EE 421/ECG 621

Digital IC Design

Lecture 4

Sept. 11, 2017

$t_d =$

$0.35 \cdot 100k \cdot 60fF$

$t_d = 2.1ns$

$t_d = 0.35 r c \ell^2$

$r \cdot \ell$ = tot. Res.

$c \cdot \ell$ = tot. cap

plate cap 100 aF/μm2

sidewall 50 aF/μm

2μ × 200μ

$C_{TOT} = C_{side} + C_{plate}$

$R = 1K \cdot \frac{200}{2} = 100k\Omega$

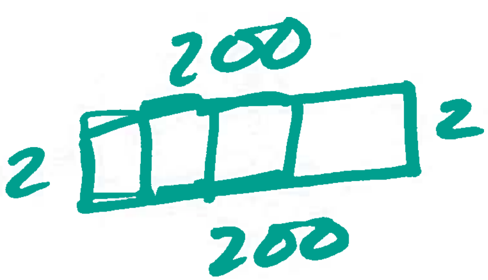
$C_{sidewall} = 404\mu \cdot \frac{50aF}{\mu m}$

$C_{plate} = \frac{100aF}{\mu m^2} \cdot 2\mu \cdot 200\mu$

$R = 100K$ $\quad l = 100$

$r = 1K$ $\quad 2 \times 2\ \square$

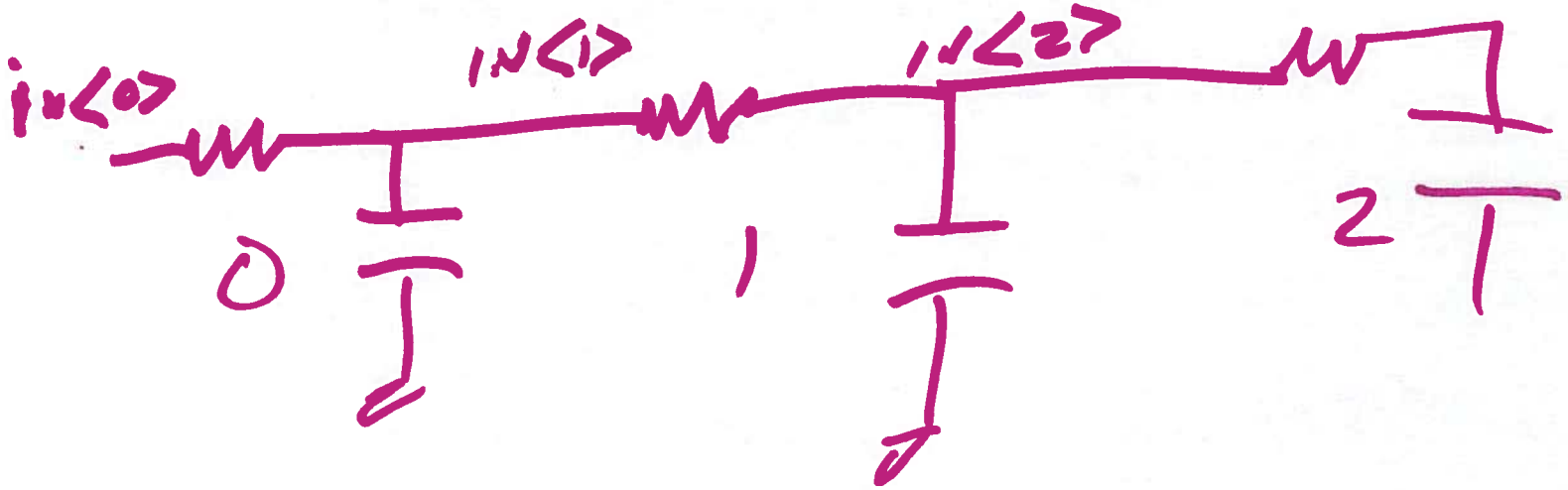
$$C = 100\,\frac{aF}{\mu m^2} \cdot 400\,\mu m^2 = 40{,}000\ aF = 40\ fF$$



