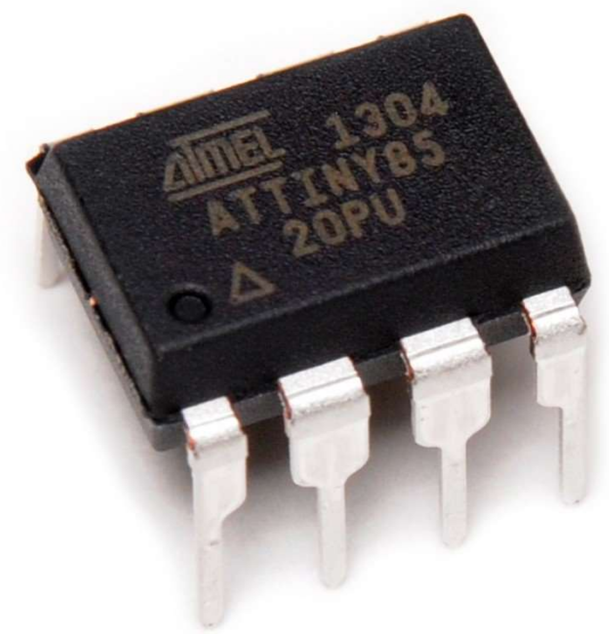
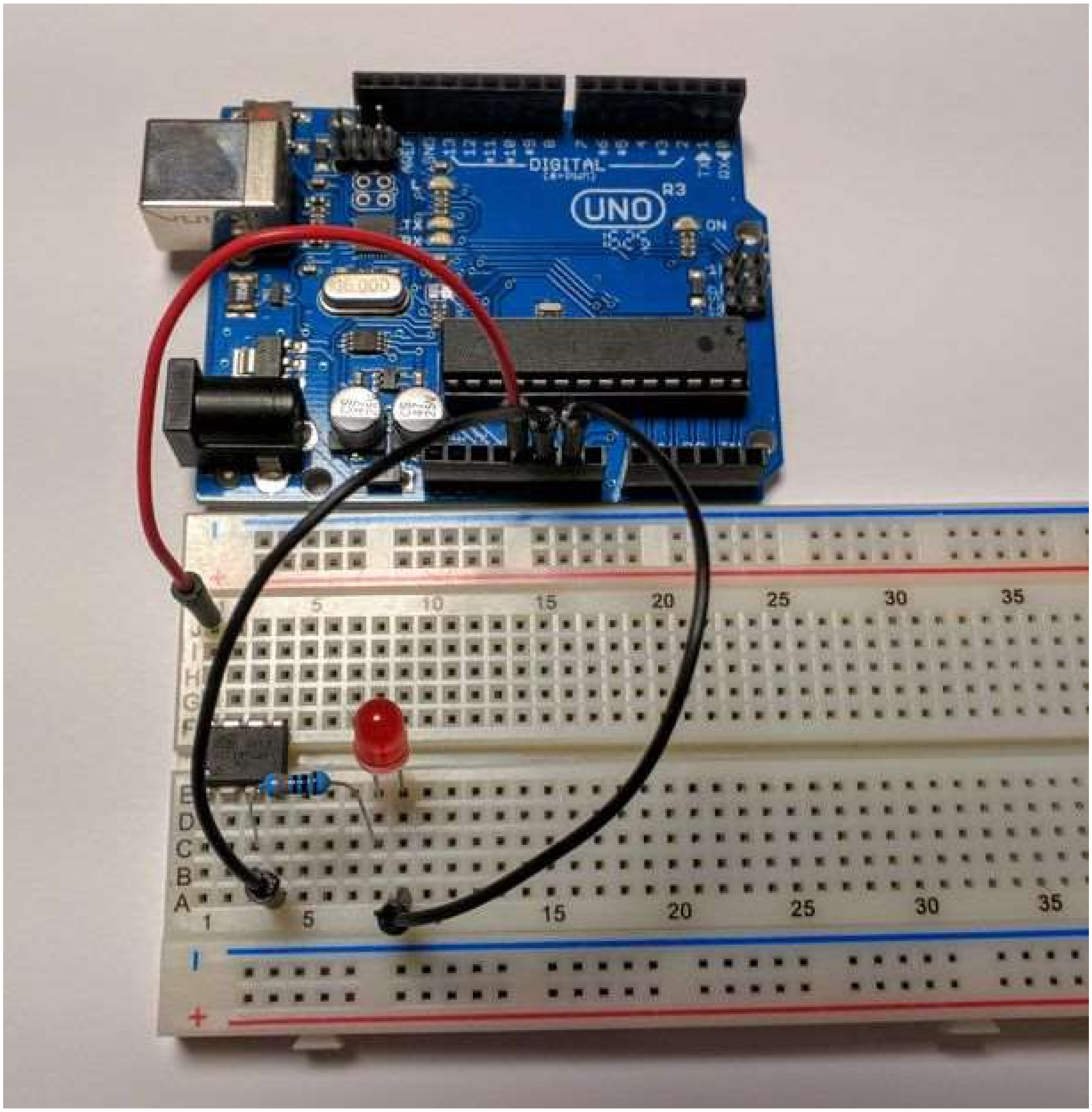
How To Program ATtiny13/ATtiny13a using Arduino IDE

