Evaluation Board for Quad, 16-Bit, Serial Input, Unipolar/Bipolar Voltage Output DAC

EVAL-AD5754R

FEATURES

Full-featured evaluation board for the AD5754R
On-board reference
Link options
Direct hook-up to USB port of PC
PC software for control

EVALUATION BOARD DESCRIPTION

The EVAL-AD5754R is a full-featured evaluation board, designed to allow the user to easily evaluate all features of the AD5754R quad-channel, 16-bit DAC. All of the AD5754R pins are accessible at on-board connectors for external connection. The board can be controlled by two means, via the on-board connector (J8) or via the USB port of a Windows®-based PC using the AD5754R evaluation software. The default setup is for control via the USB port.

DEVICE DESCRIPTION

The AD5754R is a quad-channel, 16-bit serial input, voltage output digital-to-analog converter that operates from single supply voltages of +4.5 V up to +16.5 V, or dual supply voltages of ±4.5 V up to ±16.5 V. Nominal full-scale output range is software-selectable from the options of +5 V, +10 V, +10.8 V, ±5 V, ±10 V, and ±10.8 V. Provided on the AD5754R are integrated output amplifiers, reference buffers, and proprietary power-up/power-down control circuitry.

The AD5754R offers guaranteed monotonicity, integral nonlinearity (INL) of ±16 LSB maximum, low noise, 10 μs settling time, and an on-chip +2.5 V, 5ppm/°C reference.

Complete specifications for the AD5754R are available in the AD5754R data sheet available at www.analog.com, and should be consulted in conjunction with this data sheet when using the evaluation board.
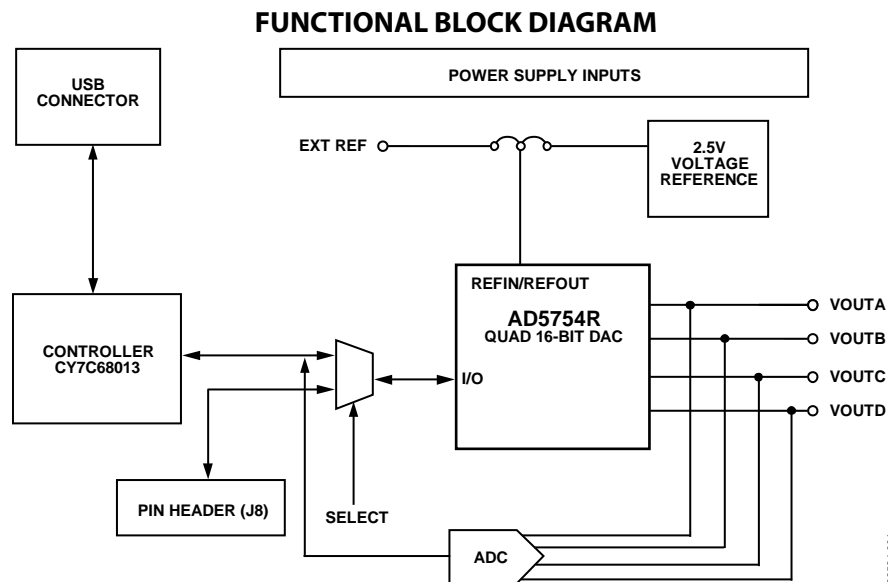
FUNCTIONAL BLOCK DIAGRAM

Figure 1.

EVAL-AD5754R

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REVISION HISTORY

5/09—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

POWER SUPPLIES

The following external supplies must be provided:

- 5 V between the 5 V and 0 V inputs for the digital supply of the AD5754R and digital circuitry. Alternatively, place LK6 in Position A to power the digital circuitry from the USB port (default).

- 5 V to 15 V between the AV_{DD} and GND inputs for the positive analog supply of the AD5754R.

- 0 V to −15 V between the AV_{SS} and AGND inputs for the negative analog supply of the AD5754R.

The analog and digital planes are connected at one location, close to the AD5754R. To avoid ground loop problems, it is recommended not to connect AGND and DGND elsewhere in the system.

Each supply is decoupled to the relevant ground plane with 10 μF and 0.1 μF capacitors. Each device supply pin is again decoupled with a 10 μF and 0.1 μF capacitor pair to the relevant ground plane.

LINK OPTIONS

Position LK7 configures the board for either PC control via the USB port (default setup) or for control by an external source via J8. Set the link options on the evaluation board for the required operating setup before using the board. The functions of the link options are described in Table 4.

