PROBLEM SET #8

Issued: Thursday, Mar. 14, 2013

Due (at 8 a.m.): Tuesday, Mar. 19, 2013, in the EE 140/240A HW box near 125 Cory.

1. In the circuit of Fig. PS8.1, assume $(W/L)_{1\text{-}4}$ = 100µm/0.5µm, I_{SS} = 1mA, V_b = 1.4V, V_{TH} = 0.7V, $\lambda = 0.2V^{-1}$, $K_n' = 60\mu A/V^2$, $K_p' = 30\mu A/V^2$, and $\gamma = 0$.

(a) If M_5 –M_8 are identical and have a length of 0.5µm, calculate their minimum width such that M_3 operates in saturation.

(b) Calculate the maximum output voltage swing.

(c) What is the open-loop voltage gain?

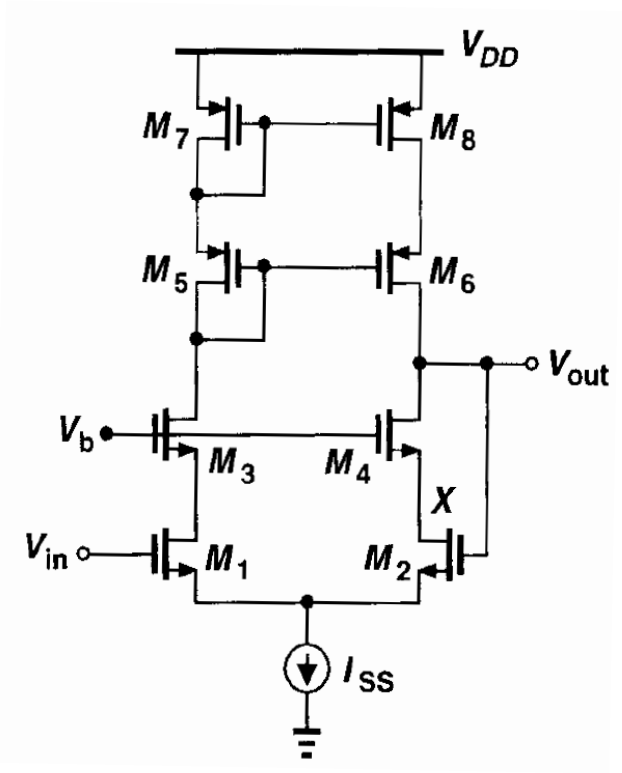

Fig. PS8.1

2. Consider the circuit in Fig. PS8.2. Assume the tail current source is ideal, and the transistors have parameters $\lambda = 0.1V^{-1}$ and $\gamma = 0$. The transistors are nominally biased so that:

$I_{D\text{-}nom}$ = 2mA, $g_{m1,2}$ = 10mS, $g_{m3,4,5,6}$ = 5mS, $g_{m7,8}$ = 10mS.

Find the open-loop voltage gain $A=V_{out}/V_{in}$ for A_{dm}, A_{cm}, $A_{dm\text{-}cm}$, and $A_{cm\text{-}dm}$ wh

en:

(a) The amplifier is perfectly matched.

(b) The amplifier is mismatched such that $(I_{D\text{-}M1,3,5,7}\text{-}I_{D\text{-}M2,4,6,8})/I_{D\text{-}nom}$ = 2%, and $(g_{m1,3,5,7}\text{-}g_{m2,4,6,8})/g_{m,nom}$ = 5%.

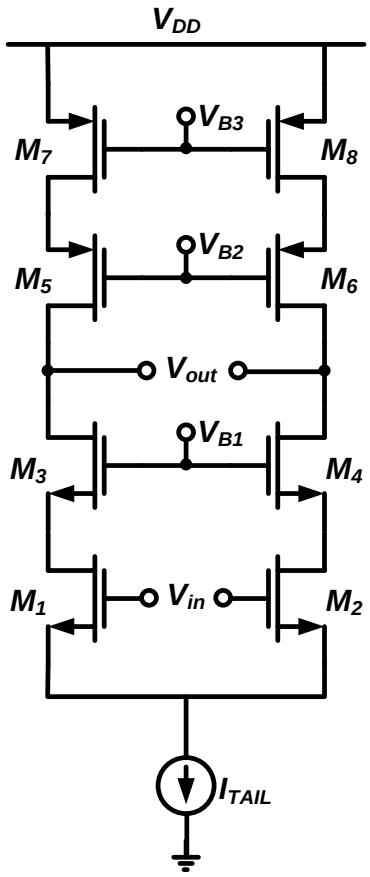

Fig. PS8.2