Arduino For Total Newbies

w/ TV-B-Gone as example project

Mitch Altman

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Inventor of **TV-B-Gone** universal remote controls
Author of ***The Brain Machine*** in MAKE Magazine #10
Co-founder of **Noisebridge** (San Francisco hacker space)

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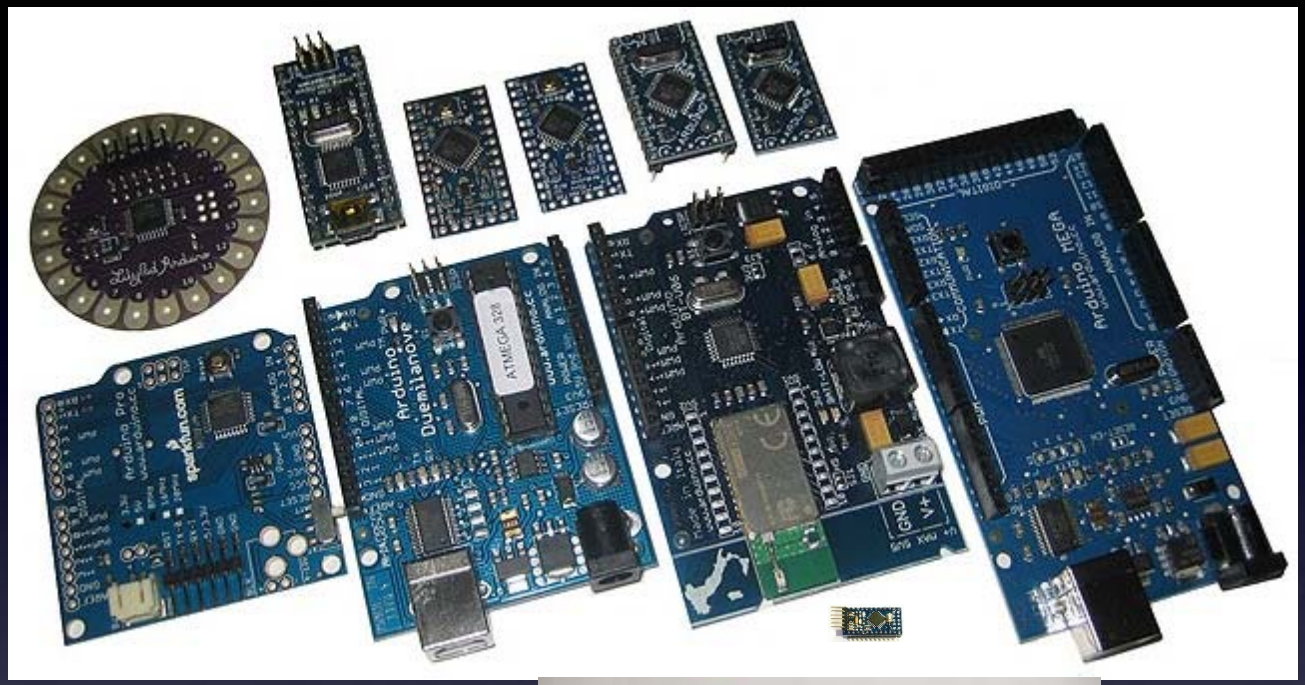
flickr: **maltman23**
phone: **415-377-5993**

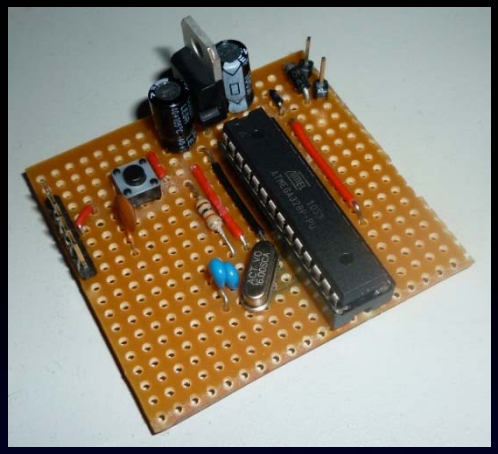
Makerspace Urbana

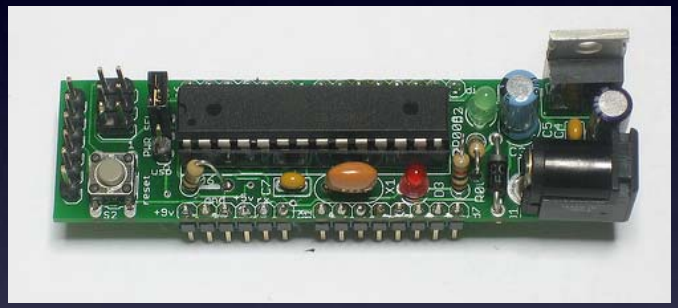
Syllabus

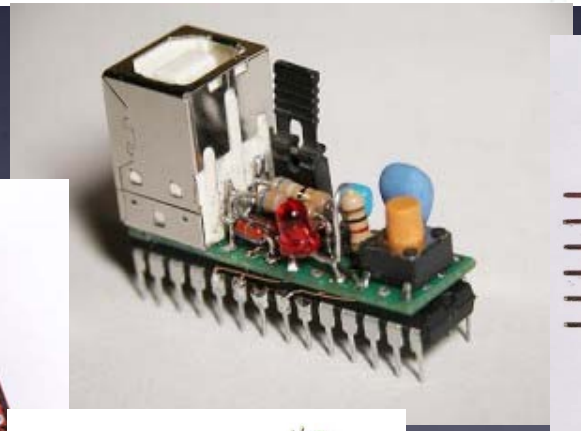
- Intro
- Everything You Need to Know About Electronics
- How to solder / make your own Arduino
- How to Set Up and Use the Arduino Software
- How to Hack Arduino Programs (“Sketches”)
- How to Use Solderless Breadboards
- How to Read a Schematic
- Make a TV-B-Gone Remote Control with your Arduino Clone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

Intro

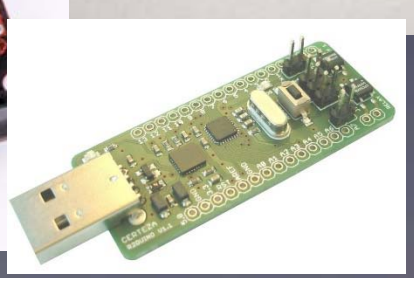

Arduino Duemilanove
ATMEGA 328
Arduino MEGA
sparkfun.com

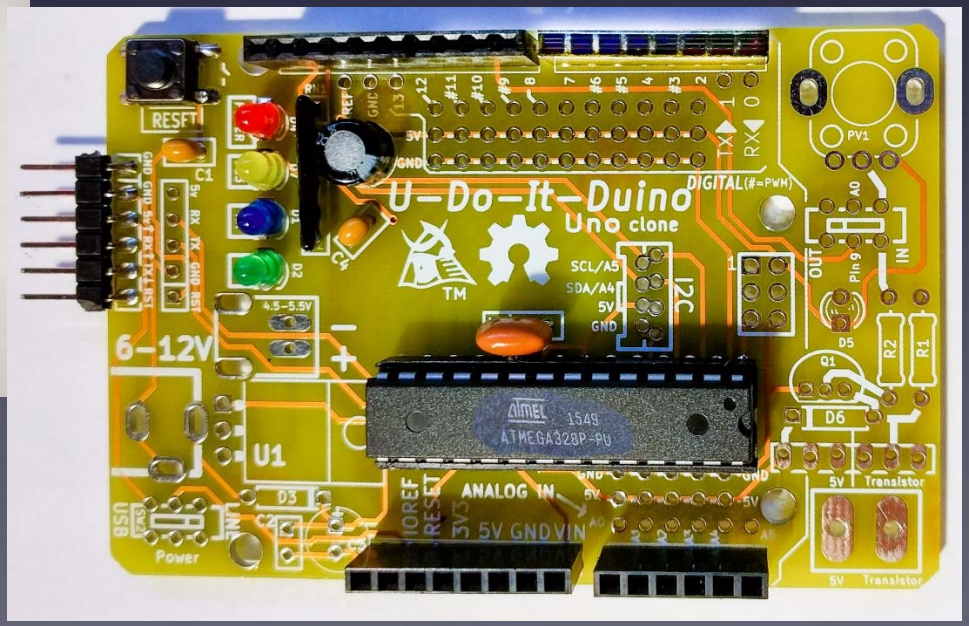




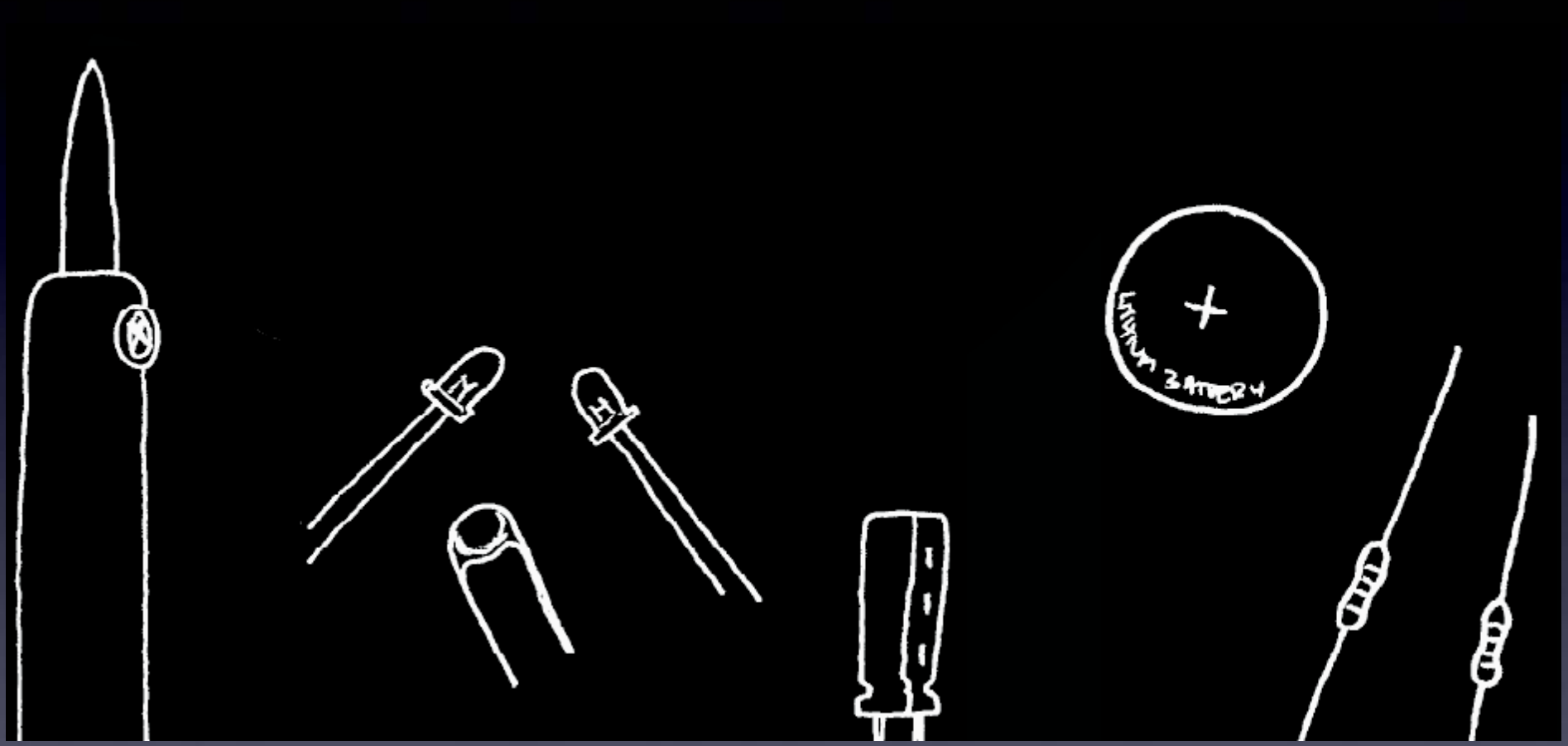


Diavolino
by Evil Mad Science

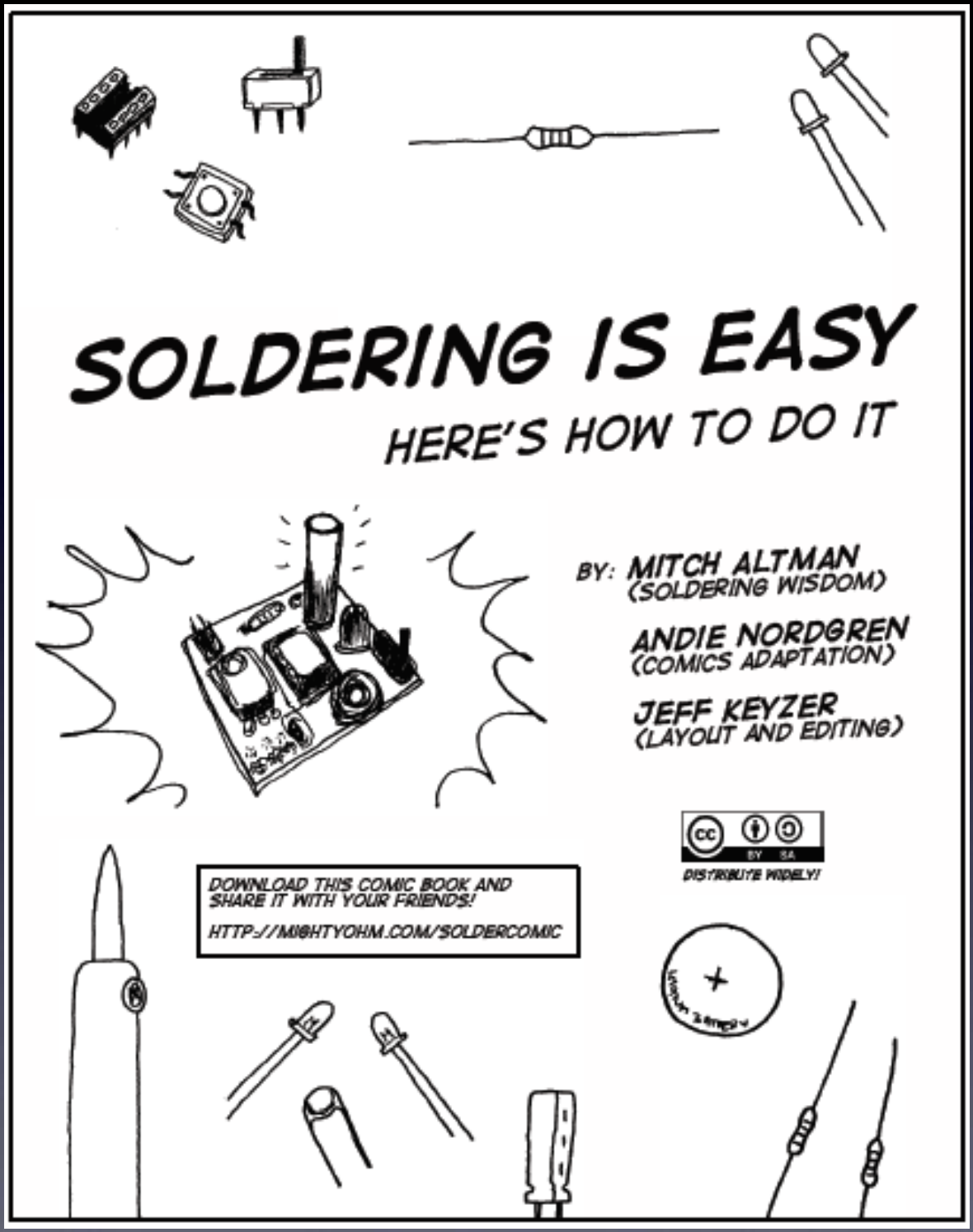



U-Do-It-Duino
Uno clone
DIGITAL(#=PWM)
SCL/A5
SDA/A4
5V
GND
I2C
RESET
6-12V
U1
ATMEGA328P-PU
ANALOG IN
IOREF
RESET
3V3
5V GNDVIN
Power
USB
Transistor

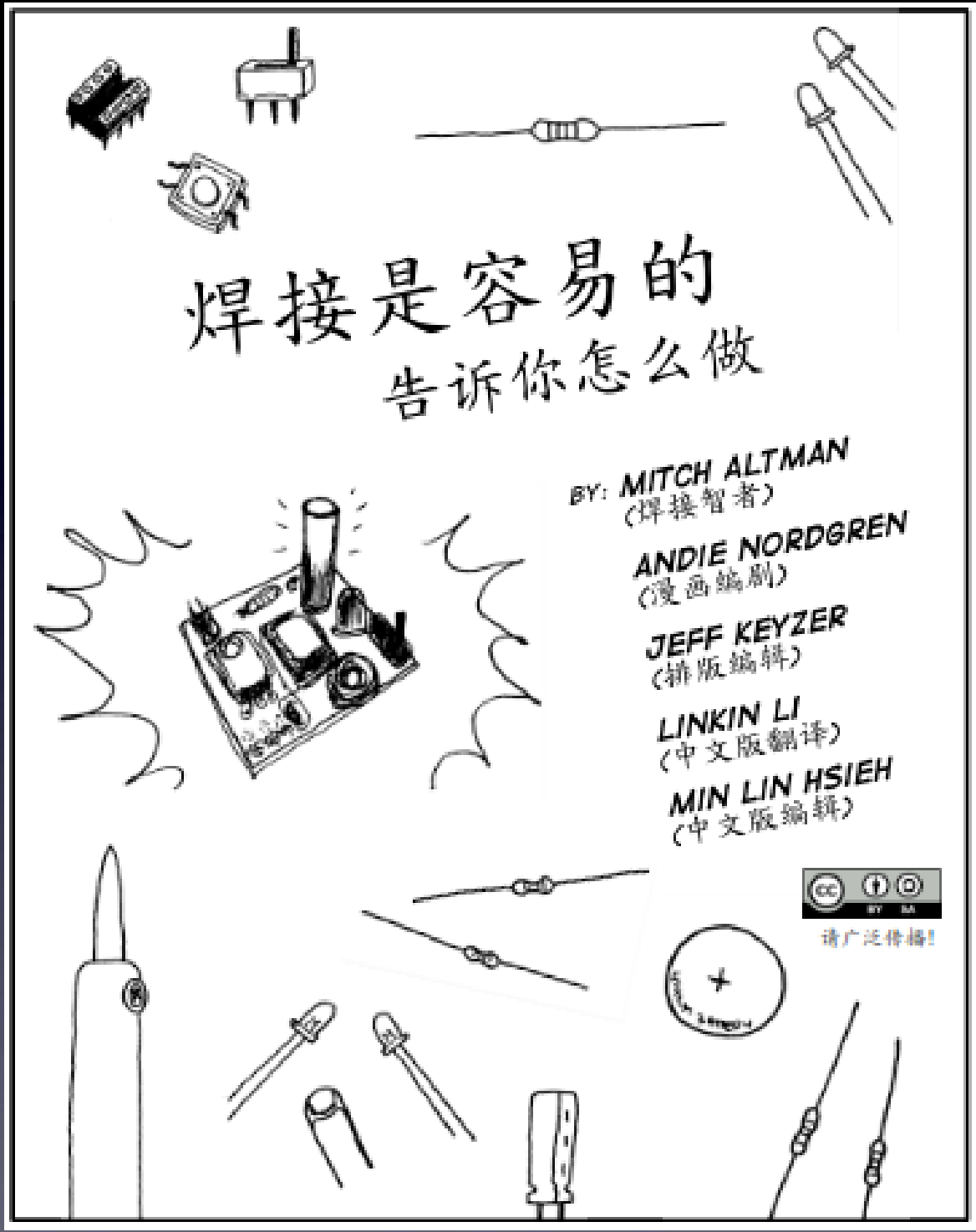
Everything You Need to Know About Electronics



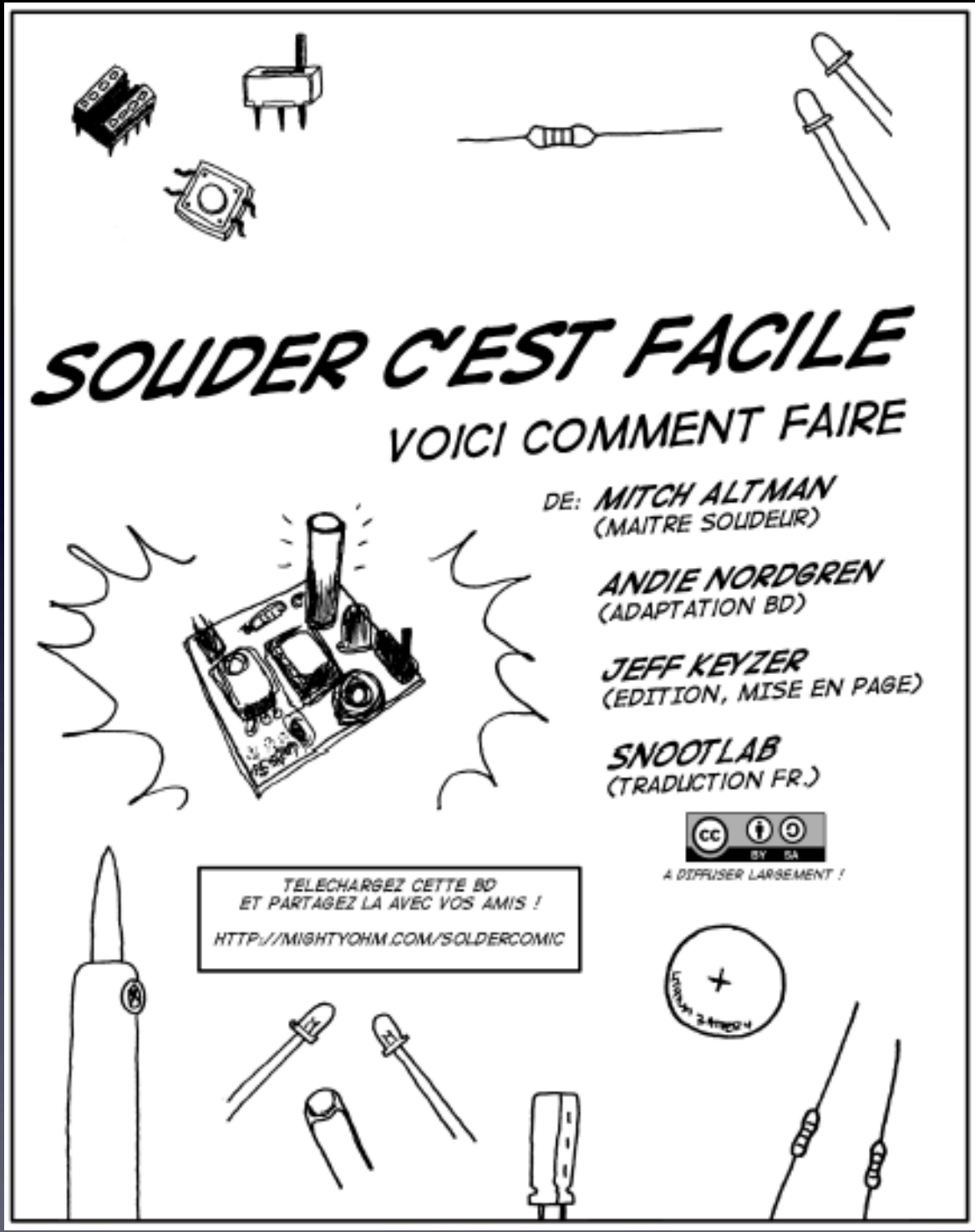
Learn To Solder



Learn To Solder



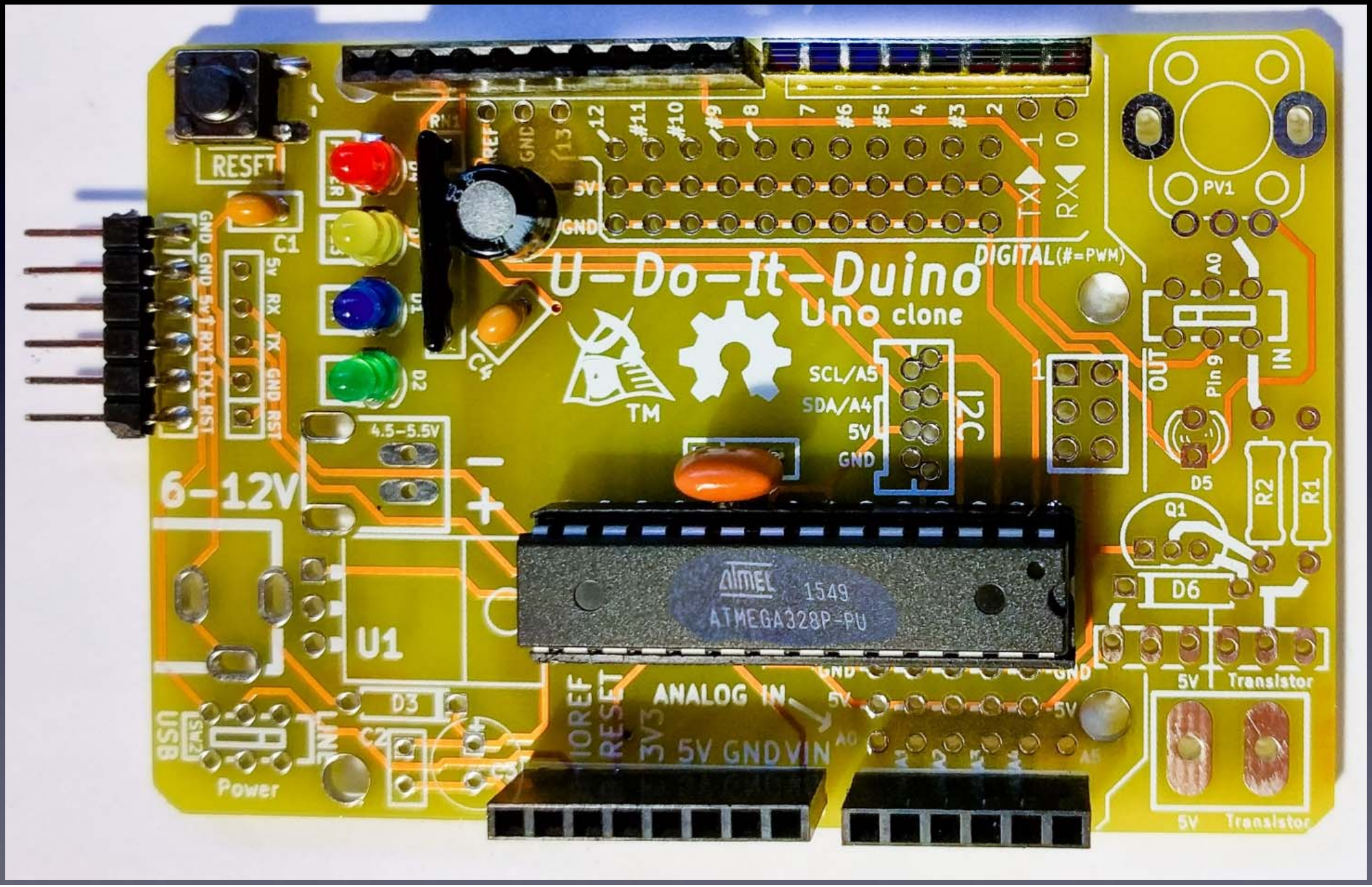
Learn To Solder



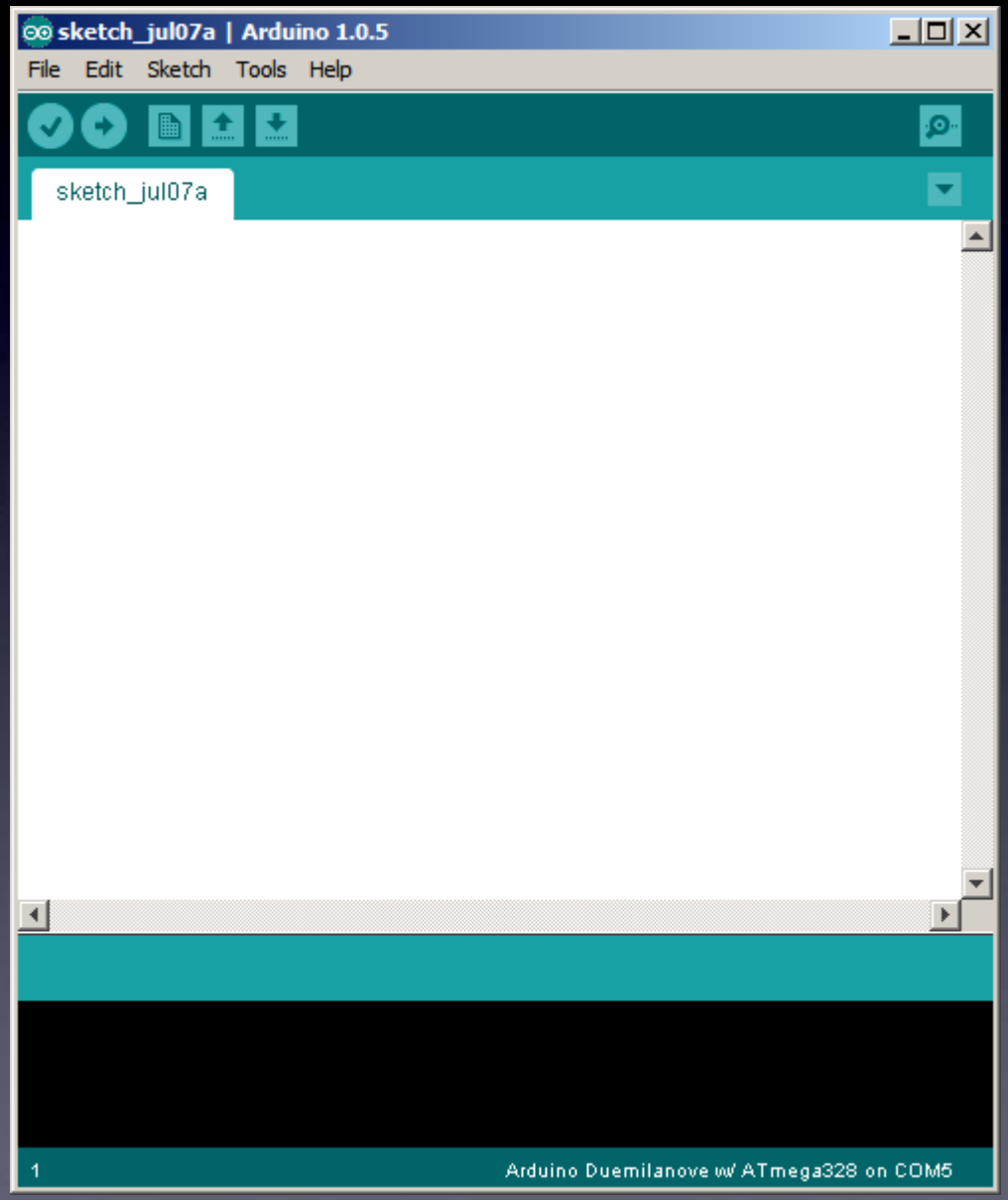
Learn To Solder

Learn To Solder

Solder Your Aruino Clone



How to Set Up and Use the Arduino Software



How to Hack Arduino Programs (“Sketches”)

Blink | Arduino 1.0.5

File Edit Sketch Tools Help

Verify

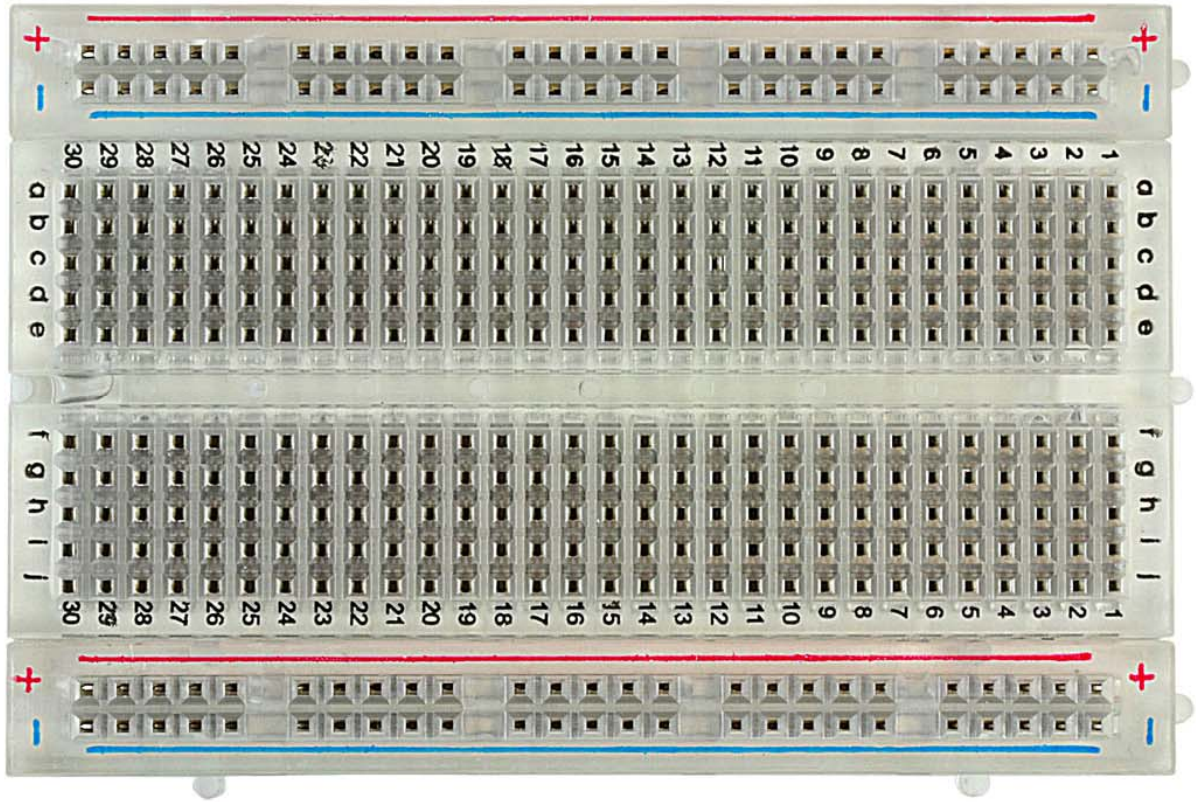
Blink

```
/*
  Blink
  Turns on an LED on for one second, then off for one second, repeatedly.

  This example code is in the public domain.
 */

// Pin 13 has an LED connected on most Arduino boards.
// give it a name:
int led = 13;

// the setup routine runs once when you press reset:
void setup() {
  // initialize the digital pin as an output.
  pinMode(led, OUTPUT);
}

// the loop routine runs over and over again forever:
void loop() {
  digitalWrite(led, HIGH);   // turn the LED on (HIGH is the voltage level)
  delay(1000);               // wait for a second
  digitalWrite(led, LOW);    // turn the LED off by making the voltage LOW
  delay(1000);               // wait for a second
}
```

1 Arduino Duemilanove w/ ATmega328 on COM5

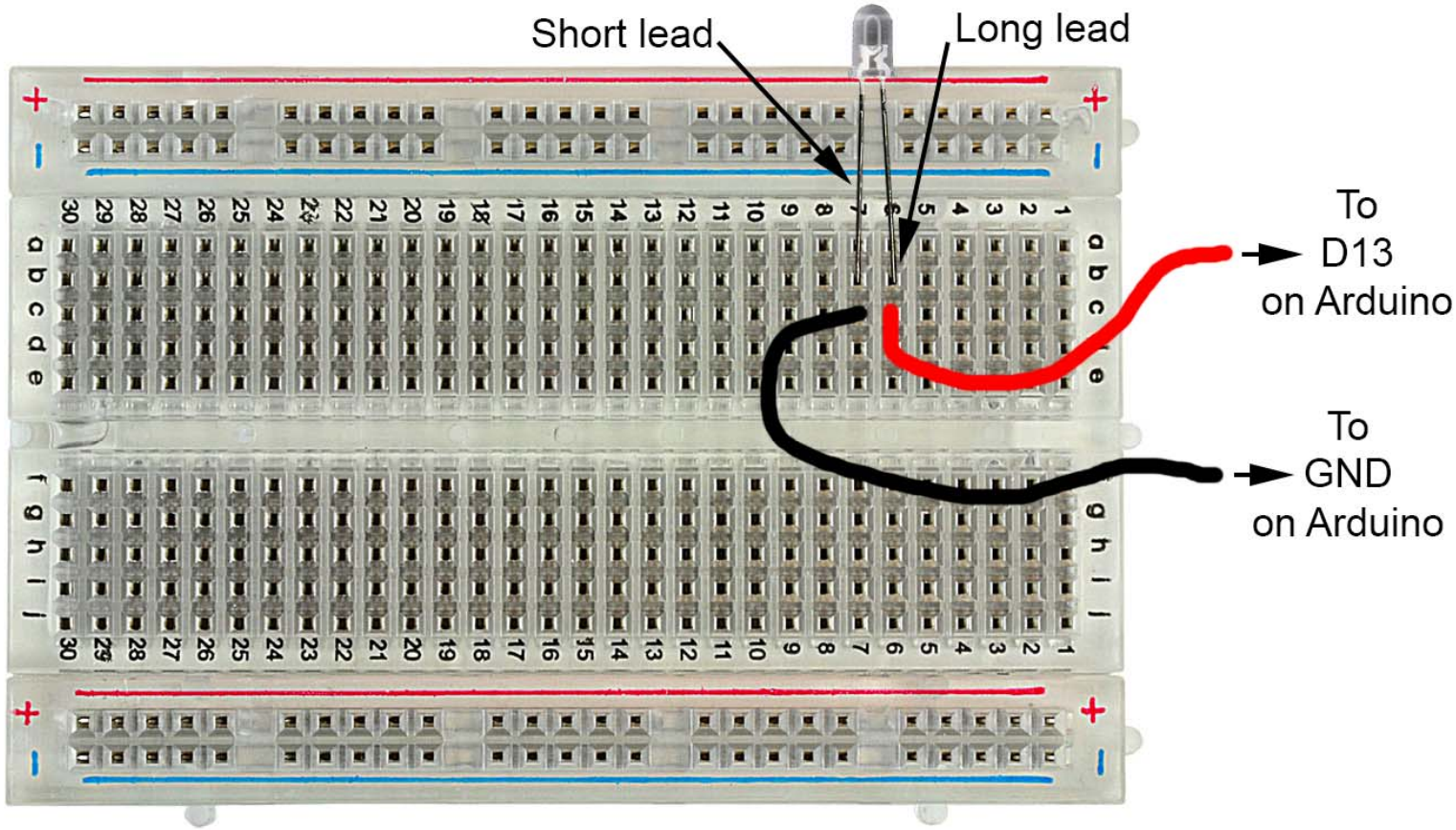
How to Use Solderless Breadboards

Solderless Breadboard



How to Use Solderless Breadboards

Solderless Breadboad with LED and wires

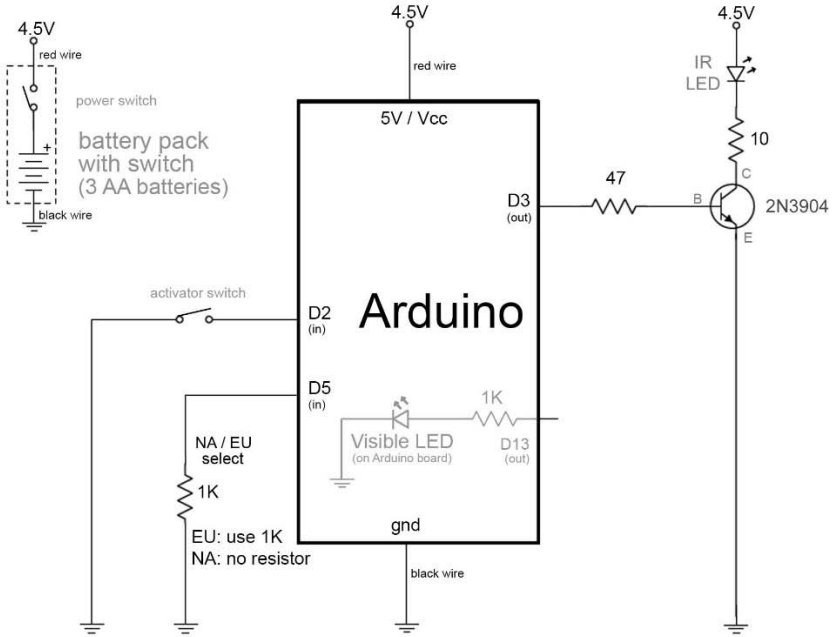


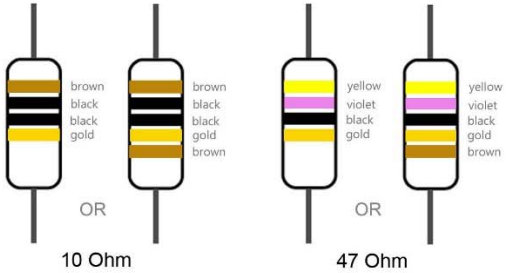
How to Read a Schematic

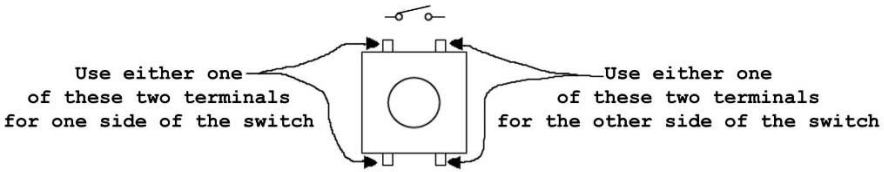
4-Sep-2015

Arduino For Total Newbies

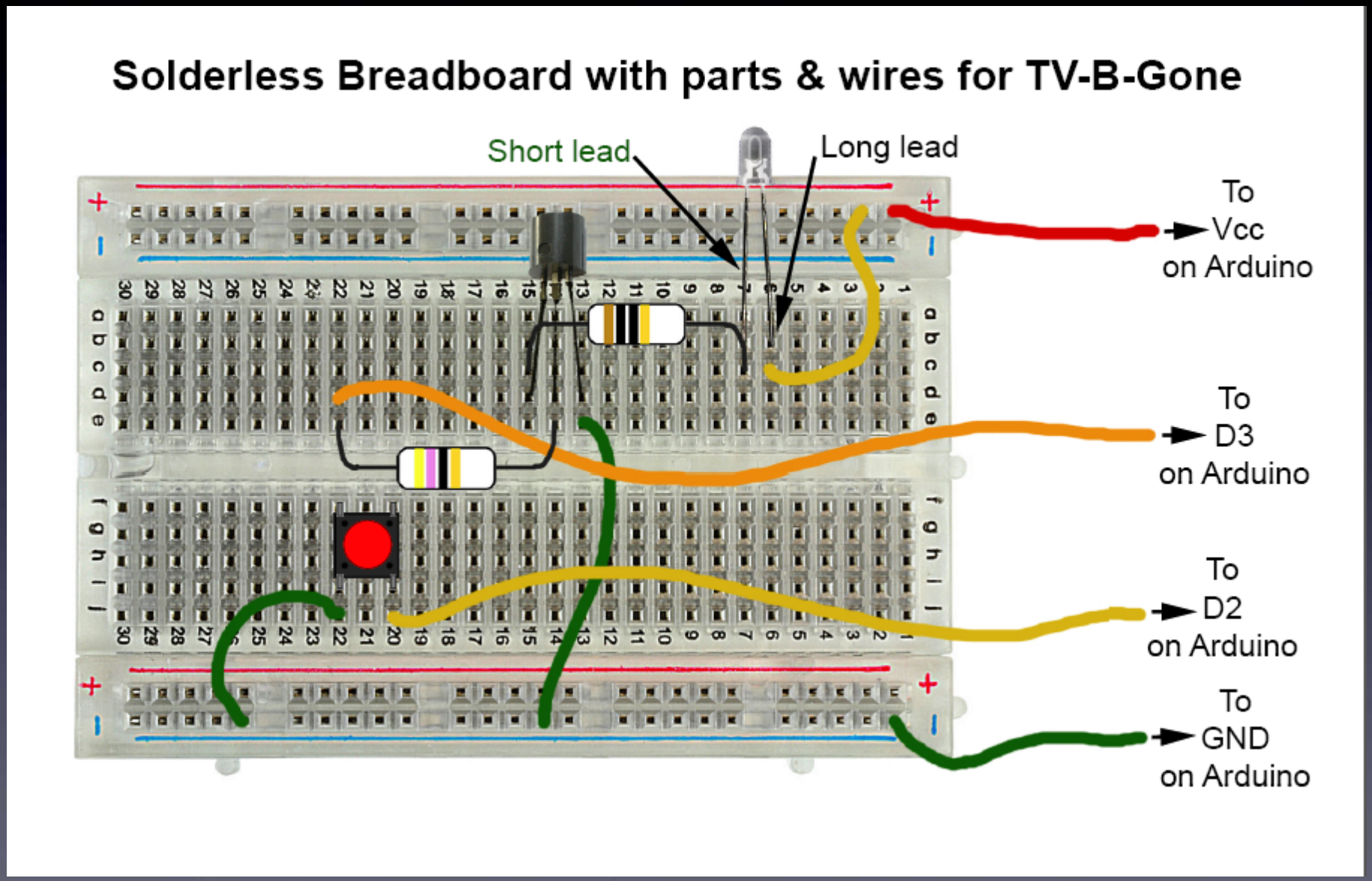
Mitch Altman (original TV-B-Gone hardware and firmware, modified TV-B-Gone Arduino design)
Limore Fried (firmware modifications, kit design)
Ken Shirriff (original modifications for Arduino)
Johannes Schneemann (documentation)

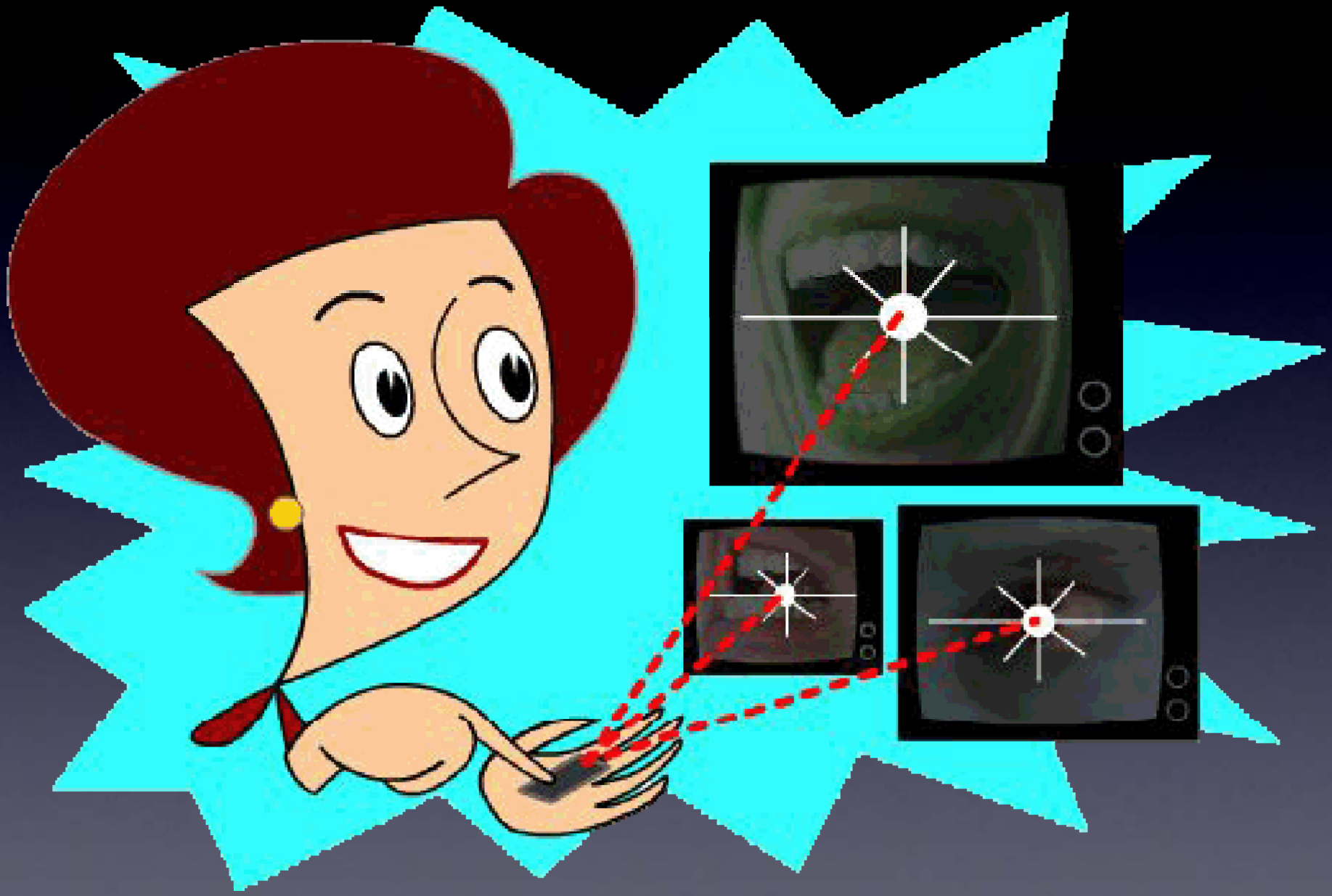






Make a TV-B-Gone Remote Control with your Arduino Clone without soldering





Questions?

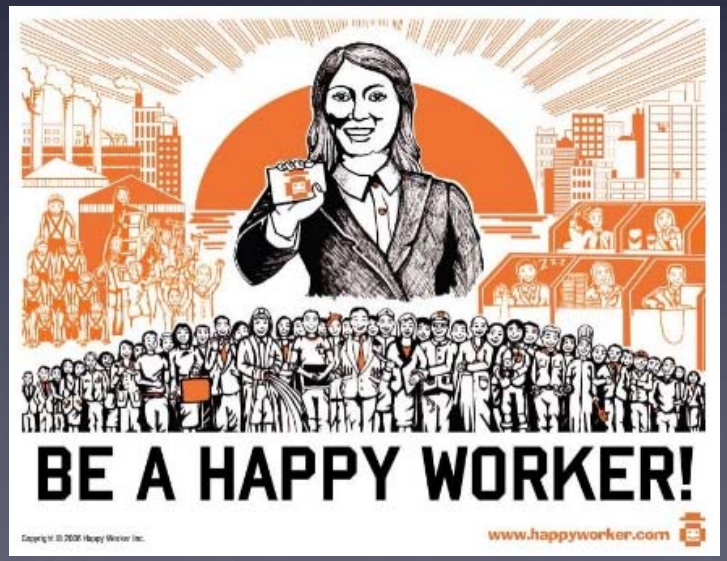
Intro

Noisebridge Hacker Space
https://noisebridge.net
2169 mission sf ca us

Intro

TV B-Gone™
Universal Remote Control
www.tvbgone.com

BUDDY L


BE A HAPPY WORKER!
www.happyworker.com

Intro

Cornfield Electronics, Inc.

