

# MAX1115X/MAX1116X Family Evaluation Kit

Evaluates: MAX11150/MAX11152/MAX11158/  
MAX11160/MAX11161/MAX11162/MAX11163/  
MAX11168/MAX11169

## General Description

The evaluation kit (EV kit) demonstrates the MAX1115X/MAX1116X family of 18-/16-bit SAR ADCs. The EV kit includes a graphical user interface (GUI) that provides communication from the target device to the PC. The EV kit can operate in multiple modes:

- 1) **Standalone Mode:** In “standalone” mode, the EV kit is connected to the PC via a USB cable and performs a subset of the complete EV kit functions with limitation for sample rate, sample size, and no support for coherent sampling.
- 2) **FPGA Mode:** In “FPGA” mode, the EV kit is connected to an Avnet ZedBoard™ through a low-pin-count FMC connector. The ZedBoard features a Xilinx® Zynq® -7000 SoC, that connects to the PC through an Ethernet port, which allows the GUI to perform different operations with full control over mezzanine card functions. The EV kit with FPGA platform performs the complete suite of evaluation tests for the target IC.
- 3) **User-Supplied SPI Mode:** In addition to the USB and FMC interfaces, the EV kit provides a 12-pin PMOD-style header for user-supplied SPI interface to connect the signals for SCLKx, DINx, DOUTx, and CNVSTx.

The EV kit includes Windows XP®, Windows® 7, and Windows 8.1-compatible software for exercising the features of the IC. The EV kit GUI allows different sample sizes, adjustable sampling rates, internal or external reference options (depending upon target device selected), and graphing software that includes the FFT and histogram of the sampled signals.

The ZedBoard board accepts a +12V AC-DC wall adapter. The EV kit can be powered by a local +20V supply. The EV kit has on-board transformers and digital isolators to separate the IC from the ZedBoard/on-board processor.

The MAX1115X/MAX1116X EV kit comes installed with a MAX1115XEUB+/MAX1116XEUB+ in a 10-pin μMAX® package, but can also evaluate other pin-compatible parts in the family. For a full list of products supported by this EV kit, see [Table 4](#).

*ZedBoard is a trademark of Avnet, Inc.*

*Xilinx and Zynq are registered trademarks of Xilinx, Inc.*

*Windows XP and Windows are registered trademarks and registered service marks of Microsoft Corporation.*

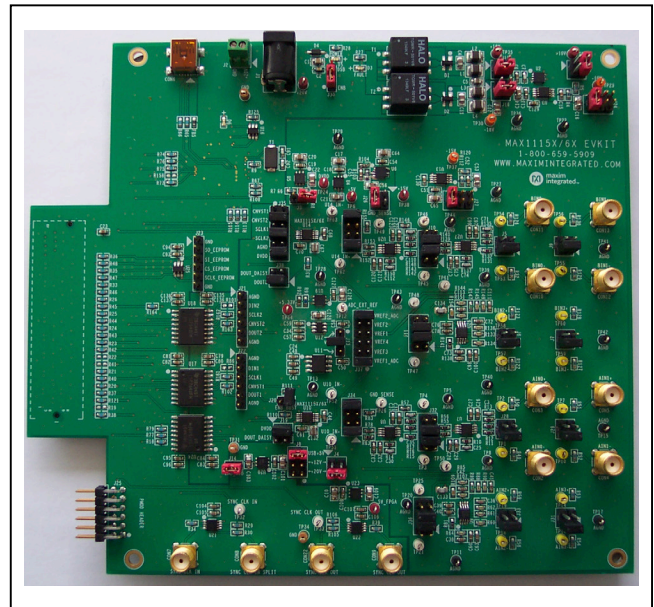
*μMAX is a registered trademark of Maxim Integrated Products, Inc.*

## Features

- High-Speed USB Connector, FMC Connector, and PMOD-Style Connector
- 75MHz SPI Clock Capability through FMC Connector
- 10MHz SPI Clock Capability in Standalone Mode
- Various Sample Sizes and Sample Rates (Up to 500ksps)
- Collects Up to 1 Million samples (with FPGA Platform)
- Time Domain, Frequency Domain, and Histogram Plotting
- Sync In/Out for Coherent Sampling (with FPGA platform)
- On-Board Input Buffers (MAX9632 and MAX44242)
- On-Board Voltage References (MAX6126 and MAX6070)
- Proven PCB Layout
- Fully Assembled and Tested
- Windows XP-, Windows 7-, and Windows 8.1-Compatible Software

*[Ordering Information](#) appears at end of data sheet.*

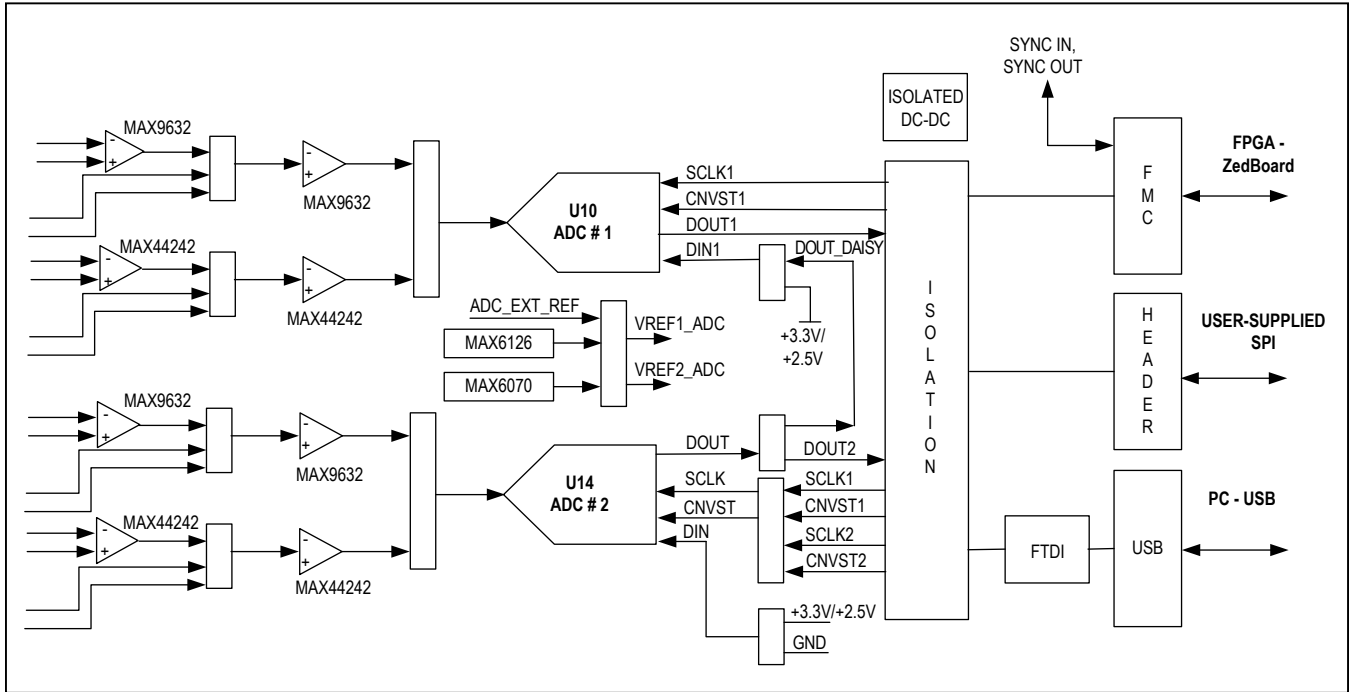
## EV Kit Photo



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## System Block Diagram



## MAX1115X/MAX1116X EV Kit Files

FILE	DESCRIPTION
MAX1115X_6XEVKitSetupV1.0.exe	Application Program (GUI)
Boot.bin	ZedBoard firmware (SD card to boot Zynq)

## Quick Start

### Required Equipment

- MAX1115X/MAX1116X EV kit
- +20V (500mA) power supply
- Micro-USB cable
- ZedBoard development board
- Function generator (optional)
- DMM (for calibration – optional)
- Windows XP, Windows 7, or Windows 8.1 PC with a spare USB port

**Note:** In the following section(s), software-related items are identified by bolding. Text in **bold** refers to items directly from the EV system software. Text in **bold and under-line** refers to items from the Windows operating system.

### Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation:

- 1) Visit <http://www.maxim-ic.com/evkitsoftware> to download the latest version of the EV kit software, MAX1115X\_6XEVK.ZIP. Save the EV kit software to a temporary folder and decompress the ZIP file.
- 2) Install the EV kit software and USB driver on your computer by running the MAX1115X\_6XEVKitSetupV1.0.exe program inside the temporary folder. The program files are copied to your PC and icons are created in the Windows **Start | Programs** menu. At the end of the installation process, the installer will launch the installer for the FTDIChip CDM drivers.

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### For Standalone Mode:

- 1) Verify that all jumpers are in their default positions for the EV kit board ([Table 2](#)).
- 2) Connect the PC to the EV kit using a micro USB cable.
- 3) Connect the +20V adapter to the EV kit.
- 4) Start the EV kit software by opening its icon in the **Start | Programs** menu. The EV kit software appears in [Figure 1](#).
- 5) The software should automatically connect to the hardware and display **EV kit Hardware Connected** in the **Status** bar. If it does not connect, then from the **Device** menu, select **Standalone** and click **Search for USB Device**. Then select **Standalone** again and select a device in the list. Verify that the lower right status bar indicates the EV kit hardware is **Connected**.

### For FPGA Mode (When Connected to a Zedboard):

- 1) Connect the Ethernet cable from the PC to the ZedBoard and configure the Internet Protocol Version 4 (TCP/IPv4) properties in the local area connection to IP address 192.168.1.2 and subnet mask to 255.255.255.0.
- 2) Verify that the ZedBoard SD card contains the Boot. bin file for the MAX1115X/MAX1116X EV kit.
- 3) Connect the EV kit FMC connector to the ZedBoard FMC connector. Gently press them together.
- 4) Verify that all jumpers are in their default positions for the ZedBoard ([Table 1](#)) and EV kit board ([Table 2](#)).

- 5) Connect the 12V power supply to the ZedBoard. Leave the Zedboard powered off.
- 6) Enable the ZedBoard power supply by sliding SW8 to ON and connect the +20V adapter to the EV kit.
- 7) Start the EV kit software by opening its icon in the **Start | Programs** menu. The EV kit software appears as shown in [Figure 1](#). From the **Device** menu select **FPGA**. Verify that the lower right status bar indicates the EV Kit hardware is **Connected**.

### For Either Standalone or FPGA Mode:

- 1) Connect the positive terminal of the function generator to the AIN0+ (TP2) test point on the EV kit. Connect the negative terminal of the function generator to the AIN0- (TP1) test point on the EV kit.
- 2) Configure the signal source to generate a 1kHz, 1V<sub>p-p</sub> sinusoidal wave with +500mV offset.
- 3) Turn on the function generator.
- 4) In the **Configuration** group, select **Device** to match IC type, select **Channel 1** and then click **Capture**.
- 5) Click on the **Scope** tab.
- 6) Check the **Remove DC Offset** checkbox to remove the DC component of the sampled data.
- 7) Click the **Capture** button to start the data analysis. The default sample size is 8192.
- 8) The EV kit software appears as shown in [Figure 1](#).
- 9) Verify the frequency is approximately 1kHz is displayed on the right. The scope image has buttons in the upper right corner that allow zooming in to detail.

**Table 1. ZedBoard Jumper Settings**

JUMPER	SHUNT POSITION	DESCRIPTION
J18	1-2	VDDIO set for 3.3V.
JP11 JP10 JP9 JP8 JP7 JP10	2-3 1-2 1-2 2-3 2-3	Boot from SD card
J12	—	SD card installed
J20	—	Connected to 12V wall adapter
SW8	OFF	ZedBoard power switch, OFF while connecting boards

**Table 2. EV kit Jumper Settings†**

JUMPER	JUMPER POSITION	DESCRIPTION
J3 (Red)	OPEN*	Set output of U5 to 3.3V
	1-2	Set output of U5 to 2.5V
J4 (Red)	1-2	Power U23 with 12V for 5V FPGA power (Do not populate 1-2 and 3-4 at same time)
	3-4*	Power U23 with 20V for 5V FPGA power (Do not populate 1-2 and 3-4 at same time)
J5 (Black)	1-2*	Connect BIN0- to AGND
	3-4	Connect BIN0+ to AGND
J6 (Black)	1-2*	Connect BIN2- to AGND
	3-4	Connect BIN2+ to AGND
J7 (Black)	1-2*	Connect BIN3- to AGND
	3-4	Connect BIN3+ to AGND
J8 (Red)	1-2	Power U20 with +12V from FPGA
	3-4*	Power U20 with 5V from USB
J9 (Black)	1-2*	Connect BIN1- to AGND
	3-4	Connect BIN1+ to AGND
J10 (Black)	1-2	Connects output of U27 (BIN0) to inverting input of U28
	3-4*	Connects BIN1- to inverting input of U28
	5-6*	Connects output of U27 (BIN0) to noninverting input of U28
	7-8	Connects BIN1+ to noninverting input of U28
J11 (Black)	1-2	Connects output of U26A (BIN2) to inverting input of U26B
	3-4*	Connects BIN3- to inverting input of U26B
	5-6*	Connects output of U26A (BIN2) to noninverting input of U28
	7-8	Connects BIN3+ to noninverting input of U28
J12 (Black)	OPEN	Disable on-board power supplies
	1-2*	Enable on-board power supplies
J13 (Black)	OPEN*	User connect external reference to TP12 – ADC_EXT_REF (If the target device has an internal reference J13 should be left open)
	1-2	MAX6070 is VREF source
	2-3**	MAX6126 is VREF source
J14 (Red)	OPEN	Disable +3V3_USB power for FTDI chip
	1-2*	Enable +3V3_USB power for FTDI chip
J15 (Red)	1-2	Power U2 from EXTERNAL +18V source
	3-4*	Power U2 from T1 +18V output
J16 (Red)	1-2	Power U3 from EXTERNAL -18V source
	3-4*	Power U3 from T2 -18V output
J17 (Red)	1-2	Use external +10V applied at TP9
	3-4*	Use U2 output for +10V, 100mA supply
J19 (Black)	1-2*	Connect U10 SDI to DVDD (CS mode)
	3-4	Connect U10 SDI to U14 SDO (daisy-chain mode)

