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FEATURES
Full-Featured Evaluation Board for the AD5532/AD5533
On-Board 3V Reference
Various Link and Switch Options
PC Software for Control af AD5532/AD5533
Socketed AD5532/AD5533 for Easy Replacement

INTRODUCTION

This Technical Note describes the evaluation board for the AD5532 and AD5533. These devices combine a 32 channel voltage translation function with an infinite output hold capability. An analog input voltage on the common input pin, Vin, is sampled and its digital representation transferred to a chosen DAC register. The output of this DAC is then updated to reflect the new contents of the DAC register. Channel selection is accomplished via the parallel address inputs A0-A5 or via the serial input port. The AD5532 is operated with AVcc= +5V+/-5%, DVcc= 2.5V to 5.25V, Vss= -4.75V to -16.5V, Vdd= 10V to 16V and requires a stable +3V reference on the REF_IN pin as well as an offset voltage on OFFS_IN. These devices are available in a 74-lead LFBGA package. Full datails are available in the AD5532 and AD5533 datasheets from Analog Devices and should be consulted in conjunction with this Technical Note when using the Evaluation Board.

On-board components include an AD780 which is a pin programmable +3V ultra high precision bandgap reference and an AD5541 which is a 16-bit DAC that can be used to provide an analog input voltage to the AD5532/AD5533. There are various link and switch options which are explained in detail on page 2.

Interfacing to this board from a PC is through a 36-way Centronics connector. This 36-way connector is compatible with most printer cables and is usually connected to the parallel printer port on a standard PC via a standard printer cable.
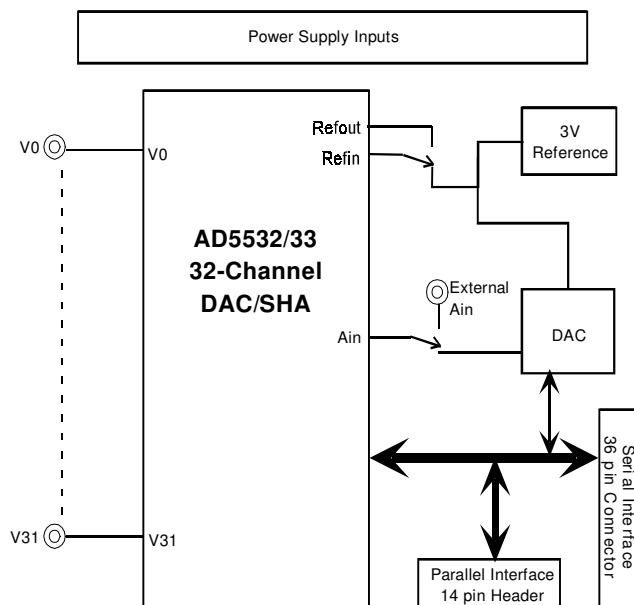
OPERATING THE AD5532 EVALUATION BOARD

Power Supplies
The following external supplies must be provided: +5V between the DVCC and DGND inputs which supplies the DVCC pins on the AD5532. +5V between the AVCC and the AGND inputs to supply the AD780, the AD5541, the AD820 and the AVCC pins on the AD5532. -15V to the VSS input to supply the AD5532 AVSS pins. +15V to the VDD input to supply the AD5532 AVDD pins.

Each supply is decoupled to the relevant ground plane with a 47uF and a 0.1uF capacitor pair as it enters the board. Each device supply pin is again decoupled with a 10uF and a 0.1uF capacitor pair to the relevant ground plane.

There are 2 ground planes on the board, AGND and DGND. These are connected together at one location close to the AD5532. It is recommended not to connect these anywhere else to avoid ground loop problems.

FUNCTIONAL BLOCK DIAGRAM

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LINK AND SWITCH OPTIONS

There are 2 link options and 3 switches which must be set for the required operating setup before using the evaluation board. The functions of these link options and switches are outlined below.

Table I. Link and Switch Functions.

Link No.	Function.
LK1	This link option allows the user to select whether the AD5532 serial or parallel interface will be used. When this link is in position "A" the SER/$\overline{\text{PAR}}$ pin is tied high thus selecting the serial interface. When this link is in position "B" the SER/$\overline{\text{PAR}}$ pin is tied low thus selecting the parallel interface.
LK2	This link option is unused.

