

# Neptune

Winterbloom

A salty diode ladder filter

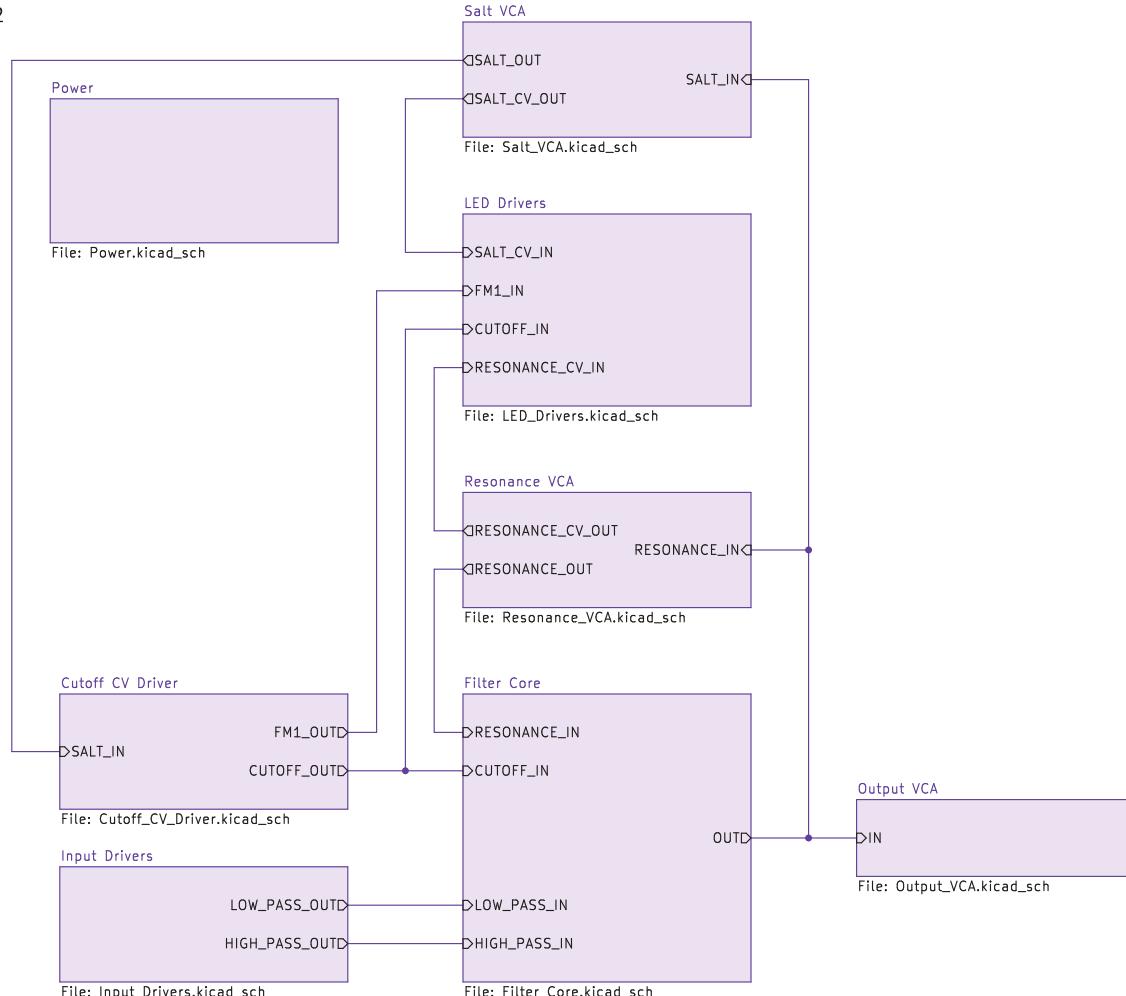
Designed by Carson Walls & Thea Flowers

Inspired by Moritz Klein & Arturia

Open-source hardware under CERN-OHL-P V2

Documentation: <https://heptune.wntr.dev>

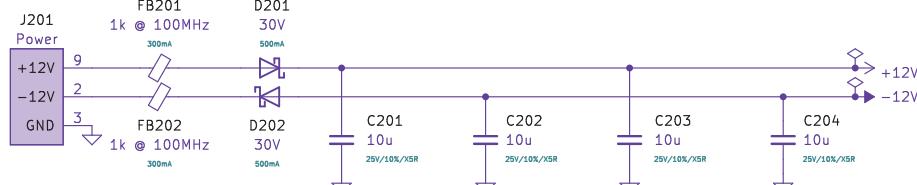
Source: <https://github.com/wntrblm/Neptune>



