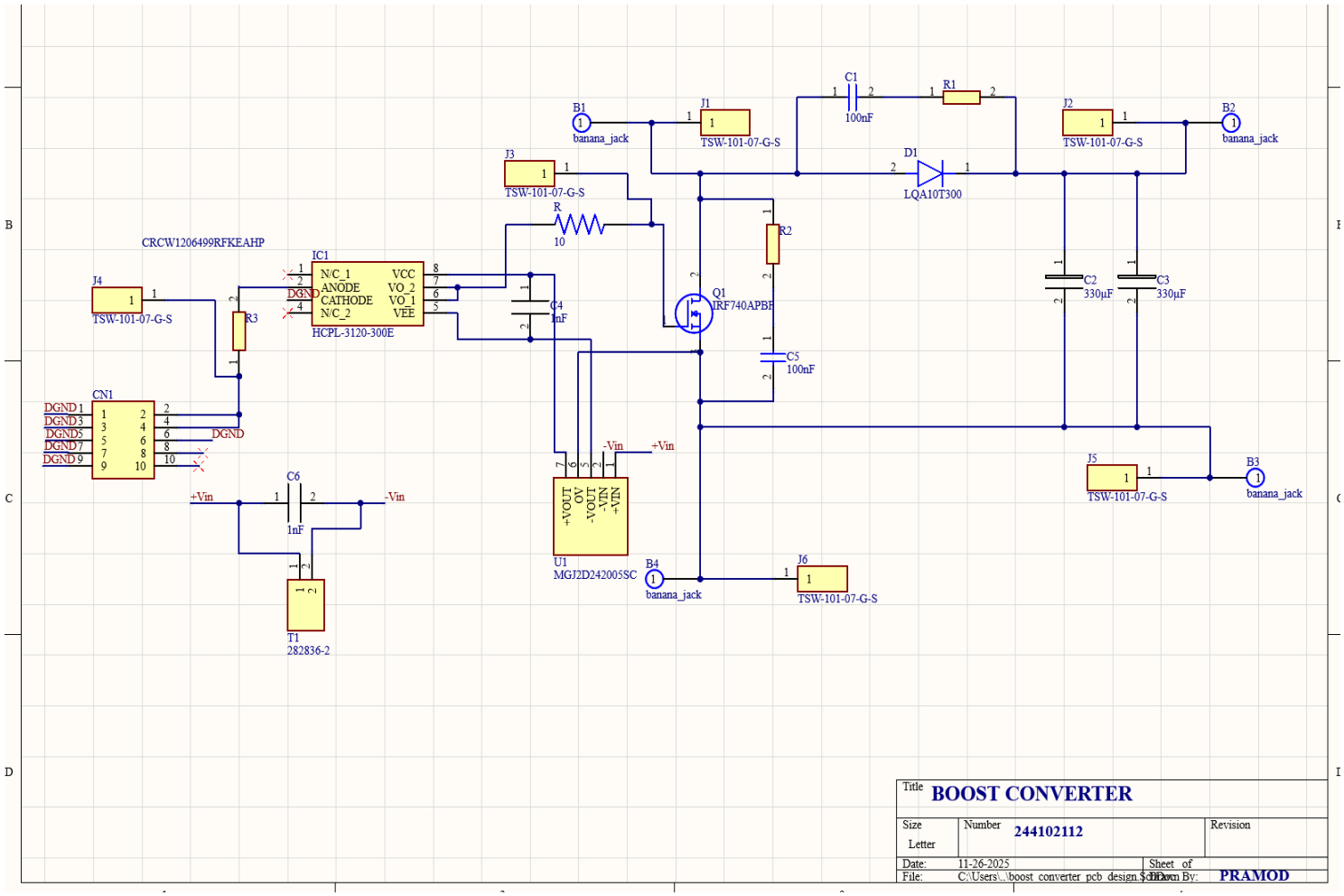
```
vin=30; D=0.6;
d=(1-D);
Vo=vin/d
I_L=Vo/(R*d)
R=18.75;
fs=50e3;
C=640e-6;
L=1.2e-3;
H=tf([d*Vo,-L*I_L],[L*C,L/R,d^2]); display(H);
[Gm,Pm,Wcg,Wcp] = margin(H)
figure(1) bode(H)
margin(H); [p,z] =
pzmap(H); grid
G=tf(d',[L*C,L/R,d^2]);
display(G);
[Gm,Pm,Wcg,Wcp] = margin(G)
figure(2) bode(G)
margin(G); [p,z] =
pzmap(G); grid
```

