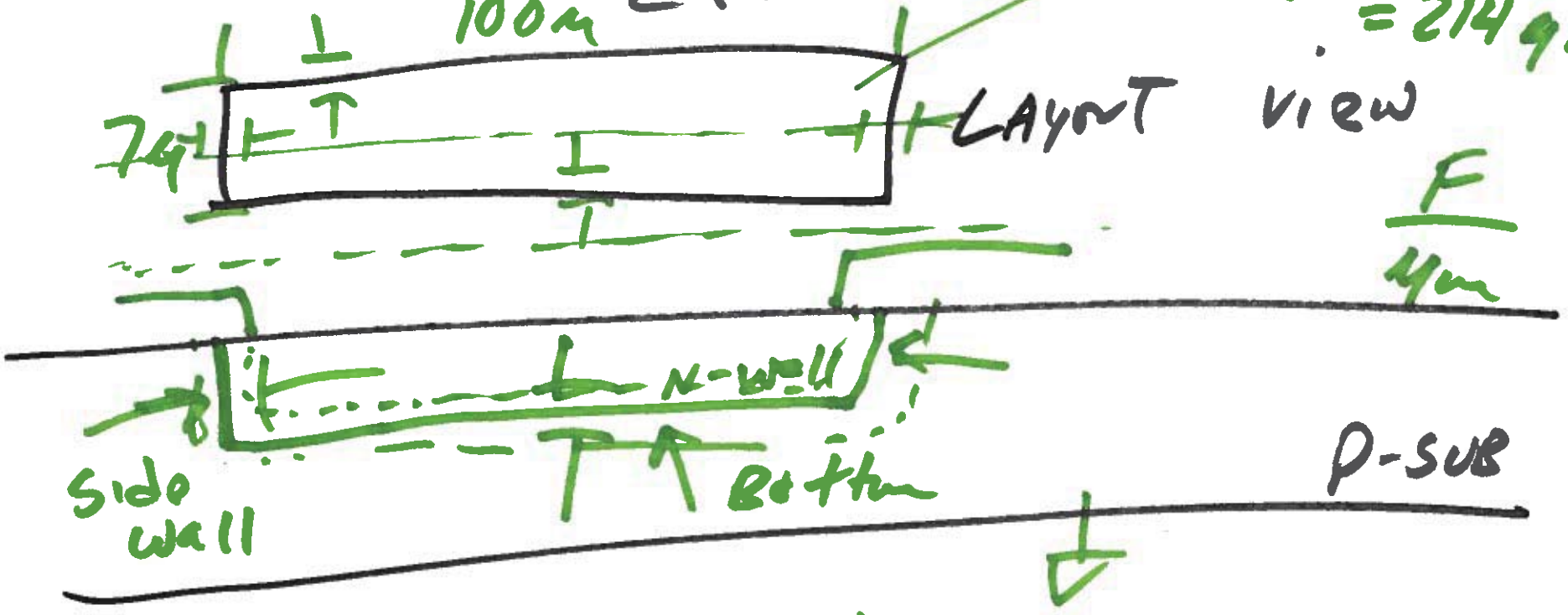
EE421/ECG 621
Digital IC Design
Sept. 4, 2019
Lecture 3