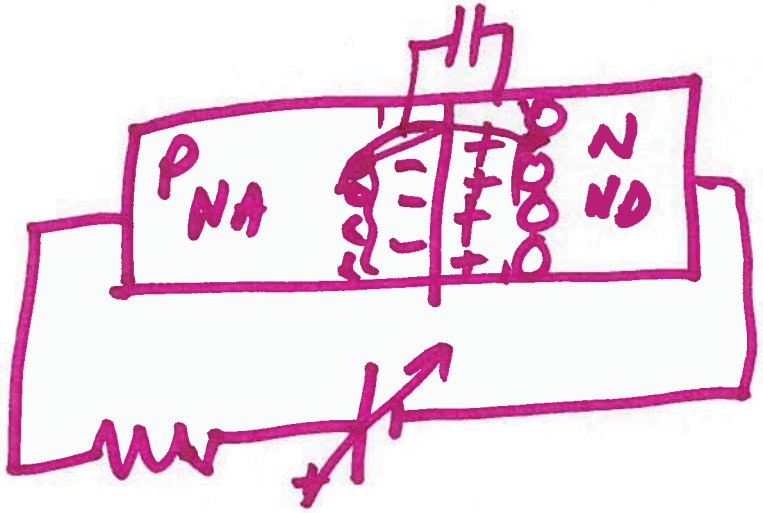
$$50\,\frac{aF}{\mu m} \cdot 404\,\mu m = 20{,}020\ aF = 20\ fF$$

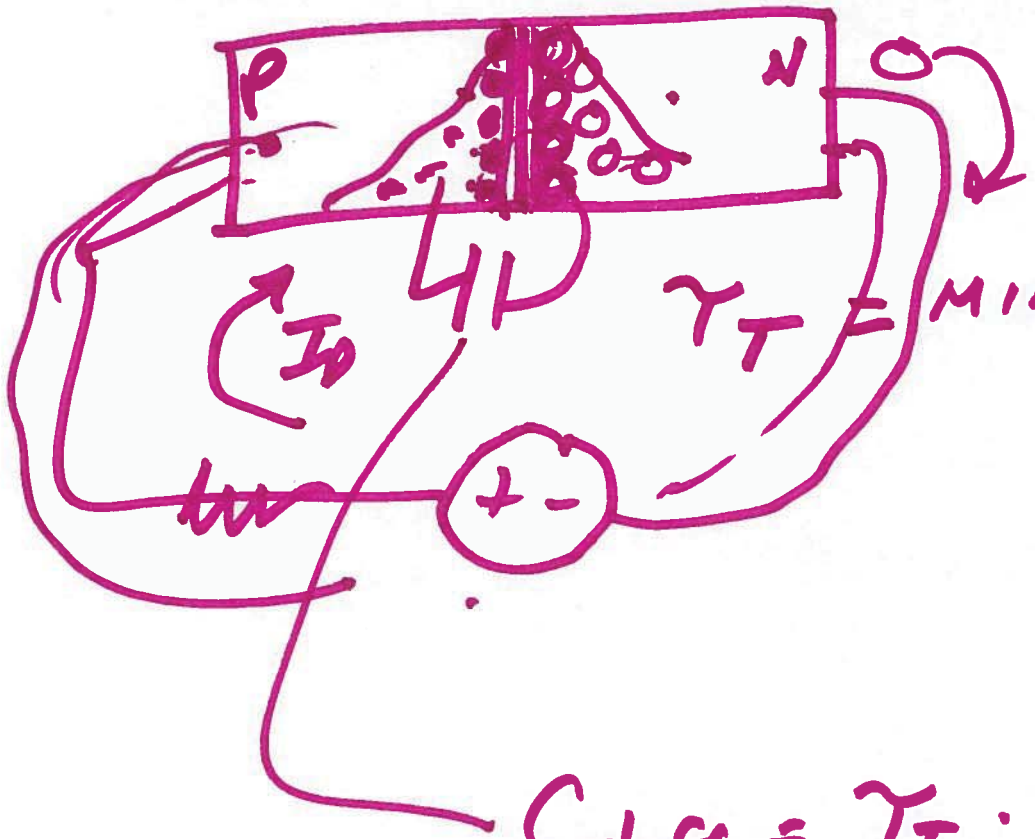
$$C_{tot} = 60\ fF$$

$$C = \frac{60\ fF}{100} = 0.6\ fF/\square$$


IN<0>
IN<1>
IN<2>
0
1
2

diffusion capacitance
storage cap.





