

# V-TUNE

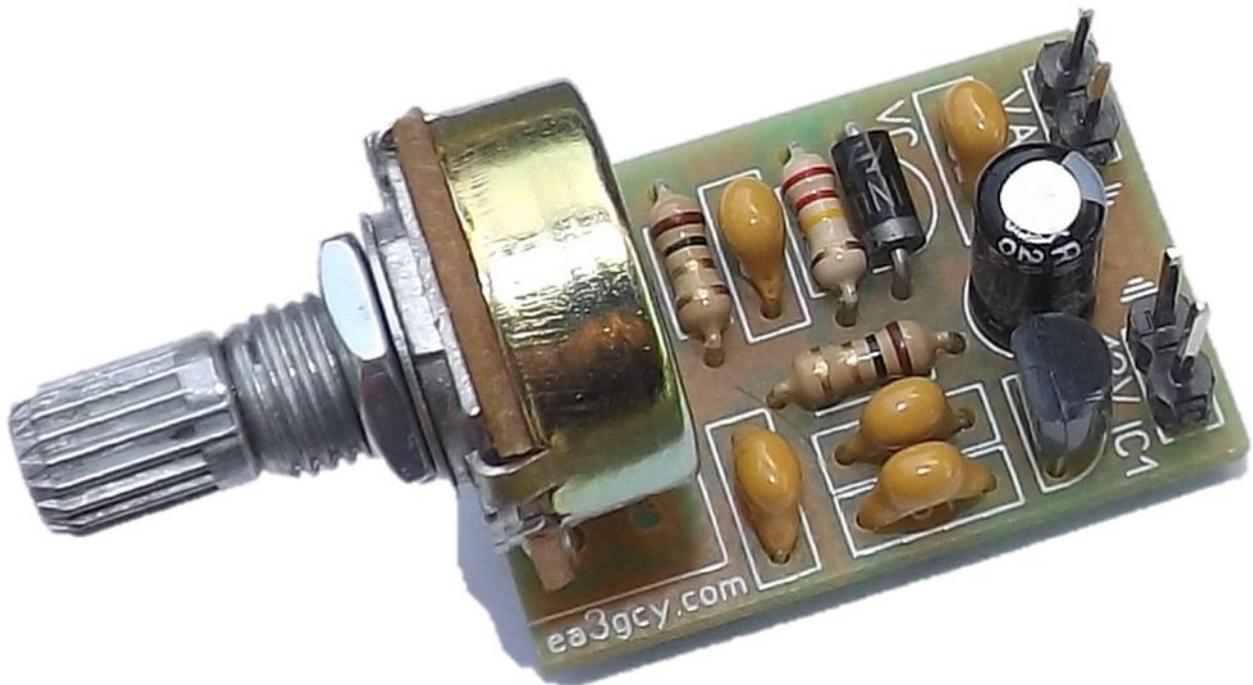
## Variable capacitance mini-circuit with Varactor diode and potentiometer control

### Assembly manual

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Updates and news at: [www.ea3gcy.com](http://www.ea3gcy.com)



Thanks for building the **V-TUNE** Varactor diode kit

Have fun assembling it and enjoy QRP! 73, Javier Solans, ea3gcy

# PLEASE READ ALL OF THE ASSEMBLY INSTRUCTIONS COMPLETELY AT LEAST ONCE BEFORE BEGINNING.

## SPECIFICATIONS

- Option of installing different types of Varactor diodes to adapt to different applications (including SVC236 and 1N4007).
- It can be used for fine tuning, for main tuning or for other resonant circuits.
- Power supply voltage from 10 to 14V (built-in 8V regulator).
- Circuit board dimensions: 20 x 30 mm.

