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SX8722 Evaluation Tools XE8000EV120

User's Guide

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1   Introduction

1.1   Context

The tool context is to enable the user to create an engineering environment that enables him to evaluate the SX8722 chip performances.

The tool is intended to be the interface between the sensor and the PC in order to ease the handling of the SX8722.

The tool is made of 3 parts:
- SX8722 application board: Holds the SX8722 and its mandatory components and reproduces the chip pin out in a dual line SMD 1.27mm pitch.
- XE8000EV120: Gives access to all pins of the application board and provides all the hardware interfaces needed to evaluate the SX8722.
- "SX87xx Evaluation Tools" Graphical User Interface (GUI): Gives the user a clear view of the registers content and allows the using of all modes and commands described in the SX8722 datasheet.

1.2   Global function

The SX8722 evaluation board's main function is to give the user the possibility to develop its application by interfacing his sensor, choosing its power supply, finding the best configuration parameters via the GUI, etc. Once the ideal settings found, the corresponding configuration can be optionally saved in a 256 kBits EEPROM and the application board used in stand-alone real application environment.

2   Installation

2.1   Installing the GUI and required software

Put the SEMTECH CD ROM in your computer and if the installation does not start launch the file "setup.exe" located at your CD ROM root directory.

The Installer will propose you to install the "SX87xx Evaluation Tools" GUI and the software needed to make it work.

2.1.1 .NET Framework 2.0

The GUI needs the .NET Framework 2.0 to work properly. The installer proposes to install it, if the installer is unable to detect it on your system.

2.1.2 FTDI USB drivers

The XE8000EV120 board uses a USB to UART converter from FTDI-Chip thus to the board work properly the USB drivers must be installed.

If the USB drivers are not detected on your PC their installation will be proposed.

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2.2 Connecting the board for the first time

Connect the board to your USB port, and then switch on the XE8000EV120 using the "power" switch (top left side of the board).

Note: Ensure that the jumper at the right of the power switch is either connected on 2.5V, 3.3V or 5V_USB.

Note: The first time you connect the kit, the system will install your XE8000EV120 connection as a new Serial COM port device.

For more information on how to determine which Serial COM port has been assigned please refer to §2.3.

Once the board is connected launch the GUI from Windows "Start Menu->Programs->SX87xx->SX87xx" and the GUI main window will open.


Figure 1 Main GUI window

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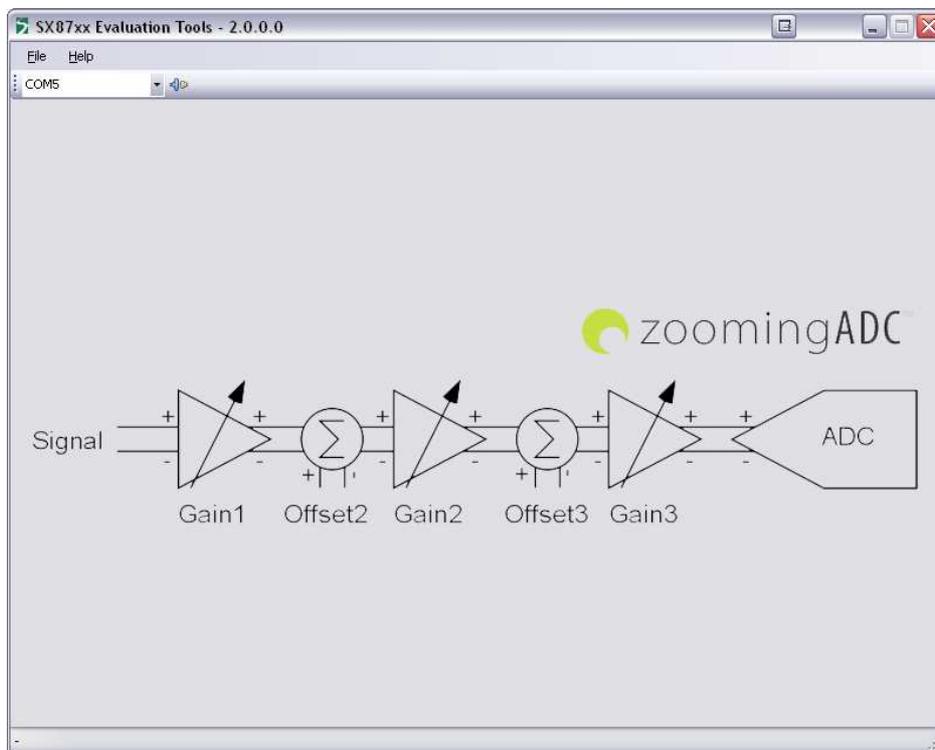
Select the Serial COM port corresponding to your XE8000EV120 board on the GUI toolbar.
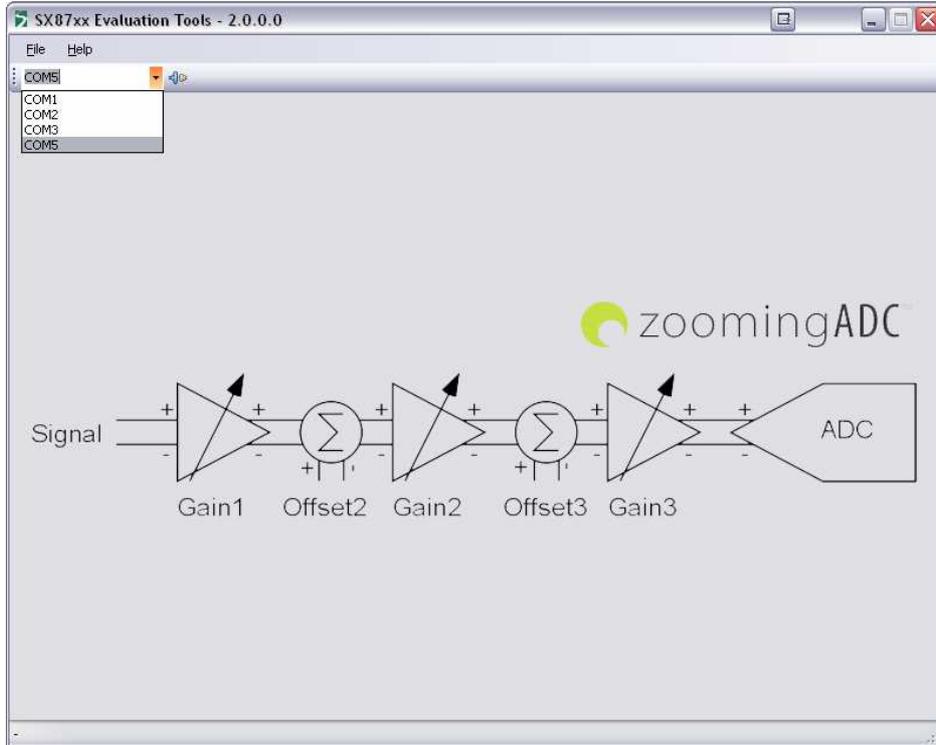
Figure 2 Serial COM port selection

Click on "Open COM" button located on the GUI toolbar.
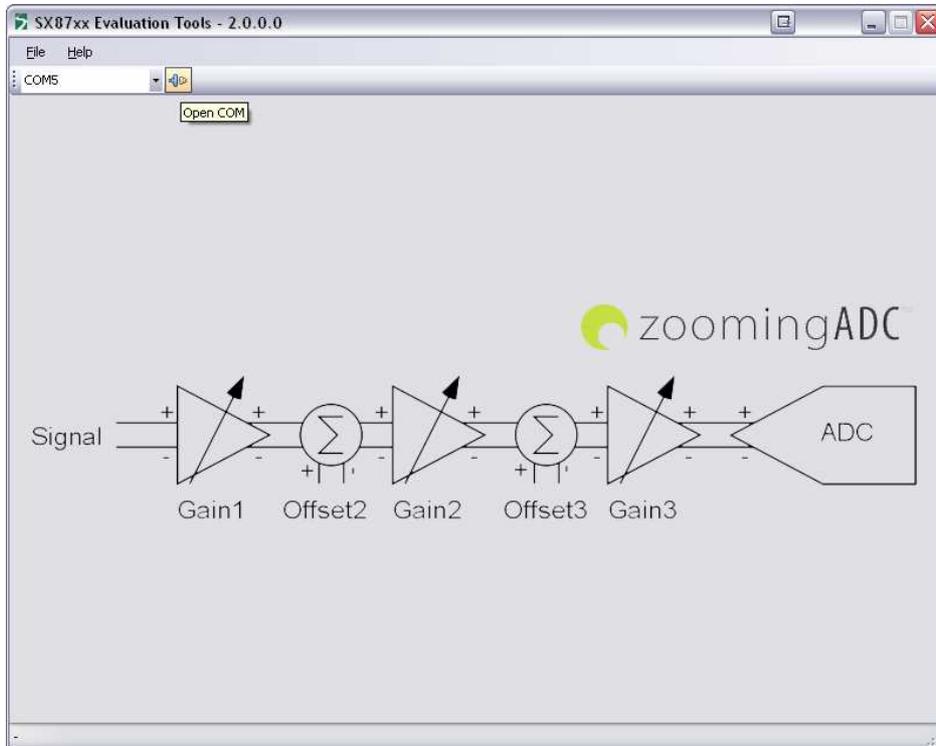
Figure 3 Open Serial COM port