Default Link Position Setup

The default setup is for the device to be controlled by the PC via the USB port. The default link positions are listed in Table 1.

Table 1. Link and Switch Positions for PC Control

Link No.	Positions
LK1	A
LK2	Inserted
LK3	Inserted
LK4	Inserted
LK5	Inserted
LK6	B
LK7	A
LK8	B
LK9	B
LK10	Inserted
LK11	Removed
LK12	Removed
LK13	Removed

Connector J8 Pin Descriptions

The pin configuration for J8 is shown in Table 2. LK7 must be in Position B to enable the use of J8. Descriptions for the J8 pins are in Table 3.

Table 2. Connector J8 Pin Configuration

2	4	6	8	10
1	3	5	7	9

Table 3. Connector J8 Pin Descriptions

Pin No.	Function
1	SDO
2	$\overline{BIN/2sCOMP}$
3	DGND
4	$\overline{CLR}$
5	DGND
6	$\overline{LDAC}$
7	SDIN
8	DGND
9	SCLK
10	$\overline{SYNC}$

Table 4. Link Options

Link No.	Function

LK1	This link selects the voltage reference source:
	    Position A selects the on-board REF192 as the voltage reference source.
	    Position B selects an external source via connector J2.
	(If the AD5754R internal reference is to be used as the voltage reference source, do not insert LK1).

LK2	This link connects the $V_{OUT}A$ output of the AD5754R to the $V_{IN}0$ input of the on-board ADC (AD7323):
	    When inserted, the voltage at the $V_{OUT}A$ pin can be read back to the PC.
	    When removed, the voltage at the $V_{OUT}A$ pin is disconnected from the on-board ADC input.

LK3	This link connects the $V_{OUT}B$ output of the AD5754R to the $V_{IN}1$ input of the on-board ADC (AD7323):
	    When inserted, the voltage at the $V_{OUT}B$ pin can be read back to the PC.
	    When removed, the voltage at the $V_{OUT}B$ pin is disconnected from the on-board ADC input.

LK4	This link connects the $V_{OUT}C$ output of the AD5754R to the $V_{IN}2$ input of the on-board ADC (AD7323):
	    When inserted, the voltage at the $V_{OUT}C$ pin can be read back to the PC.
	    When removed, the voltage at the $V_{OUT}C$ pin is disconnected from the on-board ADC input.

LK5	This link connects the $V_{OUT}D$ output of the AD5754R to the $V_{IN}3$ input of the on-board ADC (AD7323):
	    When inserted, the voltage at the $V_{OUT}D$ pin can be read back to the PC.
	    When removed, the voltage at the $V_{OUT}D$ pin is disconnected from the on-board ADC input.

LK6	This link selects the 5 V power supply source for the digital circuitry:
	    Position A selects the USB port as the 5 V digital circuitry power supply source.
	    Position B selects J7 as the 5 V digital circuitry power supply source.

LK7	This link selects whether the AD5754R evaluation board is controlled by the PC via the USB port or by an external source via J8:
	    Position A selects the evaluation board to be controlled by the PC via the USB port.
	    Position B selects the evaluation board to be controlled by an external source via J8.

LK8	This link selects the digital supply voltage value for the AD5754R and the on-board ADC (AD7323):
	    Position A selects 5 V as the supply value.
	    Position B selects 3.3 V as the supply value.

LK9	This link selects the negative supply voltage:
	    Position A selects 0 V as the negative supply voltage (unipolar operation).
	    Position B selects the AV_{SS} connection of J9 as the negative supply voltage (bipolar operation).

LK10	This link connects the voltage reference input of the on-board ADC to the selected voltage reference source.

LK11	This link sets the state of the $\overline{LDAC}$ pin (LK7 must be in Position B):
	    When inserted, the $\overline{LDAC}$ pin is tied to 0 V.
	    When removed, the $\overline{LDAC}$ pin is pulled to DV_{CC} through a 10 kΩ resistor.

LK12	This link sets the state of the $\overline{CLR}$ pin (LK7 must be in Position B):
	    When inserted, the $\overline{CLR}$ pin is tied to 0 V.
	    When removed, the $\overline{CLR}$ pin is pulled to DV_{CC} through a 10 kΩ resistor.

