AN11622

LPC82x Touch Solution Quick Start Guide

Rev. 1.0 — 22 December 2014 Application Note

Document information

Info	Content
Keywords	Capacitive Touch, Touchpad, Sensor, Electrode, Drive/Sensing lines, Dielectric, Overlay panel, Sensitivity, Touch, False Touch.
Abstract	This application note describes the overall hardware design aspect of NXP's Capacitive Touch solution, shows the schematic design, materials, and PCB design including the most critical Touch sensor design.

Revision history

Rev	Date	Description
1.0	20141222	Initial version

Contact information

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1. Introduction

NXP's Capacitive Touch solution is based on the innovative Switched Capacitor Integration technology. This variant of the solution is centered around the LPC82x MCU family. It consists of hardware and software platform for enabling the Touch user interface designs. This quick start guide briefly outlines different elements involved in this Touch solution and help in getting started with the set up.

Main Features:

- LPC824 centric capacitive Touch
- Modes supported
  - Touchpad (8-bit resolution)
  - 9 Keys
- GUI to visualize/analyze the Touch data
- On-board LCD to display Touch positions
- Arduino UNO compatible Touch Shield
- Mbed/LPCXpresso and Pmod® options
- USB Drag and drop programming
- CMSIS-DAP debug interface
- USB powered

The LPC82x Touch solution kit can be ordered from NXP's authorized distributors using the order number OM13081.

2. Hardware Setup

The LPC82x Touch solution has been realized using two boards, LPCXpresso824-MAX (LPC82x Xpresso v2/mbed) board and LPC82x Touch shield board.

2.1 LPCXpresso824-MAX (LPC82x Xpresso v2/mbed)

The LPCXpresso824-MAX is a standard Xpresso/mbed board with LPC824 on it, well supported in the overall ecosystem. This board combines the overall features of the LPCXpresso, mbed, and Arduino environments. See the LPCXpresso824-MAX board user manual for more details:

http://www.nxp.com/documents/user_manual/UM10830.pdf

- LPC824 in HVQFN33 package
- On-board CMSIS-DAP debug interface
  - Supports LPCXpresso IDE
  - Supports mbed and other third party tools
- Expansion options
  - Arduino UNO R3-compatible connectors
  - Mbed/LPCXpresso and Pmod® options
  - Prototyping area
- RGB LED for test/debug
- 10-pin SWD connector for external debug probe
- UART ISP capable
- USB powered

