

SALES INQUIRIES: 1 (888) 767-9864



FREE RESOURCES
([HTTPS://PROGRAMMINGELECTRONICS.COM/ARDUINO-TUTORIALS-2/](https://programmingelectronics.com/arduino-tutorials-2/))

KIT-ON-A-SHIELD
([HTTPS://PROGRAMMINGELECTRONICS.COM/KIT-SHIELD-ARDUINO-INFO/](https://programmingelectronics.com/kit-shield-arduino-info/))

PREMIUM COURSES
([HTTPS://PROGRAMMINGELECTRONICS.COM/ARDUINO-CRASH-COURSE/](https://programmingelectronics.com/arduino-crash-course/))

GET ACCESS
([/PRICING/](#)) /
MEMBER LOGIN
([HTTPS://ACADEMY.PROGRAMMINGELECTRONICS.COM](https://academy.programmingelectronics.com))

USE TONE() WITH ARDUINO FOR AN EASY WAY TO MAKE NOISE

Do you need to make some noise with Arduino? Maybe a simple tone for an alarm, maybe a beep to alert you when a specific input threshold is met, or maybe to play the Super Mario Brothers soundtrack to entertain your juvenile mind (it's OK, we are all there, too).

Whatever your audible need, you will likely find the *easiest, quickest and possibly the cheapest way* to make some noise is using the tone() function and piezo speaker with your Arduino (<https://programmingelectronics.com/what-is-arduino/>).

THIS IS EXACTLY WHAT YOU WILL LEARN IN THIS LESSON:



- 1. Quick intro to piezo speakers (aka piezo buzzers)
- 2. How to set up a simple piezo speaker circuit
- 3. The basics and more of using the tone() function
- 4. The limits you should know when using tone()



(<https://www.sitelock.com>)

An easy way to make noise with Arduino using tone()



YOU CAN LEARN THIS ARDUINO STUFF. WE CAN HELP.

GET ACCESS TO OUR PRIVATE TRAINING SITE.

YOU'LL LEARN TO PROGRAM ARDUINO W/O
SEARCHING THE WEB FOR ~~HOURS~~ DAYS.

FIRST NAME

EMAIL

GET ACCESS

YOU WILL RECEIVE EMAIL CORRESPONDENCE ABOUT ARDUINO PROGRAMMING, ELECTRONICS,
AND SPECIAL OFFERS. BY SUBMITTING THIS FORM YOU AGREE TO THE PRIVACY POLICY
([HTTPS://PROGRAMMINGELECTRONICS.TYPEFORM.COM/TO/DGV6JG](https://programmingelectronics.typeform.com/to/DGV6JG)), AND CAN OPT-OUT

ANYTIME.

HARDWARE YOU WILL NEED:

- Arduino board, I am using an Arduino Uno [1]
- Solderless breadboard [1]
- Jumper wire [2]
- 100 ohm resistor [1]



zo speaker (aka piezo buzzer) [1]

east 1/2 cm dental floss, with a thick wax coating (mint flavored works best) [1]

Gene in Providence just signed
up for the Arduino Crash Course



(<https://www.sitelock.com>)

A QUICK INTRO TO PIEZO SPEAKERS (AKA PIEZO BUZZERS)

Ahh, noise....

Birds make it, kids make it – it can be music to our ears or pure torture.

We are going to use a piezo buzzer to make some noise with Arduino.

A piezo buzzer is pretty sweet. It's not like a regular speaker that you might think of. It uses a material that's *piezoelectric*, it actually changes shape when you apply electricity to it. By adhering a piezo-electric disc to a thin metal plate, and then applying electricity, we can bend the metal back and forth, which in turn creates noise.

