Spec.	
DC Gain	20 dB
BW	≥1 GHz
Power Consumption	≤0.5 mW
Cap Load	50 fF

- Steps

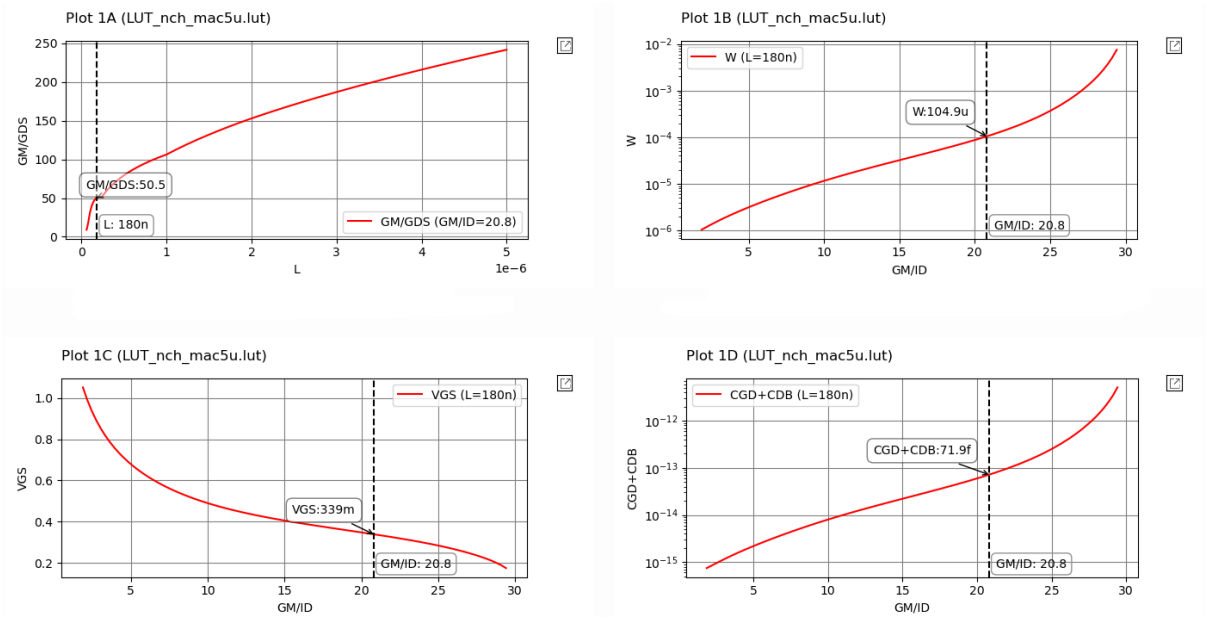
1 | $P_{cons} = V_{DD}\, I_D \leq 0.5\ \text{mW} \rightarrow I_D \leq 416\ \text{uA} \rightarrow I_D = 400\ \text{uA}$

2 | $\text{GBW} = \frac{g_m}{2\pi C_{out}} \geq 10 * 1\ \text{GHz} \rightarrow g_m \geq 3.14\ \text{mS}$

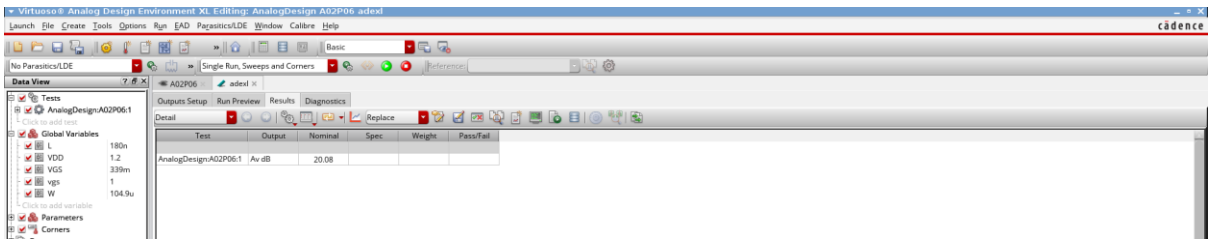
3 | $\text{Assume } V_{out} = \frac{V_{DD}}{2} \text{ to maximize output swing} \rightarrow R_D = 1.5\ \text{k}\Omega \rightarrow R_{out} = 1.2\ \text{k}\Omega \rightarrow r_o = 6\ \text{k}\Omega$

4 | $A_v = g_m R_{out} \geq 10 \rightarrow g_m = 8.33\ \text{mS} \rightarrow \frac{g_m}{I_D} = 20.8 \rightarrow g_m r_o = 50$

5 | $L = 180\text{nm} \rightarrow V_{GS} = 339\text{mV} \rightarrow W = 104.9\text{um}$

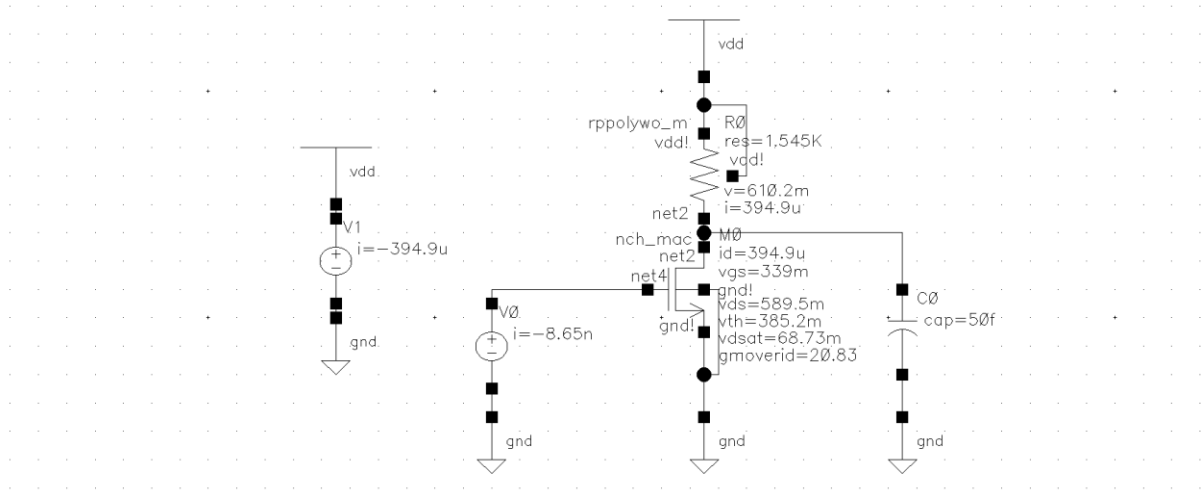


- Setup



- Results

1. DC OP



2. AC