

Arduino For Total Newbies

w/ TV-B-Gone as example project

Mitch Altman

Chief Scientist, **Cornfield Electronics**, San Francisco, CA

Inventor of **TV-B-Gone** universal remote controls

Co-founder of **3Ware** (successful Silicon Valley startup)

Pioneer of **VR** (in the mid-1980s)

Founding mentor at **HAX** (1st and biggest hardware accelerator)

Co-founder of **Noisebridge** (San Francisco hackerspace)

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site: www.CornfieldElectronics.com

facebook: [maltman23](https://www.facebook.com/maltman23)

flickr: [maltman23](https://www.flickr.com/photos/maltman23/)

WeChat: [mitchaltman](#)

Fediverse: [@maltman23@mastodon.social](https://maltman23@mastodon.social)

Patreon: [mitchaltman](#)



**PLEASE
DO NOT
open anything
yet!**

Arduino For Total Newbies

w/ TV-B-Gone as example project

Bring all of this
home with you!

Stuff!



extra parts



USB-Serial
cable



U-Do-It-Duino kit



Parts Pack

Syllabus

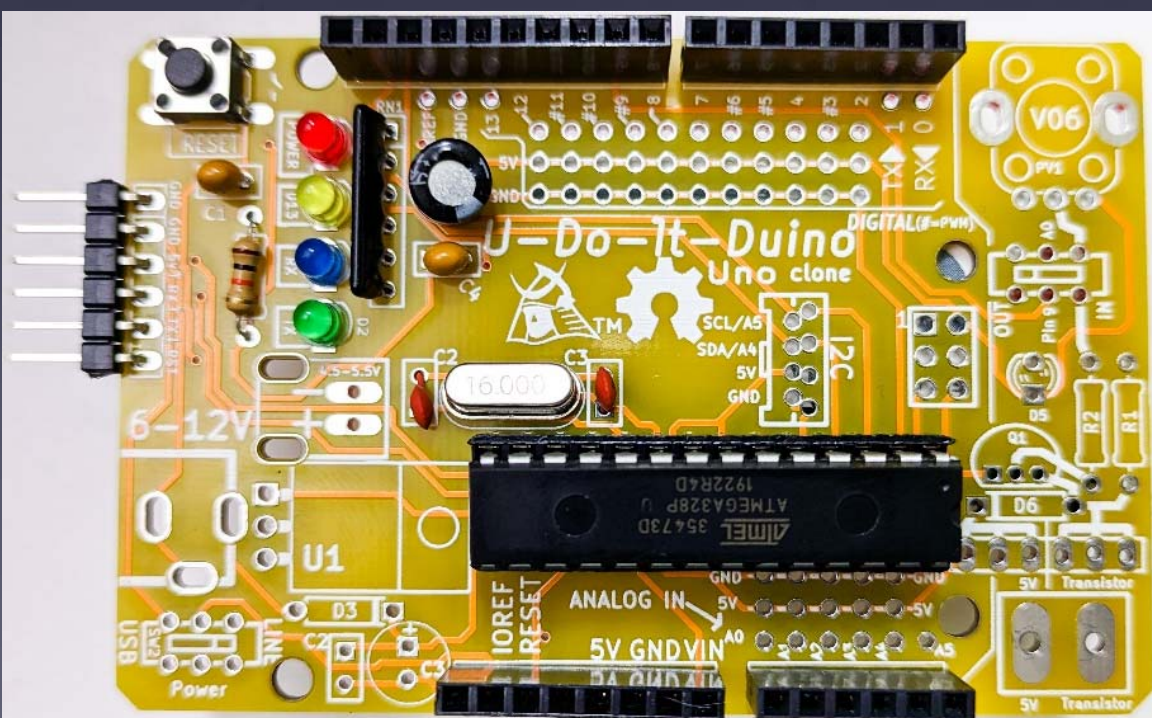
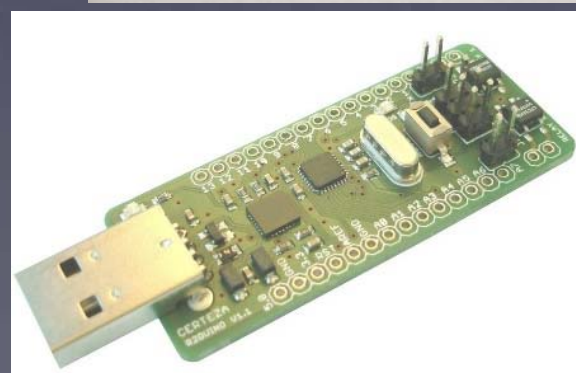
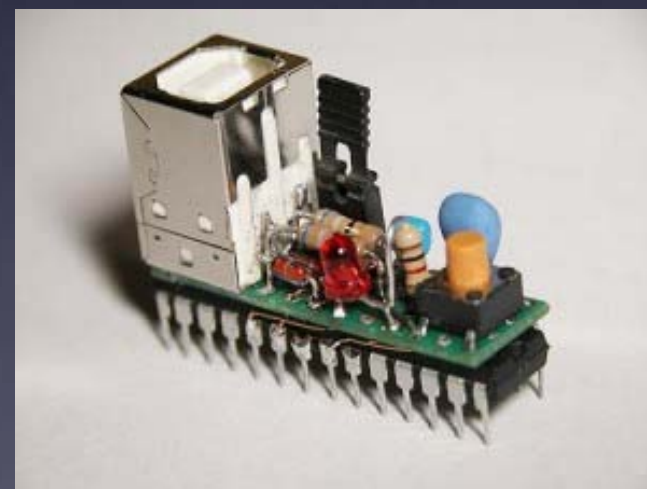
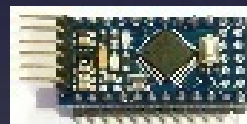
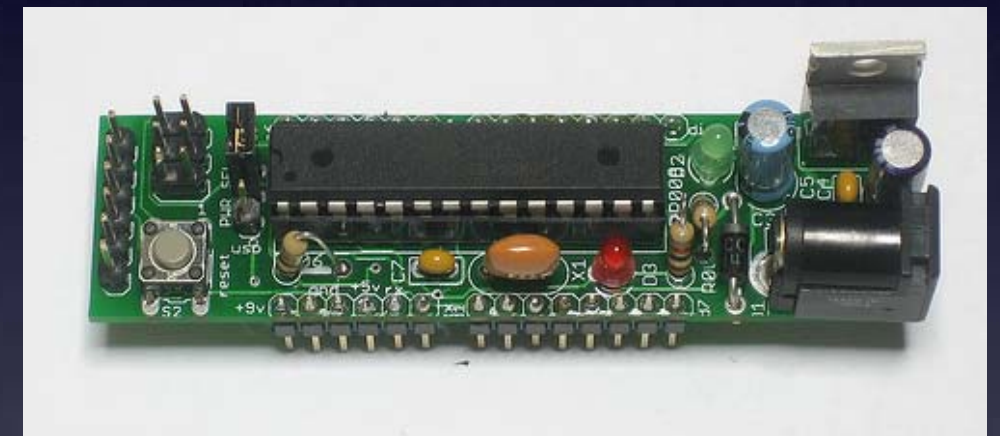
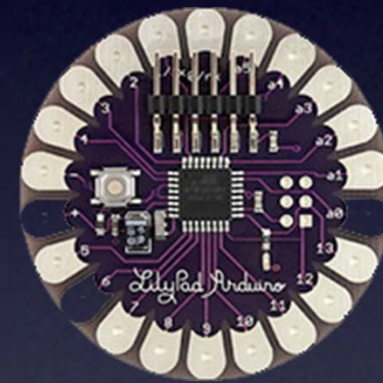
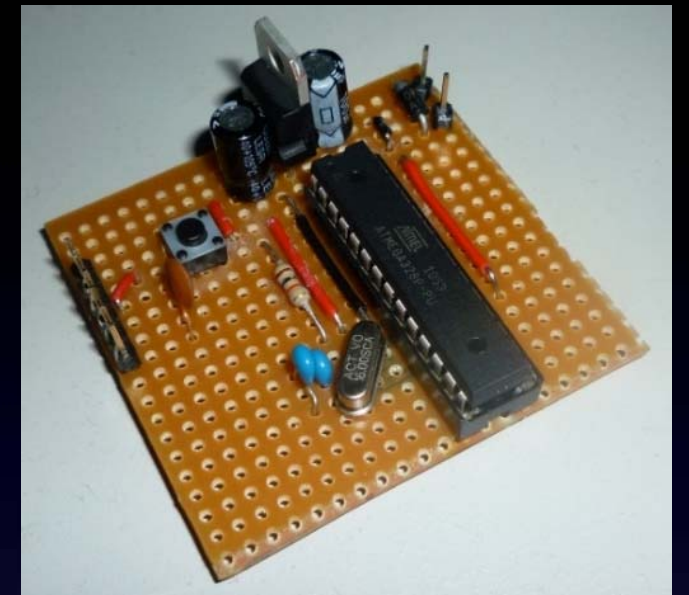
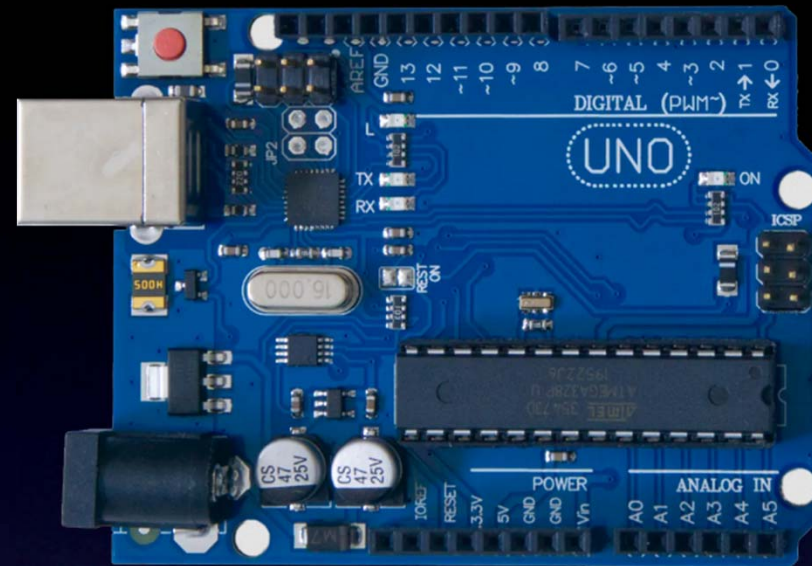
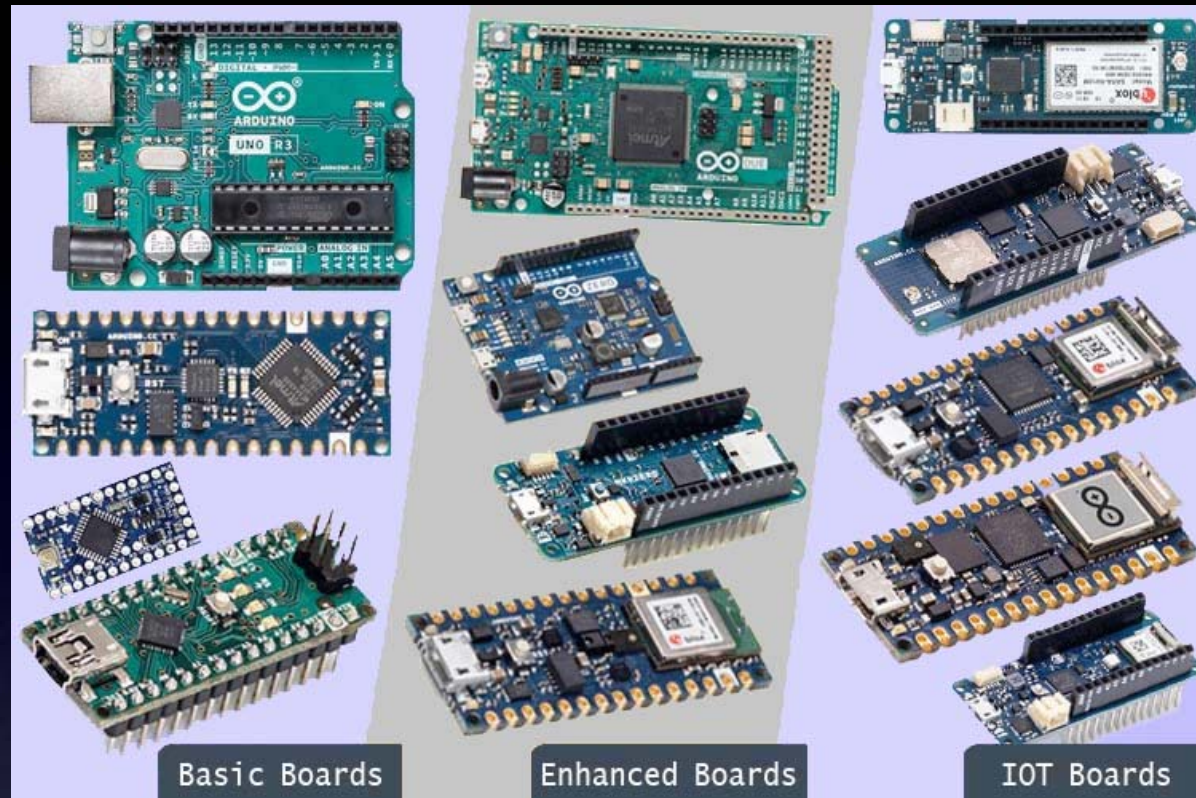
- Intro
- Everything You Need to Know About Electronics
- How to solder / make your own Arduino
- How to Set Up and Use the Arduino Software
- How to Hack Arduino Programs (“Sketches”)
- How to Use Solderless Breadboards
- How to Read a Schematic
- Make a TV-B-Gone Remote Control with your Arduino Clone without soldering

(Don't bring these home)

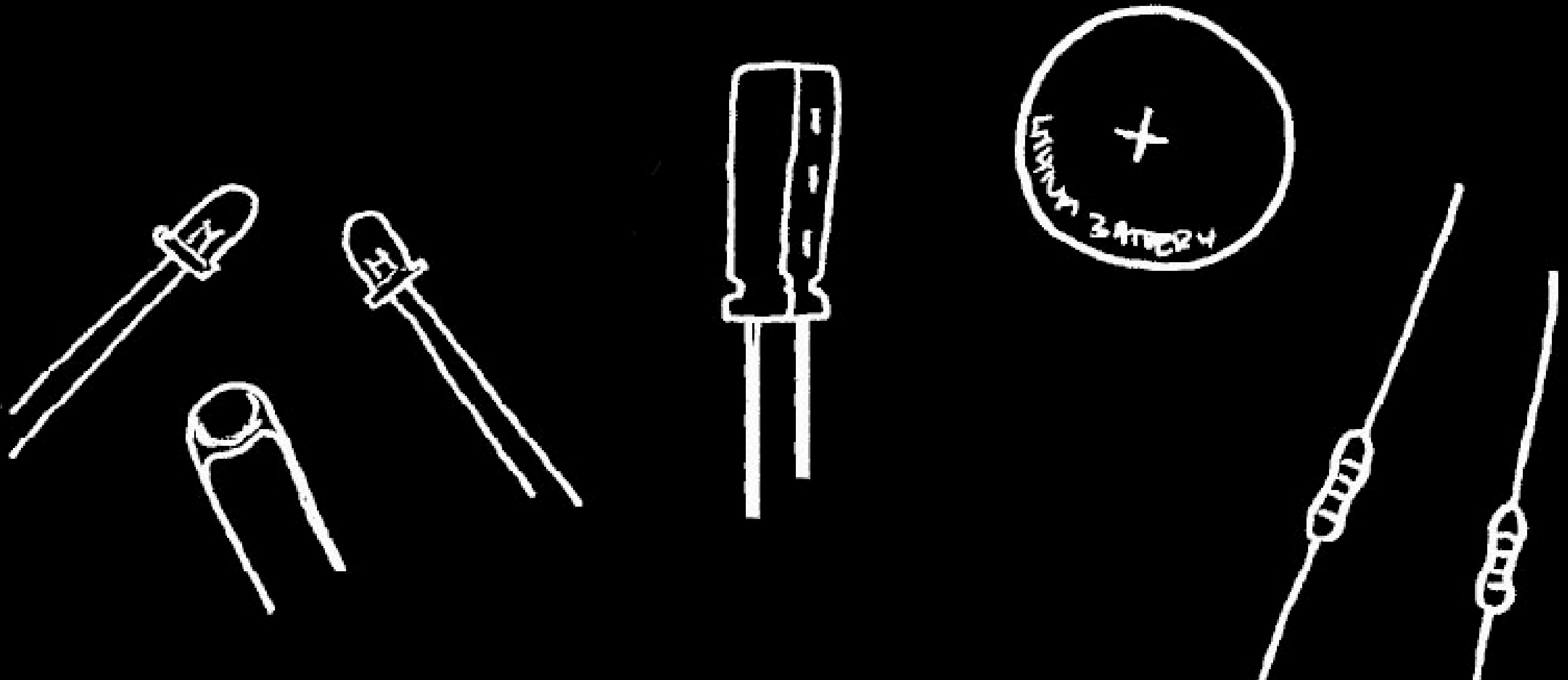
Tools



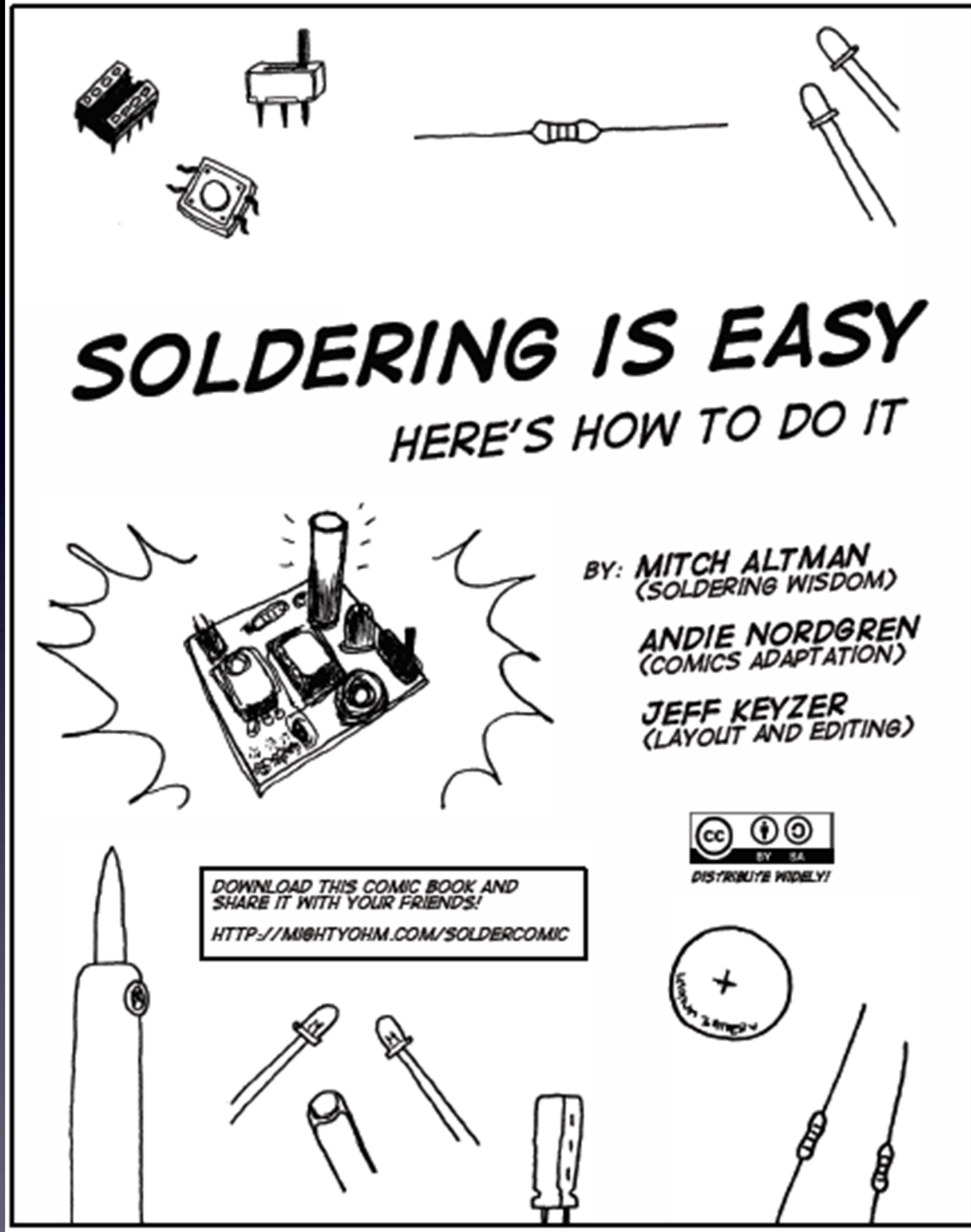
Intro



Everything You Need to Know About Electronics

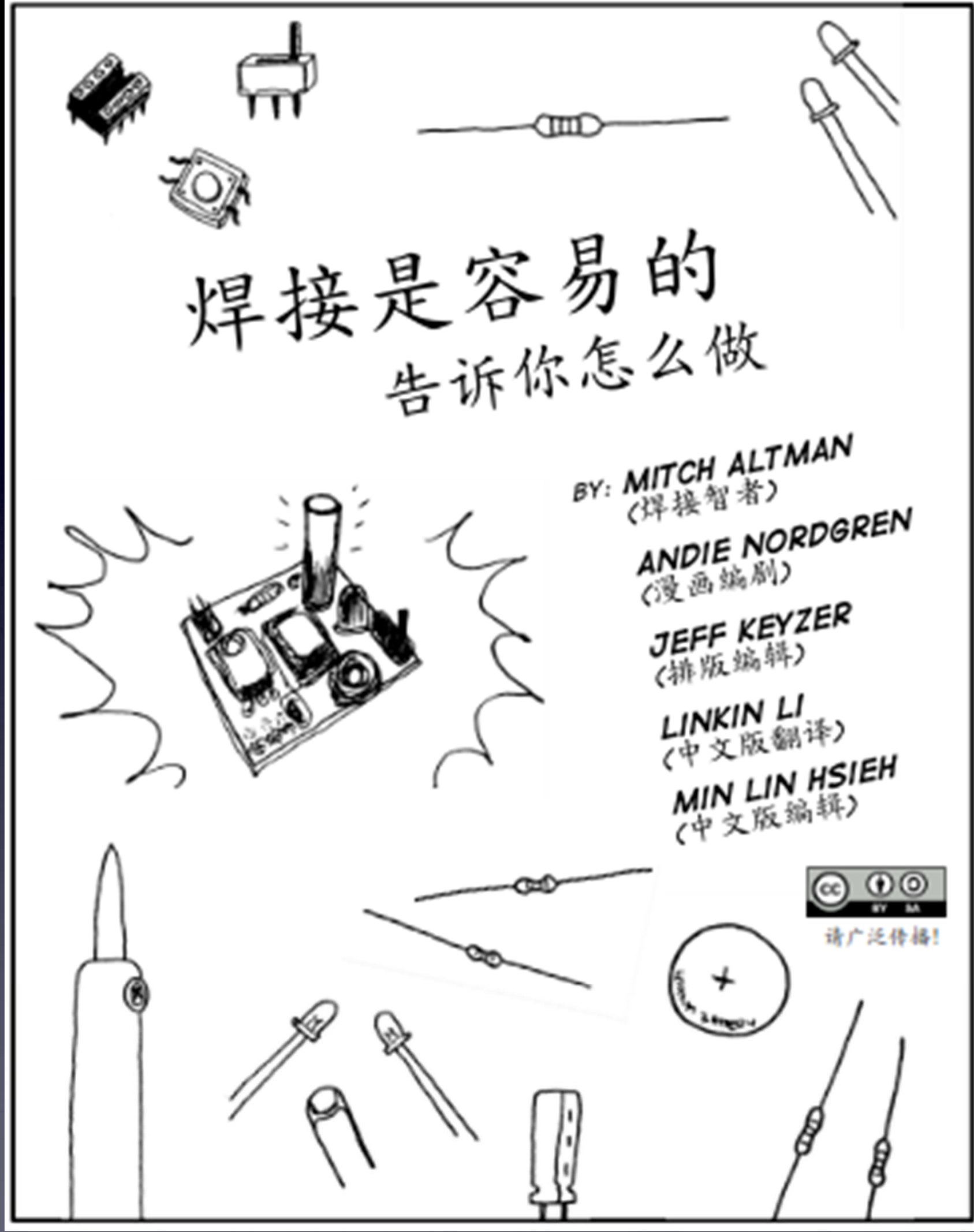


Learn To Solder



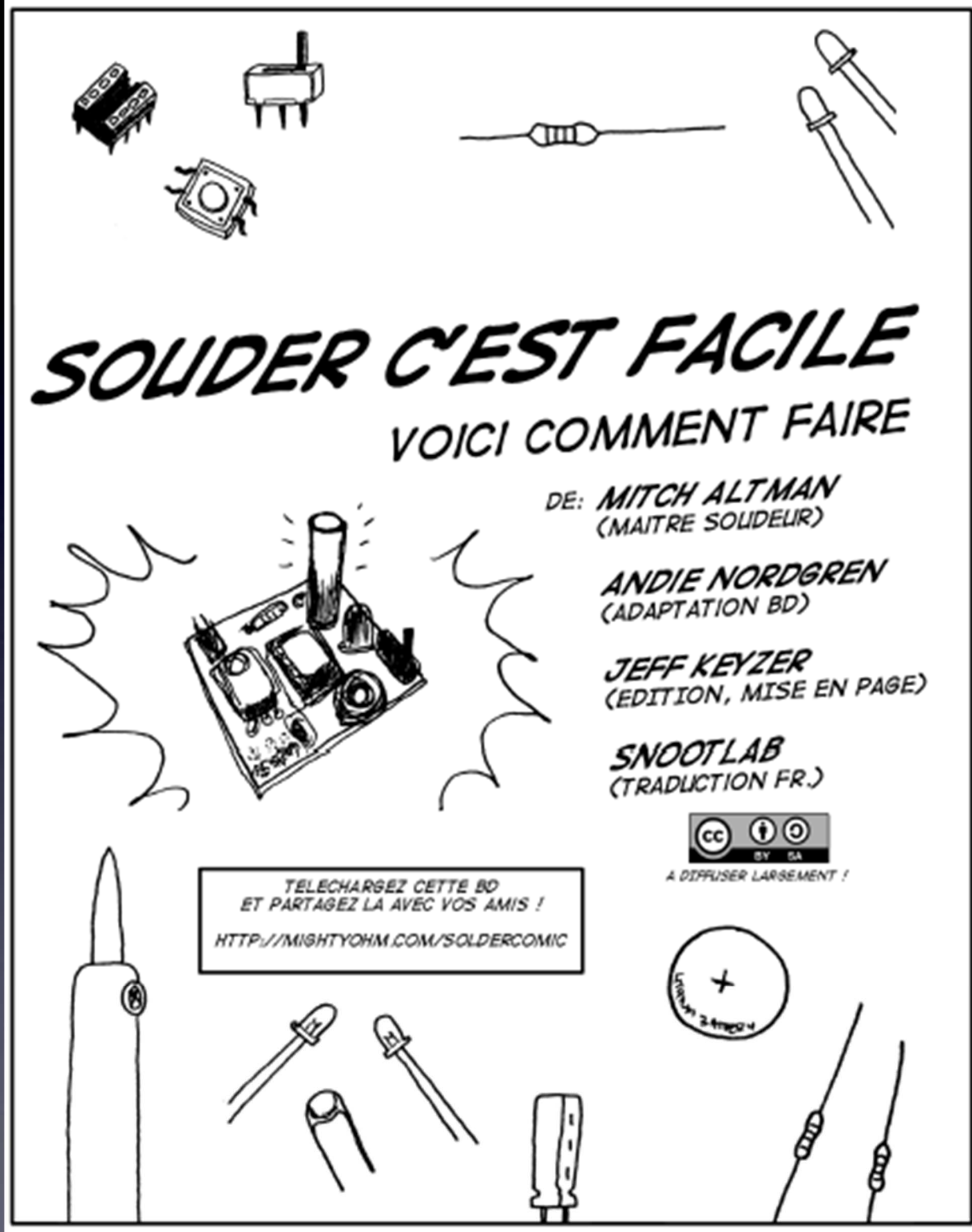
download for free at:
<http://mightyohm.com/soldercomic>
(In many different languages.)

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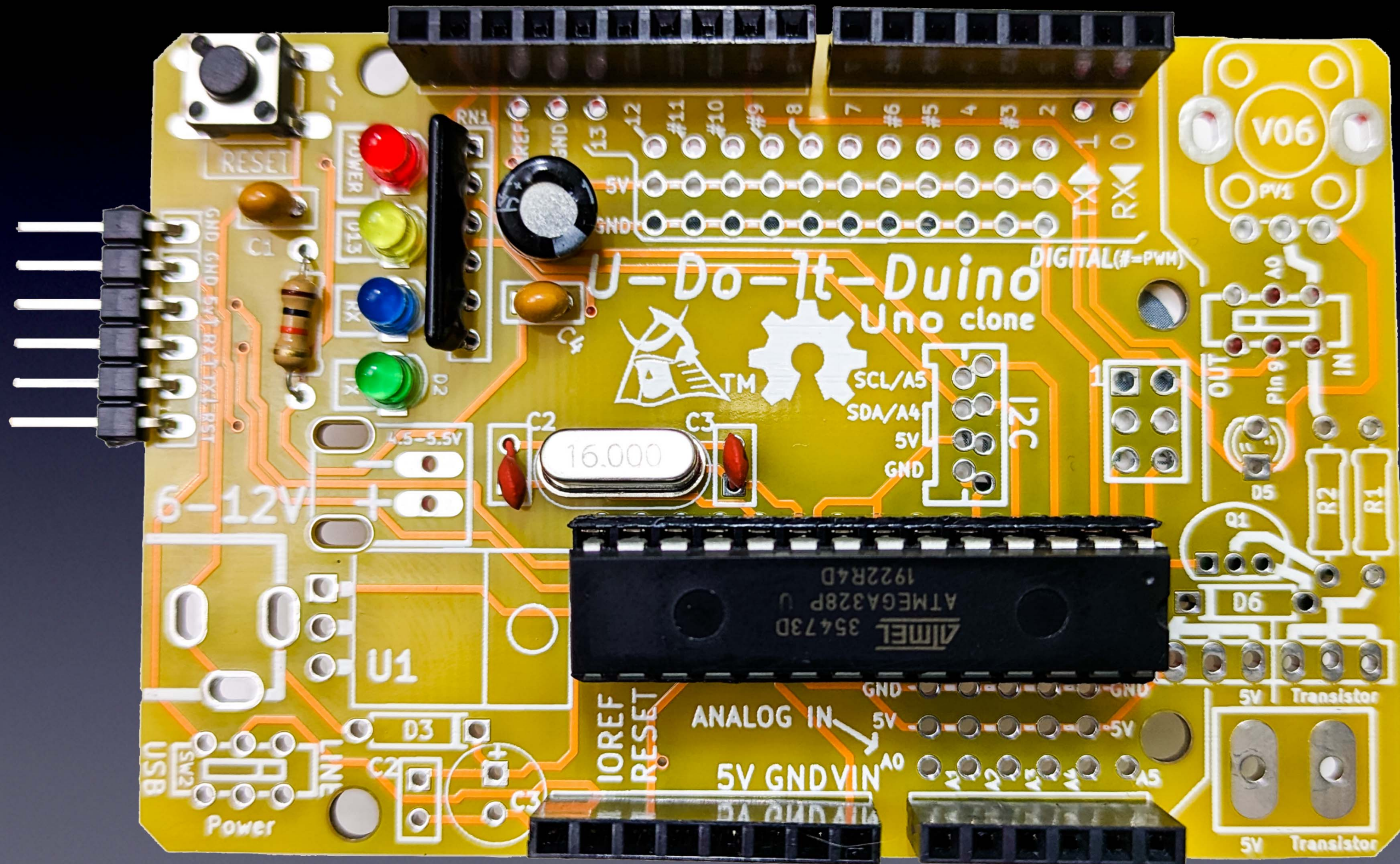
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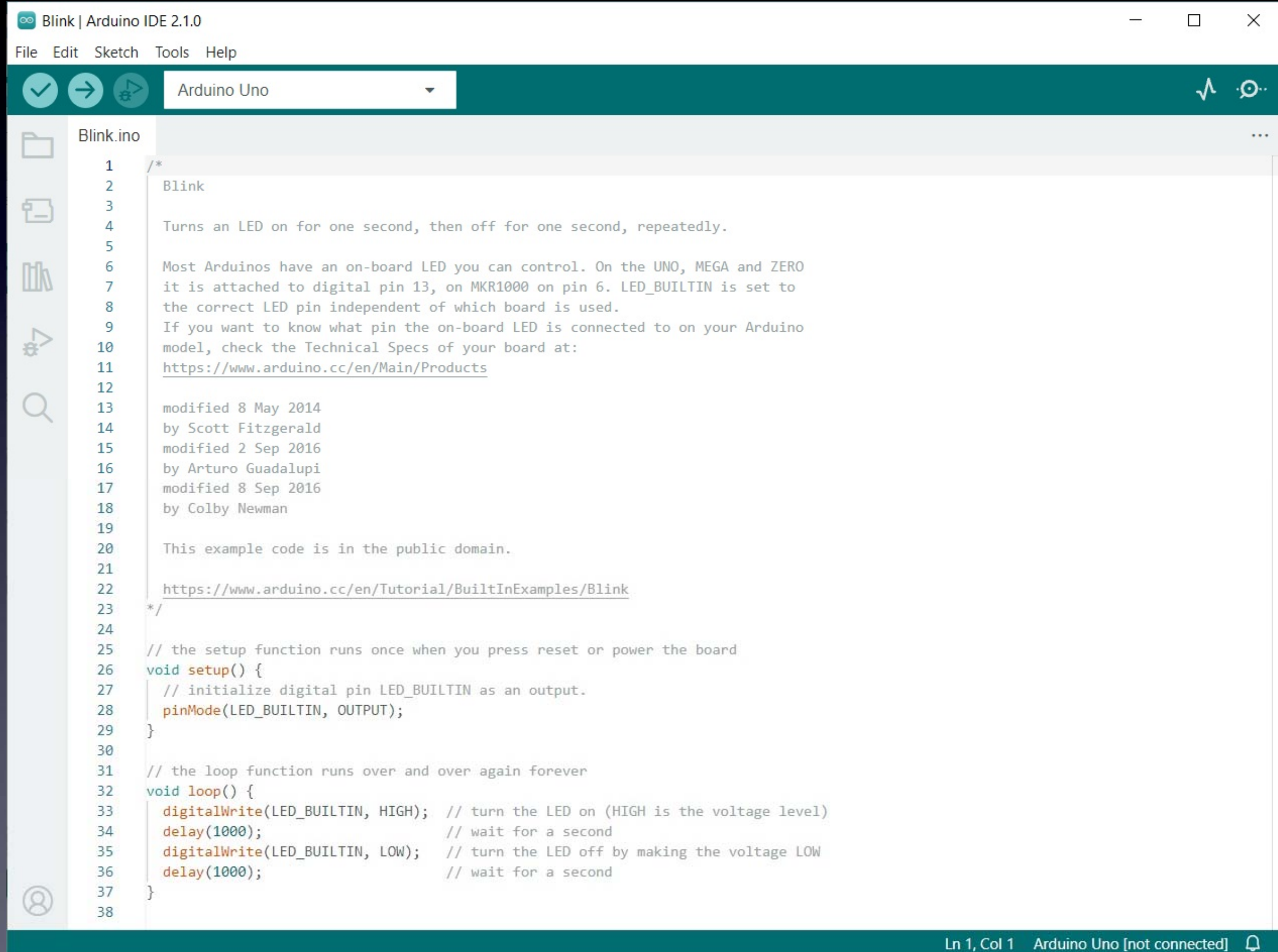
Solder Your Arduino Clone



How to Set Up and Use the Arduino Software



How to Hack Arduino Programs (“Sketches”)



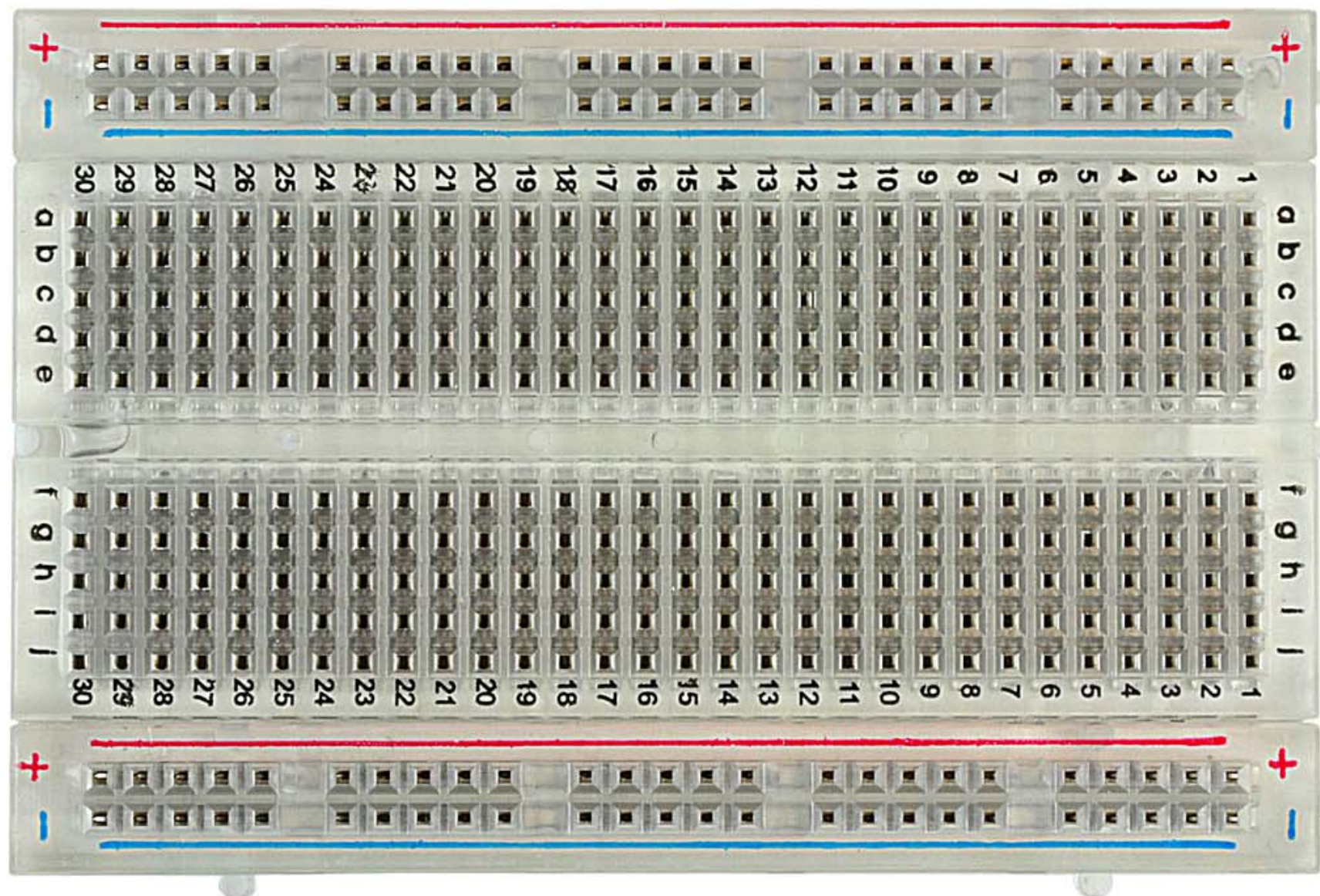
```
Blink | Arduino IDE 2.1.0
File Edit Sketch Tools Help
[Check] [Run] [Upload] Arduino Uno [Dropdown] [Waveform] [Serial]

Blink.ino
1  /*
2   Blink
3
4   Turns an LED on for one second, then off for one second, repeatedly.
5
6   Most Arduinos have an on-board LED you can control. On the UNO, MEGA and ZERO
7   it is attached to digital pin 13, on MKR1000 on pin 6. LED_BUILTIN is set to
8   the correct LED pin independent of which board is used.
9   If you want to know what pin the on-board LED is connected to on your Arduino
10  model, check the Technical Specs of your board at:
11  https://www.arduino.cc/en/Main/Products
12
13  modified 8 May 2014
14  by Scott Fitzgerald
15  modified 2 Sep 2016
16  by Arturo Guadalupi
17  modified 8 Sep 2016
18  by Colby Newman
19
20  This example code is in the public domain.
21
22  https://www.arduino.cc/en/Tutorial/BuiltInExamples/Blink
23  */
24
25  // the setup function runs once when you press reset or power the board
26  void setup() {
27    // initialize digital pin LED_BUILTIN as an output.
28    pinMode(LED_BUILTIN, OUTPUT);
29  }
30
31  // the loop function runs over and over again forever
32  void loop() {
33    digitalWrite(LED_BUILTIN, HIGH); // turn the LED on (HIGH is the voltage level)
34    delay(1000); // wait for a second
35    digitalWrite(LED_BUILTIN, LOW); // turn the LED off by making the voltage LOW
36    delay(1000); // wait for a second
37  }
38

Ln 1, Col 1 Arduino Uno [not connected]
```

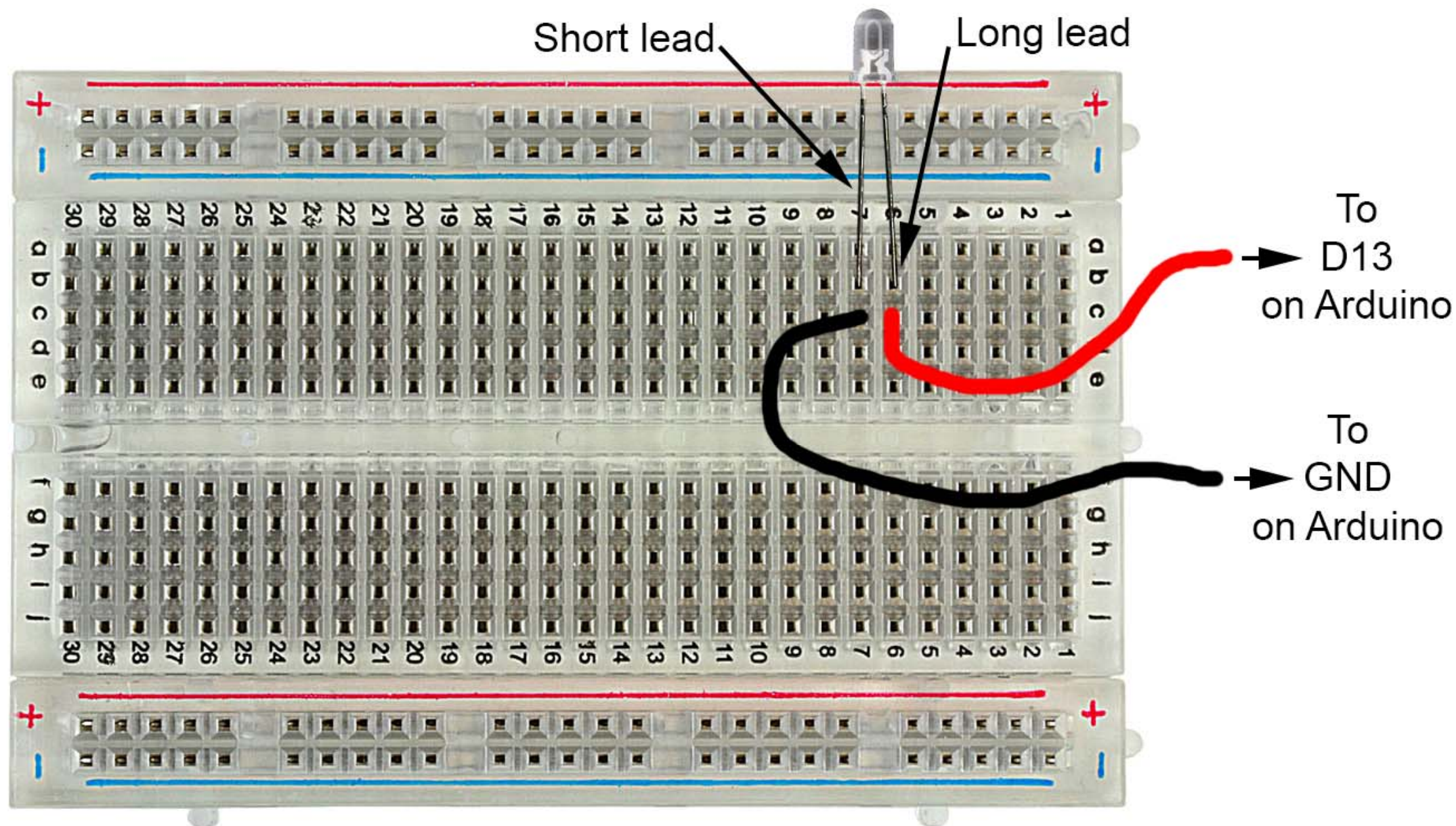

How to Use Solderless Breadboards

Solderless Breadboard



How to Use Solderless Breadboards

Solderless Breadboard with LED and wires

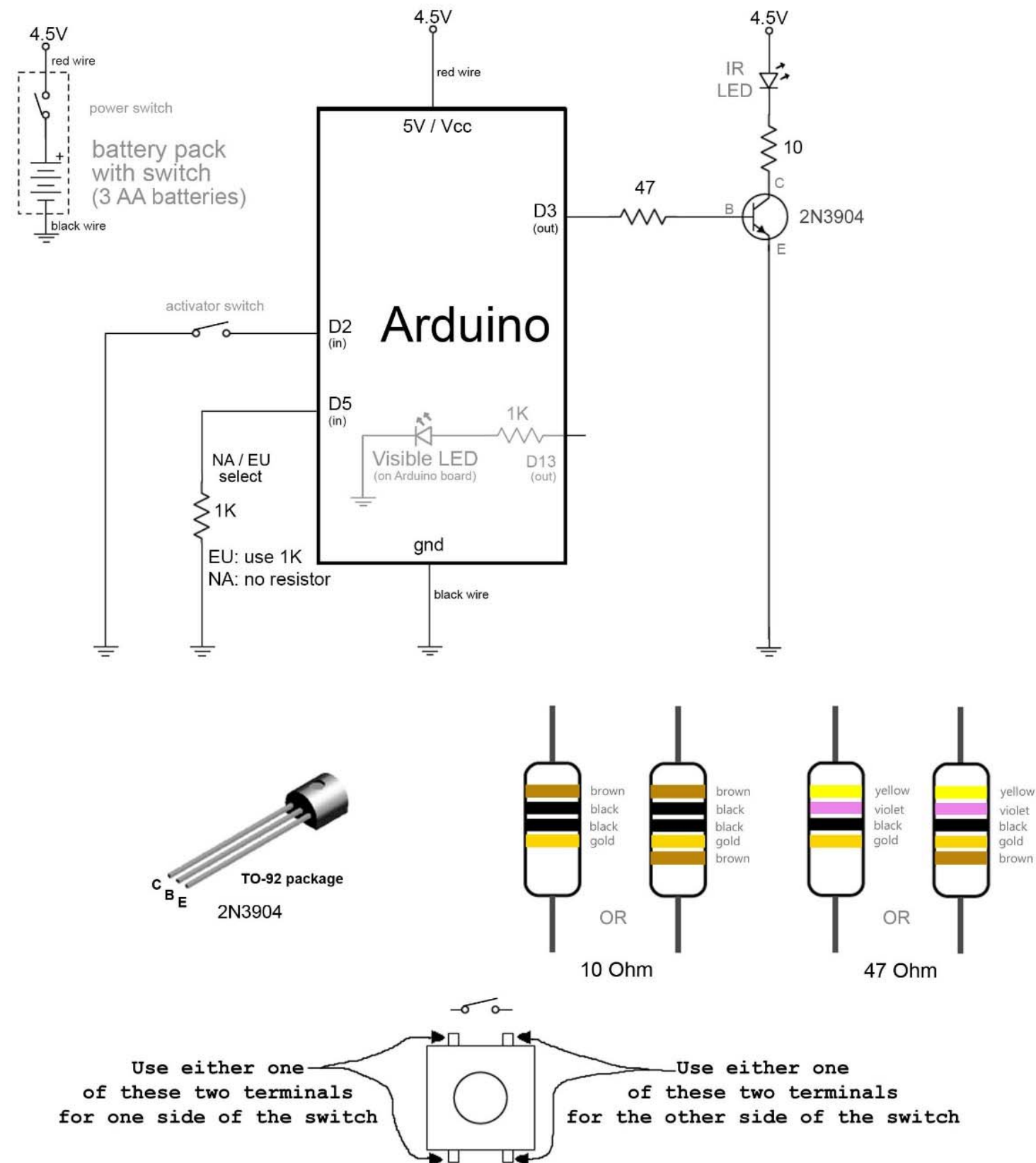


How to Read a Schematic

Arduino For Total Newbies

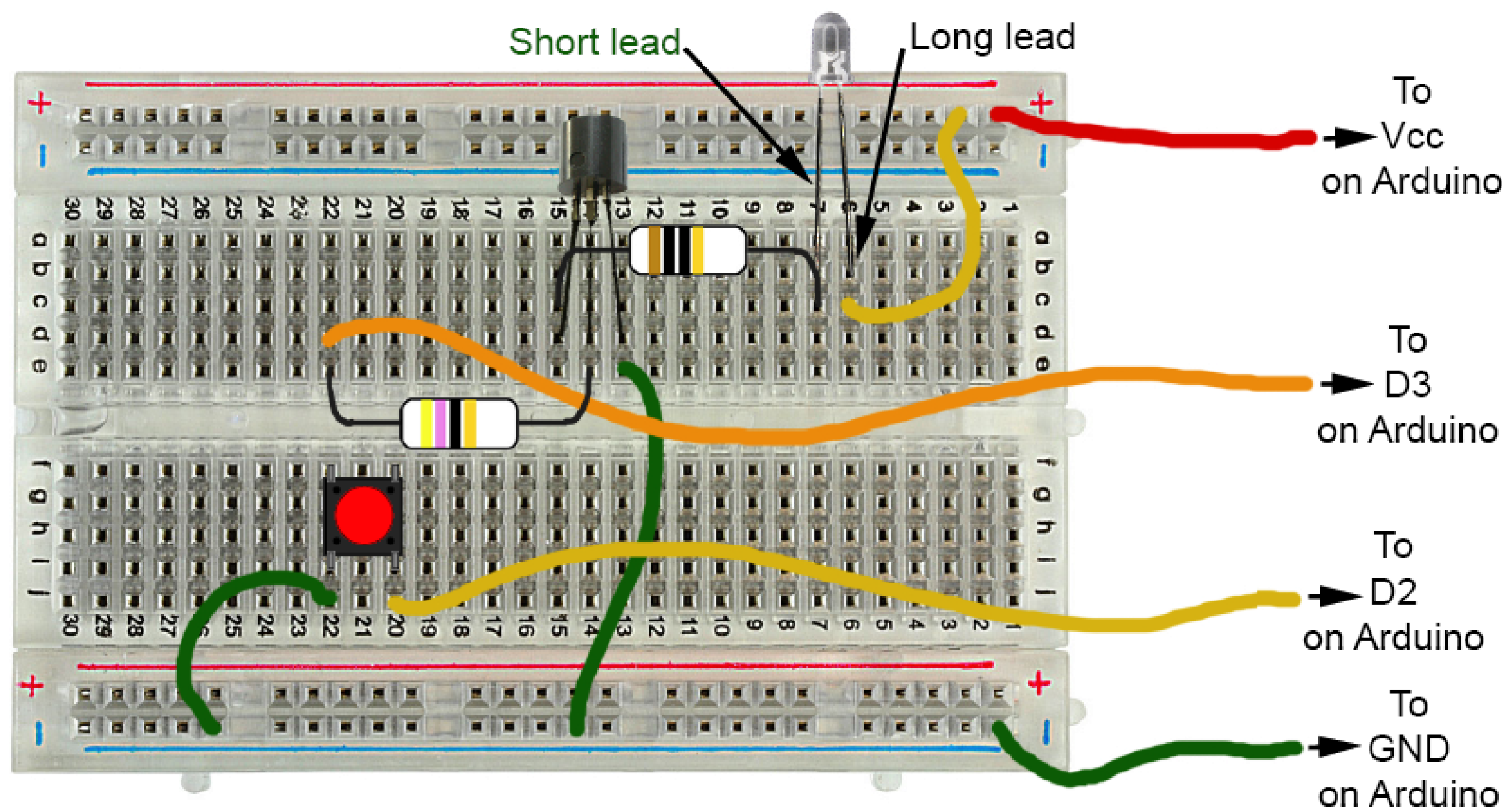
4-Sep-2015

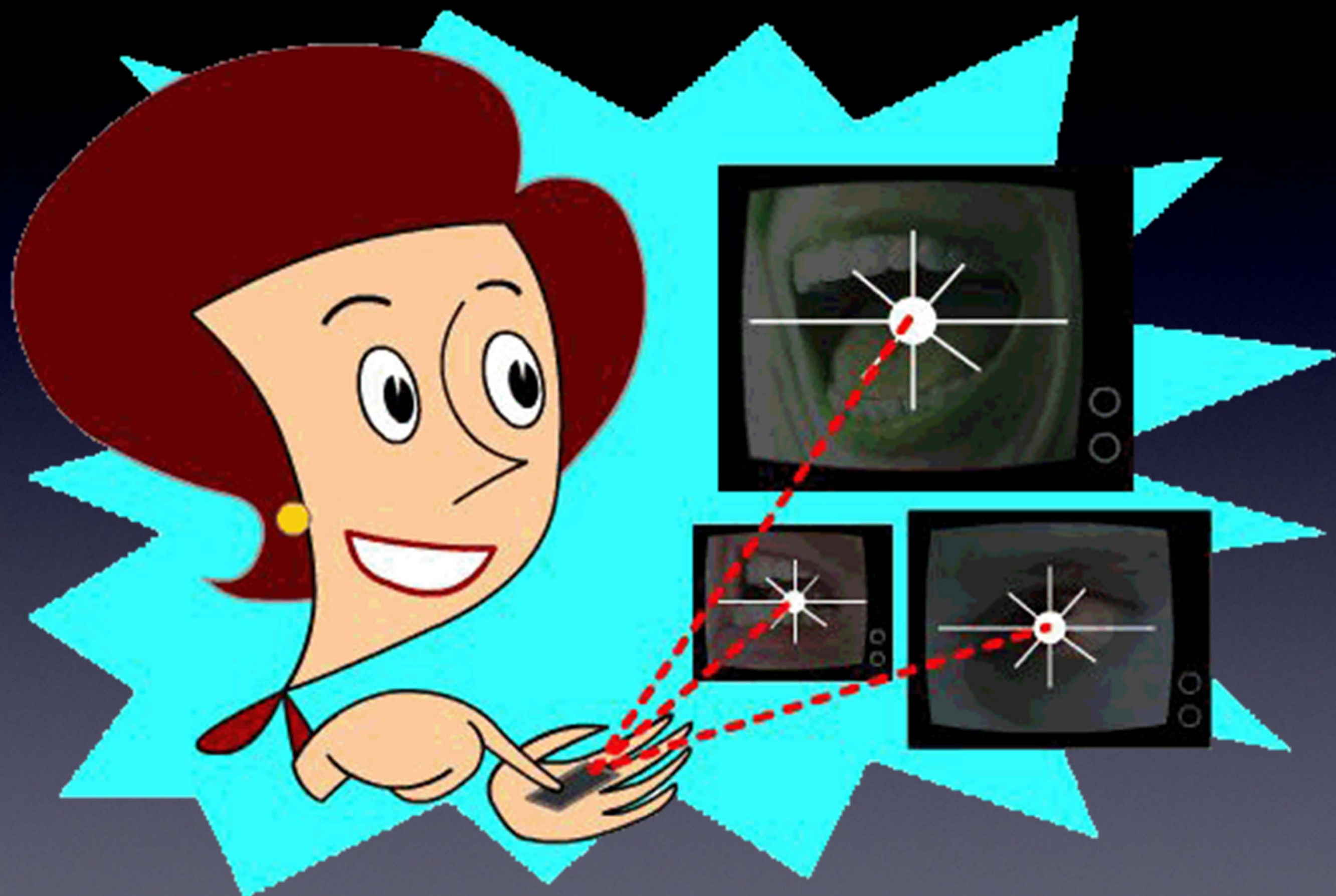
Mitch Altman (original TV-B-Gone hardware and firmware, modified TV-B-Gone Arduino design)
Limore Fried (firmware modifications, kit design)
Ken Shirriff (original modifications for Arduino)
Johannes Schneemann (documentation)



Make a TV-B-Gone Remote Control with your Arduino Clone without soldering

Solderless Breadboard with parts & wires for TV-B-Gone





Questions?

Intro

Intro



Intro

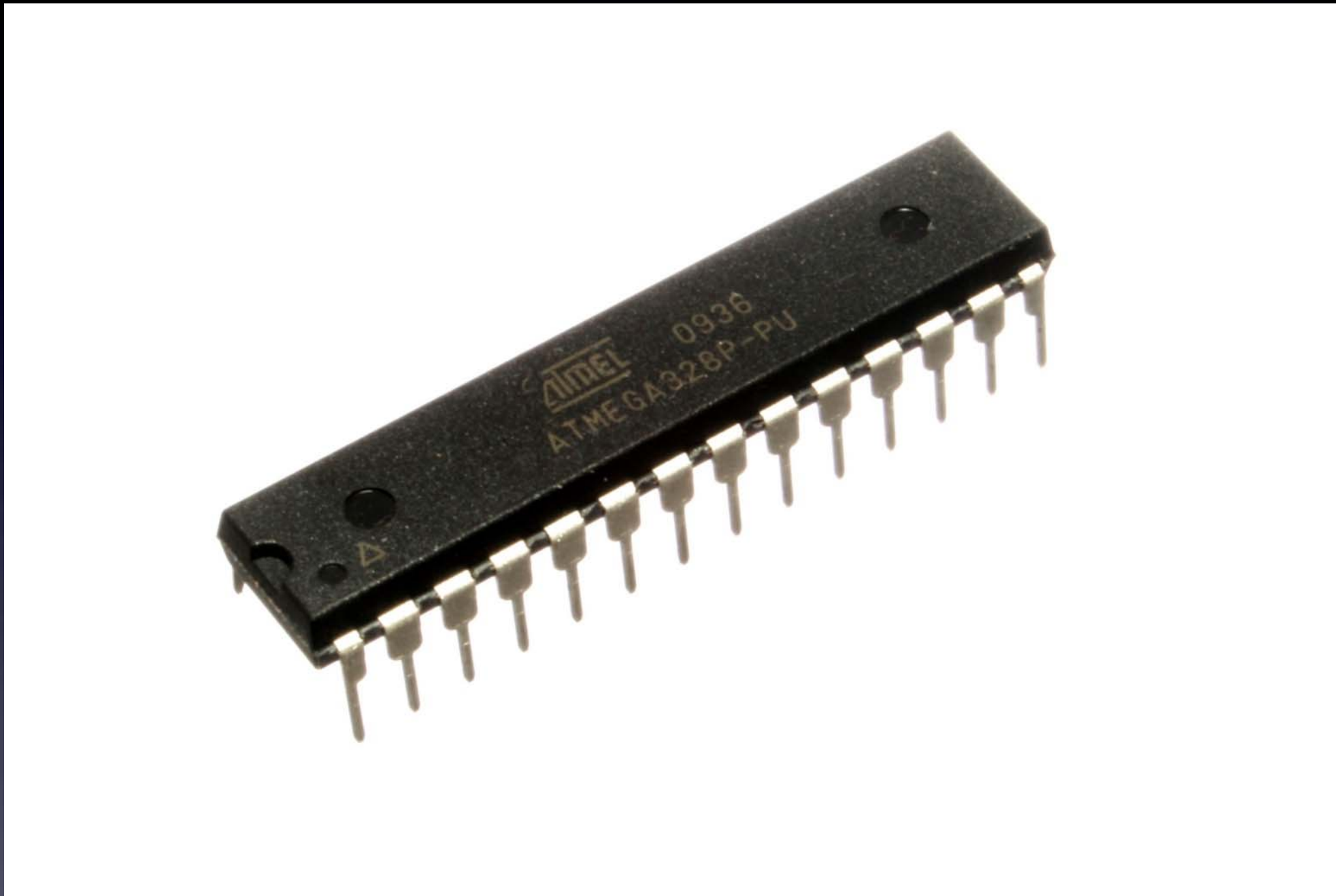


Arduino For Total Newbies Workshop at 30C3, Hamburg Germany

Intro to Arduino

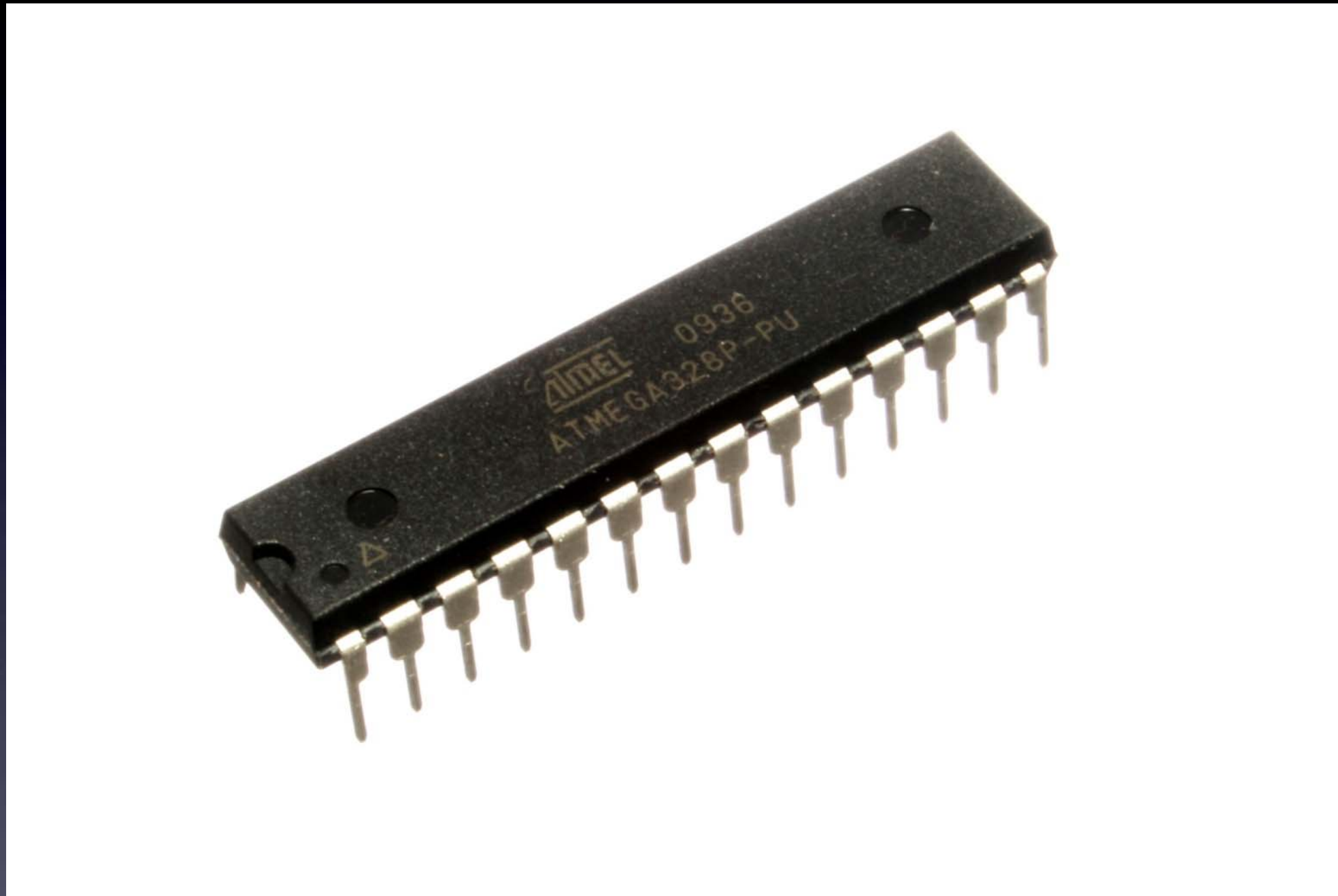


Intro to Arduino: microcontrollers



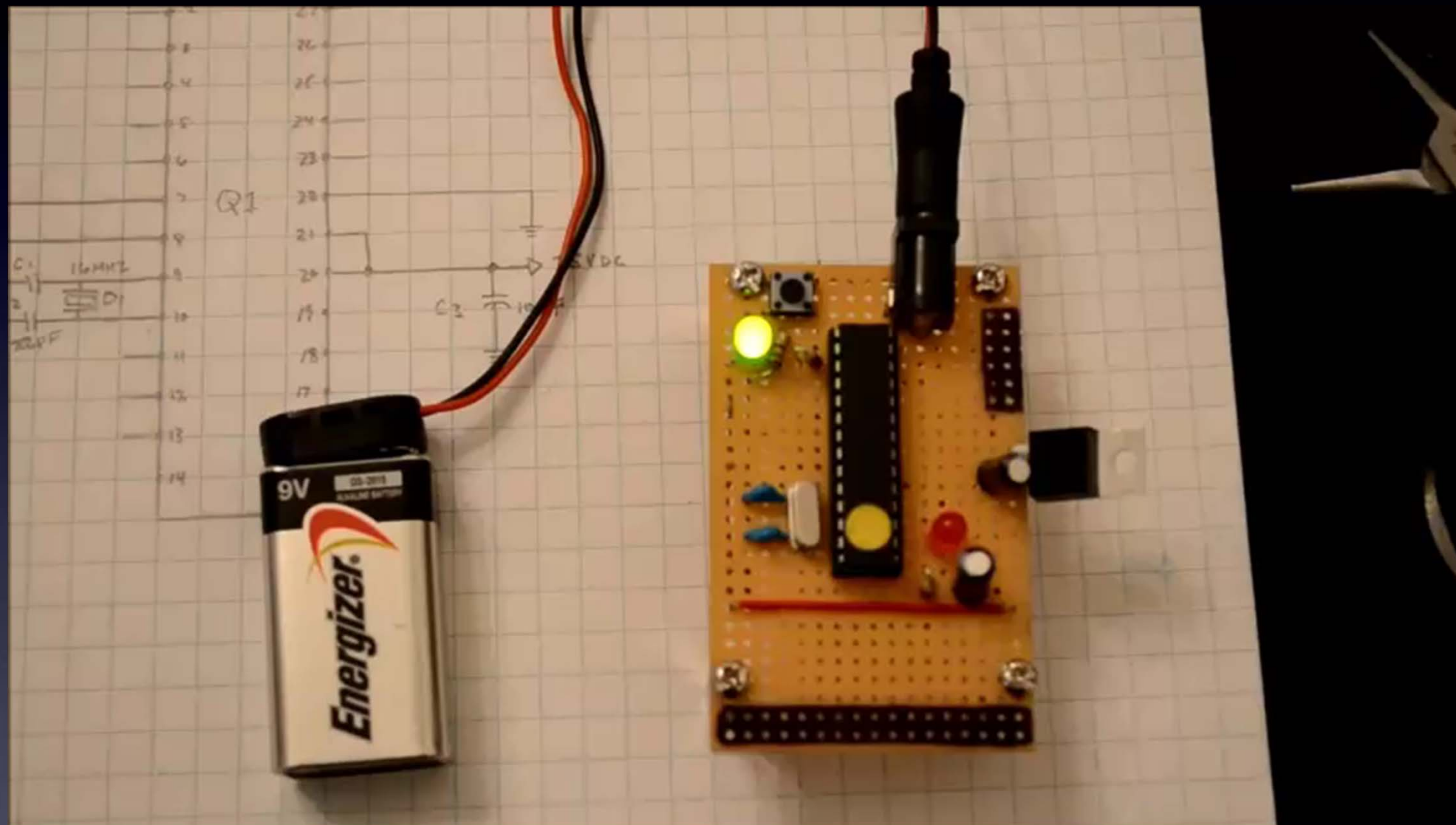
A complete computer on a chip

Intro to Arduino: microcontrollers



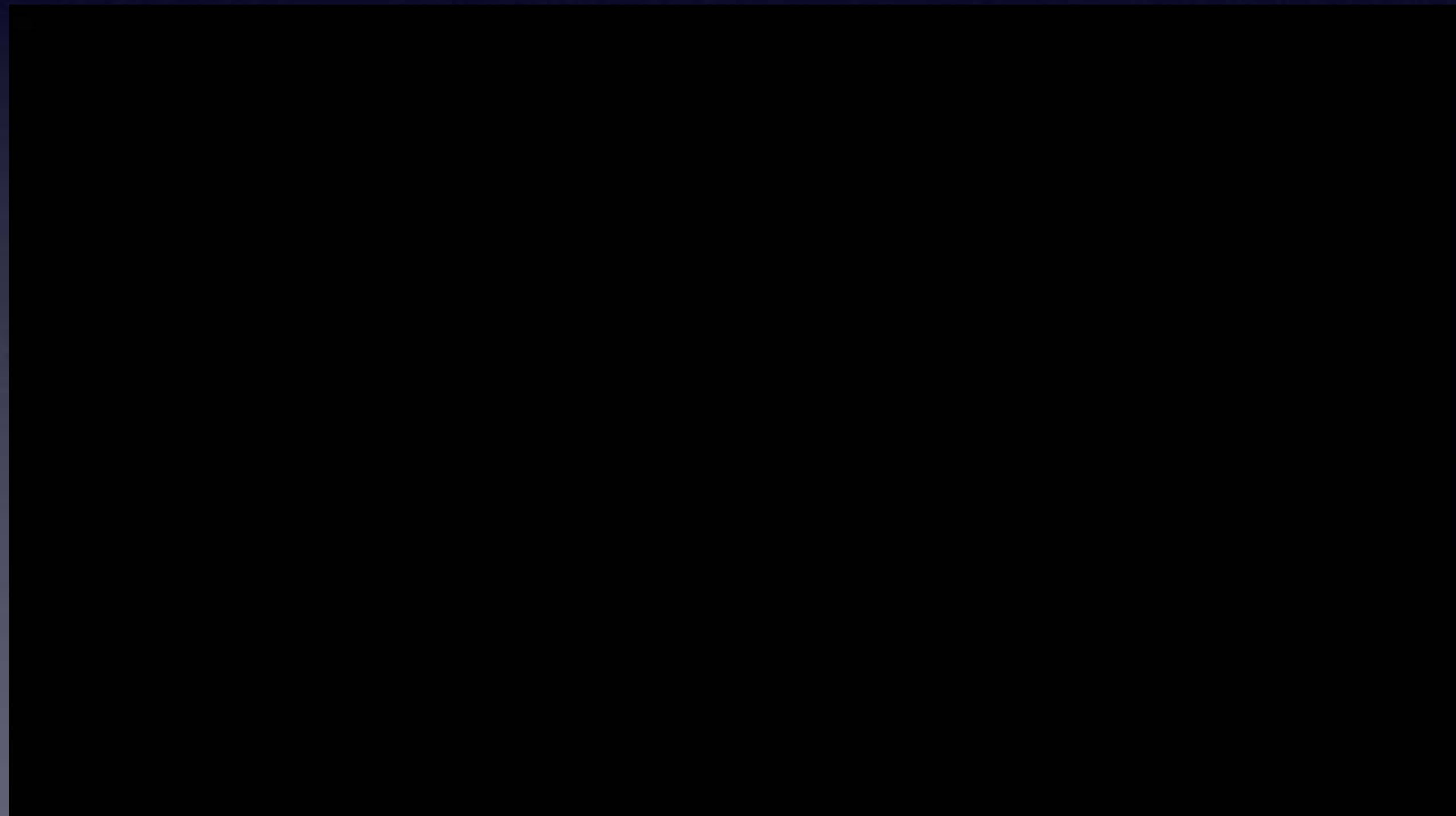
A complete computer on a chip:
they control parts connected to their pins

Intro to Arduino: microcontrollers



Intro to Arduino:
microcontrollers
-- one of Mitch's projects --

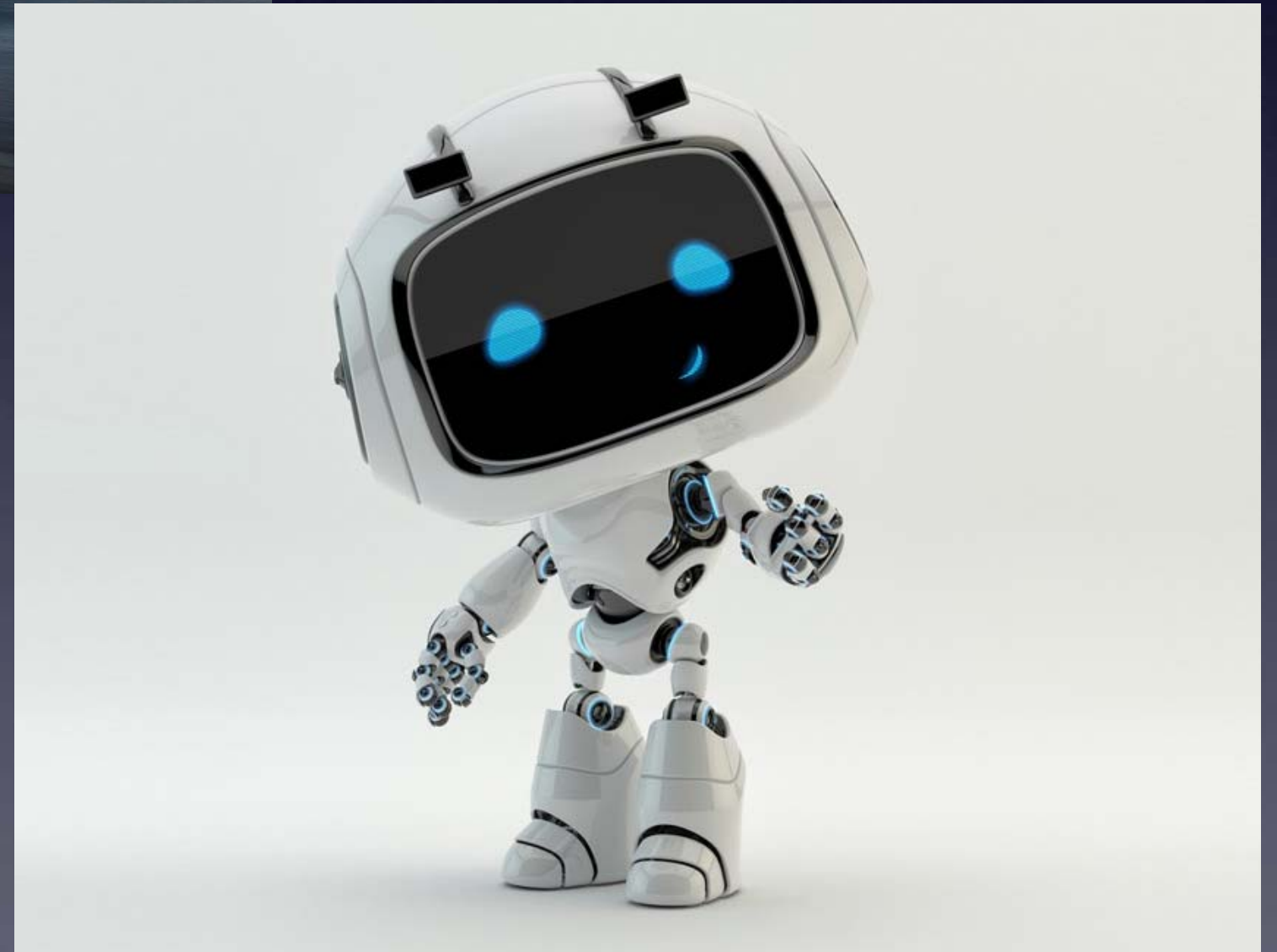
ArduTouch
music
synthesizer
kit



Intro to Arduino: microcontrollers



Intro to Arduino: microcontrollers



Intro to Arduino: microcontrollers



Intro to Arduino: microcontrollers



Intro to Arduino: microcontrollers

-- *one of Mitch's projects* --

TV-B-Gone



Intro to Arduino: microcontrollers

-- one of Mitch's projects --



TV-B-Gone
*Just a remote control,
but only one button:
OFF !*

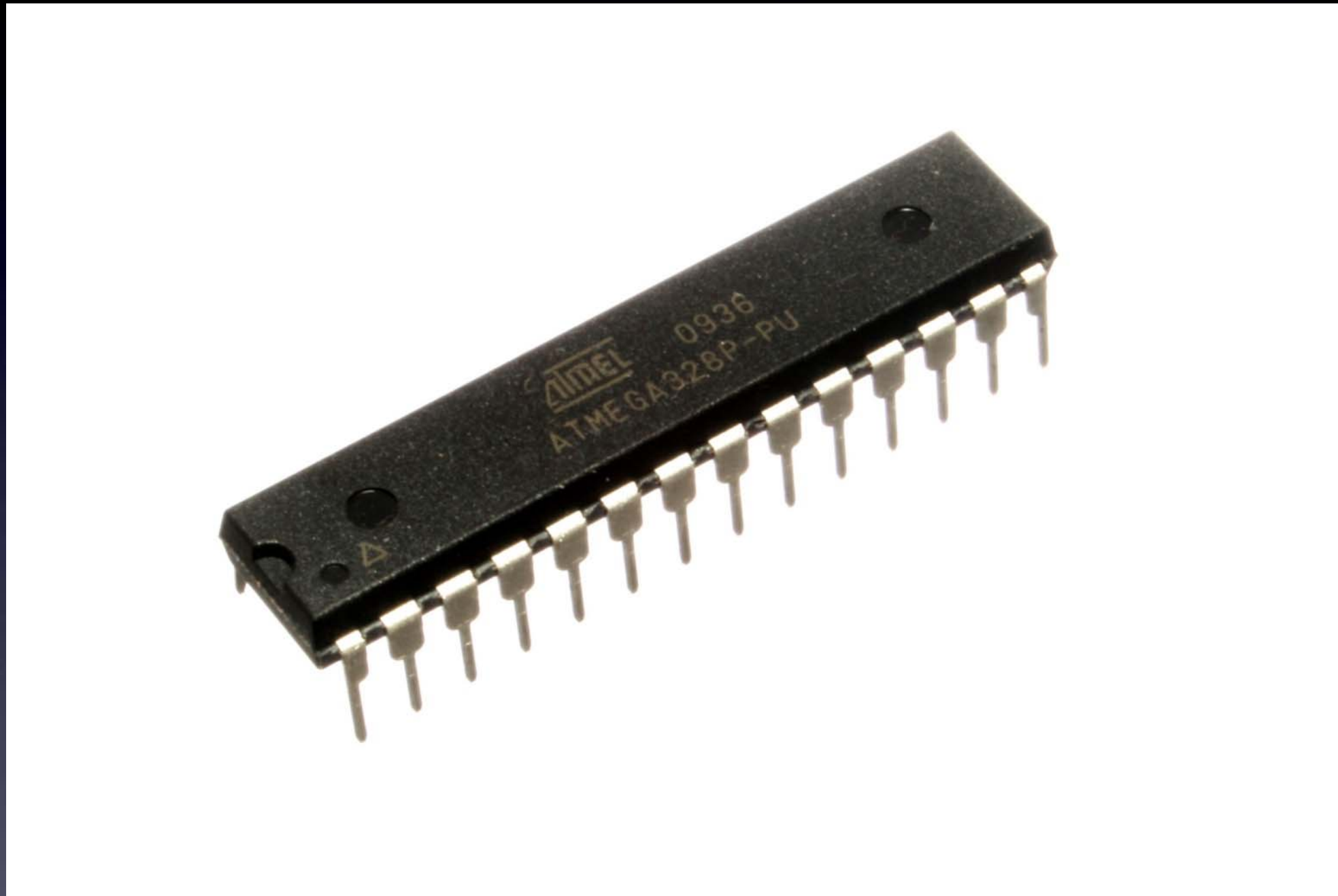
Intro to Arduino: microcontrollers

-- one of Mitch's projects --



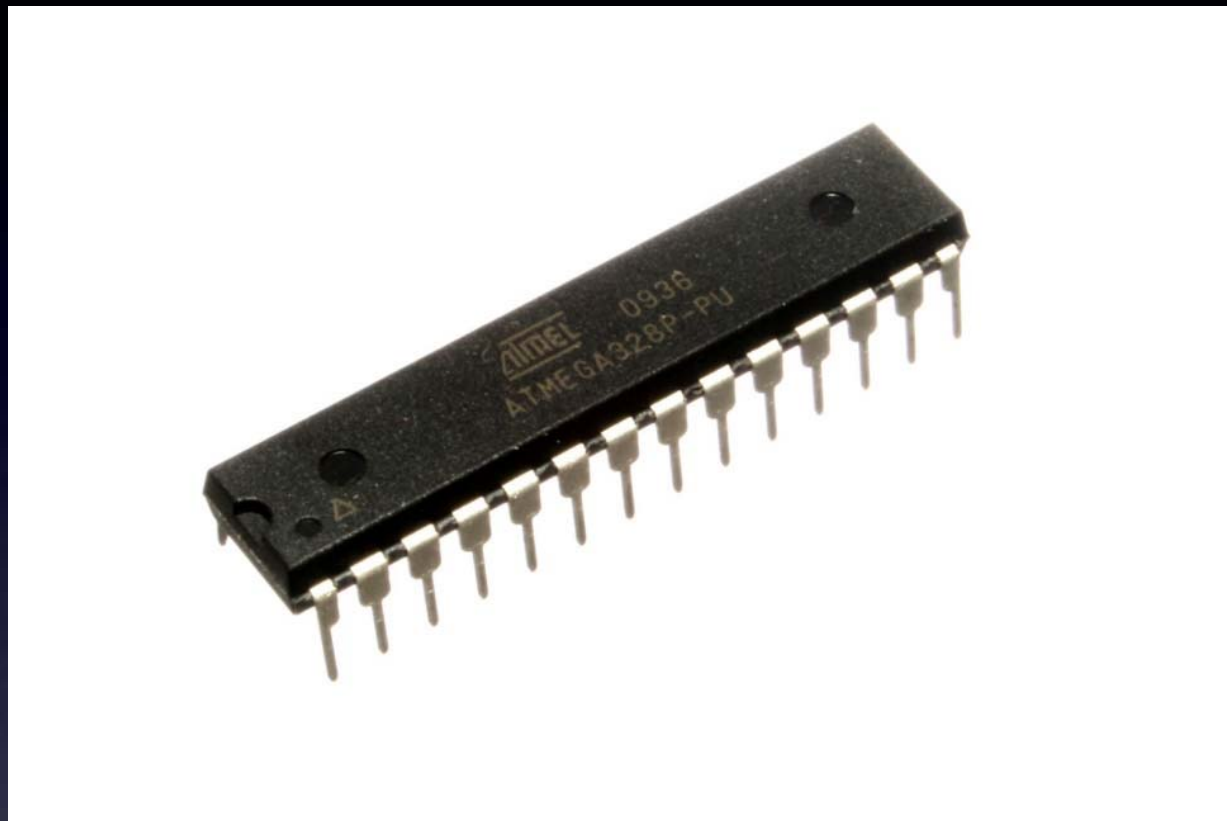
TV-B-Gone

Intro to Arduino: microcontrollers



A complete computer on a chip:
they control parts connected to their pins

Intro to Arduino: microcontrollers



A complete computer on a chip:

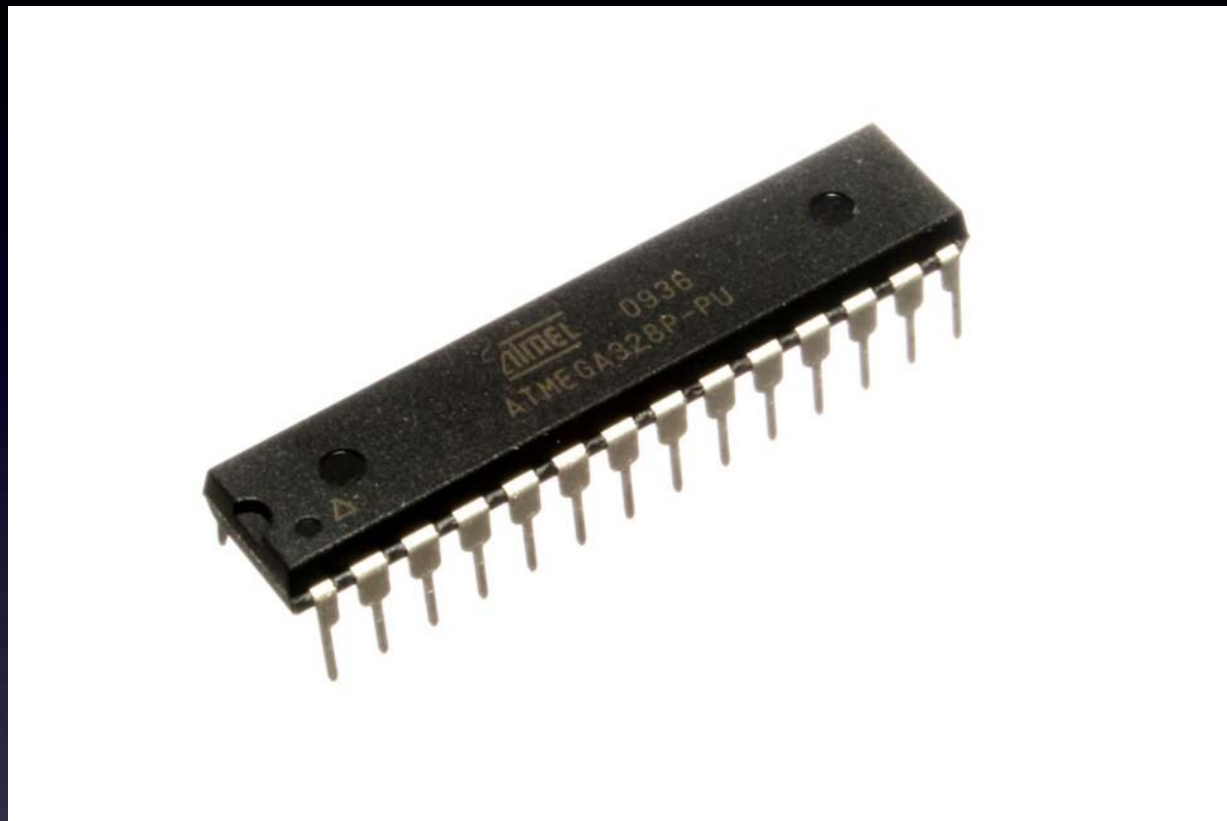
they control parts connected to their pins

But,

How do you
connect parts to its pins?

How do you
create and upload a program
to control the parts?

Intro to Arduino: microcontrollers



A complete computer on a chip:

they control parts connected to their pins

But,

How do you
connect parts to its pins?

How do you
create and upload a program
to control the parts?

Answer: Be a geek, and learn how!

