Arduino Switch Workshop

Arduino Platform and all sorts of switches

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Switches

All you ever wanted to know about Switches.

Switches

- Many different types
  push button, slide, toggle, light, magnetic, dip, micro, rotary, transistors, relays

- Both simpler and little more complex than you think

Poles and Throws

- Poles is no of separate circuits

- Throws is no of contacts on each pole

- SPST == simple one off switch

- DPST == simple toggle switch

- SPDT == simple push button

Looking at DataSheets

- Momentary or on/off?

- No of poles / no of throws

- Max current / max voltage

- Force required

- Times switch can be used

Basic Switches
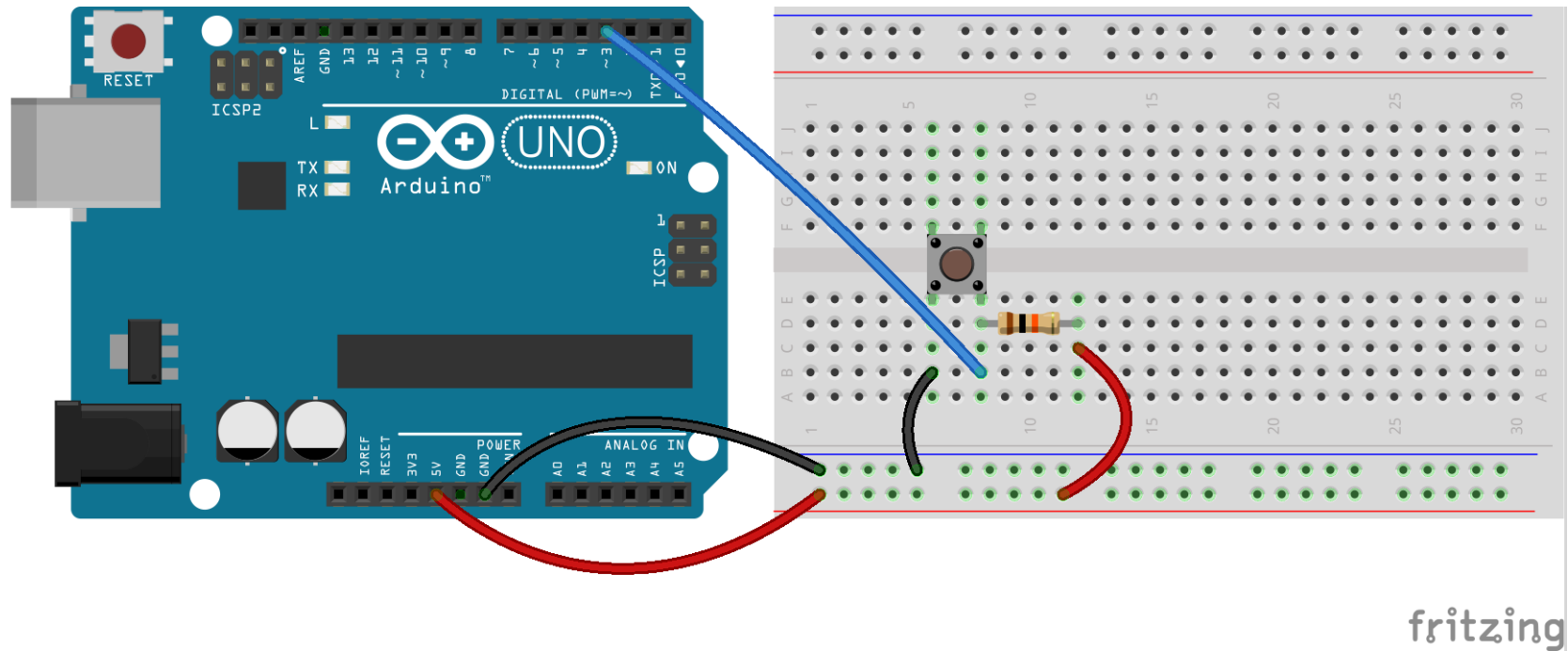
Simple push buttons and toggle switches

