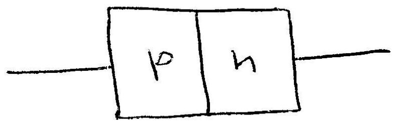
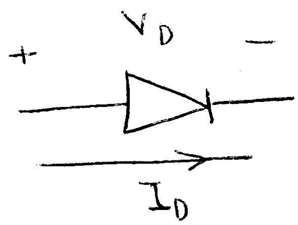
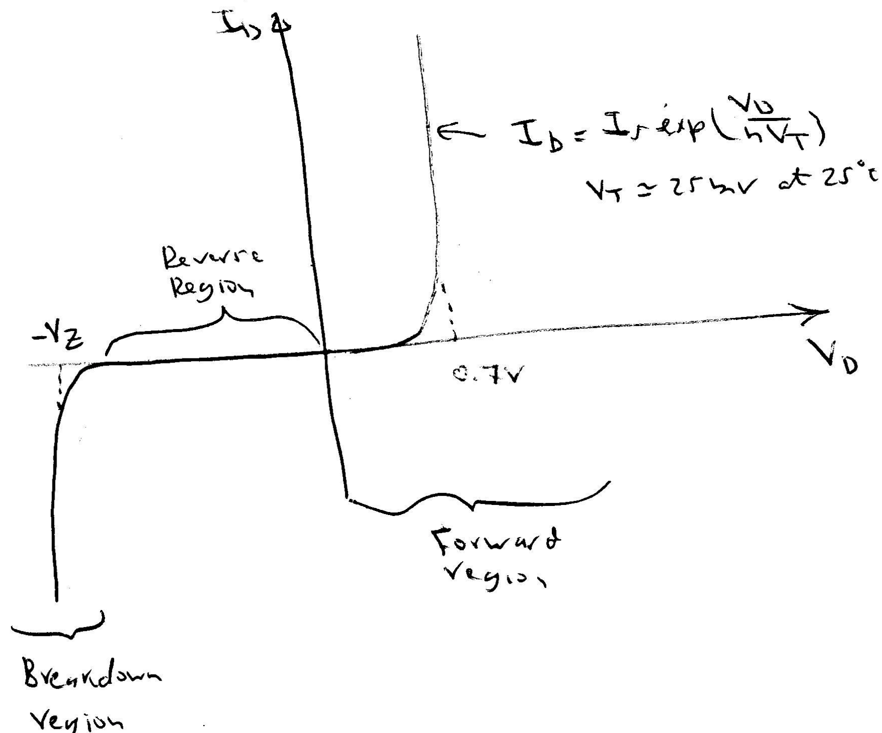
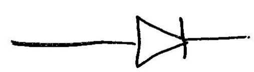


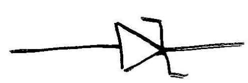


Input/output Characteristic

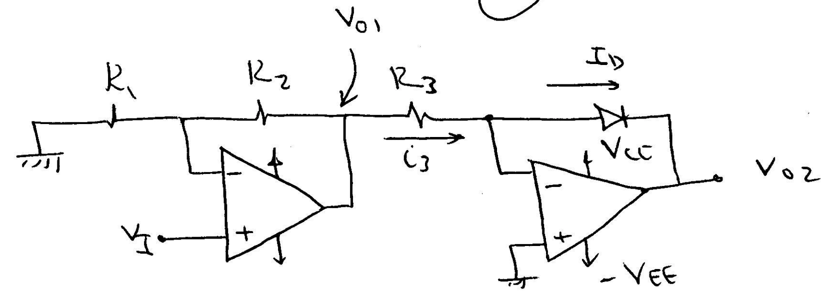




Diode



Zener Diode



$V_{o1} = V_I\left(1 + \frac{R_2}{R_1}\right)$

If $V_I > 0 \Rightarrow V_{o1} > 0 \Rightarrow i_3 > 0 \Rightarrow$ Diode is forward Biased

· Here, there is a feedback so $V_- = V_+ = 0$

$i_3 = \frac{V_{o1}}{R_3} = \frac{V_I}{R_3}\left(1 + \frac{R_2}{R_1}\right) = I_D$

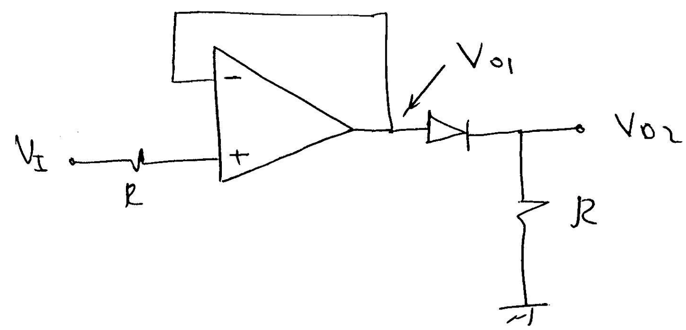
$V_{o2} = -V_D$

* By changing V_I, we are changing I_D and we measure $V_{o2} = -V_D$

* Note if $V_I < 0$, $V_{o1} < 0$, Diode is reverse biased $\Rightarrow I_D = 0 = i_3 \Rightarrow V^- = V_{o1}$ and $V_{o2} = -V_{EE}$