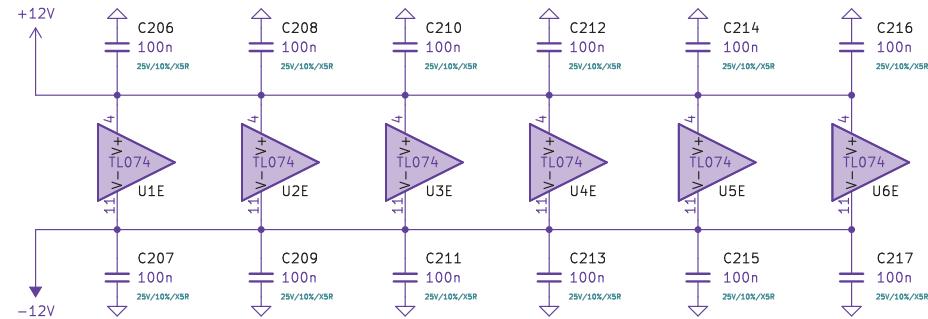
# Power

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## Power Input and Bulk Decoupling

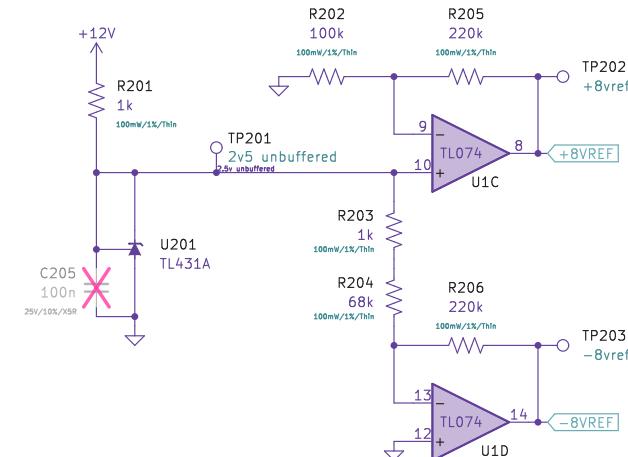


## Op Amp Decoupling



## ±8V references

Sink or source roughly  $\pm 10\text{mA}$   
Absolute accuracy is not important, just stability



# Input Drivers

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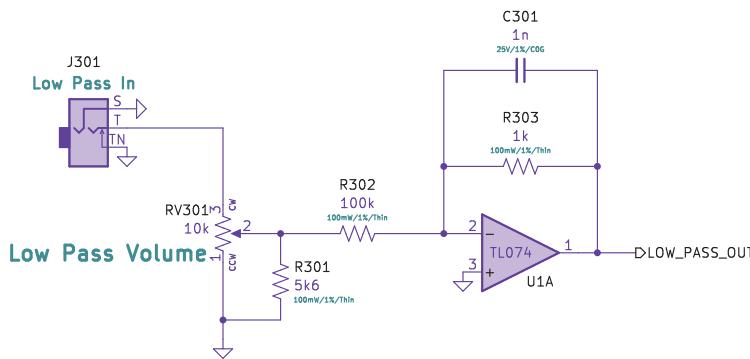
Reduces input amplitude, corrects signal inversion, and limits high frequencies into the filter core

Input amplitude:  $\pm 5$  V nominal  
Output amplitude:  $\pm 50$  mV nominal  
Cutoff frequency:  $\sim 150$  kHz