Introduction

Despite ATtiny series is considered extremely cheap and useful, still there is a lack of projects and tutorials about it. In this tutorial, you will learn how to start building applications using ATtiny13 microcontroller programmed using Arduino IDE.



First of all, ATtiny13 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATtiny13 achieves throughput approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed. After the acquisition of Atmel by Microchip, the new ATtiny13 is still in production.



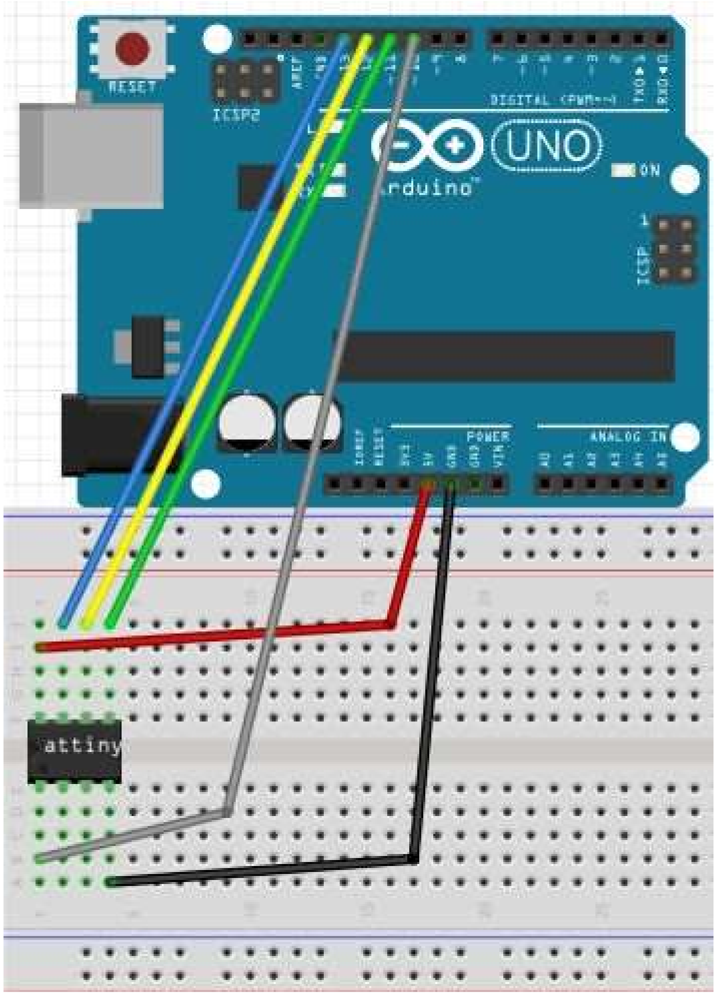
Source: NotoriousRapper2Chainz – Instructables

