# The MOS Based Differential Circuits

## DC Analysis

I.   $I_1 = 112\mu A$, $I_2 = 249\mu A$, $I = 364\mu A$.
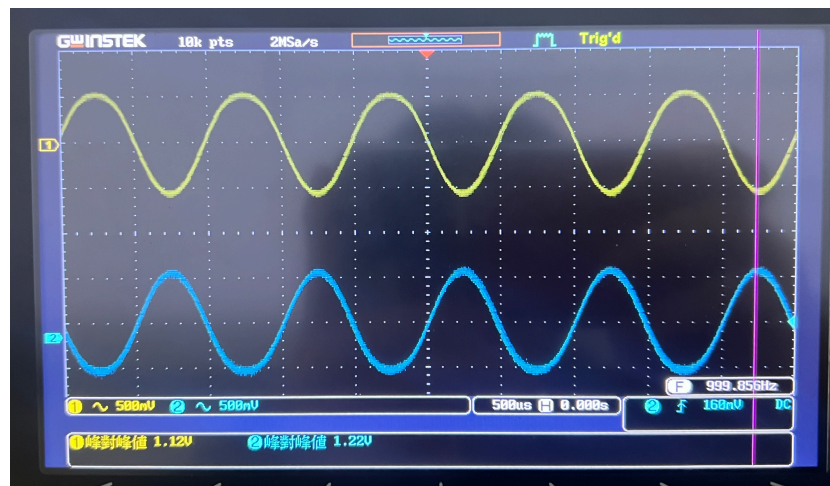
II.   $I_1 \neq I_2$

    A.   Differences in the biasing voltage applied to the gates of transistors in a differential pair can result in unequal threshold voltages. This discrepancy can lead to uneven drain currents, even if the transistors are theoretically identical.

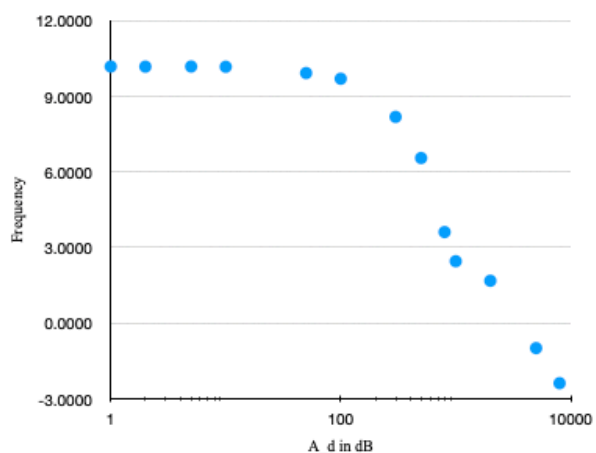III.   $I_1 + I_2 \approx I$

## AC Analysis

I.   Waveform



II.   $A_d = \dfrac{V_d}{V_i} = 3.225$

III.  Bode Plot

| Frequency(kHz) | A_d | A_d(dB) |
|---|---|---|
| 1 | 3.225 | 10.1706 |
| 2 | 3.223 | 10.1652 |
| 5 | 3.225 | 10.1706 |
| 10 | 3.221 | 10.1598 |
| 50 | 3.130 | 9.9109 |
| 100 | 3.050 | 9.6860 |
| 300 | 2.562 | 8.1716 |
| 500 | 2.123 | 6.5390 |
| 800 | 1.514 | 3.6025 |
| 1000 | 1.325 | 2.4443 |
| 2000 | 1.212 | 1.6701 |
| 5000 | 0.891 | -1.0024 |
| 8000 | 0.759 | -2.3952 |

## Conclusion:

In this experiment, we encountered issues measuring $V_d$, as the oscilloscope couldn't simultaneously display both $V_1$ and $V_d$. With the assistance of the teaching assistant, we adjusted oscilloscope settings and connections, ultimately resolving the problem. This experience taught us the importance of problem-solving and the value of teamwork.