

Builder's Guide for the Lil' Squall][Transceiver



The Setup

The first step of this build is to separate the parts into 5 bags, one for each stage of the build. The few minutes spent prepping the parts will make the build MUCH easier and faster... If you are unfamiliar with the parts, review the following parts tutorial and then sort through the parts. Carefully go through the parts list, collecting up the parts for each stage and place each stage in its own bag. Once that is accomplished, you can move on to actually assembling each stage. The easiest way to accomplish this is to label the bags 1 through 5 and as you identify a part, place it in the bag(s) indicated on the parts list. In each of the following build stages, I have listed the parts in order of suggested assembly. You might choose a different route. Assembly schemes like placing parts from the center to the edge and low parts to high parts or a merging of the two have been combined in my suggested assembly sequence.

Cast of Characters: Some info on the parts you will be using:

Jacks & connectors:

			female	male		
	screw		straight	rt. angle		
RCA jack	terminal	Stereo jack	header	header	IC socket	SIP socket

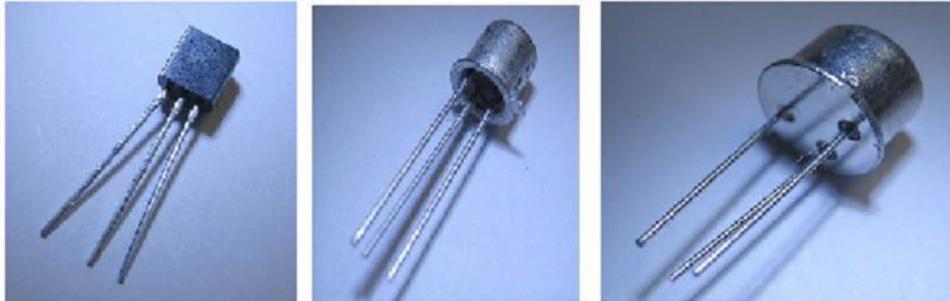


header connectors can have multiple rows of pins with all kinds of different pin spacings and configurations so they are further identified by their configurations: for example
 2x7x.1 straight male = 2 rows of 7 pins straight 'male' fingers with .1 pin spacing
 1x8x.1 female socket = 1 row of 8 IC socket pins with .1 pin spacing
 the SIP in SIP socket stands for Single Inline Package so it is always 1x something. ...

Transistors:

transistors are polarized and have 3 leads to worry about getting into the right holes ...

PN2222A	2N2222A	2N2219A or 2N3866
TO-92	TO-18	TO-39
plastic	small metal can	large metal can
E B C across the flat	C B E with E	closest to tab on side of can



Diodes:

diodes have a polarity which is marked with a band close to one end of the body match the band with the band marked on the pcb silk screen

the diode type is marked with lettering...usually in 2 rows

the picture below shows a larger plastic encased diode and a small glass diode

the lettering on the black diode is: 1N (not shown 53 43B for a 1N5343B diode

the small glass diode has similar, but much harder to read, markings



Resistors:



resistors are marked using bands of color which follow a code:

black=0 brown=1 red=2 orange=3 yellow=4 green=5 blue=6 violet=7 gray=8 white=9

the 1st band is the color band closest to the edge of the body

the 1st 2 bands convert to numbers and the 3rd band represents the # of zeros in the above picture,

the BIG power resistor: brown-black-black = 1 + 0 + 0 zeros = 1 + 0 = 10 ohms

the little resistor = red-violet-orange = 2 + 7 + 3 zeros = 27000 = 27K



Chokes:

chokes look like resistors but are a little tubbier or have a 'waist' and a different body color and colors bands are used similar to resistors but a little different

our friend the 27K resistor (top) is shown with 2 types of chokes (center & bottom)

center choke = brown-black-black = 1 + 0 + 0 zeros = 1 + 0 = 10uh

sometimes you have to identify a choke AFTER identifying all the other parts...

Capacitors: (non-polarized)



caps are usually marked with 3 numbers for value and letters for temperature and tolerance specs. While it is not necessary to know all the spec codes, it is important to know that all 100pf (or any other value) caps are not the same. Some will love working with 200 volts while others will explode with a Ka-Pow! when you put 200 volts across them. When special caps are called for in particular spot, special identifying instructions are usually added to help you select the right one from the line-up.

The capacitor numeric code:

the 1st two numbers are followed by the number of zeros indicated by the 3rd number in the above picture, 473 is $4 + 7 + 000 = 47000 \text{ pf} = .047 \text{ uf}$

the letter M (from THIS manufacturer) indicates +/- 20% and a temperature range of -10 degrees C to +85 degrees C

Capacitors: (polarized)



polarized or electrolytic capacitors are either marked similar to non-polarized caps if the body is real small or marked plainly on large body caps

in the above picture you can plainly read 22uf (with a working voltage of) 25 volts

So that's all for the parts tutorial!

Lil' Squall][Parts List

Resistors

2.7k (bag 2)
10k Qty.2 (bags 2 & 5)
2.2k (bag 2)
47k (bag 1)
1.5k (bag 1)
33k (bag 5)
1k (bag 3)
10 ohm (bag 3)

Capacitors

47pf (bag 4)
150pF (bag 4)
330pf Qty.2 (bag 4)
680pf (bag 4)
.001uf Qty.2 (bag 2)
82pf Qty.2 (bag 2)
100pf Qty.2 @ BE & EG (bag 1)
.1uf Qty.4 (bags 1=2, 2=2, 5=1)
.047uf (bag 5)
10uF electrolytic Qty.3 (bag 3)

Semiconductors

1N5818 (bag 1)
1N4148 (bag 3)
PN2222A @ Q1 (bag 1)
2N3866 (DG0001) @ Q2 (bag 5)
2N3906 @ Q3 (bag 2)
LM386 (bag 3)

RF Chokes

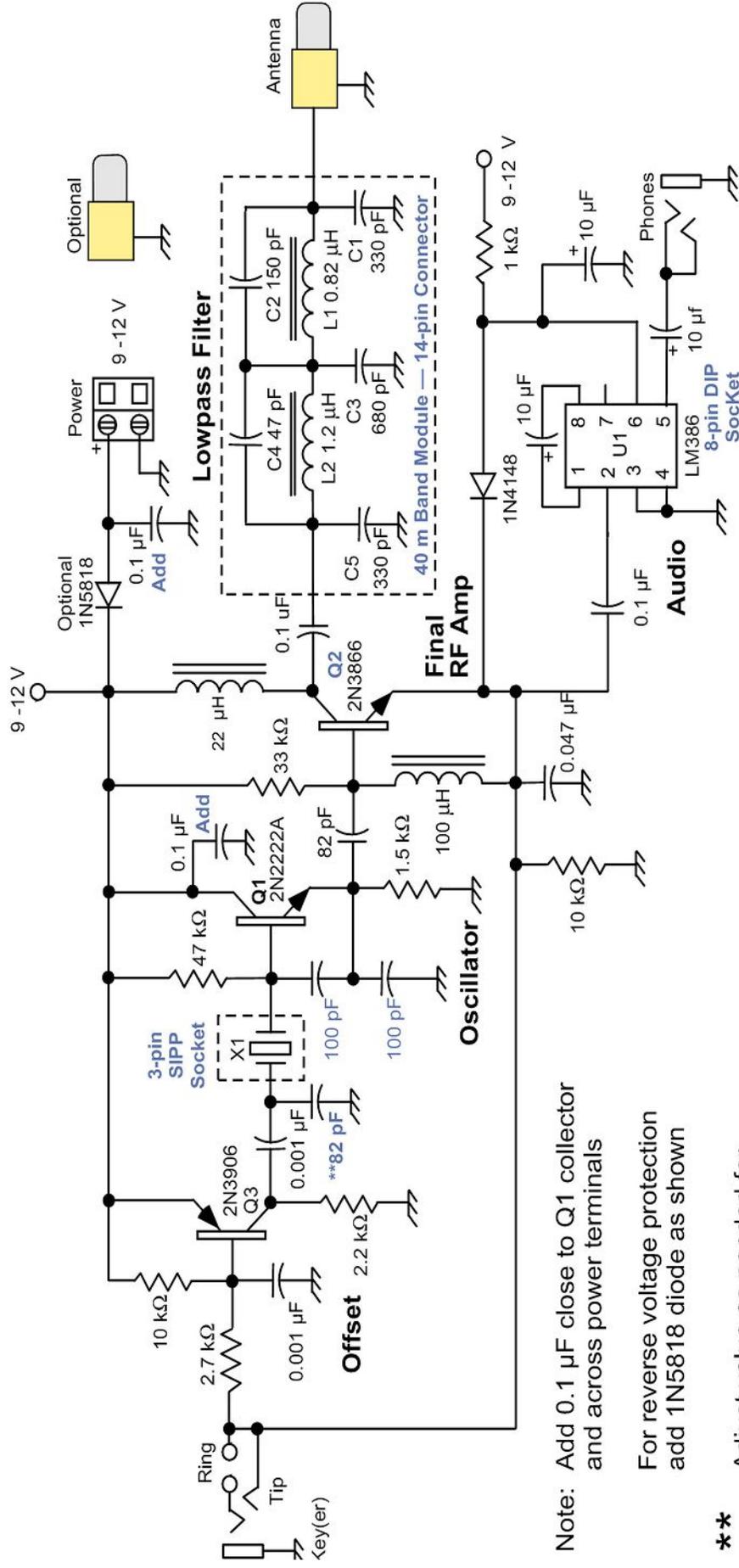
100uh (bag 5)
22uh (bag 5)
.82uh (bag 4)
1.2uh (bag 4)

