User's Manual

ISL26104AV28EV1Z

User's Manual: Evaluation Board

Industrial Analog and Power

Rev 1.00 Dec 2017

ISL26104AV28EV1Z

Evaluation Board

AN1800
Rev. 1.00
Dec 15, 2017

1. Overview

The ISL26104AV28EV1Z provides a means to evaluate the functionality and performance of the ISL26104 A/D converter.

The board includes an AT90USB162 microcontroller with a USB interface. The microcontroller connects to the ISL26104 ADC through a galvanically isolated interface and provides serial communication through USB between the board and the computer.

The evaluation software provides a GUI (Graphical User Interface) that allows the user to configure the ISL26104 device, to capture data, to process and plot the results in the time domain or as a histogram, and perform frequency domain analysis on the captured data. The evaluation software also enables the user to save conversion data from the ADC to a file, or to save the results of the analyzed conversion data.

1.1 Key Features

- ADC is galvanically-isolated from USB connection
- On-board microcontroller
- On-board voltage reference
- Evaluation software
    - Time domain analysis
    - Noise histogram analysis
    - FFT analysis

1.2 Ordering Information

Part Number	Package (Pb-Free)
ISL26104AV28EV1Z	Evaluation Board

1.3 Related Literature

- For a full list of related documents, visit our website
    - ISL26104 product page

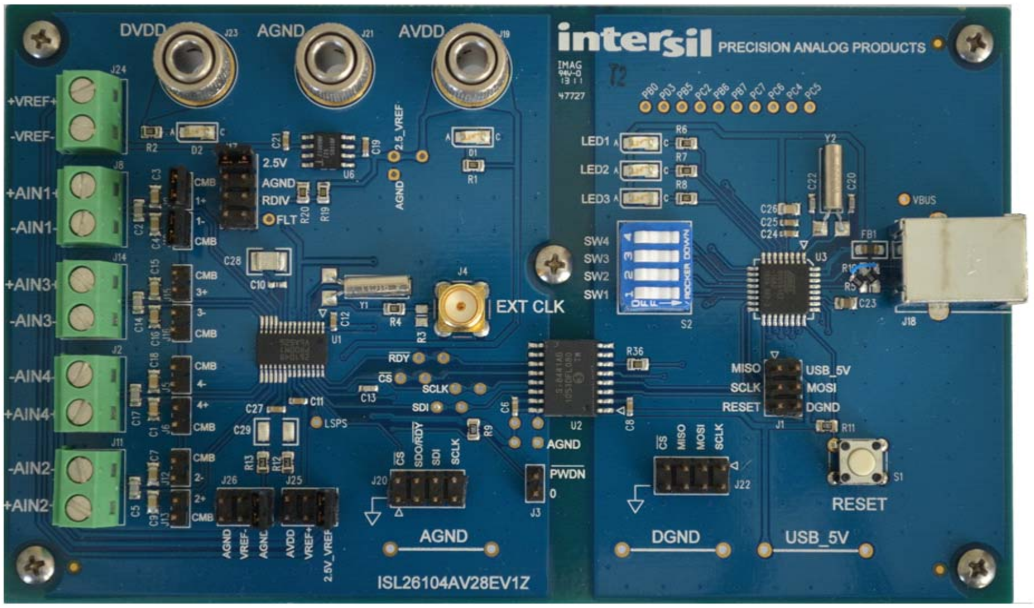


Figure 1. Evaluation Board for the ISL26104

2. Functional Description

2.1 Hardware

The ISL26104AV28EV1Z evaluation board enables evaluation of the ISL26104 Analog-to-Digital Converter (ADC). The ISL26104 is a high performance 24-bit ADC that includes a very low noise programmable gain amplifier. The ISL26104 offers multiple gain selections: 1x, 2x, 4x, 8x, 16x, 32x, 64x, and 128x. It offers 20 word rate selections from 2.5Sps to 4000Sps (clock = 4.9152 MHz). Gain and word rate selections are made by writing to on-chip registers.

The board comes with an ISL26104 soldered in place. This can be removed and an ISL26102 soldered in its place if desired.

2.2 Evaluation Board Overview

The ISL26104AV28EV1ZA evaluation board is made up of two sections. These sections are galvanically isolated with a multi-channel isolation chip. The two different sections of the board can be readily identified in Figure 1 on page 3, which shows an image of the board. The ISL26104 ADC and its associated circuitry (voltage reference and input signal components) are on the left side of the image. The ADC and its associated circuitry are powered by a laboratory supply. The microcontroller with its USB interface is on the right side of the image. This circuitry is powered from the USB connection. See Figure 2 for a block diagram of the circuitry. The microcontroller provides the USB interface to the computer. Evaluation software is available to communicate with the microcontroller and to collect and analyze data from the ADC.

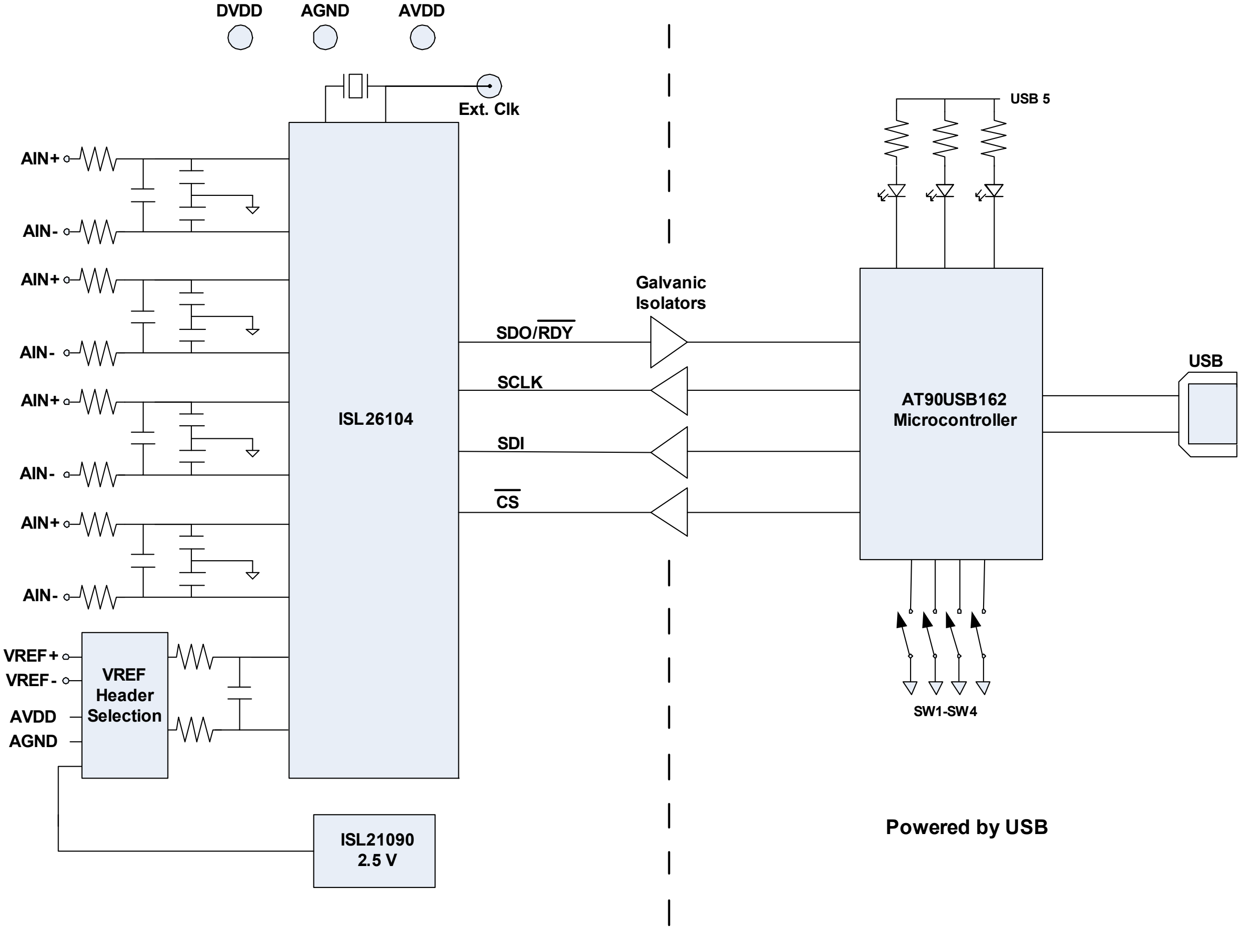


Figure 2. Block Diagram of the Evaluation Board for the ISL26104

2.3 Galvanic Isolation

Galvanic isolation is not necessary in every application. The purpose of the isolation on the evaluation board is to prevent noise from the USB ground connection from affecting the sensitive measurements made by the ADC when used in the 64X or 128X gain settings. The ground connection of the USB cable in most computers is referenced directly to the power supply ground of the computer. This ground can be especially noisy in notebook computers powered from an external power module. Operating the ADC on a power system that is galvanically isolated from the USB ground ensures that the performance of the ADC on the evaluation board will not be affected by ground noise from the computer being used to collect data from the board.

2.4 ADC Section

The ADC section of the evaluation board has three banana jack power connections that enable this portion of the board to be powered from a low noise laboratory supply.

- AGND serves as the power supply ground connection for the ADC segment of the board.
- DVDD supplies the digital portion of the ADC (3.3V to 5V) and the section of the galvanic isolation chip that interfaces to the ADC.
- AVDD supplies the analog portion of the ADC and the voltage reference.

The voltage reference used in the ADC circuitry is a ISL21090BFB825Z-TK 2.5V reference. A header is provided to also allow the use of an external voltage reference for the ADC. The ADC portion of the circuitry on the board is illustrated in Figure 3.

The ISL26104 offers several sample rate, gain, and input channel options. These options are selected using on-chip registers that can be written by the evaluation software. When a command to change the gain, the rate, or the multiplexer channel is issued by the evaluation software, the command is sent over the USB connection to the microcontroller on the evaluation board. The microcontroller then writes into the proper ADC register through the serial port using the $\overline{\text{CS}}$/, SDI, SDO/$\overline{\text{RDY}}$, and SCLK signals which are connected to the ADC from the microcontroller through the isolation chip as shown in Figure 4 on page 6.

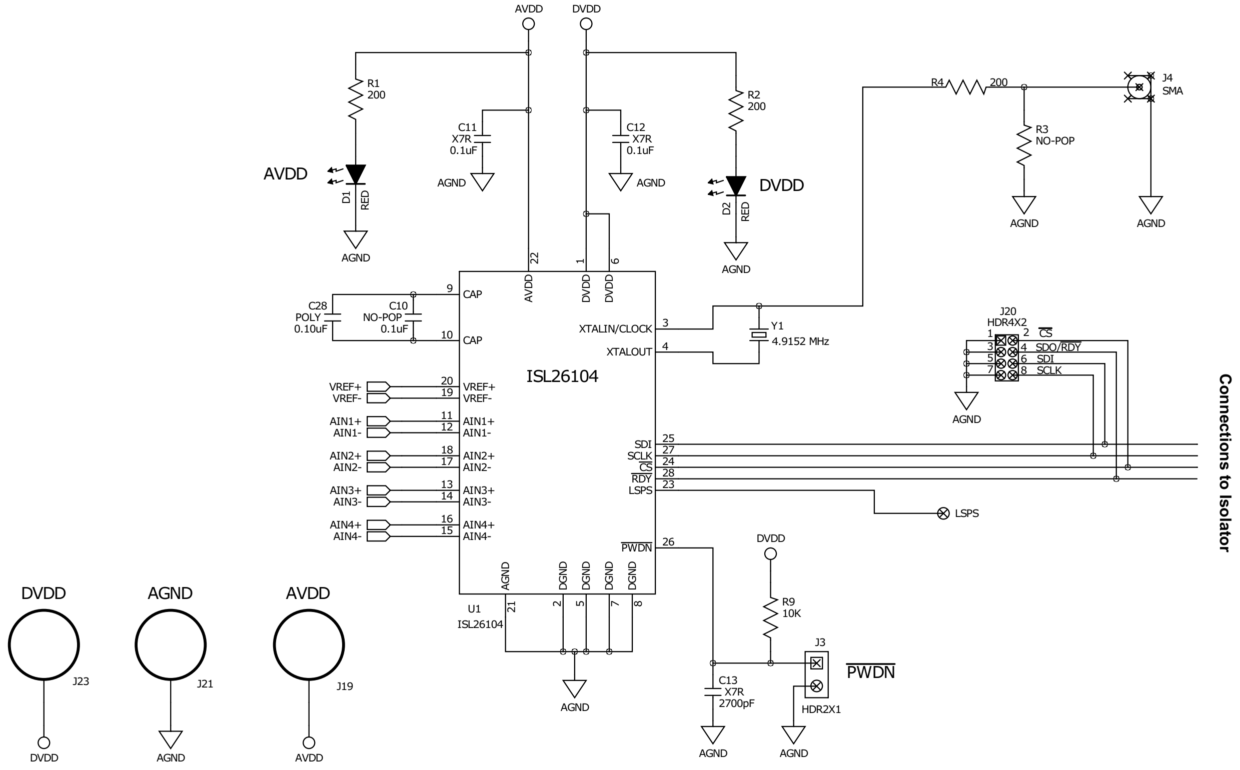


Figure 3. ISL26104 Analog-to-Digital Converter

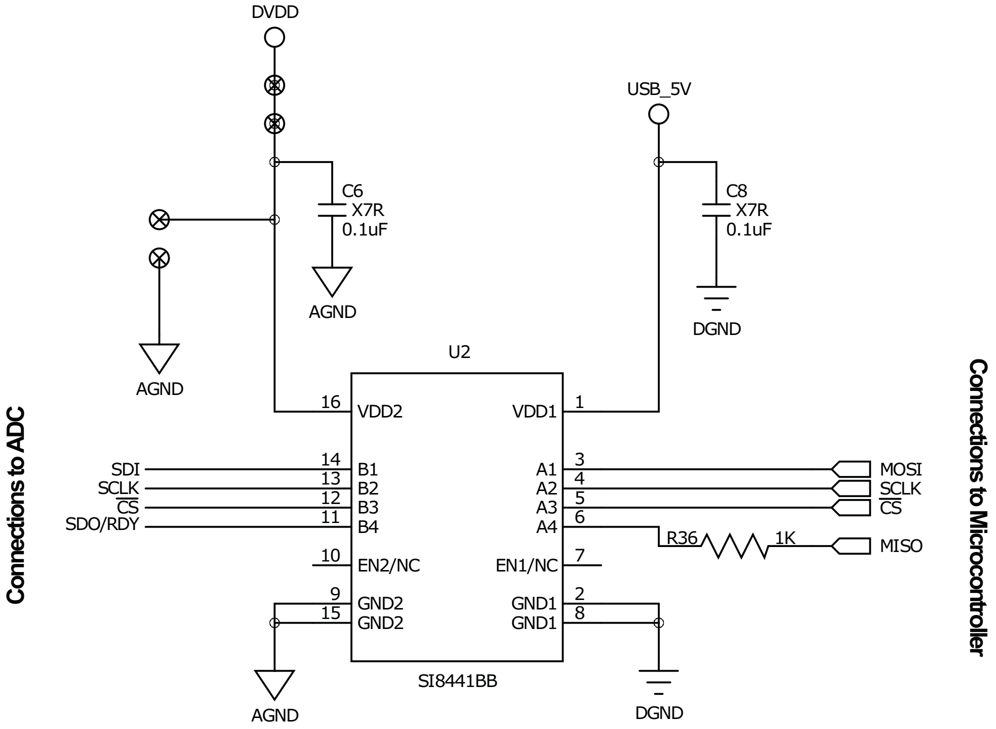


Figure 4. Galvanic Isolator Chip

The ADC uses a 4.9152MHz crystal operating with an on-chip amplifier for its clock source. This can be disconnected and an external clock can be sourced to drive the clock input to the chip. Alternately, the XTALIN/CLOCK pin can be grounded and the ADC will operate from an on-chip RC type oscillator.

