AN-1796 LMP7721 Evaluation Board

1 Introduction

The LMP7721 evaluation board provides a platform to test the input bias current and performance of the LMP7721 amplifier. The LMP7721 amplifier is optimized for ultra low input bias current, 3 fA typical, by using on chip guard drivers and a package pin out to isolate the amplifier's inputs from its power supply and output pins.

Figure 1 is the schematic diagram for the LMP7721 evaluation board.

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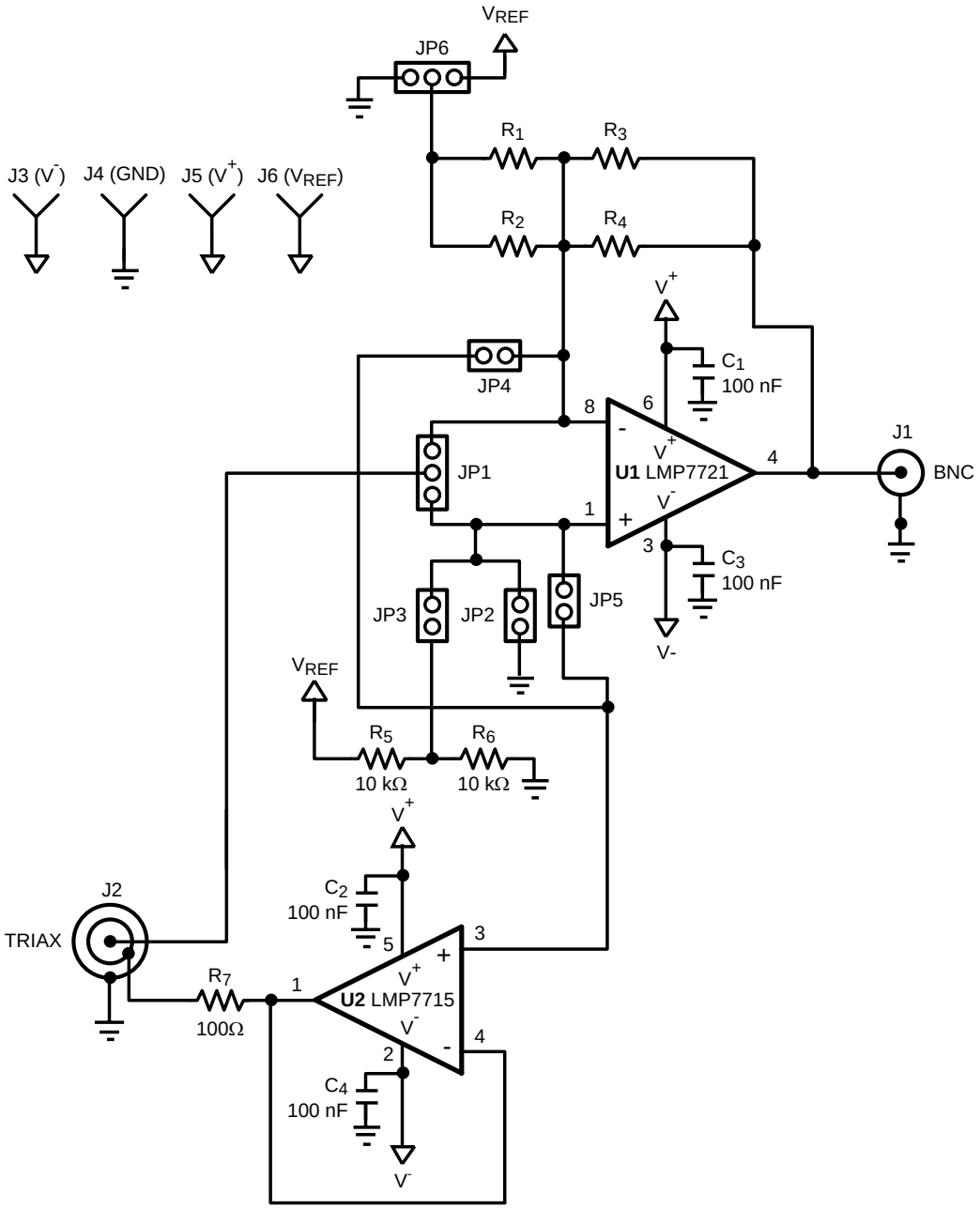

Figure 1. LMP7721 Evaluation Board

The evaluation board is design to be compatible with the 1 fA input bias current of the LMP7721 by providing a guarded area around the input puts of the amplifier. The input guard creates an equal potential zone around the input pins that prevents leakage currents from other parts of the printed circuit board (PCB) from reaching the input pins and causing an error current. A description of the board's features is discussed in the following secitons.