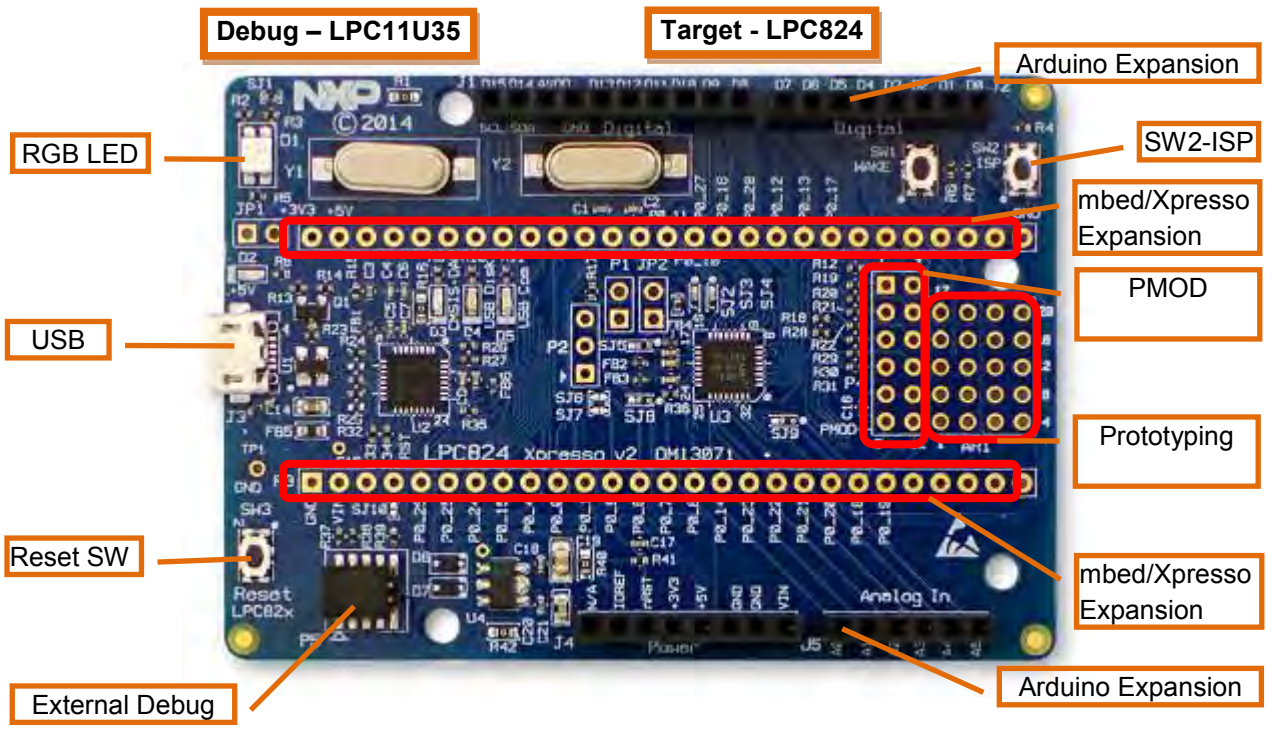

Fig 1. LPCXpresso824 –MAX board

2.2 LPC82x Touch Shield

The LPC82x Touch Shield is an add-on board with capacitive Touch sensors (3x3 Matrix touchpad) and a character LCD to display the Touch position data.

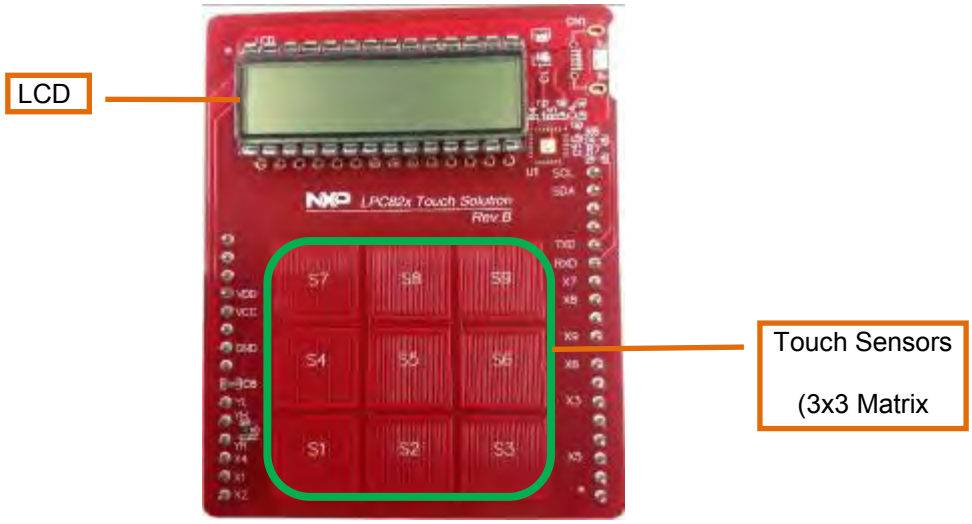

Fig 2. LPC82x Touch Shield

2.3 LPC82x Touch Setup

The LPCXpresso824-MAX board and LPC82x Touch shield are connected via Arduino UNO expansion connectors.

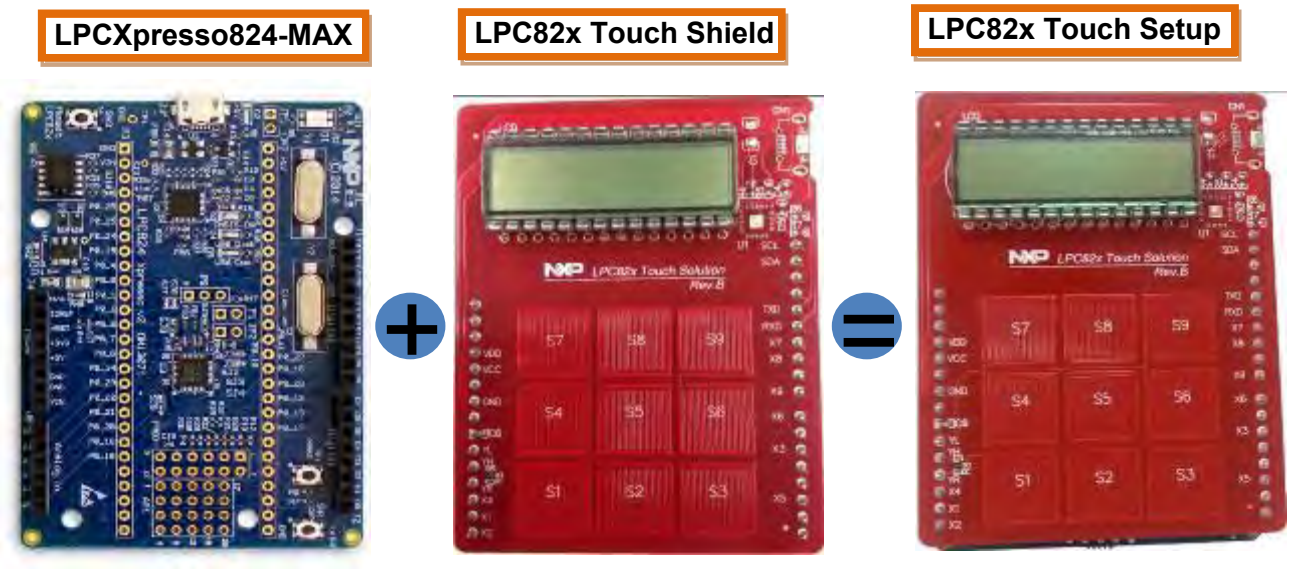

Fig 3. LPC82x Touch Setup

3. Software

3.1 Touch Firmware

The LPC82x Touch solution kit is pre-programmed with the Touch demo firmware and it can be operated in standalone mode (without GUI) or with the windows GUI.

3.2 Touch GUI

The LPC82x Touch Solution provides a Windows based GUI to visualize and analyze the Touch status/position data.

To use the Touch GUI, download and install the mbed windows serial port driver from:

