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Noise Gate
A noise reduction stomp box

The Noise Gate (NG) is a pedal for noise reduction. However, unlike other filters that changes how the instrument sounds, the Noise Gate blocks the noise when the instrument is not being played. In general, noise is only audible at low volumes. At high volumes the noise is supressed by the guitar or instrument sound. So, NG detects when the volume is low and blocks the output, and therefore eliminates the noise. Note, however, that it does not eliminate the noise of the amplifier, but only the noise introduced by other pedals, and then NG should be the last pedal before the amp.

The NG should not be seen as a normal pedal, since it does not introduce any changing. Due to this reason, it doesn't need the Stomp Switch and therefore the layout of NG does not show the DPDT switch. But it is not difficult to introduce this switch in your own project, if you want.

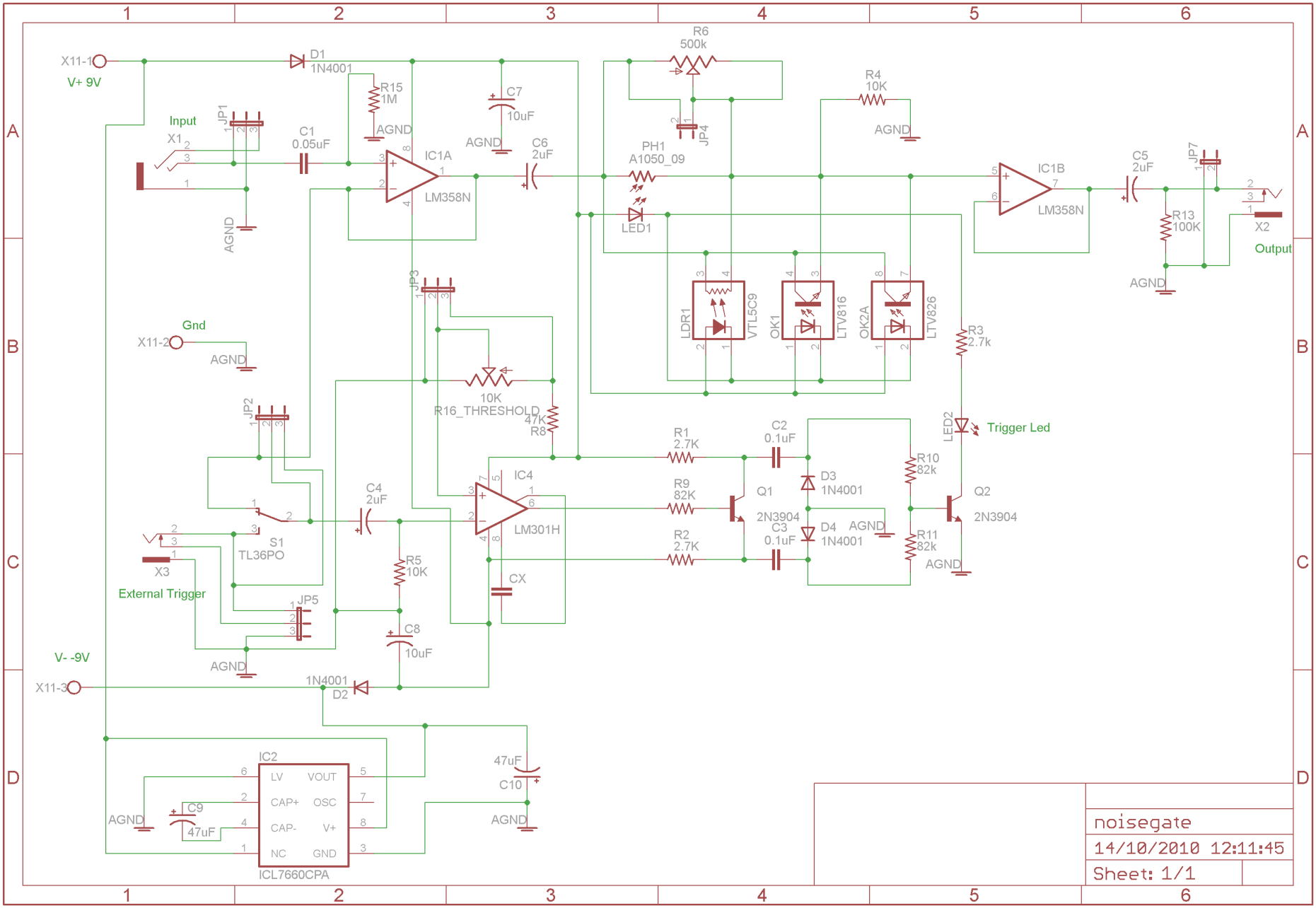
The NG project was based in the Electronic Projects for Musicians book, by Craig Anderton (Amsco Publications, New York, 1980 ISBN 0.8256.2203.4), but I made several modifications in it. I also designed a printed circuit board other than that presented in the book, in order to accommodate several mod scenarios, as will be shown below. The board was built in CadSoft Eagle, which generated the schematics also shown below. The integrated circuit IC1, originally an RC4739, was replaced by LM358N, much easier to find. The IC4 was kept as LM301H.

A very useful feature in this project, reported by Craig Anderton, is the external trigger, which allows driving the NG by other instrument, or to introduce rhythmic effects like tremolo, and even to be used as a synchronizer. In fact, introducing a signal from an external sequencer to trigger input, like a drum machine or a keyboard rhythm, NG opens and closes its output in sync with the trigger signal.

The NG has a pot for adjustment of threshold level and for a mixer. The threshold allows you to adjust the cutting volume level. The mixer combines the original signal (with noise) together with the NG output. Even in this situation the ouptut noise is reduced, since the noise present in the input is strongly attenuated.

In the original scheme of Craig, the CX capacitor is composed of two insulated wires, 5 cm long and twisted together, producing an extremely low capacitance. I selected the smallest capacitor I've found (5 pF). Originally the NG requires a +9 and -9V power supply. I changed this feature and inserted a Charge Pump circuit from GGG (www.generalguitargadget.com, see Stage Center Reverb), that inverts the input voltage. However, the contacts for the original power were kept in this layout, in case you have a +/- 9 supply. The main advantage of Charge Pump is that it eliminates the negative voltage supply, which allows the board to be powered with +9V only. The NG schematic is presented in next page, followed by the Ready-For-Transfer circuit board layout.

I inserted in the schematics a second LED ('LED Trigger'), in serie with the photo-coupler. This LED should be attached in the pedal's external panel, and allows you to see when the NG opens (LED on) or closes (LED off) the sound. Moreover, it makes it easy to adjust the cutoff or threshold level.


X11-1
V+ 9V
D1
1N4001
R15
1M
AGND
C7
10uF
AGND
C6
2uF
R6
500k
R4
10K
AGND
Input
X1
JP1
C1
0.05uF
IC1A
LM358N
PH1
A1050_09
JP4
LED1
IC1B
LM358N
C5
2uF
JP7
R13
100K
AGND
X2
Output
AGND
LDR1
VTL5C9
OK1
LTV816
OK2A
LTV826
R3
2.7k
JP3
Gnd
X11-2
AGND
10K
R16_THRESHOLD
47K
R8
JP2
R1
2.7K
C2
0.1uF
LED2
Trigger Led
IC4
LM301H
C4
2uF
R9
82K
Q1
2N3904
D3
1N4001
R10
82k
Q2
2N3904
S1
TL36PO
R2
2.7K
C3
0.1uF
D4
1N4001
AGND
R11
82k
AGND
X3
External Trigger
R5
10K
CX
JP5
C8
10uF
AGND
V- -9V
X11-3
1N4001
D2
IC2
LV
VOUT
CAP+
OSC
CAP-
V+
NC
GND
ICL7660CPA
C9
47uF
AGND
47uF
C10
AGND
noisegate
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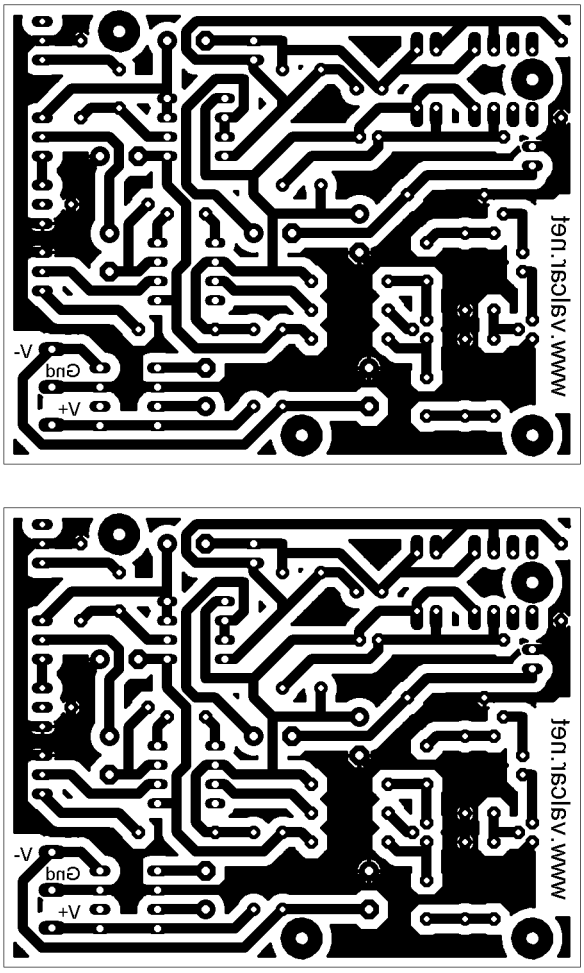
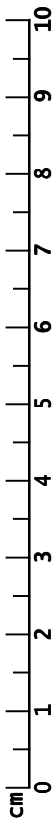
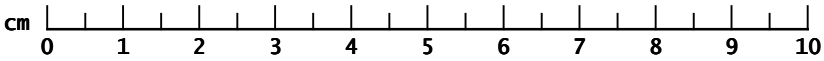
Noise Gate

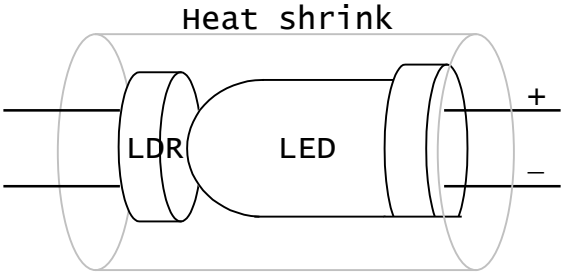


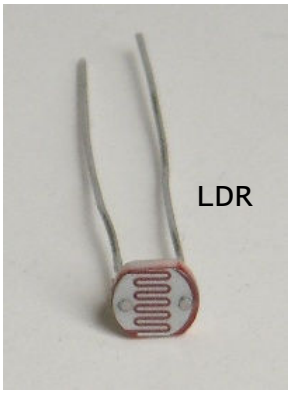


76 x 61 mm



The original circuit from Anderton's book uses a VTL5C9 photo-coupler (or opto-isolator), which is very difficult to be found. You can find it in Small Bear Electronics, www.smalbearelec.com, but it is quite expensive. I decided to build my own photo-coupler, and it worked perfectly. It has one LED (I used a white high-brightness LED) and a photoresistor or LDR, as shown in the sketch below. To make a photo-coupler, you simply join the photoresist face-to-face with the LED using a heat shrink tubing of 6 or 7 mm diameter. The heat shrink shall not cover the LED and LDR legs completely. Do not forget to mark the legs of the LED, in order to solder it properly. The heat shrink must be black, to prevent external light opening the gate, which could jeopardize the operation of the NG.





The R6 (mixer) is a 16 mm pot with on-off switch. The switch creates an infinite impedance when off. In this situation no mixing occurs between the input and the gate signals.

The complete bill list is provided below. Note that some components can be disregarded depending upon the adopted solution. I recommend you to make your own photo-coupler using the set LED-LDR, but you can alternatively use the VTL5C9, VTL5C1, LTV816 or LTV826. I didn't test the pedal with these components, and therefore I can not say that it will work.

If you intend to feed the circuit board with a +/-9V supply, or with two 9V batteries, you don't need to buy the Charge Pump components. As you to know, I used the Charge Pump in my NG and it worked fine.

Bill material list
Capacitors:

Component	Value (24 V all)
C1	0.05uF
C2	0.1uF
C3	0.1uF
C4	2uF
C5	2uF
C6	2uF
C7	10uF
C8	10uF
CX	5pF

Resistors:

Component	Value (¼ W all)
R1	2.7K
R2	2.7K
R3	2.7k
R4	10K
R5	10K
R8	47K
R9	82K
R10	82k
R11	82k
R13	100K
R15	1M

Diodes:

Component	Type
D1	1N4001
D2	1N4001
D3	1N4001
D4	1N4001

ICs:

Component	Type

IC1	LM358N,	
IC4	LM301H, LM201 ou LM748	

Photo-coupler:

Component	Type	
LED1	LED5mm	LED and
PH1	LDR5mm	LDR (photoresistor), or
(LDR1)	VTL5C9 ou VTL5C1	Photo-coupler, or
(OK1)	LTV816	Photo-coupler, or
(OK2)	LTV826	Photo-coupler.

