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Atari Punk Console

Build Instructions

Atari Punk Console

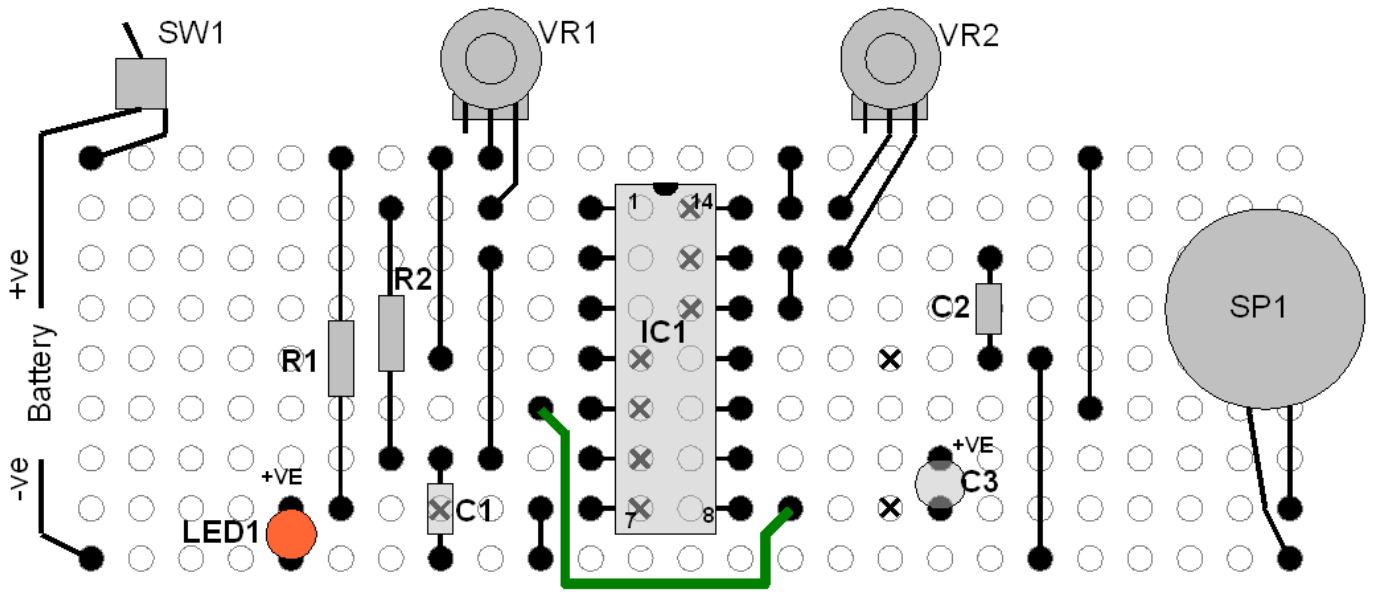
Building guide from www.lushprojects.com

The Atari Punk Console is a fun little “musical” circuit which is good for teaching basic practical skills. It gets it's name because it sounds a bit like the noises made by the first Atari computer games.

This version of the APC has both an internal speaker and a connection to an external amp or mixer. Two controls (VR1 and VR2) change the sound of the APC.

This pack contains a complete guide on how to build the APC. The diagram on the right shows the complete circuit as we are going to build it. If it looks complicated don't panic! We are going to go step by step through the build process.

Top View, Variable resistors drawn looking from front



Key

- Cut track on bottom (10 total)
- Wire connection (7 total)
- Component
- Empty hole
- Hole used for connection

Consumables needed:
Tinned copper wire (about 24SWG)
Insulated stranded wire
Solder

Tools needed:
Soldering Iron
Wire cutter
Wire stripper (ideal) or knife
Small drill (3-4mm) for cutting tracks
Small pliers (ideal)

