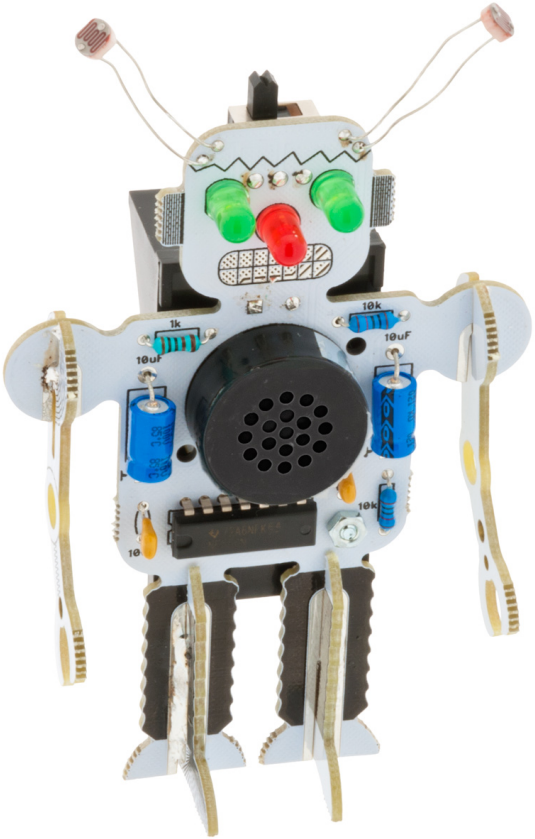
Atari Punk Robot

Assembly guide



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Kit description

The circuit you are about to build is known as a *Stepped tone generator* or *Sound Synthesizer*. It was originally conceived by electronics legend Forrest Mims III and later popularized under the name *Atari Punk Console*.

This version is made in the form of a cute robot with a speaker, light sensors that control the sound and LEDs (eyes and nose) that will pulsate and glow.

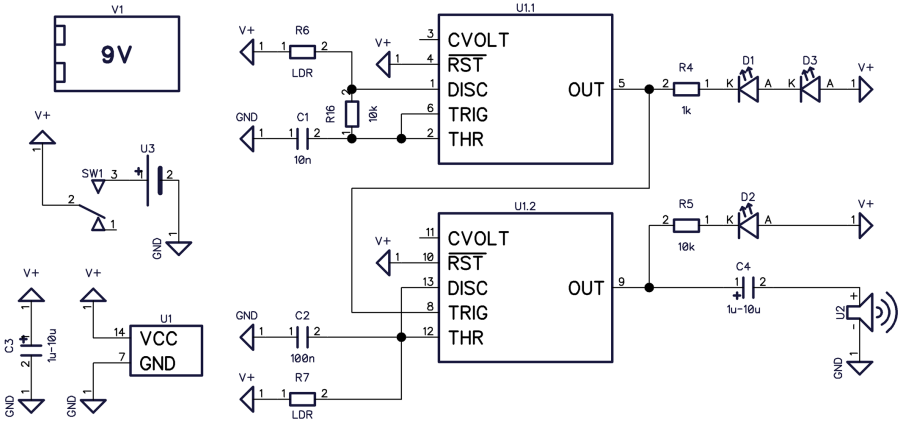
The circuit built around two 555-timer ICs. The first timer is wired as a square wave oscillator and generates a continuous tone. The second timer is wired as a one-shot pulse generator that acts as a frequency divider for the oscillator. The two timers together form a simple melody generating circuit that respond to light.

Once built, the robot will play melodies from the speaker as soon as it's powered up. Depending on how much light the two sensors receive, the tones will be higher/faster (more light) or lower/slower (less light).

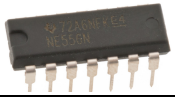
You can "play" melodies using your hands to block the light, modulate the sound using flashing lights or wave the entire robot around! Experiment with different light sources.

Other sensors with resistive output or potentiometers can be mounted instead of the light dependent resistors to access alternate ways to control the sounds. Possible alternatives are NTC resistors, temperature sensors, humidity sensors and regular potentiometers. Best results are obtained with sensors that have a range from about 5kohm to 1Mohm.

Schematic



Contents

Robot PCB	1	
LM556 dual timer IC	1	
10uF electrolytic capacitor	2	
10nF ceramic capacitor (Code 103)	1	
100nF ceramic capacitor (Code 104)	1	
10kohm resistor (brown, black, black, red, brown)	2	
1kohm resistor (brown, black, black, brown, brown)	1	
Light dependent resistor (5mm High-R)	2	
LEDs (colors may vary)	3	
Speaker (8ohm 0.1W ø23mm)	1	
Power switch	1	
9V battery holder	1	
M2 6mm screw + M2 nut	1	

Equipment

The following tools are required to assemble this kit:

- Solder station or solder pen (minimum 30W, 60W+ recommended)
- Lead-free solder wire
- Flush cutters (for cutting the component leads)

Some additional tools that makes assembly easier:

- Wire strippers (if you want to trim the battery holder wires)
- Needle nose pliers (for bending component leads)
- PCB holder or “third hand”
- Multimeter (for troubleshooting and component identification)
- Desoldering pump (for removing components and excess solder)

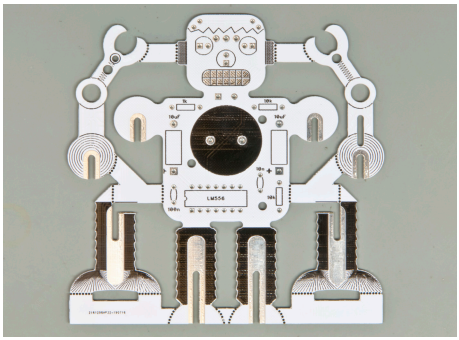
Assembly guide

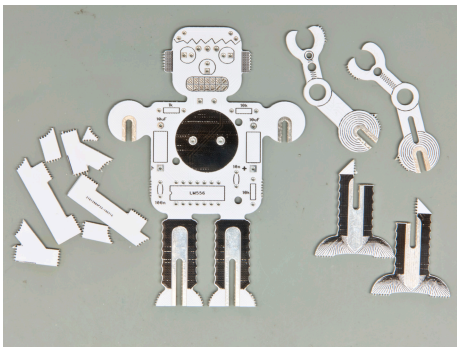
The PCB (printed circuit board) is delivered in one piece with some parts that need to be broken free before assembly.

Begin by carefully breaking off the left and right side. Then continue breaking free the individual arms, legs and feet supports.

Collect all the smaller parts and set them aside for now. The supports can be discarded as they no longer serve any purpose.

The jagged edges where the supports were attached can be trimmed down using flush cutters, a sharp knife, file or sandpaper.
This step is not necessary, but will make the robot look better.





The first component to mount is the timer IC (LM556). Orientation is very important! If inserted the wrong way, it will self-destruct. The notch on the IC should match the symbol on the PCB.

The pins on the IC must be bent slightly inwards to fit in the holes on the PCB. The best result is obtained if the pins are in a 90 degree bend relative to the IC.

The easiest way to bend the pins is by firmly pressing the IC on a flat surface and carefully angle the IC. This is repeated twice, once for each row.

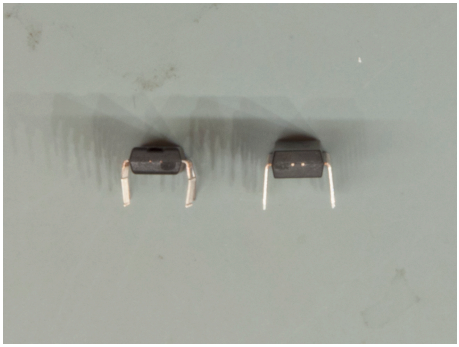
With the pins bent, the IC should be easy to insert into the PCB. Once inserted, flip the PCB over and solder each pin to its respective pad.

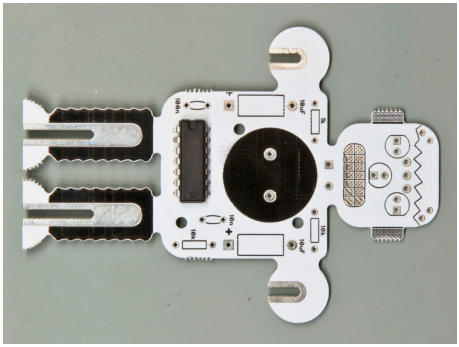
The distance between the pads are quite close, so pay attention not to bridge two adjacent pads!

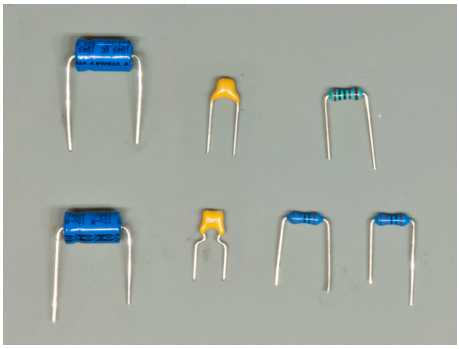
Next up are the resistors and capacitors. The component leads for the resistors and the electrolytic capacitors needs to be bent at 90 degree angle to fit into the PCB. The ceramic capacitors have both leads pointing the same way, so they can be inserted as is.

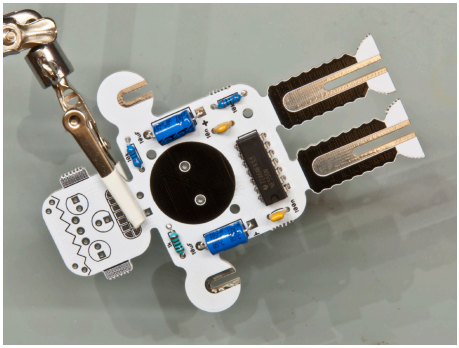
Insert one component at a time. Before inserting the next one, bend each lead slightly outwards to prevent it from falling out. Refer to the image.

Resistors and ceramic capacitors (10nF and 100nF) are non-polarized, which means they can be inserted in any direction. The electrolytic capacitors however are polarized and needs to be inserted in the correct direction. Arrows with minus signs on the body of the capacitors point towards the negative terminal. This lead should be inserted into the round hole. The other lead goes into the square hole with a plus sign next to it.









When all components are in the correct place and correct orientation, make one final inspection to make sure they are indeed in the correct place and correct orientation before soldering.

When you are absolutely sure that everything is ready, solder each lead to its pad. Make sure each solder joint looks good. There should not be too much solder, not too little and the joint should be melted to form a smooth bulge that connects to both the PCB and the component lead.

Also make sure to check that no solder has bridged two or more pads. If this happens, it can be quite easily fixed by dragging the tip of the solder iron over the bridge.

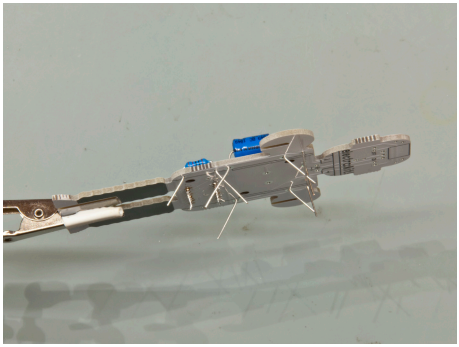
When all pads are soldered, cut all the component leads. They should be cut as short as possible, without cutting into the actual solder.

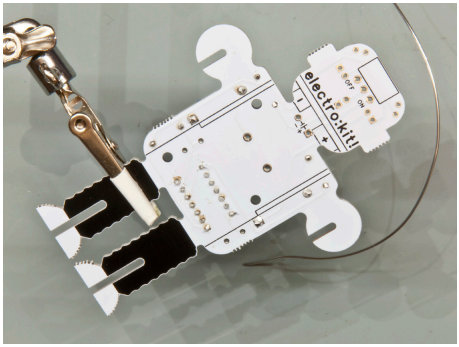
The next component to mount is the power switch.

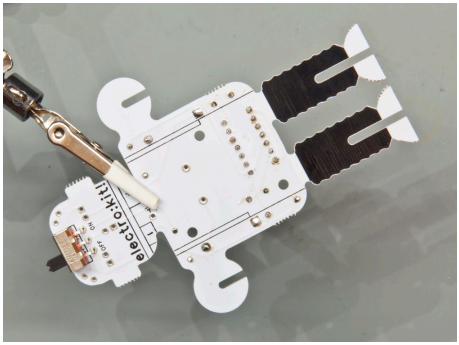
The switch should be mounted on the rear side. To keep it from falling out, lay the board flat on the table so the board is pushing down on the switch or solder the pins from the same side as the switch itself. That way it will stay in place by its own weight.

