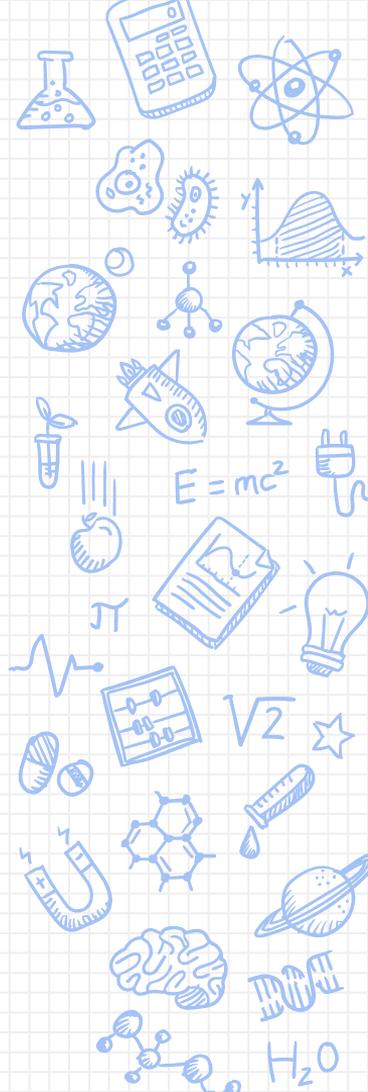


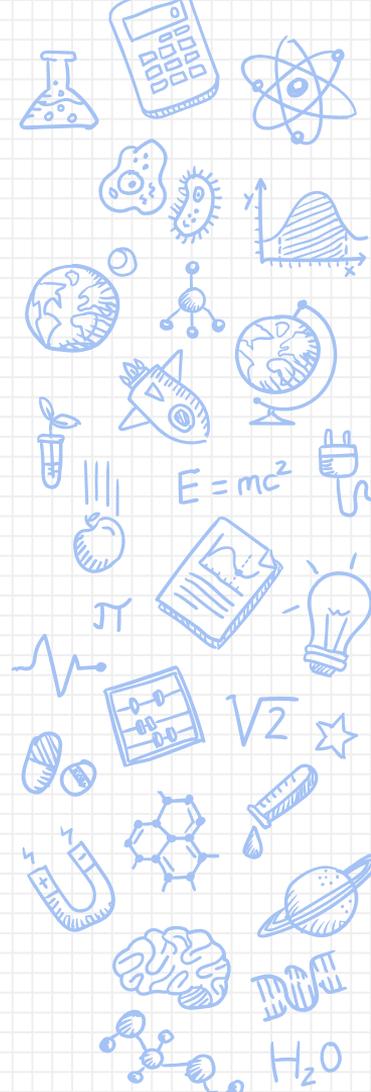
Feedback for Feedback

- ✗ Stuck waiting for question to be resolve
 - ✗ Collaborate!!!!!! Ask others in lab!!
- ✗ Pre-lab Prep
 - ✗ Download the lab in advance and look through it!
- ✗ More In Depth Understanding
 - ✗ Lab Specific Office Hours
 - ✗ Wed 2-3 (CJ and Lydia); Fri 11-12 (Lydia, Nikhil)

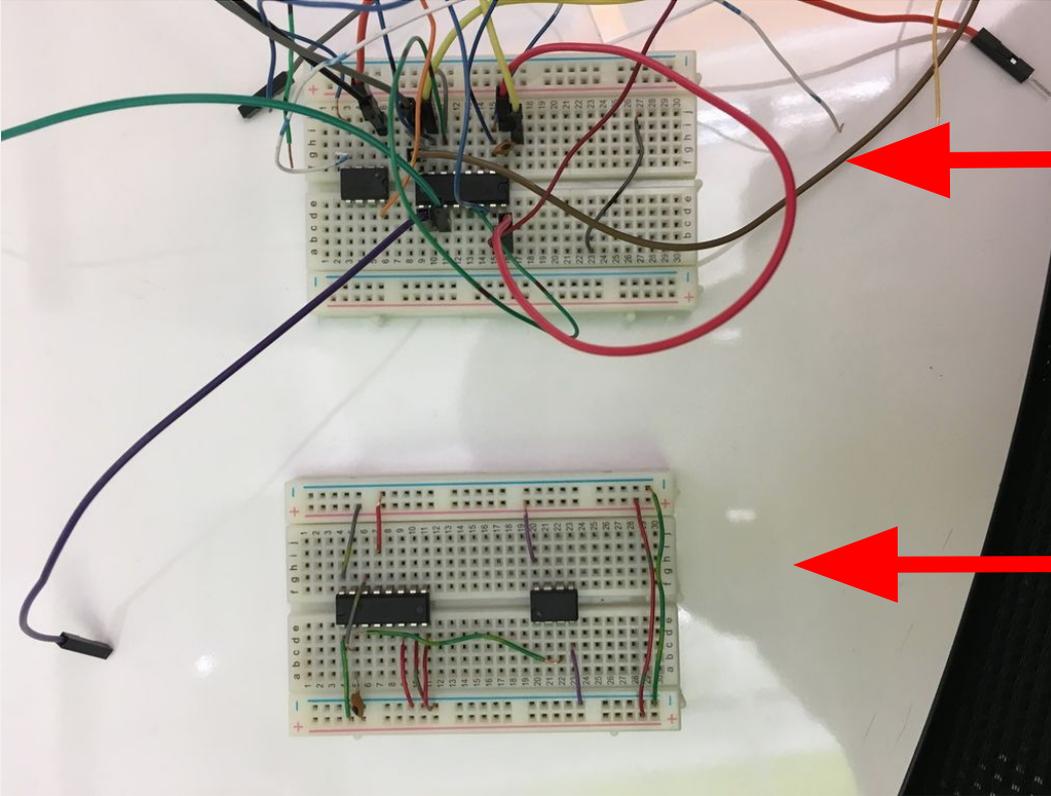


Announcements

- ✘ Bring Capacitive Touchscreen to next lab
- ✘ Planar Wiring is **REQUIRED**
- ✘ Lab Scheduling

