The 6LE8 One

Tube Broadcaster

Introduction

The purpose of this broadcaster is to transmit your favorite music to every AM radio in your home. The transmitting power is so low that it should not bother the neighbors. A common application would be to drive it from the speaker leads of your FM radio, which could then include playing your XM or Sirius to your AM sets, or just your favorite FM station.

A steady decline in the selection of quality AM stations has created the need. Now your restored antique AM's can be playing the same music throughout your home simultaneously.

The 6LE8 transmitter circuit is a modification of the 6888 tube transmitter originally designed by Norm Leal, a member of the Antique Radio Forums website (ARF).

If you have questions about the transmitter, go to the Antique Radio Forums website and post a question in the homebrew section:

www.antiqueradios.com
(Antique Radios – the collector's resource)
→ Forums
→ Homebrew
→ New Topic

Parts

The table at the following page lists the components that are needed to construct the transmitter.

Some of the parts can be obtained from Radio Shack (www.radioshack.com) and part numbers are given for those items (even if the part is supplied with the kit). However, equivalent parts from any source will work. The exception is the 6LE8 tube, as the circuit has been tested with various different brands of tubes and found not to work satisfactorily with every brand. Generally the Sylvania's provide better performance than most of the other brands. Still there were some RCA's that performed very well. Newer GEs weren't bad but early ones were distorted, as was every made in Japan tube that was tested. Some of those non-working tubes can be made to work with custom modifications to the circuit and component values but it is not discussed here.

A separate isolation transformer and filament transformer were used in the design so that the homebrewer could re-use either part in a future project if desired. Some parts such as TR1 and TR3 are not supplied in the kit.

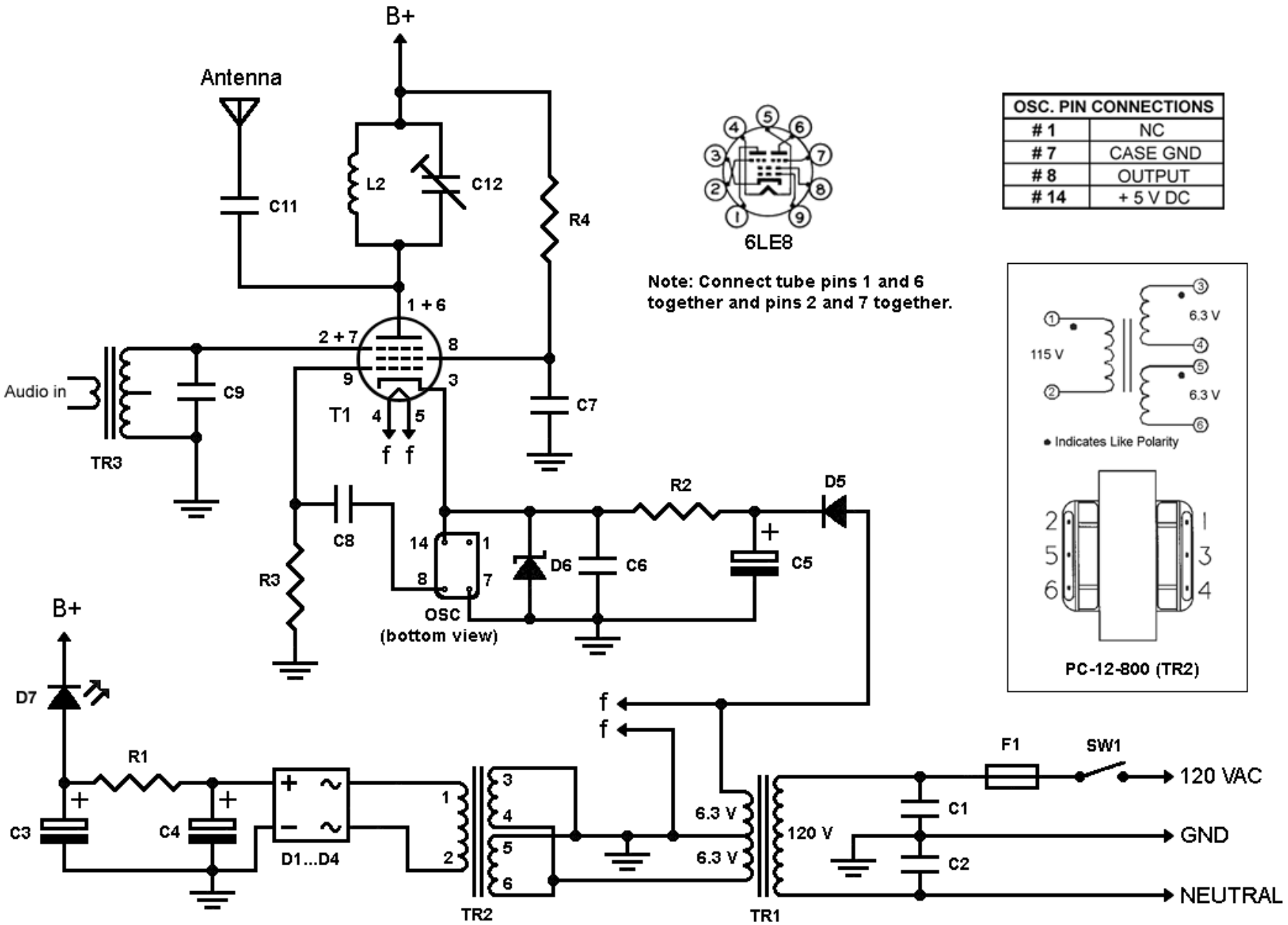
You can also use the parts list and the schematic to build the 6888 transmitter. You will need a different tube socket and the resistor R4 must be changed to 4.7 kohm (½ watt) and the value of R1 should be lowered to around 1 kohm (2 watts). You may also leave out the parts D5, C5 and R2 (and also the connection from the 6.3 V filament supply to D5) because the 6888 will work with or without them. The LED (D7) may be used even though it is not a part of the original 6888 circuit (it serves only as a power on indicator).

