Calculations for T-Core inductor

Inputs <<   Yellow color are input

Results << Green Color are results

Calculate the inductor power

$Ipeak := 8A$ — Peak current of the inductor

$L := 33\mu H$ — Required Inductance

$mJ := J \cdot 10^{-3}$ — Conversion from Joules to miliJoules

$E := \frac{1}{2} \cdot L \cdot Ipeak^2 = 1.056 \cdot mJ$ — Energy Required by core

Make selection of the core material and core size

> Selelect core material, then check core size you would like to use.
> This might need to be altered later depending on the losses and
> heat dessipation. remember lower permibiality can store more energy
> at the cost of size.
> ref :http://www.micrometals.com/parts_index.html

In this case the core selected is **T106-26.**

$nH := 10^{-9} H$ — Conversion from Henry to nano henry

$AL := 93nH$ — Inductance per turn

$\%\mu := 53\%$ — From the table find the % initial permieblity at that saturation

$Turns := \sqrt{\dfrac{L}{AL \cdot \%\mu}}$ — Calculating turns required

$Turns = 25.875$

Calculating Copperloss

$MLT := 4.49cm$ — MLT for the selected Core available in Application notes Iron Powder Cores for Switchmode Power Supply Inductors

$SA := 31 cm^2$ Surface area of the core

Selected Wire is 14AWG

$m\Omega := 10^{-3}\Omega$ Conversion of Ohm to miliOhm

$\rho := 0.842 \dfrac{m\Omega}{cm}$ Find this value in above mentioned Application note

$\phi := \rho \cdot MLT \cdot Turns$ Calculating resistance of wire

$\phi = 0.098 \ \Omega$

$Irms := 3 amp$ Rms Current flowing through the coil

$Wloss := Irms^2 \cdot \phi$ Calculate Watts lost in coil heating

$Wloss = 0.88 \ W$

$Coreloss := 83 \dfrac{mW}{cm^3}$ Coreloss

$Corearea := 0.659 cm^3$ Area of the core given in datasheet

$Tcoreloss := Corearea \cdot Coreloss$ Calculate the total core losses

$Tcoreloss = 0.055 \ W$

$Totalloss := Tcoreloss + Wloss$

$$Trise := \left(\dfrac{Totalloss \cdot cm^2 \cdot 10^3}{SA \cdot W} \right)^{0.833} \ °C$$

$Trise = 17 \cdot °C$ Temperature rise over ambient temperature