LM49370 Demonstration Board Guide

National Semiconductor
Application Note 1609
Alvin Fok
May 2007

Table of Contents

Evaluation Package Contents

- LM49370 Demonstration Board
- USB Subsystem Motherboard
- USB Cable
- LM49370 Control Software

Software Installation Instructions (Windows 2000/NT/XP)

1) Unzip the *LM49370.zip* file to a specified folder.

2) Run *setup.exe* from the specified folder.

3) The LM49370 Control Software installation will begin.

LM49370 Control Software

1) The LM49370 Control Software will operate only if the LM49370 Demonstration Board setup has been properly powered up and connected to the PC's USB port.

2) If there is no proper connection made, the LM49370 Control Software will not operate correctly.

3) If the LM49370 Demonstration Board setup is correct and the LM49370 Control Software will load normally. If the USB or power is disconnected, the LM49370 Control Software will indicate that there is a USB I/O error. Once the proper connection has been re-established, then the LM49370 Control Software will operate normally.

Hardware Installation Instructions

1) Plug the USB Subsystem Motherboard to the bottom side of the LM49370 Demonstration Board (via J1, J2, J3). The connection between the USB Subsytem Motherboard and the LM49370 Demonstration Board is keyed in a way such that there is only one possible physical orientation between the two boards.

2) Attach one end of the USB cable to a free USB port on your PC and the other end to the USB Interface Card.

3) Run the LM49370.exe file. The LM49370 Control Software will run only if a proper USB connection exists from the PC to the Demonstration Board and also if there is power supplied to the Demonstration Board (see next section).

Powering up the LM49370 Demonstration Board

1) The LM49370 Demonstration Board can be powered up through the USB Subsytem Motherboard or through an external power supply.

2) Jumpers JU6-JU9 set USB power operation or external power supply operation. Close JU6-JU9 for USB power operation. Open JU6-JU9 for external power supply operation.

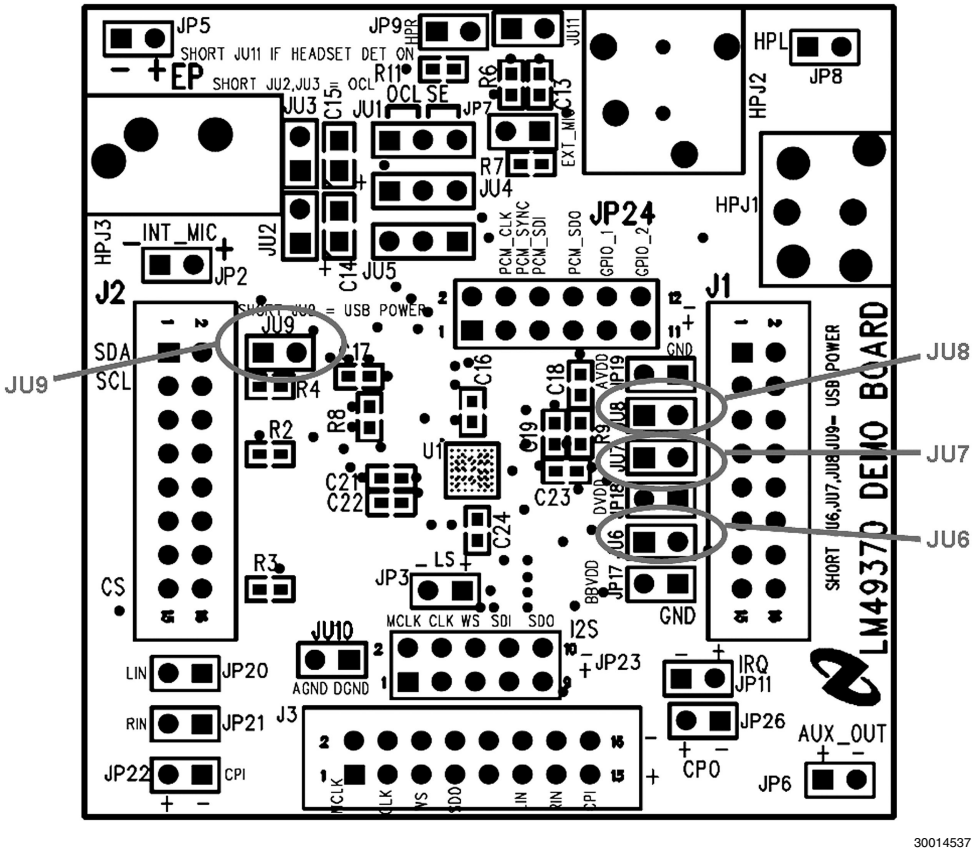


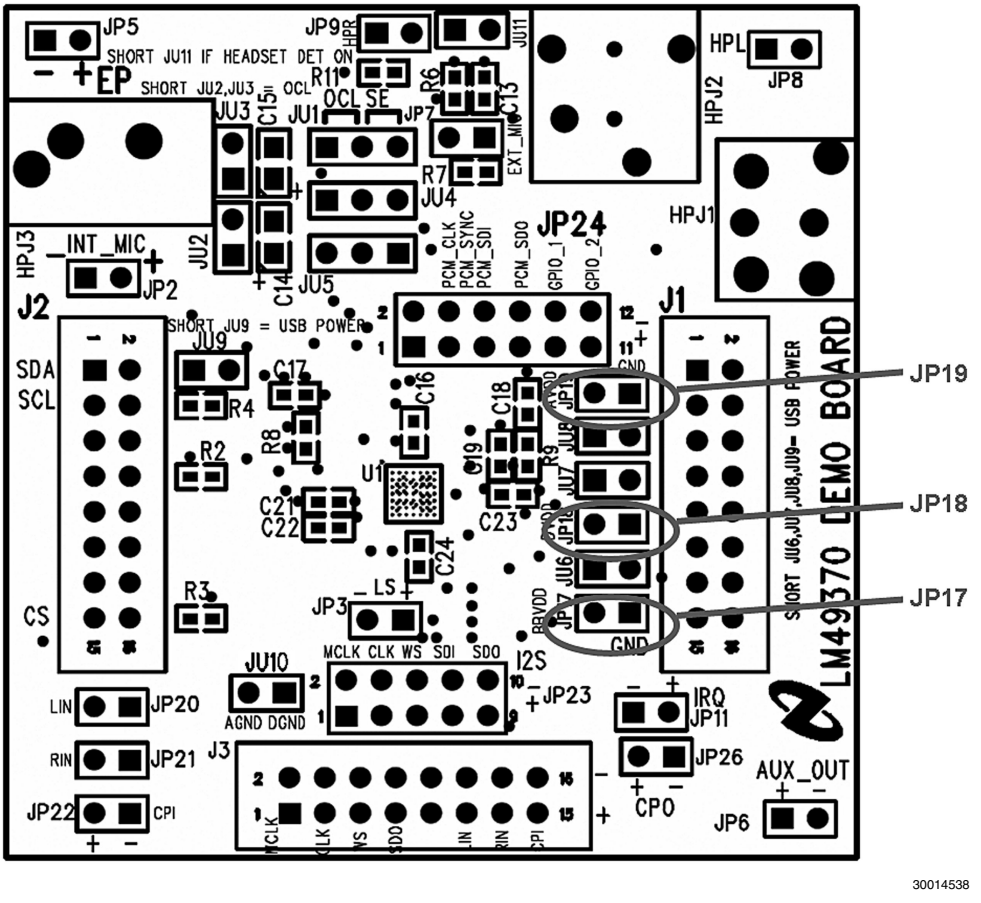
FIGURE 1. Powering up the LM49370 Demonstration Board Using USB Power

3) During USB Power operation, all external power supply lines must be disconnected from the LM49370 Demonstration Board. When configured for USB Power operation the LM49370 Demonstration Board draws its required power from the computer's USB port.

4) During USB Power operation, DV_{DD} and BBV_{DD} are set to 3.3V. AV_{DD} is set according to the position of the JP14 jumper on the USB Subsystem Motherboard. Placing the JP14 jumper at the "5V" position will set AV_{DD} to 5V. Placing the JP14 jumper at the "ADJ" position sets AV_{DD} to be either 3.8V or 3V depending on the LM49370 Control Software setting (default setting is 3.8V).

5) During External Power supply operation, the use of external power supplies is expected. There are dedicated header pins for BBVDD (JP17), DV_{DD} (JP18), AV_{DD} (JP19) to accommodate external power supply inputs. The polarity of the power supply header pins are indicated by the silkscreen "GND" label. It is recommended to keep $AV_{DD} \geq DV_{DD}$. Please refer to the LM49370 datasheet for operating ranges.

6) On the LM49370 Demonstration Board, the A_V_{DD} and LS_V_{DD} pins are tied to system AV_{DD}. The PLL_V_{DD} and D_V_{DD} pins are tied to system DV_{DD}.



