

FEATURES

**Full-Featured Evaluation Board for the
AD5370/AD5372/AD5373**

USB Interface

PC Software for Register Programming

Various Reference Voltages Available

Stand-Alone Operation

INTRODUCTION

This Technical Note describes the operation and functionality of the Evaluation Board for the AD5370, AD5372 and AD5373. As these 3 parts are pin compatible the same evaluation board is used for all. AD537x will be used throughout this technical note to refer to the actual multi-channel DAC used on the board. This note should be used in conjunction with the data sheet of the appropriate DAC. The evaluation board allows the functionality and performance of the AD537x to be evaluated easily. The evaluation board can be used as a stand alone board with control coming from an external DSP or micro-controller or it can be connected to a PC. Software is provided which can be used to program the registers of the AD537x. Control of the AD537x is achieved via a USB interface

FUNCTIONAL BLOCK DIAGRAM

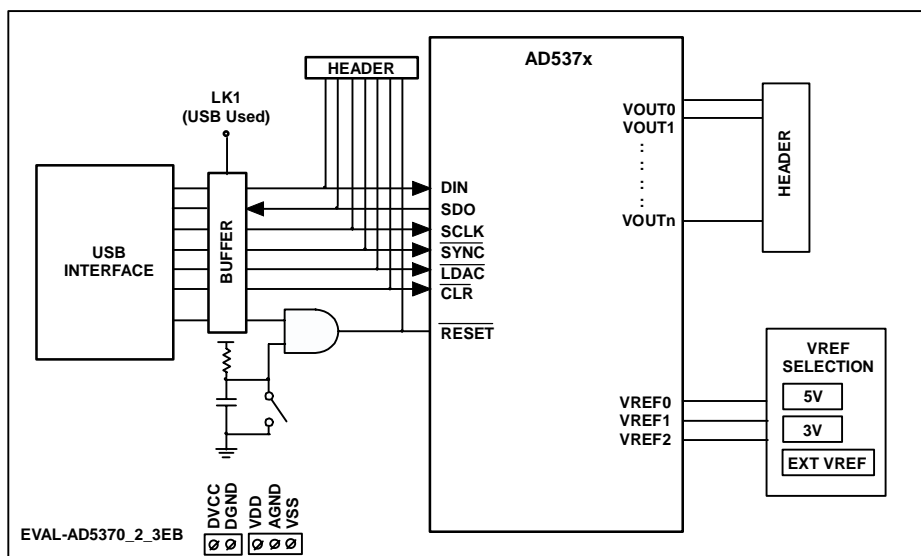


Figure 1. Functional Block Diagram

Rev. Pr A

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REVISION HISTORY

Pr. A: Initial draft

GENERAL DESCRIPTION

FUNCTIONALITY OVERVIEW

The evaluation board for the AD537x is designed to allow the user to fully evaluate all the functions and performance of the AD537x prior to designing it into a system. The evaluation board can be used in a stand-alone mode with the control signals being provided through the 20 pin header J3 or it can be connected to a PC using the USB cable supplied with the evaluation board kit. Software is provided which allows the user to program the various registers of the AD537x with ease. The software operation is described later in this document.

POWER SUPPLIES

The evaluation board requires a +5V supply for DV_{CC}. The V_{DD} and V_{SS} supplies can be any value within the power supply limits as specified in the AD537x data sheet. Power supply connections are made to the screw terminals of J2. The USB interface, if used, gets its power supply from the USB port of the PC. This power supply is not used by the AD537x or any of its associated circuitry. When connecting the power supply leads it is recommended that the supplies are turned off and that the ground leads are connected first.

REFERENCE SELECTION

The evaluation board includes two voltage references ICs, the ADR435 and ADR423 which are 5V and 3V references respectively. An SMB connector is provided to allow an external voltage to be connected for use as a reference. Link LK4 is used to select which reference source is used by the AD537x as shown in Table 1.

Table 1. Reference Selection using LK4

| LK4 Position | Description |
|--------------|--|
| A | The reference voltage is 3V (default) |
| B | The reference voltage is 5V |
| C | The voltage on the SMB, EXT_REF is used as the reference voltage |

By default the voltage reference pins of the AD537x, VREF0 and VREF1, both use the same reference, i.e. that selected by LK4. If it is required that the reference pins should use different voltage references this can be achieved by removing the 0Ω resistor associated with each VREF pin. The required reference can then be connected to the testpoint associated with the VREF pin. Table shows the 0Ω resistor and testpoint associated with each VREF pin.