Or

Intro to Arduino



Use an Arduino board

Intro to Arduino



Super easy to
connect parts
to its microcontroller's pins

Use an Arduino board

Intro to Arduino



Super easy to
connect parts
to its microcontroller's pins

Use an Arduino board

Super easy to
create and upload a program
to control the parts

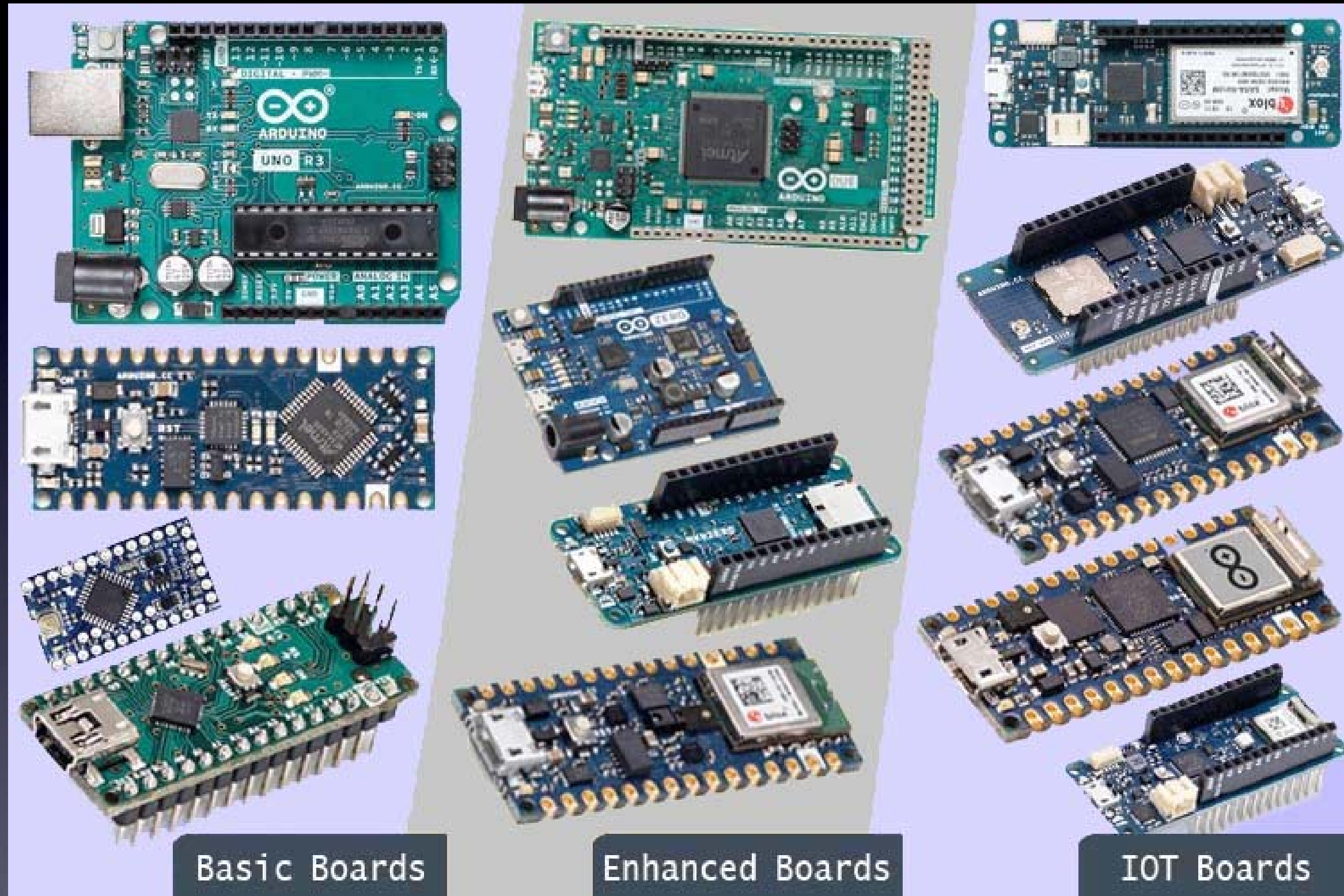
Intro to Arduino



Arduino board

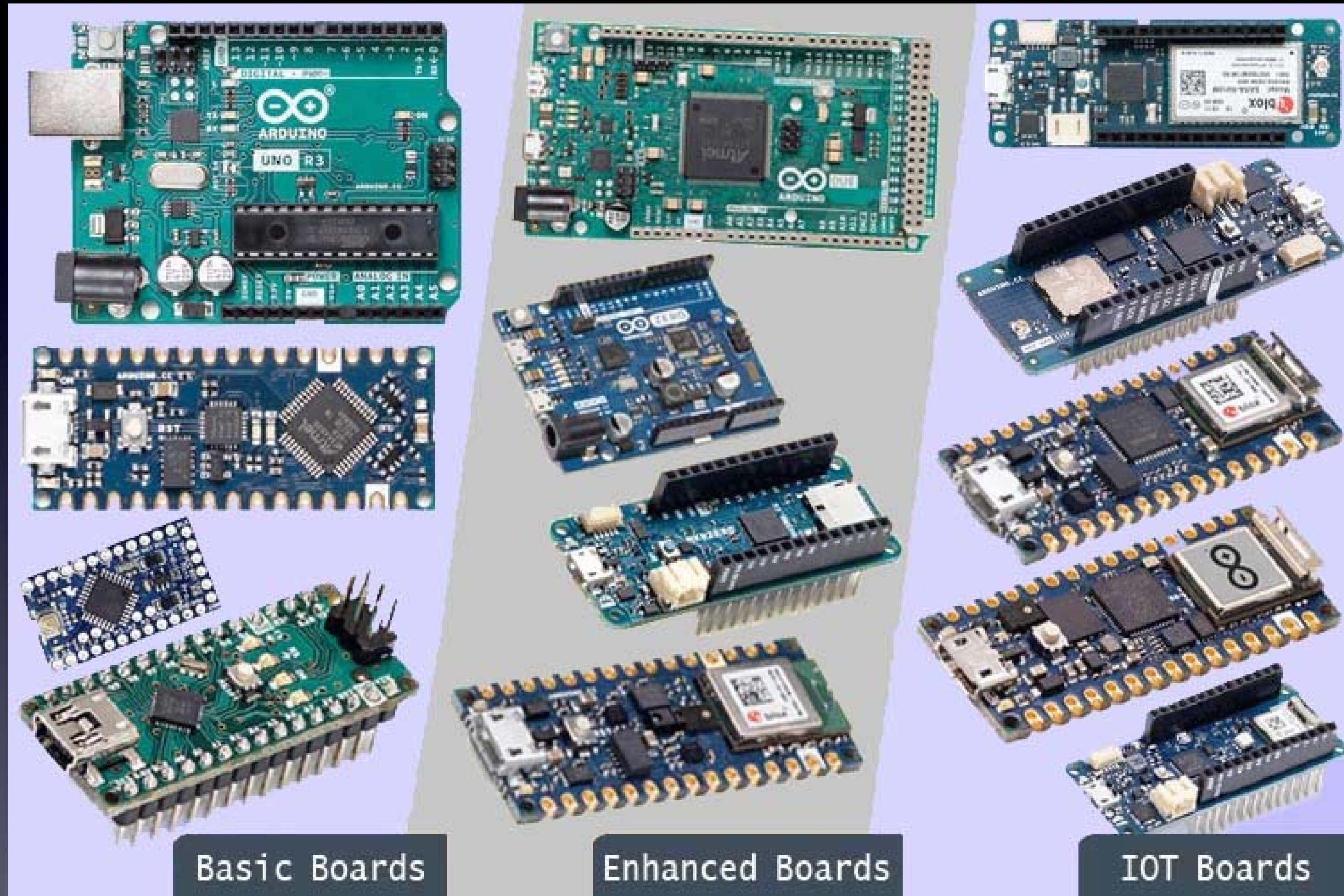
Designed for
non-geeky artists

Intro to Arduino



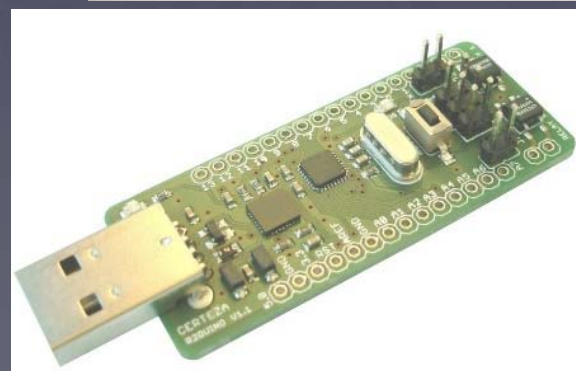
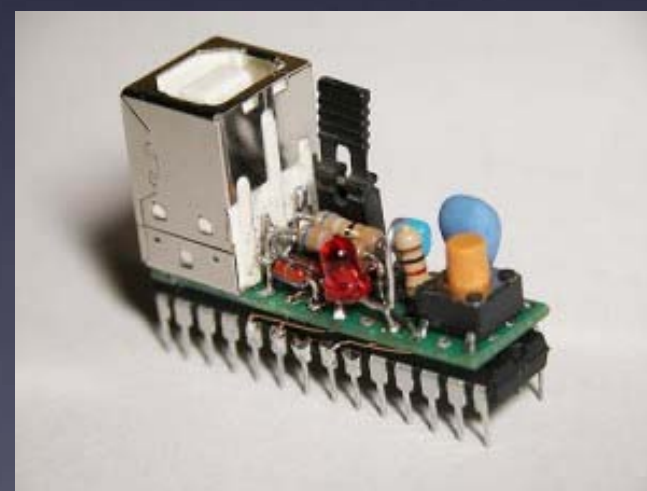
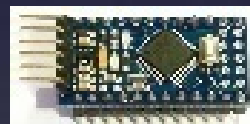
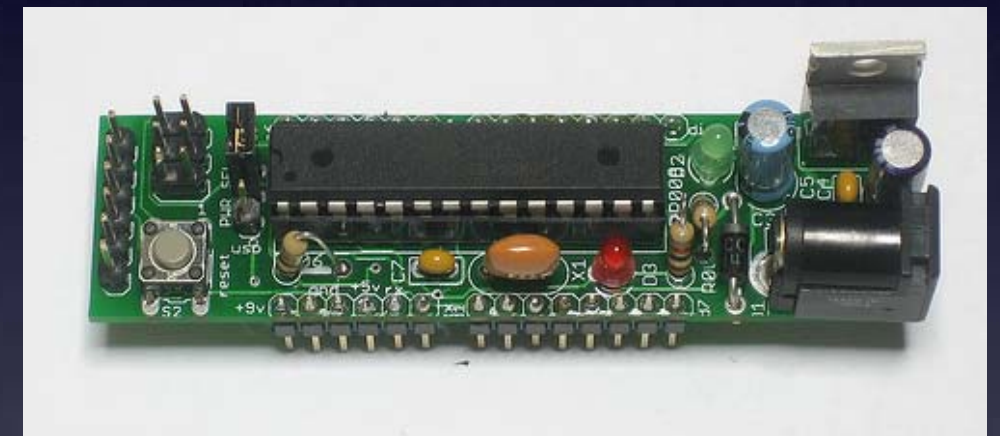
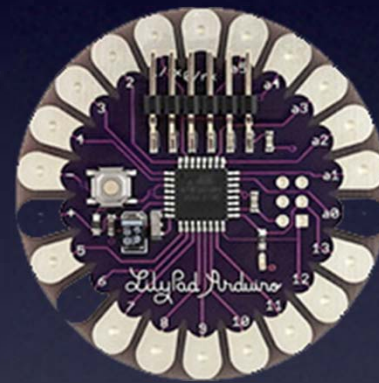
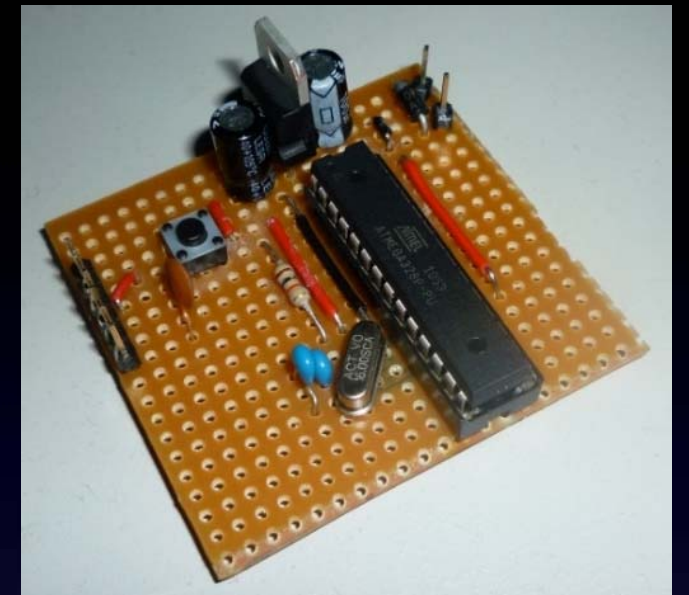
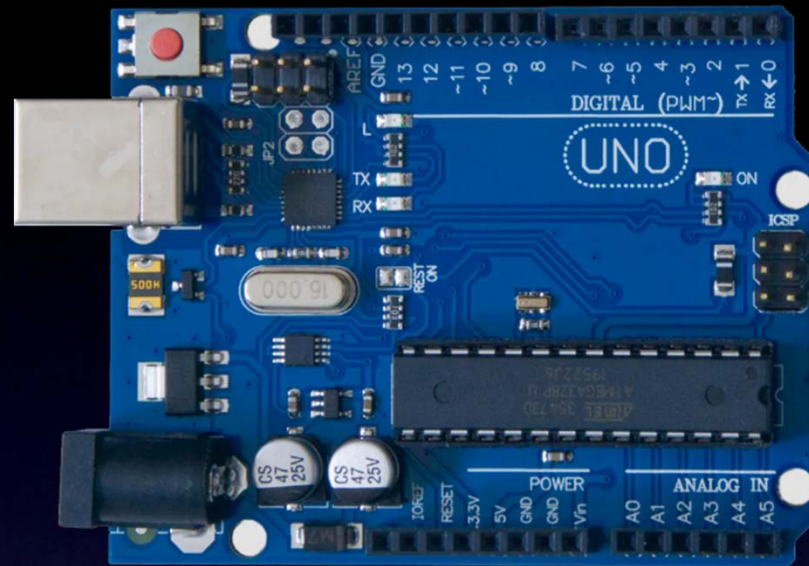
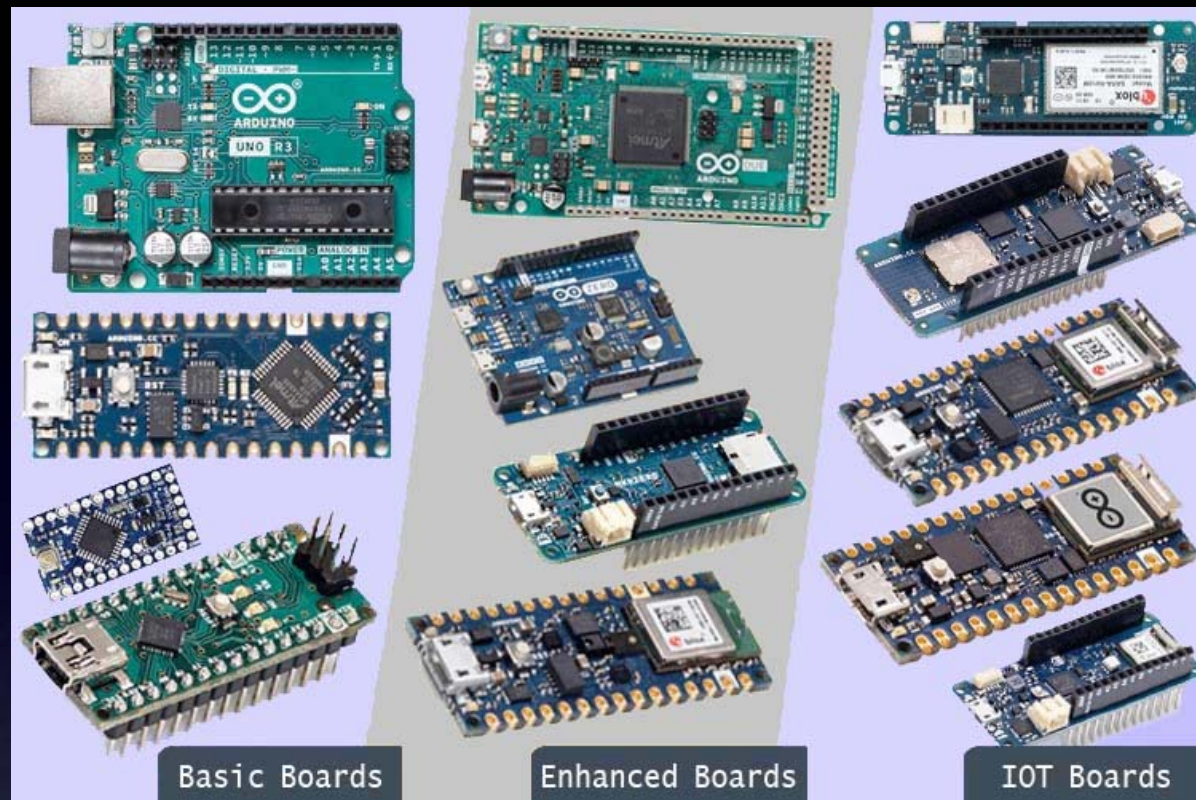
Many Arduino boards to choose from

Intro to Arduino



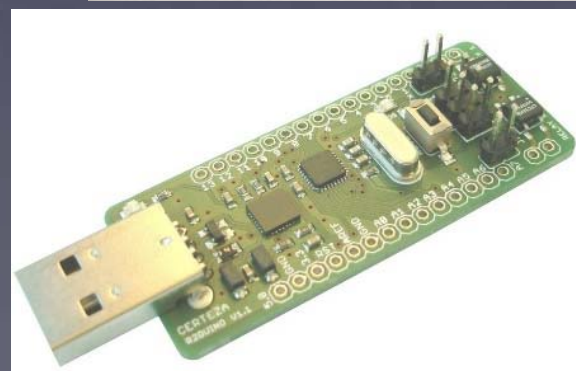
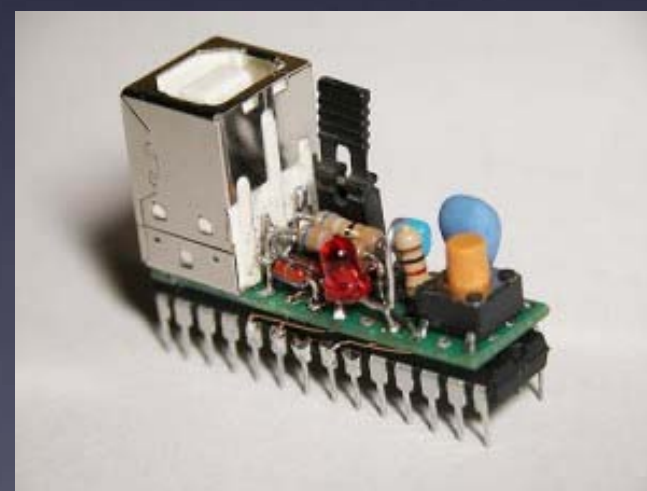
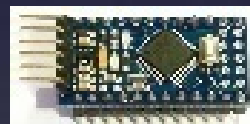
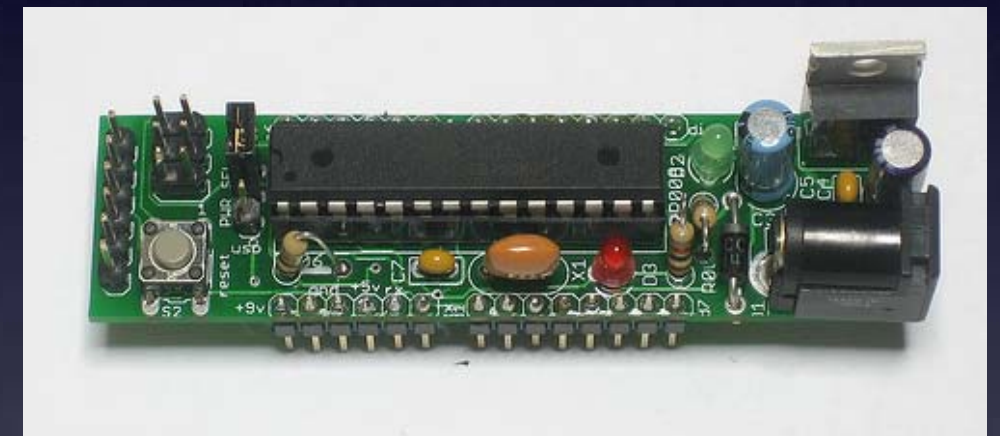
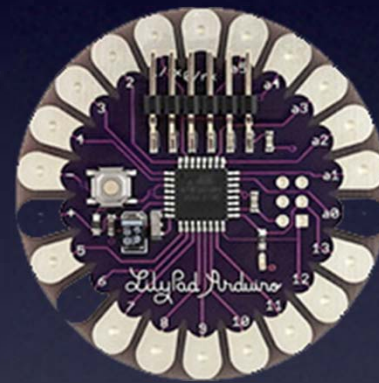
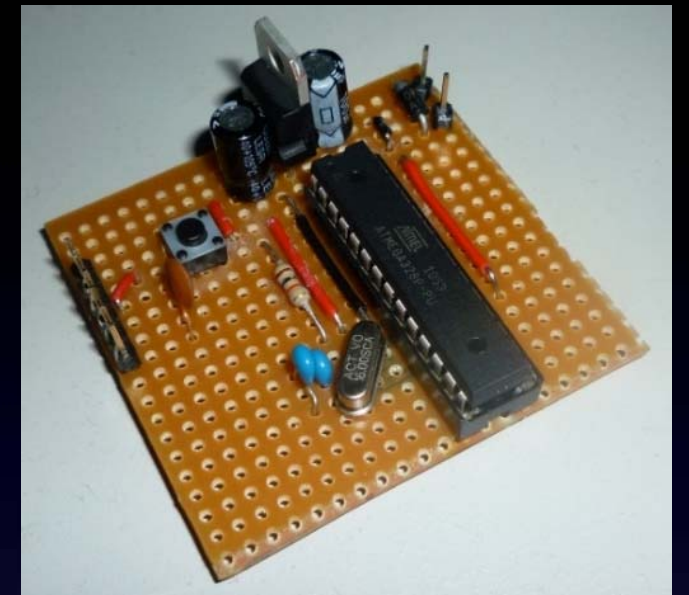
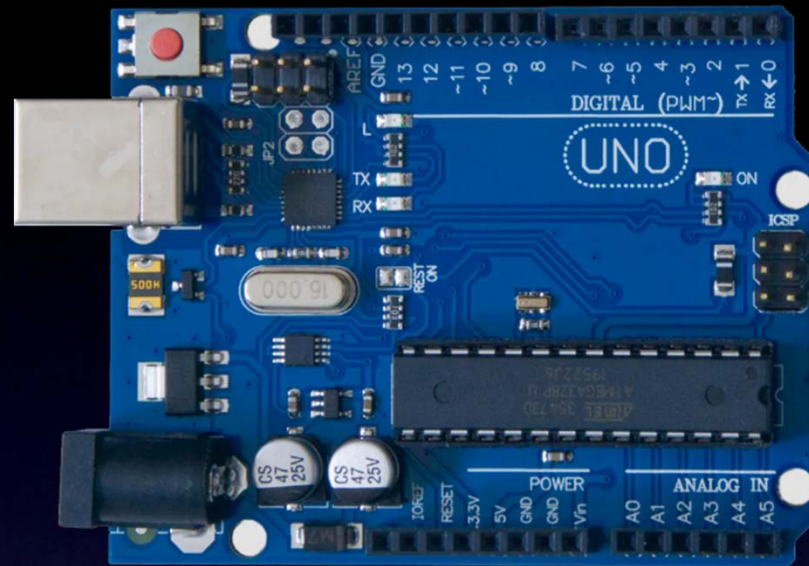
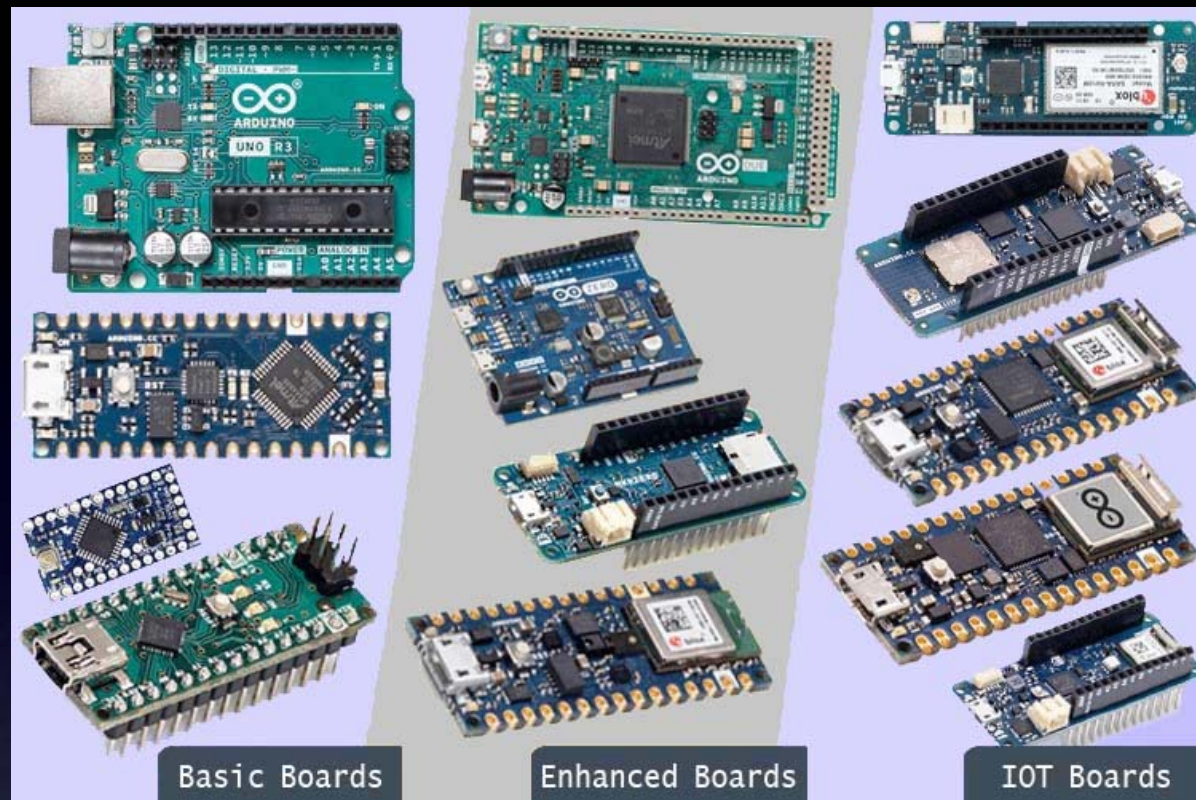
Open Source

Intro to Arduino



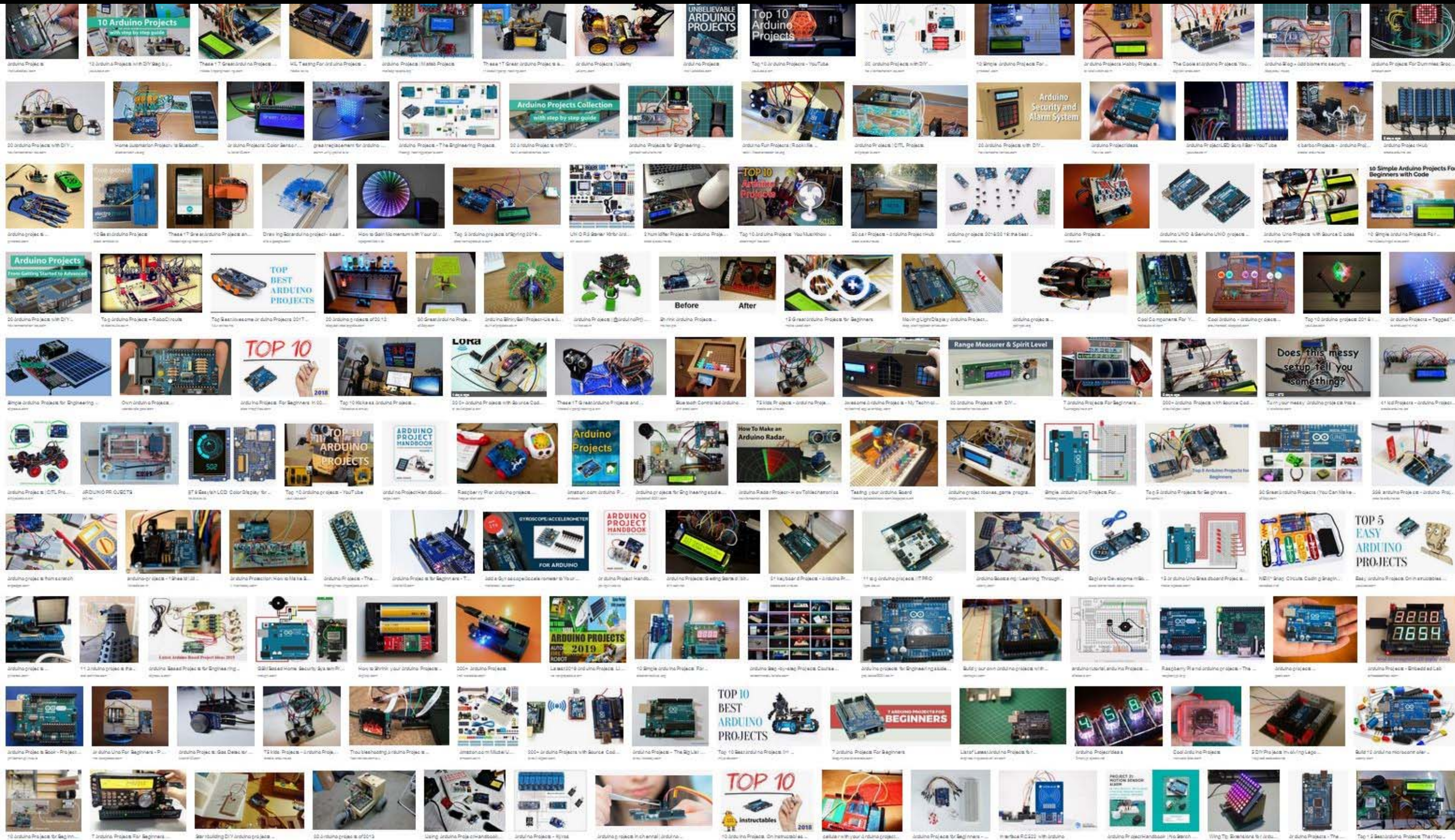
Open Source

Intro to Arduino



Arduino "Clones"

Intro to Arduino

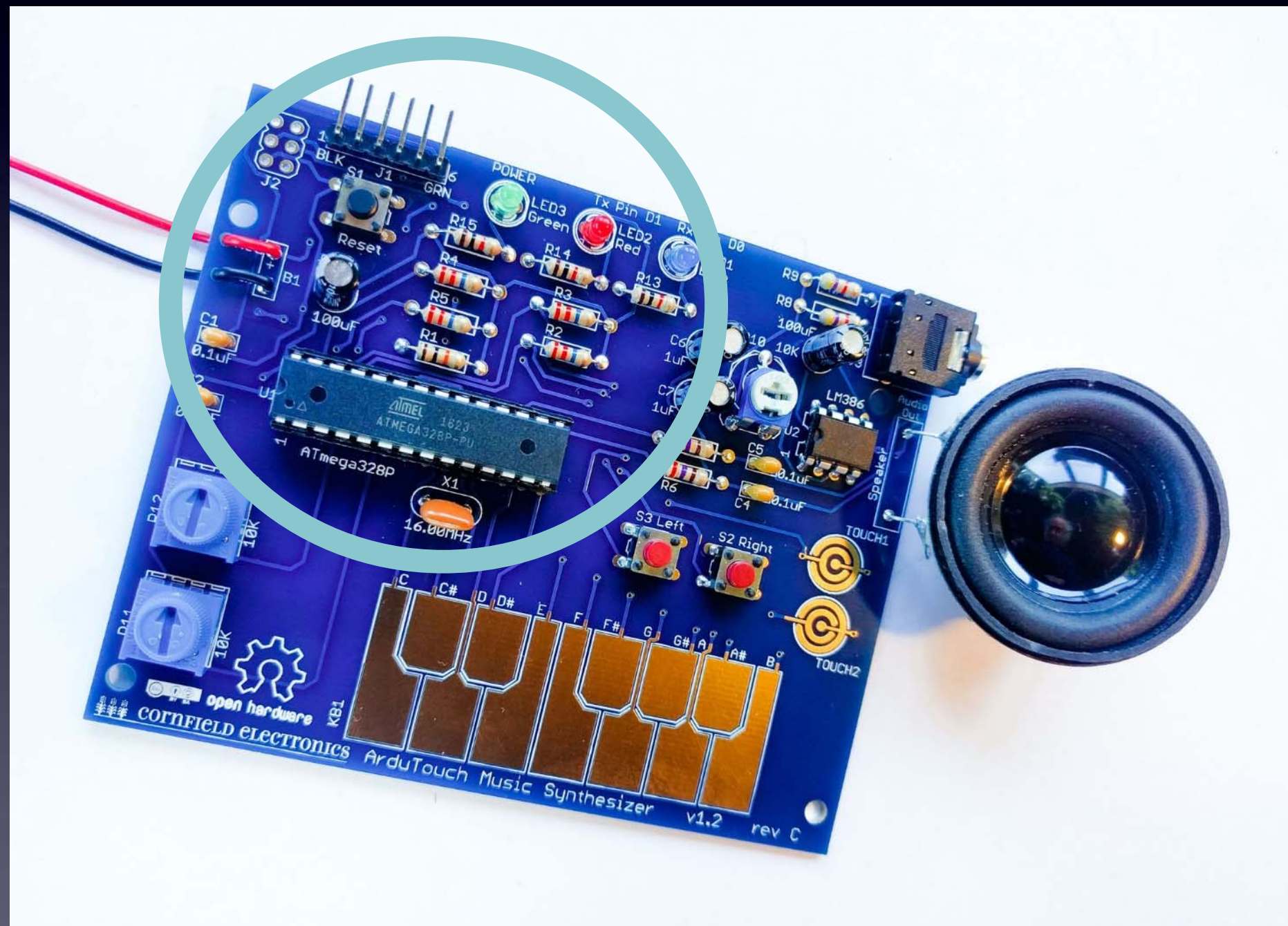


hundreds of thousands of projects online!

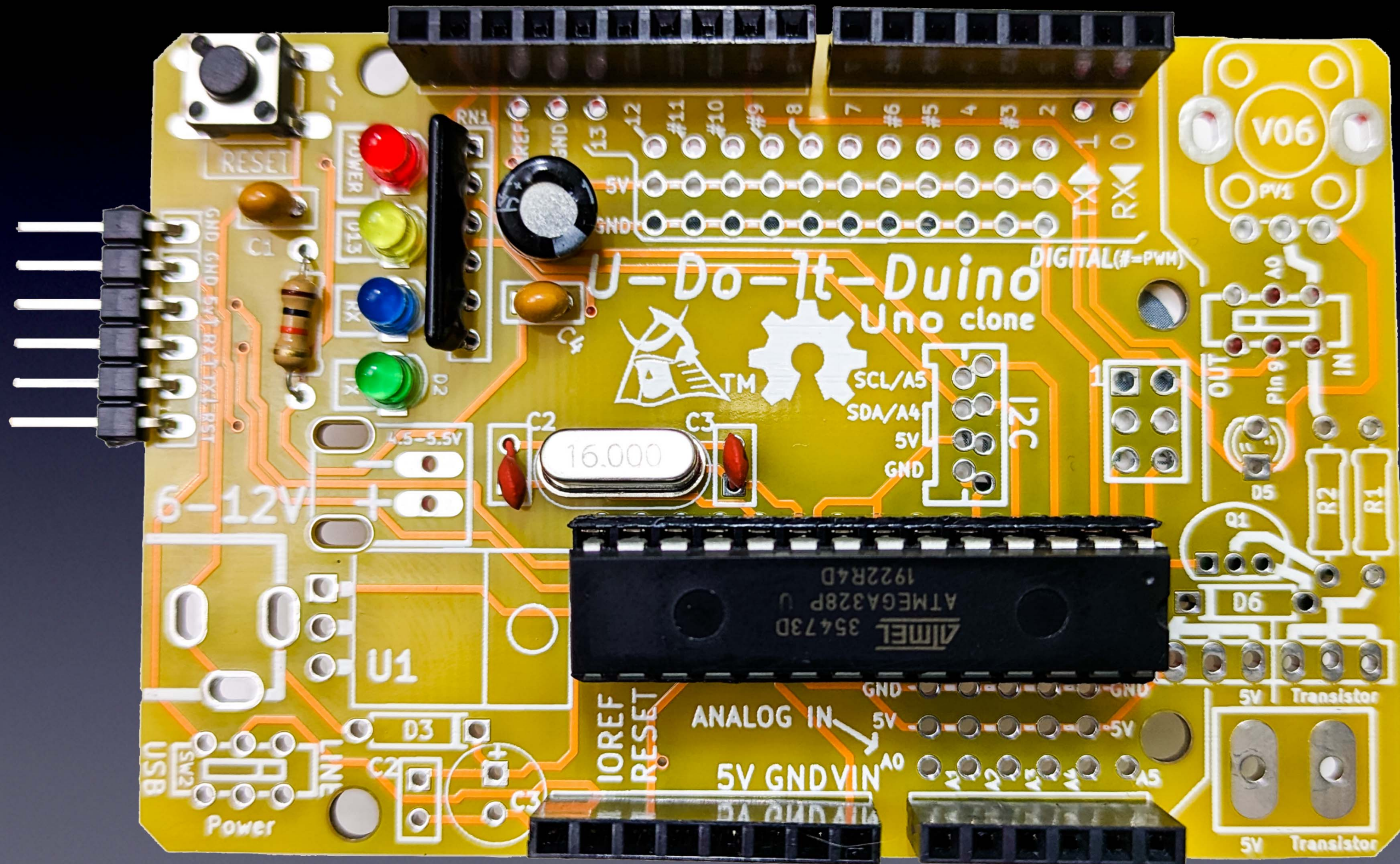
Intro to Arduino

“Arduino-Compatible”

*ArduTouch
music
synthesizer
kit*



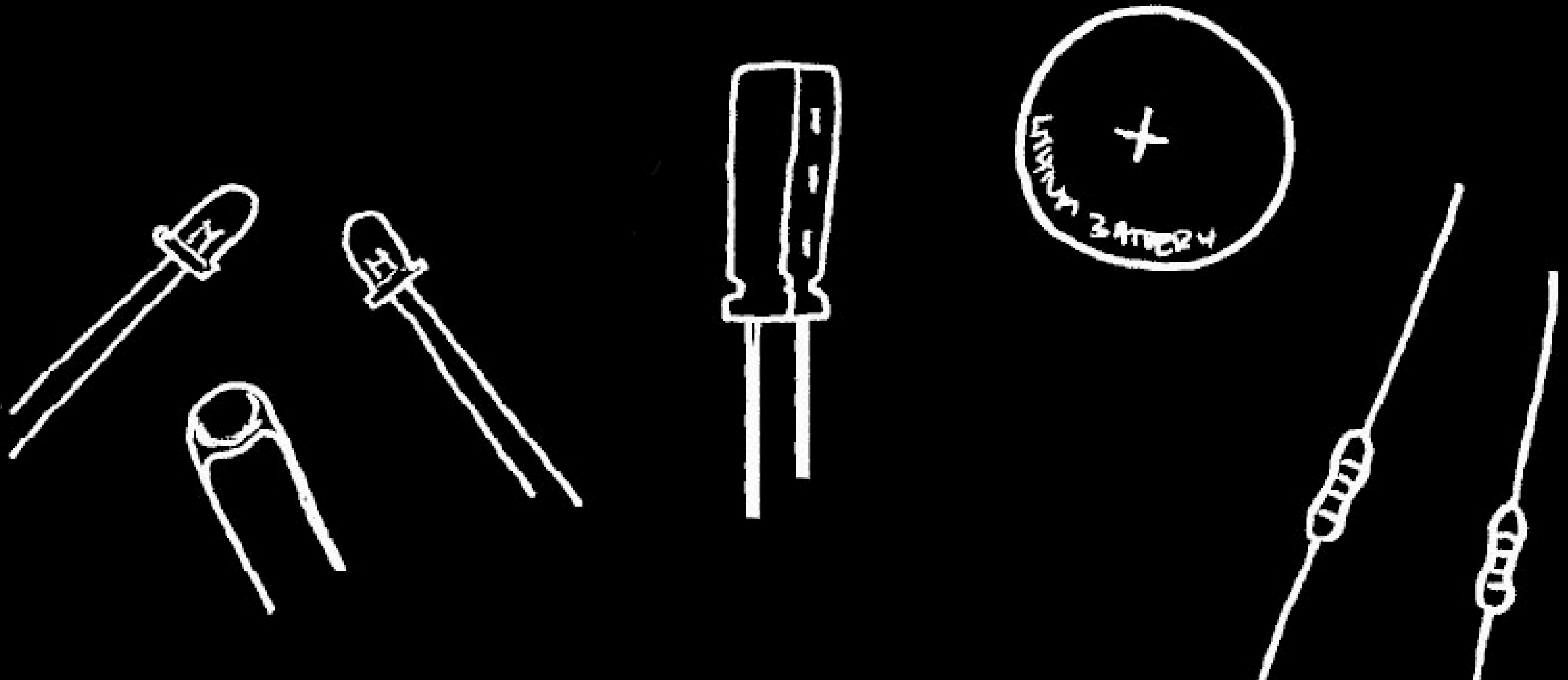
Intro



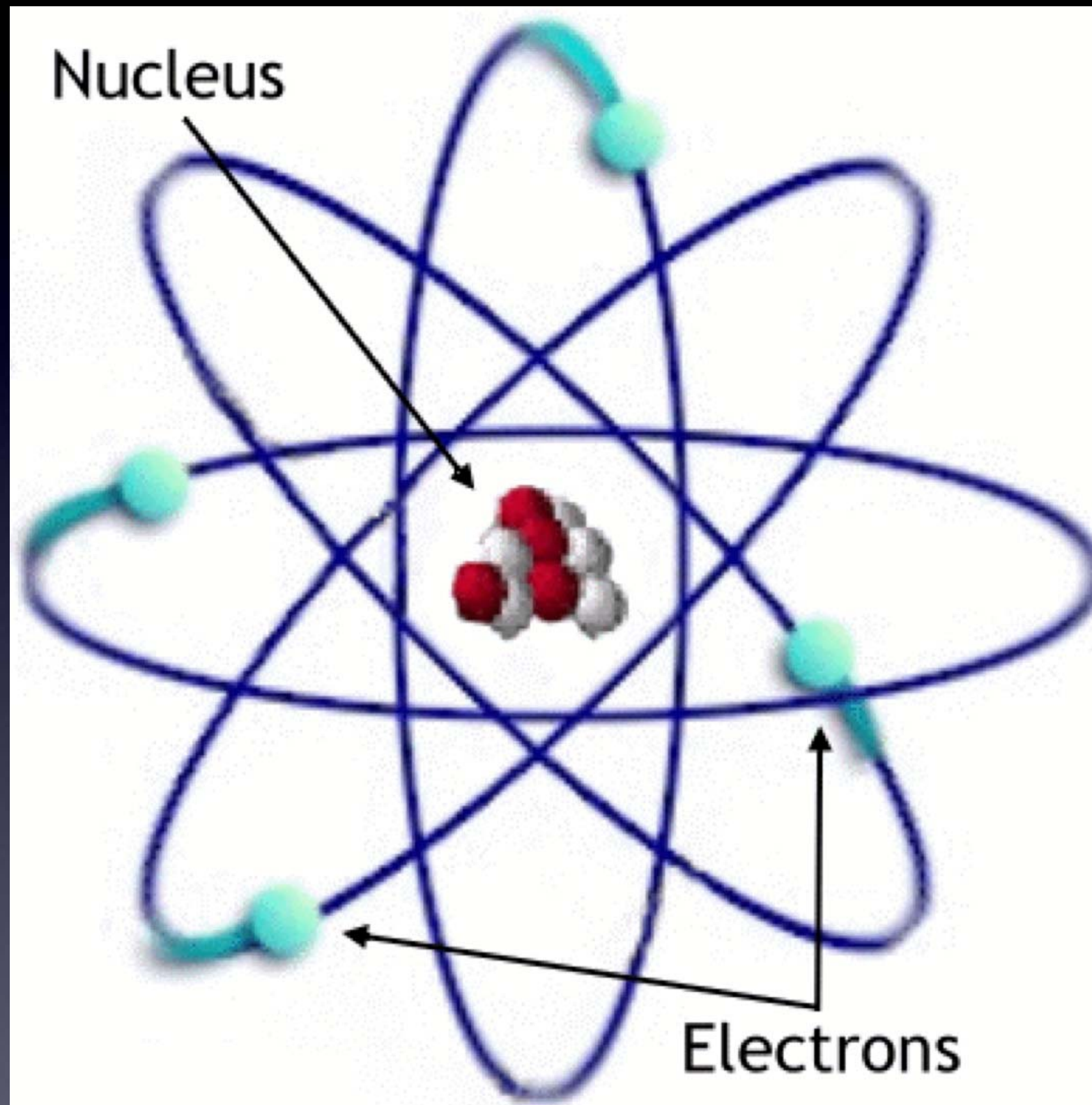
Intro

Questions?

Everything You Need to Know About Electronics

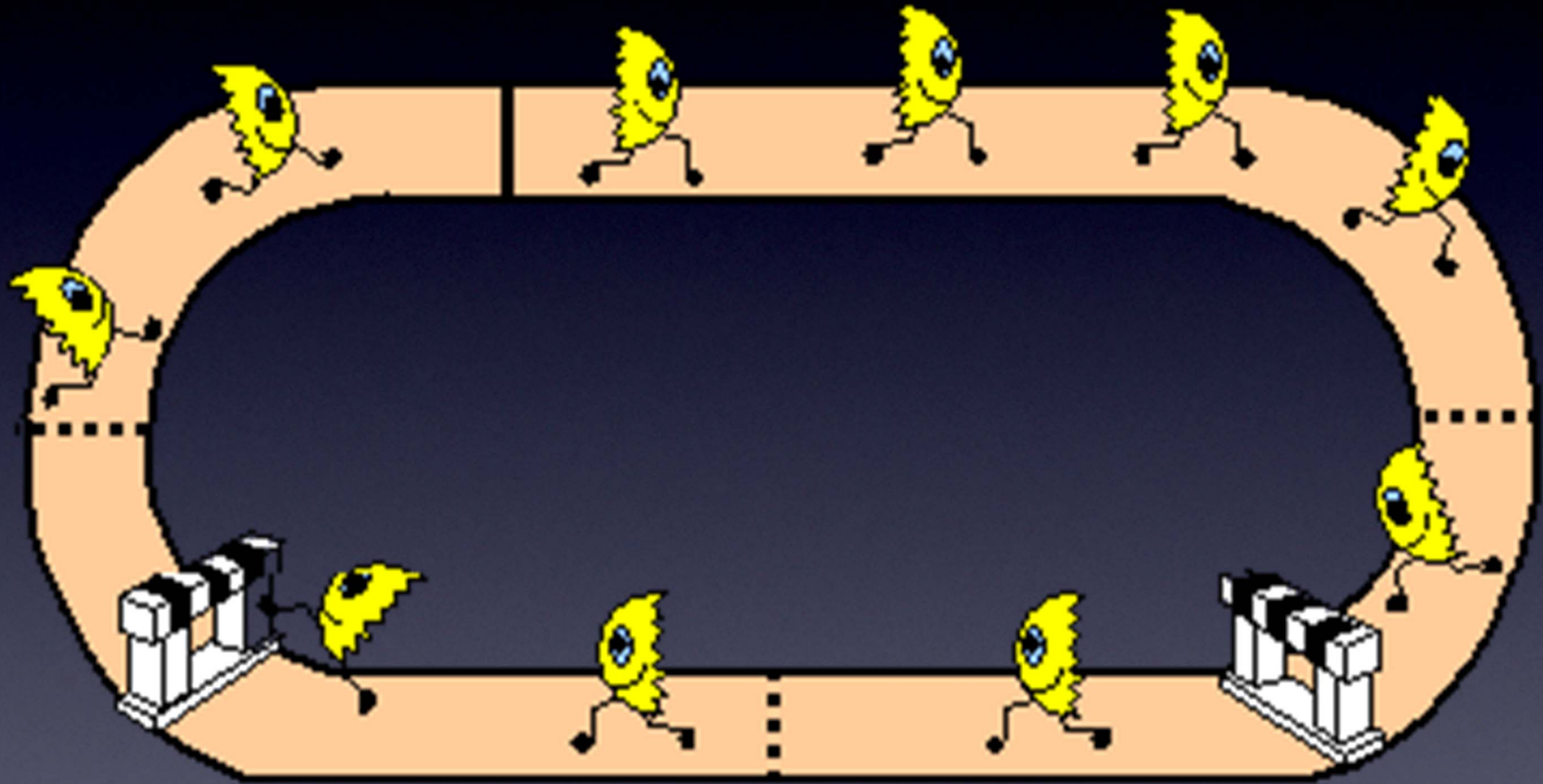


Everything You Need to Know About Electronics



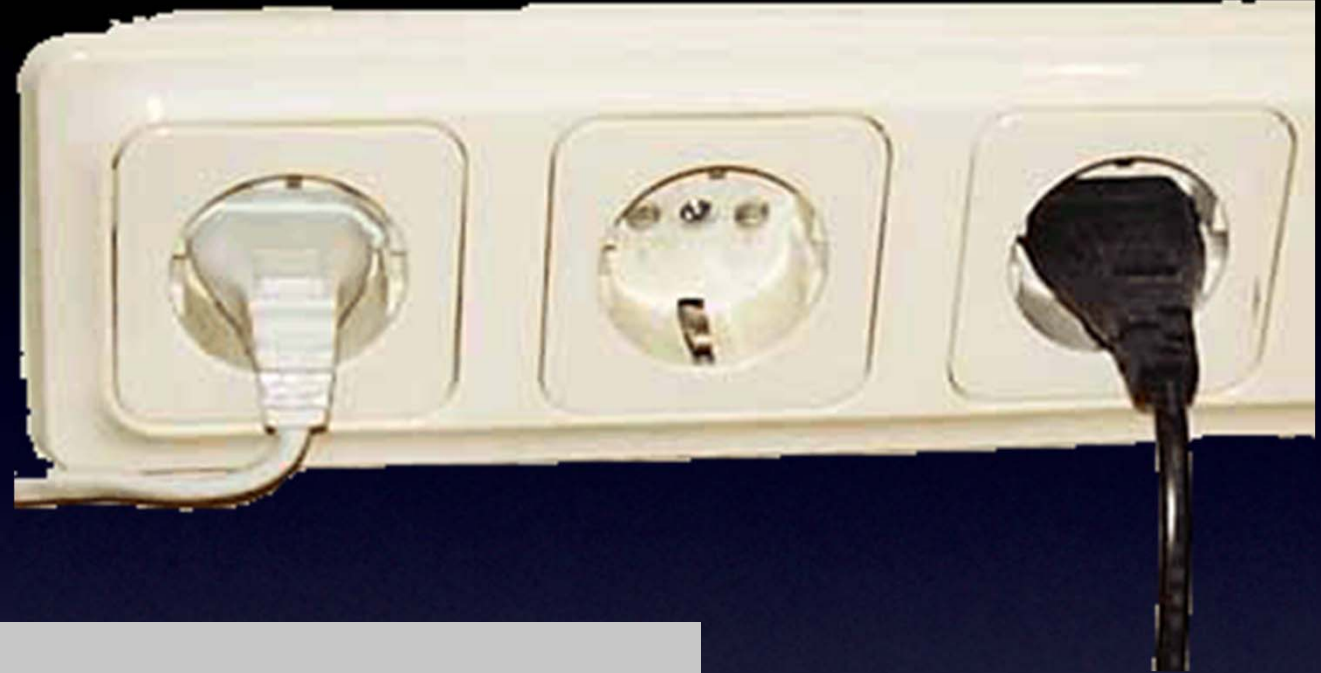
Electrons

Everything You Need to Know About Electronics



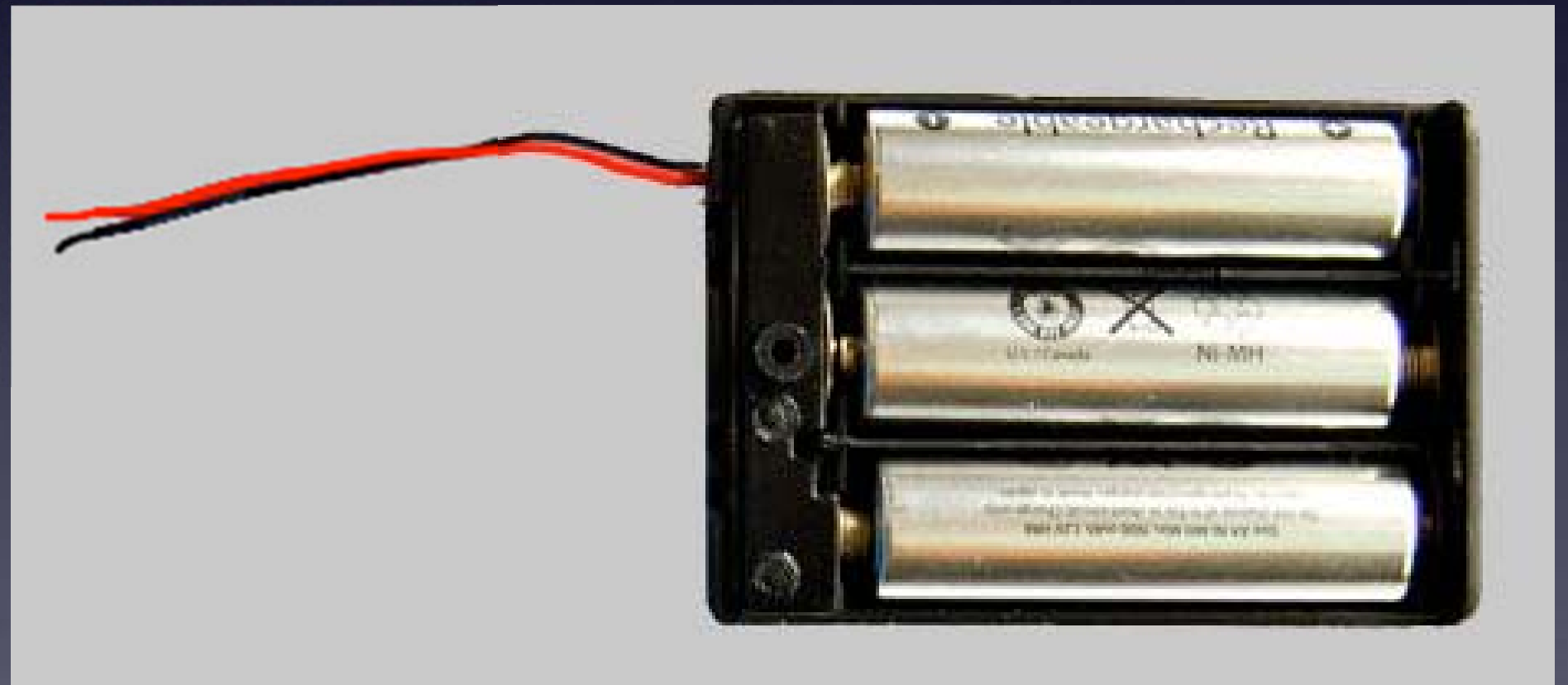
Circuit = Electrons going in complete circle = Magic!

Everything You Need to Know About Electronics



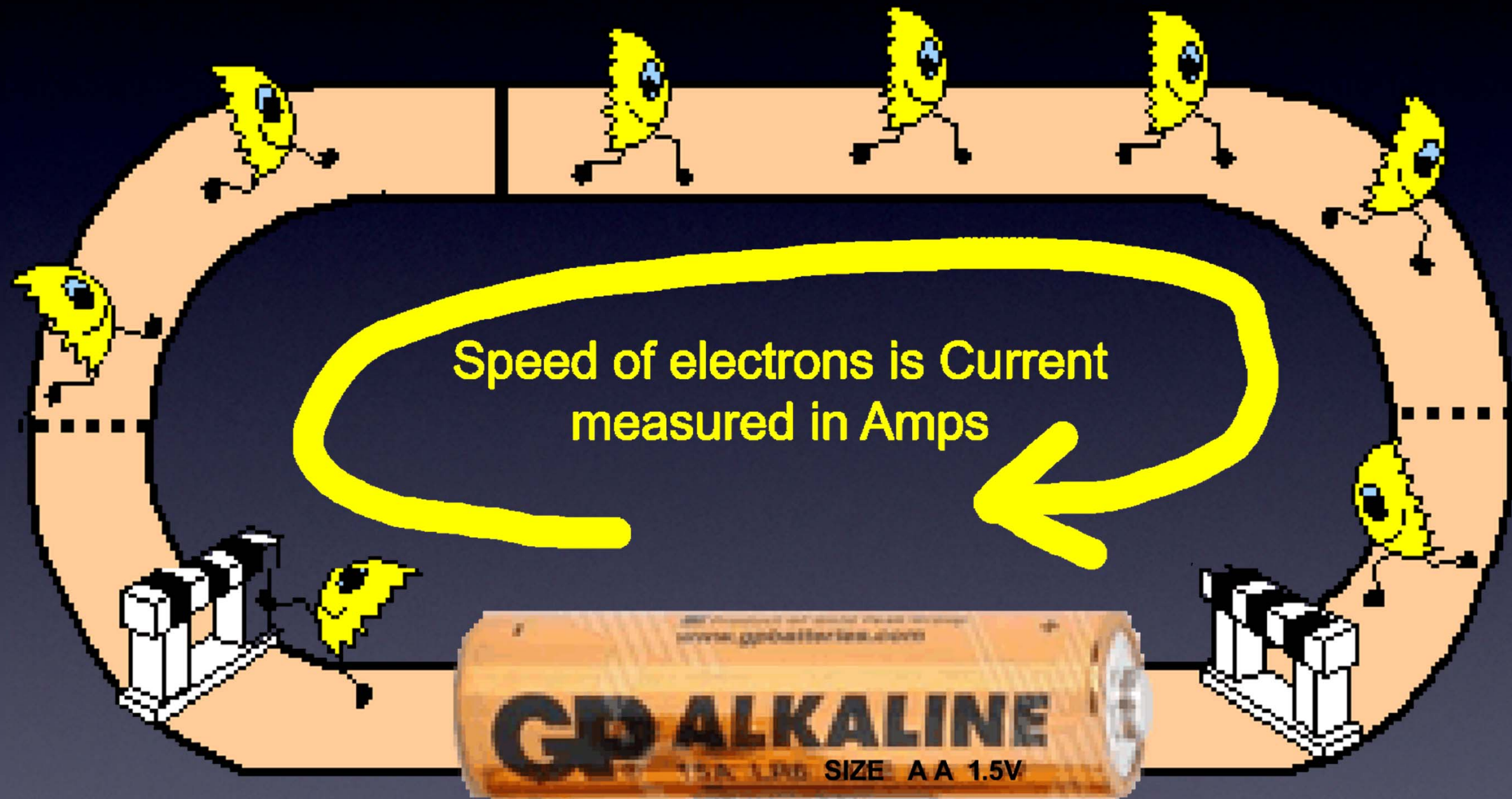
Power Supplies

Everything You Need to Know About Electronics



Voltage / **Volts**

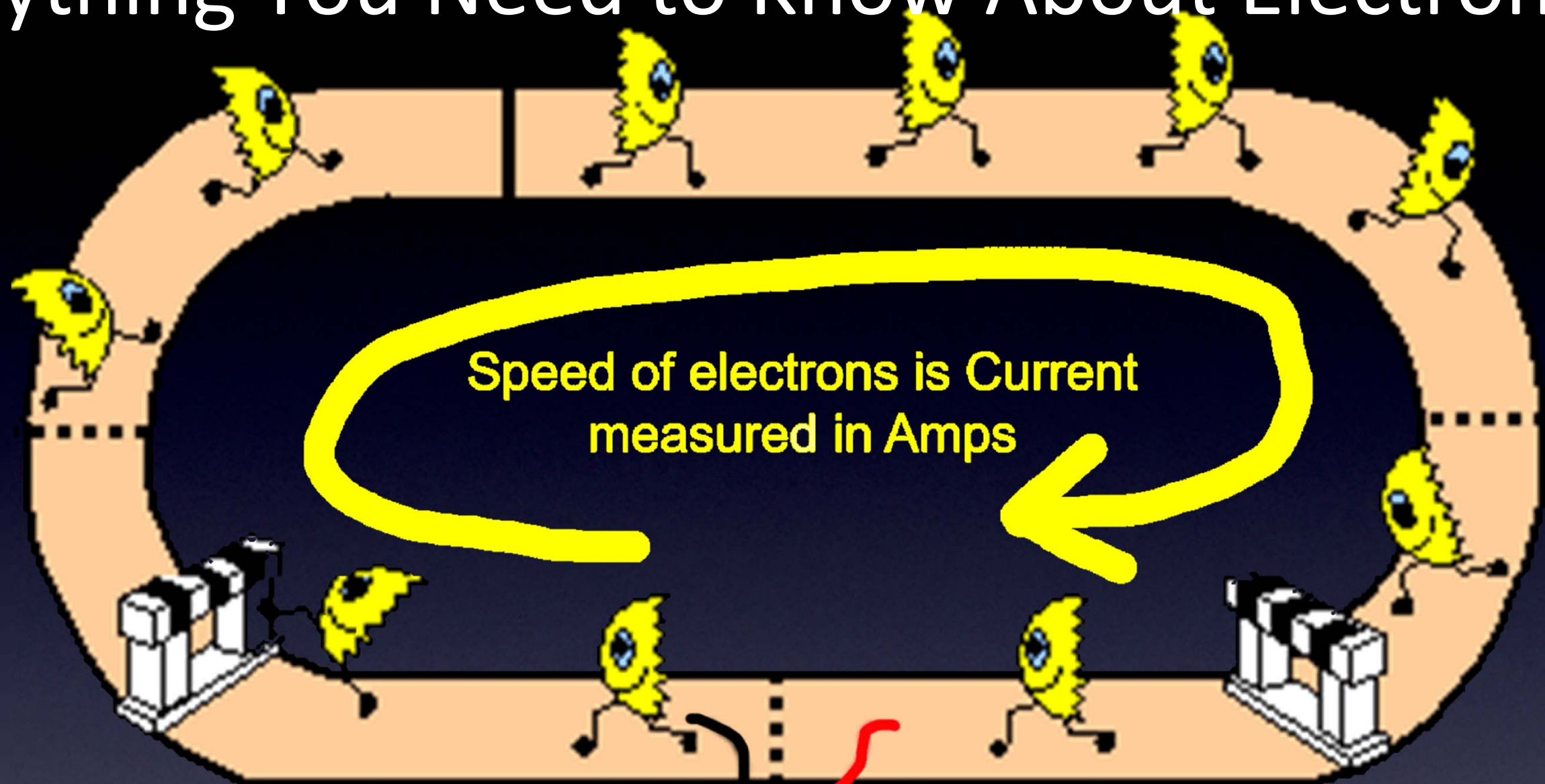
Everything You Need to Know About Electronics



Electrons pushed with 1.5V.
So, they move!

Current / **Amps**

Everything You Need to Know About Electronics



3 times more Volts
3 times more push
3 times faster electrons
3 times more current / Amps

Current / Amps

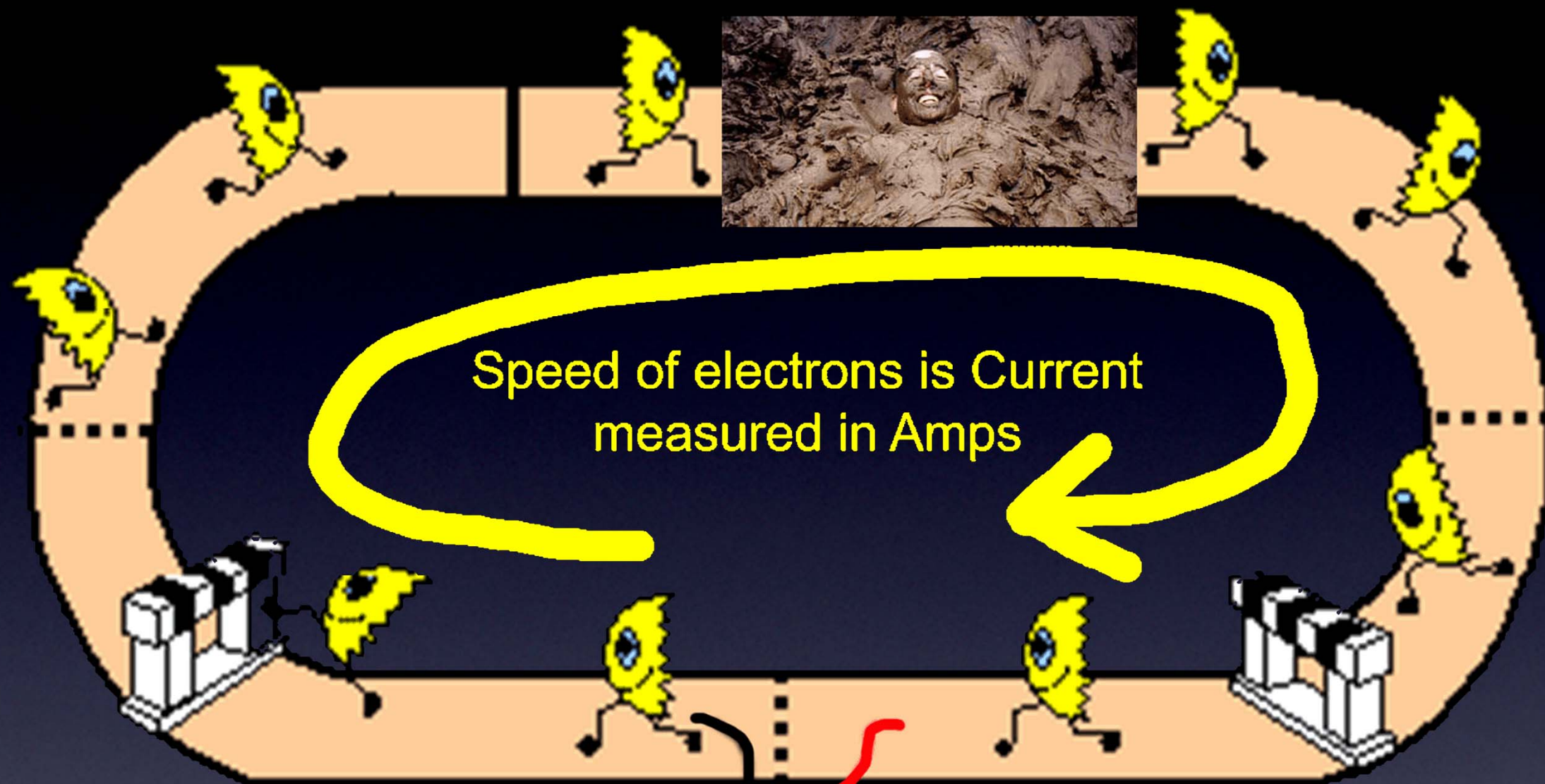
Everything You Need to Know About Electronics

Too much energy?

Lots of energy!

Current / Amps

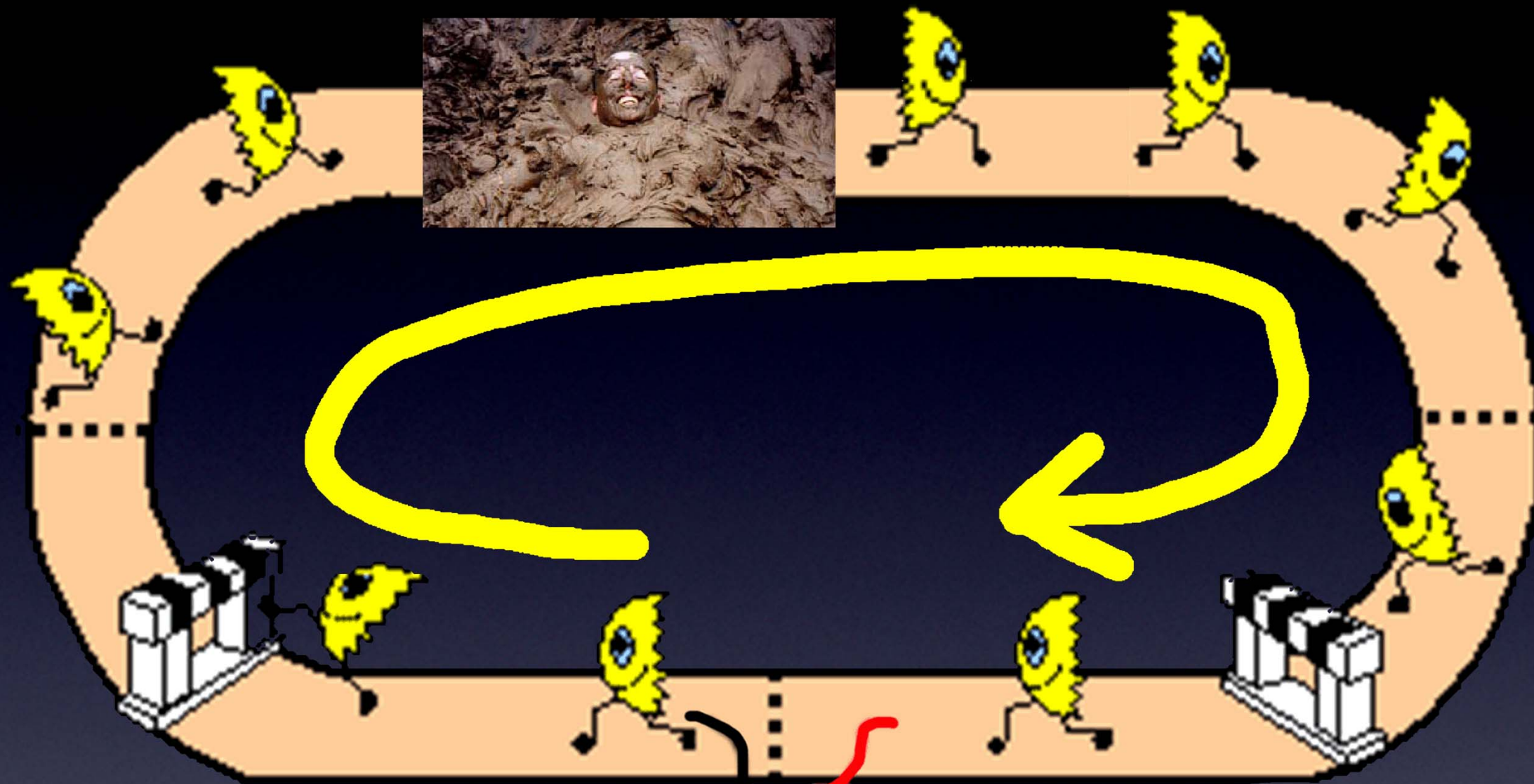
Everything You Need to Know About Electronics



Resistance in the electrons' path slows them down, which means less current (less Amps).

Resistance / **Ohms**

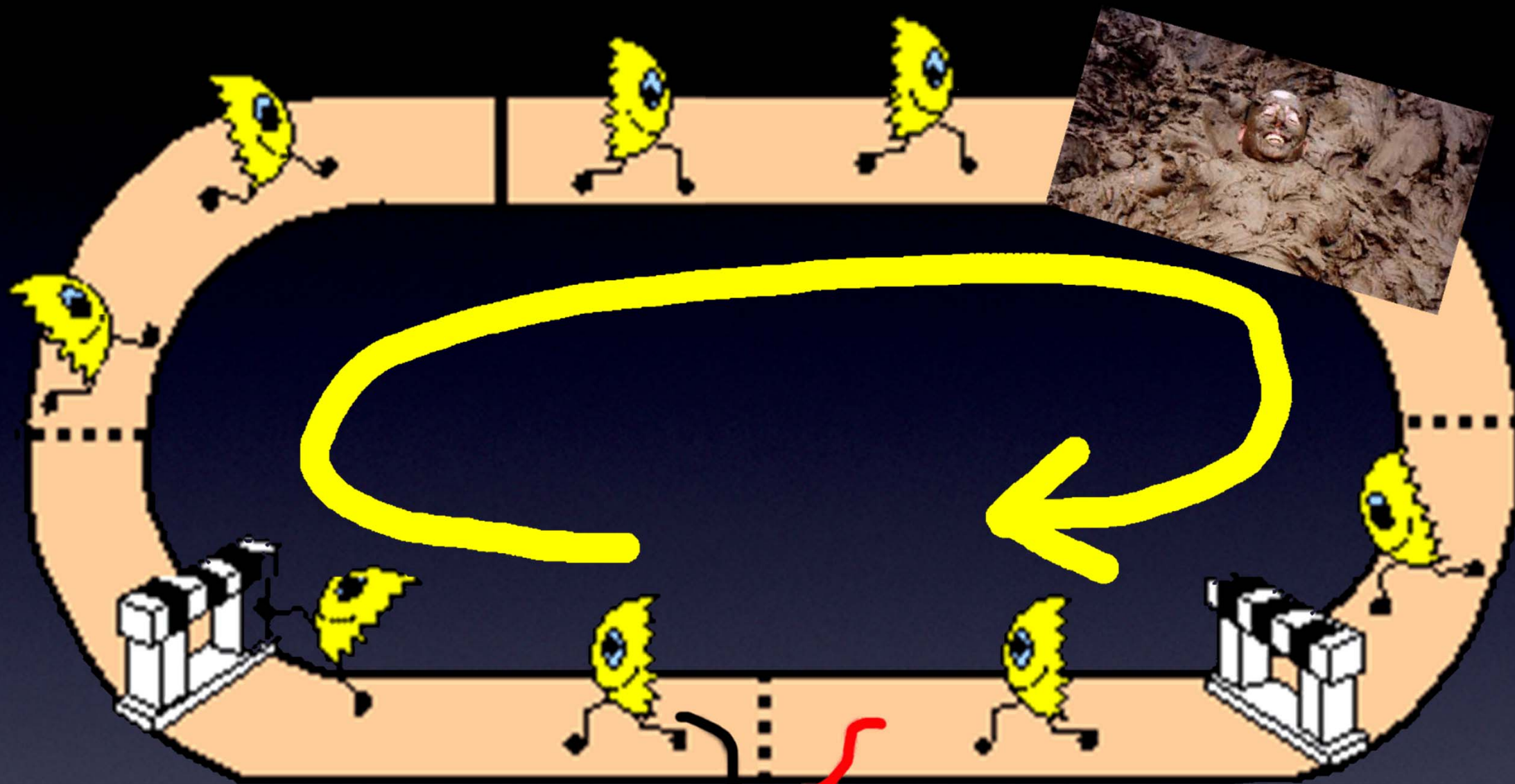
Everything You Need to Know About Electronics



Resistance / Ohms

Same
Circuit !

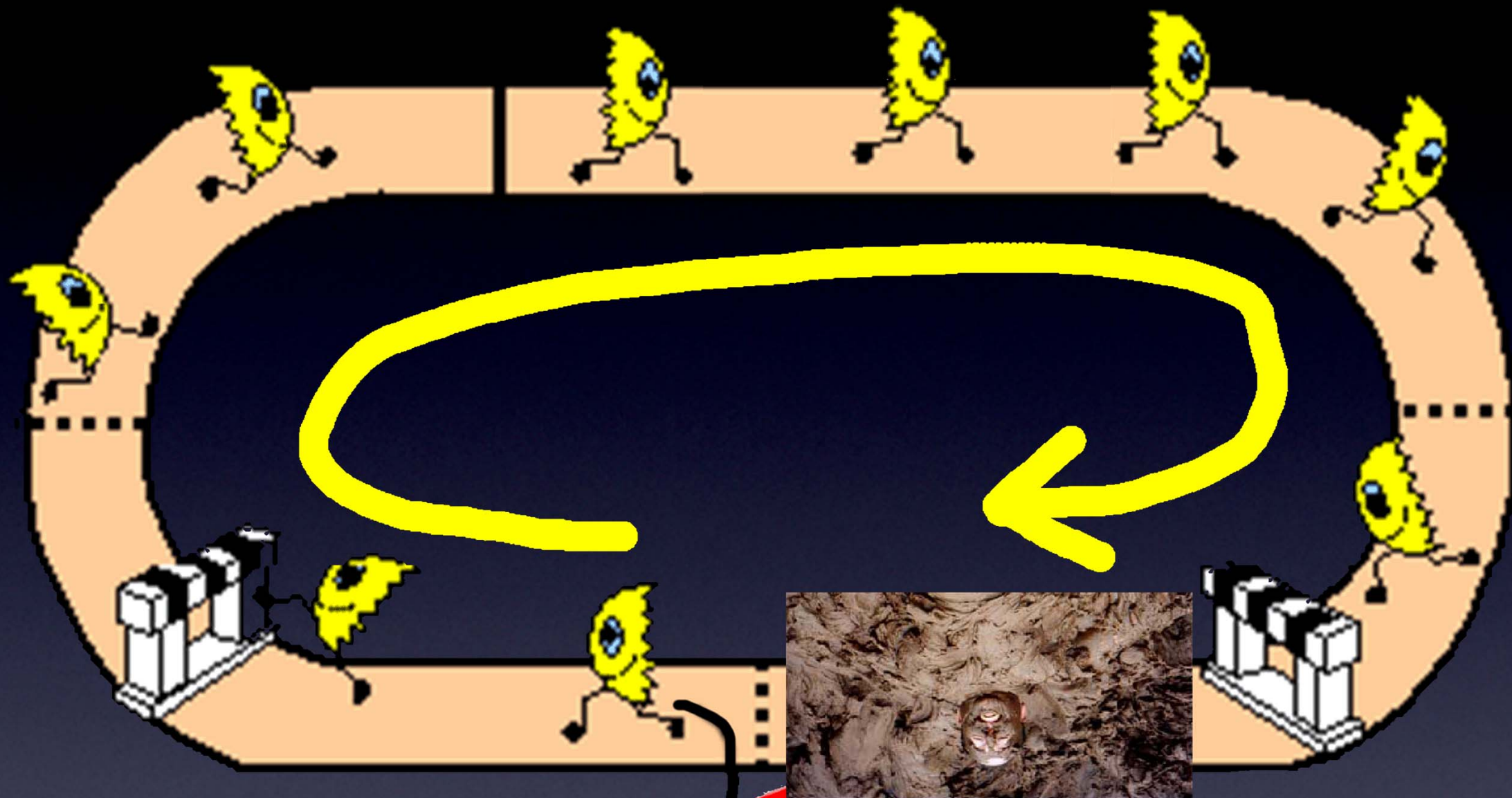
Everything You Need to Know About Electronics



Same
Circuit !

Resistance / Ohms

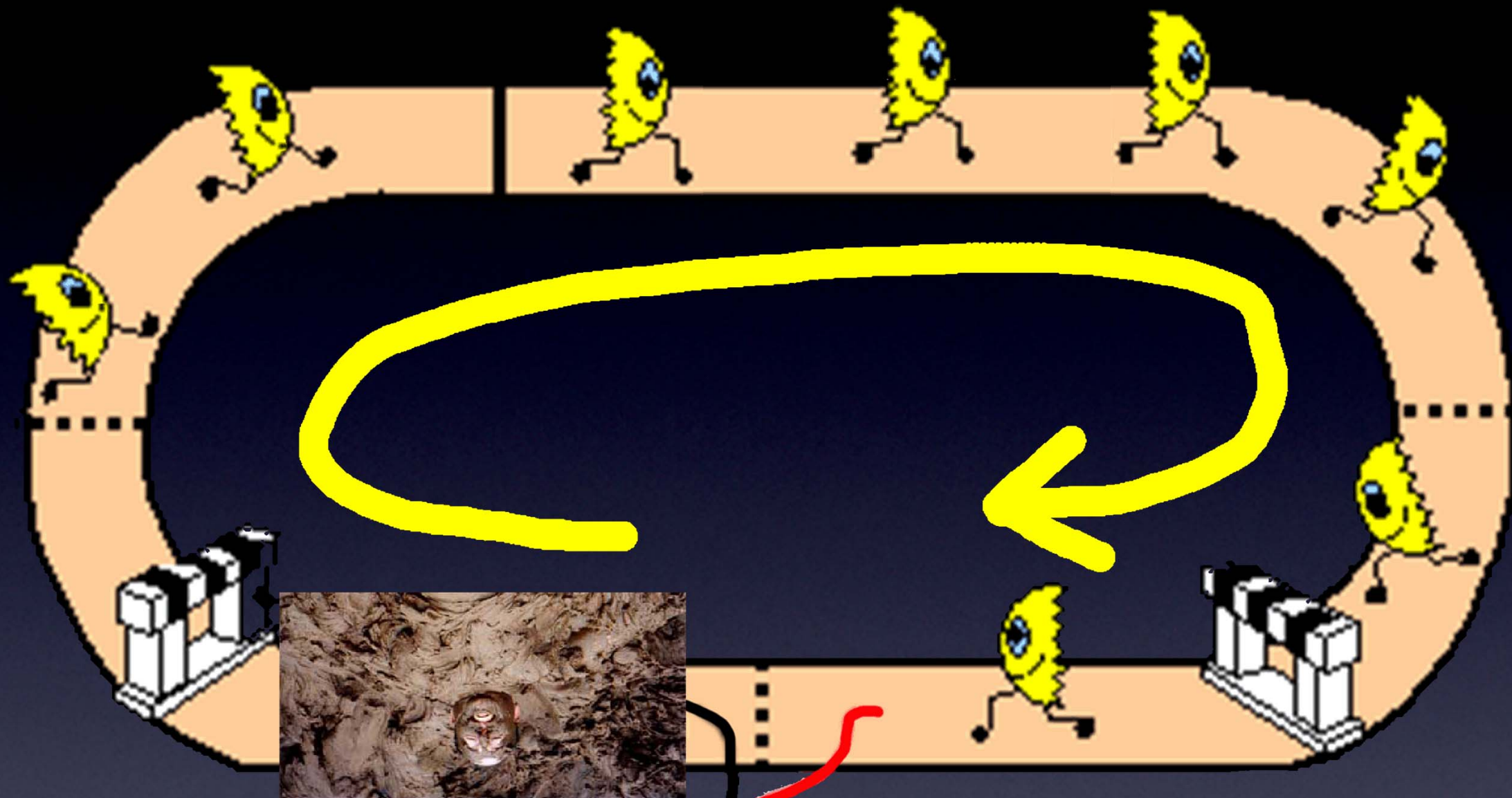
Everything You Need to Know About Electronics



Resistance / Ohms

Same
Circuit !

Everything You Need to Know About Electronics



Resistance / Ohms

Same
Circuit !

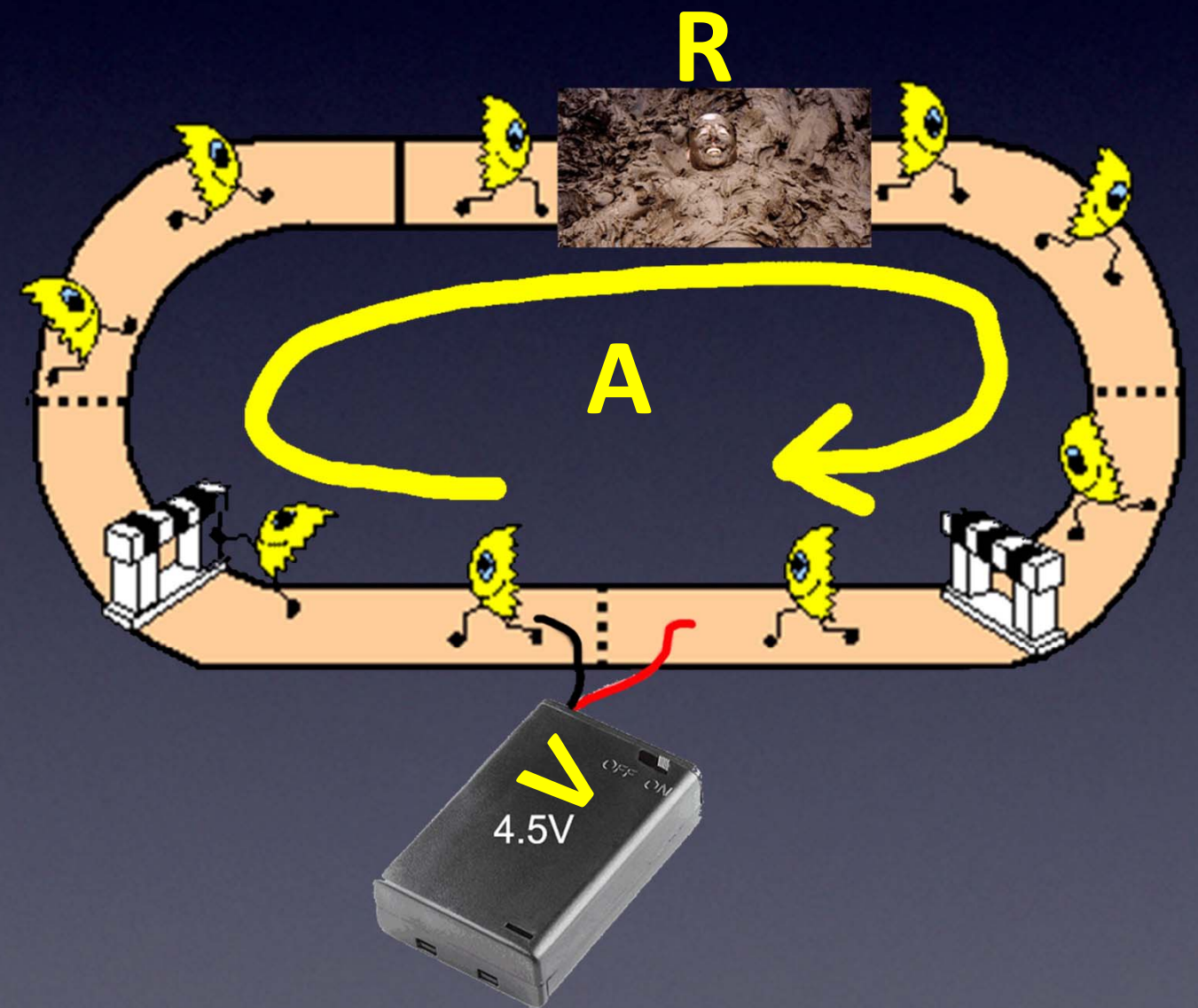
Everything You Need to Know About Electronics

Ohm's Law

Volts -- *force* pushing electrons

Amps -- *speed* of electrons

Ohms -- *Resistance* to flow of electrons



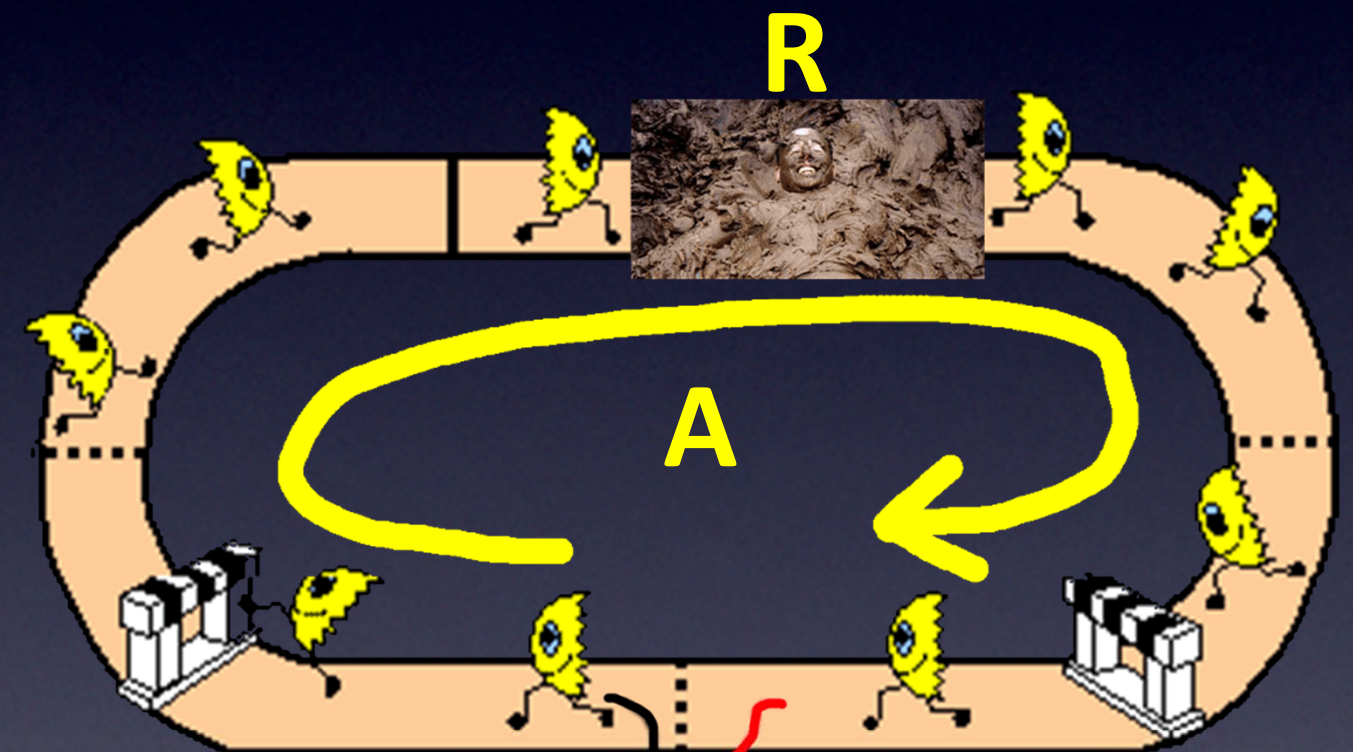
Everything You Need to Know About Electronics

Ohm's Law

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$$\mathbf{V_{olts} = A_{mps} \times R}$$



(Ohms)

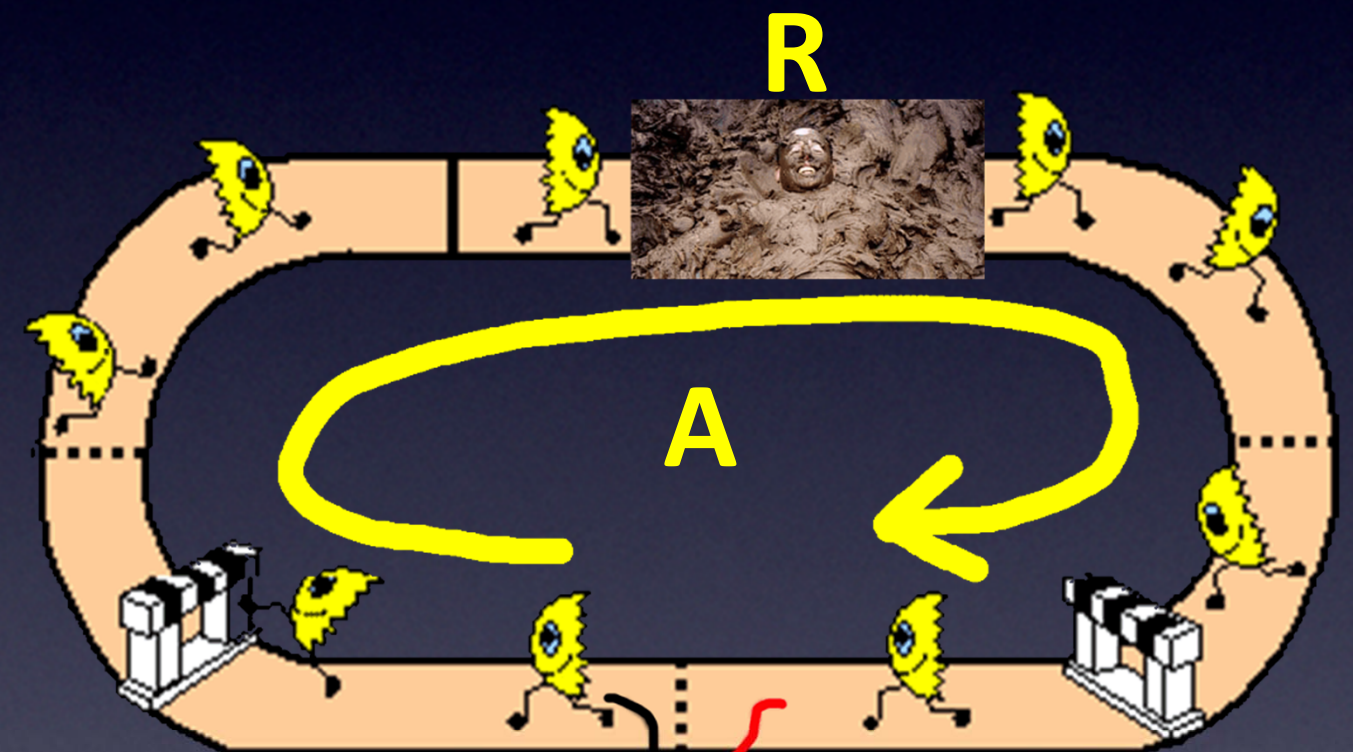
Everything You Need to Know About Electronics

Ohm's Law

Volts -- *force* pushing electrons

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$$\text{Volts} = \text{Amps} \times R$$

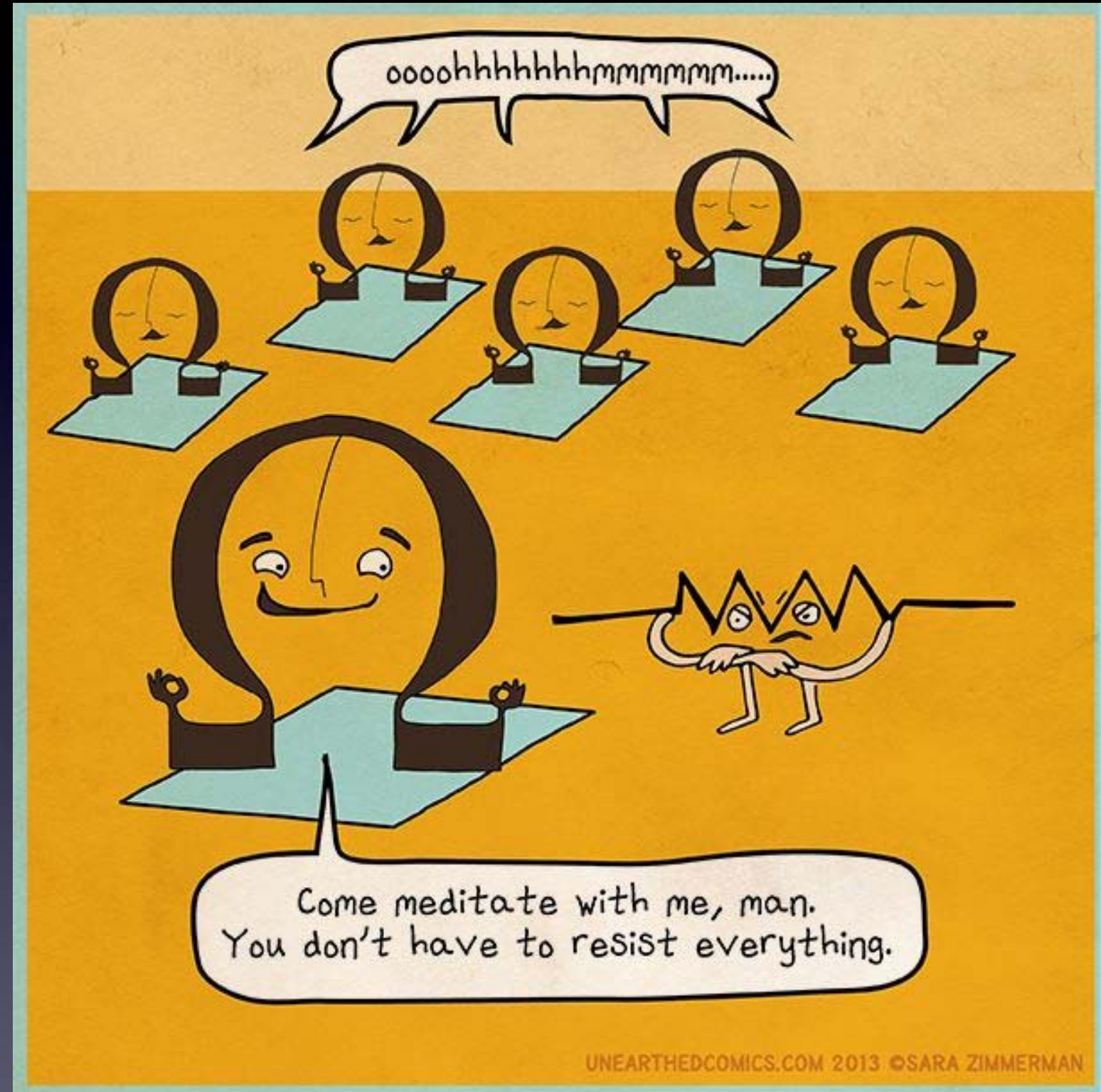
Also commonly written: $E = I \times R$

(Ohms)

Everything You Need to Know About Electronics

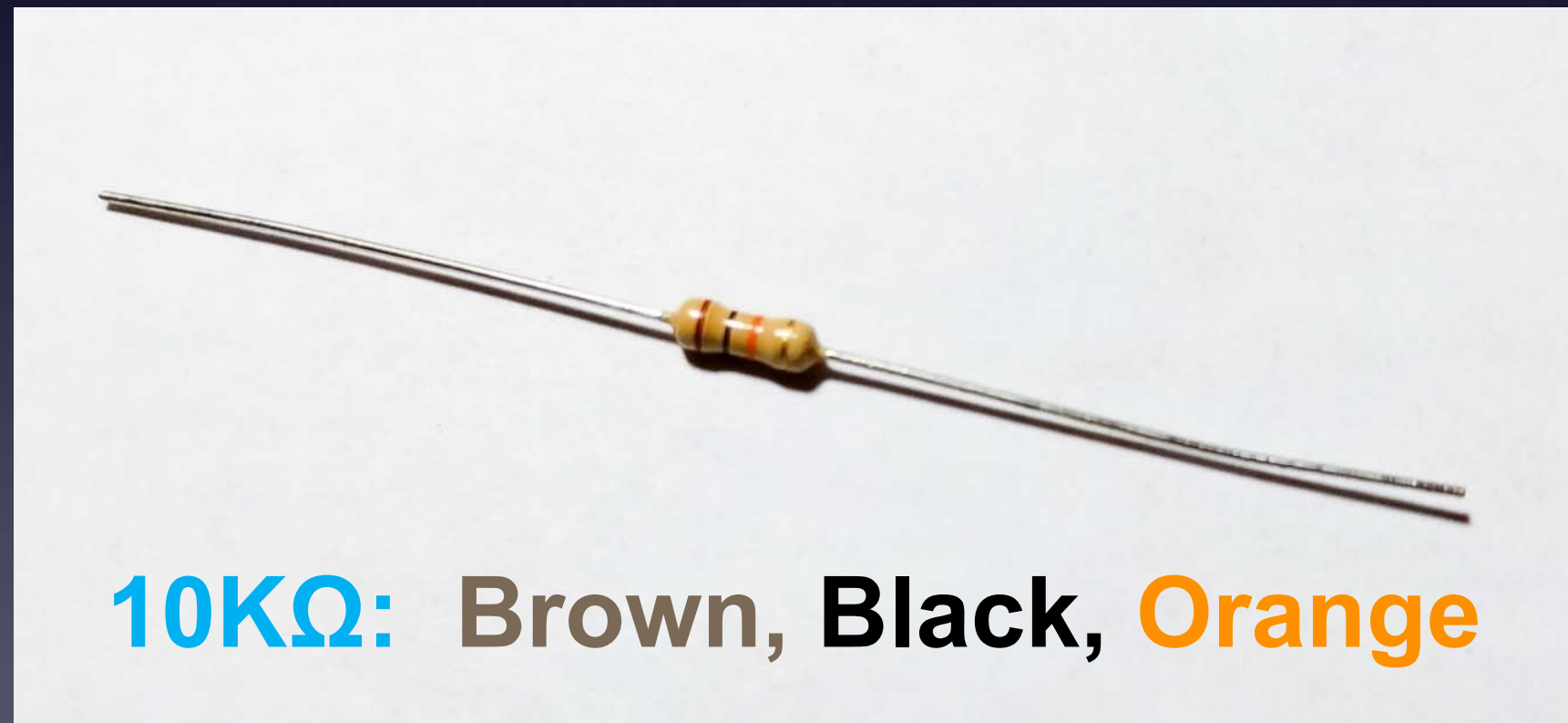
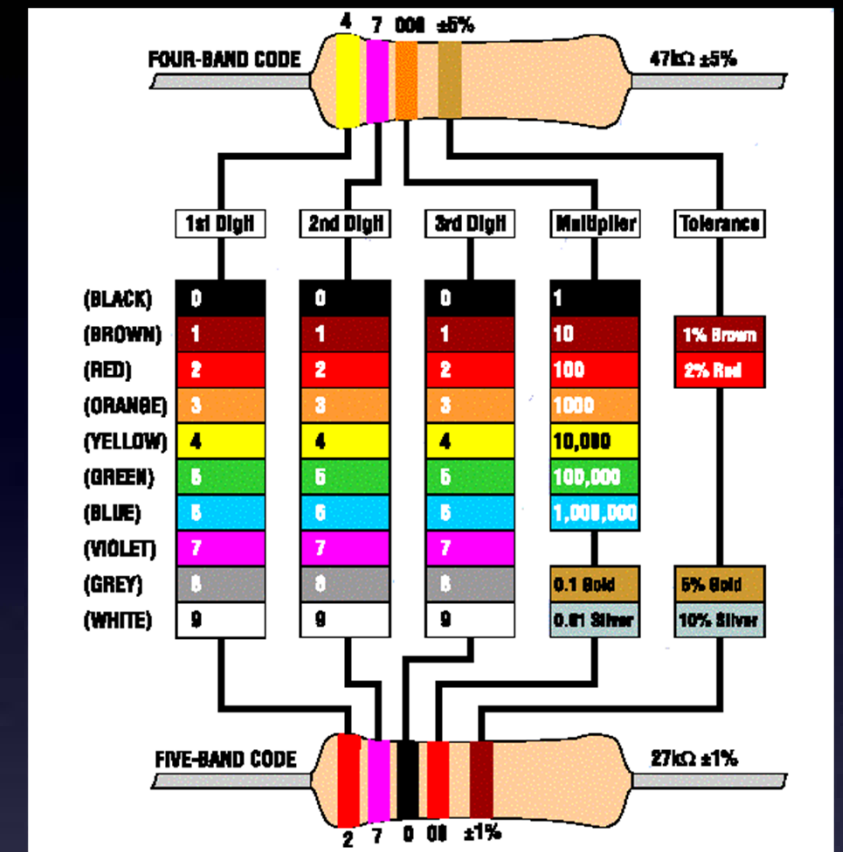
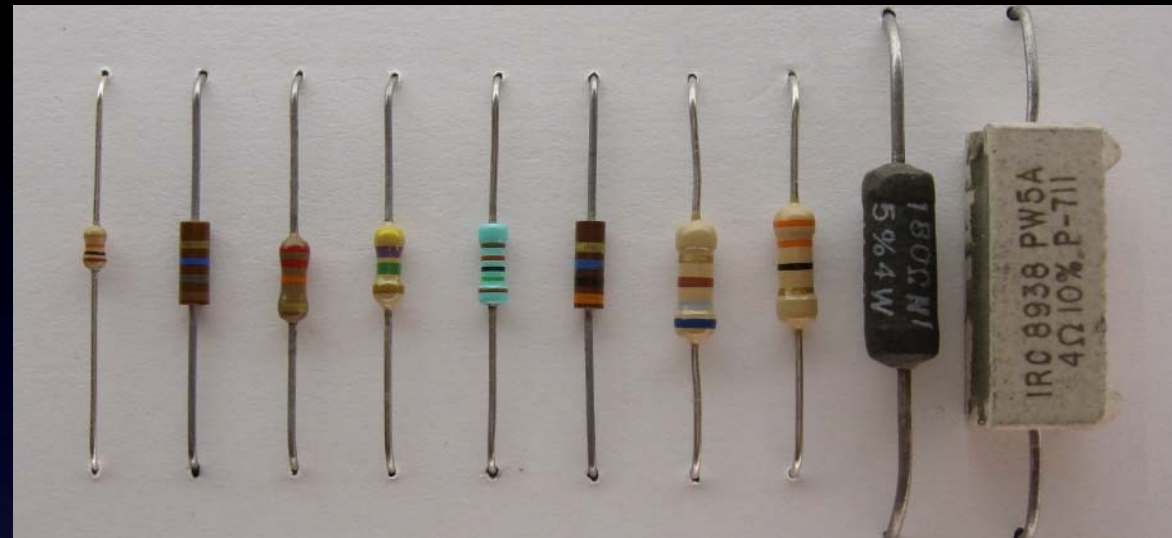
The symbol for
Resistance:

Ω



Resistor / Ohms

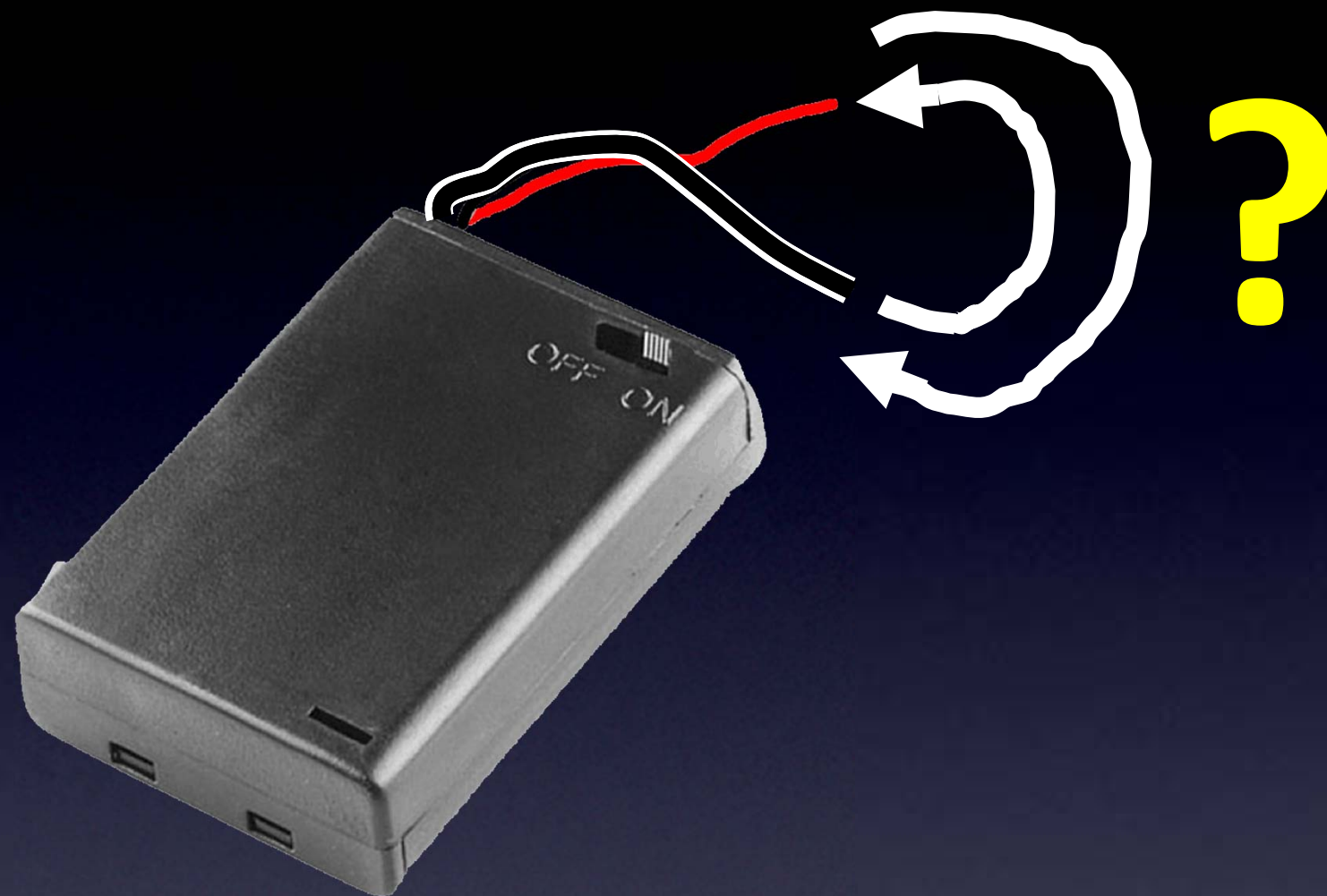
Everything You Need to Know About Electronics



10KΩ: Brown, Black, Orange

Resistor / Ohms

Everything You Need to Know About Electronics

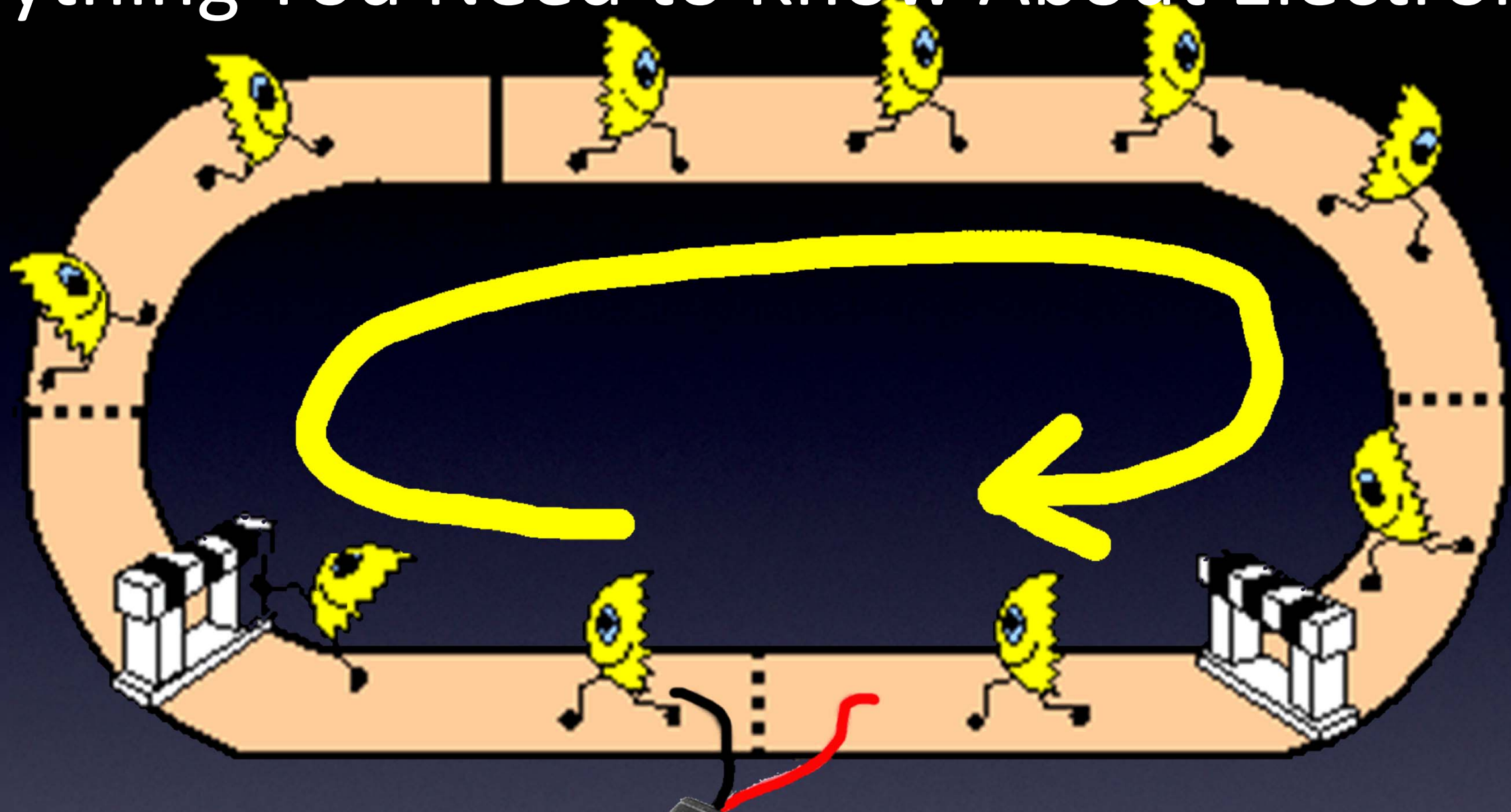


What happens?

polarity

Power Supply – it matters how you connect it!

