



QRPBUILDER K8TND Patriot S.W. Regenerative Receiver



First, familiarize yourself with the parts and check for all the components. If a part is missing, please contact us at qrpbuilder@gmail.com and we will send you one. If you are new to parts identification refer to the appendix for part markings.

Please read all the instructions before starting to assemble the receiver.

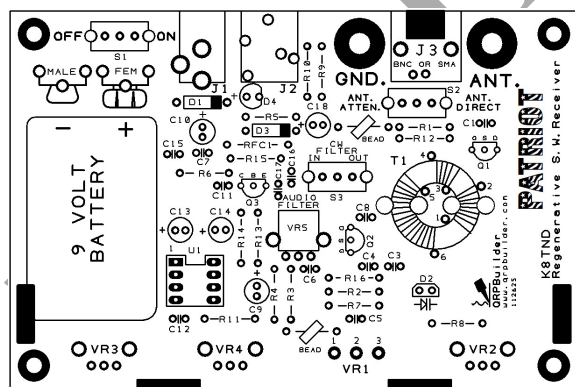
Parts List

- 1 – QRPGuys K8TND Regen Receiver PCB, 4 pieces
- 1 – U1, LM386 DIP IC
- 1 – Q3, 2N3904 transistor
- 2 – Q1,2, J310 FET
- 1 – D1, 1N4007 diode, black, silver band on one end
- 1 – D2, ISV149 varactor diode, marked v149
- 1 – D3, 1N4737A, 7.5V zener diode, small glass, black band on one end
- 1 - D4, green led
- 2 - R2,8, 1 meg ohm resistor (brown-black-green-gold)
- 5– R1,3,7,11,15, 10K resistor (brown-black-orange-gold)
- 1 – R4, 5.6K resistor (green-blue-red-gold)
- 2 – R1,5, 1K resistor (brown-black-red-gold)
- 1 – R6, 10 ohm resistor (brown-black-black-gold)
- 1 – R9, 51 ohm resistor (green-brown-black-gold)
- 1 – R10, 4.7k ohm (yellow-violet-red-gold)
- 1 – R12, 470 ohm resistor (yellow-violet-brown-gold)
- 1 – R13, 22K ohm (red-red-orange-gold)
- 1 – R14, 220K ohm (red-red-yellow-gold)
- 1– C4, 8pF ceramic disk capacitor, marked 8
- 4 – C5,7,11,12, .01uF MLCC capacitor, marked 103
- 1 – C3, 560pF NP0/C0G capacitor, marked 561
- 1 – C6, .001uF MLCC capacitor, marked 102
- 2 – C1,8, 470pF NP0/C0G capacitor, marked 471
- 2 – C9,18 4.7uF electrolytic capacitor
- 2 – C10,14, 100uF electrolytic capacitor
- 1 – C15, .1uF MLCC capacitor, marked 104
- 1 – C13, 1uF electrolytic capacitor
- 2 – C16,17 .022uF MLCC capacitor, marked 223
- 3 – VR2,3,4, 10K pcb mounted potentiometer
- 1 – VR1, 10K panel mount pot

