Assembly Instructions for KSAA03 ***(Mono Amplifier – 1 Watt)***

What it does:

This a mono (single) channel Audio Amplifier which is capable of delivering 1 Watt peak output power.

What we are making:

Fig 1: Finished Product

Technical Specs:

- Power supply: 5 -12 VDC
- Current : 150 mA (max.) 24mA (standby)
- Max output power: 1 W into 8 Ohm
- PCB dimensions: 38 x 36 mm (Height = 25 mm)

How it works:

The incoming Audio signal is passed through Capacitor C1 to the top of the Potentiometer, which acts as a "Voltage Divider". The output from the Potentiometer is fed into the Integrated Circuit "IC" . The Potentiometer is therefore acting as a "Volume Control" for the system. The "Gain" of the LM386 is fixed. It is controlled by the capacitor connected between Pins 1 and 8. In this set up the gain is fixed at 200.

Circuit Diagram:

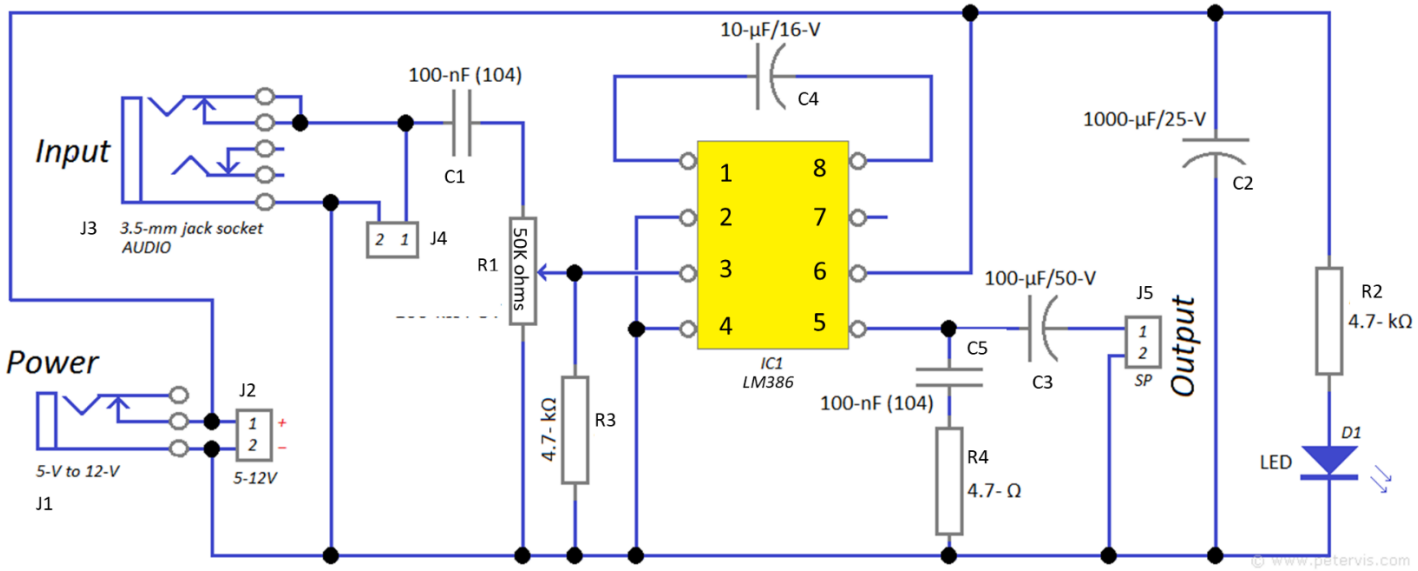


Fig 2: The Audio Amplifier Circuit Diagram

Before you start:

1) Make sure that you have all your equipment available. You will need:
    a. Soldering Iron
    b. Solder
    c. Cleaning pad (We recommend sponge which is wet with water).
    d. Side Cutters
    e. Kit KSAA03
    f. Instruction sheet
    g. A waste bin (or bag) close by for a lot of small "off cuts".
    h. We recommend a clean mat or surface protector for your desk.
    i. Ensure that you are in a well ventilated area. The fumes from the solder resin can become annoying (though they are not toxic to humans).
    j. Wash your hands after working with the electronics kits and the solder. Especially before you eat anything ! !

2) Ensure that you have plenty of space around you. (You are going to need to "spread out" your components at the start, and avoid getting them mixed with some-one else's.)

3) Ensure that you have good lighting to see and read your components.

4) We recommend that you also have some spare "bags" (or other containers) to store your components and work between classes. This is in the event that you do not get everything finished in one session.
(It can be disappointing to spend some time sorting your components and then finding them all mixed up again when you return!)

5) Do NOT rush! Time spent carefully sorting at the start and avoiding errors is wisely invested, rather than trying to fix problems later!

6) Read through the instructions for each "Step" before you start doing that step. There are often handy tips & advice in the instructions!

How to build it:

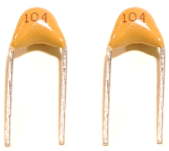
Step 1. Identify your components and sort them into groups.

