Evaluation Board for
AD5380/AD5381/AD5382/AD5383
EVAL-AD5380/1/2/3EBZ

Preliminary Technical Data

FEATURES

**Full-Featured Evaluation Board for the
AD5380/AD5381/AD5382/AD5383
USB interface
PC software for register programming
On board reference
Stand-alone operation**

INTRODUCTION

This Technical Note describes the operation and functionality of the Evaluation Board for the AD5380, AD5381, AD5382 and AD5383. As these 3 parts are pin compatible the same evaluation board is used for all. AD538x 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 AD538x 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 AD538x. Control of the AD538x is achieved via a USB interface
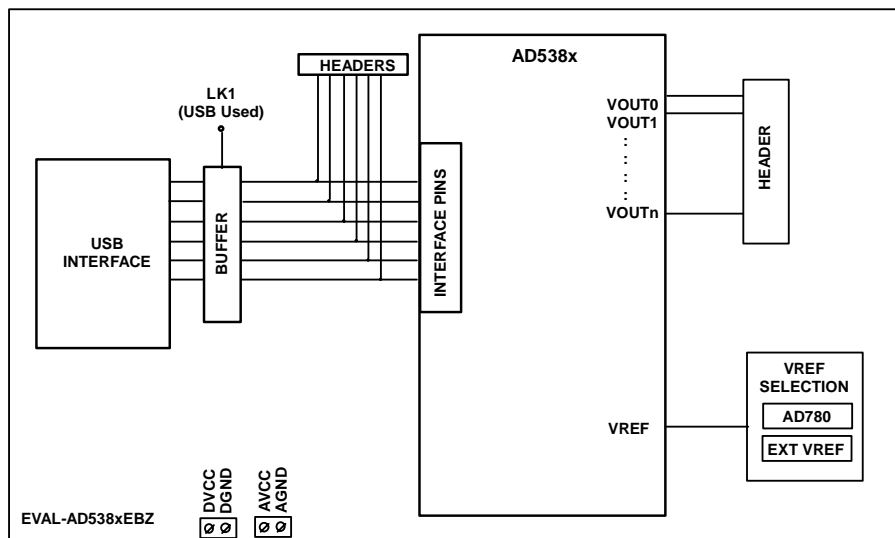
FUNCTIONAL BLOCK DIAGRAM

Figure 1. Functional Block Diagram

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FUNCTIONALITY OVERVIEW

The evaluation board for the AD538x is designed to allow the user to fully evaluate all the functions and performance of the AD538x 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 7 pin header J10, the 28 pin header J2 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 AD538x with ease. The software operation is described later in this document.

POWER SUPPLIES

The evaluation board requires a +5V supply for DV_{CC}. and AV_{CC}. Power supply connections are made to the banana sockets J12 to J15. Alternatively, the board can be powered by the USB interface.

REFERENCE SELECTION

The evaluation board includes a voltage reference IC, the ADR780 which is a 2.5 V reference. 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 AD538x as shown in Table 1.

Table 1. Reference Selection using LK4

LK4 Position	Description
A	The voltage on the SMB, EXT_REF is used as the reference voltage
B	The reference voltage is 2.5V

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 AD538x to their own DSP or micro-controller thus allowing them to write code to operate the AD538x 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 LK5, which will three-state the connections to $\overline{RESET}$, $\overline{CLR}$, $\overline{LDAC}$, $\overline{SYNC}$, SCLK and DIN. The interface signals required to control the AD538x can then be provided through the 7 pin header J10 or the 28 pin header J2. The pinout of J2 is shown in Table 2 and the pinout of J10 is shown in Table 3.

