

Cheap Crystal Sets That Works Well!

AI Klase – N3FRQ

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Rev 1.1

This is a work n progress!

Rational

- One of the traditional attractions of a crystal set was that it was inexpensive.
- However, in recent years, we've encountered snags, like \$25 for a simple 365 pF variable cap and even wire for coil winding is getting expensive..
- Of course, if we're building one set, we just grab some nice parts from the junk box and proceed.
- But, things are different when we want to "kit up" a number of radios, say for a Cub Scout Pack or [radio club activity](#)..
- So. here's my take on cheap crystal sets that actually works well.

Quick Links

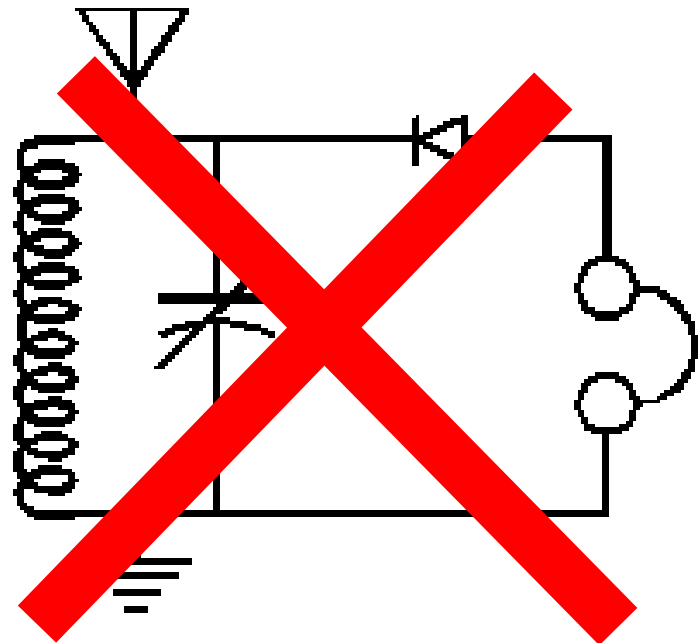
[SkyWaves Crystal Set Page](#)

[Rev 0.4 Mini-Mouse video.](#)

[Another version of this circuit using vintage AA% radio parts](#)

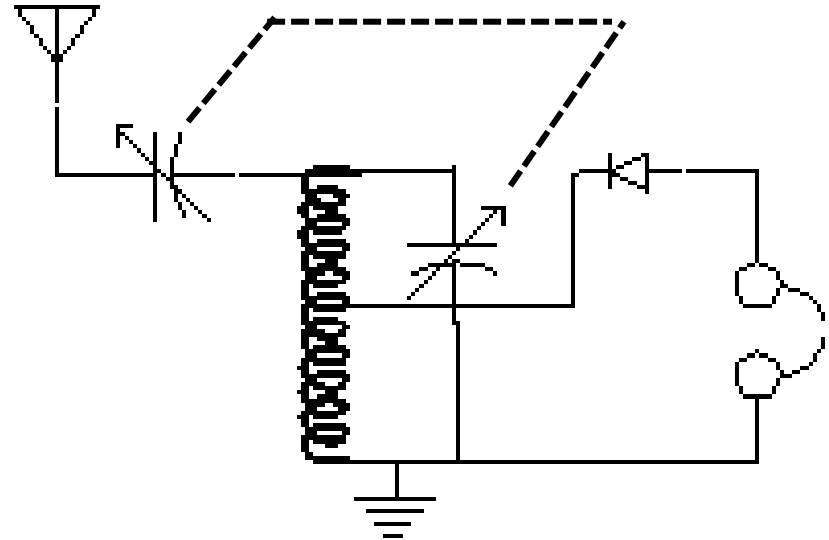
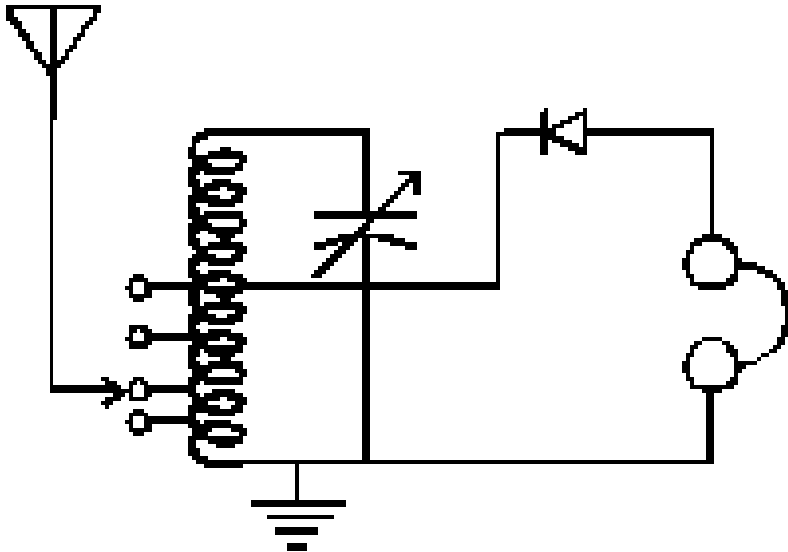
Editorial Comment

