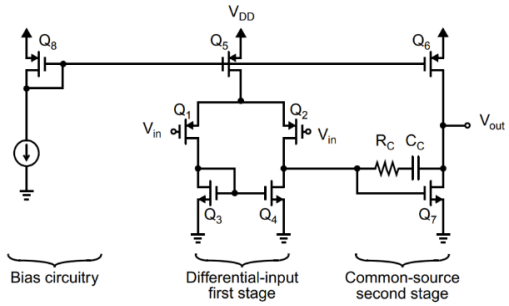
Design a Single Ended Two Stage Miller Compensated OTA meets the Specs (Use IREF = 10u)

Spec.	
DC Gain	$\geq$ 54 dB
Unity Gain Frequency	$\geq$ 300 MHz
Power Consumption	$\leq$ 1 mW
Cap Load	1 pF

- Assume $C_C = 0.5\ C_L = 0.5$ pF
- Assume CMIR from $0.2 \rightarrow 0.6$ V $\rightarrow$ use PMOS input transistors
- Assign higher gain for the first stage $A_V = A_{V1}.A_{V2} = 28 * 18$



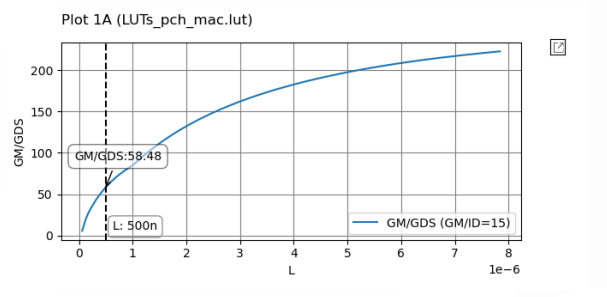
$$I_{Cons,max} = \frac{P_{cons}}{V_{DD}} \rightarrow I_{Cons,max} \leq 830\ uA$$

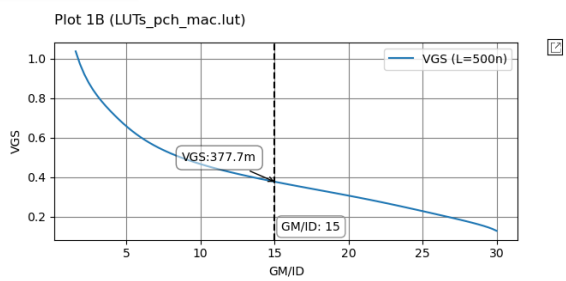
$$UGF = \frac{g_{m1,2}}{2\pi C_C} \geq 300\ MHz \rightarrow g_{m1,2} \geq 943\ uS \rightarrow g_{m1,2} = 1.2\ mS$$

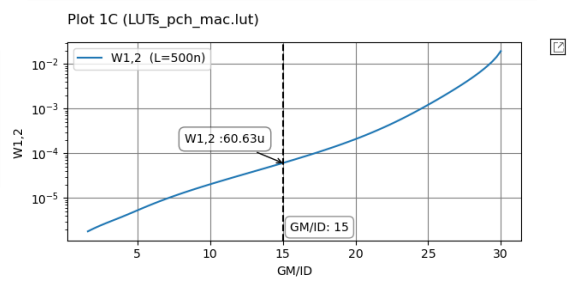
$$\text{Assume } M_{1,2} \text{ in MI } \left(\frac{g_{m1,2}}{I_D} = 15\right) \rightarrow I_{D1,2} = 80\ uA \rightarrow I_{B1} = 160\ uA$$

$$A_{V1} = \frac{g_{m1,2}r_{o2,4}}{2} (\text{Assume } r_{o2} = r_{o4}) \geq 28 \rightarrow r_{o2,4} = 47\ k\Omega \rightarrow (g_m r_o)_{1,2} = 56$$

