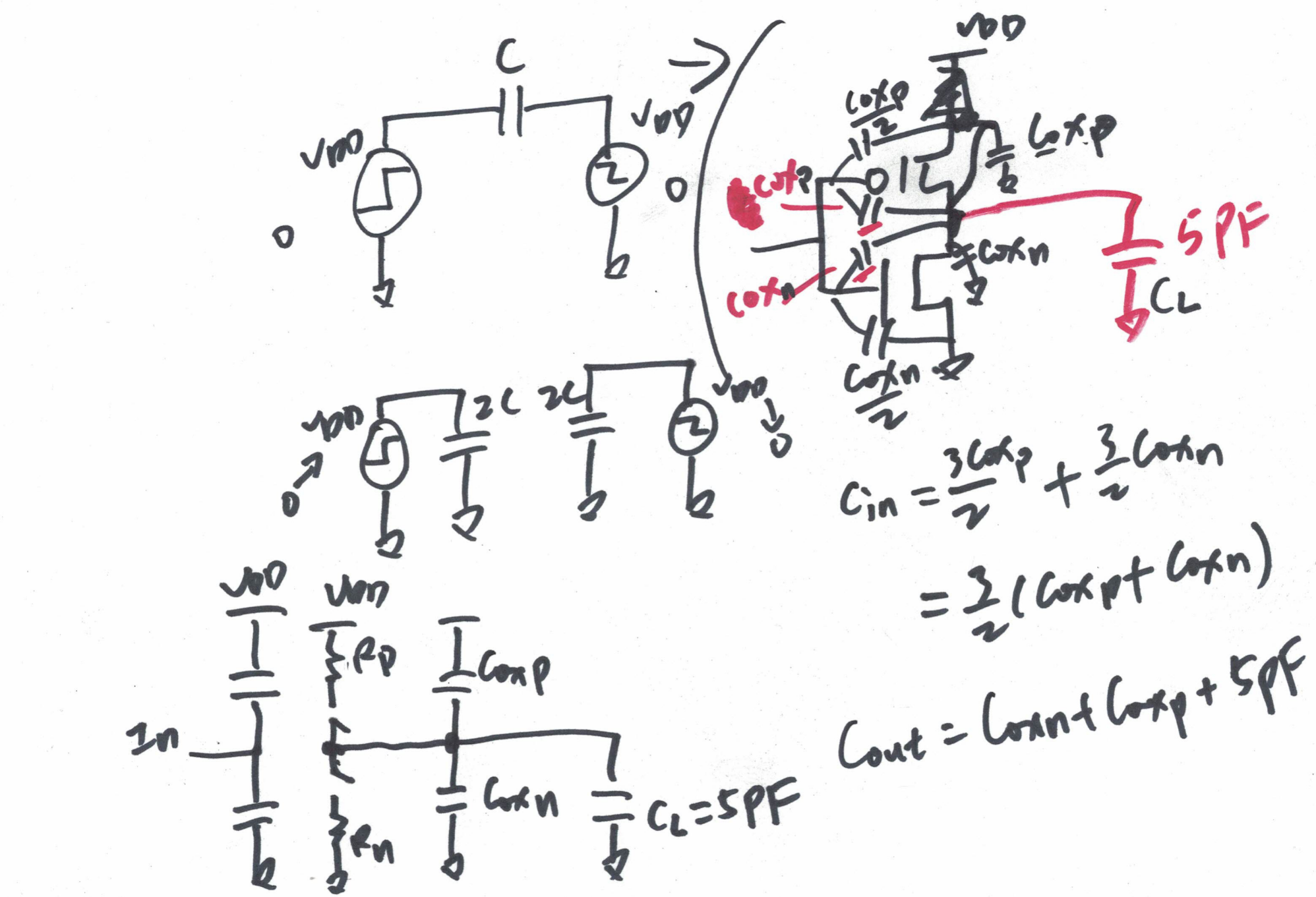
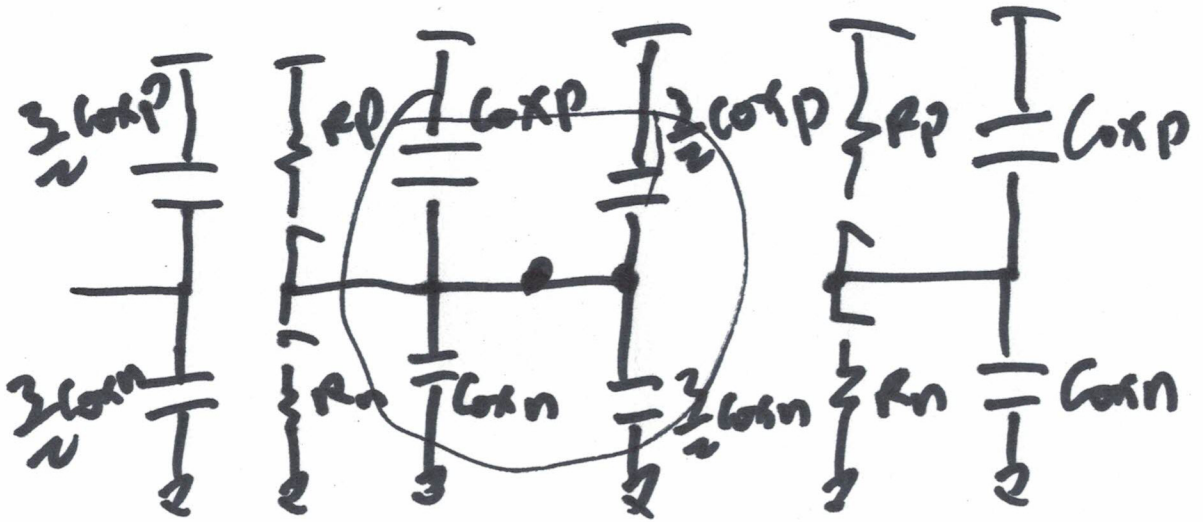


