EL 351 - Linear Integrated Circuits Laboratory
Sample and Hold Integrated Circuit and Test

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Equipment:

- Agilent 54622A Deep-Memory Oscilloscope
- Agilent E3631A Triple-Output DC power supply
- Agilent 33120A Function Generator
- Agilent 34401A Digital Multimeter

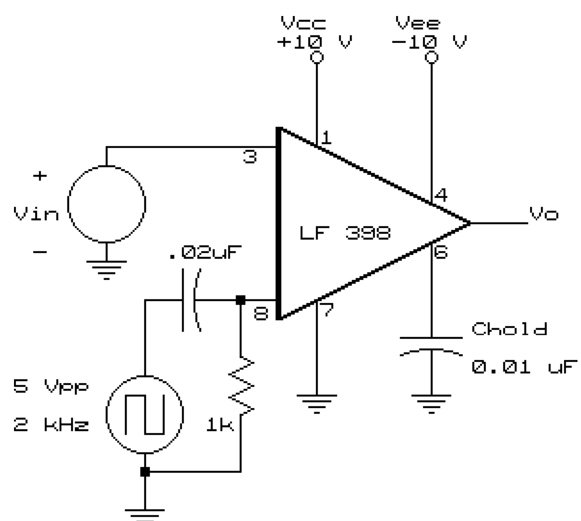
Introduction:

Analog signals, such as music, are often converted to, and stored in, digital form. To do this, the analog signal is periodically ***sampled*** (its instantaneous value is acquired by a circuit), and that constant value is then held and is converted to a digital word. For example, music signals are often sampled at 44 kHz, which means there are just a bit more than 20 microseconds available to sample, hold, and then convert the sampled value to a digital word. Then, the whole process of sample/hold/convert happens again.

So, any type of analog-to-digital converter must contain, or be preceded by, a circuit which holds the voltage at the input to the ADC converter constant during the entire conversion time. Conversion times vary widely, from nanoseconds (for flash ADCs) to microseconds (for successive approximation ADCs) to hundreds of milliseconds (for dual-slope integrator ADCs). In this experiment you will use a sample and hold integrated circuit, controlled by an external clock signal, and observe its output for a variety of input signals. In addition, the ***droop rate*** of the sample and hold IC will be measured with different values of hold capacitor.

Procedure:

I. Sample and Hold Circuit Output Voltage



1. Construct the circuit shown. For the C_{HOLD} capacitor, quality is very important. Use a capacitor with a mica, polystyrene or polypropylene dielectric.
2. Observe and record the voltage on the clock input (pin 8).
3. Adjust Vin to be a 4 Vpp sinusoid at 10 Hz. Observe it on channel 1, and make it the trigger source. Observe Vo on channel 2, changing the frequency slightly, as needed, so that the display is stable. Record Vin and Vo.
4. Repeat step 3, with Vin = 100 Hz.

5. Repeat step 3, with Vin = 1,000 Hz.

6. Now change Vin to a 4 Vpp, 50 Hz triangle waveform. Record Vin and Vo.

II. Droop Rate Determination

1. Let Vin = 1 VDC from a DC power supply (be sure to disconnect the function generator).

2. Measure Vo with a DC voltmeter while the 2 kHz differentiated squarewave is clocking the LF398 IC.

3. Disconnect the clock input, and observe Vo on a DC voltmeter for 60 seconds. Record Vo at the end of 60 seconds.

4. Calculate the droop rate in volts/sec.

5. Replace C_{HOLD} with a 500 pF capacitor. Repeat II.2, II.3 and II.4.

Lab Report:

1. What is the time constant of the RC network providing the sample commands to the logic input (pin 8 of the LF398)? Why was this network used (instead of connecting the squarewave to pin 8 directly)?

2. In parts I.3, I.4 and I.5, was the Nyquist criterion satisfied? Was the output voltage a good representation of the input voltage for all three input frequencies (10, 100 and 1000 Hz)?

3. Compare the droop rate you measured in part II with the manufacturer’s specified value.

4. Based on the measured droop rate in II.4, what value of current was flowing out of the hold capacitor? Where did this current go?