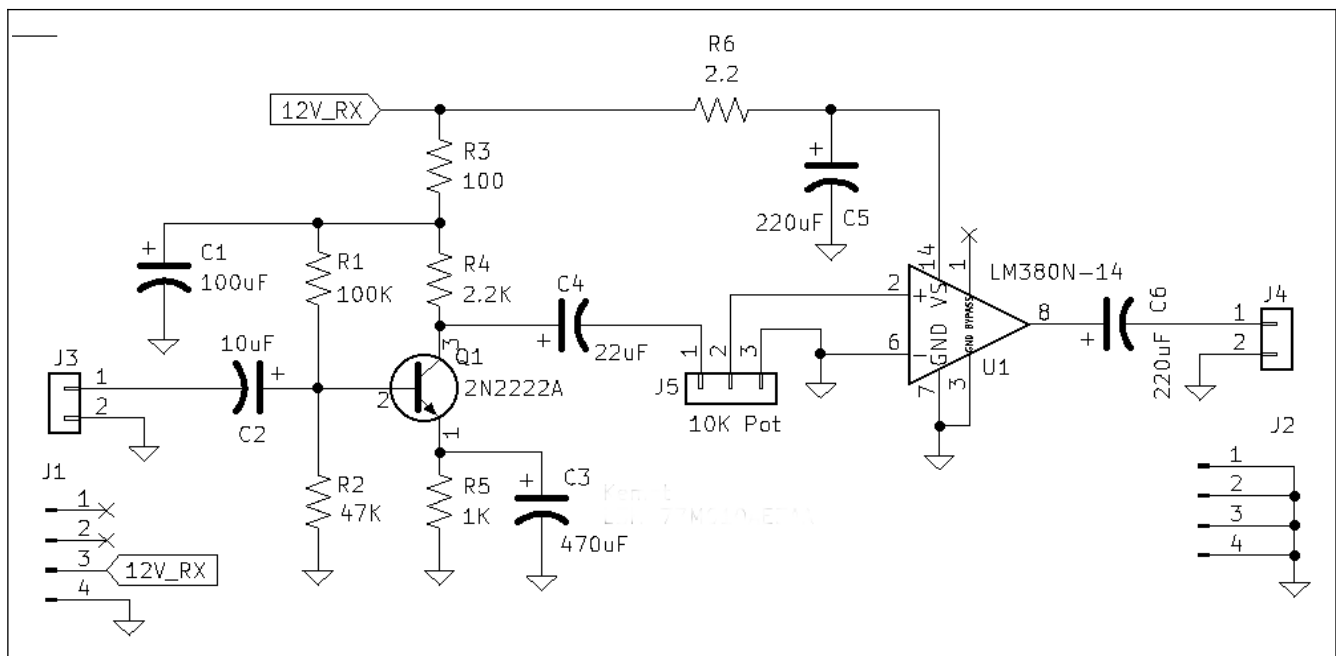


Mostly DIY RF / P3ST Transceiver Kit

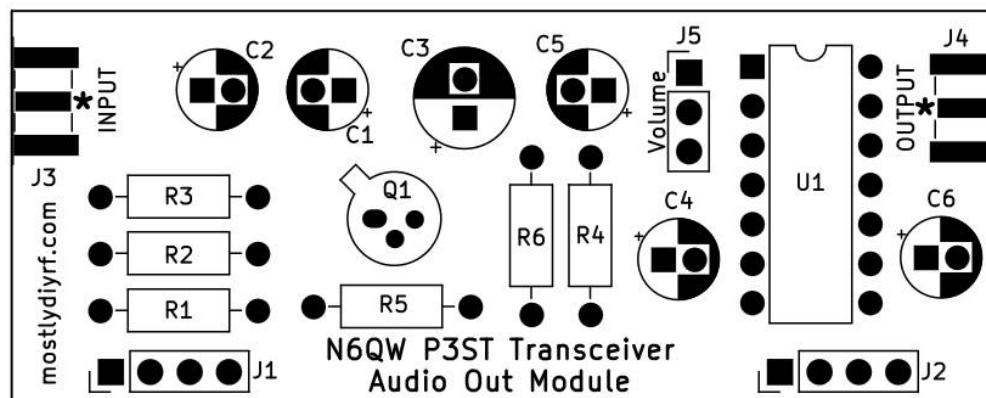
Audio Output Amplifier

Assembly and Test Instructions

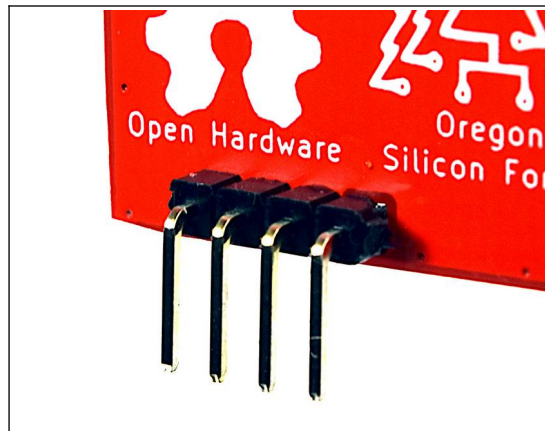
In keeping with the minimal design philosophy employed in the P3ST, the audio-output amplifier features a single NPN transistor in common-emitter configuration. It has AC-coupled input and output. The amplifier's "gain" is controlled via a remote potentiometer (typically installed on the rig's front panel). Like all the P3ST modules, its power and ground connections are made through its 4-pin mounting connectors. The audio-output amp DC power is switched by relay on the motherboard in response to a push-to-talk signal. During transmit, the module is not powered.



