**Magnetic Design**

In order to design magnetic design, first the area product is calculated.

To have a realistic core model fill factor is chosen as 0.05. According to the research, frequency of 67kHz is the most used frequency for flyback converter, it might be said that 67kHz is the standard. After calculating the area product, available component list is checked and 0P43434EC is chosen. Then sample circuits are investigated in Texas Instruments web page. For flyback converter UC3842 is the most used current mode controller, therefore we decided to use that integrated chip.

Diagram

Description automatically generated

Figure xx: Sample Flyback Converter Circuit with UC3842

In this circuit the magnetizing inductance of primary side is calculated as 42uH and 47uH is decided to be used to have less current ripple. Then minimum number of turns is calculated to not to saturate the core.

Number of turns is chosen as 1.375 then;

These values are the minimum number of turns for primary and secondary.

In order to achieve 47uH, there should be some airgap in the core. To find the airgap, one should obtain the required air reluctance.

In order to have meaningful air gap AL is chosen as 400nH.

Considering an A4 paper, this airgap value corresponds about 2 A4 paper width. After airgap calculations, number of turns is calculated to achieve 47uH magnetizing inductance.

**CABLE SELECTION**

In order to select an appropriate cable for transformer, RMS current on the primary and secondary side of the transformer are simulated.

Chart

Description automatically generated

Figure xx: Current Waveform on Primary Side

Graphical user interface

Description automatically generated with medium confidence

Figure xx: RMS Value of IL1

Chart, bar chart

Description automatically generated

Figure xx: Current Waveform on Secondary Side

Graphical user interface

Description automatically generated

Figure xx: RMS Value of IL2

According to the results, current on primary side 3.4A and on secondary side is 4.32A.

Table xx: Cable Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| AWG Number | Conductor Cross Section Area(mm2) | Ohms Per mm | Maximum Frequency for 100% Skin Depth |
| 26 | 0.162 | 0.0001061736 | 85kHz |

For primary side

For secondary side

According to the calculations, cables should be paralleled, 5 for primary and 7 for secondary. To do that, we twisted the cables to prevent proximity effect. After winding the transformer, we measured its inductance and leakage inductance.

Graphical user interface

Description automatically generated A picture containing text, indoor, shelf

Description automatically generated

Figure xx: Inductance Measurement Figure xx: Leakage Inductance Measurement

In order to measure the leakage inductance, secondary side is shorted. Note that, since cables are isolated, to measure isolation on the cables are removed. However, because they are not removed completely the resistance is higher than expected. Leakage inductance is higher than the standards, it is because winding operation is completed without tools.