ISL54409EVAL1Z, ISL54410EVAL1Z Evaluation Board User's Manual

Description

The ISL54409EVAL1Z and ISL54410EVAL1Z evaluation board are designed to provide a quick and easy method for evaluating the ISL54409 and ISL54410 Audio/USB wired-OR IC switch.

To use the evaluation board properly requires a thorough knowledge on the operation of the ISL54409 and ISL54410 IC. Refer to the ISL54409, ISL54410 data sheet for the features and functions of the device. Studying the device's logic truth table along with the Applications Block Diagram is a quick way to understanding the operation of the IC.

A picture of the main evaluation board is shown in Figure 1. The ISL54409, ISL54410 μTQFN IC is soldered onto the evaluation board. It is designated as U1.

The ISL54409 and ISL54410 is a dual SPST audio switch with low OFF capacitance on the output terminals. This allows USB 2.0 HS signals to be connected to the output terminals with minimal degradation of the USB signal in a wired-OR configuration for 2:1 multiplexing of audio and USB2.0 signals to a common connector.

For example, a headphone can be plugged into the headphone jack (J11) and an audio signal can be applied to the BNC connectors J9 and J10 when the switch is placed into the audio mode. The switch can be turned off and placed into the USB mode, allowing a USB 2.0 device to be plugged into J4 and a USB 2.0 Host to be plugged into J5. The USB D+ and D- lines are connected to the switch COM+ and COM- terminals which allows a mutually exclusive common connector for multiplexing audio and USB signals.

The ISL54409 features a low power shut down mode while the ISL54410 features integrated Audio Click and Pop Elimination. This application note will guide the user through the process of configuring and using the evaluation board to evaluate the ISL54409 or ISL54410 device.

Key Features

- Standard USB Connectors
- BNC Input Jacks and Headphone Speaker Jack
- On-board or External Logic Control
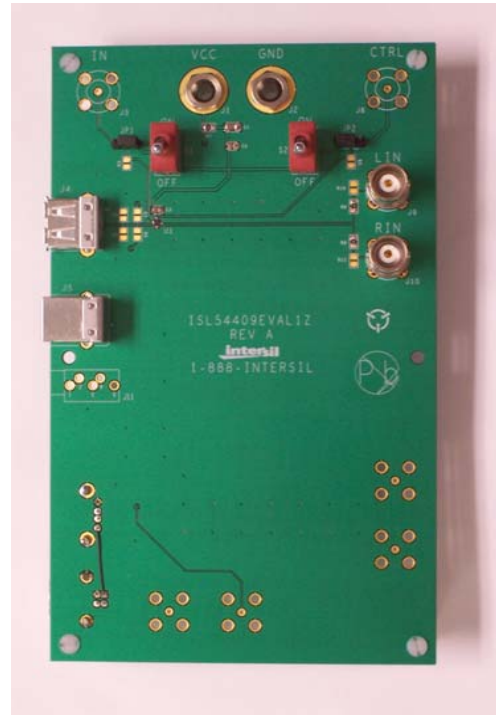- Convenient Test Points and Connections for Test Equipment

FIGURE 1. ISL54409EVAL1Z EVALUATION BOARD (TOP VIEW)

Board Architecture/Layout

Basic Layout of Evaluation Board

The basic layout of the main board is as follows: Refer to Figure 1.

1. VCC and GND connections are at the top of the board (J1 and J2). The board operates on a +2.7V to +5.0V power supply.

2. Logic control connections are at the top of the board (J3 and J8 for external control. S1 and S2 for on-board control).

3. Audio inputs are at the upper right side of the board (J9 and J10). Audio outputs are at the standard headphone connector (J11).

4. USB connection to an upstream host controller is made at connector J5. USB connection to a downstream USB device is made at connector J4.

5. Located below S1 of the board is the ISL54409 or ISL54410 IC (U1).

Power Supply

The DC power supply connected at banana jacks J1 (VCC) and J2 (GND) provides power to the evaluation board. The IC requires a +2.7V to +5.0V DC power supply for proper operation. The power supply should be capable of delivering 100µA of current.

