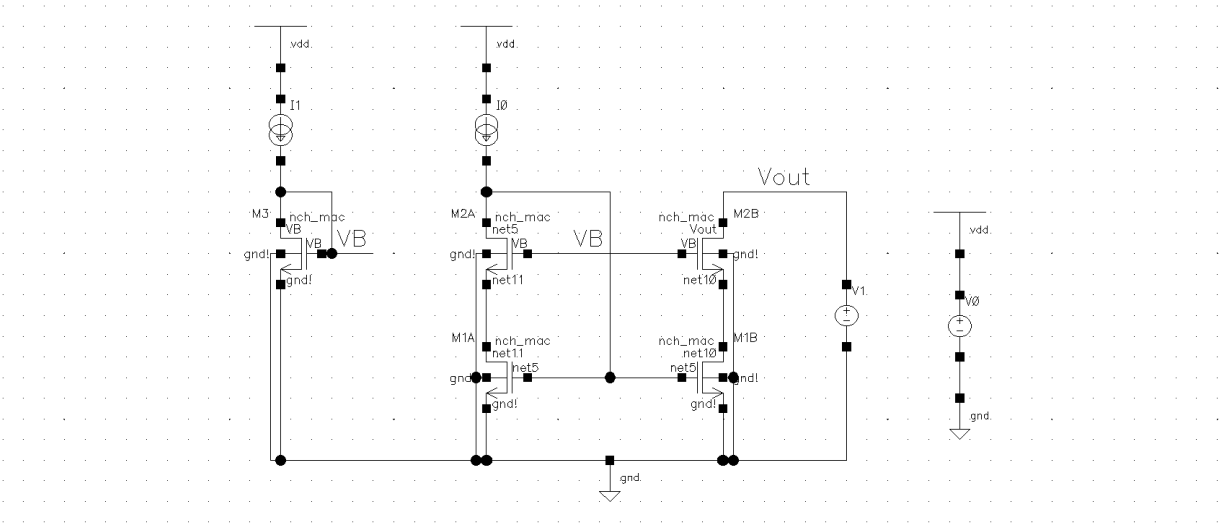
Design a low-voltage cascode current mirror with a 1:2 input current to output current ratio. The low frequency output impedance should be greater than 2 MΩ. Assume a 50 μA input current and Vout is 0.5 VDD.



1. Design (Using gmoverid charts)

$$\textit{As large Rout is required} \rightarrow \textit{ Assume } L_1 = 1um \textit{ and bias it in SI } \left(\frac{g_m}{I_D} = 10\right)$$

$$W_1 = 16.6\,um \rightarrow r_{o1} = 40.99\,k\Omega$$

$$R_{out} = g_{m2} r_{o2} r_{o1} = 2\,M\Omega$$

$$g_{m2} r_{o2} = \frac{2\,M\Omega}{40.99\,k\Omega} = 48.8$$

$$\textit{For cascode transistor bias it in MI } \left(\frac{g_m}{I_D} = 15\right)$$

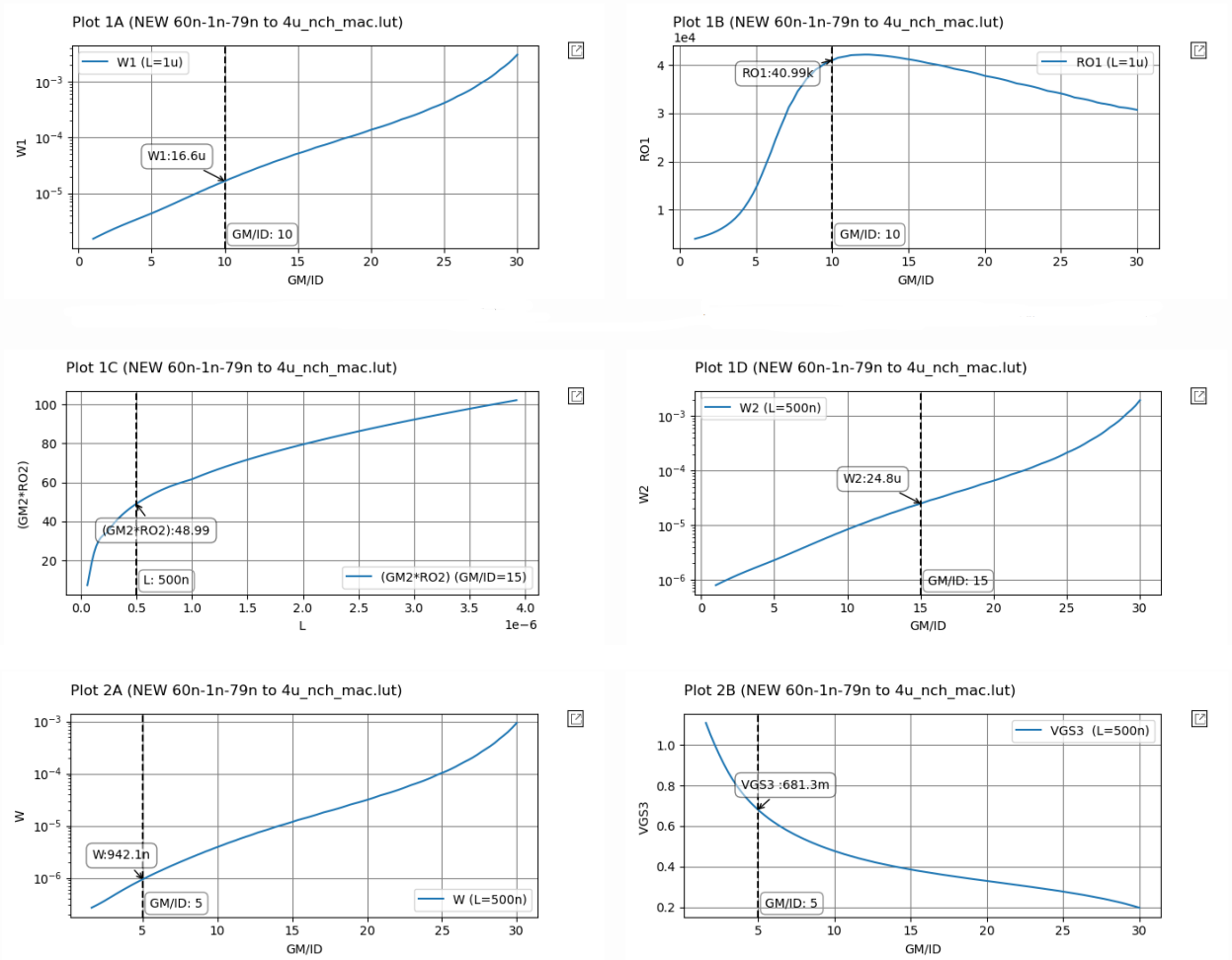
$$L_2 \geq 500\,nm \rightarrow W_2 = 24.8\,um$$