30014538

FIGURE 2. Powering up the LM49370 Demonstration Board Using an External Power Supply

Interfacing with the LM49370's Digital I/O

1) The LM49370 features two digital audio buses (I²S and PCM). The I²S bus can accept digital audio data from either the USB Subsystem Motherboard (via J3) or from an external digital audio data source (such as the Audio Precision PSIA-2722). The PCM bus can accept digital audio data from an external source (such as the PSIA-2722).

2) For the I²S stereo bus, connect an external I²S source to JP23 of the LM49370 Demonstration Board. The pinout and polarity of JP23 is indicated by the top silkscreen of the Demonstration Board. If an external I²S source is not available, the USB Subsystem Motherboard should be used instead. The LM49370 plugs into the USB Subsystem Motherboard via J1-J3. I²S data is transmitted from the Motherboard via connector J3.

3) For the mono PCM bus, connect an external PCM source to JP24 of the LM49370 Demonstration Board. The pinout and polarity of JP24 is indicated by the top silkscreen of the Demonstration Board. The LM49370's general purpose input/output pins, GPIO1 and GPIO2, is also accessed via pins 10 and 12 of JP24.

4) For proper operation, a clock source must drive the LM49370's MCLK pin. The MCLK pin of the LM49370 can be driven by two methods. An external clock source can be applied to pin 1 of JP23 for external MCLK operation. The second method is to allow the USB Subsystem Motherboard to drive the MCLK pin via pin 1 of J3. When using the MCLK generated by the USB Subsystem Motherboard, pin 1 of JP23 should be left open.

5) The LM49370's interrupt request pin (IRQ) is accessed via JP11.

