

### GENERAL DESCRIPTION

This data sheet describes the AD7152 evaluation board and PC software.

Additional details about the [AD7152](#), an ultralow power, 2-channel capacitance-to-digital converter (CDC) can be found at [www.analog.com](http://www.analog.com).

More information about the Analog Devices, Inc., family of CDC products can be found at [www.analog.com/CDC](http://www.analog.com/CDC).

### EVALUATION BOARD DESCRIPTION

The AD7152 evaluation kit is a powerful tool for exploring and evaluating the AD7152 features at many different levels.

The board is connected to a PC via a standard USB interface. The PC software allows the graphical display of real-time data, modification of the AD7152 internal settings, and generally assists in understanding the part features and performance. The flexible interface structure of the evaluation board allows it to be connected in a number of useful configurations. For example, the digital section of the evaluation board can be used independently as a convenient digital interface for a user's own sensor design PCB or as a module containing the AD7152. Alternatively, an external microcontroller can be interfaced to the AD7152 and thus the evaluation board can act as a complete analog front end for creating and debugging software on the user's own digital platform.

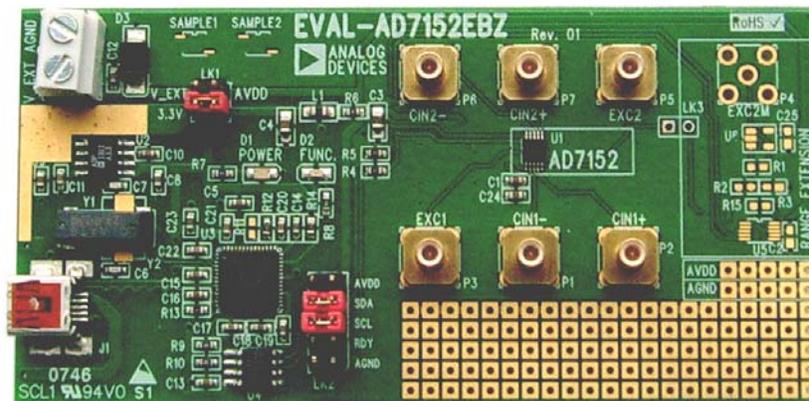


Figure 1. AD7152 Evaluation Board

#### Rev. 0

Evaluation boards are only intended for device evaluation and not for production purposes. Evaluation boards are supplied "as is" and without warranties of any kind, express, implied, or statutory including, but not limited to, any implied warranty of merchantability or fitness for a particular purpose. No license is granted by implication or otherwise under any patents or other intellectual property by application or use of evaluation boards. Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Analog Devices reserves the right to change devices or specifications at any time without notice. Trademarks and registered trademarks are the property of their respective owners. Evaluation boards are not authorized to be used in life support devices or systems.

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## REVISION HISTORY

8/08—Revision 0: Initial Version

## EVALUATION SOFTWARE INSTALLATION

The AD7152 evaluation board software must be installed before connecting the AD7152 evaluation board to the PC.

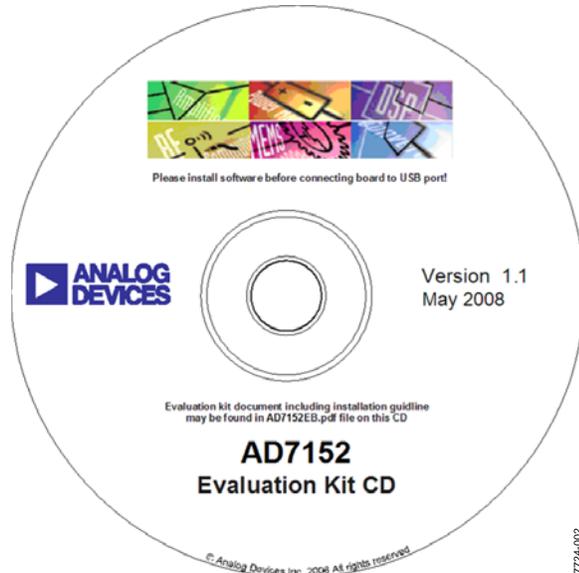


Figure 2. AD7152 Evaluation Kit CD

1. Insert the AD7152 evaluation kit CD in the CD-ROM drive of your PC. The evaluation software installation wizard should start automatically after inserting the CD. If the wizard does not start, run **Setup.exe** from the AD7152 evaluation kit CD.

