MODULE 6: Soldering

SUMMER CHALLENGE

Electrical Engineering: Smart Lighting

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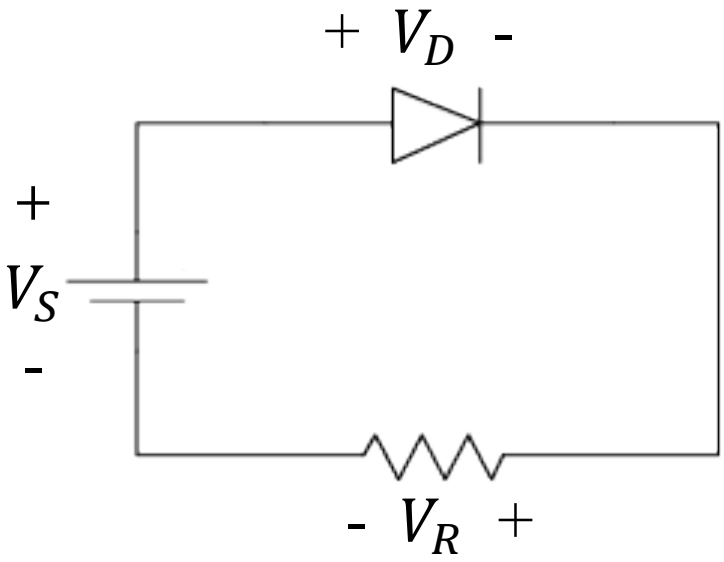
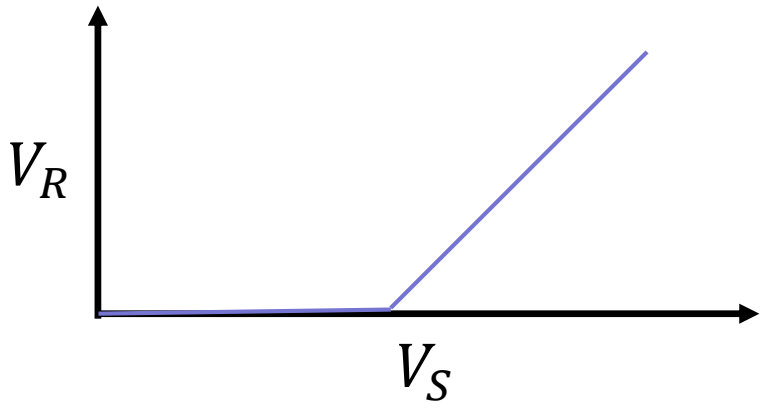
Overview

- Recap – LED Drivers
- Soldering Overview
- Soldering VLC PCBs

Recap – LED Drivers

- How does the V_R relate to the current through the resistor?
- How does the current through the resistor relate to the current through the diode?
- What does the current through an LED relate to?



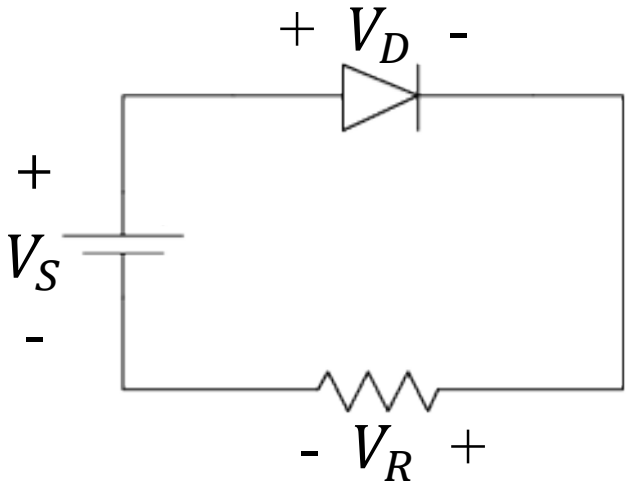


Electrical Power

- Power is the rate that energy is consumed.
  - Voltage = Potential energy difference per unit charge [V] or [J/C]
  - Current = Rate of flow of charge [A] or [C/s]

$$P = VI \Leftarrow$$ This is another one of those important equations…

- Power is measured in Watts [W] or [J/s]
- Energy *sources* (such as batteries) produce power while the *load* of the circuit absorbs power.



