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title: Prelab 0 author: Victor Perez Contreras date: April 11, 2025_____

1 Part 0

None.

2 Part 1:

1. Split rail buffer:

Split Rail Buffer

Figure 1: Split Rail Buffer

What voltage do you expect the buffered rail to have?

How much current can you draw from it?

Where do you need to inject its output?

2. Non-inverting amplifier:

Non-Inverting Amplifier

Figure 2: Non-Inverting Amplifier

For the amplifier, sketch an illustrative input trace and the expected output trace.

You'll need to pick resistor values.

Make sure this is for single-ended (0-3.3V) power.

3. Peak detector:

Peak Detector

Figure 3: Peak Detector

Sketch an illustrative input trace and the expected output trace.

Peak Detector Trace

Figure 4: Peak Detector Trace

What is a suitable decay time given the input?

The decay time depends on the beacon that is utilized. For my prelab I will assume a beacon frequency of 2.5kHz. Thus, the period would be 0.4 ms (T). For the decay to fall within the frequency, the decay τ must be below the period, T.

$$\tau < T$$

For a reasonably fast τ let,

$$\tau = \frac{T}{2}$$

Then,

$$\tau = 0.2ms$$

What values of R and C achieve this?

4. Comparator with hysteresis:

Work out the values of resistors you need to make the low threshold 1.0v and the high threshold 1.8v.

High Thresh:

$$\frac{R_2 V_R + R_1 V_P}{R_1 + R_2}$$

Low Thresh:

$$\frac{R_2 V_R + R_1 V_N}{R_1 + R_2}$$

Note the reference voltage is usually ground so:

High Thresh:

$$\frac{R_1 V_P}{R_1 + R_2}$$

Low Thresh:

$$\frac{R_1 V_N}{R_1 + R_2}$$

Expected Values:

High Thresh = 1.8V

Low Thresh = 1.0 V

What are the values of the resistors?

5. LED and buffer:

Design a circuit to take the buffered output of the comparator and throw an LED and digital signal.

How much current do you expect the LED to draw when the input is at 3V?

What about 0V? For each case, is the LED on or off?

What are the shortcomings of your circuit?

3 Part 2:

Draw a schematic for the circuit:

Circuit

Figure 5: Circuit

4 Part 3: