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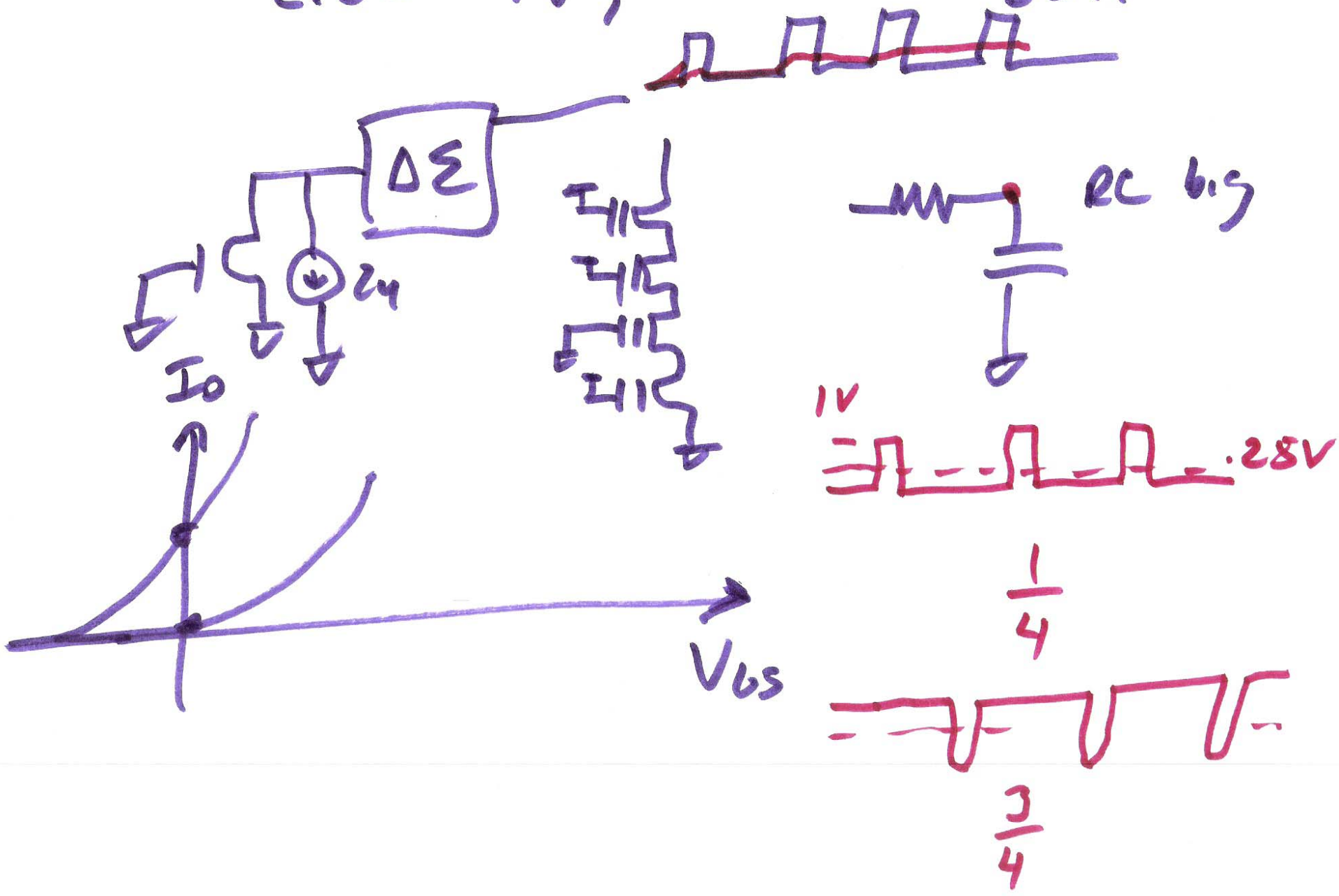
