

ENEE 302

Items to look into #2

1. Consider the meaning of "body effect" and "channel length modulation" as applied to MOS transistors.
 - a) Define the terms
 - b) Give the equations for drain current which include these effects using the Spice parameters GAMMA and LAMBDA.
 - c) Determine a test setup to see these effects via Spice and plot curves.
 - d) How could these effects be eliminated?
 - e) How could these effects be useful?

2. An npn BJT operates at room temperature with $BETA_{AF}=180$ and $V_{AF}=150$ and is biased in the forward active region such that the collector current is $I_C=2.6\text{mA}$.
 - a) Draw the small signal admittance matrix based (=hybrid-pi) equivalent circuit with numerical values for the transistor in common emitter configuration.
 - b) For $C_{pi}=25\text{pF}$ and $C_{mu}=5\text{pf}$ find the $Y(s)$ matrix.
 - c) Calculate the short circuit current gain and find the transition frequency.
 - d) Discuss how you would bias this circuit.

3. An NMOS with $K_P=2.3E-5$, $V_{TO}=0.4$, $LAMBDA=0.035$ is biased in saturation such that the drain current is $I_D=2.6\text{ma}$ at $V_{DS}=4\text{V}$.
 - a) Find W/L
 - b) Draw the small signal admittance matrix based equivalent circuit with numerical values for the transistor in common source configuration.
 - c) For $C_{GS}=C_{GD}=5\text{pF}$ find the $Y(s)$ matrix.
 - d) Find the short circuit current gain and compare with the BJT of 2. above.
 - e) Discuss how you would bias this circuit.

4. Catalog as many current mirrors as you can find in the text and compare properties.