- Over the years millions of crystal radios have been built.
- The vast majority were simply dreadful performers.
- However, it's not that difficult to build a good one.
- For example, the [Pretty Good Xtal Set](https://www.skywaves.ar88.net/Presentations/Crystal%20Sets%20202.pdf).
- A good crystal set will hear high-power daytime stations out to 40-50 miles and get DX at night.
- Take the whole course here:
<https://www.skywaves.ar88.net/Presentations/Crystal%20Sets%20202.pdf>

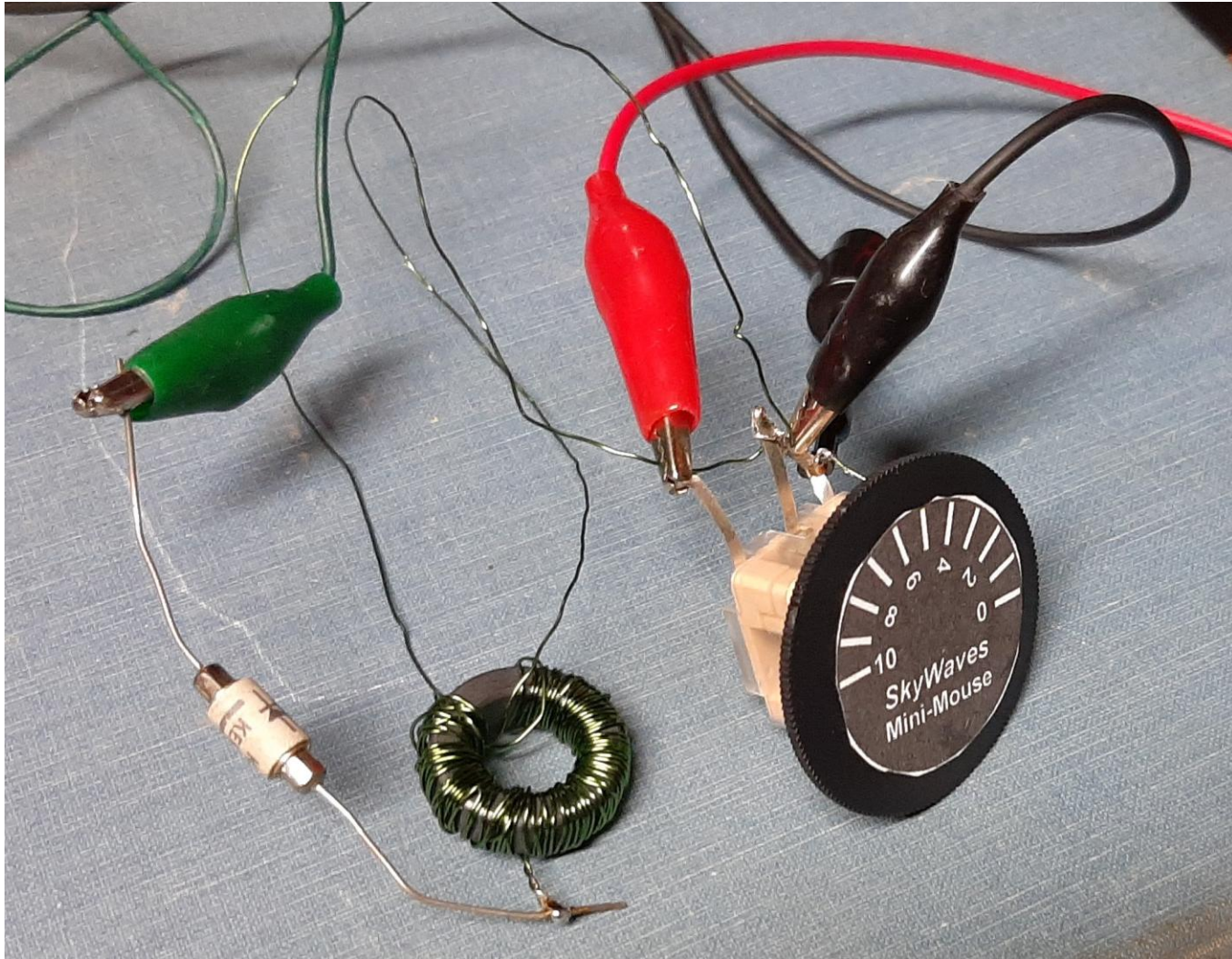


Effective Circuits

- Both of these circuits implement better match to the antenna and the detector/audio load.
- The circuit on the right leverages available and cheap two-section variable capacitors..



