I/V STD MkII user's guide

By Ian Jin and Greg Stewart March 10, 2021 Ver. 2.0

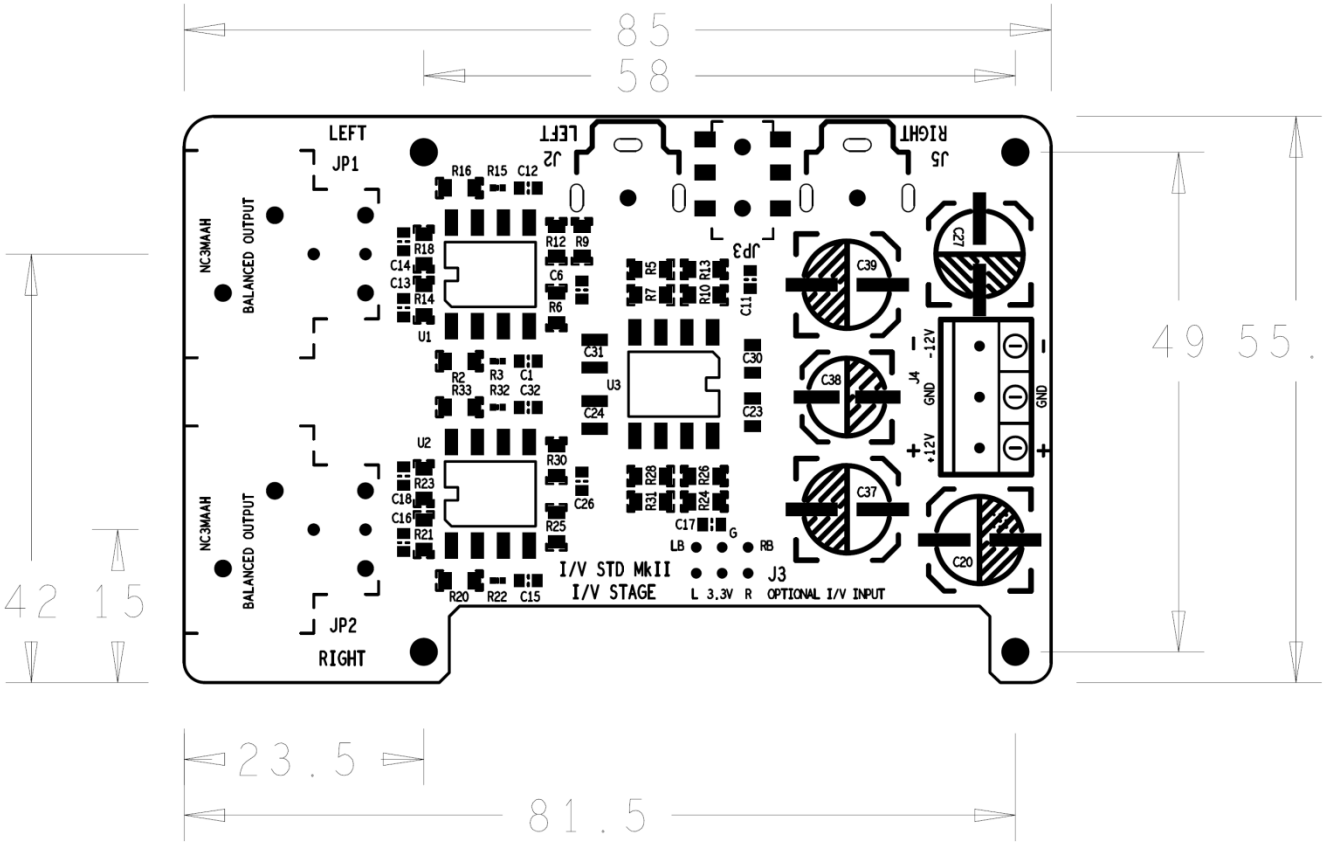
A. Highlighted Features

- Standard three-op-amplifier I/V stage.
- Single-ended, balanced, and headphone outputs.
- Connection-compatible with Ian's ES9038Q3MPi dual mono and ES9028Q2MPi DAC HATS.
- Powered by external +-V power supply.
- DIY-friendly. 8-PIN IC socket-mounted op-amplifiers can be easily swapped for upgrades.

B. MkII new features

- High precision low TCR thin metal film SMT resistors.
- Decoupling capacitance increased to 2000uF for each analog voltage rails.
- New optional input connector makes it possible to work with other DACs or as an external I/V stage.
- More room to install discrete op-amplifier boards.

