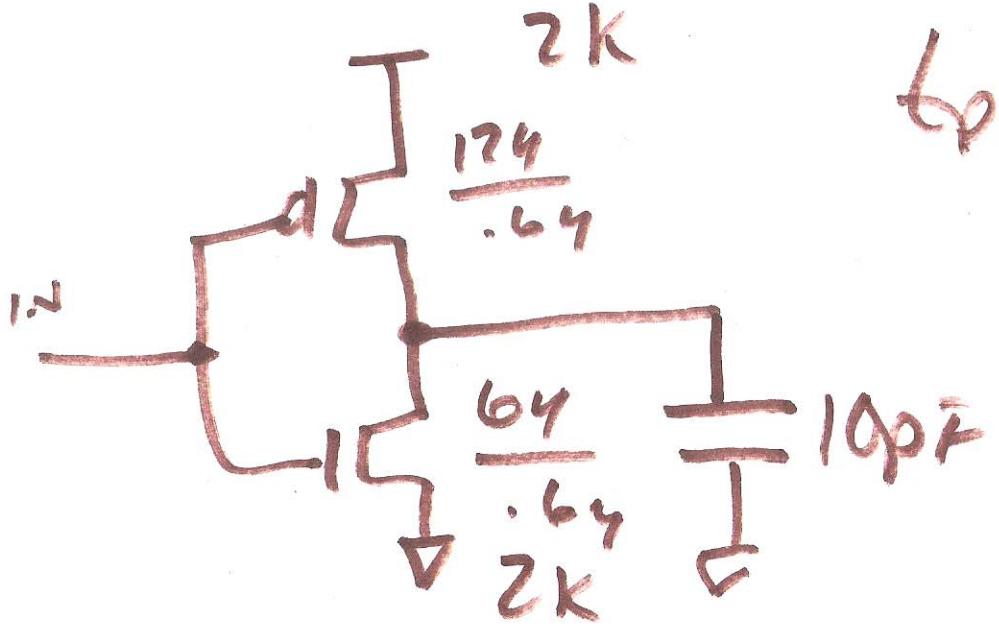
11.4 Sizing for Large capacitive loads

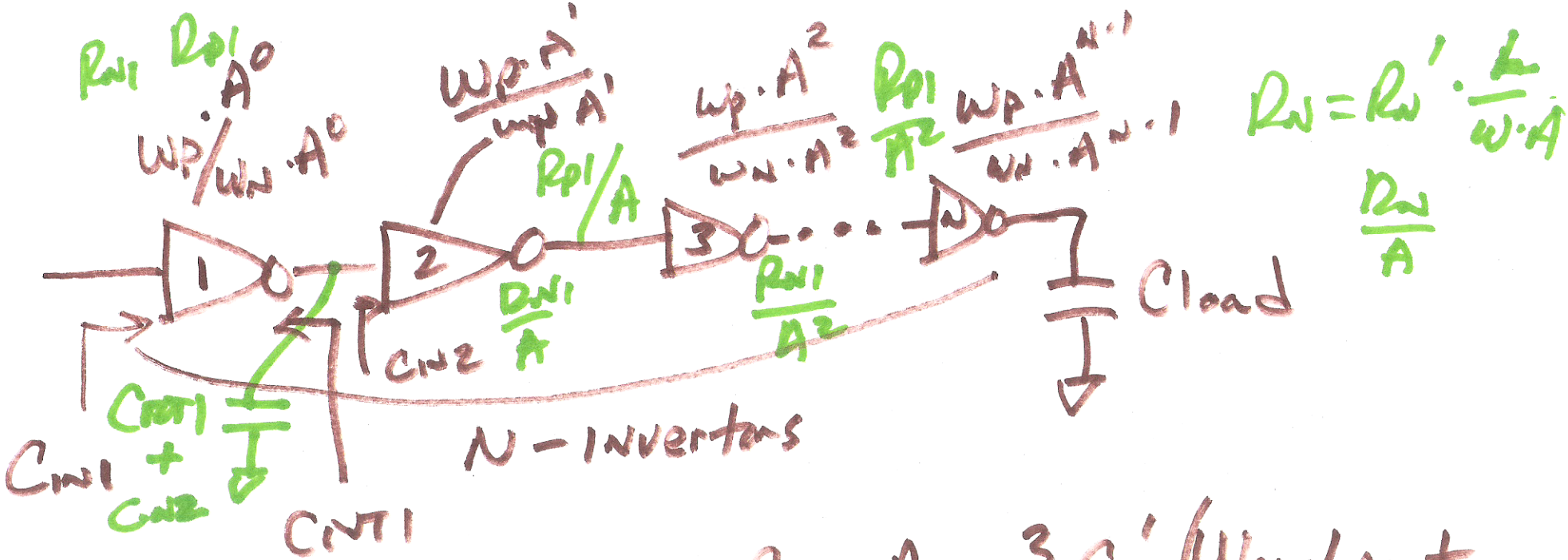
11/14/14



$t_{pHL} = t_{pLH} =$

$\simeq 0.7 \cdot 2K \cdot 10pF$

$= \underline{14ns}$



$$R_N = R_N' \cdot \frac{L}{W \cdot A}$$

$$C_{N3} = C_{N1} \cdot A^2 = C_{N2} \cdot A$$

$$C_{N2} = C_{N1} \cdot A = \frac{3}{2} C_{ox}' (W_{P1} \cdot L_{P1} + W_{N1} \cdot L_{N1}) \cdot A$$

$$C_{INT2} = C_{INT1} \cdot A = C_{ox}' (W_{P1} L_{P1} + W_{N1} L_{N1}) \cdot A$$

$$C_{INT1} \cdot \frac{3}{2} = C_{N1}$$

$$C_{load} = C_{N1} \cdot A^N$$

$$A = \left(\frac{C_{load}}{C_{N1}} \right)^{\frac{1}{N}}$$

$$t_{pHL} + t_{pLH} = 0.7(R_{n1} + R_{p1})(C_{int2} + C_{out1}) +$$

$A \cdot C_{N1}$ $\quad \frac{2}{3} C_{N1}$

$$0.7\left(\frac{R_{n1}}{A} + \frac{R_{p1}}{A}\right) \cdot \left(C_{int3} + C_{out2}\right) +$$