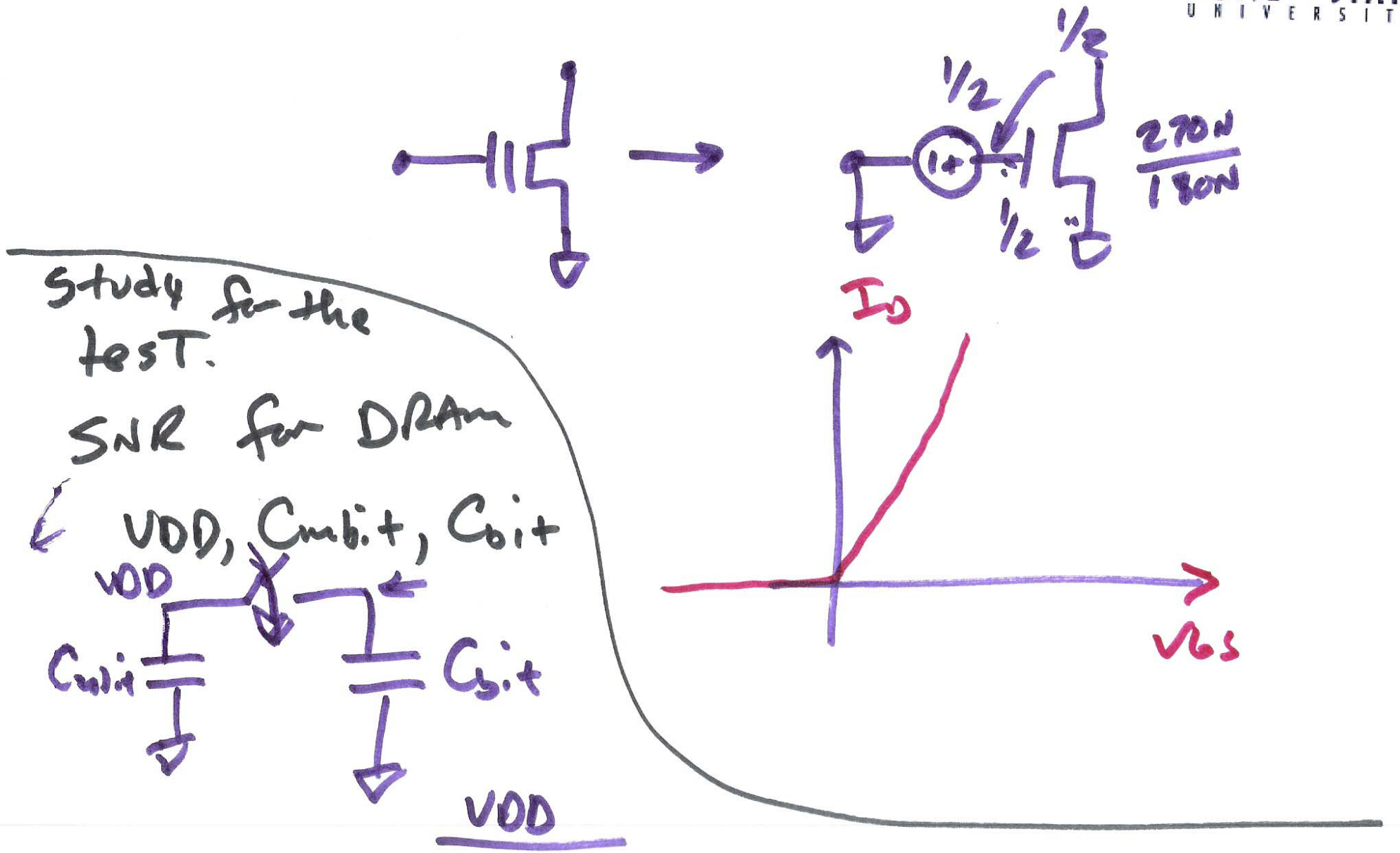
Lecture 18, March 23 2011




