Radio Shack Special

source: braincambre500@yahoo.com

Here is what one hobbiest had to say about his maiden voyage with the Radio Shack Special!

This radio is sensitive enough to tune 20 stations across the FM band, some with volume high enough to drive a small PM speaker. The ability to tune 88.9 MHz and 89.1 MHz is testimony of its selectivity. The signal-to noise ratio rivals that of the better walkman type radios". Phillip Crane mailto:plcrane@delphia.net

Just click on the above picture for an in-depth view of each component

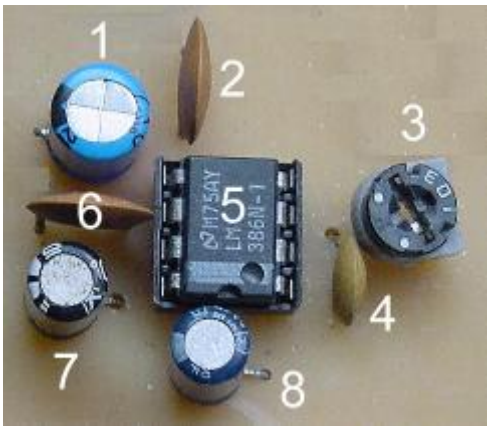
In the beginning ~

I have browsed the world wide web many a months back in 2002 in search of a one transistor FM receiver. I have seen a few... but they were always attached to some sort of added device., such as another IC or another transistor for doctoring up the receiver itself. Through my continued quest of searching for that 'too good to be true' one transistor unit, I happened to run across a particular schematic of a VHF super regenerative receiver by Charles Kitchen, famous for his vast knowledge of regenerative designs. I printed the schematic and made it. It turned out extremely well...for a two transistor, three coil unit. What made this circuitry more involved were the 13 capacitors, 4 resistors and two potentiometers. This brought the total component count to 24 in the receiver...not even mentioning the audio portion.

With the RSS 'receiver section' being only 12 components, this little jewel can be made in a short period of time. With its' marvalous sensitivity/selectivity/ and great audio sound...this simple circuitry is surely giving its' all.

With much experimentation and 'un-design'...as I call it, I began taking away a single component of the 'newly-made' receiver...one by one a component came off. Down to one transistor and two coils and 8 other components...it finally stopped. I then put component number 12 back. I must say that without sacrificing or comprimising it's superb sensitivity and selectivity in the original 24 component design, this 12 component count is still shining it's light as bright as it can; not forgetting to maintain the same crisp and clear original audio.

Close by it's side is the LM386 audio amplifying circuitry. The component count in this audio area rivals that of the receiver itself!



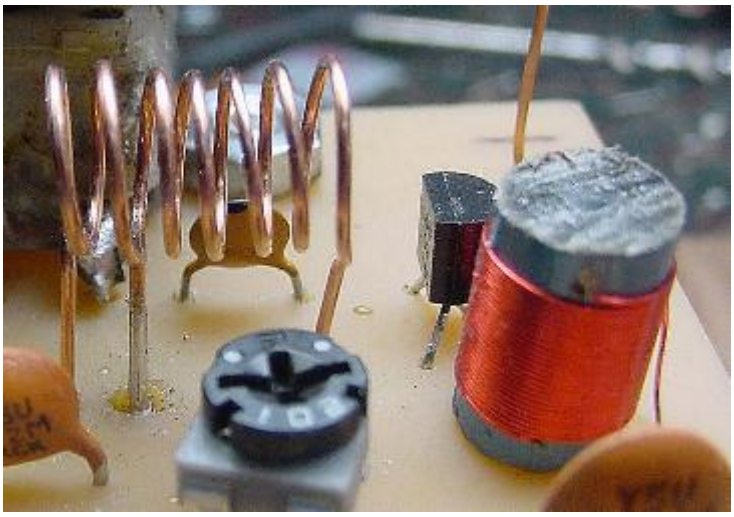
With only 8 devices, the sound quality coming from the headphones is 'quality at it's best'! Even though I took off another component in the audio section, the unit still did not deter from it's original sound quality!

The SOURCE and DRAIN Coils...

I then continued to experiment and re-design it's large RFC.

Now...standing no taller than 1/2 inch and 8mm's in diameter, this homemade choke, in which I call the SOURCE Coil, is doing its' job just fine.

Close by it's side is the DRAIN Coil, with a 2 turn tap. My latest design is made with a 3 turn tap...which makes the unit even more sensitive to stations being received. With all this load being put on the oscillator, not once did the oscillating section stop. Re-designing came around again and replaced the 5 foot telescopic antenna with a 6 inch 22 gauge un-insulated solid copper wire...which you can see in the upper right hand corner of the above picture. Right in front is the 1K pot for the gain control.



The underneath belly of the PCB shows the ON/OFF switch and the audio jack; all supported by two machine screws elevated to a height that gives the two devices enough ground clearance.

I did send an e-mail to Charles Kitchin and told him of the 'un-design' I had given to one of his designs. He wrote back saying that back in the earlier years, there was a certain TV company that had used that same type of 'un-design' method. If you would like to see just where the birth of the Radio Shack Special came from and it's theory behind it, take a trip now to see Charles Kitchen super regenerative VHF receiver.

~ The birth of the Radio Shack Special ~

And so became the birth of the Radio Shack Special...the name given to it because all of the components may be purchased at your local or nearby hardware and Radio Shack store. Although Radio Shack does not carry a typical 6 lead AM/FM variable (tuning) capacitor for tuning in to all the FM stations, I have managed to come up with a simple little way of going from station to station by just stretching and sqeezing the DRAIN coil with some sort of non-metallic small stick; such as a tapered-wooden match-stick. If you would prefer to use a variable (tuning) capacitor, you can always find these devices from any AM/FM tunable (not digital) radio or check to see if your local Wal-Mart carries a small blue portable AM/FM radio by 'Lenoxx Sound', which sells for around five dollars. From that radio, you can the salvage the variable (tuning) capacitor (with the plastic knob included), the headphones (in which I use for the Radio Shack Special) and the audio jack (also what I use for the project). A good buy for $5. The finished PCB in this project is adapted to either use a variable capacitor or not.