C. Layout and Dimensions (in mm)



D. Quick-Start Guide

1. Connect the I/V STD on top of a ES9028Q2M or a ES9038Q2M Dual Mono DAC HAT. Be sure connector J1 is properly seated.
2. Connect a dual rail (+-) power supply to power terminal block J4. We recommend +-12V for the included opamps. Other opamps may have different requirements. MAINTAIN CORRECT POLARITY!!!
3. Connect the cable to your amplifier or preamplifier to either J2 / J5 (single-ended RCA output), or JP1 / JP2 (Balanced XLR output).
4. Alternatively, connect high impendence headphones to JP3 (3.5mm audio output).
5. Apply power to your RaspberryPi, IsolatorPi II or FifoPi (if used), DAC HAT, and I/V STD as usual. We recommend you apply power to your amplifier after all upstream gear has powered up and stabilized.
6. Enjoy the music.

E. Connectors

J4: DC power input

Connect a dual rail (+-) DC supply to this 3-pin 5.0mm terminal, MAINTAINING CORRECT POLARITY!!!. The allowable voltage range will depend on the specific opamps used, use +-12V to -+15V for the supplied opamps. IF you are using opamps that can accept a higher input voltage such as many discrete opamps, you can use a voltage higher than +-15V ONLY if you replace capacitors C20 and C27 with higher-voltage-rated units. Use a good, low noise linear power supply for the best results. Our experience is that using a directly- connected LifePO4 battery or ultra capacitor power supply will produce the best possible sound quality. While you have to accommodate the current requirements the opamps you use, generally use a supply that provides at least 100mA, which will work well for the supplied opamps.

J2, J5: Single-ended output RCA sockets

Connect your left channel cable to J2, right channel to J5. With the supplied opamps, 0dB output level will be approximately 2V RMS.

JP1, JP2: Balanced output XLR connectors

Your I/V STD is supplied without these connectors installed. To use the balanced outputs, you must purchase 2 Neutrik XLR connectors (P/N NC3MAAH) and install them at JP1 and JP2. Once you have them installed, connect your left channel cable to JP1, right channel to JP2. With the supplied opamps, 0dB output level will be approximately 4V RMS.

J1 I/V input connector

When you connect your I/V STD on top of a ES9038Q3MPi or ES9028Q2MPi RaspberryPi DAC HAT (or compatible DAC HAT), ensure this 10PIN 2.54 connector is properly seated to the matching raw balanced output on the DAC HAT.

PIN number	Descriptions
1	NC
2	Pi5V
3	L+, Left positive current-mode signal input
4	L-, Left negative current-mode input signal input
5	GND
6	GND
7	R+, Right positive current-mode signal input
8	R-, Right negative current-mode signal input
9	3.3V ACVV for ESS DAC HAT
10	NC

JP3: 3.5mm audio connector for headphone

We recommend you use high impendence (200ohm or higher) headphones with the I/V STD. We also recommend you replace the supplied opamp in position U3 with an OPA1622 opamp for use with headphones.

J3: Optional I/V input connector

J3 can be used to connect to other DAC or as an external I/V board. J3 is not installed by default.

PIN number	Descriptions
1	L+, Left positive current-mode signal input
2	L-, Left negative current-mode input signal input
3	3.3V ACVV for ESS DAC HAT
4	GND
5	R+, Right positive current-mode signal input
6	R-, Right negative current-mode signal input

F. How to produce the best sound quality when using your I/V STD

Replace the supplied opamps with higher grade opamps

The I/V STD is designed to work with most standard dual package opamps. Using higher grade opamps can improve the resulting sound quality.

We have tested and recommend both the OPA1622 and OPA1612 as upgrade opamps for position U3. We have also tested OPA1612 as an upgrade opamp for positions U1 and U2. In addition to these, there are many other possible selections. We have not yet tested discrete opamps in the I/V STD, but many have used them as upgrades for similar circuits. Different opamps will produce variations in the sonic qualities of the output. You can use a selected opamp for all three positions or mix-and-match between U1/U2 and U3 to suit your personal sonic preferences.

