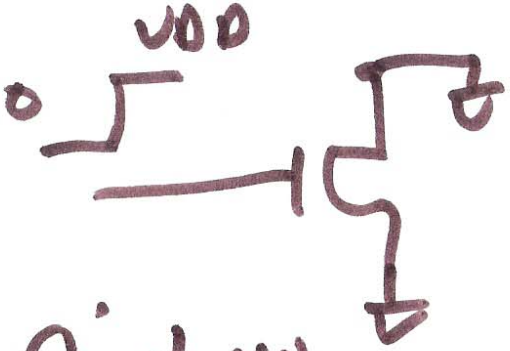
ECE 5/418 Memory circuit Design

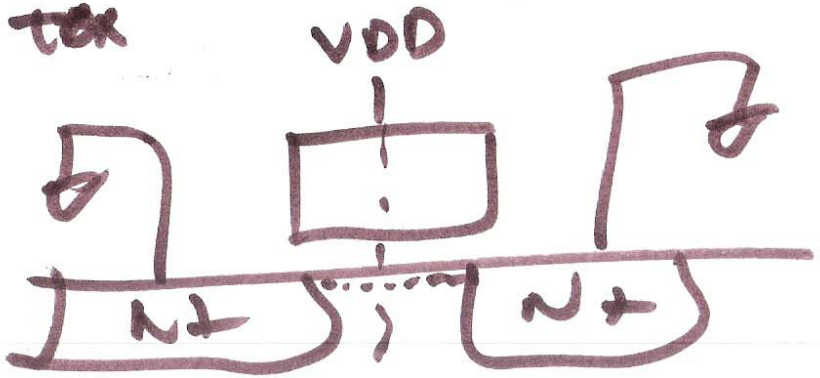
BOISE STATE UNIVERSITY

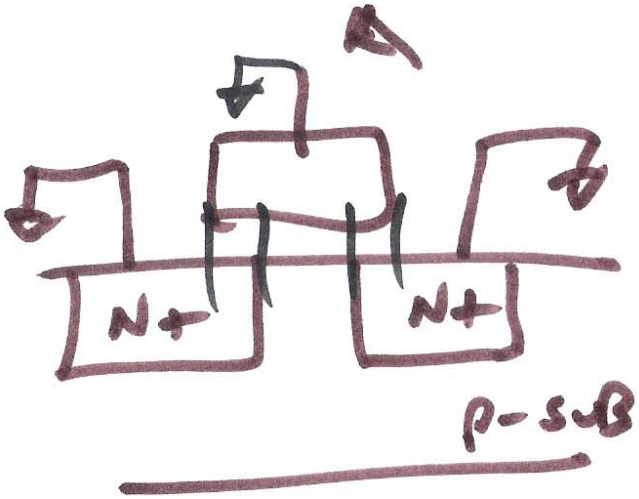
Lecture 20 April 15, 2011