All the experimentation that one can find is here in this remarkable receiver...increasing sensitivity...finding other areas of interest in the VHF spectrum...altering the uH's of the SOURCE coil for better signal clarity when spanning other parts of the VHF spectrum...adjusting antenna heights for your best overall reception...adding additional taps to the DRAIN Coil to further increase sensitivity...putting in a larger audio amplifier to drive a loud speaker ...increasing or decreasing the DRAIN/SOURCE capacitor as still another way to acheive added sensitivity...even changing the capacitance value from .01uF to .1uF on the capacitor (whose one leg is coming from Pin #3 on the LM386 and the other leg to ground) to increase volume in the headphones.....enclosing the entire unit in a metal case for that personal touch...the list goes on and on.

~ The Goal ~

My end goal was four-fold:

(1) To make a very simple FM receiver with just one transistor

(2)Maintaining the original sensitivity and selectivity of the unit while keeping the audio strong and clear.

(3) Surrendering this unit to those who would like...not only to make it...but continuing the experimentation of altering the unit to your specific needs (Do know...this unit is capable of AM/FM/SSB).

(4)And to bypass 'mail ordering', by acquiring all of the needed items for this project at your local hardware and Radio Shack Store.

~ The Maiden Voyages ~

As time went on I started posting the little jewel on many different electronic forums...as you probably already know. The first person to make this was a fellow (now good friend and co-maker of this website) named Pedro. He not only made it...but designed a beautiful looking enclosure to fit his particular taste. When Pedro completed his project, this is what he had to say about it...

'you don't need to build complex technicalities ...such as slope or phase detectors required for fm reception. The amazing simplicity of this super regenerative receiver brings you the pleasure of hearing your favourite FM stations and at the same time the satisfying sense of personal achievements.'

...Pedro

Take a break right now and look at Pedro's own Radio Shack Special. Just click HERE

Time came around again and a fellow named Dick decided to take on the project. No sooner than starting, he finished it and wrote back to me stating he could receive his repeater some 95 miles away and also had pictures of the little marvel. I told him his name would go down on the books... as another RF hobbyist who finished the project with success. Do take a look at Dick's Maiden Voyage of the Radio Shack Special!

Once more, during the latter part of the summer, a fellow named Phillip had e-mailed me and stated that he 'already' had finished the project and that it came out extremely well. I had asked him if he would like to send a few pictures, along with a documentary of the voyage. He gladly told me that he would. So without further ado, do take a look at Phillip's Maiden Voyage of the Radio Shack Special!

The most recent person to take up this venture was a friend named Murphy. He not only has a unique way of making his projects, but also adds a little note on how he makes his printed circuit boards. Do take a look at Murphy's Maiden Voyage of the Radio Shack Special!

Well, should you decide to take up another 'maiden voyage'...the project is waiting. Do let me know how things go as the project comes along. I will surely put you down on the books for another great story for guests to read. And with all said...let's us begin!

~ The plans of the Radio Shack Special ~

The

Radio Shack Special

Project

Introduction

In this exciting project, not only will you have a very unique one transistor FM receiver, but also be in-store for making home-made air-core coils. And even more than that, when you finish 'your' project, your journey has just started. With your now-working FM receiver, you can start experimenting with many wonderful things that I had mentioned above. Once you have mastered all these things...you will surely have a better grasp on the whole concept of what 'hands on' experience truly is...not to mention you are doing all of this experimentation way up in the VHF (very high frequency) electro-magnetic spectrum. It is a very rewarding experience when you have gone into the unknown...taken roads that you have never taken before...roads that lead you to knowledge of things that you would have never thought possible...and all on your own!

Throughout this website, you will also find other nice projects. Some by me and some by my good friend...Pedro. We have put all these wonderful projects out to you in hopes that...just like fishing, if you have never experienced the joy of catching your first fish...you will never know what its' like. The same goes for these projects... we have all the 'bait' here for you to take...but it will be left up to you to grab it.

Every so often I go and post my Radio Shack Special to as many radio/ham/electronic forums as I can..not to mention always updating the website from comments, questions, concerns or advice from recent guests. Pedro and I are glad to see that you have managed to get here. With all that said, continue the voyage into the wonderful world of the single and proud...MPF102 transistor.

Most of the time it is the simple things that catch our attention...realizing later that much was learned from it.

...your friend, Patrick

Page 2

Get All Of The Parts First

Get all of your parts first. Below is the list of items to get. Browse through the list, then below the list, is a more detailed look at each item needed in the project, to give you a visual feel of the components/items involved. So, without further ado, let's go!

1 - MPF102 FET Transistor	1 - .001uF Ceramic Disk Capacitor
22 Gauge Enamel-Coated Magnet Wire	1 - 5pF Ceramic Disk Capacitor
18 Gauge Enamel-Coated Magnet Wire	1 - 15pF Ceramic Disk Capacitor
1 - LM386 IC Audio Amplifier	1 Package - Dry Transfers
1 - 8 Pin Retention Contact	1 Bottle - Etchant Solution
1 - Panel Mount Phone Jack	1 - Single -Sided PCB
1 - SPST Toggle Switch	1 pair of headphones
.....blank spot.....	1 - Variable Tuning Capacitor
1 - 10K Ohm Resistor (1/2 Watt)	1 - 5" X 7" plastic tray
1 - 1K Potentiometer	1 - Non-metallic tool for adjusting pots
1 - 10K Potentiometer	Nuts and Bolts for mounting project
10uF/35v Electrolytic Capacitor	1 -9 Volt Snap Connector
100uF/35v Electrolytic Capacitor	1 - Hack Saw
220uF/35v Electrolytic Capacitor	1 - Drill
1 - .01uF Ceramic Disk Capacitor	1 - 1/32 inch drill bit
1 - .0047uF Ceramic Disk Capacitor	1 - 5/16 inch standard size bolt (2" long)
2- .047uF Ceramic Disk Capacitor	1 - Single-edged razor blade
1 - .1uF Ceramic Disk Capacitor	and one pencil and one ball-point pen

Below are pictures of all the items needed for the Radio Shack Special

FET Transistor

$0.99

Catalog #: **276-2062**

(Pricing and Availability may vary outside the contiguous 48 United States.)

Looking at the front (flat) side of this transistor, the orientation of the legs are, from left to right...D (Drain), S (Source) and G (Gate).

Magnet Wire Set

$4.39

Brand: **RadioShack**

Catalog Number: **278-1345**

This is a package that comes with three spools of 22 gauge...26 gauge...30 gauge. For the project, you will need the 26 gauge and the 30 gauge.