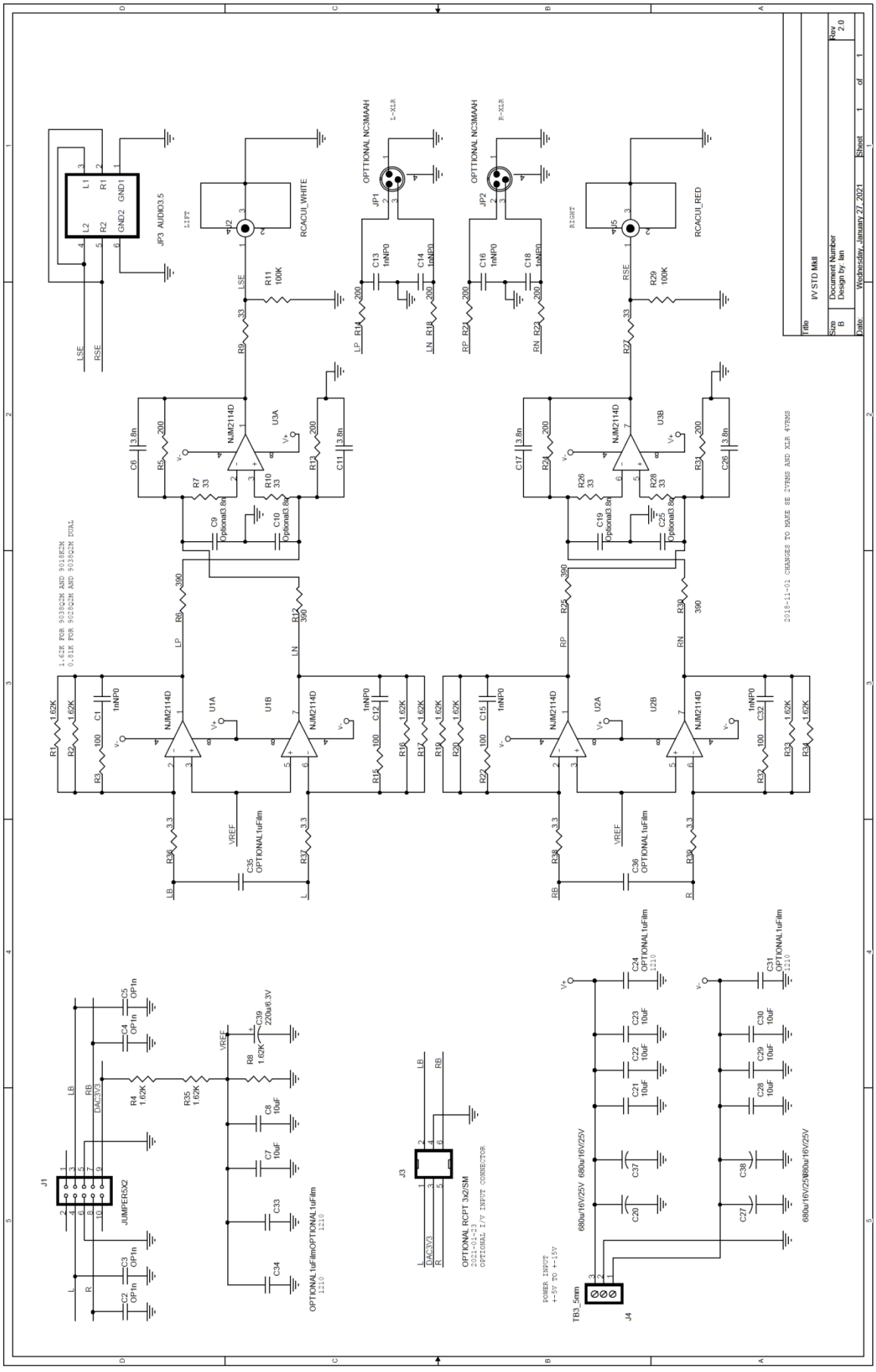
Power your I/V STD from a good linear supply or directly-connected ultra capacitor or LiFePO4 battery supply

We find that using a high quality power supply directly results in sound quality improvements. At a minimum we recommend a low noise linear analog power supply. We have also used a directly connected (no regulation) LiFePO4 battery or ultra capacitor supply with very good results. Different power supply configurations will produce variations in the sonic qualities of the output. We recommend you use the power scheme that fits best with your sonic preferences.

Use the balanced outputs to connect to your preamplifier or directly to your amplifier

Generally using the balanced outputs will result in lower noise and higher dynamic range than the single end outputs. In our tests we found using the balanced outputs of the I/V STD resulted in the best sound quality. If your preamplifier or amplifier has both single-ended and balanced inputs, we recommend you test this in your system. Some rare preamplifiers and amplifiers sound better using their single-ended inputs rather than their balanced inputs.

G. Schematic


I/V STD MkII
Document Number
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Rev 2.0
Sheet 1 of 1
JP3 AUDIO3.5
RCACUI_WHITE
RCACUI_RED
OPTIONAL NC3MAAH
L-XLR
R-XLR
NJM2114D
U1A
U1B
U2A
U2B
U3A
U3B
JUMPER8X2
OPTIONAL 1uFilm
OPTIONAL RCPT 3x2/SM
TB3_5mm
680u/16V/25V
2018-11-01 CHANGES TO MAKE SE 2VRMS AND XLR 4VRMS

H. I/V std pictures

1. I/V STD MkII as shipped

2. I/V STD with XLR connectors installed

3. I/V STD with RaspberryPi, ESS DAC HAT and ESS controller