Electronics
Other Devices

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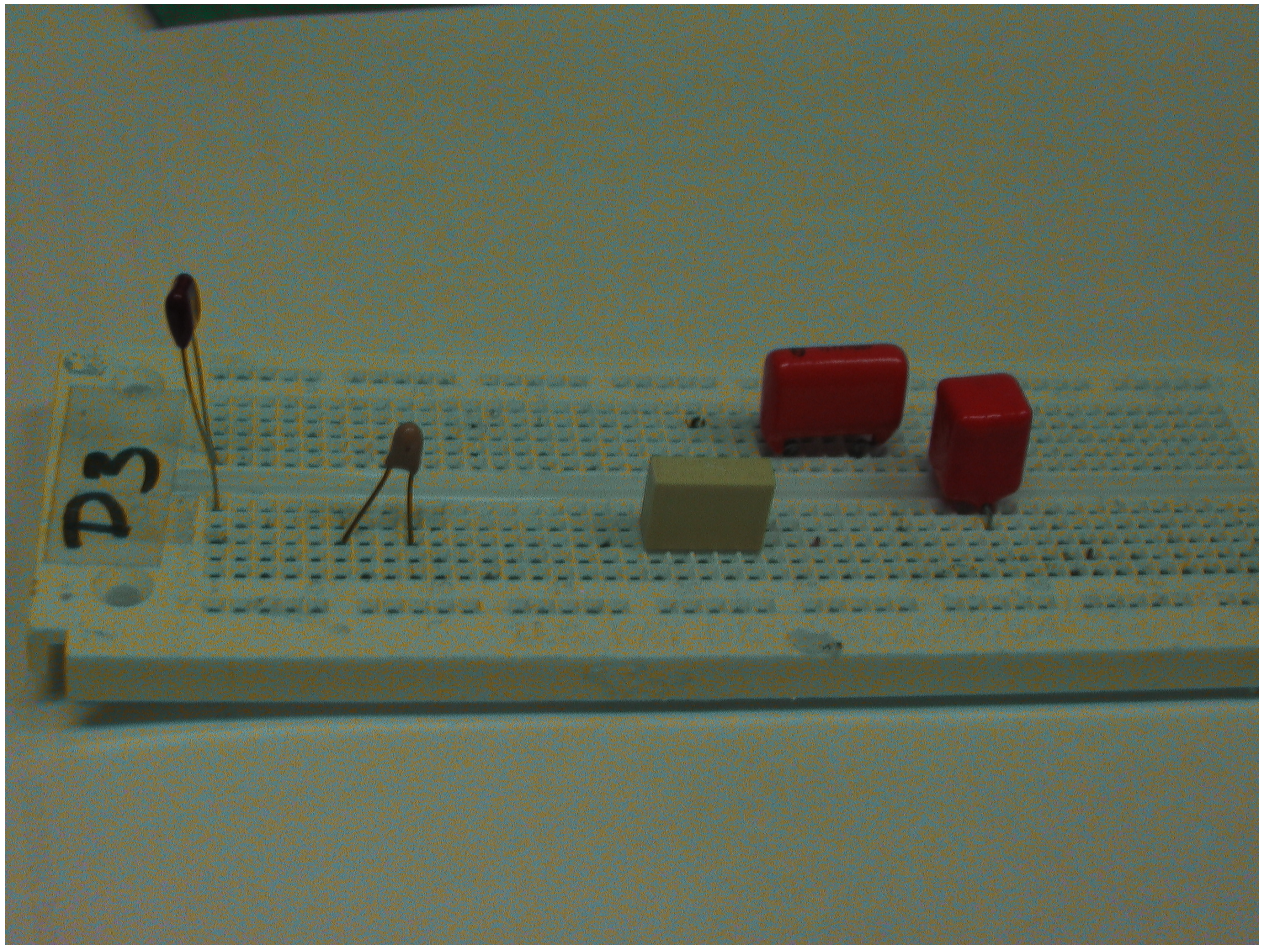
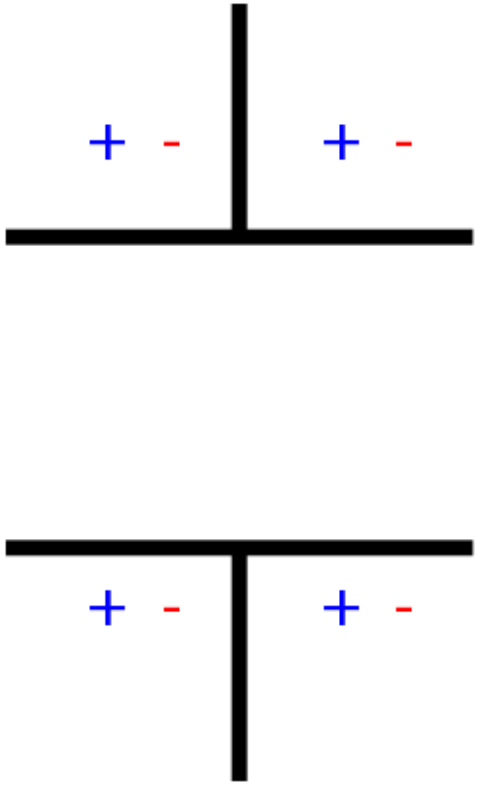
  Farads are *big*

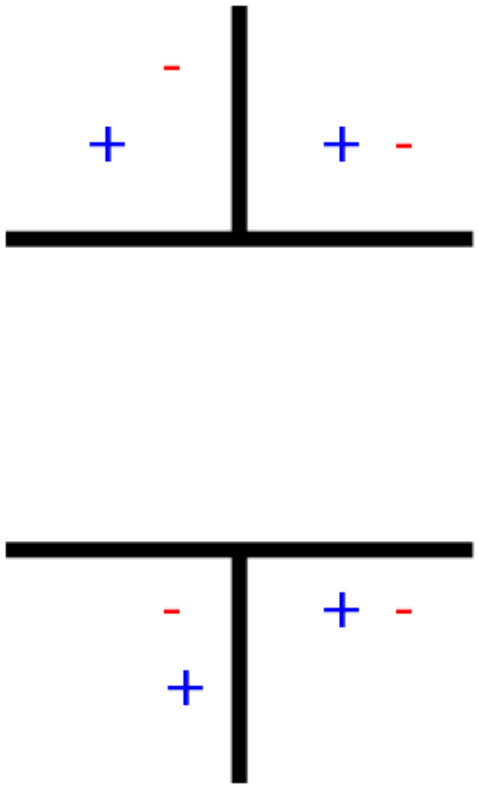
  usually microfarad (μF) or picofarad (pF) values are used



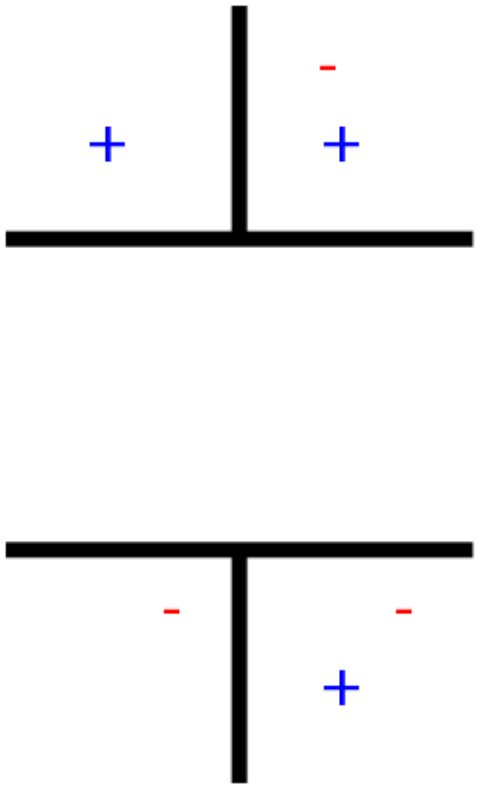
- Various capacitors



Capacitor uncharged



Capacitor charging; charge on opposite plates is equal and opposite.



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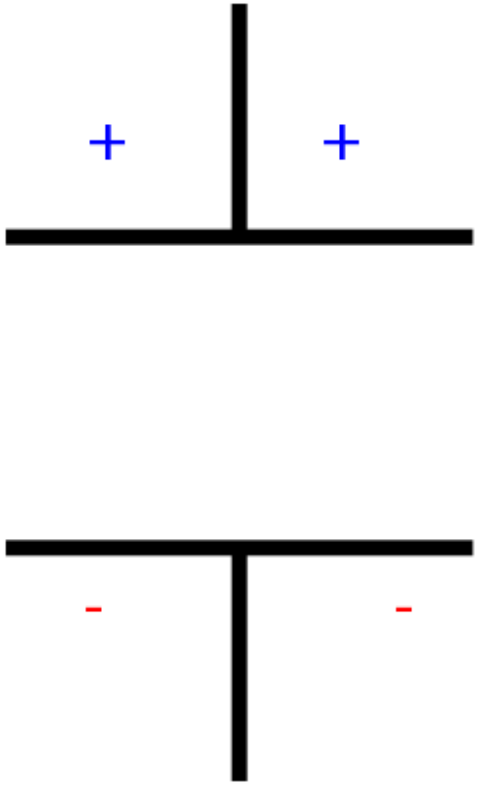

Capacitor charged; no more change

- purpose is to store electrical charge.

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  as charge is stored, voltage increases and current decreases until the voltage equals the applied voltage, when current becomes zero

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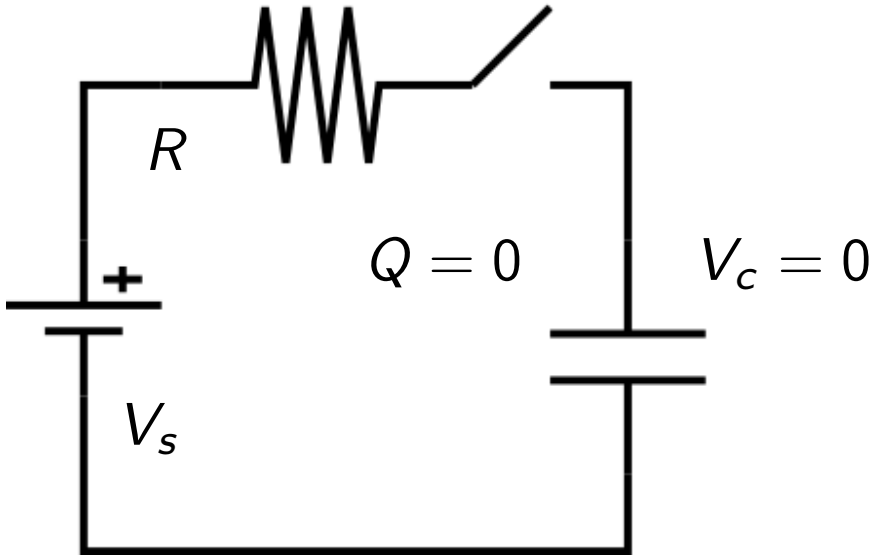
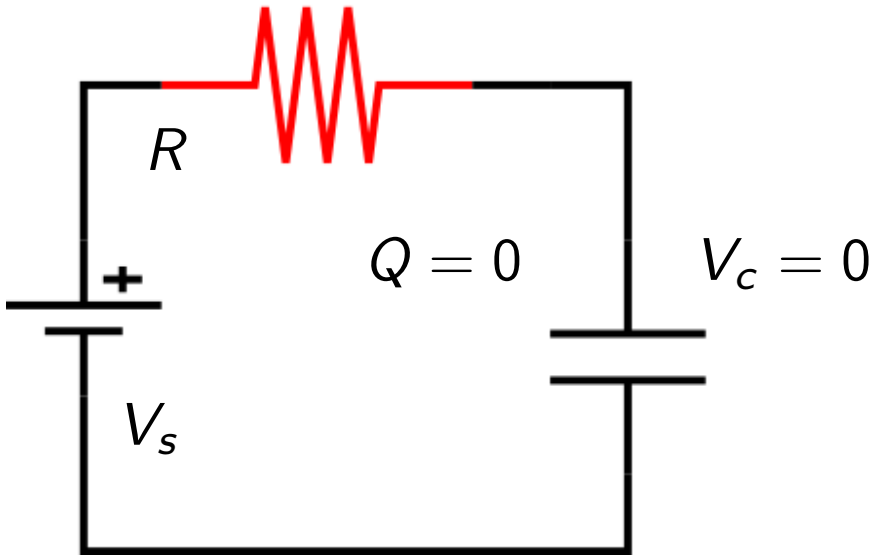
  Place $1k\Omega \rightarrow 10k\Omega$ resistor across the terminals to discharge.
- High voltage capacitors should be stored with terminals shorted.

$$I = 0$$



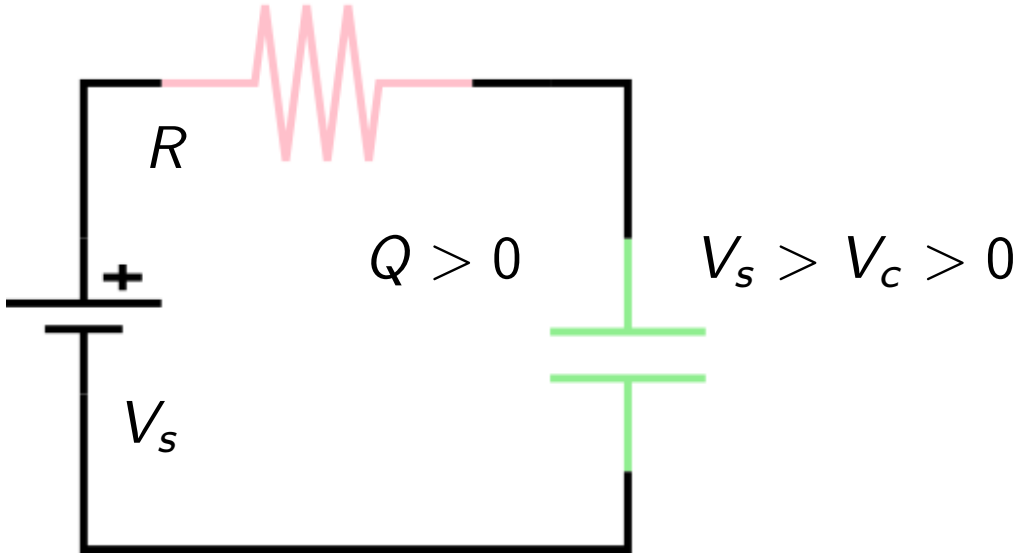
$t = 0$, switch **open**

$$I = V_s/R$$



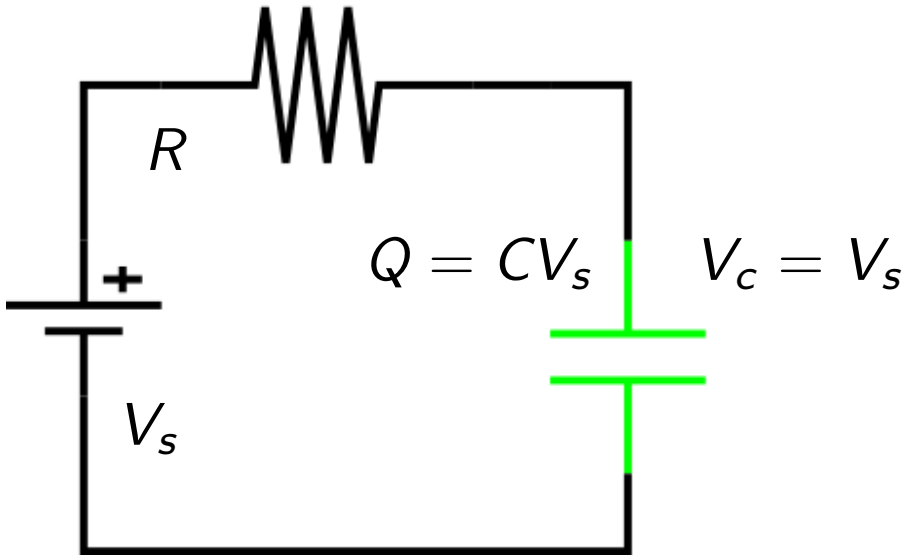
$t = 0$, switch closed

$$I < V_s/R$$



$$t \approx RC$$

$$I = 0$$



$t >> RC$

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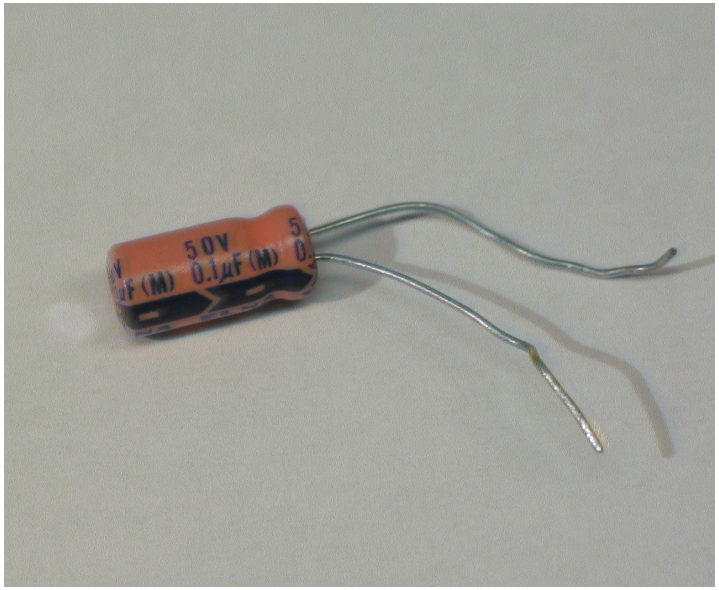
- Other types, (such as "electrolytics"), must be placed in a particular direction

  (indicated by a "+" sign at one end.)
- **Big capacitors ($\gtrsim 1\mu F$) are usually electrolytic.**

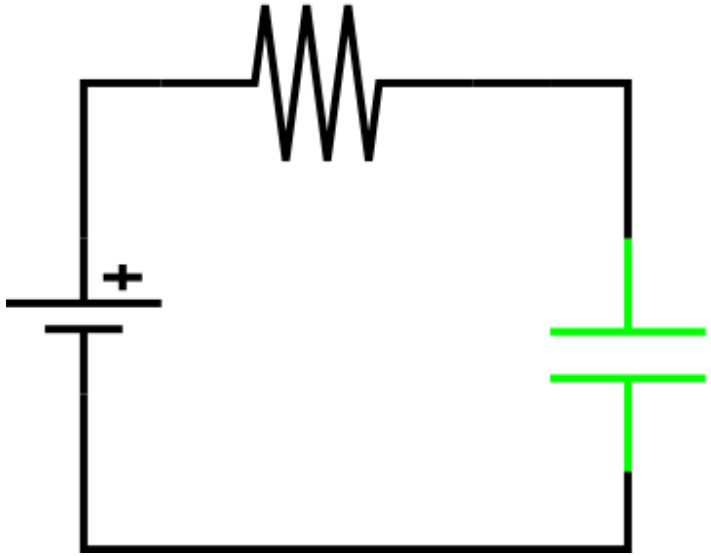


- Small electrolytic capacitor

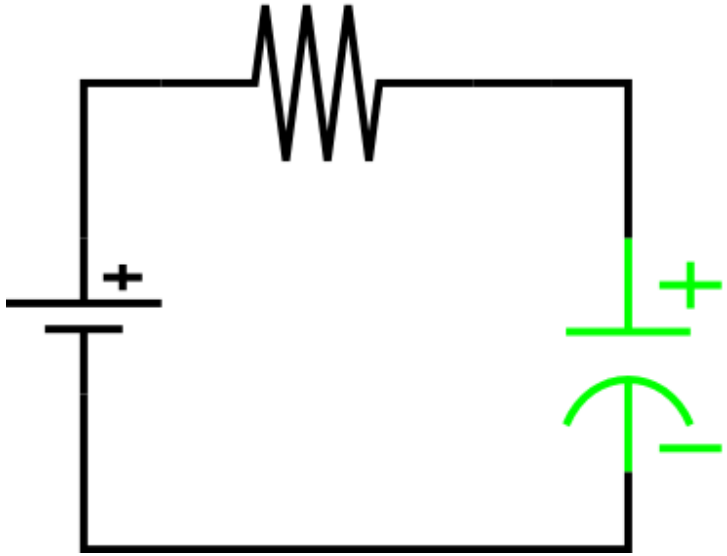
- Big electrolytic capacitor

- Big electrolytic capacitor (top view)

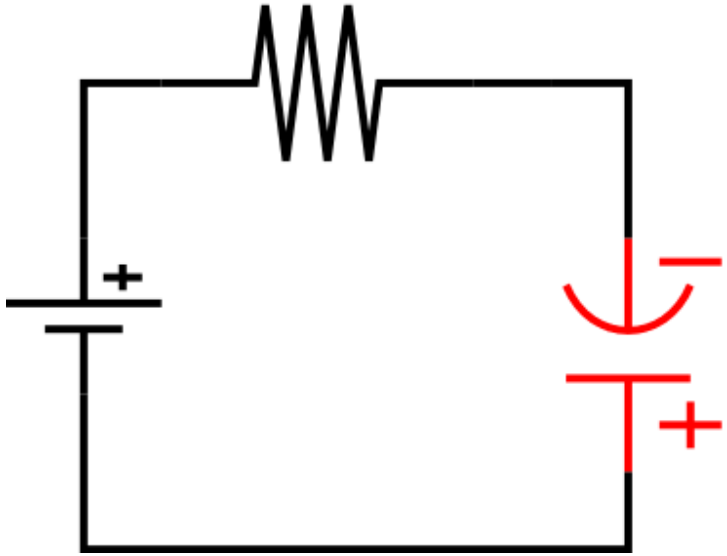
- Big electrolytic capacitor label



Non-polarized capacitor



Polarized capacitor connected the right way



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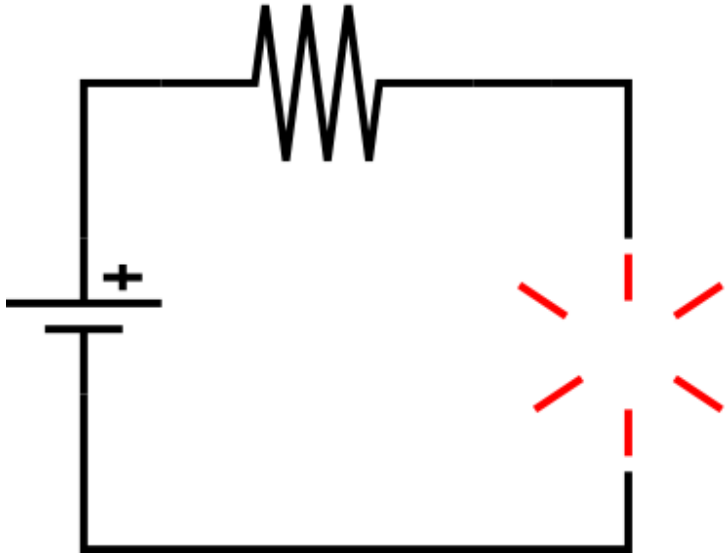

Don't do this!!!

Capacitor Labeling

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Unfortunately, capacitor labels are much less standardized than resistor labels.

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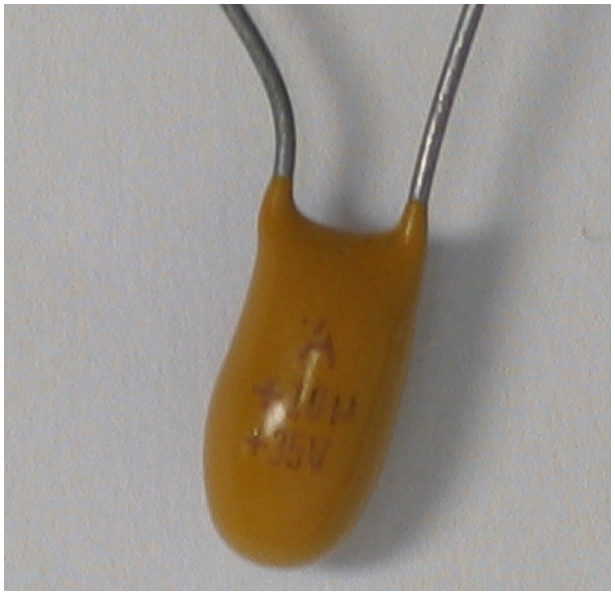

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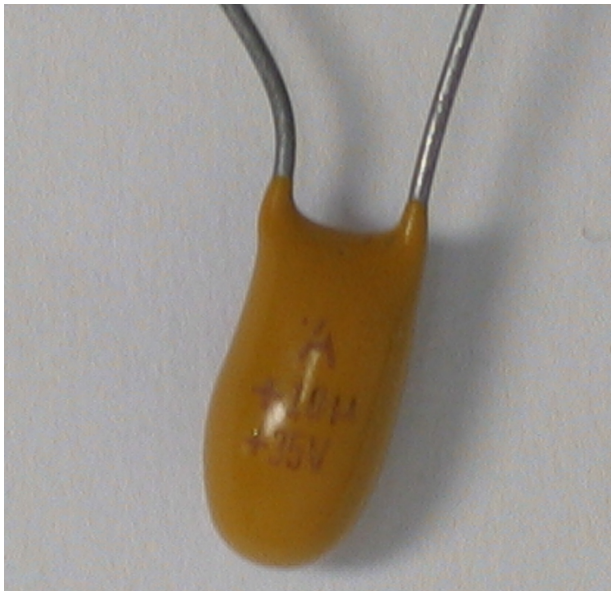
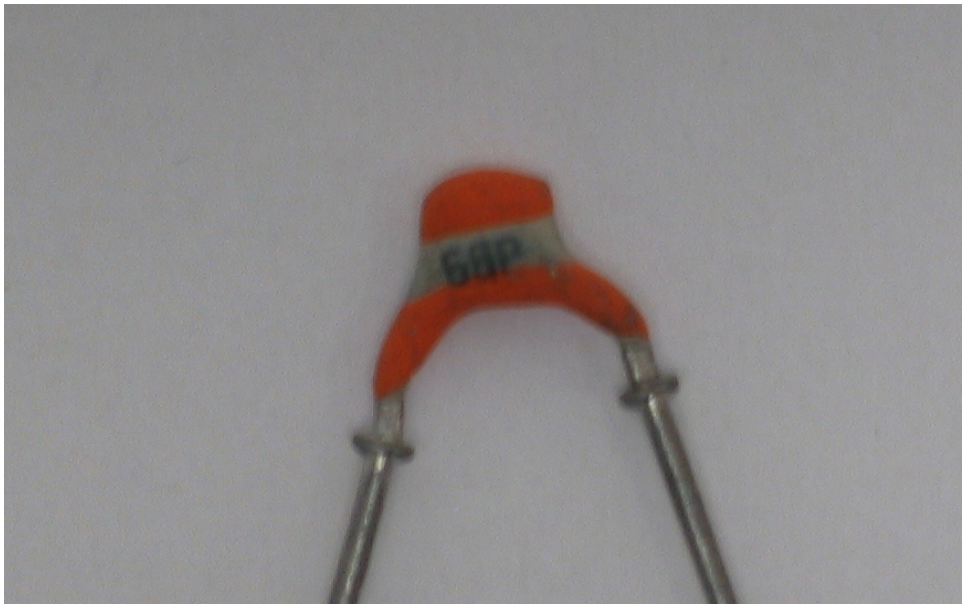
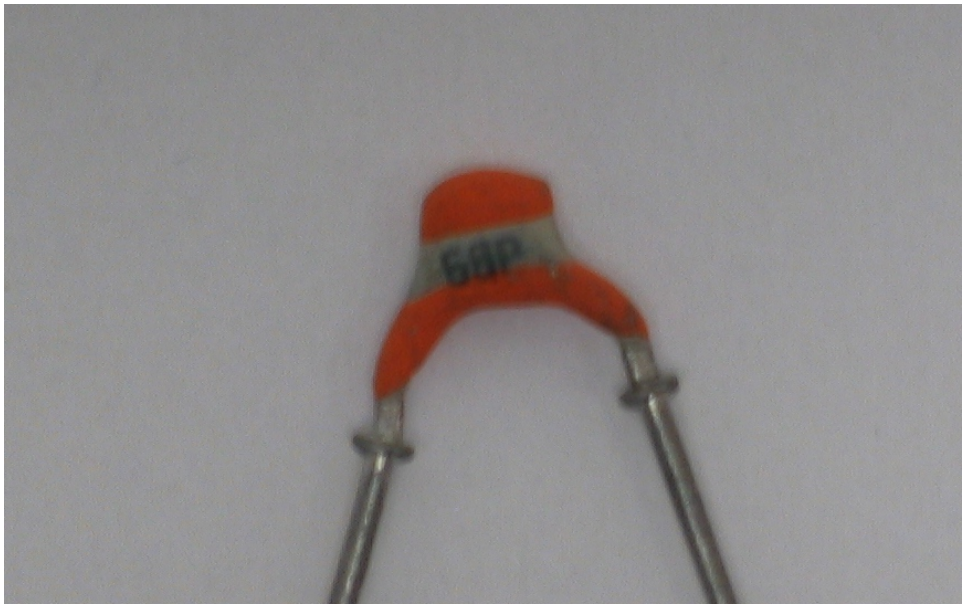
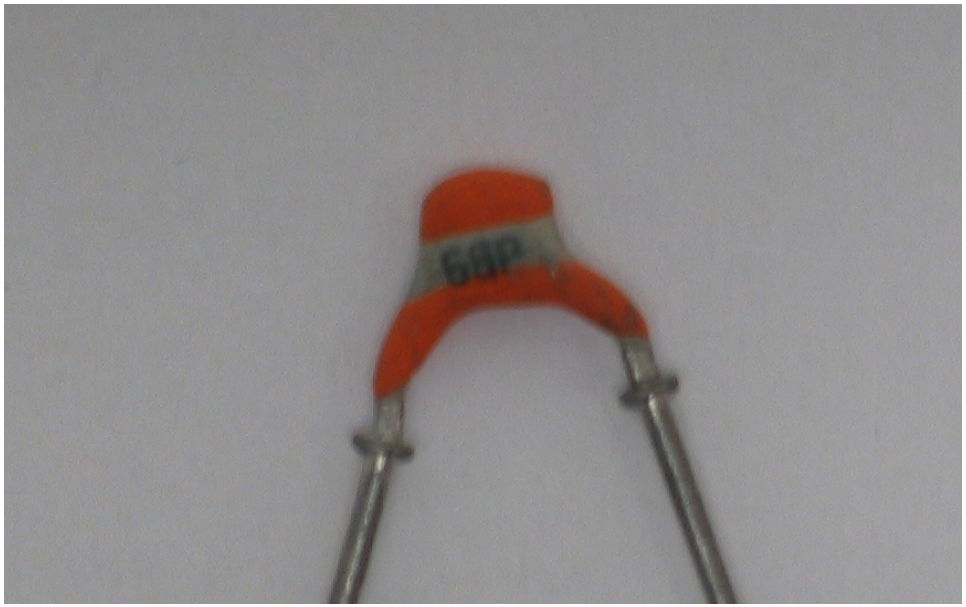


This has the value, $10\mu F$, written on it.


68P



This one indicates 68 pF.



This one indicates 68 pF. (The *p* to the right means the decimal is to the right and it's in picoFarads.)


N68

This one indicates 0.68 nF, (or 680 pF).

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100

This one indicates 1.0 nF.

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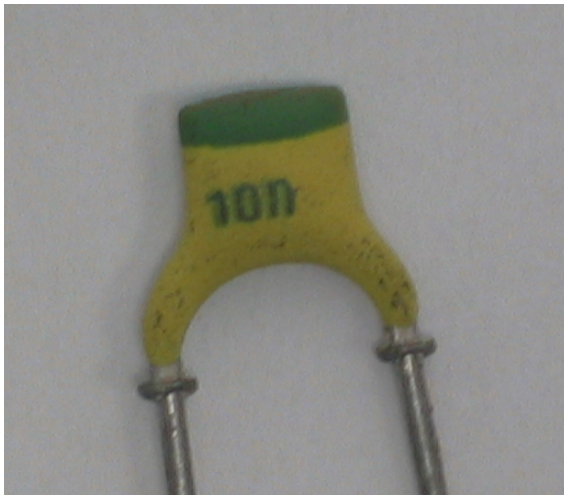
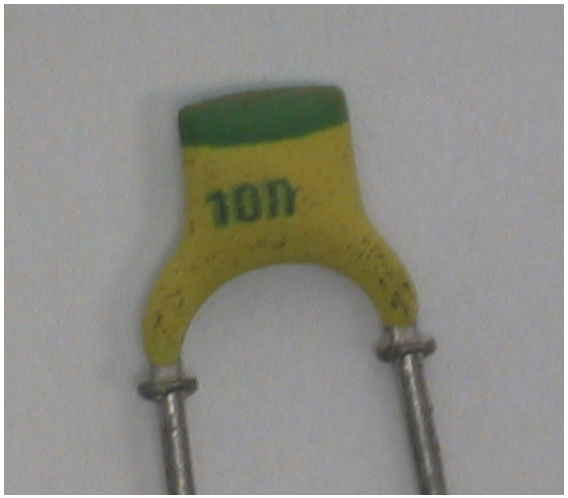
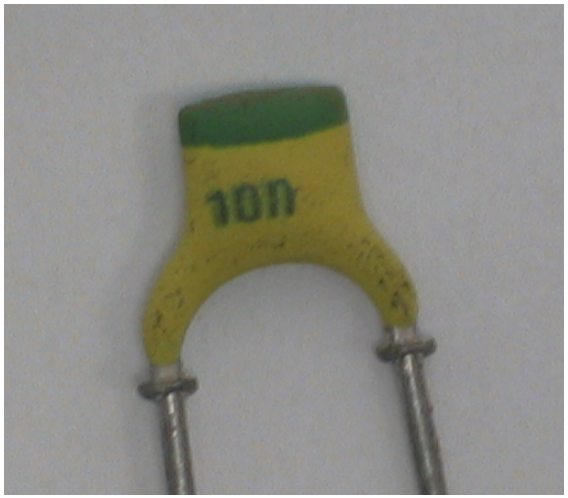

