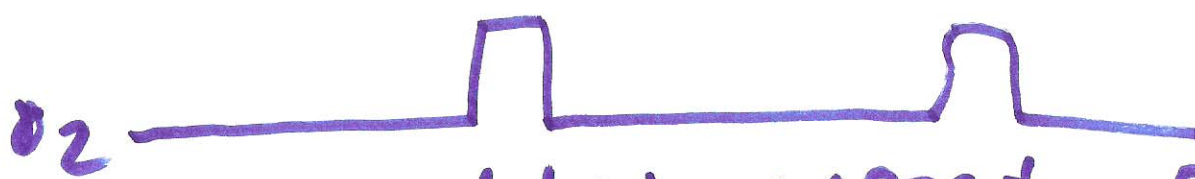
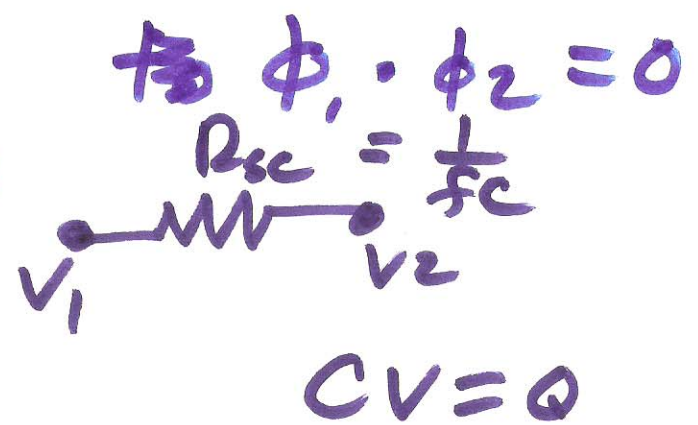
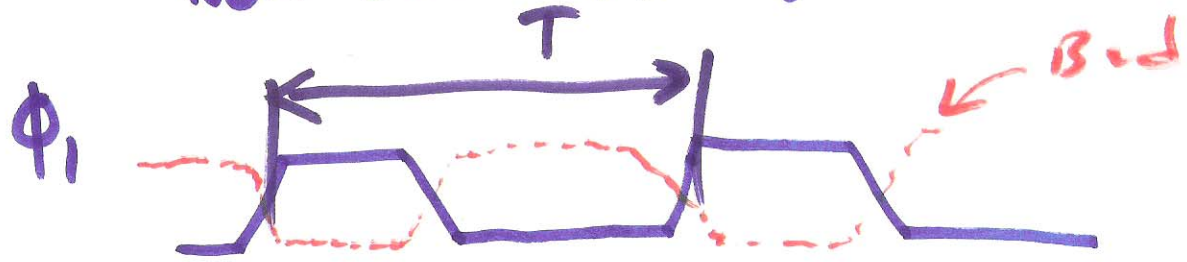


