



Simpelstark +

Power amplifier building instructions

VIRTUAL ZERO distortion AUDIO

Version V1.32, May 23, 2020



Tools required

These boards utilize purely the through-hole parts, so these instructions will focus on using a standard soldering iron.

- Good temperature controlled solder station with a large screwdriver tip, and a fine point tip
- A second iron to aid removal of parts if required (quality not as important for the second iron)
- Good quality fine tip tweezers (cheap tweezers tend to launch more parts across the room)
- Magnifying glass or loupe
- Liquid or gel flux
- .015" flux core solder
- An accurate DMM (or two)
- Oscilloscope
- Signal Generator
- High power 8 Ohm dummy load 50W minimum, 250W+ preferred
- Trim pot screw driver (plastic handle is the best).
- Distortion Analyzer (optional)
- Variac or bulb limiter
- A working power supply assembly
- The usual assorted hand tools such as screw drivers and pliers



BOM

Qty	RefDes	Pattern	Value	Suggested	
4	Faston	Terminals .250 PCB TAB	VCC	62409-1	TE Connectivity
1	C1	CAP-15.0/16.7x3	2.2uF 100v	ECW-FE2W225J	Panasonic
1	C2	3.5x7.2x5	220pF	RDE5C2A221J0K1H03B	Murata
7	C3, C4, C12, C13, C19, C20, C23	5x7.2x5	0.1uF 100v	MKP2D031001F00KA00	WIMA
2	C5, C6	5x7.2x5	0.1u	RDER72A104K1M1H03A	Murata
4	C7, C8, C14, C15	10x12.5x5	100uF 100v	UVR2A101MPD	Nichicon
2	C9, C10	6.3x11x2	100uF 25v	UVZ1V101MED1TD	Nichicon
1	C11	3.5x7.2x5	10pF	RDE5C2A100J0M1H03A	Murata
2	C16, C17	3.5x7.2x5	68pF	RCE5C2A680J0M1H03A	Murata
1	C18	3.5x7.2x5	27p	RDE5C2A270J0M1H03A	Murata
2	C21, C22	25x25x10	470uF 160V	LGU2C471MELA	Nichicon
4	D1, D2, D5, D6	DO-35		1N4148	ON Semiconductor
2	D3, D4	DO-41		1N4744A-TR	Vishay
4	D7, D8, D9, D10	DO-41		1N4003G	ON Semiconductor
1	INPUT	39-28-1023	INPUT	39-28-1023	Molex
1		Mating Connector		39-01-2020	Molex
2		Terminals		39-00-0039	Molex
1	L1	Zobel Out	2 uH		
1	Q1	TO-92-100		2sk246	
1	Q2	TO-92-100		2sj103	
2	Q3, Q6	TO-92-100		BC556BTA	ON Semiconductor
2	Q4, Q5	TO-92-100		BC546BTA	ON Semiconductor
2	Q7, Q11	TO-126		KSA1381ESTU	ON Semiconductor
2	Q8, Q12	TO-126		KSC3503DS	ON Semiconductor
1	Q9	TO-126HR		MJE350G	ON Semiconductor
1	Q10	TO-126HR		MJE340G	ON Semiconductor
1	Q13	TO-247HR		NJW0281G	ON Semiconductor
1	Q14	TO-247HR		NJW0302G	ON Semiconductor
2	Q15, Q17	TO-247HR		NJW1302G	ON Semiconductor
2	Q16, Q18	TO-247HR		NJW3281G	ON Semiconductor
1	R1	RES-12.7/7.6x2.5	47k	MFR-25FTE52-47K	Yageo
1	R2	RES-17.78/11.4x5.1	2.2	MOSX1CT528R2R2J	KOA Speer
2	R3, R29	RES-12.7/7.6x2.5	1k	MFR-25FTE52-1K	Yageo
4	R4, R10, R13, R19	RES-12.7/7.6x2.5	100	MFR-25FTE52-100R	Yageo
2	R5, R6	RES-12.7/7.6x2.5	5.6k	MFR-25FTE52-5K6	Yageo
3	R7, R31, R32	RES-12.7/7.6x2.5	22	MFR-25FTE52-22R	Yageo
1	R8	64W	200	3296W-1-201LF	Bourns
2	R9, R14	RES-12.7/7.6x2.5	560	MFR-25FTE52-560R	Yageo
2	R11, R12	RES-12.7/7.6x2.5	180	MFR-25FTE52-180R	Yageo

