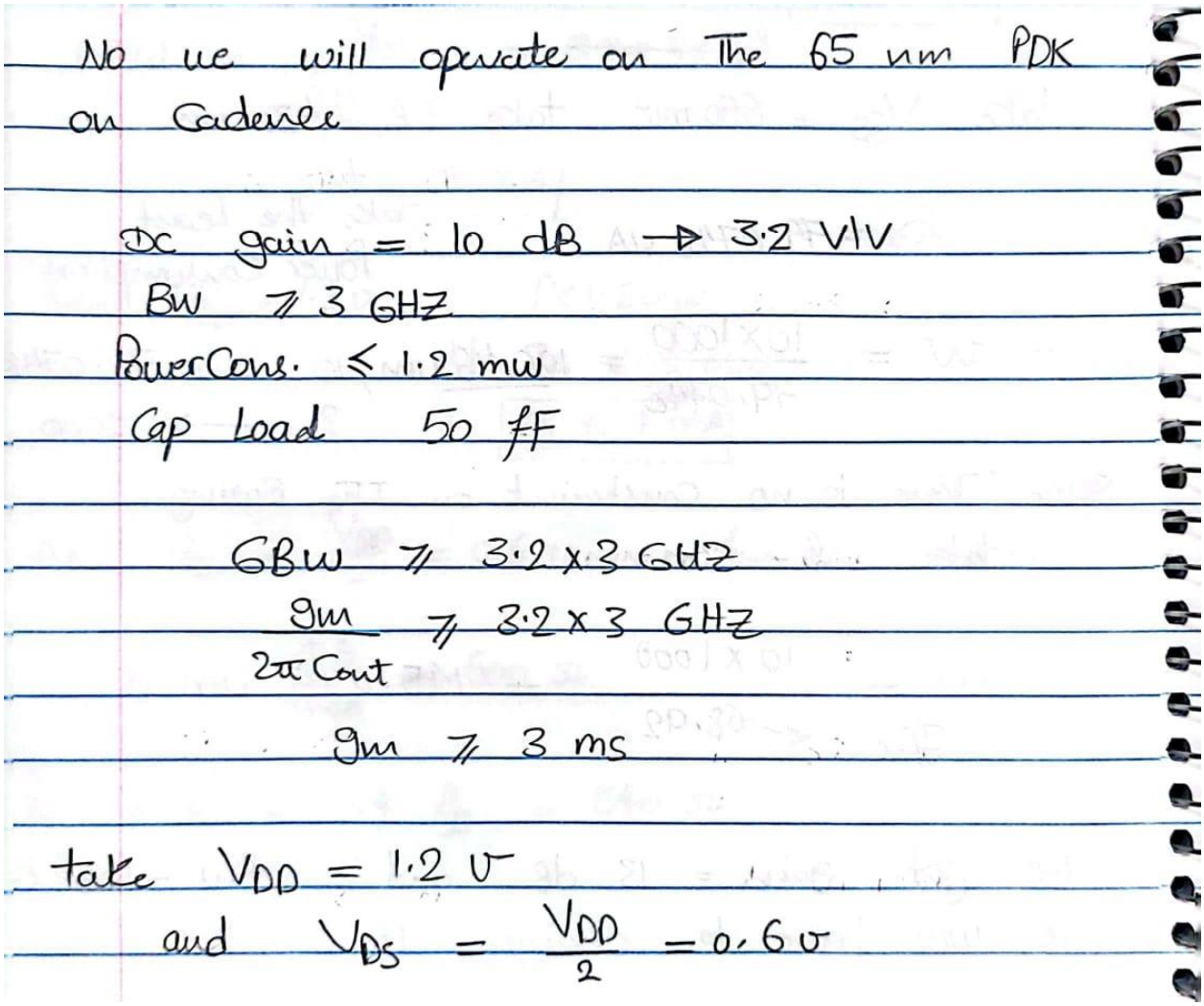
Design a Common Source Amplifier meets the following specs use PMOS input trans.

