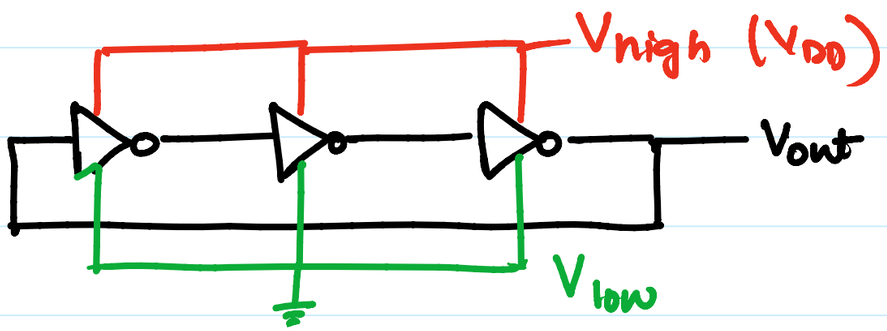
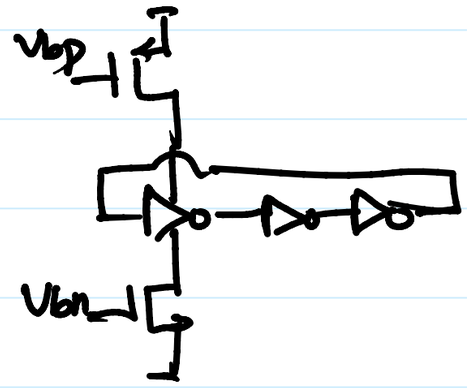
Lecture 27

Wednesday, March 15, 2017 8:08 AM

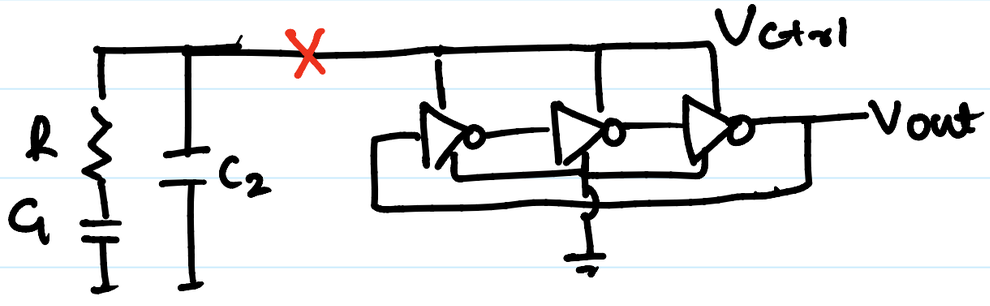
Oscillators.



- High swing oscillator
- Tuning clock freq: a) Change control voltage (Vhigh)
  b) Current starved inverters
  c) Vary capacitive load for inverters.



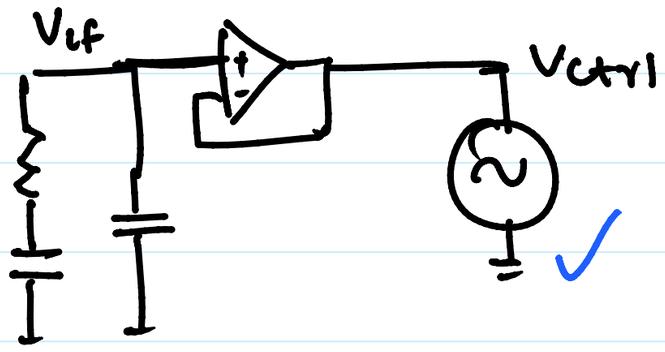
a) & (c) or (b) & (c)