LK13	This link sets the state of the BIN/$\overline{2sCOMP}$ pin (LK7 must be in Position B):
	    When inserted, the BIN/$\overline{2sCOMP}$ pin is tied to 0 V.
	    When removed, the BIN/$\overline{2sCOMP}$ pin is pulled to DV_{CC} through a 10 kΩ resistor.

EVALUATION BOARD SOFTWARE

INSTALLING THE SOFTWARE

The AD5754R evaluation kit includes self-installing software on a CD. The software is compatible with Windows 2000/NT/XP. If the setup file does not run automatically, **setup.exe** can be run from the CD.

Install the evaluation software before connecting the evaluation board to the USB port of the PC to ensure that the evaluation board is correctly recognized when connected to the PC.

1. After the installation from the CD is complete, power up the AD5754R evaluation board as described in the Power Supplies section. Then, connect it to the USB port of your PC using the supplied cable.

2. When the evaluation board is detected, proceed through any dialog boxes that appear. This completes the installation.

USING THE SOFTWARE

1. To launch the software, select the AD5754R submenu from the **Analog Devices** menu.
2. Click **AD5754R Evaluation Software.**

Figure 2 displays the main window. This window is divided into six sections: **Input Register**, **Control Register**, **Power Control Register**, **Hardware Configuration**, **Program output Voltage** and **On-Board ADC**.
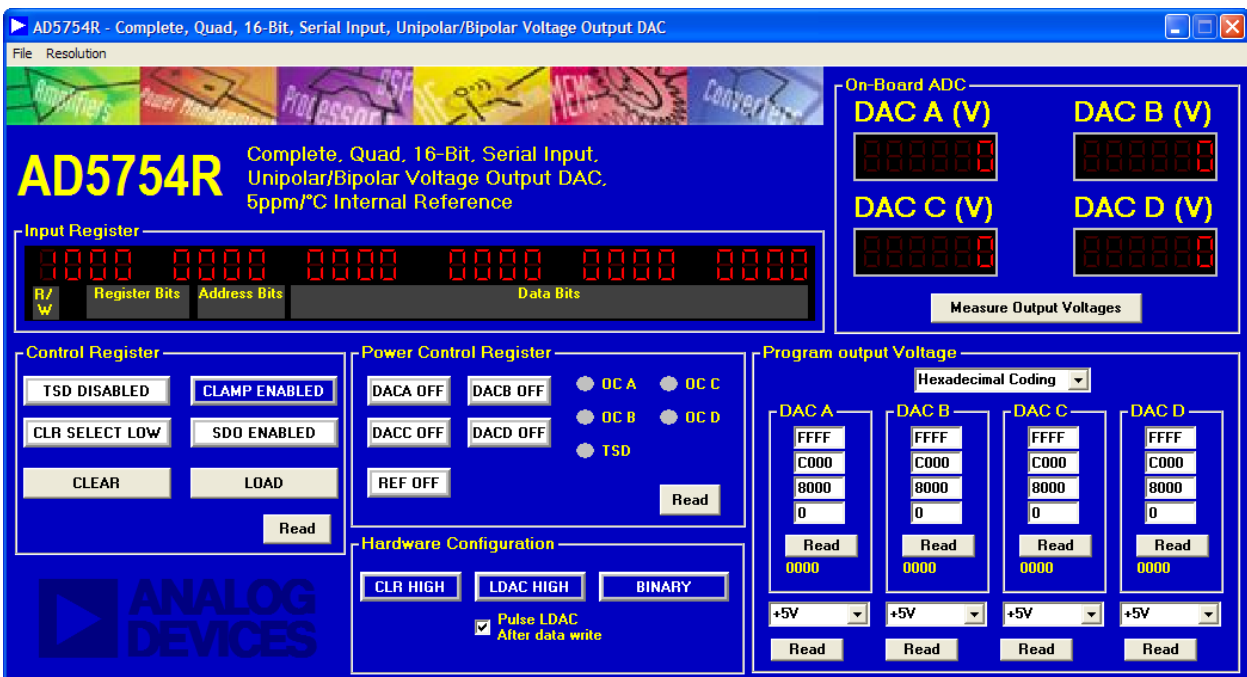

Figure 2. Main Window

Input Register

The **Input Register** section displays the current contents of the input register; the 24-bit display is updated each time you instruct a read or a write operation.

