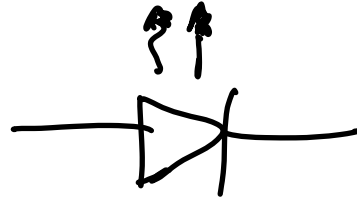
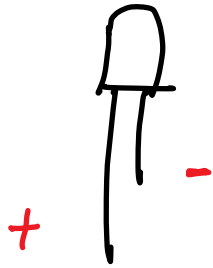
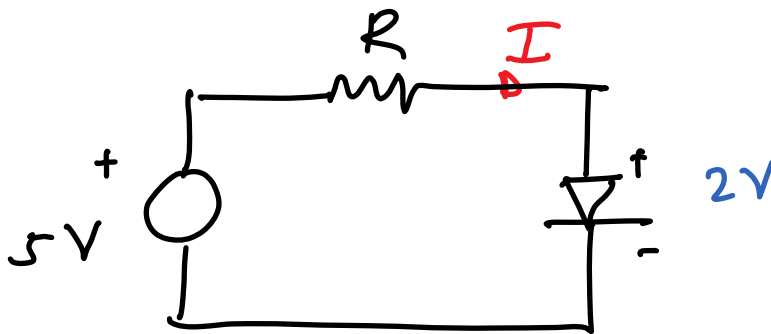


Opto electric devices

Light-emitting diode : emits light
when it is forward biased



longer is five (p)



$$5 - 2 - RI = 0$$

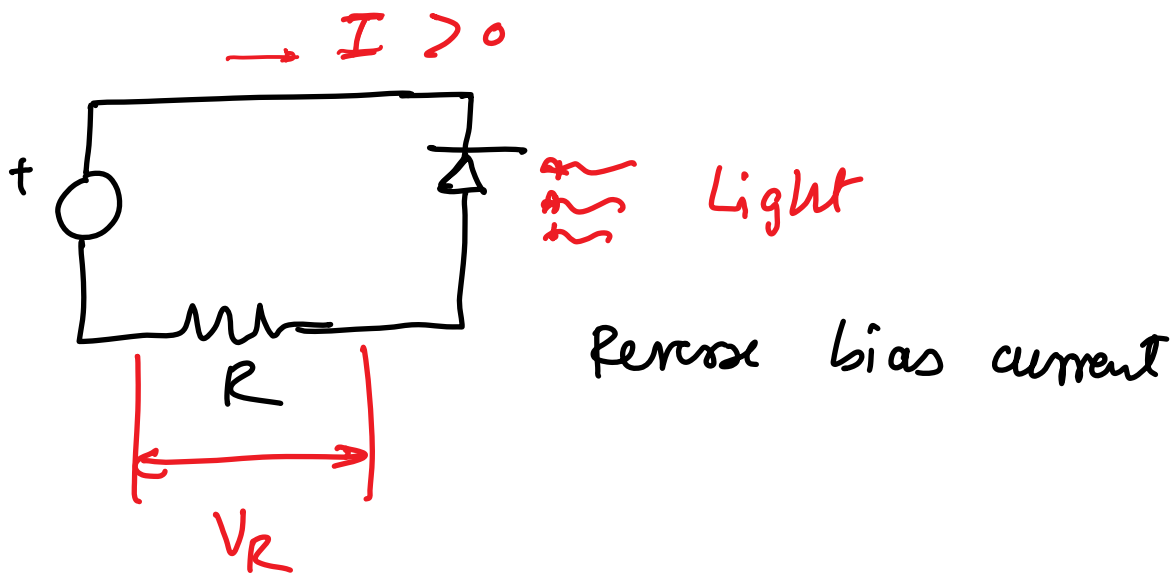
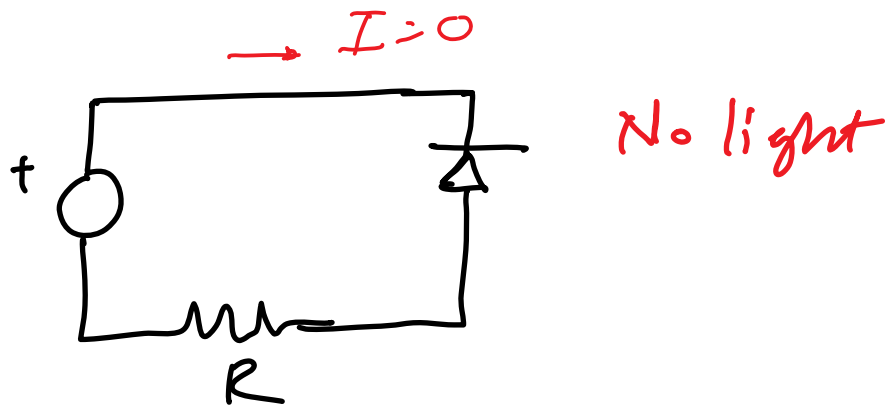
$$3 = RI$$

