GinSing V1.2 Build Guide

tools

The GinSing hardware requires only a couple of tools and basic soldering skills. You will need to have a good working **soldering iron**, **solder**, and **side cutter** | needle nose **pliers** If you are just starting out we highly recommend this beginners toolkit.

Although not required, you can reduce potential errors through the use of a **digital multimeter**. Most inexpensive meters will allow you to measure resistance and capacitance of the components quickly and easily.

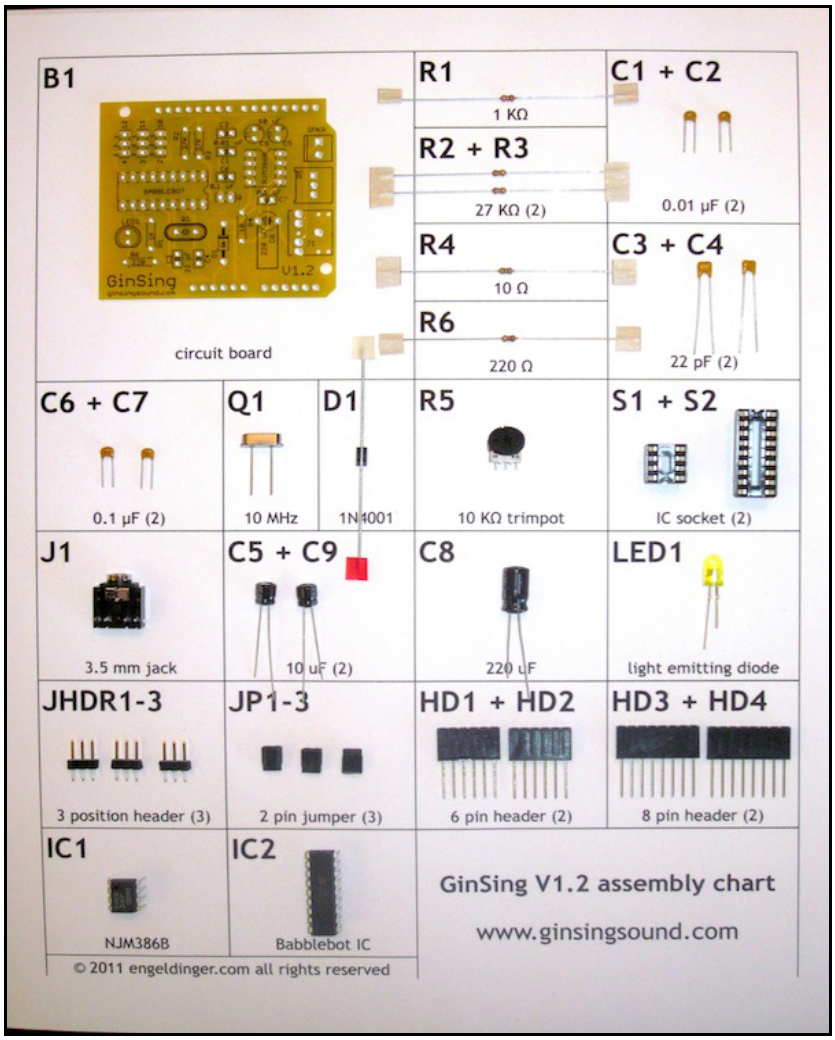
When soldering components, please make sure you have sufficient **working space** and **good ventilation** to allow for safe use of a dangerous hot iron and fumes

part chart

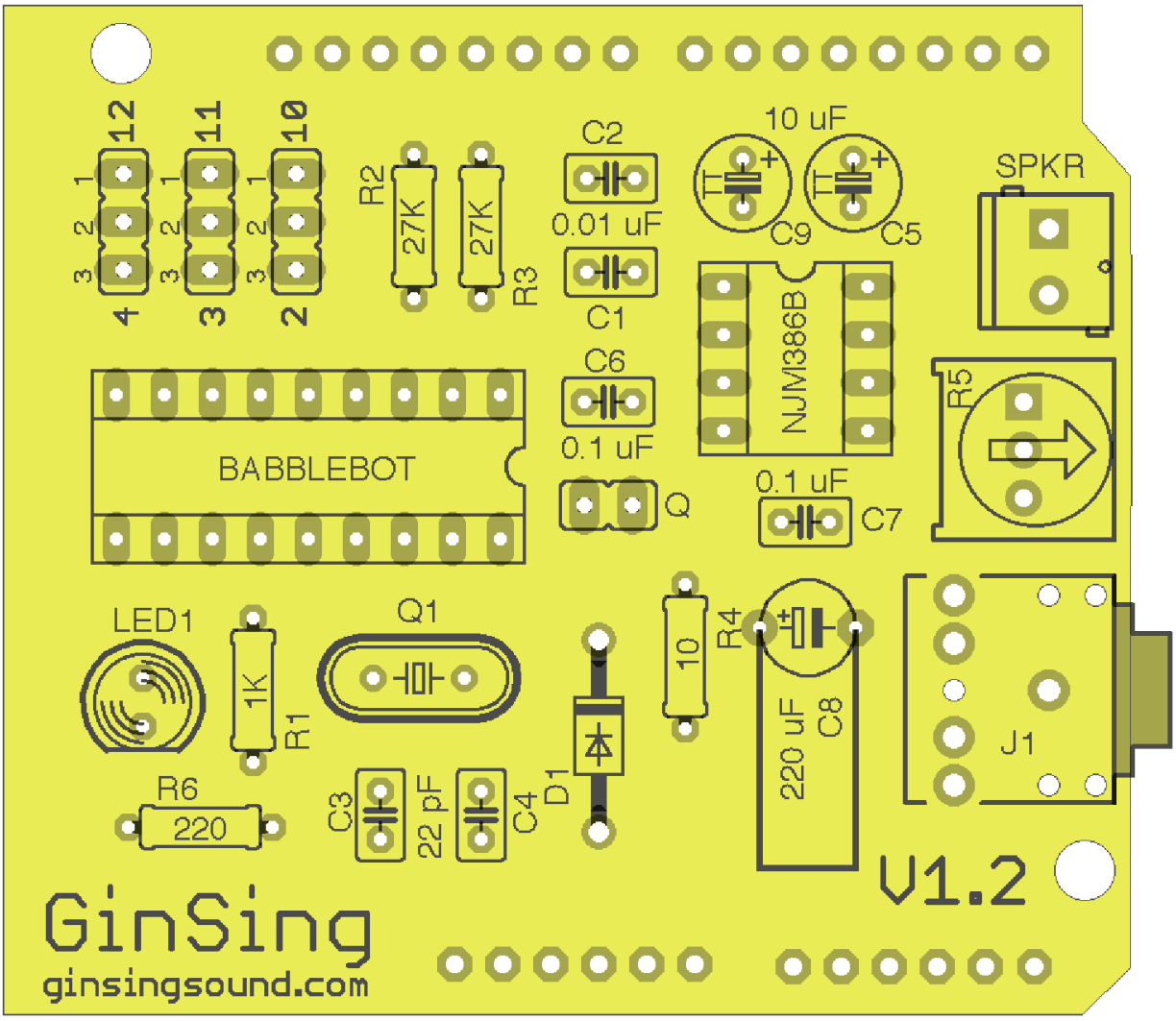
We have created a simple way for you to help organize the assembly using a part chart. In addition to helping you identify the parts beforehand, it also guides you through the installation order. Once you have populated the chart, you can assemble according to the order on the chart (left to right , top to bottom).

Remove the items from the bag and place them in the appropriate squares on the chart (after testing each component with the multimeter if possible). Note that some squares contain multiple identical parts.

Many parts look the same - if you do not have a multimeter you can advance through the installation guide to identify specific marks for the parts on the respective page.



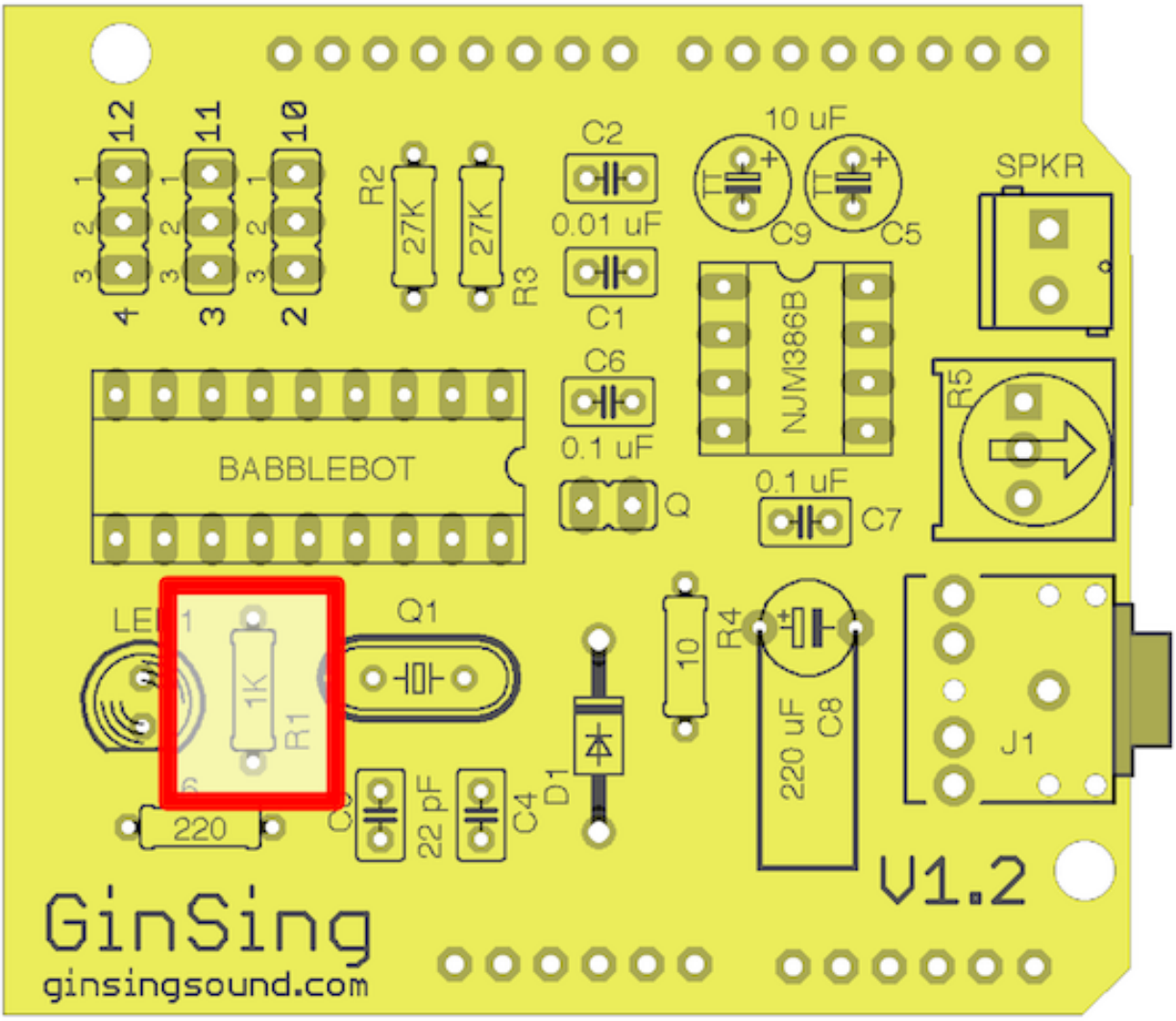
circuit board



Take a minute to examine the circuit board. You will notice that the each part and its corresponding value are marked on the silkscreen.

For devices that have polarity, special indications will help guide you through the orientation. For example C9 has a small (+) sign that designates which pin to place in the hole; likewise the IC has a notch that corresponds to both the socket and the chip.