Table 2. 0Ω Resistor and Testpoints for VREF pins

| VREF | Resistor | Testpoint |
|-------|----------|-----------|
| VREF0 | R17 | T63 |
| VREF1 | R18 | T64 |

USING THE USB INTERFACE

The software provided with the evaluation board kit allows the user to program the registers of the AD537x via the USB interface. It is important that the software supplied is installed on the PC before the board is connected. See the Using the USB Software section for more information. The USB circuitry gets its power from the USB port of the PC and will generate the required interface signals, RESET, CLR, SYNC, SCLK etc. to control the AD537x. To use the interface LK1, LK3 and LK8 should be in place. The function of these links is described in Table 4.

STAND-ALONE OPERATION

The evaluation board can be used as a stand-alone device if required. This has the advantage that it lets the user to connect the interface pins of the AD537x to their own DSP or micro-controller thus allowing them to write code to operate the AD537x as their application requires. To use the board in stand-alone mode the connection to the USB interface must be removed. This is achieved by removing LK1, which will three-state the connections to CLR, LDAC, SYNC, SCLK and DIN. LK3 should be removed to isolate the RESET pin from the USB interface and the push-button. The interface signals required to control the AD537x can then be provided through the 20 pin header J3. The pinout of J3 is shown in Table 3

Table 3. J3 Header Pinout

| Pin | Signal | Pin | Signal |
|---------------------------|-------------|-----|--------------|
| 1 | DIN | 8 | <u>LDAC</u> |
| 2 | NC | 10 | <u>CLR</u> |
| 3 | SCLK | 12 | <u>BUSY</u> |
| 4 | NC | 14 | <u>RESET</u> |
| 5 | NC | 16 | NC |
| 6 | <u>SYNC</u> | 18 | NC |
| 7,9,11,13, 15,17,19,20 | DGND | | |

Table 4. Summary of Link Positions

| Link | Description |
|------|---|
| LK1 | Determines if the USB interface is to be used If this link is inserted the USB interface will generate the signals required to control the AD537x If this link is removed the USB interface is not used and header J3 must be used to provide signals to the AD537x |
| LK3 | Selects Source of the $\overline{\text{RESET}}$ signal If this link is inserted the $\overline{\text{RESET}}$ signal comes from either the $\overline{\text{RESET}}$ push-button being pressed or a $\overline{\text{RESET}}$ signal being issued by the USB interface If this link is removed the $\overline{\text{RESET}}$ signal must come for the header J3 |
| LK4 | Selects the Reference Source If this link is in position A the 3V reference is selected If this link is in position B the 5V reference is selected If this link is in position C the voltage on SMB connector EXT_REF is selected |
| LK8 | Selects the Source of the $\overline{\text{CLR}}$ signal If this link is inserted the $\overline{\text{CLR}}$ signal comes from the USB interface If this link is removed the $\overline{\text{CLR}}$ signal must come for the header J3 |

USING THE USB SOFTWARE

The evaluation board kit comes supplied with a CD containing PC software allowing the user to control the evaluation board via the USB interface. The software **must** be installed before the evaluation board is connected to the USB port. The software installation program usually runs automatically when the CD is inserted in the drive but if this doesn't happen the user should double-click on the SETUP.EXE file in the root directory of the CD. The software will be installed and shortcuts will be placed on the Start Menu in a folder called Analog Devices. When the software has been installed the evaluation board can be connected to the USB port.

When the software is started the user is presented with a selection box. The selection box presents a choice of all the high channel count DACs in the AD536x and AD537x family. The user should click the button appropriate to the board being used.

The first tab in the main operating window, shown in Figure 6, allows the user to send data to the registers of any of the DACs. All the available channels are shown in the DAC selection section. When one of the radio buttons is selected the lower portion of the screen will show the values currently assigned to that DAC channel. The X1A, X1B, M or C registers can be updated simply by entering the desired code and clicking the X, M or C button. Note that when the X button is pressed the X1A or X1B register is updated according to the selection of the A/B radio button.

To update the DAC output the user should click the LDAC button.

The Input Code block allows the user to store several commonly used values and select between them as required.

The second tab of the tabbed dialog box also allows the user to change the contents of the Offset DACs. The values loaded to the Offset DACs will not affect the output voltages until $\overline{\text{LDAC}}$ is pulsed.

The third tab of the tabbed dialog box allows the user to assert or negate the $\overline{\text{RESET}}$, $\overline{\text{CLR}}$ and $\overline{\text{LDAC}}$. The user can also write 24 bits directly to the part. This can be useful, for example, to write to a group of channels using a single write operation. This function operates independently from the rest of the software so any changes made by a direct write will not be evident in the rest of the software. For example, if the direct write changes the X1 register of all channels to 0xFFFF the first tab in the main operating window will not be updated and will continue to show the previous values that were entered.

The fourth tab shows the expected output voltages based on the values of the X, M and C registers from the main operating window, the reference value and the Offset DAC value. These values are recalculated every time the tab is viewed.

