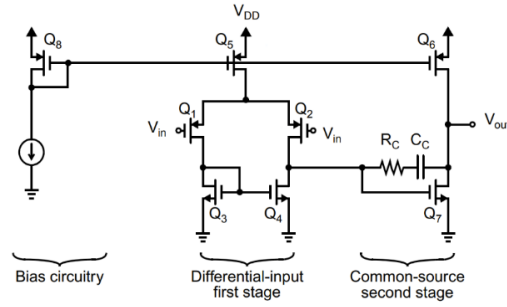


Design a Single Ended Two Stage Miller Compensated OTA meets the Specs (Use IREF = 10u)

Spec.	
DC Gain	$\geq 66 \text{ dB}$
Unity Gain Frequency	$\geq 50 \text{ MHz}$
Power Consumption	$\leq 1 \text{ mW}$
Cap Load	$1 \text{ pF}$

- Assume  $C_C = 0.5 C_L = 0.5 \text{ pF}$
- Assume CMIR from  $0.2 \rightarrow 0.6 \text{ V} \rightarrow$  use PMOS input transistors
- Assign higher gain for the first stage  $A_V = A_{V1} \cdot A_{V2} = 63 * 32$



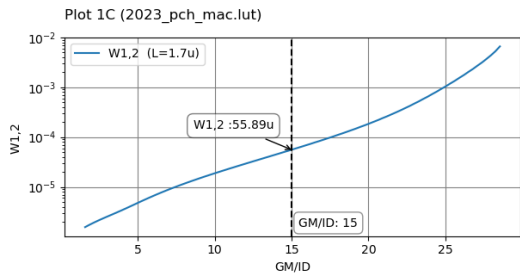
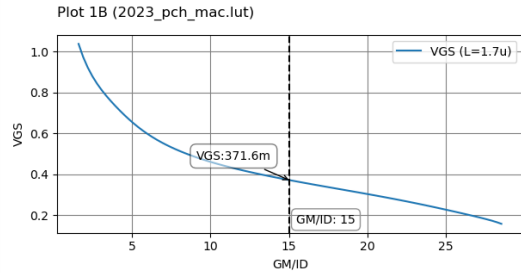
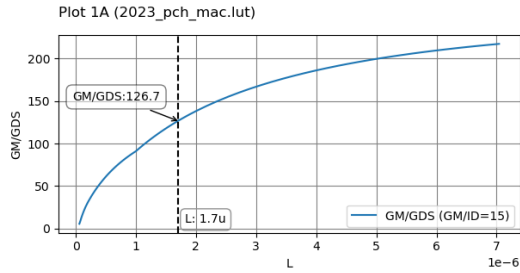
$$I_{\text{Consmax}} = \frac{P_{\text{cons}}}{V_{DD}} \rightarrow I_{D\text{max}} \leq 666 \text{ uA}$$

$$UGF = \frac{g_{m1,2}}{2\pi C_C} \geq 50 \text{ MHz} \rightarrow g_{m1,2} \geq 157 \text{ uS} \rightarrow g_{m1,2} = 300 \text{ uS}$$

$$\text{Assume } M_{1,2} \text{ in MI } \left( \frac{g_{m1,2}}{I_D} = 15 \right) \rightarrow I_{D1,2} = 20 \text{ uA} \rightarrow I_{B1} = 40 \text{ uA}$$

$$A_{V1} = \frac{g_{m1,2} r_{o2,4}}{2} (\text{Assume } r_{o2} = r_{o4}) \geq 64 \rightarrow r_{o2,4} = 420 \text{ k}\Omega \rightarrow (g_m r_o)_{1,2} = 126$$