Use the checklist below to ensure that you have all your necessary components. *(We recommend that you "tick off" each component when you know you have it clearly identified).*

KSAA03 Mono Audio Amplifier - 1 Watt

For this task you are required to :

- Identify all of the components within your kit, to ensure that your kit is complete
- Assemble the kit so that it works as per the instructions

Component Name	Value	Qty	Identification Markings	Image
Resistor 4R7Ω	4.7 Ohms	1	Yellow-Violet-Black-Silver-Brown	
Resistor 4k7Ω	4,700 Ohms	2	Yellow-Violet-Black-Brown-Brown	
Potentiometer 50kΩ	50,000 Ohms	1	B50K	
Volume Control Knob (for Potentiometer)		1		
Capacitor (Electrolytic) 10µF	0.00001 Farads or $1.0X10^{-5}$ Farads	1	10µF	
Capacitor (Electrolytic) 100µF	0.0001 Farads or $1.0X10^{-4}$ Farads	1	100µF	
Capacitor (Electrolytic) 1000µF	0.001 Farads or $1.0X10^{-3}$ Farads	1	1000µF	
Capacitor 10nF	0.00000001 Farads or $1.0 X10^{-8}$ Farads	2	104	

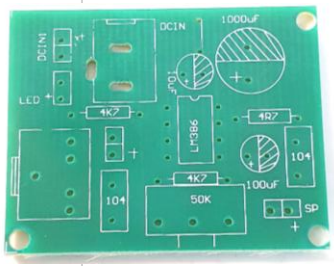
Integrated Circuit		1	LM386		
IC Socket (8 Pin)		1			
LED - red		1			
3.5 mm Audio Input Socket		1			
Pin-Headers for Stakes (for wire connections & jumpers)		3			
2.1 mm Power Input Socket		1			
PCB (Empty)		1			

Fig 3.1 Identifying Component Values

Step 2. Installing the Resistors

By referring to *Fig 3.1* determine the value of each resistor and place them in their correct positions as indicated on the printed circuit board (PCB).

Do this by carefully bending their wires down to form a 'U' shape and poke through the holes in the PCB as shown in *Fig4.1*.

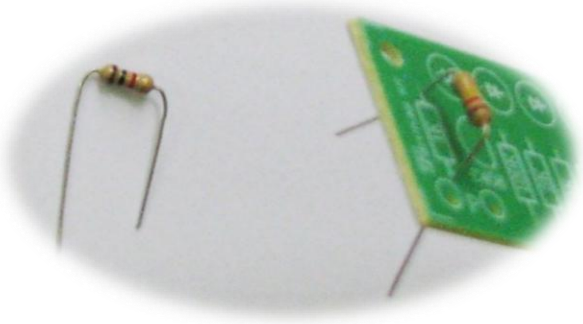


Fig 4.1 Installing Resistors

As far as possible, try to keep the resistors "oriented" in the same direction. (Try to keep the brown band at the same end of the installed resistors.) See Figs 4.2 and 4.3 for our suggested pattern.

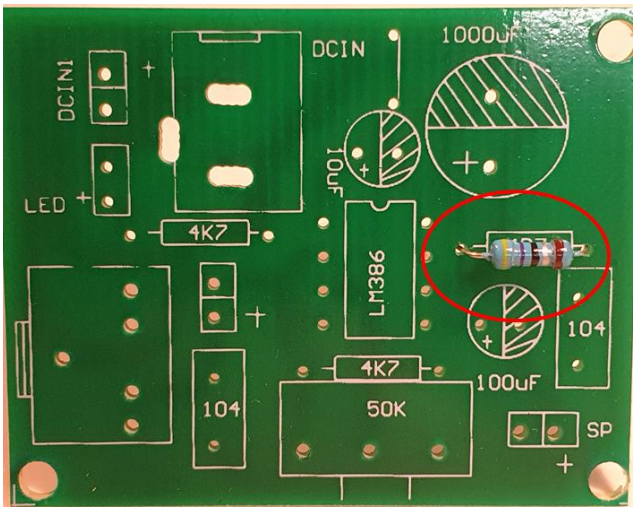


Fig 4.2 Installing 4R7Ω Resistor.

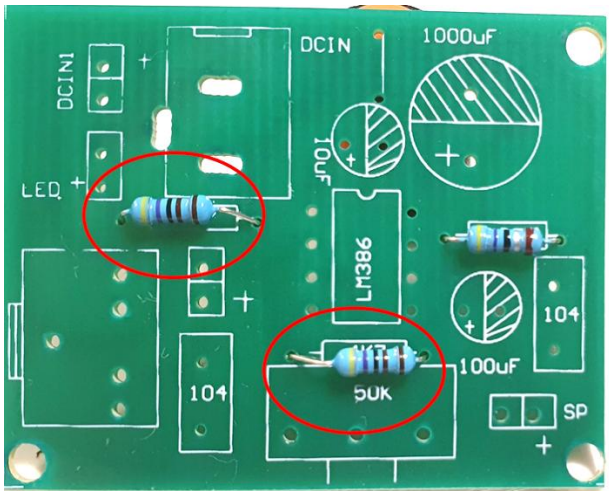


Fig 4.3 Installing 4k7Ω Resistors with consistent orientation.

Step 3. Installing the IC Socket

Please inspect the IC Socket closely, and identify a small "notch" at one end of the plastic body. Carefully insert the IC Socket so that the "notch" is at the same end as the marking on the PCB.

Take particular care to align the "notch" correctly, as that will later be used to identify the orientation for the IC to follow. Refer to Figure 5.1.

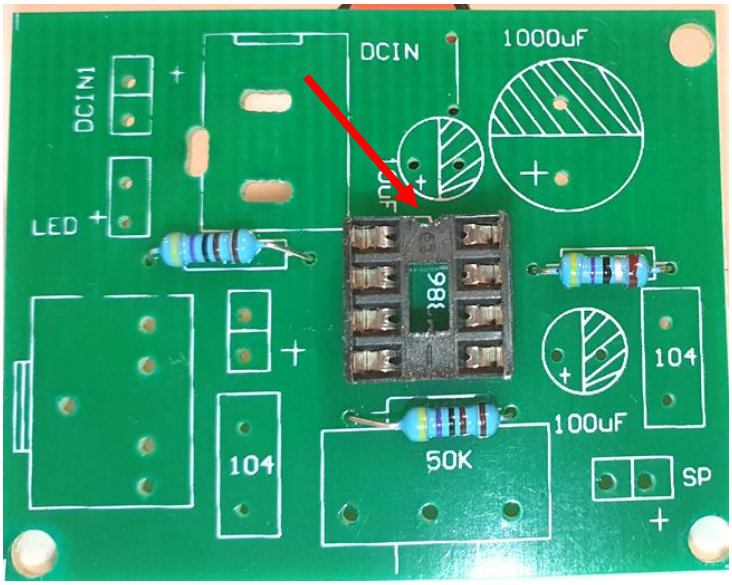


Fig 5.1 Showing the PCB with the IC Socket installed, and the "notch" highlighted for correct orientation.

Step 4. Installing the Capacitors

Carefully identify the different capacitors to be used.

There are two “families” of capacitors used in this kit. These are “Electrolytic” Capacitors and “Ceramic” Capacitors.
Refer to Fig 3.1 to determine the values of the different capacitors.

Start by identifying the (small) ceramic capacitor to be installed. For these devices polarity does not matter, so you can insert it in either direction. Insert the 10nF capacitors into the holes marked with “104” . Refer to Figure 6.1 for the PCB with the first two Capacitors installed.

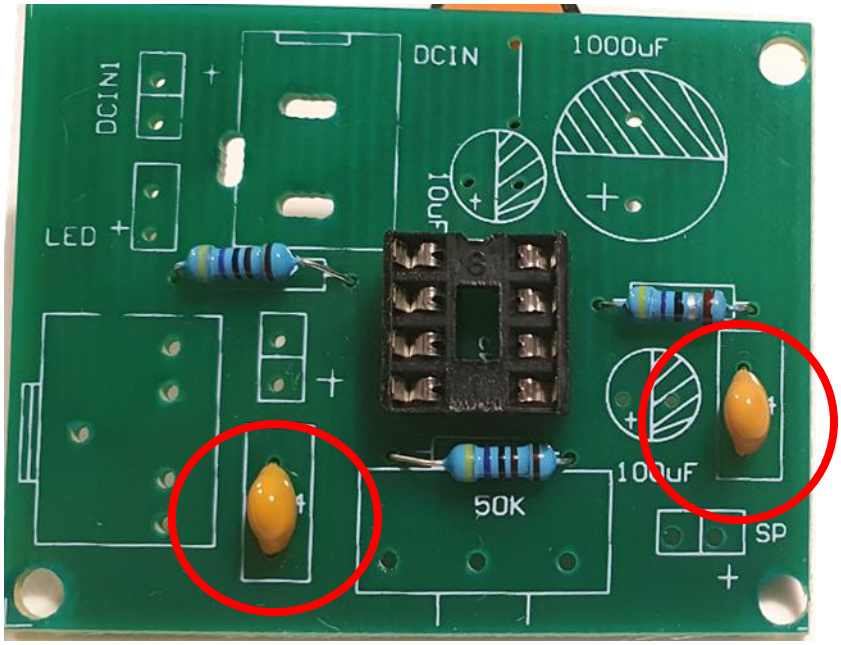


Fig 6.1 Identifying the position of the first two Ceramic Capacitors.

Once these capacitors are in the correct positions, solder into place and trim the excess wire from under the PCB.

Next identify the “electrolytic” Capacitors *(They are the larger, blue cylindrical units.)*
Now carefully identify the “+” and “-“ legs. This is important!

Hints:

i) On new components, the longer leg is the "+" leg.
ii) These capacitors also have a big stripe marking their "-" leg.

Refer to Figure 7.2

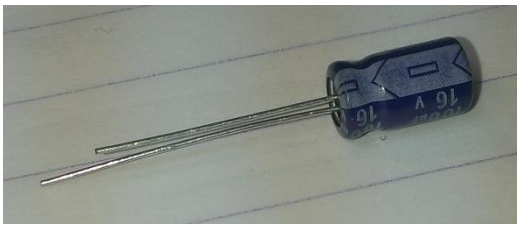


Fig 6.2 Showing the different leg lengths and the "-" marking on the body of an electrolytic Capacitor.

Next , identify the "+" holes on the PCB for the electrolytic capacitors. These MUST have the longer leg inserted into it! Refer to Figure 6.3 for some of the marked holes.

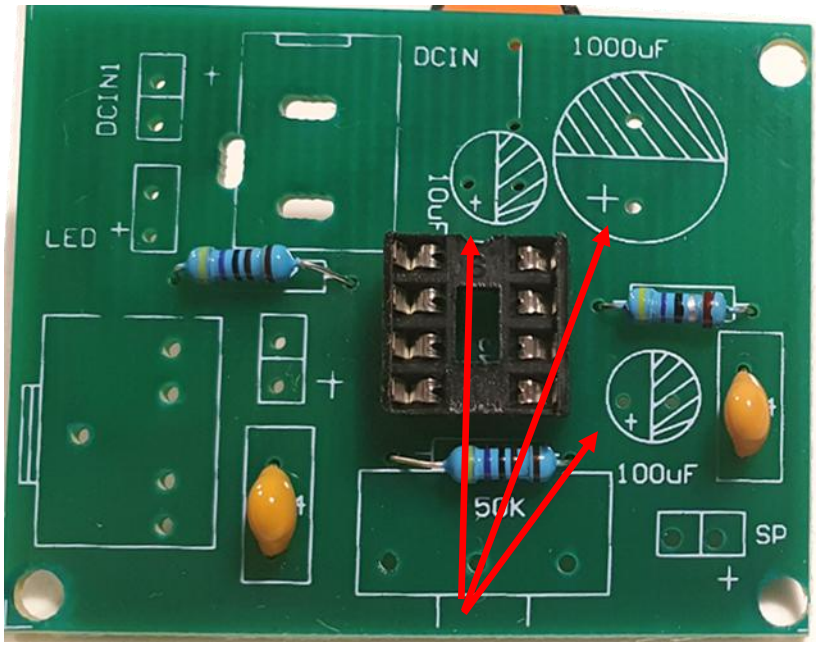


Fig 6.3 Showing the "+" hole on the PCB for the electrolytic Capacitor.

Once your electrolytic capacitors are in the correct position and facing the correct way, solder them into place and trim the excess wire from under the PCB. Refer to Figure 6.4 to 6.6.

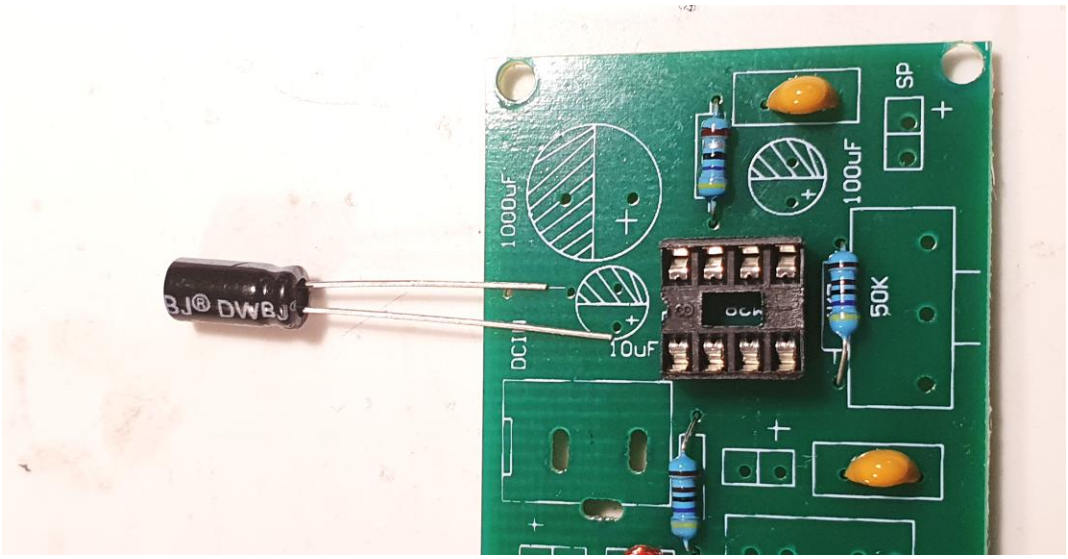


Fig 6.4 Showing the PCB with the 10μF electrolytic Capacitor about to be installed.