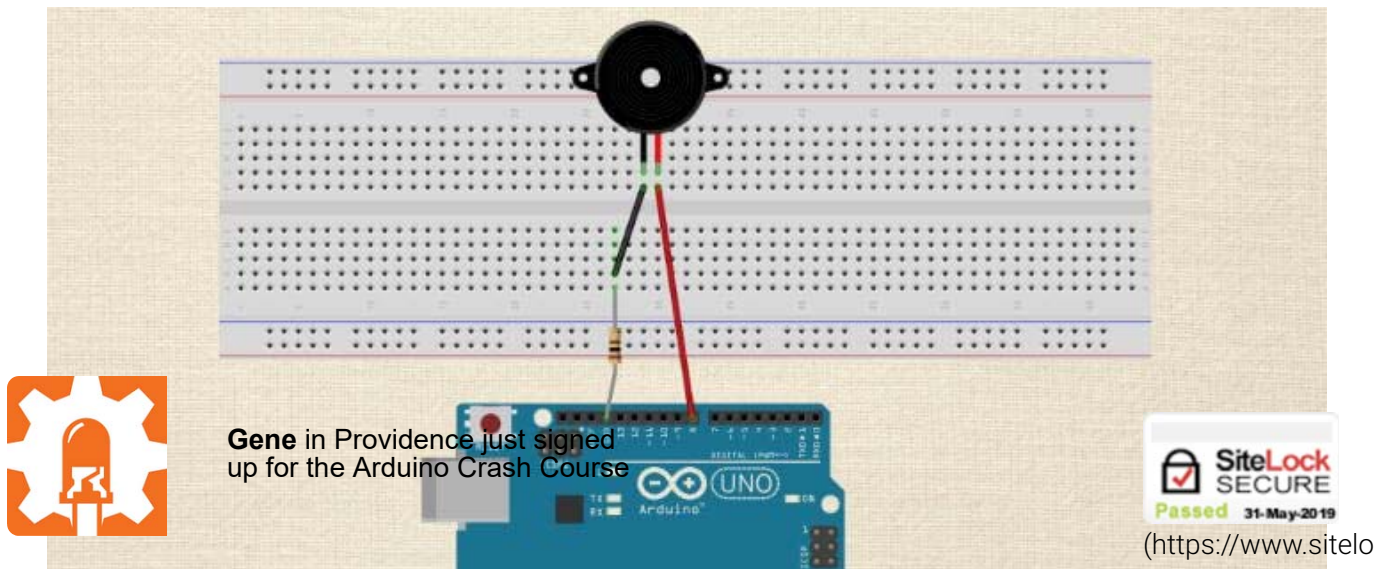
The faster you bend the material, the higher the pitch of the noise that's produced. This rate is called frequency. Again, *the higher the frequency, the higher the pitch of the noise we hear*.

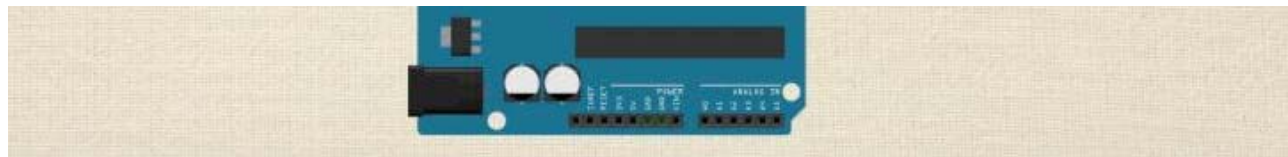
So basically, by shocking the plate over and over really fast, we can make noise. I don't know who comes up with this stuff, but they're friggin' mean.

Now, let's set up this circuit.

HOW TO SET UP A SIMPLE PIEZO SPEAKER CIRCUIT USING ARDUINO

It's painfully easy to set up a simple piezo speaker circuit with an Arduino.





(<https://4c3q4z2euxqn29mk0e34ayce-wpengine.netdna-ssl.com/wp-content/uploads/2015/07/Piezo-Circuit-2.jpg>)

1. Place the piezo buzzer into the breadboard, so that the two leads are on two separate rows.
2. Using jumper wires, connect the positive lead to Arduino digital pin 8. The case of the buzzer may have a positive sign (+) on it to indicate the positive lead (if not, then the red wire usually indicates the positive lead).
3. Connect the other lead to the 100 ohm resistor, and then to ground.

That's it.

Let's go ahead and jump into the Arduino sketch (<https://programmingelectronics.com/arduino-ide-sketch-overview/>).

