Contents

1 Objectives

- Analysis and design of CMOS transconductance amplifier.
- Find maximum output swing ,maximum gain,maximum possible bandwidth maximum power with suitable aspect ratio.

2 Tools Used

- LTspice IV

3 Schematics and Outputs

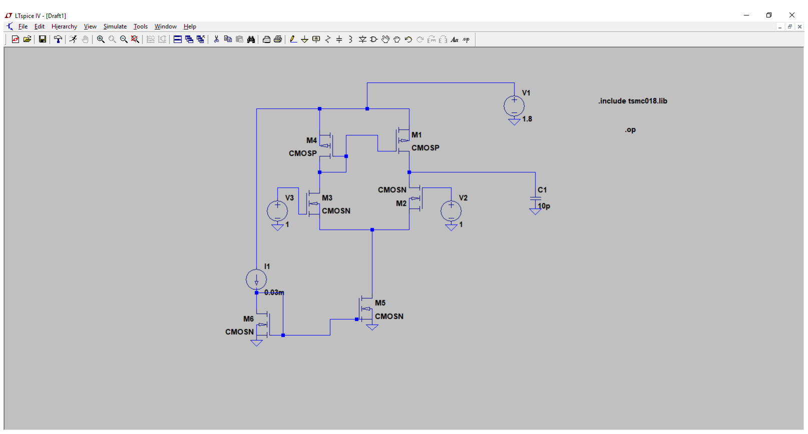

Figure 1: Schematic for operating currents

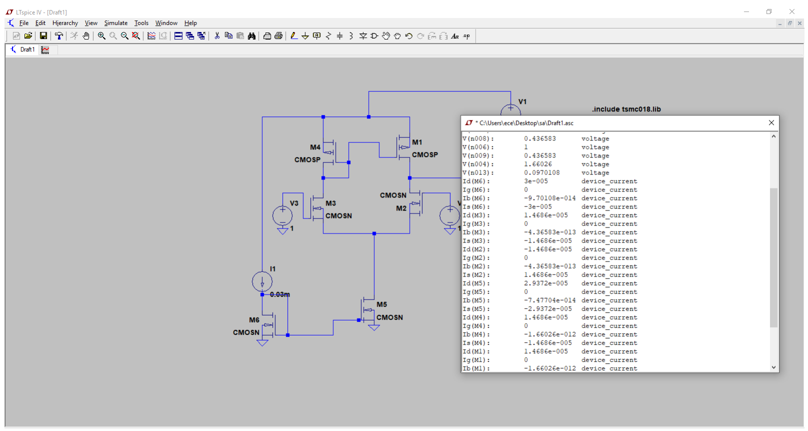

Figure 2: Operating currents

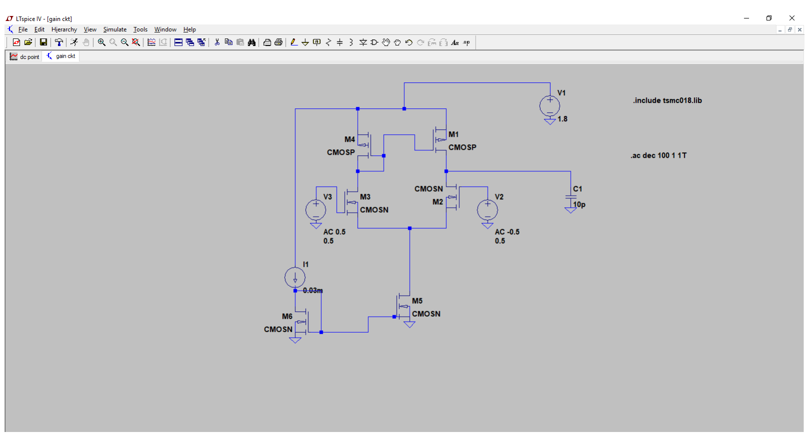

Figure 3: Gain schematic

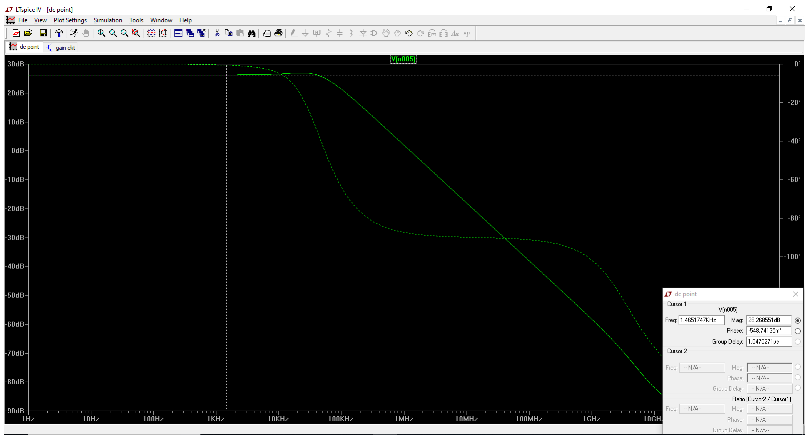

Figure 4: Gain

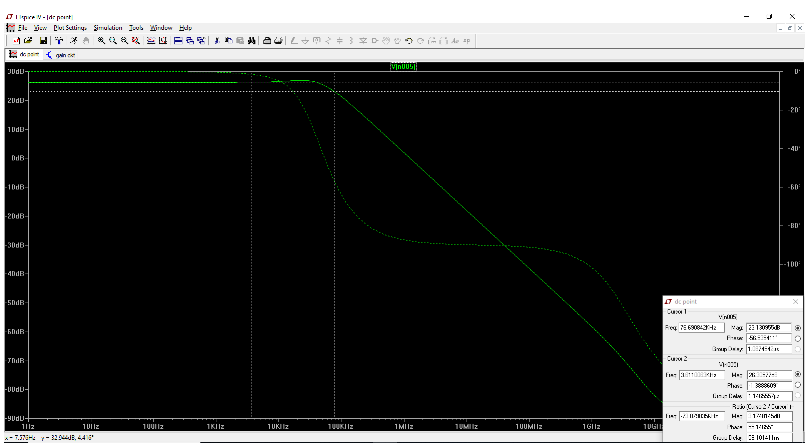

Figure 5: 3 db cutoff

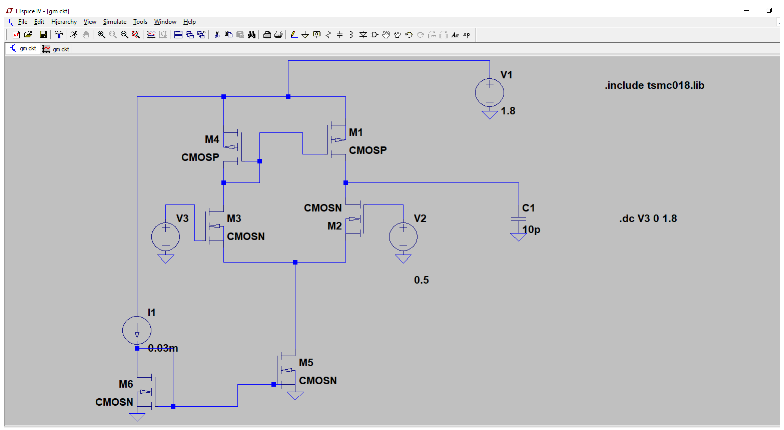

Figure 6: schematic for transconductance

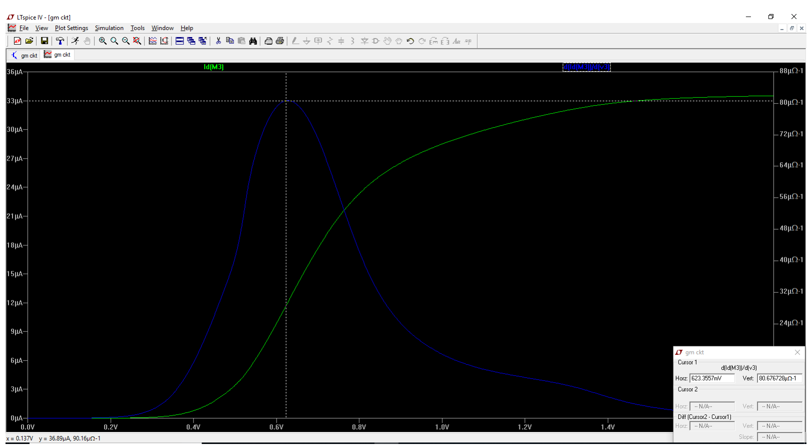

Figure 7: transconductance