**Table 2. EV kit Jumper Settings<sup>†</sup> (continued)**

JUMPER	JUMPER POSITION	DESCRIPTION
J20 (Black)	1-2	Connects U10 SDO to DVDD (enable busy bit)
	OPEN*	No pullup on U10 SDO
J21	—	ADC2 SPI Port Test Points (header – no jumpers)
J22	—	ADC1 SPI Port Test Points (header – no jumpers)
J23	—	Serial EEPROM Test Points (header – no jumpers)
J24 (Red)	1-2	Changes the -10V supply to ground
	3-4	-10V supplied by external test point (TP23)
	5-6*	-10V supplied by U3
J25	—	PMOD-style connector. Connects to ADC1 and ADC2 SPI ports, 12 pins (no jumpers).
J26 (Red)	1-2	+15V supplied from external test point (TP38)
	3-4*	+15V supplied by U6
J27 (Red)	1-2	Changes the -15V supply to ground
	3-4	-15V supplied by external test point (TP37)
	5-6*	-15V supplied by U13
J28 (Black)	1-2*	Connect AIN0- to AGND
	3-4	Connect AIN0+ to AGND
J29 (Black)	1-2*	Connect AIN1- to AGND
	3-4	Connect AIN1+ to AGND
J31 (Black)	1-2*	Connect AIN3- to AGND
	3-4	Connect AIN3+ to AGND
J32 (Black)	1-2	Connect U7 output (AIN0) to U8 inverting input
	3-4*	Connect AIN1- to U8 inverting input
	5-6*	Connect U7 output (AIN0) to U8 noninverting input
	7-8	Connect AIN1+ to U8 noninverting input
J33 (Black)	1-2*	Connect AIN2- to AGND
	3-4	Connect AIN2+ to AGND
J34 (Black)	1-2*	Connect U8 output to U10 AIN+
	3-4	Connect U9B output to U10 AIN+
	5-6	Connect GND_SENSE (TP26) to U10 AIN-
	7-8*	Connect U10 AIN- to AGND
J35 (Black)	1-2	Connect U14 CVNST to CNVST1_ADC
	3-4*	Connect U14 CVNST to CNVST2_ADC
	5-6	Connect U14 SCLK to SCLK1_ADC
	7-8*	Connect U14 SCLK to SCLK2_ADC
	9-10	Connect U14 SDI to AGND
11-12*	Connect U14 SDI to DVDD	

**Table 2. EV kit Jumper Settings<sup>†</sup> (continued)**

JUMPER	JUMPER POSITION	DESCRIPTION
J36 (Black)	1-2	Connect U9A output (AIN2) to U9B inverting input
	3-4*	Connect AIN3- to U9B inverting input
	5-6*	Connect U9A output (AIN2) to U9B noninverting input
	7-8	Connect AIN3+ to U9B noninverting input
J37 (Black)	1-2**	Connect ADC_EXT_REF to U10 REF (ADC1)
	3-4	Connect ADC_EXT_REF to U9 VREF2
	5-6	Connect ADC_EXT_REF to U8 VREF1
	7-8	Connect ADC_EXT_REF to U26 VREF4
	9-10	Connect ADC_EXT_REF to U28 VREF3
	11-12**	Connect ADC_EXT_REF to U14 REF (ADC2)
J38 (Bue)	1-2*	Connect U14 SDO to DOUT2_ADC
	3-4	Connect U14 SDO to DOUT_DAI5Y
J39 (Black)	1-2*	Connect U28 output to U14 AIN+
	3-4	Connect U26B output to U14 AIN+
	5-6	Connect GND_SENSE to U14 AIN-
	7-8*	Connect AGND to U14 AIN-

<sup>†</sup>Red test points and red jumpers are used for power settings. Black test points are used for ground points, white test points are used for all signal points, black jumper for I/O settings.

\*Default positions

\*\*If the target ADC requires an external reference this should be populated (MAX11152 and MAX11162)

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## General Description of Software

The main window of the EV kit software contains five tabs: **Configuration**, **Scope**, **DMM**, **Histogram**, and **FFT**. The **Configuration** tab provides control for the two ADCs configuration during data capture. The other four tabs are used for evaluating the data captured by the ADCs. In addition, the sample data can be saved to a file.

### Configuration Tab

The **Configuration** tab provides an interface for selecting and configuring the ADC from a functional perspective. Select the desired **Device** in the drop-down list and the corresponding properties of the device are displayed including **Resolution**, **Input Range**, **Reference Voltage**, and **Max Sample Rate**. If the selected ADC uses an external reference, then use the **Reference Voltage** numeric box to enter the measured reference value. The on-board reference is 5V.

The sampling settings are available on the left, which allow the user to select the **Channel**, **Sample Rate**, **Number of Samples**, and **SCLK Frequency**. The **SCLK Frequency** selection is required prior to adjusting to the desired sampling rate.

The two ADCs on the EV kit have a variety of interface modes to the master. The modes include CS mode and daisy-chain mode.

### CS Mode (Single ADC Mode)

The factory-default jumper settings have the ADCs on the EV kit configured for CS mode, using the Channel 1 device (U10) and Channel 2 device (U14). In the **Configuration** tab the correct selection must be made for **CS Mode**. If the busy bit is desired, select **CS Mode with Busy** and populate J20.

### Daisy-Chain Mode

To use the ADCs in daisy-chain mode, move the shunts described in [Table 3](#) for J19 and J38 so the SDO of U14 (DOUT2\_DAISSY) connects to the SDI of U10. The SDO of U10 connects to the SPI MISO for the GUI to read the data. In the **Configuration** tab, the correct selection must be made for **Interface Mode** set as **Daisy-chain**. The channel selection automatically changes to **Both Channels** in daisy-chain mode.

### Dual ADC Mode (Sequential or Simultaneous)

There are two ADCs on the EV kit. In standalone mode, the two ADCs are read sequentially, while in FPGA mode they can be read simultaneously. To use the ADCs in multichannel mode, move the shunts described in [Table 3](#) for CS Mode. In the **Configuration** tab, the correct selection must be made for **Both Channels** and the **Interface Mode** must be in CS mode.

**Table 3. Interface Mode Jumper Settings**

INTERFACE MODE	J35	J38	J19	J20
CS Mode, No Busy	CNVST2 (3-4), SCLK2 (7-8), DVDD (11-12)	DOUT2 (1-2)	DVDD (1-2)	OPEN
CS Mode, With Busy	CNVST2 (3-4), SCLK2 (7-8), DVDD (11-12)	DOUT2 (1-2)	DVDD (1-2)	SHORT
Daisy Chain	CNVST1 (1-2), SCLK1 (5-6), AGND (9-10)	DOUT_DAISSY (3-4)	DOUT_DAISSY (3-4)	OPEN

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## System Calibration

The purpose of this procedure is to calculate coefficients to compensate gain and offset error. This procedure allows the calibration using any two points that fit the input voltage range. A DC supply and DMM is required for this procedure.

- 1) Measure the zero-scale and full-scale signal applied at the input of the EV kit.
- 2) Enter the voltage values into the **Input Measured (V) Min** and **Max** numeric boxes ( $\pm 5V$  or  $\pm 10V$  depending upon the ADC device on the EV kit).
- 3) Apply a zero-scale signal ( $-5V$  or  $-10V$  depending upon ADC device on the EV kit) to the ADC inputs and click **Read Data**.
- 4) Enter the **Data (V)** value into the **ADC Data Read (V) Min** numeric box.
- 5) Apply a full-scale signal ( $+5V$  or  $+10V$  depending upon ADC device on the EV kit) to the ADC inputs and click **Read Data**.
- 6) Enter the **Data (V)** value into the **ADC Data Read (V) Max** numeric box.
- 7) Click **Calculate**.
- 8) The GUI will adjust the **Gain Coefficient** value and **Offset (mV)** value.
- 9) Software calibration is enabled by checking the **Enable Calibration** checkbox. This calibration is used for measurements taken with the **Scope**, **DMM**, **Histogram**, and **FFT** tabs.

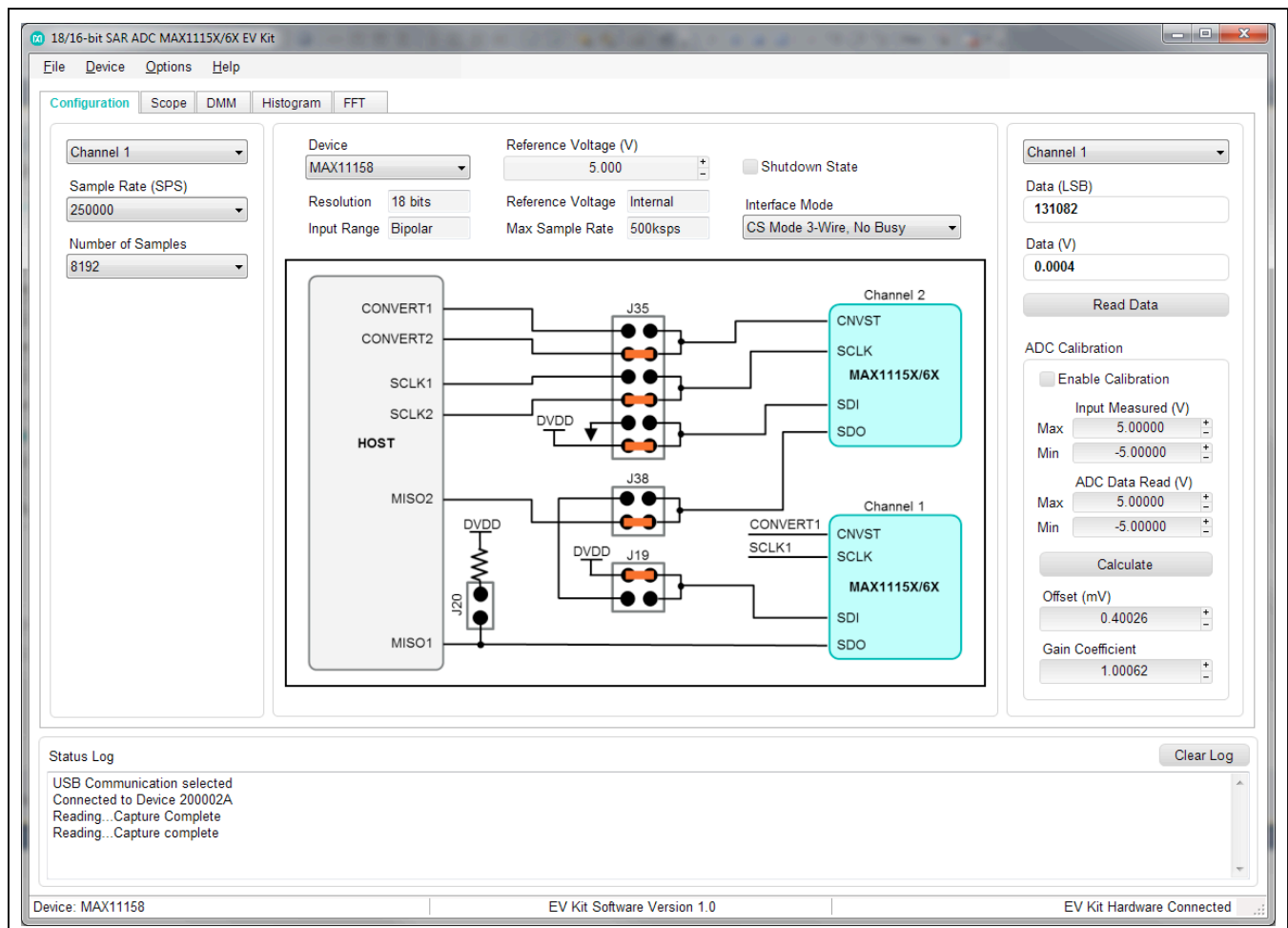


Figure 1. EV Kit Software (Configuration Tab)



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## Scope Tab

The **Scope** tab sheet is used to capture data and display it in the time domain. Sampling rate and number of samples can also be set in this tab if they were not appropriately adjusted in other tabs. The **Display Unit** drop-down list

allows counts and voltages. Once the desired configuration is set, click on the **Capture** button. The right side of the tab sheet displays details of the waveform, such as average, standard deviation, maximum, minimum, and fundamental frequency. [Figure 2](#) displays the ADC data when a sinusoidal signal is applied to the inputs on the EV kit.

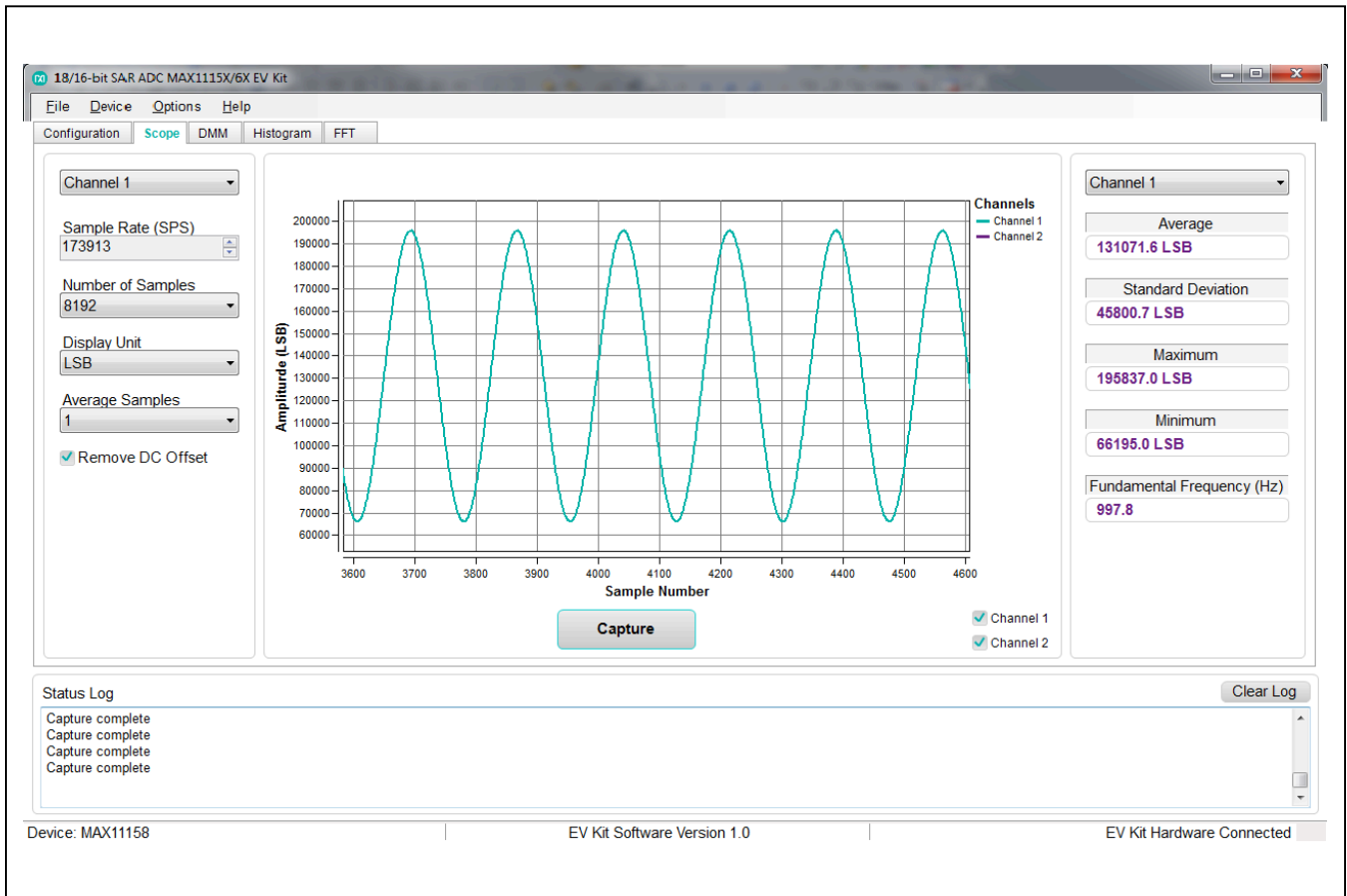


Figure 2. EV Kit Software (Scope Tab)

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## DMM Tab

The **DMM** tab sheet provides the typical information as a digital multimeter. Once the desired configuration is set, click on the **Capture** button.

