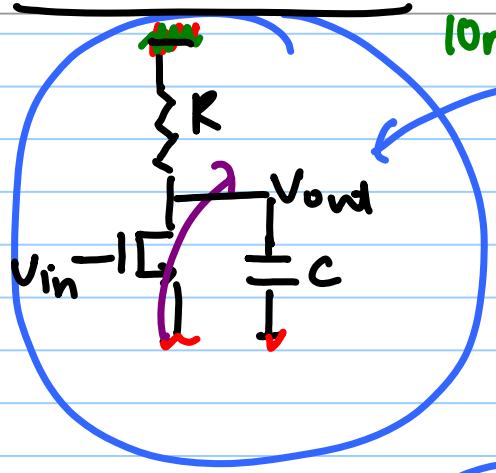
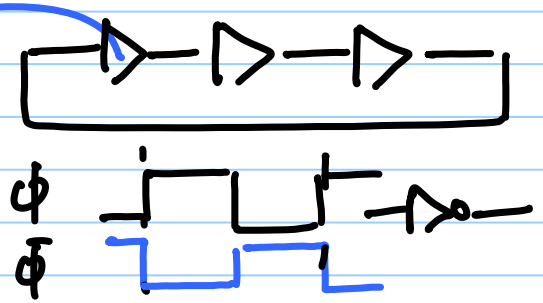
Lecture #32

Note Title 04-10-2017

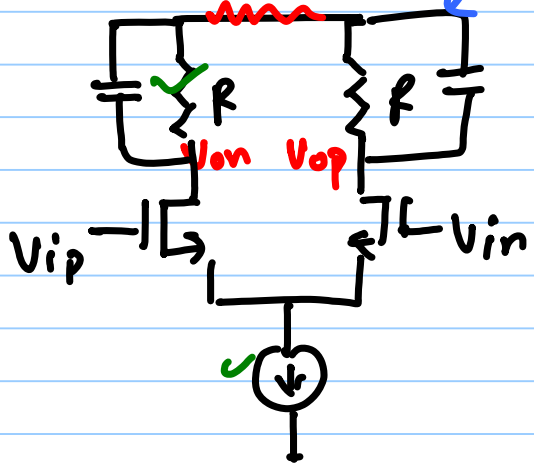


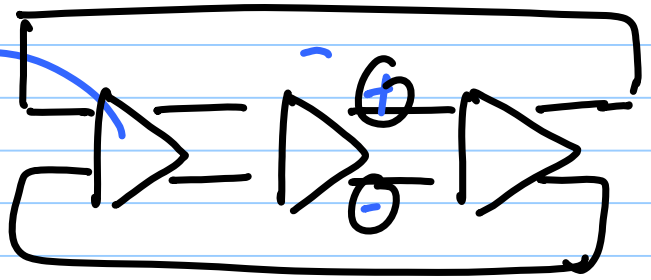
10mV @ 10MHz



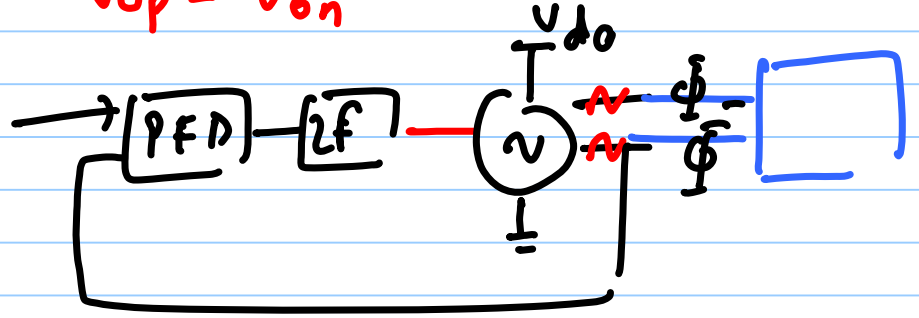
Oscillator Performance Param.

