Problem Set 8

Note Title 10/30/2008

Problem 1

$\Rightarrow$ $\mu_p C_{ox} = \dfrac{100\,\mu A}{V^2}$, $C_{ox} = 8\,fF/\mu^2$

$L = 0.18\,\mu m$, $|V_{TP}| = 0.8\,V$

$W = 9\,\mu m$, $\lambda_p = 0$

A PMOS transistor with parameters given above is biased at a quiescent current of $400\,\mu A$. The gate-drain overlap capacitance is given by

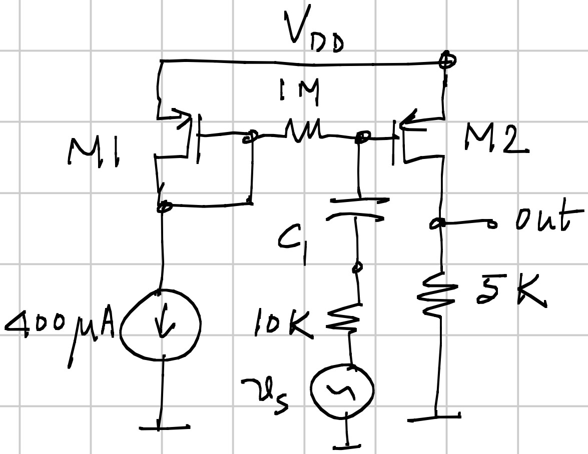
$$C_{ov} = 1\,fF/\mu m \cdot W$$

The parasitic capacitance from drain to ground is given by

$$C_D = 0.4\,fF/\mu m \cdot W$$

(a) Draw the small signal equivalent model of the transistor.

(b)

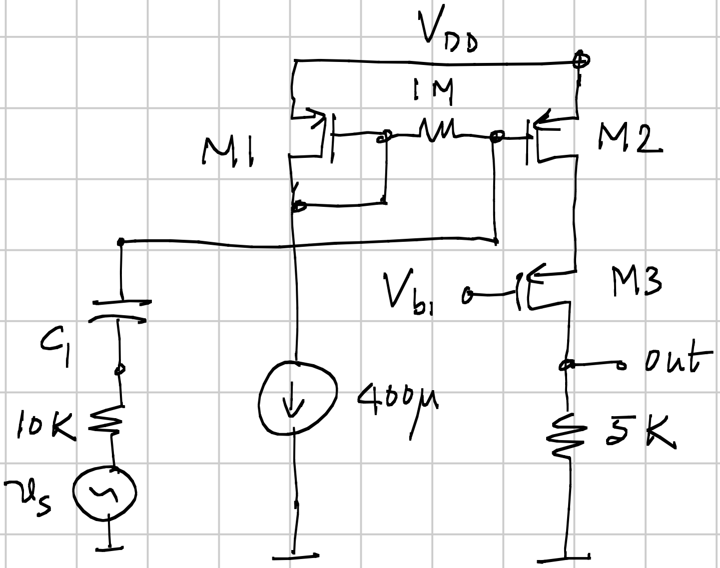


Two such transistors M1 & M2 are connected as shown. Assume C_1 is infinite. Determine the minimum V_{DD} required so that M2 just clips for an output sinusoidal amplitude of 2V.

The lowest frequency of interest in the input is 1 kHz. Determine C_1, so that the low frequency corner of the amplifier is 10 times smaller than the lowest frequency of interest.

(c) Plot the frequency response (on a log-log scale) from v_s to the output marking all critical points.

(d)

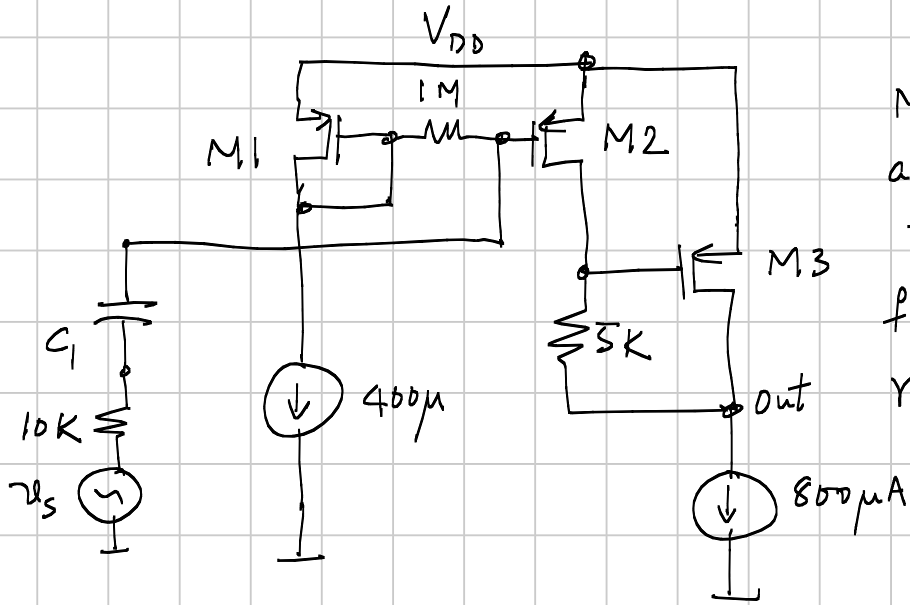


A transistor M_3 is added as shown. M3 is also identical to M2. M3 is to be kept in saturation. Determine V_{b1} so that the smallest V_{DD} can be used while accomodating a 2V sine wave at the output.