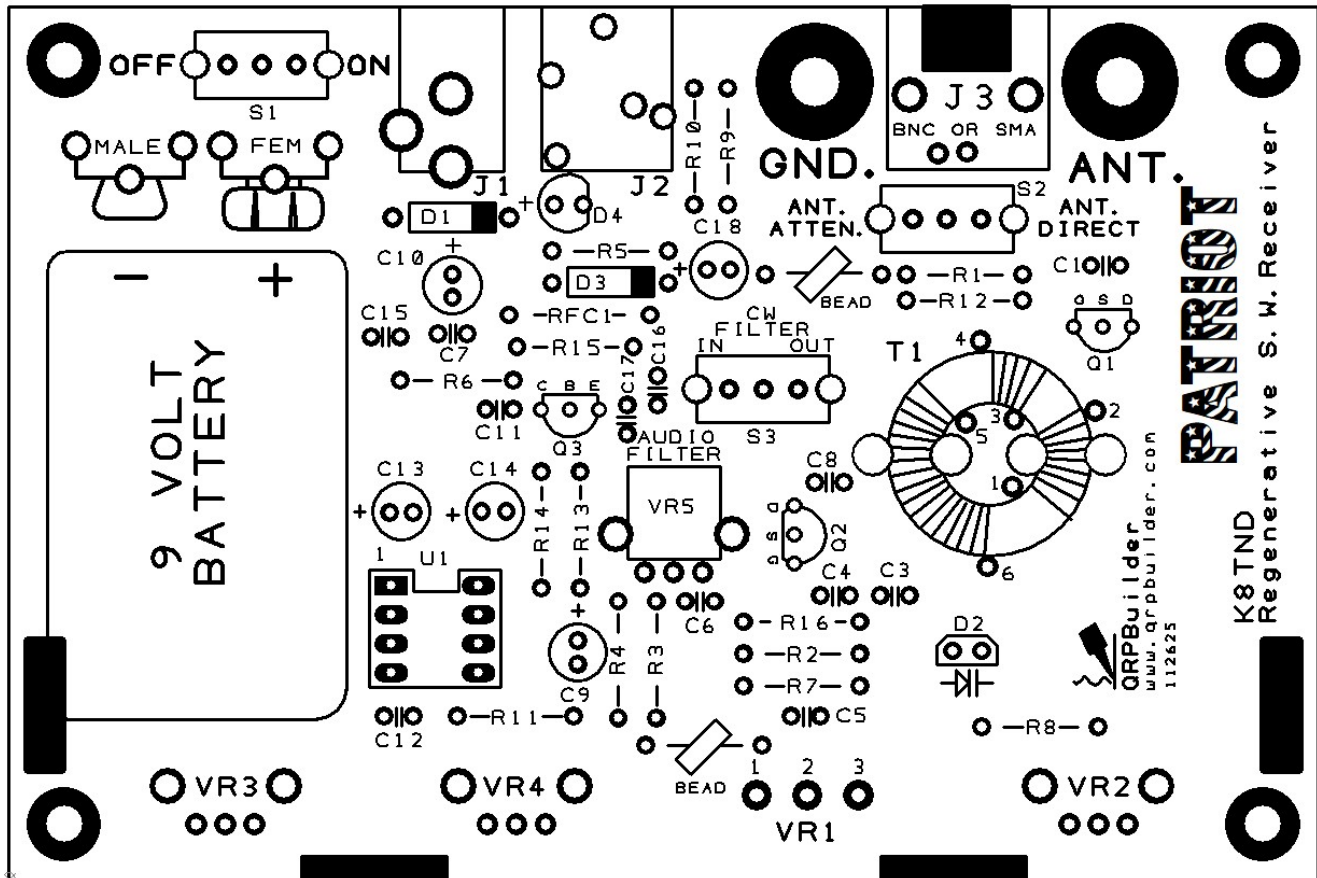
- 1 – VR5, 2K 9mm trimpot, marked B202
- 1 – RFC1, 1000uH, or 1mH molded inductor, green body (brown-black-red-silver)
- 1 – J1, DC power jack
- 1 – J2, 3.5mm stereo jack
- 3 – S1,2,3, SPDT slide switch
- 1 – 8 pin DIP socket
- 1 – 9V battery clip-female
- 1 – 9V battery clip-male
- 1 – 48" 26awg magnet wire
- 1 – T68-2 toroid core (red)
- 2 – 8-32 x 3/4" L SS Phillips pan head screw
- 4 – 8-32 SS hex nut
- 2 – 8-32 SS wing nut
- 2 – 8-32 SS internal tooth lock washer
- 2 – 4" cable tie
- 4 – 3/8" dia. rubber foot
- 1 – 8" hook-up wire
- 1 – large control knob
- 3 – small control knob

Even if you have done radio kit assembly before, please read through all the instructions before you start. This kit is a little different, in that the mechanical chassis components are the part of the printed circuit board. The instructions give you the scope of the project and an understanding of the techniques we have employed. You will be assembling the kit from four pieces of pcb material. The base pcb contains all the circuitry for the receiver. When you tack and then solder the remaining pcb components it will make a sturdy mechanical assembly. Refer to the figure below for identification of the individual pcb parts. You will be assembling all the electrical components on the Base pcb. When you have completed and tested for operation, you will then attach the remaining chassis components to the Base forming a sturdy assembly.

There is much available information on the web for electronic kit building. Also, almost all amateur radio clubs have individuals that are most willing to aid beginners. Seek them out, if this is your first kit or you are unsure how to proceed.



Using the component placement graphic guide below, start assembling and check off as you go. On any component, I always solder a single lead first, align the component if needed, then solder the other pad(s).