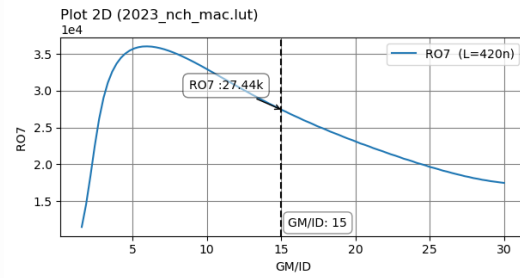
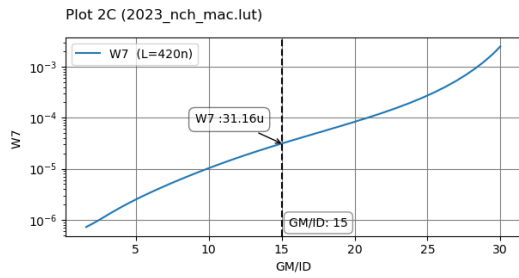
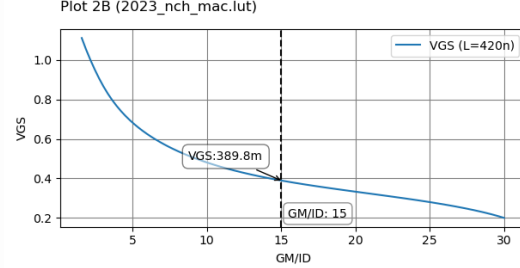
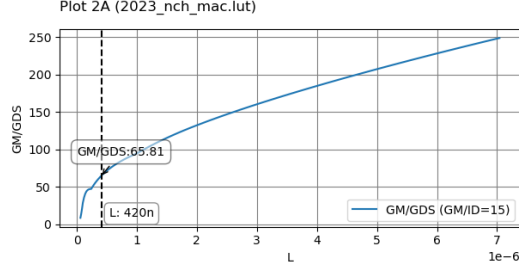
$$L_{1,2} = 1.7 \text{ um}, V_{GS1,2} = 371.6 \text{ mV}, W_{1,2} = 55.89 \text{ um}$$



Choose  $\omega_{p2} = 4\omega_u \rightarrow g_{m7} = 8 g_{m1,2} = 2.4 \text{ mS} \rightarrow I_{B2} = 4I_{B1} = 160 \text{ uA}$

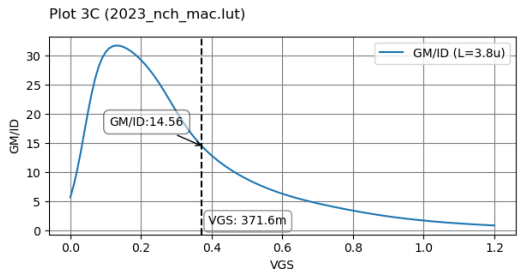
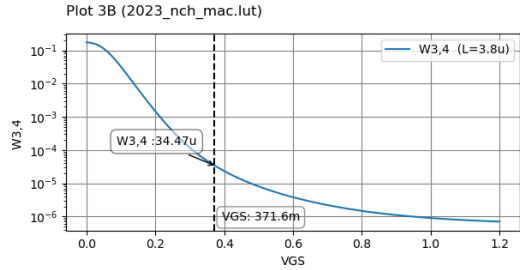
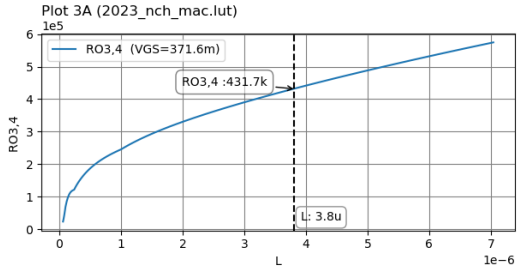
$A_{V2} = \frac{g_{m7}r_{o6,7}}{2} (\text{Assume } r_{o6} = r_{o7}) \geq 32 \rightarrow r_{o2,4} = 27 \text{ k}\Omega \rightarrow (g_m r_o)_7 = 64$

