BuzzKill
Sound Effects Board

Hardware Guide

version 1.0

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Hardware Overview

Board Layout

See the diagram at right for the general location of the features discussed below. The header connectors are marked in red along the bottom and right side, labeled J1-J4. The volume control is marked in red near the top. The speaker outputs are in pairs along the left side.

The solid black areas are the mounting holes.
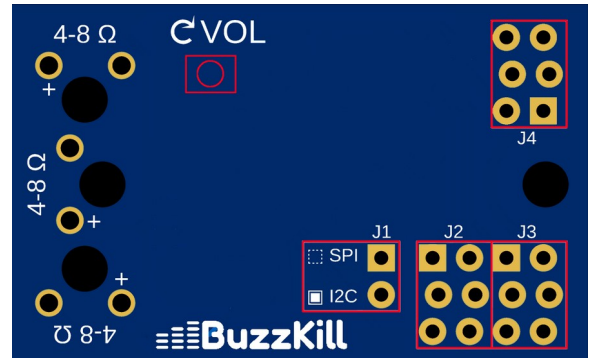
Header Connectors

The board has four separate connector areas labeled as J1, J2, J3, and J4. They are based on 0.1" spacing for compatibility with standard pin headers. Wires can be soldered directly to the pads, or common pin headers (male or female) can be used to make connections.

Header J1

J1 is simply a jumper, its pads should either be left open or connected together.

The board supports both SPI and I²C protocols for data transfer. SPI is the default, and will be selected if J1 is left open. To use I²C instead, the two pads of connector J1 must be shorted. Typically this is done by soldering a 2-pin male header onto the connector, then using a jumper to short the pins. This has the advantage of allowing easy switching between protocols. But any method of shorting the pads will work, such as soldering a small pin or wire across the pads, or using a spring clip.

Headers J2-J4

The pinouts for J2 and J3 are shown to the right. J4 is identical to J3 but rotated by 180°. Usually either J3 or J4 will be used separately, but it is also possible to mix connections to both if it is more convenient.

The pads on the J2, J3, and J4 connectors are slightly offset from their normal positions, creating a horizontal stagger pattern. This allows header pins to grip the holes and make solid contact even without soldering. It also helps to hold the headers straight, making soldering much easier.
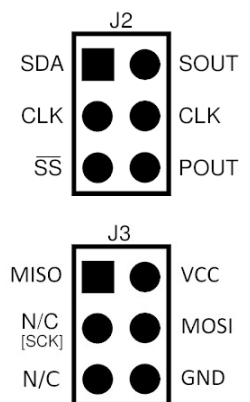
Volume Control

A volume control is positioned near the top edge of the board. Turning the control fully to the left (counter-clockwise) results in minimum volume, while turning it to the right (clockwise) results in maximum volume. High volume levels may also introduce distortion, so some experimentation may be required to find the optimum level.

Care should be taken not to overload small speakers which may not be able to handle high output power. Always start with the volume control at minimum level, and slowly adjust to a higher setting as needed.

Speaker Outputs

There are three separate pairs of speaker connections on the left side of the board. A 4-8 ohm speaker can be connected to any of the pairs. The positive pad of each pair is marked with a (+) symbol. The spacing of each pair is 0.2", which allows breadboard mounting during prototyping. Alternatively a standard (5.08mm) 2-wire terminal block can be soldered in place, allowing screw terminals or spring contacts for speaker connections.

The maximum speaker output power is 2.5 watts for a 4-ohm speak or 1.25 watts for an 8-ohm speaker, so the speaker should be chosen accordingly.

Making Connections

Power Connections

Power should be supplied on pads 2 (VCC) and 6 (GND) on either J3 or J4.

VCC should be between 2 volts and 5 volts.