Table 2. J2 Header Pinout

Pin	Signal	Pin	Signal
1	$\overline{SYNC}$	15	DB7
2	$\overline{WR}$	16	DB6
3	DIN/SDA	17	DB5
4	SCLK/SCL	18	DB4
5	DB11	19	DB3
6	DB10	20	DB2
7	DB8	21	DB1
8	DB8	22	DB0
9	A5	23	REG0
10	A4	24	REG1
11	A3	25	NC
12	A2	26	NC
13	A1	27	$\overline{BUSY}$
14	A0	28	$\overline{LDAC}$

Table 3. J10 Header Pinout

Pin	Signal	Pin	Signal
1	$\overline{LDAC}$	5	$\overline{SYNC}$
2	SCLK/SCL	6	$\overline{BUSY}$
3	DIN/SDA	7	DGND
4	SDOUT		

USING THE USB INTERFACE

The software provided with the evaluation board kit allows the user to program the registers of the AD538x 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 AD538x. To use the interface LK5 should be in place. LK1 to LK3 and S2 should be removed. The function of these links is described in.

Table 4. Default link positions for USB operation

Pin	Position	Pin	Position
LK1	Removed	S1	L
LK2	Removed	S2	Removed
LK3	Removed	S3	L
LK4	B	S4	L
LK5	IN	S5	H
		S6	L

Table 5. Summary of Link Positions

Link	Description
LK1	Selects Source of the $\overline{RESET}$ signal. LK1 should be removed when using the USB interface. When this link is inserted the $\overline{RESET}$ signal is connected to DGND and the AD538x is held in reset. When this link is removed the $\overline{RESET}$ signal can be issued by the USB interface. If the USB interface is not being used (LK5 removed) $\overline{RESET}$ is pulled high via R2.
LK2	Selects the Source of the $\overline{CLR}$ signal. LK2 should be removed when using the USB interface When LK2 is inserted the $\overline{CLR}$ signal is connected to DGND and the AD538x outputs are held in a clear state. When LK2 is removed the $\overline{CLR}$ signal can be issued by the USB interface. If the USB interface is not being used (LK5 removed) $\overline{CLR}$ is pulled high via R1.
LK3	Selects Source of the $\overline{LDAC}$ signal. LK3 should be removed when using the USB interface. When LK3 is inserted the $\overline{LDAC}$ signal is connected to DGND. When LK3 is removed the $\overline{LDAC}$ signal can be issued by the USB interface. If the USB interface is not being used (LK5 removed) $\overline{LDAC}$ is pulled high via R3.
LK4	Selects the Reference Source When LK4 is in position A the voltage on SMB connector EXT_REF is selected. When LK4 is in position B the 5V reference is selected
LK5	Determines if the USB interface is to be used When LK5 is inserted the USB interface will generate the signals required to control the AD538x When LK5 is removed the USB interface is not used and header J2 or J10 must be used to provde signals to the AD538x
S1	Determines if the SPI or I²C interface is to be used. S1 is a dual function link and is dependant on the position of S5. If the parallel interface is used (S5 is low) this link should be removed. When S1 is in the L position the SPI interface is selected. When S1 is in the H position the I²C interface is selected.
S2	In I²C mode S2 selects the state of the address bit AD0. Position H sets AD0 to 1. Position L sets AD0 to 0.
S3	In I²C mode S3 selects the state of the address bit AD1. Position H sets AD1 to 1. Position L sets AD1 to 0.
S4	FIFO enable. When S4 is in position H the FIFO is enabled. When S4 is in position L the FIFO is disabled.
S5	S5 selects either the serial or parallel interface. When S5 is in position H the serial mode is selected. When S5 is in position L the parallel mode is selected.
S6	S6 selects the power status of the AD538x. When S6 is in position H the AD538x is powered down. When S6 is in position L the AD538x is powered up.

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 devices in the AD538x family. The user should click the button appropriate to the board being used.

The first tab in the main operating window, shown in Figure 5, 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, 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 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 Control register.