Control Register

The **Control Register** section allows you to program and read the contents of the control register. The control register consists of four bits: TSD enable, clamp enable, CLR select, and SDO disable. Each of these bits is controlled by a toggle button, which sets the bit high or low; a high bit is indicated by the button turning blue, while a low bit is indicated by the button turning white. The control register also contains two functions, **CLEAR** and **LOAD**, both of which can be asserted by clicking the appropriate button.

Power Control Register

The **Power Control Register** section allows you to program and read the contents of the power control register. The power control register consists of 10 bits: five read/write bits (PU_A, PU_B, PU_C, PU_D, PU_{REF}) and five read only bits (TSD, OC_A, OC_B, OC_C, and OC_D).

Hardware Configuration

The **Hardware Configuration** section lets you configure the hardware setup of the AD5754R, that is, to set the configuration of the $\overline{CLR}$, $\overline{LDAC}$ and BIN/2sCOMP pins.

Program Output Voltage

This section allows you to program/read the data registers of the four DAC channels. A drop-down box allows you to select hexadecimal or binary coding. To program a data register, click one of the 16 text boxes (4 text boxes per DAC channel). The value in the textbox is programmed to the data register; if a new value is typed into a text box, this value can be programmed to the data register by pressing the **Enter** key. The DAC output updates if the $\overline{LDAC}$ pin is low or if the **Pulse LDAC After data write** check box is checked. This section also allows you to select the output voltage range for each DAC channel.

On-Board ADC

The AD5754R evaluation board is equipped with an on-board ADC to facilitate measurement and readback of the output voltages of each DAC channel. At any time, click **Measure Output Voltages** to display the four output voltages. The on-board ADC has a maximum input voltage range of ±10 V.

Resolution

For the purposes of evaluating the 12-bit (AD5724R) or 14-bit (AD5734R) versions of the AD5754R, the board can be operated at 12 or 14 bits of resolution by selecting the appropriate menu item from the **Resolution** drop-down menu on the menu bar.

