



LARIX ELEKTRO

AUDIO

DUAL UNDULA OSCILLATOR

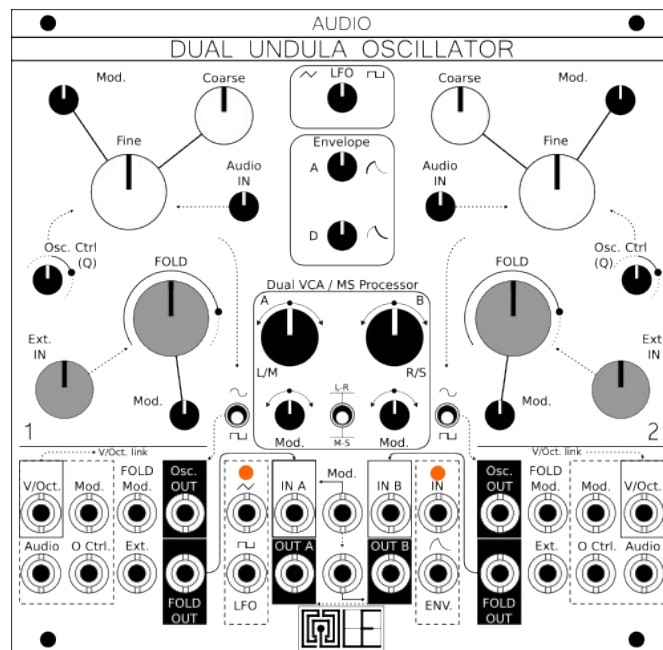
WHAT'S THAT THING ?

This is a dual complex oscillator that has a lot of internal functionalities that allows a lot of various uses beyond a simple dual oscillator.
You can build a full autonomous synth voice, a Mid-Side processor, and more !

OK, so what's inside this module ?

So, to resum :

- 2 sinus wave VCO, that can works as filter.
- 2 wave folder, one per oscillator, with a dedicated VCA in between.
- 2 bipolar VCA (that act as « lowres. Ring modulator »).
- Both VCA can be used inside a Mid-Side converter.
- 1 LFO
- 1 Attack-Decay envelope.
- A lot of options to hack the module. (DIY friendly module)



Technical specifications:

+12V : 190 mA (max.)
-12V : 190 mA (max.)
(5V is not used)
26HP, 35mm deep (Approx.) with PSU connector

VCO Frequency: 5Hz to 12KHz (approx.)
LFO Frequency: Less than 10 sec. to 24Hz (approx.)

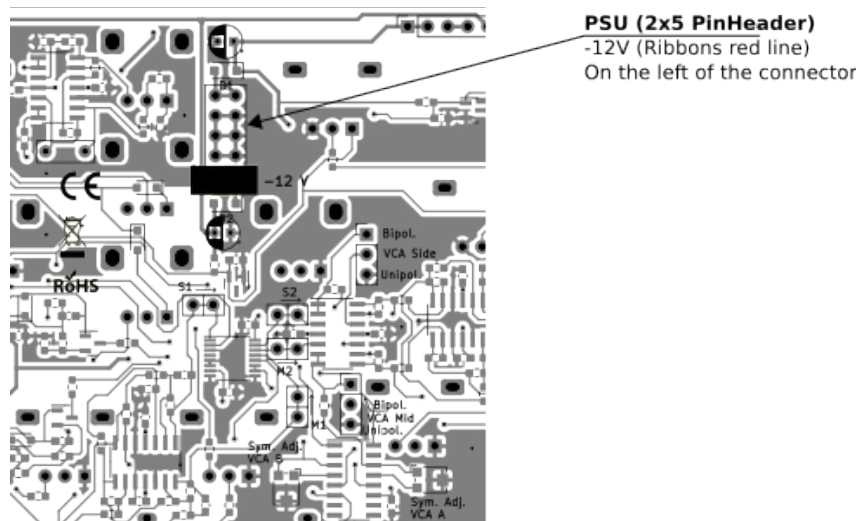
Installation:

At first, ensure that there is enough power to supply the module.
Beware of the orientation: the red strip on the ribbon cable should match the white line on the module, and on the PSU board (-12V).

Connect the PSU ribbon into the PSU connector, the small connector (2x5 pin) into the module, and the large one (2x8 pin) into the PSU Board.