Switch No.	Function.
S1	This switch selects the source of the reference voltage for the AD5532 REFIN pin. It has 2 settings each clearly labelled on the board, namely REFOUT and AD780. When the slider is moved to the REFOUT position, the AD5532 REFOUT pin provides the 3V reference. When the slider is moved to the AD780 position, the AD780 reference provides the 3V reference.
S2	This switch selects the source of the offset voltage that must be applied to the AD5532 OFFS_IN pin. It has 2 settings each clearly labelled on the board, namely OFFS_OUT and SK1. When the slider is moved to the OFFS_OUT position, the AD5532 OFFS_OUT pin provides the offset voltage. When the slider is moved to the SK1 position, the offset voltage must be provided via the exteral SMB socket, SK1
S3	This switch selects the source of the analog input voltage that must be applied to the AD5532 VIN pin. It has 2 settings each clearly labelled on the board, namely DAC and SK3. When the slider is moved to the DAC position, the AD5541 sets up the analog input voltage under the control of the evaluation software provided in the evaluation kit. When the slider is moved to the SK3 position, the analog input voltage must be provided via the exteral SMB socket, SK3

SET-UP CONDITIONS

Care should be taken before applying power and signals to the evaluation board to ensure that all link/switch positions are set as per the required operating mode. Table II shows the position in which all the links are set when the evaluation board is sent out.

Table II. Initial Link and Switch Positions

Link No.	Position	Function.
LK1	A	Serial interface selected.
LK2	-	Not used.
S1	AD780	AD780 provides 3V reference.
S2	OFFS_OUT	The AD5532 OFFS_OUT pin provides the offset voltage which is connected to the AD5532 OFFS_IN pin.
S3	DAC	The analog input voltage is provided by the AD5541 DAC under the control of the evaluation software.

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EVALUATION BOARD INTERFACING

Serial interfacing

The 36-pin centronics connector interfaces to the serial interface on the AD5532 and also interfaces to the serial interface on the AD5541. The evaluation software provided with the evaluation kit will only work when the user is using the serial interface. The pin-out description and function of the 36-pin serial interface connector, J2, is given in Table III.

Table III. 36-pin Serial Interface connector.

Pin No.	Name	Description.
2	DIN	Connects to both the AD5532 and AD5541 DIN pins. Serial data is loaded to either of these devices via this pin.
3	SCLK	Connects to the serial clock pins on the AD5532 and the AD5541.
4	SYNC(SHA)	Connects to the $\overline{\text{SYNC}}$ pin on the AD5532.
5	CS(DAC)	Connects to the $\overline{\text{CS}}$ pin on the AD5541.
6	TRACK	Connects to the $\overline{\text{TRACK}/\text{RESET}}$ pin on the AD5532.
10	DOUT	Connects to the DOUT pin on the AD5532.
13	BUSY	Connects to the $\overline{\text{BUSY}}$ pin on the AD5532.
19-30	GND	Connects to the DGND plane on the board.

For further information on the functions and timing of these signals refer to the AD5532 and AD5533 Data Sheets.

Parallel interfacing

The parallel interface connections are made available for user expansion at the 14-pin parallel interface header, J1. The pin-out description and function of this header is given in Table IV.

Table IV. 14-pin Parallel Interface connector.

Pin No.	Name	Description.
1	TRACK	Connects to the $\overline{\text{TRACK}/\text{RESET}}$ pin on the AD5532.
2	OFFS_SEL	Connects to the OFFS_SEL pin on the AD5532.
3	CAL	Connects to the CAL pin on the AD5532.
4	A5	Connects to the A5 pin on the AD5532.
5	A4	Connects to the A4 pin on the AD5532.
6	A3	Connects to the A3 pin on the AD5532.
7	-	unused
8	A2	Connects to the A2 pin on the AD5532.
9	A1	Connects to the A1 pin on the AD5532.
10	A0	Connects to the A0 pin on the AD5532.
11	WR	Connects to the $\overline{\text{WR}}$ pin on the AD5532.
12	CS	Connects to the $\overline{\text{CS}}$ pin on the AD5532.
13	BUSY	Connects to the $\overline{\text{BUSY}}$ pin on the AD5532.
14	GND	Connects to the DGND plane on the board.

