The Forward Converter topology is selected for our design. It is wanted to obtain 12 V at the output when voltages between 24-48 V given from the input.

There will also a third winding in order to provide a path for magnetizing current when the switch is open. N_3 is chosen equal to N_1 ,which yields a D_{max} of 0.5.

We have chose our duty cycle as 0.4. From the relation between the input and output of the forward converter,

$$\frac{V\,out}{V\,in} = \frac{N_2}{N_1} \times D$$

$$\frac{12}{24} = \frac{N_2}{N_1} \times 0.4$$

$\frac{N_2}{N_1}$ is founded as 30/24 and we chose 32/24=4/3 as our winding ratio.

As the core, 0P43434EC is chosen. Firstly we found the primary winding turn number is found by the following formula,

$$N_{p,\,min} = \frac{V_{DC,\,min} \times D_{max}}{A_e \times f_s \times \Delta B}$$

$A_e = 97.1\ mm^2$ for our selected core.

Operating frequency, f_s is chosen as 35 kHz.

Flux density at this operating point is approximately 0.2 T.

$N_{p,\,min} = 14.12$, hence 15 is chosen as the primary turn number. From the turns ratio, secondary winding turn number can also be found.

$$N_p = 15$$

$$N_s = \frac{N_2}{N_1} \times N_p = 20$$

$$L_m = A_L \times N_p^2 \times 10^{-9} = 0.66\ mH$$

$$I_{reset} = \frac{V_{DC,\,min} \times D_{max}}{L_m \times f_s} \times \sqrt{\frac{D_{max}}{3}} = 0.15\ A = 150\ mA$$

$$I_{secondary} = I_o \times \sqrt{\left(3 + K_{RF}^2\right) \frac{D_{max}}{3}} = 2.16\ \text{A}$$

K_{RF} is taken as 0.1 for practical design purposes.

$I_o = \frac{50}{12} = 4.16\ A$