

## Evaluating the AD9952 400MSPS, 14-Bit, 1.8V CMOS, Direct Digital Synthesizer

### FEATURES

- ▶ Full-featured evaluation board for the [AD9952](#)
- ▶ PC evaluation software for control and measurement of the AD9952
- ▶ USB interface
- ▶ GUI software with frequency sweep capability for board control and data analysis
- ▶ Factory tested and ready to use

### EVALUATION KIT CONTENTS

- ▶ AD9952/PCBZ-SDP-K1 evaluation board

### ADDITIONAL HARDWARE

- ▶ Analog Devices, Inc., [EVAL-SDP-CK1Z \(SDP-K1\)](#) controller board that must be purchased separately

### SOFTWARE NEEDED

- ▶ Analog Devices [Analysis | Control | Evaluation \(ACE\) Software](#)

### GENERAL DESCRIPTION

This user guide takes users through the setup and use of the AD9952/PCBZ-SDP-K1 evaluation board. The AD9952 is a direct digital synthesizer (DDS) that uses advanced technology, coupled with an internal high-speed, high-performance digital-to-analog converter (DAC) to form a complete, digitally programmable, high-frequency synthesizer capable of generating a frequency agile, analog output, sinusoidal waveform at up to 160MHz with many user-programmable functions.

The Analog Devices, **ACE Software** provides a graphical user interface (GUI) for simple communication with the AD9952. The AD9952/PCBZ-SDP-K1 requires the use of an SDP-K1 controller board, which is not supplied with the evaluation board kit and must be purchased separately. The SDP-K1 controller board, along with the use of the **ACE Software**, allows users the ability to program the software.

The AD9952/PCBZ-SDP-K1 uses the same evaluation board as the [AD9954/PCBZ-SDP-K1](#) with the only difference being the device on the board.

For full details on the AD9952, see the AD9952 data sheet, which must be consulted in conjunction with this user guide when using the AD9952/PCBZ-SDP-K1.

### EVALUATION BOARD PHOTOGRAPH

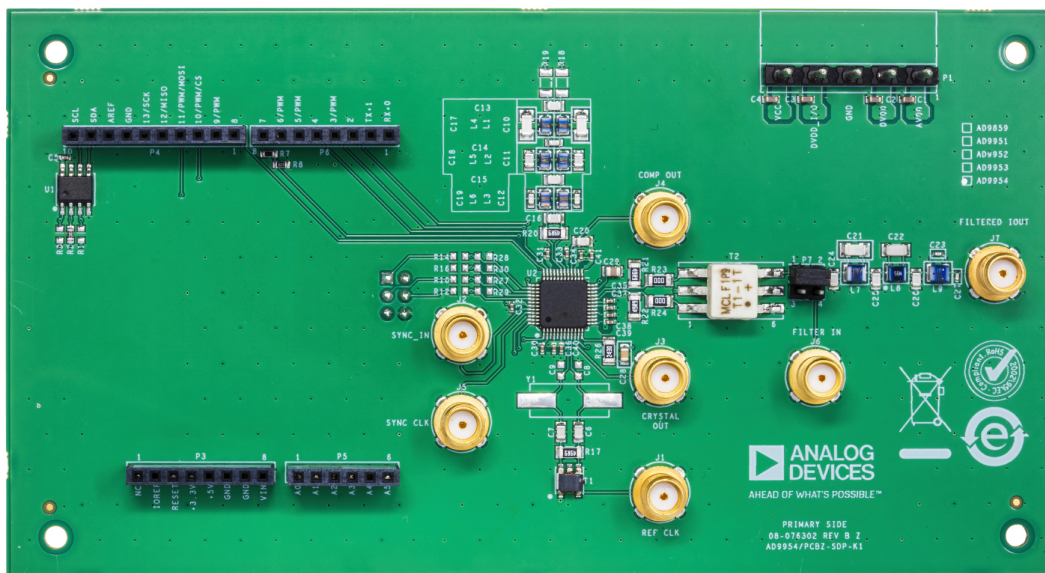


Figure 1. AD9952/PCBZ-SDP-K1 Evaluation Board Photograph

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REVISION HISTORY

4/2026—Revision 0: Initial Version

## GETTING STARTED

### SOFTWARE INSTALLATION PROCEDURE

To install the **ACE Software AD9952** plug-in, take the following steps:

1. Install the latest version of the **ACE Software** platform from the [Analysis | Control | Evaluation \(ACE\) Software](#) web page.
2. Scroll to the **ACE Evaluation Board Plug-ins** section of the ACE web page.
3. In the search bar within the **ACE Evaluation Board Plug-ins** section of the **ACE Software** web page, search for the AD9952 and install the chip and board plug-ins that appear.
4. Ensure that the AD9952 plug-ins appear when the AD9952/PCBZ-SDP-K1 board is attached through the **SDP-K1** connector board to the PC.

### EVALUATION BOARD SETUP PROCEDURE

Once the **ACE Software** has been successfully installed onto your PC, the next step is to interface the AD9952 evaluation software to the AD9952/PCBZ-SDP-K1 evaluation board via the SDP-K1.

To power-up the AD9952/PCBZ-SDP-K1, perform the following steps:

1. Set the Channel 1 voltage of the power supply to 1.8V and the current limit to 1A and then set the Channel 2 voltage of the power supply to 3.3V and the current limit to 1A.
2. Exercise caution during this procedure because all equipment must be turned off. When moving to an on state, note that the following power-up sequence must be followed:
  - a. Turn on the power supply.
  - b. Turn on the signal generator.
  - c. Connect the SDP-K1 controller board to the PC.
  - d. Configure the AD9952 with the **ACE Software**.

To run the **ACE Software**, take the following steps

1. Select **Start/All Programs/Analog Devices/ACE**.
2. Under the **Select Device and Connection** tab within the **ACE Software**, select the **AD9952 Board** that appears within the **Attached Hardware** section (see [Figure 3](#)).
3. When connecting the AD9952/PCBZ-SDP-K1, allow between 5 seconds to 10 seconds for the **Status** bar to turn green.

EVALUATION BOARD HARDWARE

REQUIREMENTS

To successfully use the AD9952/PCBZ-SDP-K1 evaluation board and run the **ACE Software**, the following requirements must be met:

- ▶ A Windows<sup>®</sup>-based PC with a USB port for the **AD9952** evaluation software (**ACE Software**).
- ▶ A signal generator capable of generating sinusoidal waves of at least 3dBm of power and up to at least 10MHz.
- ▶ A system demonstration platform, serial only **EVAL-SDP-CK1Z controller board (SDP-K1)**.
- ▶ A power supply that has the capability to generate at least two independent DC voltages (1.8V and 3.3V).
- ▶ An appropriate measurement device, such as a spectrum analyzer or a high bandwidth oscilloscope.
- ▶ A USB-C cable and Subminiature Version A (SMA)-to-x cables (x = SMA or Bayonet Neill-Concelman (BNC)), depending on the connector of the device interfacing with the AD9952/PCBZ-SDP-K1.

SETTING UP THE EVALUATION BOARD

Powering the AD9952/PCBZ-SDP-K1

The AD9952/PCBZ-SDP-K1 has one power supply connector: P1. P1 powers the DDS, PC interface logic, and USB circuitry. **Table 1** details the necessary connections and the appropriate biasing voltage, and **Figure 2** shows the AD9952/PCBZ-SDP-K1 setup diagram.

Table 1. Connections and Biasing Voltage

| Connector | Pin No. | Label    | Voltage (V) |
|-----------|---------|----------|-------------|
| P1        | 1       | AVDD     | 1.8         |
| P1        | 2       | DVDD     | 1.8         |
| P1        | 3       | GND      | 0           |
| P1        | 4       | DVDD_I/O | 3.3         |
| P1        | 5       | VCC      | 3.3         |

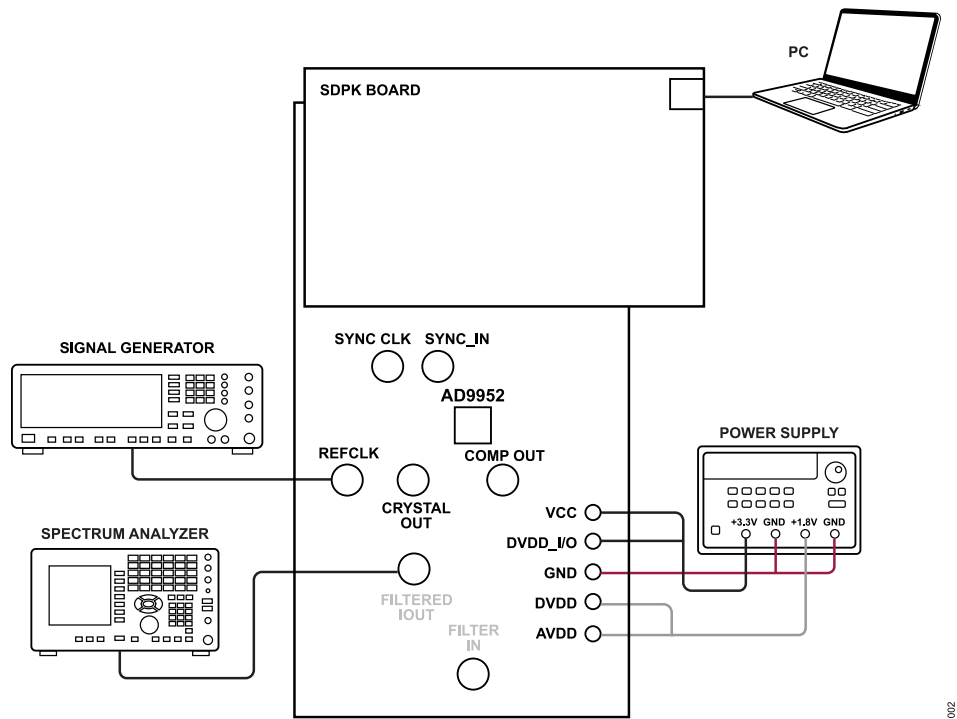


Figure 2. Evaluation Board Setup Diagram

## EVALUATION BOARD HARDWARE

### Clocking the AD9952

The AD9952 architecture provides the user with two options for providing an input signal to the AD9952. Figure 1 shows that users can clock the frequency synthesizer and DDS directly by connecting an external clocking signal to the REF CLK connector, J1, or by using an external crystal. If a user wants to use an external crystal as the clocking source, install the crystal at Y1 (see Figure 7).

Refer to the AD9952 data sheet for details on the maximum input speeds and input sensitivities of these two inputs.

### EVALUATION BOARD LAYOUT

#### Manual Input and Output Control Headers

The manual input and output control headers provide interfaces for communicating with the AD9952 when the device is being controlled by an external controller (manual control).

#### Multidevice Synchronous Control

These control connections set up the AD9952 for multidevice synchronous operation.

#### DAC Channels

These DAC channel connections are the DAC filtered and unfiltered output and AVDD power supplies.

### Clock Input Supply

The clock input supply powers the clock input circuitry of the AD9952.

### Reference Clock Input

The reference clock input is the input for the external REF CLK signal.