Parts you will need

- Arduino (Uno or any other Arduino)
- ATtiny13 or 13a
- Breadboard
- Jumper Wires

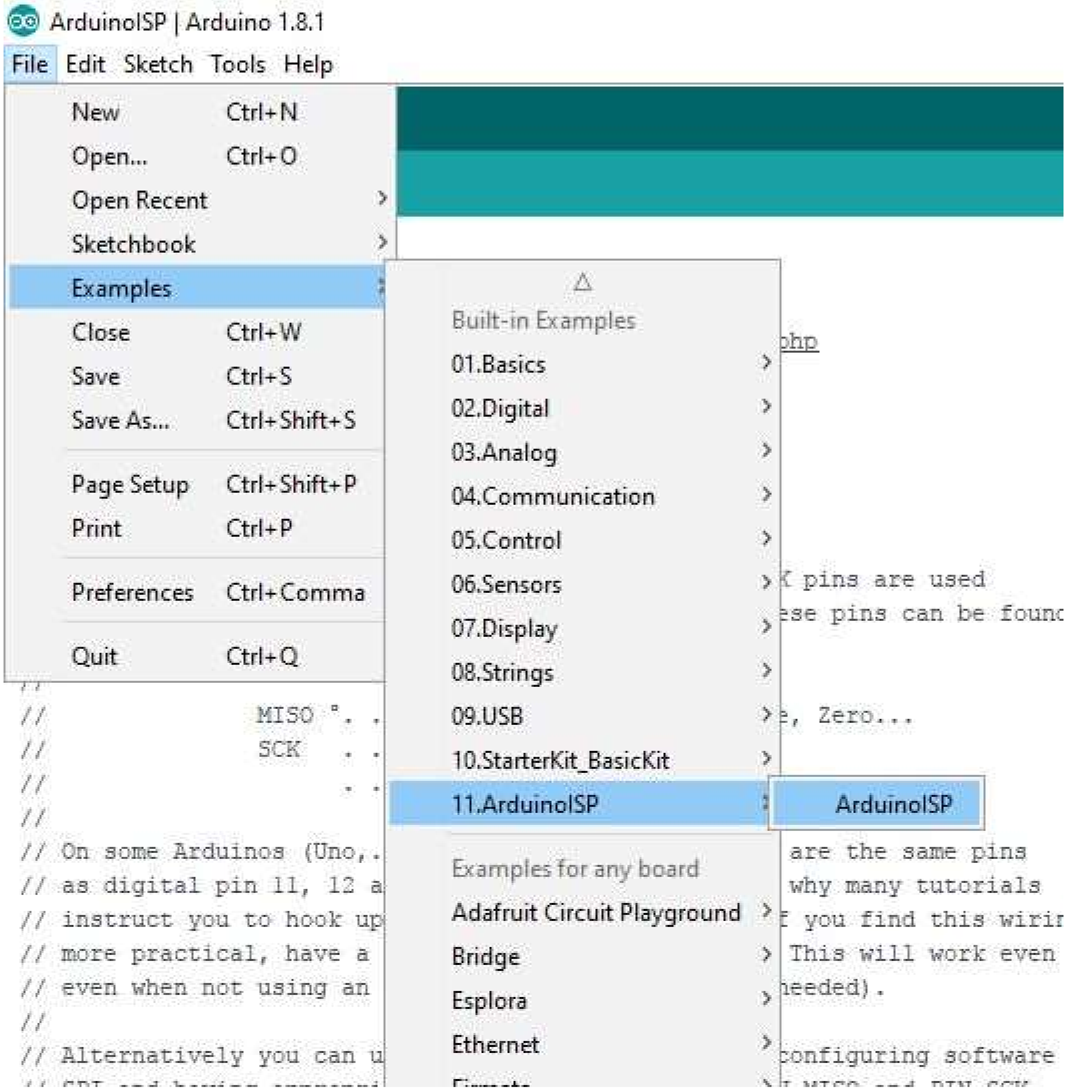
The Circuit

In order to connect the hardware you should first orient the ATtiny as shown in the image. First, connect Arduino 5V to ATtiny Pin 8. Respectively, connect GND to Pin 4, Pin 13 to Pin 7, Pin 12 to Pin 6, Pin 11 to Pin 5, and finally Pin 10 to Pin 1.