The board provides a 2.5V reference IC as the voltage reference for the ADC, as shown in Figure 5, or an external voltage can be connected to input terminals on the board (VREF+ and VREF-) and selected through jumpers on headers J25 and J26 to provide a reference voltage for the ADC as shown in Figure 6. These headers also provide the option of selecting AVDD and AGND as inputs to the VREF+ and VREF- on the ADC.

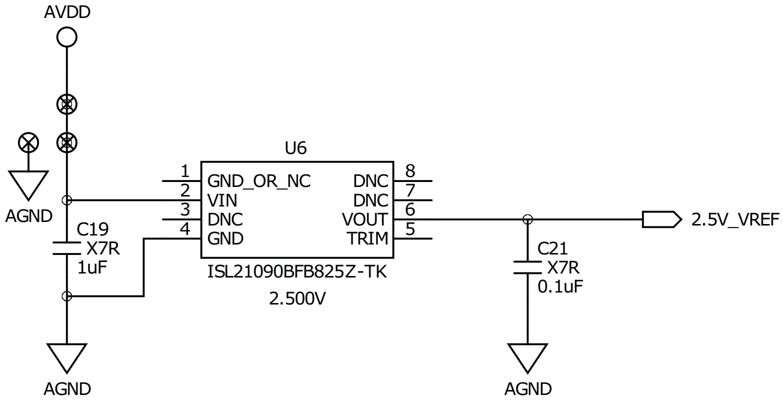


Figure 5. 2.5V Reference

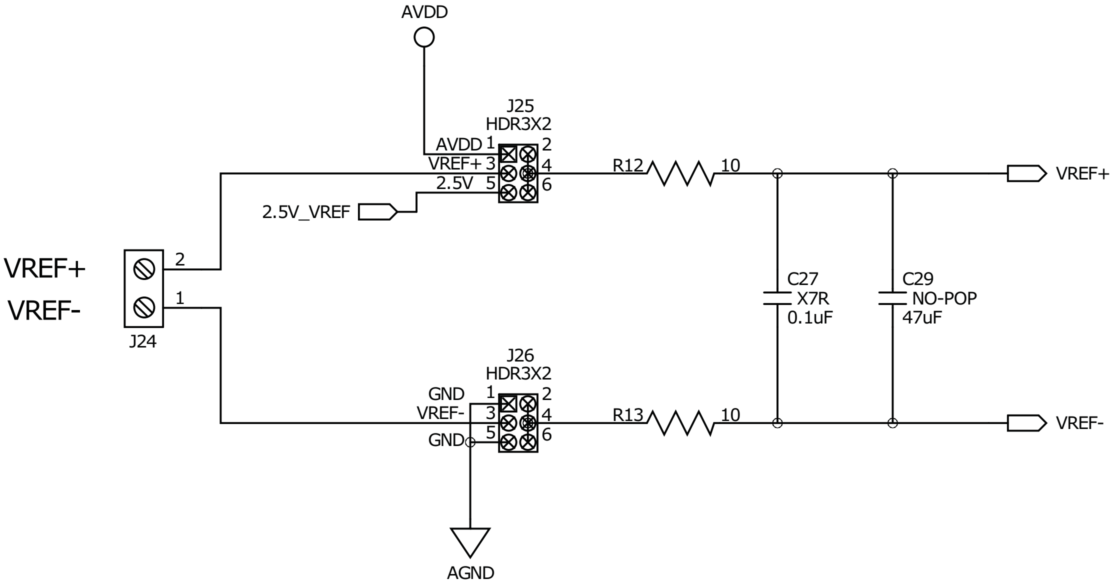


Figure 6. Voltage Reference Selection Options

The evaluation board provides separate terminal connections for each of the differential signals into the ADC. These terminals are in shown in Figure 7. Pay attention to the labeling of the connections and their polarities when connecting external signals. The channel numbers on the terminal blocks are not in numerical order and some have their polarities labeled opposite of others.

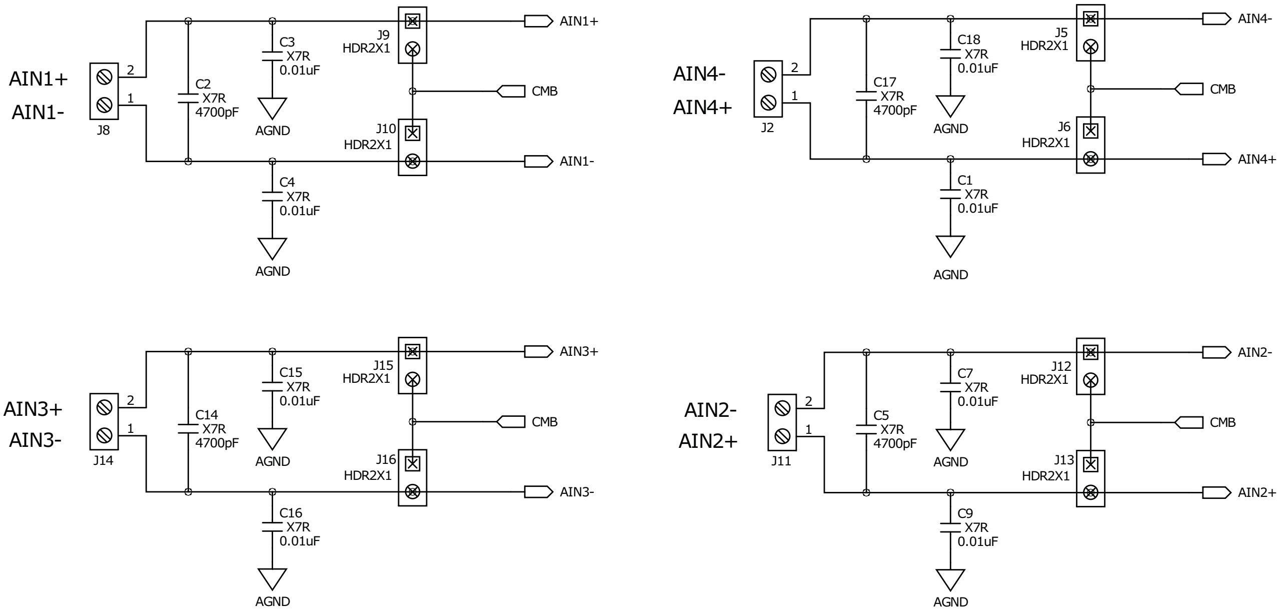


Figure 7. Analog Inputs

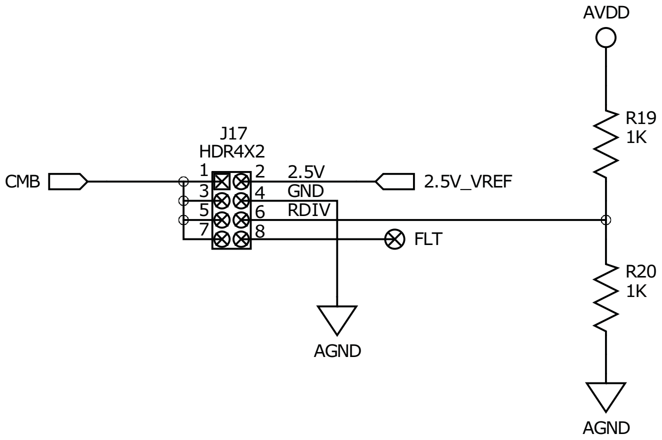


Figure 8. Common Mode Selections

Header connector J17, shown in Figure 8, allows the user to select one of the following options for the common mode bias (CMB) voltage:

- The 2.5V voltage reference output
- Ground (AGND)
- A voltage generated by a resistor divider (RDIV) that divides the AVDD supply using two 1kΩ resistors
- A voltage determined by the user that must be connected to the hole next to the header connection labeled FLT (Floating Input)

The voltage source that is selected by header J17 is provided to the analog input channels as a common mode bias voltage (CMB).

Each of the input channels has jumpers (for example, J9 and J10 for input AIN1 in Figure 7) to allow the user to connect the common mode bias (CMB) voltage to either the AIN+ or the AIN- input of the channel. This enables the external signal source to be biased to a common mode value supplied by the board. If both jumpers are put in place, and the analog inputs to the terminals are left disconnected, the inputs to this particular AIN channel of the ADC will be shorted to the common mode voltage. This provides a means for testing the noise performance of the ADC with both of its inputs (AIN+ and AIN-) shorted to a common mode voltage.

The ADC interfaces to the microcontroller through the galvanic isolators. The ADC side of the isolator chip is powered by the same supply that powers the DVDD supply of the ADC.

2.5 Microcontroller Section

Figure 9 on page 9 illustrates the microcontroller circuitry. A reset button is provided but it is seldom necessary to use. The microcontroller has its own power-on reset which initializes the microcontroller when the USB interface is connected to a computer. Power for the microcontroller section comes from the USB interface. The microcontroller circuit includes a DIP switch, three LEDs, and two header connectors.

The board is shipped from the factory with the four switches of the DIP switch set to the OFF position. This is required for normal operation. Other switch positions are used at the factory to troubleshoot the isolator interface if the board is not functioning properly. These switch positions are not useful for normal board applications, and should be kept in the OFF position.

The three LEDs light up when the USB interface is connected and actively powered. Some of the LEDs blink when the microcontroller is passing a command to the ADC or when data is being collected from the ADC.

The microcontroller section includes two headers. Header J1 is a six pin connection used to program the flash in the microcontroller. Header J22 provides access to the four signals that are used by the microcontroller to interface to the ADC.

If desired, customers could remove the isolator chip from the board and use header J22 to connect their own circuitry to the ADC. This enables the customer to use the evaluation software to evaluate the ADC in the customer's system. An alternate method of connection is to remove the ISL26104 device from the board and connect into the customer circuit through the signals on header J20. If this method is chosen, the customer would need to power the ADC side of the isolator chip from his system (3V to 5V).

The microcontroller communicates with the ADC through the galvanic isolator chip. The microcontroller side of the isolator is powered by the voltage from the USB connection.

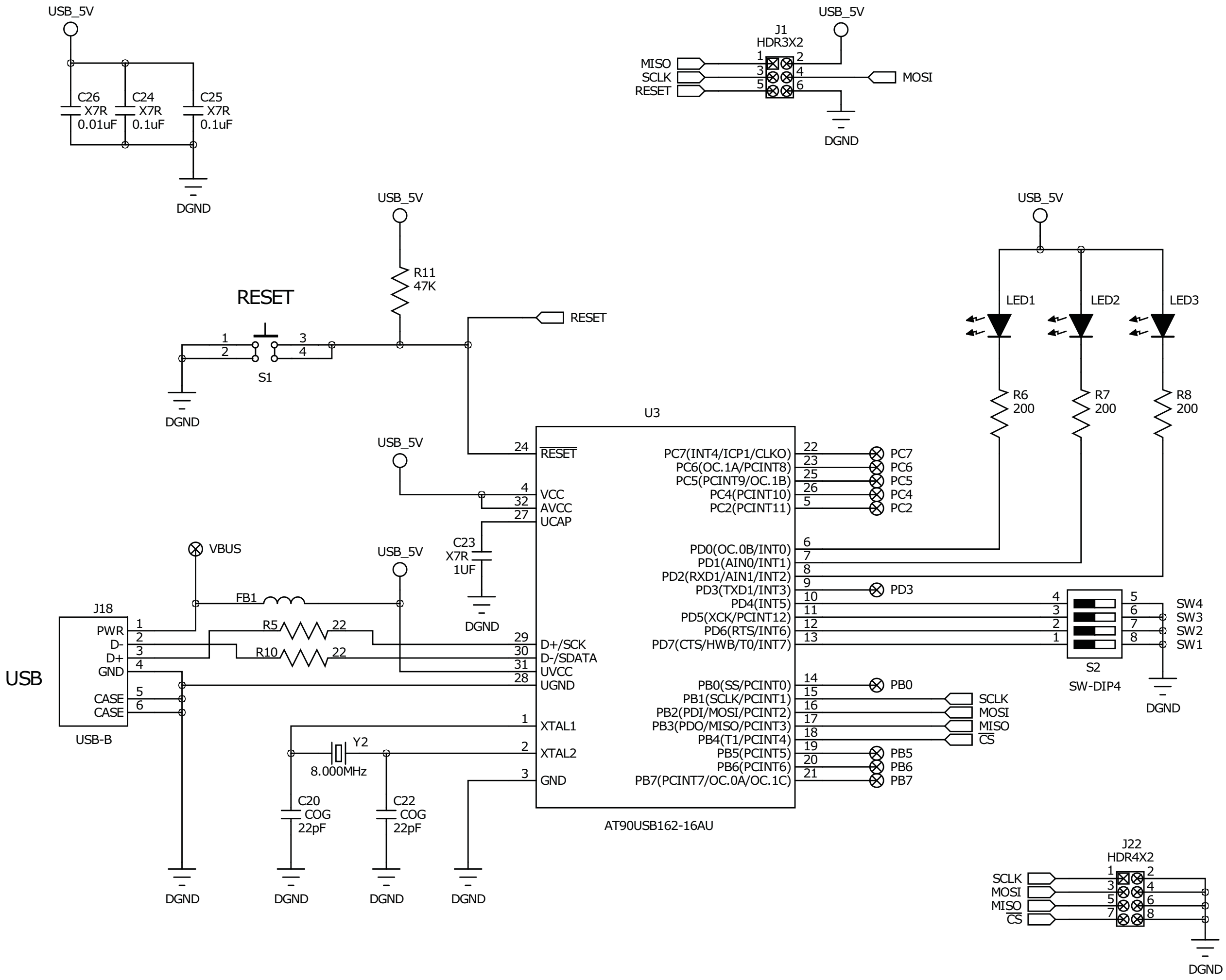


Figure 9. Microcontroller with USB Interface

2.6 Power Supply Sequencing

The board is made up of two galvanically isolated sections. The ADC portion is powered by a laboratory supply. The microcontroller section is powered by the USB connection.