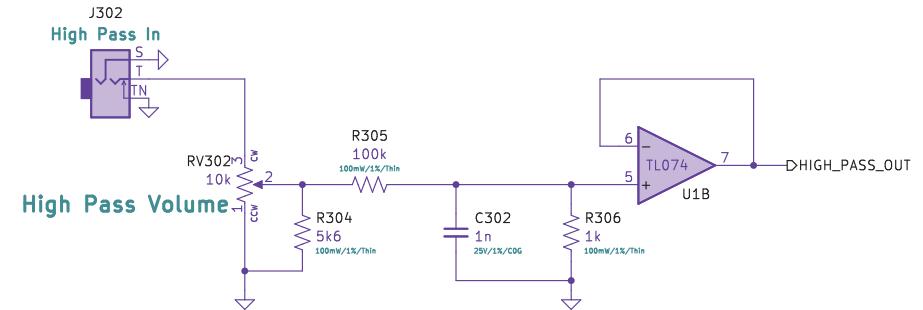
Notes:

- Resistor going from pot wiper to ground can be adjusted to change the volume curve

## Low pass



## High pass

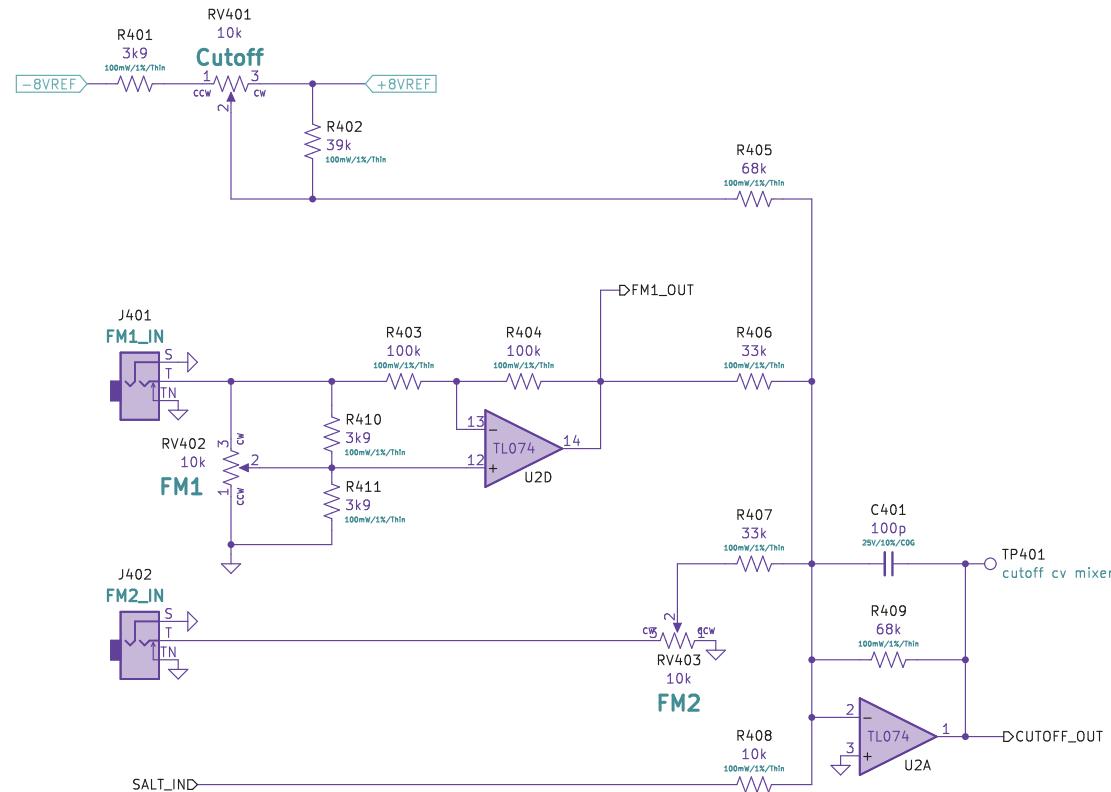


# Cutoff CV Driver

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Mixes the various modulation sources for the cutoff frequency