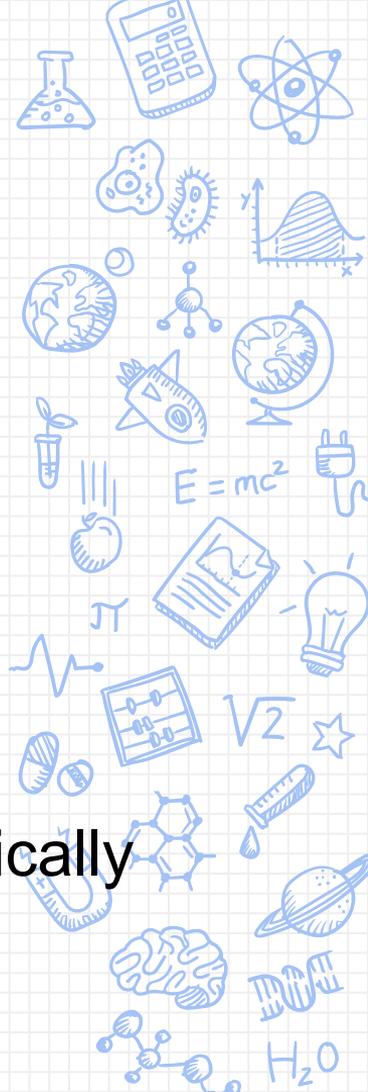


Why do u gotta be so strict tho :(



1.5 Hour to debug; Falls apart easily

5 Minutes to debug; Practically 2D; Lasts a lifetime

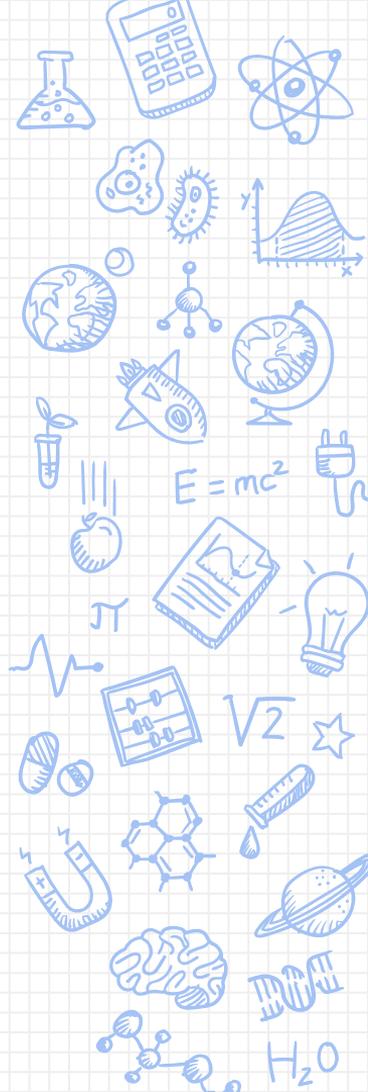


Capacitive Touchscreens



Goals: Touchscreen 3 [Capacitive]

- ✘ Understand charge-sharing circuit for a capacitive touchscreen
- ✘ Build a functioning capacitive touch screen!

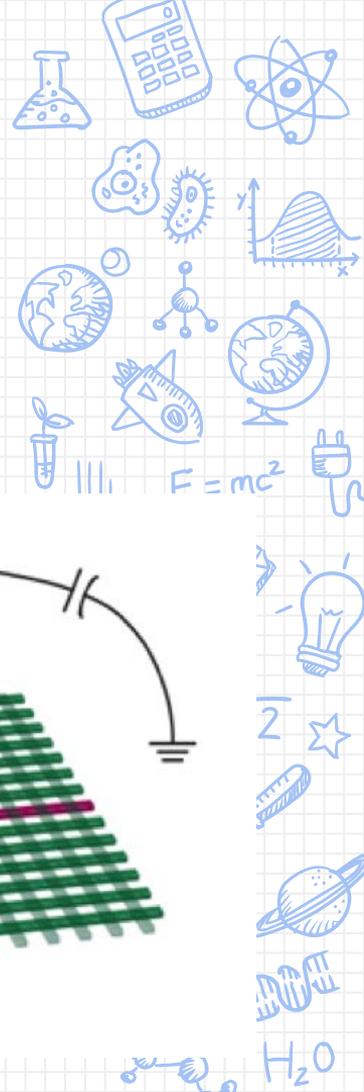
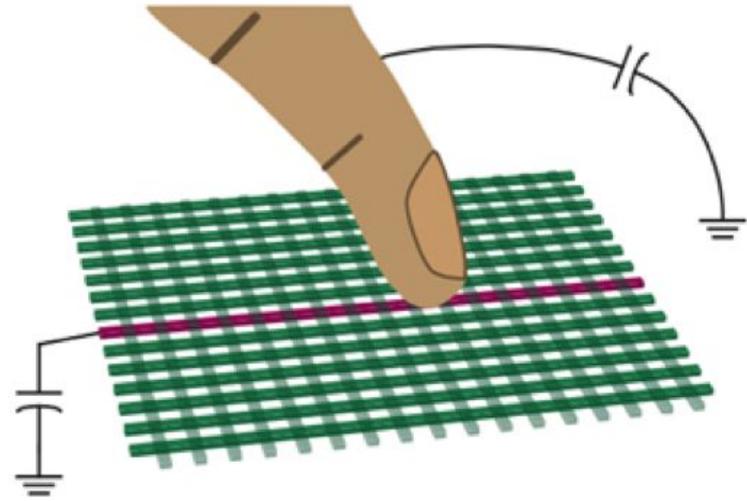


Capacitive Touchscreen

Exploits capacitive properties of finger/body

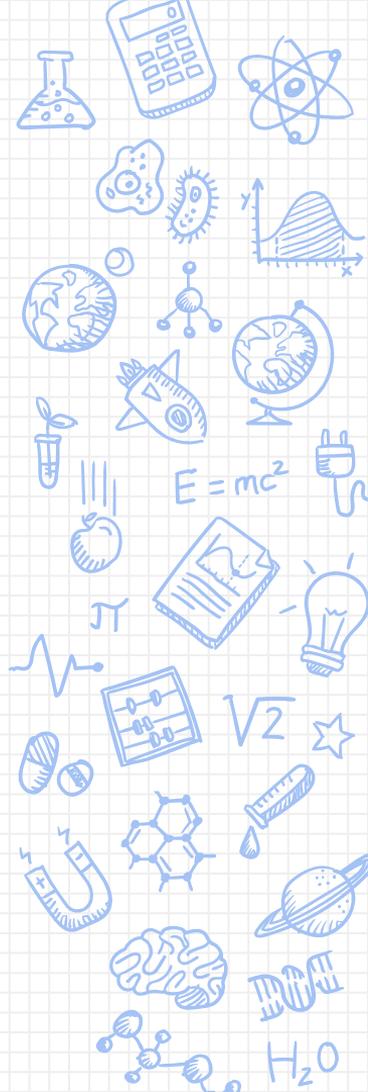
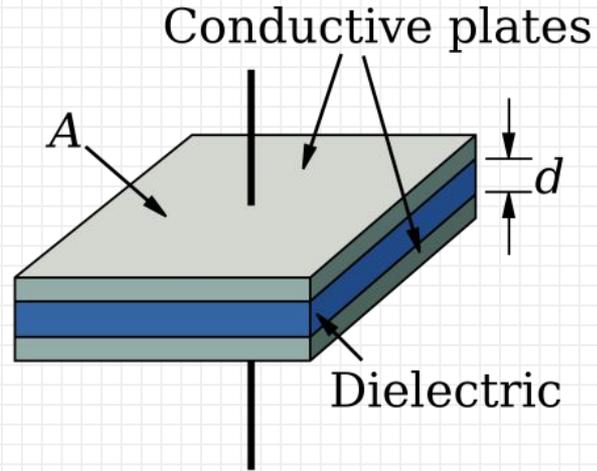
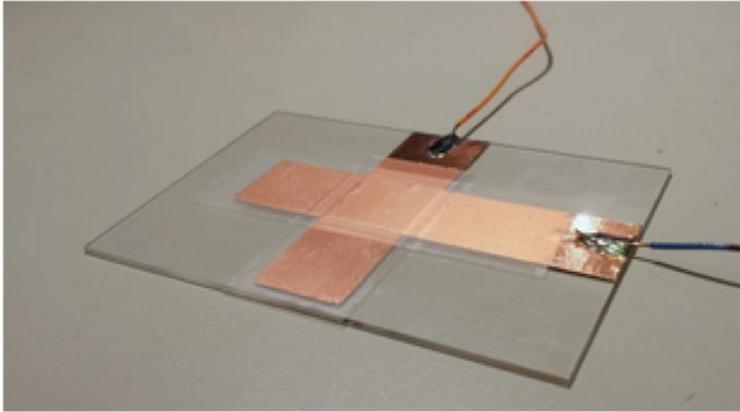
- ✘ Touching the screen changes the capacitance
- ✘ No moving parts
- ✘ Multi-touch is possible
- ✘ More sensitive