Rev. 0.1



- Hears about 7 stations in [THIS ENVIRONMENT](#) with a 2K-ohm headset.
- What you see is about 6 bucks retail.

Ferrite Toroid Inductors



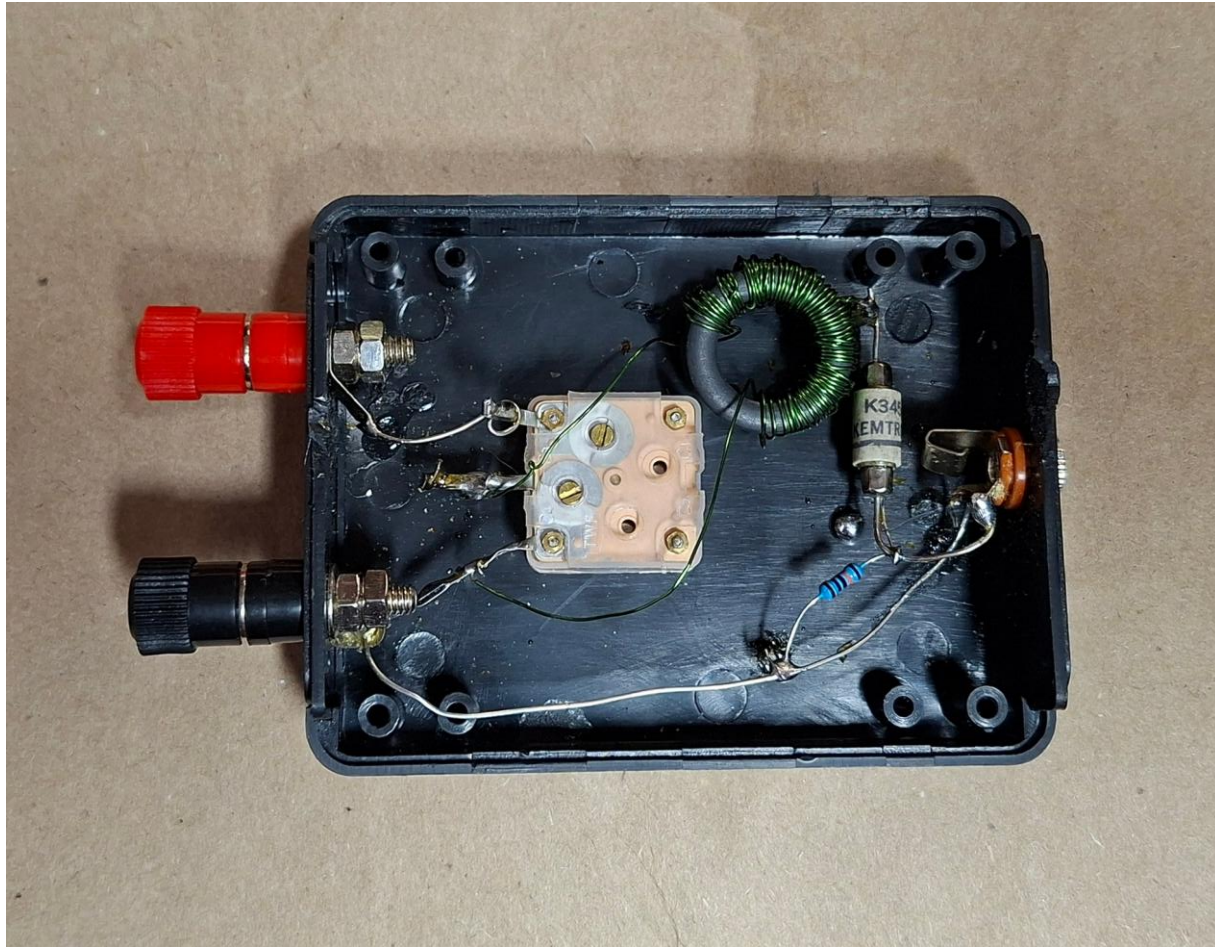
- Coils like this are easy to wind and make taps, especially if one uses an improvised bobbin.
- A handy inductance calculator is available here: <https://toroids.info/FT82-61.php>

