

Iambic Keyer Shield for Arduino by AE9RB

The Iambic Keyer Shield for Arduino is a project kit that is very easy to assemble. All of the parts are the thru-hole type and these instructions will guide you to the correct orientation of the few parts where it matters. If you don't already know how to solder electronics, you can easily learn enough from the Internet to be successful with this project.

<http://www.youtube.com/watch?v=J5Sb21qbpEQ>

<http://www.youtube.com/watch?v=fYz5nIHH0iY>

<http://www.youtube.com/watch?v=b9FC9fAlfQE>

Required Tools

- Safety glasses
- Illuminated magnification
- Soldering iron
- Flux core solder
- Desoldering wick
- ESD-safe work area and parts trays
- Small screwdriver for trim pot
- Electronics multimeter
- Wire cutters

Required Equipment

- Arduino with ATmega328 or ATmega32u
- USB cable for Arduino
- Computer running Arduino IDE
- CW Transmitter
- Morse Code Paddle

☐ Test your Arduino

The Arduino for this project must have an ATmega328 or ATmega32u. This is the most common type of Arduino. If you don't already have an Arduino or are unable to determine its compatibility for this project, the suggested model is the Arduino Uno.

Begin by learning how to load software on your Arduino board. Use the official Arduino getting started guide to make sure you can run the example program which blinks a LED.

<http://arduino.cc/en/Guide/HomePage>

Use the Arduino forums to ask for help if you have trouble with this part.

<http://forum.arduino.cc>

□ Install Iambino

Once you have the Arduino fully working, program it with the Iambino application. Use the "Download ZIP" button on the GitHub page for the latest version.

<https://github.com/AE9RB/iambino>

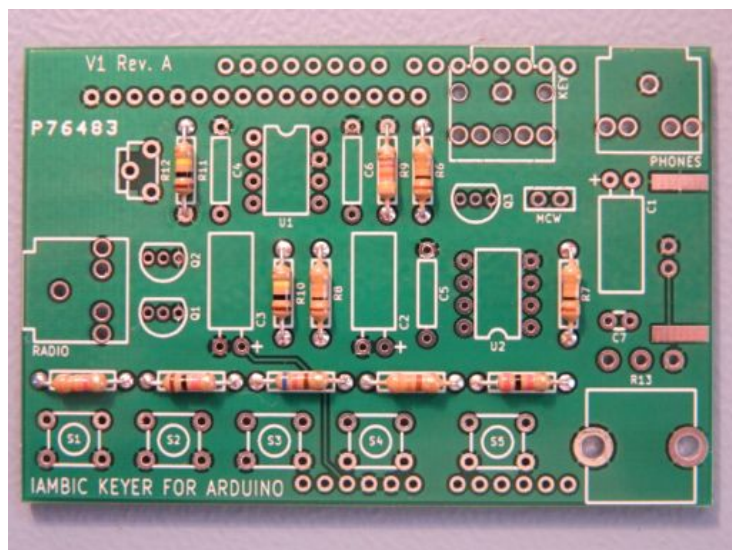
Unzip the contents on your hard drive and rename the folder to "Iambino". The ZIP file will probably unzip to a folder called "Iambino-master" which will cause problems so you must rename it. Once you have the correct folder name, open "Iambino.ino" in Arduino using the "Open..." option in the "File" menu. Finally, use the "Upload" option in the "File" menu to program the hardware.

You should always reprogram the Arduino with the correct software whenever changing shields. Remove the old shield, load the new software on the bare Arduino, then install the new shield. Failure to follow this procedure may result in damage to the Arduino and/or shield.

□ Resistors

The first components to install are the resistors. All of these have $\pm 5\%$ tolerance which is indicated by a gold band. If you're color blind or have poor lighting then use a multimeter to find the correct resistors. Be careful not to confuse red with brown because they will look nearly the same under some lighting.