$L_{1,2} = 500\ nm, V_{GS1,2} = 377.7\ mV, W_{1,2} = 60.63\ um$



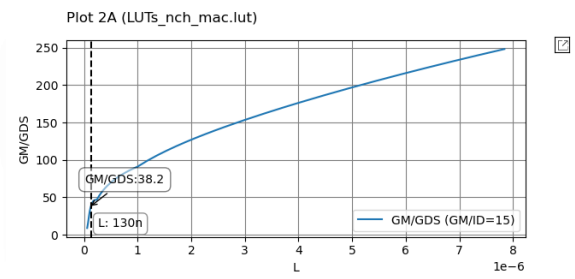


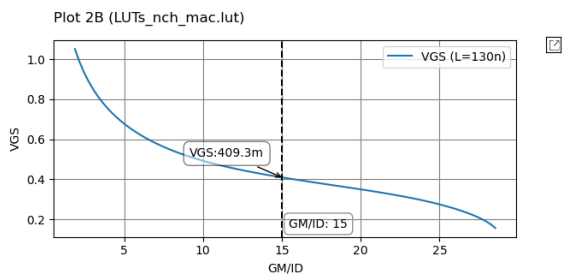


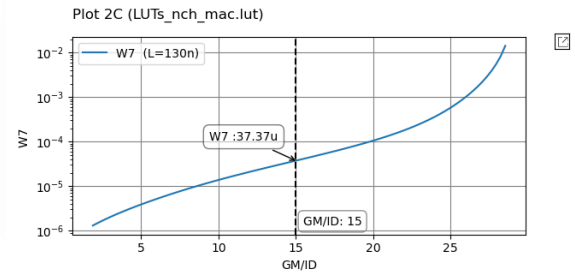
Choose $\omega_{p2} = 4\omega_u \rightarrow g_{m7} = 8\, g_{m1,2} = 9.6\ \text{mS} \rightarrow I_{B2} = 4I_{B1} = 640\ \text{uA}$

$$A_{V2} = \frac{g_{m7} r_{o6,7}}{2} (\text{Assume } r_{o6} = r_{o7}) \geq 18 \rightarrow r_{o2,4} = 47\ \text{k}\Omega \rightarrow (g_m r_o)_7 = 32$$

$$L_7 = 130\ \text{nm}\ , V_{GS7} = 409.3\ \text{mV}, W_7 = 37.37\ \text{um}$$

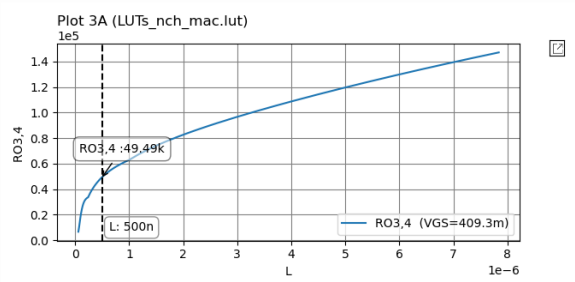


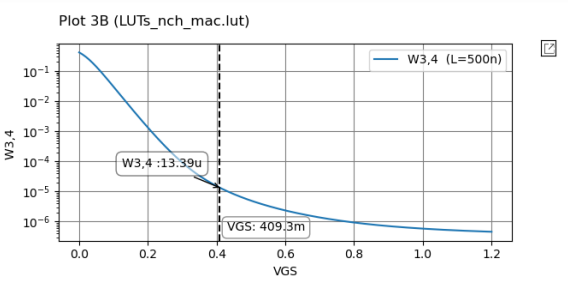




set $V_{GS3,4} = V_{GS7}$ @ $r_{o3,4} = 47\ \text{k}\Omega, I_D = 80\ \text{uA}$

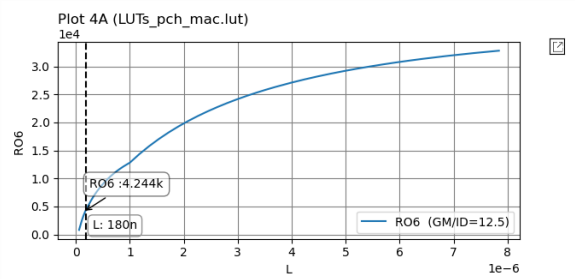
$$L_{3,4} = 500\ \text{nm}\ , W_{3,4} = 13.29\ \text{um}$$