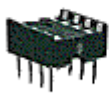
LM386 Low Voltage Audio Power Amplifier
8 Pin DIP

$1.29

Catalog Number: **276-1731**

This IC is needed to amplify the very faint audio coming from the receiver itself. With a 10uF across Pins #1 and #8, the volume is more than enough for typical headphones.

8-Pin Retention Contact



$0.59 Brand: **RadioShack**

Catalog Number: **276-1995**

This retention contact is needed for the project. It will go into eight holes that will be drilled by you on the PCB. Once it is drilled, you solder it into place. Then the LM386 is inserted into the retention contact.

Panel-Mount
Jack

$1.99

Catalog # 274-245

This audio phone jack will be used in the project for your to connect your headphones to in order to hear the audio from the Radio Shack Special.

SPST Micromini Toggle Switch

$2.99
Catalog Number: **275-624**
3A/125VAC. Requires 1/4" mounting hole.

This switch will be used to turn the unit ON and OFF.

10K Ohm Horizontal-Style Trimmer

$1.19 Brand: **RadioShack**
Catalog Number: **271-282** Model: **271-282**
Micro-size. Rated 0.1W, 50VDC.

1K Ohm Horizontal-Style Trimmer

$1.19 Brand: **RadioShack**
Catalog Number: **271-280** Model: **271-280**
Micro-size. Rated 0.1W, 50VDC.

These are 2 potentiometers that will be used for the VOLUME and and for the GAIN, respectively.

10µF 35V 20% Radial-Lead Electrolytic Capacitor

$0.99 Brand: **RadioShack**
Catalog #: **272-1025** Model: **272-1025**

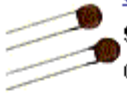
100µF 35V 20% Radial-Lead Electrolytic Capacitor

$0.99 Brand: **RadioShack**
Catalog #: **272-1028** Model: **272-1028**

220µF 35V 20% Radial-Lead Electrolytic Capacitor

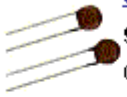
$0.99 Brand: **RadioShack**
Catalog #: **272-1029** Model: **272-1029**

These three electrolytic capacitors are needed for the added circuitry of the LM386 IC.



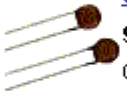
0.01µF 500V 20% Hi-Q Ceramic Disc Capacitor Pk/2

$1.19 Brand: **RadioShack**
Catalog Number: **272-131** Model: **272-131**



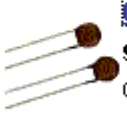
0.0047µF 500V 20% Hi-Q Ceramic Disc Capacitor Pk/2

$1.19
Catalog Number: **272-130**



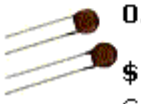
0.047µF 50V Hi-Q Ceramic Disc Capacitor Pk/2

$0.99 Brand: **RadioShack**
Catalog Number: **272-134** Model: **272-134**



0.1µF 50V Hi-Q Ceramic Disc Capacitor Pk/2

$0.99 Brand: **RadioShack**
Catalog Number: **272-135** Model: **272-135**



0.001µF 500V 20% Hi-Q Ceramic Disc Capacitor

$1.19 Brand: **RadioShack**
Catalog #: **272-126** Model: **272-126**

These are all the different values that are needed for the project. These capacitors are non-polarized, so the two leads can be placed into the circuitry either way.

10K ohm 1/2W 5% Carbon Film Resistor pk/5

$0.99 Brand: **RadioShack**
Catalog Number: **271-1126** Model: **271-1126**

The 10K resistor is needed for the receiver itself.

Set Of 80 Ceramic Disc Capacitors

$7.99 Brand: **RadioShack**
Catalog #: **272-809** Model: **272-809**
(Pricing and Availability may vary outside the contiguous 48 United States.)

Where to Buy	
On-line	Yes
In Stores (Store Locator)	Yes
1-800-THE-SHACK	Yes

Up to 50WVDC. 3 each of 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 39, 47, 56, 68, 82, 100, 150, 220, 330 and 470pF; 5 each of 15,18,22,33pF.

Radio Shack offers 80 ceramic disk capacitors, ranging from 1pF to 470pF. The project calls for one 5pF and one (15pF or one 10pF.)

Dry-Etch Transfers
$1.99
Catalog Number: **276-1490**

I explain how to make a PCB using Dry Transfers. It is a simple and good way to make copper routing on your PCB. You can even duplicate one board from another, as you will see in the instructions on this webpage...further down.

PCB Etchant - Extra Etching Solution
$3.99
Catalog Number: **276-1535**
Brand: **RadioShack**
Model: **276-1535**

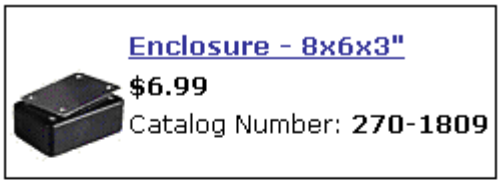
This bottle of echant solution will go a long way, after your have completed the RSS.

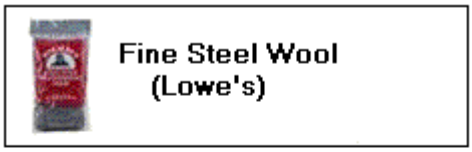
PC Board Kit
$3.99
Catalog Number: **276-1499**
2-sided board with dimensions of 4-1/2x6-1/8".

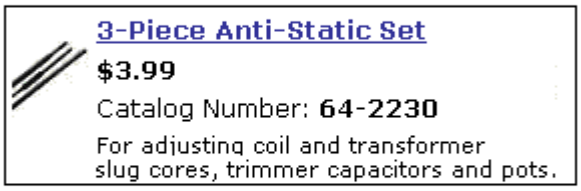
Even though the project calls for a single-sided PCB, this double-sided PCB will work fine. When it comes time to etch your PCB, go ahead and etch all of the backside copper off also.

