
Legato for Buffalo DAC

User Manual

For Board Revision 3.1.0

(Draft)



Twisted Pear Audio

Overview

The Legato is a discrete balanced I/V converter with an optional built in balanced to single ended signal converter. The single ended output has an optional buffer. The Legato circuit utilizes a common base CFP amplifier which is made up of a bipolar transistor and MOSFETs for each end of both channels. The module is designed to stack with the Buffalo II using mezzanine connectors (male and female pin headers).

Legato 3.1 differs from earlier versions in that in many cases no AC coupling capacitors will be required at all. There are two potentiometers on each channel. That are use to nullify DC. At each channel one potentiometer nulls the differential DC between the balanced outputs, the other potentiometer is used to null any remaining offset from the single ended output. It is important to note that while the balanced output differential offset can be completely nulled there will still be common mode DC bias on those outputs relative to GND. The user must be careful about this and if the next stage requires that there be no common mode DC bias then external AC coupling caps should be added to the balanced output. The single ended outputs DC offset can be completely nulled, so that if you using these you can have no AC coupling caps in the signal path at all.

Legato 3.1 has optional Buffers on the SE outputs as well as a convenient terminal labeled HP_OUT for wiring to a headphone jack. I recommend always using the buffers unless you have some good reason not to.

The output voltage at 0dbfs is about $1.5V_{RMS}$. It can be increased to $2V_{RMS}$ by using R1-R4 of 187Ω . Please keep in mind that the Legato must be carefully tuned for best THD+N. The supplied values give the best balance between signal integrity and output voltage I have found so far. It is best not exceed a value of 200R without changing R9-R16.

Power Requirements and Options

The Legato is intended for supply voltage rails (+ and -) of 12-15V with 15V getting the best theoretical performance at the expense of added heat. Any high quality bipolar power supply should work quite well. The Legato presents a nearly constant load of about $\sim 350mA$ (depending on the supply voltage) so even a good linear supply like the LCBPS will work very well. The Placid HD_BP will also work very well.

The Legato has three power terminals, and can be configured to use one, two or three power supplies by installing or omitting jumpers J1-J4. Typically, only the center terminal block is used, supplying power to all three sections (I/V Left, I/V Right and BAL/SE) via J1-J4. By omitting the jumpers, you can supply the three sections of the circuit separately.

Construction Options

The Legato is a pretty straightforward build. C1-C4 can either filter to GND or the positive rail. I prefer GND. **Please note J5 and J6 are only used if the buffers are omitted** - otherwise do not populate.

Completely omitting the opamp based BAL/SE stage:

Omit: SW1, IC1, IC2, IC3, C17,C18,C11,C12, L1, L2, R17 – R26 and R33 – R36, as well as VR3 and VR4

Completely omitting only the SE buffer:

Omit: IC2, IC3, and optionally L1 and L2. Then install jumpers at J5 and J6.

First Run and Initial Adjustment

1. Ensure the supply is not connected to the Legato and that the Legato outputs are not connected to anything.
2. Adjust the power supply rails to 12-15VDC.
3. Power off the supply and connect the supply to the Legato then power back on.
4. Adjust VR1 and VR2 so voltage between + and – on the balanced outputs measures 0VDC.
5. If the BAL/SE stage is used adjust VR3 and VR4 until the SE output on each side is at 0VDC.
6. It is now safe to wire the outputs with the power off. Add AC coupling capacitors to the balanced outputs in the unlikely event your application requires it.
7. Power back up and repeat steps 4 and 5.
8. Enjoy the music!

Other Applications

If you want to change the output voltage you need to adjust both the top - I/V (R1-R4) values and bottom - CCS (R9-R16) values in proportion to each other. I have found that a ratio of 1/4.4 works very well for top resistor values up to about 364Ω. I have not tried gain any higher than that. If you need to please contact us.

The Legato is a very flexible circuit. Not every configuration possibility can be covered here. Please visit the forums if you have any specific application questions.