For further information on the function and timing of these signals refer to the AD5532 Data Sheet.

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EVALUATION BOARD SOFTWARE

Software installation
Install the ad5532 software from the floppy disk onto your PC by executing setup.exe. Ensure that the Centronics cable connects the PC to the AD5532 eval board. Run ad5532.exe. The main menu looks as follows:

Fig. 1: Main Menu.

1) SHA Mode
In SHA mode an analog input voltage is set up on V_{IN} via the AD5541 DAC and the serial interface. The corresponding V_{OUT} output can be measured at the selected channel.

Cal Mode
This mode allows all 32 channels to acquire V_{IN} simultaneously and can be useful in calibration.
• Ensure that switch S3 is at the DAC position. This connects V_{IN} to the AD5541 output, putting V_{IN} under software control.
• Select **Cal Mode** and enter the required V_{IN} value at **Analog Input Voltage**. Press Return.
• Click on **Update Selected Channel** to acquire V_{IN}.
• De-select **Cal Mode** for individual channel selection.

Offset Channel
Program the offset voltage control channel as follows:
• Ensure that switch S2 is at the OFFS_OUT position. This connects OFFS_IN to OFFS_OUT.
• Ensure that switch S3 is at the DAC position. This connects V_{IN} to the AD5541 output, putting V_{IN} under software control.
• Select **Offset Channel** and enter the required offset value at **Analog Input Voltage**. Press Return.
• Click on **Update Selected Channel** to acquire the offset.
• De-select the **Offset Channel**.

Track OFF/ON
For evaluation purposes Track is normally set OFF so that the selected channel begins to acquire when it is addressed.

Select Channel
Once the offset is acquired you can apply an input voltage on any selected channel as follows:
• Select any channel and **e**nter the required V_{IN} value (0-3V) at **Analog Input Voltage**. Press Return.
• Click on **Update Selected Channel** to acquire the input voltage and measure the corresponding V_{OUT}. Check that $V_{OUT} = 3.52*V_{IN} - 2.52*V_{OFFSET}$ (AD5532-1/-3/-5, AD5533) and $V_{OUT} = 7*V_{IN} - 6*V_{OFFSET}$ (AD5532-2)
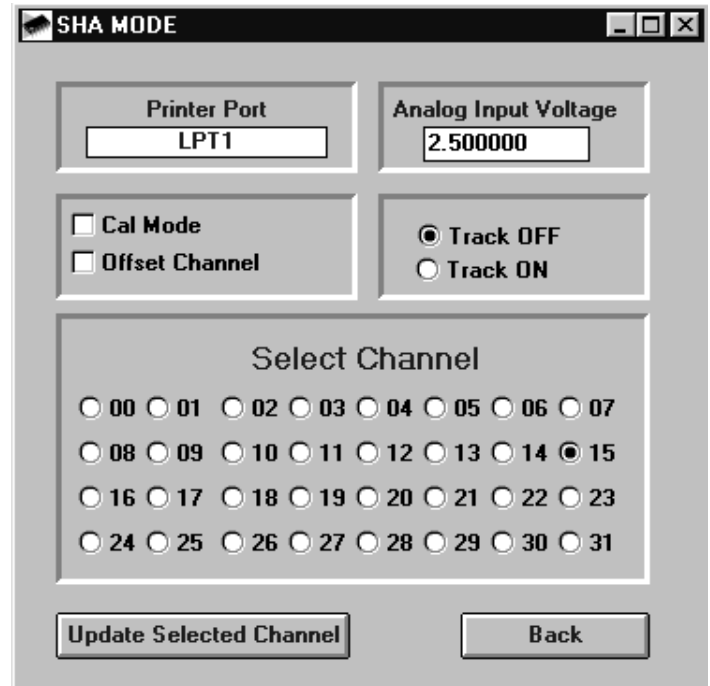
Fig. 2: SHA Mode.

2) DAC Mode
In DAC mode all or one of the 32 DAC registers are written to via the serial interface.