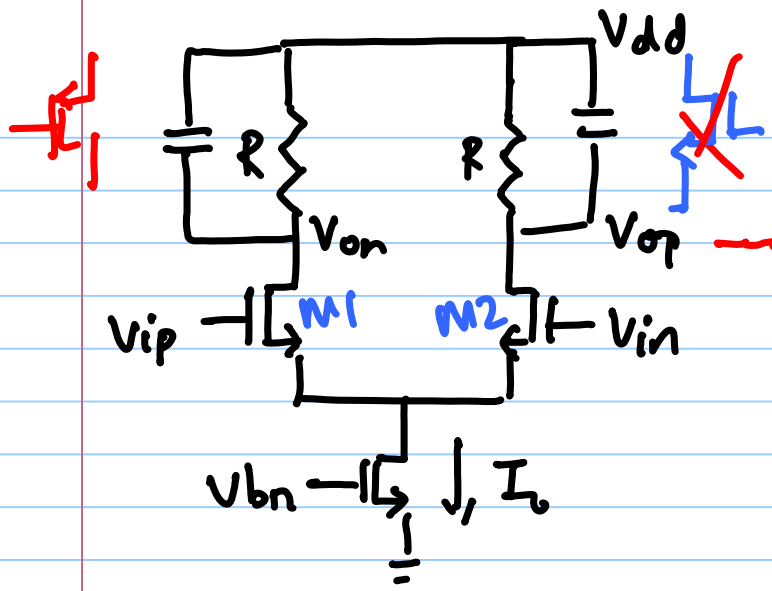
- Amplitude
- Frequency ($\omega_{osc} = \sqrt{3}\omega_p$)
- Frequency tuning.
- Power (lower power)
- Phase noise / jitter (lower jitter)
- PSRR (Power supply Rejection

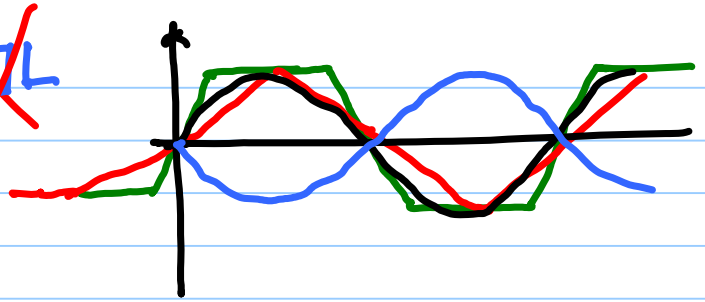


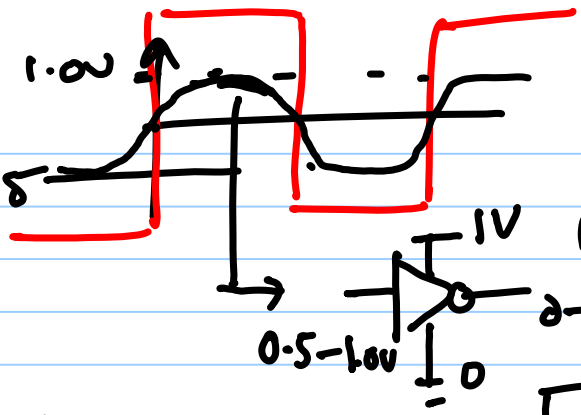


Vop - Von







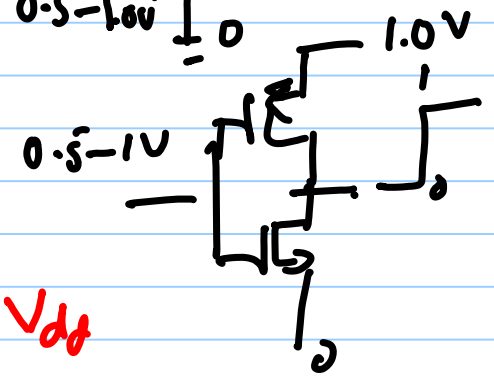


$$V_{op} = V_{dd} - \left(\frac{I_o}{2} - \Delta I\right) R$$

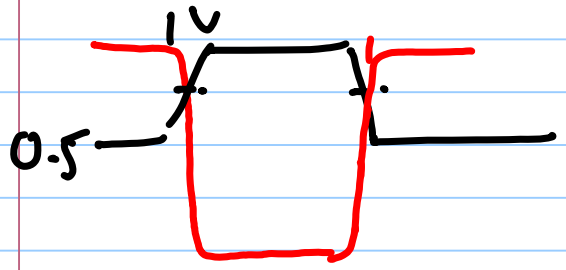
$$V_{on} = V_{dd} - \left(\frac{I_o}{2} + \Delta I\right) R$$