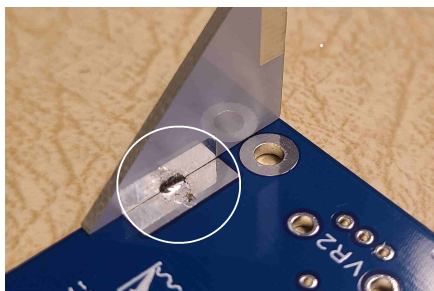
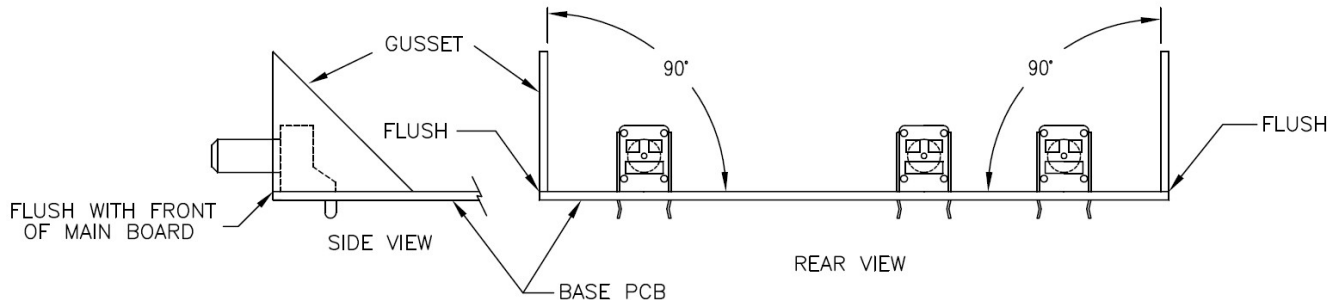


[] Install VR2,3,4, 10K pcb mounted potentiometers.

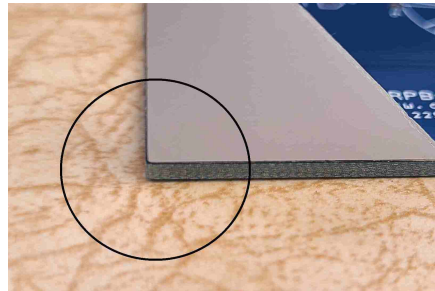
Now you are going to solder the four pcb pieces that form the chassis..

On all the mechanical assembly soldering of the pcb's, you will use the same technique. You tack a single tiny point first, and then check to see that it is square and aligned properly with the assembly notes. It is easy to re-heat the joint and adjust the alignment when there is only a single point. You will tack all the other pads, before you do the finish soldering. After finish soldering of the chassis, the assembly will be remarkably strong.

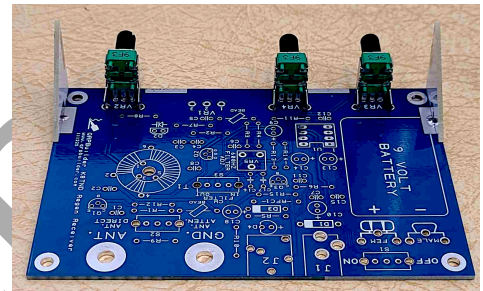
- [] First, you want only a small tack to solder the two Gussets to the Base. When finished, you want them to be 90° as shown below and **flush** with the front edge of the Base pcb and **flush** with the sides. To check the 90°, cut the corner off a piece of printer paper or 3x5 card and use it as a gage on the inside of the boards. If you do more than a small tack, The solder will cool and draw in the gusset to less than the 90° desired. Reheat the tack and reposition. **Do not try to bend the gusset without reheating, or you pull the copper off the pcb.** You will go back and finish soldering after the front panel is attached. Refer to the graphics below.



