**EE 464 – HOMEWORK 2**

**SPECS**

Specifications of the project are listed as follows:

* **Minimum Input Voltage**: 12 V
* **Maximum Input Voltage**: 18 V
* **Output Voltage**: 48 V
* **Output Power**: 48 W
* **Output Voltage Peak-to-Peak Ripple**: 3%
* **Line Regulation**(Deviation of percent output voltage when input voltage is changed from its minimum to maximum or vice versa): 3%
* **Load Regulation**(Deviation of percent output voltage when load current is changed from 10% to 100% or vice versa): 3%

**a)**

Let’s choose duty cycle range as

for safe operation After that, boundaries of turns ratio becomes,

Let’s select turns ratio = N1/N2 = 1/3. After that,

Then,

when N2/N1 = 3.

**b)**

In order to design convenient transformer, the magnetizing inductance should be decided. Maximum, average and RMS value magnetizing current should be calculated. When the switch is on, input current is equal to magnetizing current. However, input current is equal to 0 when the switch is off.

When the input voltage is equal to 12 V, duty cycle is equal to 0.58. Then,

When the input voltage is equal to 18 V, duty cycle is equal to 0.47. After that,

The ripple current formula is given below as;

We assume that fs = 50 kHz because a lot of controllers work at that frequency. Moreover, we should consider the case of input voltage = 18 V and D = 0.47 because ripple current is larger for larger Vin\*D values for same inductance value. In this case, the maximum ripple current would be equal to 5.67\*2 = 11.34 A to stay at continous conduction mode. Hence,

For the case of input voltage = 12 V, D = 0.58 and ripple current = 6.9\*2 = 13.8 A;

This result also verifies that Lm should be greater than 14.92 uH. However, inductance value can be taken as Lm = 12 uH to guarantee safe operation.

To decide the Lm current ripple we consider the 10% load case. for Vin = 18V as the lowest inductor current should be considered for not crossing DCM. Then;

= 1.134A

Imax = 6.9 + 1.134/2 = 7.467A

Then,