www.nxp.com/redirect/mbed/handbook/Windows-serial-configuration

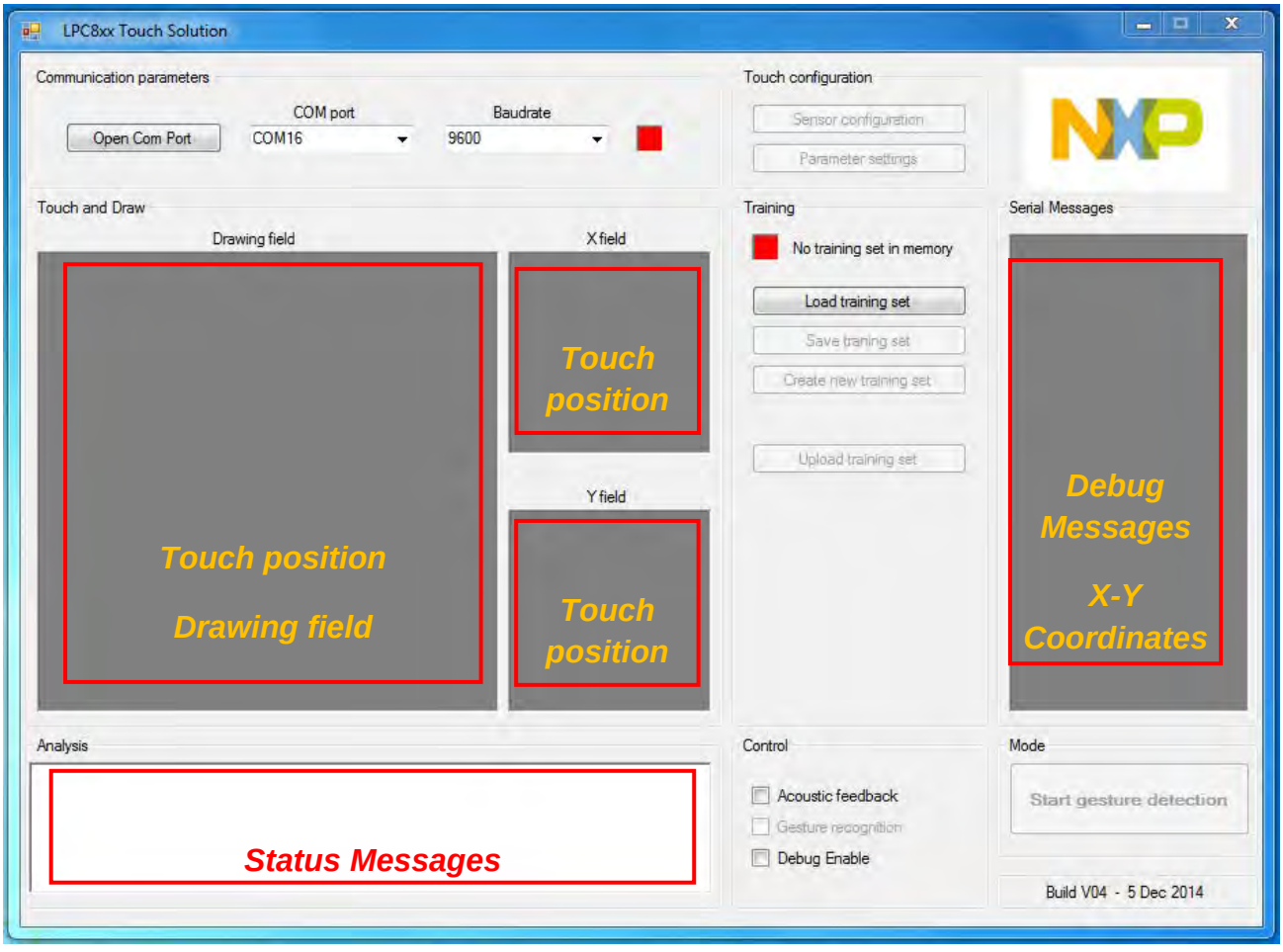

Fig 4. Touch GUI

4. Getting Started

4.1 Programming and Setting it up

- Though the kit is pre-programmed with the touch demo firmware, one can always re-program it very easily with the latest firmware available.
- Connect the LPCXpresso824-MAX board and LPC82x Touch Shield using Arduino UNO expansion connectors. See Fig 3.
- On powering-up the kit with micro USB cable, it will appear as an MBED mass storage device on the PC/Notebook.
- To program the kit with latest firmware, copy and paste or drag and drop the latest binary to this MBED mass storage device.
- Power cycle or reset the board using reset switch (SW3) to get started.

4.2 Standalone Demo (without GUI)

The standalone demo works in two different modes, **Two dimensional Mode** (Touchpad) and **One dimensional Mode** (Keys/Button).

- By default, the kit powers up in **two dimensional Mode** (position data).
- LCD will display **"NXP"→"Firmware Version"→"Touch"** in a sequence.
- And "Touch" display would remain until the touchpad is touched, as shown in Fig 5.
- Touching the touchpad area, the LCD will display X-Y coordinates of the Touch position. The actual Touch position is reported in an 8-bit resolution (0 to 255) but it is divided by a factor of 4 just to display on the LCD (00 to 63).
- Touch status is indicated by a segment right to the Y-coordinate, and it stays on as long as the finger ouches the touchpad.

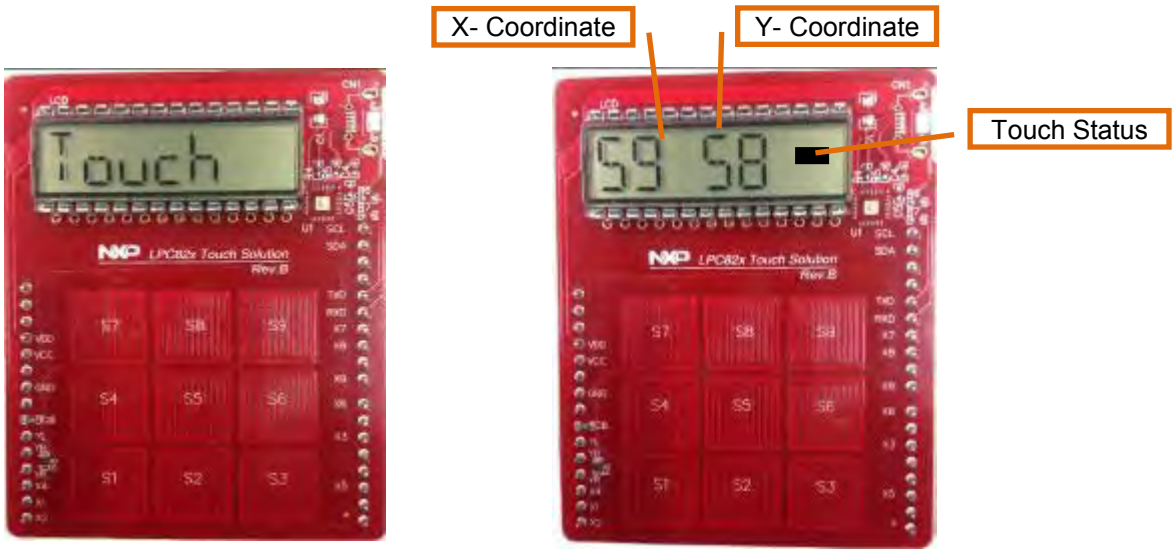

Fig 5. Standalone Demo (Touchpad Mode)

- One can switch to the **One dimensional Mode** (Keys/Button) by pressing SW2 (ISP) switch, see Fig 1 on the LPCXpresso824-MAX board.
- Change of mode is indicated by displaying **"--1D--"** which stays until the touchpad is touched, as shown in Fig 6.
- On touching the sensor/sensors, the LCD will display hexadecimal (16 bit) value of the respective sensor/sensors status (bit0:sensor0, bit1:sensor1).
- Touch status is indicated by a segment right to the Y-coordinate and stays on as long as the finger touches the touchpad.