- R1 - 3.3k Ω (Orange-Orange-Red)
- R2 - 1k Ω (Brown-Black-Red)
- R3 - 620 Ω (Blue-Red-Brown)
- R4 - 330 Ω (Orange-Orange-Brown)
- R5 - 2k Ω (Red-Black-Red)
- R6-R8 - 10k Ω (Brown-Black-Orange)
- R9 - 4.3k Ω (Yellow-Orange-Red)
- R10-R11 - 100k Ω (Brown-Black-Yellow)



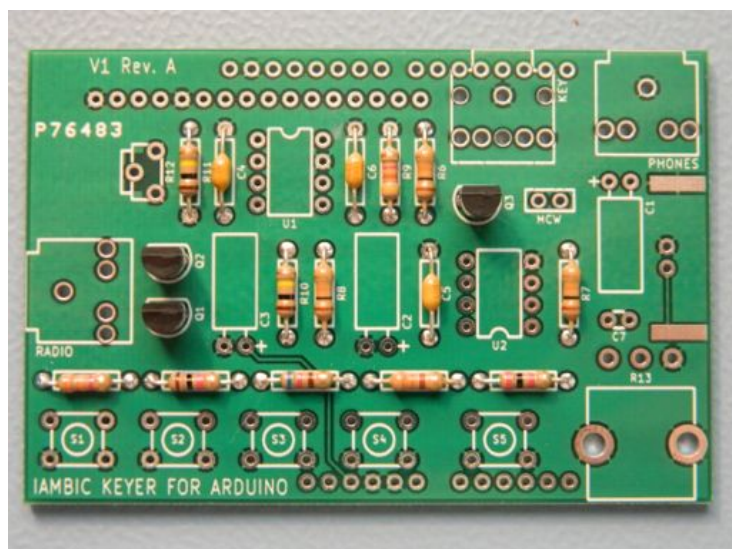
□ Axial Capacitors and Transistors

The three 0.1 μ F capacitors are axial like the resistors.

- C4-C6 - 0.1 μ F

The transistors have a flat side which must match the silkscreen on the PCB. The pads are small and close together so watch out for solder bridges.

- Q1-Q3 - 2N7000 Transistors



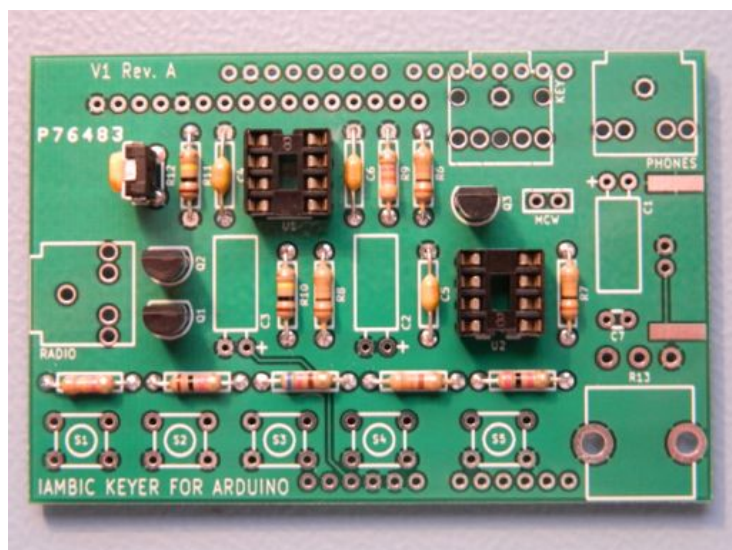
□ IC Sockets and Trim Pot

Install the sockets for the ICs. Be sure to get the orientation correct. The dimple on the socket lines up with the dimple on the PCB silkscreen. Do not install the ICs yet, just the sockets.

- U1-U2 - IC Sockets

The small trim potentiometer is for LCD contrast.