N-Well:
- Resistor
- Diode
- Body of the pMOS device



$10^{-12}\,m^2 = 700\mu m^2$

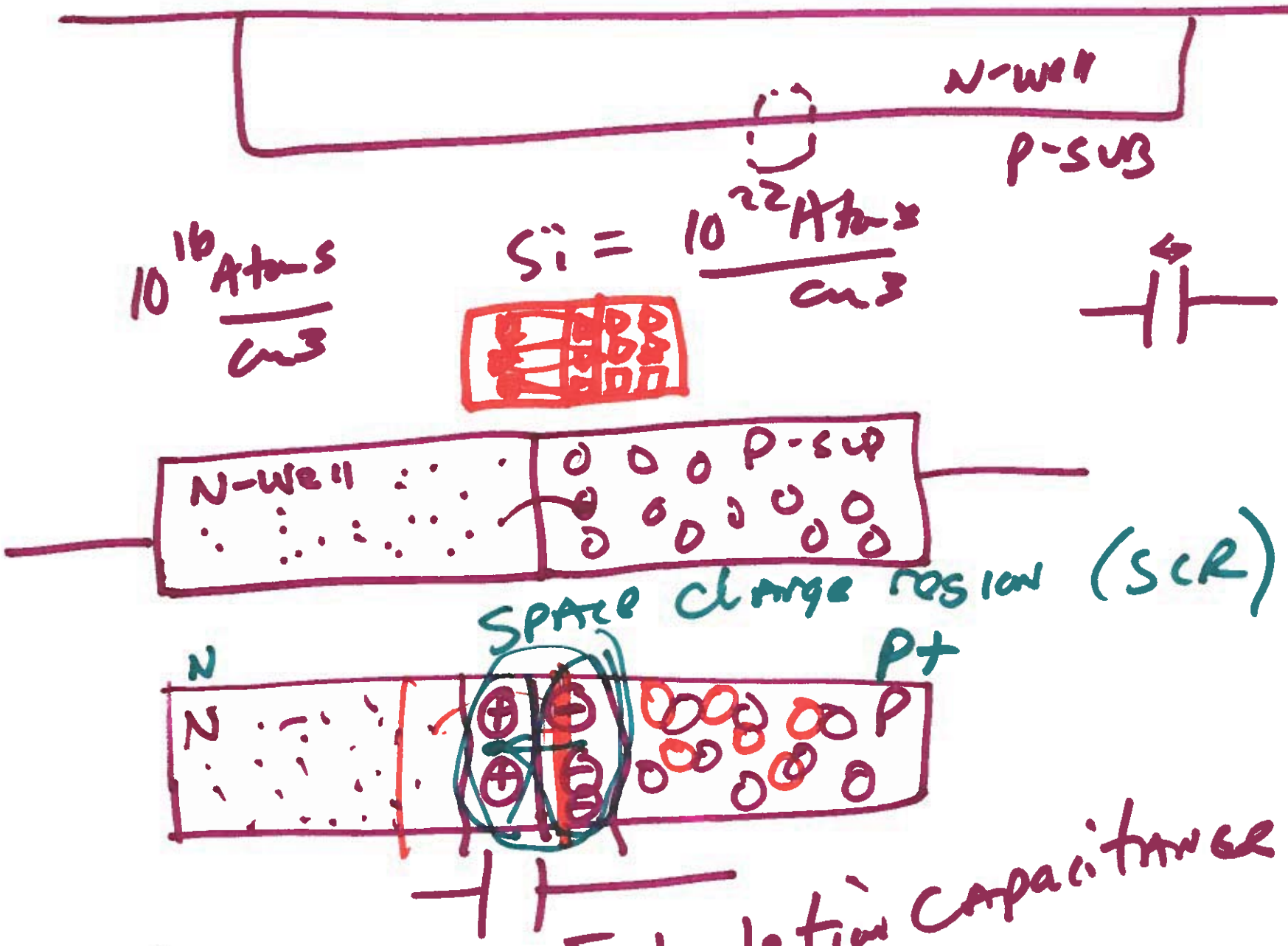
$4m \cdot 4m$

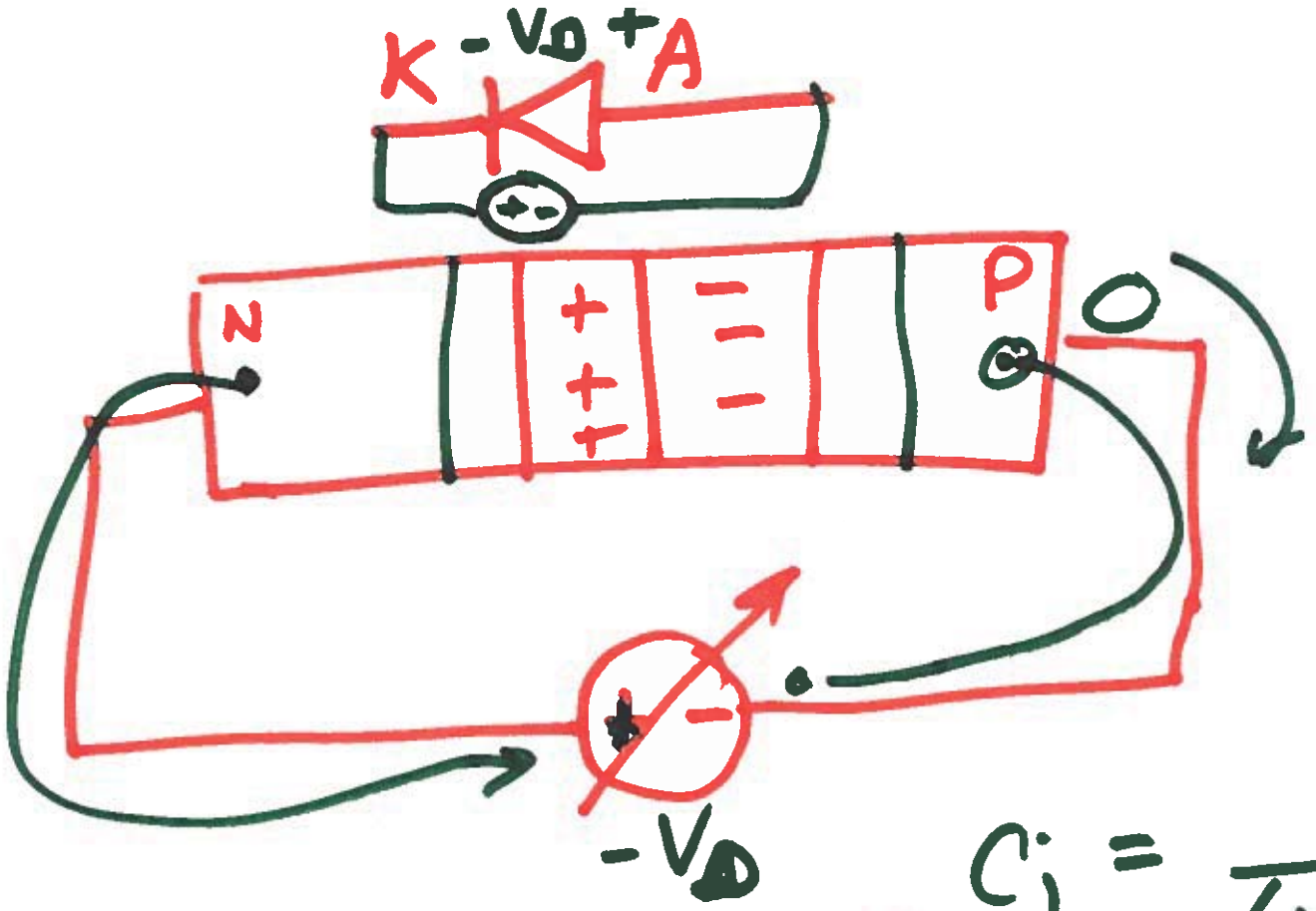
AREA 700m

7μm

perimeter = 214 μm

1) Millionth of a meter = MICRON $= 10^{-6}\,m = 4m$