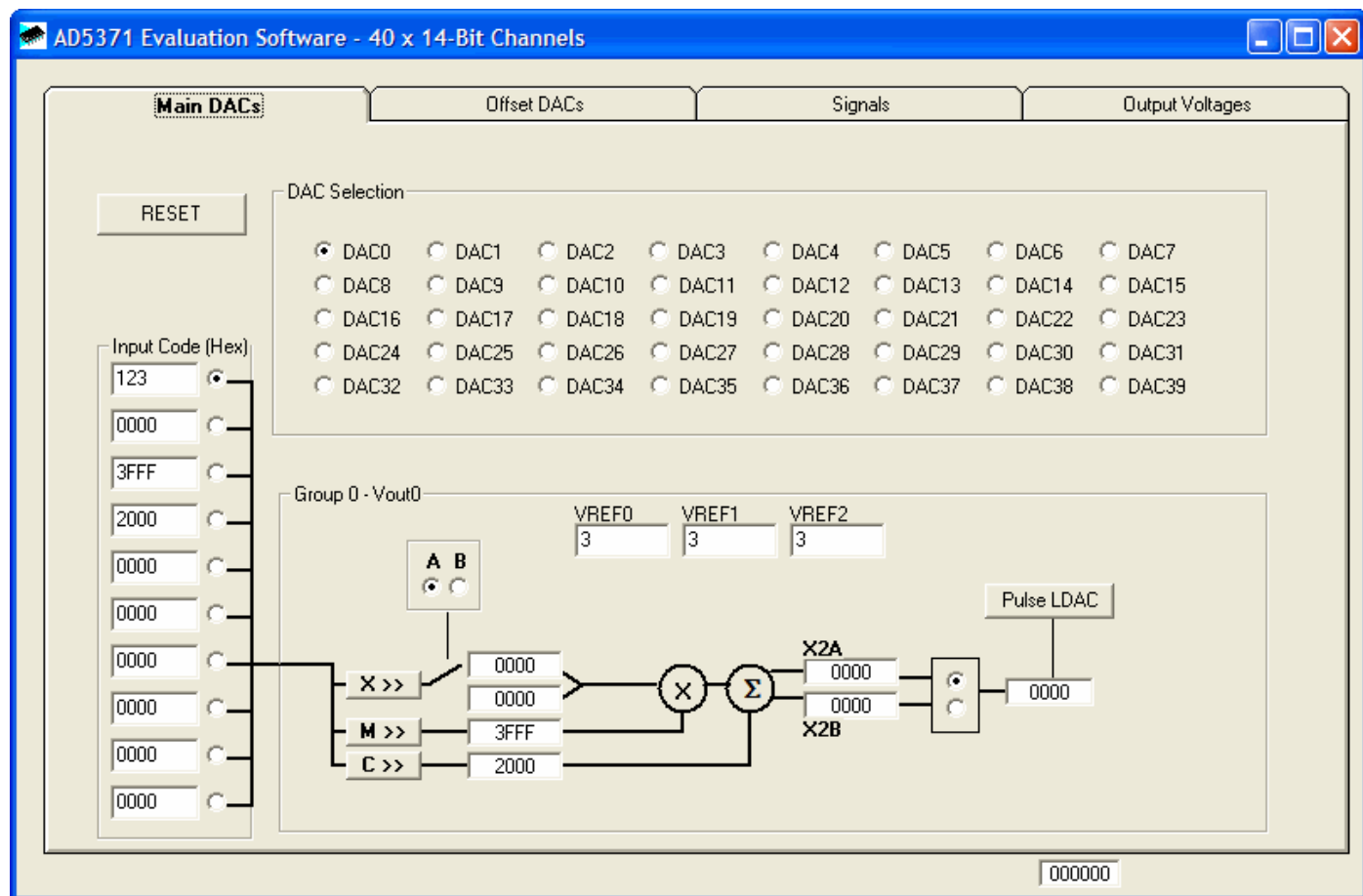


Figure 2. AD537x Tab 1 Software Screenshot

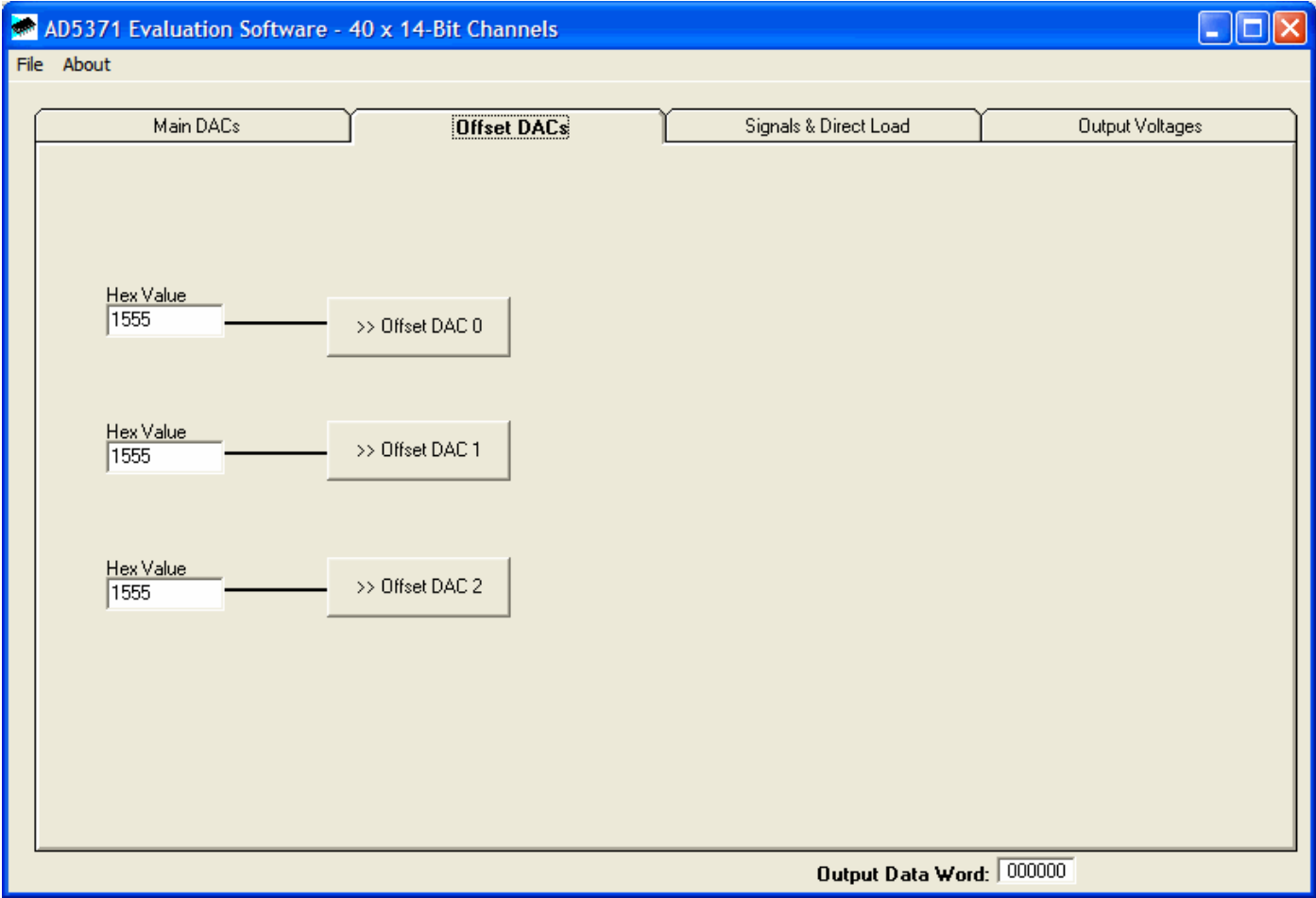