Basic Switch circuit

- Hook up a switch to digital pin

- Make pin an output

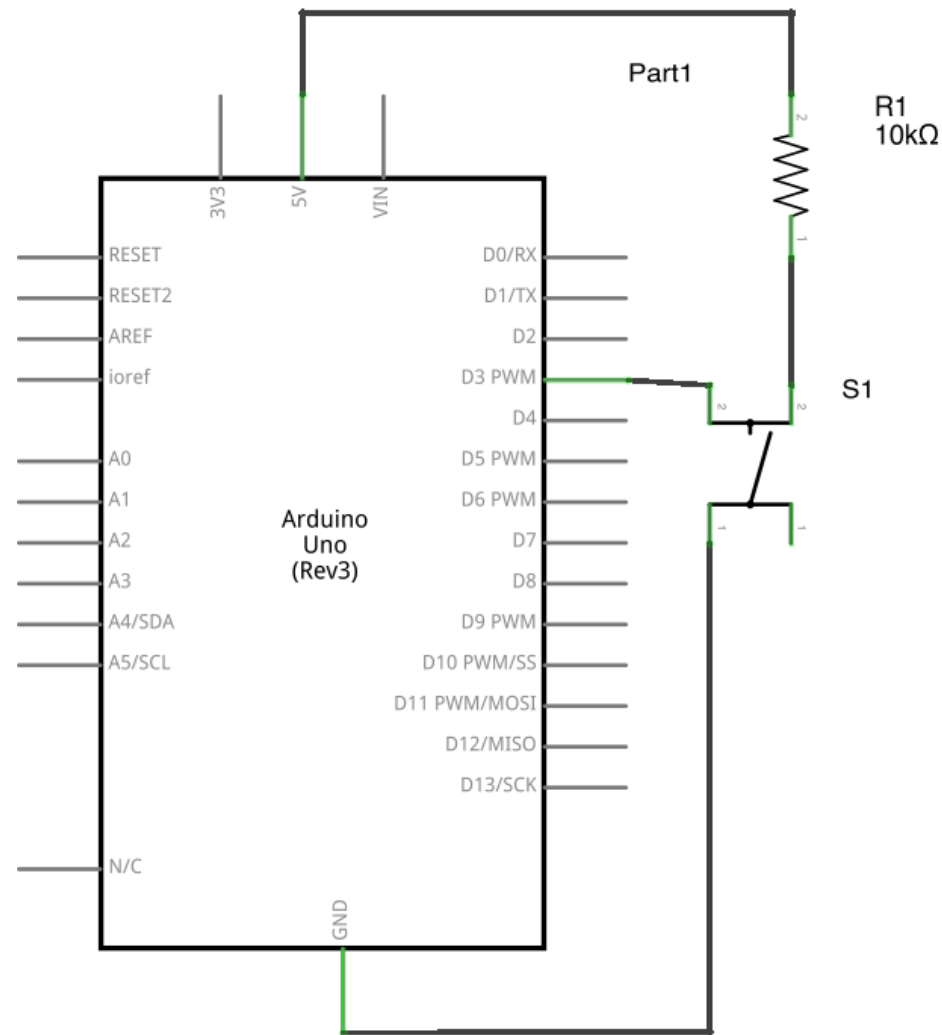- Need a pull-up resistor to work correctly

Pull up / down resistors

- Digital inputs can have 3 digital states on, off and not connected