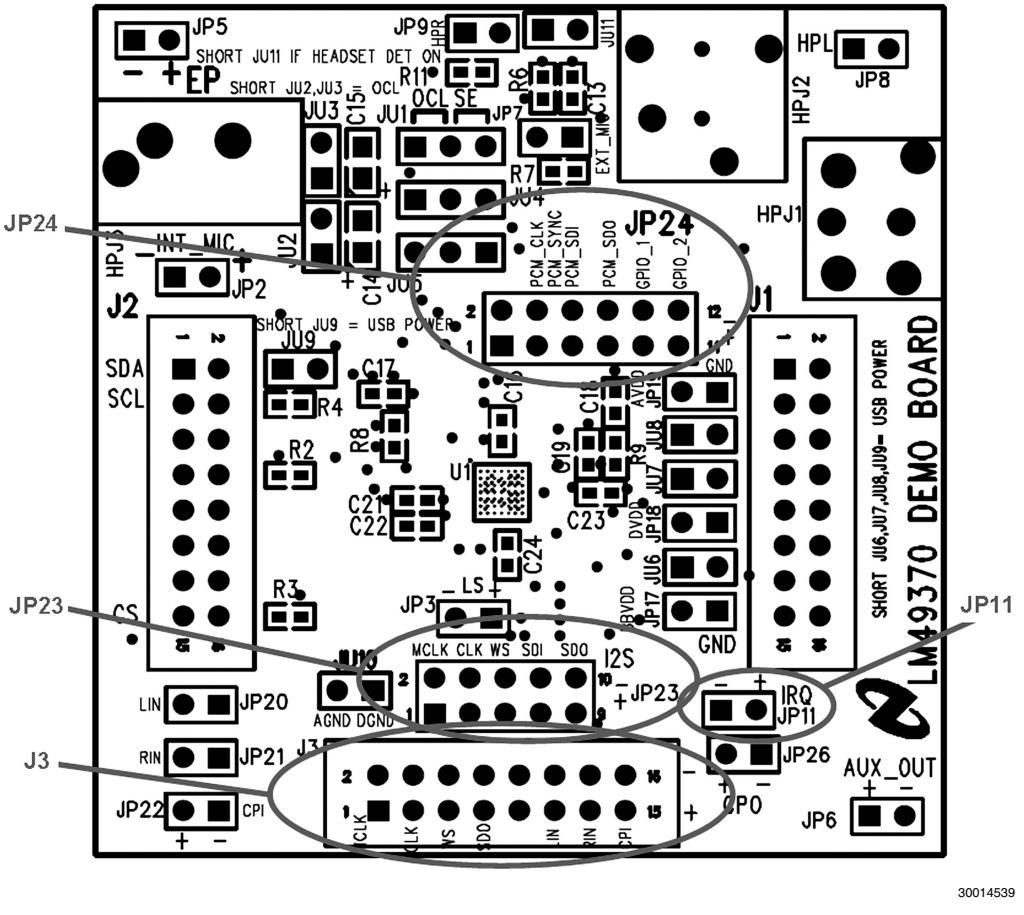


FIGURE 3. Interfacing with the LM49370 Demonstration Board's Digital I/O

Analog Audio Input Connections

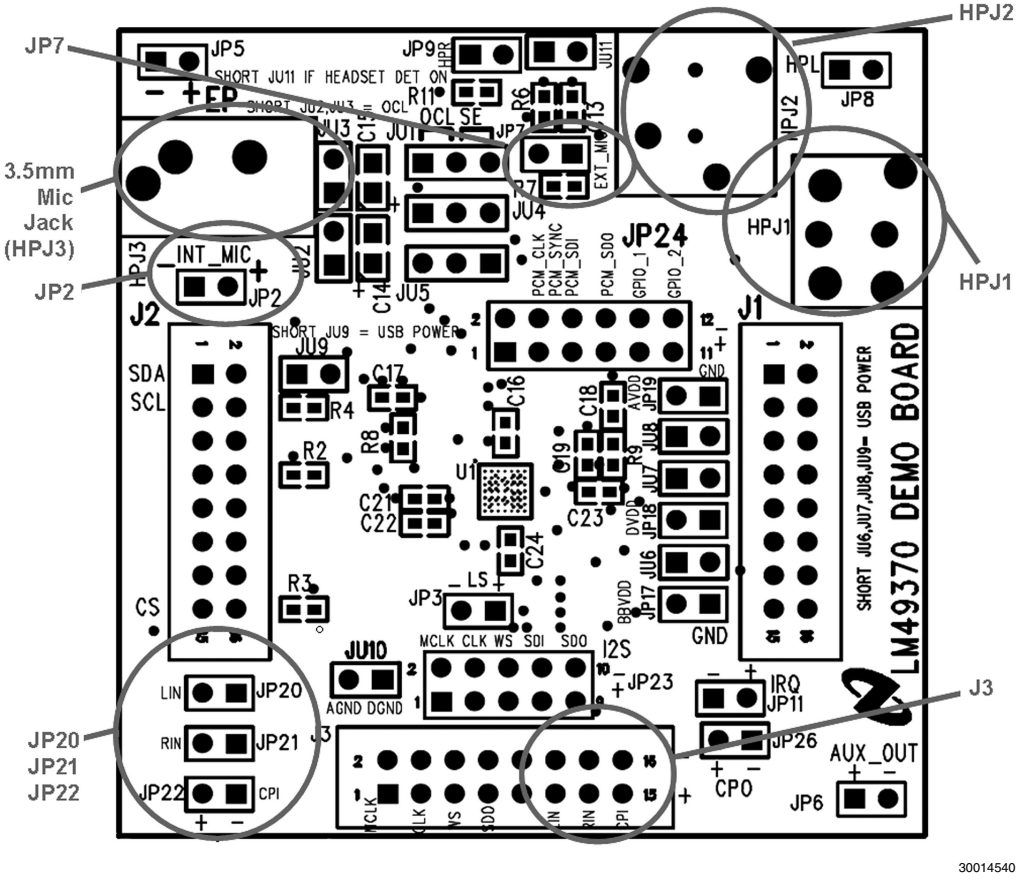
1) The USB Subsystem Motherboard can supply analog audio input signals to the AUX_L, AUX_R, CP_IN+, and CP_IN- pins of the LM49370 via connector J3.

2) The AUX_L and AUX_R single-ended stereo input pins can also be directly accessed on the Demonstration Board via JP20 and JP21.

3) The differential input, CP_IN, can also be directly accessed via JP22.

4) The single-ended external microphone input pin, EXT_MIC, is directly accessed via JP7. A headset with a microphone can be plugged into HPJ1 or HPJ2 to route a microphone signal to the EXT_MIC pin.

5) The differential internal microphone input, INT_MIC, is directly accessed via JP2. A microphone can also be plugged into mic jack HPJ3 to route a microphone signal to the INT_MIC input.