Proper voltages from an external supply must be provided to the DVDD (3.3V to 5V), AVDD (5V), and the AGND banana plug connectors for the ADC portion of the board to function. LEDs, as shown in Figure 3, will light up when DVDD and AVDD are powered. Note that these supplies, AVDD and DVDD, can be applied and removed in any sequence without regard to each other or with regard to whether the USB interface is connected and powered. The USB interface can also be disconnected and reconnected without consequence with regard to whether the power supply to the ADC section of the board is powered.

In other words, there is no power supply sequencing requirement for any of the supplies to the board, whether from the ADC section powered by the laboratory supply, or the microcontroller section powered by the USB connection.

2.7 Quick Start Guide

The evaluation board includes evaluation software for computers running Microsoft Windows XP or later.

2.8 Installing the Evaluation Software

Use the following link to go to the ISL26104 product page.

www.intersil.com/products/ISL26104

On the Documents tab, locate the Software section. Click the link to download the evaluation software setup program. The software setup program has a license agreement that must be accepted to install the software.

When the setup program has been downloaded, run setup.exe and follow the on-screen instructions.

The software communicates with the evaluation board using the USB interface. The software uses the USB HID driver included with the Windows operating system, so it is not necessary to load any other USB drivers.

2.9 Running the Evaluation Software

Note that the fonts and colors in the evaluation software are dictated by the operating system, and may vary from what is shown in this document.

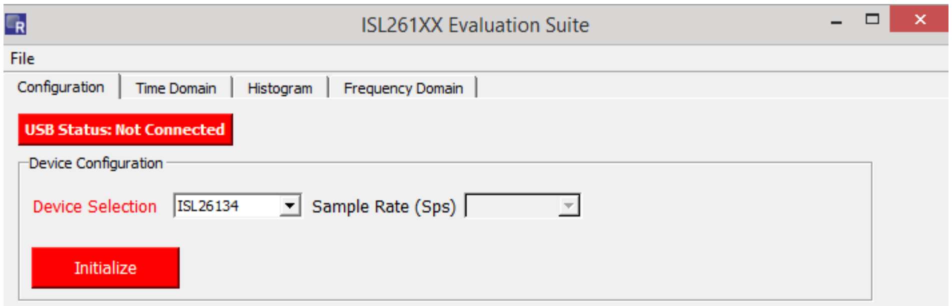
Before starting the evaluation software, connect the evaluation board to the computer with a USB cable.

To start the evaluation software, click

Start > All Programs > Renesas > ISL261XX Evaluation Software > ISL261XX Evaluation Software

If the software is started before the connection to the board is made, the software will indicate that the USB interface is not connected with the message: **USB Status: Not Connected** as shown in Figure 10.

If this occurs, connect the evaluation board to the computer with the USB cable. The USB status should change to **USB Status: Connected** as shown in Figure 11 on page 11.



USB Status: Not Connected

Device Configuration

Device Selection: ISL26134

Sample Rate (Sps):

Figure 10. USB Not Connected

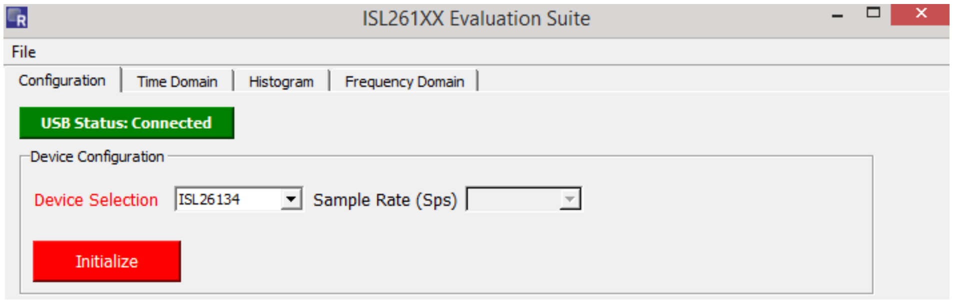


Figure 11. USB Connected

The screen shows the File menu and four tabs: Configuration, Time Domain, Histogram, and Frequency Domain. In Figure 12, the Configuration window is the active window.

(1) To configure the evaluation board, select the part number for the evaluation board to be tested. For Device Selection, select the appropriate part number.

(2) Ensure that the ADC section of the board is powered by the laboratory power supply so that the evaluation software can communicate with the ISL26104.

(3) Click **Initialize**.

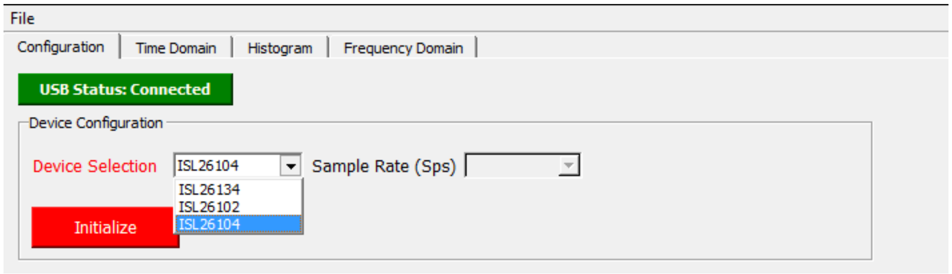
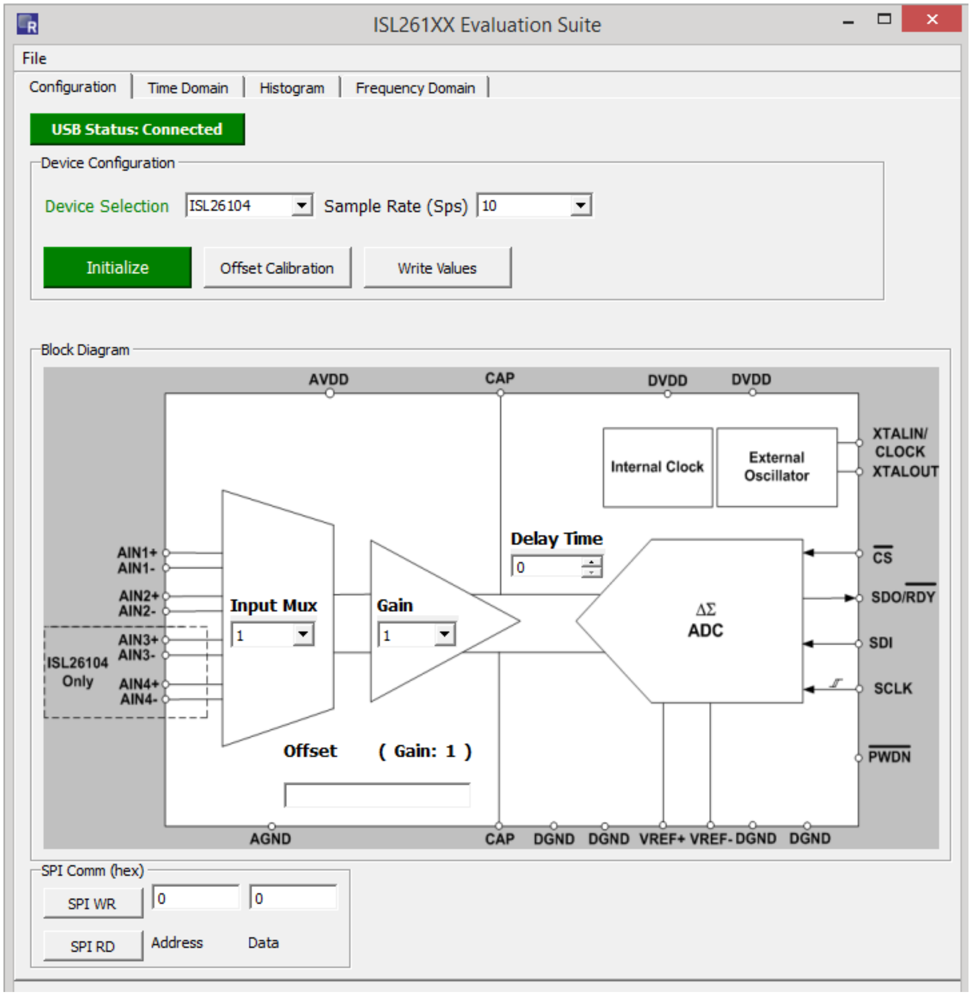


Figure 12. Device Selection



USB Status: Connected

Device Selection ISL26104

Sample Rate (Sps) 10

Input Mux 1

Gain 1

Delay Time 0

Offset (Gain: 1)

Address 0

Data 0

Figure 13. Block Diagram

After the **Initialize** button is clicked with the ISL26104 selected, the screen shows a block diagram of the ISL26104 ADC. The block diagram includes drop-down menus to select various options, such as the Input Mux channel and Gain as shown in Figure 13.

The ISL26104 device uses on-chip registers for configuration. Use the Configuration window to set up the various options for the ISL26104 device.

Some of these options are:

- Input channel (Input Mux)
- Sample Rate
- Gain

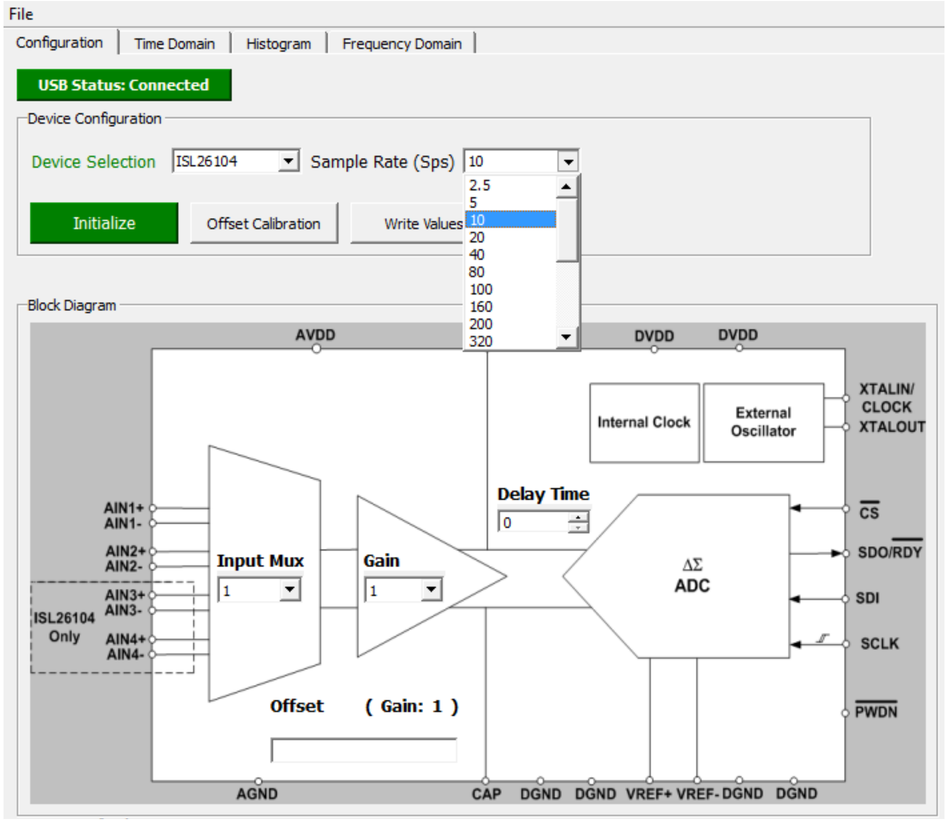
Use the Sample Rate drop-down menu to select the Sample Rate, as shown in Figure 14 on page 13. Sample rates from 2.5 to 4000 samples per second can be selected.

Use the Input Mux drop-down menu to select the input channel, as shown in Figure 15 on page 14.

Use the Gain menu to select the gain, as shown in Figure 16 on page 14.

Any time a menu option is changed, click the **Write Values** button, which instructs the evaluation software to send a command to the chip to change the appropriate on-chip register.

Note that you can change multiple items (such as Sample Rate, Input Mux, or Gain) and click the **Write Values** button only once for all the selections to be written to the evaluation board.



