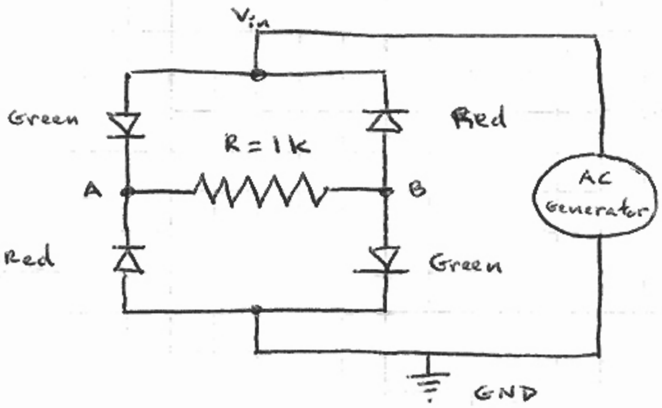
SP. 764 Homework set #3 Sept 30, 2004



Assumptions

(1) Red LED — $V_F = 1.5$ V
Green LED — $V_F = 2.0$ V } Ideal

(2) Kirchhoff's Laws

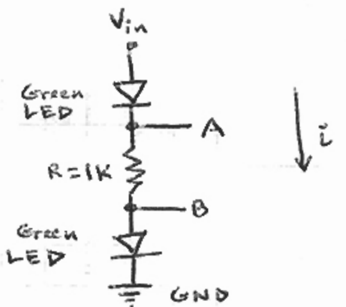
(3) No current flow (or open circuit) below V_F for each LED

(4) Positive current flow from high to low voltage

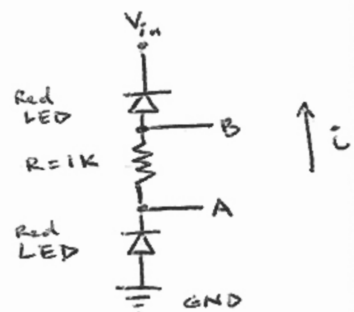
Analysis

Given assumptions above, treat given circuit as two independent circuits:

For $V_{in} > 0$



For $V_{in} < 0$



Write Kirchhoff's Voltage Law in direction of current flow

$$V_{in} - V_A = 2\text{ V}$$
$$V_B - GND = 2\text{ V}$$

$$\rightarrow \quad V_B = 2\text{ V}$$
$$V_A = V_{in} - 2\text{ V}$$

$$\boxed{V_A - V_B = V_{in} - 4\text{ V}}$$

$$GND - V_A = 1.5\text{ V}$$
$$V_B - V_{in} = 1.5\text{ V}$$

$$\rightarrow \quad V_A = -1.5\text{ V}$$
$$V_B = 1.5\text{ V} + V_{in}$$

$$\boxed{V_A - V_B = -V_{in} - 3\text{ V}}$$

These equations are valid only when the supply voltage V_{in} is greater than the minimum voltage drop across the LEDs

$\underline{|V_{in}| \geq 2V_F}$ independently for the Green & Red LEDs

with respect to a common ground reference, or else the circuit behaves like an open circuit.

* See reverse for sketches 1-5

Sketches of 2 cycles +/- 5 V square and sine wave forms applied to a simple bridge rectifier with green LEDs (V_F = 2.0 V) and red LEDs (V_F = 1.5 V) and measuring voltages at end points (A and B) of the resistor bridge.