30014540

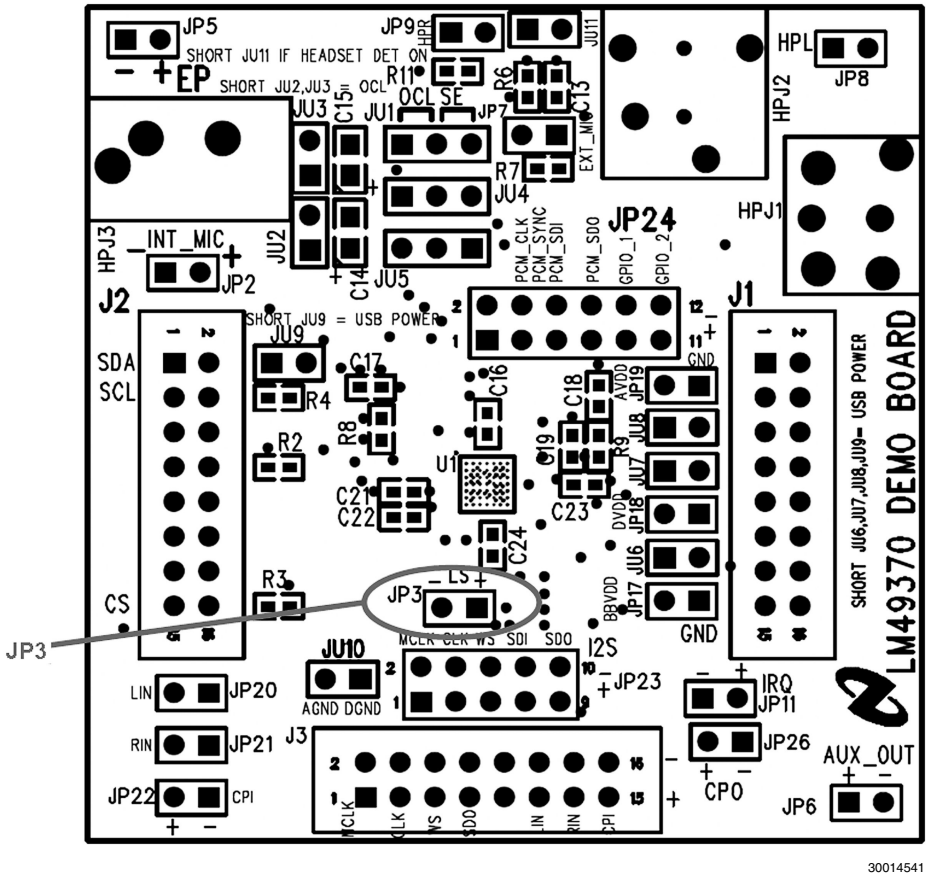
FIGURE 4. Interfacing with the LM49370 Demonstration Board's Analog Audio Inputs

Class D Amplifier Evaluation

1) The LM49370 contains a filterless Class D amplifier output designed to drive a mobile phone's handsfree loudspeaker.

2) Connector JP3 is used to directly access the Class D amplifier output. Connect any speaker load directly to JP3.

3) For measurement purposes, the LM49370 Demonstration Board requires an external measurement filter to remove the switching artifacts of the Class D amplifier output. An external lowpass filter is required to measure the loudspeaker's audio output signal (i.e. THD+N, output power).



30014541

FIGURE 5. Class D Amplifier Evaluation

Headphone Output Configuration

1) The LM49370 Demonstration Board supports two different headphone amplifier output configurations: Output-Capacitorless (OCL) and Single-ended Capacitively Coupled (SE).

2) Jumpers JU1-JU5 are used to switch between OCL and SE headphone output modes. For OCL operation close JU2, JU3 and place JU1, JU4, JU5 in the “OCL” position. For SE operation open JU2, JU3 and place JU1, JU4, JU5 in the “SE” position.

3) The LM49370 I²C/SPI Control Software programs the LM49370 to be either in OCL mode or SE mode. It is important to match the software setting to the corresponding jumper settings of the LM49370 Demonstration Board for correct headphone operation.