Programming the ATtiny13

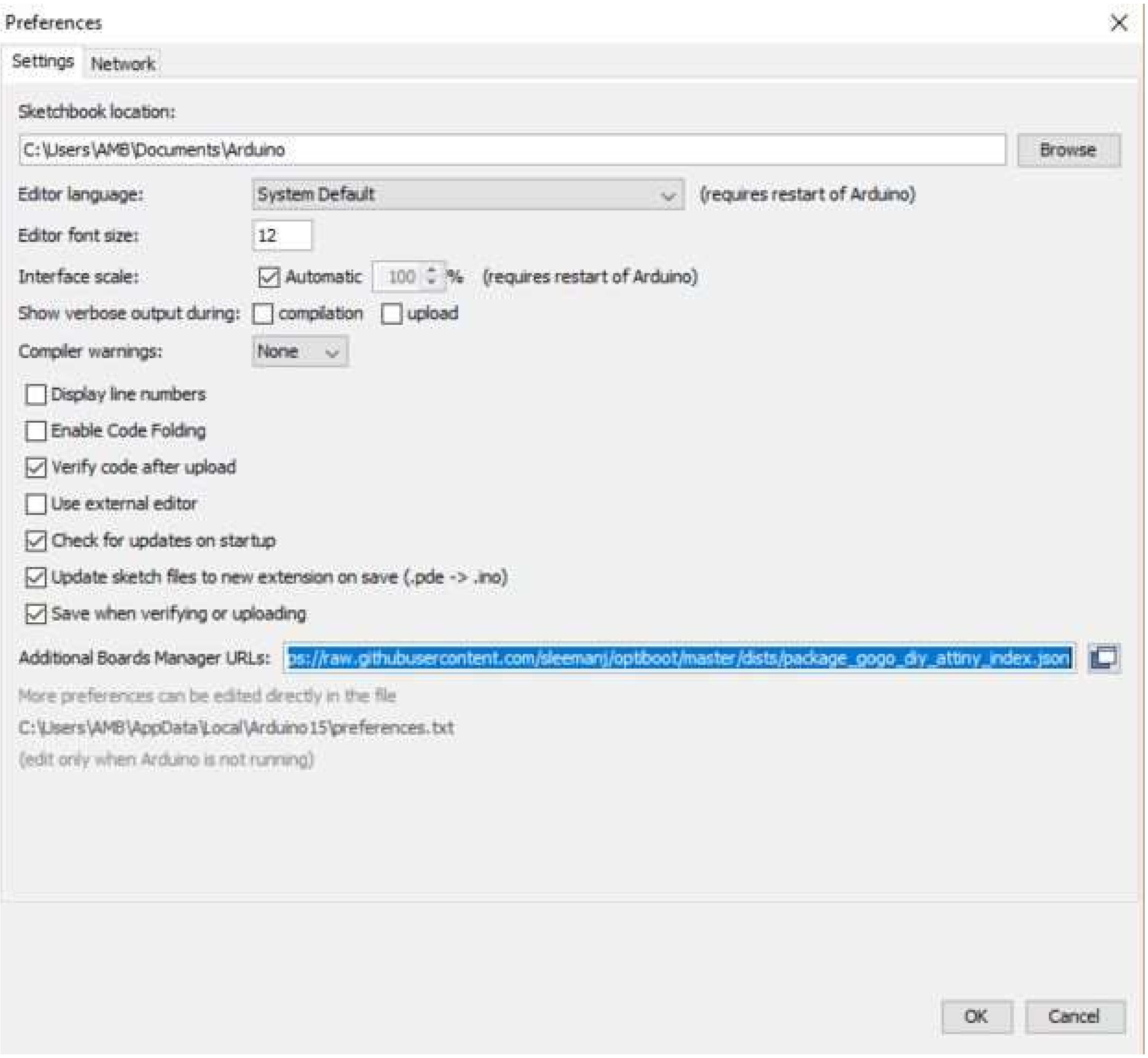
To program ATtiny13 we should set our Arduino as a programmer. This could happen by uploading ArduinoISP sketch to Arduino following this path (Files -> Examples -> ArduinoISP) in the IDE.



```
php
X pins are used
ese pins can be founc
//                MISO °. .
//                SCK   . .  e, Zero...
//                      . .
//
// On some Arduinos (Uno,.    are the same pins
// as digital pin 11, 12 a    why many tutorials
// instruct you to hook up    f you find this wirir
// more practical, have a     This will work even
// even when not using an     needed).
//
// Alternatively you can u    configuring software
```