Symbol in schematic	Qnty	Description	Notes (RS # means Radio Shack part number)
R1	1	4.7 kΩ, 2 W resistor	
R2	1	150 Ω, ½ W resistor	RS #271-1109
R3	1	47 kΩ, ½ W resistor	RS #271-1130
R4	1	1.8 kΩ, ½ W resistor	
D1…D4	1	1A, 400 V full-wave bridge rectifier	RS #276-1173
D5	1	1N4001 diode	RS #276-1101
D6	1	5.1 volt, 1 watt zener diode	RS #276-565
D7	1	light emitting diode (LED)	RS #276-041 (any colour will work)
C1, C2	2	0.0047 µF safety capacitor (Y-type)	any value between 0.001 and 0.01 µF will work
C3, C4	2	47 µF, 250 VDC electrolytic capacitor	
C5	1	1000 µF, 10 VDC electrolytic capacitor	RS #272-1032
C6, C7	2	0.1 µF, 250 VDC film capacitor	RS #272-1053
C8, C11	2	470 pF, 250 VDC ceramic capacitor	
C9	1	0.001 µF, 250 VDC ceramic capacitor	RS #272-126
C12	1	variable capacitor (trimmer)	
L2	1	180 µH coil	
TR1	1	120 V / 6.3–0-6.3 V filament transformer	RS #273-1352
TR2	1	PC-12-800, 120 V / 2 x 6.3 V filament transformer	
TR3	1	audio transformer	RS #273-1380
OSC	1	1 MHz oscillator	
T1	1	6LE8 tube	for example Sylvania brand
F1	1	400 mA slow blow fuse (T)	
SW1	1	SPST switch	RS #275-602
Miscellaneous:			
9 pin miniature tube socket			
1/8” mono audio jack			RS #274-251
14 pin IC socket (for the oscillator)			RS #276-1999
fuse holder			RS #270-739
perforated circuit board			RS #276-1396
binding post for the antenna wire			RS #274-661
project enclosure			RS #270-1806
10 ft (3 meters) of wire for antenna			
3-wire mains cord			
connecting wire			
machine screws and nuts			

Additional notes:

The voltage ratings of the capacitors may be higher than the values given in the list but no lower. Same applies to the resistor wattages.

