

## **BMC 086. Diode High Pass VCF Build Documentation.**

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## I. Using The Module.

This module is a 4-pole high pass filter using diodes as the controlling element. It's inspired by the topology used by Richard Steiner for his phaser which can be searched for online.

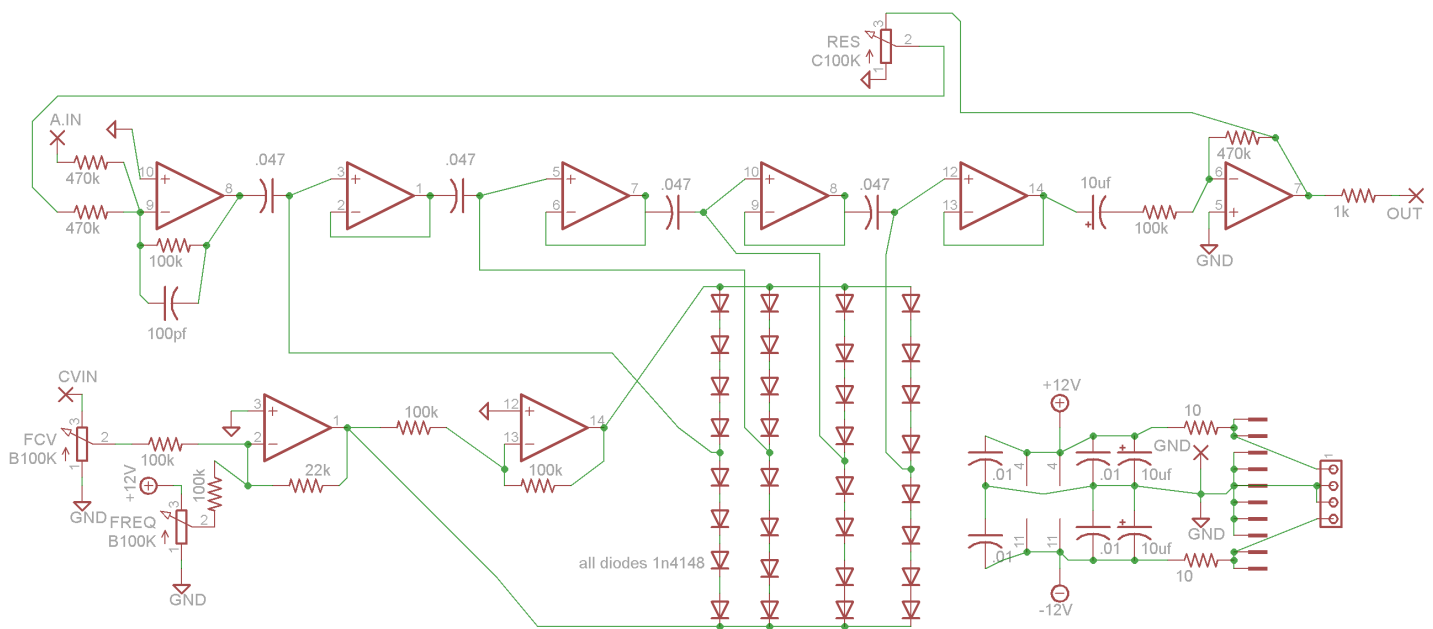
### INPUTS/OUTPUTS

1. Audio Input – AC coupled, expects a +/-5V signal
2. Cutoff CV Inputs – One of these has a built in attenuator and one does not.
3. Audio Output – DC coupled

### CONTROLS

1. Cutoff – This controls how much of the frequency range is filtered.
2. Cutoff CV (CCV) – This attenuates voltage applied to the first cutoff CV input.
3. Resonance – This controls how much positive feedback is applied to the filter, this creates greater emphasis on the highest frequencies passed by the filter.

## II. Schematic.



Above is the schematic for this module. Audio is input at the “A. IN” wirepad and connects to the inverting input of an op-amp through a 470K resistor. This op-amp also connects to the output through the resonance control and another 470K resistor providing a positive feedback loop. The 470K input resistors combined with the 100K resistor in the op-amps feedback loop give this stage a gain of ~0.2 with lower gain at higher frequencies thanks to the 100pf cap in parallel with the 100K. This low gain conditions the input signal into a range where the diodes can greatly affect it.

The output of this first op-amp connects to four filter stages, each is formed by a .047uf capacitor connecting to the center of 8 diodes that connect to the processed control voltage. When the control voltage varies, the amount of current able to flow through these diodes varies as well and they act like variable resistors, forming a high pass filter with the .047uf capacitors. Each stage is then

buffered by an op-amp stage wired as a unity buffer.

The last buffer connects to an op-amp wired as an inverting amplifier with a gain of ~5 making up for the signal loss in the input op-amp stage, its output is sent to the output wirepad through a 1K resistor and the resonance control.

The cutoff frequency is controlled by the FREQ knob and CV knob/input, these are mixed by a pair of 100K resistors into an inverting op-amp stage with a 22K resistor in the feedback path, again limiting the voltage to ~0.2. The output of this amplifier connects to the bottom cathodes of the diode arrangements for each of the four sections and then goes to another inverting op-amp whose output connects to the anodes of the diodes.

At the bottom right of the module are the power connections. Footprints for Eurorack and MOTM style connectors are in parallel. The positive and negative rails are filtered by a 10ohm/10uf capacitor pair and further filtered at the TL074's power rails by .01uf capacitors.

