Building the “Toothpick” Audio CW Filter

Introduction

The “toothpick” is a simple variable bandpass audio filter designed to compliment the “Splinter” QRPp Trans-Receiver. The filter also contains an audio amplifier which can produce room-filling volume when used with an external speaker. When used with the “Splinter” the filter has the added bonus of amplifying the sidetone oscillator during transmit. Although the design is simple and physically similar to the “Splinter” there is no reason that the “Toothpick” could not be used with other simple or vintage receivers needing a little extra audio filtering.

Building Rules

1. Take your time. We recommend that you take at least two or three days to complete your kit. It will take three coats of paint on your breadboard anyway to give it a good finish and a day of drying between each coat is recommended. So, if you take your time, in three days you can have a beautiful working project that you will be proud to own and operate.

2. If you don’t know how to solder parts on a circuit board, get help. Learning to solder is not hard, but please do not start this kit if you have never soldered before!

3. Most of the parts are tiny. Please use a magnifying glass.

4. Build the kit by the instructions, one step at a time.

5. Use protective eyewear.

6. Be careful with the ICs and transistors to avoid damage from static.

7. All parts should be mounted flush or as close as possible to the circuit board keeping leads short. After soldering, clip all wires close to the board.

Finishing The Breadboard

The wooden breadboard furnished with your kit is your opportunity to express yourself. You get to finish it any way that you like...pick your color, pick your finish. MAY WE SUGGEST THE FOLLOWING?

1. Use fine grit sand paper to remove any roughness from the wood.

2. You can use brush on or spray paint or stain or no finish at all...it’s up to you.

3. You are in charge of getting the board ready. Three coats with light sanding between coats and about 24 hours of drying time will produce great results. NOTE: The decals that will be placed on your breadboard at the end of kit construction are black and red. SO, it is best to use a lighter color (e.g. white, grey, yellow, light green or blue).

4. When the board is finished, locate the circuit board and place it on top of the breadboard. Center the circuit board and using a small nail, phillips screwdriver or other small pointed object, push a small starter hole into the breadboard at each corner mounting hole. The starter hole will help you to mount the assembled circuit board in the proper location at the end of the project. Place the breadboard aside for now.

Building the Circuit Board

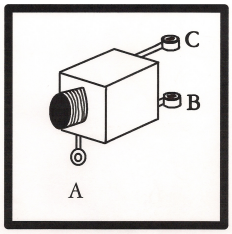
Tools and supplies needed to build the circuit board:

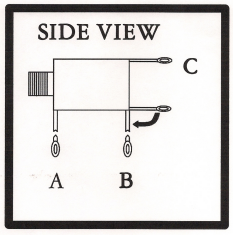
1. needle nose pliers
2. diagonal cutters
3. small flat blade and phillips screwdrivers
4. Magnifying glass
5. 35-40 watt soldering iron 6. 60/40 thin resin core solder

Locate the parts bag. All of the parts required for circuit board construction are enclosed. You can work from the bag and find each part as it is called for, but placing all of the parts from the bag into a bowl or small plastic tray may make it easier to sort and properly identify the parts.

As each part is called for, be sure to identify it, then locate the proper mounting holes on the board. Insert the part and check it's placement before soldering it in place. Cut all leads flush with the board.

1. Locate J1 a 1/8th inch phone jack and it's mounting position on the left edge of the circuit board. Refer to the diagram and modify the two lower soldering lugs to fit in the two mounting holes closest to the left side of the board. Bend the lower back lug (lug B) 90 degrees so that it points down like the front lug. Using diagonal cutters, clip off the ends of lugs A and B as close as possible to the soldering hole. The remaining lugs should be as long as possible so that they will fit through the mounting holes in the circuit board. Place J1 into position with lug A and B in the mounting holes and solder with J1 flush against the board. The lugs may need slight trimming with the diagonal cutters to fit the holes. Lug B may not come all the way through the hole, but a little extra solder to fill the hole will sufficiently hold it in place. Use a one inch bare wire to complete mounting J1. Pass one end of the wire through lug C of J1 and





into the circuit board mounting hole. Secure the top end of the wire to lug C of J1 and solder in place. Solder the other end of the wire on the bottom of the board and clip the excess wire.

2. Locate screw terminal J2 and the mounting position on the top side of the board near J1. Place J2 in the two mounting holes with the wire insertion holes facing off the back of the board. You can slightly bend the leads on the bottom of the board to help keep J2 flush to the top of the board. Solder the two leads.