Small tack

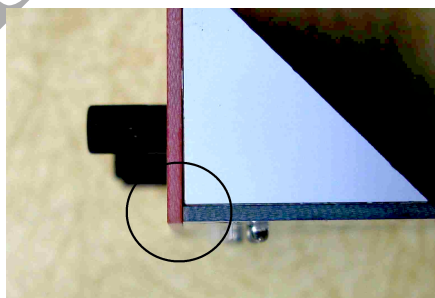
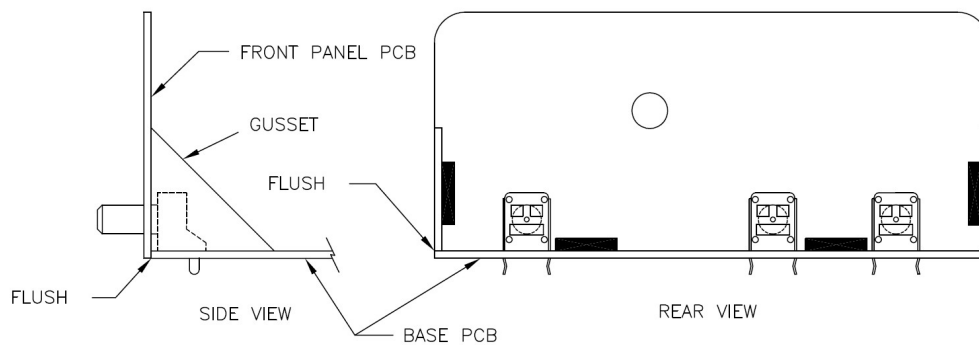


Flush on front and side

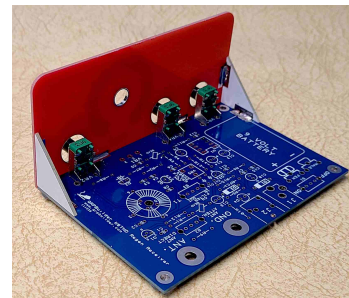


Both sides 90°, ready for next step

- [] Position the Front Panel flush with the bottom of the Base pcb, and flush with the outside edge of the Gussets as shown below. Again, use only a small tack until you have met all the flush alignments. It is easy to re-heat a small tack and re-position. **When you are satisfied all the alignments are met, you may now go back and complete the soldering of all six of the pads.**



Front panel orientation

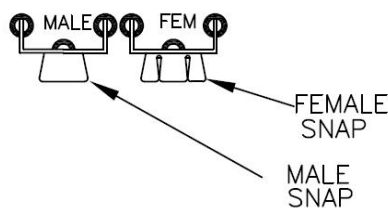


Completed pcb assembly

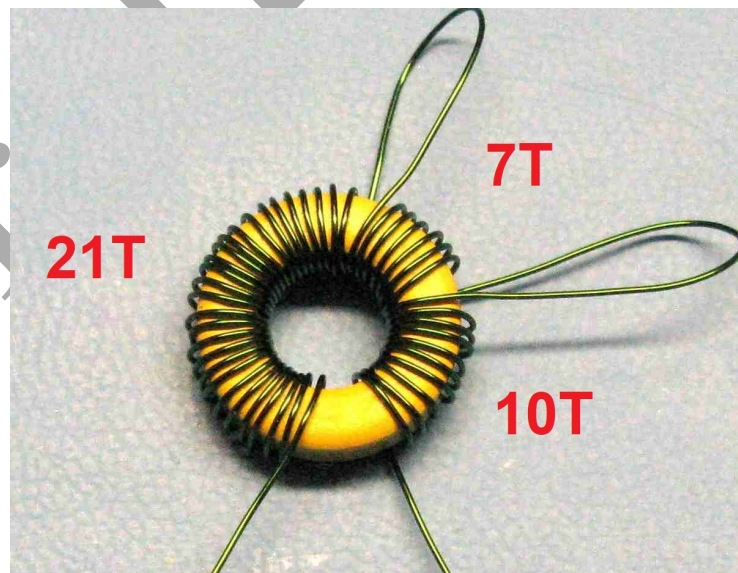
You are now ready to install the remaining electrical components.