Now our Arduino is ready to program ATtiny 13, but still we have to set up the ATtiny by installing its core files. In this tutorial, files by sleepmanj are preferred.

To install these files, open your Arduino IDE and navigate to the files drop-down menu, then select preferences. Paste this URL "https://raw.githubusercontent.com/sleemanj/optiboot/master/dists/package_gogo_diy_attiny_index.json" where it says "Additional Boards Manager URLs:". If you already have a URL here and want to add more, separate the URLs with a comma and a space.



Preferences

Settings | Network

Sketchbook location:
C:\Users\AMB\Documents\Arduino
Browse

Editor language: System Default (requires restart of Arduino)
Editor font size: 12
Interface scale: ☑ Automatic 100 % (requires restart of Arduino)
Show verbose output during: □ compilation □ upload
Compiler warnings: None

□ Display line numbers
□ Enable Code Folding
☑ Verify code after upload
□ Use external editor
☑ Check for updates on startup
☑ Update sketch files to new extension on save (.pde -> .ino)
☑ Save when verifying or uploading

Additional Boards Manager URLs: ps://raw.githubusercontent.com/sleemanj/optiboot/master/dists/package_gogo_diy_attiny_index.json

More preferences can be edited directly in the file
C:\Users\AMB\AppData\Local\Arduino15\preferences.txt
(edit only when Arduino is not running)

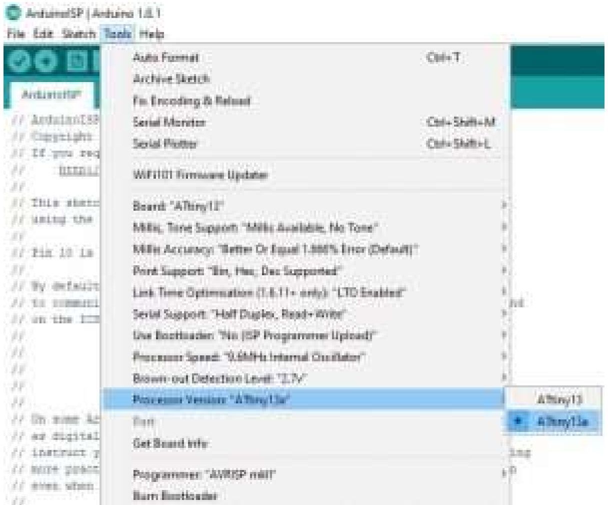
OK Cancel

Now, navigate to tools-board and click on Boards Manager…. Now scroll down until you see DIY ATtiny and click the install button.