MITCH ALTMAN

Chief Scientist / CEO

"Useful Electronics for a Better World"

TV B-Gone™ Universal Remote Control

www.CornfieldElectronics.com

572 Hill St. #Penthouse, San Francisco, CA 94114

phone: +1 415 / 377 - 5993

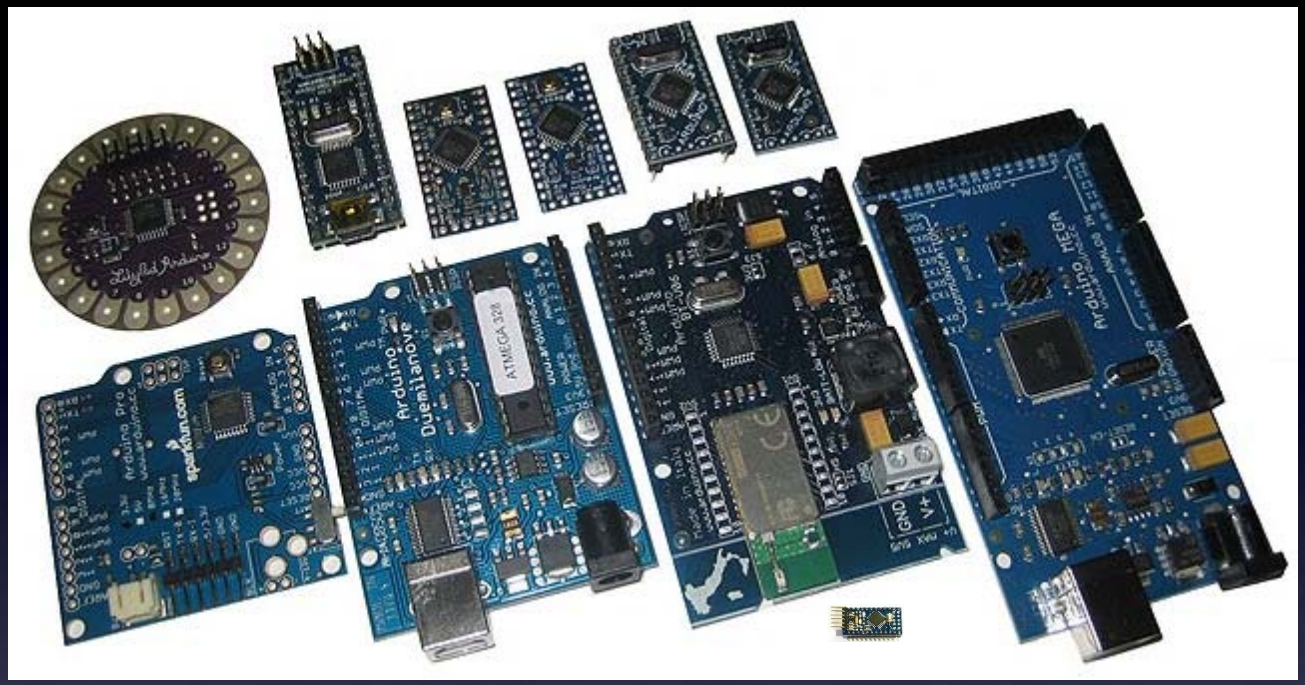
mitch@CornfieldElectronics.com

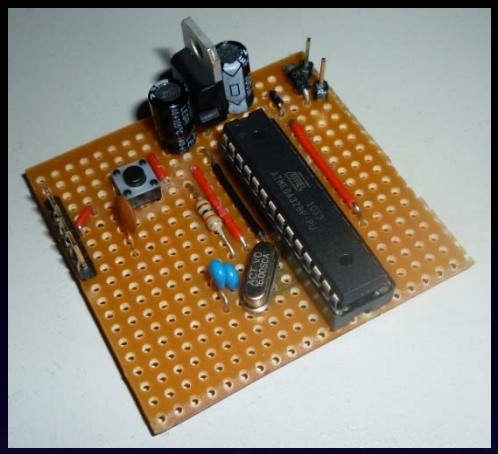
@maltman23

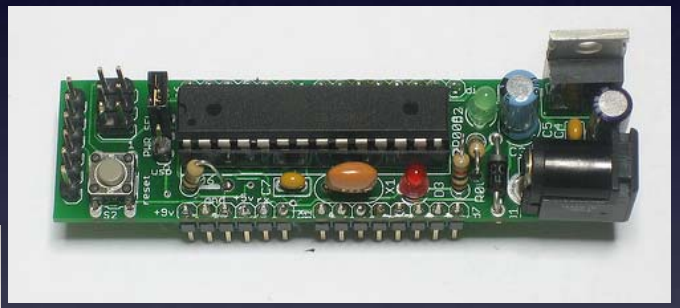
Intro

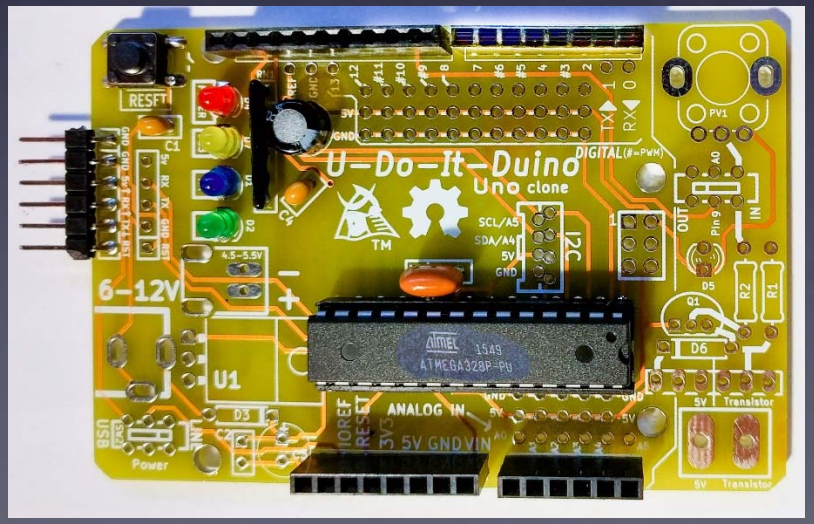
Arduino For Total Newbies Workshop at 30C3, Hamburg Germany

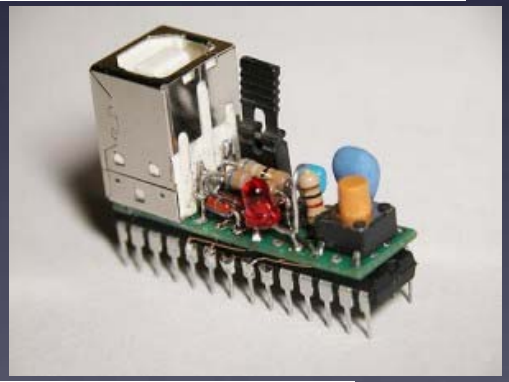
Intro

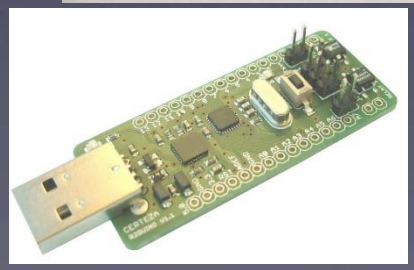






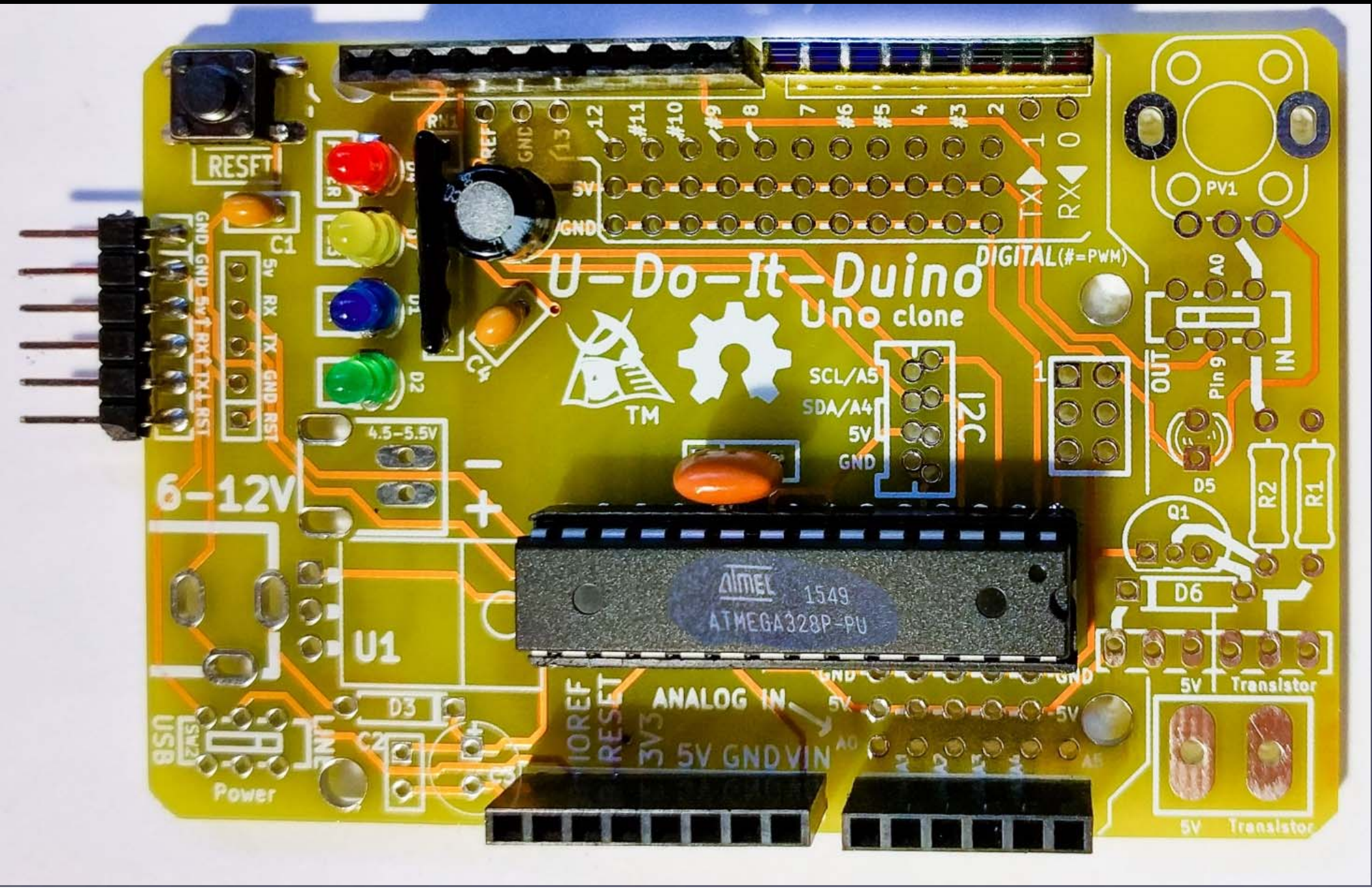






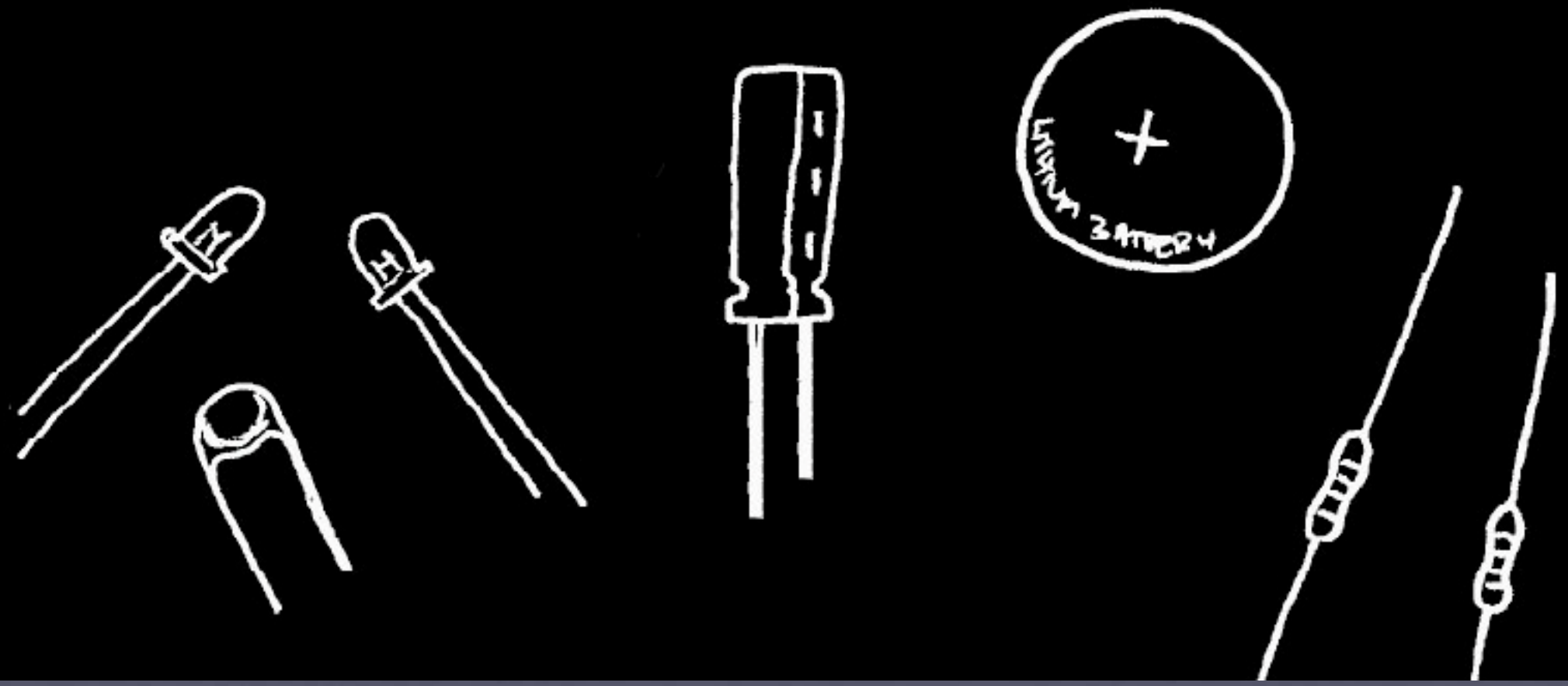
Open Source

Intro

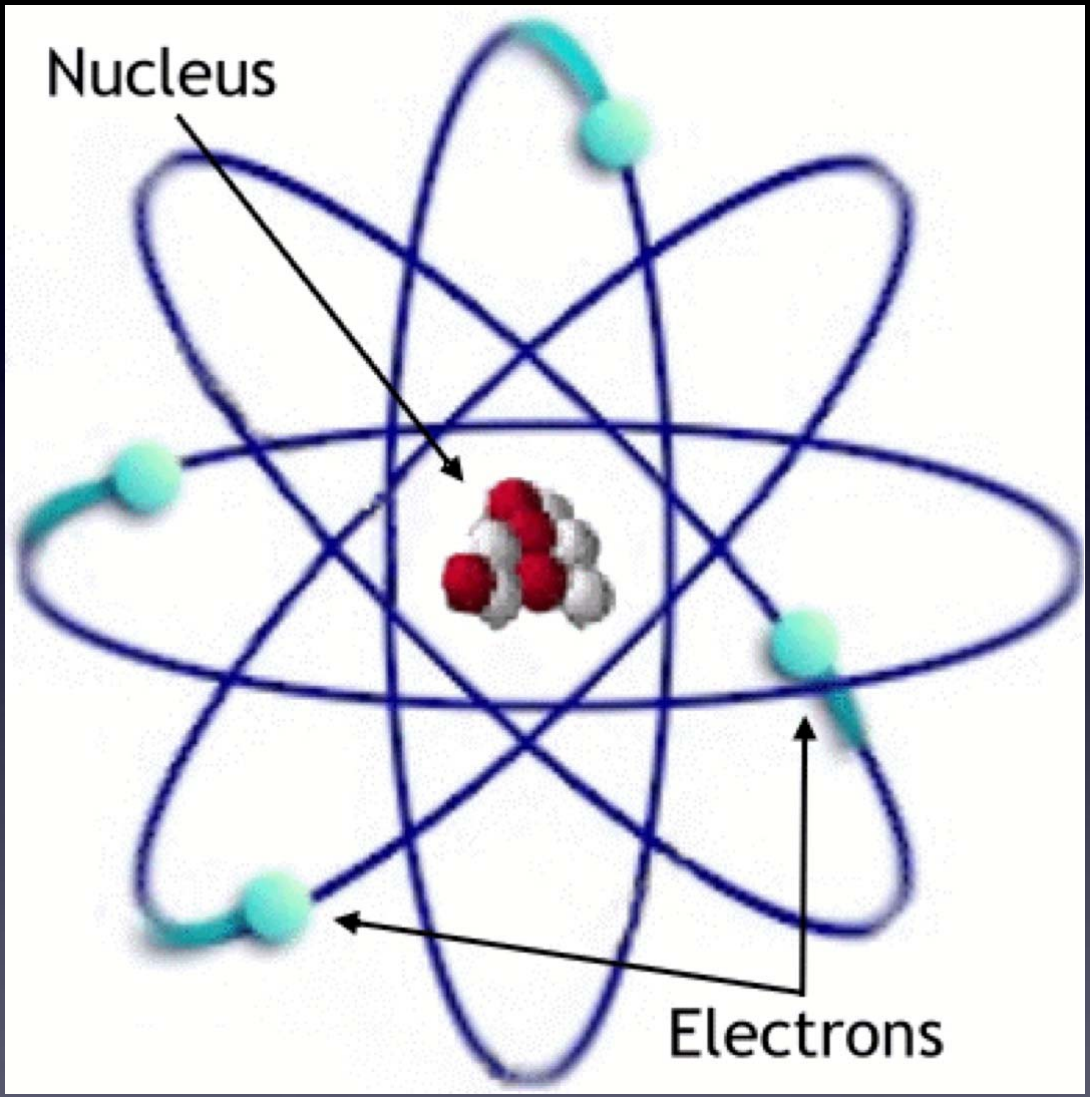

U-Do-It-Duino
Uno clone
DIGITAL(#=PWM)
RESET
6-12V
4.5-5.5V
U1
ATMEL
1549
ATMEGA328P-PU
SCL/A5
SDA/A4
5V
GND
I2C
ANALOG IN
IOREF
RESET
3V3
5V GND VIN
USB
Power
PV1
OUT
IN
Pin 9
D5
Q1
D6
R2
R1
Transistor
TM

Questions?

Everything You Need to Know About Electronics

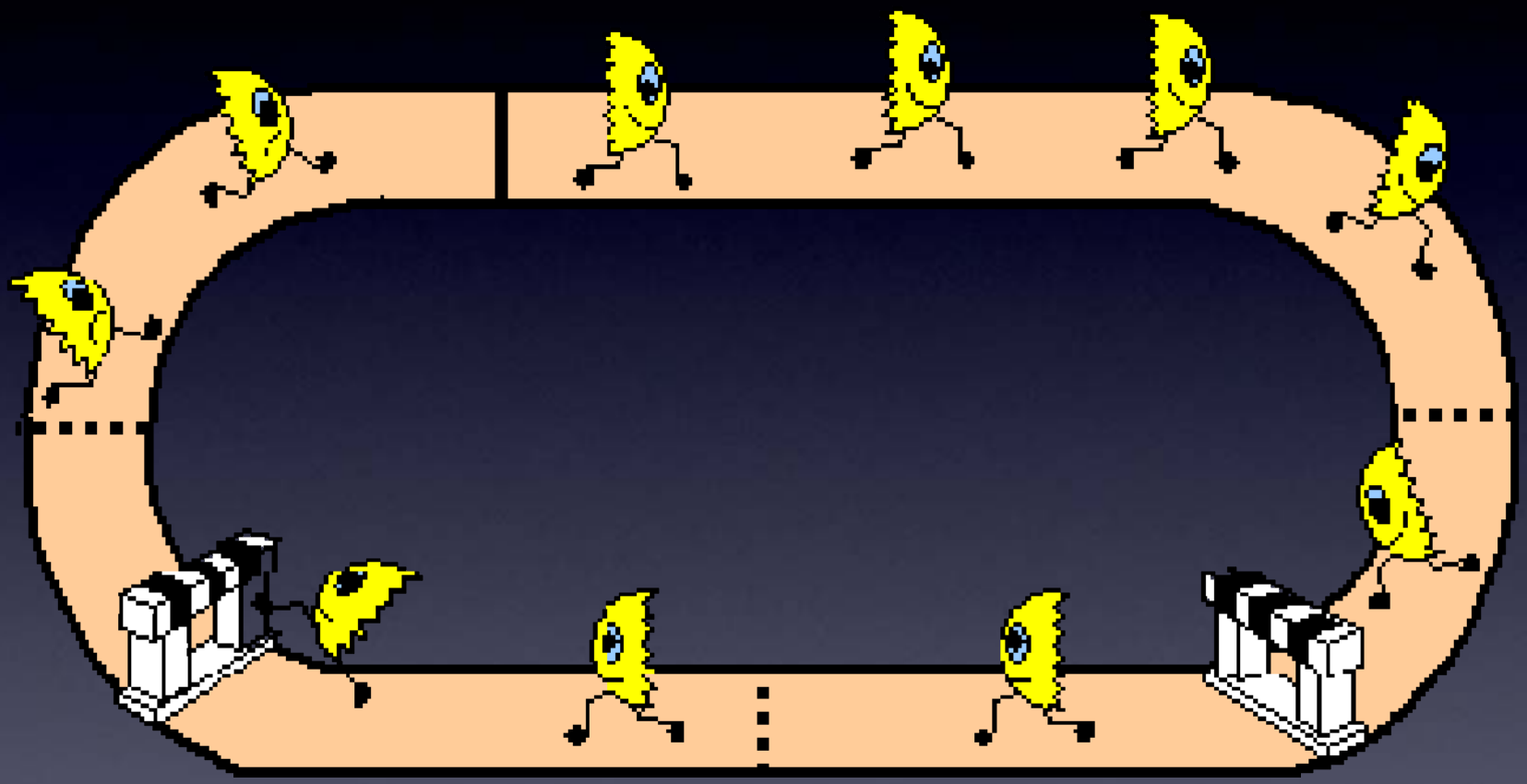


Everything You Need to Know About Electronics



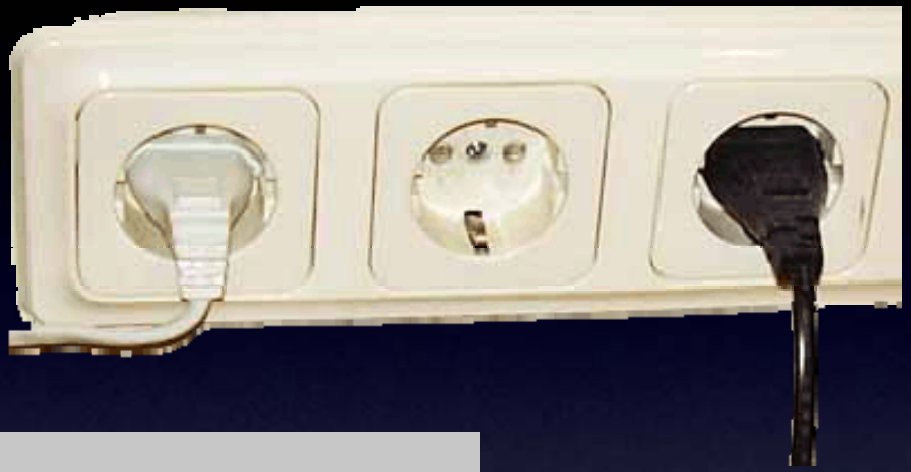
Electrons

Everything You Need to Know About Electronics



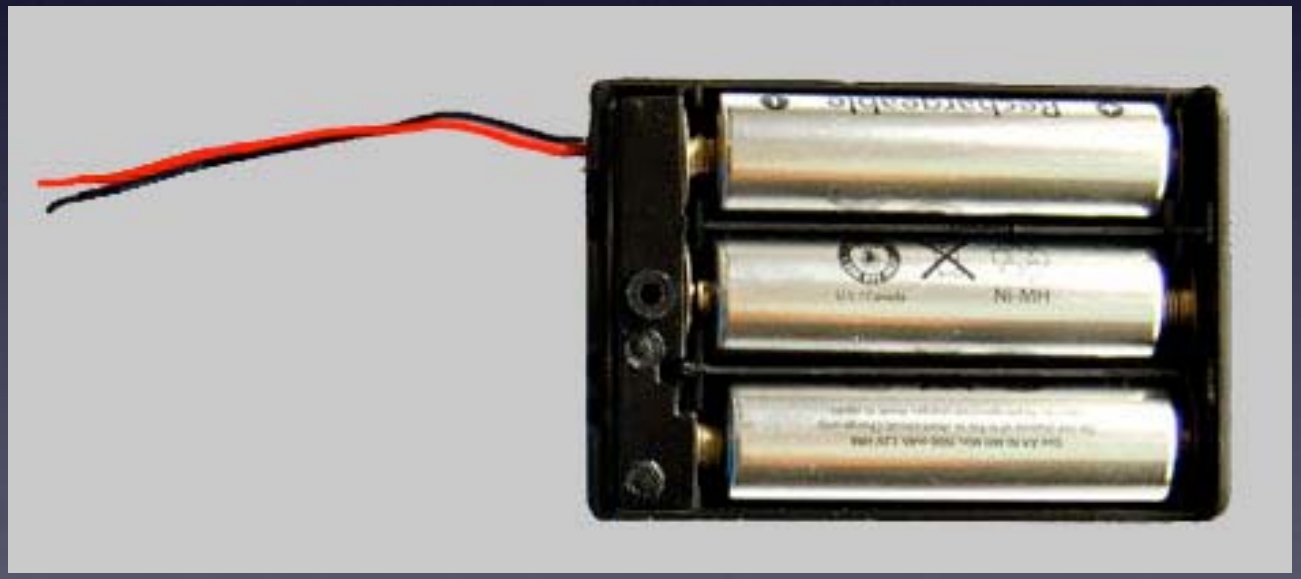
Circuits = Electrons going in circles = Magic!

Everything You Need to Know About Electronics



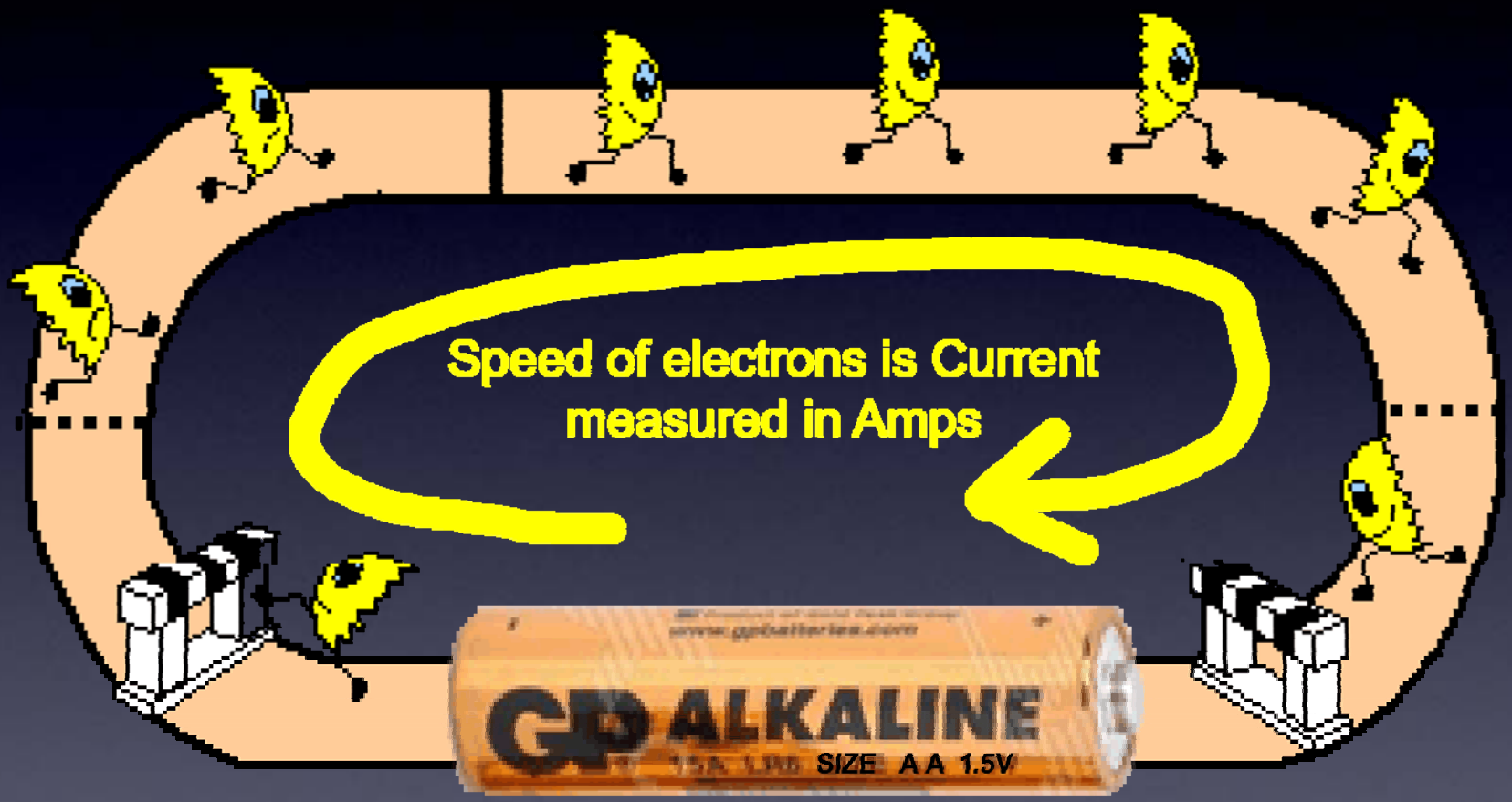
Power Supplies

Everything You Need to Know About Electronics



Volts / Voltage

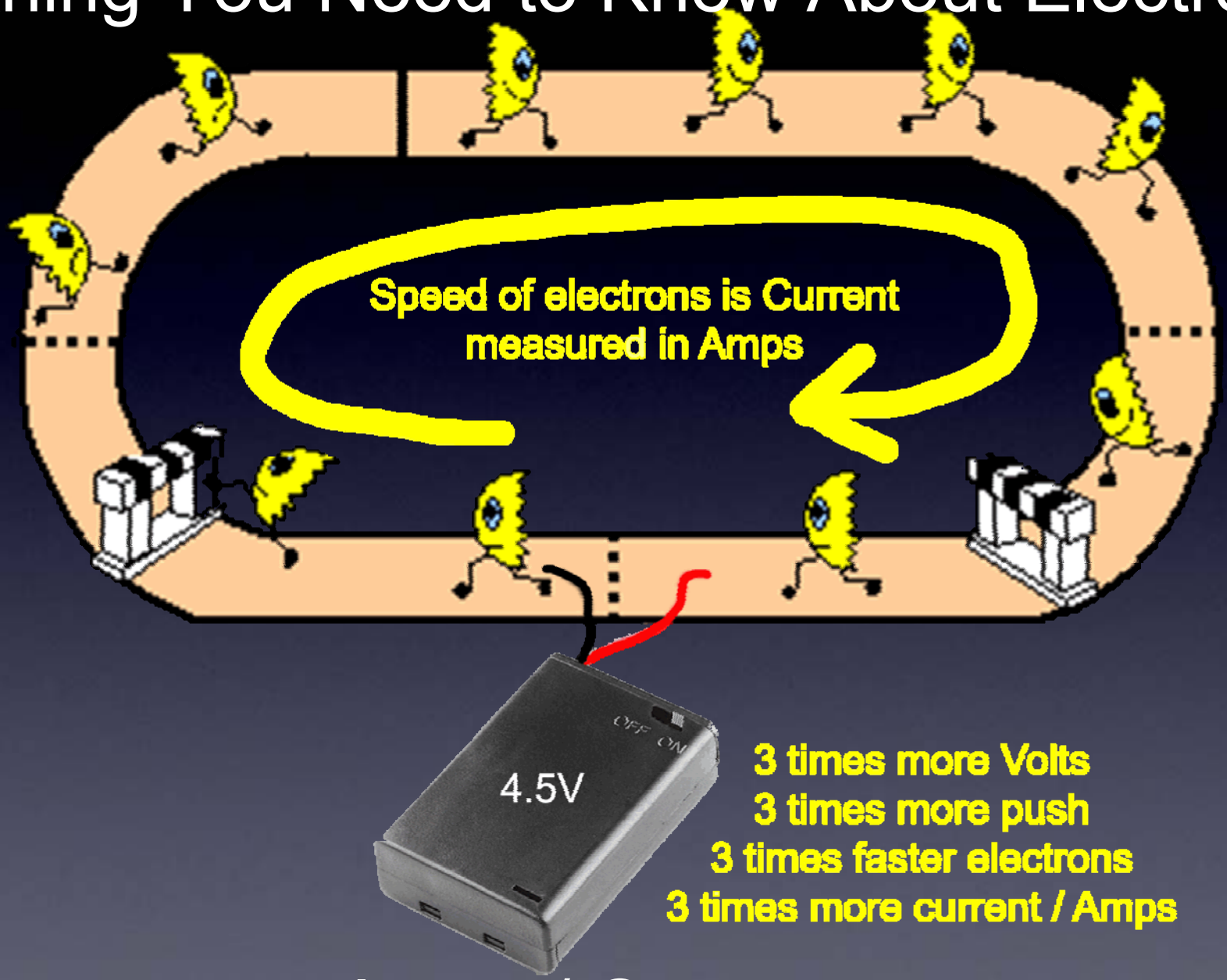
Everything You Need to Know About Electronics



Electrons pushed with 1.5V.
So, they move!

Amps / Current

Everything You Need to Know About Electronics

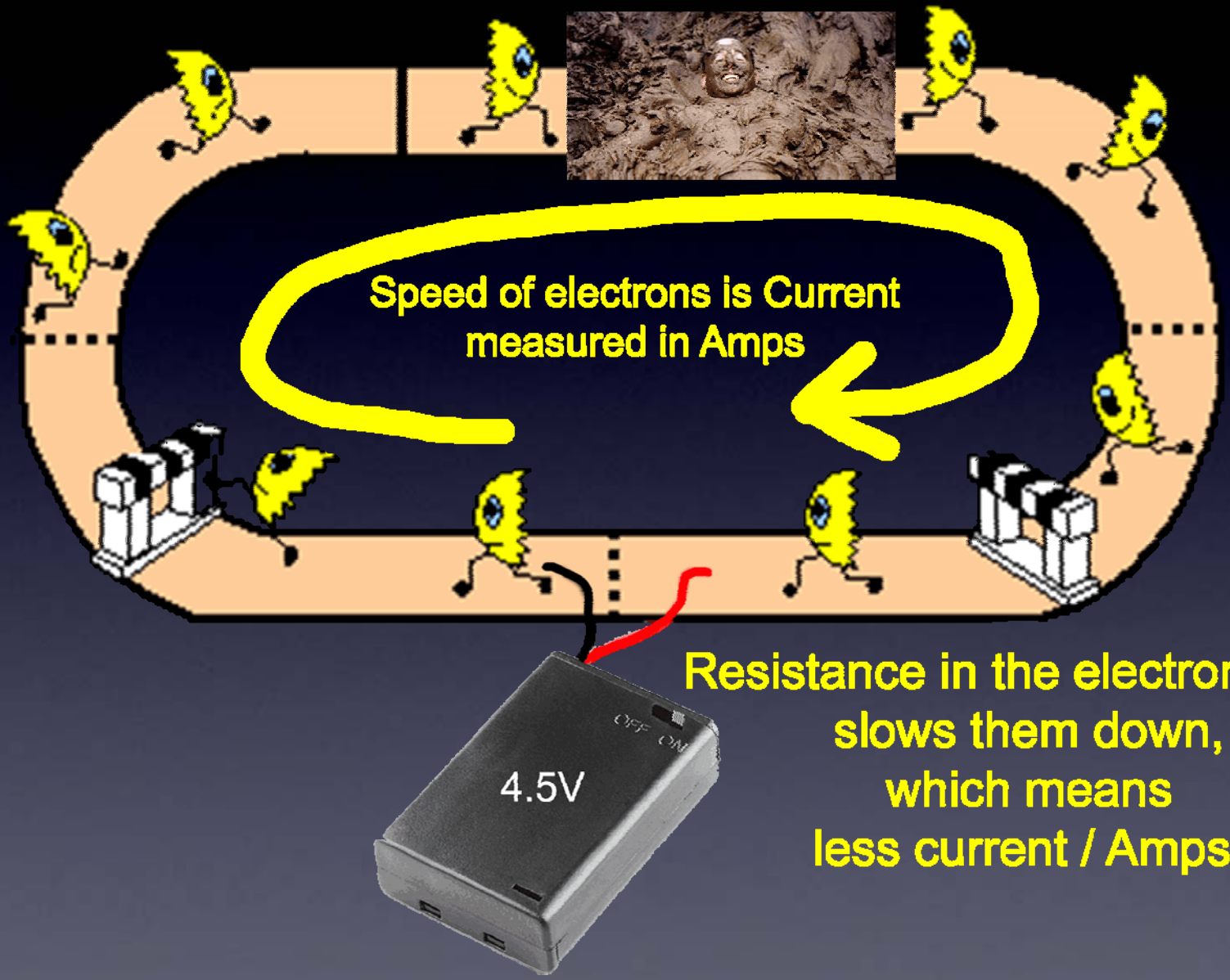


Amps / Current

Too much energy?

Amps / Current

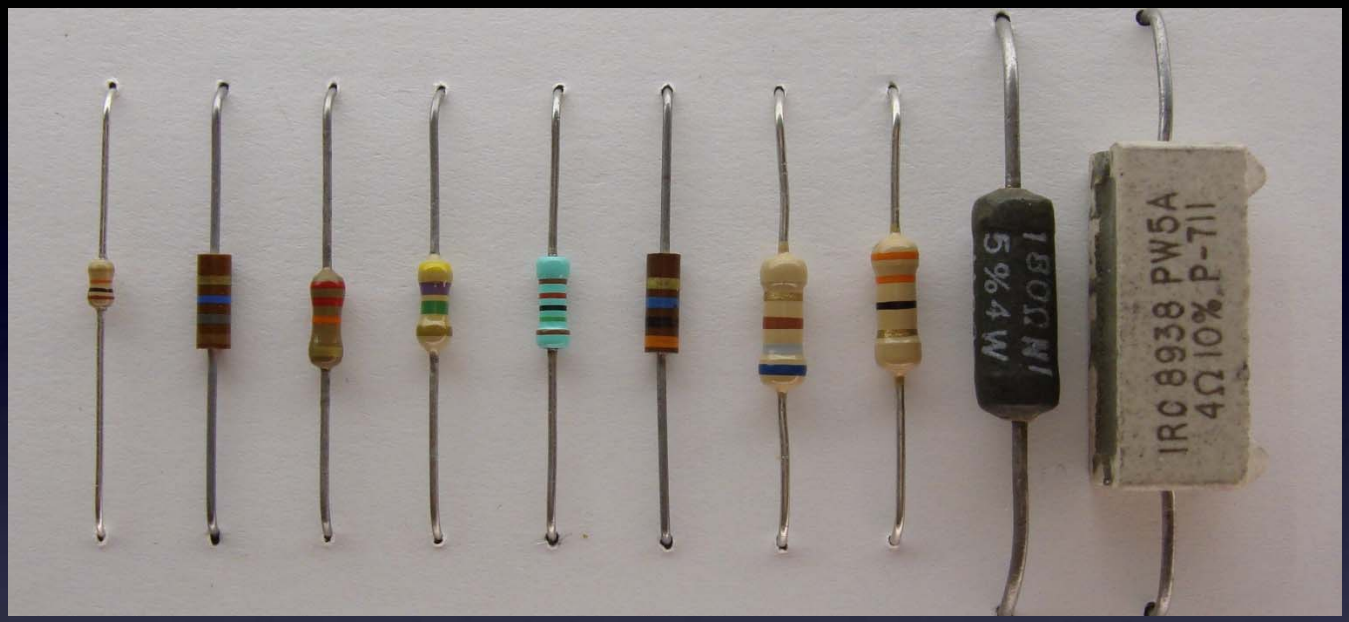
Everything You Need to Know About Electronics

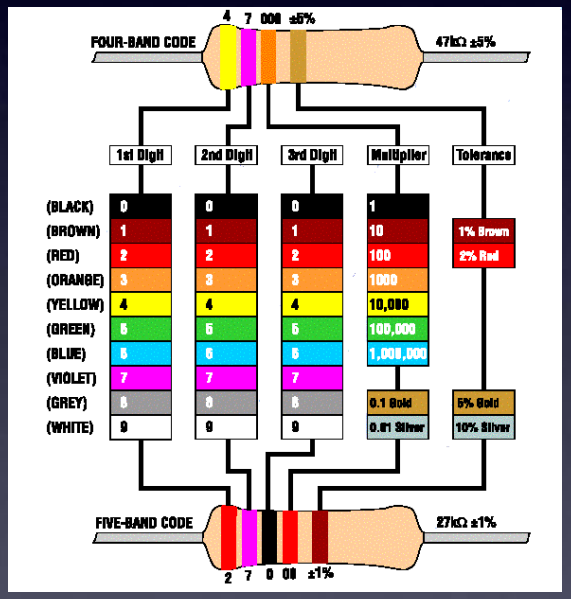


Resistance in the electrons' path
slows them down,
which means
less current / Amps.

Resistance / Ohms

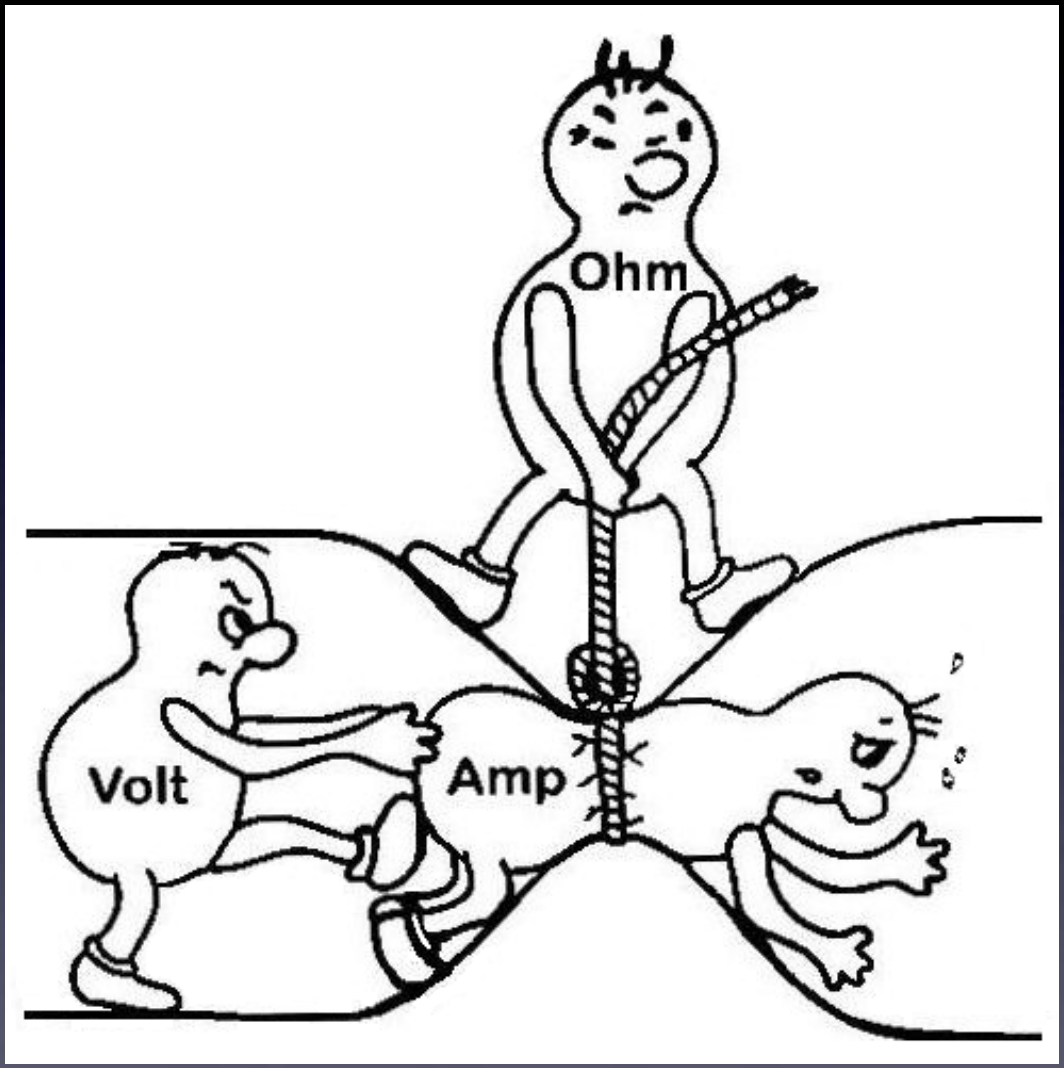
Everything You Need to Know About Electronics





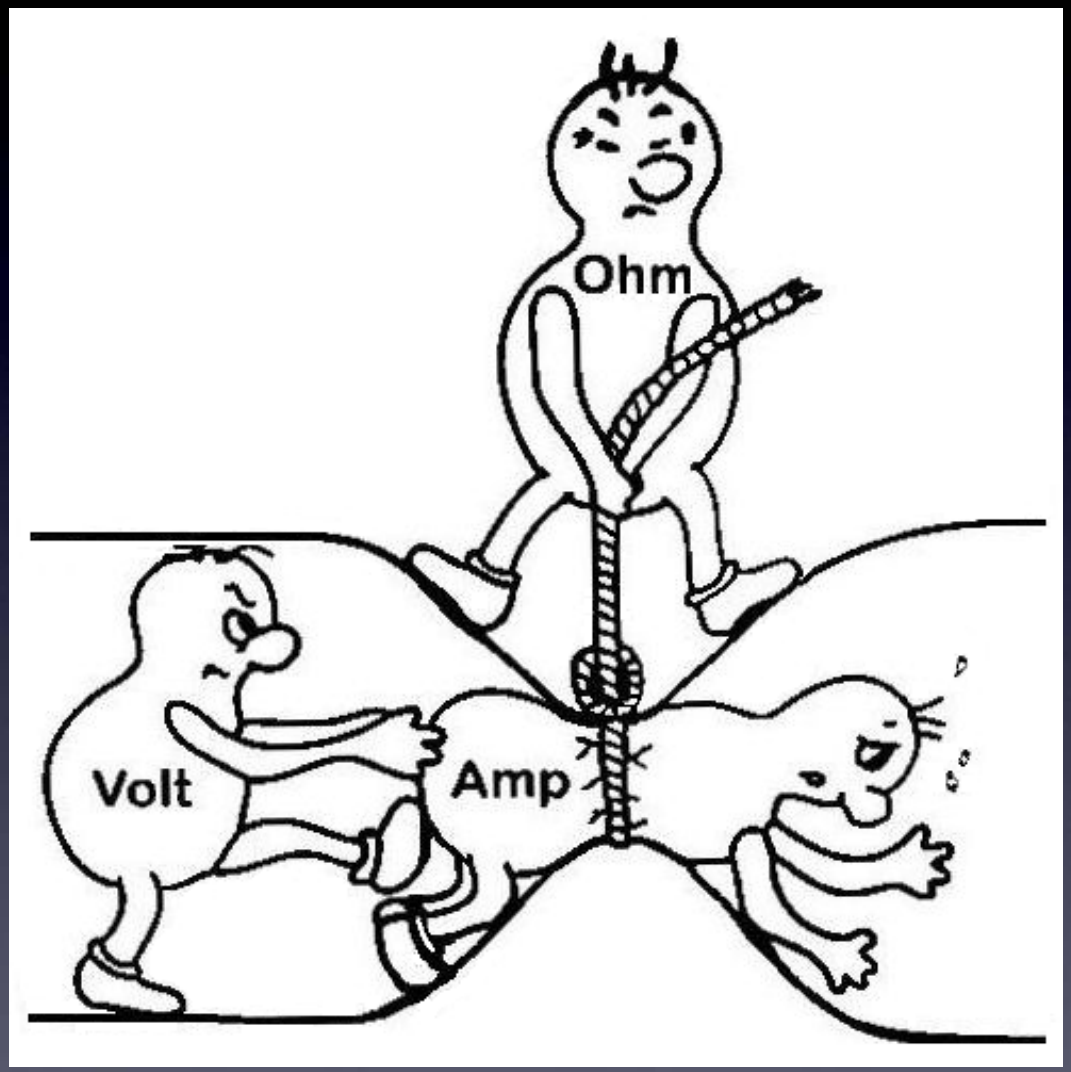
Resistors / Ohms

Everything You Need to Know About Electronics



Ohm’s Law

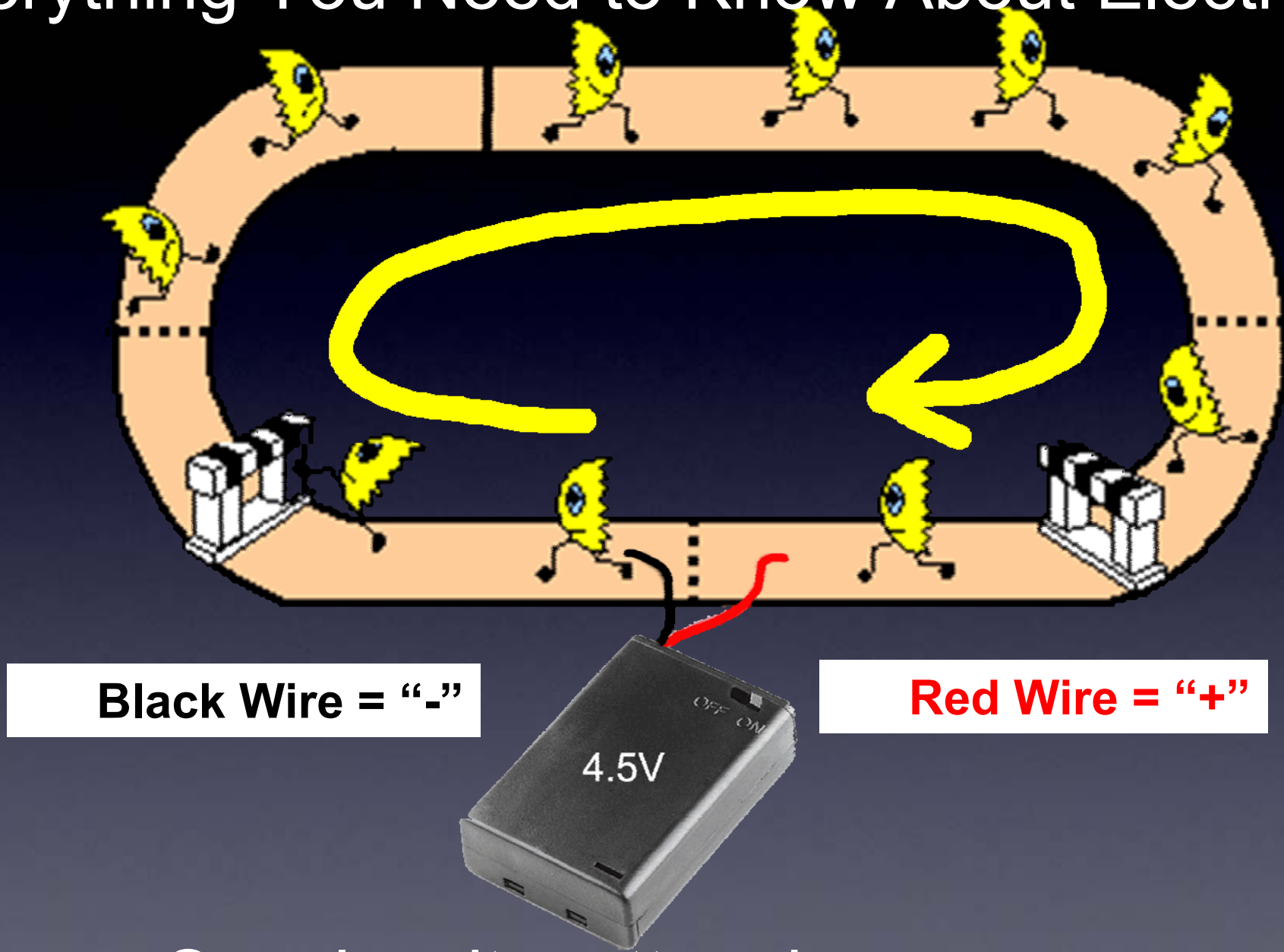
Everything You Need to Know About Electronics



Volts = Amps x Ohms

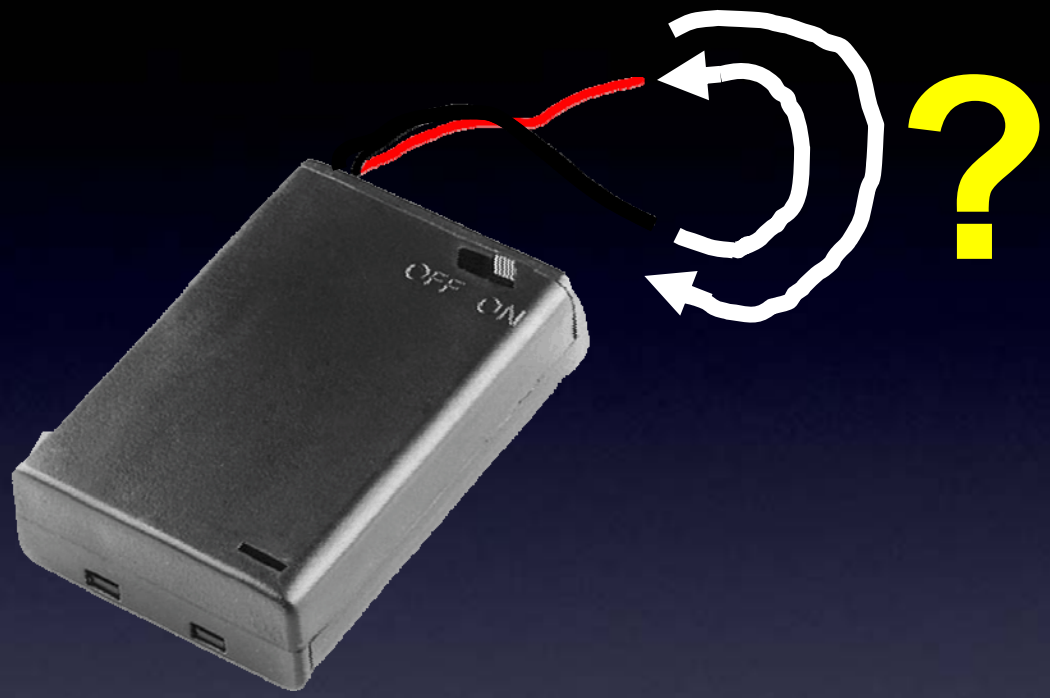
Ohm's Law

Everything You Need to Know About Electronics



Power Supply – it matters how you connect it!

Everything You Need to Know About Electronics

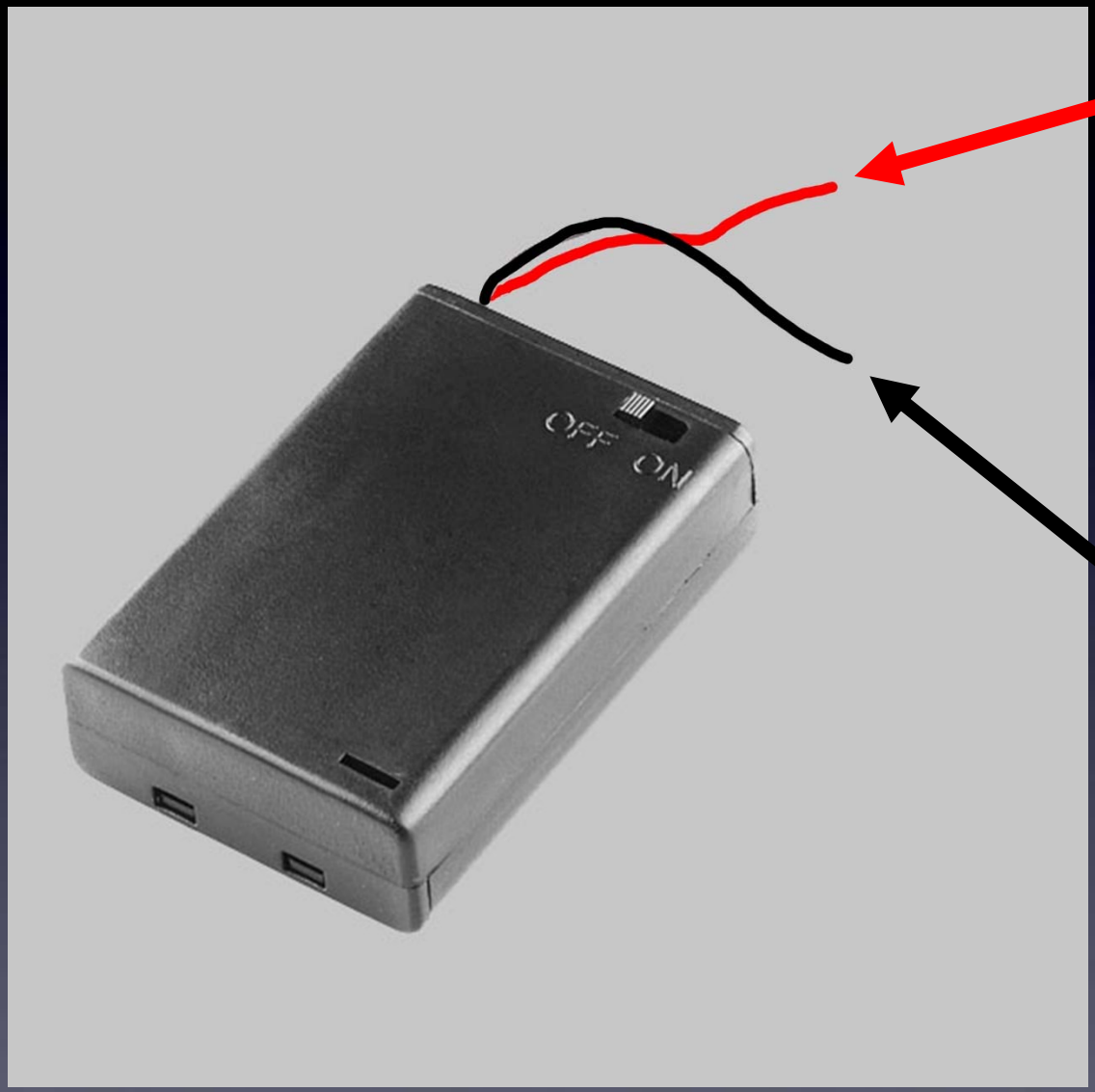


What happens?

Polarity

Power Supply – it matters how you connect it!

Everything You Need to Know About Electronics



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

Black wire:
Minus, Negative,
0V,
Ground

Power Supply – it matters how you connect it!