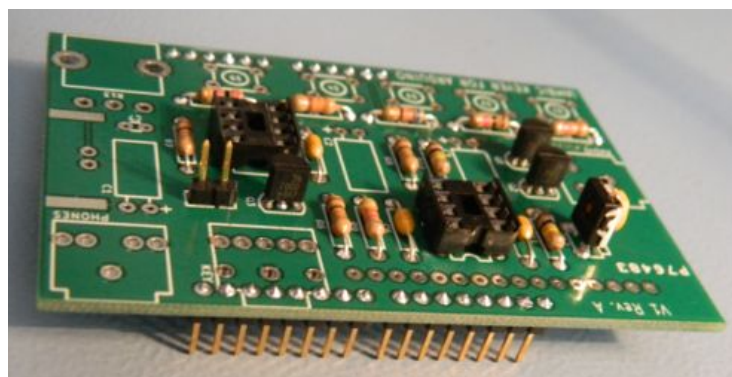
- R12 - 10k Ω trim potentiometer



□ Arduino Pins and MCW Jumper

Use wire cutters to break the 0.100" 36-pin connector into two 8-pin, two 6-pin, and one 2-pin connectors.

There are four sets of pins which connect the shield to the Arduino. It is important that these pins are accurately perpendicular to the PCB or it won't mate to the Arduino. One option to



making sure the pins will match the Arduino is to install the pins into the Arduino before soldering them to the shield PCB. If you choose to do it this way be careful that you don't use too much heat and melt the connector plastic. Also, you must solder every pin before you remove the shield or it's likely some pins will stay attached to the Arduino.

- ☐ Arduino pins

The MCW jumper is provided for experiments with modulated CW. The Iambino software does not yet support this mode. Use the 2-pin connector here.

- ☐ MCW jumper pins

☐ Tactile Pushbuttons

A small amount of force will be required for these to snap into the PCB. Be sure all four pins are started in the holes before pushing into the PCB.

- ☐ S1-S4 - black buttons
- ☐ S5 - red button

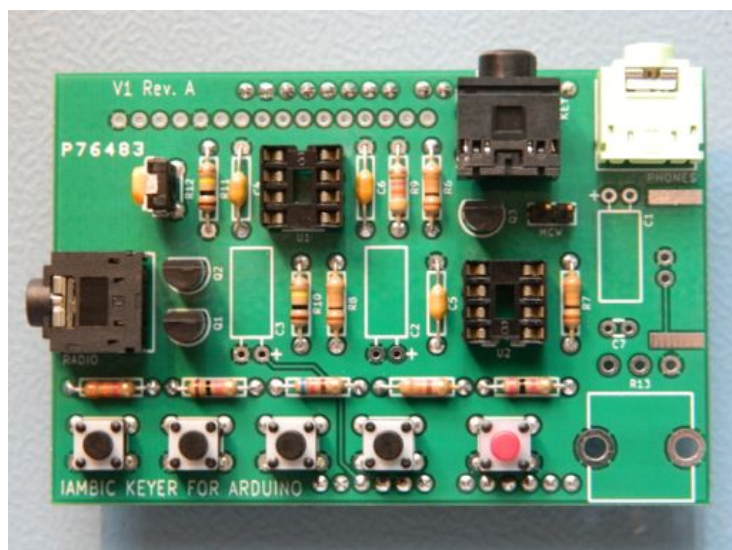
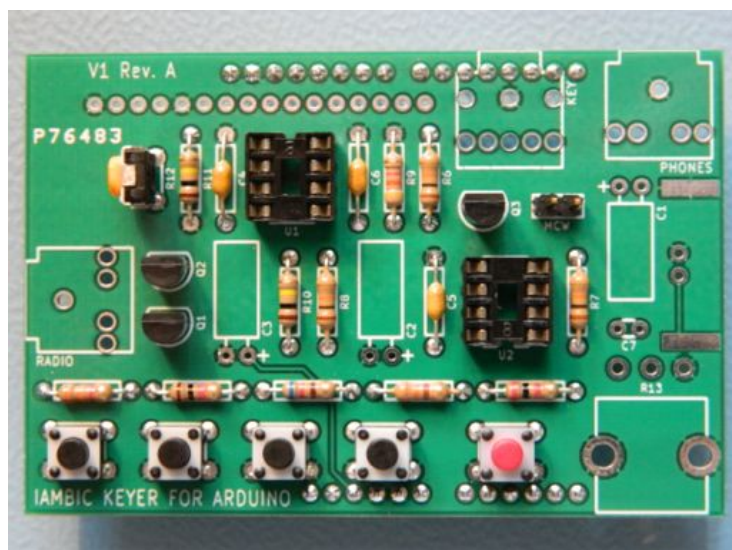
The leads on S1 should be trimmed so they don't touch the Arduino power jack. Do this after soldering.