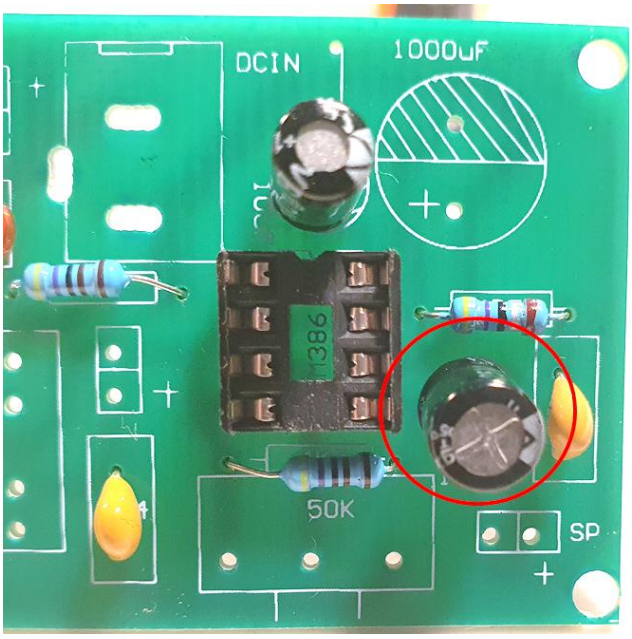


Fig 6.5 Showing the PCB with the 100μF electrolytic Capacitor now installed.

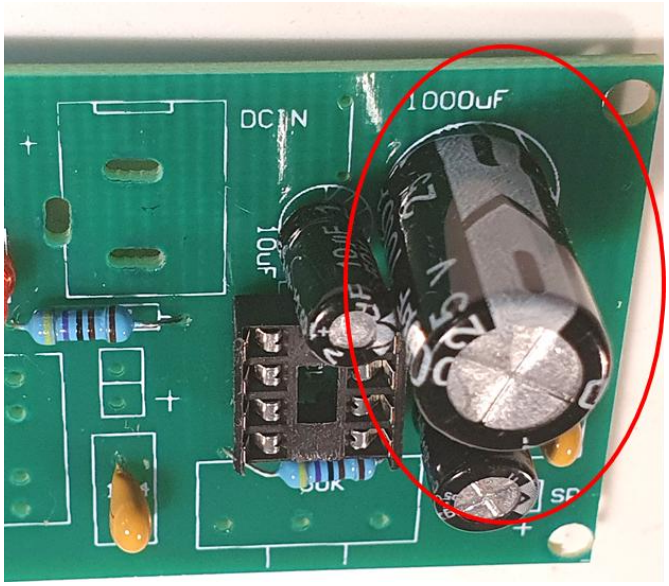


Fig 6.6 Showing the PCB with the 1000µF electrolytic Capacitor installed.

Step 5. Insert the "LED"

Take care with the polarity of any LED. They must be installed facing the correct way. Ensure the longer leg of each LED is placed at the back of the triangle in the diode symbol or to the "+" symbol which is shown on the PCB (see *Fig 7.1*). Once in the position solder it into place and trim the excess wire.

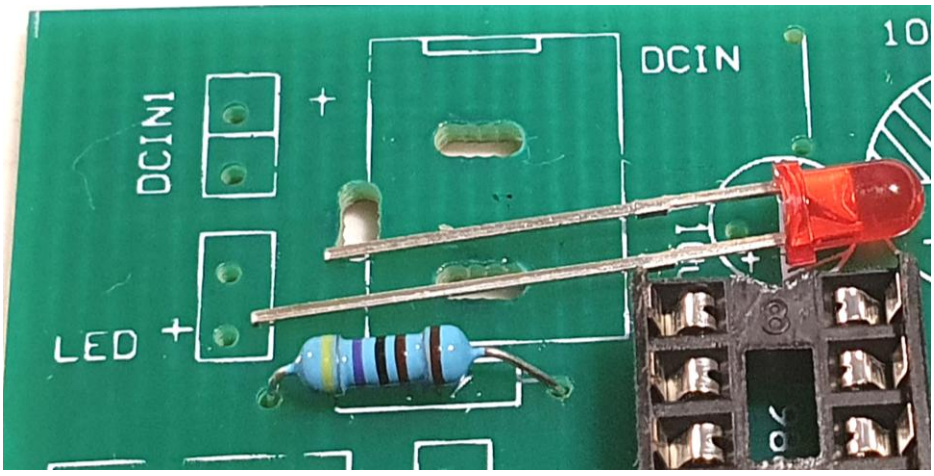


Fig 7.1 Installing the Red LED

Step 6. Install the Integrated Circuit ("IC").

Carefully orient the IC to ensure that the "notch" is aligned with the markings on the PCB and the "notch" on the IC Socket. Refer to Figure 8.1 showing the Integrated Circuit ("IC") installed.

