Dual Log/Linear VCA (Works from +/-9V to +/-15V)

Minor Bias Network Change (Mar 2010).

Previous Version for Reference
Original Version for Reference

Article by Ray Wilson

Back to "Music From Outer Space" Analog Synth Pages

Features

- Log and Linear Response to Control Voltage
- DC Coupling Throughout
- Excellent for Ring Modulation Effects
- Power Supply Range +/-9V up to +/-15V

Introduction

VCAs are essential to your synthesizer. They provide ring modulation effects, stereo panning, delayed vibrato, not to mention the normal envelope shaping of your sounds. This VCA works nicely with 10V PP (+/-5V) signal levels. If you are using +/-15 volt supplies you will probably need to mess with some values to get this to work for you.

This is an intermediate to advanced project and I do not recommend it as a first project if you are just getting started in synths or electronics. Only the circuit and some explanation are shown here. A lot of project building experience and electronics knowledge and equipment ownership (scope, meters, etc.) is taken for granted. If you are interested in building this project please read the entire page before ordering PC boards to ensure that the information provided is thorough enough for you to complete the project successfully.

View in new MFOS catalog: **Dual Log/Linear VCA PC Board**

Payment Notification Email MIA (Missing In Action)

On **very rare occasions** a payment service notification email fails to arrive in my mailbox.
If you don't receive an acknowledgement email from me within 5 days of ordering:
1) Make sure your mailbox is not full.
2) Email me the related transaction information so I can find and process your order.
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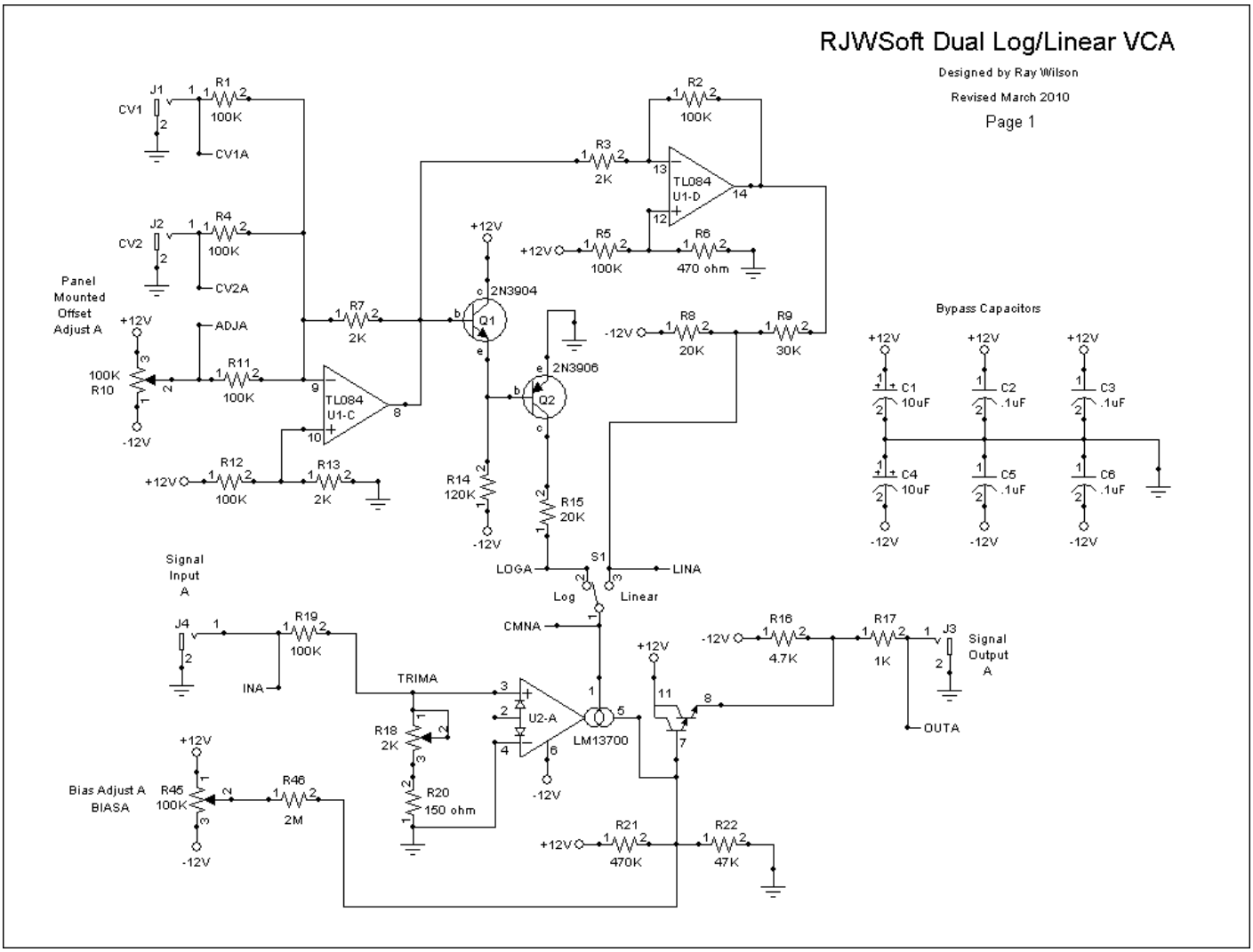
Please note: if I must re-ship an order due to an incorrect address I must charge for S&H again.