Jacks/Connectors

2x7x.1" female header socket (bag 5)
2x7x.1" right angle male header (bag 4)
RCA Qty.2 (bags 2 & 5)
8-pin DIP socket (bag 3)
Stereo jack Qty.2 (bags 2 & 5)
1 x 7 x .1" SIP female socket Qty.2 (bag 1)
3 x 1 x .1" male header (bag 2)
2 x 1 x .1" male header (bag 2)
2 x 1 x .1" female shorting jumper (bag 2)

Other

PCB LS][
PCB LPF band module (bag 4)
TO39 Heat sink (bag 5)
Can & Label
Can mounting screw and nut
7122 Quartz Crystal



Note: Add 0.1 µF close to Q1 collector and across power terminals

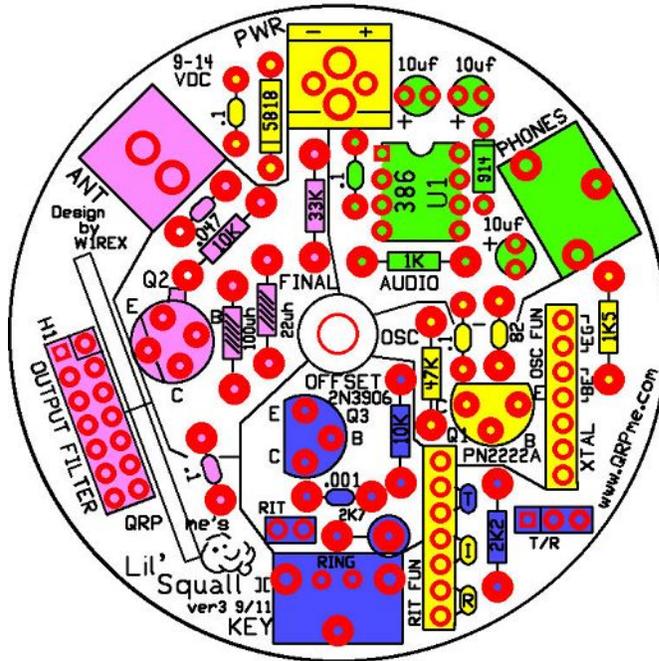
For reverse voltage protection add 1N5818 diode as shown

** Adjust value as needed for required offset, e.g., 800 Hz

For experimenting, use DIP/SIPP pins as sockets Q2, **82 pF and 100 pF(2).