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Once the Serial COM port is open the application will read all the SX8722 registers in order to update the GUI.
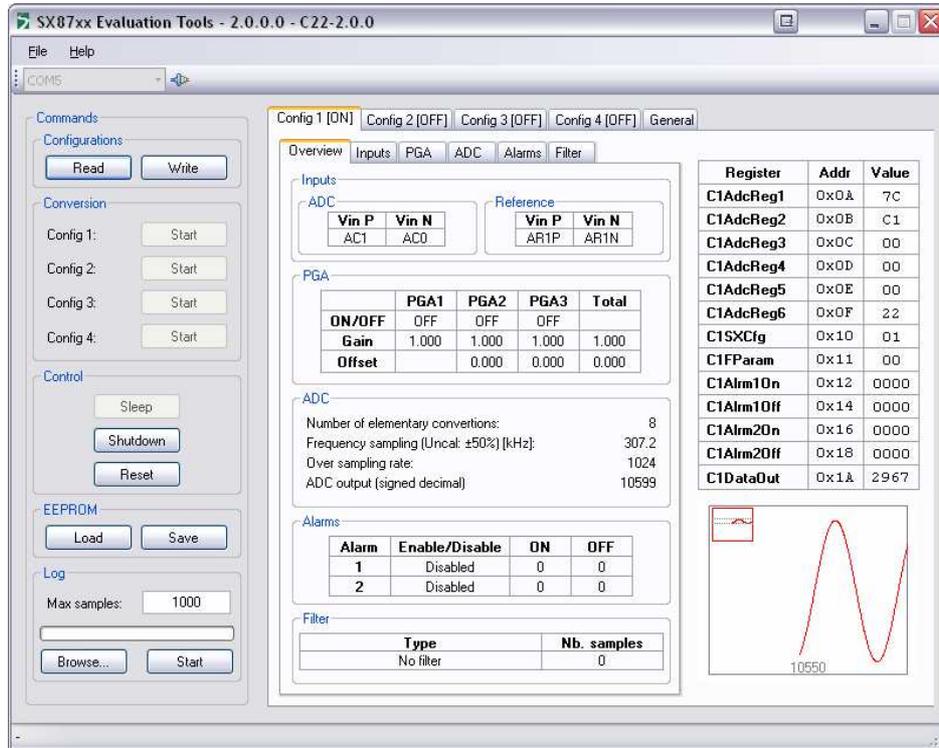
Figure 4 GUI after Serial COM port is opened

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2.3 How to determine which com port has been assigned to the XE8000EV120 board

There are two ways to determine which COM port your XE8000EV120 is using:

1. Using the GUI:
   - Click on the Serial COM port dropdown list as shown in Figure 2 and keep in mind the displayed Serial COM ports.
   - Select one of the Serial COM ports.
   - Switch off the XE8000EV120.
   - Click on the Serial COM port dropdown list as shown in Figure 2
   - The Serial COM port that has disappeared from the list the one assigned to your XE8000EV120 board.
2. Using the Windows Device manager
   - Open the Windows Device Manager by clicking on Windows "Start Menu->Settings->Control Panel->System->Hardware" and then click on "Device Manager" button.
   - Develop the "Ports (COM&LPT)" section
   - Switch ON and OFF the XE8000EV120 board
   - The Serial COM port assigned to the XE8000EV120 is the one that disappears and reappears each time.
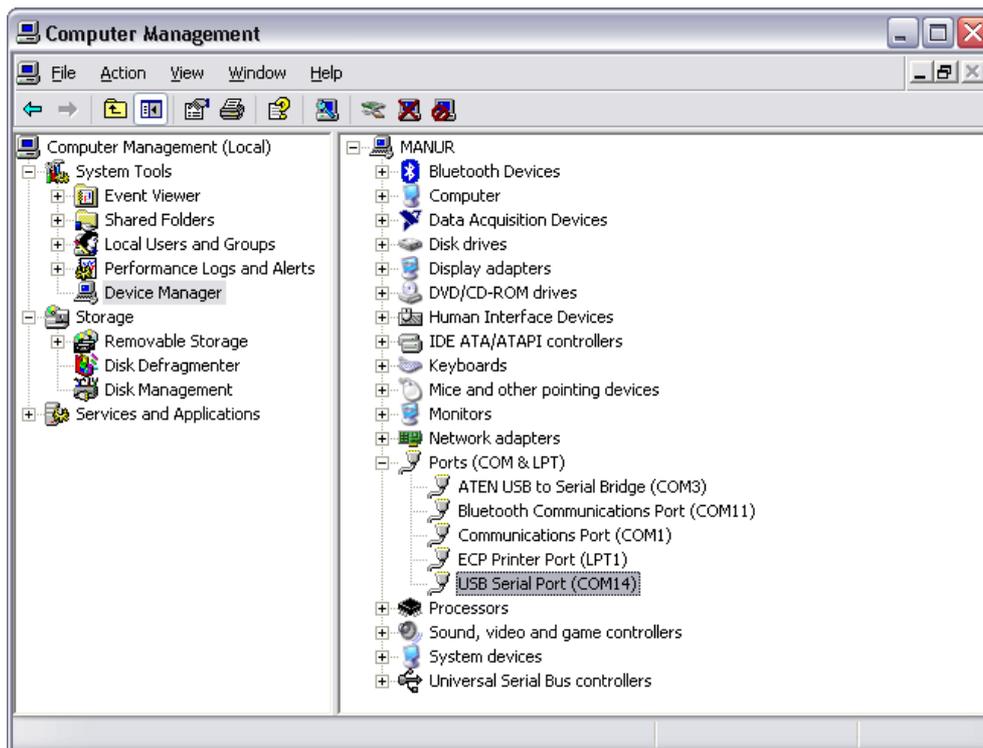
Figure 5 Windows Device manager

3 Hardware description

The evaluation tool is composed of a main and an application board.

3.1 Boards features

- XE8000EV120:
    - Ease the access to every SX8722 pin.
    - Dedicated interfaces for connection to the external world.
    - USB interface for communication between the GUI and the chip.
    - Power supply flexibility (USB, battery, DC connector…).
    - User interface (LEDS, buttons…).
- Application:
    - Holds the SX8722 and its mandatory components.
    - Can be used as a drop-in module on another application.

3.2 Communication between PC, Gateway and SX8722

The communication protocol between the PC and the gateway is made of frame exchanges. A frame is composed of a type, a size and a customized data buffer. There are 3 different types of frame: command request frame, command response frame and data frame.

The command request frame is sent by the PC to the gateway. The command response frame is sent by the gateway to the PC as a response to a command request. There is a command response sent for every command request received.

The command request frame and command response frame are implied in the following procedure:
1- PC sends a command request to the gateway via the UART.
2- The gateway will execute the command (using I2C connection with SX87xx).
3- The gateway will send a command response frame with the command result to the PC via the UART.

The data frame is used to send the measured value from the SX87xx ADC to the PC.

The data frame is implied in the following procedure:
1- SX87xx validate its READY output.
2- The gateway fetches the ADC measured value (using I2C connection with SX87xx).
3- The gateway will send a data frame with the measured value to the PC via the UART.
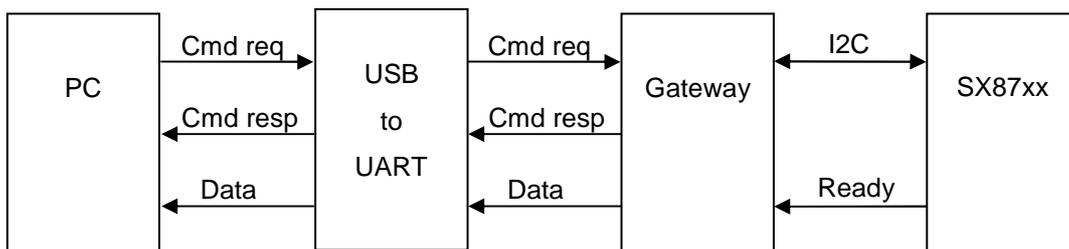
Figure 6 Hardware block diagram

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3.3 Power sources specification

Voltage range	Min	Typ	Max	Unit	Comments
1.3mm DC Plug	6	8	15	V	Regulated[1]
USB 5V	4.5	5	5.5	V	Regulated[2]
Battery	2.4	3	3.6	V	Unregulated
VDD Ext	2.4	-	5.5	V	Unregulated[3]
Consumption	Min	Typ	Max	Unit	Comments
	-	-	100	mA	[4]

Table 1 Power sources specifications

Note: The input analog voltages are specified in the SX8722 datasheet.