$$f_{out} = f(V_{ctrl}) \approx K_{VCO} \quad [Hz/V]$$

Pros: Power scales w/ frequency

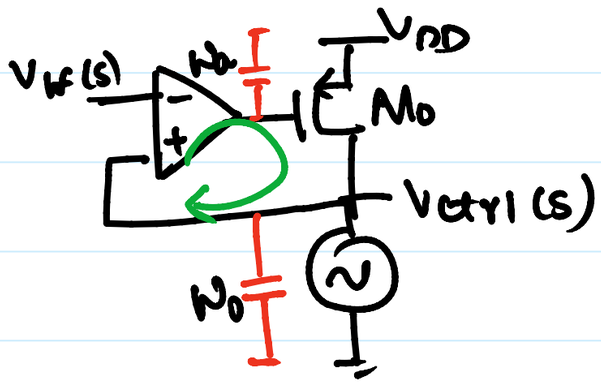
Cons: Loads the loop-filter ⟹ Charge-pump operates w/ input offset



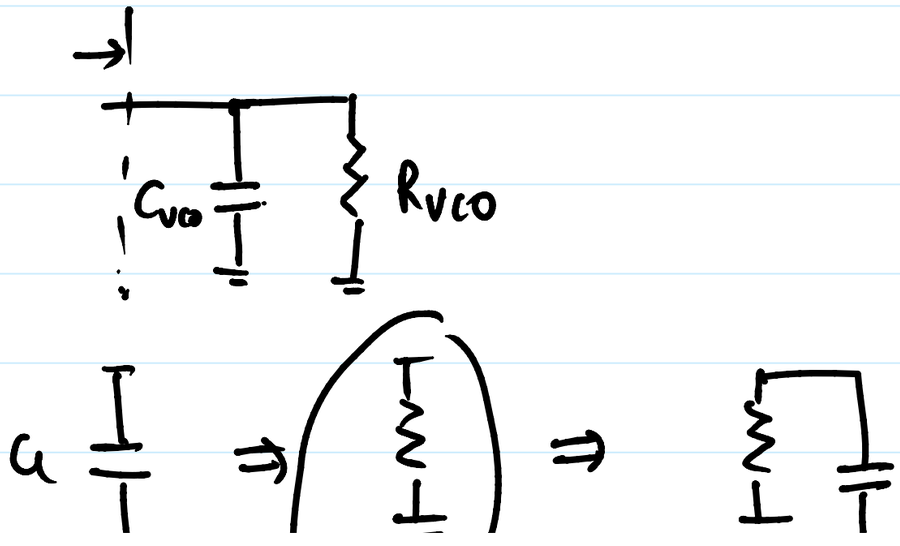
- No current drawn from loop filter
- Static current consumption increases.

