

MOSFETs and IV Curves

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1 Introduction

DACs (Digital to Analog Converters) are used in all sorts of electrical equipment. Especially those with a sensor of any kind. A R 2R Ladder is a simple way to design and implement a DAC. Although you can make a R 2R Ladder fairly simply in Electric VLSI, It is advantageous to make the ladder modular so creating DACs with varying number of bits is easier. It is also important to be able to generate a layout of these components so that they can easily be converted to real life components. This paper will go over my process of creating an improved R 2R ladder DAC in Electric VLSI and LTSpice.

2 Materials and Methods

Our first task was to create the schematic of the R 2R subcells and group them together in a 10bit DAC as per the instructions in http://www.yilectronics.com/Courses/ENGR338L_CE/f2021/lab3_DAC_Layout/Lab3.html. This DAC is computationally identical to the ladder in lab 2, however now we have the capability to easily add more bits need be.

The second task is to create the layout of the subcell and ladder. This is done by placing the MOCMOS N-RWells in the same configuration as the schematic, but in a rectangular formation since it saves more space. Then those layouts are imported to the R 2R layout and connected in the same way the schematic is.

3 Results

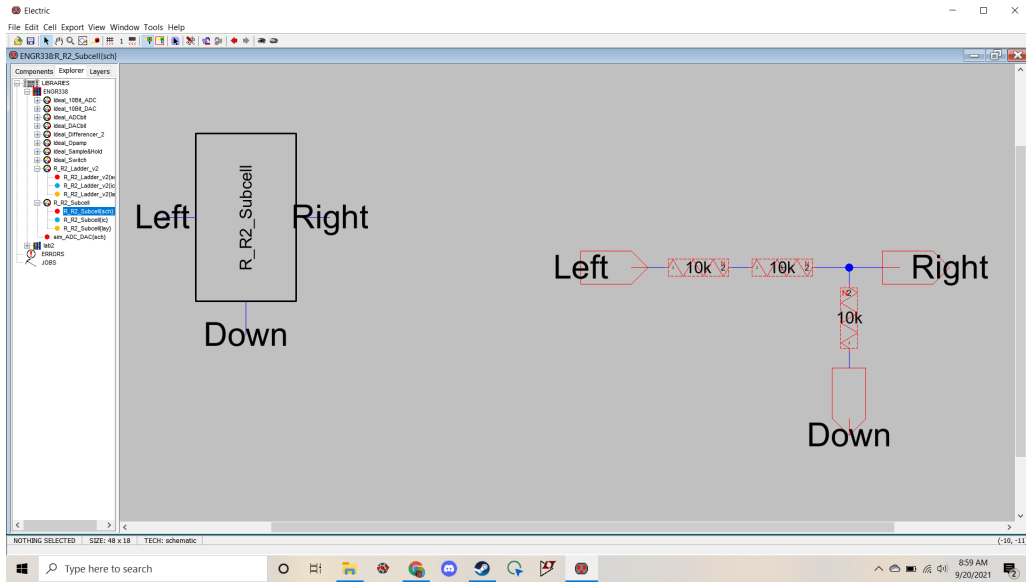


Figure 1:R 2R Ladder Subcell

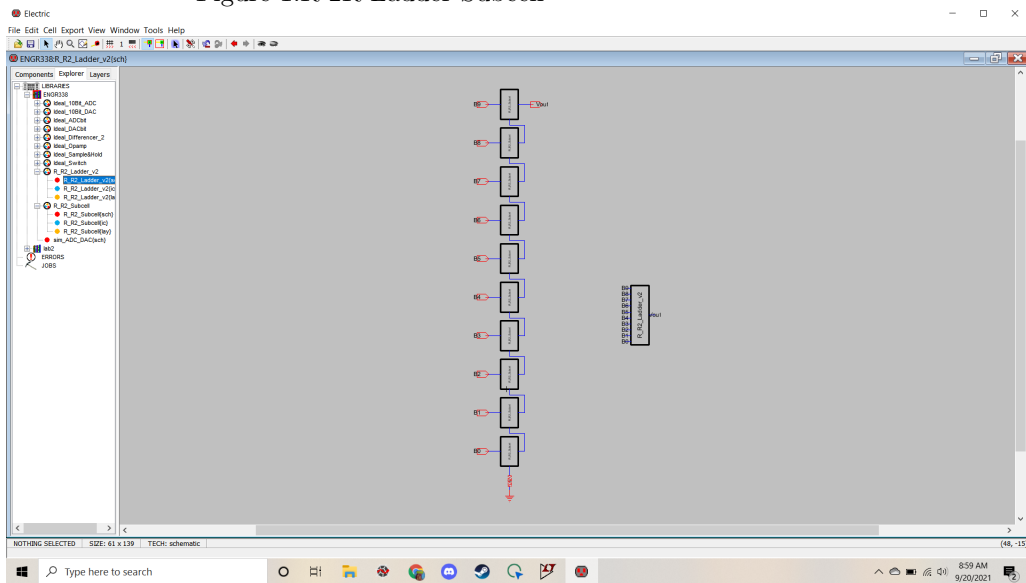


Figure 2:R 2R Ladder made of Subcell Connections

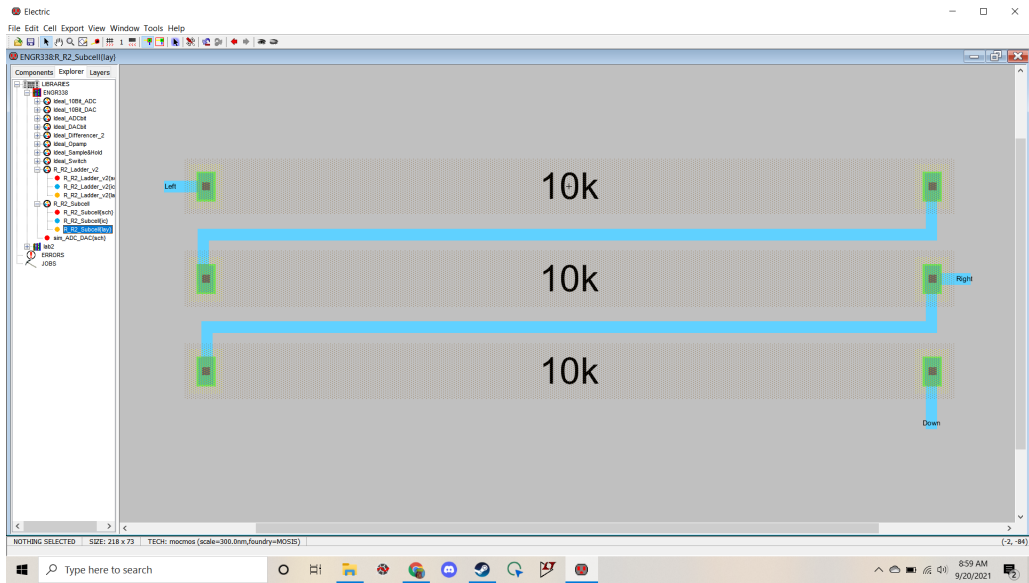


Figure 3:R 2R Ladder Subcell layout made of N-RWell Resistors

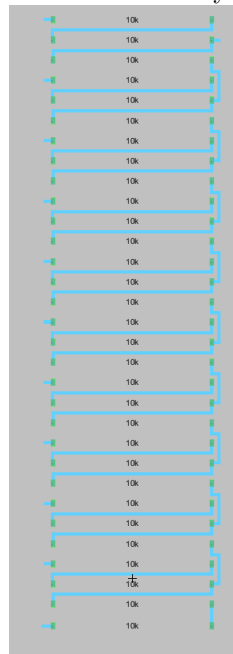


Figure 4:R 2R Ladder Layout with N-RWell Resistors Visible (note the export ports B0-B9, Vout, and gnd are there, I just couldn't get their text size to increase)

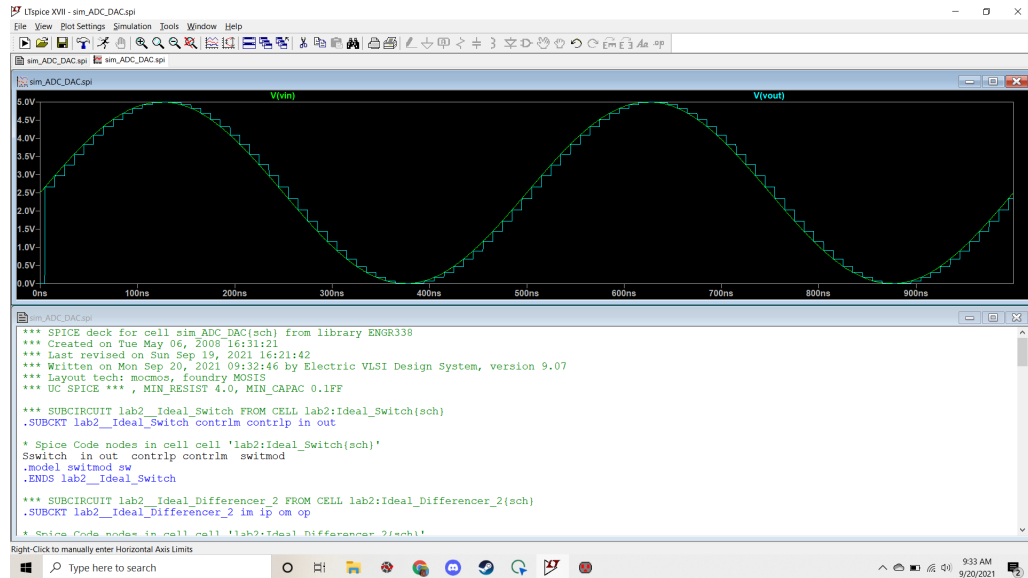


Figure 5: Sinusoidal Input (Green) and R 2R Ladder DAC output (Blue)

4 Discussion

Task one was fairly simple since it was nearly the same process as lab 2, just one more step of abstraction between the resistors and the ladder itself. Task 2 ended up being far more difficult for me since I had the scale preference incorrectly set and it wouldn't let me change it mid-project. However restarting the library with the correct setting corrected the error and enabled me to complete task 2 with no trouble. Finally to check if everything worked correctly, the DAC was tested against a sinusoidal input as shown in Figure 5. The DAC shows stepping alongside the wave as it should so all worked correctly.