1/2
1/2
1/2
270N
180N
I_D
V_{GS}
Study for the test.
SNR for DRAm
VDD, C_{mbit}, C_{bit}
VDD
C_{mbit}
C_{bit}
VDD

2)

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Circuits for folded & open bitline DRAMs

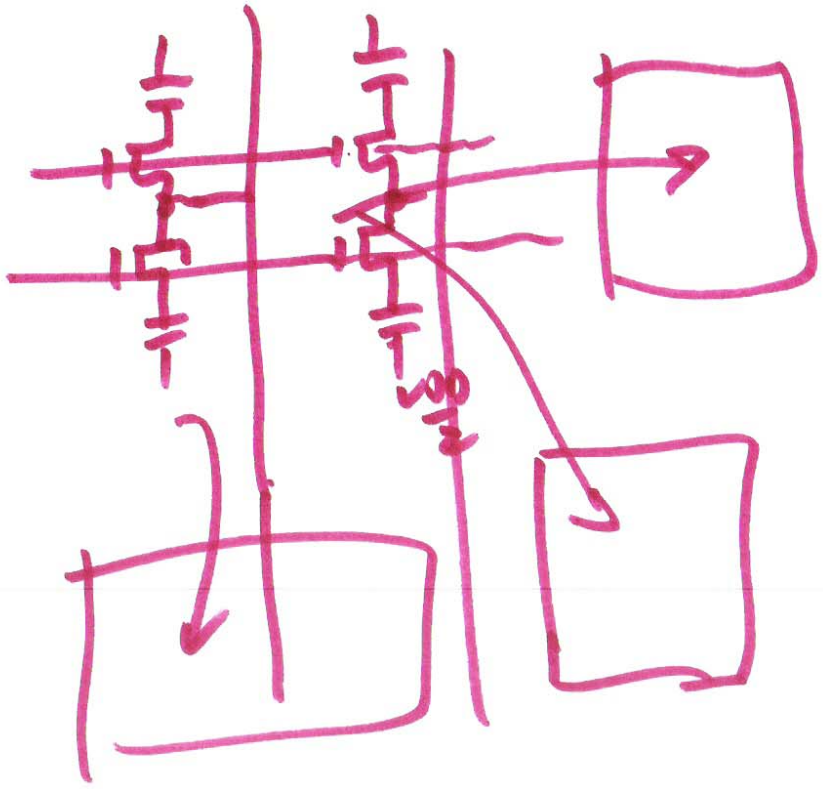
Mbit → schematic
Layout!

wordlines, bitlines, sense-Amps

Eg. Circuit

I/O devices

Helper Flip-Flop

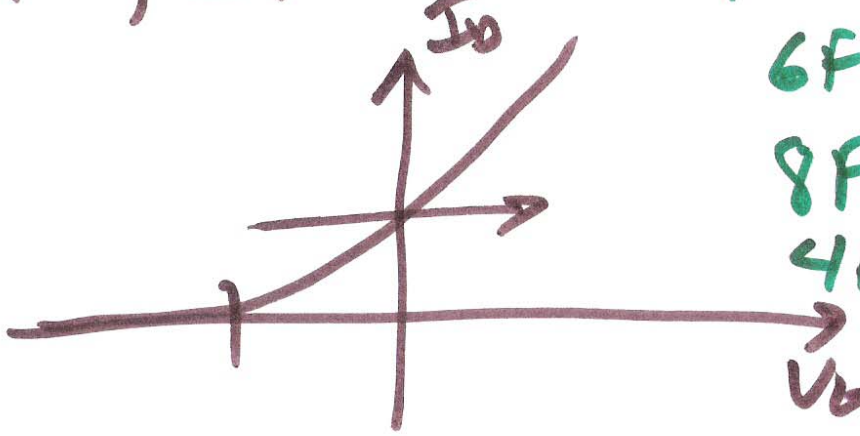


Sketch the waveforms associated with reading a DRAm.

Flash

FNT, CHE

Layout



F - feature size

$6F^2$ - DRAM

$8F^2$ = DRAM

$4F^2$ -

Design a sense Amp

Kickback noise

Memory

current draw

SRAM → 6T, poly resistors

4)

Delta-sigma sensing

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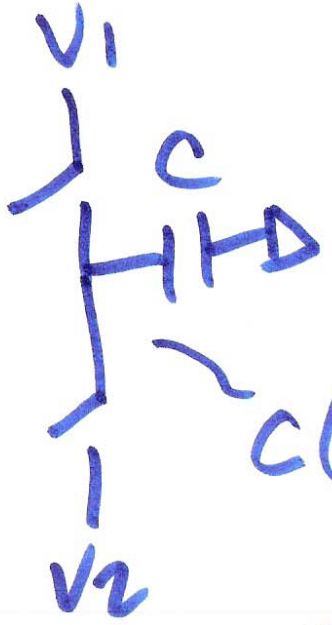
Sketch basic topologies [current, resistance]
derive
bitline voltage variations

Sketch a ΔΣ sensing circuit that can sense a resistive value.
What are the concerns?
Derive equations governing this ckts operation.