Logic Control

The state of the ISL54409 and ISL54410 device is determined by the voltage at the IN pin and the CTRL pin. When the JP1 three pin jumper is in the 1-2 position, access to the IN pin is through the BNC connector J3. When the jumper is in the 2-3 position, access to the IN pin is through switch S1. When the JP2 three pin jumper is in the 2-3 position, access to the CTRL pin is through the BNC connector J8. When the jumper is in the 1-2 position, access to the CTRL pin is through switch S2.

The IN and CTRL pins are 1.8V logic compatible which allows for control via a standard µcontroller.
Logic "0" (LOW) when ≤ 0.5V or floating
Logic "1" (HIGH) when ≥ 1.4V

Note: The evaluation board has a 1MΩ pull-down resistor from the IN pin to ground and CTRL pin to ground. In addition, the ISL54409 and ISL54410 IC have an internal 4MΩ pull-down resistor on the IN and CTRL logic pins. If the user wishes to remove the 1MΩ resistors on the board simply depopulate R_2 for the CTRL pin and R_3 for the IN pin.

If IN is LOW and CTRL is HIGH the part will be in the Audio mode. The switches will be ON and can pass audio signals from the LIN/RIN to COM-/COM+. If IN is driven HIGH and CTRL = X (don't care) the part will be in the USB mode. The switches will be turned OFF, providing excellent signal isolation from LIN/RIN to COM-/COM+.

For the ISL54409 if IN is logic "0"and CTRL is logic "0" the part will be in the Low Power mode. In Low Power mode both switches are OFF and the part will draw less than 10nA typically.

For the ISL54410 if IN is logic "0"and CTRL is logic "0" the part will be in the Audio Click and Pop mode. In Audio Click and Pop mode both switches are OFF and the LIN/RIN pins will have a 40Ω shunt path to ground.

Audio Inputs

The evaluation board has two audio inputs, LIN (J9) and RIN (J10) using BNC connectors on the right side of the evaluation board. Over a signal range of -1V to +1V (0.707V_{RMS}) these switches have an extremely low ON-resistance variation. The r_{ON} of the switch is typically less than 3Ω. They can pass ground referenced audio signals with very low distortion (<0.04% THD+N) when delivering 4mW into a 32Ω headphone speaker load. A signal range above 0.707V_{RMS} is acceptable but THD+N performance will degrade.

Audio Outputs

The evaluation board has a standard headphone jack (J11) connected to the COM- and COM+ pins. A headphone with a 3.5mm audio jack can be plugged into the evaluation board.

*Note that in a typical application the USB and audio connections use a common connector. This evaluation board has separate connectors for USB and audio for simplicity in evaluating the performance of USB and audio signals. However, for optimal USB 2.0 HS performance, the headphone jack can be disconnected from the COM-/COM+ path. This can be done by depopulating resistors R_6 and R_7 on the evaluation board.

USB Connections

A type A USB receptacle (J4) and a type B USB receptacle (J5) is located on the left side of the board. The type B receptacle should be connected using a standard USB cable to the upstream USB host controller which is usually a PC computer or hub. A USB device can be plugged directly into this receptacle. When this connection is made and the IN logic control is driven HIGH, the ISL54409, ISL54410 device will go into USB mode. The switches will be turned OFF and the USB Host and USB device can communicate.

Note: Before operating in the USB mode, the headphones must be removed from the headphone speaker jack. This will prevent the audio load from interfering with USB signal transmission. The main purpose of the ISL54409, ISL54410 IC is to allow the use of a common USB and Audio Headphone Connector in Personal Media Players and other portable battery powered equipment. Either a headphone will be in the common connector to play music or a USB cable from a computer will be in the common connector to transmit digital data.