## PARTS LIST

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	Quantity	Reference	Value	Component Type	Identification
	1	R1	1 $\Omega$	1 $\Omega$ resistor	brown-black-gold
	1	R2	1 $\Omega$	1 $\Omega$ resistor	brown-black-gold
	1	R3	220K	100K resistor	red-red-yellow
	1	C1	100nF	100nF capacitor	104 or 0.1
	1	C2	100nF	100nF capacitor	104 or 0.1
	1	C3	10uF	10uF electrolytic capacitor	10uF
	1	C4	100nF	100nF capacitor	104 or 0.1
	1	C5	100nF	100nF capacitor	104 or 0.1
	1	CL	see text	<b>(kit includes 100n, 10p and 22p)</b>	--
	1	VC	see text	<b>(kit includes SVC236 and 1N4007)</b>	--
	1	IC1	78L08	8V Regulator	78L08
	1	P1	50K	50K potentiometer	B50K
	4	Terminal pins		2 strips of 2 male pin terminals	--
	1	PCB	--	20 x 30mm printed circuit board	--

## TIPS FOR FIRST TIME BUILDERS

### Tools required:

- A fine-tipped 30W soldering iron, good-quality electronic-type solder, small diagonal wire cutters, needle-nose pliers, and tweezers to hold the SMD component.
- You will need good lighting and a magnifying glass to see the fine print on the components and other assembly details.

### Soldering:

There are two important things which need to be done to ensure successful operation of a kit. The first is to put the component into the proper place on the circuit board; the second is good soldering.

To solder properly, you must use an electronic-type solder of the highest quality possible and the correct type of iron.

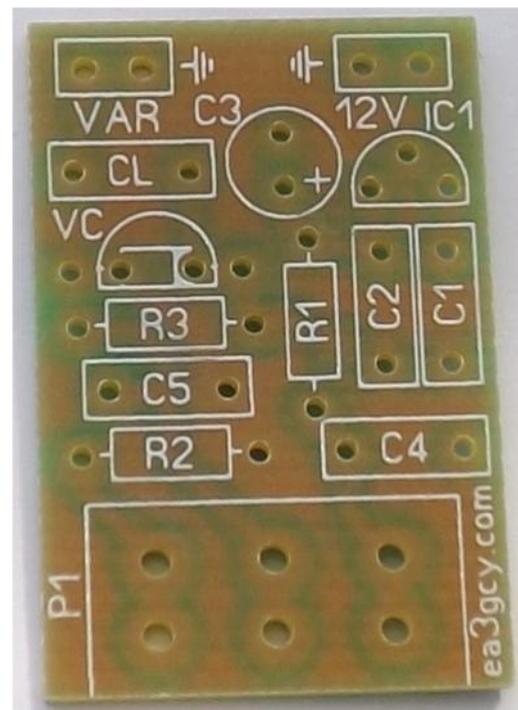
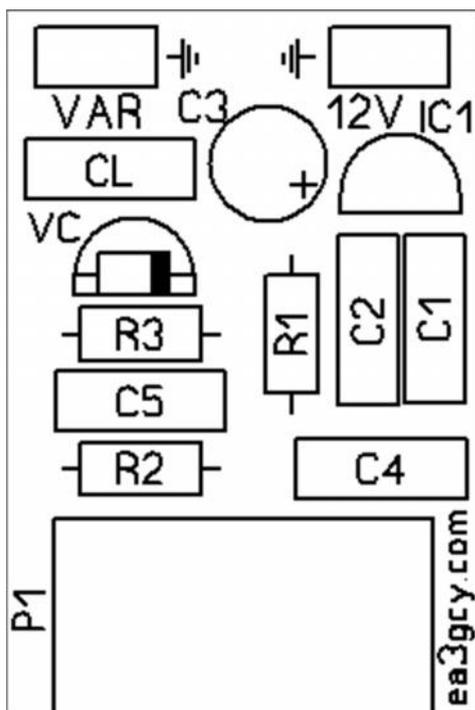
Use a quality-brand soldering iron with a short, fine-pointed tip. For this kit, the soldering iron should be about 30-35 Watts (if it is not thermostatically controlled). Use only high-quality electronic-type solder. NEVER use any extra flux. You should hold the hot soldering iron in contact with both the circuit board and the component lead for about two seconds to heat them up. Then, keeping the soldering iron in place, touch the solder at the junction of the lead and trace and wait about two seconds or so until the solder flows between the lead and the trace to form a good joint. Now remove the soldering iron. The soldering iron should have been in contact with the work piece for a total time of about 4 seconds. When soldering leads that connect to large trace surfaces, you will need to preheat the junction for a little longer so that the solder flows correctly.

