Evaluation Board for Differential Input, 12-Bit ADC with a Serial Interface

EVAL-AD7452

FEATURES

Full-featured evaluation board for the AD7452
Evaluation Control Board (EVAL-CONTROL-BRD2) compatible
Standalone capability
On-board analog buffering and reference
On-board, single-ended to differential conversion
Various linking options
PC software for control and data analysis when used with EVAL-CONTROL-BRD2

GENERAL DESCRIPTION

This data sheet describes the evaluation board for testing the AD7452 device. This device is a 12-bit, 555 kSPS, low power, successive approximation ADC with a fully differential analog input. It operates from a single 5 V or 3 V power supply. Full details on the AD7452 are available in the AD7452 data sheet, available from Analog Devices, Inc., which should be consulted in conjunction with this data sheet.

On-board components include:

- One AD780, a pin-programmable, 2.5 V or 3 V ultrahigh precision band gap reference
- One AD713 quad op amp
- Two AD8022 dual op amps
- One AD8138 differential amplifier
- One 7S04 inverter

Various link options are explained in detail in Table 1.

Interfacing to this board is via a 96-way connector. This 96-way connector is compatible with the EVAL-CONTROL-BRD2, which is also available from Analog Devices. External sockets are provided for a number of signals including the V_{REF} input, the V_{IN+} and V_{IN-} inputs, the optional, external SCLK input, the $\overline{CS}$ input, and the SDATA output.

FUNCTIONAL BLOCK DIAGRAM

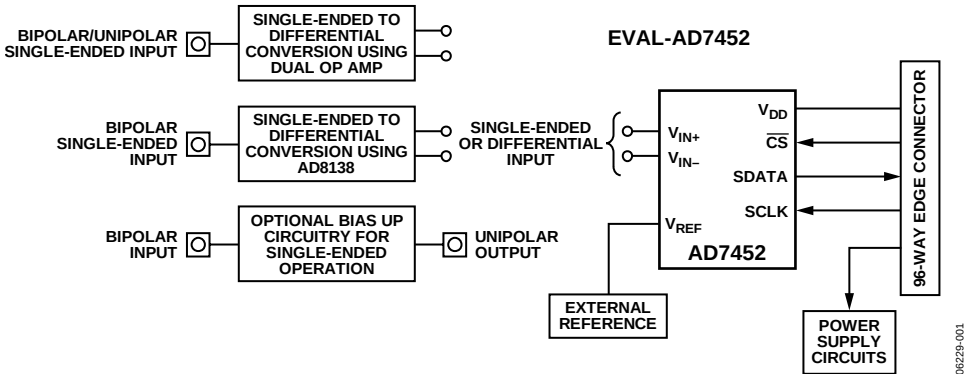

Figure 1.

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781.329.4700 www.analog.com
Fax: 781.461.3113

TABLE OF CONTENTS

REVISION HISTORY

2/07—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

POWER SUPPLIES

When using this evaluation board with the EVAL-CONTROL-BRD2, all supplies are provided from the EVAL-CONTROL-BRD2 through the 96-way connector.

When using the board as a standalone unit, external supplies must be provided. This evaluation board has the following power supply inputs:

- AV_{DD} (+5 V)
- AV_{SS} (−5 V)
- A_{GND} (AV_{DD}, AV_{SS}, +12 V, −12 V common)
- +12 V, −12V
- V_{DD} (5 V/3 V)
- D_{GND} (V_{DD} common)

If the evaluation board is used in standalone mode, 5 V/3 V must be connected to the V_{DD} input to supply the AD7452 V_{DD} pin. In addition, ±5 V must be connected to the ±5 V inputs to supply the AD8138, and +12 V and −12 V are needed to supply the AD713 quad op amp, the AD8022 dual op amps, and the AD780 voltage reference. The supplies are decoupled to the relevant ground plane with 10 µF tantalum and 0.1 µF multilayer ceramic capacitors at the point where they enter the board. The supply pins of all the op amps and the reference are also decoupled to A_{GND} with a 10 µF tantalum and a 0.1 µF ceramic capacitor. The AD7452 V_{DD} supply pin is decoupled to A_{GND} with 10 µF tantalum and 0.1 µF multilayer ceramic capacitors.

Extensive ground planes are used on this board to minimize the effect of high frequency noise interference. There are two ground planes, A_{GND} and D_{GND}. These are connected at one location close to the AD7452.

LINK OPTIONS

There are 27 link options that must be set prior to using the evaluation board. The functions of these options are outlined in Table 1. For a list of the positions where all the links are set when the evaluation board is shipped, see Table 2.

Table 1. Link Option Functions

Link No.	Function
LK1	Selects the source of the AV_{DD} +5 V supply. In Position A, the AV_{DD} is supplied from the EVAL-CONTROL-BRD2. In Position B, the AV_{DD} must be supplied from an external source via the power connector, J2.
LK2	Selects the source of the AV_{SS} −5 V supply. In Position A, the AV_{SS} is supplied from the EVAL-CONTROL-BRD2. In Position B, the AV_{SS} must be supplied from an external source via the power connector, J2.
LK3	Selects the source of the V_{DD} supply for the AD7452. In Position A, V_{DD} is supplied from the EVAL-CONTROL-BRD2 provided LK1 is in Position A. In Position B, V_{DD} must be supplied from an external source via J3. For 3 V operation, V_{DD} must be supplied from an external source via J3.
LK4	Selects the input to U4, the AD8022 dual op amp configuration for performing single-ended to differential conversion on the analog input. If LK21 is in Position A, this link should be removed so that the analog input can be applied to the dual op amp. If LK21 is in Position B, this link should be inserted to tie the analog input of the dual op amp configuration to ground, if it is not used.
LK5	Selects the reference voltage applied to the V_{REF} pin of the AD7452. In Position A, an external signal must be supplied to the V_{REF} pin via P7. In Position B, the AD780 provides a 2.5 V reference to the V_{REF} pin. This is intended for 5 V operation of the AD7452. In Position C, a 2 V reference, 4/5 the output of the AD780 is applied to V_{REF} pin. This is intended for use in 3 V operation of the AD7452.
LK6	Selects the common-mode voltage to be applied to the V_{OCM} pin of the AD8138 differential amplifier. In Position A, the common-mode voltage applied to V_{OCM} is V_{REF}. In Position B, an external common-mode voltage must be applied to V_{OCM} via P4.
LK7	Selects the source of the V+ (+12 V) supply which is used to power the op amps and the external reference. In Position A, V+ is supplied from the EVAL-CONTROL-BRD2 through the 96-way connector. In Position B, V+ is supplied from an external source via the power connector, J4.
LK8	Selects the source of the V− (−12 V) supply, which is used to power the op amps. In Position A, the V− is supplied from the EVAL-CONTROL-BRD2 through the 96-way connector. In Position B, the V− is supplied from an external source via the power connector, J4.