Figure 3. AD537x Tab 2 Software Screenshot

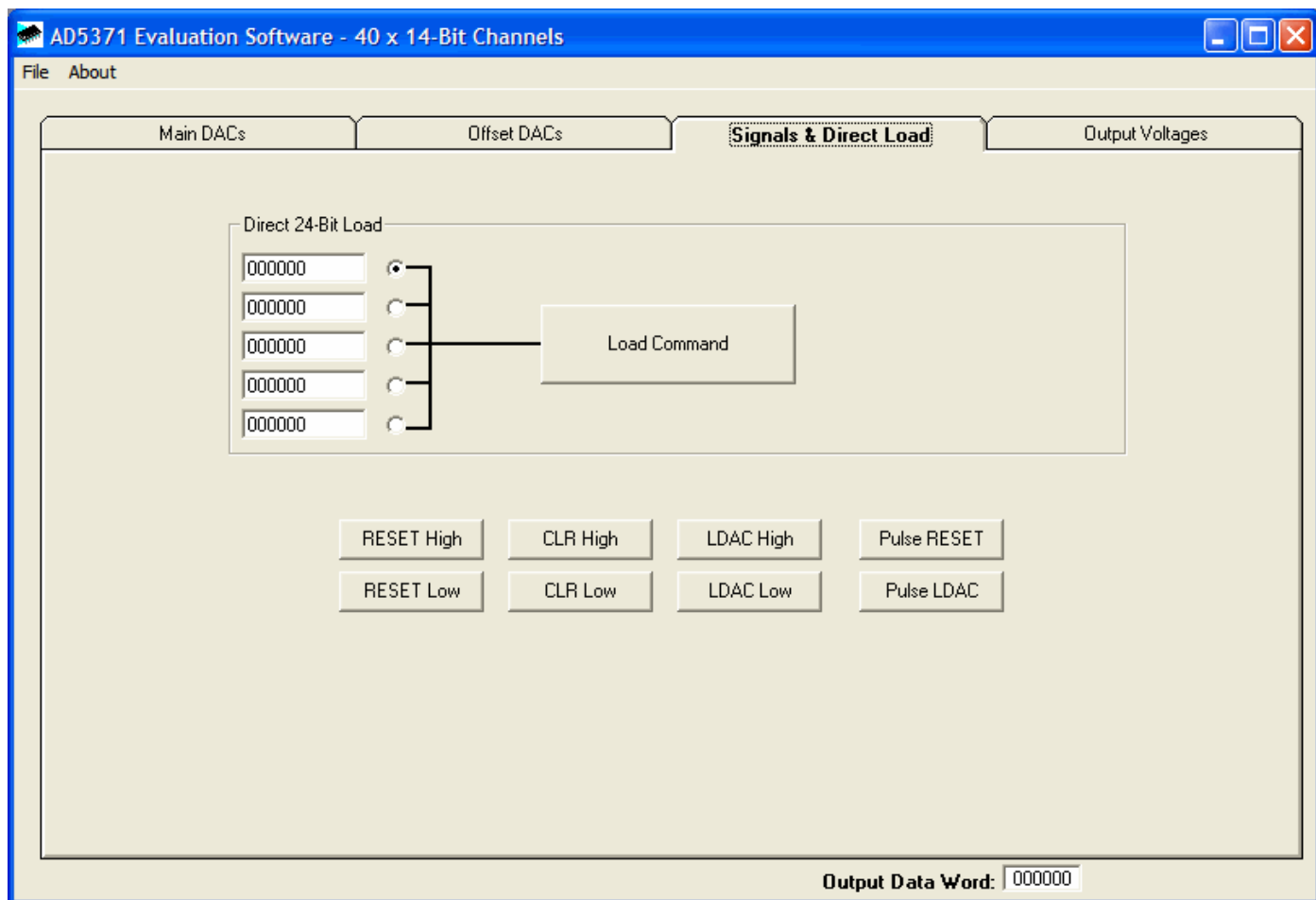


