FDC2114 and FDC2214 EVM User’s Guide

User's Guide

Literature Number: SNOU138A
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FDC2114 and FDC2214 EVM User's Guide

1 Overview

The FDC2114/2214 EVM demonstrates the use of capacitive sensing technology to sense and measure the presence or position of target objects. The EVM contains two example LC tank sensors that are connected to the FDC2114/2214 input channels. The latter is controlled by an MSP430, which interfaces to a host computer.

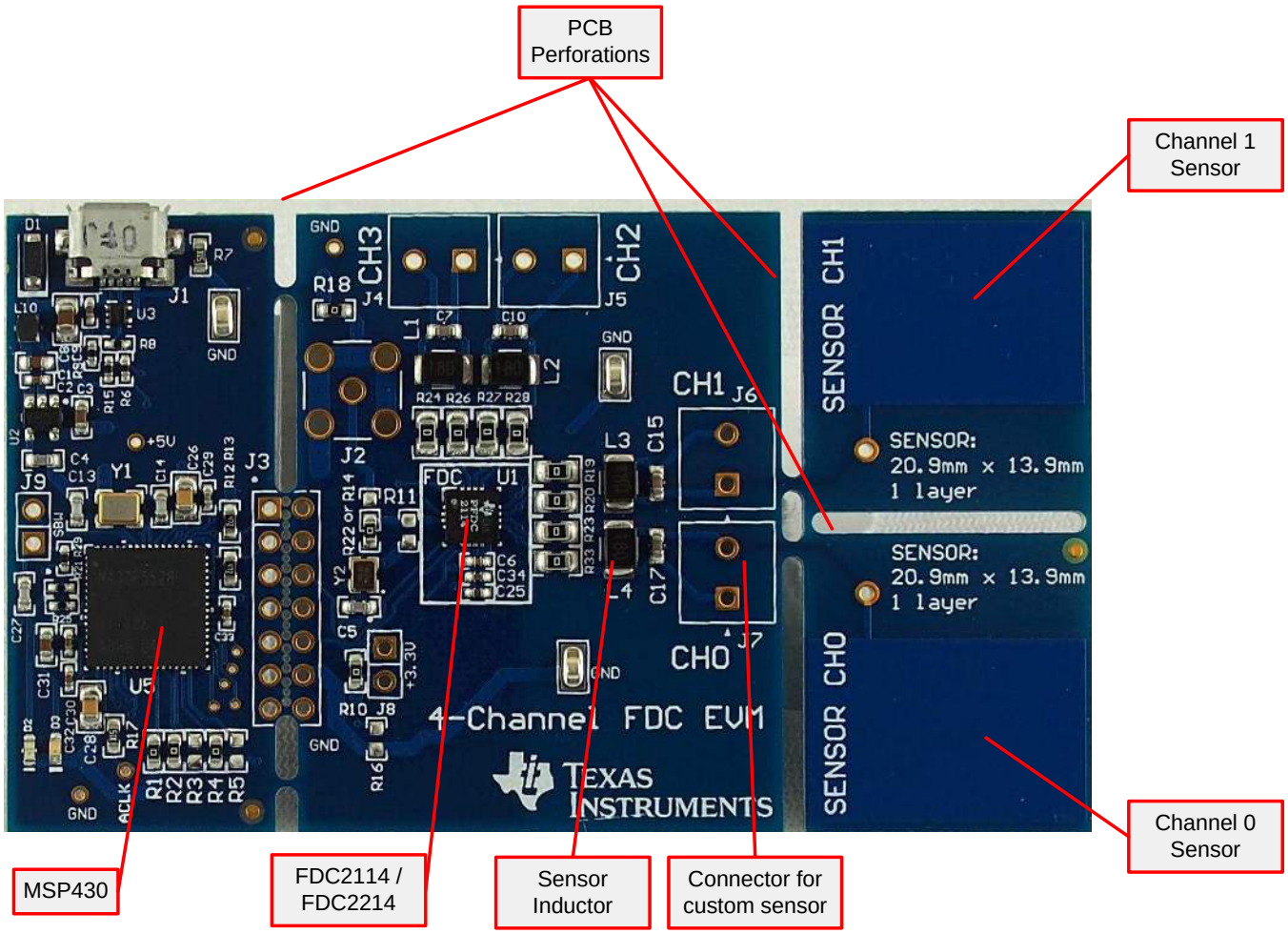


Figure 1. FDC2114/2214 Evaluation Module

The FDC2114/2214EVM includes two example PCB sensors. Each sensor consists of a single-layer capacitor plate, a 33pF 1% COG/NP0 capacitor, and a 18μH connected in parallel to form an LC tank.

PCB perforations allow separation of the sensor coils or the microcontroller, so that custom sensors or a different microcontroller can be connected.

2 Sensing Solutions EVM GUI

The Sensing Solutions EVM GUI provides direct device register access, user-friendly configuration, and data streaming.

2.1 System Requirements

The host machine is required for device configuration and data streaming. The following steps are necessary to prepare the EVM for the GUI:

- The GUI and EVM driver must be installed on a host computer
- - The EVM must be connected to a full speed USB port (USB 1.0 or above)

The Sensing Solutions EVM GUI supports the following operating systems (both 32-bit and 64-bit):

- Windows XP
- Windows 7
- Windows 8 and 8.1
- Windows 10

2.2 Installation Instructions

The Sensing Solutions GUI and EVM driver installer is packaged in a zip file. Follow these steps to install the software:

1. Download the software ZIP file from the EVM tool page
2. Extract the downloaded ZIP file
3. Run the included executable
4. If prompted by the User Account Control about making changes to the computer, click "Yes"

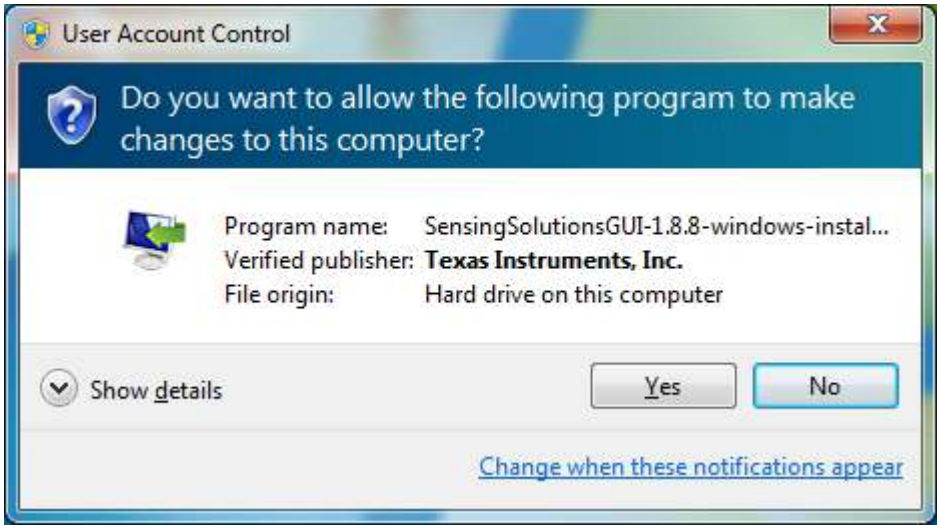


Figure 2. User Account Control Prompt

5. After the setup wizard starts, click "Next"

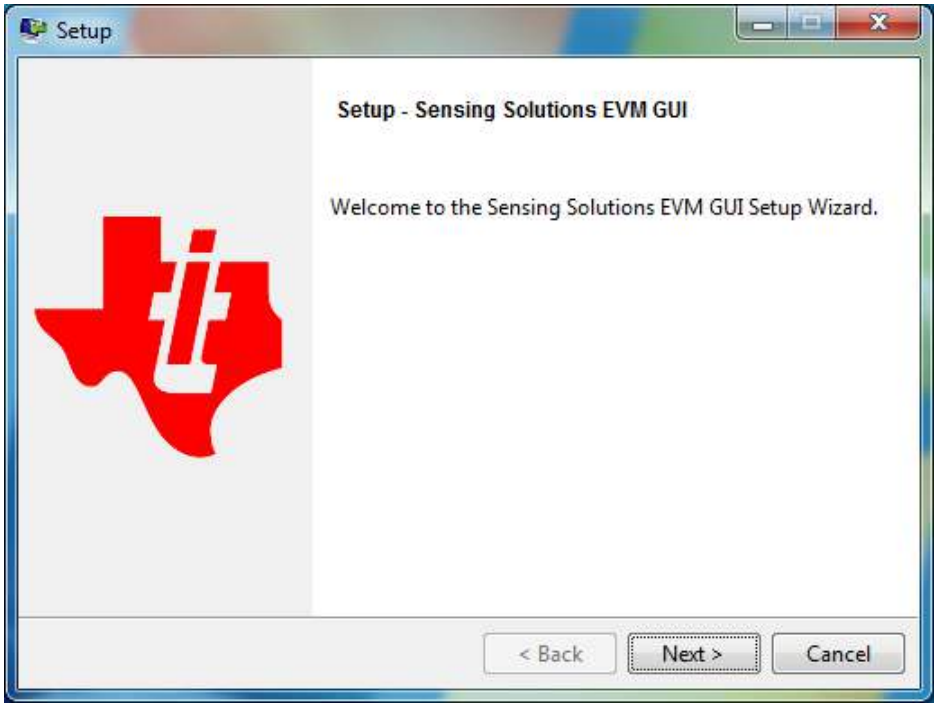


Figure 3. Software Installer Wizard

6. Read the license agreement, select "I accept the agreement", and click "Next"

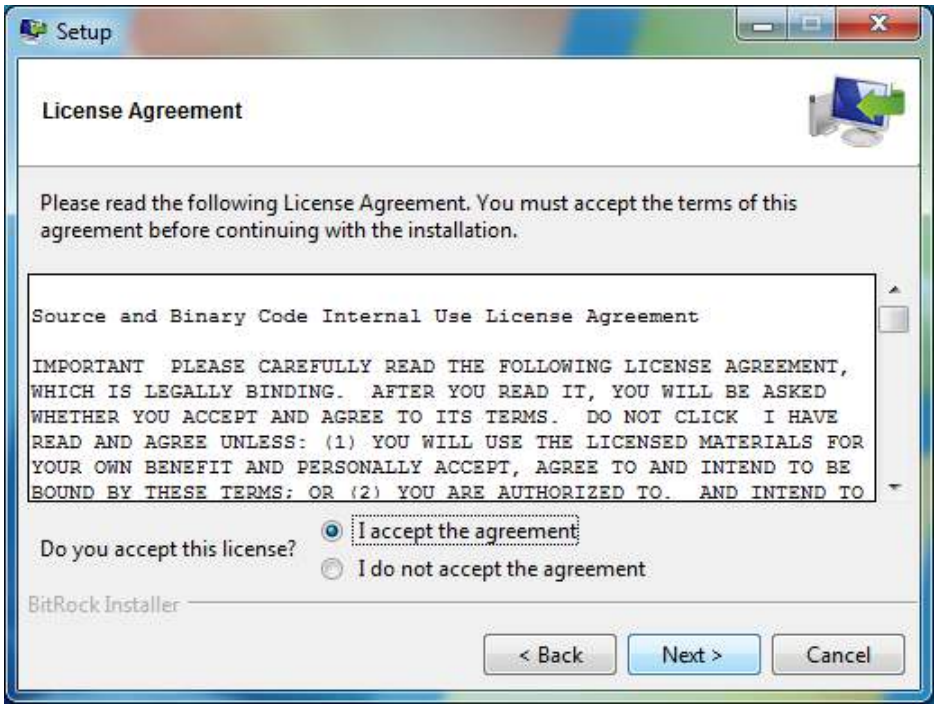


Figure 4. Software Installer License Agreement

7. Use the preselected installation directory and click "Next"

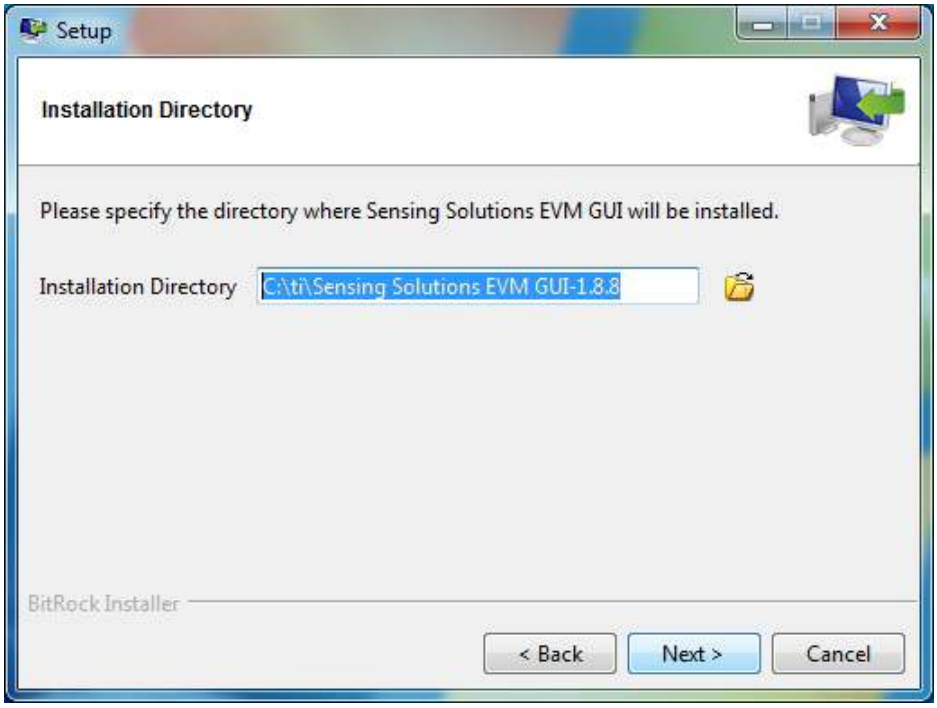


Figure 5. Software Installation Directory

8. Start the installation by clicking "Next"

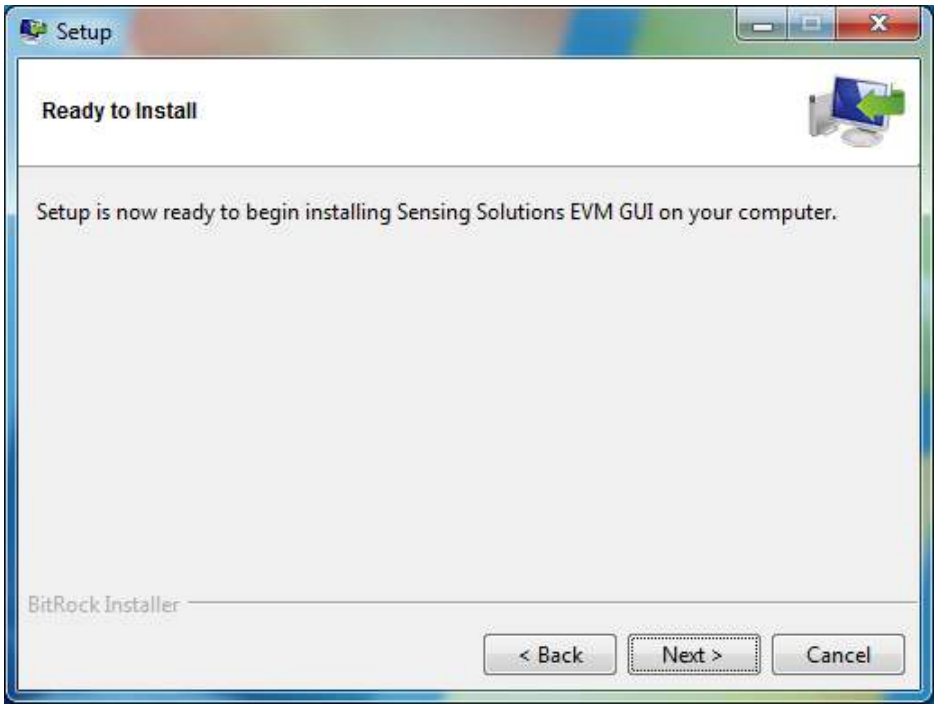


Figure 6. Software Installer Ready

9. Wait for the installation to complete

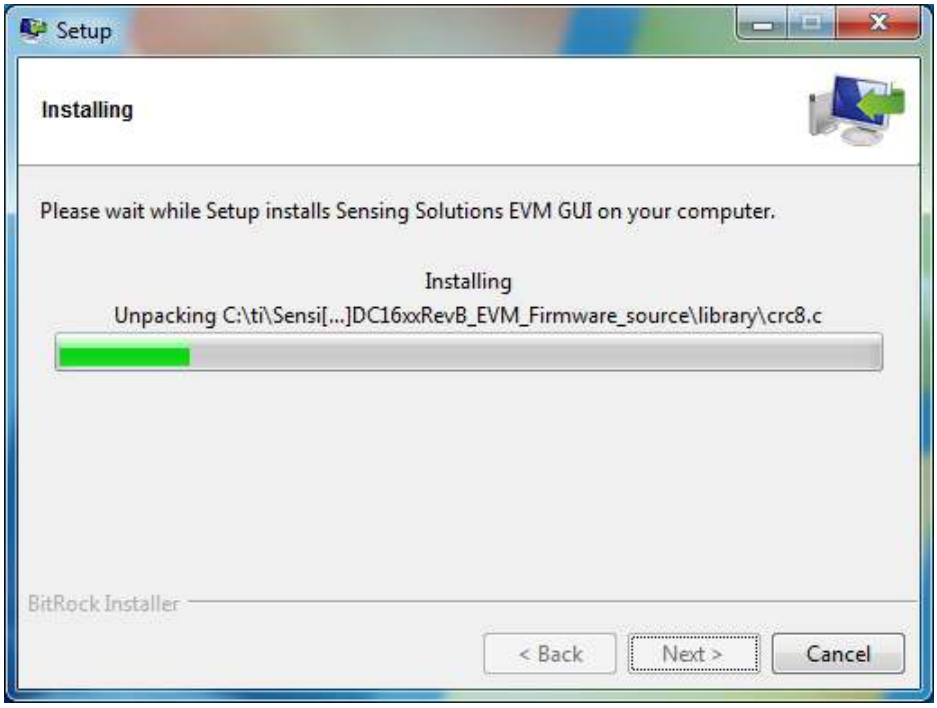


Figure 7. Software Installer In Progress

10. When the "Device Driver Installation Wizard" appears, click "Next" to install the EVM driver

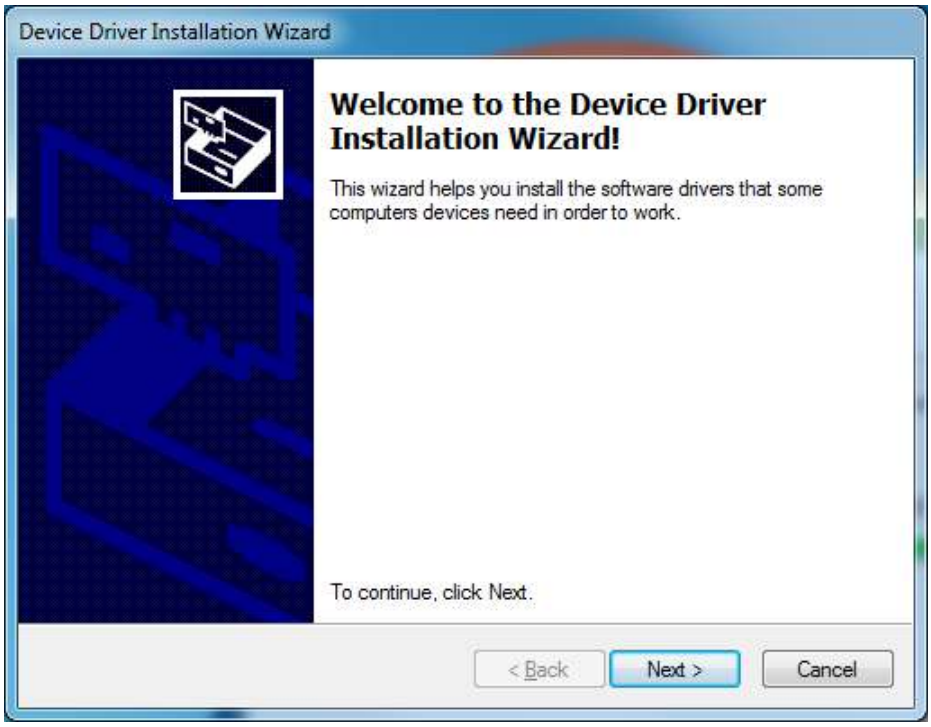


Figure 8. Device Driver Installer Wizard

11. Wait for the driver installation to complete.

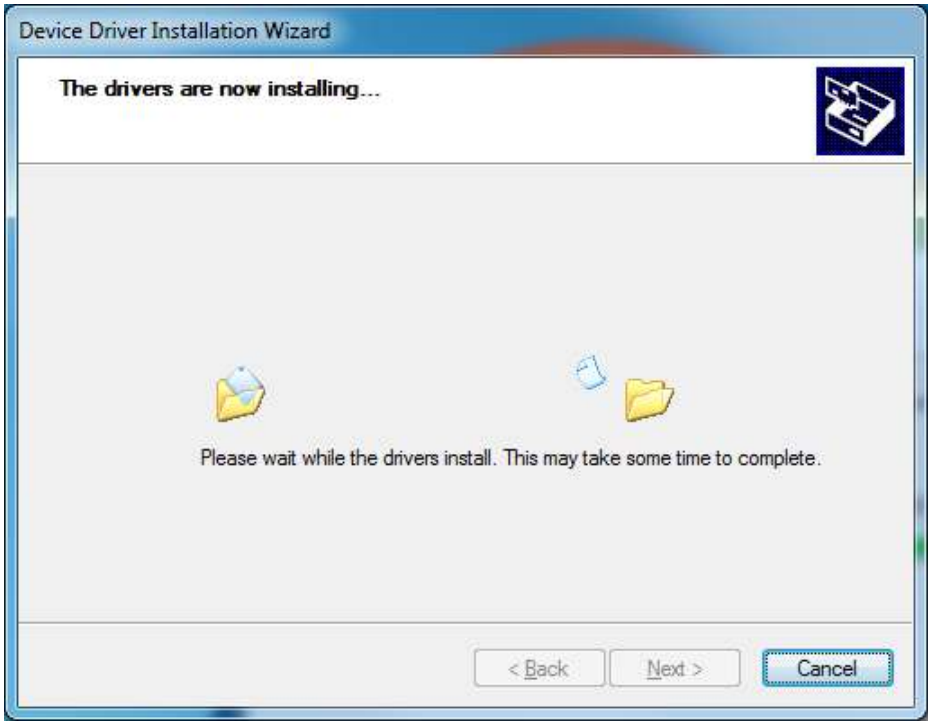


Figure 9. Device Driver Installer In Progress

12. After the driver installation is completed, click "Finish".

Figure 10. Device Driver Installer Completed

13. Click "Finish" to complete the installation.

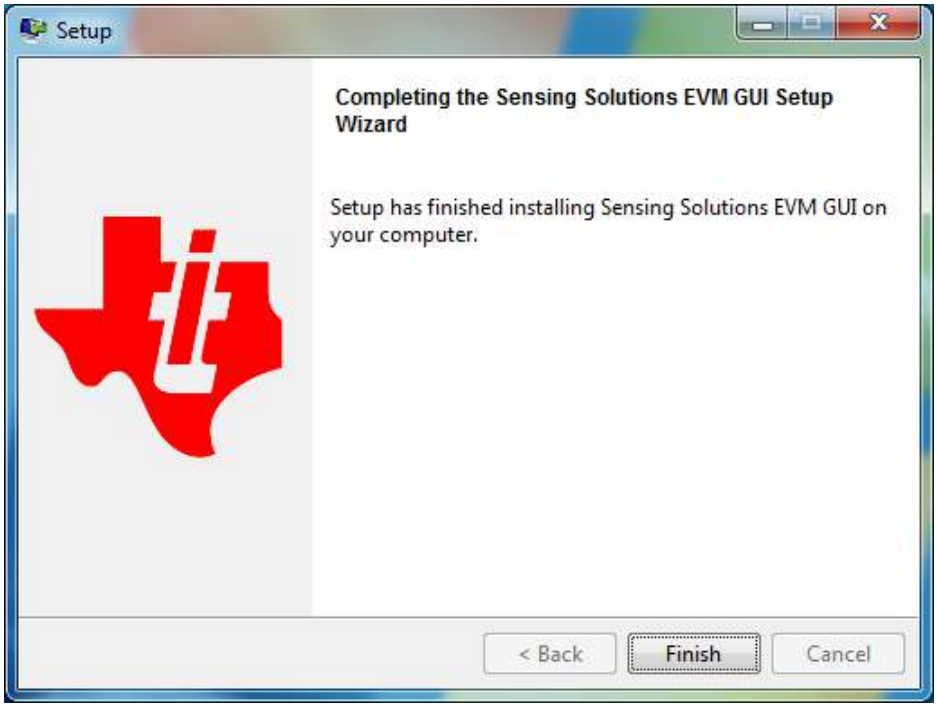


Figure 11. Software Installer Completed

2.3 Starting the GUI

Follow these steps to start the GUI:

1. Select the Windows start menu
2. Select "All programs"
3. Select "Texas Instruments"
4. Select "Sensing Solutions EVM GUI"
5. Click "Sensing Solutions EVM GUI"
6. Splash screen will appear for at least two seconds

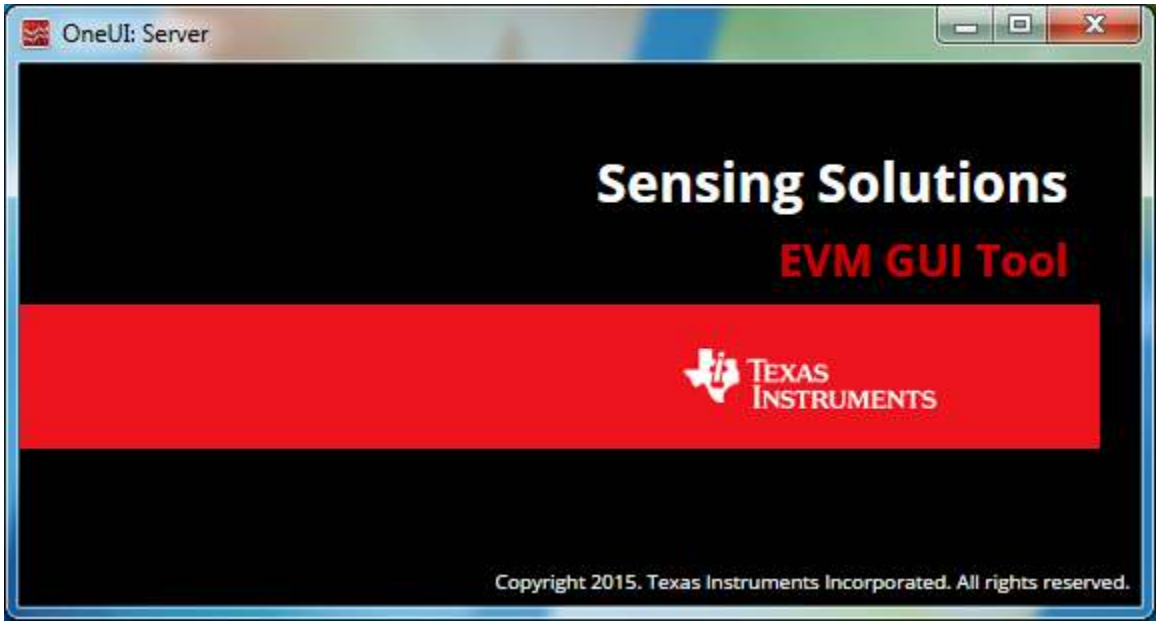


Figure 12. Splash Screen

7. After the splash screen is displayed the main window will open

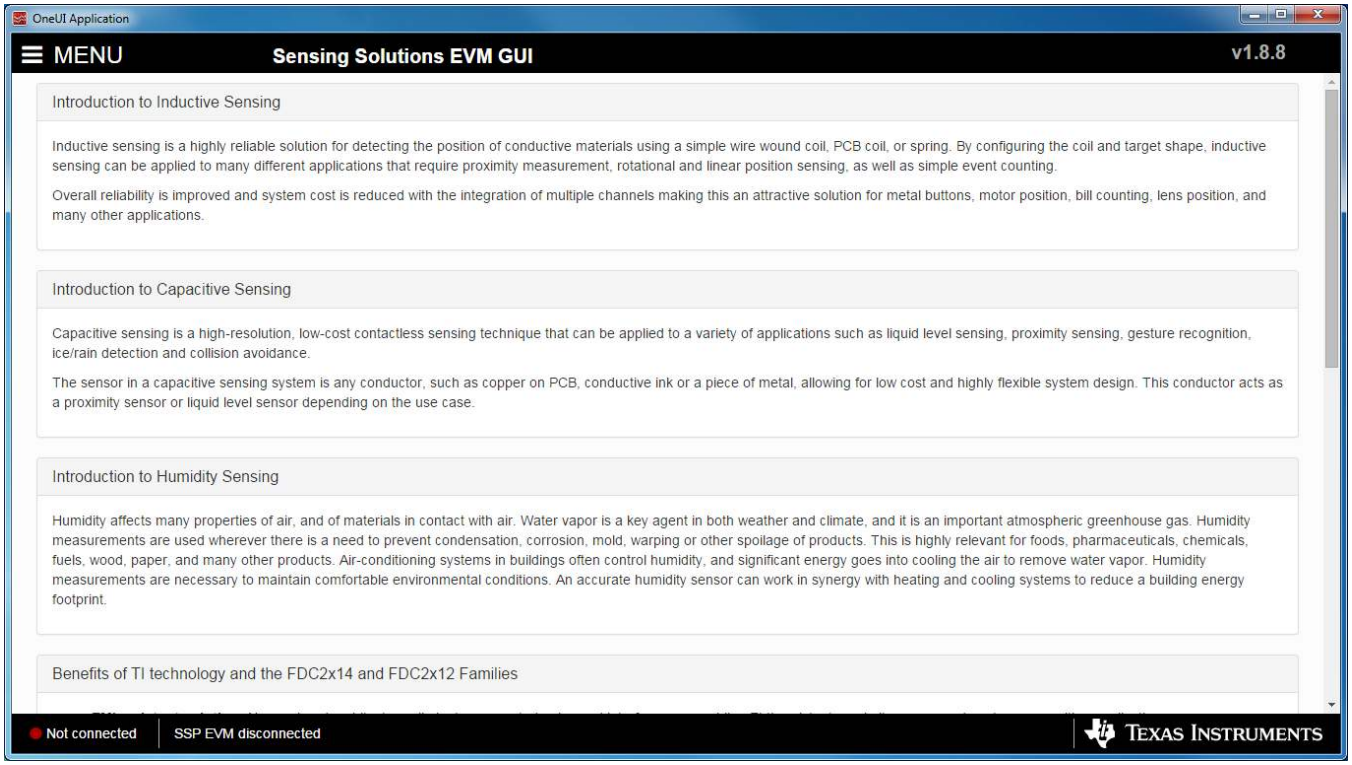


Figure 13. Introduction Page

2.4 Navigating the GUI

To navigate to different pages of the GUI follow these steps:

1. Click “Menu” in the upper left corner

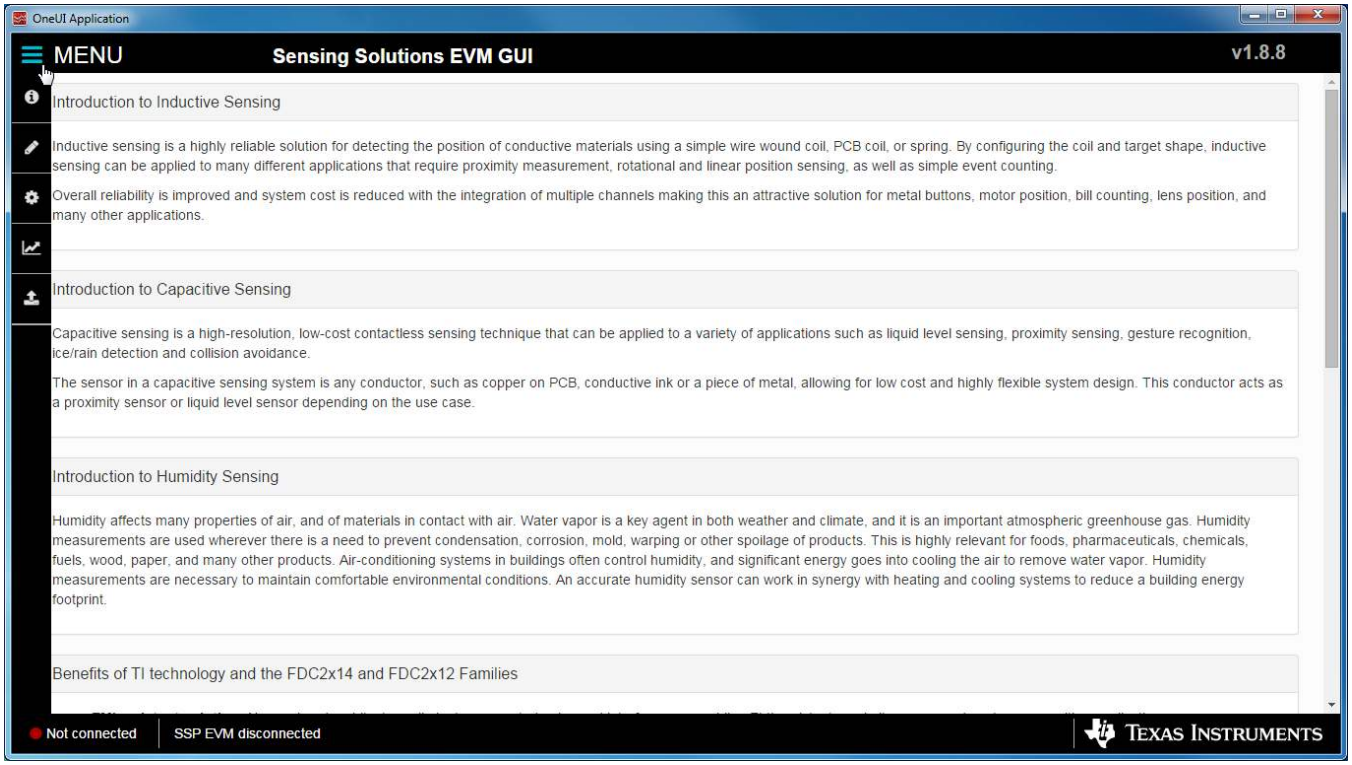


Figure 14. Mouse Hovered Over Menu Button

2. Select the desired page from the menu shown on the left

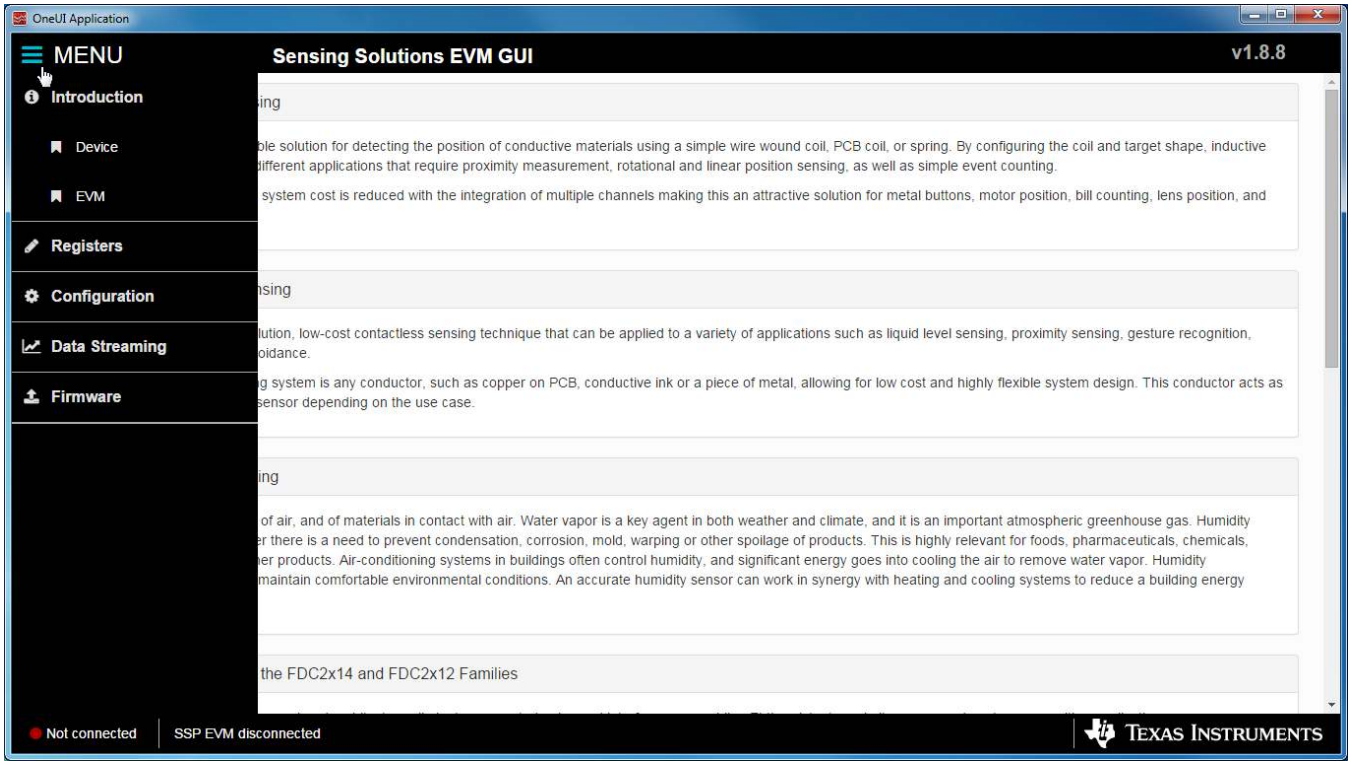


Figure 15. Menu Display After Clicking Button

2.5 Connecting the EVM

Follow these steps to connect the EVM to the GUI:

1. Attach the EVM to the computer via USB
2. The GUI always shows the connection status on the bottom left corner of the GUI

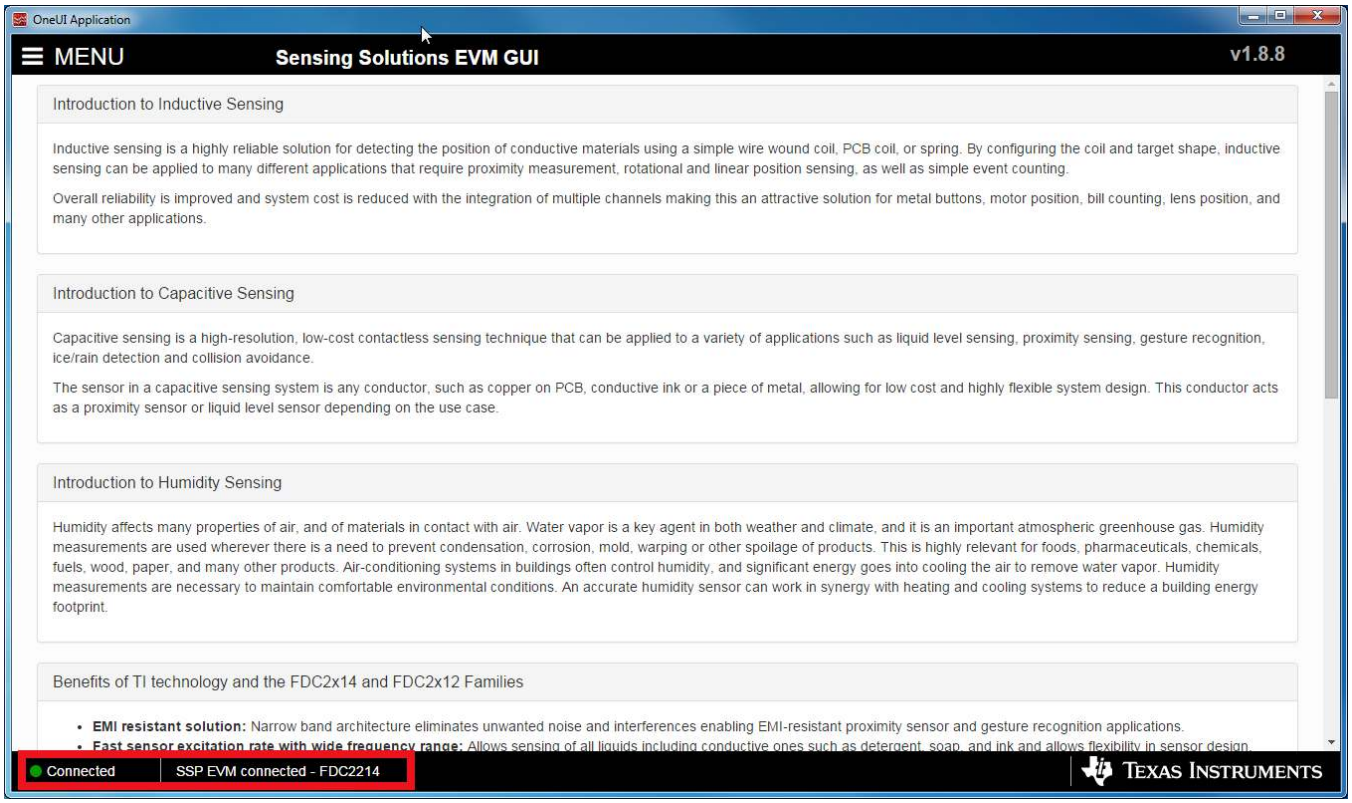


Figure 16. EVM Connected to GUI

2.6 Configuring the EVM Using the Register Page

The register page allows users to control the device directly with the register values. The user may also use this page to read the currect register values on the device.

2.6.1 Automatically Update GUI Register Values Using Auto-Read

Autoread will periodically request the register values on the device. Click the dropdown box next to “Auto Read” to select the update interval.

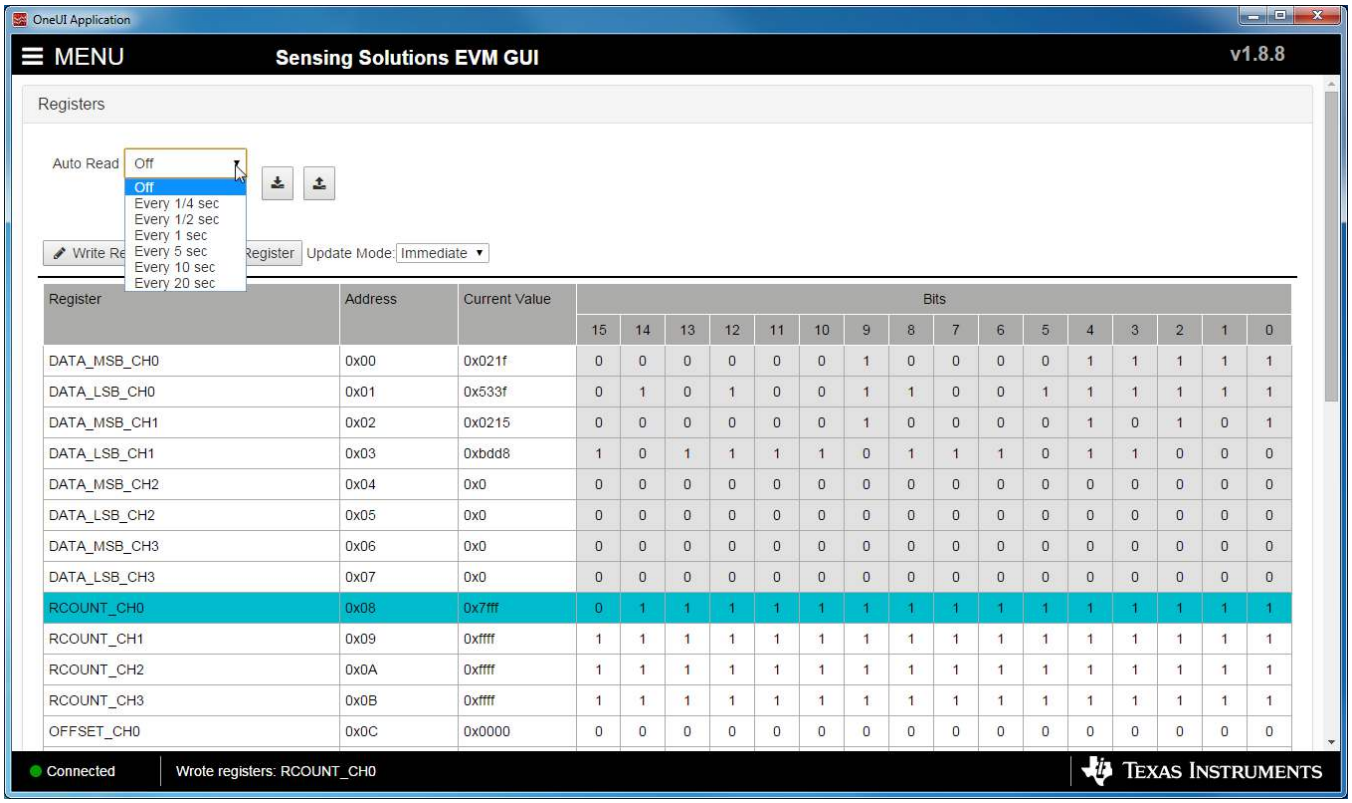


Figure 17. Selecting Auto-Read Interval on Register Page

2.6.2 Manually Update Device Register Values

There are two methods to change register values: update the entire register value or change a single bit within the register. The recommended update mode is always “Immediate” and not “Deferred”. To update register values, follow these steps.

1. Double-click the current value of the register that needs to be changed. The text will turn into an editable text box

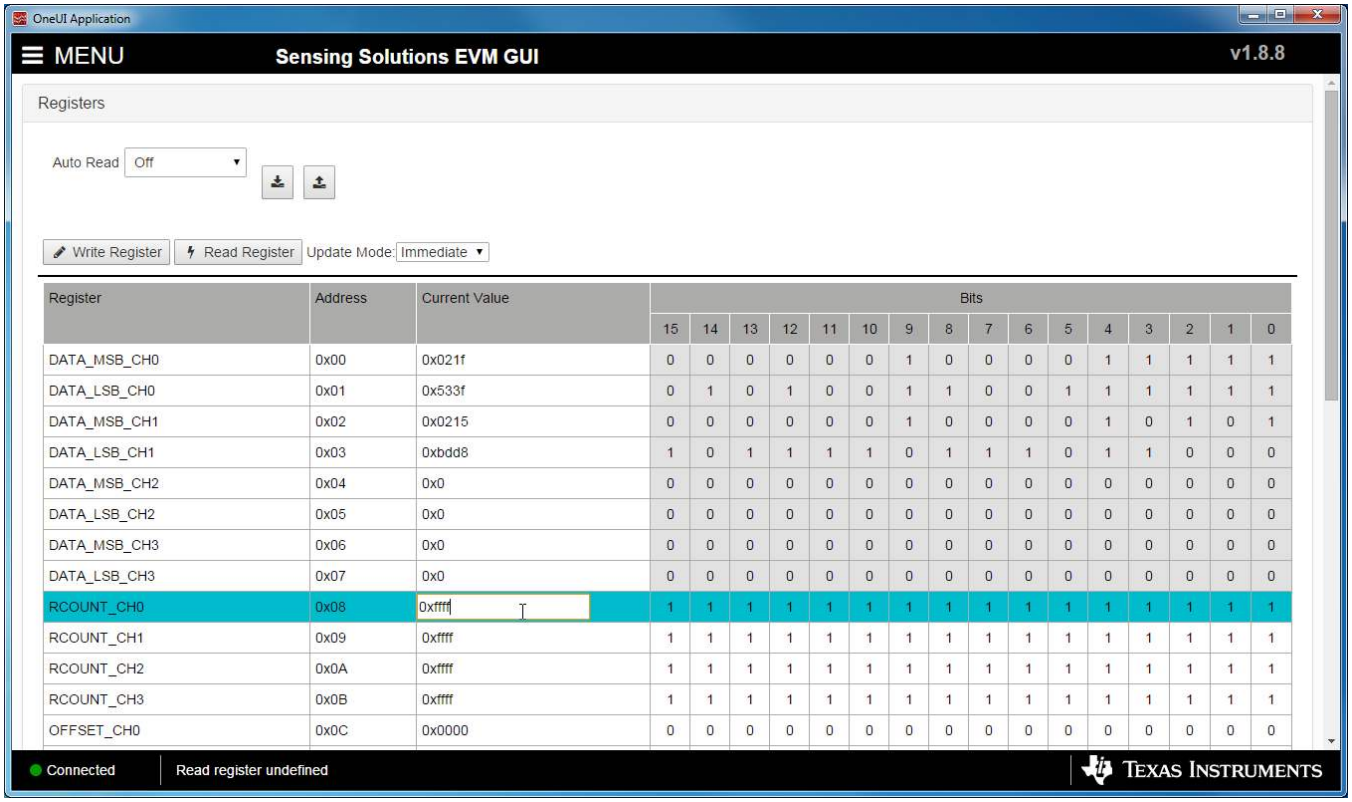
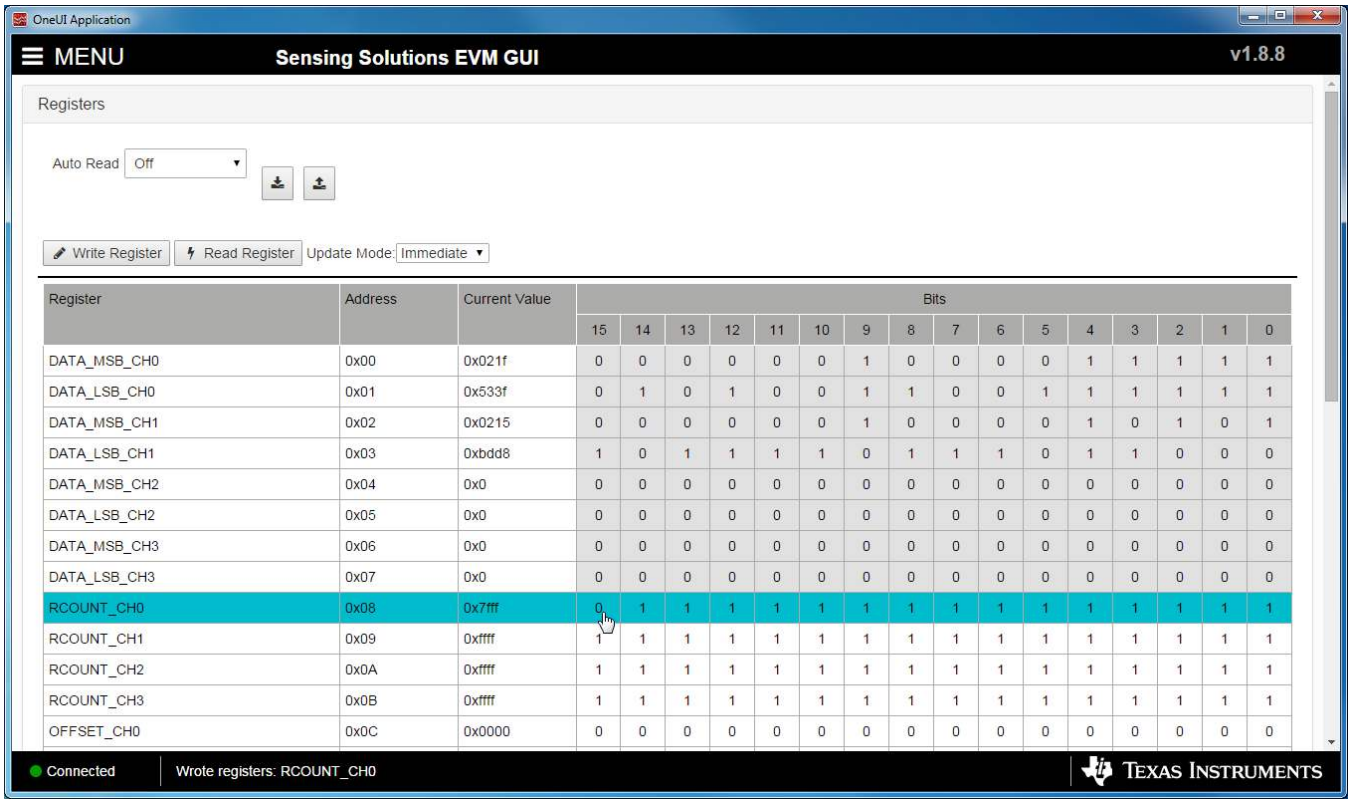


Figure 18. Selecting a Register's Current Value for Editting on Register Page

2. Type the new hexadecimal value into the box and click enter. The text box changes to normal text and the GUI will send a command to the EVM to update the device register

To change individual bit values rather that entire register values follow these steps.

1. Hover the mouse over the desired bit to change



Register	Address	Current Value	Bits															
			15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
DATA_MSB_CH0	0x00	0x021f	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	1
DATA_LSB_CH0	0x01	0x533f	0	1	0	1	0	0	1	1	0	0	1	1	1	1	1	1
DATA_MSB_CH1	0x02	0x0215	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1
DATA_LSB_CH1	0x03	0xbdd8	1	0	1	1	1	1	0	1	1	1	0	1	1	0	0	0
DATA_MSB_CH2	0x04	0x0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DATA_LSB_CH2	0x05	0x0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DATA_MSB_CH3	0x06	0x0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DATA_LSB_CH3	0x07	0x0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RCOUNT_CH0	0x08	0x7fff	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RCOUNT_CH1	0x09	0xffff	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RCOUNT_CH2	0x0A	0xffff	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RCOUNT_CH3	0x0B	0xffff	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
OFFSET_CH0	0x0C	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

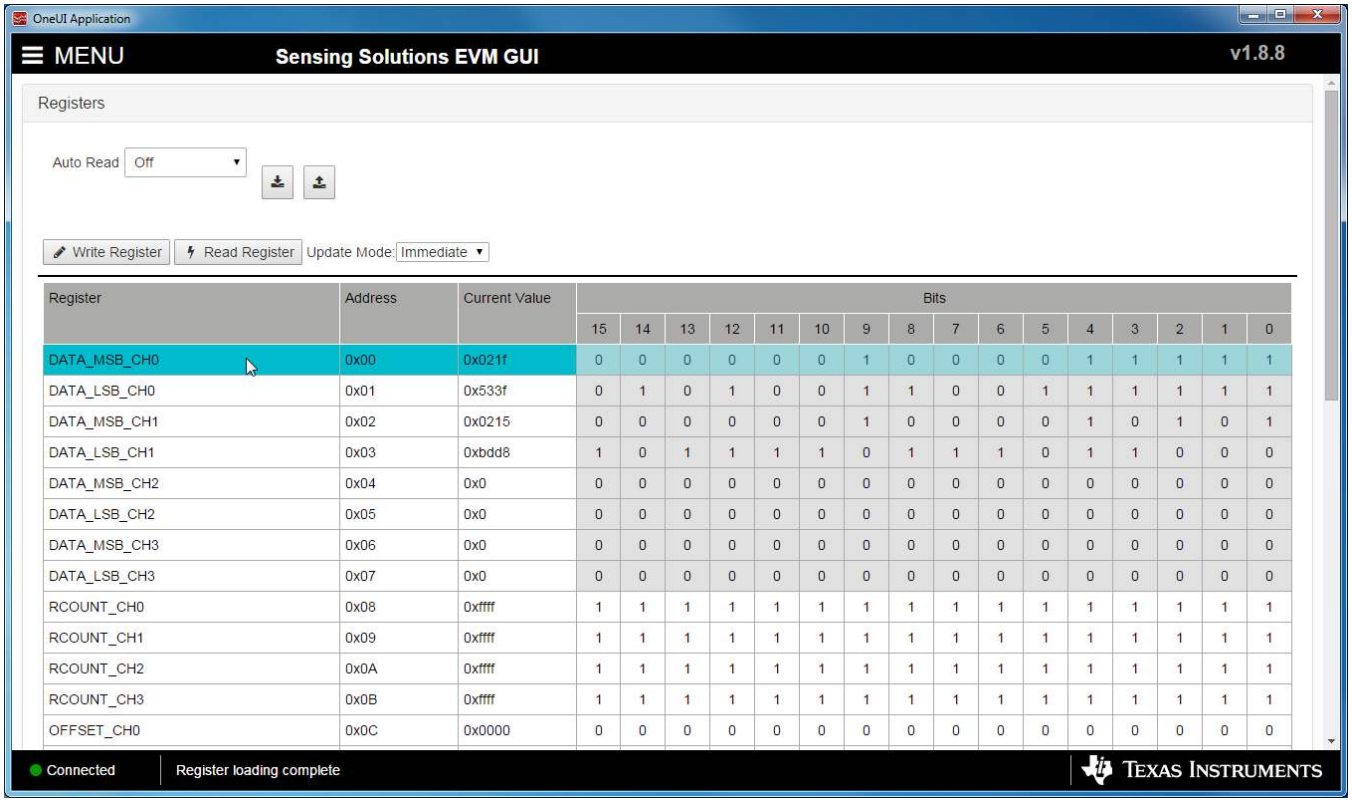
Figure 19. Hovering Mouse Over Register Bit Value on Register Page

2. Double-click the bit to toggle its value and the register's current value will update automatically

2.6.3 Reading Register Values without Auto-Read

To read register values follow these steps.

1. Select the register to update by clicking any column of the register row in the table



Register	Address	Current Value	Bits															
			15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
DATA_MSB_CH0	0x00	0x021f	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	1
DATA_LSB_CH0	0x01	0x533f	0	1	0	1	0	0	1	1	0	0	1	1	1	1	1	1
DATA_MSB_CH1	0x02	0x0215	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1
DATA_LSB_CH1	0x03	0xbdd8	1	0	1	1	1	1	0	1	1	1	0	1	1	0	0	0
DATA_MSB_CH2	0x04	0x0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DATA_LSB_CH2	0x05	0x0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DATA_MSB_CH3	0x06	0x0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DATA_LSB_CH3	0x07	0x0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RCOUNT_CH0	0x08	0xffff	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RCOUNT_CH1	0x09	0xffff	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RCOUNT_CH2	0x0A	0xffff	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RCOUNT_CH3	0x0B	0xffff	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
OFFSET_CH0	0x0C	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 20. Selecting a Register on Register Page

2. Click the “Read Register” button to update the selected register’s current value and bit values in the table

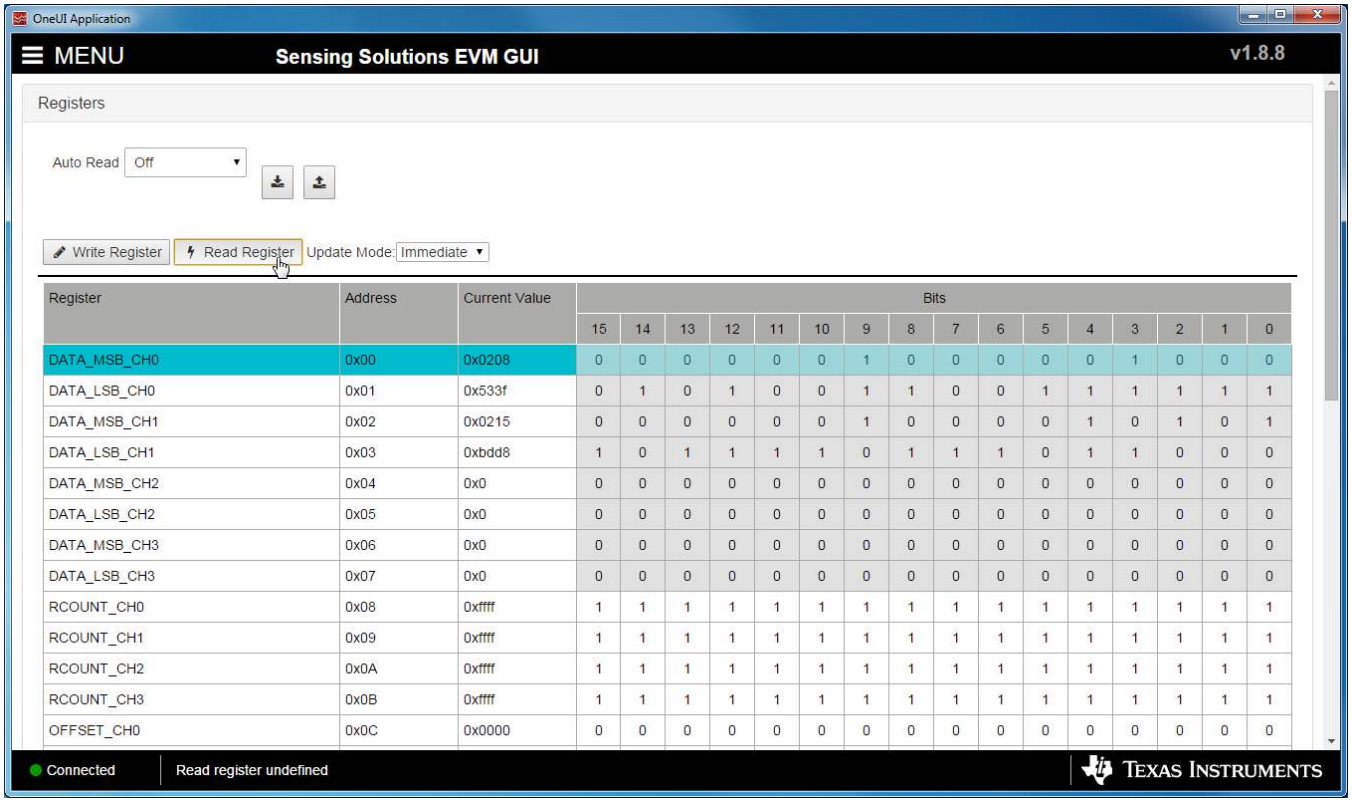
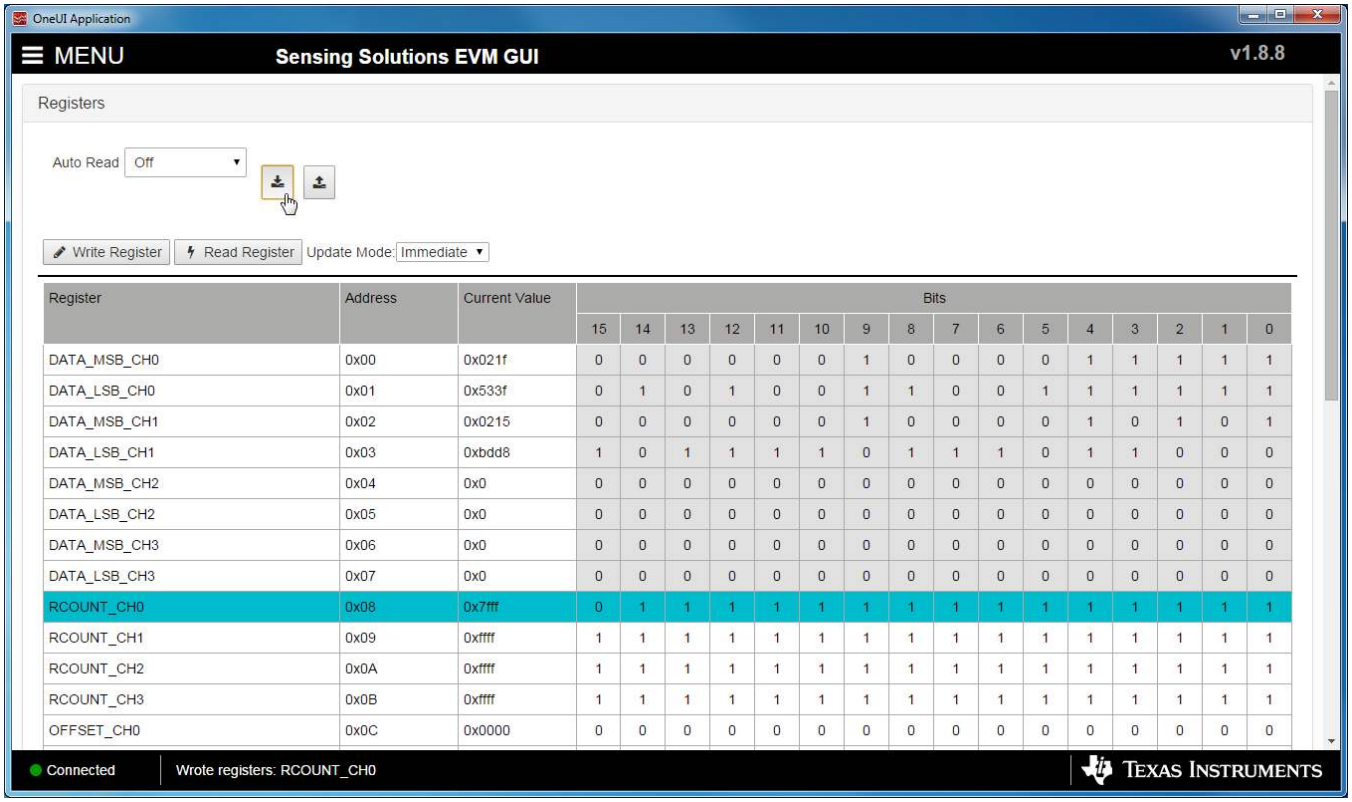


Figure 21. Reading the Current Device Register Value on Register Page

2.6.4 Saving Device Configurations

To save the current register settings of the device follow these steps.

1. Click the button immediately right to the “Auto-Read” selection dropdown



Register	Address	Current Value	Bits															
			15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
DATA_MSB_CH0	0x00	0x021f	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	1
DATA_LSB_CH0	0x01	0x533f	0	1	0	1	0	0	1	1	0	0	1	1	1	1	1	1
DATA_MSB_CH1	0x02	0x0215	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1
DATA_LSB_CH1	0x03	0xbdd8	1	0	1	1	1	1	0	1	1	1	0	1	1	0	0	0
DATA_MSB_CH2	0x04	0x0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DATA_LSB_CH2	0x05	0x0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DATA_MSB_CH3	0x06	0x0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DATA_LSB_CH3	0x07	0x0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RCOUNT_CH0	0x08	0x7fff	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RCOUNT_CH1	0x09	0xffff	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RCOUNT_CH2	0x0A	0xffff	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RCOUNT_CH3	0x0B	0xffff	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
OFFSET_CH0	0x0C	0x0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 22. Save Register Values to File on Register Page

2. Choose a name for the JSON file and the directory to save it within. Then click “Save”

2.6.5 Loading Previously Saved Configurations

To load previously saved register settings from a JSON file follow these steps.

1. Click the button furthest right from the “Auto-Read” selection dropdown

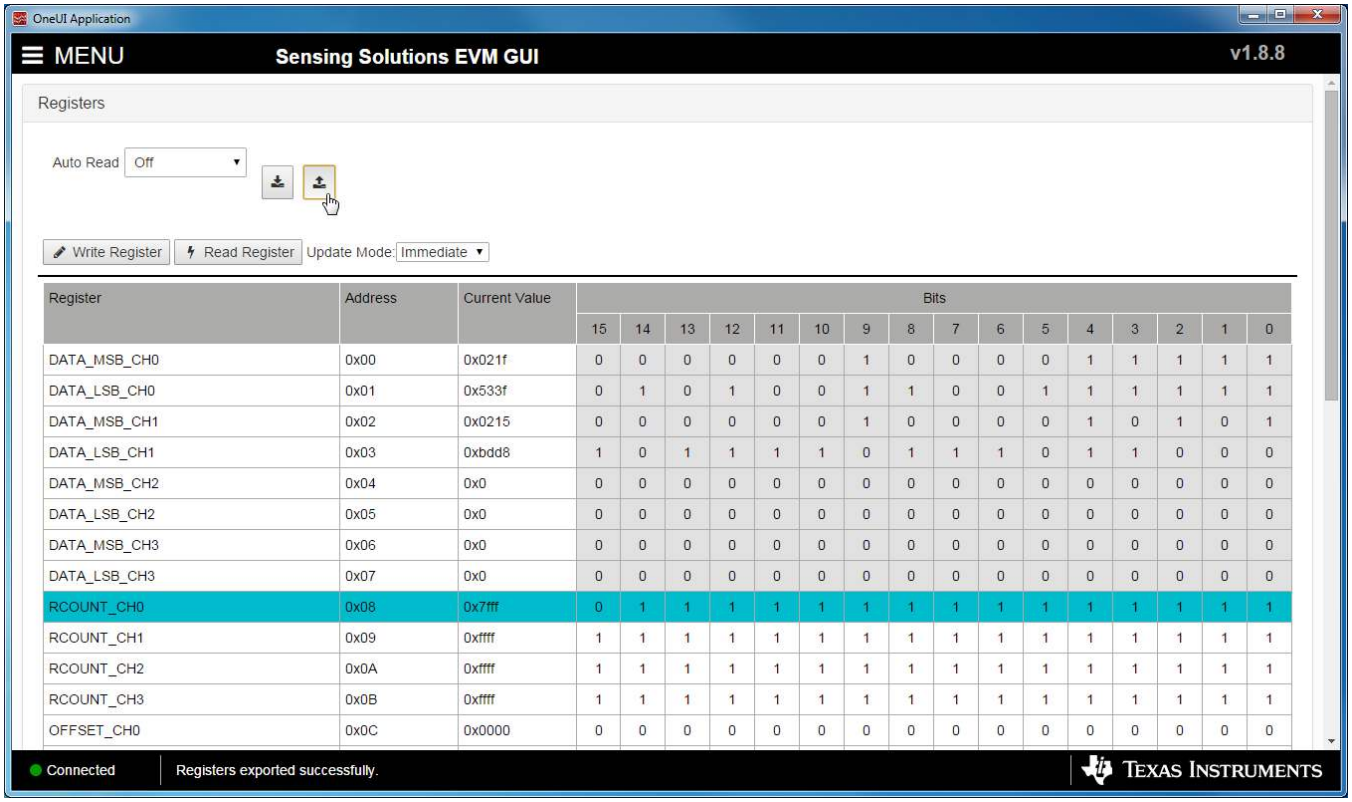


Figure 23. Loading Previously Saved Register Values from File on Register Page

2. Select the JSON file with the desired settings and click “Open”

2.7 Configuring the EVM Using the Configuration Page

The Sensing Solutions GUI is capable on configuring the device more intuitively than the direct register values. The "Configuration" page provides an easy-to-use tool for updating the device configuration and provides additional information about how the device will perform.

2.7.1 Enabling and Disabling Channel Measurements

The FDC211x and FDC221x devices take measurements in two different modes: repeated single channel measurement and measuring single channels sequentially. When the device repeatedly measures a single channel any channel can be selected for measurement. To measure a single channel follow these steps.

1. Select “Repeat single channel measurement” in the “Measurement Settings”
2. Choose which channel to measure by clicking the enable check-box of the desired channel (any channel may be selected)

If measuring more than one channel, they are always measured sequentially from channel 0 to the highest selected channel. To measure multiple channels follow these steps.

1. Select “Sequence channel measurements” in the “Measurement Settings”
2. Choose which channels to measure by clicking the highest channel desired

   Channel 0 and 1 will always be enabled in this mode

2.7.2 Selecting the Clocking Source

While the device contains an internal oscillator which requires fewer components in a system, it is recommended to use an external oscillator for precision applications. The EVM includes a 40MHz oscillator on-board, but an external off board signal can be used.

To choose the oscillator source select one of the options in the “Reference Clock Source” section of the “Measurement Settings”. If using an external oscillator, enter the oscillation frequency so that the GUI correctly displays data measurements of frequency and capacitance. Please note changing the value of the clock in the GUI is purely for calculations in the GUI, the actualy clock frequency on the EVM will not change.

2.7.3 Setting the Measurement Timings

Determining the best timing settings for the device is largely dependent on the application and sensor design, but in general the following items should be considered

- Each channel should have the maximum reference frequency possible. Most applications should have the channel Fref dividers set to one.
- Settle count needs to be long enough, but increasing it arbitrary holds no value and only decreases the sampling rate. Reference the datasheet for calculating the optimal settle count.
- Reference count has the largest effect on the accuracy of a measurement. Increasing the reference count leads to a more accurate measurement, but at the cost of decreased sampling rate. The effective number of bits for each channel is calculated in the table for each channel based on the reference count.

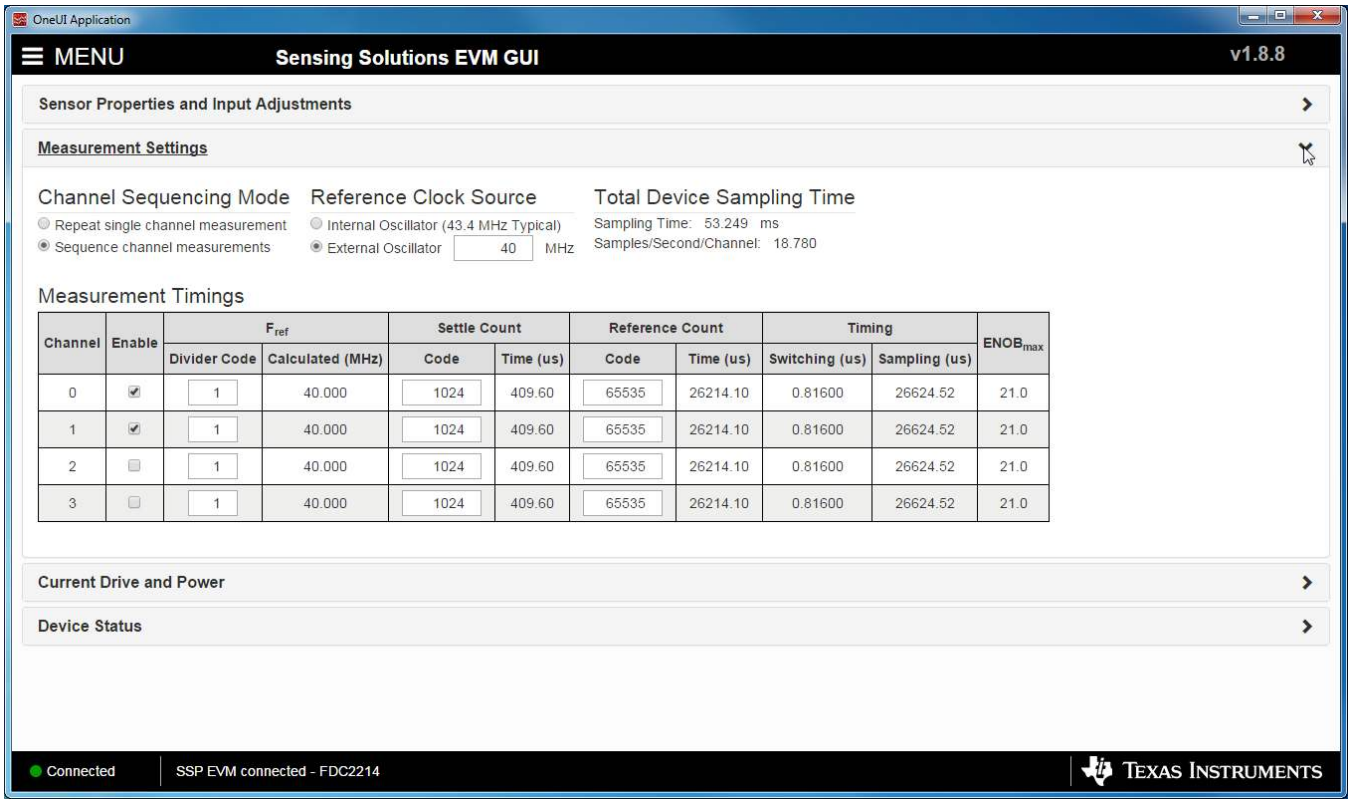


Figure 24. Measurement Settings on Configuration Page

2.7.4 Using a Different Sensor

When using a different sensor, several parameters could be changed. The sensor's resonant frequency could be vastly different or a different sensor inductor could be used. If the resonant frequency of the sensor is less than 8.75MHz the F_{in} select should be set to one. If the sensor frequency is greater than 8.75 MHz, F_{in} select should be two. The sensor filter inductor for each channel should be updated to reflect to actual component value on the sensor.

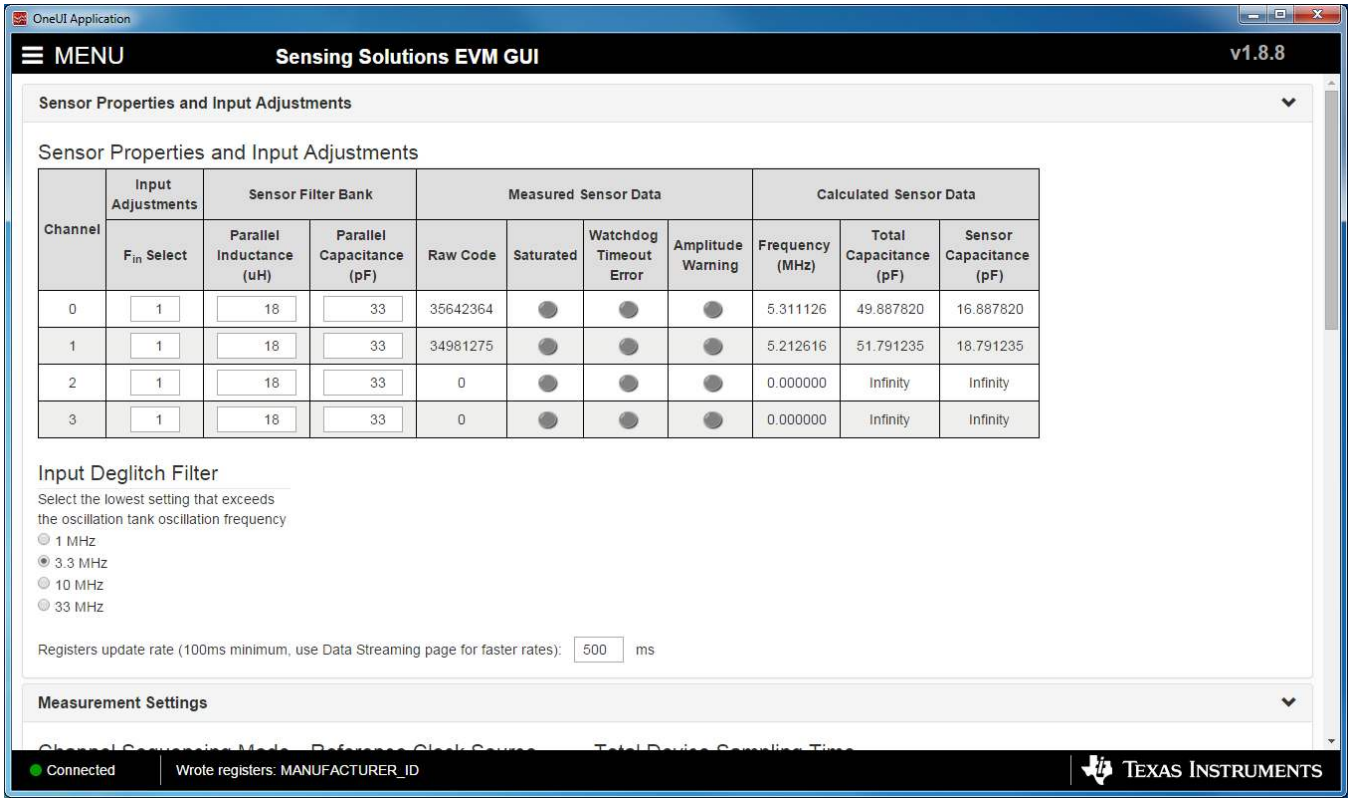


Figure 25. Sensor Properties and Input Adjustments on Configuration Page

While the FDC2214 doesn't support any gain or offset adjustments, the FDC2114 device has a limited measurement resolution and so a gain or offset may need to be set. The code offset may be set in the "Sensor Properties and Input Adjustments" table and the input gain is globally set for all channels. Please reference the device datasheet for more information to correctly set these values.

2.7.5 Setting the Input Deglitch Filter

The input deglitch filter suppresses EMI and ringing above the sensor frequency. It does not impact the conversion result as long as its bandwidth is configured to be above the maximum sensor frequency. After the sensor frequency is determined, select the lowest setting which exceeds the sensor frequency.

2.7.6 Setting the Power Mode and Sensor Initialization Currents

Most applications do not need maximum channel initialization currents and the low power sensor activation mode should be enabled. When low power sensor activation mode is enabled, the IDRIVE code determines how much current the device supplies to the sensor. To determine the optimal current drive setting, move the system target to its furthest distance from the sensor and click the “Detect iDriveInit with Auto-Amplitude Correction” button. This will take a measurement to determine an appropriate current setting. After the setting has been measured, the code value of I_{drive} must be adjusted.

If the low power sensor activation mode is disabled, the I_{drive} settings are ignored. If only measuring channel 0 and the sensor requires maximum drive current, enable the high current sensor drive.

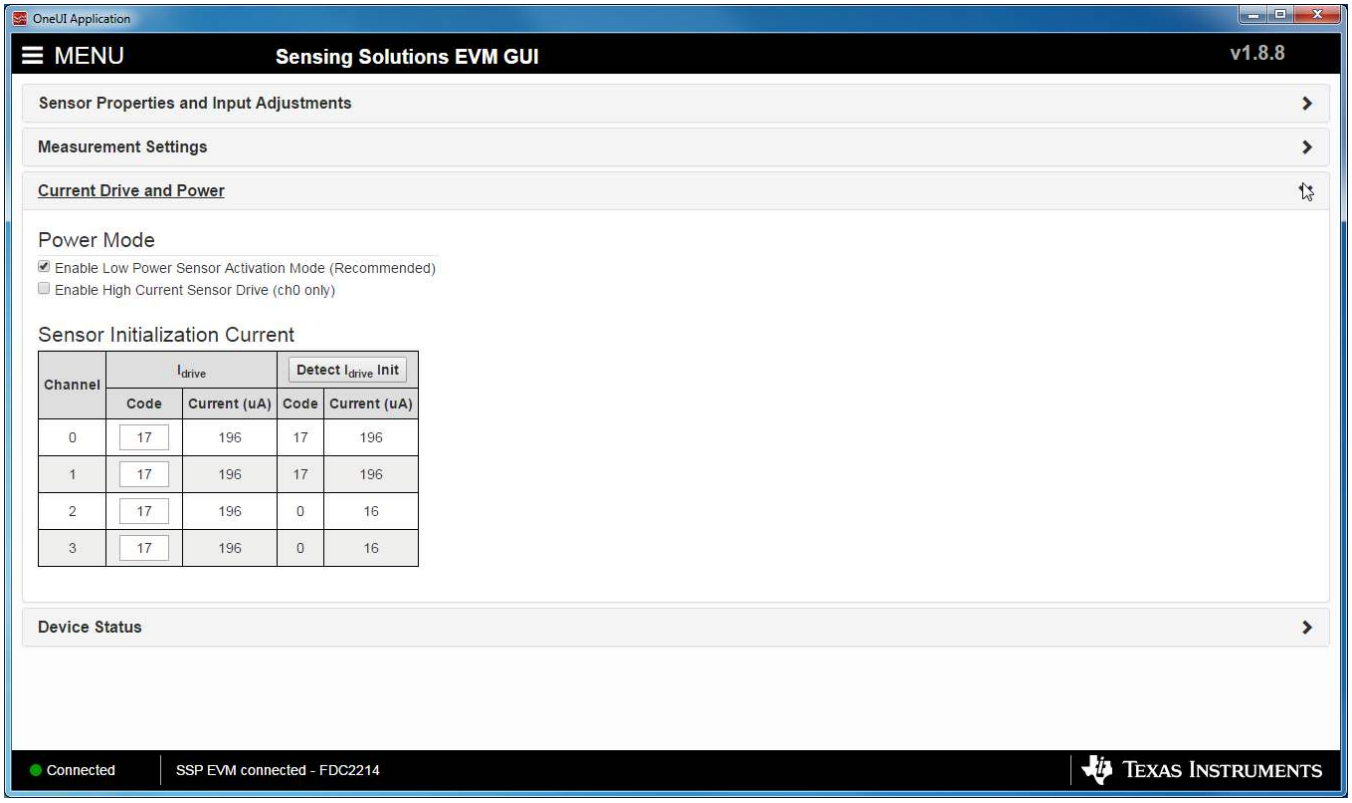


Figure 26. Current Drive on Configuration Page

2.8 Streaming Measurement Data

The Sensing Solutions GUI and EVM provide a tool to capture, display, and log measurement data. The section describes how to use the data measurement tools from the "Data Streaming" page accessible from the GUI menu.

2.8.1 Choosing the Graph and Visible Channels

Select the drop down menu on top of the y-axis to choose the graph to display.

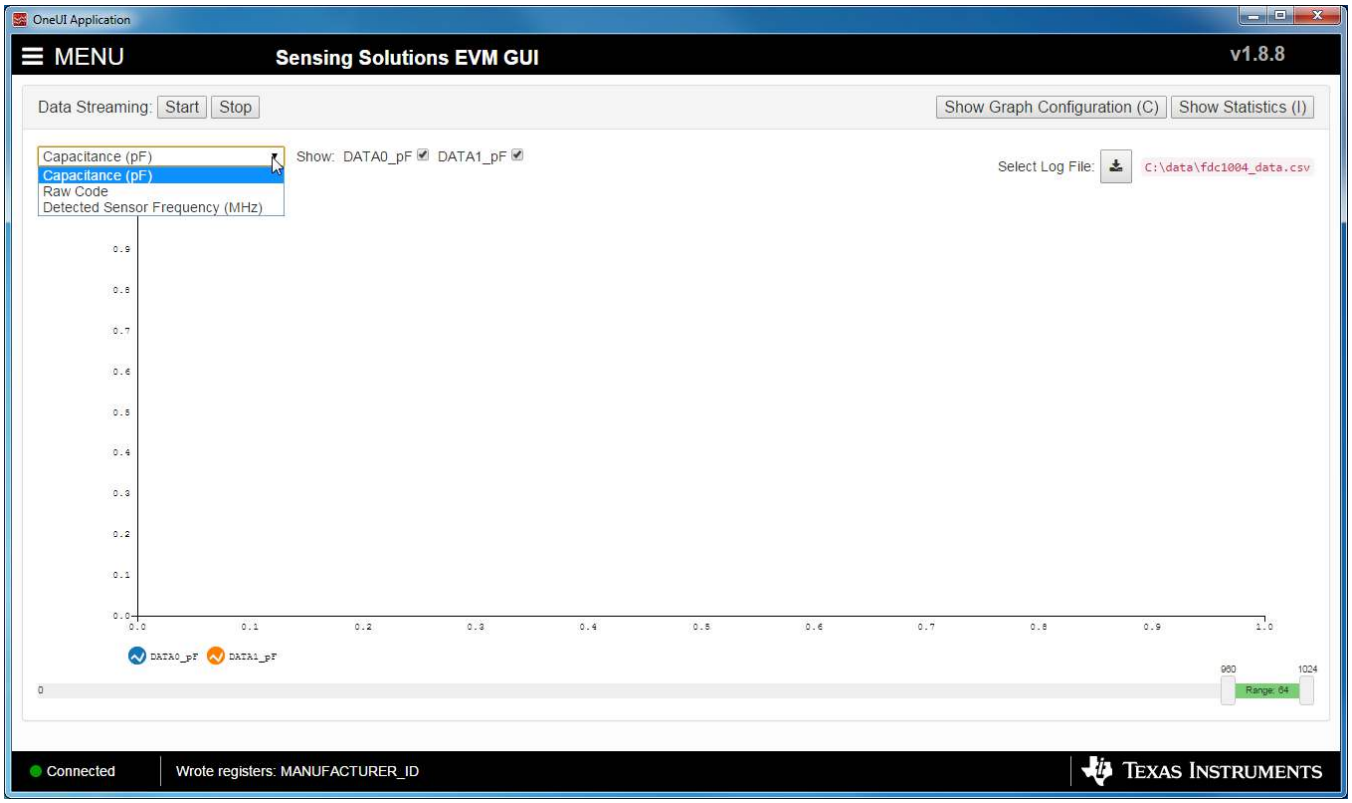


Figure 27. Select the Data Graph on Data Streaming Page

To select which channel measurements are displayed in the graph, check or uncheck the available channels shown next to the graph units. Selecting or not selecting the channels only affects the graph and not the data logged to a file. If a channel is not enabled in the Configuration page it will not appear on the Data Streaming page.

2.8.2 Logging Data to a File

Follow these steps to log measurement data to a file.

1. Click the button in the upper right under next to "Click to Select Log File"

Figure 28. Select Log File Button on Data Streaming Page

2. Select a file name and directory to save the data to and then click the “Save” button
3. Whenever data streaming is running the data for all channels will be logged to this file. The selected file is shown next to the button.

2.8.3 Starting and Stopping Data Streaming

To start data streaming click the “Start” button.

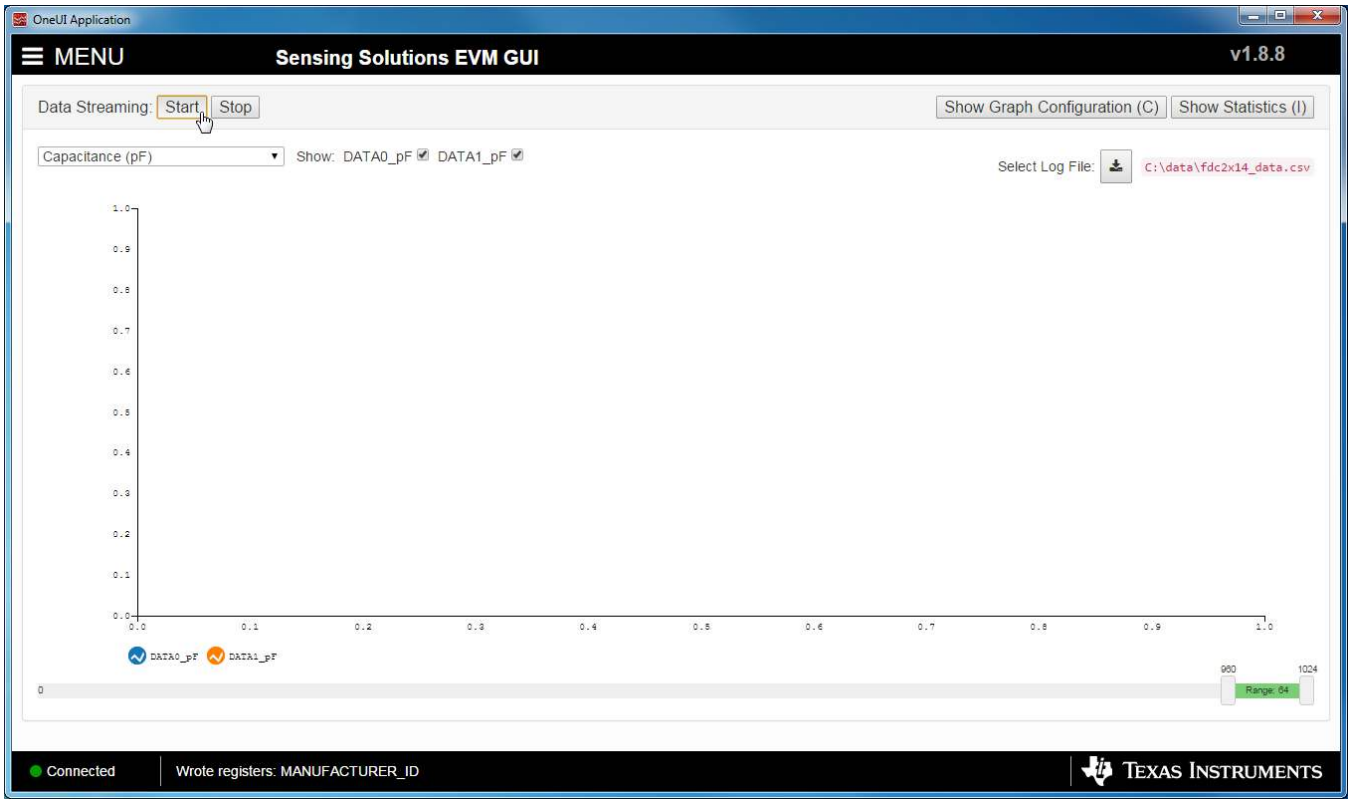


Figure 29. Start Button on Data Streaming Page

To stop data streaming click the “Stop” button.

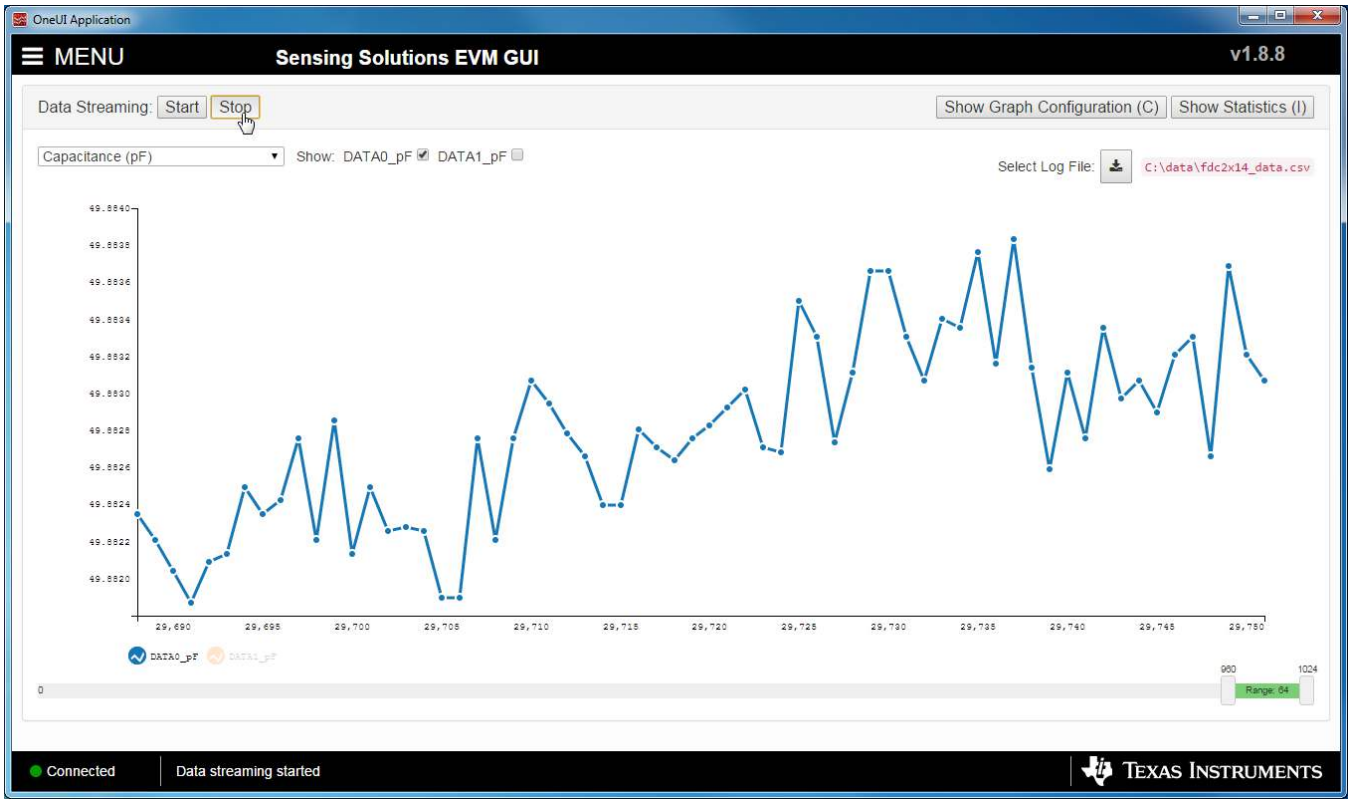


Figure 30. Stop Button on Data Streaming Page

2.8.4 Data Statistics

Click the “Show Statistics” button to view the measurement statistics.

Figure 31. Show Statistics Button on Data Streaming Page

Click the “Hide Statistics” button to hide the measurement statistics.

Figure 32. Hide Statistics Button on Data Streaming Page

2.8.5 Configuring the Graph

To configure the graph, click the "Show Graph Configuration" button.

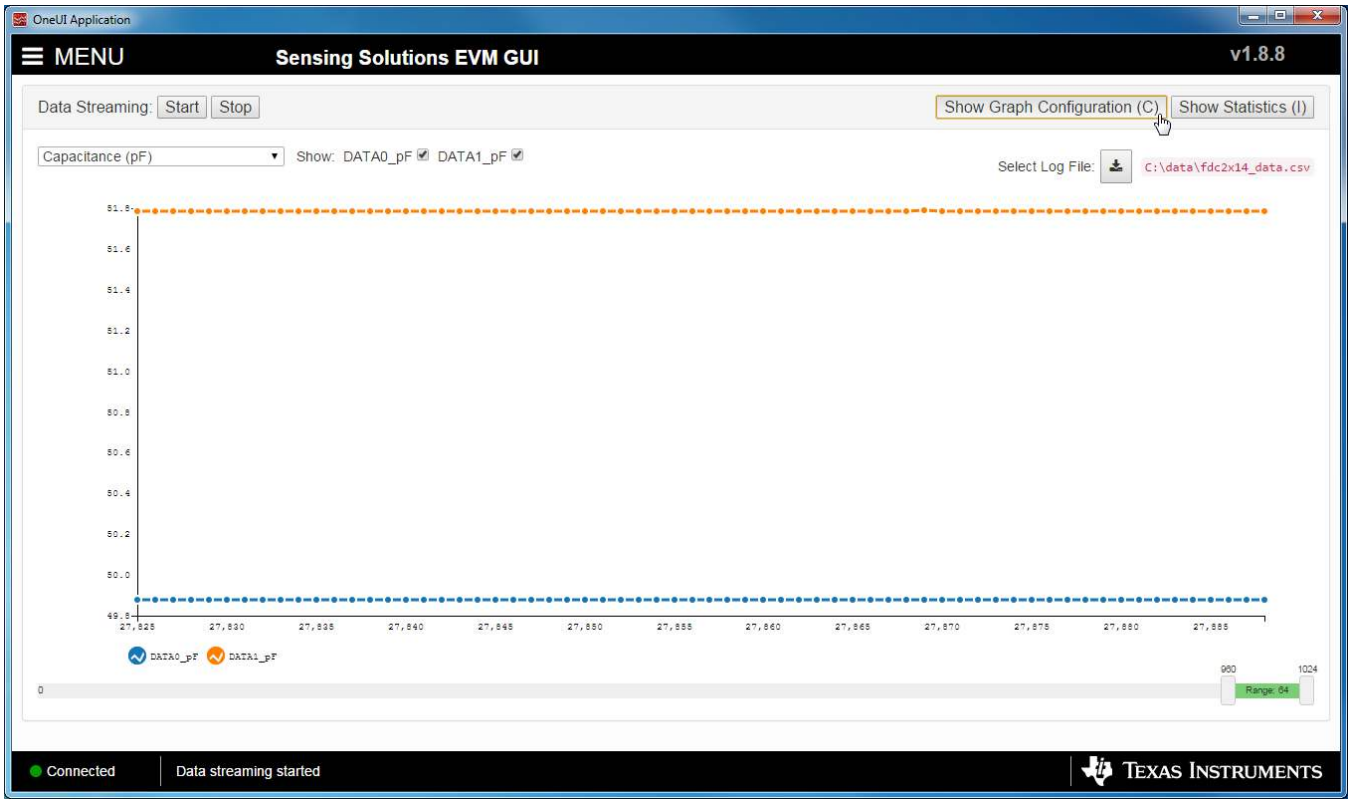


Figure 33. Show Graph Configuration Button on Data Streaming Page

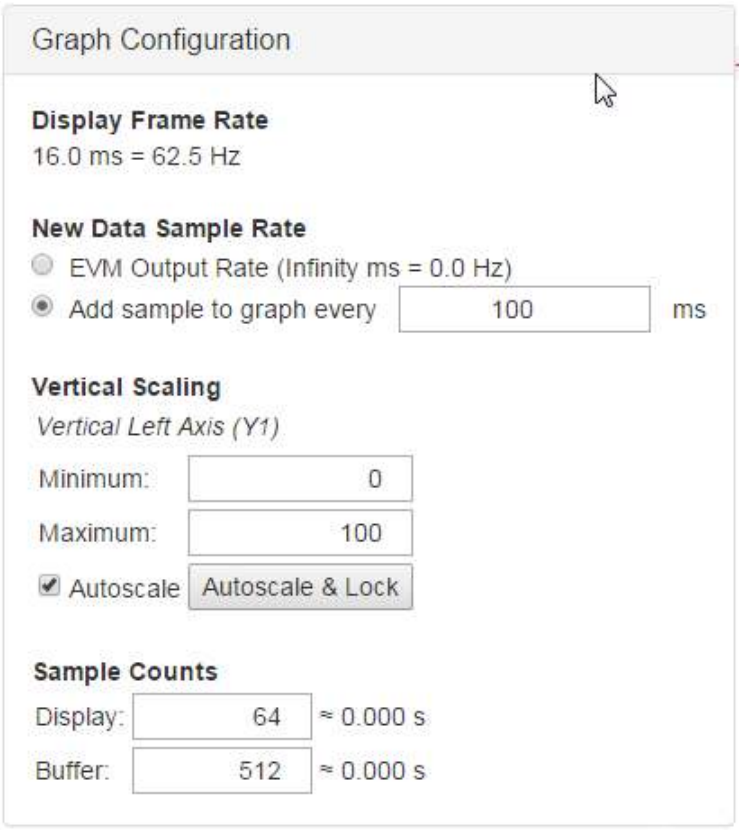


Figure 34. Graph Configuration Button on Data Streaming Page

The configuration window displays the actual frame rate of the graph, the rate at which data is added to the graph, the vertical scaling, and the sample buffer size. The display rate is the rate at which the graph updates on the computer display and is not configurable. It is automatically optimized by the GUI.

The "New Data Sample Rate" allows the user to choose when new data is added to the graph. Selecting "EVM Output Rate" will display data on the graph as fast as is available from the EVM. This should not be confused with the actual sampling rate of the device on the EVM which could be different. The "Add sample to graph every ... ms" will add a new sample to the graph at the specified rate.

The "Verical Scaling" allows the user to either manually set the minimum and maximum values of the y-axis on the graph or use auto-scaling. The "Autoscale & Lock" button scales the graph based on the data of the current display and then locks those vertical scaling settings.

The "Sample Counts" allows the user to specify the number of samples displayed on the graph and the total number of samples stored in the buffer. Please note the buffer size does not affect data logging to a file.

To hide the configuration window, click the "Hide Graph Configuration" button.

Figure 35. Hide Graph Configuration Button on Data Streaming Page

2.8.6 Navigating the Data Streaming Buffer

The Sensing Solutions EVM GUI stores a buffer of data samples and then displays a subset of those samples. The data buffer can be navigated using the horizontal slider below the graph. To show more samples on the graph, click either the slider on the left or right side of the green bar and drag it closer or further from the other slider. The number of samples displayed is shown between the left and right sliders in the green bar.

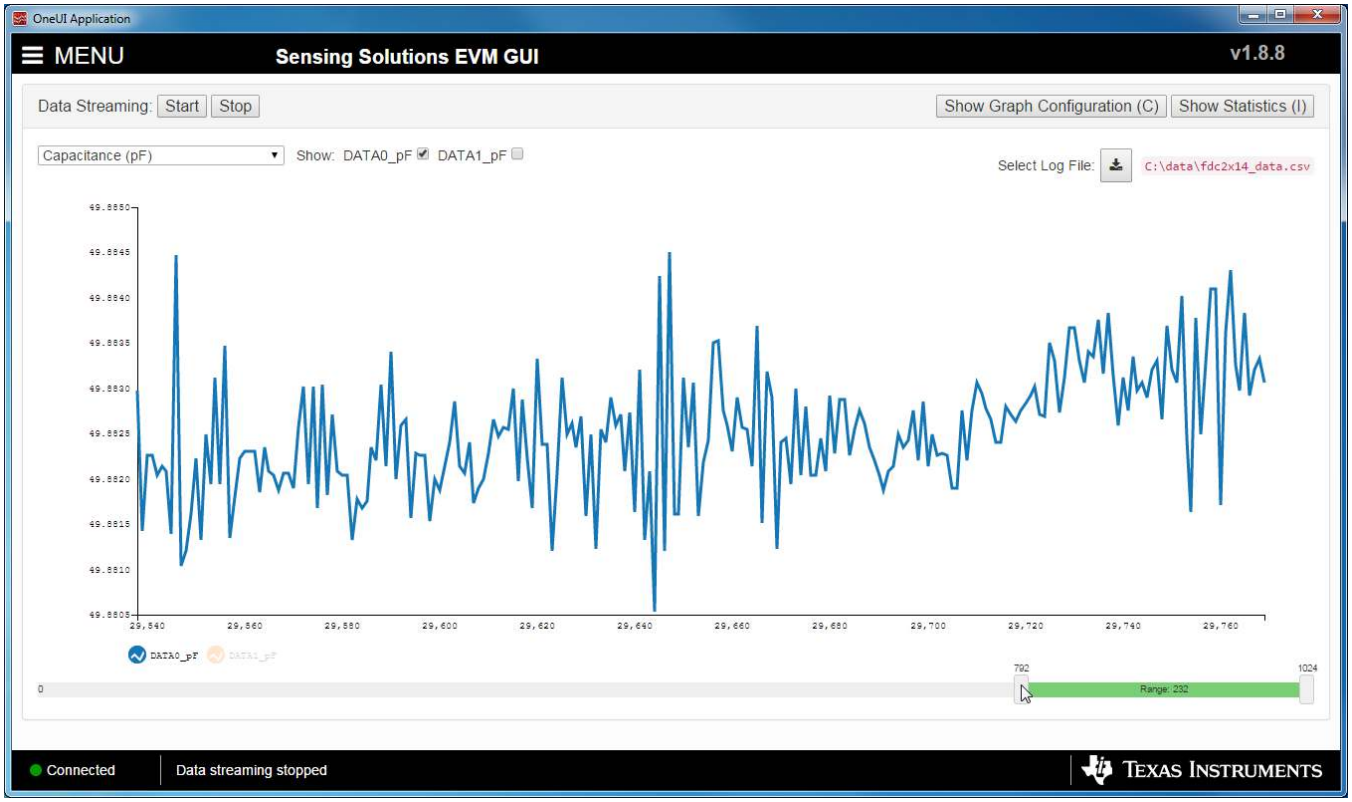


Figure 36. Changing Number of Samples Displayed in Data Graph

By clicking on the green bar and dragging the mouse left or right, previous samples in the buffer can be displayed.

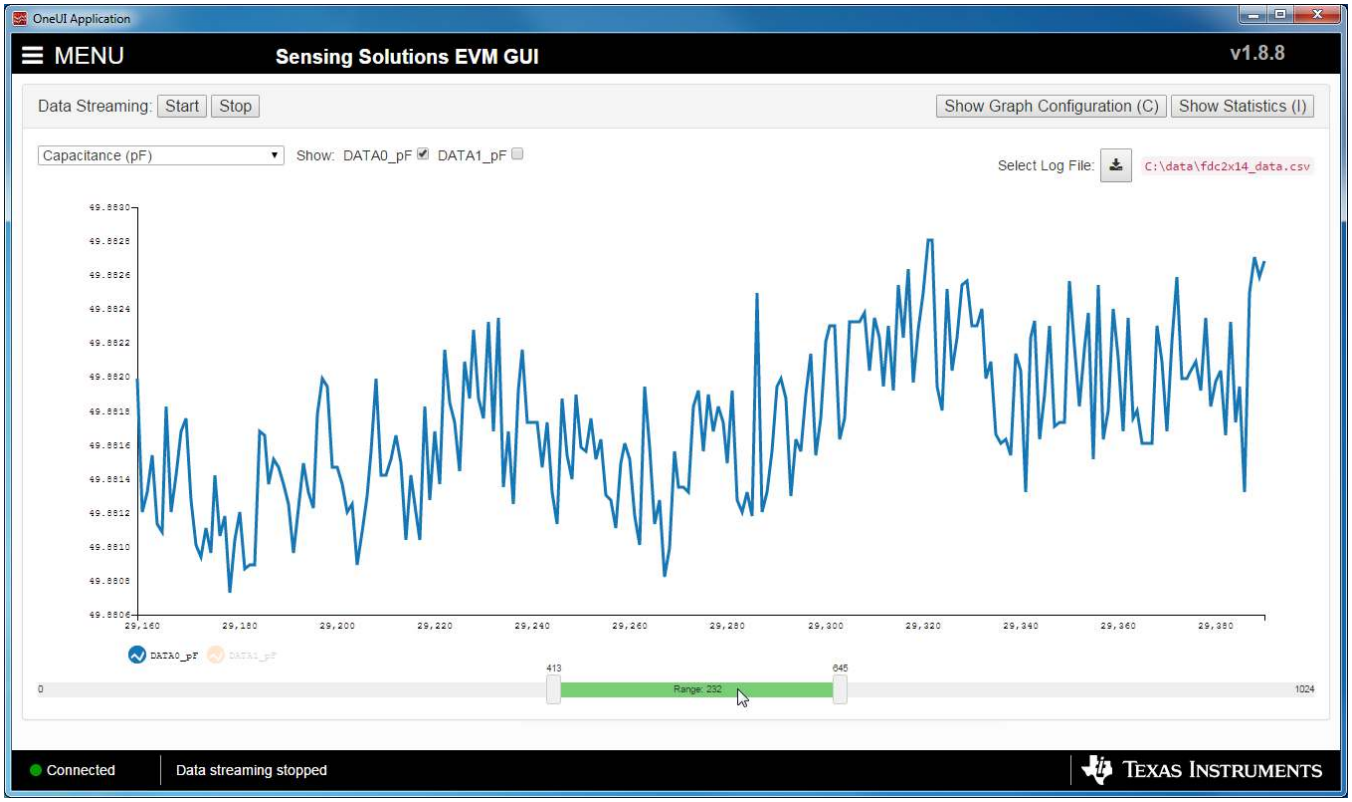


Figure 37. Displaying Previous Data Samples on the Data Streaming Page

2.9 Updating the EVM Firmware

To upload new firmware to the EVM, navigate to the "Firmware" page from the GUI menu and follow these steps. The images below show uploading the FDC2214 EVM firmware, but the steps are identical for any LDC, FDC, or HDC EVM when using their respective firmware files.

1. Click the button to select a TI-TXT firmware file

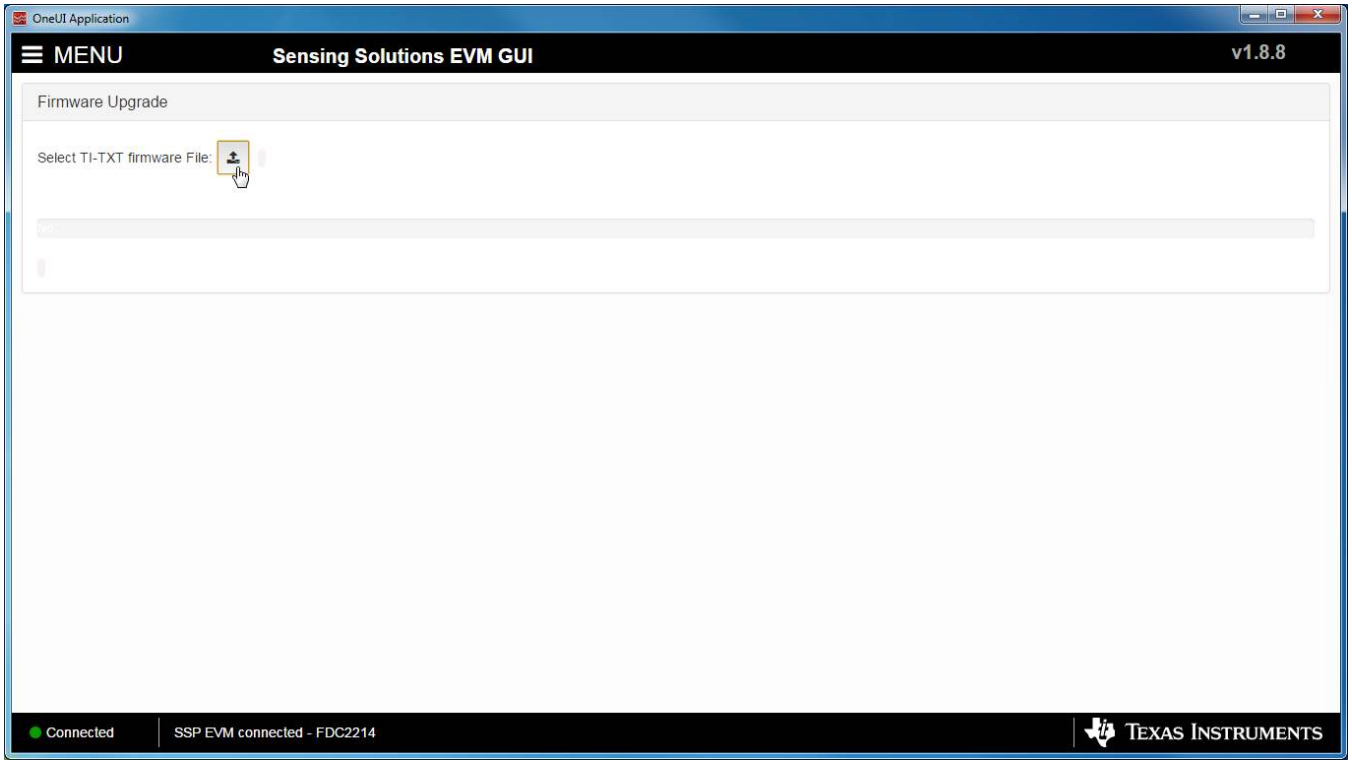


Figure 38. Select TI-TXT File Button on Firmware Upload Page

2. Select the firmware file and click “Open”

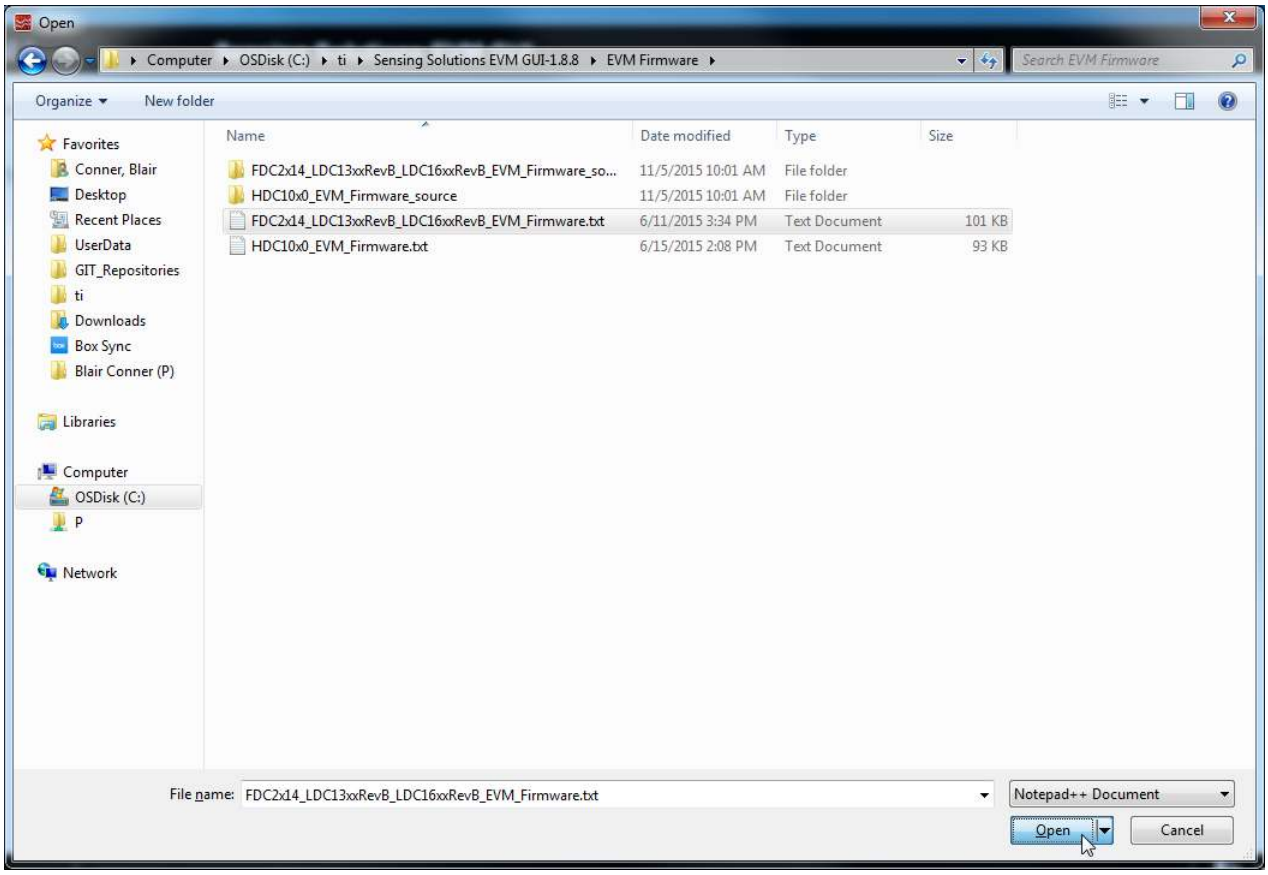


Figure 39. Selecting TI-TXT Firmware File for Upload to EVM

3. Click the “Upload Firmware” button

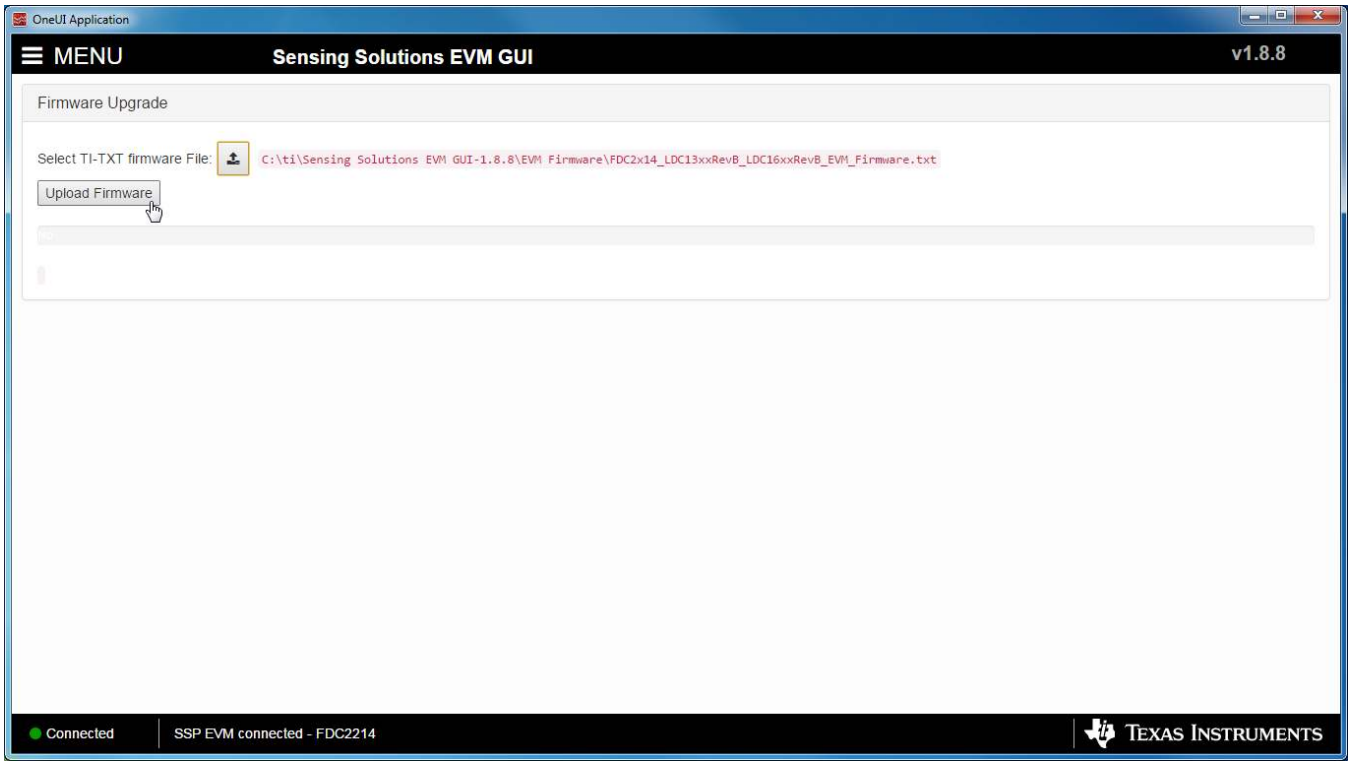


Figure 40. Upload Firmware Button on Firmware Upload Page

4. Wait for the firmware to upload. Do NOT disconnect the EVM from the PC at this time! Also note that the GUI will disconnect from the EVM. The upload process should not take more than one minute. If the upload fails or lasts longer than one minute, unplug the EVM and restart the GUI.

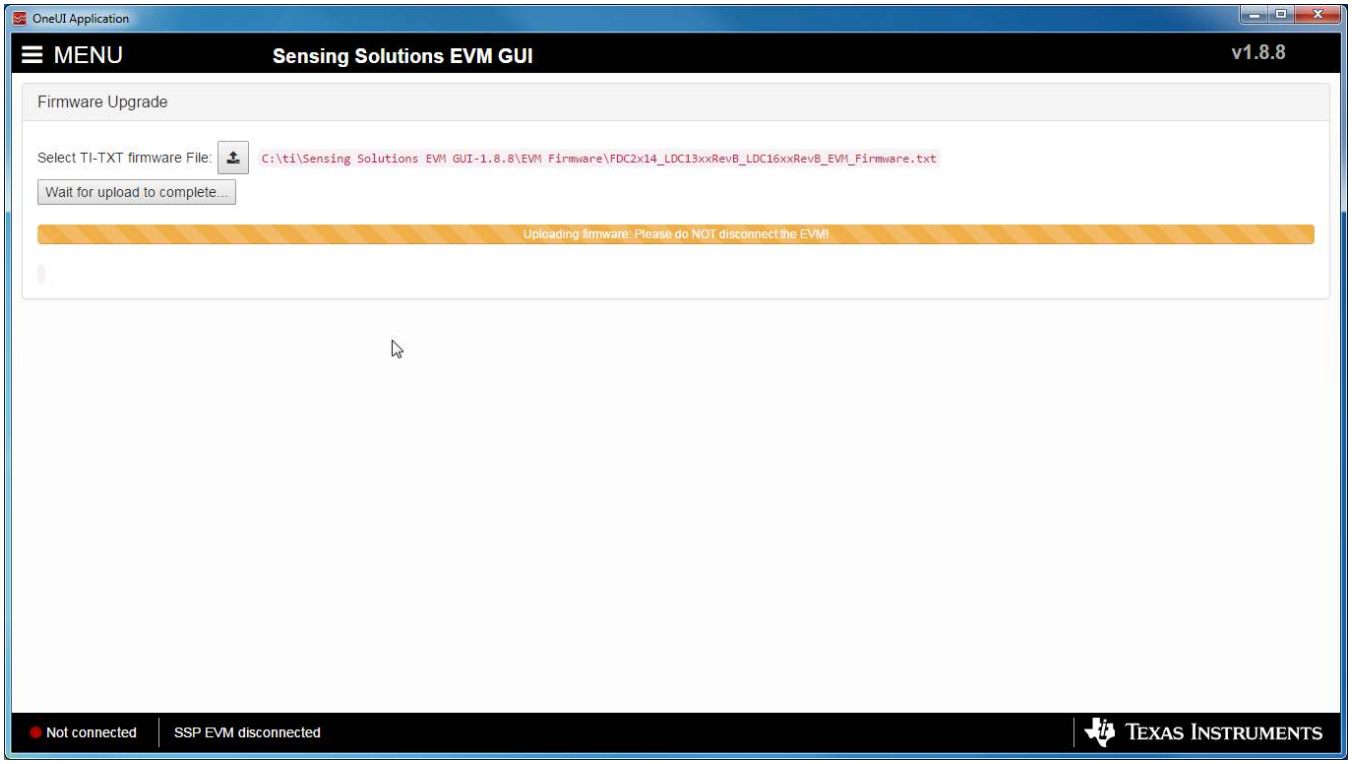


Figure 41. Firmware Upload in Progress

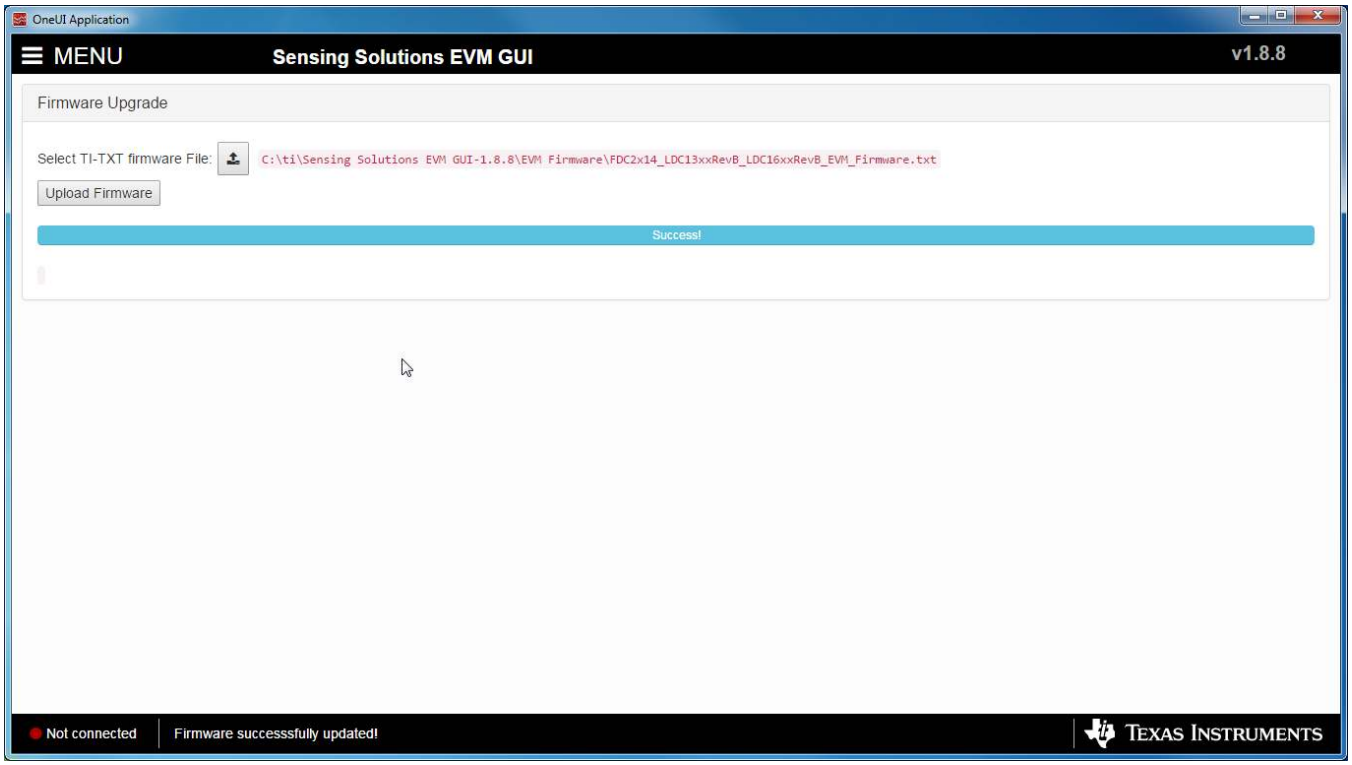


Figure 42. Firmware Upload Success

3 FDC2114/2214 EVM Schematics and Layout

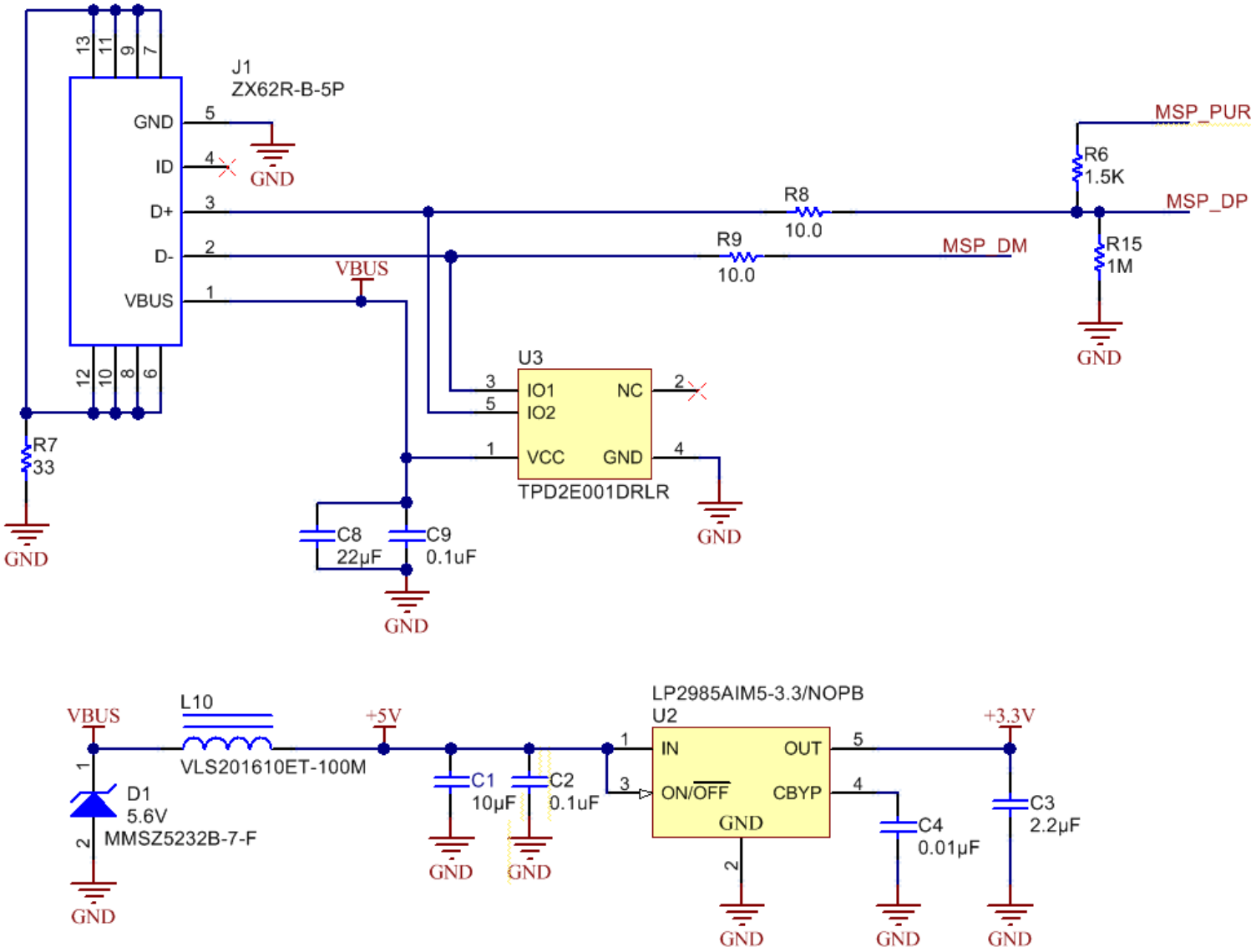


Figure 43. USB Connection and Power Circuit

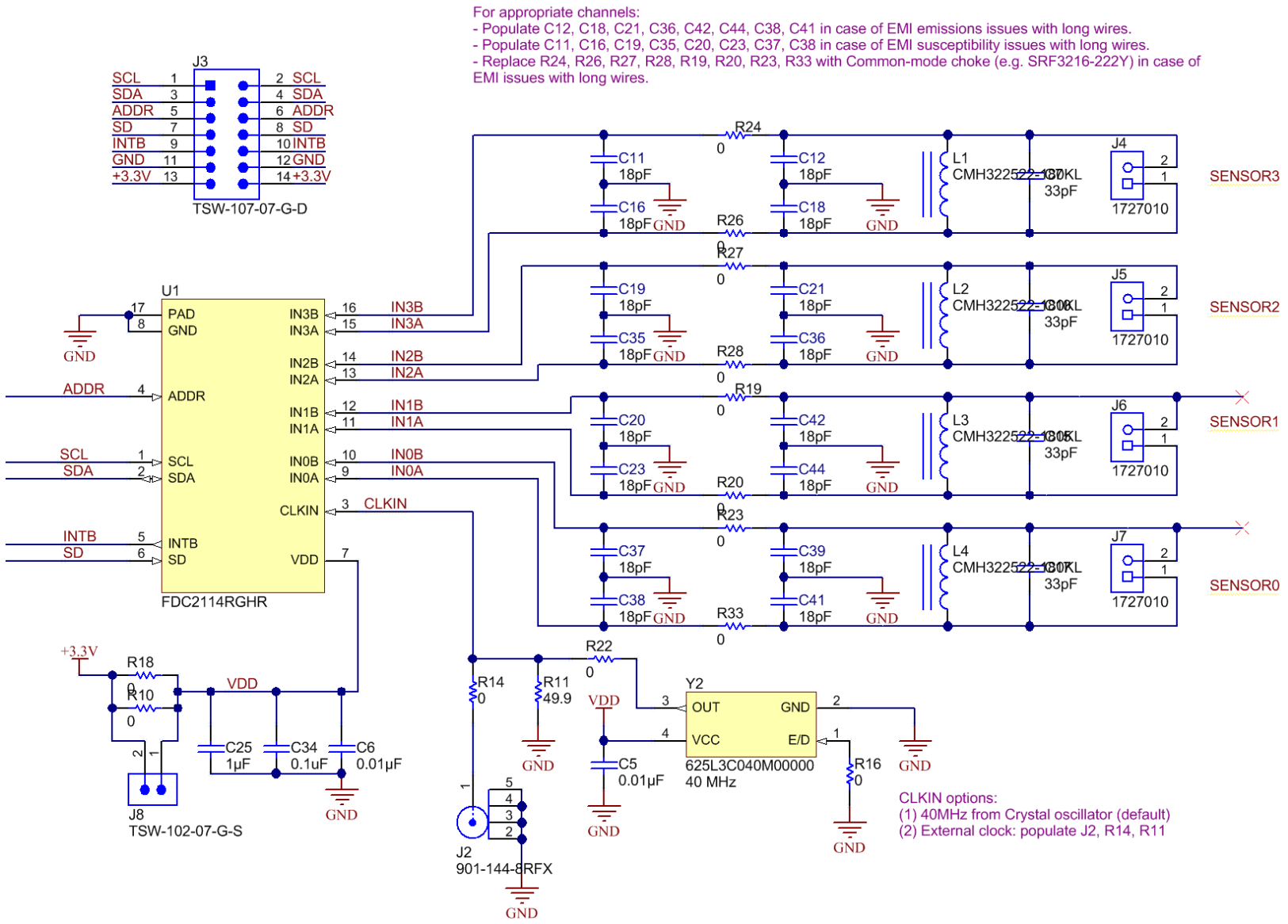


Figure 44. FDC2114/2214

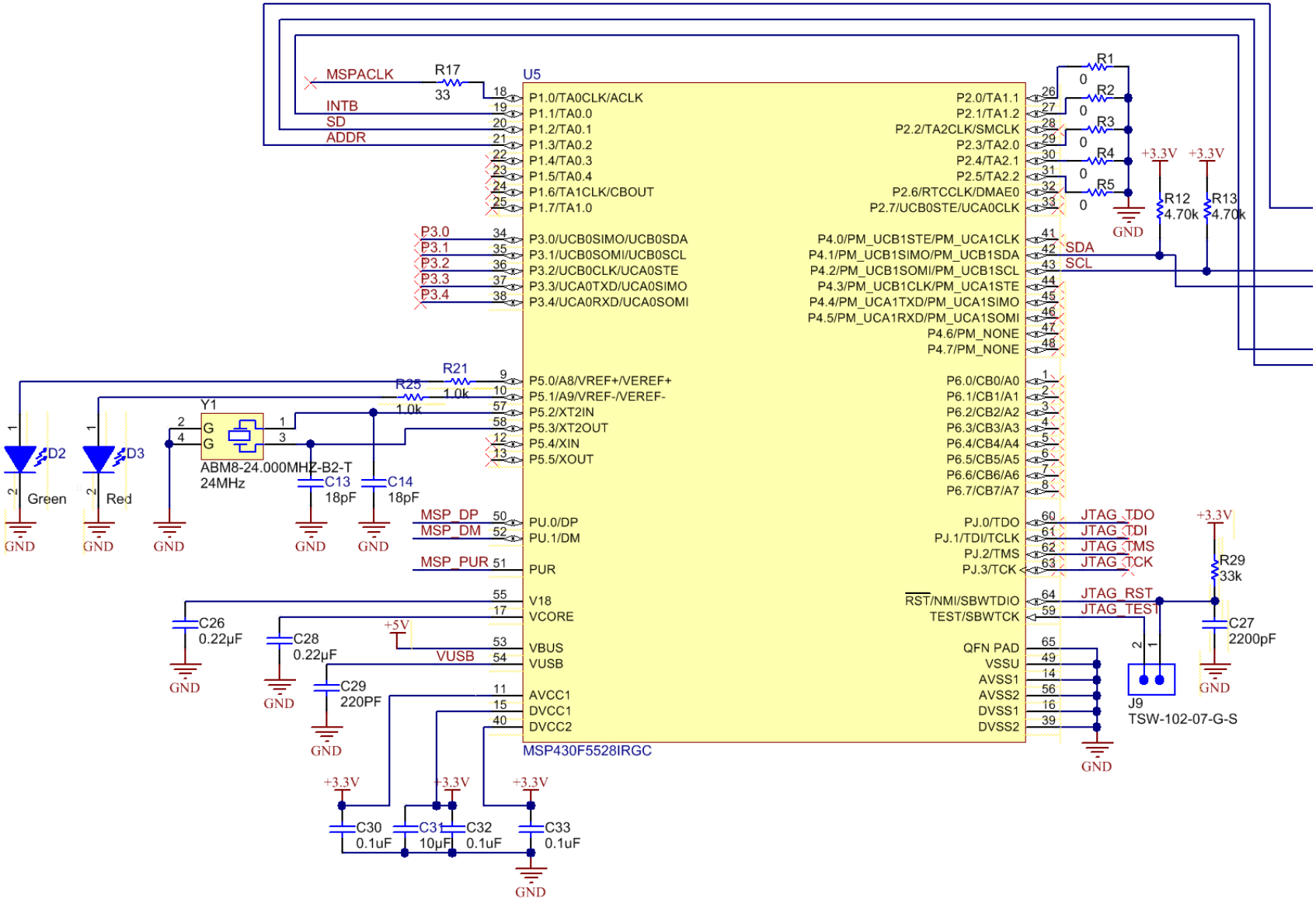


Figure 45. MSP430 Connections

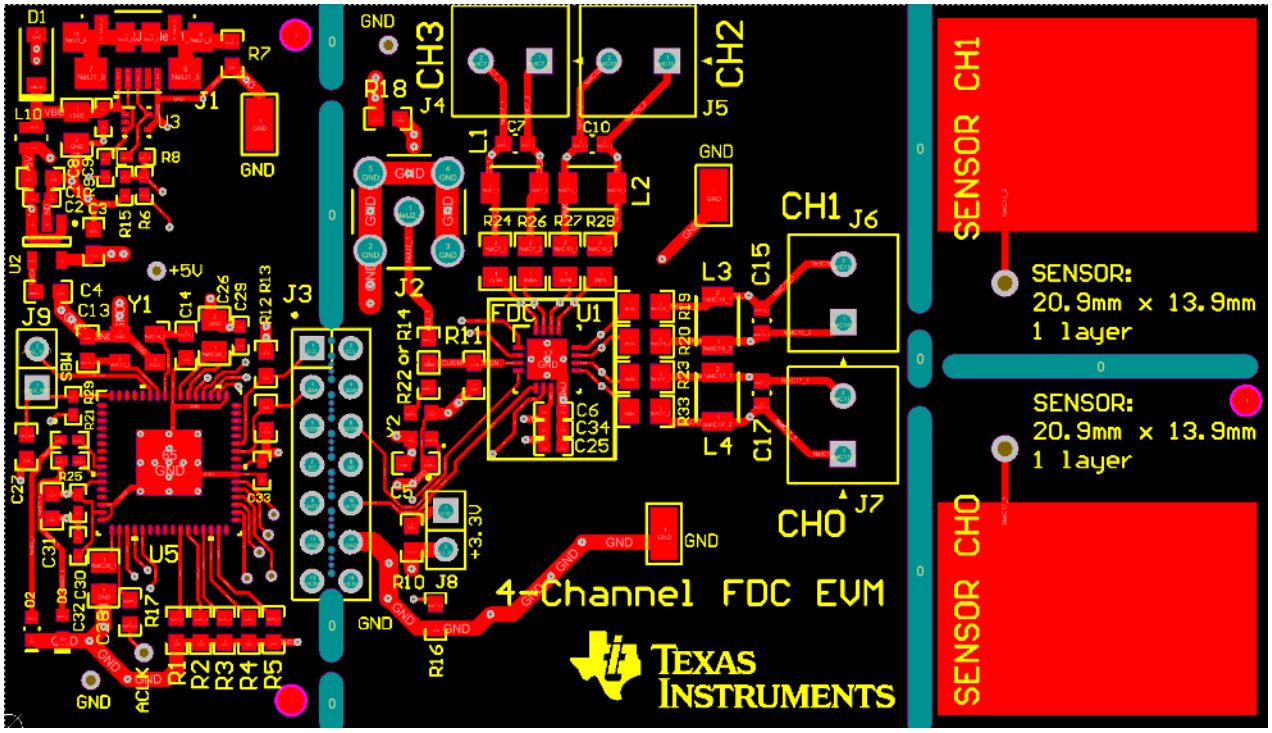


Figure 46. Layout Top Layer – Signals and Components

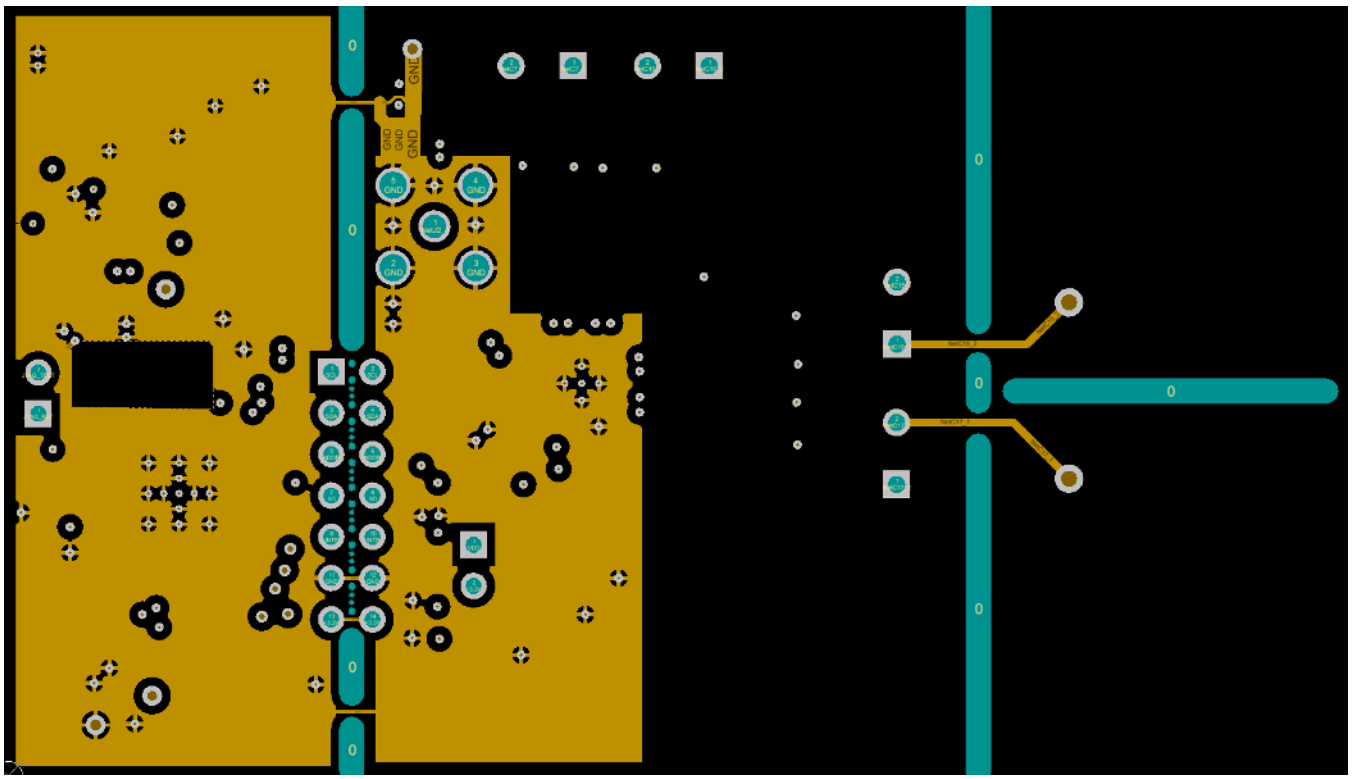


Figure 47. Layout Mid-Layer 1 – Ground Plane

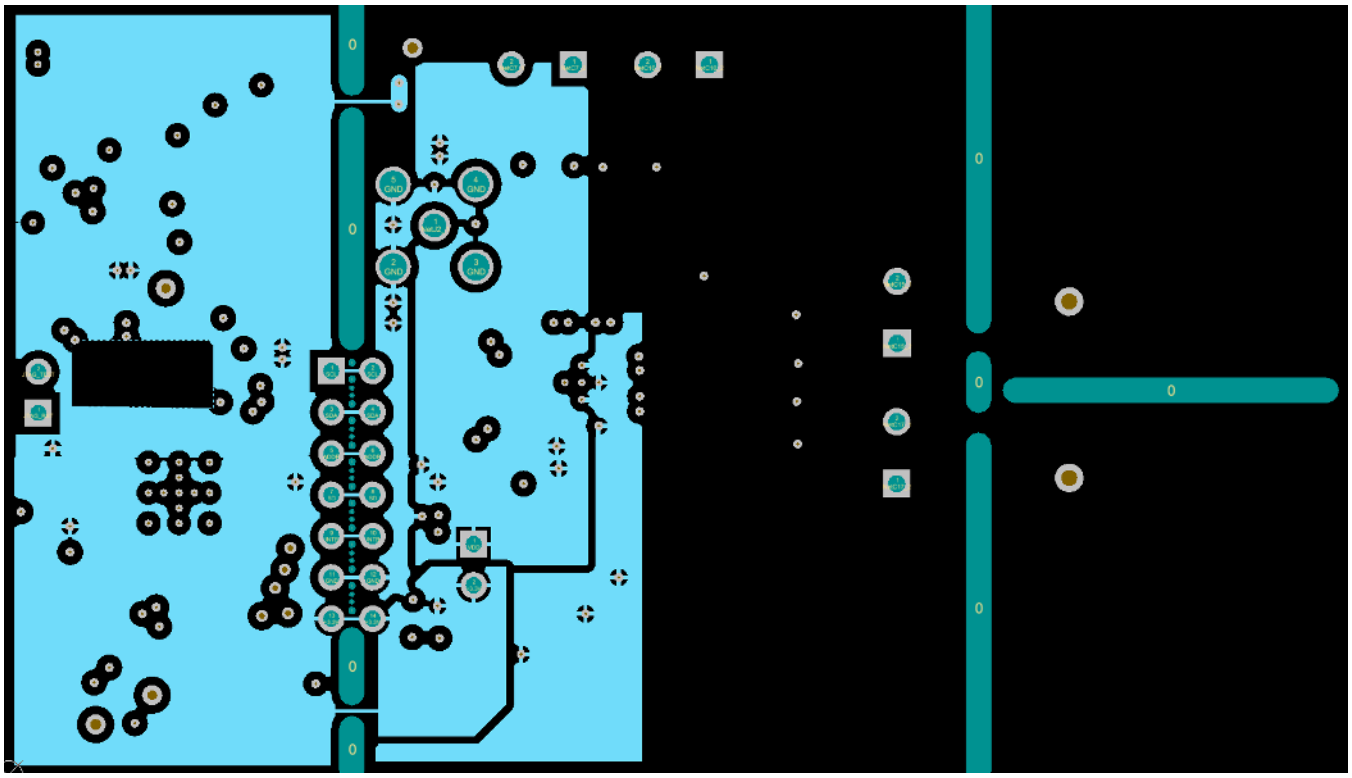


Figure 48. Mid-Layer 2 – Signals and Power Plane

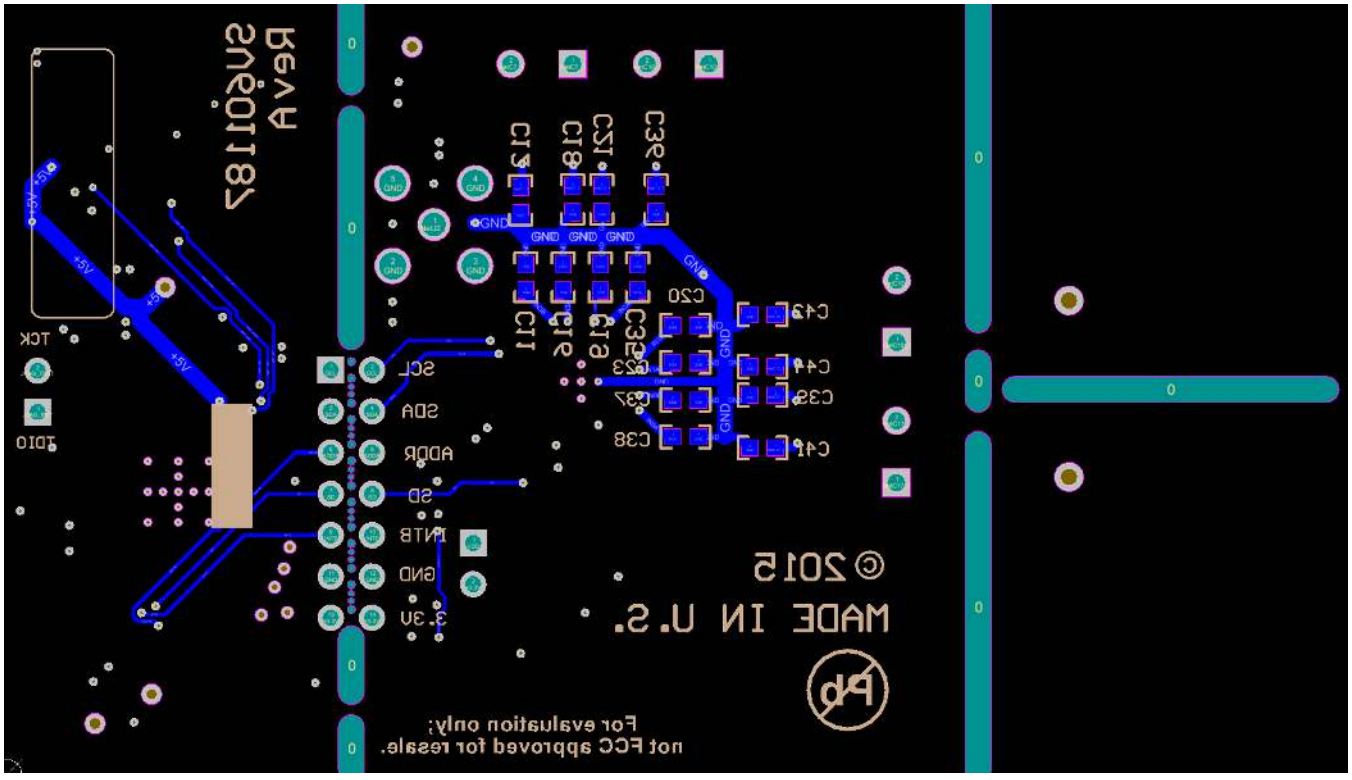


Figure 49. Layout Bottom Layer – Signals Plane

4 Bill of Materials

Table 1. BOM for FDC2114 EVM

DESIG-NATOR	QTY.	VALUE	DESCRIPTION	PART NUMBER	MANUFACTURER
!PCB1	1		Printed Circuit Board	SV601187	Any
C1, C31	2	10uF	CAP, CERM, 10uF, 10V, +/-20%, X5R, 0603	C1608X5R1A106M	TDK
C2, C9, C30, C32, C33, C34	6	0.1uF	CAP CER 0.1UF 16V 5% X7R 0402	GRM155R71C104JA88D	Murata Electronics North America
C3	1	2.2uF	CAP, CERM, 2.2uF, 10V, +/-10%, X5R, 0603	C0603C225K8PACTU	Kemet
C4, C5	2	0.01uF	CAP, CERM, 0.01uF, 25V, +/-5%, C0G/NP0, 0603	C1608C0G1E103J	TDK
C6	1	0.01uF	CAP, CERM, 0.01 µF, 16 V, +/- 10%, X7R, 0402	C1005X7R1C103K	TDK
C7, C10, C15, C17	4	33pF	CAP, CERM, 33 pF, 50 V, +/- 1%, C0G/NP0, 0603_950	CL10C330FB8NNNC	Samsung
C8	1	22uF	CAP, CERM, 22uF, 16V, +/-10%, X5R, 0805	C2012X5R1C226K125AC	TDK
C13, C14	2	18pF	CAP, CERM, 18pF, 100V, +/-5%, C0G/NP0, 0603	GRM1885C2A180JA01D	MuRata
C25	1	1uF	CAP, CERM, 1uF, 10V, +/-10%, X5R, 0402	GRM155R61A105KE15D	MuRata
C26, C28	2	0.22uF	CAP, CERM, 0.22 µF, 25 V, +/- 5%, X7R, 0805	08053C224JAT2A	AVX
C27	1	2200pF	CAP, CERM, 2200pF, 50V, +/-10%, X7R, 0603	C0603X222K5RACTU	Kemet
C29	1	220PF	CAP CER 220PF 50V 1% NP0 0402	C1005C0G1H221F050BA	TDK Corporation
D1	1	5.6V	Diode, Zener, 5.6V, 500mW, SOD-123	MMSZ5232B-7-F	Diodes Inc.
D2	1	Green	LED, Green, SMD	LG L29K-G2J1-24-Z	OSRAM
D3	1	Red	LED, Super Red, SMD	SML-LX0603SRW-TR	Lumex
GND1, GND2, GND3	3	SMT	Test Point, Miniature, SMT	5015	Keystone
J1	1		Connector, Receptacle, Micro-USB Type B, SMT	ZX62R-B-5P	Hirose Electric Co. Ltd.
L1, L2, L3, L4	4	18uH	Inductor, Shielded, Ferrite, 18 µH, 0.12 A, 3.3 ohm, SMD	CMH322522-180KL	Bourns
L10	1	10uH	Inductor, Shielded, Ferrite, 10 µH, 0.4 A, 1.38 ohm, SMD	VLS201610ET-100M	TDK
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	THT-14-423-10	Brady
R1, R2, R4, R10, R18, R22	6	0	RES, 0 ohm, 5%, 0.1W, 0603	CRCW06030000Z0EA	Vishay-Dale
R6	1	1.5K	RES 1.5K OHM 1/16W 5% 0402 SMD	CRCW04021K50JNED	Vishay Dale
R7, R17	2	33	RES, 33 ohm, 5%, 0.1W, 0603	CRCW060333R0JNEA	Vishay-Dale
R8, R9	2	10.0	RES, 10.0, 1%, 0.063 W, 0402	CRCW040210R0FKED	Vishay-Dale
R12, R13	2	4.70k	RES, 4.70k ohm, 1%, 0.1W, 0603	RC0603FR-074K7L	Yageo America
R15	1	1M	RES,1M ohm, 5%, 0.063W, 0402	RC0402JR-071ML	Yageo

Table 1. BOM for FDC2114 EVM (continued)

DESIG-NATOR	QTY.	VALUE	DESCRIPTION	PART NUMBER	MANUFACTURER
R19, R20, R23, R24, R26, R27, R28, R33	8	0	RES, 0 ohm, 5%, 0.125W, 0805	CRCW08050000Z0EA	Vishay-Dale
R21, R25	2	1.0k	RES, 1.0k ohm, 5%, 0.063W, 0402	CRCW04021K00JNED	Vishay-Dale
R29	1	33k	RES, 33k ohm, 5%, 0.063W, 0402	CRCW040233K0JNED	Vishay-Dale
U1	1		Multi-Channel 12/28-Bit Capacitance to Digital Converter (FDC) for Capacitive Sensing, RGH0016A	FDC2114RGHR	Texas Instruments
U2	1		Micropower 150 mA Low-Noise Ultra Low-Dropout Regulator, 5-pin SOT-23, Pb-Free	LP2985AIM5-3.3/NOPB	Texas Instruments
U3	1		Low-Capacitance + / - 15 kV ESD-Protection Array for High-Speed Data Interfaces, 2 Channels, -40 to +85 degC, 5-pin SOT (DRL), Green (RoHS & no Sb/Br)	TPD2E001DRLR	Texas Instruments
U5	1		Mixed Signal MicroController, RGC0064B	MSP430F5528IRGC	Texas Instruments
Y1	1		Crystal, 24.000MHz, 18pF, SMD	ABM8-24.000MHZ-B2-T	Abracon Corportation
Y2	1		OSC, 40 MHz, 3.3 V, SMD	625L3C040M00000	CTS Electrocomponents
C11, C12, C16, C18, C19, C20, C21, C23, C35, C36, C37, C38, C39, C41, C42, C44	0	18pF	CAP, CERM, 18pF, 100V, +/-5%, C0G/NP0, 0603	GRM1885C2A180JA01D	MuRata
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A
J2	0		SMA Straight Jack, Gold, 50 Ohm, TH	901-144-8RFX	Amphenol RF
J3	0		Header, 100mil, 7x2, Gold, TH	TSW-107-07-G-D	Samtec