TABLE 1. EVALUATION BOARD COMPONENT DEFINITIONS

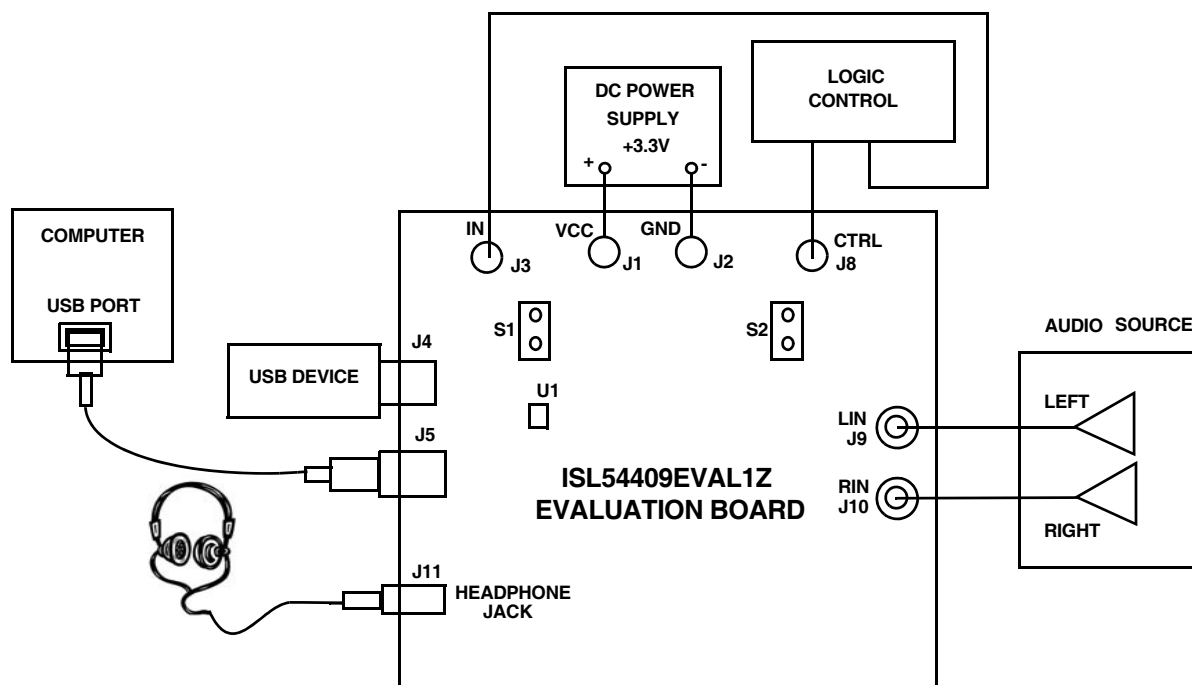| DESIGNATOR	DESCRIPTION
U1	ISL54409IRUZ or ISL54410IRUZ IC
J1	VCC Banana Jack Connection
J2	GND Banana Jack Connection
J3	IN Logic Control; BNC Connector
J4, J5	Standard USB Connectors
J8	CTRL Logic Control; BNC Connector
J9	LIN BNC Connector
J10	RIN BNC Connector
S1	IN Logic Control; Toggle Switch
S2	CTRL Logic Control; Toggle Switch

FIGURE 2. BASIC EVALUATION TEST SETUP BLOCK DIAGRAM

Using The Board (Refer to Figure 2)

Lab Equipment

The equipment, external supplies and signal sources needed to operate the board are listed as follows:

1. +2.7V to +5.0V DC Power Supply
2. Stereo Audio Source (MP3/Radio/CD Player) or Audio Generator
3. Headphone Set or Audio Analyzer/Oscilloscope
4. Standard USB 2.0 Cables
5. Computer with USB Host Port
6. USB Device (i.e. USB Memory Stick, MP3 Player with USB Port, etc.)

Initial Board Setup Procedure

1. Attach the main evaluation board to a DC power supply at J1 (VCC) and J12 (GND). The supply should be capable of delivering 2.7V to 5.0V and 100µA of current.
2. Connect the stereo audio source left channel to J9 BNC connector and right channel to J10 BNC connector.
3. Connect the USB device to the USB type A receptacle J4.
4. Connect a USB Host using a standard USB 2.0 Cable to the USB type B receptacle J5.

Audio Mode Operation

1. Install a headphone into the headphone jack, J11.
2. Logic Control: Put CTRL = Logic "1" and IN = Logic "0". You will now be in Audio mode (3Ω audio switches are ON).
3. Turn the audio source ON. You should hear the audio signal in the headphones.

USB Mode Operation

1. Turn OFF audio stereo source.
2. Remove headphone from J11 Headphone Jack.
3. Logic Control: Put IN = Logic "1". You will now be in USB mode (3Ω Audio switches are OFF).
4. The computer should indicate that it is connected to the USB device at the J4 receptacle. You will now be able to send and receive data between the computer and USB device.