Link No.	Function
LK9	Controls the program pin of the AD780 reference voltage. When this link is installed, the AD780 output voltage is set to 3.0 V. When this link is uninstalled, the AD780 output voltage is set to 2.5 V.
LK10	Adds a 50 Ω termination to AGND at the VIN S.E. socket of the bias-up circuit (P2) for the single-ended input. This link should be inserted if a 50 Ω termination is required on the analog input.
LK11	Sets the dc bias voltage that is applied to the optional bias-up circuit used in single-ended mode. In Position A, the bias voltage is set to V_{REF} (that is, 2.5 V). In Position B, the bias voltage is set to AGND. In this configuration, the bias-up circuit is not used.
LK12	Selects the input to U8, the AD8138 differential amplifier used to perform single-ended to differential conversion on the analog input. This link should be installed if LK21 is in Position A to tie the analog input of the AD8138 to ground. The AD8138 is not used. This link should be uninstalled if LK21 is in Position B so that the analog input can be applied to the AD8138.
LK13	Selects the single-ended input source to the AD7452 if operating in single-ended mode. In Position A, the single-ended input is generated by the bias-up circuit. In Position B, an external unipolar single-ended signal must be applied to the V_{IN+} input via P3. In Position C, the input to U7, the AD8022 op amp used to buffer the single-ended signal is tied to AGND. Single-ended operation is not used.
LK14	Sets up the common-mode voltage applied to U4, the AD8022 dual op amp configuration used to perform single-ended to differential conversion on the analog input. In Position A, an external common-mode voltage can be applied to U4 via P11. In Position B, this input is tied to AGND. The AD8022 dual op amp is not used. In Position C, a portion of V_{REF} is applied to U4 to set up the common-mode voltage.
LK15	Used in conjunction with LK27 to set up the AD8022 dual op amp configuration. This converts either a unipolar or bipolar, single-ended signal into a differential signal centered on the common-mode voltage. These links should be installed when the analog input is biased around 0 V (bipolar). These links should be uninstalled when the analog input is biased around 2.5 V (unipolar).
LK16	Selects the source of the SCLK input. In Position A, the SCLK input is provided via the external socket, P8. In Position B, the SCLK input is provided by the EVAL-CONTROL-BRD2.
LK17	Controls the polarity of the serial clock applied to the SCLK pin. This link must be in Position A when LK16 is in Position B and when the SCLK is provided by the EVAL-CONTROL-BRD2. This means data is valid on the falling edge of SCLK. This link may be placed in Position B when LK16 is in Position A, to invert an SCLK from P8, if necessary. This means data can be read on the rising edge of SCLK; this is only possible with a slower SCLK frequency.
LK18	Selects where the serial data output (SDATA) appears. In Position A, the data can be read by the EVAL-CONTROL-BRD2. In Position B, the data can be read via the external socket, P9.
LK19	Selects the source of the $\overline{CS}$ input. In Position A, the $\overline{CS}$ input is provided by the EVAL-CONTROL-BRD2. In Position B, the $\overline{CS}$ input is provided via the external socket, P10.
LK20	Selects the source of the 5 V digital supply. In Position A, 5 V is supplied by the EVAL-CONTROL-BRD2. In Position B, 5 V must be supplied from an external source via J5.
LK21	Selects which single-ended to differential converter to use. In Position A, the AD8022 dual op amp configuration is used. LK4 should be uninstalled and LK12 installed. In Position B, the AD8138 differential amplifier is used. LK4 should be installed and LK12 uninstalled.
LK22	Selects the input to the AD8022 (U7-A) op amp. This op amp buffers the output of the resistor divider circuit, which divides the output of the AD780 to provide a 2 V reference for 3 V operation (default). Alternatively, resistors (R16 and R17) can be changed to set up a user-defined reference. If 3 V operation is used, this link should be uninstalled. If 5 V operation is used, this link should be installed to tie the input to U7-A to ground because it is not used.
LK23	Selects whether the output of the AD780 reference is applied directly to the AD7452 or if it is divided down to provide a 2 V reference. This link should be in Position A if a 2.5 V reference is required (usually for 5 V operation). LK22 should be installed. This link should be in Position B if a 2 V reference is required (usually for 3 V operation). LK22 should be uninstalled.

Link No.	Function
LK24	Selects the source of the V_{IN+} analog input. In Position A, an external signal must be applied to V_{IN+} via P5. In Position B, V_{IN+} is supplied from the positive output of the AD8022 dual op amp configuration. In Position C, V_{IN+} is supplied from the positive output of the AD8138 differential amplifier. In Position D, a single-ended signal is applied to the V_{IN+} input.
LK25	Selects the source of the V_{IN-} analog input. In Position A, an external signal must be applied to V_{IN-} via P6, either for differential or single-ended operation. In Position B, V_{IN-} is supplied from the negative output of the AD8022 dual op amp configuration. In Position C, V_{IN-} is supplied from the negative output of the AD8138 differential amplifier. In Position D, V_{REF} is applied to the V_{IN-} input of the AD7452 for single-ended operation.
LK26	Adds a 50 Ω termination to AGND at the VIN DIFF socket used for differential operation. This link should be inserted if a 50 Ω termination is required on the analog input. If the AD8138 differential amplifier is being used, R11 should be increased to 523 Ω to balance the gain of the AD8138. If a 50 Ω termination is not required, all four resistors around the AD8138 (R10, R11, R12, R13) must have the same value.
LK27	Used in conjunction with LK15 to set up the AD8022 dual op amp configuration. This converts either a unipolar or bipolar, single-ended signal into a differential signal centered on the common-mode voltage. These links should be installed when the analog input is biased around 0 V (bipolar). These links should be uninstalled when the analog input is biased around 2.5 V (unipolar).

Setting Links by Mode

Before applying power and signals to the evaluation board, ensure that all link positions are set up as per the required operating mode. The evaluation board offers two ways to perform single-ended to differential conversion of the analog input: using the AD8138 differential amplifier or using a dual op amp configuration (AD8022).

The AD8138 can only be used with a bipolar input, while the dual op amp can be used with a unipolar or bipolar input. The AD7452 can operate with either a 5 V or a 3 V power supply.

The evaluation board can also be set up for single-ended mode when the AD7452 is operated with a 5 V supply.

Table 2 shows the position where all the links are set when the evaluation board is shipped. The evaluation board is configured for differential mode using the AD8138 and V_{DD} of 5 V. The link positions for using the dual op amp configuration are shown in Table 3, while the link positions for differential 3 V operation are shown in Table 4. The link positions for single-ended operation are shown in Table 5. The evaluation board is compatible with the EVAL-CONTROL-BRD2 when shipped.

