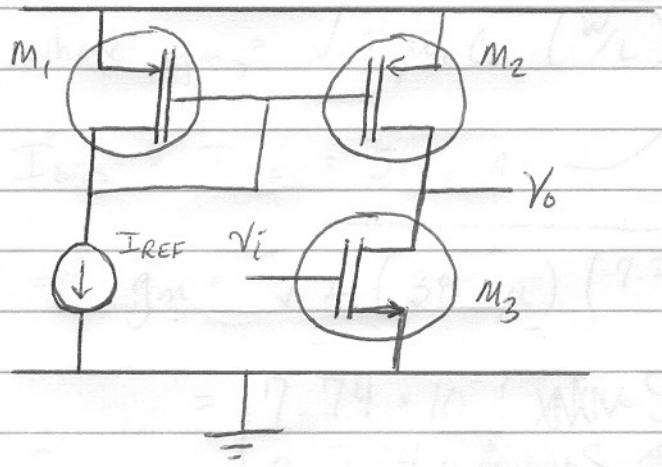
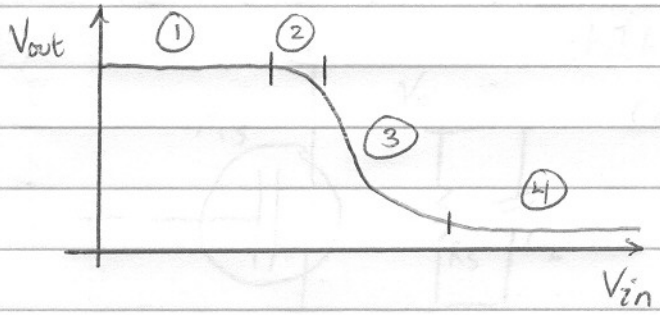
UE3003 SPR 2006 9/8/06

Q5 CMOS Amplifier



(a) Sketch $V_i - V_o$ voltage txr. char.

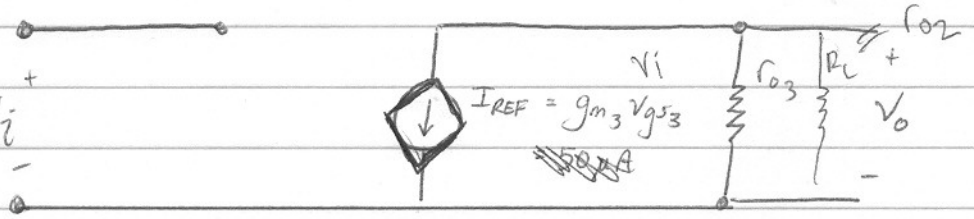


① M_3 is off / M_2 is linear
② M_3 is sat. / M_2 is linear
③ M_3 is sat. / M_2 is sat.
④ M_3 is linear / M_2 is sat.

(b) S.S. Voltage gain (A_v) and o/p res. (r_o)

$A_v = \frac{V_o}{V_i} = ?$ $\quad r_o = ?$

Small signal model:



$$\frac{V_o}{V_i} = -g_{m3}\left(r_{o3}\right)$$ ← How to calc. r_{o3} ???

where $g_{m3} = \sqrt{2\mu_n C_{ox}\left(W/L\right) I_{bias}}$

$I_{bias} = I_{REF} = 50\,\mu A$

$\Rightarrow g_n = \sqrt{2\left(387\mu\right)\left(7.2/0.36\right)\left(50\mu\right)}$ MISTAKE

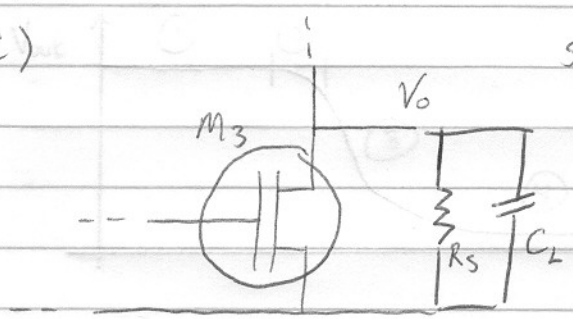
$= \sqrt{7.74 \times 10^{-7}}\ S$

$= \sqrt{774\,n}\ S$ ← $880\,\mu S$

$= 880\,\mu S$

VERIFIED BY PROF. KENNEDY

(c)



sketch Freq. response?
Calc. -3dB freq. f_H?