N-well
p-sub
10^{16} Atoms/cm³
Si = 10^{22} Atoms/cm³
N-well
p-sub
Space charge region (SCR)
N
N
P+
P
depletion capacitance



CAP with ND bias

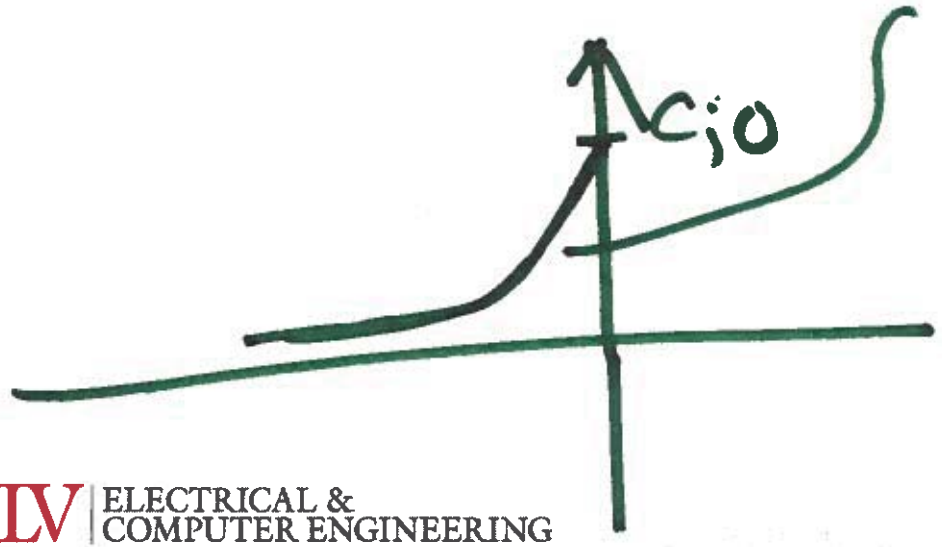
$$C_j = \frac{C_{j0}}{\left(1 + \left|\frac{V_D}{\phi_b}\right|\right)^m}$$

