

# Assignment 2

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Analog IC Design



April 17, 2022

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### Problem 1

Design a single stage Differential Amplifier for the specs: Max.Power=5mW, Gain = 40 DB, B.W =100KHz. ICMR 1 to 3V, VDD=3V, VSS=0.

In Designing of these circuits  $\frac{W}{L}$  has been chosen depending on the other parameters. Calculation for each of them is done in the excel sheet which is attached in this document.

Design of single stage Differential Amplifier:

Note: **Region 2** is for saturation region.

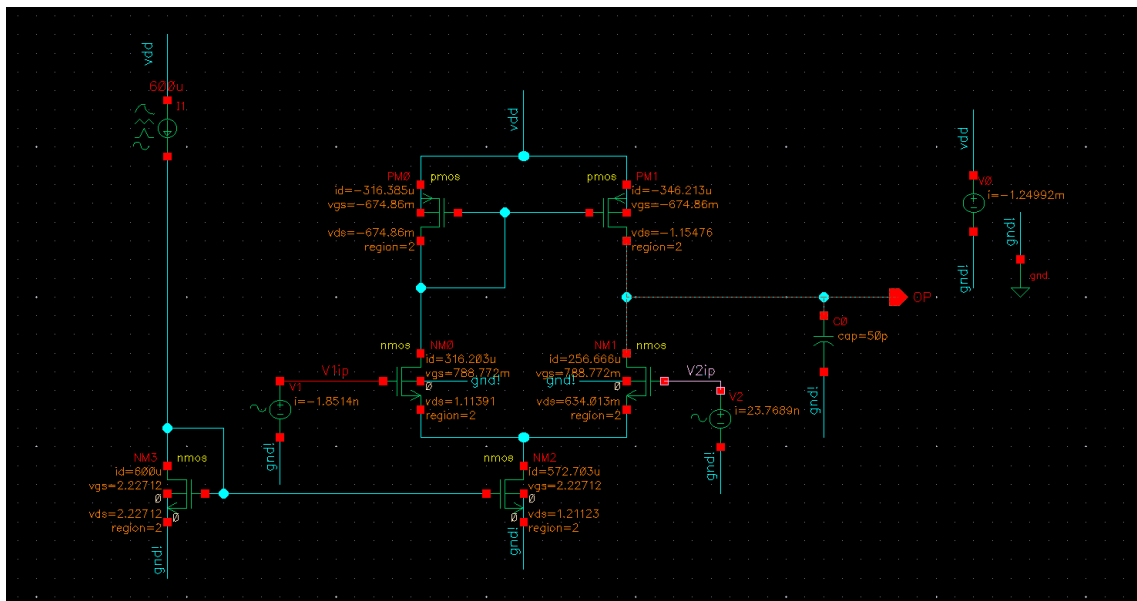


Figure 1: Schematic & DC operating Points

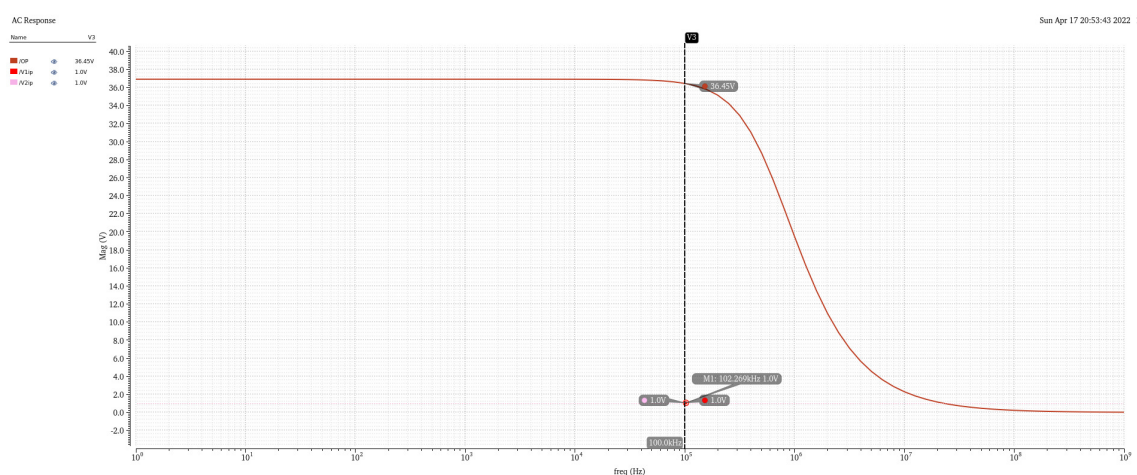


Figure 2: GAIN wrt Frequency

April 17, 2022



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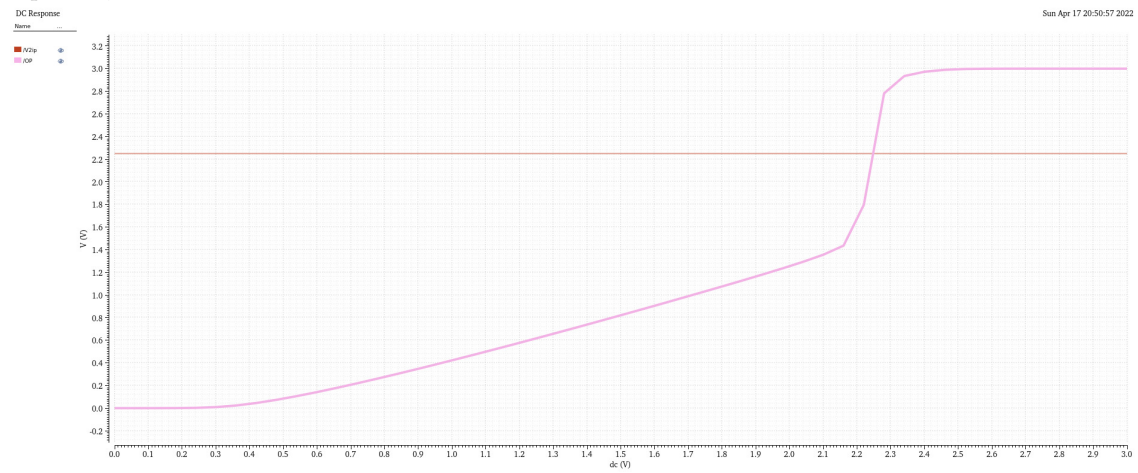


Figure 3: DC Analysis

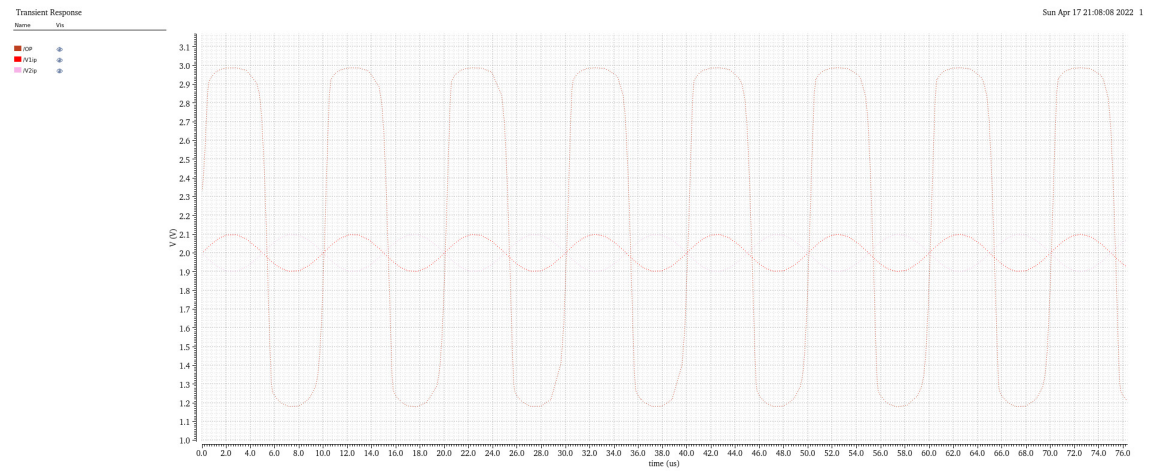


Figure 4: Transient Response

April 17, 2022

## Problem 2

Design a single stage Differential Amplifier for the specs: Max.Power=5mW, Gain = 40 DB, B.W =100KHz. ICMR 0 to 2V, VDD=3V, VSS=0.