current starved oscillator



$\frac{\epsilon_{ox}}{t_{ox}} \cdot L \cdot W = C_{ox}' \cdot L \cdot W$

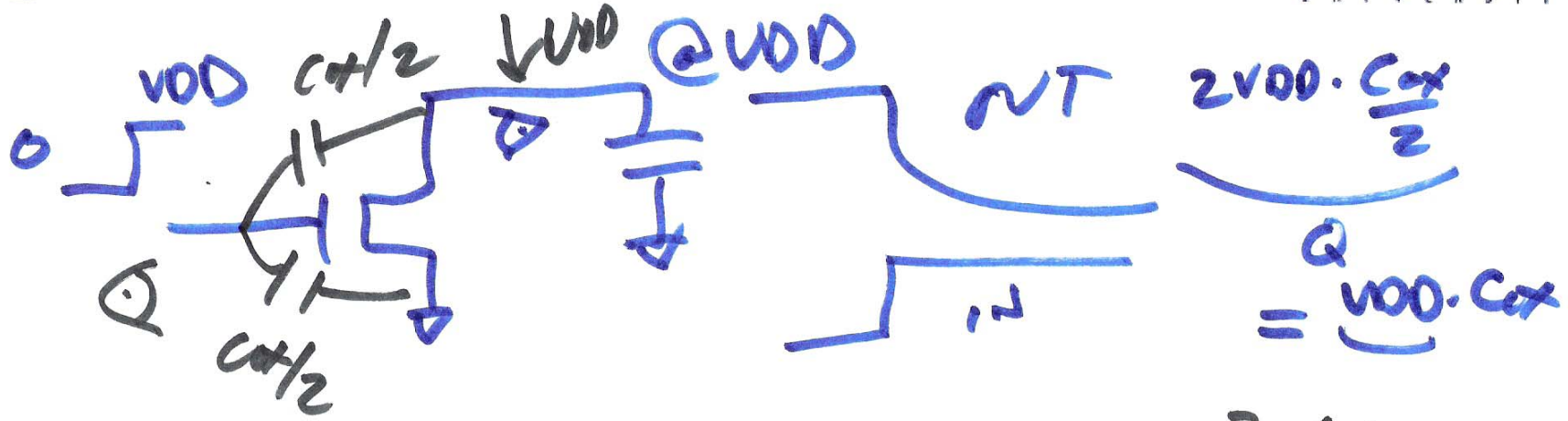




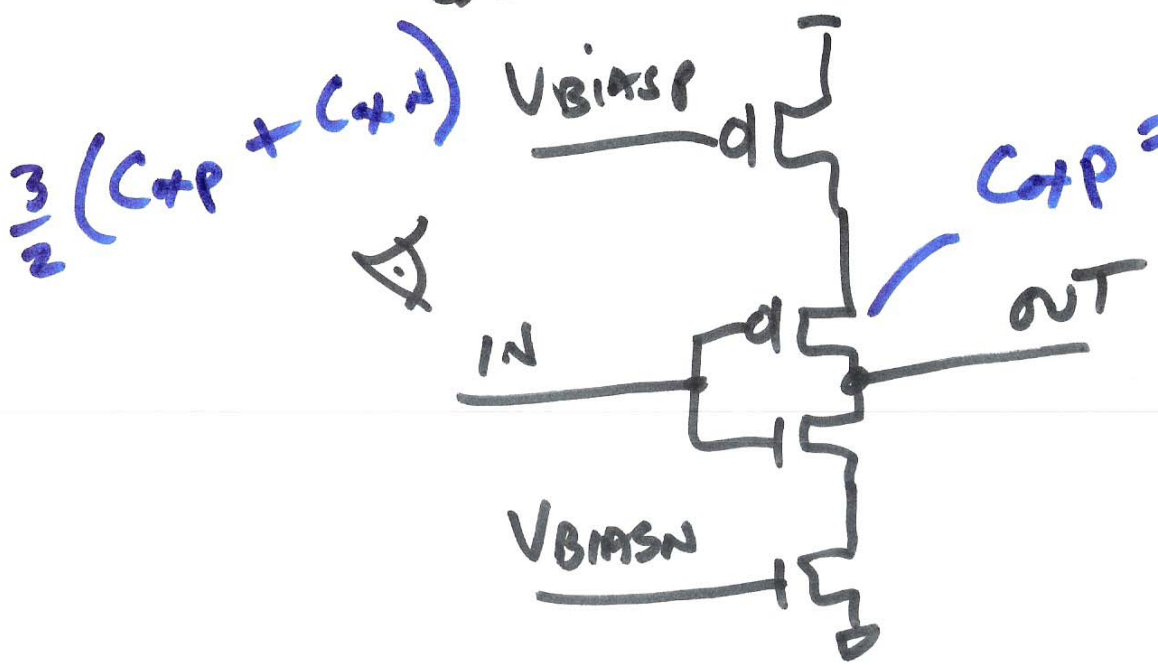
$C_{IN} = C_{GDO} \cdot W + C_{GSO} \cdot W$