Everything You Need to Know About Electronics



Black Wire = “-”

Red Wire = “+”



Power Supply – it matters how you connect it!

Everything You Need to Know About Electronics



Red wire:
Power,
Plus, Positive,
4.5V,
Vcc

Black wire:
Minus, Negative,
0V,
Ground (GND)

Power Supply – it matters how you connect it!

Everything You Need to Know About Electronics



or



or

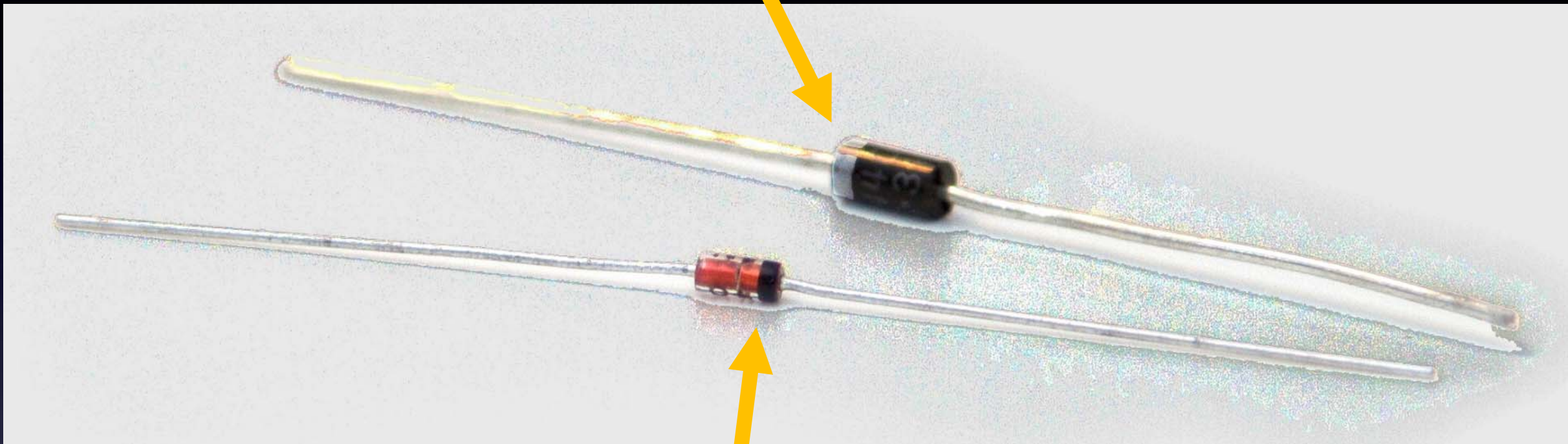


(electrons slowed down the same either way)

Resistors – it doesn't matter which way

Everything You Need to Know About Electronics

Minus / Negative side



Minus / Negative side

Diodes – One-Way valve for electrons

Diodes – it matters which way!

Everything You Need to Know About Electronics



Short wire is Minus / Negative

Special kind of Diode – it Emits Light!

LED – it matters which way!

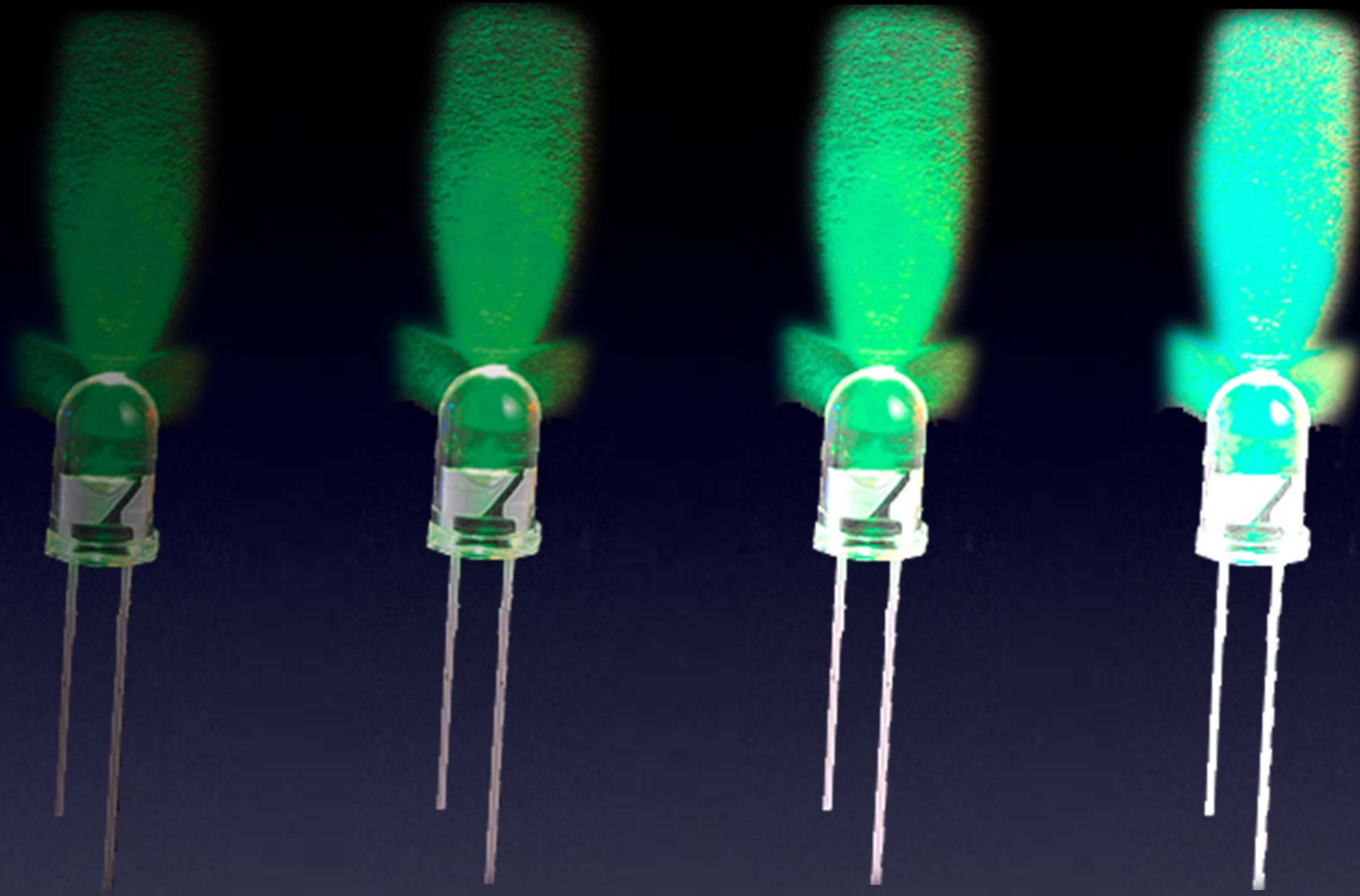
Everything You Need to Know About Electronics



Lots of different colored LEDs! (including IR)

LED

Everything You Need to Know About Electronics



More current → More brightness! (until...)

LED

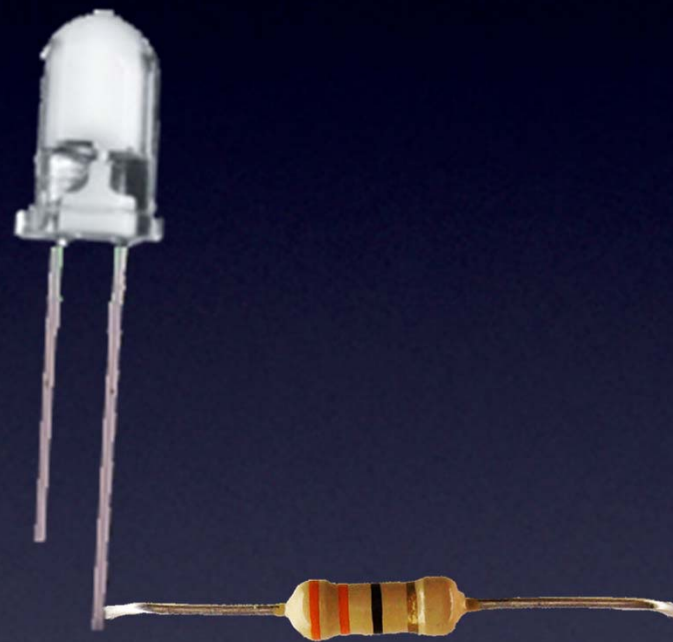
Everything You Need to Know About Electronics



More current → More brightness! (until...)

LED

Everything You Need to Know About Electronics

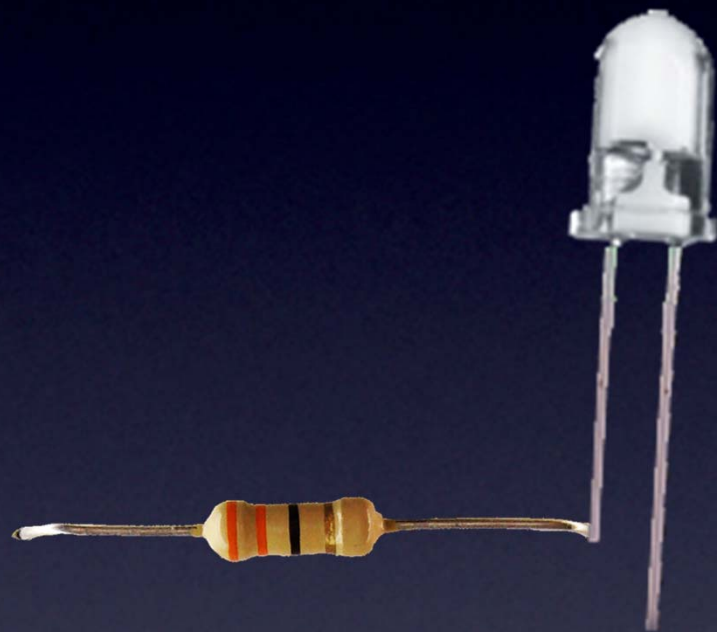


*(with a resistor
so no magic smoke goes away)*

This is why we put a resistor in line with an LED

LED

Everything You Need to Know About Electronics



(the resistor can go on either side)

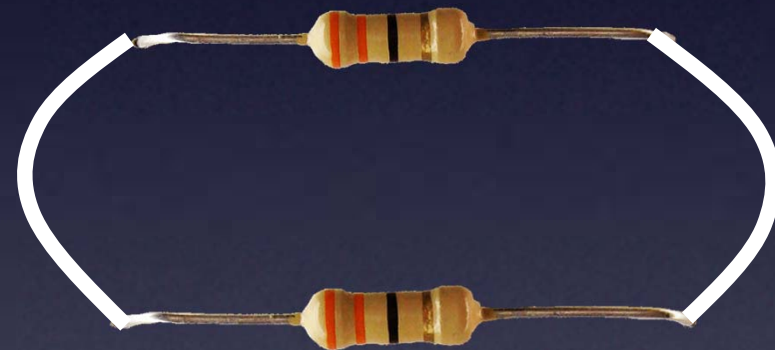
This is why we put a resistor in line with an LED

LED

Everything You Need to Know About Electronics

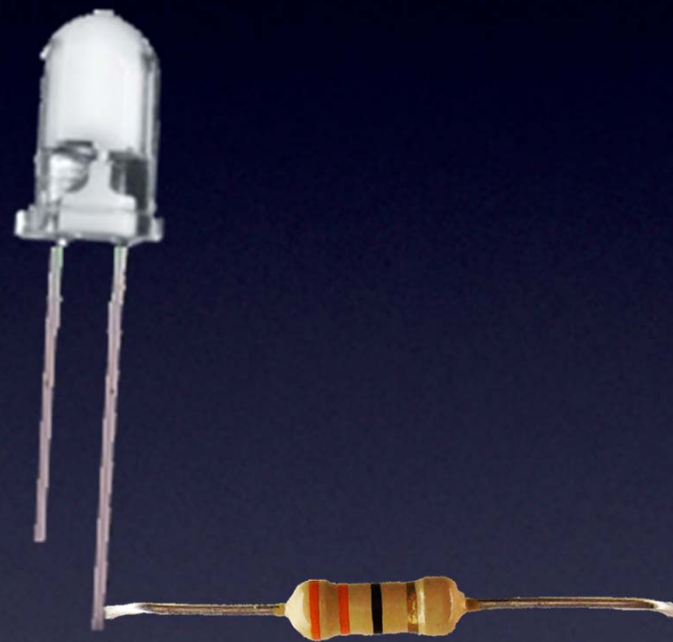


Series = in line



Parallel = across

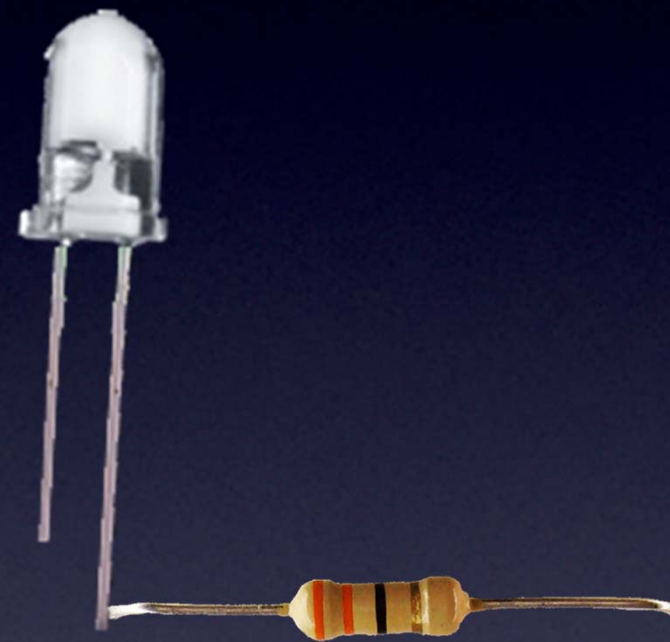
Everything You Need to Know About Electronics



Let's make this light up!

LED

Everything You Need to Know About Electronics

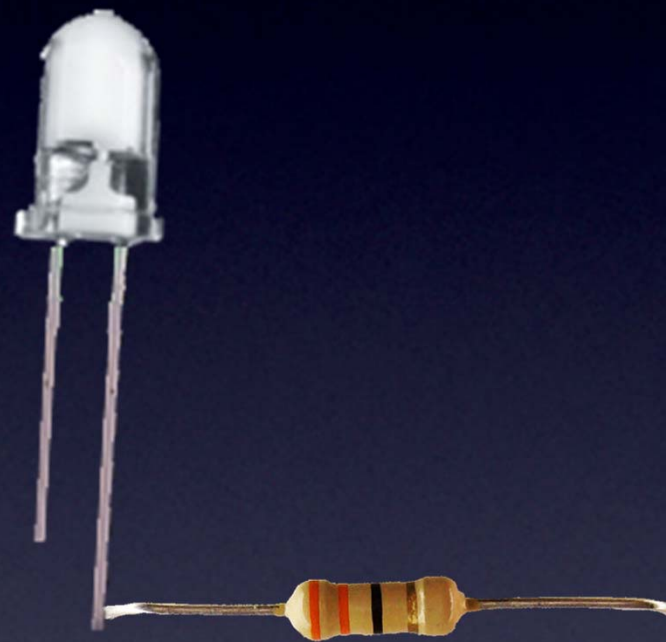
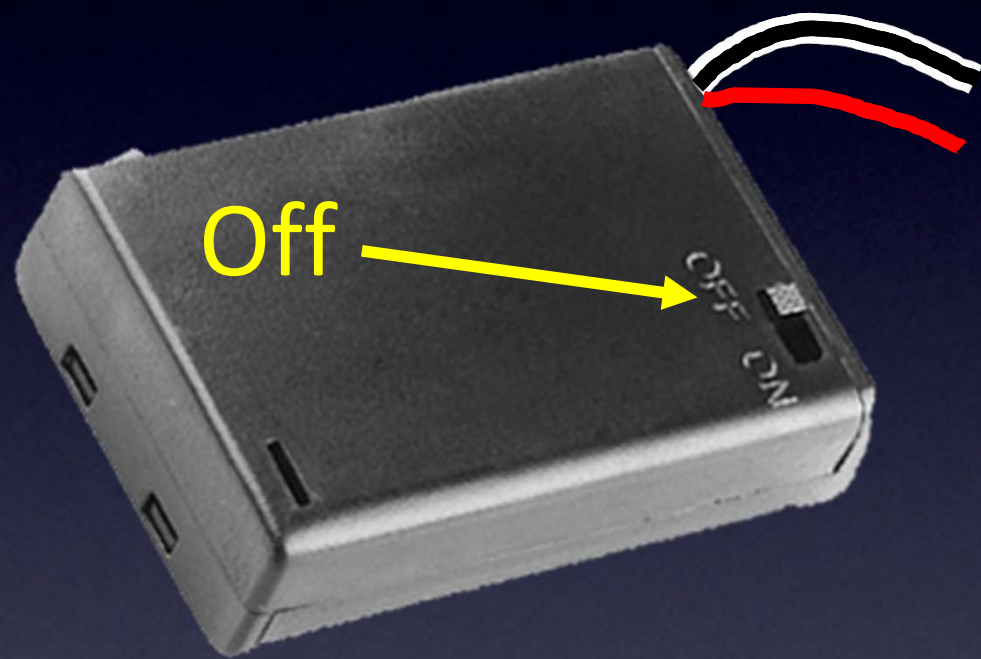


(add a power supply)

Let's make this light up!

LED

Everything You Need to Know About Electronics



Let's make this light up!

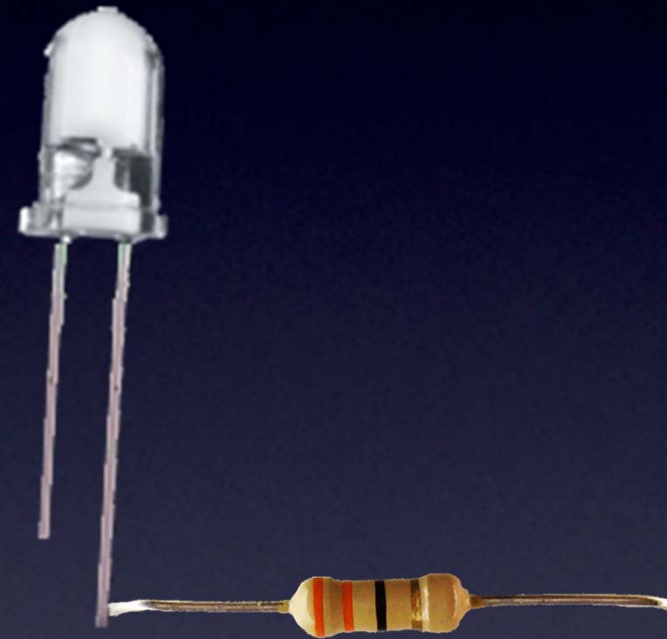
LED

Everything You Need to Know About Electronics

Black wire: “-” (ground)



Red wire: “+” power)



Let's make this light up!

LED

Everything You Need to Know About Electronics

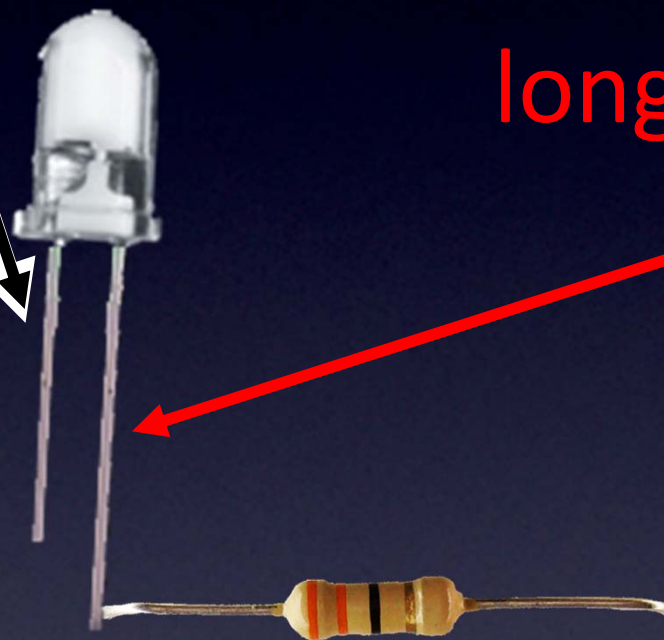
short lead: “-”

Black wire: “-” (ground)



Red wire: “+” power)

long lead: “+”



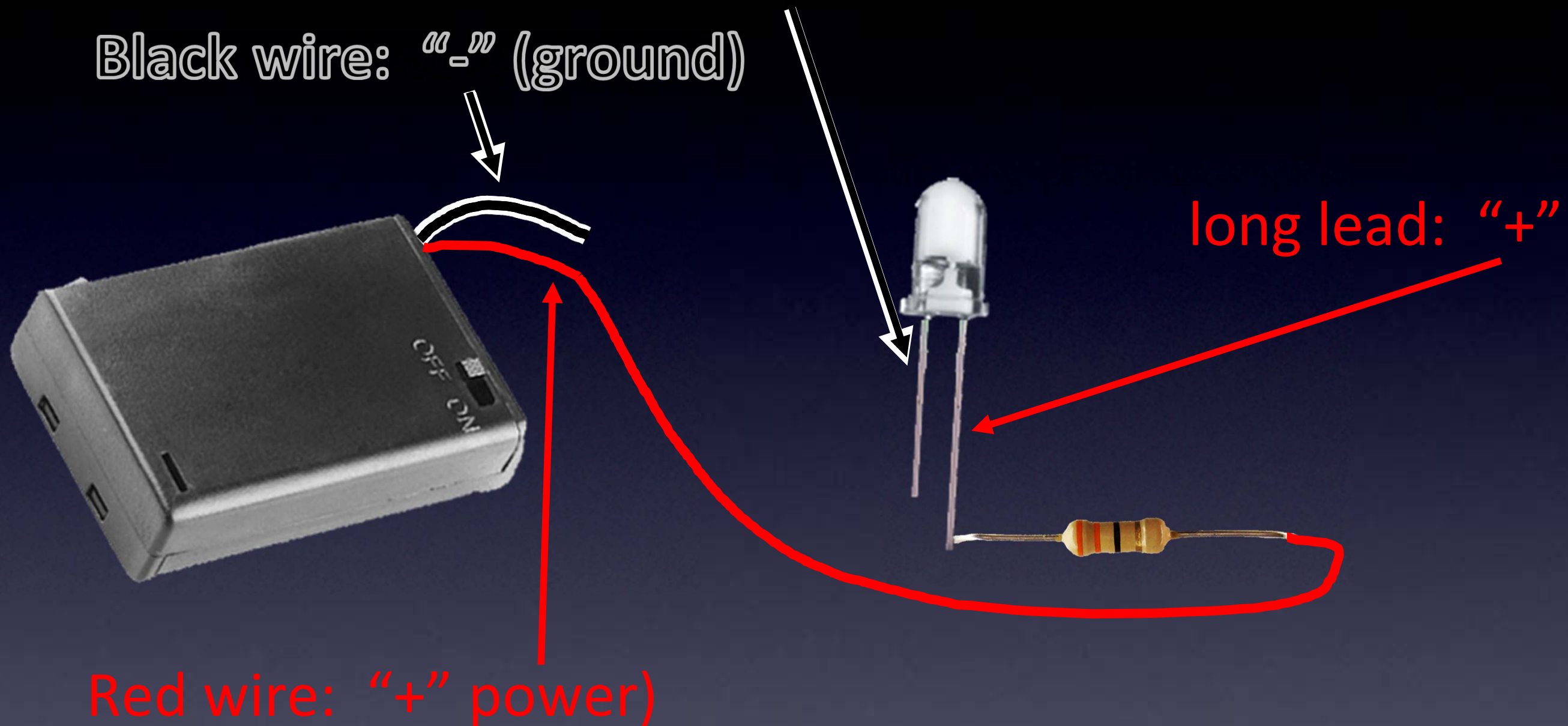
Let's make this light up!

LED

Everything You Need to Know About Electronics

short lead: “-”

Black wire: “-” (ground)



Let's make this light up!

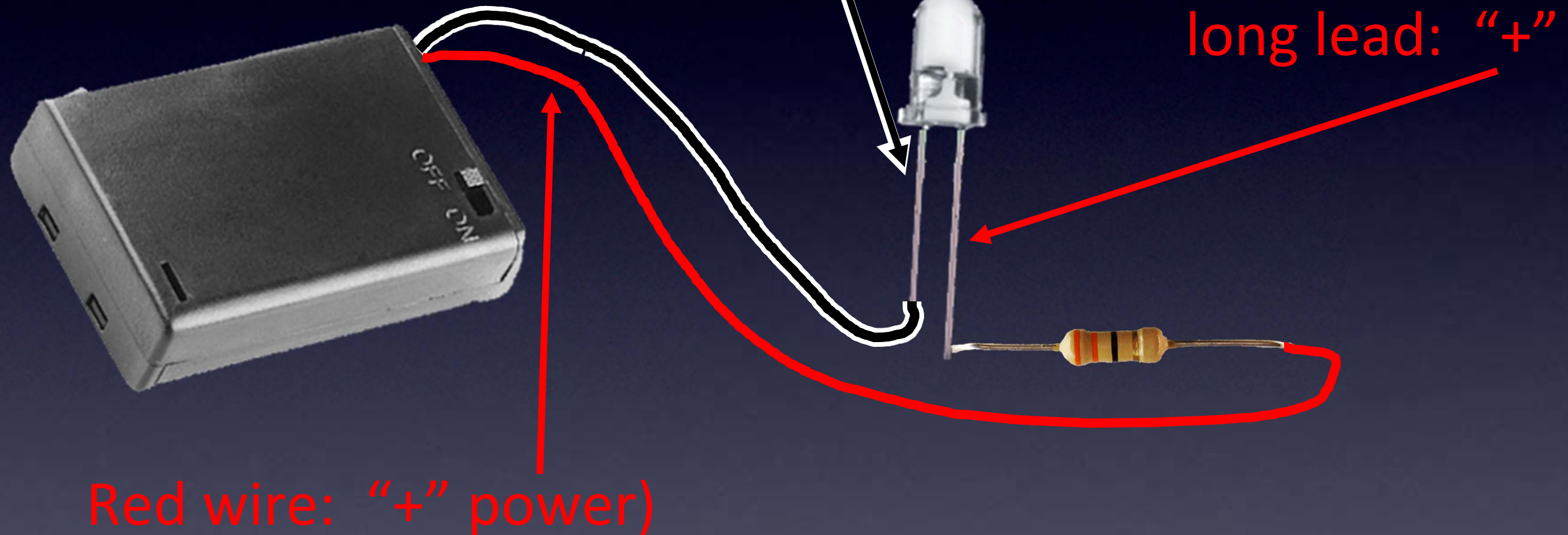
LED

Everything You Need to Know About Electronics

short lead: “-”

Black wire: “-” (ground)

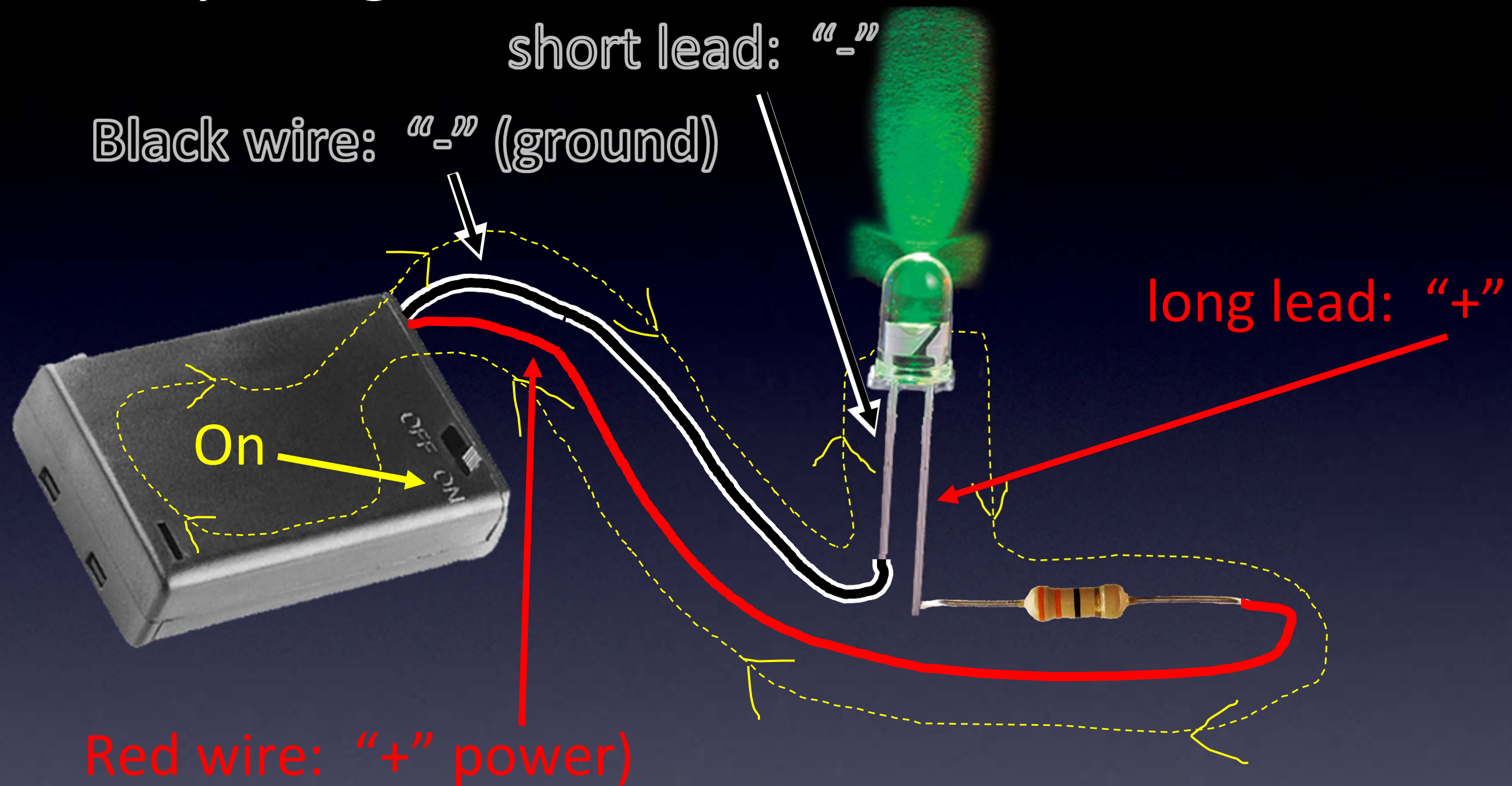
long lead: “+”



Let's make this light up!

LED

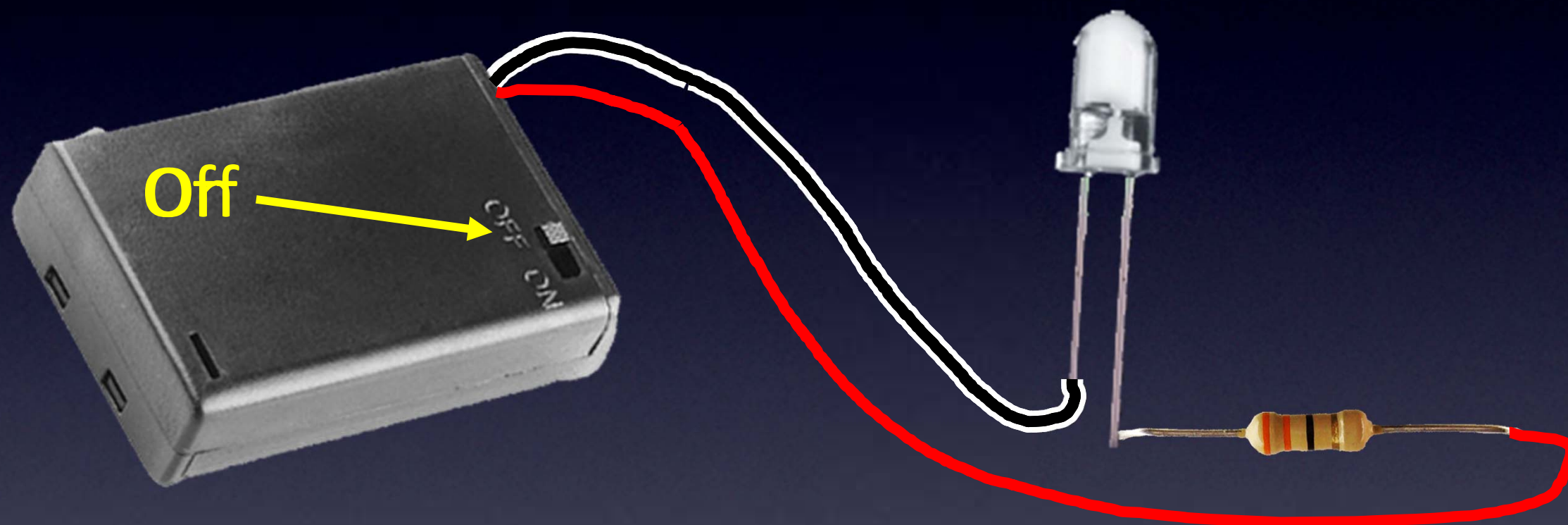
Everything You Need to Know About Electronics



It lights!

LED

Everything You Need to Know About Electronics



It's off

LED

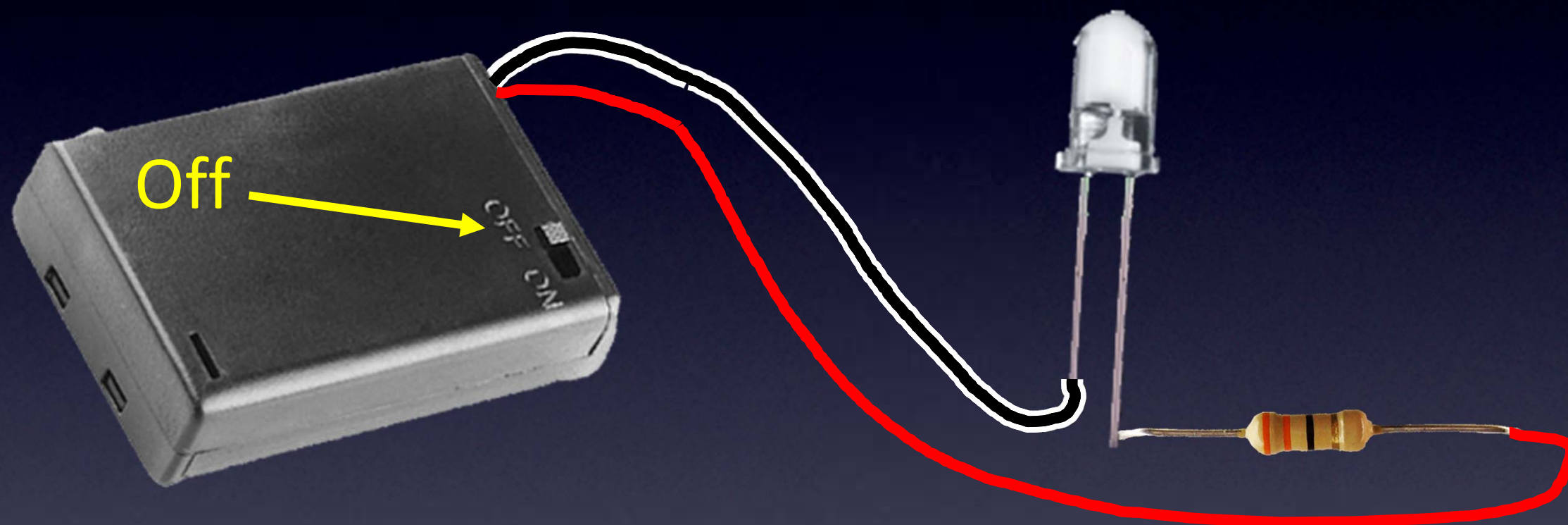
Everything You Need to Know About Electronics



LED & battery

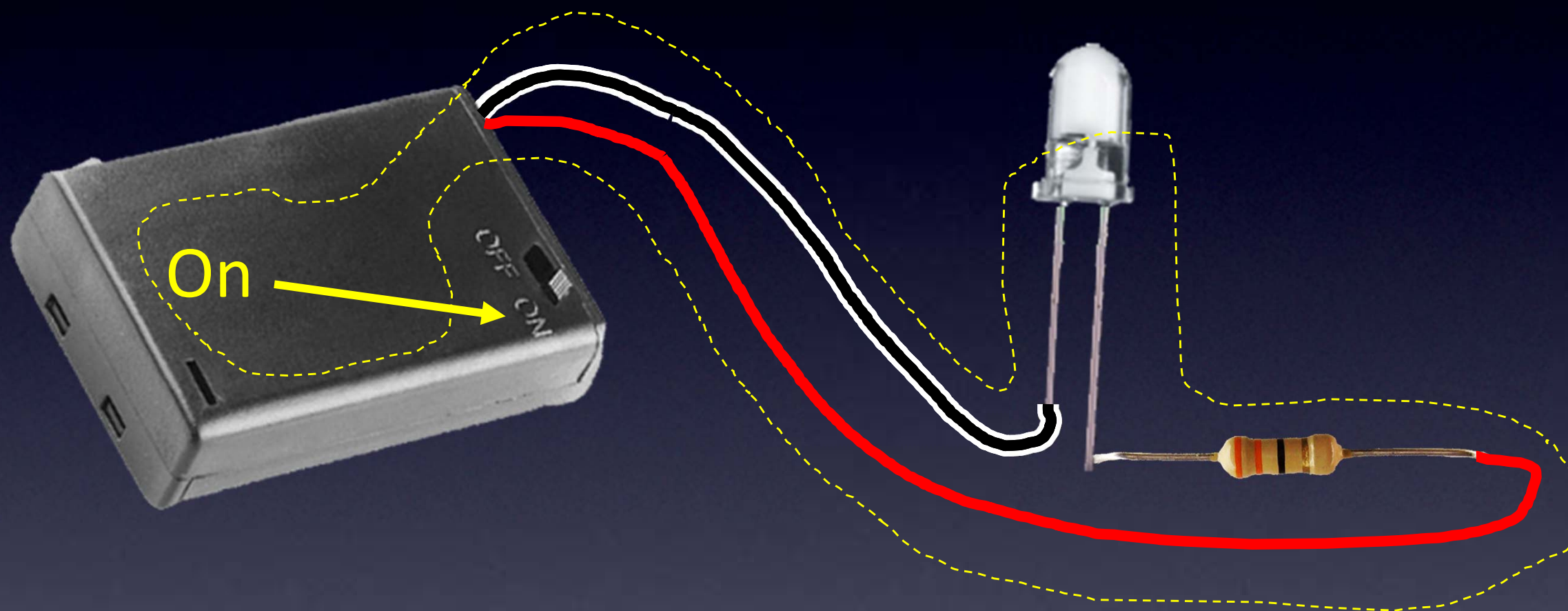
Our first circuit

Everything You Need to Know About Electronics



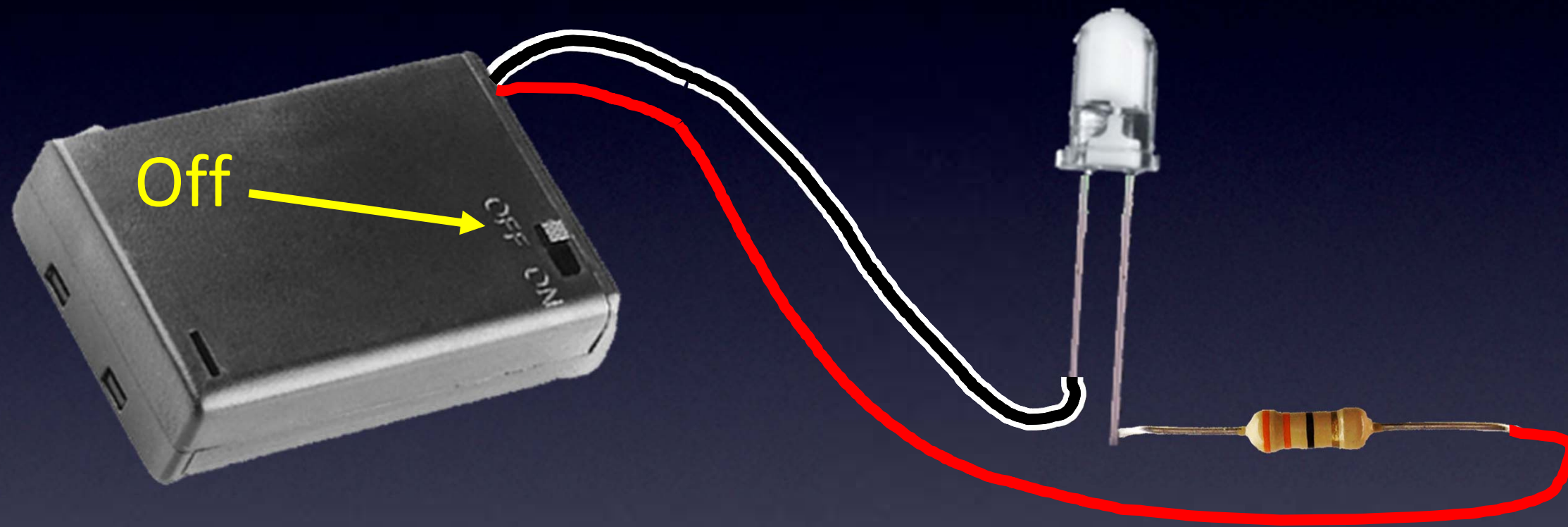
IR LED

Everything You Need to Know About Electronics



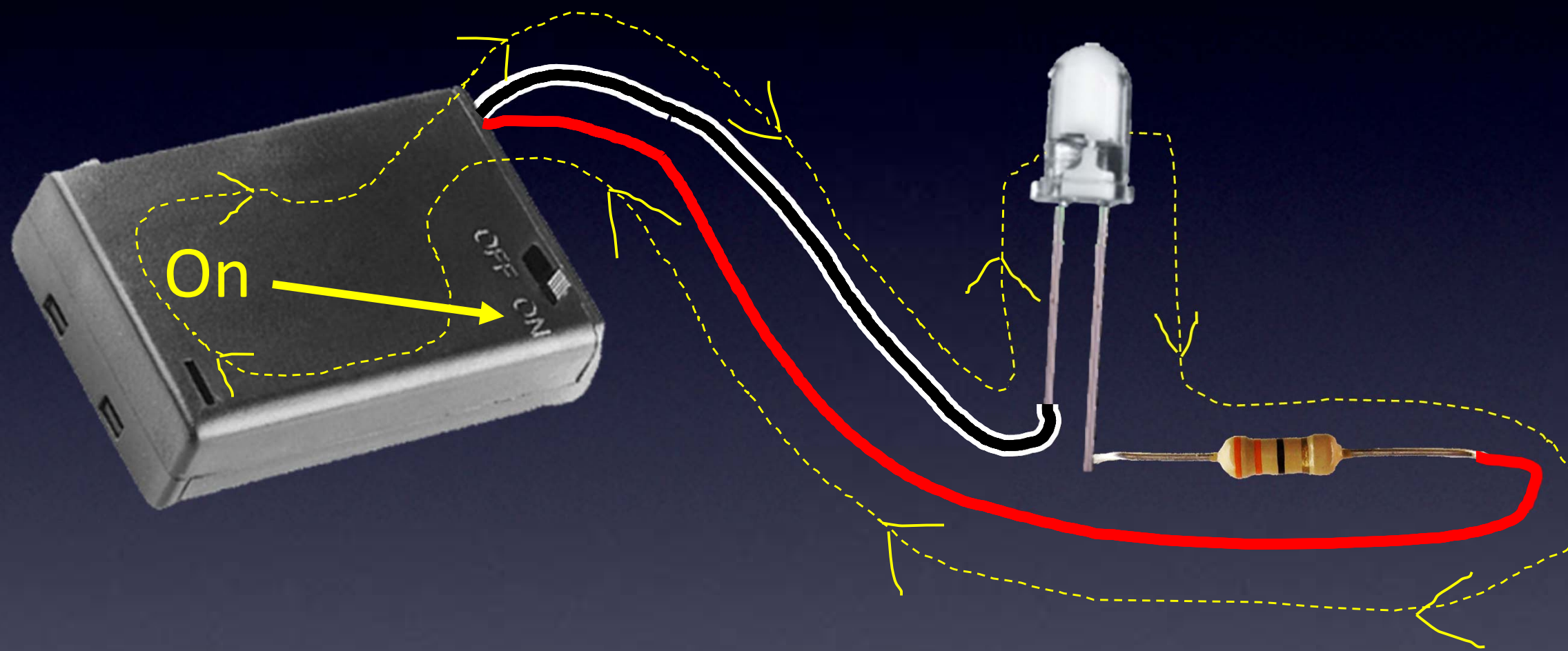
IR LED

Everything You Need to Know About Electronics



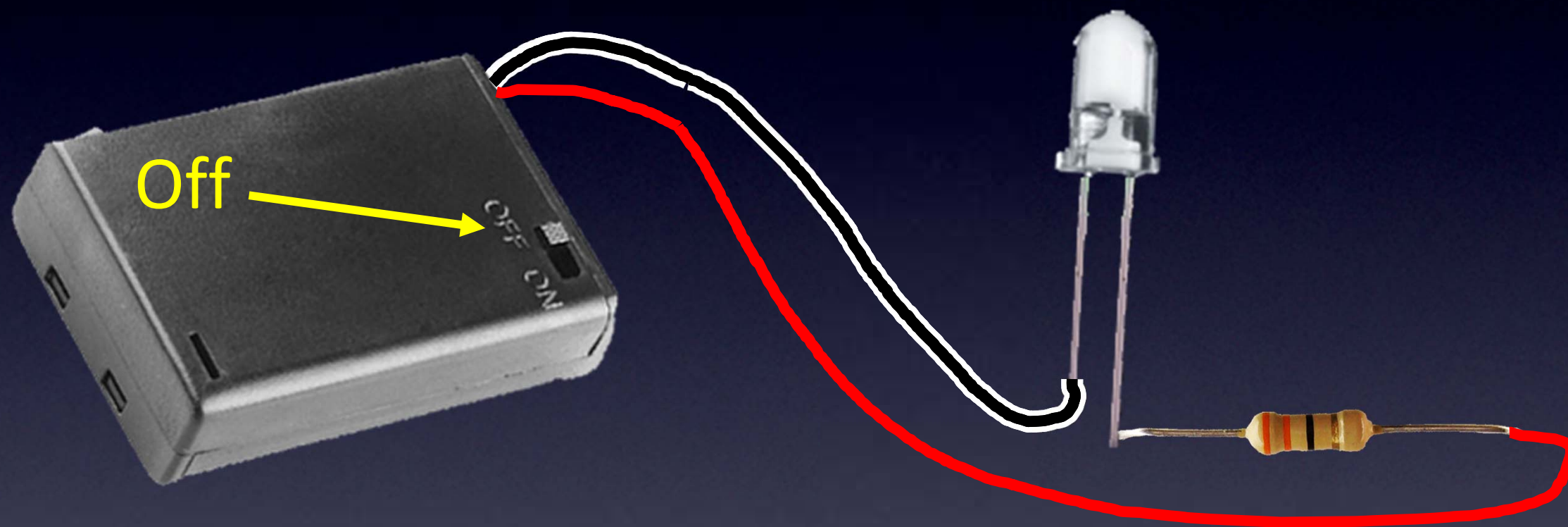
IR LED

Everything You Need to Know About Electronics



IR LED

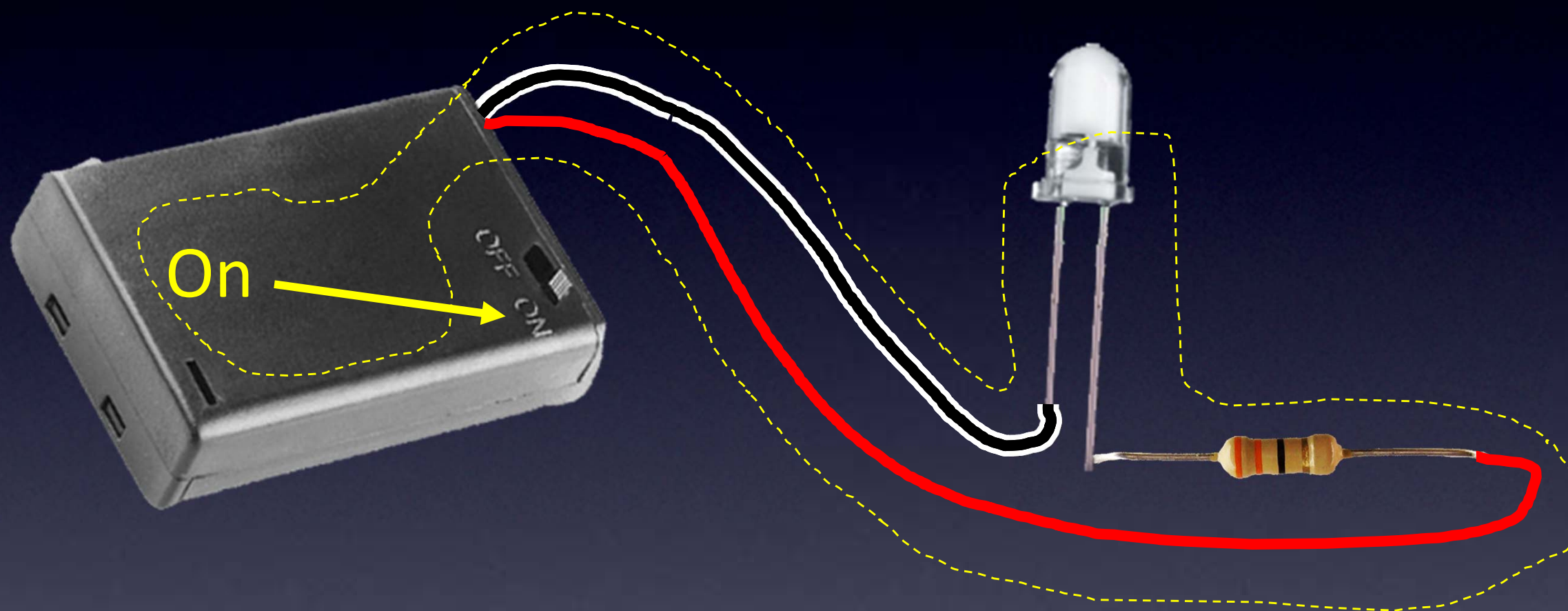
Everything You Need to Know About Electronics



A “code” is IR light blinking on-off-on-off...

IR Remote Control

Everything You Need to Know About Electronics



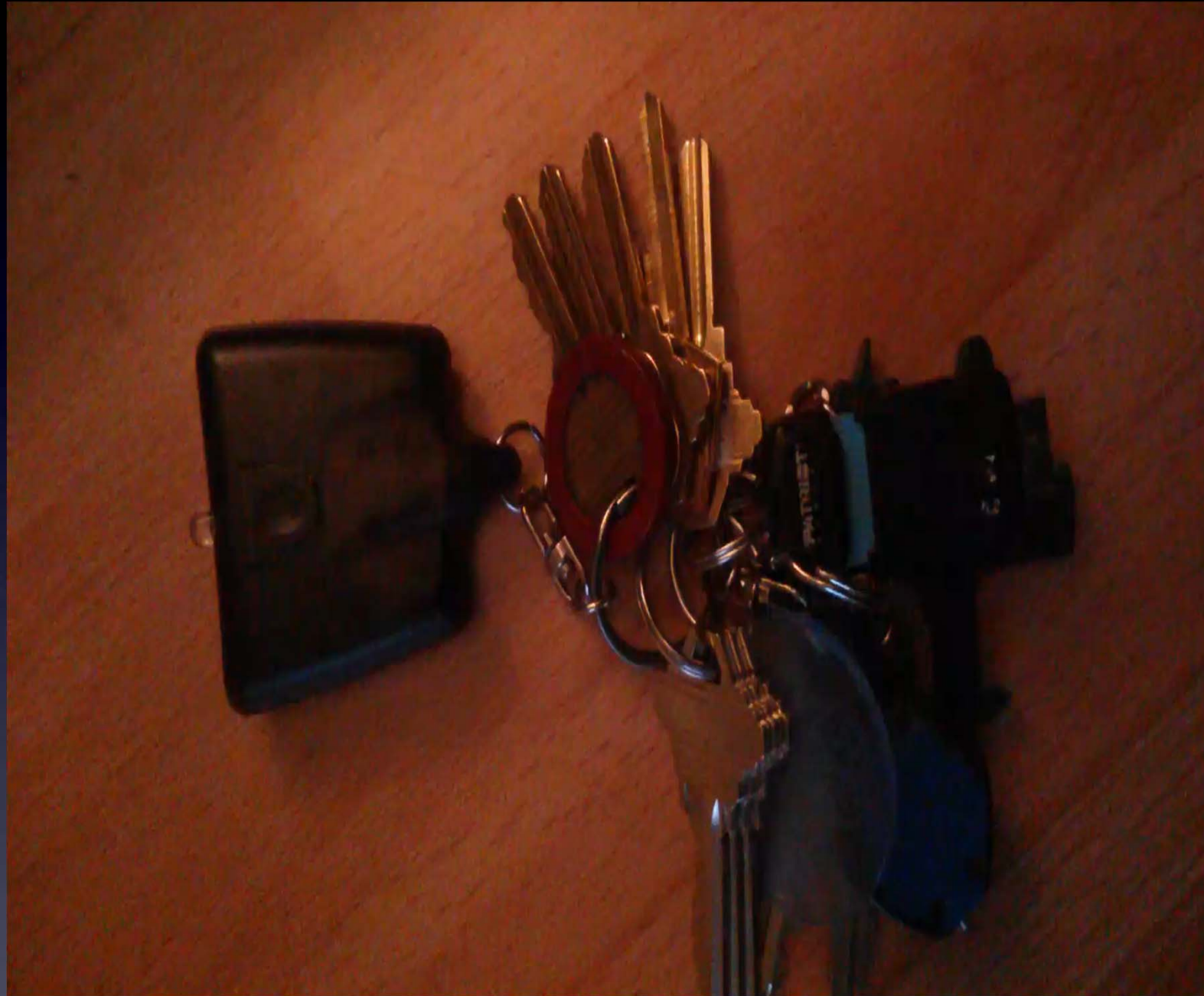
A “code” is IR light blinking on-off-on-off...

(we can't do this, but microcontrollers can!)

IR Remote Control

Everything You Need to Know About Electronics

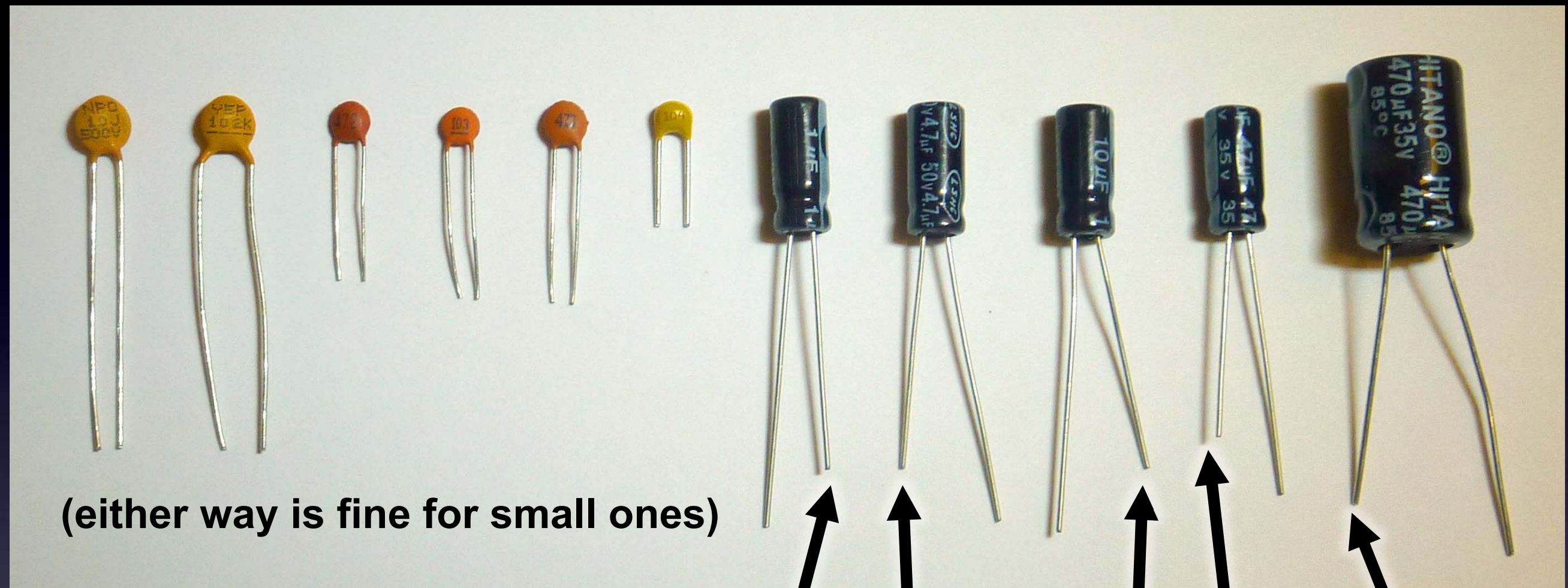
Takes about 60 seconds



About 150 IR “OFF” codes (one per blink)

TV-B-Gone universal remote control

Everything You Need to Know About Electronics



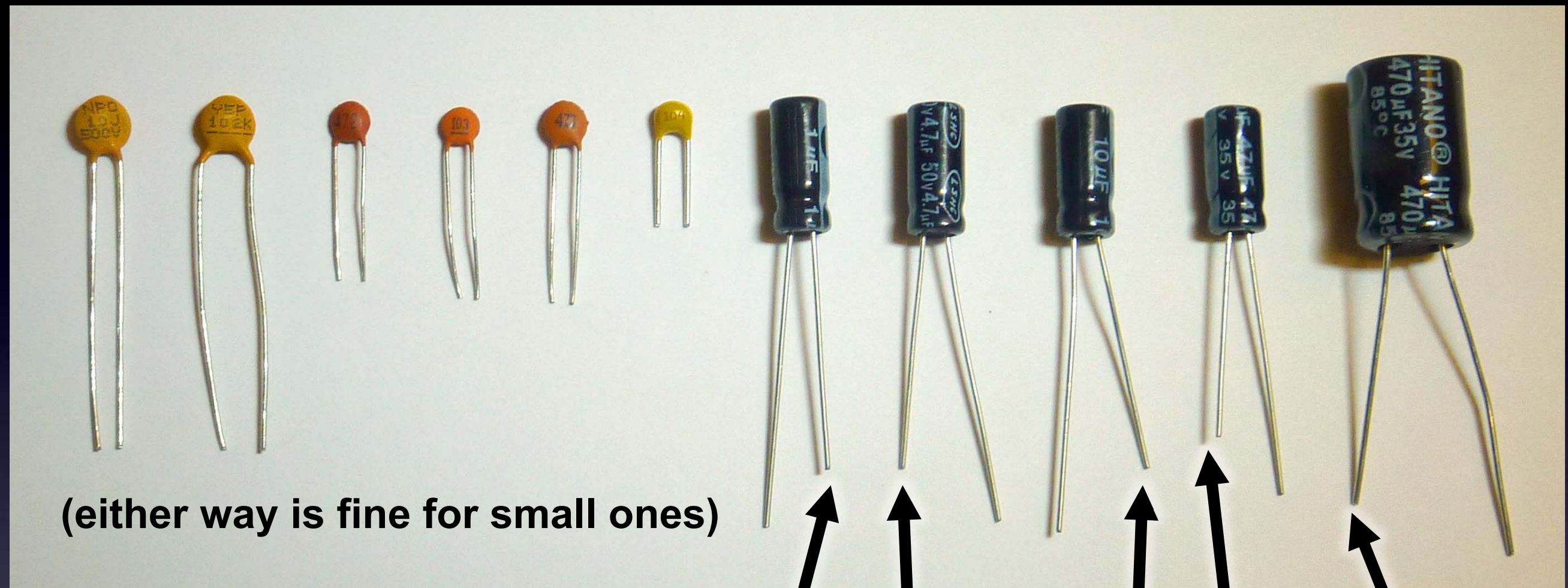
(either way is fine for small ones)

Short wire is Minus / Negative

Little buckets for electrons

Capacitor / Farads

Everything You Need to Know About Electronics



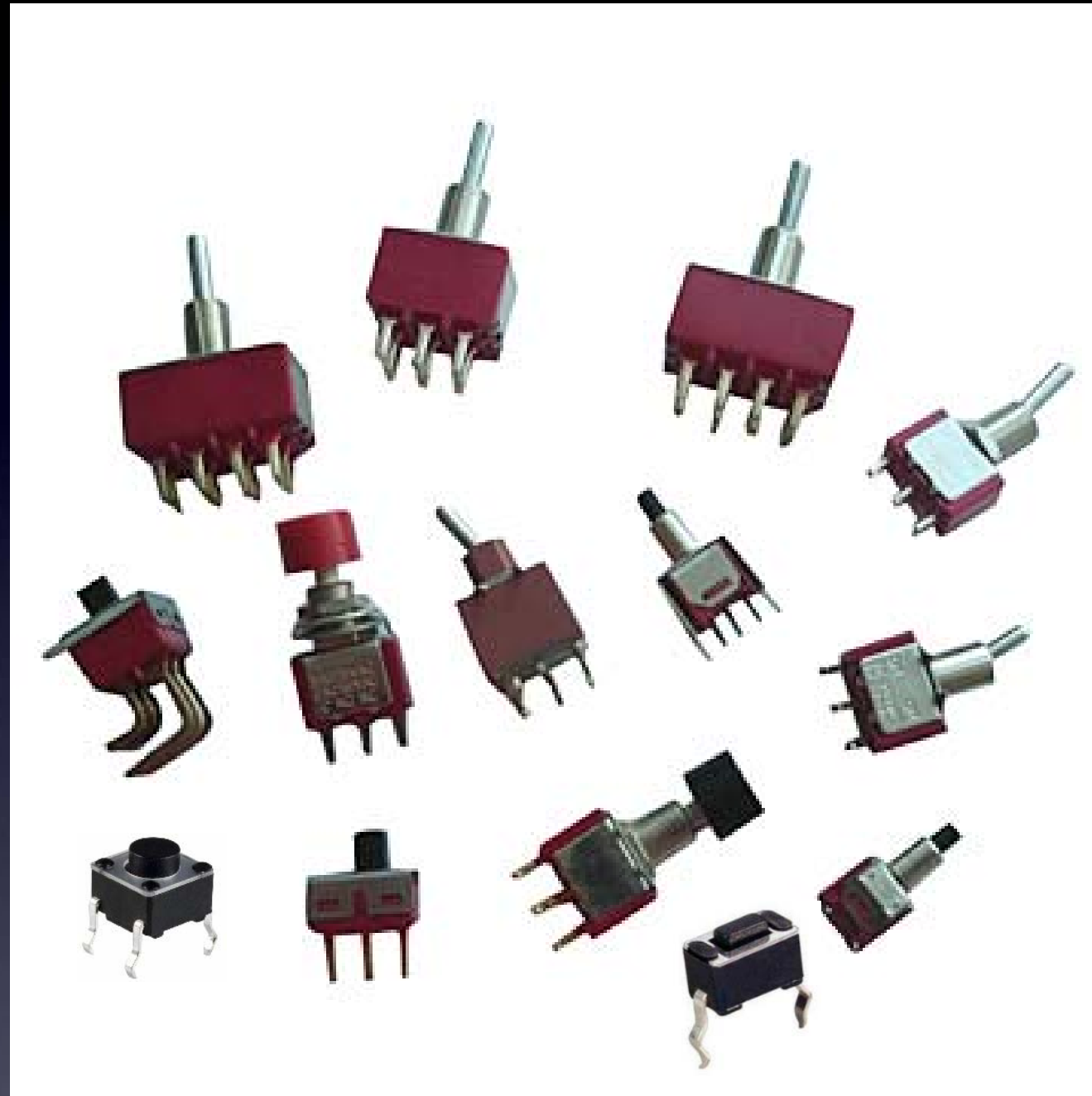
(either way is fine for small ones)

Short wire is Minus / Negative

Little buckets for electrons

Capacitor / Farads

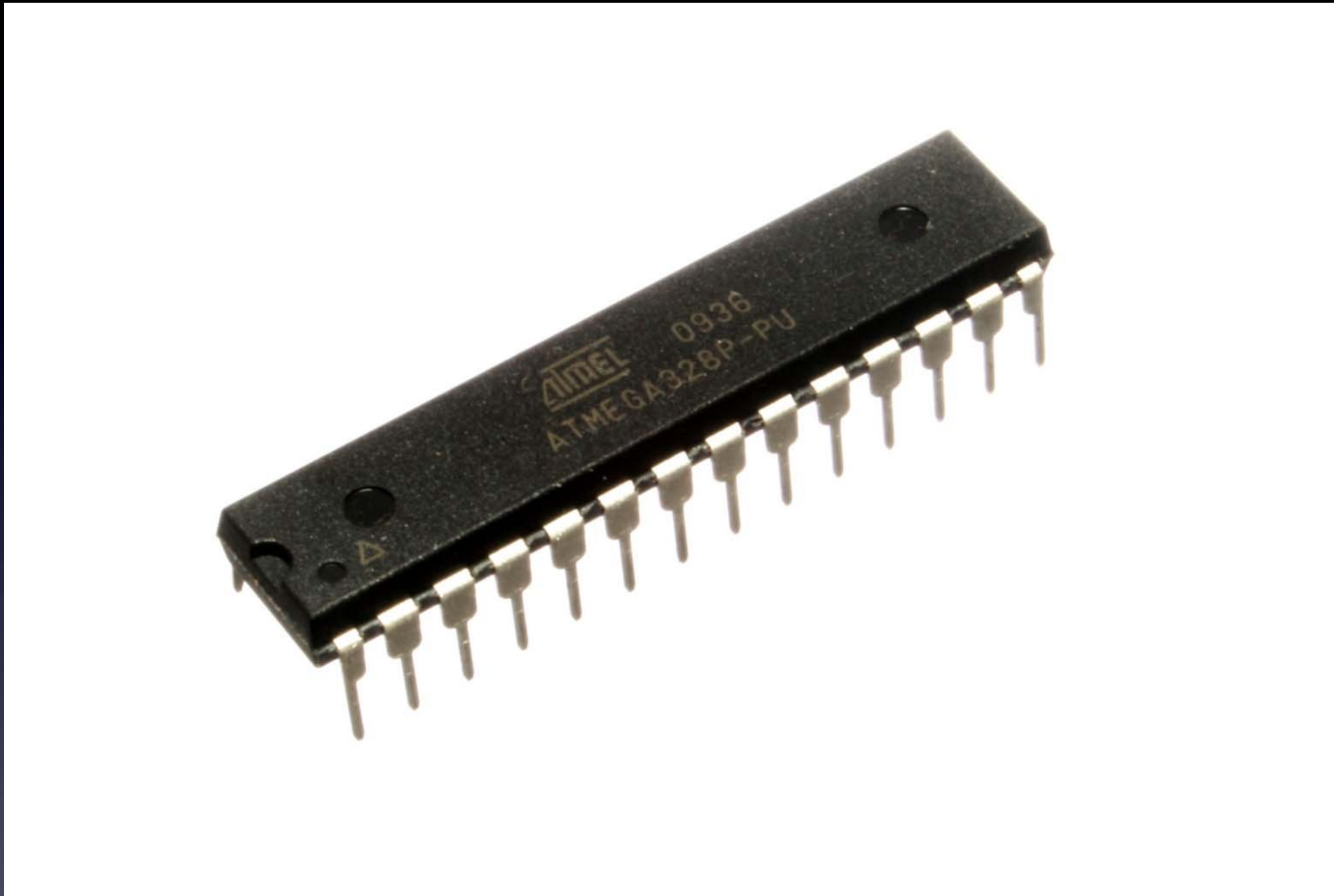
Everything You Need to Know About Electronics



Strips of metal connected together – or not

Switch

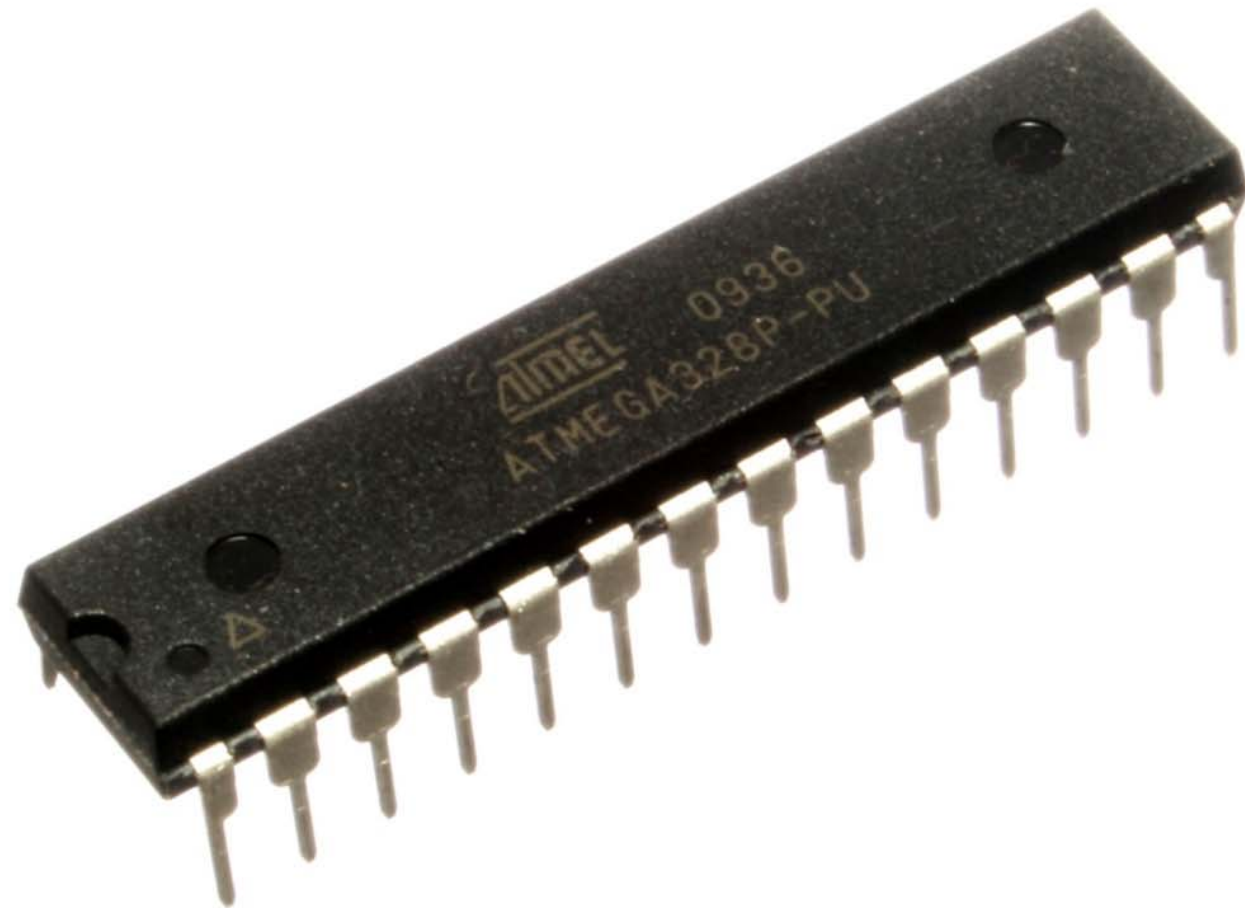
Everything You Need to Know About Electronics



A complete computer on a chip

Microcontroller

Everything You Need to Know About Electronics



It runs programs

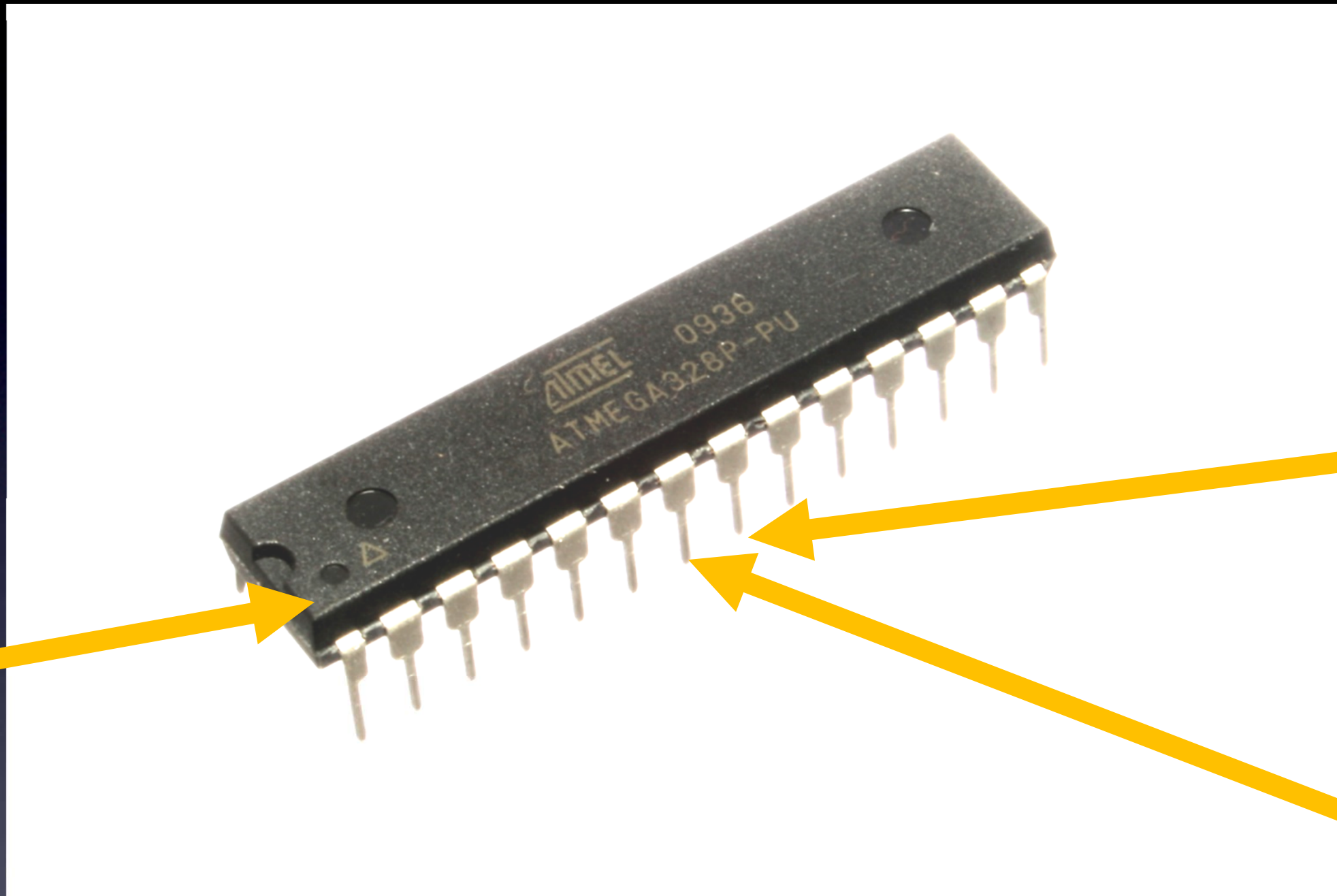
that control electronic parts connected to its pins.

Microcontroller

Everything You Need to Know About Electronics

2 special pins:

Pin 1



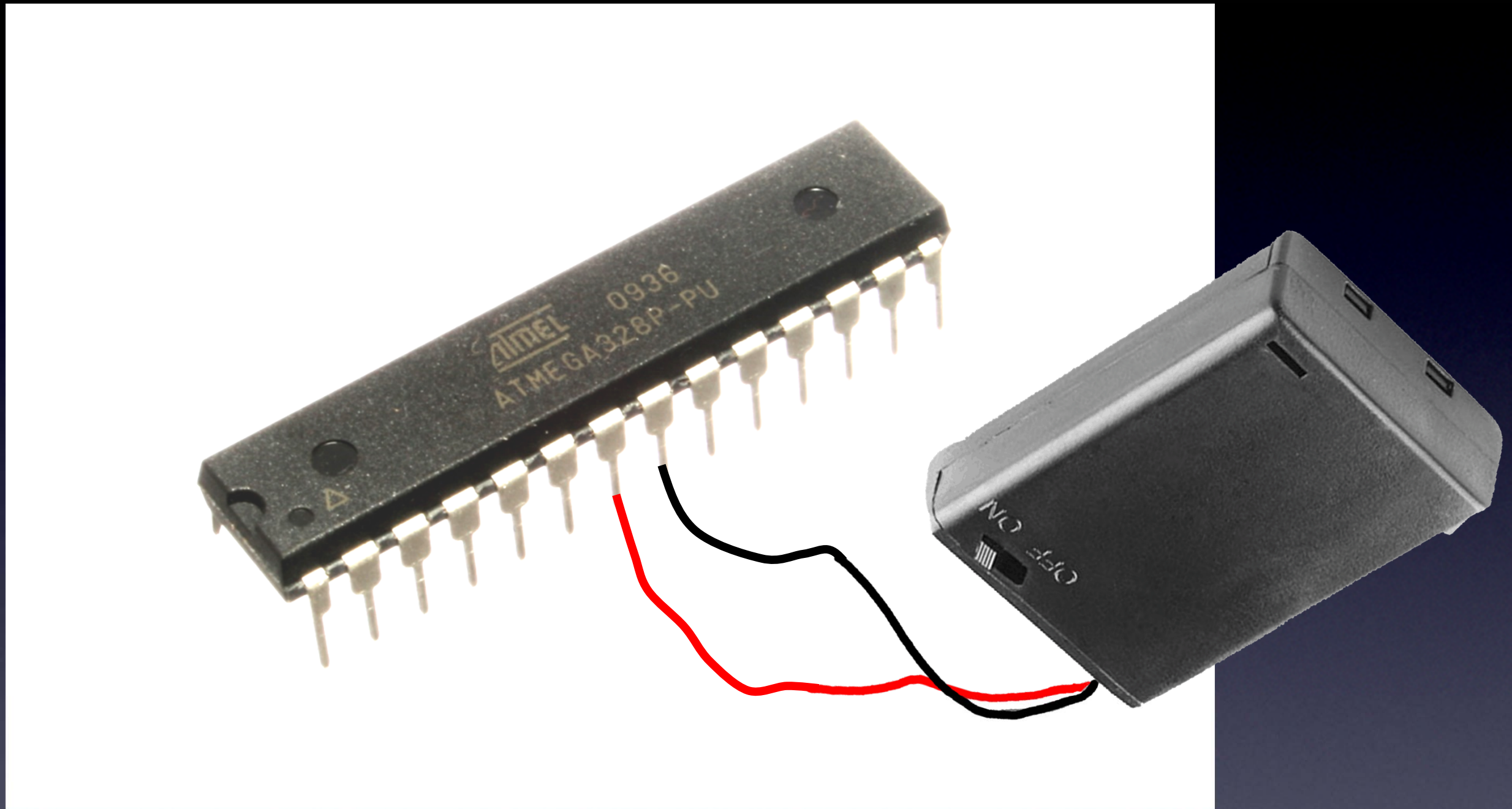
Pin 8 =
Ground

Pin 7 =
Vcc

A complete computer on a chip

Microcontroller – it matters how you hook it up!

Everything You Need to Know About Electronics

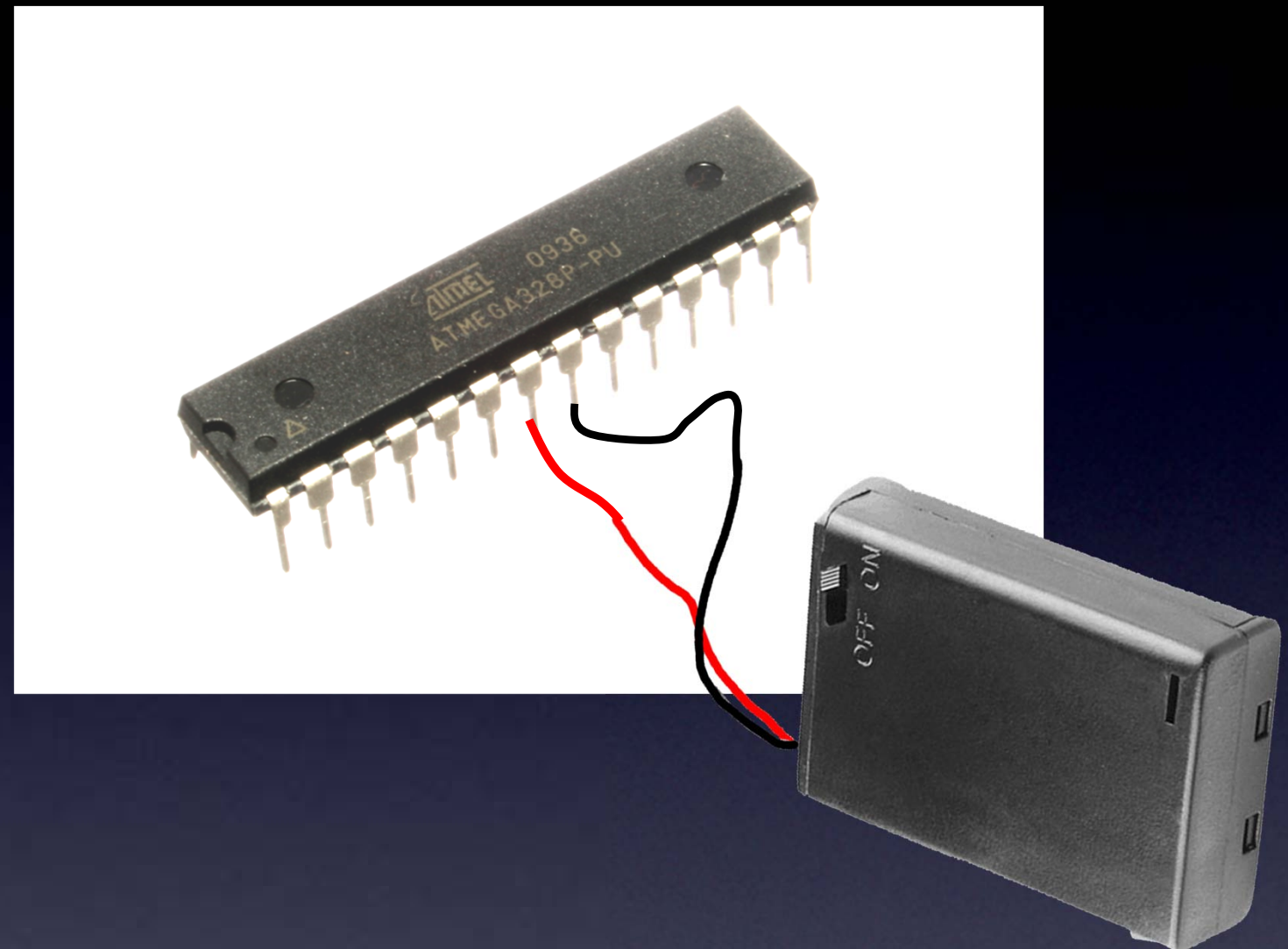


A complete computer – running a program!

Microcontroller – turned on!

Everything You Need to Know About Electronics

all other pins are
Input pins
or
Output pins



Your program controls electronics parts
on these other pins

Microcontroller

Everything You Need to Know About Electronics

Analog Electronics:

Any voltage between Ground (0V) and V_{cc}

Digital Electronics:

Only 2 choices: Ground (0V) or V_{cc}

2 types of electronics

Everything You Need to Know About Electronics

Ground (0V)

Low

Off

0

Power / Vcc

High

On

1

(without Voltage / with Voltage)

(without current / with current)

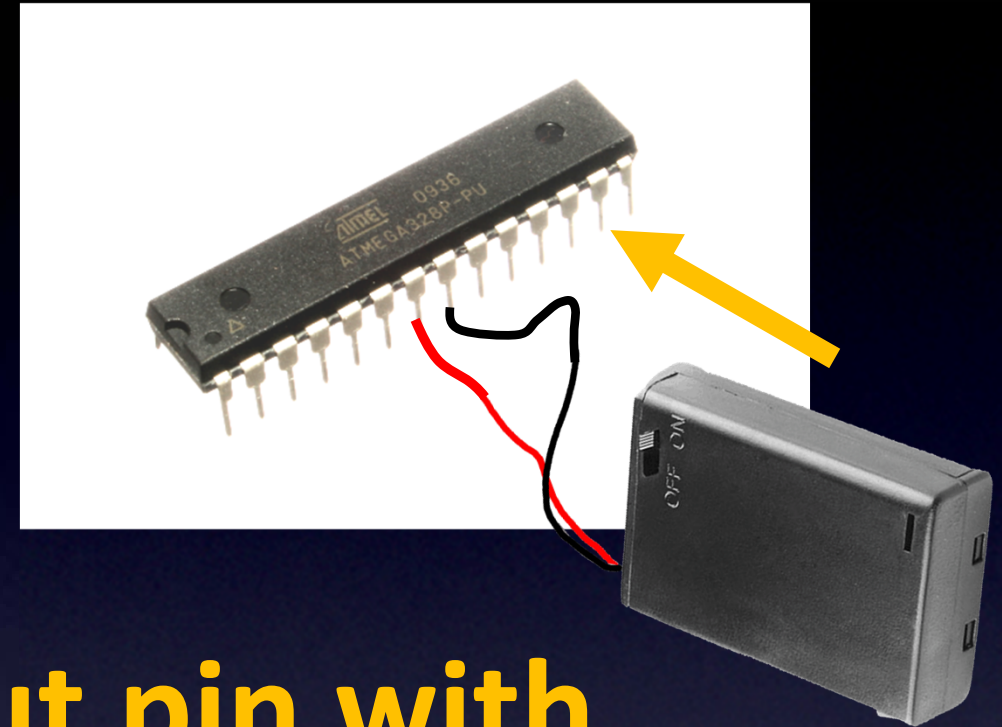
Digital Electronics:

Only 2 choices: Ground (0V) or Vcc

Digital Electronics

Everything You Need to Know About Electronics

To make a pin an
Output pin



you tell it to become an Output pin with
a statement in your program

Let's tell pin 13 to be an Output pin

Microcontroller – Output pins

Everything You Need to Know About Electronics

Low

Off

(0V)

High

On

(Power supply voltage)

-- like the Red wire of our power supply
-- *but controlled by our program!*

Only 2 choices: High or Low

Microcontroller – Output pins

Everything You Need to Know About Electronics

A real world example

How to make an LED blink?