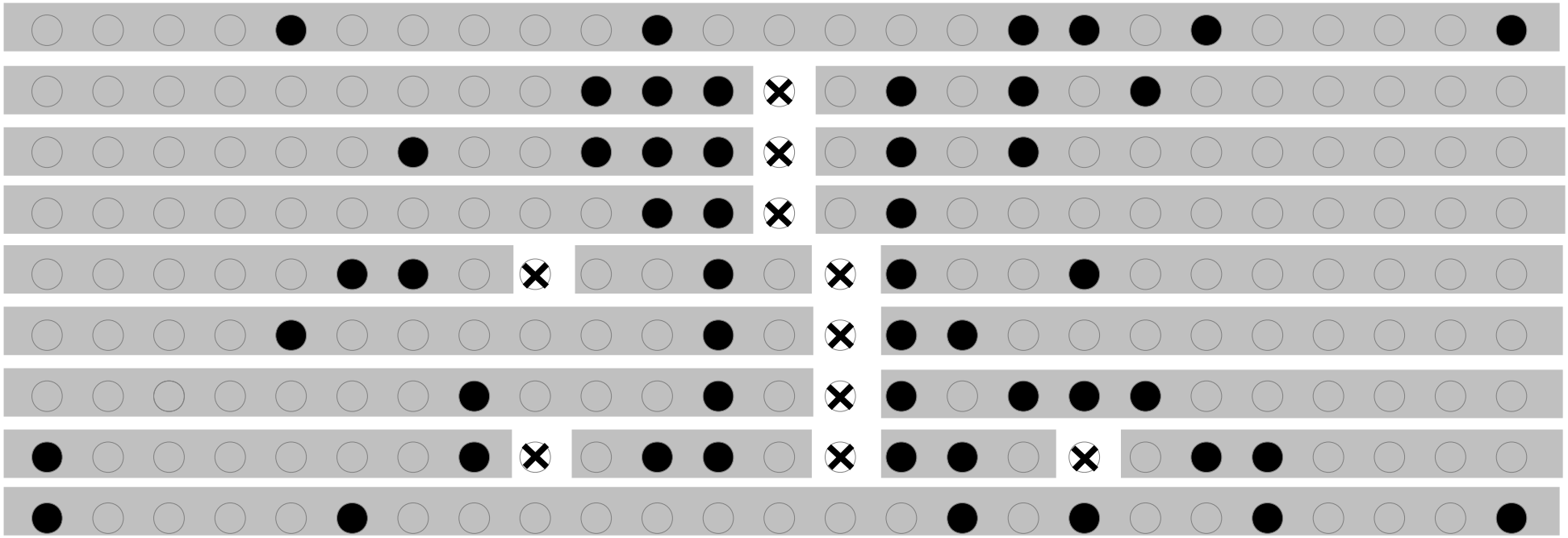
Parts list

IC1	556	(82-0344)	C1	10nF	(08-0232)
R1	120R	(62-0348)	C2	100nF	(08-0235)
R2	1k	(62-0370)	C3	10uF	(11-0220)
VR1	470k Lin	(65-0540)			
VR2	470k Lin	(65-0540)			

Battery	4x AA cells – 6 volt in box	(18-2913)
SP1	8 Ohm speaker	(18-2913)
SW1	SPST Toggle Switch	(75-0125)
LED1	3mm Orange LED	(55-0097)
Circuit board:	25 x 9 Stripboard	(34-0500)
Knobs:	3	(32-0270)
IC Socket	14 pin DIL	(22-0155)

Numbers in brackets are order codes from www.rapidonline.com

Atari Punk Console – Bottom View



○ = Empty hole

● = Hole with lead coming through

⊗ = Cut track on bottom

▭ = Copper strip

Getting started

This design for the Atari Punk Console uses “stripboard” to build the circuit. Stripboard has strips of copper on one side to make tracks to join components. Components go on the plain side and joints are made on the copper side. **Tracks have to be cut using a small drill or knife where you don't want a connection.** The easiest way to make a cut is just to spin a small drill by hand in the hole you want to cut. Check the cuts very carefully to make sure you really have cut the track.

The holes in the stripboard are 0.1” (2.54mm) apart. This is a commonly used spacing for many devices. However a lot of modern components use smaller spacings. Using stripboard is very much like using Printed Circuit Boards (PCBs) that are common for more complicated projects.

Stripboard is sometimes called “Veroboard” after the most well known manufacturer. Watch out though because some people call different types of board “Veroboard” as well!

For soldering to the stripboard see the diagram on the right. To solder to components off the board either thread the wire through a hole or wrap round a pin before soldering.

Build Step 1:
Take the stripboard and cut the 7 tracks under IC1. Use the diagram of the bottom view to make sure you cut in the right place. Just cut the copper track – you don't need to cut through the whole board
Remember: measure twice. Cut Once.

Elf and Safety

Soldering irons are hot. Anything they touch also gets hot. Take care not to touch them! If you to get burnt hold the burn under cold water for at least 5 minutes. When cutting wires try not to let little pieces ping off all round the room. Keep your build area tidy. Don't trip over power leads.

Molten solder gives off fumes which can irritate the lungs and throat. These fumes aren't the metal in the solder but are the “flux” which is put in the solder to help if flow smoothly over the joints. Use good ventilation.

Electronic parts contain materials which are not good if ingested. Wash your hands before handling food.

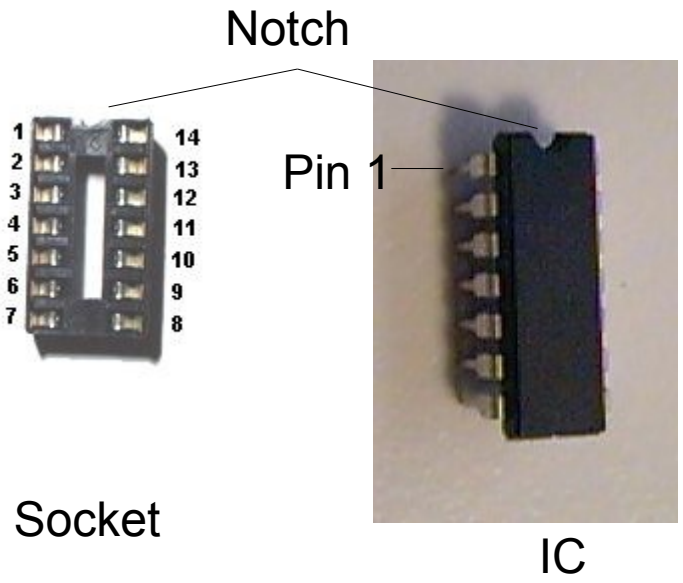
Integrated Circuits

Integrated circuits (“ICs”) are single packages that contain complete circuits consisting of many components. Today almost all ICs are silicon chips. Intel claims to have produced single ICs with 2,000,000,000 transistors.

The Atari Punk Console uses just one IC called the “556”. The 556 is a dual version of a very well known IC called the “555” timer. It contains about 20 transistors, so isn't exactly state of the art.

Like a lot of ICs used by hobbyists the 556 is in a “Dual In Line” (DIL) package with two parallel rows of pins. The pins are numbered clockwise round the package. Pin 1 is shown with a small dot or notch at one end. The pins for DIL ICs fit on the 0.1” grid used for stripboard.