International Orders: You are responsible for paying vat, customs fees and/or duties imposed on items entering your country.

Dual Log/Linear VCA Page 1 PDF



This VCA uses the LM13700 transconductance amplifier as the gain control cell. The input voltage is converted to a log response by U1-C and associated transistors Q1 and Q2.

The summed control voltage appearing at the output of U1-C is sent to U1-D for reamplification and application to the LM13700 via R9 and S1. S1 selects the current generated by either the log version of the input voltage (LOGA on the schematic) or the linear version (LINA on the schematic) and applies it to the "amp bias in" pin 1 of the LM13700 thus controlling the current through the device and subsequent amplitude of the resulting voltage generated across R16.

The LM13700's built in buffers are used to drive the output. They work quite well.

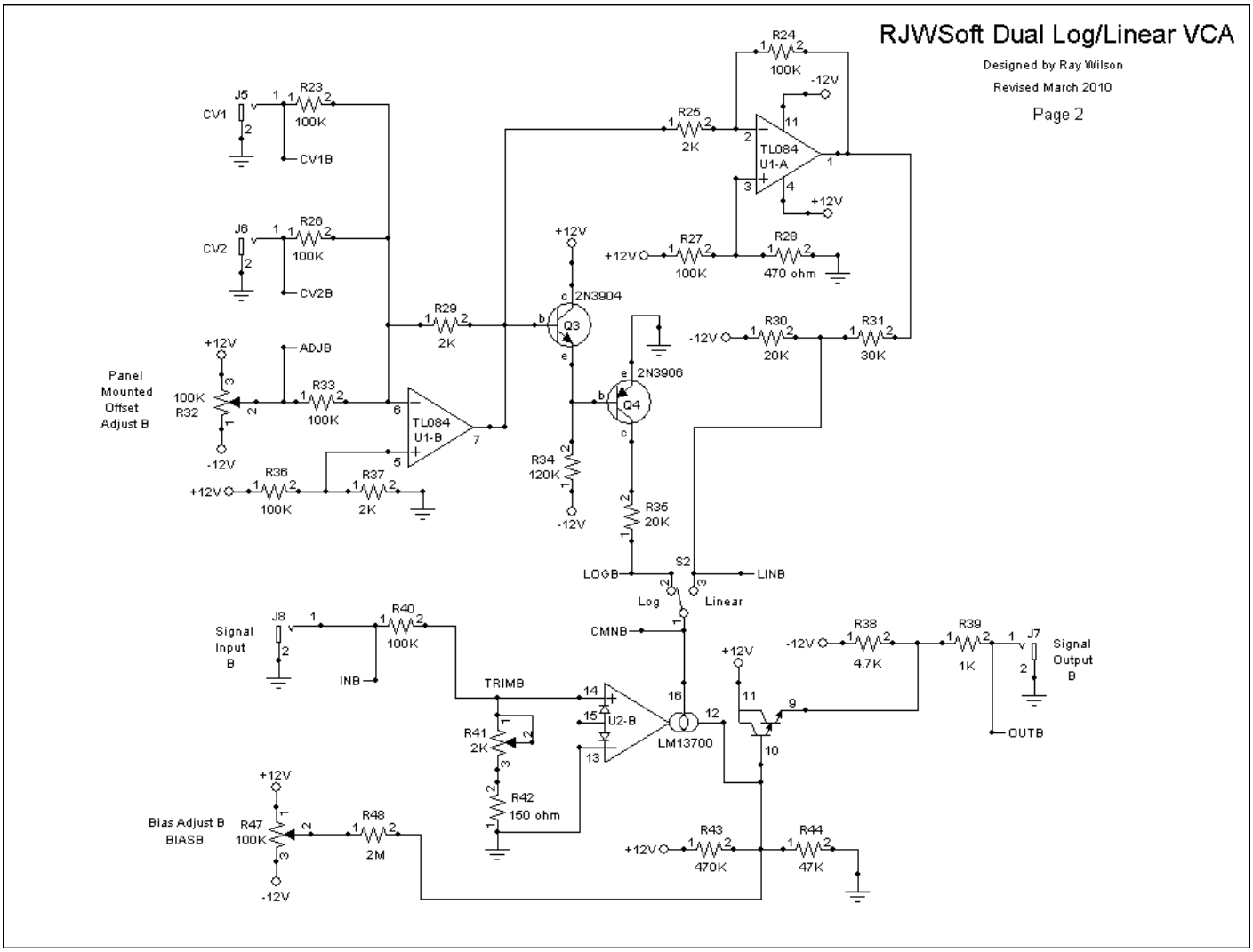
The Offset adjust is used to null the gain for whatever control voltage you are using to drive the VCA. You must readjust the null when you switch from log to linear (or visa versa). I have noticed that for control signals that are operating about ground (i.e. + and - 4 to 5 volts) the pot is usually toward the left when set to linear response and usually toward the right when set to exponential response.