### III. Construction

#### A. Parts List

##### Semiconductors

Value	Quantity	Notes
TL074	2	14 pin DIP
1N4148	32	

##### Resistors

Value	Quantity	Notes
10 ohm	2	5mm lead spacing. Use 3.5mm body length or stand up
1K ohm	1	
22K ohm	1	
100K ohm	6	
470K ohm	3	
B100K Potentiometer	2	PC Mounted 16mm <a href="#">like this package</a> .
C100K Potentiometer	1	PC Mounted 16mm

Note: This module is untested with +/-15V systems but should work with these values. Increasing the 100K resistor connected to the FREQ pot wiper to a 120K or 150K on +/-15V builds should make it identical to a 12V build.

##### Capacitors

Value	Quantity	Notes
.01uf	4	Small ceramic disc. Value not critical
100pf	1	Small ceramic disc.
.047uf	4	Polyester or Polypropelene Film
10uf	3	Electrolytic

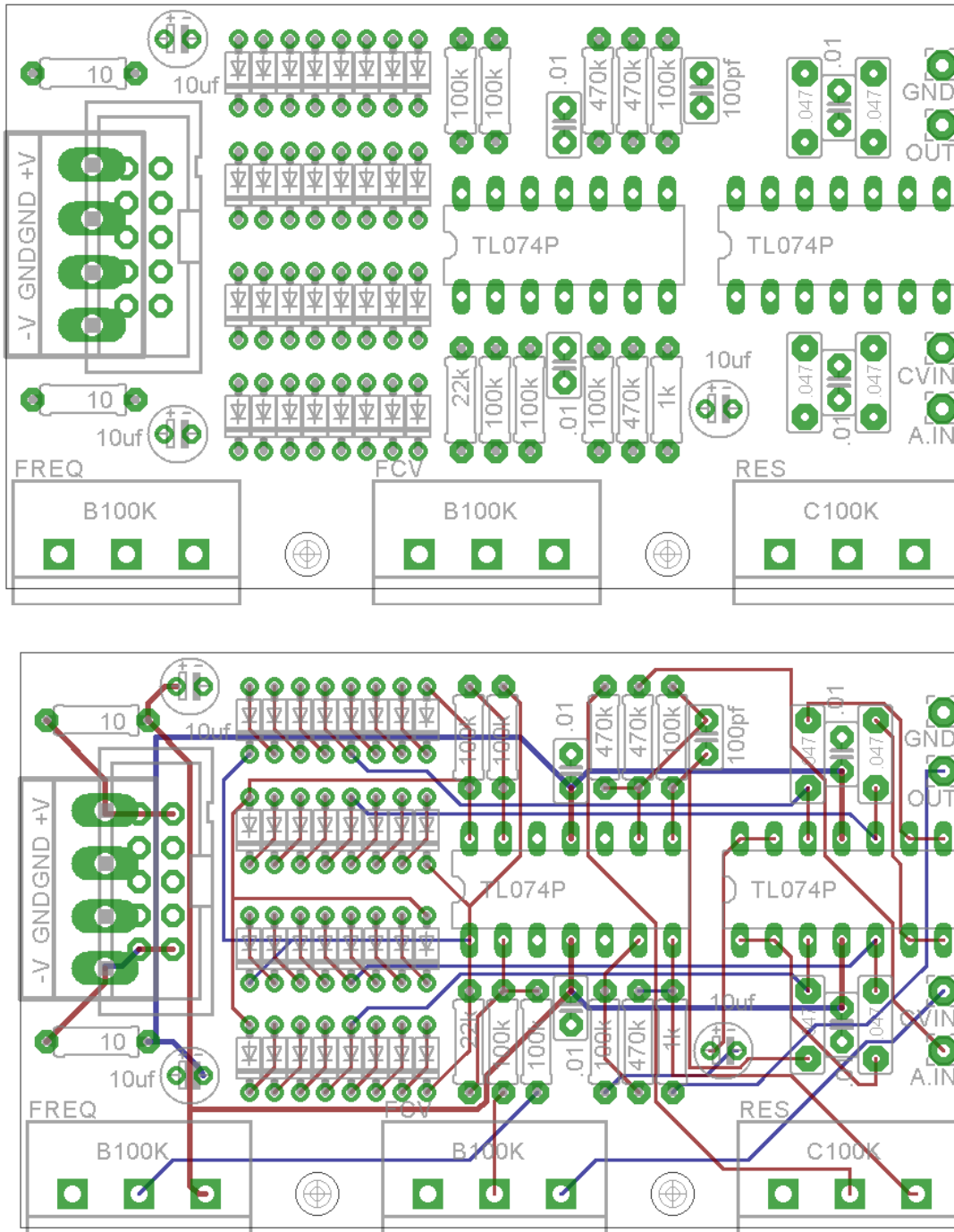
##### Other/Off Panel

Value	Quantity	Notes
Power connecter	1	Eurorack or MOTM style
Jacks	3	
14 pin DIP Socket	2	
Knobs	3	

## B. PCB Layout

Below are renderings of the PCB. The rendering showing the traces does not show the ground fill plane, so assume any missing connection is a ground fill.

The PCB measures 71mm x 43mm and the pots are spaced 26.67mm apart.



**Wiring** of this module is very straightforward. The tip connector of each jack should be wired to the corresponding wirepad. The GND wirepad should then be wired to the sleeve connector of one of the jacks. On the next page is a photo of a completed module.