Because ICs can be damaged by heat from soldering it is best to use a socket to mount them in if you are unsure of your soldering ability.

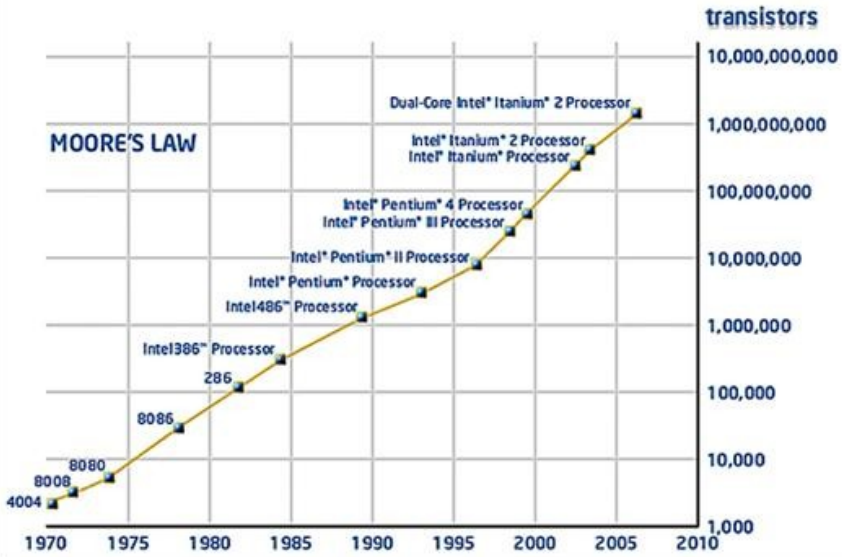


Note about IC Numbering

Numbering of ICs a pretty hit and miss. The “556” is just the base name for the device. The full number will have other numbers or letters attached depending on which company makes it, what type of package it's put in and so on. You will often find lots of variants of the same IC with similar numbers. The IC in my APC says it's an “NE556N”.

Gordon Earle Moore
(3 January 1929-)

Observed that the capacity of economically feasible ICs doubles approximately every 2 years.



Build Step 2:
Insert your IC socket in the stripboard where shown on the diagram. Make sure it's going in the right way round.

Solder one corner pin and then check that the socket is nice and level in the board. If not melt the solder on the pin and push it in nicely.

Now solder the remaining pins. Take care not to bridge adjacent tracks when soldering.

Build Step 3:
Make the three remaining cuts on the circuit board around IC1. Check they are in the right place before cutting!

About wire

For the simple straight connections on the board you can use plain (uninsulated) “tinned copper wire”.

For connections to the components off the board and the the connection round the bottom of IC1 it is best to use an insulated stranded wire. Strip about 5mm of insulation off the ends using a knife or a wire stripping tool before making connections.

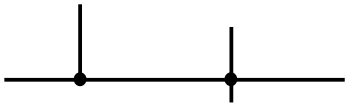
It is OK to move connections to a different hole on the same copper strip. I recommend though that you copy the diagrams above to avoid confusion.

If you run in to problems soldering it is OK to leave small solder deposits on a track. However make sure that solder bridges are not made between parallel tracks on the board.

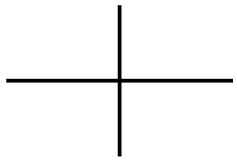
Build Step 4:
Put in the wire links on the circuit board.

Cut the wire to roughly the right length and then working from the plain side of the board bend and push each end through the right hole. On the bottom of the board bend the ends of the wire out a fraction to hold it in place.

Solder the wire in place and cut off the excess wire on the bottom.



Symbol for wires joining



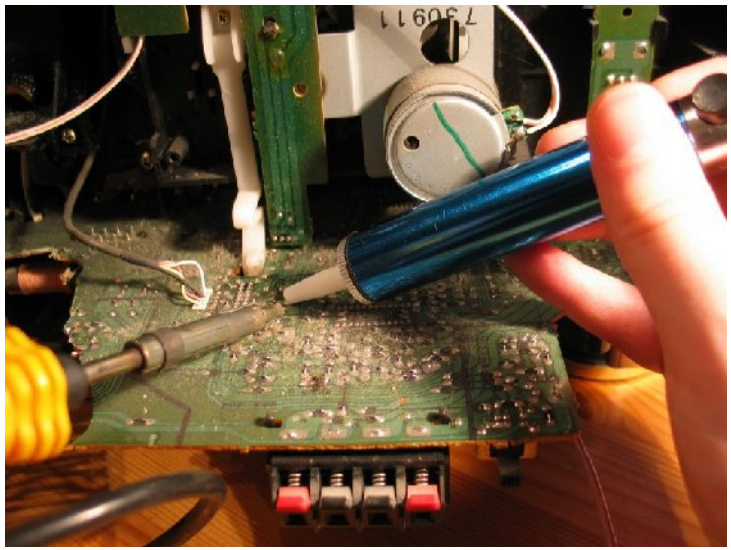
Symbol for wires crossing without joining

Fixing mistakes

Now is a good time to talk about fixing mistakes. If you solder something in the wrong place, or make a bad joint don't panic!

Using a solder-sucker (like the one above) you can fix almost anything by removing the old solder and starting again.