The TRIMA control is used to set the voltage divider which feeds the non-inverting input of the LM13700 (pin 3). Adjust it for 50mV peak to peak signal at the maximum input voltage. It permits adjustment so that voltage from about + and - 3VPP to + and - 5VPP can be accommodated.

You can use just about any general purpose quad BIFET opamp for the TL084 and you can sub any of these (LM13600, NE5517, AU5517, NTE870) for the LM13700. Just in case you are wondering, I have tried to use the bias inputs to forward bias the distortion reducing diodes in the chip but always find that it completely bugs up the biasing throughout the circuit.

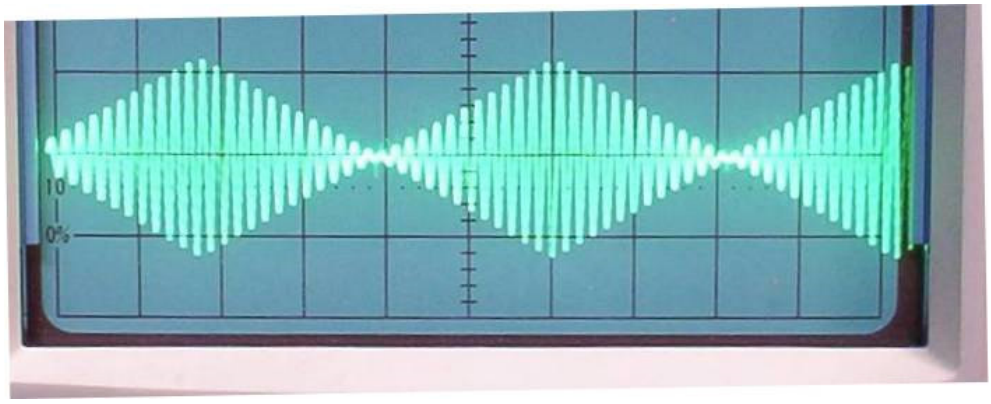
The new bias adjust injection point applies an offset voltage via 2M resistor R46 (R48) to the base of the darlington output transistor. With no input signal use the bias adjust trimmers to zero the output voltage.