### Power Supply

The power supply powers the USB circuitry, input and output circuitry, digital portion (DVDD), and analog portion (AVDD) of the AD9952 DAC.

### USB Port

When the AD9952 is under PC control, which is the default mode, the AD9952/PCBZ-SDP-K1 communicates with the AD9952 via this port.

EVALUATION BOARD SOFTWARE

The **ACE Software** is the main platform that is used to control the AD9952/PCBZ-SDP-K1. The **AD9952** plug-in uses interfaces that connect to the AD9952 and to evaluate the device. Use the following steps to open the main control window of the **ACE Software**:

1. Launch the **ACE Software**. When the **SDP-K1** controller board is connected to the AD9952/PCBZ-SDP-K1, the **Attached**
2. Double-click the **AD9952 Board** icon and the tab shown in the **Figure 4** then appears.
3. Double-click the **AD9952** icon that appears on the board GUI to open the main control window shown in **Figure 5**.

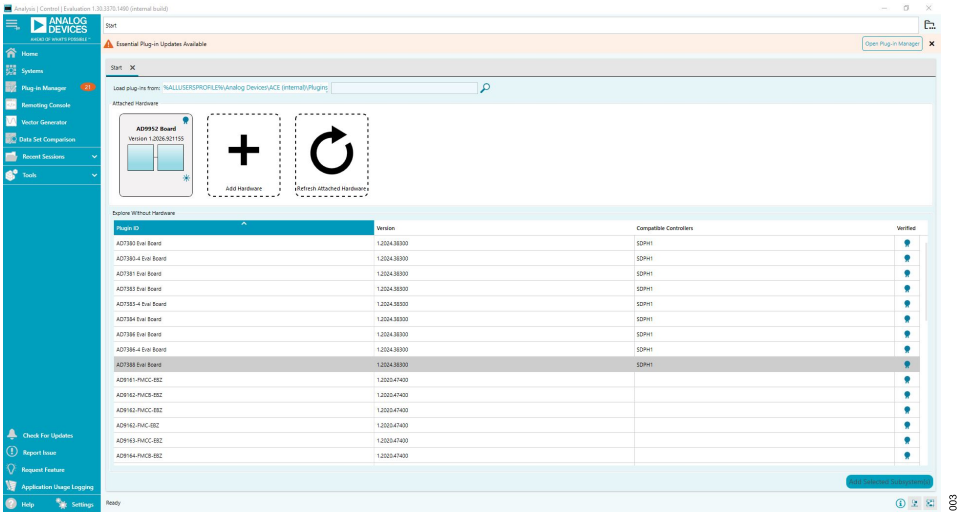


Figure 3. ACE Main Window, Attached Hardware (AD9952 Evaluation Board)



Figure 4. ACE Software AD9952 Evaluation Board Page

## EVALUATION BOARD SOFTWARE

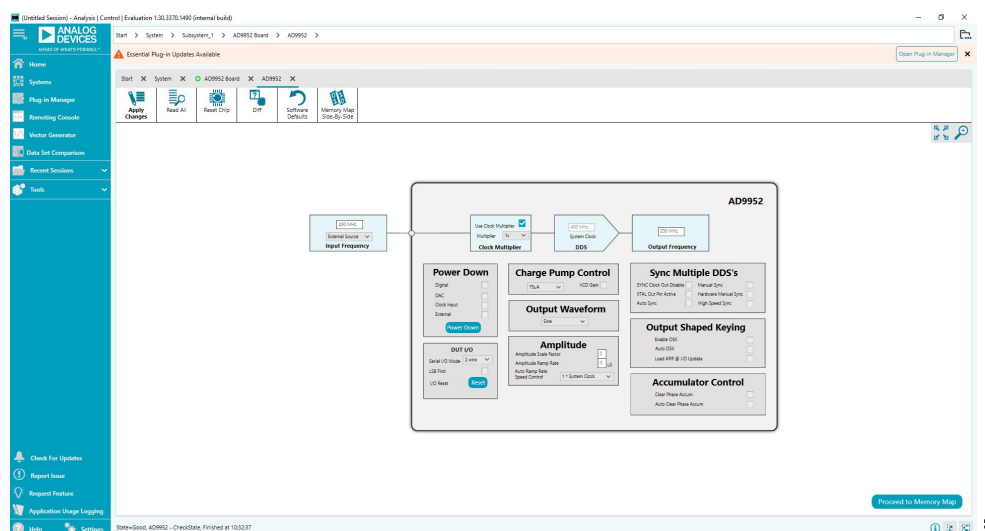


Figure 5. ACE Software Front Panel

## MAIN CONTROLS

The main controls are shown in the [Figure 5](#). To modify any controls, take the following steps:

1. Before initializing, all configuration changes must be completed. The **ACE Software** plug-in opens with a default 400MHz **System Clock** frequency register setting and a 200MHz **Output Frequency** register setting.
2. Modify any **ACE Software** front panel settings as required (see [Figure 5](#)).
3. Click **Apply Changes** to load the modified settings to the **AD9952**, which then performs the write sequence. If the **System Clock** frequency and **Output Frequency** selected are outside of the operational range, an error message will appear within the GUI. Specific blocks can be powered down by setting the corresponding power-down check boxes within the **Power Down** section shown in [Figure 5](#).

## FEATURE CONTROL WINDOWS

## Input Frequency

The **Input Frequency** section shown in [Figure 5](#) allows users to configure the reference clock.

Note that the input frequency takes control of the input of the operating frequency of the external reference clock or crystal. The maximum reference clock frequency is 400MHz for the AD9952, which is the default setting of this box. If a value is entered that is out of range, an error message will appear.

## Clock Multiplier

The **Clock Multiplier** section shown in [Figure 5](#) allows users to select the phase-locked loop (PLL) multiplication factor ( $4\times$  to  $20\times$ ) by which to scale the input frequency. The default setting of this dropdown menu is **1x**, indicating that the **Clock Multiplier** circuitry is bypassed and that the input frequency and crystal input are piped directly to the DDS core.

## System Clock

The **System Clock DSS** section shown in [Figure 5](#) displays the operating frequency of the DDS core (system). The value within this box is derived from the value entered and selected in the **Input Frequency** section and the **Multiplier** selected in the **Clock Multiplier** section by the user.

## Output Frequency

To customize the channel output configuration, go to the **Output Frequency** section shown in [Figure 5](#). By default, the channel output operates in single tone mode.

## EVALUATION BOARD SOFTWARE

### Power Down

Users can go to the **Power Down** section shown in [Figure 5](#) to power down any of the following:

- ▶ Digital logic by checking off the **Digital** box
- ▶ DAC logic by checking off the **DAC** box
- ▶ Clock input by checking off the **Clock Input** box
- ▶ External logic by checking off the **External** box

Once users select their power-down options, they must click **Power Down**. All of these boxes are unchecked by default, indicating that all of the circuitry of that channel are enabled (powered up).

### Charge Pump Control

To control the current settings on the charge pump, go to the **Charge Pump Control** section shown in [Figure 5](#). The default value of the charge pump current is **75µA**. Other dropdown menu options included the following: **100µA**, **125µA**, or **150µA**.

### Output Waveform

In the **Output Waveform** section shown in [Figure 5](#), users can select either a **Cosine** or **Sine** function for the angle-to-amplitude conversion. The default setting is **Cosine**.

### Amplitude

Use the **Amplitude** section in [Figure 5](#) to set the **Amplitude Scale Factor**, **Amplitude Ramp Rate**, and **Auto Ramp Rate Speed Control**.

The **Amplitude Scale Factor** can be set to a maximum of 1 to increment or decrement. The default setting for the **Amplitude Scale Factor** box is 1, and it can be scaled up or down by 0.0006.

Use the **Amplitude Ramp Rate** box to set the amplitude ramp rate (ARR) time. This time (entered in µs) can range from 0.01µs (minimum) to 2.55µs (maximum). If the value entered exceeds the maximum time, an alert will show in the [ACE Software](#) GUI.

Use the **Auto Ramp Rate Speed Control** dropdown menu to tell the output shaped keying (OSK) block how many amplitude steps to take for each increment or decrement.

### Sync Multiple DDS's

The SYNC\_CLK pin is active by default within the **Sync Multiple DDS's** section of [Figure 5](#). When the **SYNC Clock Out Disable** feature is enabled (checked off), the SYNC\_CLK pin assumes a static Logic 0 state to minimize the noise generated by the digital circuitry. The synchronization circuitry remains active internally to maintain the device timing.

When **XTAL Out PIN Active** is enabled (checked off), the crystal oscillator circuitry output drives the CRYSTAL OUT pin, which can be used as a reference frequency for additional devices.

When **Auto Sync** is enabled (checked off), one device is chosen as a main and the other device(s) is its subordinate. All subordinates automatically synchronize their internal clocks to the SYNC\_CLK output signal of the main device. Use automatic synchronization to configure each subordinate. Connect the SYNC\_IN input(s) to the main SYNC\_CLK output. Subordinate devices continuously update the phase relationship of their SYNC\_CLKs until they are in phase with the SYNC\_IN inputs. Note that when **Auto Sync** is enabled (checked off), the **High Speed Sync** must be enabled (checked off).

When **Manual Sync** is enabled (checked off), the SYNC\_IN input pin is configured such that it advances the rising edge of the SYNC\_CLK signal each time the device detects a rising edge on the SYNC\_CLK signal and a rising edge on the SYNC\_IN pin.

When **Hardware Manual Sync** is enabled (checked off), the user can force the device to advance the SYNC\_CLK rising edge one SYSCLK cycle (¼ SYNC\_CLK period).

## EVALUATION BOARD SOFTWARE

### Output Shaped Keying (OSK)

The shaped on-off keying function is enabled or disabled using the **Output Shaped Keying** section shown in [Figure 5](#) by enabling (checking off) **Enable OSK**. The OSK function allows users to control the ramp-up time and ramp-down time when turning the DAC on or off. This function is primarily used in burst transmissions of digital data to reduce the adverse spectral impact of short, abrupt bursts of data.

When **Auto OSK** is enabled (checked off), a single-scale factor is internally generated and applied to the multiplier input for scaling the output of the DDS core block. The scale factor is the output of the 14-bit counter that increments or decrements at a rate determined by the contents of the 8-bit output ramp rate register.

When **Load ARR @ I/O Update** is enabled (checked off), the ramp rate timer is loaded when an input or output update is done, there is a change in the profile input, or a value of 1 is reached. The ramp timer can be loaded before reaching a value of 1 by two methods.

The first method is by toggling the OSK pin, sending a rising edge to the I/O UPDATE pin, or changing the state of a profile pin. For this method, the ASFR value is loaded into the ramp rate timer, which then proceeds to count down as normal.

The second method is if the load ARR at I/O UD control bit (Register CFR1, Bit 26) is set and an I/O update (or change in profile) is issued (see the [AD9952](#) data sheet for additional information).

### Accumulator Control

In the **Accumulator Control** section of [Figure 5](#), the following options are available:

- Select **Clear Phase Accum** to clear the phase accumulator memory and maintain it in a cleared state.
- Select **Auto Clear Phase Accum** to automatically and synchronously clear the phase accumulator for one clock cycle upon receiving an input and output update signal.