CV input: 5 V nominal  
CV Cutoff: ~15 kHz

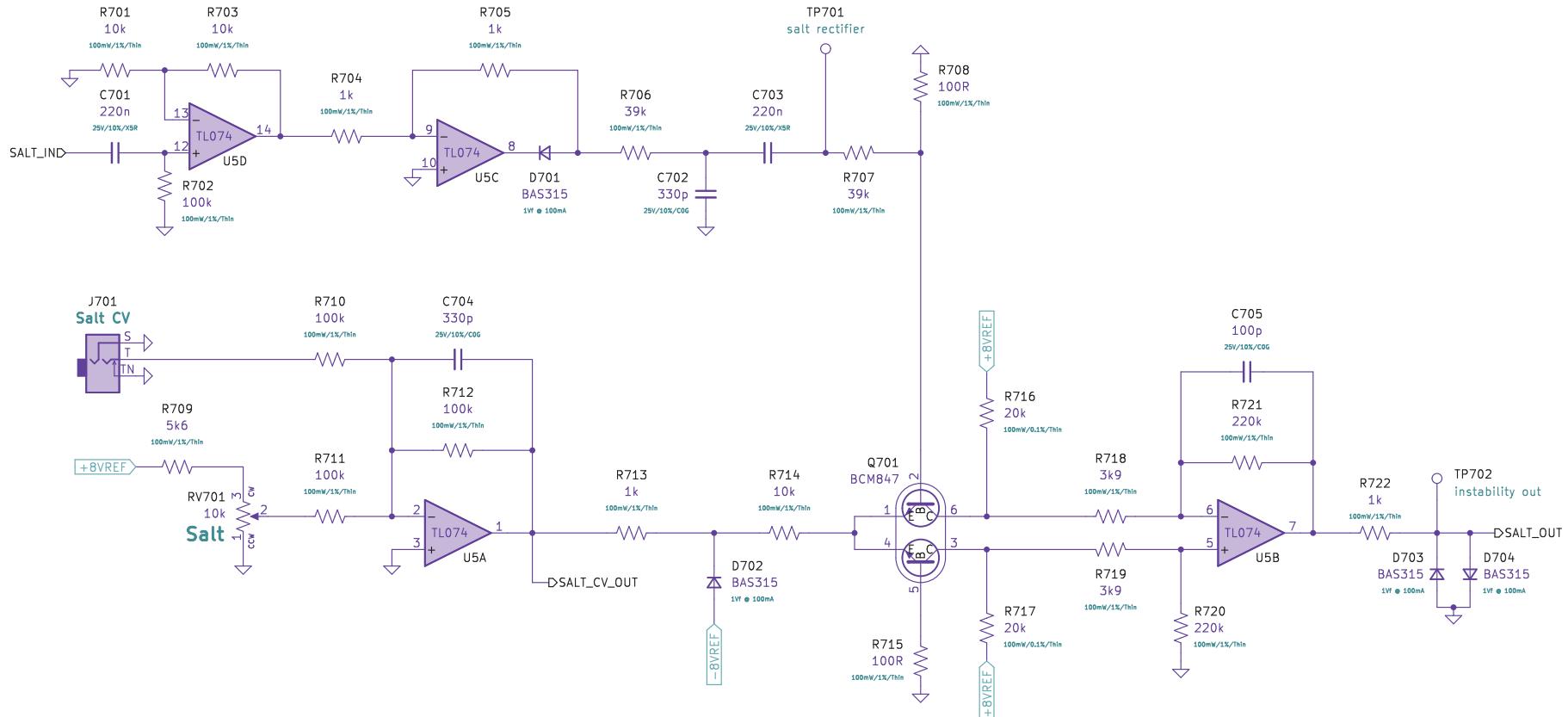


# Salt VCA

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Controls the depth of the Salt feedback circuit.  
Rectifies, AC couples, and clips filter output before using it to modulate the cutoff frequency

CV input: 5V nominal  
CV cutoff: ~2.5 kHz  
Salt in high pass cutoff frequency: TBD  
Salt in high low cutoff frequency: TBD