Table 2. Initial Link Positions—Differential Mode Using the AD8138, V_{DD} = 5 V

Link No.	Position	Function
LK1	A	AV_{DD} is supplied by the EVAL-CONTROL-BRD2.
LK2	A	AV_{SS} is supplied by the EVAL-CONTROL-BRD2.
LK3	A	V_{DD} for the AD7452 is 5 V and is supplied by the EVAL-CONTROL-BRD2.
LK4	Installed	The input to U4-A is tied to ground as the dual op amp configuration is not being used.
LK5	B	V_{REF} is selected to be 2.5 V and is supplied by the AD780.
LK6	A	The common-mode voltage applied to the V_{OCM} pin of the AD8138 is V_{REF}.
LK7	A	V+ is supplied by the EVAL-CONTROL-BRD2.
LK8	A	V− is supplied by the EVAL-CONTROL-BRD2.
LK9	Uninstalled	The AD780 is set to provide a 2.5 V reference.
LK10	Uninstalled	A 50 Ω termination to AGND is not applied to the input of the bias-up circuit; this is only used in single-ended mode.
LK11	B	The bias-up circuit is not used so the input to U2-C op amp (reference buffer) is grounded.
LK12	Uninstalled	The AD8138 is used to perform single-ended to differential conversion so the AD8138 positive input is connected to the analog input.
LK13	C	The input to U7-B, the op amp buffer for the single-ended input, is tied to ground since it is not used.
LK14	B	The input to U4-B is tied to ground because the dual op amp configuration is not used.
LK15	Uninstalled	The dual op amp configuration is not used.
LK16	B	SCLK is supplied by the EVAL-CONTROL-BRD2.
LK17	A	SCLK is not inverted.
LK18	A	SDATA is read by the EVAL-CONTROL-BRD2.
LK19	A	$\overline{CS}$ is supplied by the EVAL-CONTROL-BRD2.
LK20	A	The 5 V source is the EVAL-CONTROL-BRD2.
LK21	B	The AD8138 is used to perform single-ended to differential conversion on the analog input.
LK22	Installed	The input to the U7-A op amp is tied to ground because it is not used.
LK23	A	The output of the AD780 reference is connected directly to LK5 to provide a 2.5 V reference to the AD7452.
LK24	C	V_{IN+} is supplied by the positive output of the AD8138 differential amplifier.
LK25	C	V_{IN-} is supplied by the negative output of the AD8138 differential amplifier.
LK26	Uninstalled	A 50 Ω termination to AGND is not applied to the analog input. All four resistors around the AD8138 (R10, R11, R12, R13) have the same value.
LK27	Uninstalled	The dual op amp configuration is not used.

Table 3 shows the links to change for the dual op amp configuration (AD8022, U4) to perform single-ended to differential conversion on the analog input. Leave the others links set as shown in Table 2.

Table 3. Differential Mode—Using the Dual Op Amp Configuration (AD8022)

Link No.	Position	Function
LK4	Uninstalled	The dual op amp is used to perform single-ended to differential conversion so the U4-A input is connected to the analog input.
LK6	Uninstalled	The AD8138 is not used so the V_{OCM} pin is tied to ground through a 0.1 µF capacitor.
LK12	Installed	The input to AD8138 is tied to ground since it is not being used.
LK14	C	A portion of V_{REF} is applied to U4 to set up the common-mode voltage.
LK15, LK27		These links should be installed if the analog input is bipolar and uninstalled if the analog input is unipolar.
LK21	A	The analog input is applied to the dual op amp configuration.
LK24	B	V_{IN+} is supplied by the positive output of the AD8022 dual op amp configuration.
LK25	B	V_{IN-} is supplied by the negative output of the AD8022 dual op amp configuration.

Table 4 shows the links to change for 3 V differential operation. Leave the others links set as shown Table 2.

Table 4. Differential Mode—Using the AD8138, V_{DD} = 3 V

Link No.	Position	Function
LK3	B	3 V should be applied externally to V_{DD} of the AD7452 via J3.
LK5	C	A 2 V reference is applied to the AD7452 V_{REF} pin.
LK22	Uninstalled	AD8022 (U7-A) is used to buffer the 2 V reference before it is applied to the AD7452.
LK23	B	The output of the AD780 reference is divided to provide a 2 V reference to the AD7452.

For 5 V single-ended mode operation, change the links listed and described in Table 5. Leave the others links set as shown in Table 2.

Table 5. Single-Ended Mode, V_{DD} = 5 V

Link No.	Position	Function
LK4	Installed	The input to the AD8022 dual op amp configuration is connected to AGND because it is not used.
LK11	A	V_{REF} of 2.5 V is applied to the bias-up circuit.
LK12	Installed	Input to AD8138 is connected to AGND because it is not used.
LK13	A	The single-ended input to V_{IN+} is supplied by the bias-up circuit.
LK14	B	The input to the AD8022 dual op amp configuration is connected to AGND because it is not used.
LK24	D	The V_{IN+} input is supplied by the output of U7-B, the buffered single-ended input.
LK25	D	V_{IN-} is supplied by V_{REF} to setup the midscale value or common-mode voltage.

INTERFACING TO THE EVAL-CONTROL-BRD2

Interfacing to the evaluation board is via a 96-way connector, J1. J1 is used to connect the evaluation board to the EVAL-CONTROL-BRD2 or other system. The pinout for the J1 connector is shown in Figure 2. Table 6 describes the pins on the 96-way connector used to interface between the EVAL-CONTROL-BRD2 and the EVAL-AD7452. Table 7 gives its pin designations and functions.

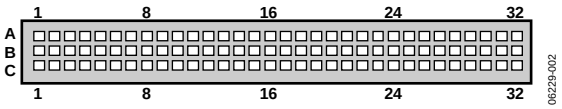

Figure 2. Pin Configuration for the 96-Way Connector, J1

Table 6. 96-Way Connector Pin Description

Pin Name	Description
DR0	Data Receive Zero. This input is connected to the SDATA pin of the AD7452 via LK18. The data stream of the AD7452 consists of four leading zeros followed by the 12-bits of conversion data, provided MSB first.
SCLK0	Serial Clock Zero. This continuous clock output is connected to the SCLK pin of the AD7452 via LK16.
TFS0	Transmit Frame Sync Zero. This output is connected to the $\overline{CS}$ pin of the AD7452 via LK19 to initiate conversions and to frame the serial data transfer.
RFS0	Receive Frame Sync Zero. This input is connected to the TFS0 pin of the ADSP-2189 to frame the serial data read. This is not a device pin, it is a pin on the 96 way connector row A pin 6
DGND	Digital Ground. These lines are connected to the digital ground plane on the evaluation board. This allows you to provide the digital supply via the connector along with the other digital signals.
AGND	Analog Ground. These lines are connected to the analog ground plane on the evaluation board.
AV_{DD}	Analog +5 V Supply. These lines are connected to the AV_{DD} supply line on the board via LK1 to provide +5 V to the AD8138 differential amplifier. They are also connected to the V_{DD} supply of the AD7452 via LK3.
AVSS	Analog −5 V Supply. These lines are connected to the AV_{SS} supply line on the board via LK2 to supply −5 V to the AD8138 differential amplifier.
±12 V	±12 V Supply. These lines are connected to the ±12 V supply lines on the evaluation board via LK7 and LK8 to supply ±12 V to the AD713 and the AD8022 devices and +12 V to the AD780.

Table 7. 96-Way Connector Pin Functions[1]

Pin No.	Row A	Row B	Row C
1			
2			
3			
4	DGND	DGND	DGND
5			DR0
6	TFS0		RFS0
7	SCLK0		SCLK0
8	+5 V	+5 V	+5 V
9			
10			
11			
12	DGND	DGND	DGND
13			
14			
15			
16	DGND	DGND	DGND
17			
18			
19			
20	DGND	DGND	DGND
21	AGND	AGND	AGND
22	AGND	AGND	AGND
23	AGND	AGND	AGND
24	AGND	AGND	AGND
25	AGND	AGND	AGND
26	AGND	AGND	AGND
27		AGND	
28		AGND	
29	AGND	AGND	AGND
30	−12 V	AGND	+12 V
31	AV_{SS}	AV_{SS}	AV_{SS}
32	AV_{DD}	AV_{DD}	AV_{DD}

[1] The unused pins of the 96-way connector are not shown.

SOCKETS

There are eleven input sockets relevant to the operation of the AD7452 on this evaluation board. These sockets are used for applying an externally generated signal to the evaluation board. When operating the board with the EVAL-CONTROL-BRD2, the only necessary external socket used is P1. All other sockets are optional and, if not used, their signals are supplied by the EVAL-CONTROL-BRD2. Most of these sockets are used when operating the board as a standalone unit, since all the signals required are supplied from external sources. The functions of these sockets are outlined in Table 8.