Everything You Need to Know About Electronics

or

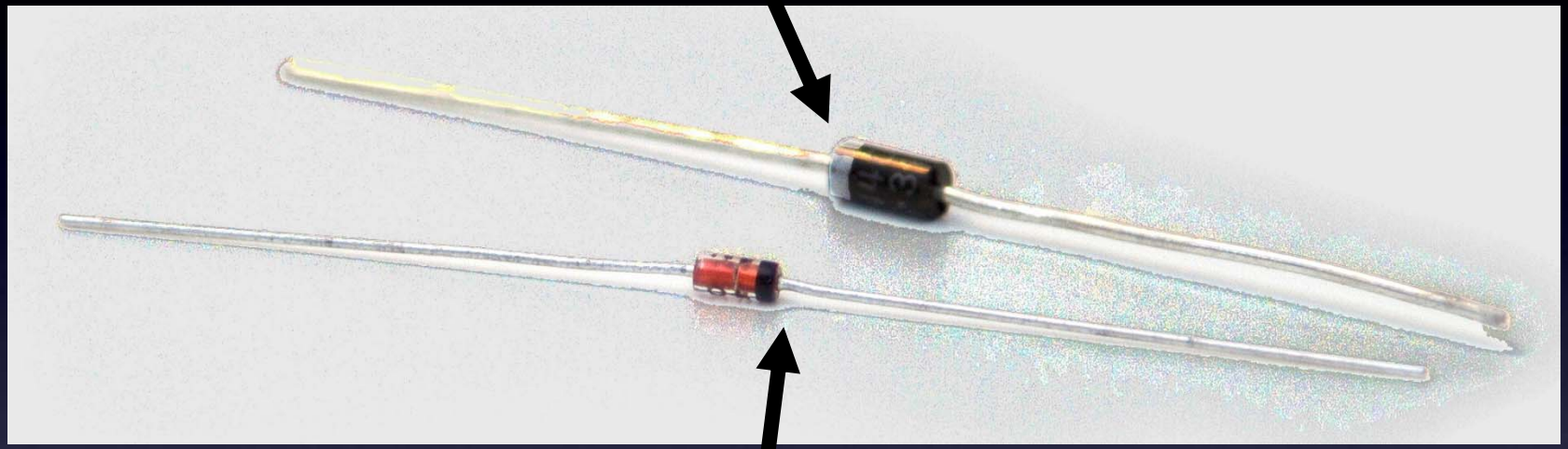
or

(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

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)

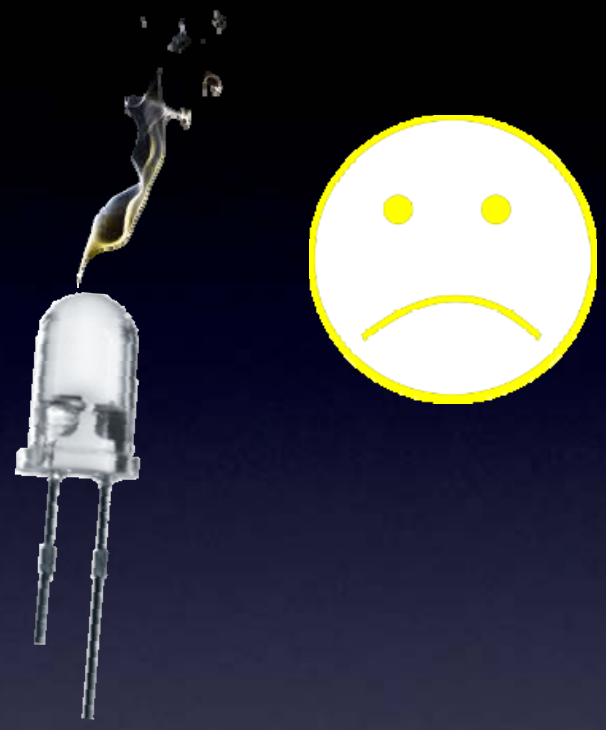
LED

Everything You Need to Know About Electronics

More current → More brightness! (until…)

LED

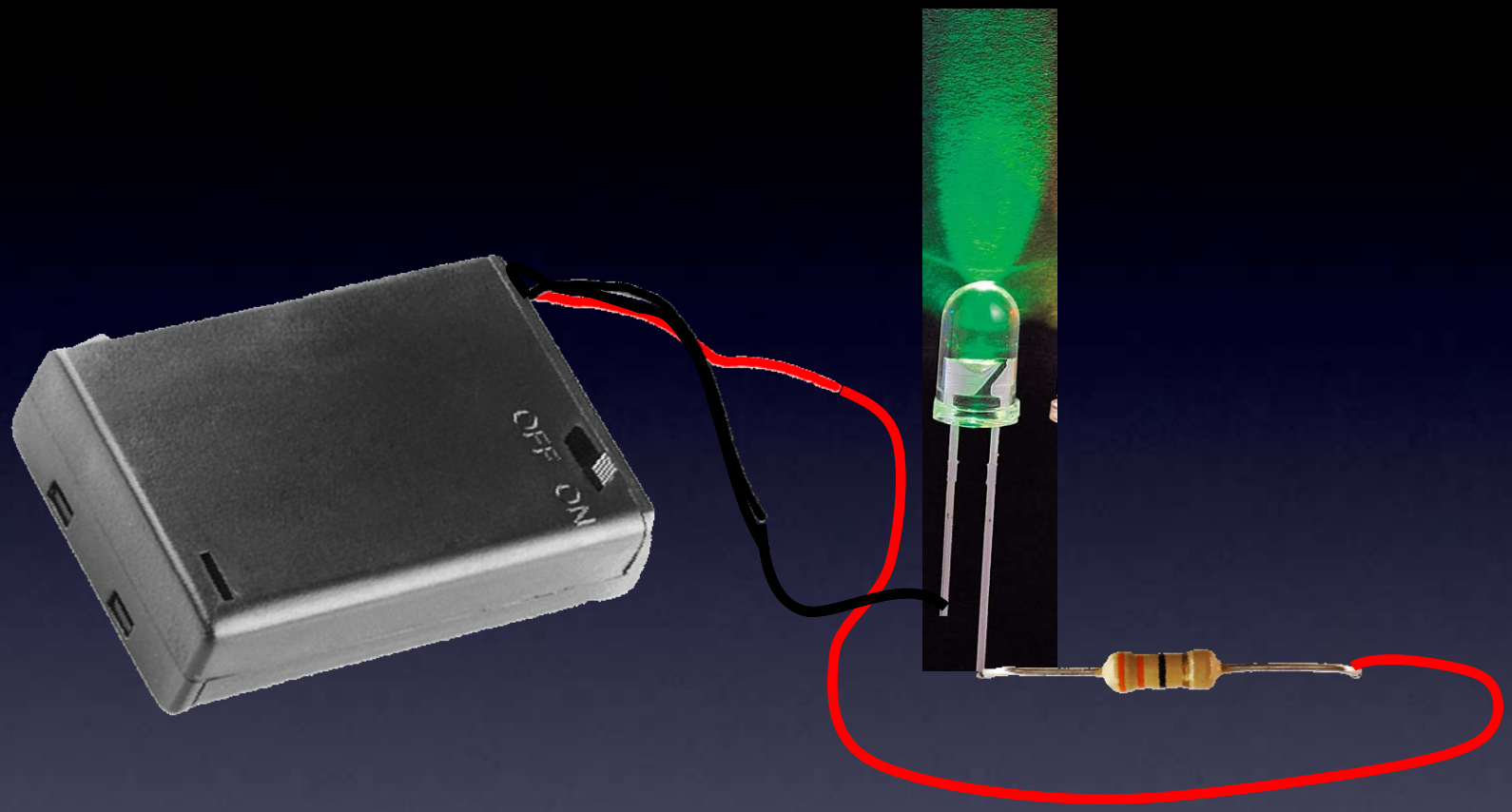
Everything You Need to Know About Electronics



More current → More brightness! (until…)

LED

Everything You Need to Know About Electronics

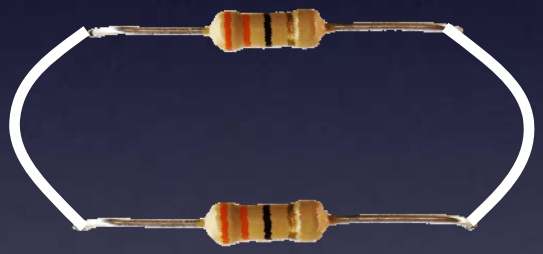


This is why we put a resistor in line

LED

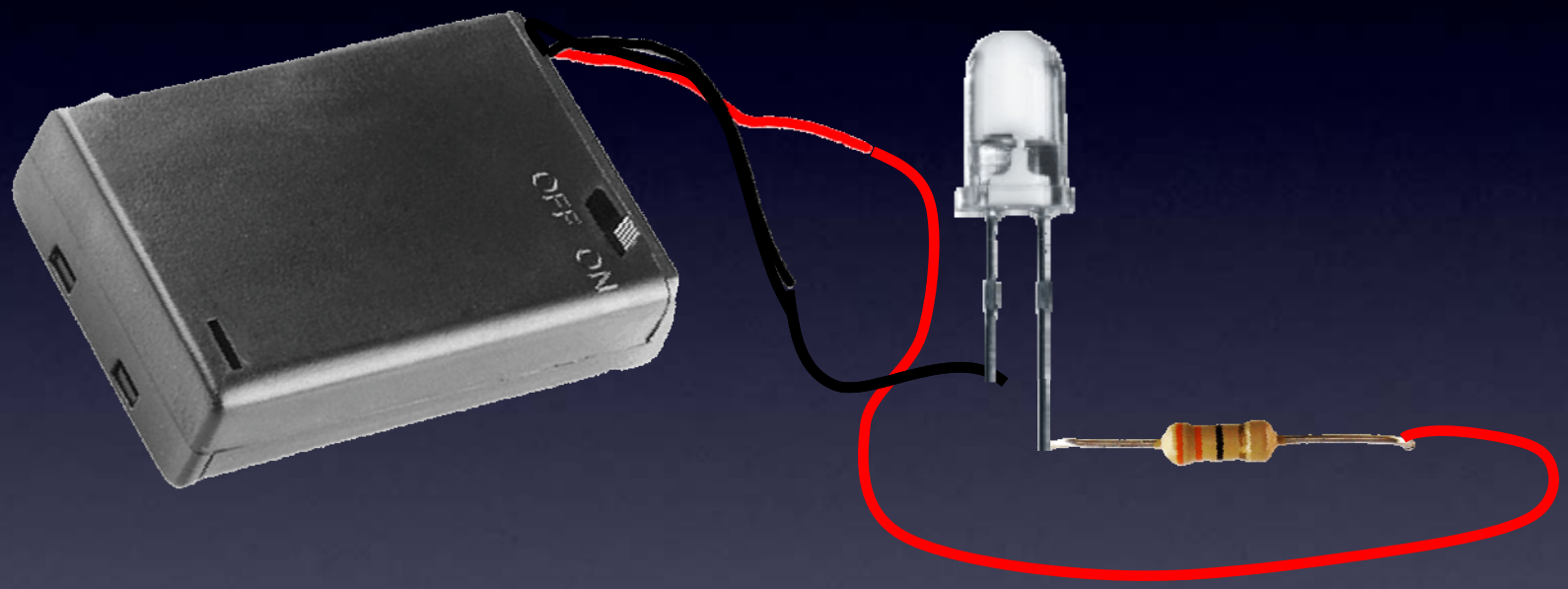
Everything You Need to Know About Electronics

Series = in line



Parallel = across

Everything You Need to Know About Electronics



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

IR Remote Control

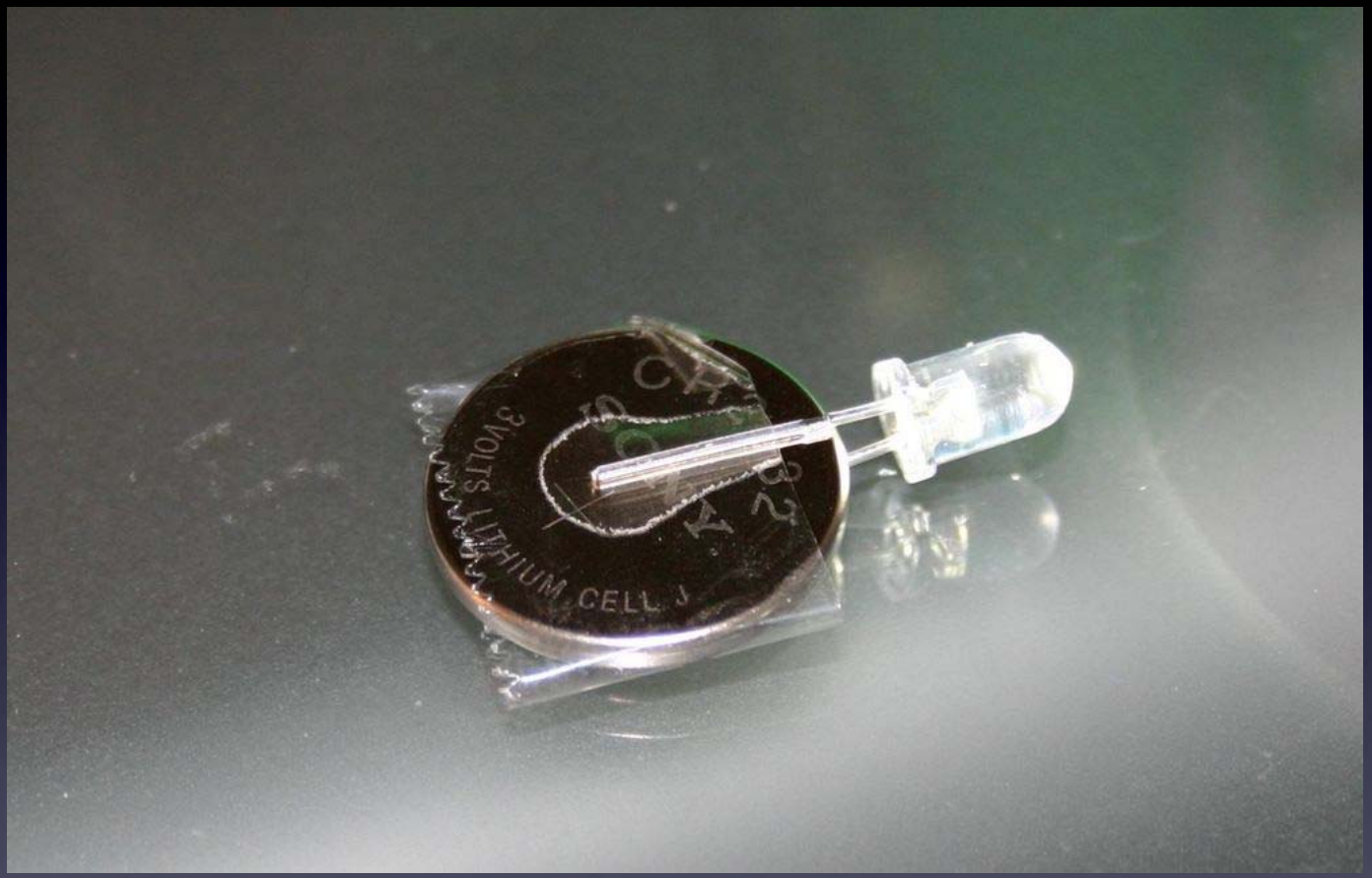
Everything You Need to Know About Electronics

Takes about 60 seconds

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

TV-B-Gone universal remote control

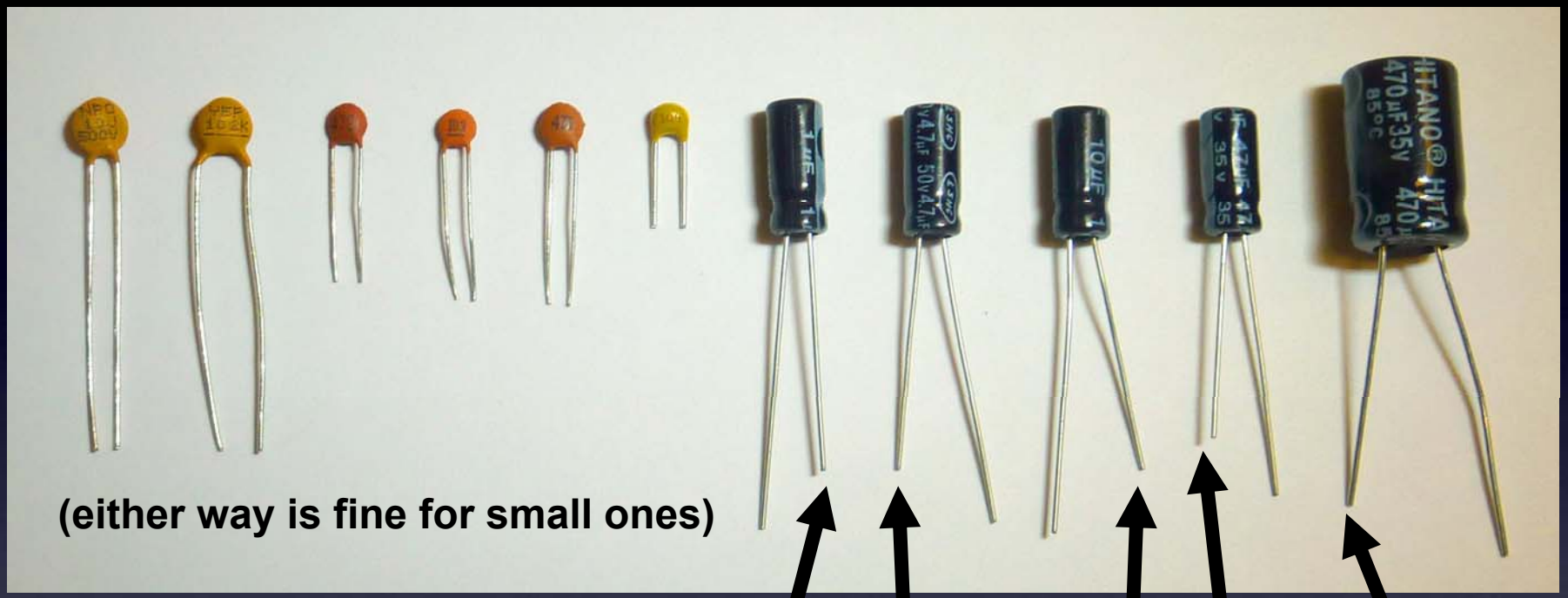
Everything You Need to Know About Electronics



LED & battery

Our first circuit

Everything You Need to Know About Electronics

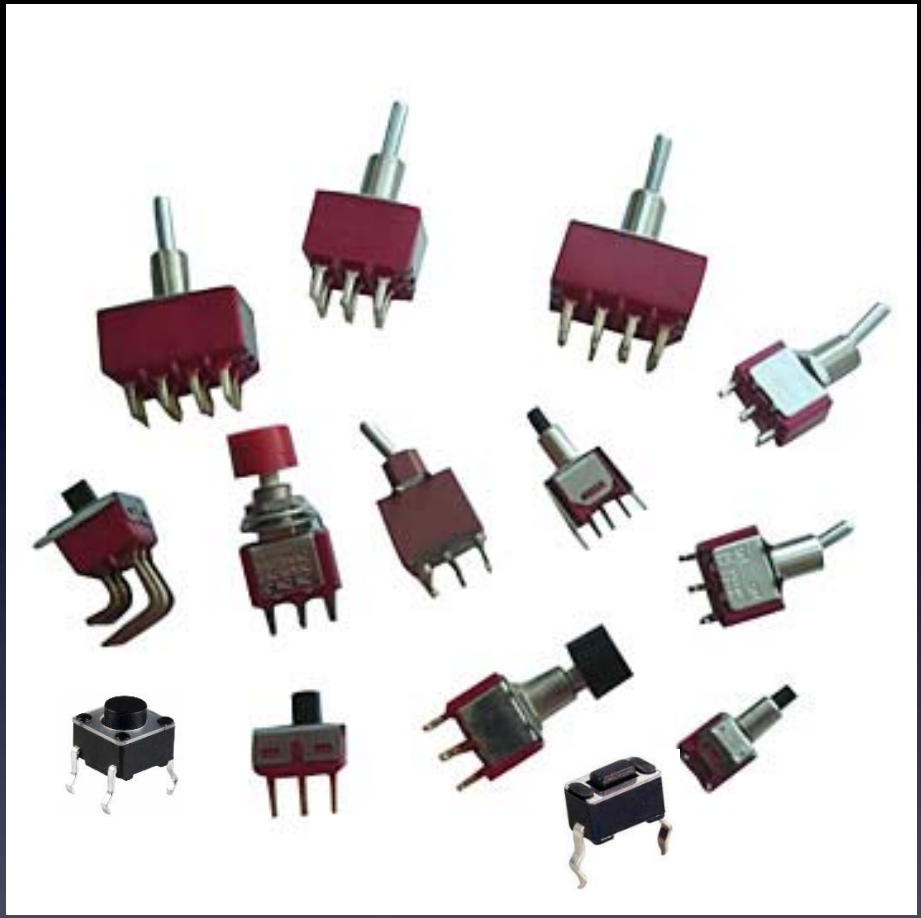


Short wire is Minus / Negative

Little buckets for electrons

Capacitor / Farads

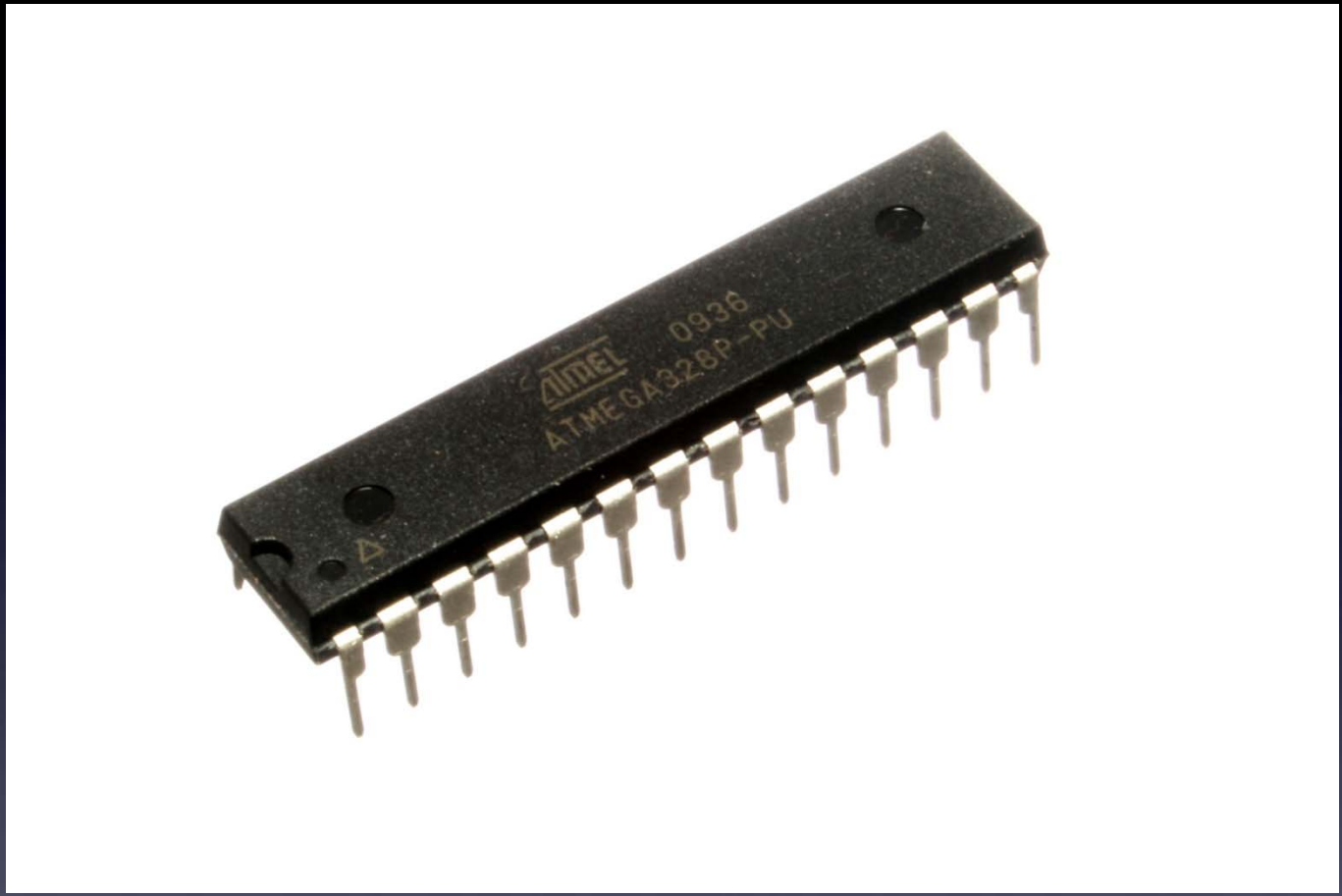
Everything You Need to Know About Electronics



Strips of metal connected together – or not

Switch

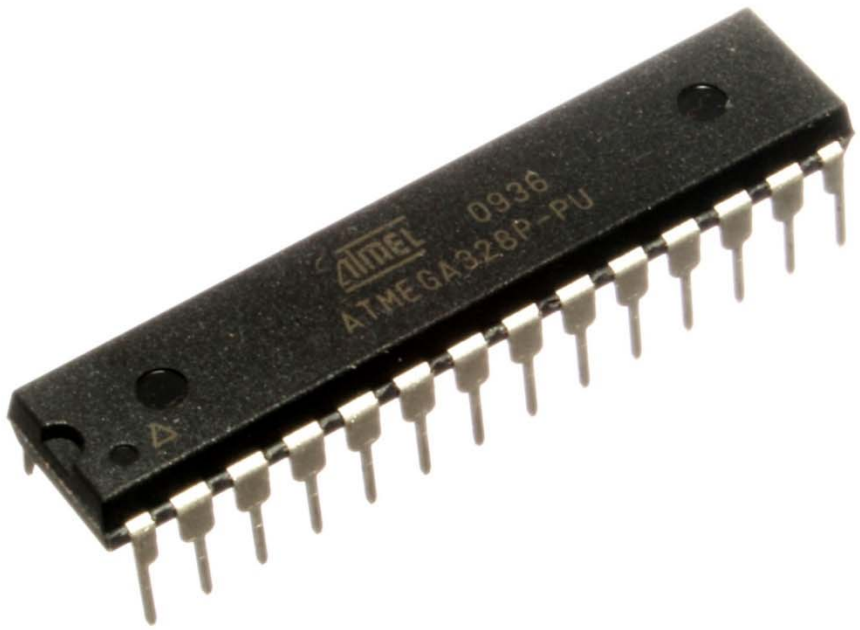
Everything You Need to Know About Electronics



A complete computer on a chip

Microcontroller

Everything You Need to Know About Electronics



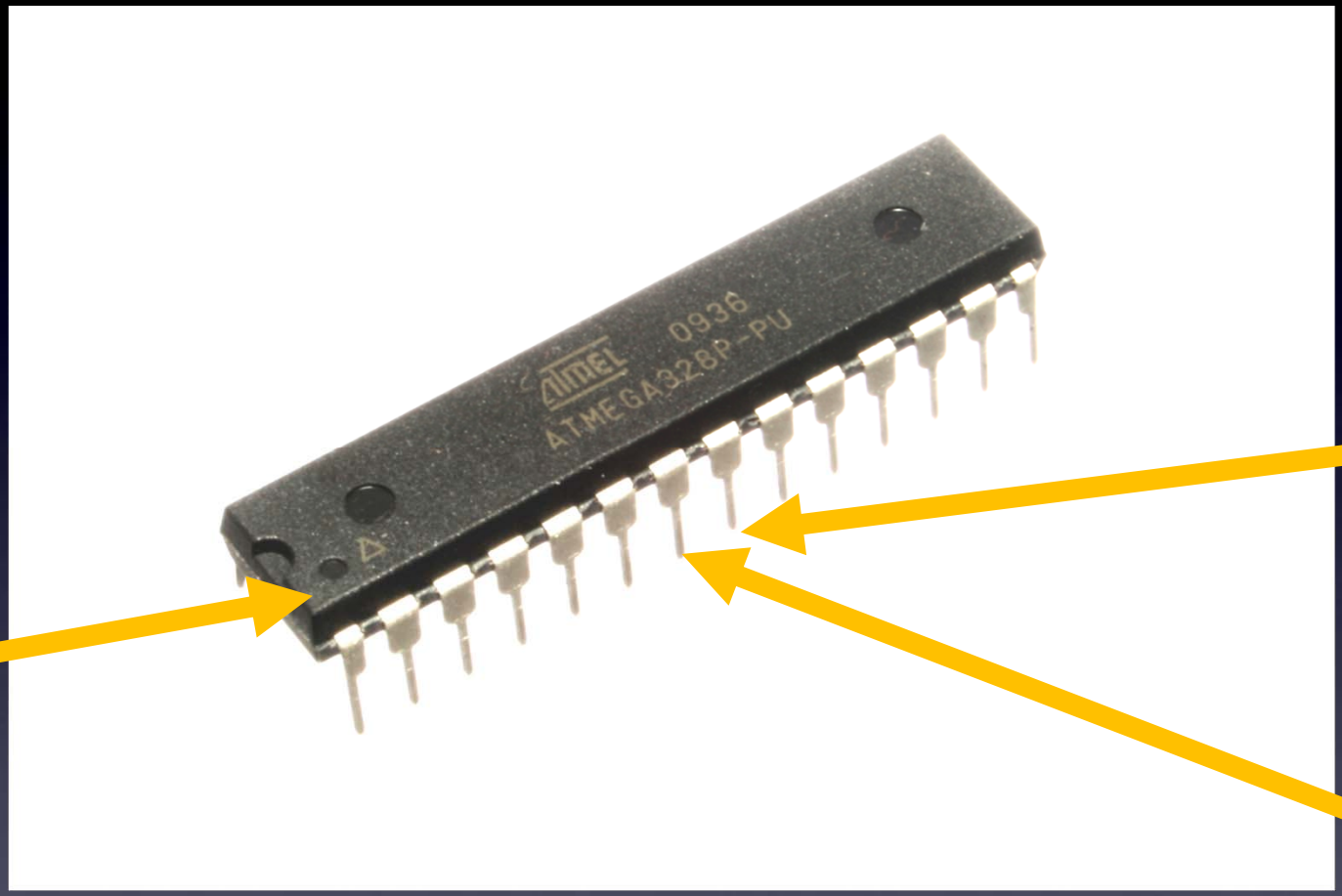
It runs programs

to control electronic parts connected to its pins.

Microcontroller

Everything You Need to Know About Electronics

2 special pins:



Pin 1

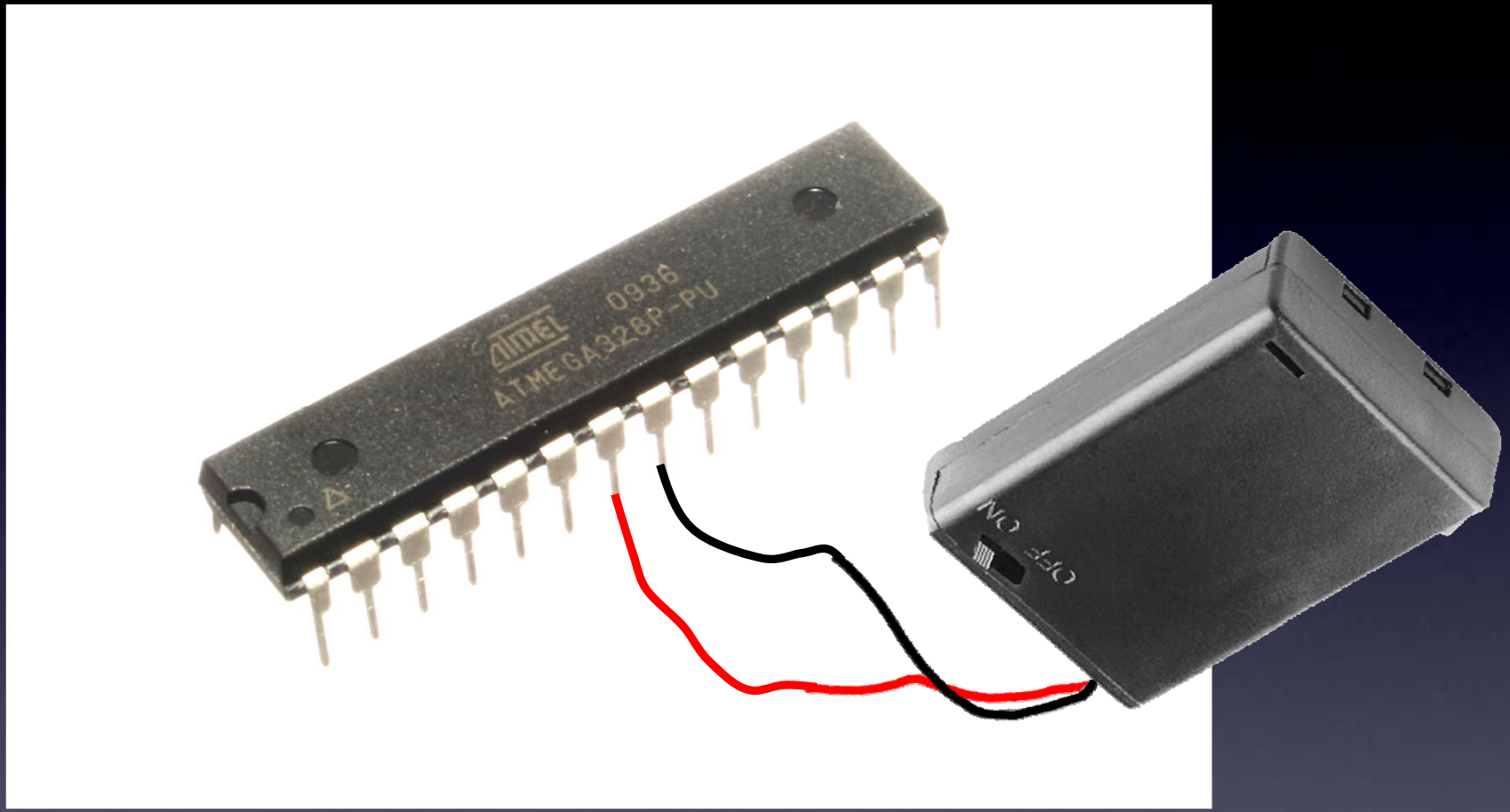
Pin 8 = Ground

Pin 7 = Vcc

A complete computer on a chip

Microcontroller – it matters how you hook it up!

Everything You Need to Know About Electronics

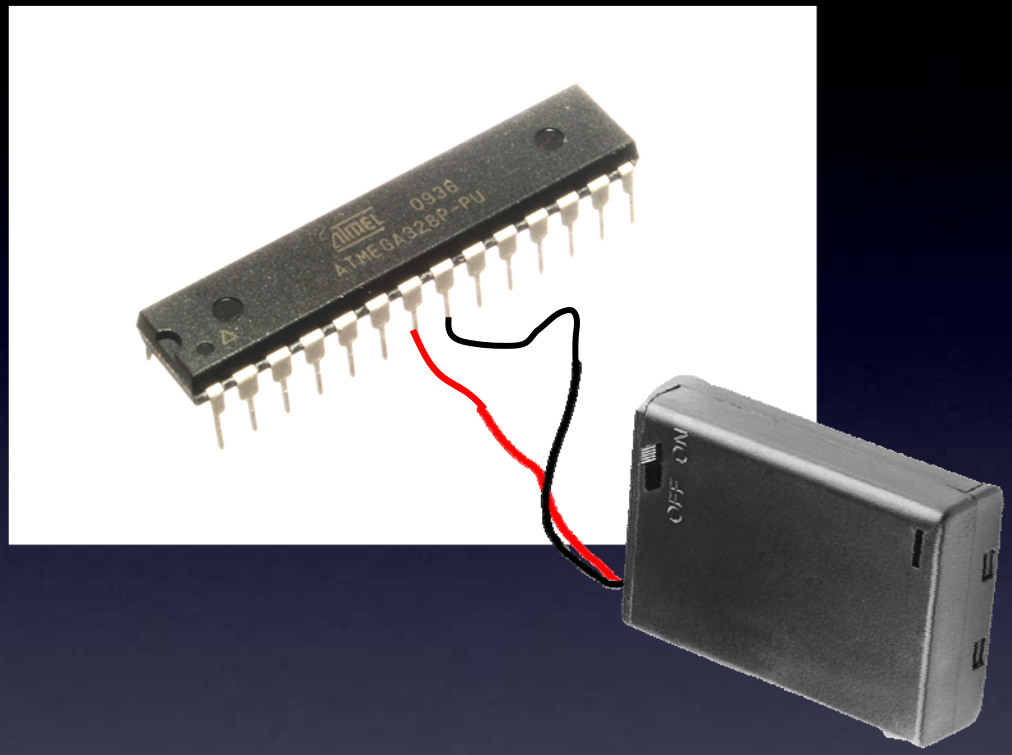


A complete computer – running a program!

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 Vcc

Digital Electronics:
Only 2 choices: Ground (0V) or Vcc

2 types of electronics

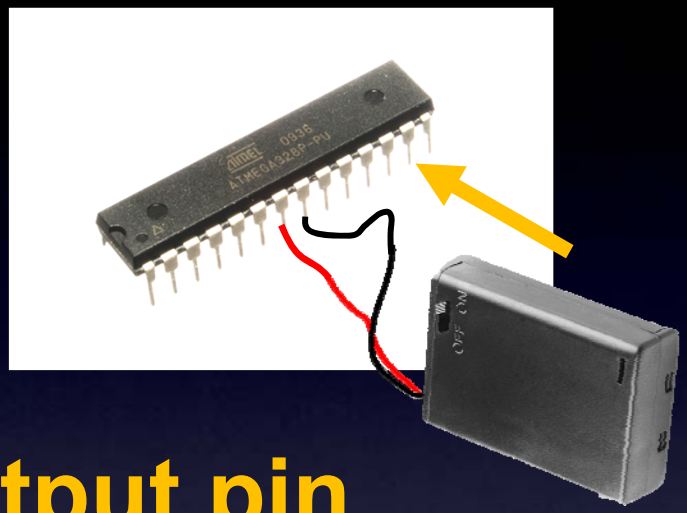
Everything You Need to Know About Electronics

Ground (0V)	Power / Vcc
Low	High
Off	On
0	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 Pin

Everything You Need to Know About Electronics

Low	High
Off	***almost* the same**
(0V)	**as the Red wire**
	of the power supply

Only 2 choices: High or Low

Microcontroller – Output Pin

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

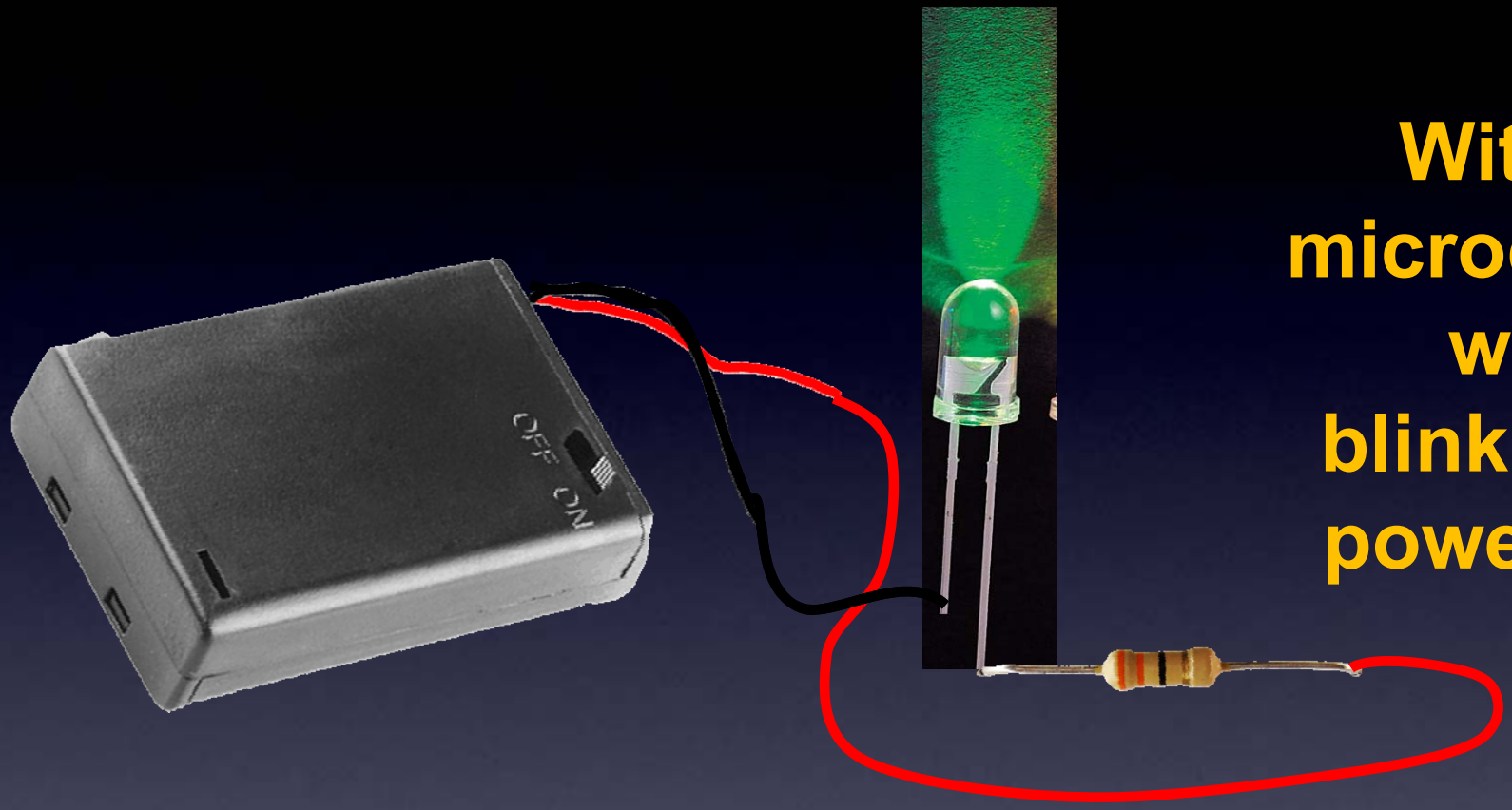
Microcontrollers

make an LED blink

Hello World

Microcontroller

Everything You Need to Know About Electronics



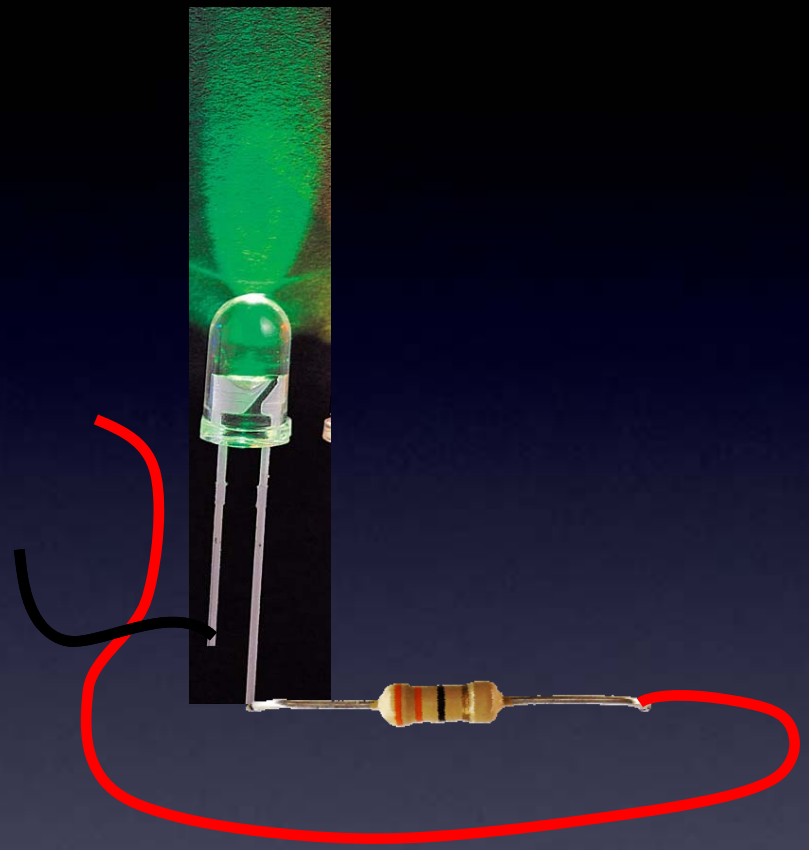
Without a microcontroller we can blink with our power supply

Turning an LED on and off

(Leading up to Hello World)

Everything You Need to Know About Electronics

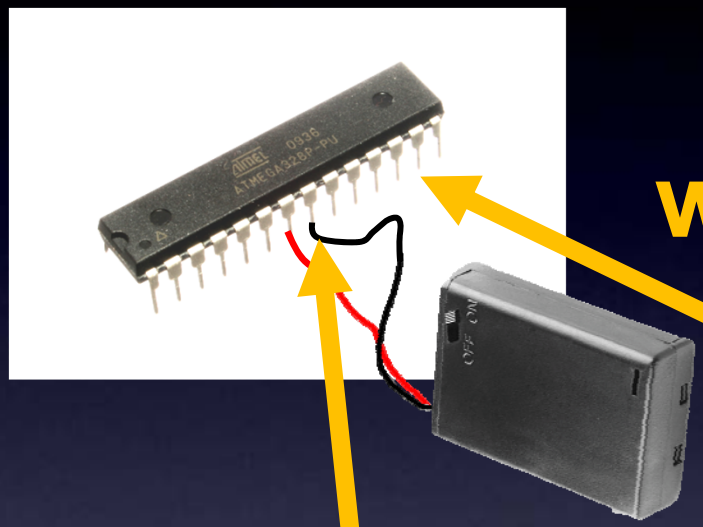
Let's replace the power supply



Turning an LED on and off

(Leading up to Hello World)

Everything You Need to Know About Electronics



With a microcontroller: we can use an Output pin for power (if it's On)

Let's use Pin 13

And we use the Ground pin for Ground

Turning an LED on and off

(Leading up to Hello World)

Everything You Need to Know About Electronics

Since an Output pin
is *almost* like the Red wire of our power supply
when it is On

Let's connect this LED to an Output pin…
…instead of our power supply

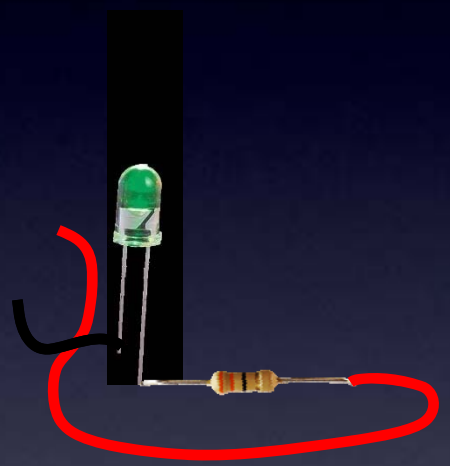
And make it blink!

Turning an LED on and off

(Leading up to Hello World)

Everything You Need to Know About Electronics

Since an Output pin
is *almost* like the Red wire of our power supply
when it is On



Let's connect this LED to an Output pin…
…instead of our power supply

With a resistor
(so no magic smoke goes away)

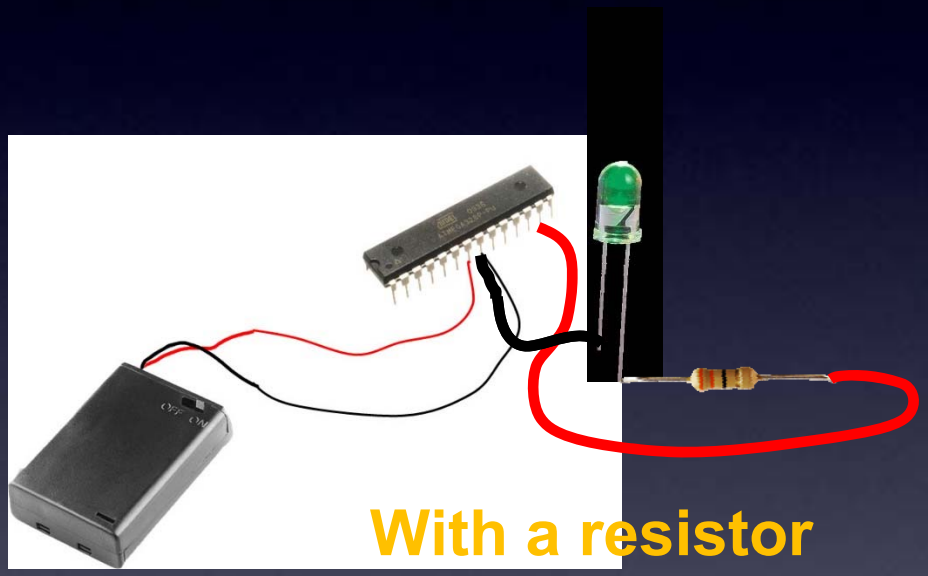
And make it blink!

Turning an LED on and off

(Leading up to Hello World)

Everything You Need to Know About Electronics

Since an Output pin
is *almost* like the Red wire of our power supply
when it is On



Let's connect this LED to an Output pin…
…instead of our power supply

With a resistor
(so no magic smoke goes away)

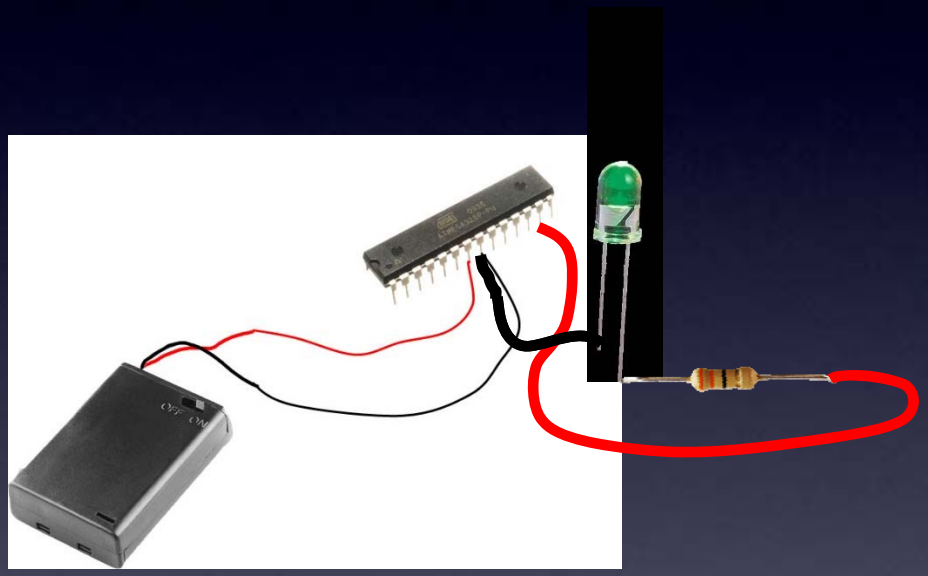
And make it blink!

Turning an LED on and off

Hello World

Everything You Need to Know About Electronics

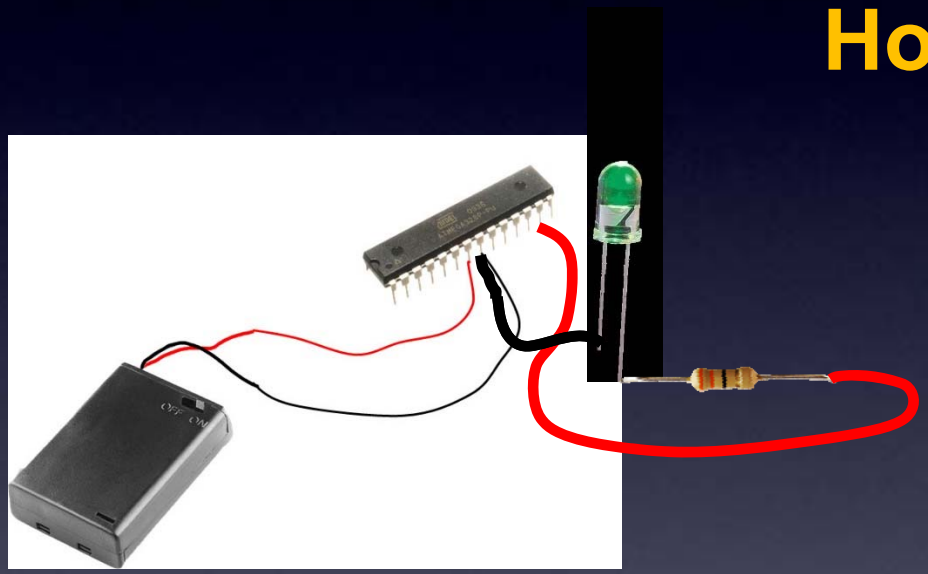
This is our **Hardware** for Hello World!



Turning an LED on and off

Hello World

Everything You Need to Know About Electronics



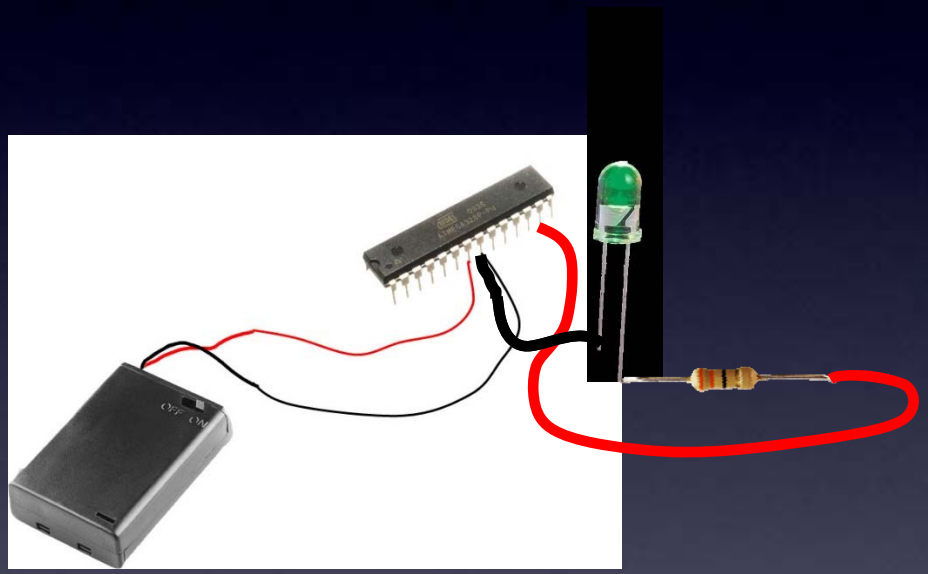
How about our program?