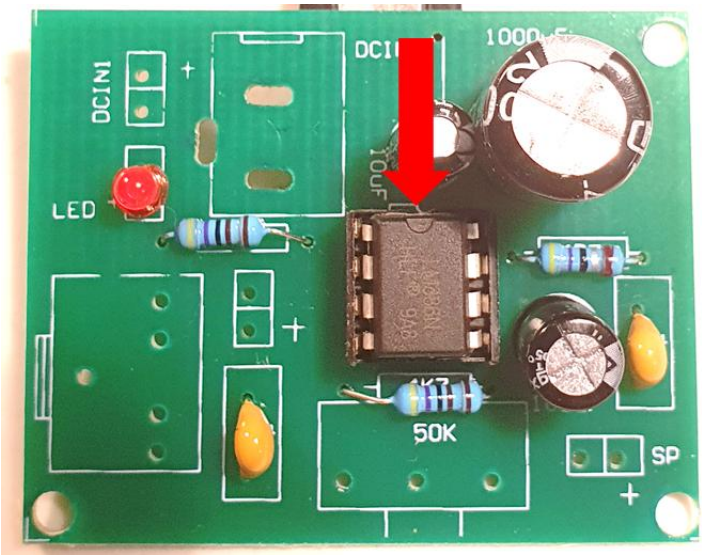


Fig 8.1 Showing the IC installed correctly.

Step 7. Insert the "Stakes"

Install the three sets of pins. Refer to Figure 9.1 .

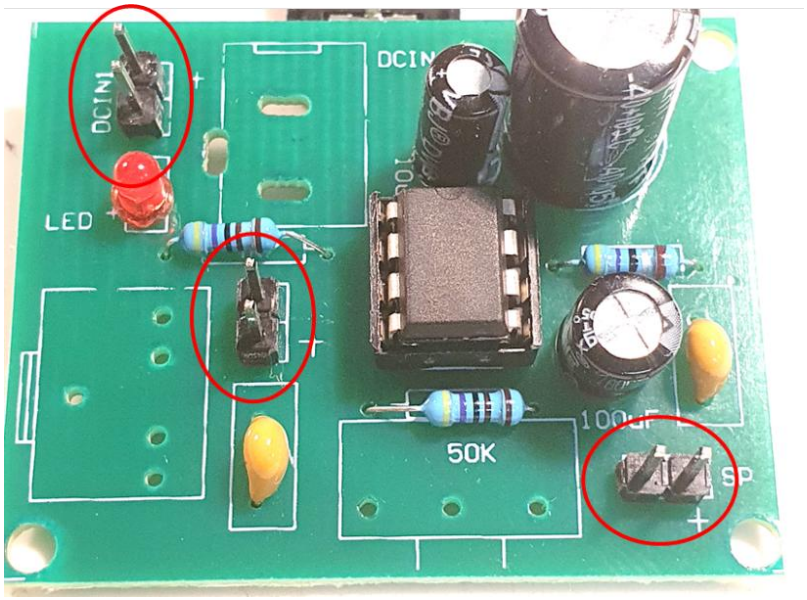


Fig 9.1 Showing the three sets of stakes installed.

Step 8. Installing the Audio Input Socket

Take particular care to align all of the pins of the Audio Socket correctly. Do not apply force. Refer to Figure 10.1.

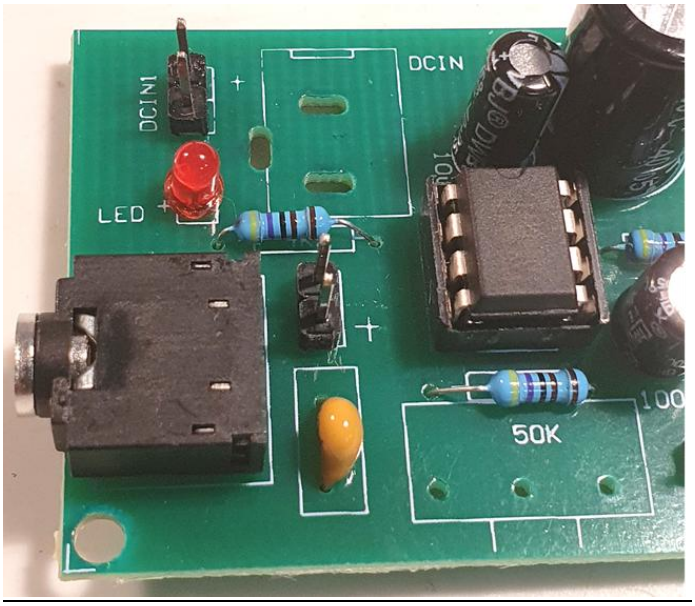


Fig 10.1 Showing the PCB with the Audio Input Socket installed

Step 9. Insert the "Power Input Socket"

Install the Power Input Socket. Do not force any of the pins. Refer to Figure 11.1 .