There are no L1 and C10. They were part of an earlier version of the schematic and have been substituted by L2 and C12.

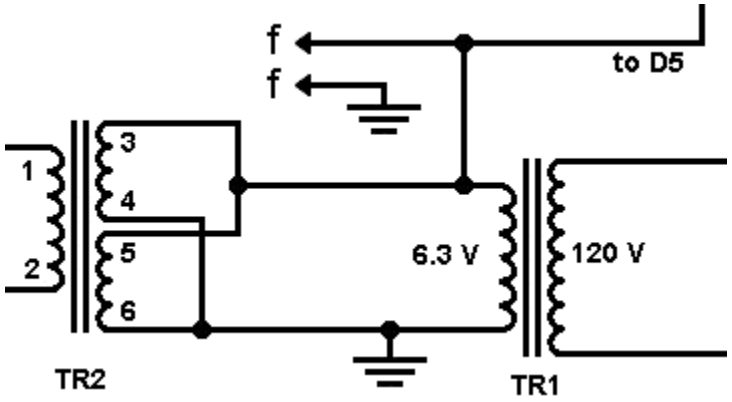

B+
Antenna
C11
L2
C12
R4
1 + 6
2 + 7
8
9
3
T1
4
5
f f
C7
Audio in
C9
TR3
C8
R3
14
1
8
7
OSC
(bottom view)
D6
C6
R2
D5
C5
B+
D7
R1
C3
C4
D1...D4
1
2
3
4
5
6
TR2
6.3 V
6.3 V
120 V
TR1
F1
SW1
120 VAC
C1
GND
C2
NEUTRAL
6LE8
Note: Connect tube pins 1 and 6 together and pins 2 and 7 together.
OSC. PIN CONNECTIONS
1 NC
7 CASE GND
8 OUTPUT
14 + 5 V DC
115 V
6.3 V
6.3 V
Indicates Like Polarity
PC-12-800 (TR2)

General Instructions

THIS CIRCUIT USES DANGEROUSLY HIGH VOLTAGES INCLUDING MAINS (AC LINE) VOLTAGE WHICH CAN BE LETHAL SO IF YOU ARE NOT SURE WHAT YOU ARE DOING, DON'T DO IT!

For safety reasons it is best to use a three wire mains (AC) cord. The safety capacitors C1 and C2 are optional but they help to reduce unwanted interference from the mains (power line) which may cause hum. C1 and C2 must be special Y-type safety capacitors and cannot be substituted with any other type.

TR1 in the schematic is a 120 VAC / 12.6 VAC centre tapped filament transformer such as the Radio Shack #273-1352 but any other transformer with similar ratings can be used. If the used transformer has only one 6.3 VAC secondary winding it should be wired like this:



The pin numbers of the TR2 are given in the schematic. You can make sure which pin is which using continuity tester: pins 1 and 2 should show continuity but pins 4 and 6 should not.

The audio transformer (TR3) can be almost any audio transformer. The ratings are not critical. One suitable option is the Radio Shack audio

transformer (#273-1380) which is also what is shown in the schematic. To avoid interference don’t mount the audio input too close to the antenna.

Before applying power for the first time make sure that everything is connected according to the schematic and that the electrolytic capacitor and diode polarities are correct.

Peaking

In order to get the maximum signal out of the transmitter, you will need to tune the tank circuit (capacitor + coil connected to the tube plate (anode)) into resonance with the oscillator frequency. An LC-circuit (L = coil, C = capacitor) will exhibit a certain resistance to AC-current flowing through it. When in resonance the resistance is at maximum.

This transmitter uses a variable capacitor (C12) and a fixed coil (L2) as the tank circuit. It is also possible to use a variable coil and a fixed capacitor.