# Resonance VCA

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Controls the depth of the resonance feedback circuit

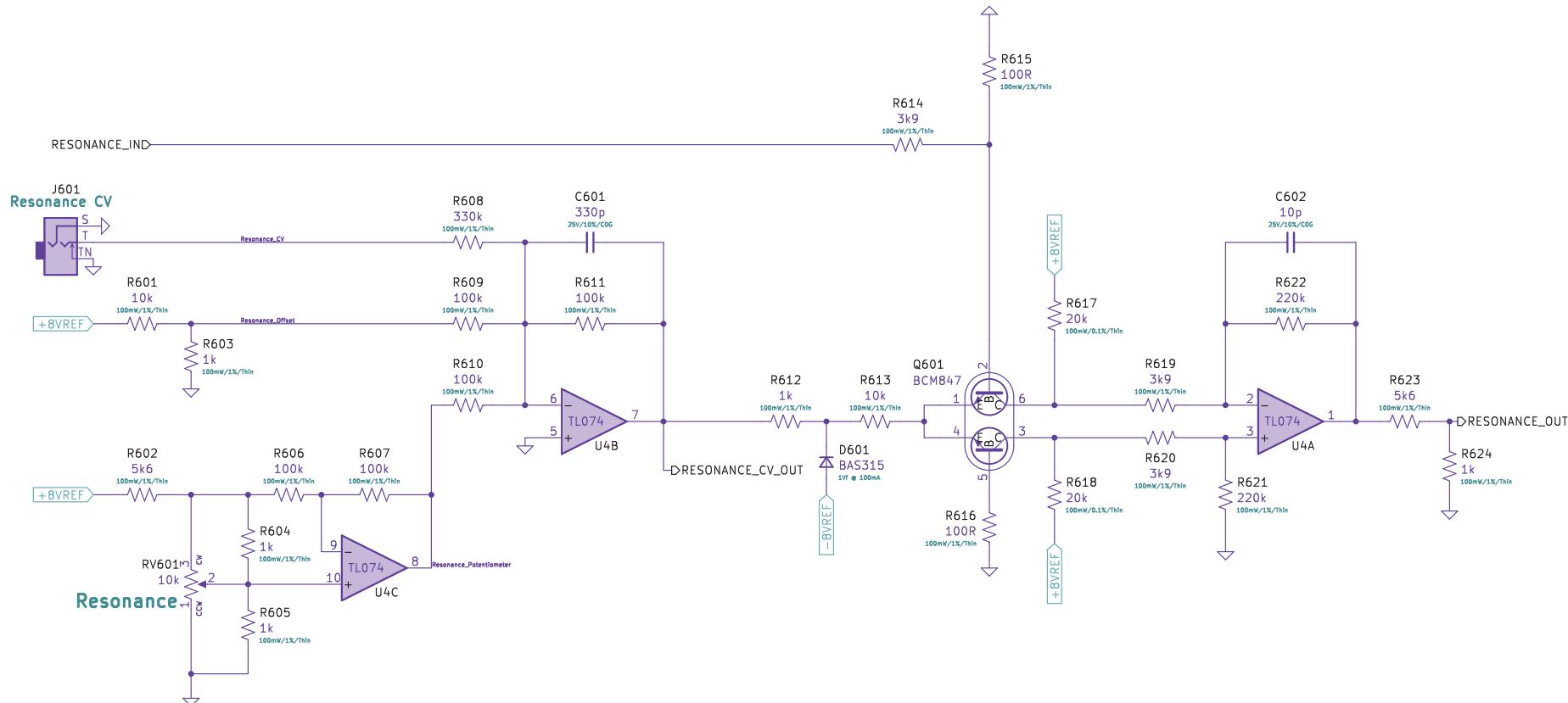
CV input: 5 V nominal

CV Cutoff: ~2.5 kHz

Self resonance gain threshold: -8 dB

Max self resonant frequency: ~16 kHz

Max gain: -5.5 dB