USB Status: Connected

Device Selection: ISL26104

Sample Rate (Sps): 10

Delay Time: 0

Input Mux: 1

Gain: 1

(Gain: 1)

Figure 14. Sample Rate Selection

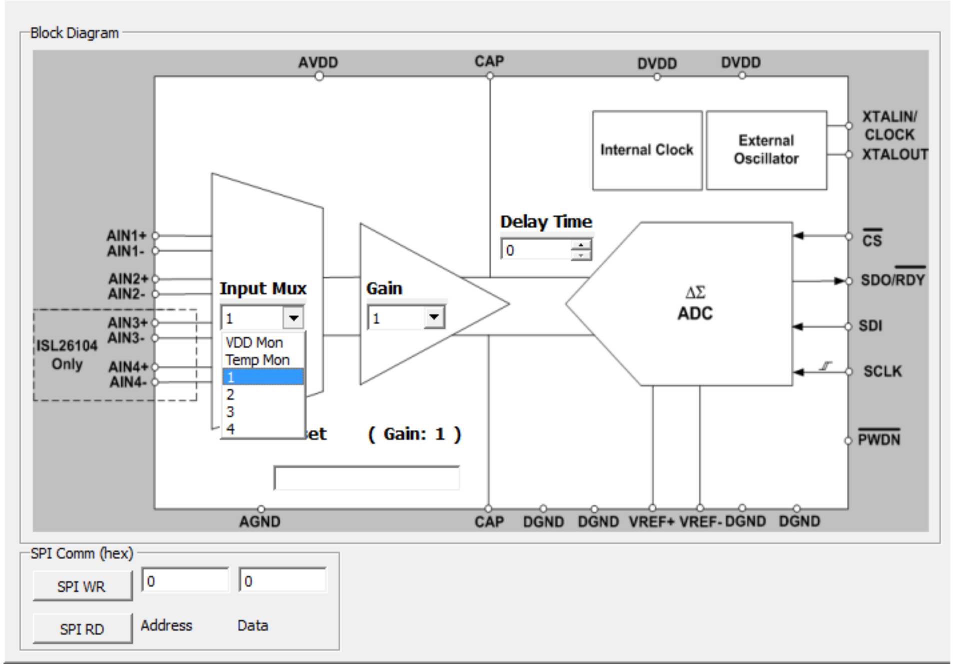


Figure 15. Input Mux Selection

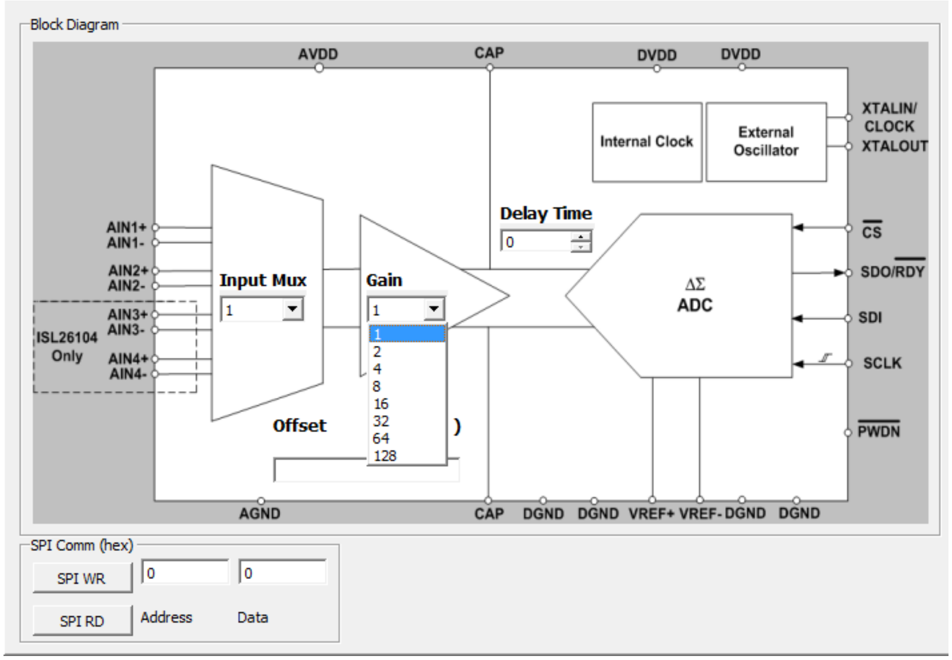
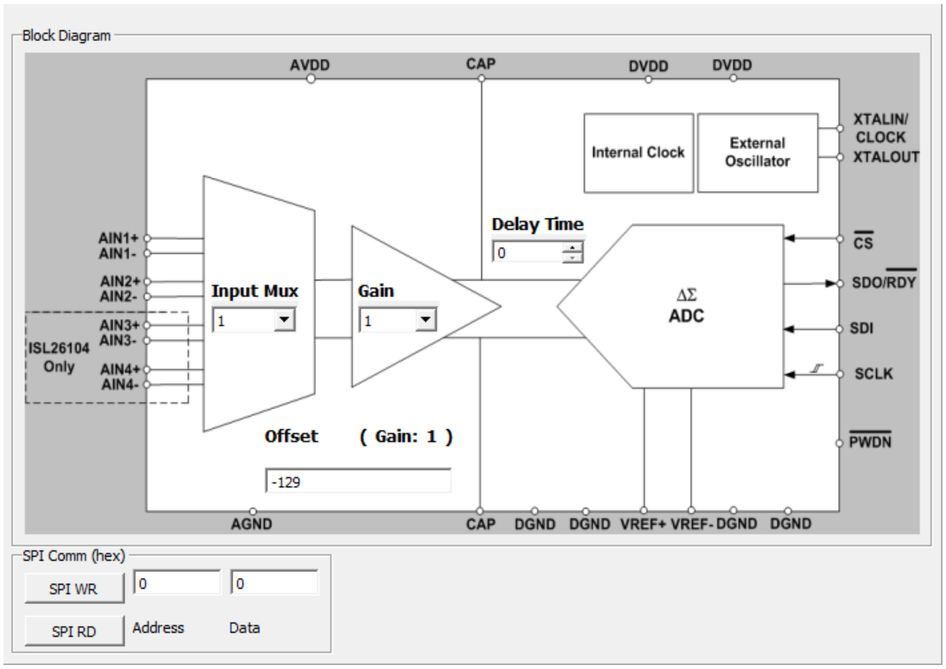


Figure 16. Gain Selection

To perform offset calibration, click the Offset Calibration button.

This issues a command for the ISL26104 to run its offset calibration operation. During offset calibration, the value of the on-chip offset registers is displayed in the Offset field in the lower left of the Configuration window.

Note that three 8-bit offset registers (high, mid, and low) inside the ISL26104 make up the entire 24-bit offset value. The decimal value of this 24-bit word is what is displayed in the Offset field as shown in Figure 17.



Input Mux 1

Gain 1

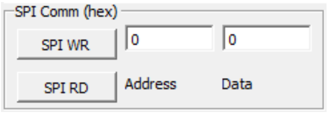
Delay Time 0

Offset (Gain: 1) -129

Address 0

Data 0

Figure 17. Offset Field



Address 0

Data 0

Figure 18. SPI Communications

The SPI Communications field is shown at the bottom of the configuration window, as shown in Figure 18.

After entering Hex values into the Address text box and the Data text box, click the **SPI WR** button to write an 8-bit value to the on-chip register associated with that address. Or, if the Data text window is empty and a Hex value is entered into the Address window, click the **SPI RD** button to read the 8-bit value of the selected register from the chip and show it in the Data text field.

For example, if you select '128' in the Gain drop-down menu and then click the **Write Values** button, the gain register in the chip will be set for a gain of 128X.

You can then use the SPI Comm feature to read the register back. Enter 17 (the address to read the on-chip gain register; do not enter the letter h or H because the text window will automatically interpret what is typed as a hex value) into the Address window and the click the **SPI RD** button. The value '7' will be returned and shown in the Data window. Hex '7' indicates that the binary value in the register was set to '00000111', gain = 128.

2.10 Signal Processing Windows

The evaluation software includes three other tabs: Time Domain, Histogram, and Frequency Domain. These tabs are shown in Figure 19.

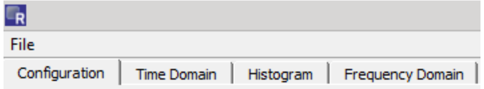


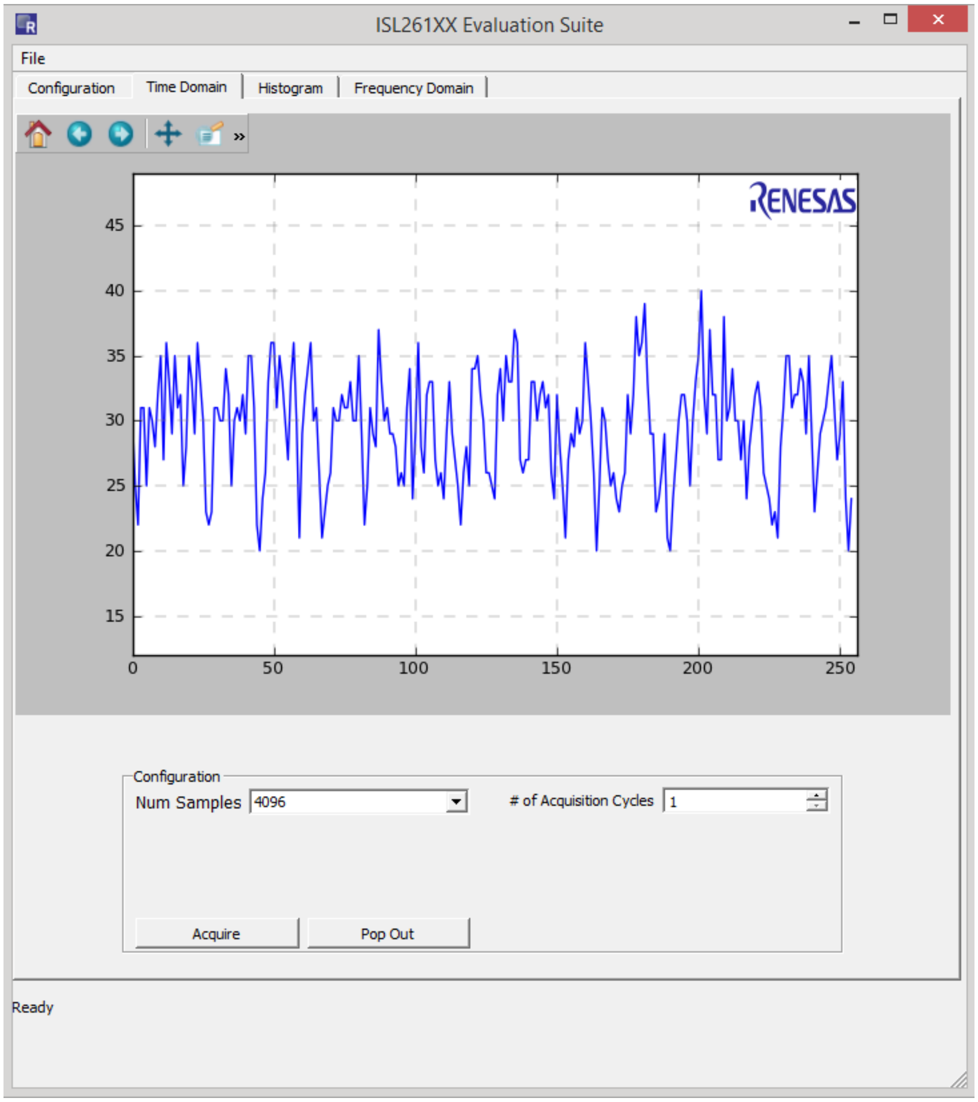
Figure 19. Main Window Tabs

Each of these windows are described in the following sections. All three allow the user to collect and process data from the ADC on the evaluation board.

2.11 Time Domain Window

Use the Time Domain window to collect samples from the ADC on the evaluation board and show them in the time domain. The number of samples is initially defaulted to 64, but can be set from 1 to 1048576 (2^{20}). If a large number of samples is requested on an ADC with a slow sample rate, be aware of the amount of time required for data collection. When the **Acquire** button is clicked, the samples are collected and transferred to the computer.

The main graphing window can graph up to 256 samples. If more than 256 samples are collected, the time plot of the entire sample set can be shown by clicking the **Pop Out** button. Figures 20 and 21 show the capture of 4096 samples. The window in Figure 20 shows only the first 256 samples. Figure 21 shows the results when the **Pop Out** button has been selected.



Num Samples: 4096

\# of Acquisition Cycles: 1

Ready

Figure 20. Time Domain Window

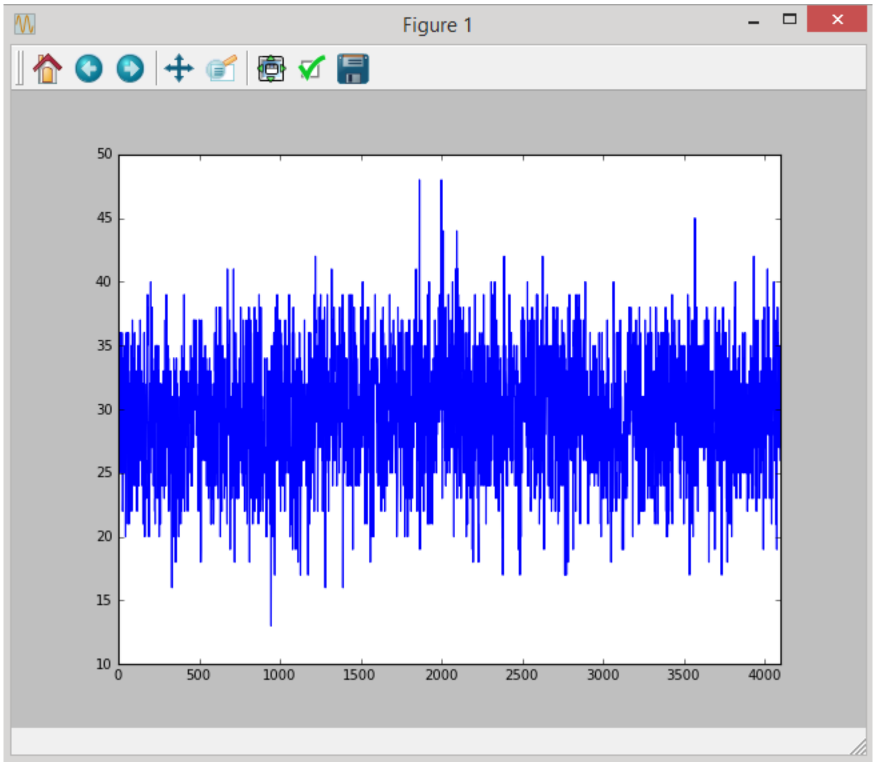


Figure 21. Time Domain Pop-Out

The buttons at the top of the plot provide several graph tool functions as follows:

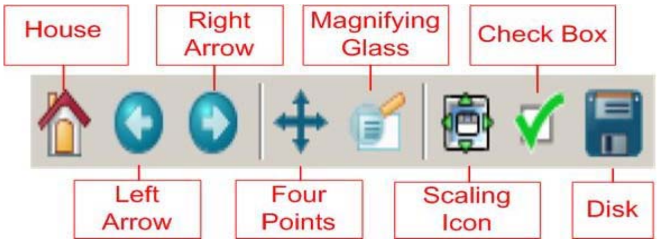


Figure 22. Graphing Toolbar

The button options shown in Figure 22 are also available in the Histogram and Frequency Domain windows.