Rev. 0.2

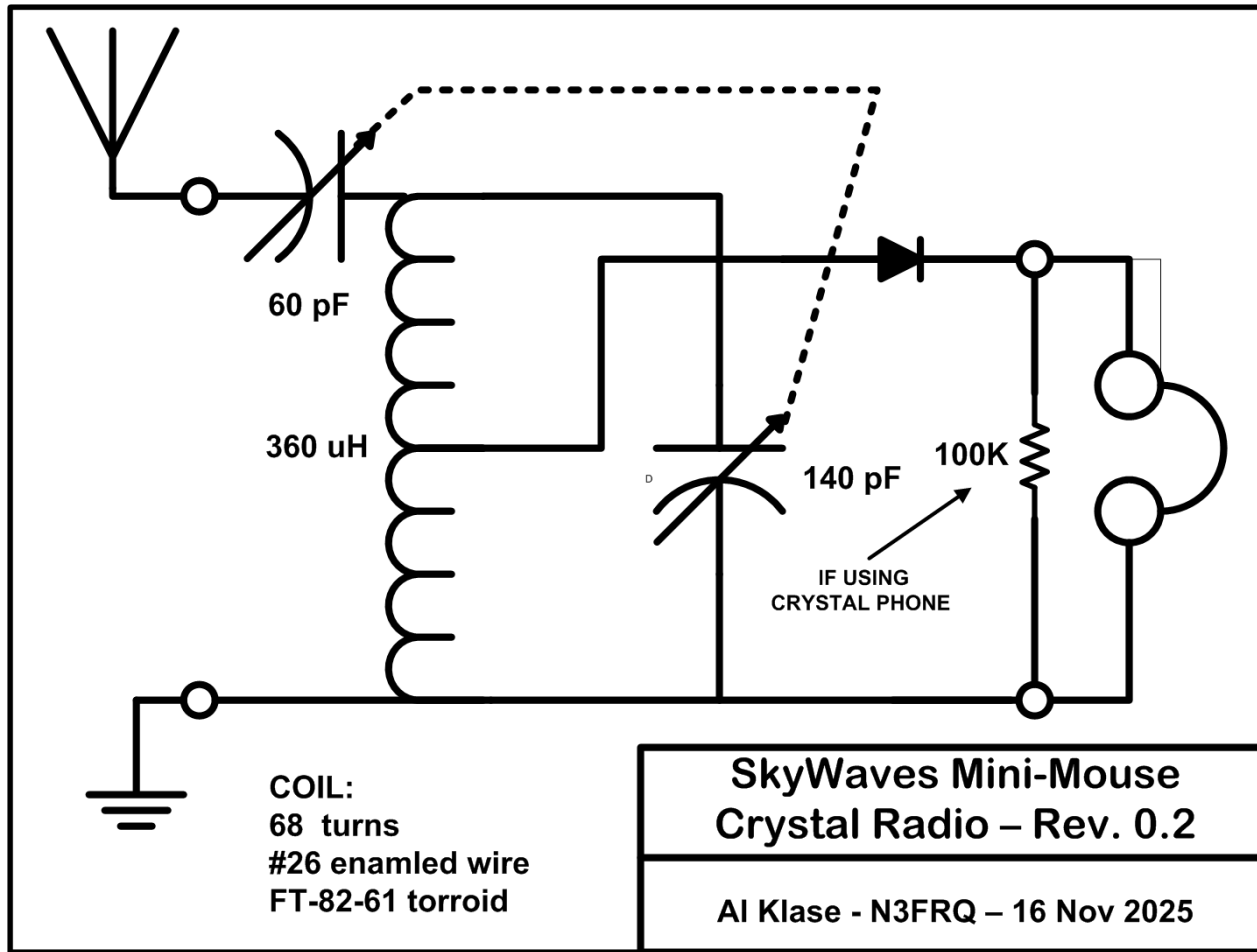


- All parts available from Amazon
- Cost about \$15
- Hearing 11 daytime station in in [THIS ENVIRONMENT](#)
- 5 Stations on 20-foot indoor antenna.

Rev. 0.2



Rev 0.2 Schematic

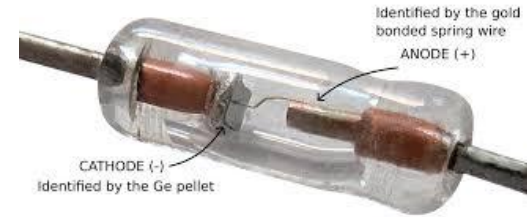


- Circuit is a simplified version of the old MRL-2A.
- Ferrite torroid allows us to get sufficient inductance, with limited stray capacitance, so we can tune the band with a relatively small variable cap..

Unresolved Problems

18 Nov 2025

- Need reliable source of point-contact germanium diodes.
 - Look for a cat's whisker inside.
 - Many fake products on the web.
 - Google: [Real 1N34A diodes](#)
 - See next page.
- Poor reliability of “crystal earplugs.”
 - Bought 4 pieces from Amazon – [ProTechTrader](#) for \$20
 - 1 unit proved to be intermittent. ProTechTrader
 - Currently out of stock.