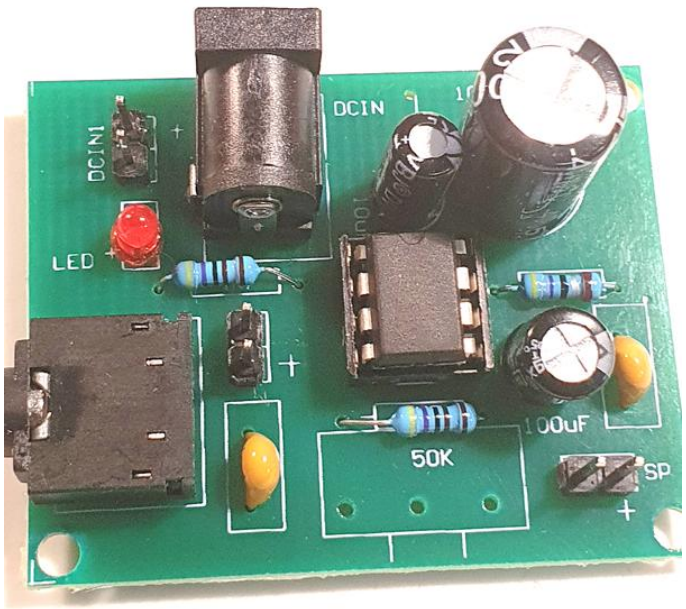


Fig 11.1 Installing the Power Input Socket.

Step 10. Insert the “Potentiometer” (Volume Control)

Install the Potentiometer. Refer to Figure 12.1

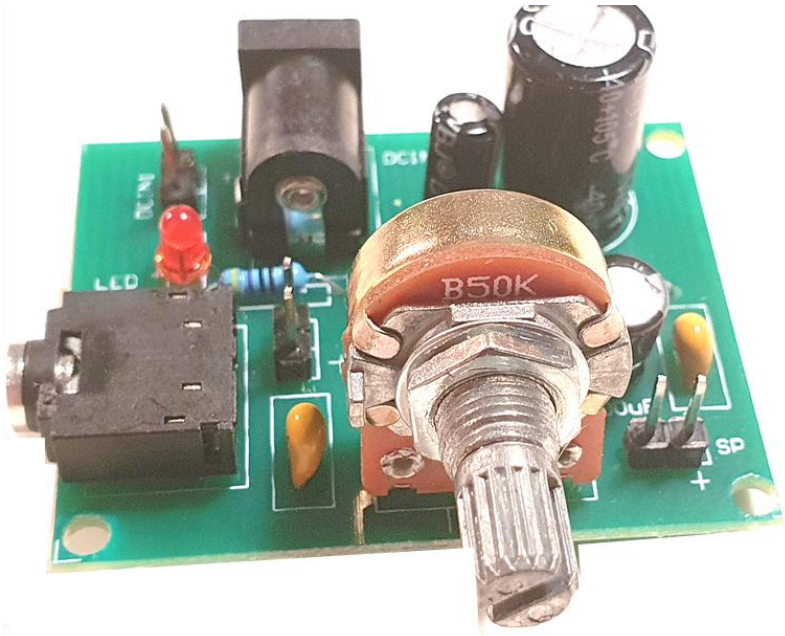


Fig 12.1 Installing the Potentiometer.

Step 11. Connecting wires, speaker and Power Supply.

The three different sets of stakes are available as back-up connections for the following:

J2 = Power input is parallel to the 2.1 mm socket.

J4 = Audio Input in parallel to the 3.5 mm Audio Socket

J5 = Speaker output

Refer to Figure 13.1 for final product, and clarity of the wire connections.
Refer to Figure 13.2 for an application example in a “Bluetooth Speaker Project”.

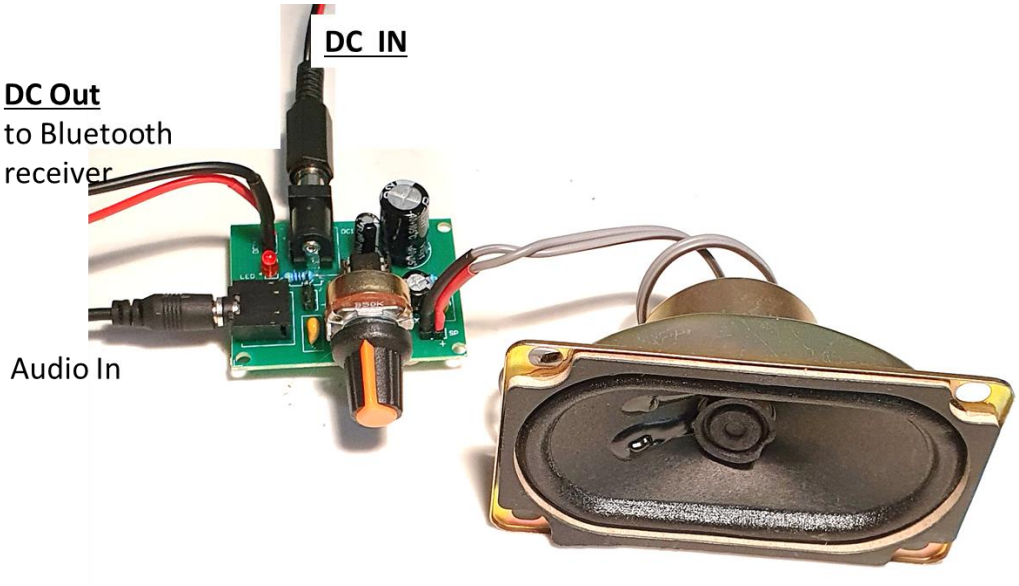


Fig 13.1 Showing the assembled product and wire connections .