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[1] Can be regulated to 5.0, 3.3 and 2.4 V
[2] Can be regulated to 3.3 and 2.4 Volts
[3] When jumper EXT_POW is connected
[4] Max current, all LEDS on 5.5V, SX8722 full speed, GUI connected.

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3.4 XE8000EV120 board overview

The picture below describes the main zones and functions accessible on the XE8000EV120

Power switch

Power supply selection

1.3mm DC connector

Application board

Digital interface

Gateway control

RC calibration jumper

Low power modes buttons

Lithium battery socket (CR2032 type)

USB connector

USB LEDS

USB transceiver

XE8806A gateway

Analog interface

Alarms display

Onboard optional reference

Reset
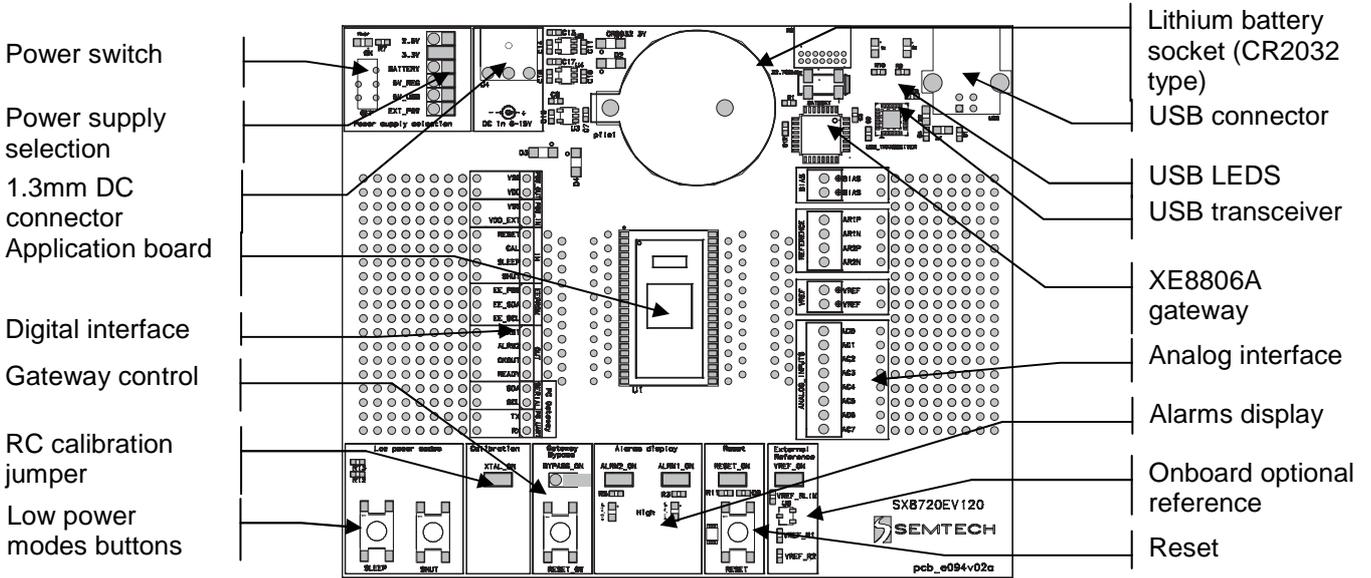
Figure 7 XE8000EV120 board overview

3.4.1 Power supply

The XE8000EV120 board provides a lot power supply voltage possibilities; the following paragraphs describe how to configure and use them.

3.4.1.1 Power sources

The board can be powered through four different power sources:
1. USB: USB power coming from the PC.
2. 1.3mm DC: Connection using a male 1.3mm DC connector[5]
3. Battery: 3.0VDC Lithium battery (CR2032 type)
4. VExt: External source applied on VDD_EXT pin of the digital interface (see § 3.5.2)

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[5] Reference example: Manufacturer: Cliff Electronic Components PN: DCPP3

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3.4.1.2 Power supply selection

Available supply voltages versus selected power source are described below:
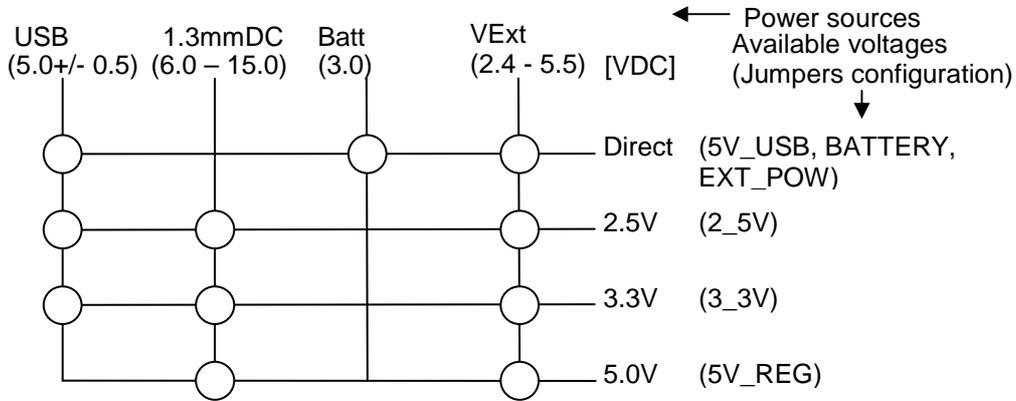
Figure 8 Power supply matrix

IMPORTANT: DO NEVER CONNECT EXT_POW JUMPER IF VDD_EXT IS HIGHER THAN 5.5VDC

The picture below shows the selector. User should place the jumper on the desired SX8722 supply voltage value.
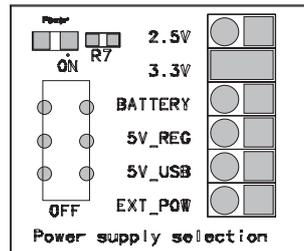
**Figure 9 XE8000EV120 power supply selector**

**Note**: Use only one jumper at the same time on the power supply selector.

3.5 User interface

3.5.1 Analog interface
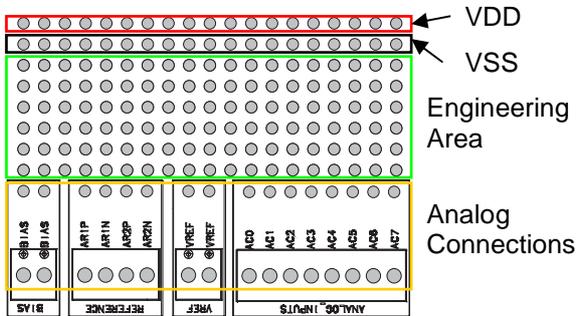
The analog interface gives access to the SX8722 analog pins, the BIAS pin and the external reference (see §3.5.8).

The connections points are available on industrial PCB terminal blocks and on the bare PCB next to the engineering area.

3.5.2 Digital interface
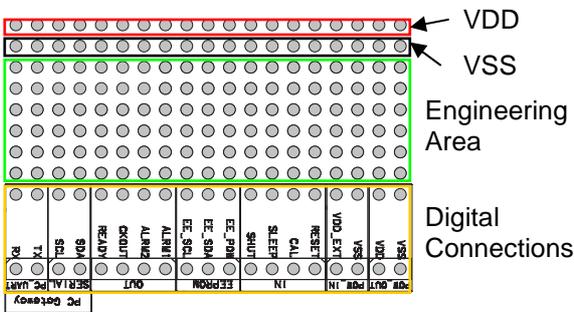
The digital interface gives access to the SX8722 digital pins, the PC gateway connections and the power supplies.

The connections are available on single row 2.54mm connectors and on the bare PCB next to the engineering area.

Using the engineering area, one can set its own application only using the SX8722 and bypassing the onboard gateway.

3.5.3 Low power modes
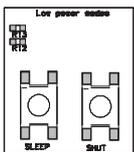
The low power modes buttons allow the user to set the SX8722 in sleep or shutdown mode.

Note: Once the shutdown mode is set, only a RESET can wake up the SX8722.

3.5.4 RC calibration

The RC calibration jumper allows connecting the pin CAL of the SX8722 to ground (default). In this case, the CAL pin indicates to the chip the presence of an external 32kHz crystal on its XIN & XOUT pins.
When not connected, the SX8722 remains uncalibrated unless its calibration values were previously saved in the external EEPROM.

Note: The calibration can also be performed via an external 32kHz square wave signal applied on CAL pin (see "Frequency calibration process" section of SX8722 datasheet).

3.5.5 Gateway control
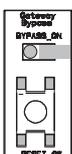
The gateway bypass jumper allows the user to bypass the onboard XE8806A. One can then set its own solution using the digital interface pins TX, RX, SDA&SCL (see §3.5.2).
By default, the jumper is not connected.

