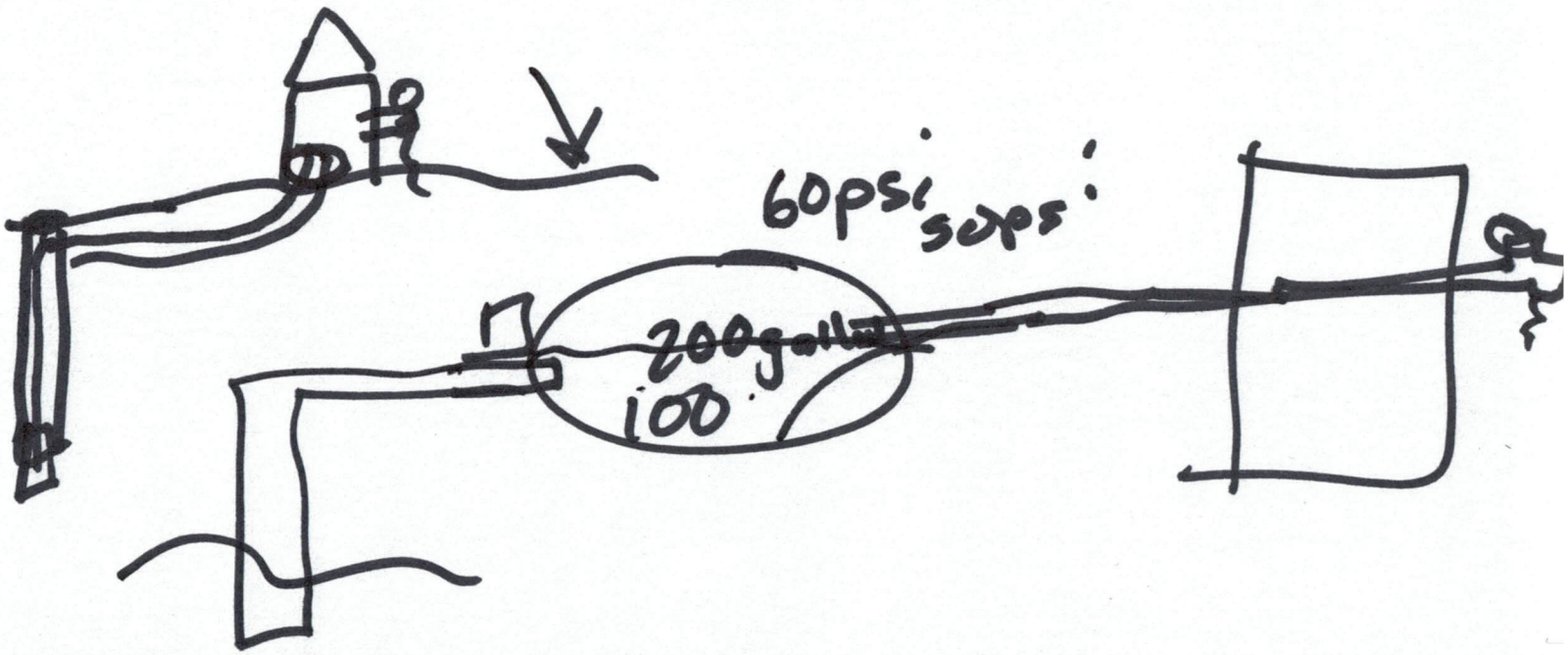
EE 421/ECG 621
Digital IC Design
September 18, 2023
Lecture 6



