15-1-2013

Note Title 15-01-2013

EE 5390

Analog IC Design

Class hrs – B-slot

M – 9 – 9:50 am

Tu – 8 – 8:50 am

W – 12 – 12:50 pm

F – 11 – 11:50 am

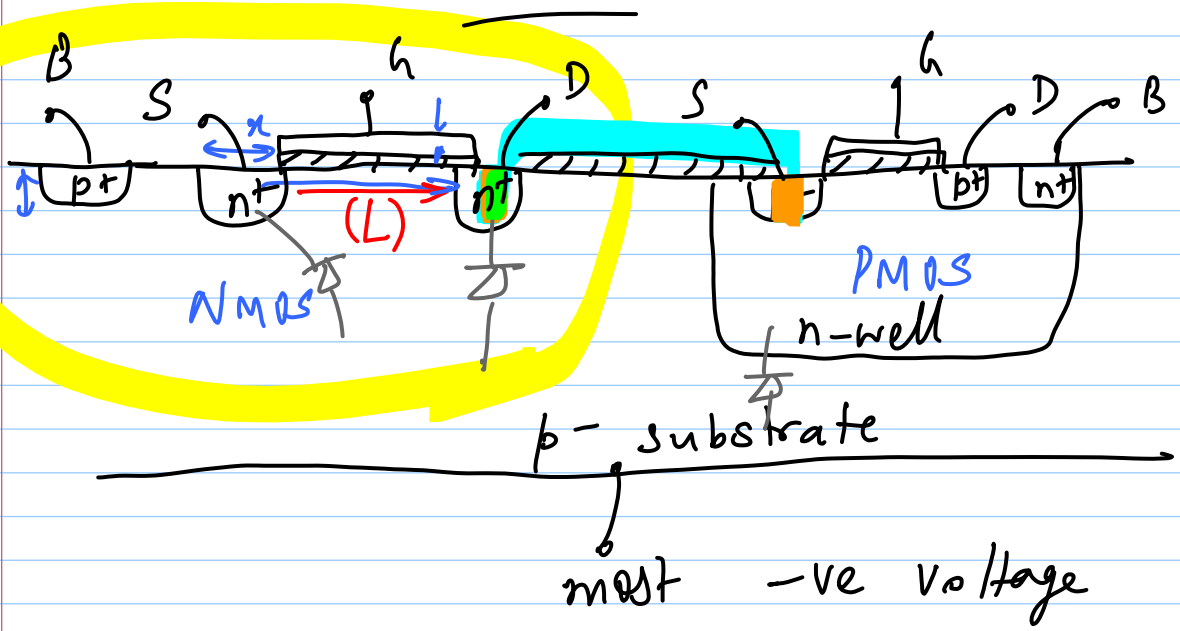
Th – 4:45 – 5:35 pm

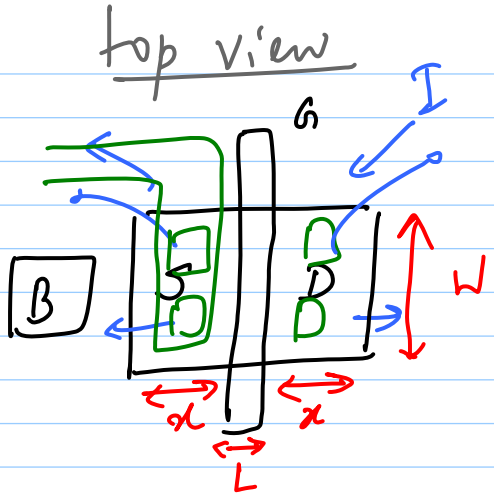
Textbook : Design of Analog CMOS Integrated Circuits
– Behzad Razavi
Tata McGraw Hill © 2002

Pre-req : EC 3102 / EC 5135

Grading : Htw, Assign., Projects – 30%.
Quiz 1 & 2 – 15% each
Final exam – 40%.

Lecture - CMOS ICs

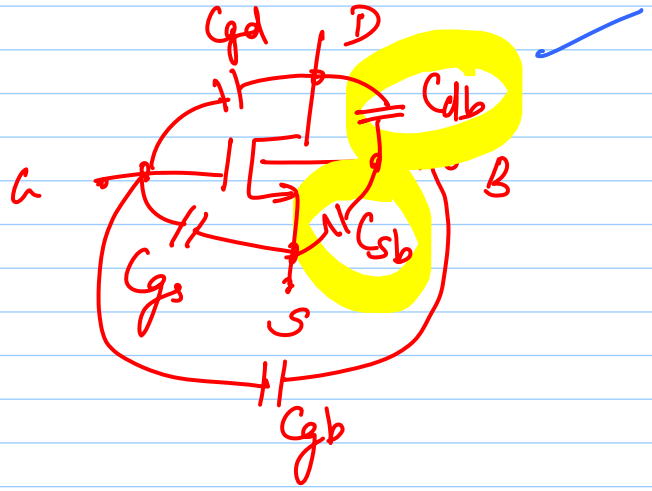




$\left(\frac{W}{L}\right)$, V_T, C_{ox}, λ, μ_n, μ_p ..