### DUT I/O

The **DUT I/O** section shown in [Figure 5](#) controls the I/O configuration for the device. Click the **Reset** button of the **I/O Reset** to send an I/O reset to the corresponding serial port state machine. Select the **LSB First** box to change the data format to LSB first from the default setting of MSB first. Use the **Serial I/O Mode** dropdown menu to select the desired I/O mode of operation: **2 wire** or **3 wire** (which is the default).

## EVALUATION BOARD SCHEMATICS AND ARTWORK

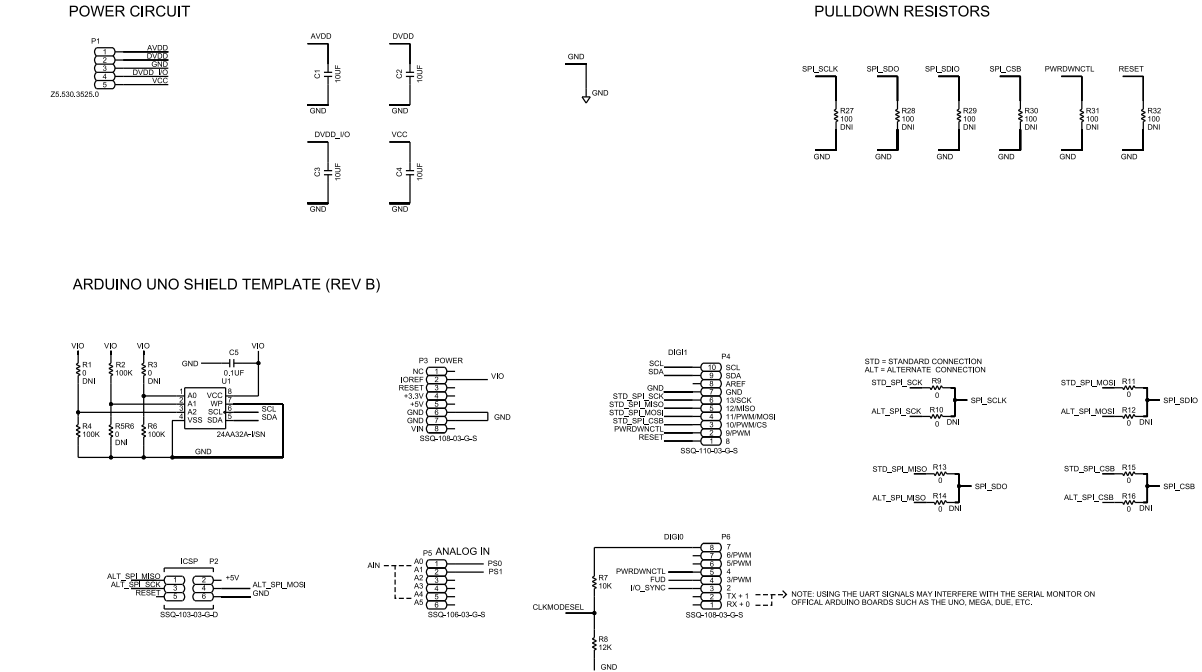


Figure 6. AD9952/PCBZ-SDP-K1 Schematic, Page 2

**NOTE 1** THE FULL-SCALE DAC OUTPUT CURRENT IS CONTROLLED BY MEANS OF AN EXTERNAL RESISTANCE R25 (RESET) CONNECTED BETWEEN THE DAC RESET PIN AND GROUND. RESISTOR VALUES FOR FULL-SCALE CURRENT ARE AS FOLLOWS: 3.92KOHM = 10MA, 5.23KOHM = 7.5MA, 7.87KOHM = 5.0MA, 15.9KOHM = 2.5MA.

**NOTE 2** C20 IS USED FOR A SIMULATED CAPACITANCE LOAD FOR THE COMPARATOR OUT. THIS CAPACITANCE VALUE SHOULD NOT EXCEED 10PF.

**NOTE 3** CAPACITORS C6 AND C7 SHOULD BE SOLDERED IN PLACE WHEN THE REF CLK INPUT IS USED. CAPACITORS C8 AND C9 SHOULD BE SOLDERED IN PLACE WHEN CRYSTAL Y1 IS USED IN CONJUNCTION WITH THE INTERNAL OSCILLATOR.

**NOTE 4** USE EITHER RESISTORS R18 AND R19 (COMPARATOR INPUTS) OR R23 AND R24 (FILTERED OUTPUT) FOR IOUT AND IOUTB. DO NOT USE BOTH SETS AT THE SAME TIME.