Lil' Squall

W5USJ Drawing 6 Mar 2011



Stage 1 bag 1: The Big Oscillator (YELLOW parts)

1x7x.1 SIP machined pin socket Qty=2: 1 @ SIPP FUN & 1 @ RIT FUN

.1uf disc ceramic cap (104) Qty=2

1.5K (brn-grn-red) resistor

47K (yel-vio-org) resistor

PN2222A NPN TO92 transistor @ Q1

82pf disc ceramic cap (82) Qty.2: 1 @ 82 & 1 @ RIT - R
R is just inserted, NOT soldered!

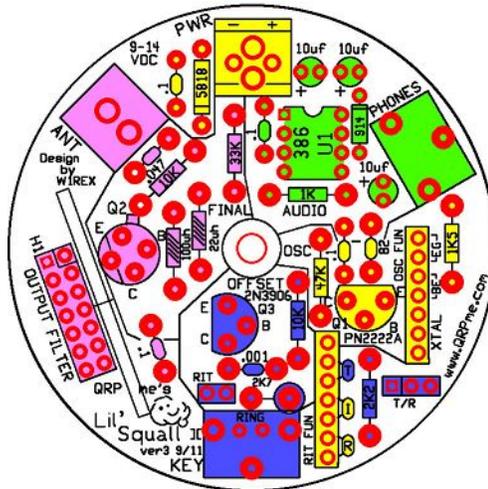
100pf disc ceramic caps (101) Qty=2: 1 @ RIT - BE & 1 @ RIT - EG
BOTH are just inserted, NOT soldered!

RCA video jack (or optional 2 position screw terminal block) @ PWR 9-12V

1N5818 diode

7.122 crystal at XTAL - just inserted, NOT soldered!

Solder in the SIP sockets, resistors, transistor, .1uf caps, ONE of the 82pf caps and RCA jack and 1N5818 diode at the indicated locations. Install a shorting jumper in RIT-I in lieu of an optional crystal shifting inductor. Use a small piece of clipped component lead for the jumper. Inspect your handiwork, install crystal and caps in the proper OSC & RIT FUN pins, apply power to the RCA power jack and listen for the oscillator in a nearby receiver tuned at the crystal frequency.



Stage 2 bag 2: To Key or Not to Key (BLUE parts)

2.2K (red-red-red) resistor

2.7K (red-vio-red) resistor (standing up in holes just above and right of RING)

10K (brn-blk-org) resistor

1000pf disc ceramic cap (102) Qty.2 1@.001 and 1 @ RIT - T

Just insert T cap, do NOT solder!

Stereo phone jack @ KEY

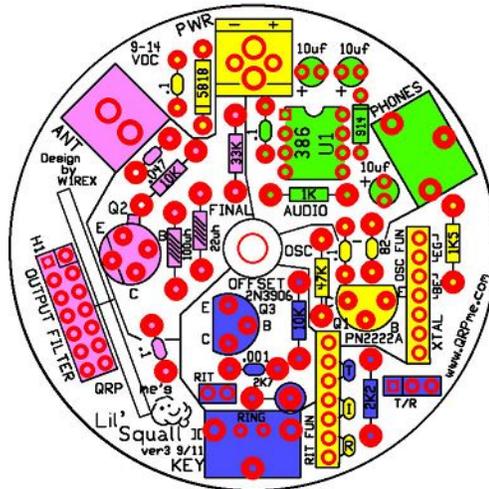
1x2x.1" male header connector Qty.2 1 @ RIT and 1 later in MODS)

1x2x.1" female shorting jumpers Qty.2 1 @ RIT and 1 later in MODS)

1x3x.1" male header connector @ T/R

2n3906 PNP TO92 transistor

Solder in the resistors, cap, jack and connectors and insert the .001 cap in the SIP socket RIT - T. Inspect your work. Attach a key to the key jack, apply power to the RCA power jack, tune the nearby receiver to the crystal frequency and listen to a change in the signal tone when keying the key...