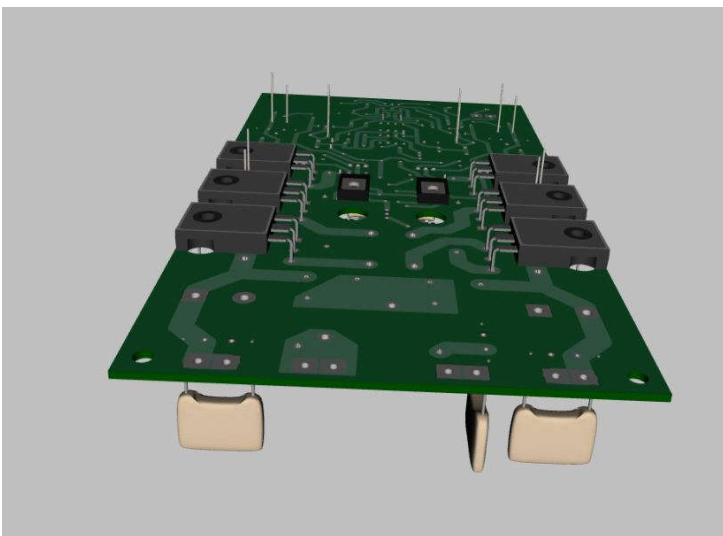


4	R15, R16, R17, R18	RES-17.78/11.4x5.1	3k	MO1C302J	KOA Speer
2	R20, R21	RES-12.7/7.6x2.5	5.1k	MFR-25FTE52-5K1	Yageo
2	R22, R23	RES-12.7/7.6x2.5	220	MFR-25FTE52-220R	Yageo
2	R24, R25	RES-17.78/11.4x5.1	22	MOS3CT631R220J	KOA Speer
1	R26	64W	500	3296W-1-501LF	Bourns
1	R27	64W	2k	3296W-1-202LF	Bourns
2	R28, R30	RES-12.7/7.6x2.5	680	MFR-25FTE52-680R	Yageo
1	R33	RES-12.7/7.6x2.5	750	MFR-25FTE52-750R	Yageo
1	R34	RES-12.7/7.6x2.5	33k	MFR-25FTE52-33K	Yageo
2	R35, R37	RES-12.7/7.6x2.5	10	MFR-25FTE52-10R	Yageo
1	R36	RES-12.7/7.6x2.5	360	MFR-25FTE52-360R	Yageo
2	R38, R41	RES-17.78/11.4x5.1	5.6	PNP300JR-73-5R6	Yageo
2	R39, R40	RES-17.78/11.4x5.1	1	MOX1CT52R1R0J	KOA Speer
4	R42, R43, R44, R45	5W Flat	1	WNE1R0FET	Ohmite
1	R46	RES-17.78/11.4x5.1	10R	EP3WS10RJ	TE Connectivity
1	R47	RES-17.78/11.4x5.1	2R2	MOSX3CT631R2R2J	KOA Speer
5	TP1, TP2, TP3, TP4, TP5	5001		5001	Keystone Electronics
2	U1, U2	DIP-8		OPA134PA	Texas Instruments

Assembly

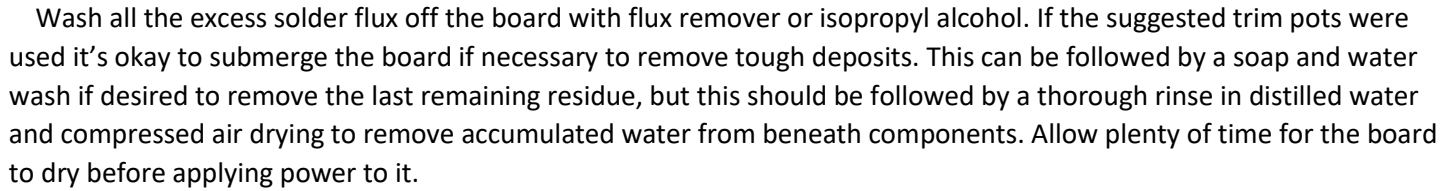
The amplifier board should be assembled in a clean well-lit area on a solid flat work surface. Any parts accidentally dropped or launched from the tweezers are much easier to find on a freshly swept hard smooth surface floor. Antistatic precautions should be observed when handling any semiconductors (Touch something grounded first. Don't wear wool or work over carpet).

