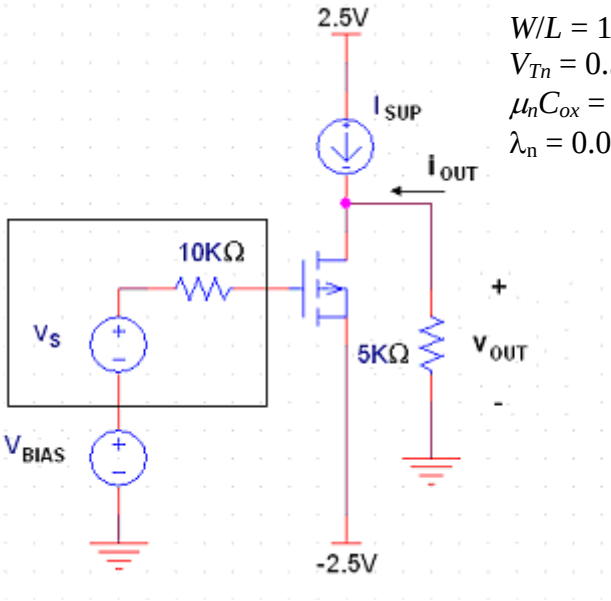
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Electrical Engineering and Computer Science

6.012
Microelectronic Devices and Circuits
Spring 2009

April 24, 2009 - Homework 7
Due May 1, 2009

Problem 1

You are given a CS amplifier and NMOS device parameters shown below. The current source supply provides 100μA and has an infinite output resistance, (i.e. ISUP = 100 μA and roc → ∞). The current source supply must have at least 0.5 V across it in order to maintain the high output resistance.



W/L = 150/1.5
V_{Tn} = 0.5 V
$\mu_n C_{ox}$ = 50 μA/V^2
λ_n = 0.067 V^{-1} @ L = 1.5 μm

a) Calculate V_{BIAS} such that V_{OUT} = 0 V.

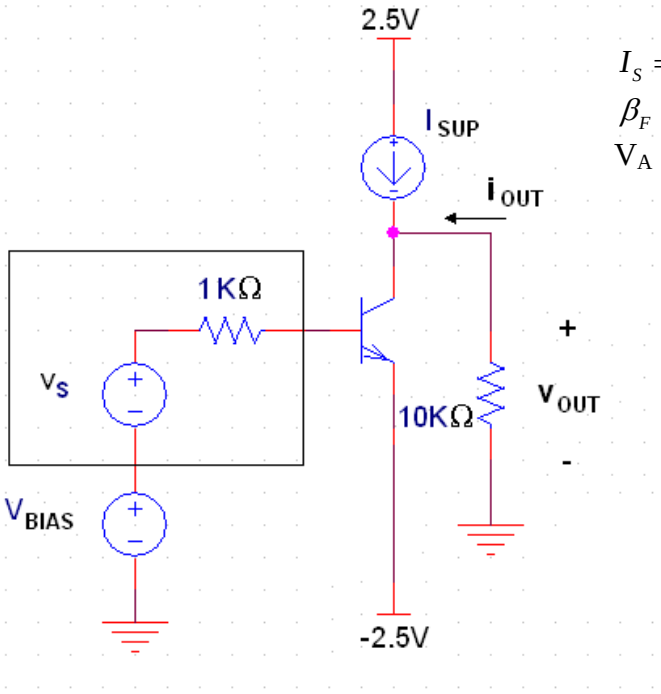
b) Draw the two-port model and calculate the two-port parameters R_{in}, R_{out}, and A_v.

c) Calculate the overall voltage gain v_{out}/v_s.

d) Calculate the output voltage swing.

Problem 2

You are given a CE amplifier and NPN device parameters shown below. The current source supply provides 250μA and has an output resistance equal to r_o of the NPN (i.e. I_{SUP} = 250μA and $r_{oc} = r_o$). The current source supply must have at least 0.5V across it in order to maintain the high output resistance.



$I_S = 10^{-15}$ A

$\beta_F = 100$

V_A = 25V

a) Calculate V_{BIAS} such that V_{OUT} = 0 V.

b) Draw the two-port model and calculate the two-port parameters R_{in}, R_{out}, and A_v.

c) Calculate the overall voltage gain v_{out}/v_s.

d) Calculate the output voltage swing. Assume V_{CEsat} = 0.2V.

Problem 3

Howe and Sodini P8.30

Problem 4

Howe and Sodini P8.39, V_{TOn} = 0.7V

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