Cal Mode
This mode allows all 32 DACs to be loaded with all zeros or all ones for system calibration.
• Select **Cal Mode** and enter a hex value at **DAC Word**. The maximum value is 3FFFh. Press Return.
• Click on **Update Selected Channel** to update all DACs.
• De-select **Cal Mode** for individual DAC selection.

Offset Channel
Use this to program the offset as follows:
• Ensure that switch S2 is at the OFFS_OUT position. This connects OFFS_IN to OFFS_OUT.
• Select **Offset Channel** and enter the required offset value in hex at **DAC Word**. Press Return.
• Click on **Update Selected Channel** to acquire the offset.
• De-select the **Offset Channel**.

Select Channel

Once the offset is acquired you can write a value (in hex) to any selected DAC register as follows:
• Select any channel and enter the required hex value (0000 to 3FFF) at **DAC Word (Hex)**. Press Return.
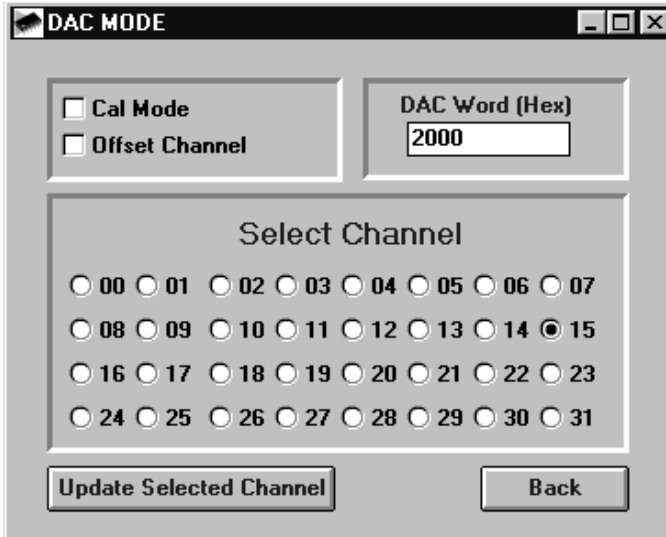• Click on **Update Selected Channel.**
• Measure the corresponding V_{OUT}.

Fig. 3: DAC Mode.

3) Acquire/Readback Mode

This mode allows the user to read back the data in a particular DAC register via the serial interface.

Acquire & Readback

Use this function to acquire VIN and read back the corresponding DAC value as follows:
• Select any channel and enter the required V_{IN} value (0-3V) at **Analog Input Voltage**. Press Return.
• Click on **Acquire & Readback** to acquire V_{IN} and read back the DAC value in hex at **DAC Code**.

Readback

Use this function to readback a particular DAC as follows:
• Select any channel and press Return.
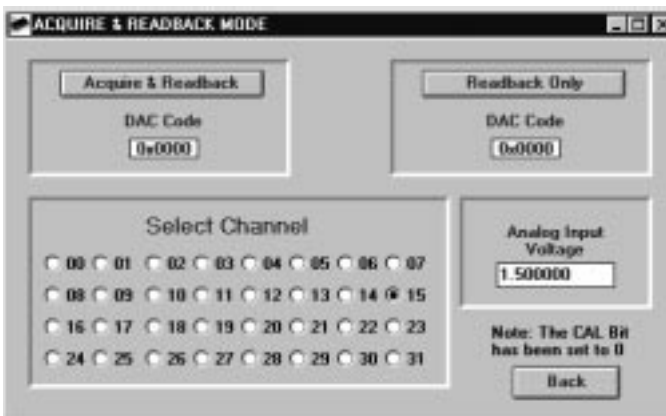• Click on **Readback Only** to read back the DAC value in hex at **DAC Code**.

Fig. 4: Acquire & Readback Mode.

4) Calibrated/SHA Mode

This mode allows the user to determine the output range of each channel for a particular offset value. Results can be saved to a file and re-loaded in a later session.