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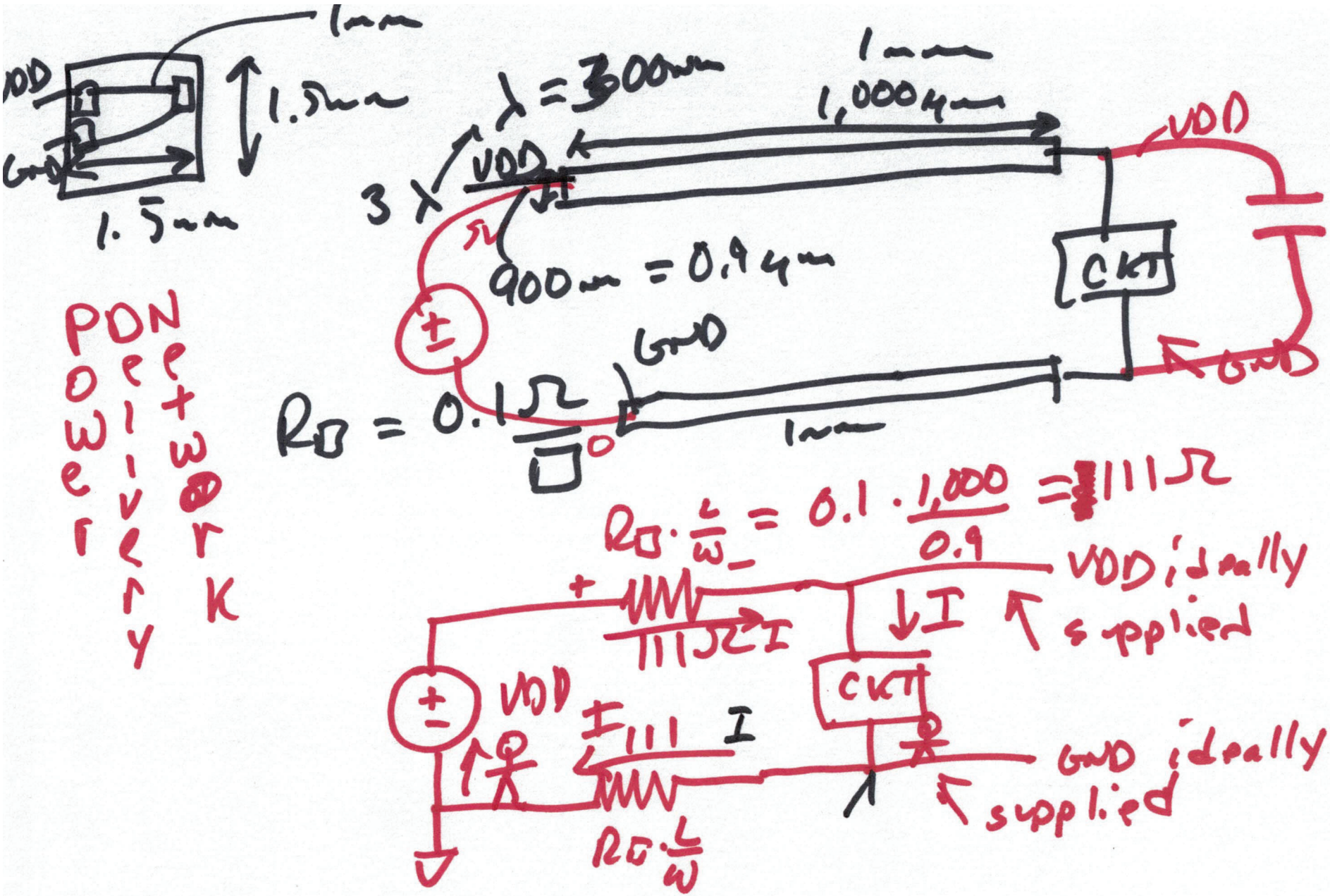
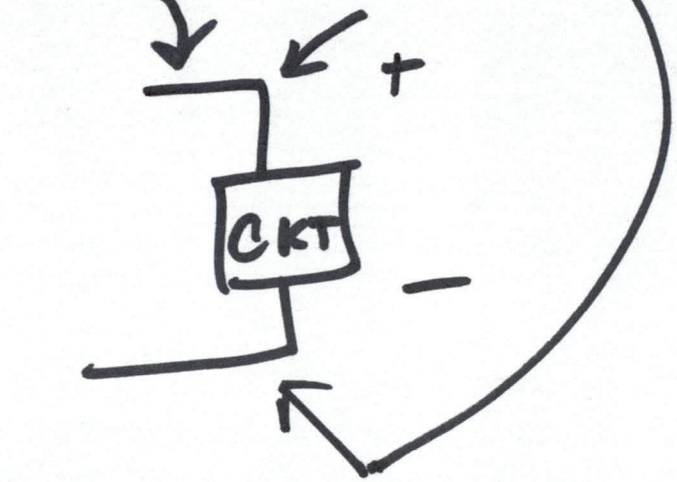

