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### Section: 009

### Lab: 04

### AD2 #: 210321AA2E82

### Date: 9/19/2024

### Abstract

The purpose of this lab was to demonstrate the fundamentals of a current mirror and how it is applied within an amplifier. An AD2 was used to generate waveforms, measure voltage, and visualize waveforms. The circuits were built on a breadboard using one ALD1106 chip. The unknown values of current and voltage within the current mirror were found. Afterwards, the current mirror was placed within an amplifier and the values for each capacitor, gain, and the largest signal that can be applied to the circuit without distortion were found. These two tasks were important in demonstrating how the circuits and theory actually apply to real life applications.

## Task 1

### Objective

The objective of this task is to demonstrate how a current mirror is built, applied, and how to measure different values within it.

### Procedure

First, the circuit shown below was constructed. Using an AD2, the voltage across and were measured. The and were then found by dividing the voltage across and by and , respectively. Next, and were plotted on excel to show how they related. Afterwards, the current was set to the one found in the prelab and and were measured for both transistors.

### Results

Circuit

A diagram of a circuit

Description automatically generated

Plots

Measurements

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **v Rref** | **v Rtest** | **Rref (ohms)** | **Rtest (ohms)** | **I Ref (A)** | **I test (A)** | **I ref (mA)** | **Itest (mA)** |
| 0.01 | 0.38 | 1000 | 1000 | 0.00001 | 0.00038 | 0.01 | 0.38 |
| 0.126 | 0.218 | 1000 | 1000 | 0.000126 | 0.000218 | 0.126 | 0.218 |
| 0.476 | 0.552 | 1000 | 1000 | 0.000476 | 0.000552 | 0.476 | 0.552 |
| 0.926 | 1.02 | 1000 | 1000 | 0.000926 | 0.00102 | 0.926 | 1.02 |
| 1.29 | 1.392 | 1000 | 1000 | 0.00129 | 0.001392 | 1.29 | 1.392 |
| 1.364 | 1.468 | 1000 | 1000 | 0.001364 | 0.001468 | 1.364 | 1.468 |
| 1.428 | 1.534 | 1000 | 1000 | 0.001428 | 0.001534 | 1.428 | 1.534 |
| 1.504 | 1.606 | 1000 | 1000 | 0.001504 | 0.001606 | 1.504 | 1.606 |
| 1.556 | 1.66 | 1000 | 1000 | 0.001556 | 0.00166 | 1.556 | 1.66 |
| 1.83 | 1.93 | 1000 | 1000 | 0.00183 | 0.00193 | 1.83 | 1.93 |
| 2.514 | 2.596 | 1000 | 1000 | 0.002514 | 0.002596 | 2.514 | 2.596 |

Value from Prelab:

= 4.91mA

at specified

|  |  |  |
| --- | --- | --- |
|  | MOSFET 1 | MOSFET 2 |
| (V) | 1.04 | 1.058 |
| (V) | 1.062 | 3.428 |

### Conclusions

The task was successful since the current mirror was successfully built. There were some difficulties originally since we originally powered the ALD1106 with both V+ and V-, but once we sorted it out, the transistors worked as expected. The values for current and resistance were found and successfully plotted by applying the circuit and the values found in the prelab.

## Task 2

### Objective

The objective of this task is to demonstrate how a current mirror is applied and used within an amplifier. The task builds on the previous task to build on the previous knowledge.

### Procedure

First,and were calculated so that each filter had a 3dB point lower than 30Hz. Using the found values from the prelab and the capacitors, the circuit was built using 1 ALD1106. The of the circuit was set to 0 and the DC value of was measured. Afterwards, the value was set to 1V by adjusting the potentiometer. A screenshot was captured when was set to be a 200 500Hz sin wave and the gain was found. Using the AD2, a plot of gain vs frequency was found. Next, the was set to a 1 5khz triangle wave. The amplitude was slowly raised until it was distorted to find the largest amplitude with no distortion.

### Results

equations:

These equations give us:

= .1uf

= 10uf

Circuit diagram

A diagram of a circuit board

Description automatically generated

DC value of :

Screenshot (ch1 / orange) and (ch2 / blue)

A screenshot of a computer

Description automatically generated

Gain

Gain v frequency - Ch1 in ch2 out

A graph with blue lines and orange lines

Description automatically generated

 1hz < f <500khz

Distortion graphs:

A screenshot of a computer

Description automatically generated  
No distortion (700mV)

A screenshot of a computer

Description automatically generated

Distortion (800mv)

A screenshot of a computer

Description automatically generated  
Very high distortion (1.2V)

### Conclusions

The task was successfully completed. The circuit was built by building upon the previous task’s circuit, and it worked as intended. The gain was successfully found and the frequency response graph looked as it should. Finally, the maximum amplitude input without distortion was found successfully. The application of a current mirror within an amplifier was demonstrated.

## References

<https://www.alldatasheet.com/datasheet-pdf/download/55017/ALD/ALD1106.html>

<https://www.youtube.com/watch?v=k85mRPqvMbE>