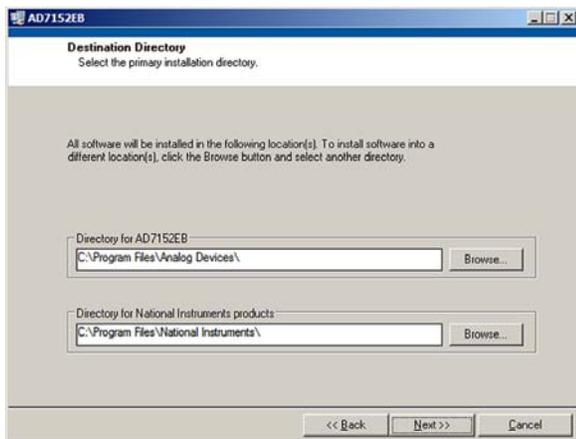


Figure 3. AD7152 Evaluation Software Installation

2. Follow the steps in the evaluation software installation wizard until the installation is completed.

3. Connect the AD7152 evaluation board to your PC USB connector using the USB cable included in the evaluation kit. The POWER LED on the evaluation board turns on and the **Found New Hardware Wizard** starts automatically on the PC.



Figure 4. Found New Hardware Wizard

4. Follow the steps in the **Found New Hardware Wizard** window. If a message that the software has not passed Windows® Logo testing, click **Continue Anyway**.

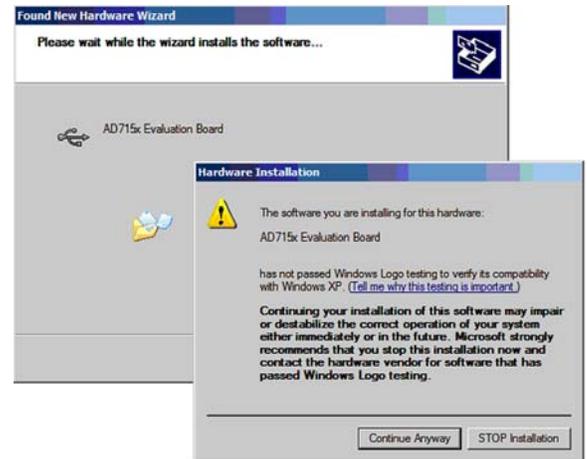


Figure 5. Windows Logo Warning

5. Follow the steps in the **Found New Hardware Wizard** until the installation is completed.

## EVALUATION BOARD HARDWARE

### POWER SUPPLY

To use the AD7152 evaluation board, make sure that the AVDD link (LK1) is in place, either in 3.3 V when using the on-board voltage supply or in V\_EXT when using an external voltage source via J2.

In both cases, the LED labeled POWER on the board should turn on when connected to either of the supply sources.

### I<sup>2</sup>C INTERFACE CONFIGURATION OPTIONS

The AD7152 evaluation board allows different digital interface configurations by redirecting the I<sup>2</sup>C® signals, SDA and SCL, on LK2.

#### Default

Links in the SDA and SCL positions of LK2 connect the USB microcontroller as the I<sup>2</sup>C bus master to the on-board AD7152, as shown in Figure 6. This allows easy use of the evaluation board together with the PC software.

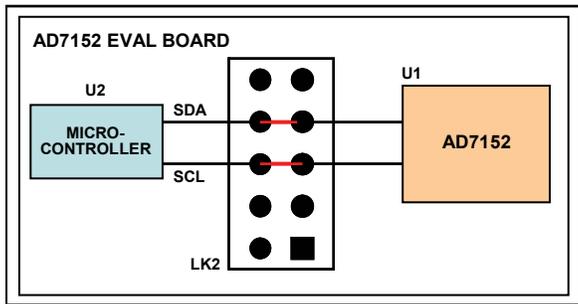


Figure 6. AD7152 Evaluation Board in Default Configuration

#### USB—External Connection

The AD7152 evaluation board allows customers to connect their own specific AD7152 application board to Pin 6 and Pin 8 of LK2. This enables customers, together with the PC evaluation software, to evaluate their application hardware using the AD7152 evaluation board only as a USB-to-I<sup>2</sup>C digital interface as shown in Figure 7.