It is better to have a **well-insulated box** because parasites can be added to the signal of the modules. If you are not familiar with electronics, prefer commercial boxes. This is especially true for power supplies: a poorly designed power supply can damage the modules.

To avoid various problems, electromagnetic, but not only, **complete the empty spaces with blind front panels** (Blank panels).



After power on, wait for 15min, the time for the module to warm, and to stabilize the frequency. Yes, **The module produces heat**. This is partly due to the choice of the value of certain components, to have a lower noise at the audio output. The « flip side » is higher power consumption and a bit of heating.

VCO section :

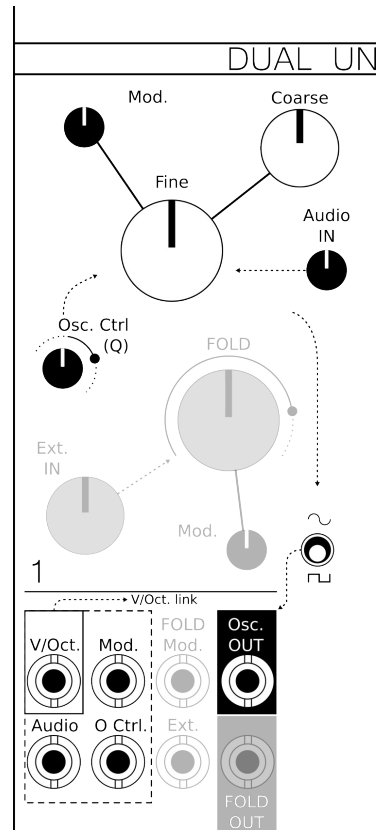
KNOBS :

(Left and right VCO are mirrored)

- **Fine (Large white knob)** : Frequency, fine tune.
- **Coarse (Small white knob)** : Frequency, coarse tune.
- **Mod.** : Frequency modulation amount (exponential FM)
- **Osc. Ctrl (Q)** : Auto-oscillation control.
 - On the pointer, almost pure sinus.
 - Beyond: more saturated
 - Before: no oscillation. (use the VCO as a VCF)
- **Audio IN**: Audio input volume, using the oscillator as a filter.

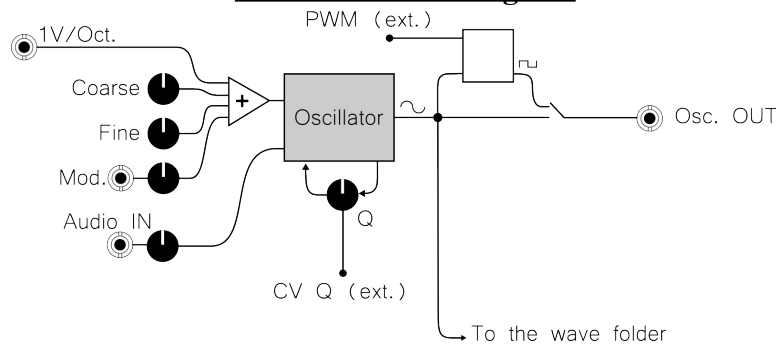
Jack I/O :

- **V/Oct.** : CV Input for frequency control, Normaled between the two oscillators. (VCO 1 to VCO 2)
- **Mod.** : CV Input for Frequency modulation, amount controlled by the corresponding knob.
- **O Ctrl.**: CV Input, control of the auto-oscillation.
- **Audio**: Audio Input. Amount controlled by the corresponding knob.
- **Osc. Out** : Audio Output. Direct oscillator output. Can be the sinus wave or a square wave.
The waveform is selected by the **switch** under the Wave folder section (Follow the arrow!).



SWITCH: Selection of which waveform is sent to the **Osc. Out** jack : Sinus or Square.

Oscillator block diagram



The oscillator is designed to generate a sine signal. For this purpose, the circuit is almost similar to a filter. Electroncially speaking, it's a controlled feedback loop. It means we can use it as a VCF.

Two controles are added :

Osc. Ctrl. is similar to the resonance amount or Q.

Audio input insert an external signal into the feedback loop, to use the circuit as a filter.

Try it as a kind of sync input.

The frequency range is high, but on the other hand, the tracking is not as good as the best VCO.

PWM (ext.) adds a control of Square width.

CV Q (ext.) adds

Both are option on the back of the module. See more below.

