## **Magnetic Design**

### **a) Core selection**

For core selection, looking at area product of the core is a good start. Assume that the fill factor should be larger or equal to 0.3. Then, the limit of area product can be calculated as follows:

**We decided Bac,max=0.12T** which is below the saturation point of the cores we are investigating (0.3-0.47T). Also, maximum magnetic flux density is obtained when Vin=24V. **Also, the current density is assumed as Jrms= 4A/mm2**

**Choosing WaAc of core=0.04cm4 which satisfies the above condition,**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Effective crosssectional area Ae (mm2)** | **Maximum Magnetic Flux density (T)** | **AL-value with the air gap (nH/N^2)** |
| **B66307G0500X187 [2]** | **20.12** | **0.49** | **110** |

**[2]** [**https://www.tdk-electronics.tdk.com/inf/80/db/fer/e\_16\_8\_5.pdf**](https://www.tdk-electronics.tdk.com/inf/80/db/fer/e_16_8_5.pdf)

**This core is chosen since it has low AL with gap and cross-section is small compared to the others. 110nH/T2 is required to obtain the assumed magnetic flux density. 110nH/T2 can be obtained by the addition of 0.24mm air gap. This will be proved after other calculations. Also, a minimum cross-section that satisfies area product expectations is selected to make the most compact design.**

**Saturation flux density of the core is checked, and saturation value of the core is 0.49T for N87 material. Therefore, the core would not saturate.**

**tablo içeren bir resim

Açıklama otomatik olarak oluşturuldu**

* **Calculation of turn numbers,**

**Firstly find the condition that satisfy the core is not saturated,**

**Find the turn number,**

As calculated, primary turn number is larger than saturation turn number.

As it is seen from the calculations, number of turns in primary secondary windings are selected as 12 and 8 respectively.

* Calculation of peak currents,

@ Vin=24V(BCM)

@ Vin=48V(DCM)

Since it is in BCM, ripple current is equal to maximum current,

* Also, it is important to be sure expected magnetic flux density is obtained,

## b) Cable Selection

Choose,

We have decided to use 4 parallel connected 26AWG instead of one AWG copper for primary, and 6 parallel connected 26AWG cable instead of one copper cable. Since cables with a larger cross-section have a smaller maximum frequency for 100% skin depth, we have decided to multiple cables that have enough maximum frequency for 100% skin depth instead of one cable. The maximum frequency for 100% skin depths is 107kHz for 26 AWG.This selection makes AC and DC resistances the same since we operate with 100% skin depth.

* Calculation of fill factor,