Assembly



1. As suggested by **General Tips and Tricks** (see last page), begin installing components (two or three at a time) near the center of the PCB, bending their leads slightly on the underside of the board to hold them until they're soldered. Prior to soldering, though, double-check their values and orientation.
2. As with the 4-pin headers on all the modules, install them with the right-angle pins extending out the back side of the PCB. Also as with all the modules, the input and output pads may be used either to attach board-edge-style SMA connectors or, with the help of the thru-holes in the middle of the pads, directly-soldered connections may be made.



Four-pin right-angle header orientation

If desired, install the 3-pin straight pin header for the volume potentiometer. You can use a three-pin socket header (not provided) or solder directly using the red-black-white cable provided (one-half of which is for the mic amp gain pot).

3. When installing the metal-can **2N2222A** transistor, place it so its bottom touches the surface of the PCB. This will allow the top ground-plane of the circuit board to act as a heat sink.

4. The silkscreen legend for C2 is incorrect. C2 should be installed with the negative lead on the left rather than as shown. This will result in the positive lead attached to the +V bias voltage and the junctions of R1, R2, and the base of Q1.

Static (Pre-Power-Up) Test Procedure

1. Using magnification, visually inspect both sides of the PCB to look for solder bridging or other conductive debris. It's usually best to clean off flux residue first. Because the power, input, and output pins are closely-spaced, do not use alligator (a.k.a. crocodile) clips for temporary connections. Dupont-style jumper leads, however, are very convenient for this purpose.

2. connect an ohmmeter to the **+12V input** pin and one to a **GND** pin. After the on-board capacitors charge (this could take several seconds since the ohmmeter applies very-low current), the measurement should settle somewhere around **138K Ω** . Anything significantly

lower than that means trouble. The three possible culprits could be a leaky or shorted **C1** or **C5**, or a bad (shorted-out) **Q1**.

3. Make sure there is no DC continuity between the amp input and output. Likewise, assure there is no continuity between pins 1 & 2 of J1 and GND. Pin 4 of J1 should have continuity to GND, as should all the pins of J2.

4. You must not attempt to power-up the amplifier until you find and correct any problem(s) you found in steps #1 through #3.

Dynamic (Powered-Up) Test Procedure

1. Use a clean and stable power supply (+12VDC) for all tests. Because there is no reverse-polarity protection at the module level, take extra care when applying power for testing. All of the following tests are with the module powered-up.

2. Read voltage at the junction of R1, R2, and the base of Q1. It should be around 3.15V.

3. Read voltage at top of R4. It should be about 0.6V below the reading at R1, around 2.5V.

4. Pin 14 of U1 should read around 11.85V.

4. Ensure there is no DC voltage on any of the gain-pot pins or on the amplifier input or output.

5. If you have built the audio-output module first, you can test both by connecting the output of the mic amp (with a microphone attached) to the input of the output amp. Listen on a small speaker or low-impedance headphones. Otherwise, you can inject a 0.5 to 1.0Vpp audio signal from a generator and listen for the output.

A poor-man's audio generator can be made using a cell-phone app and test cable that plugs into the phone's earphone jack. Adjust the phone's volume to minimum (but still audible when held to ear). For more on using your cellphone as a audio generator, see <https://bit.ly/phone-sig-gen>.

General Tips and Tricks

■ Save yourself some troubleshooting grief later on: test every part before you install it. Though MDRF uses components only from reputable sources, even those have finite failure rates. Testing is easier than it sounds, and it's quick since you only need to test for part failure.

- Test resistors for continuity and approximate value ($\pm 5\%$)
- Test capacitors for *no* continuity. DC resistance should be infinite or ultra high after they charge up during testing. Note: this may take several seconds since the current an ohmmeter injects is very low.
- Test diodes to ensure no reverse continuity.
- Test transistors for high or infinite collector/drain and emitter/source DC resistance. Use diode test function to test base-emitter junction (base as anode).

■ Double-check component markings and color codes. Pin up a reminder chart nearby. Whether you need it or not, look it over before an assembly session.

■ It's usually easiest to begin stuffing parts in the center of a PCB and work your way out.

■ Insert component leads and bend them about 45 degrees to keep the parts from falling out when you flip the board over to solder on the backside.

■ The PCB holes are "through-plated" (copper plated and solder coated on the insides of the holes) for maximum connectivity and mechanical strength, but this makes rework (removing a part and installing a new one) a little more difficult than with other circuit-board methods. So before soldering, double check the component value and orientation.

■ A good habit is to install components such that they are "right-reading" relative to circuit-board nomenclature. For a resistor, this would mean the color code would read from left to right when the silk-screened legend does. For parts oriented vertically, they should read from top to bottom. For other non-polarized parts (such as ceramic capacitors) it's useful to install so their values can be read at a later time (and not, for instance, obscured by another part).

■ Because the power, input, and output pins are closely-spaced, do not use alligator (a.k.a. crocodile) clips for temporary connections. Dupont-style jumper leads, however, are very convenient for this purpose.