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**EE464 STATIC POWER CONVERSION II**

**Homework #2: Magnetic Design of the Hardware Project**

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Deadline: 30/04/2023 23:59

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## Introduction

Explain the content and the aim

## Answers

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%

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.

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.

To decide the Lm current ripple we consider the 10% load case. For Vin = 18V, the minimum inductor current should not be dropping to zero. Then;

= 1.134A

Imax = 6.9 + 1.134/2 = 7.467A

Then,

For the core selection, we consider magnetic flux, cross sectional area of the core and copper properties. First, we searched the ferrite cores, however, they are not suitable for flyback converter design if we do not use air gap. The reason is that they have large permeability so that they are not convenient for storing energy. Then, we look at Kool Mu cores from Magnetics from the excel table. We prepared Matlab Script that we also added it to the Github repository. We compared different cores from the Excel table that are already in the lab and will come in the May. The core 00K4022E090 satisfied the requirements as follows:

We have calculated to primary number of turns as;

However, the number of turns should be integer number. Therefore we have taken as

After that, we have calculated the reluctance of the core from the formula of

Then, the maximum flux in the core is calculated

From the part a, we calculated Imax as a 7.467 A.

## A

## A

## A

1. **Figures with white background, axes names with good font.**
2. **Grammarly.**

## Conclusions

NOT SUMMARY