Dual Log/Linear VCA Page 2 PDF

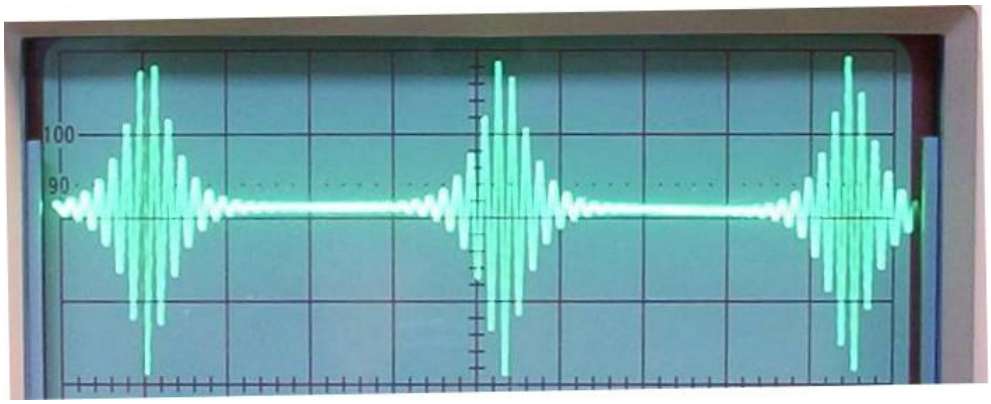


Page 2 is the same as page one but with different part designators.