10n



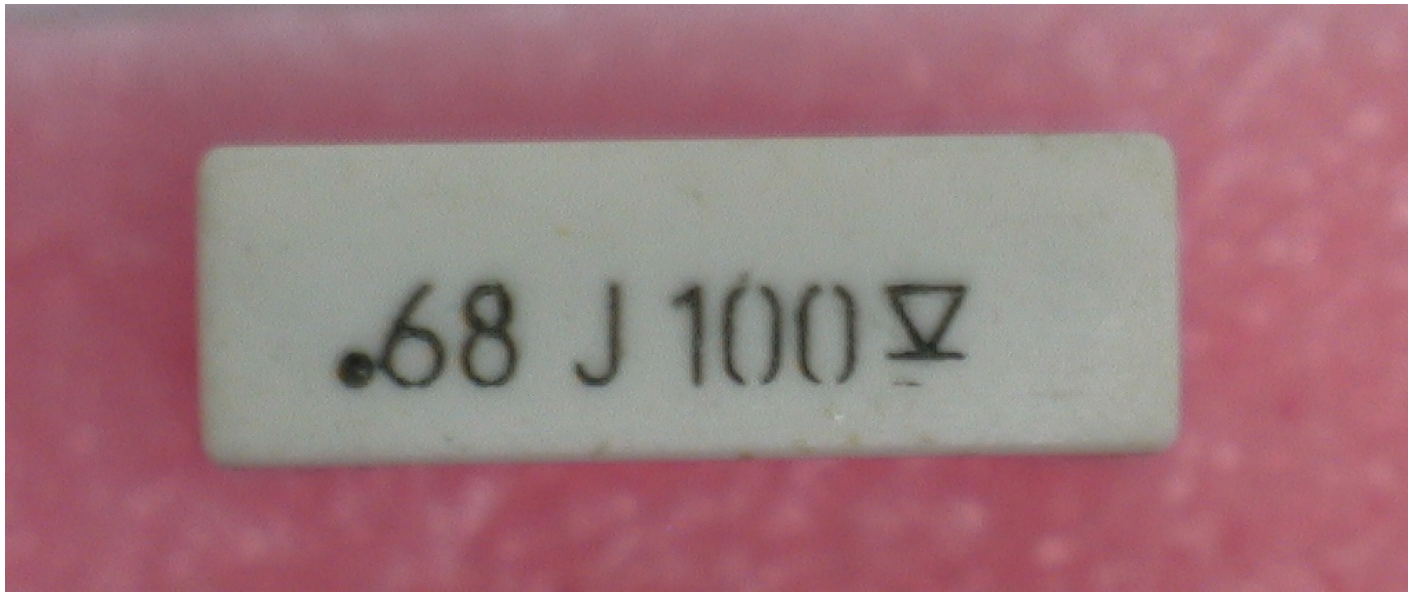
This one indicates 10 nF.

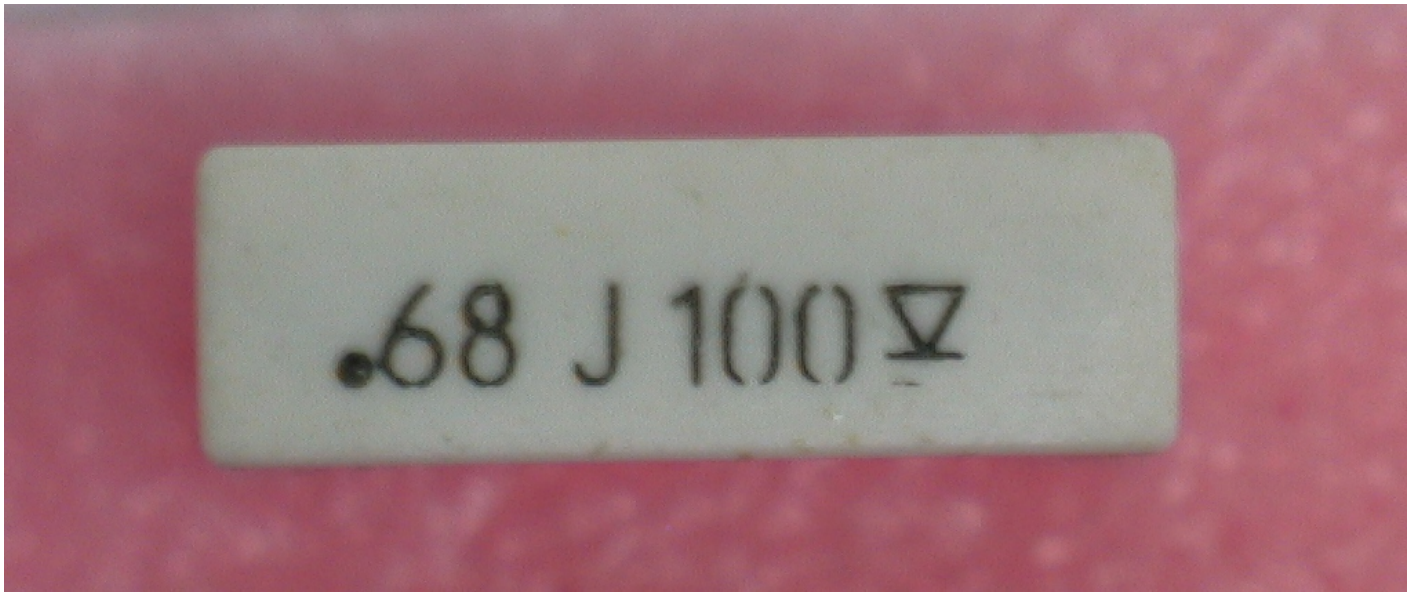


This one indicates 10 nF. (The *n to the right* means the decimal is to the right and it's in nanoFarads.)


MAC
0,01 K
100V

This is a $0.01\mu F$ capacitor. The "K" indicates a 10% tolerance.


.68 J 100 V



This is a $0.68\mu F$ capacitor. The "J" indicates a 5% tolerance.


103J

This one gives the value in picoFarads, with the 3 numbers handled as for resistors.

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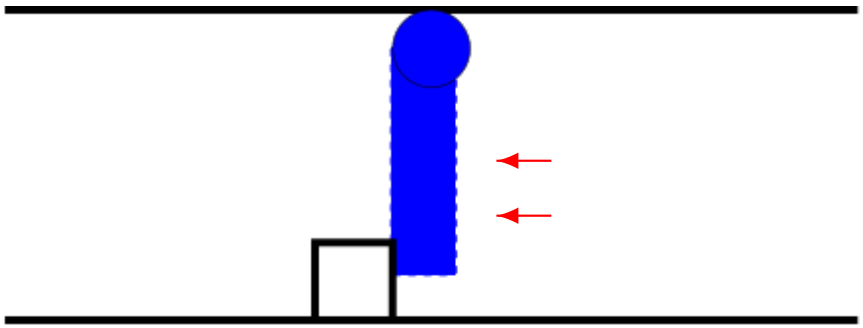
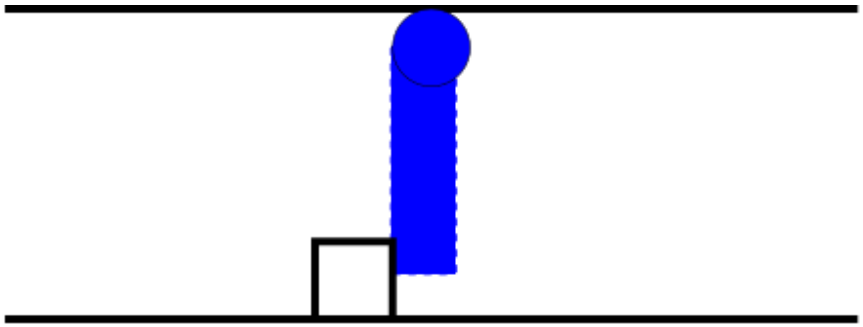
- diode starts to allow current in the forward direction when the voltage reaches around 0.6V
- If the voltage gets high enough in the reverse direction, the diode will conduct; *"reverse breakdown voltage"*

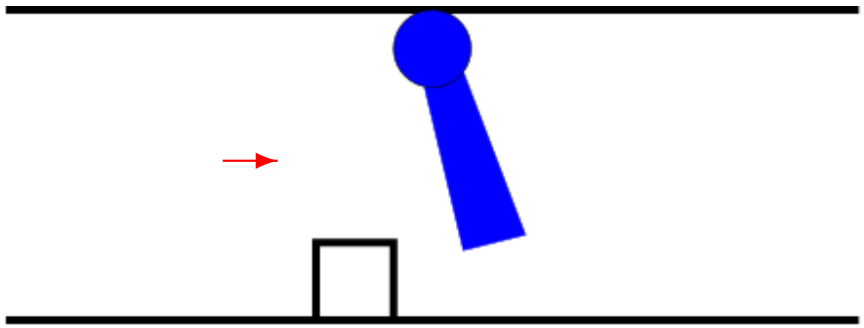
Negative pressure; no flow possible



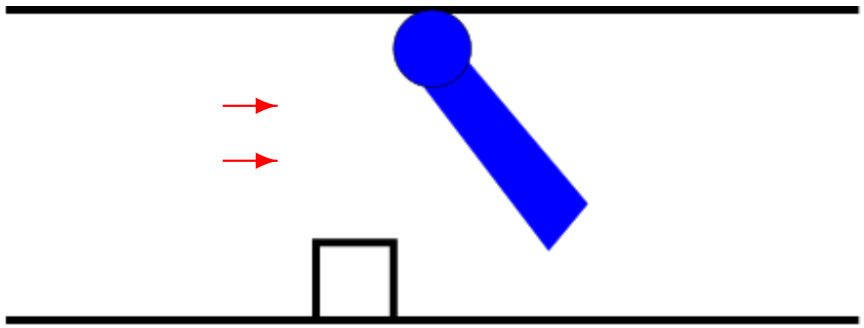
No pressure; resistance to flow is large



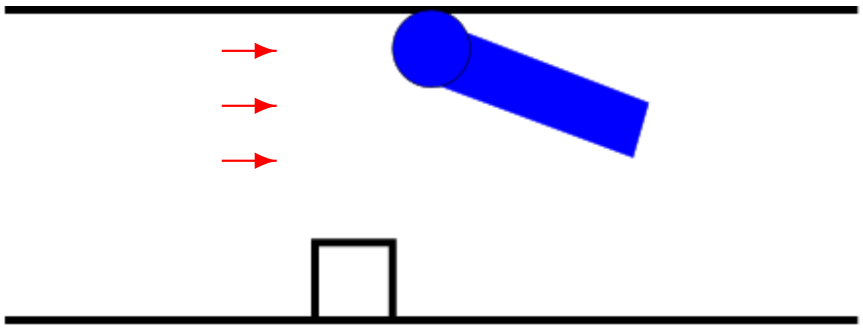
Small pressure; resistance to flow decreases