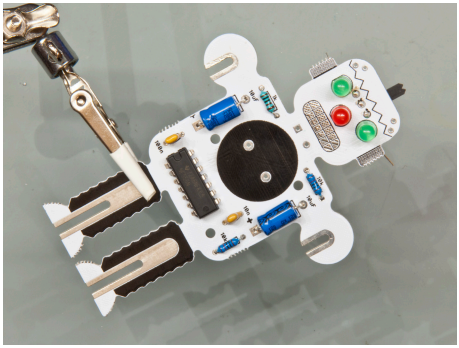
The eyes and nose LEDs are next. The LEDs are also polarized and must be in the correct orientation to function properly.

On this board, all the long leads should be facing toward each other. Another indicator is that the flat edge of the LED should line up with the flat edge of the symbol on the PCB. The final indicator is the square pad on the PCB, in which the short lead of the LED should go.







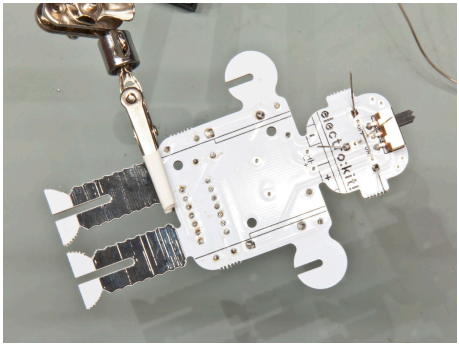


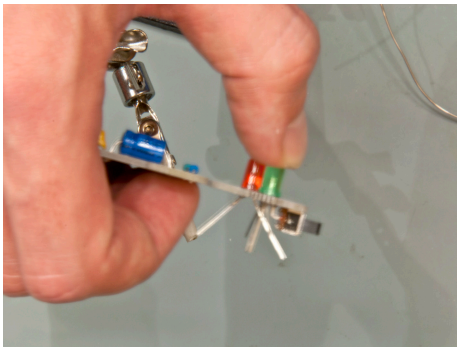
Repeat the same process as for the resistors and capacitors. Insert one component at a time; bend the leads, double check the orientation, and then solder both leads.

If the leads are in the way when soldering, just cut them down to length a bit. Cut away the rest of the lead once soldered.

The LEDs can be a bit tricky as well to mount straight and flush to the PCB. If they are crooked after they have been soldered, simply push down on the LED with one hand and melt the solder with the other hand. Work with one lead at a time, alternating between leads until the LED is mounted properly.

The pads for the LEDs are spaced very close, so be careful not to bridge adjacent pads.

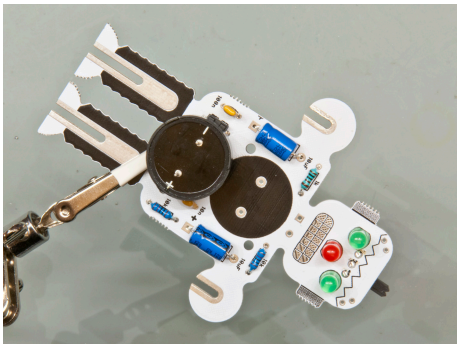




Almost done now!

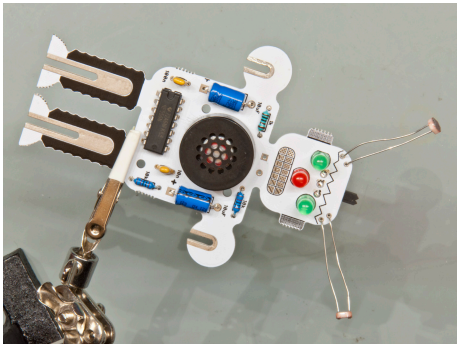
Next up is the speaker. The speaker is kind of polarized, but in this circuit it doesn't really matter which way it's oriented.

The leads are short and thick and can be hard to bend, but a slight bend is recommended as it will make it easier to mount it flush to the board. Use a plier if you find it difficult to bend the leads by hand.