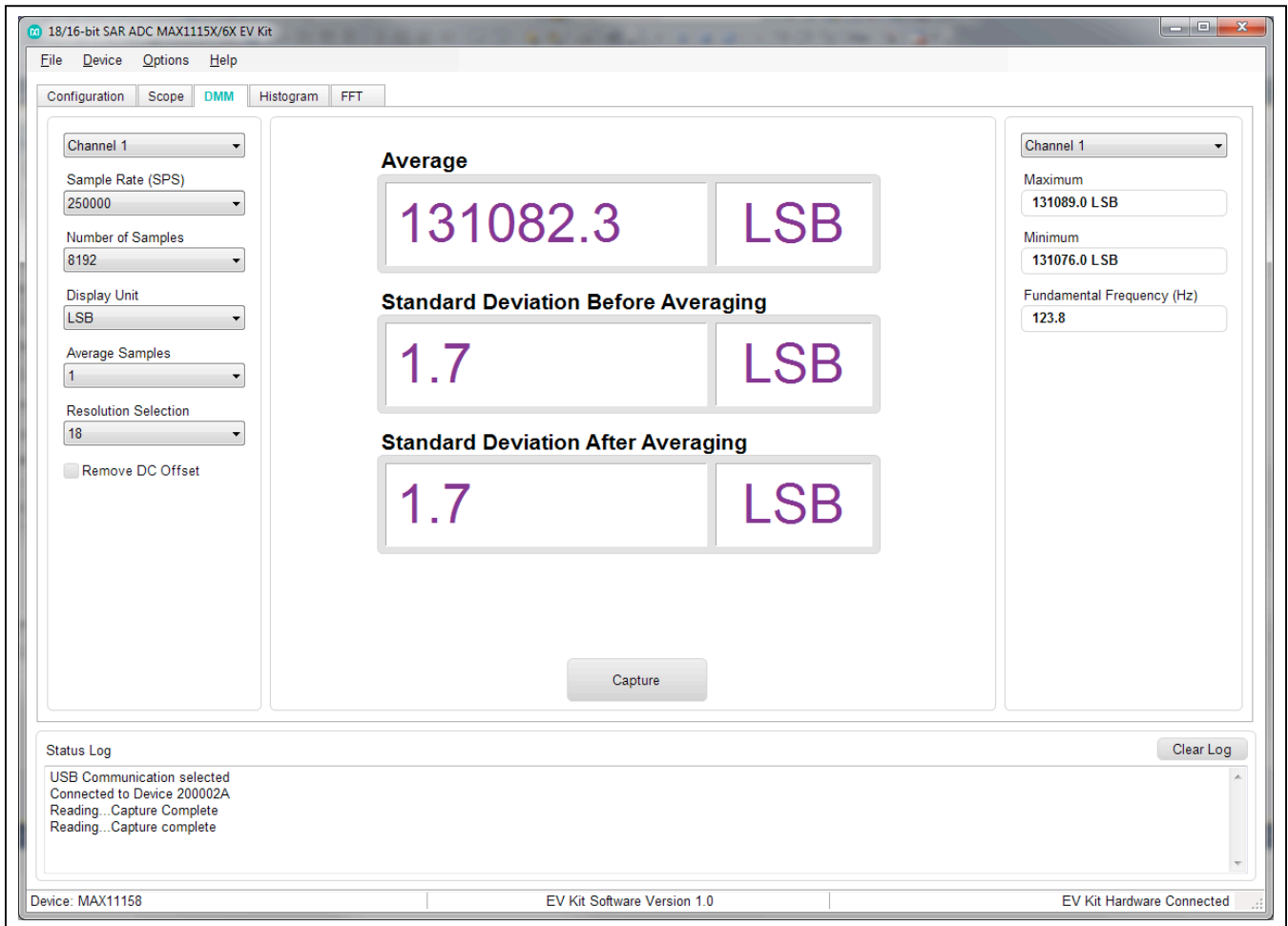


Figure 3. EV Kit Software (DMM Tab)

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## Histogram Tab

The **Histogram** tab sheet is used to capture the histogram of the data. Sampling rate and number of samples can also be set in this tab if they were not appropriately adjusted in other tabs. Once the desired configuration is set, click on the **Capture** button. The right side of the tab

sheet displays details of the histogram such as average, standard deviation, maximum, minimum, peak-to-peak noise, effective resolution, and noise-free resolution. [Figure 4](#) shows data when inputs AIN0+ and AIN0- are connected to GND.

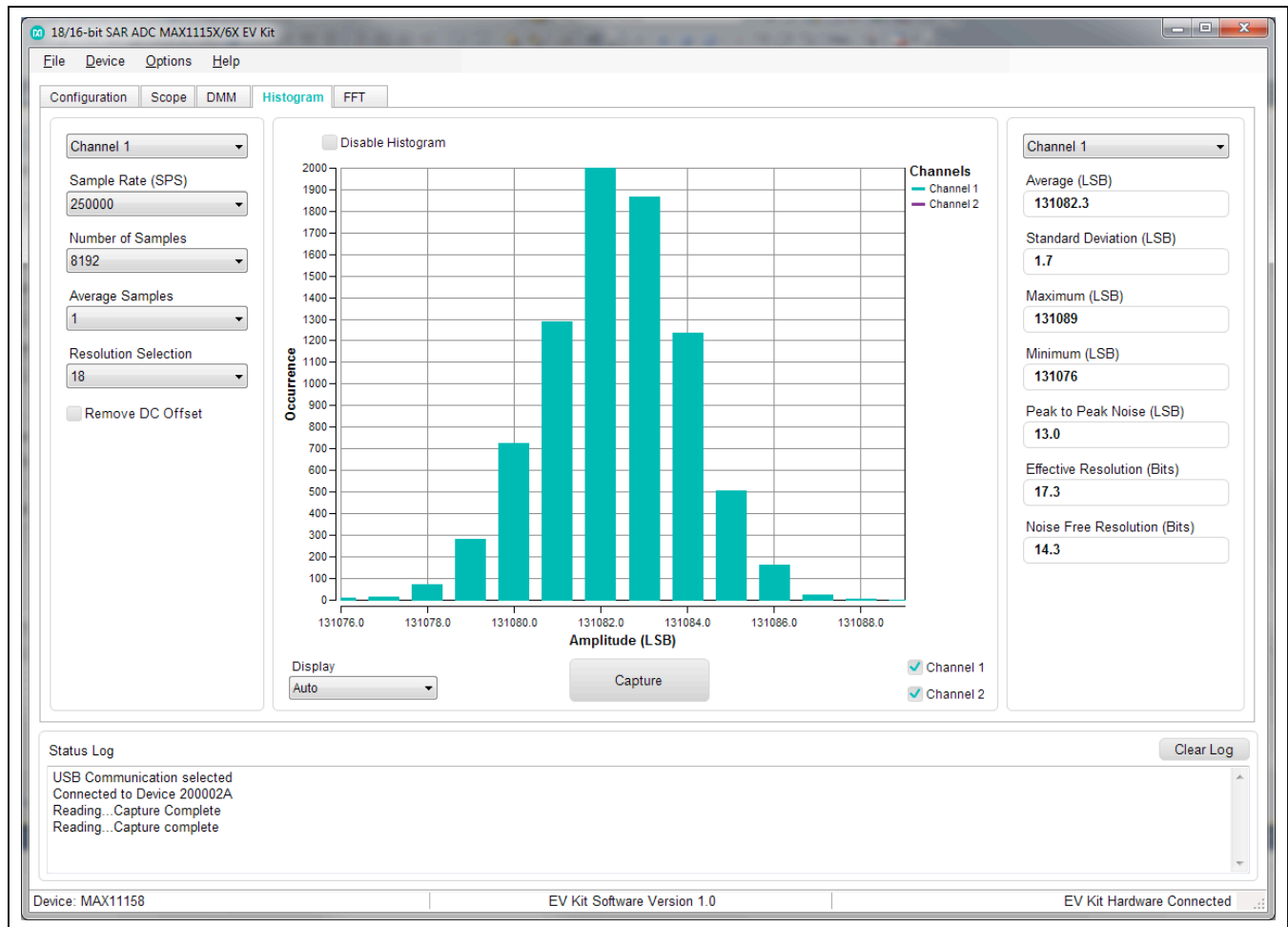


Figure 4. EV Kit Software (Histogram Tab)

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## FFT Tab

The **FFT** tab sheet is used to display the FFT of the data. Sampling rate and number of samples can also be set in this tab if they were not appropriately adjusted in other tabs. Once the desired configuration is set, click on the **Capture** button. The right side of the tab displays the performance based on the FFT, such as fundamental frequency, SNR, SINAD, THD, SFDR, ENOB, and noise floor.

When coherent sampling is needed, this tab allows the user to calculate the input frequency or the master clock coming into the board. Either adjust the input frequency applied to the signal generator or adjust the master clock applied to the SYNC\_IN SMA connector. See the [Sync Input and Sync Output](#) section before using this feature. [Figure 13](#) shows the setup Maxim Integrated uses to capture data for coherent sampling.

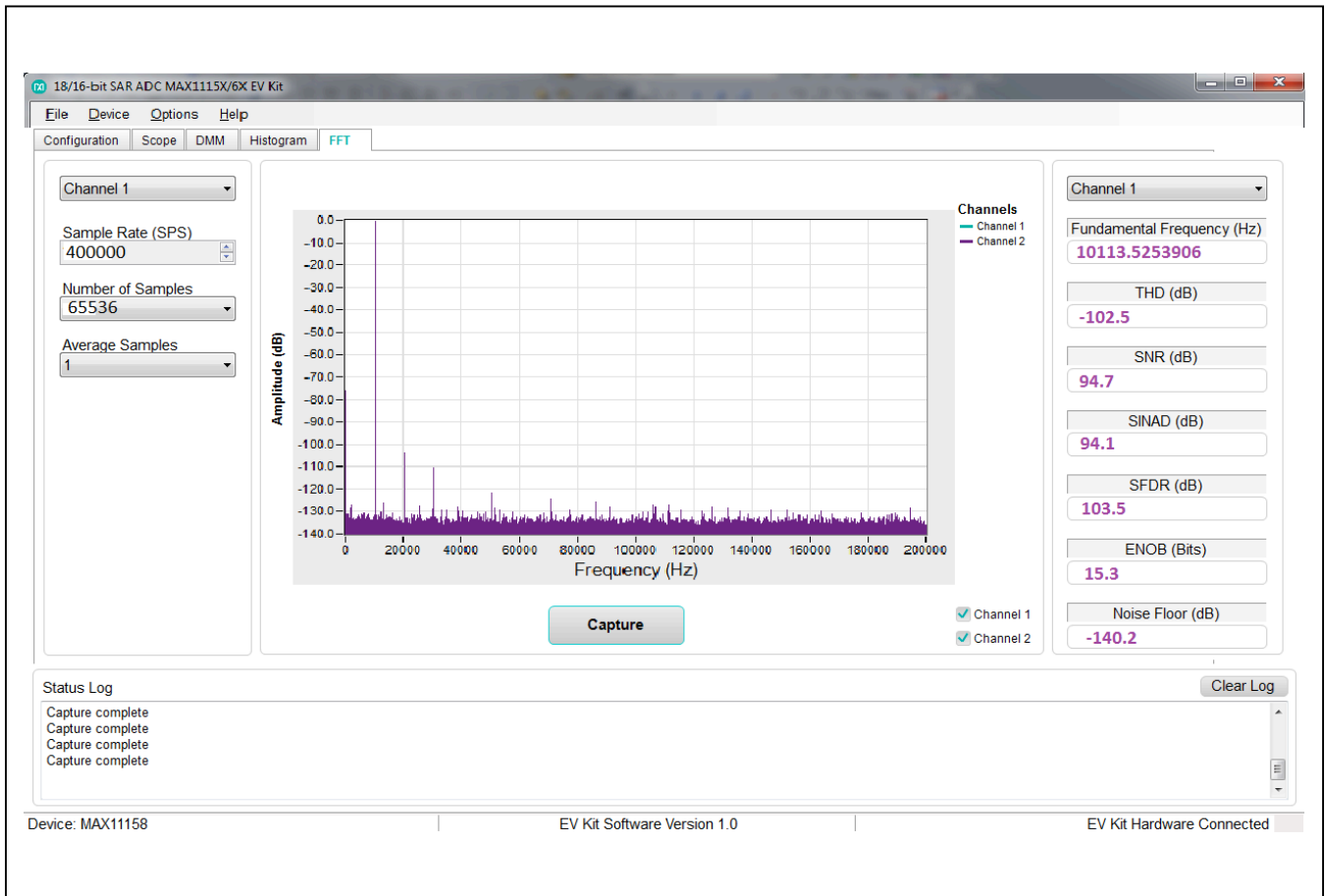


Figure 5. EV Kit Software (FFT Tab)

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### Detailed Description of Hardware

The MAX1115X/MAX1116X EV kit provides a proven signal path to demonstrate the performance of the MAX1115X/MAX1116X 18-/16-bit SAR ADCs. Included in the EV kit are digital isolators, isolated DC-DC converters, ultra-low-noise LDOs to all supply pins of the IC, on-board references (MAX6126 and MAX6070), precision amplifiers (MAX9632 for bipolar and MAX44242 for unipolar) for analog inputs, and sync-in and sync-out signals for coherent sampling. Two ADCs are on the board to allow daisy-chain mode operation if desired.

An on-board FTDI controller is provided to allow for evaluation in standalone mode, which has limitations on maximum sample speed and on sample depth. The EV

kit can be used with a FPGA to achieve full speed and a larger sample depth.

The EV kit supports a number of different devices with a 10-pin  $\mu$ MAX package as listed in [Table 4](#).