Stage 3 bag 3: Audio-thon (GREEN parts)

8 pin DIP IC socket (Make special note of pin1 notch orientation before soldering)

1N914 or 1N4148 diode

1K (brn-blk-red) resistor

.1uF disc ceramic capacitor (104) Qty.2: 1 @ .1 & 1 later in MODS

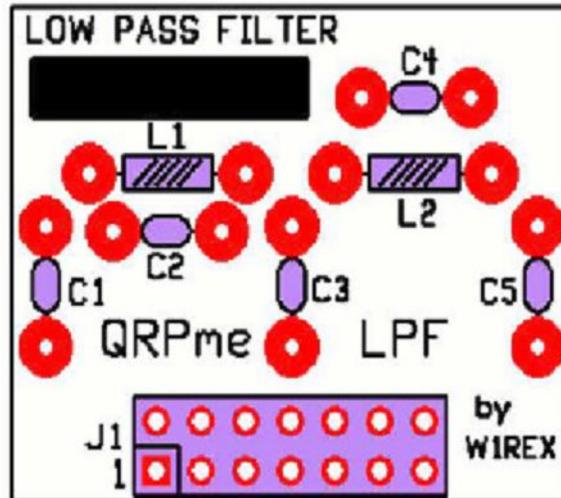
10uF aluminum electrolytic capacitor (blue can marked 10uF)

Stereo jack @ PHONES

LM386 audio amplifier integrated circuit

10 ohm (brn-blk-blk) resistor (install later in MODS)

Solder in the IC socket, resistors, capacitors and PHONES jack. I insert the LM386 chip into the socket. I inspect your soldering of the parts for this stage. I insert a set of headphones in the phones jack, apply power and then touch the left side of the amplifier chip. You should input enough noise into the input to be heard as loud static in the headphones. Take your finger off the amplifier chip and the noise goes away...



Stage 4 bag 4: Getting the Band back together! (PURPLE parts)

Lil' Squall band module printed circuit board

330pf disc ceramic caps (331) Qty.2: 1 @ C1 & 1 @ C5

680pf disc ceramic cap (681) @ C3

150pf disc ceramic cap (151) @ C2

47pf disc ceramic cap (47) @ C4

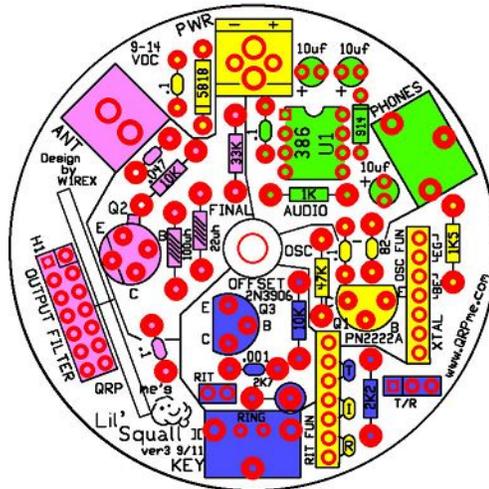
1.2uh choke (brn-red-gold) @ L2

.82uh choke (gry-red-silver) @ L1

2x7x.1" right angle male header @ J 1

The Lil Squall band module is very straight forward. Solder in all the parts and then inspect all your solder joints. You will have to trust that this board works until you can actually get it into a working transmit circuit ...

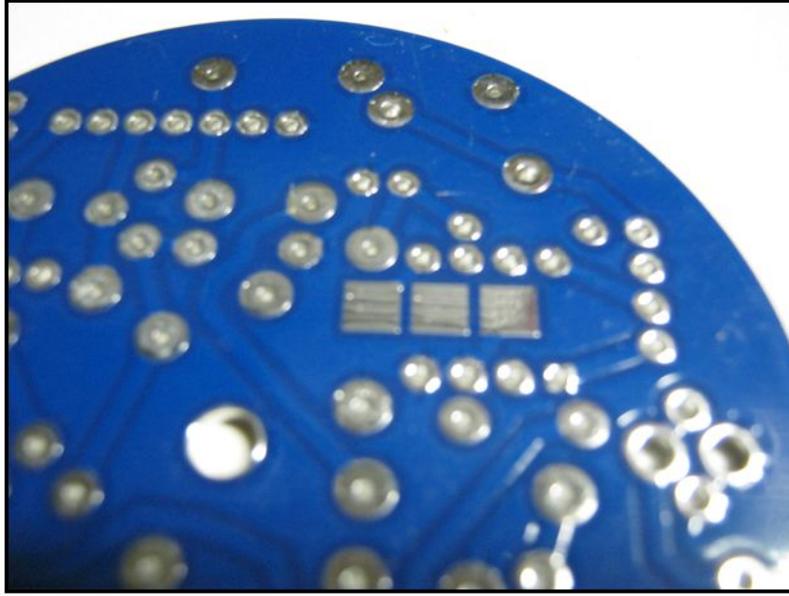
Please Note: This low pass filter board can be used for other projects by using a mating connector in the project. It can also be used when making a jiffy prototype design on a solderless breadboard. Note that when using this low pass filter board in conjunction with the Lil' Squall circuit board, the INPUT of the low pass filter is on the RIGHT end of the board. The OUTPUT of the low pass filter board is then on the LEFT end of the module...