1mm
VDD
GND
1.5mm
1.5mm
λ = 300nm
3 λ
VDD
1mm
1,000λ = 300mm
VDD
CKT
900nm = 0.9λ
GND
GND
R□ = 0.1Ω
1mm
Power Delivery Network
R□ · L/W = 0.1 · 1,000/0.9 = 111Ω
111Ω I
VDD ideally supplied
I
CKT
VDD
111 I
GND ideally supplied
R□ · L/W

$+VDD - I \cdot R_D \cdot \frac{L}{W} = VDD|_{supplied}$

$R_D \cdot \frac{L}{W} \cdot I = GND|_{supplied}$



$VDD - I R_D \cdot \frac{L}{W}$

$- R_D \cdot \frac{L}{W} \cdot I$

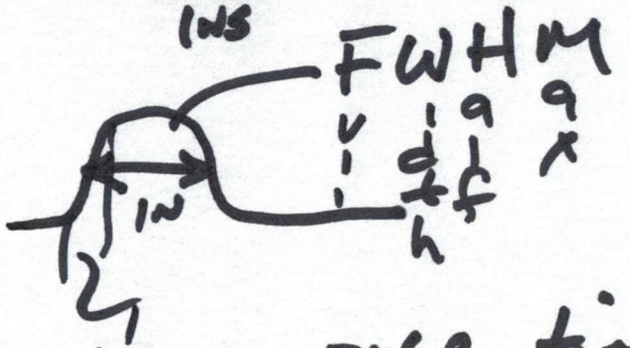
Voltage across CKT

$= VDD - 2I \cdot R_D \cdot \frac{L}{W}$

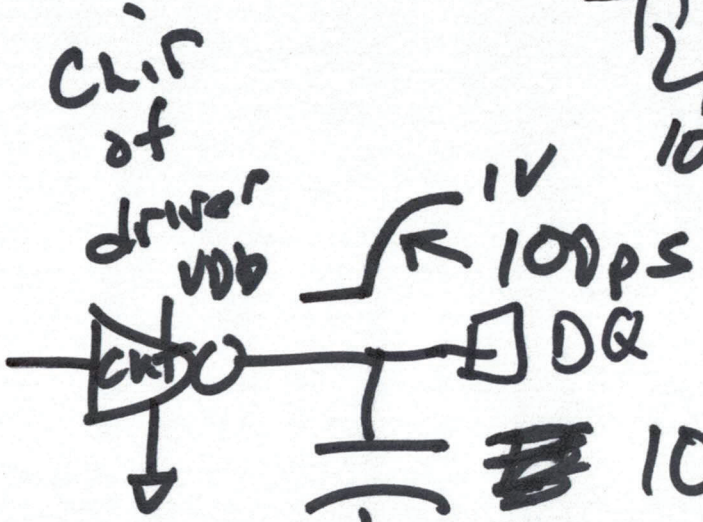
I/O 1 Gbit/s

$CV = Q$

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



100ps = rise time

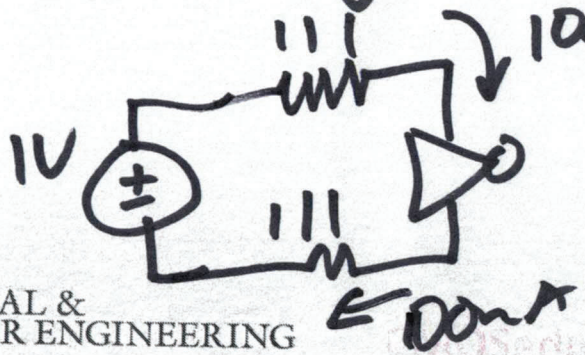


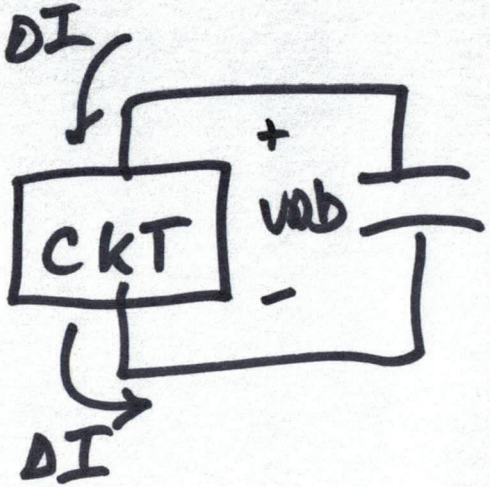
$I = C\frac{dV}{dT}$

$= 10pF \cdot \frac{1V}{100ps}$

$= \frac{1V \cdot s}{10\Omega} = 100mA$

