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# Evaluation Board for 24-Bit,8.5mW,109dB, 128/64/32kSPs ADC

**Preliminary Technical Data**

## EVAL-AD7767/67-1/67-2EDZ

## FEATURES

**Full-featured evaluation board for the:**
   **AD7767**
   **AD7767-1**
   **AD7767-2**
**CED compatible**
**Standalone capability**
**On-board analog buffering and voltage reference**
**Various linking options**
**PC software for control and data analysis when used with the**
   **EVAL-CED1Z**
**Linearity Evaluation**

## GENERAL DESCRIPTION

This data sheet describes the evaluation board for the,  AD7767, AD7767-1, AD7767-2, which are 24-bit, single-channel, oversampled successive-approximation (SAR) ADCs. These parts operate from 2.5V power supply, (AVDD1, DVDD), a 1.8V to 5V VDRIVE and use a 5V reference ADR445.

The AD7767 has a maximum output data rate of 128 KHz. The derivatives AD7767-2 operate at a max speed of 64 KHz, with the AD7767-2 offering a max speed of 32 KHz. The AD7767-1

and AD7767-2 versions digitally filter more rigorously, meaning that greater noise performance is achieved, trading off on output data rate.

All the AD7767 devices (AD7767, AD7767-1, AD7767-2) offer 18-bit linearity (3ppm).

Full details on the versions of the AD7767 are available in the AD7767 data sheet, which is available from Analog Devices, Inc., and should be consulted in conjunction with this data sheet when using the evaluation board.

## ON-BOARD COMPONENTS INCLUDE:

ADR445, 5 V ultrahigh precision band gap reference
Two ADA4841-1 operational amplifiers
(Run from 7.5V and -2.5V external supplies).
Various MCLK options

Various link options are explained in the Evaluation Board Hardware section. Interfacing to this board is through a 96-way connector. This 96-way connector is compatible with the CED, which is available from Analog Devices. External connectors are provided for a number of signals.
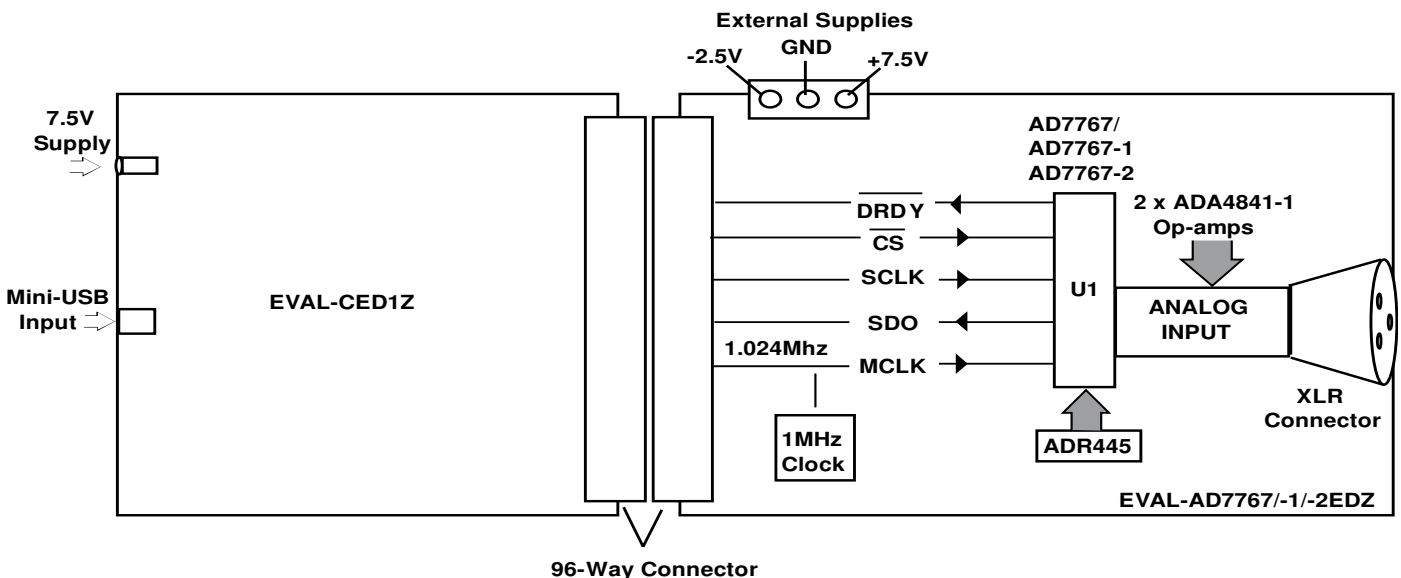


*Figure 1. Evaluation Board Block Diagram*

**Rev. PrB**

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## REVISION HISTORY

6/07—Revision PrA
10/07— Revision PrB

# EVALUATION BOARD HARDWARE

## POWER SUPPLIES

When using this evaluation board with the CED, incorporating the use of the ADA4841-1 amplifiers (maximum supply spread of 12V) a +7.5V and -2.5V supply must be provided at the connector marked J12. When using J12 as the source connection to power the AD7767/-1/-2 board then links LK1 and LK2 must be placed in position B.

The 7.5V supply to J12 is then routed through ADP3330 LDO to create the +2.5V supply to power AVDD1 (pin 1), DVDD (pin 8) and VDRIVE (pin 9). The 7.5V is also supplied to the reference (ADR445) which creates the 5V reference signal applied to pin 2 of the converter.

An extensive ground plane is used on this board to minimize the effect of high frequency noise interference. All supplies are decoupled to to one ground plane.

## LINK OPTIONS

Three link options must be set for the required operating setup before using the evaluation board. The functions of the options are outlined in Table 1. These options are initially setup so that the user supplies +7.5V and -2.5V to the V+ and V- terminals of J12 in order to comply with the voltage regulations of the ADA4841-1 amplifiers (U2 & U3) as seen in the default value listed. If the user wishes to substitute the AD8021 amplifier for ADA4841 then the CED board can be used to supply the required ±12V to the evaluation board. See Table 1 for further details.

**Table 1. Link Option Functions**

| Link No. | Position | Function | Default |
|---|---|---|---|
| LK1 | | This link option is used to select the source of the V+ voltage, which is used to power the evaluation board. When using the ADA4841 amplifiers the evaluation board must be supplied with a +7.5V at the V+ terminal at (J12). | B |
| | A | V+ is supplied from the CED through the 96-way connector. Do not use this option when using the ADA4841-1 amplifiers. In the case of use of the AD8021 amplifiers LK1 may be set to A, allowing the AD8021 to be powered off the +12V supplied by the CED board through the 96-way connector. | |
| | B | In Position B, $V_{DD}$ is supplied from an external source via the power connector, J12. Set LK1 to B to operate the AD7767 evaluation board using the ADA4841-1 devices. | |
| LK2 | | This link option is used to select the source of the V- voltage, which is used to power the evaluation board. When using the ADA4841 amplifiers the evaluation board must be supplied with a -2.5V at the V- terminal at (J12). | B |
| | A | V- is supplied from the CED through the 96-way connector. Do not use this option when using the ADA4841-1 amplifiers. In the case of use of the AD8021 amplifiers LK2 may be set to A, allowing the AD8021 to be powered off the -12V supplied by the CED board through the 96-way connector. | |
| | B | In Position B, $V_{DD}$ is supplied from an external source via the power connector, J12. Set LK2 to B to operate the AD7767 evaluation board using the ADA4841-1 devices. | |
| LK3 | | This link option selects the source of the voltage input to the precision reference (either ADR445 or ADR425) | A |
| | A | The V+ voltage supplied to the reference is generated by the external supply at J12 or from CED depending on the settings used for LK1 and LK2. | |
| | B | Allows the user to apply an external supply directly to the reference. | |

There are a further 10 solder link options for various functions. These link options are outlined in Table 2. All solder links are set so that the user can plug and play the evaluation board direct. The default settings lists the settings for the AD7767/-1/-2 evaluation board for operation with the CED board and are listed in the right hand column of the table.

**Table 2.Solder Link Option Functions**

| Link No. | Position | Function | Default / Packaged Setting |
|---|---|---|---|
| SL1 | | Selects the source of the SCLK applied to the AD7767/-1/-2 | A |
| | A | Selects CED as SCLK source. | |
| | B | In stand-alone operation an external SCLK can be applied to the AD7767/-1/-2 device by means of J8 | |
| SL2 | | Selects the source of the $\overline{CS}$ signal to be applied to AD7767/-1/-2 device. | A |
| | A | Selects CED as $\overline{CS}$ source. | |
| | B | In stand-alone operation an external $\overline{CS}$ can be applied to the AD7767/-1/-2 device by means of J5 | |
| SL3 | | Selects the source of the signal applied to SDI (serial data input) pin of the AD7767/-1/-2, used in daisy-chain applications. | B |
| | A | Ties SDI pin to 2.5V volts logic high. Default setting for SDI pin when using the AD7767/-1/-2 devices singly. | |
| | B | Allows user to input data from another AD7767/-1/-2 device to verify daisy-chain functionality. | |
| SL4 | | Selects the path of the $\overline{DRDY}$ output from the AD7767/-1/-2 device | A |
| | A | Use for CED board. Routes the $\overline{DRDY}$ signal from the AD7767/-1/-2 device to the CED control board via the 96-way connector. | |
| | B | In stand-alone operation the $\overline{DRDY}$ can be routed to the SMB connector J11. | |
| SL5 | | Selects the MCLK source applied to the AD7767/-1/-2 device. | C |
| | A | External MCLK source applied to SMB connector J7 is applied to the AD7767/-1/-2 MCLK pin. | |
| | B | On board crystal oscillator, Y1 output is routed to the AD7767/-1/-2 applying a 1Mhz clock to the MCLK pin (a 1Mhz MCLK signal allows the AD7767/-1/-2 devices to operate with an output data rate of 128 kHz, 64 kHz, and 32 kHz respectively). Placing 1KΩ resistors in positions R43 and R23 allows the user to potentially divide the 5V output of the crystal to 2.5V as per the $V_{DRIVE}$ voltage default on the AD7767/-1/-2 evaluation board. | |
| | C | Applies the 1.024Mhz MCLK signal created by the CED board to be applied to the AD7767/-1/-2 MCLK pin. Enables the AD7767/-1/-2 device to operate at the maximum output data rate. | |
| SL6 | | Routes the Serial Data Output (SDO) to the CED board or the SMB connector J9. | B |
| | A | Routes the SDO signal to J9, the SMB connector marked "SDO" allowing data to be acquired by an external element in stand-alone mode. | |
| | B | Routes the SDO signal to the 96-way connector so that the CED control board can acquire data. | |
| SL8 | | Selects the source of the voltage applied to the $V_{DRIVE}$ pin. | C |
| | A | A 2.5V supply created by the CED board is supplied to the AD7767/-1/-2 $V_{DRIVE}$ pin. | |
| | B | Allows the user to apply an external $V_{DRIVE}$ supply (via the J13 connector) to the AD7767/-1/-2 $V_{DRIVE}$ pin. | |
| | C | Applies the 2.5V supply created by the ADP3330-2.5 regulator (U11) to the AD7767/-1/-2 $V_{DRIVE}$ pin. | |
| | D | Allows a 2.5V supply to be applied to the AD7767/-1/-2 VDRIVE pin from a star point at the output of the ADP3330-2.5 regulator (U8) which creates the 2.5V supply for the DVDD pin. When using this option, ensure that the resistive link between AD7767/-1/-2 side of R7 and the D pad of SL8 is shorted. | |
| SL9 | | Selects the 2.5V path that is routed to the AVDD1 pin of the AD7767/-1/-2 device (pin 1). | B |
| | A | Allows the AD7767/-1/-2 to be run off one 2.5V regulator by linking the pin to the DVDD star point on the AD7767/-1/-2 side of the resistor R7. Using this option requires that the resistive place holder between pad A of SL9 and the DVDD star point (device side of R7) is shorted. | |
| | B | Routes the 2.5V supply created by the ADP3330-2.5 device (U9) to the AVDD1 pin of the AD7767/-1/-2 device. | |
| SL11 | | Selects the common mode source, which is applied to the operational driving amplifiers. The | B |