- [] Install R2,8, 1 meg ohm resistor (brown-black-green-gold)
- [] Install R3, 7,11,15 10K resistor (brown-black-orange-gold)
- [] Install R4, 5.6K resistor (green-blue-red-gold)
- [] Install R1,5, 1K resistor (brown-black-red-gold)
- [] Install R6, 10 ohm resistor (brown-black-black-gold)
- [] Install R9, 51 ohm resistor (green-brown-black-gold)
- [] Install R10, 4.7k ohm (yellow-violet-red-gold)
- [] Install R12, 470 ohm, (yellow-violet-brown-gold)
- [] Install R13, 22K ohm, (red-red-orange-gold)
- [] Install R14, 220K ohm, (red-red-yellow-gold)
- [] Install R16, 100k ohm, (brown-black-yellow-gold)
- [] Install RFC1, 1000uH, or 1mH molded inductor, green body (brown-black-red-silver)
- [] Install D1, 1N4001-7 diode, *match the band on the diode with the outline*
- [] Install D3, 1N4737A, small glass diode, *match the band on the diode with the outline*
- [] Install D4, green led, *observe polarity, the long lead is positive*
- [] Install D2, ISV149, marked V149, *polarity sensitive, match the board outline*
- [] Install C5,7,11,12, .01uF MLCC capacitor, marked 103
- [] Install C3, 560pF NP0/C0G capacitor, marked 561
- [] Install C4, 8pF ceramic disk capacitor, marked 8
- [] Install C6, .001uF MLCC capacitor, marked 102
- [] Install C1,8, 470pF NP0/C0G capacitor, marked 471
- [] Install C15, .1uF MLCC capacitor, marked 104
- [] Install C16,17, .022uF MMLC capacitor, marked 223
- [] Install 8 pin DIP socket, *match the notch on the socket with the silkscreen on the pcb*
- [] Install J2, 3.5mm stereo jack
- [] Install S1,2,3 SPDT slide switch

- [] Install Q3, 2N3904, *match the board outline*
- [] Install Q1,2, J310 transistor, *match the board outline*
- [] Install C9,18, 4.7uF electrolytic capacitor, *observe polarity, the long lead is positive*
- [] Install C10,14 100uF electrolytic capacitor, *observe polarity, the long lead is positive*
- [] Install C13, 1uF electrolytic capacitor, *observe polarity, the long lead is positive*
- [] Install J1, DC power jack
- [] Install VR5, 2k trimpot, marked B202
- [] Install 9V battery clip-*female*, as shown below. ***Don't mix them up.***
- [] Install 9V battery clip-*male*, as shown below. ***Don't mix them up.***

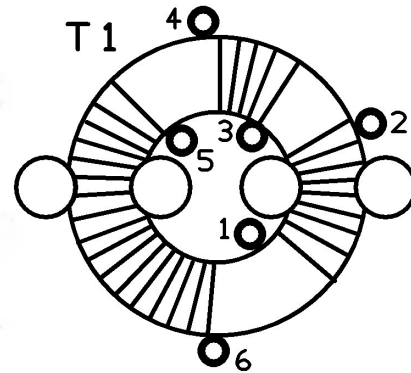
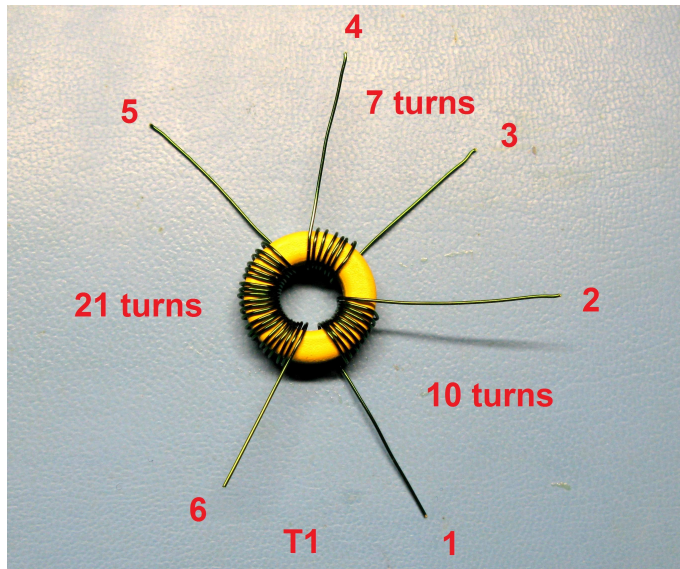


- [] Use the T68-2 toroid core (red), the supplied magnet wire, and wind T1 as shown below, start winding at the 5 o'clock position. Push 1" of the wire down the hole from the top and hold it, feed the remaining turns up from the bottom. ***Every time the wire goes thru the center counts as one turn.*** Wind a total of 10 turns, and form a 1" loop, wind another 7 turns, and form another 1" loop, then finish with 21 more turns. If you have your own special technique for winding toroids, use it. The wires must be over the core or under the core for each group of turns as shown below. If the wound core does not look like the picture below, it will not align with the pcb holes. ***Be sure to verify the turn counts on each group before you cut the loops.***



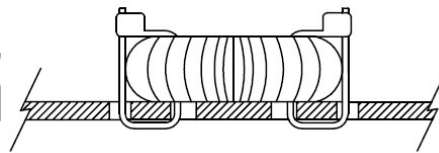
Your core is **red**, this yellow core is shown for clarity.