You should clean the soldering tip before soldering each joint. This prevents accumulating solder on the tip and mixing in residues from previous soldering operations with the next one.

## RECOMMENDED ASSEMBLY SEQUENCE

It is recommended to assemble the kit in the following order:

1. Following the list of components, solder resistors R1, R2 and R3.
2. Next, place and solder the capacitors C1 thru C5 ("CL" will be installed later). C3 is an electrolytic capacitor and must be placed with its longest lead matching with the "+" sign printed on the board.



3. Place the regulator IC1 and the two pairs of terminals "VAR" and "12V".
4. Place and solder the 50K P1 potentiometer (bend and break off the small protruding tab so that it isn't in the way when securing the potentiometer to the front panel).
5. The type of Varactor diode VC and the value of capacitor CL will depend on the application for which the "V-TUNE" is being used. See the next paragraph.

## TYPES OF VARACTOR "VC"

The location of VC provides for different types of varactor diodes to be installed.

The "V-TUNE" can be used as fine tuning (connected in parallel with the main tuning capacitor) or as the main tuning (replacing the variable capacitor).

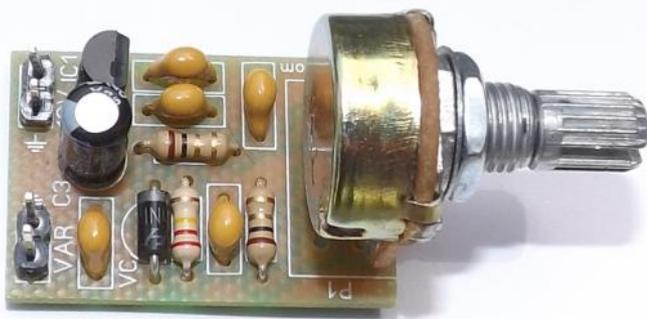
**You need to have sufficient knowledge to understand the operation of this circuit and to assess which type of varactor is most suitable for your particular application.**

Main specifications of some varactor diodes:

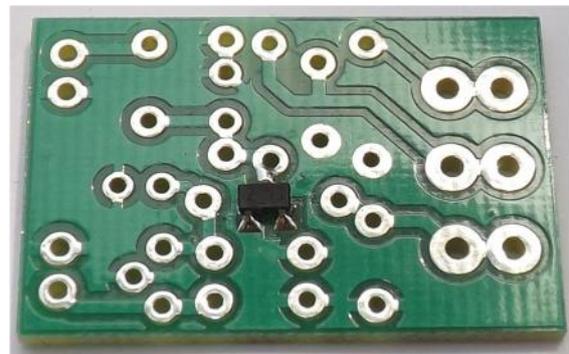
Reference	Capacitance/Voltage range	Format
**SVC236	120pF @ 0V - 12pF @ 8V	*SMD SOT-32
BB112	440pF @ 1V - 20pF @ 8V	TO-92
1SV149	500pF @ 1V - 25pF @ 8V	TO-92
BB201	100pF @ 1V - 25pF @ 8V	*SMD SOT-32
**1N4007	18pF @ 0V - 5pF @ 12V (rectifier diode)	DO-41

\* The varactors in SMD SOT-32 format are installed on the underside of the printed circuit board.

\*\* These components are included in the kit.



Diode 1N4007 installed



Varactor with SOT-32 format installed

## Capacitor "CL"

In addition to choosing the type of varactor that you are going to use, keep in mind that you can choose the value of CL that suits you. Capacitor CL is in series with the output of the circuit and acts as a "limiter" to the capacitance variation that is obtained with the varactor.