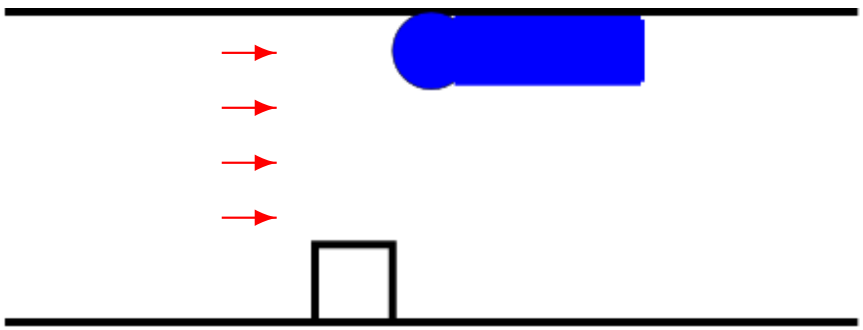
Medium pressure; resistance to flow still decreasing

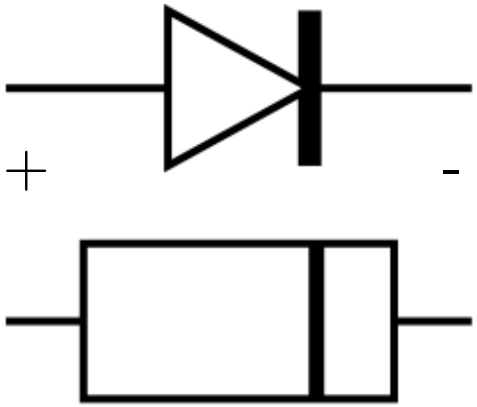


High pressure; resistance to flow small

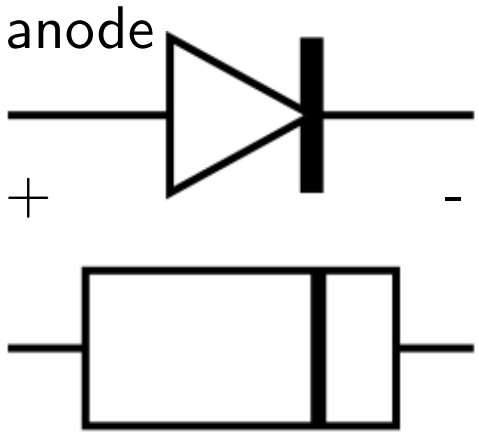


Very high pressure; resistance almost zero





Diode symbol and physical appearance



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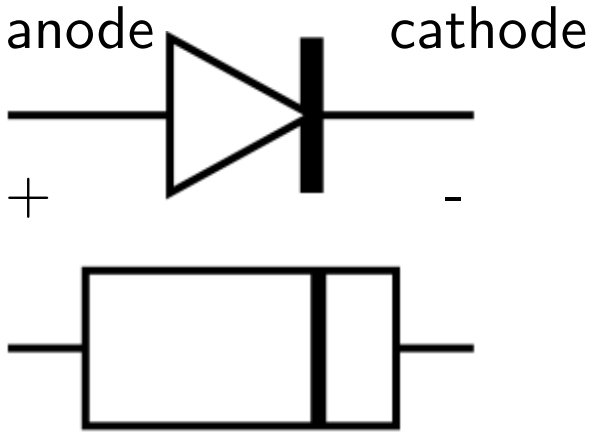

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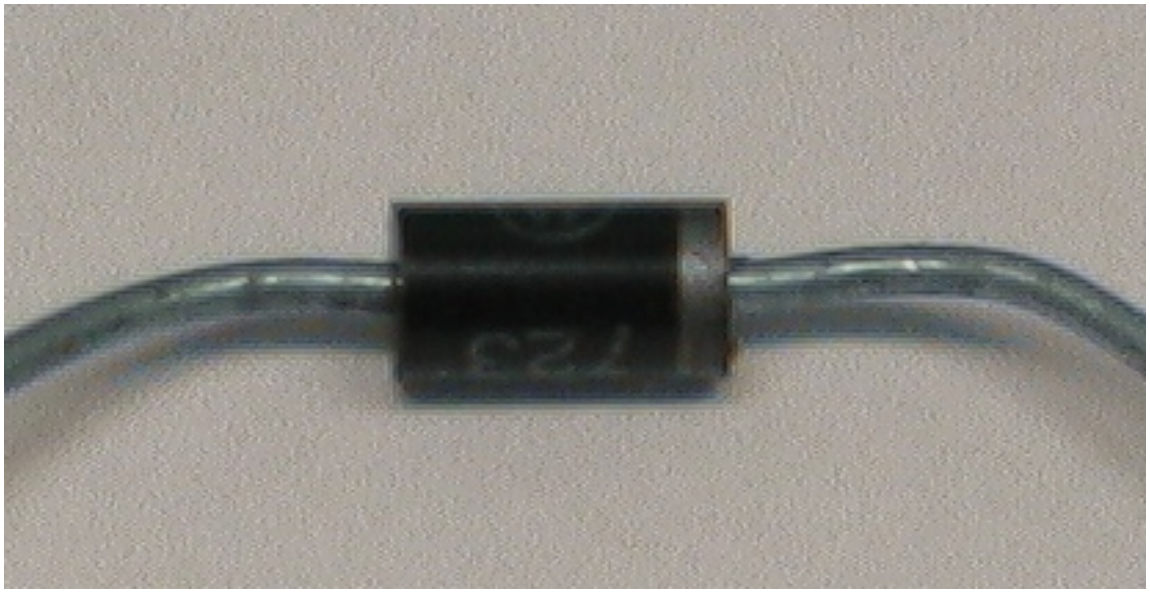
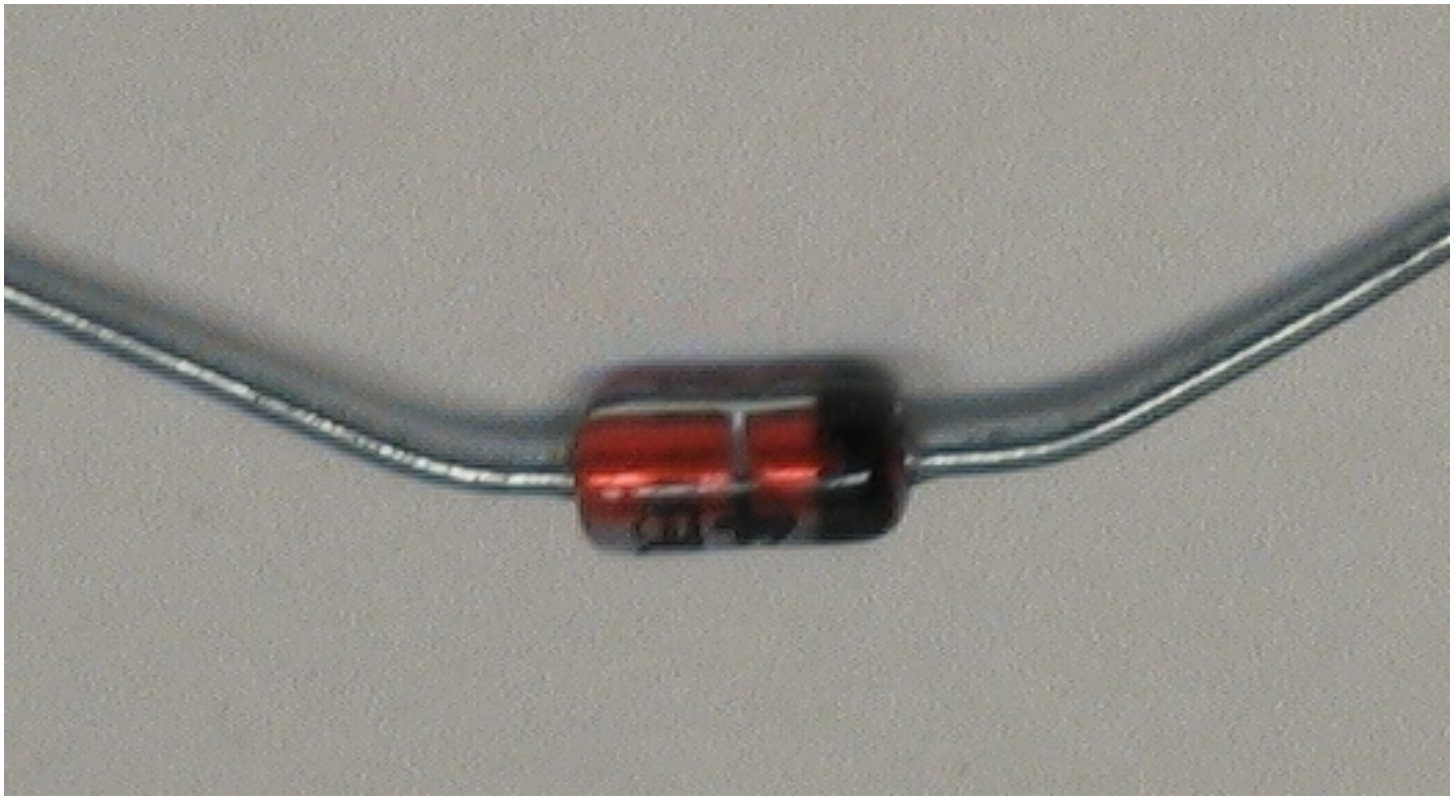
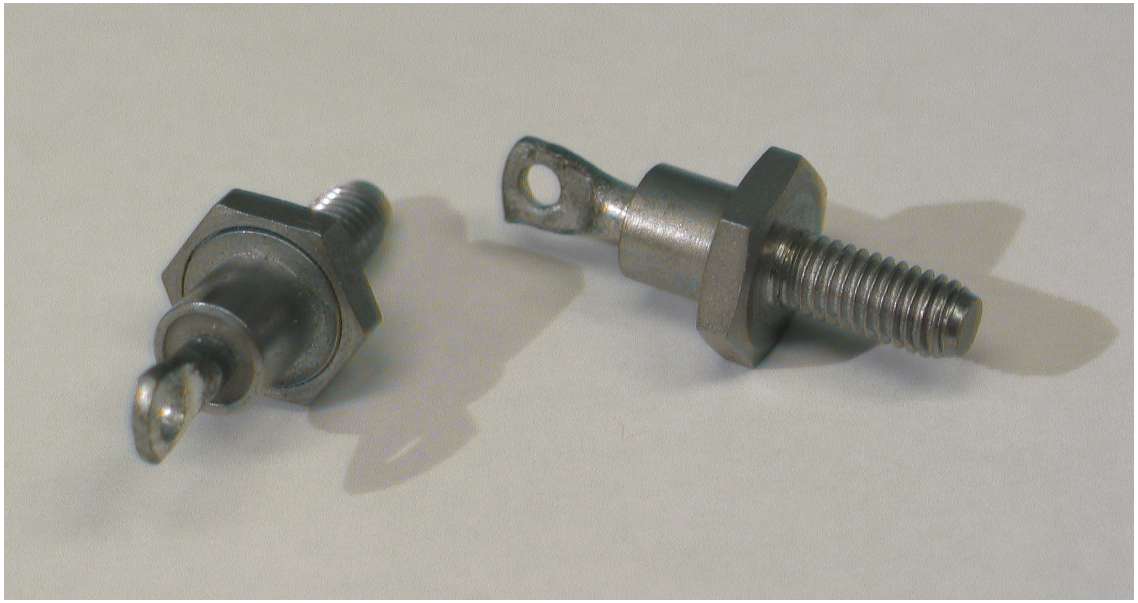


- Signal diodes (one type)



- Signal diodes (another type)

- Power diodes (one type)