Note: Now is a good time to mention a good way for counting the turns on your toroids. Many times if a toroid has a lot of turns, you can lose track going around. A good trick is to take a digital picture of it *before* you trim the leads and enlarge it on your computer screen. Counting is clearly a lot easier.

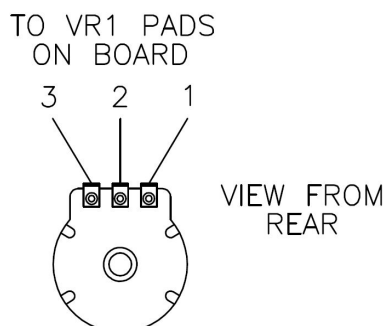


Yellow core is shown for clarity

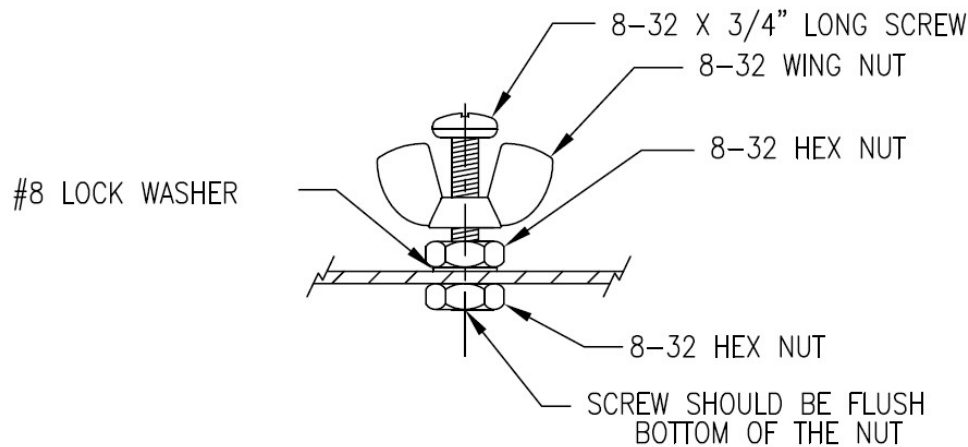
- [] Cut the loops and straighten the wires. It should look like the picture above. If you have wound it properly, when the leads are bent down, they will align with the six pcb pads shown in the graphic above. The magnet wire has Thermalze enamel, and can be removed with a hot soldering iron. Remove the insulation, and **tin the leads before installing** on the pcb. Now install T1 flush with the pcb, and solder the six leads.
- [] Secure T1 with the two nylon cable ties, as shown below.



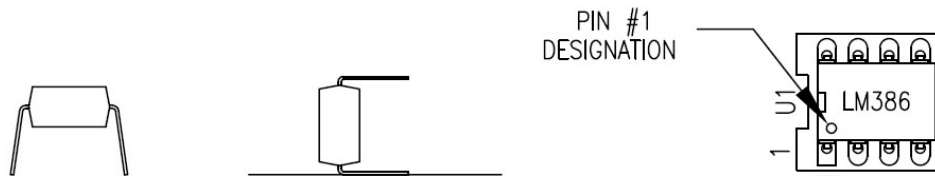
- [] Mount VR1 to the front panel with the nut that came with the pot. If the potentiometer has a tab for clocking the pot, cut it off. Use three 2 1/2" long pieces of the hook-up wire supplied to connect the potentiometer to the pcb matching the number sequence in the graphic with the pcb. Finally secure the knob to the shaft.



- [] Install the three small control knobs on VR2,3,4.
- [] Install the antenna and ground connection hardware as shown in the graphic below.



- [] Next, power up the receiver with a 9V battery. **Anytime the 12V power jack is used, be sure to remove the 9V battery.** The center pin is "+" on J2. With a battery check for ~+8.5V on pin #6 of the U1 socket. If all is ok, install The LM386 into the socket noting the position of pin 1 Shown in the graphic below.



When inserting new IC's, the pins are flared so that they can be retained by automatic insertion tools. Carefully and gently rock it on a flat surface so the pins are parallel and it will insert into the socket more easily reducing the risk of breaking or bending a pin.