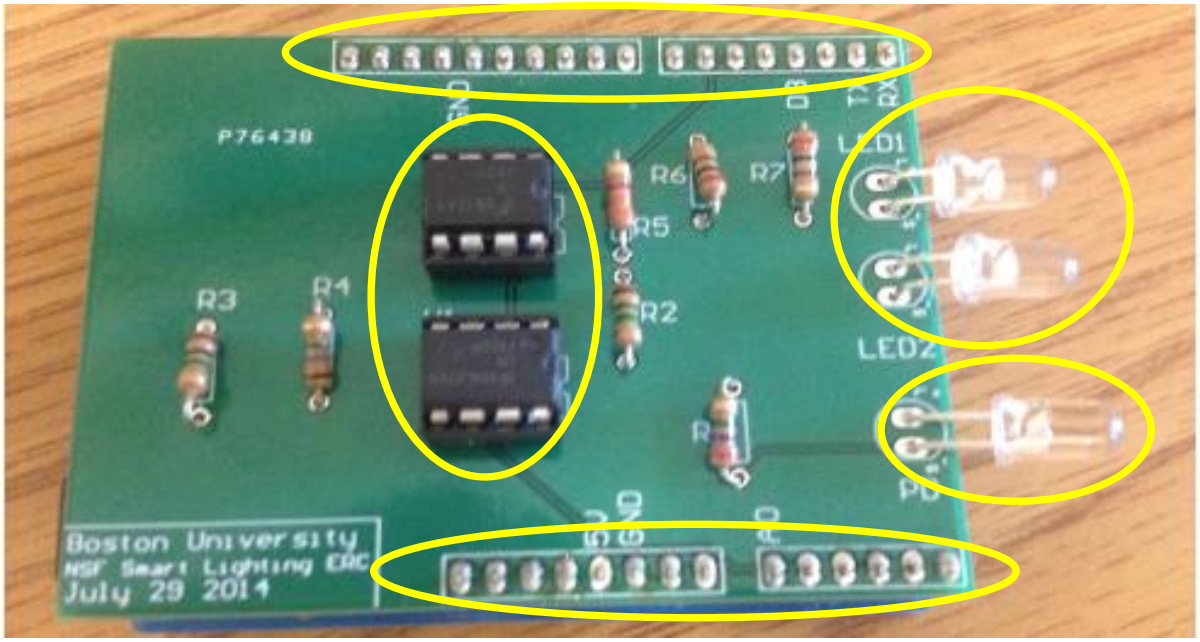
$$I = \frac{V_R}{R} = \frac{V_S - V_D}{R}$$

$$P_D = V_D I = \frac{V_D(V_S - V_D)}{R}$$

$$P_R = V_R I = \frac{(V_R)^2}{R} = I^2 R$$

VLC Transceiver

- Components
  - 2 - Sockets
  - 1 – LM741 Op Amp
  - 1 – LM393 Comparator
  - 1 – Photodiode
  - 1 – White LED
  - 1 – HB LED
  - 4 – Header Pins
  - 7 – Resistors