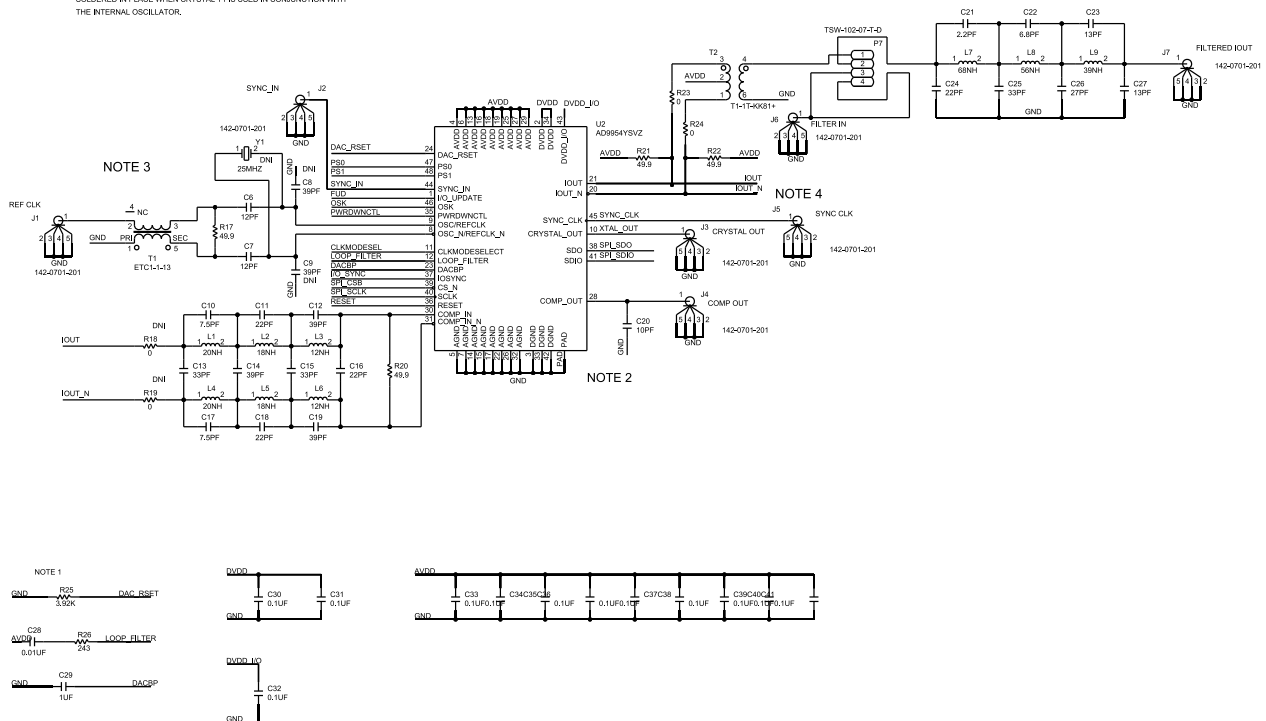


Figure 7. AD9952/PCBZ-SDP-K1 Schematic, Page 3

## EVALUATION BOARD SCHEMATICS AND ARTWORK

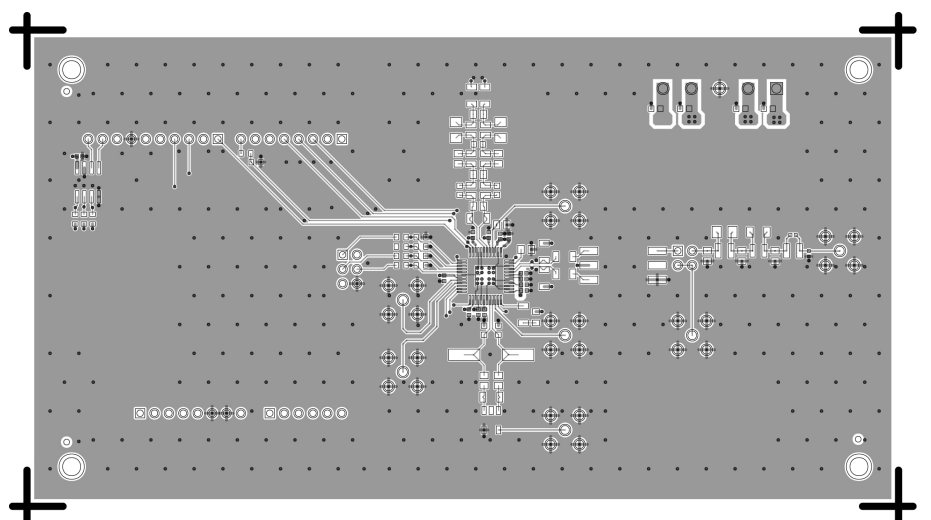


Figure 8. AD9952/PCBZ-SDP-K1 Schematic, Primary

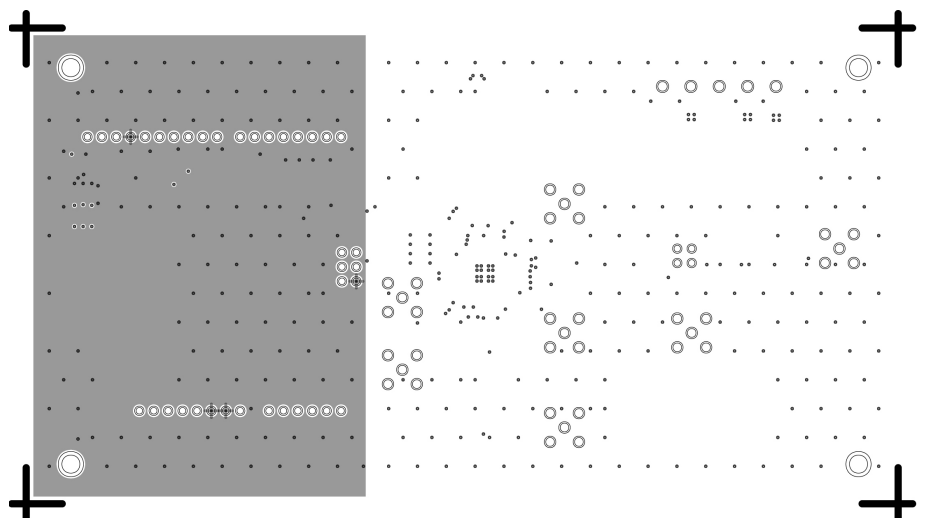


Figure 9. AD9952/PCBZ-SDP-K1 Schematic, Ground

## EVALUATION BOARD SCHEMATICS AND ARTWORK

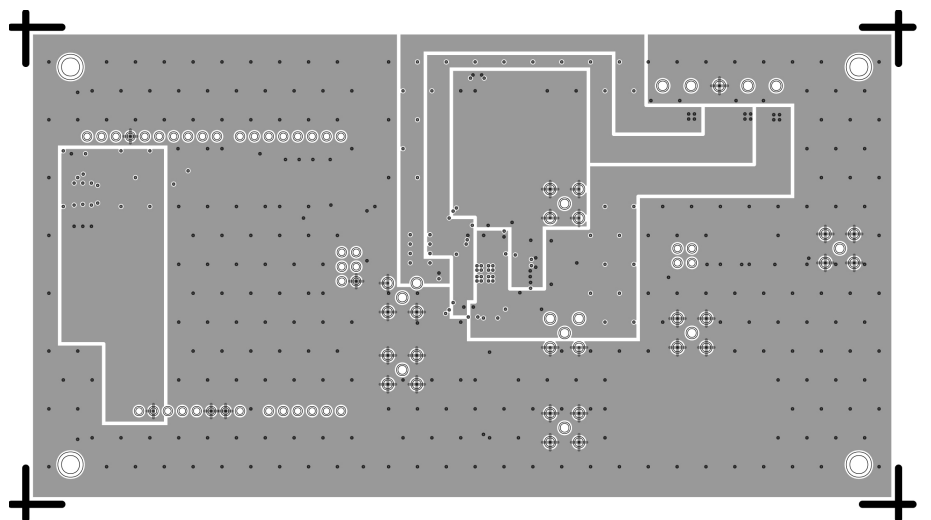


Figure 10. AD9952/PCBZ-SDP-K1 Schematic, Power

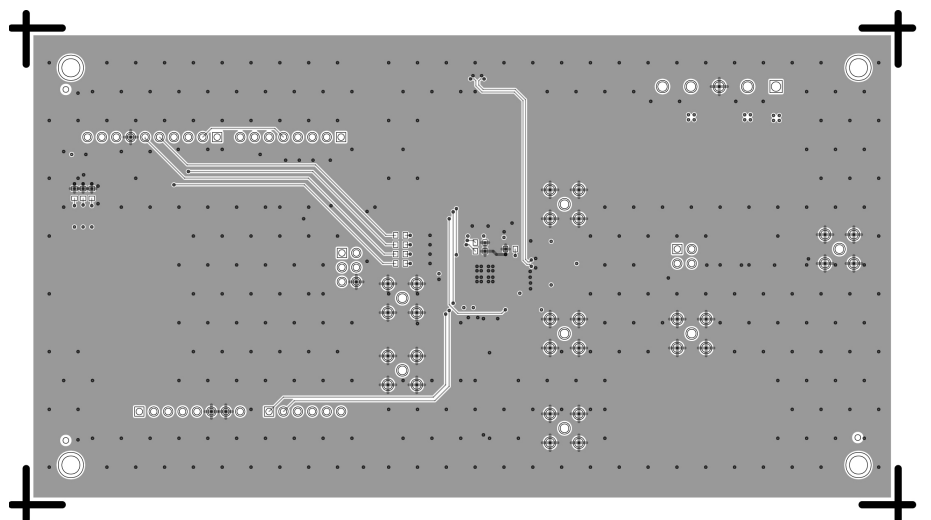


Figure 11. AD9952/PCBZ-SDP-K1 Schematic, Secondary

**Figure 13. AD9952/PCBZ-SDP-K1 Schematic, Bottom Side Silkscreen**

## ORDERING INFORMATION

## ORDERING GUIDE

| Model              | Description      |
|--------------------|------------------|
| AD9952/PCBZ-SDP-K1 | Evaluation Board |

## BILL OF MATERIALS

Table 2. Bill of Materials

| Reference Designator                                       | Description                                                                                                                          | Manufacturer                 | Part Number            |
|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------|
| C1, C2, C3, C4                                             | Ceramic capacitors, 10µF, 35V, 20%, X5R, 0603                                                                                        | Murata                       | GRM188R6YA106MA73D     |
| C10, C17                                                   | Ceramic capacitors, 7.5pF, 50V, 0.5pF, C0G, 1206, extreme low, effective series resistance (ESR)                                     | KEMET                        | C1206C759D5GACTU       |
| C11, C16, C18, C24                                         | Ceramic capacitors, 22pF, 50V, 5%, C0G, 0805, extreme low, ESR                                                                       | KEMET                        | C0805C220J5GACTU       |
| C12, C14, C19                                              | Ceramic capacitors, 39pF, 50V, 5%, C0G, 0603                                                                                         | AVX Corporation              | 06035A390JAT2A         |
| C13, C15, C25                                              | Ceramic capacitors, 33pF, 50V, 5%, C0G, 0805, extreme low, ESR                                                                       | KEMET                        | C0805C330J5GACTU       |
| C20                                                        | Ceramic capacitor, 10pF, 50V, 0.5pF, C0G, 0805, extreme low, ESR                                                                     | KEMET                        | C0805C100D5GACTU       |
| C21                                                        | Ceramic capacitor, 2.2pF, 50V, 0.25pF, C0G, 1206                                                                                     | Yageo                        | CC1206CRNPO9BN2R2      |
| C22                                                        | Ceramic capacitor, 6.8pF, 50V, 0.25pF, C0G, 1206                                                                                     | AVX                          | 12065A6R8CAT2A         |
| C23, C27                                                   | Ceramic capacitors, 13pF, 50V, 5%, C0G, 0402, extreme low, ESR                                                                       | KEMET                        | C0402C130J5GACTU       |
| C26                                                        | Ceramic capacitor, 27pF, 50V, 5%, C0G, 0805                                                                                          | Yageo                        | CC0805JRNPO9BN270      |
| C28                                                        | Ceramic capacitor, 0.01µF, 100V, 5%, X7R, 0805                                                                                       | AVX Corporation              | 08051C103JAT2A         |
| C29                                                        | Ceramic capacitor, 1µF, 100V, 10%, X7R, 0805, AEC-Q200                                                                               | Kyocera                      | 08051C105K4T2A         |
| C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41 | Ceramic capacitors, 0.1µF, 16V, 10%, X7R, 0402                                                                                       | Samsung                      | CL05B104K05NNNC        |
| C5                                                         | Ceramic capacitor, 0.1µF, 16V, 10%, X7R, 0402, AEC-Q200                                                                              | Murata                       | GCM155R71C104KA55D     |
| C6, C7                                                     | Ceramic capacitors, 12pF, 50V, 5%, C0G, 0805, extreme low, ESR                                                                       | KEMET                        | C0805C120J5GACTU       |
| J1, J2, J3, J4, J5, J6, J7                                 | Connector, PCB, coax Subminiature Version A (SMA) straight                                                                           | Cinch Connectivity Solutions | 142-0701-201           |
| L1, L4                                                     | Inductors, wire wound, chip, 0.055Ω DCR, 1.4A                                                                                        | Coilcraft Inc.               | 0805HQ-20NXJLB         |
| L2, L5                                                     | Inductors, wire wound, chip, 0.06Ω DCR, 1.4A                                                                                         | Coilcraft Inc.               | 0805HQ-18NXJLB         |
| L3, L6                                                     | Inductors, wire wound, chip, 0.045Ω DCR, 1.6A                                                                                        | Coilcraft Inc.               | 0805HQ-12NXJLB         |
| L7                                                         | Inductor, wire wound, chip, 0.13Ω DCR, 1.1A                                                                                          | Coilcraft Inc.               | 1008HQ-68NXGLB         |
| L8                                                         | Inductor, surface-mounted device (SMD), 1008                                                                                         | Würth Elektronik Group       | 744762156A             |
| L9                                                         | Inductor, wire wound, chip, 0.09Ω DCR, 1.3A                                                                                          | Coilcraft Inc.               | 1008HQ-39NXGLB         |
| P1                                                         | Connector, PCB, header, terminal, strip, 5.0mm pitch, 1× M026826                                                                     | Wieland Electric             | Z5.530.3525.0          |
| P2                                                         | Connector, PCB, receptacle 25mil square, post, dual-row 2.54mm pitch                                                                 | Samtec                       | SSQ-103-03-G-D         |
| P3, P6                                                     | Connectors, PCB, receptacle 25mil square, post, 2.54mm pitch                                                                         | Samtec                       | SSQ-108-03-G-S         |
| P4                                                         | Connector, PCB, receptacle 25mil square, post, 2.54mm pitch                                                                          | Samtec                       | SSQ-110-03-G-S         |
| P5                                                         | Connector, PCB, receptacle 25mil square, post, 2.54mm pitch                                                                          | Samtec                       | SSQ-106-03-G-S         |
| P7                                                         | Connector, PCB, 4 position male header, unshrouded header, double row straight, 2.54mm pitch, 5.84mm post height, 2.54mm solder tail | Samtec Inc.                  | TSW-102-07-T-D         |
| R9, R11, R13, R15                                          | Resistors, SMD, 0Ω, jumper, 1/10W, 0603, AEC-Q200                                                                                    | Panasonic                    | ERJ-3GEY0R00V          |
| R17, R20, R21, R22                                         | Resistors, SMD, 49.9Ω, 1%, 1/4W, 1206, AEC-Q200                                                                                      | Panasonic                    | ERJ-8ENF49R9V          |
| R2, R4, R6                                                 | Resistors, SMD, 100kΩ, 1%, 1/16W, 0603                                                                                               | Multicomp (SPC)              | MC 0.063W 0603 1% 100K |
| R23, R24                                                   | Resistors, SMD, 0Ω jumper, 1/4W, 1206, AEC-Q200                                                                                      | Panasonic                    | ERJ-8GEY0R00V          |
| R25                                                        | Resistor, SMD, 3.92kΩ, 1%, 1/10W, 0603 AEC-Q200                                                                                      | Panasonic                    | ERJ-3EKF3921V          |
| R26                                                        | Resistor, SMD, 243Ω, 1%, 1/4W, 1206, AEC-Q200                                                                                        | Panasonic                    | ERJ-8ENF2430V          |
| R7                                                         | Resistor, SMD, 10kΩ, 1%, 1/10W, 0603, AEC-Q200                                                                                       | Panasonic                    | ERJ-3EKF1002V          |
| R8                                                         | Resistor, SMD, 12kΩ, 0.1%, 1/10W, 0603, AEC-Q200, high reliability                                                                   | Panasonic                    | ERA-3AEB123V           |

## ORDERING INFORMATION

Table 2. Bill of Materials (Continued)

| Reference Designator | Description                                                                                          | Manufacturer               | Part Number  |
|----------------------|------------------------------------------------------------------------------------------------------|----------------------------|--------------|
| T1                   | Transformer (XFMR) RF, 1:1 transmission line, 4.5MHz to 3000MHz                                      | Macom Technology Solutions | ETC1-1-13    |
| T2                   | XFMR RF                                                                                              | Mini Circuits              | T1-1T-KK81+  |
| U1                   | IC, 32-KBIT serial, electrically erasable programmable read-only memory (EEPROM)                     | Microchip Technology       | 24AA32A-I/SN |
| U2                   | IC, 400MSPS, 14-bit, 1.8V complementary metal-oxide semiconductor (CMOS), direct digital synthesizer | Analog Devices             | AD9952YSVZ   |

**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.

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