$C_{IN} = \frac{1}{2} C_{ox}' \cdot LW + \frac{1}{2} C_{ox}' \cdot L \cdot W$

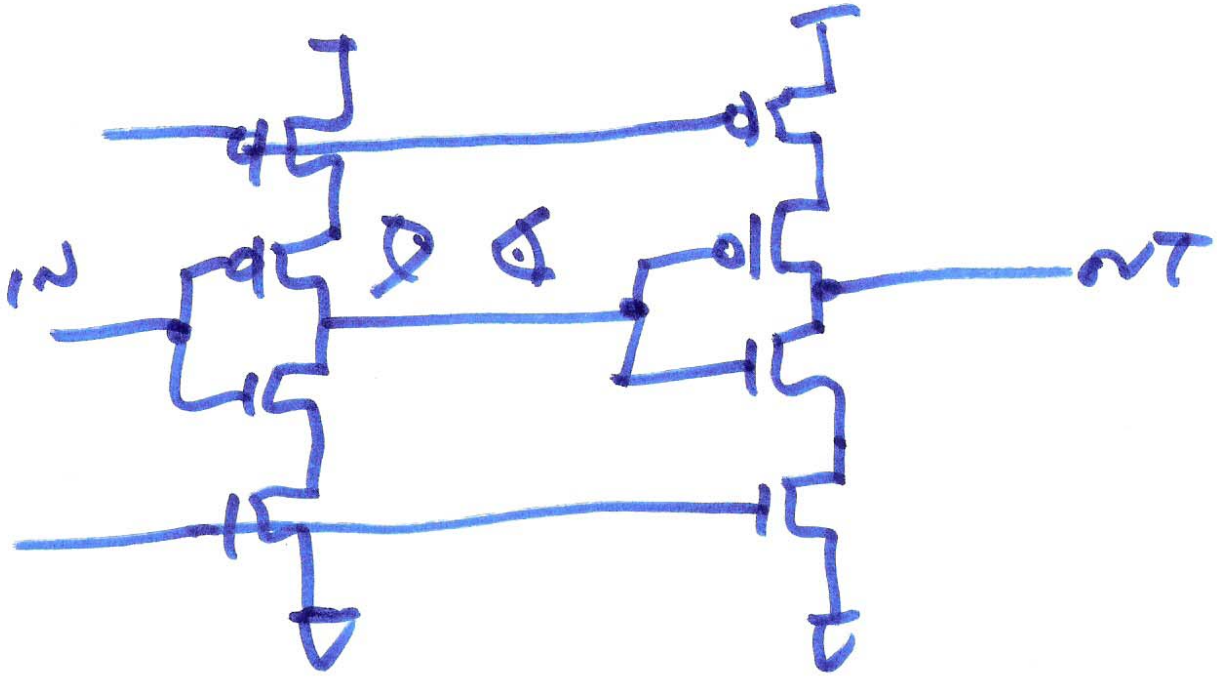
$= C_{ox}' \cdot L \cdot W = C_{ox}$



$$\frac{3}{2} C_{ox} = \frac{3}{2} C'_{ox} \cdot L \cdot W = \frac{3}{2} \frac{\varepsilon_{ox}}{t_{ox}} \cdot L \cdot W$$



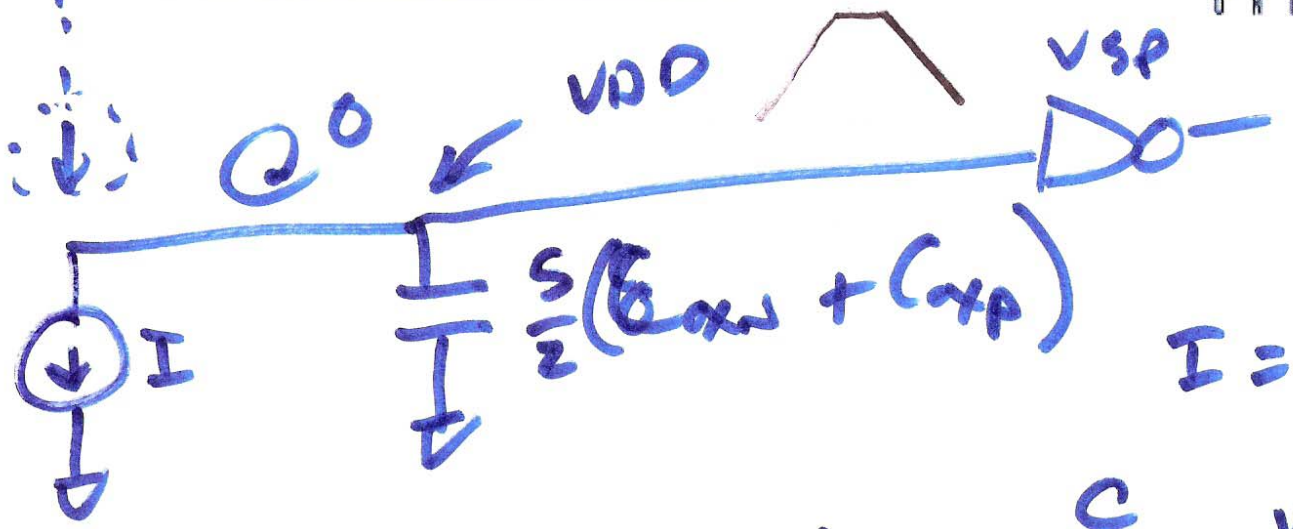
2)