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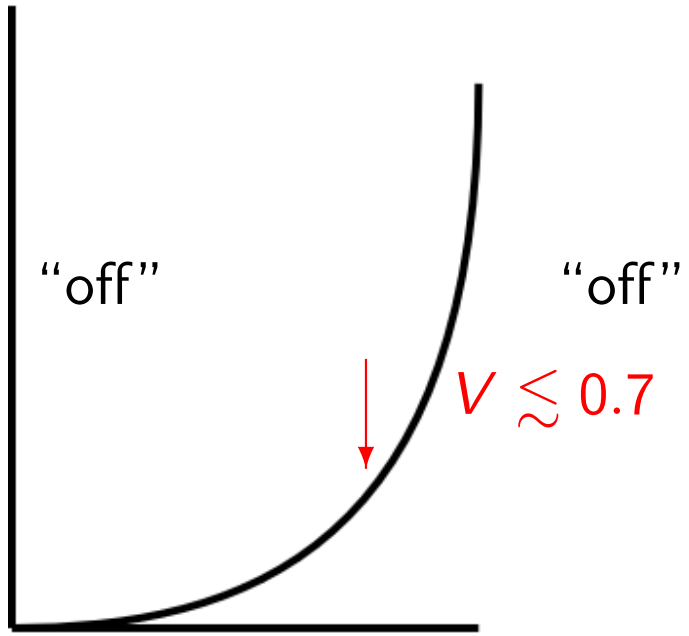
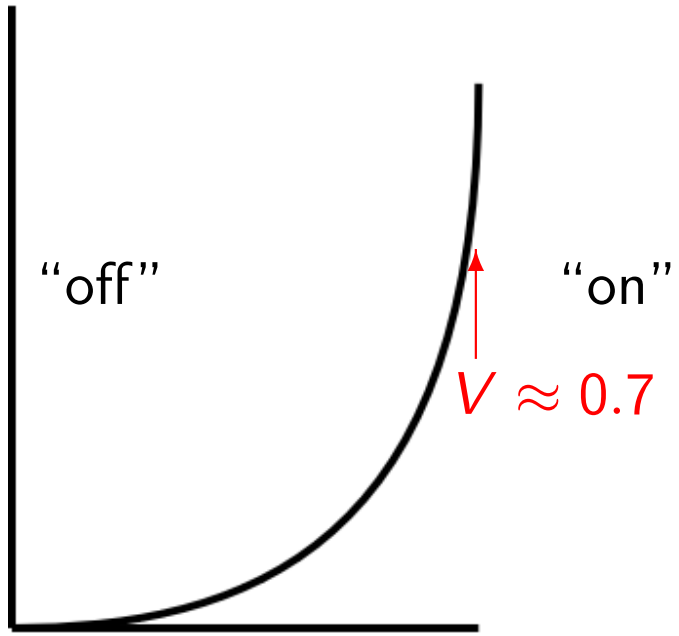
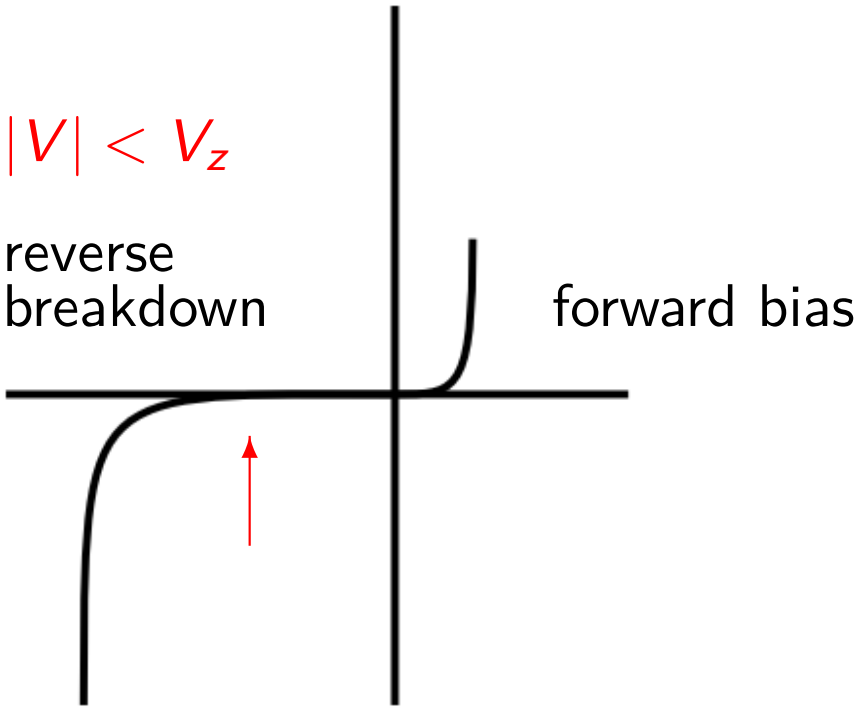


I small; changes slowly



I large; almost independent of V



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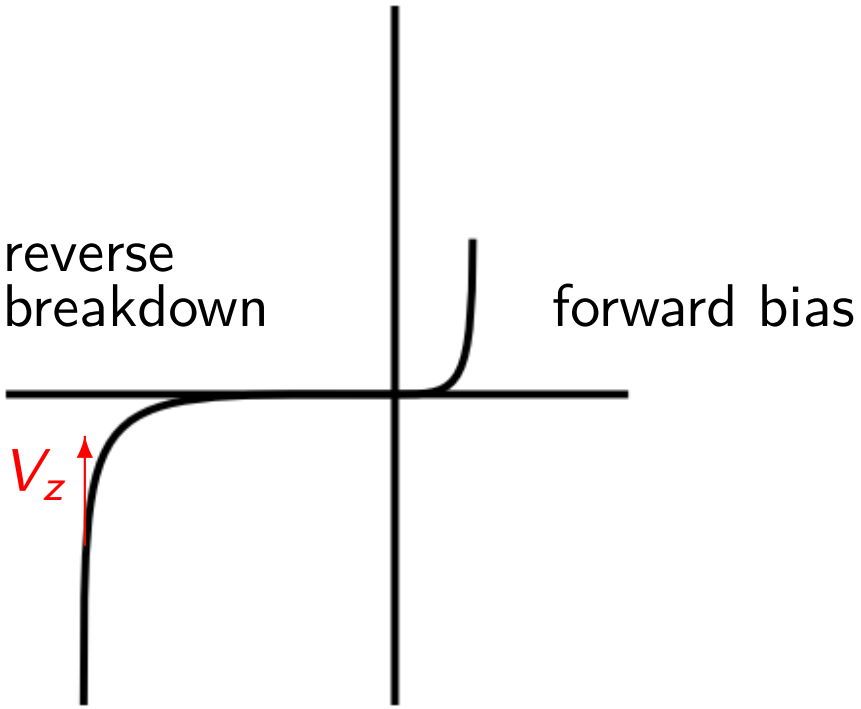

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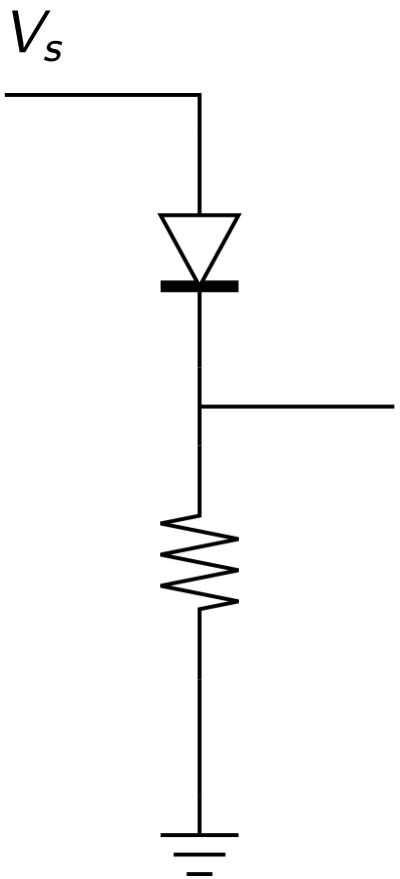
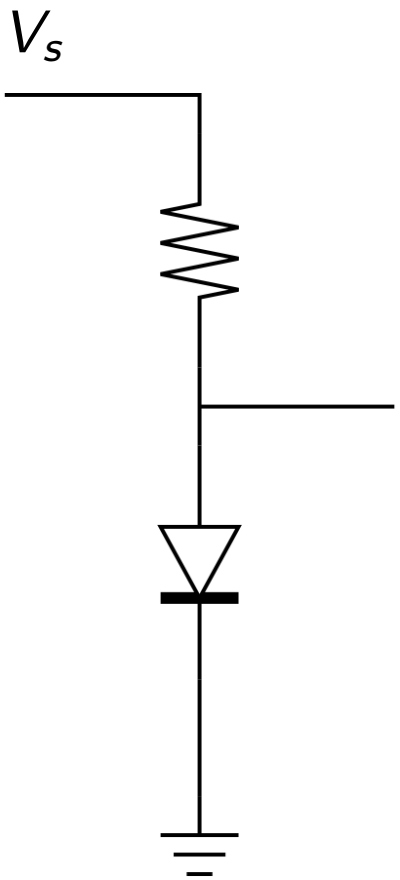


$V_D \approx 0.7$

$V_o \approx V_s - 0.7$
(assuming $V_s \gtrsim 0.7$)