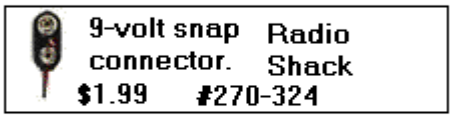
HEADPHONE RADIO
PR35
Available at all Wal-Mart Stores

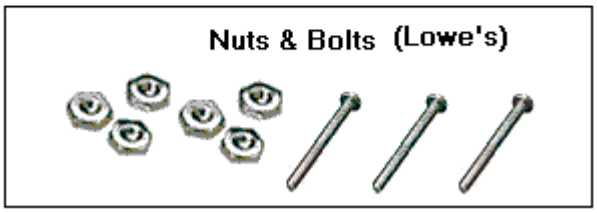
There are only a few things left to get for the project. You will need a set of headphones and a variable tuning capacitor. By going to Wal-Mart, in the 'music department', you will probably find this little AM/FM radio (with headphones) on the shelf. It sells for $5.00 You cannot beat the price for what you will salvage from it. The company name in front of the radio is LENOXX SOUND - Model No. PR35. All the ones that I have bought (6), are all BLUE in color. Do take a little trip there, and see if your Wal-Mart also carries it....they should. Using a variable tuning capacitor in the Radio Shack Special does indeed work fine.











The 'enclosure' is for you to have a plastic tray when it comes time The 'enclosure' is for your etchant solution to etch your PCB. The 'anti-static' set it to adjust both your potentiometers. The 'nuts and bolts' are for mounting your project on a non-metallic form...such as a any 1/8 inch wood paneling. The ' fine steel wool' is needed to polish up the PCB just before putting down your Dry Transfers. The '9-volt snap connector' goes to the battery...and the two leads are solder onto the PCB. The 'hack saw' is to cut your PCB to the right dimensions, mentioned further down on the webpage.

A drill with a 1/32 inch drill bit will also be needed. Plus a 5/16 inch standard threaded bolt about two inches long; this bolt will be needed in making your home-made 'Single Layer Tapped Air Core Coil (which is termed the DRAIN Coil in the project).

When you have gotten' all of the items required, the next step is to actually start the project. The next page will begin with making two home-made devices...the SOURCE Coil and the DRAIN Coil. Let's us begin!

Page 3

Making The Homemade Devices

The following two devices must be strictly made according to plan. It is these devices, that if not made to exact trueness, will warrant a 'no-go' situation, when it comes time to turn the unit on for the first time. I will go into great detail in how to make each one of these items. I will begin with the SOURCE Coil....then the DRAIN Coil. Let us begin:

The SOURCE Coil

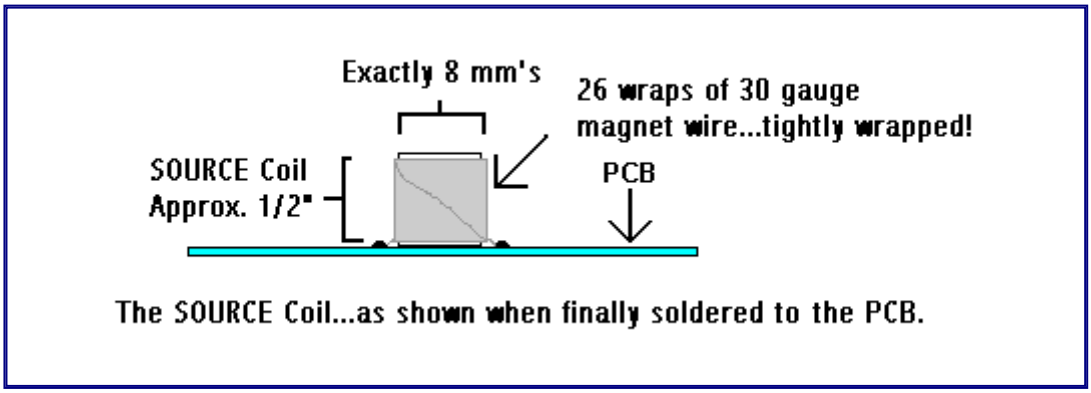
Items Needed

(1) An drill
(2) A 1/32 inch drill bit
(3) A round non-metallic form, whose measurements in width are exactly 8mm's.
(4) 30 gauge enamel-coated solid copper wire (magnet wire)

Begin by drilling a 1/32" hole somewhere toward the center of the non-metallic form. Take the end of the 30 gauge magnet wire and place through the hole of the form. Let it stick out 1/2 inch and then make a 90 degree bend with it. This will keep the wire in place while you are making your wraps around the form. Now make 26 close-wound wraps around the form. I use the term 'close-wound' meaning that each turn MUST be touching the next turn. Remember now, it is OK for the turns to touch, since you are using enamel-coated wire. When you get to your 26th wrap, take the drill

and make another hole right beside the last wrap. Then cut the magnet wire and place thru this second hole. Make sure the wire extends out of the hole a good 2 inches. Then make a 90 degree bend in the wire so as the wire can hold itself in place. The coil should be good and tight and should not come undone. Then use some type of bonding agent to cover the two ends from loosening. I use a dab of 'super glue' on the top hole and the bottom hole, where the wire went through. Let it set for a good hour before handling. When that is dry, trim both ends of the wire for enough length needed to be soldered onto the respective place on the PCB. do not have any slack in the wire coming from the coil to the PCB. The picture is what it should look like when you have soldered the SOURCE Coil into place on the PCB. Although, once you have finished making it, place it aside until it is time to solder it on the PCB.

Simulation of the SOURCE Coil



Below is an actual view of a home-made SOURCE Coil

The DRAIN Coil

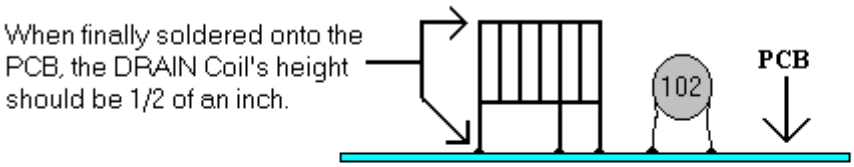
Items Needed

(1) 22 Gauge Solid Copper Wire (Magnet Wire)
(2) A 2 inch long 5/16 of an inch standard threaded bolt

This coil will be a single layer 'tapped' air core coil. Since this coil is homemade, refer to the Construction of Single Layer 'tapped' Air Core Coilsfor the plans on how to make this unique device. Once you have understood how to make it, come back to this webpage for the specified number of turns/taps for this particular DRAIN Coil.

This DRAIN Coil will be a total of 7 turns, with a 3 turn tap; that is, if you intend to use a variable tuning capacitor. If you do not want to use a variable tuning capacitor...then make a total of 9 turns with the DRAIN Coil...with a 3 turn tap. Go ahead and make your coil right now. Once it is made, place it aside until the time comes to solder onto the PCB. Below is a drawing on how the DRAIN Coil should look like, once it is soldered onto the PCB. Notice the coil is situated with the tap being closest to the .001uF ceramic capacitor.