* The Diode may reach breakdown for large negative V_I

③

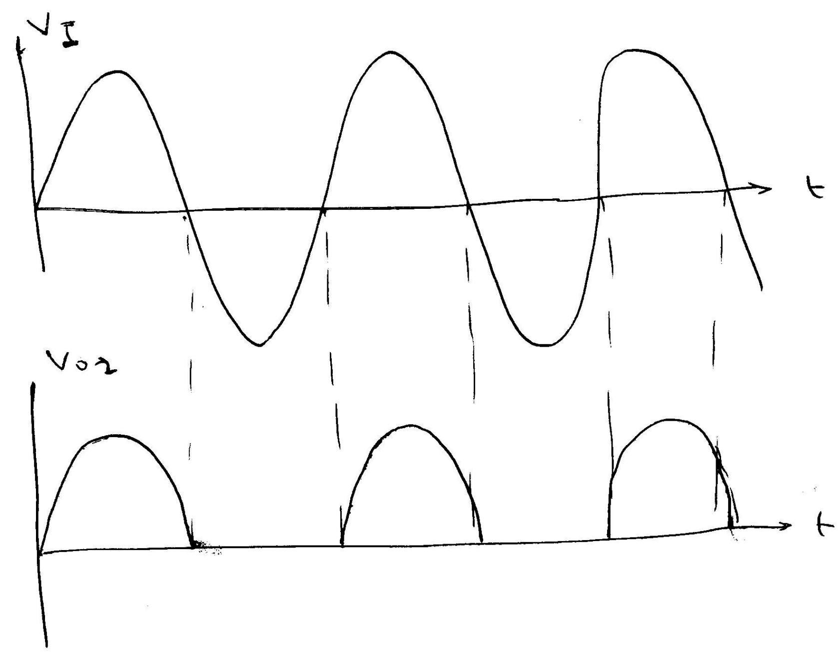


* If $V_I > 0$; $V_{o1} \simeq V_I$, Diode is forward-biased,

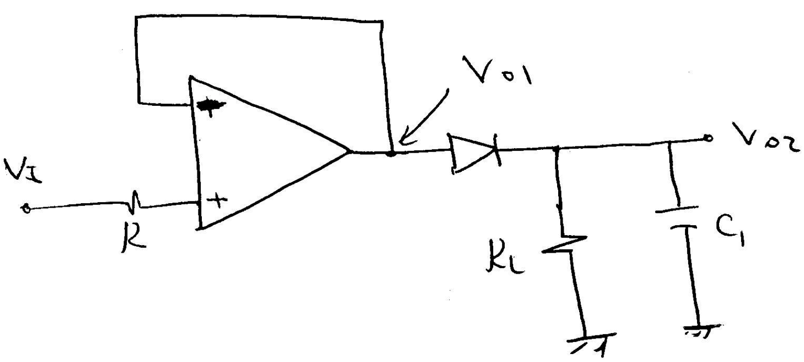
$V_{o2} \simeq V_{o1}$ (neglecting the small diode drop)

If $V_I < 0$, $V_{o1} \simeq V_I$, Diode is reverse-biased

$V_{o2} = 0$



④



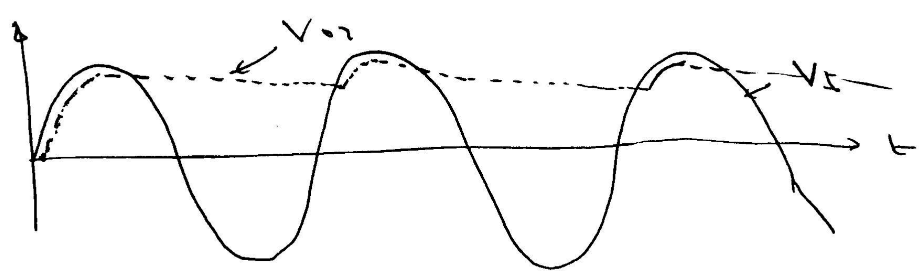
At $t=0$, $V_C = 0$

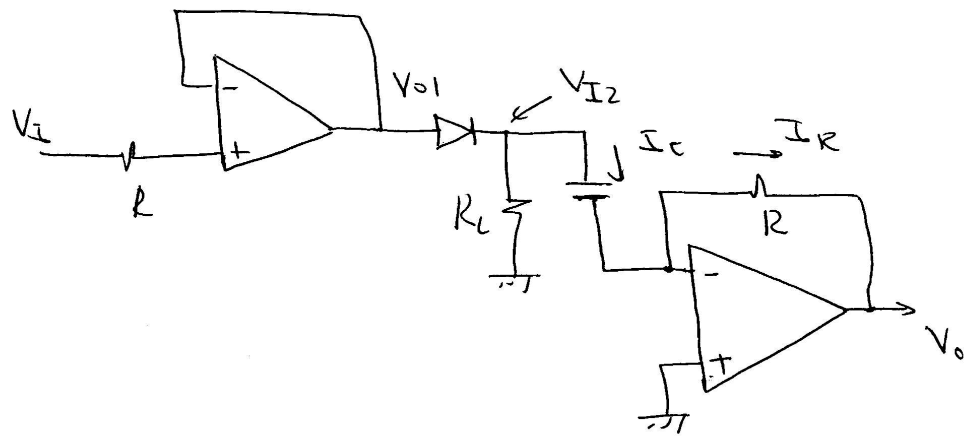
* If $V_I > 0$, $V_{o1} = V_I > 0$, Diode conducts,

$V_{o2} = V_{o1} = V_C$.

* This continues until V_I starts to drop. Here $V_{o1} < V_C \Rightarrow$ Diode is reverse biased $\Rightarrow$ Capacitor is discharging slowly through R_L

* If $V_I < 0$, $V_{o1} = V_I$. Diode is off





This circuit is identical to the previous one except that capacitor is now connected to virtual ground

$V_{o1} = V_I$

$V_{I2} = V_{IC}$, $I_C = C \frac{dV_{I2}}{dt}$

$I_R = I_C \implies V_o = -I_R R = -C \frac{dV_{I2}}{dt} R$