From spec sheet $I \approx 10 \text{ mA}$

$$3 = R (10 (10^{-3})) = 0.01 R$$

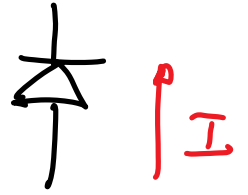
$$\underline{\underline{R \approx 300 \Omega}}$$

Photodiode

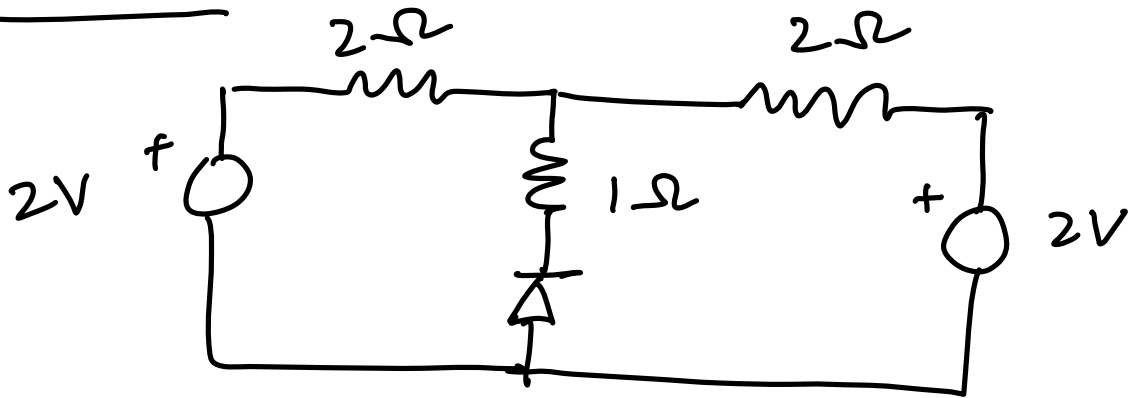


Analyze circuit with diodes

- ① Assume diode is conducting
- ② Use KVL/KCL to compute current flow in the diode
- ③a If current direction is the same as what you assume (diode is conducting) then you are done
- ③b If current direction is in the opposite direction then diode is not conducting, so you should repeat the calculation assuming diode is non-conducting.

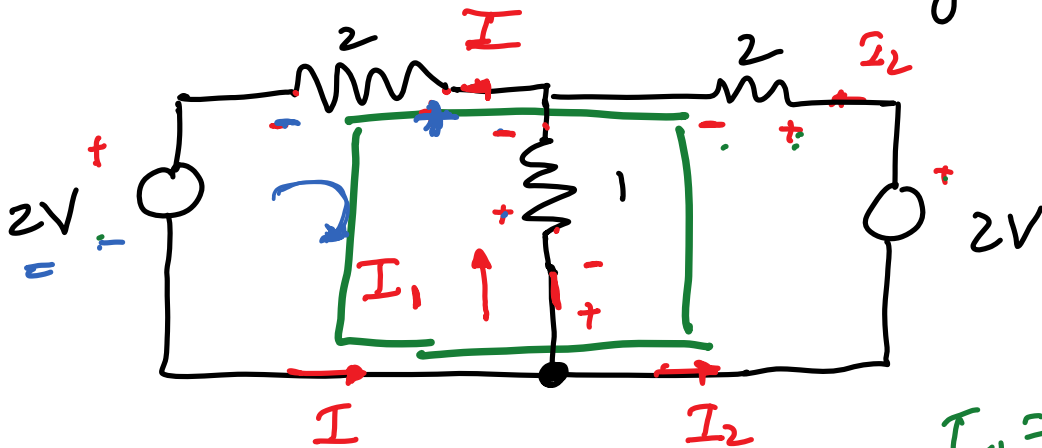


EXAMPLE:



Compute the current in each branch

① Assume diode is conducting



I, I_1, I_2

$$I_1 = -2 - 2(-0.5) = -1$$

KCL: $I - I_1 - I_2 = 0$

KVL: $2V + 2I + 1I_1 = 0$

KVL: $+2 + 2I + 2I_2 - 2 = 0$

$$\begin{cases} I_1 + I_2 - I = 0 \\ I_1 + 2I = -2 \\ \underline{\underline{I_2 + I = 0}} \end{cases}$$