Turning an LED on and off

Hello World

Everything You Need to Know About Electronics

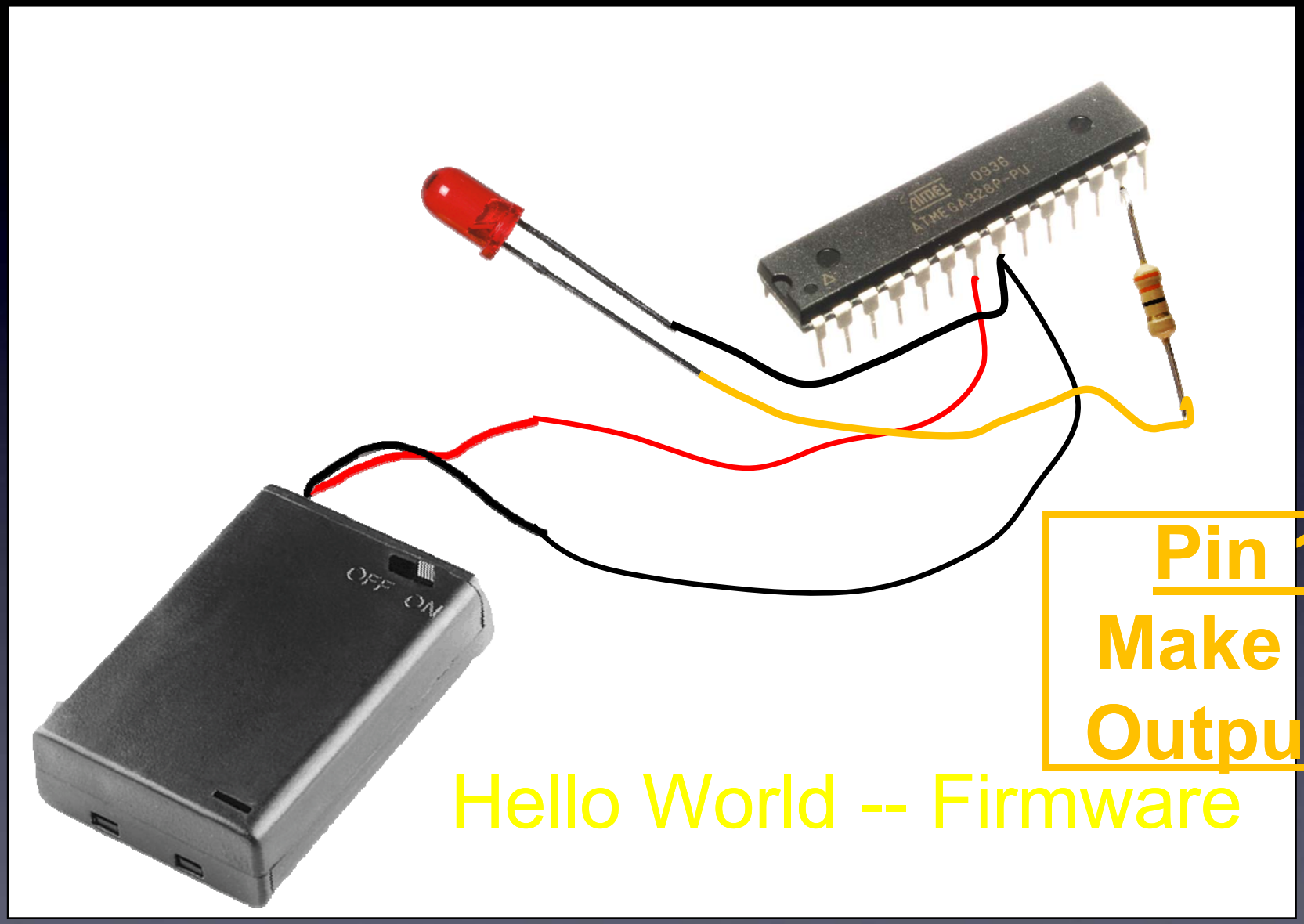
Programs on microcontrollers are called "Firmware"



Turning an LED on and off

Hello World

Everything You Need to Know About Electronics

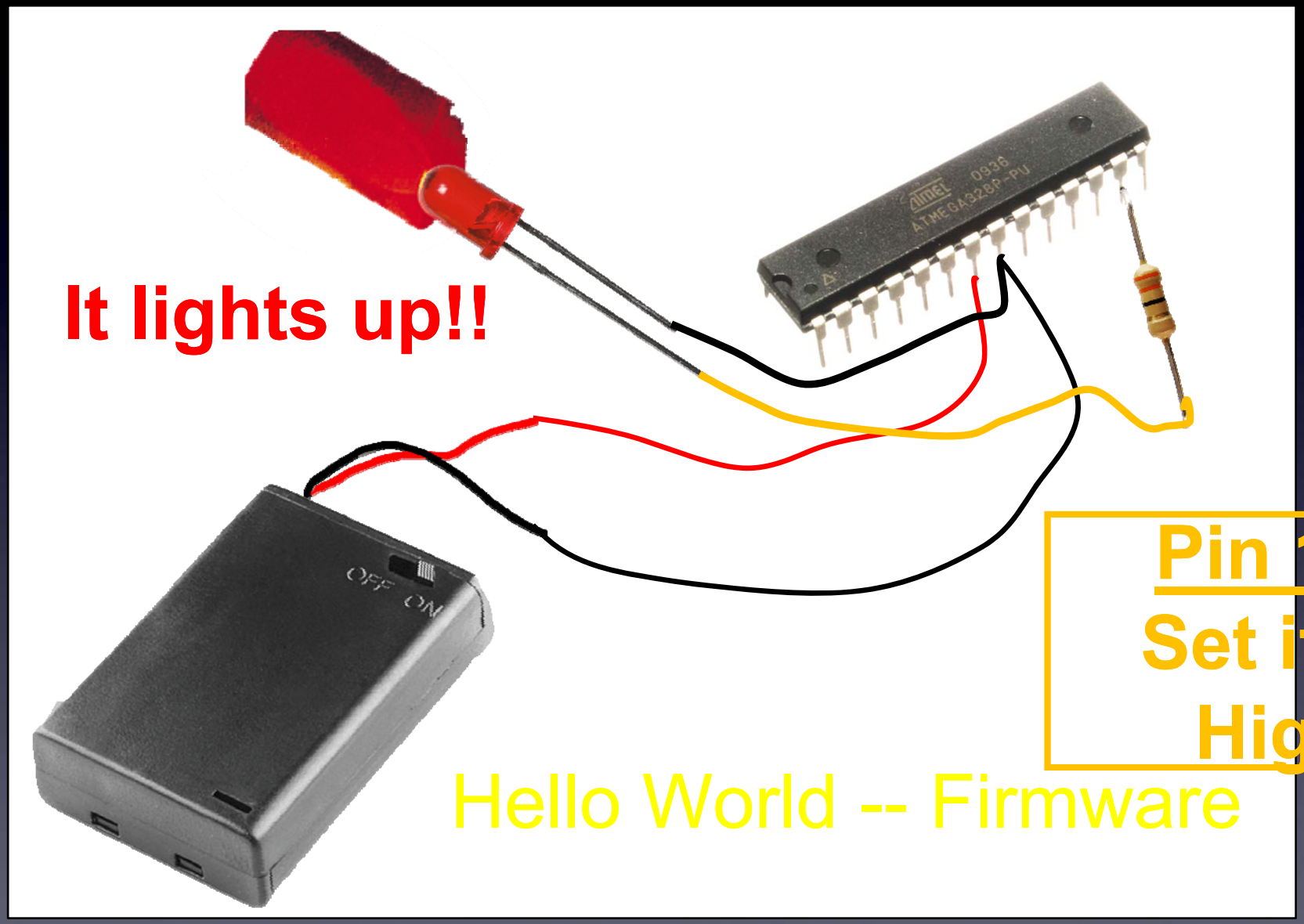


Pin 13:
Make it an Output Pin

Hello World -- Firmware

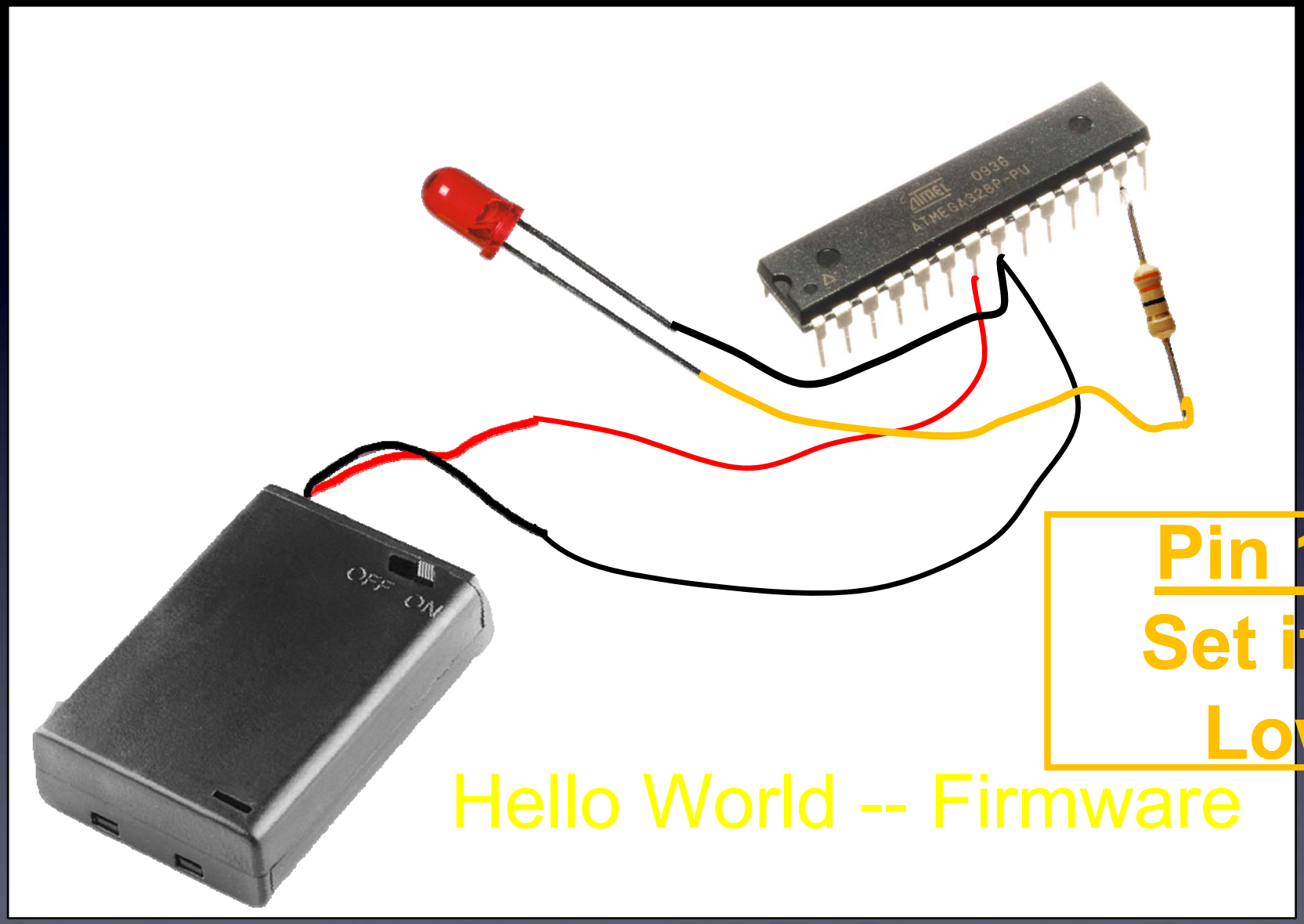
Microcontroller

Everything You Need to Know About Electronics



Microcontroller

Everything You Need to Know About Electronics



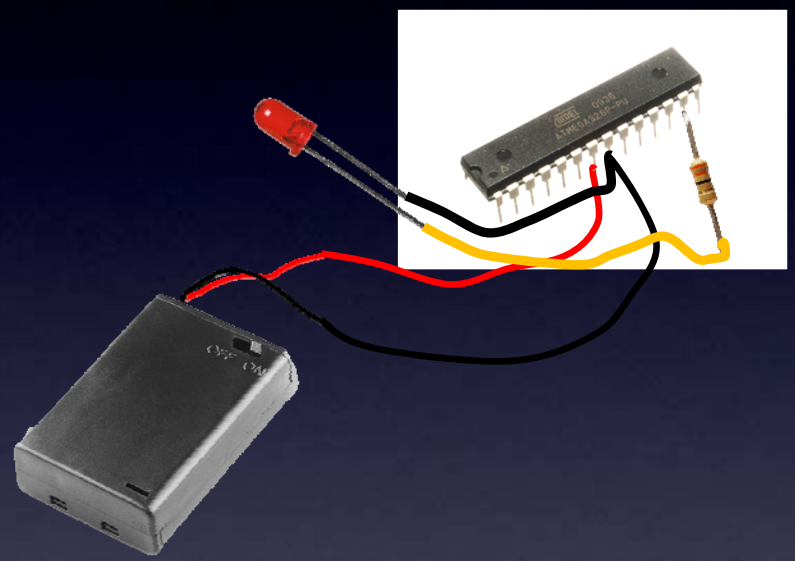
Microcontroller

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

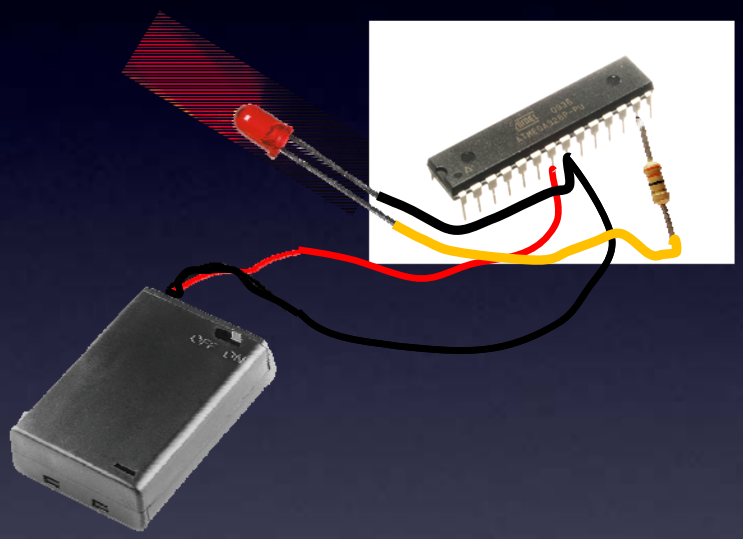
We need a delay

Hello World – for real now!

Microcontrollers – they go really fast!

Everything You Need to Know About Electronics

Hardware



Firmware

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

Programs on microcontrollers are called “Firmware”

Hello World

Microcontroller – Firmware

Everything You Need to Know About Electronics

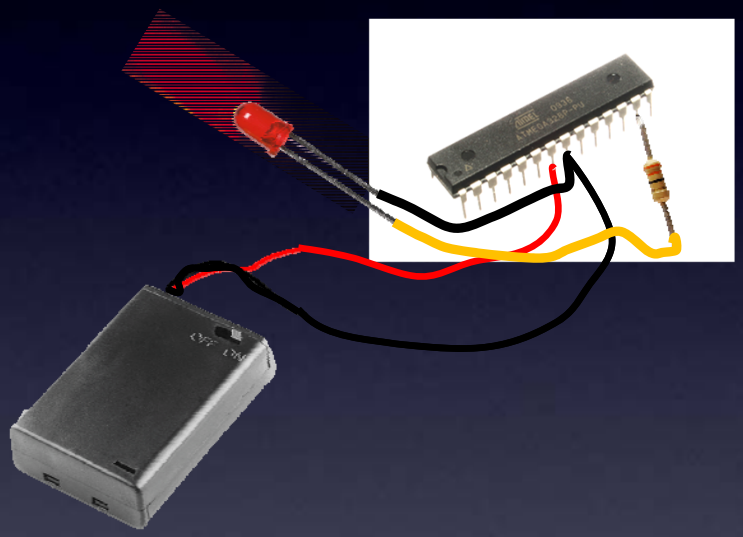
A precision cut piece of quartz crystal

For precise timing

Crystal

Everything You Need to Know About Electronics

Hardware



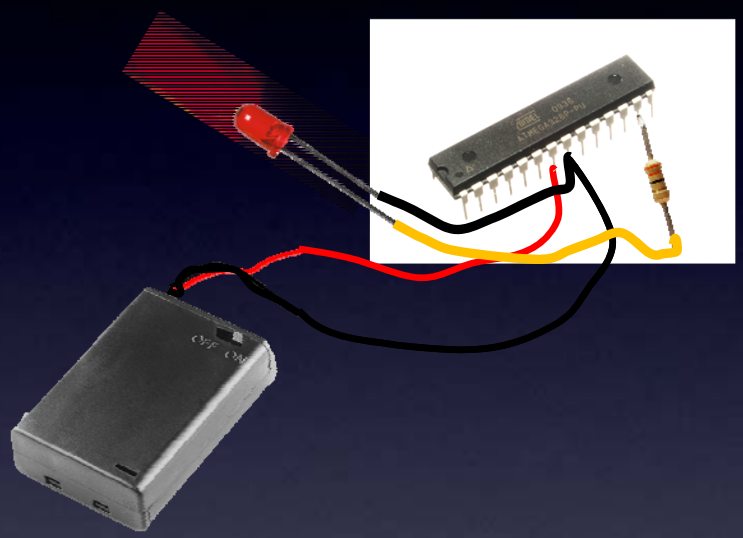
Firmware

- 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

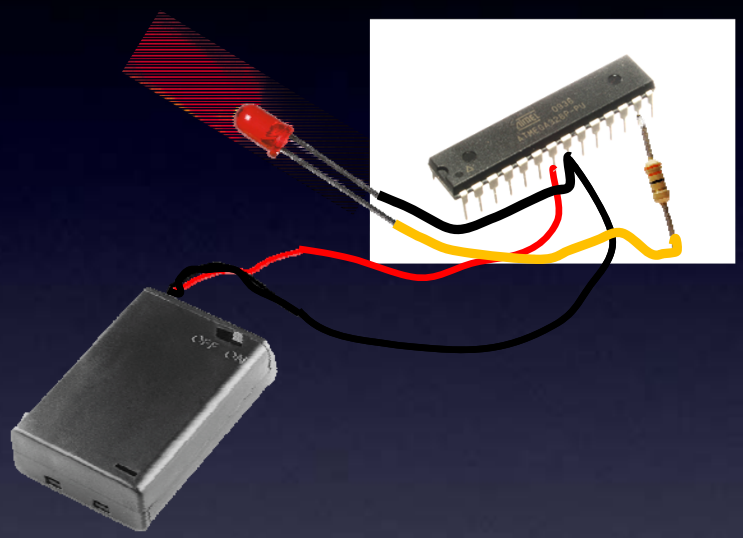


Add an IR LED to another pin

IR “OFF” code

Microcontroller

Everything You Need to Know About Electronics

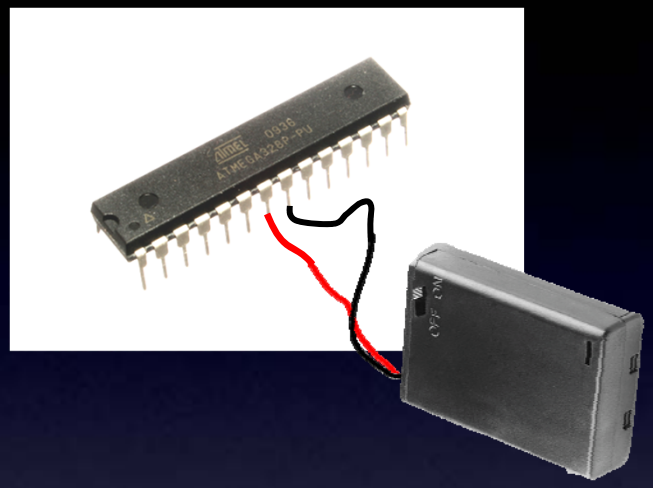


Add an IR LED to another pin (say, pin3)
and a resistor so no magic smoke goes away

IR “OFF” code

Microcontroller

Everything You Need to Know About Electronics

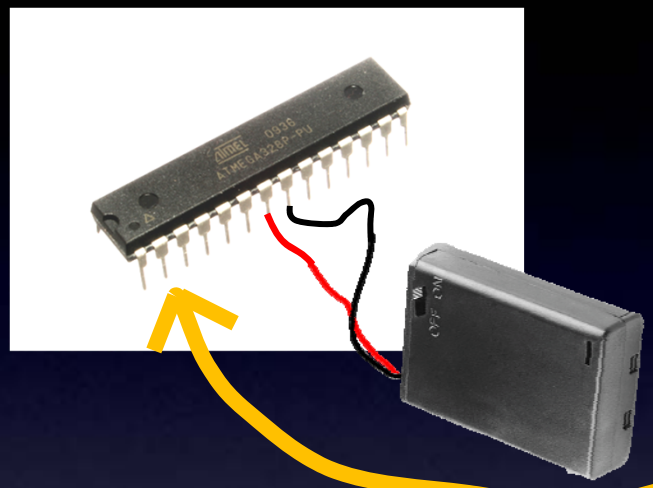


Let’s add an Input pin!

We can add a Start button

Microcontroller

Everything You Need to Know About Electronics



How do we make a pin an Input pin?

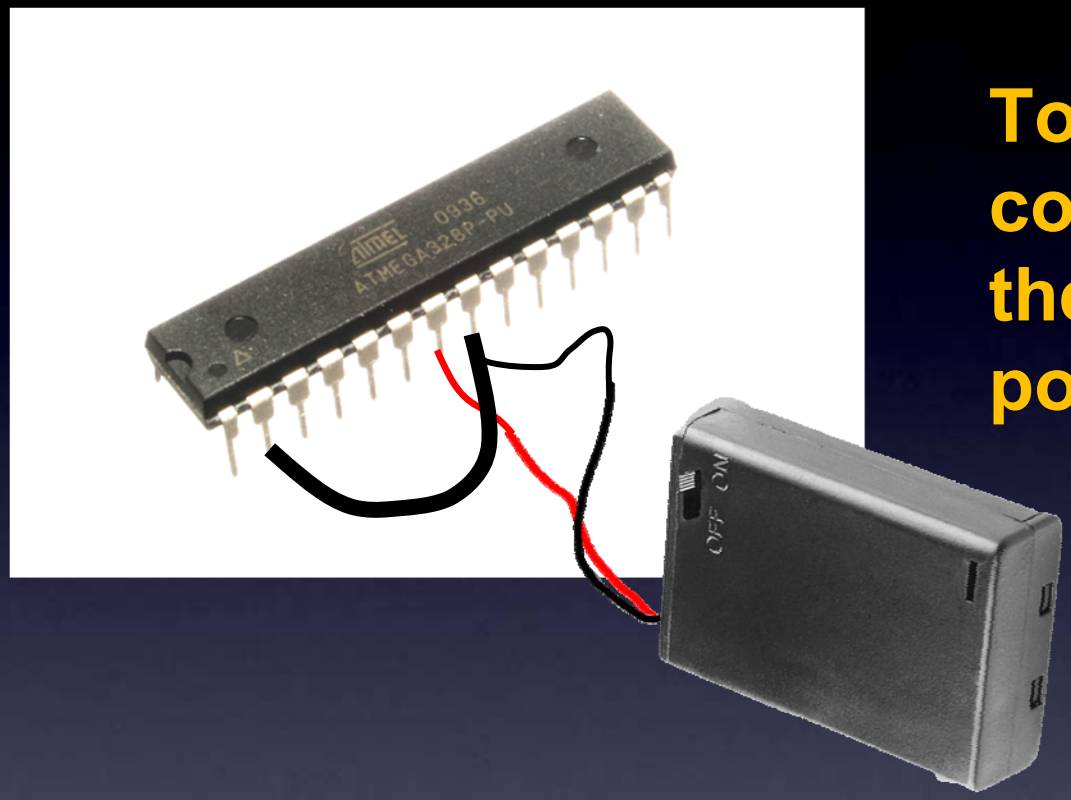
We tell it to be one – with our program.

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

Only 2 choices: High or Low

Microcontroller – Input Pin

Everything You Need to Know About Electronics

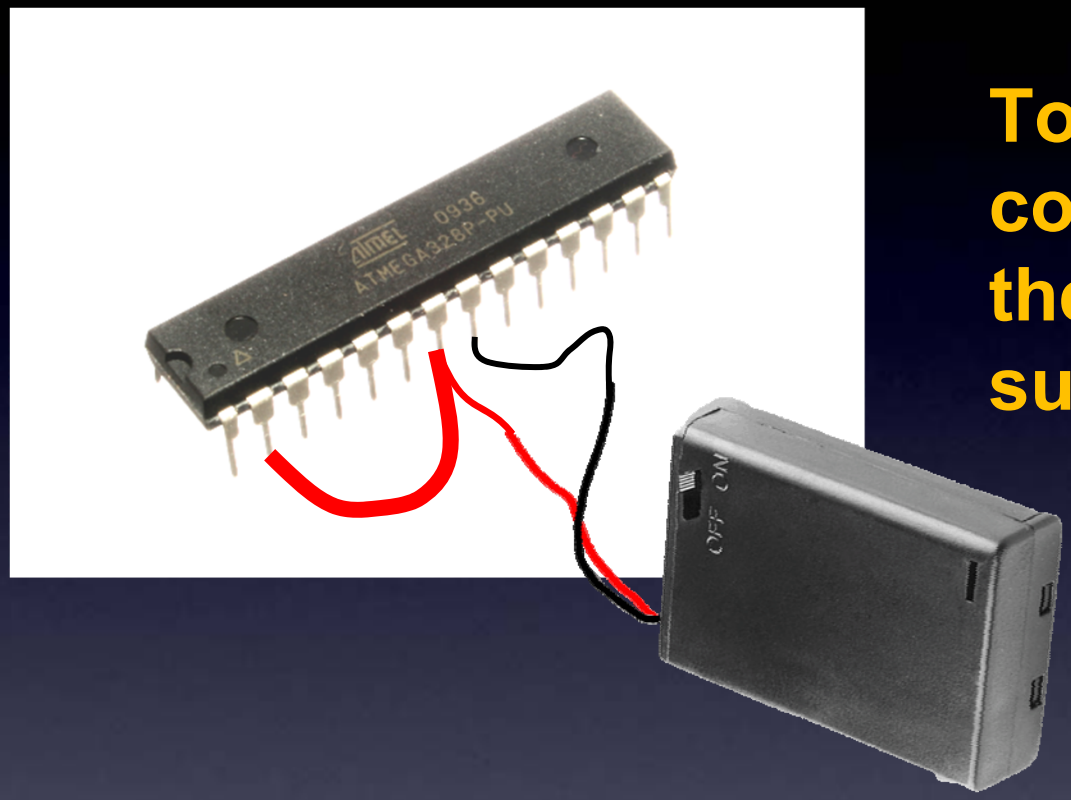


To make the Input pin Low, connect it to the Black wire of our power supply (Ground).

Low

Microcontroller – Input Pin

Everything You Need to Know About Electronics

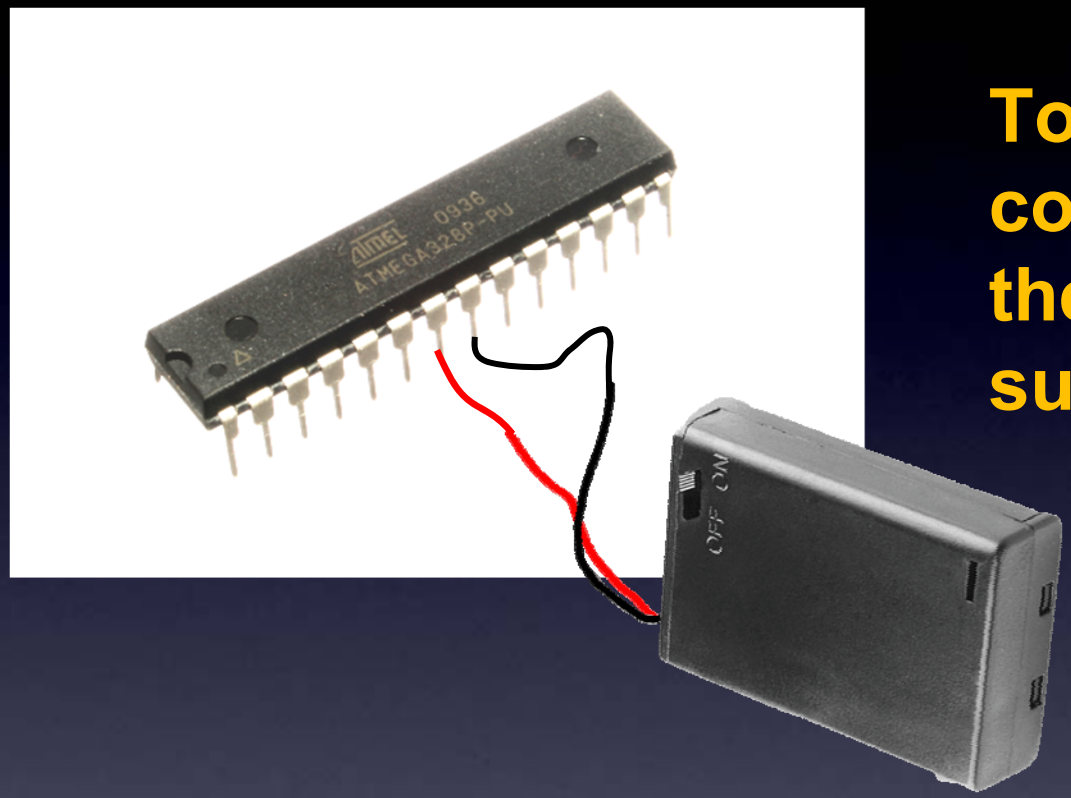


To make the Input pin High, connect it to the Red wire of our power supply (Vcc).

High

Microcontroller – Input Pin

Everything You Need to Know About Electronics



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

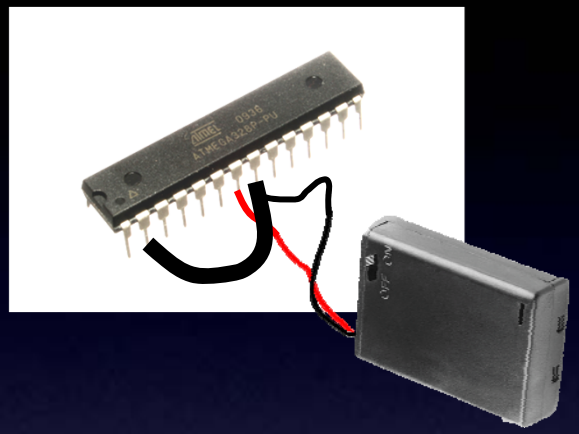
OR:

just leave it blank

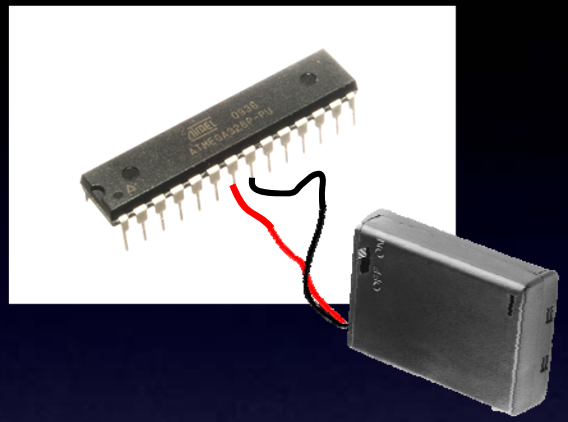
High

Microcontroller – Input Pin

Everything You Need to Know About Electronics



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

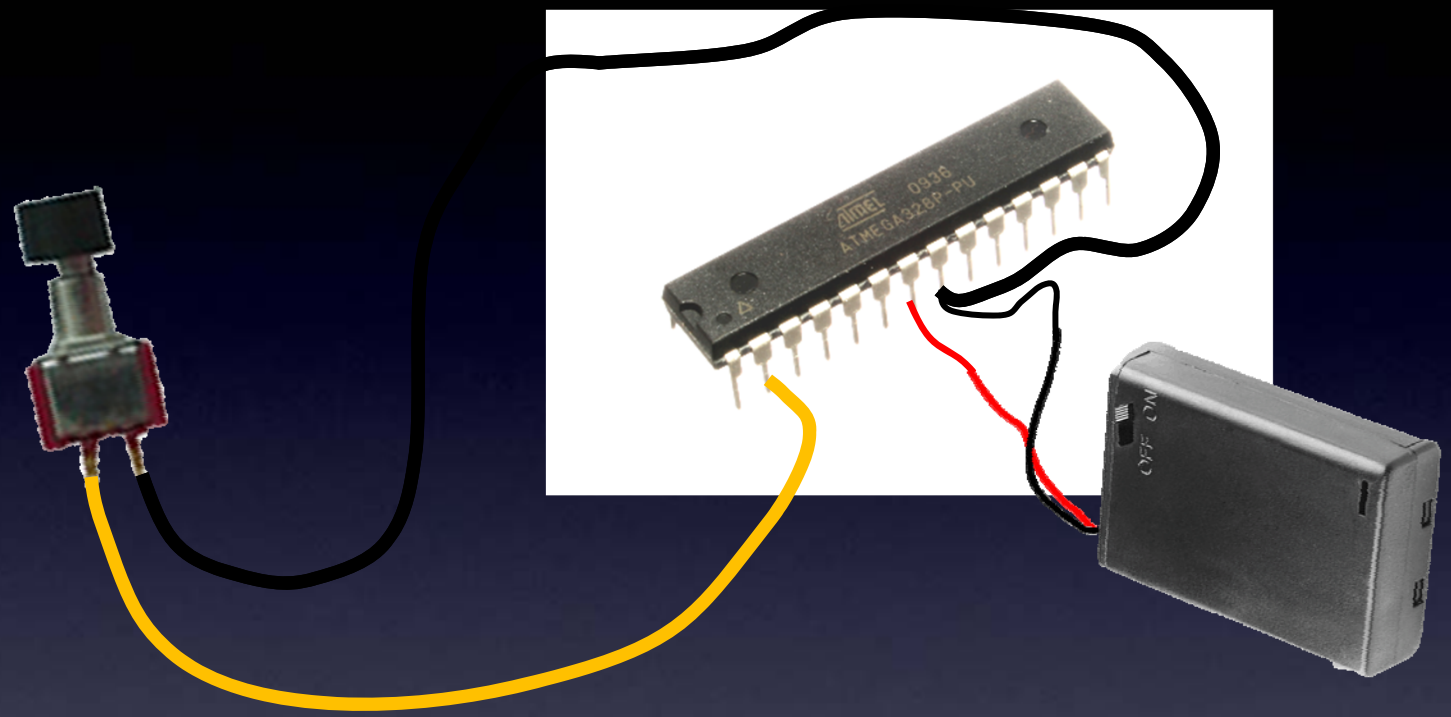


If firmware looks at Pin 2 when it's like this, it reports back: High

Reading the Input pin

Microcontroller – Input Pin

Everything You Need to Know About Electronics

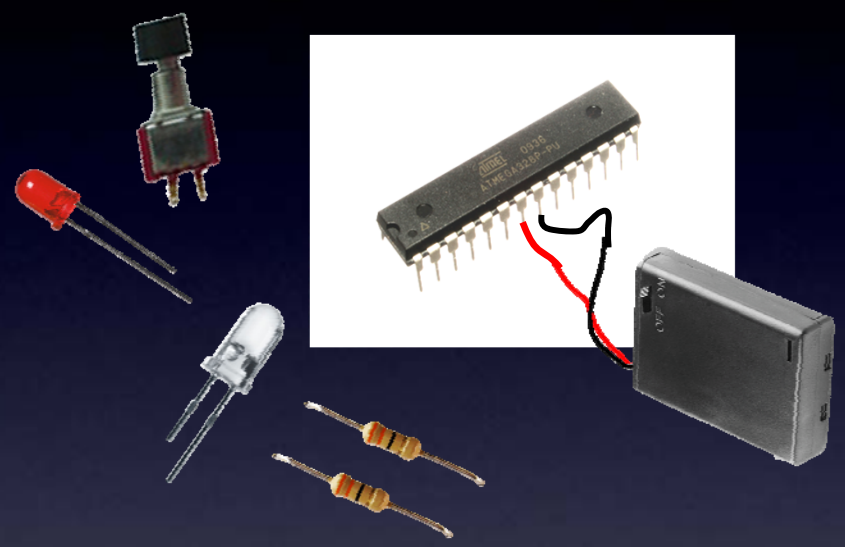


Reading the Input pin with a Switch

Microcontroller – Input Pin

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…

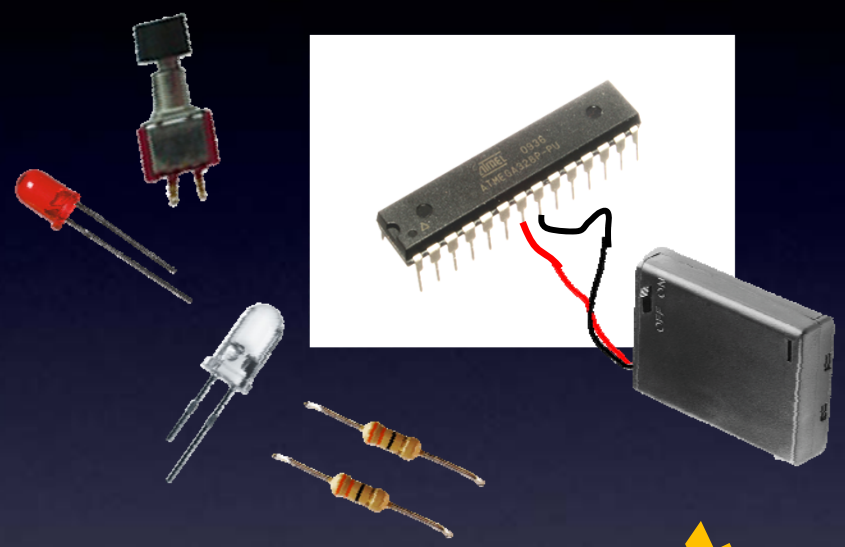
Etc for all "OFF" codes

TV-B-Gone remote control

Microcontroller

Everything You Need to Know About Electronics

Hardware



Firmware

Pin 13 Output – visible LED pin
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Blink visible LED:
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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

Except

TV-B-Gone remote control

Microcontroller

Everything You Need to Know About Electronics

Review:

Low

Off

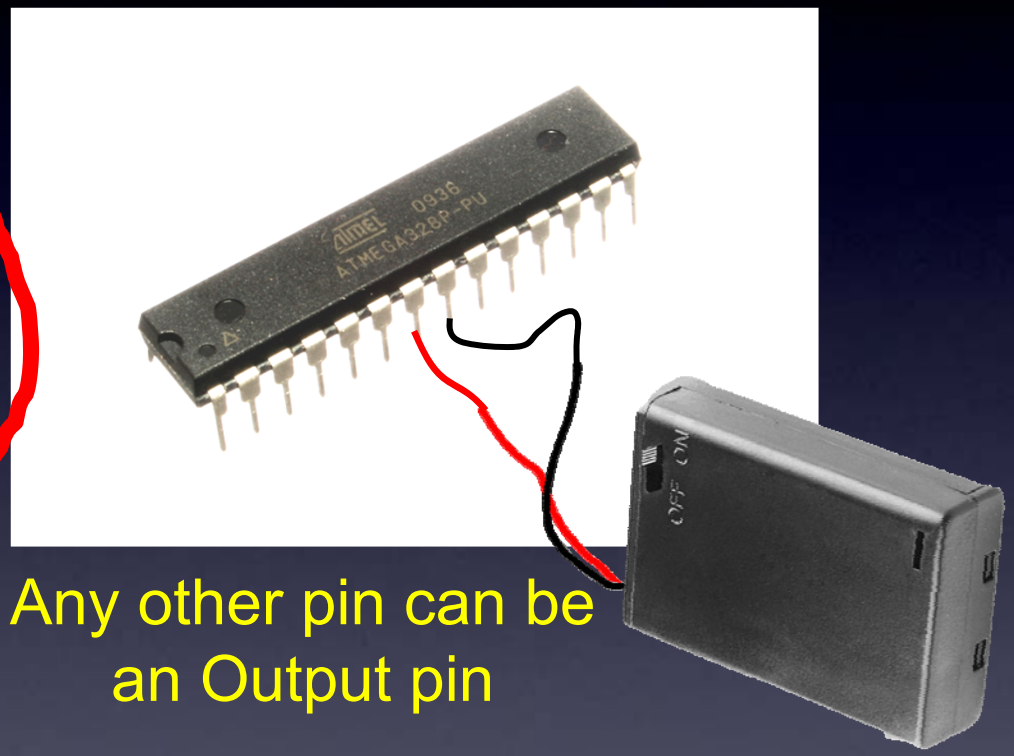
(0V)

High

***almost* the same**

as the Red wire

of the power supply



Any other pin can be
an Output pin

Output pin – only 2 choices: High or Low

Microcontroller – Output Pin

Everything You Need to Know About Electronics

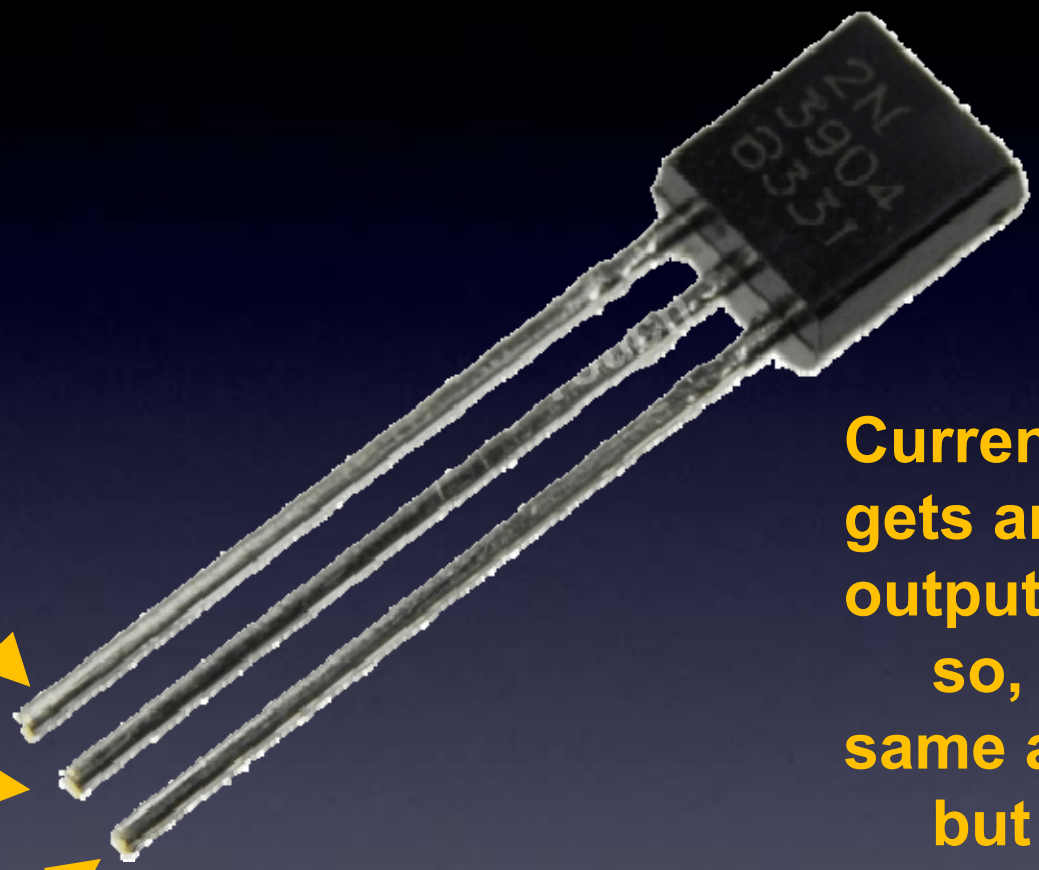
Low	High
Off (0V)	*almost* the same as the Red wire of the power supply

So,
IR LED
can only light up
dimly
from the output pin

Output pin – only limited current

Microcontroller – Output Pin

Everything You Need to Know About Electronics



Ground

Input

Output

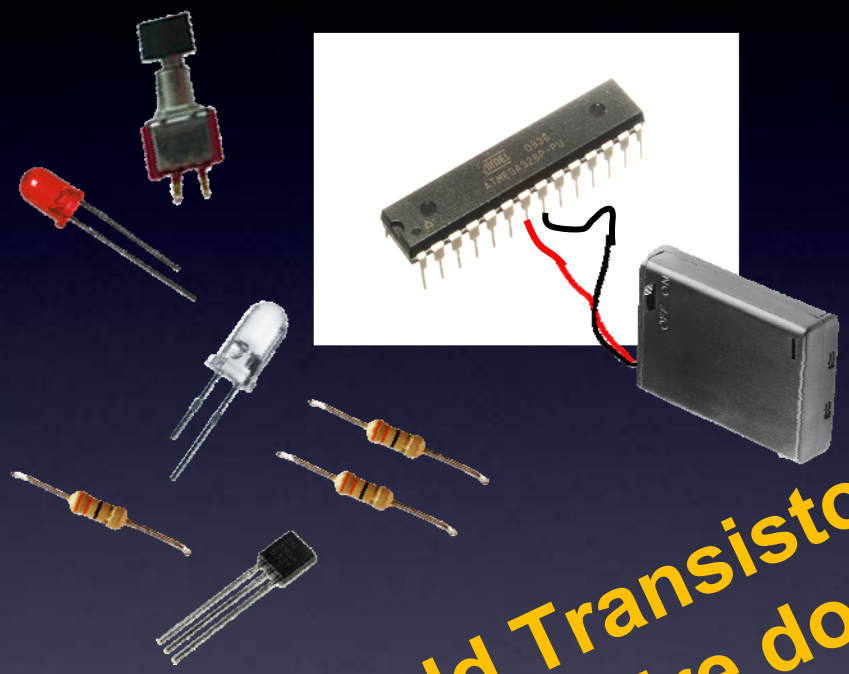
Current on input pin gets amplified on output pin
so, output is the same as input,
but bigger current!

Current amplifier

Transistor

Everything You Need to Know About Electronics

Hardware



Add Transistor and, we're done!

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…

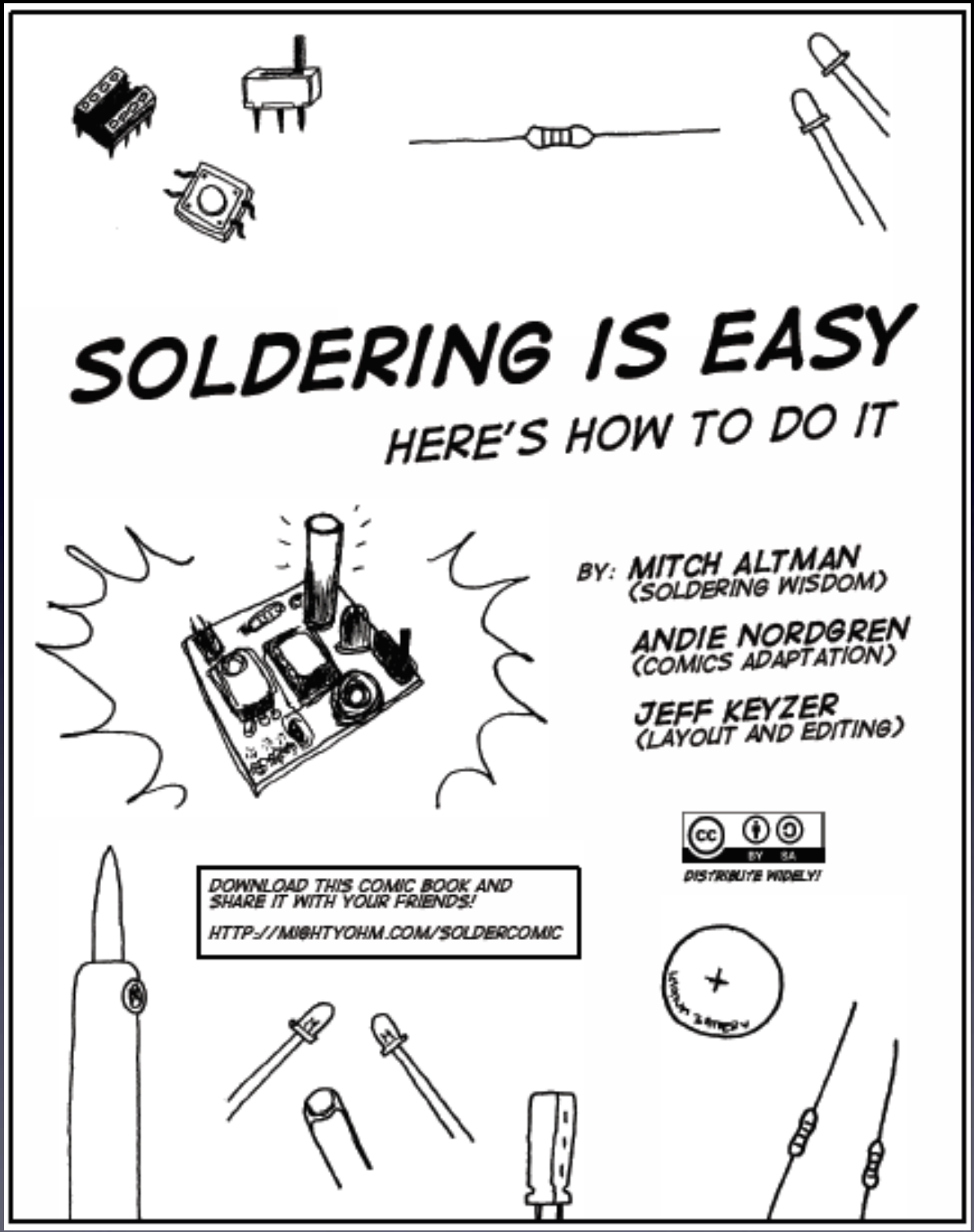
Etc for all "OFF" codes

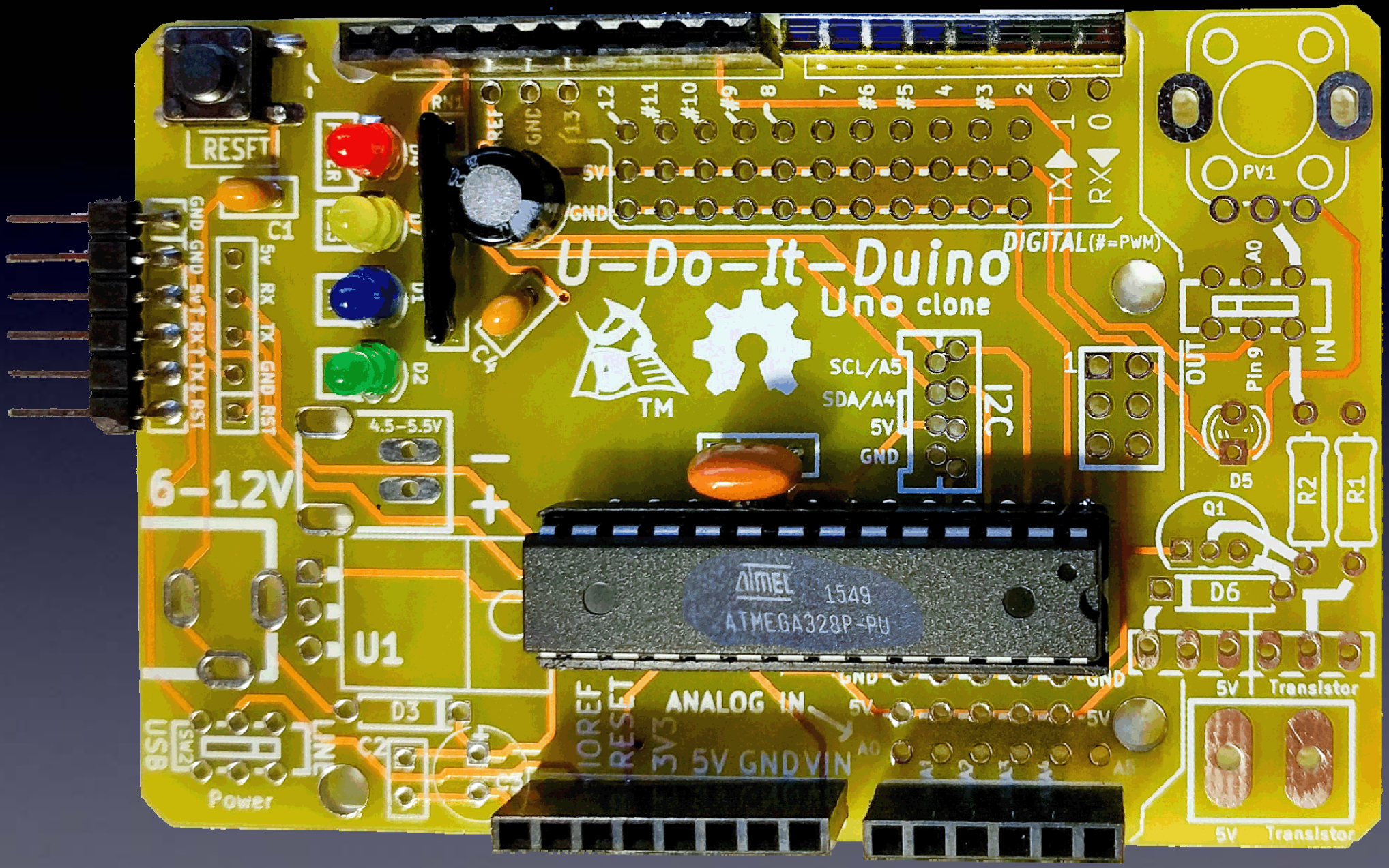
TV-B-Gone remote control – we're done!

Microcontroller

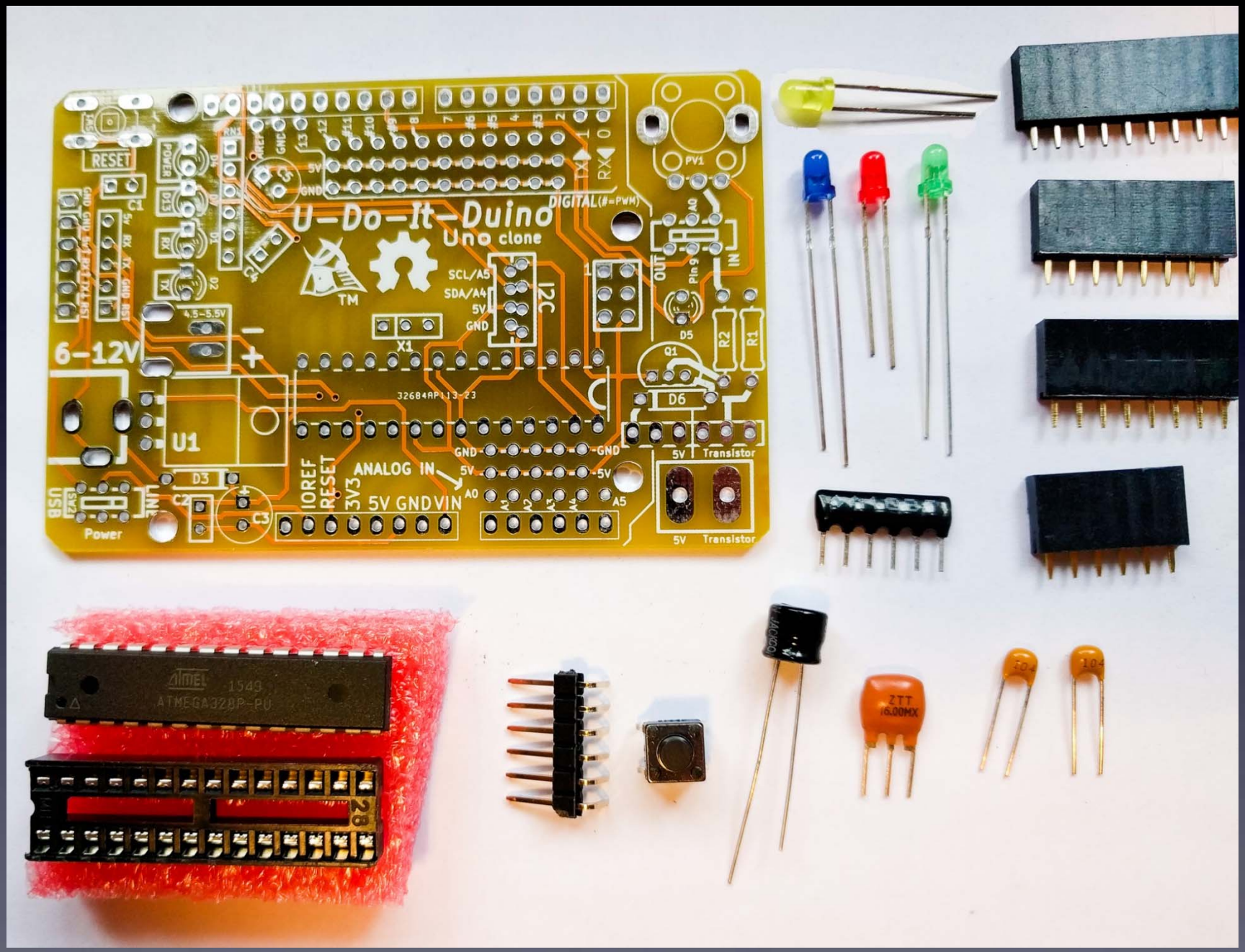
Questions?