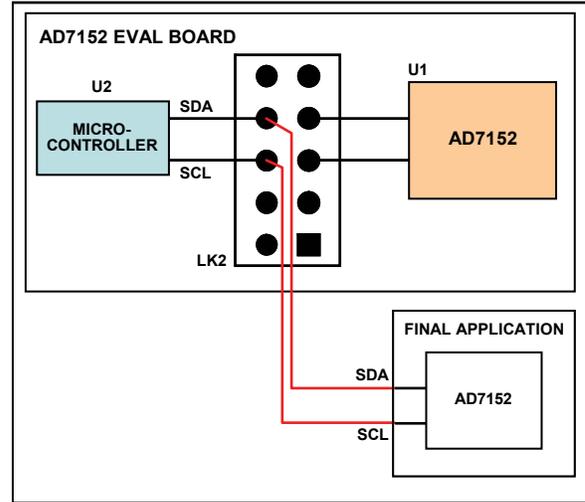


Figure 7. AD7152 Evaluation Board as USB-to-I<sup>2</sup>C interface

#### External Connection—AD7152

The AD7152 evaluation board can be used for software development by connecting a customer-specific external microcontroller board to Pin 5 and Pin 7 of LK2, as shown in Figure 8, using the AD7152 CDC on the evaluation board as the sensing device.

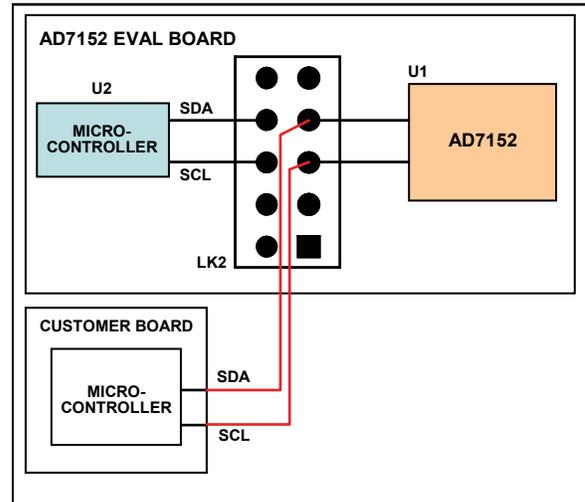


Figure 8. AD7152 Evaluation Board Software Development Platform

## EVALUATION BOARD SOFTWARE

### STARTING THE EVALUATION SOFTWARE

Start the AD7152 evaluation software on the PC.

Click the **Start** button, located at the bottom left-hand corner of your desktop. Select **Programs**, then **Analog Devices**, then **AD7152 Evaluation Software**, and then **AD7152EB** to run the software.

If a connection between the software and the evaluation board is correctly established, the window shown in Figure 9 appears. The USB indicator in the top right corner of the software window turns on green, and the LED labeled FUNC on the AD7152 evaluation board flashes in approximately 1 sec intervals.

### REAL-TIME MODE

#### Analysis Mode

To open the AD7152 analysis window (see Figure 11), which provides the ability to perform a noise analysis on the AD7152 capacitive inputs, click **Analysis Mode** in the real-time mode window.

#### Log Data to File

When **Log data to file** is clicked, the software allows you to log the acquisition data into a text file with the ASCII tab character as the delimiter to allow easy import to a data processing tool, such as Microsoft® Excel.

#### Setup AD7152

Click **Setup AD7152** to open the AD7152 setup window (see Figure 10), which provides access to the AD7152 settings.