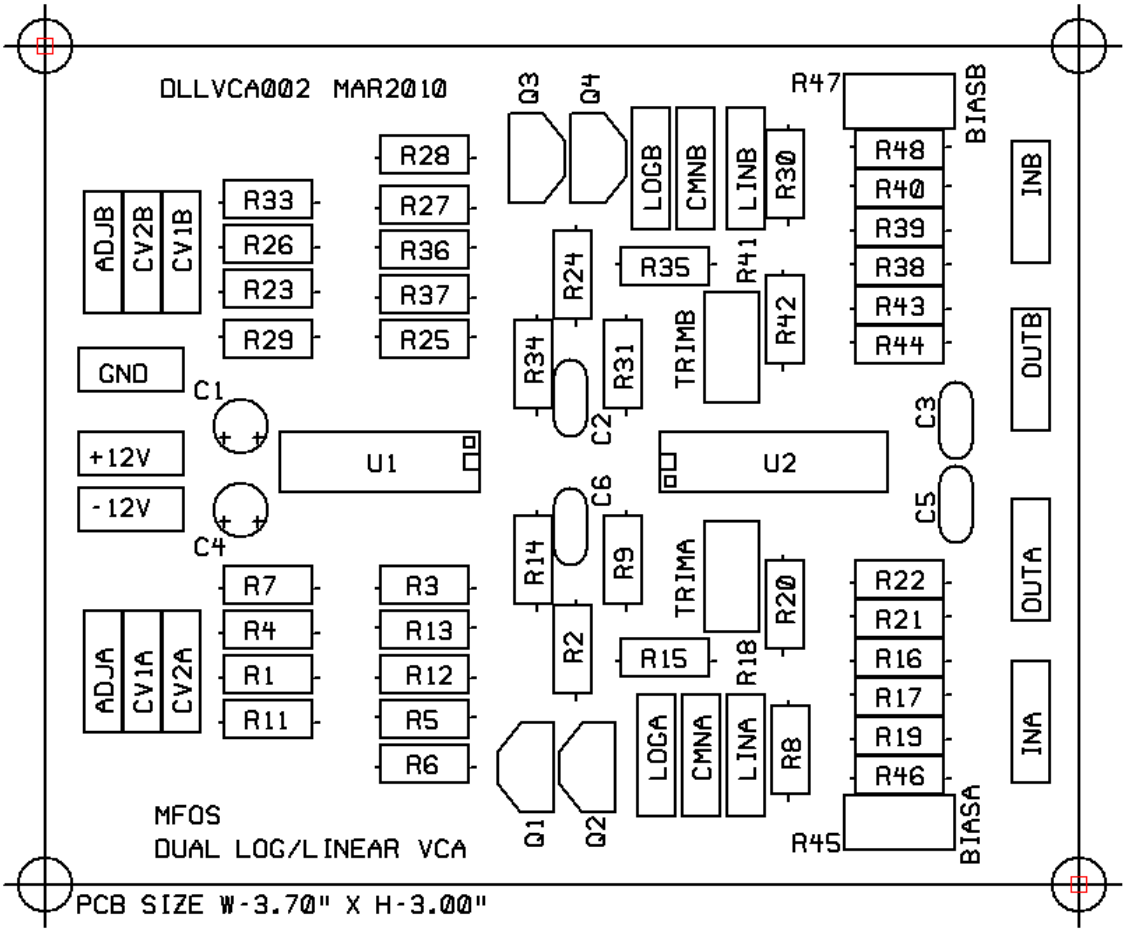
Triangle Wave Modulation in Linear Mode



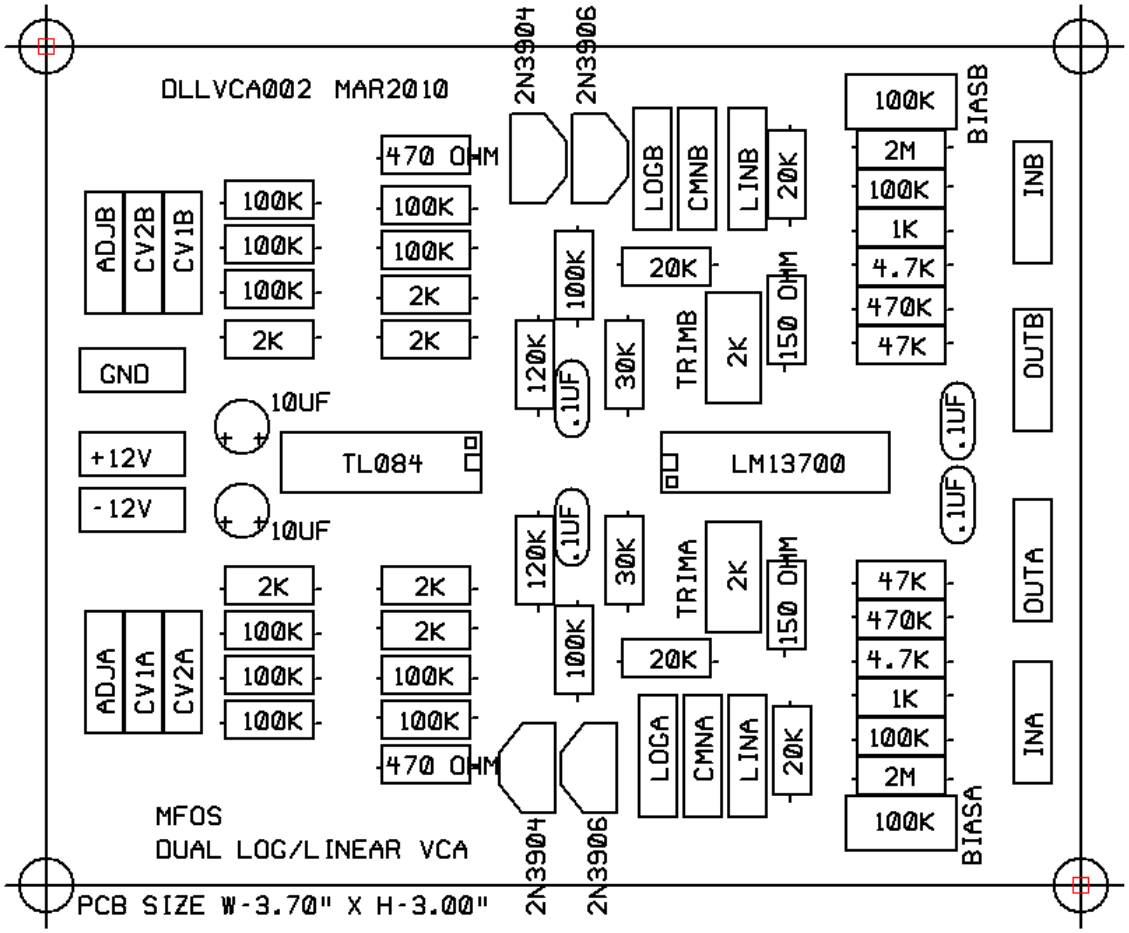
Triangle Wave Modulation in Log Mode



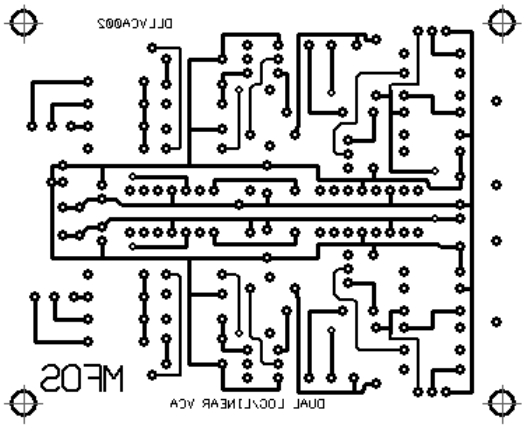
Dual Log/Linear VCA PCB Parts Layout (Parts Side Shown) PDF