Figure 4. AD537x Tab 3 Software Screenshot

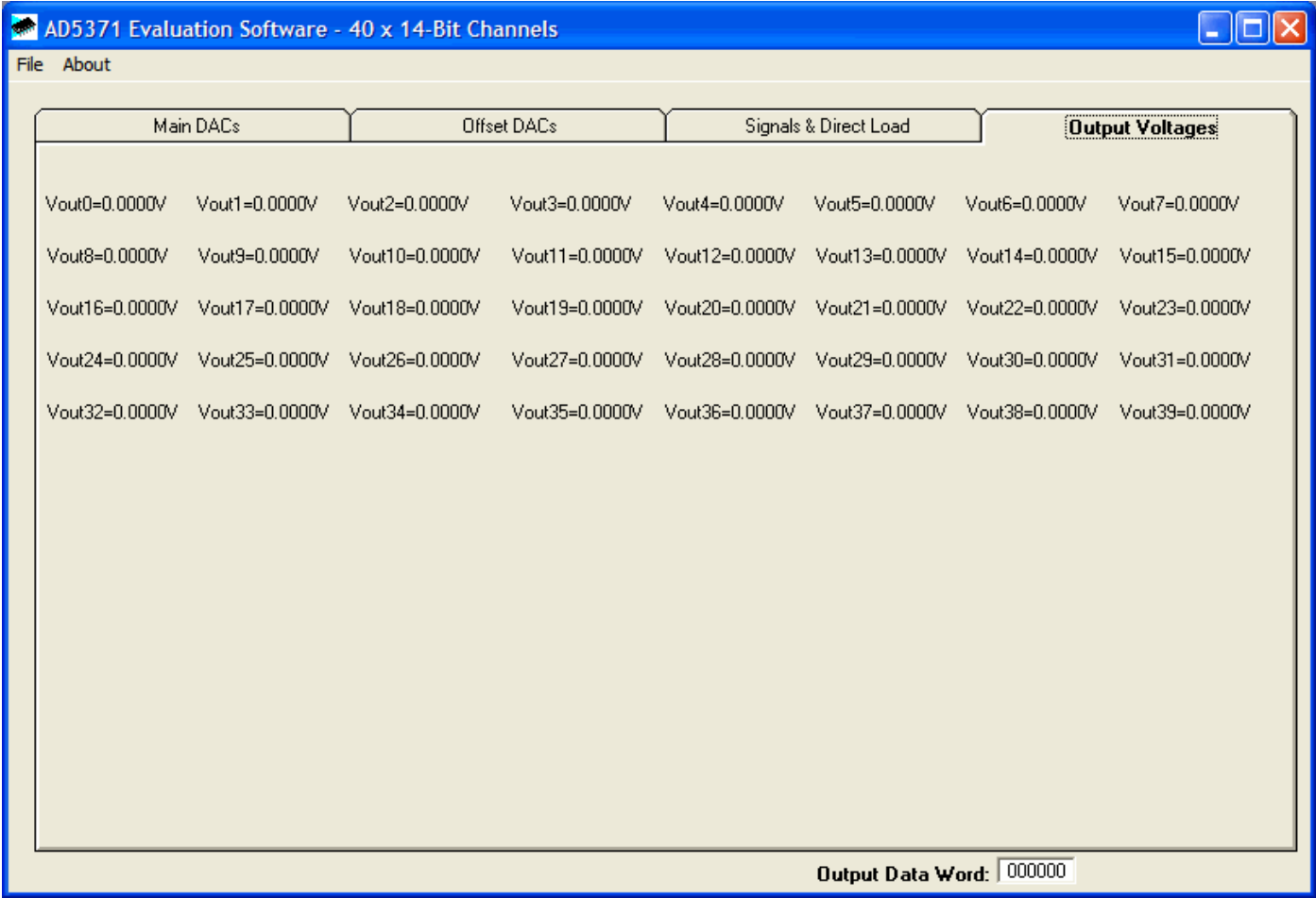


Figure 5. AD537x Tab 4 