The RESET_GW button allows the user to reset the gateway.

3.5.6 Alarms display
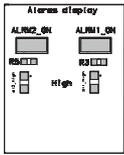
The jumpers ALRM1_ON & ALRM2_ON connect the corresponding pins of the SX8722 to LEDs. These can then be unconnected if needed.

3.5.7 Reset
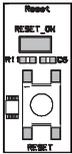
The RESET_ON jumper connects the SX8722 RESET pin to an RC network and a push button, allowing the user to RESET manually the SX8722. The RC network ensures a clean startup.

3.5.8 Onboard optional reference

When connected the VREF_ON jumper powers the onboard optional reference which is then present on the analog interface.

The reference chip is a Semtech SC431 shunt regulator adjustable from 2.5 to 5.5VDC

It is configured to provide a reference voltage of 2.5V. To set other voltages, please refer to SC431 datasheet and adjust the reference with VREF_R1 & VREF_R2 resistors.

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3.6 Application board overview

The picture below shows the SX8722 application board pin map. This board can be used as a drop in module in the user application (see §7)
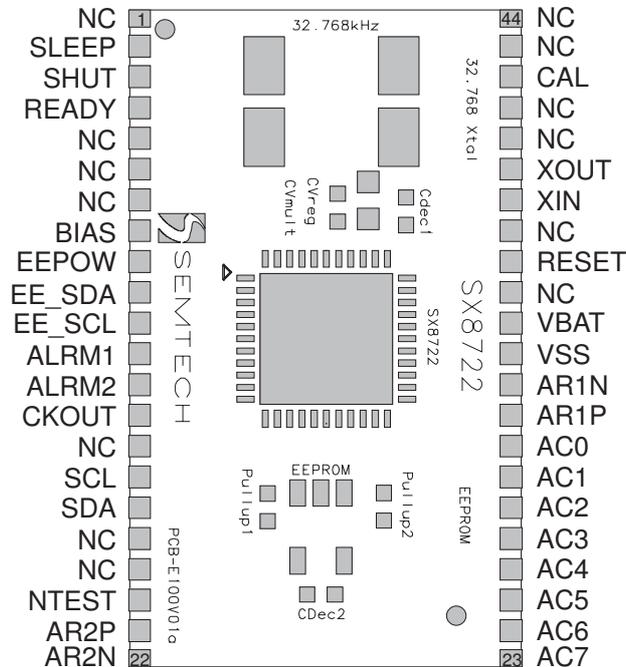
Figure 10 SX8722 Application board

Note 1: Application board GERBER files are available on request trough a request to our support team , these board are NOT sold without the XE8000EV120 evaluation kit.

Note2: Application board has been designed for a Zero Insertion Force socket (optional on the XE8000EV120 evaluation boards) which order information are described below:

Manufacturer: ENPLAS
Part No: OTS-44-1.27-03
Distributor: MSC Vertrieb GMBH
Ordering info: OTS-44-1.27-03

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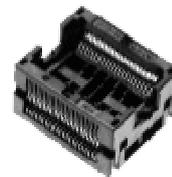
4 SX87xx Evaluation Tools Graphical user Interface (GUI)

The GUI enables the user to interact with the XE8000EV120 and the Application board.

4.1 Overview

The GUI gives a complete overview of the current SX8722 configuration plus the ability to control it. The GUI is mainly divided in 4 sections:

1. Menu and Tool bar.
2. Commands.
3. SX8722 Registers.
4. Status bar
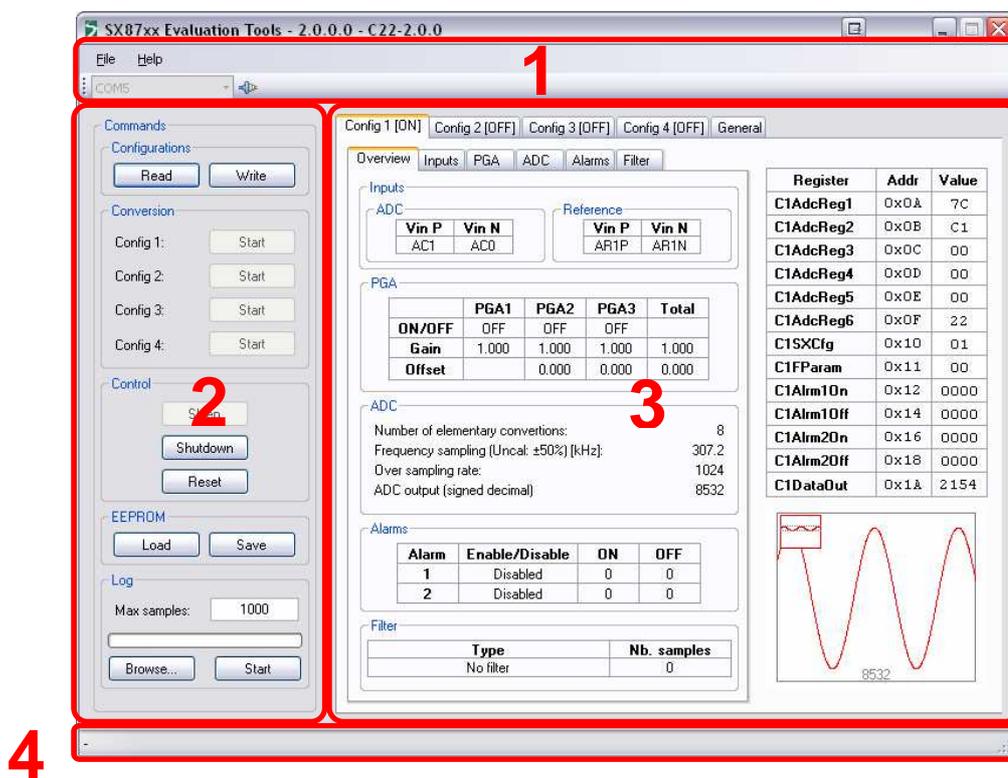
Figure 11 GUI Startup window

4.1.1 Menu and Tool bar (1)

The GUI menu is composed of 2 items:
1. The File menu gives the possibility to exit the application.
2. The Help menu gives the possibility to show the application "About box".

The GUI Toolbar is composed of 2 items:
1. A "Combo box" that lists the available Serial COM ports on the PC.
2. A button that opens or closes the Serial COM port selected in the "Combo box".

4.1.2 Commands (2)

The Commands section is composed of 5 items that enables the user to control the SX8722:

1. Configurations
   a. Read button will read all the SX8722 registers and update the section 3 of the GUI.
   b. Write button will write all the values from the section 3 to the SX8722.
2. Conversion
   a. If the corresponding configuration ZoomingADC is set in single mode conversion the start button will be enabled. Each time you press this button a conversion is started. (please refer to chapter 5 troubleshooting §5)
3. Control
   a. The Sleep button sends the Sleep command to the SX8722. (please refer to chapter 5 troubleshooting)
   b. The Shutdown button sends the Shutdown command to the SX8722.
   c. The Reset button sends a command to the gateway in order to reset the SX8722.
4. EEPROM
   a. The Load button loads the registers values stored in the EEPROM to the SX8722.
   b. The Save button stores the SX8722 registers values to the EEPROM.
5. Log
   a. Max Samples input box indicates how many ZoomingADC samples are stored in the log file.
   b. Browse button let the user choose where to store the log file and which name it will have.
   c. Start button starts the logging process. While the logging process is running a progress bar will show the progress.

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4.1.3 SX8722 Registers (3)

The SX8722 Registers section is composed of 5 tab pages that enable the user to modify or read the actual SX8722 settings.