$$C_{in} = \frac{3}{2}C_{gsp} + \frac{3}{2}C_{gsn}$$

$$= \frac{3}{2}(C_{gsp} + C_{gsn})$$

$$C_{out} = C_{gsn} + C_{gsp} + 5pF$$

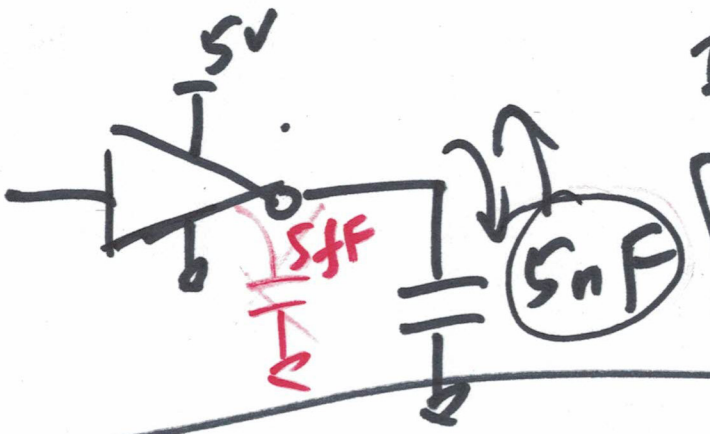


$C_{tot} = \frac{5}{2}(Coxp + Coxn)$

$t_{pLH} = 0.7 R_p \cdot C_{tot}$

$t_{pHL} = 0.7 R_n \cdot C_{tot}$

Dynamic Average Power

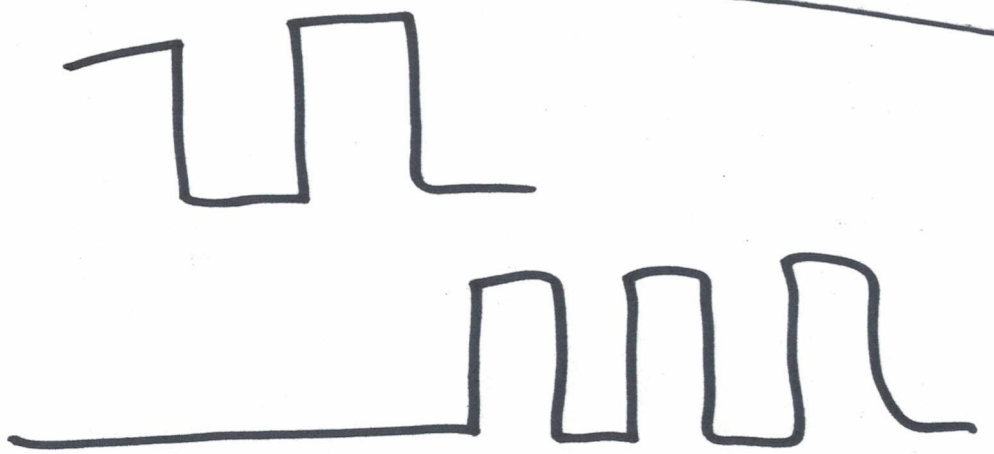


