Construction of electronic systems

Exercise 3: USB DAQ project
Power supply schematics

Short explanations regarding the tasks

Task 4 – understanding the ADP1613 controller

Our DAQ system contains a switched-mode power supply unit (SMPS). Switched-mode power supplies can be problematic because of the electromagnetic interferences they can generate due to their switching mode of operation, which causes fast voltage and current transients. In order to be able to minimize the electromagnetic interference (EMI) generated by a switched-mode power supply, one must first understand how such a power supply circuit works.

Therefore, study the application note of our SMPS controller to the degree where you get a general idea how the power flows from the input to the output. You will find out that this controller actually employs two different *converter topologies* at the same time: the SEPIC converter and the Ćuk converter. You can also study their operation using the online simulations provided by the links above.

It turns out that the two inductors that the SEPIC (or Ćuk) topology contains can be wound on a *same ferrite core*, which means that the two inductors can be replaced with so-called *coupled inductors* (slo. sklopljeni tuljavi). Coupled inductors are, in a way, similar to transformers, but their application is different: coupled inductors can store energy in their core, while the transformers are not meant for storing the energy, but for transferring the energy from one inductor to the other.

Task 5 – the "*split*" analog power supply

The so-called *split power supply* means that the power supply circuit provides two supply voltages that are *equal in magnitude but have opposite polarities* (e.g. +15 V and –15V). In our case we use a step-up SMPS to generate such a split power supply from the USB +5V power supply voltage. Such a split power supply voltage is then used to supply the output signal amplifiers, enabling them to generate larger output signals between ±12 V.

Task 5 – creating a module using a sheet symbol

When the power supply schematic is finished, you will use the "Power_supply.SchDoc" document to create a missing module in the top schematic of our USB DAQ project. See below.
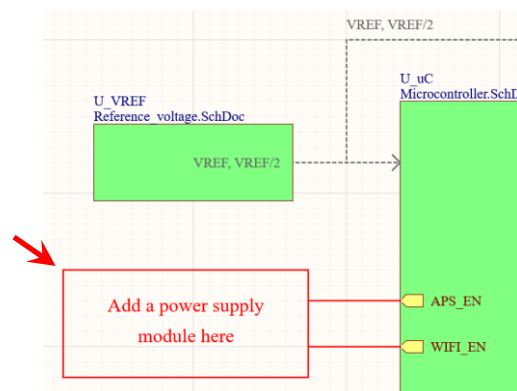

Figure 1 - create a missing module using the "sheet symbol" object

In this way you will gradually complete the missing parts of the USB DAQ hierarchical schematic.