The third tab of the tabbed dialog box allows the user to assert or negate the $\overline{RESET}$, $\overline{CLR}$ and $\overline{LDAC}$. The user can also write the value to be used for the soft clear function.
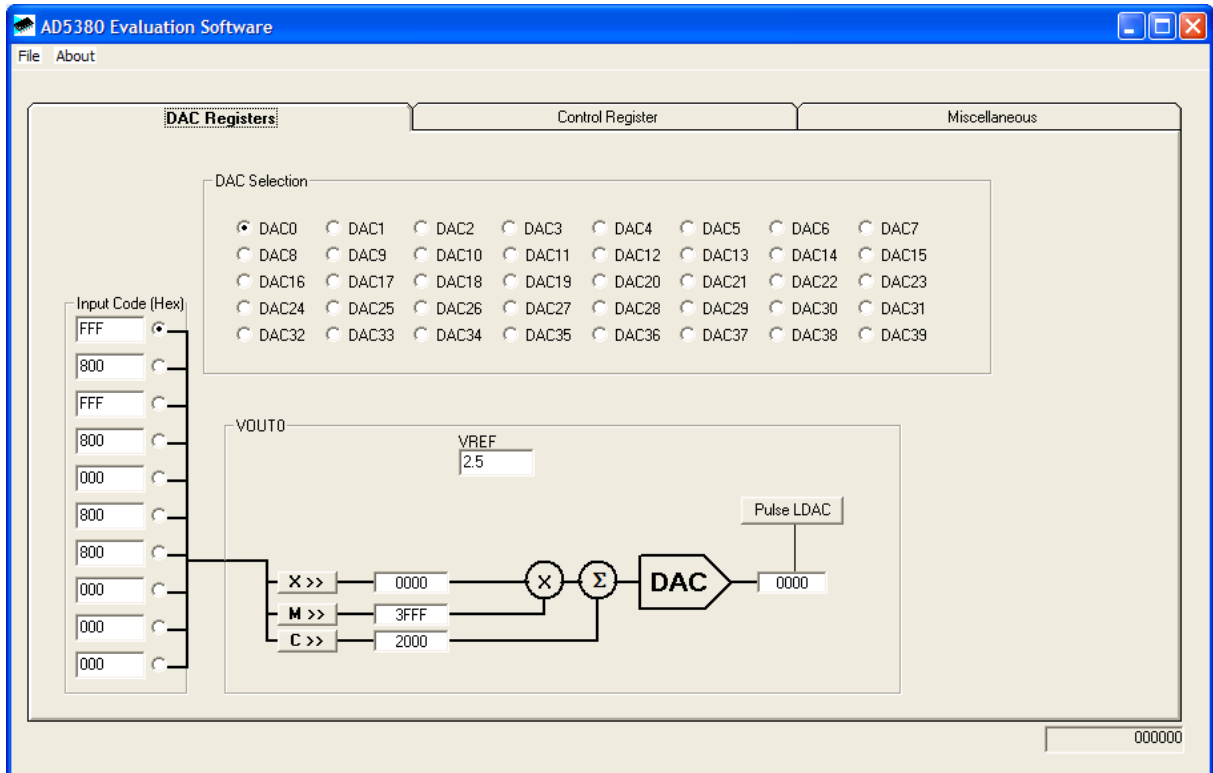
Figure 2. AD538x Tab 1 Software Screenshot
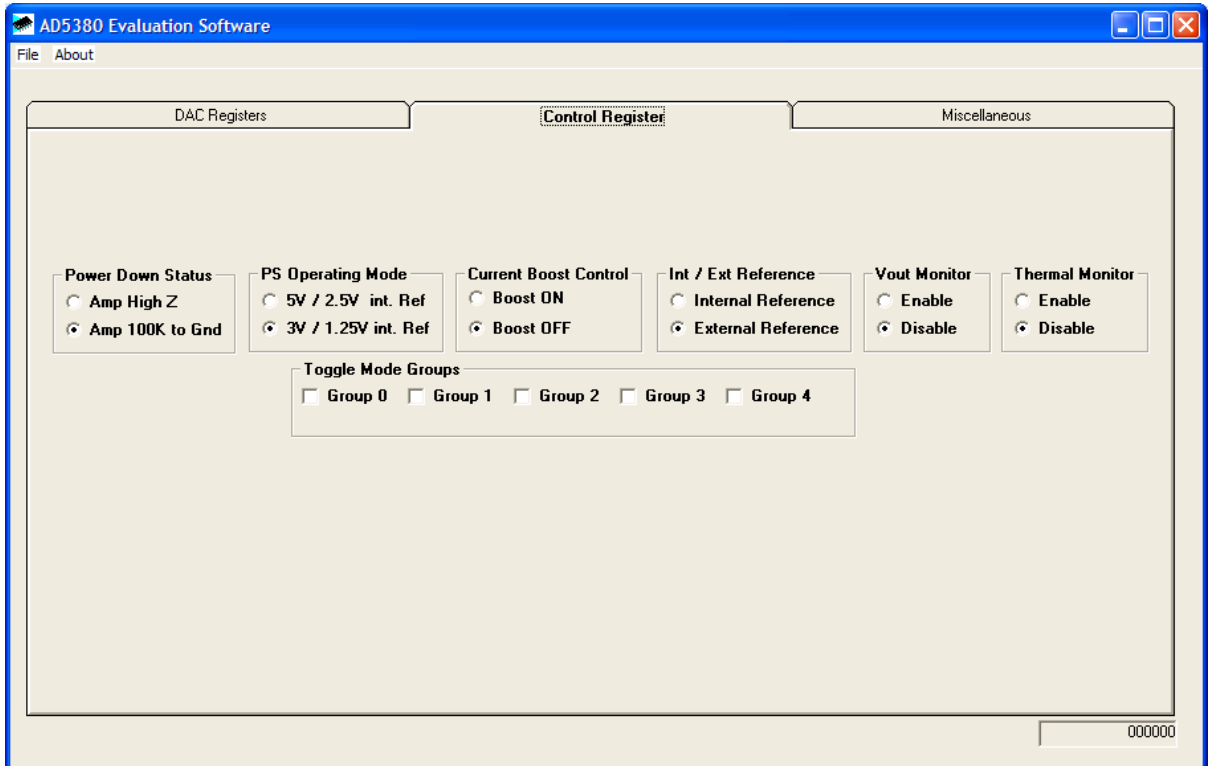
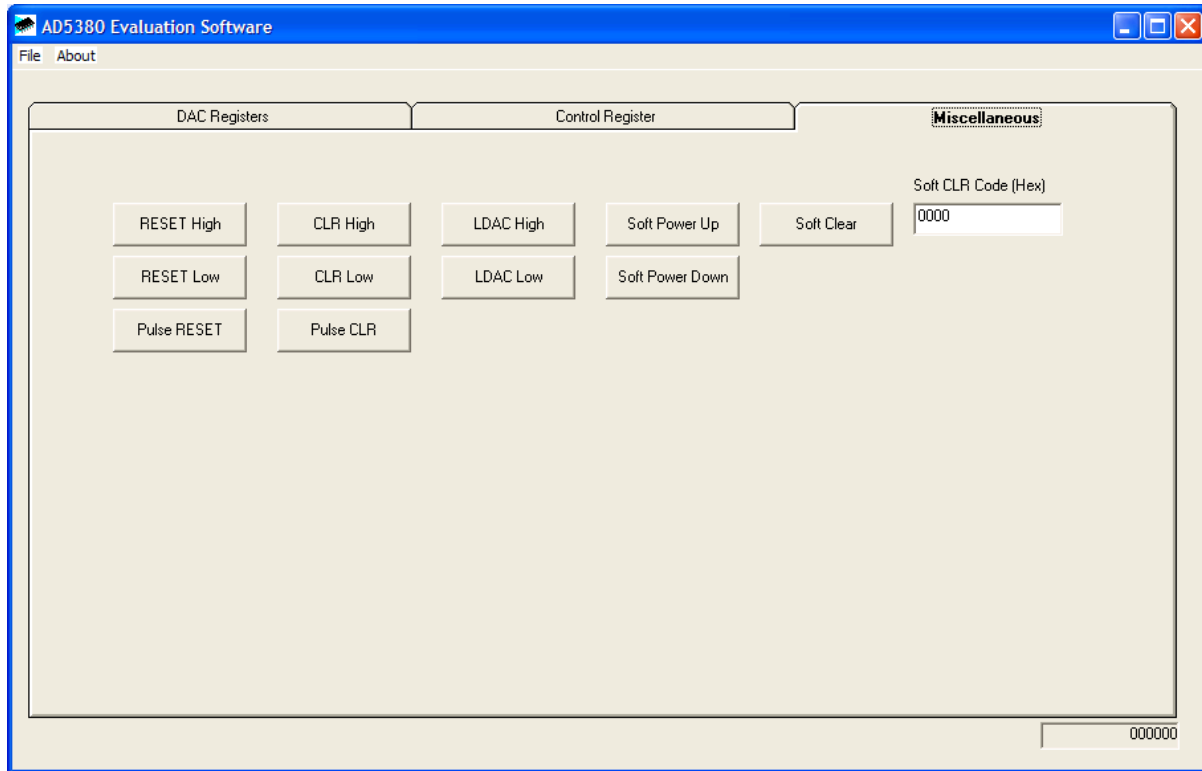

