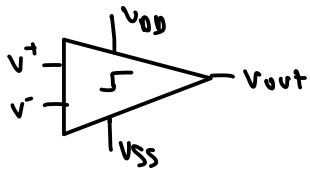
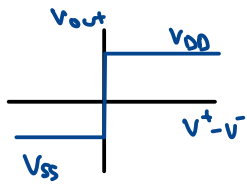
Week 9 Cribsheet

NOTES: 18, 19, 20

COMPARATORS

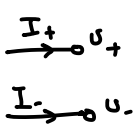


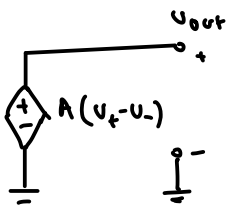


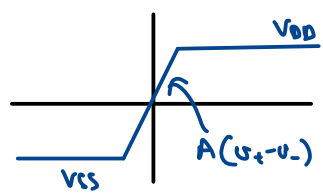
$$V_{out} = \begin{cases} V_{DD} & \text{if } V^+ > V^- \\ \text{undefined} & \text{if } V^+ = V^- \\ V_{SS} & \text{else} \end{cases}$$

useful trick: say you want to compare some voltage V with a fixed voltage, e.g. $1V$. Then, attach V to V^+ and fixed to V^-.

OP AMPS

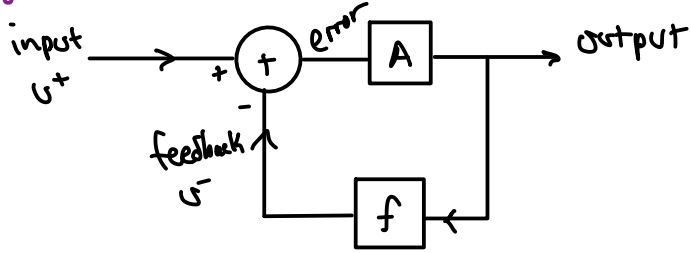






why is it clipped at V_{DD} and V_{SS}? op-amp uses these as power.

Negative feedback:



(NFB)

if error ↑, then output ↑, then feedback ↑, then error ↓

$v_- = \frac{\beta A}{1+\beta A} v_+$. $\lim_{A \to \infty} v_- = v_+$.

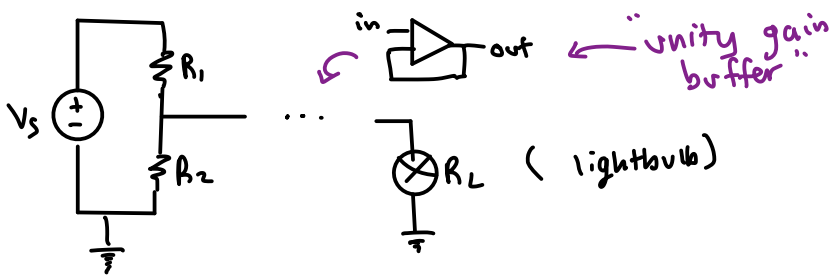
GOLDEN RULES

1. $I_+ = I_- = 0$
2. During negative feedback, $V_+ = V_-$ (see limit above)

DESIGN

1. Specifications: ensure all goals are clearly stated
2. Strategy: draw a block diagram
3. Implementation: pattern match / change into circuits
4. Verification: make sure circuits don't interfere w/ others

★ COMMON PITFALL: LOADING (CSM WS 9 #5)



Say I want R_L to have $\frac{R_2}{R_1+R_2} V_S$ volts across.

However, attaching this voltage divider won't work!

Need a unity gain buffer.