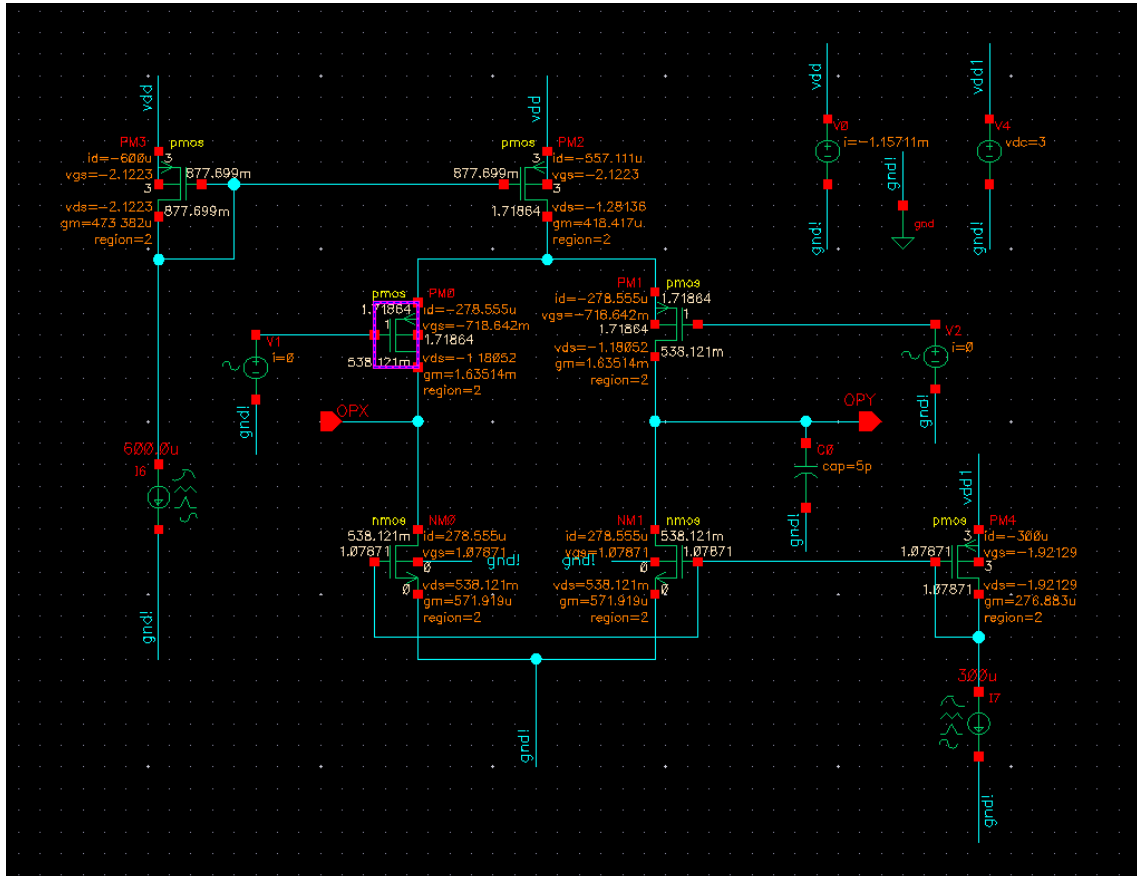


Figure 5: Schematic & DC operating Points

April 17, 2022

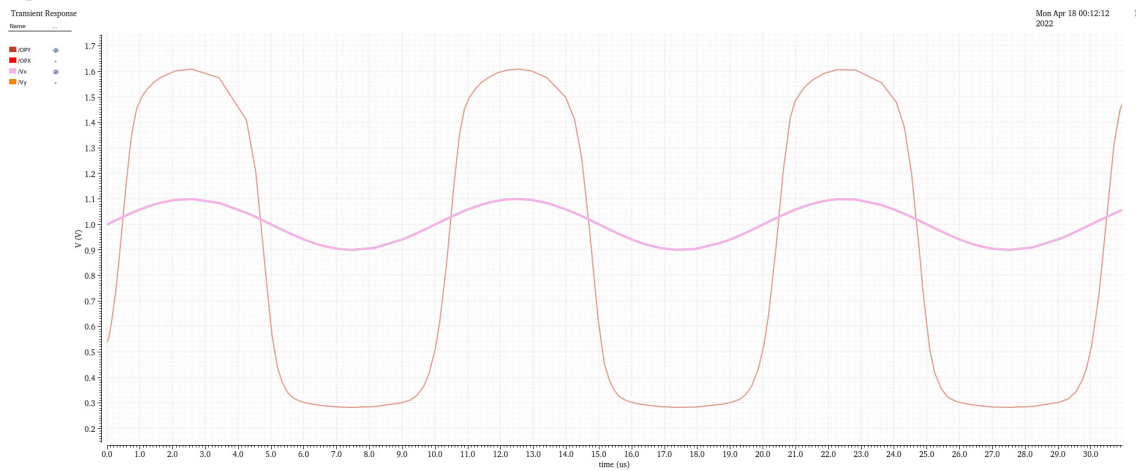


Figure 6: Transient Response

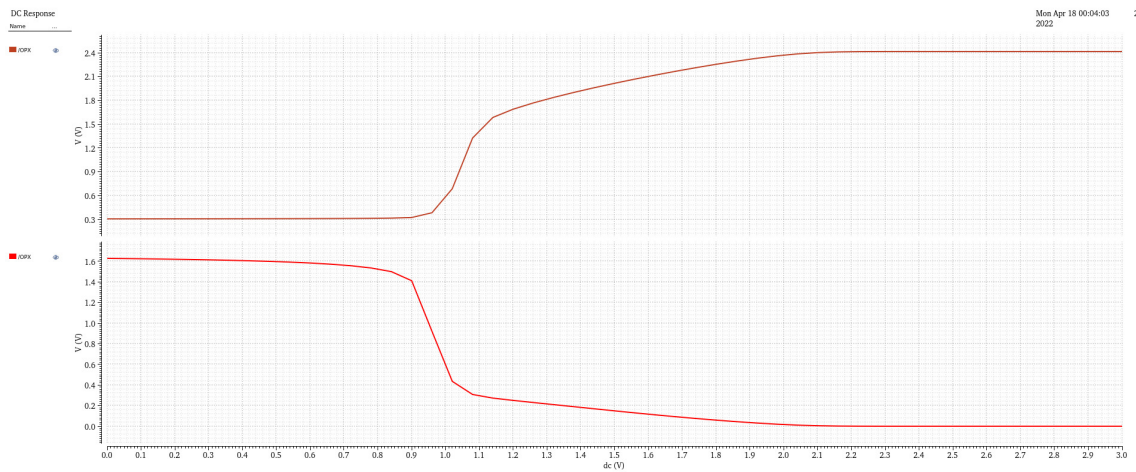


Figure 7: DC Analysis

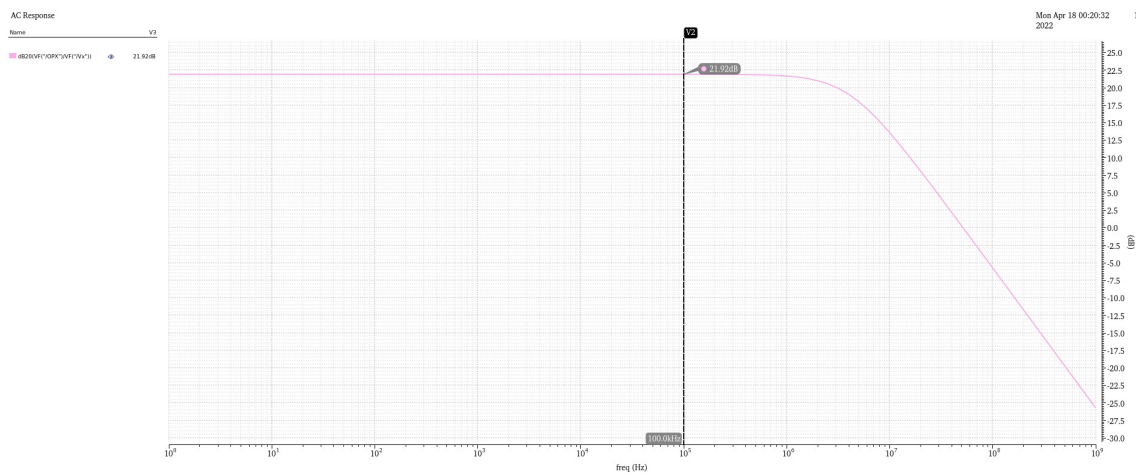


Figure 8: GAIN wrt Frequency



April 17, 2022

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Slew rate	Un	Cox	W/L	Vgs	Vth	(Vgs-Vth)*2	Lamda p.n	Iss	I1=I3	I2=I4	Rout	f	c	ldminf	ldminsr	UpCox
2	2.94E-04	3.00E-04	1.00E+00	1.00E+00	2.00E+00	6.00E-01	1.96E+00	1.00E-02	6.00E-04	3.00E-04	3.00E-04	1.67E+05	1.00E+05	5.00E-12	1.57E-04	5.00E-04	6.00E-05
3																	
4																	
5	slew rate	Cl		Power	Ismx	Vdd	Vss	(W/L)3	Vdsat1	(W/L)1	Vdsat5	(W/L)5	Vdsat3				
6	1.00E+08	5.00E-12		5.00E-03	1.67E-03	3.00E+00	0.00E+00	2.78E+01	1.00E+00	2.00E+00	-6.00E-01	1.11E+01	6.00E-01				
7								4.47E-01	1.00E+01	-4.72E-02	1.79E+03						
8																	
9	Vicmax	Vicmin															
10	3.00E+00	1.00E+00															
11																	
12																	
13																	
14	OS, for ICMR 0 to 2V																
15																	
16																	
17	(W/L)3		(W/L)5	(W/L)1	Vicmax	Vicmin		Vsd5									
18	3.00E-03		5.00E+00	5.56E+00	2.00E+00	0.00E+00		4.00E+00									
19	4.00E+01																
20																	
21																	

Figure 9: Excel Sheet Used for Calculations