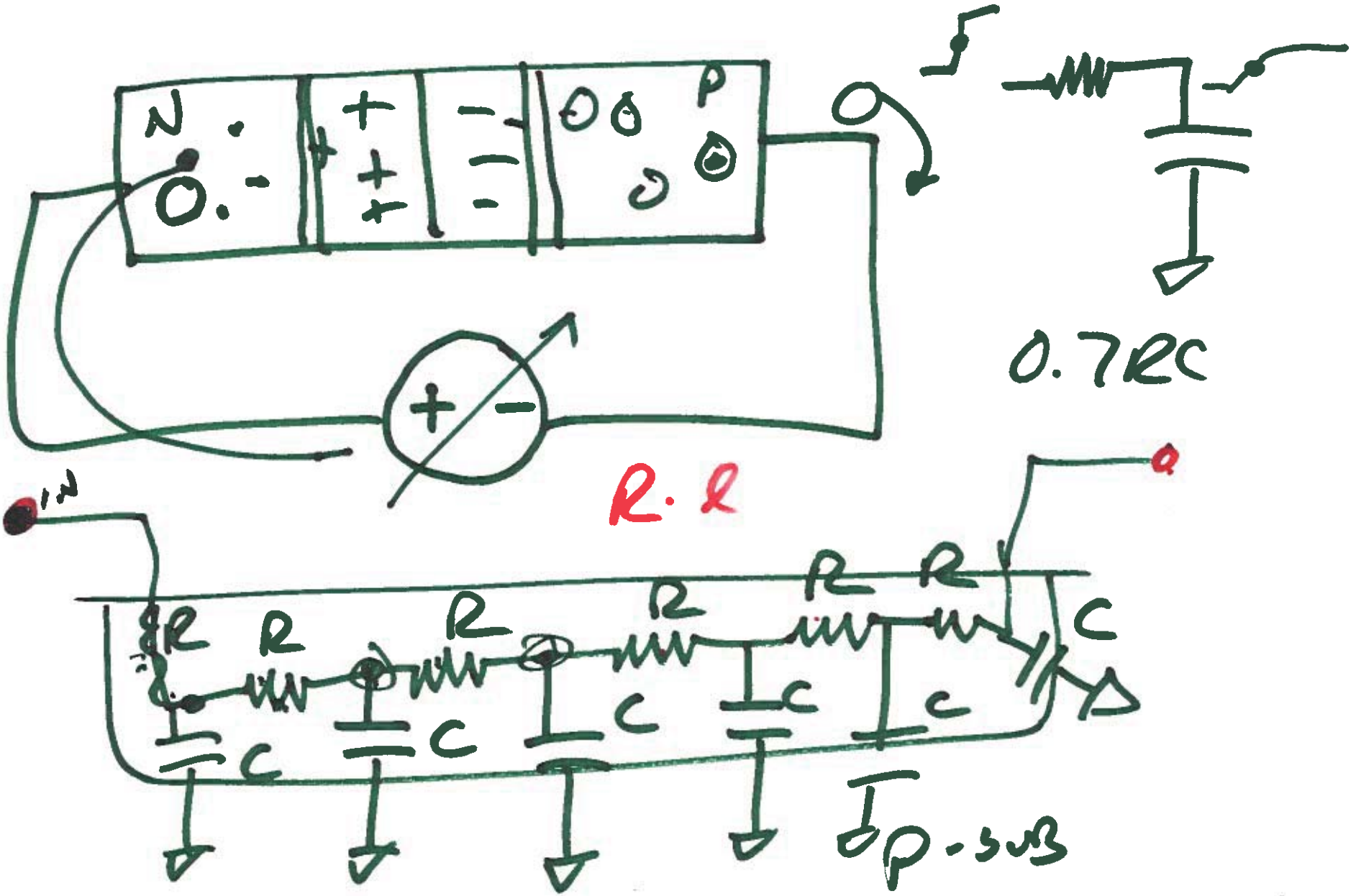
C_j = Rev.

C_{j0}

built-in potential

grading coeff.





$0.7RC + 0.72RC + 0.73RC + 0.7$ 4R!

4) $t_2 = 0.7RC\,(1+2+3+\cdots l)$

$$t_d = 0.7RC \cdot \frac{\ell(\ell+1)}{2}$$

ℓ is big

$$t_d \approx 0.7RC \cdot \frac{\ell^2}{2}$$

$$\boxed{t_d = 0.35 \cdot R \cdot C\ell^2}$$

$R_{\square} = \frac{1k}{\square}$

$\ell = 100$

$r_s = 3\,1k$

$R = 1k \cdot \frac{200}{2}$

$= 100k$

$100aF/\mu m^2 \rightarrow$ zero bias

$C_b = 2\mu \times 2\mu \times 100\frac{aF}{\mu^2} = 400aF$

$C_{sw} = \frac{50aF}{4\mu m} \cdot 4\mu = 200aF$

$C = C_b + C_{sw} = 600aF$

$C_{TOT} = 600aF \cdot 10^5 = 60fF$

$l = 100$, $C = 600aF$, $r = 1k$

$$t_d = 0.35 \cdot 1k \cdot 600aF \cdot 100^2$$

$$\simeq 10^{8^7} \cdot 10^{-18} \cdot 210$$

$$= 210 \cdot 10^{-10} = \underline{21ns}$$