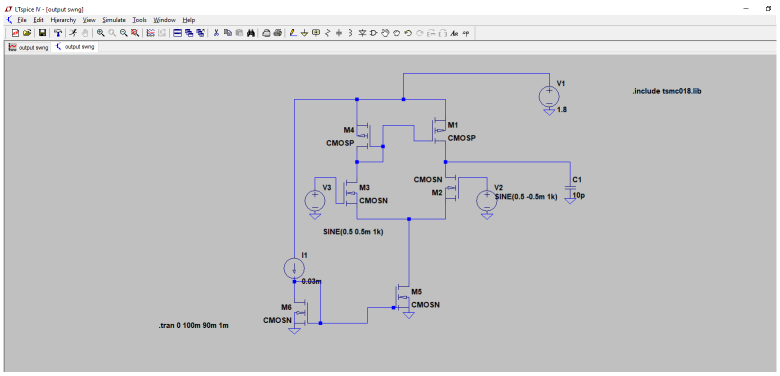

Figure 8: schematic for output swing

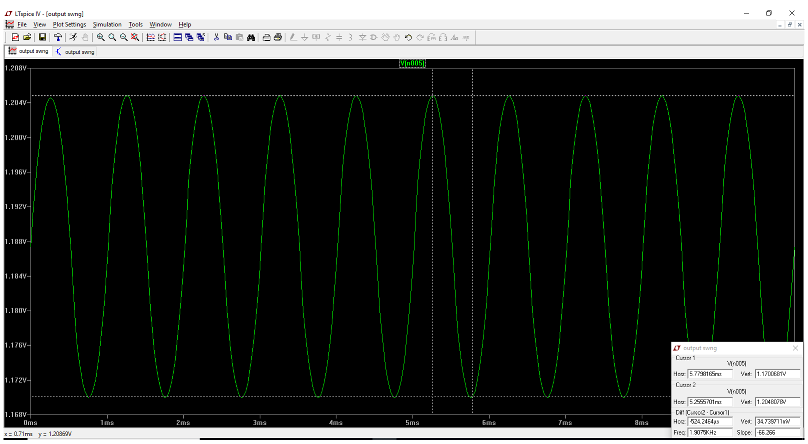

Figure 9: output swing

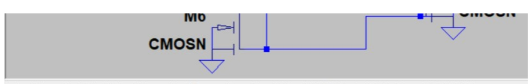

Figure 10: power consumption

4 Results

- AC Gain = 26.26 dB
- 3 db Bandwidth= 76.69 KHz
- output swing=34.73 mV
- power consumption= 66.28 μ W
- transconductance g_m= 80.67 $\mu\Omega^{-1}$

5 Observations

- The source voltage = 1.8 V.
- Load capacitance = 10 pF
- $\frac{W}{L}$ RATIOS

$(W:L)_{M1}$	$\frac{360n}{180n}$
$(W:L)_{M2}$	$\frac{720n}{180n}$
$(W:L)_{M3}$	$\frac{720n}{180n}$
$(W:L)_{M4}$	$\frac{360n}{180n}$
$(W:L)_{M5}$	$\frac{450n}{180n}$
$(W:L)_{M6}$	$\frac{360n}{180n}$

- PMOS current mirror is used to provide bias current to NMOS differential input and single ended amplifier.
- The W/L ratios were selected such that M1 and M4 carry equal currents.
- NMOS current mirror was used to provide tail current.
- By changing the $\frac{W}{L}$ ratios of transistors M2 and M3 the gain of the circuit changes.
- By increasing $\frac{W}{L}$ ratios of M2 and M3 the gain increases.

6 Conclusions

- Opertational transconductance amplifier is a Voltage controlled current source.
- Opertational transconductance amplifier is a differential input and single ended output amplifier.
- OTA rejects input noise.
- The circuit has a pole at frequency $\frac{1}{2\pi R_{out} C}$ where slope of the gain falls by 20dB per decade.
- It has high $R_{out}(\ r_{o1}||r_{02})$.
- The gain bandwidth product of the circuit is constant.