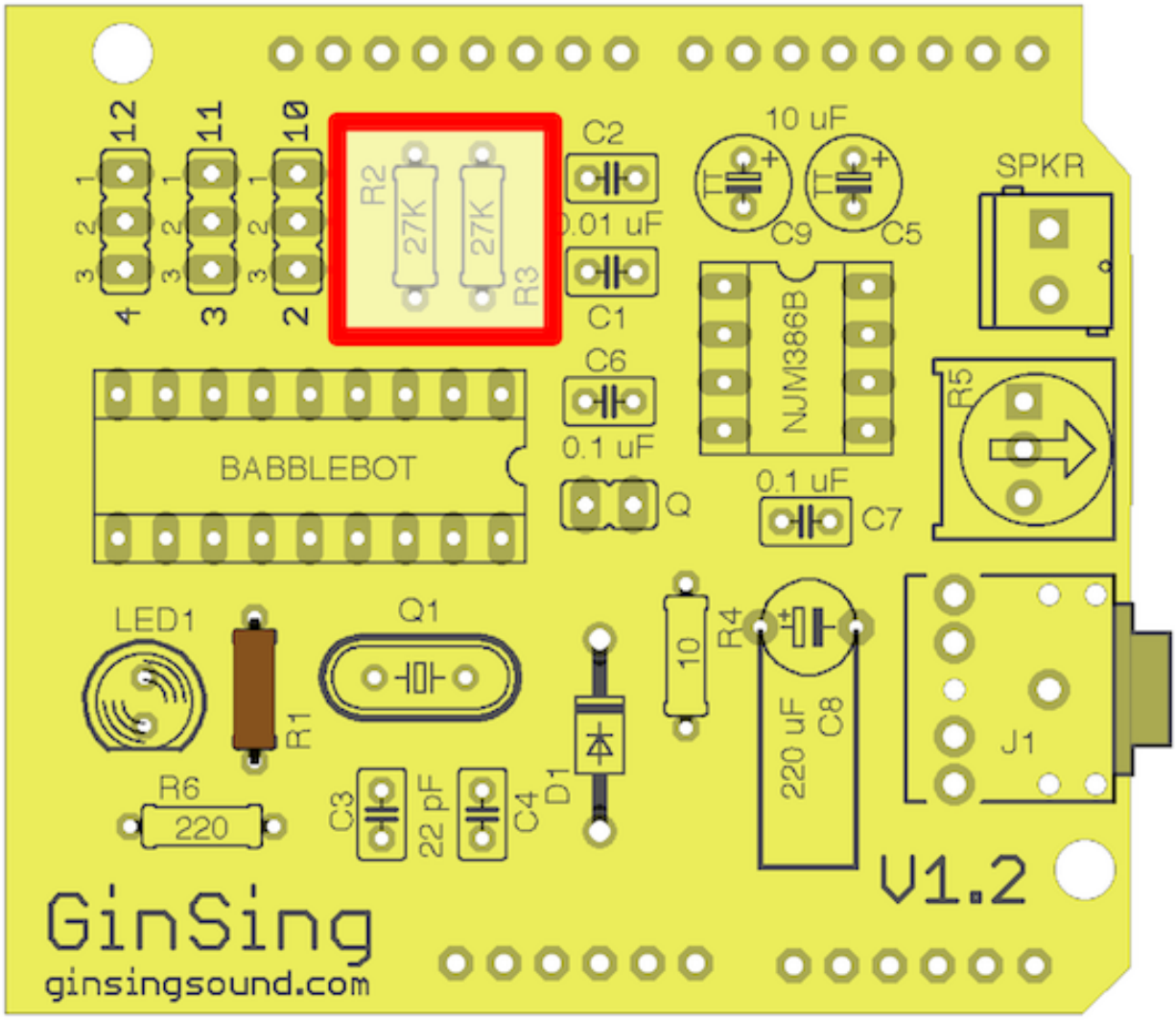
R1



1 K ohm 1/8 watt resistor

This 1 K ohm resistor is used by the Babblebot to set the baud rate to 9600, which is its fastest setting. The software has this communication speed built in. The resistor can be identified by the first three color bands (left to right) as **brown, black, red**. The fourth band indicates tolerance and can be either gold or silver.

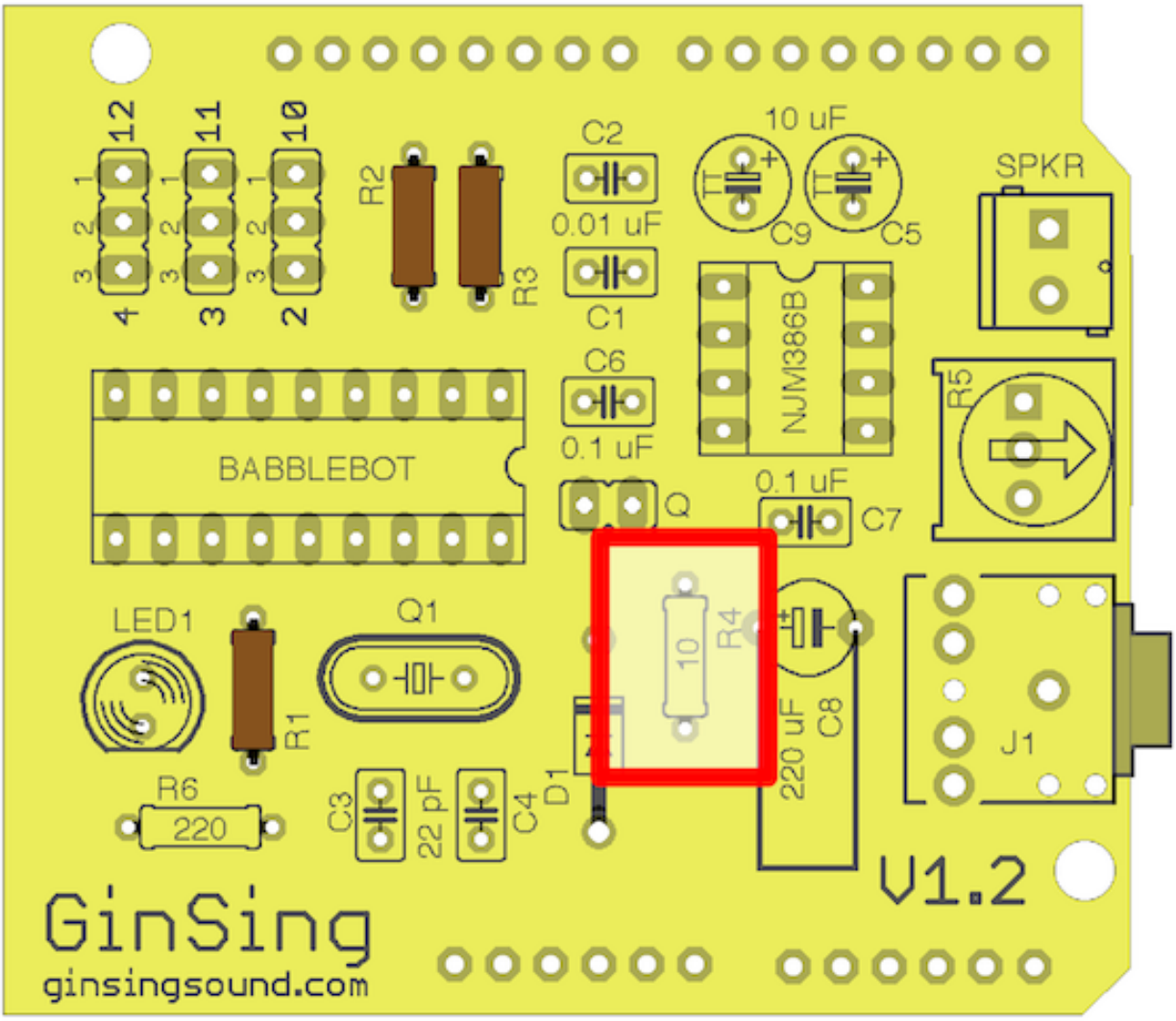
R2 + R3



27 K ohm 1/8 watt resistor

These resistors are part of the bandwidth filter that convert the 160 kHz PWM output of the Babblebot IC into an analog signal. They have no polarity. These resistors come grouped together for easy identification, and can be identified by the first three color bands (left to right) as **red, violet, orange**.

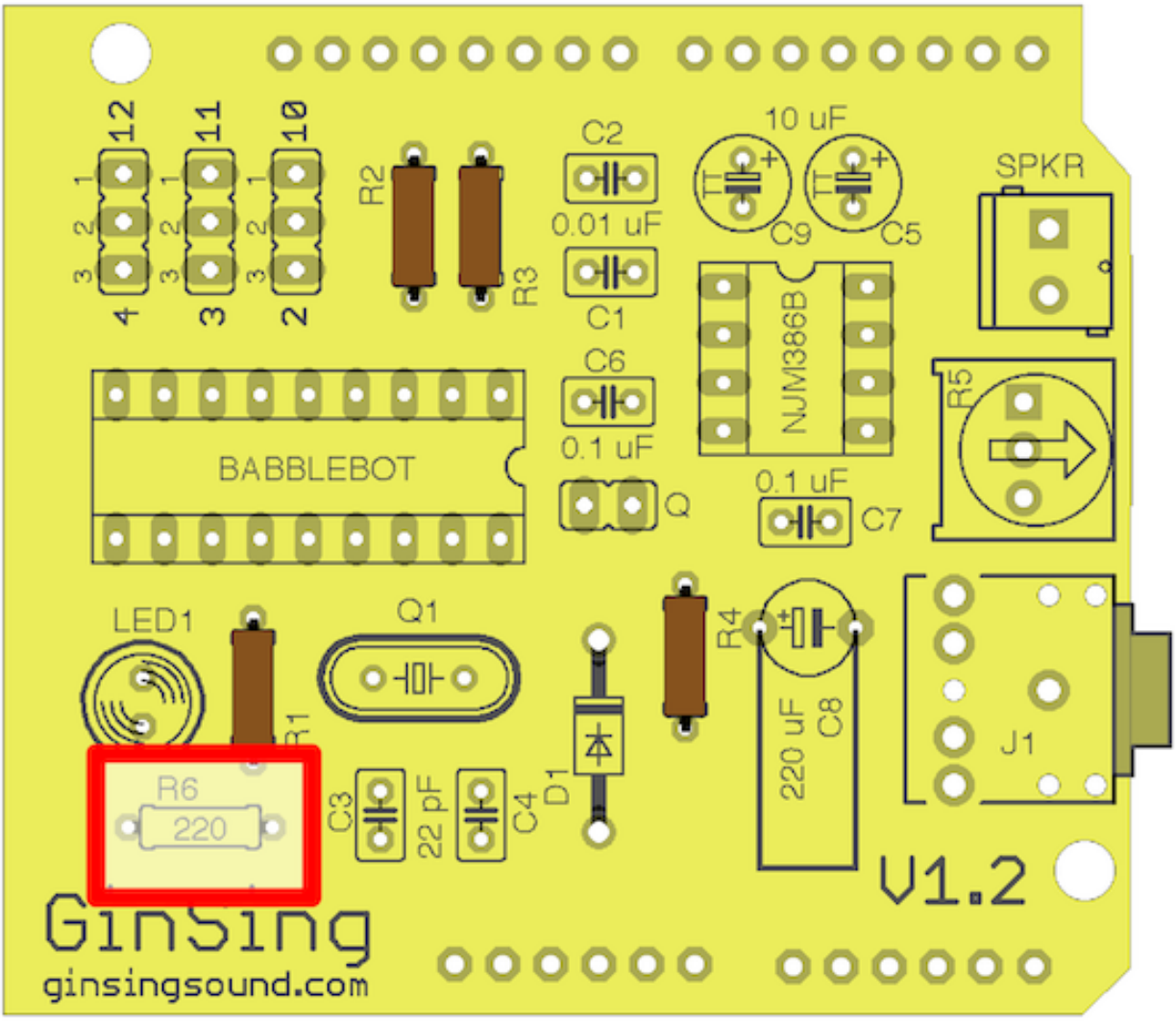
R4



10 ohm 1/8 watt resistor

This resistor is part of the stabilization circuit for the audio IC. It has no polarity. This resistor can be identified by the first three color bands (left to right) as **brown, black, black**.