Software Screenshot

SCHEMATICS

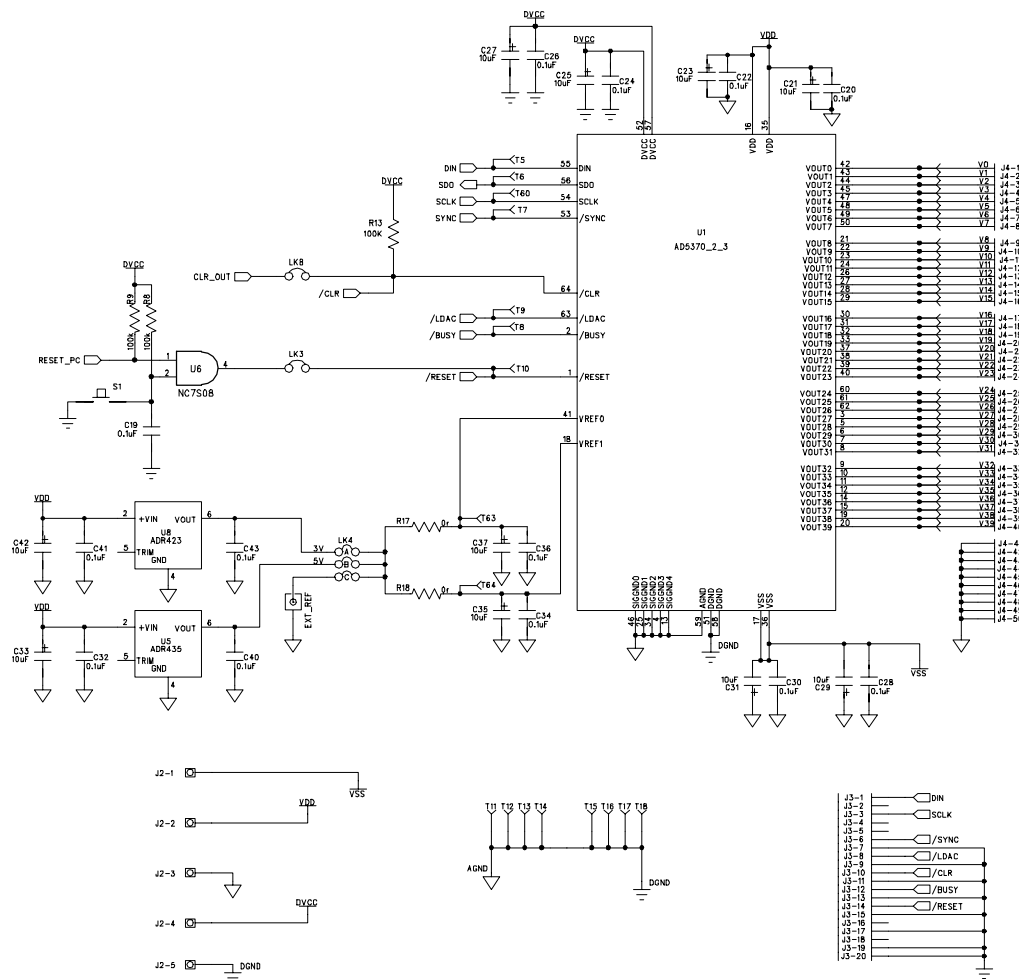


Figure 6. AD537x Schematic (1 of 2)

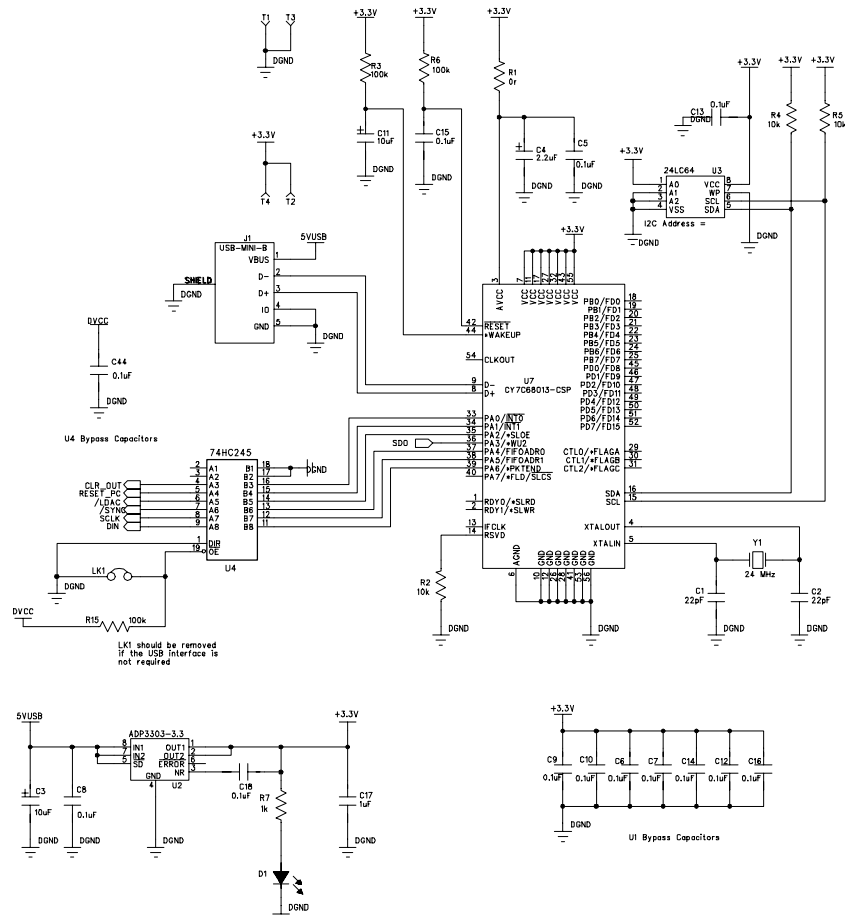
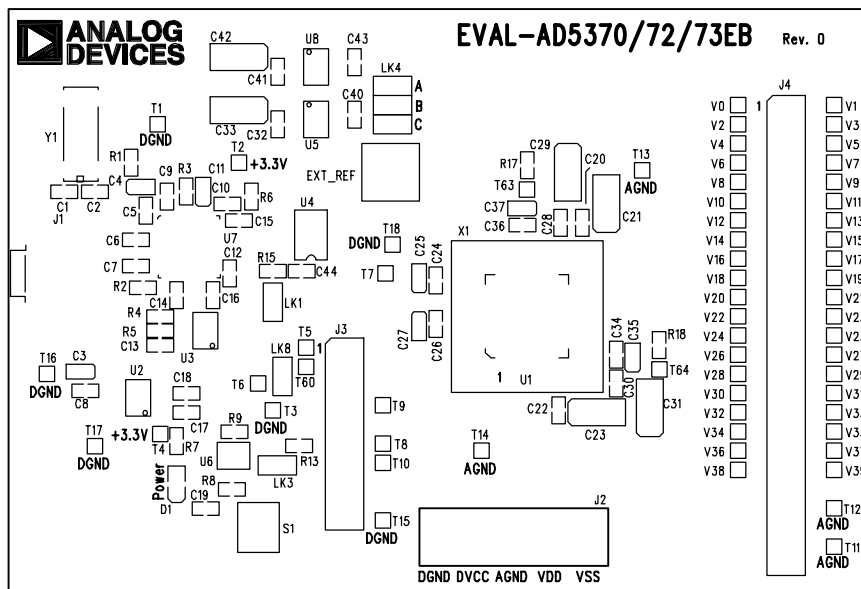


Figure 7. AD537x Schematic (2 of 2)



Eval-AD5370/72/73EB Rev. 0 (Component Side View)