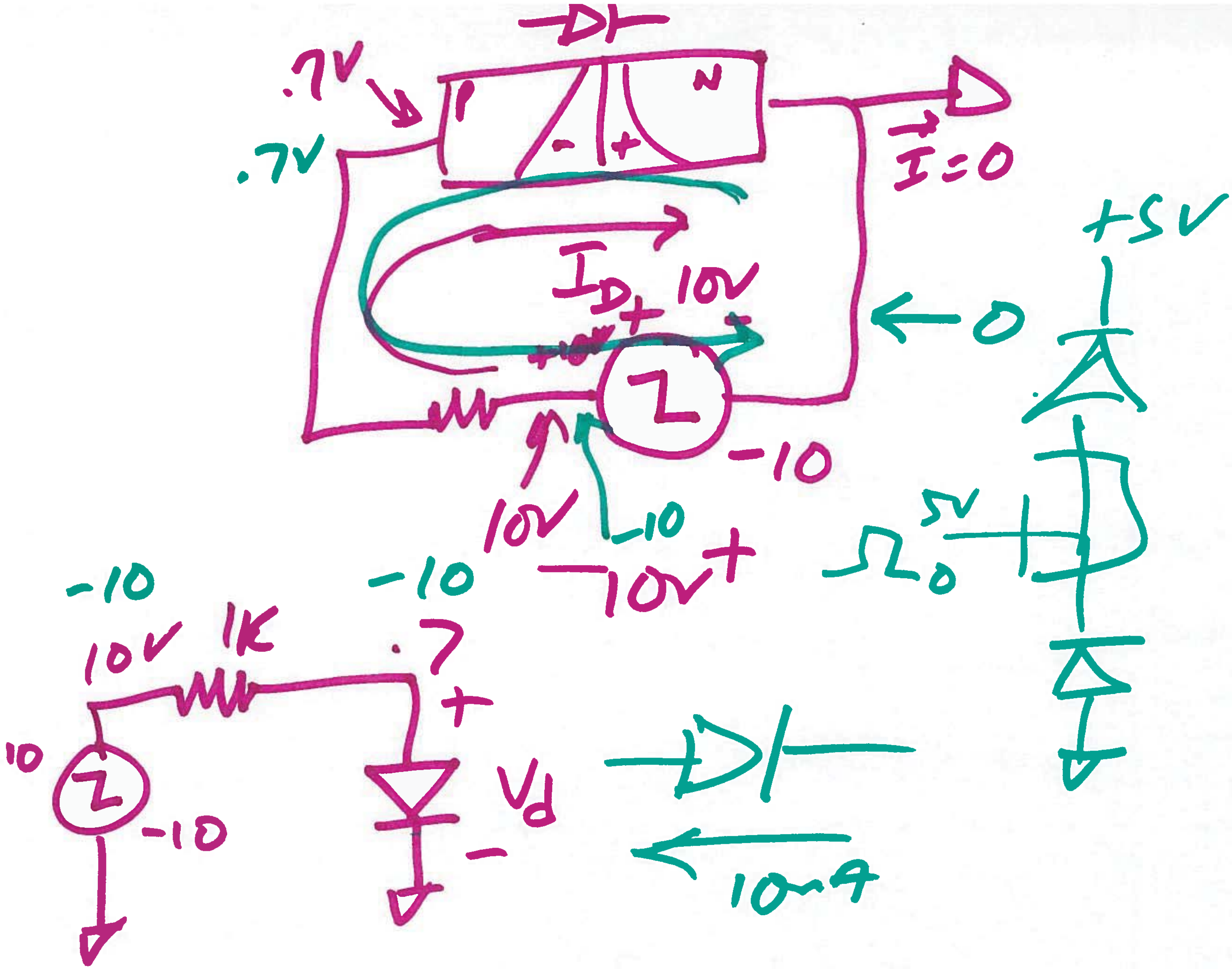
$$C_{diff} = \tau_T \cdot \frac{I_D}{V_T \cdot N}$$

$N \rightarrow$ emission coefficient $\simeq 1$

V_T → thermal voltage

$\frac{kT}{q} \Rightarrow 26\,mV$

c)



.7V
.7V
P
N
I = 0
I_D
10V
0
+5V
-10
10V
-10
10V
5V
1K
.7
+
Vd
-
10nA