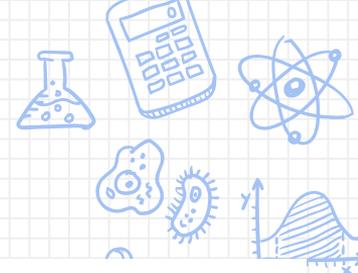
How to measure capacitance?



Capacitance and the touchpad

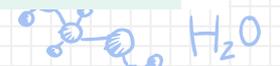
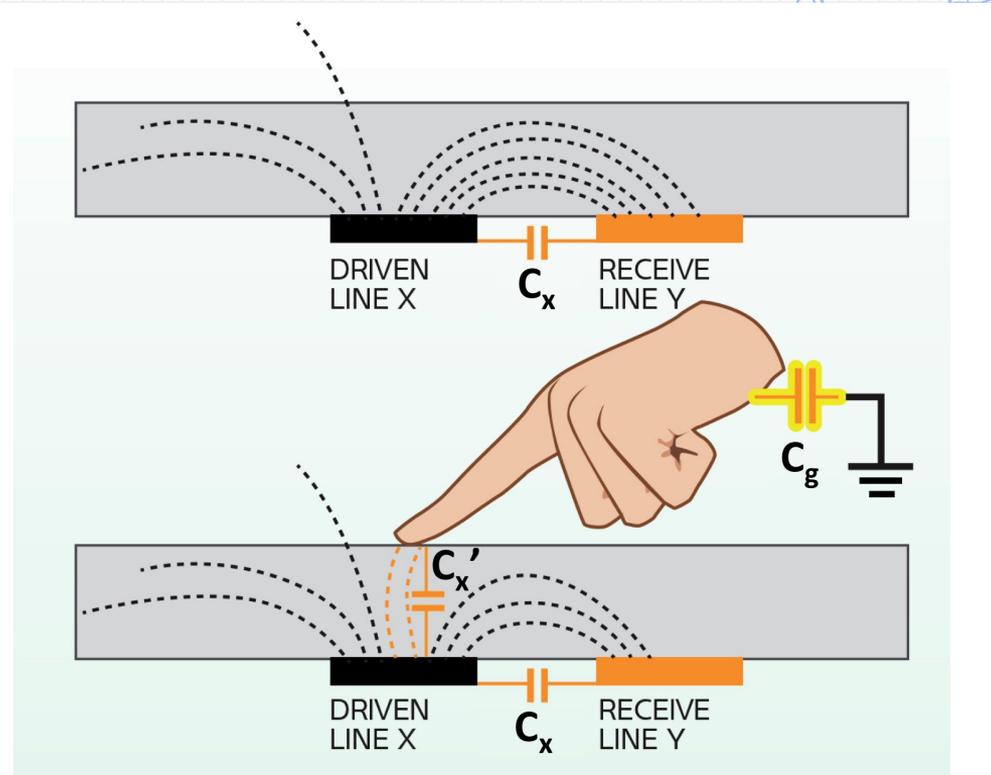
What is a capacitor and how does it work?



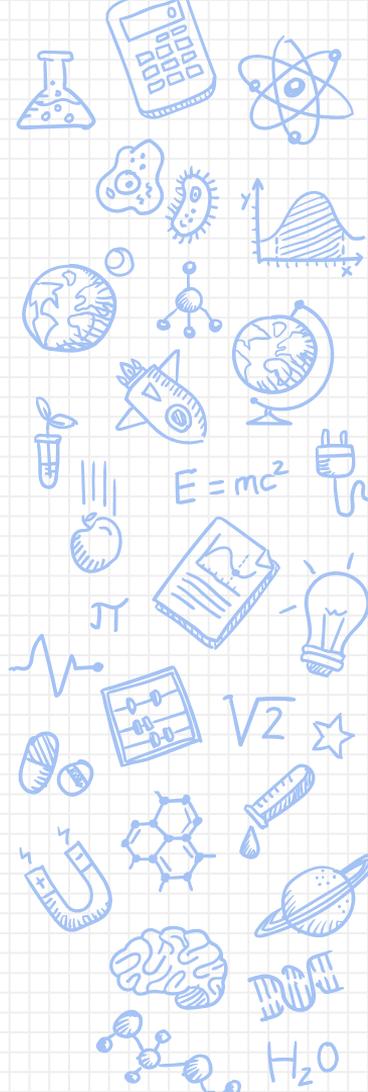
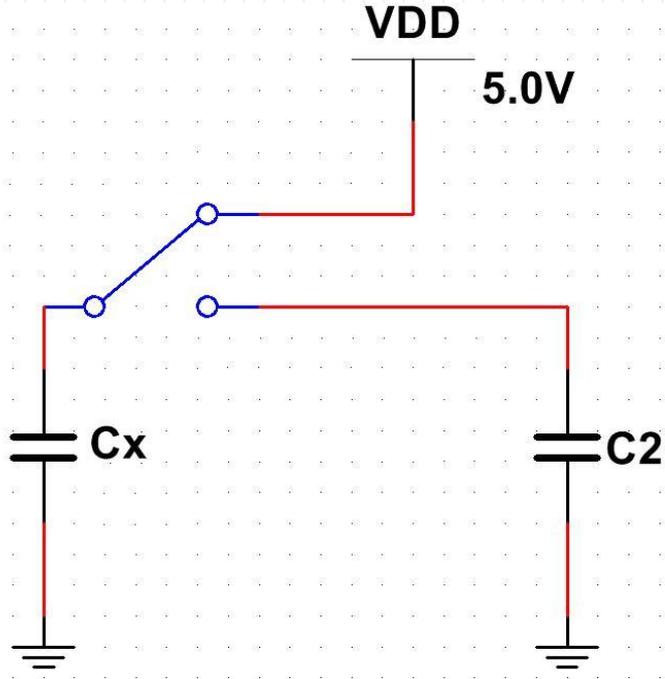