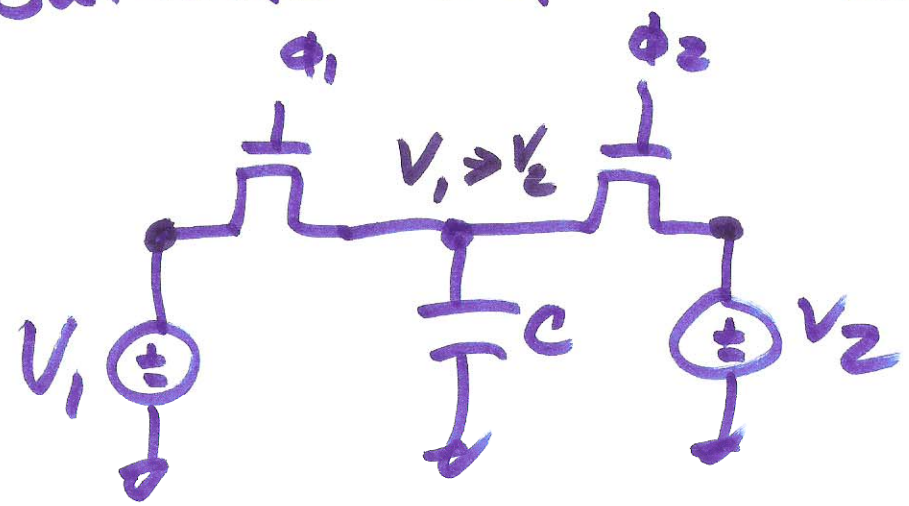
Section 25.3

Switched-capacitor CIRCUITS

NON-OVERLAPPING clocks



Switched-capacitor Resistor

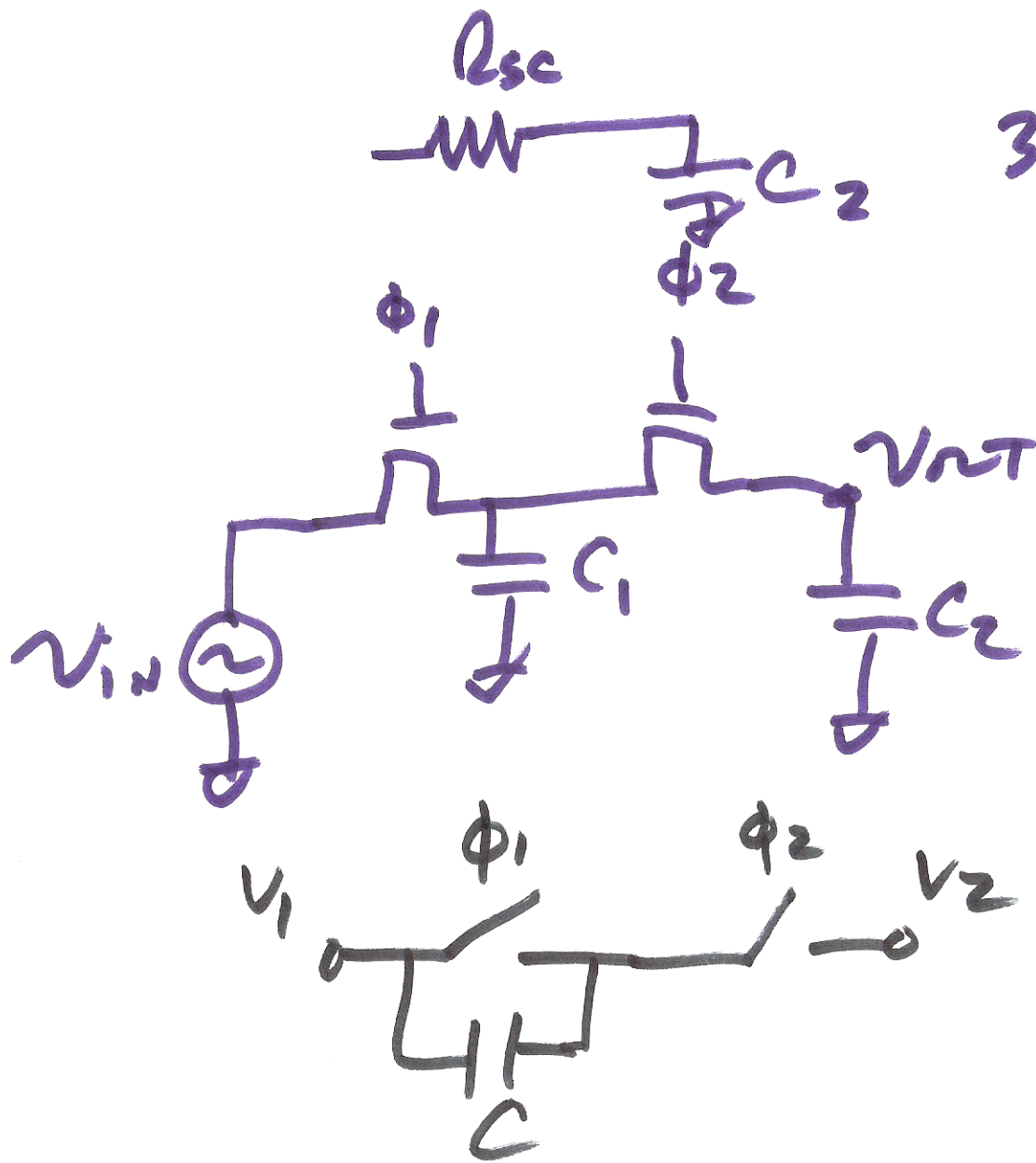


$$(V_1 - V_2)C = Q$$

$$I = \frac{Q}{T} = Q \cdot f$$

$$I = \frac{(V_1 - V_2)}{1/fc}$$