#### Demo Setup

To start the data acquisition, click **Demo Setup** to configure both capacitive channels of the AD7152 to be in differential mode with a range of  $\pm 2$  pF. The AD7152 is set to run in

continuous conversion mode with a conversion time of 5 ms per channel.

#### Start

Clicking the green **Start** button in the AD7152 evaluation software window starts the data acquisition. The LED labeled FUNC on the evaluation board turns on, the RUN indicator in the top right corner of the software window turns on red, and graphs in the software start displaying the measured data.

The data displays and the traces in the graphs represent real-time data read from the AD7152.

#### Reset

When **Reset** is clicked, the software accesses AD7152 Register Address 0xBF to reset the part. See the AD7152 data sheet for details on the serial interface.

#### Graphs

Graphs show the history of data up to 65,536 samples. You can modify the graph appearance. For example, the scale can be modified by typing minimum and maximum numbers when the autoscale is turned off. Place the cursor on the graph and right-click the mouse to open the graph submenu, which allows different individual graph settings.

When **Clear Graphs** is clicked, the graph and the graph history are cleared.

#### Data Format and Units

Both displays show the data as hexadecimal codes read from the AD7152 and translated to picofarads (pF). The graphs can show the data in either hexadecimal codes or translated in picofarads. To switch between these two modes, click **Graphs in Code**. The **Graphs in Code** button switches to **Graphs in pF** when clicked.

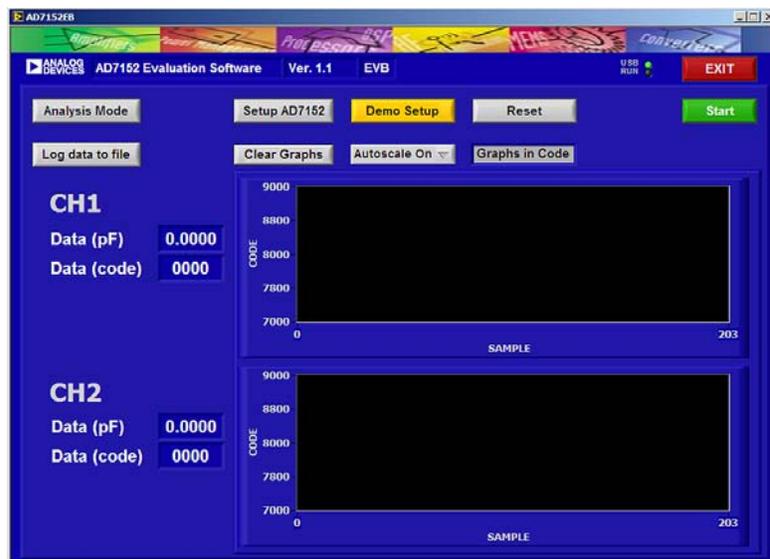


Figure 9. AD7152 Evaluation Software Real-Time Mode Window

## SETTING UP THE AD7152



Figure 10. AD7152 Evaluation Software Setup Window

### Register Field

The register section of the setup window (left portion of the window) indicates the address, register name, and the current content in hexadecimal and binary form for each AD7152 register.

### Read

When **Read** is clicked, the evaluation software reads the current register content of the AD7152 registers and the updates are shown in the setup window.

### Write

When **Write** is clicked, the evaluation software writes the current settings shown in the setup window into the AD7152 registers.

### Reset

When **Reset** is clicked, the software accesses AD7152 Register Address 0xBF to reset the part. See the AD7152 data sheet for details on the serial interface.

### OK

When **OK** is clicked, the evaluation software writes the current settings into the AD7152 registers, the setup window closes, and the software returns to the real-time mode window.

### Cancel

When **Cancel** is clicked, the evaluation software writes the register settings that were buffered from the time the setup window was opened into the AD7152 registers, regardless of whether **Write** was clicked previously. The setup window then closes and the software returns to the real-time mode window.

