Evaluation Board for
AD5371

EVAL-AD5371EBZ

FEATURES

Full-Featured Evaluation Board for the AD5371
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 AD5371 Evaluation Board. This note should be used in conjunction with the AD5371 data sheet. The evaluation board allows the functionality and performance of the AD5371 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 AD5371. Control of the AD5371 is achieved via a USB interface
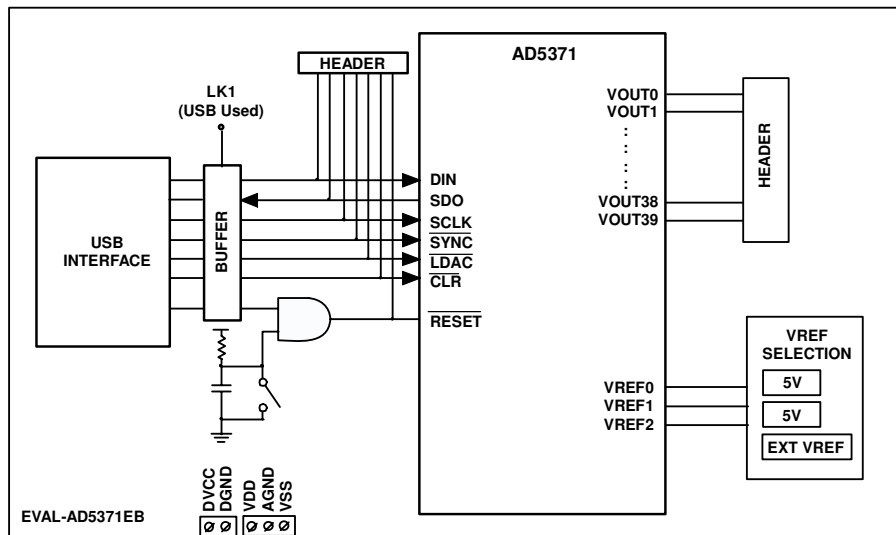
FUNCTIONAL BLOCK DIAGRAM

Figure 1. Functional Block Diagram

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GENERAL DESCRIPTION

FUNCTIONALITY OVERVIEW

The evaluation board for the AD5371 is designed to allow the user to fully evaluate all the functions and performance of the AD5371 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 AD5371 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 AD5371 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 AD5371 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 AD5371 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 AD5371, VREF0, VREF1 and VREF2, all 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	R16	T62
VREF1	R17	T63
VREF2	R18	T64

USING THE USB INTERFACE

The software provided with the evaluation board kit allows the user to program the registers of the AD5371 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, $\overline{RESET}$, $\overline{CLR}$, $\overline{SYNC}$, SCLK etc. to control the AD5371. To use the interface LK1, LK3 and LK8 should be in place. The function of these links is described in Table 4. LK2 should be in position A to select the SPI interface which is required for USB operation.

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 AD5371 to their own DSP or micro-controller thus allowing them to write code to operate the AD5371 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 $\overline{CLR}$, $\overline{LDAC}$, $\overline{SYNC}$, SCLK and DIN. LK3 should be removed to isolate the $\overline{RESET}$ pin from the USB interface and the push-button. The interface signals required to control the AD5371 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	$\overline{LDAC}$
2	$\overline{DIN}$	10	$\overline{CLR}$
3	SCLK	12	$\overline{BUSY}$
4	$\overline{SCLK}$	14	$\overline{RESET}$
5	SYNC	16	TEST_IP[1]
6	$\overline{SYNC}$	18	TEST_OP[1]
7,9,11,13, 15,17,19,20	DGND		

[1]These are test pins and should not be used

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 AD5371 If this link is removed the USB interface is not used and header J3 must be used to provde signals to the AD5371
LK2	Selects whether the SPI or LVDS interface mode is to be used If this link is in position A the SPI inter face mode is selected If this link is in position B the LVDS interface mode is selected
LK3	Selects Source of the $\overline{RESET}$ signal If this link is inserted the $\overline{RESET}$ signal comes from either the $\overline{RESET}$ push-button being pressed or a $\overline{RESET}$ signal being issued by the USB interface If this link is removed the $\overline{RESET}$ 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 $\overline{CLR}$ signal If this link is inserted the $\overline{CLR}$ signal comes from the USB interface If this link is removed the $\overline{CLR}$ 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 $\overline{LDAC}$ is pulsed.

