
Legato for Buffalo DAC

User Manual

For Board Revision 1.0.2



Twisted Pear Audio

Overview

The Legato is a discrete balanced I/V converter with an optional built in balanced to single ended signal converter. It utilizes a common base CFP amplifier which is made up of an NPN bipolar transistor and a P-Channel MOSFET for each end of both channels. There is also an optional buffer which is made up of 4 discrete single-ended Class-A buffers. With the stock parts it is only recommended to use the buffers if your load is less than 4K. The module is designed to stack with the Buffalo II using mezzanine connectors (male and female pin headers).

The supplied parts provide a 1st-order low pass filter with a corner of around 85KHz. The high pass will depend on the load, but is about 0.5Hz at $5K\Omega_{LOAD}$ with the stock parts.

The output voltage at 0dbfs is about $1.5V_{RMS}$. It can be increased to $2V_{RMS}$ by using R1-R4 of 187Ω . Just 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.

Power Requirements and Options

The Legato is intended for supply voltage rails (+ and -) between 10V and 15V, with 12V being a good balance between power dissipation and overall performance. Any high quality bipolar supply should work quite well. The Legato presents a nearly constant load of about 360mA (depending on the supply voltage) so even a good linear supply like the LCBPS will work very well. The Placid 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.

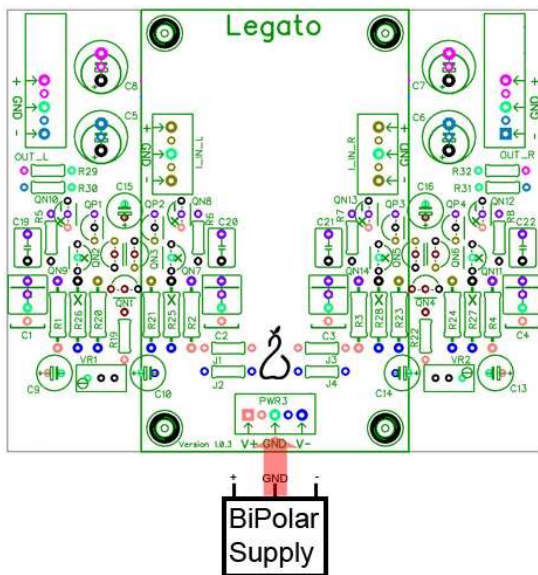


Figure 1: I/V stages installed (only), single power supply. J1-J4 installed.

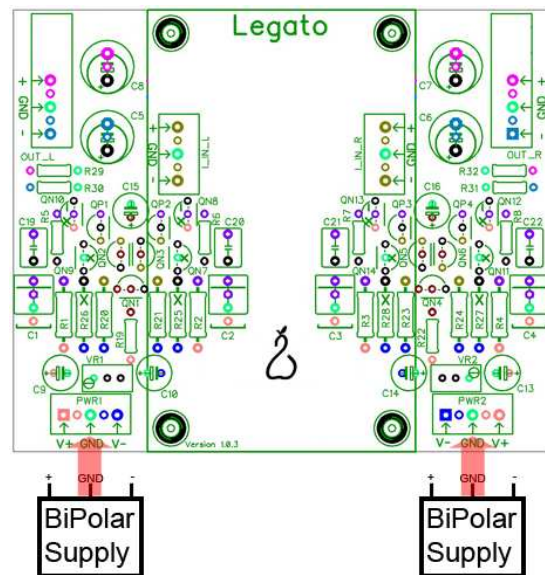


Figure 2: I/V stages installed (only), two power supplies. J1-J4 not installed.

One possible scenario is to install and power the I/V stages but not the BAL/SE stage, as seen in Figures 1 and 2 above. These configurations can be used if BAL/SE is not required, or if it is to be performed by some other means, such as transformers. See the Construction Options section for details on omitting the BAL/SE stage.

In Figure 1, the power jumpers J1-J4 are installed, allowing the use of a single power supply for both channels. This is the simplest configuration and yields very good results.