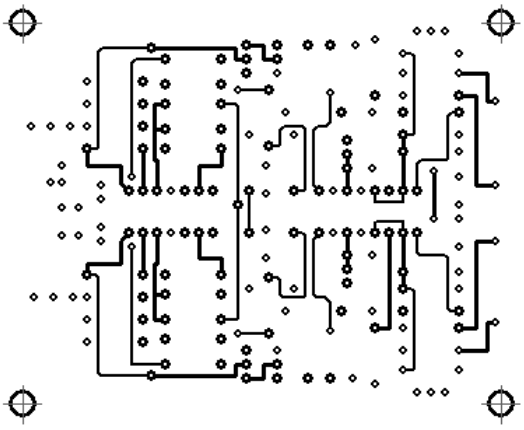
Dual Log/Linear VCA PCB Part Values View (Parts Side Shown) PDF



Dual Log/Linear VCA PCB Bottom Copper (Parts Side Shown)

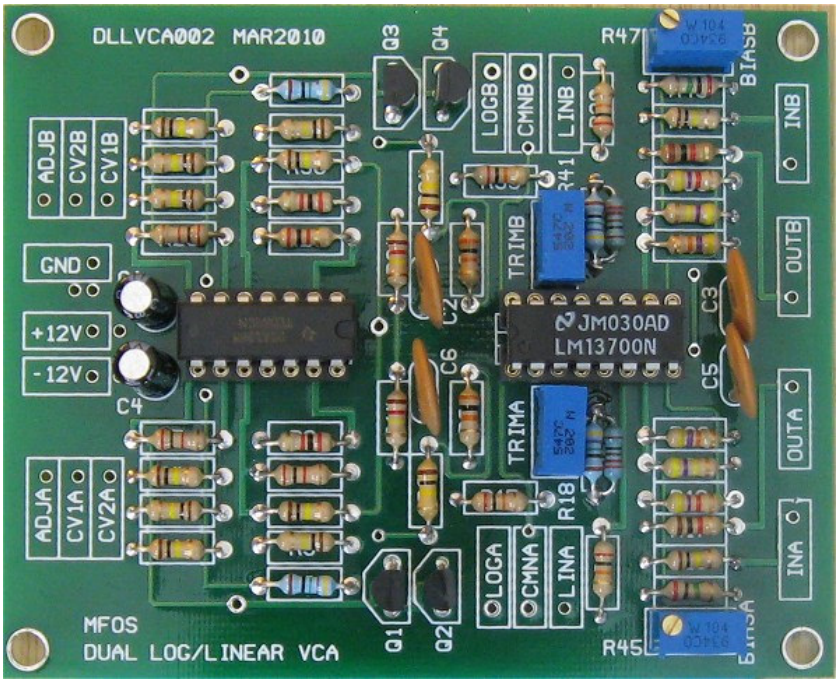


Dual Log/Linear VCA PCB Top Copper(Parts Side Shown)