House: Zooms to the original zoom scale factor.

Left/Right: Goes back/forward 1 zoom command. So if you zoom in twice and want to go back to the first zoom, you'd click the left arrow.

Four Points: Moves the axes around.

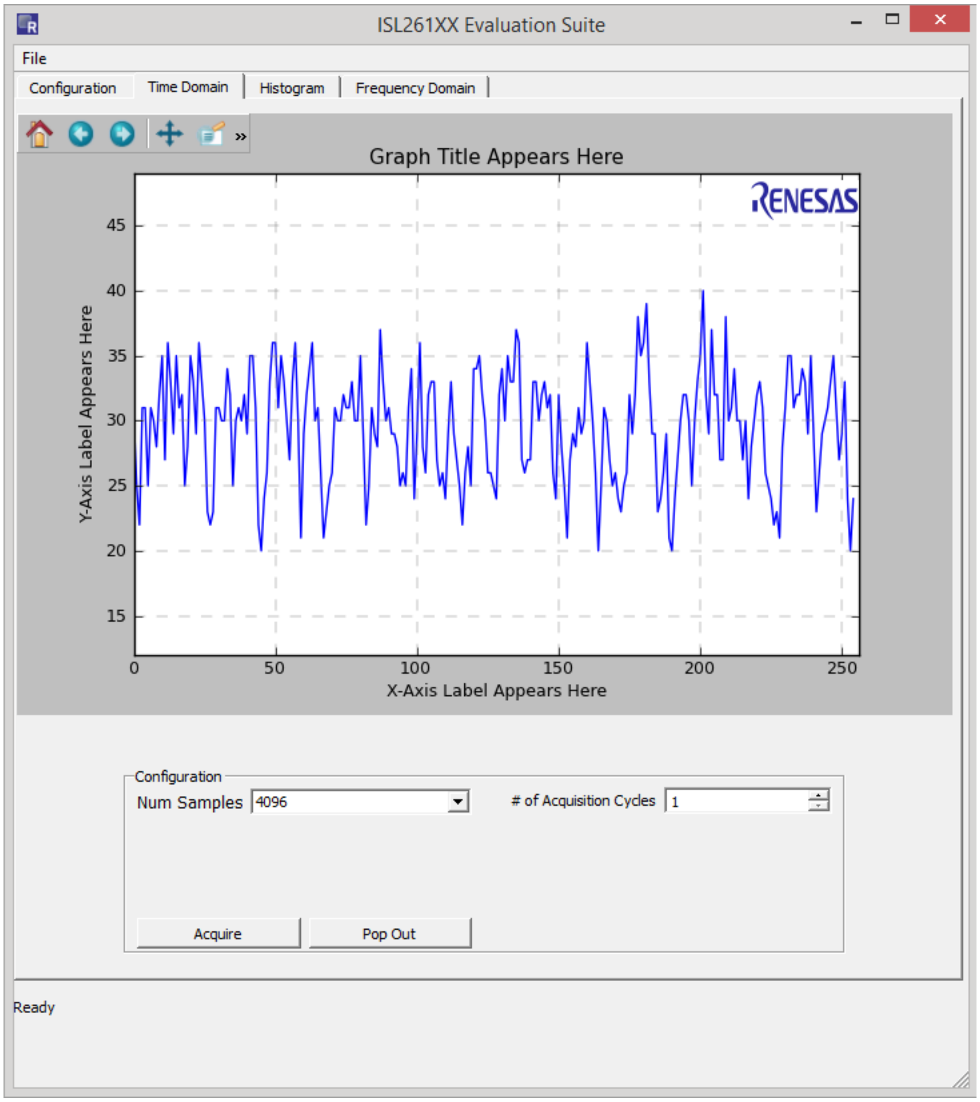
Magnifying Glass: Zoom box.

Scaling (Up/down/left/right): Changes the size of the plot in the window. You can scale the graph as large as the border.

Check Box (Customize): Allows customization of axis labels/plot title as shown in the Figure 23.

Disk (Save): Saves the plot as an image. When selected, a window will open that offers several image format options.

When the data from the ADC has been captured, it can be saved to a file. The histogram and the spectrum analysis can also be saved. See "Data File Formats" on page 30 for a discussion of the formats of the saved files. Note that the raw data (conversion words from the ADC) files can also be read back into the evaluation software after it is saved. Or data collected from another source can be read into the evaluation software for analysis if the proper data format is used. See "Data File Formats" on page 30 for details.



Num Samples 4096

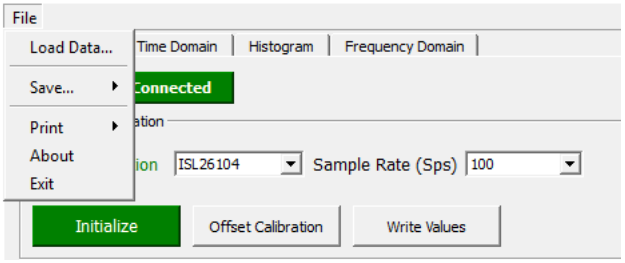
# of Acquisition Cycles 1

Ready

Figure 23. Custom Labels

2.12 File Operations

The File menu includes the following options, as shown in Figure 24.



Sample Rate (Sps) 100

Figure 24. File Menu

The File > Load Data option allows the user to read back into the evaluation software raw data (conversion words for the ADC) once saved or, data collected from another source can be read into the evaluation software for analysis if the proper data format is used. See "Data File Formats" on page 30 for more information.

The File > Save option is available only after data has been collected using the functions on the Time Domain, Histogram, or Frequency Domain windows. Figure 25 on page 19 shows that the options under the File > Save selection are Raw Data (text), Histogram Data (text), Spectrum Data (text), All Data (Excel), and Configuration. These options allow the user to save data to a file. The file formats for each of the options are discussed in "Data File Formats" on page 30. Note that the Excel format is for Excel 2003 and is limited to 65k cells, which limits the number of samples that can be saved in this format.

The File >Save > Configuration option allows the user to save the register configuration of the ADC that is being used to collect data. See "Data File Formats" on page 30 for an example configuration file format.

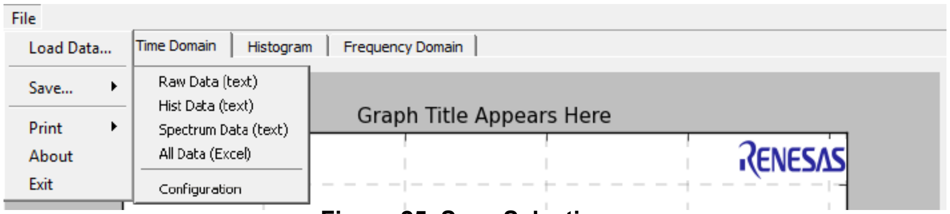
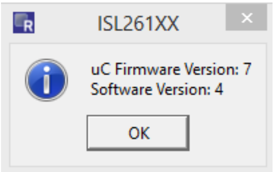


Figure 25. Save Selections

The File > About option shows the version number of the microcontroller firmware, and the evaluation software version as shown in Figure 26. The firmware version is read from the microcontroller when the evaluation software starts.



uC Firmware Version: 7
Software Version: 4

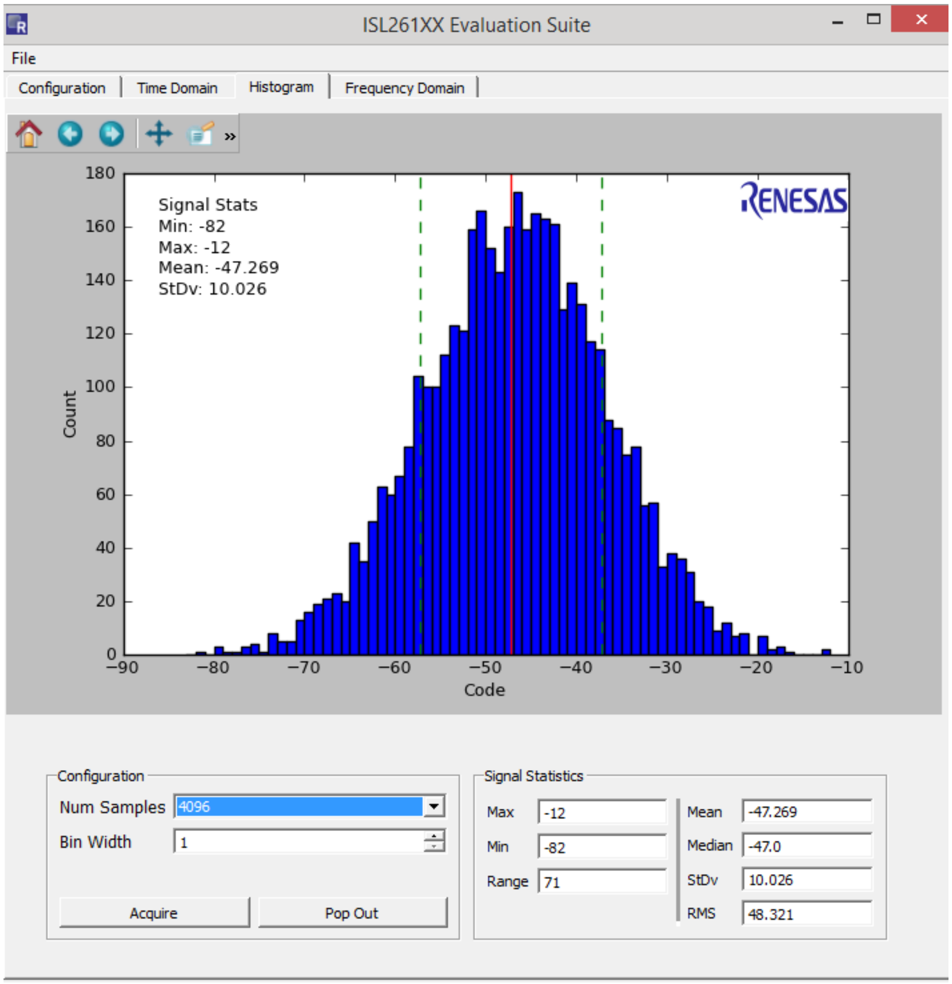
Figure 26. About Box

The File > Exit option closes the evaluation software.

2.13 Histogram Window

After collecting data using the Time Domain window, click the histogram window to plot the histogram of the time domain data. Alternatively, use the options in the Histogram window to set the number of samples to be collected and to acquire a new sample set based upon this selection. Use the Bin Width window to set the number of converter codes that are counted in one bin of the histogram. This number is “1” by default.

When the histogram is plotted, the plot includes markers for the mean value (red vertical line) and for one standard deviation from the mean on each side (green dashed lines). Signal statistics are listed in the plot itself and in the text boxes below the graph as shown in Figure 27. The **Pop Out** button shows the graph without the statistics listed.



Signal Stats
Min: -82
Max: -12
Mean: -47.269
StDv: 10.026

Num Samples 4096

Bin Width 1

Max -12

Min -82

Range 71

Mean -47.269

Median -47.0

StDv 10.026

RMS 48.321

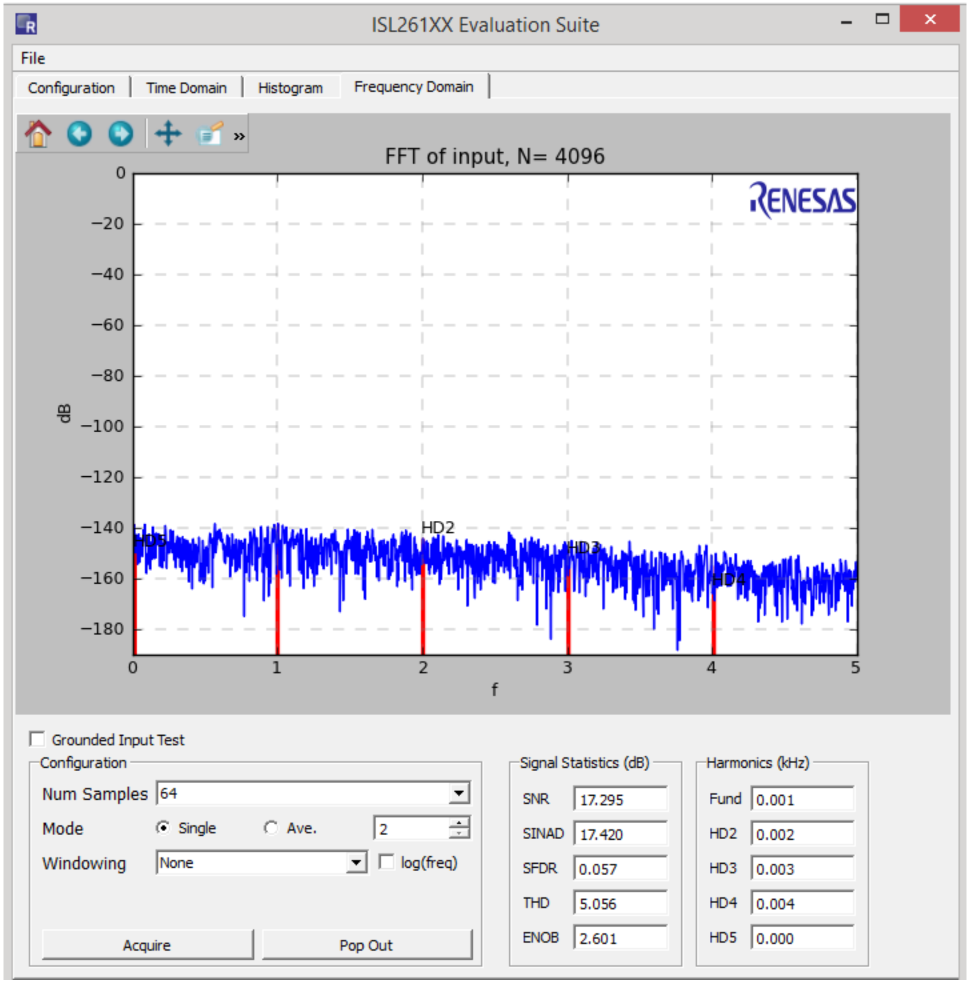
Figure 27. Histogram Window

2.14 Frequency Domain Window

After collecting data using the Time Domain window or the Histogram window, click the Frequency Domain menu option to process the data with the FFT algorithm and show the resulting spectral information, as shown in Figure 28.

