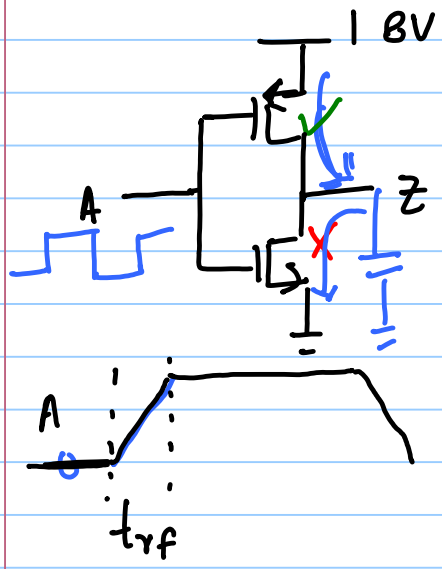
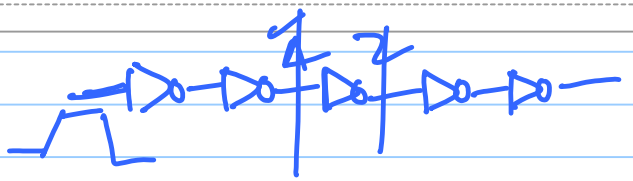
Lecture # 37

Note Title 18-10-2018

Digital cells



12 – 16 % clock period.



$\mu_p < \mu_n$

$$I_p = \mu_p C_{ox} \frac{W}{L} \left((V_{sg} - |V_{thl}|) V_{SD} - \frac{V_{SD}^2}{2} \right)$$

$$I_p = \mu_p C_{ox} \frac{W}{2L} (V_{sg} - |V_{tml}|)^2$$

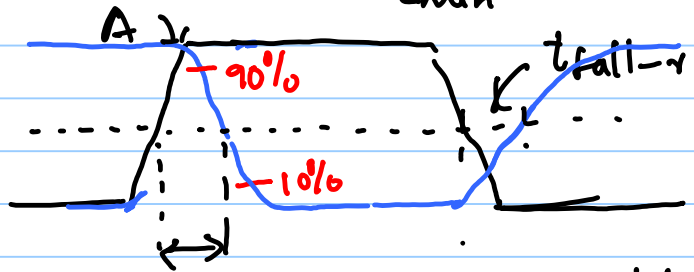
$$\frac{W_p}{L_p} = \frac{0.68\,\mu m}{0.18\,\mu}$$

$$\frac{W_n}{L_n} = \frac{0.24\,\mu m}{0.18\,\mu m}$$

cut-off → sub-threshold → saturation → linear.

NMOS : $\frac{W}{L} = \frac{0.24\ \mu m}{0.18\ \mu m}$

$L_{min} = 0.18$



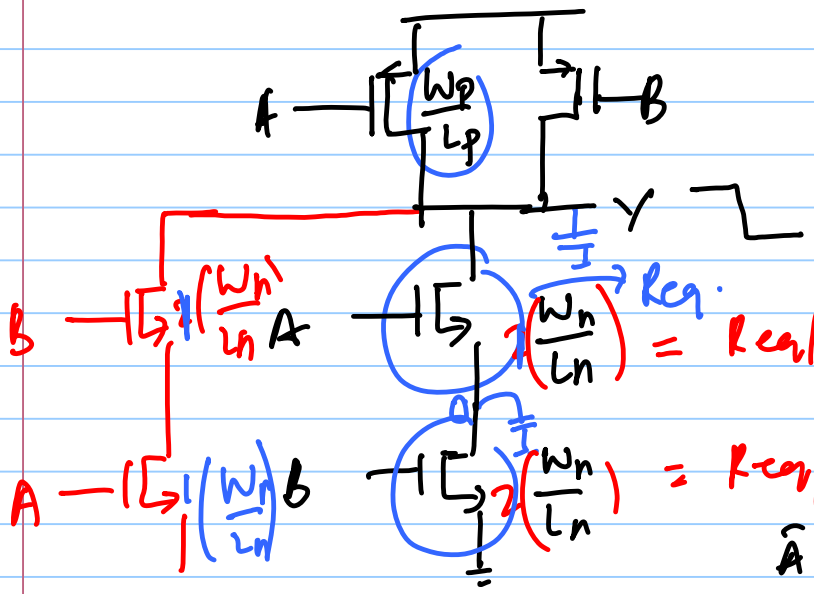
$t_{rise/fall}$ — 20 – 80 %

10 – 90 %

- $t_{rise} \downarrow \geq t_{fall} \uparrow$
- $t_{rise-fall-del} = t_{fall-rise-del} \downarrow$