Figure 3. AD538x Tab 2 Software Screenshot
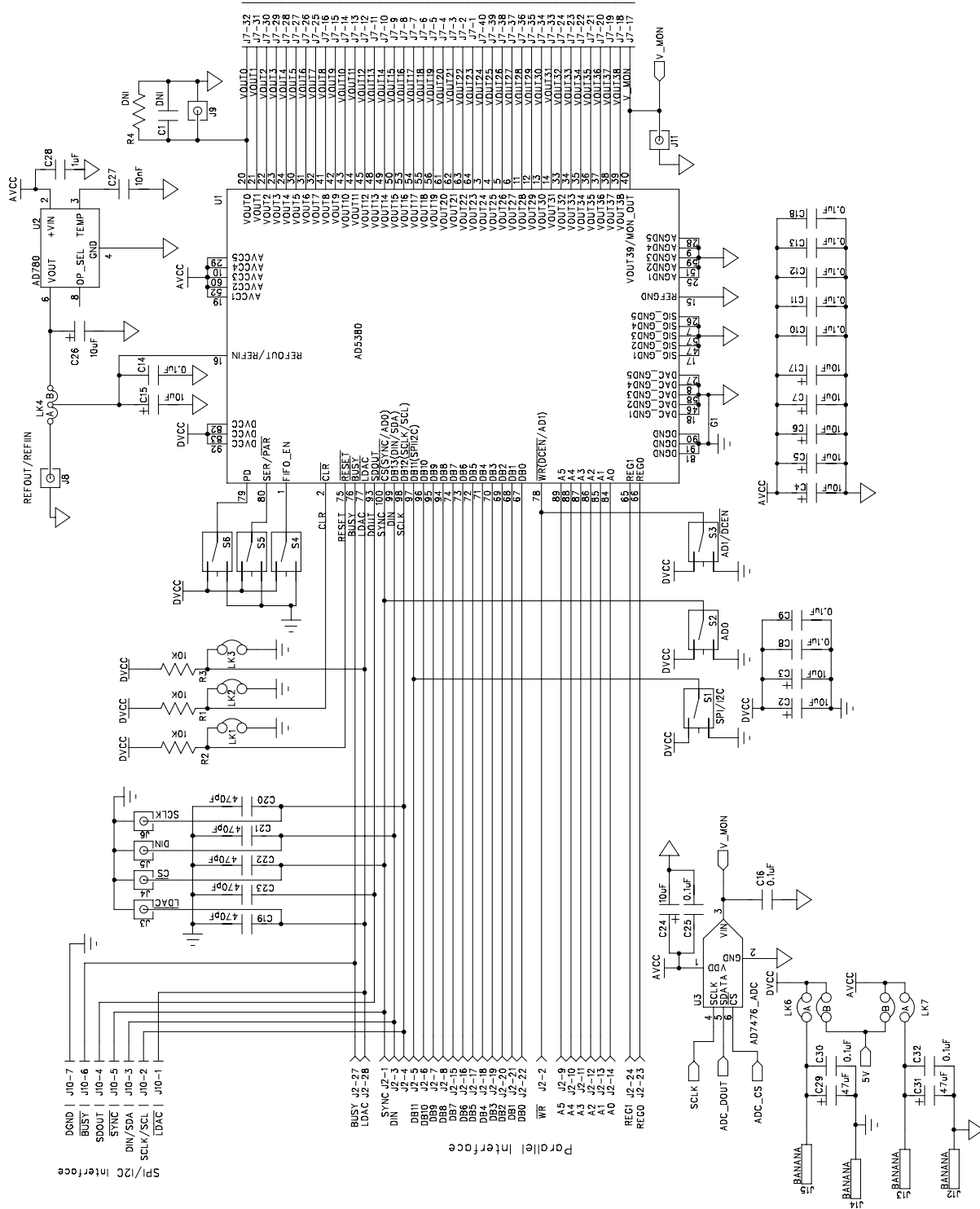
Figure 4. AD538x Tab 3 Software Screenshot