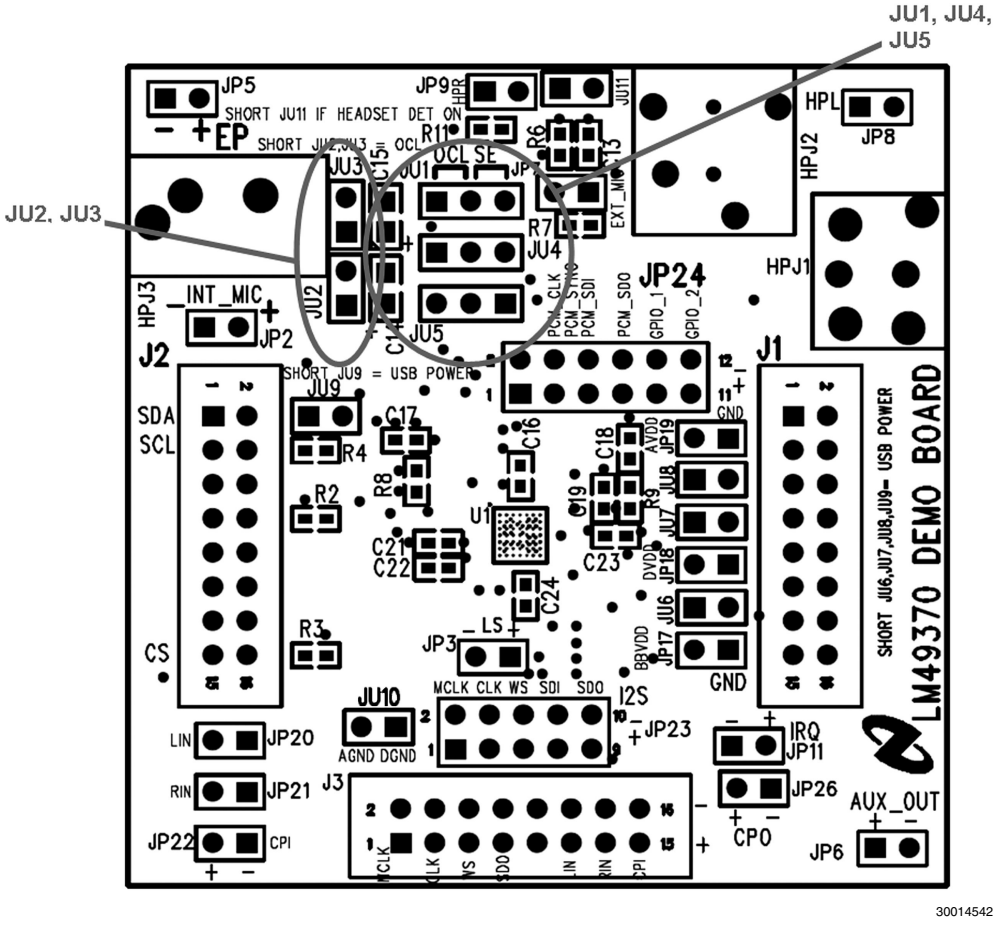
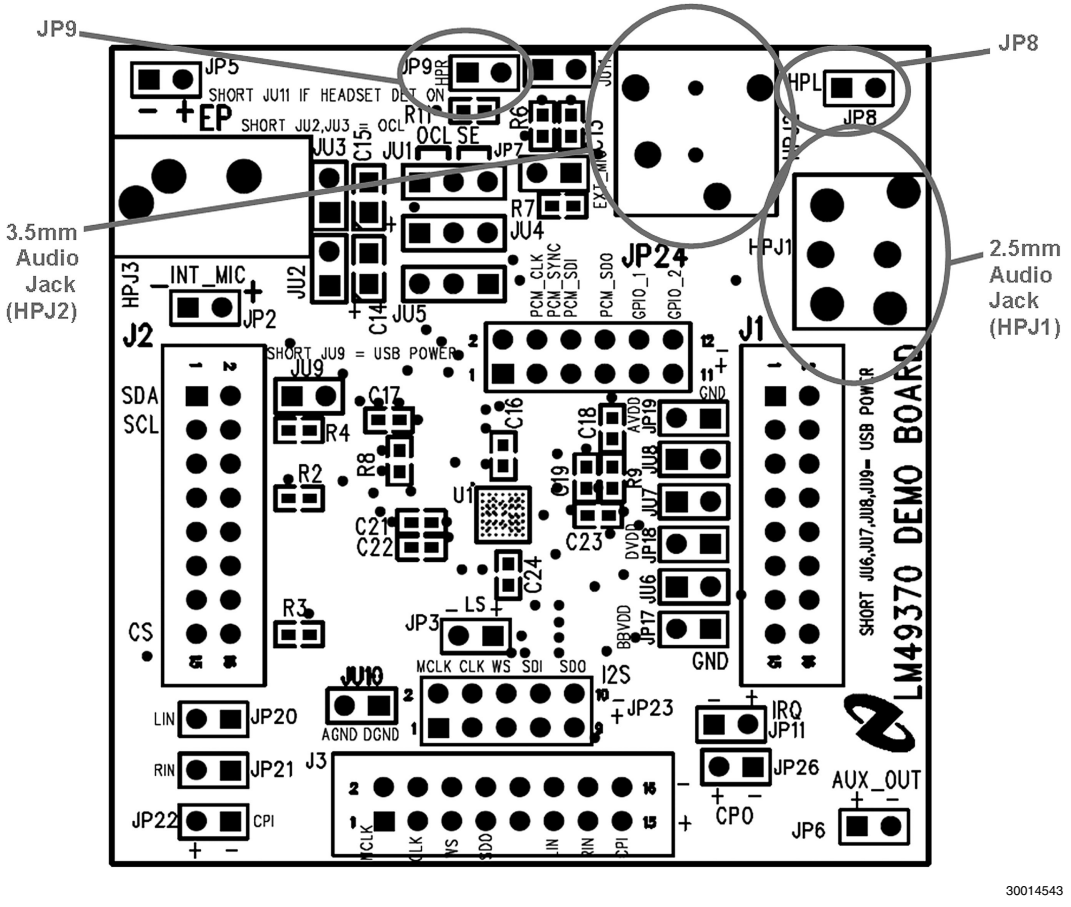