The red lines indicate harmonics. If no signal is present, the software assumes the highest point in the spectrum is the fundamental. If the log(freq) check box is selected, the spectral plot will be graphed with the frequency axis on a Log scale, as shown in Figure 29. If the Grounded Input Test check box is selected, and data is collected with the input of the converter shorted, the evaluation software will calculate the various parameters such as SNR (signal to noise ratio) by computing the ratio of an artificial full scale sine wave to the total noise in the bandwidth.

Select the Grounded Input Test option only if there is no actual signal input into the converter (the board provides a means to short both differential inputs to an ADC channel to a common mode voltage for this test). Note that if the Grounded Input Test check box is not selected, the software will compute parameters such as SNR by calculating the ratio of the largest magnitude component in the spectrum (other than the DC offset) to the noise.



☐ Grounded Input Test

Configuration

Num Samples 64

Mode ● Single ○ Ave. 2

Windowing None ☐ log(freq)

Signal Statistics (dB)

SNR 17.295

SINAD 17.420

SFDR 0.057

THD 5.056

ENOB 2.601

Harmonics (kHz)

Fund 0.001

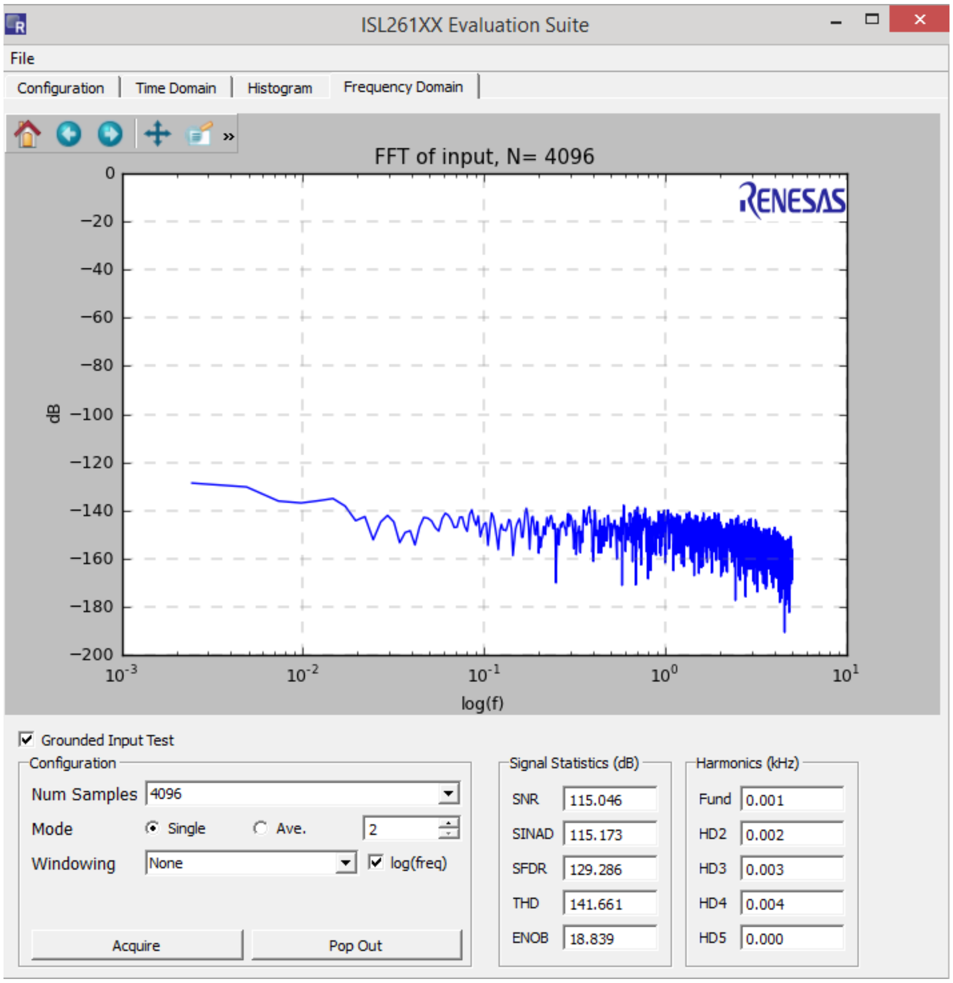
HD2 0.002

HD3 0.003

HD4 0.004

HD5 0.000

Figure 28. Frequency Domain Window



☑ Grounded Input Test

Configuration

Num Samples: 4096

Mode: ● Single ○ Ave. 2

Windowing: None ☑ log(freq)

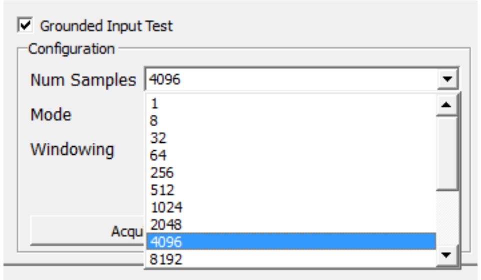
Signal Statistics (dB)	
SNR	115.046
SINAD	115.173
SFDR	129.286
THD	141.661
ENOB	18.839

Harmonics (kHz)	
Fund	0.001
HD2	0.002
HD3	0.003
HD4	0.004
HD5	0.000

Figure 29. Frequency Domain Log Scale

The Frequency Domain window includes several different selectable options.

The number of samples can be set up to 1048576 (2^{20}) using a drop-down menu as shown in Figure 30. Note that the frequency domain software (FFT computation) must have at least 1024 samples to compute a proper spectral plot. The software allows several different window functions to be used.



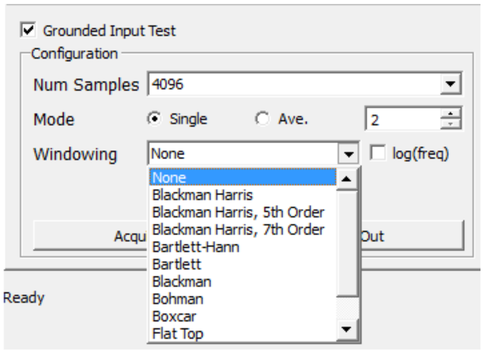
☑ Grounded Input Test

Configuration

Num Samples: 4096

Figure 30. Number of Samples

The different windowing options can be selected in the Windowing menu as shown in Figure 31. These options are typically used when testing with a sine wave as the input signal. The software supports other ADC platforms (higher speed SAR ADCs) that commonly use these windowing options.



☑ Grounded Input Test

Configuration

Num Samples 4096

Mode ● Single ○ Ave. 2

Windowing None ☐ log(freq)

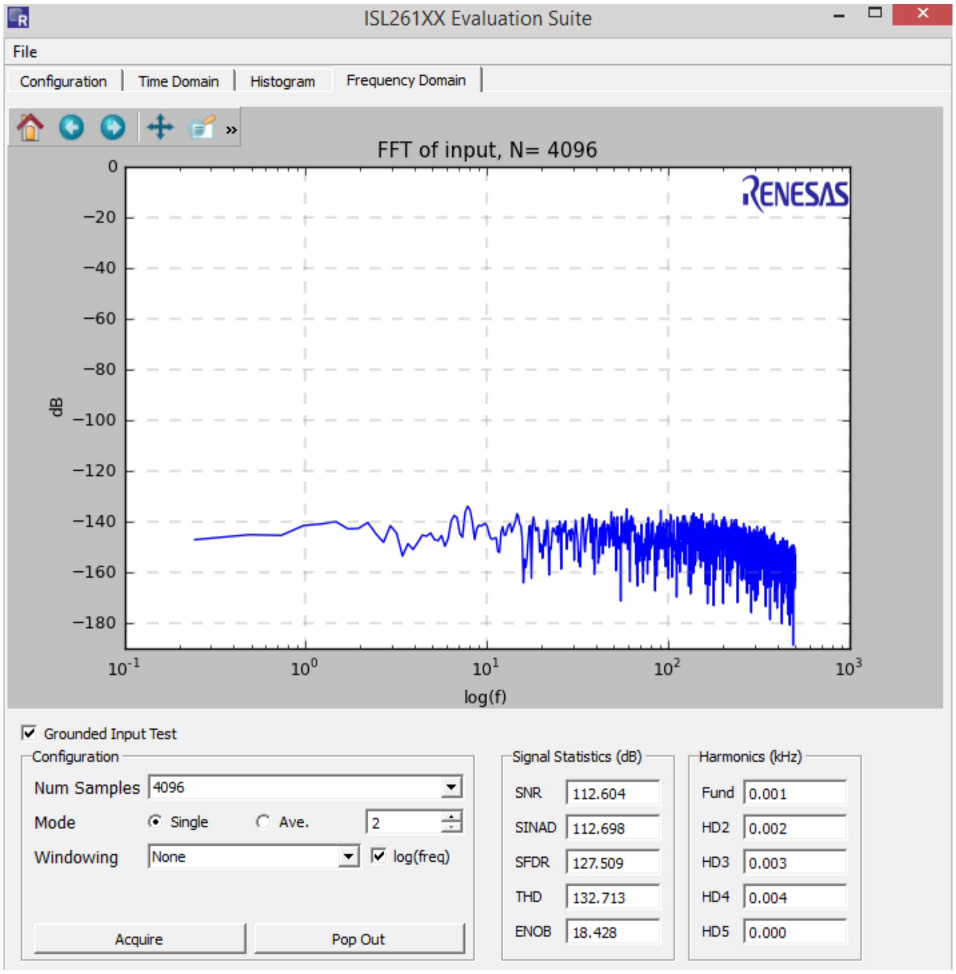
Ready

Figure 31. Windowing Options

Figure 32 illustrates the spectral plot of one data set of 4096 samples. For this data collection, the ADC had its gain set to 1X and its sample rate set to 1000Sps.

The results of the FFT can be averaged by setting the **Mode** radio button to **Ave.** and then using the window next to the **Ave.** button to set the number of data sets to be averaged. When averaging is performed, the output results of many FFTs are averaged and are used to produce a spectral plot with a smoothed (averaged) spectrum as shown in Figure 33.

The spectrum plot data can be saved by clicking File > Save > Spectrum Data from the top of the window.



☑ Grounded Input Test

Configuration

Num Samples: 4096

Mode: ● Single ○ Ave. 2

Windowing: None ☑ log(freq)

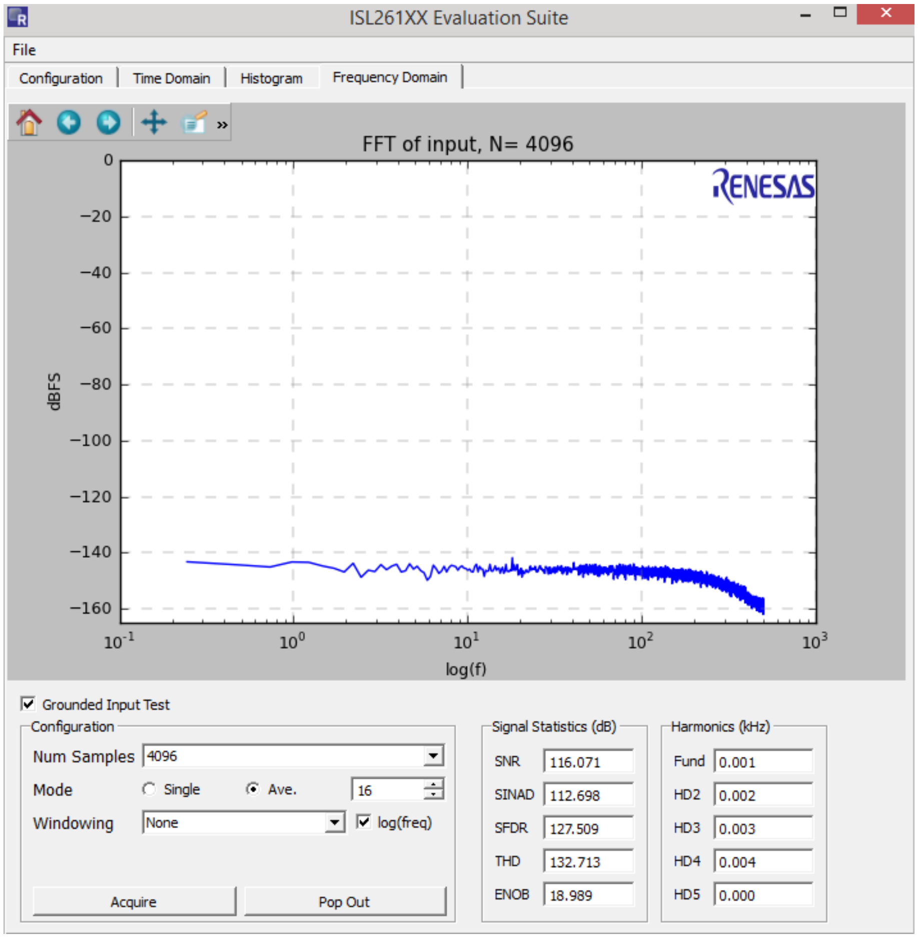
Signal Statistics (dB)

SNR	112.604
SINAD	112.698
SFDR	127.509
THD	132.713
ENOB	18.428

Harmonics (kHz)

Fund	0.001
HD2	0.002
HD3	0.003
HD4	0.004
HD5	0.000

Figure 32. Spectral Plot Sample



☑ Grounded Input Test

Configuration

Num Samples: 4096

Mode: ○ Single ● Ave. 16

Windowing: None ☑ log(freq)

Signal Statistics (dB)