Hello World

Microcontroller

Everything You Need to Know About Electronics

Software

Type:

Hello World
on your screen

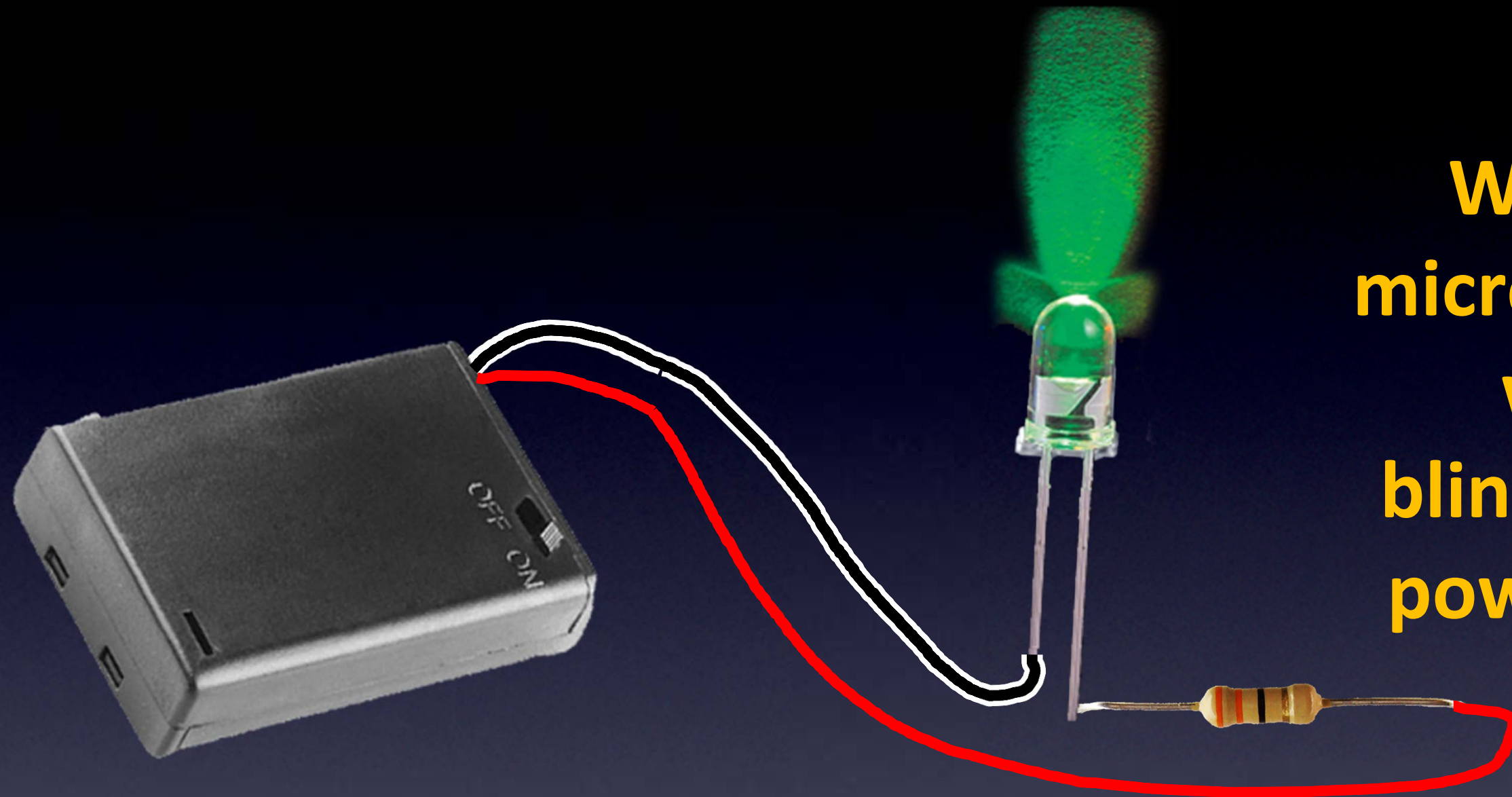
Microcontrollers

make an LED blink

Hello World

Microcontroller

Everything You Need to Know About Electronics



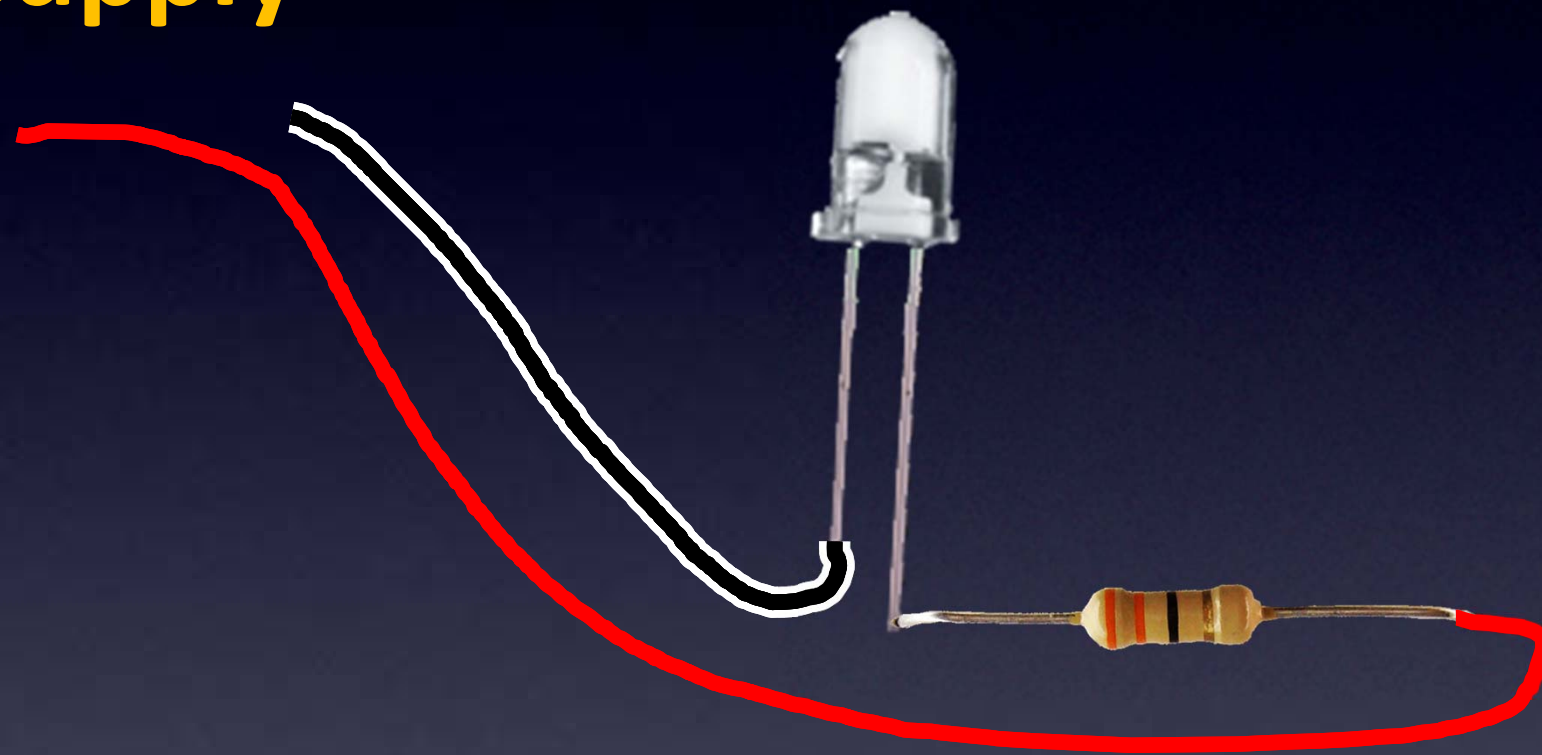
**Without a
microcontroller
we can
blink with our
power supply**

Turning an LED on and off

(Leading up to Hello World)

Everything You Need to Know About Electronics

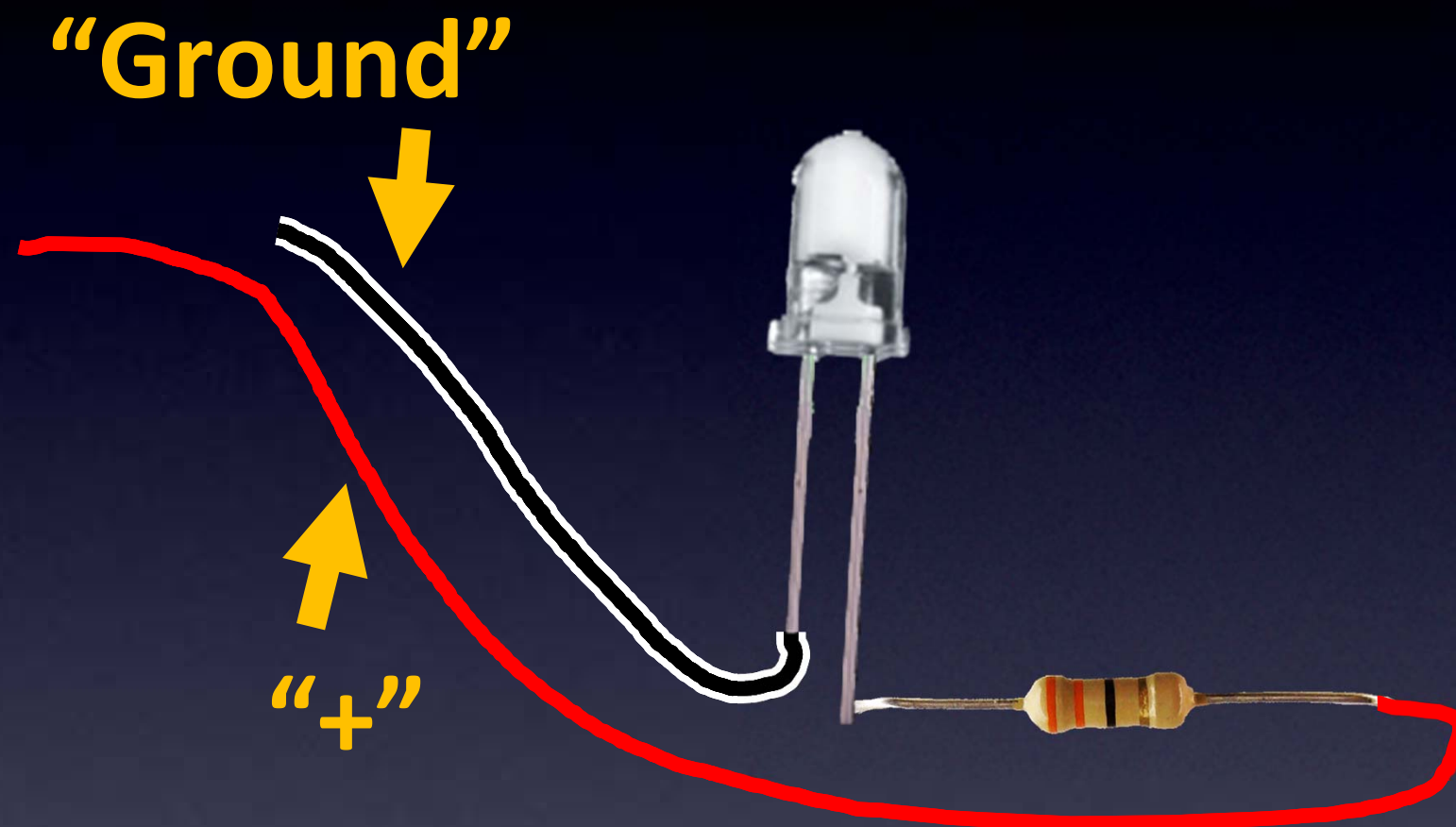
**Let's replace
the power supply**



Turning an LED on and off

(Leading up to Hello World)

Everything You Need to Know About Electronics

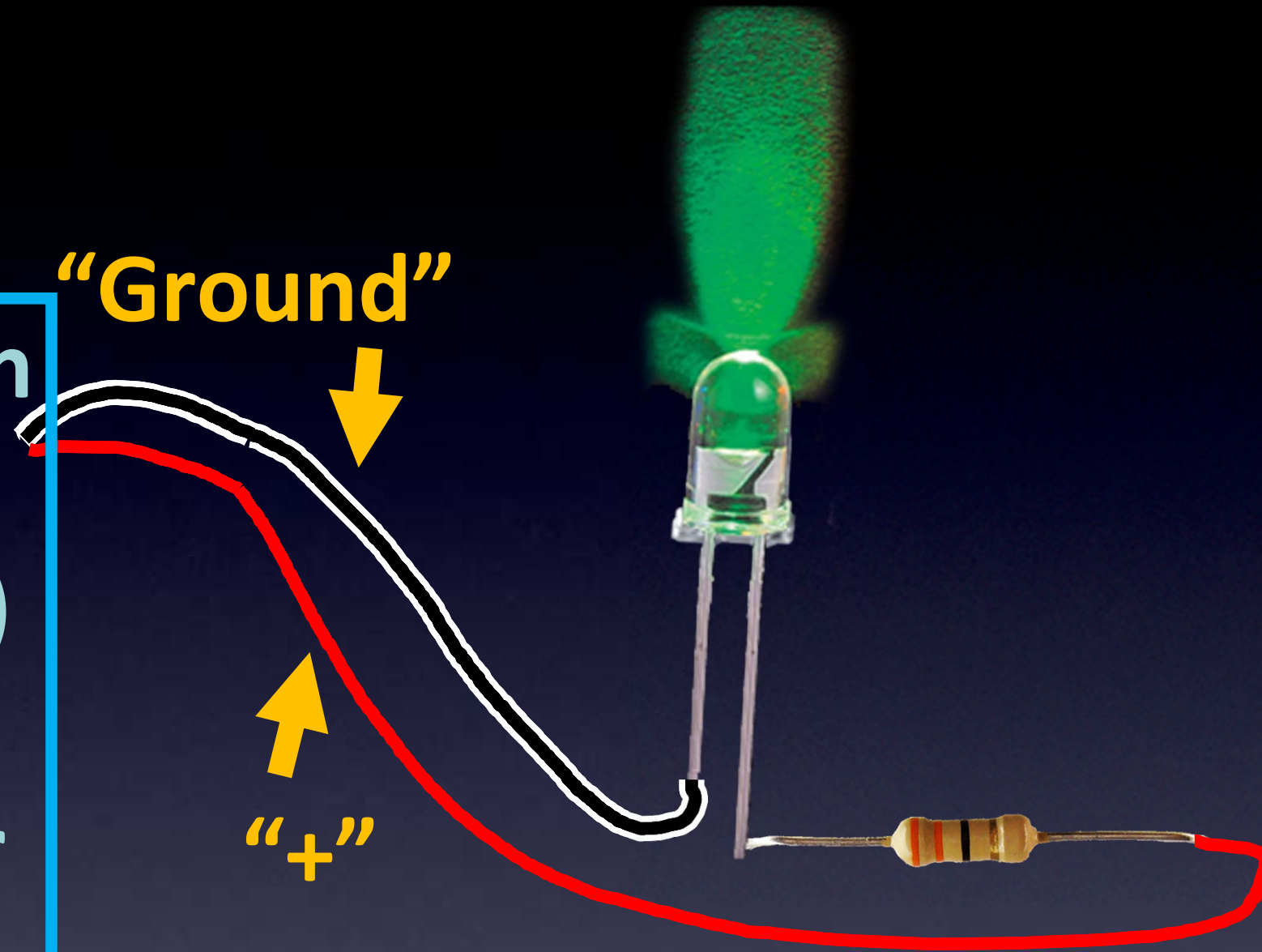


Turning an LED on and off

(Leading up to Hello World)

Everything You Need to Know About Electronics

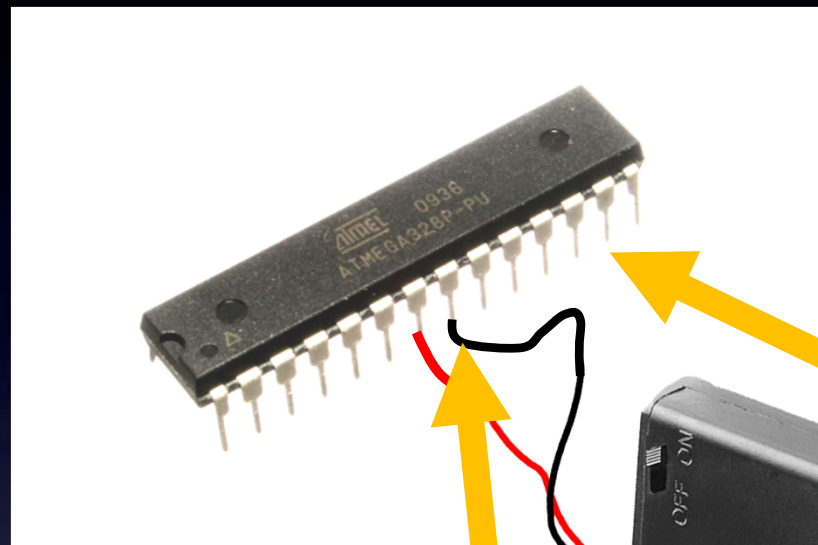
We can use an
Output pin
(and Ground)
as our power
supply



Turning an LED on and off

(Leading up to Hello World)

Everything You Need to Know About Electronics



Ground



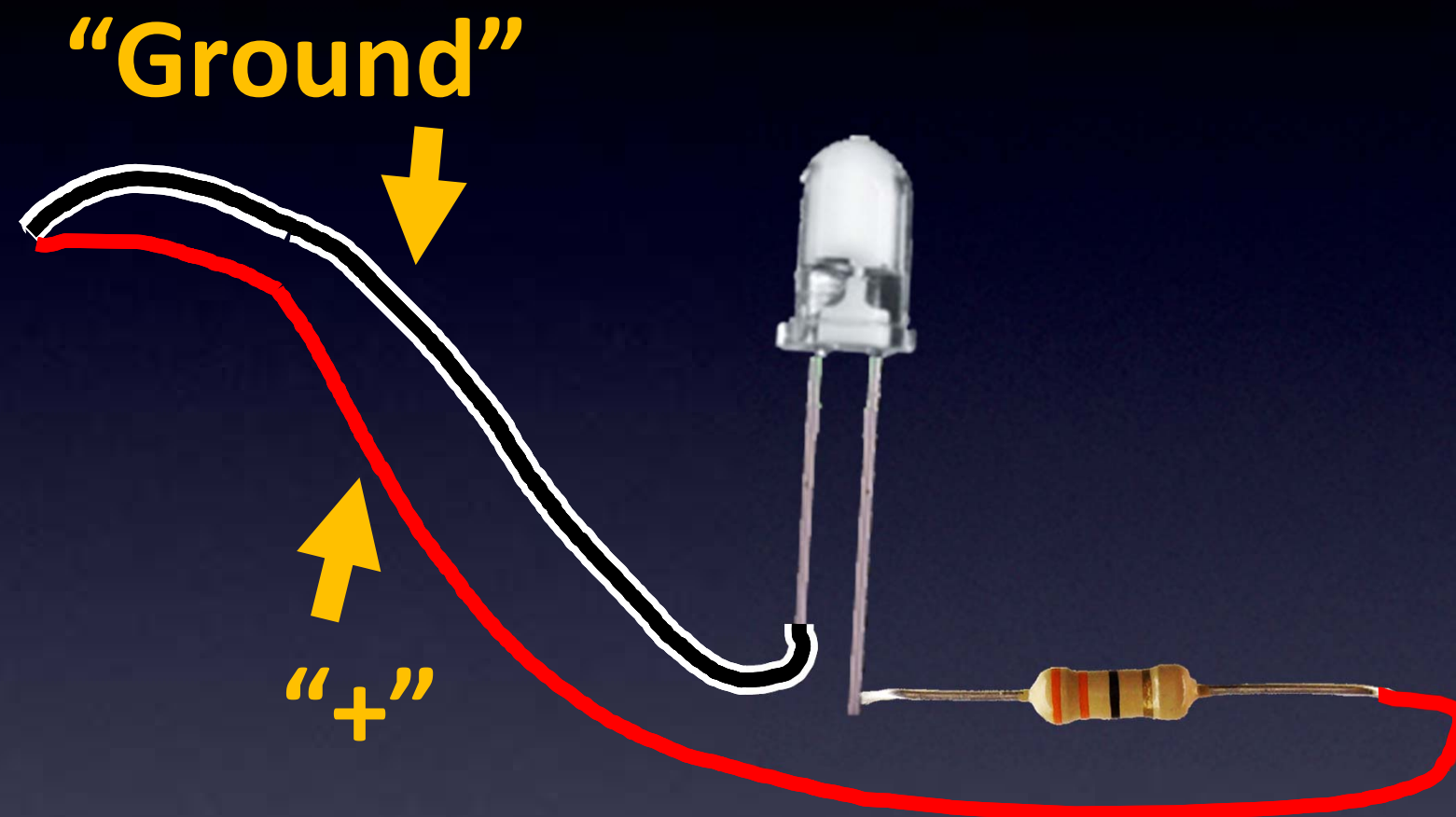
Pin 13

is our **Output pin**
(which can be On or Off)

Turning an LED on and off

(Leading up to Hello World)

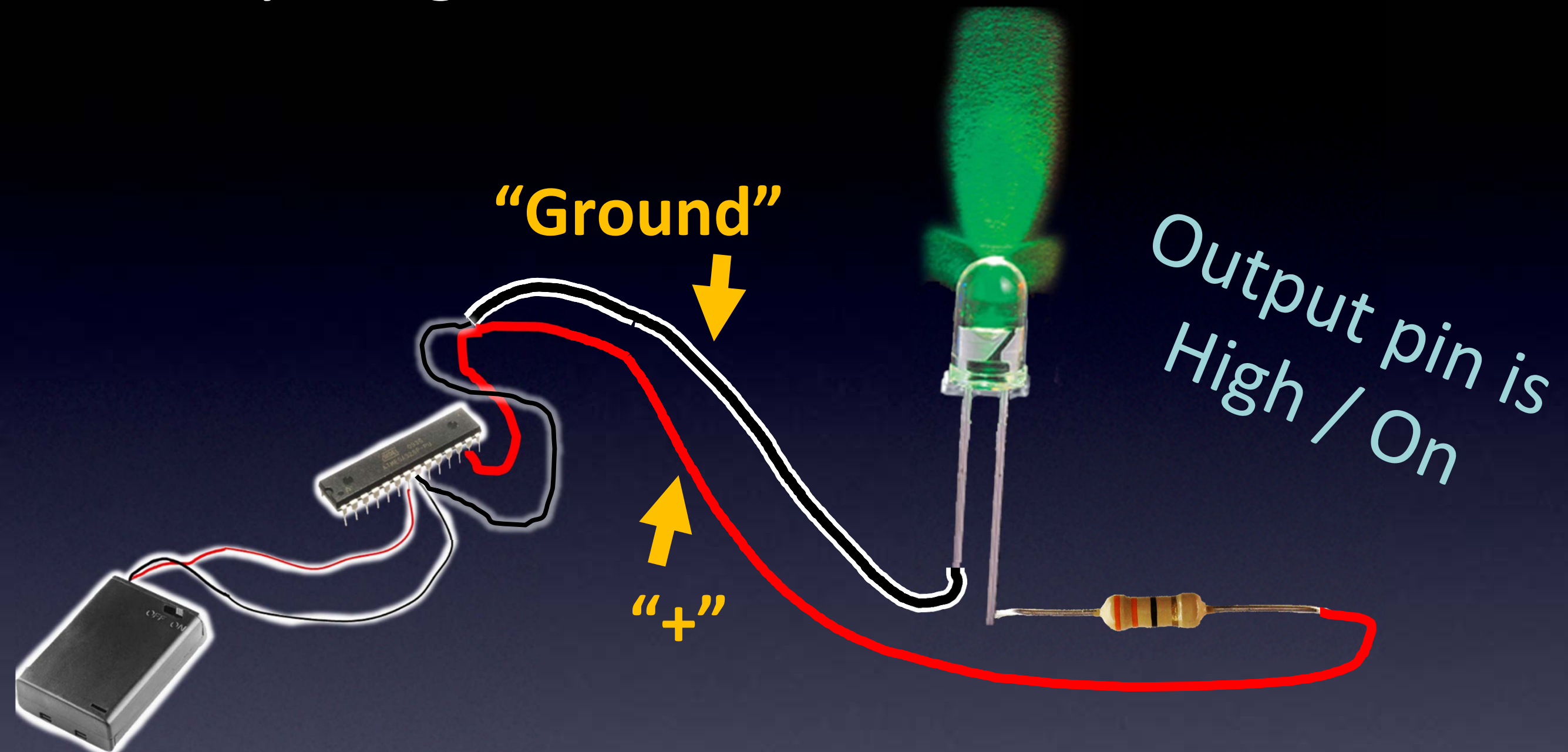
Everything You Need to Know About Electronics



Turning an LED on and off

(Leading up to Hello World)

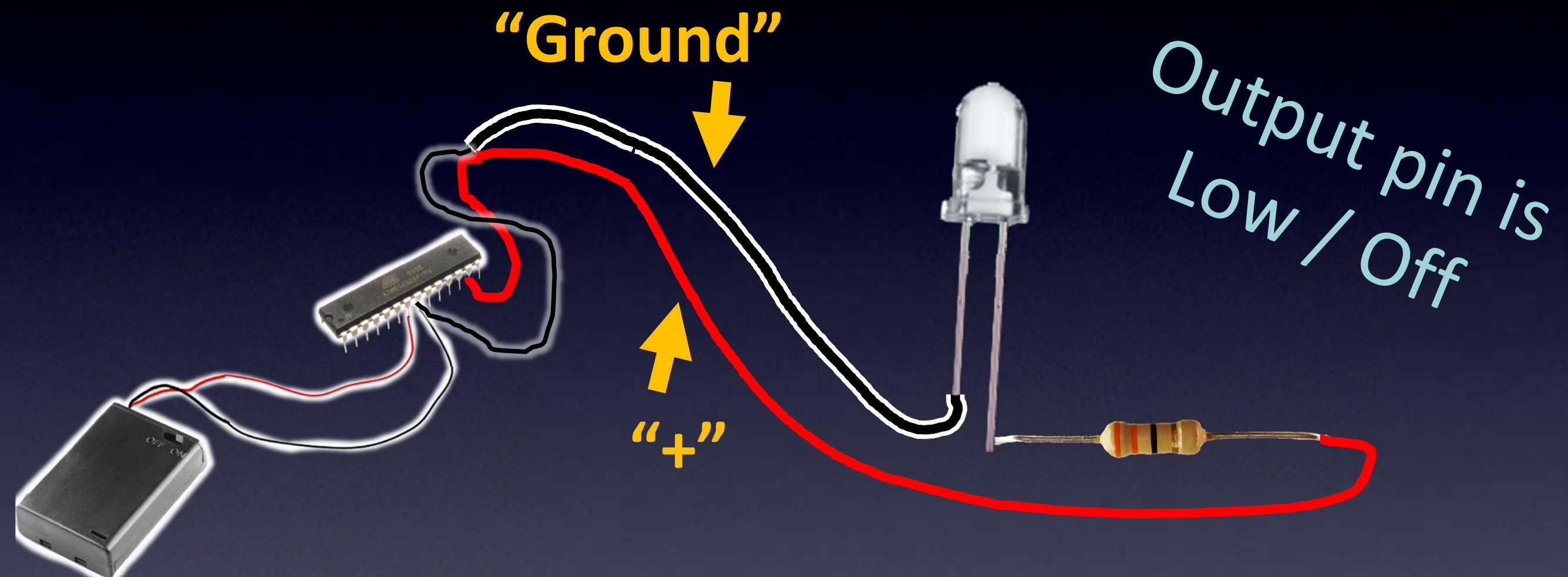
Everything You Need to Know About Electronics



Turning an LED on and off

(Leading up to Hello World)

Everything You Need to Know About Electronics

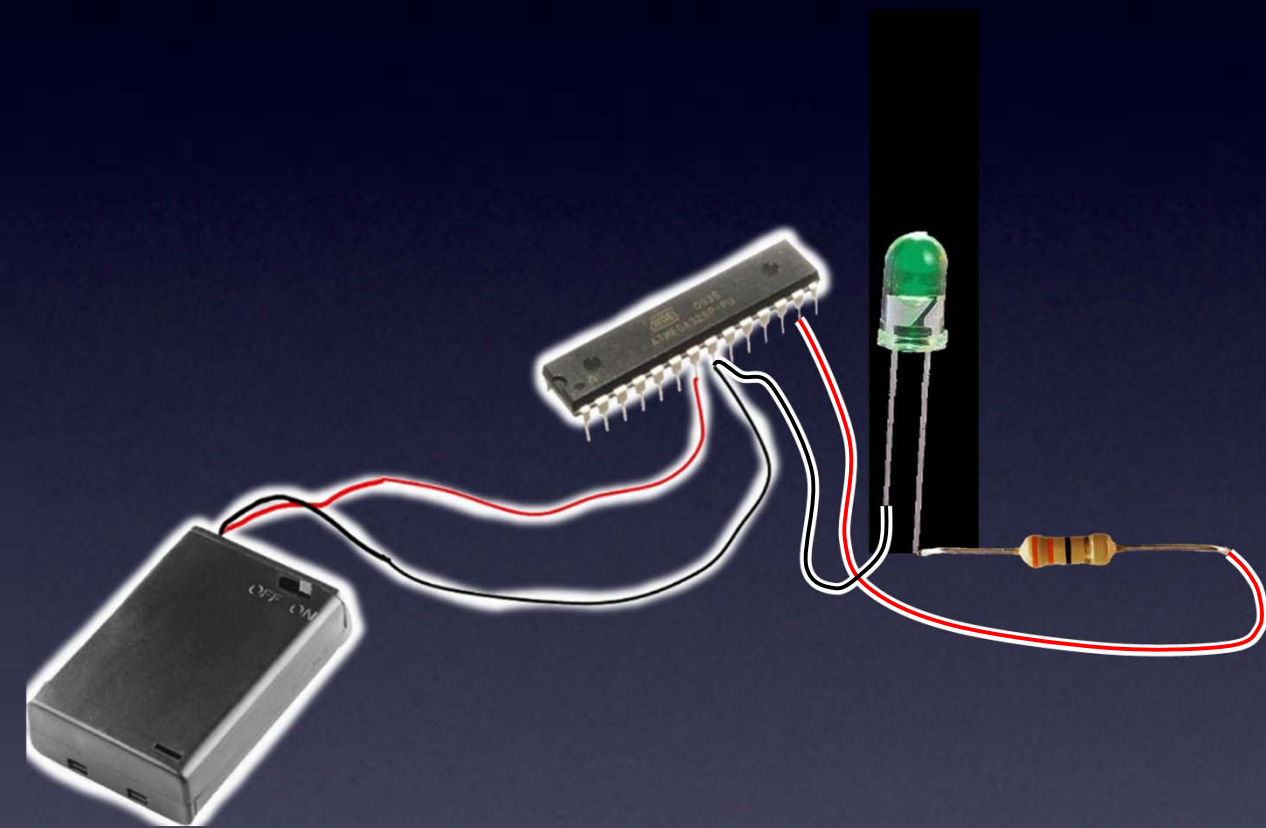


Turning an LED on and off

(Leading up to Hello World)

Everything You Need to Know About Electronics

This is our Hardware for Hello World!

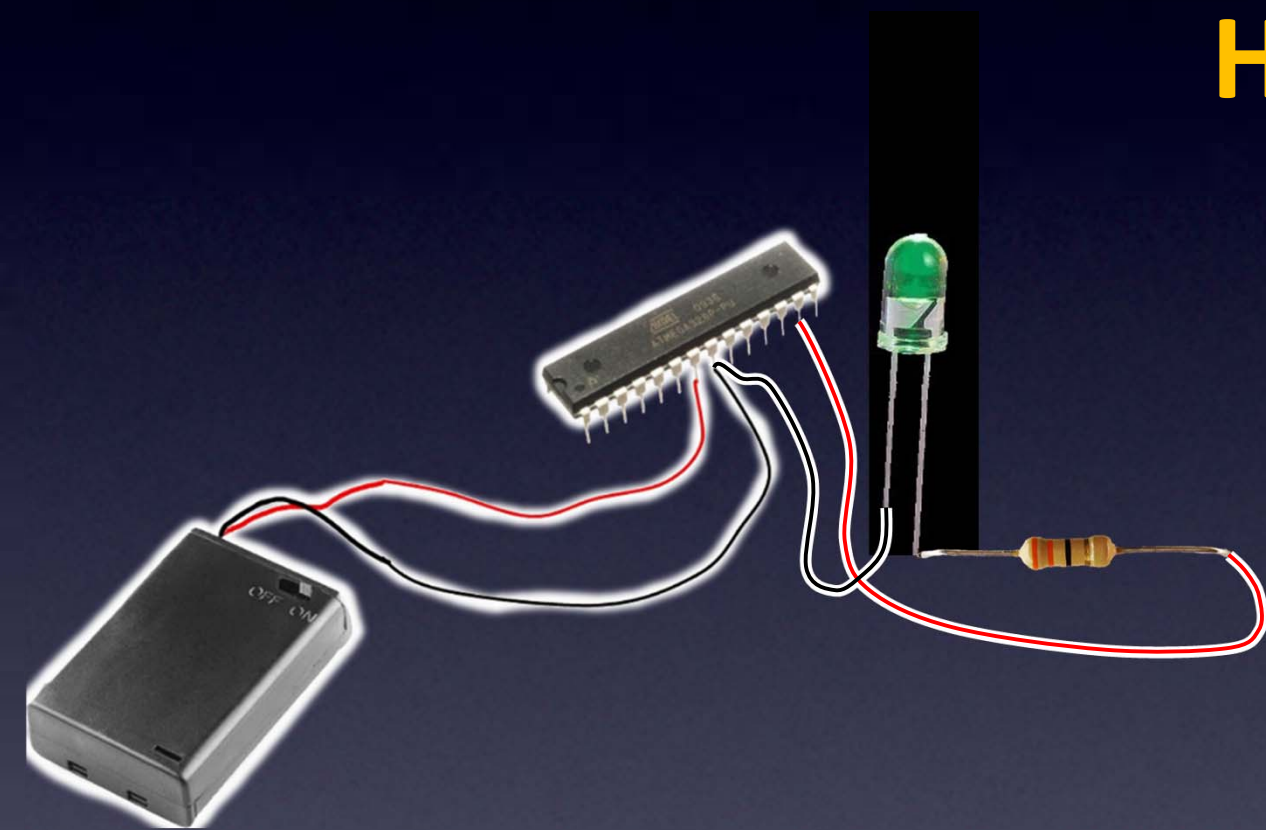


Turning an LED on and off

Hello World

Everything You Need to Know About Electronics

How about our program?

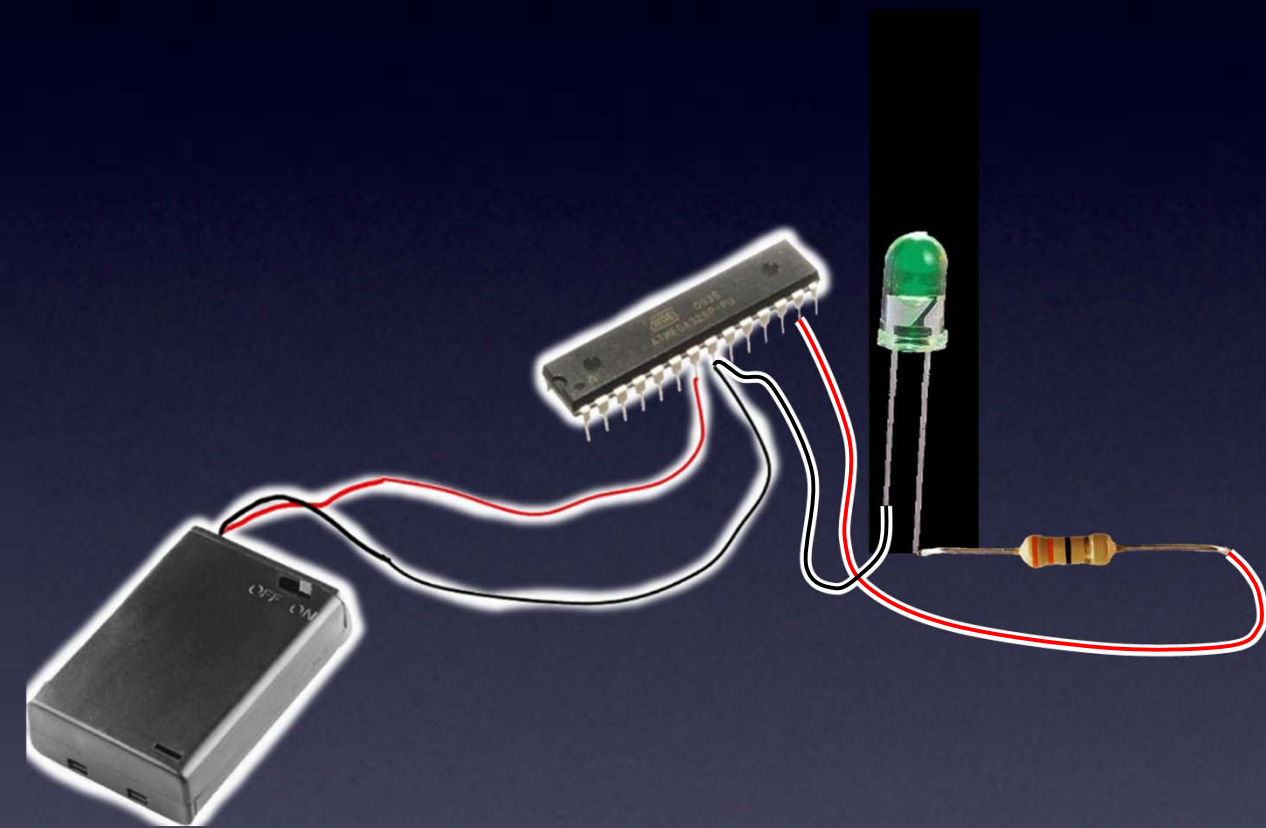


Turning an LED on and off

Hello World

Everything You Need to Know About Electronics

Programs on microcontrollers are called **“Firmware”**



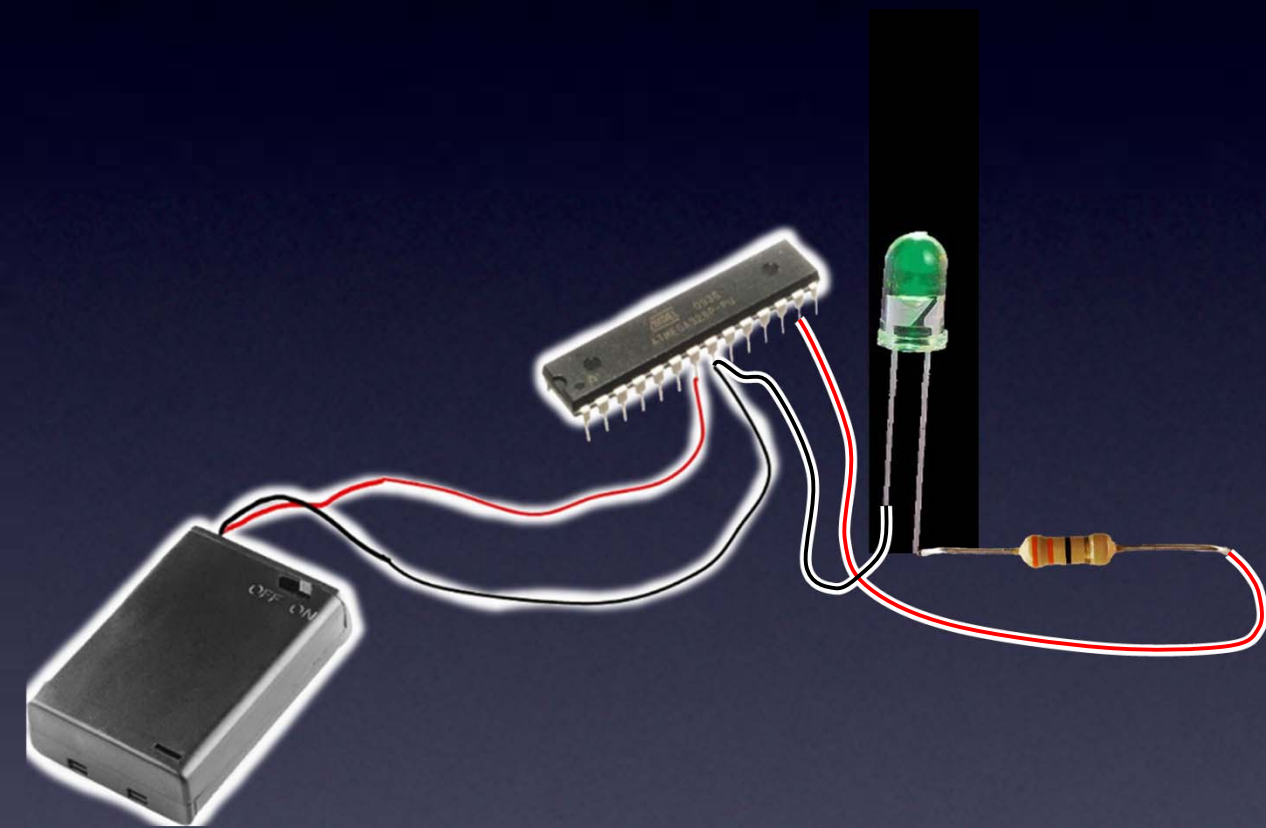
Turning an LED on and off

Hello World

Everything You Need to Know About Electronics

Programs on microcontrollers are called **“Firmware”**

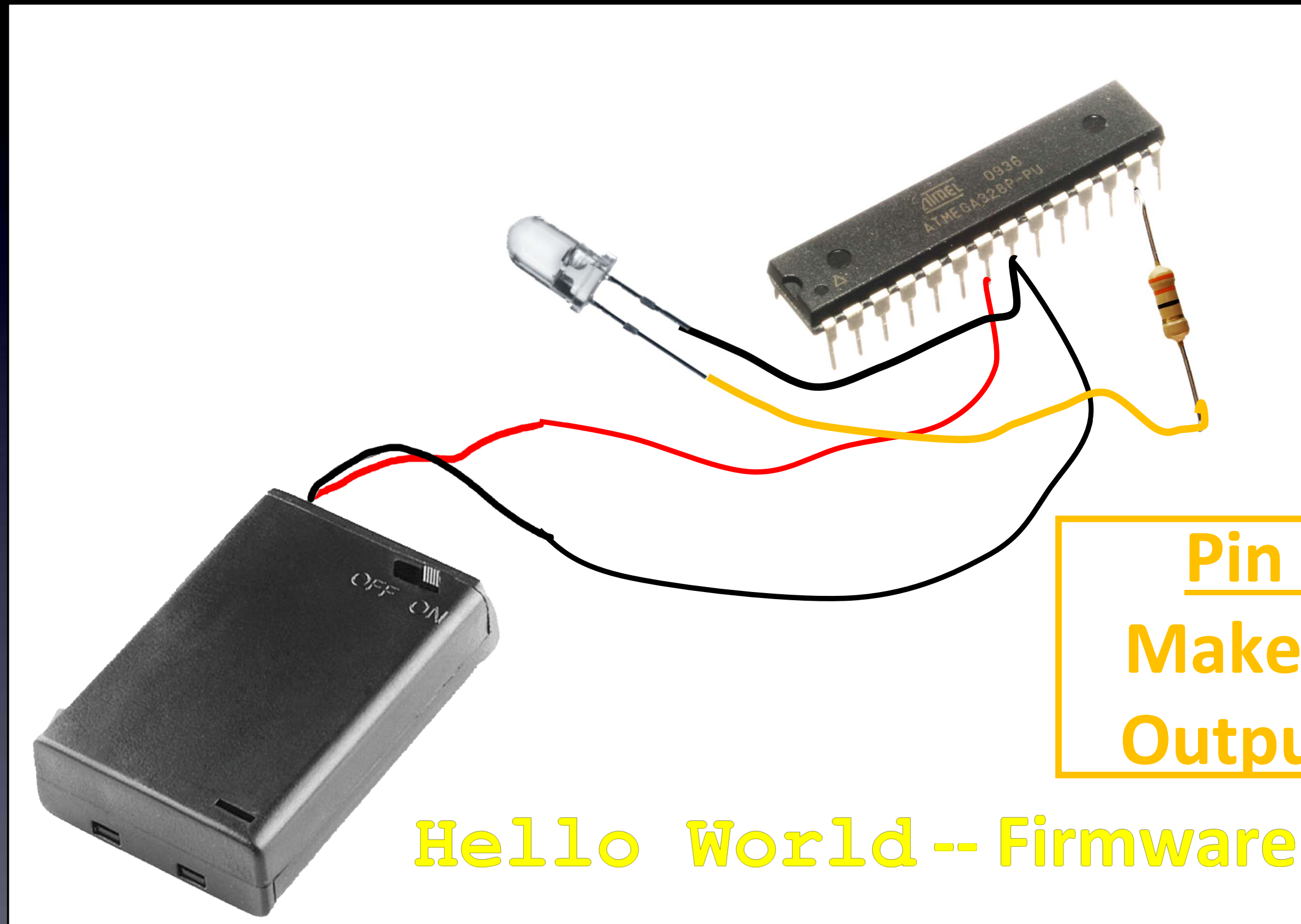
A programs for Arduino is called a
“Sketch”



Turning an LED on and off

Hello World

Everything You Need to Know About Electronics

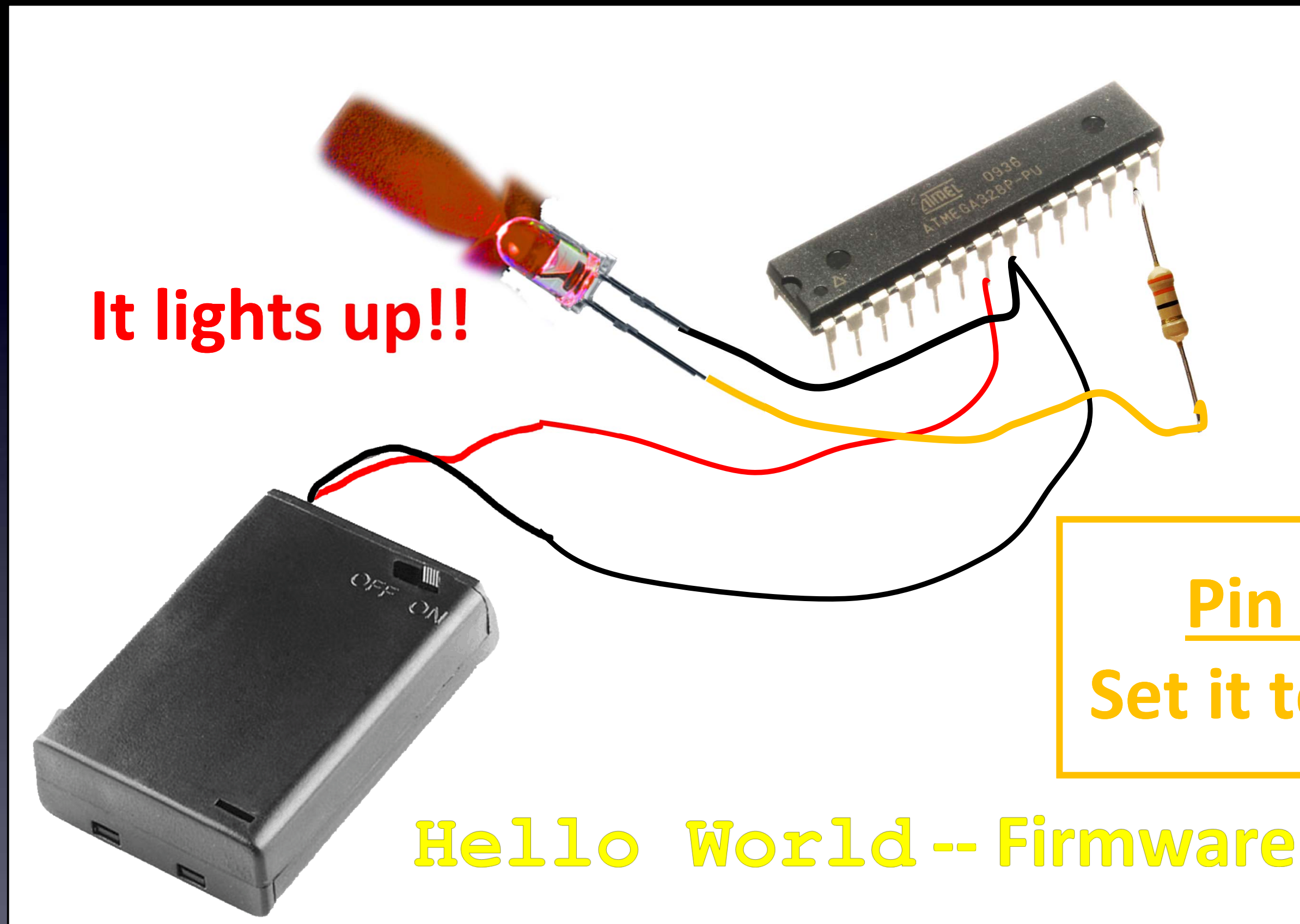


Pin 13:
Make it an
Output pin

Hello World -- Firmware

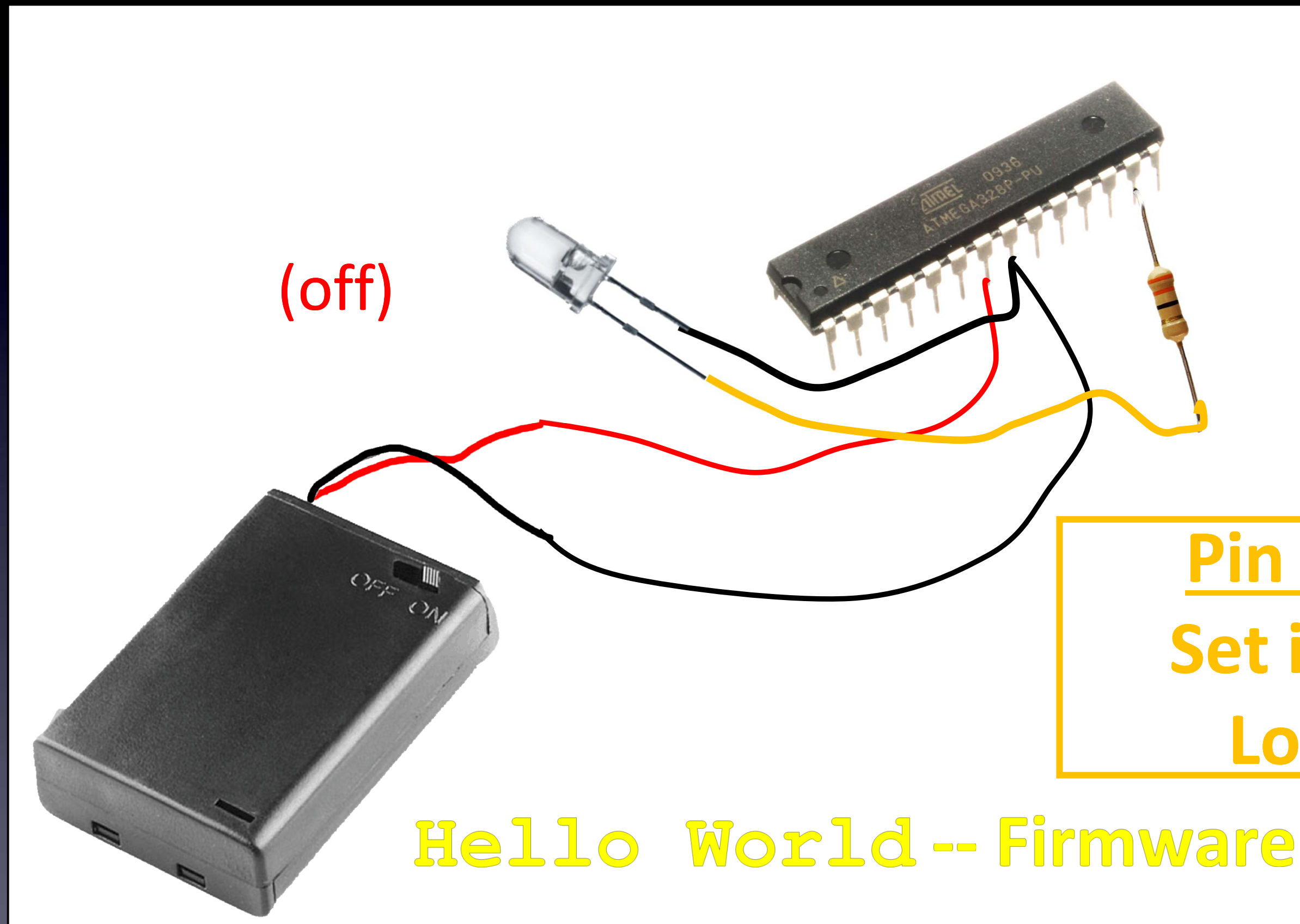
Microcontroller

Everything You Need to Know About Electronics



Microcontroller

Everything You Need to Know About Electronics



Microcontroller

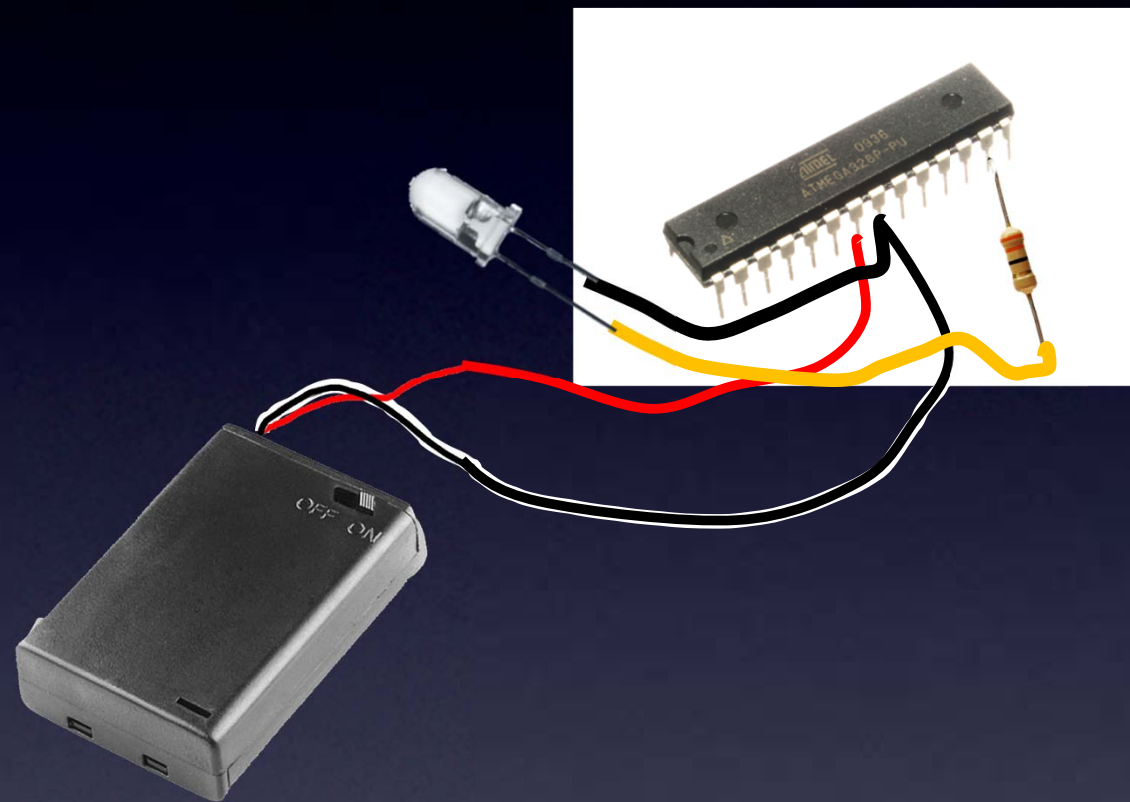
Everything You Need to Know About Electronics



We now have
Hello World !

Microcontroller

Everything You Need to Know About Electronics



We now have
Hello World !

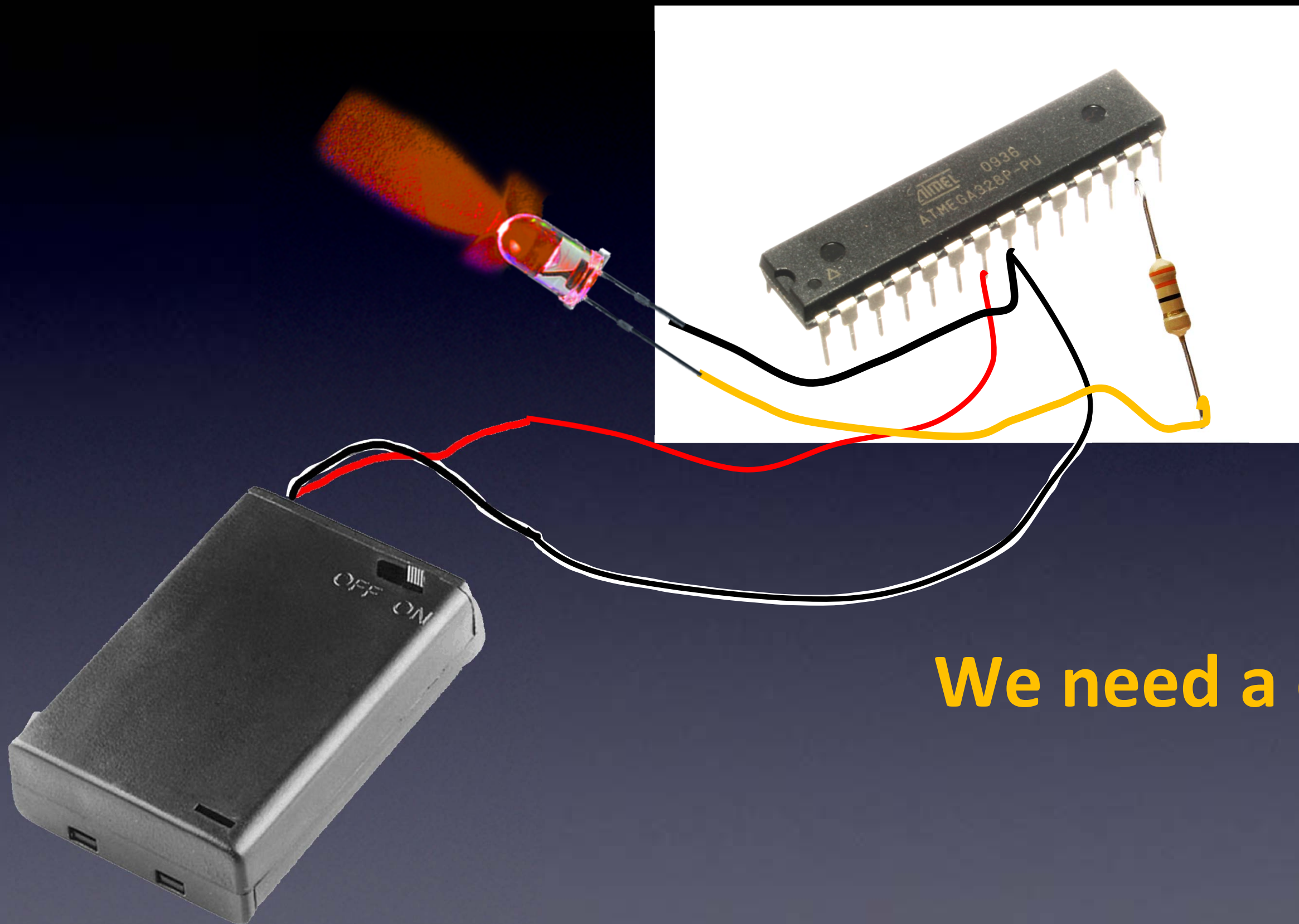
Except

We won't see it



Microcontroller

Everything You Need to Know About Electronics

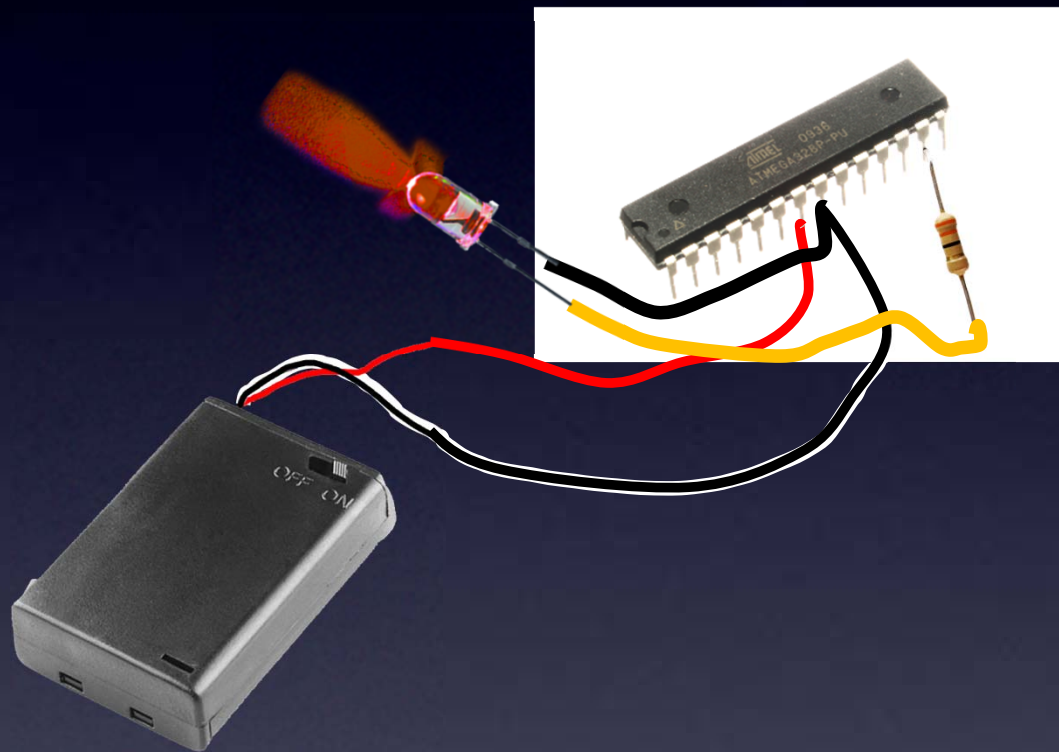


We need a delay

Microcontrollers – they go really fast!

Everything You Need to Know About Electronics

Hardware



Firmware

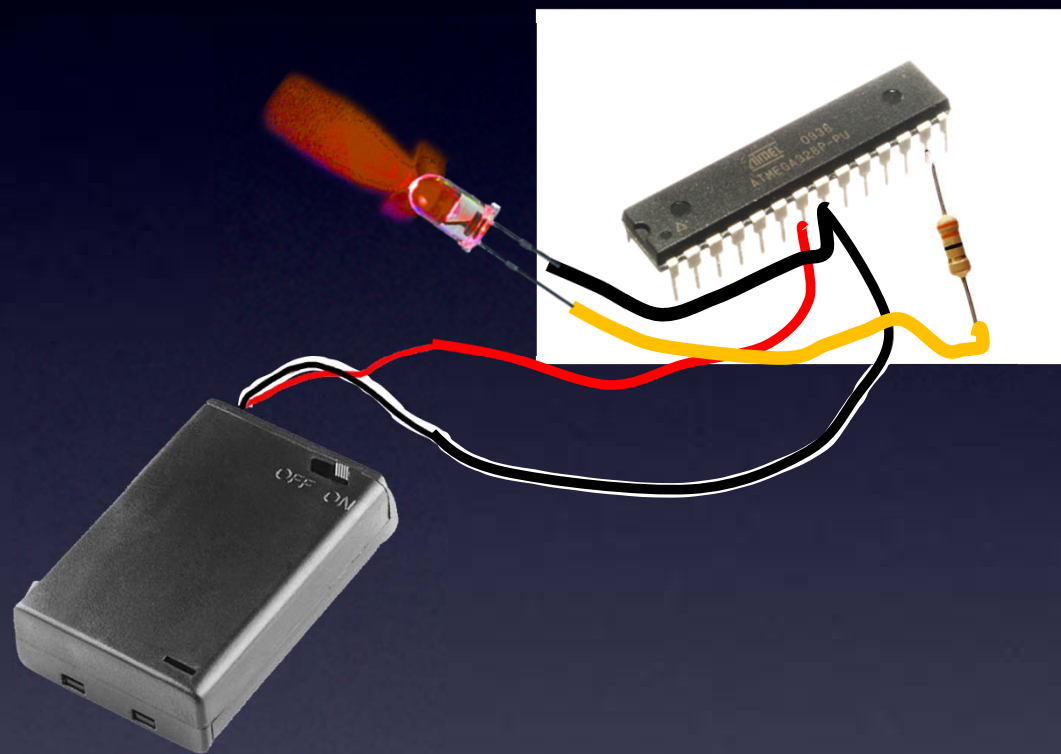
- pin 13 is Output pin
- set pin 13 High
- delay
- set pin 13 Low

Hello World – for real now!

Microcontroller – Firmware

Everything You Need to Know About Electronics

Hardware



Firmware

- pin 13 is Output pin
- set pin 13 High
- delay
- set pin 13 Low
- delay

Hello World – for real now!

Microcontroller – Firmware

Everything You Need to Know About Electronics



A precision cut piece of quartz crystal

For precise timing

Crystal / Hertz

Everything You Need to Know About Electronics

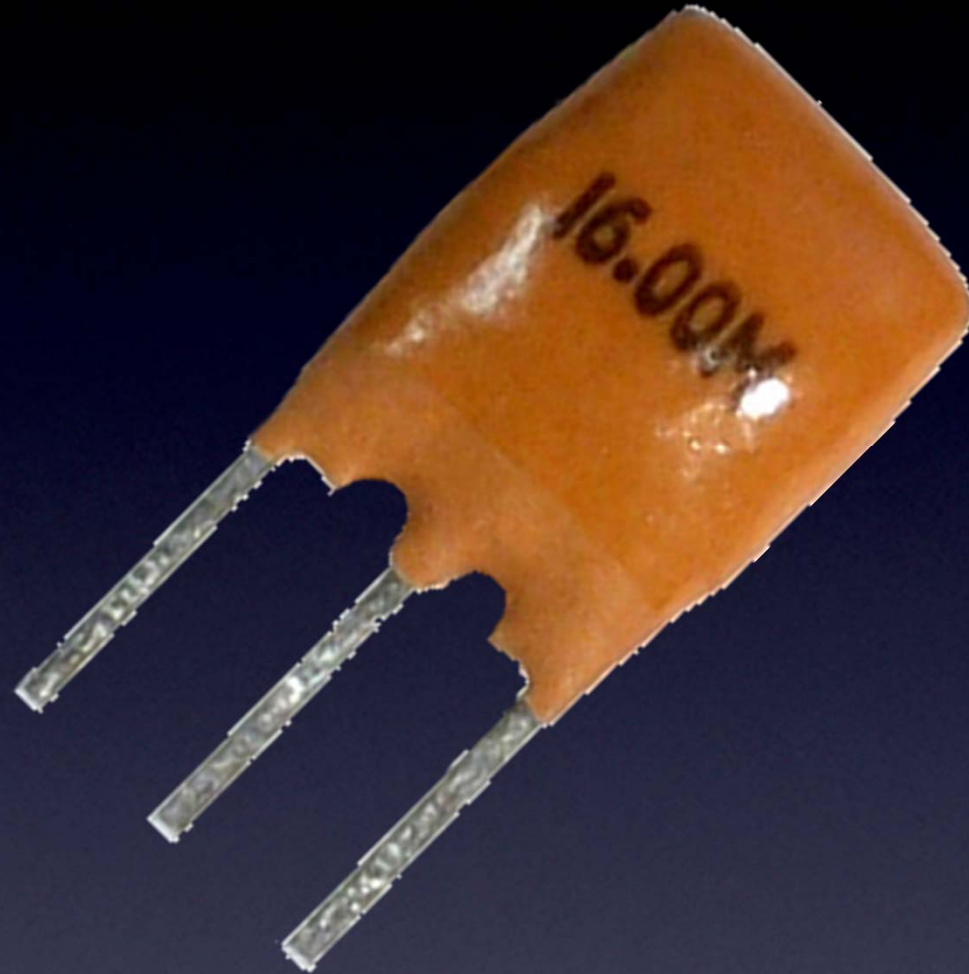


Frequency, measured in **Hertz**

For precise timing (but less than a crystal)

Crystal / **Hertz**

Everything You Need to Know About Electronics



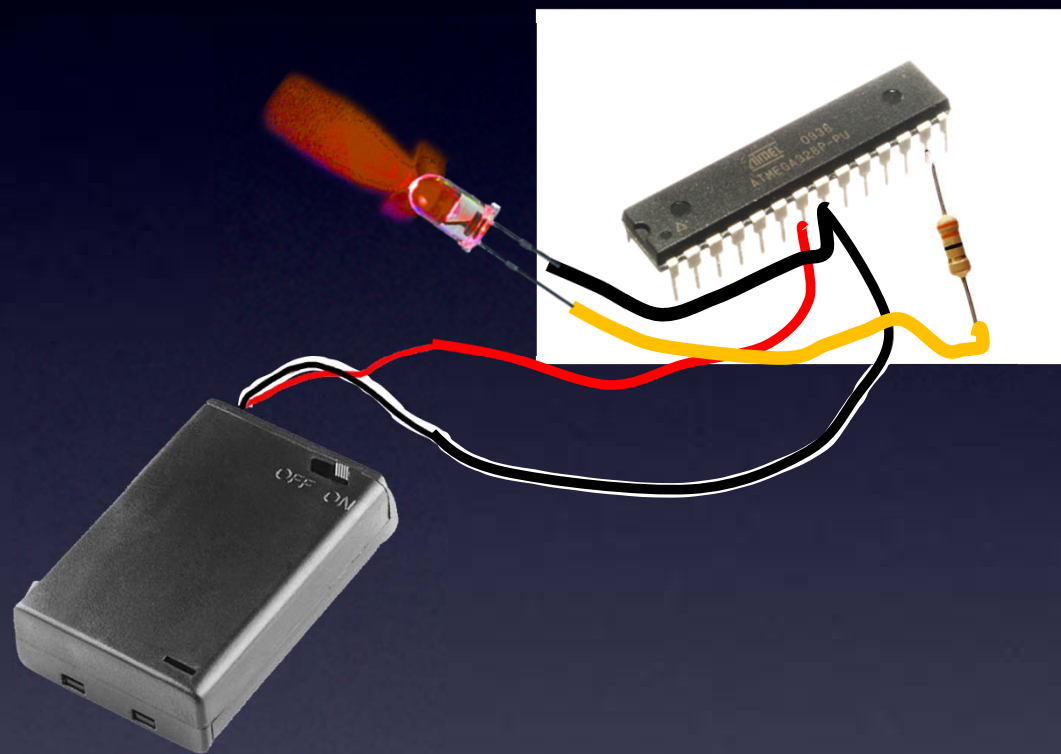
A bunch of resistors and capacitors

For precise timing (but less than a crystal)

Ceramic Resonator / Hertz

Everything You Need to Know About Electronics

Hardware



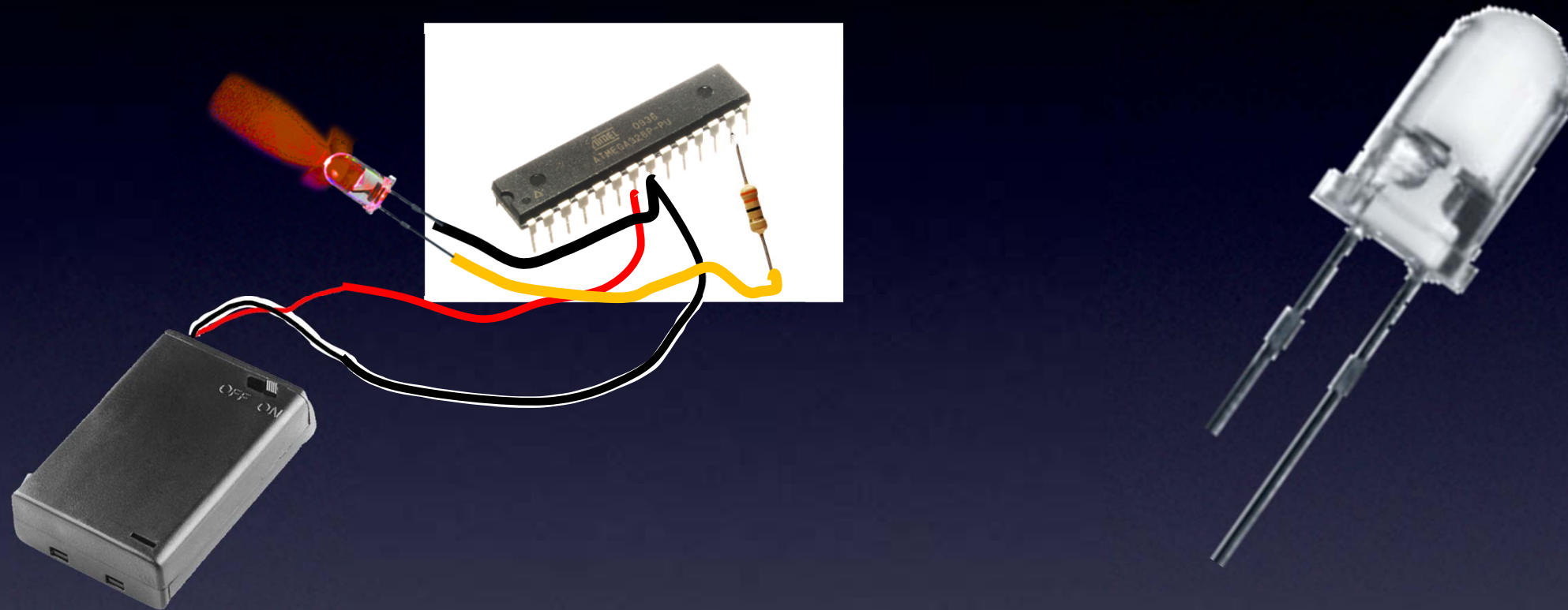
Firmware

- pin 13 is Output pin
- set pin 13 High
- delay
- set pin 13 Low

Let's hack Hello World!

Microcontroller

Everything You Need to Know About Electronics

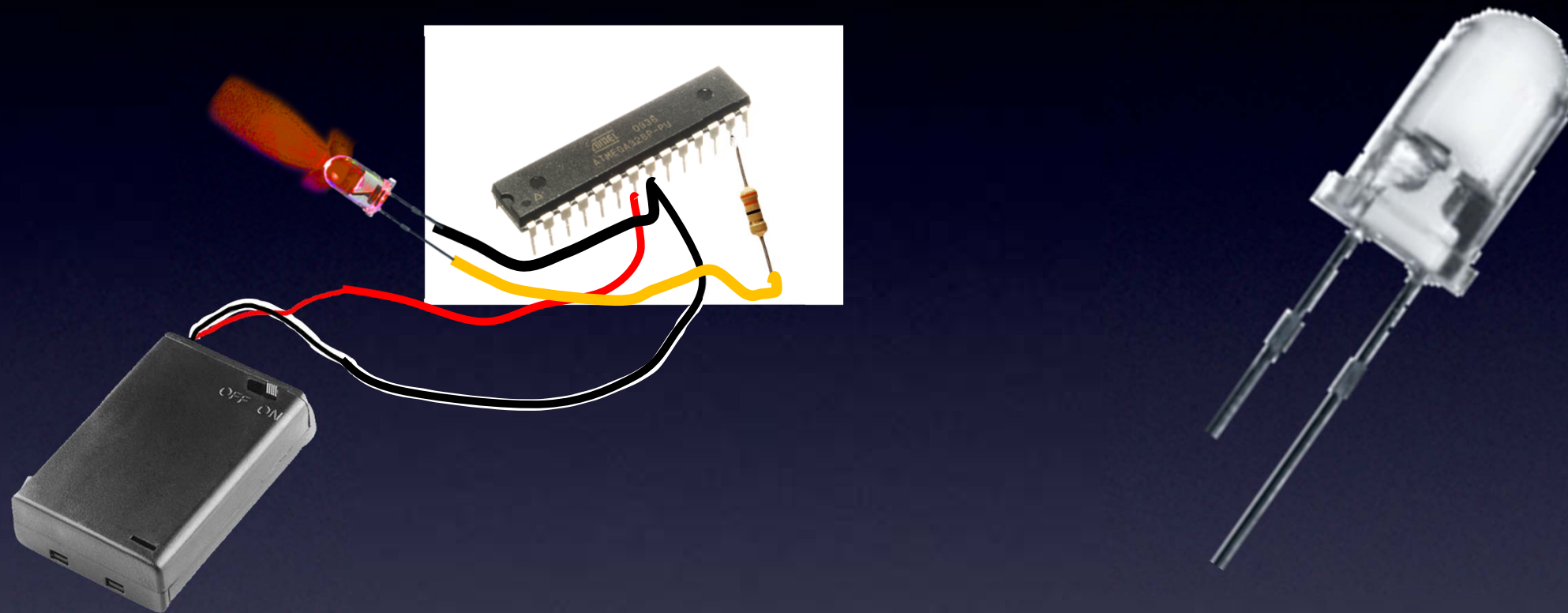


Add an IR LED to another pin

IR “OFF” codes

Microcontroller

Everything You Need to Know About Electronics

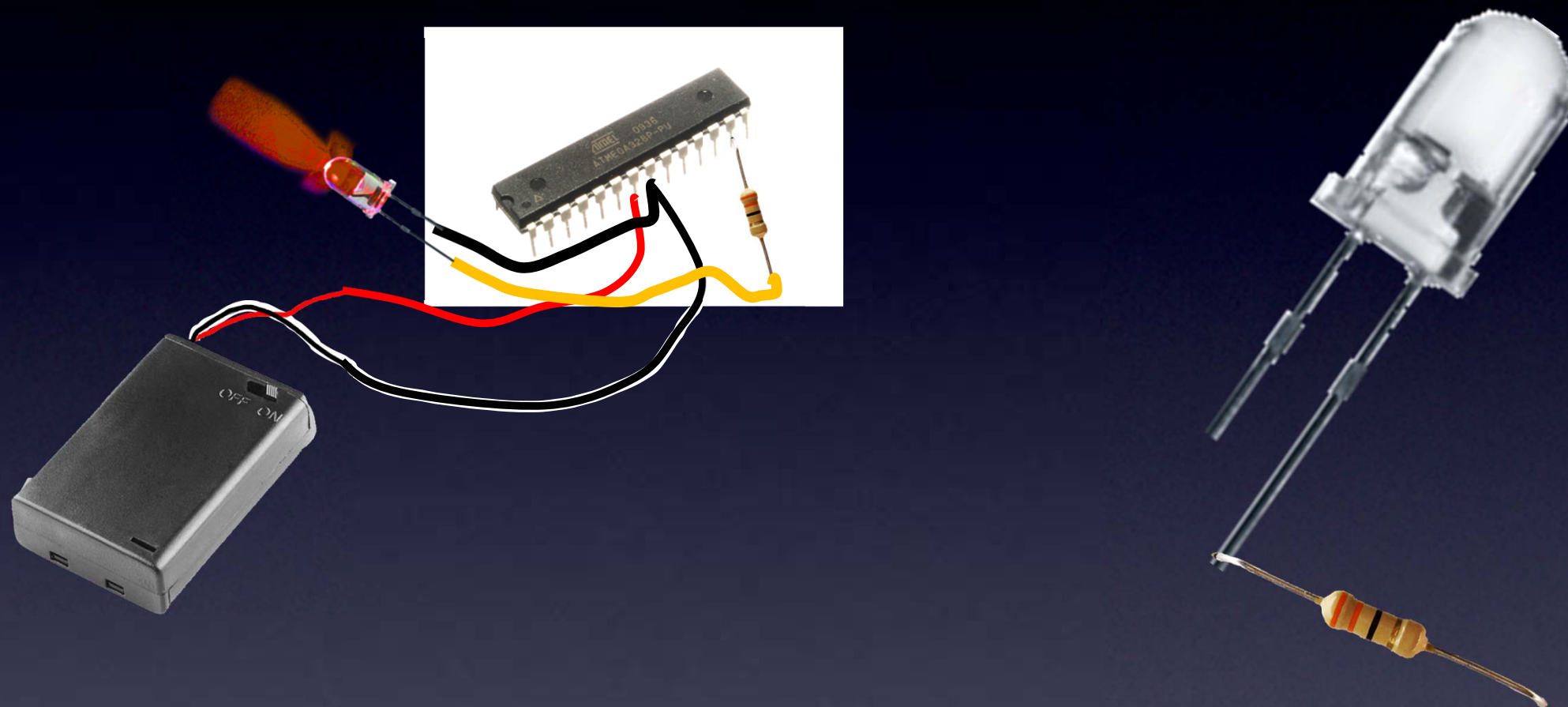


Add an IR LED to another pin (say, pin3)

IR “OFF” codes

Microcontroller

Everything You Need to Know About Electronics

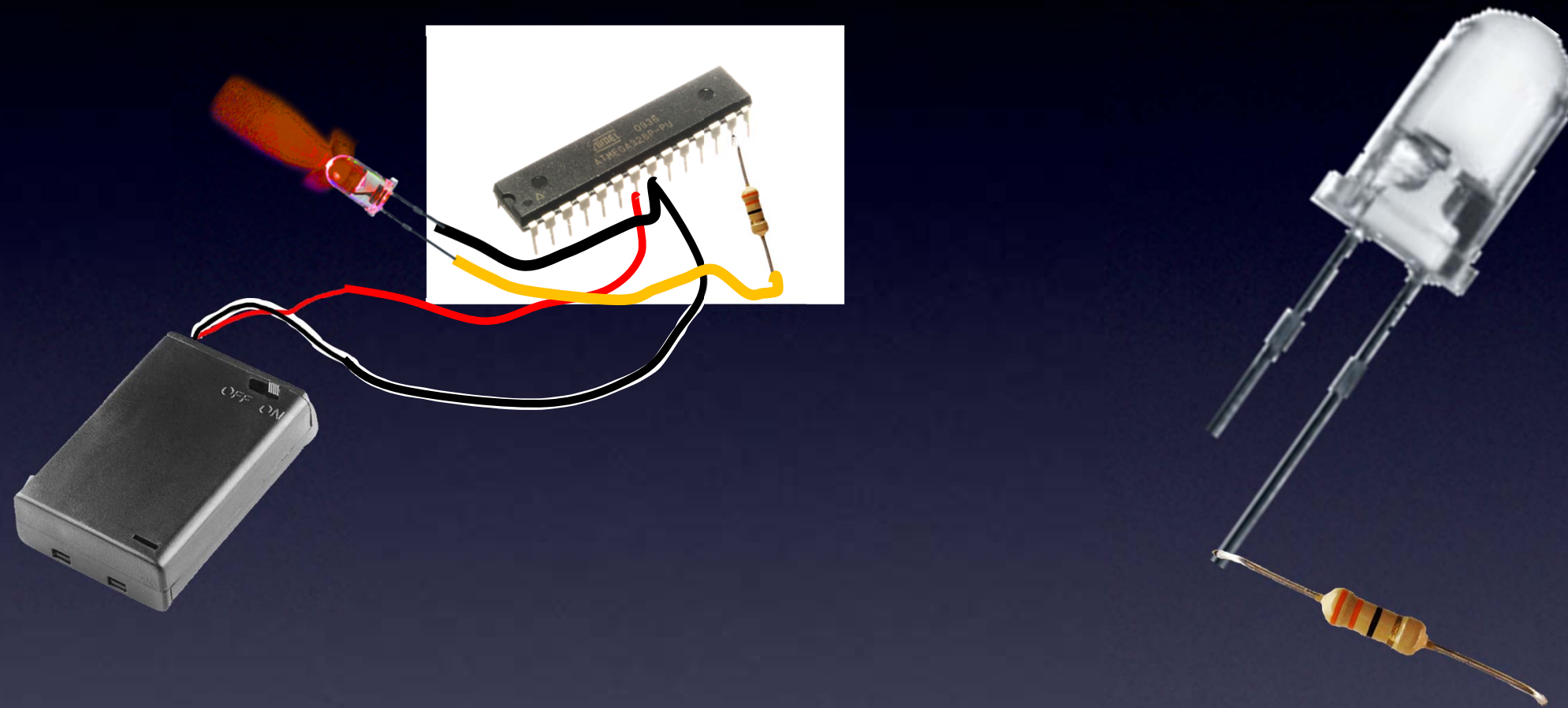


Add an IR LED to another pin (say, pin3)
and a resistor so no magic smoke goes away

IR “OFF” codes

Microcontroller

Everything You Need to Know About Electronics

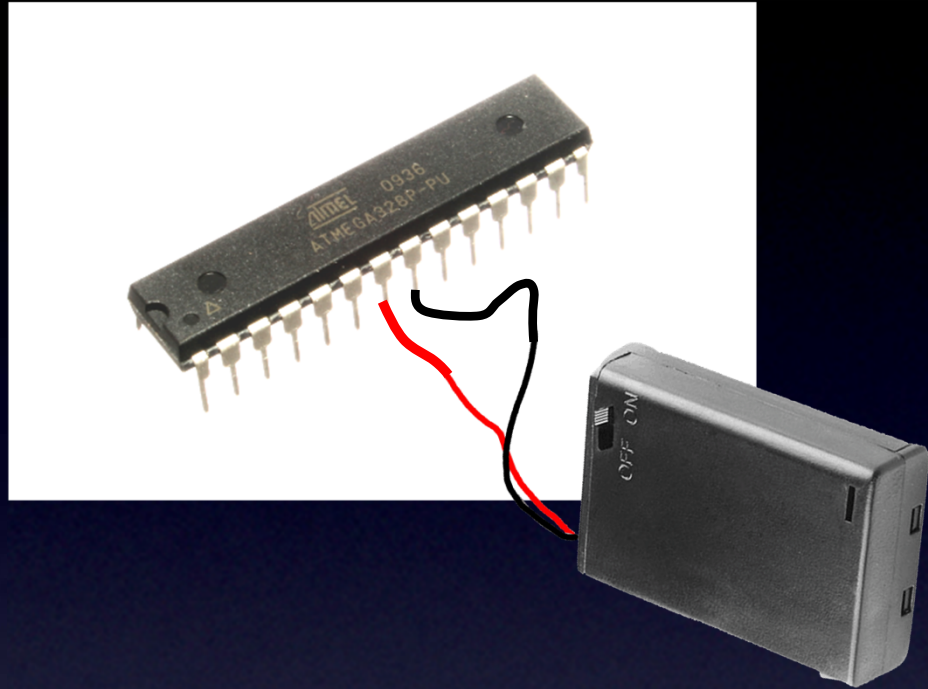


But, *When?*

IR "OFF" codes

Microcontroller

Everything You Need to Know About Electronics



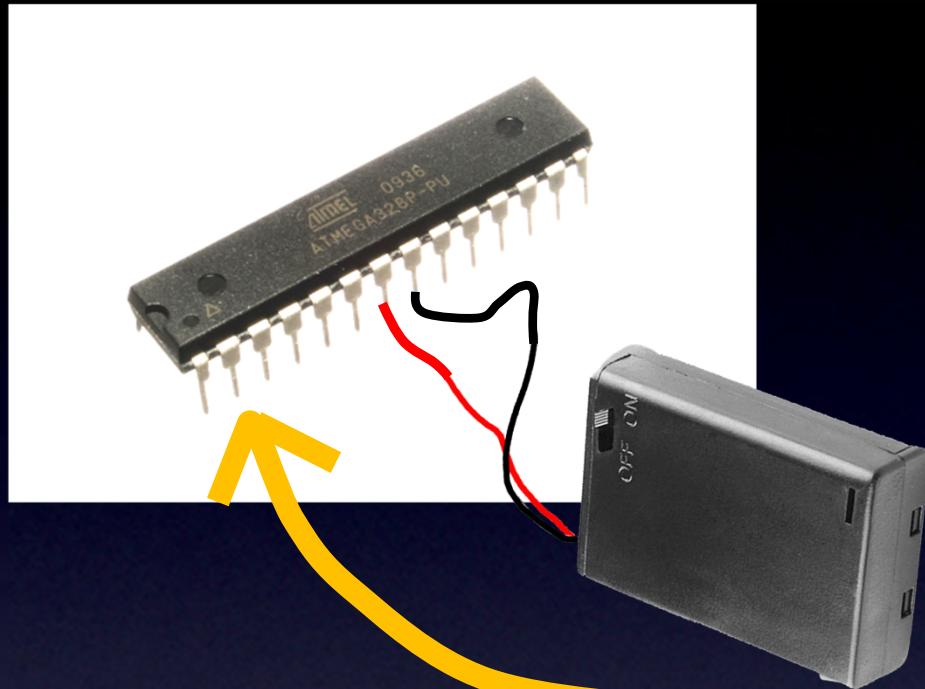
Let's add an Input pin!

and

We can add a Start button

Microcontroller

Everything You Need to Know About Electronics



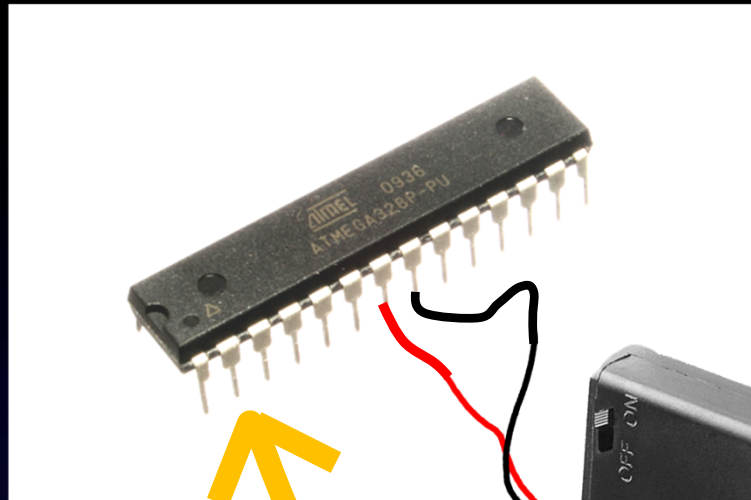
How do we make a pin an Input pin?

We tell it to be one – with our program.

Any pin can be an Input pin (like, pin 2).

Microcontroller – Input pins

Everything You Need to Know About Electronics

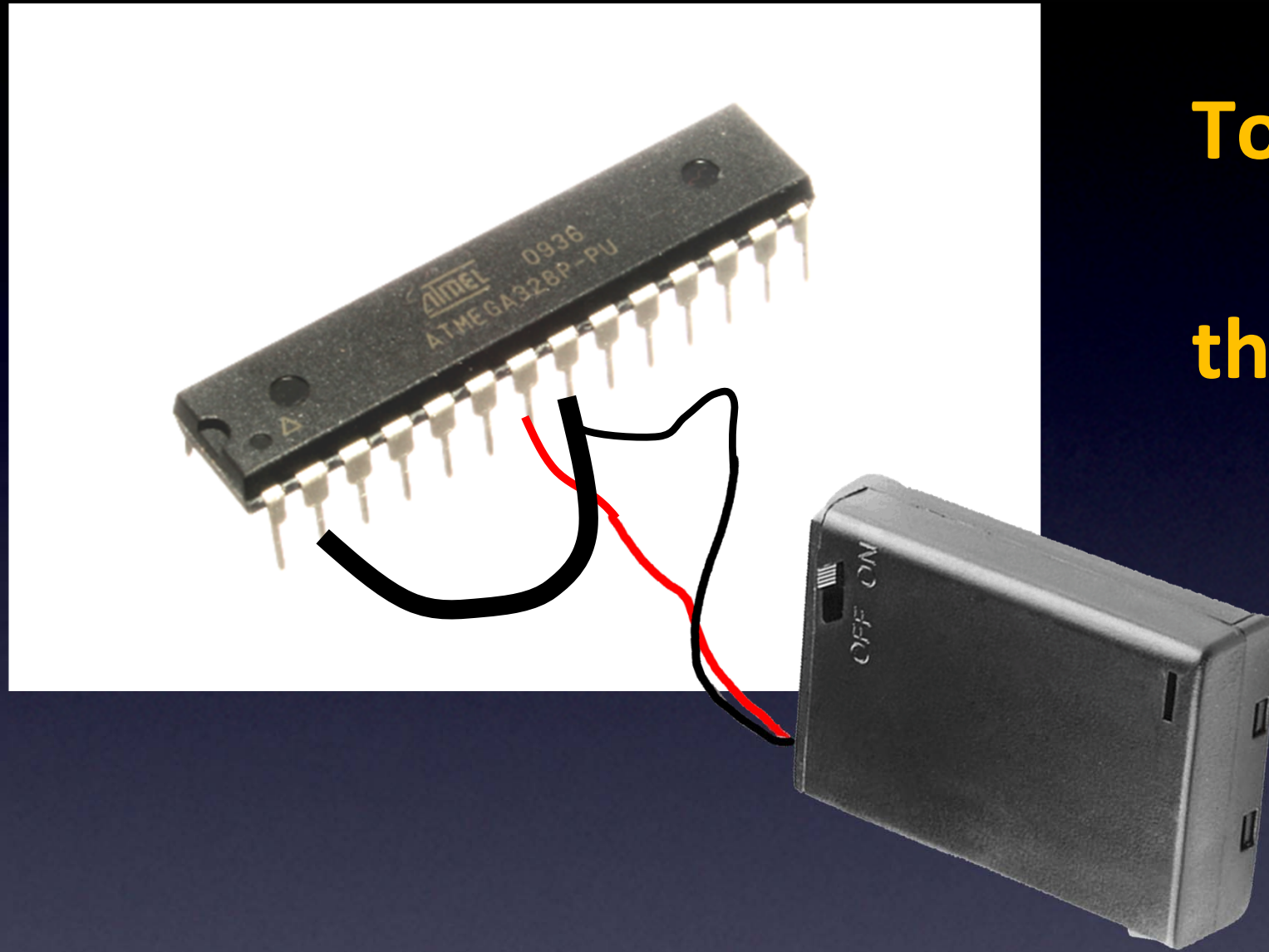


Once we have an **Input pin** (like, pin 2):

only 2 choices – is the Input pin: **High** or **Low** ?

Microcontroller – Input pins

Everything You Need to Know About Electronics

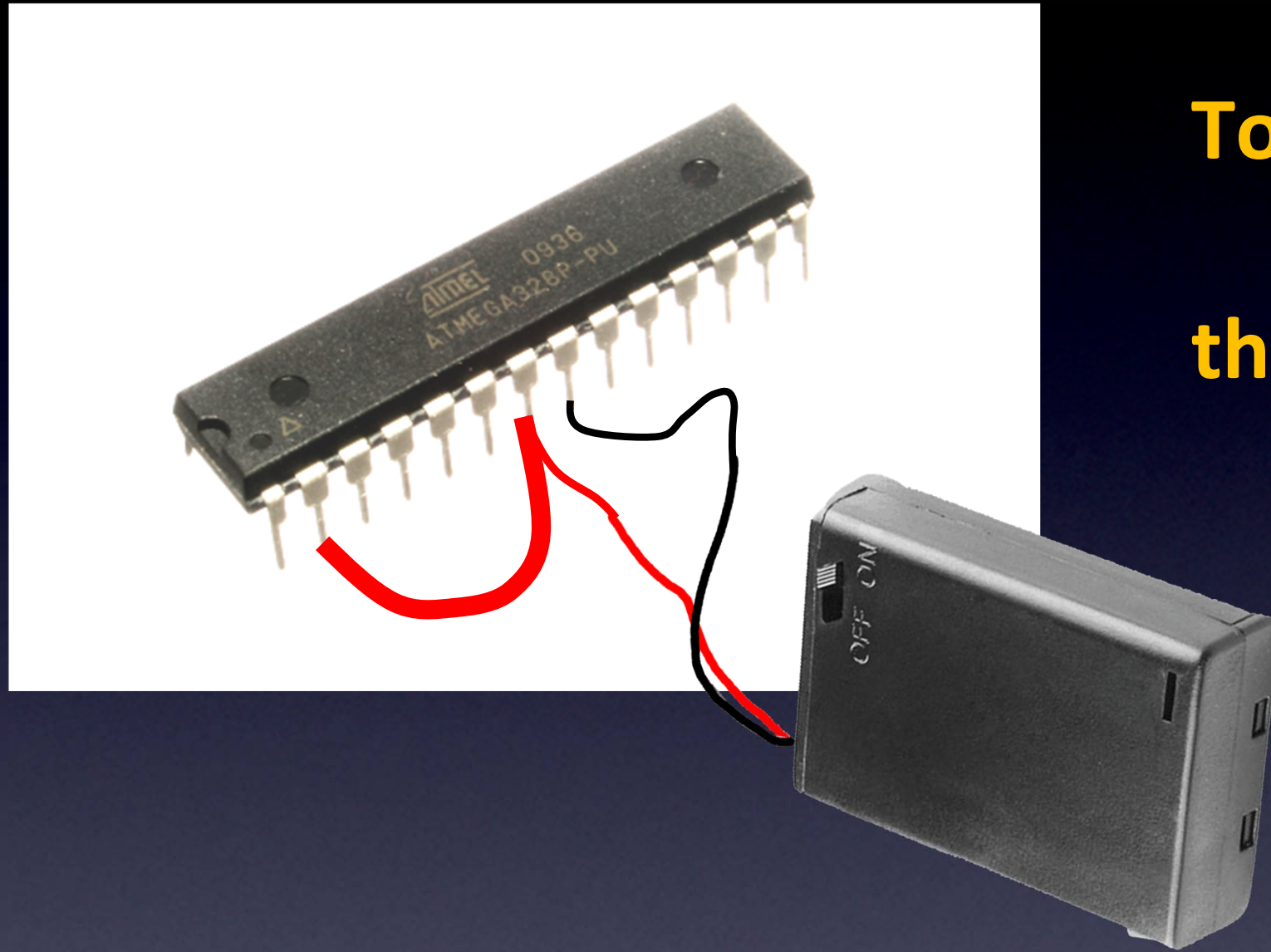


**To make the Input pin Low,
connect it to
the Black wire of our power
supply (Ground).**

Low

Microcontroller – Input pins

Everything You Need to Know About Electronics

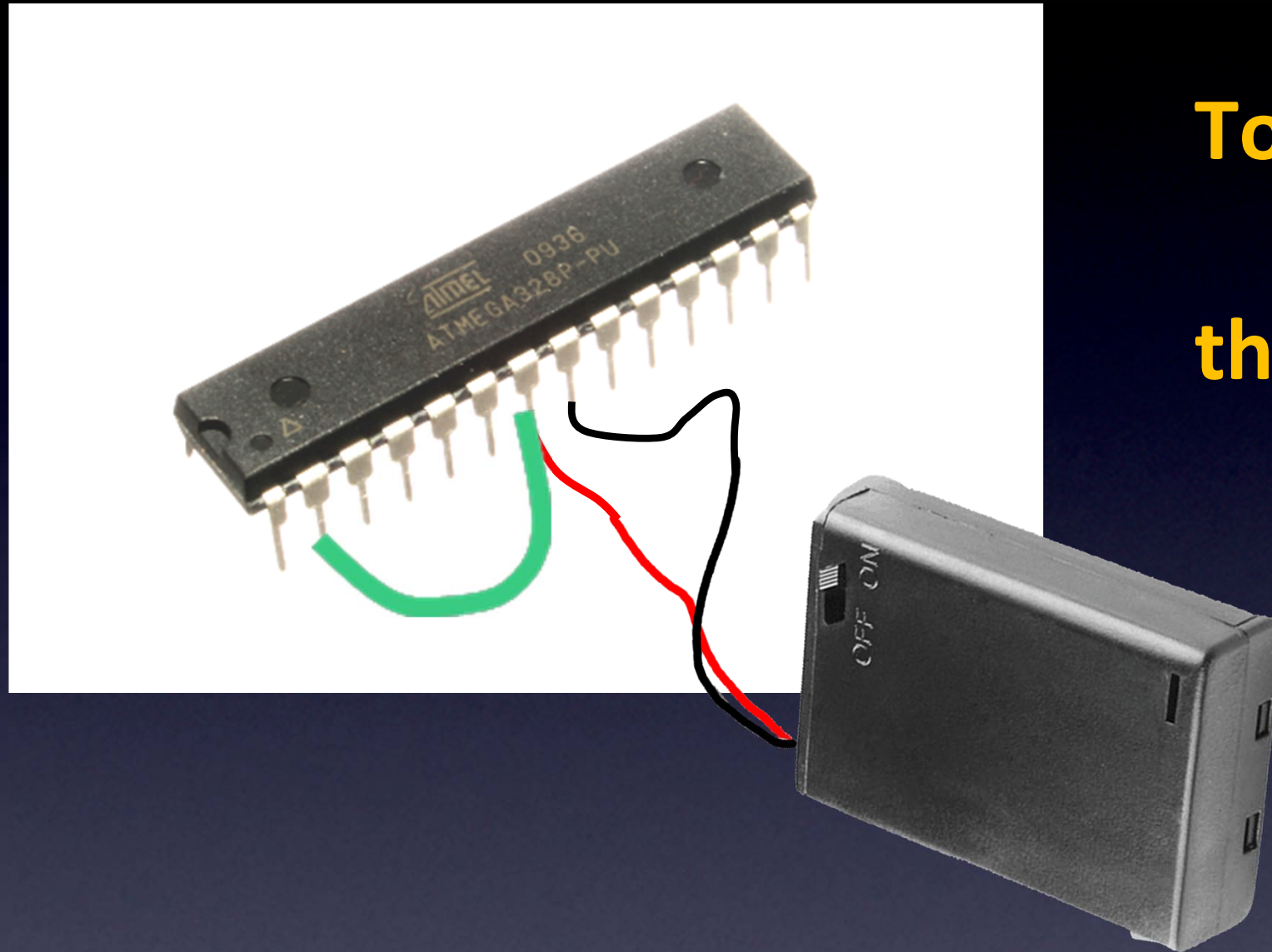


**To make the Input pin High,
connect it to
the Red wire of our power
supply (Vcc).**

High

Microcontroller – Input pins

Everything You Need to Know About Electronics



To make the Input pin High,
connect it to
the Red wire of our power
supply (Vcc).