Capacitive Touchscreen

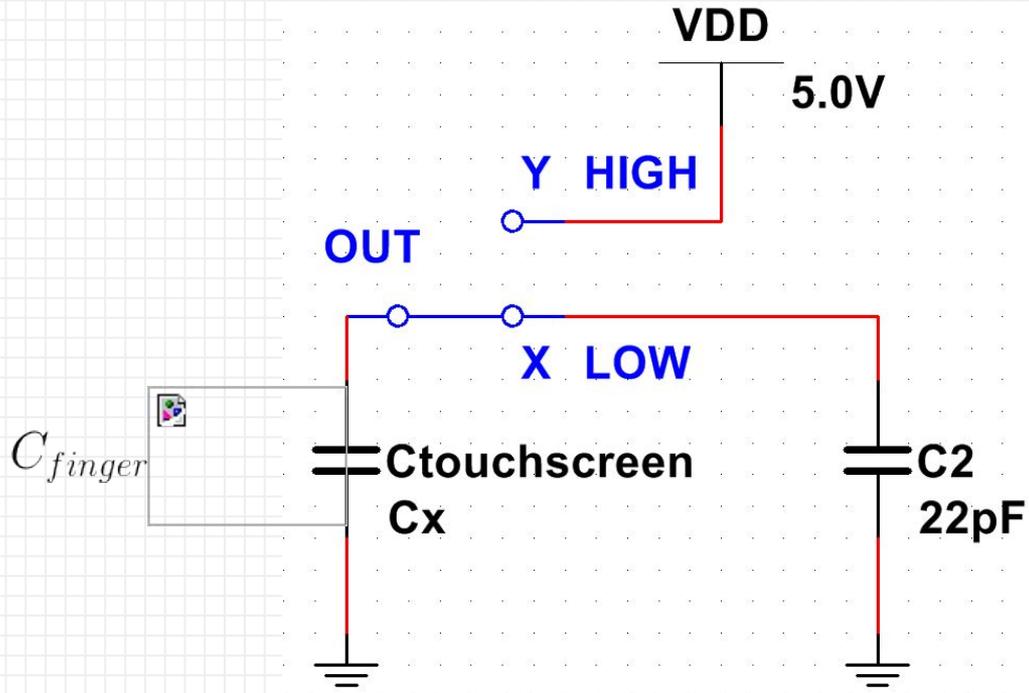
- ✗ Screen + finger = unknown capacitance
- ✗ In parallel with known capacitance



Measuring Capacitance: Charge Capacitor



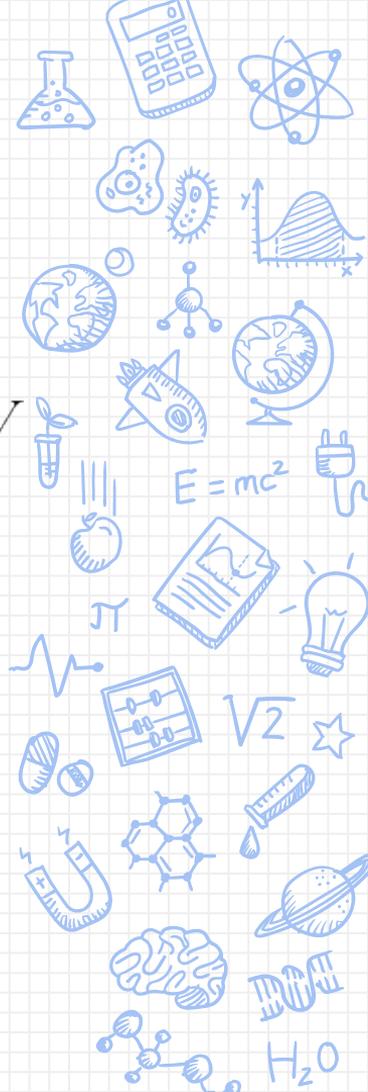
Measuring Capacitance: Finger Touch

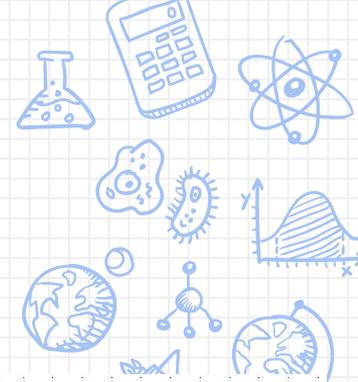


C_X may or may not include C_{finger} at a given time but the switch moves within fractions of a second.

Charge-sharing
invariant: $Q = CV$

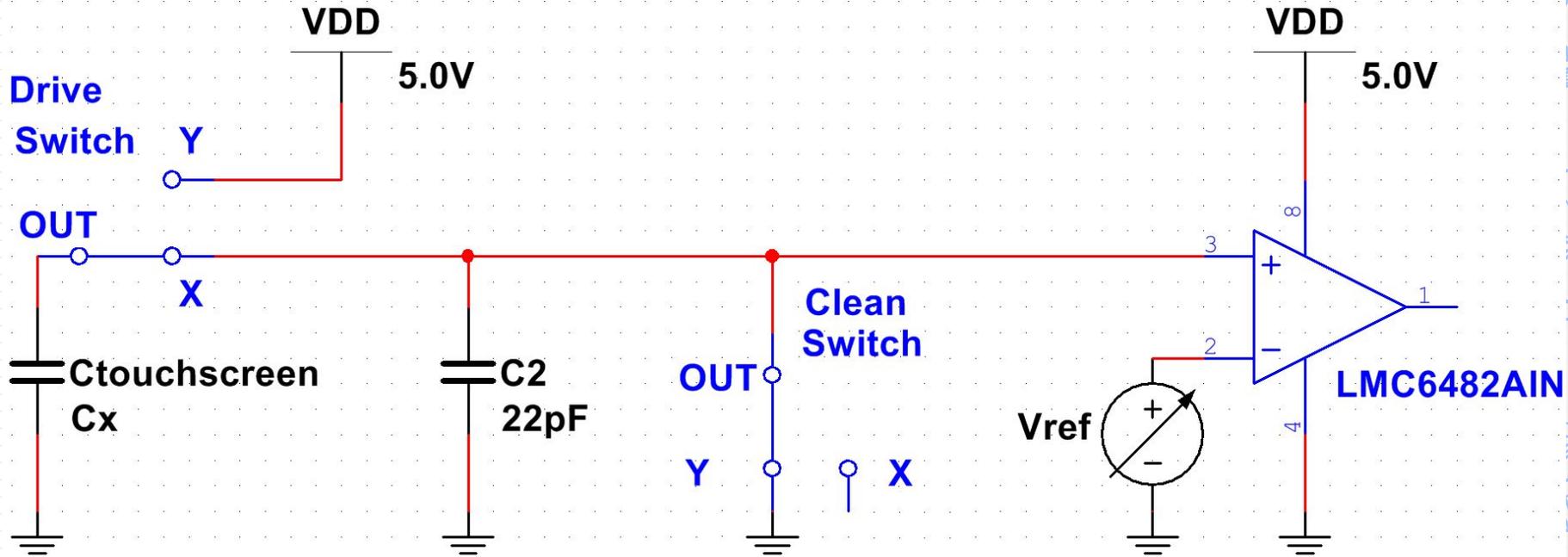
What happens to C
touchscreen?