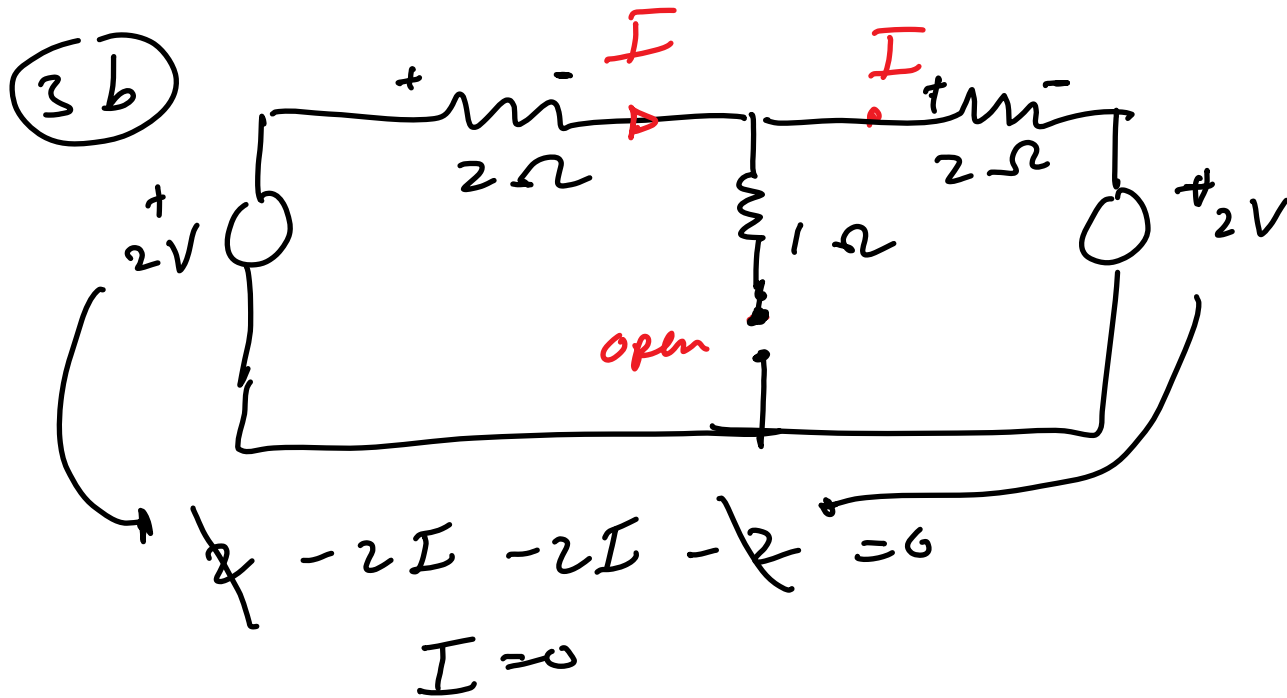
$$I_2 = -I; I_1 = -2 - 2I; \underline{\underline{I = -0.5}}$$

$$KVL: 2V + 2I + 2I_2 - 2 = 0$$

$$KVL: +2 + 2I + 2I_2 - 2 = 0 \quad \left. \begin{array}{l} +1 \quad -1 \\ \underline{\underline{I_2 + I = 0}} \end{array} \right\}$$

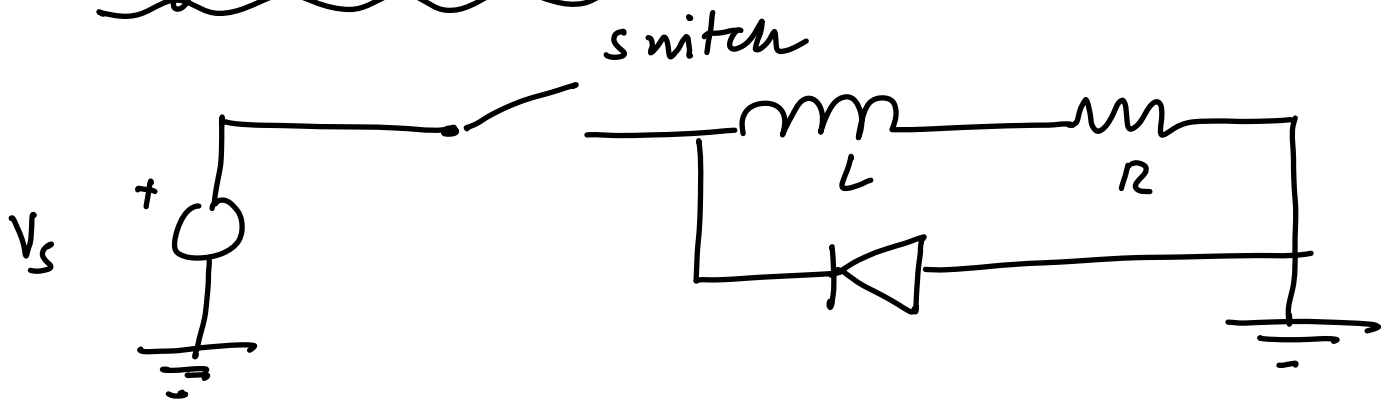
$$I_2 = -I; \quad I_1 = -2 - \underline{2I}; \quad \underline{-2 - 2I} - \underline{I} - \underline{I} = 0$$
$$I = -0.5$$