SCHEMATICS

Figure 5. AD538x Schematic (1 of 2)

Figure 6. AD538x Schematic (2 of 2)

Table 6. Bill Of Materials

Name	Part Type	Value	PCB Decal	Part Description	Stock Code[1]
C7	CAP+	10uF	CAP\TAJ_A	CAPACITOR, CASE A 10UF 10V	FEC 9751041
C8	CAP	0.1uF	0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C9	CAP	0.1uF	0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C10	CAP	0.1uF	0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C11	CAP	0.1uF	0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C12	CAP	0.1uF	0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C13	CAP	0.1uF	0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C14	CAP	0.1uF	0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C15	CAP+	10uF	CAP\TAJ_A	CAPACITOR, CASE A 10UF 10V	FEC 9751041
C16	CAP	0.1uF	0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C17	CAP+	10uF	CAP\TAJ_A	CAPACITOR, CASE A 10UF 10V	FEC 9751041
C18	CAP	0.1uF	0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C19	CAP	470pF	0603	63V X7R Ceramic Capacitor	FEC 498-580
C20	CAP	470pF	0603	63V X7R Ceramic Capacitor	FEC 498-580
C21	CAP	470pF	0603	63V X7R Ceramic Capacitor	FEC 498-580
C22	CAP	470pF	0603	63V X7R Ceramic Capacitor	FEC 498-580
C23	CAP	470pF	0603	63V X7R Ceramic Capacitor	FEC 498-580
C24	CAP+	10uF	CAP\TAJ_A	CAPACITOR, CASE A 10UF 10V	FEC 9751041
C25	CAP	0.1uF	0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C26	CAP+	10uF	CAP\TAJ_A	CAPACITOR, CASE A 10UF 10V	FEC 9751041
C27	CAP	10nF	0603	25V X7R Ceramic Capacitor	FEC 499-146
C28	CAP	1uF	0805	25V Y5V Ceramic Capacitor	FEC 1216536
C29	CAP+	47uF	CAP\TAJ_C	16V Tantalum Taj Series Capacitor	FEC 197-324
C30	CAP	0.1uF	0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C31	CAP+	47uF	CAP\TAJ_C	16V Tantalum Taj Series Capacitor	FEC 197-324
C32	CAP	0.1uF	0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C33	CAP	22pF	C0603	CAPACITOR, 0603 22PF 50V	FEC 9406107
C34	CAP	22pF	C0603	CAPACITOR, 0603 22PF 50V	FEC 9406107
C35	CAP	0.1uF	C0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C36	CAP	0.1uF	C0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C37	CAP	0.1uF	C0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C38	CAP	0.1uF	C0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C39	CAP	0.1uF	C0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C40	CAP	0.1uF	C0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C41	CAP	0.1uF	C0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C42	CAP+	10uF	RTAJ_A	CAPACITOR, CASE A 10UF 10V	FEC 9751041
C43	CAP+	10uF	RTAJ_A	CAPACITOR, CASE A 10UF 10V	FEC 9751041
C44	CAP+	2.2uF	RTAJ_A	CAPACITOR, CASE A 2.2UF 10V	FEC 9753796
C45	CAP	0.1uF	C0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C46	CAP	0.1uF	C0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C47	CAP	0.1uF	C0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C48	CAP	0.1uF	C0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C49	CAP	0.1uF	C0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C50	CAP	0.1uF	C0603	CAPACITOR, 0603 100NF 50V	FEC 431989
C51	CAP	0.1uF	C0603	CAPACITOR, 0603 100NF 50V	FEC 431989
D1	LED		LED_R0805	LED, SMD 0805 GREEN	FEC 8529906
G1	GROUNDLINK		COMPONENTLINK	Copper Short	n/a
J1	USB-MINI-B		USB-MINI-B	USB Mini-B Connector (usb-otg)	FEC 9786490
J2	HEADER28		HEADER28	28 Pin (2x14) Header 0.1" Pitch	FEC 1022243
J3	SMB		SMB	50R SMB Jack	FEC 1111349
J4	SMB		SMB	50R SMB Jack	FEC 1111349