FIGURE 6. Headphone Output Configuration

Headphone Amplifier Evaluation

1) The LM49370 Demonstration Board accommodates both 3.5mm and 2.5mm audio plugs for 3 or 4 wire headphones and headsets. The headphone jacks, HPJ1 and HPJ2, can be used to monitor the LM49370's stereo headphone outputs. HPJ1 and HPJ2 can also accommodate an external microphone input (EXT_MIC) from a headset.

2) The right headphone output (HPR) is directly accessed via JP9. The left headphone output (HPL) is directly accessed via JP8.



30014543

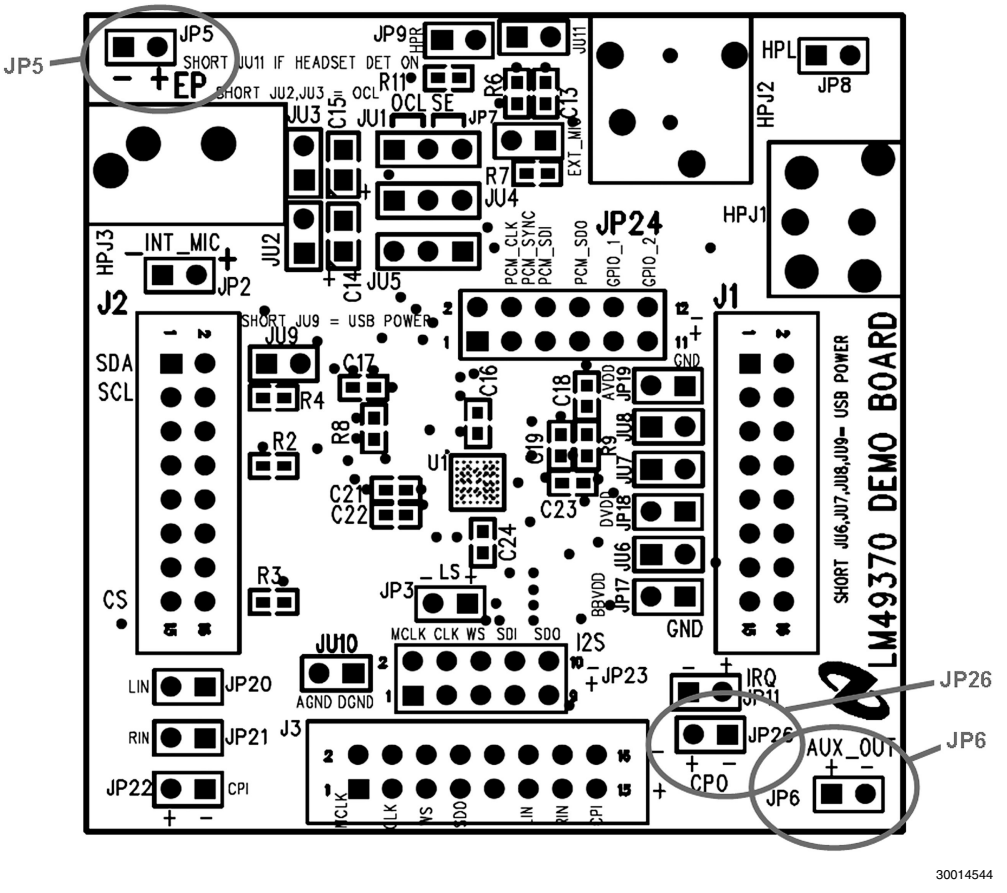
FIGURE 7. Headphone Output Connections

Additional Audio Amplifier Evaluation

1) The AUX_OUT amplifier output is directly accessed on the LM49370 Demonstration Board via JP6.

2) The CP_OUT amplifier output is directly accessed on the LM49370 Demonstration Board via JP26.

3) The earpiece amplifier output (EP) is directly accessed on the LM49370 Demonstration Board via JP5.