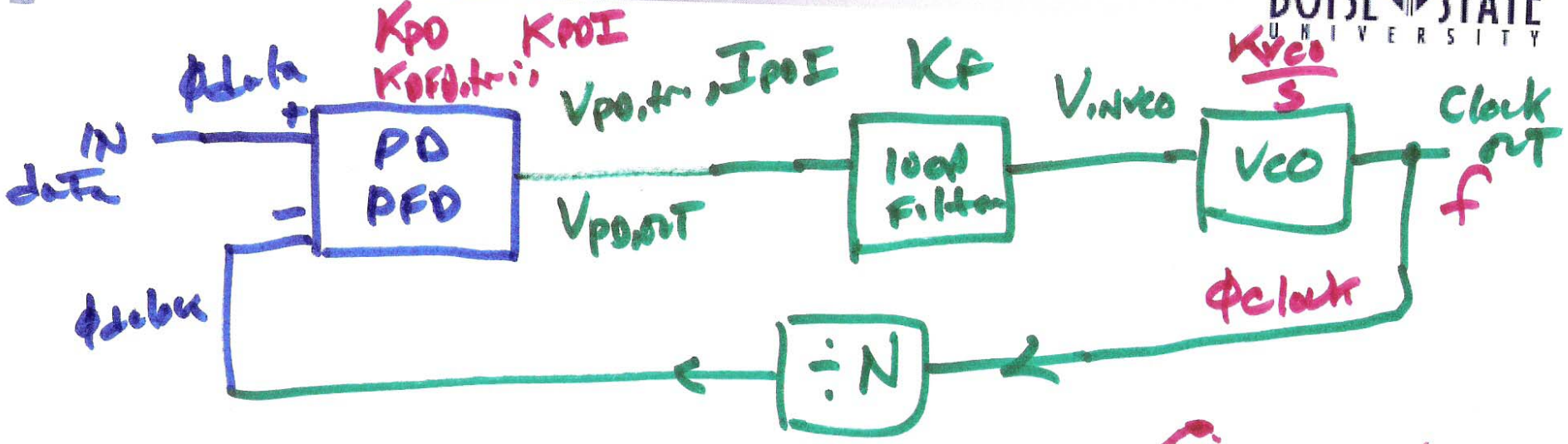
Bit line variations

$$I_{ARC} = \frac{V_1 - V_2}{R_{SC}} \qquad R_{Mbit} = \frac{M}{N} R_{ref}$$

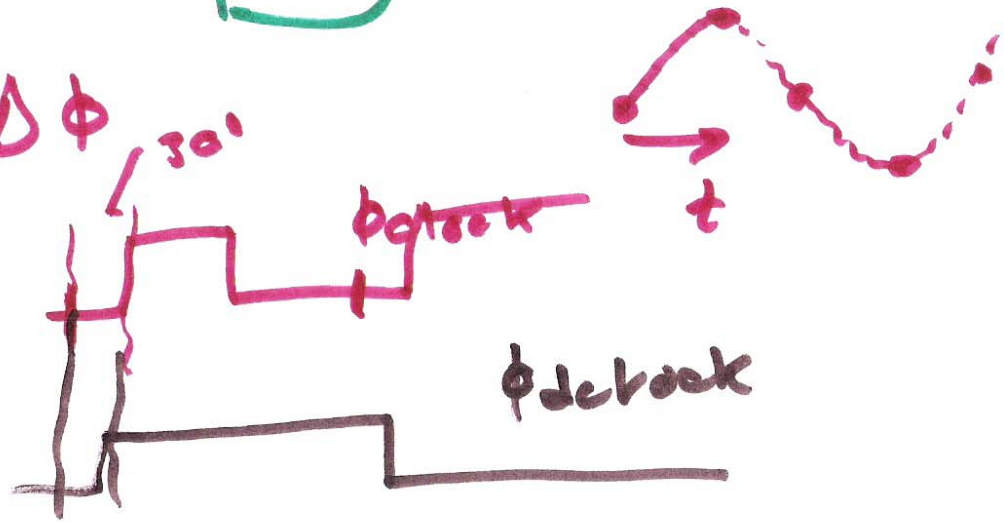
$$R_{SC} = \frac{1}{fC}$$ derive this!