Learn To Solder




U-Do-It-Duino
Uno clone
TM
RESET
C1
GND GND 5V RX TX GND RST
GND 5V RX TX GND RST
6-12V
4.5-5.5V
U1
USB
Power
D3
C2
C3
C4
R1
D1
D2
D3
D4
D5
D6
Q1
R2
PV1
DIGITAL(#=PWM)
TX
RX
SCL/A5
SDA/A4
5V
GND
I2C
OUT
IN
Pin 9
A0
5V
Transistor
ANALOG IN
IOREF
RESET
3V3
5V GND VIN
ATMEL
1549
ATMEGA328P-PU

Parts to use


U-Do-It-Duino
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RESET
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DIGITAL(#=PWM)
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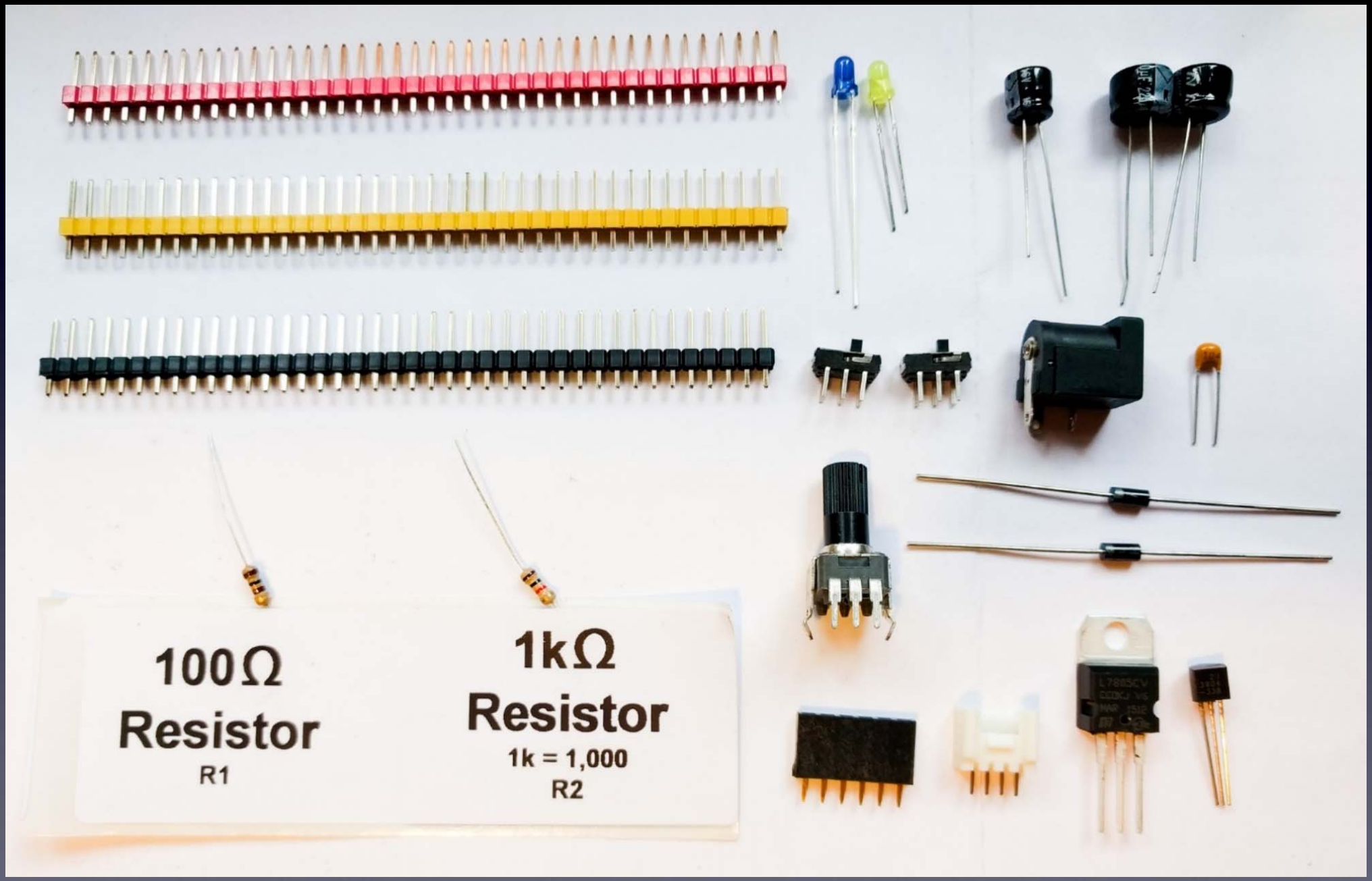
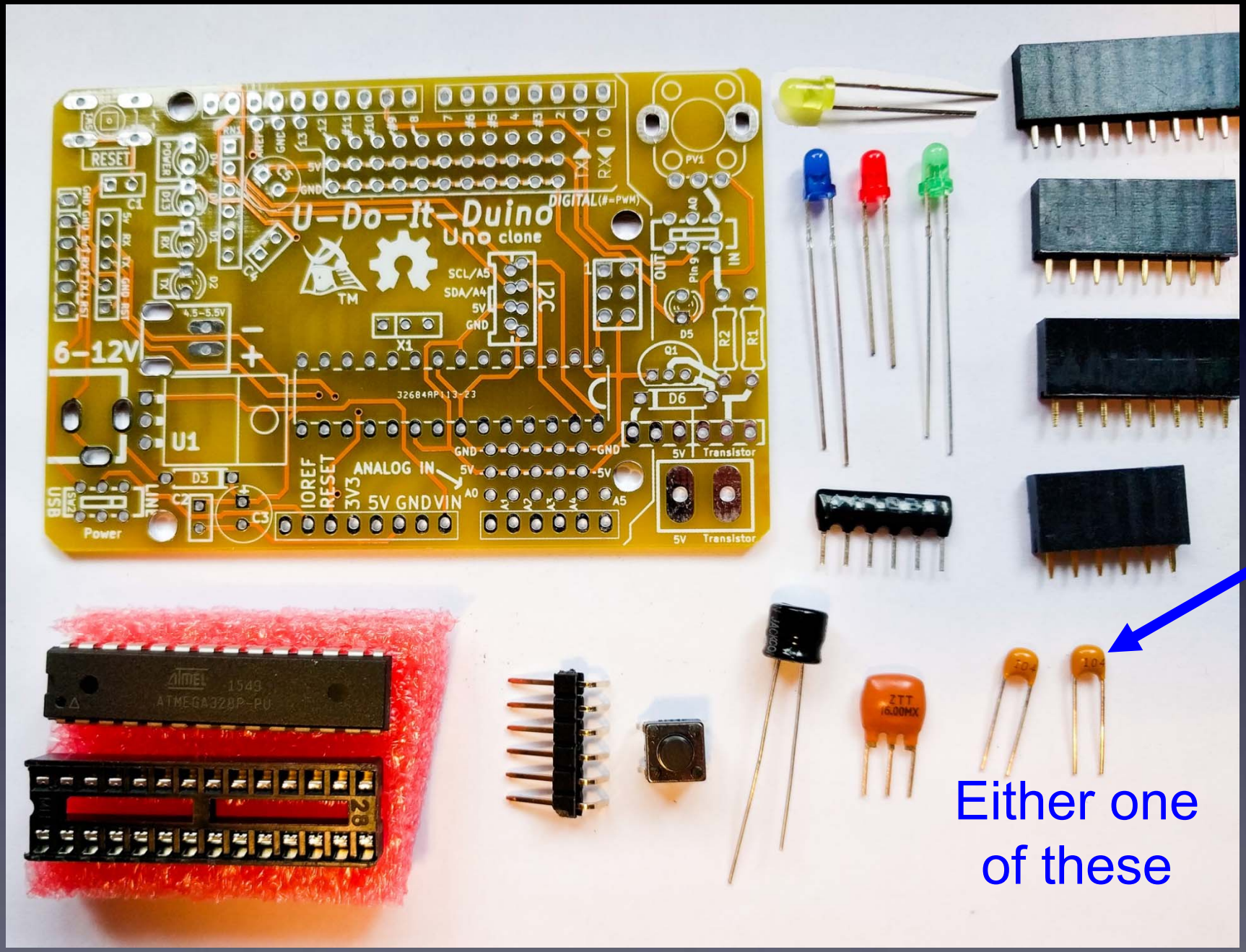
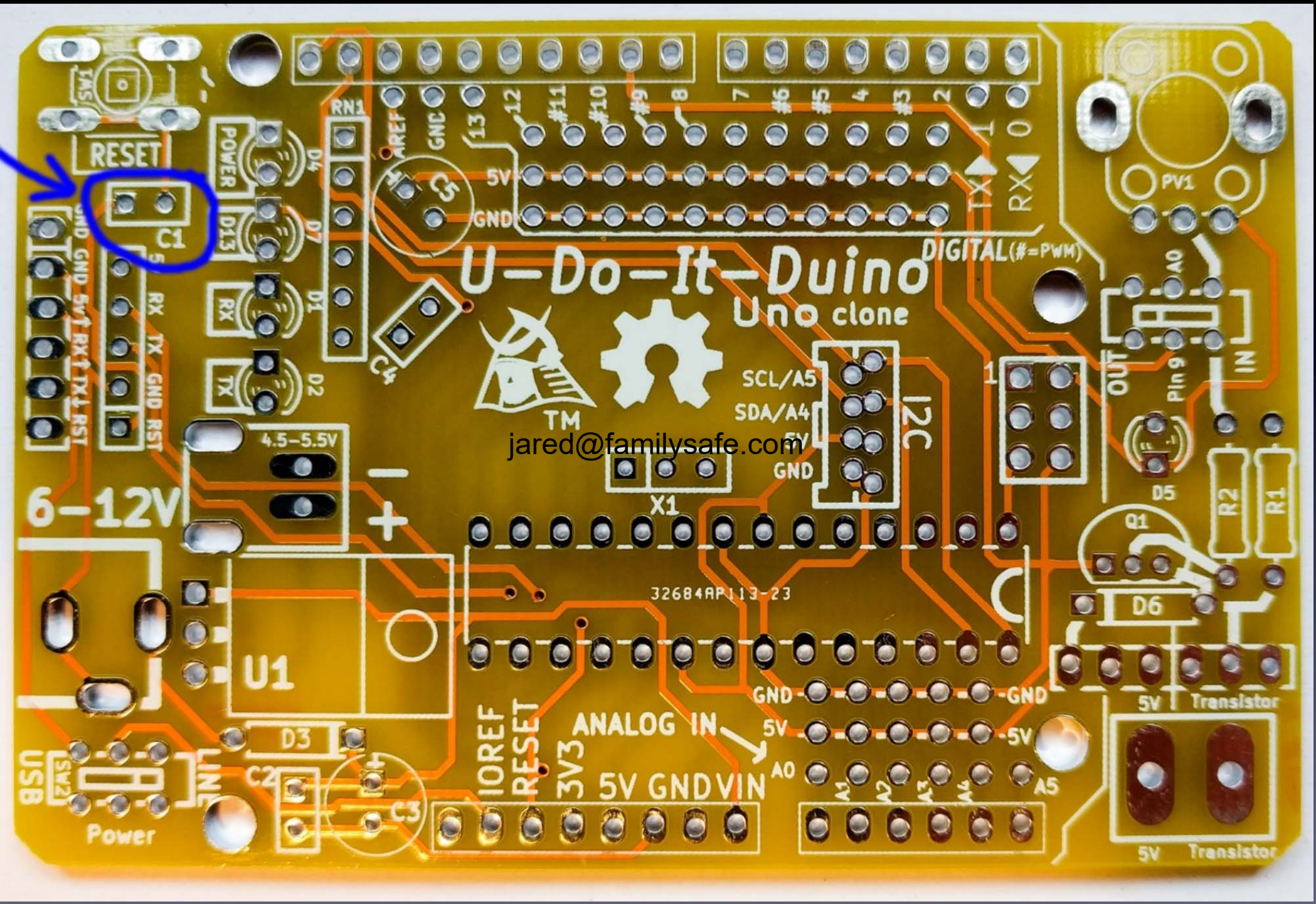
5V
GND
I2C
ANALOG IN
IOREF
RESET
3V3
5V GND VIN
Transistor
Power
USB
ATMEL
ATMEGA328P-PU
28

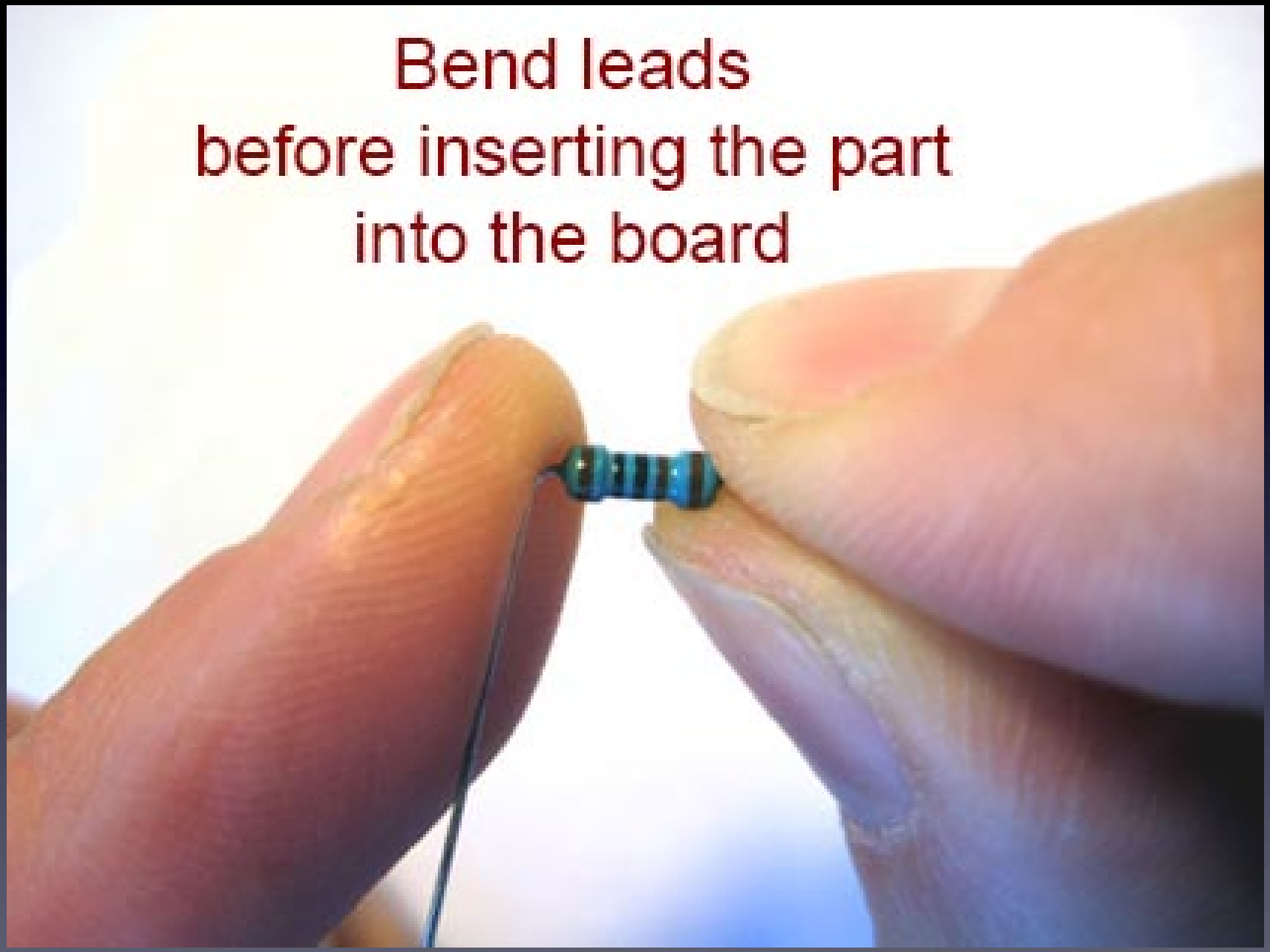
Unused parts



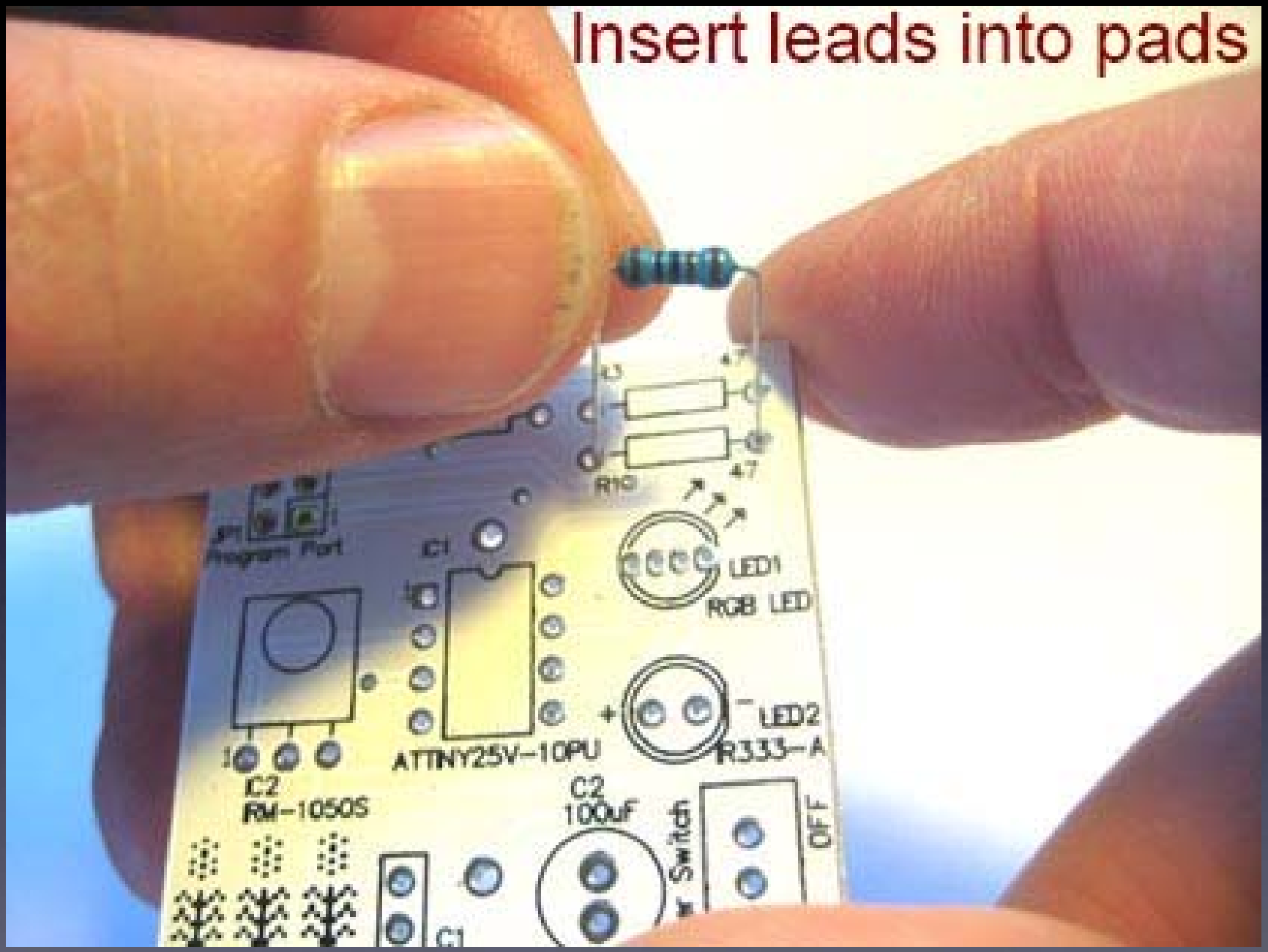
Our first part to solder: C1

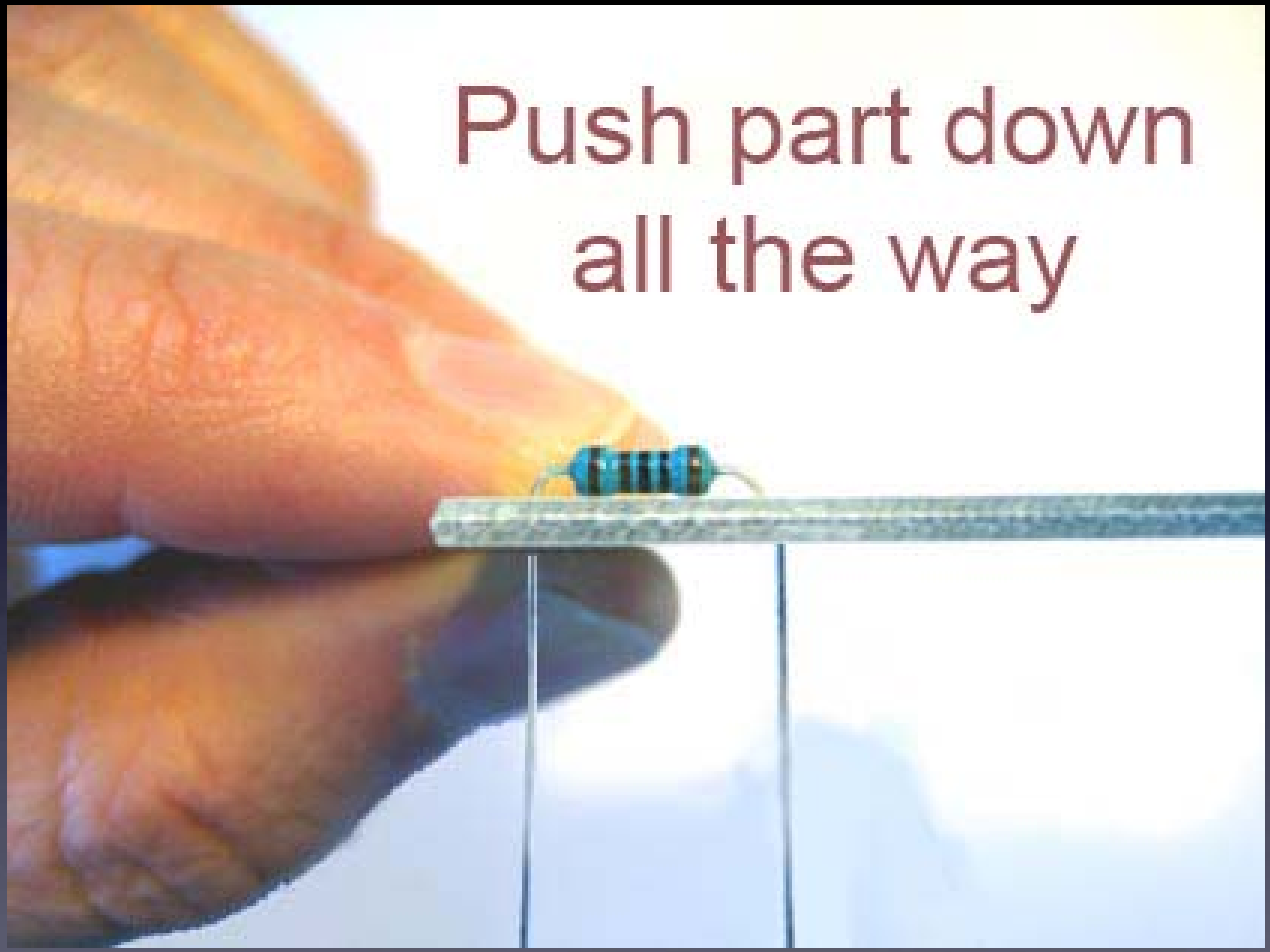


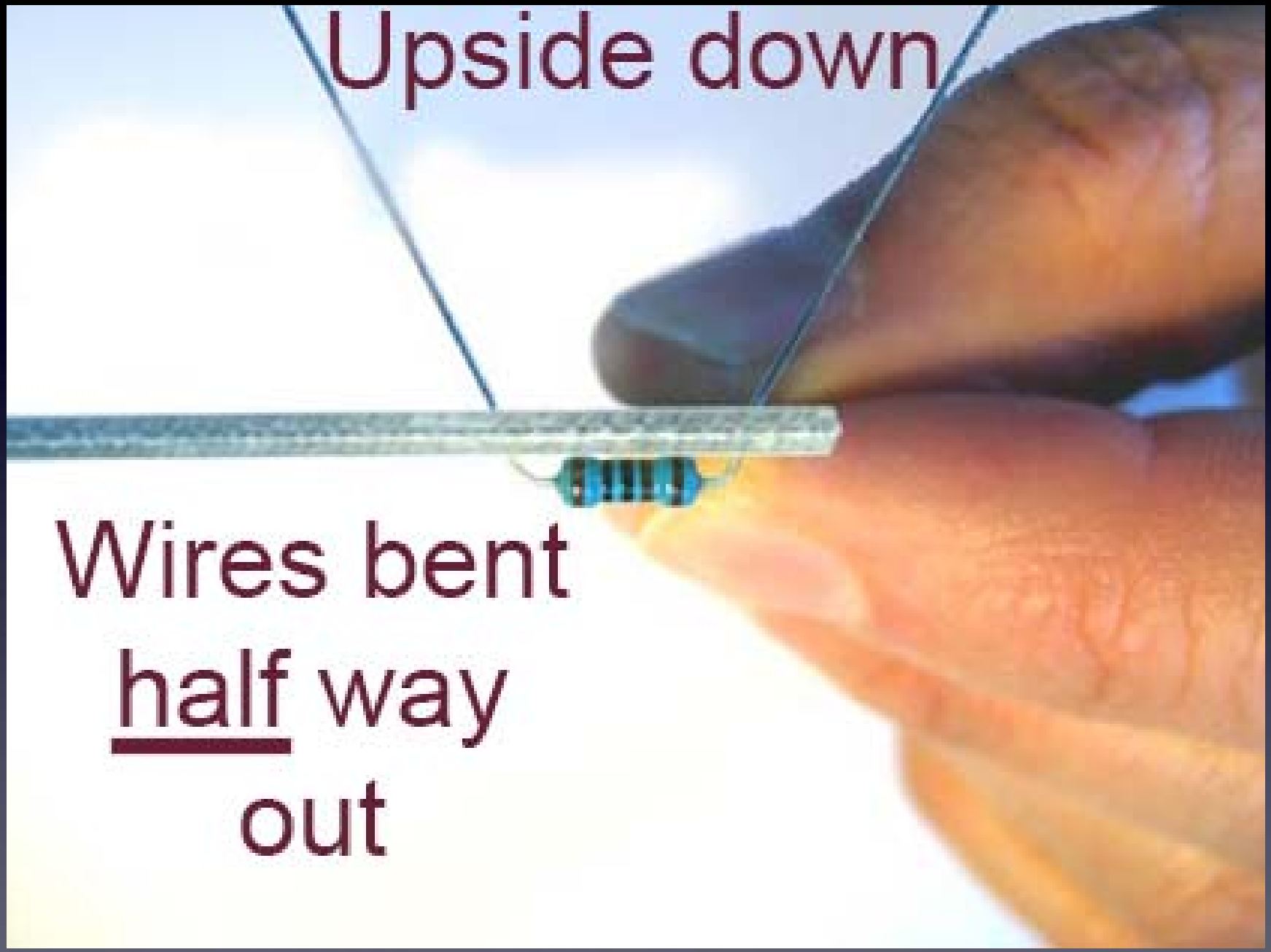

U-Do-It-Duino
Uno clone
jared@familysafe.com
RESET
POWER
DIGITAL(#=PWM)
SCL/A5
SDA/A4
5V
GND
I2C
X1
6-12V
4.5-5.5V
U1
32684AP113-23
IOREF
RESET
3V3
5V GND VIN
ANALOG IN
A0
A1
A2
A3
A4
A5
USB
Power
D3
C2
C3
C4
C5
C1
RN1
PV1
Pin 9
OUT
IN
D5
Q1
R2
R1
D6
5V
Transistor


Bend leads
before inserting the part
into the board

Insert leads into pads




Push part down
all the way


Upside down
Wires bent
half way
out

104

104

How to hold a soldering iron

The perfect kind of solder for electronics:

60/40 rosin core,

0.031” diameter

3 Safety Tips…

Safety Tip #1:

Hot !!

Safety Tip #2:

Lead (Pb) is toxic

Safety Tip #3:

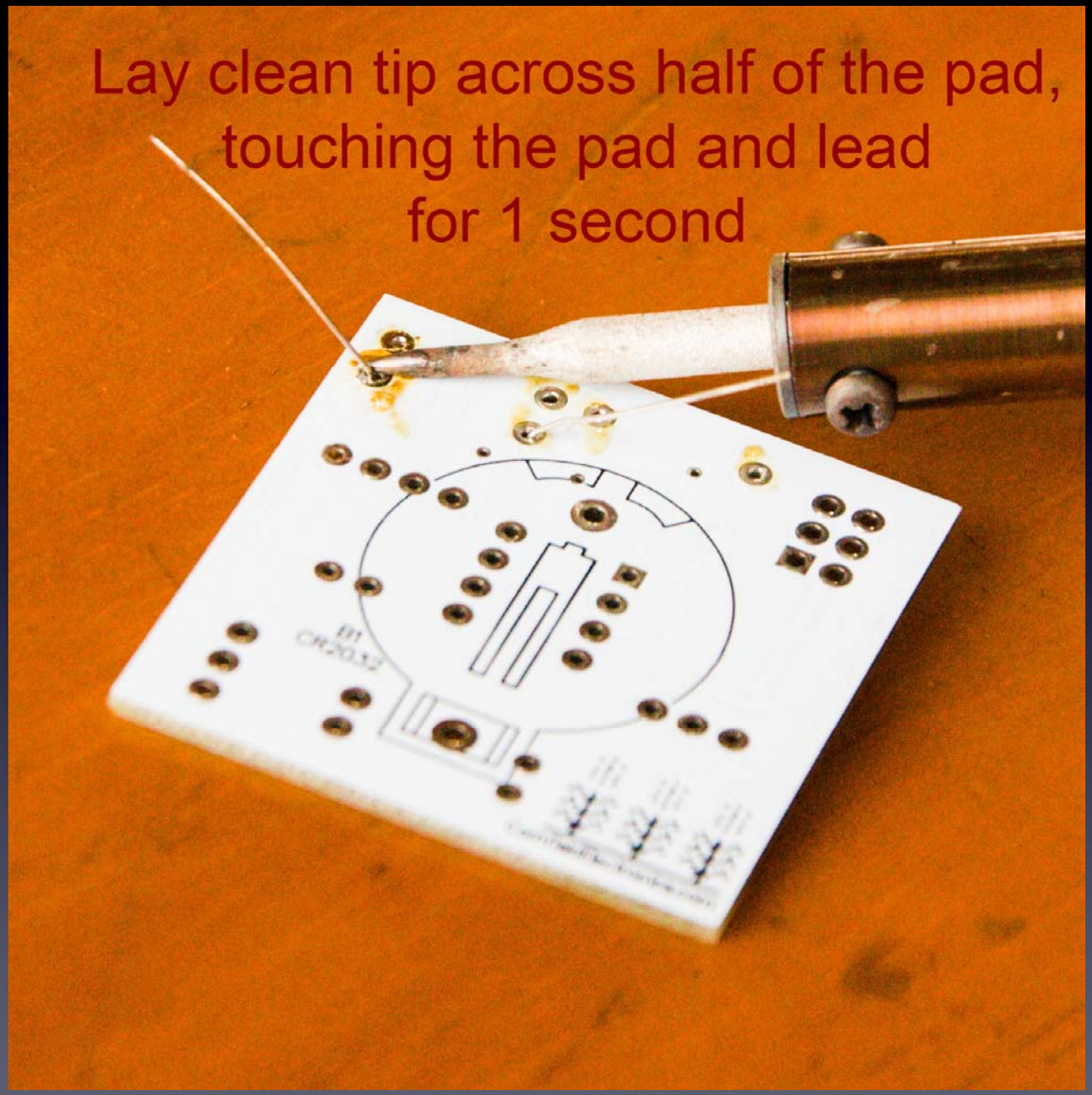
(coming soon)

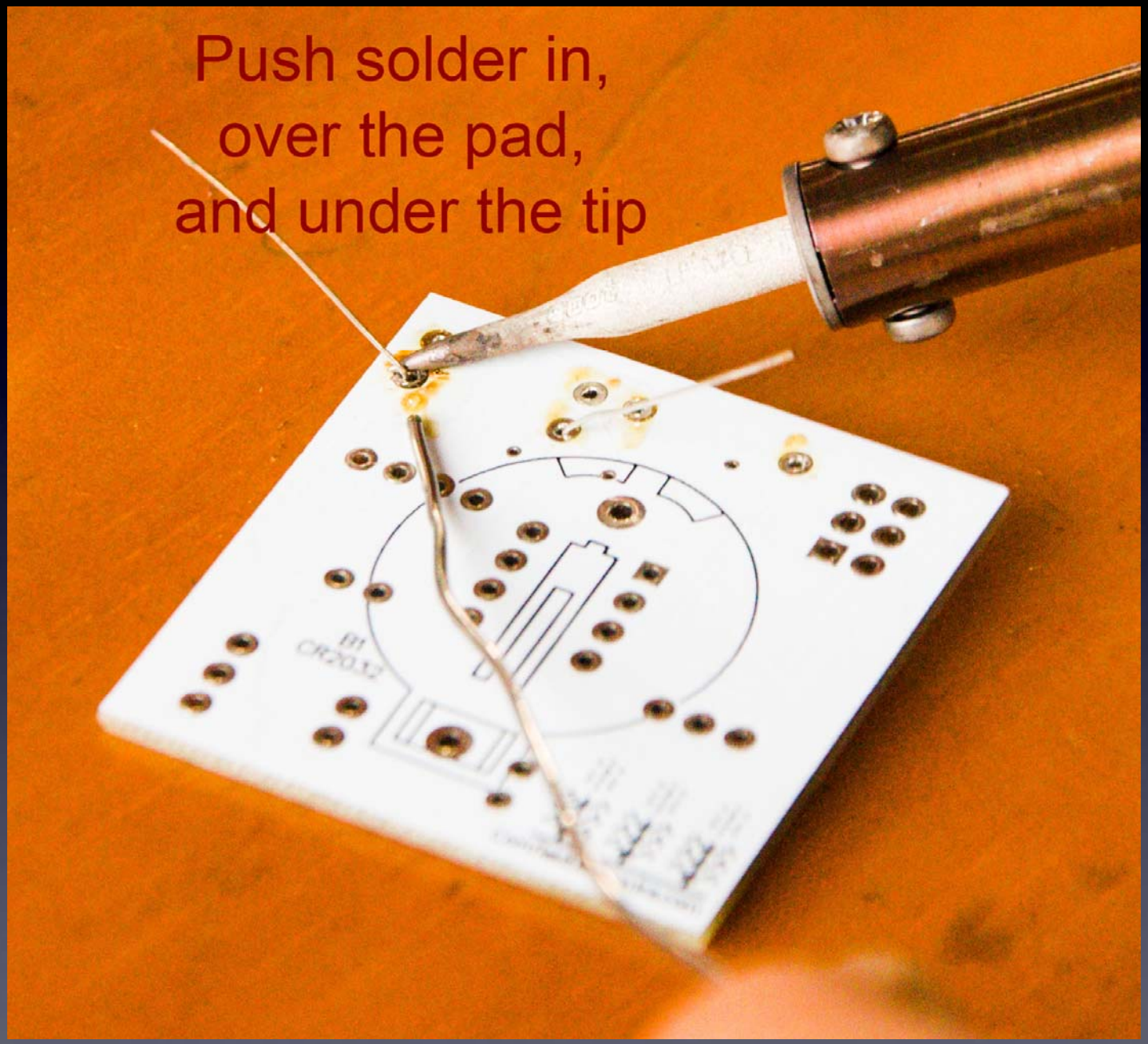
2 secrets
to good soldering…

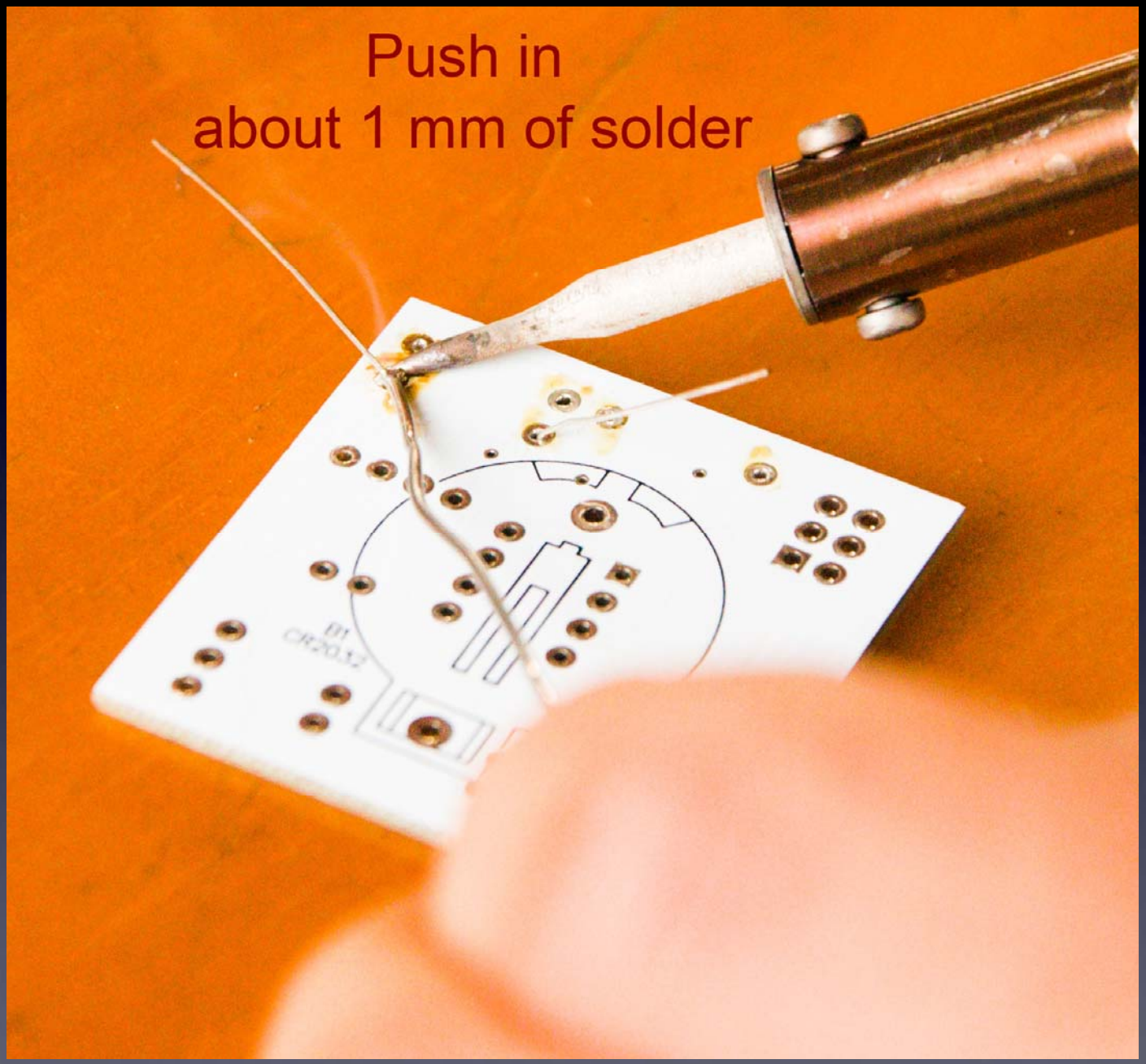
Secret #1:

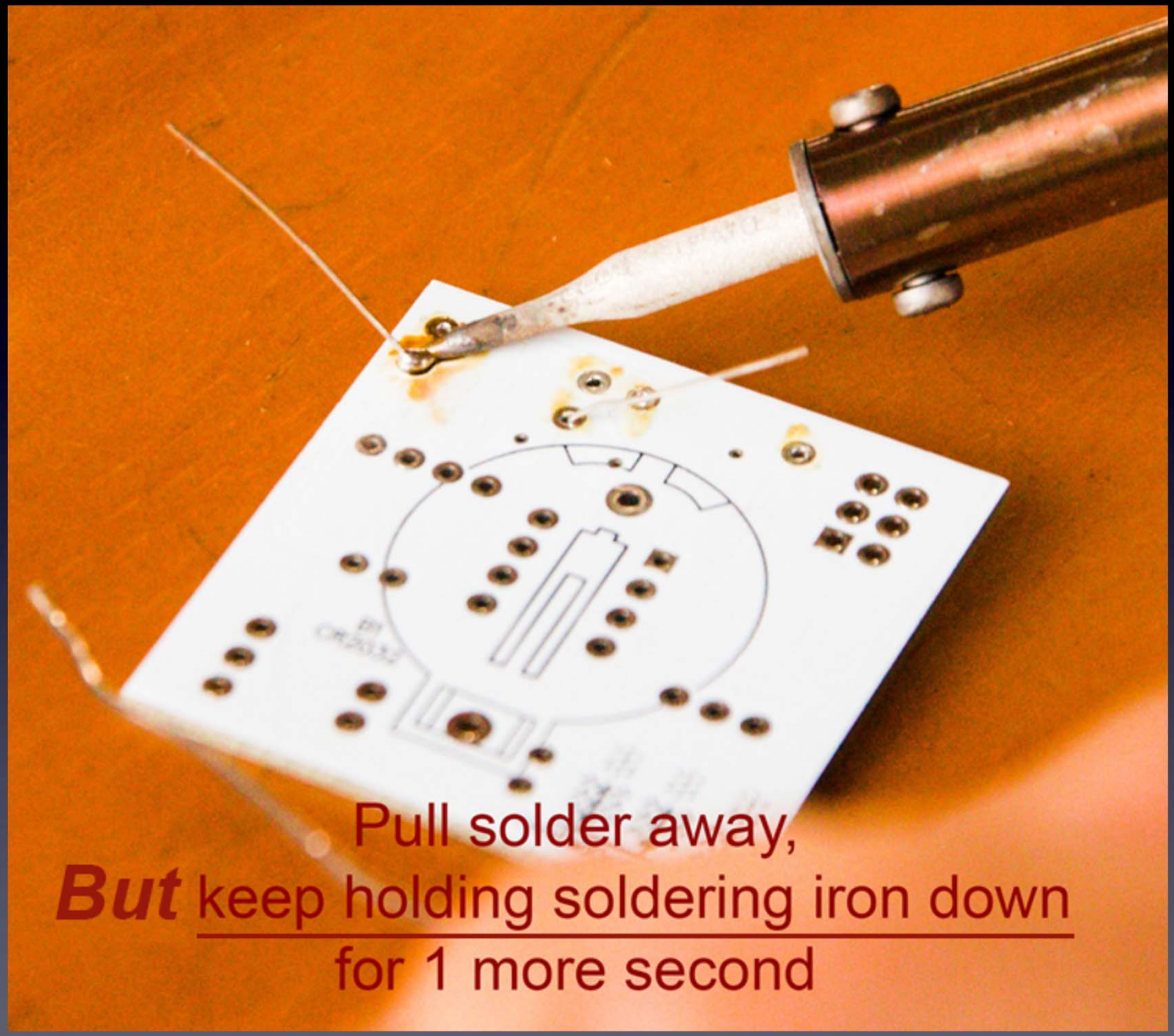
Clean the tip!

Bang 3 times,
Swipe, Rotate, Swipe


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

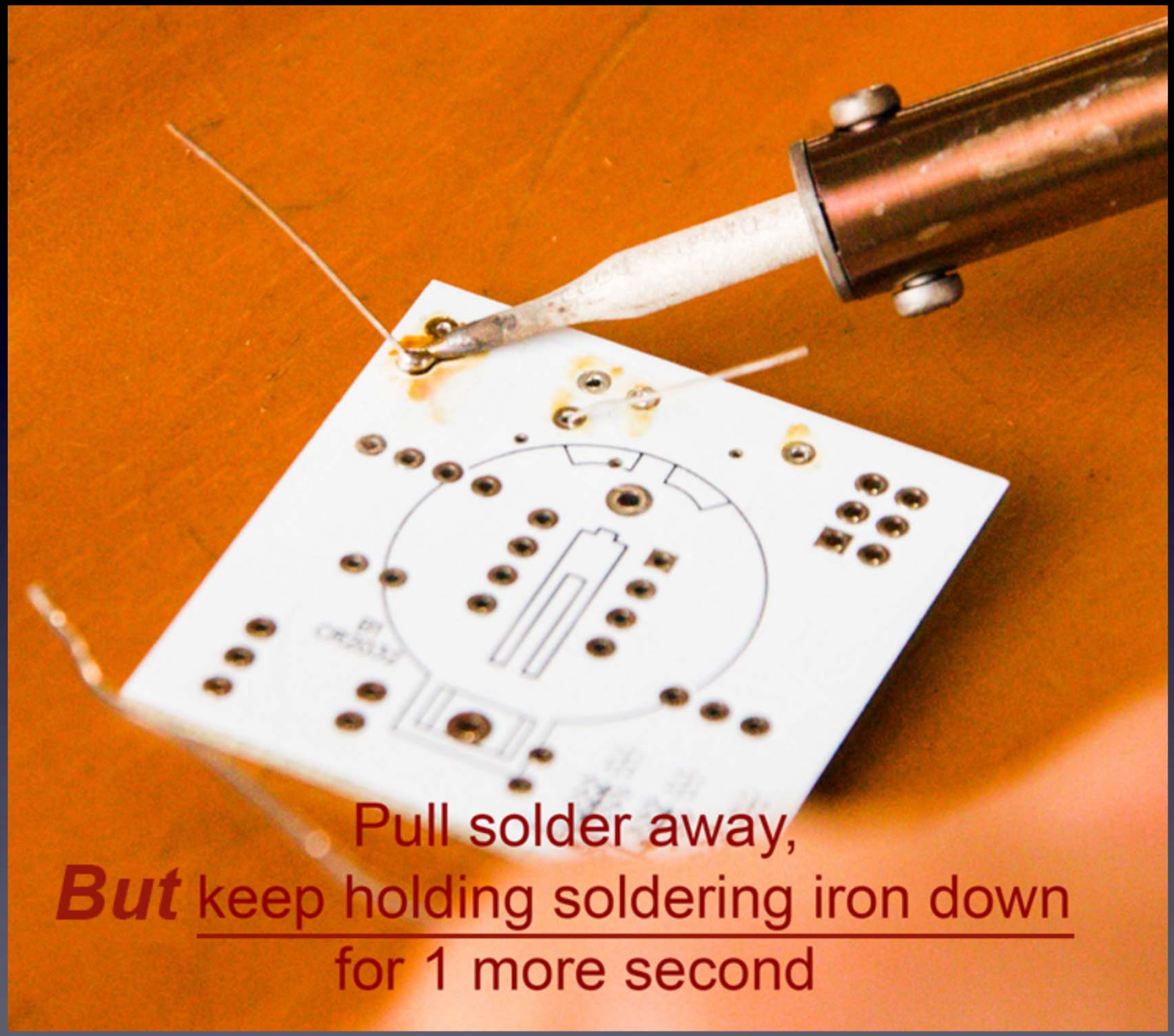

Push solder in,
over the pad,
and under the tip

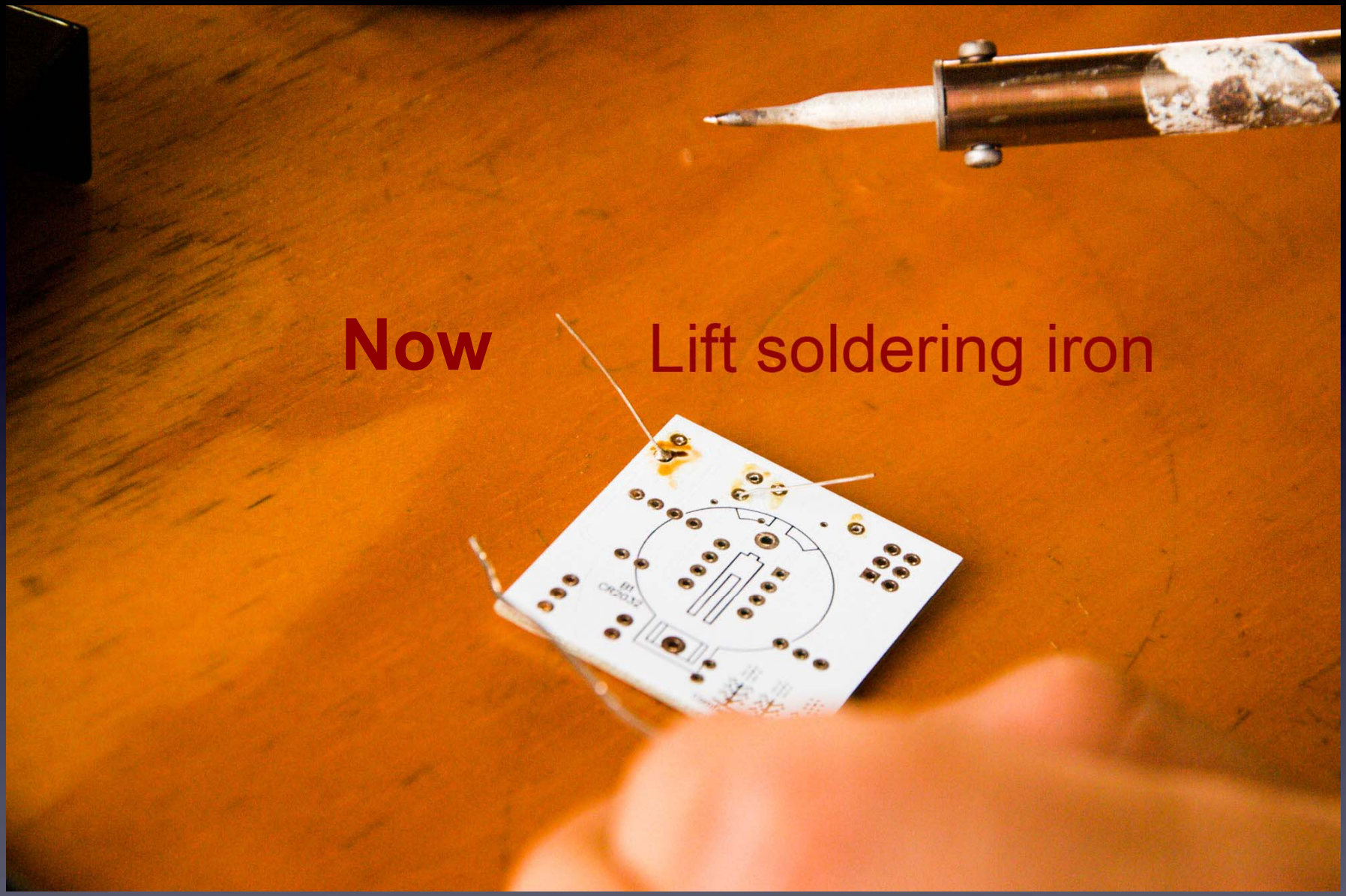

Push in
about 1 mm of solder

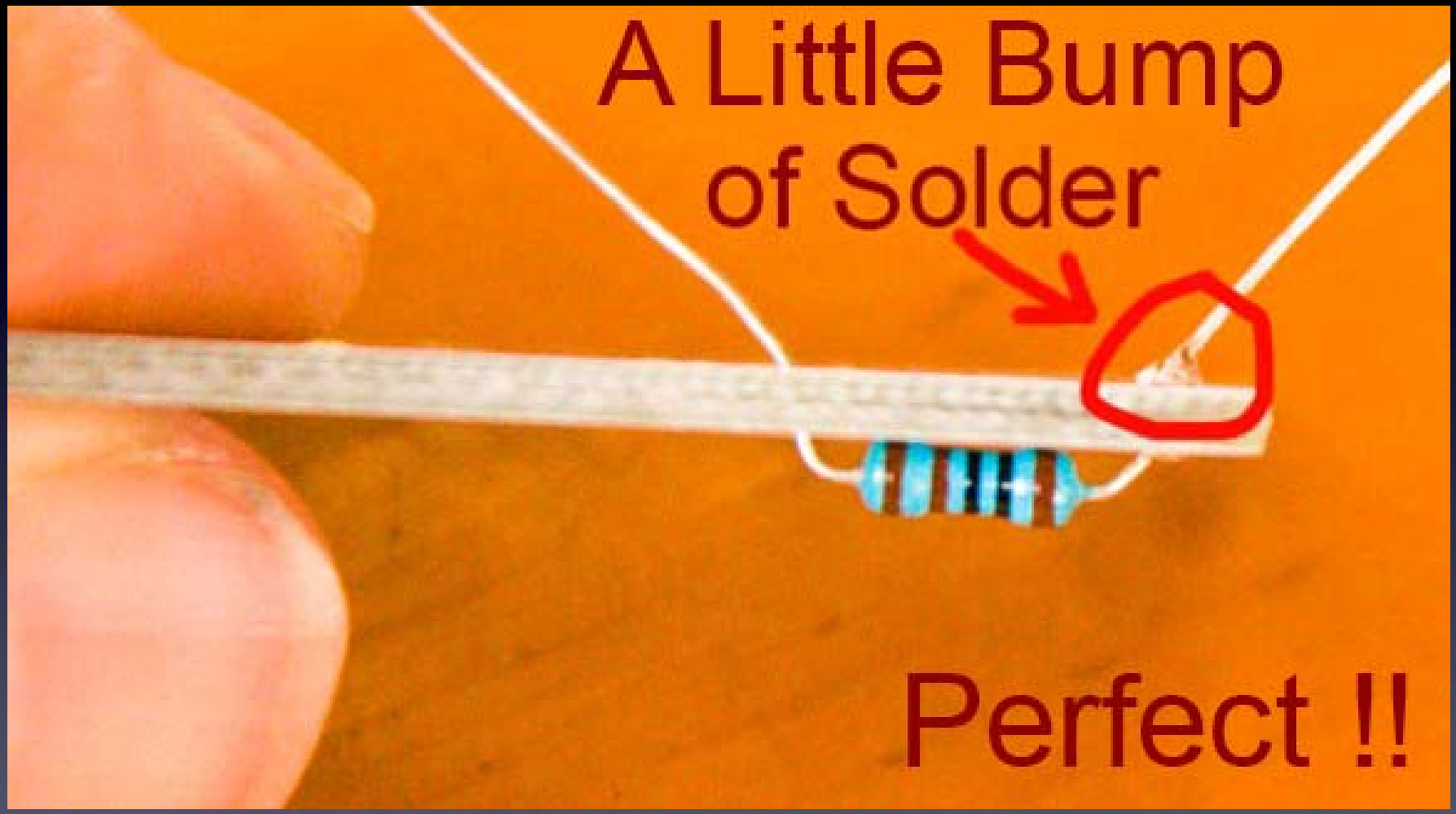

Pull solder away,
But keep holding soldering iron down
for 1 more second

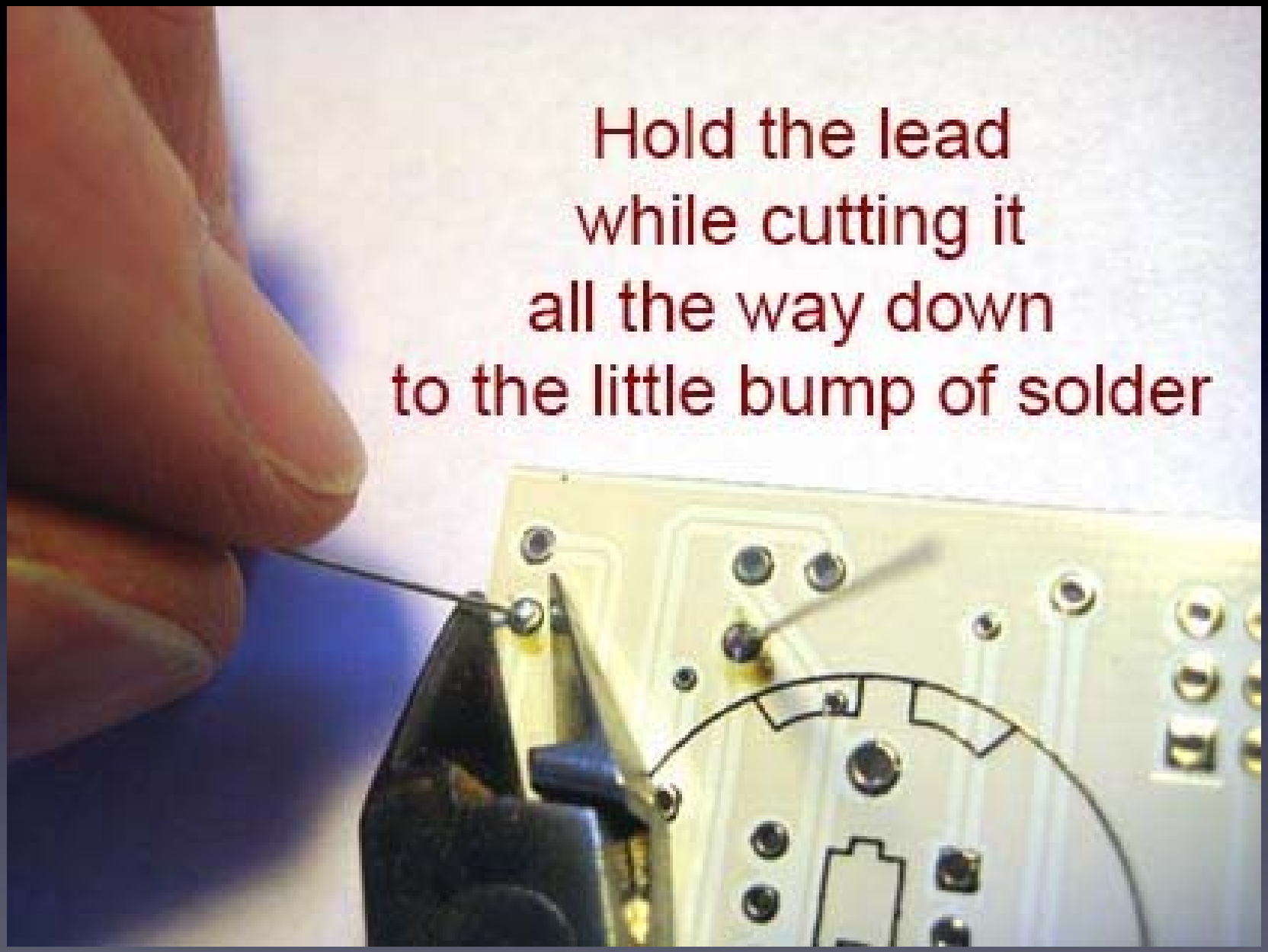
Secret #2:

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


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


Now
Lift soldering iron

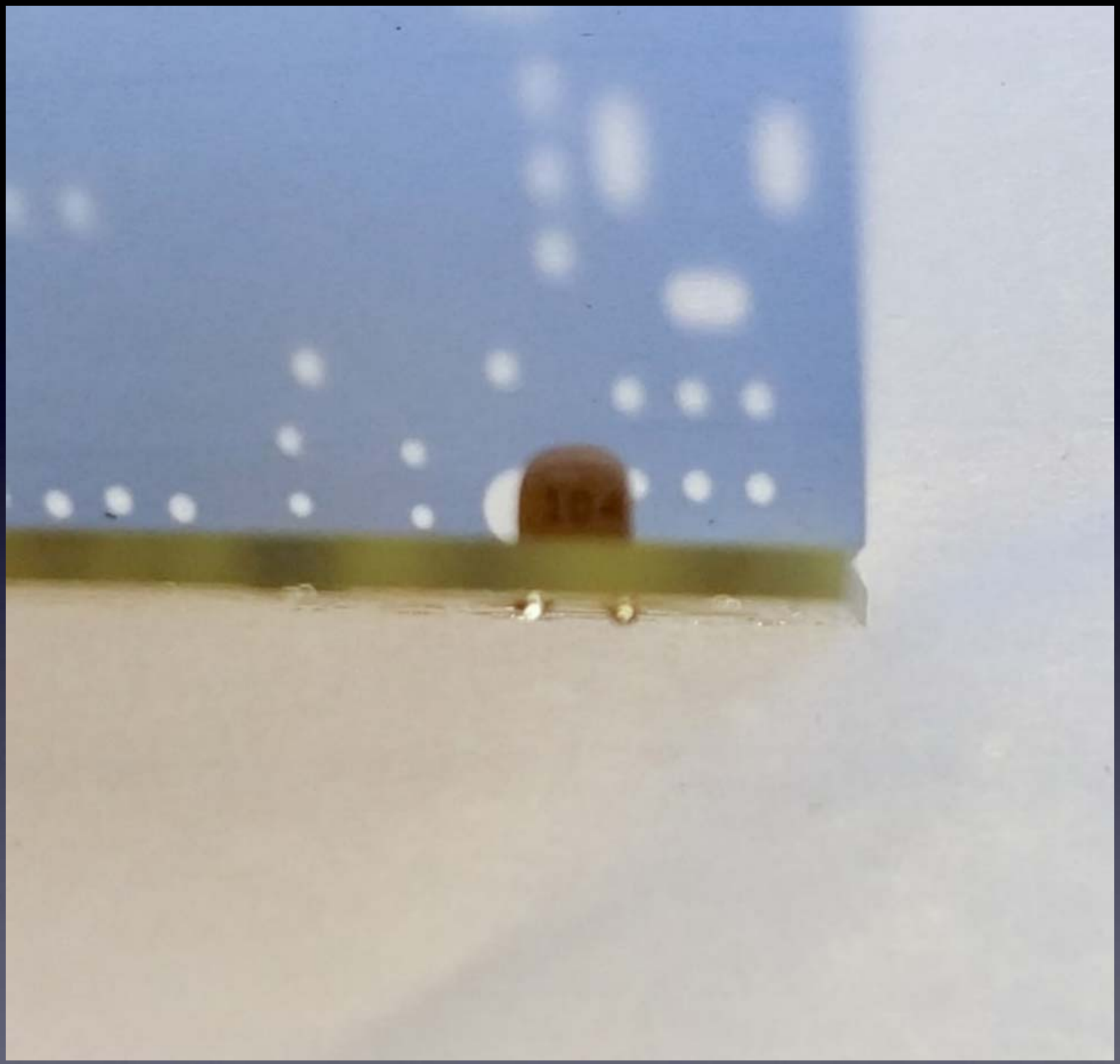

A Little Bump
of Solder
Perfect !!


