

Circuit Variables

Voltage

- Positive and negative terminal
- Voltage is across the terminals
- Assumption: Voltage across a wire is zero

$$V = \frac{dw}{dq}$$

energy (Joules, J)
charge (Coulombs, C)
voltage (Volts, V)

Current

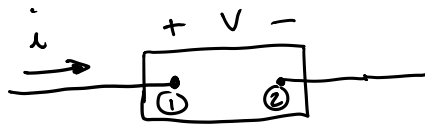
- Time rate change of charge flow

$$i = \frac{dq}{dt}$$

time (seconds, s)
Current (Amps, A)

Ideal Basic Circuit Element

- Two terminals
- Behavior can be described mathematically in terms of voltage and/or current
- Can't be divided into other elements



Power

$$P = \frac{dw}{dt}$$

Power (J/s, Watt, w)

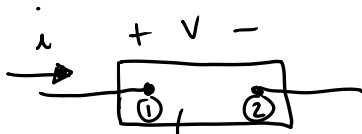
$$P = \frac{dw}{dt} \left(\frac{dq}{dq} \right) = \underbrace{\left(\frac{dw}{dq} \right)}_V \underbrace{\left(\frac{dq}{dt} \right)}_i$$

$P = vi$

Sign Convention for Power

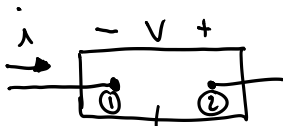
$p > 0$: The circuit element is absorbing (dissipating) power (energy)

$p < 0$: The circuit element is developing (delivering, supplying) power (energy)



Current flows from (+) to (-)

$$p = vi$$



Current flows (-) to (+)

$$p = -vi$$