Simulation of the DRAIN Coil



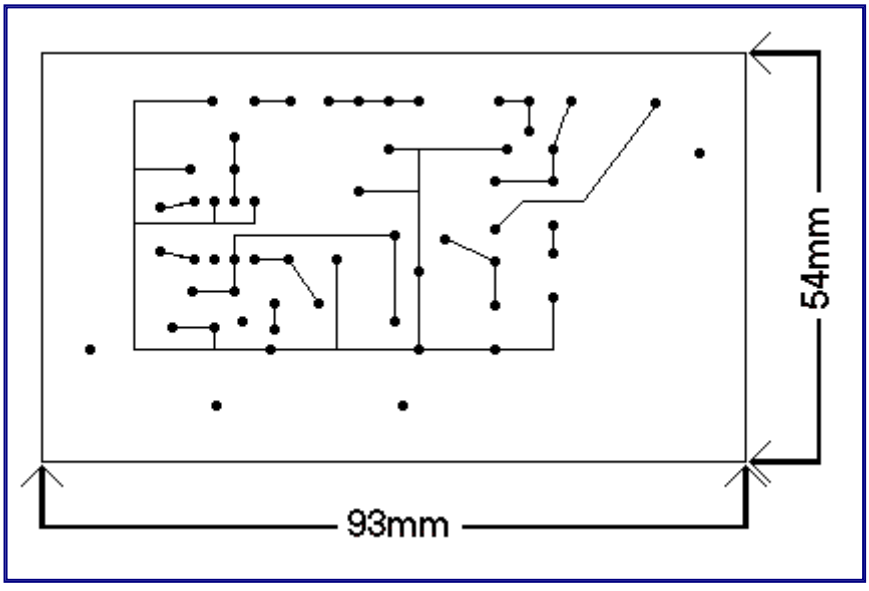
This is a drawing of the DRAIN Coil when it is finally soldered onto the PCB. Notice the .001uF capacitor on the right. The tapped leg of the DRAIN Coil should be on the side closest to the ceramic capacitor.

Below is an actual view of the home-made DRAIN Coil

Page 4

The Printed Circuit Board (PCB)

The Radio Shack PCB Template



Understanding the Above Template

This must be a single-sided PCB. That means there must only be copper on ONE side of the printed circuit board. The other side of the board MUST NOT HAVE COPPER. The overall dimensions are shown in the above template. Go ahead and print out a copy of the template. Once you have done that, take a ruler and make sure your printed copy

measures out to the same measurements as stating above. If not, send the drawing to a graphics program (such as the Paint Program in Windows 98) and stretch or squeeze the drawing until the right dimensions (both height and length) can be printed out. Now you can proceed to make the PCB.

I made my PCB using Dry Transfers from Radio Shack. If you are familiar with making PCB's, then go ahead and make it your typical way. Understand that you MUST adhere to the same routing as I have on the PCB template.

If you have never made a PCB before, I will explain to you how one can make a great looking board...using Dry Transfers from Radio Shack. The link I am about to give you will show you how a PCB is made with Dry Transfers. Although the link is old and needs to be updated with the new single-sided PCB, the routing will differ. Please do not use the PCB template on that link page. It is NOT the updated one as you see on this webpage. Therefore, just read how one goes about in making a PCB using those transfers. Once you understand that, you may come back here and proceed to make your PCB using the current and updated PCB template on this webpage. Please click on the link HERE.

Page 5

The Ordered Way of Soldering the Components (cont'd)

You shall start to solder/place all of the components onto the PCB. You shall solder/place in an ordered way so as not to get caught in a 'cornered' spot when soldering or placing components on the PCB. Also, since there are certain components that need to be solder and placed correctly, I will explain how 'each' component must go...so as to stay true as you can to the project plans.

Below these words are three Charts: CHART I, CHART II and CHART III. Print out these 3 charts...as it will be needed when you are in the process of soldering the components to the board. When you have finished printing out those 3 charts, place them aside on your workbench and then use Chart III to begin an ordered way of putting all the devices onto the etched PCB. CHART I and CHART II will give you a FULL EXPLANATION on 'where and how' each item is to be placed/soldered on the board for completion.

When you have completed putting all of the items on the board, go to Page for your first 'Turn-On' of the Radio Shack Special.