$L_7 = 420 \text{ nm}, V_{GS7} = 389.8 \text{ mV}, W_7 = 31.16 \text{ um}$



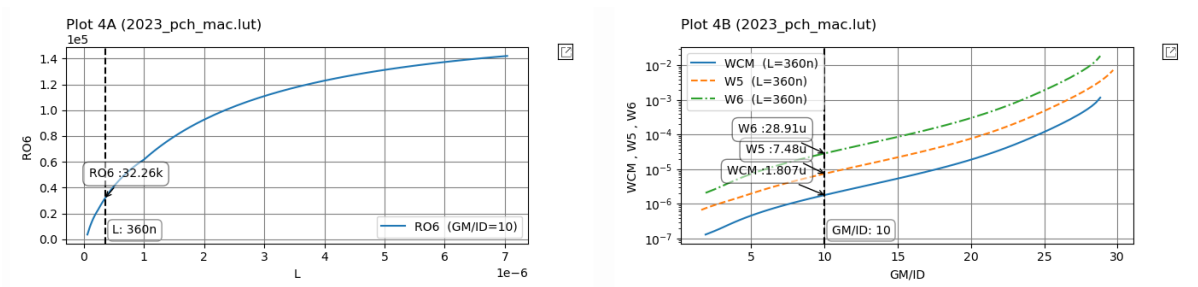
set  $V_{GS3,4} = V_{GS7} @ r_{o3,4} = 420 \text{ k}\Omega$

$L_{3,4} = 3.8 \text{ um}, W_{3,4} = 34.47 \text{ um}, \left(\frac{g_{m3,4}}{I_D}\right) = 14.56$



$CMIR_H = -V_{SG1,2} - V_5^* + V_{DD} = 0.6 \rightarrow V_5^* \leq 0.2284 \text{ V} \rightarrow V_5^* = 0.2 \text{ V} \rightarrow \left(\frac{g_{m5}}{I_D}\right) = 10$

$L_{CM} = L_5 = L_6 = 360 \text{ nm}, W_{CM} = 1.807 \text{ um}, W_5 = 7.228 \text{ um}, W_6 = 28.91 \text{ um}$



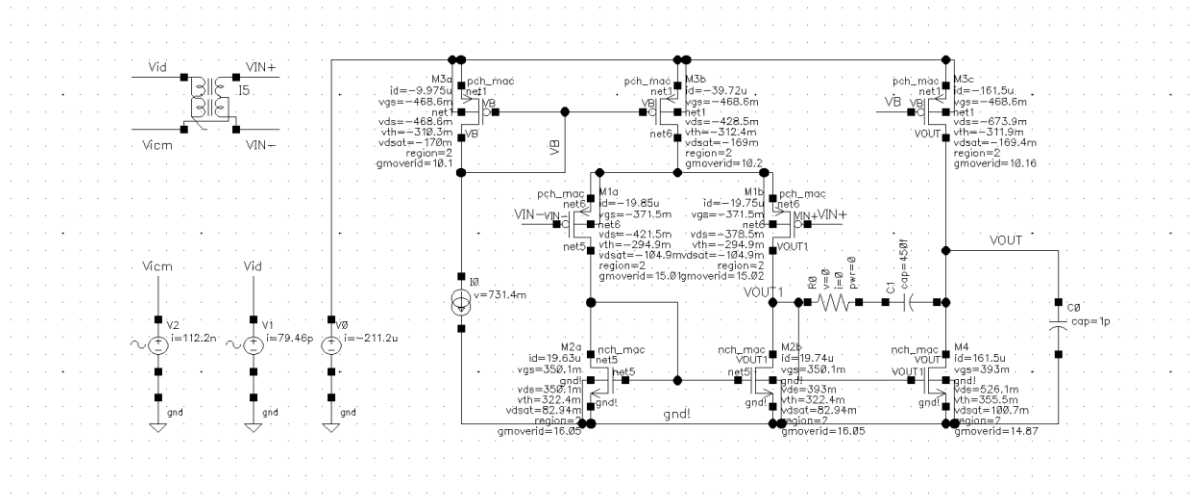
\*\* After Running DC Analysis W3,4 needed to be increased to 47.72u \*\*