Set R8, R26 (the offset and ODNF balancer trimmers) to the middle position, R27 (the bias pot) to its highest value setting. This will turn off bias current flow to the output transistors on initial power up.



Bend the leads for all the transistors mounted below the board and slip them into place with the board resting upside down. It makes sense to solder the output transistors before you solder their corresponding emitter resistors for convenience.

Set predrilled heat sink with standoffs installed on top of the board/transistors, and flip the whole assembly upright. Screw the board and transistors down finger tight. Now is a good time to double check your output transistor locations. If everything looks correct, solder everything in place. Remove all the screws and remove the board from the heat sink.



Amplifier testing

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The Amplifier board will now be live and lethal, so work accordingly. Use one hand to work to minimize risk of electric shock across your heart. Pause and think for a couple second before you touch anything. You don't want to touch a live part of the board. Make sure the board is stable and not able to short to objects around it. Voltage between the parts may be as high as 100-150V DC, depending on the rails you use, which can be life-threatening dangerous in case of electric shock.

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Measure offset voltage at the output. Don't worry if you see some hundreds millivolts there – simply zero it out, turning R8. It will become rather sensitive close to zero offset, so turn it carefully there. If all looks good, slowly turn R27 (the bias pot) until you are reading a few millivolts on the emitter resistors. Current should rise smoothly and if you used a low wattage bulb in your bulb limiter, you should be able to make it glow slightly and be able to control it. If current flow changes abruptly when turning up the bias pot and the bulb suddenly turns on brightly, the amplifier might be going into oscillation (almost impossible with this design) in which case remove power and don't power it up again until you've figured out why and fixed it. If all looks good, remove power and remove the bulb limiter. Return the bias pot to it's highest setting.

Power up the amp again without the bulb limiter in series with the transformer. Slowly wind the bias pot until there is 20mV reading across one of the 5W emitter resistors. Let the amplifier warm up like this for 20 minutes to get a bit of heat in the heat sink and to let things stabilize. Monitor temperature and bias current as it warms up. If current starts to creep up excessively, adjust the bias pot.

After the amp has warmed up and temperature has stabilized, readjust bias current. Next measure output offset. The input connector should still be shorted. Adjust DC offset to as close to zero as you can get with R8. This will wander around a bit but should be able to be kept under 5mV.

Now it's time to adjust the ODNF balancer (R26). For doing that, connect the signal generator to the input, the oscilloscope - to the output. Set 1KHz sine wave at the generator and adjust the amplitude in a way that you have 10V RMS at the amplifier's output. It's better to have the 8 ohm dummy load connected to the output at this stage – the error signal will have higher amplitude, allowing more precise adjustment. As soon as you see 10V RMS steady at the dummy load, disconnect the oscilloscope from the amplifier's output and connect it to TP1 (you can use the 2-nd channel of your oscilloscope as an option for that). You will see the sine wave. Turn R26 in the direction of the signal amplitude decrease until you reach the minimum amplitude of the error signal. It will look like a corrupted sine wave at the minimum – that will be a pure error signal crystallized at that point.

That's it – the amplifier setup is done. Repeat the same procedure for the 2-nd channel. We always recommend to use some soft-start / protection board in order to guarantee safe operation. See more details here:

<http://virtualzeroaudio.com/collections/amp-control-boards>

Amplifier performance is guaranteed only in case it's built on the boards purchased from us. However, we support all the builds, regardless of their nature, quality and overall setup.