The final components to add to the board are the antennae, or light sensors if you will. They are not polarized and can be inserted in any direction.

They can be mounted close to the board like the rest of the components, but for a cooler look, try to mount them using the full length of the leads.



The circuit is powered by a 9V battery. The battery travels securely with the robot in its backpack, the battery holder.

You can solder the wires directly without cutting them, or if you prefer a more collected look, cut them to about 30mm length and strip the ends.

The red wire goes into the hole marked "+", the black wire goes into the hole marked "-".

When both wires are soldered in place, fold them out so they don't get squished between the holder and the board.

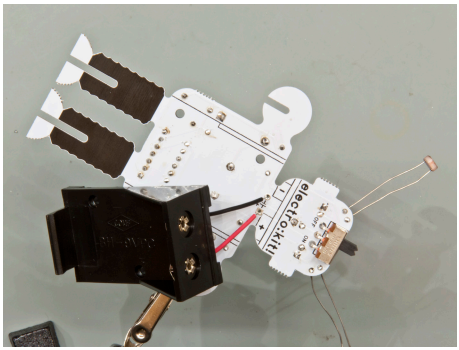
Due to the massive speaker size, only one screw will fit. But that's ok. The holder will sit firmly in place with just one screw.

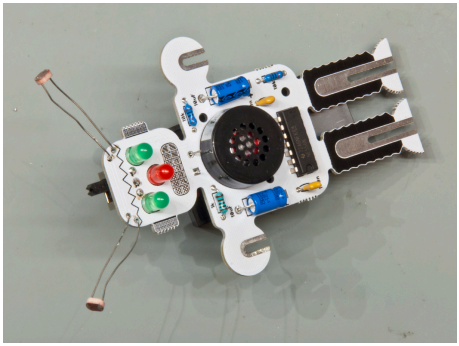
Secure the holder to the board using the included M2 screw and nut. The screw is inserted through the bottom hole of the holder and the nut goes on the front.

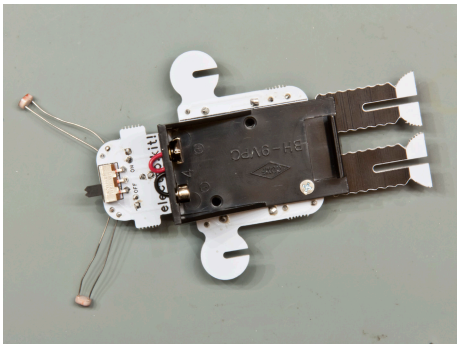
When the wires are soldered in place, snip off the excess

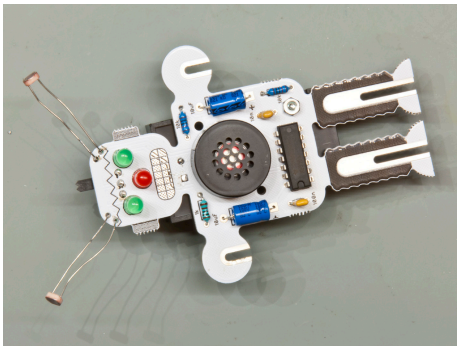
Now would be a good time to do some measuring to check whether there are any shorts or broken connections. To test for shorts, measure resistance between V+ and V- (red wire and black wire). The meter should read around 7.5kohm. If the resistance is lower, you might have a short somewhere. If the resistance is higher than 7.5kohm, you have probably missed a solder joint somewhere. The LEDs can be tested using the LED setting on a multimeter.

If everything looks ok and the measured resistances are fine, you can go ahead and plug in the battery and power on the circuit. If it makes noises and the LEDs light up, you have done well and can continue to the next step!







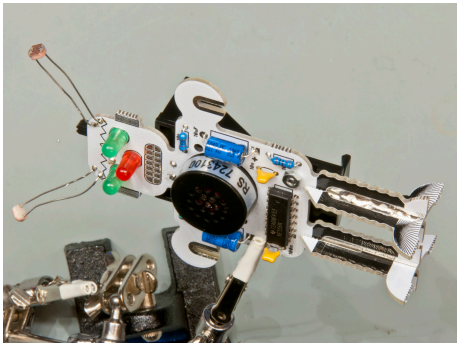


Here comes the fun, 3D part, of the build!