$$\textit{For the VB device } M3 : V_{GS3} \geq V_{GS2} + V_1^*$$

$$\textit{assume } V_{th1} = V_{th2}$$

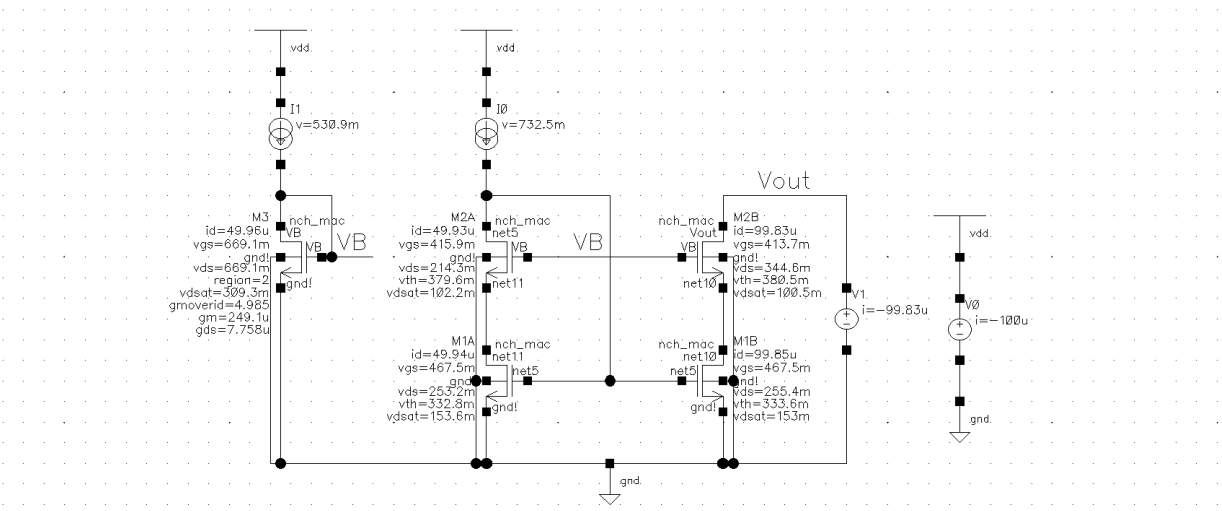
$$V_3^* \geq V_1^* + V_2^* \rightarrow V_3^* \geq 0.334 \rightarrow V_3^* = 0.4 \rightarrow \left(\frac{g_m}{I_D}\right)_3 = 5$$

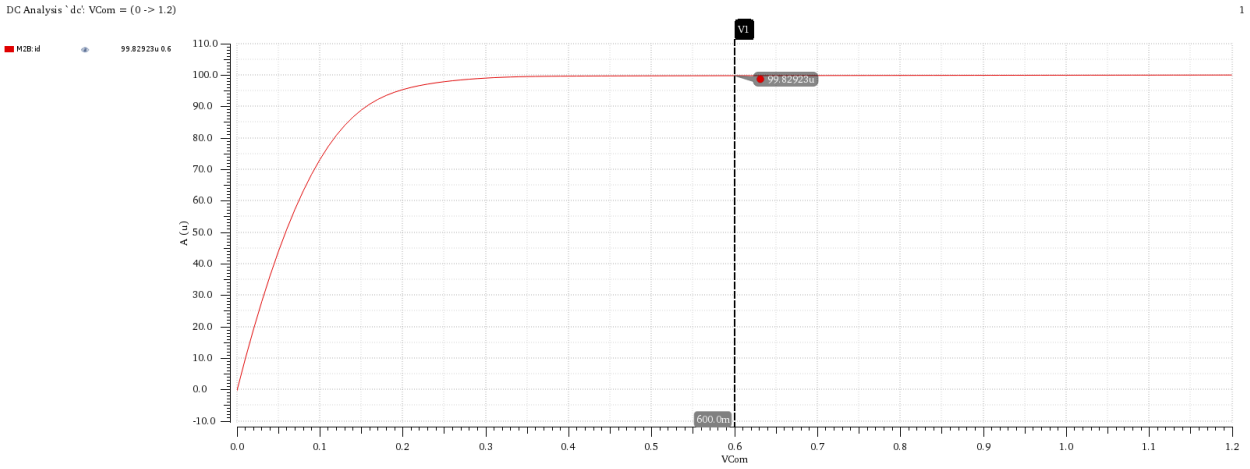
$$L_3 = L_2 \rightarrow W_3 = 0.95\,um$$



2. *Simulations*

- *DC OP*





- *AC Output Impedance*