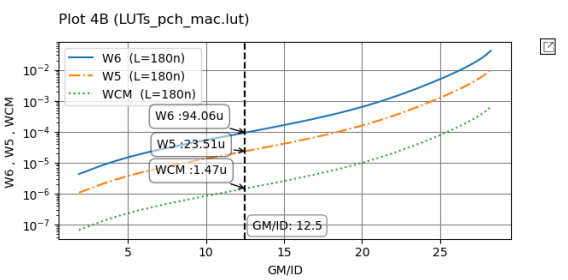




$$\text{CMIR}_H = -V_{SG1,2} - V_5^* + V_{DD} = 0.6 \rightarrow V_5^* \leq 0.19\ \text{V} \rightarrow V_5^* = 0.16\ V \rightarrow \left(\frac{g_{m5}}{I_D}\right) = 12.5$$

$$L_{CM} = L_5 = L_6 = 180\ \text{nm}, W_{CM} = 1.47\ \text{um}, W_5 = 23.51\ \text{um}, W6 = 94.06\ \text{um}$$

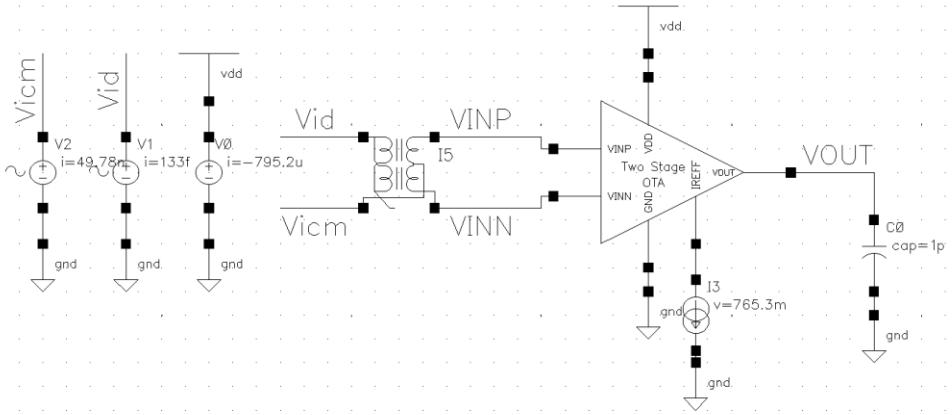




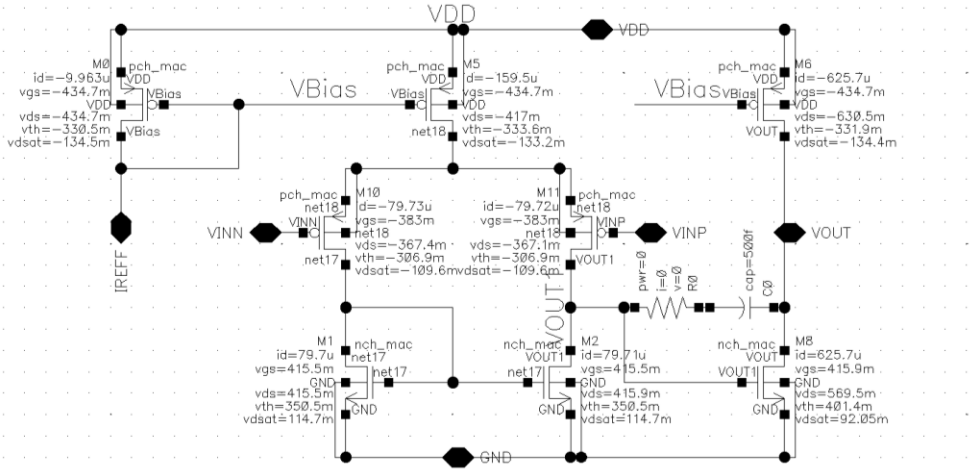
	M1	M2	M3	M4	M5	M6	M7	MCM
L	500n	500n	500n	500n	180n	180n	130n	180n
W	60.63u	60.63u	13.29u	13.29u	23.51u	94.06u	37.37u	1.47u