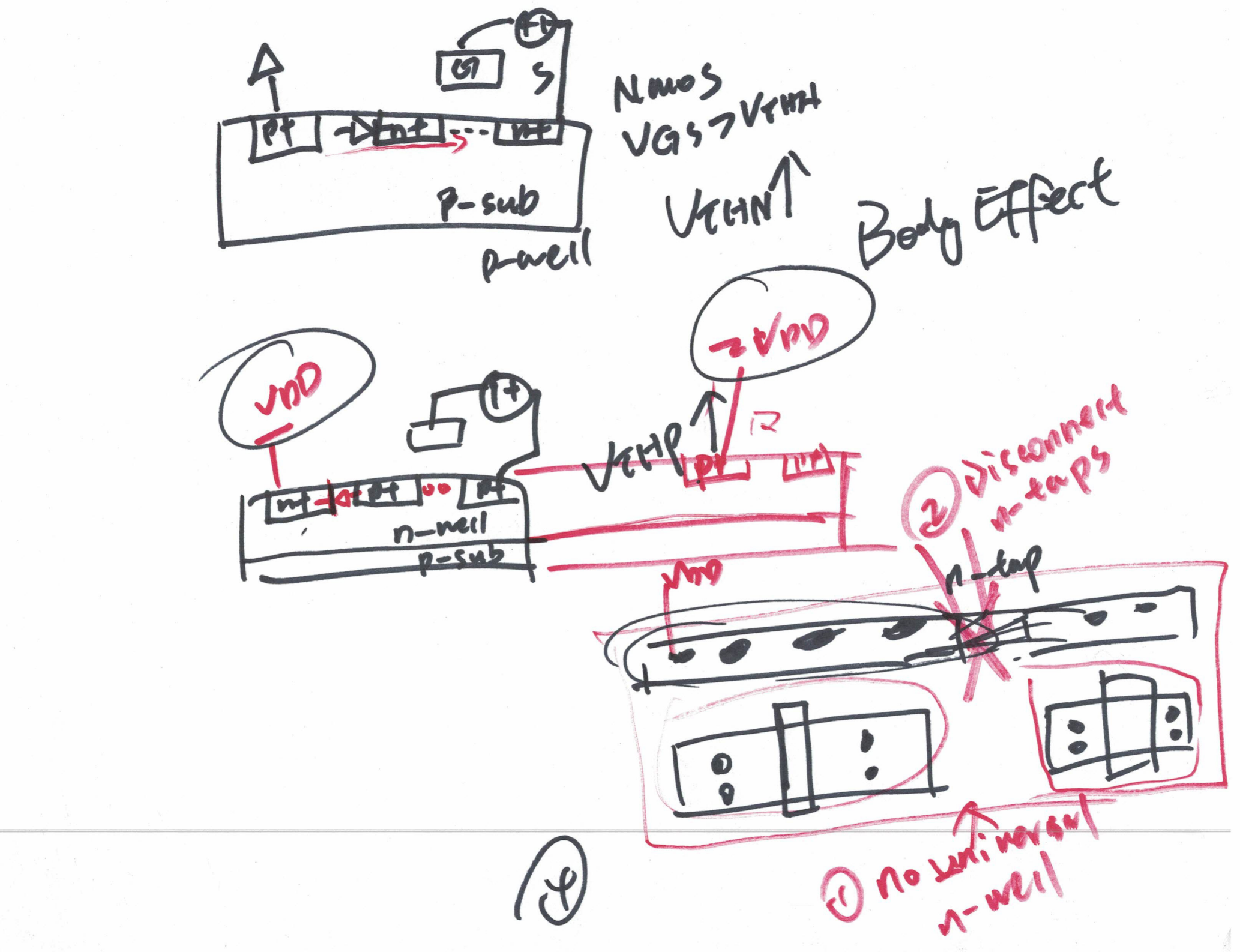
$$I_{avg} = \frac{Q}{t} = \frac{V_{DD} \cdot C}{t}$$

$$P_{avg} = V_{DD} \cdot I_{avg} = V_{DD}^2 \, C \, f$$

PULSE(0 5 0 1p 1p 1u 2u)

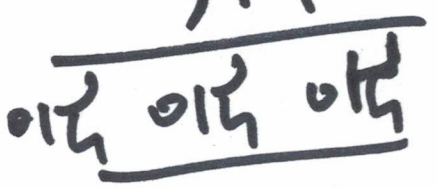
- 0 — Low voltage
- 5 — High voltage
- 0 — delay
- 1p — rising edge
- 1p — falling edge
- 1u — On time
- 2u — period