Forward biased diode in a voltage divider



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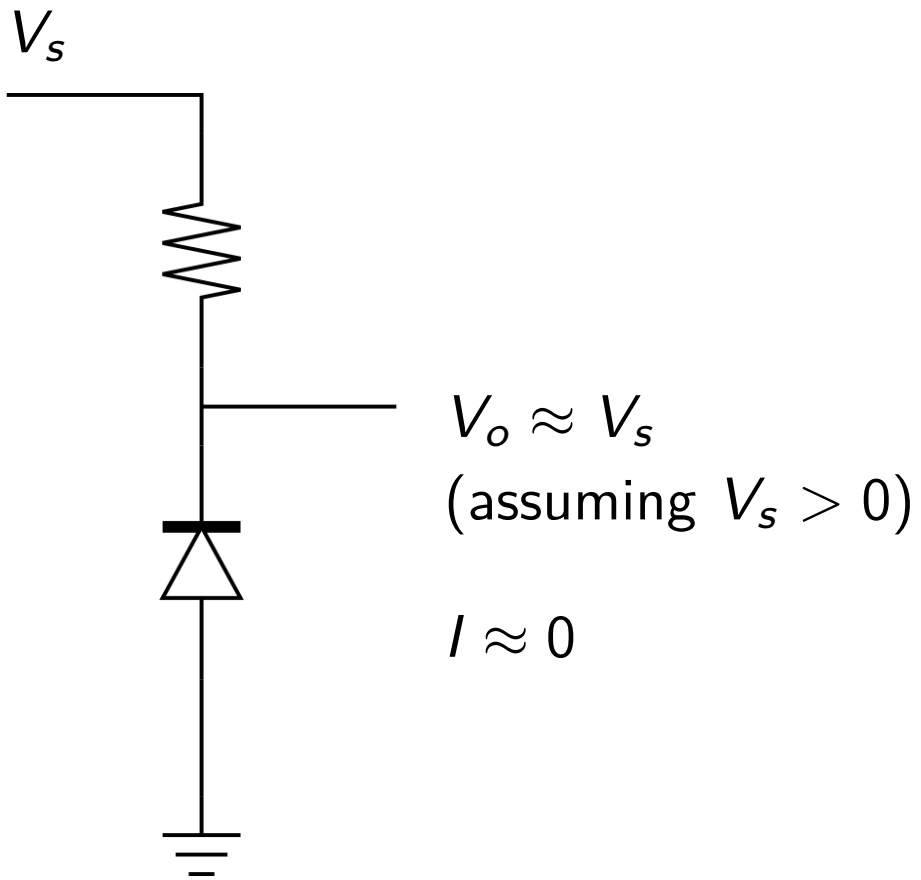
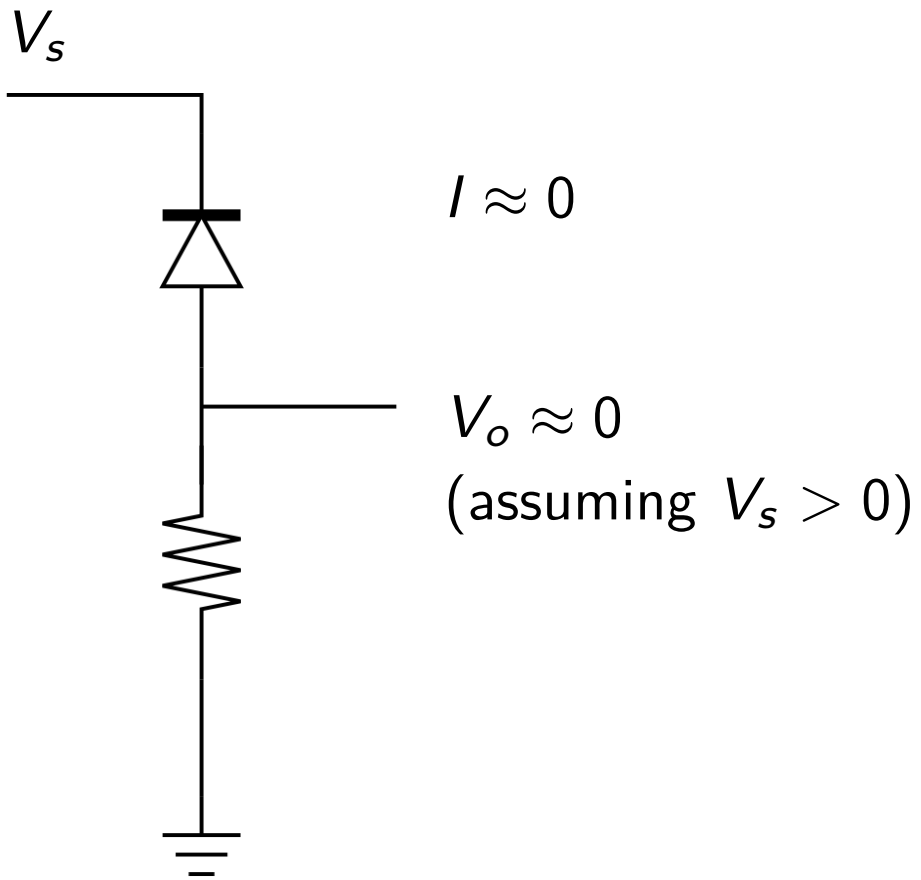
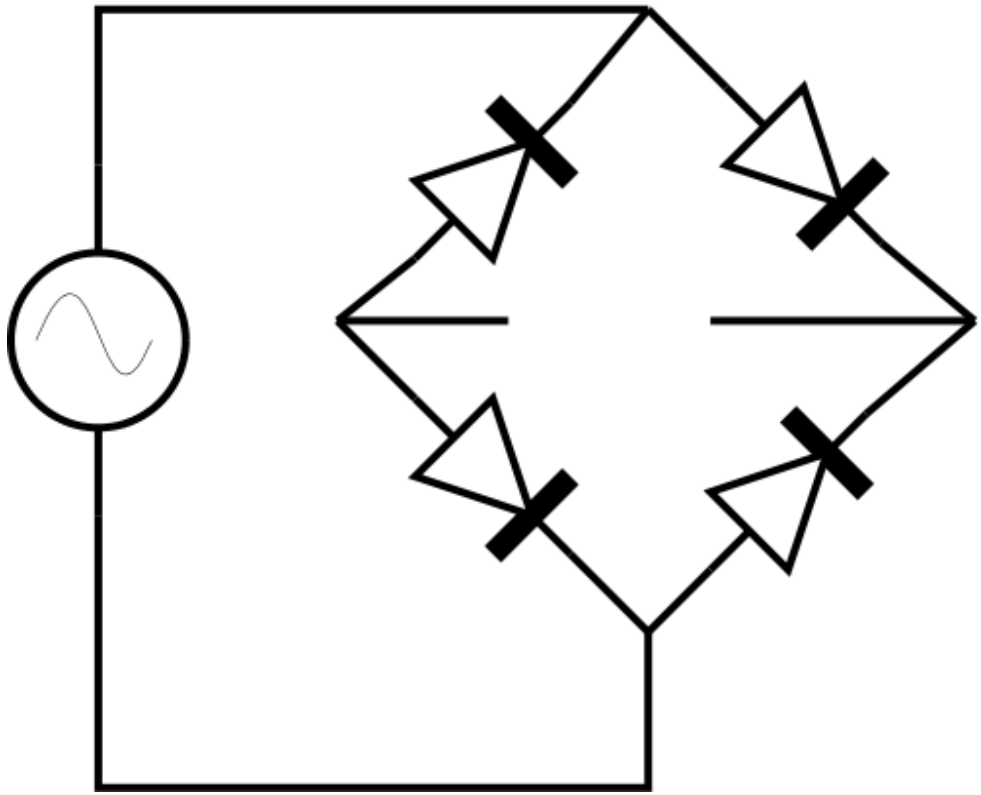


Reverse biased diode in a voltage divider

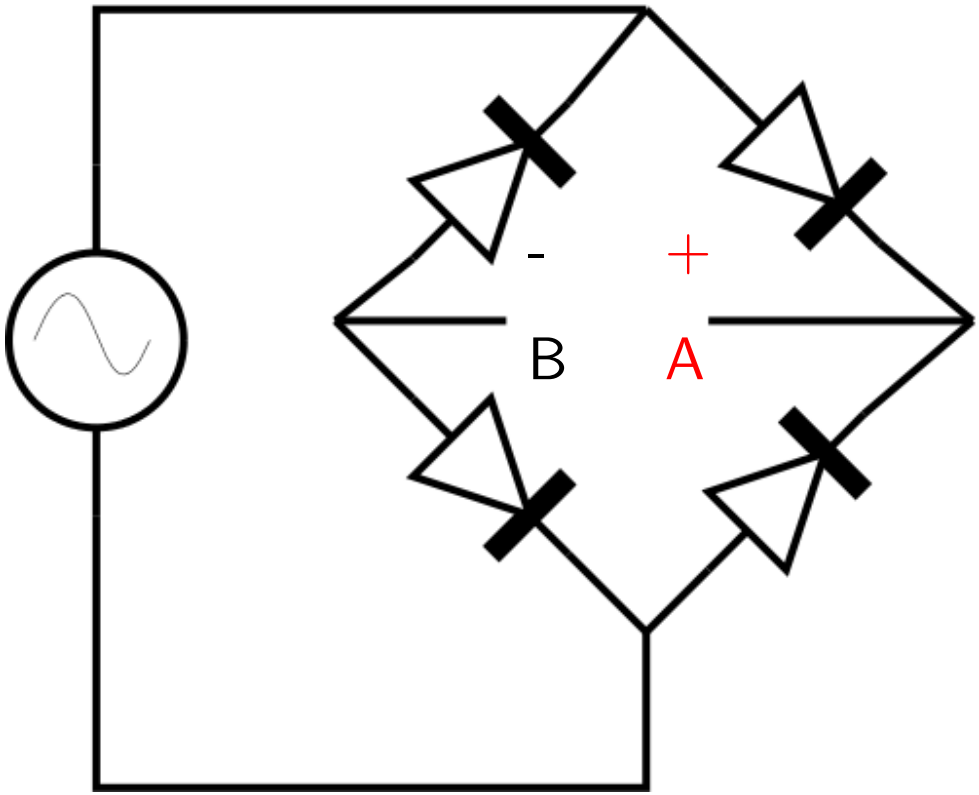


Reverse biased diode in a voltage divider

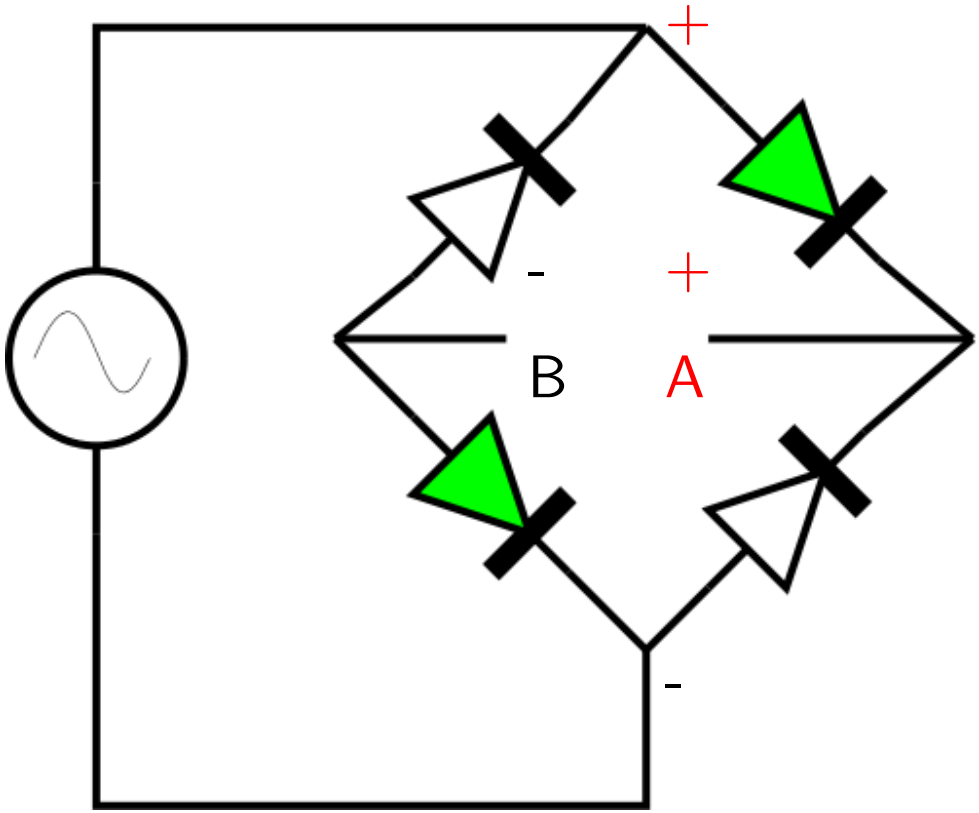
One common use of diodes is for **rectification**, by putting diodes in a bridge circuit.