- ☐ S1 - trim leads

☐ Jacks

There are three different 1/8" (3.5mm) jacks in the kit. The pads are close together so be careful with solder bridges. Use enough solder to fill the holes so the pins can't break loose from the mechanical stresses of inserting and removing plugs.

- ☐ RADIO - small black jack
- ☐ KEY - large black jack
- ☐ PHONES - green jack



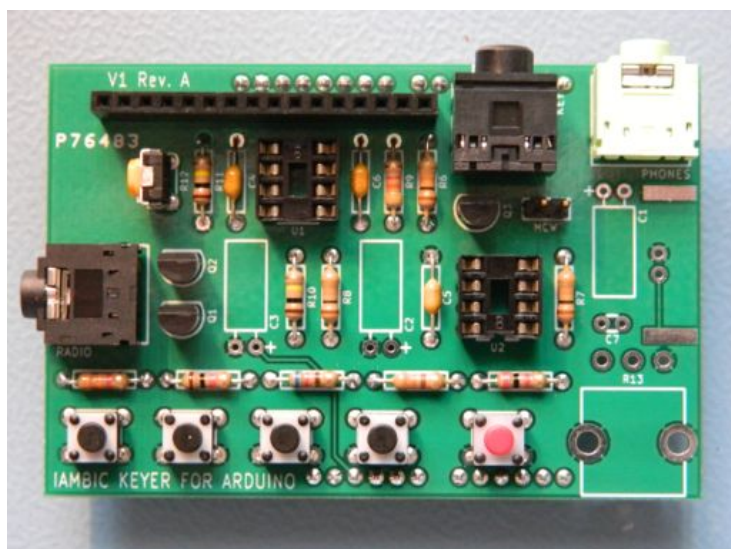
□ LCD socket

Install the 16 pin socket for the LCD.

□ LCD socket

Trim the leads of this socket after soldering so there's no risk of them touching the pins on the Arduino.

□ Trim LCD socket leads

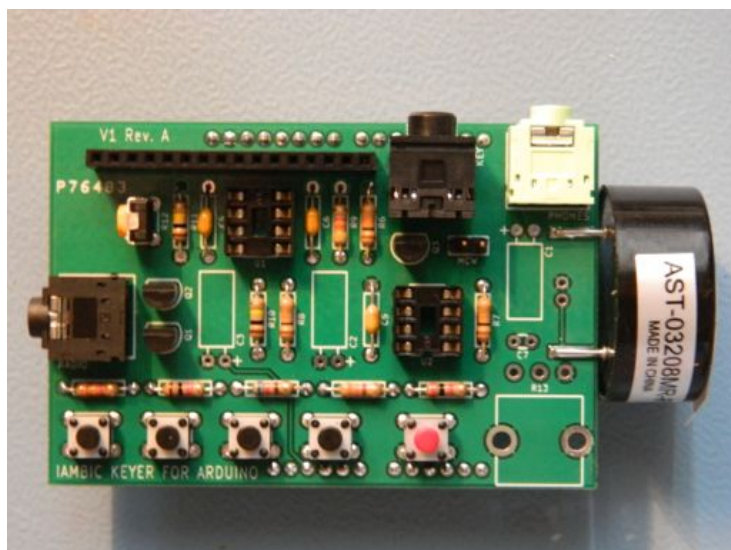


□ Speaker

This is the most difficult part of assembly. Apply solder to one pad and pin then melt them together while holding the speaker in place. Once you have it aligned you can easily solder the other side. The speaker has polarity markings but you can install it either direction.