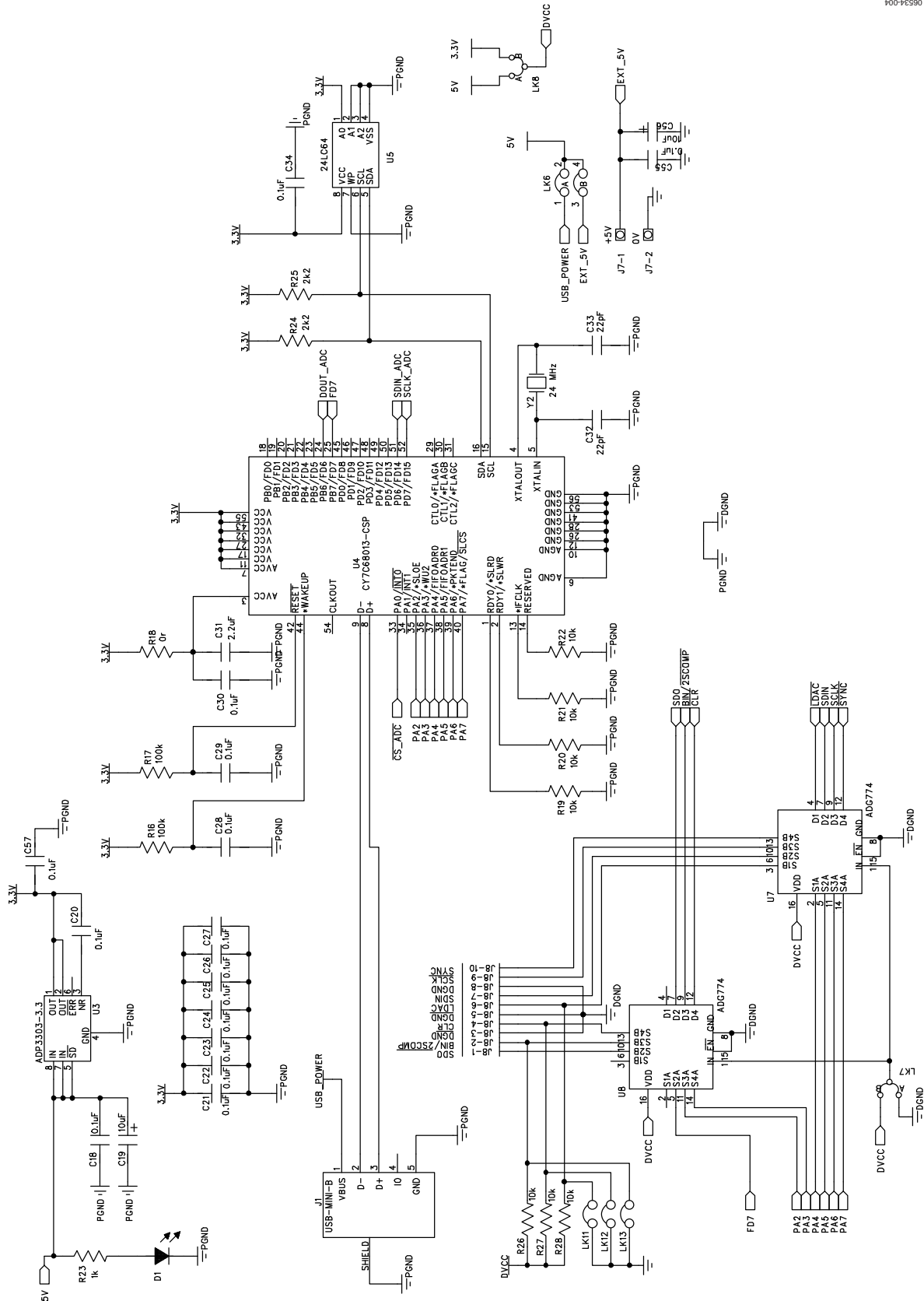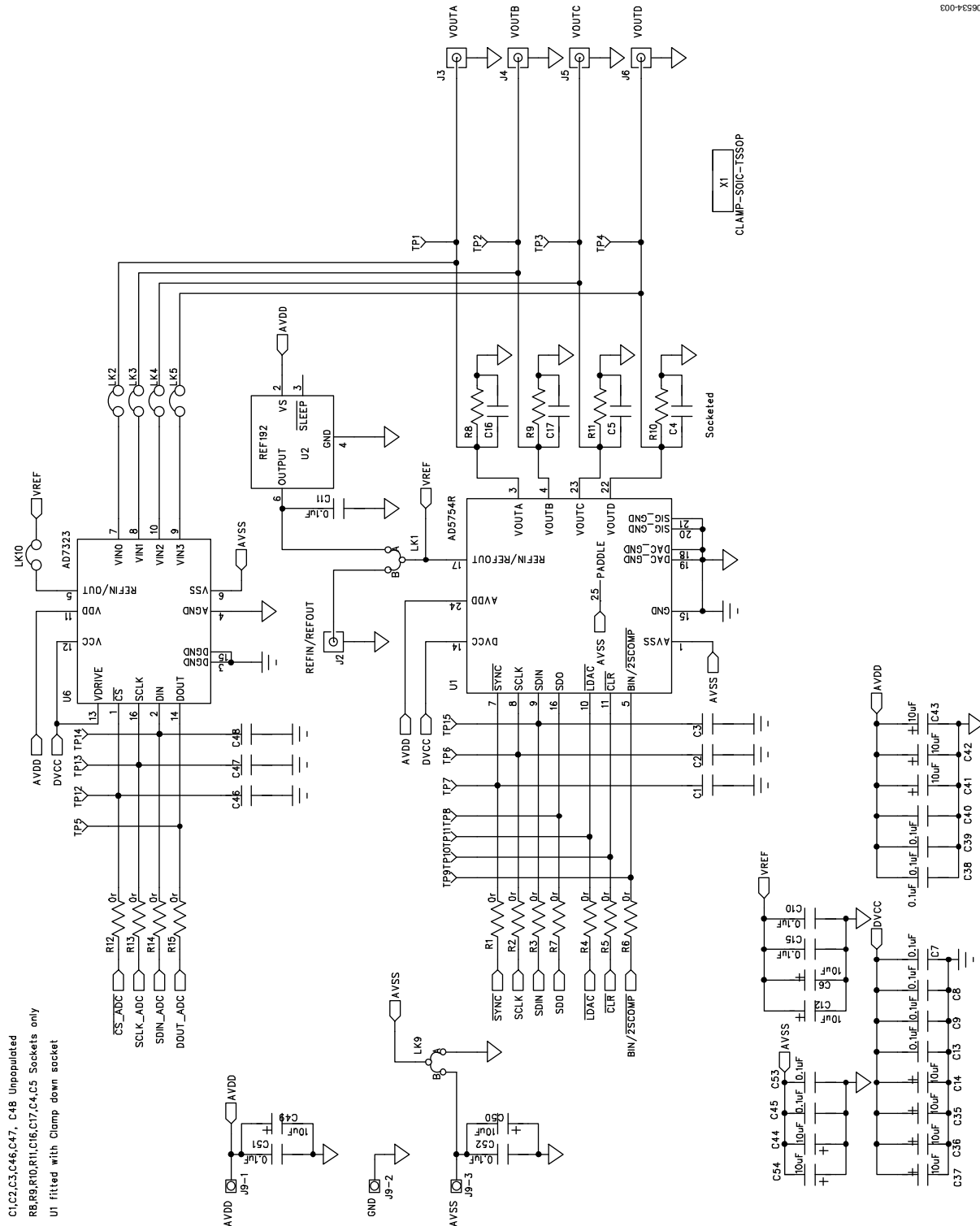# EVALUATION BOARD SCHEMATICS AND ARTWORK