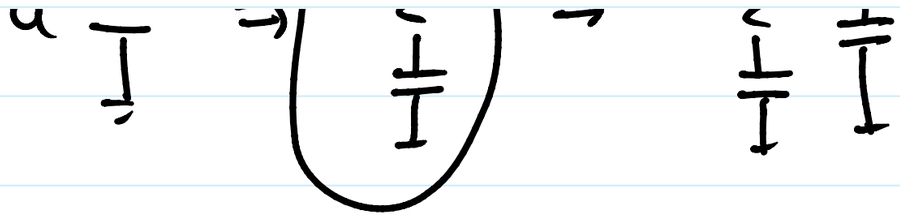
$$\frac{V_{ctrl}(s)}{V_{LF}(s)} = 1$$

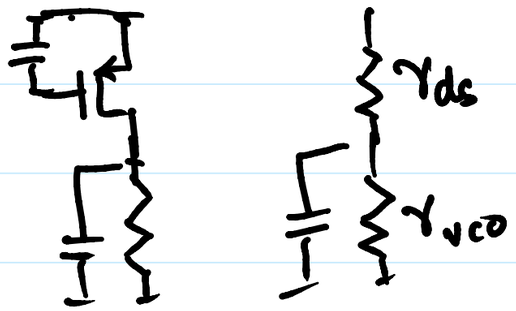
- output swing is limited by opamp



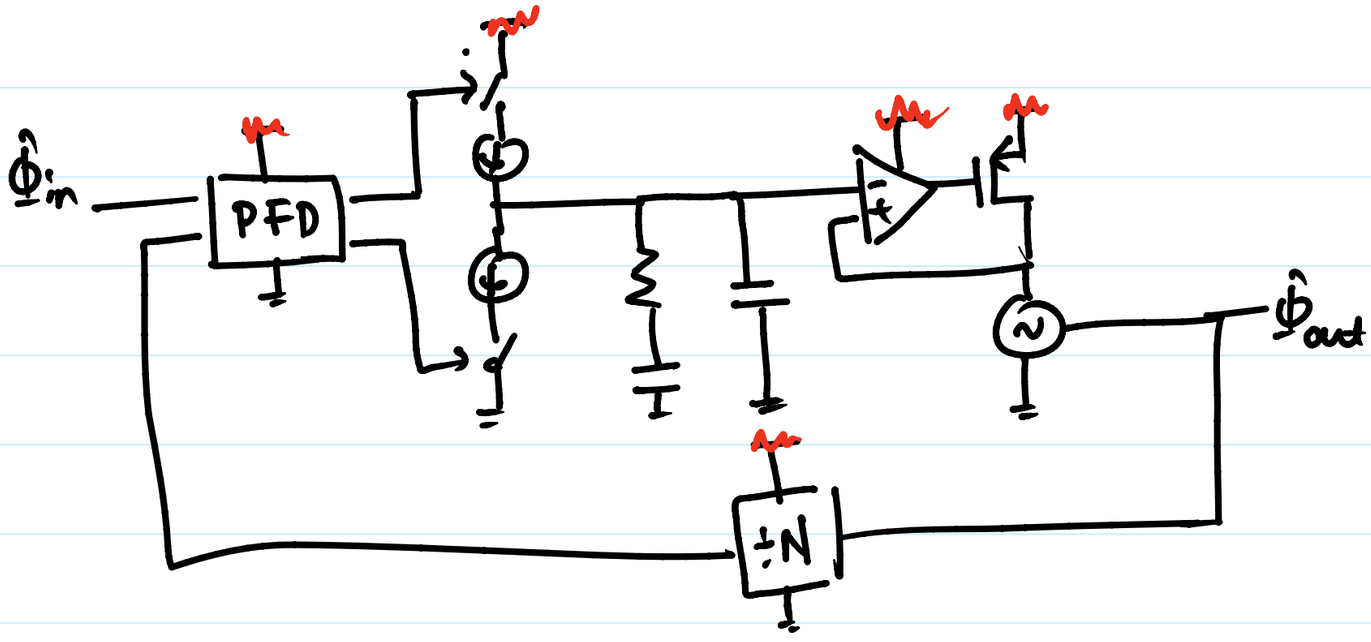
- Relaxed opamp static power consumed
- $0 \leq V_{ctrl} \leq V_{DD} - V_{OV,M0}$
- Regulation bandwidth for VCO $> 5\omega_{PLL}$