- Get around this issue you can use a pull out or pull down resistor

- Pull ups build into Arduino but not recommended to use

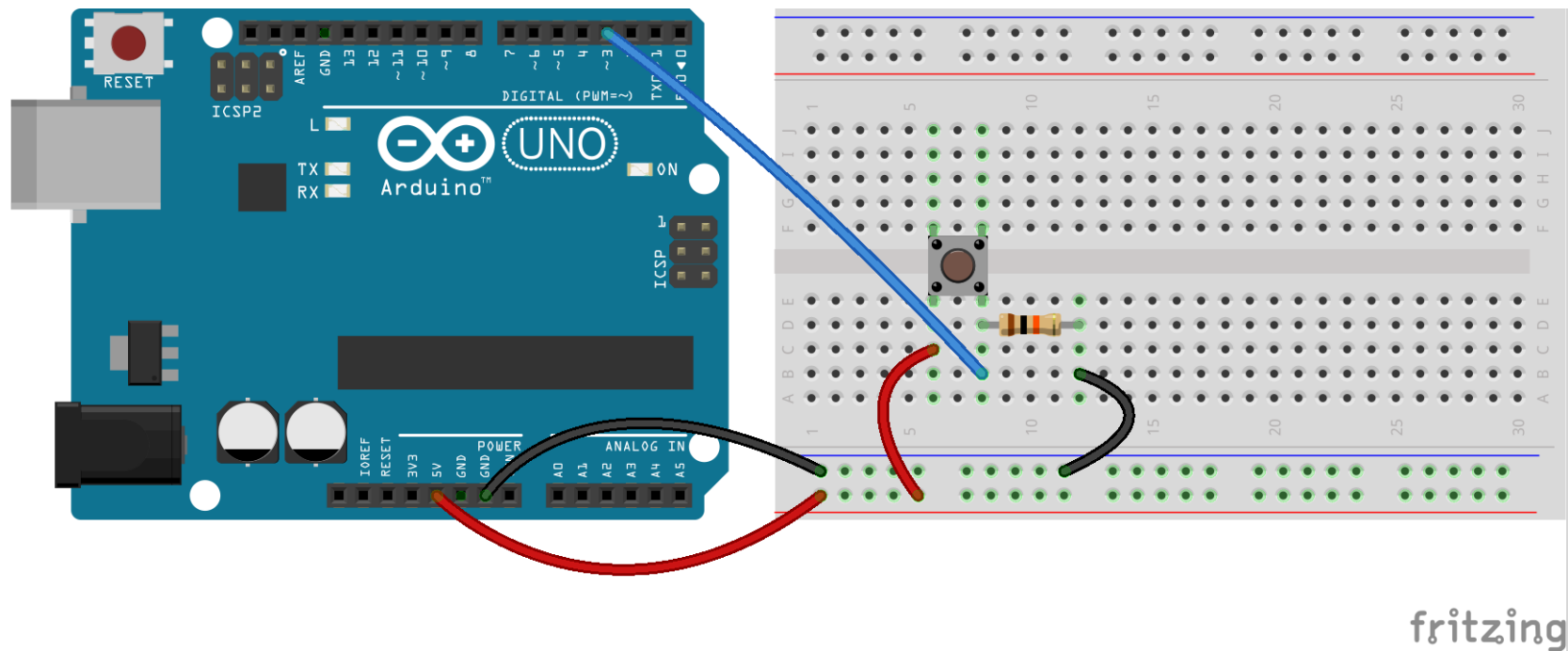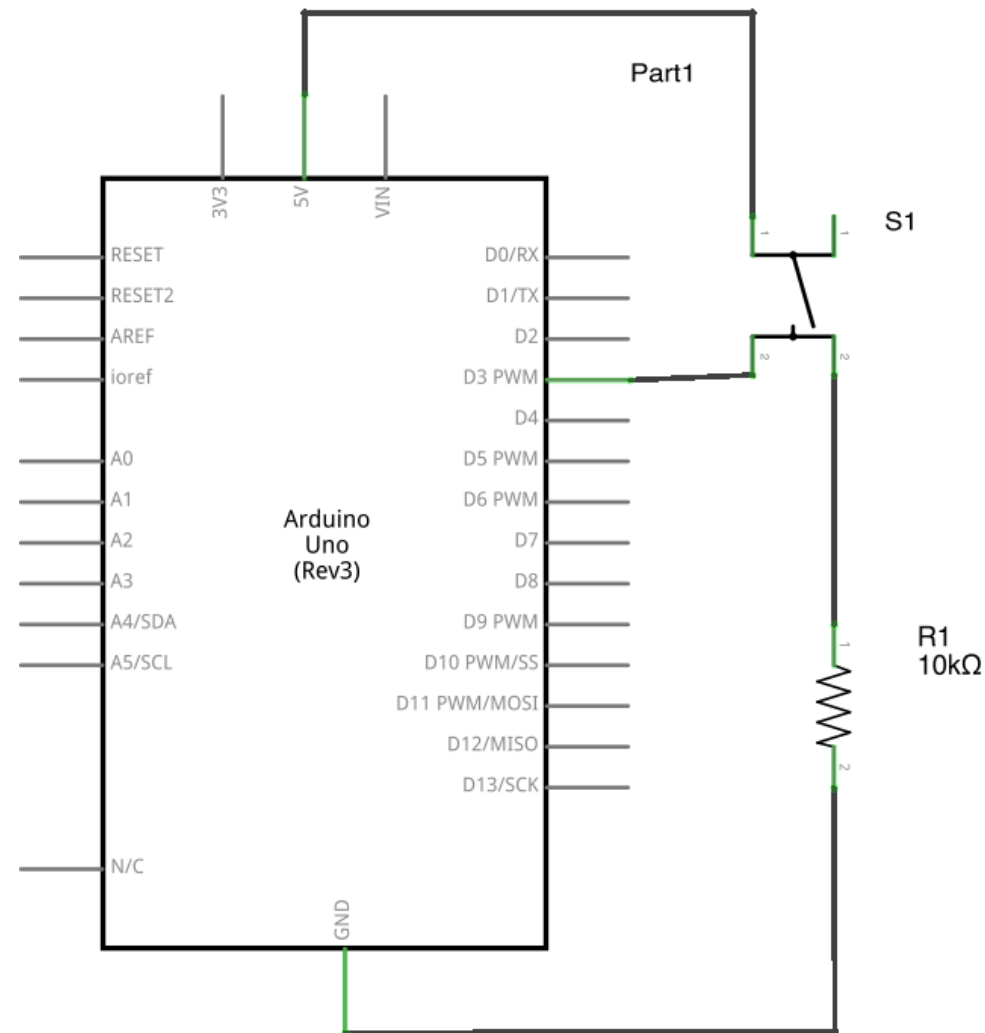- Pull down vs Pull up - what is better?