Wave Folder section :

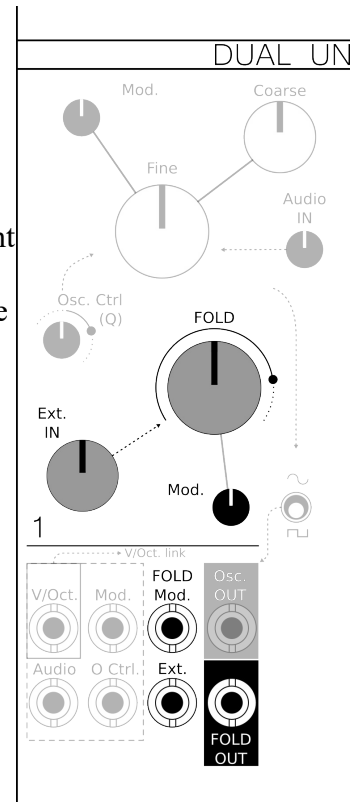
KNOBS :

(Left and right VCO are mirrored)

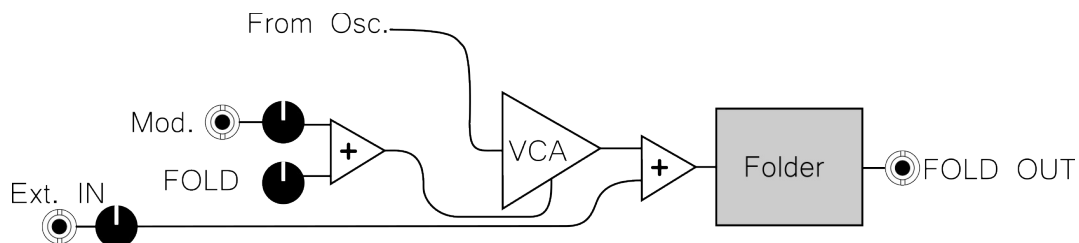
- **Fold (Large grey knob):** Manual control of the amount of the oscillator (Sinus) sent to the wave folder.
- **Mod. (Small grey knob) :** CV control of the amount of the oscillator sent to the wave folder.
- **Ext. IN :** Manual control of the amount of an external signal, sent to the wave folder.
Both signal from the oscillator (via **Fold** and **Mod.**) and from the external input are added before they are sent to the wave folder.

Jack I/O :

- **FOLD mod. :** CV Input connected to the **Mod.** knob.
- **Ext. :** Audio Input, amount are adjusted via the **Ext. IN** knob.
- **FOLD OUT :** Audio Output, after the wave folder.



Wave folder block diagram



The effect of the wave folder depend on the amplitude of the input signal.

The signal from the associated VCO is controlled by a VCA. It means that the effect of the wave folder can be controlled by an external CV.

As we can see on the diagram, the external signal does not pass thru the VCA, but it summed after the VCA.

It's possible to change the signal routing. See below for more information.

Dual VCA (Center section):

KNOBS :

Both VCA are identical

- **Black Knob (A an B) :** Input volume.
This is an attenuverter :
 - In the central position, the volume is null.
 - Right, the volume increase.
 - Left, the volume increase, but inverted.

In unipolar mod., this knob works differently and is not an attenuverter. *See below for more explanation*

- **Mod. :** Amount of the CV input. This is an attenuverter:
 - In the central position, the CV is null.
 - Right, the CV increase.
 - Left, the CV increase, but inverted.

So yes : there are two 'level' of atteuverters :
Manual control of the VCA.
Amount of CV.

Jack I/O :

- **IN A (IN B):** Input volume, normaled with the Folder output (**FOLD OUT**) of the associated wave folder.
- **OUT A (OUT B):** Signal Output.
OUT B is summed with the OUT A if nothing is connected to OUT B.
- **Mod. :** Modulation input. (Mod. B input is normaled to the A input)