30014544

FIGURE 8. Additional Output Connections

LM49370 Demonstration Board Schematic

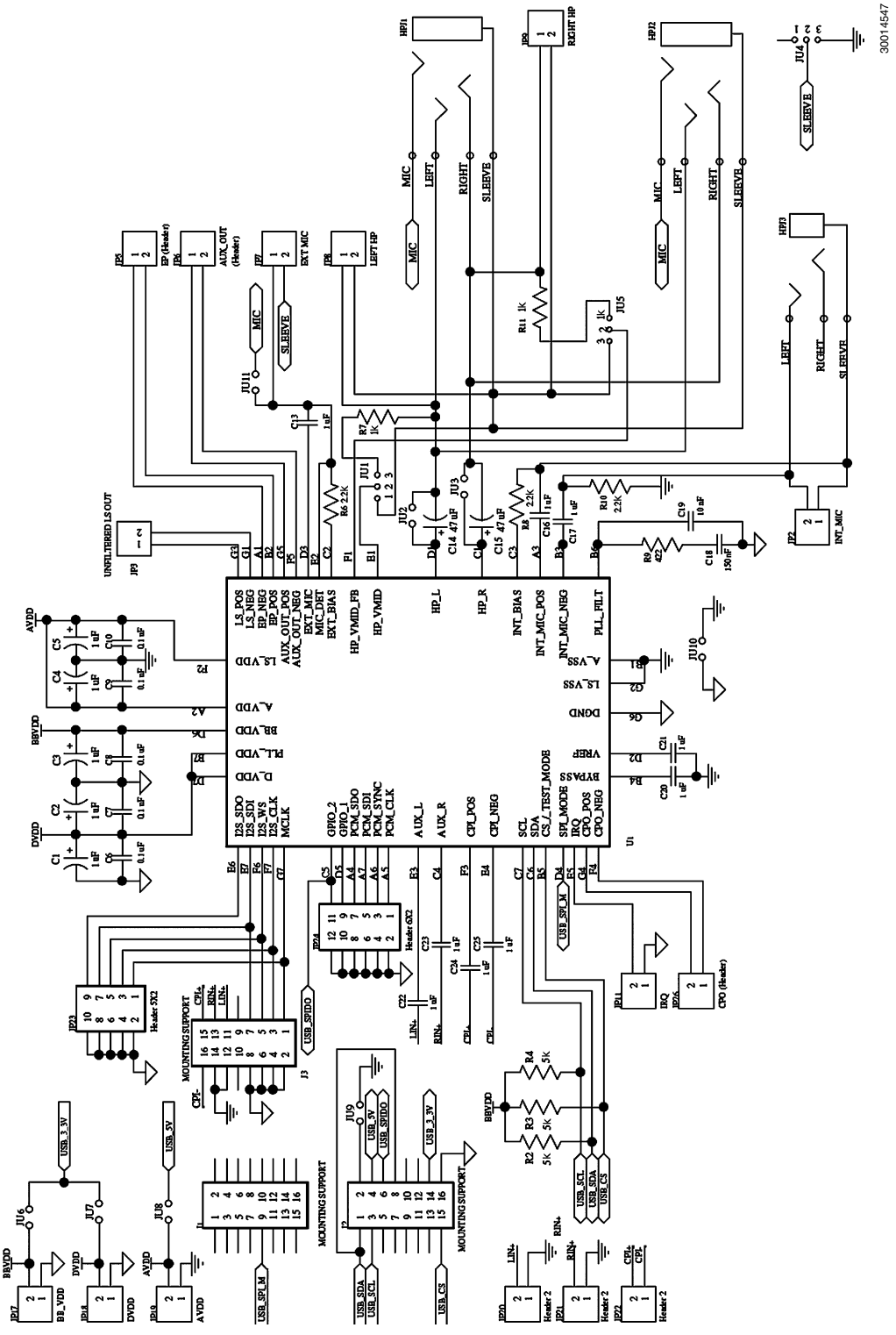


FIGURE 9. LM49370 Demonstration Board Schematic

Revision History

Rev	Date	Description
1.0	05/08/07	Initial release.

Notes

National Semiconductor Americas Customer Support Center
Email: new.feedback@nsc.com
Tel: 1-800-272-9959

National Semiconductor Europe Customer Support Center
Fax: +49 (0) 180-530-85-86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 69 9508 6208
English Tel: +49 (0) 870 24 0 2171
Français Tel: +33 (0) 1 41 91 8790

National Semiconductor Asia Pacific Customer Support Center
Email: ap.support@nsc.com

National Semiconductor Japan Customer Support Center
Fax: 81-3-5639-7507
Email: jpn.feedback@nsc.com
Tel: 81-3-5639-7560