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Figure 3. Schematic of Controller Circuitry
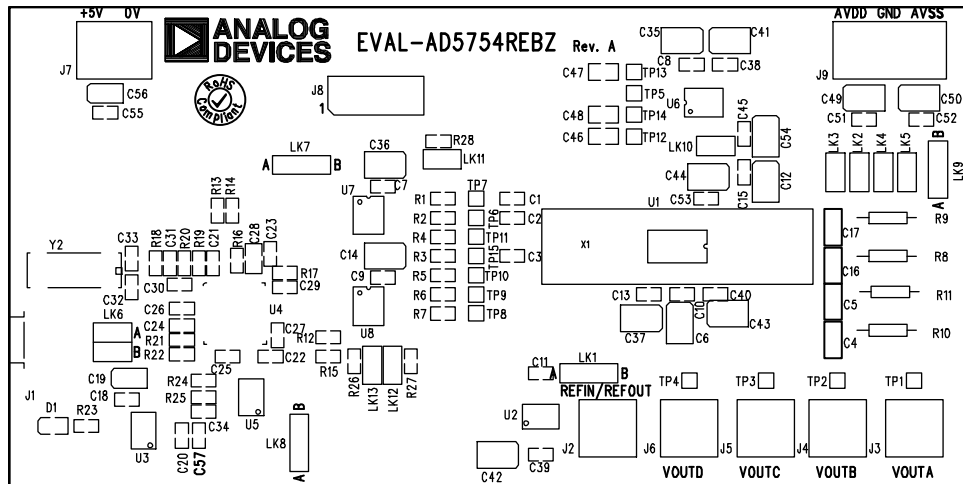
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Figure 4. Schematic of AD5754R Circuitry