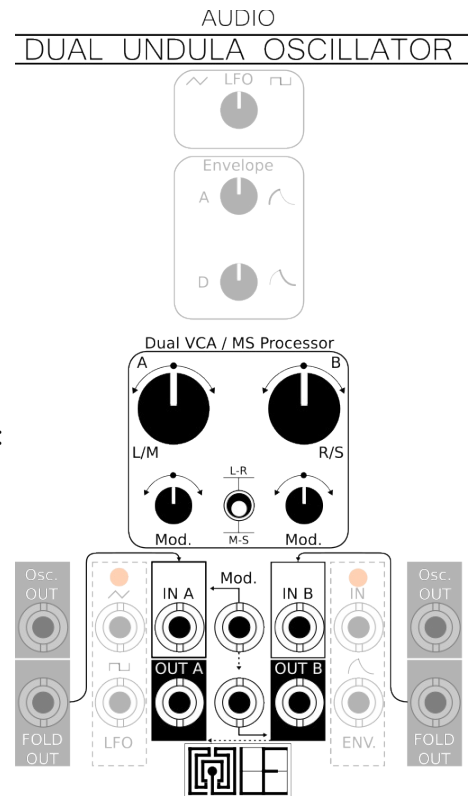
SWITCH :

L-R / M-S :

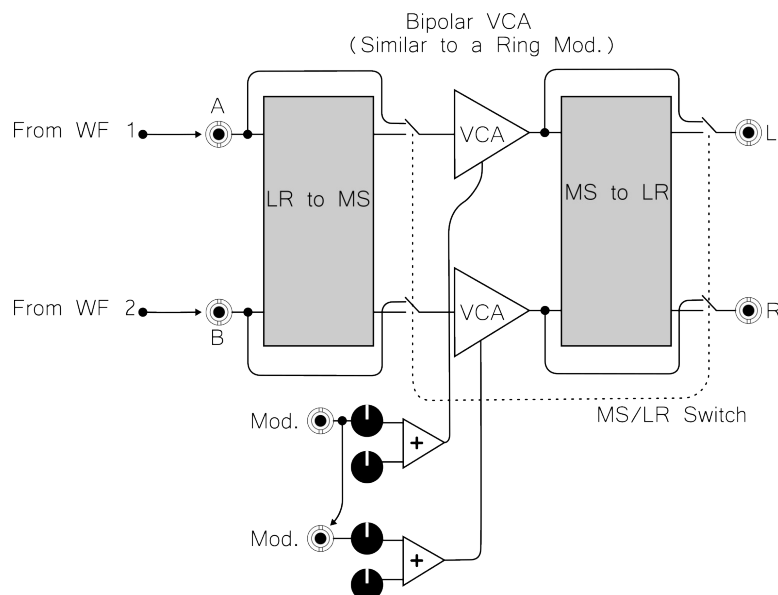
In L-R mode, the dual VCA circuit works like two independant VCA.

In M-S mode, a LR to MS circuit is added before the VCA, and a MS to LR is added after.

In this case, the VCA A controles the Mid of the signal, and the VCA B the Side.



Dual VCA block diagram



But... what it mid/side ???

It's something we can find in some studio tools : eq. or compressor for example. Or to controle the stereo width. Or a way to use microphone, too.

It's a way to process what is in the center (means what is identical between Left and Right) and what is in the side (means what is NOT identical between Left and Right) independantly. Instead of processing Left and Right.

Technical considerations :

Because the VCA can works in unipolar mode, it means that it can be considered as a ring modulator. So a VCO can be used a a modulation source.

But don't expect to have the same audio quality as a good ring modulator. Even if it has its own interesting color.

For the same quality reasons, it's difficult to have a complete silence at the center position, which is embarrassing if you want to build a synth voice...

This is why it's possible to change the VCA (one or both) in unipolar mode. *See below.*

Modulation circuits (Center section):

The module contains one LFO and one AD envelope.

Both are very simple, but useful to build a standalone synth voice. Or simply modulate some parmeters without the need of others modules.

LFO: With a LED for frequency visualization

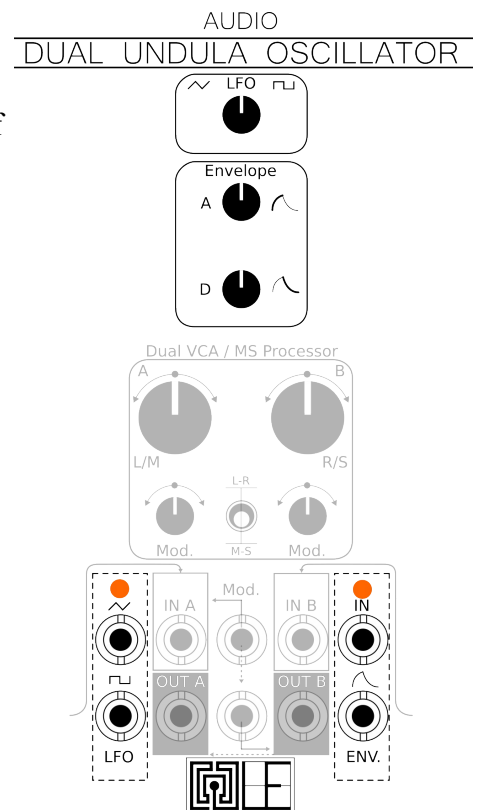
- Knob for frequency adjustment
- Triangle and Square output.