□ Speaker

There's some stickers on the speaker which you can remove now. I like to remove the silver one with the part number just so the project looks cleaner. The big white one must be removed or you will not hear any sound.



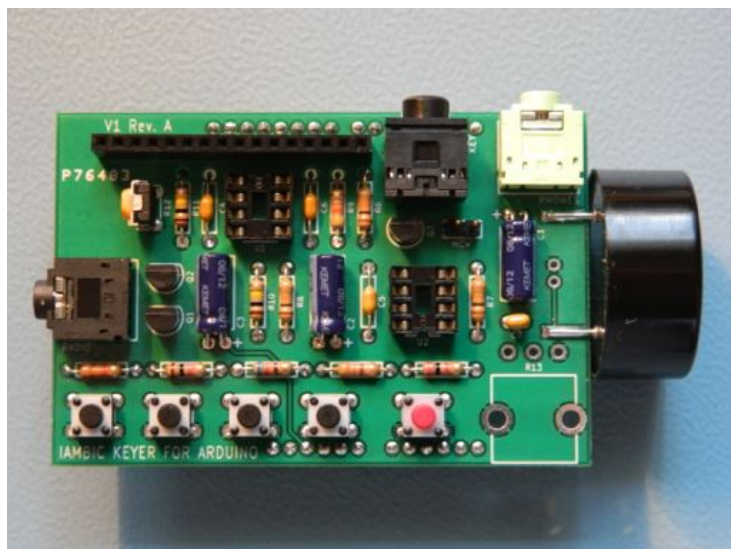
□ Capacitors

The 3300pF capacitor is the only ceramic disc type in the kit.

□ C7 - 3300pF

Electrolytic capacitors are polarized. The package will indicate the negative lead. The PCB indicates the positive lead.

□ C1-C3 - 10μF



☐ Speed Potentiometer and ICs

Be sure to use enough solder to completely fill the large holes.

- ☐ R13 - 10k Ω potentiometer

Install both ICs now. Make sure the orientation is correct and they are in the correct socket. DIPs like these always come with the pins splayed so you will need to straighten them.

- ☐ U1 - MCP4921
- ☐ U2 - TS922

☐ LCD

Insert the 16 pin header into the LCD socket. Put the LCD in place on this header. You will notice that it falls slightly angled, resting on U2 and the radio jack. This angle is intentional so don't try to "level" the LCD.

When soldering the first couple pins, hold the LCD in place while pushing it towards the rear of the board (see photo). If you fail to do this then the LCD may flop around a bit after assembly which may feel sloppy but is not a problem at all.