CHART I

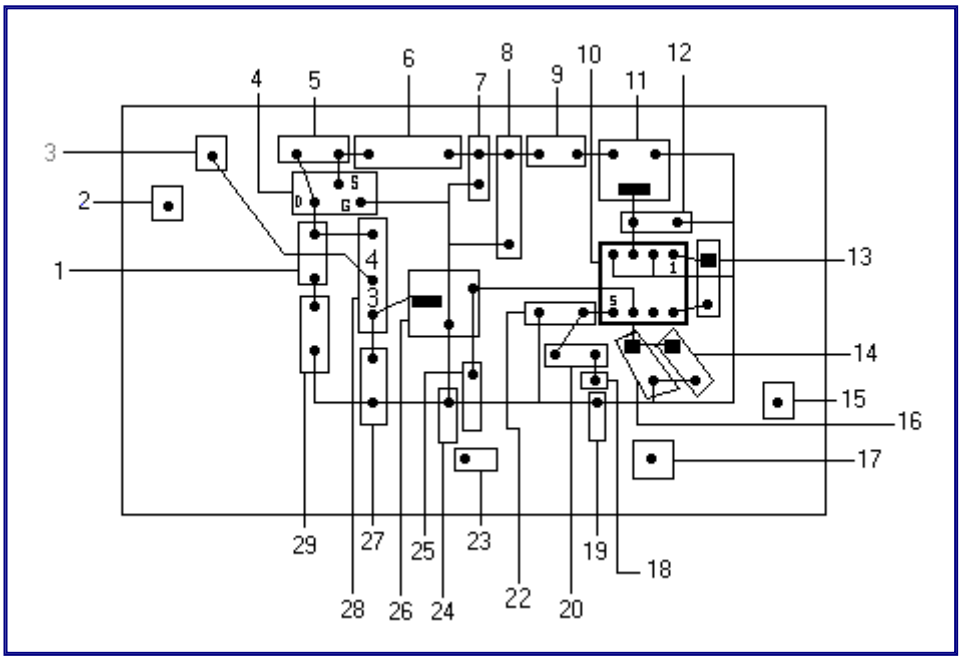


CHART II

1 - DRAIN Capacitor (15pF ceramic capacitor if you are using a tuning capacitor...if not, use a 10pF)	17 - Hole for audio jack placement
2 - Hole for mounting purposes.	18 - This is where the POSITIVE lead of the audio jack is soldered.
3 - Antenna (6 inches of un-insulated 22 gauge wire)	19 - This is where the NEGATIVE lead of the audio jack is soldered.
4 - MPF102 FET Transistor (orientation is shown in picture.)	20 - Electrolytic Capacitor (220uF/10v) Positive lead is a black square.
5 - DRAIN/SOURCE Capacitor (5pF ceramic capacitor)	21 - OMITTED
6 - SOURCE Coil (The top lead goes to the .0047uF capacitor. Bottom lead goes to the SOURCE leg on the MPF102.)	22 - Ceramic Capacitor (.047uF)
7 - SOURCE Capacitor (.0047uF ceramic)	23 - This is the hole for the SPST switch (The ON/OFF button).
8 - Resistor (10K ohm - 1/2 watt)	24 - Battery connection - This is where the NEGATIVE lead is soldered.
9 - Ceramic Capacitor (.1uF)	25 - Battery connection - This is where the POSITIVE lead is soldered.
10 - LM386 IC (Pin #1 & Pin#5 is marked.)	26 - 1K Potentiometer - The middle leg is in BLUE.
11 - 10K Potentiometer (Center leg is a black rectangle.)	27 - Ceramic Capacitor (.001uF)
12 - Ceramic Capacitor (.01uF)	28 - The DRAIN Coil - Position the tapped leg so that it is closest to the .001uF capacitor.
13 - Electrolytic Capacitor (10uF/50v) Positive lead is a black square.	29. This is a typical 6 lead variable (tuning) capacitor. You may find these in AM/FM tunable radios. Refer to CHART III, Step 23, for proper orientation of this component.
14 - Electrolytic Capacitor (100uF/10v) Positive lead is a black square.	
15 - For mounting purposes	
16 - Ceramic Capacitor (.047uF)	

CHART III

The Ordered Way of Putting all the Items onto the PCB

Step 1 - Begin by getting some sort of non-metallic form to mount your PCB. I use a 9" X 9" 1/8 of an inch wood paneling. Find whatever may suffice. Next, drill out your two mounting holes (#2 and #15) with a drill bit that will fit the nut and bolt you will use in order to mount the PCB onto the wood paneling. Do not let the board 'touch' the wood paneling. Have is raised up to about inch above the paneling, to leave room for adding the ON/OFF switch and the Audio Jack. These two items will go underneath the PCB. Once you have your PCB mounted in a sturdy fashion, dis-assemble it from the mount. Put the wood paneling aside until all items are finished on the PCB. Then you can re-mount the PCB to the wood paneling.

Step 2 - Two more holes need to be enlarged. It is Item #17 and Item #23. Item #17 will be the hole for the audio phone jack (Radio Shack Part # 274-245). Item #23 will be for the ON/OFF switch (Radio Shack Part #275-624). Drill the holes now and make sure that both items fit in their respectives holes. Then take them out and place them aside. It will be put in later.

Step 3 - Take your 8 Pin DIP IC Socket (Radio Shack Part # 276-1995) and place it into the 8 holes (#10) on your PCB. Flip the PCB upside-down, and solder into place now. Then flip the PCB right-side up again, and insert your LM386 IC into the 8 Pin DIP IC Socket. Make sure Pin #1 of the LM386 goes into Pin #1 into the correct hole of the 8 Pin DIP IC Socket. Double-check by looking at the CHART I. The chart shows where Pin #1 should go.

Step 4 - Item #13 in CHART I is a polarized electrolytic 10uF/50v (radial lead) capacitor. Pay particular attention to the polarity of this capacitor. The positive lead on the capacitor will go to Pin #1 on the LM386 IC. The negative lead on the capacitor will go to Pin #8 on the LM386 IC. Solder into place now.

Step 5 - Item #14 in CHART I is a polarized electrolytic 100uF/10v (radial lead)capacitor. Pay particular attention to the polarity of this capacitor. The positive lead on the capacitor will go to Pin #6 of the LM386 IC. The negative lead on the capacitor will go to GROUND. Solder into place now.

Step 6 - Item #16 in CHART I is a .047uF ceramic capacitor. One leg will go to Pin #6 of the LM386 IC. The other leg will go to GROUND. Since this capacitor is NOT polarized, the legs are inter-changeable. Solder into place now.

Step 7 - Item #21...OMITTED

Step 8 - Item #22...OMITTED.

Step 9 - Item #26 is the 1K Potentiometer. The center leg will go to the bottom outside leg of the DRAIN Coil. CHART I shows the center leg as being a large black rectangle. The bottom leg (in respect to CHART I) will go to GROUND. The top leg will go to the + of the battery and to Pin #5 of the LM386 IC. You may have to 'bore out' your three 1/32" holes on the PCB where the pot will go, as the legs of the potentiometer may be a little too big for the 1/32" hole. Then solder into place.

Step 10 - Item #11 is the 10K Petentiometer. The center leg will be go to Pin #3 on the LM386 IC. CHART I shows the center leg as being a large black rectangle. The left leg (in respect to CHART I) will go the the .1uF ceramic capacitor. The right leg will go to GROUND. You may have to 'bore out' your three 1/32" holes on the PCB where the pot will go, as the legs of the petentiometer may be a little too big for the 1/32" hole. Then solder into place.

Step 11 - Item #4 is the MPF102 FET Transistor. Look at CHART I for the correct orientation of the device. Make sure you push the legs in all the way through the three holes. You want the tip-top of the transistor at a height of 1/4 of an inch above the PCB. Then solder into place.

Step 12 - Item #27 is a .001uF ceramic capacitor. One leg will go to the bottom leg (in respect to CHART I) of the DRAIN Coil. The other leg will go to GROUND. Both the legs on the capacitor are inter-changeable. Then solder into place.

Step 13 - Item #1 is the DRAIN Capacitor. You have two options here:

1) If you decide NOT to use a variable tuning capacitor, then Item #1 will be a 10pF ceramic capacitor.

a) Put a piece of small wire between the two terminals on Item #29 in Chart I.

b) Then take your 10pF capacitor and solder into place in Item #1 in Chart 1.