There is 4 Configurations tab pages that are exactly the same excepting the registers addresses. The configuration tabs enables the user to see the ZoomingADC registers detailed by function and also the corresponding hexadecimal registers value.
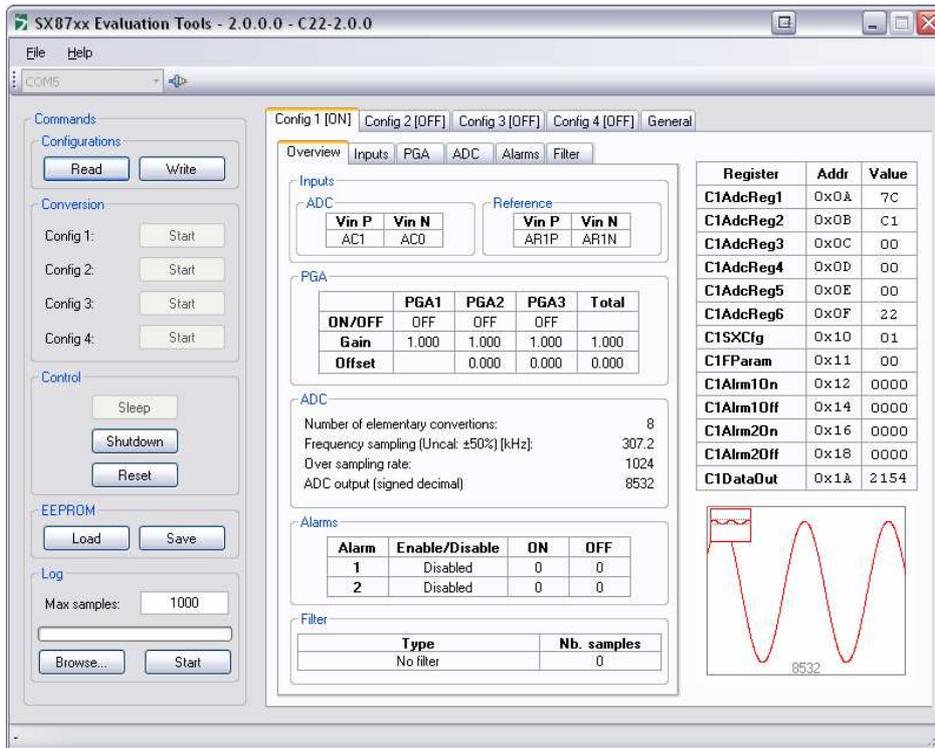
Figure 12 SX8722 Registers Tabs Configuration 1

The sub tab named "Overview" gives an indication of the configuration current settings for the ZoomingADC. This tab is read-only.
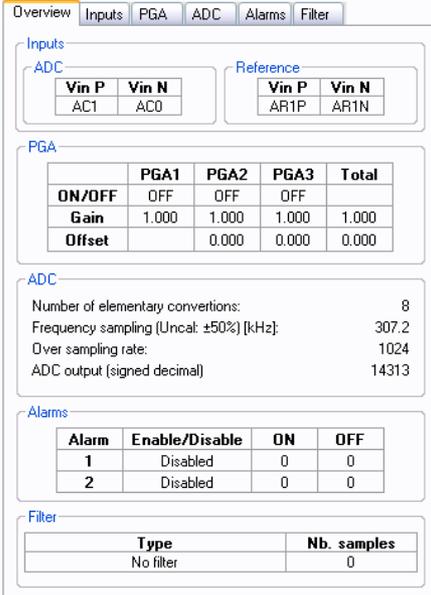
Figure 13 "Overview" sub tab

The sub tab named "Inputs" lets the user choose which inputs and which reference pins will be used to make the measurement. On this sub tab the user may also choose if the inputs are "Single-ended" or "Differential" as well as choosing which of the inputs is used as "Positive" or "Negative" input.
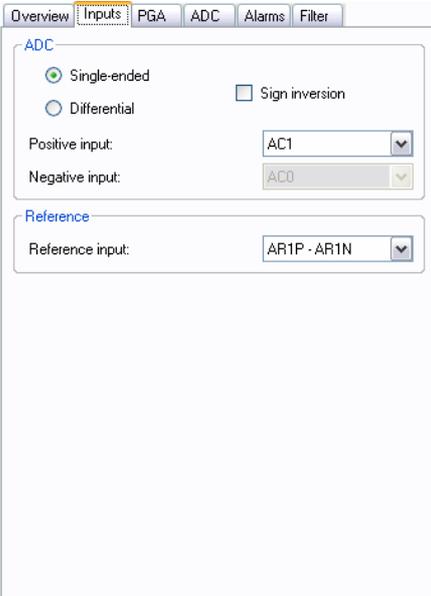
Figure 14 "Inputs" sub tab

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The sub tab named "PGA" lets the user control the gain, offset and enabling disabling each PGA individually. The user has also the possibility to control the PGA's biasing.

Figure 15 "PGA" sub tab

The sub tab named "ADC" lets the user control the ADC parameters. Parameters like number of elementary conversions, the oversampling rate, the sampling frequency and the ADC biasing can be tuned.

The user has also the possibility to decide if the ADC will work in one shot or in continous mode.

When the Read button is pressed the last ADC converted value is also displayed in this sub tab.
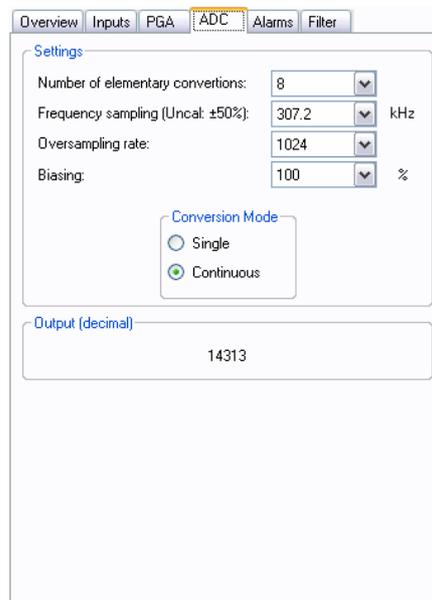
Figure 16 "ADC" sub tab

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The sub tab named "Alarms" lets the user enable or disable the alarms on the current configuration. The users can also specify the "ON" and "OFF" alarm thresholds.
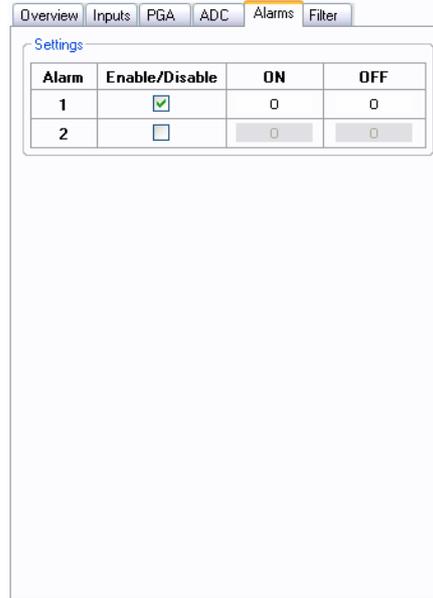
Figure 17 "Alarms" sub tab

The sub tab named "Filter" lets the user enable or disable the integrated filtering options. The user can choose between two kinds of filters (Average and Moving Average) as well as choosing how much samples are used for the average calculation.
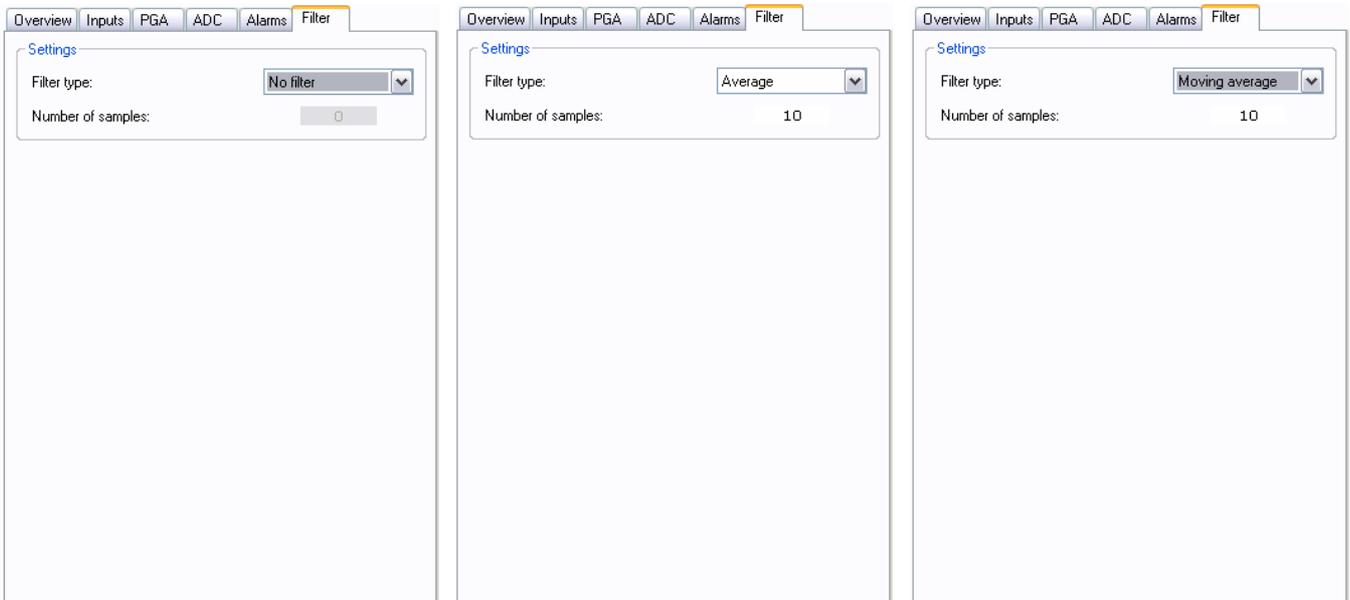
Figure 18 "Filter" sub tab

Each configuration has its own Graphic representing the ADC output. The graphic is in auto-scale mode.