$x \uparrow \Rightarrow C_{db}, C_{sb} \uparrow$

$x \leftrightarrow$ power handling capability



Layers

* Substrate (p^-)
* n-well (n)
* diffusions (n^+, p^+)
* oxide (SiO_2)
* polysilicon (Si)
* metal (Cu, Al)
* contact & vias

Resistors

n-well, poly, n^+, p^+, metal

poly: 10^3 of $\Omega/\square$

metal: mΩ to Ω per $\square$

n-well: kΩ to 10^3 of kΩ per $\square$

n^+, p^+: 10^1 of Ω to 10^3 of Ω

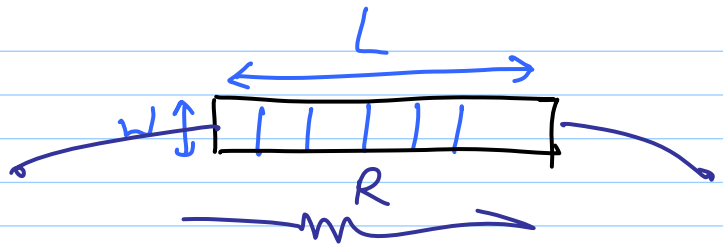
~~lightly~~ doped

high ρ

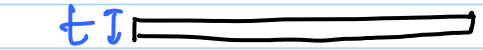
(t)

choose R based on

* tolerance
* area
* freq. characteristics (parasitics)
* linearity
* temp. co.



top-view

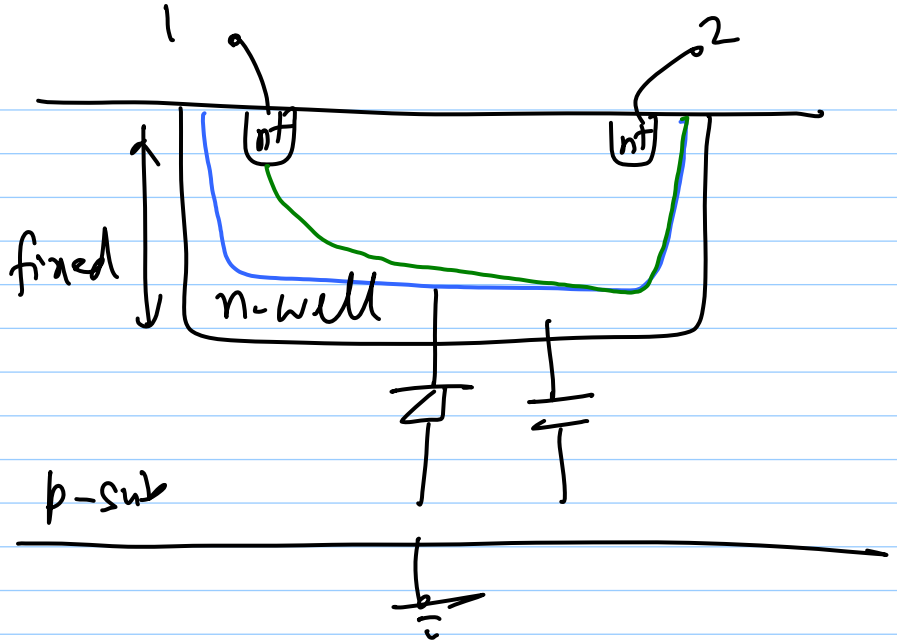


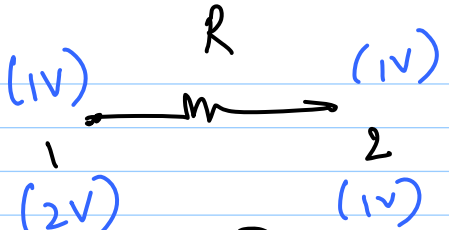
side view

t = fixed

$$R = \frac{\rho \cdot L}{t \cdot W} = \underbrace{R_{sh}}_{\text{sheet resistance}} \cdot \frac{L}{W}$$

$\Omega/\square$





$V = IR$

$I = \frac{V}{R}$

$$I = \frac{V}{R} + \alpha_2 V^2 + \alpha_3 V^3 + \cdots$$