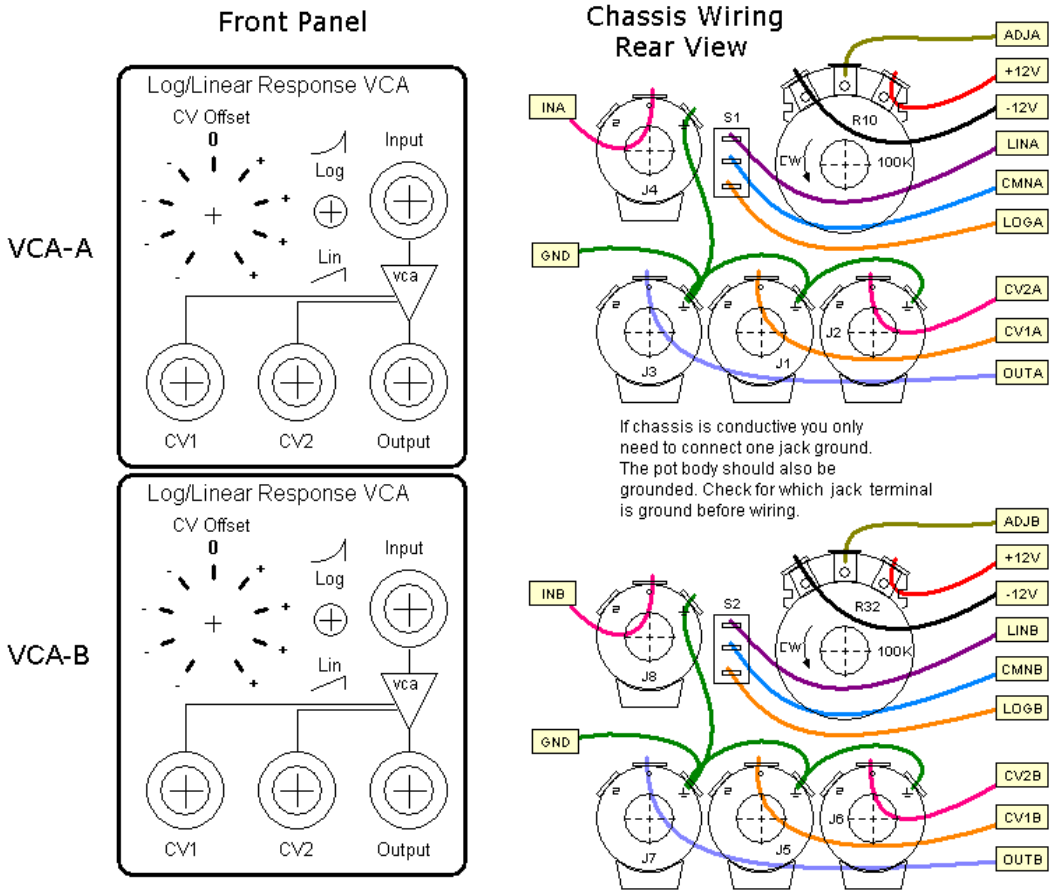


Dual Log/Linear VCA PCB Populated

I used 475 ohm parallel with 220 ohm to get the 150 ohm resistor value I needed but did not have in my drawers.



Dual Log/Linear VCA Front Panel and Wiring PDF



Jason Proctor took the time to make a nice Front Panel Express design and share it with all of us. If you use it make sure you take into account any differences related to the wiring diagram.

Click image to download .FPD File (Front Panel Express) File

Jason Proctor did a nice Front Panel Express layout. **Click for a larger image**
Visit Front Panel Express
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Dual Log/Linear VCA Project Parts List

Qty.	Description	Value	Designators
1	LM13700 Dual gm OpAmp	LM13700	U2
1	TL084 Quad Op Amp	TL084	U1
2	2N3904	2N3904	Q1, Q3
2	2N3906	2N3906	Q2, Q4
14	Resistor 1/4 Watt 5%	100K	R1, R2, R4, R5, R11, R12, R19, R23, R24, R26, R27, R33, R36, R40

2	Resistor 1/4 Watt 5%	120K	R14, R34
2	Resistor 1/4 Watt 5%	150 ohm	R20, R42
2	Resistor 1/4 Watt 5%	1K	R17, R39
4	Resistor 1/4 Watt 5%	20K	R8, R15, R30, R35
6	Resistor 1/4 Watt 5%	2K	R3, R7, R13, R25, R29, R37
2	Resistor 1/4 Watt 5%	2M	R46, R48
2	Resistor 1/4 Watt 5%	30K	R9, R31
2	Resistor 1/4 Watt 5%	4.7K	R16, R38
2	Resistor 1/4 Watt 5%	470 ohm	R6, R28
2	Resistor 1/4 Watt 5%	470K	R21, R43
2	Resistor 1/4 Watt 5%	47K	R22, R44
2	Trim Pot	100K	R45, R47
2	Trim Pot	2K	R18, R41
4	Ceramic Capacitor (S)	.1uF	C2, C3, C5, C6
2	Electrolytic Capacitor (S)	10uF	C1, C4

Miscellaneous

- (1) 4" x 10" 1/16" thick Aluminum plate for mounting the pots and switches.
- Unit is typically mounted in a synth case with other synth modules.
- Assorted hardware 1" 6-32 nuts and bolts, 1/2" #8 wood screws, etc
- Knobs for potentiometers, wire, solder and typical assorted electronics hand tools.
- Digital Volt Meter and a Signal Tracer or oscilloscope for testing.