If you have questions – please contact Jeff and/or Valery via the contact form here: <http://www.vzaudio.com/contacts>

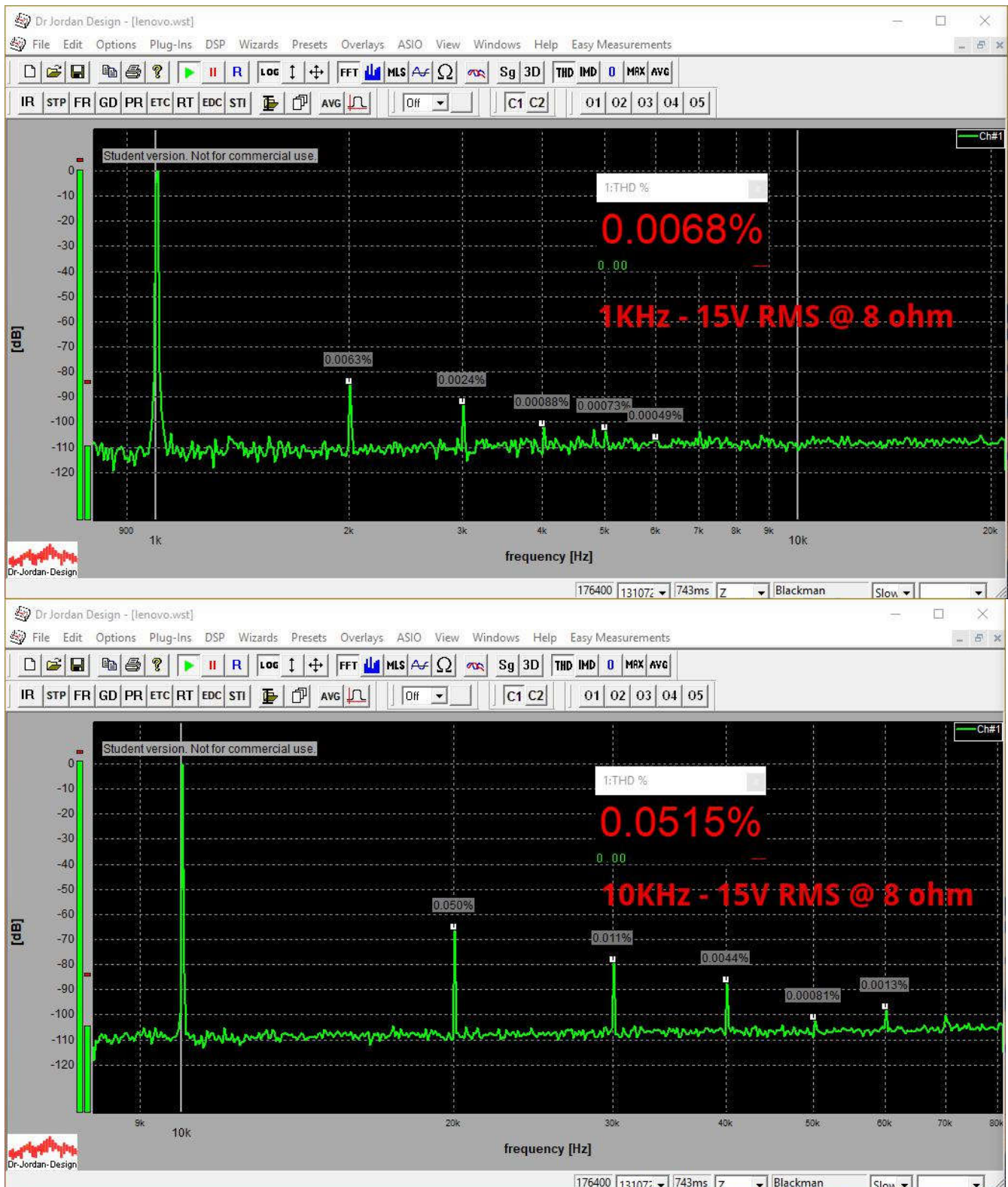
We wish you a pleasant build and unprecedented listening experience!



Live measurements

All these measurements are performed at 15V RMS output swing @ 8 ohm dummy load.

Measurement equipment: RTX6001 audio analyzer (HW), Dr. Jordan Design WinAudioMLS (SW).