One way to do the peaking is to monitor the cathode current of the tube. This will require disconnecting that particular circuit from ground (pin 3 6LE8) and hook an ammeter in between. Next adjust the variable capacitor and look for a "dip" in the current. An analog meter is the best for this, because the needle movement is so easy to observe but it can be done with digital meter also. Because the resistance is at maximum when correctly tuned you'll need to find a spot where the current is at minimum. The "peak" will be somewhat pronounced. The current will be somewhere in the range of 10 to 20 mA with this particular transmitter. The antenna is an important part of this and must be connected when peaking. The length of the antenna will affect the location of the "sweet spot" so use the antenna that you're going to use in the future with the transmitter.

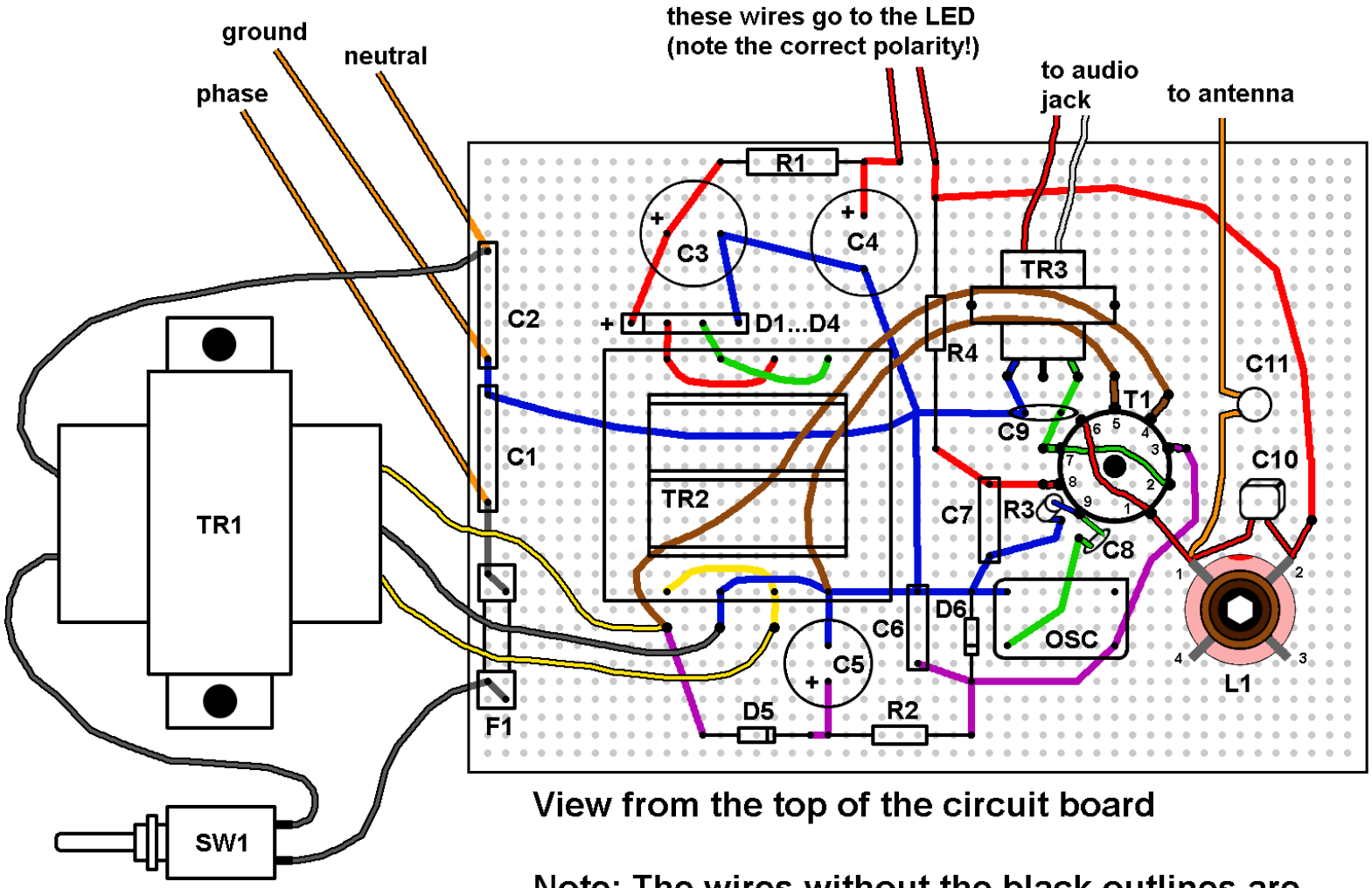
Another method is to monitor the B+ voltage at the second filter cap. Using this method, nothing needs to be disconnected. This time you're looking for maximum voltage because with minimum current the load to the power