# Filter Core

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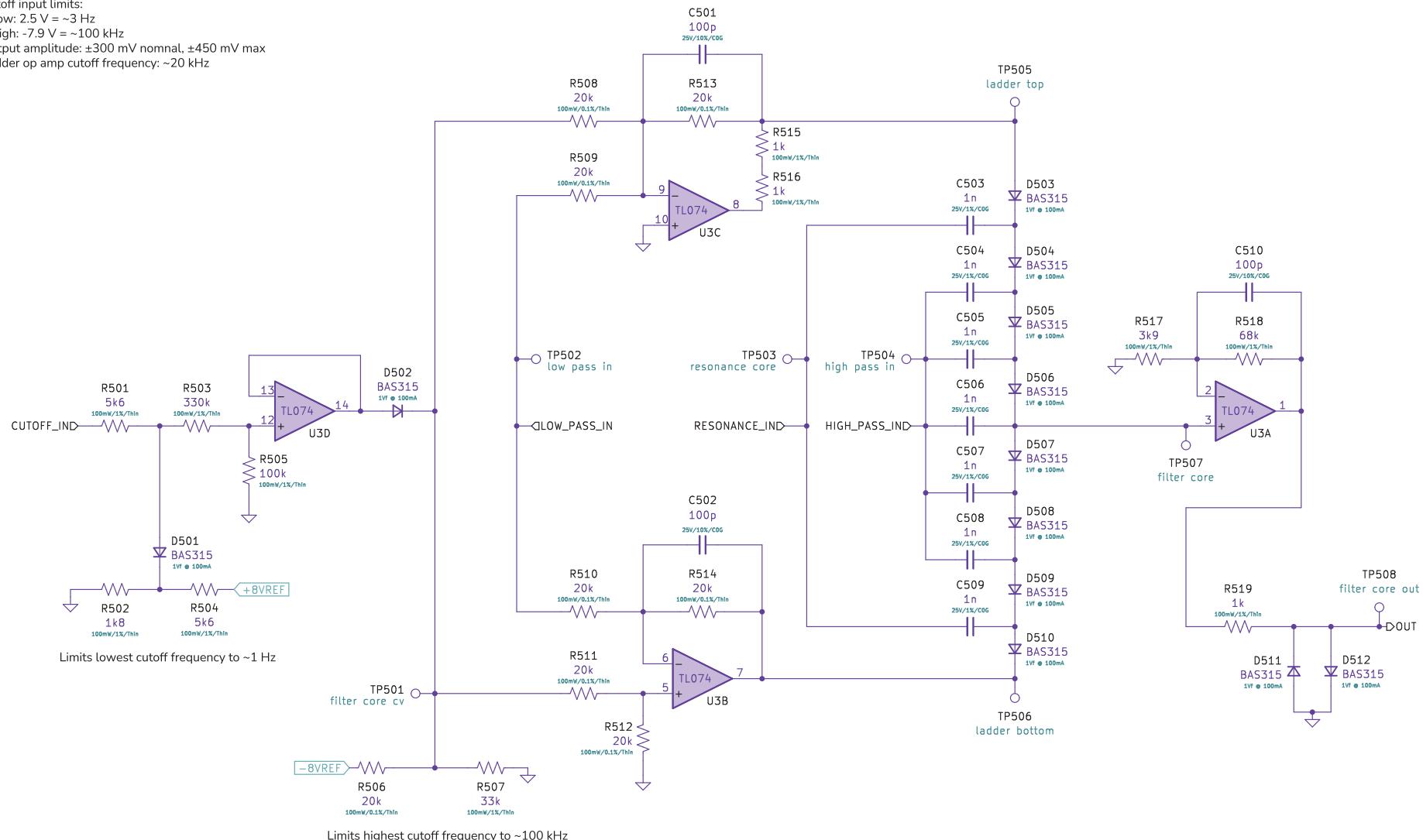
4-pole diode ladder filter topology

Low pass & high pass input amplitude:  $\pm 50 \text{ mV}$  nominal max  
Resonance input self oscillation threshold:  $\sim 200 \text{ mV}$

Cutoff input limits:

- Low:  $2.5 \text{ V} = \sim 3 \text{ Hz}$
- High:  $-7.9 \text{ V} = \sim 100 \text{ kHz}$