To use the sucker:
1) prime the sucker by pressing the big plunger at the end down until it clicks.
2) melt the solder with your soldering iron.
3) keeping the iron on the joint use your other hand to bring the tip of the solder sucker next to the joint.
4) press the button in the middle of the sucker. The plunger will pop out and suck the molten solder off with it.
5) repeat as necessary until you can free the wires



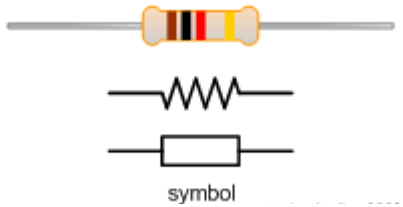
Resistors

Resistors limit the flow of electricity through part of the circuit. This can be used to control timing circuits and divide voltages in to smaller portions.

Resistance is measured in Ohms (Ω),
kilohms (1,000Ω=1kΩ) or
Megohms (1,000,000Ω =1MΩ)

Resistors can go in the circuit either way round. The value is marked on the device with a colour code (see right), or it can be measured with almost any multimeter.

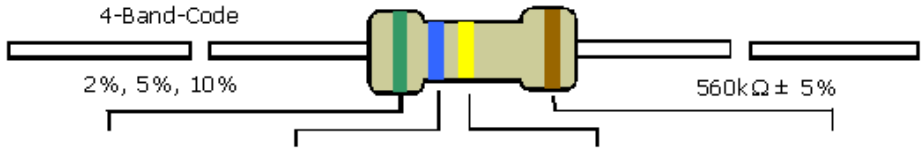
A shorthand is often used to write the value of a resistor. For example:
“100R”=100Ω
“10k”=10kΩ
“4k7”=4.7kΩ



Colour codes for resistors used in this circuit (first three bands of a “four band” resistor):
R1 = 120R = Brown, Red, Brown
R2= 1k = Brown, Black, Red

Build Step 5:
Put the four resistors on to the Atari Punk Console circuit board. Mount the resistors as shown on page 3

Resistor Colour Code



COLOR	1st BAND	2nd BAND	3rd BAND	MULTIPLIER	TOLERANCE	
Black	0	0	0	1Ω		
Brown	1	1	1	10Ω	± 1%	(F)
Red	2	2	2	100Ω	± 2%	(G)
Orange	3	3	3	1KΩ		
Yellow	4	4	4	10KΩ		
Green	5	5	5	100KΩ	±0.5%	(D)
Blue	6	6	6	1MΩ	±0.25%	(C)
Violet	7	7	7	10MΩ	±0.10%	(B)
Grey	8	8	8		±0.05%	
White	9	9	9			
Gold				0.1	± 5%	(J)
Silver				0.01	± 10%	(K)

Georg Simon Ohm

(16 March 1789 – 6 July 1854)

Discovered the relationship between voltage and current in electrical circuits “Ohm's Law”.

Capacitors

Capacitors store and release small amounts of electrical charge. In electronic circuits they are used to control the timing of circuits, “smooth out” electrical waveforms and to separate DC and AC components of a signal.

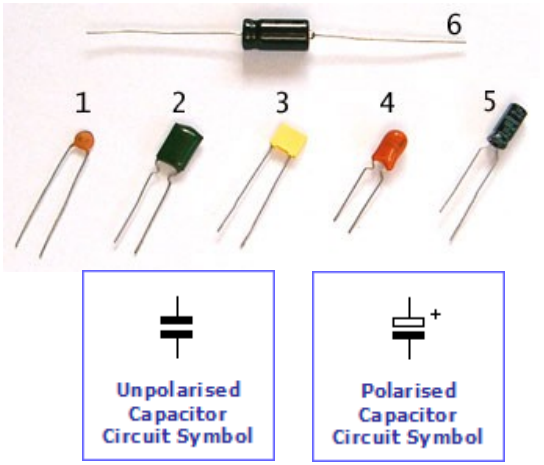
Capacitance is measured in Farads (F), but one Farad is much too big to be practical. Useful units are:
Micro Farads (µF or uF) = 1/1,000,000th of a Farad
Nano Farads (nF) = 1/1,000,000,000th of a Farad
Pico Farads (pF) = 1/1,000,000,000,000th of a Farad

Capacitors less than 1uF can normally go in a circuit either way round. Larger capacitors normally have a polarity (normally the negative end is marked) and have to go in a circuit the right way round.

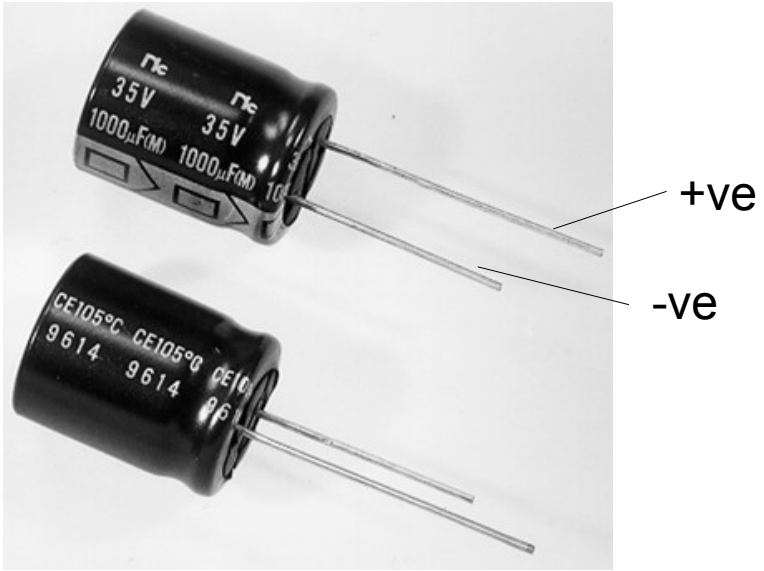
Capacitors come in a many different types that are designed for different applications. For this circuit the type used isn't important so we've used the cheap and cheerful options. The small capacitors are “ceramic discs” and the large capacitors are “electrolytics”.