The higher the CL value, the greater the effect of the varactor to the output capacitance and vice versa. A value of 10nF or greater will act as a jumper in function of reactance and will not offer any limit to the varactor's capacity.

If you want to limit the effect of the varactor, you can start with values as low as 10pF or less and increase until you get the excursion that you want. It is a work of "trial and error".

The use of low "CL" values affects the linearity of the varactor.

Note: If you have theoretical knowledge, you can perform calculations to find out what type of varactor and what value of "CL" is most appropriate for your application, as well as the most recommendable value for resistors R1 and R2 (read below).

## Resistors R1 and R2

The value for R1 and R2 will usually be 1 ohm so that the minimum potentiometer voltage is practically 0V and the maximum is the voltage of the regulator IC1 (8V). If needed, you can increase the value of R1 so that the minimum voltage level is greater than 0V. And if you increase the value of R2, then the maximum voltage level of the potentiometer will decrease.

**R1 and R2 allow you to modify the varactor's range to adapt to your needs or place it in the most appropriate part of the V/C curve (see the data sheet of the varactor that you will use).**

## The "V-TUNE" as fine tuning for the ILER-40/20/17

If you use the V-TUNE as fine tuning for the ILER40/20/17 kits, you can use the 1N4007 diode that is included in the kit. Place it in its correct position as indicated by the component outline printed on the board.

Since the capacitance range of the 1N4007 diode is small, for "CL" you can use a 100nF capacitor (marked 104 or 0.1).

- Note that the effect of fine tuning will be markedly different depending on whether the main tuning capacitor is set at one extreme or the other; this is normal. This is due to the fact that when the main tuning is in its position of maximum capacitance, it is affected less by the external capacitance that is added to it; conversely, in its position of minimum capacitance, the opposite happens.

- Keep in mind that when using the "V-TUNE" with a VFO or VXO, the original maximum frequency of the oscillator will drop by a few kHz, more or less depending on the value of the capacitance of the main tuning capacitor and also the value of "CL" and type of varactor "VC".

- The interconnections to the VXO should use wires that are as short as possible. Any movement or vibration will affect the tuning.

It is only necessary to use three wires:

- 1) From the active terminal of "VAR" (the one that is not marked as GND) to the active terminal of the main tuning capacitor (they will be in parallel).
- 2) From the terminal marked GND (ground) from "VAR" to the nearest grounding point.
- 3) From the positive "12V" terminal to the power supply; it doesn't need to be rigid wire (the GND terminal doesn't need to be connected since it is already connected to the "VAR" terminal).

## Using as fine tuning

We recommend that you normally set the knob in its center position. Once you have found a station with the main tuning, move the fine tuning knob to finish tuning it. When the QSO is finished or when you want to search for another station, first return the Fine tuning knob to its center position.

# Using the "V-TUNE" as main tuning

As was already mentioned, the "V-TUNE" can be used as fine tuning (connected in parallel with the main tuning capacitor) or as the main tuning (replacing the variable capacitor).