Table 8. Socket Functions

Socket	Function	Function
P1	Differential Input	Subminiature BNC socket for the bipolar analog input to the AD8138 or the bipolar/unipolar input to the AD8022 dual op amp configuration. These two circuits are used in differential mode.
P2	Single-Ended Input	Subminiature BNC socket for the bipolar analog input to the bias-up circuit. This is an option when operating in single-ended mode.
P3	External Single-Ended Input	Subminiature BNC socket for the unipolar analog input to V_{IN+} which is an option when operating in single-ended mode.
P4	V_{OCM} Input	Subminiature BNC socket for the dc analog input to the V_{OCM} pin on the AD8138 differential amplifier.
P5	External V_{IN+} Input	Subminiature BNC socket for a signal to be applied directly to V_{IN+}.
P6	External V_{IN-} Input	Subminiature BNC socket for a signal to be supplied directly to V_{IN-}.
P7	External V_{REF} Input	Subminiature BNC socket for an external V_{REF} input.
P8	External SCLK Input	Subminiature BNC socket for an external SCLK input.
P9	External SDATA Input	Subminiature BNC socket for the SDATA output.
P10	External $\overline{CS}$ Input	Subminiature BNC socket for an external $\overline{CS}$ input.
P11	External AD8022 Common-Mode Input	Subminiature BNC socket for setting up the common mode of the AD8022 dual op amp configuration.

CONNECTORS

There are five connectors on the AD7452 evaluation board as outlined in Table 9.

Table 9. Connector Functions

Connector	Function
J1	96-way connector for serial interface and power supply connections.
J2	External AV_{DD}, AV_{SS}, and A_{GND} power connectors.
J3	External V_{DD} power connector.
J4	External +12 V, −12 V, and A_{GND} power connectors.
J5	External +5 V power connector.

TEST POINTS

There are five test points on the inputs and the data output on the AD7452 evaluation board. These test points provide easy access to these signals for probing, evaluation, and debugging.

OPERATING WITH THE EVAL-CONTROL-BRD2

The evaluation board can be operated as a standalone unit or operated in conjunction with the EVAL-CONTROL-BRD2. The EVAL-CONTROL-BRD2 is available from Analog Devices under the order entry EVAL-CONTROL BRD2.

When interfacing the EVAL-AD7452CB directly to the EVAL-CONTROL-BRD2, all supplies and control signals to operate the AD7452 are provided by the EVAL-CONTROL-BRD2.

Software to communicate with the EVAL-CONTROL-BRD2 and the AD7452 is provided with the AD7452 evaluation board package. The EVAL-CONTROL-BRD2 also operates with all Analog Devices evaluation boards that end with the letters CB in their title.

The 96-way connector on the EVAL-AD7452CB plugs directly into the 96-way connector on the EVAL-CONTROL-BRD2. The EVAL-CONTROL-BRD2 provides all the supplies for the evaluation board. It is powered from a 12 V ac transformer. Suitable transformers are available from Analog Devices as an accessory under the following part numbers:

- EVAL-110VAC-US: (for use in the U.S. or Japan)
- EVAL-220VAC-UK: (for use in the U.K.)
- EVAL-220VAC-EU: (for use in Europe)

These transformers are also available from Digi-Key Corp. (U.S.) and Campbell Collins. Ltd. (U.K.).

Connection between the EVAL-CONTROL-BRD2 and the serial port of a PC is via a standard Centronics printer port cable, provided as part of the EVAL-CONTROL-BRD2 kit.

EVALUATION BOARD SOFTWARE

INSTALLING THE SOFTWARE

The EVAL-AD7452 kit includes self-installing software on CD-ROM. This CD-ROM contains software for controlling and evaluating the performance of the AD7452 when operated in conjunction with the EVAL-CONTROL-BRD2.

Insert the CD into the drive on your PC, and an installation program automatically begins. This program installs the evaluation software onto the PC as well as electronic versions of the evaluation board data sheet, the AD7452 device data sheet, and the EVAL-CONTROL-BRD2 data sheet.

CHECKING THE EVAL-CONTROL-BRD2

The EVAL-CONTROL-BRD2 and evaluation board should be connected together as described in the Interfacing to the EVAL-CONTROL-BRD2 section.

At this stage, the red LED on the EVAL-CONTROL-BRD2 should be flashing. This indicates that the EVAL-CONTROL-BRD2 is functional and ready to receive instructions.

Note that the software should be installed before the printer port cable is connected between the EVAL-CONTROL-BRD2 and the PC. This ensures that the printer port has properly initialized.

THE MAIN WINDOW

The main window, shown in Figure 4, allows you to read a predetermined number of samples from the evaluation board and display them in both the time and frequency domain. This screen can be divided into three sections.

The upper portion of the screen contains the control buttons, the menu bar, and the status windows.

Control Buttons

Use control buttons to take samples (**Sample**), reset the board (**Reset**), and quit the program (**Quit**).

The **Reset** button resets the EVAL-CONTROL-BRD2. The power supplies are turned off and the program in DSP memory is lost. Repeat the setup instructions to download another program, if required.

The **Quit** button exits the software, however programs running on the EVAL-CONTROL-BRD2 are not terminated.

Power Down and **Power Up** buttons allow you to power down and then power up the device (see the AD7452 data sheet).