Simulations Results

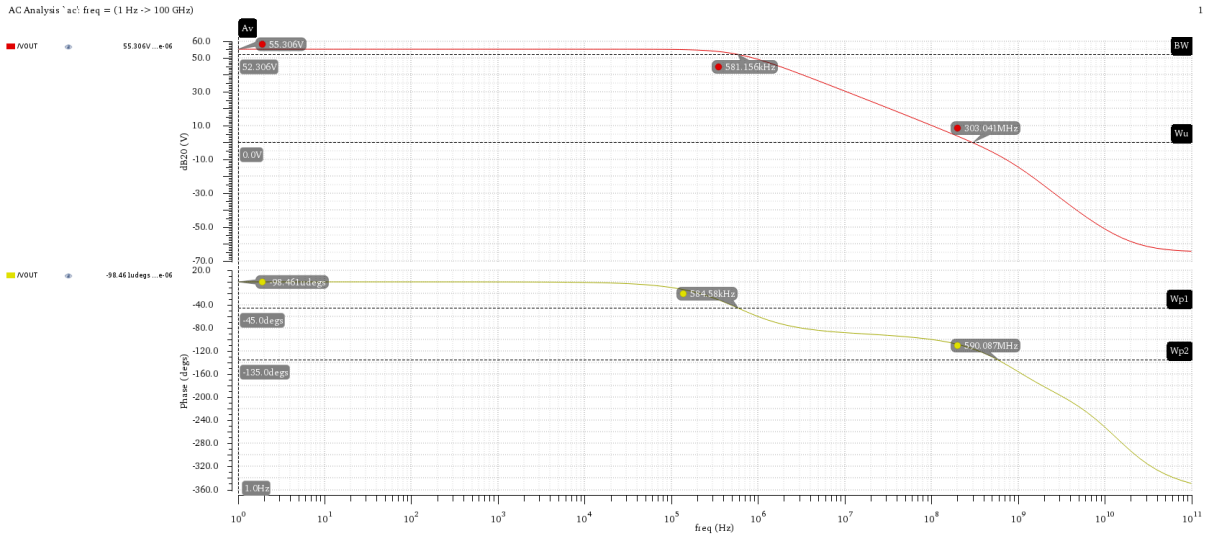
- TB



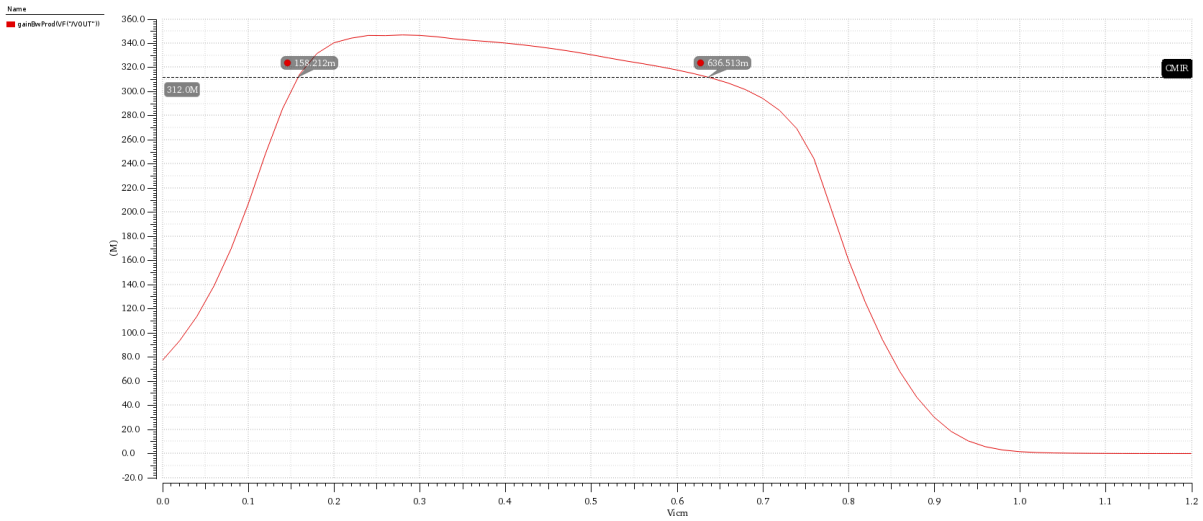
- DC Operating Points



- AC Analysis



- CMIR Results



- STB Analysis