### Conv Time

From the **Conv Time** box, you can select from the following conversion times (single channel or dual channel):

- 5 ms/200 Hz or 10 ms/100 Hz
- 20 ms/50 Hz or 40 ms/25 Hz
- 50 ms/20 Hz or 100 ms/10 Hz
- 60 ms/16.7 Hz or 120 ms/8.33 Hz

### Operating Mode

The **Operating Mode** box allows you to put the AD7152 into the following operating modes:

- Standby mode (idle).  
Part is fully powered up, but not performing any conversion.
- Continuous conversion.  
Part is repeatedly performing conversions on the enabled channel(s). If two channels are enabled, the part is sequentially switching between them.
- Single conversion.  
Part performs a single conversion on the enabled channel. If two channels are enabled, the part performs two conversions, one on each channel. After finishing the conversion(s), the part goes to standby mode (idle).
- Power-down.  
Powers down the on-chip circuits, except the digital interface.

### Single Conversion Loop

You can operate the AD7152 repetitively in single conversion mode by clicking **Single Conversion Loop**. The AD7152 returns into standby mode (idle) when the acquisition is stopped.

This mode of operation was implemented to compensate for possible coupling effects between the SCL signal of the I<sup>2</sup>C interface and the CIN2(-) signal due to their close proximity on chip.

#### **Offset Calibration**

Note that the AD7152 cannot perform an offset calibration with both channels enabled.

When **Offset Calibration** is clicked, the evaluation software performs a sequential offset calibration if both channels are enabled; otherwise, it performs an offset calibration on the enabled channel.

#### **Capacitive Input Setting.**

By clicking **Channel1** or **Channel2**, the evaluation software allows you to enable or disable the capacitive input channels individually.

The **Range** box allows you to select the following capacitive input ranges for each channel depending on the input selected mode (differential or single ended):

- $\pm 2$  pF or 4 pF
- $\pm 1$  pF or 2 pF
- $\pm 0.5$  pF or 1 pF
- $\pm 0.25$  pF or 0.5 pF

The **Mode** box allows you to select between differential mode and single-ended mode.

Note that the change of input mode requires an offset calibration for that channel.

In differential mode, the AD7152 requires an offset of 0x8000, with 0x0000 representing negative full scale and 0xFFFF0 representing positive full-scale.

In single-ended mode, the AD7152 requires an offset of 0x3000, with 0x0000 representing 0 pF and 0xFFFF0 representing full scale.

#### **CAPDAC**

When **DAC+** or **DAC-** is clicked, you can enable the CAPDACs to allow compensation for capacitive offsets (nonchanging).

You can set the required capacitive offset by using the **DAC Value** up and down arrows to bring the measurement back into the capacitive input range.

# EVAL-AD7152

## ANALYSIS MODE

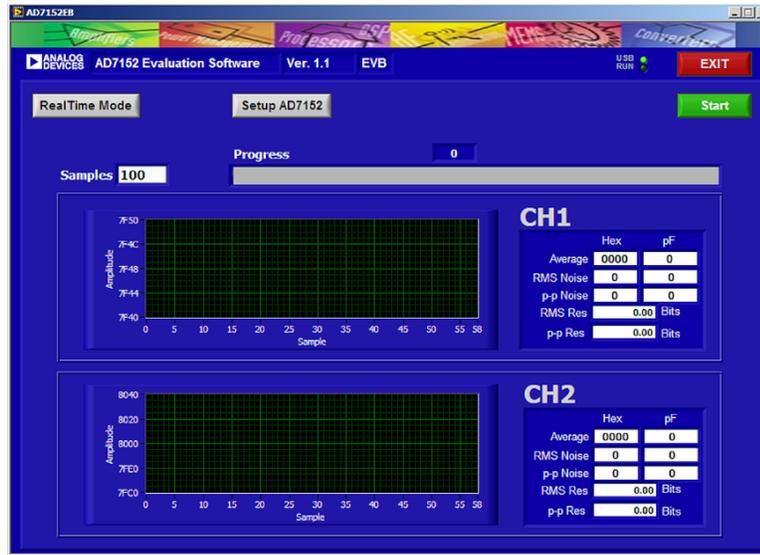


Figure 11. AD7152 Evaluation Software Analysis Window

### RealTime Mode

Click **RealTime Mode** to open the AD7152 real-time mode window.

### Setup AD7152

Click **Setup AD7152** to open the setup window, which provides access to the AD7152 settings.

### Capacitive Input Noise Analysis

#### Samples

You can set the required samples for the analysis in the **Samples** text box.

### Progress

The **Progress** bar indicates how far the analysis has progressed.

### Graphs

The graphs show the individual conversion results of all samples used in the analysis.

### Result Area

The result area on the right portion of the window shows the **Average**, **RMS Noise**, and **p-p Noise** in hexadecimal code and in picofarads over all samples taken, as specified in the **Samples** box.

The result area also shows the result in bits for the effective rms resolution and the peak-to-peak resolution.

# EVALUATION BOARD SCHEMATIC AND ARTWORK

## SCHEMATIC

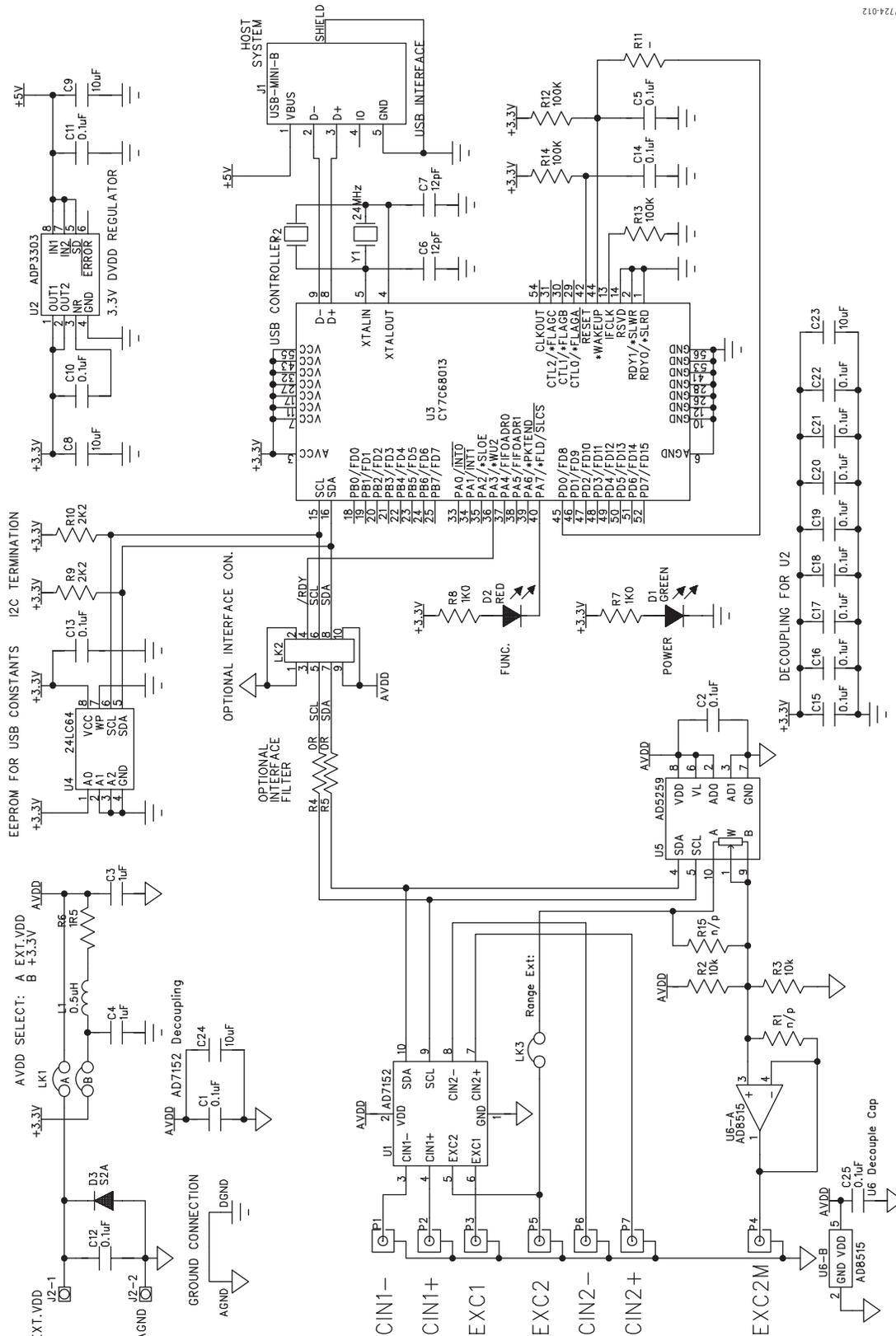


Figure 12. AD7152 Evaluation Board Schematic—Analog Part

# EVAL-AD7152

## COMPONENT ID

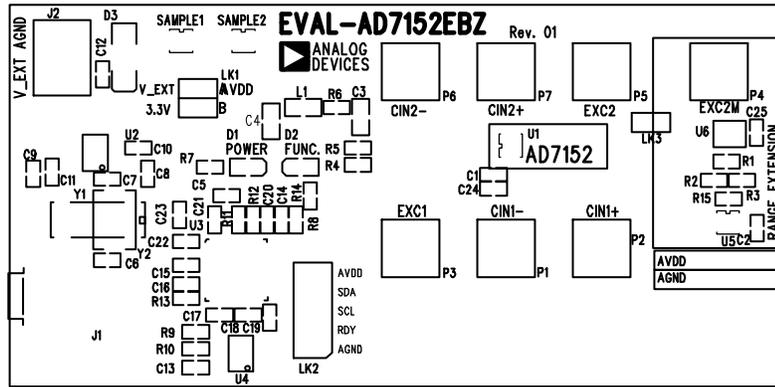


Figure 13. AD7152 Evaluation Board Layout—Silkscreen

## LAYOUT

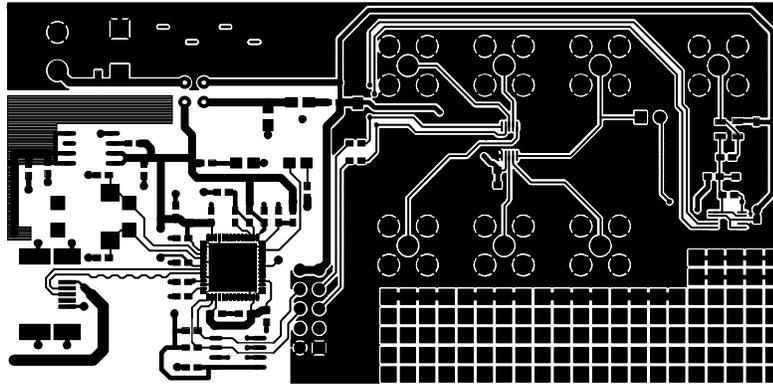


Figure 14. AD7152 Evaluation Board Layout—Component Side

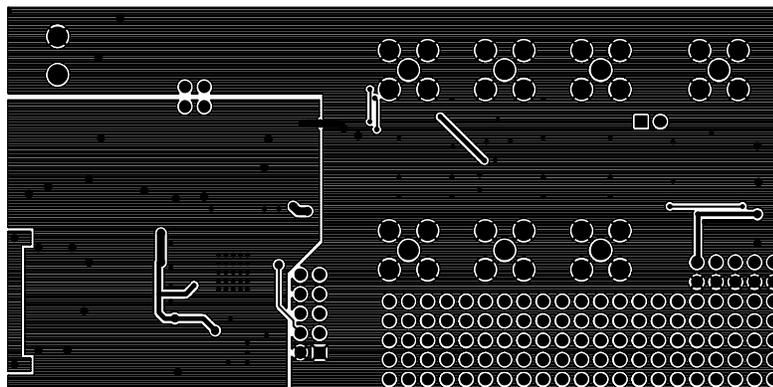


Figure 15. AD7152 Evaluation Board Layout—Bottom Side

## ORDERING INFORMATION

### BILL OF MATERIALS

Table 1.