2) If you decide to USE a variable tuning capacitor, then Item #1 will be a 15pF ceramic capacitor.

a) Your variable tuning capacitor ground lead will go to the 'lower' terminal in Item #29 in Chart 1. The other lead from the variable tuning capacitor will go to the 'upper' terminal in Item #29 in Chart 1.

b) Your 15pF ceramic capacitor will be soldered in Item #1 in Chart 1.

Step 14 - Item #5 is the DRAIN/SOURCE Capacitor. It is a 5pF ceramic capacitor. One leg will go to the DRAIN leg of the MPF102. The other leg will to the SOURCE Coil and also to the SOURCE leg of the MPF102. Solder into place.

Step 15 - Item #7 is the SOURCE Capacitor. It is a .0047uF ceramic capacitor. One leg will go in between the SOURCE Coil and the 10K resistor. The other leg will go to GROUND. Solder into place.

Step 16 - Item #8 is a 1K resistor (1/2 watt in rating). One leg will go in between the .1uF ceramic capacitor and the .0047uF ceramic capacitor. The other leg will go to GROUND. Solder into place.

Step 17 - Item #9 is a .1uF ceramic capacitor. One leg will go to the 10K potentiometer. The other leg will go to the 10K resistor. Solder into place.

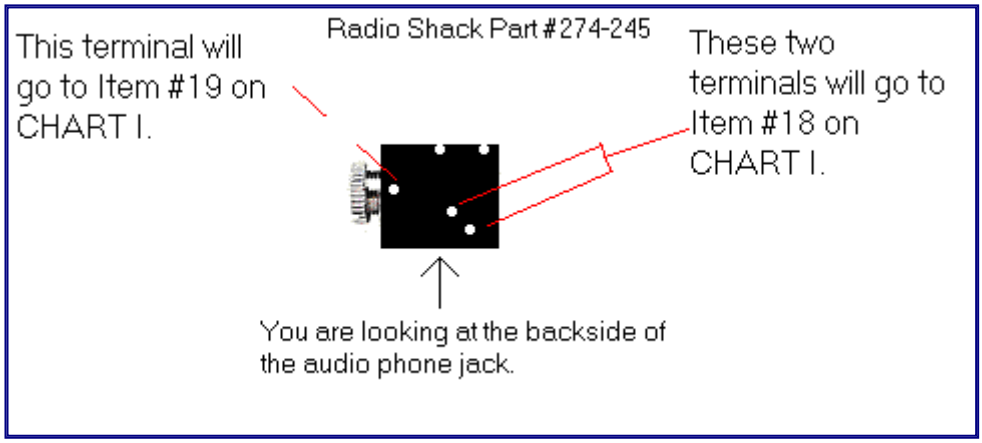
Step 18 - Item #12 is a .01uF ceramic capacitor. One leg will go to the middle leg of the 10K pot. The other leg will go to GROUND. Solder into place.

Step 19 - Item #28 is the DRAIN Coil. This coil is home-made. It is actually a single layer 'tapped' air core coil. Please refer to my special section on how to make the DRAIN Coil. Once it is made, the tapped leg goes into the middle hole (Refer to CHART I), but make sure you have the coil positioned so that the tapped leg is closest to the .001uF ceramic capacitor. You will have to bore-out the tapped hole on the PCB a little...in order for the tapped leg to fit. Then solder into place.

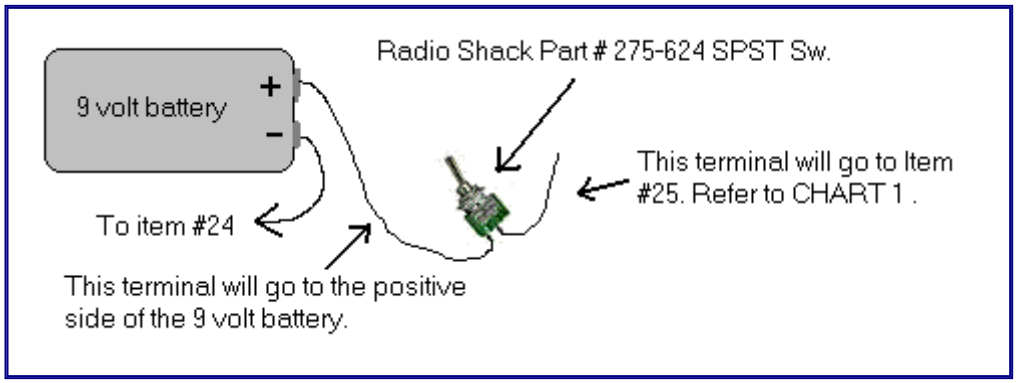
Step 20 - Item #6 is the SOURCE Coil. Have one lead go to the SOURCE leg on the MPF102. Have the other lead go to the .0047uF ceramic capacitor. Solder into place. Then use a dab of super glue to make a small bond between the PCB and the coil itself. This is to keep the coil good and secure.

Step 21 - Go ahead and put in your audio phone jack. Secure it to the PCB with the attached nut. There are five connections on the backside of this device. Look at the drawing below in understanding how it is to be hooked up to the

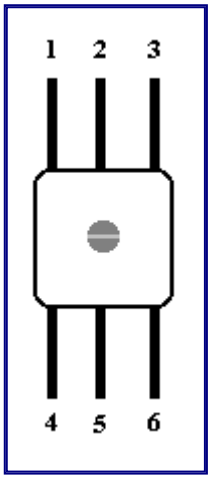
PCB.



Step 22 - Item #23 is the ON/OFF (SPST) switch. It is Radio Shack Part #275-624. Secure it to the PCB with the attached nut. There are two terminals to the back side of the switch. Refer to the drawing below in understanding how it is to be attached to the PCB. The battery hook-up will also be shown in the drawing.



Step 23 - Item #29 is the 6 lead variable tuning capacitor. Below is a drawing on how the capacitor is to be applied to the PCB.



This will be a little trial and error for this device. Since most people do not have a capacitance meter to check which side of this variable capacitor is the 'right' side, we will find out another way. Here we go!