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

Safety Tip #3:

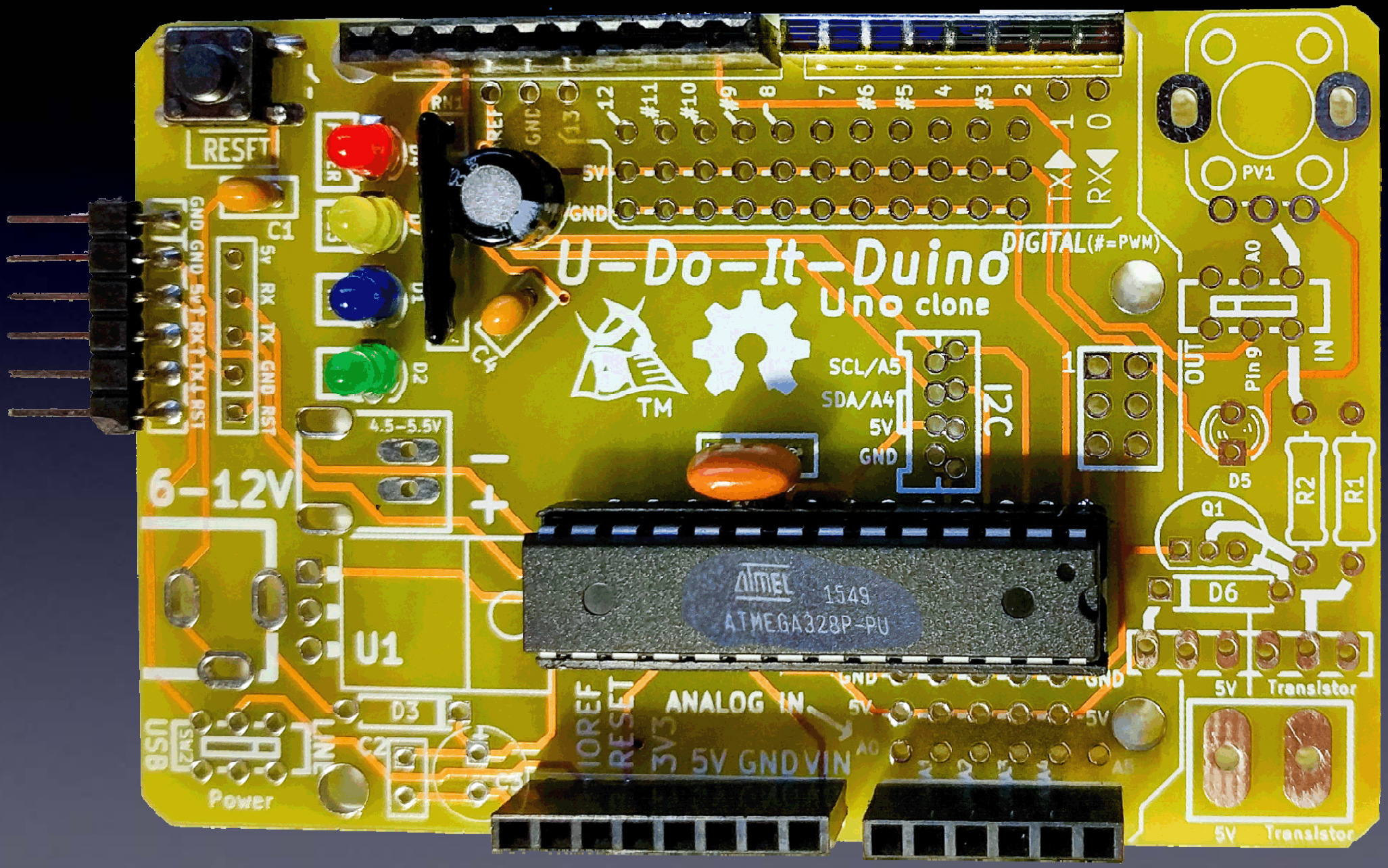
Hold or cover the lead !

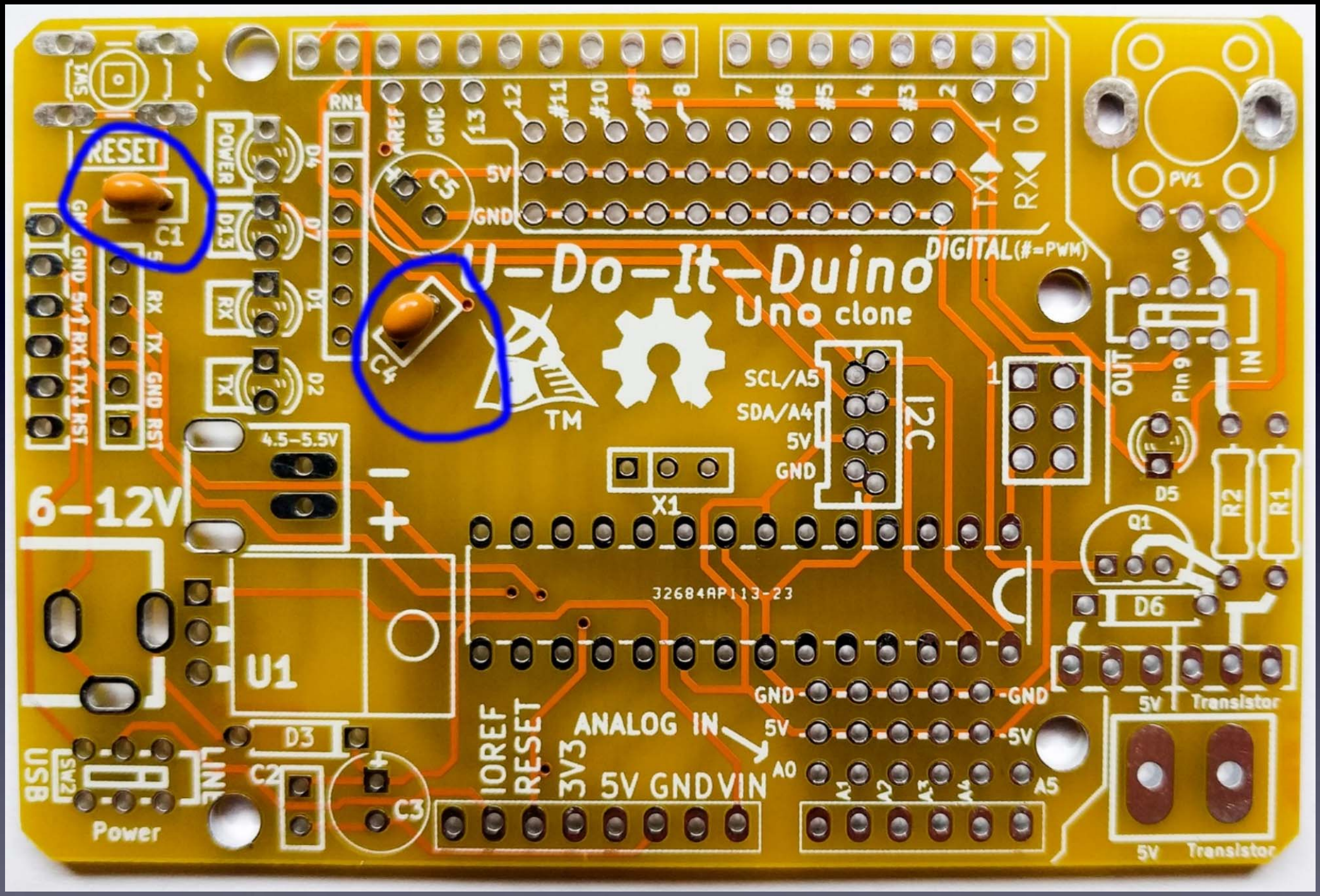
All done !

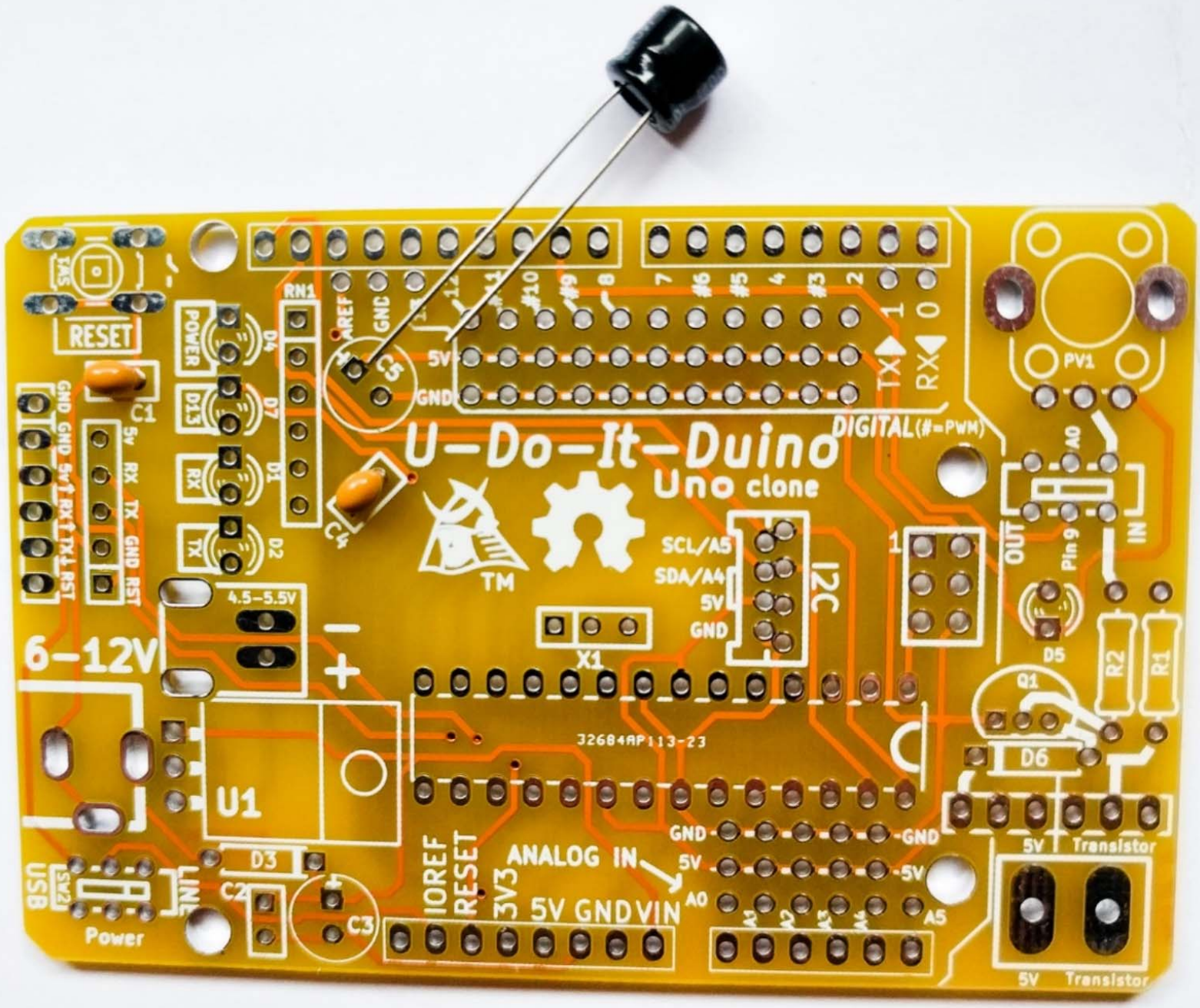


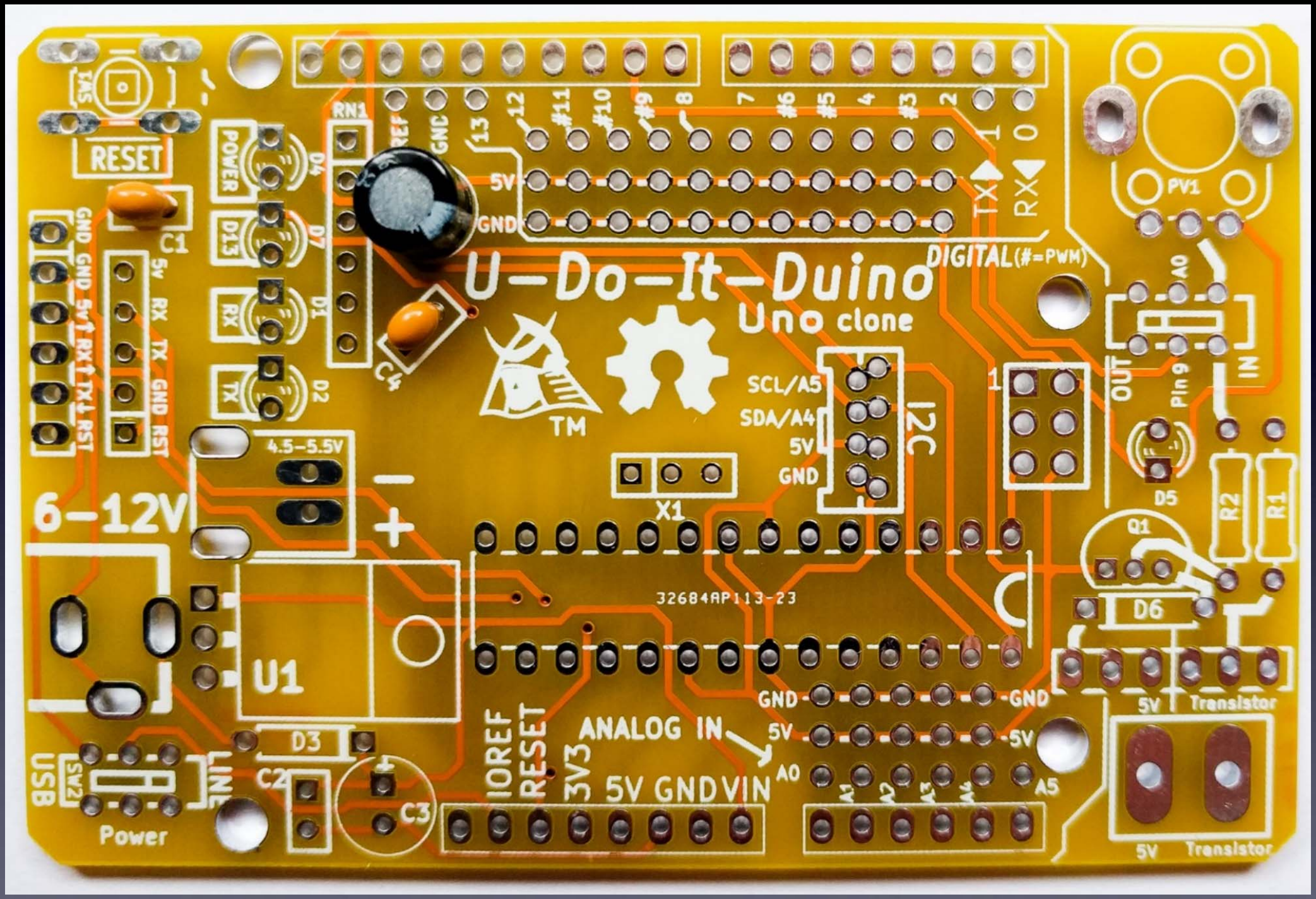
One part at a time

Till all the parts are soldered


U-Do-It-Duino
Uno clone
TM
RESET
C1
GND GND 5v RX1 TX1 RST
5v RX TX GND RST
4.5-5.5V
6-12V
U1
D3
C2
C3
USB
SW2
Power
IOREF
RESET
3V3
5V GND VIN
ANALOG IN
A0
A1
A2
A3
A4
A5
GND
5V
GND
5V
5V
Transistor
5V
Transistor
ATMEL
1549
ATMEGA328P-PU
SCL/A5
SDA/A4
5V
GND
I2C
DIGITAL(#=PWM)
TX
RX
PV1
A0
OUT
IN
Pin 9
D5
Q1
R2
R1
D6
D2
D4
D1
D7
D8
RN1
REF
GND
13
12
#11
#10
#9
8
7
#6
#5
4
#3
2
1
0


U-Do-It-Duino
Uno clone
DIGITAL(#=PWM)
RESET
C1
C4
C5
POWER
D13
D4
D7
D1
D2
RX
TX
RN1
AREF
GND
13
12
#11
#10
#9
8
7
#6
#5
4
#3
2
1
0
5V
GND
TX
RX
PV1
A0
OUT
IN
Pin 9
D5
R2
R1
Q1
D6
5V
Transistor
SW1
GND
5V
RX1
TX1
RST
4.5-5.5V
6-12V
U1
32684AP113-23
SCL/A5
SDA/A4
5V
GND
I2C
X1
TM
D3
C2
C3
USB
SW2
Power
LINE
IOREF
RESET
3V3
5V GND VIN
ANALOG IN
A0
A1
A2
A3
A4
A5
GND
5V


U-Do-It-Duino
Uno clone
TM
DIGITAL(#=PWM)
RESET
POWER
6-12V
4.5-5.5V
U1
USB
Power
LINE
D3
C1
C2
C3
C4
C5
RN1
D1
D2
D4
D5
D6
D7
D13
RX
TX
SCL/A5
SDA/A4
5V
GND
I2C
X1
32684AP113-23
IOREF
RESET
3V3
5V GND VIN
ANALOG IN
A0
A1
A2
A3
A4
A5
-GND
-5V
Q1
R1
R2
PV1
OUT
IN
Pin 9
Transistor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Uno clone
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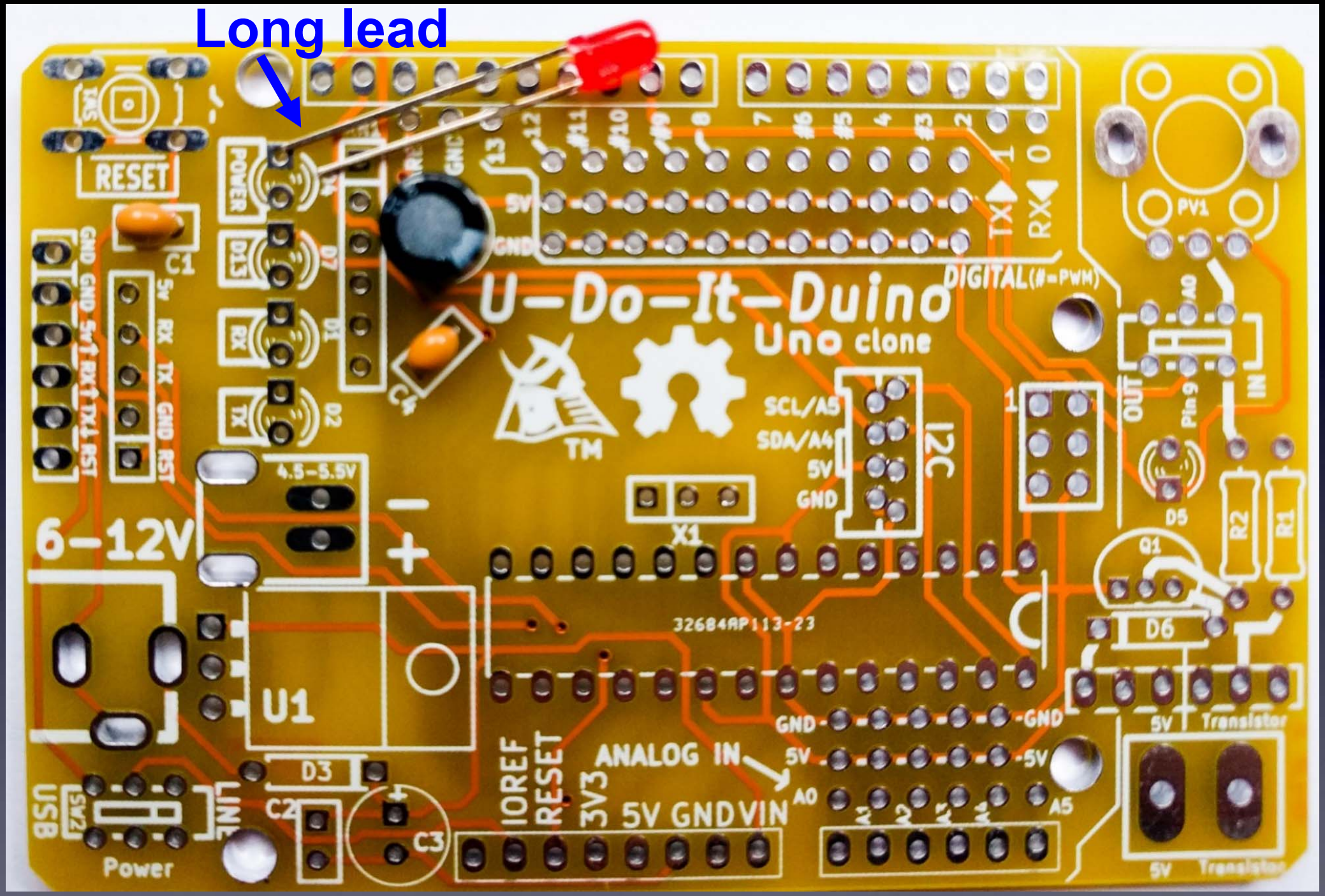
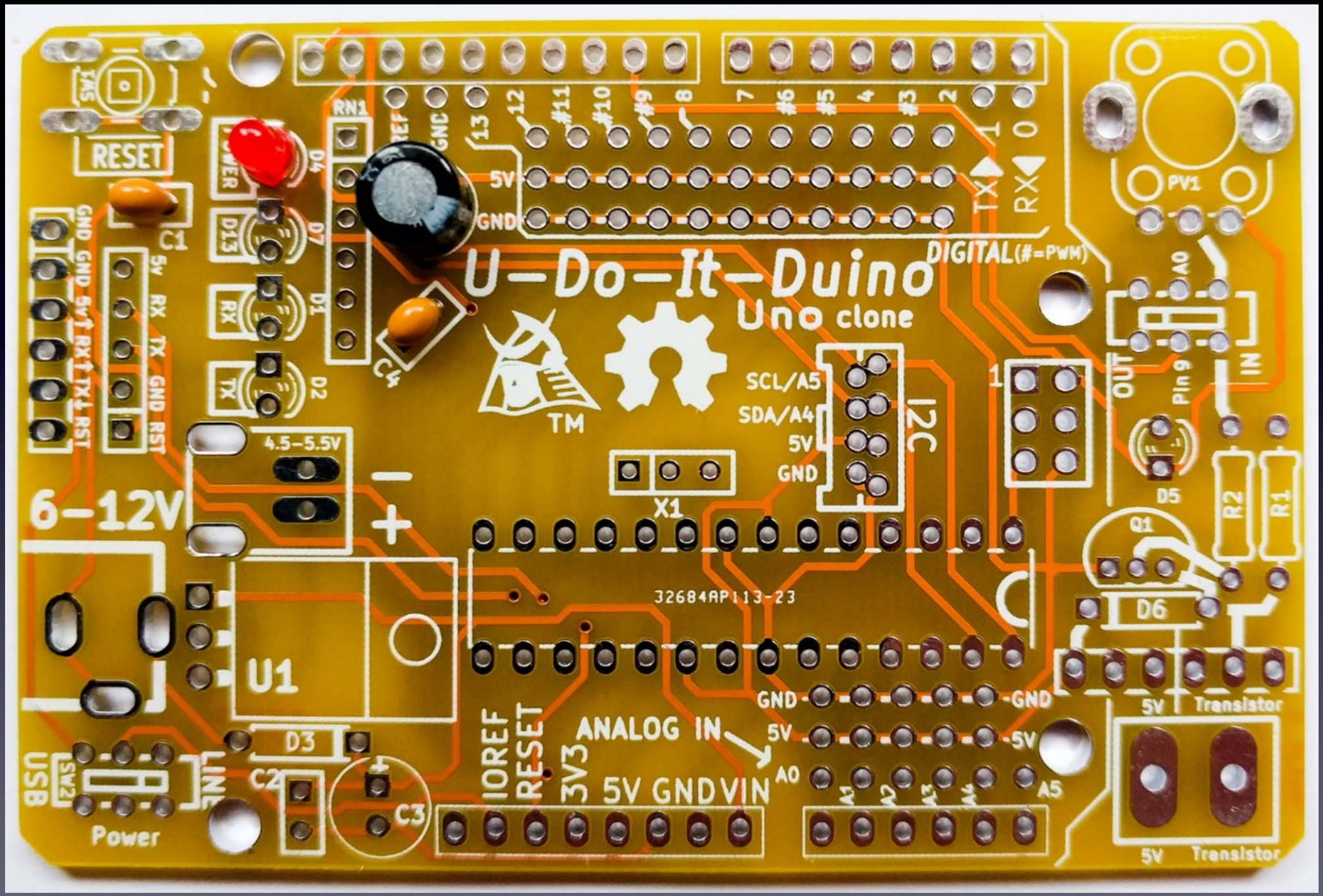
RESET
SW1
POWER
D4
D13
D7
RX
D1
TX
D2
RN1
C1
C4
5V
GND
TX
RX
PV1
A0
OUT
IN
Pin 9
D5
R2
R1
Q1
D6
5V
Transistor
SCL/A5
SDA/A4
I2C
X1
4.5-5.5V
6-12V
U1
32684AP113-23
GND
5V
A0
A1
A2
A3
A4
A5
ANALOG IN
IOREF
RESET
3V3
5V GND VIN
D3
C2
C3
USB
SW2
LINE
Power


Long lead
RESET
POWER
D13
RX
TX
D2
C1
C4
U1
4.5-5.5V
6-12V
U-Do-It-Duino
Uno clone
TM
SCL/A5
SDA/A4
5V
GND
I2C
X1
DIGITAL(~=PWM)
PV1
OUT
GND
Pin 9
IN
D5
R2
R1
Q1
D6
32684AP113-23
GND
5V
A0
A1
A2
A3
A4
A5
ANALOG IN
IOREF
RESET
3V3
5V GND VIN
D3
C2
C3
USB
Power
Transistor


U-Do-It-Duino
Uno clone
DIGITAL(#=PWM)
RESET
SW1
POWER
D4
D13
D7
D1
RX
TX
D2
C1
C4
RN1
IOREF
GND
13
12
#11
#10
#9
8
7
#6
#5
4
#3
2
1
0
5V
GND
TX
RX
PV1
A0
OUT
IN
Pin 9
D5
R2
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5V
Transistor
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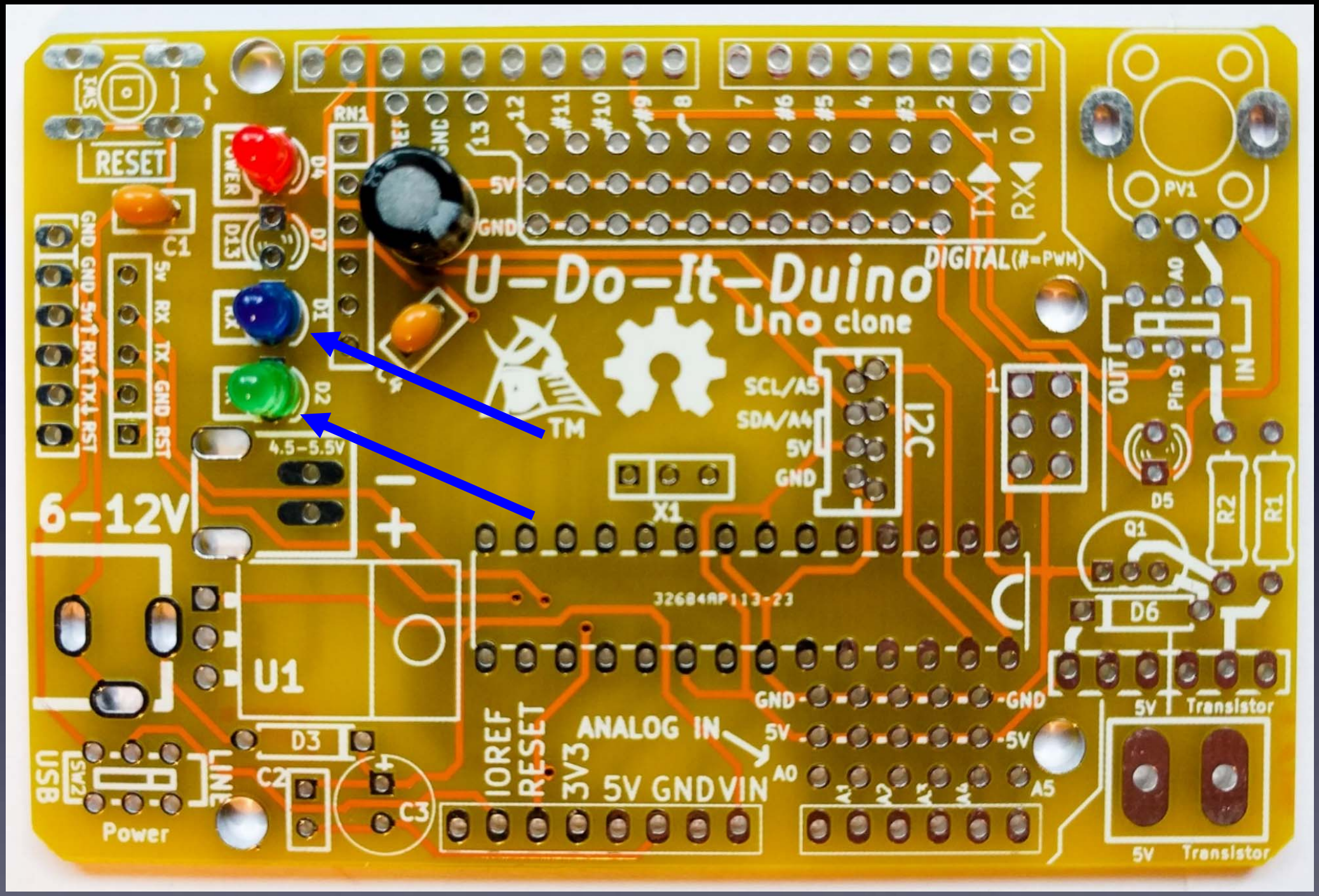
32684AP113-23
U1
D3
C2
C3
USB
SW2
Power
LINE
IOREF
RESET
3V3
5V
GND
VIN
ANALOG IN
A0
A1
A2
A3
A4
A5
GND
5V


RESET
SW1
RN1
D4
D7
D13
D1
D2
C1
C4
U-Do-It-Duino
Uno clone
DIGITAL(#=PWM)
TX
RX
5V
GND
PV1
A0
OUT
IN
Pin 9
D5
R2
R1
Q1
D6
5V
Transistor
SCL/A5
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X1
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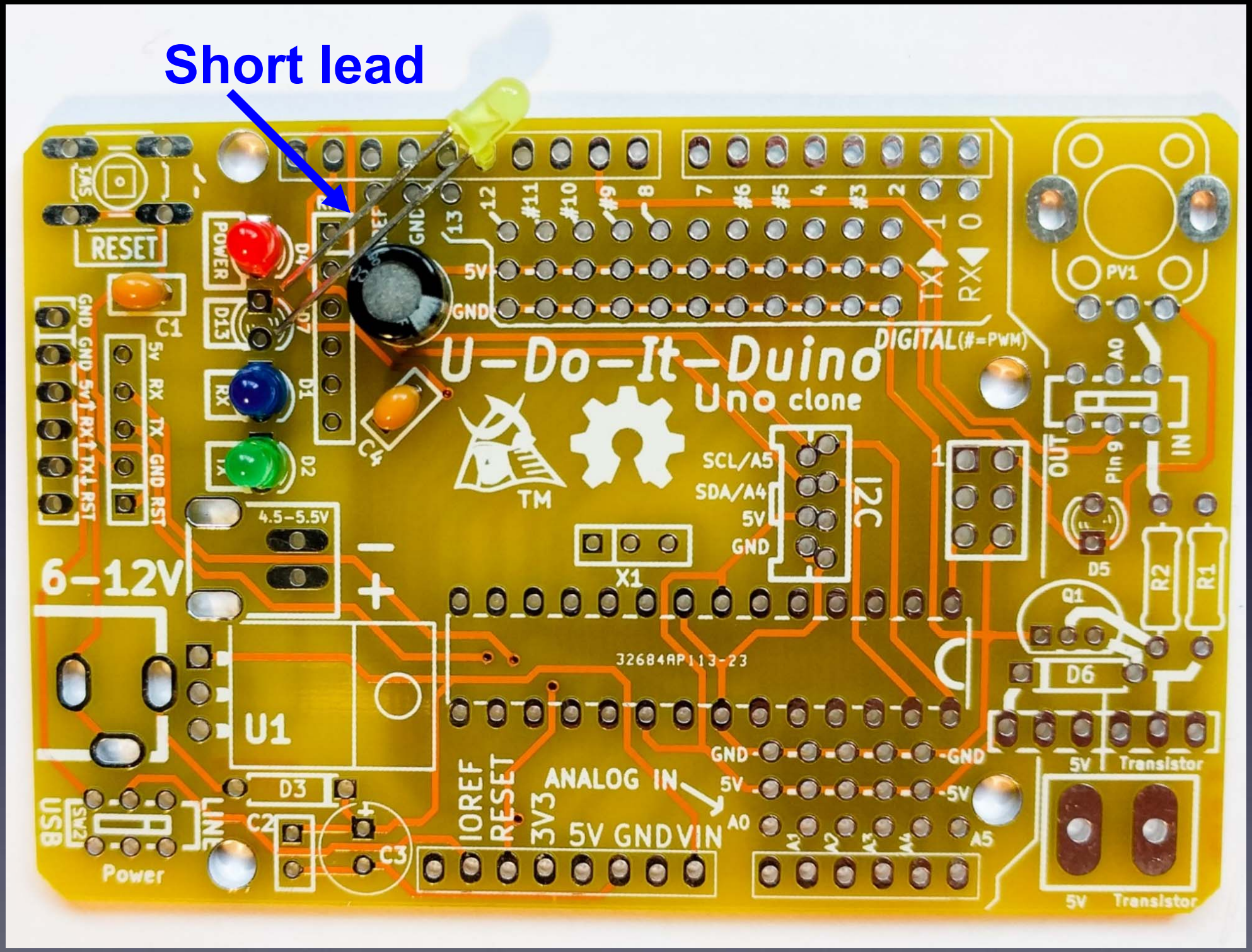
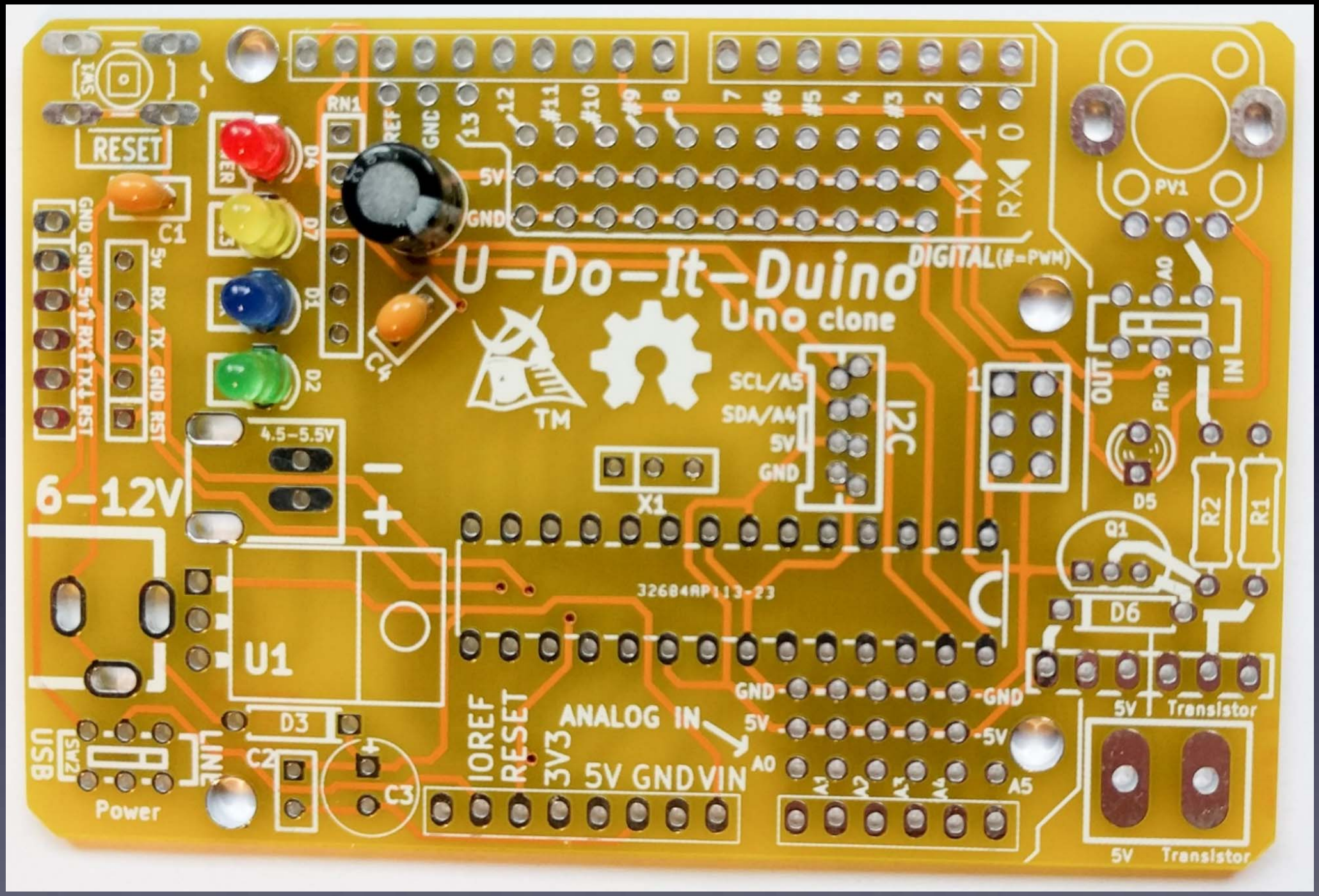
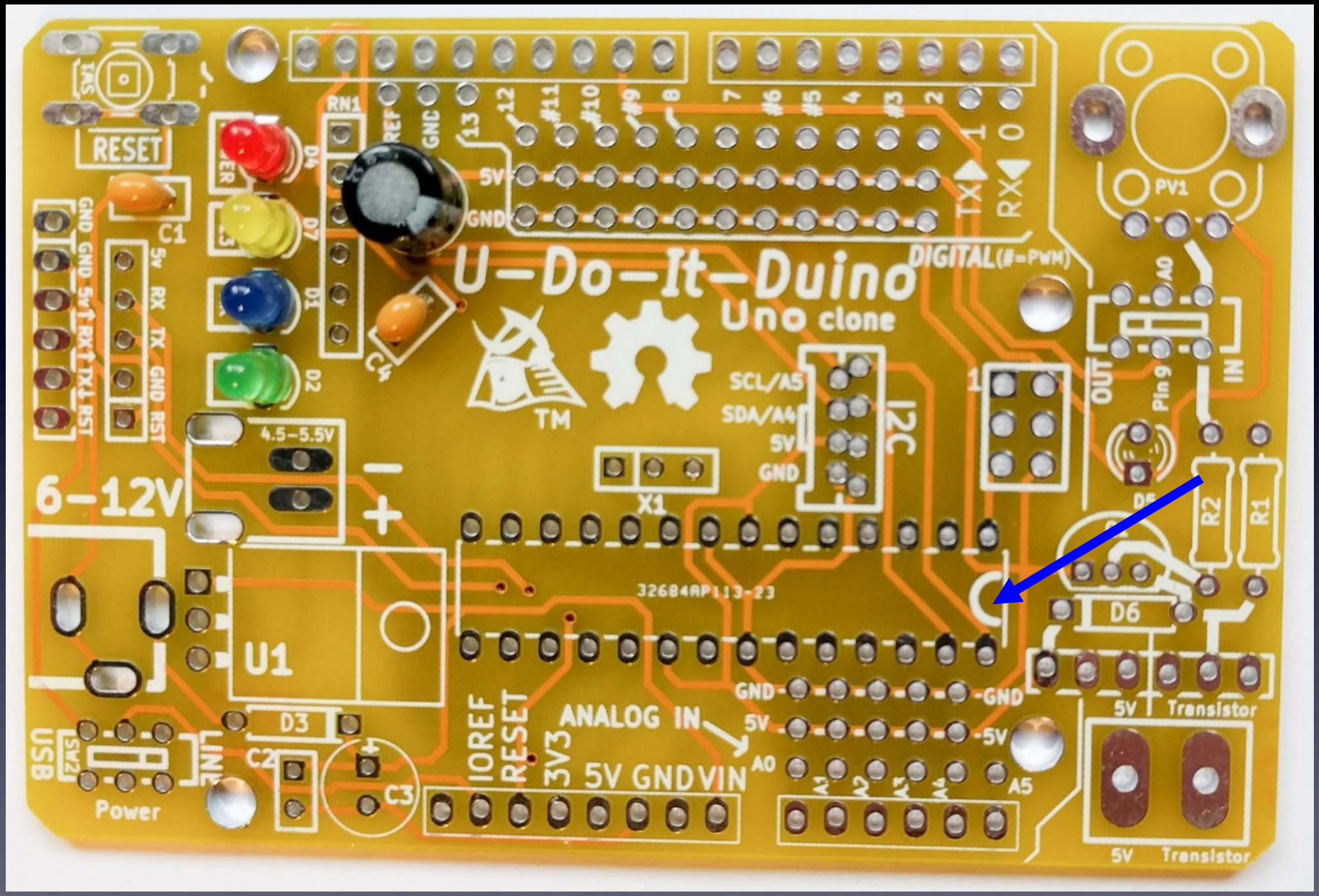
U1
32684AP113-23
D3
C2
C3
USB
SW2
Power
LINE
IOREF
RESET
3V3
5V GNDVIN
ANALOG IN
A0
A1
A2
A3
A4
A5


Short lead
U-Do-It-Duino
Uno clone
DIGITAL(#=PWM)
RESET
POWER
6-12V
4.5-5.5V
U1
32684AP113-23
I2C
SCL/A5
SDA/A4
ANALOG IN
IOREF
RESET
3V3
5V GNDVIN
Power
USB
Transistor
PV1
OUT
IN
Pin 9


U-Do-It-Duino
Uno clone
TM
RESET
SW1
RN1
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX 1
RX 0
5V
GND
DIGITAL(~=PWM)
PV1
A0
OUT
IN
Pin 9
D5
R2
R1
Q1
D6
5V
Transistor
C1
C4
D4
D7
D1
D2
GND
5v
RX
TX
RST
4.5-5.5V
6-12V
U1
X1
SCL/A5
SDA/A4
I2C
32684AP113-23
IC
GND
5V
A0
A1
A2
A3
A4
A5
ANALOG IN
IOREF
RESET
3V3
5V GND VIN
D3
C2
C3
USB
SW2
Power
LINE


RESET
U-Do-It-Duino
Uno clone
DIGITAL(#=PWM)
6-12V
4.5-5.5V
U1
32684AP113-23
I2C
SCL/A5
SDA/A4
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C1
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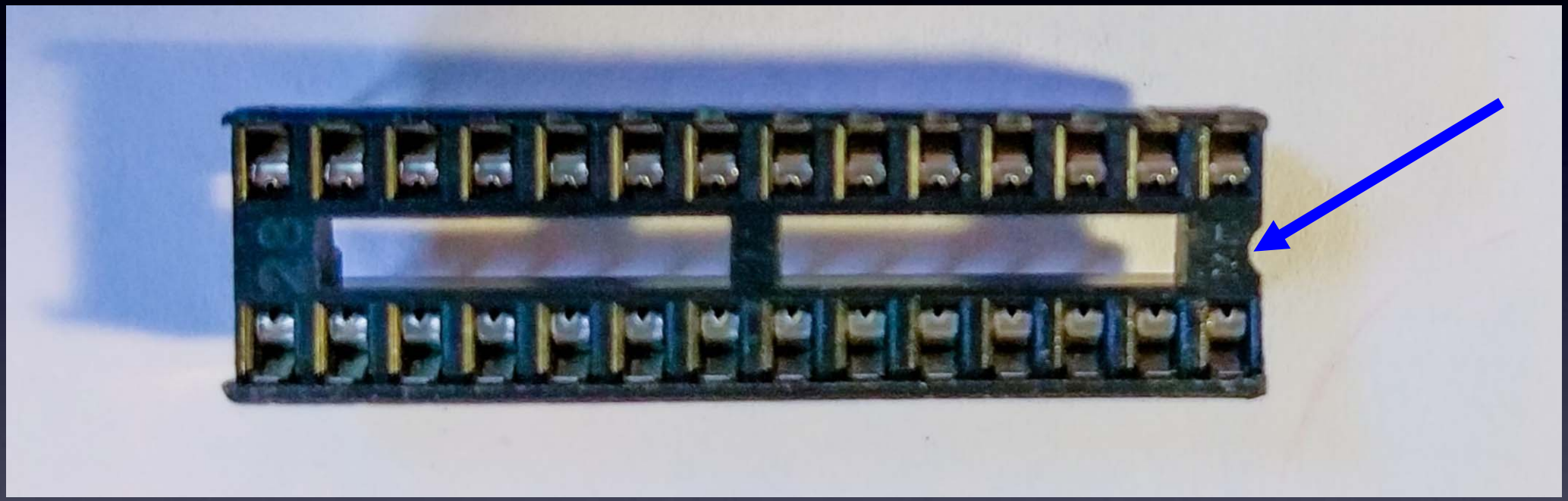
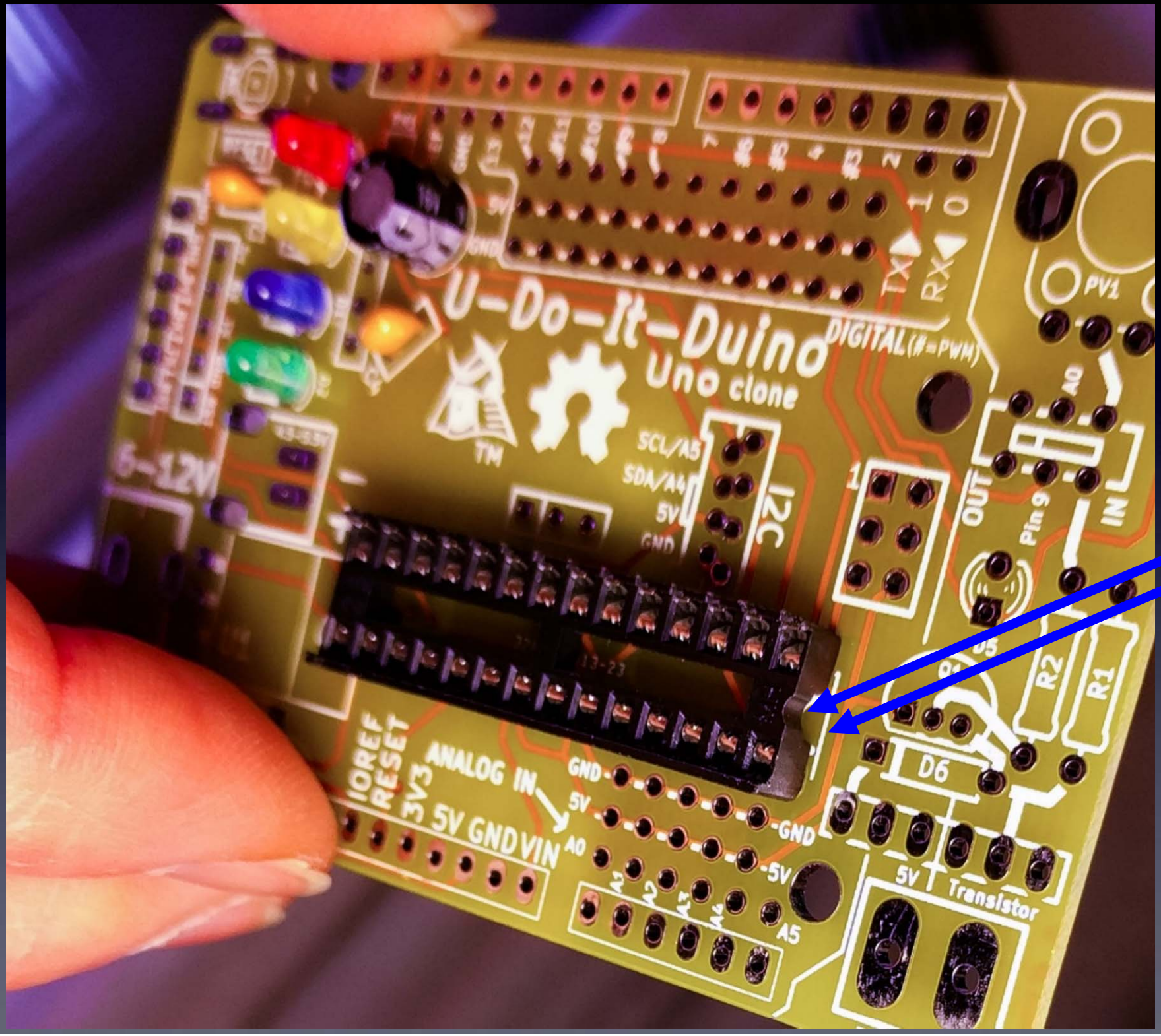
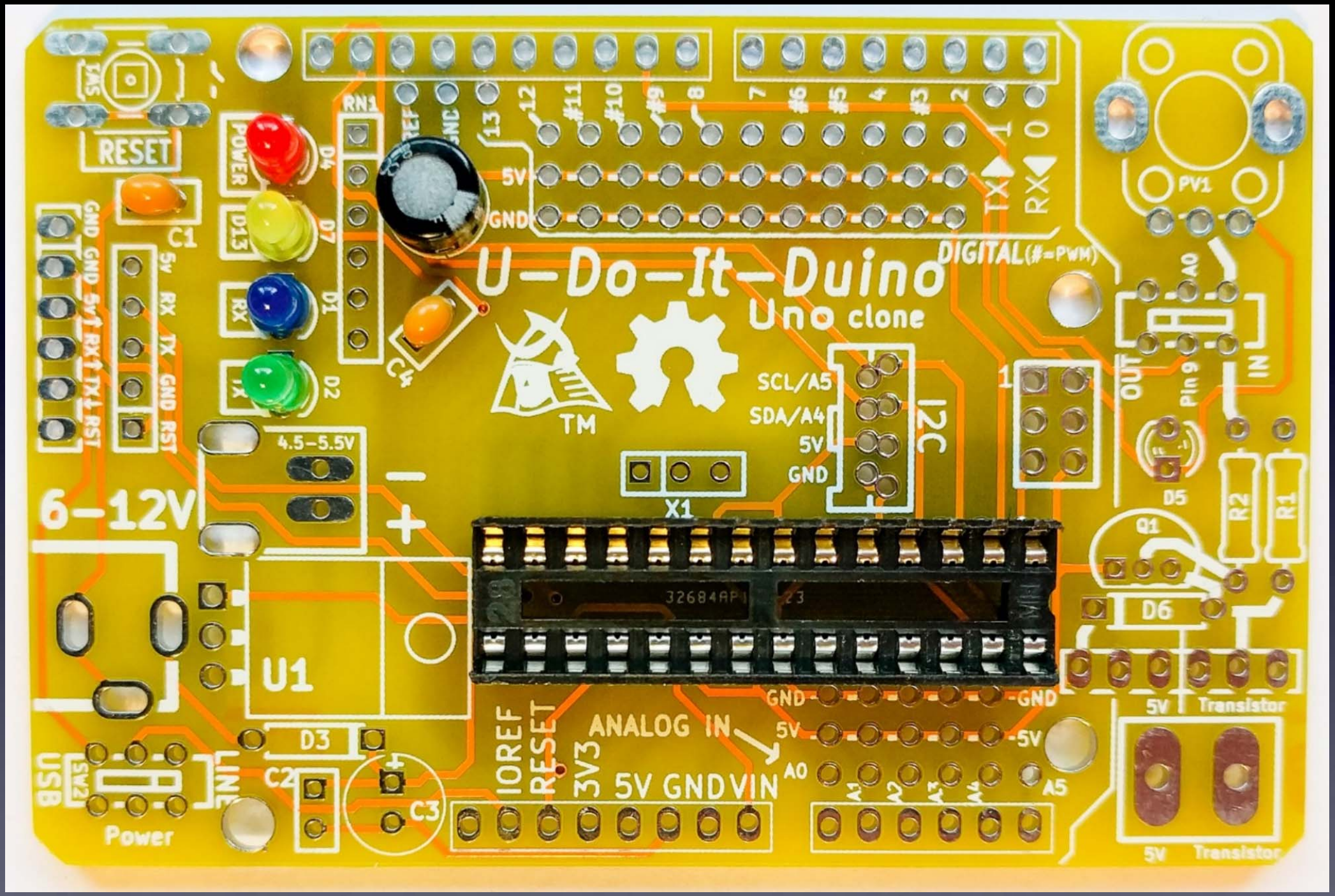
IN
Pin 9