| Link No. | Position | Function | Default / Packaged Setting |
|---|---|---|---|
| | | AD7767/67-1/67-2, inputs must be driven differentially using a common mode voltage of $V_{REF}$/2. For the EVAL-AD7767/67-1/67-2EDZ $V_{REF}$ = 5V. | |
| | A | Allows the user to supply the common mode voltage from the 2.5V star point created at the 2.5V DVDD supply. In this case, eliminate the two potential dividers (R9 & R11) and (R10 & R12) which are set by default on the AD7767/-1/-2 board. Also ensure that the resistive link R39 (underside of the PCB) is shorted. | |
| | B | Selects the 5V output of the ADP3330-5 device (U10). | |
| | C | Allows the user to apply an external common mode voltage using the SMB connector (J15) marked "EXT_CMODE. | |
| | D | Setting the link to position, D allows the user to take the common mode for the ADA4841-1 amplifiers directly from the reference supply (output of U5, either ADR425 of ADR445). For this, option short across the unpopulated resistor R34. | |

## SOCKETS

There are 12 SMB input sockets relevant to the operation of the AD7767/-1/-2 on this evaluation board. All of these sockets are used for applying an externally generated signal to the evaluation board. When operating the board with the CED, the only external sockets necessary are those used to supply the analog inputs to the ADC (that is, VA, VB). All of the other sockets are optional and if they are not used, the CED supplies their signals. Most of these sockets are used when operating the board as a standalone unit, as all the signals required are supplied from external sources. The functions of these sockets are outlined in Table 3.

**Table 3. Socket Functions**

| Socket | Designator | Function |
|---|---|---|
| **ANALOG INPUTS** | | |
| DIFFERENTIAL INPUT | J4 | XLR socket allowing a differential input from an audio cable to be applied to the AD7767/-1/-2 driving circuitry. |
| SINGLE-ENDED INPUT | J2 | Subminiature BNC socket allowing a single-ended analog input to be split and routed to each of the AD4841-1 amplifiers, allowing the AD7767/-1/-2 to be driven differentially. |
| **LOGIC INPUTS** | | |
| EXT_CMODE | J15 | Subminiature BNC socket allowing the common mode voltage to be supplied from an external source. |
| MCLK | J7 | Subminiature BNC socket allowing application of an external MCLK input. |
| SCLK | J9 | Subminiature BNC socket for SCLK output. |
| SDO | J8 | Subminiature BNC socket for an external SDO input. |
| $\overline{CS}$ | J5 | Subminiature BNC socket allowing application of an external $\overline{CS}$ input. |
| $\overline{SYNC/PD}$ | J10 | Subminiature BNC socket allowing application of an external $\overline{SYNC/PD}$ input. The . $\overline{SYNC/PD}$ pin can be controlled using an external source, or using the software front panel, or otherwise through the hardware button marked S2. |
| SDI | J6 | Subminiature BNC socket for an external SDI input. |
| $\overline{DRDY}$ | J11 | Subminiature BNC socket for an external $\overline{DRDY}$ input. |

## CONNECTORS

There are four connectors on the AD7767/-1/-2 evaluation board as outlined in Table 4.

**Table 4. Connector Functions**

| Connector | Function |
|---|---|
| J1 | 96-way connector for the digital interface and power supply connections to the CED board. |
| J3 | External voltage supply to the ADR425 or ADR445. |
| J12 | External V+, V- and GND power connector. Use this connector in conjunction with the default amplifier ADA4841-1.l |
| J13 | External V$_{DRIVE}$, and DGND power connector. |

## OPERATING WITH THE CED

The evaluation board can be operated in a standalone mode or operated in conjunction with the EVAL-CEDZ.

When interfacing the AD7767/-1/-2 evaluation boards directly to the EVAL-CEDZ, all control signals are provided by the EVAL-CEDZ. Sampling rates of 128 kHz, 64 KHz and 32 kHz respectively are supported when interfacing this evaluation board directly to the EVAL-CEDZ.

Software to communicate with the EVAL-CEDZ and AD7767/-1/-2 evaluation boards is provided with the AD7766.AD7767 evaluation board package.

The 96-way connector on the AD7767/-1/-2 evaluation board plugs directly into the 96-way connector on the EVAL-CEDZ. When using the AD7767/-1/-2 evaluation board with the EVAL-CEDZ board the board must be powered off +7.5V and -2.5V external supplies, in order to operate the ADA4841-1 Amplifiers within the maximum ratings.

# EVALUATION BOARD SOFTWARE

## INSTALLING THE SOFTWARE

The EVAL-AD7767/-1/-2 evaluation kit includes self-installing software on CD ROM, for controlling and evaluating the performance of the AD7767/-1/-2 when it is operated with the EVAL-CEDZ board. The software is compatible with Windows® 2000/XP®. If the setup file does not run automatically, setup.exe can be run from the CD-ROM.

When the CD is inserted into the PC, an installation program automatically begins. This program installs the evaluation software. The user interface on the PC
is a dedicated program written especially for the AD7766/AD7767 when operating with the EVAL-CEDZ board.

**The software should be installed before the USB cable is connected between the EVAL-CEDZ and the PC.** This ensures that the appropriate USB driver files have been properly installed before the EVAL-CEDZ is connected to the PC.

When the software is ran for the first time with the EVAL-CEDZ board connected to the PC, the PC will automatically find the new device and will identify it. Follow the onscreen instructions that appear automatically. This installs the drivers for the CED on the PC. If an error appears on screen when the software is first opened, then the PC is not recognizing the USB device. This error is corrected by

1. Opening the PC's Device Manager. The Device Manager is accessed by right clicking on the My Computer Icon, and selecting Properties. When the System Properties Window opens, select the Hardware tab.
2. Click on Device Manager in the Hardware Tab of the System Properties window.
3. Examine the devices listed under the Universal Serial Bus Controller heading.
4. If an unknown device is listed, right click on this option and select, Update Driver.
5. The New Hardware Wizard will run twice, and under the ADI Development Tools the following hardware is listed:

ADI Converter Evaluation and Development Board (WF)

6. Reboot the PC.

## SETTING UP THE EVAL-CEDZ

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

Install the AD7767/-1/-2 evaluation board software:
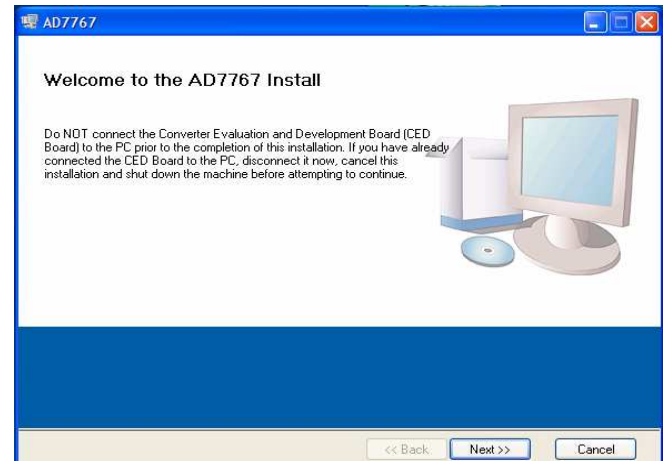1) Load the AD7767/-1/-2 Evaluation Software CD.



*Figure 2.AD7767 Installation Window 1*

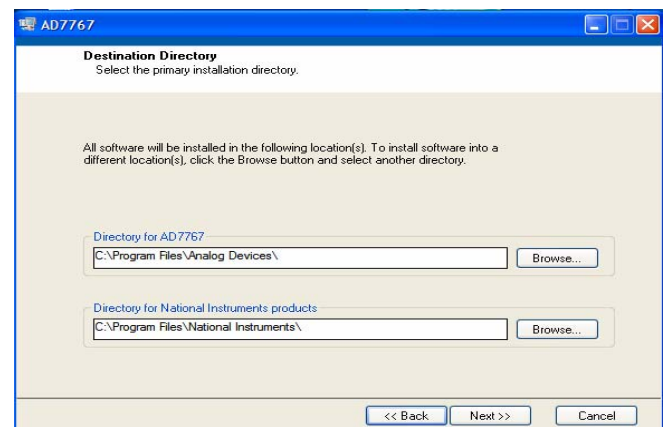2) The destination directory can be chosen using the default clicking "Next" as shown in Figure 3.



*Figure 3 AD7767/-1/-2 Evaluation software install 2.*

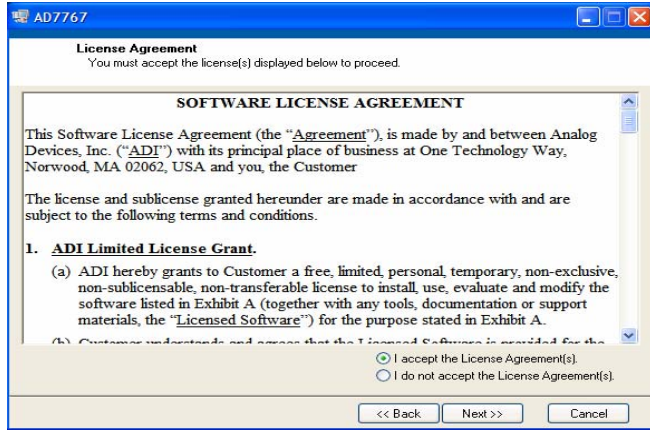3) Accept the license agreement by selecting the correct option and clicking "Next" as shown in Figure 4.



*Figure 4. AD7767/-1/-2 Evaluation software install 3.*

4) To start the installation, click the "Next" button as shown in Figure 5. This window details the actions of the installation.
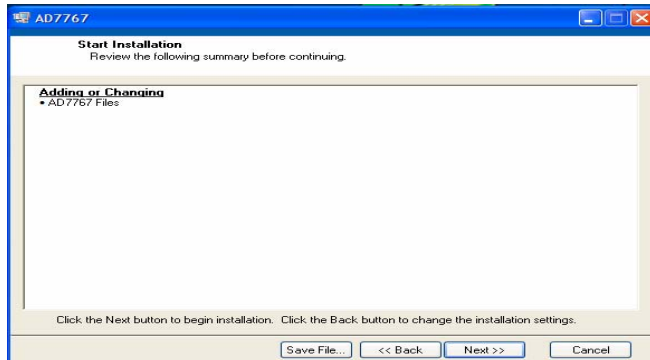


*Figure 5.AD7767/-1/-2 Install actions*

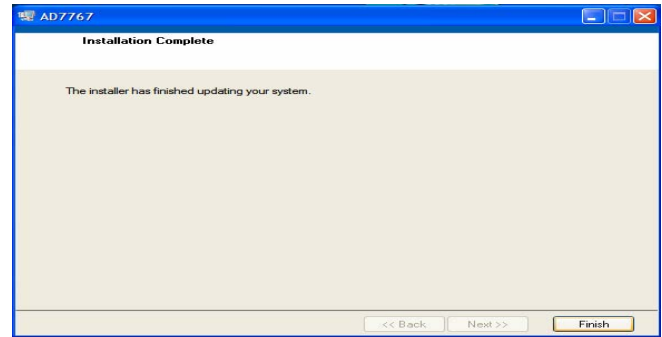5) On completion of the installation, the window as shown in figure 4 is displayed.