$$C_{gN} + C_{gP} + \frac{3}{2}C_{gN} + \frac{3}{2}C_{gP}$$

$$C_{TOT} = \frac{5}{2}(C_{gN} + C_{gP})$$

3)



$I = C\frac{dV}{dt}$

$t_{dis} = \frac{C}{I} \cdot VDD - V_{SP}$

$t_{voltage} = \frac{C}{I} \cdot V_{SP}$

$f_{osc} = \frac{1}{N(t_{voltage} + t_{discharge})}$

$\frac{1}{10} \frac{1}{2} \cdot 10^9 = 1GHz$

$= \frac{1}{11 \cdot \left(\frac{4.6f}{25\mu} \cdot \frac{1V}{2}\right)}$

delay of a stage $= \frac{C}{I} \cdot VDD$

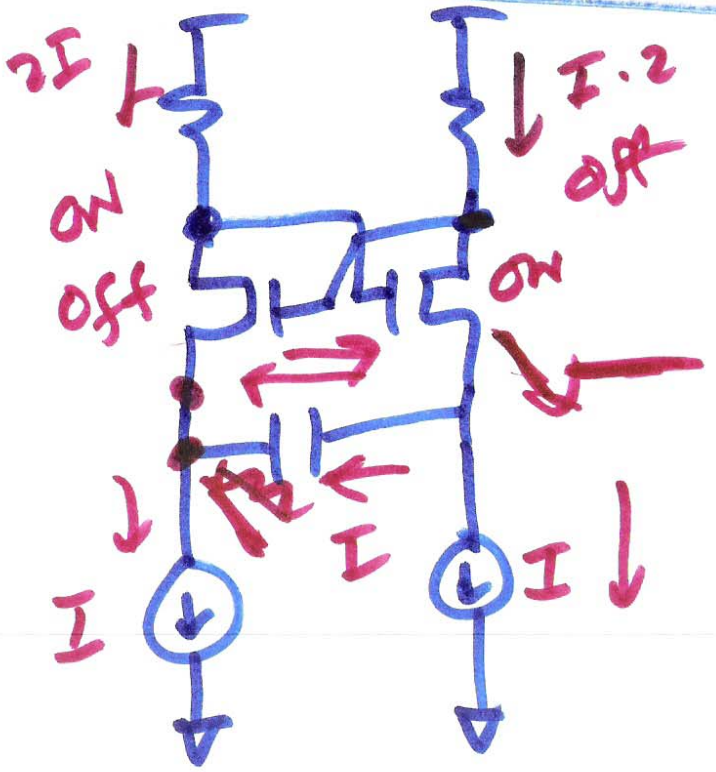
$2.5 \cdot (1.85ff) = 4.6ff$

4)