Output amplitude:  $\pm 300 \text{ mV}$  nominal,  $\pm 450 \text{ mV}$  max  
Ladder op amp cutoff frequency:  $\sim 20 \text{ kHz}$

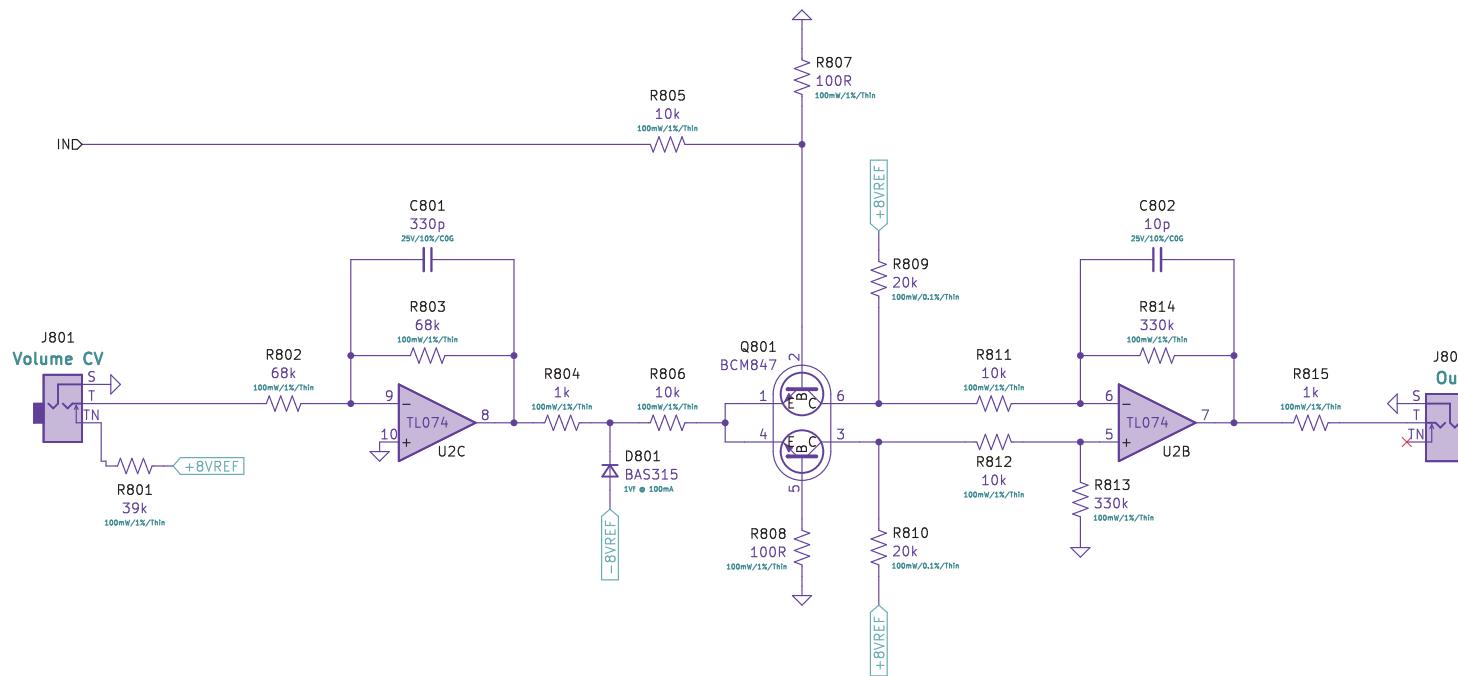


# Output VCA

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Controls overall output volume

CV input: 5 V nominal  
CV cutoff: ~2.5 kHz



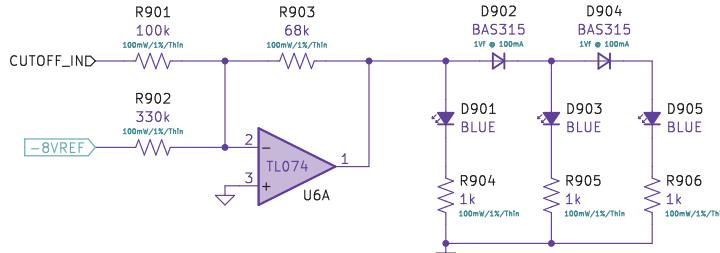
# LED Drivers

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All LEDs target max brightness @ 5 mA