Diodes

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- DigiKey Tech Forum: [Substitution for the 1N34A Diode for Crystal Radios](#)

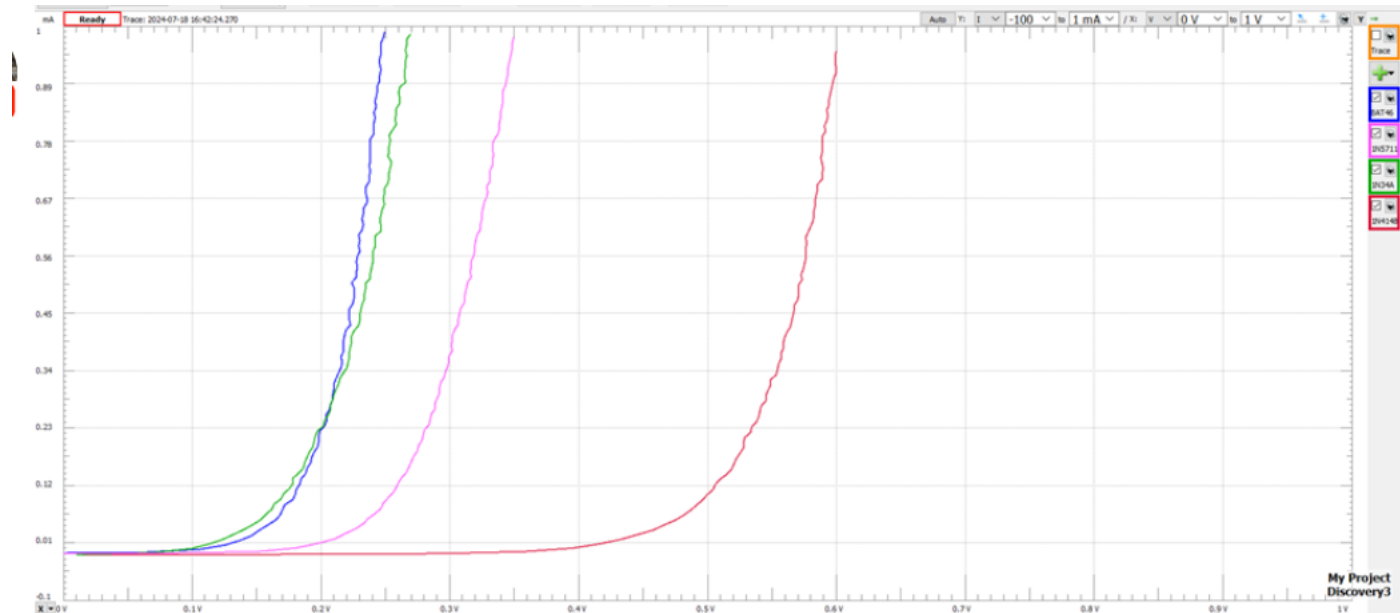
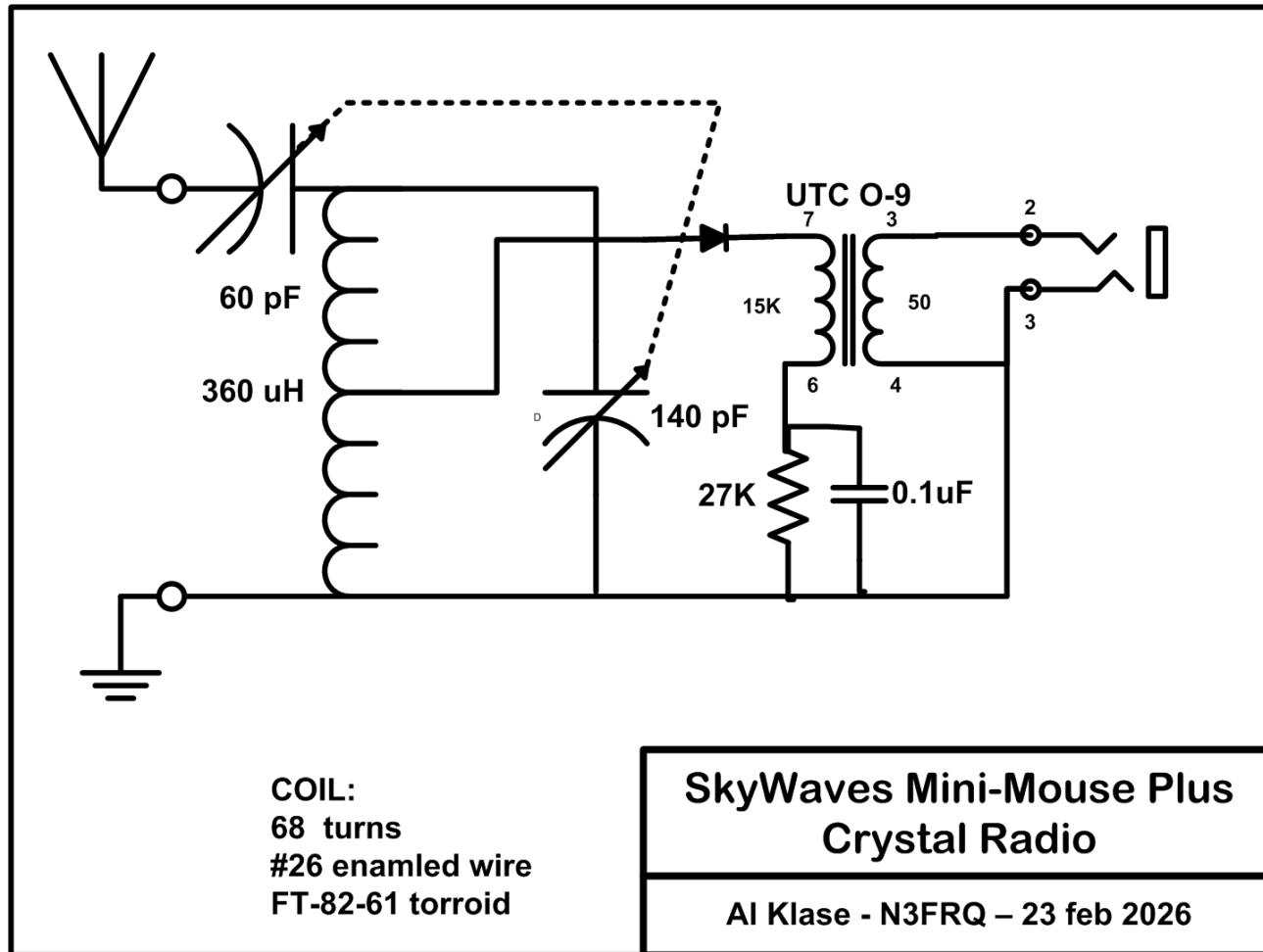