$$C_{TOT} = 1.85fF \cdot 2.5 = 4.6fF$$

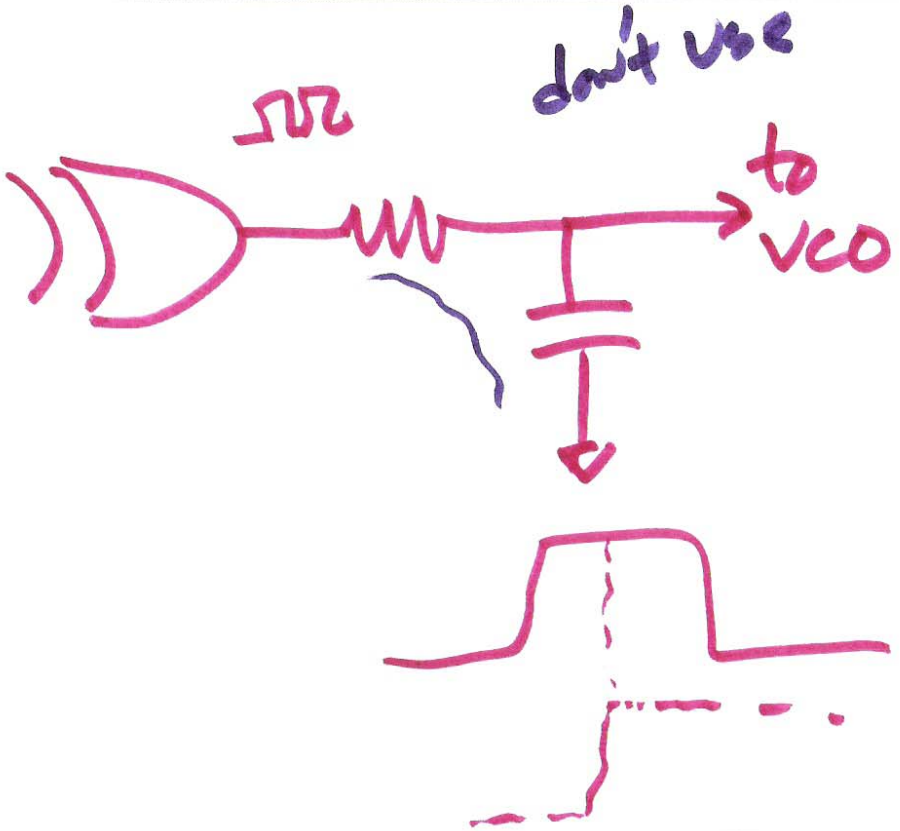
$$f_{OSC} = \frac{5\mu}{11 \cdot 4.6fF \cdot 1V} = 97.75\ MHz$$

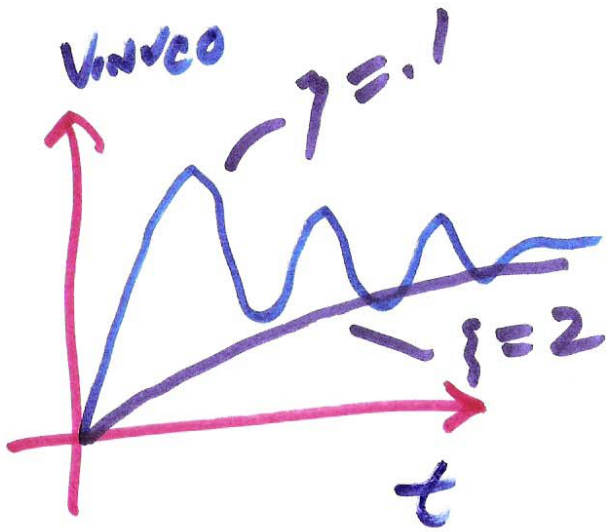
$$10.23\ ns$$



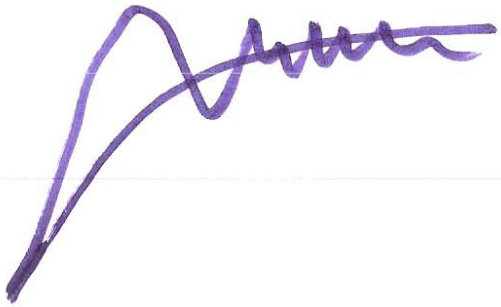
5)