Measuring Capacitance: Full Cycle

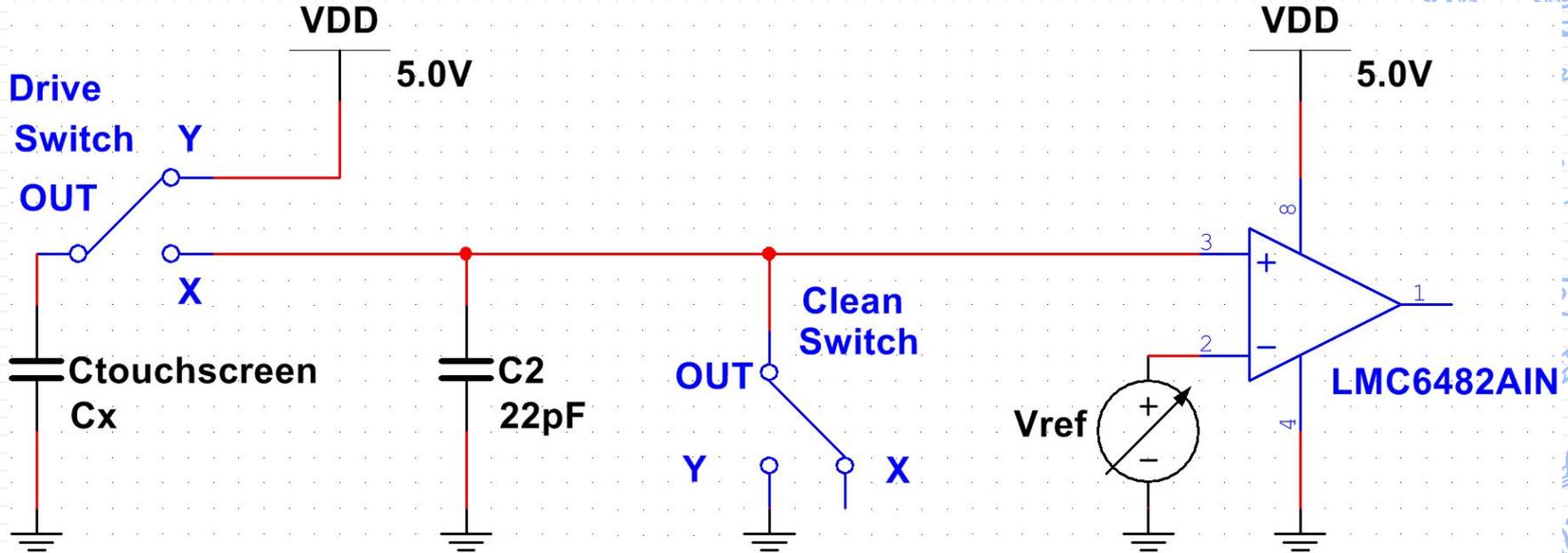
1. Connect capacitors to ground to discharge fully

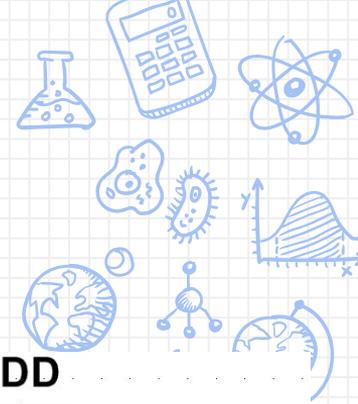




Measuring Capacitance: Full Cycle

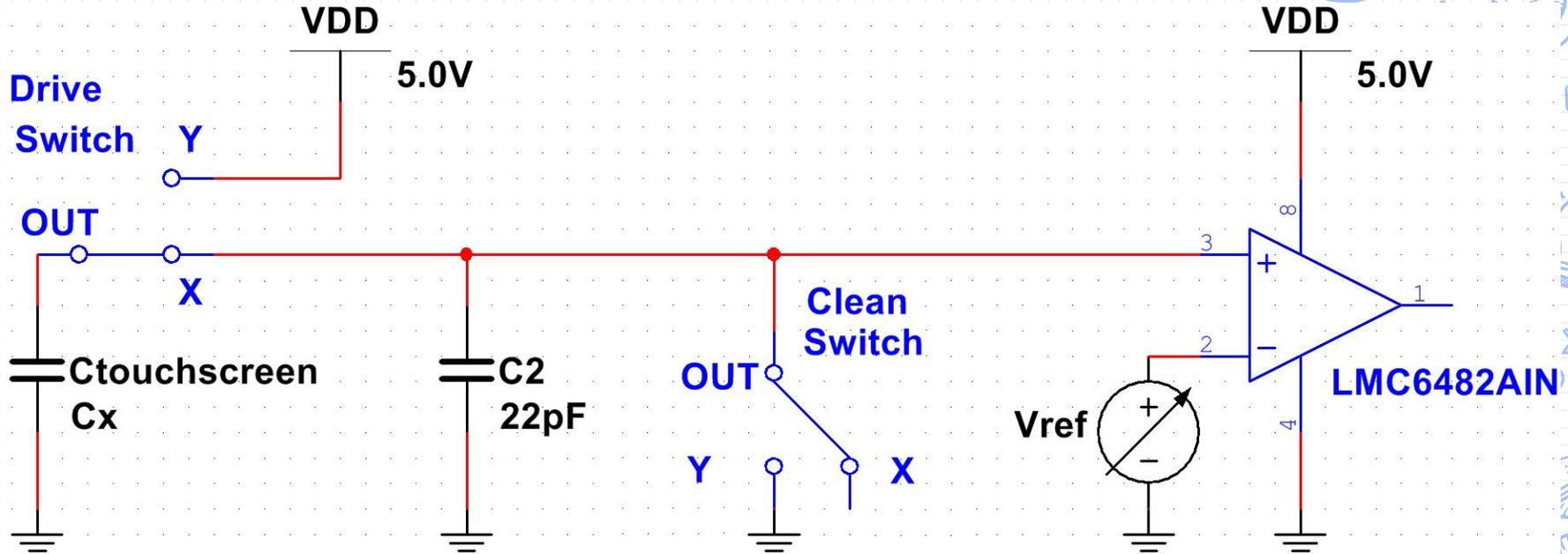
3. Charge touchscreen (+ finger?) to a known voltage [5V]