*Figure 6.Install completed.*

6) On completion of the installation it is advised that the user re-starts the PC in order for the software to take full effect.
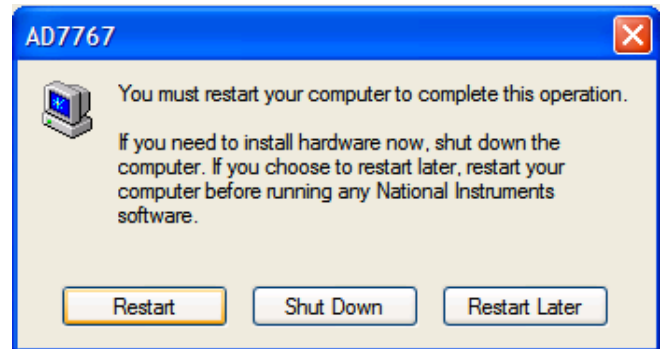


*Figure 7.Restart PC message*

# USING THE EVALUATION SYSTEM

## HARDWARE CONNECTIONS

1. Apply power to the EVAL-CED1Z via +7V, 15W power supply provided with the EVAL-CED1Z board. At this stage, the green LED labeled 'Power' on the EVAL-CED1Z should be lighting. This indicates that the EVAL-CED1Z is receiving power The USB cable can then be connected between the PC and the EVAL-CED1Z.

2. Connect the EVAL-CEDZ and the evaluation board together via the 96-way connector. The EVAL-AD7767/-1/-2EDZ board is powered by a 7.5V and -2.5V external supply.

3. Connect the USB cable between the PC and the EVAL-CEDZ. A green LED positioned beside the USB connector on the EVAL-CEDZ board will light indicating that the USB connection has been established.

4. The EVAL- AD7767EDZ will be detected - proceed through any dialog boxes that may appear (use the recommended options), to finalize the installation.

5. Start the EVAL- AD7767EDZ software.

With the hardware set up, you can now use the software to control the EVAL-CED1Z and the AD7767/-1/-2 evaluation board. To launch the software, from the **Analog Devices** menu click on the **AD7767** submenu, then click on the **AD7767 icon.** Figure 8 displays the main window that opens.

Note: In the case where an Error message appears, click OK and restart the application after checking the connection between the adapter board and the USB port on the PC. Also, check that the USB device is identified by the Device Manager as detailed in the first time use of EVAL-CED1Z paragraph of Installing the Software section.

## USING THE SOFTWARE

### Menu Bar

The menu bar consists of the following menus:

**File – Open (Sample Data)**

Opens previously saved sample data.

**File – Save (Sample Data)**

Saves the sample data this is currently displayed.

**File – Open (Linearity Data)**

Opens previously saved linearity data.

**File – Save (Linearity Data)**

Saves the linearity data that is currently displayed.

**File – Print Front Panel Picture**

Prints the software screen displayed.

**File – Save as Picture**

Saves the displayed screen plot, i.e. waveform, histogram, FFT.

**File – Exit**

Closes the software.

**Edit – Reinitialize Values to Default**

Reinitializes all the controls on the front panel to their default values.

**Help – Open analog.com**

Opens the www.analog.com website.

The software that controls the AD7767/-1/-2 evaluation board through the EVAL-CED1Z has four main sections. As shown in Figure 8. The top portion of the screen contains the menu bar. The **Part Information** section is on the left hand side of the screen. The **Data Capture** and **Linearity** tabs are in the centre of the screen each of which contains a number of sub-tabs.

### Part Information Tab

The **Part Information** tab allows the user to select a variety of configurations

Just underneath the **Part Information** text is the drop down menu to select the EVAL-CEDZ to operate with the AD7767/-1/-2 evaluations board. This enables all the required signals that are to be generated to run the AD7767/-1/-2 device.

Prior to taking samples from the AD7767/-1/-2 device the user must provide a SYNC/PD pulse to the AD7767/-1/-2 device. Press the **Sync / Power Down** button so that the AD7767/-1/-2 device is set-up to sample. This process must be followed each time the EVAL-CEDZ is powered on. Following the SYNC/PD samples can be acquired from the AD7767/-1/-2 device.

The AD7767/-1/-2 evaluation board runs using a 1.024MHz MCLK. You can choose the sampling frequency up to this rate by setting the MCLK frequency on the AD7767/-1/-2 front panel. Please note though that the MCLK frequency supplied by the EVAL-CEDZ board is not controlled by the MCLK setting on the software front panel, it is set constant to 1.024 MHz. However if an external MCLK signal is applied the MCLK control on the front panel may be used so that all the frequency calculations from the results of the samples are scaled correctly.

The frequency of the EVAL-AD7767EDZ crystal oscillator is 1MHz.

The **Part Information** tab also includes a **Busy** status indicator, which lights when the evaluation board is busy and an **Exit** button to allow the user quit the program.

### Data Capture Tab

In the **Data Capture** tab, the user can select the number of samples to be captured from the drop down menu. The default number of samples is 4096; the user is free to change this as required. When looking at the AD7767/-1/-2 device it's often beneficial to look at the statistics for a certain analog input over larger sample sets, such as 65536 samples.

To initiate a conversion and capture the sample data you must click on the **Sample** button or the **Continuous** button. Both the **Sample** and the **Continuous** sample buttons are located on the top right hand corner of the **Data Capture Tab**. When you click the **Sample** button, the software instructs the EVAL-CED1Z board to take the required number of samples at the required frequency from the evaluation board.

The samples taken are then uploaded and displayed. An FFT and/or histogram can be calculated and displayed. If you click the **Continuous** button, the software repeats the process indefinitely until you click **Stop.** (The **Continuous** button switches to **Stop** when clicked). The desired display option is selected by clicking on the **Waveform**, **Histogram**, **FFT** and **Summary** tab buttons. Please note that there is a certain delay (associated with data transfer on the USB link) which means that the data shown in **Continuous** mode is not sequential data. The mode is designed so that the user can see multiple sets of samples without having to constantly click the Sample button.

**The Data Capture Tab has the following sub-tabs:**

**Waveform Tab**

The **Waveform** sub-tab displays a digital storage oscilloscope (DSO) that allows you to display a waveform. When samples are uploaded from the EVAL-CED1Z board, they are displayed here. The samples are displayed as integer code values.

At the bottom left of the graph are the zoom options. These allow you to zoom in and out to get a closer look at a sample, if required. The **Waveform Analysis** section, which is located beneath the waveform graph, contains information about the samples taken, for example, minimum/ maximum position or frequency, the spread, the standard deviation, and the mean.

**Histogram Tab**

This tab displays a Histogram of the captured ADC codes. It can be used to give an indication of the ADC's performance in response to dc inputs. The **Histogram Analysis** section contains information about the samples taken, for example, maximum and minimum codes captured, spread, mean and standard deviation.

**FFT Tab**

This tab displays a Fast Fourier Transform (FFT) Plot. The FFT is typically used for examining the ADC's performance in the frequency domain. The **Spectrum Analysis** section contains information about the samples taken; SNR, THD, Peak Spurious Noise, Individual Harmonic levels etc...

### Summary Tab

This tab displays a summary of the graphs shown in the **Waveform Tab**, **Histogram Tab** and **FFT Tab**.
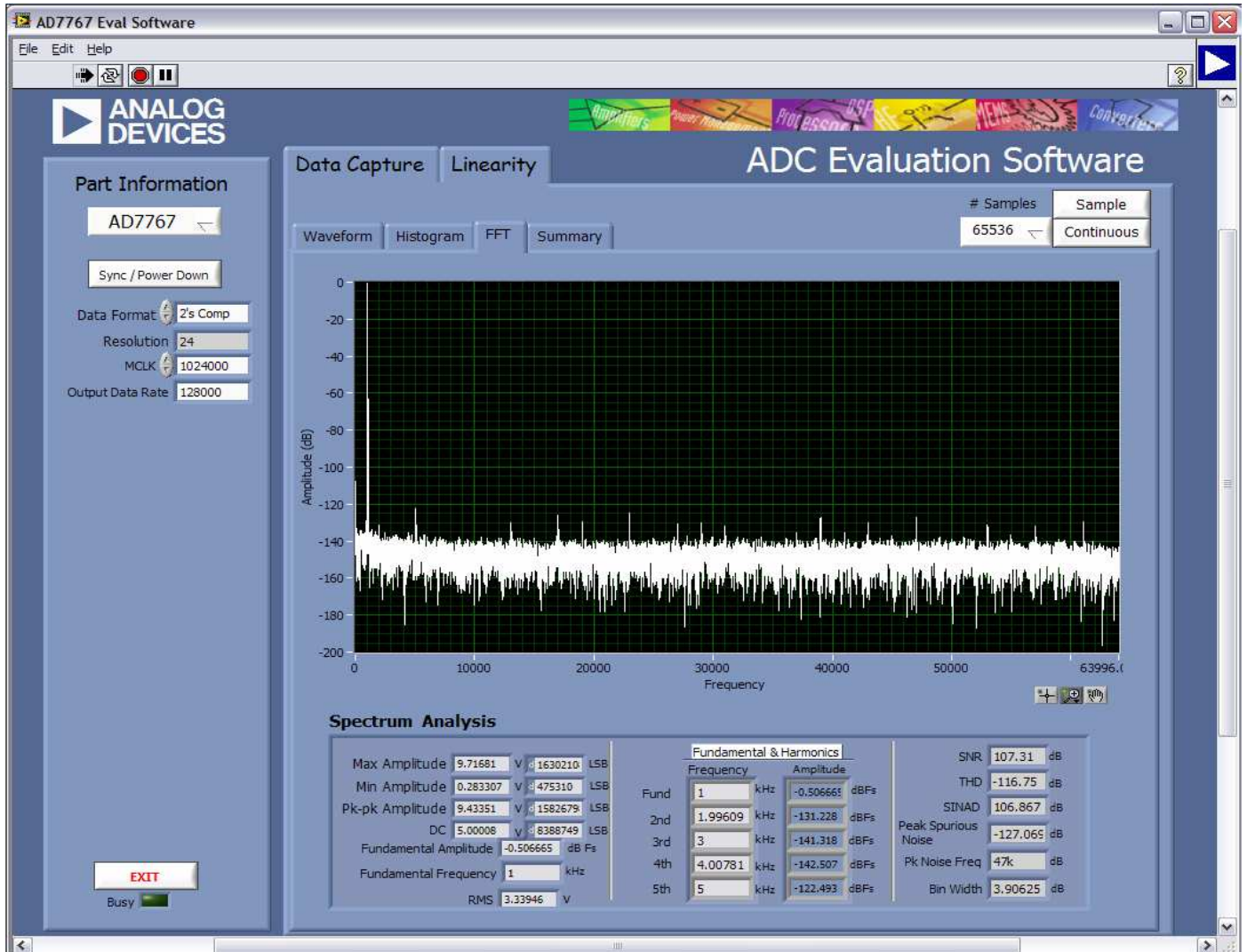
Figure 8 .Data Capture AD7767/AD7767-1/AD7767-2 tab.

