1. **Magnetic Design**
   1. Power Calculations

The design of the transformer is one of the most critical parts of flyback topology. The maximum duty cycle for this design is 0.5 and the flyback operates at CCM. To design transformer and choose core, the worst-case Lm can be calculated from the Equation M1 firstly [M1].

(M1)

In the equation, Vmin is given as 12V and Dmax is specified before as 0.5. The desired efficiency is 85%. Therefore, from output power requirements, input power can be found as around 56.5W. The Lm can be found as 13.3uH from equation M1. In the next step to find turns ratio, peak and rms current value of primary side must be found. The peak current and rms can be found from the equation M2 and M3 respectively.

(M2)  
 (M3)

From equation M2 and M3 peak and rms current can be found as 18.8A and 7.68A respectively. After these parameters are calculated, the saturation of flux density must be specified. Since there is no limitation for this design, Bmax can be selected as 0.3T. With these parameters the core for transformer was selected.

* 1. Core Selection

There are two important parts of core selection. One of them is core type and another one is dimensions and magnetic parameters of the core. In this design, two types of cores were considered because of other cores’ prices. These are powdered core and ferrite core. Even if powdered core store more energy than ferrite core, the ferrite core has higher magnetic permeability for high frequencies. Since the switching frequency of the design is 60kHz, ferrite will be a more reasonable option. This low permeability can cause more leakage inductance for powdered core. Because of these reasons, ferrite core was chosen as core type.

Two ferrite core option was simulated with all calculations. These are 00K3515E090 and E42/21/20-3C94.

Therefore, E42/21/20-3C94 was selected as core of the flyback transformer.

* 1. Transformer Characteristics and Calculations
  2. Cable Selection
  3. Core and Copper Loss