U-Do-It-Duino
Uno clone
DIGITAL(~=PWM)
TX
RX
PV1
SCL/A5
SDA/A4
5V
GND
I2C
OUT
IN
Pin 9
A0
R2
R1
D6
5V
Transistor
IOREF
RESET
3V3
5V GND VIN
ANALOG IN
GND
5V
A0
A1
A2
A3
A4
A5
GND
5V
6-12V

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.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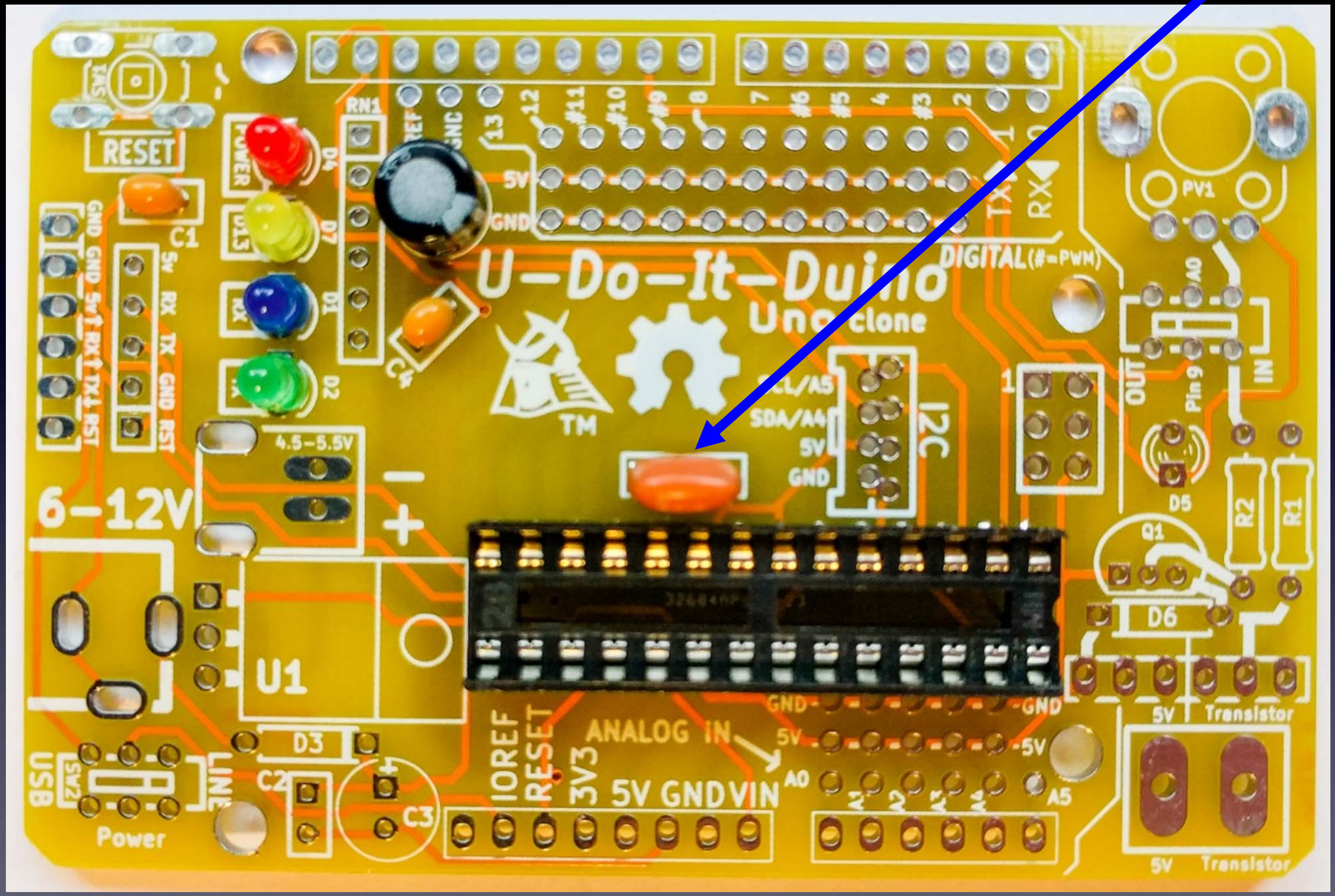
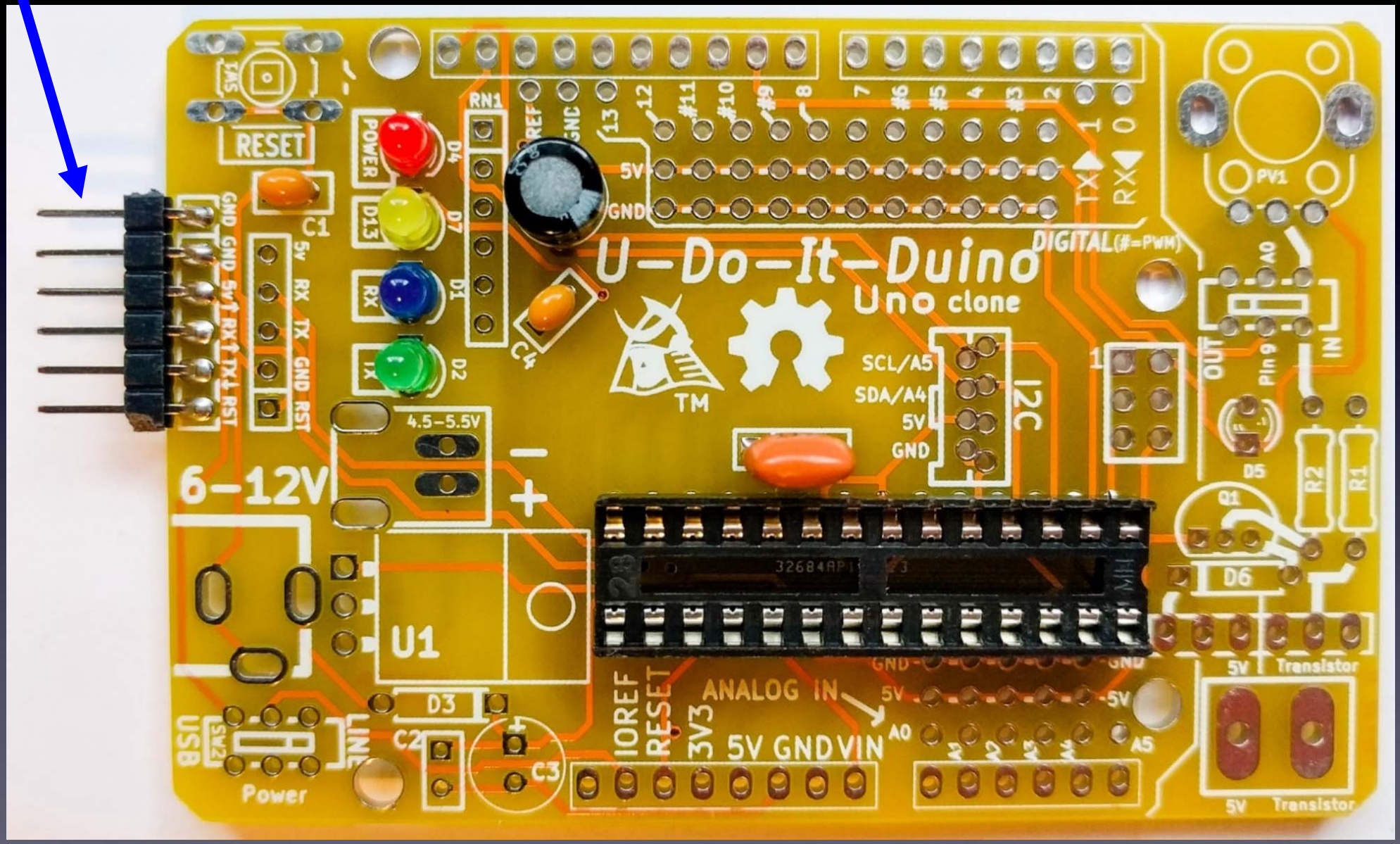
Uno clone
TM
RESET
SW1
POWER
D4
D13
D7
RX
D1
TX
D2
C1
C4
RN1
IOREF
GND
13
12
#11
#10
#9
8
7
#6
#5
4
#3
2
1
0
5V
GND
TX
RX
DIGITAL(#=PWM)
PV1
A0
OUT
Pin 9
IN
D5
R2
R1
Q1
D6
5V
Transistor
GND
5V
A0
A1
A2
A3
A4
A5
SCL/A5
SDA/A4
5V
GND
I2C
X1
4.5-5.5V
6-12V
U1
32684AP1
23
D3
C2
C3
USB
SW2
Power
LINE
IOREF
RESET
3V3
5V
GND
VIN
ANALOG IN


RESET
SW1
POWER
D4
D7
D1
D2
RN1
C1
C4
U-Do-It-Duino
Uno clone
TM
DIGITAL(#=PWM)
TX
RX
5V
GND
PV1
OUT
IN
Pin 9
D5
R2
R1
Q1
D6
I2C
SCL/A5
SDA/A4
4.5-5.5V
6-12V
U1
D3
C2
C3
USB
Power
LINE
IOREF
RESET
3V3
5V GND VIN
ANALOG IN
A0
A1
A2
A3
A4
A5
Transistor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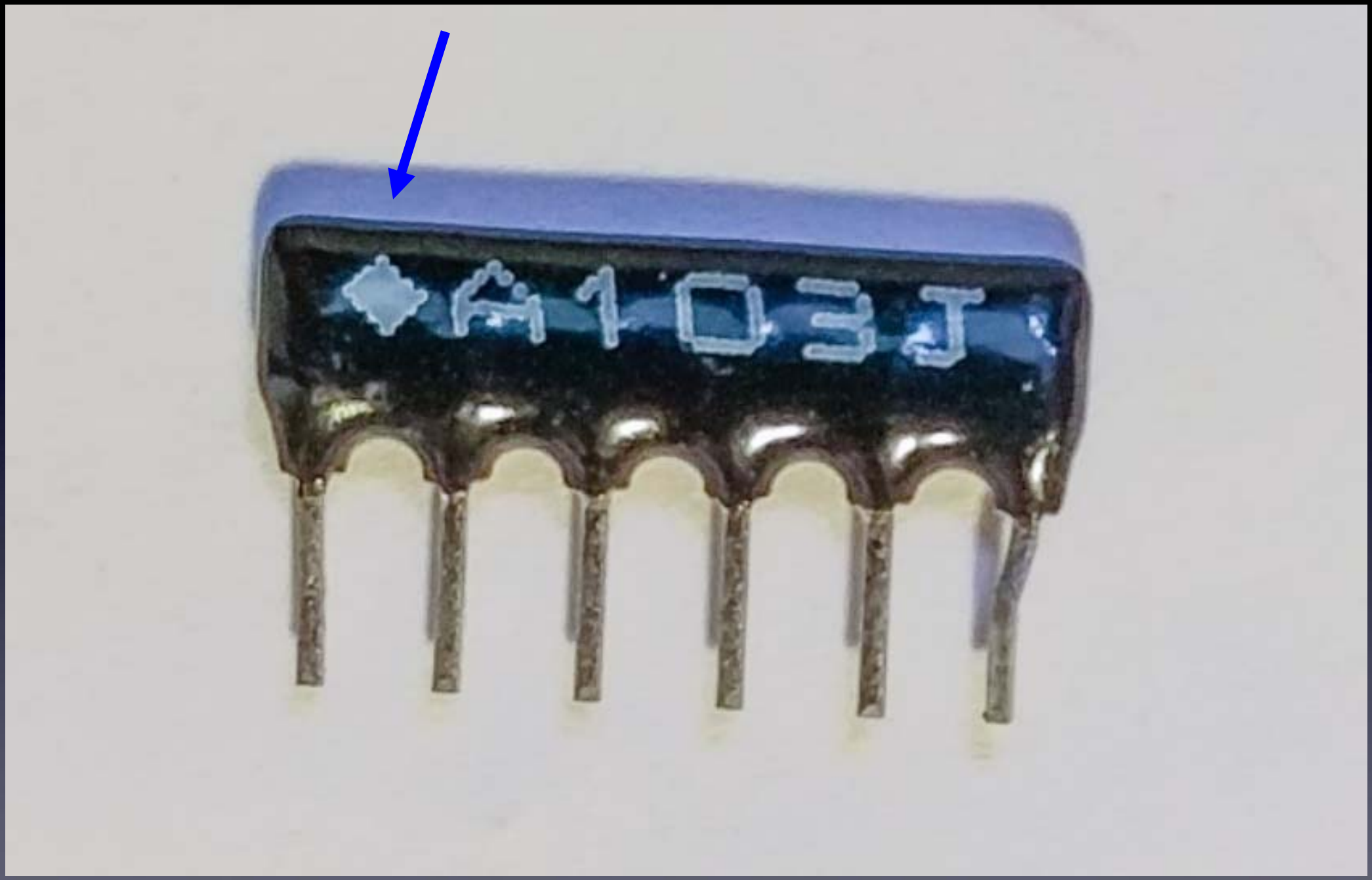
Uno clone
TM
RESET
SW1
POWER
D13
RX
TX
D4
D7
D1
D2
RN1
C1
C4
C2
C3
D3
U1
6-12V
4.5-5.5V
USB
SW2
Power
LINE
IOREF
RESET
3V3
5V GND VIN
ANALOG IN
A0
A1
A2
A3
A4
A5
SCL/A5
SDA/A4
5V
GND
I2C
DIGITAL(#=PWM)
PV1
OUT
IN
Pin 9
D5
D6
Q1
R2
R1
Transistor
5V
GND
VIN
32684AP1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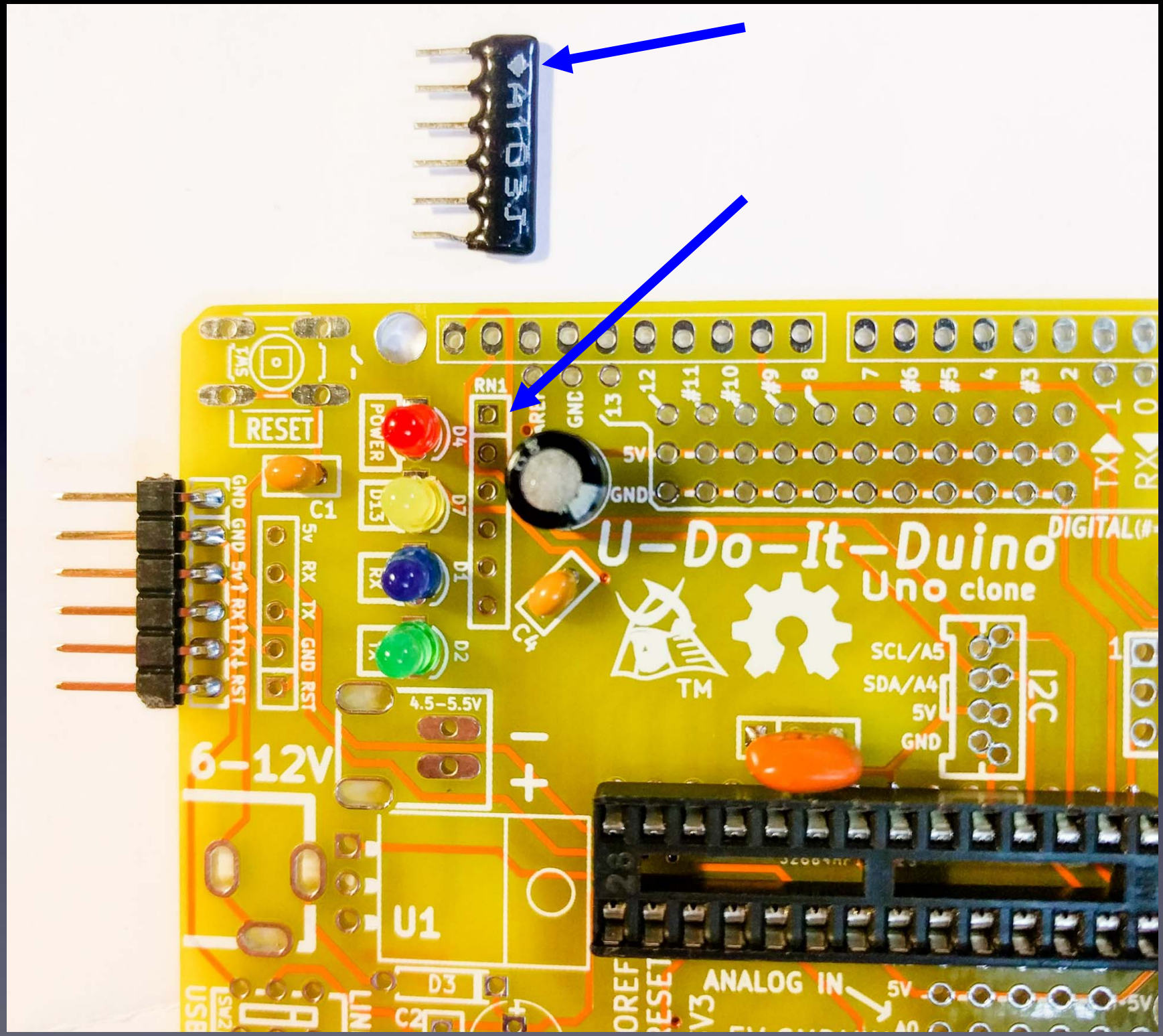
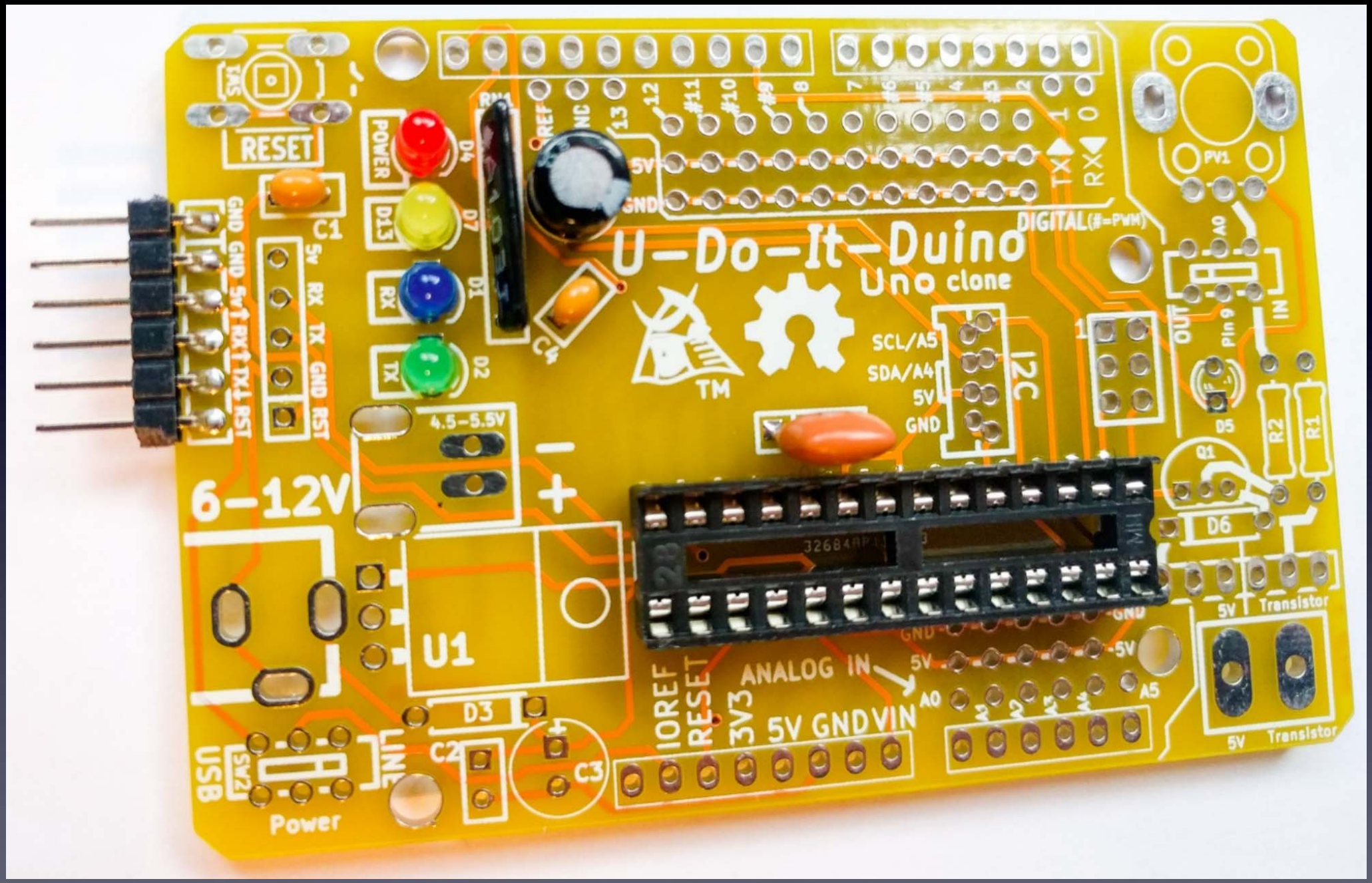
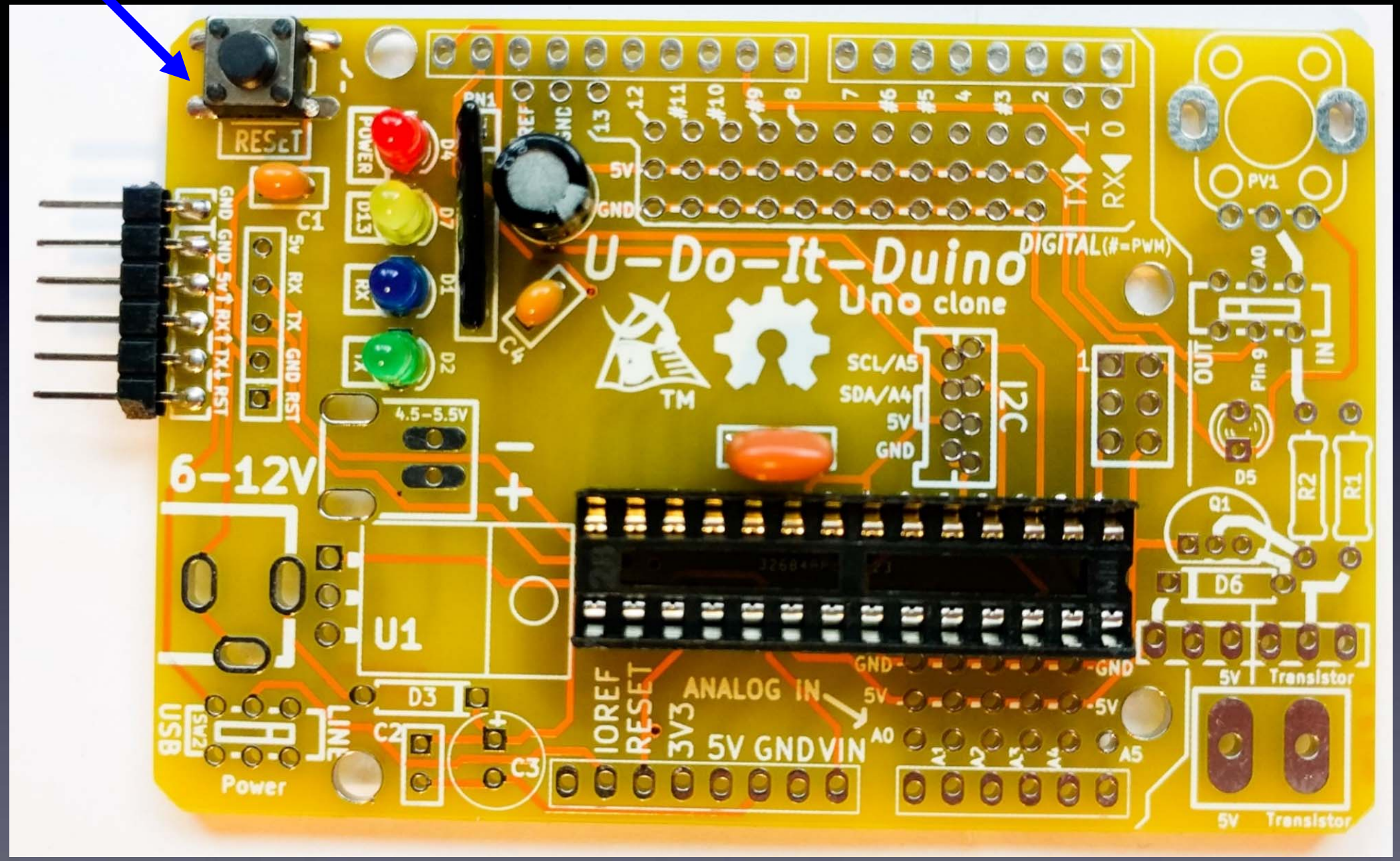
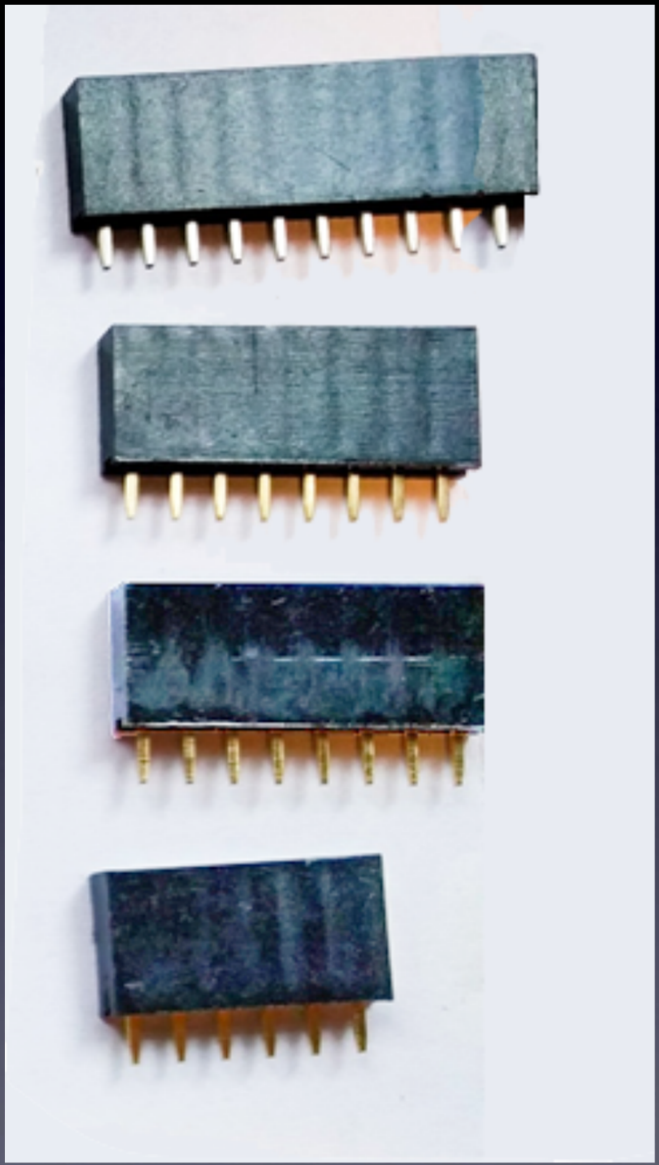

ATMEGA
RESET
POWER
D4
D13
D7
RX
D1
TX
D2
RN1
C1
C4
GND
5V
U-Do-It-Duino
Uno clone
TM
SCL/A5
SDA/A4
5V
GND
I2C
4.5-5.5V
6-12V
U1
D3
C2
ANALOG IN
DIGITAL(#
TX
RX

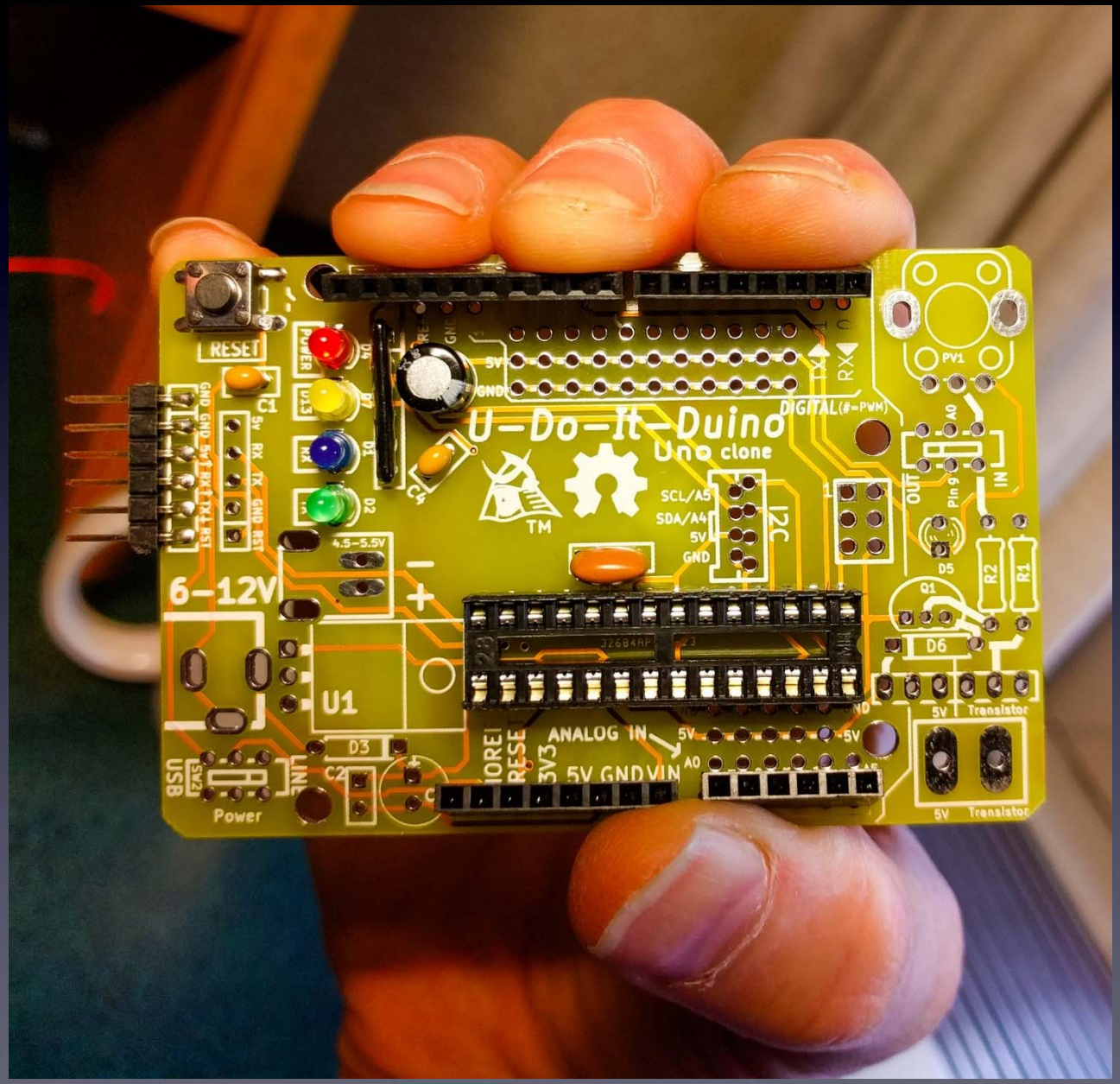

U-Do-It-Duino
Uno clone
RESET
POWER
D4
D7
D13
D1
RX
D2
TX
C1
C4
5V
GND
RX
TX
GND
RST
4.5-5.5V
6-12V
U1
D3
C2
C3
USB
Power
IOREF
RESET
3V3
5V GND VIN
ANALOG IN
A0
A5
DIGITAL(#=PWM)
SCL/A5
SDA/A4
I2C
TM
PV1
OUT
IN
Pin 9
D5
Q1
R2
R1
D6
Transistor


RESET
POWER
D13
RX
TX
D4
D7
D1
D2
C1
C4
DN1
IOREF
GND
13
12
#11
#10
#9
8
7
#6
#5
4
#3
2
1
0
5V
GND
TX
RX
DIGITAL(#=PWM)
U-Do-It-Duino
Uno clone
TM
SCL/A5
SDA/A4
5V
GND
I2C
PV1
A0
OUT
IN
Pin 9
D5
R2
R1
Q1
D6
5V
Transistor
4.5-5.5V
6-12V
U1
D3
C2
C3
USB
Power
LINE
IOREF
RESET
3V3
5V
GND
VIN
ANALOG IN
A0
A1
A2
A3
A4
A5
GND
5V

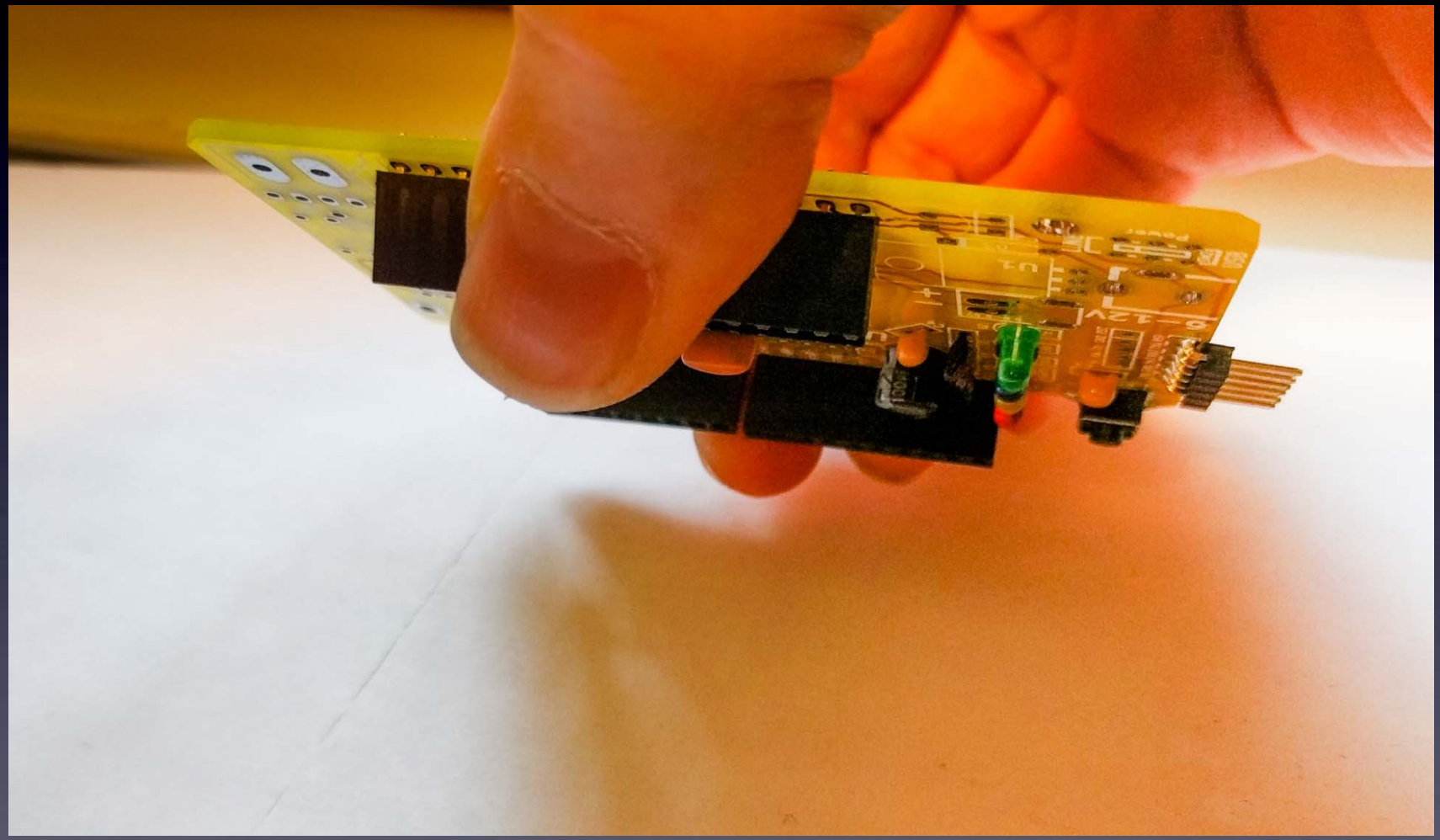
Headers



Headers


RESET
U-Do-It-Duino
Uno clone
DIGITAL(#=PWM)
SCL/A5
SDA/A4
5V
GND
I2C
6-12V
U1
ANALOG IN
5V GND VIN
A0
Power
USB
Translator

Headers



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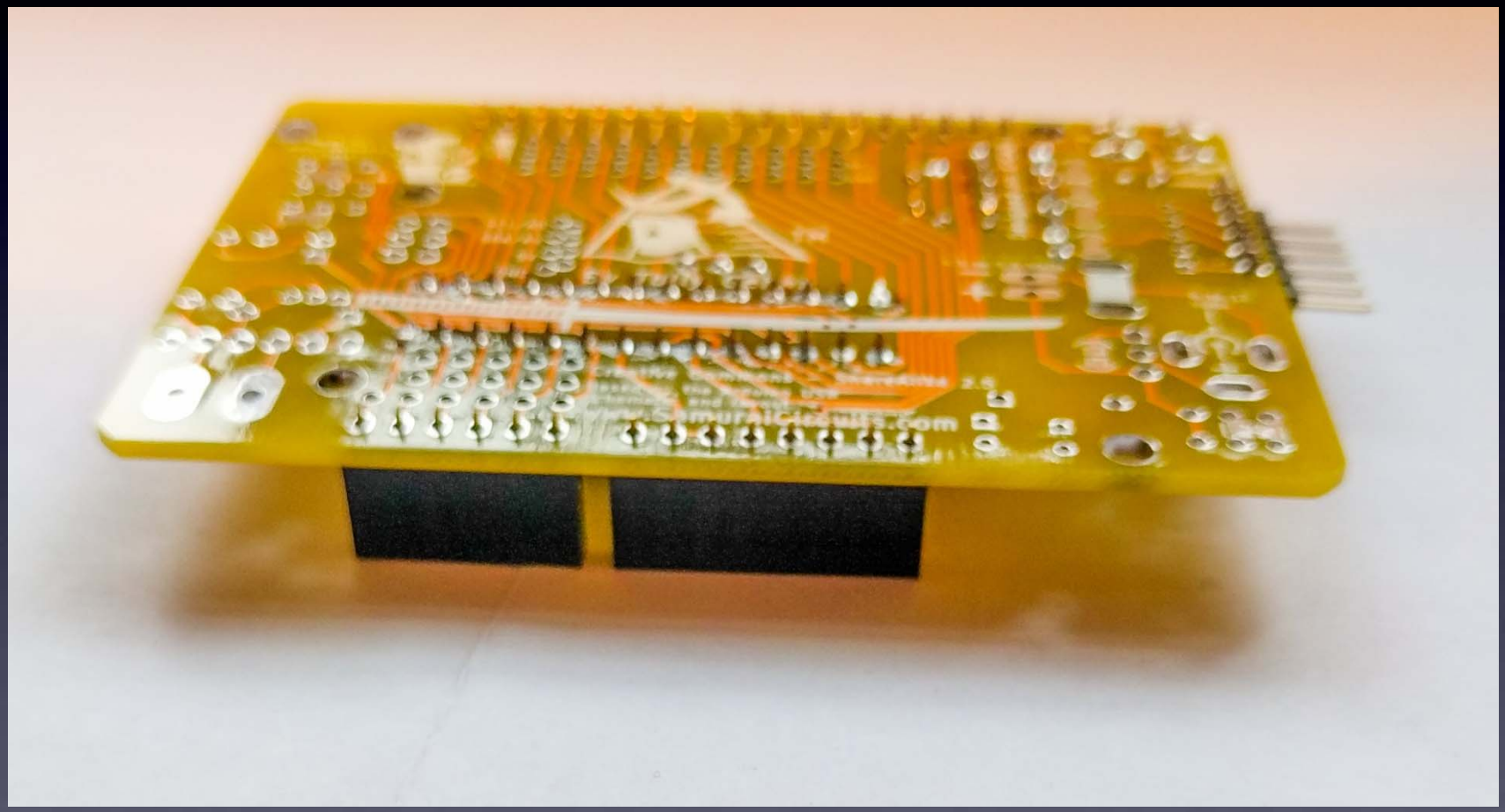
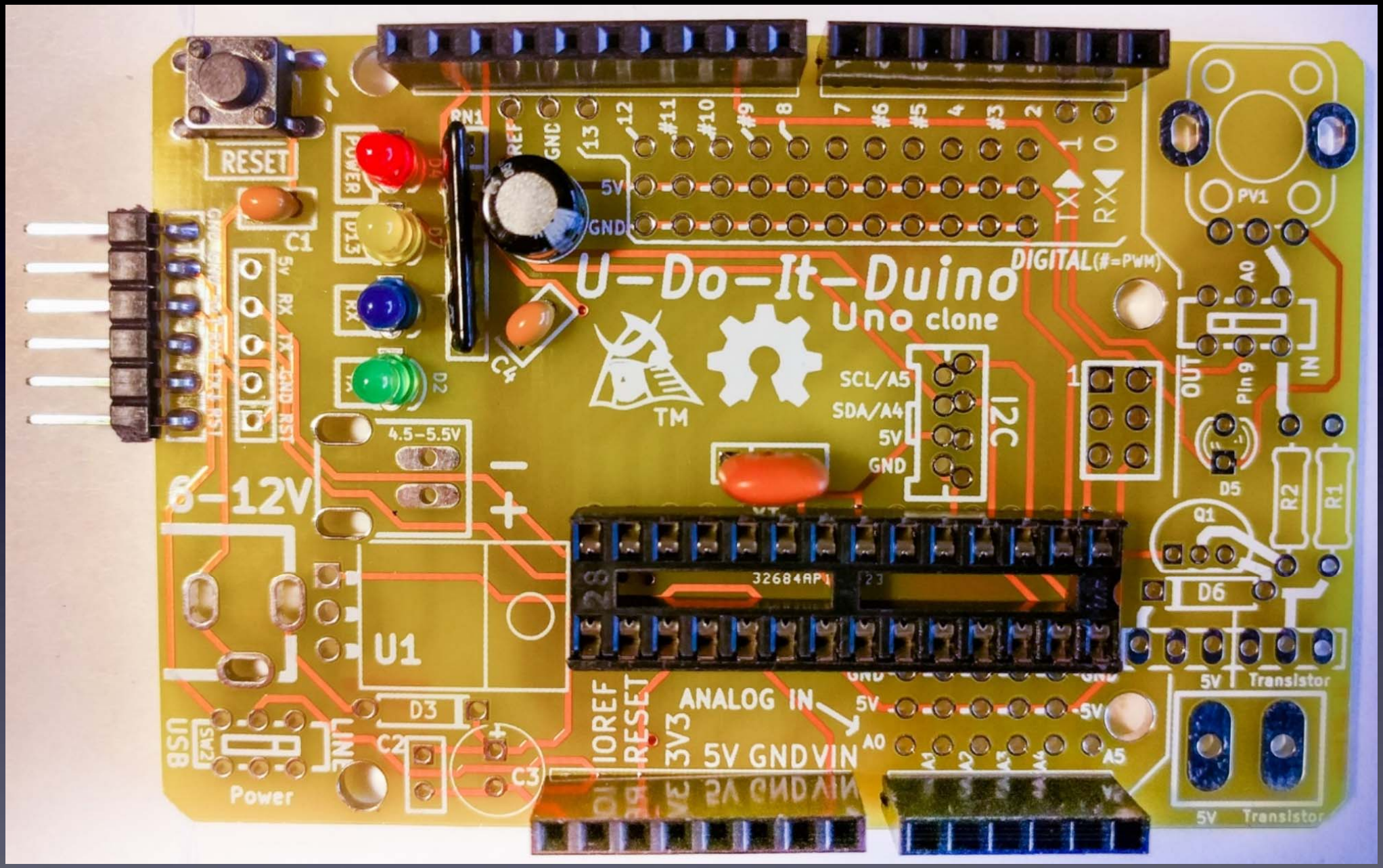
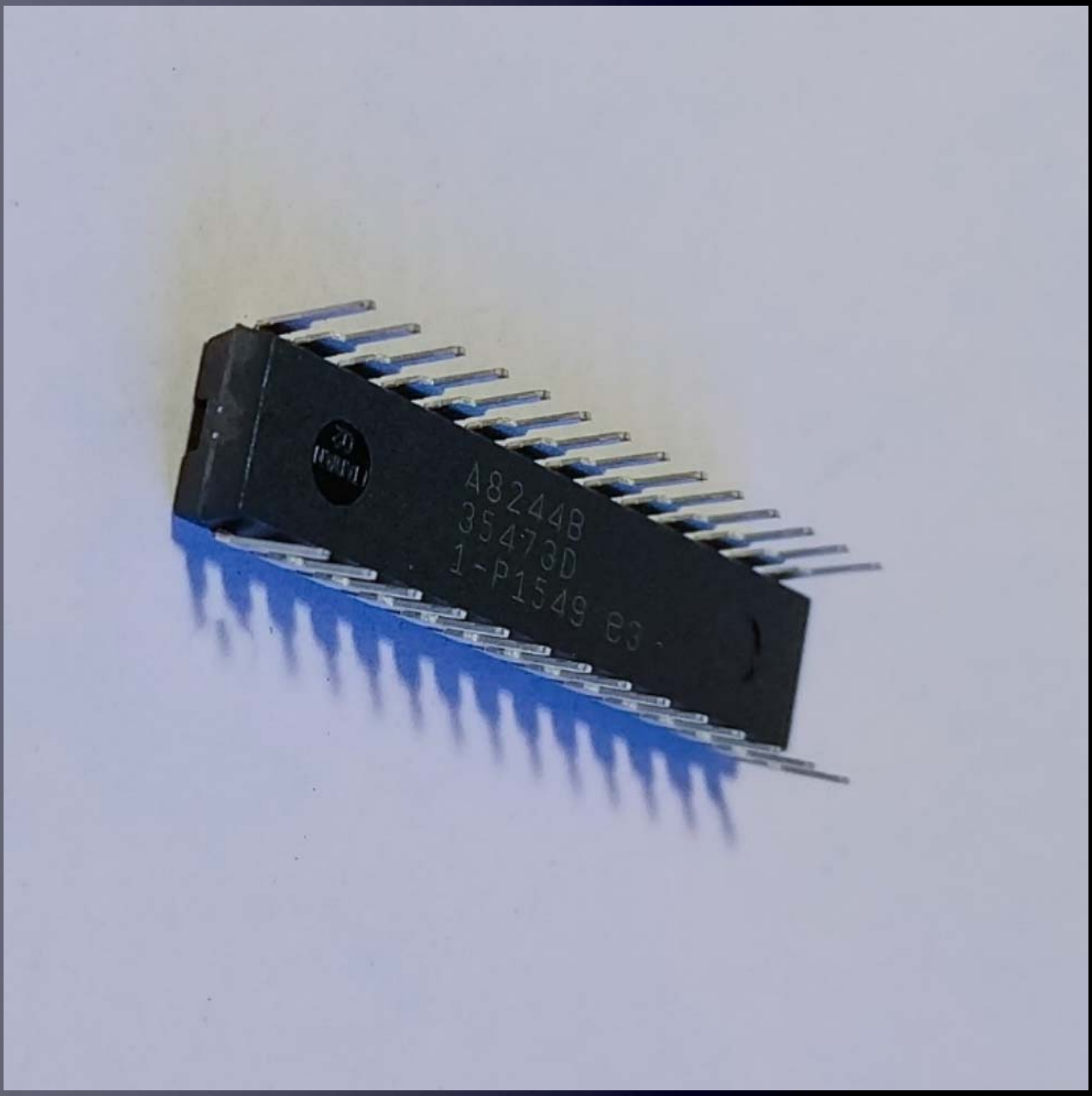
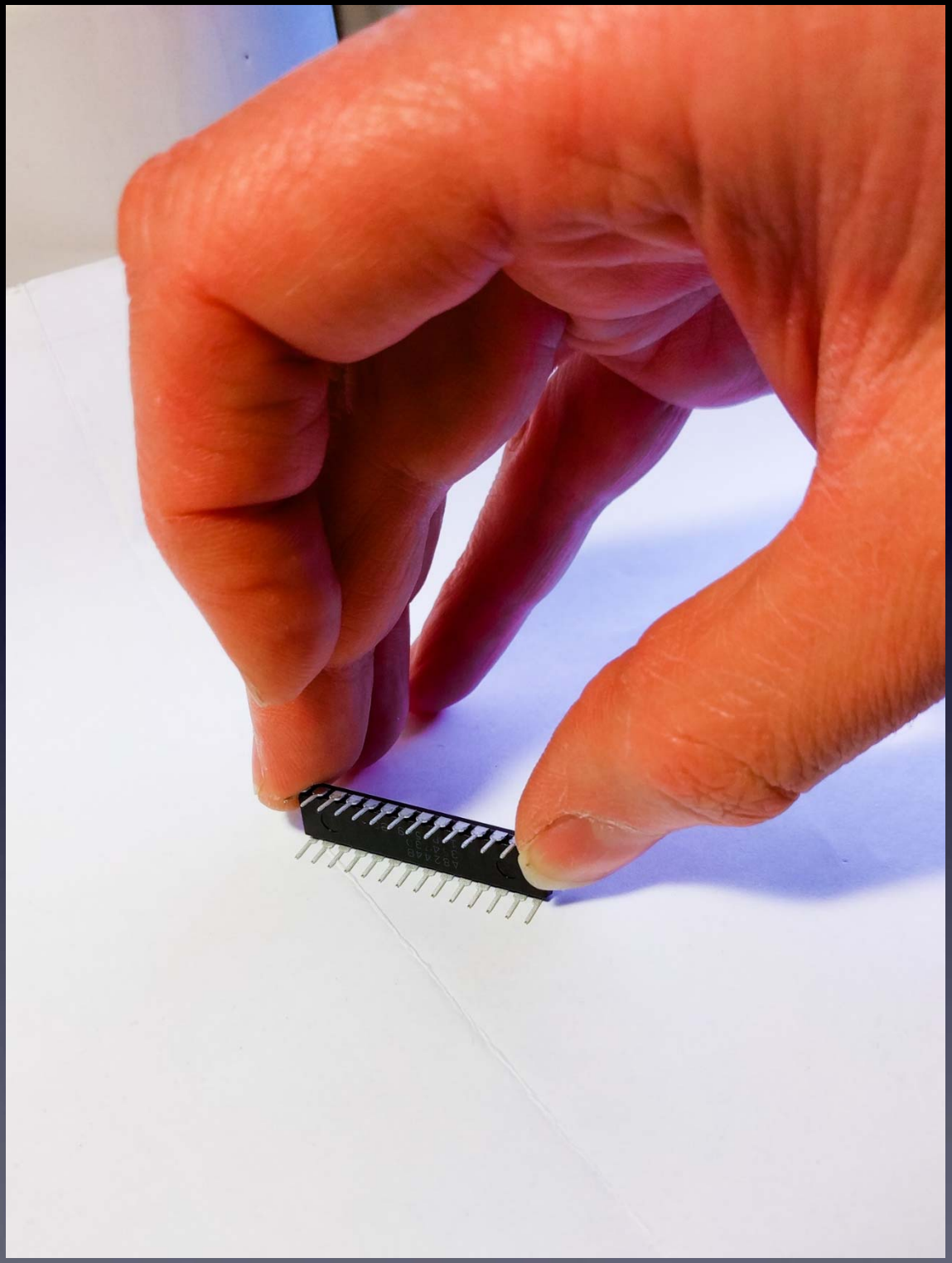
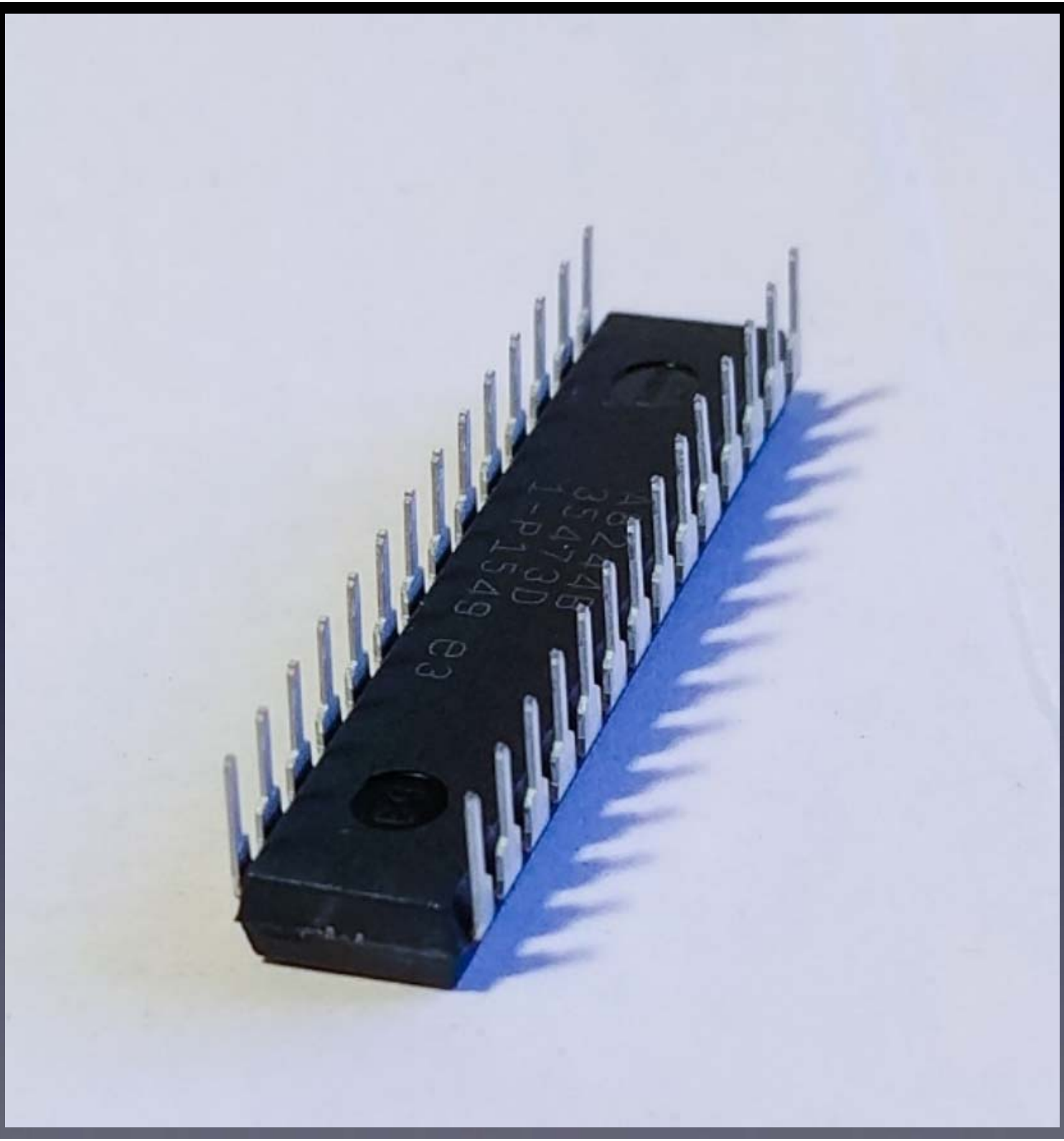
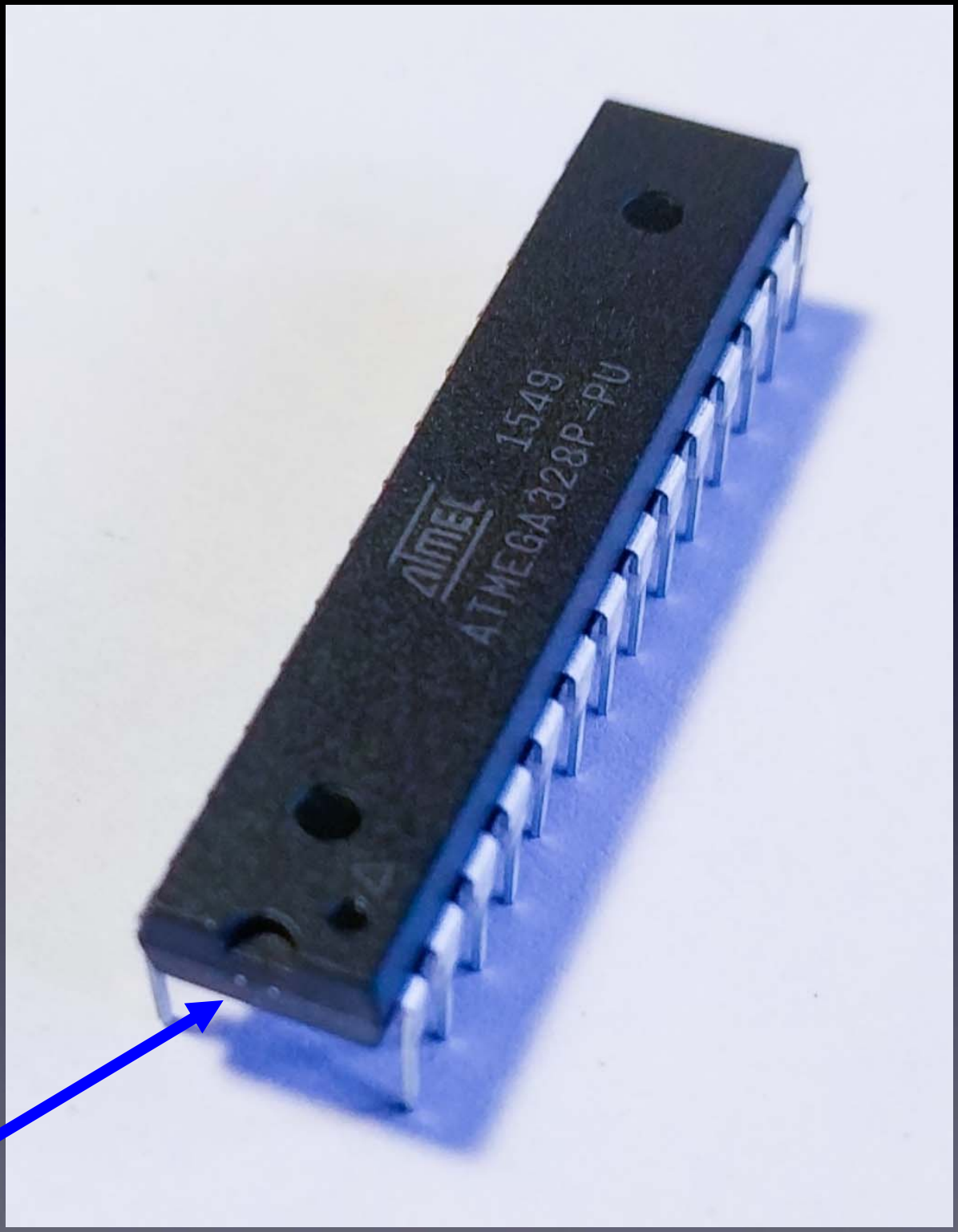