supply it at minimum hence the max voltage. Again an analog meter is easiest to observe, but a digital will be fine. The variation in B+ voltage will be in the range of millivolts (be careful since the B+ is over 100 volts!).

It is important to use a non-metallic tool when doing the adjustments, as it can affect the result. The transmitter will work if not exactly tuned, but the performance will be a bit poorer. And if you change the oscillator to one that has a different frequency or change the length of the antenna you'll need to do the peaking again.

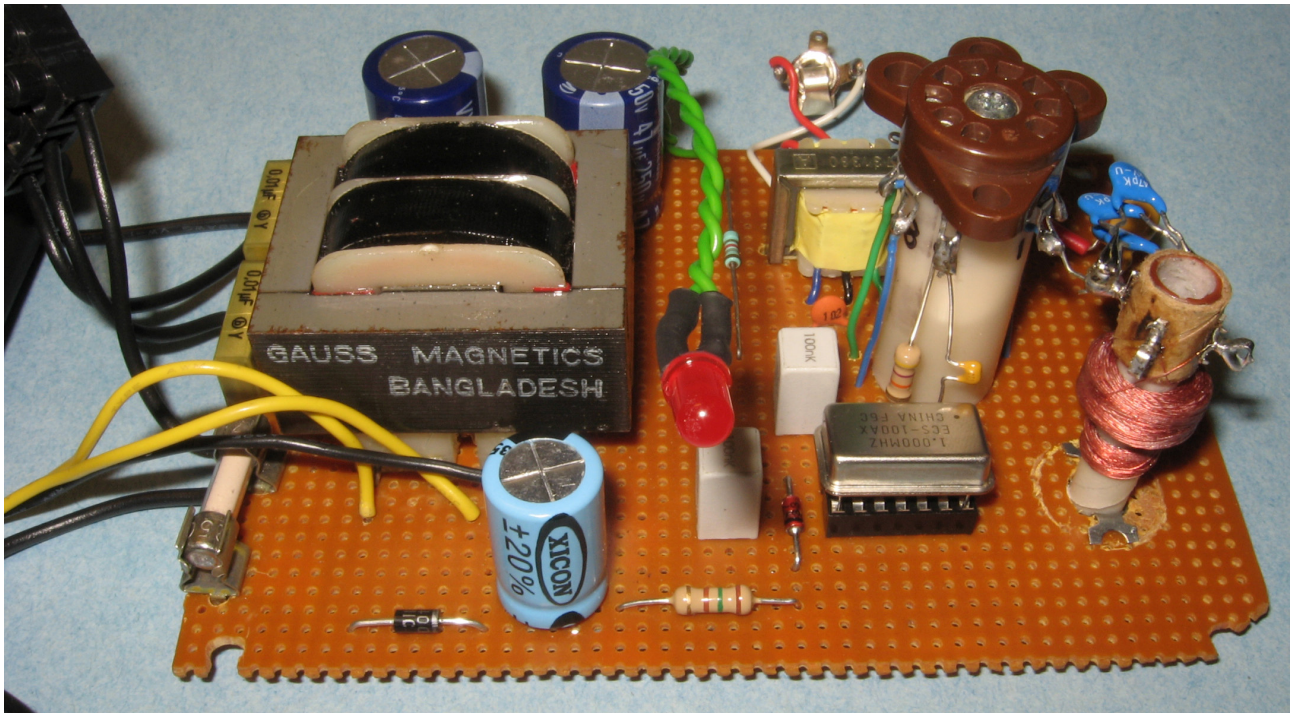
The following pages show a component placing / wiring diagram and some pictures of the prototype 6LE8 transmitter which was assembled in a 6x4x2” project enclosure from Radio Shack. The picture in the cover is also from the same prototype. Some of the parts are different in the current kit. For example the prototype used Miller P-70-A adjustable antenna coil and a fixed 150 pF capacitor in the tank circuit. However, the pictures may still be useful for ideas.