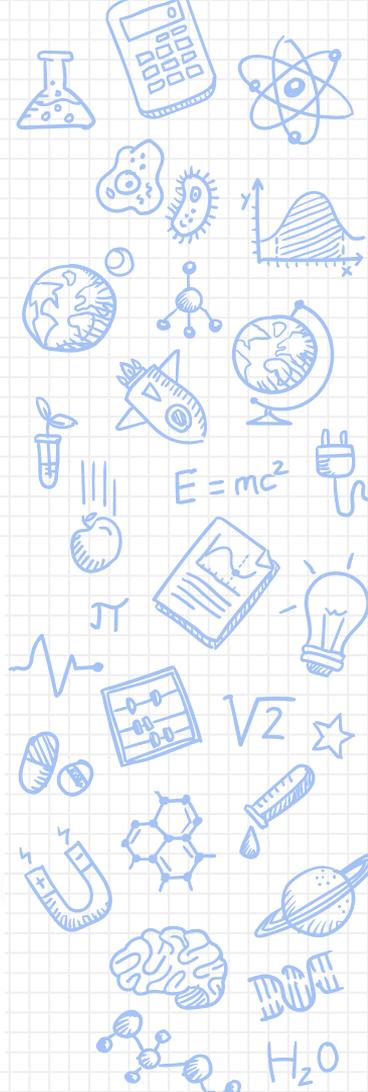




Measuring Capacitance: Full Cycle

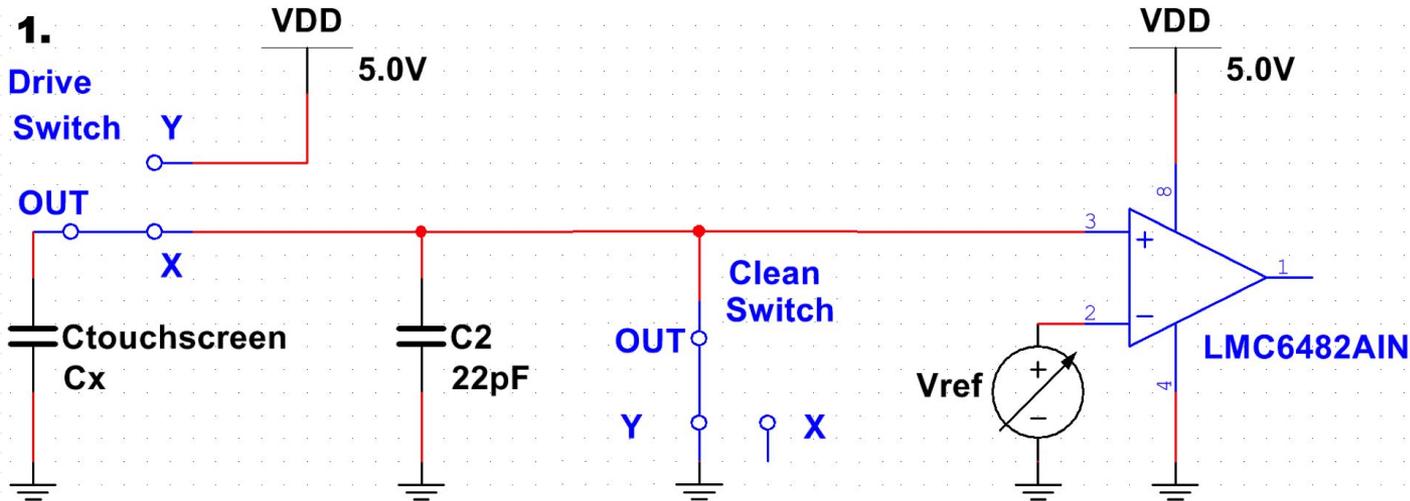
4. Share charge between C_x , touchscreen and $C2$



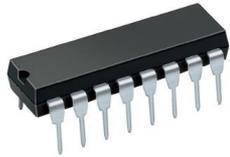


Measuring Capacitance: Full Cycle

- ✗ Clean switch serves as a reset button on the whole system (lets current go to ground, so we can start fresh)
- ✗ Switch moves in fractions of a second and is automated (ignore it when wiring your circuit)

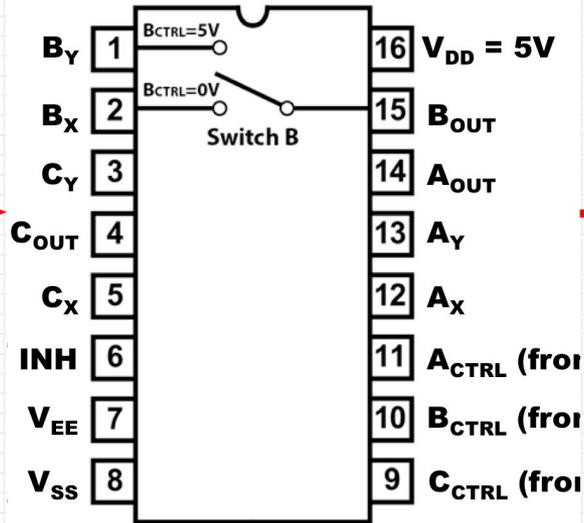


Supplies for Today: IC (Integrated Circuit)