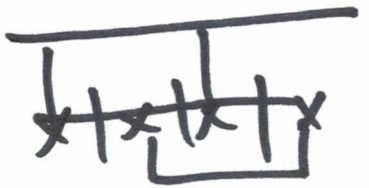



G
S
NMOS
VGS > VTHN
VTHN ↑
Body Effect
p-sub
p-well
VDD
VDD
VTHP ↑
n-well
p-sub
n-tap
2 Disconnect n-taps
n-tap
1 no Limitation n-well

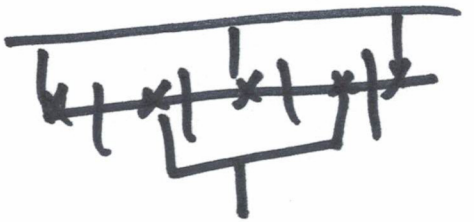
Stick Diagrams

3 in parallel



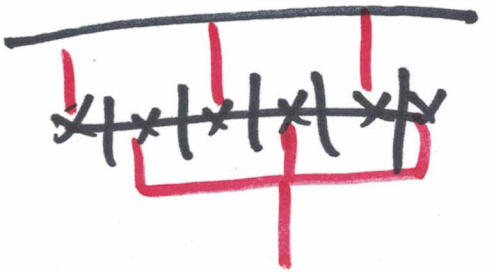


4 in parallel



AOI

5 in parallel

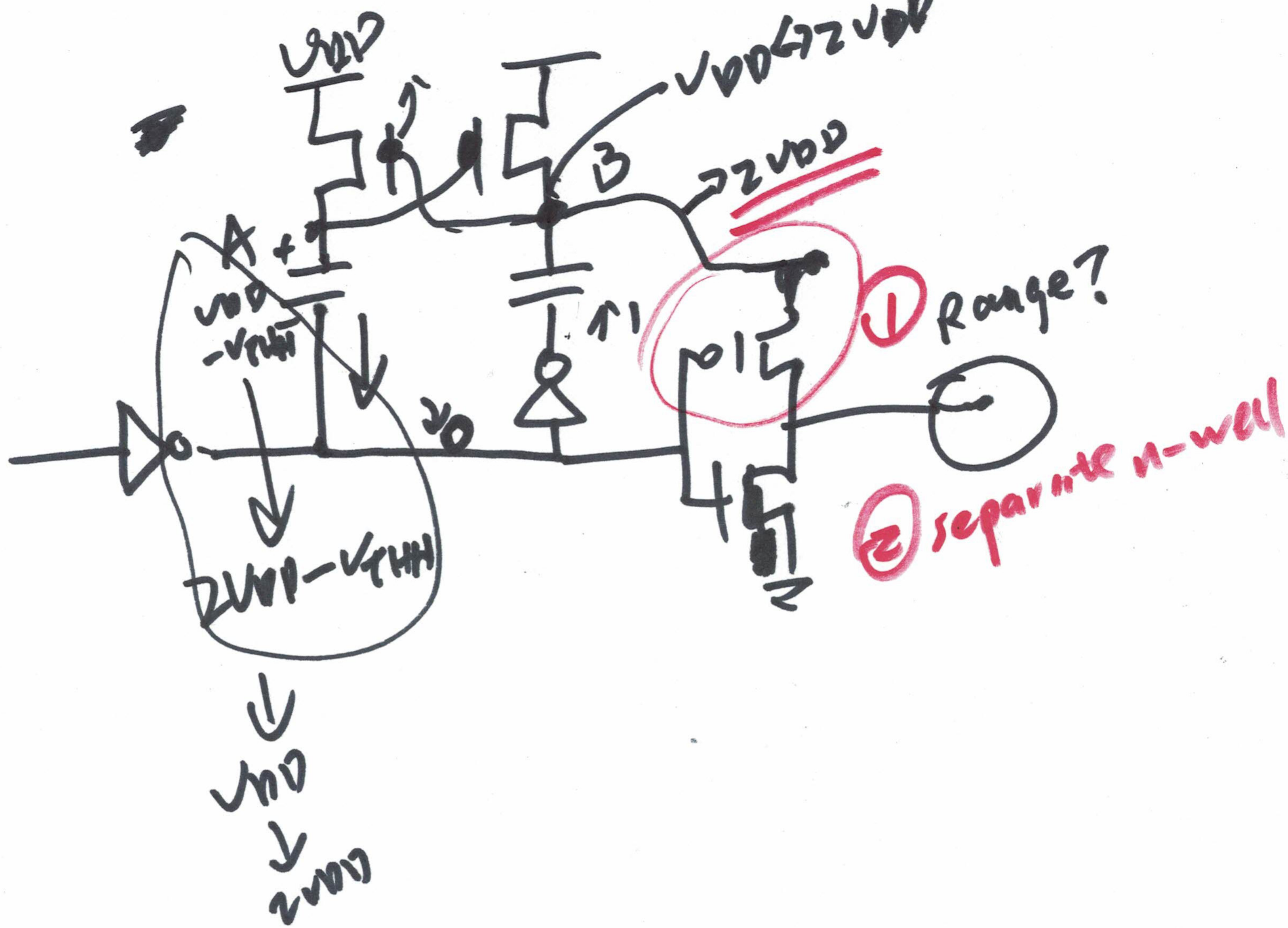


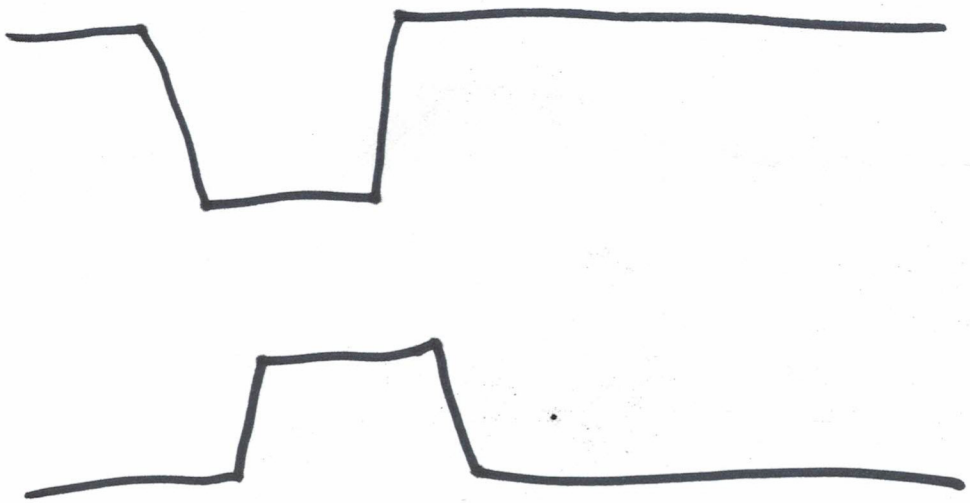
$$Y = AB + CD$$

$$= \overline{\overline{AB + CD}}$$

$$= \overline{\overline{AB} \cdot \overline{CD}}$$