For the MAX11156 and MAX11154 in a 12-pin TDFN package, please refer to the MAX11156EVSYS# and for the MAX11166, MAX11167, MAX11164, and MAX11165 in a 12-pin TDFN package, please refer to the MAX11166EVSYS#. A full 18-bit data acquisition system featuring the MAX11156 ADC and the MAX5318 DAC is available as the MAXREFDES74# reference design, which includes an FMC interface to the FPGA and stand-alone USB.

**Table 4. Products Supported with MAX1115X/MAX1116X EV Kit**

PART NO.	RESOLUTION (BITS)	MAX. SAMPLE RATE (ksps)	INPUT RANGE (V)	VOLTAGE REFERENCE
MAX11150	18	500	0 to +5	Internal REF
MAX11152	18	500	0 to +5	External REF
MAX11158	18	500	$\pm 5$	Internal REF
MAX11160 (MAX11161)	16	500 (250)	0 to +5	Internal REF
MAX11162 (MAX11163)	16	500 (250)	0 to +5	External REF
MAX11168 (MAX11169)	16	500 (250)	$\pm 5$	Internal REF

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## USB Interface

The maximum sample rate is 250ksps and the maximum sample size is 16384.

## FMC Interface

The user should confirm compatibility of pin usage between their own FMC implementation and that of the MAX1115X/MAX1116X EV kit before connecting the MAX1115X/MAX1116X EV kit to a different system with FMC connectors.

## User-Supplied SPI Interface

In addition to the USB and FMC interfaces, the EV kit provides a 12-pin PMOD-style header (J25) for user-supplied SPI interface. To evaluate the EV kit with a user-supplied SPI bus, disconnect from the FMC bus and remove jumper J14. Apply the user-supplied SPI signals to SCLK, CNVST, DIN, and DOUT at the PMOD header. Make sure the return ground is connected to the PMOD ground.

The on-board FTDI chip used for standalone mode does not conflict with the user-supplied SPI if it is powered off by removing jumper J14.

**WARNING: DO NOT PLUG THIS HEADER INTO A STANDARD PMOD INTERFACE FOUND ON OTHER FPGA OR MICROCONTROLLER PRODUCTS. THE SIGNAL DEFINITION IS UNIQUE TO THIS EV KIT.**

## Reference

Depending upon the target IC on the EV kit, there are different sources for the voltage reference. As listed in [Table 4](#), some ADCs have the option to use an internal reference. In addition, there are two voltage references on the board and the option to provide a user-supplied external reference signal.

For ADCs that require an external reference, the EV kit includes two on-board references plus the option for a user-supplied reference. The MAX6126 (U11) is an ultra-high-precision, ultra-low-noise, series voltage reference with 3ppm/°C maximum temperature coefficient and the MAX6070 (U12) low-noise, high-precision series voltage reference offers the highest performance SOT23 voltage references with 6ppm/°C maximum temperature coefficient.

To use these voltage reference sources, populate jumpers J13 and J37. See [Table 5](#) for jumper settings.

For a user-supplied external reference, remove the jumper on J13 and connect a reference voltage to ADC\_EXT\_REF at TP12. Measure and enter the value of the external reference voltage into the **Reference Voltage** edit box on the **Configuration** tab of the GUI. When using devices with an internal reference, remove all jumpers from J13 and J37.

**Table 5. Reference Source Options**

REF SOURCE	JUMPER	CONNECTION	FUNCTION
MAX6070	J13	1-2	Select U12 MAX6070
	J37	1-2 and 11-12	VREF1_ADC, VREF2_ADC
MAX6126	J13	2-3	Select U11 MAX6126
	J37	1-2 and 11-12	VREF1_ADC, VREF2_ADC
EXT_REF (TP12)	J13	OPEN	Select ADC_EXT_REF
	J37	1-2 and 11-12	VREF1_ADC, VREF2_ADC
INT_REF	J13	OPEN	—
	J37	OPEN	MAX11150/MAX11158/MAX11160/MAX11168 only

**MAX1115X/MAX1116X Family  
Evaluation Kit**

**Evaluates: MAX11150/MAX11152/  
MAX11158/MAX11160/MAX11161/MAX11162/  
MAX11163/MAX11168/MAX11169**

**User-Supplied Power Supply**

The EV kit receives power from a single DC source of 20V, 500mA through a J1 power jack. The MAX13256, H-bridge driver and transformer create an additional negative rail for +18V and -18V. The power is then rectified and regulated down to a +15V and -15V supplies

for the MAX9632 op amps, as well +10V and -10V supplies for the MAX44242 op amps. Additional supplies are generated for +5V, +5.33V, and +3.3V/+2.5 for the ADCs and V<sub>REF</sub>. See the EV kit schematics for details. Specific voltages can be connected to the board for each rail, see [Table 6](#) for corresponding jumper positions.

**Table 6. Power Supply to the Board**

POWER	INPUT CONNECTORS	JUMPERS
Single +20V input from a wall adapter (default)	J1	J12: 1-2 J15: 3-4 J16: 3-4 J26: 3-4 J27: 5-6 J17: 3-4 J24: 5-6
An external ±18V	TP35 (+18V) TP30 (-18V)	J12: Open J15: 1-2 J16: 1-2 J26: 3-4 J27: 5-6 J17: 3-4 J24: 5-6
An external ±15V	TP38 (+15V) TP37 (-15V)	J12: Open J15: Open J16: Open J26: 1-2 J27: 3-4 J17: 3-4 J24: 5-6
An external ±10V	TP9 (+10V) TP23 (-10V)	J12: Open J15: Open J16: Open J26: 3-4 J27: 5-6 J17: 1-2 J24: 3-4

# MAX1115X/MAX1116X Family Evaluation Kit

Evaluates: MAX11150/MAX11152/  
MAX11158/MAX11160/MAX11161/MAX11162/  
MAX11163/MAX11168/MAX11169

## Analog Input Voltage Ranges

The MAX1115X/MAX1116X are 18-/16-bit, single-channel, pseudo-differential ADCs. The ADCs convert input signals on the ADC pin AIN+ (ADx\_INP) in the range of ( $\pm 5V + AIN-$ ) for bipolar or ( $5V + AIN-$ ) to AIN- for unipolar. For accurate conversions, the ADC pin AIN+ should also be limited to  $\pm(V_{DD} + 0.1V)$  for bipolar and  $(V_{DD} + 0.1V)$  to  $-0.1V$  for unipolar. The ADC pin AIN- (ADx\_INM) has an input range of  $-0.1V$  to  $+0.1V$  and is typically connected to the analog ground plane (AGND) of the EV kit. The MAX1115X/MAX1116X perform a true differential sample on inputs between AIN+ and AIN- with good common-mode rejection and by connecting the EV kit input signal GND\_SENSE to the ground reference of the input signal source. This allows for improved sampling of remote transducer inputs. See the jumper settings in [Table 2](#) for J34 and J39.

## ADC Input Amplifiers

The input amplifiers allow for significant flexibility, supporting bipolar or unipolar input paths, as well as the option

for gain control. Each ADC channel can be configured as single-ended bipolar, differential bipolar, single-ended unipolar, and differential unipolar. See Tables 8 and 9 for these analog input configurations for channels A and B, respectively.

The analog front-end consists of two channels (A and B, one for each ADC) and for each channel there are four user-selectable input pairs (for example AINx+ and AINx- where x is 0, 1, 2, or 3) allowing selection between one of two op amp solutions. The MAX9632, which is a 36V, precision, low-noise, wide-band amplifier or the MAX44242, which is a 20V, low input-bias-current, low-noise, dual op amp. The op amps can be configured as inverting or noninverting amplifiers by jumper selectors. Both op amps work as anti-aliasing lowpass filters (LPF) and can be daisy-chained to create a second-order LPF.

The range of possible configurations for Channels A and B are listed in Tables 8 and 9, and the jumper connections are shown in Figures 6 to 12.

**Table 7. Analog Input Voltage Ranges**

ADC	ADC INPUT RANGE	MAX9632 INPUT RANGE	MAX44242 INPUT RANGE	COMMENTS
MAX11158, MAX11168	$\pm 5V$	$\pm 10V$	$\pm 10V$	Beyond-the-Rail ADCs work from unipolar supply
MAX11150, MAX11152, MAX11160, MAX11162	0 to +5V	$\pm 5V$ VREF1 bias's common mode for U8 (MAX9632) at 2.5V. VREF3 bias's common mode for U28 (MAX9632) at 2.5V	$\pm 5V$ VREF2 bias's common mode for U9 (MAX44242) at 2.5V. VREF4 bias's common mode for U26 (MAX44242) at 2.5V	VREF is used to bias the op amp common mode to support 0 to +5V input to the ADC. The first ADC (U10) Common Mode (CM) bias is set with VREF1 and VREF2 depending upon the op amp selected, and the second ADC (U14) CM bias is set with VREF3 and VREF4 depending upon the op amp selected.



**Table 8. Analog Input Configurations (Channel A0–A3)**

CONFIGURATION		SIGNAL-PATH INPUT CONFIGURATION	INPUT CONNECTORS	JUMPER POSITIONS
NO.	DESCRIPTION			
1	MAX9632, Channel A0	Noninverting, single-ended, second-order LPF (default)	CON3: AIN0+ (or TP2) and AGND (or TP8)	J28: 1-2 J29: 1-2 J32: 5-6 and 3-4 J34: 1-2 and 7-8
2	MAX9632, Channel A0	Noninverting, differential, second-order LPF	CON3 (TP2): AIN0+ CON2 (TP1): AIN0-	J28: Open J29: 1-2 J32: 5-6 and 3-4 J34: 1-2 and 7-8
3	MAX9632, Channel A0	Inverting, single-ended, second-order LPF	CON3: AIN0+ or (TP2) and AGND (or TP8)	J28: 1-2 J29: 3-4 J32: 1-2 and 7-8 J34: 1-2 and 7-8
4	MAX9632, Channel A0	Inverting, differential, second-order LPF	CON2 (TP1): AIN0- CON3 (TP2): AIN0+	J28: Open J29: 3-4 J32: 1-2 and 7-8 J34: 1-2 and 7-8
5	MAX9632, Channel A1	Noninverting, single-ended, first-order LPF	CON5: AIN1+ (or TP7) and AGND (or TP15)	J28: Open J29: 1-2 J32: 3-4 and 7-8 J34: 1-2 and 7-8
6	MAX9632, Channel A1	Differential, first-order LPF	CON5 (TP7): AIN1+ CON4 (TP10): AIN1-	J28: Open J29: Open J32: 3-4 and 7-8 J34: 1-2 and 7-8
7	MAX9632, Channel A1	Inverting, single-ended, first-order LPF	CON4: AIN1- (or TP10) and AGND (or TP15)	J28: Open J29: 3-4 J32: 3-4 and 7-8 J34: 1-2 and 7-8
8	MAX44242, Channel A2	Noninverting, single-ended, second-order LPF (default)	TP19: AIN2+ and AGND (or TP11)	J33: 1-2 J31: 1-2 J36: 5-6 and 3-4 J34: 3-4 and 7-8
9	MAX44242, Channel A2	Noninverting, differential, second-order LPF	TP19: AIN2+ TP18: AIN2-	J33: Open J31: 1-2 J36: 5-6 and 3-4 J34: 3-4 and 7-8
10	MAX44242, Channel A2	Inverting, single-ended, second-order LPF	TP19: AIN2+ and AGND (or TP11)	J33: 1-2 J31: 3-4 J36: 1-2 and 7-8 J34: 3-4 and 7-8

**Table 8. Analog Input Configurations (Channel A0–A3) (continued)**

CONFIGURATION		SIGNAL-PATH INPUT CONFIGURATION	INPUT CONNECTORS	JUMPER POSITIONS
NO.	DESCRIPTION			
11	MAX44242, Channel A2	Inverting, differential, second-order LPF	TP18: AIN2- TP19: AIN2+	J33: Open J31: 3-4 J36: 1-2 and 7-8 J34: 3-4 and 7-8
12	MAX44242, Channel A3	Noninverting, single-ended, first-order LPF	TP14: AIN3+ and AGND (or TP17)	J31: 1-2 J36: 3-4 and 7-8 J34: 3-4 and 7-8
13	MAX44242, Channel A3	Differential, first-order LPF	TP14: AIN3+ TP16: AIN3-	J31: Open J36: 3-4 and 7-8 J34: 3-4 and 7-8
14	MAX44242, Channel A3	Inverting, single-ended, first-order LPF	TP16: AIN3- and AGND (or TP17)	J31: 3-4 J36: 3-4 and 7-8 J34: 3-4 and 7-8

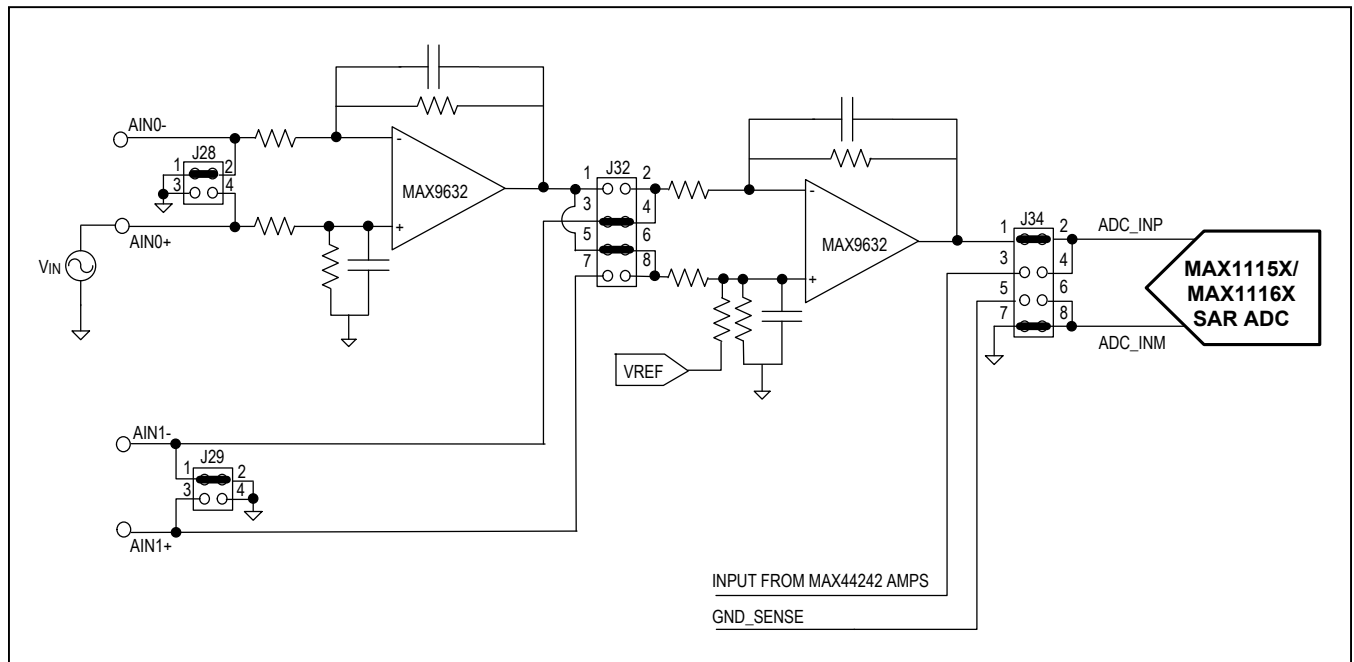


Figure 6. Noninverting, Single-Ended, Second-Order LPF

MAX1115X/MAX1116X Family  
Evaluation Kit

Evaluates: MAX11150/MAX11152/  
MAX11158/MAX11160/MAX11161/MAX11162/  
MAX11163/MAX11168/MAX11169