3. Locate screw terminal J3 and the mounting position on the top side of the board near J2. Place J3 in the two mounting holes with the wire insertion holes facing off the back of the board. You can slightly bend the leads on the bottom of the board to help keep J3 flush to the top of the board. Solder the two leads.

4. Locate screw terminal J4 and the mounting position on the top side of the board near J3. Place J4 in the two mounting holes with the wire insertion holes facing off the back of the board. You can slightly bend the leads on the bottom of the board to help keep J4 flush to the top of the board. Solder the two leads.

5. Locate SW1 a single pole double throw slide switch. Mount it on the left rear of the board and solder it in place. The mounting pins will be tight and may require some gentle force to push it flush with the board.

6. Locate SW2 a double pole double throw slide switch. Mount it on the right rear of the board and solder it in place. The mounting pins will be tight and may require some gentle force to push it flush with the board.

7. Locate IC1 a LM386 integrated circuit. Mount it on the left side of the board and solder it in place. You will need to slightly bend the legs on each side of the IC to facilitate fitting into the parallel rows of mounting holes. Observe the screen printed mounting key on the circuit board.

8. Locate IC2 a LM741 integrated circuit. Mount it on the right side of the board and solder it in place. You will need to slightly bend the legs on each side of the IC to facilitate fitting into the parallel rows of mounting holes. Observe the screen printed mounting key on the circuit board.

9. Locate C1 a 220uf. electrolytic capacitor. Observe the proper polarity and solder it in place.

10. Locate C2 a 47uf. electrolytic capacitor. Observe the proper polarity and solder it in place.

11. Locate C3 a 0.01uf (103) ceramic capacitor. Mount and solder in place.

12. Locate C4 a 0.01uf. (103) ceramic capacitor. Mount and solder in place.

13. Locate C5 a 0.047uf. (473) ceramic capacitor. Mount and solder in place.

14. Locate C6 a 0.01 (103) ceramic capacitor. Mount and solder in place.

15. Locate C7 a 10uf. electrolytic capacitor. Observe polarity as you mount and solder in place.

16. Locate C8 a 0.1uf (104) ceramic capacitor. Mount and solder in place.

17. Locate C9 a 0.1uf (104) ceramic capacitor. Mount and solder in place.

18. Locate R1 a 47K ohm resistor (yellow, purple, orange) mount and solder in place.

19. Locate R2 a 270K ohm resistor (red, purple, yellow) mount and solder in place.

20. Locate R3 a 270 ohm resistor (red, purple, brown) mount and solder in place.

21. Locate R4 a 100 ohm resistor (brown, black, brown) mount and solder in place.

22. Locate R5 a 1K ohm resistor (brown, black, red) mount and solder in place.

23. Locate R6 a 10K ohm resistor (brown, black, orange) and solder in place.

24. Locate R7 a 10K ohm potentiometer. Mount and solder in place.

25. Locate R8 a 1K ohm potentiometer. Mount and solder in place.

This completes construction of the circuit board. Inspect the board for proper parts placement. Make sure that solder connections are good and that there are no solder bridges.

Final Assembly

1. Mount the circuit board on your finished wooden breadboard with four brass wood screws and four 3/16th inch black spacers.

2. Install the knobs on potentiometers R7 and R8.

3. Mount the four rubber feet on the bottom of the wooded breadboard in the corners.

4. Mount the decals on your finished breadboard. Cut the decals out with scissors and place in warm water for about 30 - 45 seconds. Place the wet decals on the breadboard in the correct place and slide the backing away. Carefully align the decals and allow them to dry.

Using the Filter

There are four possible interconnections to the filter which are made at J1 through J4.

J1 is a 1/8 inch phone jack. This jack is for audio output to stereo earphones. Audio is present when SW1 is switched towards the front of the board.

J2 is a 2 position screw terminal. This terminal is used to connect an external speaker. Audio is present when SW1 is switched towards the rear of the board. Looking at the back of the filter, the screw terminal on the left is ground.

J3 is a 2 position screw terminal. This terminal is the audio input to the filter from your receiver. Looking at the back of the filter, the screw terminal on the left is ground.

J4 is a 2 position screw terminal. This terminal is the DC voltage input. Looking at the back of the filter, the screw terminal on the left is (negative) ground. Positive voltage goes to the terminal on the right. The filter requires 9 to 12 volts DC. CAUTION: Be sure that the positive voltage is connected to the terminal on the right as you are looking at the rear of the filter. Reverse polarity will damage the filter!

When SW2 (located on the right side rear of the board) is in the forward position, the filter is on and operational (ON). When SW2 is switched to the rear the filter is off, but the audio is bypassed to SW1.

R7 controls the audio output (volume) of the filter when SW2 is in the on position.