Since I_1 is negative, diode is NOT
conduction



Currents in all branches are zero.

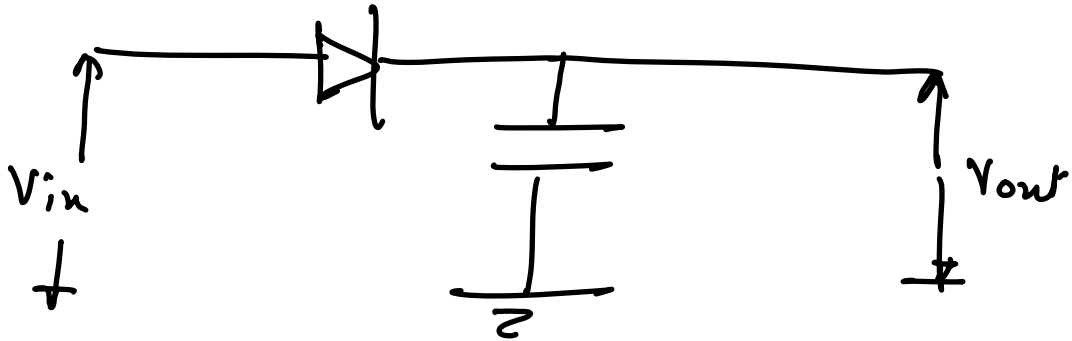
Flyback diode



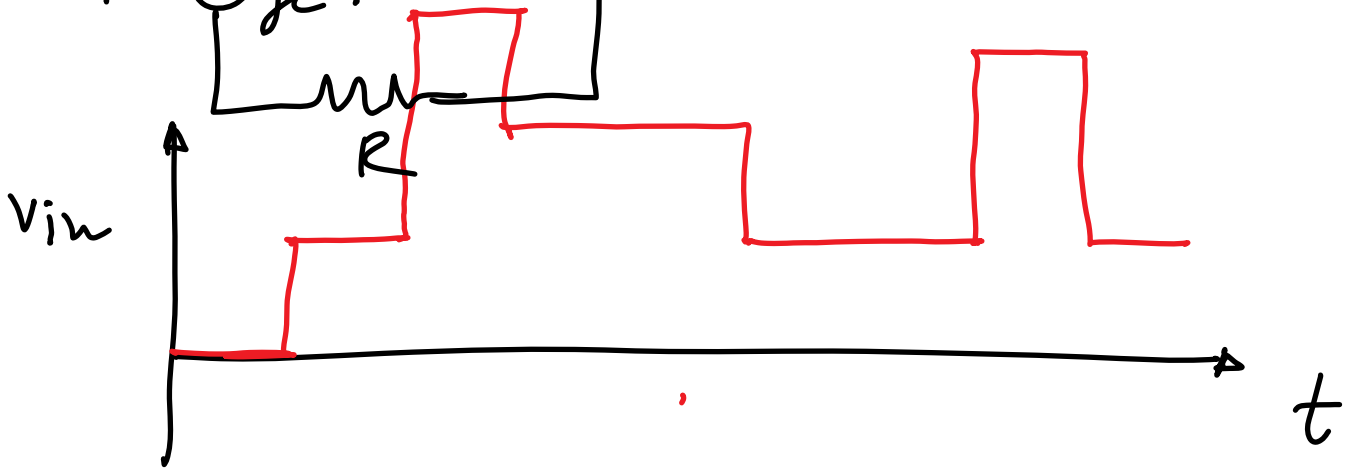
A flyback diode is used to protect the switch. The diode prevents the switch from sparking when it is opened.

Analyze the circuit and explain how the flyback diode protects the switch

Peak detector



The circuit is used to detect peak voltage.
 No light
 $I = 0$



Analyze the circuit and draw V_{out} as a function of time (t)