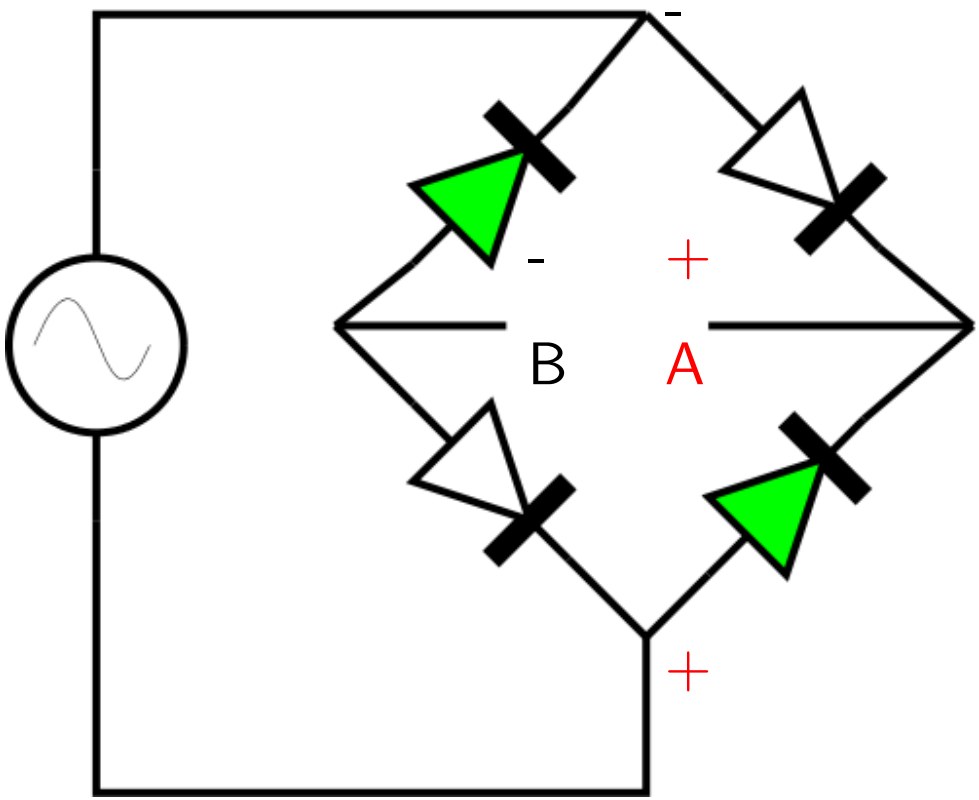
Here's the basic bridge.



The output is taken between A and B.



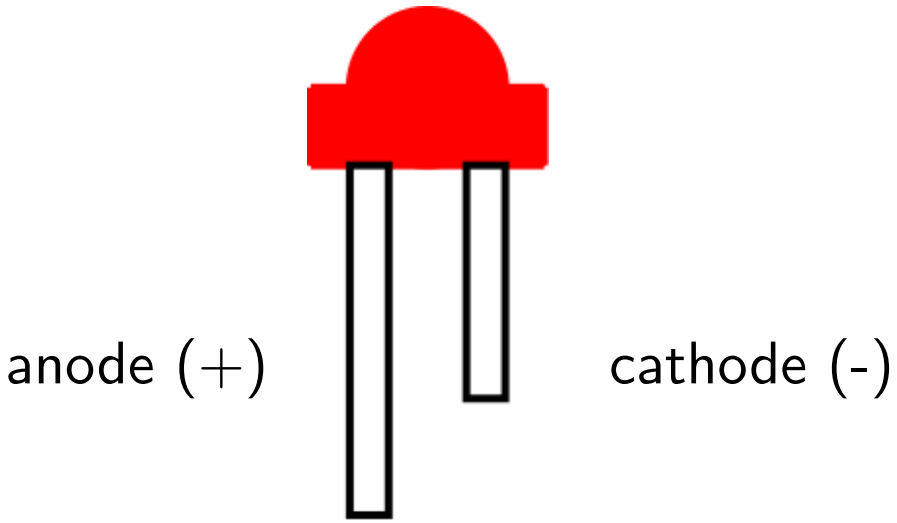
For one half of the cycle, these two diodes shown in green are forward biased, so they're on. (The others are off.)



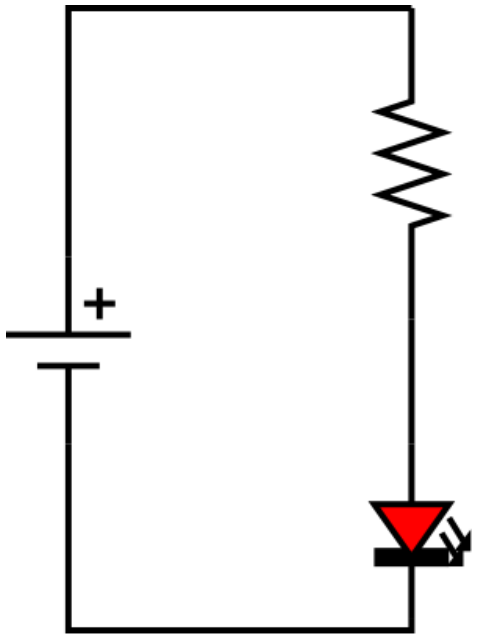
For the other half of the cycle, the other two diodes shown in green are forward biased, so they're on. (The others are off.)

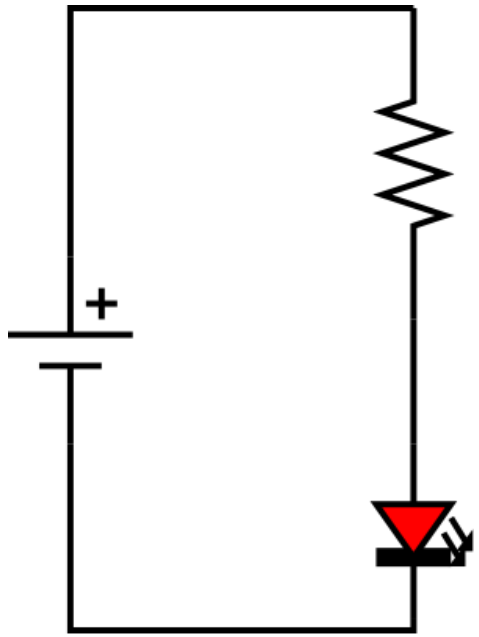
For both parts of the cycle, A is positive relative to B.

LEDs are a special case; they light up above a certain voltage. The voltage depends on the colour.

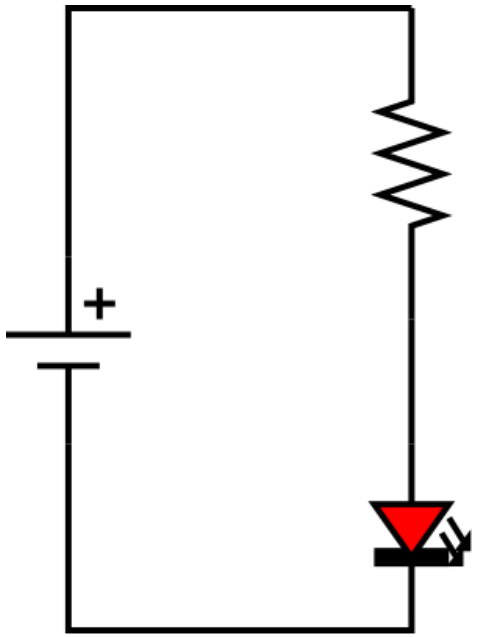


- The LED lights up when current flows from the anode to the cathode..

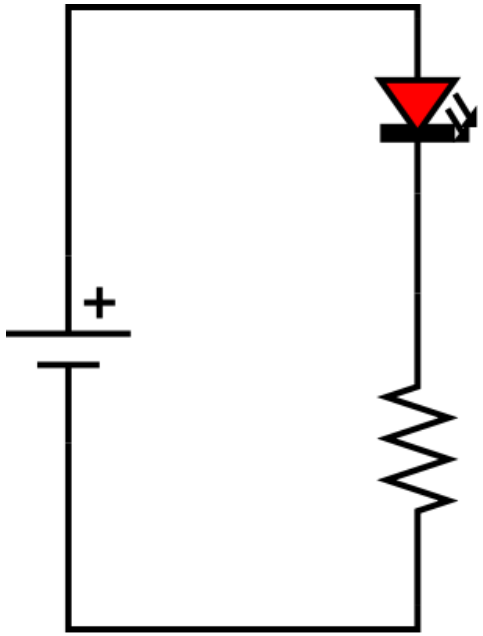




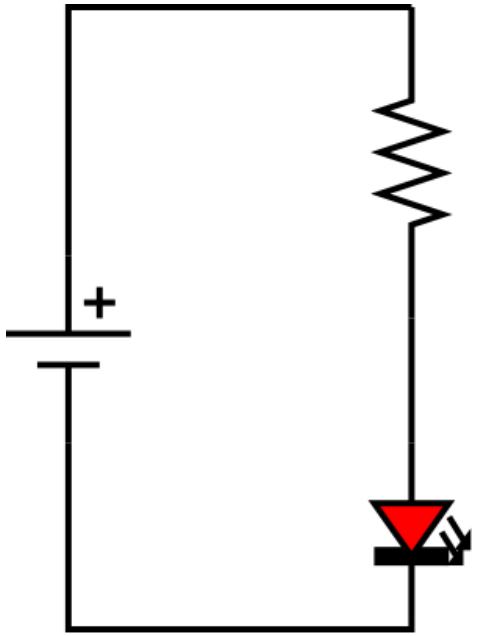
- You must use a resistor to limit the current.



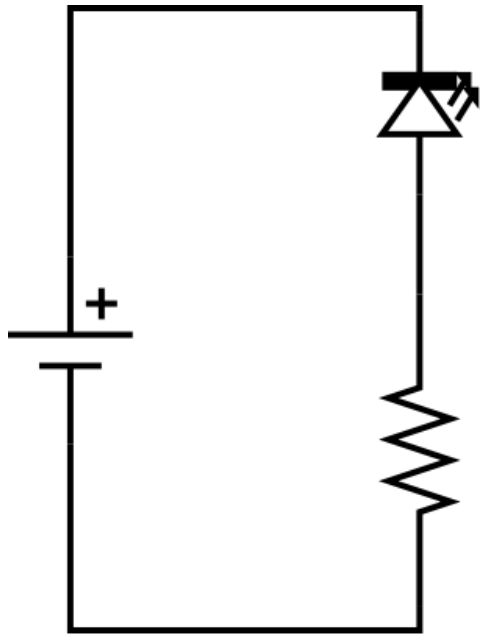
- You must use a resistor to limit the current.
- *Without a resistor, the LED will probably be destroyed.*



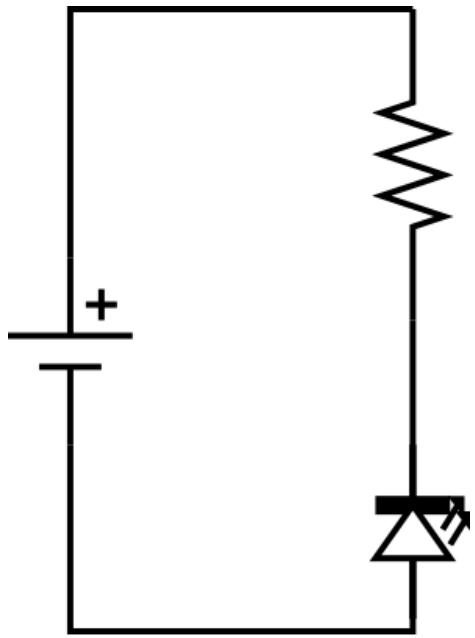
- The resistor can go before or after the LED.



- The resistor can go before or after the LED.



- Reverse-biased, the LED won't light up.



- Reverse-biased, the LED won't light up.