Name	Part Type	Value	PCB Decal	Part Description	Stock Code[1]
J5	SMB		SMB	50R SMB Jack	FEC 1111349
J6	SMB		SMB	50R SMB Jack	FEC 1111349
J7	HEADER40		HEADER40	40 Pin (2x20) Header 0.1" Pitch	FEC 1022243
J8	SMB		SMB	50R SMB Jack	FEC 1111349
J9	SMB		SMB	50R SMB Jack	FEC 1111349
J10	HEADER07		SIP-7P	7 Pin (1x7) Header 0.1" Pitch	FEC 1022257
J11	SMB		SMB	50R SMB Jack	FEC 1111349
J12	BANANA	Red	BANANA	Horizontal 4mm PCB Banana Socket (Black)	FEC 110-1128
J13	BANANA	Red	BANANA	Horizontal 4mm PCB Banana Socket (Red)	FEC 110-1127
J14	BANANA	Red	BANANA	Horizontal 4mm PCB Banana Socket (Black)	FEC 110-1128
J15	BANANA	Red	BANANA	Horizontal 4mm PCB Banana Socket (Red)	FEC 110-1127
LK1	JUMPER		SIP-2P	2 Pin (0.1" Pitch) Header & Shorting Shunt	FEC 1022247 & 150-411
LK2	JUMPER		SIP-2P	2 Pin (0.1" Pitch) Header & Shorting Shunt	FEC 1022247 & 150-411
LK3	JUMPER		SIP-2P	2 Pin (0.1" Pitch) Header & Shorting Shunt	FEC 1022247 & 150-411
LK4	JUMPER2\SIP3		LINK-3P	3 Pin (0.1" Pitch) Header & Shorting Shunt	FEC 1022249 & 150-411
LK5	JUMPER		SIP-2P	2 Pin (0.1" Pitch) Header & Shorting Shunt	FEC 1022247 & 150-411
LK6	JUMPER-2		JUMPER_2	4 Pin (2x2) 0.1" Header & Shorting Block	FEC 1022243 & 150-411 (36 Pin Strip)
LK7	JUMPER-2		JUMPER_2	4 Pin (2x2) 0.1" Header & Shorting Block	FEC 1022243 & 150-411 (36 Pin Strip)
R1	RES	10K	R0603	SMD Resistor	FEC 9330399
R2	RES	10K	R0603	SMD Resistor	FEC 9330399
R3	RES	10K	R0603	SMD Resistor	FEC 9330399
R4	RES	DNI	R1/8W	Unpopulated Capacitor Location - Keep holes free of solder	n/a
R5	RES	100K	0603	SMD Resistor	FEC 9330402
R6	RES	10K	R0603	SMD Resistor	FEC 9330399
R7	RES	100K	R0603	SMD Resistor	FEC 9330402
R8	RES	2k2	R0603	SMD Resistor	FEC 9330810
R9	RES	1K	R0603	SMD Resistor	FEC 9330380
R11	RES	100K	R0603	SMD Resistor	FEC 9330402
R12	RES	2k2	R0603	SMD Resistor	FEC 9330810
R15	RES	0R	R0603	SMD Resistor	FEC 9331662
S1	JUM_CHANGE_1		JUMP_CHANGE_1	3 Pin (0.1" Pitch) Header & Shorting Shunt	FEC 1022249 & 150-411
S2	JUM_CHANGE_1		JUMP_CHANGE_1	3 Pin (0.1" Pitch) Header & Shorting Shunt	FEC 1022249 & 150-411
S3	JUM_CHANGE_1		JUMP_CHANGE_1	3 Pin (0.1" Pitch) Header & Shorting Shunt	FEC 1022249 & 150-411
S4	JUM_CHANGE_1		JUMP_CHANGE_1	3 Pin (0.1" Pitch) Header & Shorting Shunt	FEC 1022249 & 150-411
S5	JUM_CHANGE_1		JUMP_CHANGE_1	3 Pin (0.1" Pitch) Header & Shorting Shunt	FEC 1022249 & 150-411