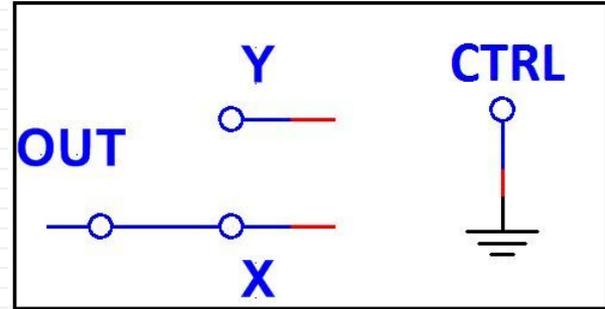
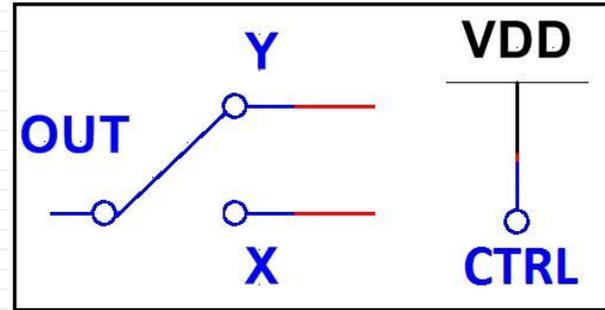


74053B (PDIP, CDIP, SOP, TSSOP)

TOP VIEW



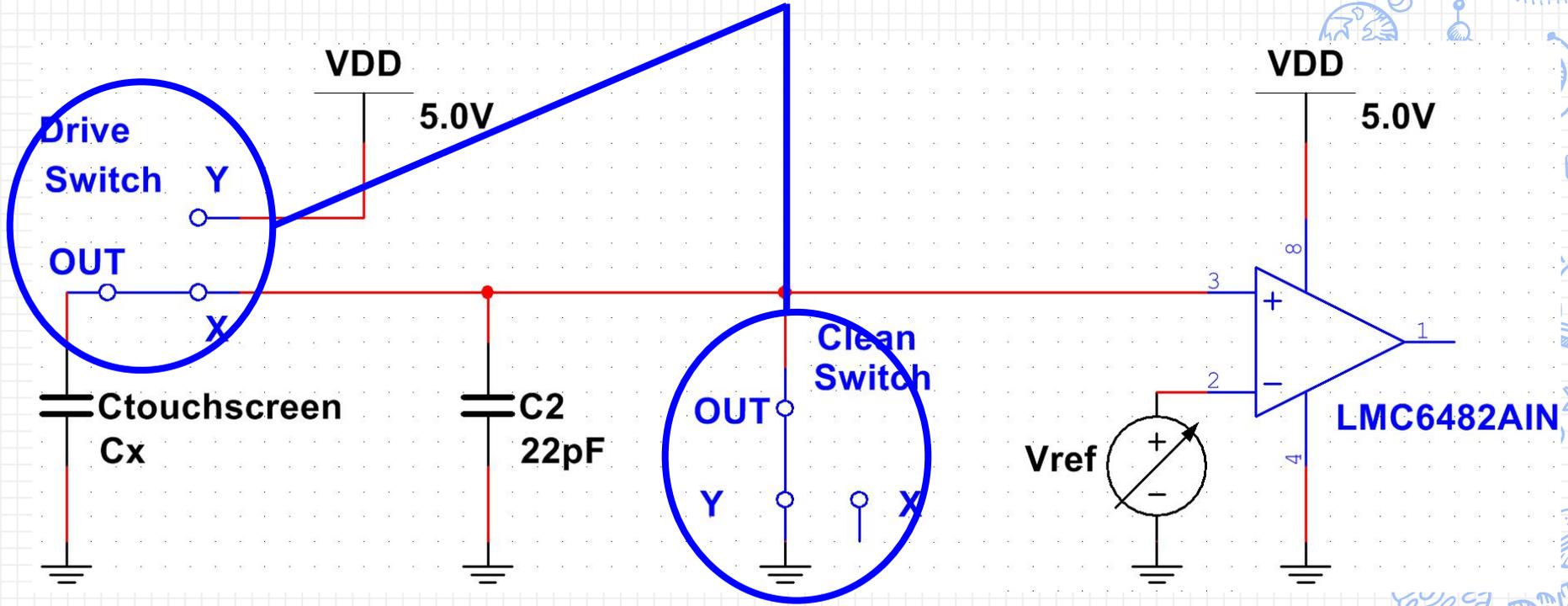
3 Different Switches (A, B, C)
Use Switch B for Drive switch
Use Switch A for Clean switch



Each switch has 3 terminals, represented by the circles on the diagram.
The blue lines represents the switch and is not controlled by the user

Bringing it together!

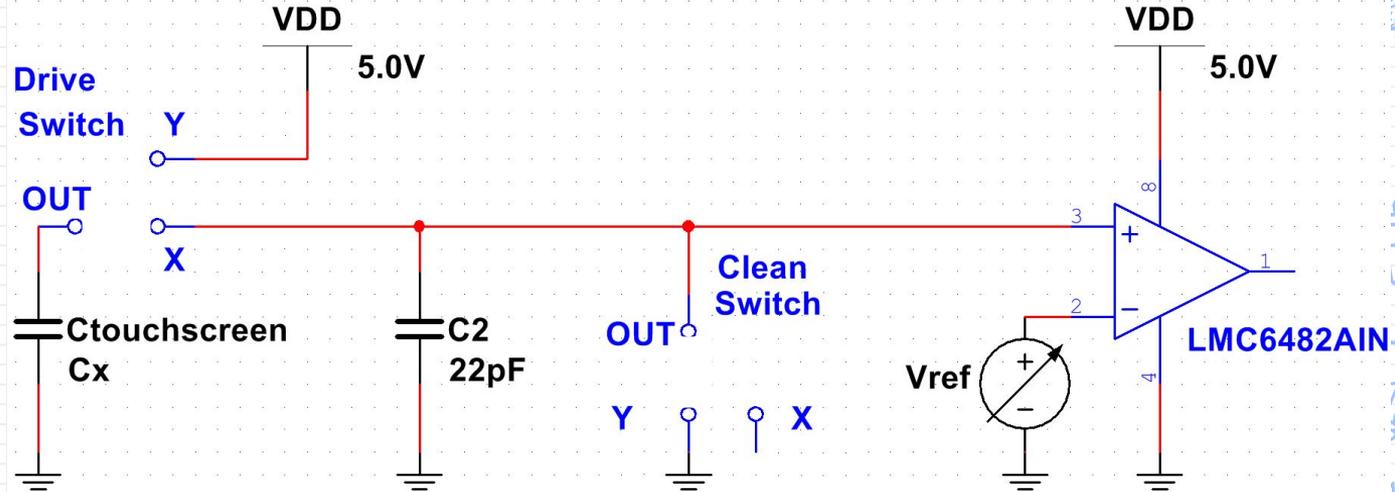
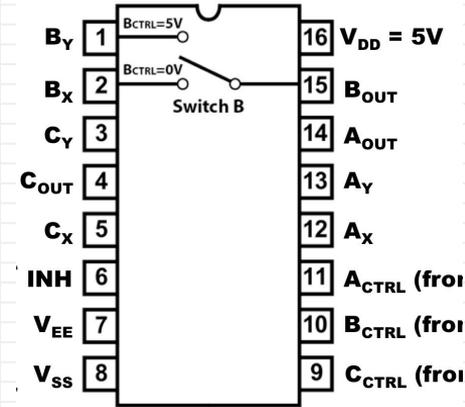
Blue lines mean we can ignore these because the IC will handle it!