The third tab of the tabbed dialog box allows the user to assert or negate the $\overline{RESET}$ and $\overline{CLR}$ and $\overline{LDAC}$. 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.
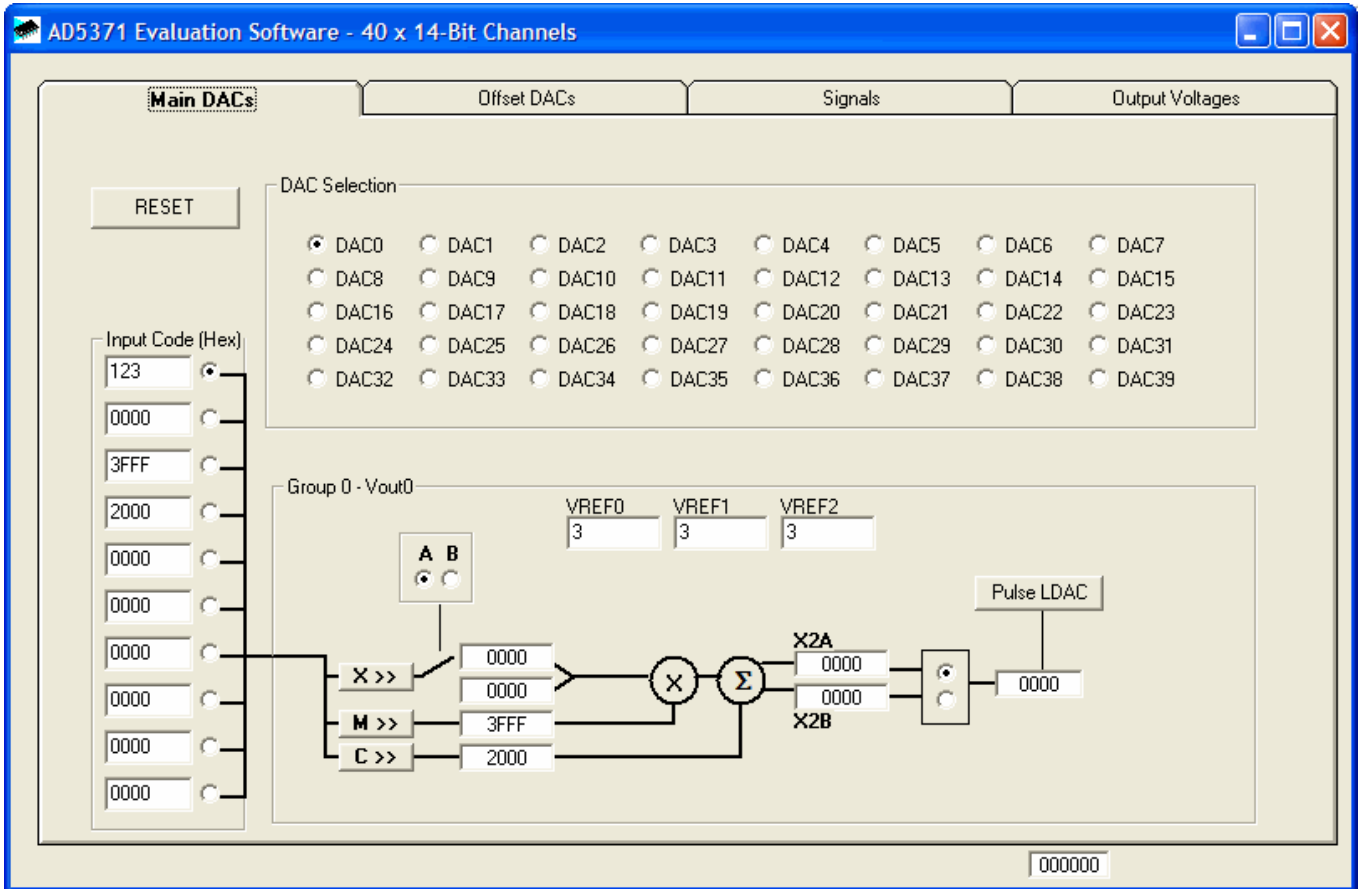
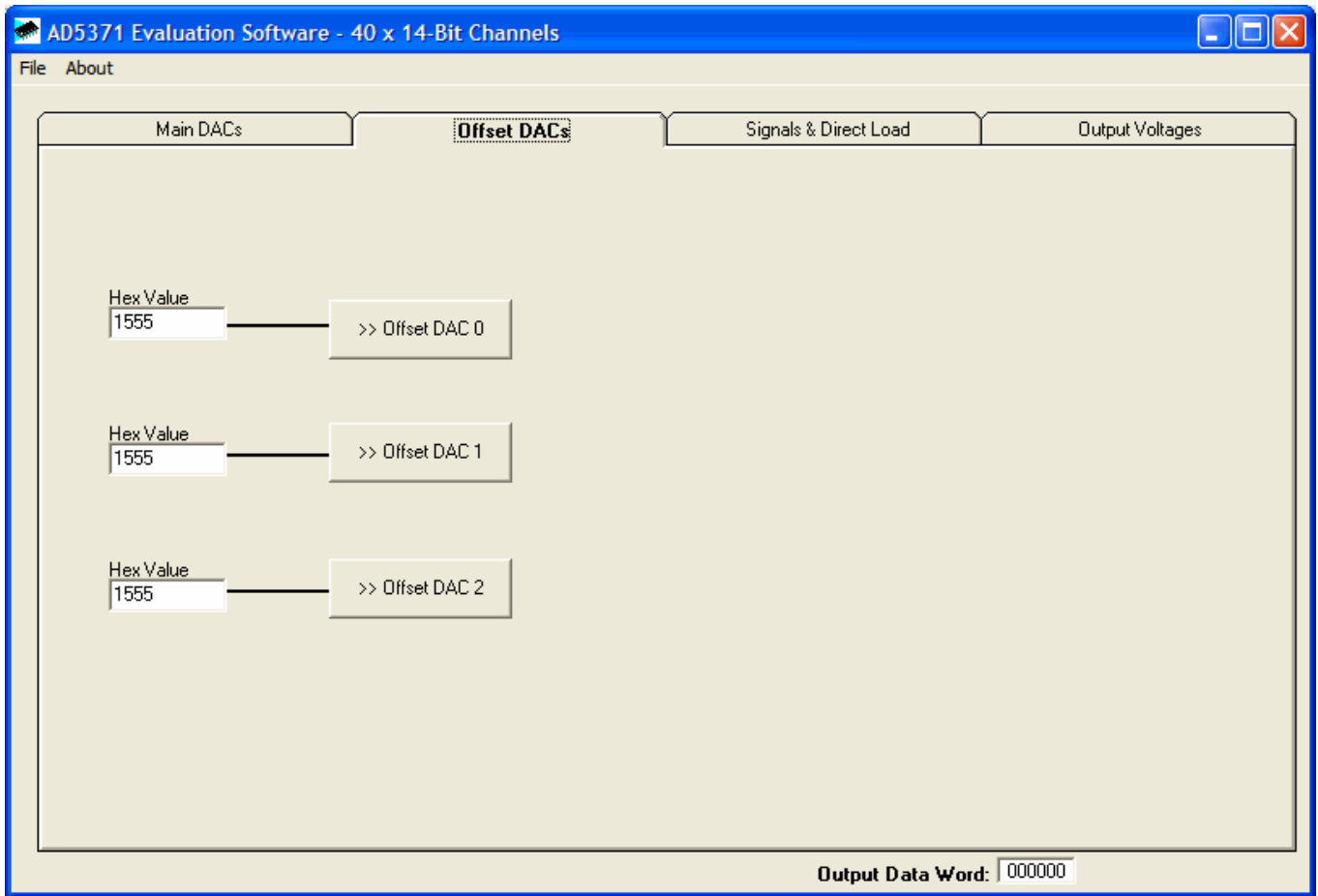*Figure 