| Reference Designator   | Qty. | Description   | Manufacturer       | Part No.            |
|------------------------|------|---|--------------------|---------------------|
| PCB                    | 1    | 2-layer FR4 PCB, 1.6 mm × 75 mm × 115 mm                        | Analog Devices     | EVAL-AD7152EBZ      |
| U1, Sample1, Sample2   | 3    | CDC for capacitive sensing, 10-lead MSOP                        | Analog Devices     | AD7152BRMZ          |
| U2                     | 1    | Voltage regulator, 3.3 V, low quiescent current, 8-lead SOIC    | Analog Devices     | ADP3303ARZ-3.3      |
| U3                     | 1    | Microcontroller, EZ-USB FX2LP™, 56-lead QFN                     | Cypress            | CY7C68013A-56LFXC   |
| U4                     | 1    | EEPROM, I <sup>2</sup> C, 64 kB, 8-lead SOIC                    | Microchip          | 24LC64-I/SN         |
| C1, C2, C5, C10 to C22 | 16   | Capacitor ceramic, 0.1 μF, 16 V, X7R, 0603                      | Murata             | GRM188R71C104K      |
| C3, C4                 | 2    | Capacitor ceramic, 1 μF, 16 V, X7R, 0805                        | Murata             | GRM21BR71C105K      |
| C6, C7                 | 2    | Capacitor ceramic, 12 pF, 50 V, COG, 0603                       | Murata             | GRM1885C1H120J      |
| C8, C9, C23, C24       | 4    | Capacitor ceramic, 10 μF, 4 V, X5R, 0603                        | Murata             | GRM188R60G106M      |
| D1                     | 1    | LED, green, 0805  | Avago              | HSMG-C170           |
| D2                     | 1    | LED, red, 0805  | Avago              | HSMS-C190           |
| D3                     | 1    | Diode, V <sub>RRM</sub> = 50 V, I <sub>F(AV)</sub> = 1.5 A, SMB | Vishay             | S2A                 |
| J1                     | 1    | Connector, USB Mini-B, SMD                                      | Molex              | 0548190572          |
| J2                     | 1    | Two-way terminal block, pitch 5 mm                              | Camden Electronics | CTB5000/2           |
| L1                     | 1    | 300 Ω @ 100 MHz, ferrite bead, 0805                             | TDK                | MMZ2012D301B        |
| LK1                    | 1    | Header, straight, pitch 2.54 mm, 2 × 2 pin                      | Harwin             | M20-9980246         |
| LK2                    | 1    | Header, straight, pitch 2.54 mm, 2 × 5 pin                      | Harwin             | M20-9980546         |
| P1 to P3, P5 to P7     | 6    | Connector, SMB, 50 Ω, PCB, straight                             | Amphenol           | SMB1251B1-3GT30G-50 |
| R4, R5                 | 2    | Resistor, 0 Ω, 0603   | Phycomp            | 232270296001        |
| R6                     | 2    | Resistor, 1.5 Ω, 5%, 0603                                       | Phycomp            | 232270260158        |
| R7, R8                 | 2    | Resistor, 1.0 kΩ, 1%, 0603                                      | Phycomp            | 232270461002        |
| R9, R10                | 2    | Resistor, 2.2 kΩ, 1%, 0603                                      | Phycomp            | 232270462202        |
| R12, R13, R14          | 4    | Resistor, 100 kΩ, 1%, 0603                                      | Phycomp            | 232270461004        |
| Y2                     | 1    | Crystal, 24 MHz, 12 pF, CMS-8 series                            | ECS                | ECS-240-12-20A-TR   |

### ORDERING GUIDE

| Model                       | Description      |
|-----------------------------|------------------|
| EVAL-AD7152EBZ <sup>1</sup> | Evaluation Board |

<sup>1</sup> Z = RoHS Compliant Part.

### 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**

Purchase of licensed I<sup>2</sup>C components of Analog Devices or one of its sublicensed Associated Companies conveys a license for the purchaser under the Philips I<sup>2</sup>C Patent Rights to use these components in an I<sup>2</sup>C system, provided that the system conforms to the I<sup>2</sup>C Standard Specification as defined by Philips.