2 Power Supply Connections

J3, J4 and J5 are the power supply connections. The power supply can be a single supply with a range 1.8 to 5.5 V. Also, a split supply voltage can be used with the with the condition that 1.8 V ≤ V^+ -(V^-) ≤ 5.5 V.

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For single supply operation, J3 and J4 are connected together and is the ground connection. The positive supply voltage connection is J5.

For split-supply operation, the negative supply voltage is connected to J3. The positive supply voltage is connected to J5 and the ground (or common) connection of the supplies is connected to J4.

3 Reference Voltage Connection (V_{REF})

The LMP7721 can be configured as an inverting amplifier or a non-inverting amplifier. In each case, it may be required to provide a level shift voltage to keep the output voltage within a specified range and is accomplished by using the V_{REF} connection. Jumper JP3 is used to connect the V_{REF} to the non-inverting input of U1 when U1 is used in an inverting amplifier configuration. Jumper JP6 is used to connect the V_{REF} to the inverting input of U1 when U1 is used in a non-inverting amplifier configuration.

4 Components R_1, R_2, R_3, R_4, R_5, R_6 and R_7

These components are shown as resistors on the schematic, but are not mounted on the board. This evaluation board uses pin sockets at the location of these components to give you the freedom to configure the LMP7721 amplifier to best fit the application being considered.

5 Jumper Functions

JP1— JP1 is used to connect the signal terminal of the triax connector (J2) to the inverting input or the non-inverting input of U1, the LMP7721 amplifier.

JP2— JP2 is used to connect the non-inverting input of U1 to ground.

JP3— JP3 is used to connect the non-inverting terminal of the LMP7721 to the V_{REF} voltage. The connection to V_{REF} can be direct by using a wire jumper in the position of R_5, or through a voltage divider by using resistors in the positions of R_5 and R_6.

JP4— JP4 is used to connect the guard and guard driver to the inverting terminal of the LMP7721 when it is the low impedance node. This is the case when the LMP7721 is used as a non-inverting amplifier.

JP5— JP5 is used to connect the guard and guard driver to the non-inverting terminal of the LMP7721 when it is the low impedance node. This is the case when the LMP7721 is used as an inverting amplifier.

JP6— JP6 is used to connect the inverting terminal of the LMP7721 to the V_{REF} voltage or to ground. These is used when U1 is used as a non-inverting amplifier.

6 Input and output connectors

J1— J1 is a BNC connect and is the output of the LMP7721 amplifier

J2— J2 is a Triax connector and is used to connect a signal source to the input of the LMP7721. This component is not mounted on the board. A Triax connector is similar to a BNC connector but includes a shield between the central conductor and the outer shield and is referred to as a guard. A guard driver drives the guard to the same voltage as the center conductor, which minimizes any leakage currents in the connector or in the triax cable connected to it.

7 Example Applications

Non-inverting amplifier with a gain of two:

In this example, a sensor such as a pH electrode is the signal source and the LMP7721 is being used to buffer and amplify the signal. The output of a pH electrode, at 25°C ranges from about +415 mV to −415 mV as the pH ranges from 0 to 14. The output impedance of a pH electrode is extremely high, greater than 5 to 10 MΩ, so the LMP7721 is an excellent amplifier to buffer the output of a pH electrode.

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For this application, a ±2.5 V supply voltage is used. Figure 2 shows the placement of the jumpers and components.