Transistors:

Component	Type	
Q1	2N3904	transistor-npn
Q2	2N3904	transistor-npn

Potentiometers:

Component	Value (16 mm, knurled shaft)	
R6	500k switched	Mixer
R16	10K	Threshold

Charge pump:

IC2	MAX1044 ou ICL7660CPA	
C9	47uF	
C10	47uF	

Other:

X1	Jack J10 stereo ¼ in	Input
X2	Jack J10 mono ¼ in	Output
X3	Jack J10 ¼ in NC contact	External Trigger
LED2	LED5MM	Trigger LED

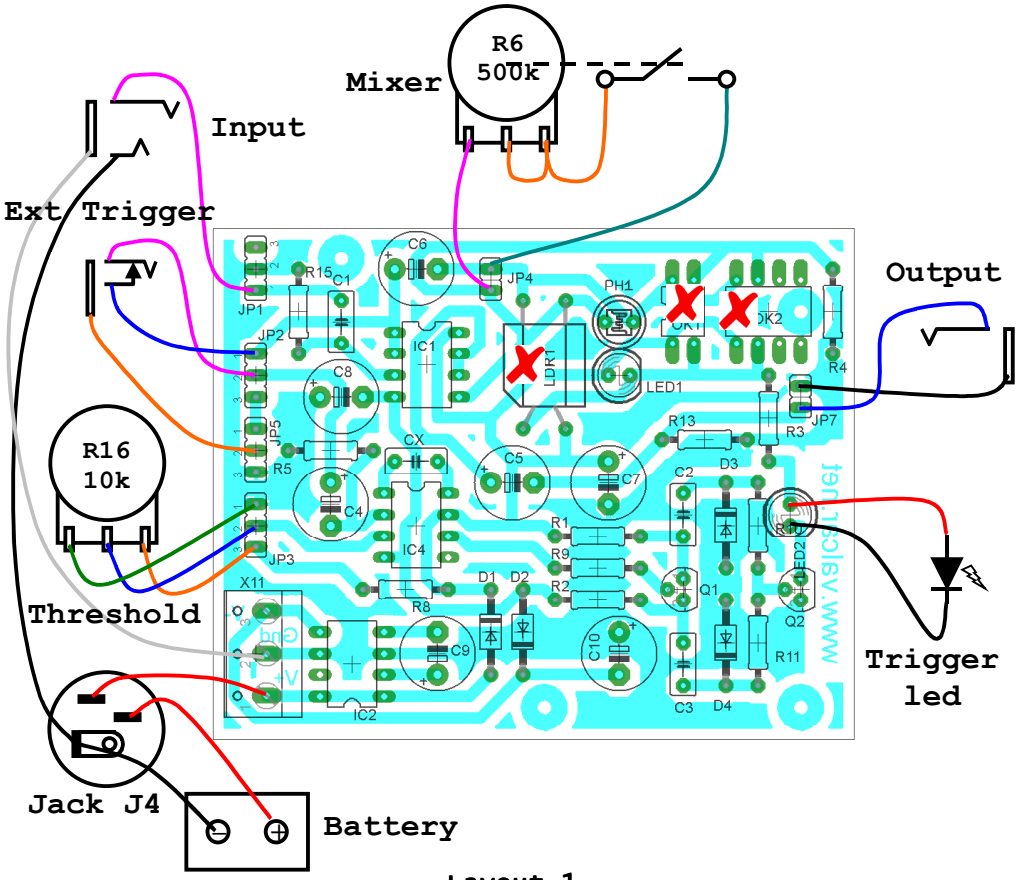
Jack for DC Power, 2.1 mm Plastic, Round, External Nut
2 Knobs for knurled shaft

Optional:

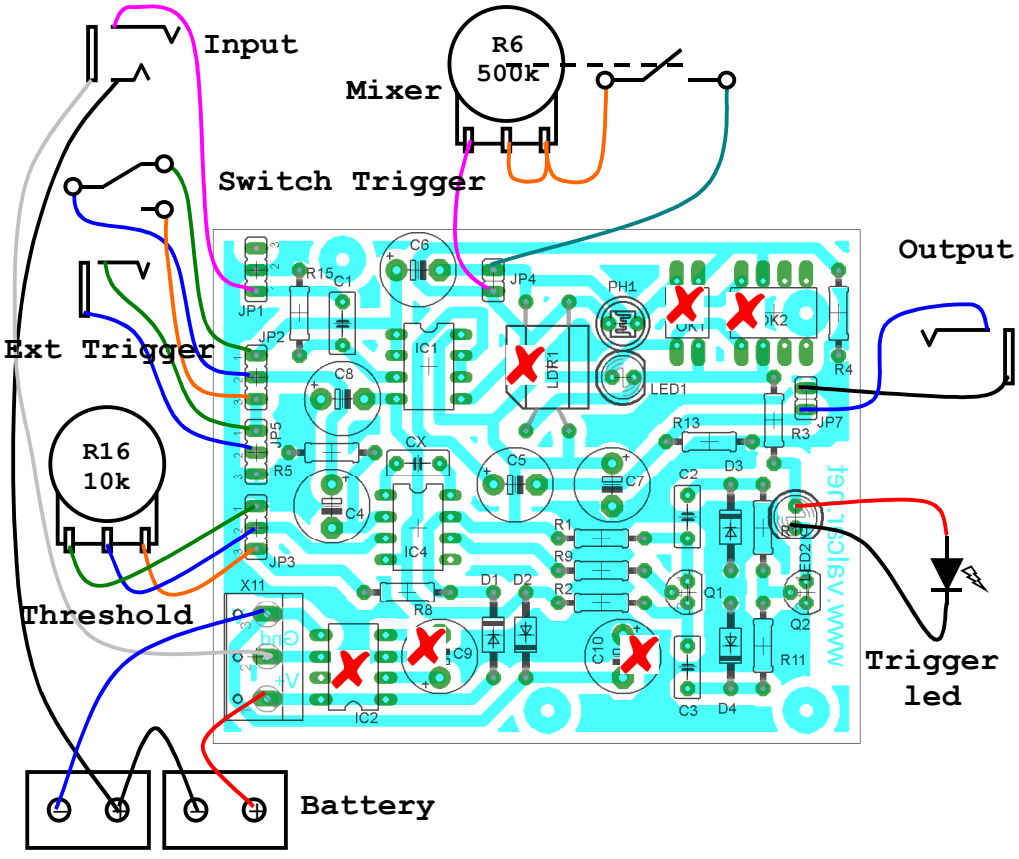
S1	Switch SPDT	Switch Trigger

Switch DPDT Foot Switch
Battery drawer
Battery snap

Below is shown two possible layouts for board wiring. The differences are in the power supply and in the External Trigger. The first one shows a conventional power supply through battery or external +9VDC, with the negative voltage generated by Charge Pump from the positive voltage. In the second layout you must supply the board with a +/- 9VDC, or with two 9V batteries. In this case the components listed in the Charge Pump are no longer required. You can connect the External Trigger by means of switch, as indicated in layout 2, or without this switch, as seen in layout 1. In the latter, the External Trigger Jack must have a NC (normally closed) contact. In this case, if the External Trigger jack is plugged, this input drives the NG. Otherwise the gate is driven from the standard input.

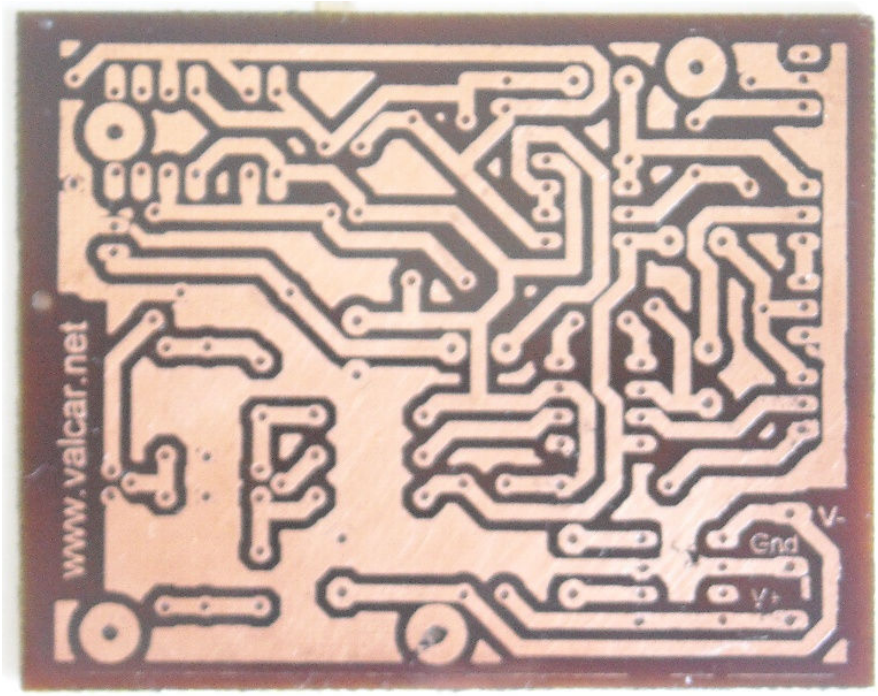


Layout 1



Layout 2

Printed circuit:



Assembled Noise Gate: