



Evaluation Board for Single Supply, 12-Bit 500 kSPS ADC

EVAL-AD7892-2CB

FEATURES

Full-Featured Evaluation Board for the AD7892-2

EVAL-CONTROL BOARD Compatible

Stand Alone Capability

On-Board Analog Buffering and Reference

Various Linking Options

Single Supply Operation

**PC Software for Control and Data Analysis when used
with EVAL-CONTROL BOARD**

INTRODUCTION

This Application Note describes the evaluation board for the AD7892-2 12-Bit A/D converter. The AD7892-2 is a high speed, low power, 500ksp/s successive approximation ADC which operates from a single +5V supply. It incorporates an on-chip track/hold amplifier, an internal +2.5V reference and on-chip versatile interface structures that allow both serial and parallel connection to a microprocessor. This flexible serial interface allows the AD7892-2 to connect directly to Digital Signal Processors (ADSP-2101, TMS320C25, etc.) and Microcontrollers (8XC51, 68HC11, etc.). Full data on the AD7892-2 is available in the AD7892 data sheet available from Analog Devices and should be consulted in conjunction with this Application Note when using the Evaluation Board.

On-board components include an AD780 which is a pin programmable +2.5 V or +3V ultra high precision bandgap reference and an input buffer amplifier to buffer the analog input.

Interfacing to this board is through a 9-way D-type connector and a 96-way connector. This 96-way connector is compatible with the EVAL-CONTROL BOARD which is also available from Analog Devices. External sockets are provided for the conversion start input, analog inputs and an external reference input option.

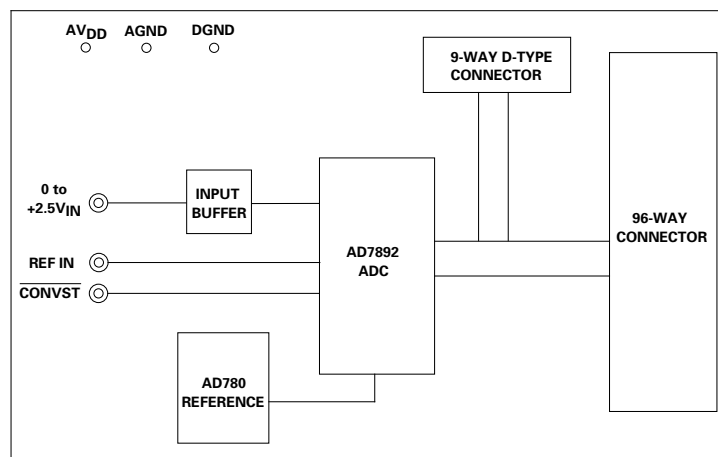
OPERATING THE AD7892-2 EVALUATION BOARD

Power Supplies

This evaluation board has two analog power supply inputs: AV_{DD} and AGND. These supplies are used to power the on-board amplifiers and to provide the V_{DD} for the AD7892-2 and the V_{in} for the AD780 voltage reference. A DGND connection is provided on the board. This DGND connects to the AGND at the AD7892-2. Therefore, it is recommended not to connect AGND and DGND elsewhere in the system. The various analog and digital supplies are provided through the power-supply terminals on the board or the V_{DD} and DGND supplies can be provided through the D-type connector. When using the evaluation board with the EVAL-CONTROL BOARD, all supplies for the evaluation board are provided by the EVAL-CONTROL BOARD.

The supplies are decoupled to ground with 10 μ F tantalum and 0.1 μ F ceramic disc capacitors. The AV_{DD} supply for the AD7892 is decoupled to the AGND plane through the 10 μ F capacitor and to the DGND plane through the 0.1 μ F capacitor.

FUNCTIONAL BLOCK DIAGRAM



REV. A

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Link and Switch Options

There are six link options and there is one switch option which must be set for the required operating setup before using the evaluation board. The functions of these options are outlined below.

Link No.	Function
LK1	<p>This option is used to determine whether the AD7892 operates in its normal operating mode or in its STANDBY (power-down) mode.</p> <p>With this link in position A, the $\overline{\text{STANDBY}}$ pin is connected to V_{DD}, thus configuring the part for normal operation.</p> <p>In position B, the $\overline{\text{STANDBY}}$ pin is connected to DGND and the AD7892 is placed in its power-down mode.</p>
LK2	<p>This link option is used to select the interface mode for the AD7892.</p> <p>In position A, the MODE pin is connected to DGND and the AD7892 operates in its serial interface mode. In this mode, the interface to the evaluation board is via the 9-way D-type connector.</p> <p>In position B, the MODE pin is connected to V_{DD} and the AD7892 operates in its parallel interface mode. In this mode, the interface to the evaluation board is via the 96-way connector. The link option must be in this position when the evaluation board is intended for use with the EVAL-CONTROL BOARD.</p>
SW1	<p>This is the switch option and the switch should be placed in the same position (either A or B) as the second link, LK2.</p> <p>In position A, the DB10 and DB11 pins of the AD7892 are connected to DGND to satisfy the requirement that these pins must be low for serial mode operation of the AD7892.</p> <p>In position B, both DB10 and DB11 are connected to their corresponding pins on the 96-way connector.</p>
LK3	<p>This option is used to select the analog input source for the V_{IN1} pin.</p> <p>In position A, the V_{IN1} pin is left unconnected. This link position is not used on the EVAL-AD7892-2CB.</p> <p>In position B, the V_{IN1} pin is connected to the output of amplifier A2. The link should be in this position when the analog input is applied to SKT2.</p> <p>In position C, the V_{IN1} input is connected to AGND.</p>
LK4	<p>This link option is permanently placed in position A, which connects the V_{IN2} pin of the device to AGND.</p>
LK5	<p>This link option is used to select the reference source for the AD7892 REF OUT/REF IN pin.</p> <p>With this link in position A, the AD780 +2.5V reference is selected as the reference for the AD7892.</p> <p>In position B, the reference connects to the external socket, SKT4.</p> <p>With this link out, the REF OUT/REF IN pin remains open-circuited, thus the reference source is the AD7892's internal reference.</p>
LK6	<p>This final link option selects the $\overline{\text{CONVST}}$ signal source for the part.</p> <p>In position A, the $\overline{\text{CONVST}}$ pin is connected to the FL0 pin on the 96-way connector. When using the evaluation board with the EVAL-CONTROL BOARD, there are two program options, one where the $\overline{\text{CONVST}}$ signal is generated from the EVAL-CONTROL BOARD; the second where the $\overline{\text{CONVST}}$ signal is externally supplied. When the internal $\overline{\text{CONVST}}$ program is used, this link must be in position A.</p> <p>In position B, the $\overline{\text{CONVST}}$ signal for the part is provided from the external socket, SKT5. When the external $\overline{\text{CONVST}}$ program is used, this link must be in position B.</p>

SET-UP CONDITIONS

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

Table I. Initial Link and Switch Positions

Link No.	Position	Function.
LK1	A	STANDBY pin is high and part is placed in its normal operating mode.
LK2	B	MODE pin is connected to V_{DD} and part is configured for its parallel operating mode.
SW1	B	DB10 and DB11 connected to the 96-way connector.
LK3	B	V_{IN1} pin is connected to the output of amplifier A2.
LK4	A	V_{IN2} connected to AGND.
LK5	A	Connects the AD780's V_{OUT} pin to the AD7892's REF OUT/REF IN pin and thus selects the AD780 as the reference source for the AD7892.
LK6	A	Connects the AD7892's \overline{CONVST} pin to the FL0 pin of the edge connector. Sets up the board for the \overline{CONVST} being generated from the EVAL-CONTROL BOARD.

EVALUATION BOARD INTERFACING

Interfacing to the evaluation board is either via a 96-way connector, J1 or a 9-way D-Type connector, J2. J1 is used to connect the evaluation board to the EVAL-CONTROL BOARD. It can also be used for parallel interface connections to the evaluation board when operating the AD7892 in its parallel interface mode without the EVAL-CONTROL BOARD. J2 is used for serial interface connections when operating the AD7892 in its serial interface mode. The pinout for the J1 connector is shown in Figure 1 and its pin designations are given in Table II. The pinout for the J2 connector is given in Figure 2 and its corresponding pin designations are given in Table III.

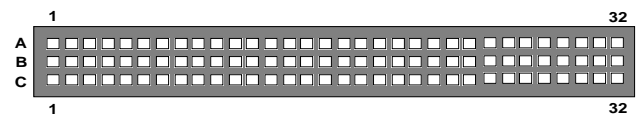


Figure 1. Pin Configuration for the 96-Way Connector, J1

96-Way Connector Pin Description

D0-D11	Data Bit 0 to Data Bit 11. These are three-state TTL-compatible outputs from the AD7892. Parallel data from the part is obtained at these pins.
DGND	Digital Ground. These lines are connected to the digital ground plane on the evaluation board. It allows the user to provide the digital supply via the connector along with the other digital signals.
\overline{RD}	Read. This is an active low logic input which is used in conjunction with \overline{CS} low to enable the data outputs.
\overline{CS}	Chip Select. This is an active low logic input which is used in conjunction with \overline{RD} low to enable the data outputs.
FL0	Flag zero. This is a logic input and is connected to the \overline{CONVST} logic input on the device via LK6. A low to high transition on this input puts the track/hold amplifier into its hold mode and starts a conversion.
$\overline{IRQ2}$	Interrupt Request 2. This is a logic output and is directly connected to the EOC logic output on the device. This active low logic output indicates the converter status. The end of a conversion is signified by a low-going pulse on this line.
AGND	Analog Ground. These lines are connected to the analog ground plane on the evaluation board.
AV_{SS}	Analog -5V Supply. This supply is not used on the EVAL-AD7892-2CB.
AV_{DD}	Analog +5V Supply. These lines are connected to the V_{DD} supply line on the board.

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Table II. 96-Way Connector Pin Functions.

ROW	PIN NO.	MNEMONIC
B	2	D0
B	3	D1
A	4	DGND
B	4	DGND
C	4	DGND
B	5	D2
B	6	D3
B	7	D4
A	9	\overline{RD}
B	9	D5
B	10	D6
C	10	\overline{CS}
B	11	D7
A	12	DGND
B	12	DGND
C	12	DGND
B	13	D8
B	14	D9
B	15	D10
A	16	DGND
B	16	DGND
C	16	DGND
A	17	FL0
B	17	D11
C	17	$\overline{IRQ2}$
A	20	DGND
B	20	DGND
C	20	DGND
A	22	AGND
A	23	AGND
A	24	AGND
A	25	AGND
A	26	AGND
A	29	AGND
B	29	AGND
C	29	AGND
A	31	AV_{SS}
B	31	AV_{SS}
C	31	AV_{SS}
A	32	AV_{DD}
B	32	AV_{DD}
C	32	AV_{DD}

Note : The remainder of the pins on the 96-way connector are no connects.

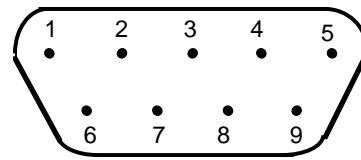


Figure 2. Pin Configuration for D-Type Connector, J2

Table III. J2 Pin Functions

PIN NO.	MNEMONIC
1	SCLK
2	\overline{EOC}
3	\overline{RFS}
4	N/C
5	N/C
6	DGND
7	SDATA
8	V_{DD}
9	N/C

9-Way D-Type Connector Pin Description

- SCLK** Serial Clock Input. When the device is in its serial mode, an external serial clock is applied through this input to obtain serial data from the part.
- \overline{EOC}** End-of-Conversion. This output indicates the status of conversion. A low going pulse on this line signifies the end of a conversion.
- \overline{RFS}** Receive Frame Synchronisation. When the device is in its serial mode, an external \overline{RFS} signal is applied to this input to obtain serial data from the part.
- DGND** Digital Ground. This line is connected to the digital ground plane on the evaluation board. It allows the user to provide the digital supply via the connector along with the other digital signals.
- SDATA** Serial Data Output. Serial data from the part is obtained at this output. The serial data is clocked out by the rising edge of SCLK and is valid on the falling edge of SCLK for sixteen edges after \overline{RFS} goes low.
- V_{DD}** +5 V Supply. This line is connected to the V_{DD} supply line on the evaluation board. It allows the user to provide the digital supply via the connector along with the other digital signals.

SOCKETS

There are three input sockets relevant to the operation of the AD7892-2 on this evaluation board. The function of these sockets is outlined in Table IV.

Table IV. Socket Functions

Socket	Function
SKT2	Sub-Minature BNC Socket for V_{IN1} .
SKT4	Sub-Minature BNC Socket for external reference.
SKT5	Sub-Minature BNC Socket for \overline{CONVST} input.

CONNECTORS

There are two connectors on the AD7892-2 evaluation board as outlined in Table V.

Table V. Connector Functions

Connector	Function
J1	96-Way Connector for Parallel Interface connections.
J2	9-Way D-Type Connector for Serial Interface Connections.

OPERATING WITH THE EVAL-CONTROL BOARD

The evaluation board can be operated in a stand-alone mode or operated in conjunction with the EVAL-CONTROL BOARD. This EVAL-CONTROL BOARD is available from Analog Devices under the order entry "EVAL-CONTROL BOARD". When operated with this control board, all supplies and control signals for operating the AD7892 are provided by the EVAL-CONTROL BOARD when it is run under control of the AD7892 software which is provided with the AD7892 evaluation board package. This EVAL-CONTROL BOARD will also operate with all Analog Devices evaluation boards which end with the letters CB in their title.

The 96-way connector on the EVAL-AD7892-2CB plugs directly into the 96-way connector on the EVAL-CONTROL BOARD. No power supplies are required in the system. The EVAL-CONTROL BOARD generates all the required supplies for itself and the EVAL-AD7892-2CB. The EVAL-CONTROL BOARD is powered from a 12V ac transformer. This is a standard 12V ac 1A transformer. These can also be ordered from Analog Devices under the order entry "EVAL-110AC" for a 110V compatible transformer and "EVAL-220AC" for a 220V compatible transformer. These transformers are also available for other suppliers including Digikey (110V models) and Campbell Collins (220V models).

Connection between the EVAL-CONTROL BOARD and the serial port of a PC is via a standard RS-232 cable which is provided as part the EVAL-CONTROL BOARD package. Please refer to the manual which accompanies the EVAL-CONTROL BOARD for more details on the EVAL-CONTROL BOARD package.

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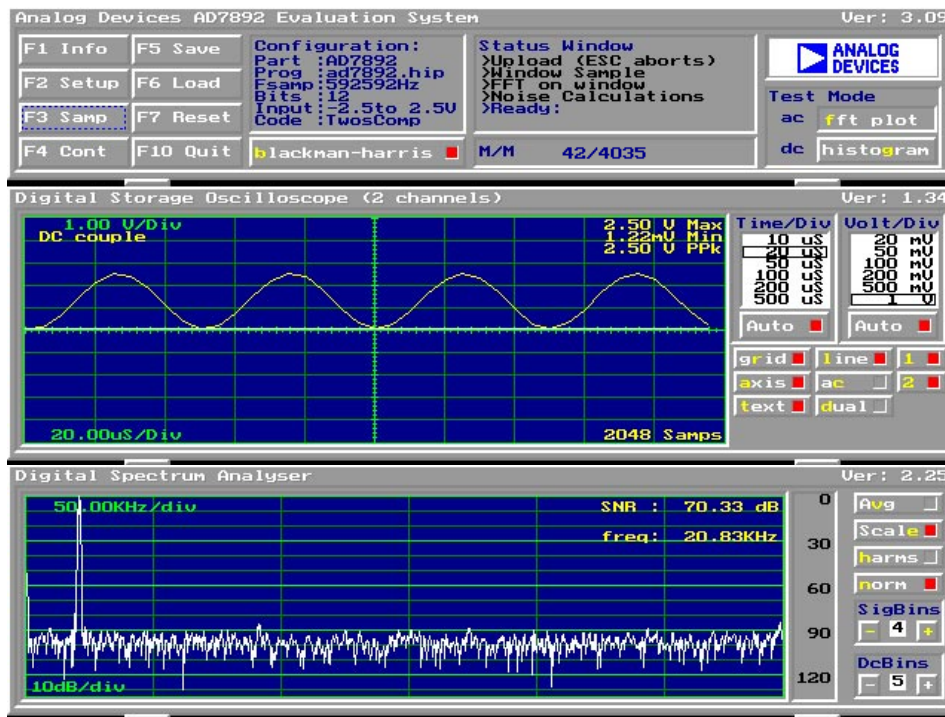


Figure 3. FFT Screen

SOFTWARE DESCRIPTION

Included in the EVAL-AD7892-2CB evaluation board package is a PC-compatible disk which contains software for controlling and evaluating the performance of the AD7892-2 when it is operated with the EVAL-CONTROL BOARD. The EVAL-AD7892-2CB Demonstration/Evaluation Software runs under DOS. The system runs under DOS 4.0 or later and requires a minimum of a 386-based machine. It needs 400kB of base RAM and 500kB of free hard disk space. The user interface on the PC is a dedicated program written especially for the AD7892.

The disk which accompanies the EVAL-AD7892-2CB contains several files. The user should create a new directory on the main PC drive and label this "AD7892". Then, all files on the EVAL-AD7892-2CB disk should be copied into this directory. The Mouse Driver on the PC should be enabled before running the software. If this has not been loaded, the program will not run.

To run the software, simply call up the directory and type "go". When the software opens, the user sees the screen shown on Figure 3 (without any FFT or scope waveforms). This is the FFT screen and is the default start-up for the software. There are 3 menus available: The Setup Menu; The AC Test Menu; The DC Test Menu. Function Keys and Buttons are employed to navigate the menus. In addition, Hot Keys can be used to activate the Buttons (the appropriate character is highlighted in each button. Lower Case must be used.)

On initially entering the front panel, the user should hit the "F2" key to go to the Setup Menu. There are two program options available in this Setup Menu. One of these is where the EVAL-CONTROL BOARD provides the CONVST signal for the AD7892. This program is labelled "AD7892int" and in the Setup Menu, the user should select "ad7892int.hip" and activate the "load device file" button (Hot Key "l") to operate this

program. The second is where the CONVST is externally supplied by the user. This program is labelled "AD7892ext" and in the Setup Menu, the user should select "ad7892ext.hip" and activate the "load device file" button (Hot Key "l") to operate this program. When the file is downloaded to the EVAL-CONTROL BOARD, it is possible to choose the sample rate and number of samples to be taken. Hit the OK Button (Hot Key "o") when the desired operating conditions have been chosen.

Now, the screen displays the secondary menus. The Function Keys and Hot Keys are described below. All Function Keys and most of the Hot Keys are also available as On-Screen Buttons.

Function Keys

- F1:** Info. This is basic information on the software.
- F2:** Setup Menu as described above.
- F3:** Samp. When this key is pressed, the software takes one set of samples. When the samples have been taken they are displayed on the Digital Storage Oscilloscope. After this, either the ac or dc analysis is done. If ac Test Mode is chosen, then the Digital Spectrum Analyzer displays the FFT of the sampled data. If the dc Test Mode is chosen, the Histogram Analyzer displays the spread of codes on the input. Another set of samples may be taken by pressing the F3 key again.
- F4:** Cont. When this key is pressed, the software continuously takes continuous sets of samples of the input. Once the analysis has been done for one set of samples, it automatically goes and repeats the process. It will continue to do this until the ESC key is pressed.

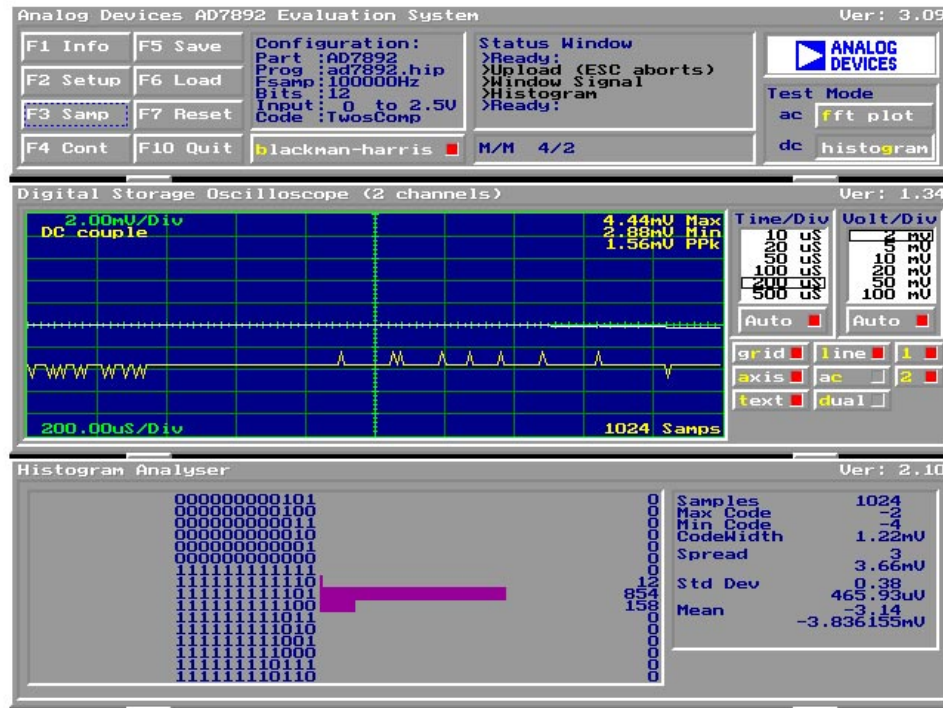


Figure 4. Histogram Screen

- F5:** Save. This allows the user to save a set of samples to a file for use either at a later date or with other software.
- F6:** Load. This allows the user to load data from a file. Once loaded, it can be analyzed in the same fashion as the sampled sets of data. The file must have a .DAT extension.
- F7:** Board Reset.
- F10:** Quit. This quits out of the software and returns to the PC.
- ESC:** Stop Current Operation.

Hot Keys

As well as using the Function Keys to run the software, extensive use is made of "Hot Keys". The Hot Key has one letter highlighted (for example, the "b" in "blackman-harris" button) and pressing this key is the same as clicking on the equivalent on-screen button. When the button is activated, there is a red square indication. All Hot Keys listed in this section are also available as On-Screen Buttons.

- blackman-harris:** Pressing the "b" key toggles the Blackman-Harris Window On/Off. When doing an analysis (FFT) in a non-coherent setup, this should be On.
- ac:** Pressing the "a" key selects the ac Test Mode. When an input is sampled, the software produces an FFT Plot of the sampled data. It gives the SNR(Signal-to-Noise Ratio) in dB's. This is the ratio of the rms input signal to the rms sum of all the noise bins. It also give the DR (Dynamic Range). This is the ratio of 2.5V (Full Scale Input Range) to the rms sum of all the noise bins.

- dc:** Pressing the "d" key selects the dc Test Mode. When an input is sampled, the software does a Histogram of the codes. The standard deviation (which is the equivalent to rms noise) is computed and displayed. The max code, min code and spread of codes are also displayed.
- avg:** Pressing the "v" key selects averaging in the ac Test Mode. The software must be set up for Cont. operation. Then, with each new set of samples, an averaged FFT is produced. With each new set of samples, the number of averages is displayed on the FFT.
- scale:** Pressing the "c" key turns the frequency scaling of the FFT OFF/ON.
- harms:** Pressing the "h" key includes/excludes the harmonics in the FFT SNR calculation.

On-Screen Buttons

- The following two functions are only available as On-Screen Buttons.
- SigBins:** This allows control of the number of bins included for the signal in the FFT.
- DcBins** This allows control of the number of bins included for the dc component in the FFT.

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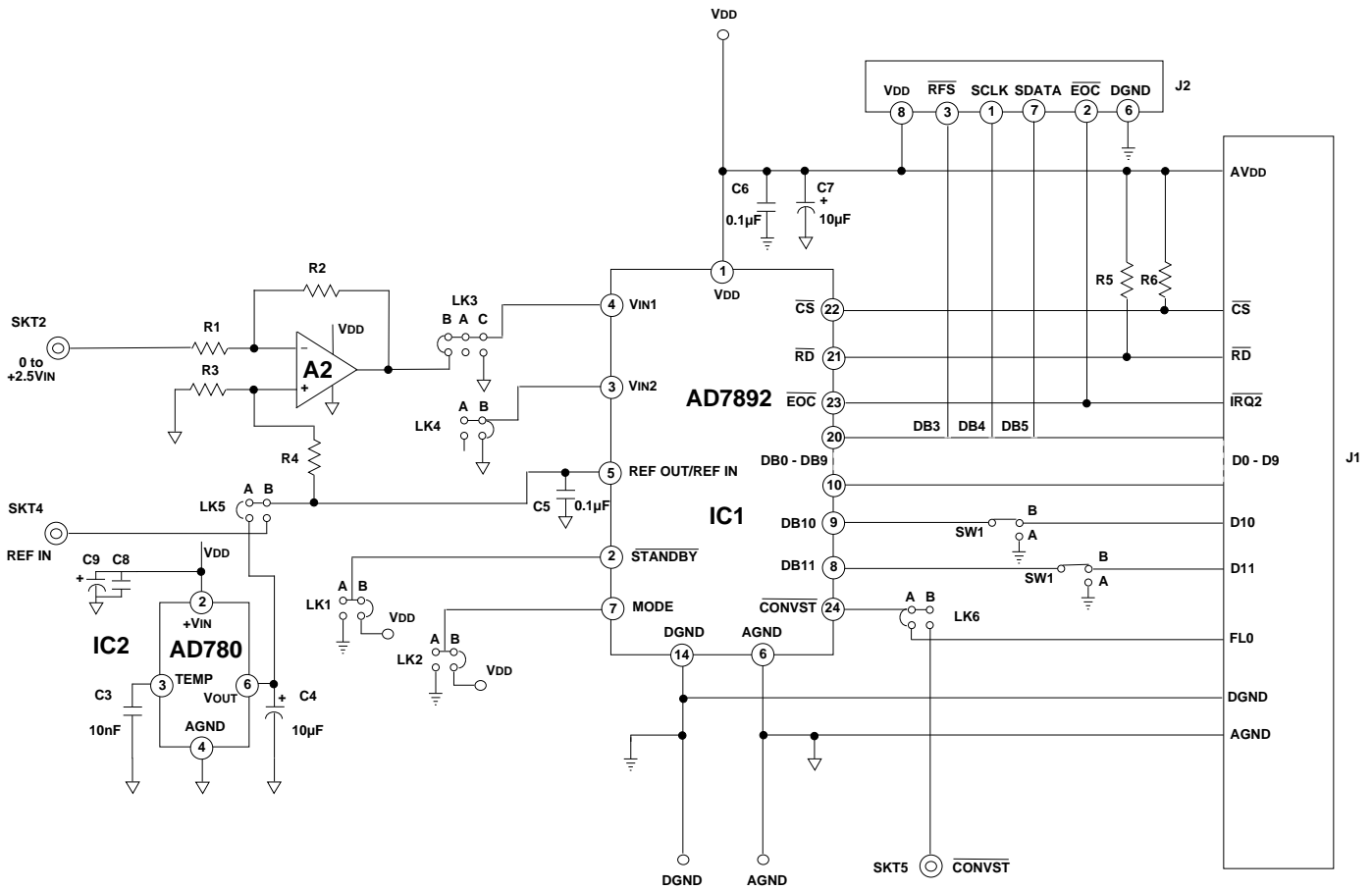


Figure 5. AD7892-2 Evaluation Board Circuit Diagram

COMPONENT LIST

Integrated Circuits

IC1	AD7892-2
IC2	AD780 Voltage Reference
A2	AD820

Capacitors

C4, C7, C9	10 μ F Capacitors
C5, C6, C8	0.1 μ F Capacitors
C3	10nF Capacitor

Resistors

R1,R2, R3, R4, R5, R6	10k Ω Resistors
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Links

LK1, LK2, LK3, LK4, LK5, LK6	Shorting Plugs
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Switches

SW1	Double-pole Change-over Switch
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Sockets

SKT2, SKT4, SKT5	Sub-Minature BNC Sockets
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Connectors

J1	96-Way Connector
J2	9-Way D-Type Connector