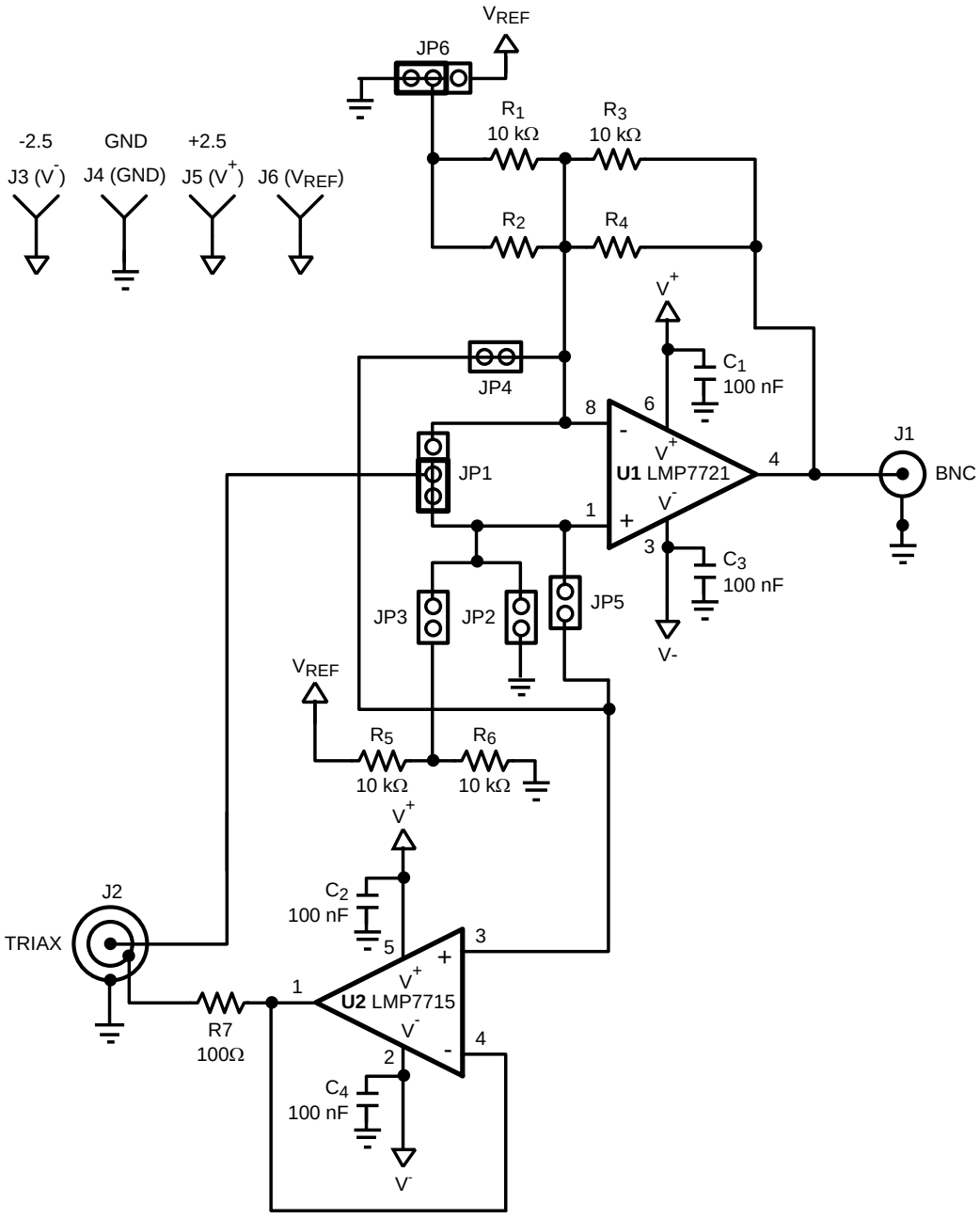

Figure 2. Schematic Showing Placement of Jumpers and Components

8 Transimpedance Amplifier (Inverting Amplifier With Level Shift)

In this application, the LMP7721 is used as a transimpedance amplifier that converts the current generated in the pin diode by light, or other radiation source, to a voltage at the amplifiers output. The input is biased to 2.5 V by the V_{REF} and the resistive divider R_5 and R_6. Current from the pin diode generates a voltage at the amplifier's output equal to (2.5 V - ($I_{pin-diode}$) X (R_3)).