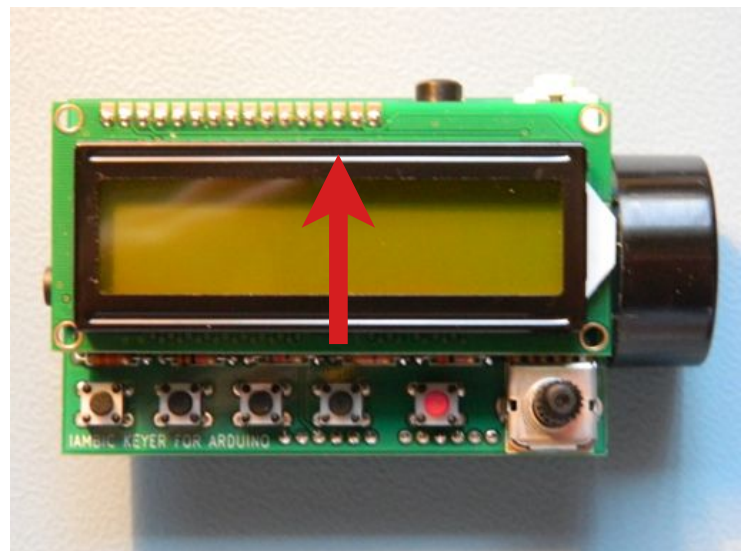
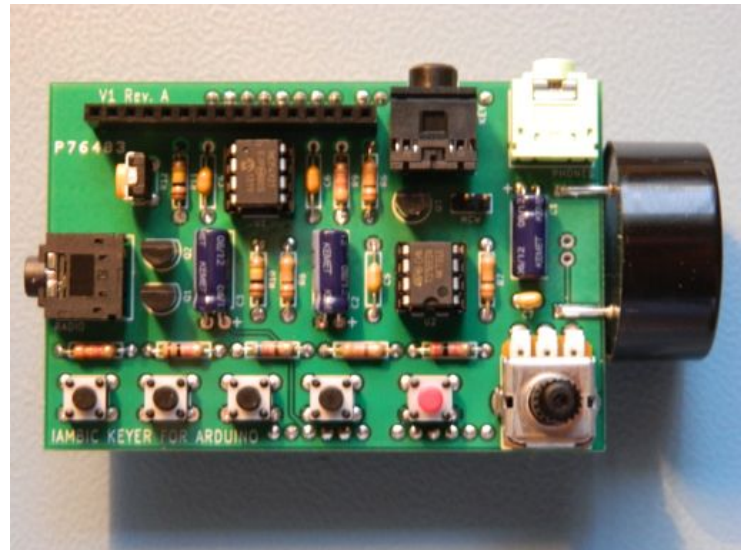
- ☐ LCD pins

☐ Pre-Powerup Test

Before powering the shield or installing it on the Arduino, test the resistance across C3.

- ☐ C3 - test for 3.1k Ω \pm 20%

It is also a good idea to take some time to go over all your work with good light and a magnifier.



□ **Arduino Feet**

Attach the rubber bumpers to the bottom of your Arduino. This will protect your table and keep everything from sliding around.

- Arduino rubber feet

□ **Welcome to Iambino**

Attach the shield to your Arduino. Power it up and use a small screwdriver to adjust R12 so that the LCD is readable.

- R12 - adjust

Your keyer is now ready for operation. Nearly all solid-state radios will work with a straight-thru audio cable. Consult Appendix A and B for the electrical specifications and pinouts of the jacks.

Operation of the software is covered in the README included with the Iambino software. You can also read it at the code repository:

<https://github.com/AE9RB/iambino>

A discussion forum is available for support and to connect with other users.

<http://ae9rb.com/forum/viewforum.php?f=5>



Troubleshooting

Component failures are very rare. You'll want to look for obvious problems first. The #1 problem is a soldering error. Most bad parts are actually due to a soldering error causing a current overload. Here's some tips for narrowing down the search.

If you have a used Arduino, consider it may have been damaged by the previous application.

If the LCD does not work, plug in a key to see if the speaker makes sidetone. If you get sidetone the problem is strictly with the LCD. Try adjusting the trim pot first. The LCD is connected directly to the ATmega on the Arduino except for the backlight which is switched by Q3.