THE BASICS AND MORE OF USING THE TONE() FUNCTION

The tone() function works with two arguments, but can take up to three arguments. Let's address the two required items first:

```
tone( pin number, frequency in hertz);
```

1. The pin number that you will use on the Arduino.
2. The frequency specified in hertz. Hertz are cycles per second.

The frequency is an unsigned integer and can take a value up to 65,535 – but if you are trying to make tones for the human ear, then values between 2,000 and 5,000 are where our ears are most tuned.

Here is a simple sketch demonstrating the tone() function:



Gene in Providence just signed up for the Arduino Crash Course



(<https://www.sitelock.com>)

```
//A sketch to demonstrate the tone() function

//Specify digital pin on the Arduino that the positive lead of piezo
int piezoPin = 8;

void setup() {
  //close setup
}

void loop() {
```

As an experiment, try changing the second argument in tone() to 100, 1000, 10000, 650000 and listen to the effect it has on the audio signal.

You will notice that the higher the number, the higher the pitch that is created.

HOW TO SEPARATE THE NOISE – AKA MAKE A BEAT

What if we want to add some space between the noise, so we can get a beat?

We can try adding a delay(1000) after the tone(), but if you test this out, you will find it doesn't get you anywhere.

This is because the tone() function uses one of the built in timers on the Arduino's micro-controller. **tone() works independently of the delay() function.** You can start a tone and do other stuff – while the tone is playing in the background.



to that question, *how can we separate the noise a little?*
Gene in Providence just signed up for the Arduino Crash Course

about that third parameter we can pass to the tone() function – it is the duration of the tone.
(<https://www.sitelock.com>)



milliseconds.

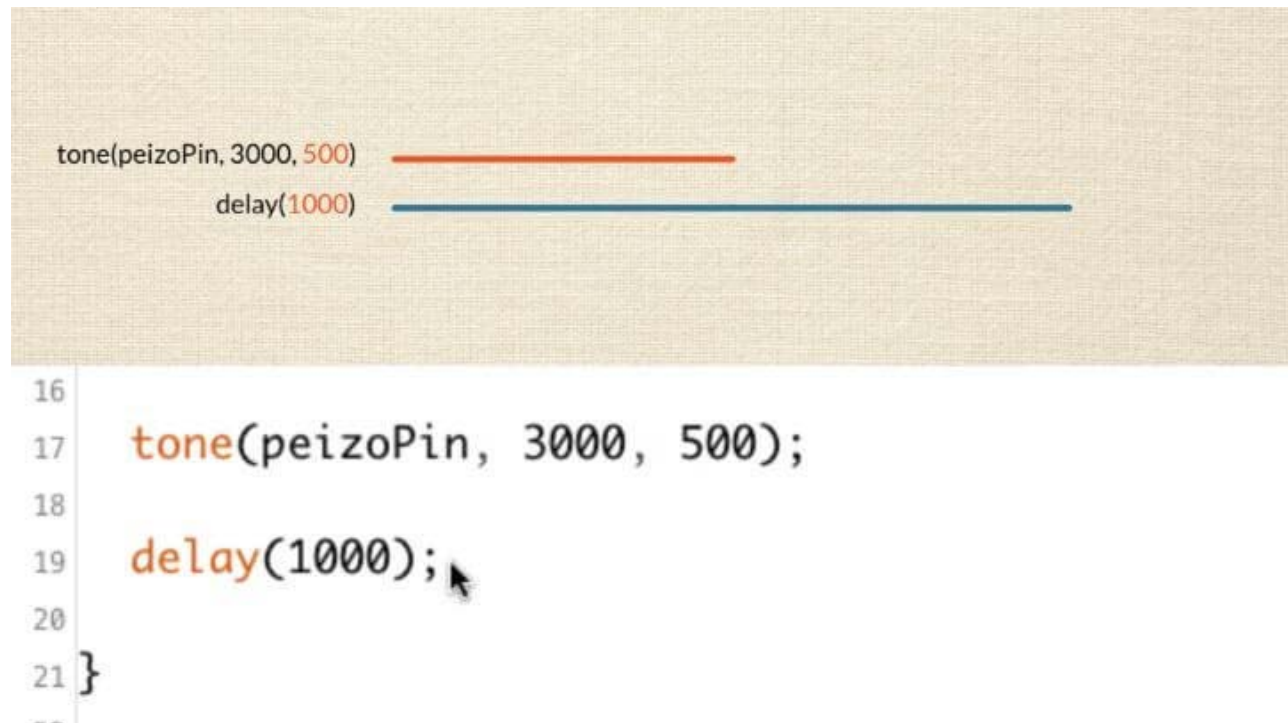
```
tone( pin number, frequency in hertz, duration in milliseconds);
```

If you want to generate distinct beats, and you want to do this with the delay() function, then you need to keep in mind what we just said, that the tone() function uses one of the built in timers on the Arduino board.