Pullup Switch Breadboard

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Pullup Switch Circuit

Pulldown Switch Breadboard

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Pulldown Switch Circuit

Switch code

- Detect if switch is on via Digital Read

- Detect push down

- Detect push up

- Count pushes

- Detect if held for x time

Experiment

- Is counting switches it accurate?

- How fast can you turn it on and off?

- Change the circuit to use a pull down rather than a pull up resistor. Does the code need to change?

- Do you have to use the pull-up resistor?

Joystick Circuit

- Actually 5 switches

- One for up, down, left, right and centre

- Some joysticks uses two analog potentiometers

Switch Issues

- Switch bounce

- Varies each time and by switch types

- Typically stated 5 to 20 ms, but for switch we using 1ms or less

Switch debounce code

- Wait for change

- Wait some time (5 - 20 ms is good)

- If value still changed good to go

Questions

- When is the button push detected?

- Can you fool the software?

- Is this accurate?

RC Filter

- Can slow down sudden changes with a capacitor and a resistor

- delay time = R * C, T5 = fully charged

- However > 2.5V is HIGH so rough time is just R * C

- Example 10K resistor and 1uF capacitor 10,000 ohms * 0.000001 farads = 0.01 seconds = 10 milli secends
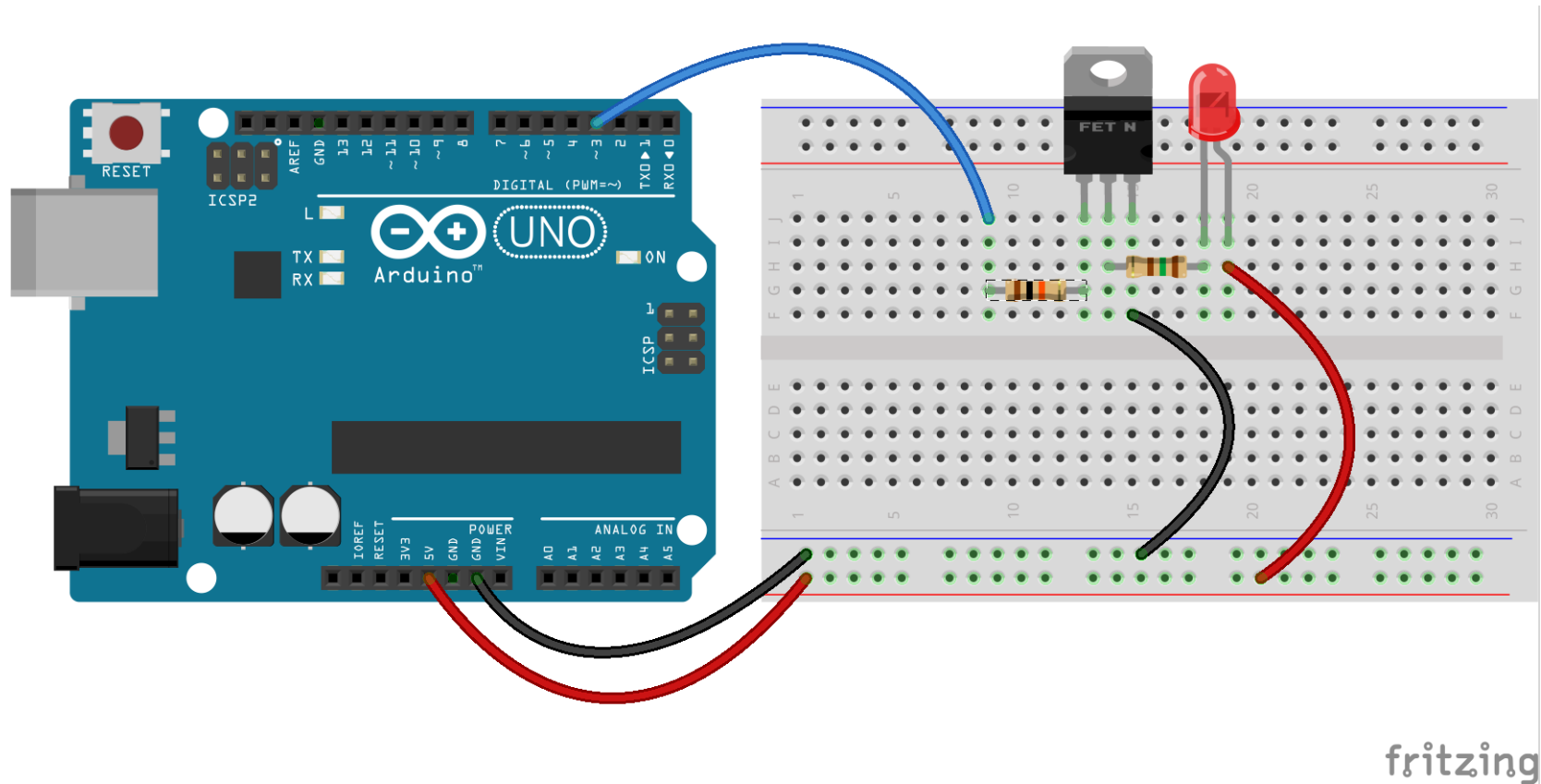
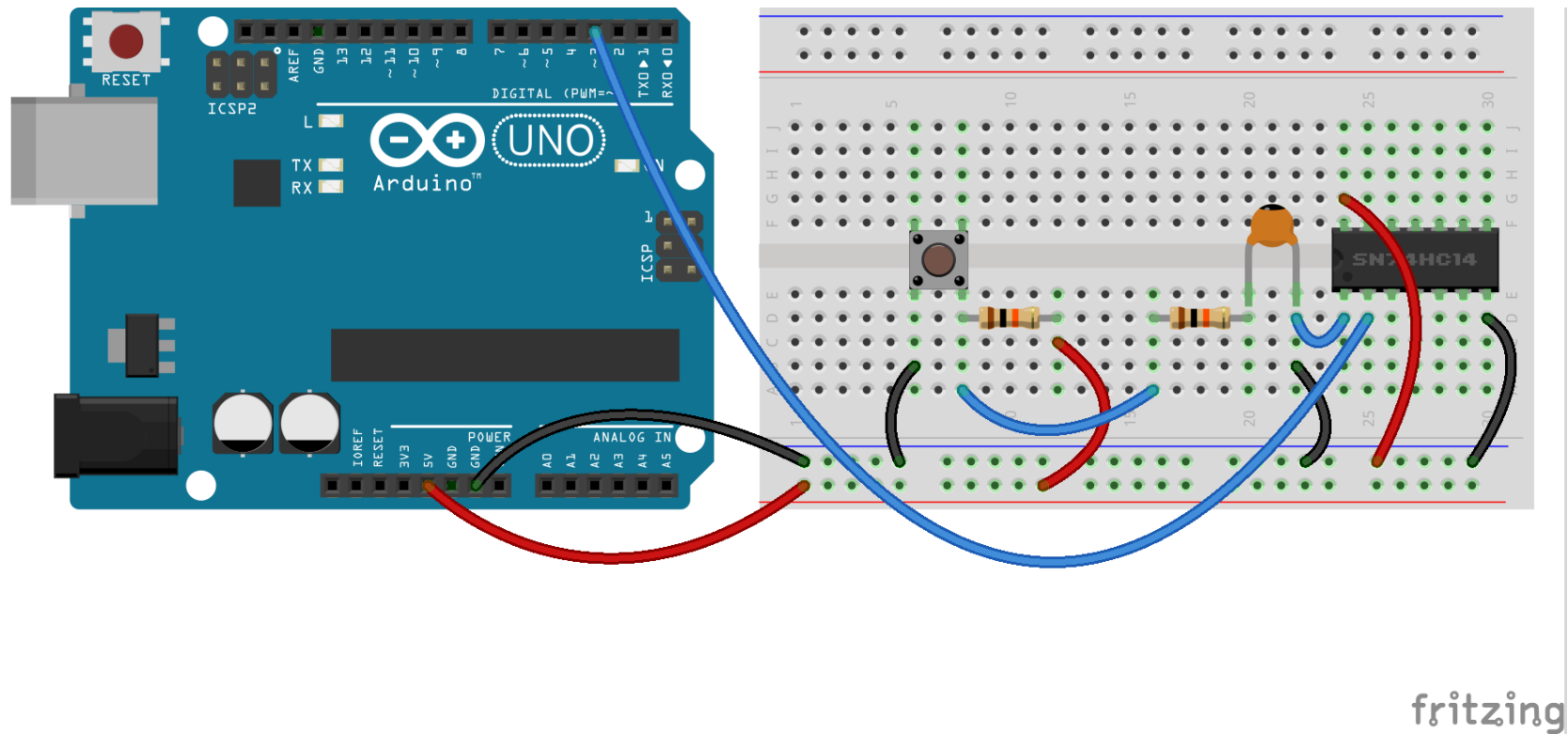# RC Switch Breadboard