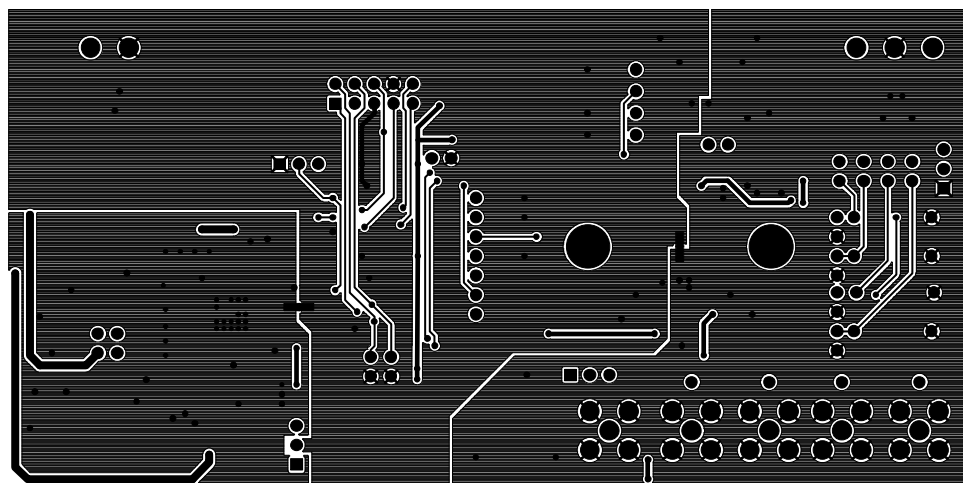Figure 5. Component Placement Drawing

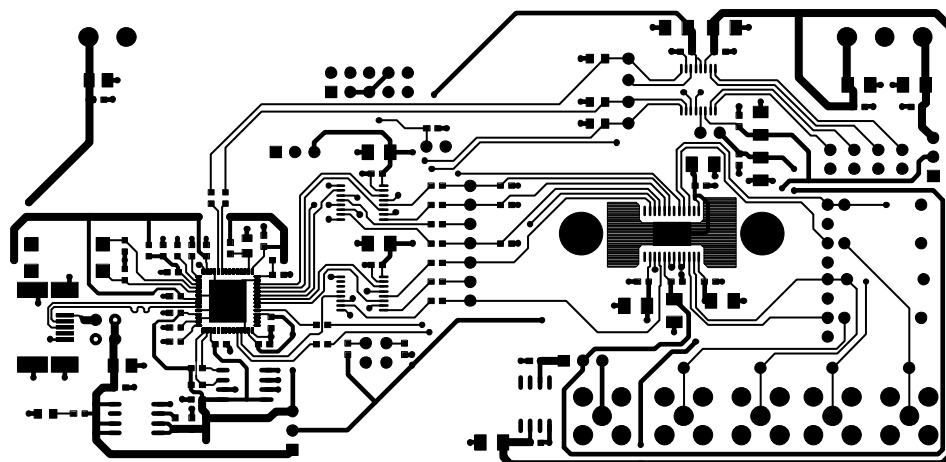Figure 6. Solder Side PCB Drawing

Figure 7. Component Side PCB Drawing

ORDERING INFORMATION

BILL OF MATERIALS

Table 5.

Qty	Reference Designator	Description	Supplier/Number
12	R1 to R7, R12 to R15, R18	0 Ω resistor, 0603 package	FEC 9331662
2	R16, R17	100 kΩ resistor, 0603 package	FEC 9330402
7	R19 to R22, R26 to R28	10 kΩ resistor, 0603 package	FEC 9330399
1	R23	1 kΩ resistor, 0603 package	FEC 9330380
2	R24, R25	2.2 kΩ resistor, 0603 package	FEC 9330810
2	C19, C56	10 µF tantalum capacitor, TAJ_A package	FEC 1135234
13	C6, C12, C14, C35, C36, C37, C41 to C44, C49, C50, C54	10 µF tantalum capacitor, TAJ_B package	FEC 197427
1	C31	2.2 µF ceramic capacitor, 0603 package	FEC 9402098
2	C32, C33	22 pF ceramic capacitor, 0603 package	FEC 722005
29	C7 to C11, C13, C15, C18, C20 to C30, C34, C38 to C40, C45, C51, C52, C53, C55, C57	0.1 µF ceramic capacitor, 0603 package	FEC 9406140
1	Y2	24 MHz crystal	FEC 9509658
1	D1	LED, 0805 package	FEC 1318243
1	J1	USB-Mini-B	FEC 9786490
5	J2 to J6	Subminiature BNC connector (SMB)	FEC 1111349
1	J7	2-way screw terminal	FEC 9632972
1	J8	10-pin dil header	FEC 5217842
1	J9	3-way screw terminal	FEC 1357319
4	LK1, LK7, LK8, LK9	3-pin sil header and shorting link	FEC 1022218 and FEC 150-411 (36-pin strip)
1	LK6	4-pin sil header and shorting link	FEC 1022244 and FEC 150-411 (36 + 36 pin strip)
8	LK2 to LK5, LK10 to LK13	2-pin sil header and shorting link	FEC 1022247 and FEC 150-411
15	TP1 to TP15	Test point	FEC 8731128
1	U1	Quad, 16-bit digital-to-analog converter	Analog Devices, AD5754RBREZ
1	U2	2.5 V voltage reference	Analog Devices, REF192GSZ
1	U3	3.3 V voltage regulator	Analog Devices, ADP3303ARZ-3.3
1	U4	USB controller (Cypress CY7C68013A-56LFXC)	Digi-Key 428-1669-ND
1	U5	EEPROM memory	Digi-Key 24LC64-I/SN-ND
1	U6	Quad, 12-bit analog-to-digital converter	Analog Devices, AD7323BRUZ
2	U7, U8	Quad, 2:1 multiplexer	Analog Devices, ADG774BRQZ

ORDERING GUIDE

Model	Package Description
EVAL-AD5754REBZ[1]	AD5754R Evaluation Board

[1] Z = RoHS Compliant Part.

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

NOTES

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DEVICES

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