Figure 8. AD537x Component Side Silkscreen

Table 5. Bill Of Materials

| Name | Part Type | Value | PCB Decal | Part Description | Stock Code ¹ |
|--|---------------|--------|---------------|--|---------------------------------------|
| U1 | AD5370/2/3 | | LQFP64 | Multichannel 16/14-Bit denseDAC | |
| U2 | ADP3303-3.3 | | SO8NB | Precision Low Dropout Voltage Regulator | ADP3303AR-3.3 |
| U8 | ADR423 | | SO8NB | 3V Reference | ADR423AR |
| U5 | ADR435 | | SO8NB | 5V Reference | ADR435AR |
| U3 | 24LC64 | | SO8NB | 64K I2C Serial EEPROM | Digikey 24LC64-I/SN-ND |
| U4 | 74HC245 | | TSSOP20 | Bus Transceiver | Digikey 296-8279-1-ND |
| U7 | CY7C68013-CSP | | LFCSP-56 | USB Microcontroller | CY7C68013-56LFC |
| J1 | USB-MINI-B | | USB-MINI-B | USB Mini-B Connector (usb-otg) | FEC 476-8309 (Digikey WM2499CT-ND) |
| J2 | CON\POWER5 | | CON\POWER5 | 5 Pin Termical Block | FEC 151-785 & 151-786 |
| J4 | HEADER50 | | HEADER50 | 50 Pin (2x25) 0.1" Pitch Header | FEC 148-535 |
| S1 | SW-PUSH | | SW_PB_SMD_6MM | Push Button Switch (sealed 6mm x 6mm) | FEC 177-807 |
| C3 | CAP+ | 10uF | CAP\TAJ_A | 10V SMD Tantalum Capacitor | FEC 197-130 |
| C21, C23, C29, C31, C33, C42 | CAP+ | 10uF | CAP\TAJ_C | 25V SMD Tantalum Capacitor | FEC 197-518 |
| C17 | CAP | 1uF | 0603 | 10V DC Y5V Ceramic Capacitor | FEC 318-8840 |
| D1 | LED | | LED-0805 | Green Light Emitting Diode | FEC 359-9681 |
| EXT_REF | SMB | | SMB | 50r Straight SMB Jack | FEC 365 1228 |
| | | | | | |
| C4 | CAP+ | 2.2uF | CAP\TAJ_A | 10V SMD Tantalum Capacitor | FEC 498-646 |
| LK1, LK3, LK8 | JUMPER | | SIP-2P | 2 Pin (0.1" Pitch) Header & Shorting Shunt | FEC 511-705 & 150-411 |
| LK4 | JUMPER-3 | | JUMPER_3 | 6 Pin (3x2) 0.1" Header & Shorting Block | FEC 511-780 & 150-411 |
| J3 | HEADER20 | | HEADER20 | 20 Pin (2x10) 0.1" Pitch Header | FEC 511-833 |
| Y1 | XTAL-CM309S | 24 MHz | XTAL_CM309S | Plastic SMD Crystal | FEC 569-872 |
| U6 | NC7S08 | | SOT23-5 | Tinylogic AND Gate | FEC 685-926 |
| C1, C2 | CAP | 22pF | 0603 | 50V NPO SMD Ceramic Capacitor | FEC 722-005 |
| R1, R17, R18 | RES | 0R | 0603 | SMD Resistor | FEC 772-227 |
| T1, T3, T11, T12, T13, T14, T15, T16, T17, T18 | TESTPOINT | | TESTPOINT | Black Testpoint | FEC 873-1128 |
| T2, T4, T5, T6, T7, T8, T9, T10, T60, T63, T64 | TESTPOINT | | TESTPOINT | Red Testpoint | FEC 873-1144 |
| V0-V39 | TESTPOINT | | TESTPOINT | Red Testpoint | FEC 873-1144 |

| Name | Part Type | Value | PCB Decal | Part Description | Stock Code ¹ |
|--|-----------|-------|-----------|--------------------------------------|-------------------------|
| C5, C6, C7, C8, C9, C10, C12, C13, C14, C15, C16, C18, C19, C20, C22, C24, C26, C28, C30, C32, C34, C36, C40, C41, C43, C44 | CAP | 0.1uF | 0603 | 50V X7R Multilayer Ceramic Capacitor | FEC 882-0023 |
| R7 | RES | 1k | 0603 | SMD Resistor | FEC 911-239 |
| R2, R4, R5 | RES | 10k | 0603 | SMD Resistor | FEC 911-355 |
| R3, R6, R8, R9, R13, R15 | RES | 100k | 0603 | SMD Resistor | FEC 911-471 |

¹FEC refers to Farnell In One (www.farnell.com). Digi-Key refers to Digi-Key Corporation (www.digikey.com)

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