RC Switch Circuit

Questions

- When is the button push detected?

- Can you fool the hardware?

- What happens if you change the value of the capacitor?

Schmitt Trigger

- Cheap (< 20 cents for 6 on an IC)

- Output is always HIGH or LOW

- Negates input i.e. HIGH becomes LOW and LOW becomes HIGH

- Hysteresis solves bounce issues

Trigger Switch Breadboard

Trigger Switch Circuit

Questions

- When is the button push detected?

- Can you fool the hardware?
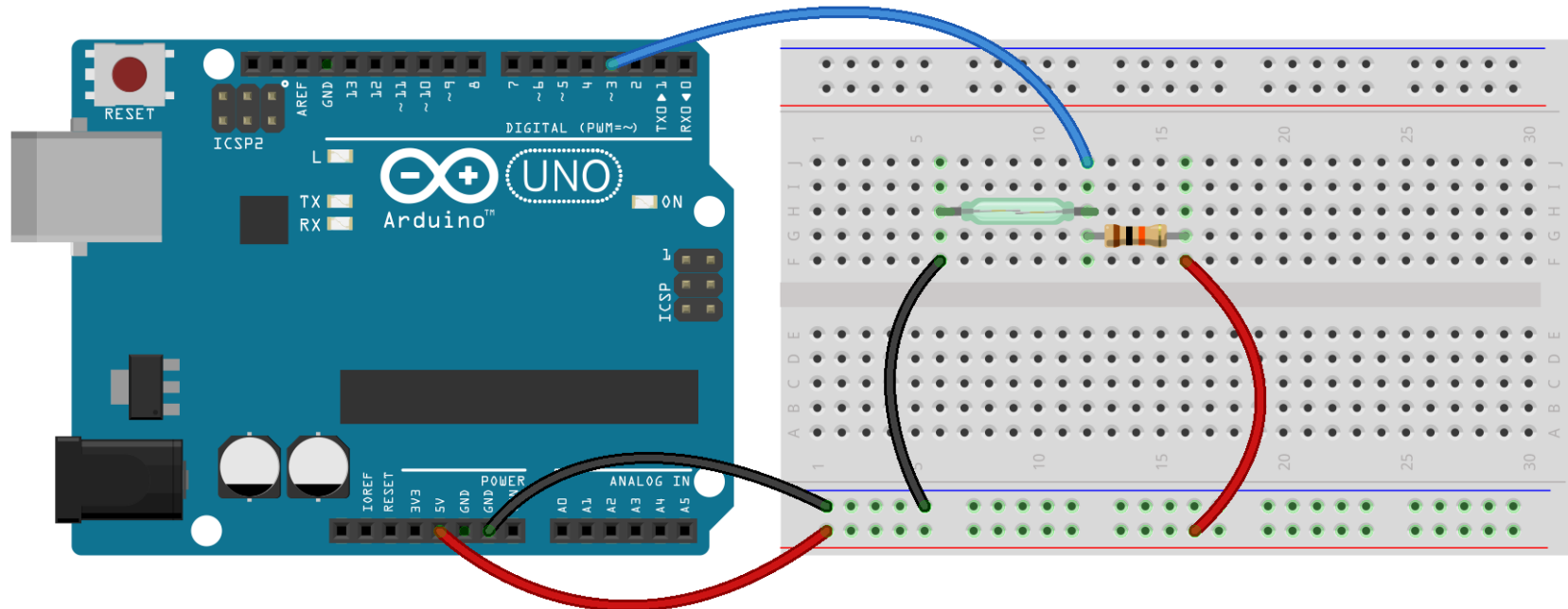
Analog Input as switches

- Can use as a 1 bit A to D converter!