SNR: 116.071
SINAD: 112.698
SFDR: 127.509
THD: 132.713
ENOB: 18.989

Harmonics (kHz)

Fund: 0.001
HD2: 0.002
HD3: 0.003
HD4: 0.004
HD5: 0.000

Figure 33. Spectral Plot with Smoothed Spectrum

3. PCB Layout Guidelines

3.1 Evaluation Board Layout and Component Placement

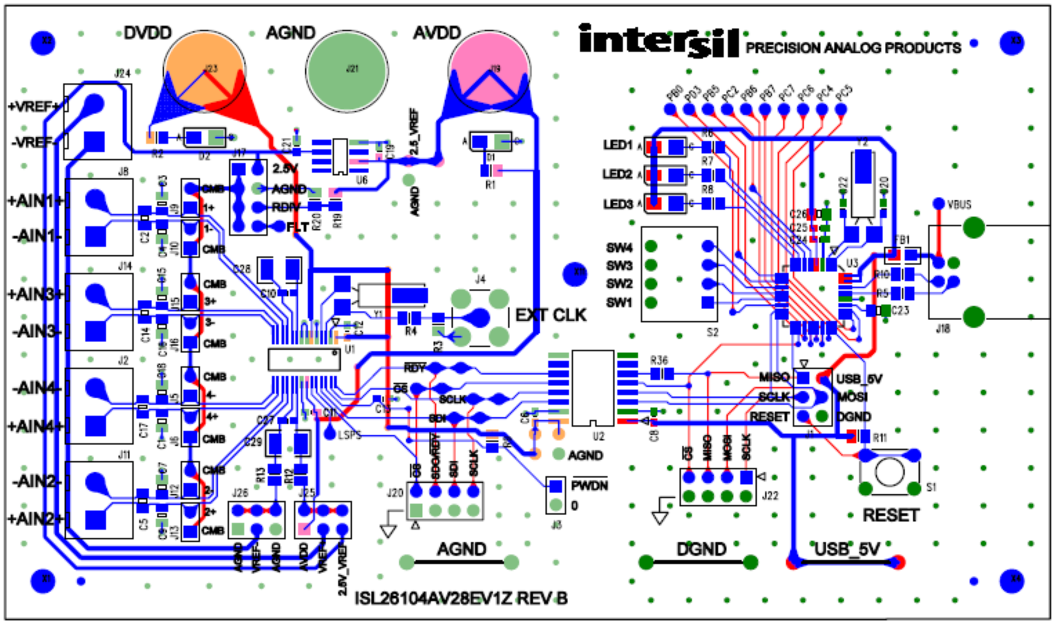


Figure 34. Evaluation Board Layout

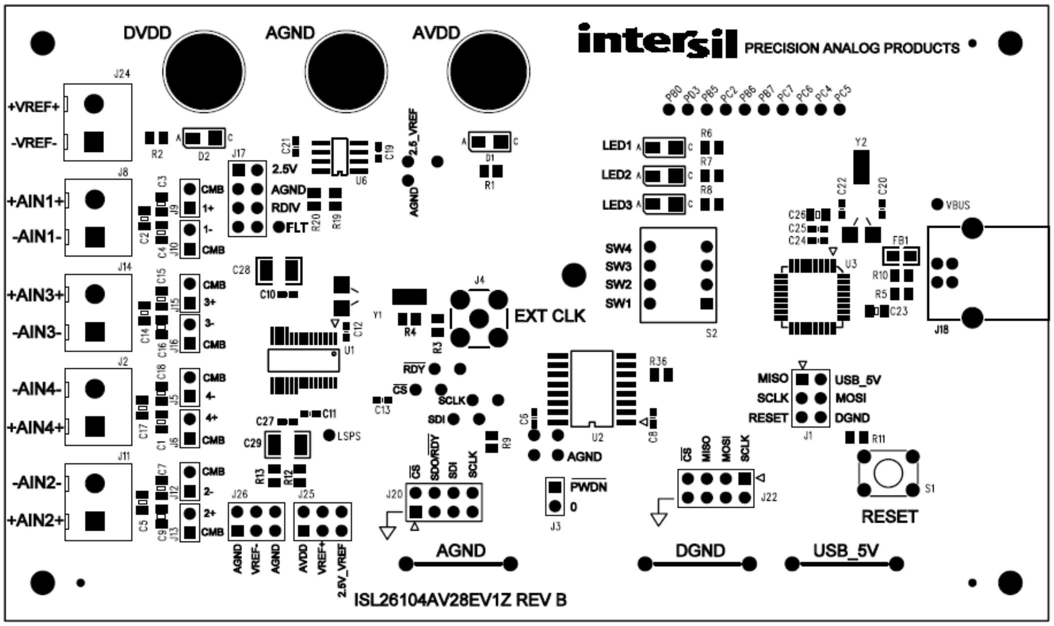


Figure 35. Component Placement

3.2 Schematics

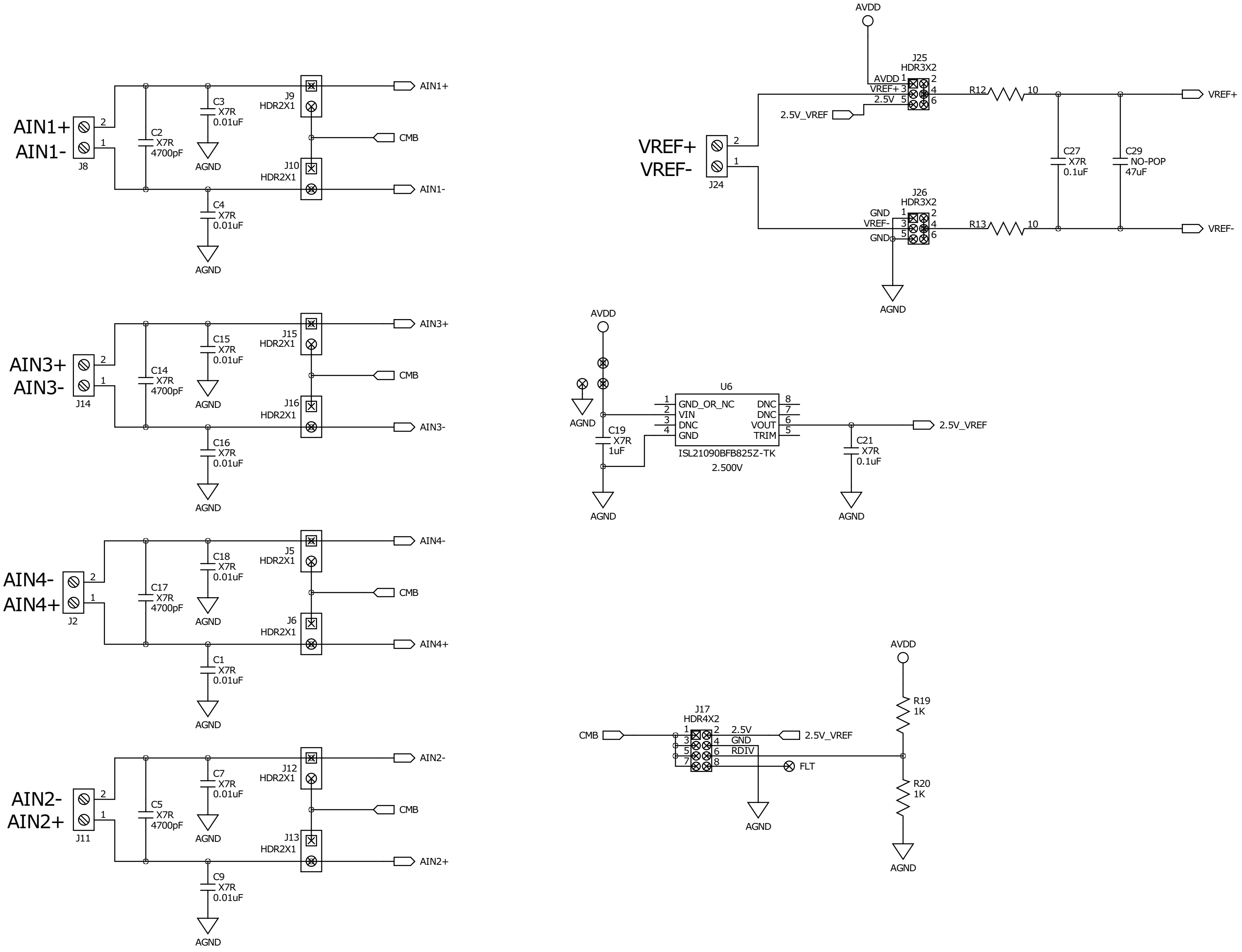


Figure 36. ISL26104AV28EV1Z Schematic - 1

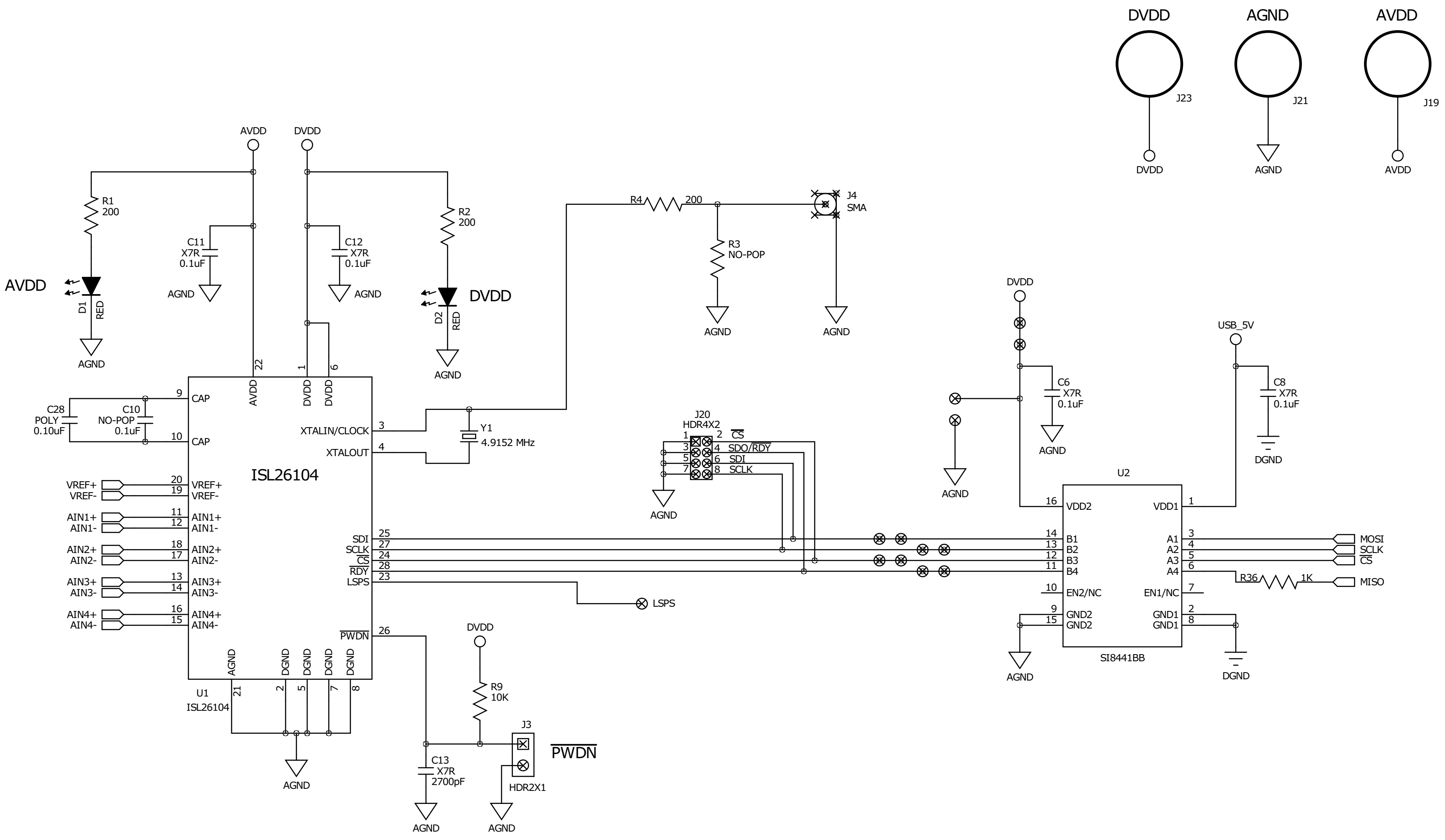


Figure 37. ISL26104AV28EV1Z Schematic - 2

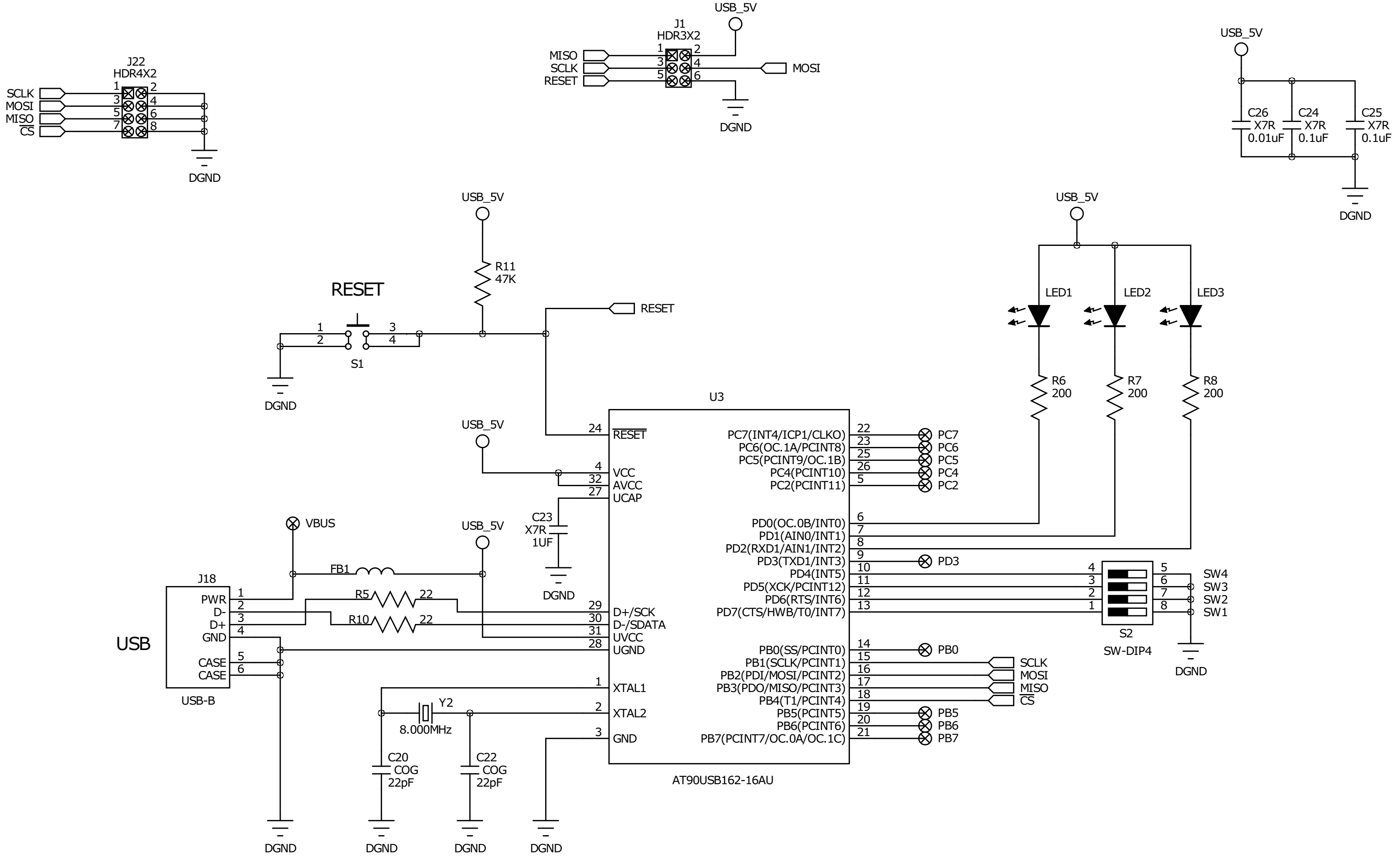


Figure 38. ISL26104AV28EV1Z Schematic - 3

4. Data File Formats

The evaluation software allows the user to save data from the time domain (raw data), data from the histogram processing, and data from the spectrum processing segments of the software. It also allows raw data (time domain data) files to be read back into the evaluation software if they have the proper header and format.

4.1 Raw Data

As an example, a time domain collection of only 8 samples has been collected and saved to a file. The content of the file that is saved has the following format:

```
ISL26104
10.0
24
8
-214
-226
-241
-234
-219
-213
-224
-224
```

The file has a header that consists of the part number (ISL26104), the sample rate (10), the number of bits in the conversion word (24), and the number of samples in the file (8). The header is followed by the 8 conversions words in signed decimal format.

4.2 Histogram Data

A data collection of 1024 data words was collected and the histogram performed. The histogram data was then saved into a file. The content of the file has the following format. The histogram statistics are listed first, followed by the converter codes and their respective histogram counts.

```
Signal Statistics
Min: 23
Max: 35
Range: 13
Mean: 29.356
StDv: 1.976

Code          Hits
21            0
22            0
23            1
24            2
25            8
26            58
27            103
28            179
29            229
30            164
31            129
32            89
33            34
34            21
35            7
36            0
```

4.3 Spectrum Data

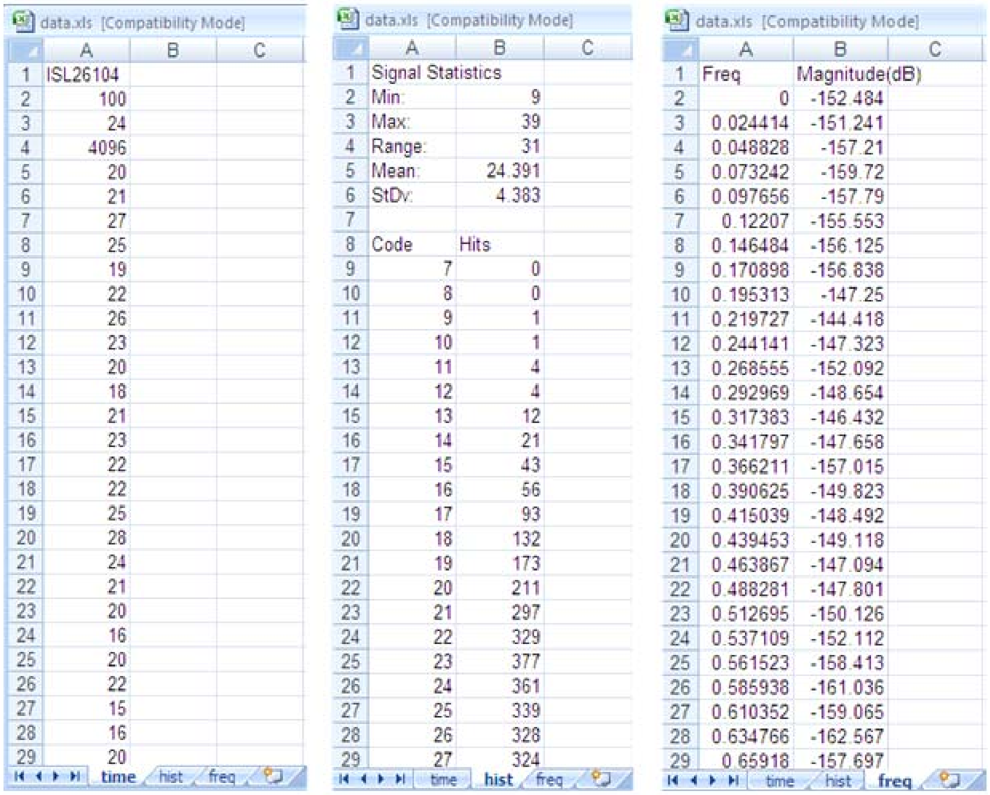
A data set of 1024 points was collected at a sample rate of 100Sps. The FFT output will produce a spectrum plot with 512 Bins of magnitude data. Only the beginning and ending portion of the data file has been reproduced here to save space. Note that the Bins start at 0 frequency and increase to one half the sample rate (50Hz). Note that the magnitude in dB is the magnitude of the noise in dB below full scale rms but it is scaled based upon magnitude/√BIN, not magnitude/√Hz.

Freq	Magnitude(dB)
0.0	-127.490860112
0.09765625	-130.138393031
0.1953125	-139.550586747
0.29296875	-132.866111959
0.390625	-127.884217984
0.48828125	-126.538951953
0.5859375	-126.769048076
0.68359375	-131.31820625
0.78125	-149.352655015
0.87890625	-134.478247602
0.9765625	-139.032099632
1.07421875	-133.269604586
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	
48.92578125	-144.77615475
49.0234375	-154.371891495
49.12109375	-142.708481612
49.21875	-138.531922503
49.31640625	-138.378824752
49.4140625	-142.563086329
49.51171875	-158.690364592
49.609375	-144.250894284
49.70703125	-142.996812327
49.8046875	-144.030316874
49.8046875	-144.707081022

4.4 Excel Data Format

Use the File > Save > Excel option to save the Time Domain, Histogram and Frequency Domain data to an Excel file with each of the three data sets on a different sheets as shown in Figure 39.

Note that the Excel format is for Excel 2003 and is limited to 65k cells, which limits the number of samples that can be saved in this format.



	A	B	C
1	ISL26104		
2	100		
3	24		
4	4096		
5	20		
6	21		
7	27		
8	25		
9	19		
10	22		
11	26		
12	23		
13	20		
14	18		
15	21		
16	23		
17	22		
18	22		
19	25		
20	28		
21	24		
22	21		
23	20		
24	16		
25	20		
26	22		
27	15		
28	16		
29	20		

	A	B	C
1	Signal Statistics		
2	Min:	9	
3	Max:	39	
4	Range:	31	
5	Mean:	24.391	
6	StDv:	4.383	
7			
8	Code	Hits	
9	7	0	
10	8	0	
11	9	1	
12	10	1	
13	11	4	
14	12	4	