2. AD5371 Tab 1 Software Screenshot*
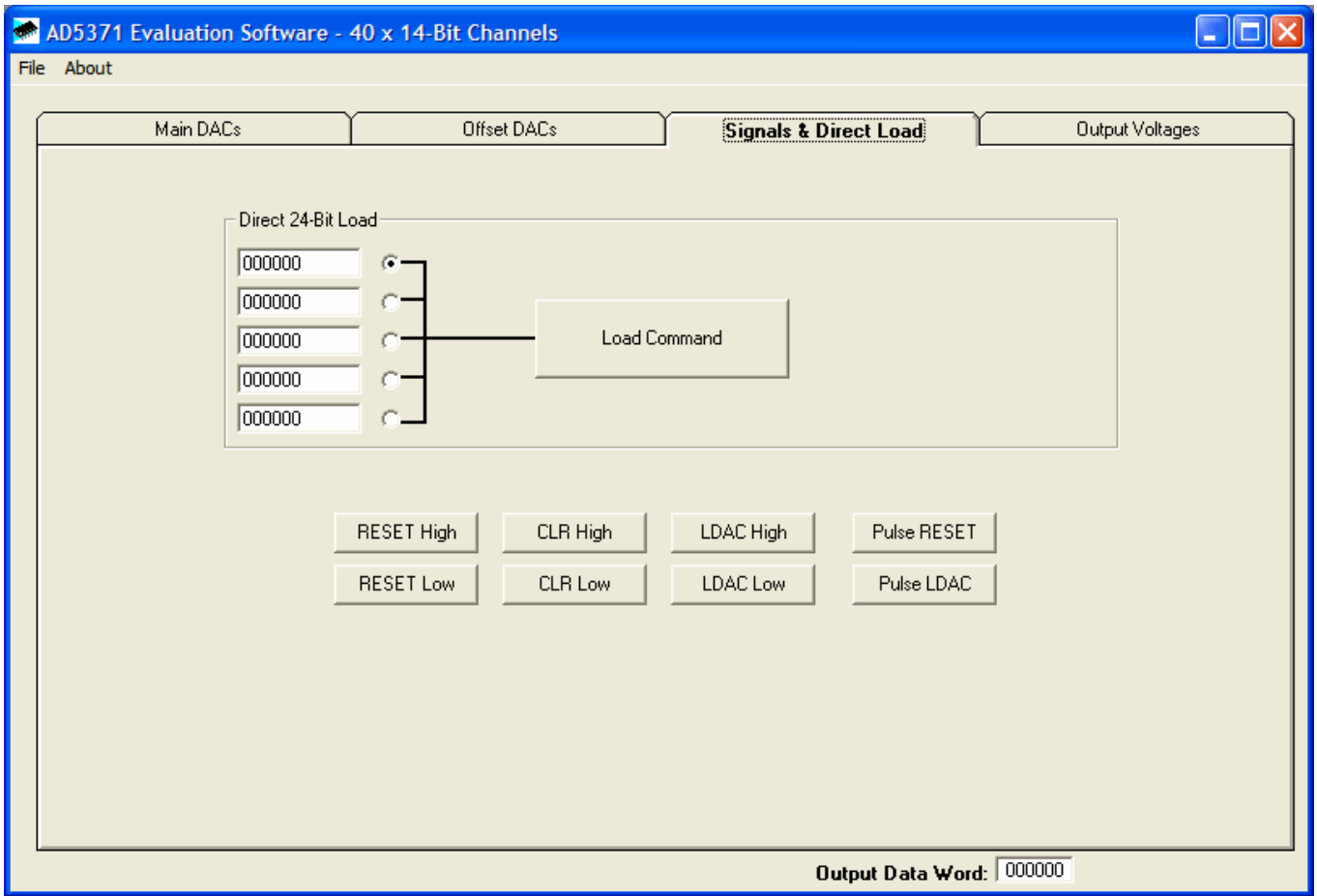
Figure 3. AD5371 Tab 2 Software Screenshot

