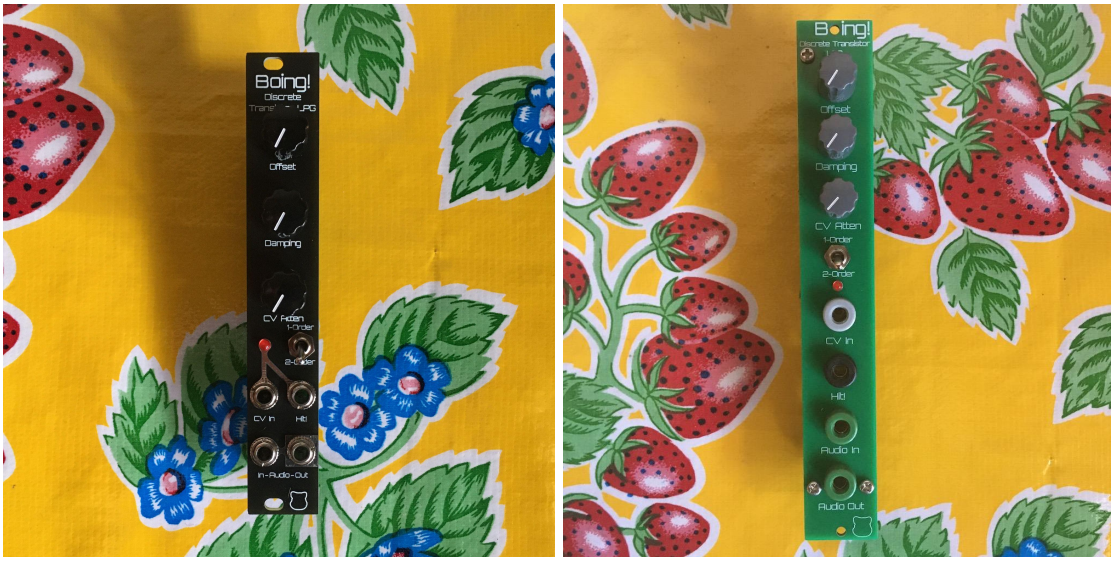

Boing! Discrete Transistor Low Pass Gate User's Manual

Updated November 2021

Hello and thank you for using the Boing! Discrete Transistor Low Pass Gate. We hope you will find its tones most pleasing!

1. Connecting your Boing!

Use a typical 10-16-pin Eurorack ribbon power cable to connect the rear header of your Boing! to your Eurorack case's power bus. The -12V (red stripe) side of the ribbon cable must be aligned with the white silkscreen indicator stripe for proper use. This module is reverse diode protected, but it is still not recommended that you plug it in backwards to see what happens.

2. Theory of Operation

The Boing! Discrete Transistor LPG was conceived and designed with two things in mind: we loved the sound of discrete transistor gain stages such as those found in the Moog CP3 and Buchla Model 106 mixers, and we also loved the sound of simple passive LPG modules such as the PassiVac and Meng Qi DPLPG. Why not combine them?

Well, there are a few reasons! Given the advent and development of op-amps and OTA's, transistors offer a less precise and linear way to provide amplification or process Control Voltage, and Low Pass Gates process the frequency spectrum less unevenly (low frequency will always pass through more than high) than a modern "clean" amplifier.These circuits also operate between +12V and Ground, which is half the headroom of an op-amp powered with a bipolar supply. If the amplified signal exceeds about +10V at any stage, clipping will occur. Vactrols, or in this case LEDs facing Light-Dependent-Resistors, have a distinct "lag" behind their controlling signal.

However, the ear hears what it likes, and it *likes* distortion, Vactrol lag, and the sound of filters opening and closing completely. Together with an inverted feedback loop which can tame some of the wilder harmonics introduced by the various stages, these elements offer new ways to process sound, distinct from other Low Pass Gate designs, and can consistently offer up new and exciting sounds each time it's patched.

The Boing! operates like a typical Low Pass Filter in most regards: it has one Audio Input and one Audio Output, and the signal present at the Output will represent a modified version of the Input. The knob labeled "Offset," Control Voltage present at the "CV In" jack (attenuated via the "CV Atten" knob), and Triggers or Gates sent to the jack labeled "Hit!" will all influence the filter's cutoff frequency. Early builds of this module will require a +10V gate or trigger to significantly "ping" the LED, while any built post-October 2021 will work well with +5V.

Negative control voltage can be used to influence the control LEDs as well in combination with the Offset knob. Finally, the knob labeled "Damping" introduces a phase-inverted signal to the first filter stage which changes the filter's timbre.

In the case of the Boing!, filtration is being done by one or two Light-Dependent Resistors configured as Low Pass Filters, depending on the position of the Switch: "1-Order" indicates one stage of Low Pass Filter, while "2-Order" indicates two stages. The LDRs determining the cutoff of each stage are controlled

by optically coupled LEDs which in turn are controlled by the "CV" input, "Hit!" trigger input, and "Offset" knob, forming what is commonly known as a Vactrol. As is characteristic of LDRs, this filter's response to CV relative to its frequency sweep will be less linear than a "typical" active filter, though in the case of the Boing! measures have been taken to improve this over regular passive LPGs.

A note on distortion in the Boing!: the sonic characteristics of this module are heavily influenced by the two JFET transistor-based amplification circuits on the input and output of the filter stages. These single-supply amplifiers are significantly less “clean” than more modern op-amp-based solutions. They will introduce significant clipping to a traditional Eurorack-level input, i.e. 10Vpp, and break up entirely as the input level approaches approximately 16Vpp. Users wishing to achieve anything close to a “clean” sound with the Boing! will need to attenuate the input signal and amplify the output signal using external module(s).

3. Patch Ideas

"Buchla Bongo"
Turn Offset fully CCW and set switch to "2-Order." Patch a sine or triangle wave VCO into the Audio In and send a short, fast-attack envelope to the CV Input and trigger input simultaneously. Adjust Damping to modify harmonic level. Optional: if your VCO has a hard-sync, send your envelope or a synced trigger to the Sync input to reset the phase with each Bongo hit.

"Vactrol Compression"
Turn Offset fully CW, Feedback fully CCW and set switch to "2-Order." Patch audio signal into Audio In and an envelope follower. Invert output of envelope follower using a CV processor and patch to "CV In" and use CV Atten to adjust amount of compression/ducking.

“Moving-Membrane Drum”
Patch an oscillator into the Audio Input and monitor the output. Send a repeating trigger or trigger pattern into the “Hit!” input and feed an LFO or sample and hold into the CV input. (This works especially well with bipolar CV input.) Attenuate the CV input and adjust the Offset to taste.

These are but three ideas, and many other delightful sounds can also be achieved through a thorough exploration of the module. We hope that the Boing! can help to bridge the gap between the delightful immediacy of a passive Low Pass Gate and the expanded tonal possibilities of more sophisticated filters. Enjoy!