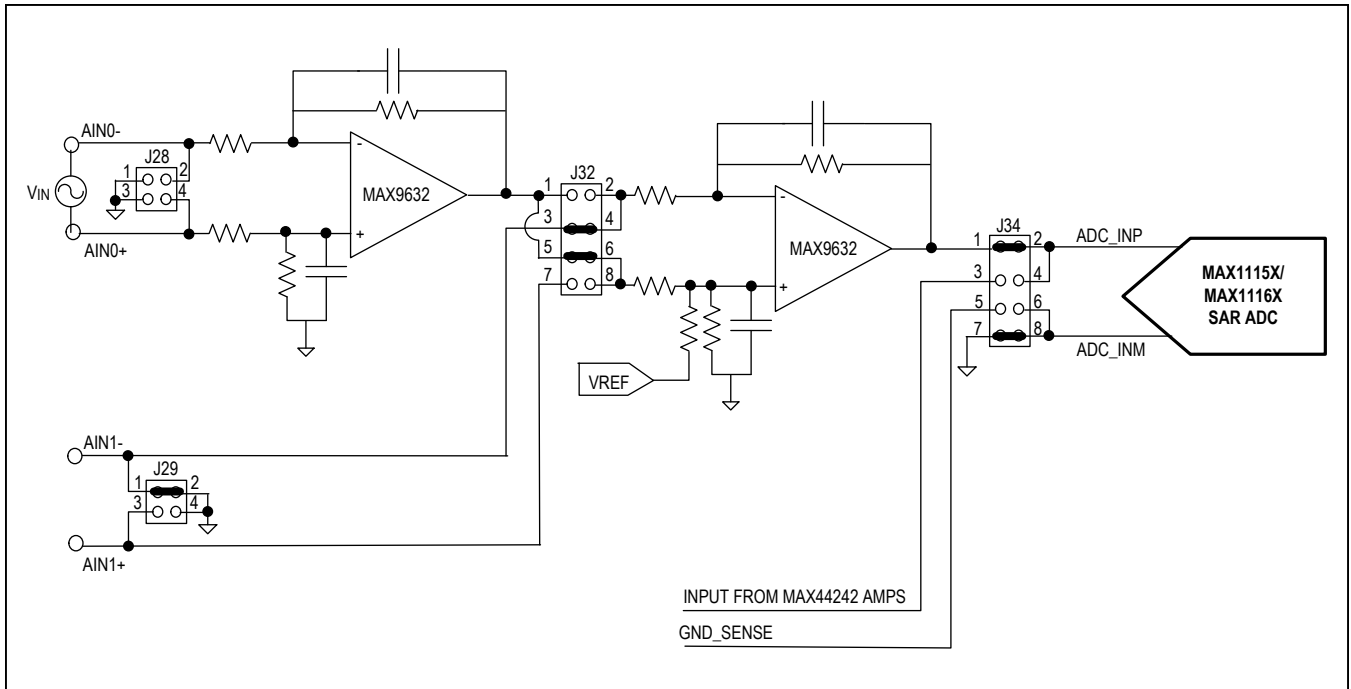


Figure 7. Noninverting, Differential, Second-Order LPF

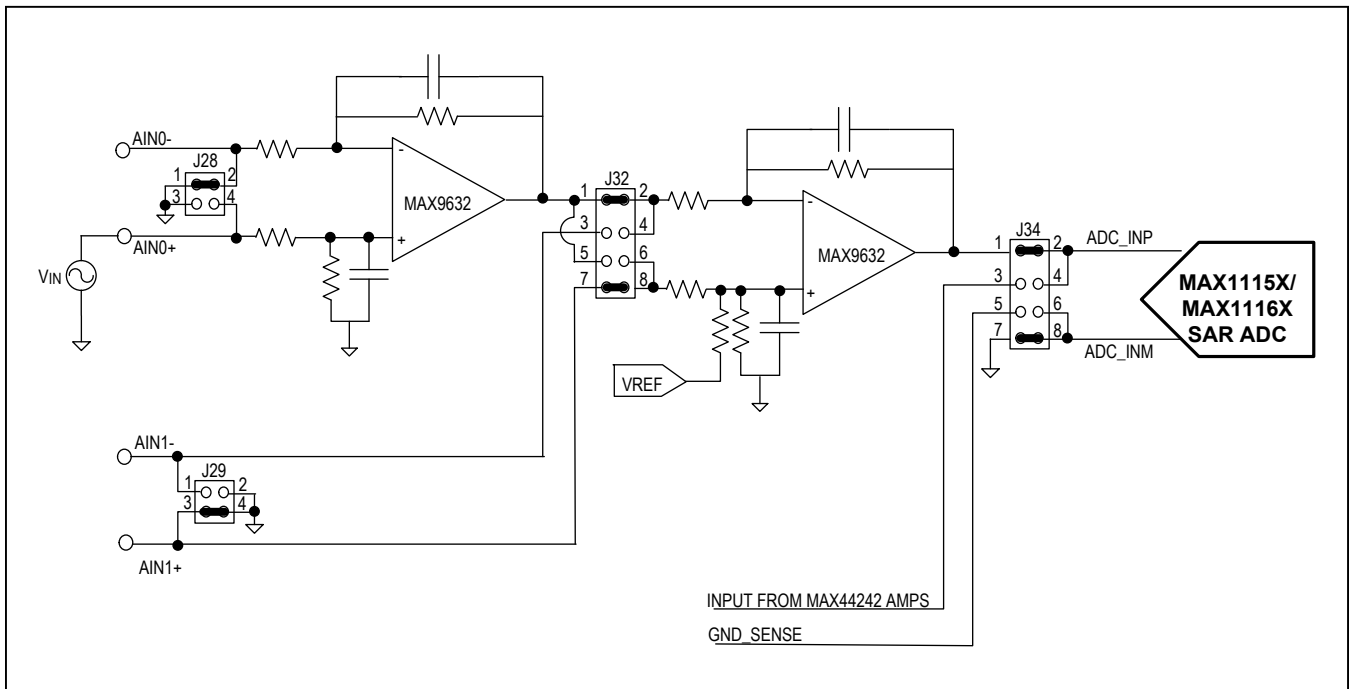


Figure 8. Inverting, Single-Ended, Second-Order LPF

MAX1115X/MAX1116X Family  
Evaluation Kit

Evaluates: MAX11150/MAX11152/  
MAX11158/MAX11160/MAX11161/MAX11162/  
MAX11163/MAX11168/MAX11169

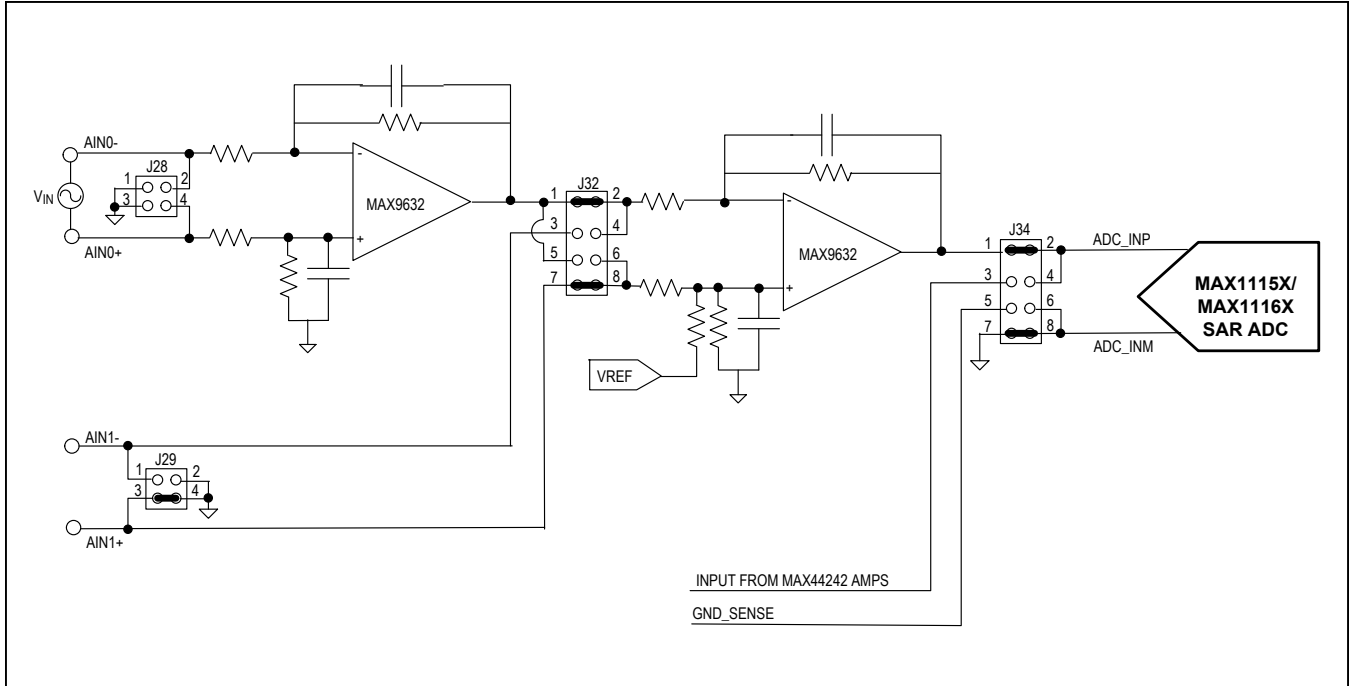


Figure 9. Inverting, Differential, Second-Order LPF

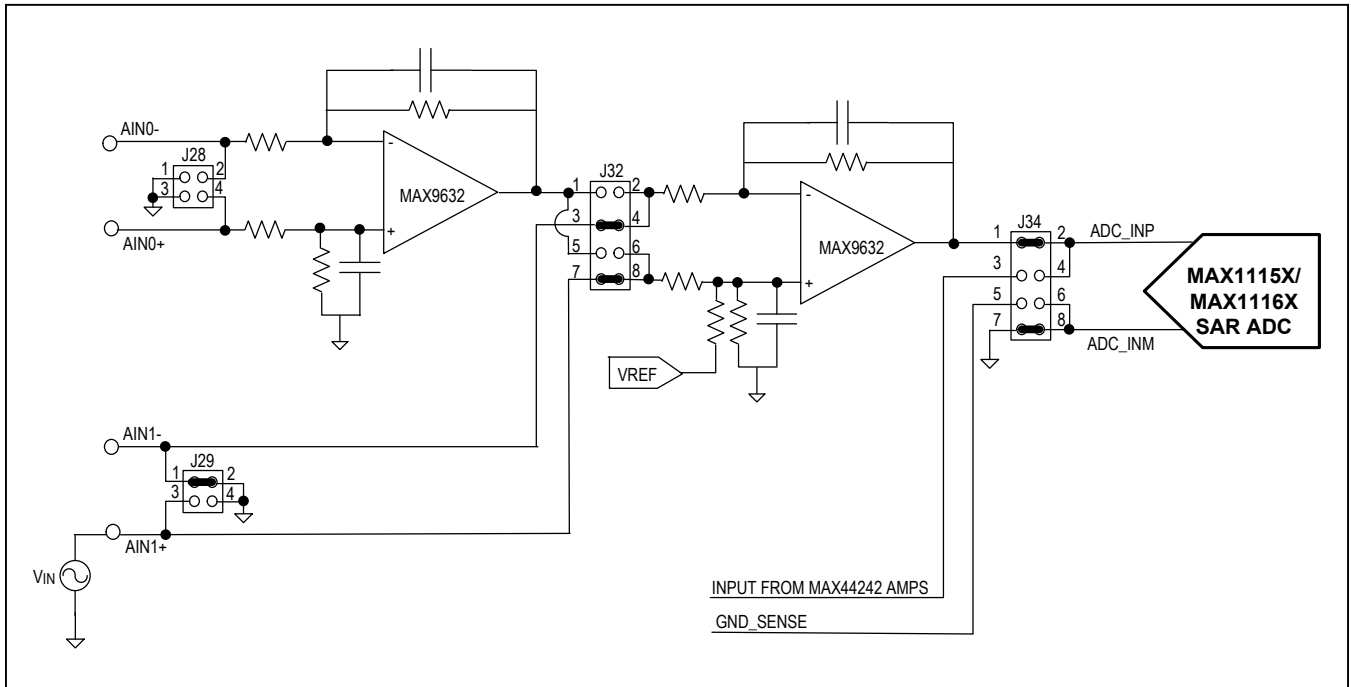


Figure 10. Noninverting, Single-Ended, First-Order LPF

MAX1115X/MAX1116X Family  
Evaluation Kit

Evaluates: MAX11150/MAX11152/  
MAX11158/MAX11160/MAX11161/MAX11162/  
MAX11163/MAX11168/MAX11169