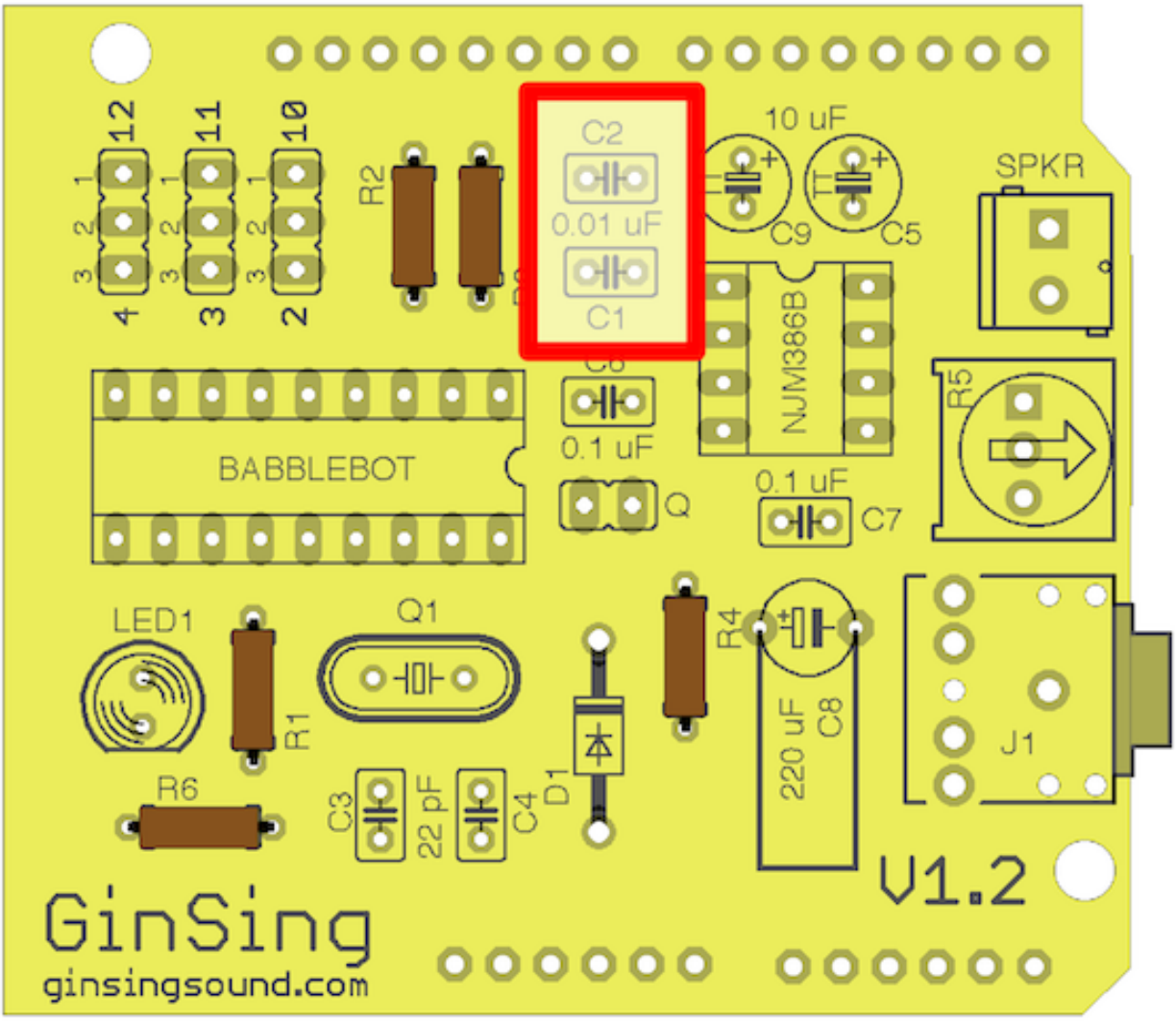
R6



220 ohm 1/8 watt resistor

This resistor is the current limiter for the LED. If you do not wish to use the output LED (for example to conserve power), you can choose to not install this part along with LED1. This might make debugging the circuit more difficult, however. It has no polarity. This resistor can be identified by the first three color bands (left to right) as **red, red, brown**.

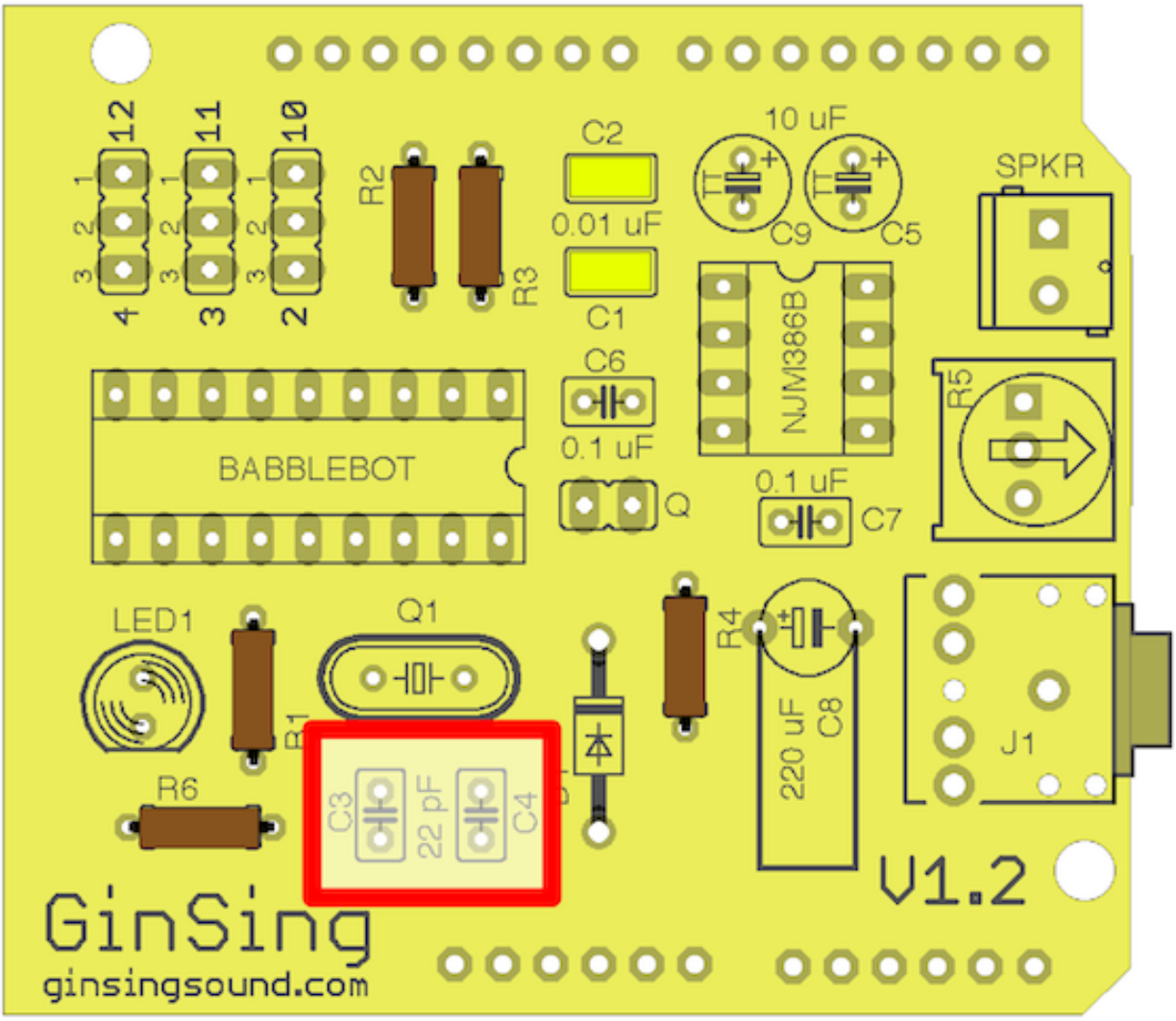
C1 + C2



0.01 uF capacitor

These capacitors make up the second half of the PWM filter (along with R2 and R3). These capacitors have **short leads**, and look the same as C6 and C7; therefore take special care to ensure that these are the proper capacitors. If you do not have a multimeter, you can identify these by the marking **103** on the side. They have no polarity.

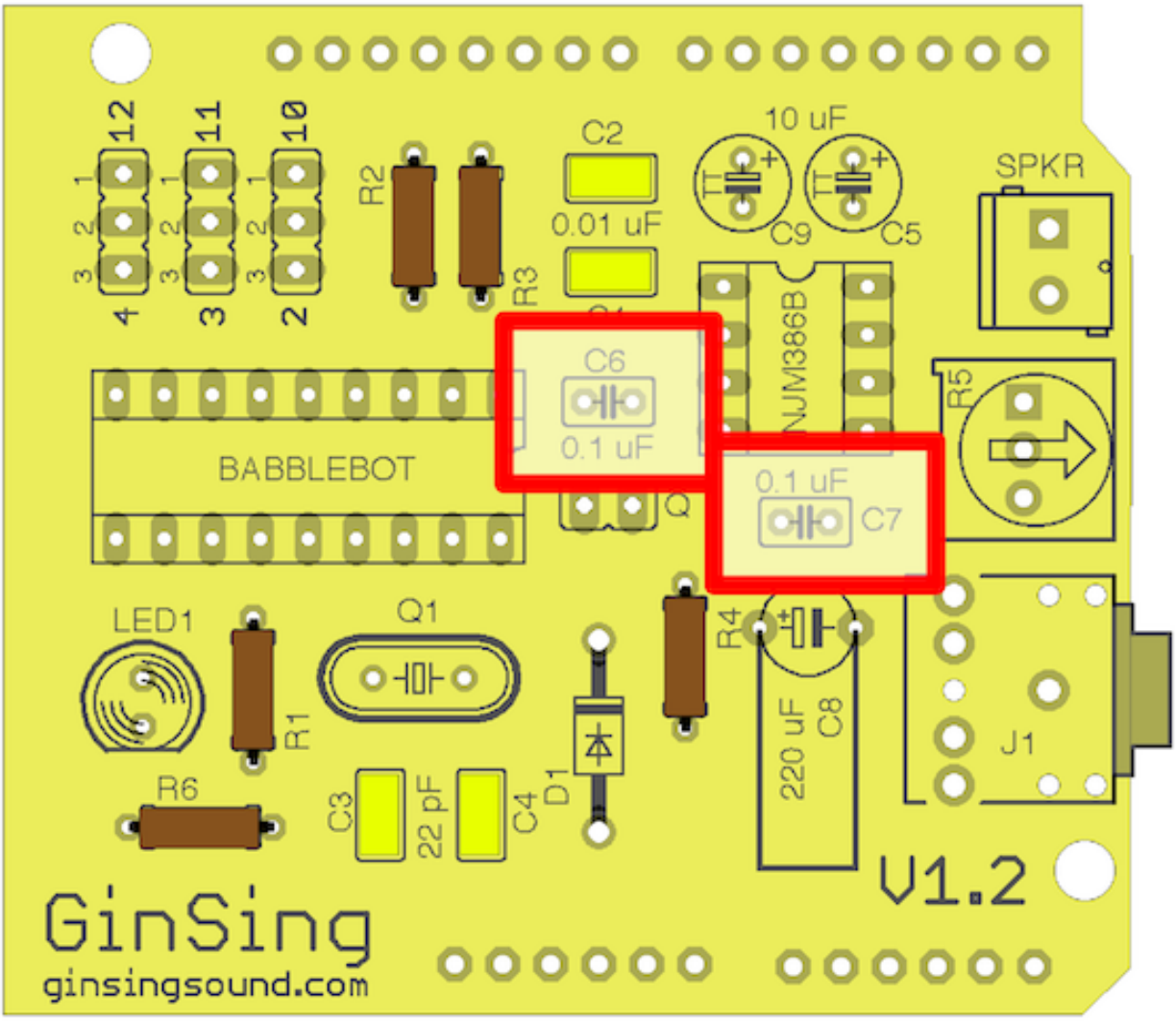
C3 + C4



22 pF capacitor

These capacitors (along with Q1) create the clock circuit for the Babblebot IC. These capacitors have **long leads** compared to the other capacitors, and are marked **220** on one side. They have no polarity.