$A^2 \cdot C_{N1}$ $\quad \frac{2}{3} C_{N1} \cdot A$

$$0.7\left(\frac{R_{n1}}{A^2} + \frac{R_{p1}}{A^2}\right)\left(A^3 \cdot C_{N1} + \frac{2}{3} C_N \cdot A^2\right)$$

$$t_{pHL} + t_{pLH} = 0.7(R_{n1} + R_{p1}) \cdot \sum_{K=1}^{N} \left(C_{out1} + A \cdot C_{N1}\right)$$

NS $C_{load} = C_N \cdot A^N$

$$\frac{\delta t_{pHL} + t_{pLH}}{\delta A} = 0$$

$$D = 0.7(R_{N1} + R_{P1})C_{load} + (R_{N1} + R_{P1})0.7 \cdot C_{N1}$$

$$\left(\frac{\ln \frac{C_{load}}{C_{N1}}}{-N^2}\right) N \left(\frac{C_{load}}{C_{N1}}\right)^{1/N} =$$

$$\left(\left(\frac{C_{load}}{C_{N1}}\right)^{1/N} + N\left(\frac{C_{load}}{C_{N1}}\right)^{1/N}\right) \cdot \left(\frac{\ln \frac{C_{load}}{C_{N1}}}{-N^2}\right)$$

$$\left(\frac{C_{load}}{C_{N1}}\right)^{1/N}$$

$$N = \ln \frac{C_{load}}{C_{N1}} \simeq 3 \qquad \frac{\ln A}{-N} = \ln \left(\frac{C_{load}}{C_{N1}}\right)^{1/N}$$