Figure 4. AD5371 Tab 3 Software Screenshot

AD5371 Evaluation Software - 40 x 14-Bit Channels

File   About

| Main DACs | Offset DACs | Signals & Direct Load | Output Voltages |

Vout0=0.0000V Vout1=0.0000V Vout2=0.0000V Vout3=0.0000V Vout4=0.0000V Vout5=0.0000V Vout6=0.0000V Vout7=0.0000V

Vout8=0.0000V Vout9=0.0000V Vout10=0.0000V Vout11=0.0000V Vout12=0.0000V Vout13=0.0000V Vout14=0.0000V Vout15=0.0000V

Vout16=0.0000V Vout17=0.0000V Vout18=0.0000V Vout19=0.0000V Vout20=0.0000V Vout21=0.0000V Vout22=0.0000V Vout23=0.0000V

Vout24=0.0000V Vout25=0.0000V Vout26=0.0000V Vout27=0.0000V Vout28=0.0000V Vout29=0.0000V Vout30=0.0000V Vout31=0.0000V

Vout32=0.0000V Vout33=0.0000V Vout34=0.0000V Vout35=0.0000V Vout36=0.0000V Vout37=0.0000V Vout38=0.0000V Vout39=0.0000V

Output Data Word: 000000

Figure 5. AD5371 Tab 4 Software Screenshot
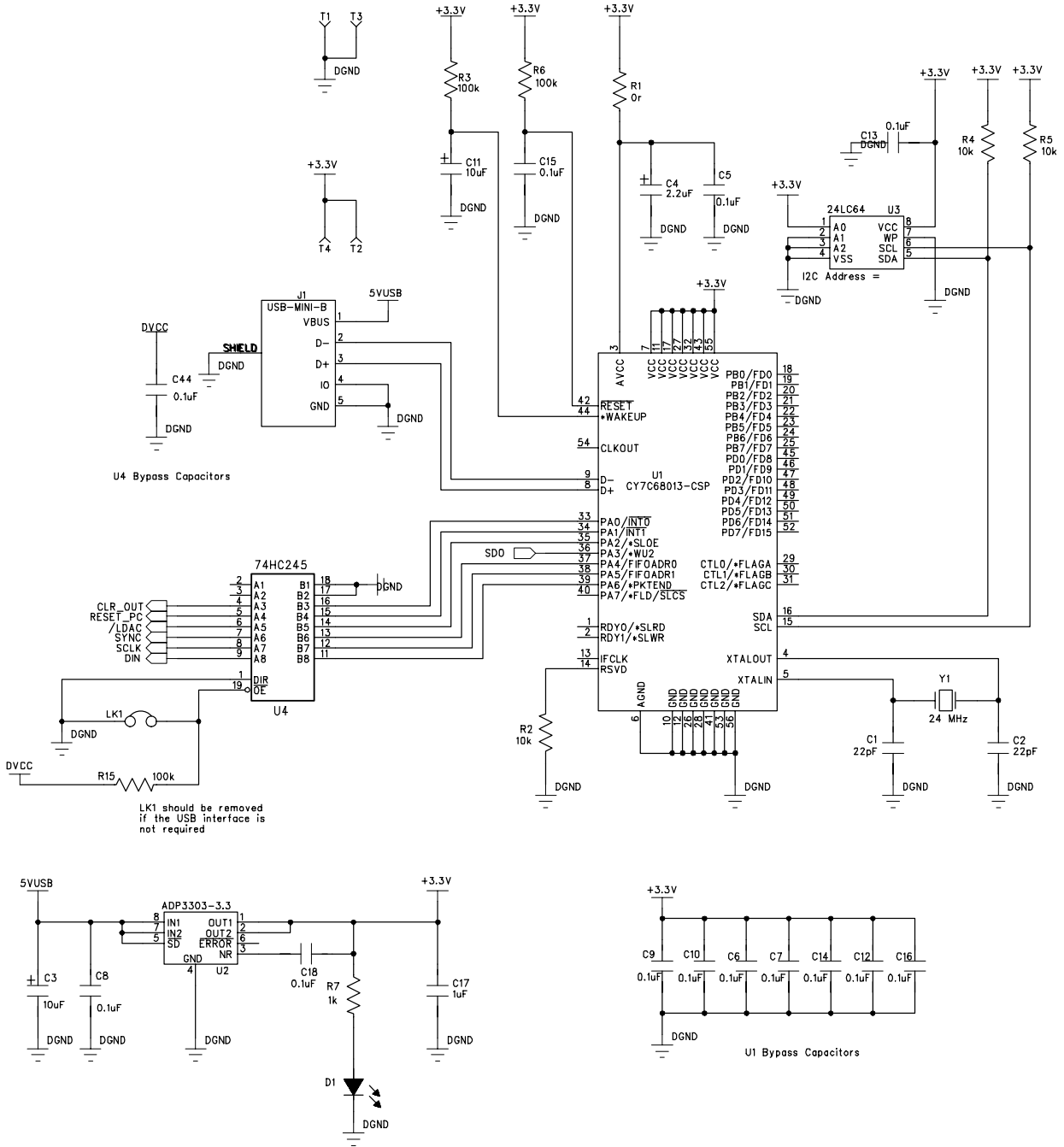
SCHEMATICS