3.7 Bode Plots of Boost converter:



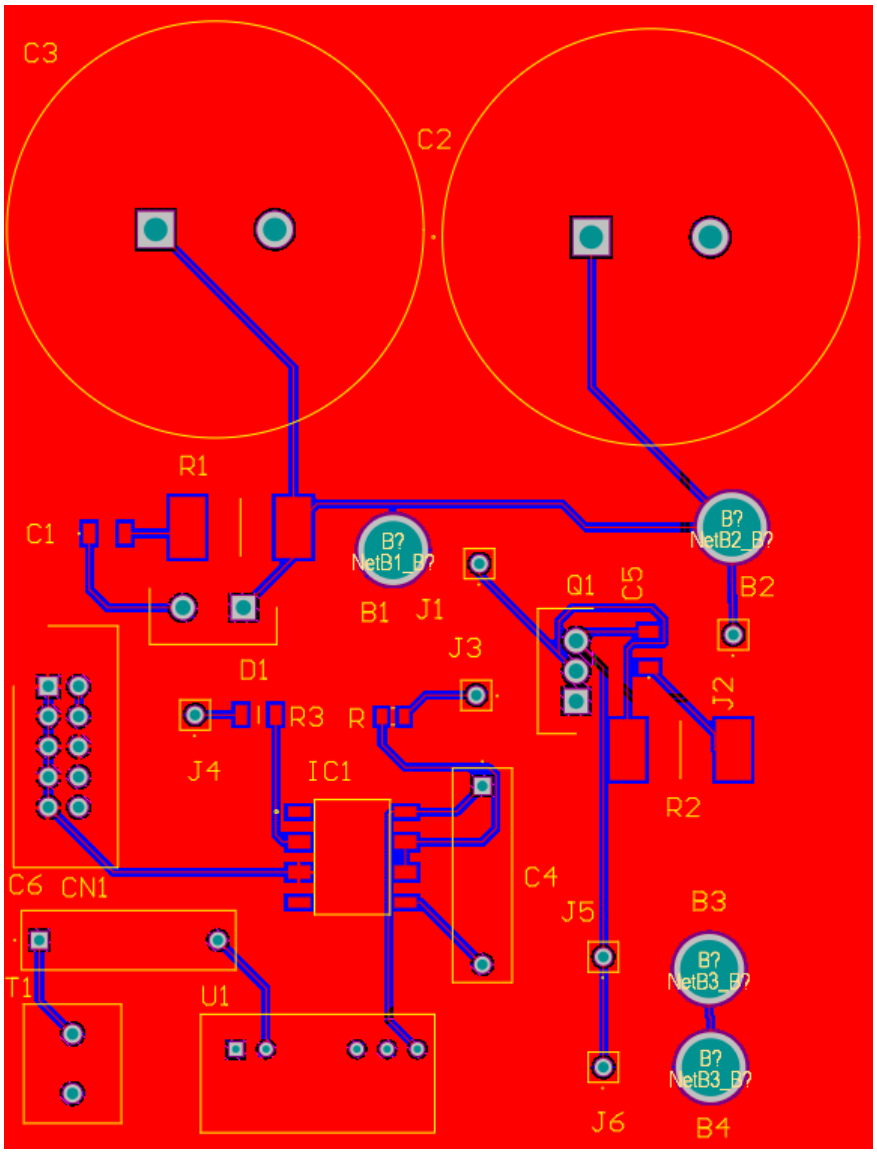


3.8 PCB Schematic:

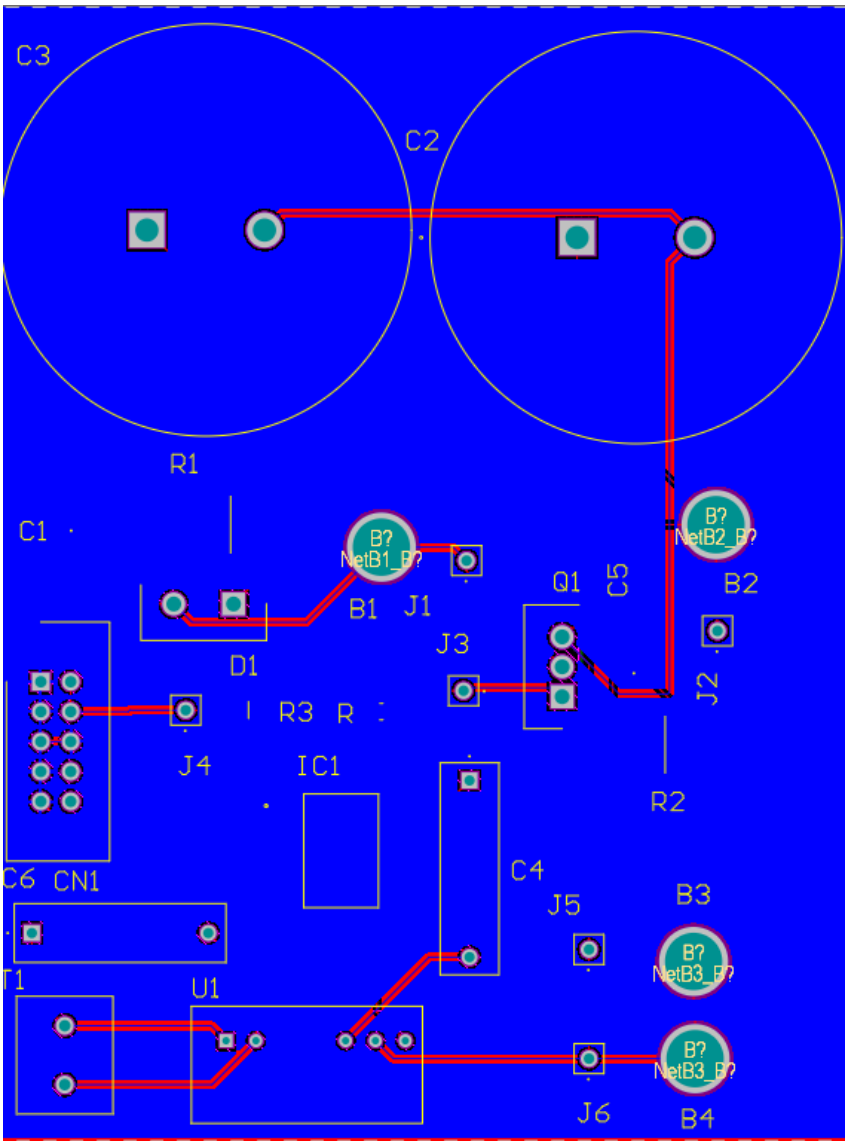


3.9 PCB Board:

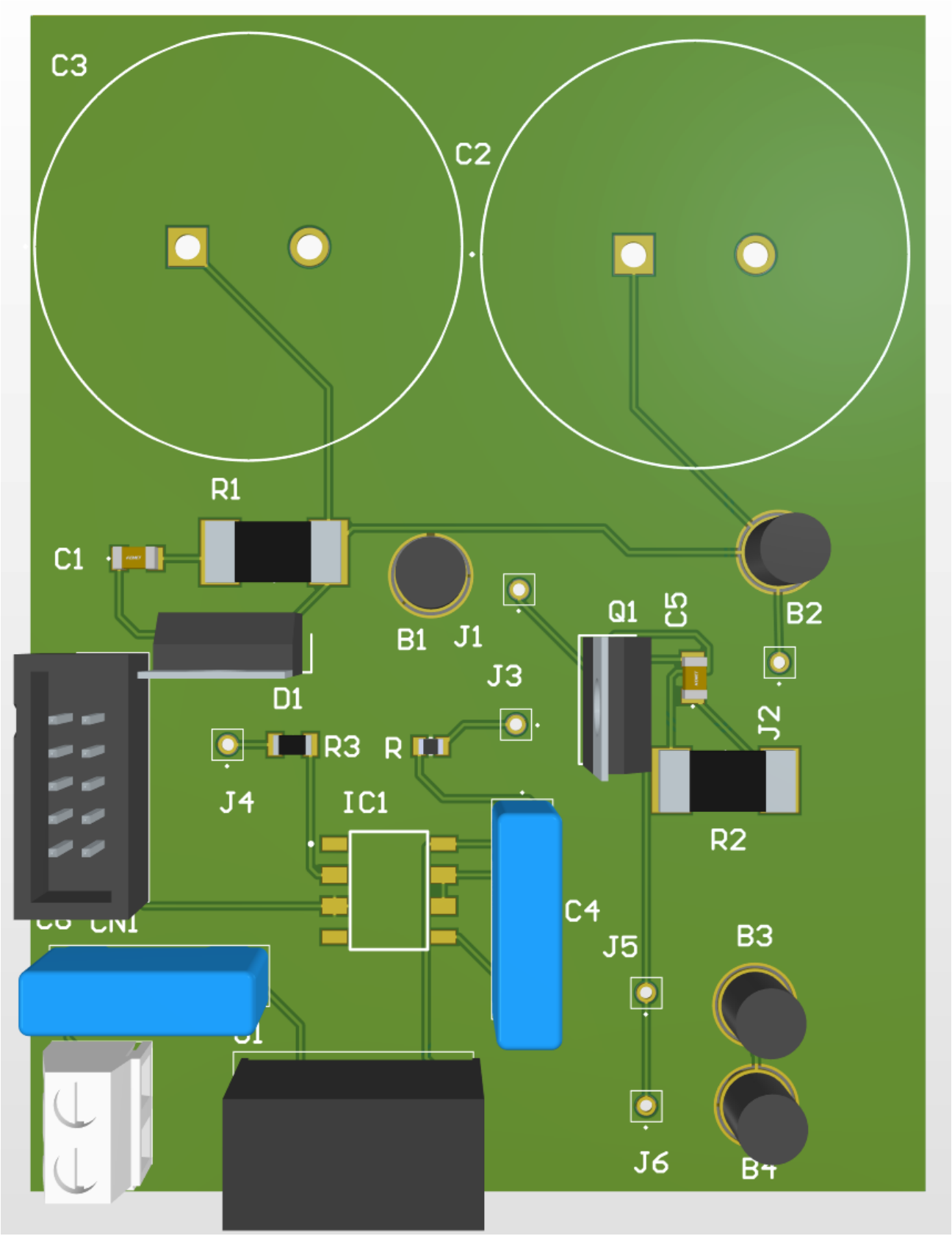
TOP LAYER



BOTTOM LAYER



3.10: Manufacturing Board of PCB



Conclusion:

I successfully created the simulation of BOOST CONVERTER in Matlab simulink,and its schematic and layout in Altium Designer and generated the final Gerber files and Bill of Materials for manufacturing the board.