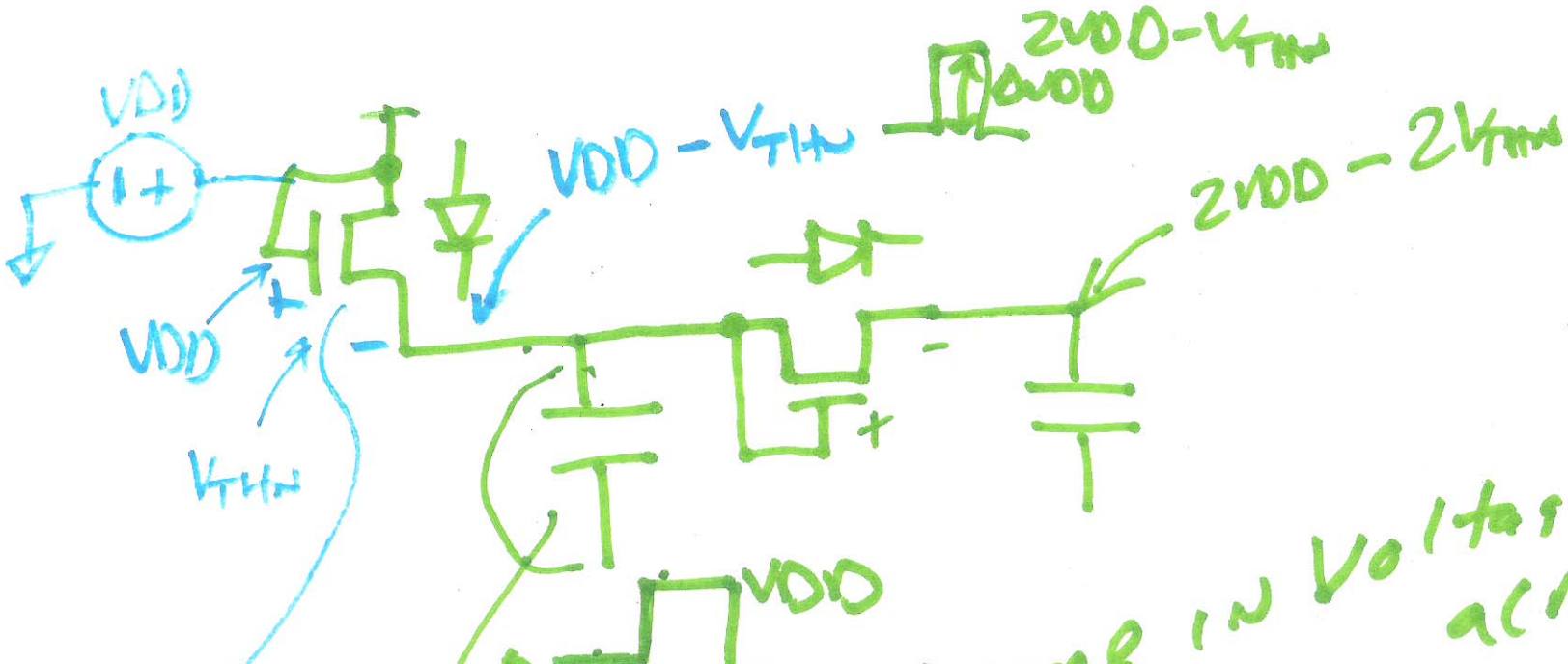
$$A = \left(\frac{C_{load}}{C_{N1}}\right)^{1/N} = 2.92$$

$C_{load} = 10pF$

$C_{N1} = \frac{3}{2} \cdot 2.5ff \left(\frac{12 \cdot .6}{6 \cdot .6}\right)$

Ideal $A = e = 2.71 = 40ff$

4)



Change in Voltage across the CMPS

e.g. 200mV

$$\frac{\Delta V}{\Delta t} = \frac{I}{C}$$

100µ

period / 2

$$I = C\frac{dV}{dt}$$

$$\frac{200mV}{10ns} = \frac{100\mu}{C}$$

$$C = \frac{10^{-4} \cdot 10^{-8}}{0.2 \cdot [illegible]}$$

5 pF