1)



$$3dB \rightarrow \frac{1}{2\pi R_{sc} \cdot C_2}$$

$$= \frac{1}{2\pi \frac{1}{f_c} \cdot C_2}$$

$$\propto \frac{C_1}{C_2}$$

1MHz
 C = 1pF
 R_{sc} = 10⁶

φ₁ closed
 Q = 0

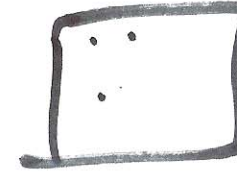
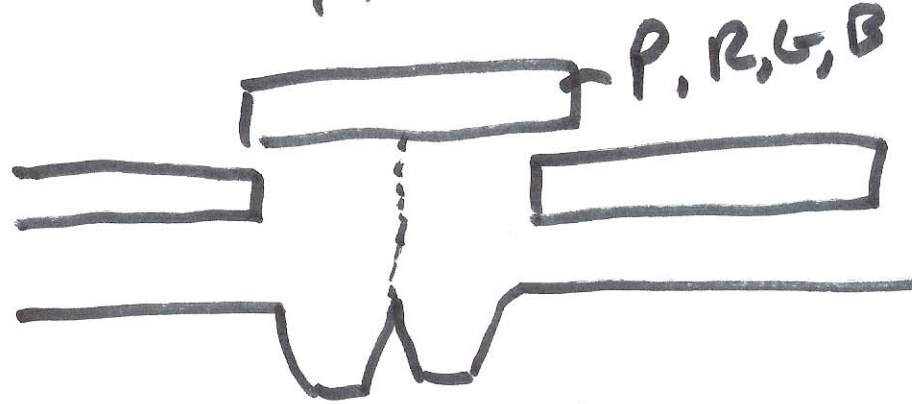
φ₂ closed