Figure 3: Representative diode curves for the BAT46 (blue), 1N34A (green), 1N5711 (purple), and 1N4148 (red). The curve for the BAT46 is nearly identical to the 1N34A.

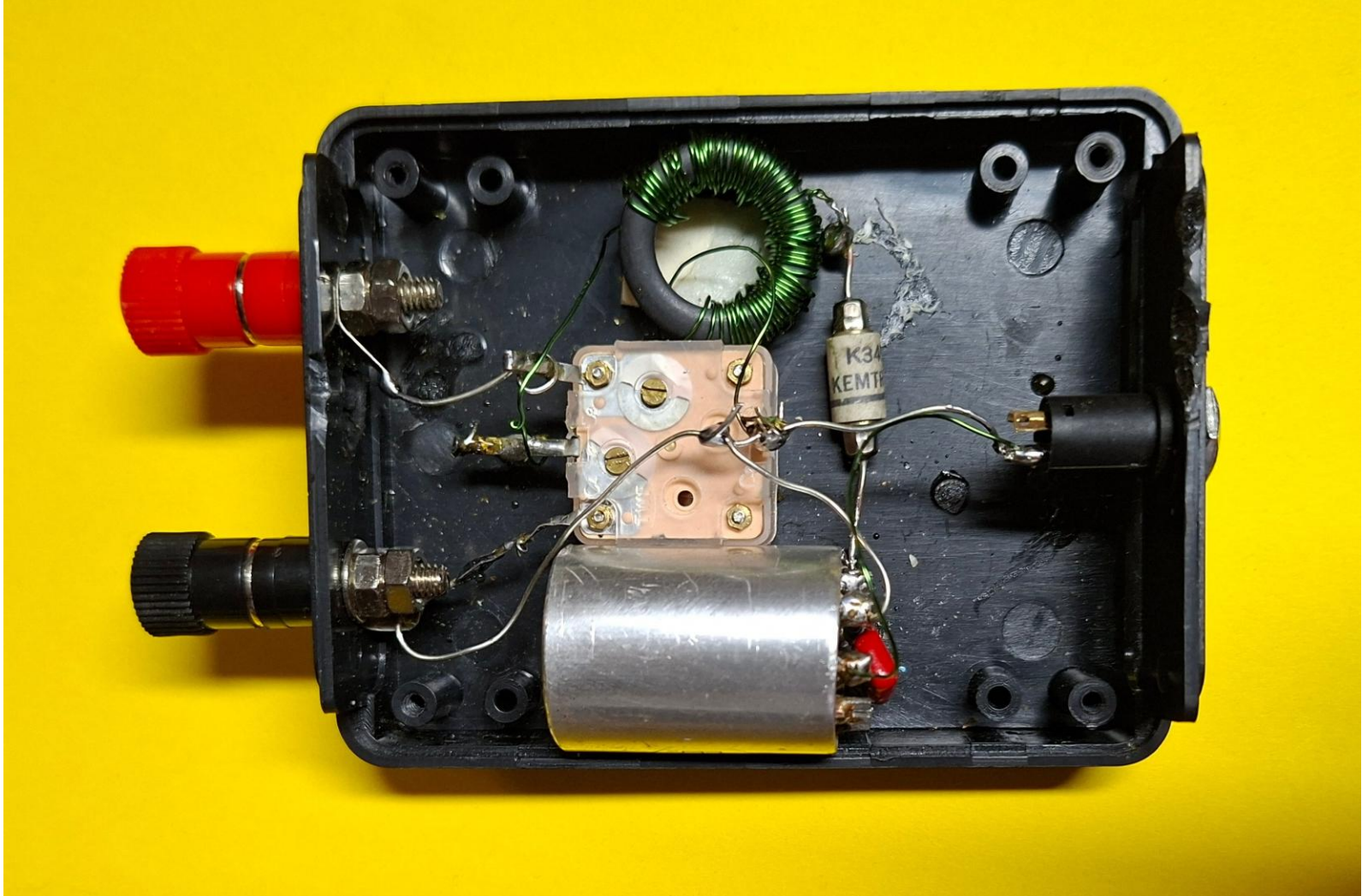
Tech Tip: Each curve in Figure 3 represents the data from a single diode. Please use care when interpreting this data, as there will be variation between devices and between manufacturers. This caution is especially important in critical application such as the crystal radios, where performance is highly correlated with the threshold voltage.