$100mA = 0.1A$

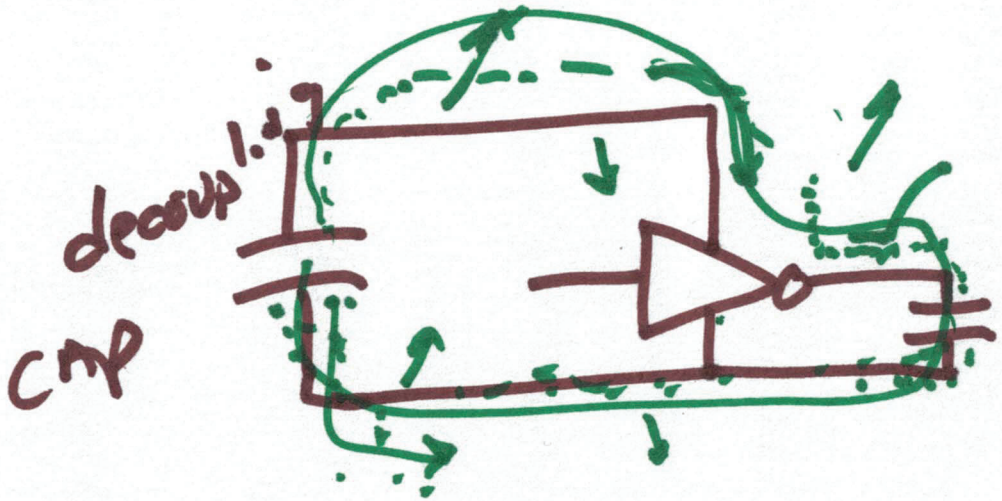


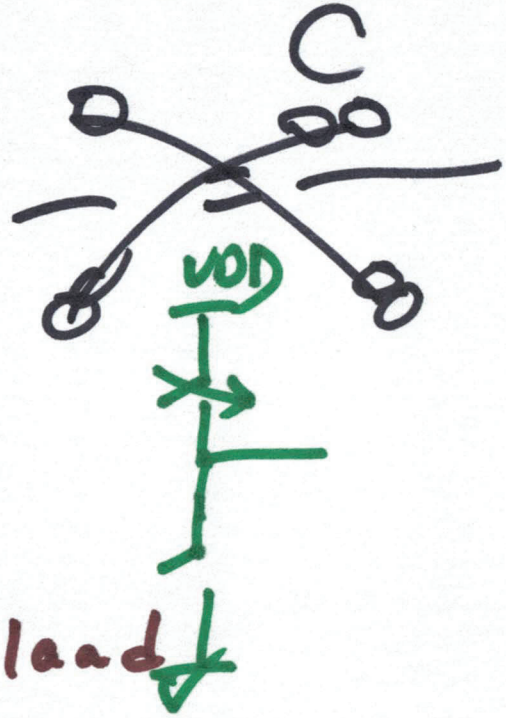


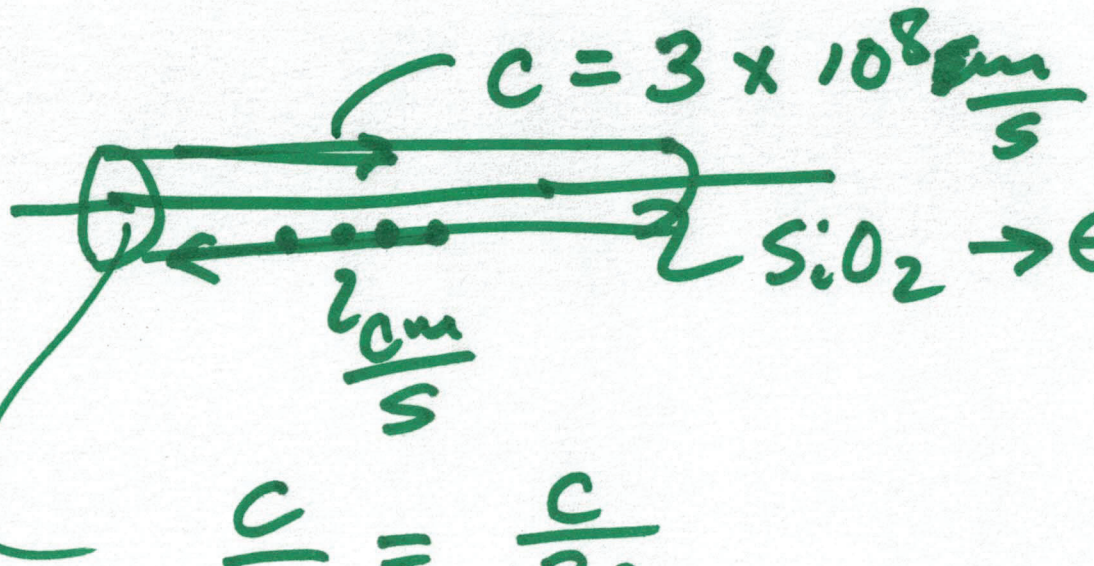
$$\Delta I = C \frac{\Delta VDD}{\Delta t}$$

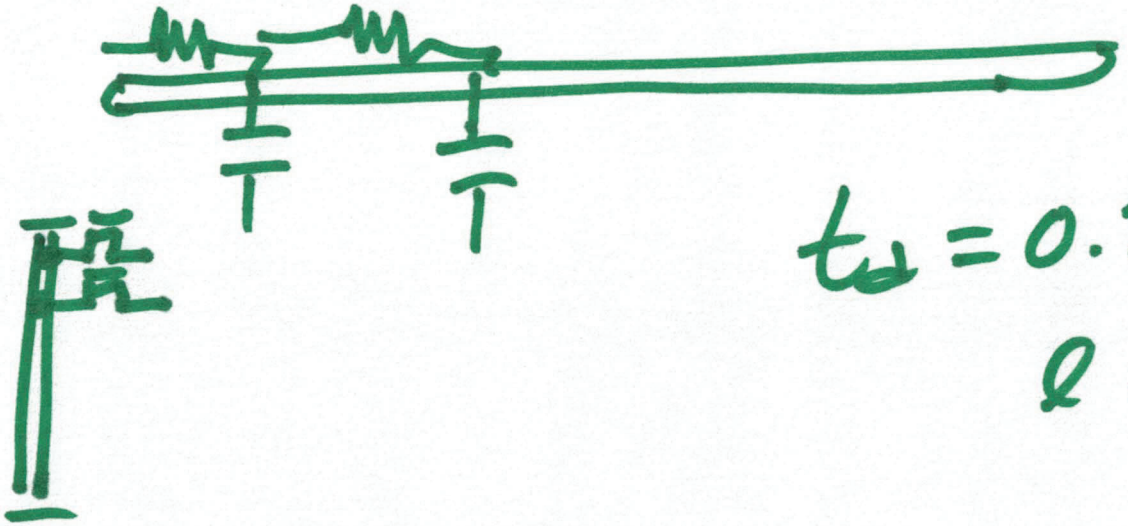
$$\Delta VDD = \frac{\Delta I \cdot \Delta t}{C}$$

$\Delta VDD \rightarrow \Delta IDD$









$t_d = 0.35 \cdot \ell \cdot c \cdot \ell \cdot r$ (cap/□, r/□)

ℓ = # of squares