If the user double-clicks on the graphic it will expand until it fills the whole configuration space. (See Figure bellow).
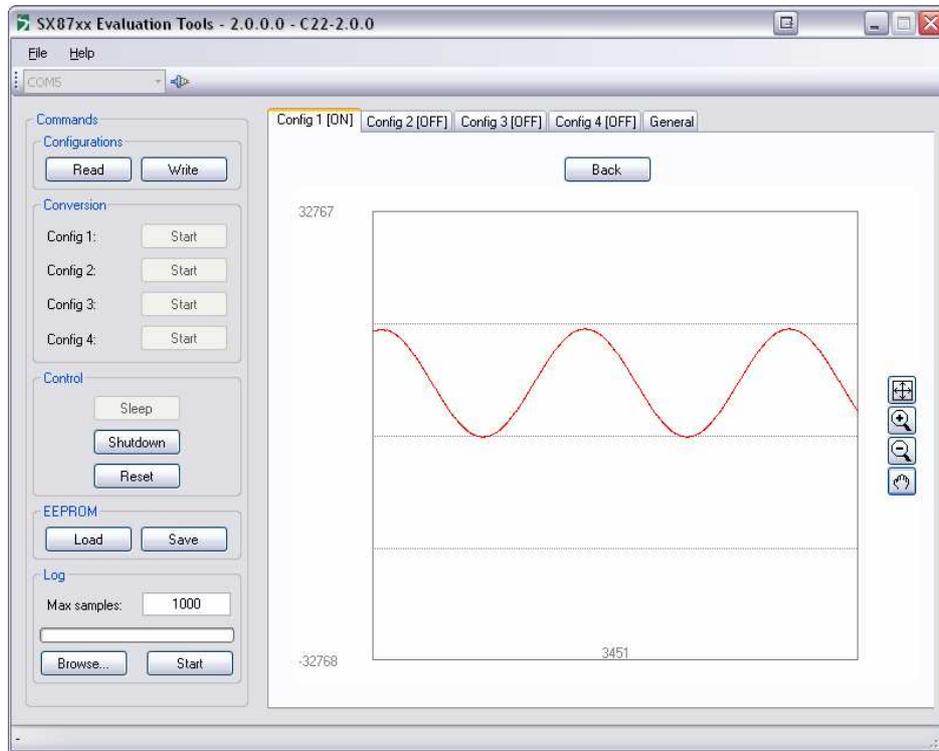
Figure 19 Expanded ADC graphic

The "Back" button will reduce the Graphic and will show again the ZoomingADC configuration.

The 4 small buttons on the Graphic give the user the possibility to:

1. Perform an auto scale of the graphic. If the button is double-clicked the auto scale is permanent until one of the buttons is pressed again.

2. Zoom +, If the user draws a rectangle in the graphic and then release the mouse button the graphic will zoom the signal inside the rectangle.
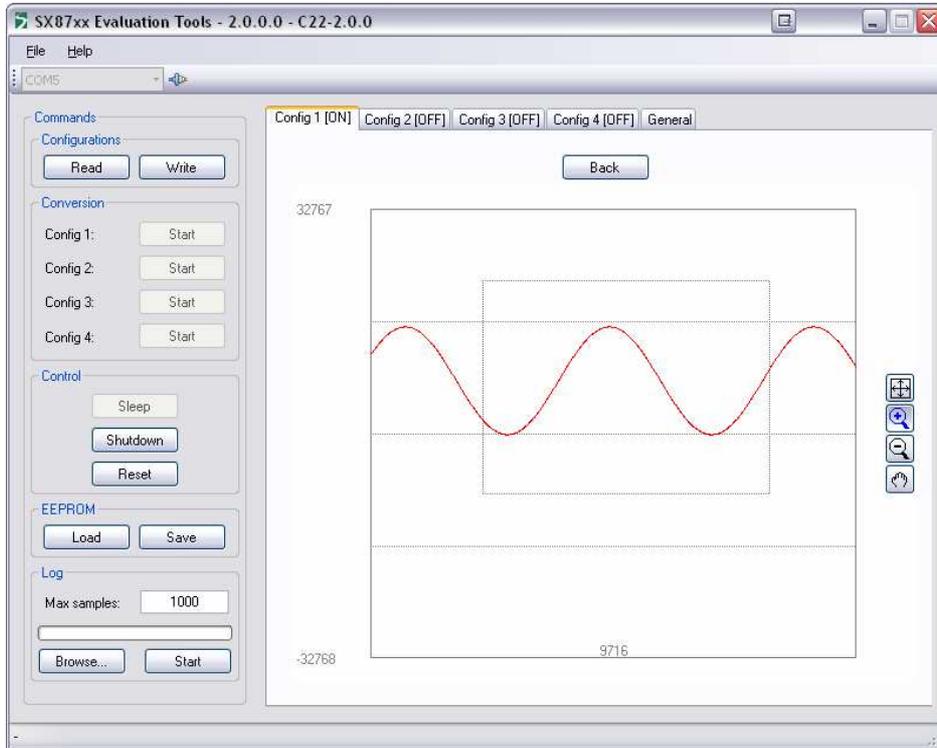
Figure 20 Zoom +

Figure 21 After zoom +

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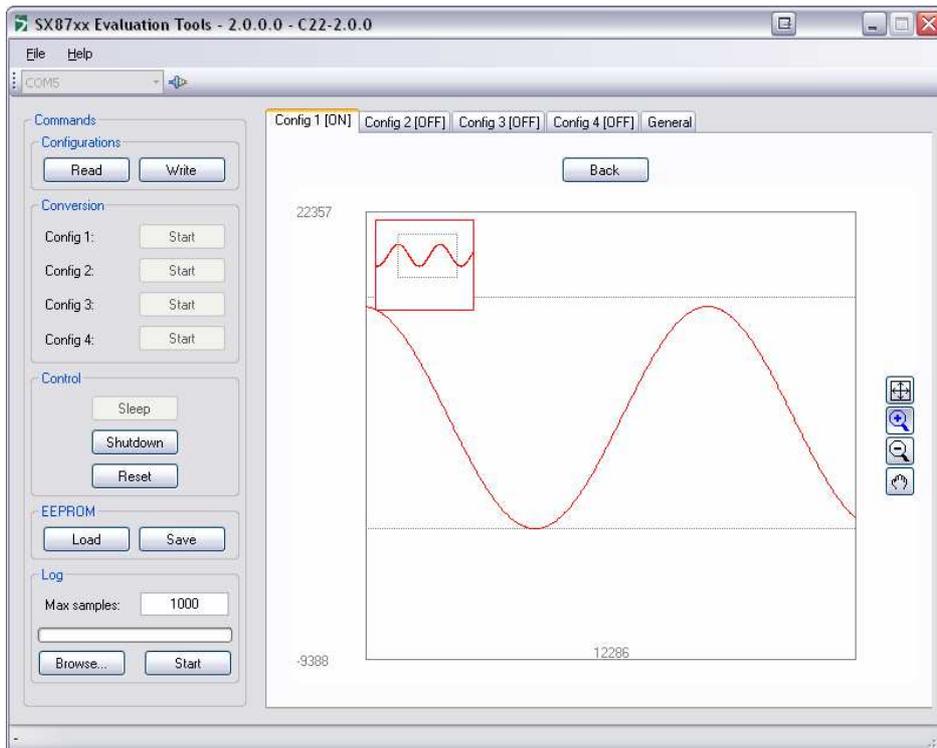
3. Zoom –, Once the button is selected each time the user clicks on the graphic it will zoom out.
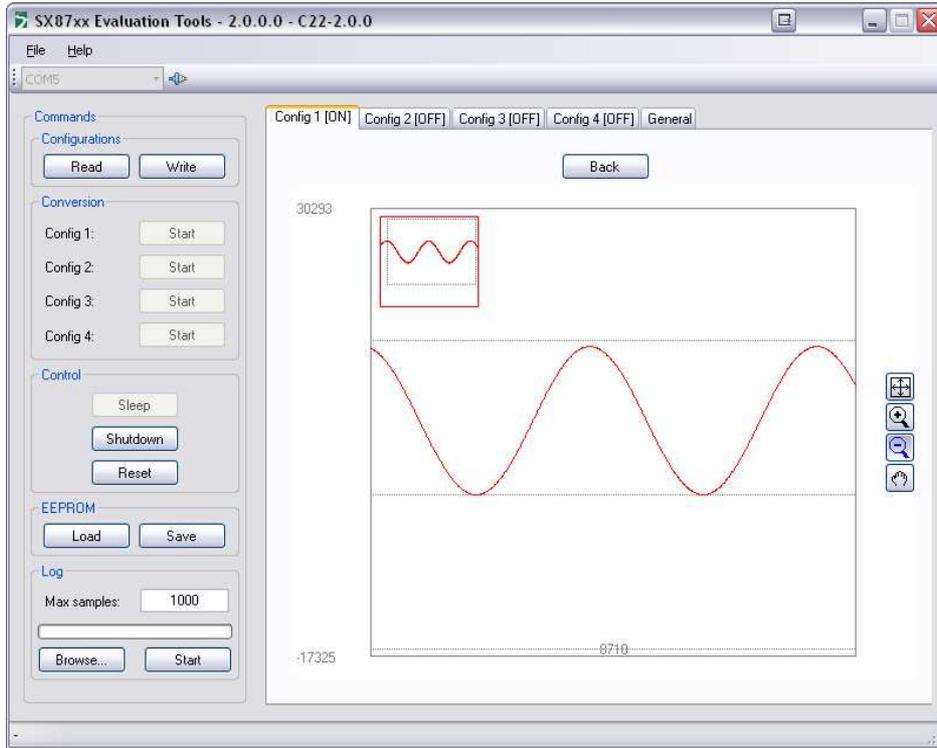
Figure 22 After Zoom -