- Noisy input can be an issue

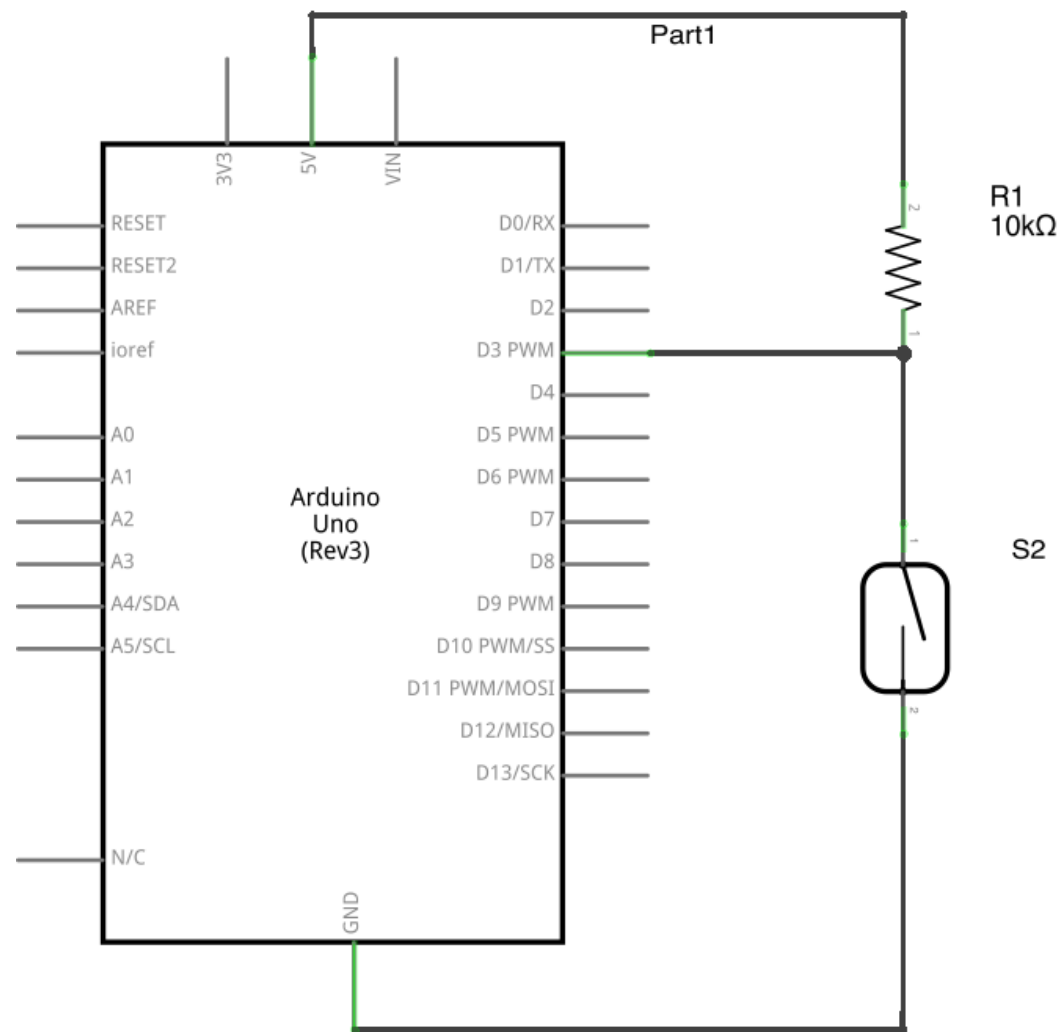# Magnetic

Reed and hall effect switches

Reed switch

- Circuit same as basic switch

- Can get normally open or normally closed reed switches

- Code the same as basic switch circuit

Reed Switch Breadboard

fritzing

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ReedSwitch Circuit

Questions

- When might you need a normally closed switch?

- How long would a reed switch last?

