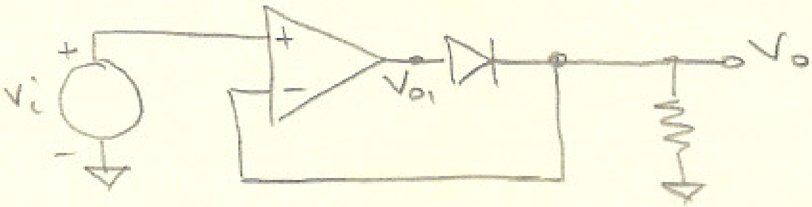
Percision Rectification "Super Diode"



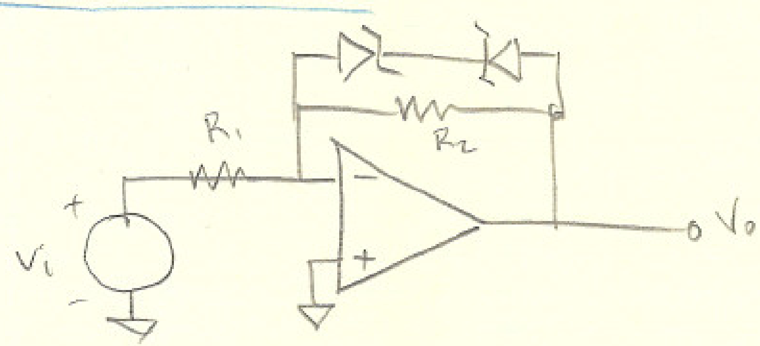
$V_I > 0 \Rightarrow$ neg feedback $\Rightarrow V_{ID} = 0$

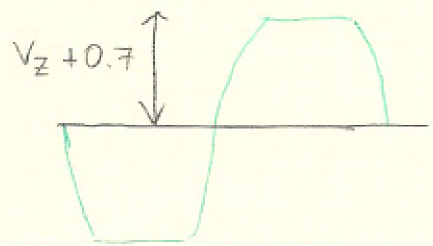
$V_I < 0 \Rightarrow$ no neg feedback $\Rightarrow V_{ID} = +V_I$

$V_{O1} = -V_{cc}$

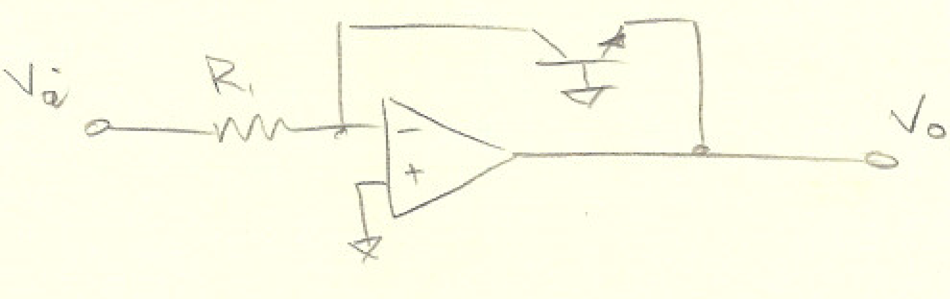
$V_o = 0$

Limiter Circuit





Logarithmic Amplifier

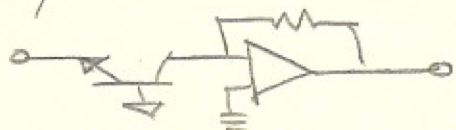


$V_I > 0$ & $V_o < 0$ } then we have neg feedback.

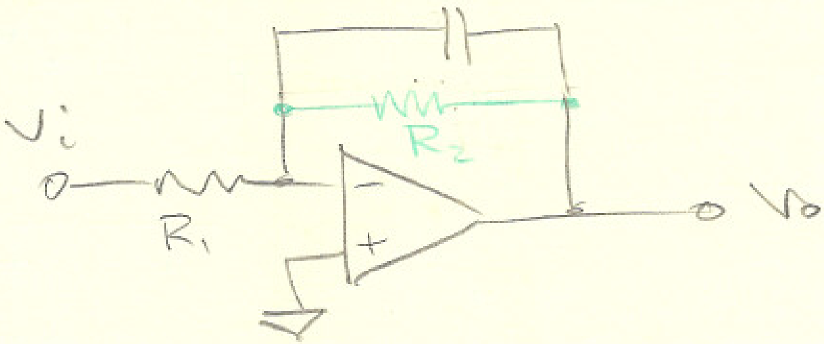
$$i_1 = \frac{V_I}{R_1} = I_s \exp\left(\frac{-V_o}{V_T}\right)$$

$$\frac{V_I}{R_1 I_s} = \exp\left(\frac{-V_o}{V_T}\right)$$

$$\therefore V_o = -V_T \ln\left(\frac{V_I}{R_1 I_s}\right)$$

Note exponential amplifier 

Integrator

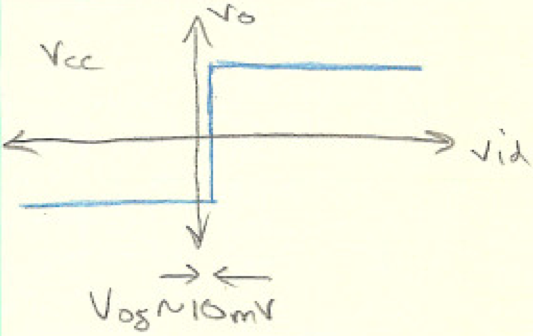


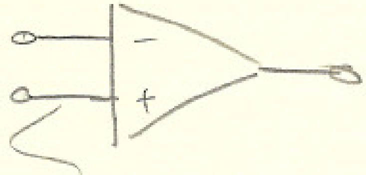
$$i_1 = \frac{V}{R_s} = C\frac{dV_c}{dt} = -C\frac{dV_o}{dt}$$

$$\frac{dV_o}{dt} = \frac{1}{R_1 C} V_s$$

$$V_o = \frac{1}{R_1 C}\int_0^t V_s \, dt$$

Now adding R_2 b/c of offset voltage.





there really should be a supply equal to Vos in our theoritical Op amp.

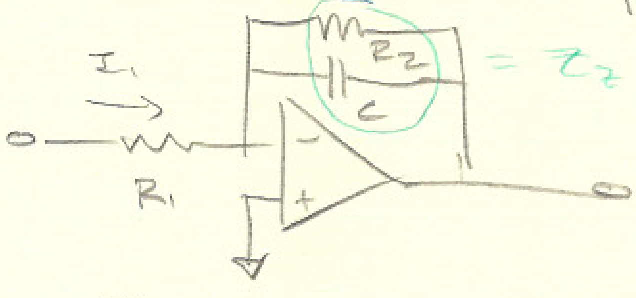
$$i_1 = -\frac{V_{os}}{R_1} = C\frac{dV_c}{dt} = C\frac{d(V_{os}-V_o)}{dt} = C\frac{dV_{os}}{dt} - C\frac{dV_o}{dt}$$

($C\frac{dV_{os}}{dt}$: assume zero.)

$$V_o = +\frac{1}{RC}\int_0^t V_{os}\,dt + V_o(0)$$

here we see that the voltage grows forever because of the offset voltage

But with resistor in place.



$$Z_2 = \left[R_2^{-1} + j\omega C\right]^{-1}$$

$$I_1 = \frac{V_s}{R_1} = \frac{-V_o}{Z_2} = -V_o\left(\frac{1}{R_2} + j\omega C\right)$$

$$\frac{V_o}{V_s} = -\frac{R_2}{R_1}\,\frac{1}{1+j\omega C}$$