Spec.	
DC Gain	10 dB
BW	≥ 3 GHz
Power Consumption	≤ 1.2 mW
Cap Load	50 fF



$P \leq 1.2mw \quad V_{DD} I_D \leq 1.2mw \quad \therefore I_D \leq 1mA$

$\therefore R_D = \frac{0.6}{1mA} = 600\ \Omega$

$\frac{g_m}{I_D} = 3$ for Margin let $g_m = 6\ ms$

$\therefore$ Gain $= g_m R_{out}$

$3.2 = 6 \times 10^{-3} R_{out} \quad \therefore R_{out} = 533.3\ \Omega$

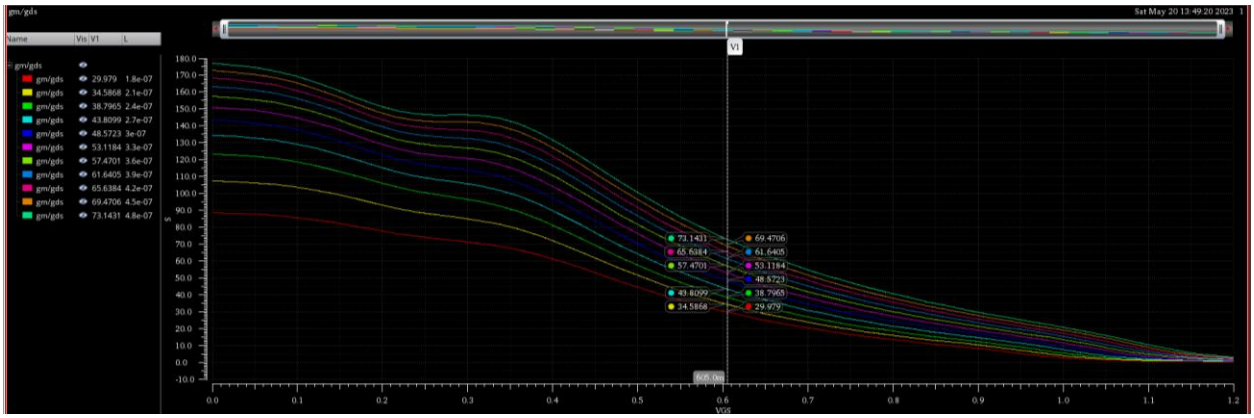
$\therefore$ let $R_{out} = 540\ \Omega$

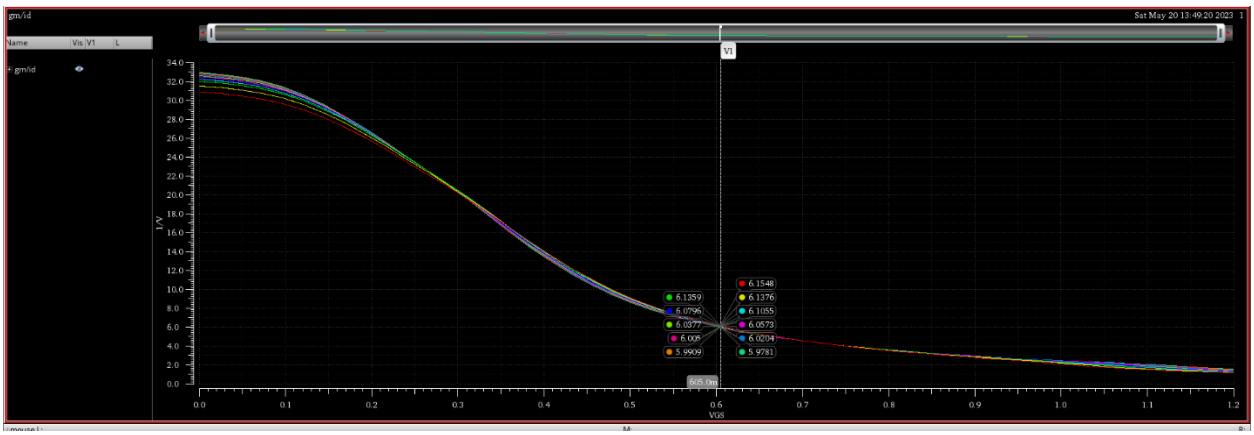
$\therefore \frac{R_D r_o}{R_D + r_o} = 540 \quad \therefore r_o = 5400\ \Omega$