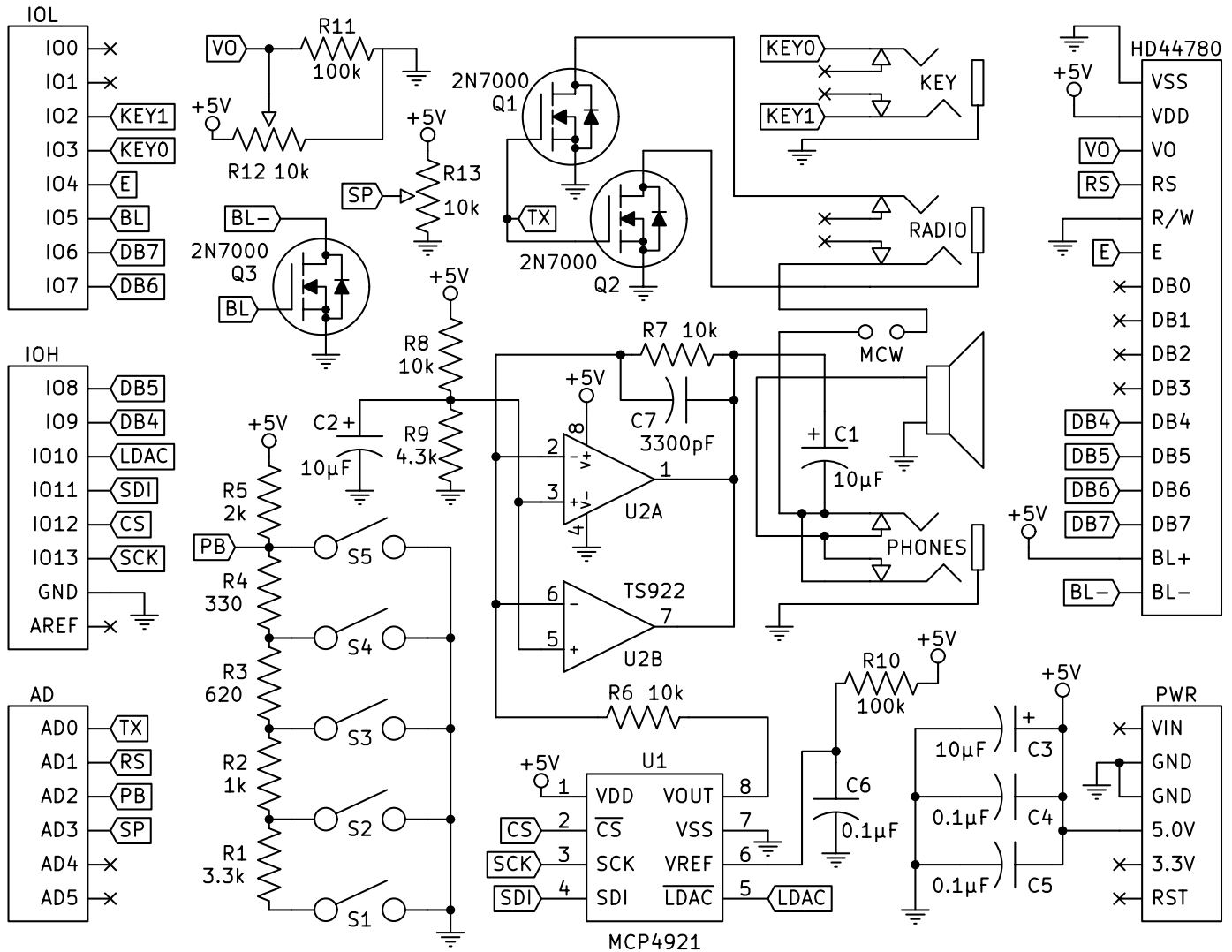
If the LCD and sidetone both do not work, make sure you are running the lambino software on your Arduino.

If the LCD works and you can't get sidetone, check for letters to come up on the LCD as you send. If nothing comes up, the key jack isn't working.

If the LCD works and letters you send come up but you can't get sidetone, make sure U1 and U2 are installed correctly. Also, check R7-R10, C1-C2, C6-C7, and phone jacks. If you think the speaker is bad, try some headphones.

If your radio doesn't key but everything else works, look at Q1-Q2 and their connection to the Arduino.

Appendix A: Schematic



Appendix B: Hardware Specifications

Power: 50-200mA. This will vary with different settings and LCD models.

Radio jack: Up to 60V 200mA 400mW with positive or negative keying.

Phones jack: 250mW at 4 ohms (or two 8 ohm speakers in parallel).

Speaker: Resonant frequency at 1500Hz \pm 20%.