Figure 6. AD5371 Schematic (1 of 2)

Figure 7. AD5371 Schematic (2 of 2)

Table 5. Bill Of Materials

Reference	Description	Value	PCB Decal	Part Description	Stock Code[1]
U7	AD5371		LQFP80-	40 Channel 14-Bit DAC	AD5371BST
U2	ADP3303-3.3		SO8NB	Precision Low Dropout Voltage Regulator	ADP3303AR-3.3
U8	ADR423		SO8NB	5V Reference	ADR423AR
U5	ADR435		SO8NB	5V Reference	ADR435AR
U3	24LC64		SO8NB	64K I2C Serial EEPROM	Digikey 24LC64-I/SN-ND
U4	74HC245		TSSOP20	Bus Transciever	Digikey 296-8279-1-ND
U1	CY7C68013-CSP		LFCSP-56	USB Microcontroller	CY7C68013-56LFC
J4	HEADER50		HEADER50	50 Pin (2x25) 0.1" Pitch Header	FEC 148-535
J2	CON\POWER5		CON\POWER5	5 Pin Termical Block	FEC 151-785 & 151-786
S1	SW-PUSH		SW_PB_SMD_6MM	Push Button Switch (sealed 6mm x 6mm)	FEC 177-807
C3, C11, C25, C27, C35, C37,C39	CAP+	10µF	CAP\TAJ_A	10V SMD Tantalum Capacitor	FEC 197-130
C21, C23, C29, C31, C33, C42	CAP+	10µF	CAP\TAJ_C	25V SMD Tantalum Capacitor	FEC 197-518
C17	CAP	1µF	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
J1	USB-MINI-B		USB-MINI-B	USB Mini-B Connector (usb-otg)	Digikey WM2499CT-ND
C4	CAP+	2.2µF	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
LK2	JUMPER2\SIP3		LINK-3P	3 Pin (0.1" Pitch) Header & Shorting Shunt	FEC 511-717 & 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, R16, R17, R18	RES	0Ω	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, T61, T62, T63, T64	TESTPOINT		TESTPOINT	Red Testpoint	FEC 873-1144
V0 to V39	TESTPOINT		TESTPOINT	Red Testpoint	FEC 873-1144

Reference	Description	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, C38, C40, C41, C43, C44	CAP	0.1uF	0603	50V X7R Multilayer Ceramic Capacitor	FEC 882-0023
R10, R11, R12	RES	100Ω	0603	SMD Resistor	FEC 911-112
R7	RES	1kΩ	0603	SMD Resistor	FEC 911-239
R2, R4, R5	RES	10kΩ	0603	SMD Resistor	FEC 911-355
R3, R6, R8, R9, R13, R14, R15	RES	100kΩ	0603	SMD Resistor	FEC 911-471

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