You will either use numbers 1 and 2.....or you will be using numbers 5 and 6. To find out which set of numbers are the correct ones, you will need to turn on the radio. Only one set of numbers will give you the full span of the FM broadcast band. That is, from 88 to 108 Mhz...and then some. The other set will only give you a portion of it. It is up to YOU to find out, once the unit is operating, to make this call. BUT DO REMEMBER ..Number 2 and number 5 are GROUND. So whatever set of numbers you use, make sure one of those numbers go to GROUND on the PCB. Let's take an example...say you decided to use the set of numbers 1 and 2. That means 2 will HAVE to go to GROUND. Let's say you decided to use the set of numbers 5 and 6. That means 5 will HAVE to go to GROUND. That would be the lower terminal in Item#29 (Refer to CHART I). Decide to you one set of numbers now, and solder them in. Later, when it comes time to turn the unit on, you can them experiment more on this device to find out what set of numbers are the correct ones. Once you have found that out. you can dab a little super glue on each ends of the device. This will keep it good and secure.

Step 24 - Item #3 if the antenna. The antenna is a 6 inch length of 22 gauge un-insulated solid copper wire. Go ahead and solder it in.

Looks like you have just completed everything there is to put on the PCB. Go ahead and mount the PCB back on it's non-metallic form. The next page will be the 'first' TURN ON! Let's go!

Page 6

The First 'Turn-On'

Here we go...

Take a good overall look of the PCB. Look and inspect for solder droppings, electrical routing 'breaks' or bad soldering on components. This will be your final inspection before turning the unit on.

With a 'fresh' 9-volt battery in place and switch to OFF and a 'standing tall' 6 inch 22 gauge magnet wire in place for the antenna...set the unit accordingly...make sure the 1K potentiometer is turned all the way to the right...make sure the 10K potentiometer is turned all the way to the left, then turn 1/4 the way to the right.

With the headphones on the ears and with the potentiometer tool (the tool needed to adjust both potentiometers) in hand, turn the receiver ON!

One of two things will happen...

You will either receive good clean static...

Or you will be on an FM Radio Station...

If everything went according to plan...it should have come on. For the ones that had decided NOT TO USE the variable tuning capacitor, squeeze and stretch the DRAIN Coil to adjust for different stations. For the ones that had decided TO USE the variable tuning capacitor, turn the plastic knob on the shaft of the variable tuning capacitor and adjust for different stations. And also remember, find out which set of numbers on the variable tuning capacitors are the correct ones. Try them both.

Now take the potentiometer tool and begin to turn the 1K pot to the left, slowly, until you hear the static increase...as you keep turning the static will then decrease again and then the unit will go out. When it does, then turn back to the right until you hear that loud static again...that is where you want the pot to remain. There is a certain area where the static gets the loudest, right before it goes out...try to find that spot. Once you have it, you may now breeze through the stations and can also use your volume control (10K pot) to regulate the audio in your headsets..

There you have it, my friend! I hope everything went well and that you are experiencing the many benefits from the...

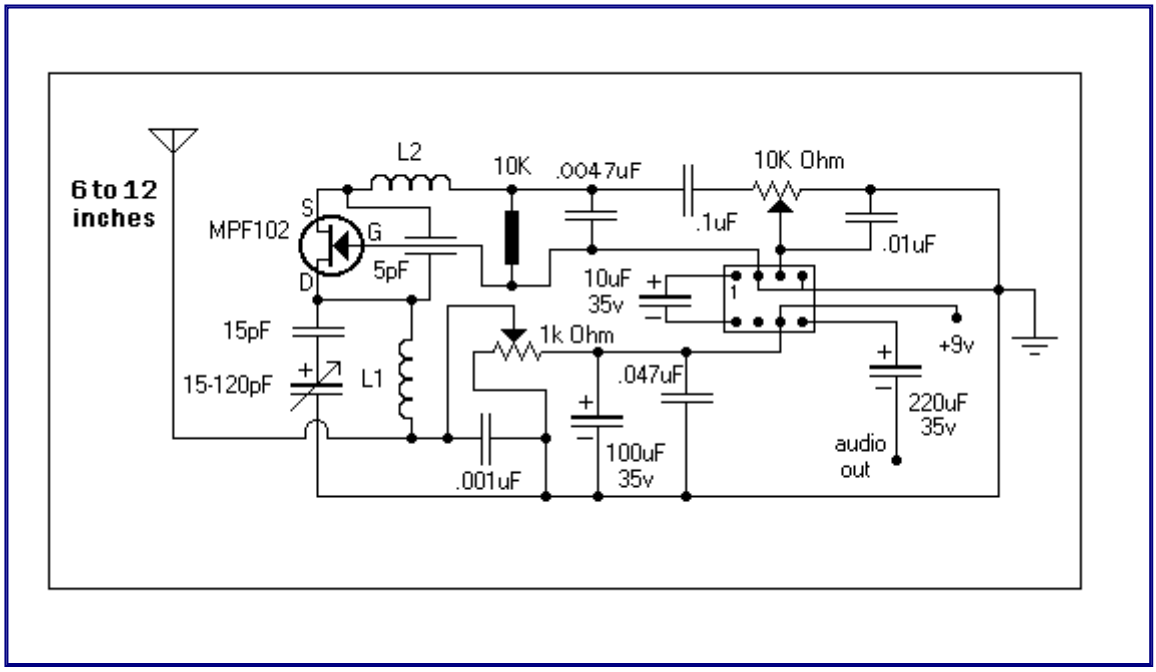
Radio Shack Special!

Troubleshooting the Radio Shack Special

Along the way of making it, you may unhesitatingly e-mail me for whatever concern or advice or question you make have concerning the project. If you have come this far, and it doesn't perform at all...or for that matter 'well', it would seem there could be another culprit lying in the circuitry there to challenge you a little more. Re-look at everything you went through...correct polarity on capacitors...correct circuitry placement...droppings of solder in between two separate electrical routings...a break in an electrical routing. Also, touch the .1uF fixed capacitor on the receiver output to see if you hear a humm in your headphones. This would let you know if the audio section is up and running. If you do not hear a humm when you touch this capacitor, increase the volume and try again. Still if no humm, then your audio section will have to be looked at again...Do please send me a line if a culprit is still there...two heads are always better than one!

Page 7

Below is the schematic layout for the Radio Shack Special. Although one needs to pay strict adherence to following the exact routing of all the electrical circuitry as shown on the PCB routing, which is shown further up on this webpage, this schematic is intended just to show how the components are arranged in relation to one another.



...and let the project beg

..your friend, Patrick

More info and updated schematics to the author's site.