AD envelope: With a LED for shape visualization.

- Attack and Decay adjustment.
- **IN:** Trigger input
- **ENV.:** Envelope output

The square output of the LFO is connected to the trig input (**IN**) of the envelope.

So by default, the envelope is triggered by the LFO.



Modulation block diagram

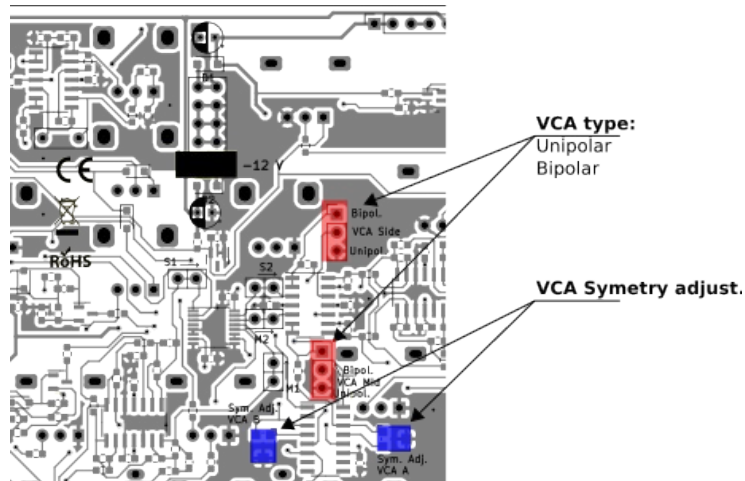


Extension Connectors & jumper:

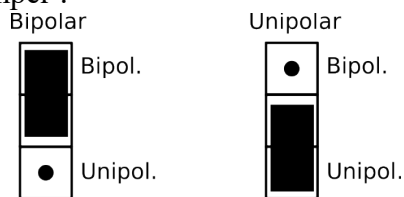
The module is build with one main PCB and two voice card.

On the main PCB, under the Voice A, there is all things concerning the VCA and the MS converter.

VCA configuration :



As already explained, each VCA can be configured as unipolar (classical VCA) or bipolar (default configuration), with the jumper :



On the top, the VCA B (or Right, or Side VCA).

On the bottom, the VCA A (or Left, or Mid VCA)

TIP :

For DIYers, try to solder some cables to the pinheader (yes, remove the jumper before!) and solder a switch on the other side of the cables. For sur, you can easily build a front panel, or modify an old one, to add this switch on the front panel. So you can change the VCA setting easily.

*The **LARIX-ELEKTRO Mult.**, a multiple(!), but also a fully configurable Jack I/O, in 2HP, can be used for this pupose, simply by cutting an half part of the PCB, and use the holes for the jack to insert the switch.*

The **VCA Symetry adjust.** allows to adjust the control of the knob of the volume of the VCA, in bipolar mode. Indeed, at the center position, the volume should be zero, i.e. no signal) (Because it's not a real ring modulator, this is not exactly zero...)

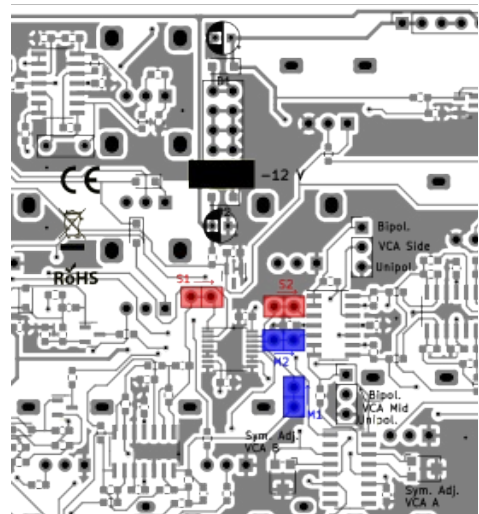
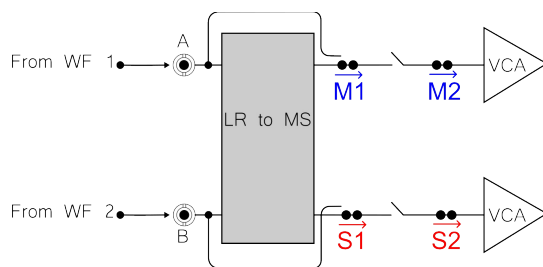
MS Processing, access points.

