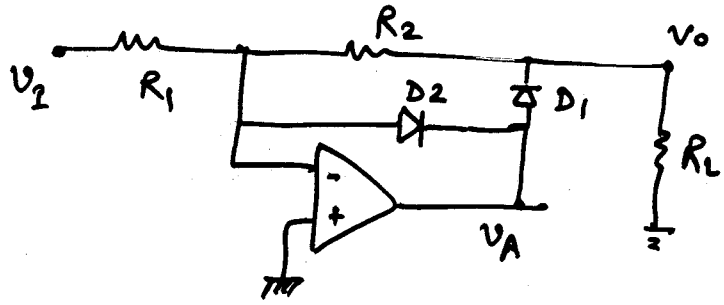
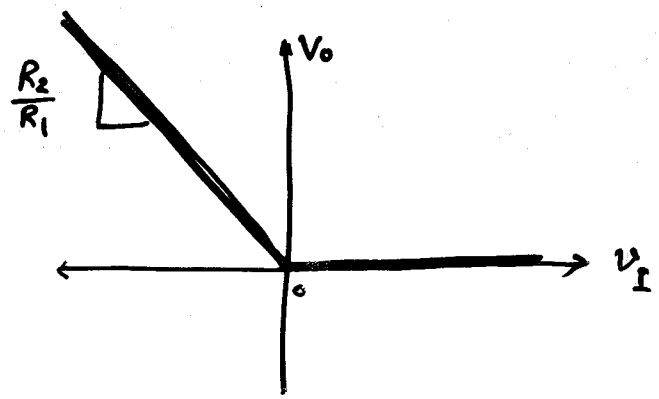
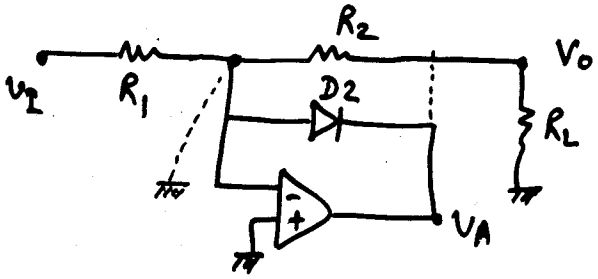
Practical Op Amp Rectifier



$V_I < 0$

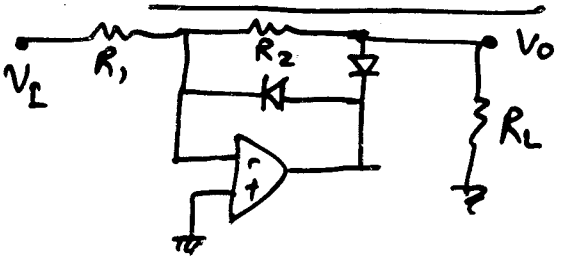


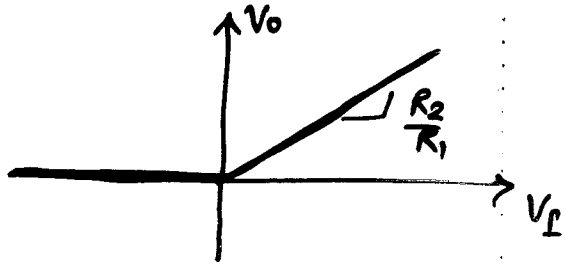
$V_I > 0 \Rightarrow D_2 \rightarrow ON,\ D1 \rightarrow OFF$