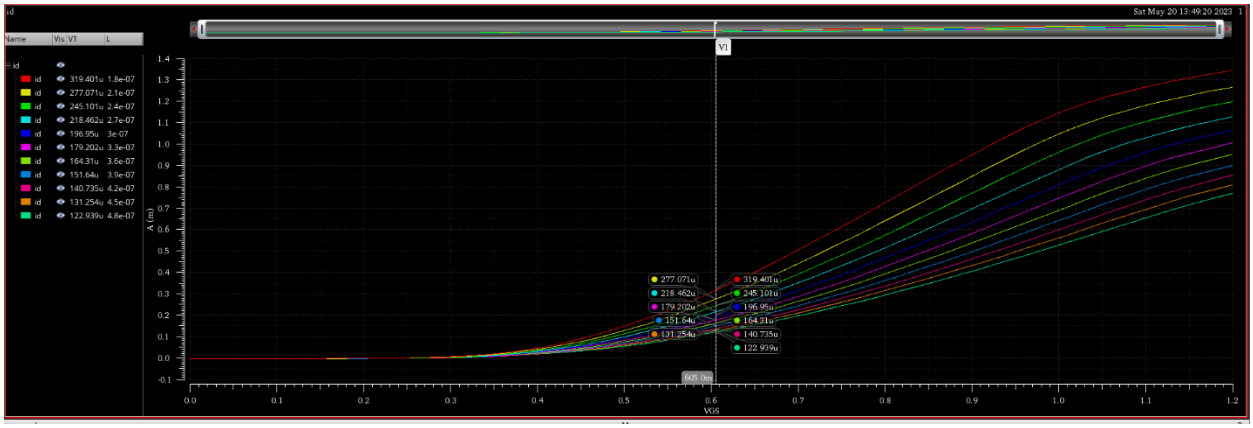
$\therefore g_{ds} = \frac{1}{5400}\ S$

$\therefore \frac{g_m}{g_{ds}} \geq 32.4$

$\frac{g_m}{I_D} = 6 \qquad V^* = \frac{2}{g_m/I_D} = 0.333\ v$







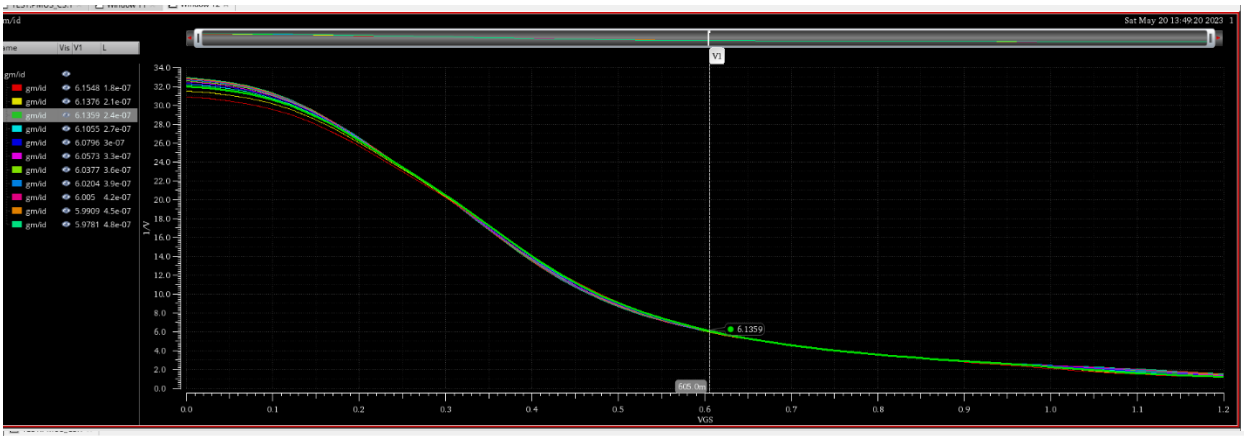
from the graphs we will take an average V_{GS} of 605 mv

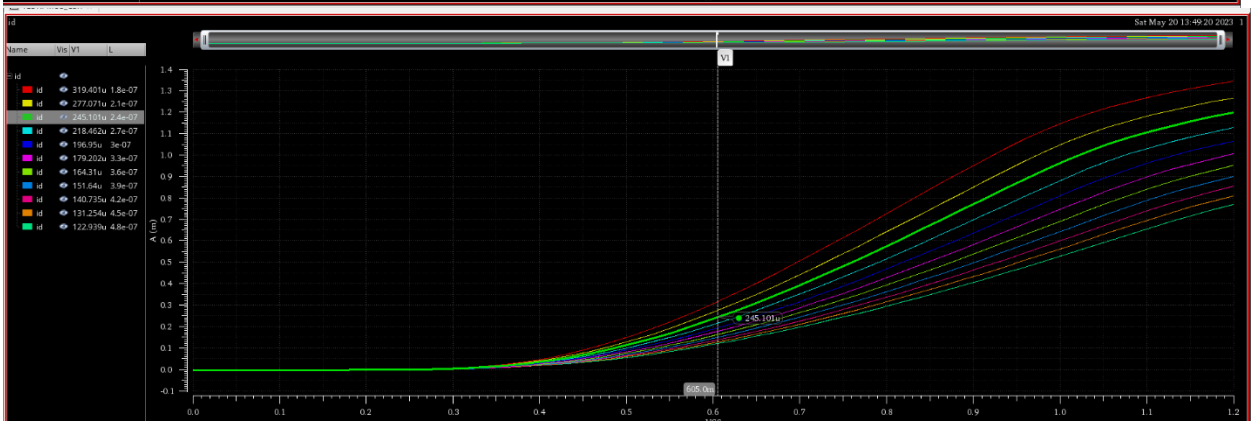
from the $\frac{g_m}{g_{ds}}$ graph the first (1)