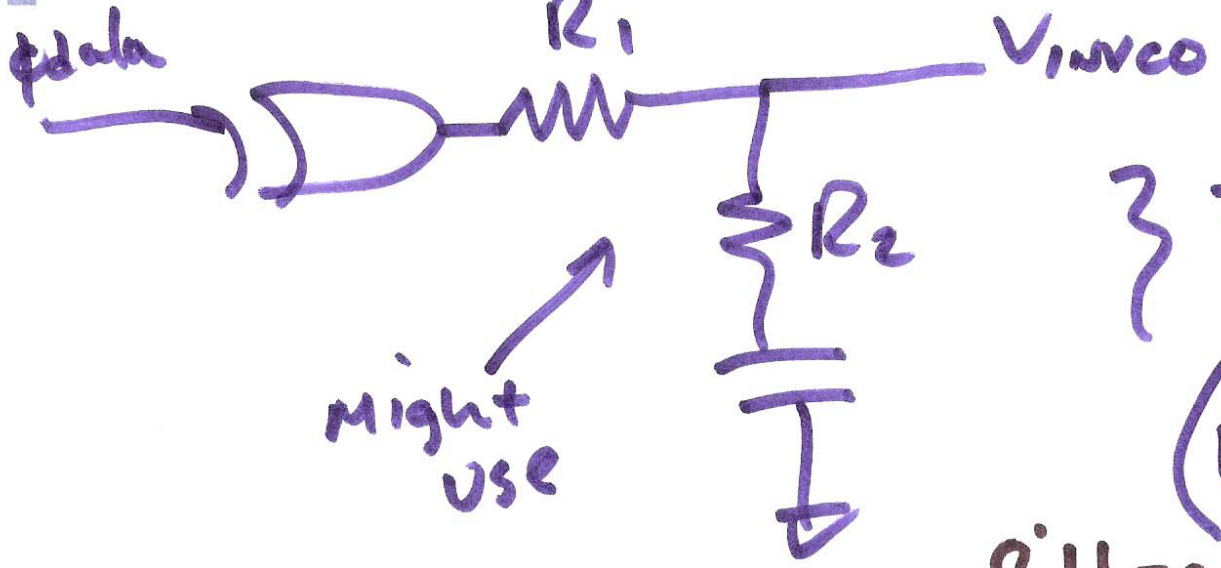
XOR PD Loop filter





$$f = \frac{1}{2}\sqrt{\frac{N}{K_{PD} \cdot K_{VCO} \cdot RC}}$$

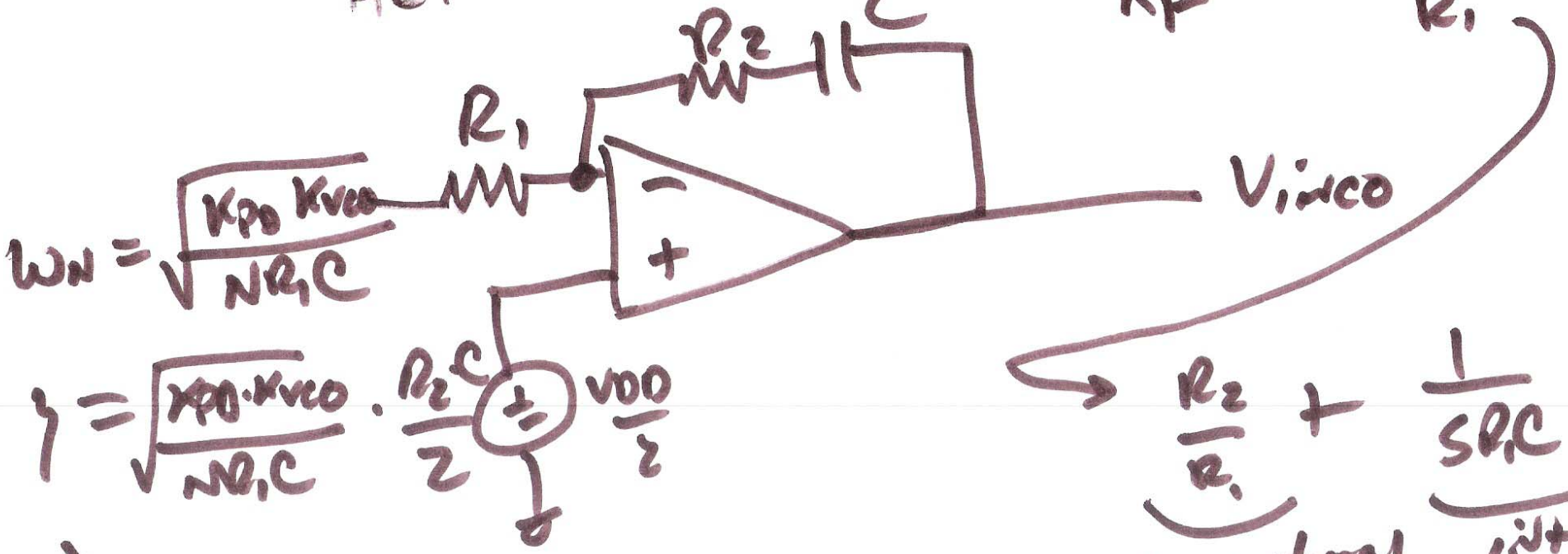




$$\zeta = \frac{1}{2}\sqrt{\frac{K_{PD} K_{VCO}}{N(R_1+R_2)C}} \cdot \left(R_2 C + \frac{N}{K_{PD} K_{VCO}}\right)$$