Name	Part Type	Value	PCB Decal	Part Description	Stock Code[1]
S6	JUM_CHANGE_1		JUMP_CHANGE_1	3 Pin (0.1" Pitch) Header & Shorting Shunt	FEC 1022249 & 150-411
T5	TESTPOINT		TESTPOINT	TERMINAL, PCB RED	FEC 8731144
T16	TESTPOINT		TESTPOINT	TERMINAL, PCB RED	FEC 8731144
T18	TESTPOINT		TESTPOINT	TERMINAL, PCB RED	FEC 8731144
T22	TESTPOINT		TESTPOINT	TERMINAL, PCB RED	FEC 8731144
T23	TESTPOINT		TESTPOINT	TERMINAL, PCB RED	FEC 8731144
T24	TESTPOINT		TESTPOINT	TERMINAL, PCB RED	FEC 8731144
U1	AD5380		LQFP100	40 Channel Vout DAC	AD5380BSTZ-x AD5381BSTZ-x AD5382BSTZ-x AD5383BSTZ-x
U2	AD780		SO8NB	2.5/3 V Reference	AD780ARZ
U3	AD7476_ADC		SOT23-6	ADC	AD7476BRTZ
U4	24LC01		SO8NB	IC SERIAL EEPROM 64K 2.5V 8-SOIC	FEC 9758070
U5	ADP3303-3.3		SO8NB	Precision Low Dropout Voltage Regulator	ADP3303ARZ-3.3
U6	CY7C68013-CSP		LFCSP-56_RP	USB Microcontroller	Digikey 428-1669-ND
U7	74HC245		TSSOP20	Bus Transciever	Digikey 296-8279-1-ND
X1	CLAMP-14MM		CLAMP-14MM	14mm QFP Clamp	
Y1	XTAL-CM309S	24 MHz	XTAL_CM309S	CM309S SMD Crystal	FEC 9509658
				M2.5 PEM Nuts (x4)	
				M2.5 (6mm) Philips Head Screws (x4)	

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

NOTES