Hall effect

- Latch not switch, but can get switch forms

- South pole turns on, north pole turns off

- Digital output with right components

Questions

- Why use a hall effect switch over a reed switch?
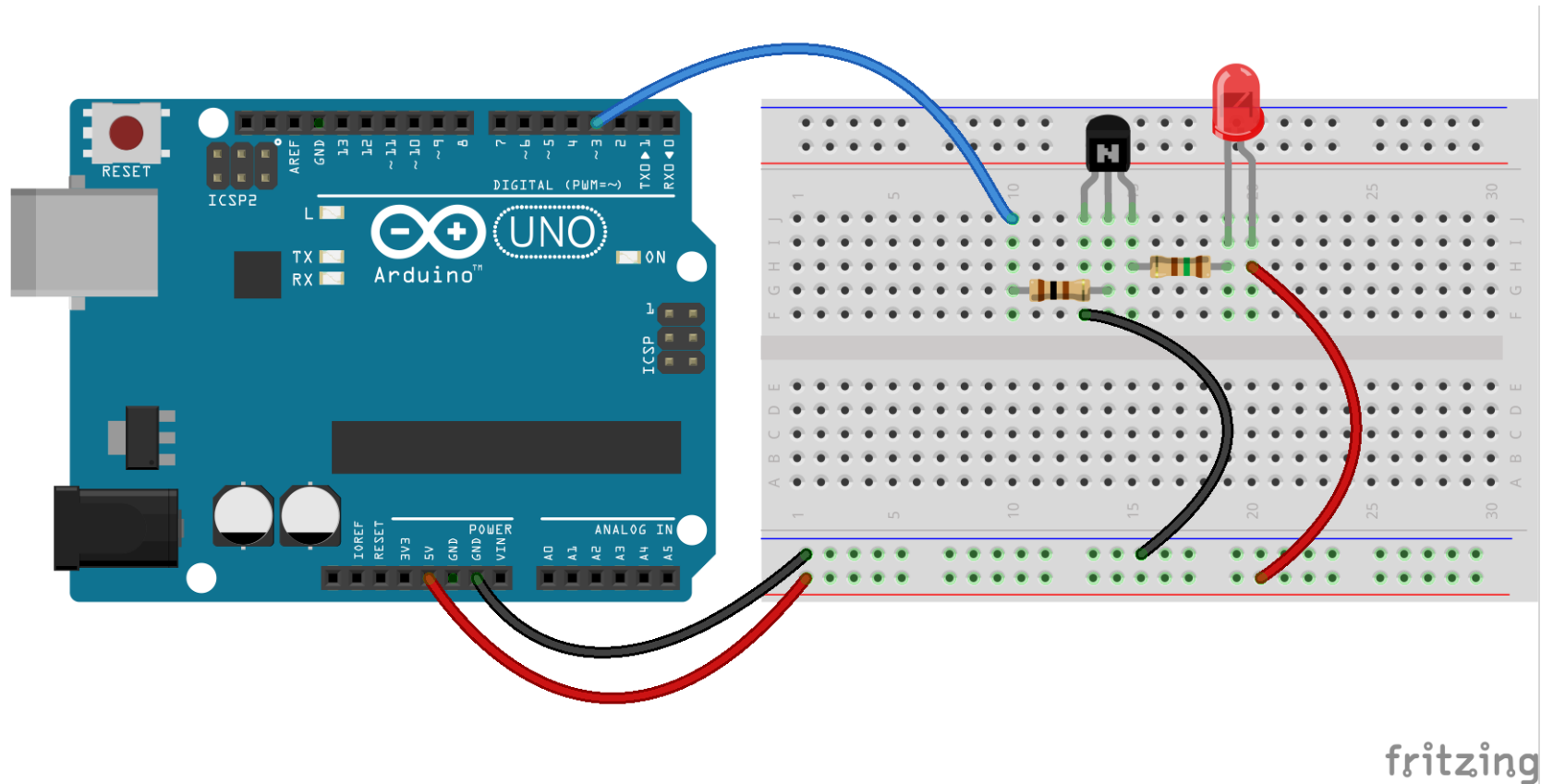
Transistors

Using transistor to switch

Transistors Switch

- Transistors can be used as a switch

- Can use small current / voltage to switch larger current voltage

- Need a (large value) resistor

- NPN vs PNP

- HFE is important

Transistor code

- Circuit with standard NPN transistor

- Load is connect to 5V

- Make a LED Blink!

NPN Switch Breadboard

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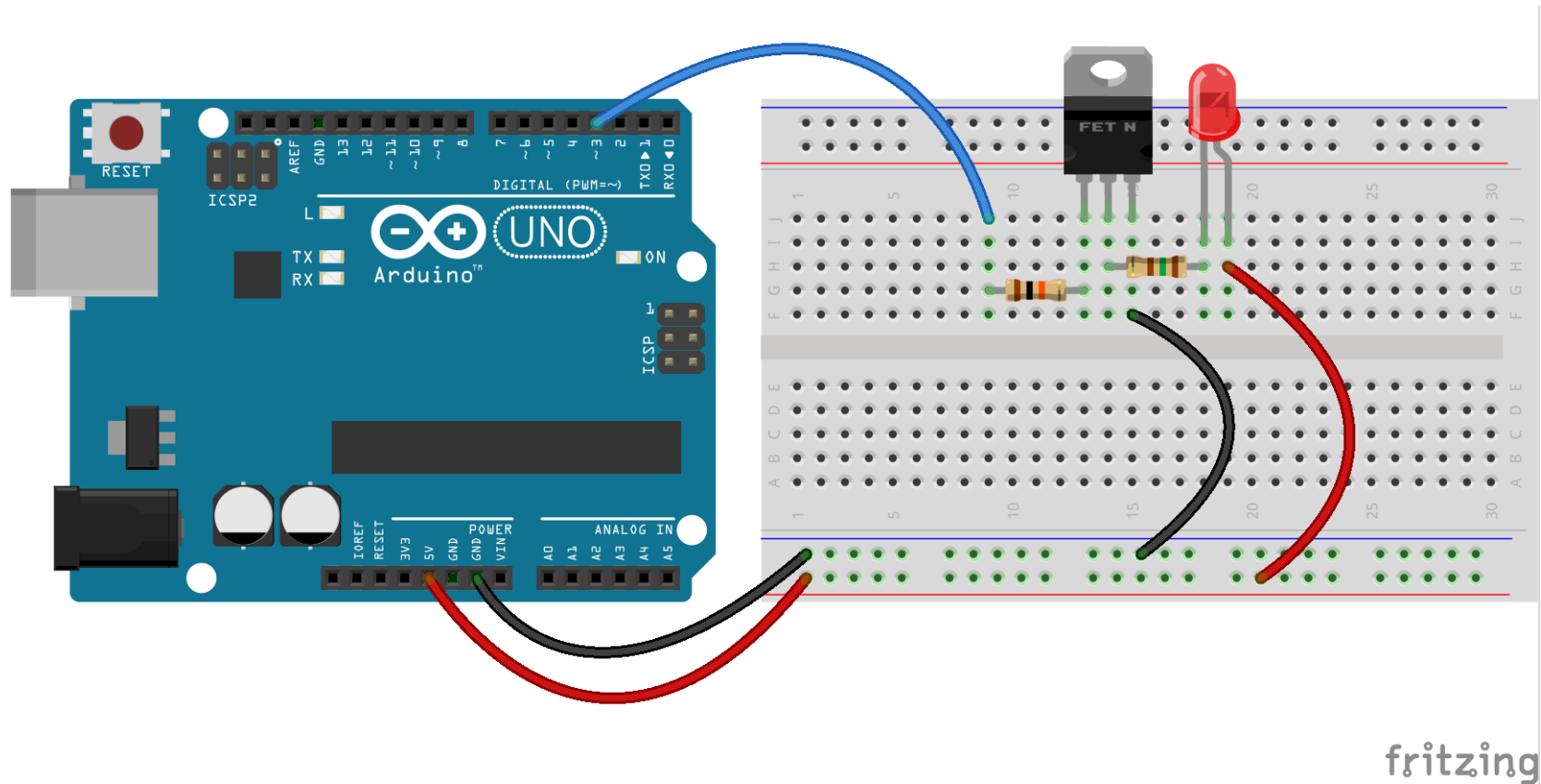
NPN Switch Circuit