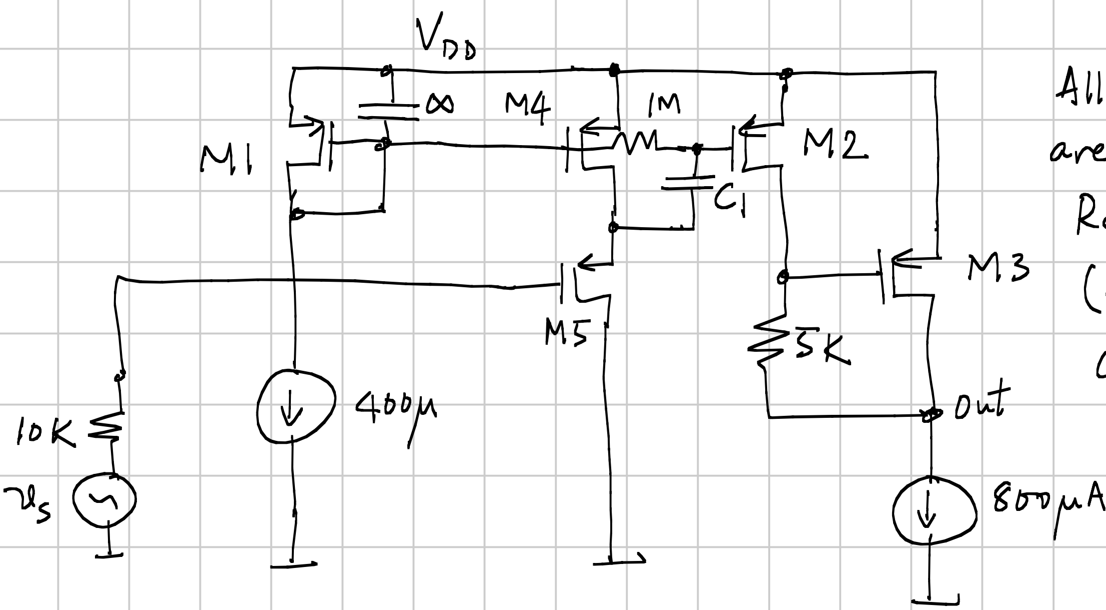
Again, determine C_1, and also plot the frequency response from v_s to the output.

Compare the results from part (c) & (d). What do you notice? Why?

(e)

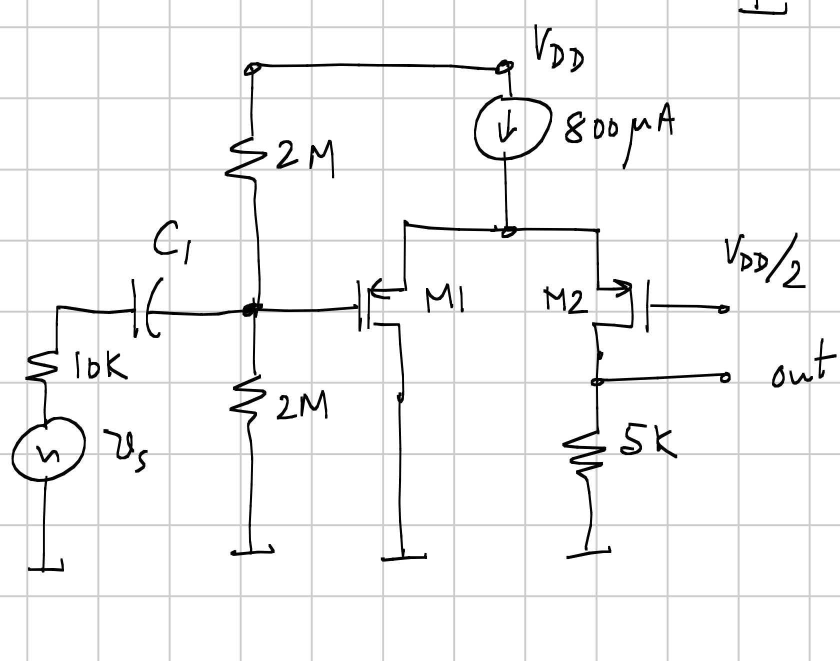


M3 & M2 are identical. Determine the frequency response from v_s to out.



All devices are identical. Repeat part (d) for this circuit....

(f)



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