$$= \overline{(\bar{A} + \bar{B}) \cdot (\bar{C} + \bar{D})}$$


VDD
VDD≫2VDD
B
2VDD
A
VDD
-VTHH
2VDD-VTHH
① Range?
② separate n-well
VDD
2VDD



$t_r, t_f, t_{pHL}, t_{pLH}$

- R-2R DAC
  - Thevenin's circuit
  - Vout
- SAR ADC
  - Algorithm
  - State diagrams

△ CS layers

↙ Quiz ↓ HW ↓ lecture notes

Miller

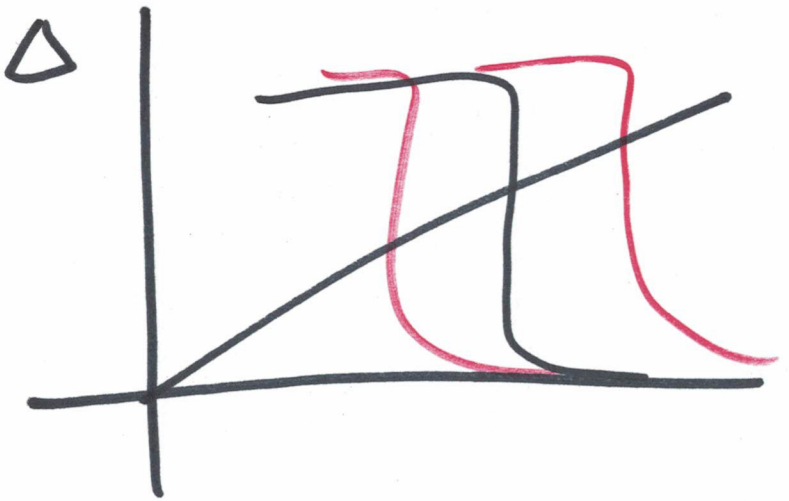
90-min

Thur 2:30-4pm

close book

close notes

calculator is allowed



△ Dickson's charge pump circuit.

Voltages at different nodes