Rev 0.3



- I became frustrated with the poor quality of the available piezo earplugs..
- Installed a transformer from my junk box.
- UTC O-9 is a vacuum-tube output transformer.
- Such transformers are antiques and command a high price on Ebay.
- If you have something like this or a microphone input transformer, use it!

Rev 0.3



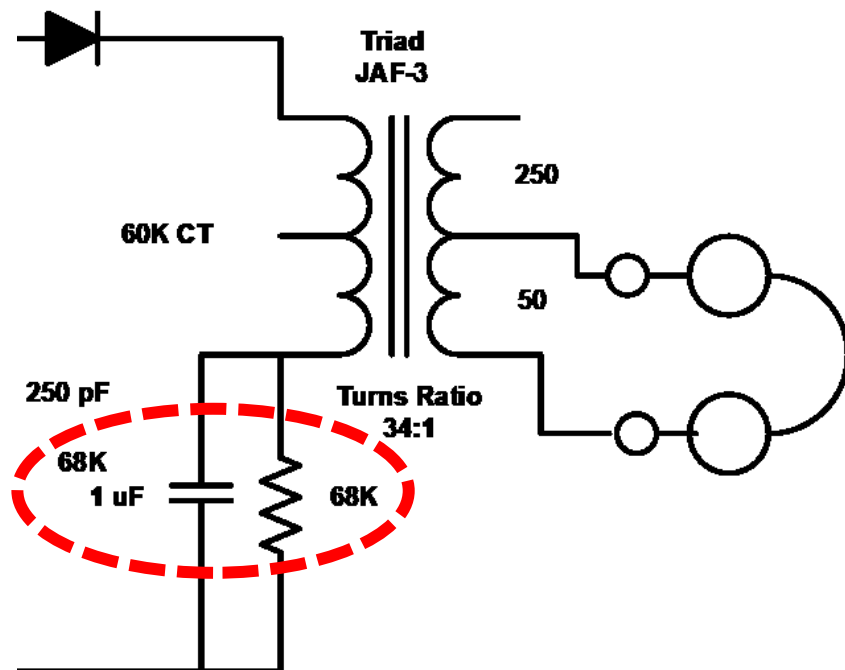
Rev 0.3



- This allows the use of readily available stereo earbuds.
- Many of these are quite sensitive.
- I estimate the impedance of mine to be about 16 Ohms, so I've been wiring the two sides in series to raise the transformed impedance seen by the detector.
- Just connect to the tip and ring as shown in the schematic.

The “Benny” Resistor

- Pointed out by the late Ben Tongue, captain-of-industry, electrical engineer and crystal-set maven.
- The DC resistance of a matching transform primary is much smaller than the AC impedance.
- The heavy DC load on the diode detector causes distortion and loss, especially on strong signals.
- Bypassed resistor, approximately equal to the transformer primary impedance, in series with the primary solves the problem.