Burning the Bootloader to the Attiny

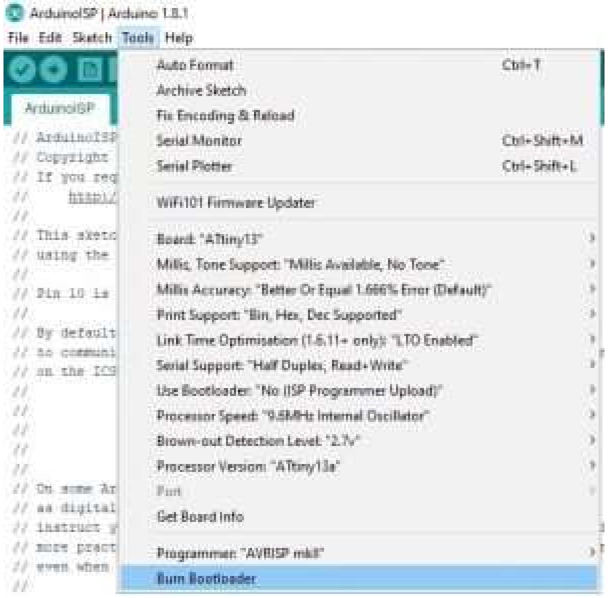
In fact, the bootloader is a piece of firmware in your microcontroller that allows installing new firmware via serial communication. In order to start programming ATtiny 13, we must burn Bootloader to it. There are two steps to achieve this: first, go to Tools-Board and select ATtiny13, and second, click the Burn Bootloader button at the bottom of the tools drop-down menu.

You should pay attention to your ATtiny version, navigate to Tools-Processor Version and select either ATtiny13 or ATtiny13a depending on your chip.



Auto Format Ctrl+T
Archive Sketch
Fix Encoding & Reload
Serial Monitor Ctrl+Shift+M
Serial Plotter Ctrl+Shift+L
WiFi101 Firmware Updater
Board: "ATtiny13"
Millis, Tone Support: "Millis Available, No Tone"
Millis Accuracy: "Better Or Equal 1.666% Error (Default)"
Print Support: "Bin, Hex, Dec Supported"
Link Time Optimisation (1.6.11+ only): "LTO Enabled"
Serial Support: "Half Duplex, Read+Write"
Use Bootloader: "No (ISP Programmer Upload)"
Processor Speed: "9.6MHz Internal Oscillator"
Brown-out Detection Level: "2.7v"
Processor Version: "ATtiny13a"
Port
Get Board Info
Programmer: "AVRISP mkII"
Burn Bootloader

ATtiny13
● ATtiny13a



Auto Format Ctrl+T
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Board: "ATtiny13"
Millis, Tone Support: "Millis Available, No Tone"
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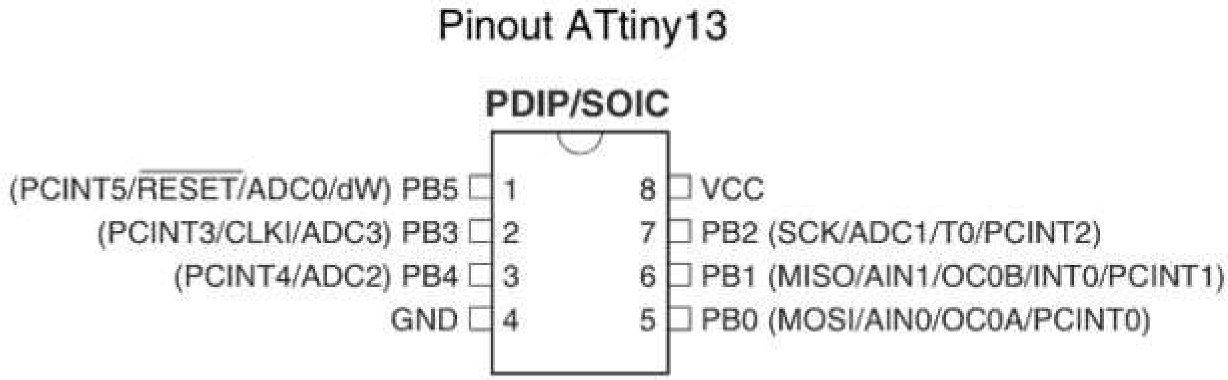
Processor Speed: "9.6MHz Internal Oscillator"
Brown-out Detection Level: "2.7v"
Processor Version: "ATtiny13a"
Port
Get Board Info
Programmer: "AVRISP mkII"
Burn Bootloader

After burning the Bootloader, our ATtiny is now ready to be programmed. You can try now Arduino IDE examples like the Blink sketch.