That satisfies the curve equation

and it gives $g_m/I_d = 6.1359$

$g_m/g_{ds} = 38.7965$ v/v





Thus we will take $L = 240$ nm

$I_{Dx} = 245.101$ u

$$W = \frac{10 \times 1000}{245.101\ u} = 40.8 \text{ um}$$

we got gain = 2.954 v/v

BW = 4.185 GHz

ive R_D to 700 Ω

we obtained: gain = 10.3132 dB

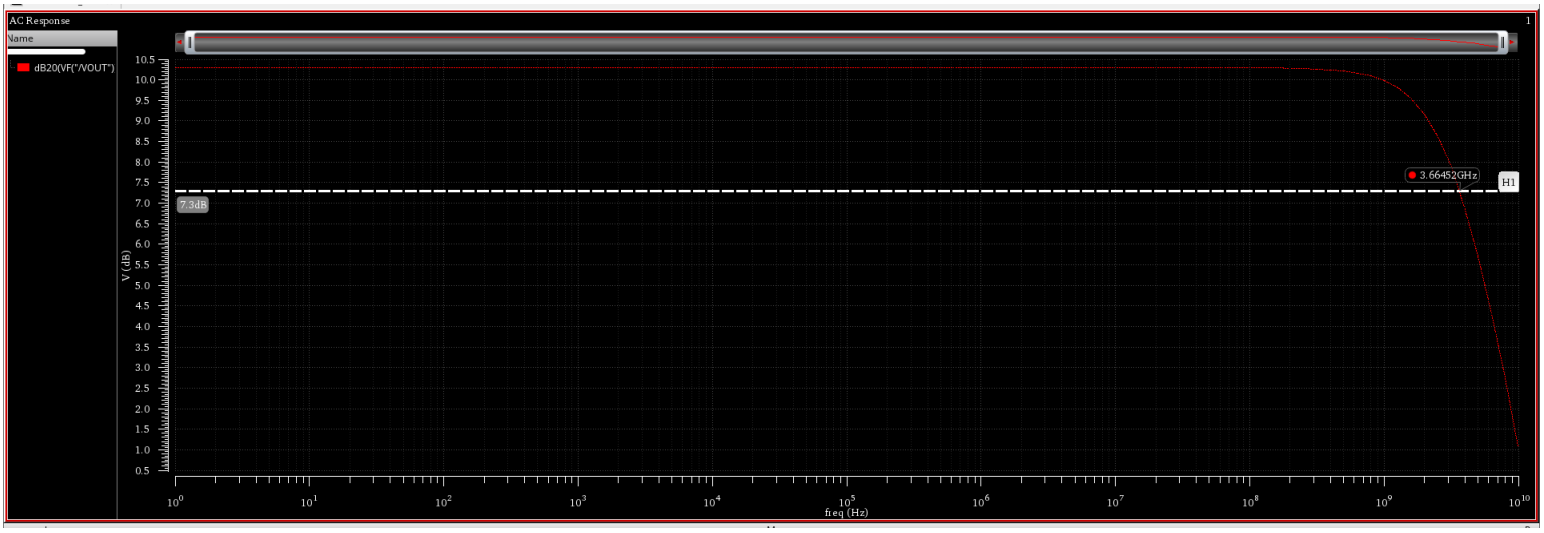
BW = 3.664 GHz

i_d = 903.8 uA

@

L = 240 um

W = 40.8 um



Specs	Desired	obtained
gain	≥ 10 dB	10.3132 dB
Bw	≥ 3 GHz	8.664 GHz
Power	≤ 1.2 mw	1.084 mw
Cf	= 50 fF