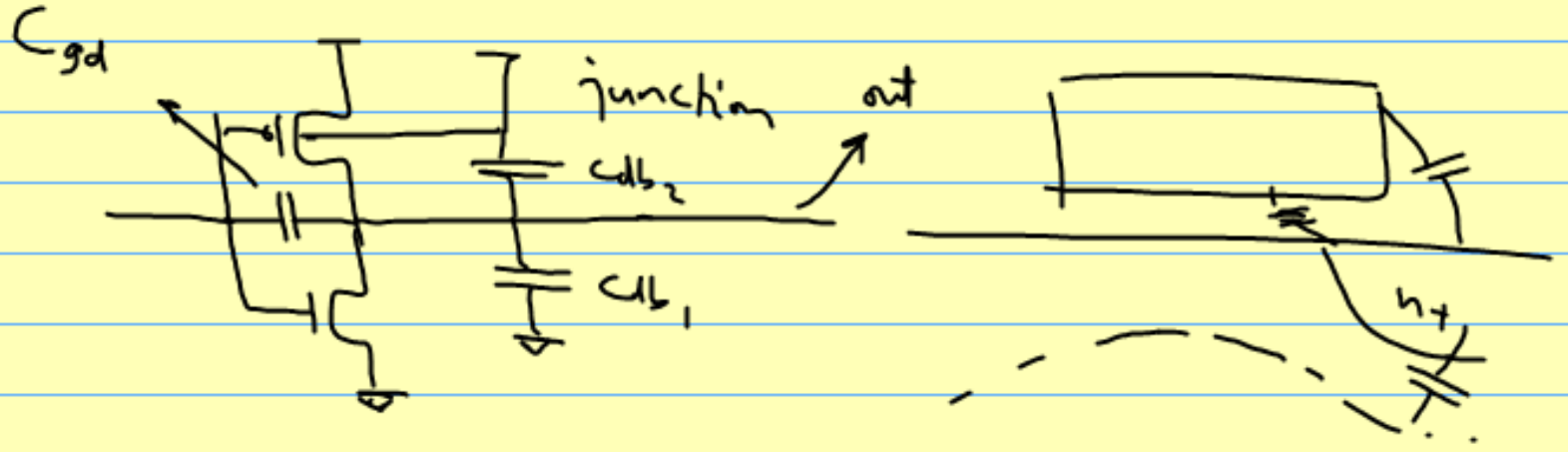
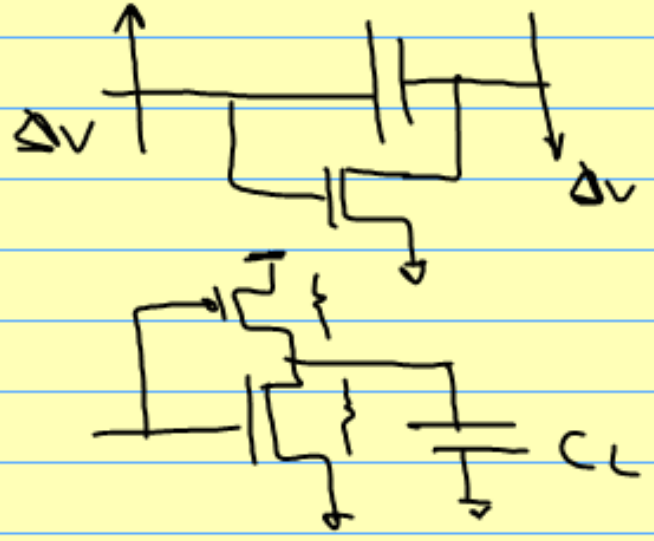
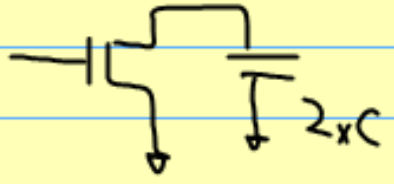
Caps