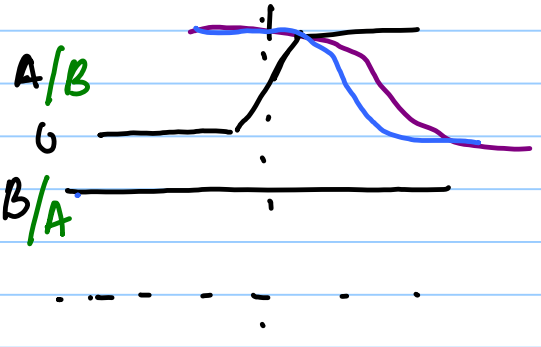
W_p : 0.24 μm → + 0.48 μm

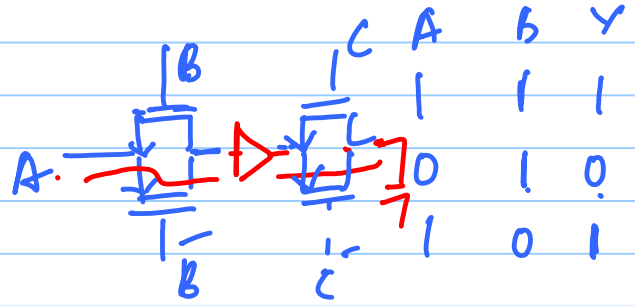
Nand Gate $Y = \overline{A \cdot B}$



$$\frac{W_n}{L_n} = \frac{0.24}{0.18} \qquad Req = R_{nmos}$$

$$\frac{W_p}{L_p} = \frac{0.68}{0.18} \qquad Req = R_{pmos} = R_{nmos}.$$