In Figure 2, the jumpers are not installed, and each side uses a separate power supply for improved channel separation. Although the BAL/SE are not shown in Figure 2, it could be installed and simply not powered to achieve the same effect.

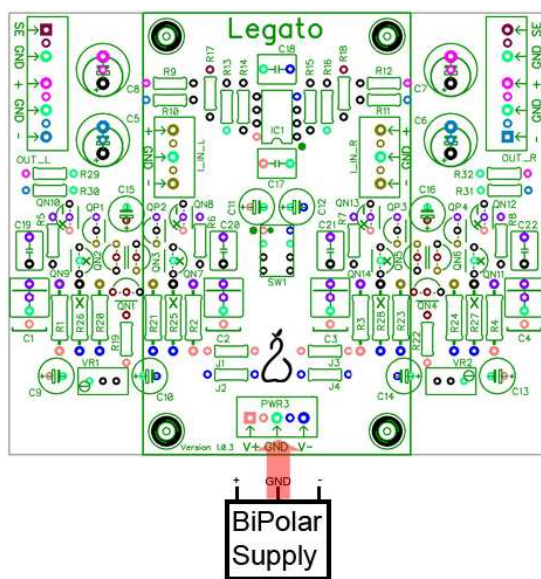


Figure 3: I/V and BAL/SE stages installed, single power supply. J1-J4 installed.

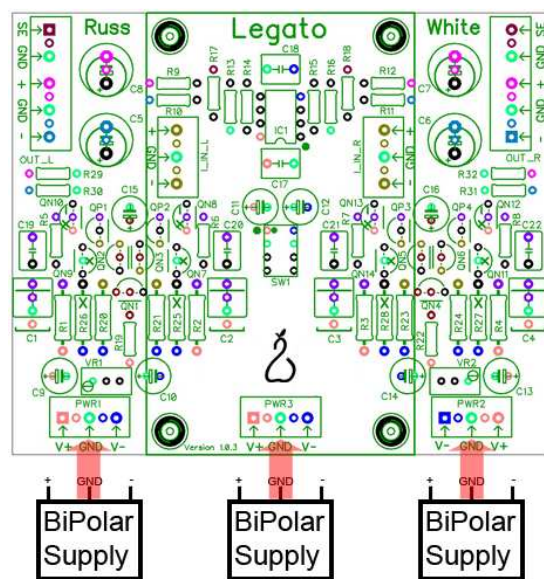


Figure 4: I/V and BAL/SE stages installed, three power supplies. J1-J4 not installed.

In Figures 3 and 4, the BAL/SE stage has been installed. Figure 3 shows how to power all three stages with a single supply by installing jumpers J1-J4 (this is the typical configuration).

In Figure 4, the jumpers are not installed, and each of the three stages has its own power supply. This configuration is a little over the top, as you end up with discrete supplies for the left and right channels for I/V, but a shared supply for the channels in the BAL/SE stage.

Construction Options

The Legato is a pretty straightforward build. C1-C4 can either filter to GND or the positive rail. I prefer GND.

Omitting the output buffer:

Omit: QN7-QN14, R25-R28

Then you need to place a jumper between the pad marked with a line at QN8, QN10, QN12, QN13.

Completely omitting the opamp based BAL/SE stage:

Omit: SW1, IC1, C17, C18, C11, C12, R9 - R18

First Run and Initial Adjustment

Before connecting to power supply:

- Adjust power supply output voltage to the desired output level ($\pm 12\text{VDC}$ recommended)

Prior to connecting the Legato to the DAC:

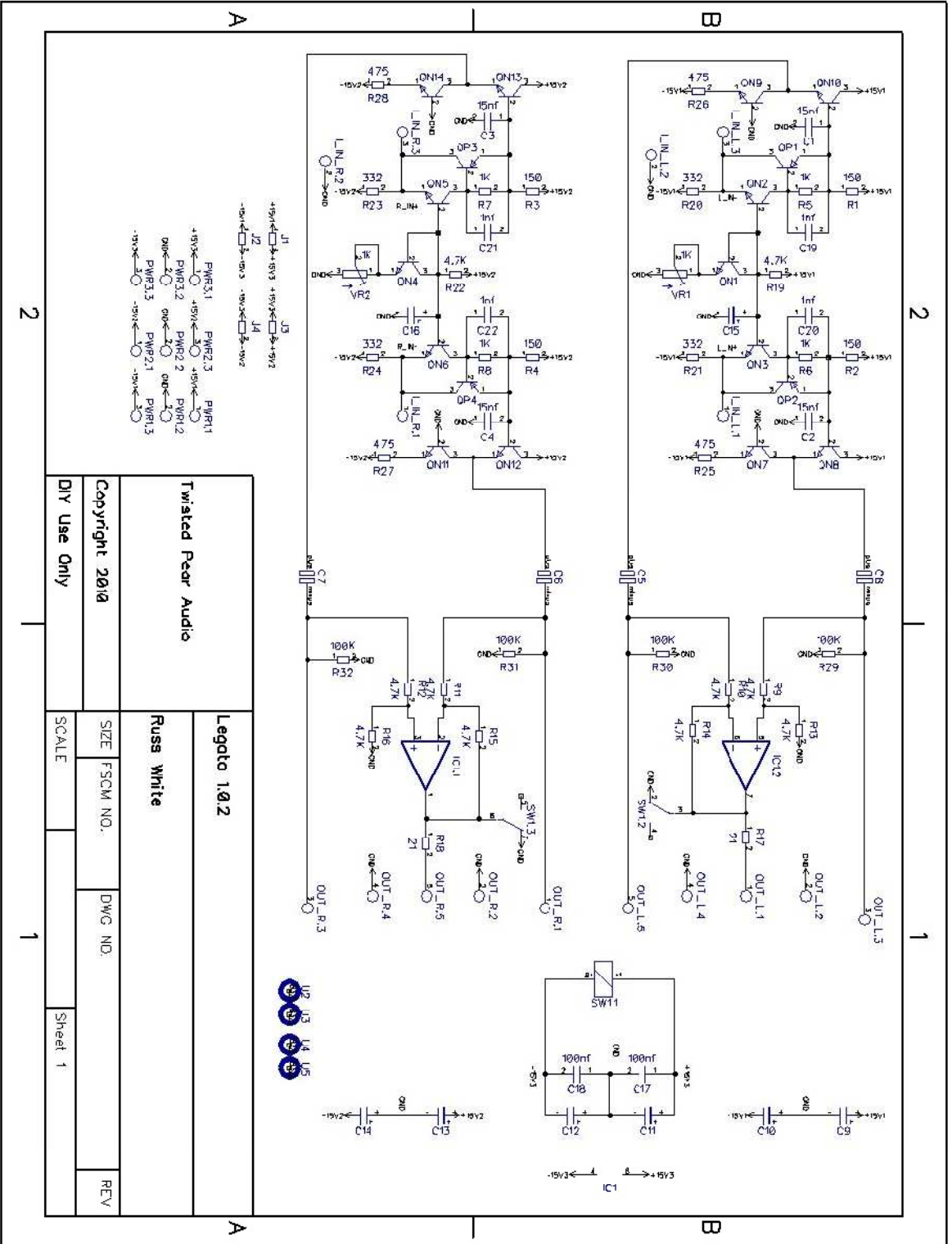
- Power it up
- Adjust VR1 and VR2 until the + and – inputs measure approximately 0VDC (do not worry if it is not exactly 0V, it is not critical).
- Power down
- Connect to DAC

You could leave the Legato exactly as is right now and things will be fine. To go the extra mile:

- (Very carefully) Measure AVCC (on the Buffalo, at the output of the AVCC module)
- Adjust VR1 and VR2 on the Legato until each of the inputs sit as close to AVCC/2 as possible. Don't sweat over this very much. Testing has shown that anything close is just fine.

Other Applications

If you want to change the output voltage you need to adjust both the top (R1-R4) value and bottom (R20, R21, R23, R24) values in proportion to each other. I have found that a ratio of 1/2.2 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.



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