Gather up the broken off parts of the PCB. Two leg parts and two arm parts are needed.

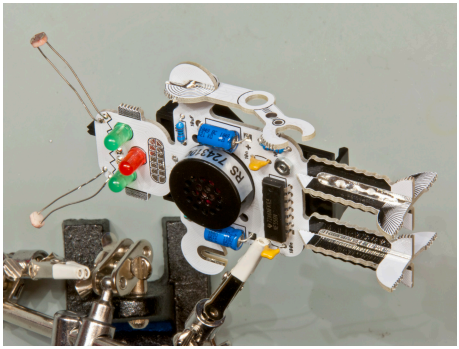
You can mount the PCB parts in any order, but in this guide we start with the legs.

First position the leg in the slot. The flattened, upper edge of the leg should line up with the battery holder on front.



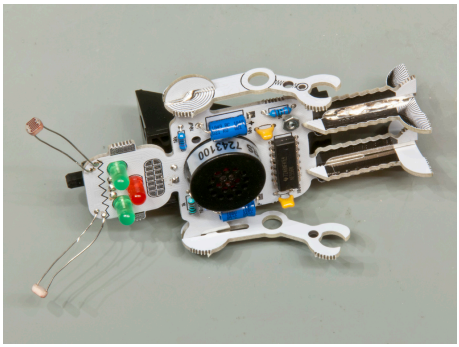
Make sure that the solder pad is facing out from the side; otherwise it will be very hard to solder it.

Position the robot so the leg stays in place. Placing the robot sideways at an angle like the image shows is recommended.



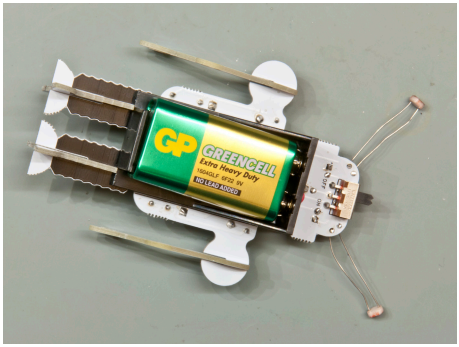
Then simply solder the entire length of the pad. Make sure the solder makes a nice slope between the two boards. Be careful not to drag the leg out of place when you solder.

Repeat the same process for the other leg and the two arms.



A note regarding the arms: The pads are a bit too small, so to fasten it really well, add a bit of glue to the joint after it's soldered.

The robot should now be fully assembled. Insert the battery in the holder. Flip the switch to ON and it should come alive!



The LEDs should light up and the speaker should make noise.

When exposed to light, the pitch should increase and when light is blocked, the pitch will decrease.

Troubleshooting

- The robot does nothing!
  - ✓ Go over all the solder joints. The most common mistake is a missed solder joint, a bad solder joint or a bridge between two pads.
  - ✓ Check that all components are correctly oriented and in the correct place.
  - ✓ Measure the battery voltage. If it's lower than 8.5V, replace the battery.
  - ✓ Make sure the power switch is in the "ON" position.

- The robot just makes a high pitched tone and nothing else!
  - ✓ The antenna leads might be shorted. The leads should not be touching each other.

- It makes sound, but the LEDs are not working!
  - ✓ Make sure they are oriented the right way.
  - ✓ If the robot is in a dark place, try shining some light on it.

- I can't get the arms and legs to stick to the rest of the body!
  - ✓ These are the hardest parts to solder as they require lots of heat to solder. It can take up to a minute with a low power iron to fully heat the pads. Be patient!

- The robot is wobbly and falls over!
  - ✓ Check that the legs are soldered at the same height. If not, you can reheat the pads while the robot is standing up and move the legs so they are both the same height.

- I have checked all the extremely helpful tips above but it still doesn't work!
  - ✓ Then you should contact Electrokit for robot counseling.

Errata

- The pads for the arms are wrong size and will break easily. To secure them more permanently, a dab of glue can be added after they are soldered in place.

- Silkscreen for the speaker and one of the capacitors are obscured.

- Two of the mounting holes for the battery holder are too close to the speaker and cannot be used. This is quite ok though as it will be firmly mounted with just one screw.