$$Q = (v_1 - v_2) \cdot C$$

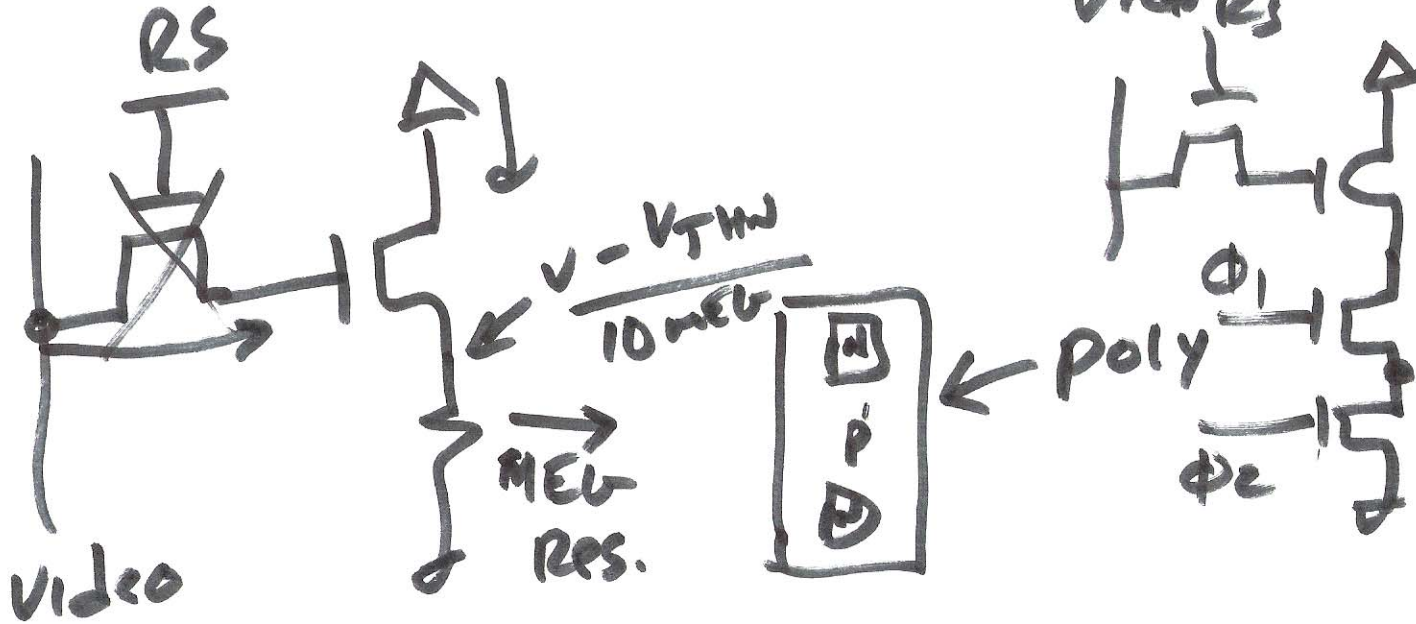
$$I_{avg} = \frac{Q}{T} = f_c$$

$$R_{sc} = \frac{1}{f_c C}$$

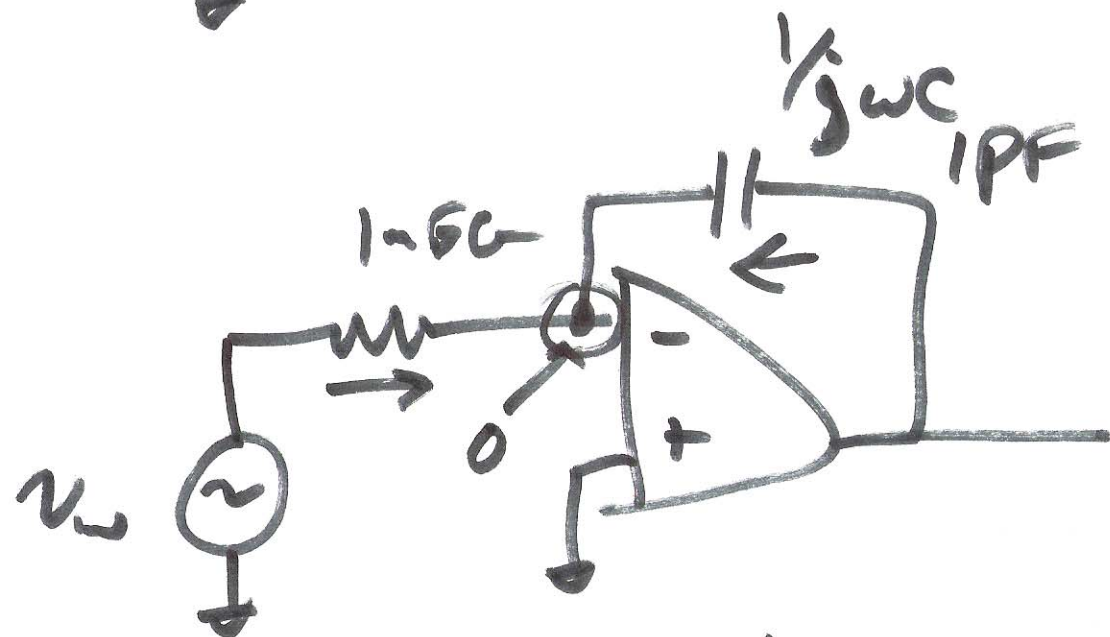
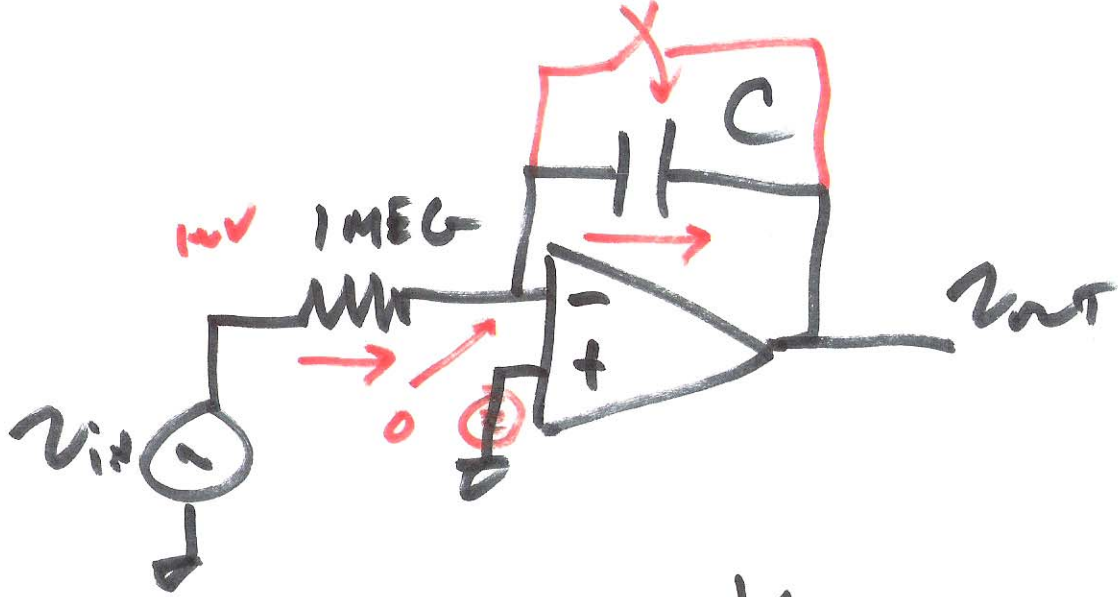
Field Emitting Display



54 NMOS



3
2)



$$v_{out} = A_{OL} (v_+ - v_-)$$

$$\frac{v_{in}}{1 \text{ MEG}} + \frac{v_{out}}{j\omega C} = 0$$

$$\frac{v_{out}}{v_{in}} = -\frac{1}{j\omega \cdot 10^{-6}}$$

4/3)

$$\frac{v_{out}}{v_{in}} = -\frac{1}{j\omega \cdot 10^{-6}} = -\frac{1}{j\omega RC}$$