Therefore, if you use 500 milliseconds as the third argument in tone(), and follow that by a delay of 1000 milliseconds, you will only be creating a “quiet time” of 500 milliseconds.

```
//This code only generates a delay of 500 milliseconds between the  
  
tone( 8, 2000, 500);  
  
delay(1000);
```

Instead of the time being added together – as in 500 millisecond of noise, and then 1000 milliseconds of delay – the delay and the tone start at about the exact same time, so we get 500 millisecond of tone separated by 500 milliseconds of quiet.



(<https://4c3q4z2euxqn29mk0e34ayce-wpengine.netdna-ssl.com/wp-content/uploads/2015/07/timing.jpg>)



quirky to wrap your mind around, but if you play around with it a little, you'll pick u
s. **Gene in Providence just signed up for the Arduino Crash Course**



(<https://www.sitelock.com>)

THE LIMITS YOU SHOULD KNOW WHEN USING TONE()

Like everything else in the world, the `tone()` function has some limitations of which you should be aware. Let's touch on them here:

1. You can't use `tone()` while also using `analogWrite()` (<https://programmingelectronics.com/fade-led-pulse-width-modulation-using-analogwrite/>) on pins 3 or 11. If you do – you get some whacky results – neither will work like you expect. That's because the `tone()` function uses the same built in timer that `analogWrite()` does for pins 3 and 11. It's worth trying just hear the weird noises.
2. You cannot generate a tone lower than 31 HZ. You can pass values 31 and less to the `tone()` function, but it doesn't mean you will get a good representation of it.
3. The `tone()` function cannot be used by two separate pins at the same time. Let's say you have two separate piezo speakers, each on a different pin. You can't have them both play at the same time. One has to be on, and then the other. Furthermore, before you can have the other pin use the `tone()` function, you must call the `noTone()` function and "turn off" the tone from the previous pin.

REVIEW THE LESSON

Here is a quick breakdown of what we just covered:

1. A piezo speaker use piezo-electric material to bend a metal diaphragm which makes noise.
2. The `tone()` function needs at least two arguments to operate (pin#, frequency in hertz), but can take a third argument, duration – which is in milliseconds.
3. The `tone()` function works independently of the `delay()` function. The duration of the `tone()` will be continuous if you don't use the third parameter.
4. The limitations of the `tone()` function include:
 1. Not being able to use PWM on pins 3 and 11 while you use `tone()`
 2. You can't go lower than 31 hertz.
 3. When using `tone()` on different pins, you have to turn off the tone on the current pin with `noTone()` before using `tone()` on a different pin.

I find it can facilitate learning to review what you cover after you learn about it. *The best teacher is practice though* – so get a piezo speaker and start making some mad jams with your Arduino! I would love to hear about them in the comments.

FURTHER READING:

1. `tone()` in the Arduino reference (<https://www.arduino.cc/en/Reference/Tone>)
- Sketch to play Super Mario Brothers sound track (<http://www.linuxcircle.com/2013/03/play-super-mario-brothers-sound-track-with-arduino-and-piezo-buzzer/>)

Gene in Providence with signed up for the Arduino Crash Course



(<https://www.sitelock.com>)

project up and running?
teaches the details of Arduino programming and
electronics and doesn't assume you have a PhD.

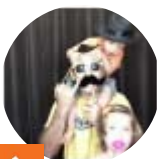
10 COMMENTS



Jammus on September 4, 2015 at 9:20 pm

Does tone() works simultaneously with an addressable LED strip? I couldn't make it work right.
When there is a LED, weird sounds is generated. Without LED, speaker works fine.