Supplies for Today: IC (Integrated Circuit)

04053B (PDIP, CDIP, SOP, TSSOP)

TOP VIEW



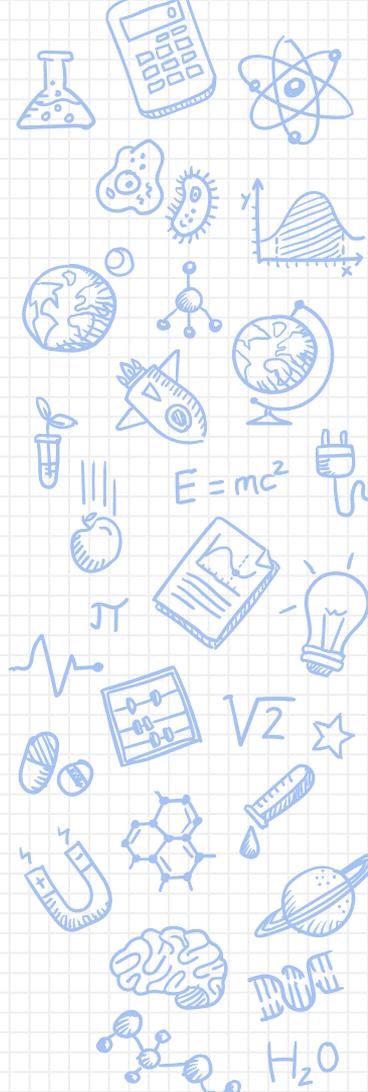
Connect the respective elements to the circular nodes and their respective pins on the chip! The MSP will handle the actual moving of the switches.

B_x , B_y , B_{out} for Drive Switch

A_x , A_y , A_{out} for Clean Switch

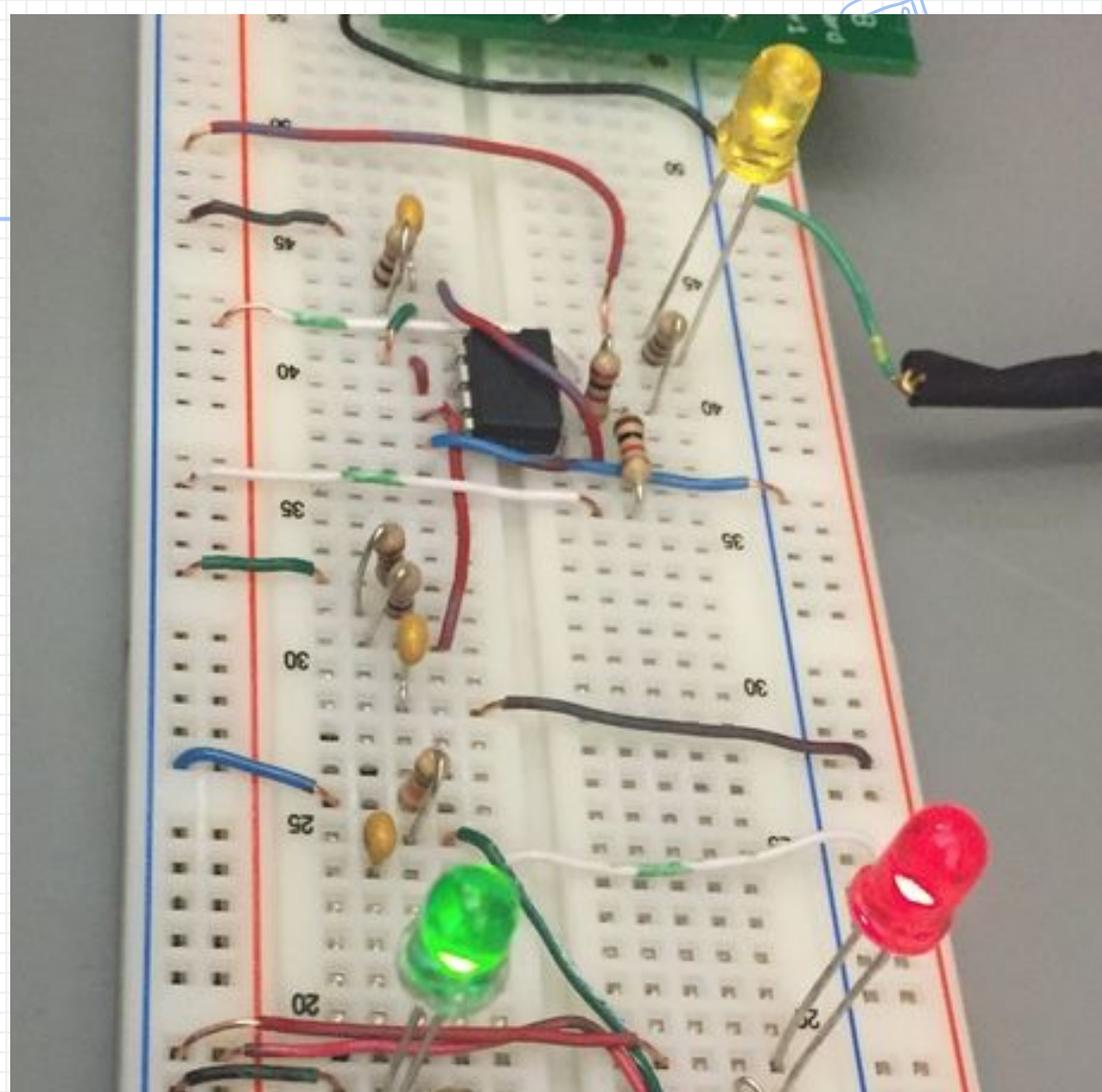
Notes

- ✗ Materials: 2 copper strips, glass slide, tape
- ✗ Only need 4" of tape and enough solder for two connections
- ✗ Remember to **remove the backing of the copper strips** [they are tape]
- ✗ **Remember to build the clean switch with A**
- ✗ Task 2A diagrams are theoretical. Don't start building until task 2B.



Notes

- ✘ Make your circuits neat!
Cut wires to correct lengths.
- ✘ Chips go across the middle of your breadboard.
- ✘ If circuit is not neat, will not debug until it is.



Notes

- ✘ Remember to **remove the backing of the copper strips** [they are tape]
- ✘ Remember to build the **clean switch**
- ✘ **PLANAR WIRING!**

Check off: tinyurl.com/sp17-lab-checkoff

Form: tinyurl.com/lab113-form-sp17

Queue: tinyurl.com/lab113-queue-sp17

