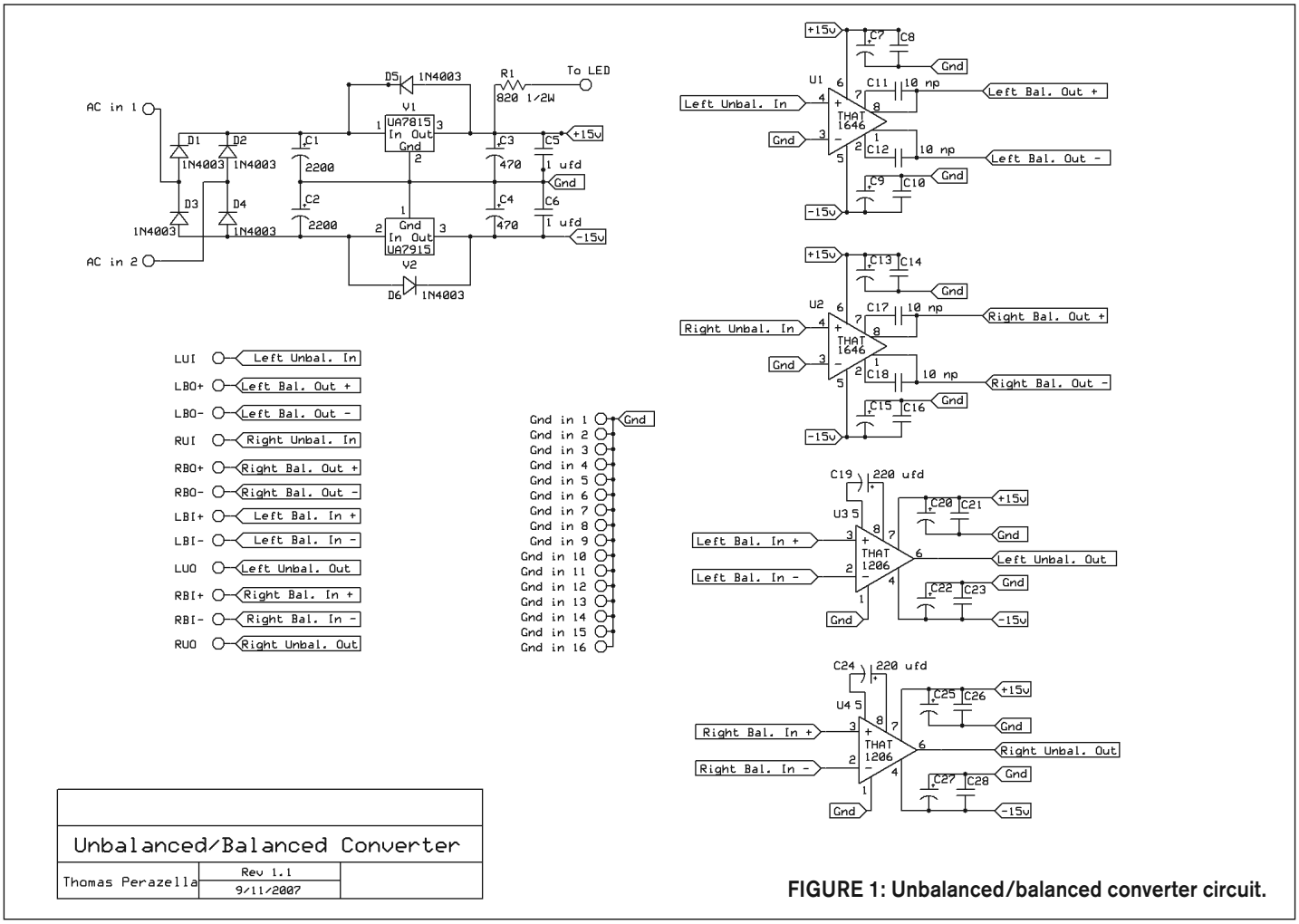

FIGURE 1: Unbalanced/balanced converter circuit.

You can print out several aids including:

- A schematic as previously shown in **Fig. 1**.
- A component layout diagram without pins as shown in **Fig. 2**.
- A component layout diagram with pins as shown in **Fig. 3**.
- A trace map of the top side of the board as shown in **Fig. 4**.
- A trace map of the bottom side of the board as shown in **Fig. 5**.

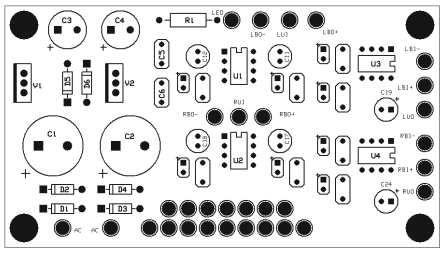

FIGURE 2: Layout diagram.

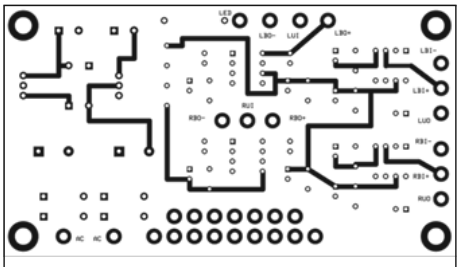

FIGURE 4: Top traces.

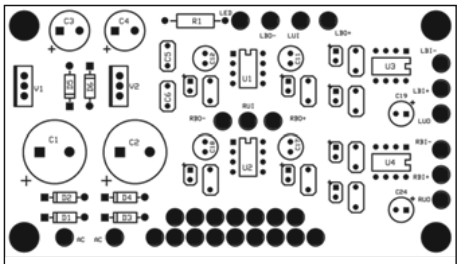

FIGURE 3: Components with pins and text.