J4, J5, J6, J7	0	2x1	Conn Term Block, 2POS, 3.81mm, TH	1727010	Phoenix Contact
J8, J9	0		Header, TH, 100mil, 2x1, Gold plated, 230 mil above insulator	TSW-102-07-G-S	Samtec, Inc.
R3, R5, R14, R16	0	0	RES, 0 ohm, 5%, 0.1W, 0603	CRCW06030000Z0EA	Vishay-Dale
R11	0	49.9	RES, 49.9, 1%, 0.1 W, 0603	CRCW060349R9FKEA	Vishay-Dale

Table 2. BOM for FDC2214 EVM

DESIG-NATOR	QTY.	VALUE	DESCRIPTION	PART NUMBER	MANUFACTURER
!PCB1	1		Printed Circuit Board	SV601187	Any
C1, C31	2	10uF	CAP, CERM, 10uF, 10V, +/-20%, X5R, 0603	C1608X5R1A106M	TDK
C2, C9, C30, C32, C33, C34	6	0.1uF	CAP CER 0.1UF 16V 5% X7R 0402	GRM155R71C104JA88D	Murata Electronics North America
C3	1	2.2uF	CAP, CERM, 2.2uF, 10V, +/-10%, X5R, 0603	C0603C225K8PACTU	Kemet
C4, C5	2	0.01uF	CAP, CERM, 0.01uF, 25V, +/-5%, C0G/NP0, 0603	C1608C0G1E103J	TDK
C6	1	0.01uF	CAP, CERM, 0.01 µF, 16 V, +/- 10%, X7R, 0402	C1005X7R1C103K	TDK
C7, C10, C15, C17	4	33pF	CAP, CERM, 33 pF, 50 V, +/- 1%, C0G/NP0, 0603_950	CL10C330FB8NNNC	Samsung
C8	1	22uF	CAP, CERM, 22uF, 16V, +/-10%, X5R, 0805	C2012X5R1C226K125AC	TDK
C13, C14	2	18pF	CAP, CERM, 18pF, 100V, +/-5%, C0G/NP0, 0603	GRM1885C2A180JA01D	MuRata
C25	1	1uF	CAP, CERM, 1uF, 10V, +/-10%, X5R, 0402	GRM155R61A105KE15D	MuRata
C26, C28	2	0.22uF	CAP, CERM, 0.22 µF, 25 V, +/- 5%, X7R, 0805	08053C224JAT2A	AVX
C27	1	2200pF	CAP, CERM, 2200pF, 50V, +/-10%, X7R, 0603	C0603X222K5RACTU	Kemet
C29	1	220PF	CAP CER 220PF 50V 1% NP0 0402	C1005C0G1H221F050BA	TDK Corporation
D1	1	5.6V	Diode, Zener, 5.6V, 500mW, SOD-123	MMSZ5232B-7-F	Diodes Inc.
D2	1	Green	LED, Green, SMD	LG L29K-G2J1-24-Z	OSRAM
D3	1	Red	LED, Super Red, SMD	SML-LX0603SRW-TR	Lumex
GND1, GND2, GND3	3	SMT	Test Point, Miniature, SMT	5015	Keystone
J1	1		Connector, Receptacle, Micro-USB Type B, SMT	ZX62R-B-5P	Hirose Electric Co. Ltd.
L1, L2, L3, L4	4	18uH	Inductor, Shielded, Ferrite, 18 µH, 0.12 A, 3.3 ohm, SMD	CMH322522-180KL	Bourns
L10	1	10uH	Inductor, Shielded, Ferrite, 10 µH, 0.4 A, 1.38 ohm, SMD	VLS201610ET-100M	TDK
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	THT-14-423-10	Brady
R1, R2, R5, R10, R18, R22	6	0	RES, 0 ohm, 5%, 0.1W, 0603	CRCW06030000Z0EA	Vishay-Dale
R6	1	1.5K	RES 1.5K OHM 1/16W 5% 0402 SMD	CRCW04021K50JNED	Vishay Dale
R7, R17	2	33	RES, 33 ohm, 5%, 0.1W, 0603	CRCW060333R0JNEA	Vishay-Dale
R8, R9	2	10.0	RES, 10.0, 1%, 0.063 W, 0402	CRCW040210R0FKED	Vishay-Dale
R12, R13	2	4.70k	RES, 4.70k ohm, 1%, 0.1W, 0603	RC0603FR-074K7L	Yageo America
R15	1	1M	RES,1M ohm, 5%, 0.063W, 0402	RC0402JR-071ML	Yageo
R19, R20, R23, R24, R26, R27, R28, R33	8	0	RES, 0 ohm, 5%, 0.125W, 0805	CRCW08050000Z0EA	Vishay-Dale

Table 2. BOM for FDC2214 EVM (continued)

DESIG-NATOR	QTY.	VALUE	DESCRIPTION	PART NUMBER	MANUFACTURER
R21, R25	2	1.0k	RES, 1.0k ohm, 5%, 0.063W, 0402	CRCW04021K00JNED	Vishay-Dale
R29	1	33k	RES, 33k ohm, 5%, 0.063W, 0402	CRCW040233K0JNED	Vishay-Dale
U1	1		Multi-Channel 12/28-Bit Capacitance to Digital Converter (FDC) for Capacitive Sensing, RGH0016A	FDC2214RGHR	Texas Instruments
U2	1		Micropower 150 mA Low-Noise Ultra Low-Dropout Regulator, 5-pin SOT-23, Pb-Free	LP2985AIM5-3.3/NOPB	Texas Instruments
U3	1		Low-Capacitance + / - 15 kV ESD-Protection Array for High-Speed Data Interfaces, 2 Channels, -40 to +85 degC, 5-pin SOT (DRL), Green (RoHS & no Sb/Br)	TPD2E001DRLR	Texas Instruments
U5	1		Mixed Signal MicroController, RGC0064B	MSP430F5528IRGC	Texas Instruments
Y1	1		Crystal, 24.000MHz, 18pF, SMD	ABM8-24.000MHZ-B2-T	Abracon Corportation
Y2	1		OSC, 40 MHz, 3.3 V, SMD	625L3C040M00000	CTS Electrocomponents
C11, C12, C16, C18, C19, C20, C21, C23, C35, C36, C37, C38, C39, C41, C42, C44	0	18pF	CAP, CERM, 18pF, 100V, +/-5%, C0G/NP0, 0603	GRM1885C2A180JA01D	MuRata
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A
J2	0		SMA Straight Jack, Gold, 50 Ohm, TH	901-144-8RFX	Amphenol RF
J3	0		Header, 100mil, 7x2, Gold, TH	TSW-107-07-G-D	Samtec
J4, J5, J6, J7	0	2x1	Conn Term Block, 2POS, 3.81mm, TH	1727010	Phoenix Contact
J8, J9	0		Header, TH, 100mil, 2x1, Gold plated, 230 mil above insulator	TSW-102-07-G-S	Samtec, Inc.
R3, R4, R14, R16	0	0	RES, 0 ohm, 5%, 0.1W, 0603	CRCW06030000Z0EA	Vishay-Dale
R11	0	49.9	RES, 49.9, 1%, 0.1 W, 0603	CRCW060349R9FKEA	Vishay-Dale

Revision History

Changes from Original (June 2015) to A Revision	Page
• Changed GUI version to Sensing Solutions EVM GUI 1.8.8	7

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