## LINEARITY

The **Linearity** tab allows the user to evaluate the linearity of the device, creating an accumulating histogram for a non-coherent sampling system. Figure 9 shows an example of a linearity test conducted using the clipped sine-wave method. When evaluating linearity it is **Max Hits Per Code** that determines the duration it takes to complete the data capture. In this case, **Max Hits Per Code** was set to 400. This is the recommended number of hits per code for evaluation of the AD7767/AD7767-1/AD7767-2 devices.

For the results shown in Figure 9 an Audio Precision 2700 series sine source was used to apply a 10.5Vpp (as per Ap front panel) to the AD7767. This input amplitude provides a clipped output from the ADC. The frequency of the sine wave used was 324.25Hz. It is important that the frequency of the input is not an integer division of the ADC sampling rate, which was set to 1.024MHz in this case. Using a setting of 400 hits per code the test took approximately 25 to 30 minutes.

The AD7767/AD7767-1/AD7767-2 software is configured to generate 21-bit linearity plots. Running the AD7767 linearity with greater than 400 hits per code will show improved INL performance. The INL results are graphed with ppm on the y-axis and bins on the x-axis. Each bin represents eight 24-Bit codes.

The DNL plots prove only that there are no missing codes to 21-bits. This is set to 21 bits due to a hardware limitation on the CED board. The SRAM address is limited to 21-bits. Plots to show 24-bit no-missing codes are on the AD7767 datasheet.

To initiate conversions and perform the linearity routine the user must click on the **Get Linearity Data** button. This instructs the EVAL-CED1Z board to take the required number of samples at the required frequency from the evaluation board. Both the **Max Hits Per Code** control and the **Get Linearity Data** button are located on the top right hand side of the Linearity tab.

The samples are then uploaded and processed. The INL and DNL are calculated during the processing. The results are displayed in the **Histogram**, **DNL**, **INL** and **Summary** tab buttons.

The linearity analysis is displayed at the bottom of the **Linearity** tab. This section contains information about the samples taken as well as the worst-case positive (WCP) and worst-case negative (WCN) INL and DNL data.

Sub tabs on the Linearity Tabs are:

**Histogram Tab**

This tab displays a Histogram of the captured ADC codes.

**DNL Tab**

This tab displays a plot of the DNL results.

**INL Tab**

This tab displays a plot of the INL results.

**Summary Tab**

This tab displays the histogram, INL and DNL plots together on one screen.
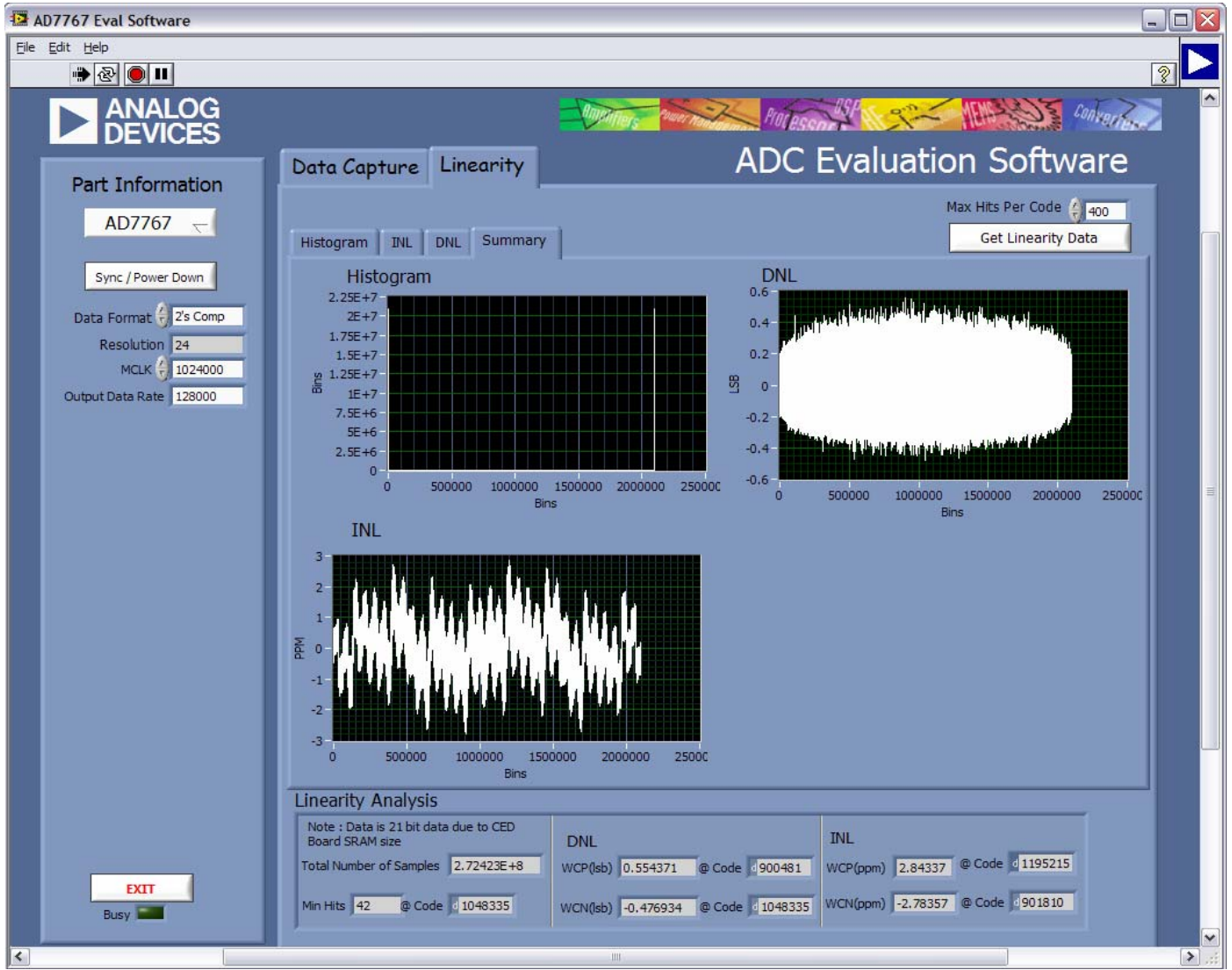
Figure 9. AD7767/-1/-2 Linearity Tab

# EVALUATION BOARD SCHEMATICS AND ARTWORK

AD7767/-1/-2 schematics, silkscreen, and layout can be found in Figure 10 to Figure 20.
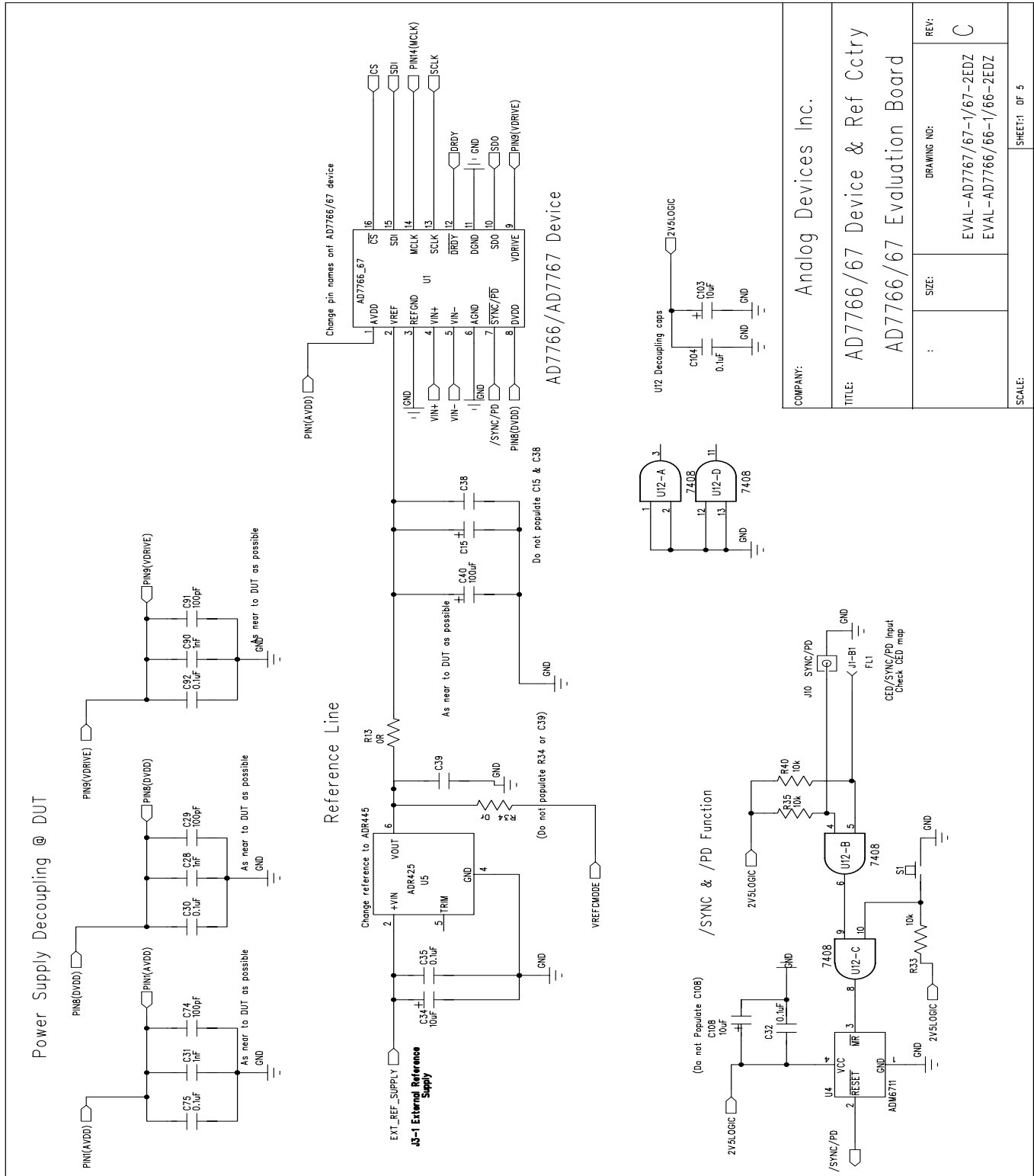


Figure 10. AD7767/-1/-2 Evaluation Board Circuit Diagram Page 1 of 5.
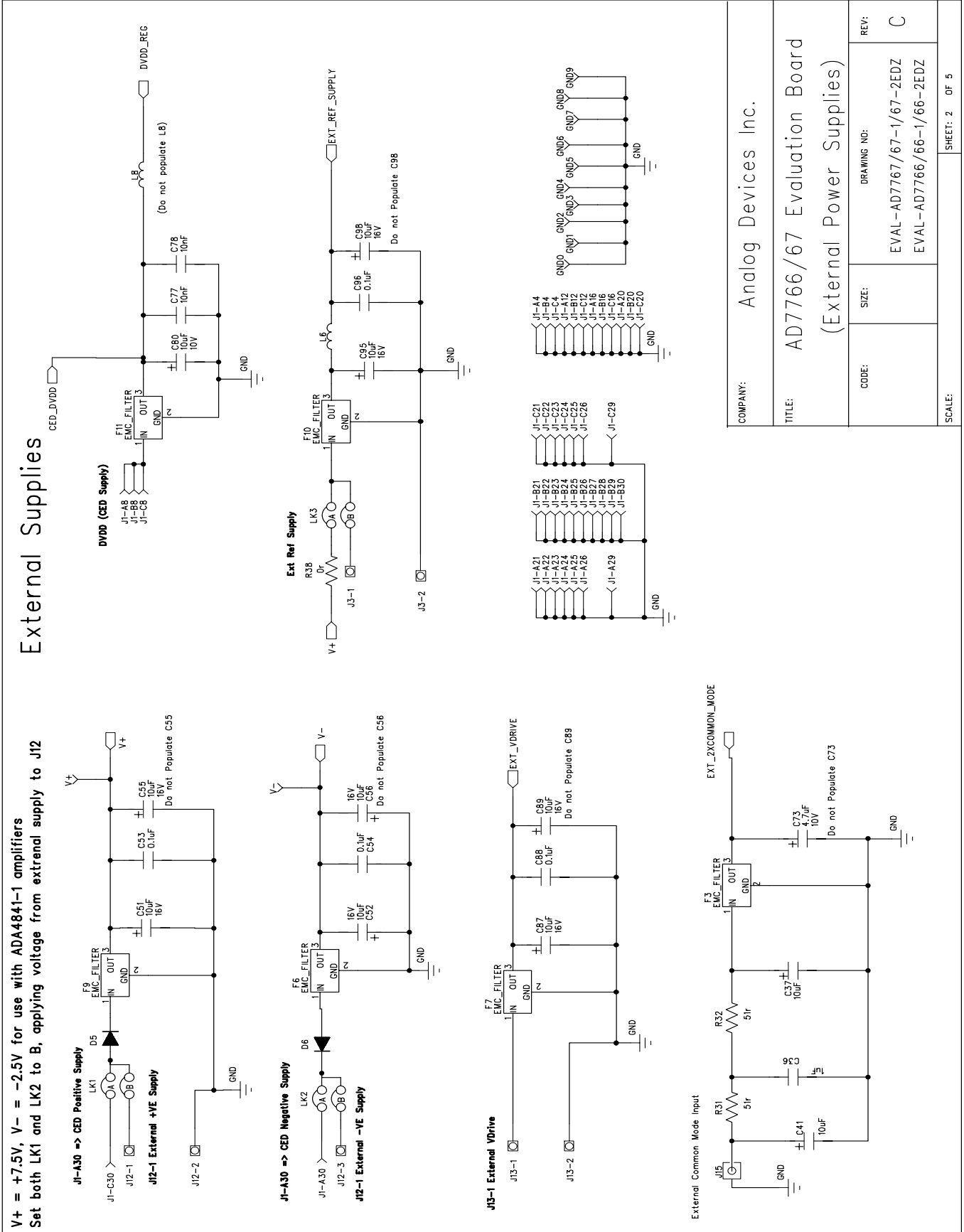
Figure 11. AD7767/-1/-2 Evaluation Board Circuit Diagram Page 2 of 5.

*Figure 12. AD7767/-1/-2 Evaluation Board Circuit Diagram Page 3 of 5.*
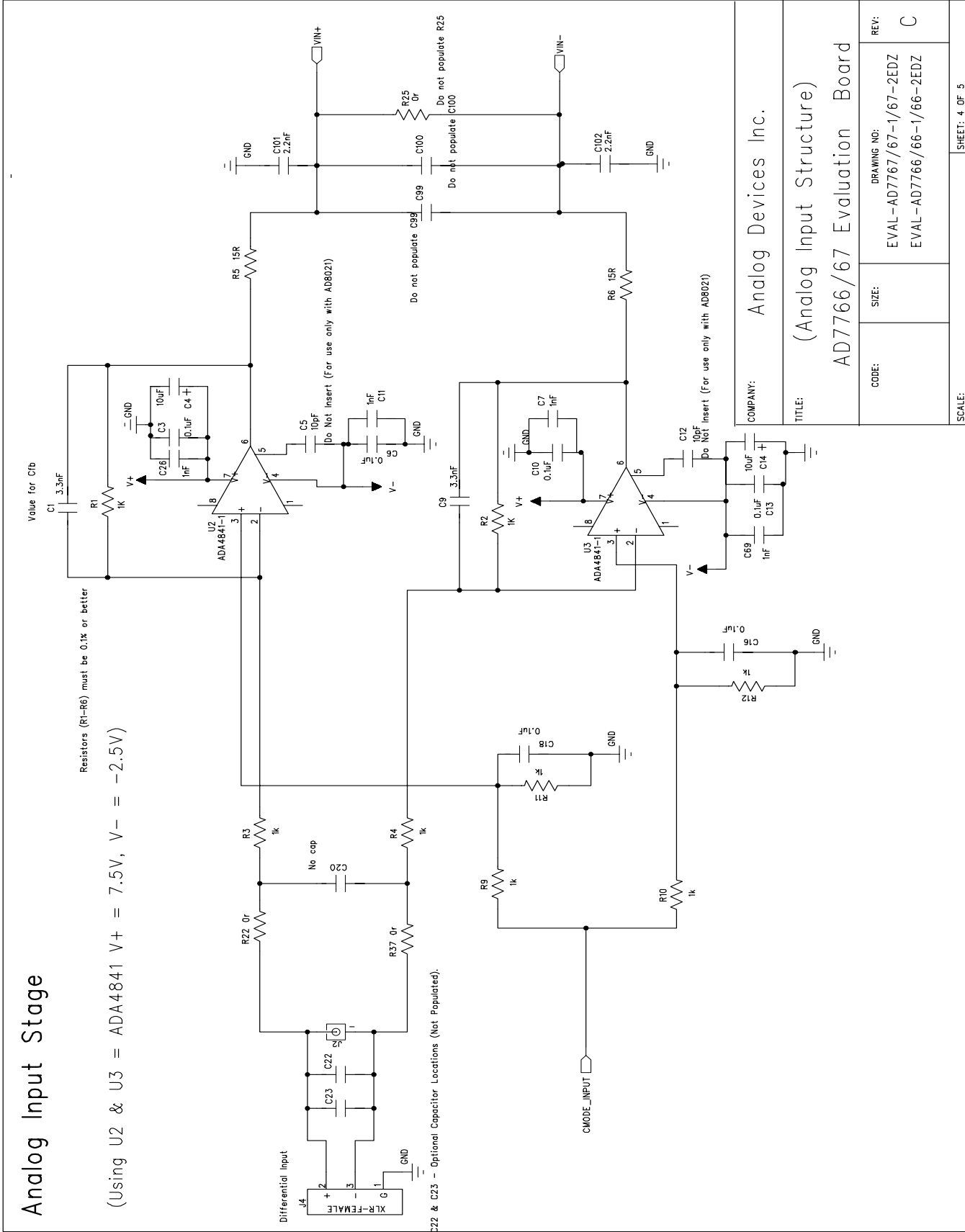
Figure 13. AD7767/-1/-2 Evaluation Board Circuit Diagram Page 4 of 5.
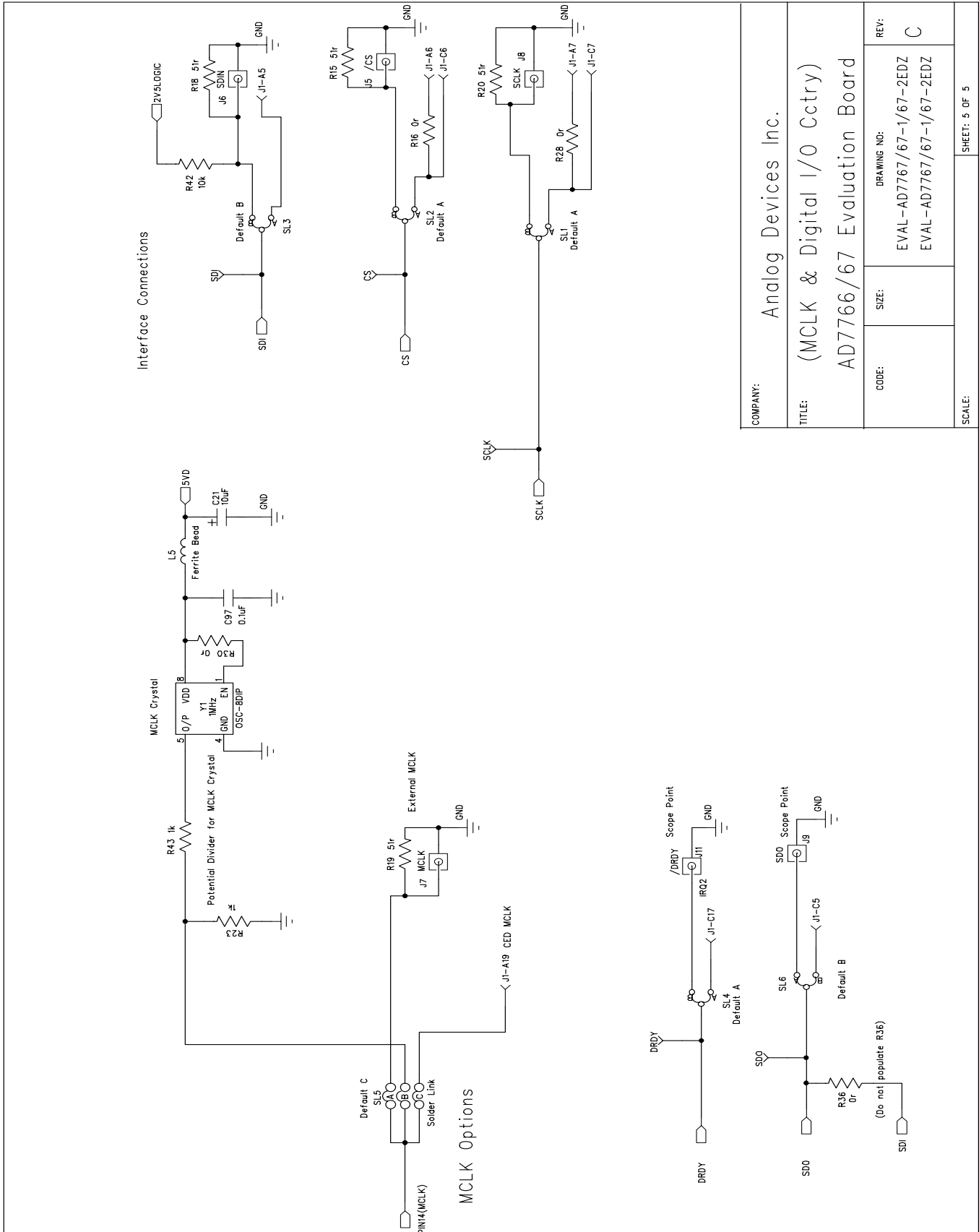
*Figure 14. AD7767/-1/-2 Evaluation Board Circuit Diagram Page 5 of 5*

EVAL-AD7766/67EDZ Rev. C - Component Side View

Silkscreen Top

*Figure 15. AD7767/67-1/67-2 Evaluation Board Top Silkscreen.*
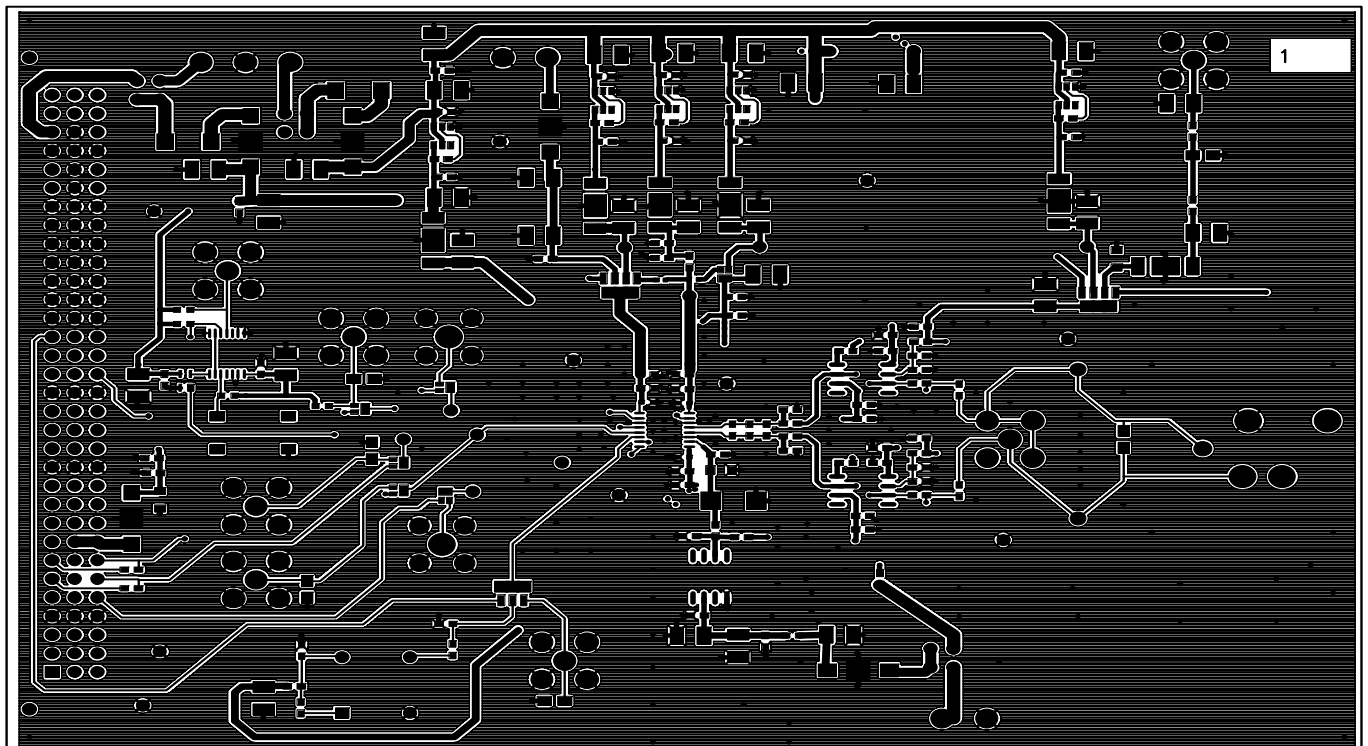


EVAL-AD7766/67EDZ Rev. C - Component Side View

Layer 1 - Component side

*Figure 16. AD7767/67-1/67-2 Evaluation Board Layer 1*

EVAL—AD7766/67EDZ Rev. C — Component Side View

Layer 2 — Ground plane

*Figure 17. AD7767/67-1/67-2 Evaluation Board Layer 2*



EVAL—AD7766/67EDZ Rev. C — Component Side View

Layer 3 — Power Plane

*Figure 18. AD7767/67-1/67-2 Evaluation Board Layer 3*

EVAL-AD7766/67EDZ Rev. C - Component Side View

Layer 4 - Solder Side

Figure 19. AD7767/67-1/67-2 Evaluation Board Layer 4 Solder side view.



EVAL-AD7766/67EDZ Rev. C - Component Side View

Silkscreen Bottom

Figure 20. AD7767/67-1/67-2 Evaluation Board BottomSilkscreen

## ORDERING INFORMATION

**BILL OF MATERIALS**

Table 5

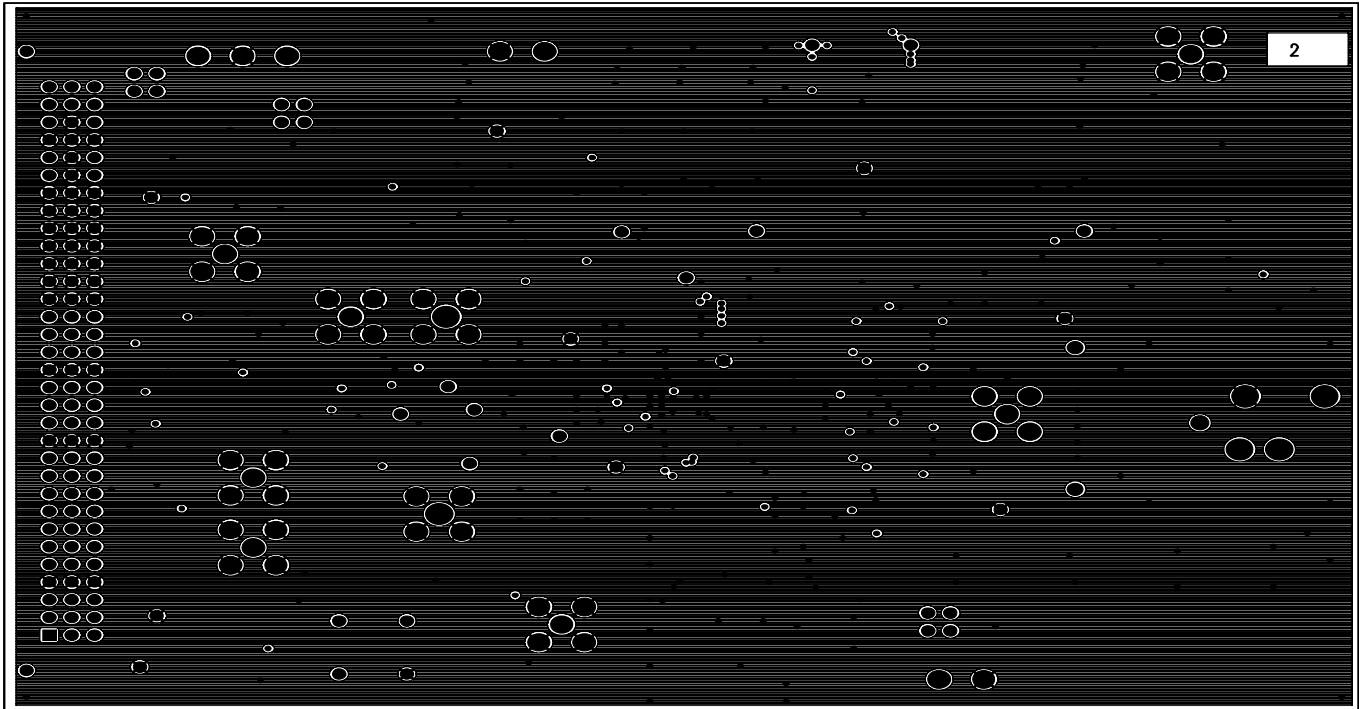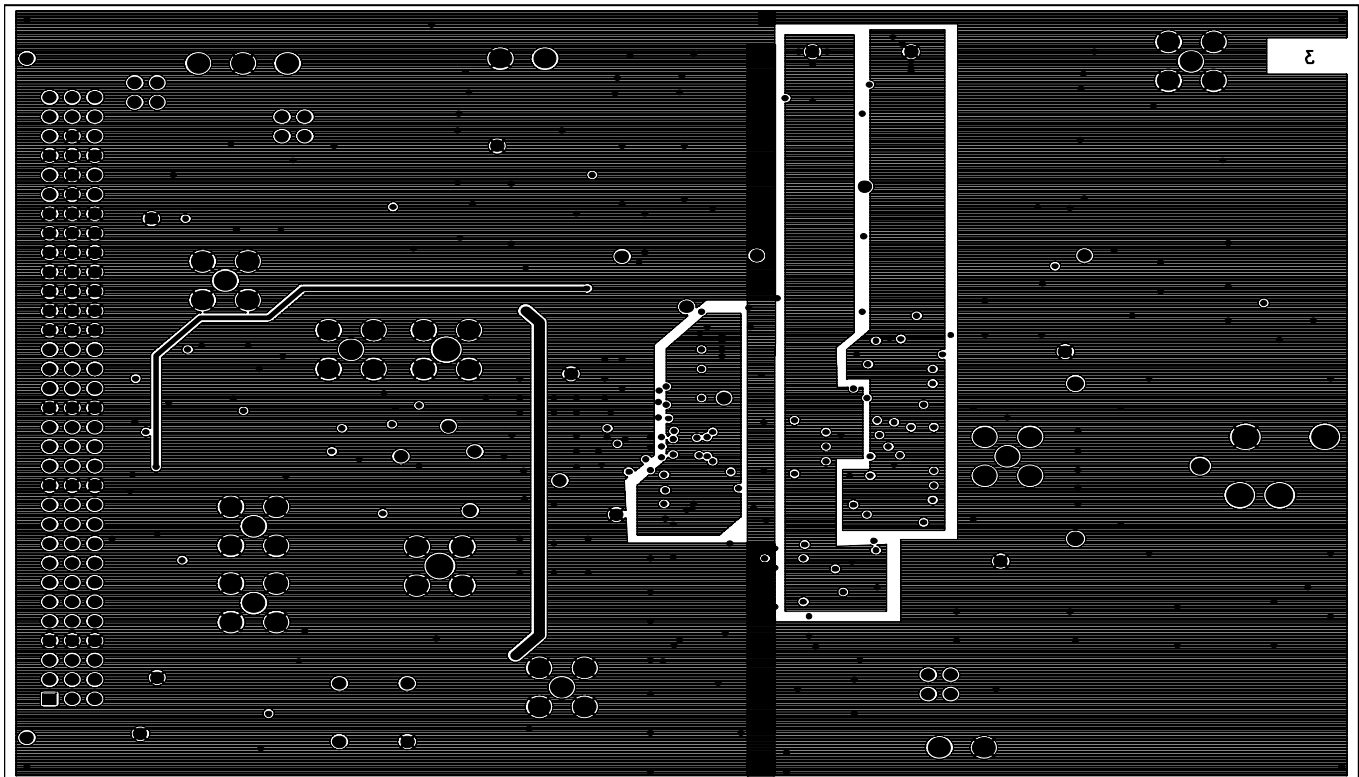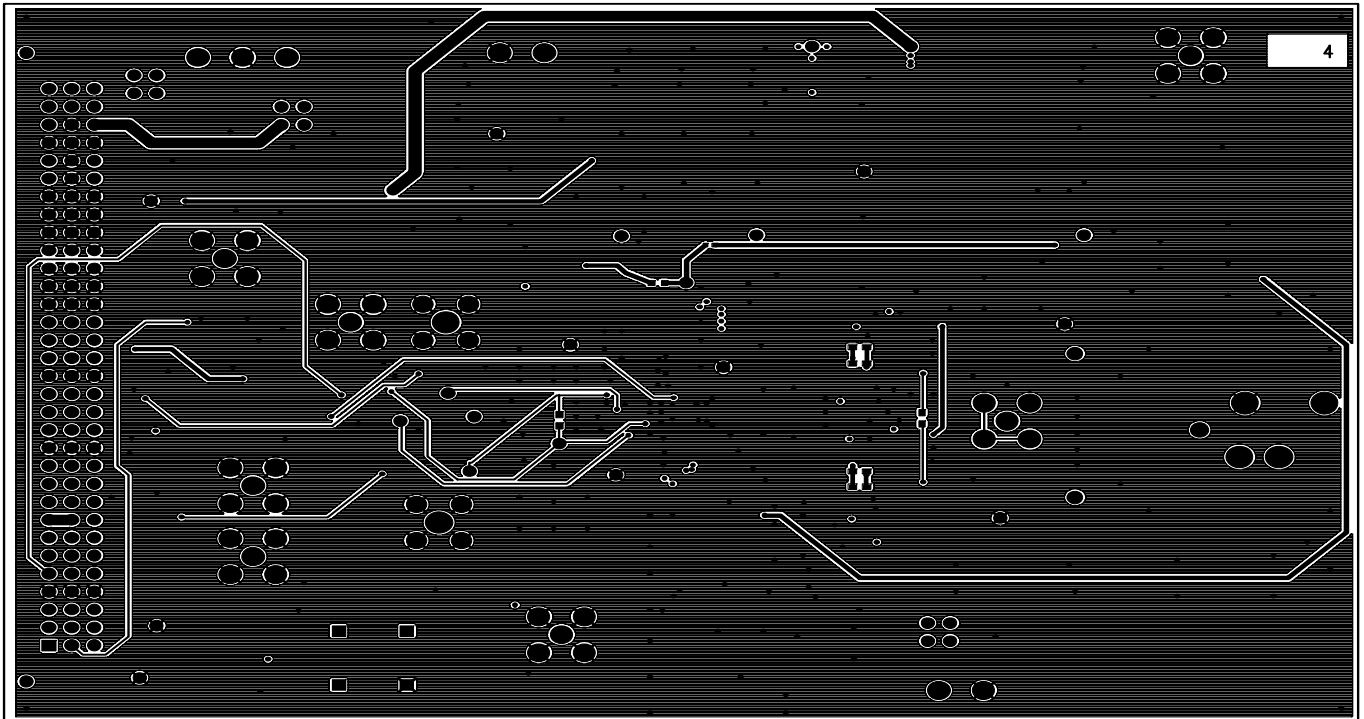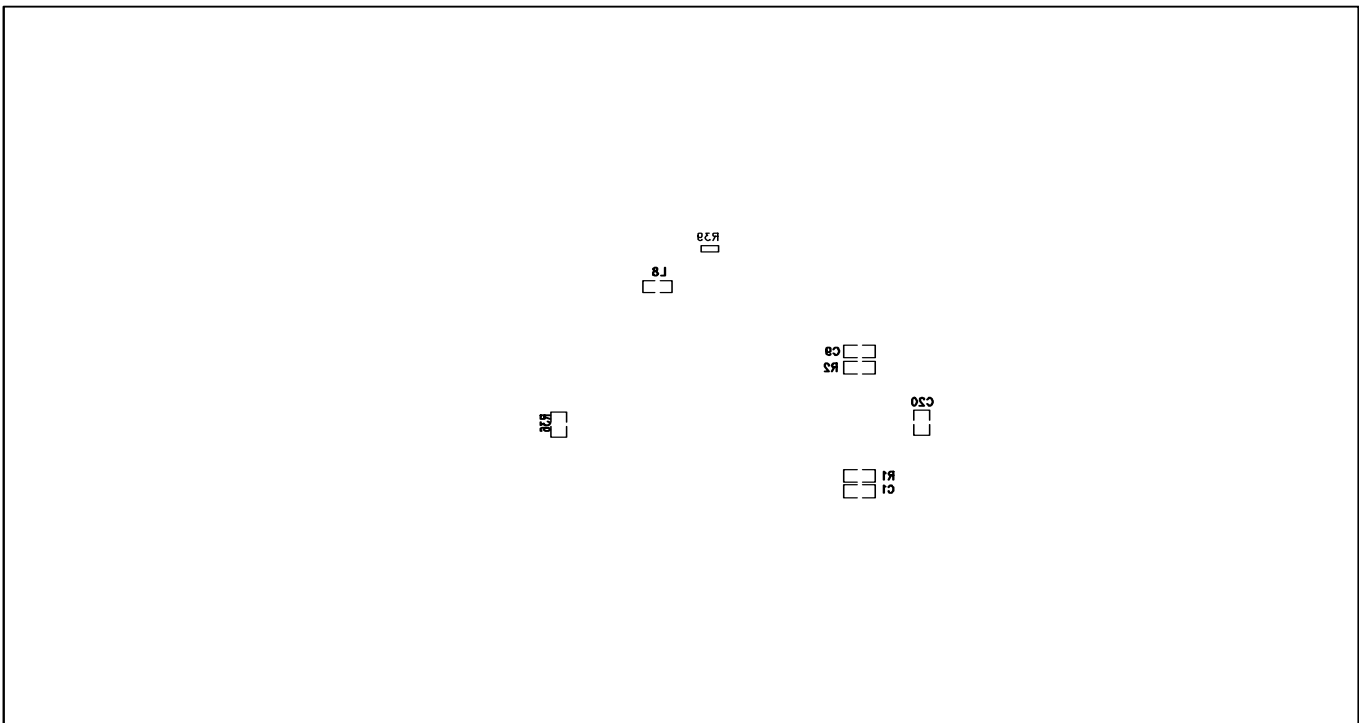| Reference Designator | Part Type | Reference Designator | Manufacturer | Supplier No. |
|---|---|---|---|---|
| 2XCMODE_REG | | Red Testpoint | Vero | FEC 8731144 (Pack) |
| AVDD_REG | | Red Testpoint | Vero | FEC 8731144 (Pack) |
| C1 | 3.3nF | 50V NPO Multilayer Ceramic Capacitor | Murata | FEC 8820040 |
| C2 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C3 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C4 | 10uF | 20V Tantalum Capacitor | AVX | FEC 197427 |
| C5 | 10pF | | | Do Not Insert (For use only with AD8021) |
| | | 50V NPO Multilayer Ceramic Capacitor | n/a | |
| C6 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C7 | 1nF | 50V X7R Multilayer Ceramic Capacitor | Phycomp | FEC 722170 |
| C8 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C9 | 3.3nF | 50V NPO Multilayer Ceramic Capacitor | Murata | FEC 8820040 |
| C10 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C11 | 1nF | 50V X7R Multilayer Ceramic Capacitor | Phycomp | FEC 722170 |
| C12 | 10pF | | | Do Not Insert (For use only with AD8021) |
| | | 50V NPO Multilayer Ceramic Capacitor | n/a | |
| C13 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C14 | 10uF | 20V Tantalum Capacitor | AVX | FEC 197427 |
| C15 | 10uF | 10V Tantalum Capacitor | AVX | Do not insert |
| C16 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C17 | 1nF | 50V X7R Multilayer Ceramic Capacitor | Phycomp | FEC 722170 |
| C18 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C19 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C20 | n/a | 50V NPO Multilayer Ceramic Capacitor | n/a | Do not insert |
| C21 | 10uF | 20V Tantalum Capacitor | AVX | Do not insert |
| C22 | n/a | Optional Capacitor Footprint (0603) | n/a | n/a |
| C23 | n/a | Optional Capacitor Footprint (0603) | n/a | n/a |
| C24 | 10uF | 20V Tantalum Capacitor | AVX | FEC 197427 |
| C25 | 10uF | 20V Tantalum Capacitor | AVX | Do not Insert |
| C26 | 1nF | 50V X7R Multilayer Ceramic Capacitor | Phycomp | FEC 722170 |
| C27 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C28 | 1nF | 50V X7R Multilayer Ceramic Capacitor | Phycomp | FEC 722170 |
| C29 | 100pF | 50V  X7R Multilayer Ceramic Capacitor | Phycomp | FEC 3019329 |
| C30 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C31 | 1nF | 50V X7R Multilayer Ceramic Capacitor | Phycomp | FEC 722170 |
| C32 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C33 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C34 | 10uF | 20V Tantalum Capacitor | AVX | FEC 197427 |
| C35 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C36 | 1uF | 10V X7R Multilayer Ceramic Capacitor | Multicomp | FEC 9406301 |
| C37 | 10uF | 20V Tantalum Capacitor | AVX | FEC 197427 |
| C38 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | Do not insert |
| C39 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | Do not insert |
| C40 | 100uF | 10v Tantalum Capacitor | AVX | FEC 197180 |
| C41 | 10uF | 20v Tantalum Capacitor | AVX | FEC 197427 |
| C44 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C45 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |

| Reference Designator | Part Type | Reference Designator | Manufacturer | Supplier No. |
|---|---|---|---|---|
| C46 | 1nF | 50V X7R Multilayer Ceramic Capacitor | Phycomp | FEC 722170 |
| C47 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C48 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C49 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C50 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C51 | 10uF | 20v Tantalum Capacitor | AVX | FEC 197-427 |
| C52 | 10uF | 20v Tantalum Capacitor | AVX | FEC 197-427 |
| C53 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C54 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C55 | 10uF | 20v Tantalum Capacitor | AVX | Do not insert |
| C56 | 10uF | 20v Tantalum Capacitor | AVX | Do not insert |
| C57 | 10uF | 20V Tantalum Capacitor | AVX | FEC 197427 |
| C59 | 10uF | 20V Tantalum Capacitor | AVX | FEC 197427 |
| C60 | 100pF | 50V NPO Multilayer Ceramic Capacitor | Multicomp | FEC 9406115 |
| C61 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C62 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C63 | 10uF | 20V Tantalum Capacitor | AVX | FEC 197427 |
| C64 | 10uF | 20V Tantalum Capacitor | AVX | FEC 197427 |
| C67 | 10uF | 20V Tantalum Capacitor | AVX | FEC 197427 |
| C68 | 100pF | 50V NPO Multilayer Ceramic Capacitor | Multicomp | FEC 9406115 |
| C69 | 1nF | 50V X7R Multilayer Ceramic Capacitor | Phycomp | FEC 722170 |
| C72 | 10uF | 20V Tantalum Capacitor | AVX | FEC 197427 |
| C73 | 4.7uF | SMD Tantalum Capacitor | n/a | Do not insert |
| C74 | 100pF | 50V  X7R Multilayer Ceramic Capacitor | Phycomp | FEC 3019329 |
| C75 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C77 | 10nF | 50V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753-622 |
| C78 | 10nF | 50V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753-622 |
| C79 | 10uF | 20V Tantalum Capacitor | AVX | FEC 197427 |
| C80 | 10uF | 20v Tantalum Capacitor | AVX | FEC 197-130 |
| C81 | 100pF | 50V NPO Multilayer Ceramic Capacitor | Multicomp | FEC 9406115 |
| C85 | 10uF | 20V Tantalum Capacitor | AVX | FEC 197427 |
| C86 | 10uF | 20V Tantalum Capacitor | AVX | FEC 197427 |
| C87 | 10uF | 20v Tantalum Capacitor | AVX | FEC 197-427 |
| C88 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C89 | 10uF | 20v Tantalum Capacitor | AVX | Do not insert |
| C90 | 1nF | 50V X7R Multilayer Ceramic Capacitor | Phycomp | FEC 722170 |
| C91 | 100pF | 50V  X7R Multilayer Ceramic Capacitor | Phycomp | FEC 3019329 |
| C92 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C93 | 100pF | 50V NPO Multilayer Ceramic Capacitor | Multicomp | FEC 9406115 |
| C94 | 100pF | 50V NPO Multilayer Ceramic Capacitor | Multicomp | FEC 9406115 |
| C95 | 10uF | 20v Tantalum Capacitor | AVX | FEC 197-427 |
| C96 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C97 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C98 | 10uF | 20v Tantalum Capacitor | AVX | Do not insert |
| C99 | 10nF | 50V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753-622 |
| C100 | 10nF | 50V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753-622 |
| C101 | 2.2nF | 50V X7R Multilayer Ceramic Capacitor | Murata | FEC 8819963 |
| C102 | 2.2nF | 50V X7R Multilayer Ceramic Capacitor | Murata | FEC 8819963 |
| C103 | 10uF | 20V Tantalum Capacitor | AVX | FEC 197427 |
| C104 | 0.1uF | 16V X7R Multilayer Ceramic Capacitor | Epcos | FEC 753567 |
| C108 | 10uF | 20V Tantalum Capacitor | AVX | Do not Insert |
| C109 | 1nF | 50V X7R Multilayer Ceramic Capacitor | Phycomp | FEC 722170 |