Reply



MICHAEL JAMES (<http://www.opensourcehardwaregroup.com/>) on



Gene in Providence just signed
up for the Arduino Crash Course



Hi Jammus, That is a good question and thanks for asking. Which pins were you using to

control the LED strip? I think you should be able to use analogWrite() (PWM) on pins other than 3 and 11 when using tone().

Reply



Jamil on July 30, 2016 at 4:03 pm

Wait, what do I do with the dental floss?

Reply



vincenzo on November 30, 2016 at 9:24 am

clean your teeth

Reply



Dimitar on May 13, 2017 at 3:34 am

first i want to thank you ,it works. But when i disconnect the buzzer from the bord and try to conect it to bateries . Its like i have done nothing. No sound.

Reply



Gene in Providence just signed up for the Arduino Crash Course



(<https://www.sitelo>)



MICHAEL JAMES (<http://www.opensourcehardwaregroup.com/>) on

May 26, 2017 at 6:12 am

Hi Dimitar, great question!

The Tone() function use Pulse Width Modulation to create that tone from the buzzer, which means the voltage goes up and down real fast at different cycles depending on the input you send to the tone() function.

<https://www.arduino.cc/en/reference/tone> (<https://www.arduino.cc/en/reference/tone>)

With just a battery, you don't get that modulation of voltage, which is why I am guessing you do not hear a buzz. Hope this helps some and thanks for asking!

Reply



Kathia Coronado on October 23, 2017 at 11:35 pm

This is great! I have one question can one code a motor to only activate to the specified frequency and duration in the tone function?

Reply



Baun Baum on January 15, 2018 at 10:02 am



Gene in Providence just signed up for the Arduino Crash Course



(<https://www.sitelock.com/>)

Reply



Rick H on February 8, 2018 at 11:03 am

what is the purpose for the 100 ohm resistor? is it to lower the volume or ??? I want this to play a tone very loud.

Reply

Arduino - Colegio Cristo Crucificado (<http://colegiovalverde.com/wp/?p=2238>) on March 8, 2018 at 6:48 am

[...] The proyect: <https://programmingelectronics.com/an-easy-way-to-make-noise-with-arduino-using-tone/> (<https://programmingelectronics.com/an-easy-way-to-make-noise-with-arduino-using-tone/>) [...]

Reply

LEAVE A COMMENT

Comment

Name (required)



I not ~~Be published~~ (required) signed up for the Arduino Crash Course



(<https://www.sitelock.com>)

Website

Submit Comment

PROUD SUPPORTERS OF



SUBSCRIBERS FROM



AS SEEN IN



Dr. Duino
Gene in Providence just signed up for the Arduino Crash Course



mjLorton.com



(<https://www.sitelock.com>)

FREE ARDUINO COURSE ([HTTPS://PROGRAMMINGELECTRONICS.COM/ARDUINO-CRASH-COURSE/](https://programmingelectronics.com/arduino-crash-course/))

ARDUINO SHIELD ([HTTPS://PROGRAMMINGELECTRONICS.COM/KIT-SHIELD-ARDUINO-INFO/](https://programmingelectronics.com/kit-shield-arduino-info/))

COURSES ([HTTPS://PROGRAMMINGELECTRONICS.COM/PRICING/](https://programmingelectronics.com/pricing/))

ABOUT ([HTTPS://PROGRAMMINGELECTRONICS.COM/ABOUT/](https://programmingelectronics.com/about/))

CONTACT ([HTTPS://PROGRAMMINGELECTRONICS.COM/CONTACT/](https://programmingelectronics.com/contact/))



(<https://www.youtube.com/c/Opensourcehardwaregroup>)



(<https://www.facebook.com/ProgrammingElectronicsAcademy/>)



(<https://twitter.com>

/ProgElecAcademy)

© 2019 OPEN HARDWARE DESIGN GROUP LLC | [PRIVACY POLICY \(/PRIVACY-POLICY\)](#)



BBB Rating: A+
as of 5/31/2019

(<https://www.bbb.org/cleveland/business-reviews>

[Click for Profile](#)

/training-program/programming-electronics-academy-in-ashtabula-oh-92021031/#sealclick)



Gene in Providence just signed up for the Arduino Crash Course



(<https://www.sitelock.com>