SPI Interface

Connect the controller's $\overline{SS}$ (or $\overline{CS}$) pin to J2 pad 5 ($\overline{SS}$). Connect the controller's MOSI pin to J3/J4 pad 4 (MOSI). Connect the controller's SCK (or SCLK) pin to J2 pad 3/4 (CLK). NOTE: J3/J4 pad 3 is not internally connected, it cannot be used for an SCK input. The incoming SCK signal must be connected to either pad 3 or 4 on J2.

I²C Interface

Connect the controller's SDA pin to J2 pad 1 (SDA). Connect the controller's SCL pin to J2 pad 3/4 (CLK).

Also remember to close jumper J1 (short the pads together) so that I²C mode will be selected.

Interface Speed

For either SPI or I²C interface, there is no fixed transfer speed and the bit rate is left entirely to the controlling device. However it is recommended to use rates of 500 kbps or below. Faster speeds will still work, but may have an audible effect on any currently playing sounds.

Optional Connections

Two additional pads are available for output signaling. SOUT will be high whenever speech is being output, and low otherwise. POUT is controlled by software and can be used to synchronize sounds and other actions. Both can be connected to a controller's available input pins, or can be jumpered to MISO (J3 pad 1) and read through the SPI interface.

Mounting Options

Mounting Holes

Four separate mounting holes are available, three on the left side of the board and one on the right side. The holes are each 1/8" (3.175mm) in diameter. Care must be taken with the left side, where the mounting holes are fairly close to the speaker outputs. A metal screw head or nut could cause a short between the positive and negative output pads. Plastic or rubber mounting hardware should be used to prevent this.

Breadboard Mounting

For quick prototyping, you can install BuzzKill onto a breadboard with no soldering necessary. You will need two or three 3x1 male-male headers, which will connect to the "outside" column of pads on J2, J3 and optionally J4. The staggered pad pattern will hold the board securely while still being easily removable. See diagram at right for details of pin placement. With this arrangement, you will have access to SDA/CLK/$\overline{\text{SS}}$ from J2, and VCC/GND/MOSI from J3. The J4 header is optional but can provide greater mechanical stability.
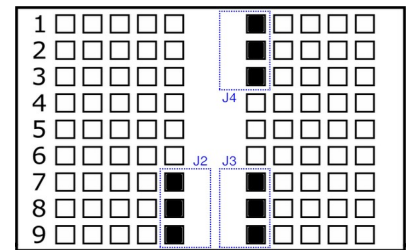
Arduino Mounting

Many Arduinos (and some other microcontroller boards) have a special header called an ICSP header. This is a 2x3 pin male header containing power and SPI connections.

The pinout of J3/J4 has been designed for compatibility with this header. If you place the BuzzKill board so that either J3 or J4 is directly on top of the ICSP header (with proper orientation of course) you will find that the VCC, GND, MOSI, and MISO pads will correctly match up. This will automatically provide power to the BuzzKill board, in addition to a convenient mechanical mounting.
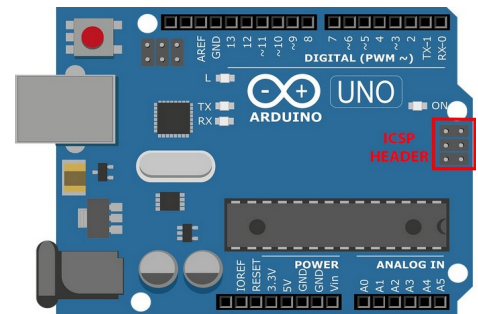
If you are using I^{2}C, you will just need to run separate wires from the Arduino's SDA pin (to J2 pad 1) and SCL pin (to J2 pad 3/4).

If you are using SPI, the MOSI line will be automatically connected but the SCK and $\overline{\text{SS}}$ lines will not. The ICSP SCK pin will be in place at J3/J4 pad 3, but not automatically connected to anything. You can simply place a jumper between J3 pad 3 and J2 pad 4 to connect the SCK signal to the correct place. You will also need to use a wire or lead to connect the Arduino's $\overline{\text{SS}}$ pin to J2 pad 5.