## Sizing Summary

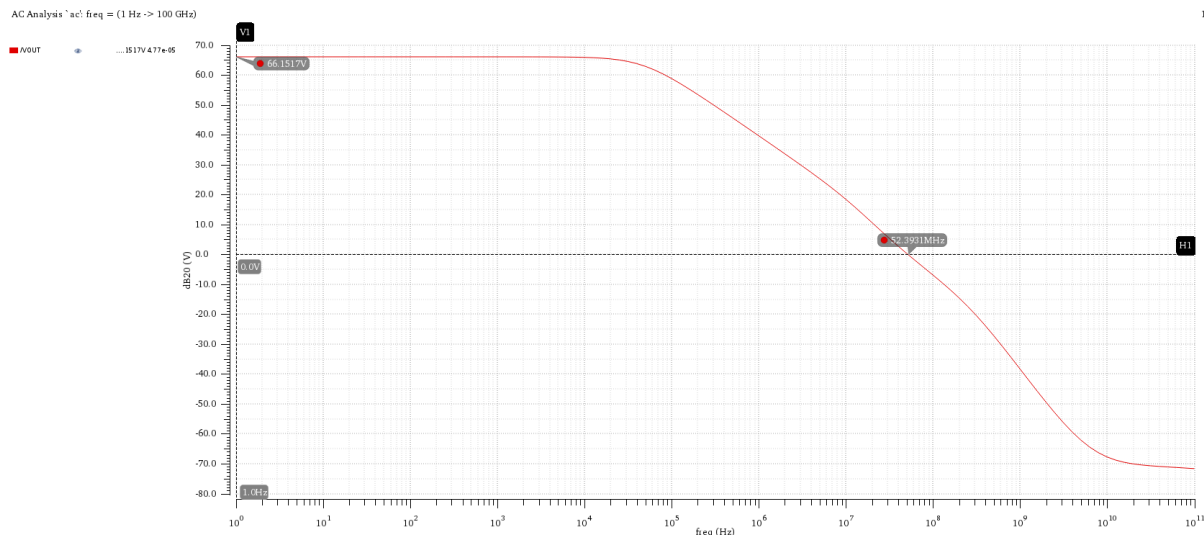
	M1	M2	M3	M4	M5	M6	M7	MCM
L	1.7u	1.7u	3.8u	3.8u	360n	360n	420n	360n
W	55.89u	55.89u	47.72u	47.72u	7.48u	28.91u	31.16u	1.807u

## Simulations Results

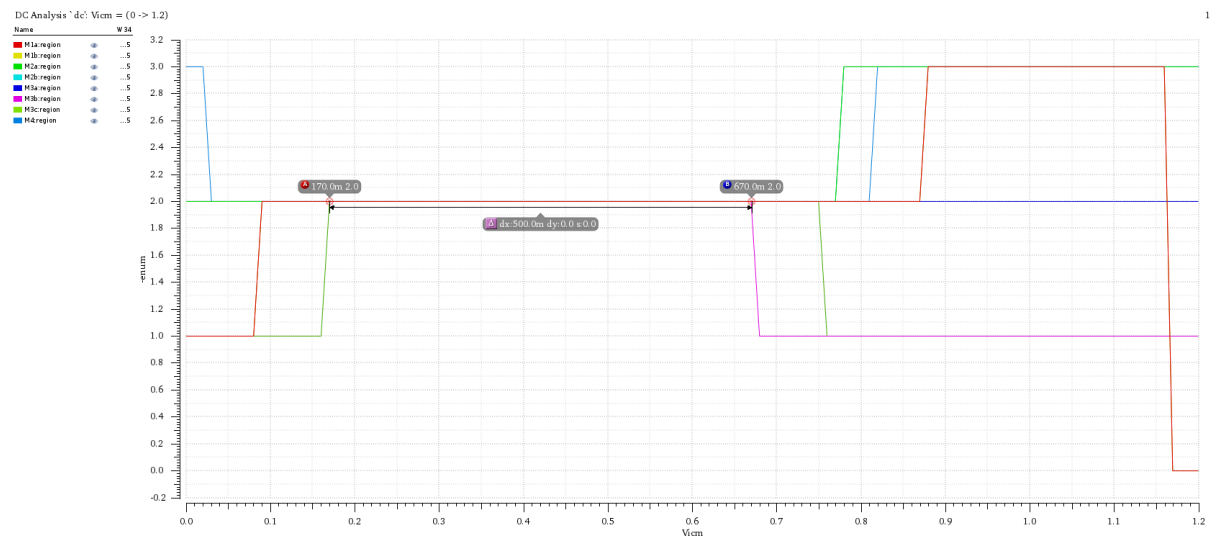
### - DC Operating Points



### - AC Analysis



## - CMIR Results



## - STB Analysis