15	13	12	
16	14	21	
17	15	43	
18	16	56	
19	17	93	
20	18	132	
21	19	173	
22	20	211	
23	21	297	
24	22	329	
25	23	377	
26	24	361	
27	25	339	
28	26	328	
29	27	324	

	A	B	C
1	Freq	Magnitude(dB)	
2	0	-152.484	
3	0.024414	-151.241	
4	0.048828	-157.21	
5	0.073242	-159.72	
6	0.097656	-157.79	
7	0.12207	-155.553	
8	0.146484	-156.125	
9	0.170898	-156.838	
10	0.195313	-147.25	
11	0.219727	-144.418	
12	0.244141	-147.323	
13	0.268555	-152.092	
14	0.292969	-148.654	
15	0.317383	-146.432	
16	0.341797	-147.658	
17	0.366211	-157.015	
18	0.390625	-149.823	
19	0.415039	-148.492	
20	0.439453	-149.118	
21	0.463867	-147.094	
22	0.488281	-147.801	
23	0.512695	-150.126	
24	0.537109	-152.112	
25	0.561523	-158.413	
26	0.585938	-161.036	
27	0.610352	-159.065	
28	0.634766	-162.567	
29	0.65918	-157.697	

Figure 39. Excel Data

4.5 Configuration Data

Table 1. Configuration Data

ISL26104 Register Name	Register Address	Register Value (Hex)
Word Rate	0x85	0xb
Input Mux	0x87	0x0
Channel Ptr	0x88	0x0
PGA Gain	0x97	0x0
Delay Timer	0xc2	0x0

4.6 Load Data Function

The evaluation software allows raw (time domain) data to be loaded back into the evaluation software. Alternately, the user might collect data in another system and import the conversion word data into the evaluation software to perform analysis. To be able to read the data the file must have the proper header, as described in "Raw Data" on page 30.

The header must have a header with a part number (this can be something other than a chip number), sample rate, number of bits in the converter, and the number of samples, followed by the data in decimal format. The largest value of any reading cannot exceed one half $2^{\text{(number of bits in the converter).}}$ For example, if the number of bits in the converter is 12, then the largest reading can be no greater than (2^{12})/2 or 2048.

```
ISL26104 > part number
100.0             > sample rate
24                > number of bits in the converter
8                 > number of data samples in the file
-394              > conversion data in signed decimal format
-361
-405
-411
-397
-416
-423
-416
```

5. USB VID and PID

The VID (Vendor ID) and PID (Product ID) for the evaluation board can be found in the Windows Systems Information under Components > USB. The VID for Intersil is 09AA and the PID for the evaluation board is 201C. The device will be listed as a HID Compliant device with the VID and PID indicated as follows:

HID-compliant device HID\VID_09AA&PID_201C\6&2ADC8489&0&0000

6. Evaluation Board Factory Jumper Settings

Figure 40 shows the position of the header shunts when the board is shipped from the factory.

Header J17 is connected with the 2.5V reference selected as the common mode voltage.

Headers J9 and J10 are shorted with shunts to connect the common mode voltage to the AIN1+ and AIN1- signals coming from the terminal block connector. This effectively shorts both inputs to Channel 1 on the ADC to the common mode voltage and enables the ADC to be tested with a shorted input. One or both of these jumpers must be removed if the ADC is to measure a signal on this channel.

Headers J25 and J26: the 2.5V_VREF option is selected on J25. The AGND option is selected on J26. These enable the 2.5V voltage reference chip to be the voltage reference for the ADC.

DIP switch: Switches S2-1, S2-2, S2-3, and S2-4 must be placed in the off position. If the switches are placed with any switch in the closed (ON) position, the microcontroller will be put into a factory test mode, or into a non-functional state. If the microcontroller is in either of these states, it will not communicate properly with the evaluation software.

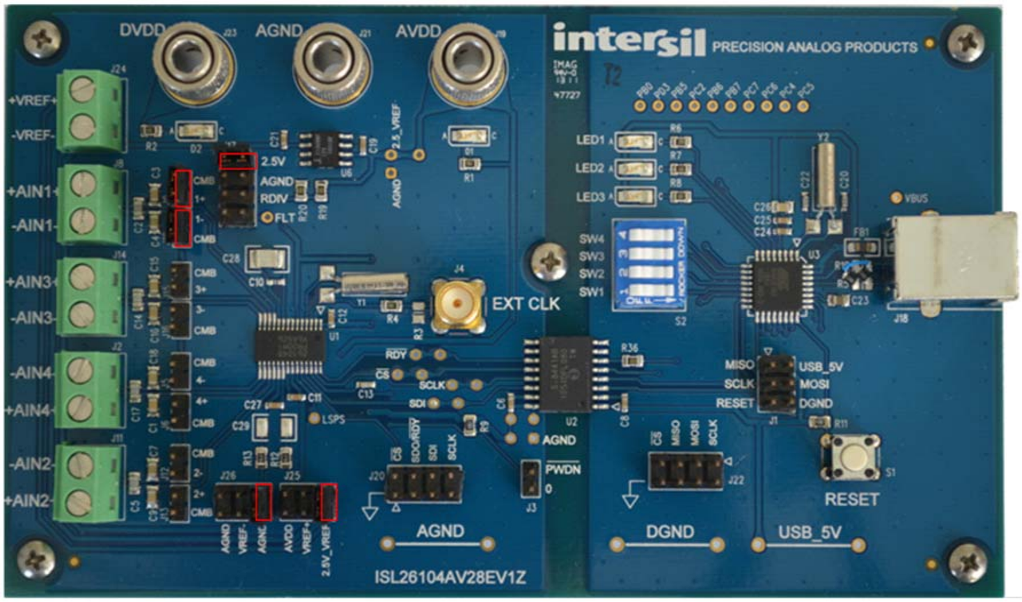


Figure 40. Jumper Settings

7. Revision History

Rev.	Date	Description
1.00	Dec 15, 2017	In Figures 2, 5, and 38, changed the part number from ISL21009 to ISL21090. In Figures 8 and 36, changed pin 6 label from RVIV to RDIV. In Section 2.4, changed ISL21009BFZ25 to ISL21090BFB825Z-TK. Updated screen captures to reflect new branding in the user interface. Updated the document to the current format.
0.00	Dec 18, 2012	Initial release

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