

Lab 7: OPAMP Phase Shift Oscillator

Introduction

"We don't take a trip. The trip takes us."
- John Steinbeck

Lab procedure

1. Draw the schematic of the following phase shift OPAMP oscillator in your lab notebook.

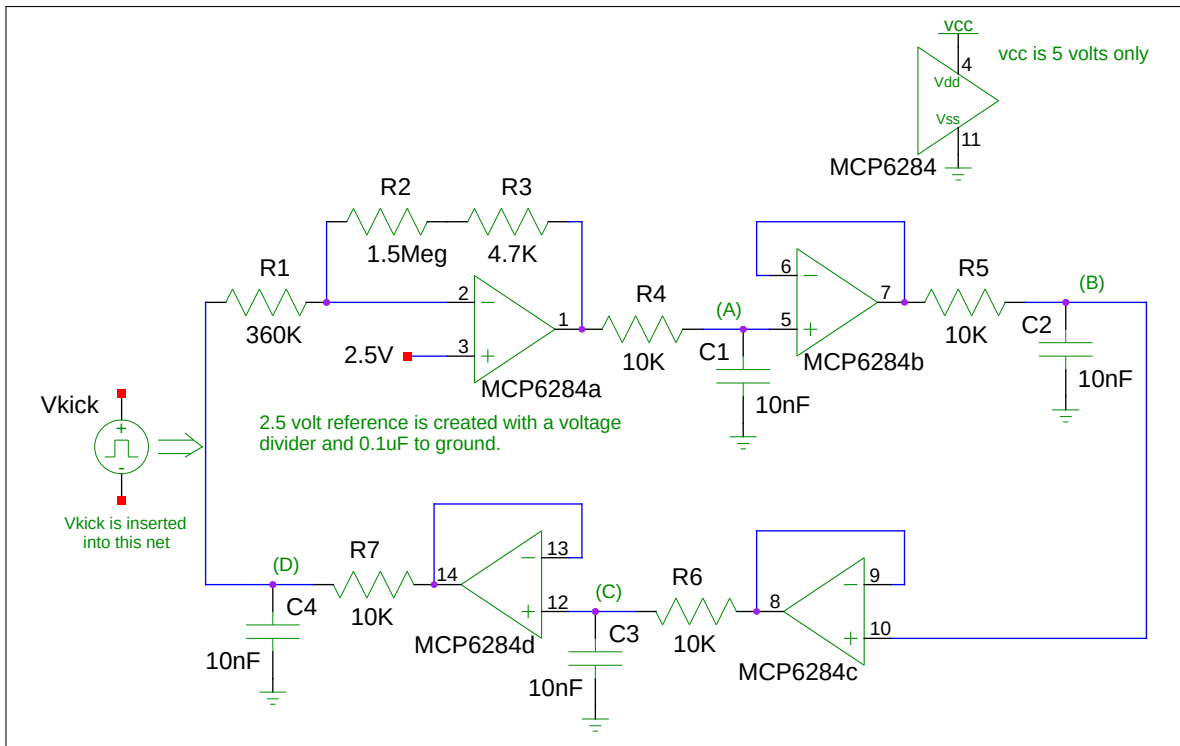


Figure 1: OPAMP Phase Shift Oscillator

2. We are using a "quad" OPAMP, the MCP6284. It has four OPAMPS in one package. All the OPAMPS are identical. Thus, you only need one IC. If you want to swap some pins so that construction is easier, that is fine but record your changes.

3. The 2.5V reference is created with a voltage divider using two equal-size resistors greater than 1K ohm. At the junction of the resistors, put a 0.1uF capacitor to ground to provide a low impedance AC ground.
4. Create an ngspice file for this circuit and simulate it but with R3 set to zero ohms. Each OPAMP is created with a separate instantiation of a subcircuit representing the amplifier. You must include the subcircuit file in the same way you did with model files. Look inside the subcircuit file: [MCP6281.subckt](#). to determine the correct connection to each amplifier. You will need four separate subcircuit statements where each starts with an "X" in column one. One instantiation would look like this:

```
XOPAMP1 in_pos1 in_neg1 vcc gnd opamp_out1 MCP6281 ;OPAMP "a"
```

Note that manufacturers model only one amplifier per subcircuit file. This is why you see the file as "6281", not "6284". There is no need to model 4 identical amplifiers.

You will also need to include a 1V, 1mS "kicker" to start the oscillator. The parameters for the kicker voltage source are:

```
pulse(0 1 1.0m 0.1u 0.1u 0.1m 2 0) ; 1V kick
```

Use a V_{dd} of 5V. The oscillator should oscillate around 10Khz. Plot the nodes A, B, C, and D in such a way that the phase difference at each node is clearly seen. Repeatedly decrease R2, by 10K ohms or so and rerun the simulation. At what point does the oscillation stop? Why?

5. Build the circuit on your protoboard but include R3 as the schematic shows. The circuit must be built as you have been shown previously. If not, you will receive greatly reduced credit.

Your lab notebook should have the following:

- The schematic diagram and ngspice file you created for simulation
- Results from your simulation showing correct operation of the oscillator

Show your working circuit to your TA.