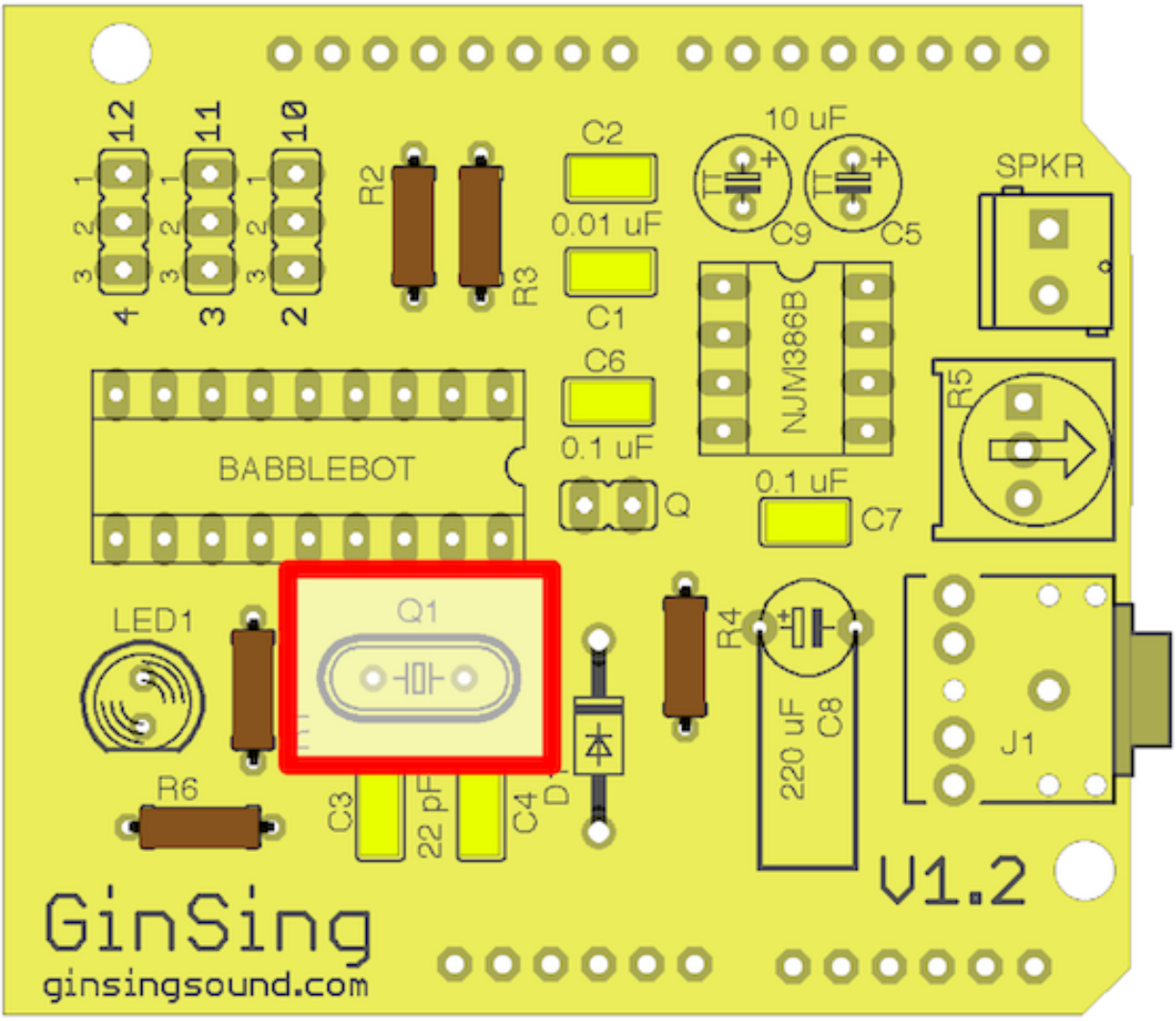
C6 + C7



0.1 uF capacitor

Capacitor C6 is a noise filter for the Babblebot IC. C7 is part of the audio IC stabilization circuit. These have **short leads** and look similar to C1 and C2, which should already be placed on the board. They are marked **104** on the side. They have no polarity.

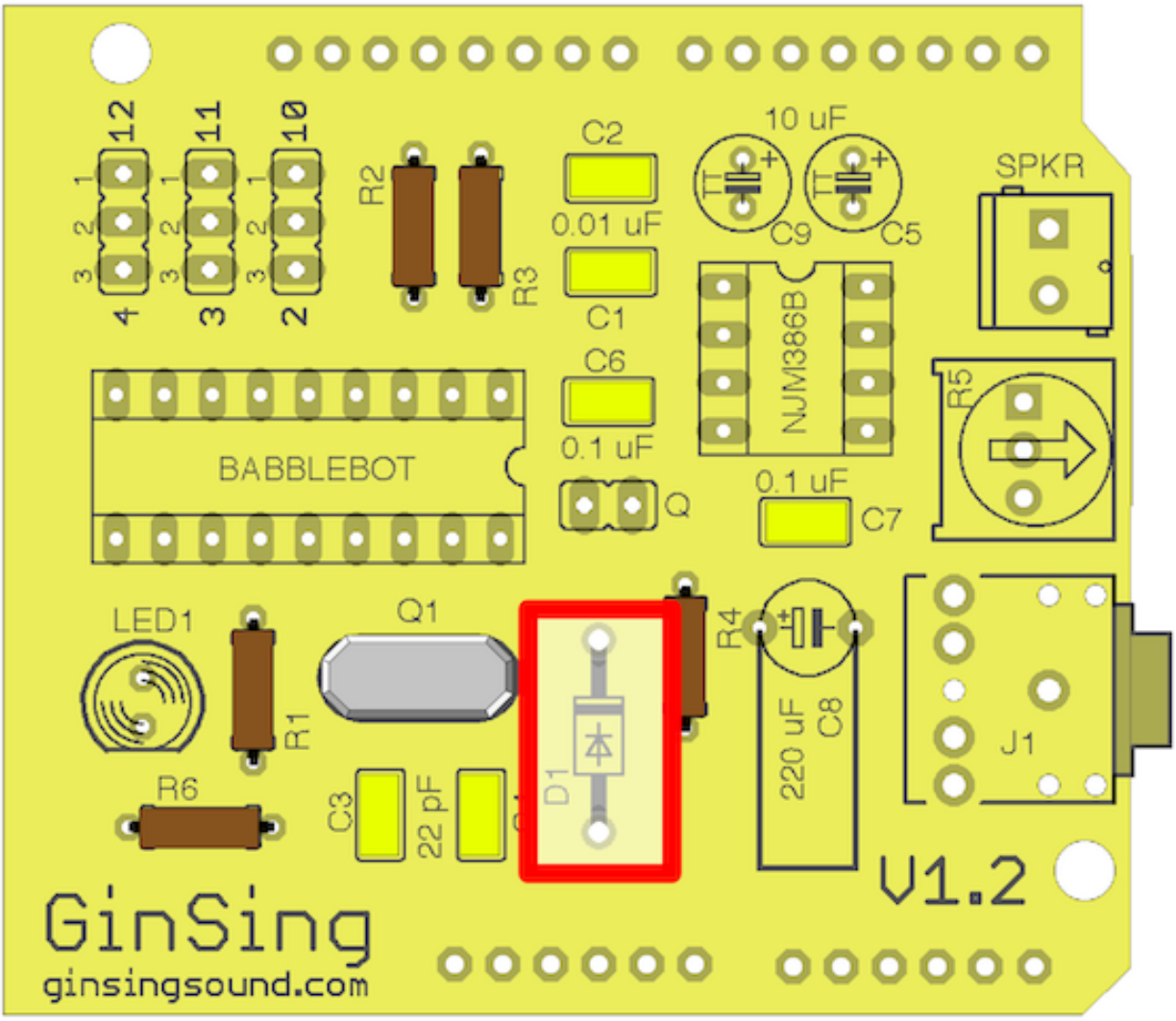
Q1



10 MHz crystal

Crystal oscillator Q1, along with C3 and C4 provide the clock signal to the Babblebot IC. It can be identified as the oval shaped all metal case and is marked **FS10.00P** on the top. It has no polarity.

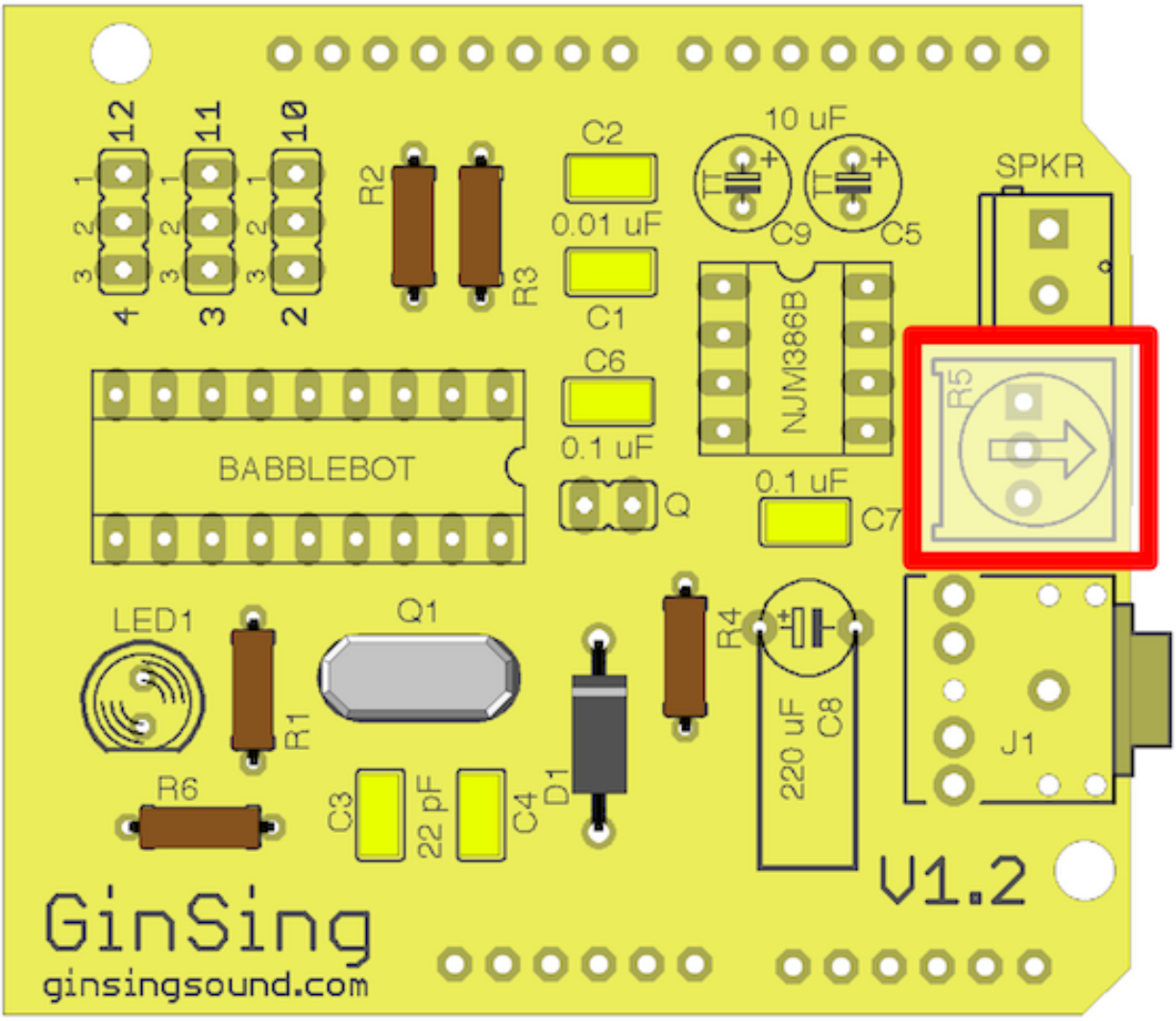
D1



1N4001 diode

This diode supplies optional power from the Arduino external power jack to the amplifier IC. This allows you to produce more audio output power when you connect a higher voltage source to the Arduino external power jack. You can connect up to 18 volts to the power jack, and hence to to the amplifier. **The diode is marked with a bar on one end that must be placed according to the board diagram.**

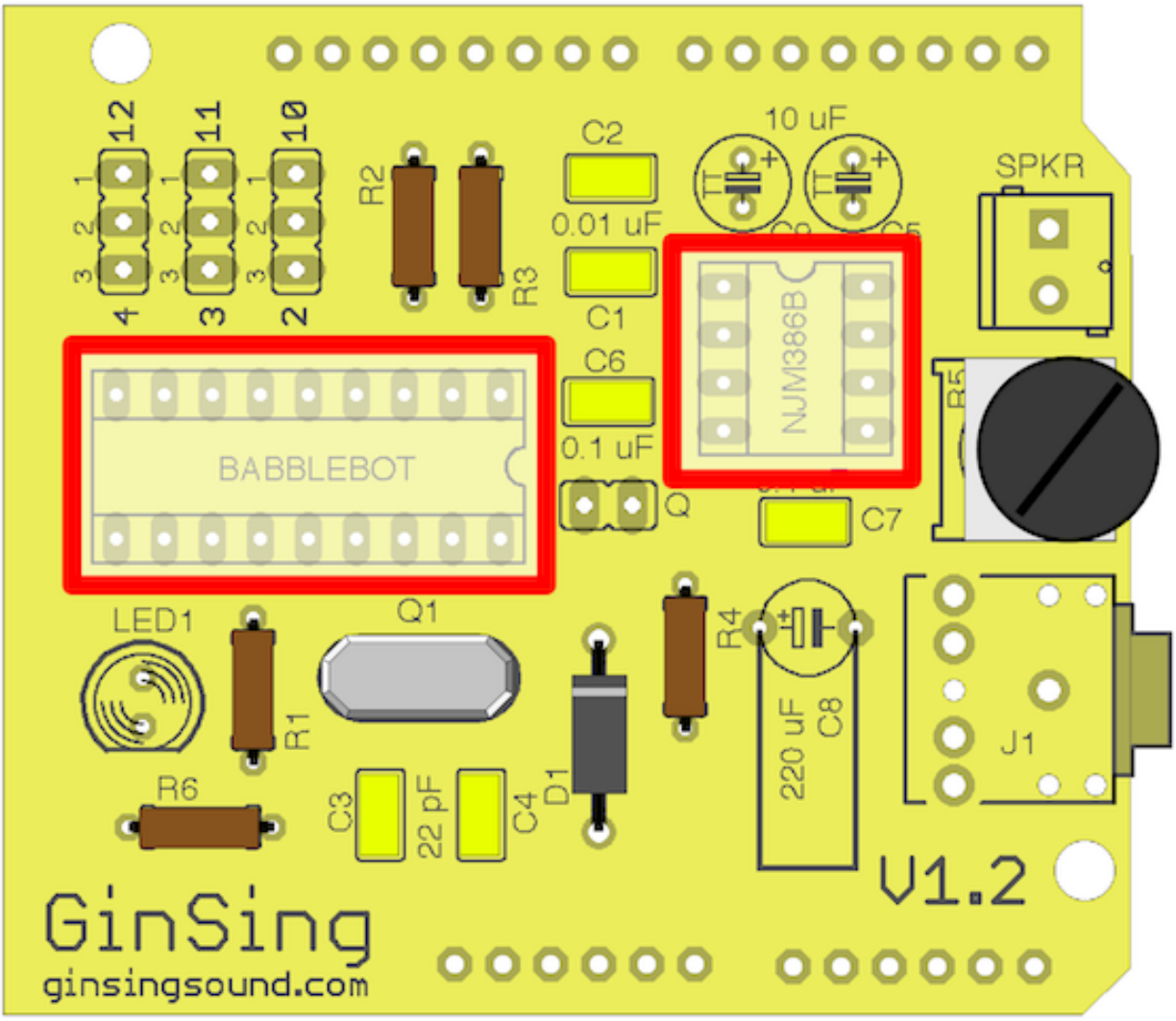
R5



10 k ohm trimpot

This potentiometer is the volume control for audio output. This volume control functions for both the speaker and headphone output. When adjusting volume, take special care when connected to either headphones or stereo input as you may damage your ears and/or the device it might be connected to. The pot is at its minimum value when turned completely clockwise. **Orient the trimpot so that the thumbwheel is facing out from the board.**

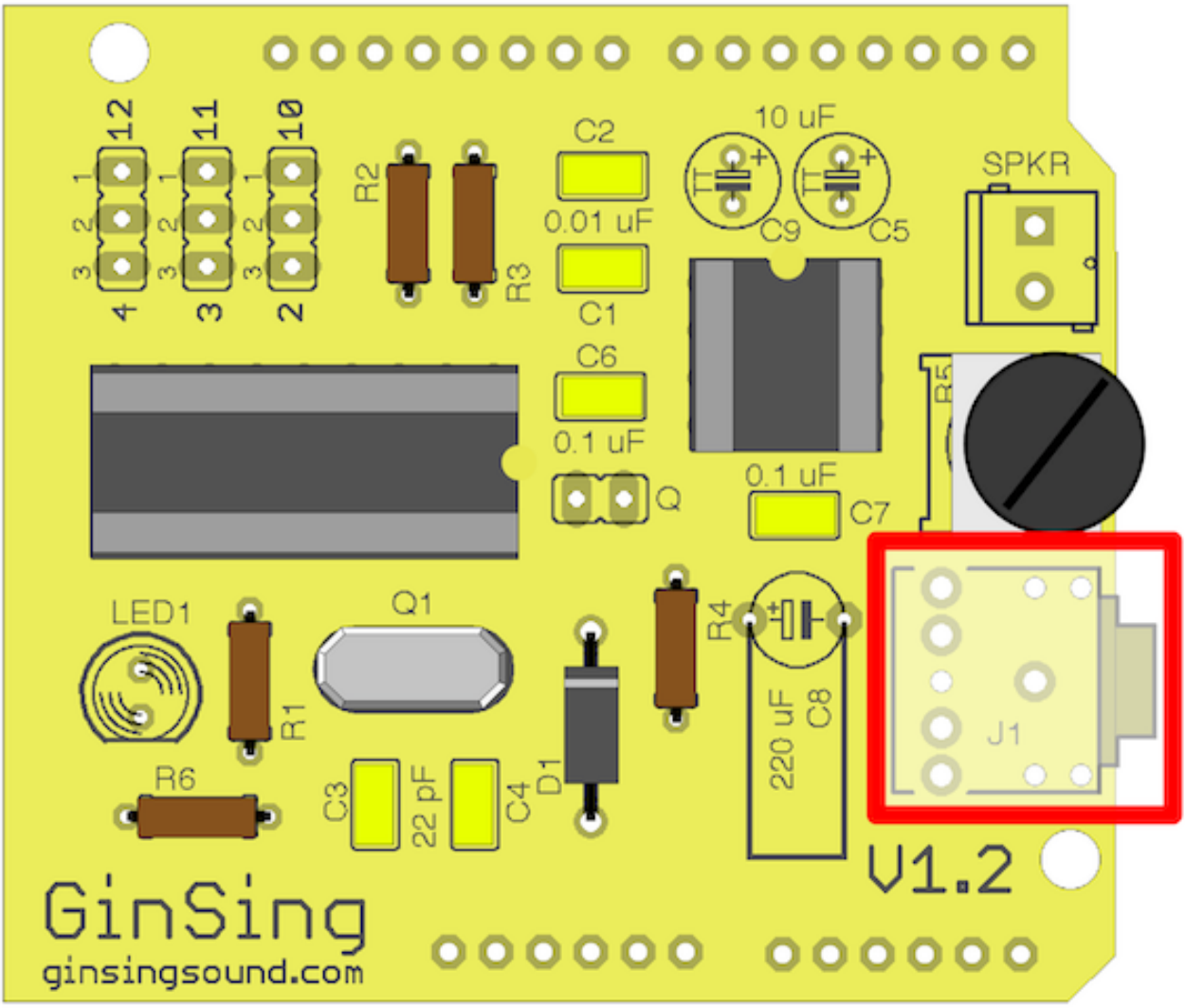
S1 + S2



IC sockets

The IC sockets provide protection against the ICs during build and allow removal/replacement if needed. Note that the sockets have a notch on one end that identifies proper orientation - this will help ensure that the chips are placed in the proper orientation as well. **Orient the sockets according to the diagram on the board.**

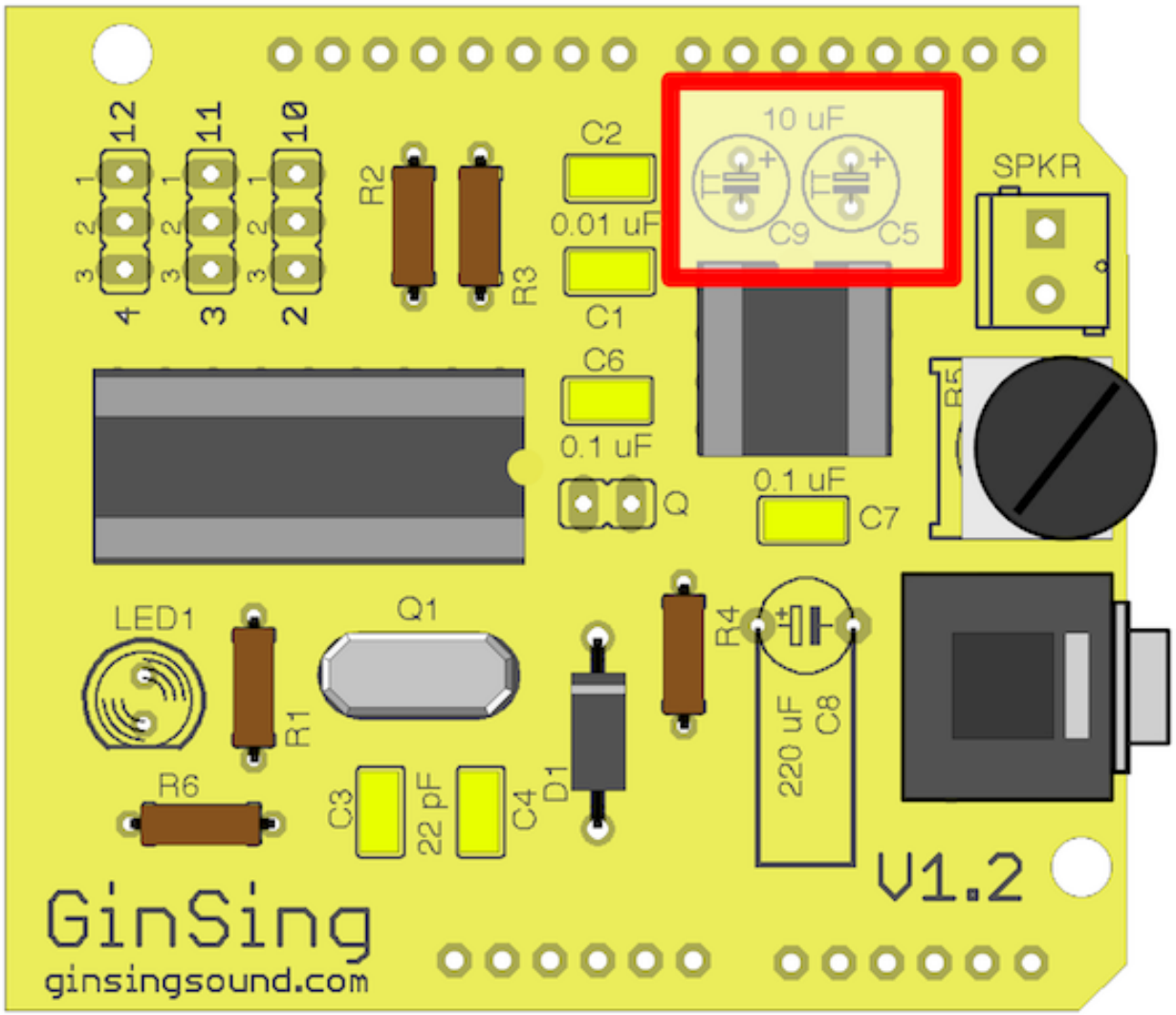
J1



3.5mm stereo audio jack

The audio jack allows you to insert a 3.5mm (1/8") stereo headphone jack for audio output. When a jack is inserted, the speaker pads on the board are automatically disconnected. This jack is connected to the audio amplifier, and as such and produce high volume levels into headphones and stereo input - take care to adjust the volume level down before inserting. Although the Babblebot IC produces only mono sound, it is internally connected inside the jack to both the left and right output channels. **Orient the jack so that the connection is facing out from the board.**

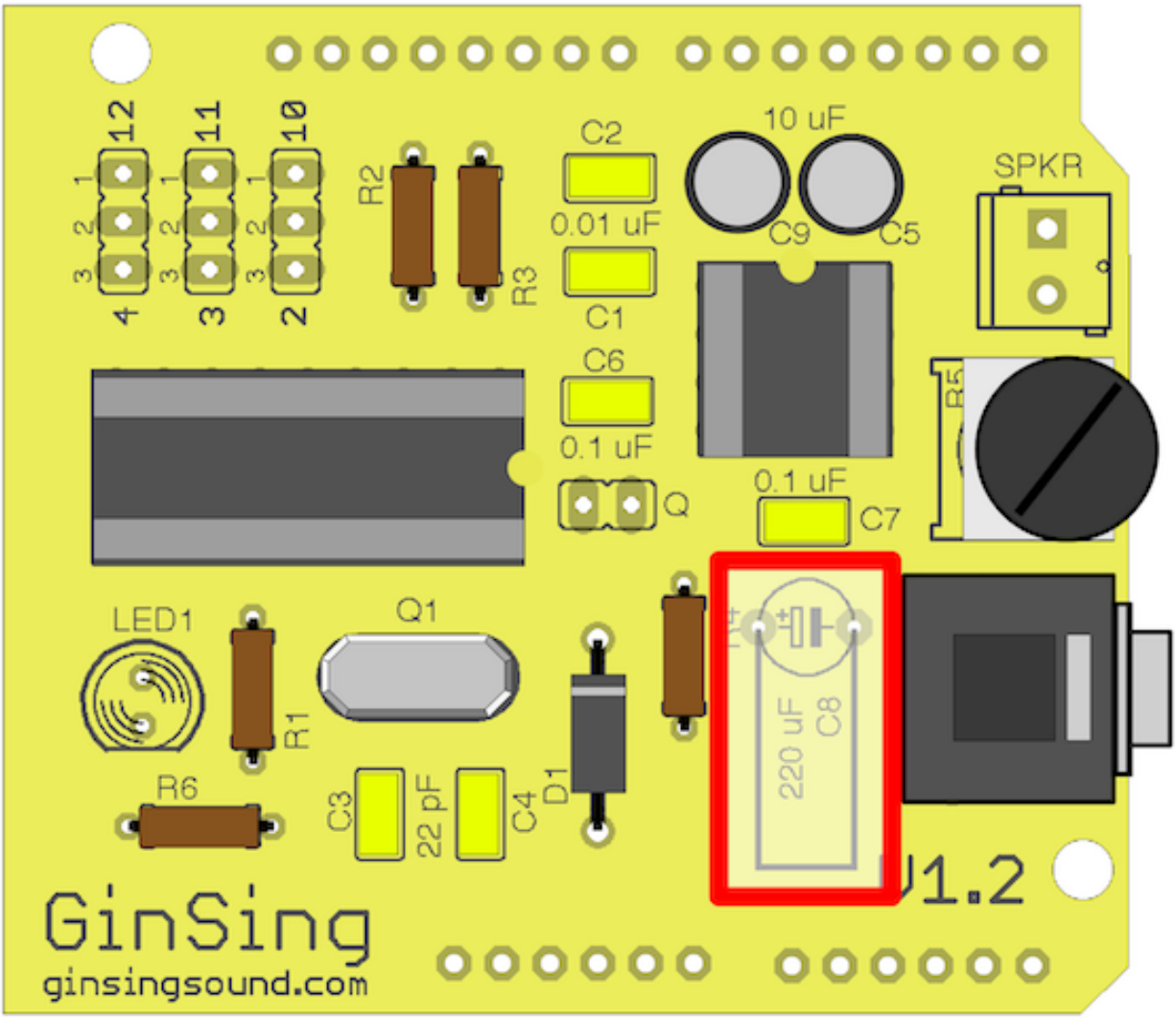
C5 + C9



10 uF electrolytic capacitors

These capacitors decouple the Babblebot IC from the audio IC and provide stabilization for the amplifier. Note on the board the small (+) signs that indicate polarity. On the capacitor housing, you will see a small banner that has a (-) sign; this should be placed in the opposite hole from the (+) marking on the board. This part can be identified with the **10uF** marking next to the banner. **Orient the capacitors so that the (-) banner faces the amplifier IC.**

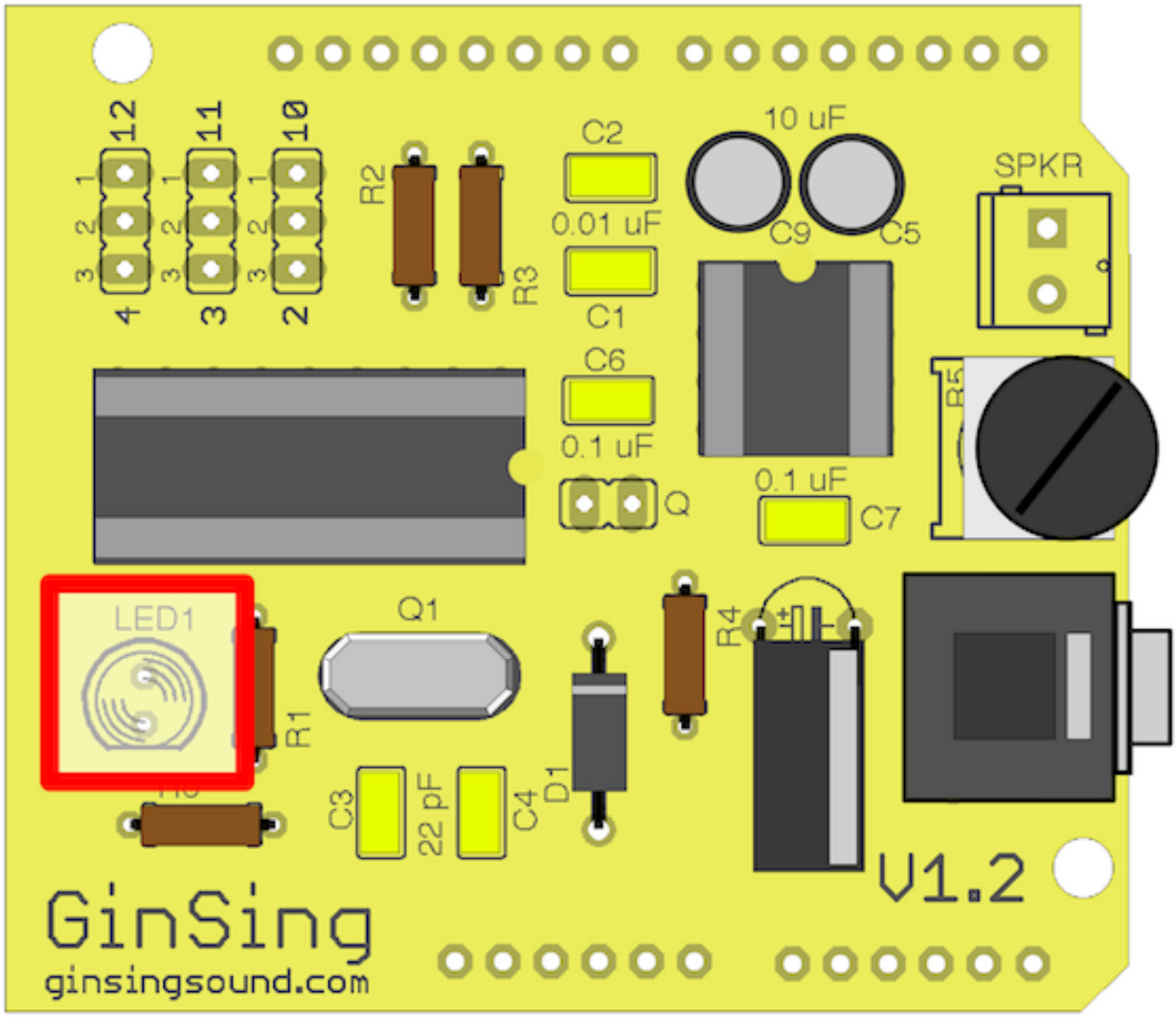
C8



220 uF electrolytic capacitor

This capacitor is decouples the audio amplifier IC from the jack and speaker pads. The board is designed so that you lay this capacitor on it side to allow for other boards to be stacked on top of this one. This part can be identified with the **220uF** marking next to the banner. Note the (+) sign on the board to indicate polarity. Place the capacitor into the holes, and bend the pins at 90 degrees to allow the capacitor to sit flat on its side. **Orient the capacitor flat and such that the (-) banner faces towards the audio jack.**

LED1

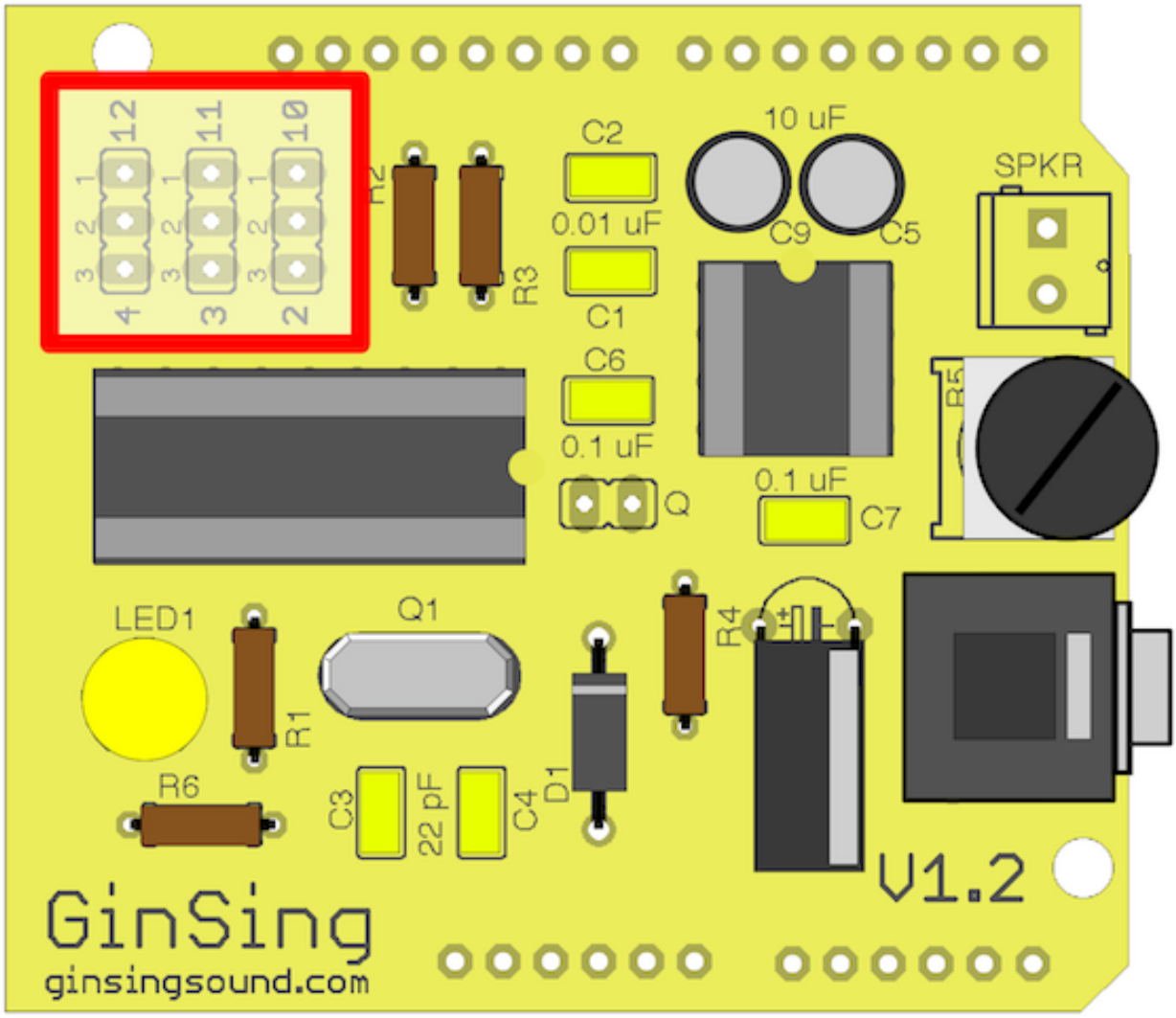


amber light emitting diode

This LED lights up whenever the Babblebot IC is creating output. It can be used for debugging, or provide solder pads if you wish to relocate the LED (or LEDs up to 25 mA) to a case. If you wish to conserve board power and don't need the LED you can omit this part (along with R6). The LED has two different lead lengths - the longer lead is the anode, and the shorter is the cathode. On the board the cathode is denoted as the notch in the circle. **Place the shorter lead of the LED (cathode) into the notch on the circle.**

Important: The LED may have lead tabs that do not allow it to be placed flush and will NOT allow for stackable boards. To make the board stackable either trim the lead tabs to fit, or bend the LED over to face the outside of the board.

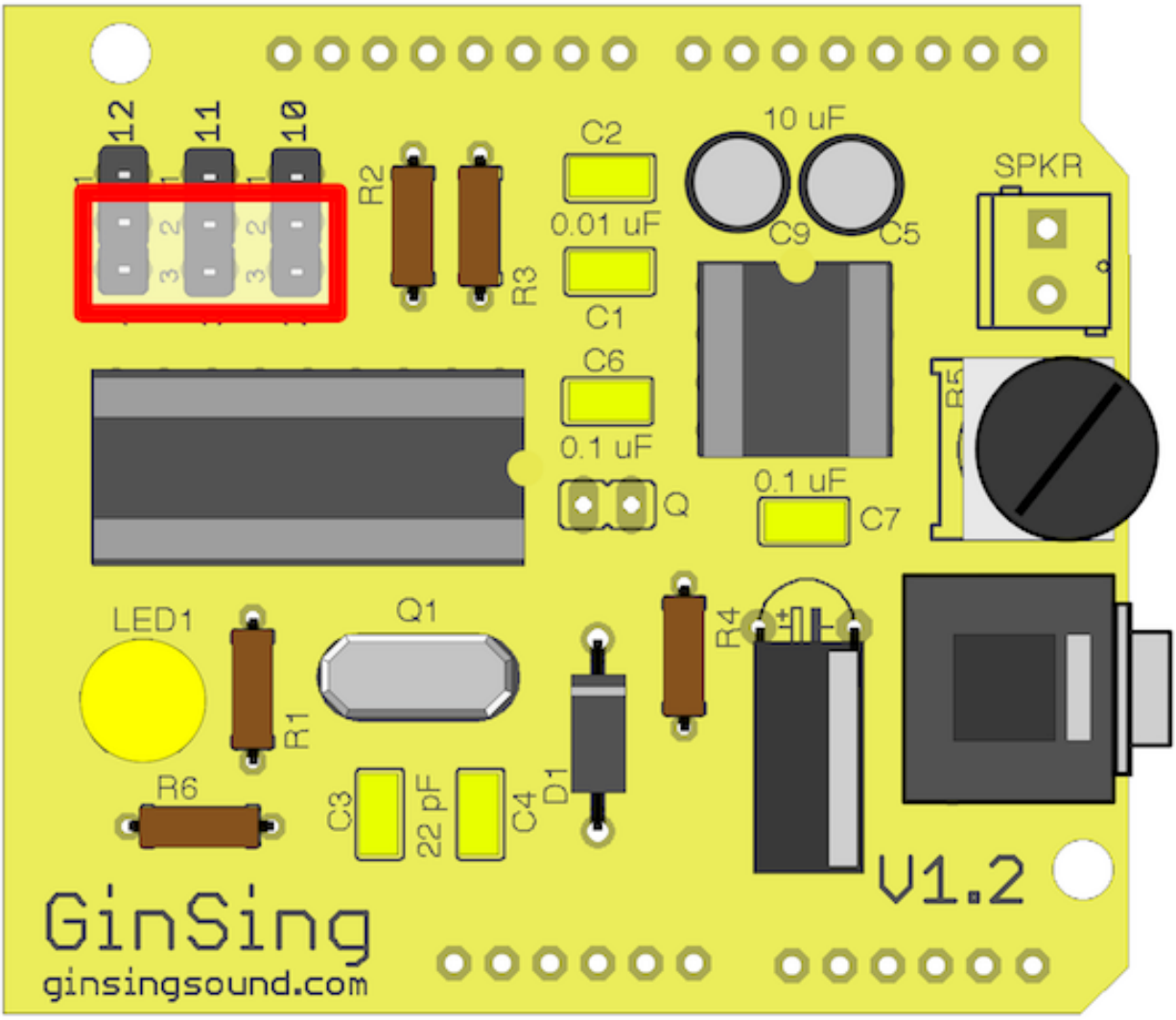
JHDR 1 + 2 + 3



3 position jumper header

The jumper headers allow you to configure the communication pins on the Arduino that are used by GinSing. By default, the board and software is configured to utilize pins 2, 3, and 4, but you can change these in any combination to (10, 11, and 12) if you are using other shields that might use these pins. In software you specify what pins the GinSing hardware will use. The headers should be placed according to the alignment on the board. **Place the shorter leads of the header into the board - the longer leads are used for the jumpers.**

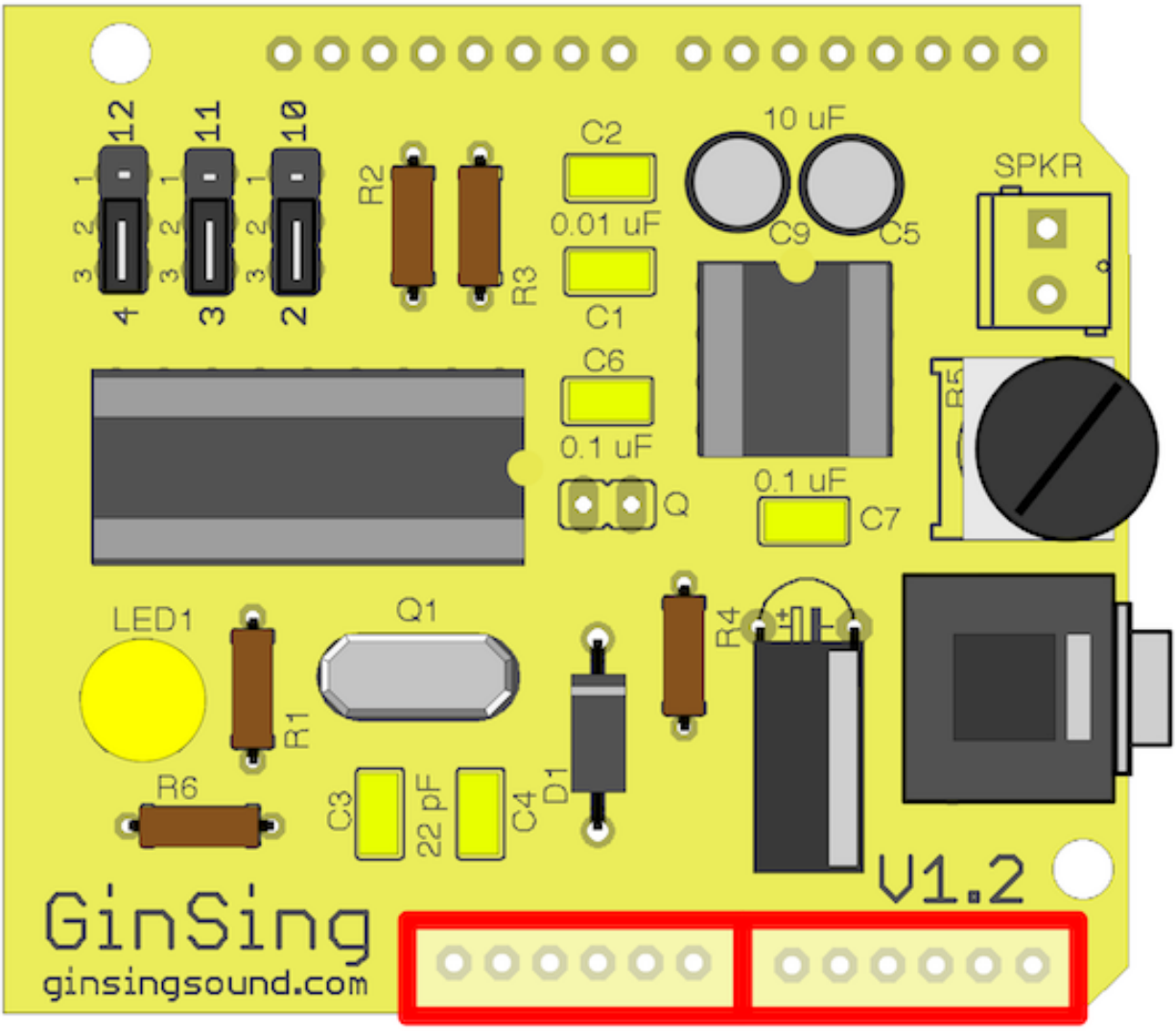
JP 1 + 2 + 3



board jumper

For initial testing and configuration, place each of the jumpers on the headers such that each jumper connects the center pin with each of the connections marked 2, 3, and 4 on the board. They can be moved later, but the software by default expects them in this configuration. **Place the jumpers so that they connect towards the Babblebot IC.**