FYI:

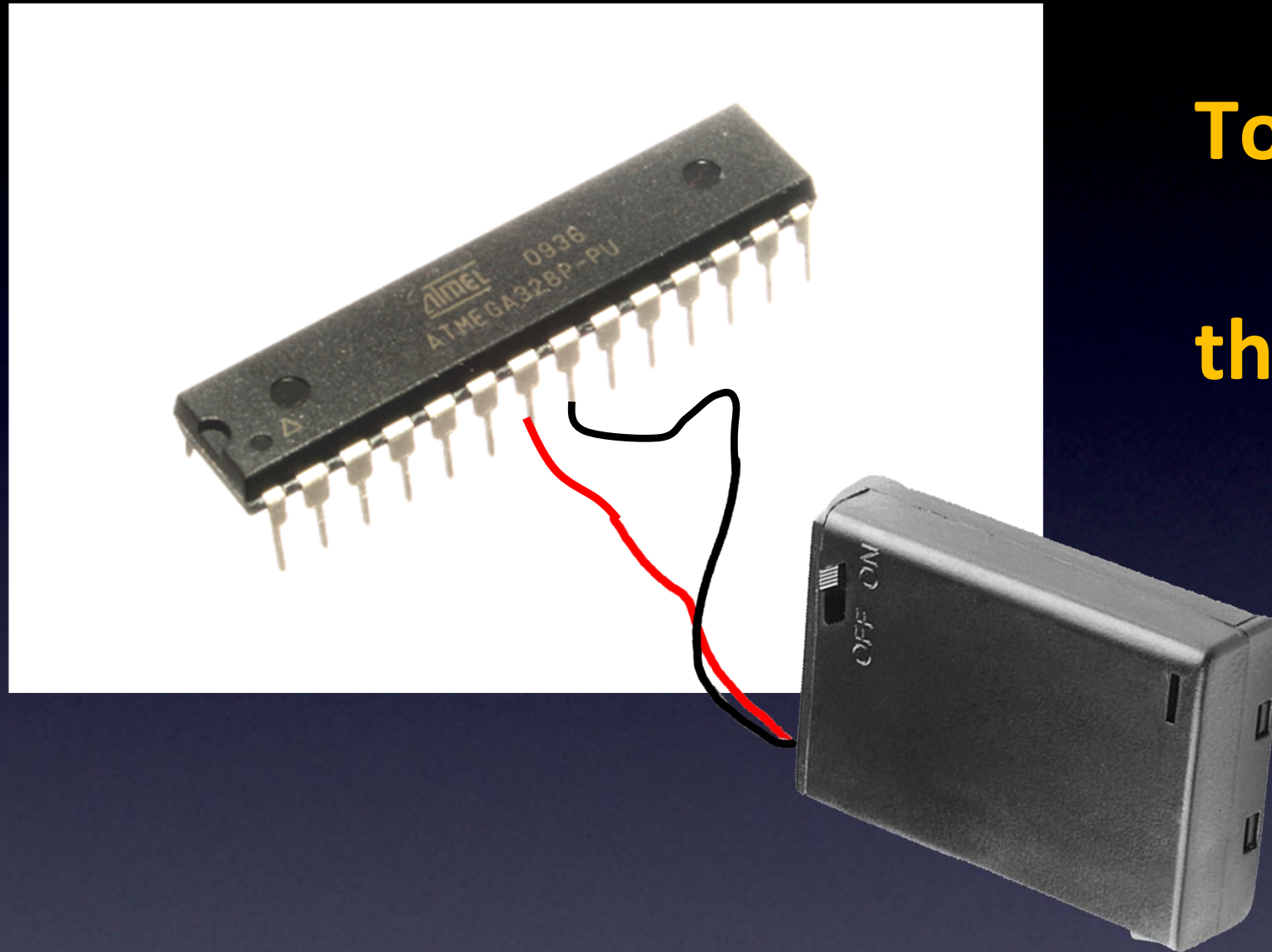
Wire color does not matter !

(electrons don't care)

High

Microcontroller – Input pins

Everything You Need to Know About Electronics



**To make the Input pin High,
connect it to
the Red wire of our power
supply (Vcc).**

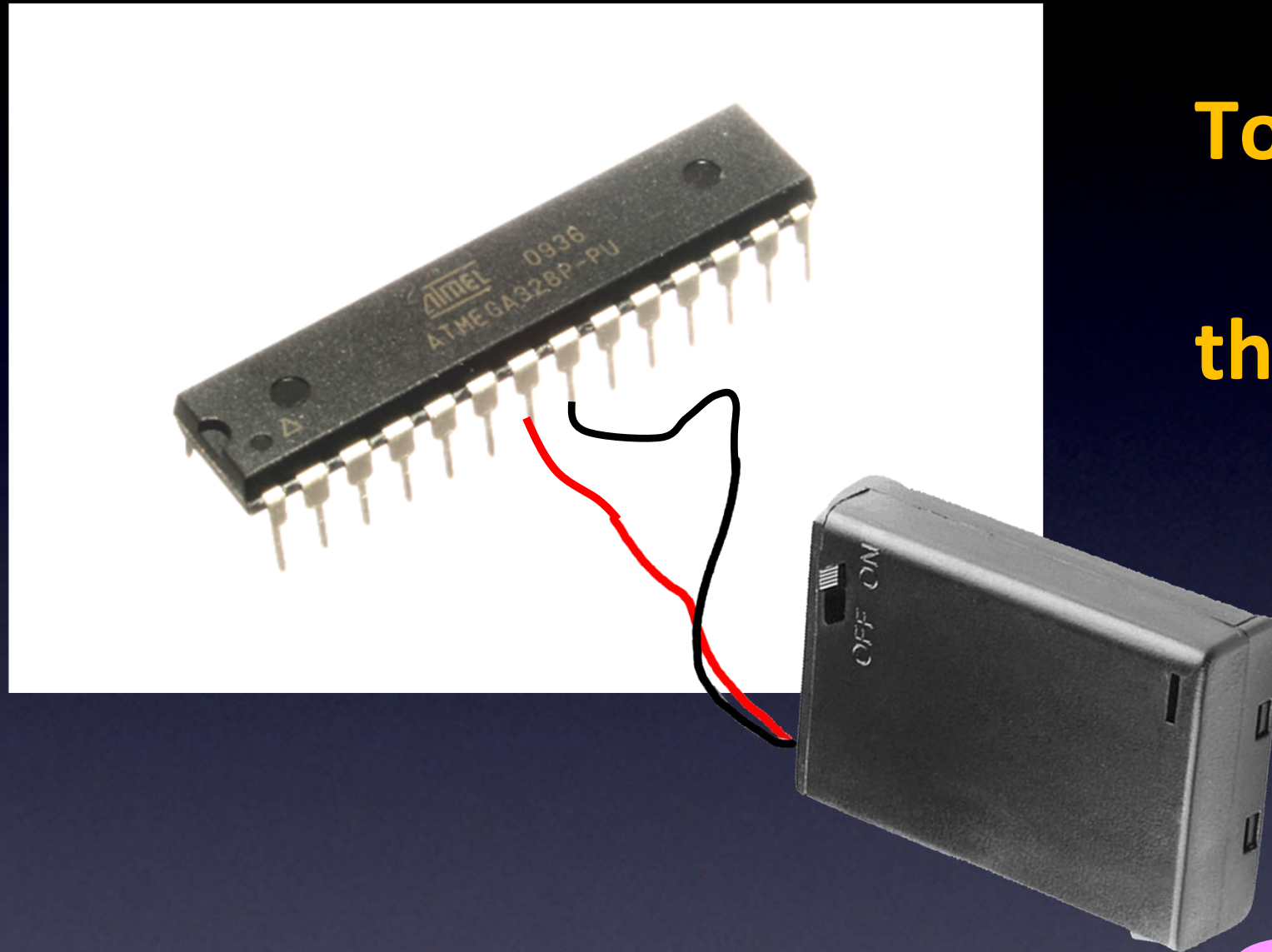
OR:

just leave it blank
(built-in resistors on each Input pin)

High

Microcontroller – Input pins

Everything You Need to Know About Electronics



To make the Input pin High,
connect it to
the Red wire of our power
supply (Vcc).

OR:

just leave it blank
(built-in resistors on each Input pin)

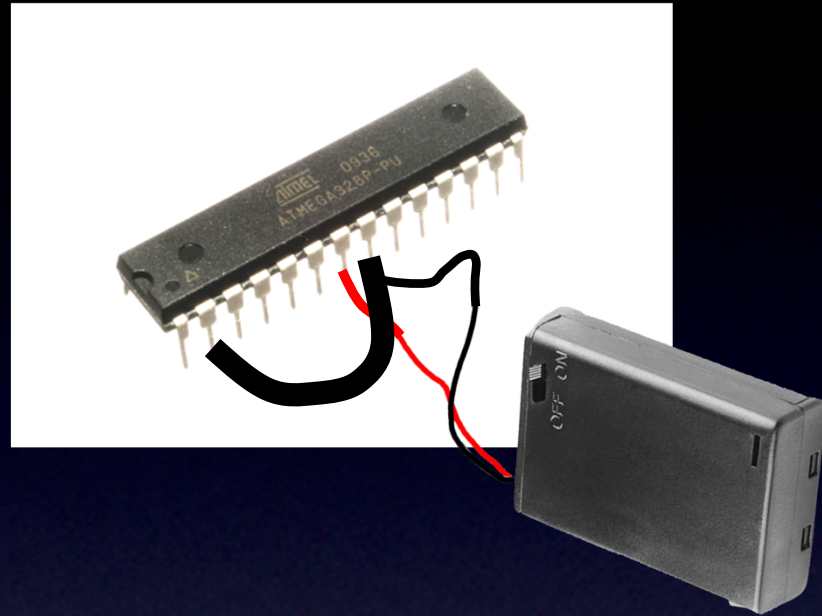
High

"Pull-up" Resistors
are built-in
to the microcontroller's
Input pins



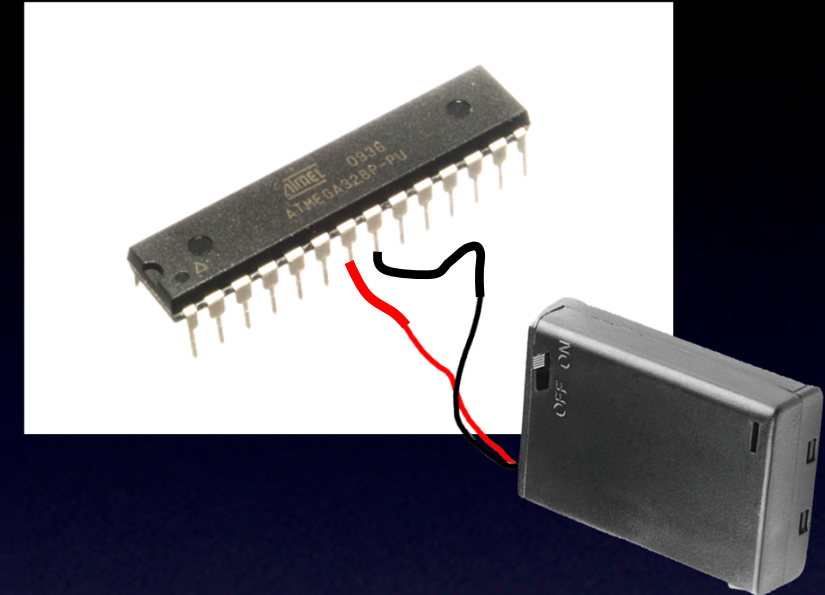
Microcontroller – Input pins

Everything You Need to Know About Electronics



If firmware looks at
Pin 2 when it's like this,
it reports back:

Low



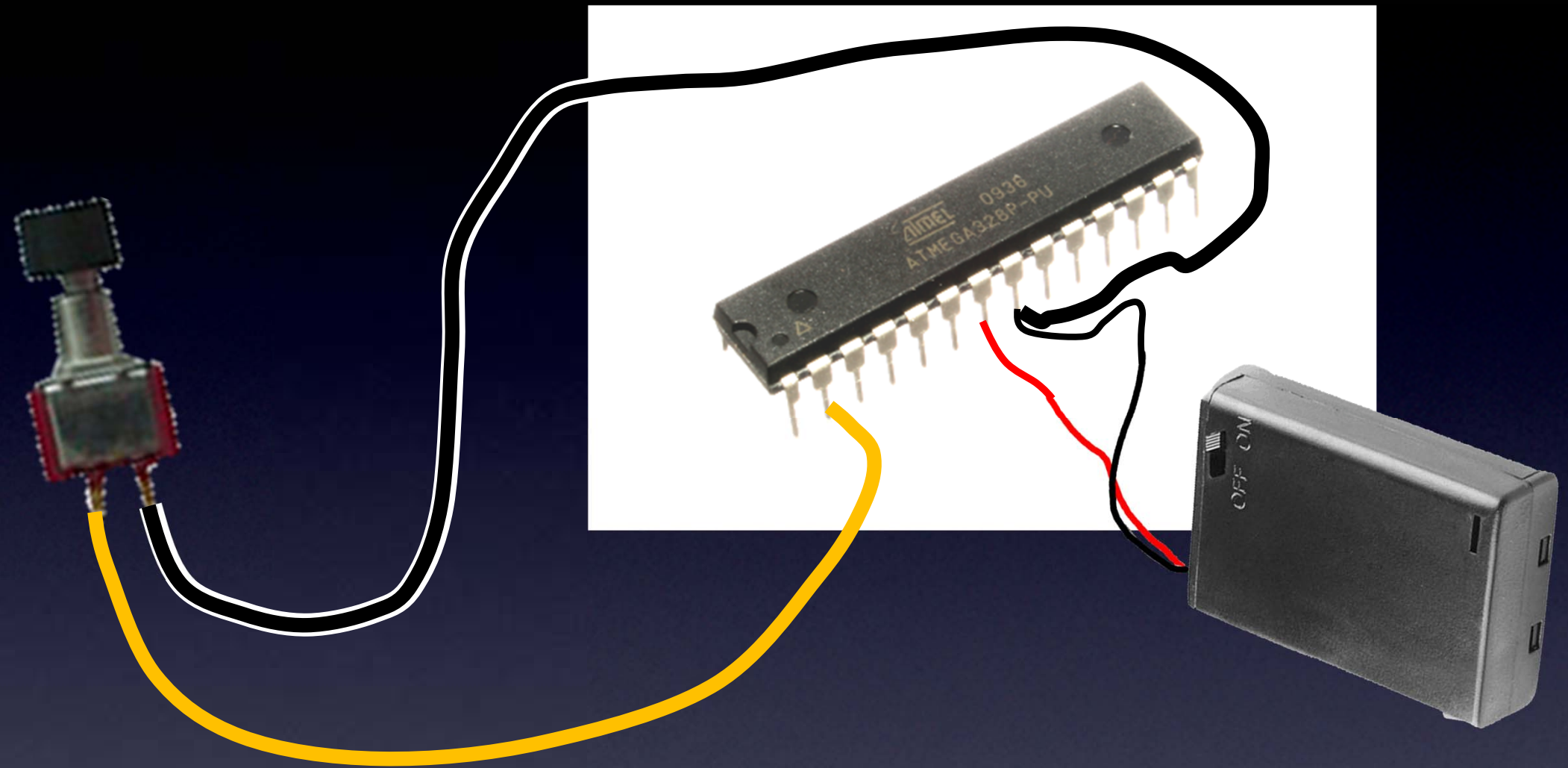
If firmware looks at
Pin 2 when it's like this,
it reports back:

High

Reading the Input pin

Microcontroller – Input pins

Everything You Need to Know About Electronics

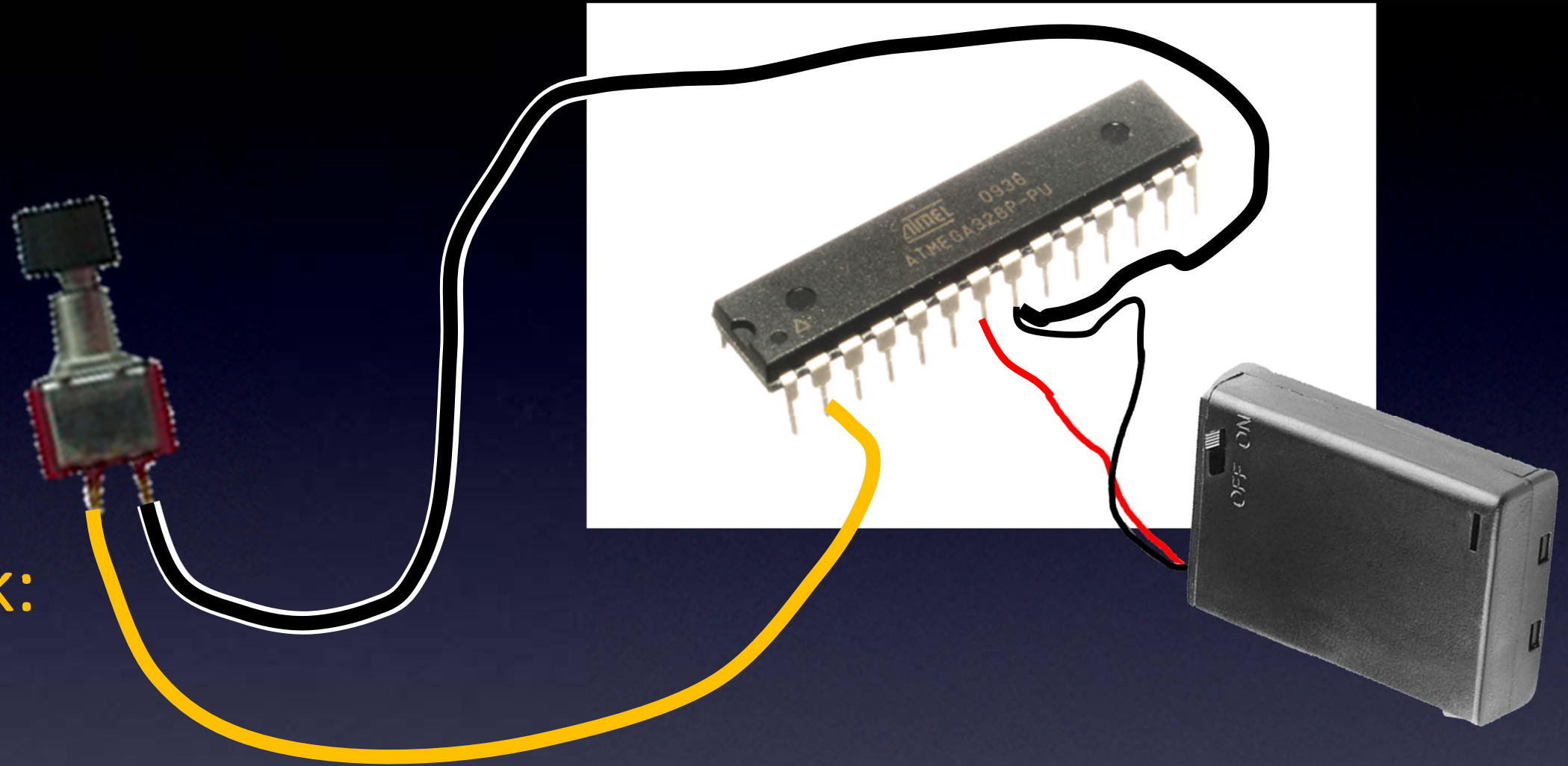


Reading the Input pin, with Switch

Microcontroller – Input pins

Everything You Need to Know About Electronics

If firmware
looks at Pin 2
when switch
NOT pushed,
it reports back:
High

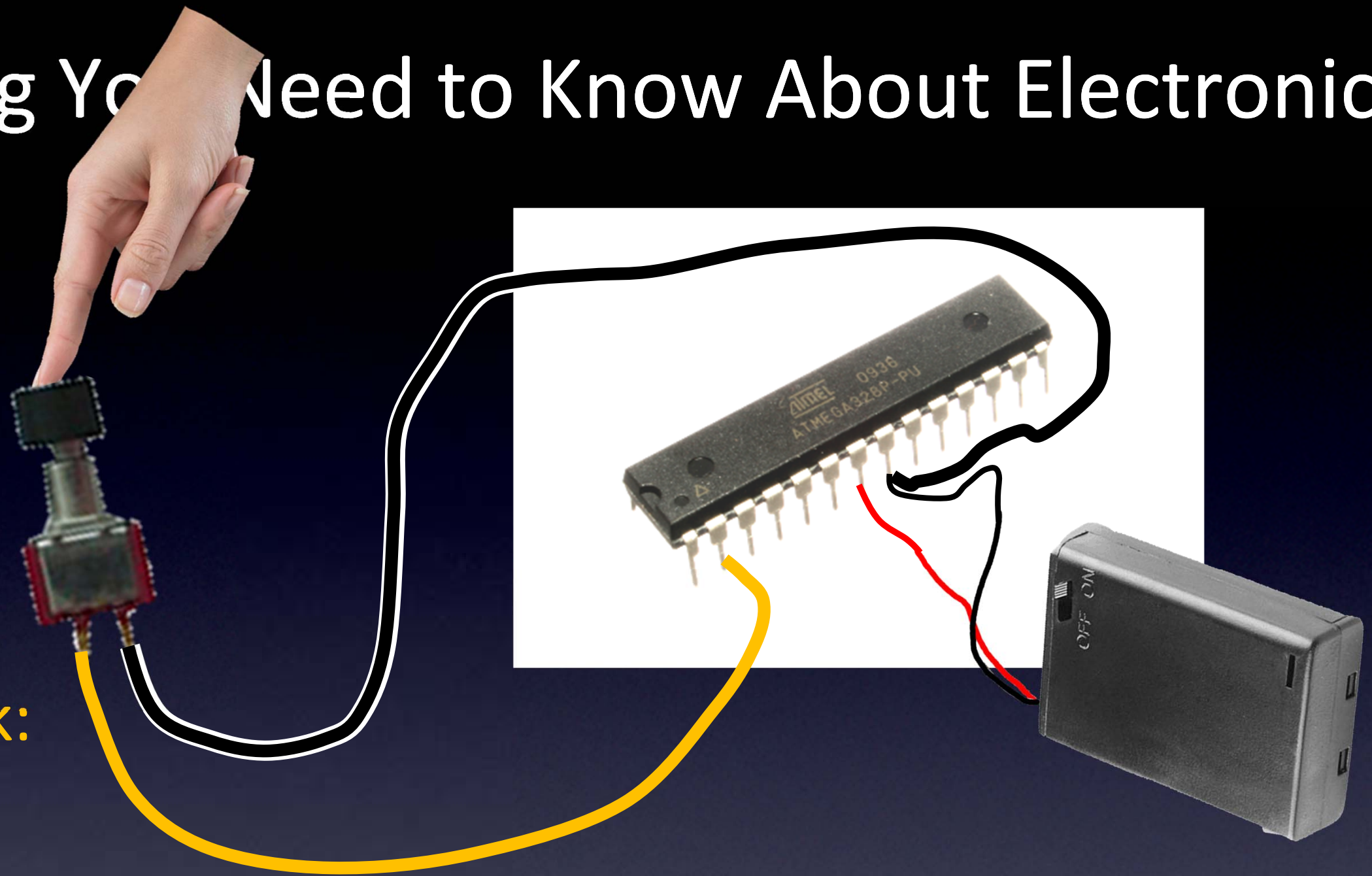


Reading the Input pin, with Switch

Microcontroller – Input pins

Everything You Need to Know About Electronics

If firmware
looks at Pin 2
when switch
pushed,
it reports back:
Low

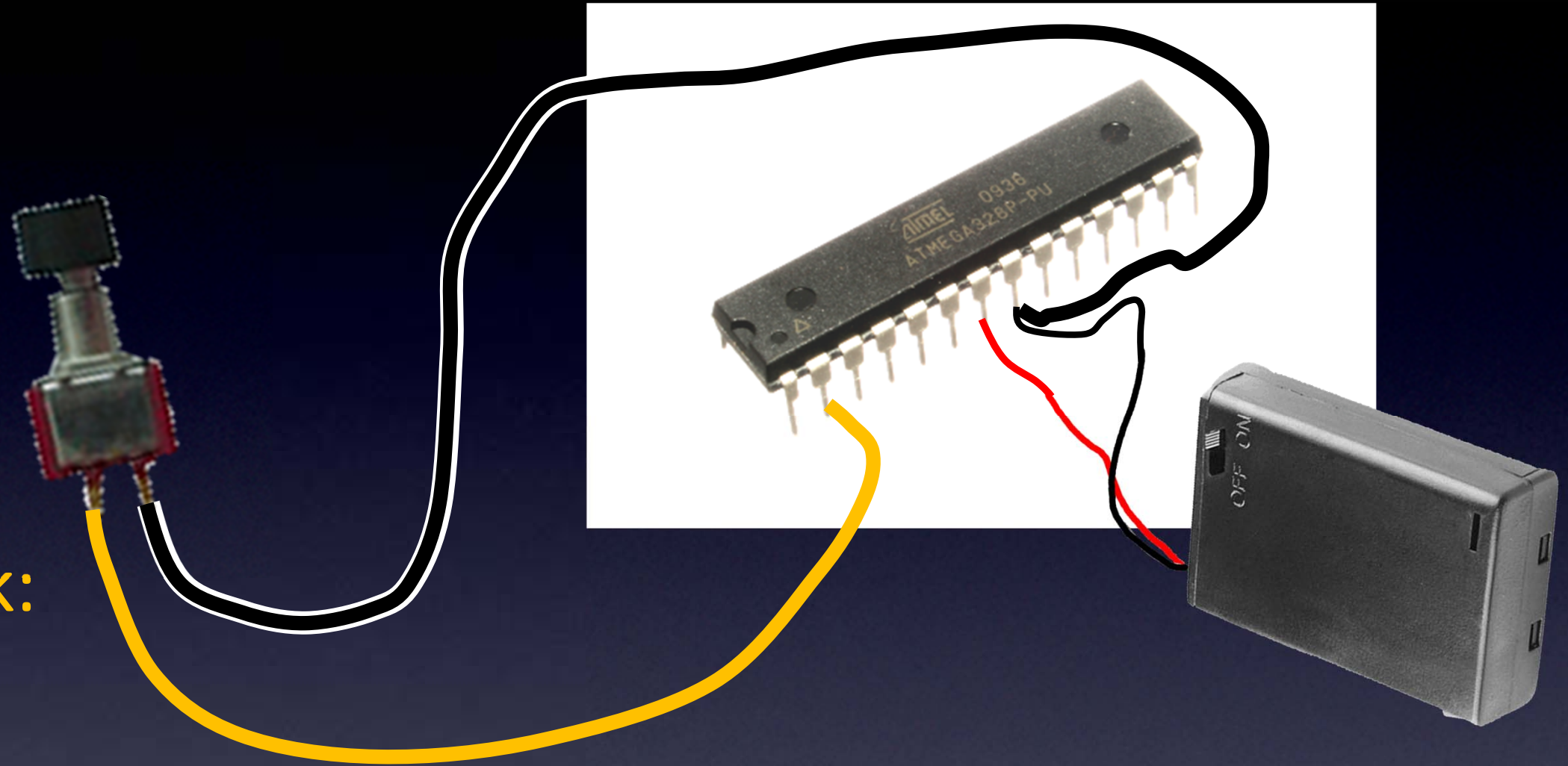


Reading the Input pin, with Switch

Microcontroller – Input pins

Everything You Need to Know About Electronics

If firmware
looks at Pin 2
when switch
NOT pushed,
it reports back:
High

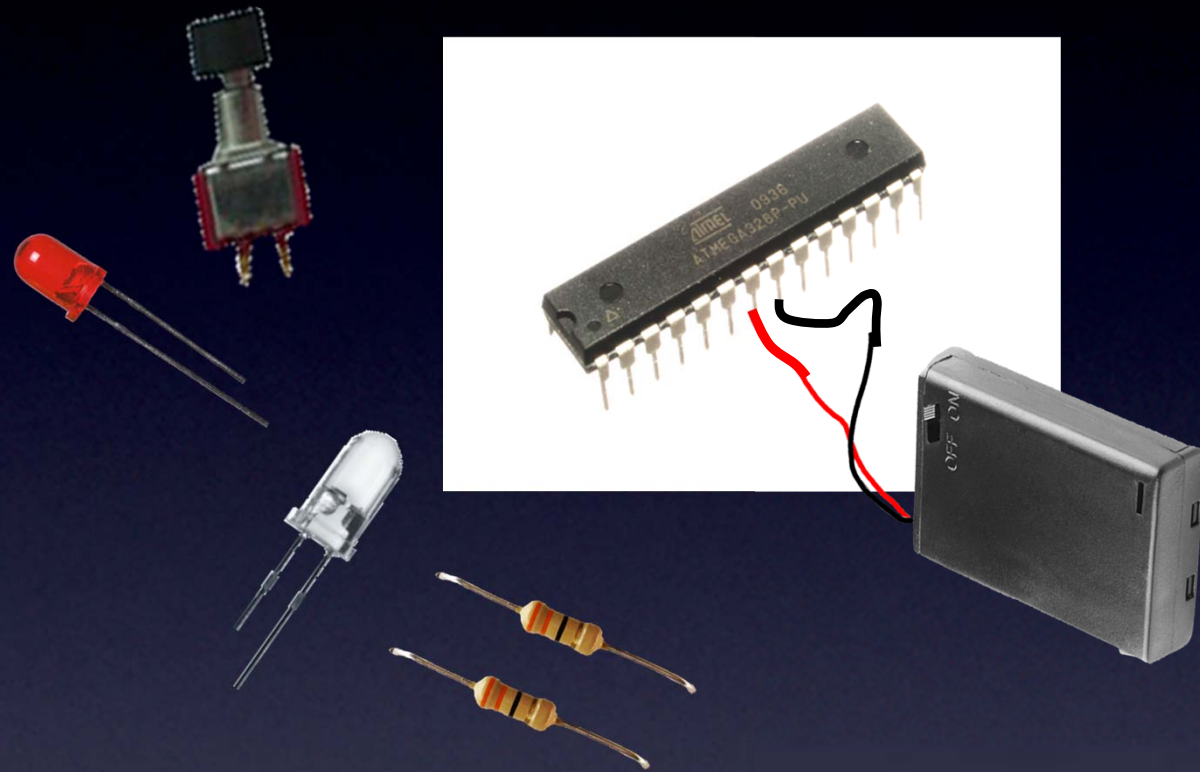


Reading the Input pin, with Switch

Microcontroller – Input pins

Everything You Need to Know About Electronics

Hardware



Firmware

Pin 13 Output – visible LED pin

Pin 3 Output – IR LED pin

Pin 2 Input – Push Button

Wait for Switch to be Low

Blink visible LED:

High, Delay, Low

Pulse IR LED for Sony “OFF” code:

High, Delay, Low, Delay...

Blink visible LED:

High, Delay, Low

Pulse IR LED for Panasonic “OFF” code:

High, Delay, Low, Delay...

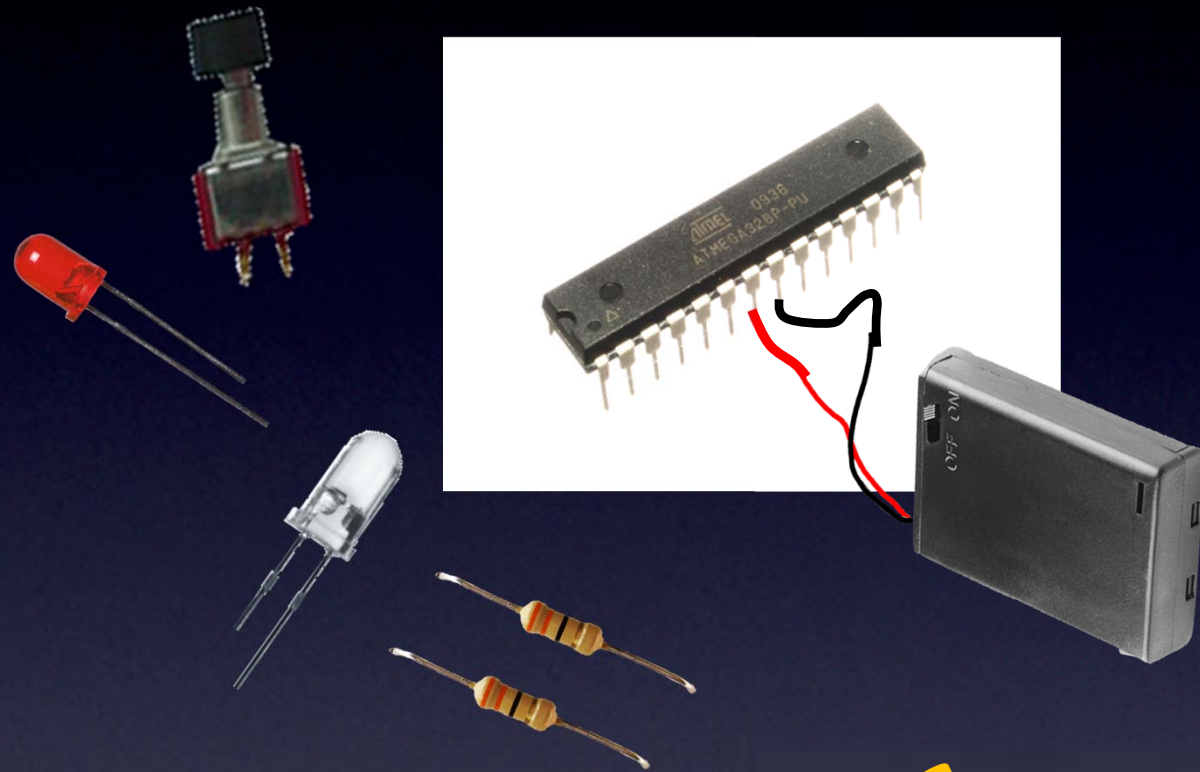
Etc for all “OFF” codes

TV-B-Gone remote control

Microcontroller

Everything You Need to Know About Electronics

Hardware



Except
doesn't go very far

Firmware

Pin 13 Output – visible LED pin

Pin 3 Output – IR LED pin

Pin 2 Input – Push Button

Wait for Switch to be Low

Blink visible LED:

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Pulse IR LED for Sony “OFF” code:

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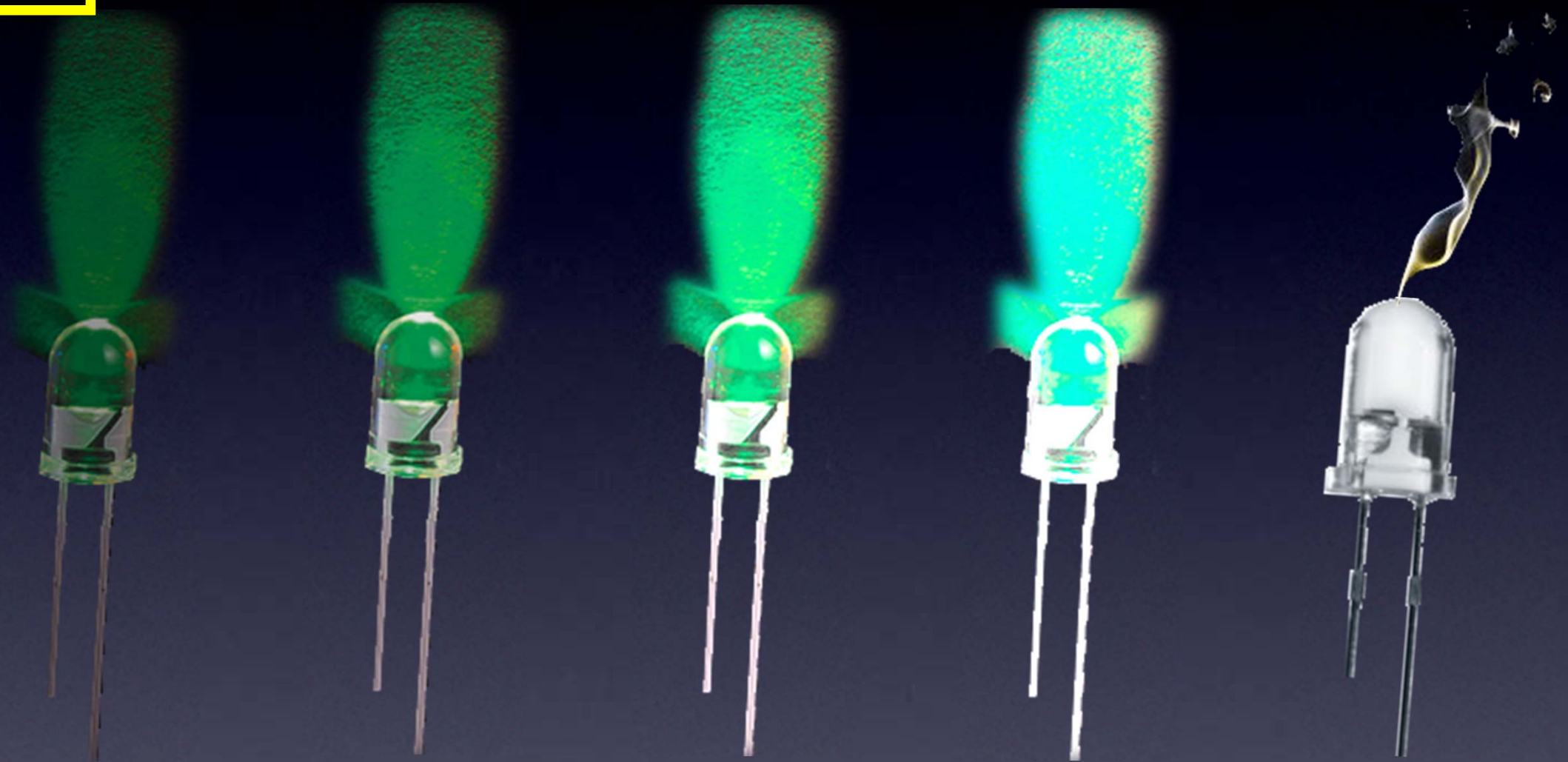
Etc for all “OFF” codes

TV-B-Gone remote control

Microcontroller

Everything You Need to Know About Electronics

Remember:

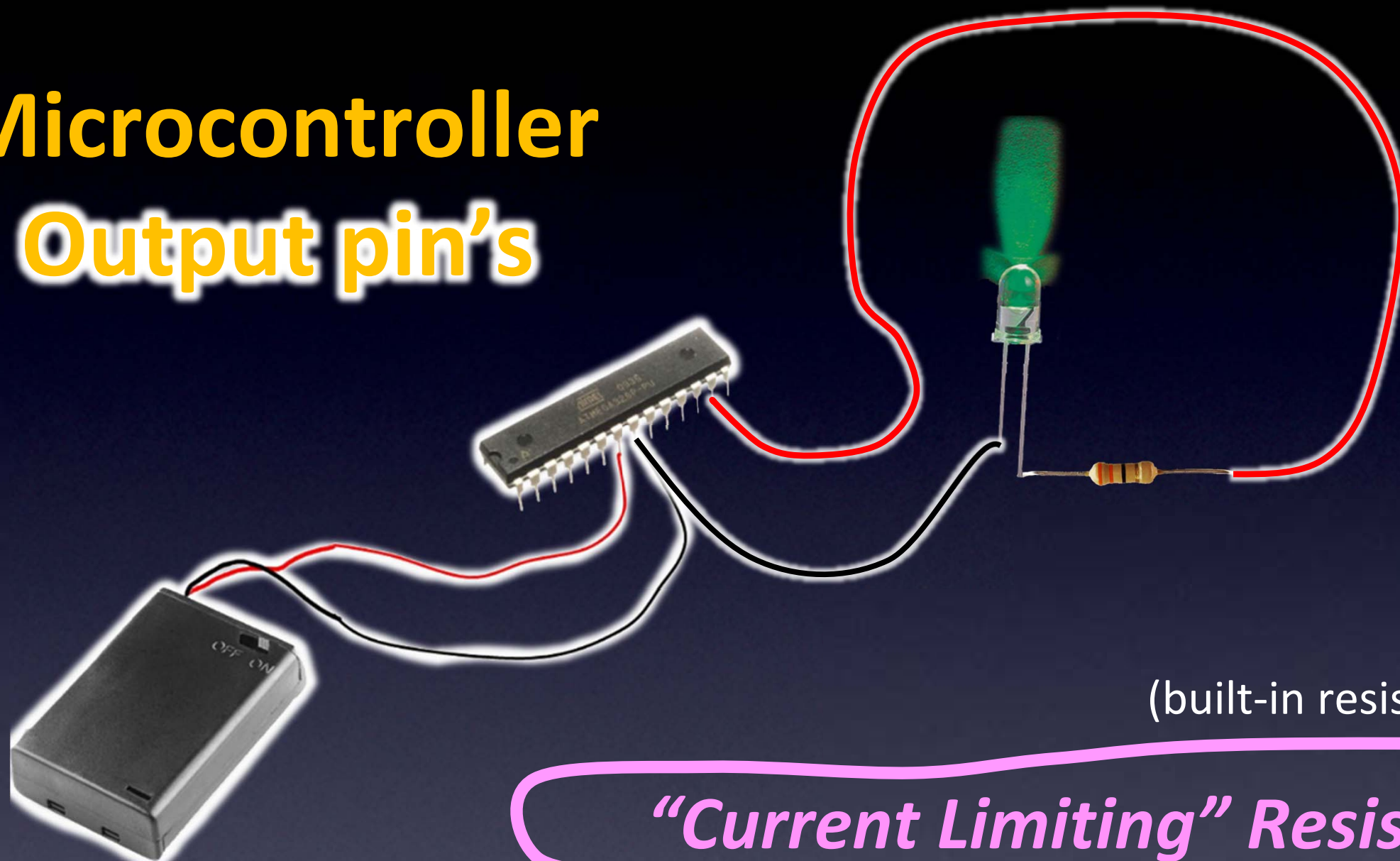


More current → More brightness! (until...)

LED

Everything You Need to Know About Electronics

Microcontroller Output pin's



(built-in resistors on each Output pin)

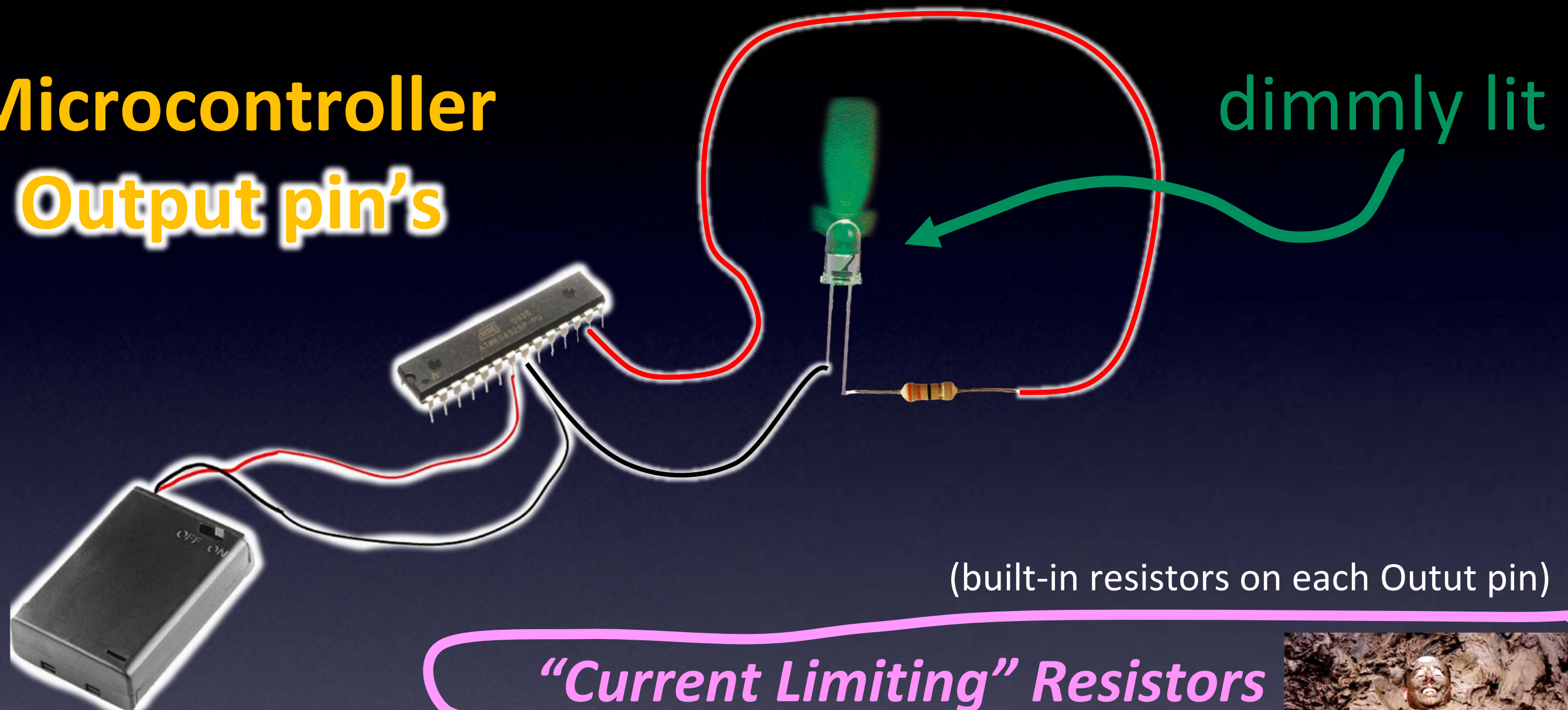
“Current Limiting” Resistors
are built-in
to the microcontroller’s
Output pins



Microcontroller – Output pins

Everything You Need to Know About Electronics

**Microcontroller
Output pin's**



“Current Limiting” Resistors
are built-in
to the microcontroller’s
Output pins



Microcontroller – Output pins

Everything You Need to Know About Electronics

So,

let's amplify the current

from the Output pin

with

a

Current amplifier !

Everything You Need to Know About Electronics

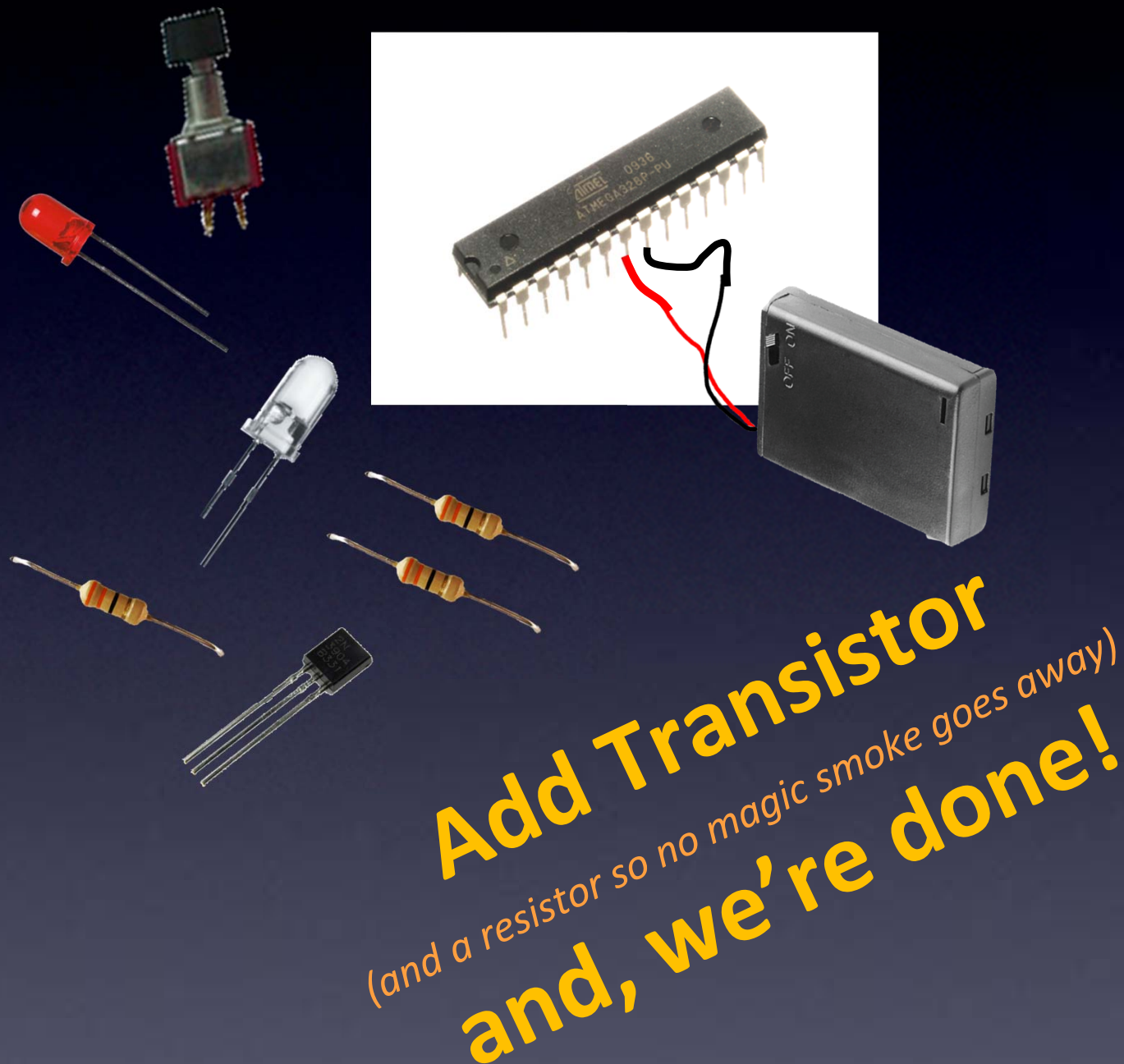


Current amplifier !

Transistor

Everything You Need to Know About Electronics

Hardware



Firmware

Pin 13 Output – visible LED pin

Pin 3 Output – IR LED pin

Pin 2 Input – Push Button

Wait for Switch to be Low

Blink visible LED:

High, Delay, Low

Pulse IR LED for Sony “OFF” code:

High, Delay, Low, Delay...

Blink visible LED:

High, Delay, Low

Pulse IR LED for Panasonic “OFF” code:

High, Delay, Low, Delay...

Etc for all “OFF” codes

TV-B-Gone remote control – we're done!

Microcontroller

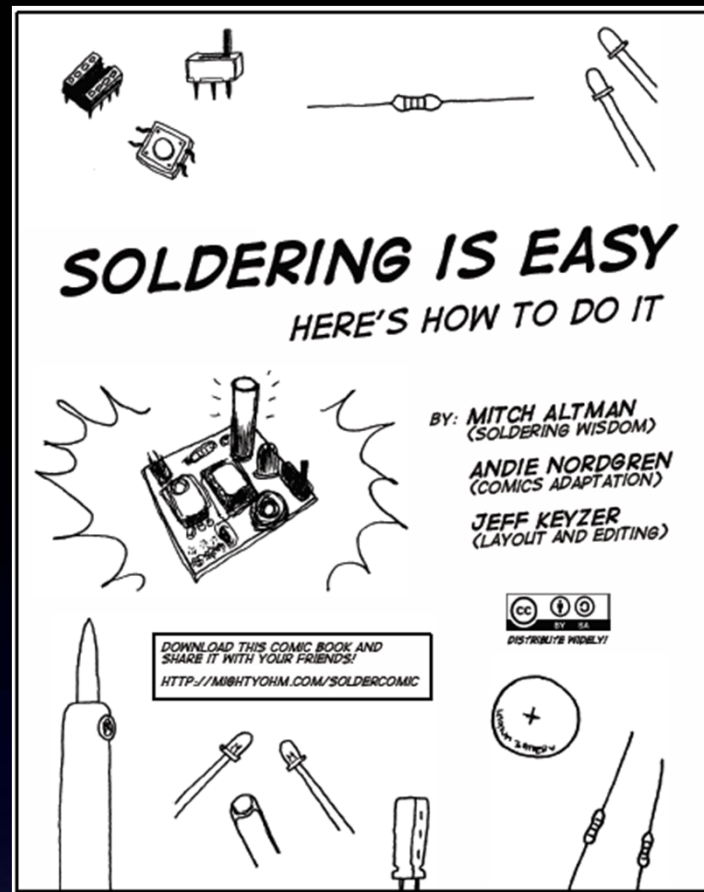
And, that is

And, that is

Everything You Need to Know About
Electronics

Questions?

Learn To Solder



The following photos will show you how to solder.

But feel free to download the “Soldering Is Easy” comic book for free!

(In many different languages.)

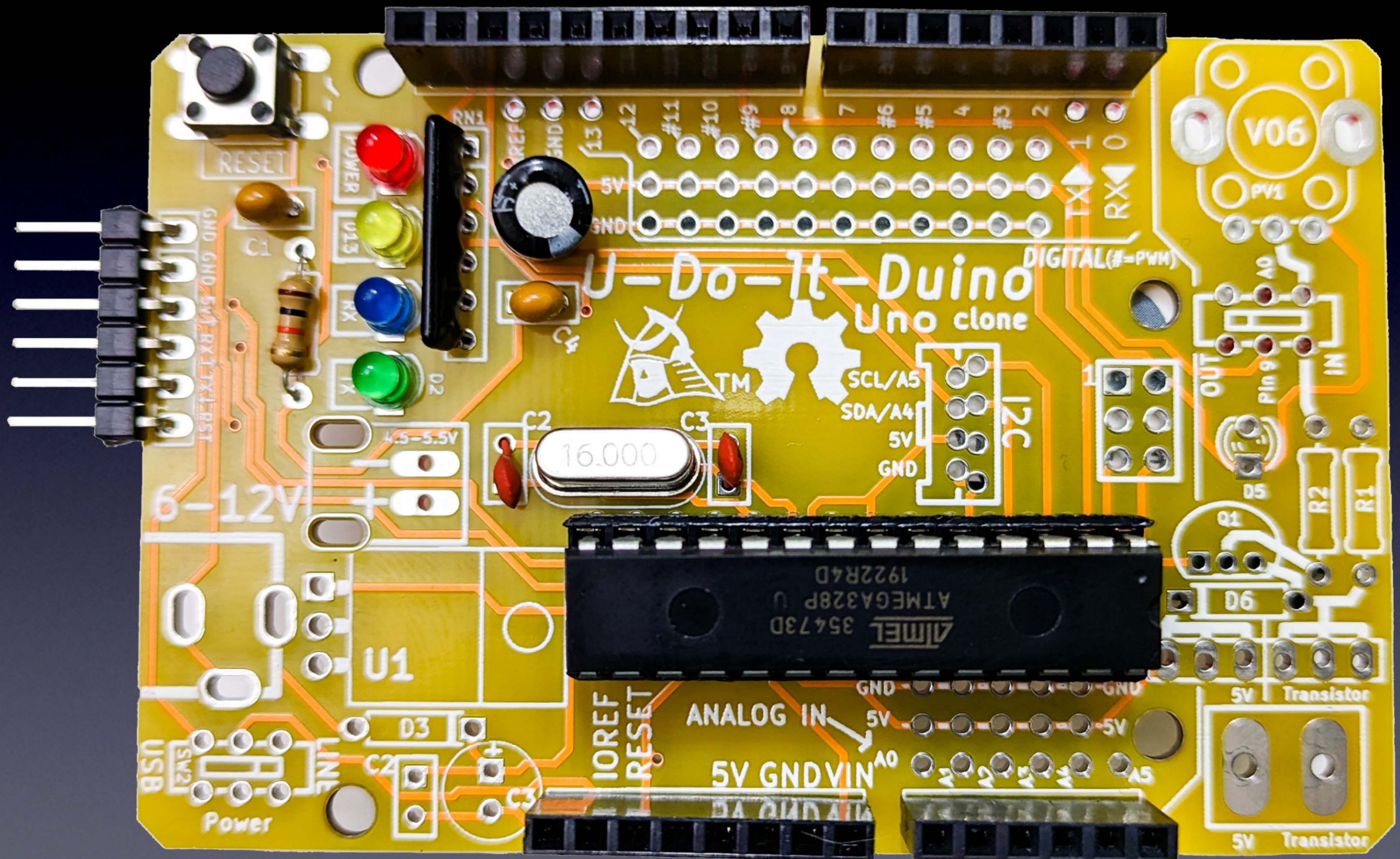
download for free at:
<http://mightyohm.com/soldercomic>

Learn To Solder



download for free at:
<http://mightyohm.com/soldercomic>
(In many different languages.)

U-Do-It-Duino – we will solder this!



PLEASE
DO NOT open
anything yet!



All of the parts

These are:
C2, C3

Set aside
these
2 capacitors

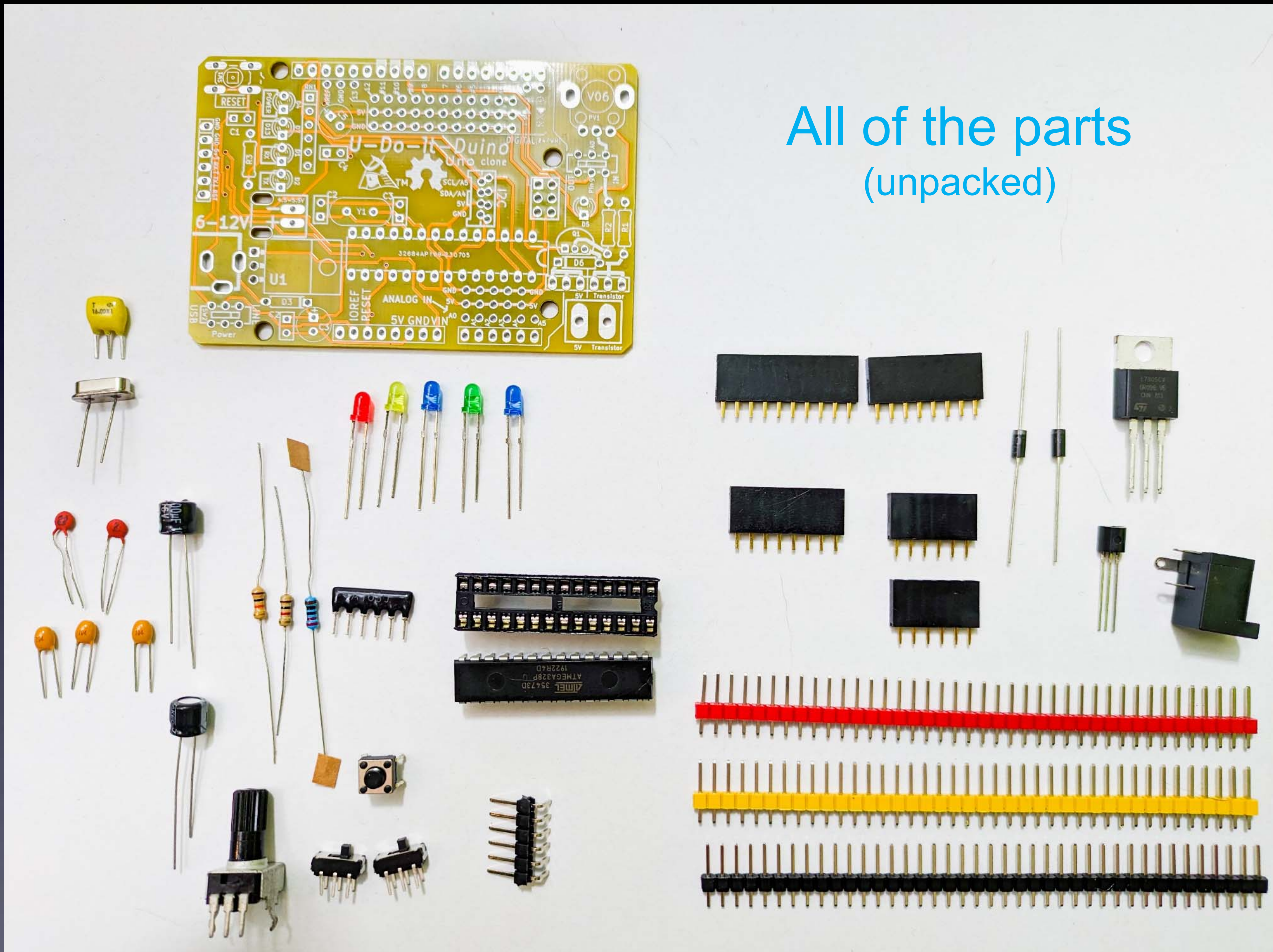


**Now,
please open
all of these parts**

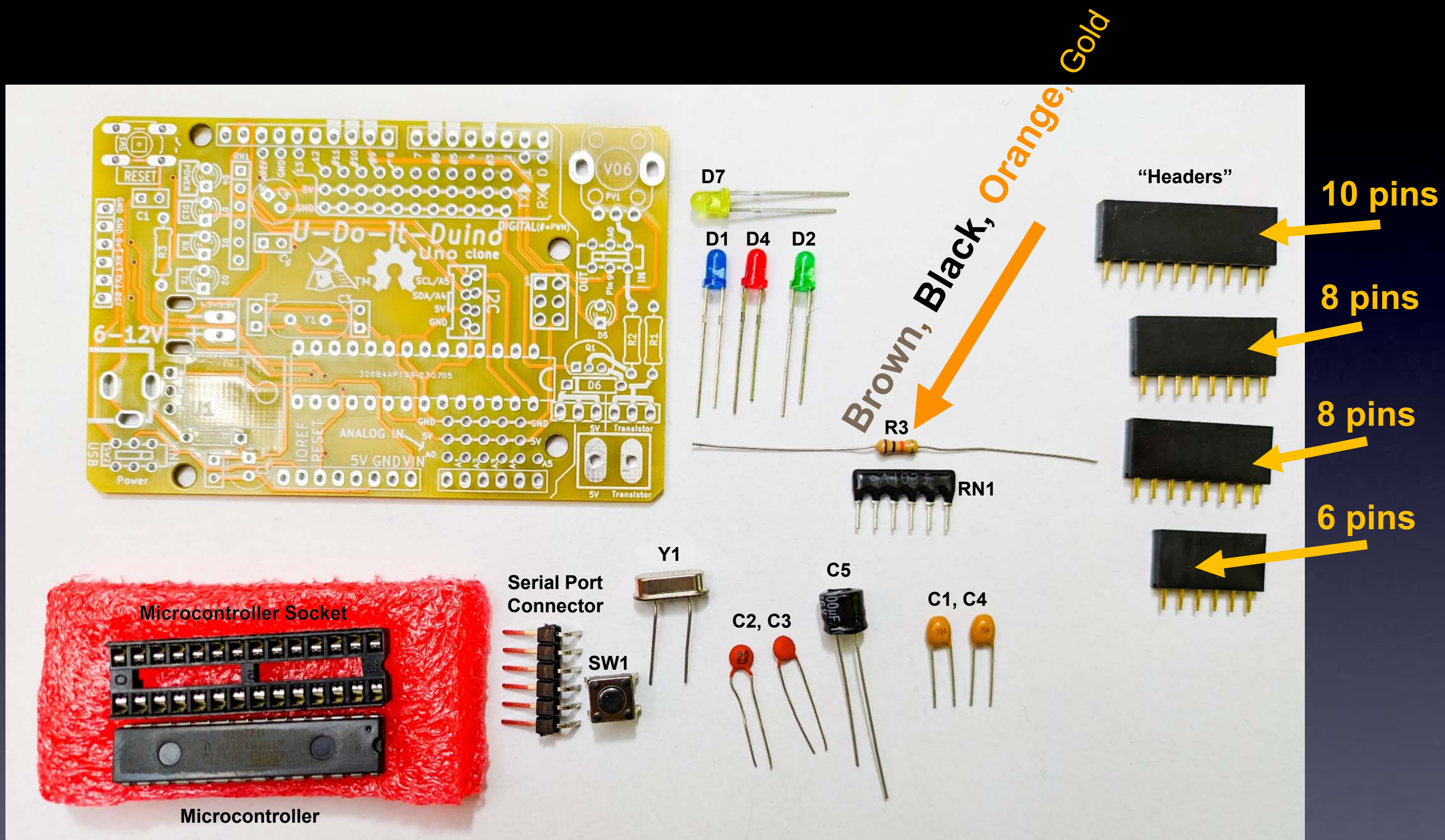


All of the parts

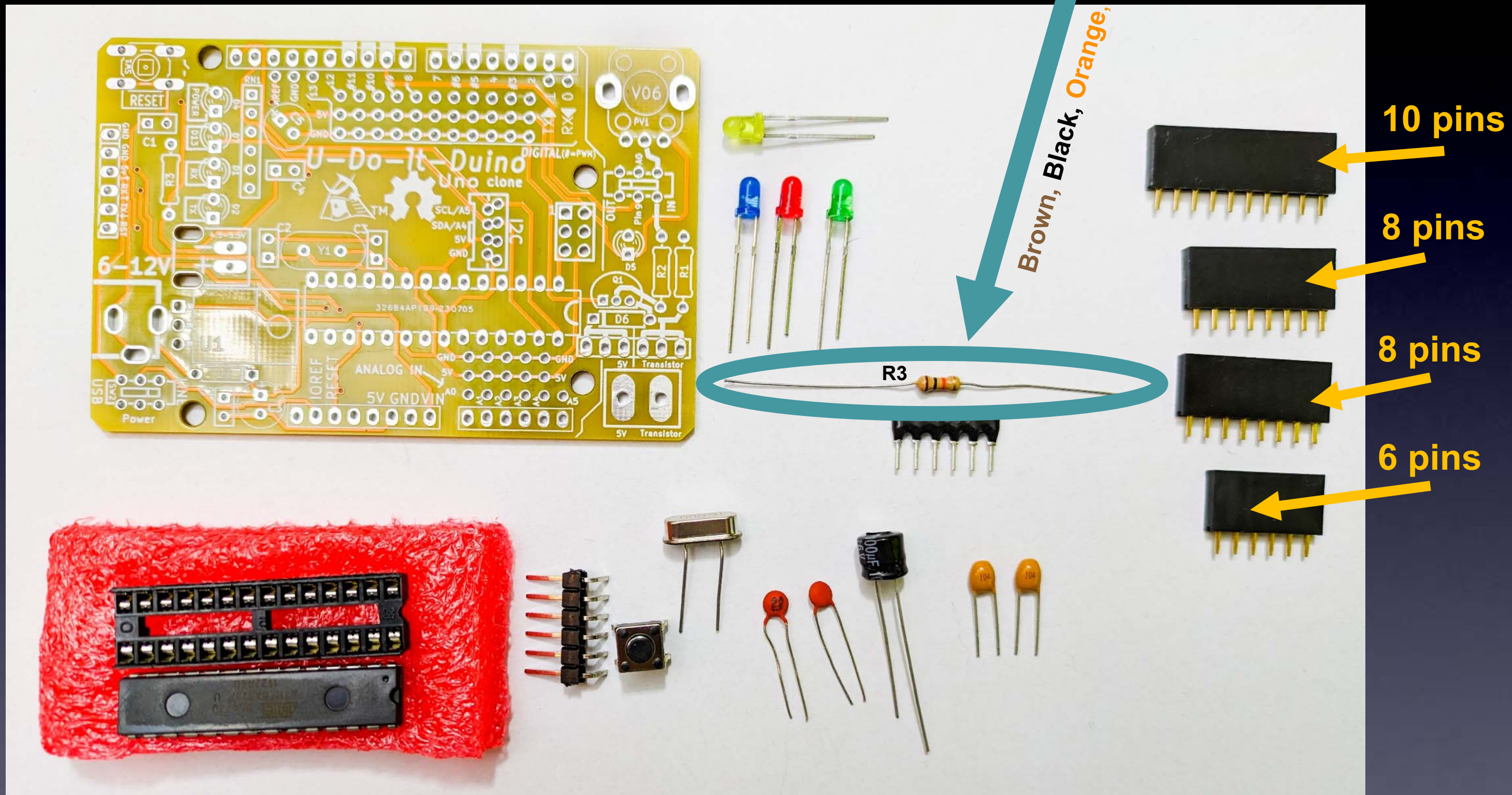
U-Do-It-Duino – we will NOT use all of these parts



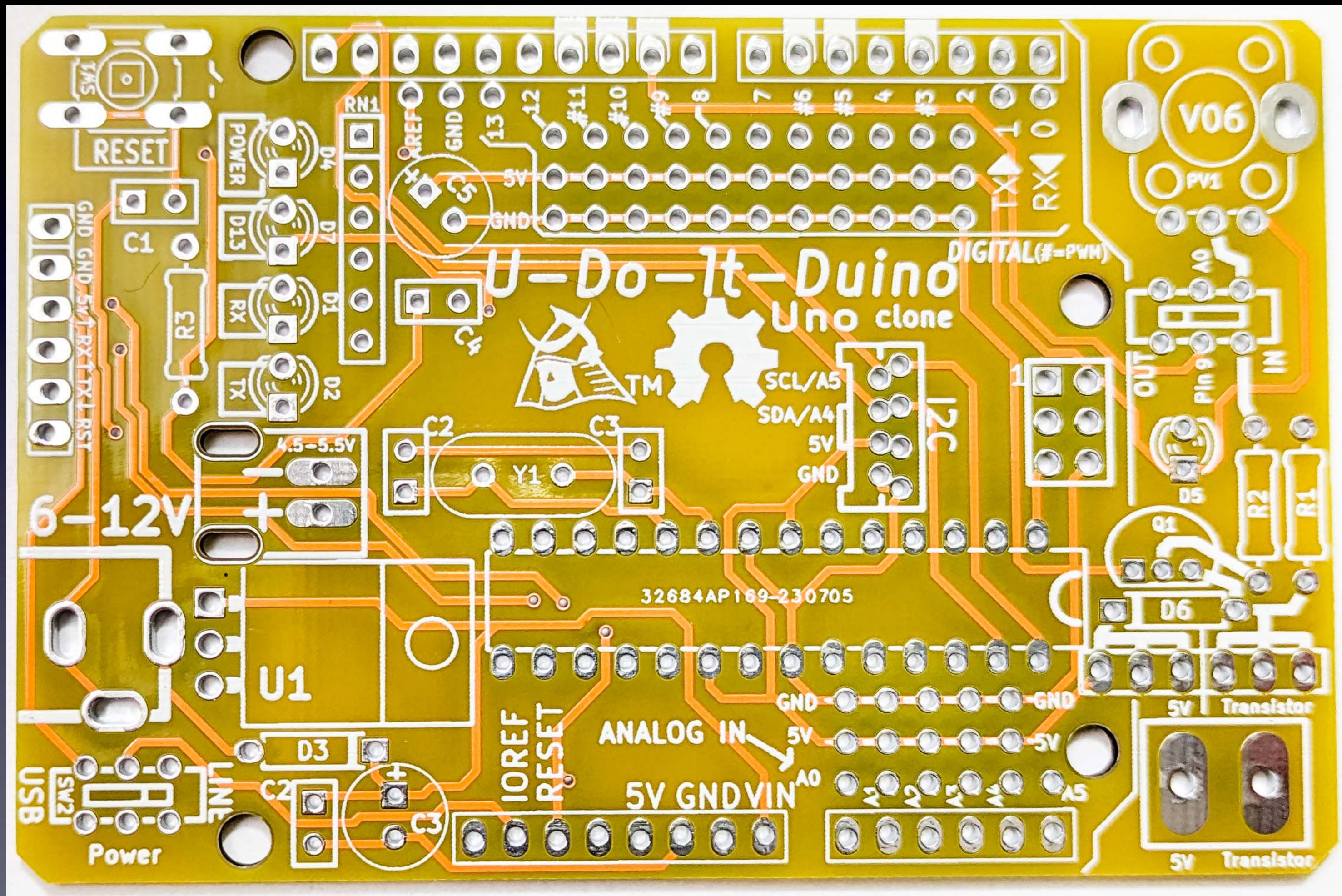
Parts to use



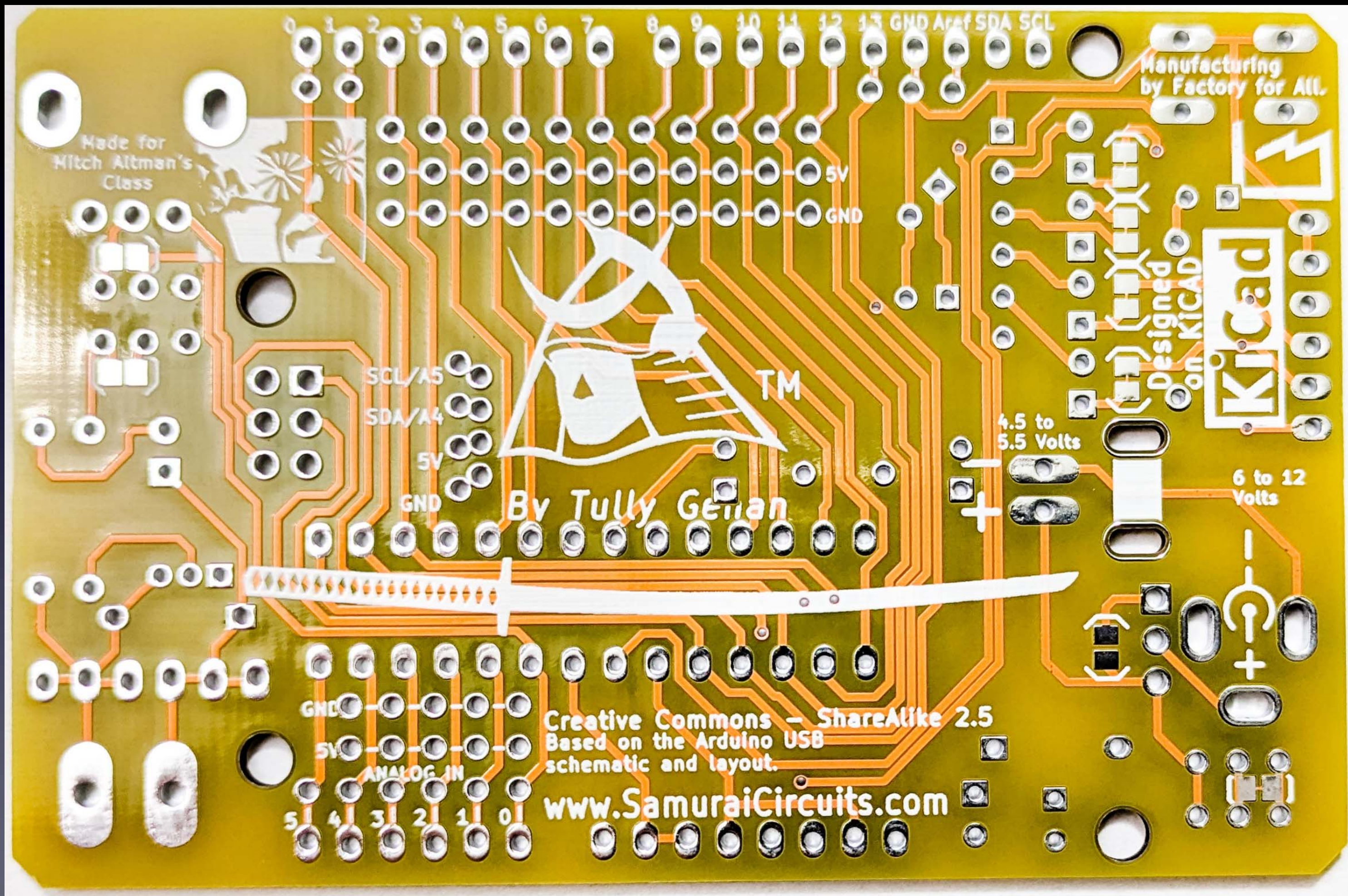
Our first part to solder: R3



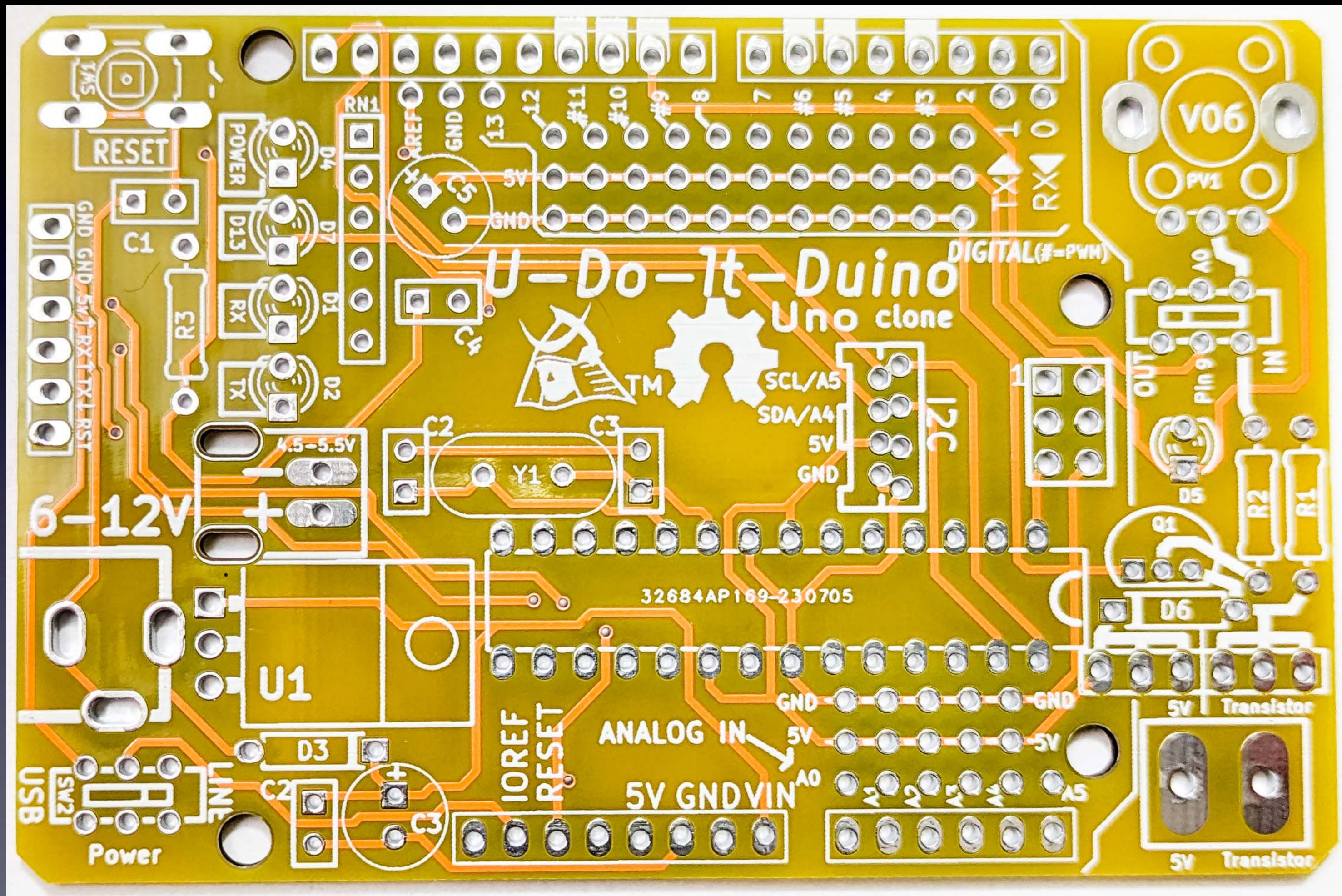
Top of Board



Bottom of Board



All Parts are soldered on the Top of Board !





Note:
Since we will use
Lead-Free solder
it is helpful
to also have
flux paste in a syringe
And Isopropyl Alcohol



The tools you'll need:

- soldering Iron (35W or less)
- solder (*more details coming*)
- soldering iron stand
- cellulose kitchen sponge (*not plastic!*)
- *small* wire cutter

Our first part to solder



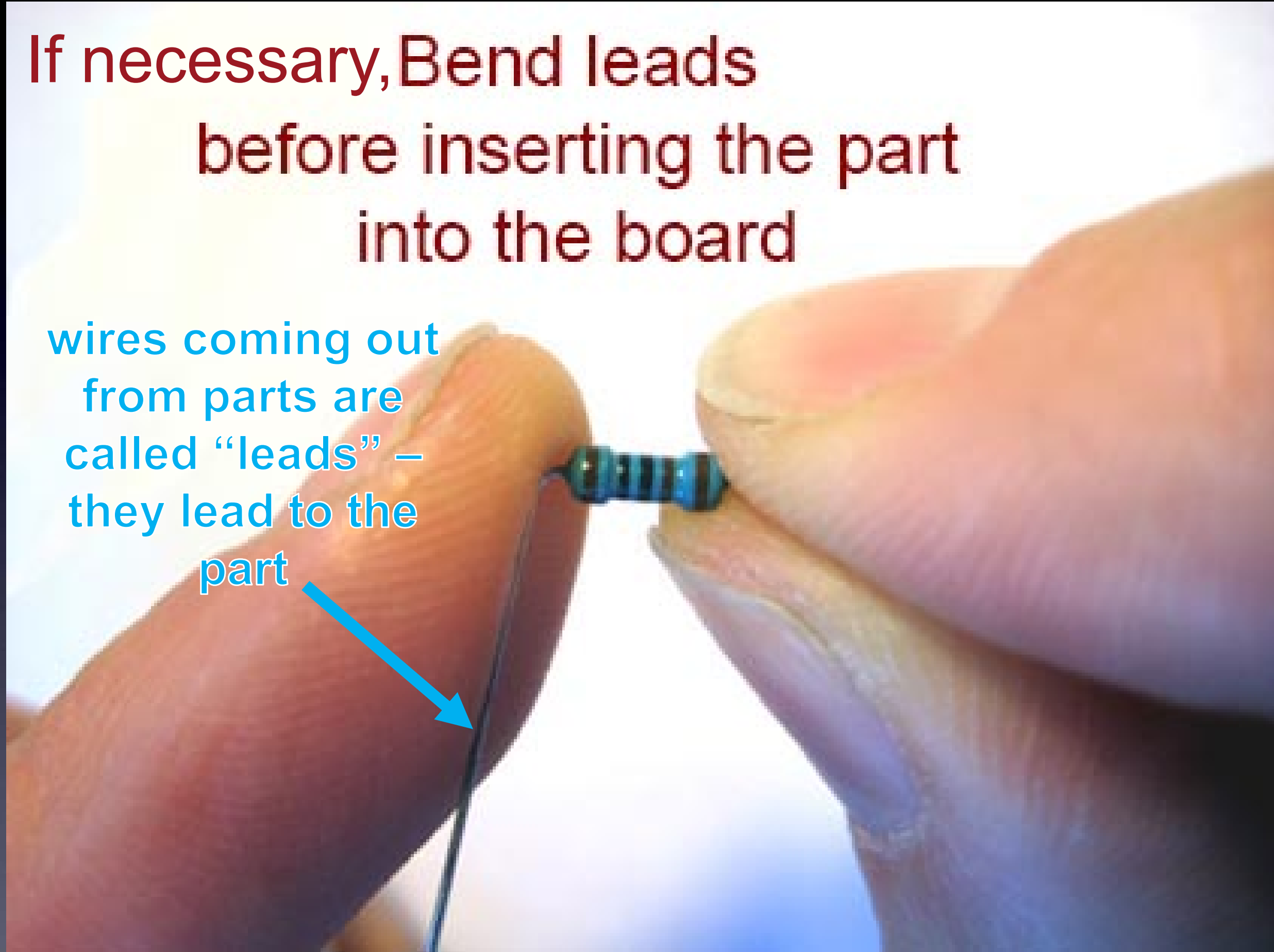
R3: Brown, Black, Orange

→ **(not Brown, Black, ~~Red~~)** ←

Some parts, such as resistors, need their leads bent first

If necessary, Bend leads
before inserting the part
into the board

wires coming out
from parts are
called “leads” –
they lead to the
part





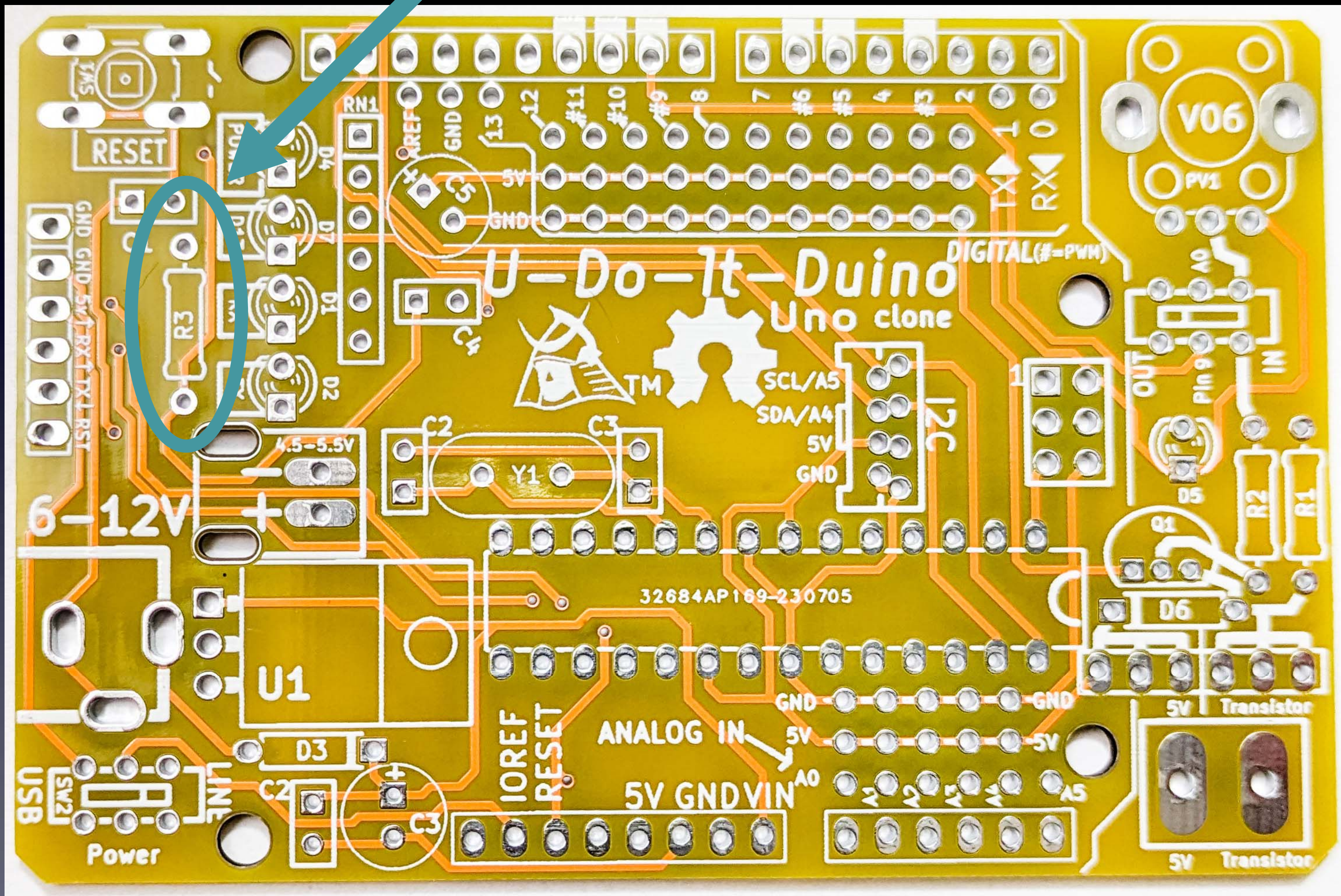
R3 – this is how it will look *before* inserting it into the board

R3: Look down at the shape of this part



R3: Brown, Black, Orange, Gold

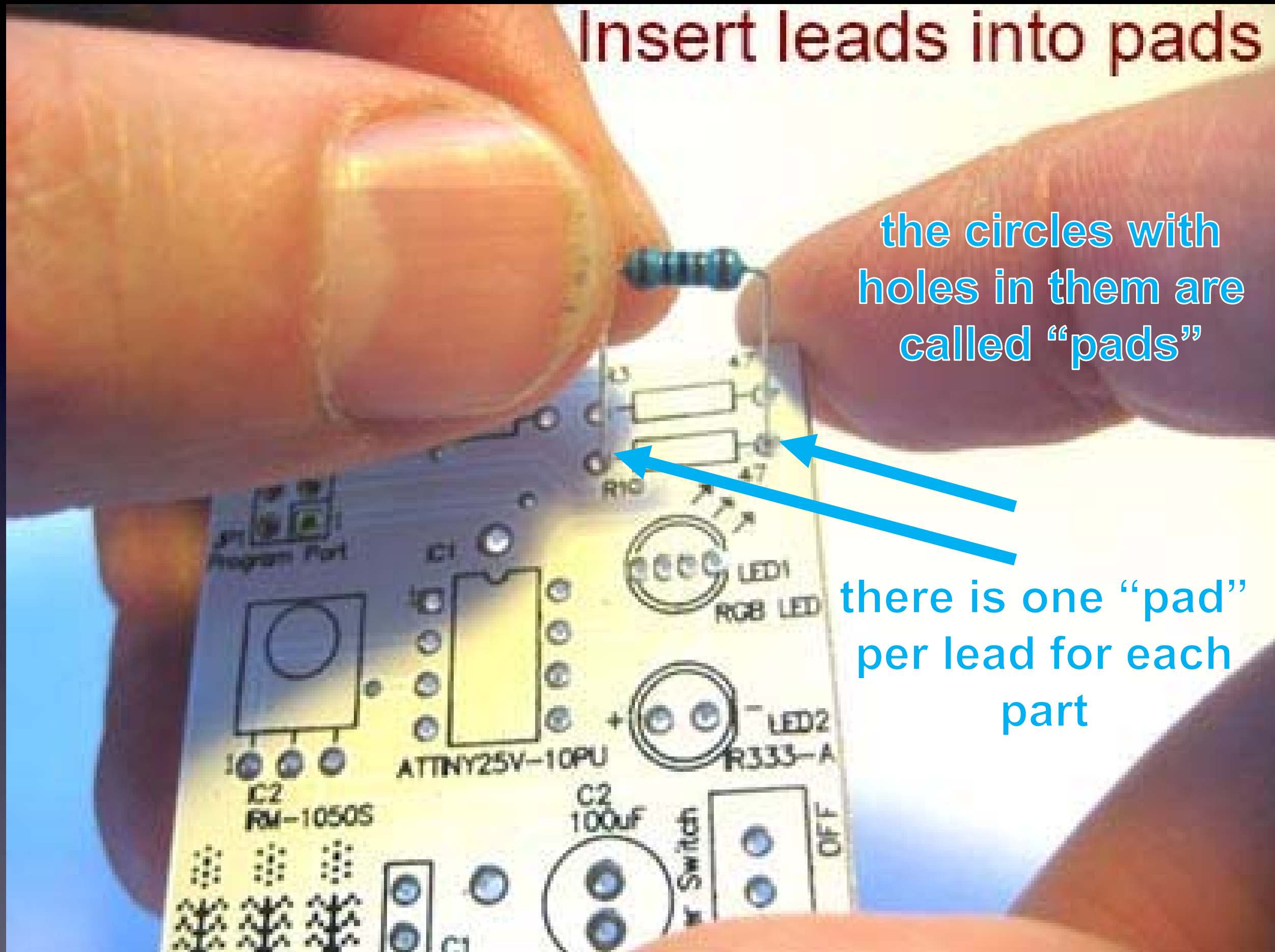
R3: Same shape as the actual resistor



Insert leads into pads

the circles with
holes in them are
called "pads"

there is one "pad"
per lead for each
part



**R3: leads inserted
into their pads**



Push part down all the way

R3: board upside down



Bend leads
half way out

(only half way) like a “V”

so that the part won't fall out while soldering it

R3: board upside down



Bend leads
half way out

(only half way) like a “V”

Ready to Solder !



How to hold a soldering iron

(Like a pencil – held from underneath)

Important

The best kind of solder for DIY electronics:

(Sn – Tin / Pb – Lead)

63/37 rosin core,

0.031" (0.8mm) diameter (or smaller)

(60/40 is also good)

Note:

Most

***Lead-Free* solder**

has poisonous fumes!

This is what we will use:

A good kind of solder for DIY
electronics:

*This is the only good **Lead-Free** solder I have found!*
(after years of searching)



Kester
K100LD Rosin
(not "No Clean")
0.031" diameter (0.8mm)

This is what we will use:

A good kind of solder for DIY electronics:

*This is the only good **Lead-Free** solder I have found!*
(after years of searching)



Kester **K100LD Rosin** Solder

0.031" diameter (0.8mm)

Note:

Since we will use **Lead-Free** solder
it is *helpful*
to also have
flux paste in a syringe
And Isopropyl Alcohol



99%



Another good kind of solder for DIY electronics:

*This is another good **Lead-Free** solder I have found!*



**Duratool
D01685 Rosin**

0.7mm diameter

*(as good as the
Kester K100LD Rosin)*

Another good kind of solder for DIY electronics:

*This is another good **Lead-Free** solder I have found!*



**MG Chemicals
4900 Rosin (112g, 227g, 454g)**

0.8mm diameter

*(as good as the
Kester K100LD Rosin)*

3 Safety Tips...

Safety Tip #1:

Hot !!

(When you touch the tip,
you will let go quickly -- every time!)

Safety Tip #2:

Soldering chemicals
are toxic

But they easily wash off your hands
with soap and water

Safety Tip #3:

(coming soon)

2 secrets
to good soldering...

Secret #1:

Clean the tip!