Several labelling schemes are in common use for capacitors. The ceramic discs used in this circuit are labelled with three digit codes. The first two digits are the value and the third digits is the number of zeros making up the capacitance in pF.

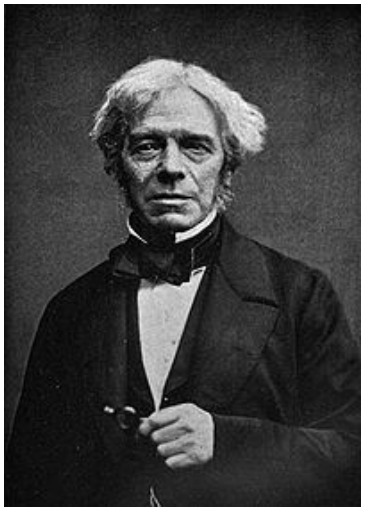
So:
C1= 10nF = 10,000 pF = “103”
C2 = 100nF = 100,000pF = “104”



Electrolytic polarity



Build Step 6:
Add the three capacitors to the circuit. Take care to connect C3 the right way round.



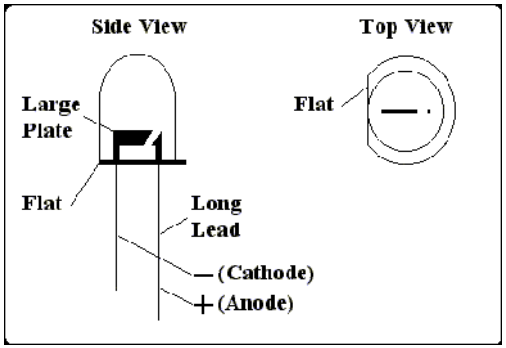
Michael Faraday

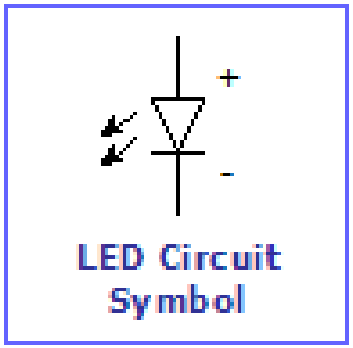
(22 September 1791 – 25 August 1867)

Discovered the fundamental relationship between electricity and magnetism (amongst many things).

Light Emitting Diode (LED)

LEDs are solid state devices that emit light when electricity passes through them. They are directional and need to go in the circuit the right way round. This circuit has one LED as a power indicator.





Build Step 7:
Add the LED to the circuit board (check it is the right way round).

Congratulations – you have now put all the components on the circuit board! All the remaining components are off the board. We'll be using “flying leads” (ie short lengths of wire) to connect them.

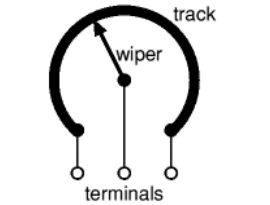
Captain Henry Joseph Round

(2 June 1881 –17 August 1966, Bognor Regis)
First to observe light emitted by a solid state diode

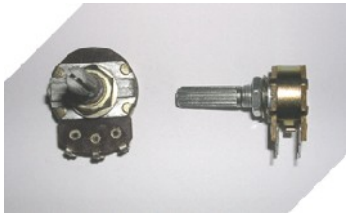
Variable Resistors

A variable resistor changes it's value depending on the position of rotating shaft (or slider). They are often used as controls in electronic circuits. There are two basic types: “linear” (lin) and “logarithmic” (log). Log types are used as volume controls as this matches the characteristics of the human ear.

Variable resistors have a wiper contact that moves over a resistance track. There are three connections – each end of the track and the wiper. The wiper is the connection in the middle.



symbol



Build Step 8:
Connect VR1 and VR2 to the circuit board. To make the connection use insulated stranded wire. Stranded wire is made of thin strands twisted together and is designed to withstand movement. To make the connections strip each end of the wire and twist the inner wires together before threading them through or around the thing they are to be attached to. Solder the connections up.

Speaker 1 (SP1)

Speakers convert electrical signals in to sounds using electromagnets. Like resistors they have a resistance measured in Ohms.

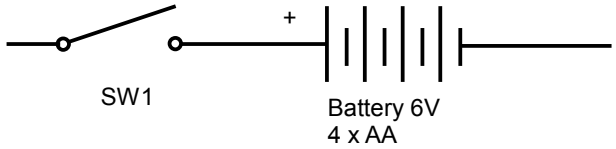
Speakers are normally labelled with “+ve” and “-ve” terminals, but the polarity doesn't normally matter unless there is more than one speaker in the system.

Build Step 10:
Connect speaker 1 to the circuit.

Switch 1 (SW1) and batteries

Switch 1 is an on/off switch for the project. It is a Single Pole Single Throw (SPST) switch. This means it has one connection that is either on or off. The switch can go in either way round.

The batteries are four AA (1.5v) batteries making 6v in total. We are going to use a box with flying leads to contain the batteries.



Switch and battery symbols

Build Step 11:
Connect the switch and the battery box in to the circuit as shown on the master diagram. The positive battery lead is the red one.

Build Step 12:
Check your work. Look at all the connections. Do they look good? Are they in the right place and connecting the right components? Be methodical. Make sure you look carefully at everything. Compare to the diagrams in this pack.

Spending time on a through check now will save time later.

Build Step 13:
Insert IC1 in to the socket. Make sure it goes in the right way round. You may have to use small pliers to bend the pins in to the middle before it will fit properly.