Stage 5 bag 5: The Final detail. (PINK parts)

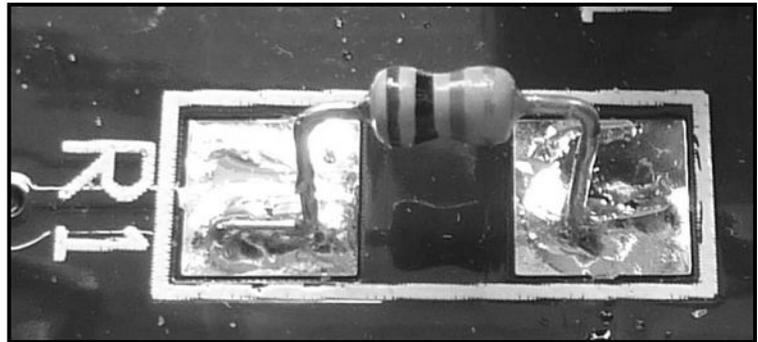
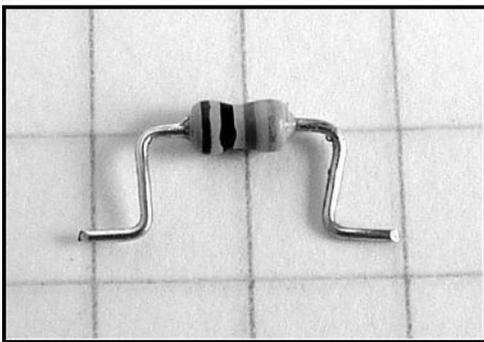
- 22uh choke (red-red-blk)
- 100uh choke (brn-blk-brn)
- 10K (brn-blk-org) resistor
- 33K (org-org-org) resistor
- .1uf disc ceramic cap (104)
- .047uf disc ceramic cap (473) stand-in for .05uf near the ANT jack
- Individual SIP IC socket pins @ Q2 Qty.3 cut from an 8 pin socket strip
- 2x7x.1" female header socket @ H1
- RCA jack @ ANT
- 2N3866 (house marked as DG0001) @ Q2 2N2222A (Just inserted into socket pins)

Solder in the chokes, resistors, caps IC socket pins and connectors. I inspect all your work for this stage. Bend the leads into the proper position for the 2N3866 transistor (house marked as: DG0001) and install in the socket pins at Q2. I install the band module. Attach a dummy load to the ANT jack. Apply power to the kit and key the rig. You should hear the oscillator in a nearby receiver and then hear a much louder shifted transmit signal when keying the key.



Stage 6: The MOD Squad... What to do with leftover parts...

The latest version of the Lil' Squall][transceiver has only one mod. A .1uf capacitor and series 10 ohm resistor are soldered to the SQUARE pads on the underside of the board. These are soldered 'Limerick Style'.



1. You can solder in a .1uf and 10 ohm resistor to the square pads on the bottom side. The two parts are in series so they can be soldered to the pads in either order R-C or C-R. Bend the component leads to make small 'feet'. Tin the pads and 'feet' then solder the components to the pads.

These two components form a 'hiss' filter for the audio amp.

Once everything works OK, you can install the board on top of the can using the nut & bolt supplied. The Lil' Squall is a very simple minimalist transceiver but you can still have hours and hours of fun playing with all the changeable features. Enjoy!