Varactor Diode Tuned Crystal Detector Radio Receiver

OddMix.com - Crystal Radio Note - CRN0808 - Karl Nagy

Traditionally, in a crystal detector radio tuned circuits, a mechanical type variable capacitor is used. For those of you who would like to eliminate this mechanical component, here is a modern version of the classic detector set. This radio, as shown on **Figure 1**, uses a varactor diode instead of the usual mechanical rotary device. The varactor is also known as a variable capacitance or a varicap diode. It provides an electrically controllable capacitance, which can be used in many different circuits. Varactors are small and inexpensive, which makes their use advantageous in many applications. Its disadvantages are a lower Q (quality), nonlinearity, lower voltage rating and a more limited capacitance range.

A tuned circuit with a higher Q has a narrow pass-band that makes it better able to pick out a station of many equally strong. A lower Q tuned circuit has a wider pass band. It allows more neighbor stations through and makes listening to either radio stations frustrating. Frequency change with a varactor diode equipped tuned circuit is as simple as a voltage change.

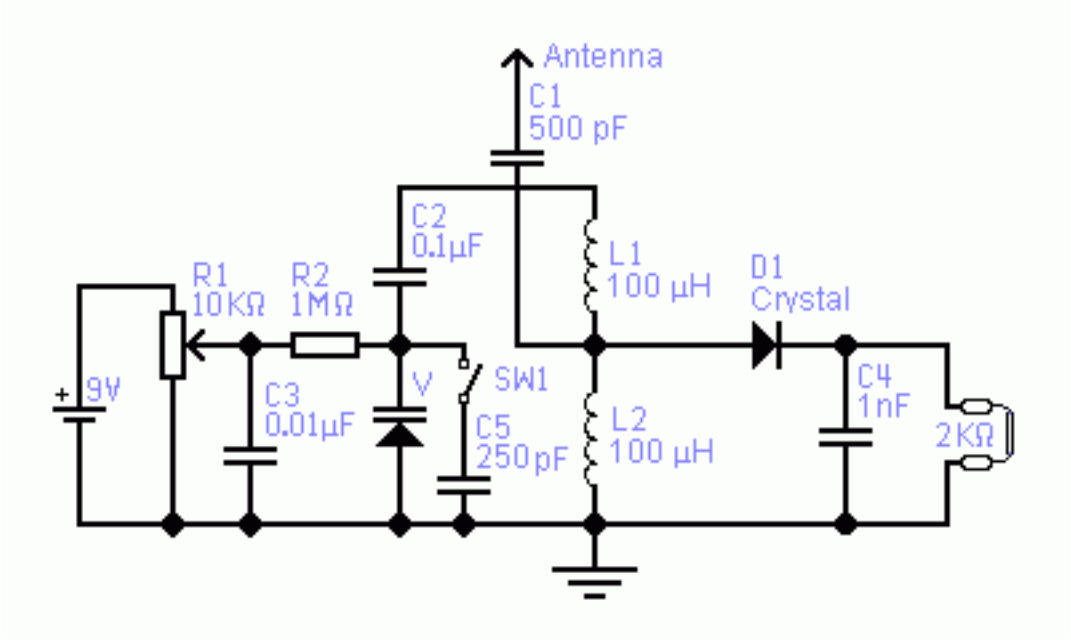

Figure 1. Varactor crystal detector radio

Any PN junction has a junction capacitance. The amount of that is a function of the voltage across the junction. Varactors are always made with an abrupt or hyper abrupt junction. A higher reverse bias voltage widens the depletion layer and the capacitance decreases. The capacitance in a varactor diode is largest with less reverse voltage and lower with a higher voltage. Because the V varactor diodes capacitance is only 250 pF maximum, the C5, 250 pF capacitor is also necessary to cover the entire AM band. Two varactors can be also paralleled to achieve the same result.

Parts List for Varactor Crystal Detector Radio:

L1 - Primary, Antenna coil 1 - 100 uH
L2 - Primary, Antenna coil 2 - 100 uH
C1 - Antenna Capacitor - 500 pF, 200 VDC
C2 - Capacitor - 0.1 uF 50 VDC
C3 - Capacitor - 0.01 uF, Disc, 10 VDC
C4 - 1 nF, Disc, 10 VDC
C5 - 250pF, Band Extender Capacitor, Mica, 50 VDC
D1 - Diode - Germanium, point contact
R1 - Potentiometer - 10 kOhm
R2 - Resistor - 1 MOhm, 0.25 Watt, CC
V - Varactor Diode - Motorola MV1662, 250 pF
B - Battery 9 Volt - Transistor carbon zinc is fine
SW1 - SPST Switch, Band Extender
Magnetic headphone, or high impedance speaker

All components on the left side of the schematic are used instead of the usual rotary capacitor. The antenna coupler C1 is a good grade mylar or preferably mica type capacitor with at least a 200 Volt DC (Direct Current) rating. The current load on the B1 battery by the R1 potentiometer is less then one mA (milliamperes - thousandth of an ampere). Remove the battery when not in use. The C3 capacitor filters the control voltage. It suppresses any noise pickup via the battery and potentiometer components.

The R2, 1M resistor isolates the DC voltage source from the rest of the radio circuit attached to the varactor. The 0.1uF, C2 capacitor blocks the DC bias voltage. The V varactor diode is a Motorola type MV1662 with a 250 pF maximum capacitance, but it can be substituted with whatever is on hand. Two diodes can be used in parallel, or L1 can be switched in and out of the circuit as required to cover the entire AM band.

The best RF amplifier is always a long, high wire antenna. The C1 antenna capacitor is attached to L1-L2 as shown on Figure 1, but it can also be connected to the L1-C2 junction if that connection produces higher sound.

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