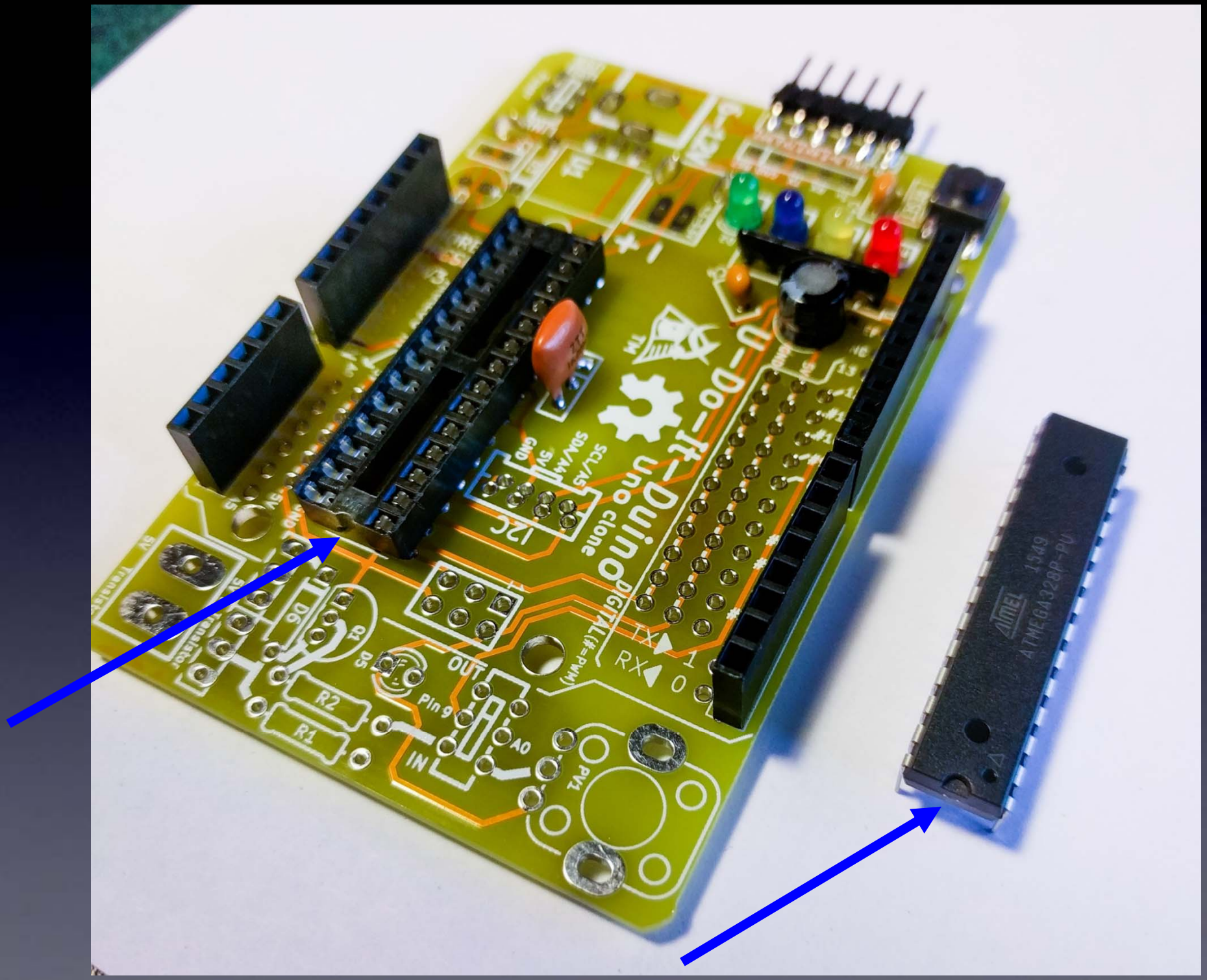

U-Do-It-Duino
Uno clone
TM
RESET
POWER
D4
D7
D2
C1
C4
PN1
REF
GND
13
12
#11
#10
#9
8
7
#6
#5
4
#3
2
1
0
5V
GND
TX
RX
DIGITAL(#=PWM)
PV1
A0
OUT
IN
Pin 9
D5
R2
R1
Q1
D6
5V
Transistor
SCL/A5
SDA/A4
5V
GND
I2C
4.5-5.5V
6-12V
U1
32684AP1
D3
C2
C3
USB
SW2
Power
IOREF
RESET
3V3
5V GND VIN
ANALOG IN
A0
A1
A2
A3
A4
A5

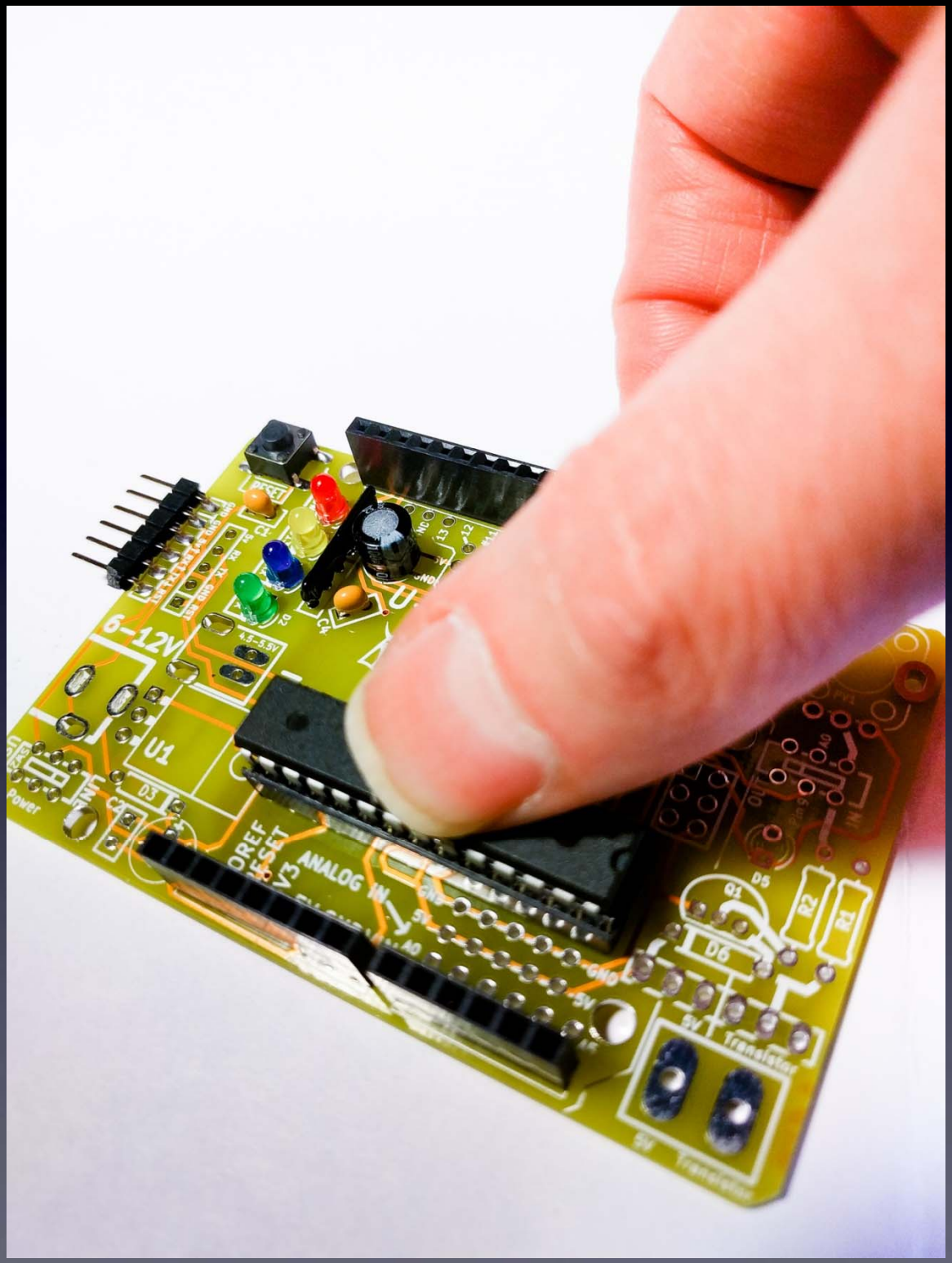

A8244B
35473D
1-P1549 E3

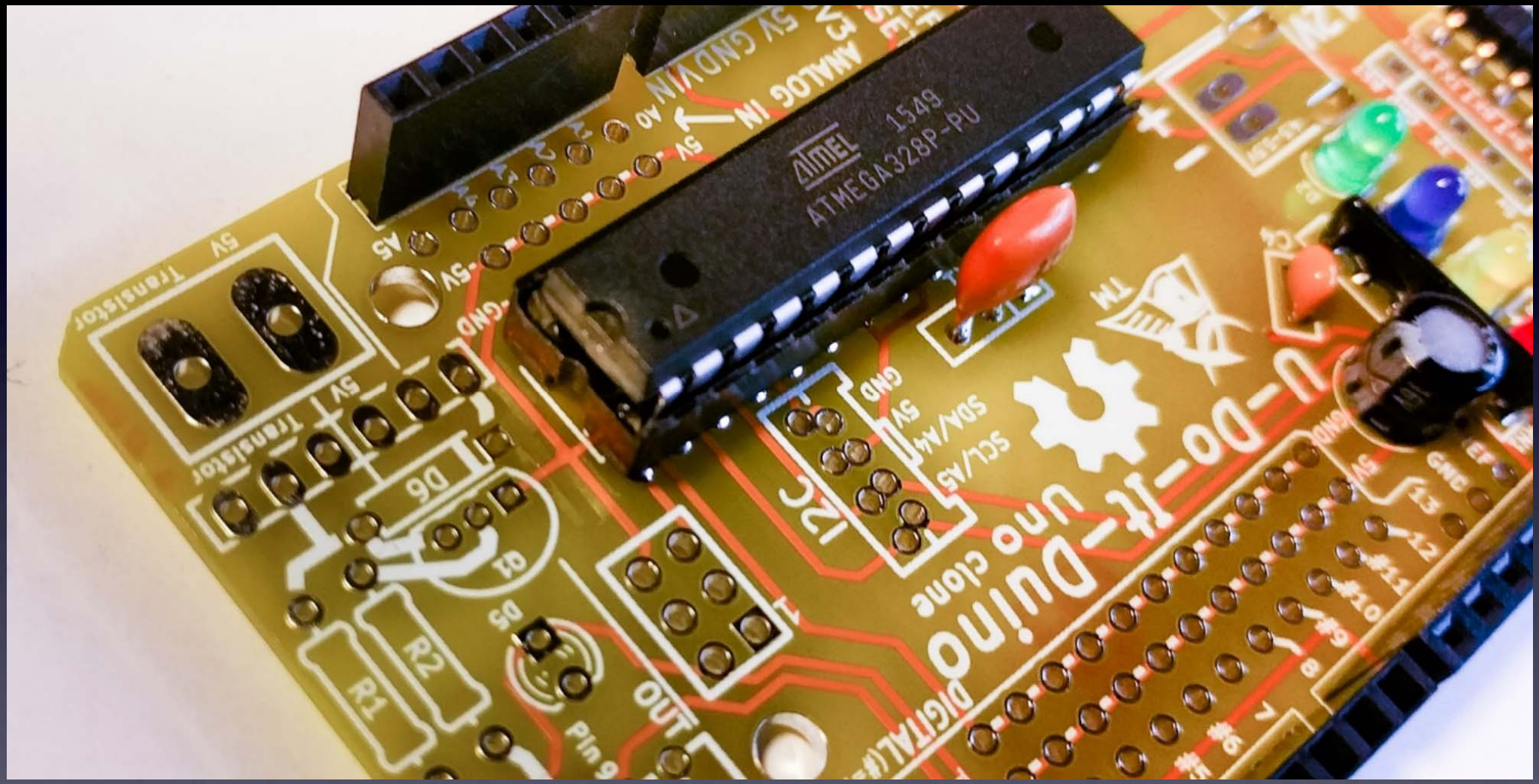




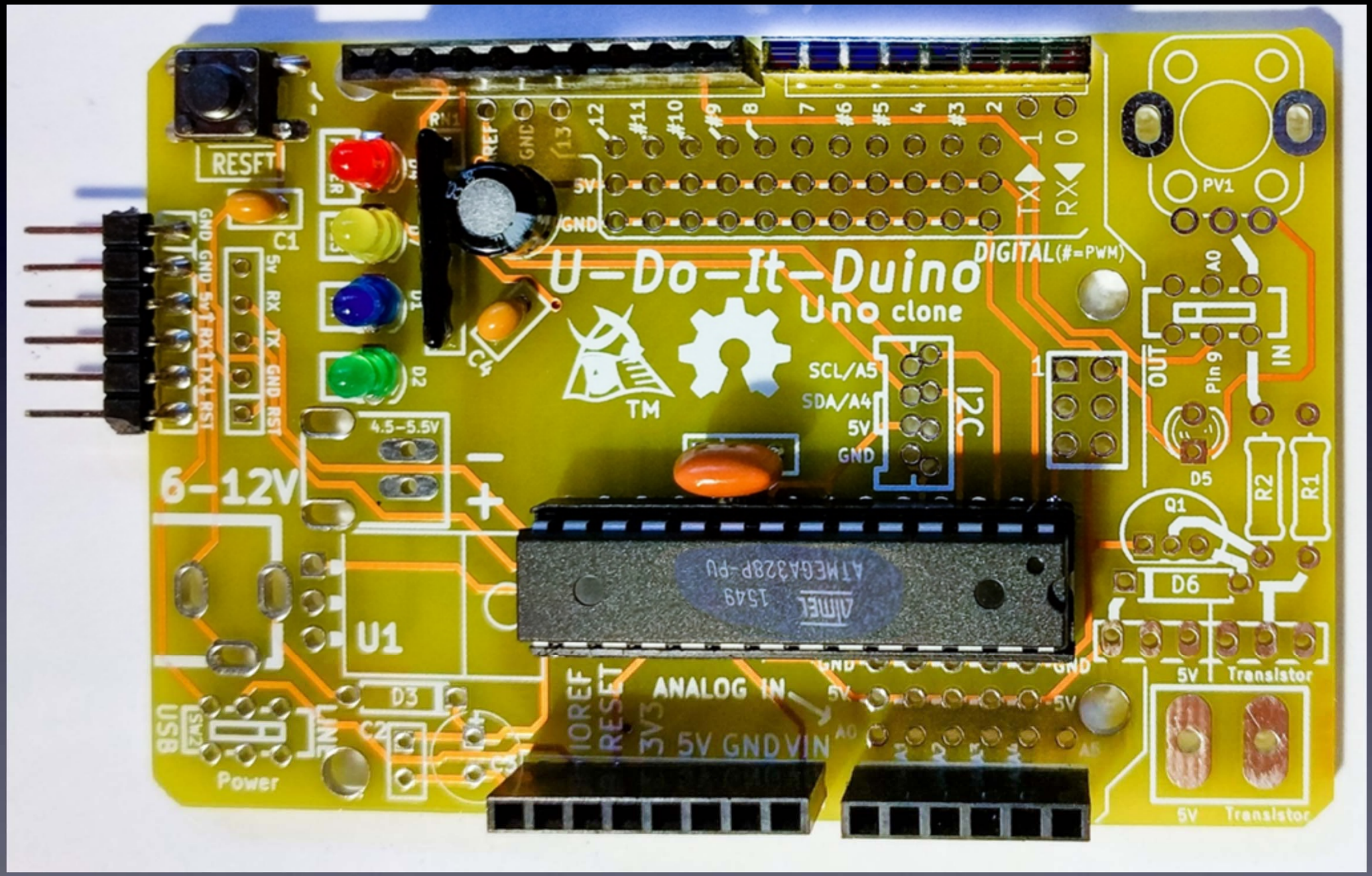

1549
ATMEGA328P-PU


Do-It-Duino
Uno clone
DIGITAL(~=PWM)
I2C
SCL/A5
SDA/A4
5V
GND
TX
RX
OUT
IN
Pin 9
A0
PV1
R1
R2
D5
D6
Q1
5V
Translator
ATMEGA328P-PU
1549

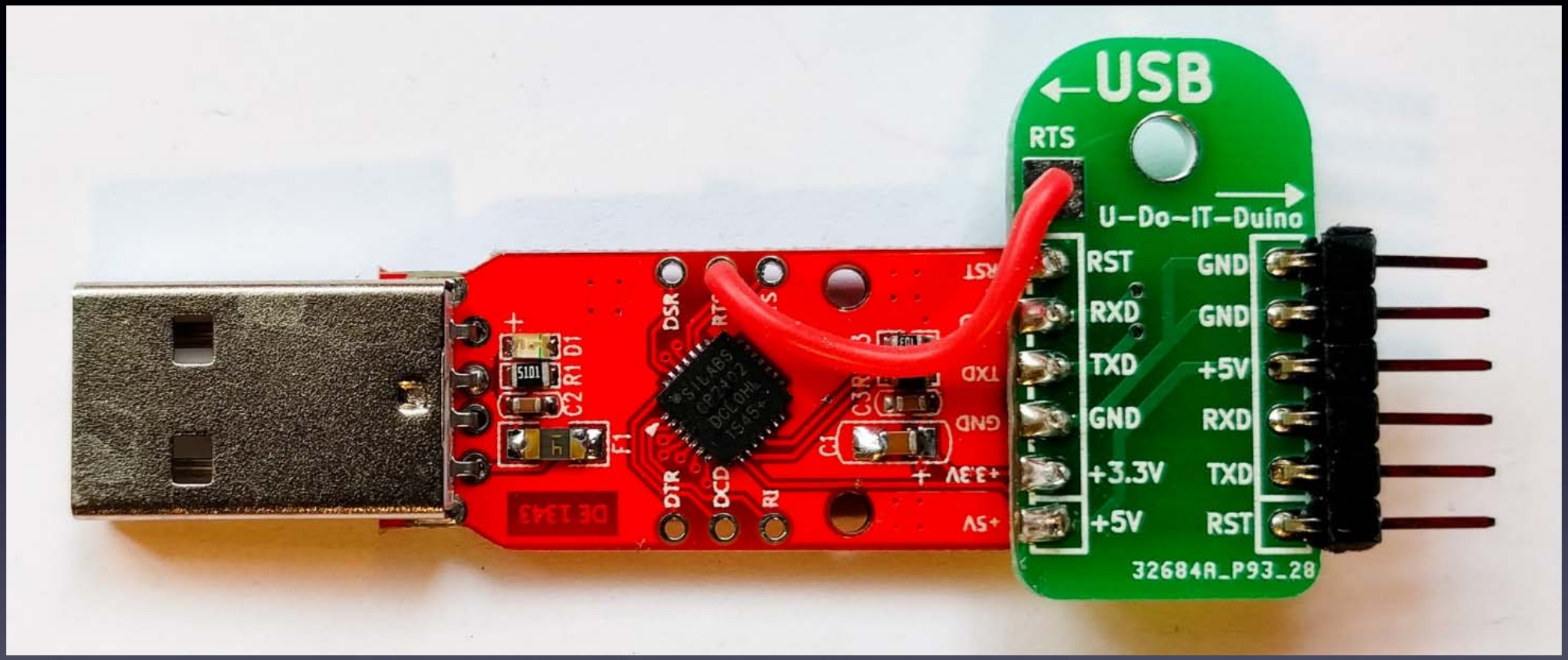

6-12V
U1
D3
Power
ANALOG IN
D5
Q1
R2
R1
D6
5V
Transistor


ATMEGA328P-PU
ATMEL
1549
Uno clone
Do-It-Duino
I2C
SCL/A5
SDA/A4
5V
GND
ANALOG IN
5V GND VIN
A5
A0
Transistor
D6
Q1
D5
R1
R2
OUT
DIGITAL(PWM~)
Pin 9

We're done!


U-Do-It-Duino
Uno clone
DIGITAL(#=PWM)
RESET
6-12V
4.5-5.5V
USB
Power
U1
ANALOG IN
IOREF
RESET
3V3
5V GND VIN
SCL/A5
SDA/A4
5V
GND
I2C
PV1
OUT
IN
Pin 9
D5
R2
R1
Q1
D6
Transistor
ATMEGA328P-PU
ATMEL
1549

Now we can
connect parts to our Arduino,
and program it!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RTS
U-Do-IT-Duino
RST
RXD
TXD
GND
+3.3V
+5V
GND
GND
+5V
RXD
TXD
RST
32684A_P93_28
DSR
DTR
DCD
RI
F1
C1
C2
C3
R1
D1
SILABS
CP2102
DE 1343

USB
RTS
U-Do-IT-Duino
RST
RXD
TXD
GND
+3.3V
+5V
GND
GND
+5V
RXD
TXD
RST
32684A_P93_28
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RI
F1
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C1
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CP2102
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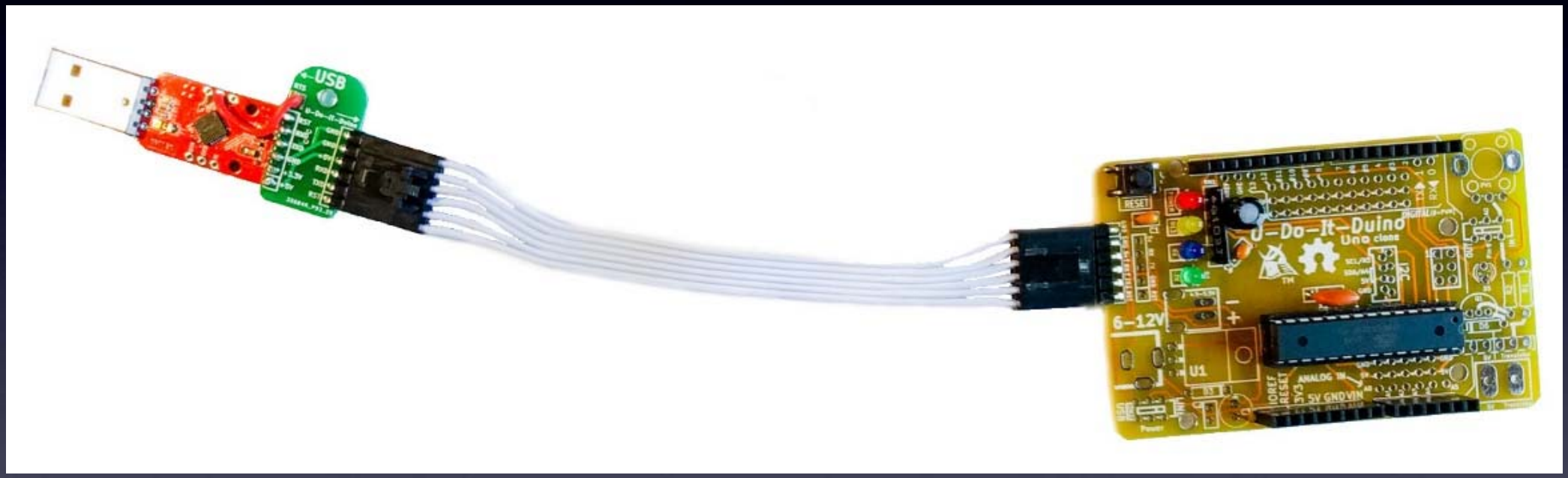
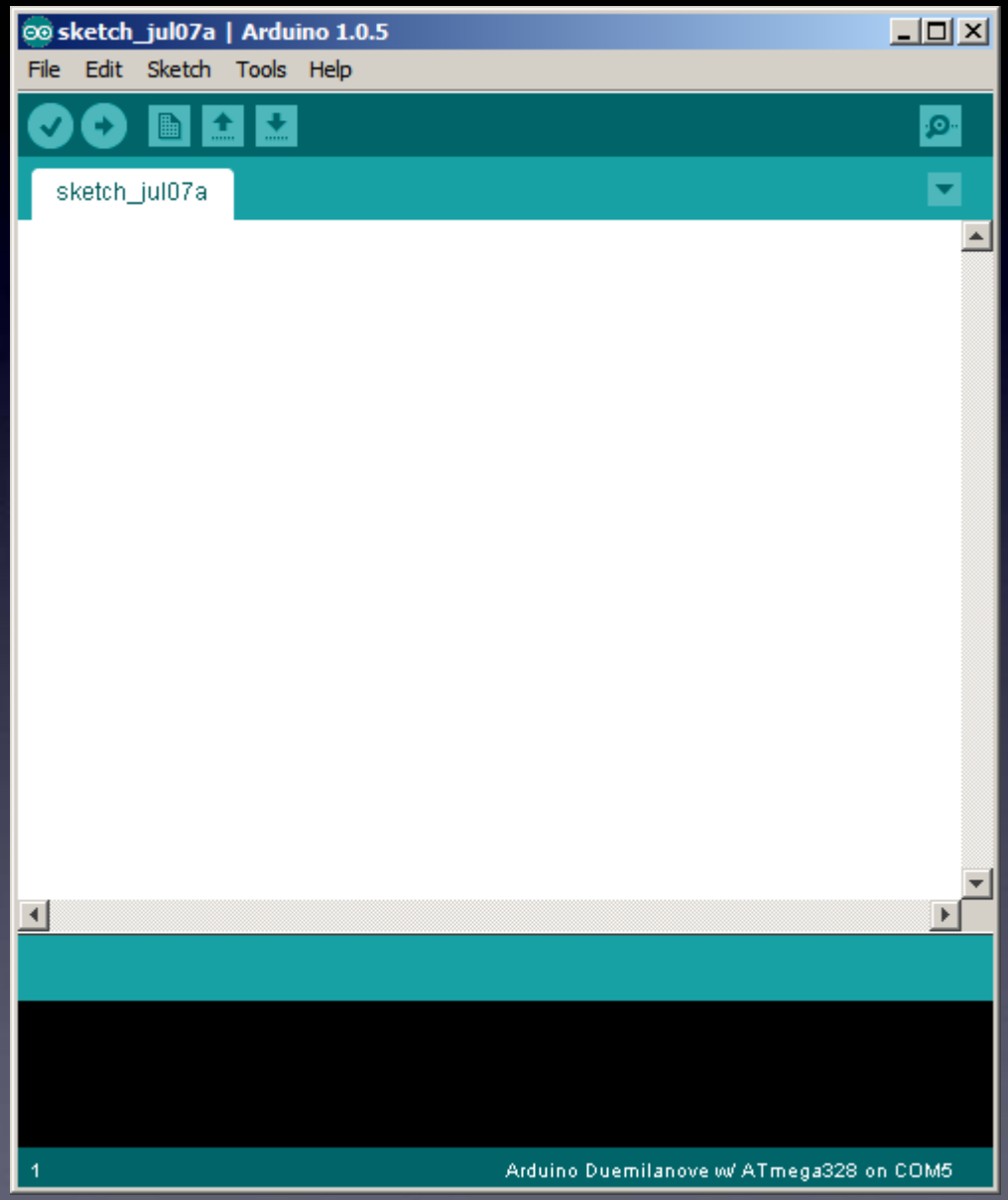
1S45


USB
RESET
U-Do-It-Duino
Uno clone
6-12V
U1
IOREF
RESET
3V3
5V GND VIN
ANALOG IN

How to Set Up and Use the Arduino Software



How to Hack Arduino Programs (“Sketches”)

Blink | Arduino 1.0.5

File Edit Sketch Tools Help

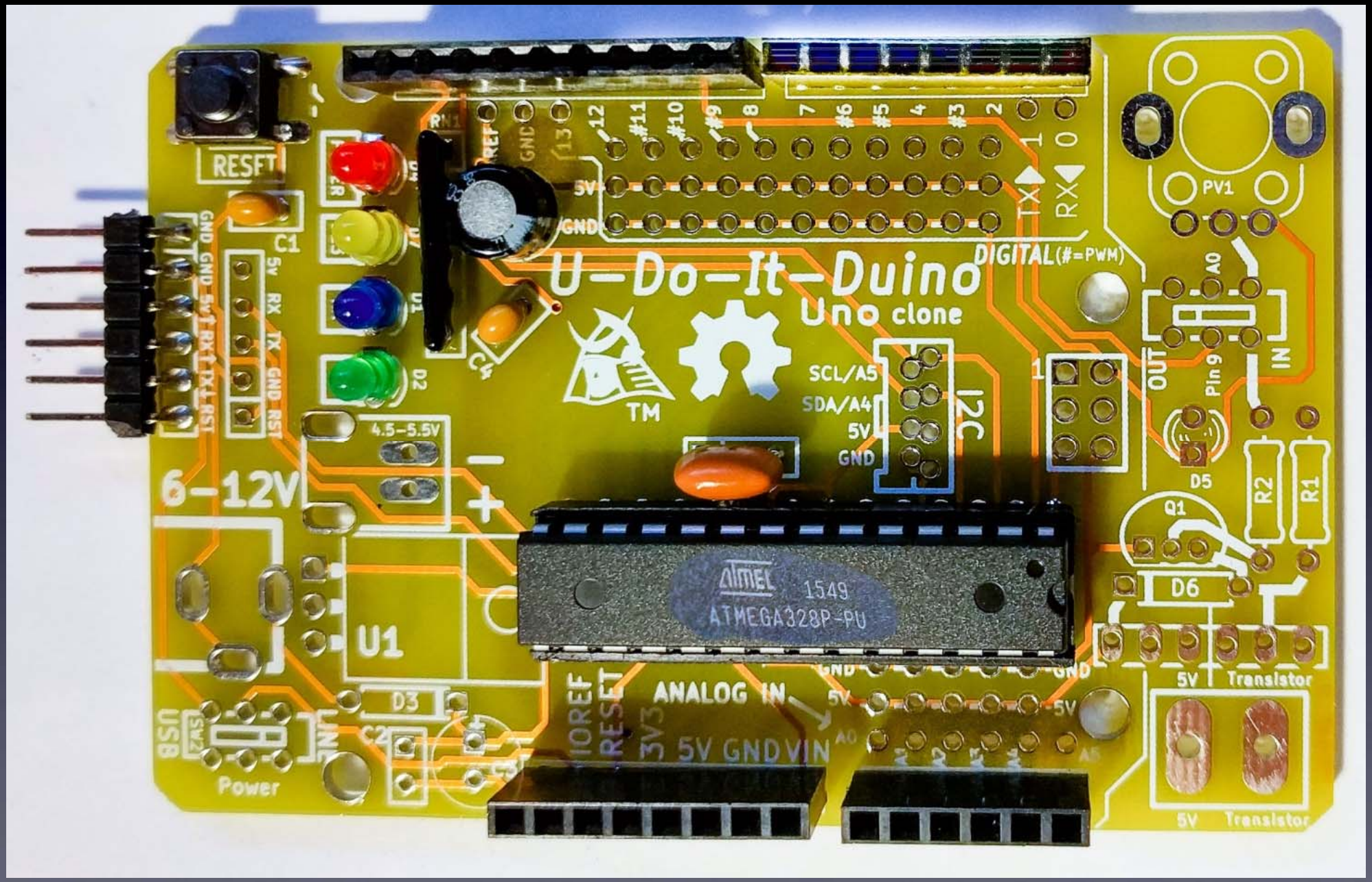
Verify

Blink

```
/*
  Blink
  Turns on an LED on for one second, then off for one second, repeatedly.

  This example code is in the public domain.
 */

// Pin 13 has an LED connected on most Arduino boards.
// give it a name:
int led = 13;

// the setup routine runs once when you press reset:
void setup() {
  // initialize the digital pin as an output.
  pinMode(led, OUTPUT);
}

// the loop routine runs over and over again forever:
void loop() {
  digitalWrite(led, HIGH);   // turn the LED on (HIGH is the voltage level)
  delay(1000);               // wait for a second
  digitalWrite(led, LOW);    // turn the LED off by making the voltage LOW
  delay(1000);               // wait for a second
}
```

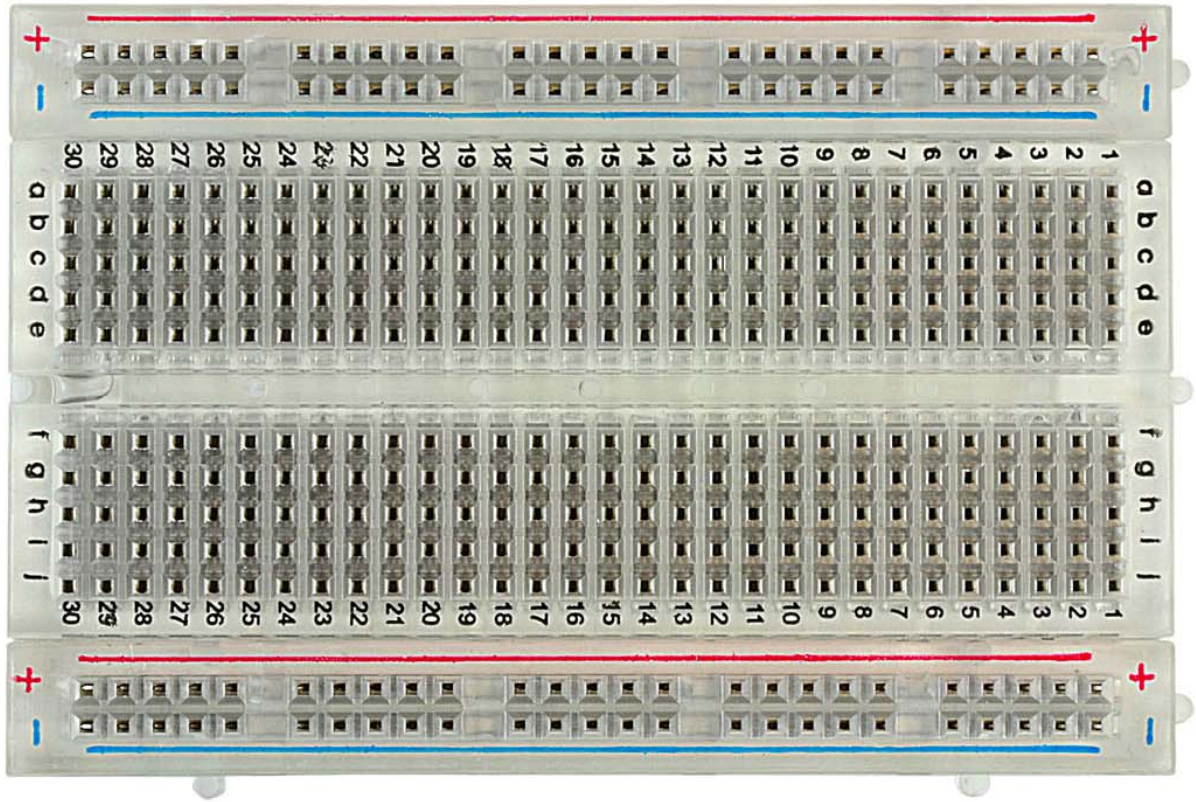
1 Arduino Duemilanove w/ ATmega328 on COM5

How to Hack Arduino Programs (“Sketches”)



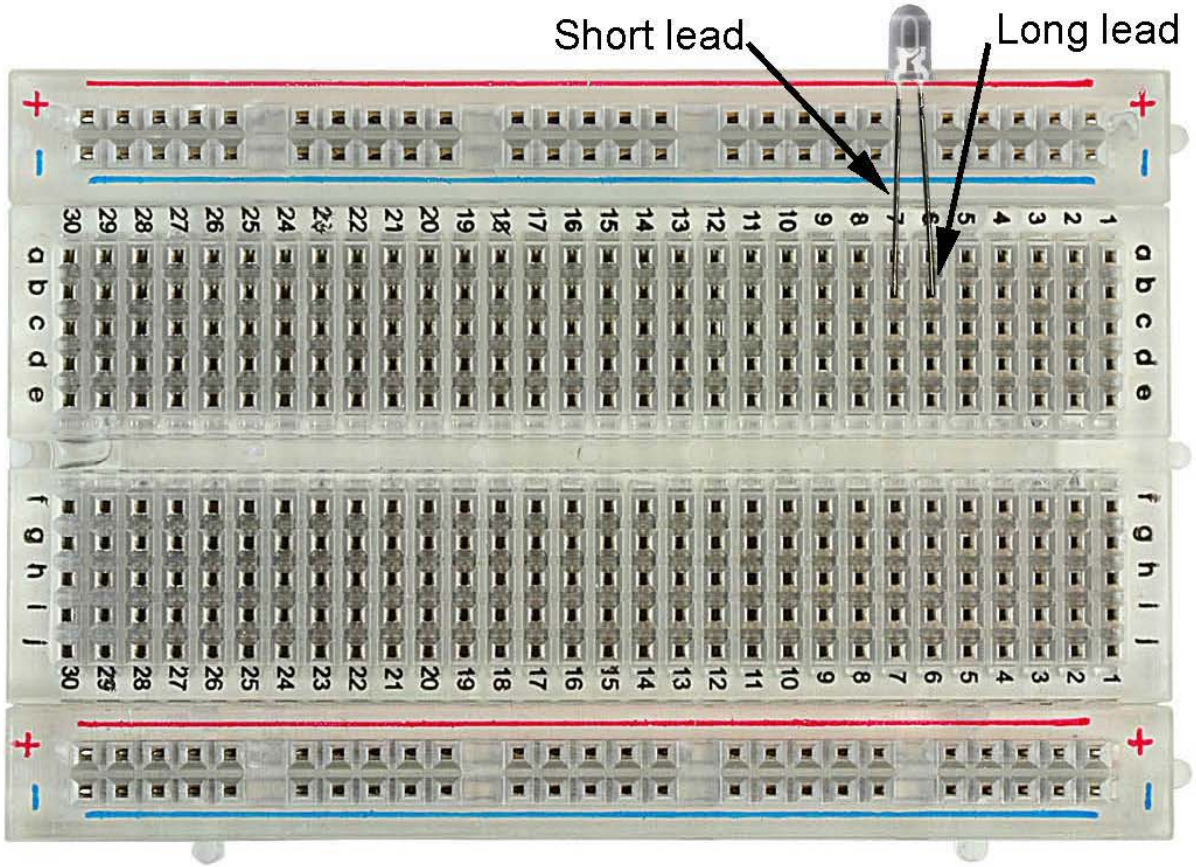
How to Use Solderless Breadboards

Solderless Breadboard



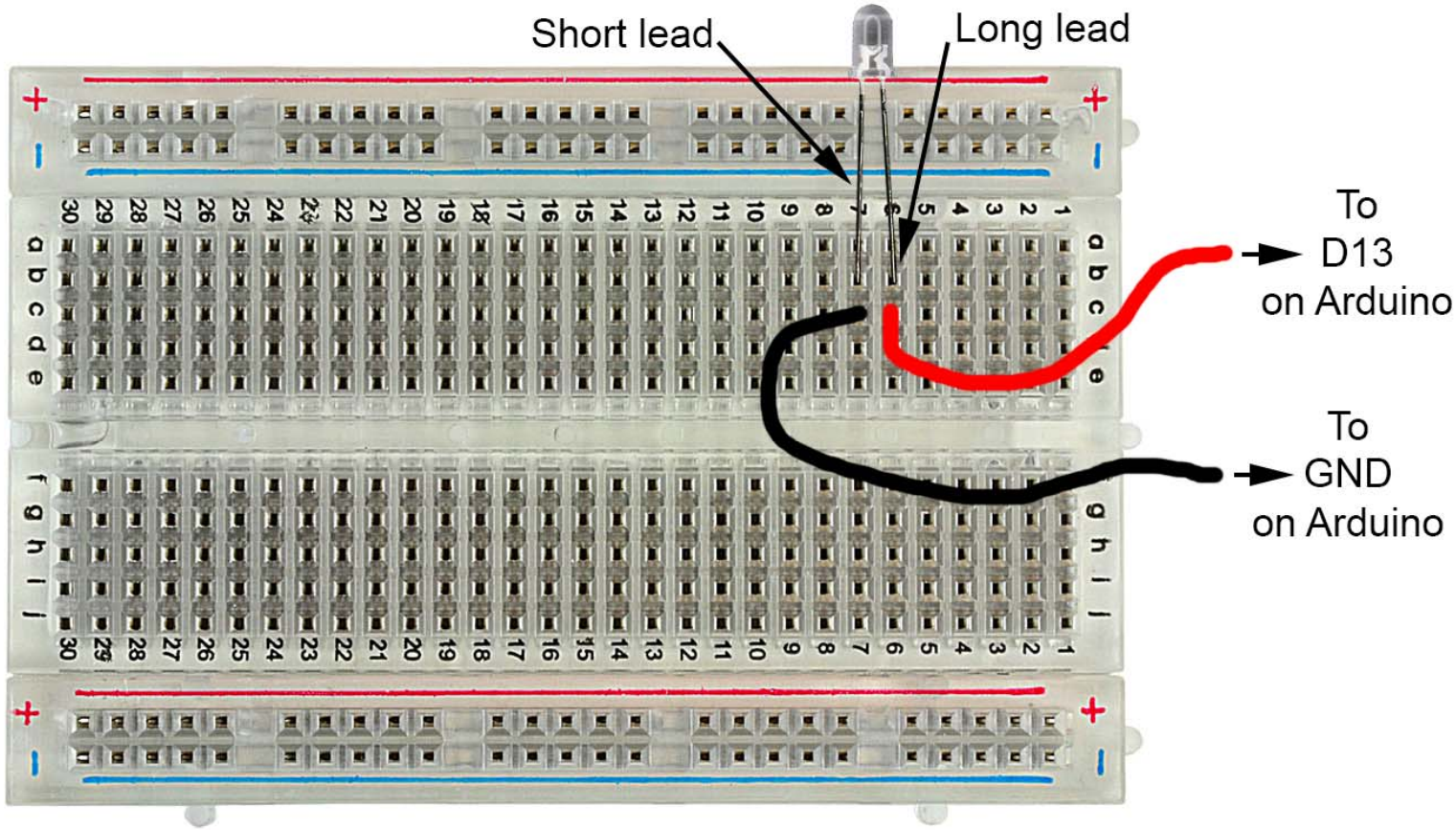
How to Use Solderless Breadboards

Solderless Breadboad with LED



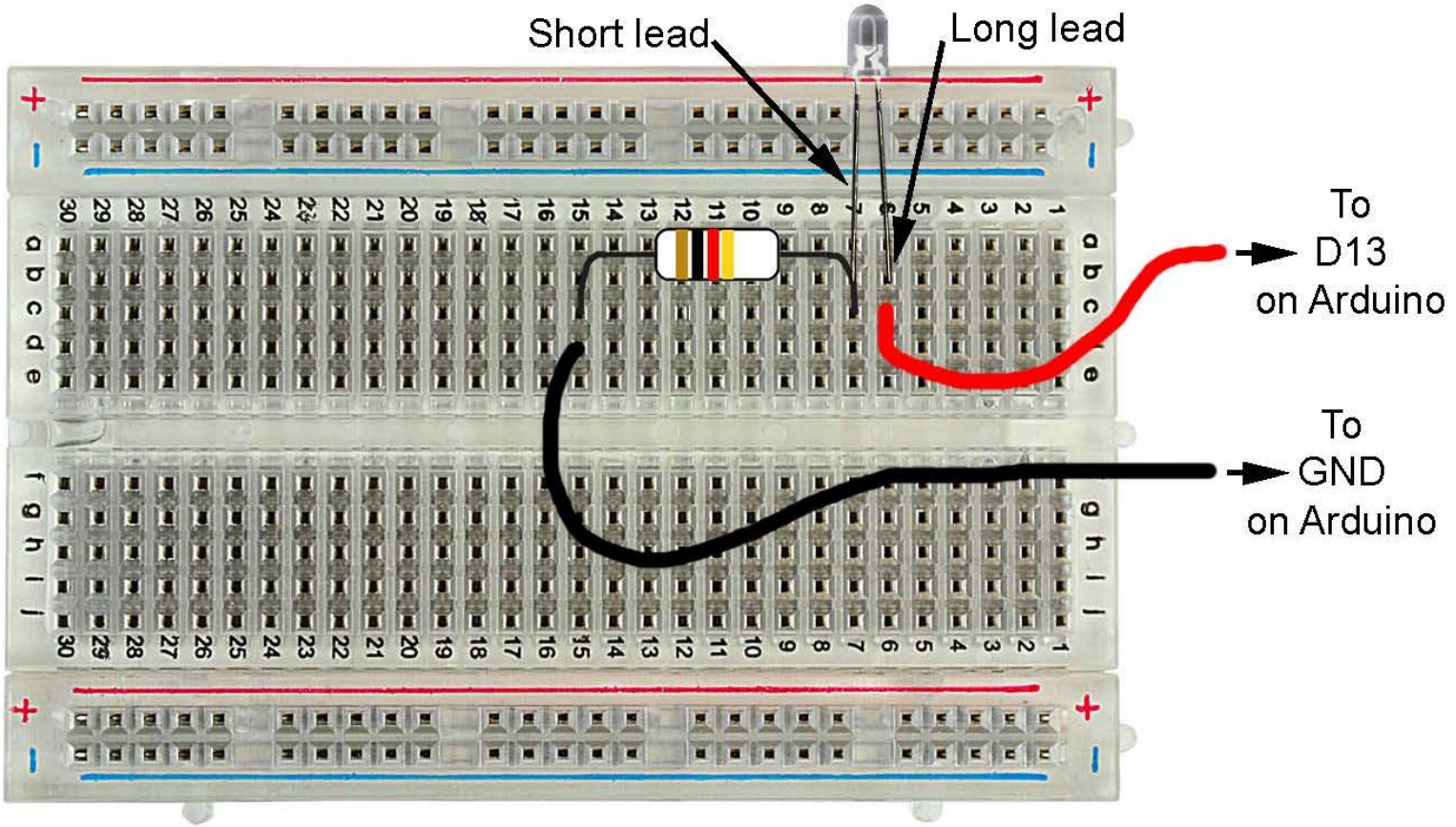
How to Use Solderless Breadboards

Solderless Breadboad with LED and wires

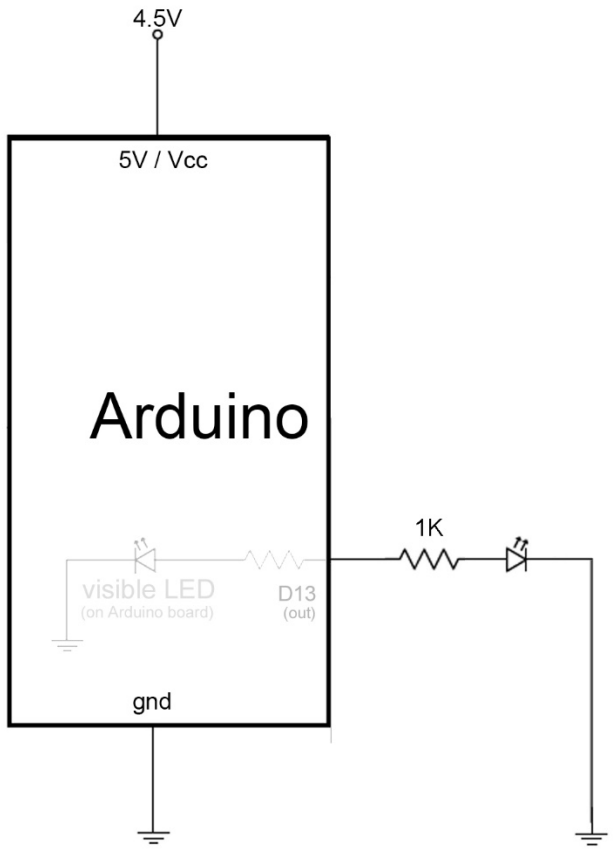


How to Use Solderless Breadboards

Solderless Breadboad with LED and Resistor and wires

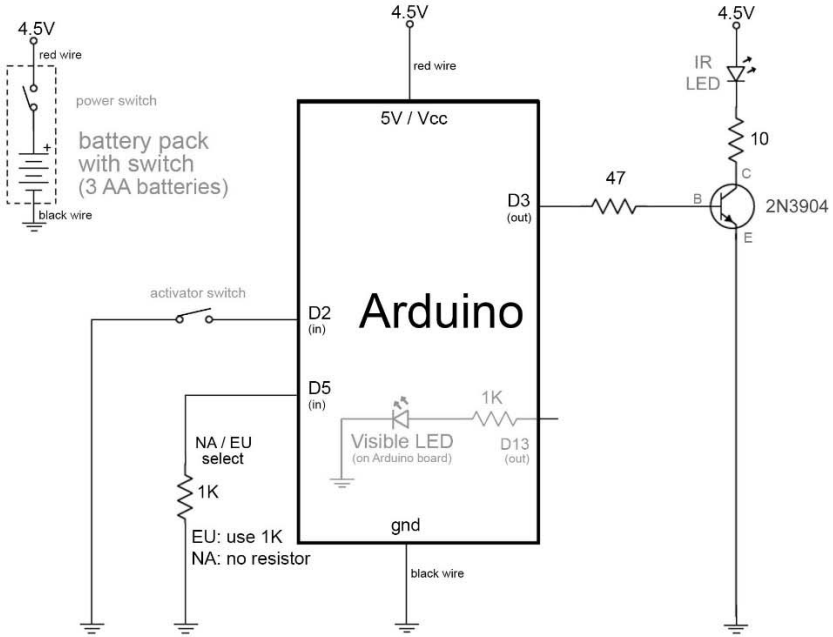
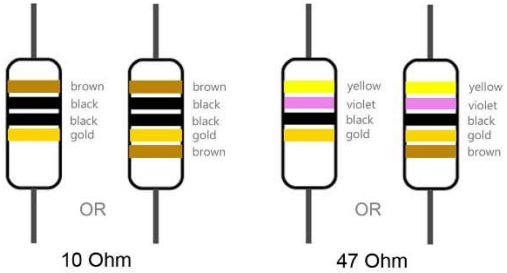
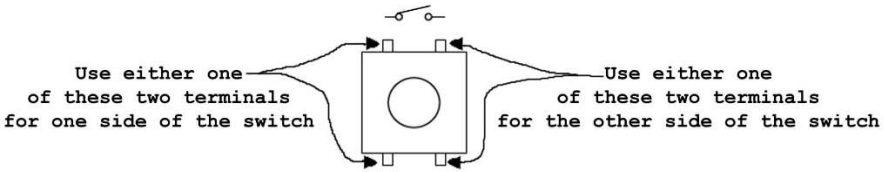


How to Read a Schematic



How to Read a Schematic

4-Sep-2015

Arduino For Total Newbies

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)