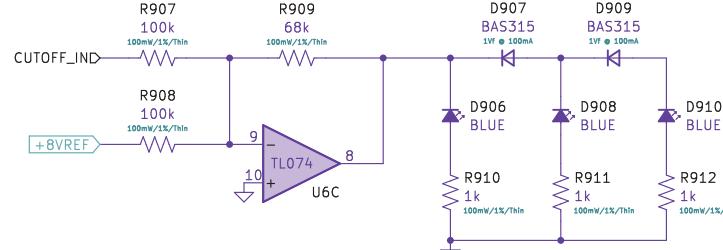
## Cutoff low pass LEDs

Illuminates as low pass filter opens up

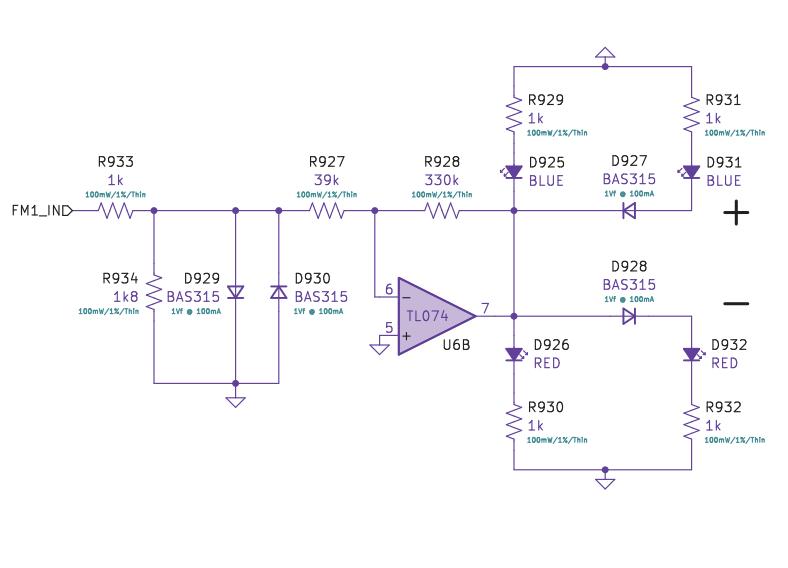


## Cutoff high pass LEDs

Illuminates as high pass filter opens up

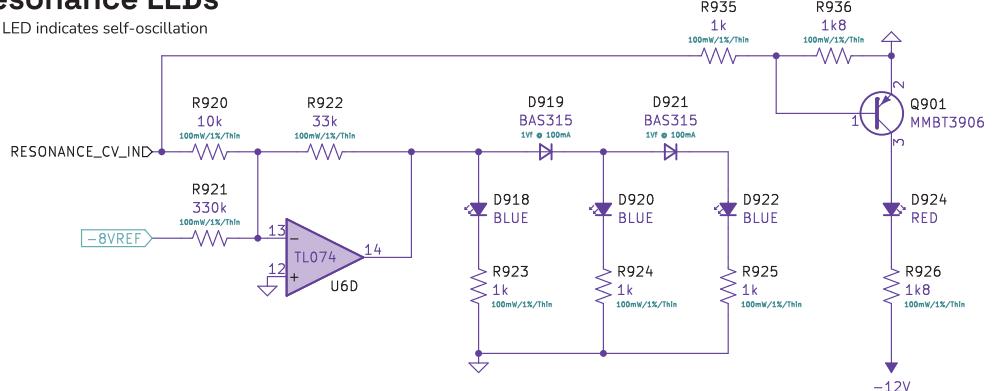


## FM1 LEDs



## Resonance LEDs

Red LED indicates self-oscillation



## Salt LEDs