4. Move the zoomed window. To move the zoomed window the user must select the corresponding button and then click on the graphic without releasing the button and move the mouse.
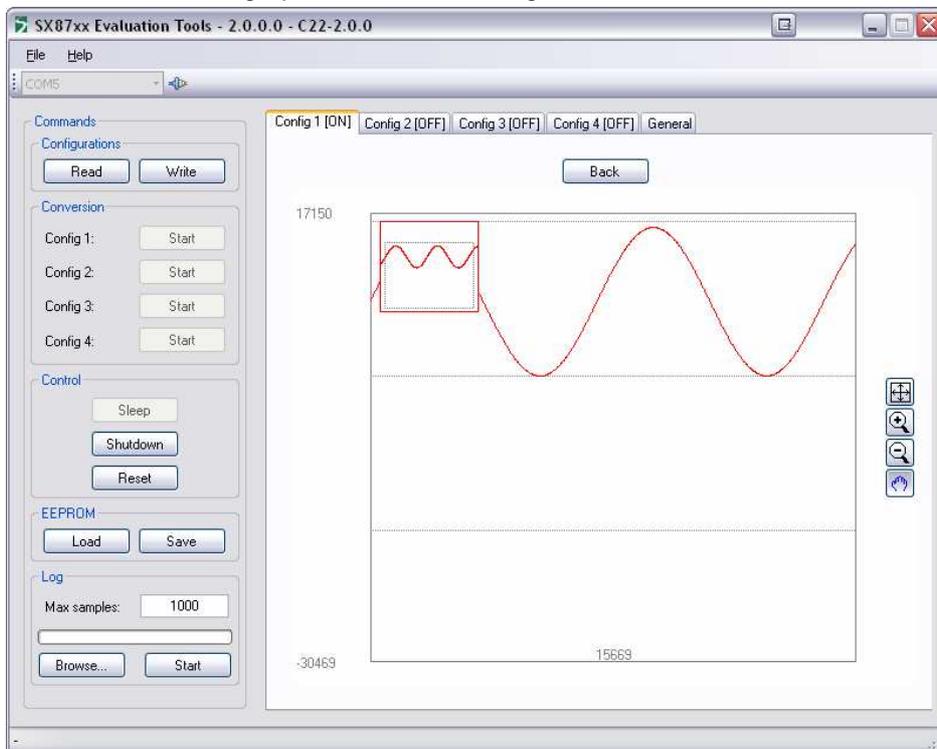
Figure 23 After the graphic has been moved

The tab named "General" gives access to the SX8722 common features. The user can change the "Alarms" behavior as well as enabling or disabling the ZoomingADC configurations. The user can also see the SX722 status and the graphics of the 4 ZoomingADC configurations if they are enabled.
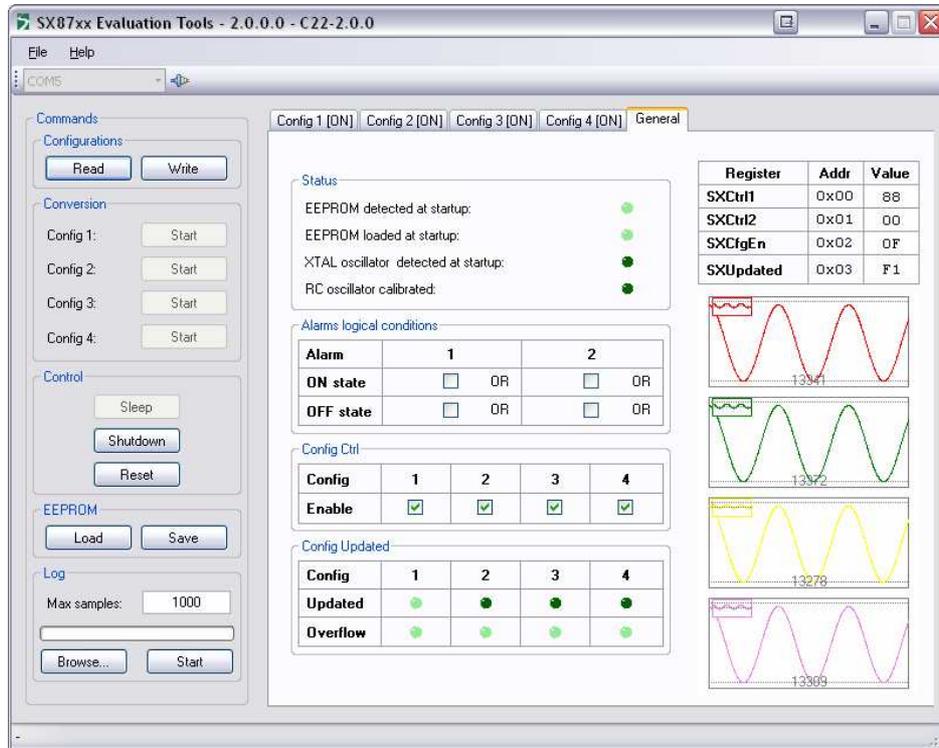
Figure 24 SX8722 Registers General Tab

4.1.4 Status bar (4)

The Status bar will display application errors that may happen while using the GUI. If there is no error the status bar shows a "-"sign.

5 Troubleshooting

The SX8722 chip has some issues that are described in the SX8722 errata document. In order to avoid problems we decided to block the access to some functionality.

1. The "Sleep" button has been disabled.
2. The ZoomingADC single mode has been disabled.
3. The "Reset" button has been disabled if a version "1.00" of the Gateway is detected.

The SX87xx Evaluation tools software has also some known issues. These are:

1. If Palm HotSync tool is running the GUI doesn't start correctly.
   Solution: When using the SX87xx tools please disable the HotSync application.
2. When using a SX8722 Evaluation board with a Gateway version "1.00" communication errors may happen.
   Solution: If the user is no more able to communicate with the Evaluation board just reset the Gateway and the SX8722 chip and click on the Write button to send your configuration again.
3. If the user disconnects the USB cable or shuts down the Evaluation board a Windows error message may appear when the GUI is closed or the user closes the Serial Port.
   Solution: None.

