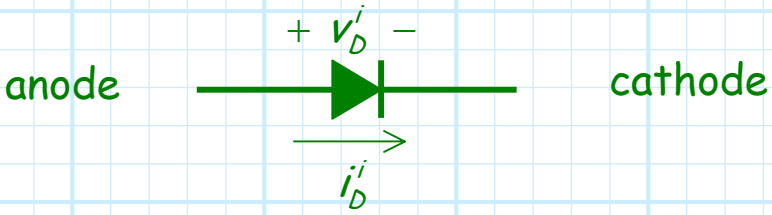
3.1 The Ideal Diode (pp.139-141)

Diodes: The most fundamental non-linear circuit element

A. The Ideal Diode Symbol



Note:

1. Device is not symmetric!

2. Positive current defined as flowing from anode to cathode.

3. Voltage across diode defined as positive when anode voltage > cathode voltage.

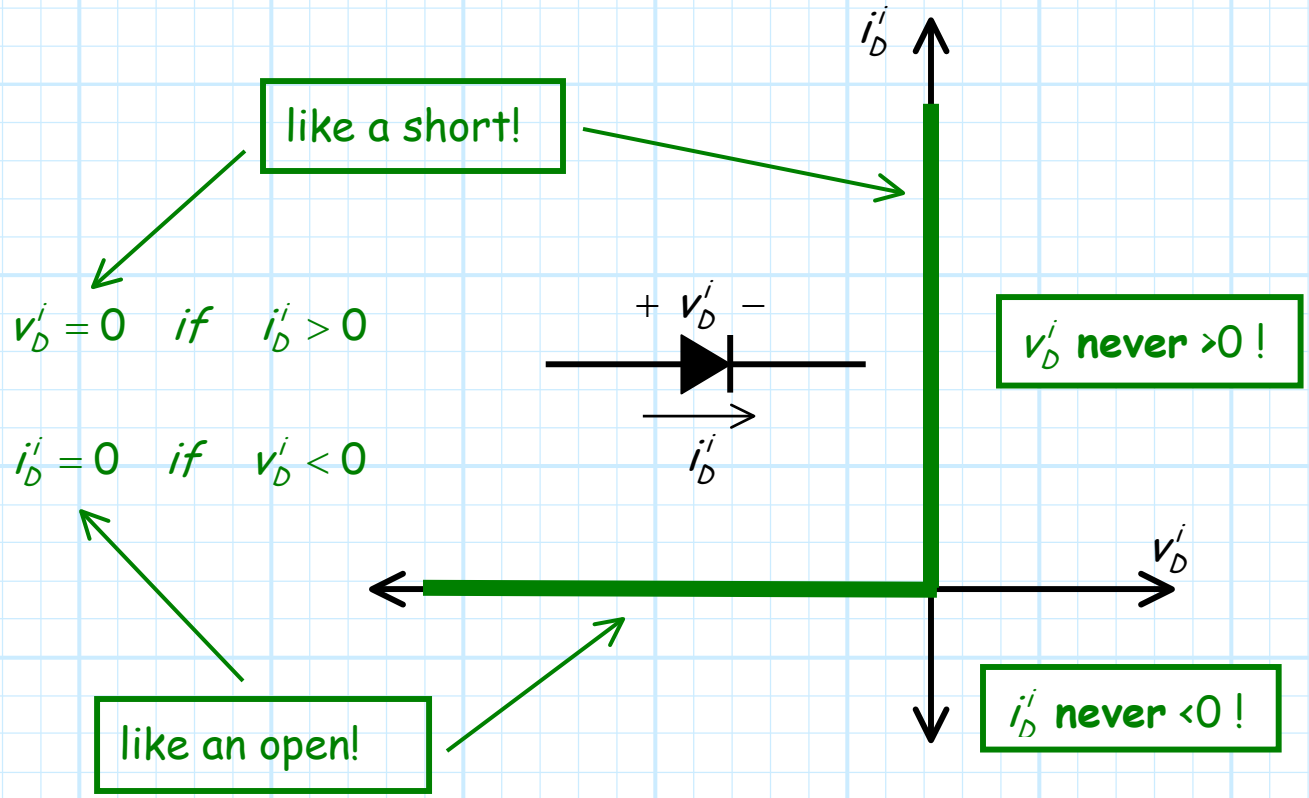
B. Ideal Diode Behavior

The ideal diode → a close approx. of a physical diode.

First, let's recall linear device behavior!

HO: Linear Device Behavior

For an ideal diode:



The Ideal Diode is non-linear!

C. Diode Bias Regions

Ideal diode operates in one of two states:

1) Forward Biased → "on" or "active"

$$v_D^i = 0 \quad if \quad i_D^i > 0$$

i.e., acts as a short, IF current is positive.

2) Reverse Biased → "off" or "inactive"

$$i_D^i = 0 \quad if \quad v_D^i < 0$$

i.e., acts as a open, IF voltage is negative.

Note: No power is dissipated in either mode!

→ $P_D^i = v_D^i \, i_D^i = 0$ always!

HO The Ideal Diode

HO Diode Mechanical Analogy

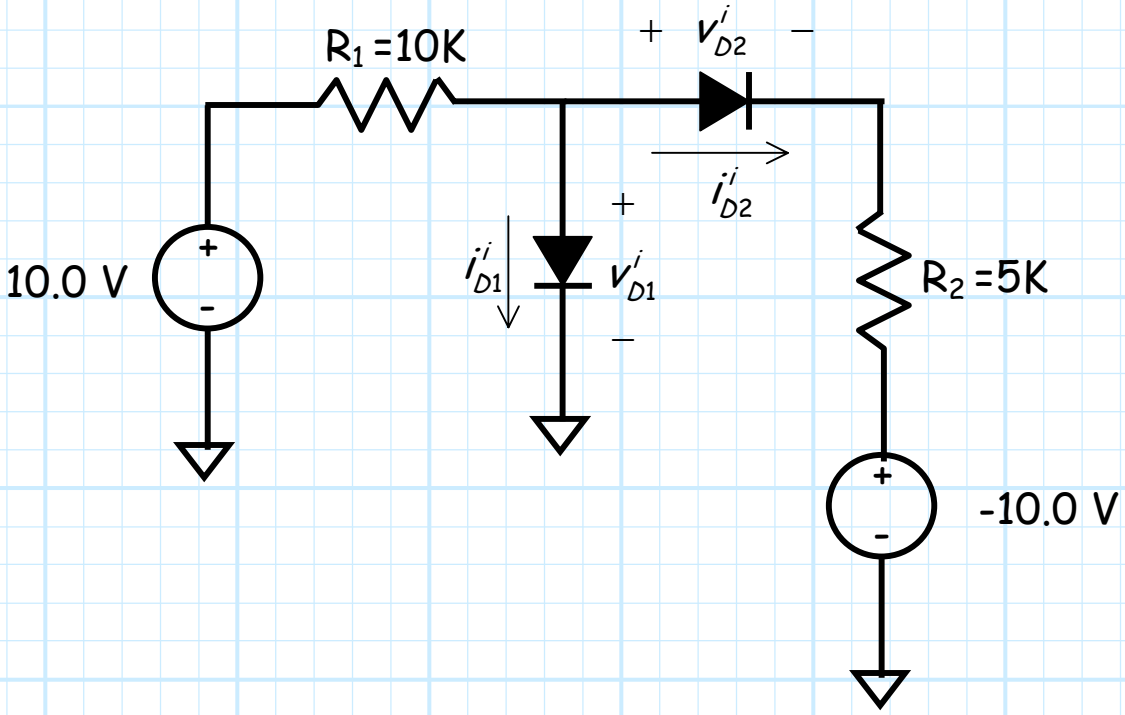
Q: What turns a diode "on" or "off"?

A: The circuit attached to it!

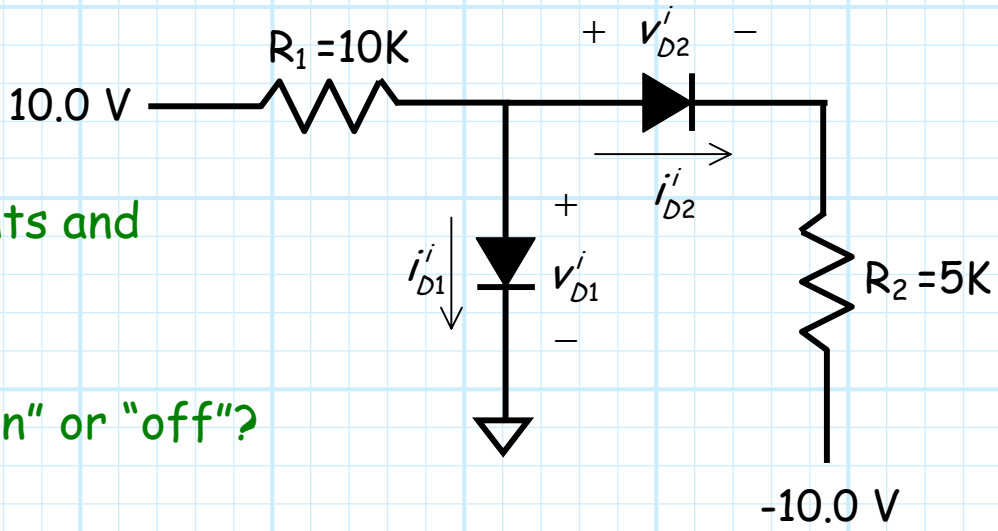
Problem: It is very difficult to determine what the circuit is trying to do!

D. Ideal Diode Circuit Analysis

Consider this ideal diode circuit:



Which we more compactly write as:



What are currents and Voltages ?

Q: Are diodes "on" or "off"?

A: Can't tell! We must GUESS !!!

HO: The Ideal Diode Circuit Analysis Guide

HO: Example: A Simple Ideal Diode Circuit

HO: Example: Analysis of a Complex Diode Circuit