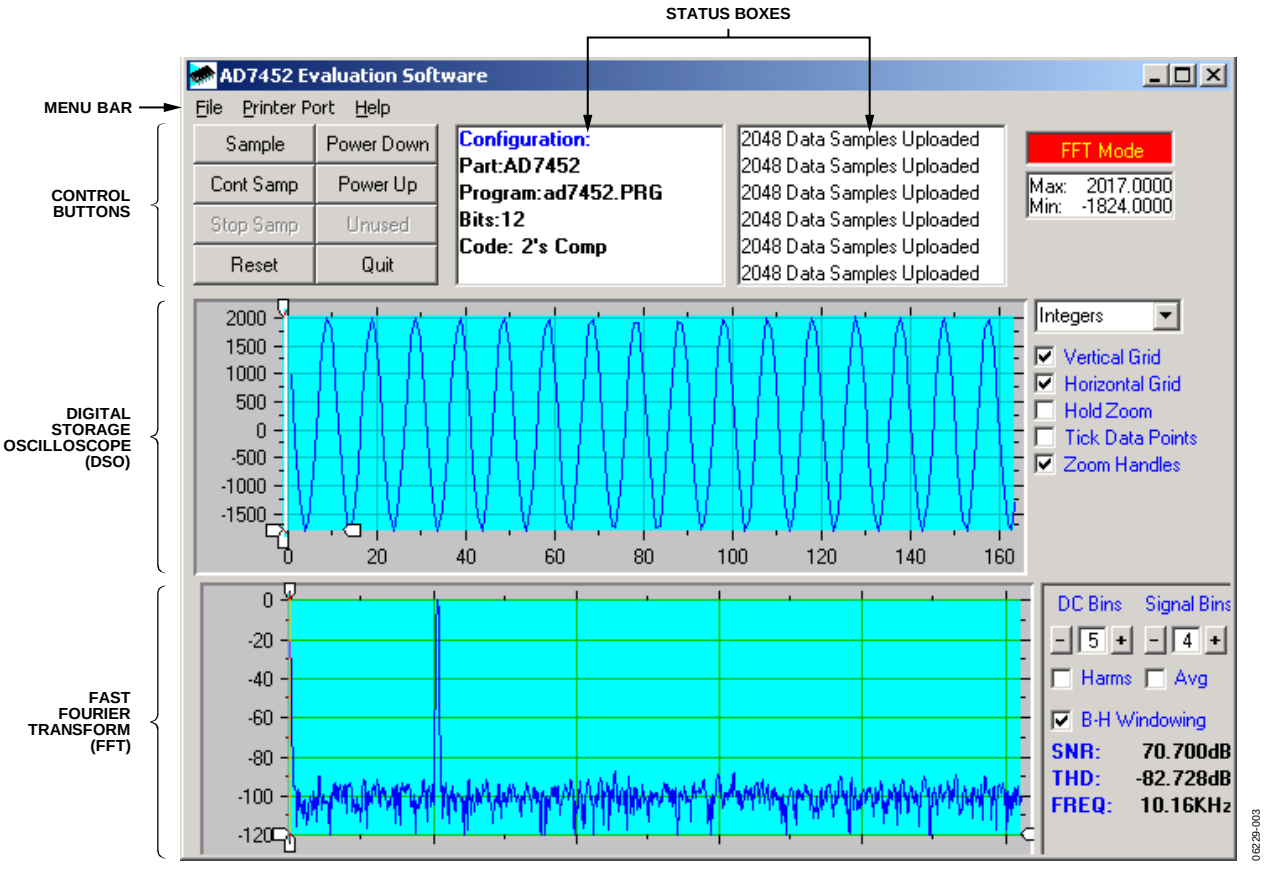

Figure 3. AD7452 Main Window–FFT Mode

Menu Bar

The menu bar consists of the **File**, **Printer Port**, and **Help** menus.

The **File** menu offers the following selections:

- **Setup Menu**. Select this option to display the Setup Menu as shown in Figure 5.
- **Load Raw Data**. Select this option to load data saved by the software during a previous session.
- **Save Raw Data**. Select this option to save the current set of sample data points. The data can be reloaded to the EVAL-CONTROL-BRD2 software later or used by other programs for further analysis
- **Save Binary Data**. Select this option to save the current set of sample data points. The data is saved in binary format as a text file. This method can be useful for examining code flicker and looking for stuck bits.
- **Save FFT Data**. Select this option to save the current set of FFT data points. FFT data cannot be reloaded into the EVAL-CONTROL-BRD2 software, but can be loaded into other software packages for further analysis.
- **Exit**. Quits the program.

The **Printer Port** menu allows you to select which printer port to use to communicate with the EVAL-CONTROL-BRD2 if the Windows® 95 or Windows® 98 operating system is being run.

- **LPT1**. This option selects 0x378 as the printer port address. This is the default option.
- **LPT2**. This option selects 0x278 as the printer port address.
- **PRN**. This option selects 0x3BC as the printer port address. If Windows® 2000 or Windows® NT is being run, the software automatically detects the first printer port.

The **Help** menu provides information about the current version of evaluation board software.

Status Boxes

The status boxes display the setup of the evaluation board and the device, along with the number of samples taken and other information, such as error messages generated.

Oscilloscope

The middle portion of the main window is a digital storage oscilloscope (DSO). Samples uploaded from the EVAL-CONTROL-BRD2 are displayed here. Samples can be displayed as integer values or as voltages. Once the samples are displayed, clicking any point in the graph displays the sample number and the value of the point directly beneath the cursor.

Zoom handles, which appear along the axis of the graph, allow you to zoom in and out to get a closer look at a particular sample. When another set of samples is taken, the graph attempts to display all values collected unless the **Hold Zoom** check box is checked. The graph retains the same axis settings as for the previous set of data samples. Additional check boxes are provided allowing you to control the vertical and horizontal grids and data points.

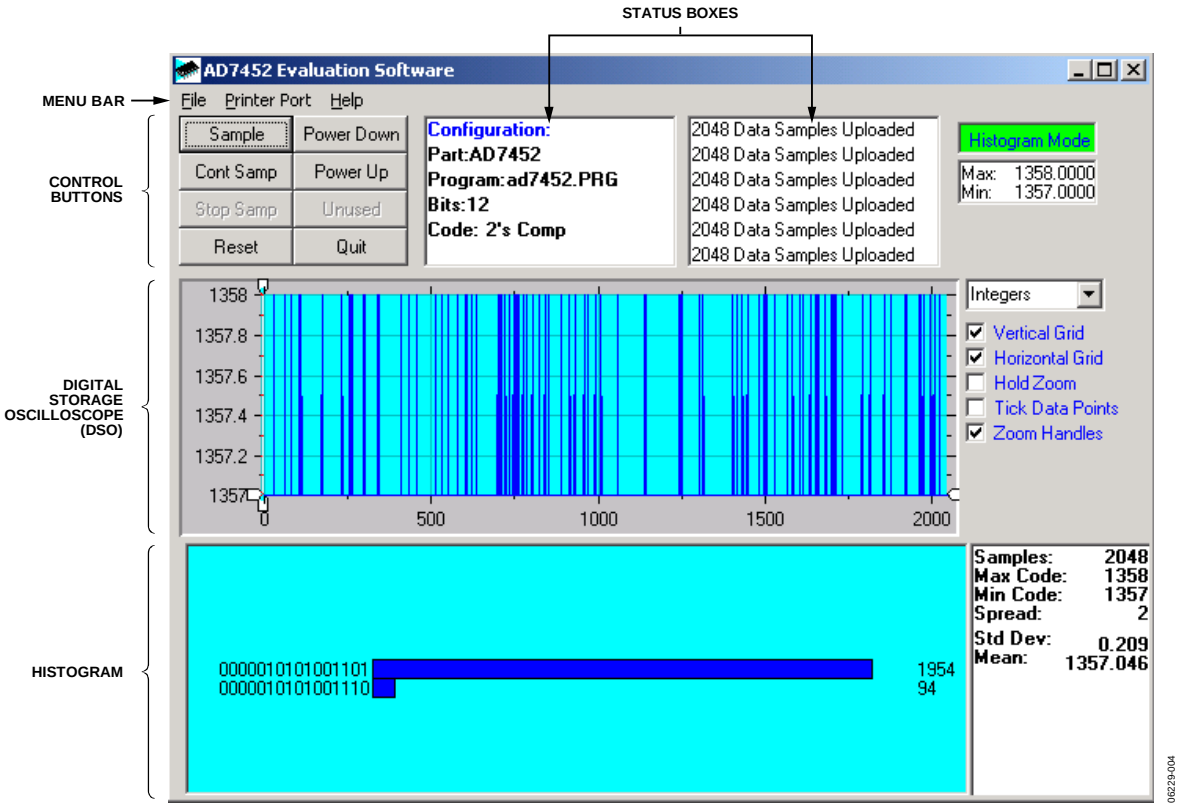

Figure 4. AD7452 Main Window–Histogram Mode

Fast Fourier Transform/Histogram

The lower portion of the main screen shows either a fast fourier transform (FFT) of the data or a histogram, which shows the number of occurrences of each particular code read back. The FFT (the default option) is typically used if you are concerned with examining ADC performance in the frequency domain, while the histogram indicates performance with DC signals. The option displayed can be changed by clicking on the **FFT Mode/Histogram Mode** button at the top right of the screen. Figure 4 shows the main window with the histogram mode is selected.

SETUP MENU

The **Setup Menu**, shown in Figure 5, allows you to load the required configuration file for the evaluation board. Once the configuration file is loaded, the software acquires detailed information about the AD7452 evaluation board and the device connected to the EVAL-CONTROL-BRD2. This includes information such as the number of bits, maximum sampling rate, output coding, maximum analog input, and power supply requirement.

The configuration file also communicates to the software the name of the DSP program file to download to the EVAL-CONTROL-BRD2.

The **Setup Menu** allows you to choose the sampling frequency and the number of samples to take.

SETTING UP THE EVAL-CONTROL-BRD2

This section describes how the evaluation board, the EVAL-CONTROL-BRD2, and software should be set up for you to begin using the complete system.

The EVAL-CONTROL-BRD2 and evaluation board should be connected together (via the 96-way connector). The power should be applied to the EVAL-CONTROL-BRD2 via a 12 V ac transformer. At this stage the red LED should be flashing which indicates that the EVAL-CONTROL-BRD2 is functional and ready to receive instructions. The software should be installed and loaded before the printer port cable is connected between the EVAL-CONTROL-BRD2 and the PC. This ensures that the printer port has been initialized properly. The printer port cable can then be connected between the PC and the EVAL-CONTROL-BRD2.

RUNNING THE SOFTWARE

Once the software is installed and running, perform Step 1 through Step 3.

1. From the **File** menu, select **Setup**.

   The **Setup Menu** displays. Notice that the **Select a Configuration File** window lists all the available configuration files. The configuration files are text-based files containing information about the device to be tested. The information includes the part name, number of samples to be taken, default and maximum sampling frequency, and power supply settings. The configuration file also contains the name of the DSP program file to be downloaded to the EVAL-CONTROL-BRD2.

2. Select the relevant configuration file and then click **Load**.

   Choose the configuration file depending upon which device is in the socket of the evaluation board. The EVAL-CONTROL-BRD2 is then reset and the DSP program is downloaded. Once the download is complete, the power supply settings indicated in the configuration file are set and you may hear some of the relays clicking. The pull-down menus, **Select No. Of Samples** and **Select Sample Frequency,** are set to the default values specified in the configuration file. Note that you can change these settings at any point.

3. Once all the settings are set, click **Close** to return to the main window.

SOFTWARE CONFIGURATION FILES

Software configuration files provide the EVAL-CONTROL-BRD2 software with information on how the software and hardware should perform. These files contain information, such as the name of the DSP program to download, the default and maximum sample frequencies, the number of samples to take, and the power supply settings to use.

Typical Configuration File

```
EVAL-CONTROL-BRD2
partname:AD7452
programname:ad7452.PRG

samplefrequency:100000
maxsamplefrequency:555000
samples:2048

+/-15V:on
dvdd:5:on
avdd:5:on
bus:on
;options 2scomp, binary
dataformat:2scomp
numberofbits:12
inputVmax:5
inputVmin:0
[endofconfig]
```

Operating with Difference Voltage Reference Inputs

The functionality of the AD7452 allows a variable reference input in the range of 100 mV to 3.5 V. The allowable reference input is dependent on the power supply to ensure that the maximum ratings of the device are not exceeded.

For 5 V operation, the standard reference on the evaluation board is 2.5 V, which corresponds to a differential input of 5 V. This maximum input voltage is set up in the configuration file. See the **inputVmax: 5** in the Typical Configuration File section.

For 3 V operation, the standard reference on the evaluation board is 2 V which corresponds to a differential input of 4 V. Therefore, when operating with 3 V supplies, the configuration file has to be adjusted to show **inputVmax: 4**. As you change the reference input, make sure that you adjust the **inputVmax** figure in the configuration file to ensure that accurate data is displayed in the software. Note that **inputVmax** is always $2 \times V_{REF}$.

TAKING SAMPLES

To instruct the EVAL-CONTROL-BRD2 to take the required number of samples at the required frequency, follow these steps:

1. Click **Sample** on the main window.
2. Select the required number of samples (**Select No. of Samples**) and the sampling frequency (**Select Sample Frequency**) from the **Setup Menu**.

   Because the evaluation board runs up to 555 kSPS, choose a sampling frequency up to this rate.
   Samples are uploaded and displayed. An FFT and histogram are also calculated and displayed.
3. Click **Cont Samp** on the main window to continue taking samples.

   Note that while the software is continuously sampling data, the other control buttons are disabled.
4. Click **Stop Samp** on the main window when you are finished taking samples.

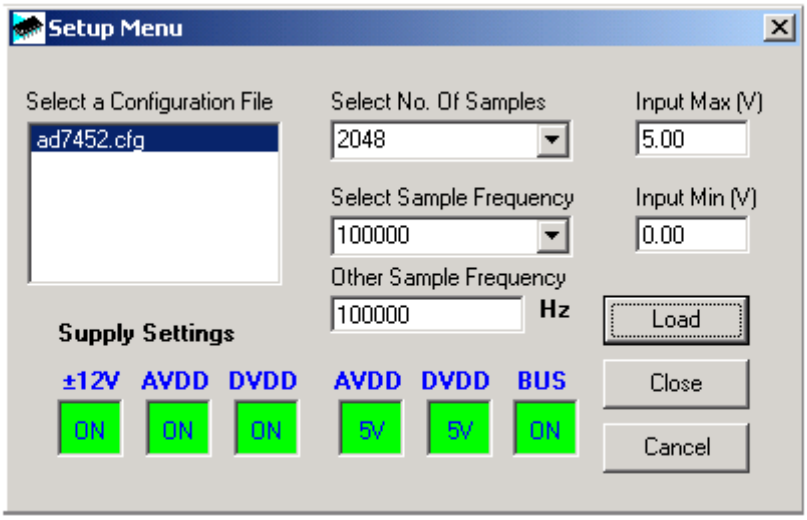

Figure 5. The Setup Screen

EVALUATION BOARD SCHEMATICS AND ARTWORK

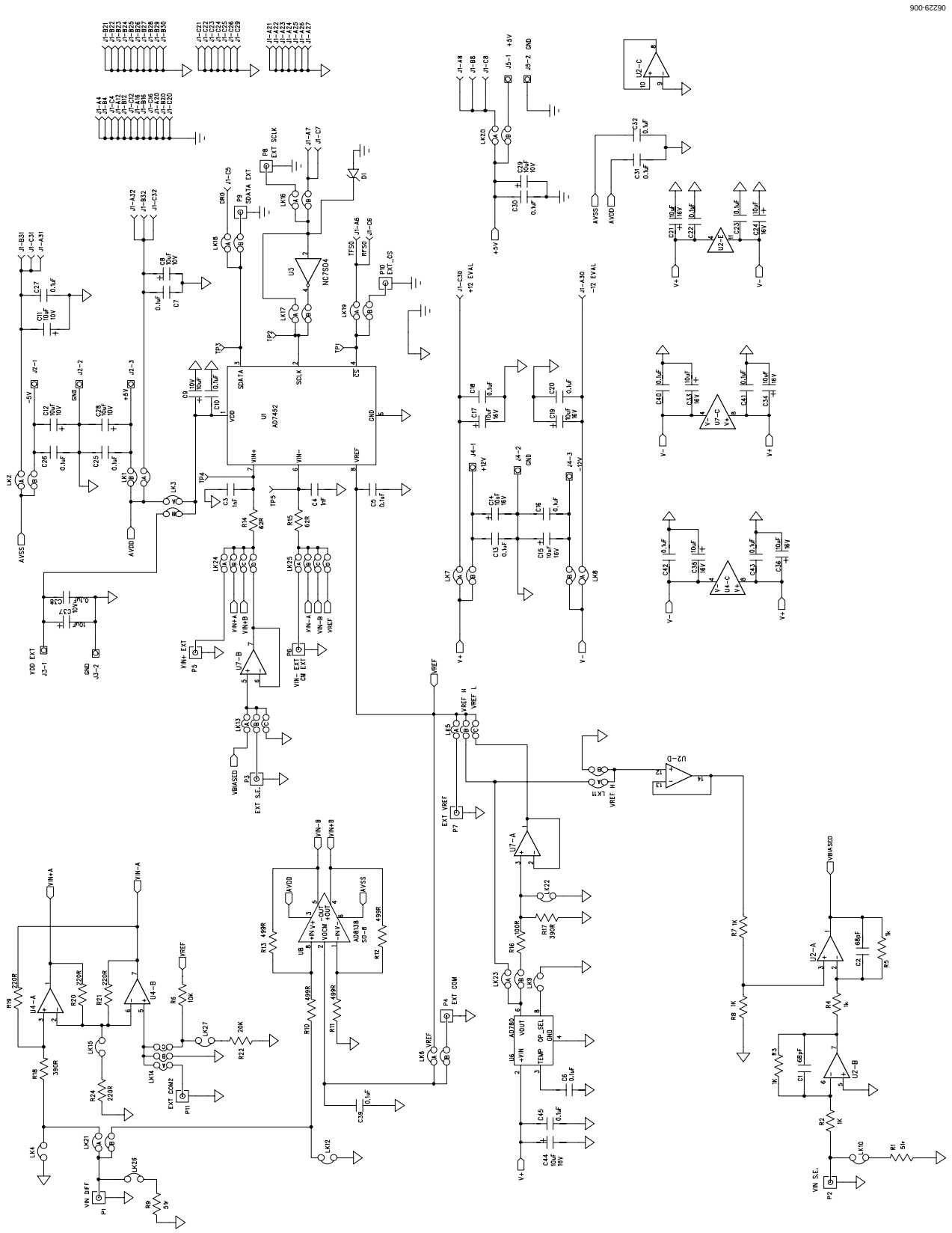

Figure 6. Circuit Diagram

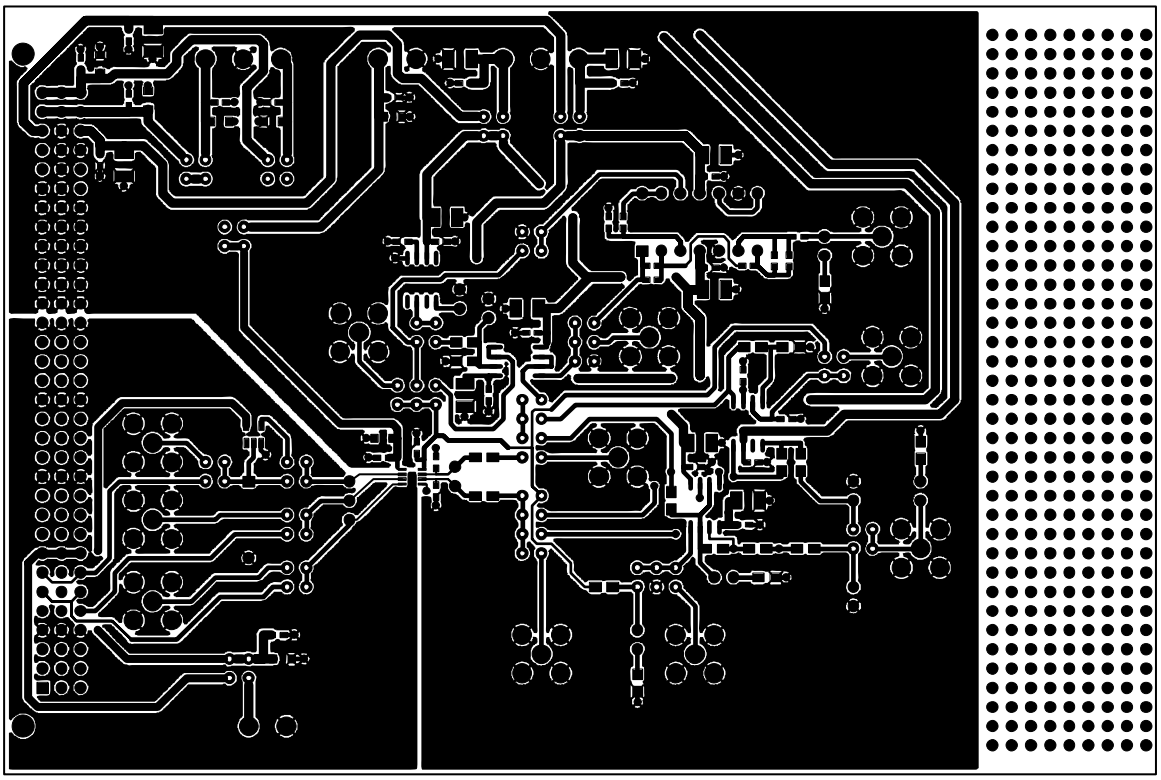

Figure 7. Component Side Artwork

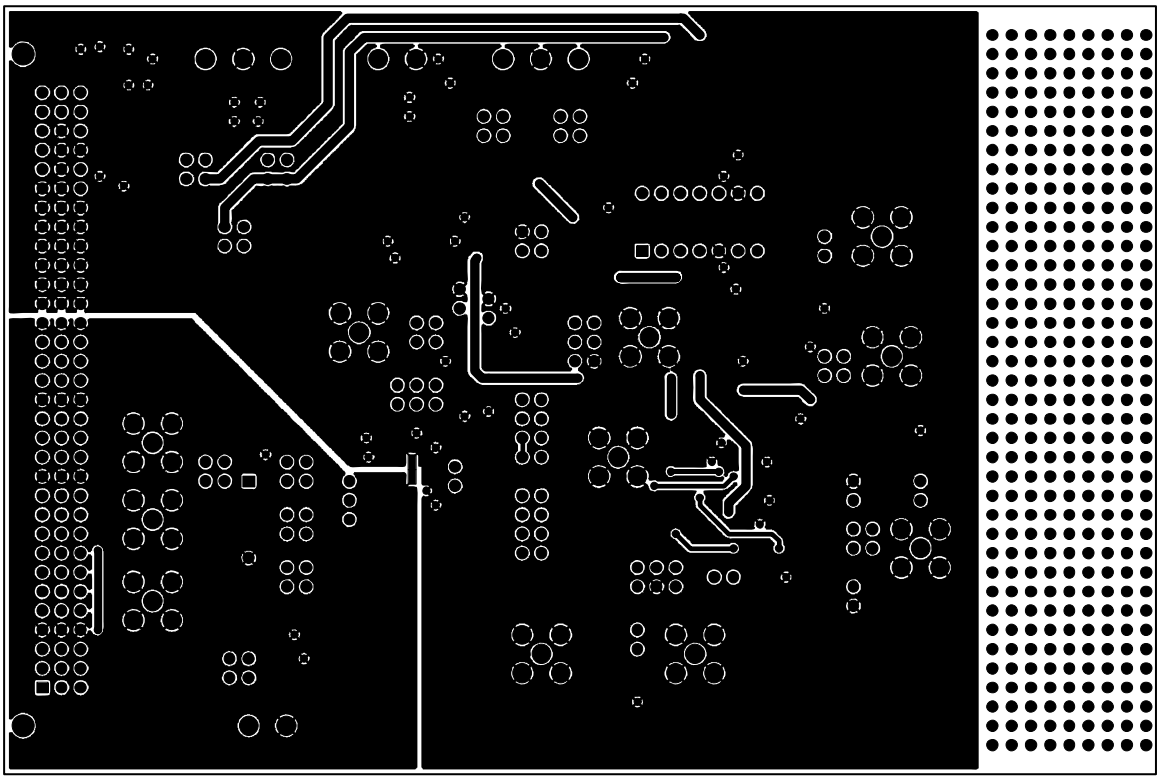

Figure 8. Solder Side Artwork

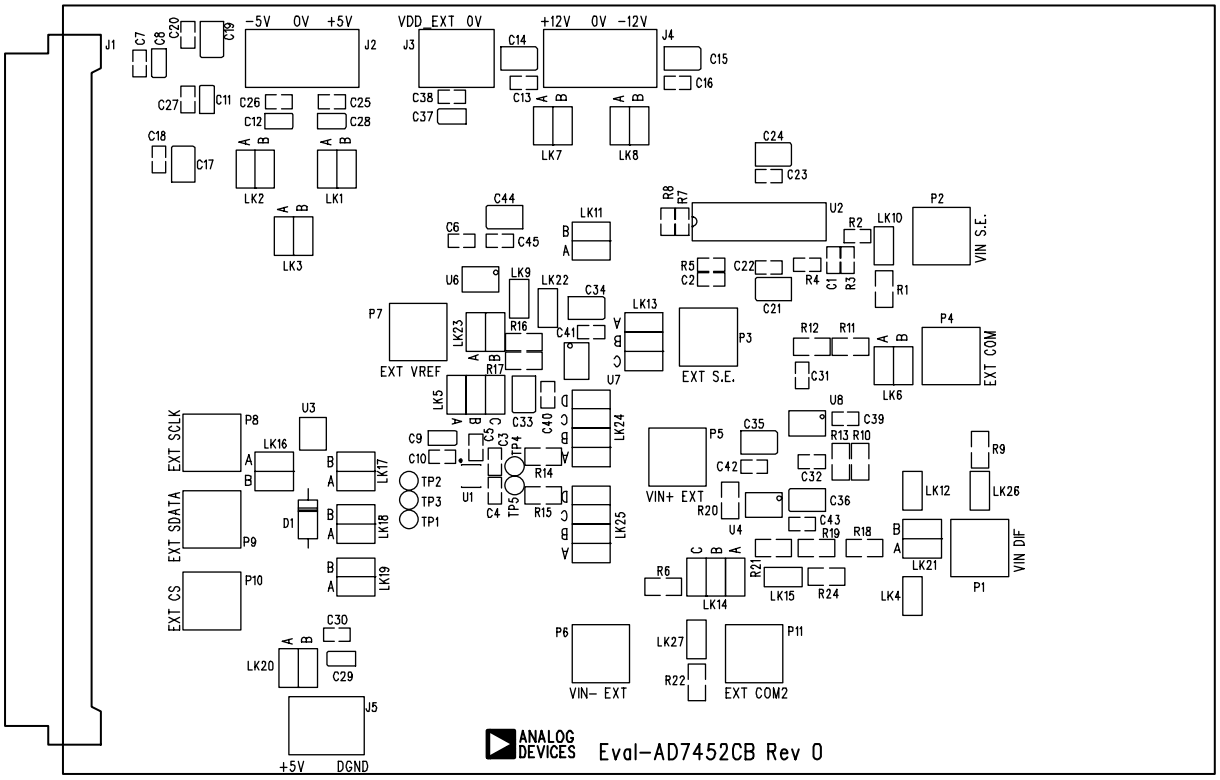

Figure 9. AD7452 Evaluation Board Component Placement Drawing

ORDERING INFORMATION

BILL OF MATERIALS

Table 10. AD7452 Evaluation Board Bill Of Materials

Qty.	Reference Designator	Part Type	Order Number[1]
1	U1	AD7452	AD7452BRT
1	U2	AD713	AD713JN
1	U3	NC7S04M5	FEC 685-914
2	U4 and U7	AD8022	AD78022AR
1	U6	AD780	AD780AR
1	U8	AD8138	AD8138AR
2	C1, C2	68 pF ceramic capacitor, SMD 0603	FEC 722-066
2	C3, C4	1 nF ceramic capacitor, SMD 0603	FEC 317-202
23	C5, C6, C7, C10, C13, C16, C18, C20, C22, C23, C25 to C27, C30 to C32, C38 to C43, C45	0.1 µF ceramic capacitor, SMD 0603	FEC 699-675
7	C8, C9, C11, C12, C28, C29, C37	10 µF tantalum capacitor 10 V	FEC 197-130
11	C14, C15, C17, C19, C21, C24, C33, C34, C35, C36, C44	10 µF tantalum capacitor 16 V	FEC 498-737
1	D1	SD103C Schottky diode (by Digi-Key Corp.)	SD103CDITB-ND
1	R1 and R9	51 Ω, 0.1W, 0.1% resistor SMD 0805	FEC 321-7905
6	R2, R3, R4, R5, R7, R8	1 kΩ, 0.063W, 0.1% resistor, SMD 0603	FEC 911-239
1	R6	10 kΩ, 0.1W, 0.1% resistor SMD 0805	FEC 321-7905
4	R10, R11, R12, R13	499 Ω 0.1W, 0.1% resistor, SMD 0805	FEC 553-712
2	R14, R15	62 Ω 0.1W, 0.1% resistor, SMD 0805	FEC 321-7917
1	R16	100 Ω 0.1W, 0.1% resistor, SMD 0805	FEC 933-2375
2	R17, R18	390 Ω, 0.1W, 0.1% resistor SMD 0805	FEC 911-800
4	R19, R20, R21, R24	220 Ω, 0.1W, 0.1% resistor SMD 0805	FEC 911-770
1	R22	20 kΩ, 0.1W, 0.1% resistor SMD 0805	FEC 321-8211
1	J1	CON\41612\96 connector	FEC 225-393
2	J2 and J4	3-pin terminal block	FEC 151-786
2	J3 and J5	2-pin terminal block	FEC 151-785
8	LK4, LK9, LK10, LK12, LK15, LK22, LK26, LK27	1-way jumper (2 × 1)	FEC 511-705
14	LK1 to LK3, LK6 to LK8, LK11, LK16 to LK21, LK23	2-way jumper (2 × 2)	FEC 511-791
3	LK5, LK13, LK14	3-way jumper (2 × 3)	FEC 511-780
2	LK24, LK25	4-way jumper (2 × 4)	FEC 511-791
27	LK1 to LK27	Shorting link	FEC 150-411
11	P1 to P11	Gold 50 Ω SMB jack	FEC 310-682
5	TP1, TP2, TP3, TP4, TP5	Test point	FEC 240-333
4	Each Corner	Stick-on feet	FEC 148-922

[1] FEC = Farnell Electronic Components.

ORDERING GUIDE

Model	Description
EVAL-AD7452CB	AD7452 Evaluation Board

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

NOTES

NOTES

EB06229-0-2/07(0)