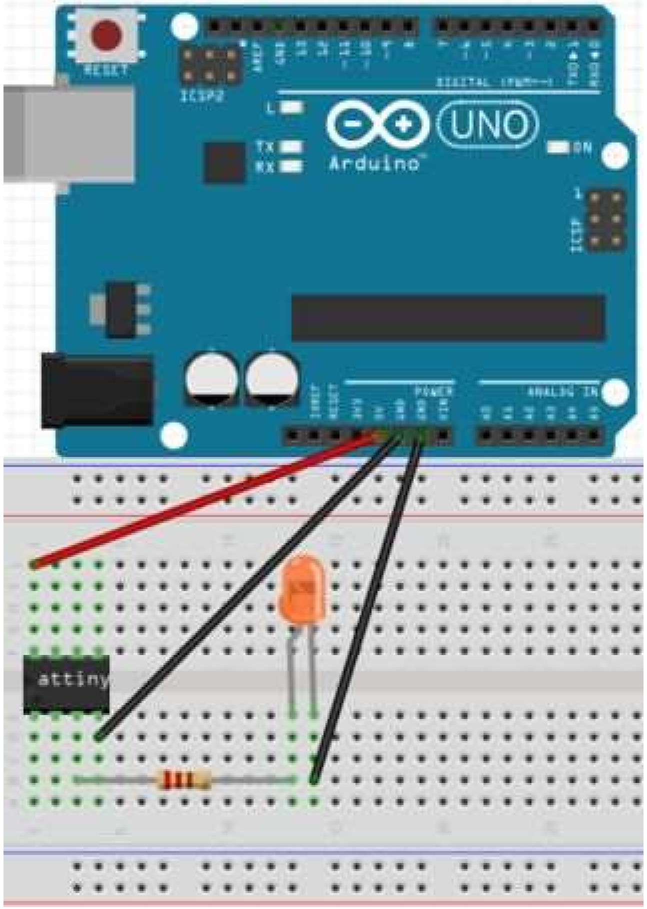
To make sure that Blink will work correctly, you should first check the diagram below.



Right here, Pin 3 is defined in hardware as PB4, now let’s take a look at the edited code:

```
//We will replace "LED_BUILTIN" with "4" since ATtiny does not have a built-in led!
void setup() {
// initialize digital Pin 3 of ATtiny 13(defined in hardware as 4) as an output.
pinMode(4, OUTPUT);
}
// the loop function runs over and over again forever
void loop() {
digitalWrite(4, HIGH); // turn the LED on (HIGH is the voltage level)
delay(1000); // wait for a second
digitalWrite(4, LOW); // turn the LED off by making the voltage LOW
delay(1000); // wait for a second
}
```

Next, modify your circuit by adding an LED between Pin 3 and GND with a suitable resistor as shown in the picture.



Troubleshooting

If you faced any issues while building this project, you can check this list to troubleshoot your project:

- Double check all of your connections and your orientation of the ATtiny and LED.
- Re-upload the ArduinoISP sketch to your Arduino.
- Connect a 10uf electrolytic capacitor between ground and reset on your Arduino. Make sure to plug in the capacitor in the correct orientation, negative goes to ground.
- Connect any large capacitor between the 5v and ground on the breadboard, this will help smooth out any voltage spikes.
- Make sure enough power is getting to the Arduino that is programming the ATtiny, a 9 volt battery might not work.
- Switch out your Arduino with a different Arduino
- Make sure you’re using an up to date IDE and up to date core files
- Click on tools and make sure the drop down menu looks the same as the menu shown in the Burn the Bootloader” step. If something is different, change it and re-burn the bootloader.

You also may need these components while trying to figure out what’s wrong: 10uf electrolytic capacitor a large electrolytic capacitor (>100uF)

You are now all set, it is time to test new ideas and applications with ATtiny programmed using Arduino IDE!

References

- This tutorial is inspired by NotoriousRapper2Chainz on Instructables, you can see more details on the original article by checking this link.

Downloads