Build Step 14:
Insert the batteries (the right way round) and switch on. You should now have a little electronic instrument you can play with.

Yay it works!

Congratulations. Hope you enjoyed the build and feel inspired to try other projects in the future.

Ahhh It's Not Working

OK you've got this far and it isn't working. Don't panic. Check these things:

- Have you put all the components and wire links in? In particular check the very short wire links around IC1.

- Make sure VR1 and VR2 are around the middle. This is where the circuit works best.

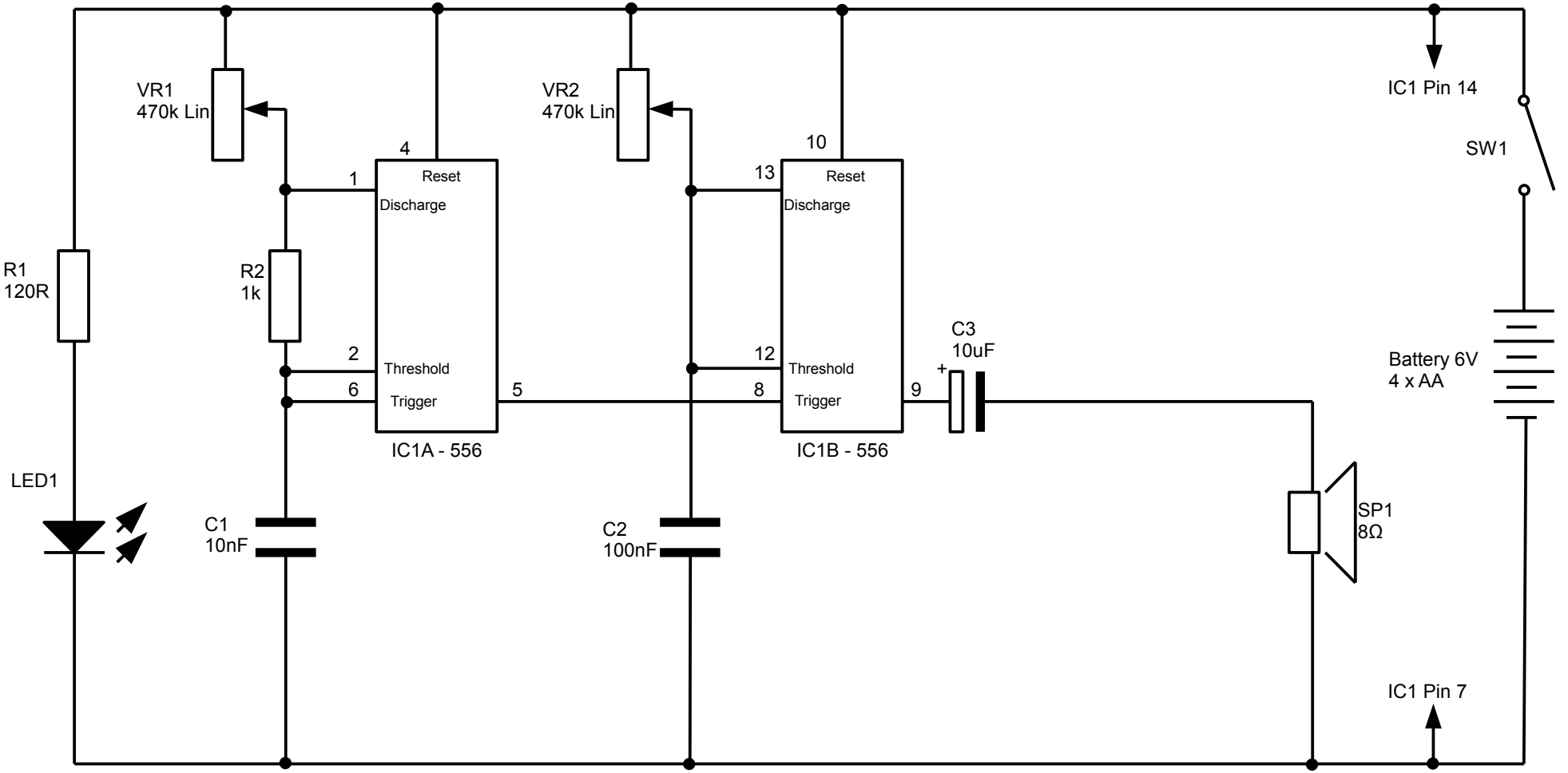
- Go back to step 12 and double check everything. 99% of problems are caused by small mistakes in wiring – eg solder bridges between connections or track cuts that haven't gone all the way through.

- Does LED1 light up? If not then you probably have a problem with the power connections. Check the batteries, switch and connections to the board to help find the fault. Check LED1 is round the right way.

- Are IC1 and C3 the round the right way? If you put IC1 in backwards you may have destroyed it.

- If all else fails try connecting your speaker between pin 5 of IC1and the -ve battery lead. This is the output of the first part of the circuit. If you hear a tone then VR1, R2 and IC1 are all working. Check the remainder of the circuit to find the fault.