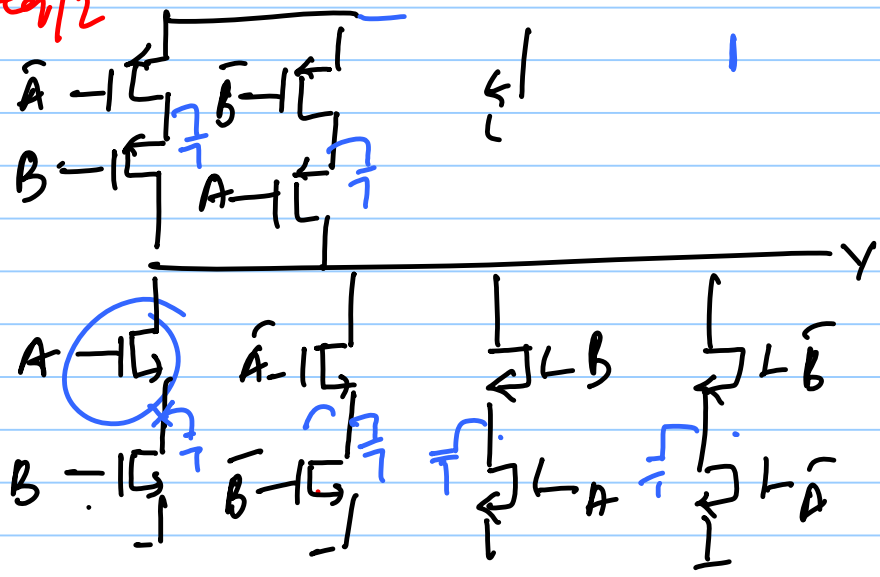


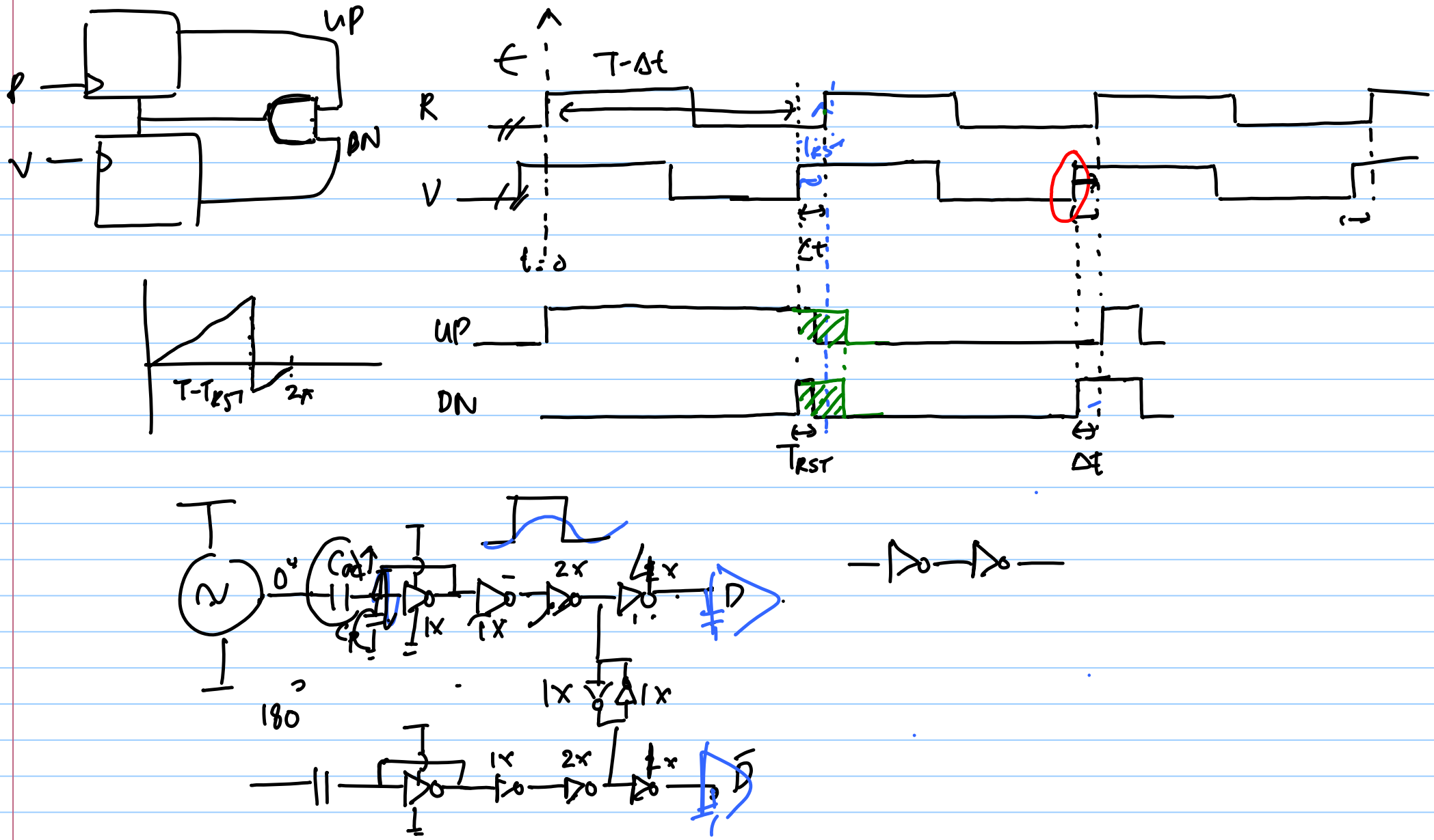


C	A	B	Y
1	1	1	1
1	0	1	0
1	1	0	1

$$Y = A\bar{B} + \bar{A}B$$

$$\bar{Y} = AB + \bar{A}\bar{B} \checkmark$$




UP
R
DN
V
T-Δt
R
V
t=0
Δt
UP
DN
T-TRST
2π
TRST
Δt
0°
180°
1x
1x
2x
4x
D
1x
1x
1x
2x
4x
D̄