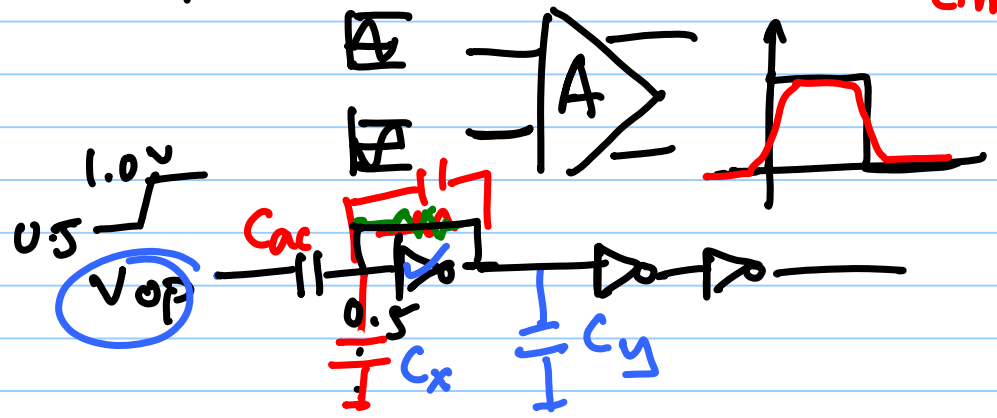
$$V_{ow} = V_{op} - V_{on} = 2 \cdot \Delta I \cdot R \leq I_o R < V_{dd}$$

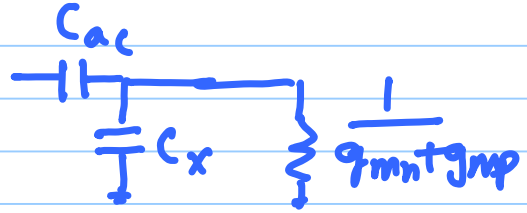
↳ To vary amp.
Limited o/p swing.