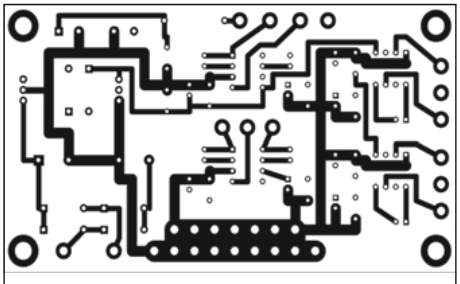

FIGURE 5: Bottom traces.

Using these, you can trace all connections to ensure the file is correct before sending it out for processing. One thing is certain—complacency leads to errors. I checked the schematics and maps several times before sending the file out, and everything checked OK. However, I was complacent and checked the pin connections for the positive regulator from memory because I had used that device so many times. I remembered the pinouts incorrectly. As a result, I reversed the output and ground connections, which went unnoticed until the boards were built and I began testing. Shame on me!

I sent out the file via e-mail, and the completed boards arrived a few days later. The quality looked very high. Views of the top and bottom of the boards are shown in **Photos 7** and **8**.

As is my regular process for building circuits, I build the power supply sections first and test them before adding other components. This helps prevent catastrophic failure in case the power supply has problems.

After the power supply components were added to the board, I connected the transformer and slowly increased the input voltage with a Variac while measuring output voltage. The mistake I made with the regulator pin connections was immediately evident in the output voltage measurements. After checking the board and finding that it was correct to my specifications, I looked up the pin diagram for the regulator and realized my mistake. I made a simple manual fix to the board to re-route the traces. Pictures of the fixes for both sides of the board are shown in **Photos 9** and **10**.

I removed two of the traces with a sharp knife blade and used replacement connections made out of solid hook-up wire. The re-tested supply worked properly. I re-checked my other connections and corrected the schematic and board layouts—all the diagrams in this article are correct. I added the rest of the components to the board and tested the completed board (**Photo 11**).

Preparation of the housing started with selection of the appropriately sized die-cast aluminum box. I prefer metal boxes to plastic for their ease of machining and shielding. I mounted the transformer and circuit board on the base of the box with all the signal connectors attached to the main body of the box, and with all the necessary holes drilled and de-burred. I then cleaned, primed, and painted the box parts.

In the past, when doing a one-off project, I would use press-type letters with a protective coating of clear urethane. Unfortunately, those type sheets are no longer to be found. For this project, I formed the letters and symbols using a Brother P-Touch label printer with a tape cartridge having white type on a clear background. It worked, but was not as professional-looking as the press-type. The finished box is shown in **Photo 12**.

To mount the board and transformer, I made two sets of brackets from flat steel barstock. The brackets allowed vertical mounting of the two pieces for better internal space utilization. I wired the transformer to the board as shown in **Photo 13**. Note the central chassis grounding lug mounted under the nut on one of the circuit board brackets.

The next step was to mount the signal connectors to the box. One of the biggest problems with noise in balanced circuits is the so-called "pin-1 problem" as detailed by Neil Muncy in his June 1995 paper. The preferred method of grounding XLR connectors is to connect pin-1 and any connector-shell grounds to the chassis as close to the connector as possible. **Photo 14** shows the pin-1 con-

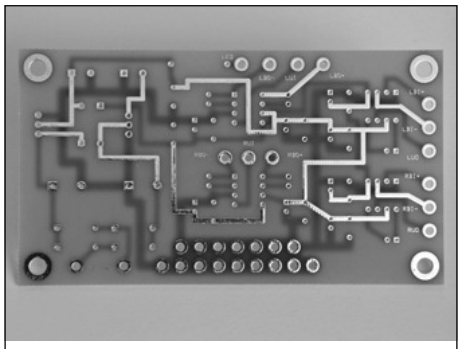

PHOTO 7: Top of board.

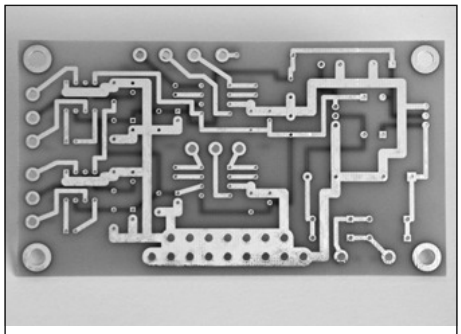

PHOTO 8: Bottom of board.

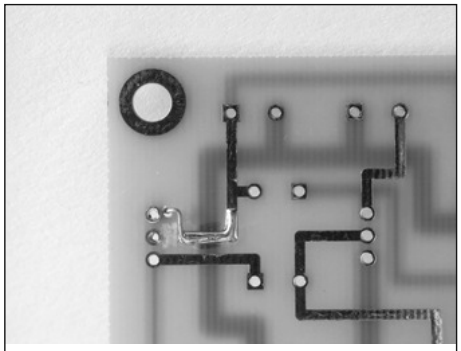

PHOTO 9: Fix for error on top side of board.

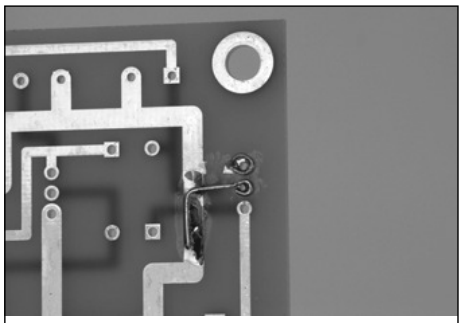

PHOTO 10: Fix for error on bottom side of board.