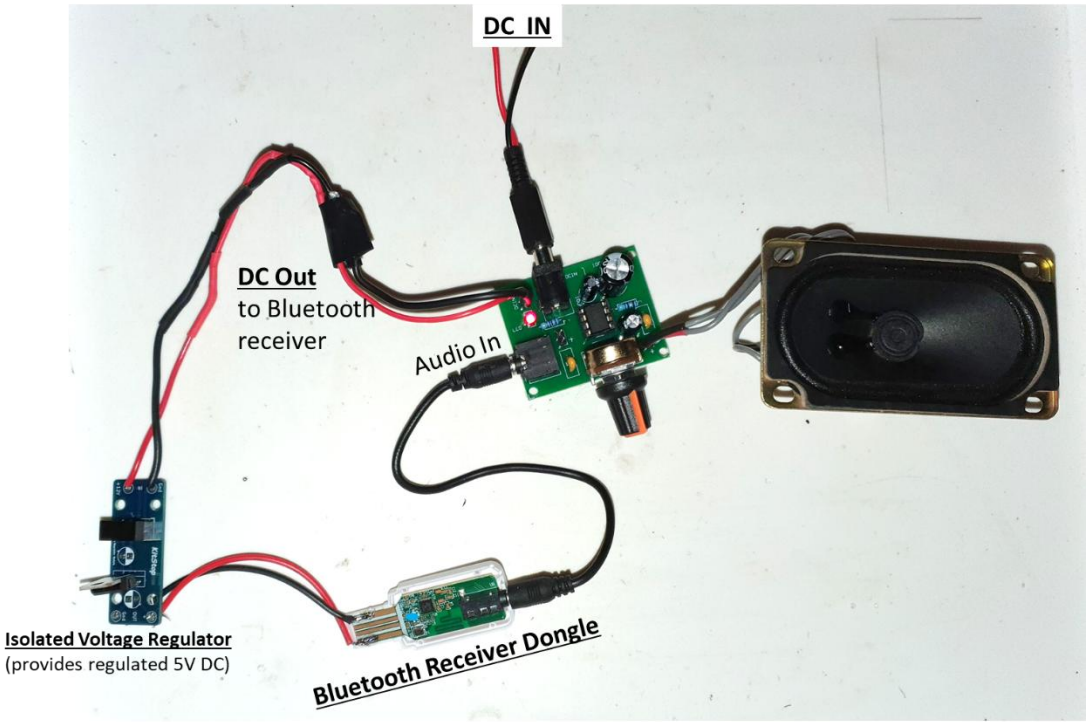


Fig 13.2 An application example:
KSAA03 being used in a "Bluetooth Speaker Project"

Testing:

Gently connect the power supply terminals. Watch for any sparks or signs of overheating on the PCB.

If you see any sparks:

- Do not worry (yet). It is common for many circuits which have capacitors in them (like this one) to draw an "in-rush" current at the first contact.
- Disconnect the power immediately.
- Test for any "hot spots".
- If no obvious hot spots, then
    - Reconnect the power and watch for sparks a second time.
    - If NO sparks a second time, this is normal! Things are looking good! Connect the power/battery properly.
    - If you continue to see sparks, you will need to recheck all of your soldering for any "Short Circuit" bridges.
    - There should be NO sound coming from your speaker until the Audio input is connected.
- If you find a "hot spot":
    - Check for solder bridges which are causing a short circuit somewhere.
    - Check that all components have been inserted correctly.
    - Check for any loose "wire" off cuts which may be causing a short circuit.

Once you have the power/battery connected and no signs of other problems, it is time to test the audio amplifier.

- Turn the volume control to minimum.
- Connect an audio input source.
- The speaker should sound gently.
- Turn up the volume and check that the Amplifier and Speaker are working properly.

Trouble shooting:

Most of the problems we have experienced with this kit are one of three kinds:

1) Soldering induced problems. (Short circuit bridges as well as poor quality "cold solder joints")
2) Component misplaced or misaligned.
3) Wire connections intermittent.

Three most common problems at "initial testing":

1) No sound at all from the speaker.
    a. Carefully check all the soldering again.
    b. We have found a common error is solder bridges (short circuits) on the component legs under the PCB …. Some are easily bridged by accident, since they are so close together!

2) Speaker volume cannot be adjusted …
    a. This may be caused by a fault associated with the Volume Control potentiometer
    b. May be the result of a Short Circuit in the soldering.

3) After checking above, Speaker still gives no output.
    a. Check the IC is inserted in correct orientation.
    b. If the IC has been installed wrongly, it will need to be replaced and a new IC installed correctly.
    c. The old IC will have been destroyed and will not be reusable.