There are some holes on the PCB where it's possible to solder pin or wire.
At each point, there are two holes.

The idea is to be able to retrieve the signal after the LR to MS circuit. (M1 and S1)
And to be able to put some signal directly to the VCA without passing thru the LR to MS circuit (M2 and S2)

If you want to add this kind of « insert », simply cut the circuit between the two holes.

For what purpose? Don't know, it's up to you and your imagination ;-)



Access point to PWM and CV for Q :

Between the jacks sockets, there are 2 more holes for each VCO :
This is the access point to add PWM control, for the square signal.

The **Q Ctrl** has no knobs to control the amount of CV. If necessary, you can use an external module.
To save some cables (noddles!) most LARIX-ELEKTRO modules has pinheaders on the back for all CV parameters that has no control knobs.

The **Attv-4**, a bank of four attenuverter has the same pinheaders with small cables to connect the module on the back.

It adds an attenuverting function, and save a cable.

TIP :

*You can use the **Attv4** (or even the **Attv-Bank** that has the same connector on its back) to have access to PWM or Q.*

*For people that don't need to control the amount, the **Mult.** is made for you :*

It's a multiple module, but with jumpers to configure each jack, and allowing access to it separately.

*Foe DIYers, one **Mult.** module can be used to add switches to configure the VCA, and the others jack, to have access to the MS I/O and PWM.*

Last note for DIYers :

Under the left PCB, there are two through holes capacitors :

The .47 is for the AD envelope. (470nF)

The .22 is for the LFO. (220nF)

Feel free to change them !

Voice PCB :

The two identical PCB connected to the main PCB contains the oscillator and the wave folder. As explained above, there is a VCA between the oscillator and the wave folder.

Two access are available, in case of somebody have some ideas :

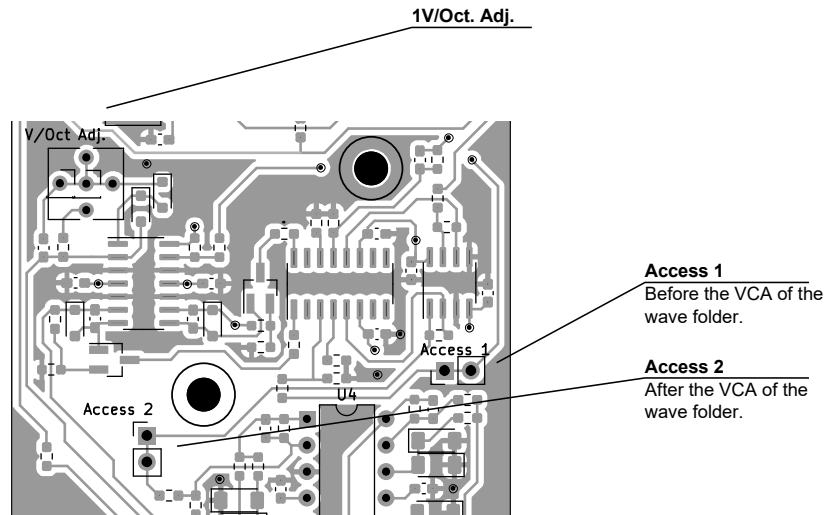
Access 1 in before the VCA.

Access 2 is after the VCA.

As for the MS Access, there are two holes, so it's possible to cut the circuit in between.

The PCB contains also the 1V/Oct. Adjustment.

Don't change it, except if you know what you're doing !



Note (1) : The four through holes capacitors defines the frequency range of the oscillator. It is not recommended to change the value of these capacitors.

Note (2) : Some components are through holes, it's because this part of the circuit warms a bit. Don't worry about it, the prototype with surface mount components has passed the critical test of the Superbooth : 3 day of constant and intensive use without any issues !

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