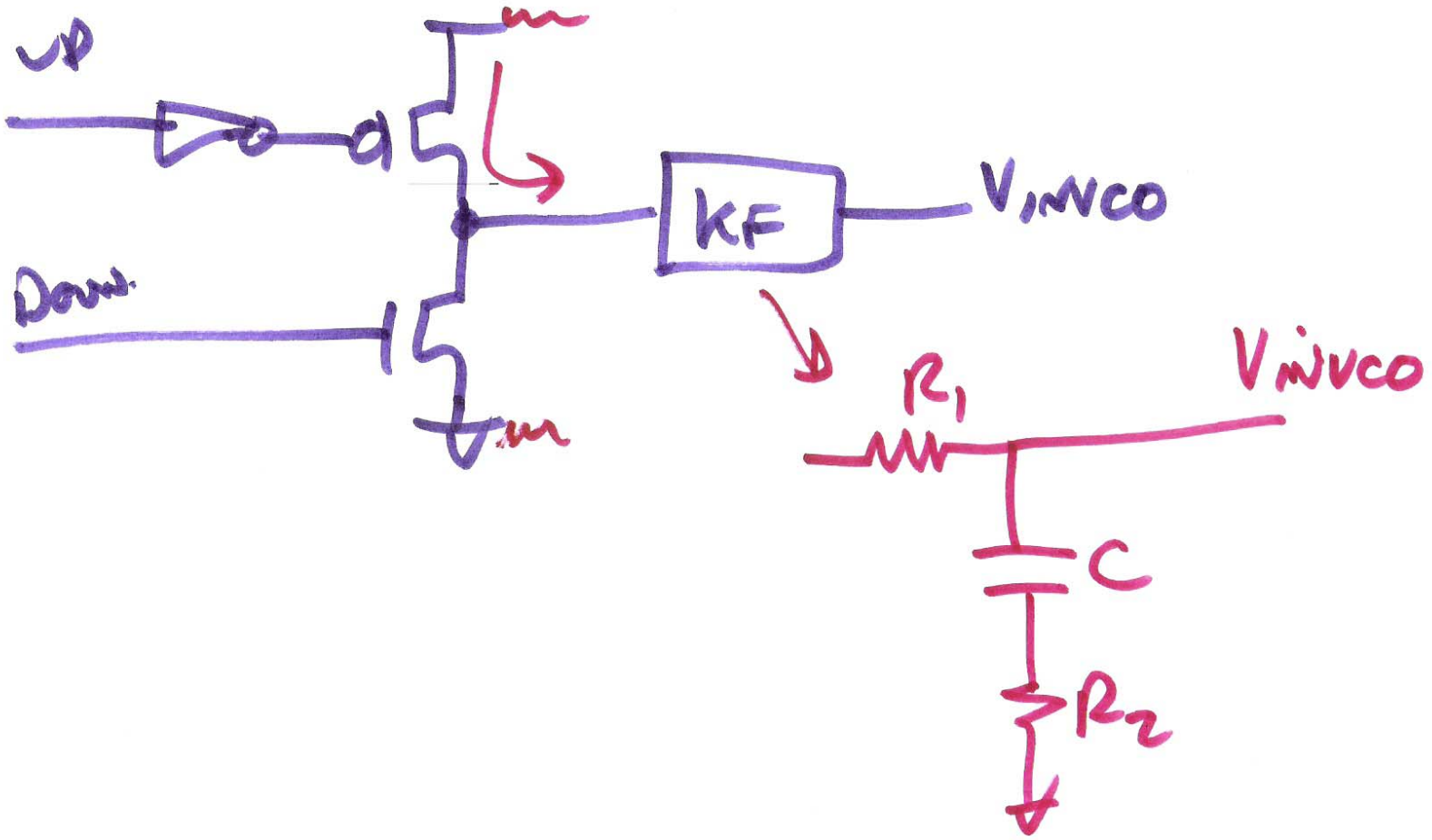
Active PI loop filter

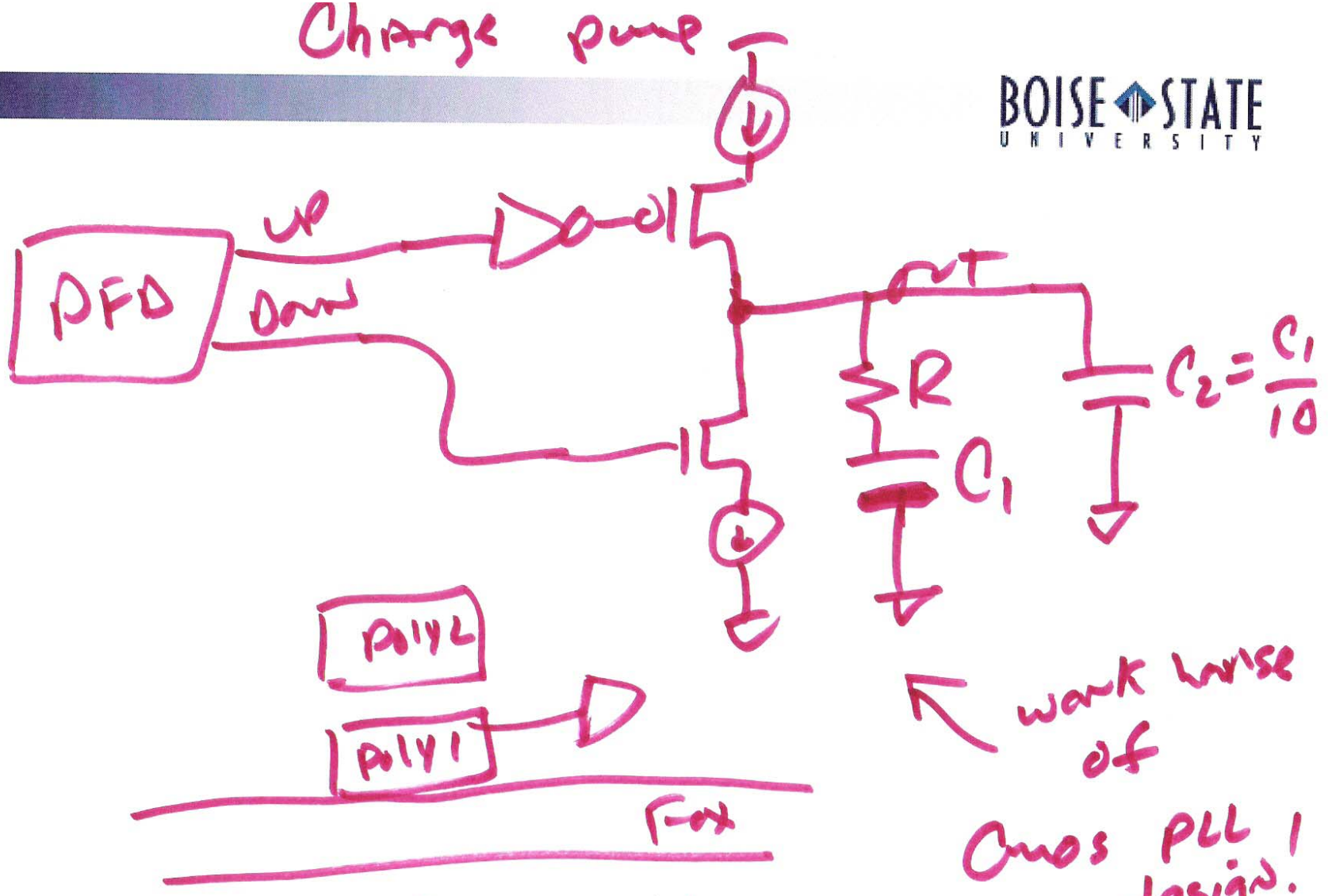
$$K_F = \frac{R_2 + 1/sC}{R_1}$$



7)

tri-state





$$\omega_N = \sqrt{\frac{K_{PDI} \cdot K_{VCO}}{N C_1}}$$

$$\zeta = \frac{\omega_N}{2} \cdot RC_1$$

9)