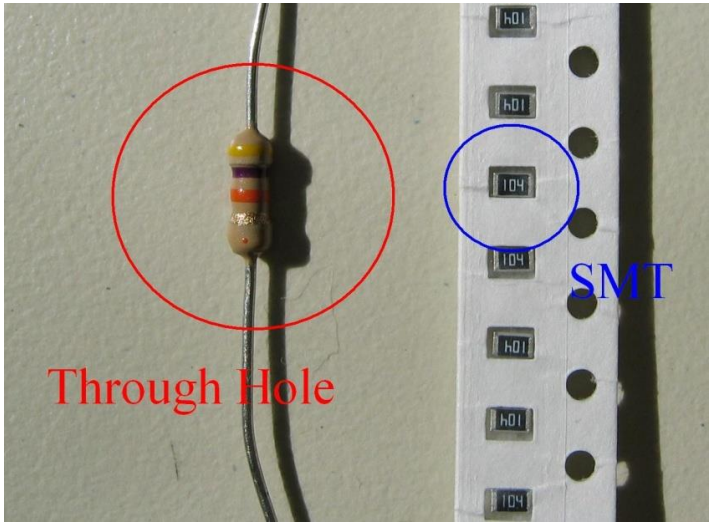


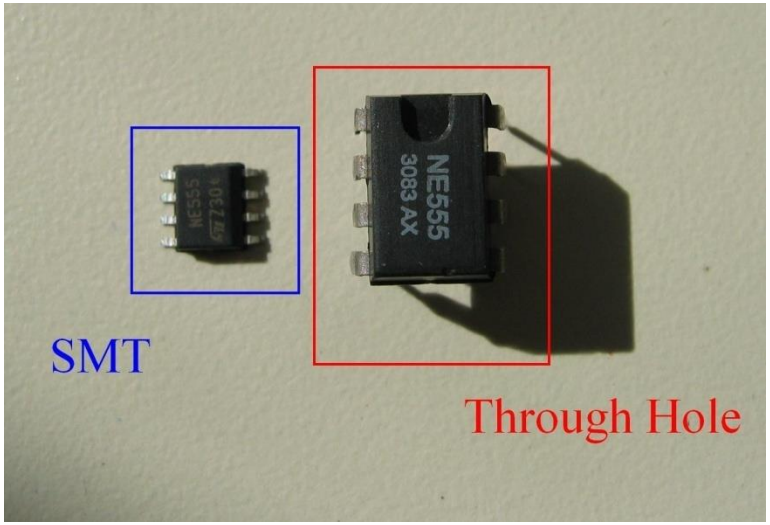
Soldering Overview

- PCB: Printed Circuit Board
- Thru-hole: Components with leads that go *through* the circuit board and get soldered on the other side.
- Surface-mount: Components that are soldered on the same surface on which it is mounted.
- Track/trace: The “wires” connecting components.
- Pad: Exposed points where components are soldered.
- Silkscreen: Print text on PCB

Thru-Hole vs. Surface Mount

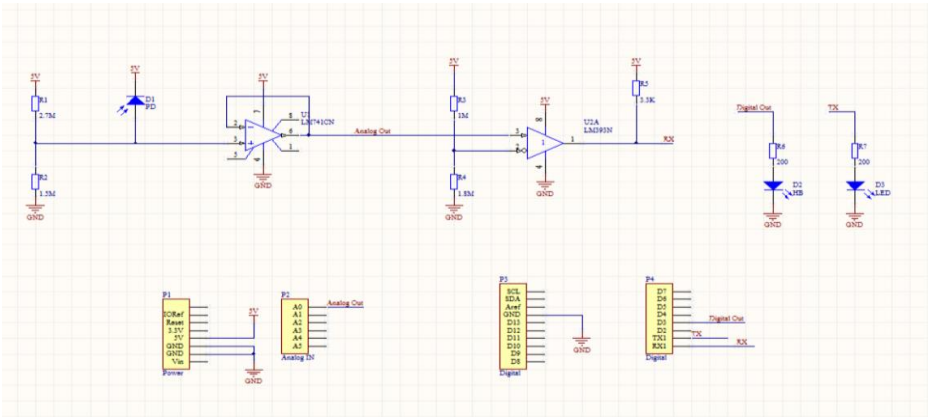
- Surface Mount Advantages
  - Smaller size and more compact layout
  - Components can be placed on both sides of the board
- Thru-Hole Advantages
  - Much easier to solder by hand
  - Easier to rework



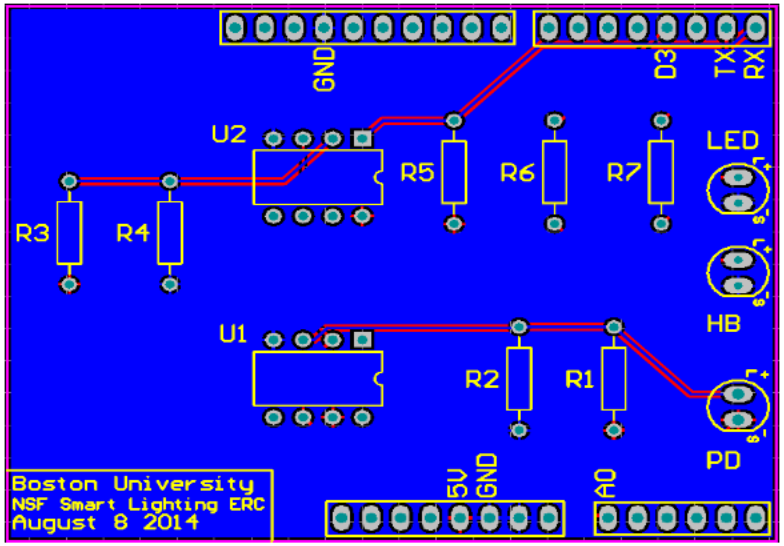


Schematics vs. Layout

- Schematics are a symbolic representation of the circuit
- Layout indicates the physical arrangement on the PCB