This is the excellent sounding amplifier, especially shining with acoustic music. Highly natural, detailed sound with excellent micro-dynamics and engaging character.

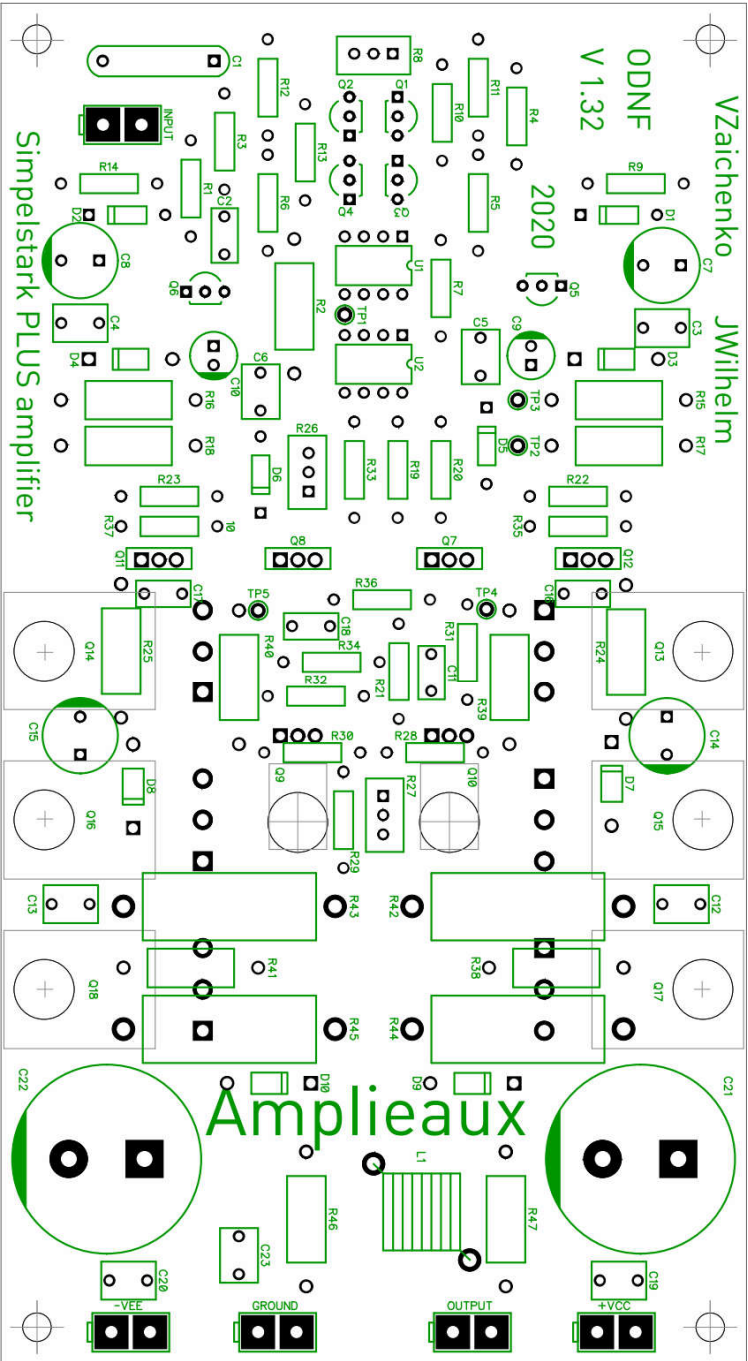


Troubleshooting

It is unlikely that the amplifier, operating in normal conditions, will break by itself. However, if something went wrong – here are a few things you can do. In case the protection tripped, indicating DC offset or over-current, we recommend not to try switching the amp on right away. Disconnect the output and the power rails. Measure the continuity between the rails, each rail to Ground and each rail to the output terminal. If there's no continuity in all these places – you can connect the rails back and try to power-on. If your measurements show close-to-zero resistance somewhere, try to localize the output device that has burnt and contact Jeff and/or Valery via the contact form here: <http://virtualzeroaudio.com/pages/contact-us> **We will assist** you with more detailed troubleshooting and bringing the amplifier back to operation.