5)

PLL



$$\phi_{data} - \phi_{dclock} = \Delta\phi$$



$$\phi_{dclock} = \frac{\phi_{Clock}}{N}$$

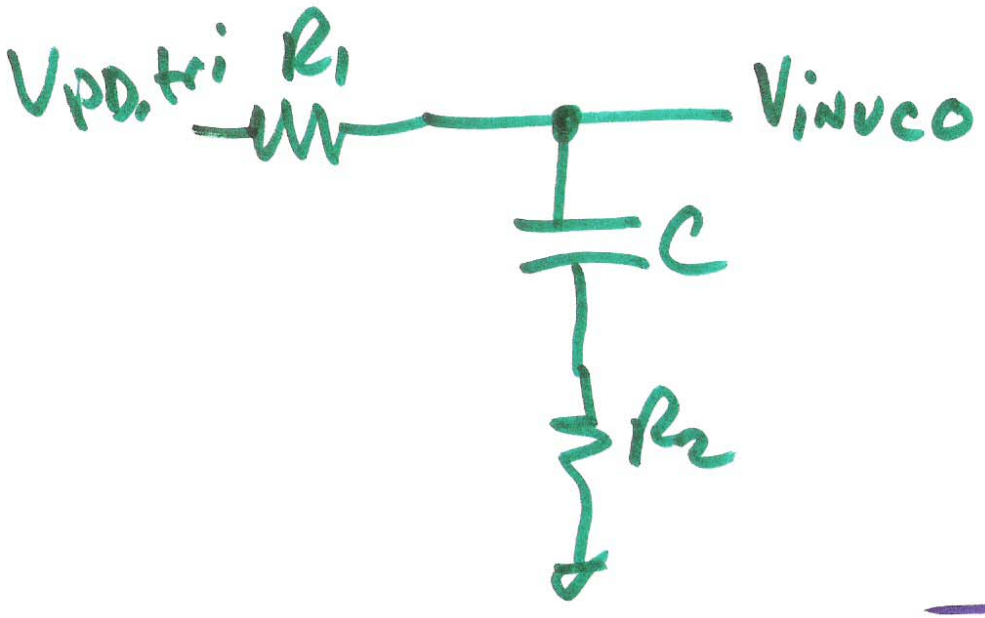
$$\left(\phi_{data} - \phi_{dclock}\right) \cdot K_{PD} \cdot K_F \cdot \frac{K_{VCO}}{s} = \phi_{clock}$$

$$\phi_{dclock} = \frac{\phi_{clock}}{N}$$

$$\phi_{data} \cdot K_{PD} \cdot K_F \cdot \frac{K_{VCO}}{s} = \phi_{clock}\left(1 + \frac{K_{PD} \cdot K_F \cdot K_{VCO}}{Ns}\right)$$

$$\frac{\phi_{data}}{\phi_{dclock}} = \frac{K_{PD} \cdot K_F \cdot \frac{K_{VCO}}{s}}{1 + \frac{K_{PD} \cdot K_F \cdot K_{VCO}}{Ns}}$$

$$\boxed{\frac{\phi_{data}}{\phi_{clock}} = \frac{K_{PD} \cdot K_F K_{VCO}}{s + K_{PD} \cdot K_F \cdot \frac{K_{VCO}}{N}}}$$