| Reference Designator | Part Type | Reference Designator | Manufacturer | Supplier No. |
|---|---|---|---|---|
| C110 | 10uF | 20V Tantalum Capacitor | AVX | Do not Insert |
| C111 | 10uF | 20V Tantalum Capacitor | AVX | Do not Insert |
| CS | | Red Testpoint | Vero | FEC 8731144 (Pack) |
| D5 | | 2A Rectifier Diode | General Semicoductor | FEC 646-982 |
| D6 | | 2A Rectifier Diode | General Semicoductor | FEC 646-982 |
| DRDY | | Red Testpoint | Vero | FEC 8731144 (Pack) |
| DVDD_REG | | Red Testpoint | Vero | FEC 8731144 (Pack) |
| F1 | | 1nF 3-Terminal Capacitor | Murata | FEC 9528202 |
| F2 | | 1nF 3-Terminal Capacitor | Murata | FEC 9528202 |
| F3 | | 1nF 3-Terminal Capacitor | Murata | FEC 9528202 |
| F4 | | 1nF 3-Terminal Capacitor | Murata | FEC 9528202 |
| F5 | | 1nF 3-Terminal Capacitor | Murata | FEC 9528202 |
| F6 | | 1nF 3-Terminal Capacitor | Murata | FEC 9528202 |
| F7 | | 1nF 3-Terminal Capacitor | Murata | FEC 9528202 |
| F8 | | 1nF 3-Terminal Capacitor | Murata | FEC 9528202 |
| F9 | | 1nF 3-Terminal Capacitor | Murata | FEC 9528202 |
| F10 | | 1nF 3-Terminal Capacitor | Murata | FEC 9528202 |
| F11 | | 1nF 3-Terminal Capacitor | Murata | FEC 9528202 |
| GND0 | | Black Testpoint(Pack) | Vero | FEC 8731128 |
| GND1 | | Black Testpoint(Pack) | Vero | FEC 8731128 |
| GND2 | | Black Testpoint(Pack) | Vero | FEC 8731128 |
| GND3 | | Black Testpoint(Pack) | Vero | FEC 8731128 |
| GND4 | | Black Testpoint(Pack) | Vero | FEC 8731128 |
| GND5 | | Black Testpoint(Pack) | Vero | FEC 8731128 |
| GND6 | | Black Testpoint(Pack) | Vero | FEC 8731128 |
| GND7 | | Black Testpoint(Pack) | Vero | FEC 8731128 |
| GND8 | | Black Testpoint(Pack) | Vero | FEC 8731128 |
| GND9 | | Black Testpoint(Pack) | Vero | FEC 8731128 |
| J1 | | DIN41612 PCB Connector 96-Pin | Harting | FEC 1096832 |
| J2 | | Straight PCB Mount SMB Jack | Tyco | FEC 1206013 |
| J3 | | 2 Pin Terminal Block (5mm Pitch) | Lumberg | FEC 151-785 |
| J4 | | XLR Female Audio Connector | Neutrik AG | FEC 724518 |
| J5 | | Straight PCB Mount SMB Jack | Tyco | FEC 1206013 |
| J6 | | Straight PCB Mount SMB Jack | Tyco | FEC 1206013 |
| J7 | | Straight PCB Mount SMB Jack | Tyco | FEC 1206013 |
| J8 | | Straight PCB Mount SMB Jack | Tyco | FEC 1206013 |
| J9 | | Straight PCB Mount SMB Jack | Tyco | FEC 1206013 |
| J10 | | Straight PCB Mount SMB Jack | Tyco | FEC 1206013 |
| J11 | | Straight PCB Mount SMB Jack | Tyco | FEC 1206013 |
| J12 | | 3 Pin Terminal Block (5mm Pitch) | Lumberg | FEC 151-786 |
| J13 | | 2 Pin Terminal Block (5mm Pitch) | Lumberg | FEC 151-785 |
| J15 | | Straight PCB Mount SMB Jack | Tyco | FEC 1206013 |
| L5 | 0r | SMD Resistor | Multicomp | FEC 9331662 |
| L6 | 0r | SMD Resistor | Multicomp | FEC 9331662 |
| L8 | 0r | SMD Resistor | Multicomp | FEC 9331662 |
| LK1 | B | 2 LINK BLOCK, 4 PINS 0.1" sq. SPACING(36 Pin Strip) | Harwin | FEC 148-535 & 150-411 |
| LK2 | B | 2 LINK BLOCK, 4 PINS 0.1" sq. SPACING(36 Pin Strip) | Harwin | FEC 148-535 & 150-411 |
| LK3 | A | 4 Pin (2x2) 0.1" Header & Shorting Block (36 Pin Strip) | Harwin | FEC 148-535 & 150-411 |
| R1 | 1k | 0.10%, 0603, Precision SMD Resistor | Holsworthy (Tyco) | FEC 4628846 |
| R2 | 1k | 0.10%, 0603, Precision SMD Resistor | Holsworthy (Tyco) | FEC 4628846 |

| Reference Designator | Part Type | Reference Designator | Manufacturer | Supplier No. |
|---|---|---|---|---|
| R3 | 1k | 0.10%, 0603, Precision SMD Resistor | Holsworthy (Tyco) | FEC 4628846 |
| R4 | 1k | 0.10%, 0603, Precision SMD Resistor | Holsworthy (Tyco) | FEC 4628846 |
| R5 | 15R | 1%, 0603, SMD Resistor | Multicomp | FEC 9330631 |
| R6 | 15R | 1%, 0603, SMD Resistor | Multicomp | FEC 9330631 |
| R7 | 0r | 1%, 0603, SMD Resistor | Multicomp | FEC 9331662 |
| R8 | 0r | 1%, 0402, SMD Resistor | Multicomp | Do not insert |
| R9 | 1k | 0.10%, 0603, Precision SMD Resistor | Holsworthy (Tyco) | FEC 4628846 |
| R10 | 1k | 0.10%, 0603, Precision SMD Resistor | Holsworthy (Tyco) | FEC 4628846 |
| R11 | 1k | 0.10%, 0603, Precision SMD Resistor | Holsworthy (Tyco) | FEC 4628846 |
| R12 | 1k | 0.10%, 0603, Precision SMD Resistor | Holsworthy (Tyco) | FEC 4628846 |
| R13 | 0r | 1%, 0603, SMD Resistor | Multicomp | FEC 9331662 |
| R15 | 51r | 1%, 0805, SMD Resistor | Multicomp | FEC 9333355 |
| R16 | 0r | 1%, 0603, SMD Resistor | Multicomp | FEC 9331662 |
| R18 | 51r | 1%, 0805, SMD Resistor | Multicomp | FEC 9333355 |
| R19 | 51r | 1%, 0805, SMD Resistor | Multicomp | FEC 9333355 |
| R20 | 51r | 1%, 0805, SMD Resistor | Multicomp | FEC 9333355 |
| R22 | 0r | 1%, 0603, SMD Resistor | Multicomp | FEC 9331662 |
| R23 | 1k | 0.10%, 0603, Precision SMD Resistor | Holsworthy (Tyco) | FEC 4628846 |
| R24 | 0r | 1%, 0402, SMD Resistor | Multicomp | Do not insert |
| R25 | 0r | 1%,0603, SMD Resistor | Multicomp | FEC 9331662 |
| R28 | 0r | 1%,0603, SMD Resistor | Multicomp | FEC 9331662 |
| R30 | 0r | 1%,0603, SMD Resistor | Multicomp | FEC 9331662 |
| R31 | 51r | 0.10%, 0603, SMD Resistor | Holsworthy (Tyco) | FEC 4627623 |
| R32 | 51r | 0.10%, 0603, SMD Resistor | Holsworthy (Tyco) | FEC 4627623 |
| R33 | 10k | 1%, 0603, SMD Resisitor | Multicomp | FEC 9330399 |
| R34 | 0r | 1%,0603, SMD Resistor | Multicomp | FEC 9331662 |
| R35 | 10k | 1%, 0603, SMD Resisitor | Multicomp | FEC 9330399 |
| R36 | 0r | 1%,0603, SMD Resistor | Multicomp | FEC 9331662 |
| R37 | 0r | 1%,0603, SMD Resistor | Multicomp | FEC 9331662 |
| R38 | 0r | 1%,0603, SMD Resistor | Multicomp | FEC 9331662 |
| R39 | 0r | 1%, 0402, SMD Resistor | Multicomp | Do not insert |
| R40 | 10k | 1%, 0603, SMD Resisitor | Multicomp | FEC 9330399 |
| R42 | 10k | 1%, 0603, SMD Resisitor | Multicomp | FEC 9330399 |
| R43 | 1k | 0.10%, 0603, Precision SMD Resistor | Holsworthy (Tyco) | FEC 4628846 |
| S1 | SW-PUSH-SMD | SMD Push Button Switch (sealed 6mm x 6mm) | Omron | FEC 177-807 |
| SCLK | TESTPOINT | Red Testpoint | Vero | FEC 8731144 |
| SDI | TESTPOINT | Red Testpoint | Vero | FEC 8731144 |
| SDO | TESTPOINT | Red Testpoint | Vero | FEC 8731144 |
| SL1 | 2 Way solder Bridge | Solder to Link A | n/a | n/a |
| SL2 | 2 Way solder Bridge | Solder to Link A | n/a | n/a |
| SL3 | 2 Way solder Bridge | Solder to Link B | n/a | n/a |
| SL4 | 2 Way solder Bridge | Solder to Link A | n/a | n/a |
| SL5 | 4-Way Solder Link | Solder to Link C | n/a | n/a |
| SL6 | 2 Way solder Bridge | Solder to Link B | n/a | n/a |
| SL8 | 4-way Solder link | Solder to link C | n/a | n/a |
| SL9 | 2 Way solder Bridge | Solder to Link B | n/a | n/a |
| SL11 | 4-Way Solder Link | Solder to Link B | n/a | n/a |
| U1 | AD7767/67-1/67-2 | ADC (AD7767BRUZ, AD7767-1BRUZ or AD7767-2BRUZ) | Analog Devices | AD7767BRUZ* |
| U2 | ADA4841-1 | SINGLE SUPPLY OP-AMP | Analog Devices | ADA4841-1YRZ |
| U3 | ADA4841-1 | SINGLE SUPPLY OP-AMP | Analog Devices | ADA4841-1YRZ |
| U4 | ADM6711 | Reset Generator | Analog Devices | ADM6711ZAKSZ |
| U5 | ADR425 | 5V Reference | Analog Devices | ADR445BRZ |