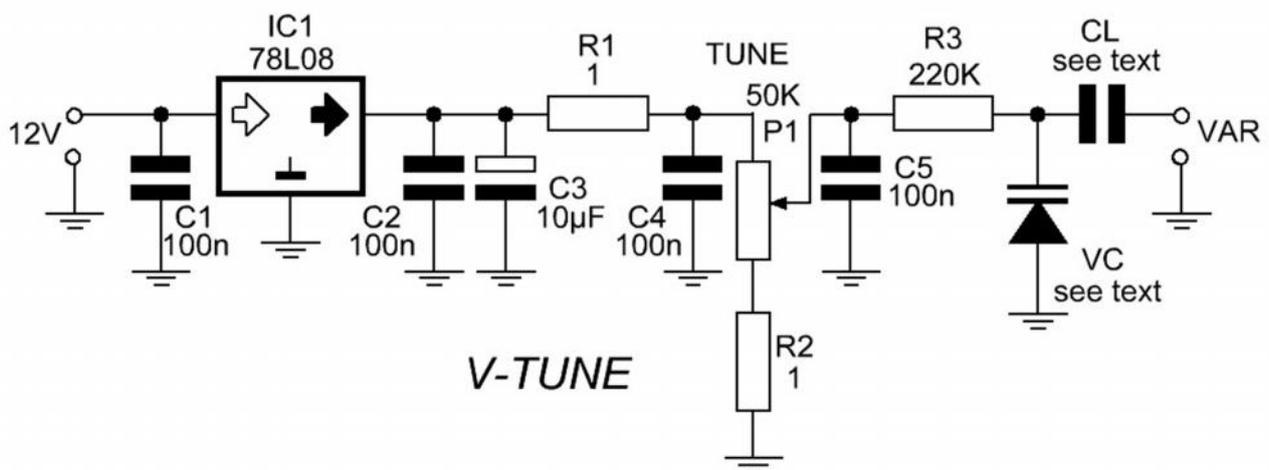
To use it as the main tuning, you must choose the appropriate varactor and configure the "V-TUNE" so that the capacitance range it offers is very similar to the variable capacitor you want to replace.

For example, to replace a variable capacitor of 120pF you can use the SVC236 varactor (included in the kit), and to replace a variable tuning capacitor of 400 or 500pF you can try the BB112 or 1SV149 (not included in the kit). In these cases, "CL" may be 10nF or greater.

## OBSERVATIONS

- For more comfortable tuning, you can use a 10-turn potentiometer instead of the single-turn potentiometer. You can also add a mechanical reducer with a scale (Vernier) for the potentiometer.
- If the varactor diode that you use needs to work with a voltage greater than 8V, you will need to replace IC1 with a higher voltage regulator or remove it and work directly with the supply voltage (not recommended).
- Position the V-TUNE board as close as possible to the associated oscillator circuit. Use a short wire for the "VAR" connection. The "GND" connection must be connected to a GND location that is as close as possible.
- **Remember that tuning with a varactor diode is usually slightly less stable than tuning with an air variable capacitor.** However, this differs greatly from one circuit to another.

## SCHEMATIC



# LIMITED WARRANTY

## Please read carefully BEFORE building your kit

All electronic components and hardware supplied with the kit are under warranty in case of any manufacturing defect for the period of one year after purchase. The warranty does not include the transmitter final amplifier transistor.

The original purchaser has the option of examining the kit and manual for 10 days. If within this period, the buyer decides not to build the kit, he/she may return the entire unassembled kit at their own expense for the shipping expenses. The shipping expenses and sales commissions (i.e. bank, Ebay, and Paypal commissions) included in the purchase price will not be returned.

Please, BEFORE returning a product, request instructions by email at: [ea3gcy@gmail.com](mailto:ea3gcy@gmail.com).

Javier Solans, EA3GCY, warrants this device to function according to the specifications, provided that it is assembled and adjusted as described in this documentation, and used correctly according to all provided instructions.

It is your responsibility to follow all the instructions in the manual, to identify all the components correctly, and to use good workmanship and proper tools and instruments in the construction and adjustment of this kit.

REMEMBER: This kit will not work as a commercially manufactured product; however, in some situations, it can give very similar results. Do not expect great performance, BUT YOU ARE SURE TO HAVE LOTS OF FUN!

If you believe that there is a missing component for the kit, please do a thorough inventory of all parts using the parts list in the manual. Check all bags, envelopes and boxes carefully. If needed, you may email me and I will replace any component that you are missing. Even if you can find the exact part locally, please let me know so that we are aware of the problem to help other customers.

I can also supply any part that you have lost, damaged or broken accidentally.

If you find any errors in this manual or would like to make a comment, please do not hesitate to contact me at: [ea3gcy@gmail.com](mailto:ea3gcy@gmail.com)

THANKS for building the V-TUNE Varactor diode kit.

Enjoy QRP!

73 Javier Solans, ea3gcy