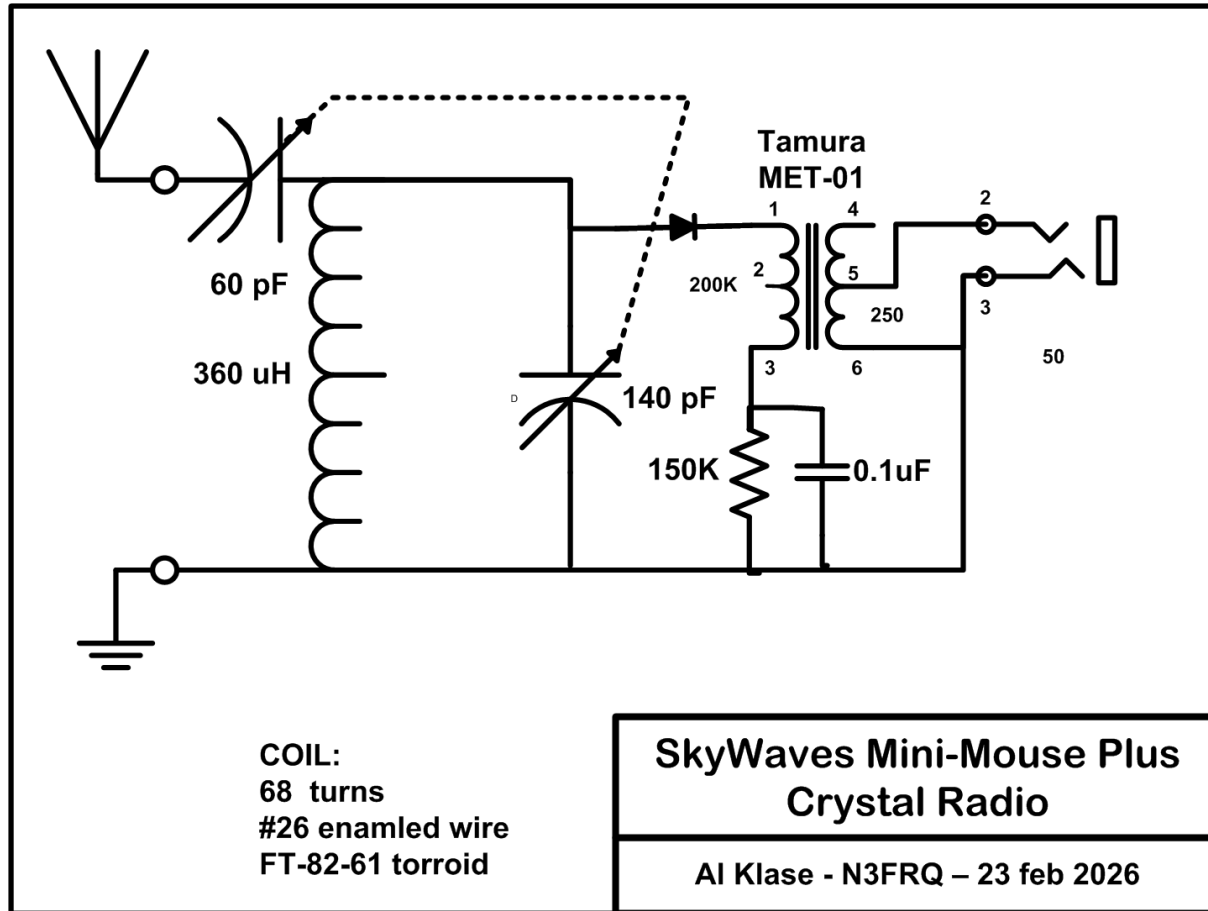


[Ben Tongue on Crystal sets](#)



Ben (left) supervising PGXS check out at our 2006 clinic.

Rev 0.4



- Rev 0.4 incorporates a Tamura Met-01 transformer available from DigiKey or Mouser.
- This is the only affordable transformer (about \$13) that I could find.
- High primary impedance allows the diode to be connected to the top of the tuned circuit, improving weak signal performance..

Rev 0.4



- Again, we can use inexpensive earbuds.

Bill of Materials

FT-82-61 Ferrite Core	\$3.33	Amazon 3 for \$10
10 Ft. #26 Magnet Wire	0.37	Amazon 4oz for \$12 (325 ft)
2-Section Variable Cap	2.06	Amazon 5 for \$10.34
Germanium Diode		
Piezo Ear Piece	3.83	Amazon 2 for \$7.65
3.5 mm Phone Jack	0.50	
Project Box	2.20	Amazon 5 fro \$10.99
Binding Posts	0.80	Amazon 10 pairs \$.799
Phone Jack	0.80	Amazon 10 for \$7.99
Tamura MET-01 Transformer	≈ \$13	Mouser or DigiKey

Audio Transformers

- The Eagle P631M transformer (formerly called the LT44) is a 20k:1k CT transformer that is commonly used for audio applications, particularly as an inter-stage push-pull driver. See Ebay etc.