Lab activities for the 2nd week of ECE 432/532

Spring 2016

Goal of the lab activities is to have students do the DC and S-parameter measurements on actual transistors (SAV 541+ from MiniCircuits). Device data (specs etc) can be found on their website www.minicircuits.com (do a search on SAV-541+).

We will attempt to replicate specified characteristics:

1. Output curves (I_{DS} vs. V_{DS} for fixed V_{GS}; see documentation for the plot)
2. Transfer curve(s) – this is not specified but it is useful to know and to illustrate where the threshold voltage is: I_{DS} vs. V_{GS} for fixed V_{DS}. The range of V_{GS} is 0 – 0.7 V (100 mA max), and V_{DS} can be set to 3V.
3. Gain characteristics vs. frequency and Gain vs. I_{DS}.
4. S-parameters vs. frequency for one or two bias points. Chose bias points to make comparison with manufacturer's data easy (or easier).

There will be two groups, one for DC and another for S-parameter measurements but everyone is expected to do both sets of measurements. Here are a few things to report on:

1. Discuss what "bias-T" is, its function and how it is made.
2. Make nice plots of items 1 – 2 above. For item 1 comment on how well it compares with specs. For item two, plot the I-V curve but also calculate g_m (transconductance) and overlay it. Comment on the dependence of g_m on I_{DS}. What are the pros and cons of trying to maximize g_m?
3. For items 3 and 4 compare measured data with S-parameters provided by the company (it's in Touchstone format). Do it separately for all four S parameters and use dB plots for magnitude. For S_{11} and S_{22} also plot Smith chart and compare the two results.
4. Measure S-parameters for the fixture and try to use our deembedding procedures from 431/531. Comment on whether this improves the data overall and comparison with manufacturer's data? (for this we may have to de-solder some parts first)
5. Try to replicate $|S_{21}|$ and MSG/MAG plots from manufacturer's specs; comment on agreement.
6. As usual, discuss two new things that you learned last week and that you find interesting.