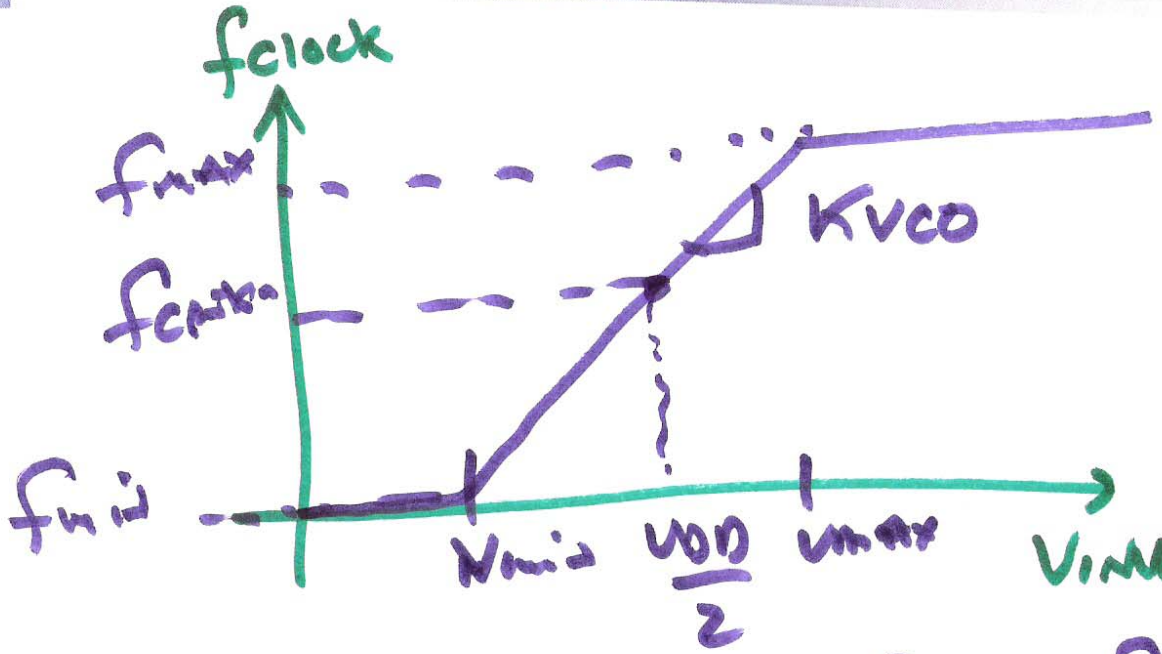


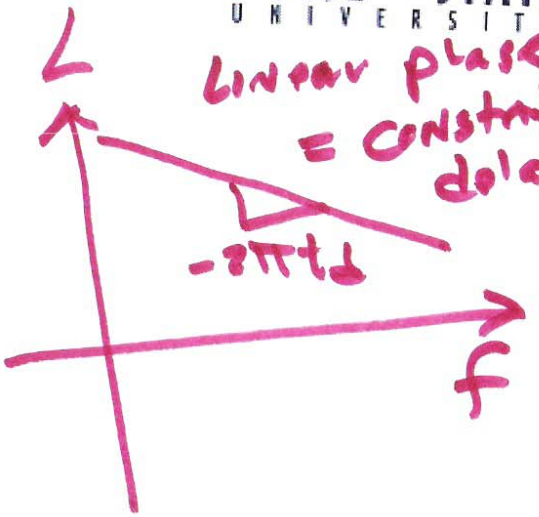
$K_F = ?$

$$V_{inVCO} = V_{PD.tri} \cdot \frac{\frac{1}{j\omega C} + R_2}{\frac{1}{j\omega C} + R_2 + R_1}$$

$$K_F = \frac{V_{inVCO}}{V_{PD.tri}} = \frac{1 + j\omega R_2 C}{1 + j\omega C(R_1 + R_2)}$$

VCO





$$K_{VCO} = \frac{f_{max} - f_{min}}{V_{INMAX} - V_{INMIN}} \left(\frac{Hz}{V}\right)$$

$$\frac{K_{VCO}}{s}$$

$$\phi_{clock} = \frac{t_d}{T} \cdot 360 = t_d \cdot f \cdot 360$$

$$\phi_{clock} = \frac{K_{VCO} \cdot V_{INVCO}}{s} = e^{2\pi f \cdot t}$$

9) $V_{out}(t) = \frac{dS}{dT} \sin(w(t) \cdot t)$