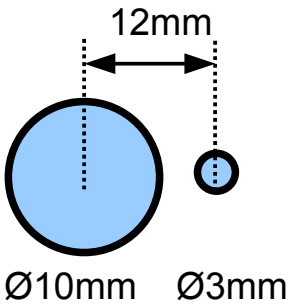
Atari Punk Console – Circuit Diagram



Case Making

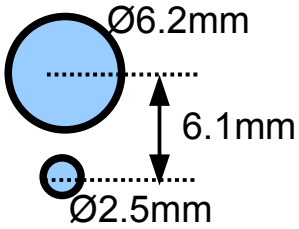
Hole cut outs

VR 1- 2



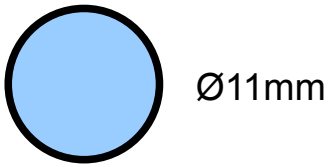
NB: Small hole is optional to locate tab. Bend tab out of way if not using

SW 1



NB: Small hole is optional to locate tab. Remove tabbed washer if not using.

SK 1



Drilling Tips

1) Mark out all holes and check before drilling

2) Put a pilot dimple in the centre of each hole. For plastic and wood press in with a pointed metal tool. For sheet metal use a centre punch.

3) Put scrap wood under item to be drilled

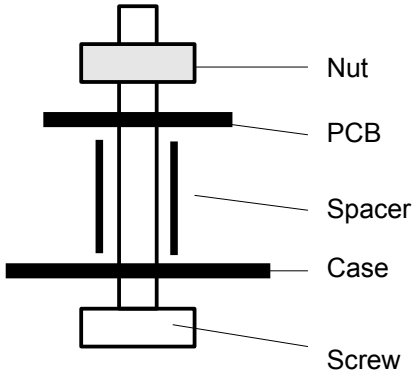
4) Drill hole. For larger sizes (>5mm) drill up in several steps

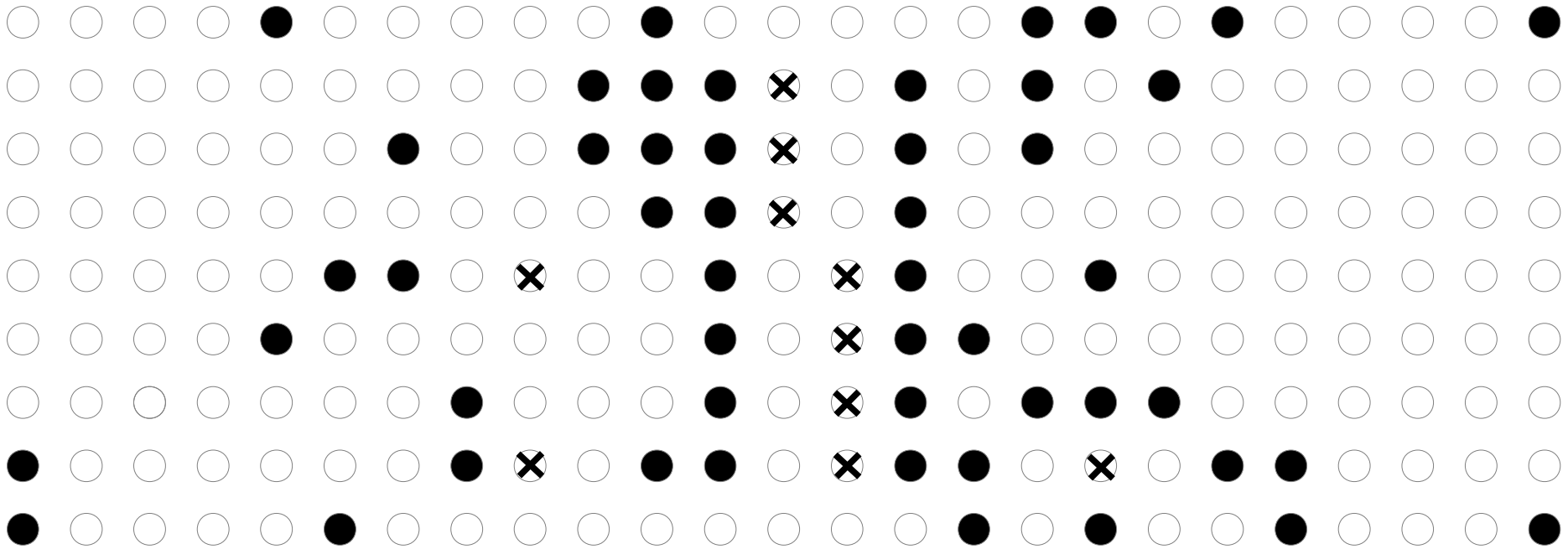
Safety: Never put your hand behind an item you are drilling. Wearing safety glasses is advisable. Remember drills can easily grab work and spin it around. Take extra care when the drill is “breaking through” or use clamps.

