LDC1000 Evaluation Module

User's Guide

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LDC1000 Evaluation Module

1.1 Overview

The LDC1000 Evaluation Module is designed to provide an example LC tank and coil structure application, to interface to a host computer. The module can be used independently of the GUI by the on-board embedded LED, which demonstrates threshold detection.

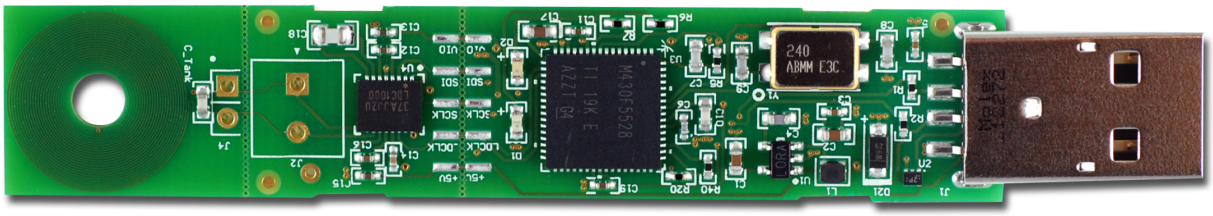

Figure 1-1. Evaluation Module

The EVM includes an example PCB sensor which is 14mm in diameter and contains 2 layers. A 100pF 1% COG cap is connected, in parallel, to the PCB coil, in order to form an LC tank.

The EVM is perforated at two locations: One between Coil and LDC1000, which provides the option to snap the PCB coil and connect a custom coil required in the application. The second perforation is between LDC1000 and MSP430, and provides the option to connect the LDC1000+Sensor into a different system or use multiple of such sensors in one system for prototyping.

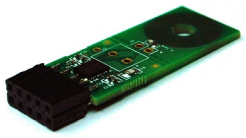

Figure 1-2. LDC1000+Sensor

When the evaluation module first powers up from the USB port, it will flash a series of green and red LED lights to indicate self-test. When self-test is finished, the green LED indicates the status of the LDC1000 INT pin. When INT is asserted, the green LED is lit. By default, INT is configured for threshold detection.

Quick Start Guide LDC1000 Evaluation Module

2.1 LDC1000 Evaluation Module Overview

The LDC1000 Evaluation Module (EVM) enables the user to test out analog and digital capabilities of the LDC1000 Inductance-to-Digital Converter. The EVM is a USB device used with a host computer and accessed using the Inductive Sensing Graphical User Interface (GUI) software, which is documented in Chapter 3.

To quickly get started on the LDC1000 GUI, follow the steps below to load and configure a device.

2.1.1 Evaluation Module

Set Up Requirements

1. The LDC1000 GUI and drivers must be installed on the host.
2. The USB port of the EVM must be connected to the host.

Loading and Running

1. Plug the EVM into the host computer. The host computer should automatically detect the device as LDC1000EVM.
2. Launch the GUI. It should automatically detect the target, read all the configuration registers, and begin streaming data.

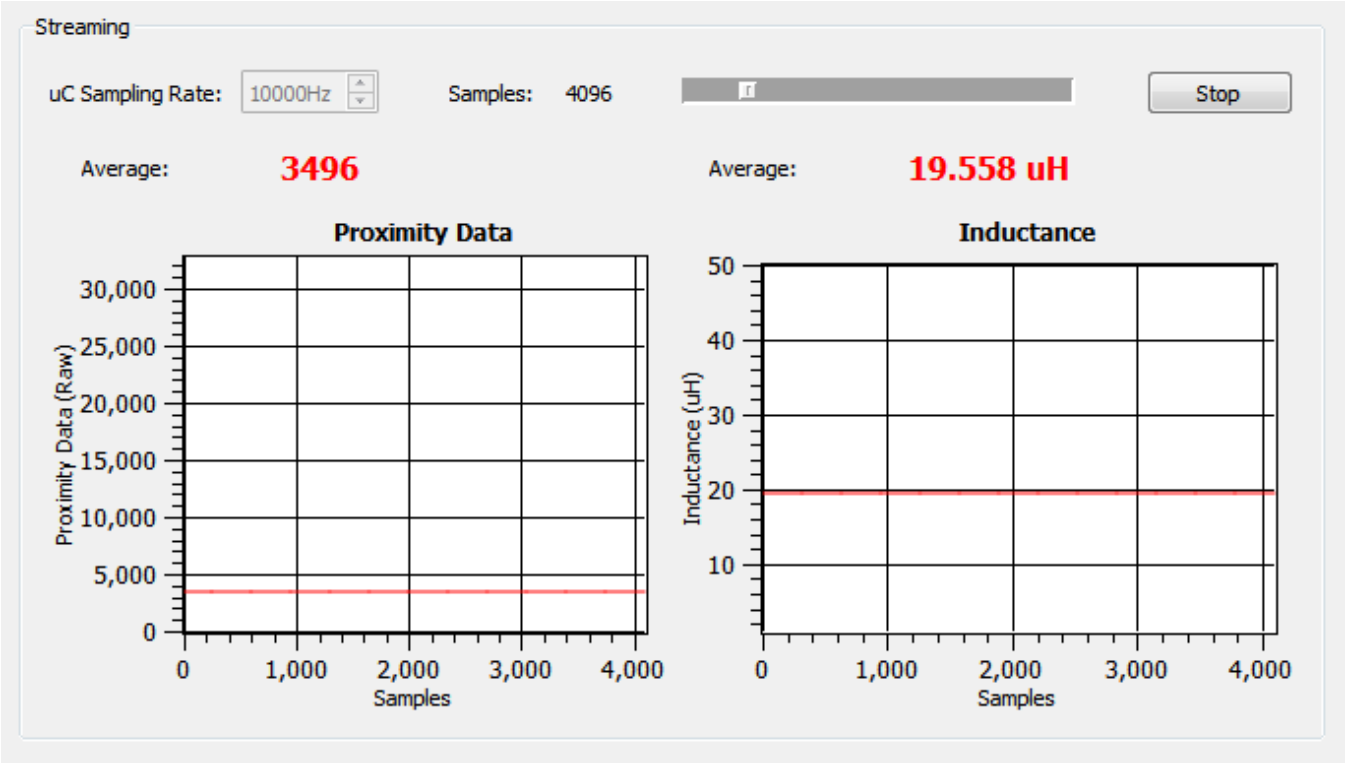

Figure 2-1. Streaming Section

Reloading the Device

If the EVM is disconnected from the host at any time, simply reconnect the device and the GUI will automatically discover and re-establish the streaming abilities with the device.

Configuring the Device Manually

1. The GUI puts the device in streaming mode by default. Click on "Stop" in the Streaming Section to stop streaming.

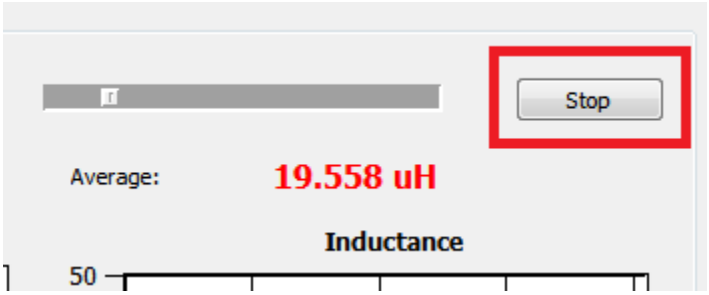

Figure 2-2. Stop Streaming

2. Click on the "Configuration Section" icon in the main window toolbar.

Figure 2-3. Configuration Section Icon

3. Select the parameter to change. When entering the comparator thresholds, press ENTER to confirm the change. Changes are applied immediately.

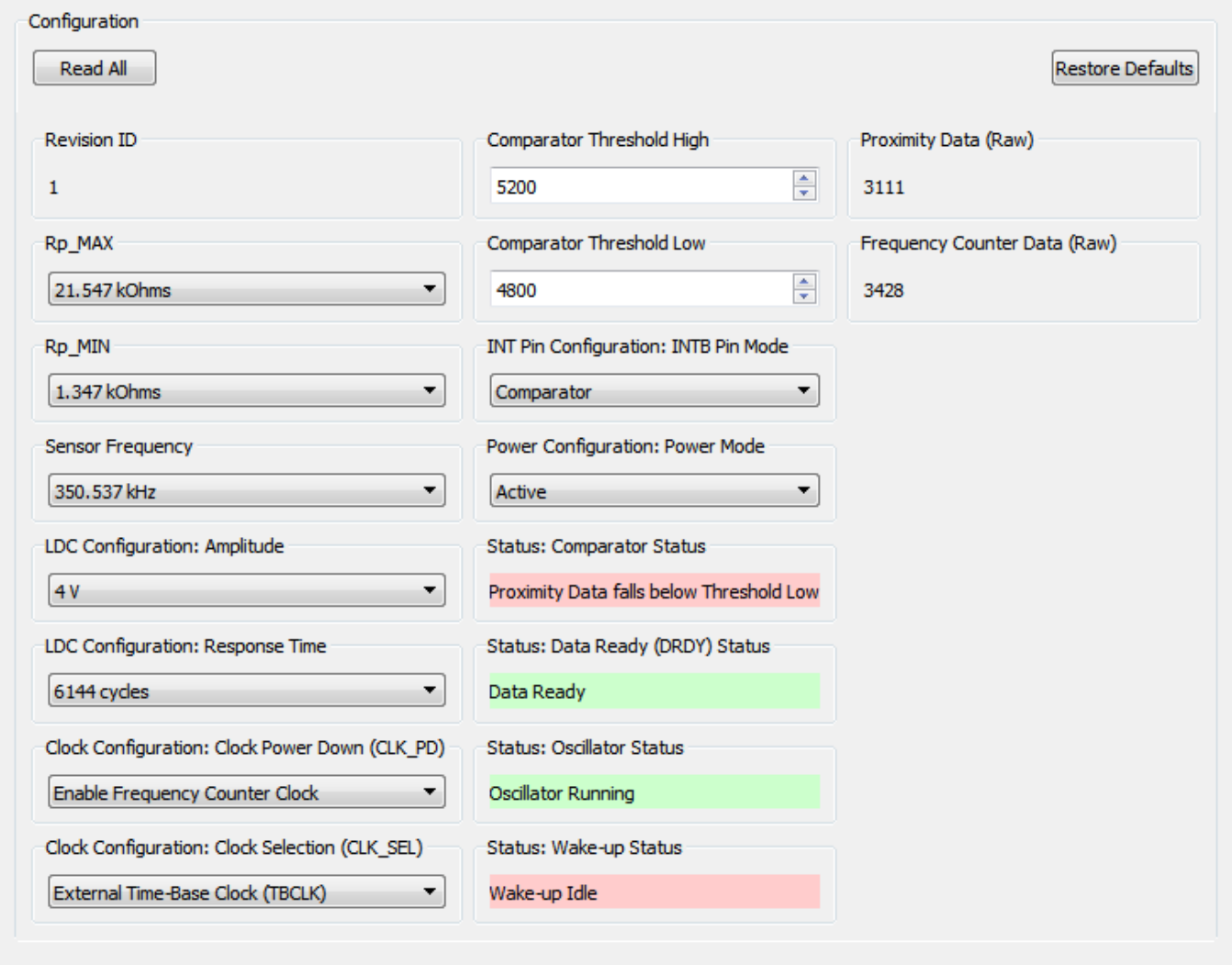

Figure 2-4. Configuration Section

Saving Device Configuration

1. Click on the "Save" icon in the toolbar.

Figure 2-5. Save Icon

2. Type a name for the file.

Configuring the Device with Configuration File Defaults

1. The GUI puts the device in streaming mode by default. Click on "Stop" in the Streaming Section to stop streaming.
2. Click on the "Open" icon in the toolbar.

Figure 2-6. Open Icon

3. Select the configuration file.

4. After the configuration file is loaded, current values are written once to all supported registers. To restore defaults *defined in the configuration file*, click on Restore Defaults to write all current registers with the new configuration file defaults.

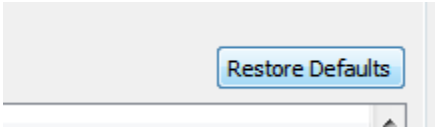

Figure 2-7. Restore Defaults

Inductive Sensing GUI User Guide

3.1 Inductive Sensing GUI Overview

The inductive sensing GUI provides graphical configuration and streaming support for the LDC1000. **The GUI package includes drivers for use with the LDC1000 Evaluation Modules (EVM).** The EVM provides a device abstraction layer for the GUI to communicate with the LDC1000 through SPI, and includes other extended functionality.

3.2 Host platform Requirements

The Inductive Sensing GUI supports:

- 32-bit and 64-bit Windows 7
- 32-bit and 64-bit Windows XP

The host machine is required for device configuration and data streaming.

3.3 EVM Information

For the TI LDC1000 EVM:

- The EVM allows the GUI to:
  - Configuring register data through SPI (CSB, SCLK, SDO, SDI)
  - Stream register data through **SPI**
  - Stream register data through **SPI**
  - Detect interrupts through **SPI**

3.4 Hardware Setup

Below are the steps which are necessary to prepare the EVM for the GUI:

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

3.5 Icon Toolbar

The icon toolbar contains various icons which navigate between sections and perform various functions.

Figure 3-1. Icon Toolbar

Name	Description	Icon
Connection Information	Indicates whether an EVM is connected to the PC, and if so, provides details of the connected device.	• EVM is connected  • EVM is disconnected 
Open	Opens saved register settings and defaults	
Save	Saves all current register settings and defaults	
Register Settings	Show Register Settings Section	
Configuration	Show Configuration Section	
Streaming	Show Streaming Section	

3.6 Connecting and Disconnecting

Device discovery, connection, and disconnection is performed automatically.

3.7 Multiple EVMs

If the user desires to connect to multiple EVMs, multiple instances of the GUI can be launched. Multiple instances cannot connect to the same EVM; only one instance of the GUI can be connected to one EVM.

3.8 General Configuration

In the configuration section, all registers of the device can be accessed. To access this section, streaming must be stopped.

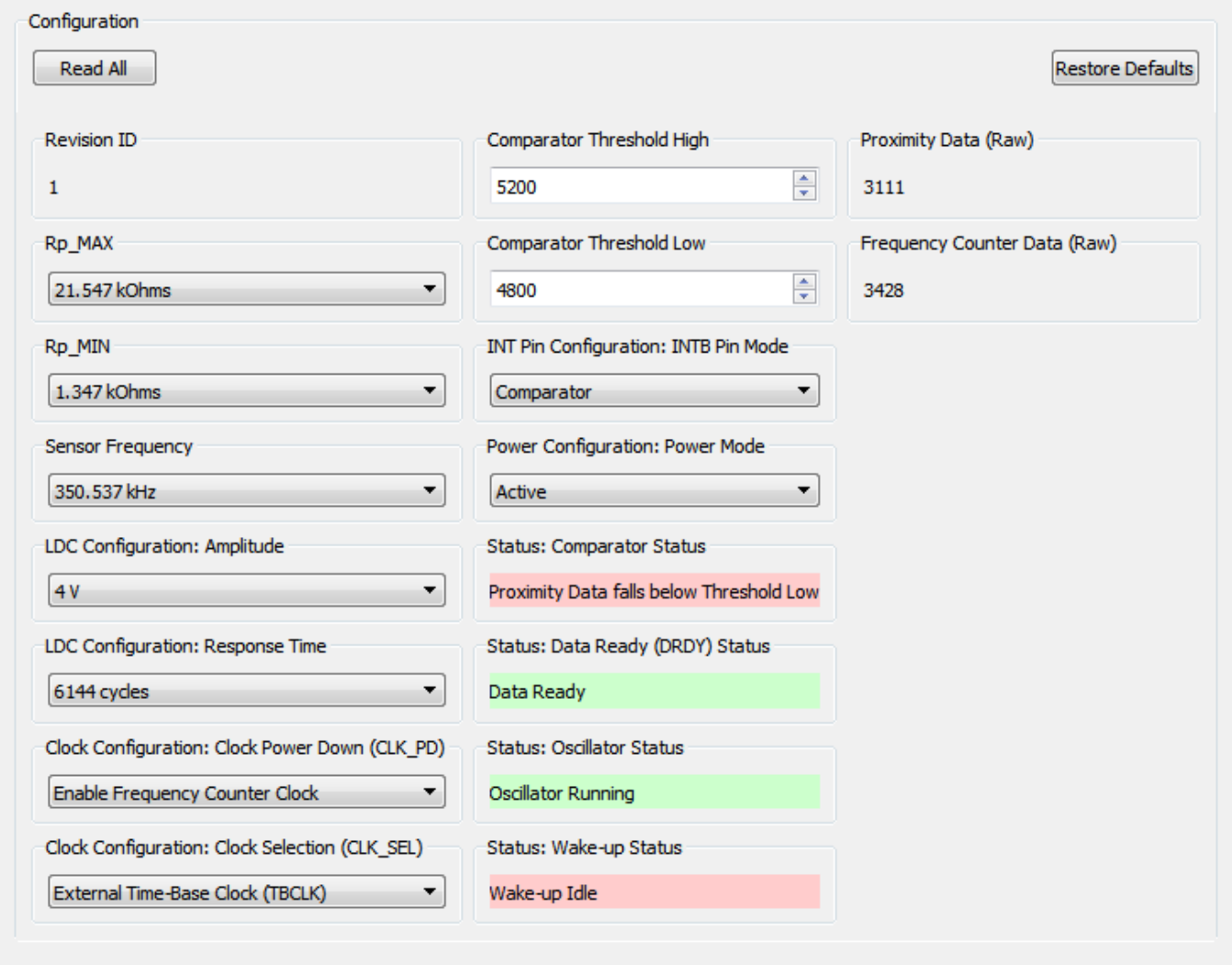

Figure 3-2. Configuration Section

In the configuration window, select the parameter to change. When entering the comparator thresholds, press ENTER to confirm the change. Changes are applied immediately.

Press “Read All” to refresh all configuration, status, and data.

Press “Restore Defaults” to write values from the default column (if they exist) to the current register value.

3.9 Register Settings

In the register settings section, all registers of the device can be accessed. To read/write registers, streaming must be stopped.

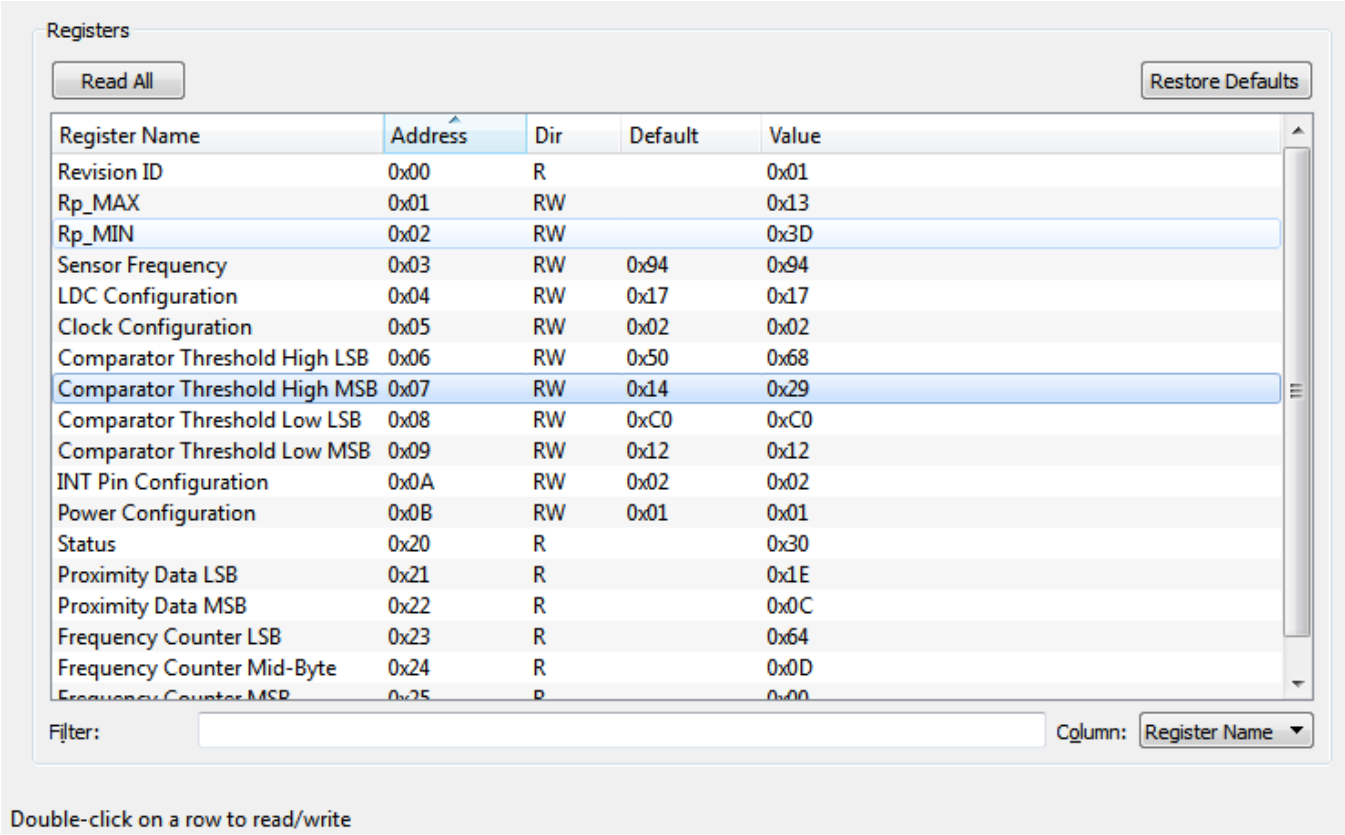

Figure 3-3. Register Settings

Double-click on a register in the table to read/write. If a register is read only, the selected register is read immediately and the table value updated. If the register is read/write, a dialog pops up and the user can choose a new register value. If the value is not changed, it will default to a read.

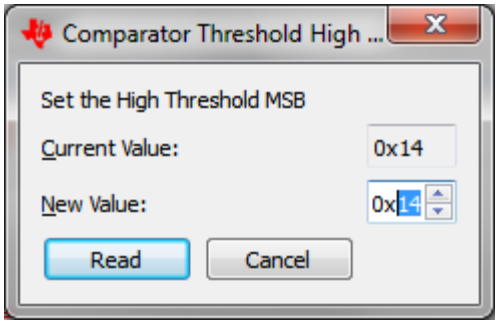

Figure 3-4. Read/Write Register Dialog

Press “Read All” to refresh all configuration, status, and data.

Press “Restore Defaults” to write values from the default column (if they exist) to the current register value.

3.10 Data Streaming

Data is streamed from the EVM to the GUI when streaming is started. The sampling rate of the EVM and the number of samples to plot can be configured.

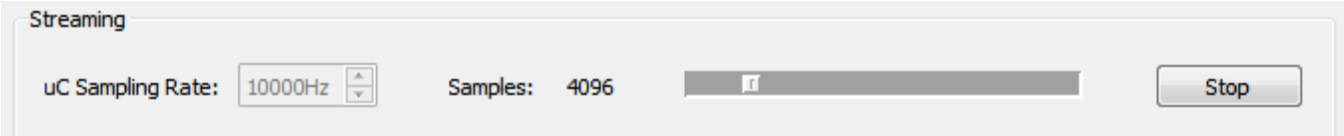

Figure 3-5. Streaming Configuration

The sampling rate can only be set when streaming is stopped.

3.10.1 Average, Point, Min, Max Values

Average is the default display type. To toggle between sample point, min, and max values, right-click the display.

Average	The average of all the data points currently in the plot
Point	The newest data point value currently in the plot
Min	The minimum data point value currently in the plot
Max	The maximum data point value currently in the plot

A larger number of samples would result in a larger averaging window.

3.10.2 Zooming and Scaling

Plots are interactive. Zooming options are available by right-clicking the plot and selecting an option from the context menu.

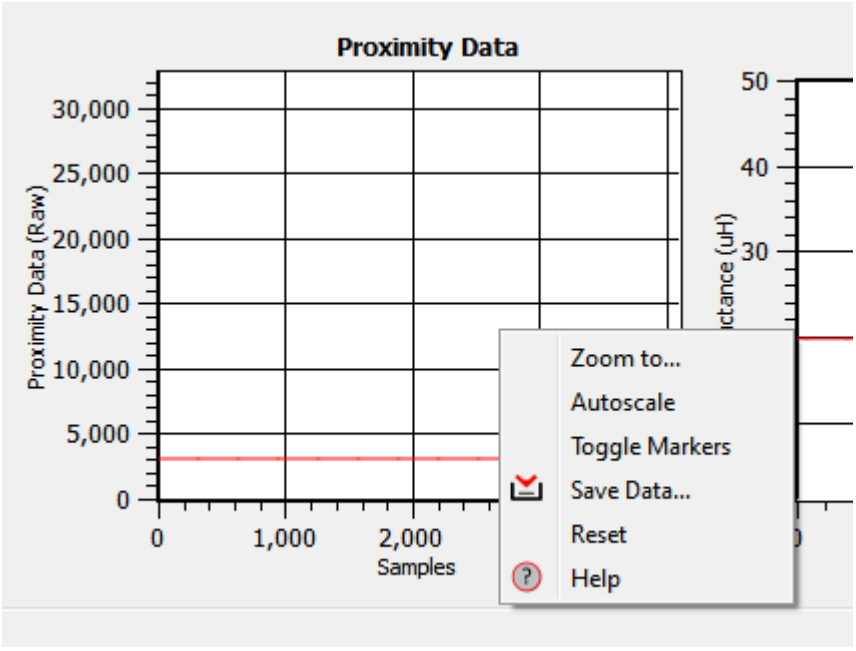

Figure 3-6. Plot Context Menu

Zoom to...	Zooms to window
Autoscale	Autoscales the data in the plot
Reset	Resets the Zoom window to its default setting
Help	Displays shortcut keys and mouse mappings for scaling and zooming

3.10.3 Threshold Display

To display Rp Thresholds, right-click the plot and select “Toggle Markers.”

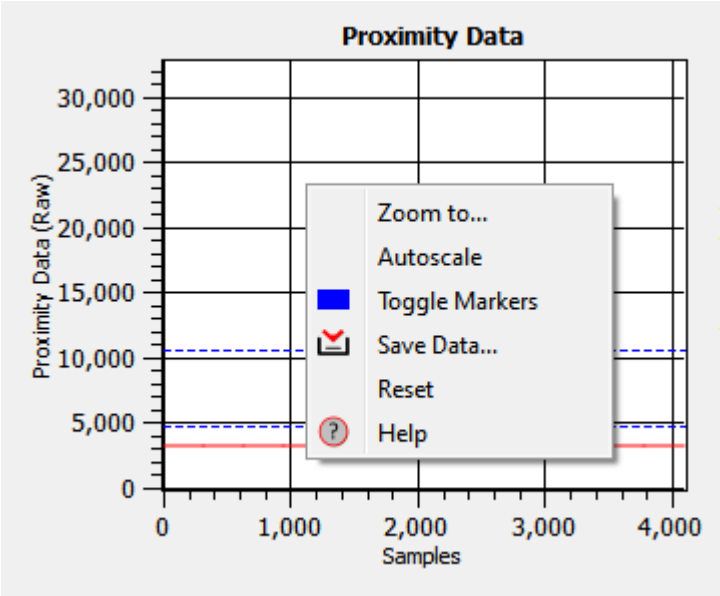

Figure 3-7. Toggling Markets

3.11 Saving and Loading

3.11.1 Configurations

Configurations can be saved and loaded. To save a configuration, click on the **"Save"** icon. To load a configuration, click on the **"Open"** icon.

Configurations include all register names, current values, and default values. They are saved in Comma-Separated Files (*.csv) and can be modified using a text or spreadsheet editor.

3.11.2 Plot Data

Right-click a plot and select “Save Data…”

Data can be saved to a new file or an existing one. If an existing file is chosen, data will be appended.

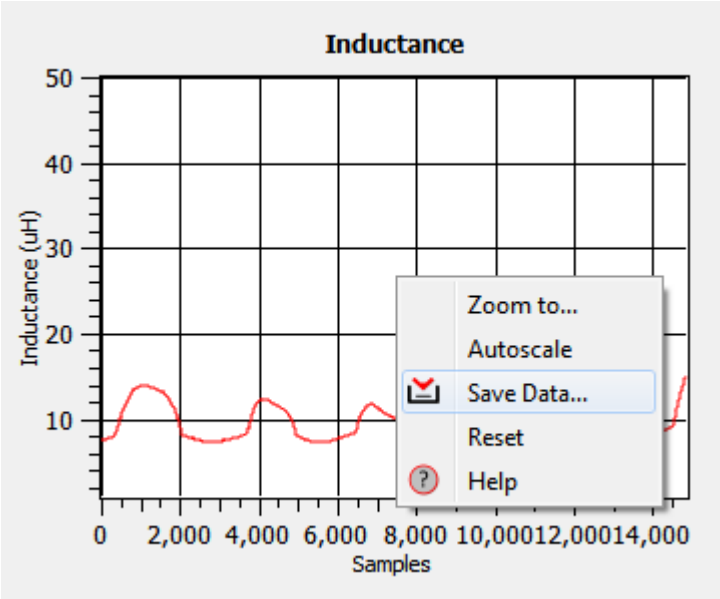

Figure 3-8. Saving Data from a plot

Schematics

4.1 LDC1000 Schematics

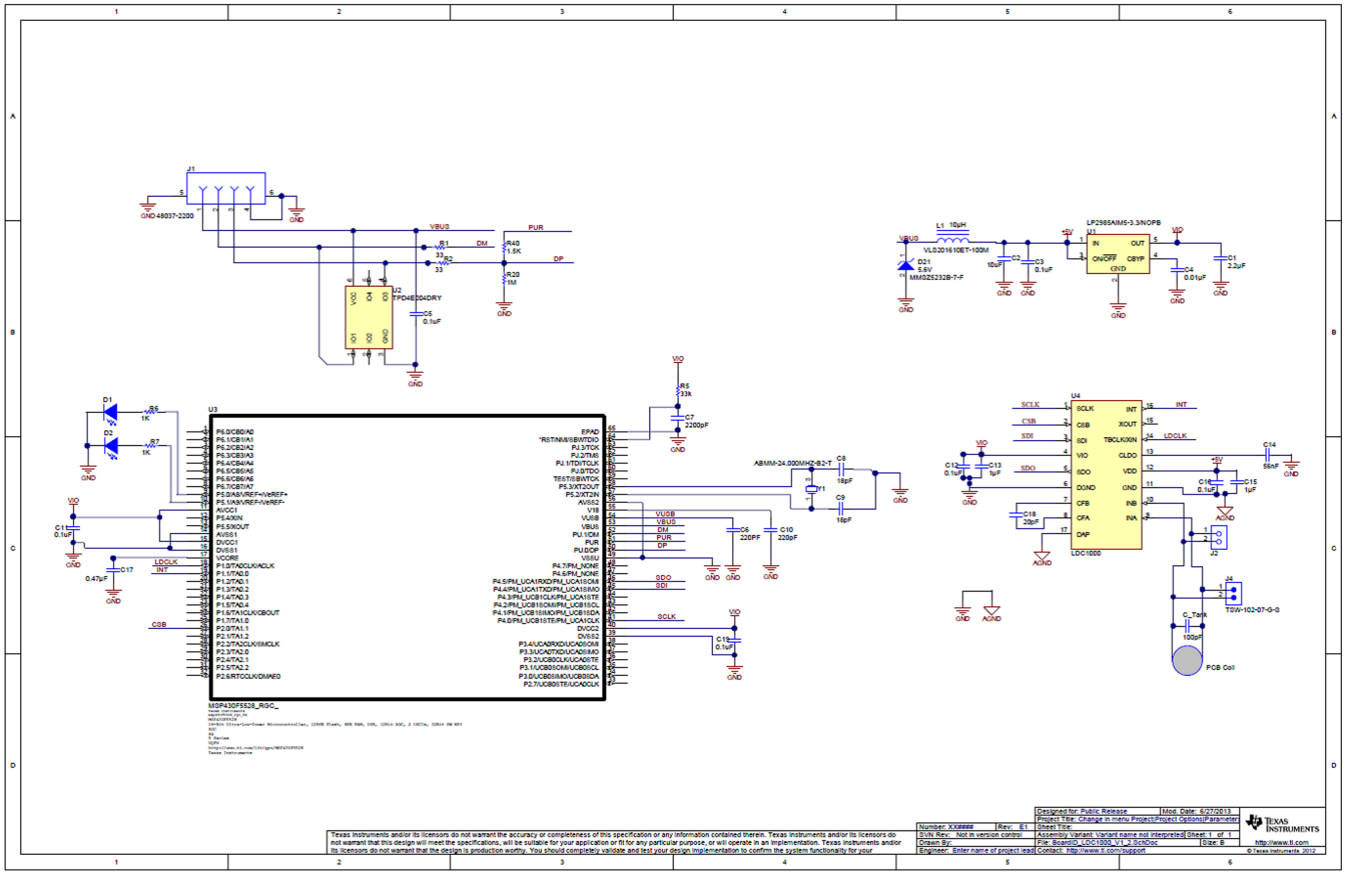

Figure 4-1. Layout

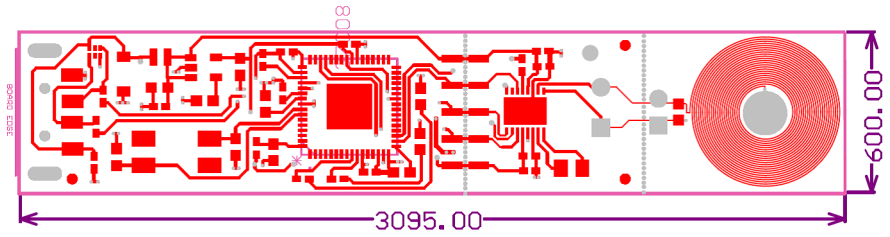

Figure 4-2. Top Layer

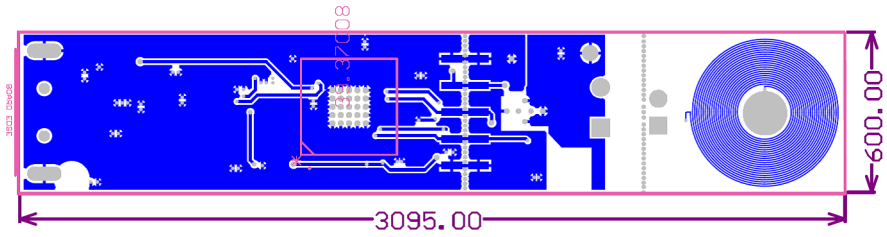

Figure 4-3. Bottom Layer

Bill of Materials

Designator	Quantity	Description	Manufacturer	Part Number
C1	1	CAP, CERM, 2.2uF, 10V, +/-10%, X5R, 0603	Kemet	C0603C225K8PACTU
C2	1	CAP CER 10UF 10V 10% X5R 0603	TDK Corporation	C1608X5R1A106K080AC
C3, C5, C11, C12, C16, C19	6	CAP CER 0.1UF 16V 5% X7R 0402	Murata Electronics North America	GRM155R71C104JA88D
C4	1	CAP, CERM, 0.01uF, 25V, +/-5%, C0G/NP0, 0603	TDK	C1608C0G1E103J
C6	1	CAP CER 220PF 50V 1% NP0 0402	TDK Corporation	C1005C0G1H221F050BA
C7	1	CAP, CERM, 2200pF, 50V, +/-10%, X7R, 0603	Kemet	C0603X222K5RACTU
C8, C9	2	CAP CER 18PF 100V 5% NP0 0603	MuRata	GRM1885C2A180JA01D
C10	1	CAP, CERM, 220pF, 50V, +/-1%, C0G/NP0, 0603	AVX	06035A221FAT2A
C13, C15	2	CAP, CERM, 1uF, 10V, +/-10%, X5R, 0402	MuRata	GRM155R61A105KE15D
C14	1	CAP CER 0.056UF 16V 5% X7R 0402	Kemet	C0402C563J4RACTU
C17	1	CAP, CERM, 0.47uF, 10V, +/-10%, X7R, 0603	Kemet	C0603C474K8RACTU
C18	1	CAP CER 20PF 50V 5% NP0 0805	Kemet	C0805C200J5GACTU
C_Tank	1	CAP CER 100PF 50V 1% NP0 0603	AVX Corporation	06035A101FAT2A
D1	1	LED SMARTLED GREEN 570NM 0603	OSRAM Opto Semiconductors Inc	LG L29K-G2J1-24-Z
D2	1	LED 660NM SUPER RED DIFF 0603SMD	Lumex Opto/Components Inc	SML-LX0603SRW-TR
D21	1	Diode, Zener, 5.6V, 500mW, SOD-123	Diodes Inc.	MMSZ5232B-7-F
FID1, FID2, FID3	3	Fiducial mark. There is nothing to buy or mount.	N/A	N/A
J1	1	Connector, USB Type A, 4POS R/A, SMD	Molex	48037-2200
L1	1	INDUCTOR POWER 10UH .45A SMD	TDK Corporation	VLS201610ET-100M
R1, R2	2	RES, 33 ohm, 5%, 0.063W, 0402	Vishay-Dale	CRCW040233R0JNED
R5	1	RES, 33k ohm, 5%, 0.063W, 0402	Vishay-Dale	CRCW040233K0JNED
R6, R7	2	RES 1K OHM 1/10W 5% 0402 SMD	Panasonic Electronic Components	ERJ-2GEJ102X
R20	1	RES,1M ohm, 5%, 0.063W, 0402	Yageo	RC0402JR-071ML
R40	1	RES 1.5K OHM 1/16W 5% 0402 SMD	Vishay Dale	CRCW04021K50JNED

Designator	Quantity	Description	Manufacturer	Part Number
U1	1	Micropower 150 mA Low-Noise Ultra Low-Dropout Regulator, 5-pin SOT-23, Pb-Free	Texas Instruments	LP2985AIM5-3.3/NOPB
U2	1	4-CHANNEL ESD-PROTECTION ARRAY FOR HIGH-SPEED DATA INTERFACES, DRY006A	Texas Instruments	TPD4E004DRY
U3	1	MCU	Texas Instruments	MSP430F5528IRGCR
U4	1	Inductance to Digital Converter	Texas instruments	LDC1000
Y1	1	CRYSTAL 24.000MHZ 18PF SMD	Abracon Corporation	ABMM-24.000MHZ-B2-T
J2	0	TERM BLOCK 2POS 3.81MM PCB HORIZ	FCI	20020327-D021B01LF
J4	0	Header, TH, 100mil, 2x1, Gold plated, 230 mil above insulator	Samtec, Inc.	TSW-102-07-G-S

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