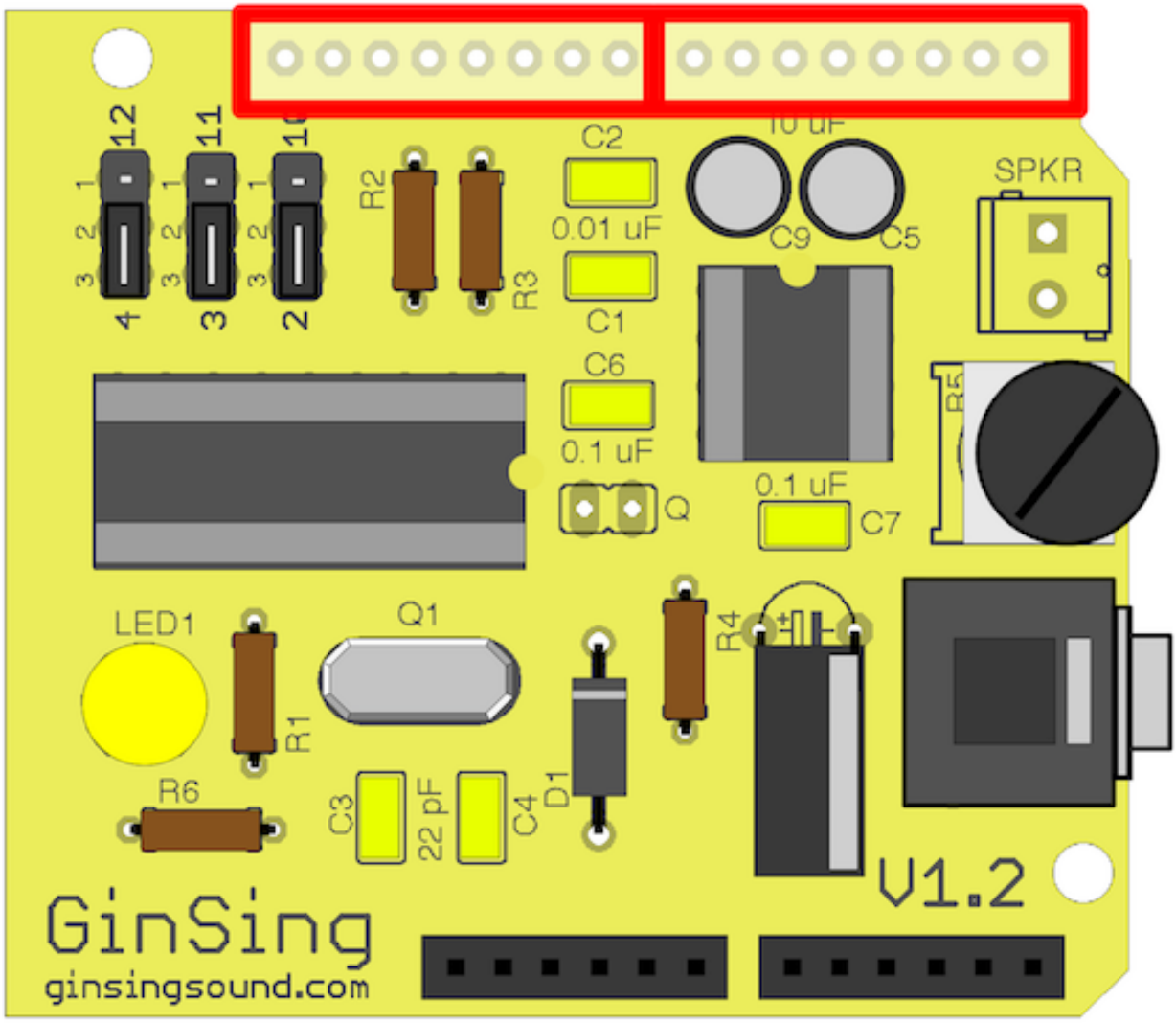
HD1 + 2



6 pin header

These headers connect the board to the Arduino and allow for additional boards to be stacked on top of this one. It is important to solder these headers flat on the board, and to keep the solder low to the board to allow the pins to seat firmly on the Arduino board. An easy way to align the headers is to solder only one pin at first on the end. By heating up this solder you can square up the header before soldering on the remaining pins. **Do not trim the leads!** they must be at full length to properly seat into the Arduino.

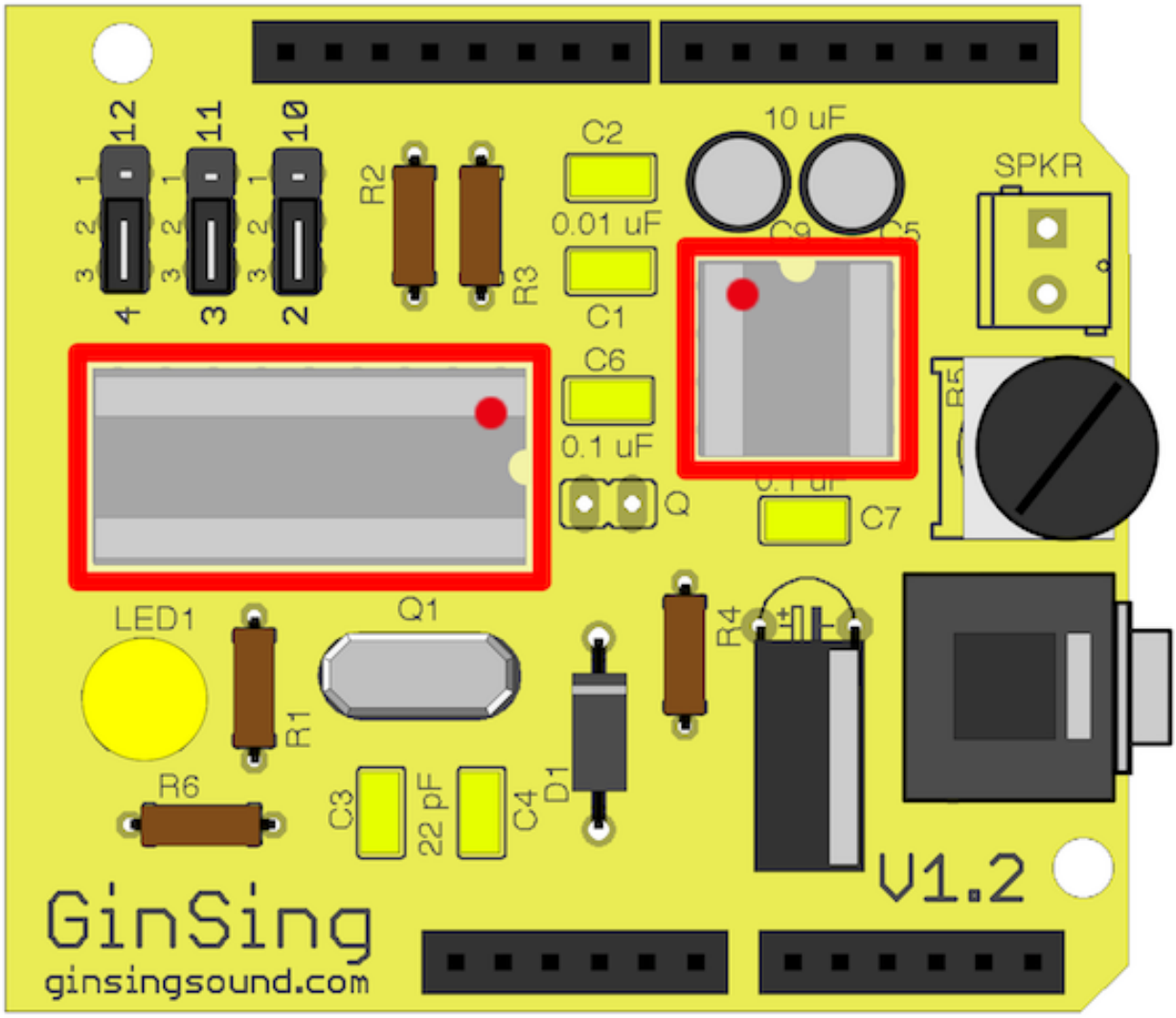
HD3 + 4



8 pin header

These headers connect the board to the Arduino. As per the previous step, solder these headers flat on the board, and **do not trim the leads!** they must be at full length to properly seat into the Arduino.

IC1 + 2



integrated circuits

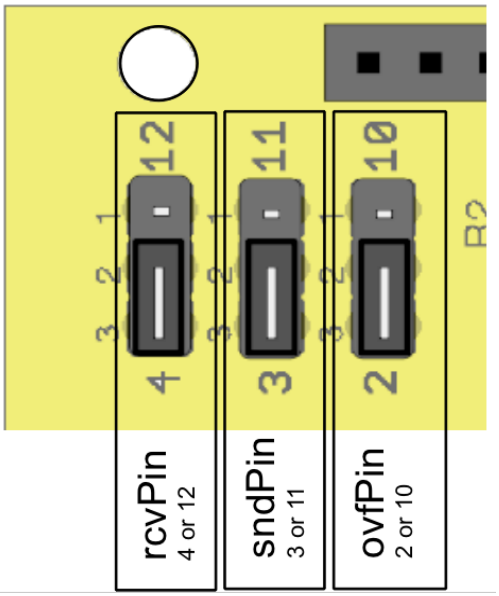
The 18 pin IC is the Babblebot IC, which interprets serial commands sent from the Arduino board (via the GinSing library) and generates sound in digital form. The 8 pin IC is a basic audio amplifier that creates up to 1.2 W of audio output into an 8 ohm speaker. Proper orientation of these ICs are critical - **if you place an IC in upside down it will destroy it without any indication!** To make sure the IC is placed properly, the surface of the chip will contain either a notch or a dot that should be aligned according to the notch or dot as per the diagram above. To seat a chip into its socket, apply light pressure to bend the pins inward and seat firmly. To do this, place one side of the chip into the socket without pressing, then while applying slight pressure on the other side, seat all of the pins in the socket. Confirm visually that all the pins are in the socket form, and then press down on the chip from opposite ends, rocking if need be to seat the chip completely in the socket.

configuration

communication pins

The serial interface pins between the GinSing board and the Arduino are configurable to allow for better compatibility with other shields. Configuration is accomplished in both hardware and software.

By default, the GinSing hardware is assumed to be set up such that pins 2,3, and 4 are used for communication. If you have a need to change these settings, you can move the jumpers as indicated above to alternate pins, altogether or individually.



By default, the GinSing software is assumed to be set up such that pins 2,3, and 4 are used for communication. When the GinSing software is initialized, you specify the pins that correspond to each of the hardware pins. This is the sample code that initializes GinSing and determines what pins will be used:

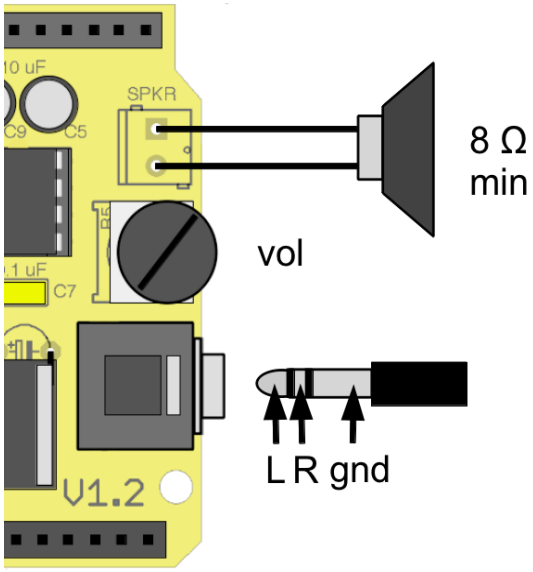
```
#define rcvPin  4     / the pin used for receiving    ( can be either 4 or 12 )
#define sndPin  3    // the pin used for transmitting ( can be either 3 or 11 )
#define ovfPin  2    // the pin used for overflow control ( can be either 2 or 10 )

GS.begin ( rcvPin , sndPin , ovfPin );
```

At this point you are ready to mount the hardware onto your Arduino board. Seat the board carefully atop the Arduino to ensure that no pins are bent during insertion. Once the board is seated, you may install the GinSing software and begin programming.

connections

audio connection



The audio output of the board can be connected through either the speaker pads or the 3.5mm jack. The volume control can be used to set the desired output level by turning the potentiometer counter-clockwise to increase the volume. **During initial setup set the potentiometer to approximately 1/4 of its travel counter-clockwise from its full off (fully clockwise) position.**

To use the speaker connections, simply solder your speaker wire to the contact pads located in the figure above. The audio amplifier IC can directly drive an 8 ohm or higher impedance speaker. If you experience distortion at lower levels than you need, you can power the amplifier with a higher voltage (up to 18 volts) through the use of the external power jack on the Arduino board.

You can also connect through the 3.5mm stereo audio jack. The audio jack provides the same output level as the speaker output, so **be careful when connecting to headphones or other audio components** to avoid damage to your ears or other equipment. Either a mono or stereo jack will work through this connection; if you use a stereo jack both channels will receive the same mono signal from the board. When a jack is plugged in, the speaker connection is disabled.

B1 circuit board			**R1** 1 KΩ	**C1 + C2** 0.01 µF (2)
			R2 + R3 27 KΩ (2)	
			R4 10 Ω	**C3 + C4** 22 pF (2)
			R6 220 Ω	
C6 + C7 0.1 µF (2)	**Q1** 10 MHz	**D1** 1N4001	**R5** 10 KΩ trimpot	**S1 + S2** IC socket (2)
J1 3.5 mm jack	**C5 + C9** 10 uF (2)		**C8** 220 uF	**LED1** light emitting diode
JHDR1-3 3 position header (3)	**JP1-3** 2 pin jumper (3)		**HD1 + HD2** 6 pin header (2)	**HD3 + HD4** 8 pin header (2)
IC1 NJM386B	**IC2** Babblebot IC		**GinSing V1.2 assembly chart** www.ginsingsound.com	