A component placing / wiring diagram of the prototype 6LE8 transmitter. Some components (for example TR2) are different in the current kit.

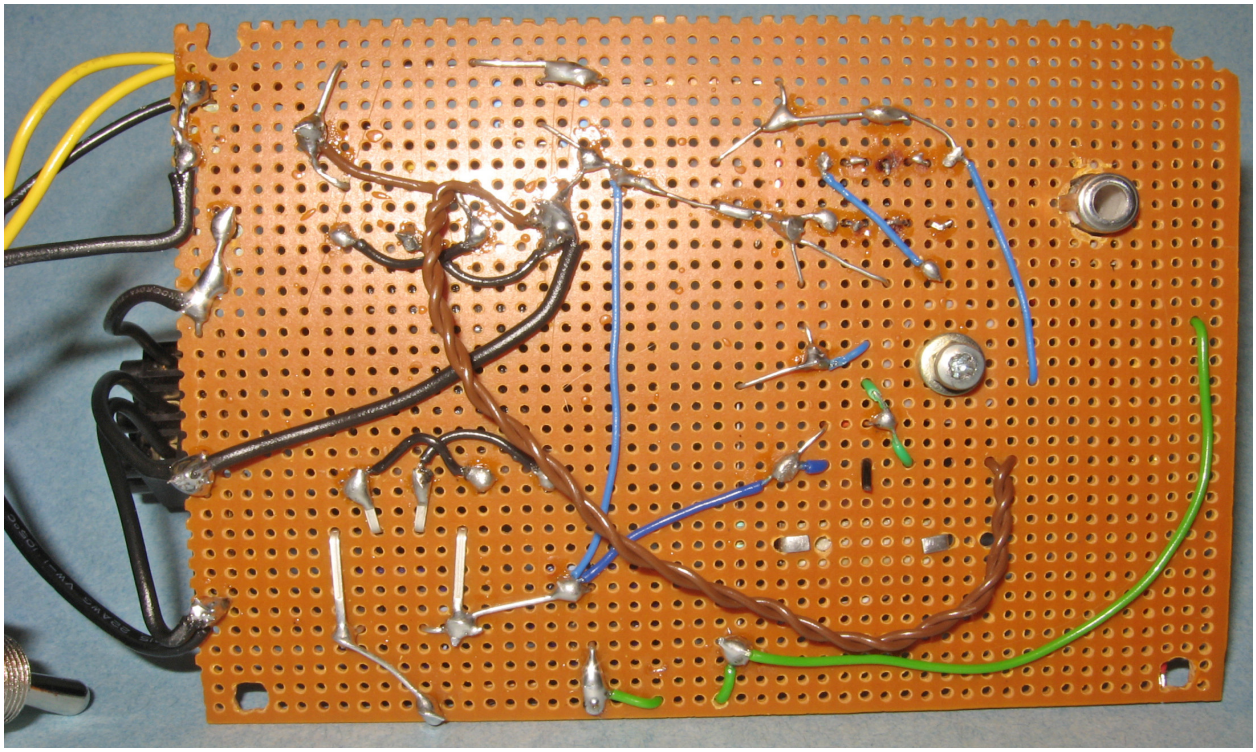


View from the top of the circuit board

Note: The wires without the black outlines are under the board and outlined wires are on top.


GAUSS MAGNETICS
BANGLADESH
XICON
+20%


GME 322
nichicon




273-1352A