(before every solder connection)

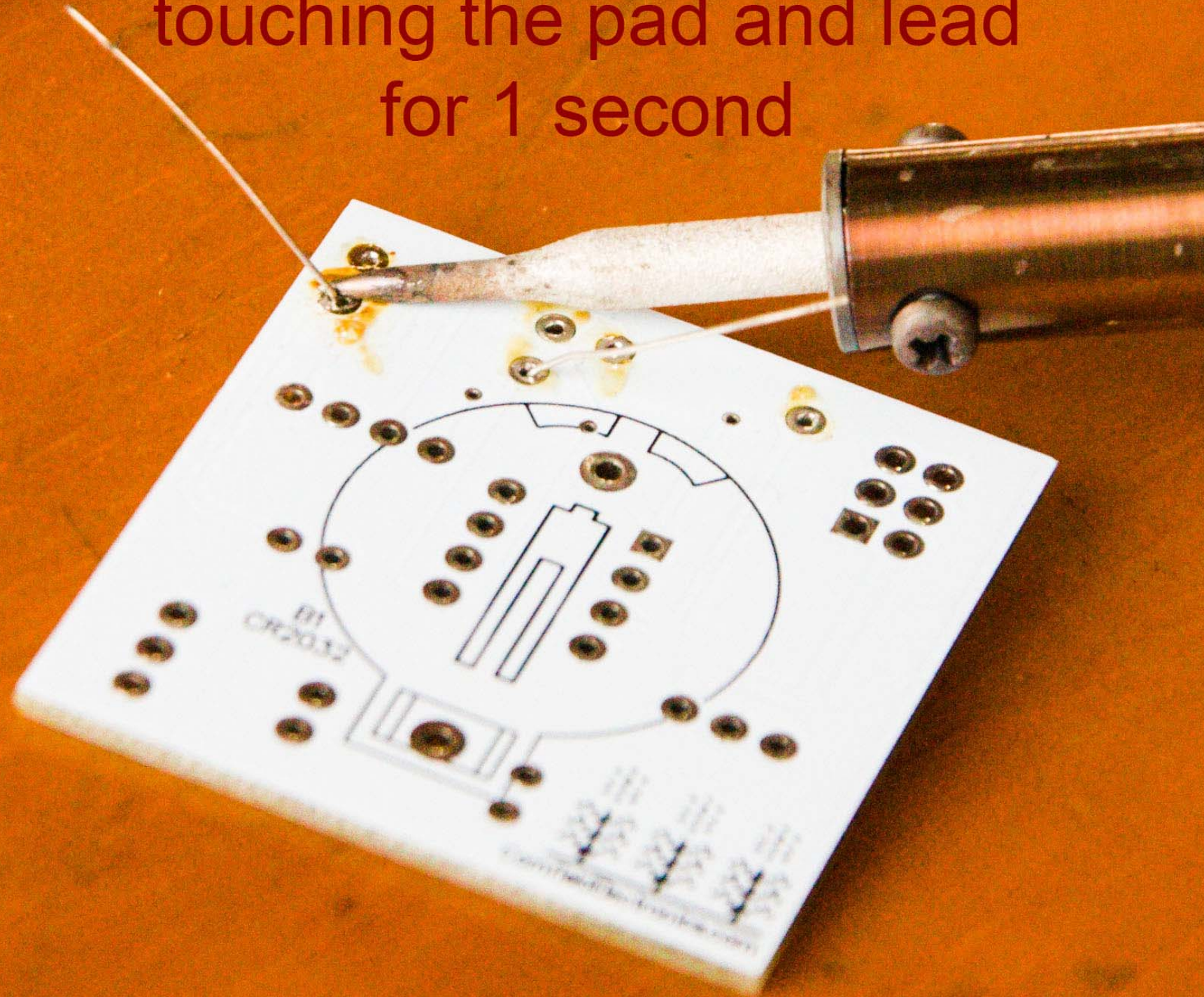
Bang (lightly) 3 times,

Swipe, Rotate, Swipe (on the sponge):

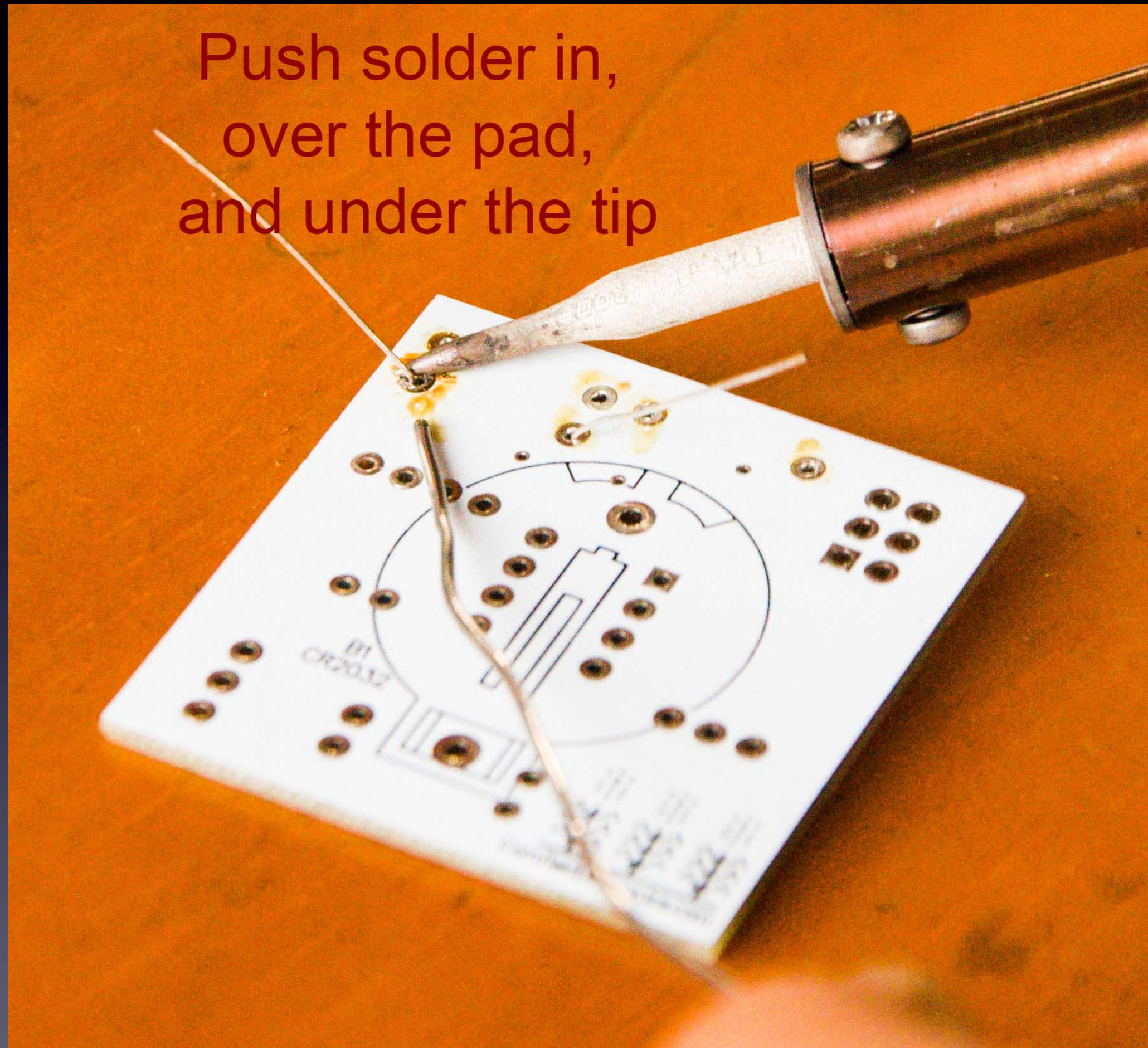
Keep the tip shiny silver!

knock solder off the tip

Lay clean tip across half of the pad,
touching the pad and lead
for 1 second

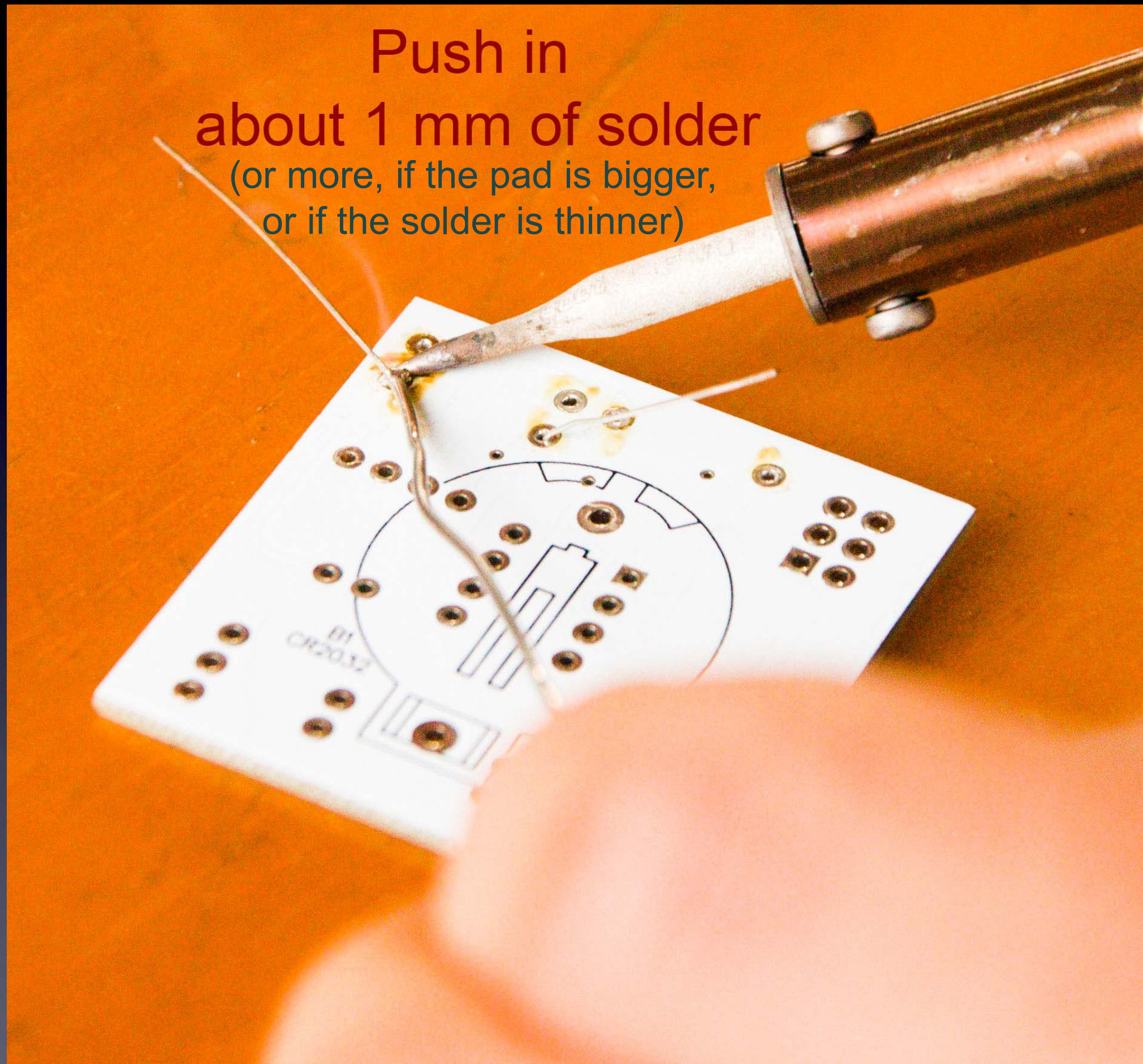


Do this quickly (slowly doesn't work well) – solder in & out in about 1 second

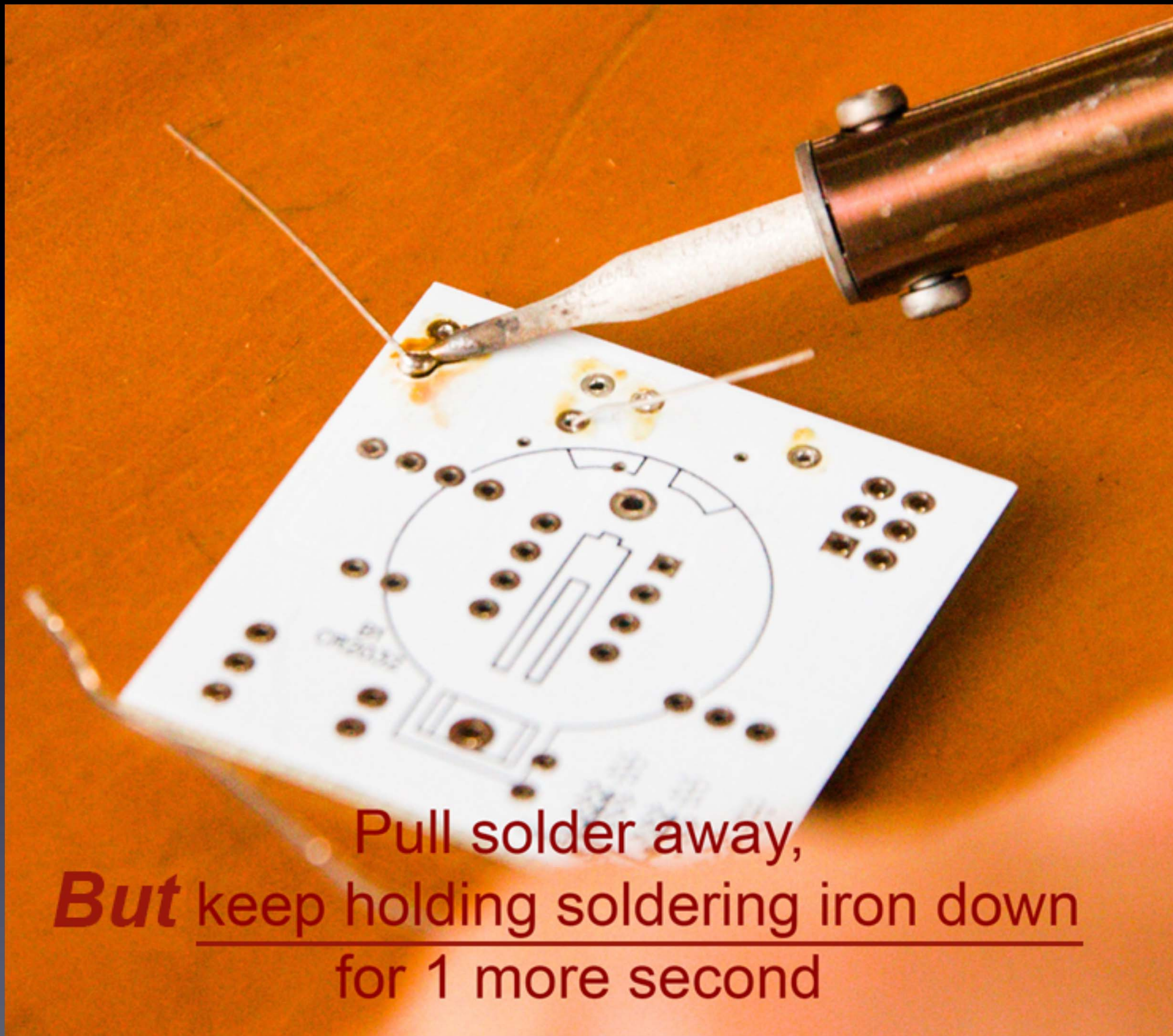


Make sure solder melts on the underside of the soldering iron tip
(not the side or top of the soldering iron tip)!

Do this quickly (slowly doesn't work well) – solder in & out in about 1 second



Make sure solder melts on the underside of the soldering iron tip
(not the side or top of the soldering iron tip)!



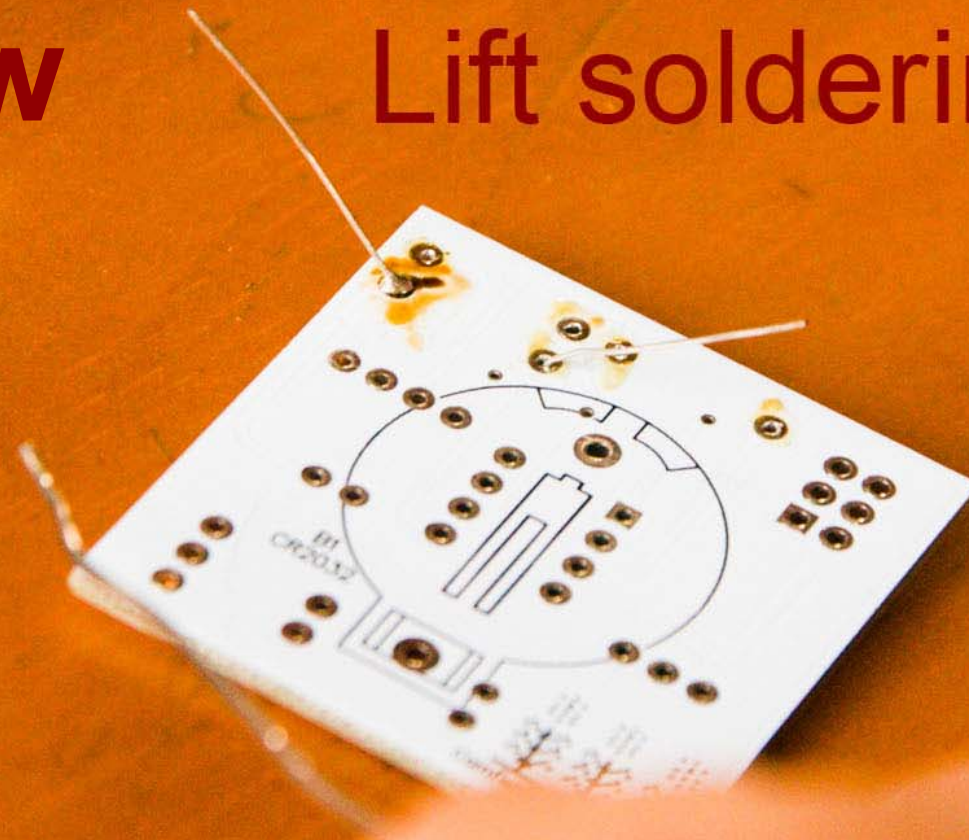
Pull solder away,
But keep holding soldering iron down
for 1 more second

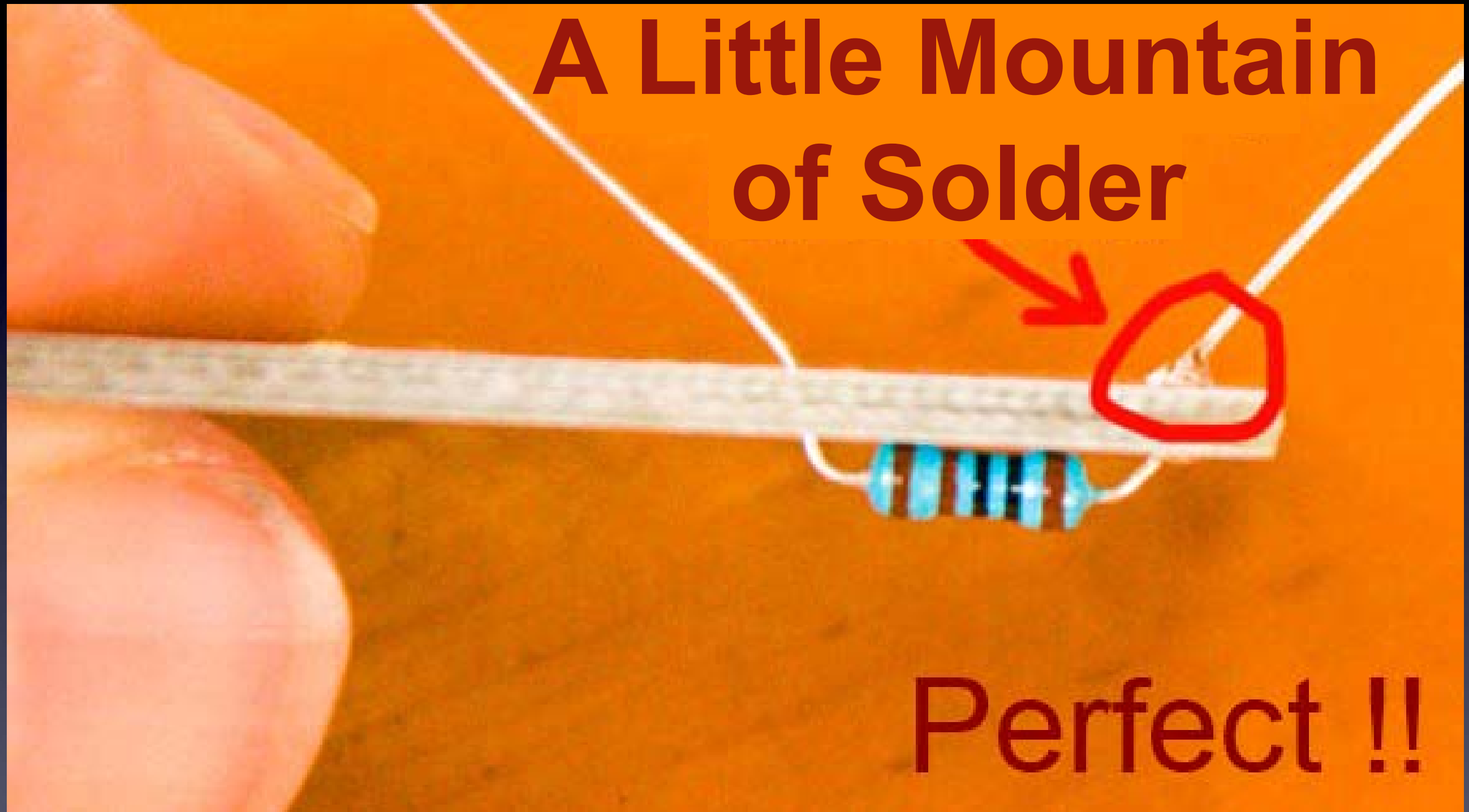
Secret #2:

Keep hot tip down
1 second
for solder to flow !!

Now

Lift soldering iron





If you can see any of the pad, or the hole, you need more solder
– so, just do all the steps again to make it perfect.

The Rhythm !

is just as important as the preceding steps!

The Rhythm !

and speed (about 1 second per step)



The Rhythm !

and speed (about 1 second per step)

Clean the tip



The Rhythm !
and speed (about 1 second per step)



Tip **Down**

The Rhythm !
and speed (about 1 second per step)



Solder **In**

The Rhythm !
and speed (about 1 second per step)



Solder **Out**

The Rhythm !
and speed (about 1 second per step)



WAIT !

The Rhythm !
and speed (about 1 second per step)



Lift Tip

The Rhythm !

and speed (about 1 second per step)



The Rhythm !

and speed (about 1 second per step)

Clean the tip



The Rhythm !
and speed (about 1 second per step)



Tip **Down**

The Rhythm !
and speed (about 1 second per step)



Solder **In**

The Rhythm !
and speed (about 1 second per step)



Solder **Out**

The Rhythm !
and speed (about 1 second per step)



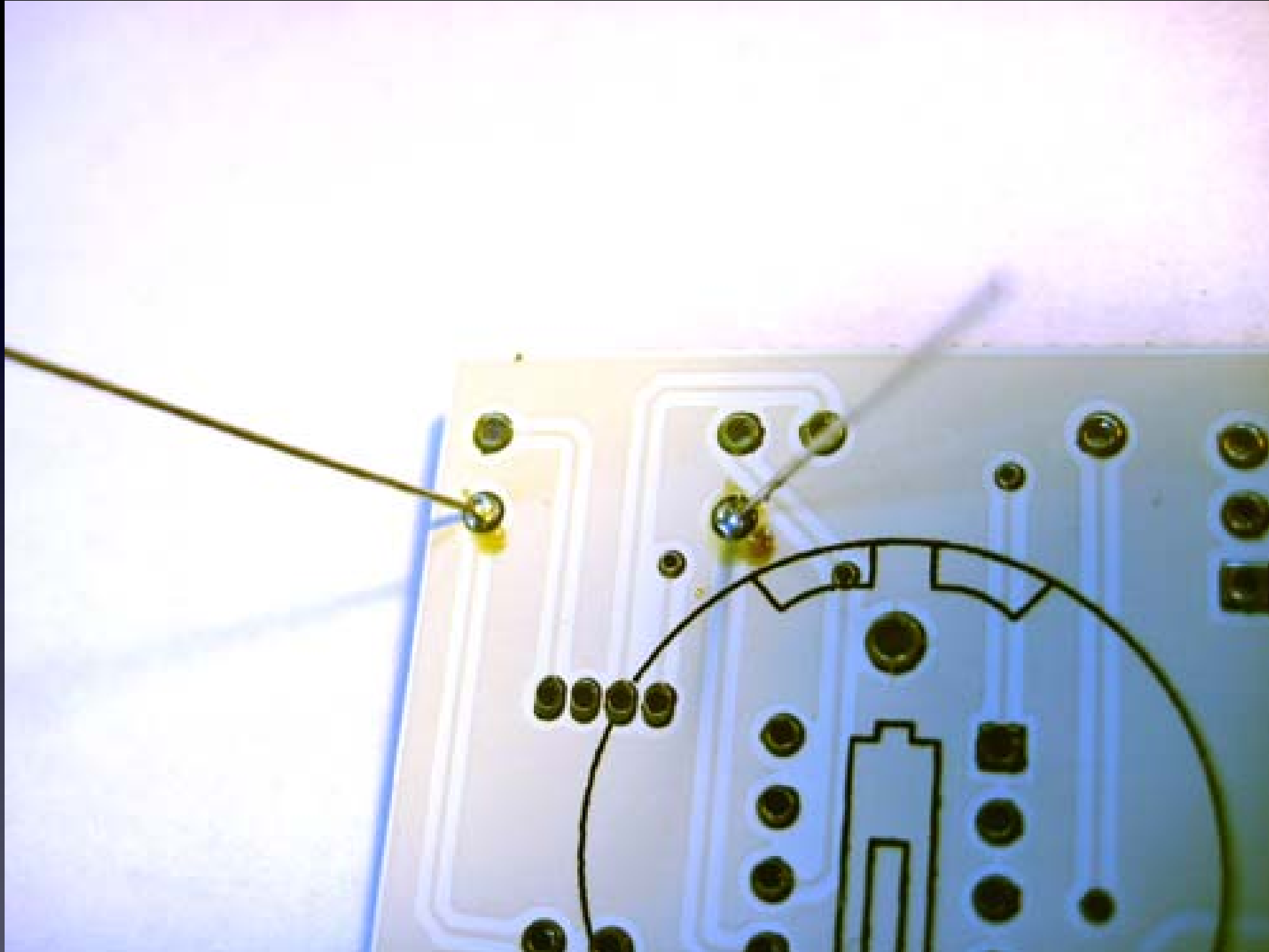
WAIT !

The Rhythm !
and speed (about 1 second per step)



Lift Tip

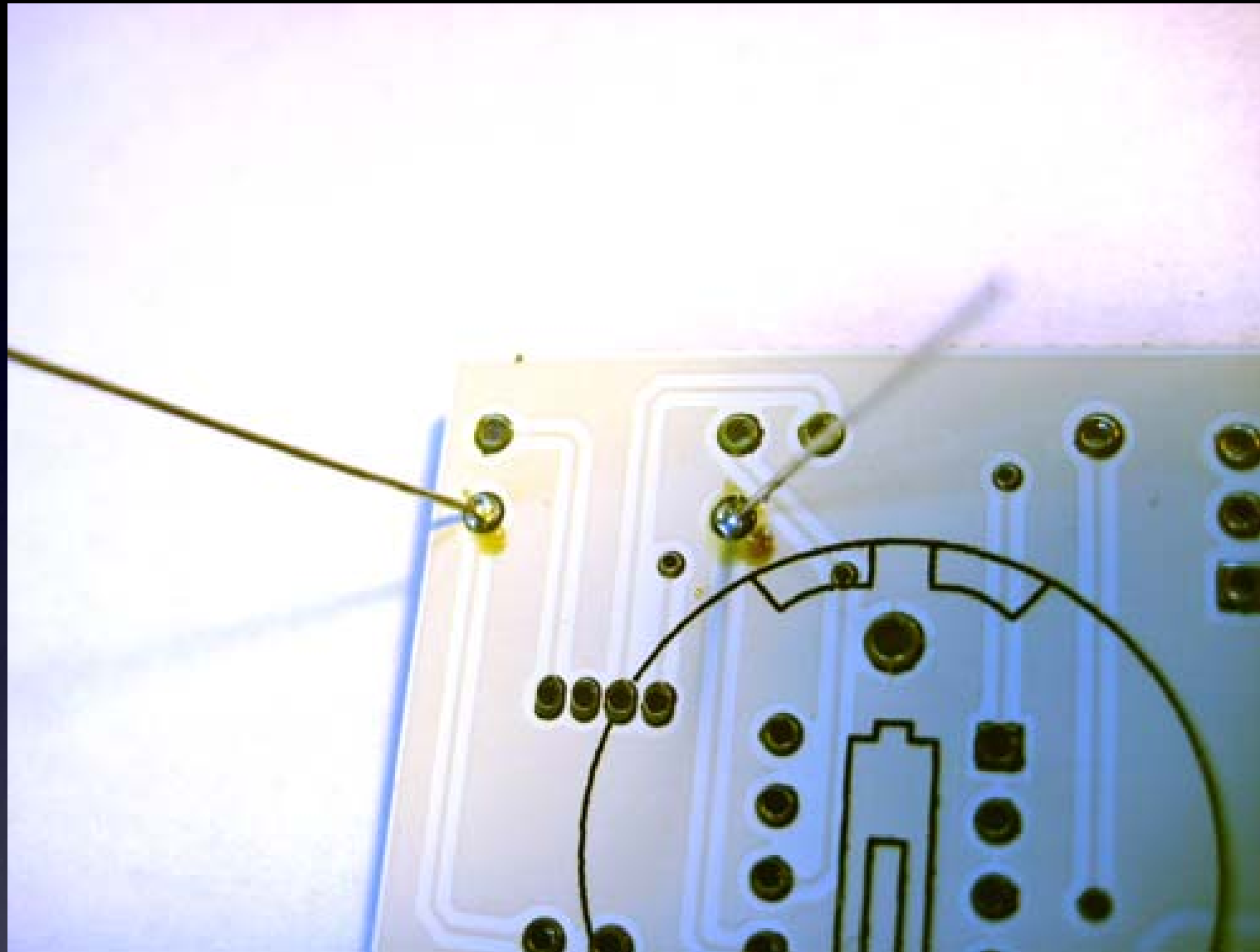
Solder all of the leads of the part to the board



For this part, there are two leads

Here you can see two good solder connections

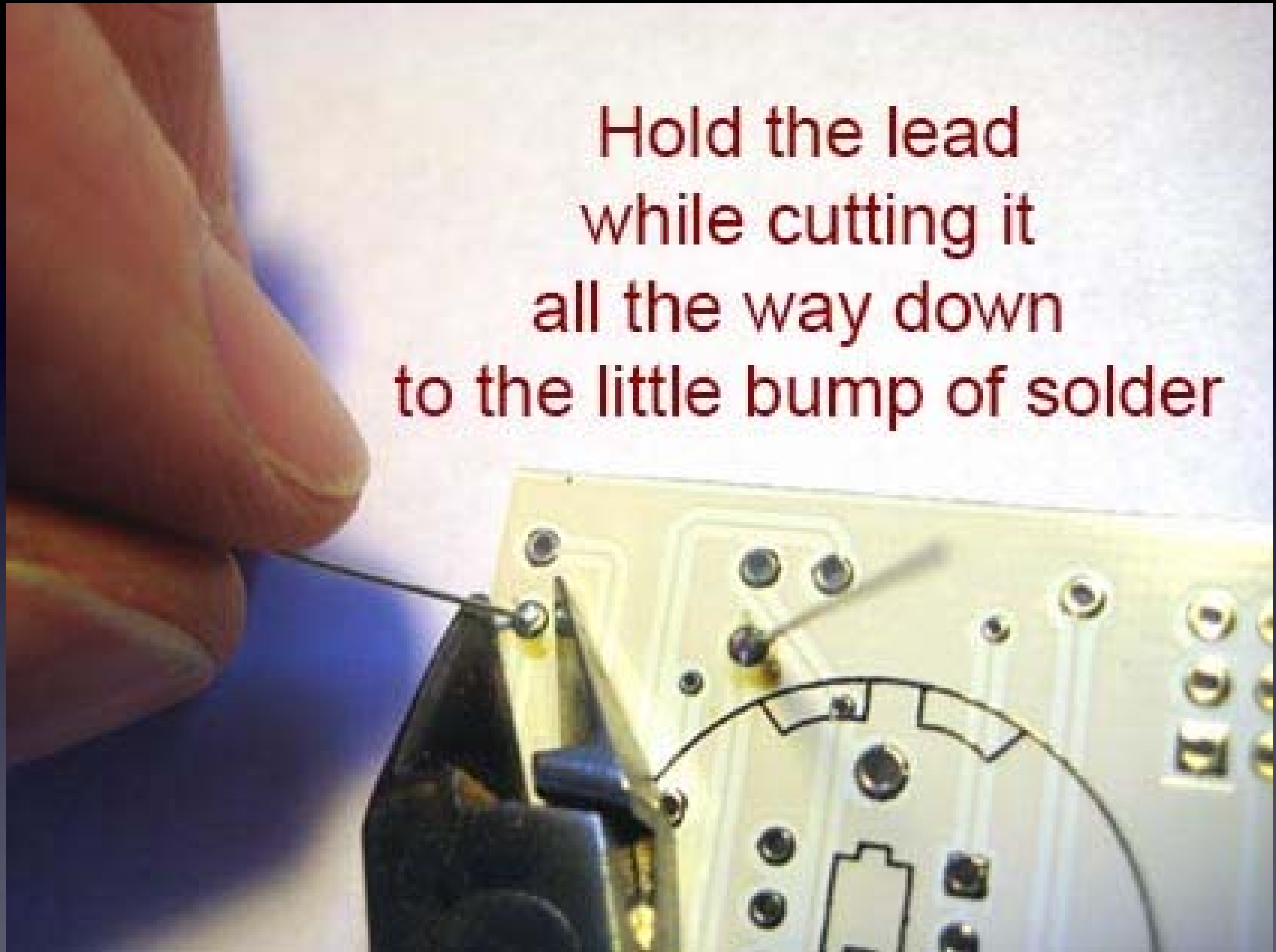
Two good solder connections



- Little mountains (not flat)
- Pads totally covered in solder
- Can't see the hole
- No connections to other pads

Now cut the leads short

Hold the lead
while cutting it
all the way down
to the little bump of solder



Cutting with the tip of the wire cutter gives you more control

Safety Tip #3:

Hold or cover the lead !

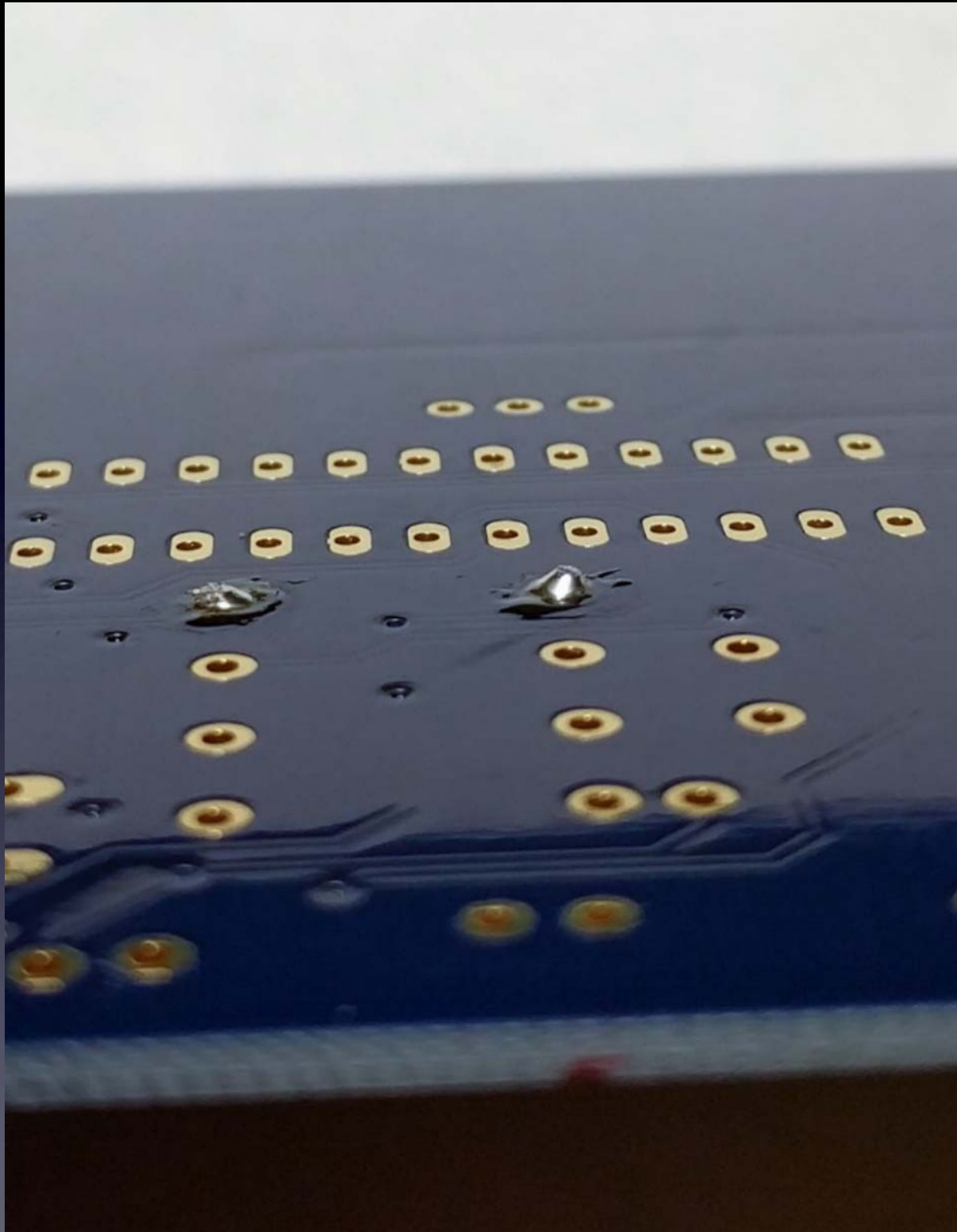
(or it will fly into your eye!)

(They like doing that – so please hold or cover the lead when you cut.)



All done !

No wires sticking out



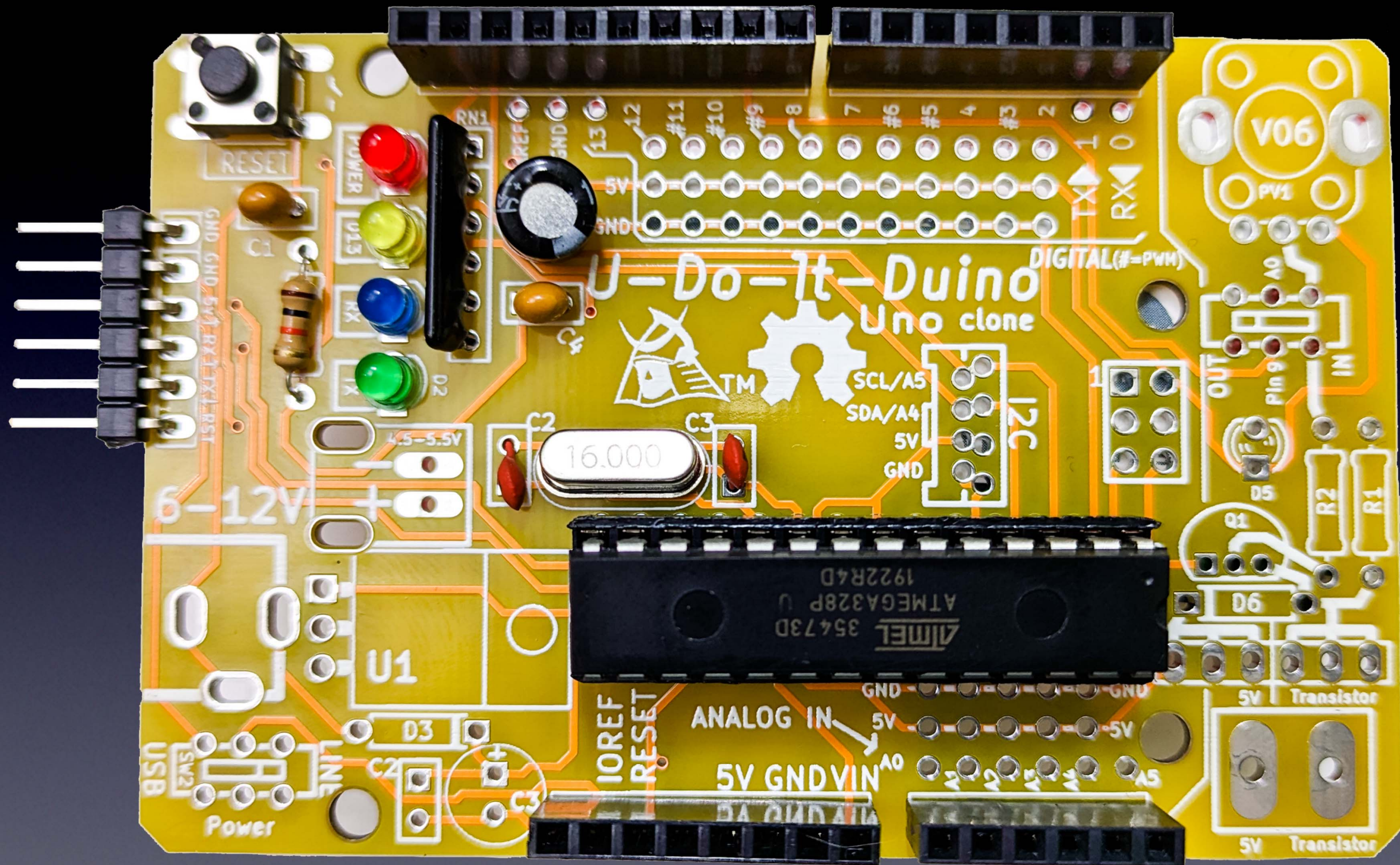
A closer look at good solder connections

Notice that:

- Each connection is a small mountain (not flat)
- You cannot see any pad (they're totally covered with solder)
- You cannot see the holes (they're totally covered with solder)
- No connections to other pads

One part at a time

Till all the parts are soldered

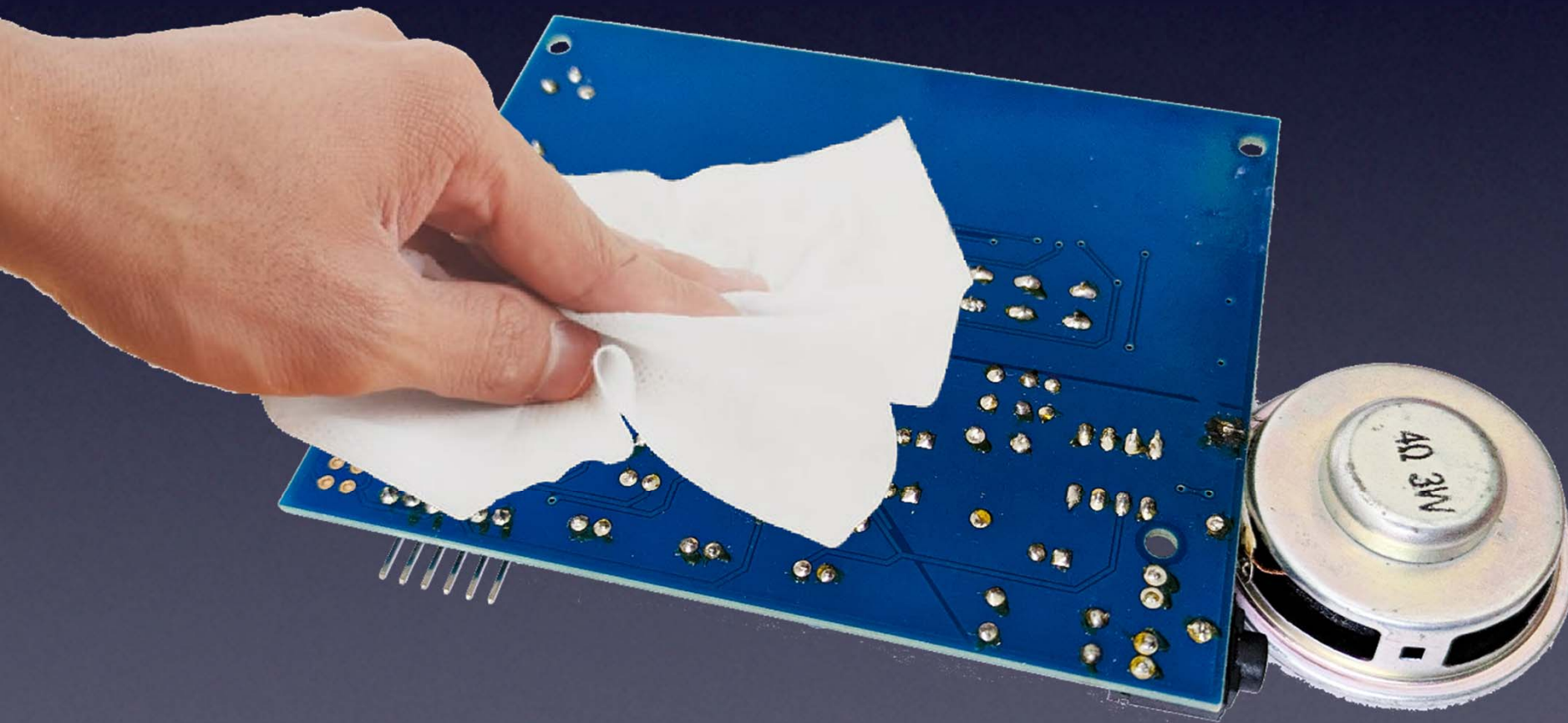


And it will look like this when you're done.

If you used any *flux paste* for re-working problems



The bottom of the PCB will be sticky from the flux



You can clean it with a cloth wet with *Isopropyl Alcohol*

Then test with battery pack,

Turn it on,

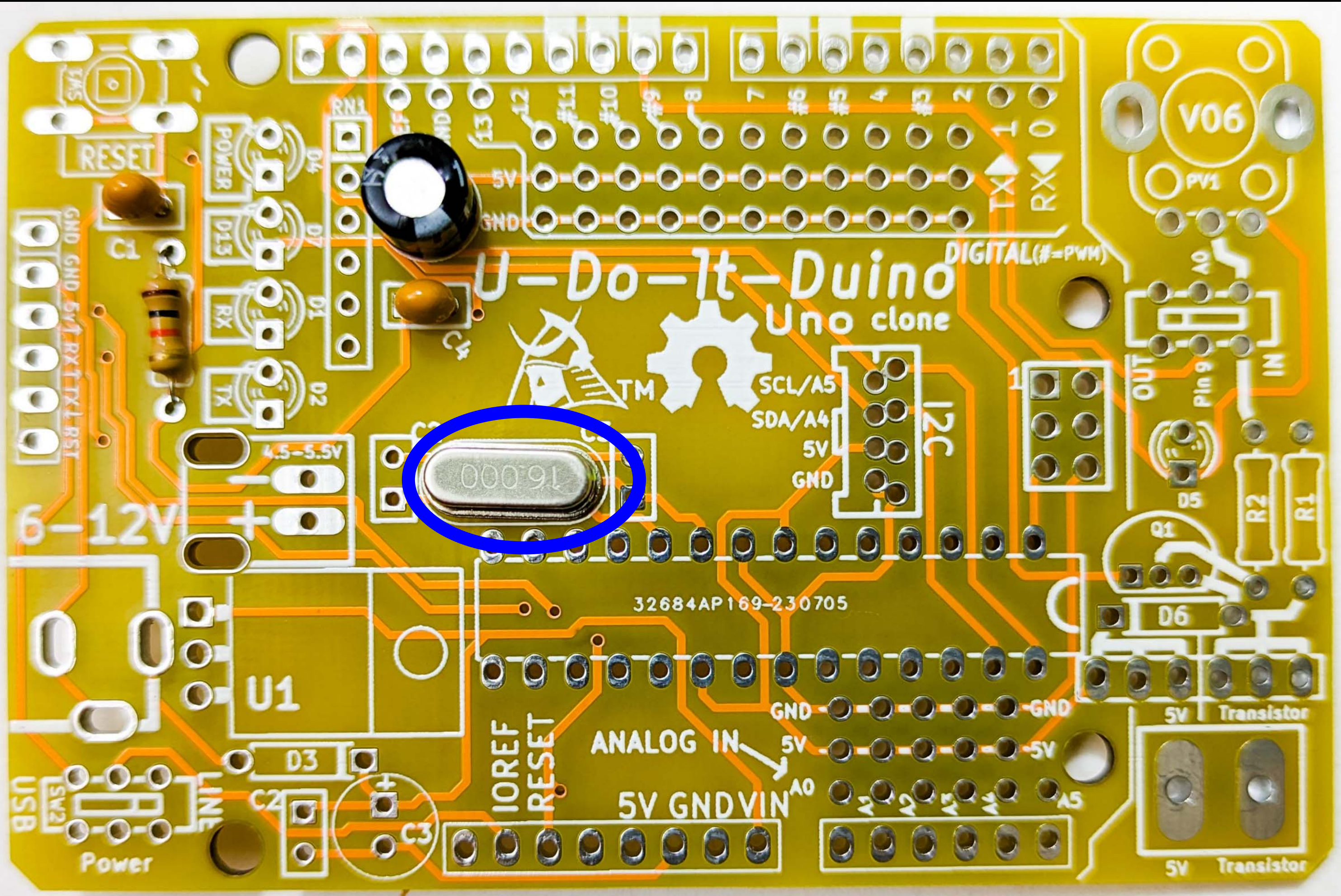
And it works!

(Or you start debugging.)

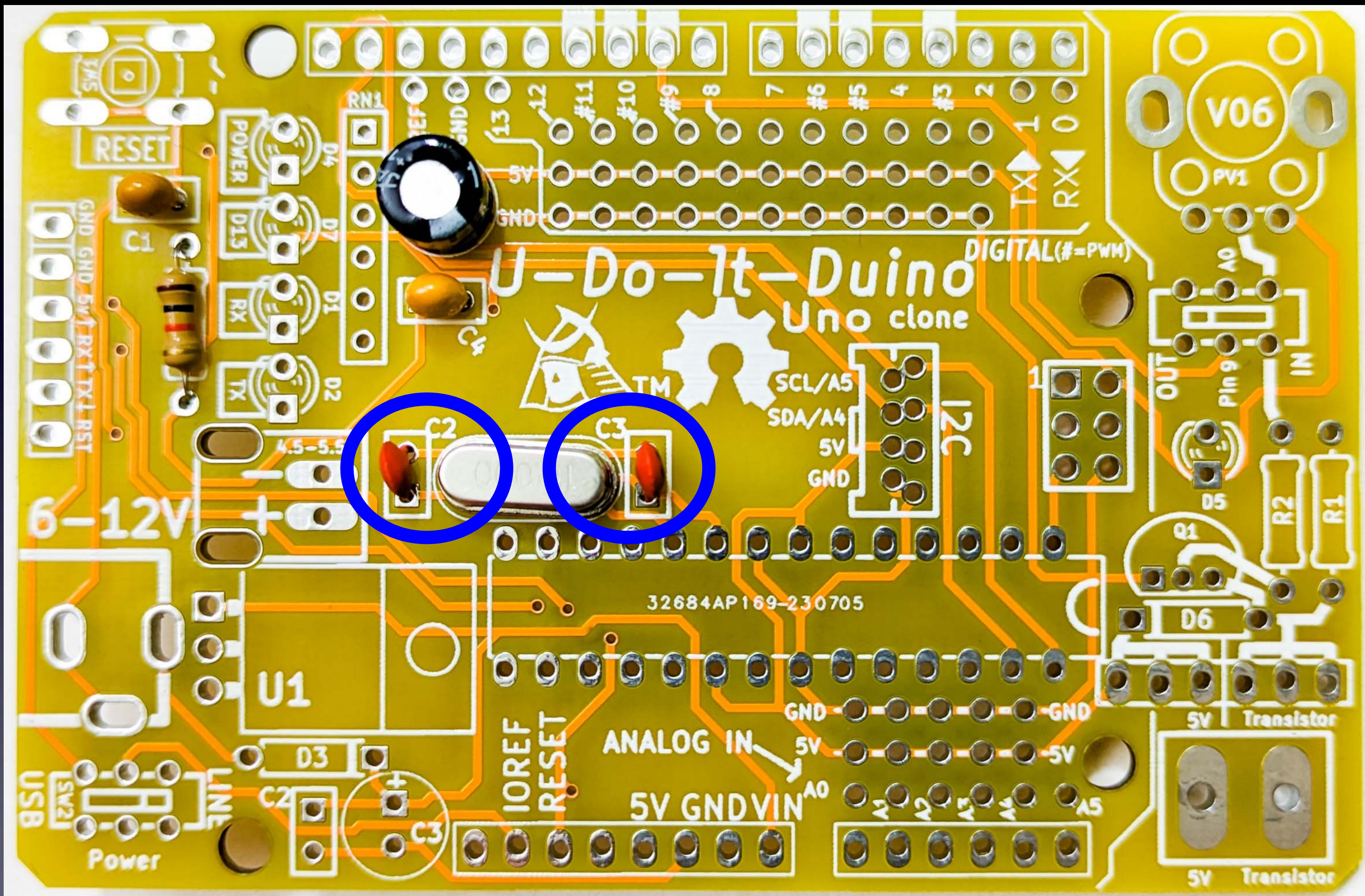
Let's start!



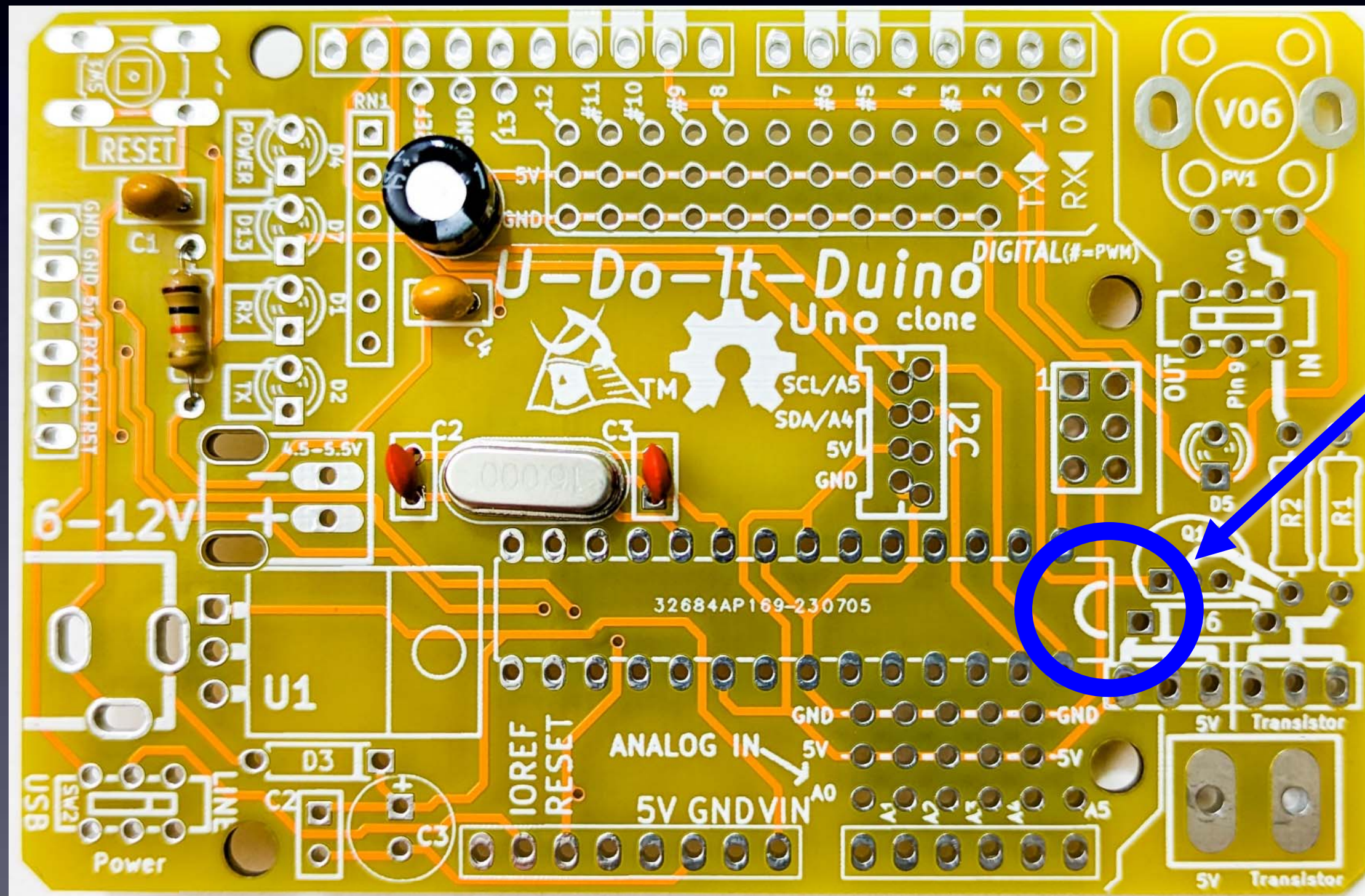
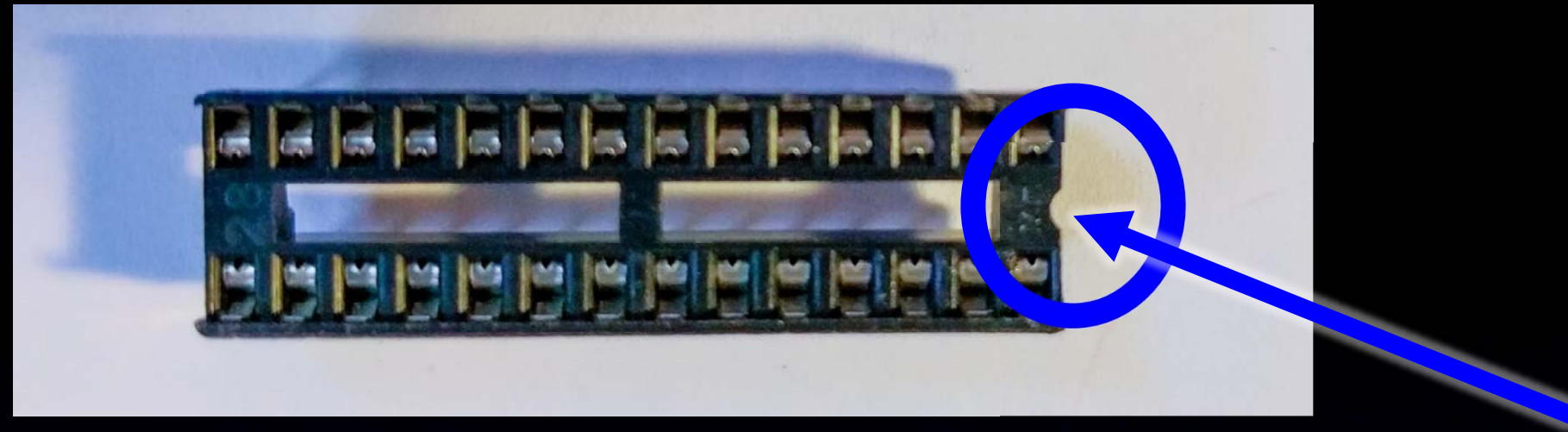
C5: Long lead “+” (square pa



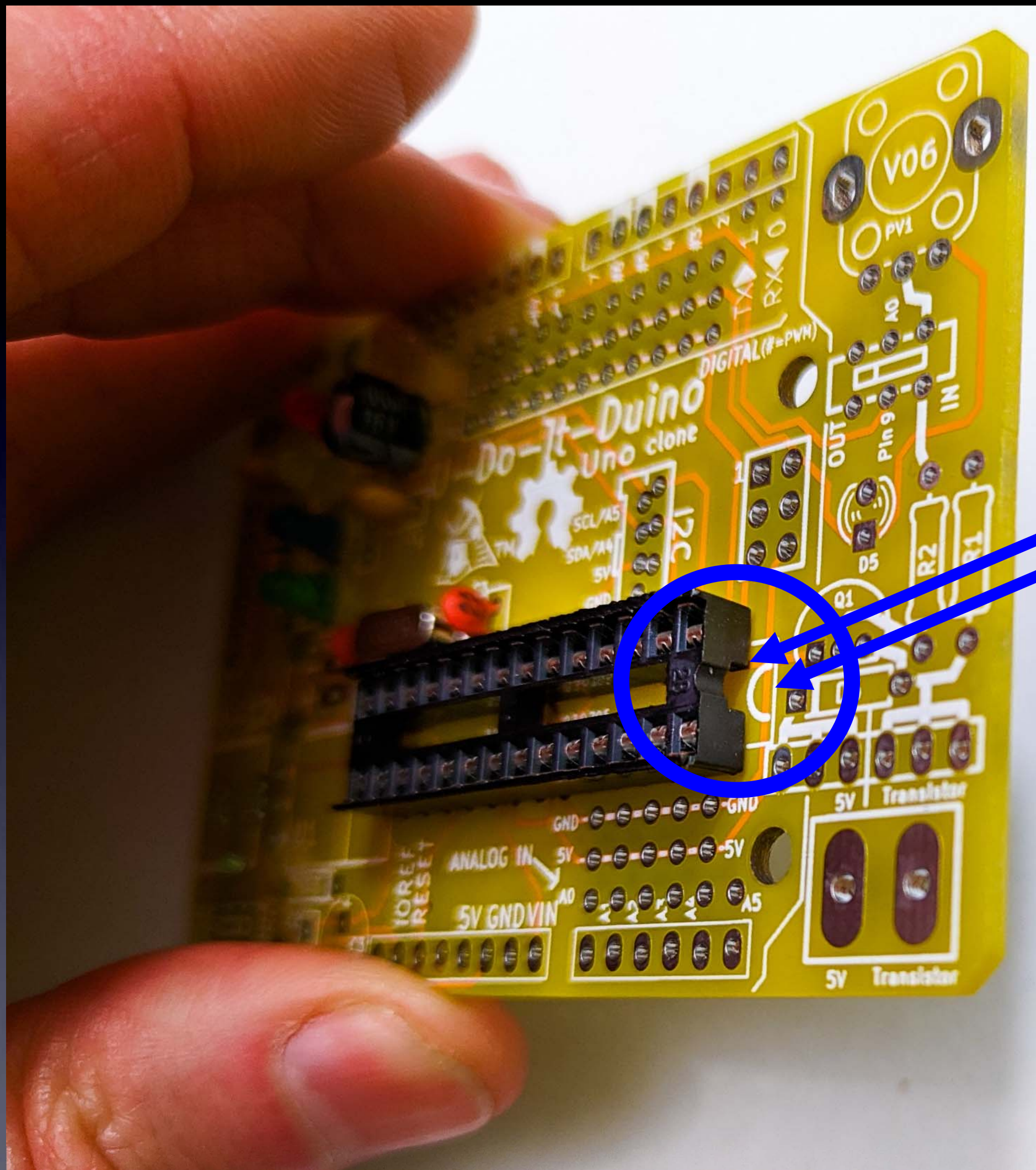
Y1



C2 and C3 (The 2 capacitors you set aside)



Orientation of Microcontroller Socket

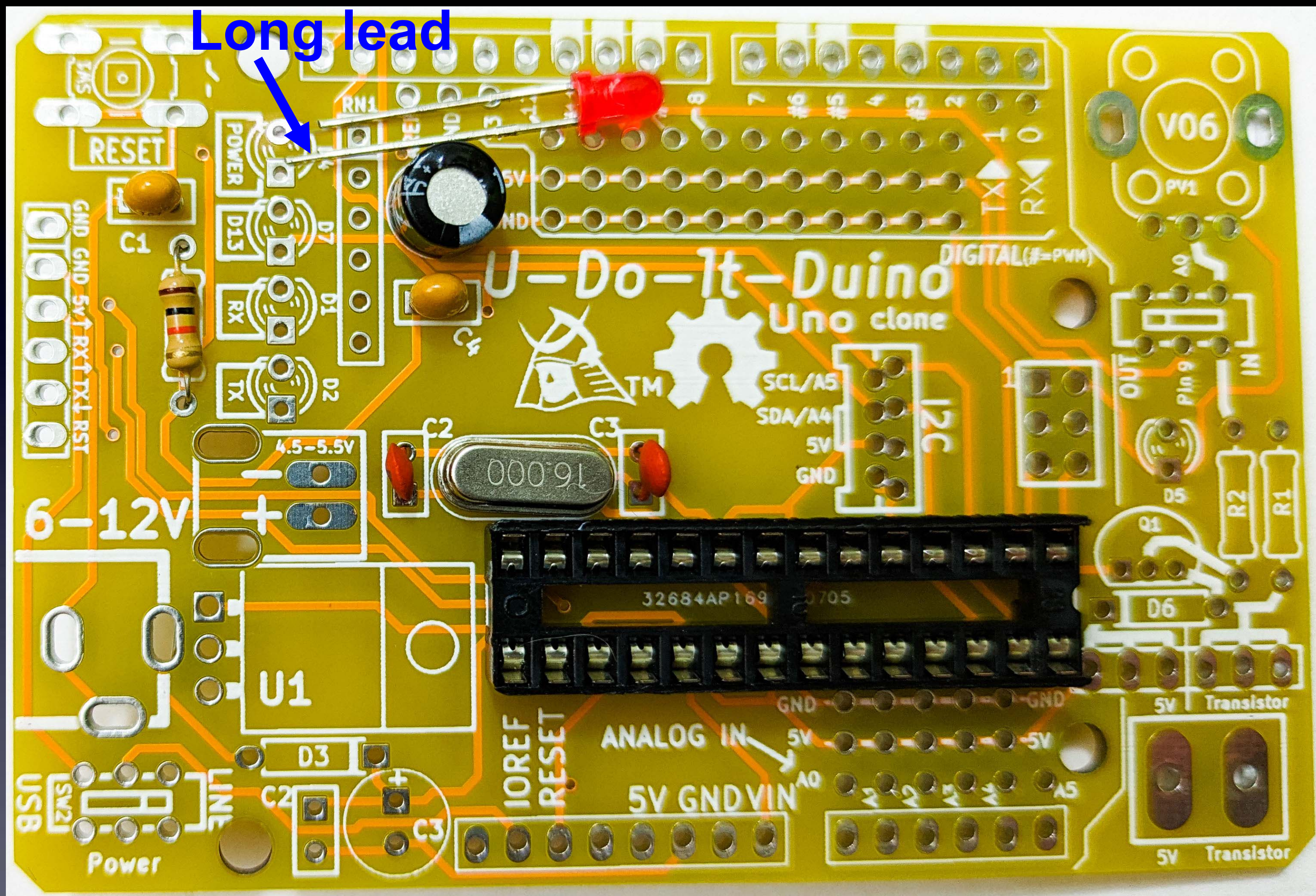


Orientation of Microcontroller Socket

Bend pins down on two opposite corners

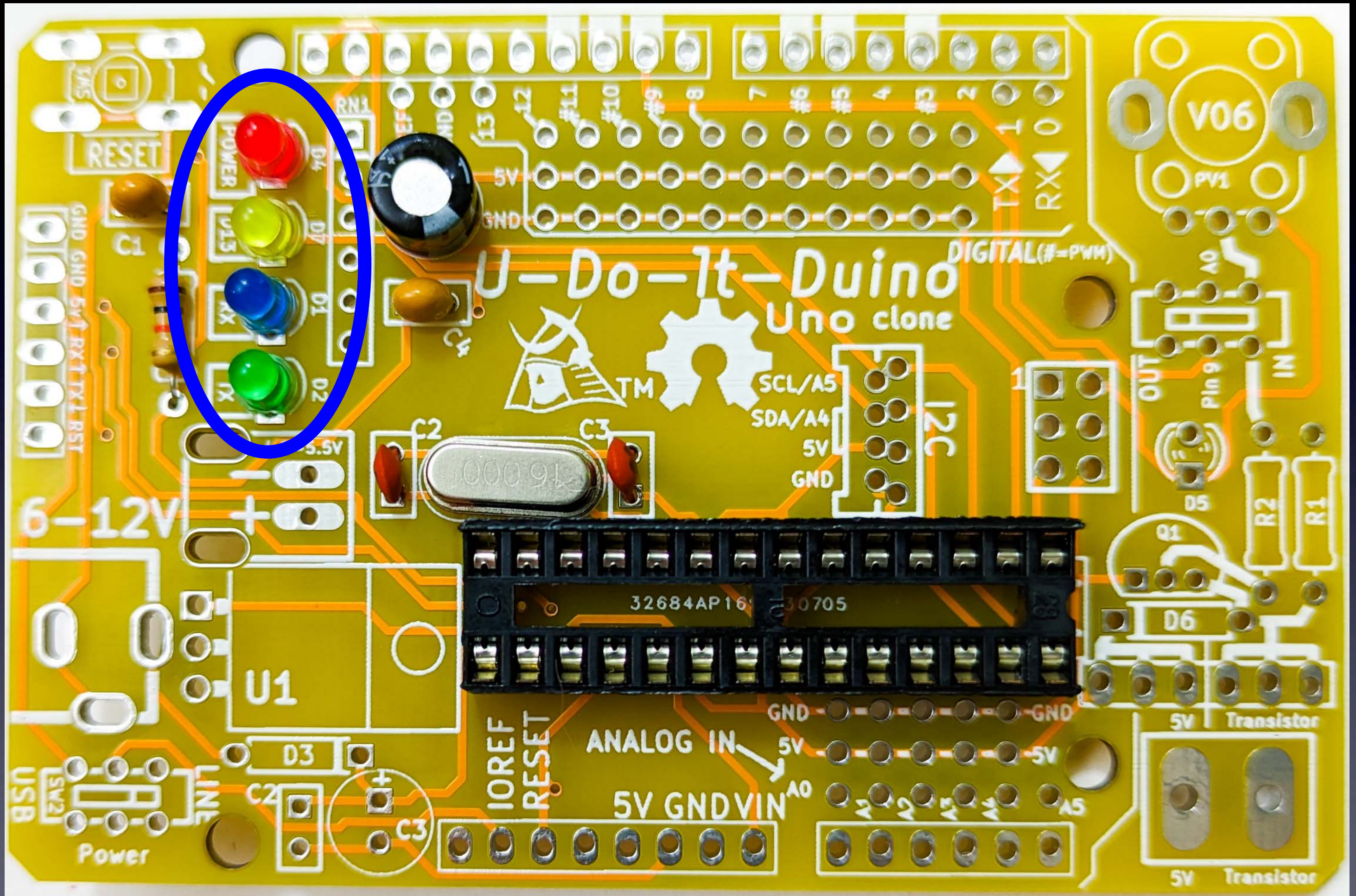


- Solder all 28 pins.
- Only need to clean the tip after it gets dirty.
- No need to cut the pins short after soldering.



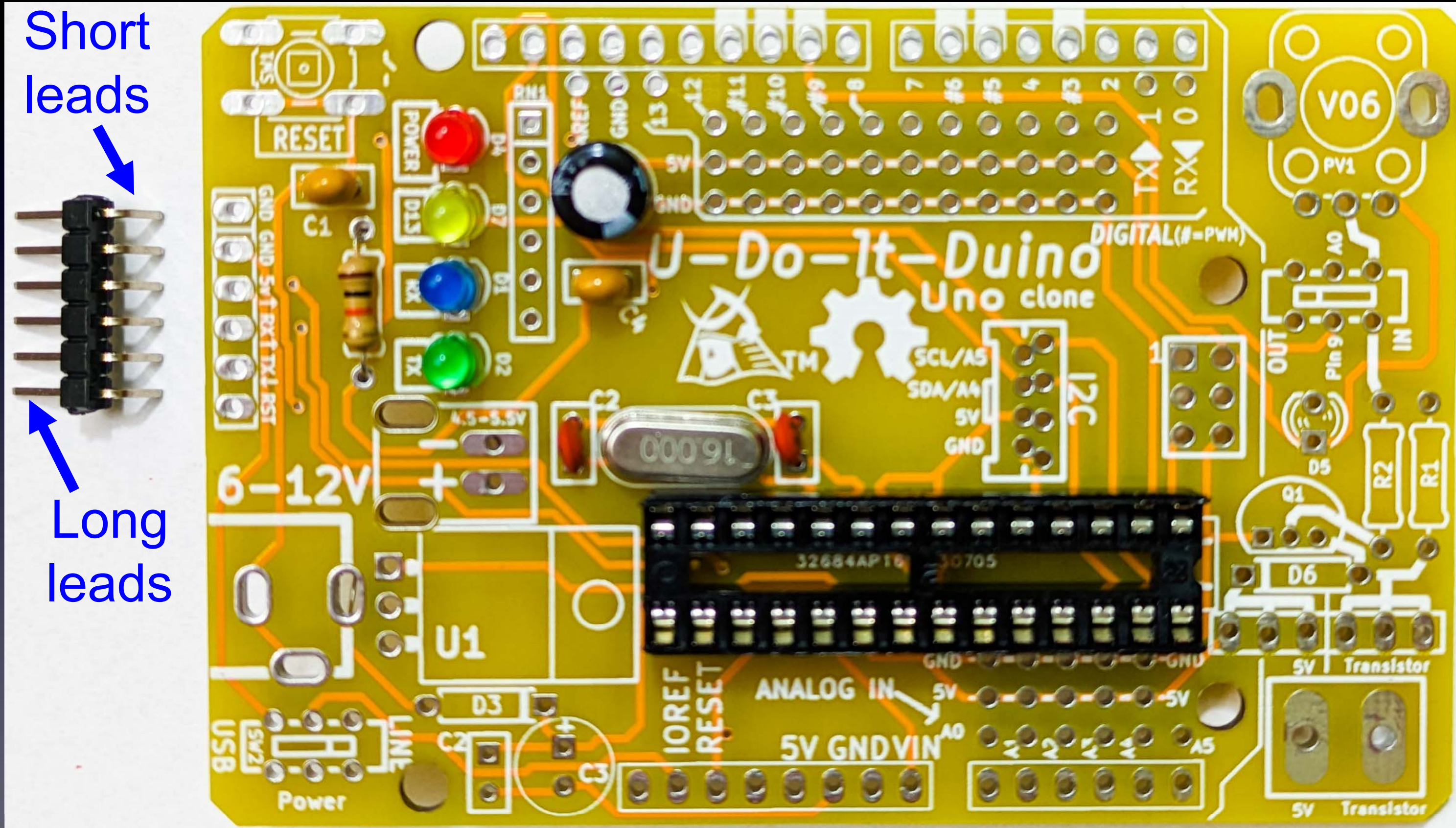
Long lead

LEDs: Long lead "+" (square pad)



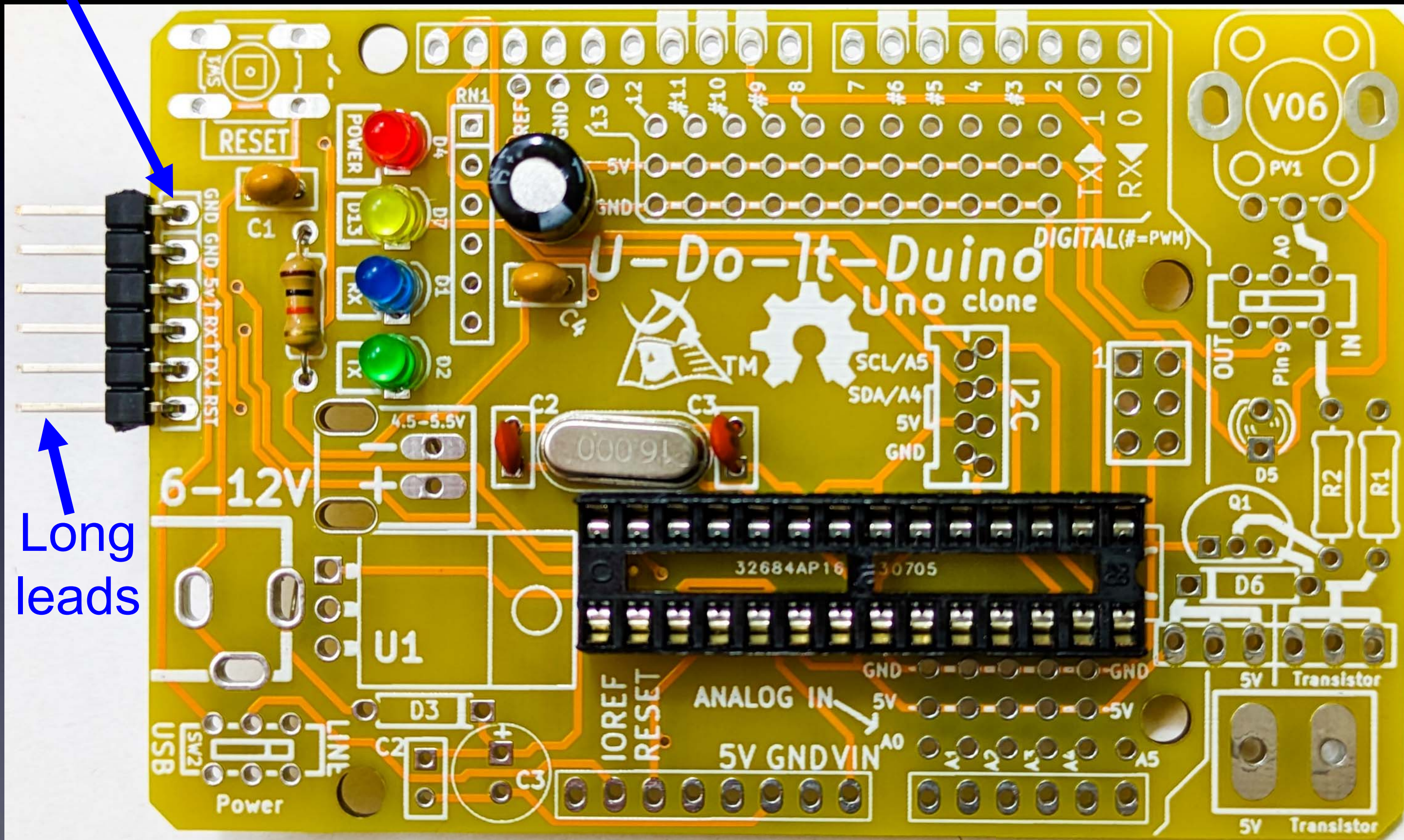
LEDs: Long lead “+” (square pad)

Short leads of the Serial Port Connector go into the board



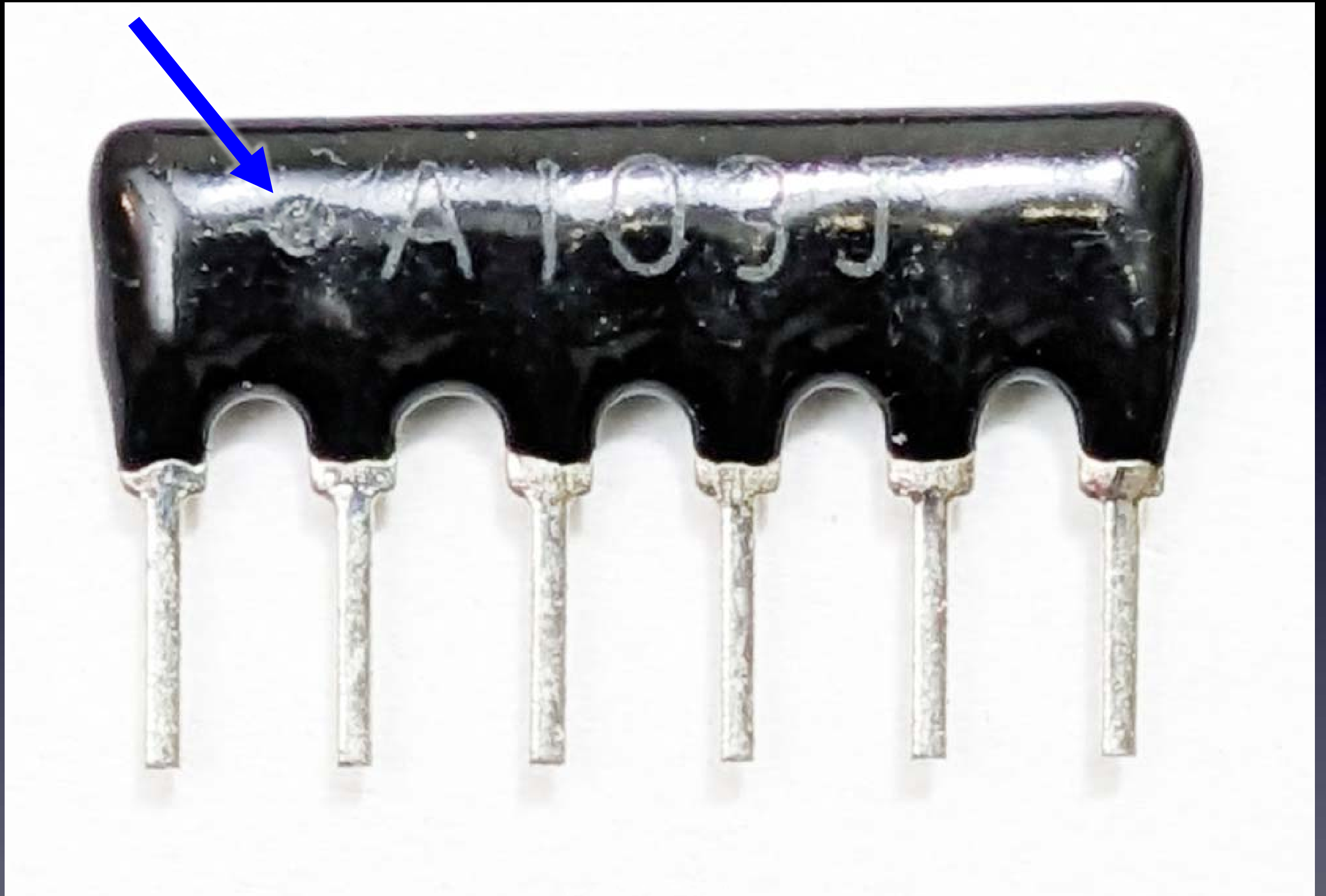
Serial Port Connector: Long leads point to the left

Solder on top of board if it falls out upside down



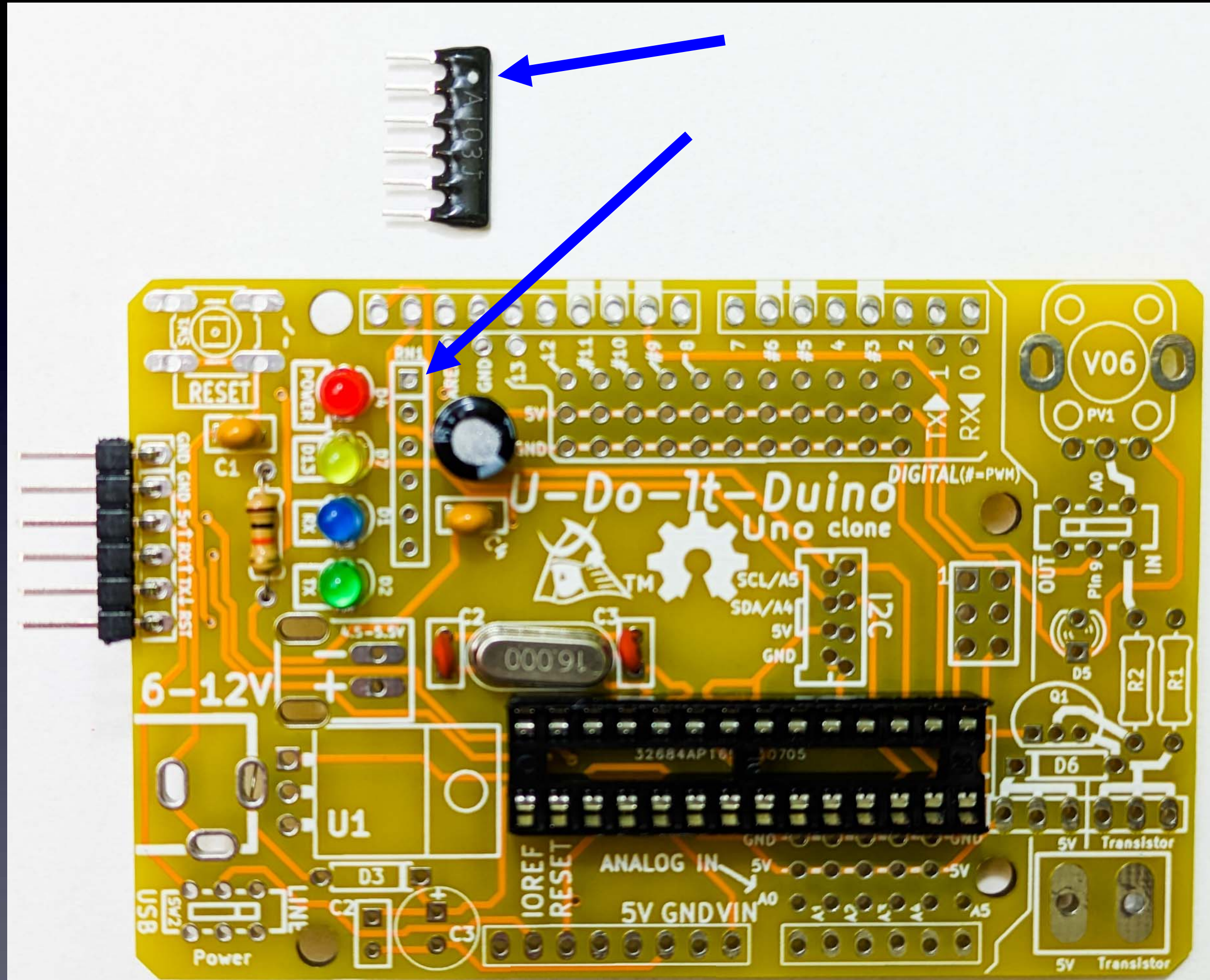
Serial Port Connector

The white circle (or diamond)



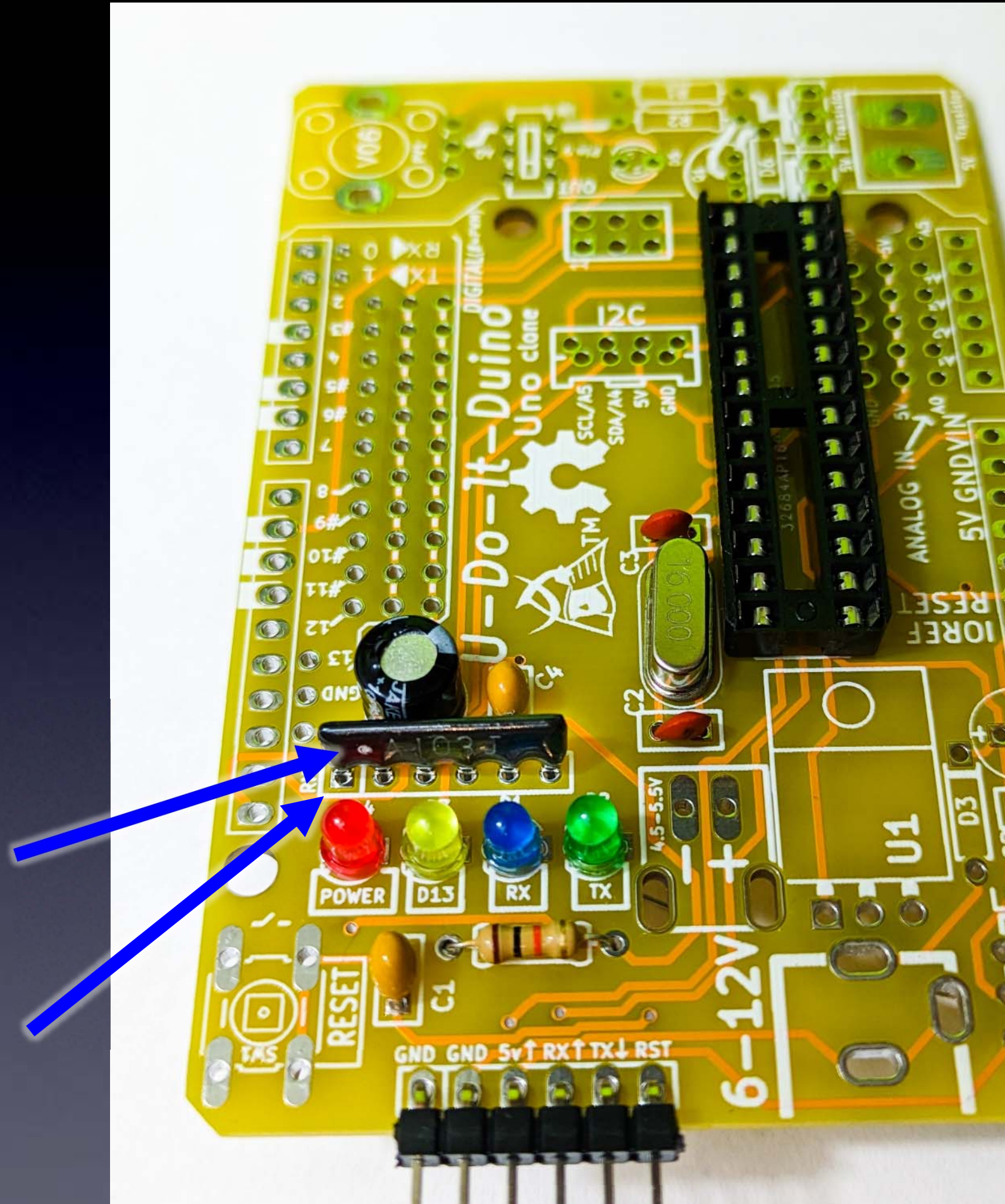
RN1

The white circle (or diamond) goes in the square pad



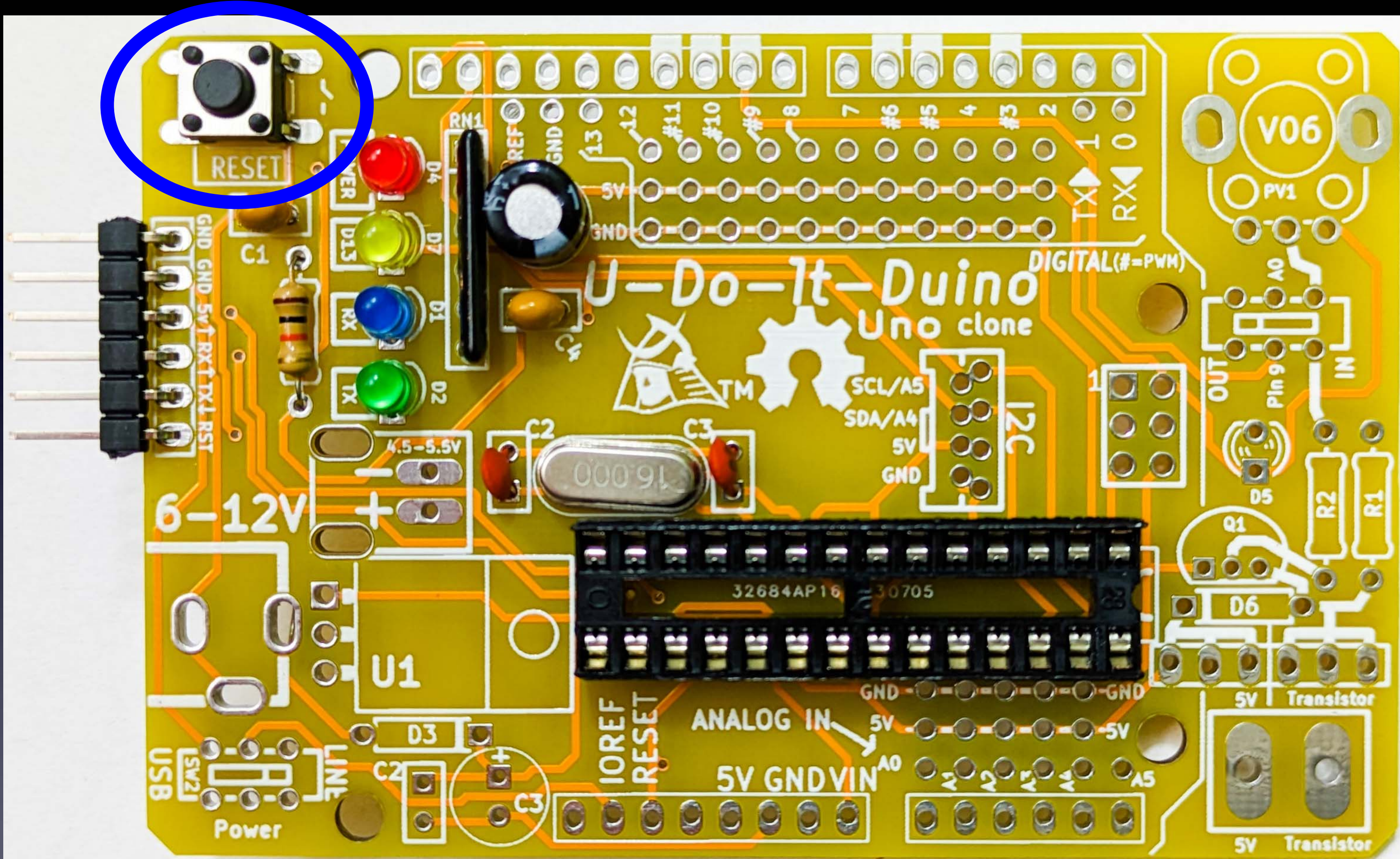
RN1

The white circle (or diamond) goes in the square pad

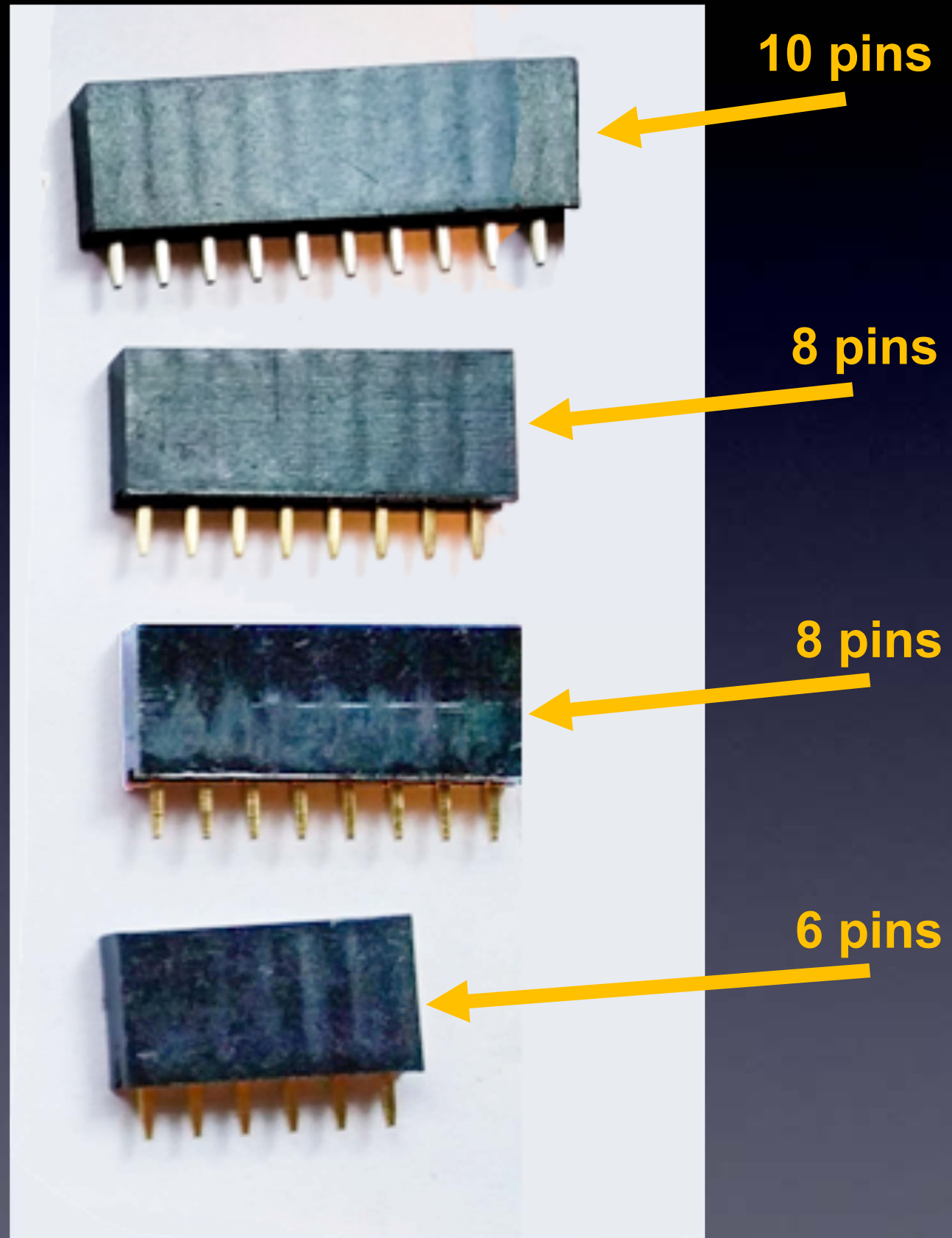


RN1

The Reset Switch fits in 2 ways – either way is fine

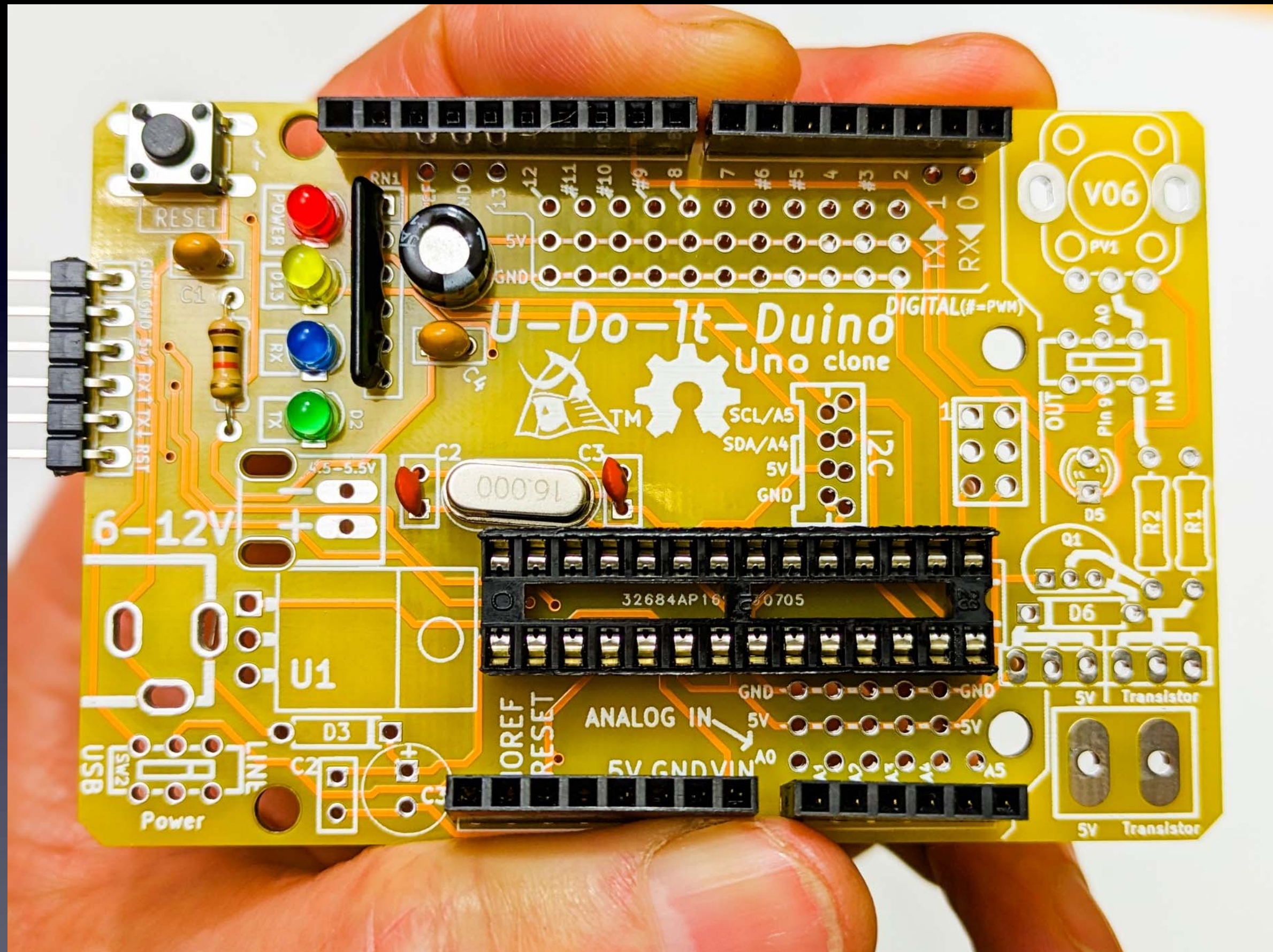


Reset Switch



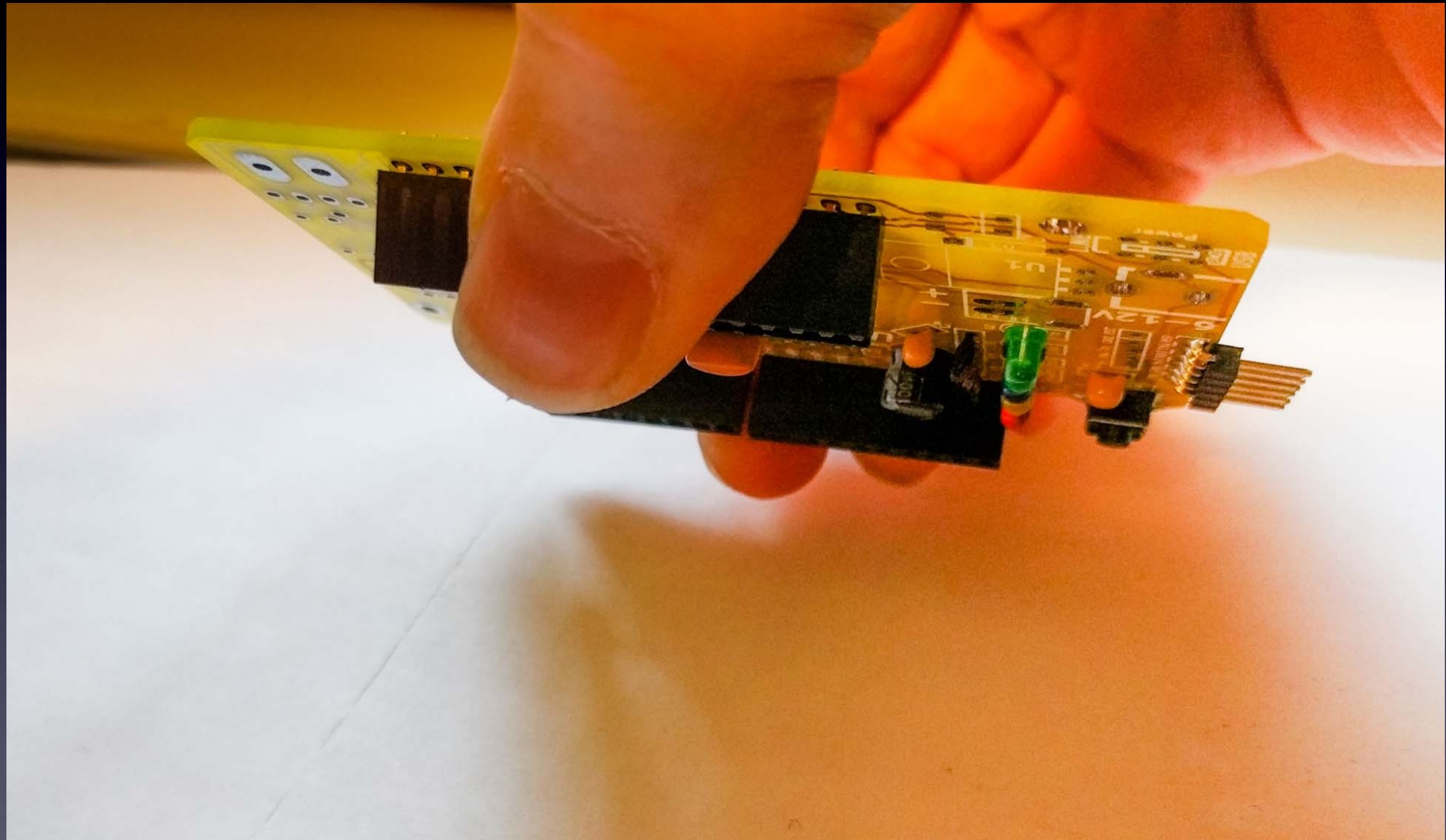
Headers

It's easiest to solder all Headers at once.
Insert, and hold them like this:



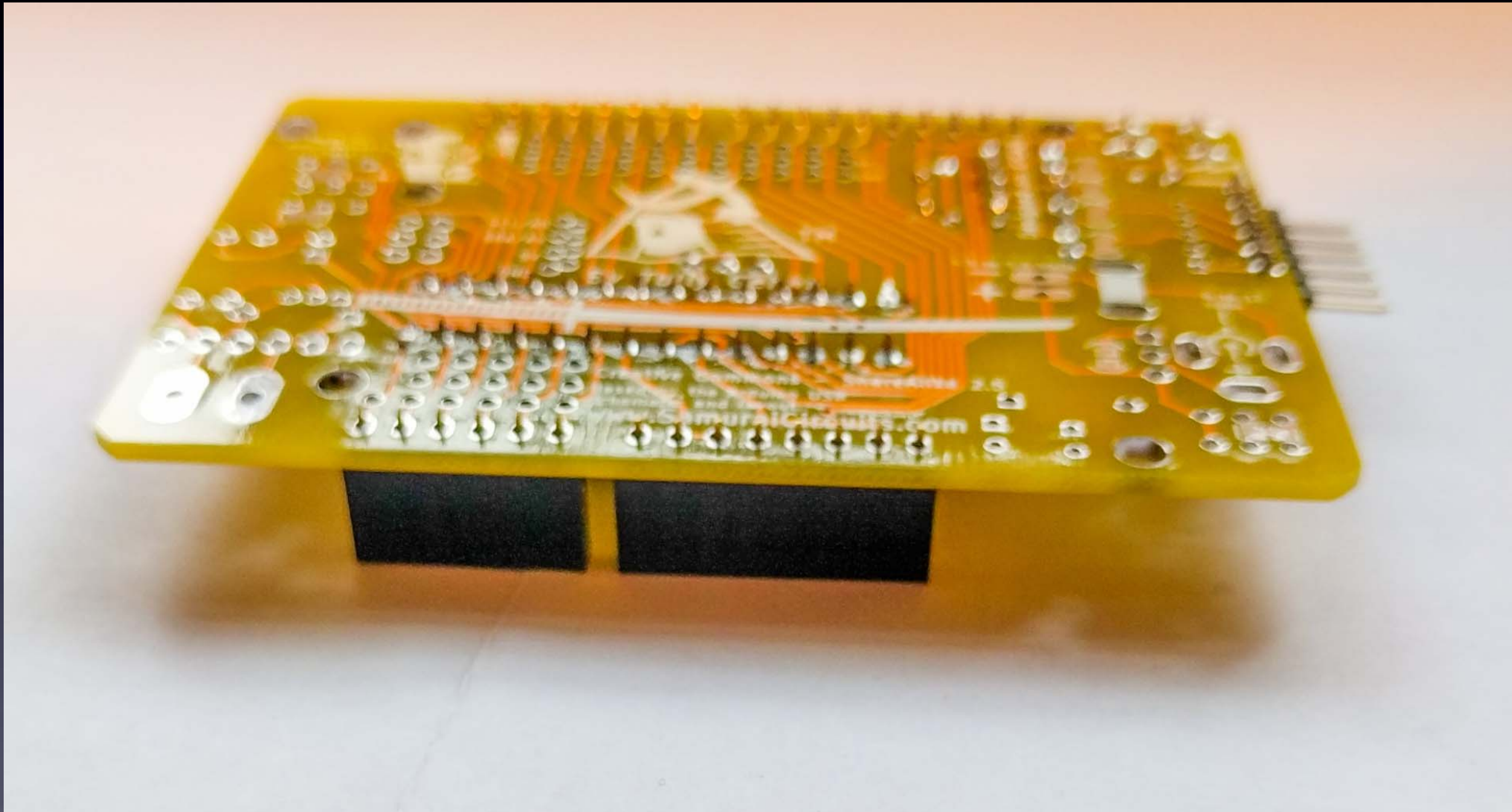
Headers

**It's easiest to solder all Headers at once.
Lay it all on the table:**



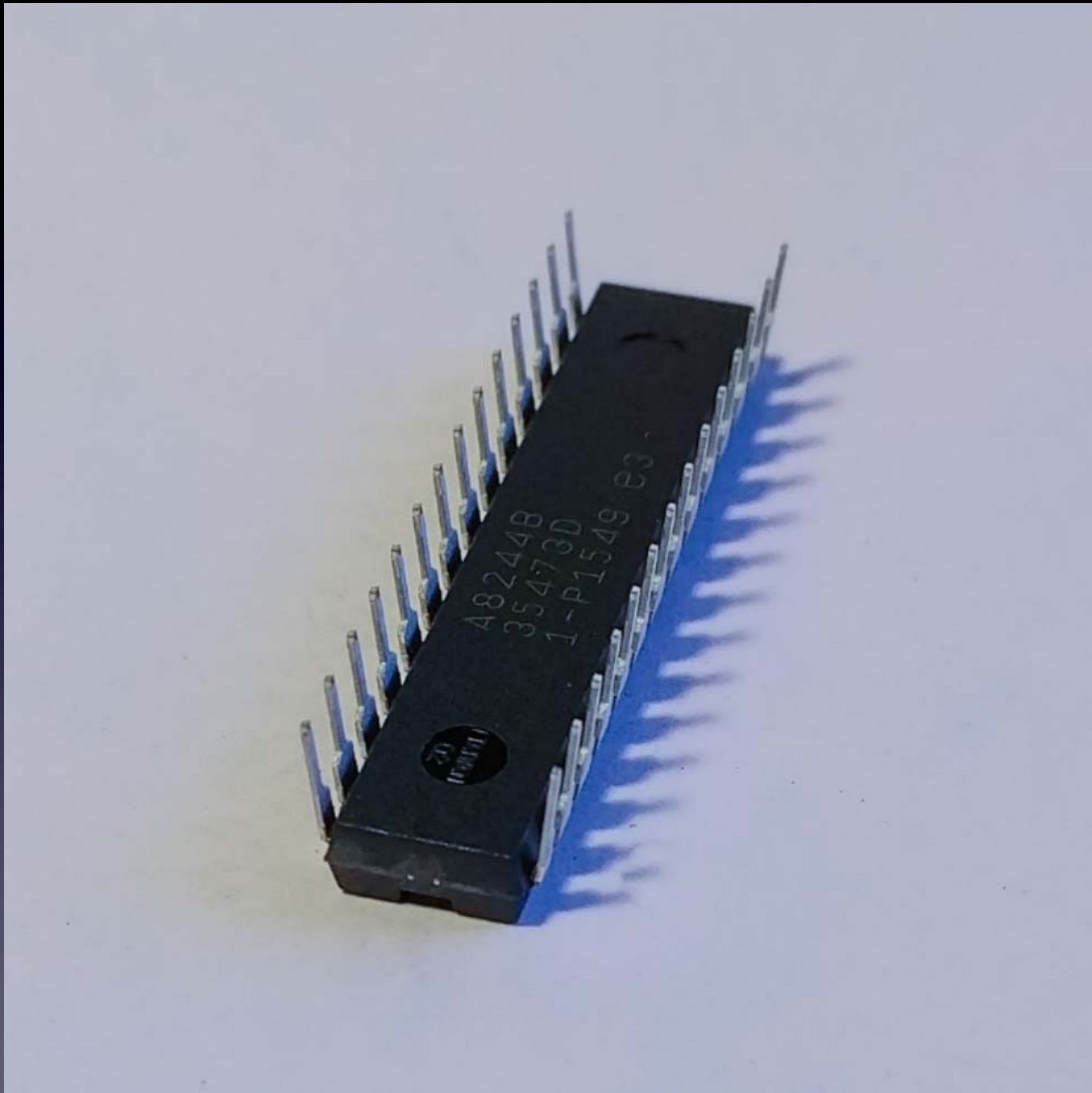
Headers

Now it is easy to solder all of the Header pads at once.



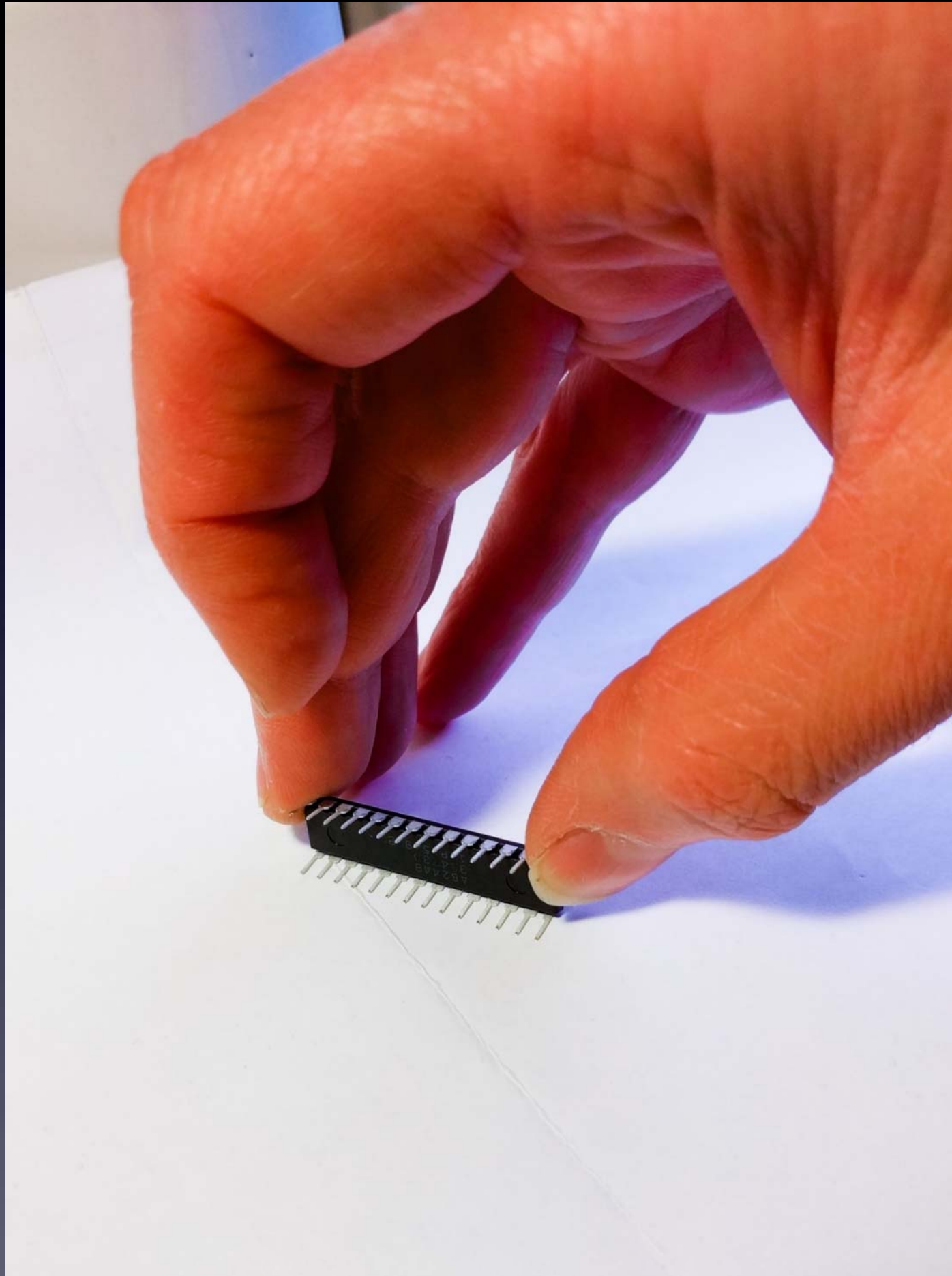
Headers

You probably need to bend the pins so they're parallel



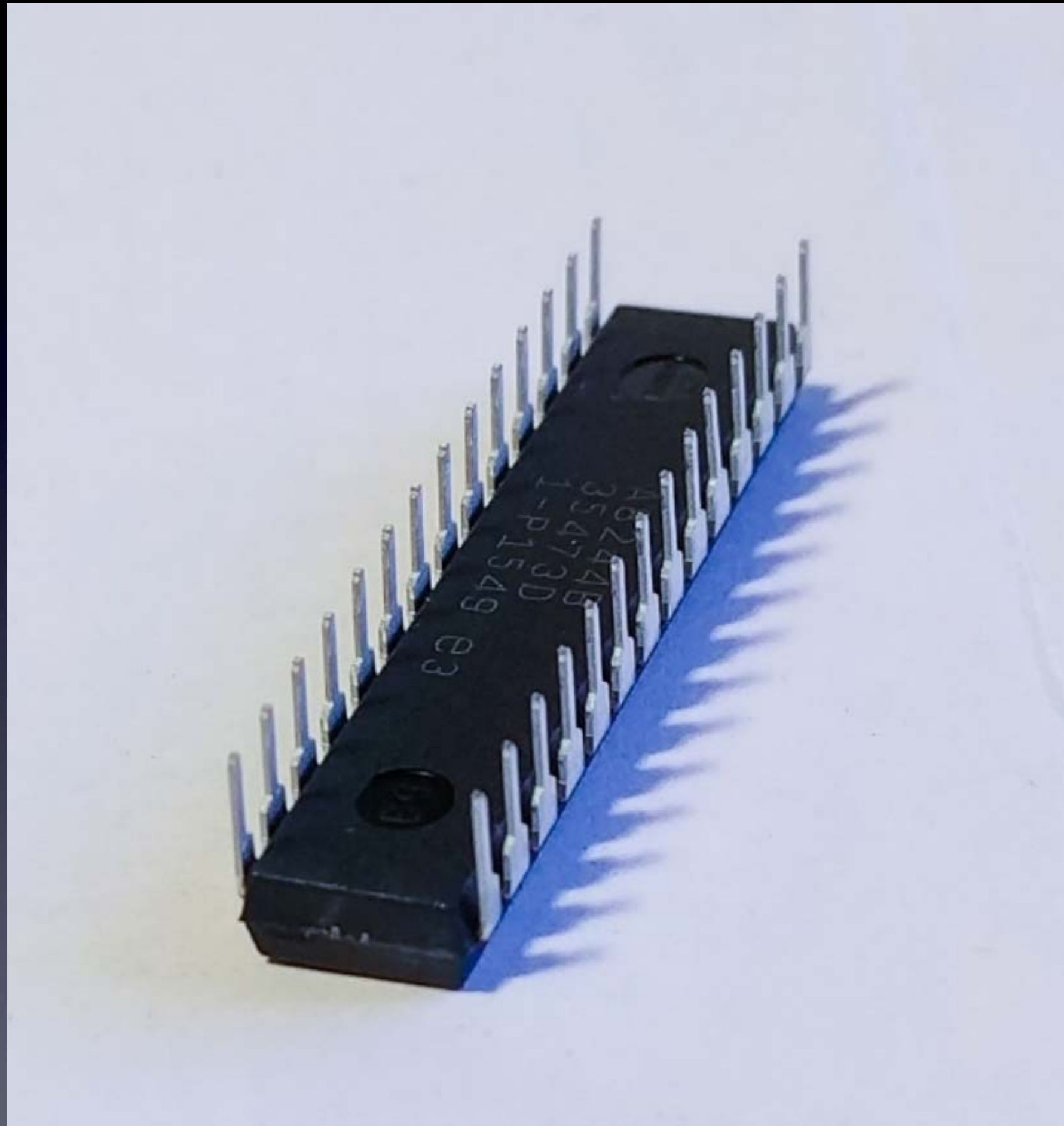
Microcontroller

You probably need to bend the pins so they're parallel



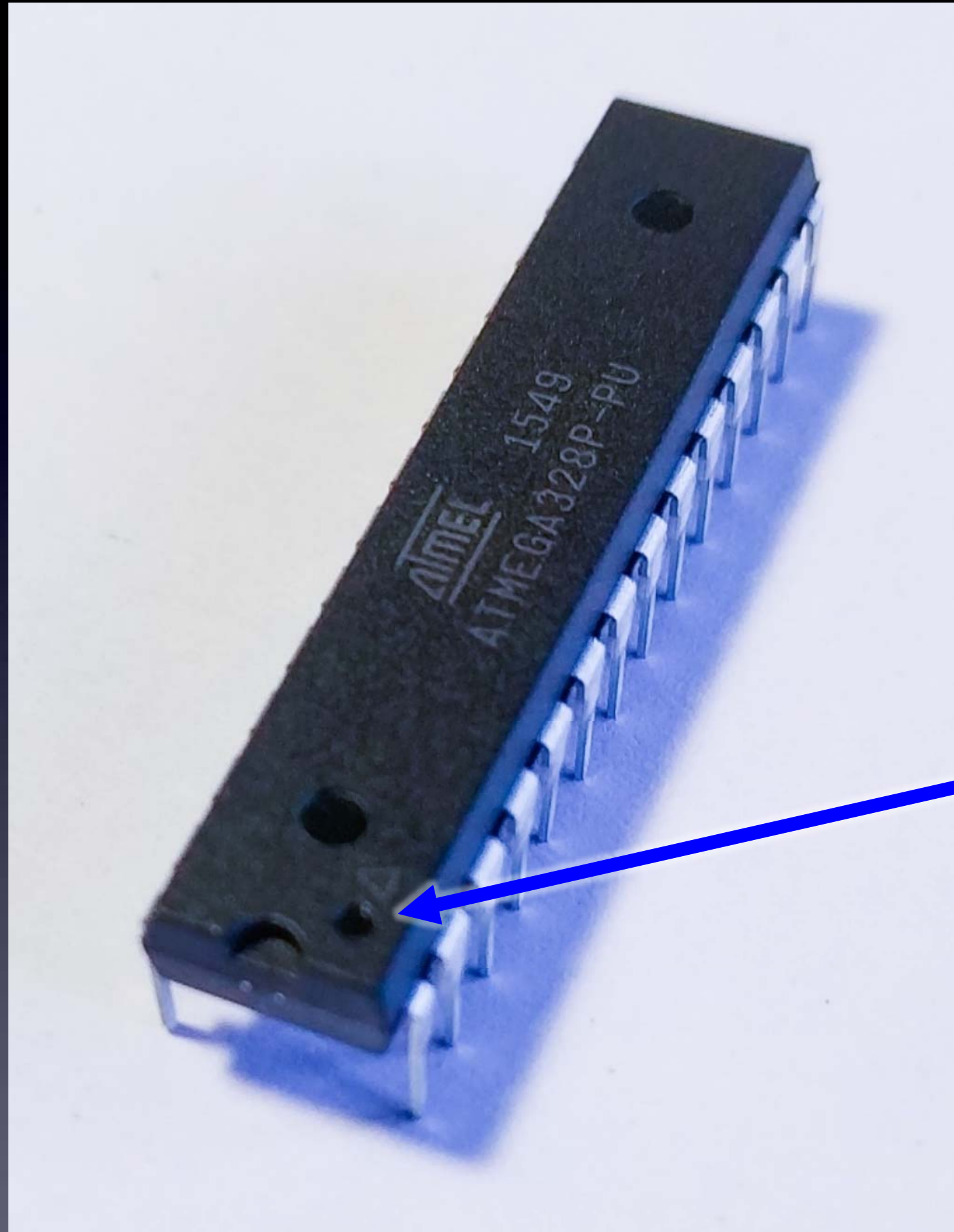
Microcontroller

You probably need to bend the pins so they're parallel



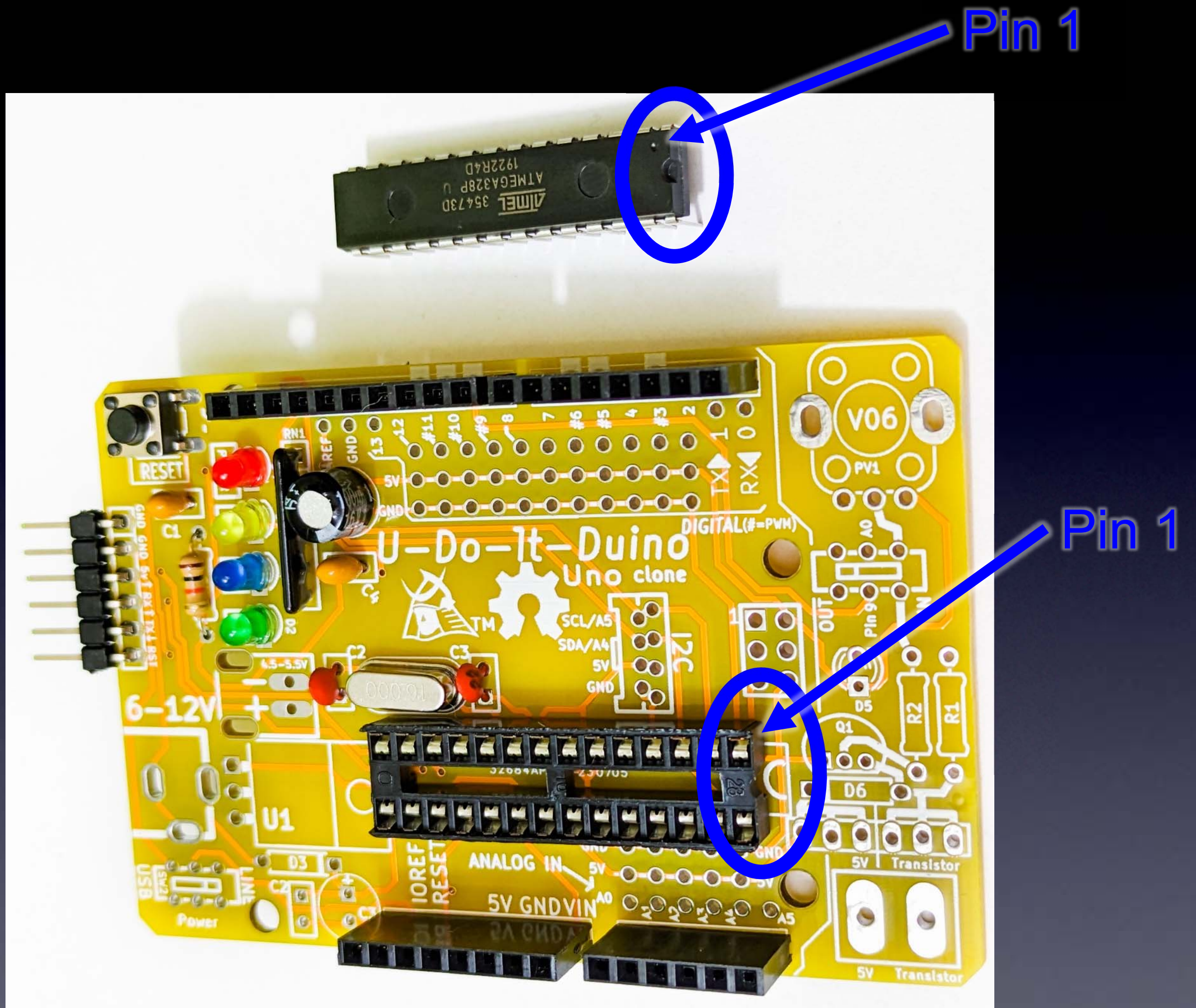
Microcontroller

Ready to insert into its socket



Pin 1

Microcontroller



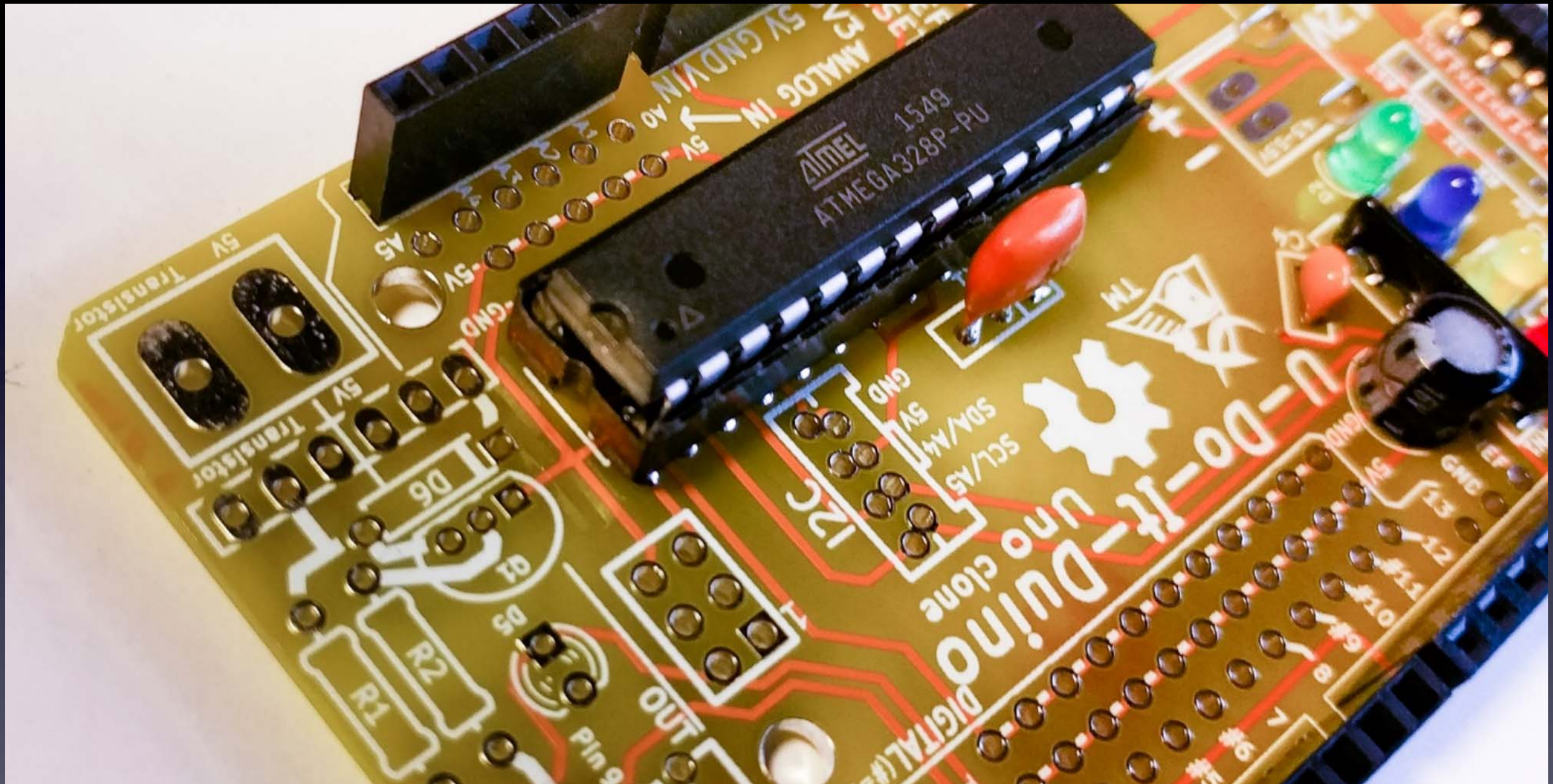
Microcontroller

**When all pins fit in their holes,
use both thumbs to push chip into socket**



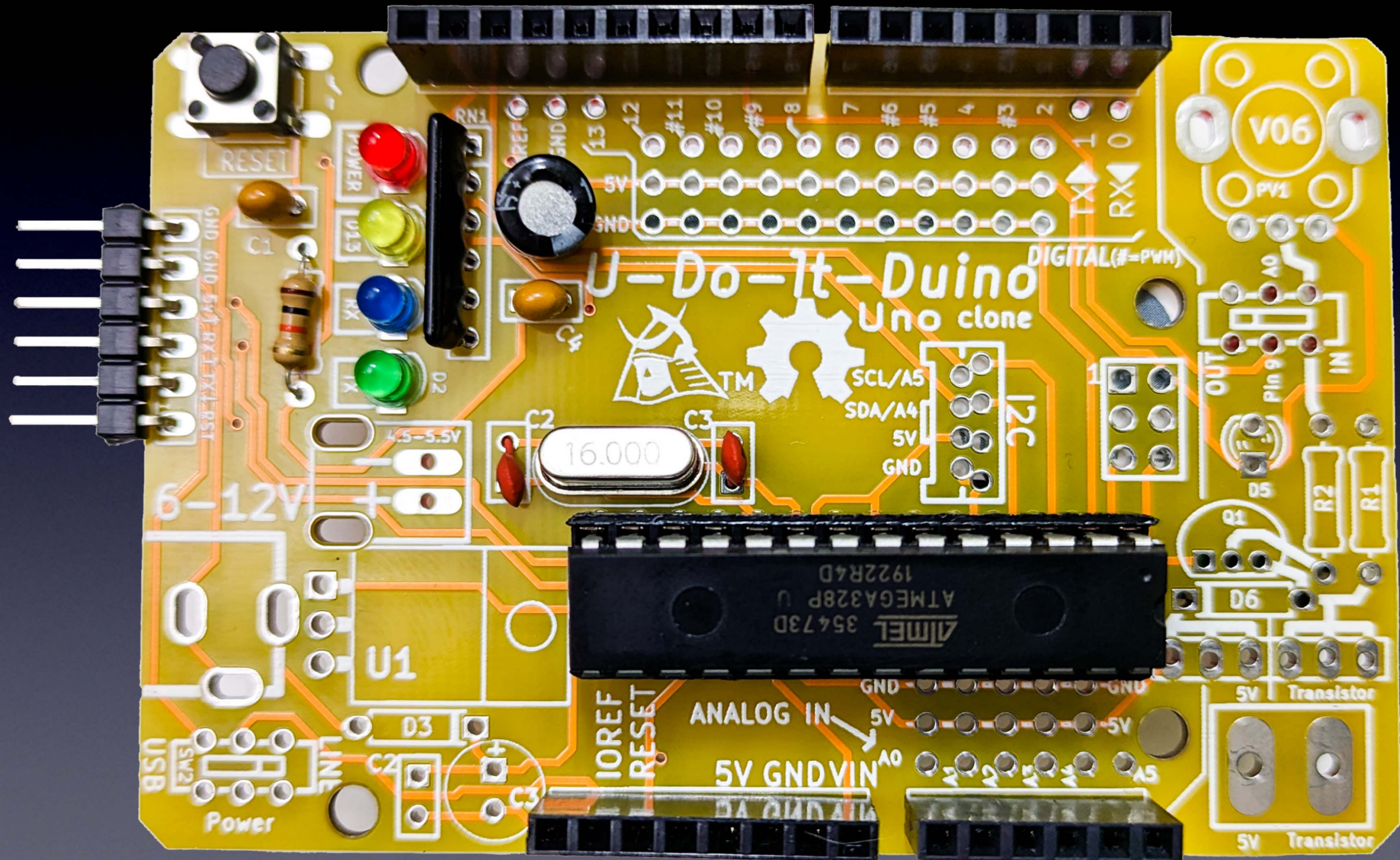
Microcontroller

**Each pin in its hole, chip pushed down all the way.
Pin 1 is oriented correctly.**

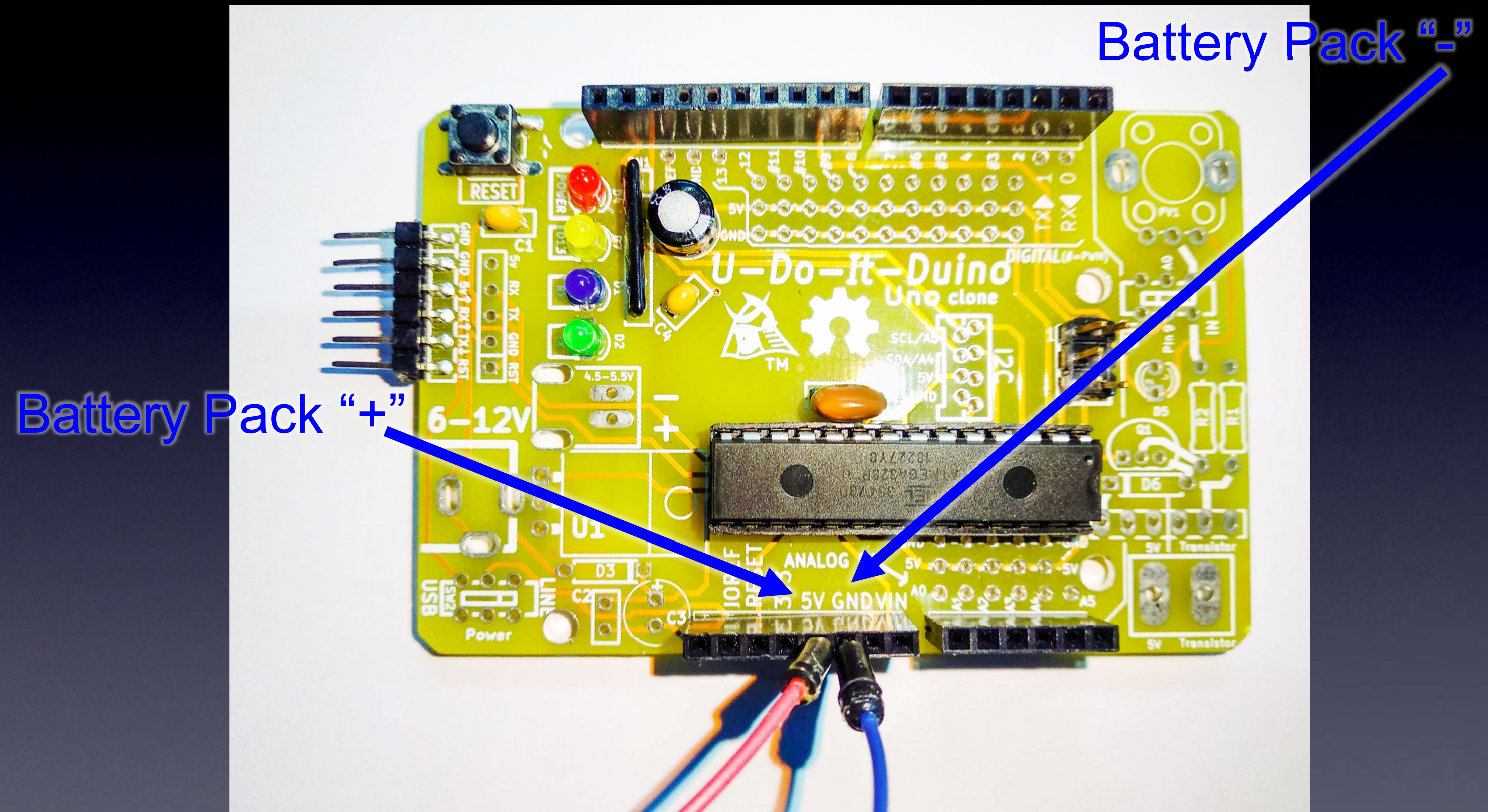


Microcontroller

We are done soldering!

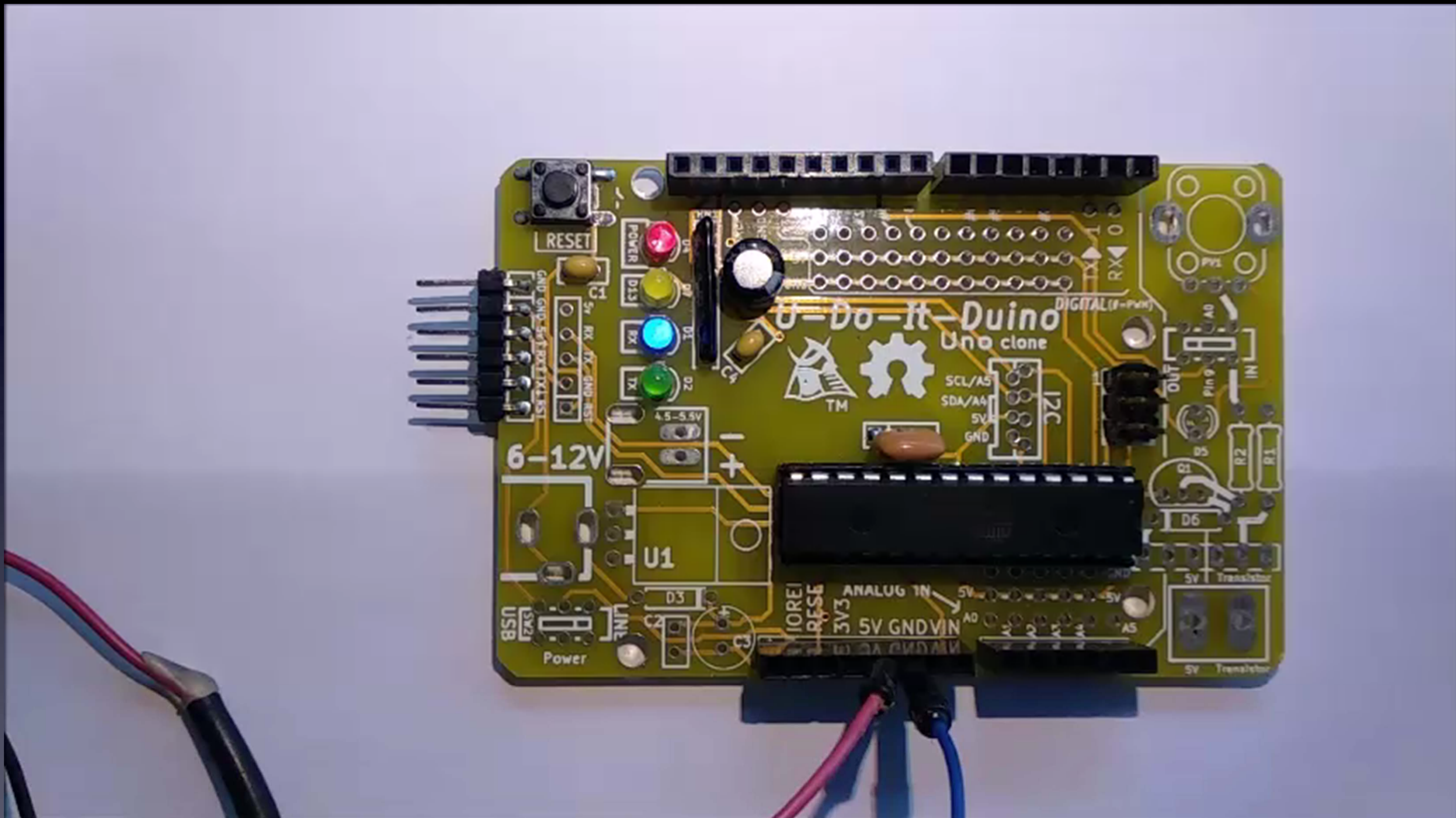


First test:



Connect power with a battery pack...

First test:

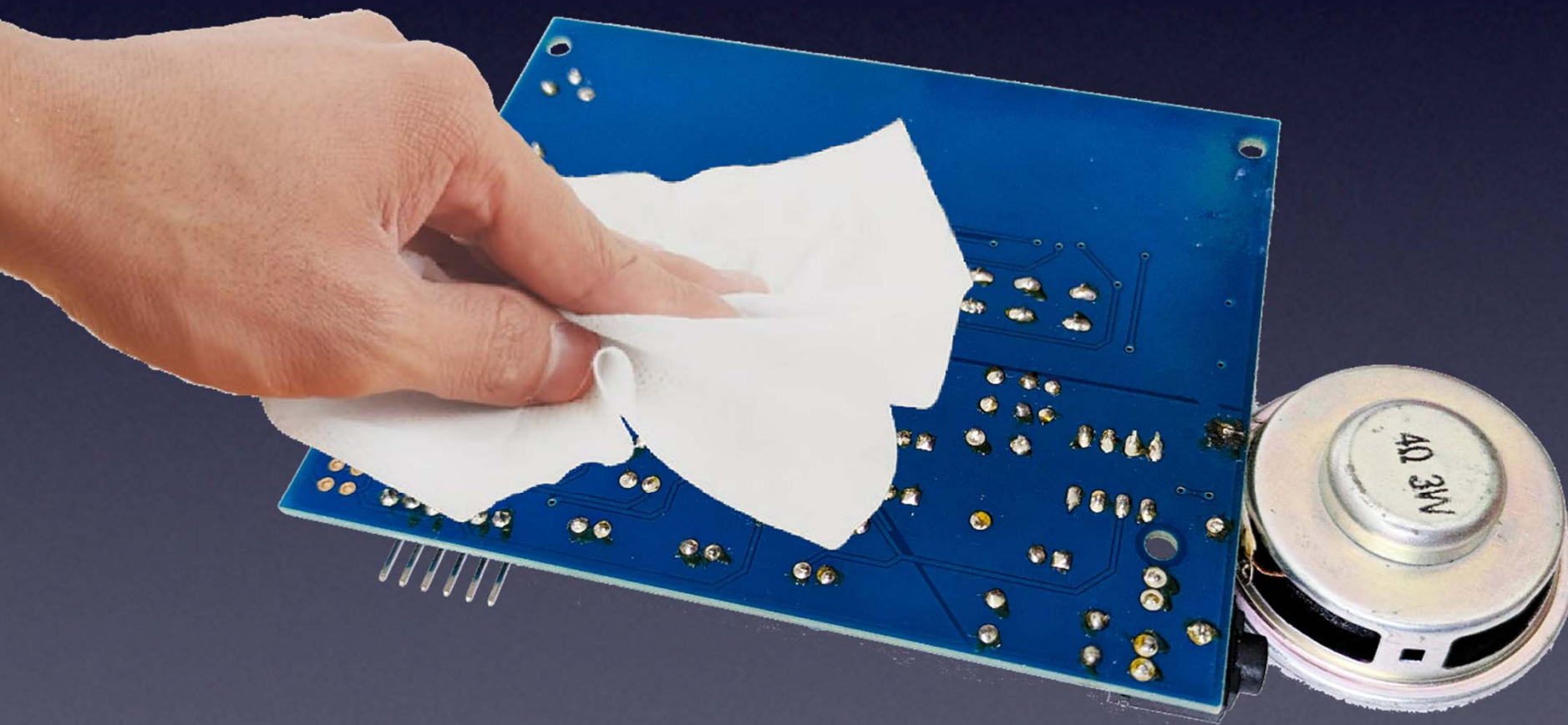


... and it blinks !

If you used any *flux paste* for re-working problems

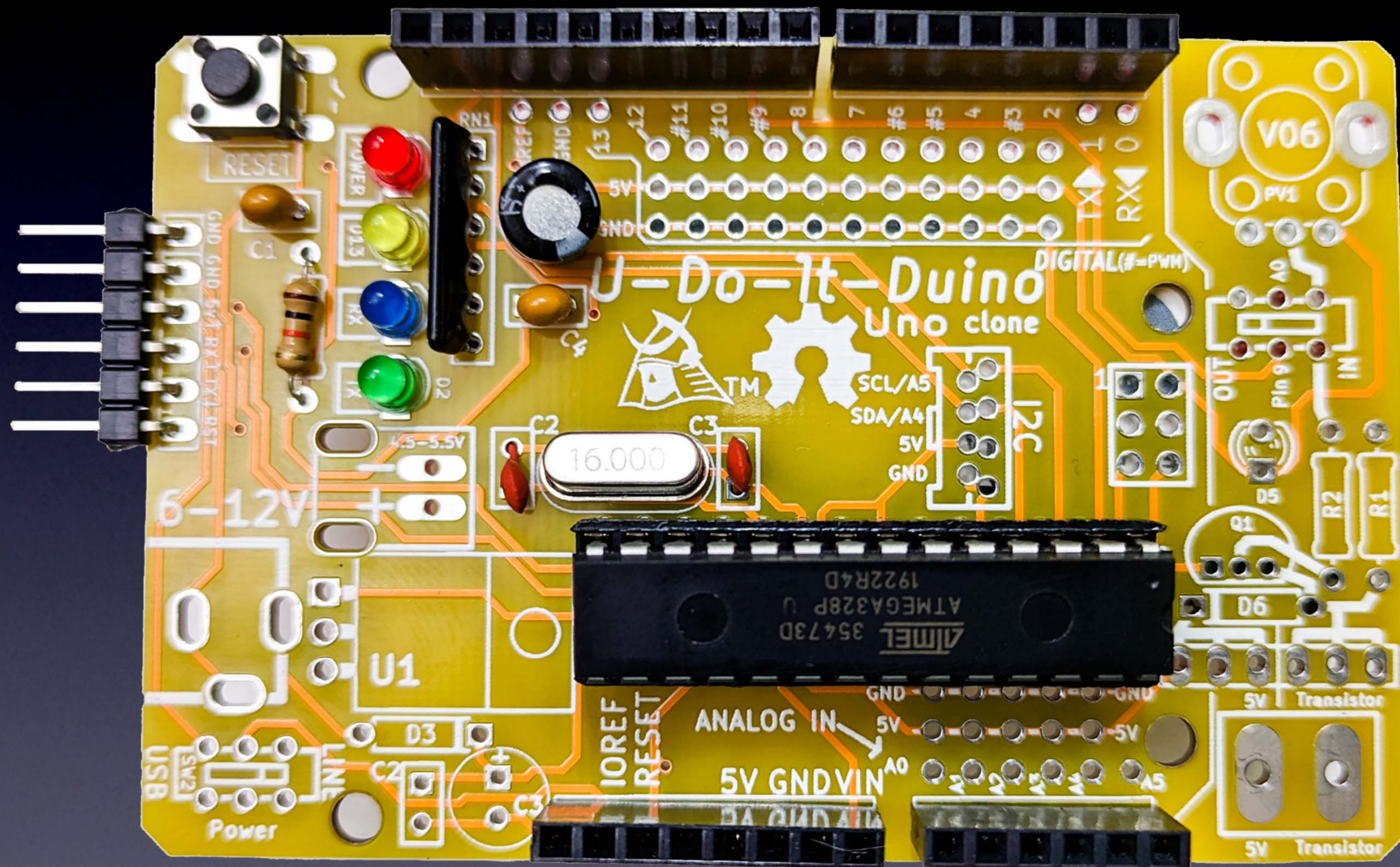


The bottom of the PCB will be sticky from the flux



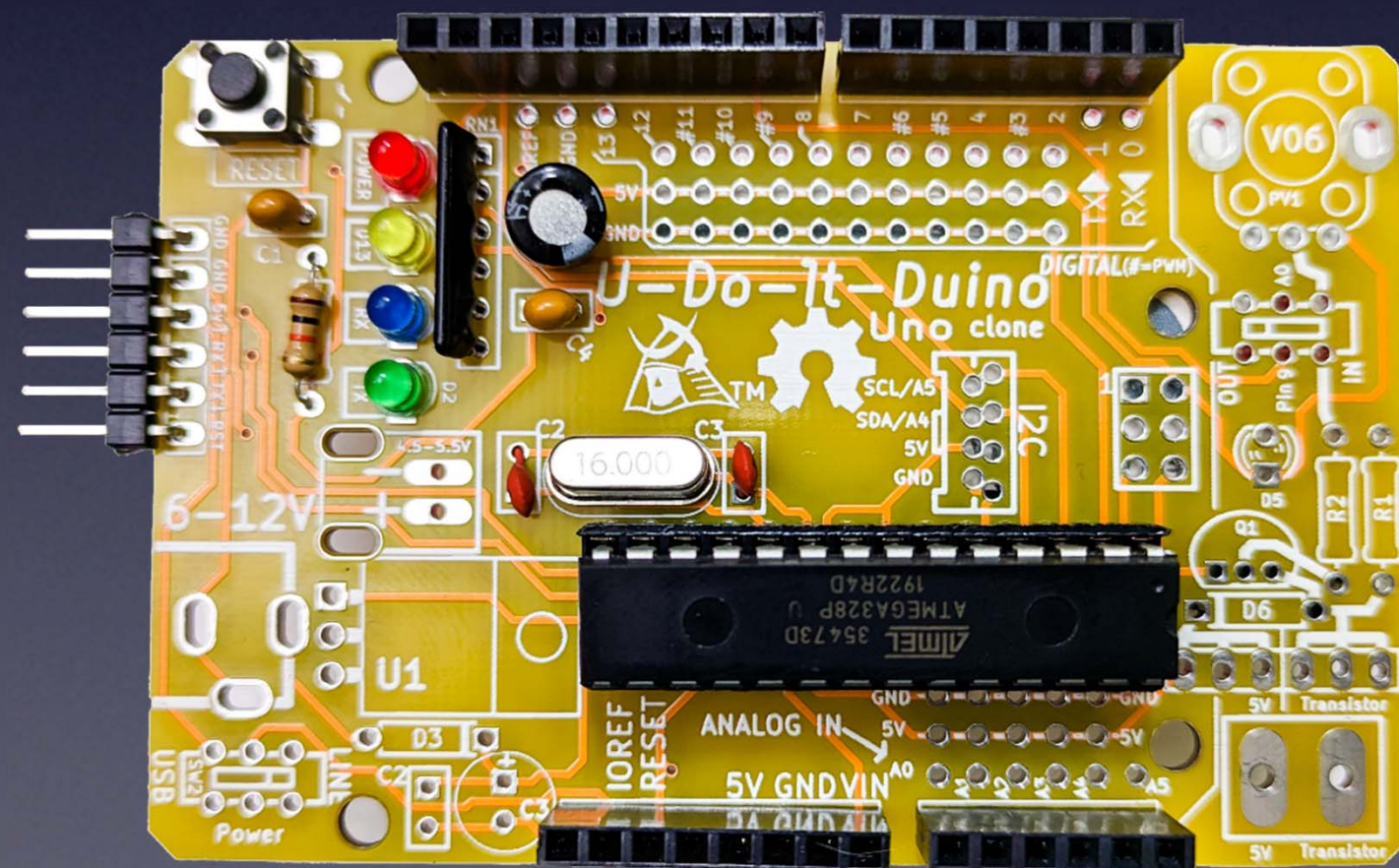
You can clean it with a cloth wet with *Isopropyl Alcohol*

You now have your own Arduino !



Yay!

Now we can
connect parts to our Arduino,
and program it!



Helpful info

on the

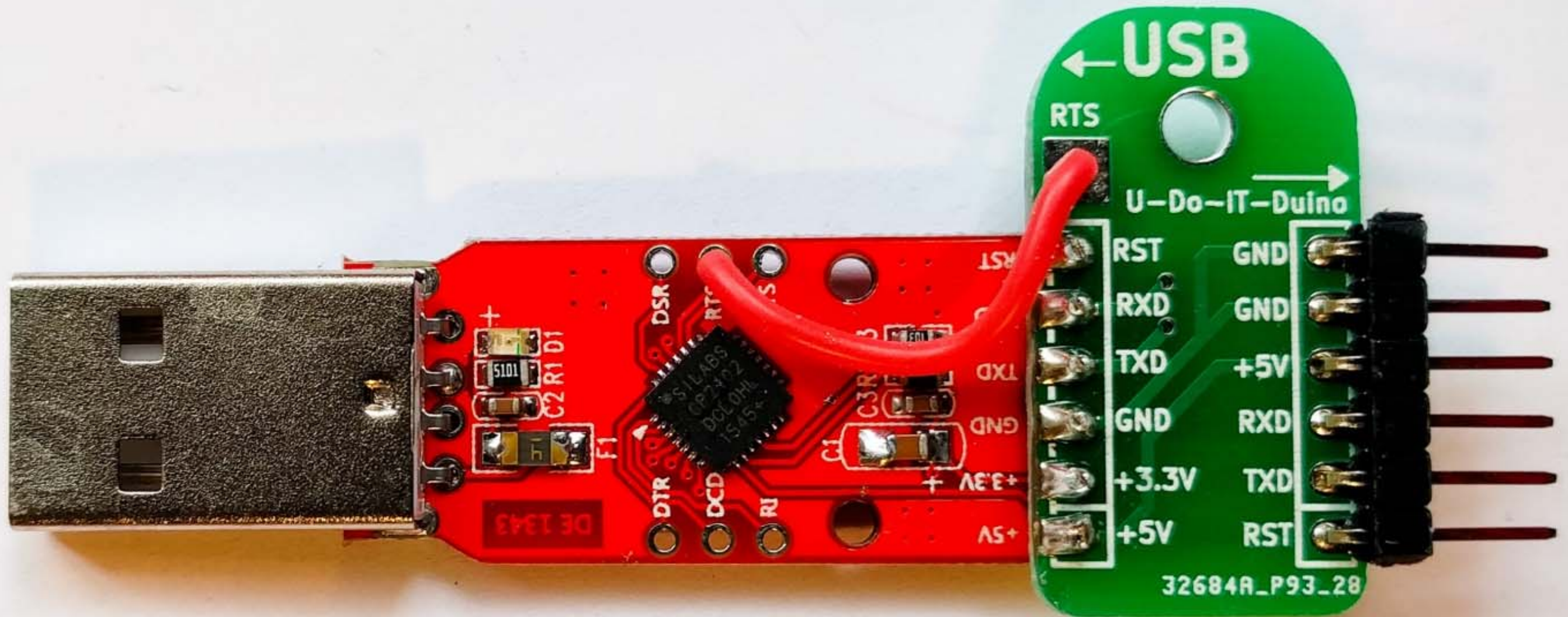
Ardduino for(4) Total Newbies

workshop

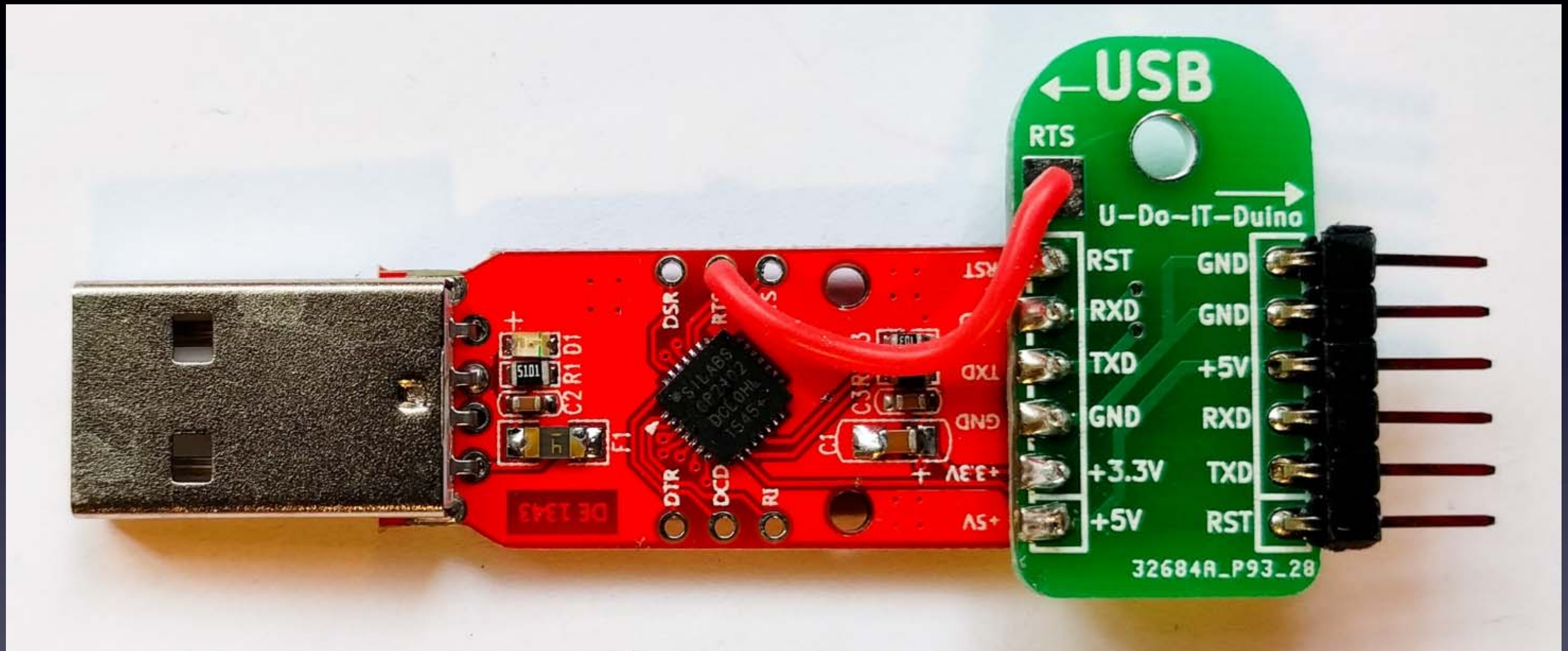
web-page:

<https://tinyurl.com/A4TNworkshop>

USB-Serial Cable



USB-Serial Cable Driver



**You may need to download and install a driver
for your Operating System (Windows, MacOS, or Linux):**

[<https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers>](https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers)

Helpful info on the

Ardduino for(4) Total Newbies

workshop
web-page:

<https://tinyurl.com/A4TNworkshop>



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Take CONTROL

At Cornfield Electronics we create devices that give people opportunities for effective choices in their lives. Each of us can decide whether to watch TV monitors, and when to watch. Each of us can decide when to get the rest we want, and how we dream. Everyone can learn to make cool things with our kits. Please explore our [products](#), make your own choices, and see how *your* life can be enhanced.

[join our mailing list](#)

Love it or hate it, TV screens are all around us. [TV-B-Gone®](#) universal remote control is the first fruit of our technical savvy, embodying our belief in empowerment, and sense of humor. This universal remote control fits in your pocket and allows you to discreetly turn TVs off wherever you go. TV-B-Gone fans around the world are using it for a variety of practical, philosophical, and humorous purposes. Imagine the possibilities...

Years in the making [NeuroDreamer](#) sleep mask is another of our personal empowerment inventions. We all need rest, but we don't always get it in our busy lives. NeuroDreamer sleep mask lets you use your own brainwaves to

bring you the rest you need. And with the [lucid dreaming model](#), you can take control of your dreams.

Want to learn electronics? We make way cool, fun, intriguing, educational [kits](#) that **anyone can make!** Our most **POPULAR** kits are: [ArduTouch music synthesizer kit](#) and [TV-B-Gone kit!](#)

We make truly useful technological solutions that put you in charge.

Welcome to our better world!

NOTE: As of 14-Feb-2023 Cornfield Electronics is a sole proprietorship of Mitch Altman.



DO-IT-YOURSELF PROJECTS

by **Mitch Altman**, and friends.

Last modified: 5-Oct-2022

You Can Make Cool Things With Electronics!

The projects on this page were all created for total beginners, with no experience, so everyone can complete them successfully at my workshops, or at home, or anywhere!

All you need is:

a desire, a handful of parts, a soldering iron (with stand and sponge), a wire-cutter, a wire-stripper, solder, and an afternoon.



[Here](#) is a really nice tutorial on how to solder -- for total beginners!

[Soldering Tutorial for total beginners](#)

Open Hardware!

Everything on this page (and everything I do) is free and open source!

(That's *free* as in *freedom*.)

(But everything here is free to download -- and that is *free* as in *beer*.)

If you have any questions on anything, please feel free to email me:

mitch AT CornfieldElectronics DOT com



Soldering!

Soldering is fun! And it is easy! Really, it is!

I have taught tens of thousands of people around the world how to solder.

Everyone can do it! All ages, all skill levels.

People who have never even sewn a button can easily learn to solder. Even you!

Once you learn how to make one good solder connection, you can make anything on this page.

And if you can make anything on this page, you can learn to make anything with electronics and microcontrollers.

Project: Make your own open source TV-B-Gone Kit (developed with Ladayada)

The TV-B-Gone Kit was originally developed from a MiniPOV3 hack (see below) (which, of course, I hacked from my original [TV-B-Gone](#).)

For excellent **assembly instructions**, please go to the [TV-B-Gone Kit page](#) of the of the Adafruit.com website.

For **questions** about the TV-B-Gone Kit, please go to the [TV-B-Gone Kit user forum](#).
To see the **schematic, firmware, and board layout**, please go to [TV-B-Gone Kit downloads](#).

TV-B-Gone Kits are available for **purchase** from the [TVBGone.com](#) website.

Project: Arduino For Total Newbies workshop
-- Learn Arduino, and make your own TV-B-Gone!

This workshop covers lots of ground -- all you need to learn how to play with Arduinos. As an example project, you can make your own TV-B-Gone using [Arduino](#).
Many thanks to Ken Shirriff for the original [TV-B-Gone for Arduino project](#)!
For documentation on this workshop, please see the:
[Arduino For Total Newbies Workshop](#) page.

scroll down



Project: Make your own open source TV-B-Gone Kit (developed with Ladayada)



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For documentation on this workshop, please see the:

[Arduino For Total Newbies Workshop page](#).



Arduino For Total Newbies Workshop

last updated: 1-May-2023

Learn how to make your own way cool projects with Arduino,
using TV-B-Gone as an example project to learn from.



I've given this workshop at [Noisebridge](#) hackerspace in San Francisco (several times), at [27C3](#) and [28C3](#) in Berlin, and [29C3](#), [30C3](#), [31C3](#), [32C3](#), and [33C3](#) in Hamburg, and at [34C3](#), [35C3](#), [36C3](#) in Leipzig, and [RC3](#) online, at [CCCamp2011](#) [CCCamp2015](#) and [CCCamp2019](#) outside of Berlin, at [HeatSync Labs](#) hackerspace in Phoenix, AZ, at [Fabelier](#) hackerspace in Paris, at Unit One in [2012](#), [2014](#), [2016](#), and [2018](#) as Hacker In Residence at the University of Illinois, in Urbana, IL, at Makerspace Urbana in Urbana, IL in [2012](#) and in [2016](#), at [Workshop Weekend](#) in Oakland, CA (twice), at [XinCheJian](#) hackerspace in Shanghai, at [Maker Carnival](#) in Beijing (twice) at several conferences and hackerspaces on my [Hackers on a Train Workshop Tour 2012](#) including at [HOPE Number 9](#) in New York City, at [ToorCamp 2012](#) in Neah Bay, WA, at [OHM 2013](#) and [SHA 2017](#) outside of Amsterdam, at [RockIT CoLabs](#) in San Francisco, at [BalcCon2k14](#) in Novi Sad, Serbia, at [HOPE X](#), [The Eleventh HOPE](#), [The Circle of HOPE](#) [A New HOPE](#) in New York City, and [HOPE 2020](#) online, at [the iCenter](#) as Hacker In Residence at Tsingua University in Beijing, at [EMF Camp 2016](#), [EMF Camp 2018](#), and [EMF Camp 2022](#), outside of London, at [Tami](#) hackerspace in Tel Aviv, at [Le Wagon](#) and [Zhongxi](#) in Chengdu, at [Astralship](#) hackerspace in North Wales (three times), at [Open Source Microfactory Build Camp](#) online, at [Newline](#) in Ghent, at [GPN20](#) in Karlsruhe, at [Fri3d Camp 2022](#) near Sint-Joris-Weert, Belgium, at [Maker Faire Brno 2022](#) in Brno, Czech Republic, at [HiP-Berlin](#) in Berlin, Germany, and lots of other places.

Each time 10 to 50 people show up. (Folks seem to like it.)

Itinerary for Arduino For Total Newbies Workshop:

Here is what is available for downloading for the Arduino For Total Newbies Workshop:

1) If you don't already have **Arduino software** you need to download it for your computer (Windows, Mac OS, or Linux):

[Arduino download page](#)

2) You need a **driver for your USB communications/programming cable**. Several different ones are available. Choose the driver for the cable you have and the operating system for your computer.

Samurai Circuits board (SiLabs CP210x USB-to-Serial TTL) drivers:

[The latest drivers from SiLabs' website](#)

The SiLabs driver is installed by default on most Linux systems.

Adafruit FTDI Friend drivers:

[The latest drivers from FTDI's website](#)

The FTDI driver is installed by default on most Linux systems.

FTDI Cable drivers:

[The latest drivers from FTDI's website](#)

The FTDI driver is installed by default on most Linux systems.

3) You also need the **TV-B-Gone Arduino Sketch**

(download this, unzip it, and copy it to your computer in the "examples" folder inside your "arduino" folder that you downloaded):

[TV-B-Gone Arduino sketch\(22KB\)](#)

4) **Schematic Diagram for Arduino TV-B-Gone remote control:**

[Schematic Diagram\(449KB\)](#)

Parts List for Arduino TV-B-Gone remote control:

[Parts List \(Open Office\)\(12KB\)](#)

[Parts List \(MS Office\)\(9KB\)](#)

Schematics for the U-Do-It-Duino Arduino clone kit:

[U-Do-It-Duino schematic \(110KB\)](#)

Complete assembly instructions for the U-Do-It-Duino Arduino clone kit:

[U-Do-It-Duino complete assembly instructions](#)

Stuff to download

scroll down



The SiLabs driver is installed by default on most Linux systems.

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[U-Do-It-Duino complete assembly instructions](#)

Soldering Is Easy comic book:

[Solder Comic \(English\)\(809KB\)](#)

[Many other languages are available!](#)

Here are links to the slides I use in the workshop:

[Arduino For Total Newbies workshop slides \(with U-Do-It-Duino kit\)\(69.2MB\)](#)

[Arduino For Total Newbies workshop slides \(with Arduino Uno -- no soldering\)\(56.0MB\)](#)

Slides for this
workshop

scroll down

1) If you don't already have **Arduino software** you need to download it for your computer (Windows, Mac OS, or Linux):
[Arduino download page](#)

Arduino software:
Any version you have is fine !

The screenshot shows a web browser window with the URL <https://www.arduino.cc/en/Main/Software>. The page features the Arduino logo and a navigation menu with links to HOME, STORE, SOFTWARE, EDUCATION, RESOURCES, COMMUNITY, and HELP. The 'SOFTWARE' link is highlighted. Below the navigation bar, there is a section titled 'SOFTWARE' with a language dropdown set to 'ENGLISH'. The main content area is decorated with a grid of red and yellow dots. It features a large image of the Arduino Web Editor interface, which shows a code editor with the following code:

```
void setup(){  
  //  
}  
  
void loop(){  
  //  
}
```

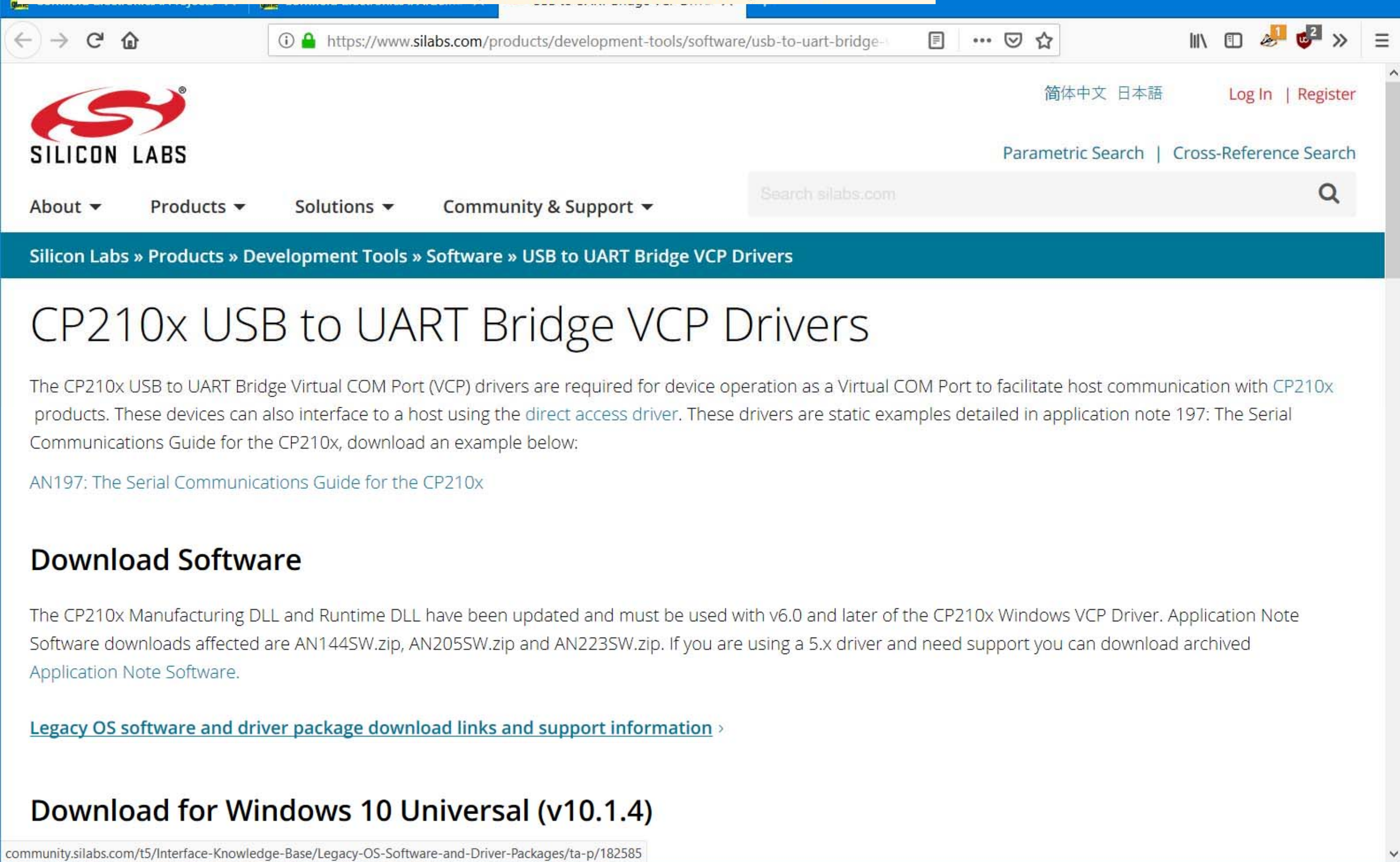
Below the image, the text reads: "Start coding online with the [Arduino Web Editor](#), save your sketches in the cloud, and always have the most up-to-date version of the IDE, including all the contributed libraries and support for new Arduino boards." To the right of this text are two buttons: "GETTING STARTED" and "CODE ONLINE". At the bottom of the page, there is a section titled "Download the Arduino IDE" with two download options: "Windows Installer, for Windows XP and up" and "Windows ZIP file for non admin install".

2) You need a **driver for your USB communications/programming cable**. Several different ones are available. Choose the driver for the cable you have and the operating system for your computer.

Samurai Circuits board (SiLabs CP210x USB-to-Serial TTL) drivers:

The latest drivers from SiLabs' website

The SiLabs driver is installed by default on most Linux systems.



The screenshot shows a web browser window displaying the Silicon Labs website. The address bar shows the URL: <https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge->. The page features the Silicon Labs logo and navigation links: About, Products, Solutions, and Community & Support. A search bar is also present. The main content area is titled "CP210x USB to UART Bridge VCP Drivers" and includes a description of the drivers, a link to "AN197: The Serial Communications Guide for the CP210x", and a section for "Download Software". The "Download Software" section mentions updates to the CP210x Manufacturing DLL and Runtime DLL and provides links to download archived Application Note Software. A link for "Legacy OS software and driver package download links and support information" is also visible.

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Parametric Search | Cross-Reference Search

Search silabs.com

Silicon Labs » Products » Development Tools » Software » USB to UART Bridge VCP Drivers

CP210x USB to UART Bridge VCP Drivers

The CP210x USB to UART Bridge Virtual COM Port (VCP) drivers are required for device operation as a Virtual COM Port to facilitate host communication with CP210x products. These devices can also interface to a host using the [direct access driver](#). These drivers are static examples detailed in application note 197: The Serial Communications Guide for the CP210x, download an example below:

[AN197: The Serial Communications Guide for the CP210x](#)

Download Software

The CP210x Manufacturing DLL and Runtime DLL have been updated and must be used with v6.0 and later of the CP210x Windows VCP Driver. Application Note Software downloads affected are AN144SW.zip, AN205SW.zip and AN223SW.zip. If you are using a 5.x driver and need support you can download archived Application Note Software.

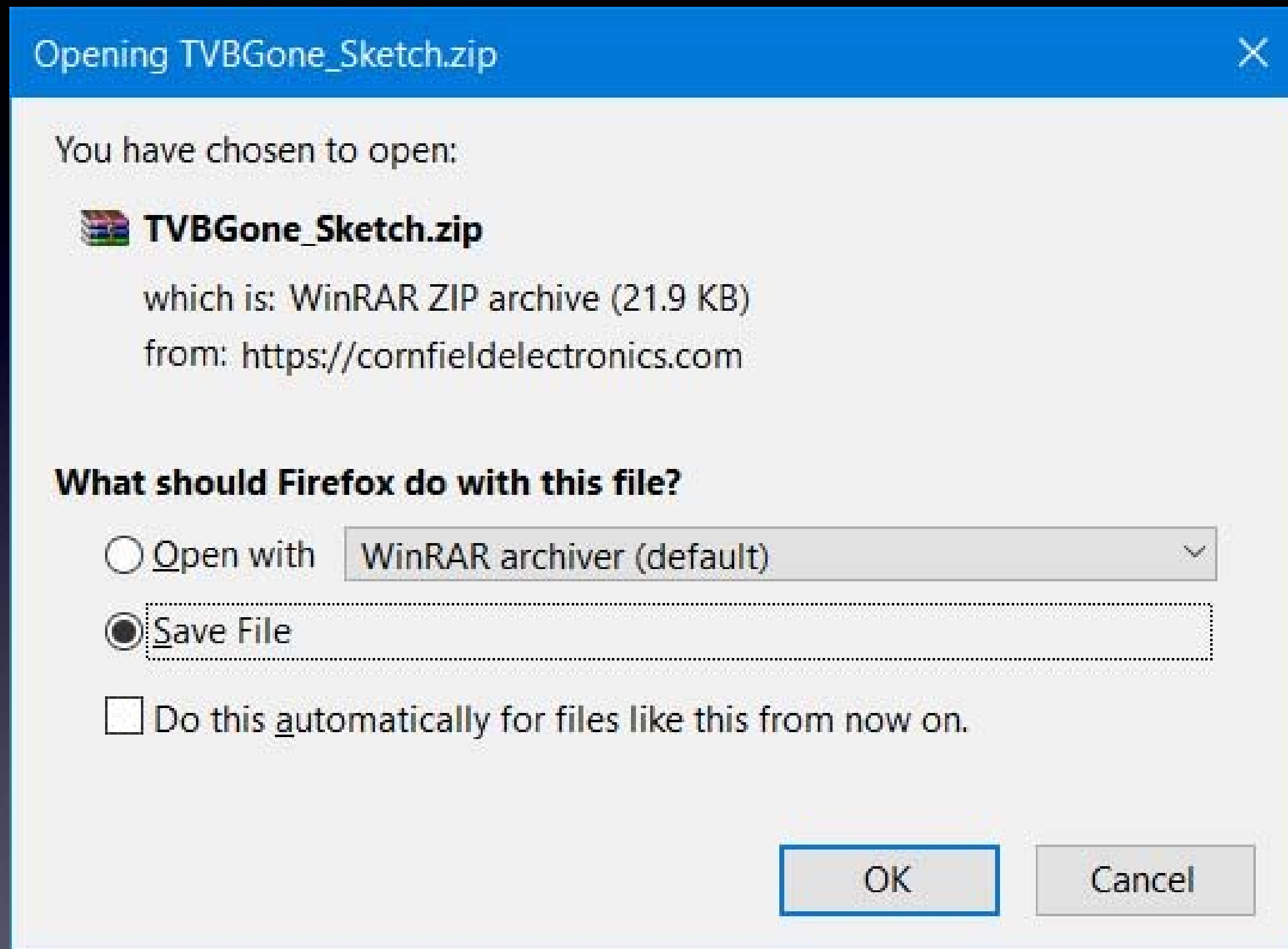
[Legacy OS software and driver package download links and support information](#) >

Download for Windows 10 Universal (v10.1.4)

community.silabs.com/t5/Interface-Knowledge-Base/Legacy-OS-Software-and-Driver-Packages/ta-p/182585

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[TV-B-Gone Arduino sketch\(22KB\)](#)



4) Schematic Diagram for Arduino TV-B-Gone remote control: Schematic Diagram(449KB)

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https://cornfeldelectronics.com/cfe/projects/tvbg_arduino/arduino_tvbgone_schematic.pdf

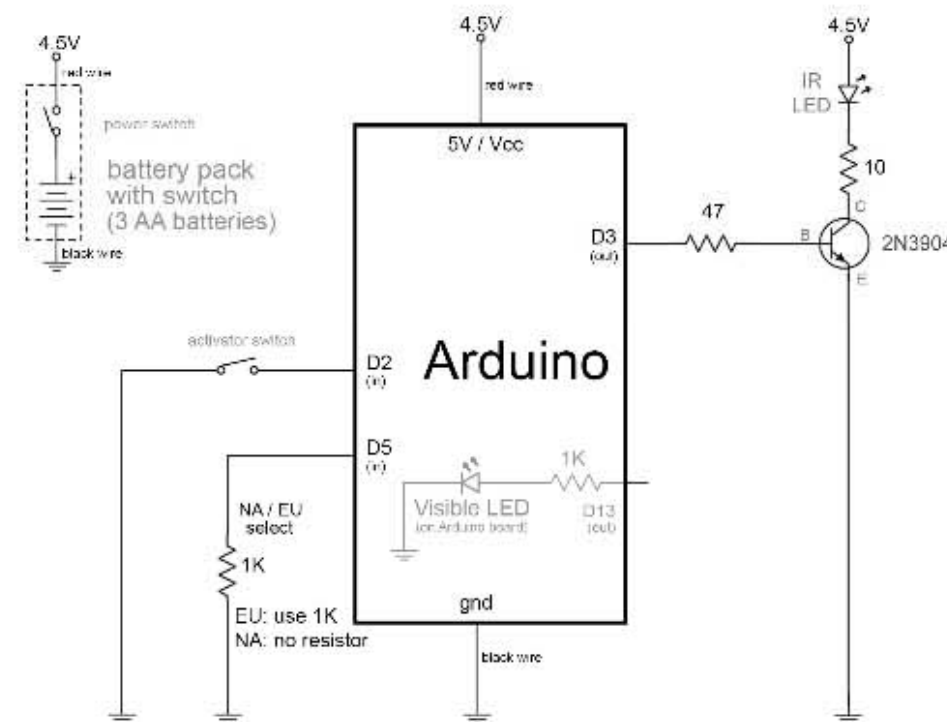
1 of 1

70%

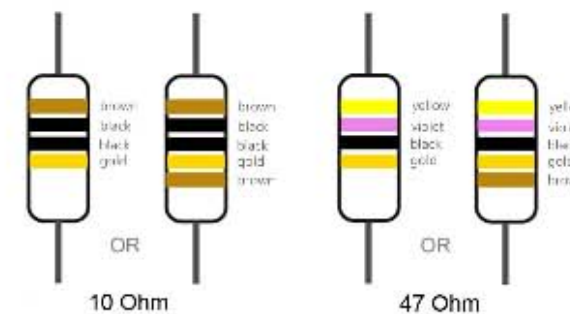
Arduino For Total Newbies

4-Sep-2015

Mitch Altman (original TV-B-Gone hardware and firmware, modified TV-B-Gone Arduino design)
Limore Fried (firmware modifications, kit design)
Ken Shiffert (original modifications for Arduino)
Johannes Schneemann (documentation)

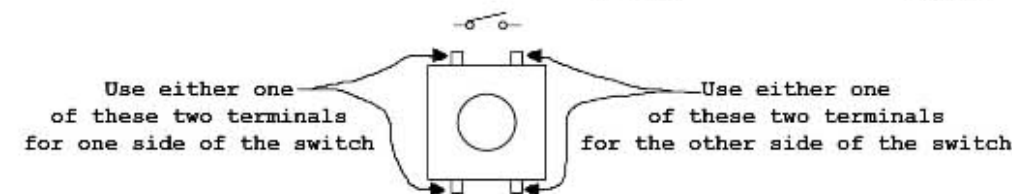


2N3904

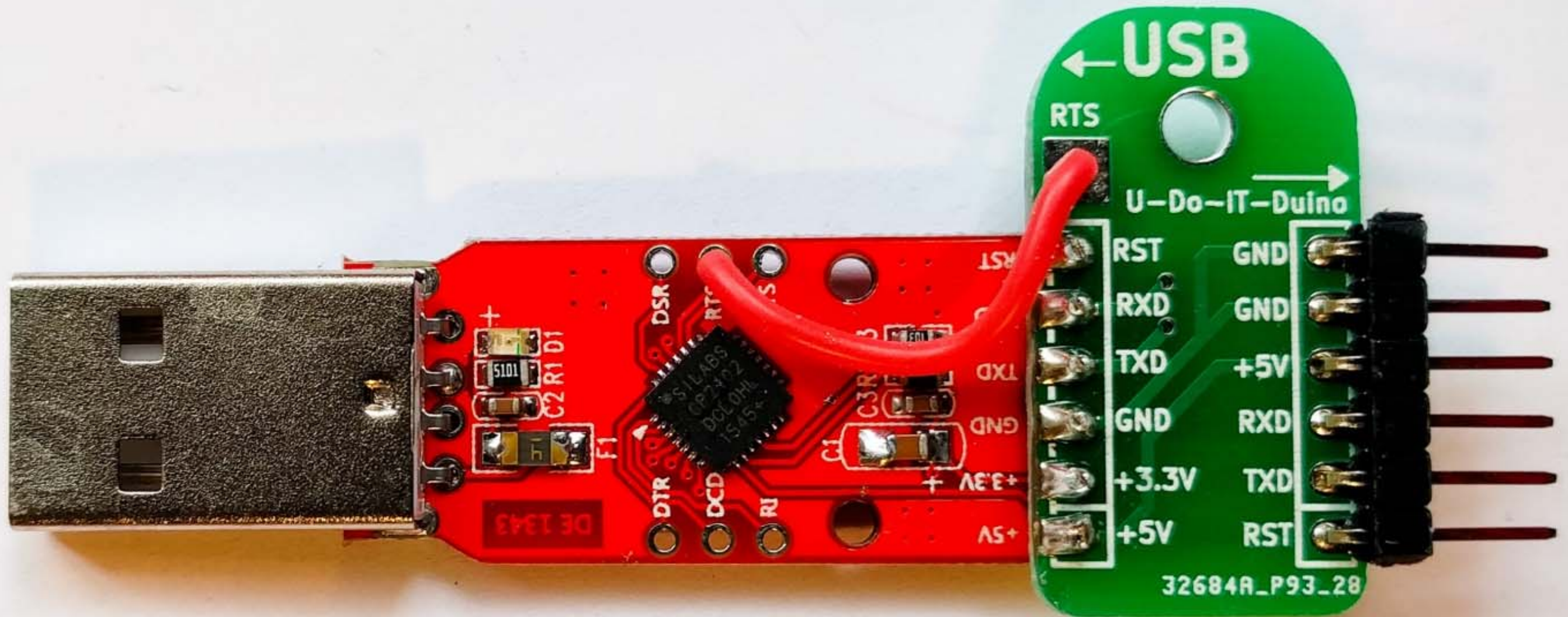


10 Ohm

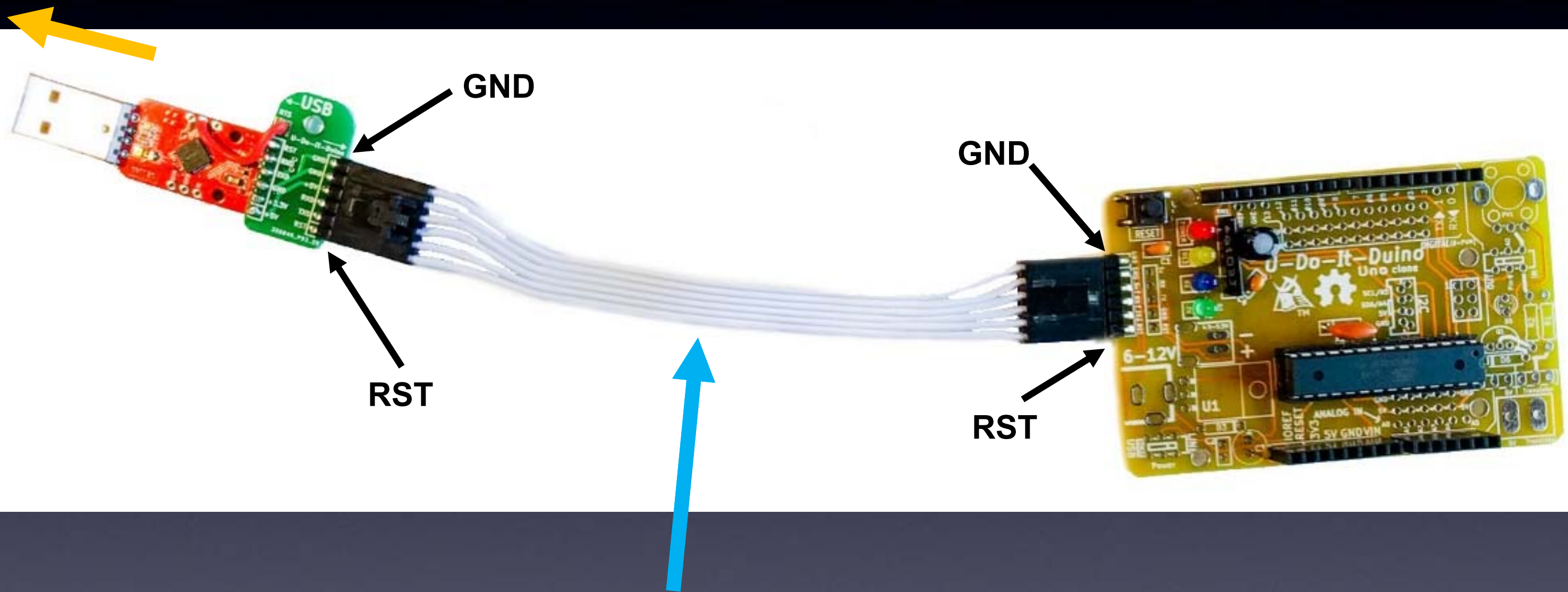
47 Ohm



USB-Serial Cable



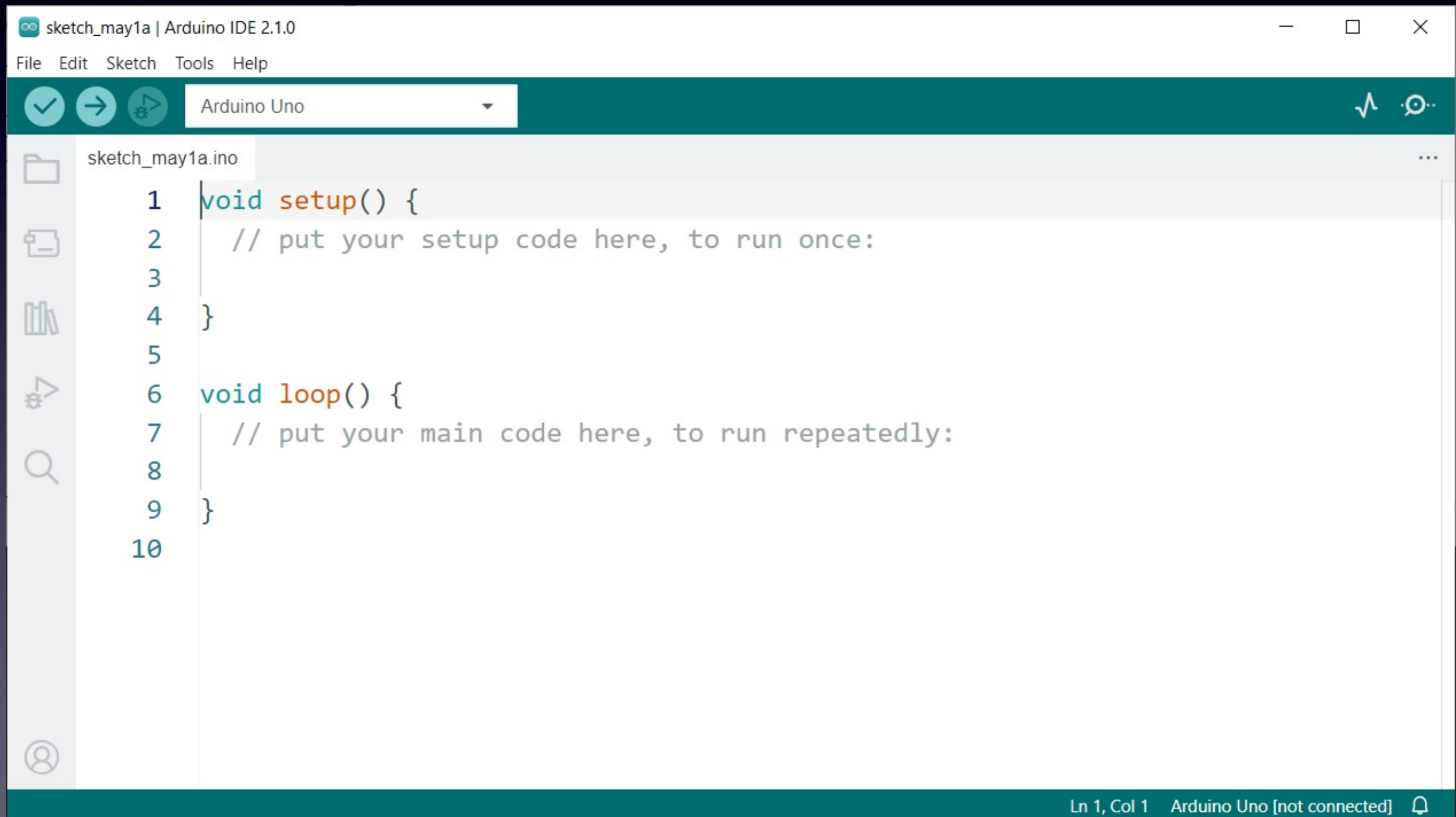
To computer's USB



no twists

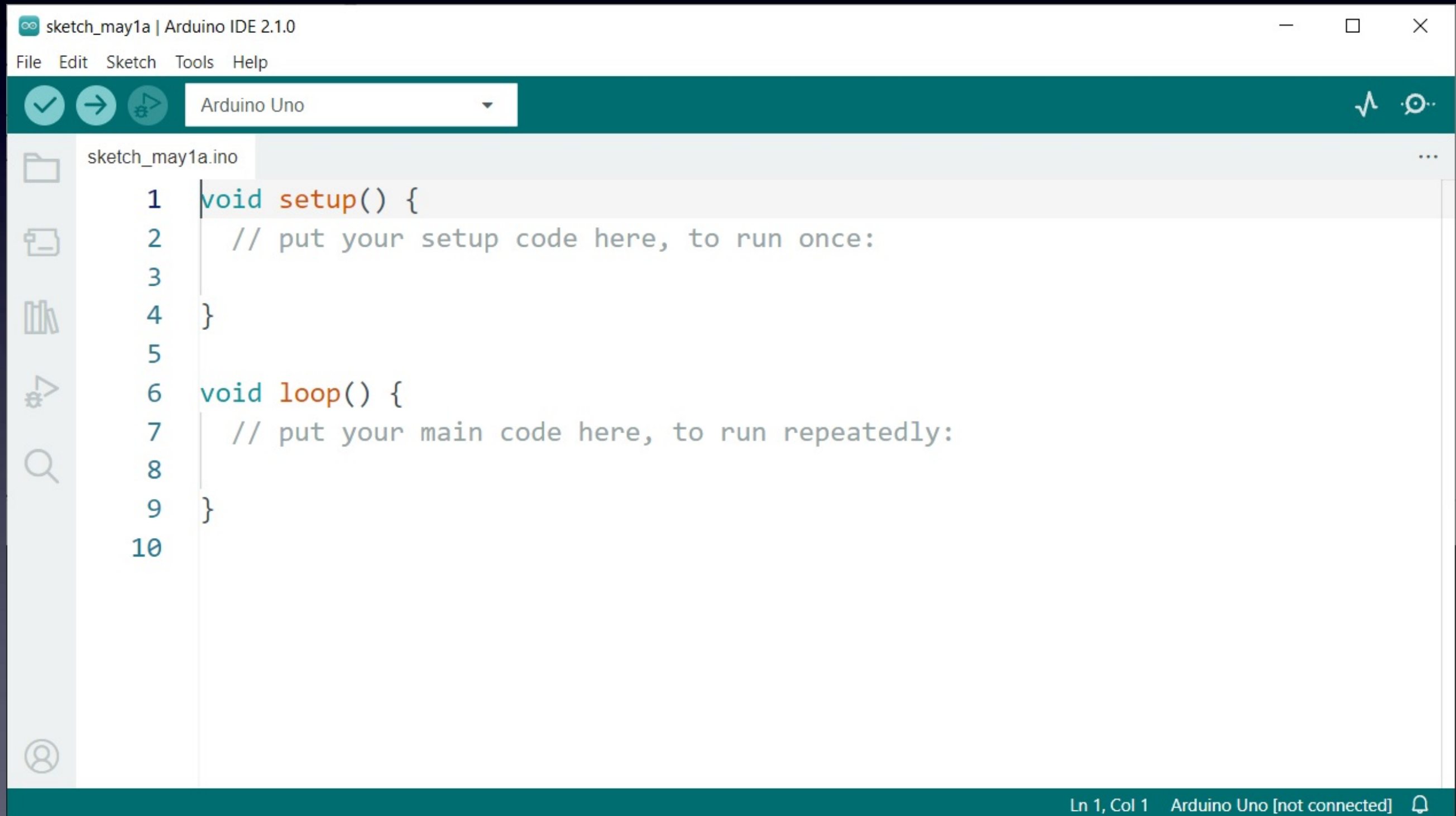
Arduino

After you download and install the Arduino software start it, and you will see a screen that looks like this:



Arduino

The **first time** you start your Arduino software you need to do **two things** to set things up:

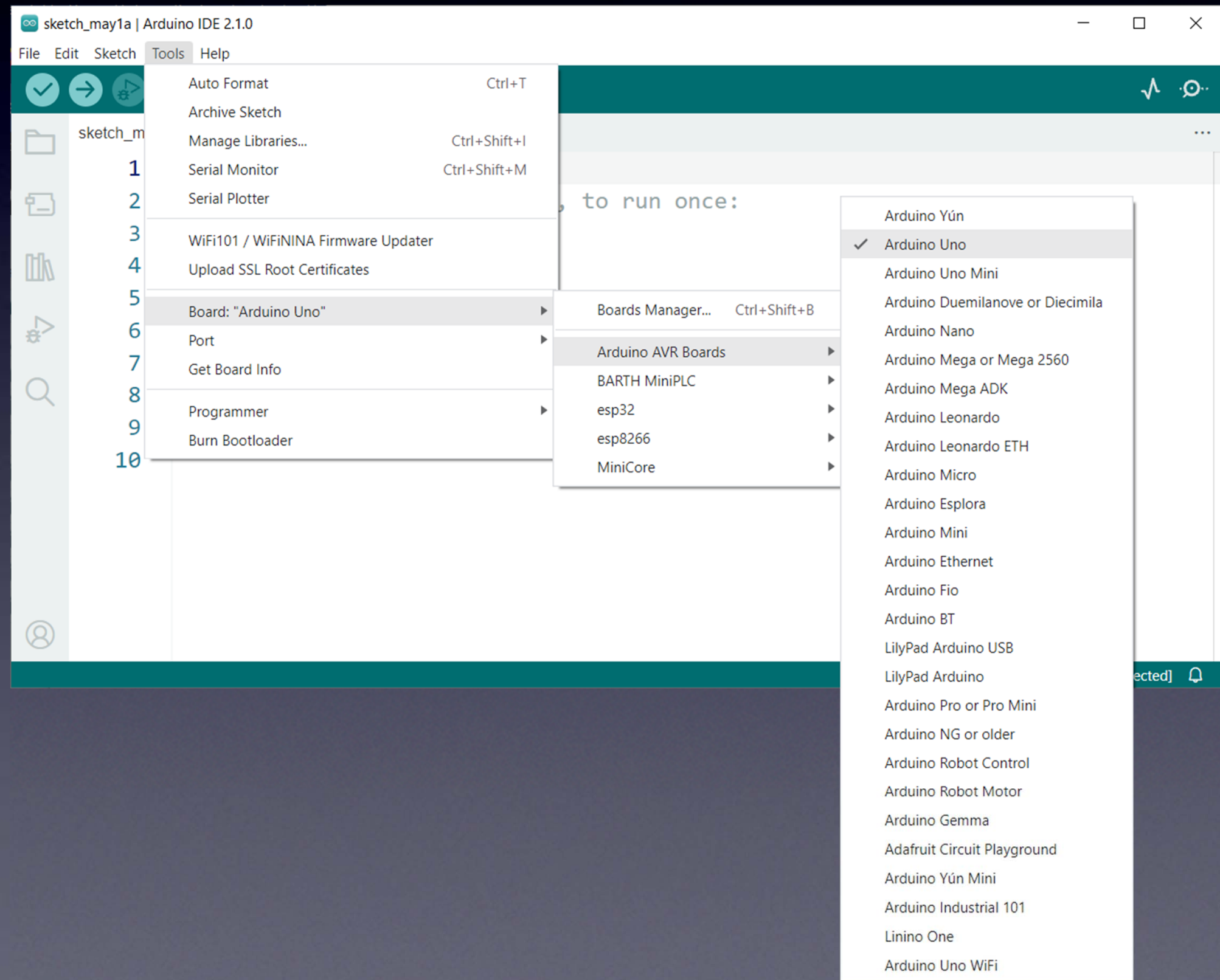


Arduino

The **first time** you start your Arduino software you need to do **two things** to set things up:

(1)
Choose “Uno”
as the Board

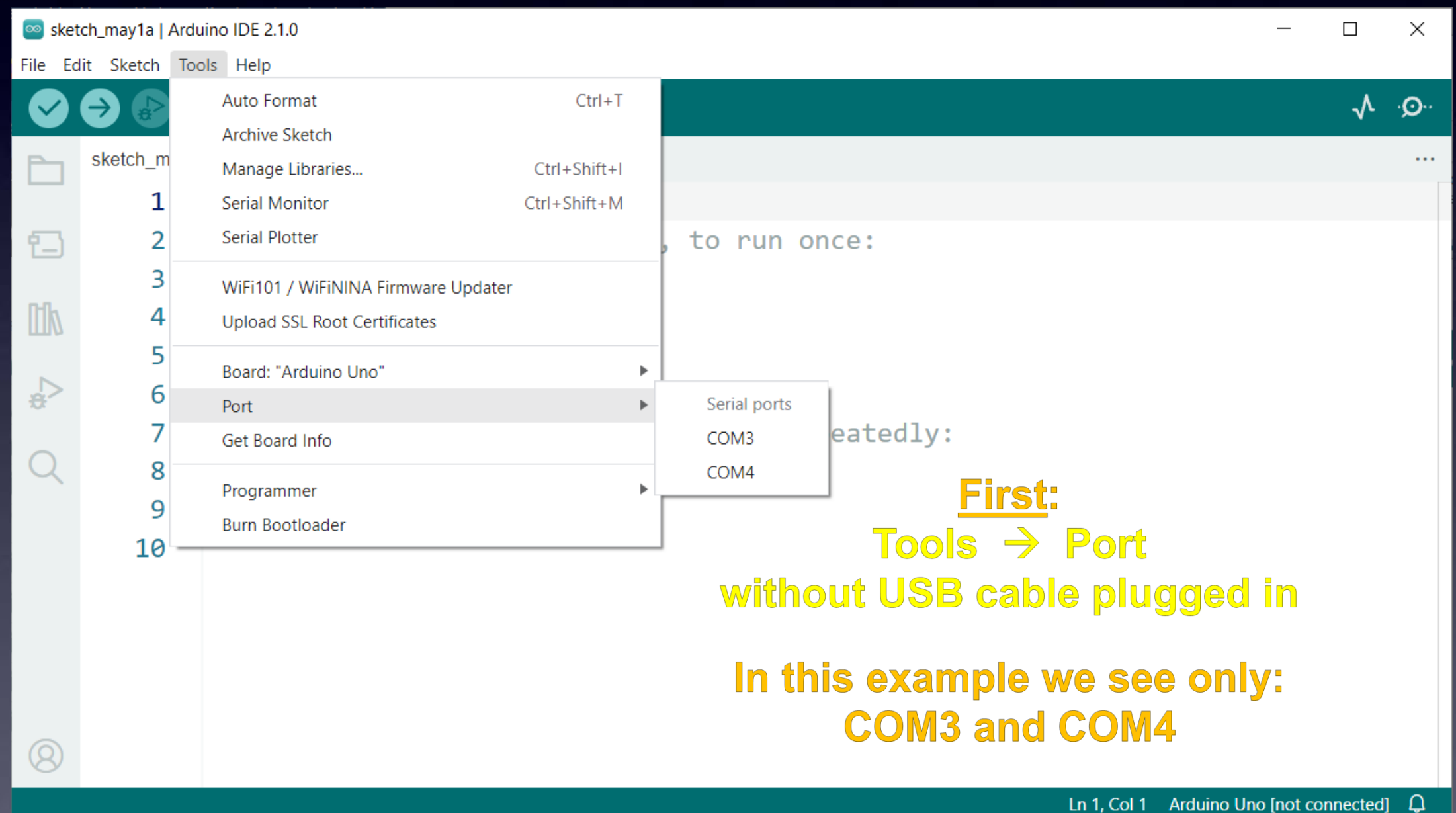
(Your
U-Do-It-Duino
acts
just like
an
Arduino Uno board)



Arduino

The **first time** you start your Arduino software you need to do **two things** to set things up:

(2)
Choose the Port
(this will be different depending on your Operating System)



First:
Tools → Port
without USB cable plugged in

In this example we see only:
COM3 and COM4

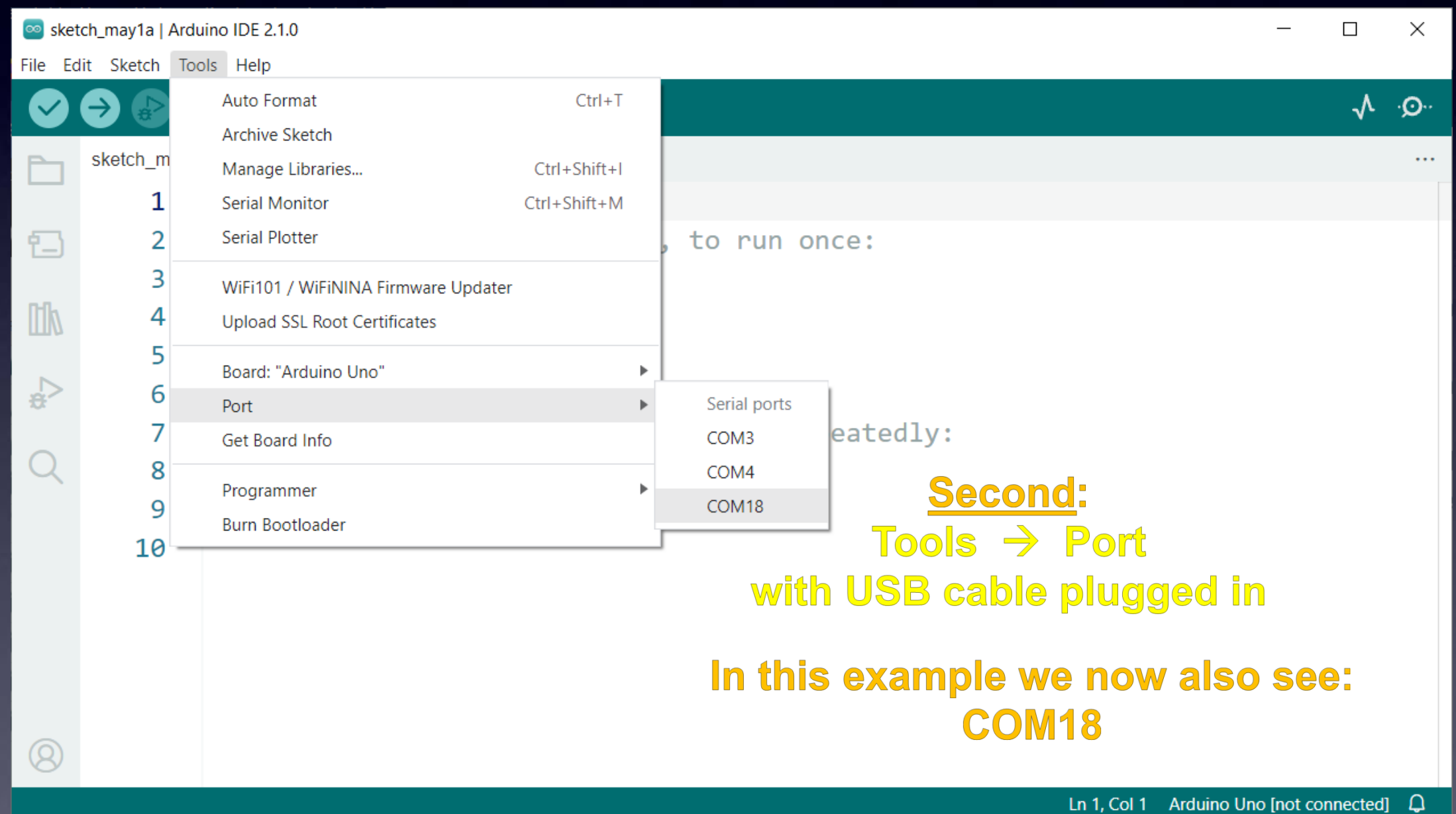
Arduino

The **first time** you start your Arduino software you need to do **two things** to set things up:

(2)

Choose the Port
(this will be different depending on your Operating System)

(After installing the driver for your USB-Serial cable, and plugging it in your operating system will see a serial port and it appears here.)



Second:
Tools → Port
with USB cable plugged in

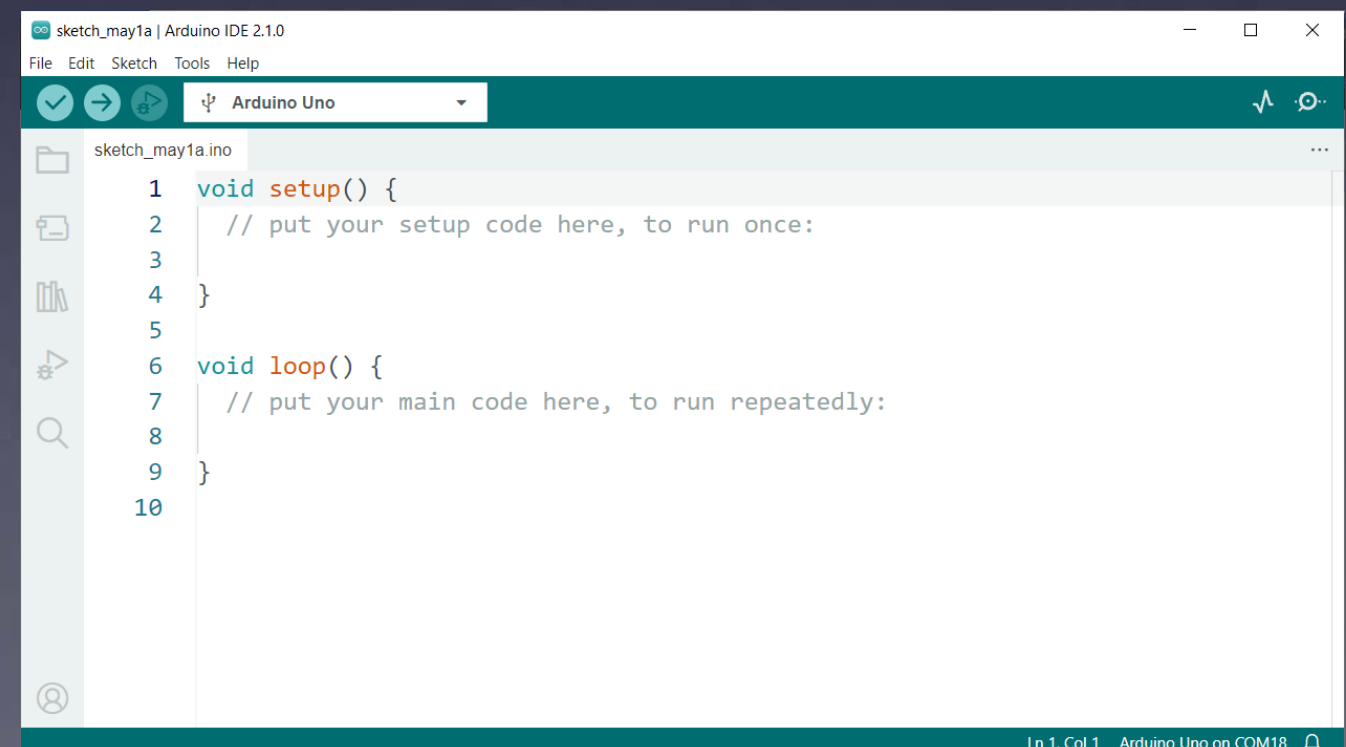
In this example we now also see:
COM18

Choose the new port:
In this example: COM18

Arduino

The *first time* you start your Arduino software
you need to do *two things* to set things up:

Your Arduino software is now ready
to program your
U-Do-It-Duino !

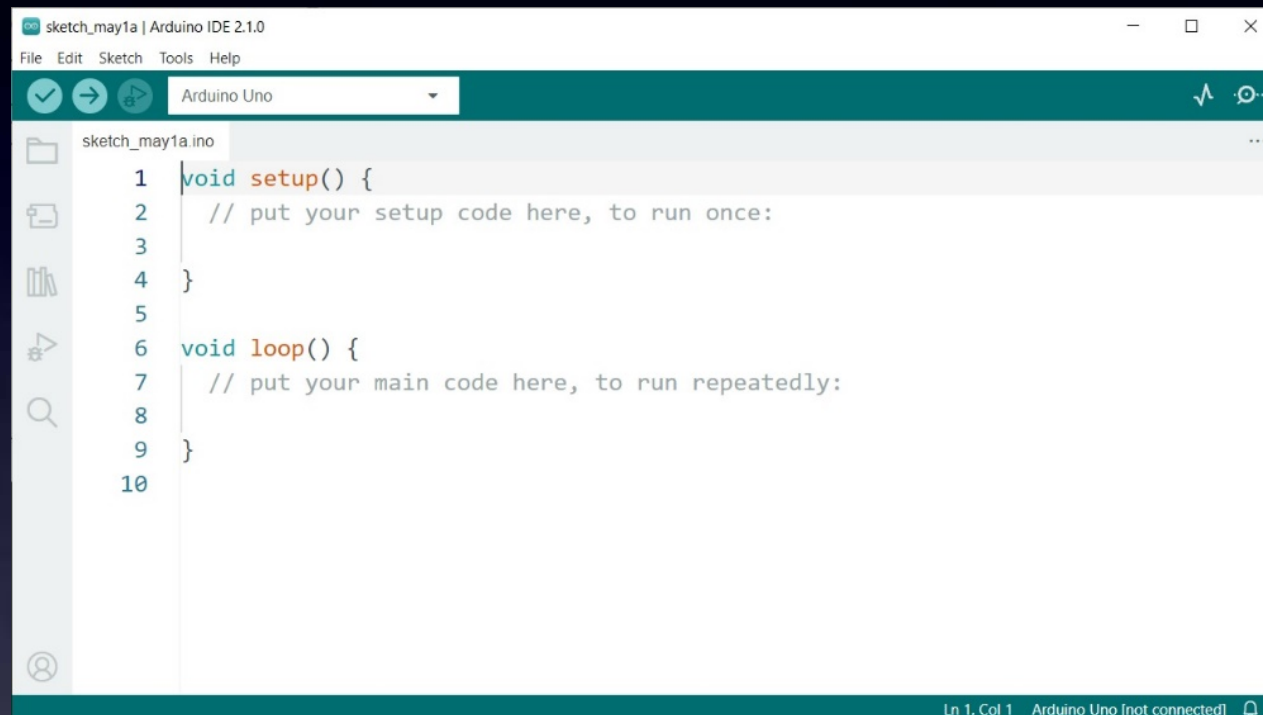


```
sketch_may1a | Arduino IDE 2.1.0
File Edit Sketch Tools Help
[Icons] Arduino Uno
sketch_may1a.ino
1 void setup() {
2   // put your setup code here, to run once:
3
4 }
5
6 void loop() {
7   // put your main code here, to run repeatedly:
8
9 }
10
```

Ln 1, Col 1 Arduino Uno on COM18

Arduino

Designed for non-geeky artists



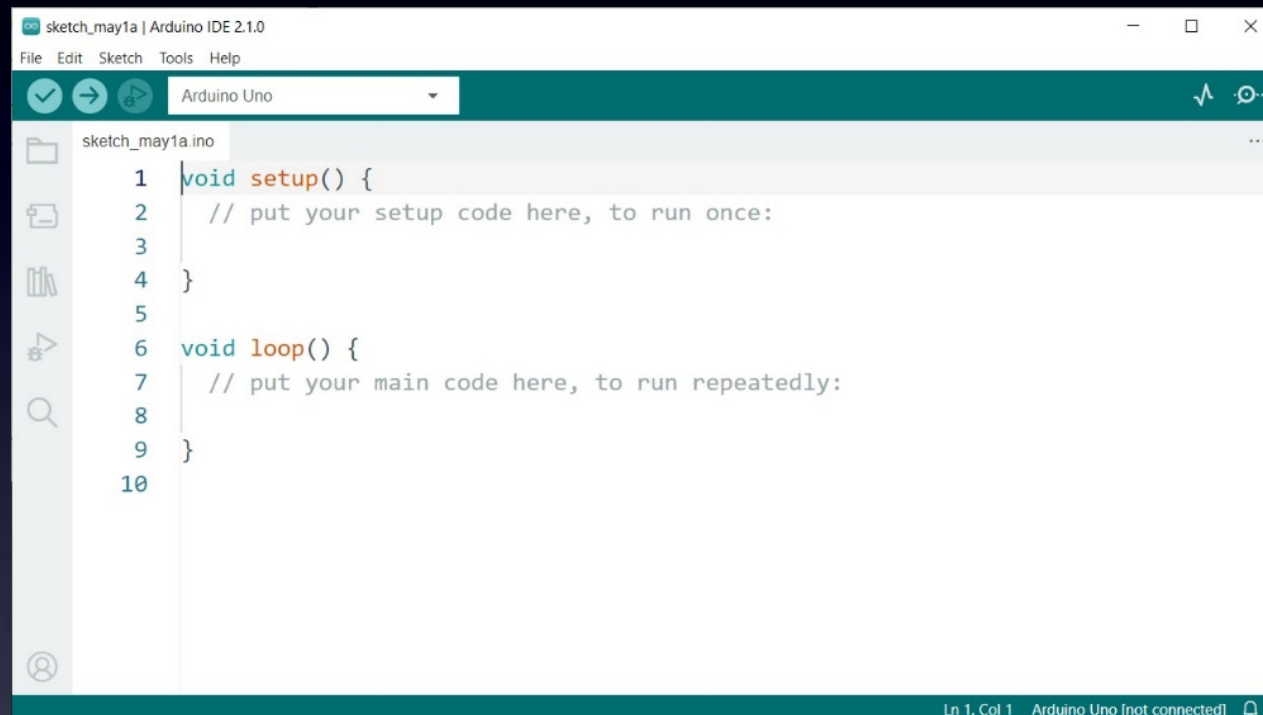
```
1 void setup() {  
2   // put your setup code here, to run once:  
3  
4 }  
5  
6 void loop() {  
7   // put your main code here, to run repeatedly:  
8  
9 }  
10
```

“Sketch” :

an Arduino program

Arduino

Designed for non-geeky artists



```
1 void setup() {  
2   // put your setup code here, to run once:  
3  
4 }  
5  
6 void loop() {  
7   // put your main code here, to run repeatedly:  
8  
9 }  
10
```

The Arduino language :

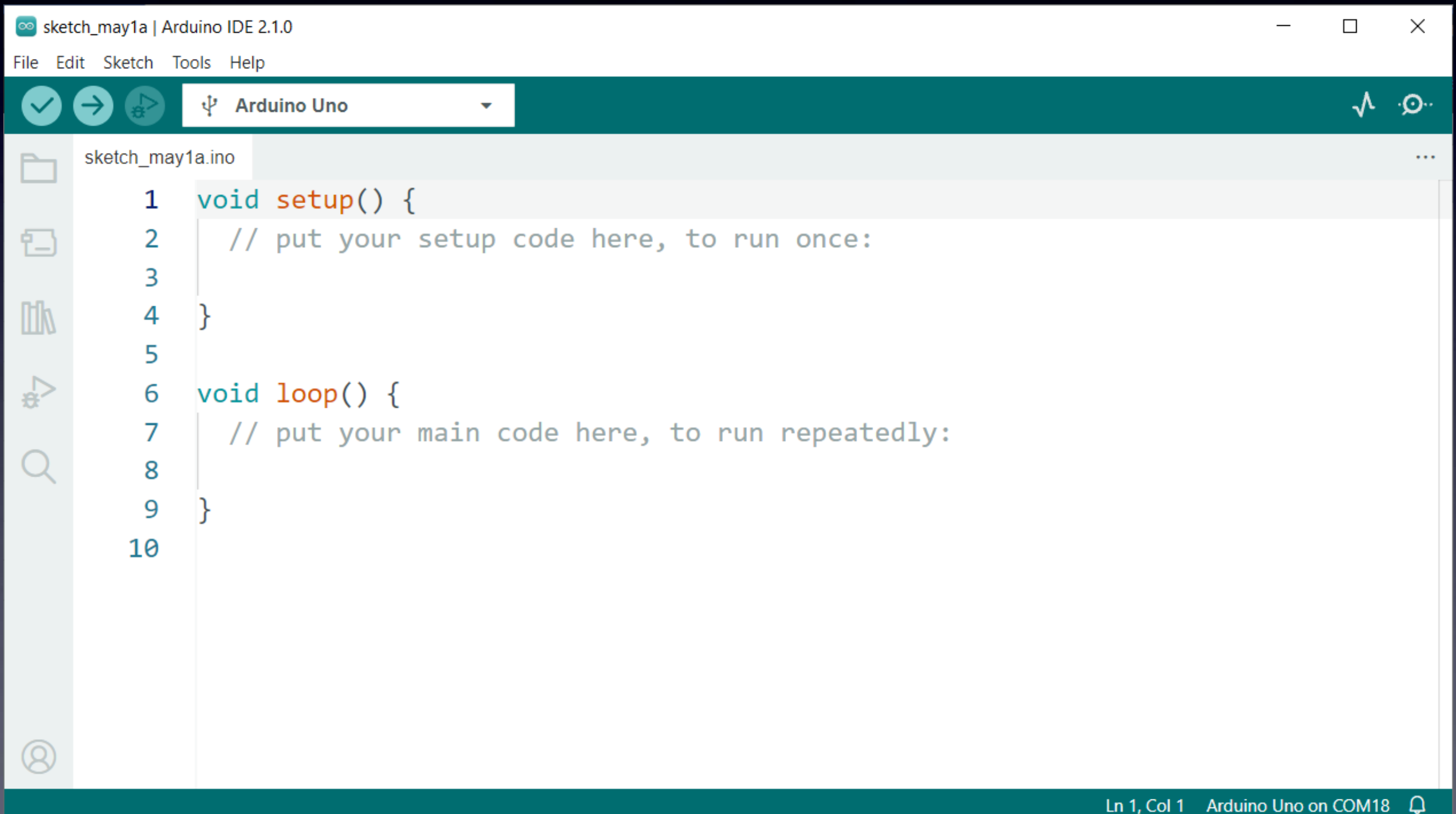
“Wiring”

(actually C/C++)

Arduino

Your Arduino software is now ready to program your U-Do-It-Duino !

Let's make an LED blink! Hello World

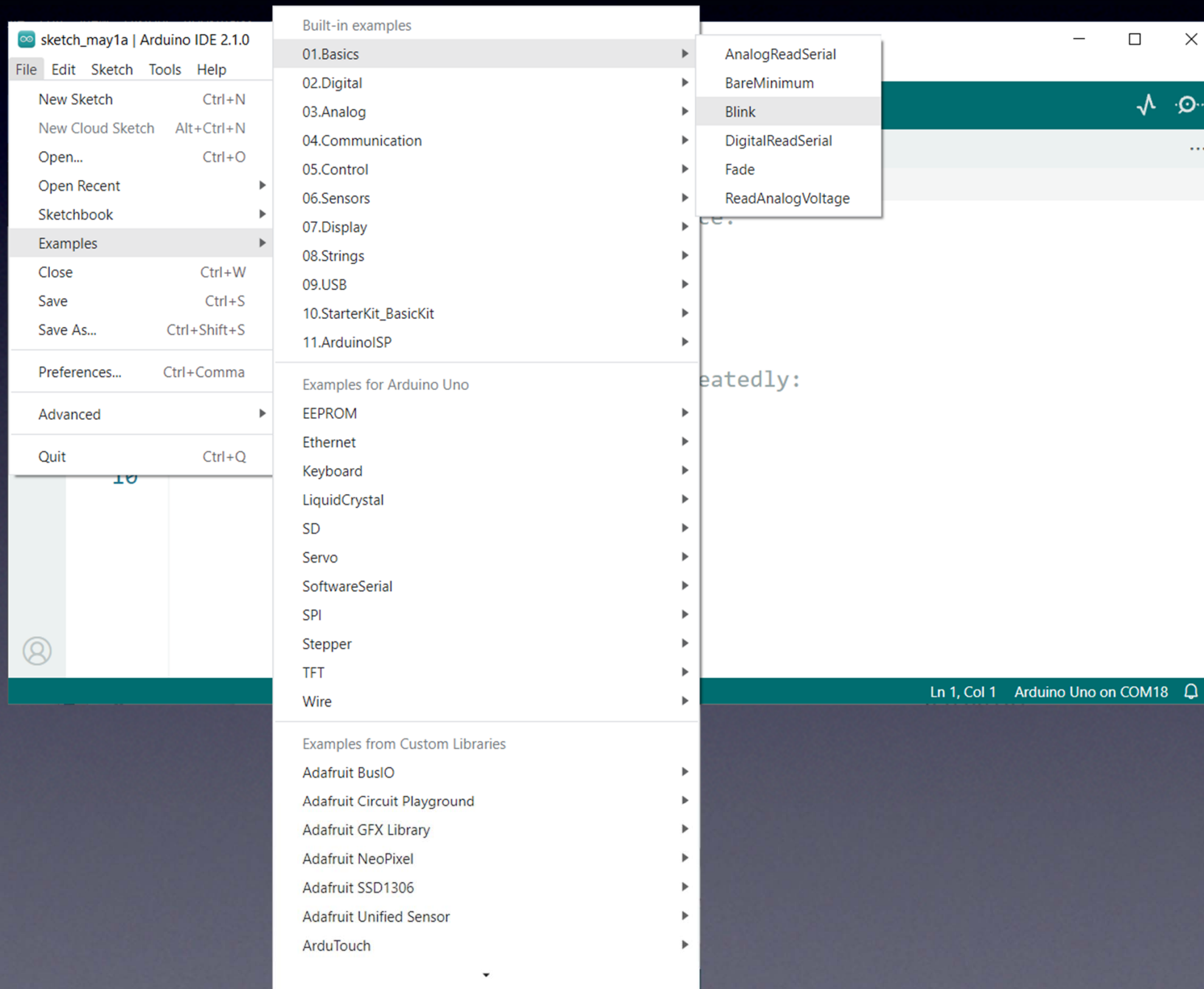


```
sketch_may1a | Arduino IDE 2.1.0
File Edit Sketch Tools Help
[Check] [Run] [Upload] Arduino Uno
sketch_may1a.ino
1 void setup() {
2   // put your setup code here, to run once:
3
4 }
5
6 void loop() {
7   // put your main code here, to run repeatedly:
8
9 }
10
Ln 1, Col 1 Arduino Uno on COM18
```


Arduino

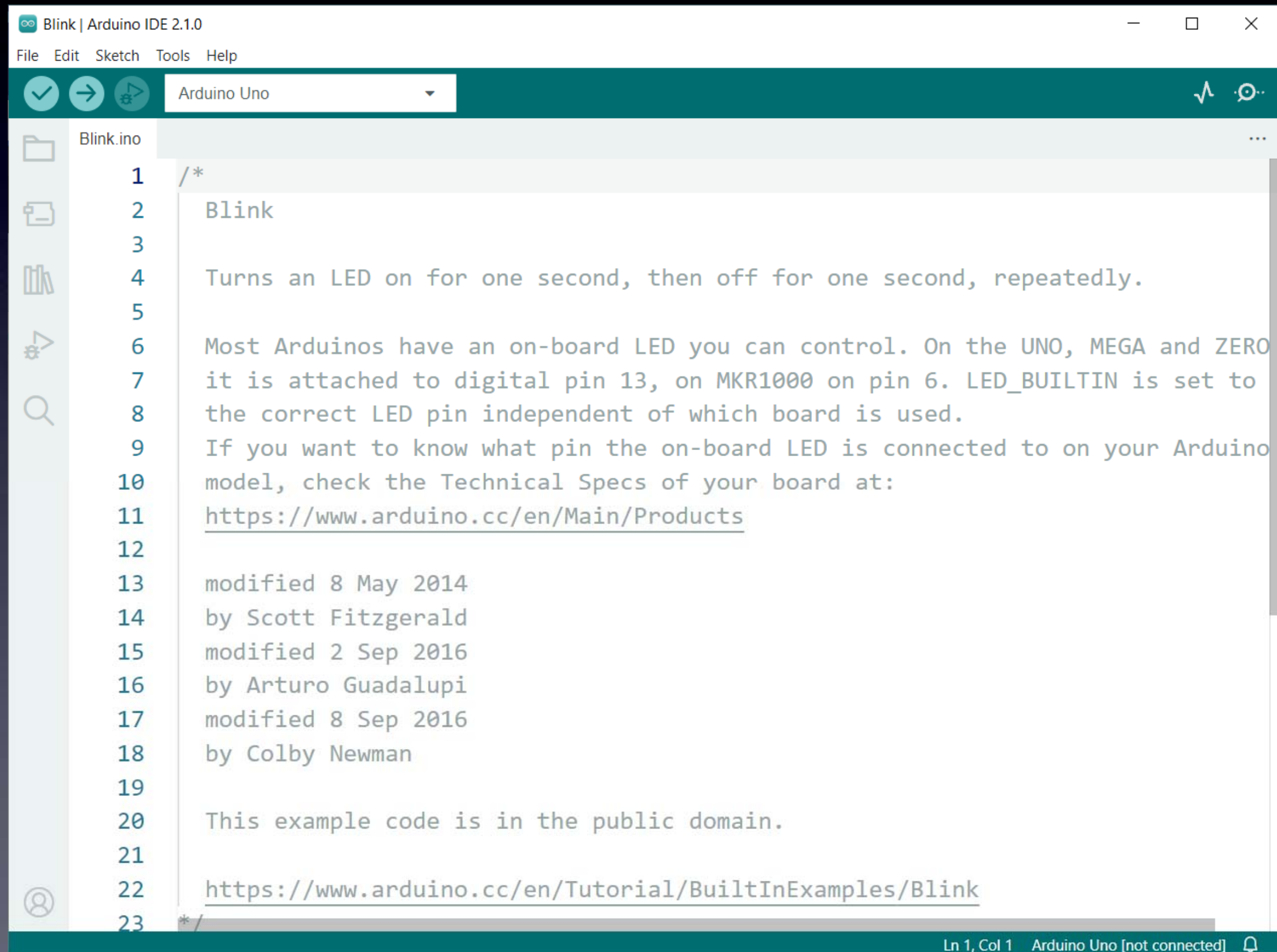
Your Arduino software is now ready to program your U-Do-It-Duino !

Let's make an LED blink! Hello World



Arduino

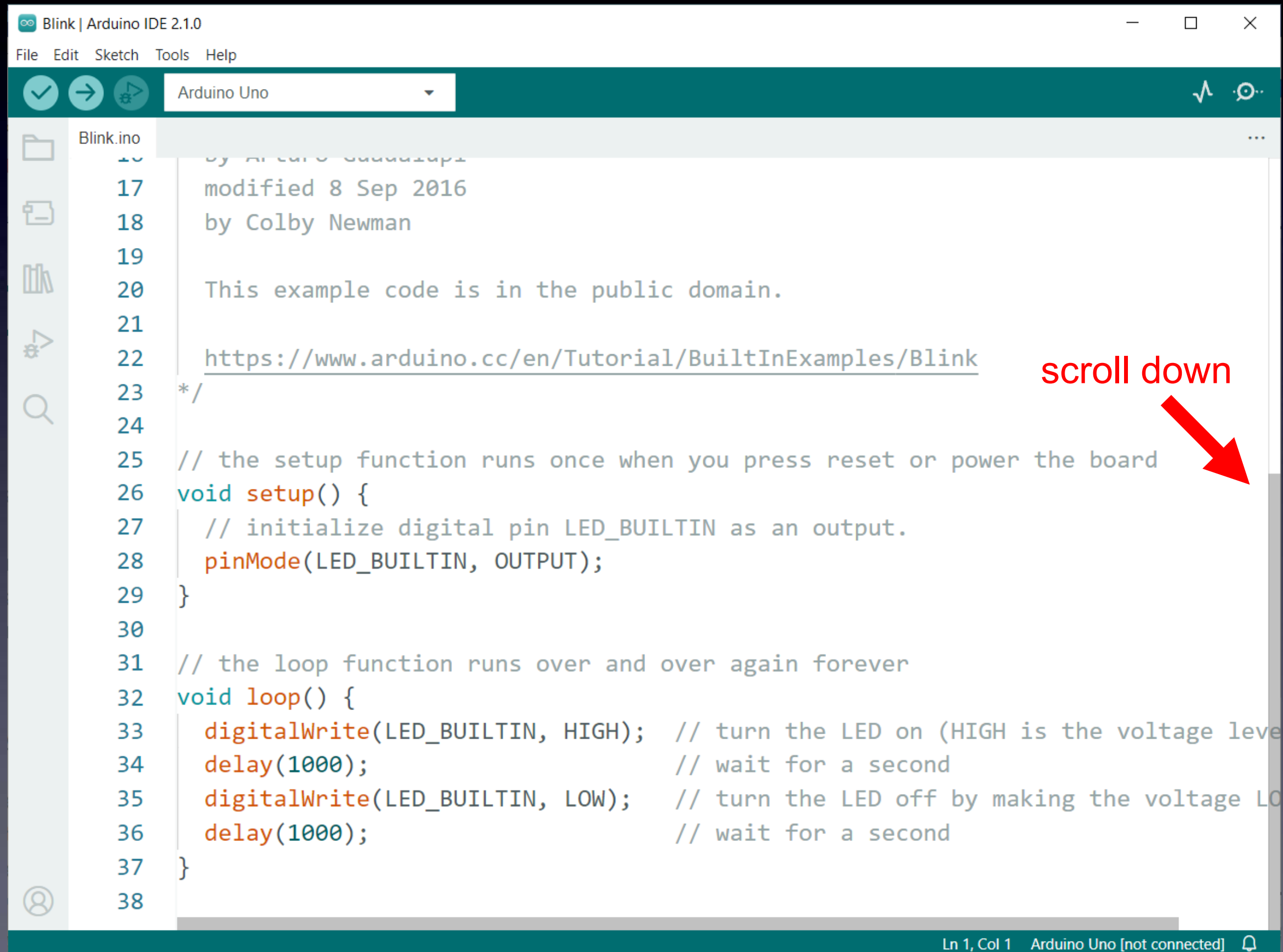
Let's make an LED blink! Hello World



```
1  /*
2   Blink
3
4   Turns an LED on for one second, then off for one second, repeatedly.
5
6   Most Arduinos have an on-board LED you can control. On the UNO, MEGA and ZERO
7   it is attached to digital pin 13, on MKR1000 on pin 6. LED_BUILTIN is set to
8   the correct LED pin independent of which board is used.
9   If you want to know what pin the on-board LED is connected to on your Arduino
10  model, check the Technical Specs of your board at:
11  https://www.arduino.cc/en/Main/Products
12
13  modified 8 May 2014
14  by Scott Fitzgerald
15  modified 2 Sep 2016
16  by Arturo Guadalupi
17  modified 8 Sep 2016
18  by Colby Newman
19
20  This example code is in the public domain.
21
22  https://www.arduino.cc/en/Tutorial/BuiltInExamples/Blink
23  */
```


Arduino

Let's make an LED blink! Hello World



Blink | Arduino IDE 2.1.0

File Edit Sketch Tools Help

Arduino Uno

Blink.ino

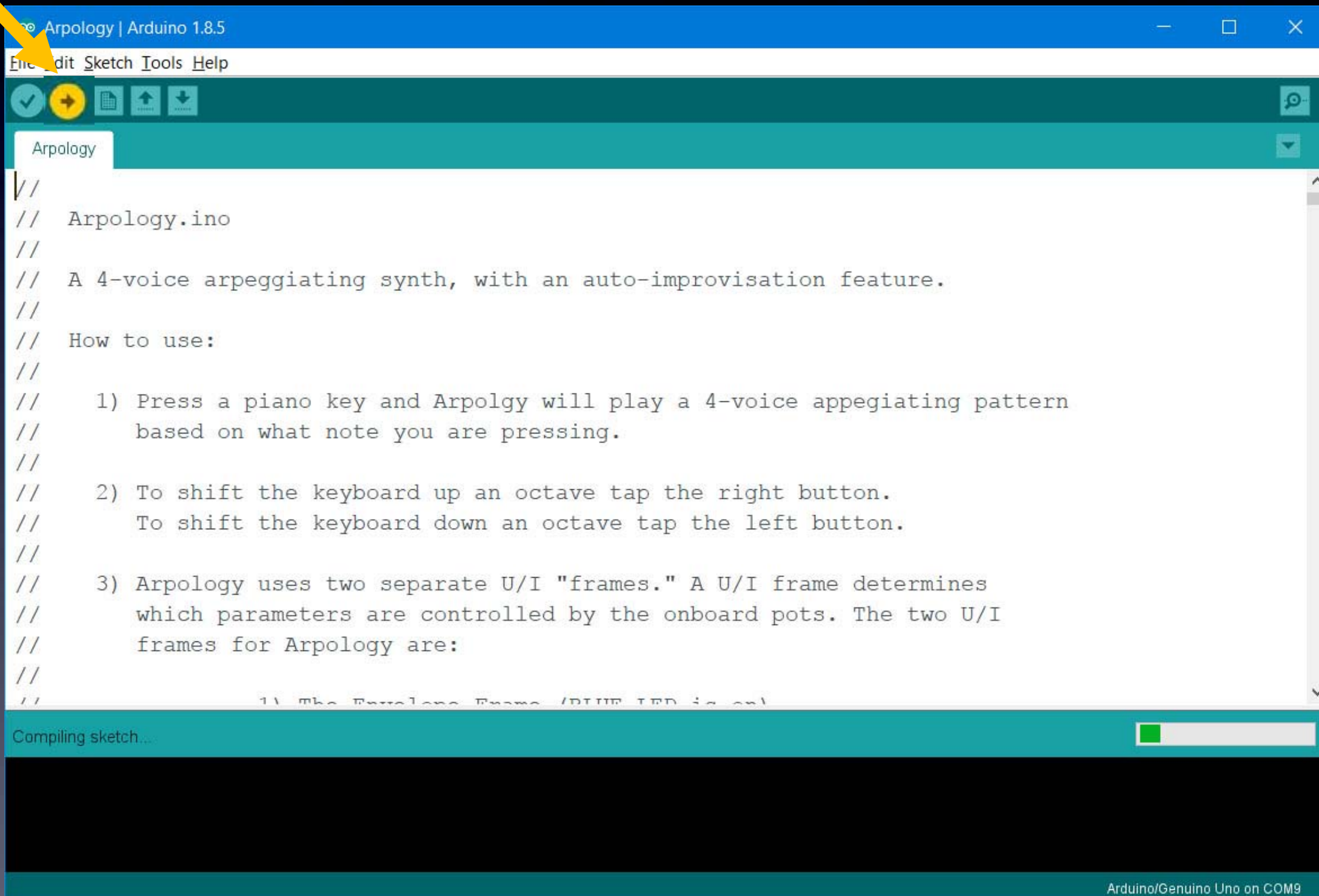
```
16  // by Arduino.cc
17  modified 8 Sep 2016
18  by Colby Newman
19
20  This example code is in the public domain.
21
22  https://www.arduino.cc/en/Tutorial/BuiltInExamples/Blink
23  */
24
25  // the setup function runs once when you press reset or power the board
26  void setup() {
27    // initialize digital pin LED_BUILTIN as an output.
28    pinMode(LED_BUILTIN, OUTPUT);
29  }
30
31  // the loop function runs over and over again forever
32  void loop() {
33    digitalWrite(LED_BUILTIN, HIGH); // turn the LED on (HIGH is the voltage level)
34    delay(1000);                      // wait for a second
35    digitalWrite(LED_BUILTIN, LOW);  // turn the LED off by making the voltage LOW
36    delay(1000);                      // wait for a second
37  }
38
```

scroll down

Ln 1, Col 1 Arduino Uno [not connected]

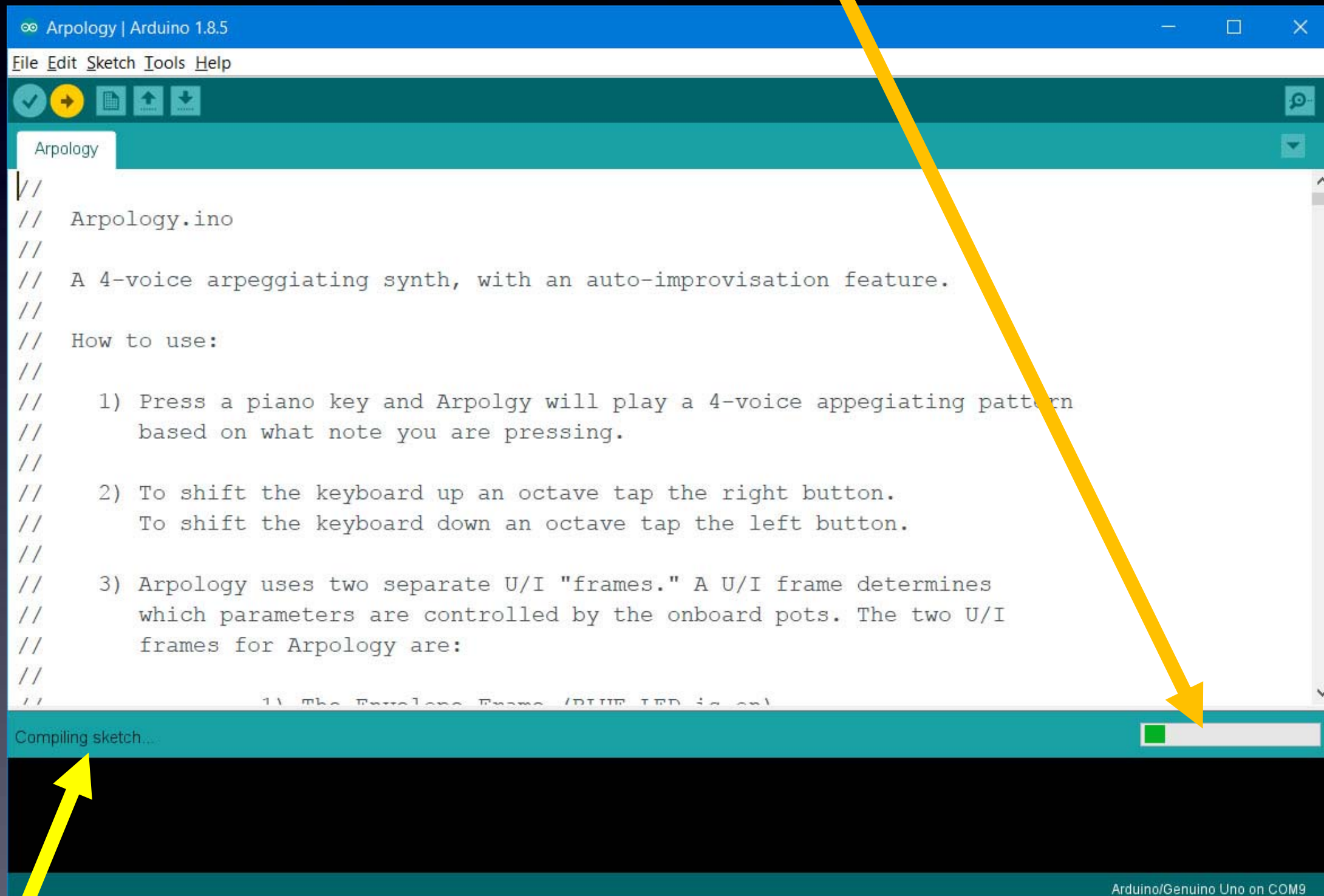
Arduino

With the USB-Serial cable connected to your ArduTouch board press the Upload button



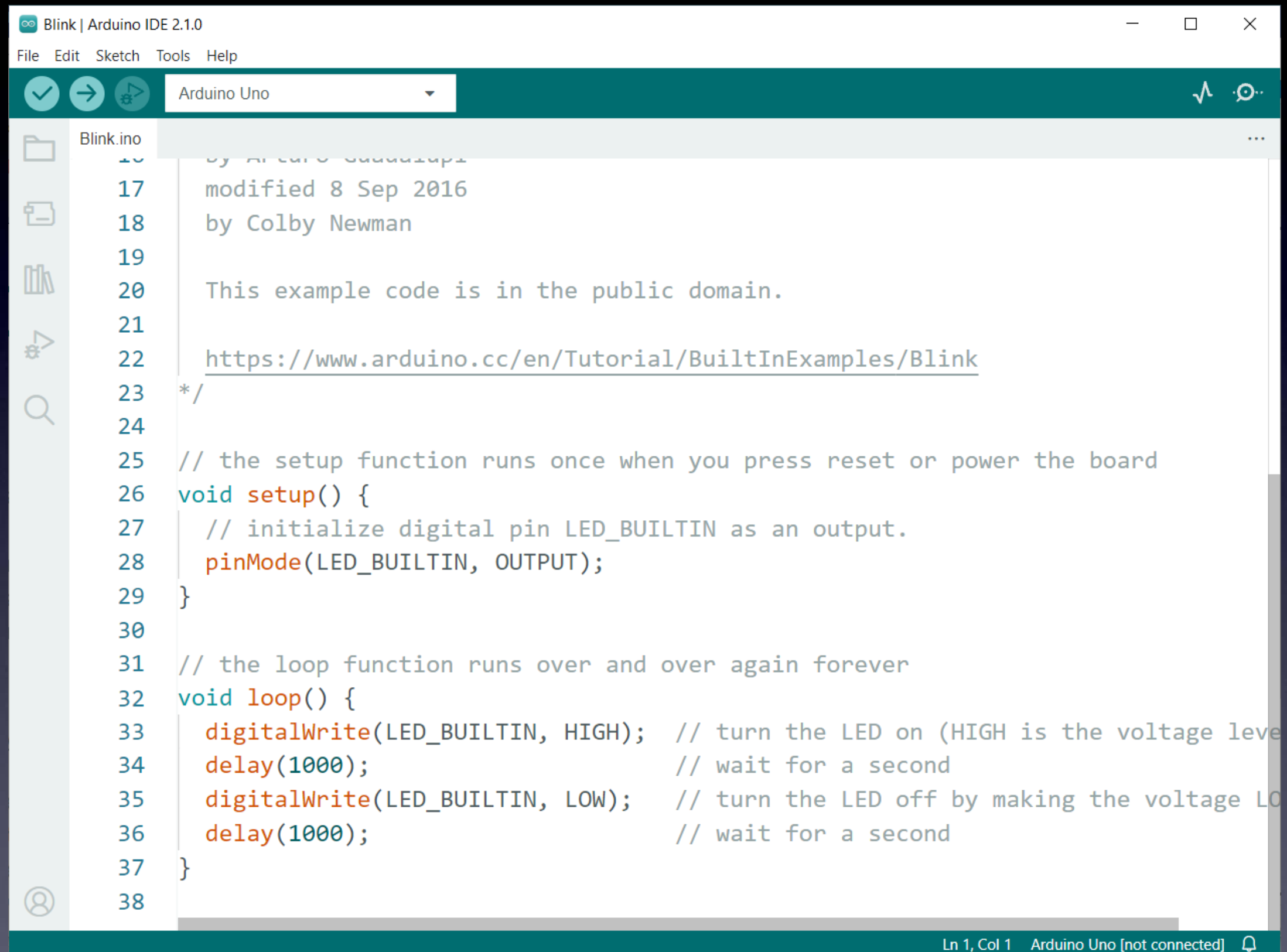
Arduino

While uploading, you will see a progress bar...



...and when it's completed successfully, it says: "Upload done"

How to Hack Arduino Programs (“Sketches”)



```
16  by Arduino Corporation
17  modified 8 Sep 2016
18  by Colby Newman
19
20  This example code is in the public domain.
21
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```

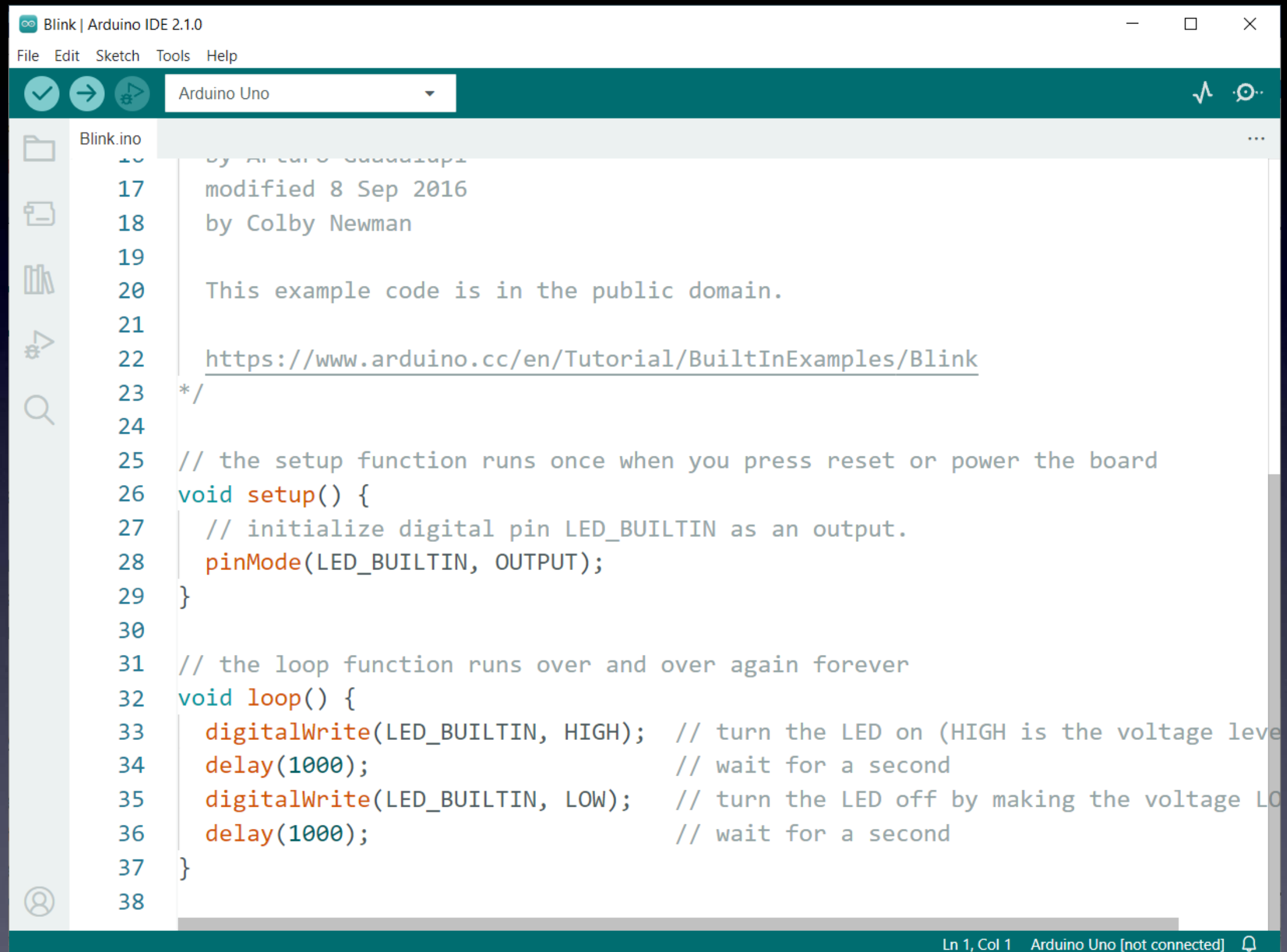
Ln 1, Col 1 Arduino Uno [not connected]

How to Hack Arduino Programs (“Sketches”)

Many ways!

Here are just a few:

- Change blink rates
- External LED
- External motor
- External speaker
- External LED on Solderless breadboard
- More complex projects on Solderless breadboard

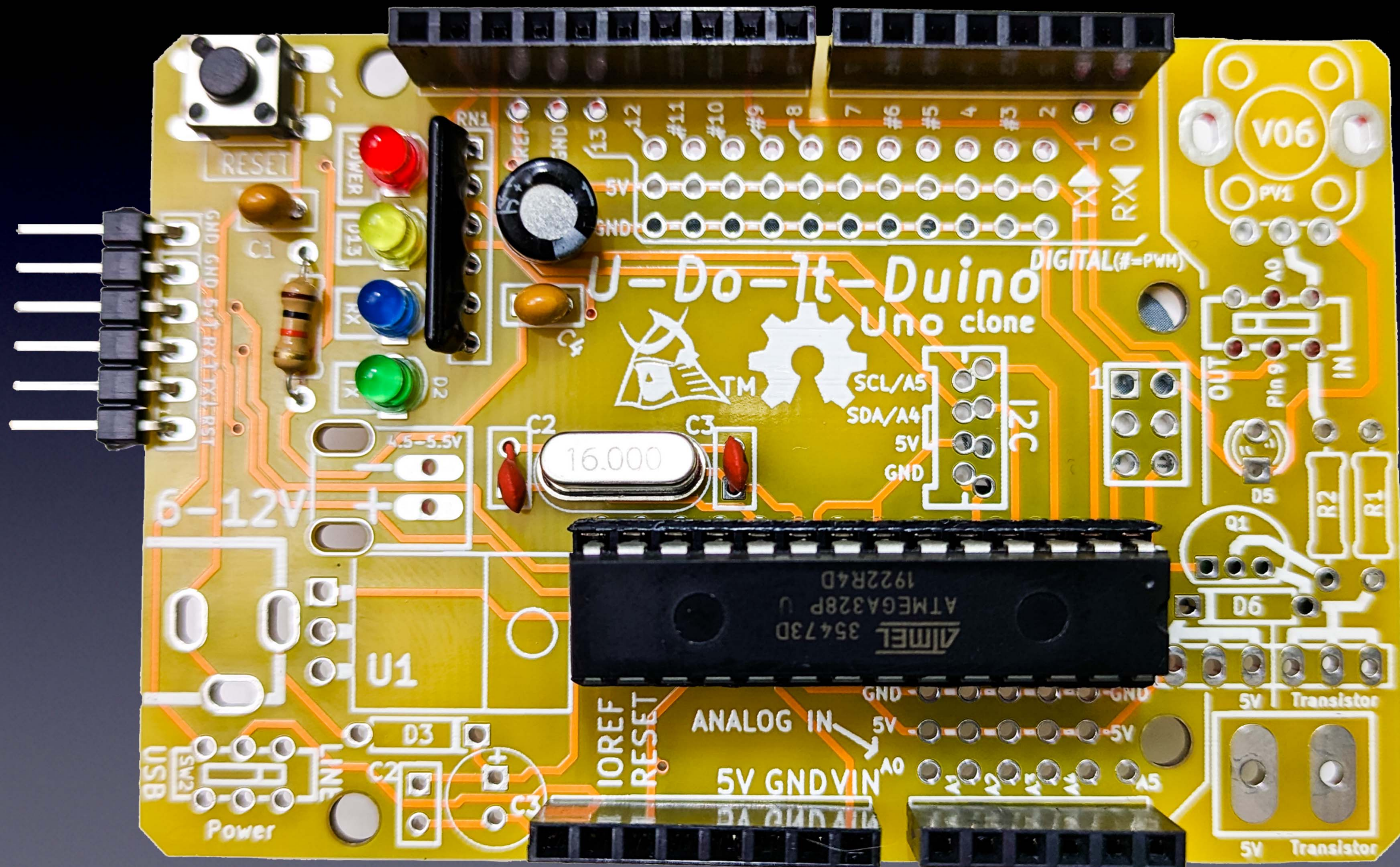


```
Blink | Arduino IDE 2.1.0
File Edit Sketch Tools Help
[Icons] Arduino Uno [Dropdown] [Icons]

Blink.ino
16 by Arduino Corporation
17 modified 8 Sep 2016
18 by Colby Newman
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20 This example code is in the public domain.
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22 https://www.arduino.cc/en/Tutorial/BuiltInExamples/Blink
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```

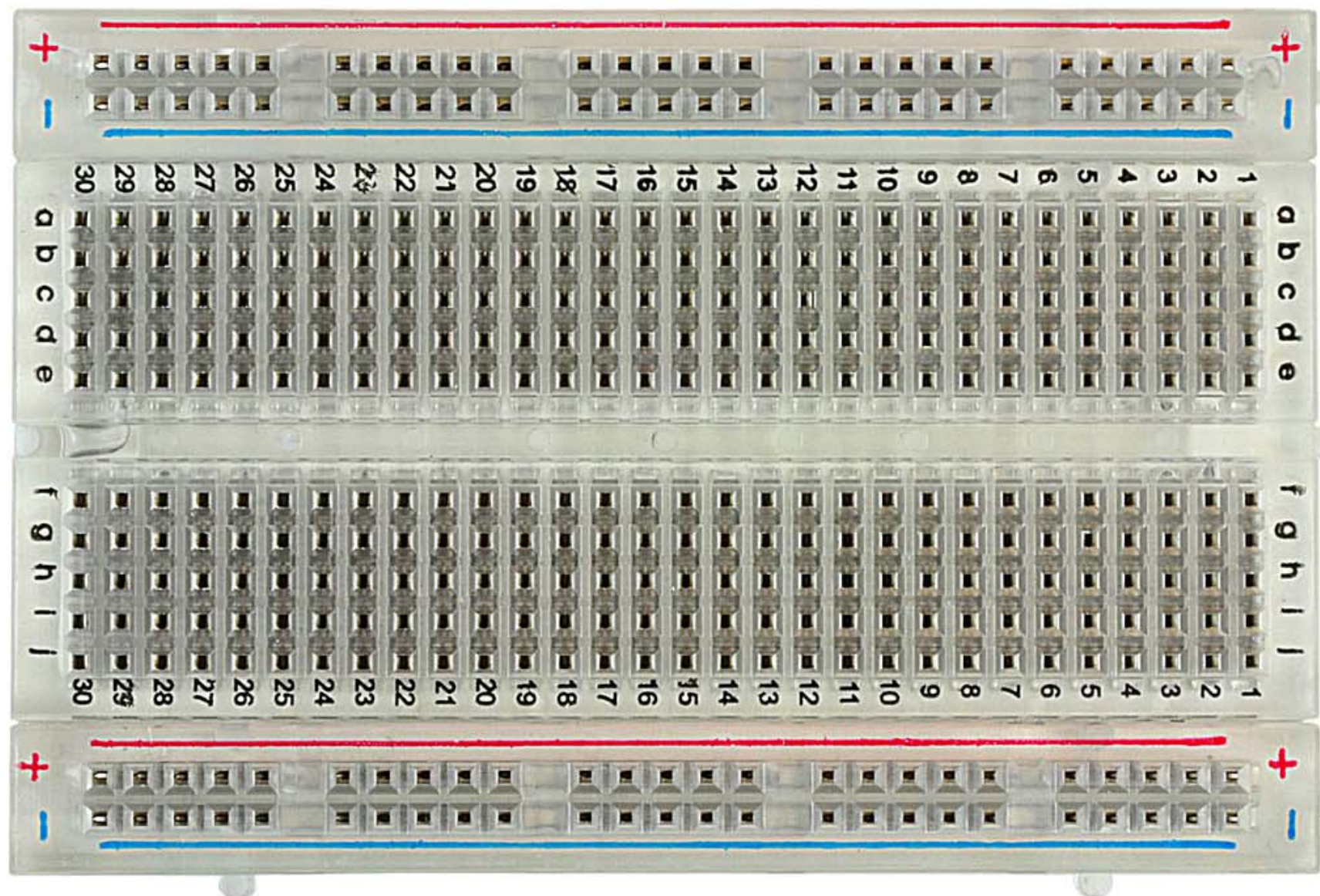
Ln 1, Col 1 Arduino Uno [not connected]

How to Hack Arduino Programs (“Sketches”)



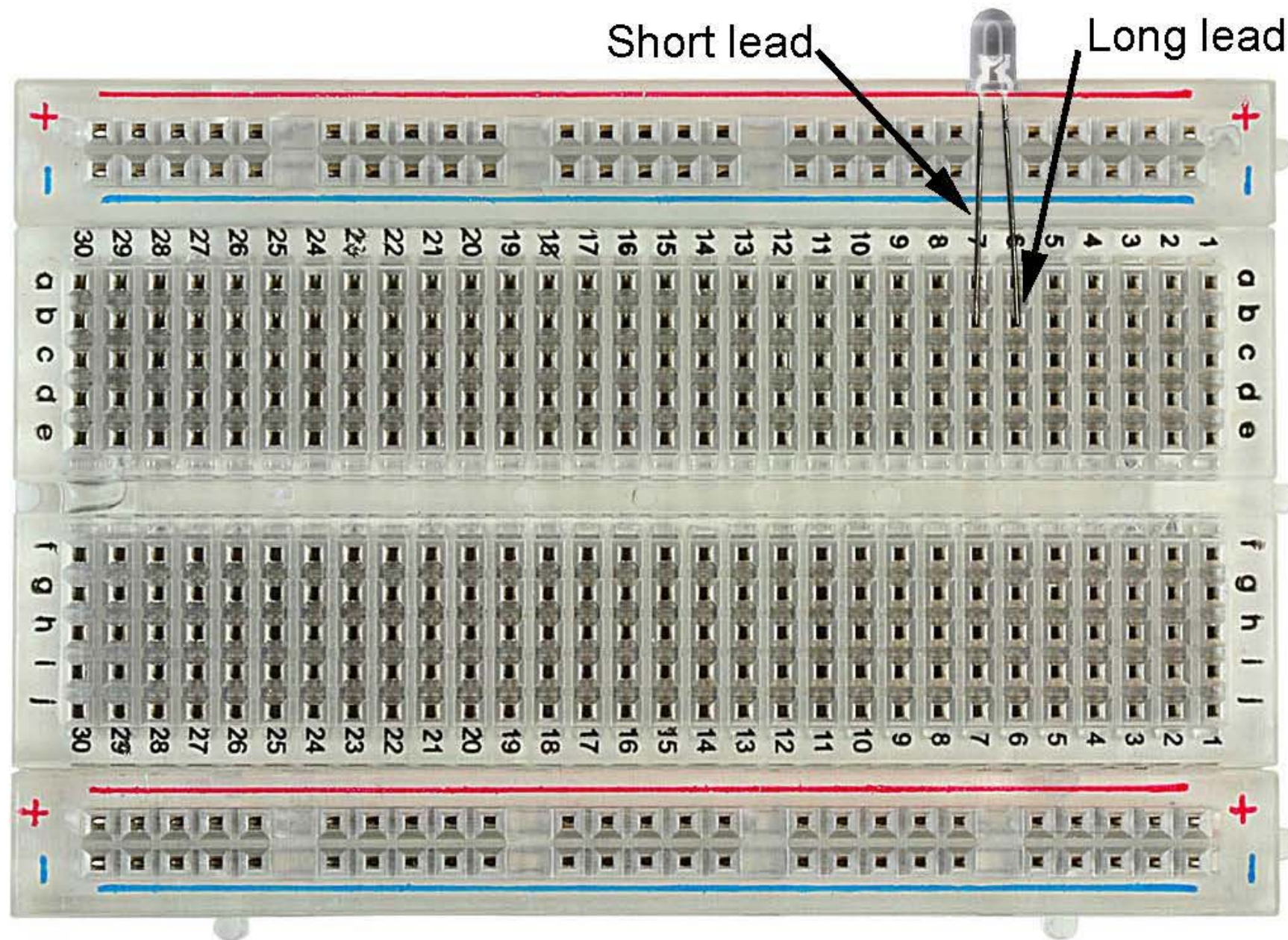
How to Use Solderless Breadboards

Solderless Breadboard



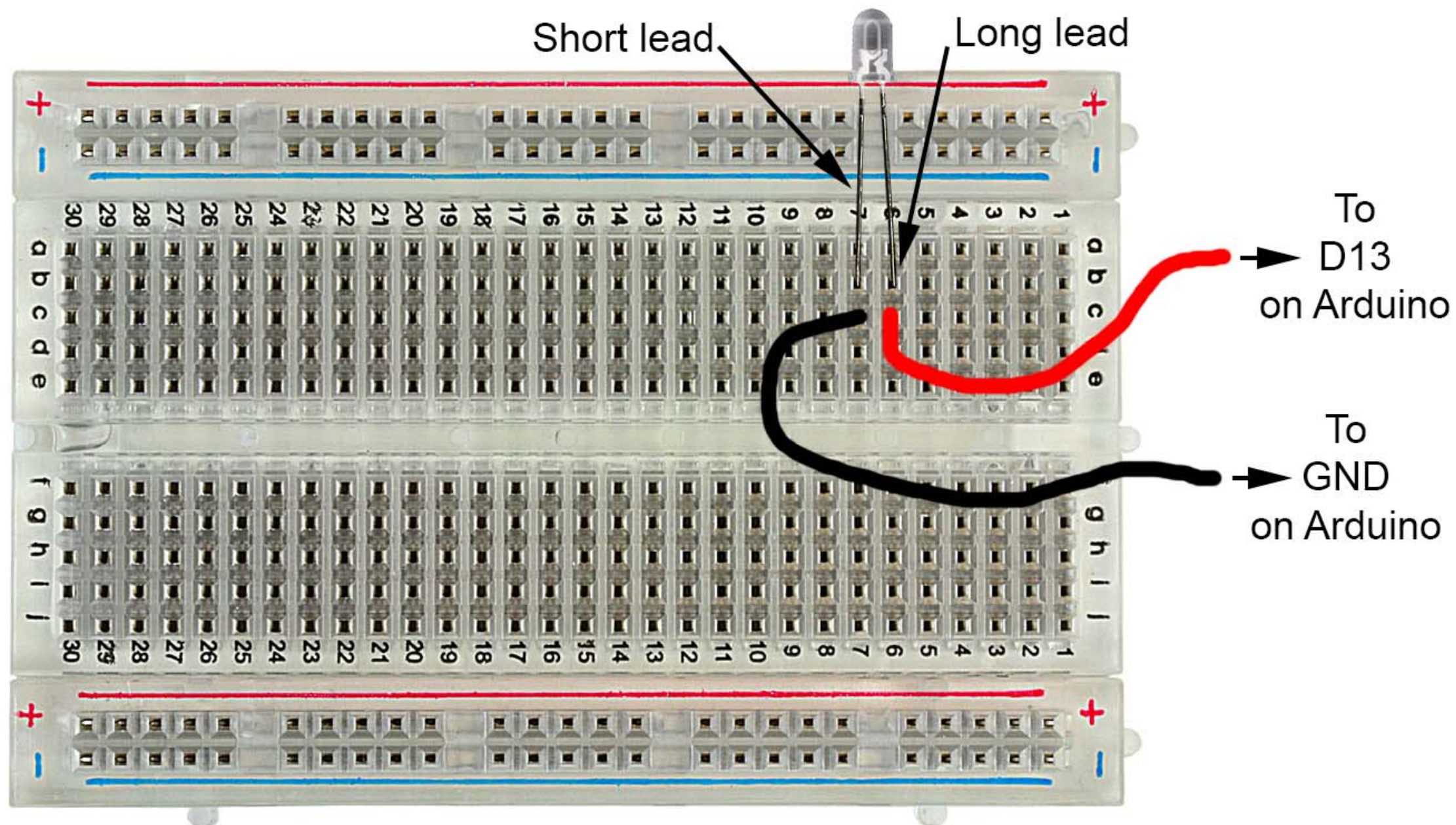
How to Use Solderless Breadboards

Solderless Breadboard with LED



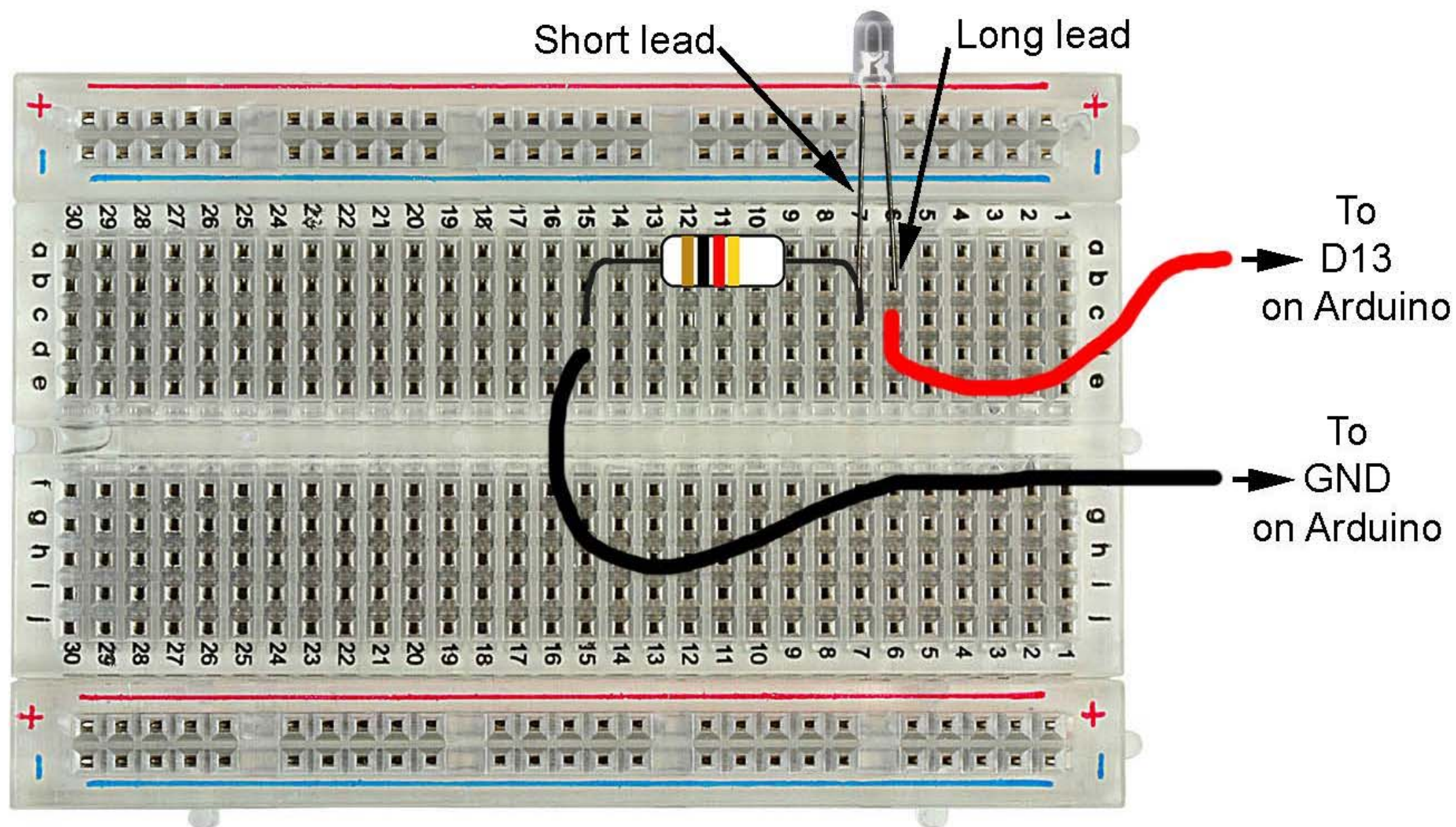
How to Use Solderless Breadboards

Solderless Breadboard with LED and wires

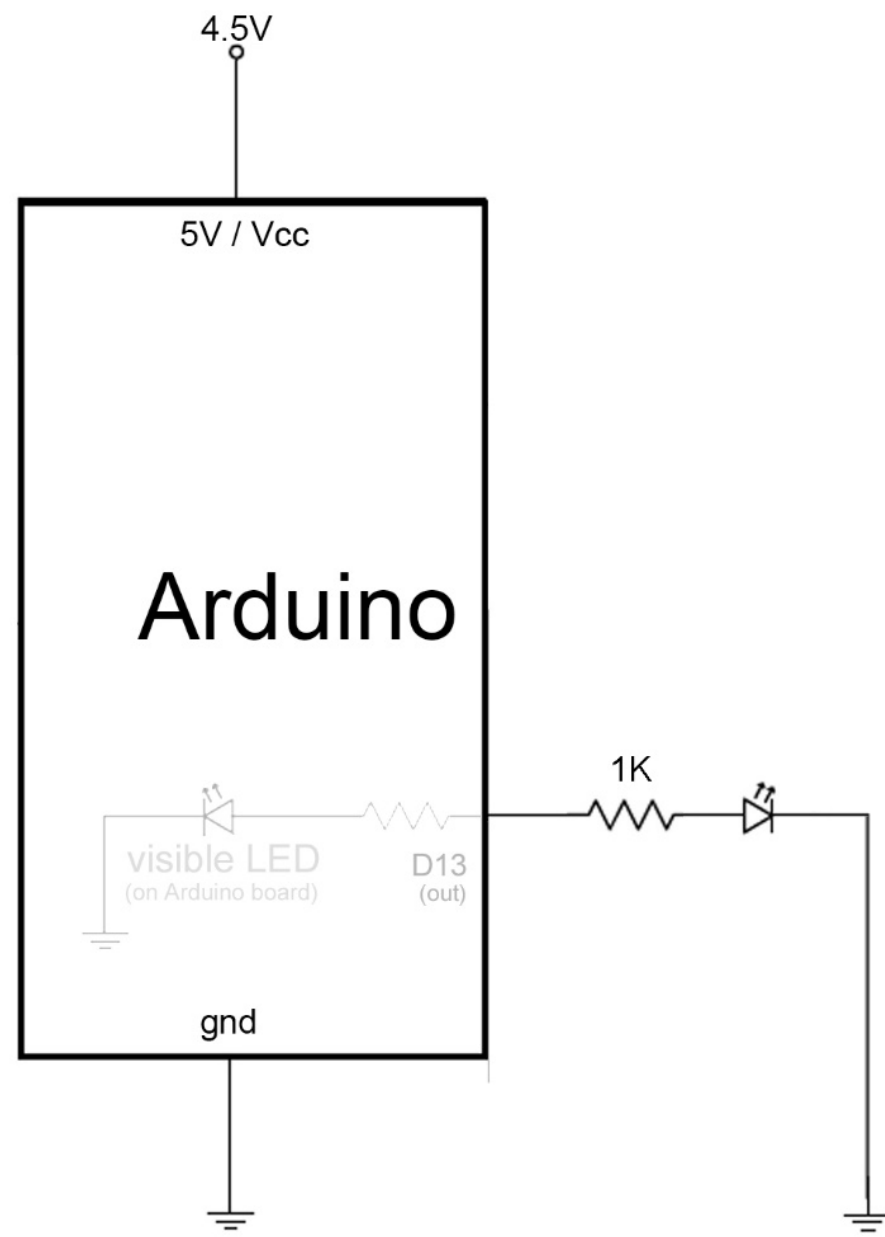


How to Use Solderless Breadboards

Solderless Breadboard with LED and Resistor and wires



How to Read a Schematic

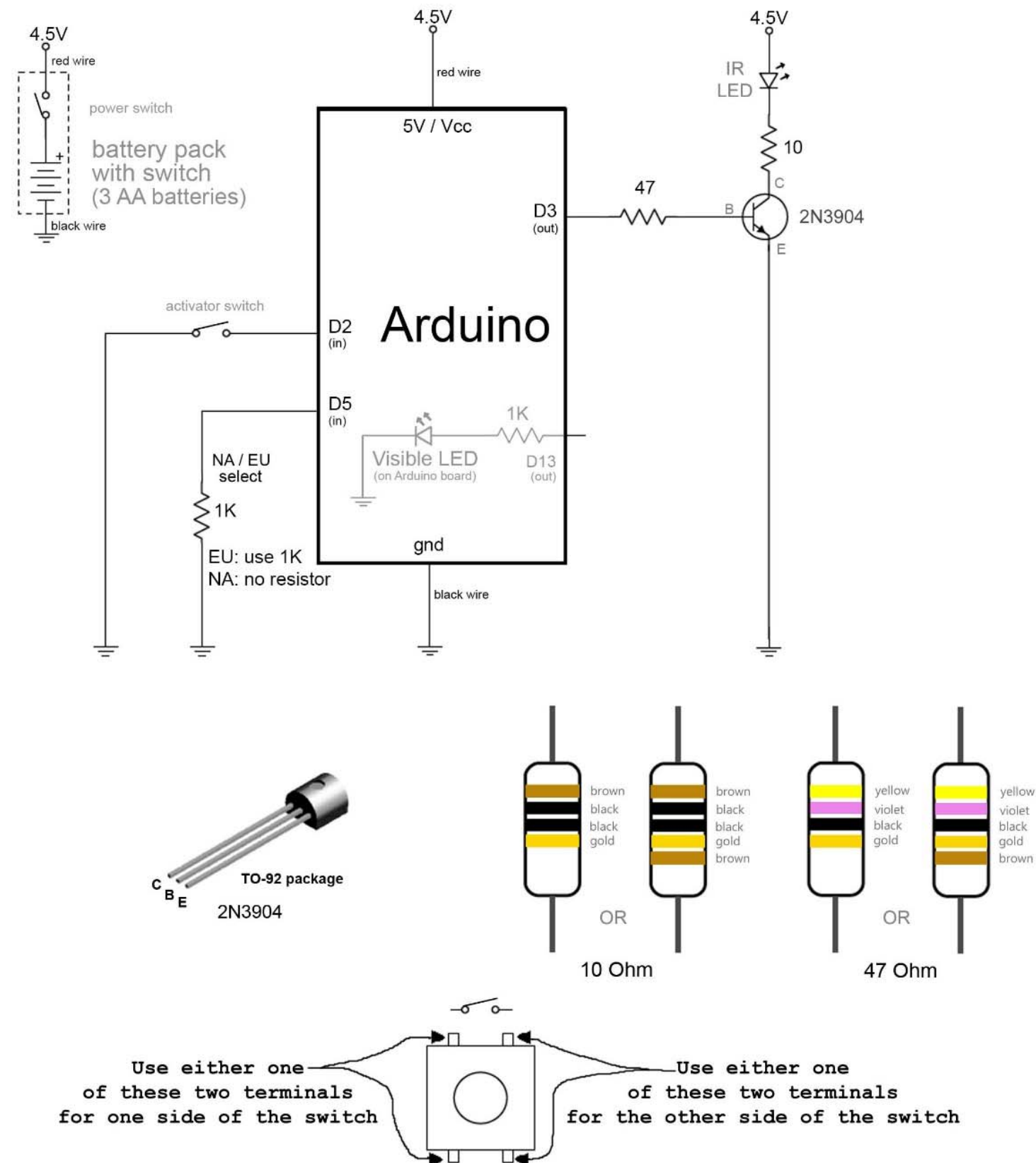


How to Read a Schematic

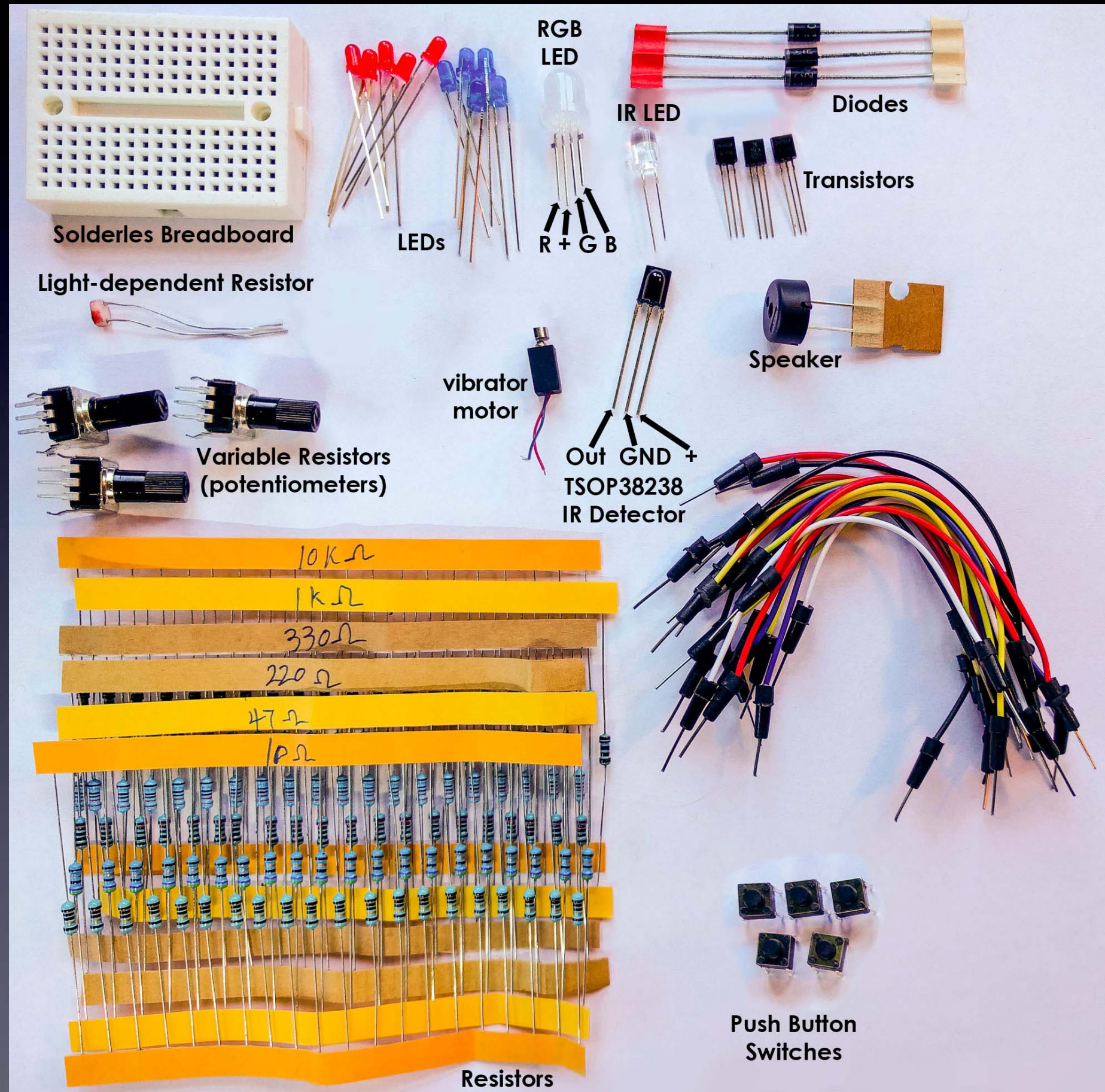
Arduino For Total Newbies

4-Sep-2015

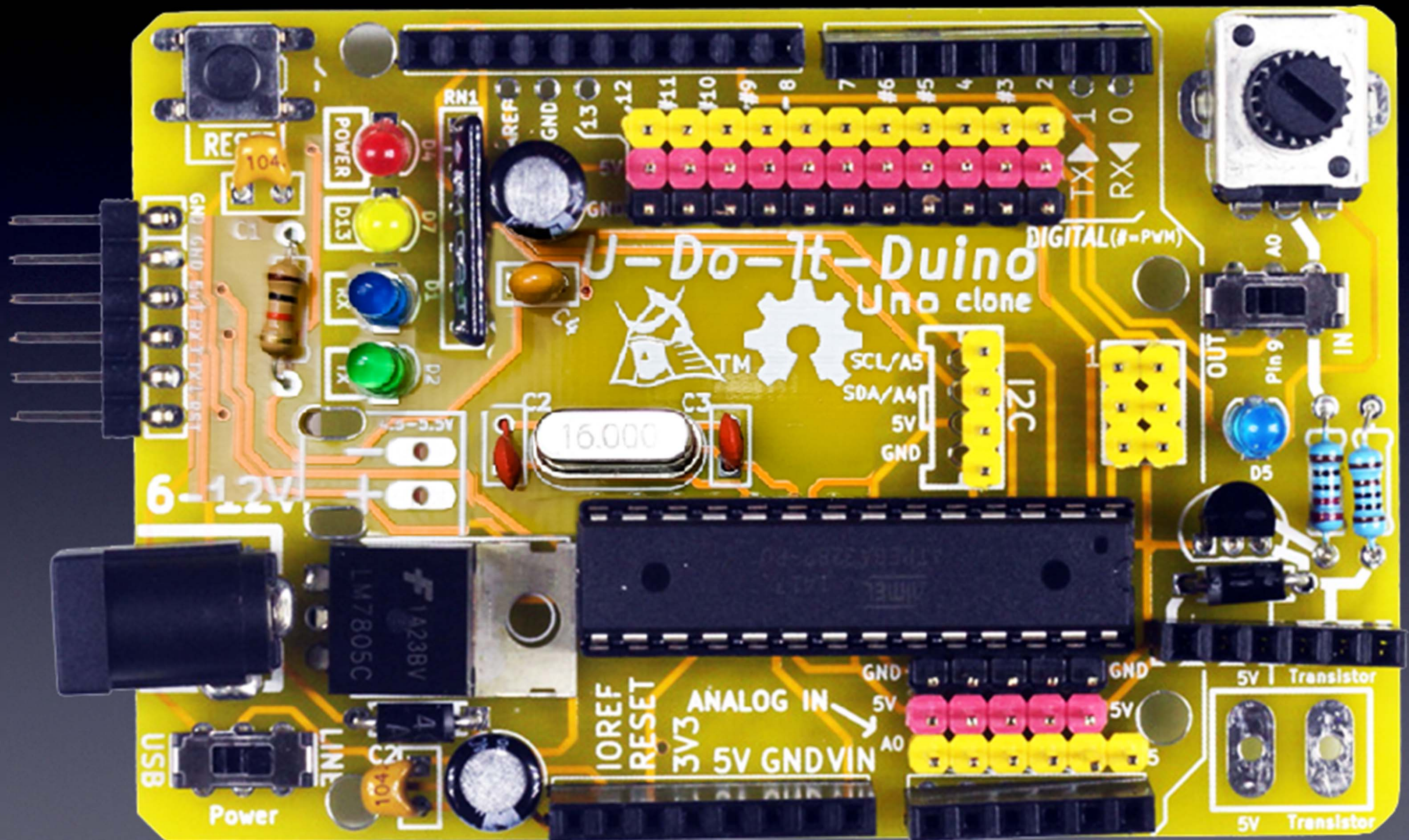
Mitch Altman (original TV-B-Gone hardware and firmware, modified TV-B-Gone Arduino design)
Limore Fried (firmware modifications, kit design)
Ken Shirriff (original modifications for Arduino)
Johannes Schneemann (documentation)



Parts Pack Contents



If you want to:



[https://cornfieldelectronics.com/cfe/u do it duino complete.php](https://cornfieldelectronics.com/cfe/u%20do%20it%20duino%20complete.php)

To Download these slides

see the

Arduno for(4) Total Newbies

workshop web-page:

<https://tinyurl.com/A4TNworkshop>

Please Remember:

to

Wash your hands

after soldering

Arduino For Total Newbies

w/ TV-B-Gone as example project

Mitch Altman

Chief Scientist, **Cornfield Electronics**, San Francisco, CA

Inventor of **TV-B-Gone** universal remote controls

Co-founder of **3Ware** (successful Silicon Valley startup)

Pioneer of **VR** (in the mid-1980s)

Founding mentor at **HAX** (1st and biggest hardware accelerator)

Co-founder of **Noisebridge** (San Francisco hackerspace)

email: mitch@CornfieldElectronics.com

site: www.CornfieldElectronics.com

facebook: [maltman23](https://www.facebook.com/maltman23)

flickr: [maltman23](https://www.flickr.com/photos/maltman23/)

WeChat: [mitchaltman](#)

Fediverse: [@maltman23@mastodon.social](https://maltman23@mastodon.social)

Patreon: [mitchaltman](#)