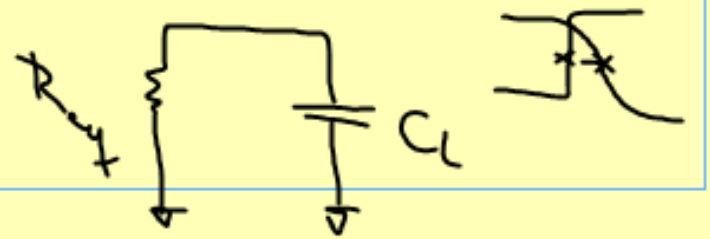


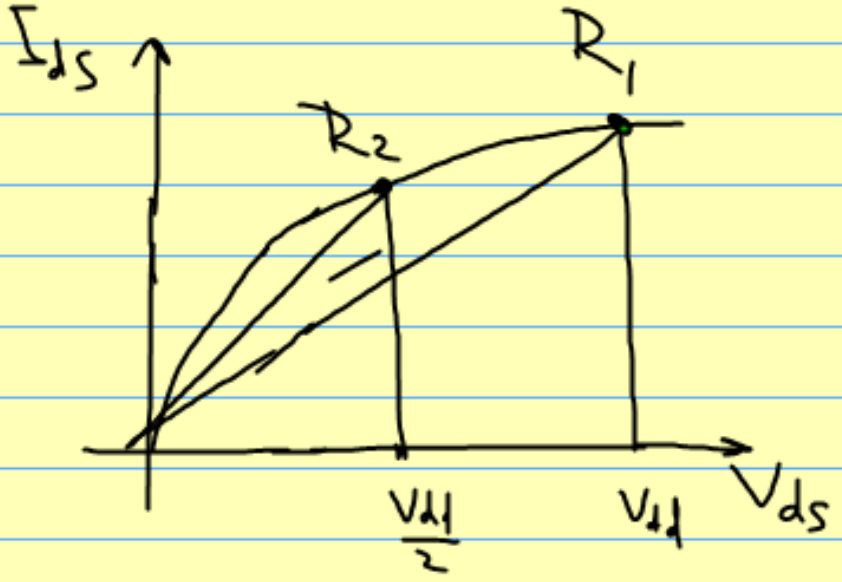
$2\Delta V$

Miller effect



R_{eff} R_{eq}





$$I_{ds} = I_{dsat} \cdot (1 + \lambda V_{ds})$$

$$V_{gs} = V_{dd}$$

$$I_{dsat} = \frac{\mu C_{ox} W}{L} V_{dsat} \left(V_{gs} - V_t - \frac{V_{dsat}}{2} \right)$$

$$R_{eq} = \frac{1}{2} \left(\frac{V_{dd}}{I_{dsat}\big|_{V_{gs}=V_{dd}} (1 + \lambda V_{dd})} + \frac{V_{dd}/2}{I_{dsat}\big|_{V_{gs}=V_{dd}} \left(1 + \lambda \frac{V_{dd}}{2}\right)} \right)$$

$$= \frac{V_{dd}}{2 I_{dsat}} \left(1 - \lambda V_{dd} + \frac{1}{2} \left(1 - \lambda \frac{V_{dd}}{2}\right) \right.$$

R_{eq}

$$= \frac{3}{4} \frac{V_{dd}}{I_{dsat}} \left(1 - \frac{5}{6} \lambda V_{dd}\right)$$

0.83

assume $\frac{1}{2}(R_1 + R_2)$

$$R_{eq} = \frac{1}{-V_{dd}/2} \int_{V_{dd}}^{V_{dd}/2} \frac{V}{I_{dsat}(1+\lambda V)} dV$$

$$= \frac{3}{4} \frac{V_{dd}}{I_{dsat}} \left(1 - \frac{7}{9} \lambda V_{dd}\right)$$

0.77

$$t_{pHL} = 0.69 R_{eq} C_L = 0.69 \times \frac{3}{4} \frac{C_L V_{dd}}{\mu C_{ox} \frac{W}{L} V_{dsat}(V_{dd} - V_t - \frac{V_{dsat}}{2})}$$

high perf $C_L \downarrow$ $W \uparrow$ $V_{dd} \uparrow$