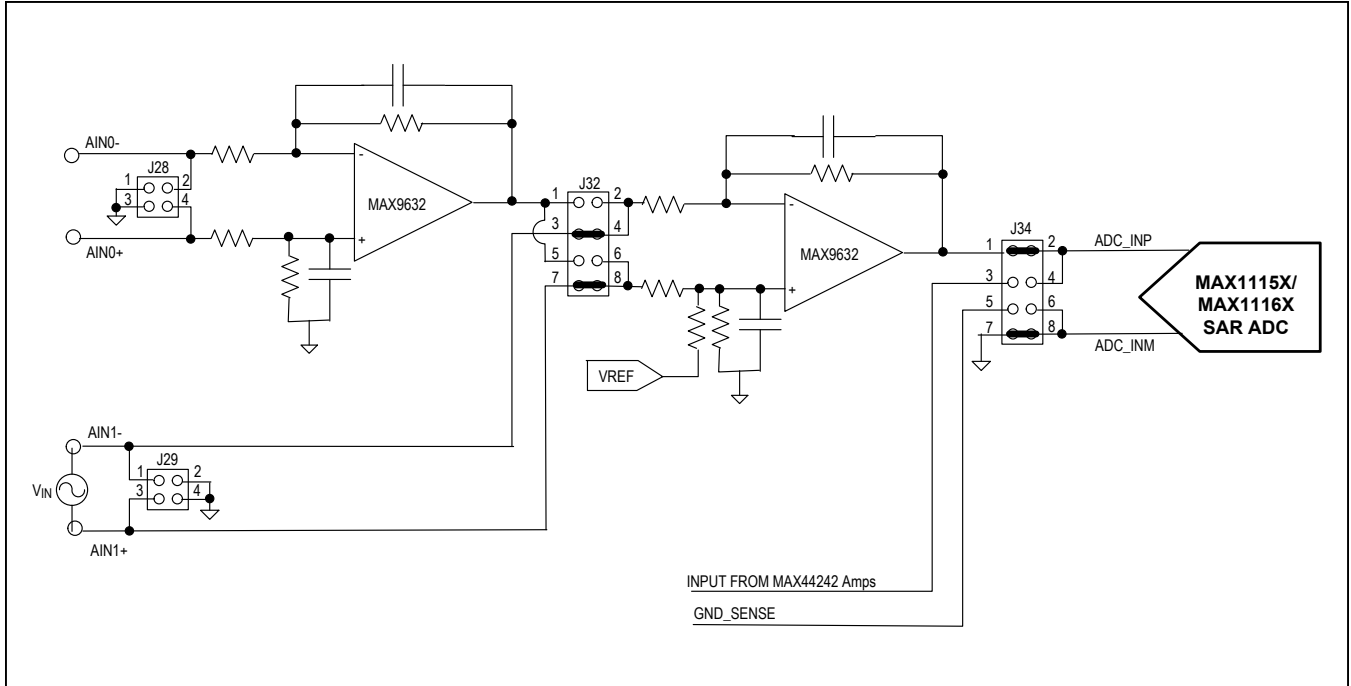


Figure 11. Differential, First-Order LPF

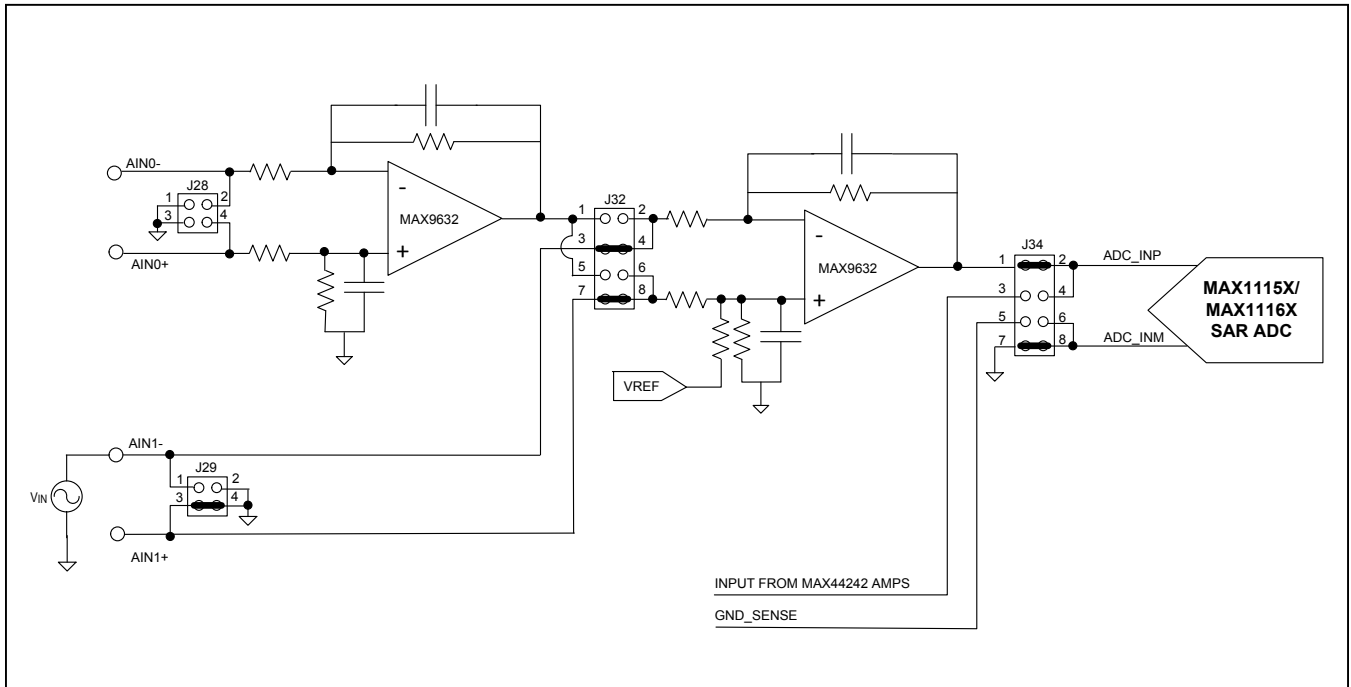


Figure 12. Inverting, Single-Ended, First-Order LPF

**Table 9. Analog Input Configurations (Channel B0–B3)**

CONFIGURATION		SIGNAL-PATH INPUT CONFIGURATION	INPUT CONNECTORS	JUMPER POSITIONS
No.	DESCRIPTION			
1	MAX9632, Channel B0	Noninverting, single-ended, second-order LPF (default)	CON11: BIN0+ (or TP54): and AGND (or TP39)	J5: 1-2 J9: 1-2 J10: 5-6 and 3-4 J39: 1-2 and 7-8
2	MAX9632, Channel B0	Noninverting, differential, second-order LPF	CON11 (TP54): BIN0+ CON10 (TP53): BIN0-	J5: Open J9: 1-2 J10: 5-6 and 3-4 J39: 1-2 and 7-8
3	MAX9632, Channel B0	Inverting, single-ended, second-order LPF	CON11: BIN0+ or (TP54): and AGND (or TP39)	J5: 1-2 J9: 3-4 J10: 1-2 and 7-8 J39: 1-2 and 7-8
4	MAX9632, Channel B0	Inverting, differential, second-order LPF	CON10 (TP53): BIN0- CON11 (TP54): BIN0+	J5: Open J9: 3-4 J10: 1-2 and 7-8 J39: 1-2 and 7-8
5	MAX9632, Channel B1	Noninverting, single-ended, first-order LPF	CON13: BIN1+ or (TP56): and AGND (or TP41)	J9: 1-2 J10: 3-4 and 7-8 J39: 1-2 and 7-8
6	MAX9632, Channel B1	Differential, first-order LPF	CON13 (TP56): BIN1+ CON12 (TP55): BIN1-	J9: Open J10: 3-4 and 7-8 J39: 1-2 and 7-8
7	MAX9632, Channel B1	Inverting, single-ended, first-order LPF	CON12: BIN1- or (TP55): and AGND (or TP41)	J9: 3-4 J10: 3-4 and 7-8 J39: 1-2 and 7-8
8	MAX44242, Channel B2	Noninverting, single-ended, second-order LPF (default)	TP58: BIN2+ and AGND (or TP40)	J6: 1-2 J7: 1-2 J11: 5-6 and 3-4 J39: 3-4 and 7-8
9	MAX44242, Channel B2	Noninverting, differential, second-order LPF	TP58: BIN2+ TP57: BIN2-	J6: Open J7: 1-2 J11: 5-6 and 3-4 J39: 3-4 and 7-8
10	MAX44242, Channel B2	Inverting, single-ended, second-order LPF	TP58: BIN2+ and AGND (or TP40)	J5: 1-2 J7: 3-4 J11: 1-2 and 7-8 J39: 3-4 and 7-8

**Table 9. Analog Input Configurations (Channel B0–B3) (continued)**

CONFIGURATION		SIGNAL-PATH INPUT CONFIGURATION	INPUT CONNECTORS	JUMPER POSITIONS
No.	DESCRIPTION			
11	MAX44242, Channel B2	Inverting, differential, second-order LPF	TP57: BIN2- TP58: BIN2+	J6: Open J7: 3-4 J11: 1-2 and 7-8 J39: 3-4 and 7-8
12	MAX44242, Channel B3	Noninverting, single-ended, first-order LPF	TP60: BIN3+ and AGND (or TP42)	J7: 1-2 J11: 3-4 and 7-8 J39: 3-4 and 7-8
13	MAX44242, Channel B3	Differential, first-order LPF	TP60: BIN3+ TP59: BIN3-	J7: Open J11: 3-4 and 7-8 J39: 3-4 and 7-8
14	MAX44242, Channel B3	Inverting, single-ended, first-order LPF	TP59: BIN3- and AGND (or TP42)	J7: 3-4 J11: 3-4 and 7-8 J39: 3-4 and 7-8

**Note:** Alternate connections are shown in parentheses.

**Sync Input and Sync Output**

Sync input and sync output is applicable to the FPGA (ZedBoard) and is not used in standalone mode. The SYNC\_IN SMA accepts an approximate 100MHz waveform signal to generate the system clock of the ZedBoard. For maximum performance, use a low-jitter clock that syncs to the user’s analog function generator. The SYNC\_OUT SMA outputs a 10MHz square waveform that syncs to the user’s analog function generator. Both options are used for coherent sampling of the IC. Only

one option should be used at a time. The relationship between  $f_{IN}$ ,  $f_S$ ,  $N_{CYCLES}$ , and  $M_{SAMPLES}$  is given as follows:

$$f_{IN}/f_S = N_{CYCLES}/M_{SAMPLES}$$

where:

$f_{IN}$  = Input frequency

$f_S$  = Sampling frequency

$N_{CYCLES}$  = Prime number of cycles in the sampled set

$M_{SAMPLES}$  = Total number of samples

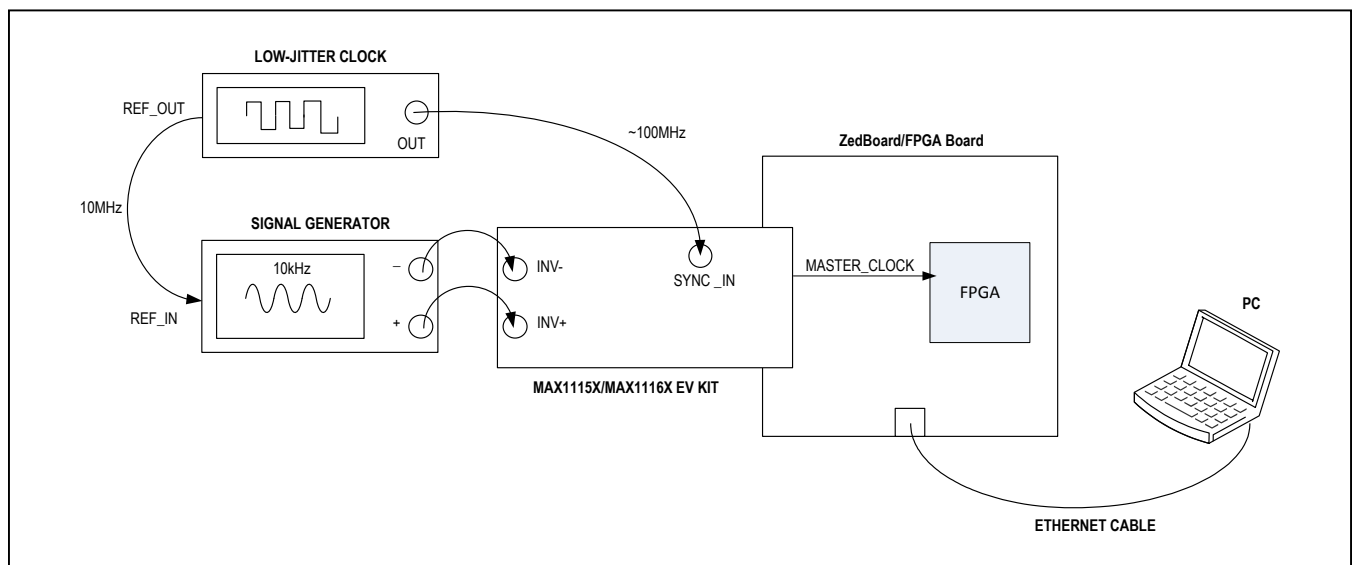


Figure 13. EV Kit Coherent Sampling Setup

# MAX1115X/MAX1116X Family Evaluation Kit

Evaluates: MAX11150/MAX11152/  
MAX11158/MAX11160/MAX11161/MAX11162/  
MAX11163/MAX11168/MAX11169