R8 controls the bandpass frequency when SW2 is in the on position. The band pass will peak from approximately 1000 Hertz to 700 Hertz.

While this type of filter will not provide the selectivity of an I.F. crystal type, it does provide improved audio selectivity by attenuating high and low frequency audio signals above and below the bandpass, especially the high frequencies.

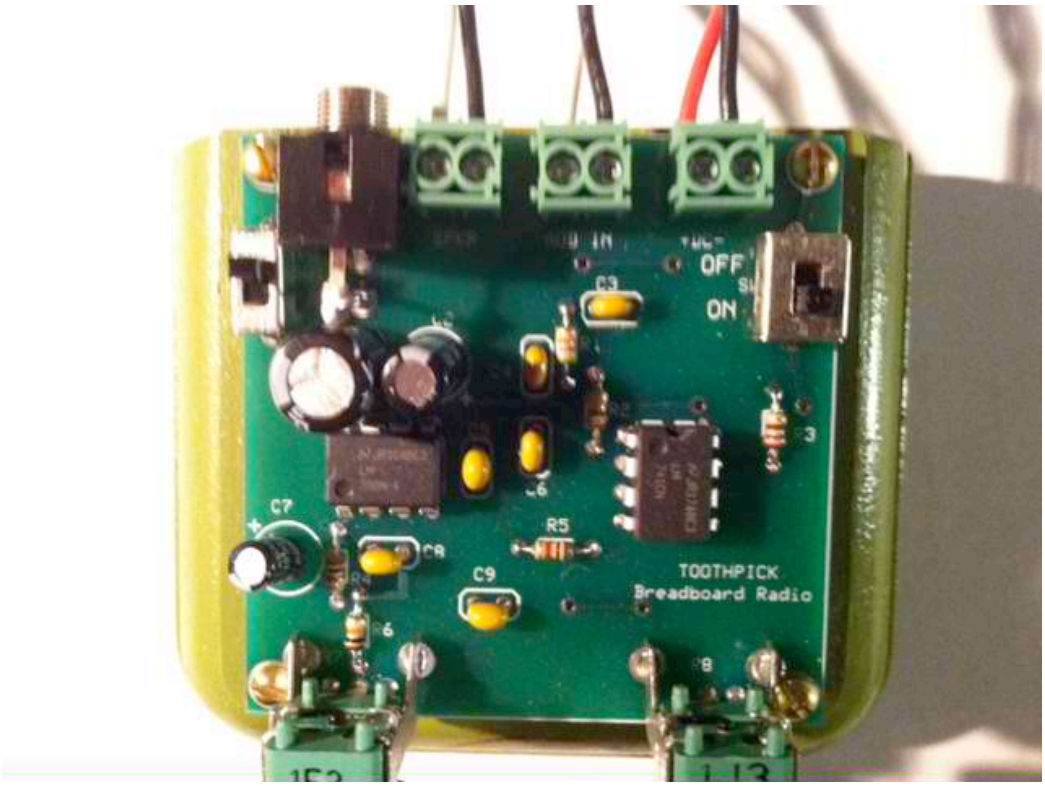
After making appropriate connections turn on the filter and adjust the filter and receiver volume to the desired level. You will notice that as you tune through a signal, a peak in volume will occur. This peak frequency can be adjusted with R8. When R8 is all the way to the right, the bandpass peak is at approximately 700 Hertz. With R8 all the way to the left, the bandpass peak is at approximately 1000 Hertz. NOTE: Most operators

prefer 700-1000 Hz for copying cw. Most cheap earbuds/earphones have very high audio responses (above 1000 Hz) so when using these devices set R8 all the way to the left and tune in the desired signal for peak signal. Better low frequency response is found when using good headphones or speakers. In any case, by using the volume, bandpass and receiver controls you will be able to improve signal reception.

Connecting the Toothpick to the Splinter

You may use the included hook-up wire or your own wire to connect between the appropriate terminals provided on the Toothpick and Splinter (audio and power). The audio connection will require a 1/8th inch stereo phone plug. Connect the ground to the ring and the audio line to the tip and or the center ring. Use wire connected to an external speaker to connect to the speaker (SPKR) terminal. Use caution when connecting the power from the Splinter to the Toothpick. The wires will need to be "piggy backed" to the power wires already in the Splinter power screw terminals. Alternately, you may run power directly to the Toothpick from your power source or a 9.0 volt battery. Just make sure to put the positive and negative wires in the correct side of the power terminal.

SEE PHOTOS


OFF
ON
C3
C7
C8
C9
R5
R6
TOOTHPICK
Breadboard Radio