Drill Template

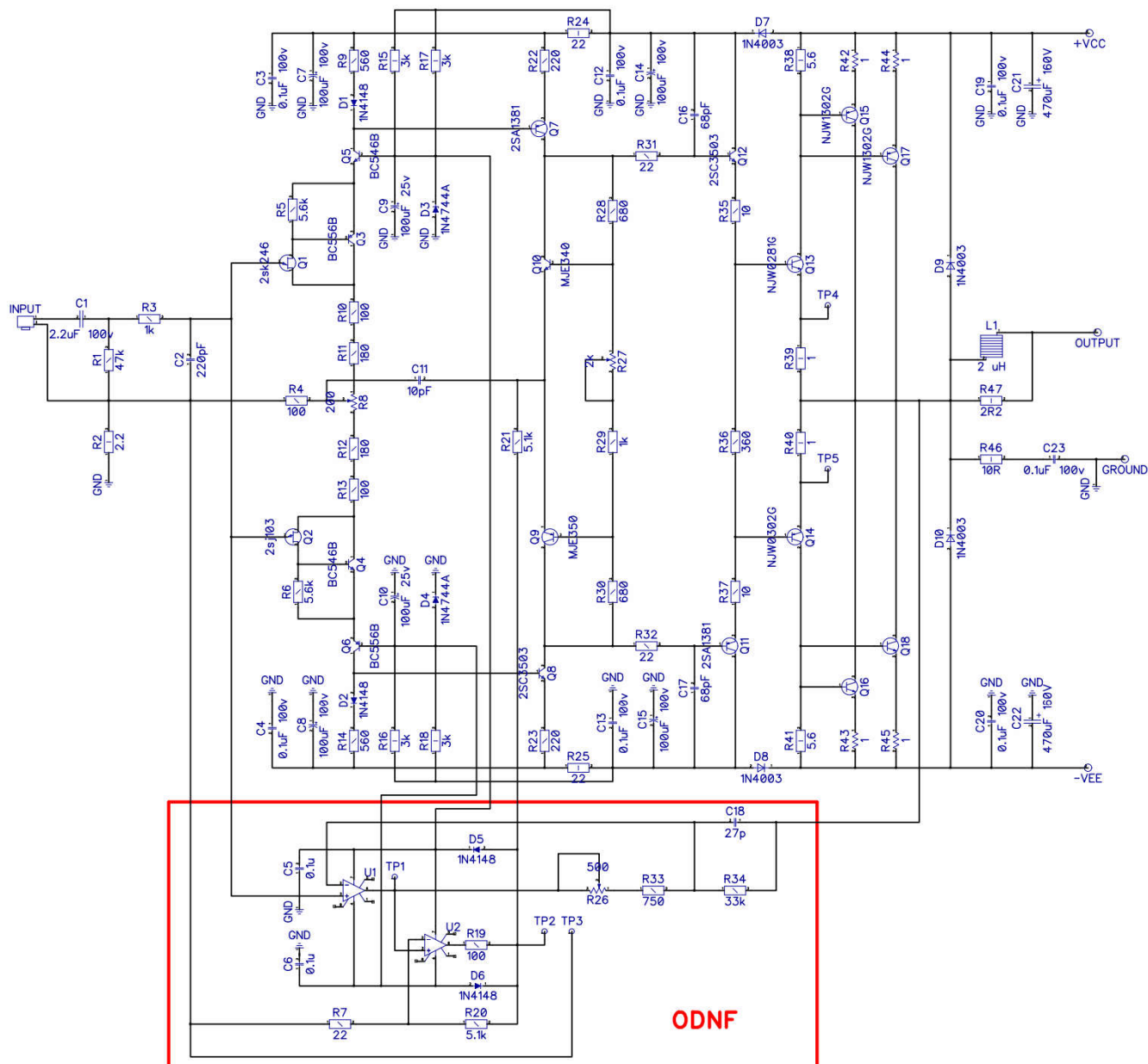




Simpelstark PLUS

18db ODNF amplifier v1.31

Amplieaux





<http://www.vzaudio.com/>