f when $\left| \frac{v_{out}}{v_{in}} \right| = 1$

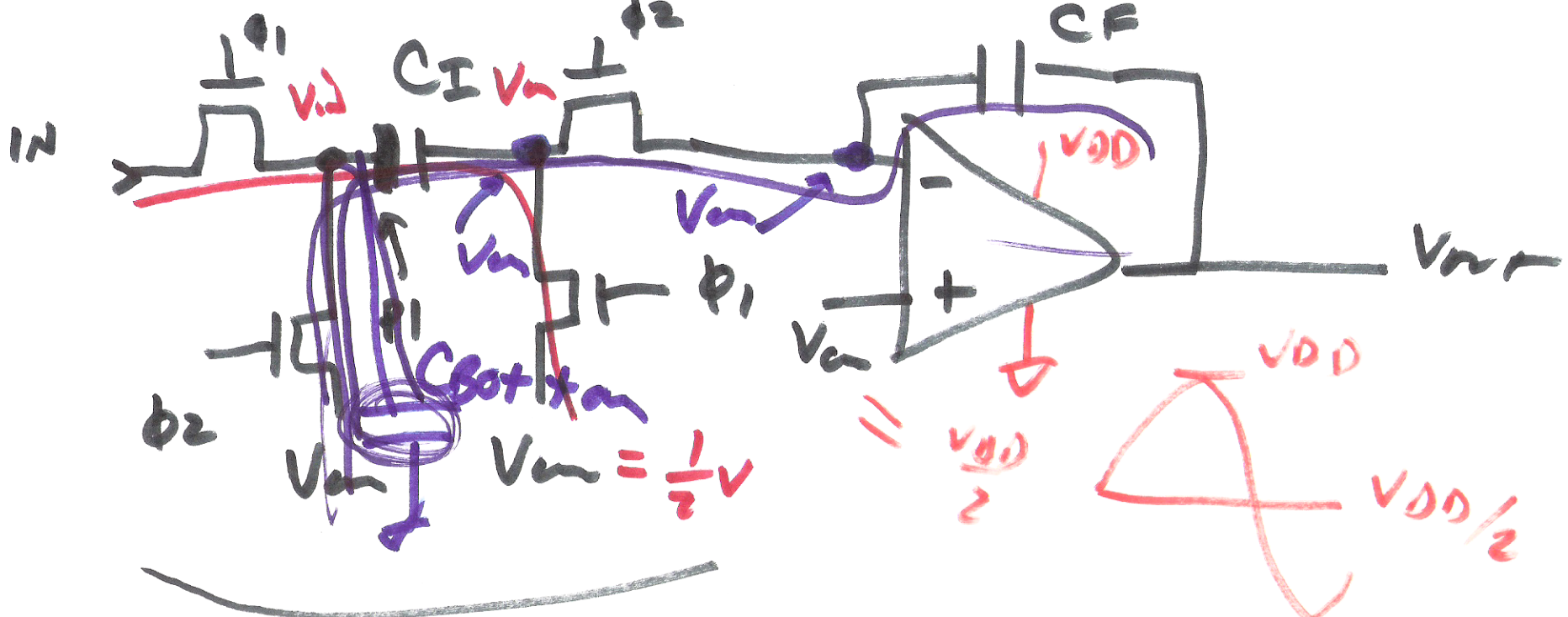
phase $\frac{-1 + j0}{0 + j \cdot \omega \cdot 10^{-6}}$

$\angle \left[\tan^{-1} \frac{0}{-1} - \tan^{-1} \frac{j\omega \cdot 10^{-6}}{0} \right]$