Channel Calibration

Determine the endpoints (V_{IN} = 0.1V and V_{IN} = 2.98V) of any channel as follows:
• Enter the value at the OFFS_IN pin at **Offset In(V)**.
• Select any particular input channel.
• Click on **Calibrate Channel**.
• Measure V_{OUT} at the selected channel and enter it's value for V_{IN} = 100mV.
• Measure V_{OUT} at the selected channel and enter it's value for V_{IN} = 2.98V.
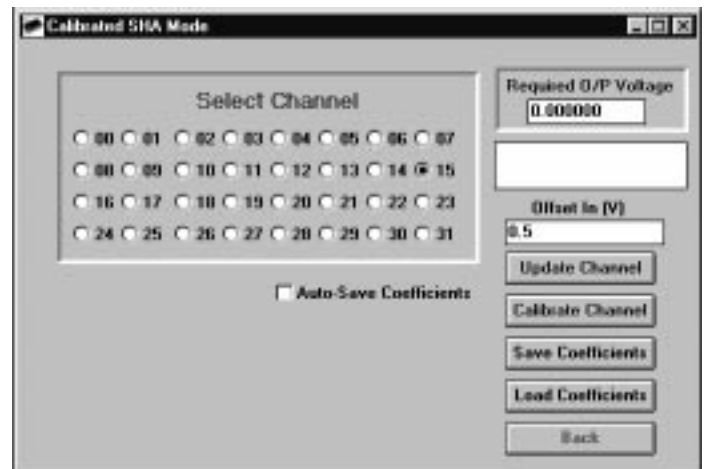
See the **Usable Range** for the selected channel.

Fig. 5: Calibrated SHA Mode.

Saving calibration results

Offset and Gain values for all channels can be saved to a file by clicking on **Save Coefficients**. To automatically save all coefficients click on **Auto-save Coefficients.** Use **Load Coefficients** to reload coefficients from a previous session.