- [] Attach the 4 rubber feet to the corners of base pcb where indicated.

This completes the assembly.

Testing with an antenna and alignment:

It is easiest to mark the approximate locations of the SWL bands, WWV, etc. by using another receiver. Loosely couple the antenna with that of a nearby receiver and it will pick up the local oscillator in your regen receiver. Note the frequency or band of interest and mark with a pencil on the front panel. Make sure your fine tuning pot is in the middle of its range and you will have fine tuning either side of the frequency or band you marked. The "Fine Tuning" will cover a range of about 30Khz.

General tips and operation using a Regenerative receiver:

AM stations are best heard with the Regen control to the counterclockwise side of the knob travel, and the advanced clockwise just before sidetones are heard. **CW/SSB** stations are best heard with the Regen control to the clockwise side of the knob travel, as they require the sidetones to be present. The Regen and both Tuning controls interact with each other so a little tweaking is required. For CW reception, switch the filter "IN" and adjust the VR4 trim pot for the best tone and selectivity. For AM and SSB reception, switch the audio filter "OUT".

When changing frequency by any appreciable amount, it will be necessary to re-adjust the "Regen" control for maximum signal strength. Adjustment will also be necessary if the "Regen" starts to oscillate. If you cannot get the regen to stop oscillating, squeeze the winding groups closer together and separate them from each other. Use the minimum amount of volume for comfortable listening. With a regenerative receiver a little back and forth is necessary, and you will get the hang of it after a few tries.

Other great tips on regenerative receiver tuning can be found here at the ARRL site, <http://www.arrl.org/tuning-a-regenerative-receiver>.

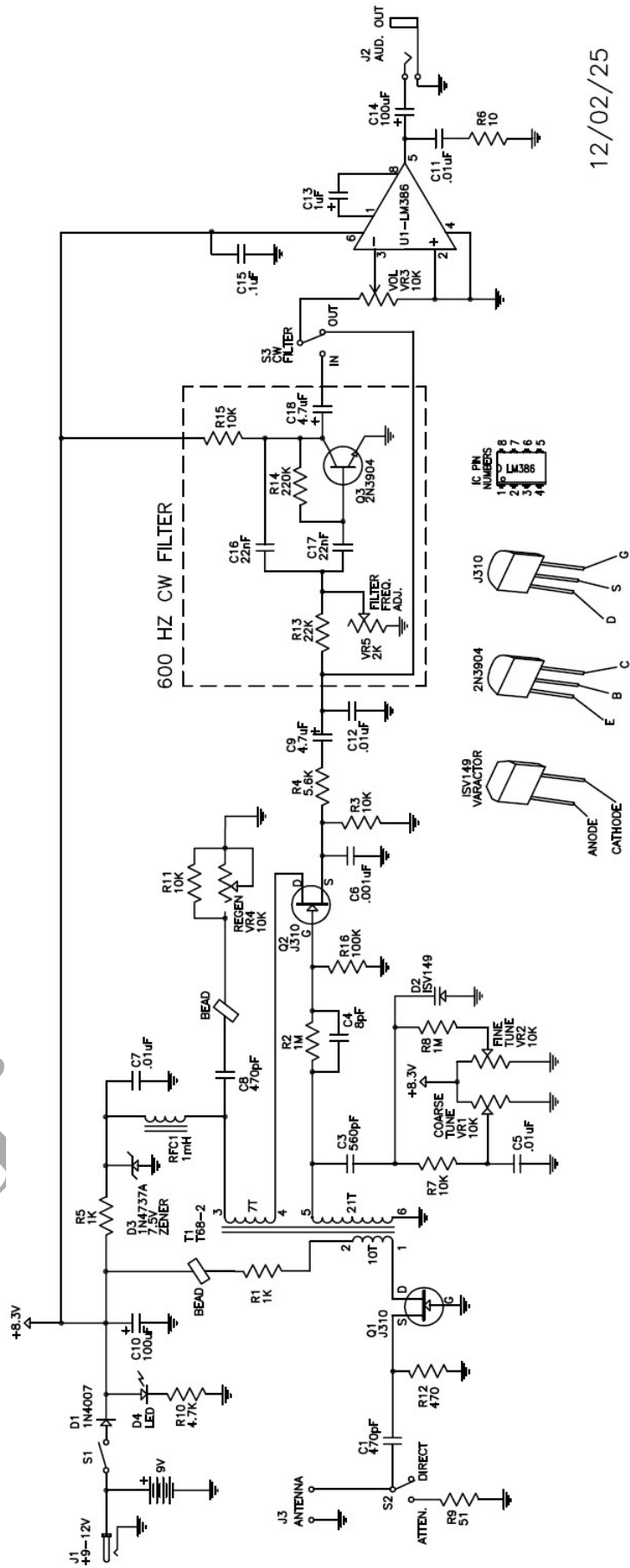
Other notes:

If you use an external 12V power source, be sure to remove the 9V battery. Also, avoid wallwarts, as some are unregulated or much higher voltage than stated on the labels. They can also introduce hum and other undesirable effects.

We provided provisions for a female BNC or SMA pcb connector for anyone that want to substitute a coaxial connection. We have not included the connectors in the kit, but they are readily available on eBay as shown below.



Schematic:

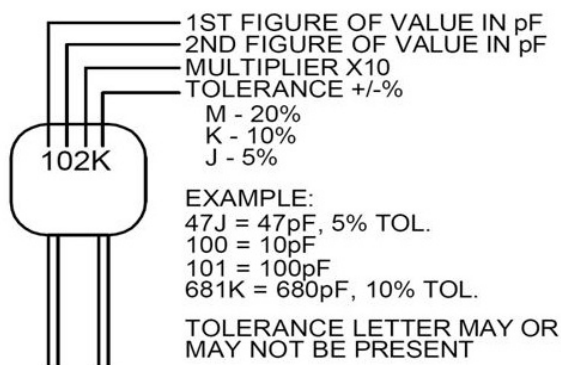


Notes:

Lined area for notes, featuring horizontal ruling lines and a large diagonal watermark reading "Preliminary".

Appendix:

- All the resistors are 4 color, 5% tolerance, 1/4 watt, carbon type, tan body colored so the colors are easy to identify.
- Ceramic disk and multi-layer ceramic capacitors (MLCC) capacitors are all clearly marked, although some may quite small and may need magnification. Tolerance code may be omitted.
- Electrolytic capacitors are polarized, clearly marked, and for this kit, can be 16V, 25V, or 50V.
- Molded inductor bodies are green and identified by the chart below.
- Some of the integrated circuits, diodes and transistor markings may be quite small and require some magnification.

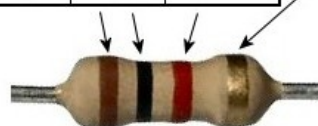


Ceramic capacitor markings

Resistor Color Codes

| | Value | Multiplier |
|--------|-------|------------|
| Black | 0 | 1 |
| Brown | 1 | 10 |
| Red | 2 | 100 |
| Orange | 3 | 1k |
| Yellow | 4 | 10k |
| Green | 5 | 100k |
| Blue | 6 | 1M |
| Violet | 7 | 10M |
| Grey | 8 | |
| White | 9 | |

| | Tolerance |
|--------|-----------|
| Silver | 10% |
| Gold | 5% |
| Red | 2% |
| Brown | 1% |



$$1 \ 0 \ 2 = 10 \times 100 = 1k \text{ Ohm}$$

Note: When reading the mono capacitor values, do not confuse the manufacturing codes with the component value. If it looks strange, it may be a manufacturing code, look on the other side of the component. Also the tolerance letter may be omitted.

Molded Inductor Color Codes



This example
1mH or 1000uH

| | 1st Digit | 2nd Digit | 3rd Digit | or | Multiplier | Tolerance |
|--------|-----------|-----------|-----------|----|------------|-----------|
| Black | 0 | 0 | 0 | or | 1 | |
| Brown | 1 | 1 | 1 | or | 10 | 1 % |
| Red | 2 | 2 | 2 | or | 100 | 2 % |
| Orange | 3 | 3 | 3 | or | 1 000 | 3 % |
| Yellow | 4 | 4 | 4 | or | 10 000 | 4 % |
| Green | 5 | 5 | 5 | | | |
| Blue | 6 | 6 | 6 | | | |
| Violet | 7 | 7 | 7 | | | |
| Gray | 8 | 8 | 8 | | | |
| White | 9 | 9 | 9 | | | |
| Gold | Decimal | Decimal | | | | 5 % |
| Silver | | | | | | 10 % |
| None | | | | | | 20 % |