If you disconnect the USB cable from J1 and take the IN pin LOW, the IC will return to Audio mode. You can now plug the headphone set into headphone jack, turn the audio source ON to once again play music.

ISL54409EVAL1Z Evaluation Board Schematic
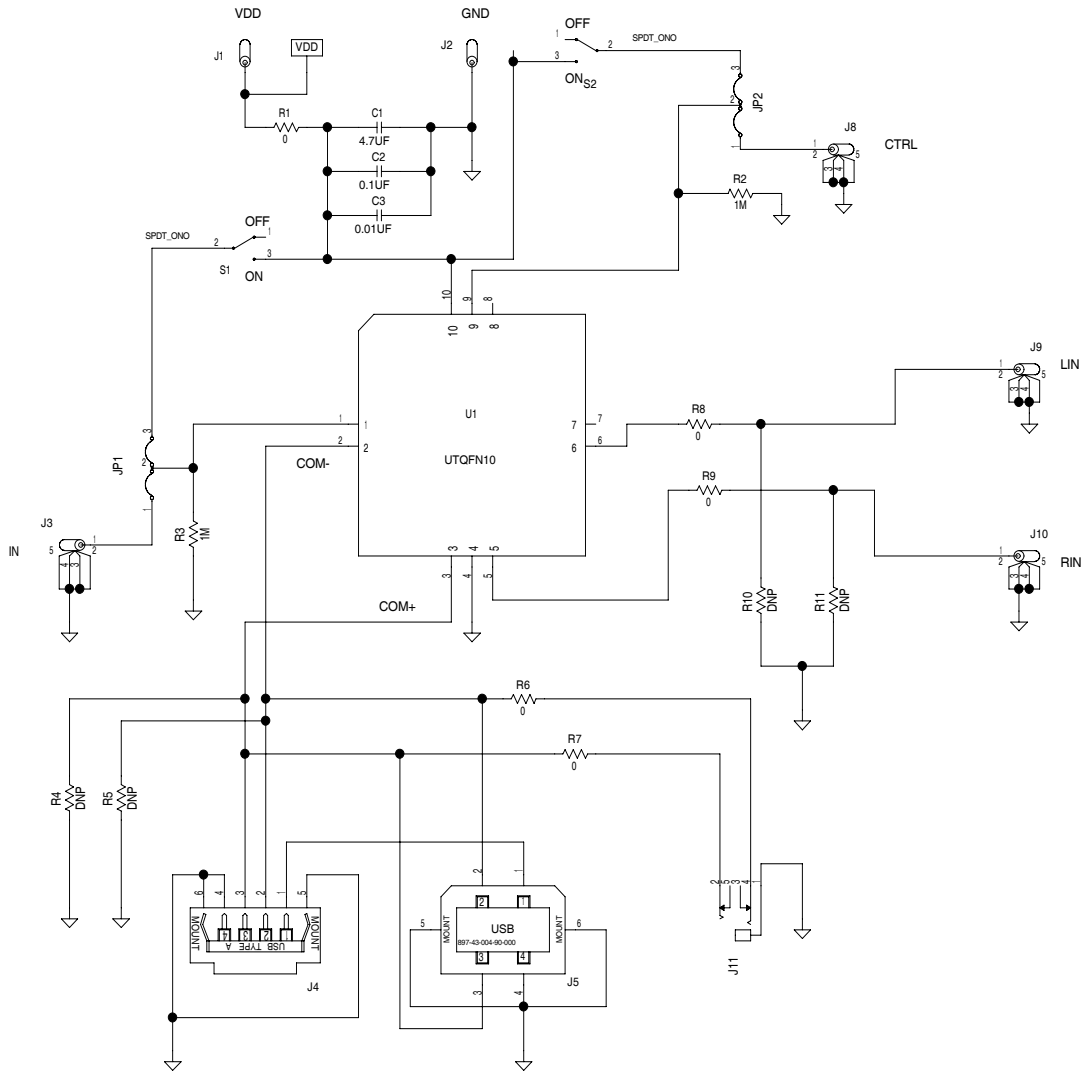
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