Schematic



Layout

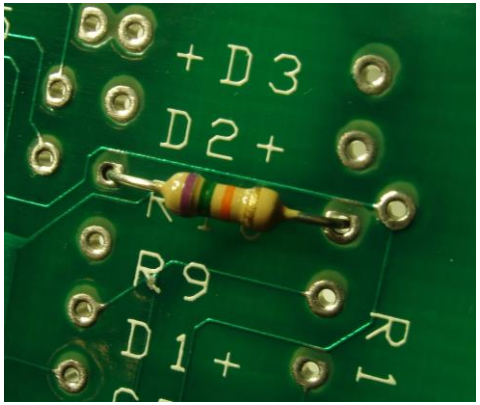
About Soldering

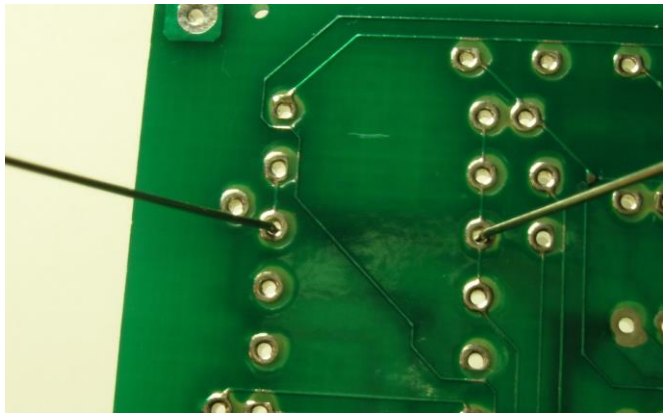
- Process of joining metal items together by melting a filler metal, solder and contacting the items to be joined.
- Requirements:
  - Heat source (Soldering Iron)
  - Low melting point metal (Solder)
  - Flux (Prevents oxidization)
- Temperature
  - Typically set around 700° F
  - DO NOT TOUCH THE IRON!!
  - Note: Wires can also get very hot

Temperature Controlled Solder Station

Lab Instructions

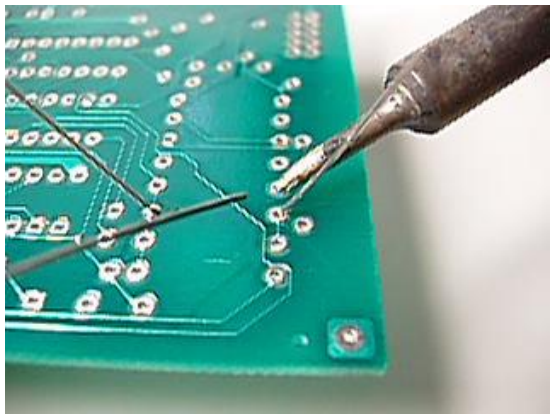
- Insert leads through the holes in the PCB
- Turn board over and bend leads outward
- Clean iron tip on a damp sponge
- *Tin* the iron tip by applying solder, then wipe again

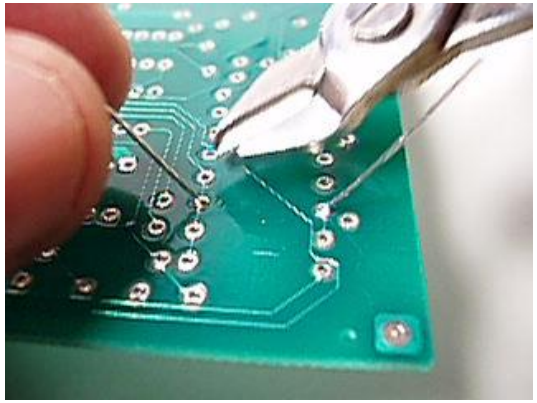


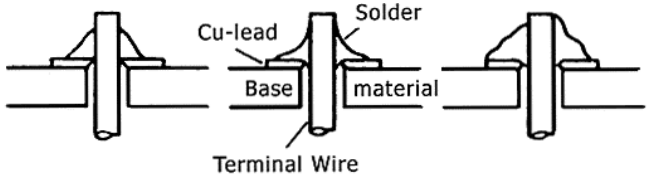


Lab Instructions

- Apply the iron such that it contacts the pad and lead
- Apply solder to the joint, NOT the iron
  - The heated metal of the pad and lead should melt the solder
- Use wire cutters to clip the excess lead.
  - Be cautious when clipping the lead!
- Have a TA inspect the board for shorts







Desoldering

- Copper Solder Wick/Braid
  - For removing excess solder
  - Braided copper mesh “pulls” solder off the board

- De-Solder Vacuum
  - Uses a vacuum action to pull solder from the board

Experiment

- Soldering Lab
- When you finish:
  - Return to PHO 115
  - Work on Module 5 Activity I (Photodiode circuit)

Recap

- What did you 

today?