Transistor code

- Circuit with standard PNP transistor

- Load is connected to ground

- Make a LED Blink!

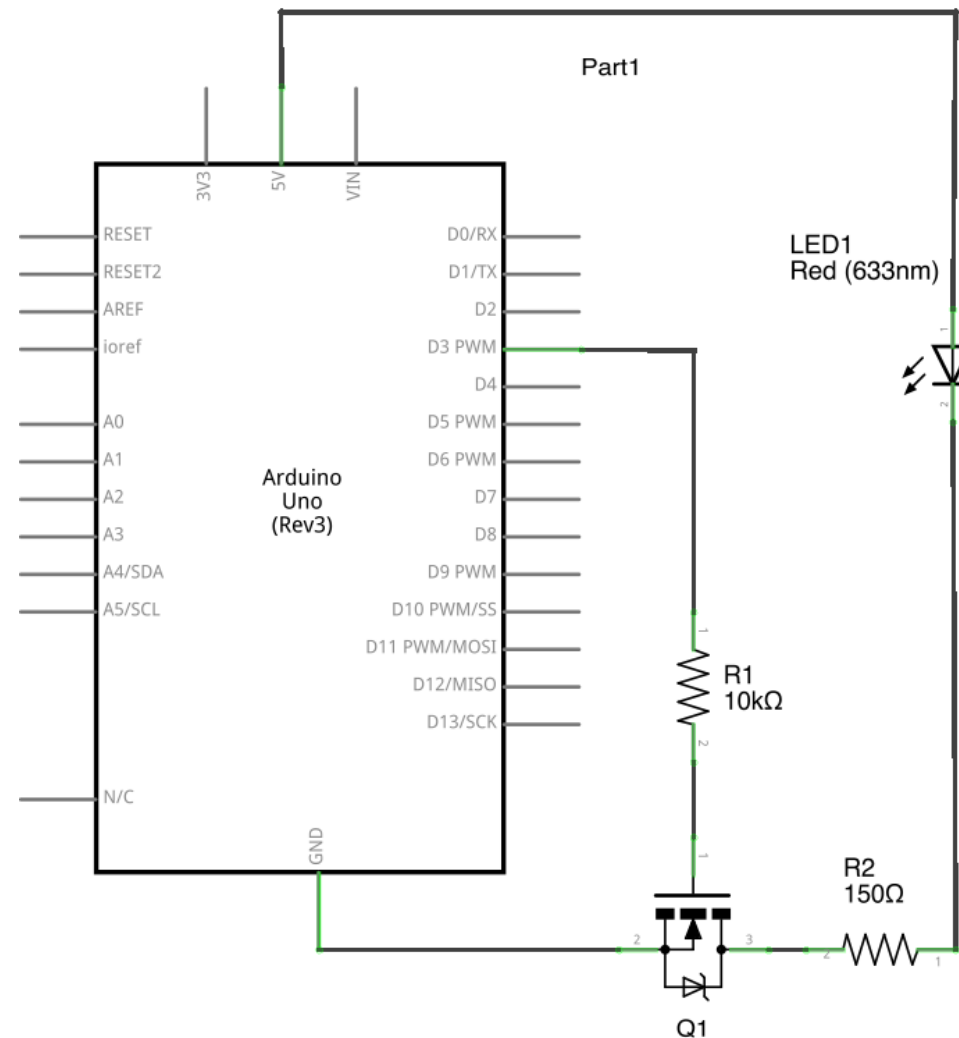# Transistor code

- Circuit with mosfet transistor

- Make a LED Blink!

Mosfet Switch Breadboard

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Mosfet Switch Circuit

Questions

- Why use a transistor as a switch?

Light

Photo-interrupter, optocoupler and reflective sensor

Basic Switch circuit

- Hook up a switch to digital pin

- Make pin an output

- Add pull-up resistor

Switch code

- Detect if switch is on

Experiment

- Can you count presses? Is it accurate?

- How fast can you turn it on and off?

Questions

- Why is a pull up resistor required?

Keypad

Description

Basic Switch circuit

- Hook up a switch to digital pin

- Make pin an output

- Add pull-up resistor

Switch code

- Detect if switch is on

Experiment

- Can you count presses? Is it accurate?

- How fast can you turn it on and off?

Questions

- Why is a pull up resistor required?

Relays

Using a relay as a switch

Basic Switch circuit

- Hook up a switch to digital pin

- Make pin an output

- Need a pull-up resistor to work correctly

Switch code

- Detect if switch is on

Experiment

- Can you count presses? Is it accurate?

- How fast can you turn it on and off?

Questions

- Why is a pull up resistor required?