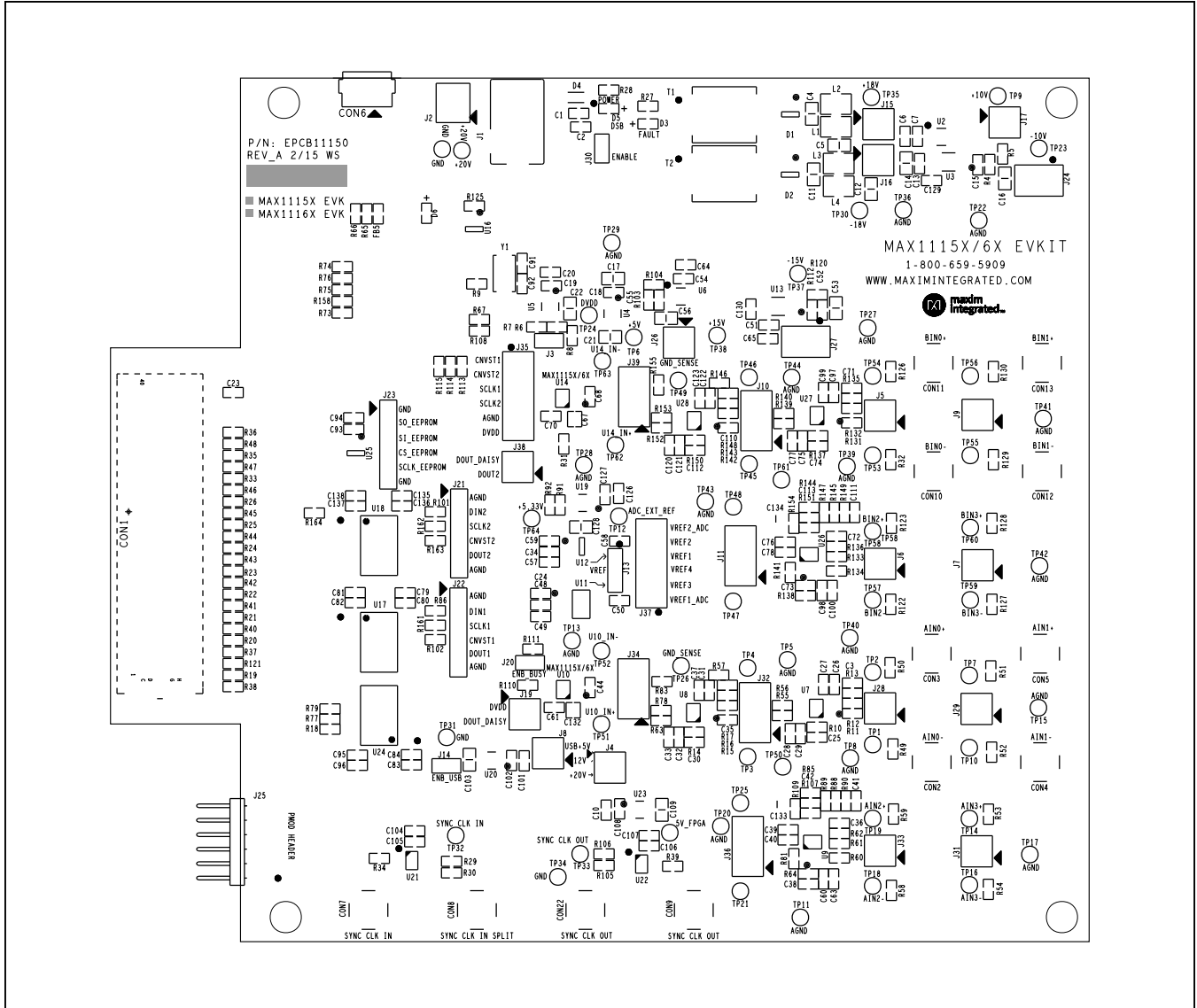


Figure 14. MAX1115X/MAX1116X EV Kit Component Placement Guide—Top Side



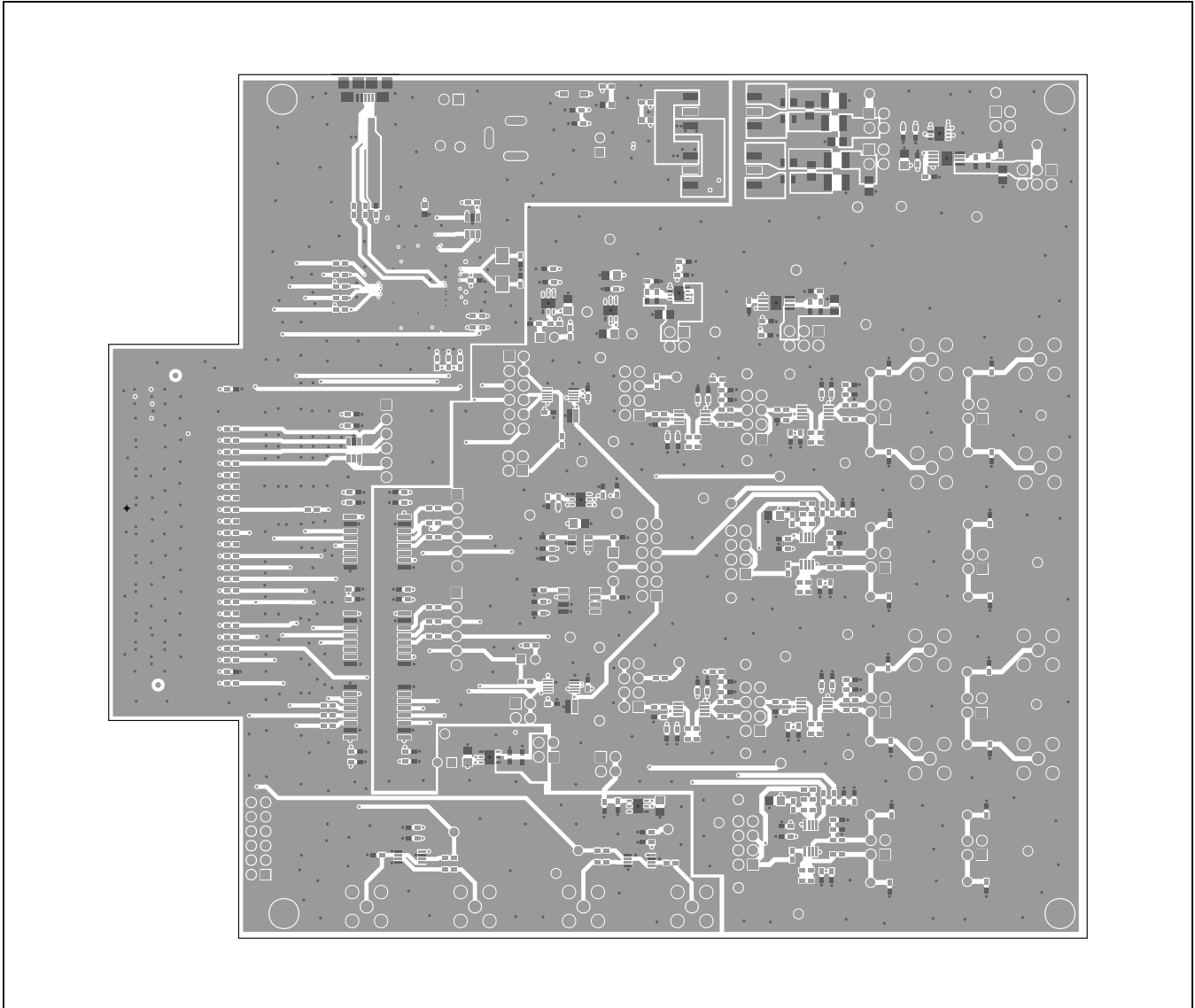


Figure 15. MAX1115X/MAX1116X EV Kit PCB Layout—Layer 1

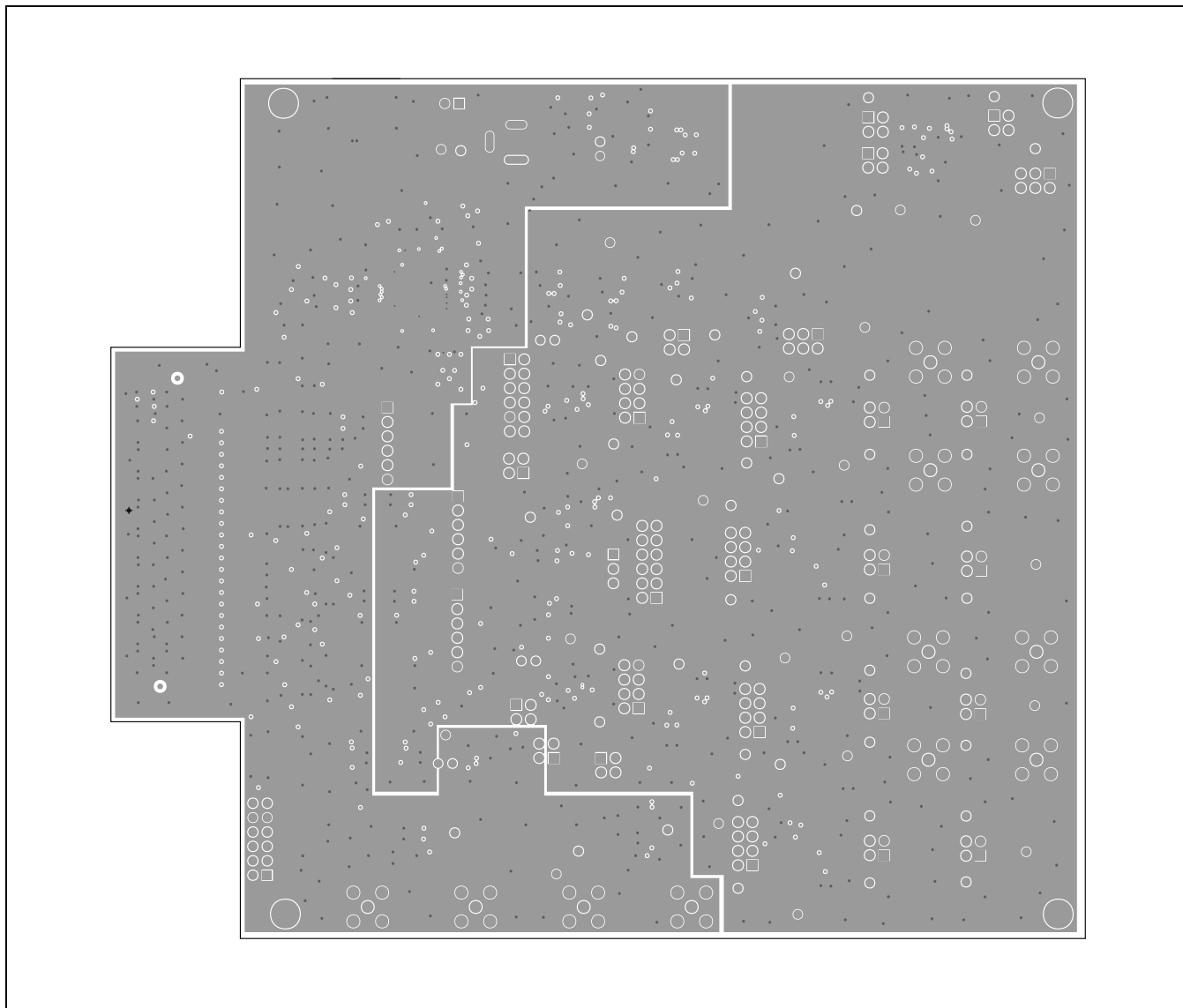


Figure 16. MAX1115X/MAX1116X EV Kit PCB Layout—Layer 2

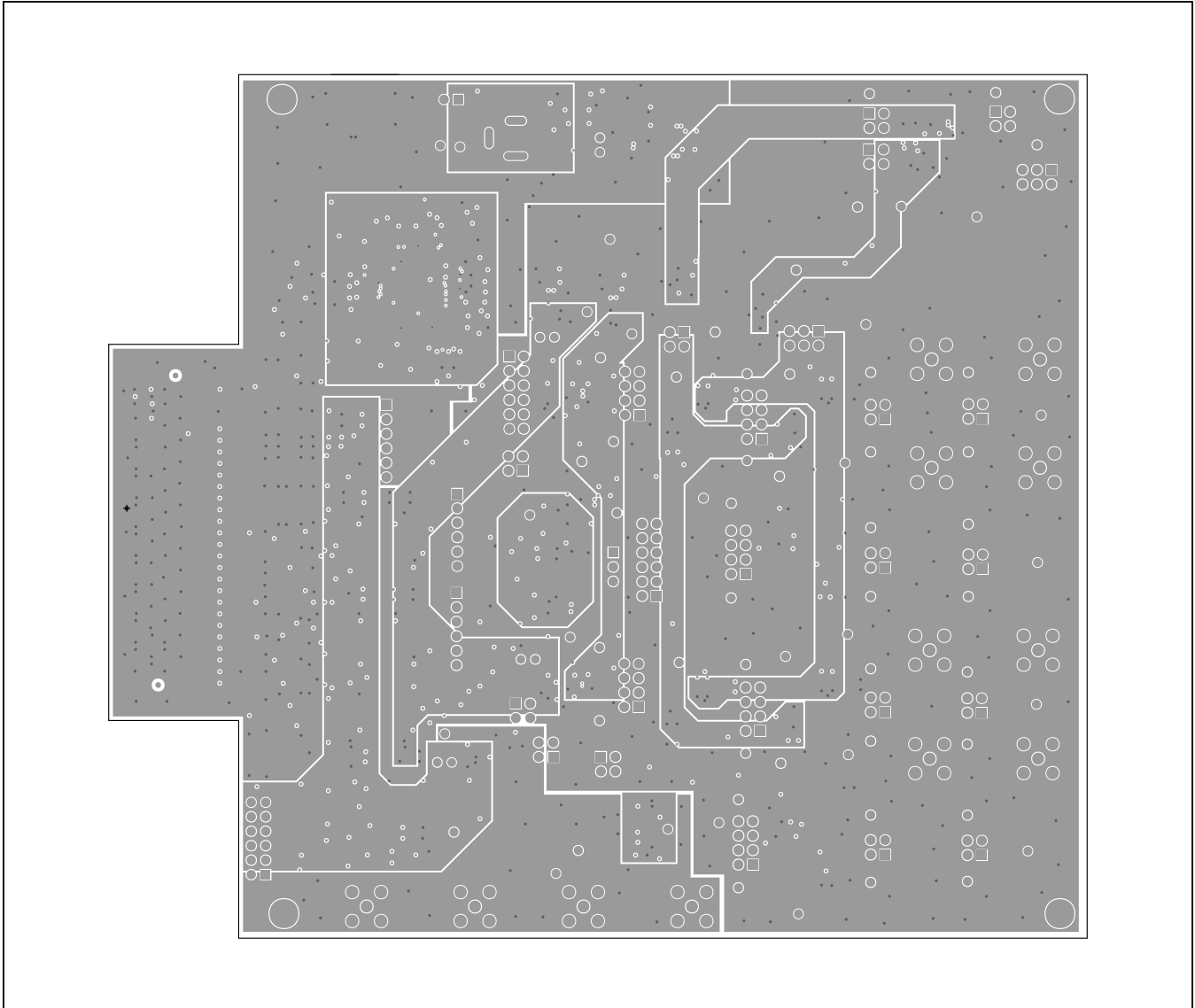


Figure 17. MAX1115X/MAX1116X EV Kit PCB Layout—Layer 3

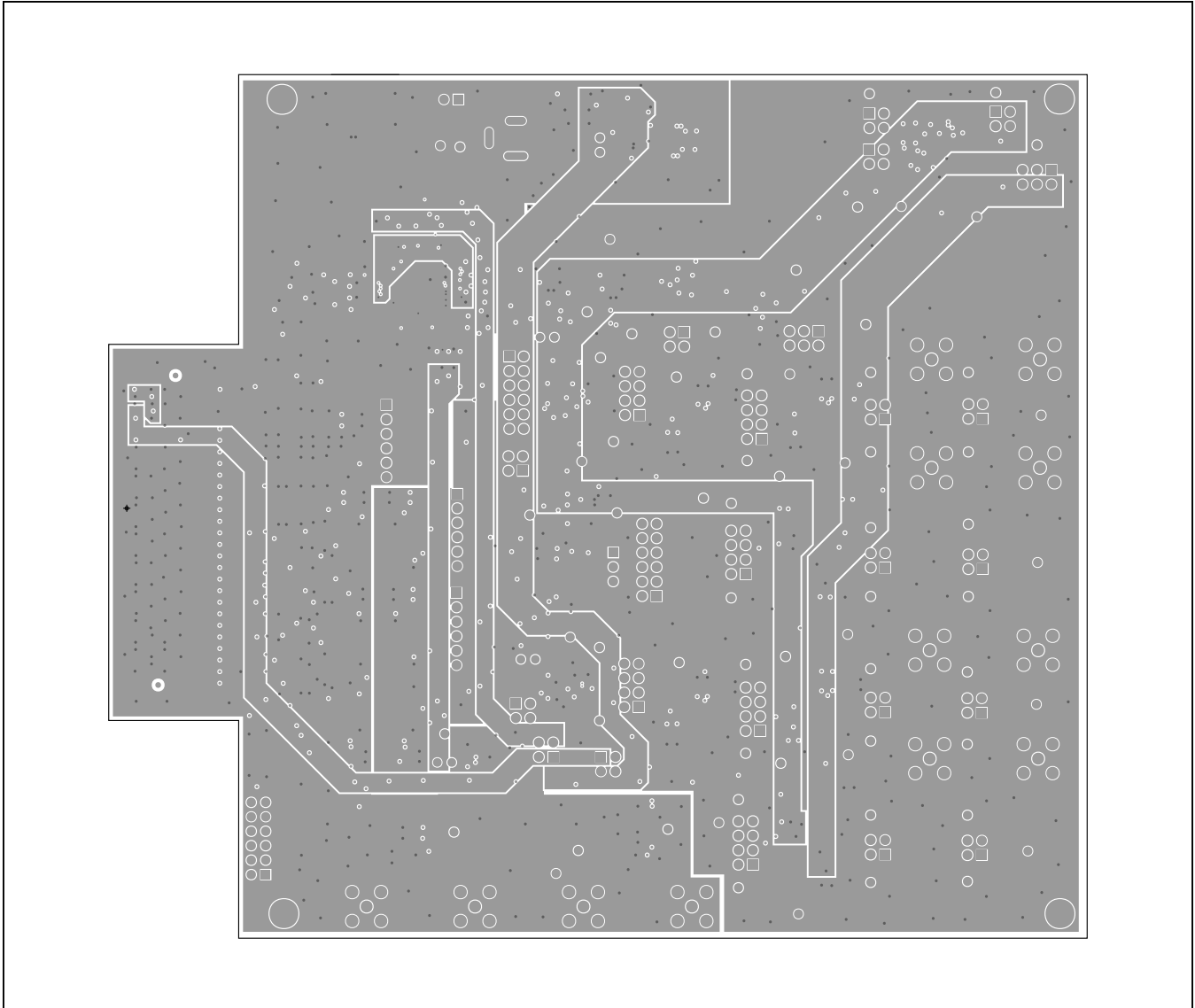


Figure 18. MAX1115X/MAX1116X EV Kit PCB Layout—Layer 4

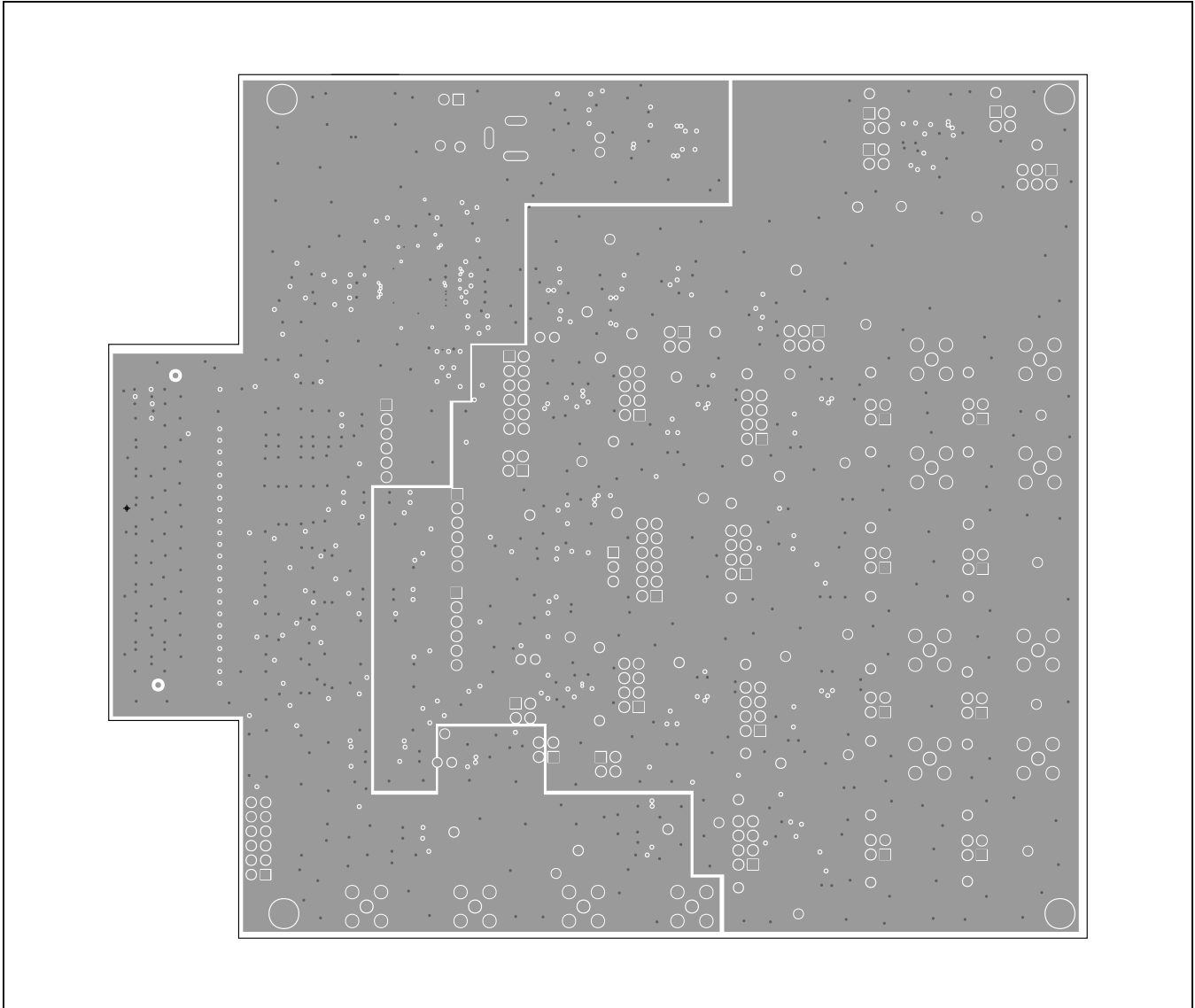


Figure 19. MAX1115X/MAX1116X EV Kit PCB Layout—Layer 5

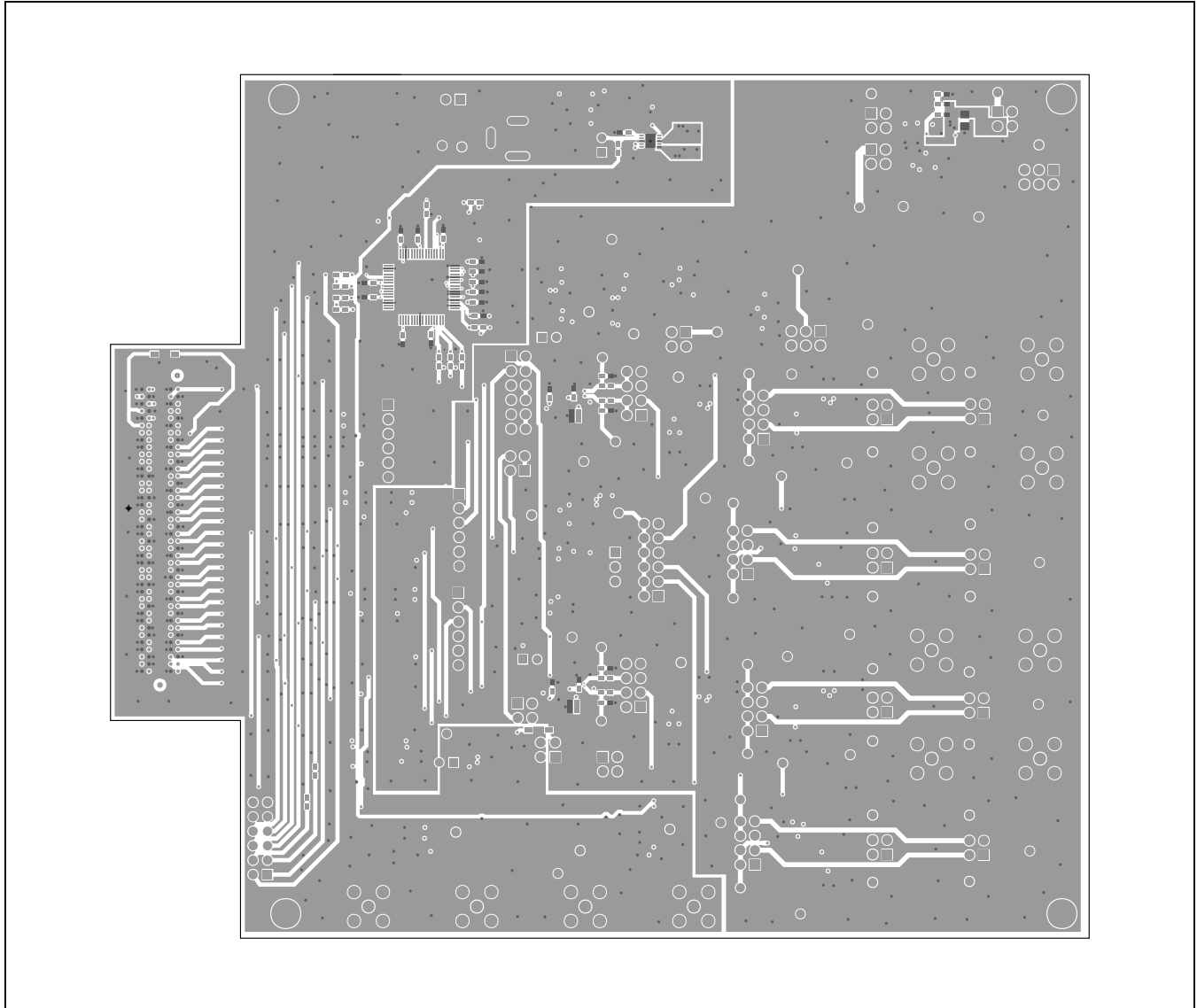


Figure 20. MAX1115X/MAX1116X EV Kit PCB Layout—Layer 6

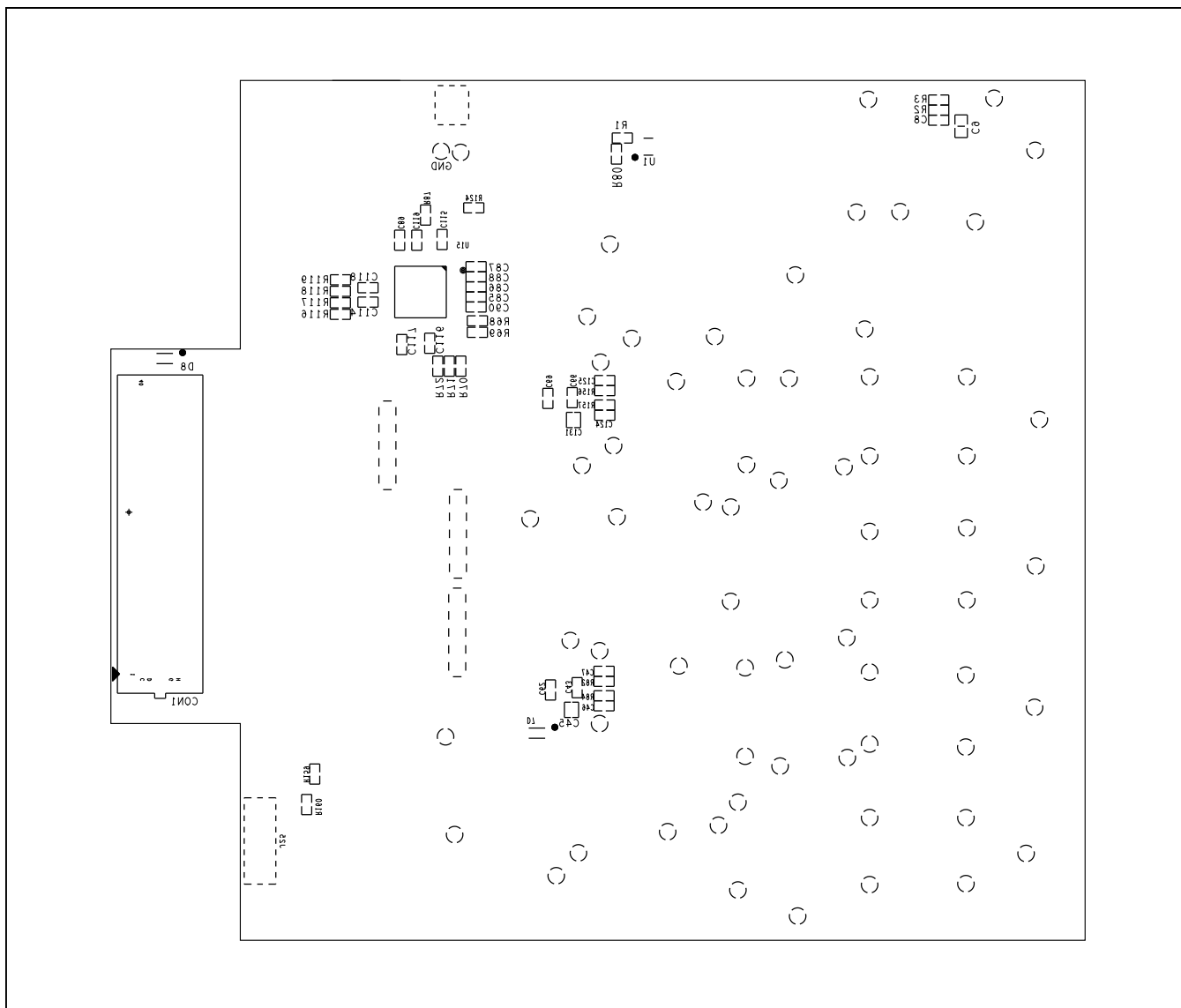


Figure 21. MAX1115X/MAX1116X EV Kit Component Placement Guide—Bottom Side

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## MAX1115X/MAX1116X Family Evaluation Kit

Evaluates: MAX11150/MAX11152/  
MAX11158/MAX11160/MAX11161/MAX11162/  
MAX11163/MAX11168/MAX11169

### Component List and Schematic Diagrams

Refer to files "[evkit\\_bom\\_max1115x6x\\_evkit\\_revA.csv](#)" and "[MAX1115X6X\\_EVKIT\\_Reva.SCH.pdf](#)" attached to this data sheet for component information and schematics diagrams.

Contact Avnet to purchase a ZedBoard (AES-Z7EV-7Z020-G) to communicate with the MAX1115X/MAX1116X EV kit.

### Ordering Information

PART	TYPE
MAX11150EVKIT#	EVKIT
MAX11152EVKIT#	EVKIT
MAX11158EVKIT#	EVKIT
MAX11160EVKIT#	EVKIT
MAX11162EVKIT#	EVKIT
MAX11168EVKIT#	EVKIT

#Denotes RoHS compliant.



MAX1115X/MAX1116X Family  
Evaluation Kit

Evaluates: MAX11150/MAX11152/  
MAX11158/MAX11160/MAX11161/MAX11162/  
MAX11163/MAX11168/MAX11169

## Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	5/15	Initial release	—

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim Integrated's website at [www.maximintegrated.com](http://www.maximintegrated.com).

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