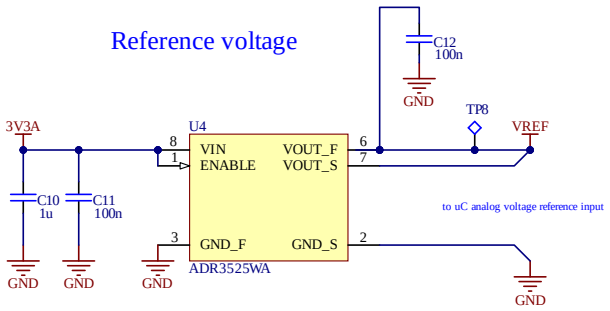
Construction of Electronic Systems

Exercise 11: USB DAQ project: designing the rest of the PCB

Designing the reference voltage part for precision



Slika 1 - the analog section that provides the precise reference voltage for the A/D conversion

The reference voltage is critical because it is used in analog-to-digital conversion where, in a way, it provides a basic unit for measuring all other voltages. Due to this important role we would definitely like to ensure that the reference voltage is as precise as possible (the DC part of the reference signal) and containing as little noise as possible (the AC part of the reference signal).

By now you already know how to prevent noise-coupling into the signal:

- by keeping the sensitive signals short,
- current loops small,
- using additional low-pass filters,
- and by wisely placing the filter components.

This means that the voltage reference part should be *placed near the microprocessor where the reference voltage is needed*.

But how to ensure that the reference voltage stays precise and that the precision is not lost on the way to the A/D converter? This is solved by an additional pair of so-called *sense connections* that provide the *feedback information about the actual reference voltage at the point where it is needed*. See the idea below (taken from the datasheet).

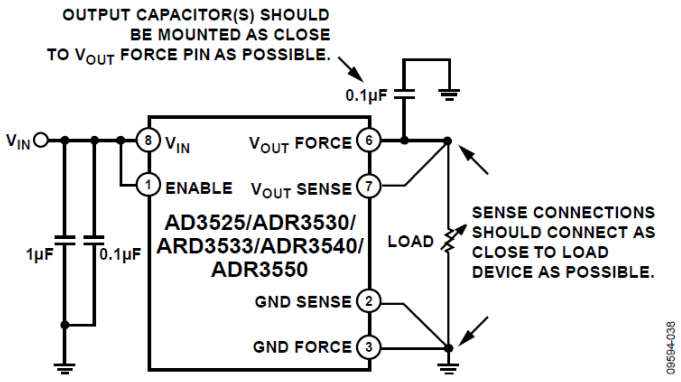


Figure 38. Application Showing Kelvin Connection

Figure 1 - sensing the voltage at the point where it is actually needed (i.e. at the load) can help improve the reference voltage precision

Obviously, you need to be careful with how you route these two sense connections. You will have to try to ensure that the voltage between the $V_{OUT\ SENSE}$ and GND_{SENSE} really reflects the reference voltage for the A/D conversion, that is the voltage between the ADVREF pin and the GND pin of the microcontroller.

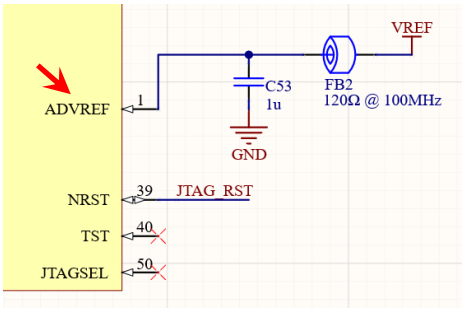


Figure 2 - the ADVREF microcontroller pin is where the A/D converter gets the reference voltage