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6 XE8000EV120 board

6.1 Schematics
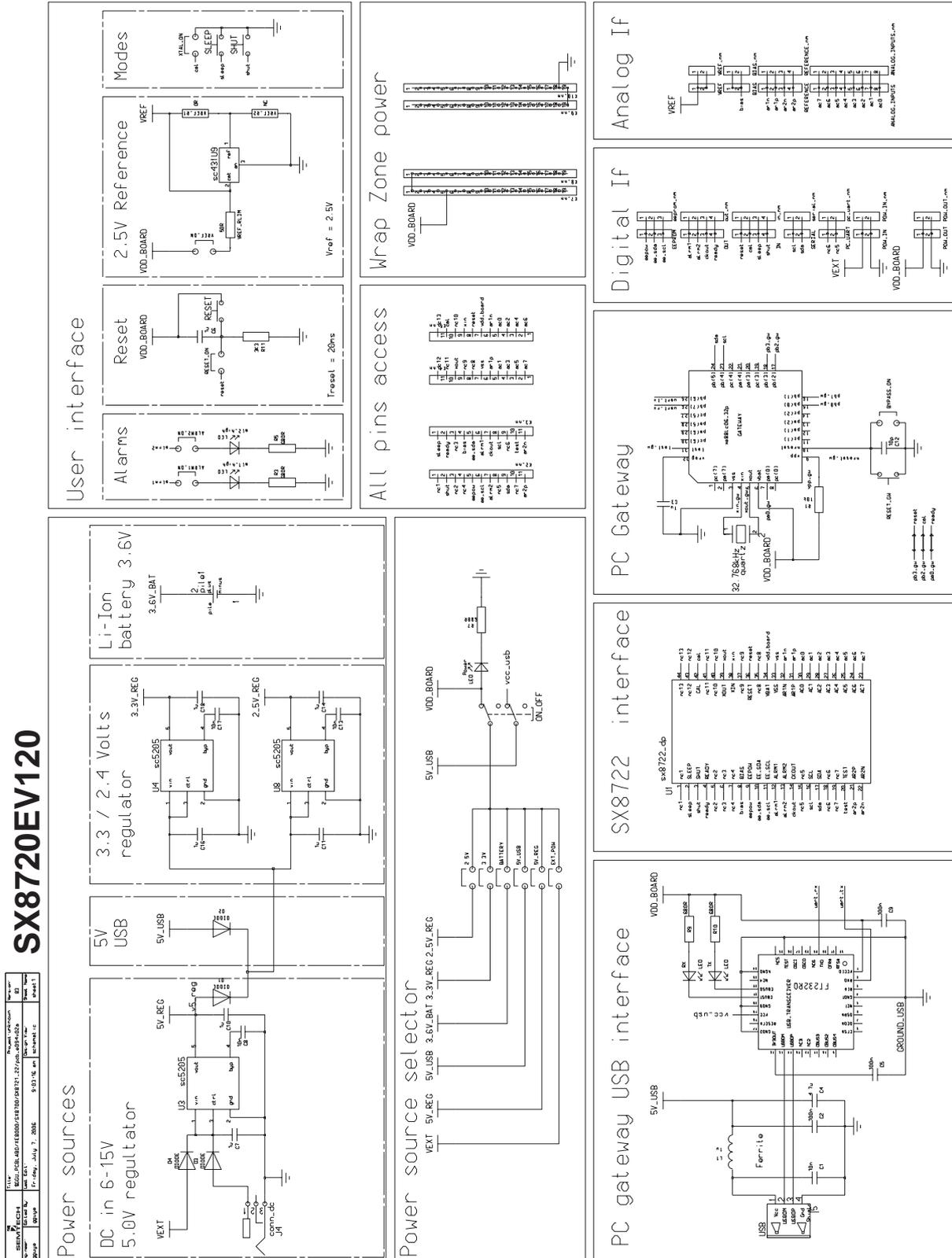
Figure 25 XE8000EV120 board schematic

## 6.2 Physical dimensions

The XE8000EV120 is a 2 layers board.
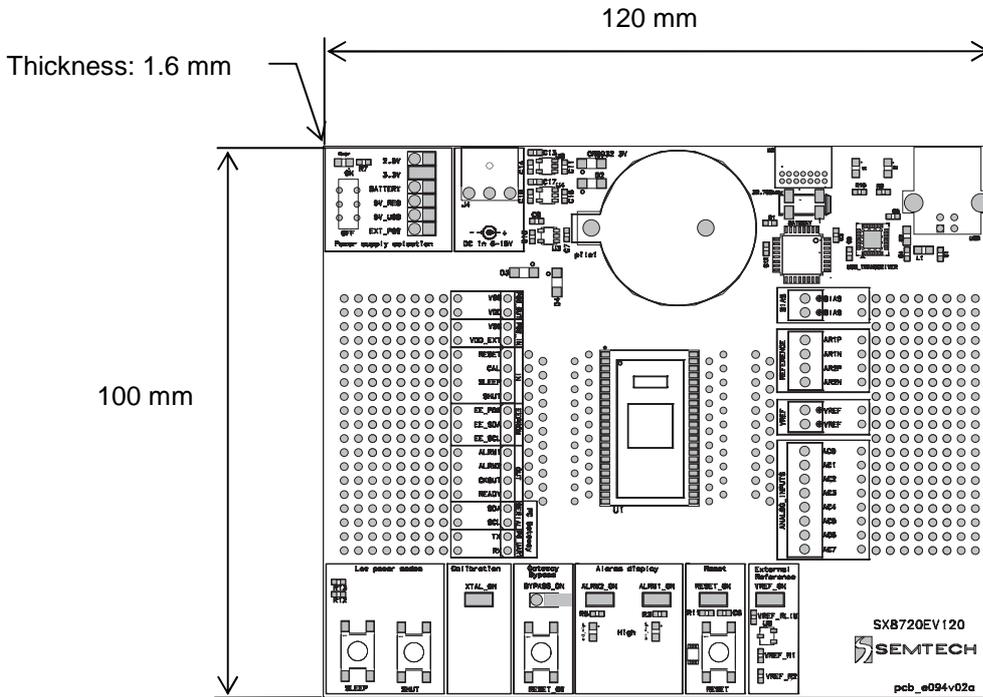
Figure 26 XE8000EV120 physical dimensions

7 Application board

7.1 Schematics

Figure 27 Application board schematic

7.2 Physical dimensions
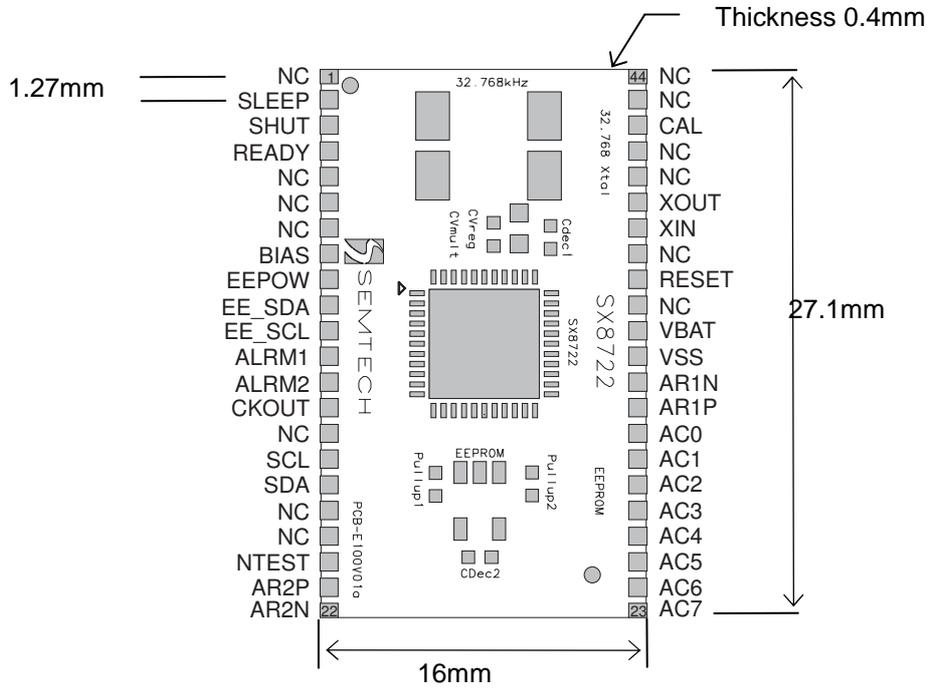
Figure 28 Application board physical dimensions

7.3 Footprint
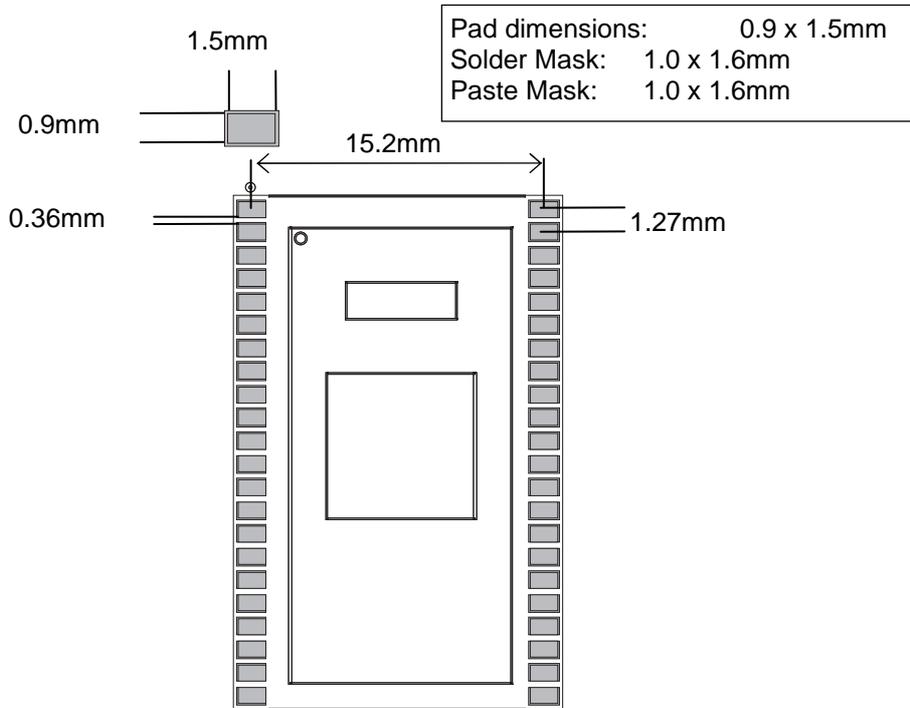
Figure 29 Application board footprint

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