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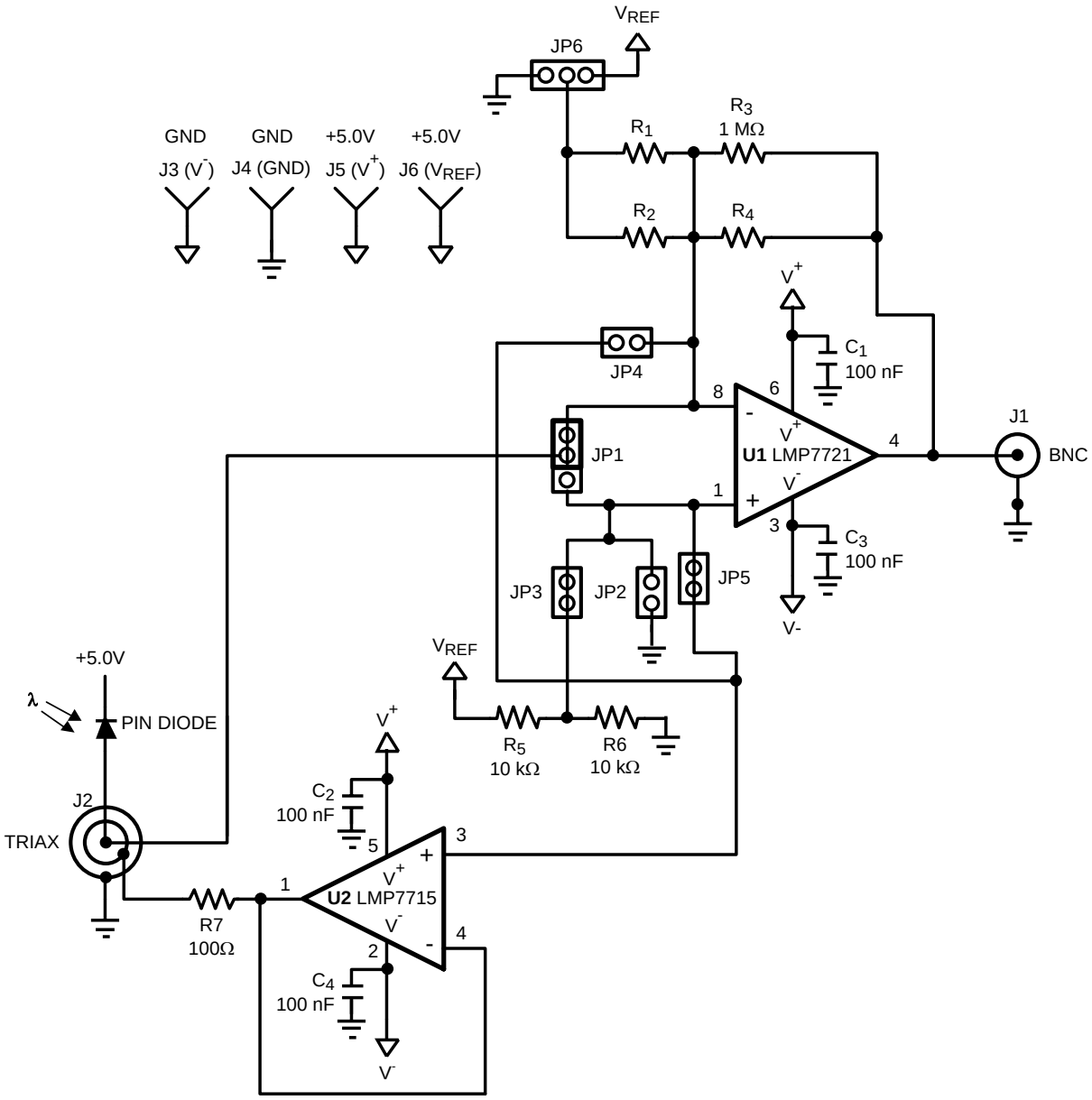

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Table 1 shows the Bill of Material (BOM) of the evaluation board.

Table 1. Bill of Material (BOM)

Designator	Description	Comment
J5	Jack connector	Red
J3	Jack connector	Green
J4	Jack connector	Black
J6	Jack connector	Yellow
C1 –C4	0805 capacitor	100 nF
J1	BNC	
JP1, JP6	3 pin header	
JP2 –JP5	2 pin header	
U1	LMP7721	8-Pin SOIC
U2	LMP7715	5-Pin SOT-23
R1 – R7	Leaded resistor	Not stuffed
J2	Triax connector	Not stuffed
No Designator	PC pin receptacle	For R1 – R7
No Designator	1/2”, 4–40 nylon threaded standoff	Qty. 4
No Designator	3/8”, 4–40 Screw	Qty. 4

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