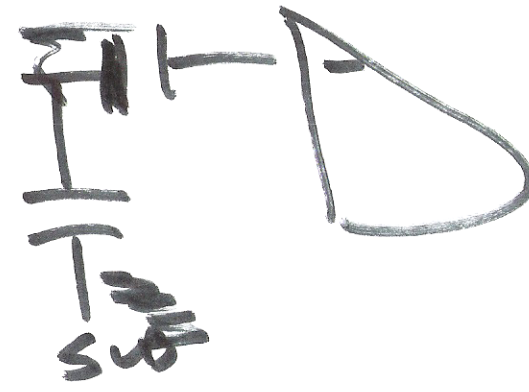
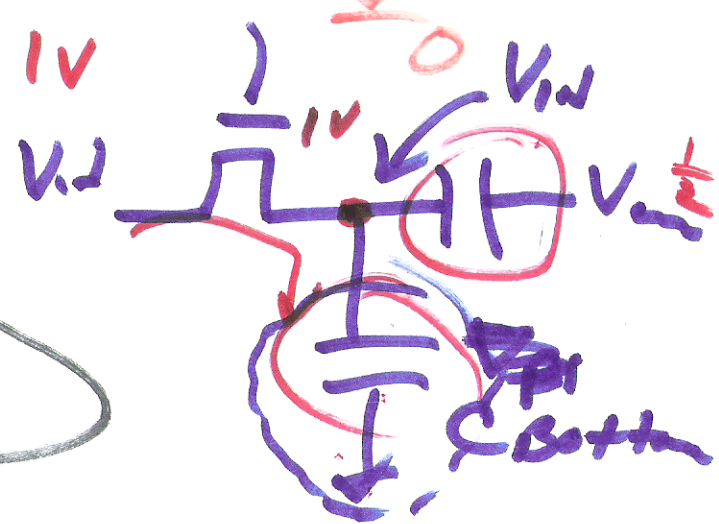
$180^\circ - 90^\circ = +90^\circ \Rightarrow \text{for all } f$

$\left| \frac{1}{2\pi f \cdot 10^{-6}} \right| = 1 \quad \boxed{f = 159 \text{ KHz}}$

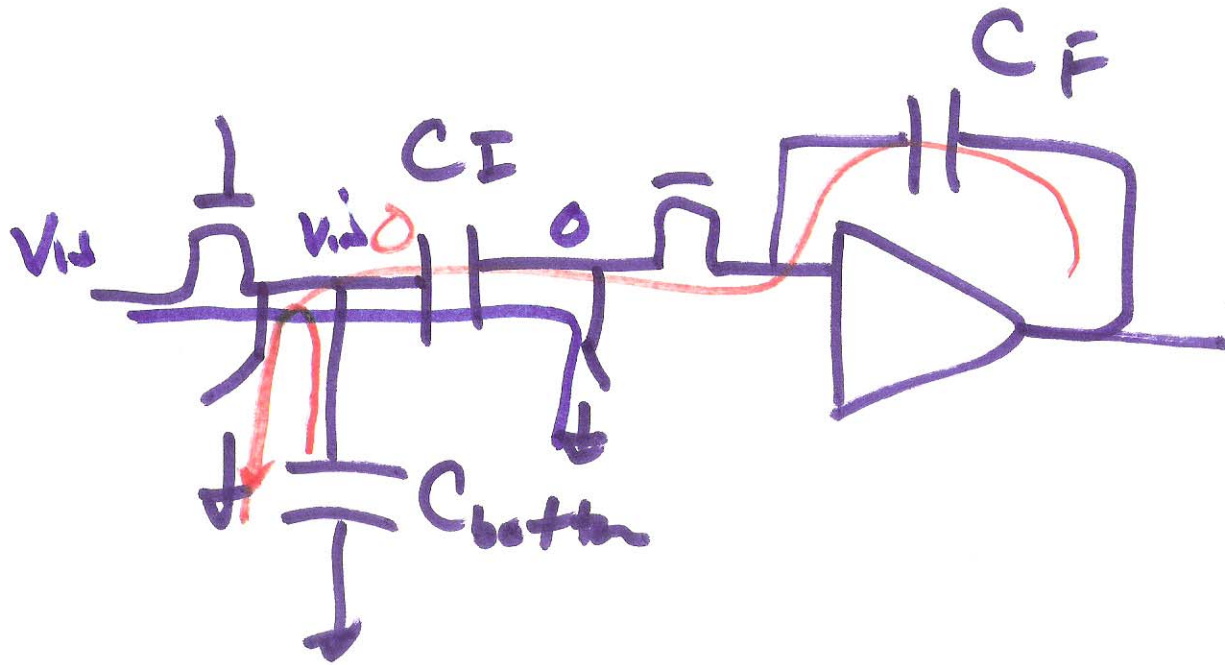
5)



R_{sc}



6)



7)