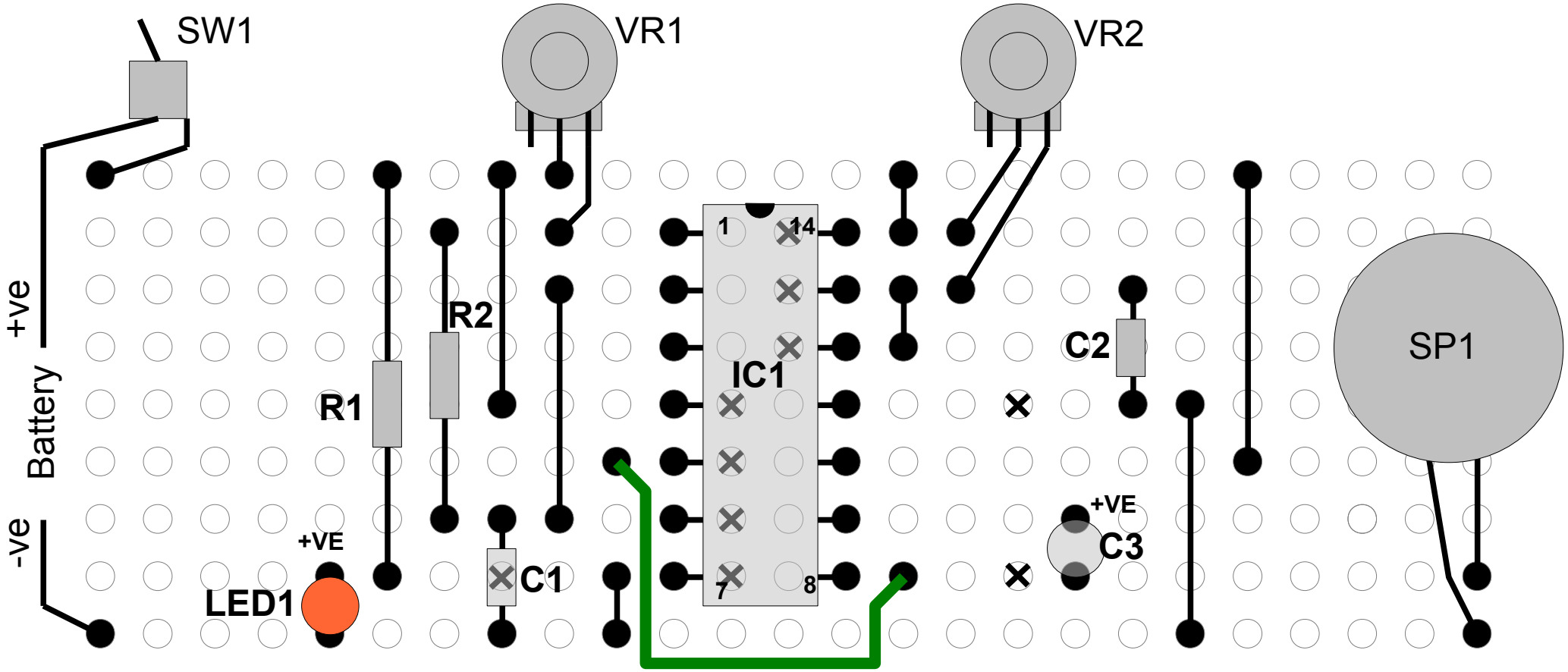
Mounting the Circuit Board

Option 1 (quick and dirty): Use sticky pads.

Option 2 (proper but slow):
a) Drill two 3mm holes at either end of the board.
b) Cut the tracks near the holes so that metal screws through the holes won't interfere with the circuit.
c) Drill corresponding holes in the bottom of the case.
d) Thread 3mm screws up from the bottom of the case and then through spacers and the circuit board. Secure with a nut.

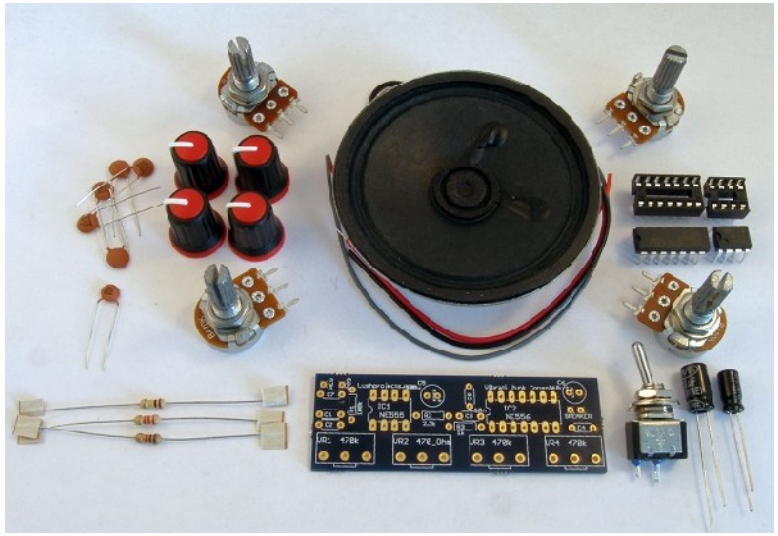


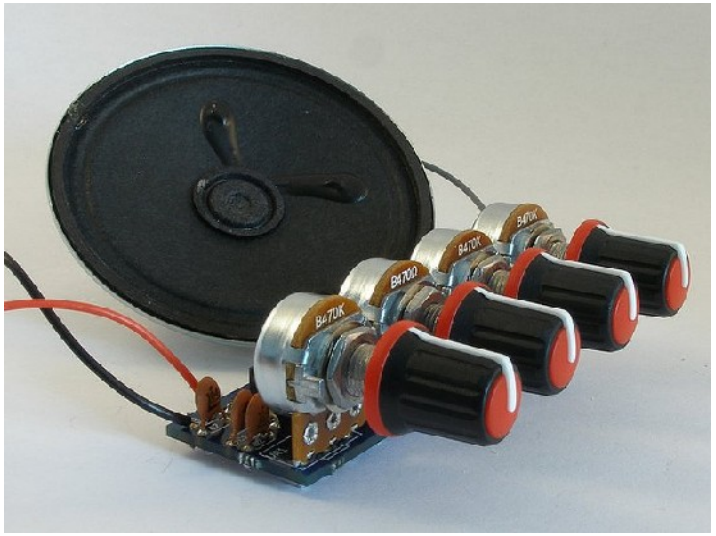



SW1
VR1
VR2
+ve
Battery
-ve
R1
R2
C1
+VE
LED1
IC1
1
14
7
8
C2
+VE
C3
SP1

Vibrati Punk Console kit available at:

lushprojects.com/vpc





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