$\Rightarrow V_o = 0$

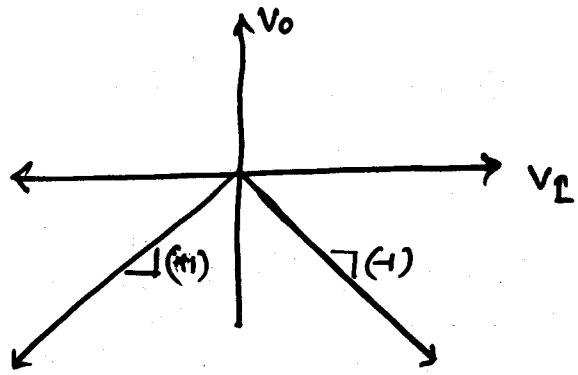
Reverse the diodes

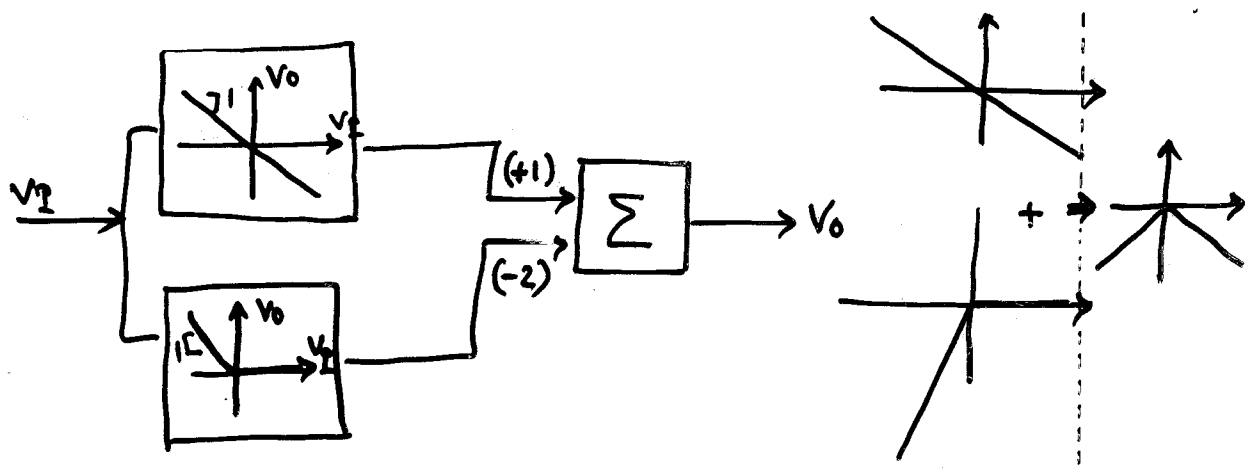




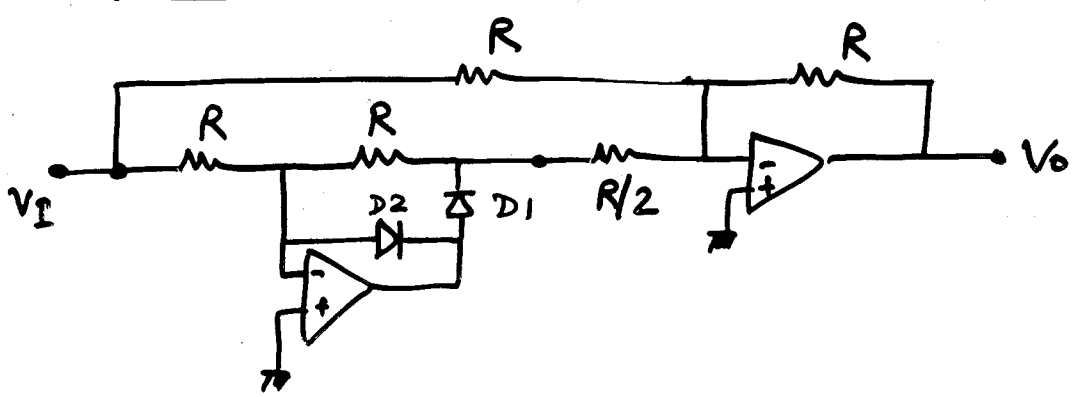
Absolute value circuit

$V_o = -|v_I|$ using precision rectifier circuit

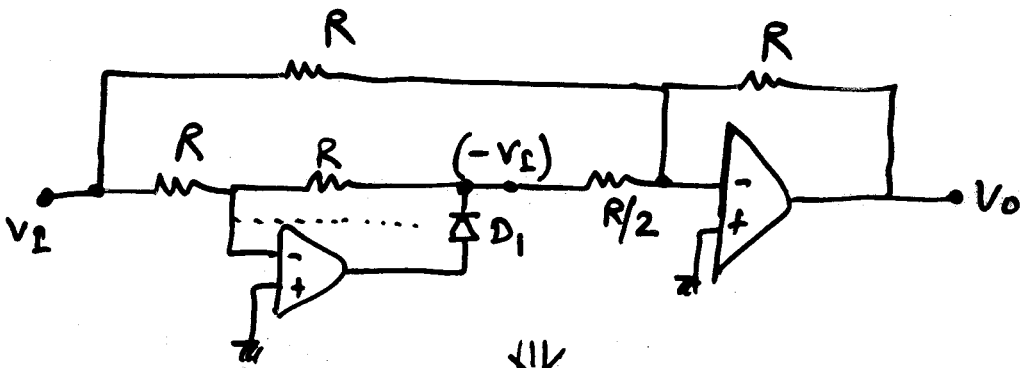


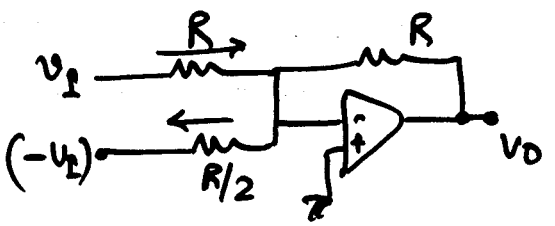


Realization

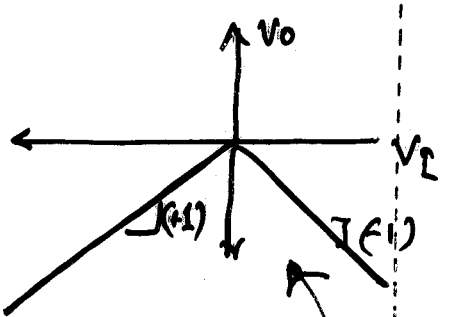


When $V_I < 0$

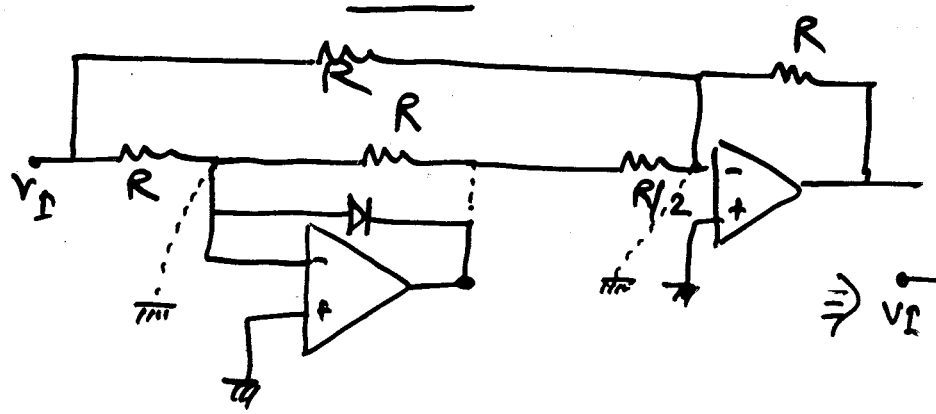


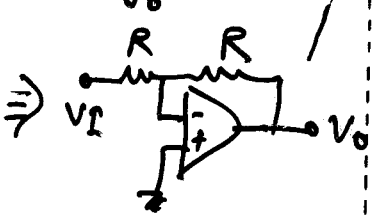


$V_O = (+V_I)$



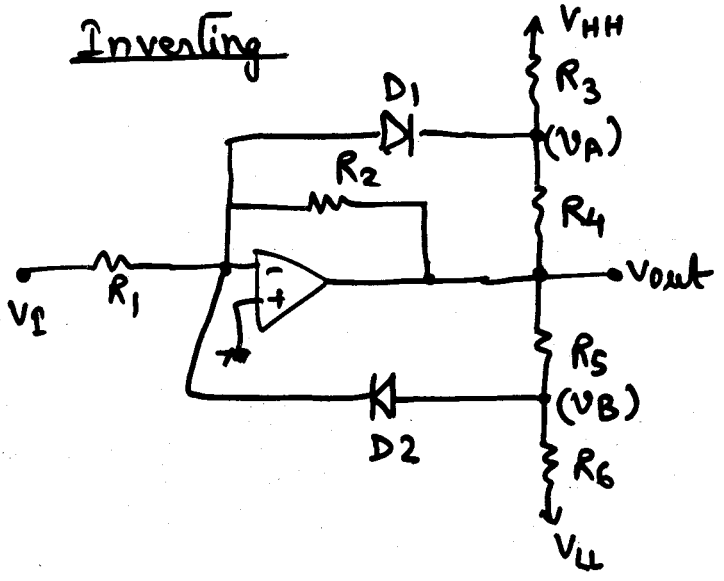
When $V_I > 0$





Limiting amplifiers

Inverting



D1	D2	
OFF	OFF	✓
ON	OFF	✓
OFF	ON	✓
~~ON~~	~~ON~~	x

① D1 and D2 → OFF

$$v_{out} = \left(\frac{-R_2}{R_1}\right) v_I$$

② D1 is on and D2 is off:

↳ $V_A \leq 0$

$$V_A = \left(\frac{R_4}{R_3+R_4}\right) V_{HH} + \left(\frac{R_3}{R_3+R_4}\right) v_{out} \leq 0$$

$$v_{out} \leq \left(\frac{-R_4}{R_3}\right) V_{HH}$$

When D1 is on $\Rightarrow$ $v_{out} = \dfrac{(R_2 \| R_4)}{R_1} v_{in} - \dfrac{(R_2 \| R_4)}{R_3} V_{HH}$

When $V_A = 0$ { point when D1 goes off }

$$V_{out} = \left(\frac{-R_2}{R_1}\right) V_I \quad ; \quad V_{out} = \left(\frac{-R_4}{R_3}\right) V_{HH}$$

$$\left(\frac{-R_2}{R_1}\right) V_I = \left(\frac{-R_4}{R_3}\right) V_{HH}$$

$$\boxed{V_I = \left(\frac{R_1 R_4}{R_2 R_3}\right) V_{HH}}$$