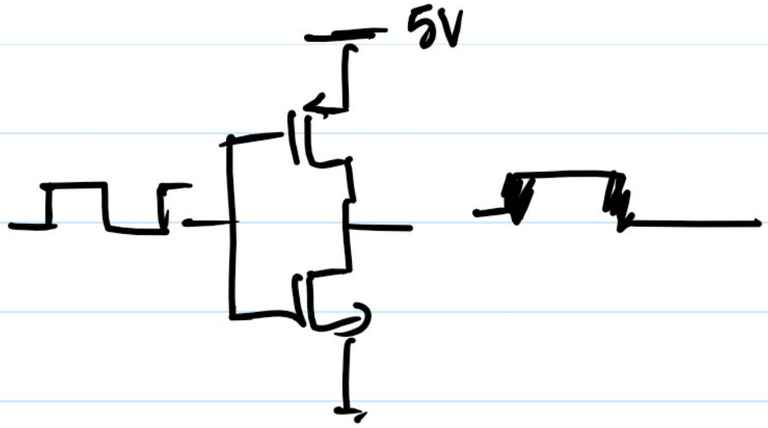




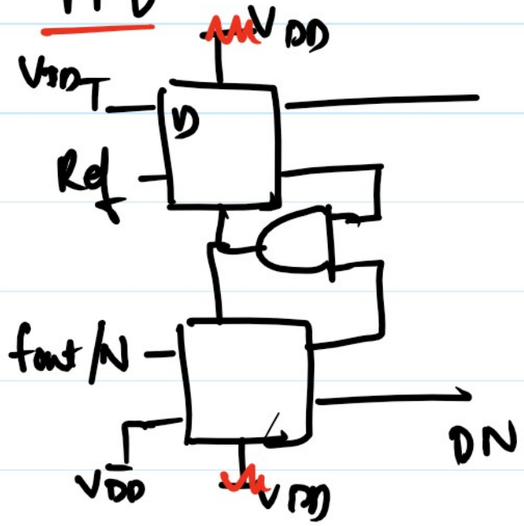
Power Supply Noise in Ring PLL

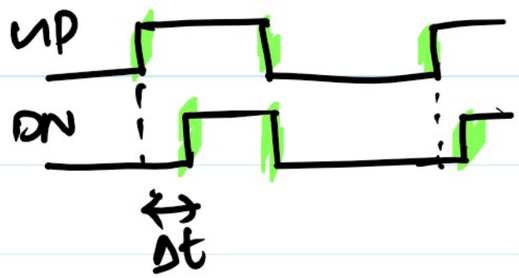


Power Supply Noise Ratio (PSNR) = $20 \log_{10}\left(\frac{\Delta T_j / T}{\Delta V_{DD}}\right)$

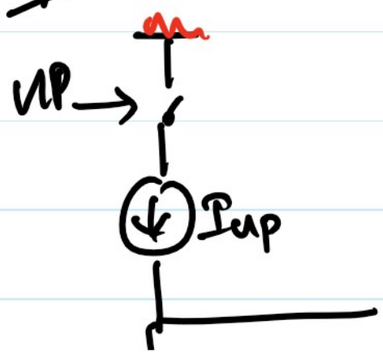


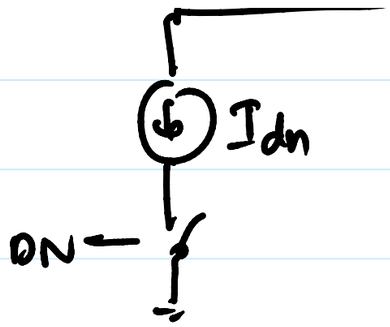
PFD

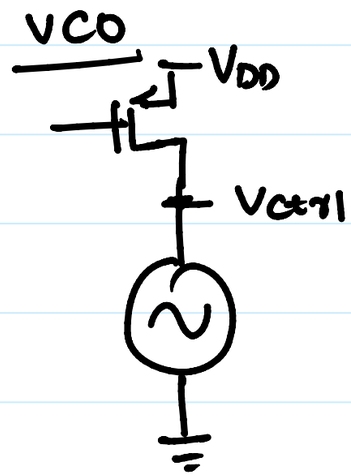




CP







$$\frac{V_{Ctrl}(s)}{V_{DD}(s)} = K_{Vdd}$$

$$N_{out} = K_{Vco}\, V_{Ctrl} = K_{Vco}\, V_{Ctrl10} + K_{Vco} \cdot K_{Vdd}\, V_{dd,n}$$

$$\Delta\Phi = K_{Vco} \cdot K_{Vdd} \int V_{dd,n}\, dt$$

$$= K_{Vco} \cdot K_{Vdd} \cdot A_{Vdd} \int \sin(\omega_n t) \cdot dt$$

$$= K_{Vco} \cdot K_{Vdd} \cdot \frac{A_{Vdd}}{\omega_n} \cos(\omega_n t)$$

$$\text{PSNR [dB]} = 20 \log_{10} \left[\frac{K_{Vco} \cdot K_{Vdd} \cdot}{\omega_n \cdot 2\pi} \right]$$