Required O/P voltage

Enter a value at **Required O/P Voltage** to program a specific value at V_{OUT} for the selected channel.
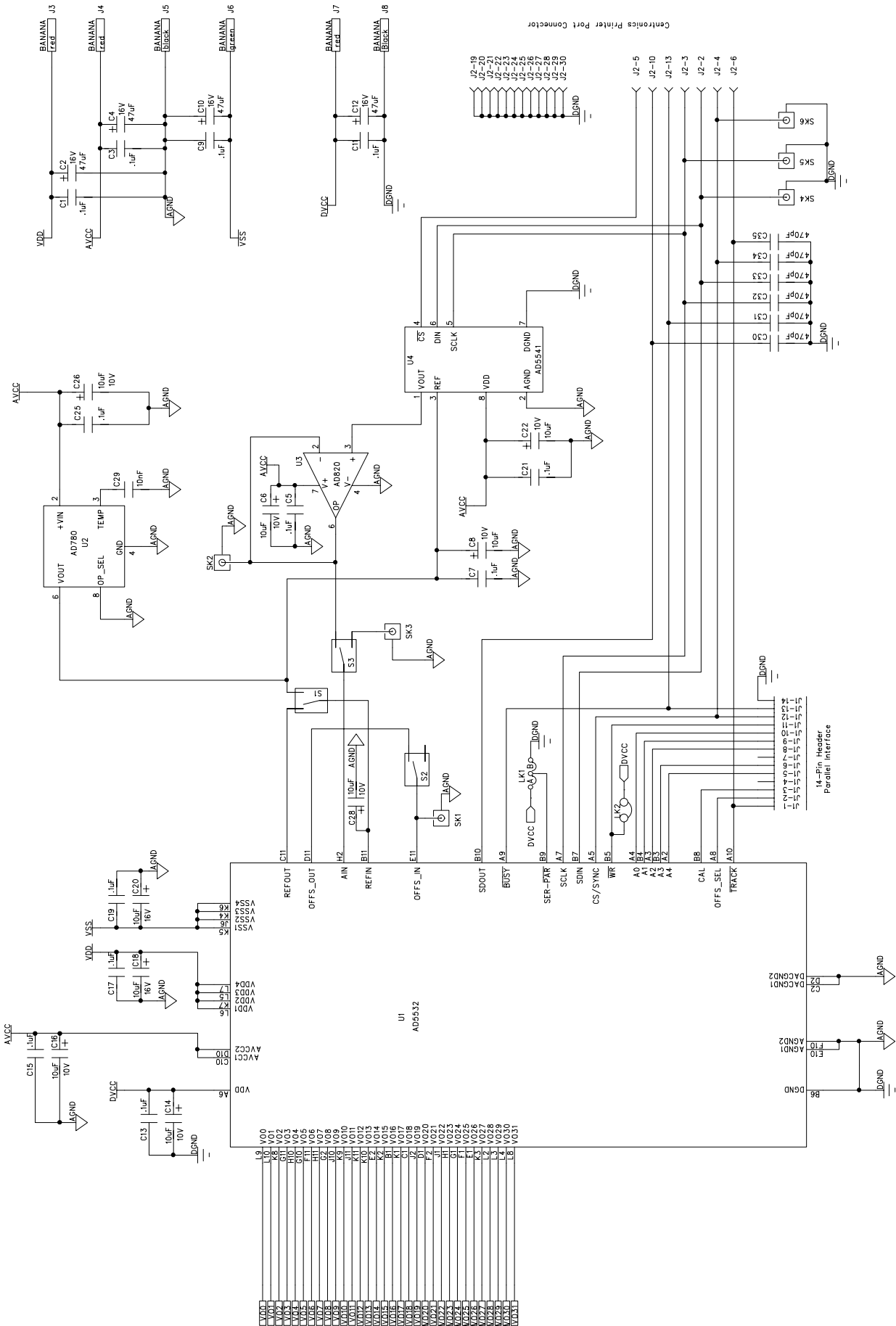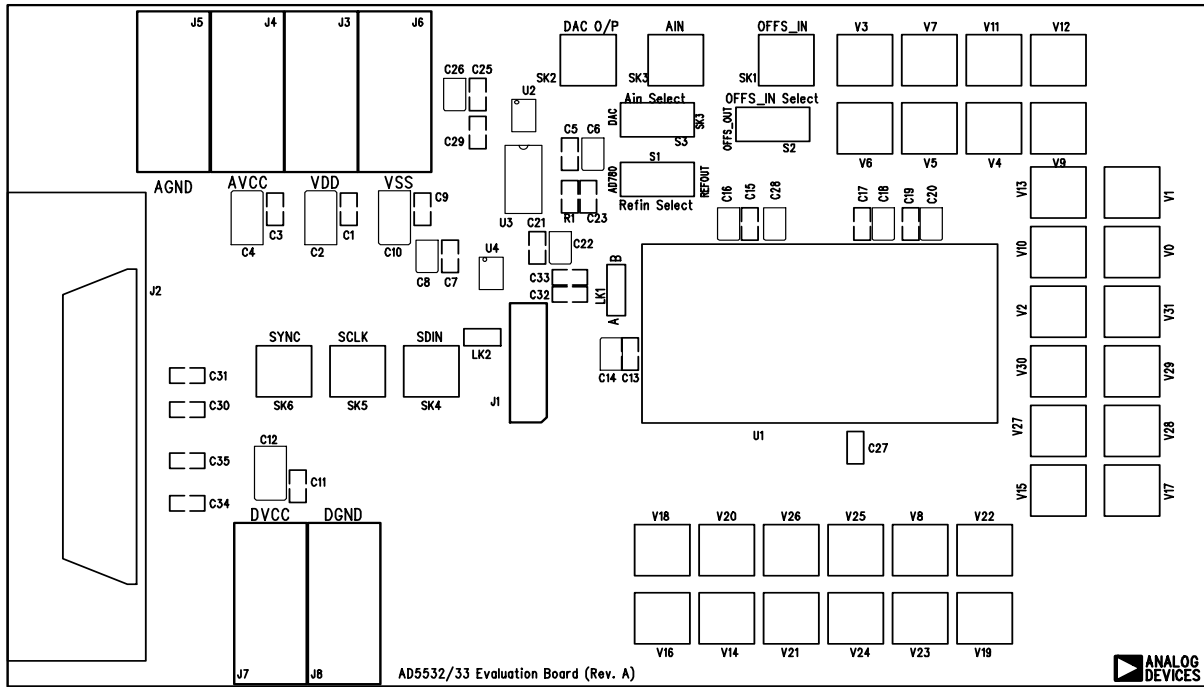
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Fig. 6: Evaluation Board Circuit Diagram.

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Fig. 7: Eval-AD5532EB Evaluation Board.