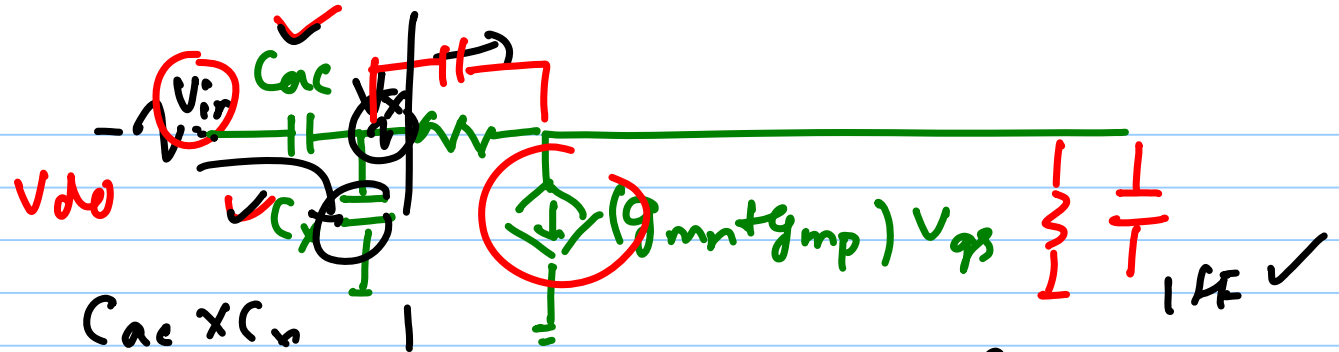


$$\omega_{osc} = \frac{\sqrt{3}}{RC}$$









$$= \frac{C_{ac} \times C_x}{C_{ac}+C_x} \quad \frac{1}{}$$

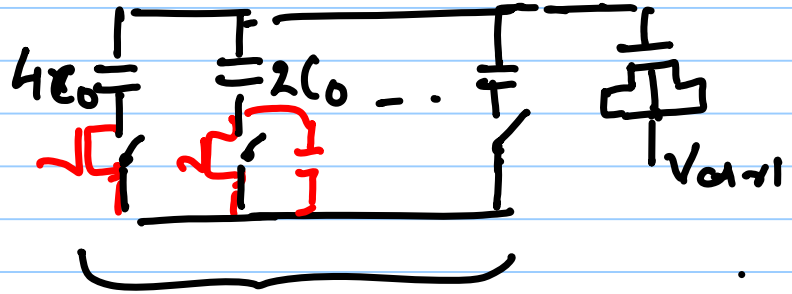
$C_x = 5ff$

Cac
1 ff ✓
10 ff
100 ff

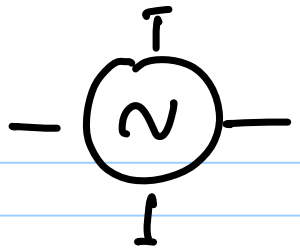
$$V_x = \frac{C_{ac}}{C_{ac}+C_x} V_{in}$$

Frequency ($\omega_{osc} = \sqrt{3}/RC$)

- Vary R
- Vary C
- Vary both R, C



R, C ± 10-30%

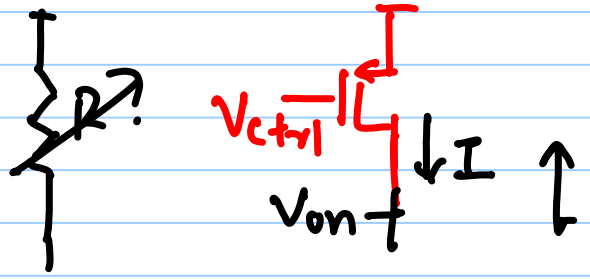


R, C — $\pm 10\text{-}30\%$ ⟶ freq

$$f_{osc} = \frac{1}{2_1 RC} = \frac{f}{0.64}$$

$f_0 \pm 20\%$

cap bank → f_0



$$V_{SG} - |V_{TP}| > V_{SD}$$

$$V_{DD} - V_{ctrl} - |V_{TP}| > V_{DD} - V_{on}$$

$$\Rightarrow \underbrace{V_{ctrl}}_{\text{limited}} < V_{on} - |V_{TP}|$$

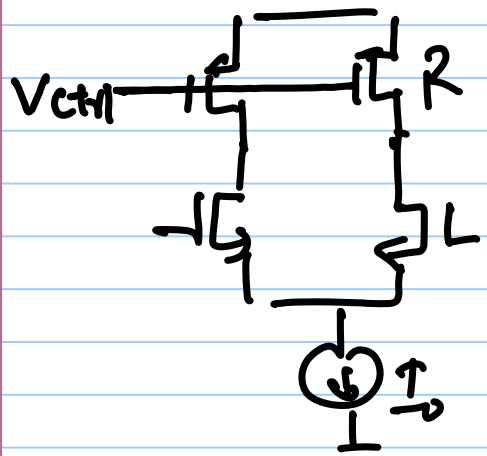
$$I = \frac{KW}{L}\left[(V_{DD} - V_{ctrl} - |V_{TP}|)(V_{DD} - V_{on}) - \frac{(V_{DD} - V_{on})^2}{2} \right]$$

V_{SD} $\qquad$ V_{SD}^2

$$R = \frac{V_{SD}}{I} \approx \frac{1}{\frac{KW}{L}(V_{DD} - V_{ctrl} - |V_{TH}|)}$$

$V_{SG} - |V_{TH}|$

$$f_{osc} = \frac{\sqrt{3}}{2\pi RC} \propto \frac{kW}{L}(V_{DD} - V_{ctrl} - |V_{tp}|)$$



$$V_{out} = I_0 . R \propto \frac{1}{\frac{kW}{L}(V_{DD} - V_{ctrl} - |V_{tp}|)}$$

$$V_{out} \propto \frac{1}{f_{osc}}$$

- Osc. o/p amp. varies w/ frequency.
- Osc o/p amp. $\propto \frac{1}{f_{osc}}$

I_0	$I_0 \propto \frac{1}{R}$
~~R~~	~~R~~
~~f_{osc}~~	~~f_{osc}~~
~~V_{amp}~~	V_{amp}