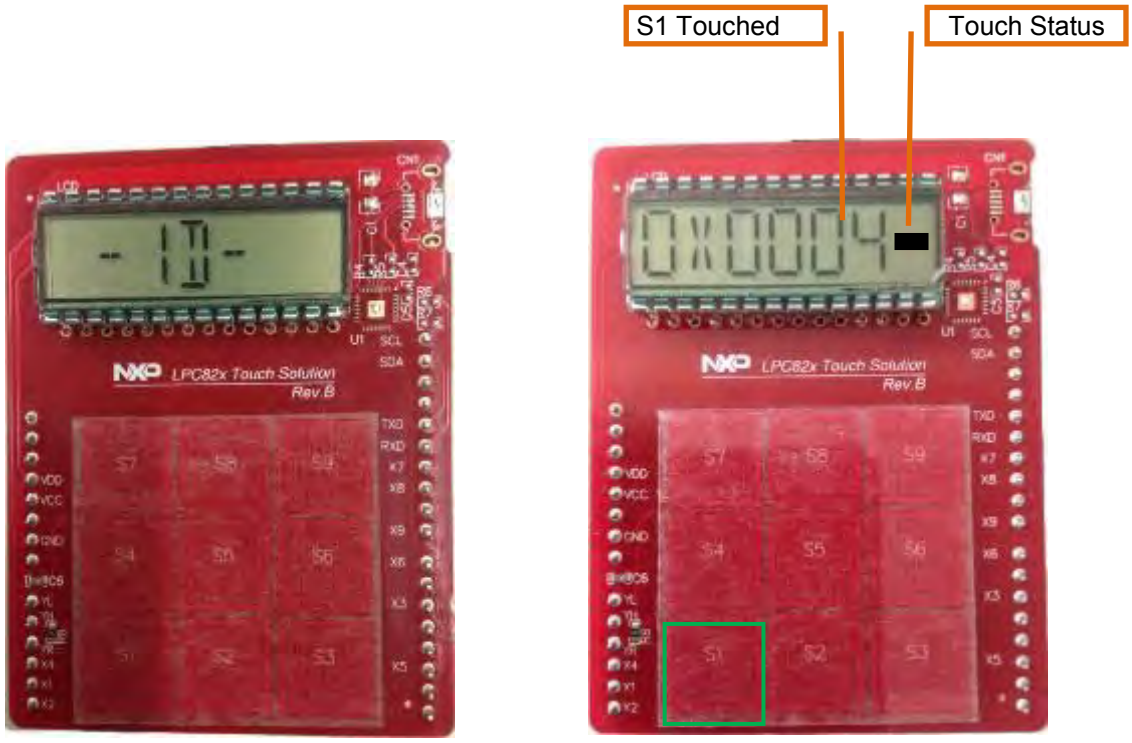

Fig 6. Standalone Demo (Key Mode)

- Press SW2 (ISP) switch to switch back to the **Two dimensional Mode** (Touchpad).
- Change of mode is indicated on the LCD by displaying **"--2D--"** which stays until the touchpad is touched.
- Now the touchpad starts reporting X-Y coordinates of the touchpad.

4.3 Touch GUI Demo

Touch GUI provides many more features to visualize, test, and validate the LPC82x Touch Solution.

Powering-up the LPCXpresso824-MAX board using Micro USB cable, the USB port should be recognized as a “mbed Serial Port” by PC/Notebook. If not, download and install the mbed windows serial port driver from:

www.nxp.com/redirect/mbed/handbook/Windows-serial-configuration

- Launch the LPC82x Touch solution GUI, see Fig 7.
- Select proper COM port (check the device manager to make sure, if needed).
- Set the baud rate as 9600 and Open the Com port.
- Analysis window will display the communication errors, if there’s any problem with the COM port or Baud rate selection.
- Successful Com port opening is indicated by a small radio button (next to Baud rate) turning “Green” from “Red”.
- By default, the kit starts up in **Two dimensional mode** (Touch Position Mode).

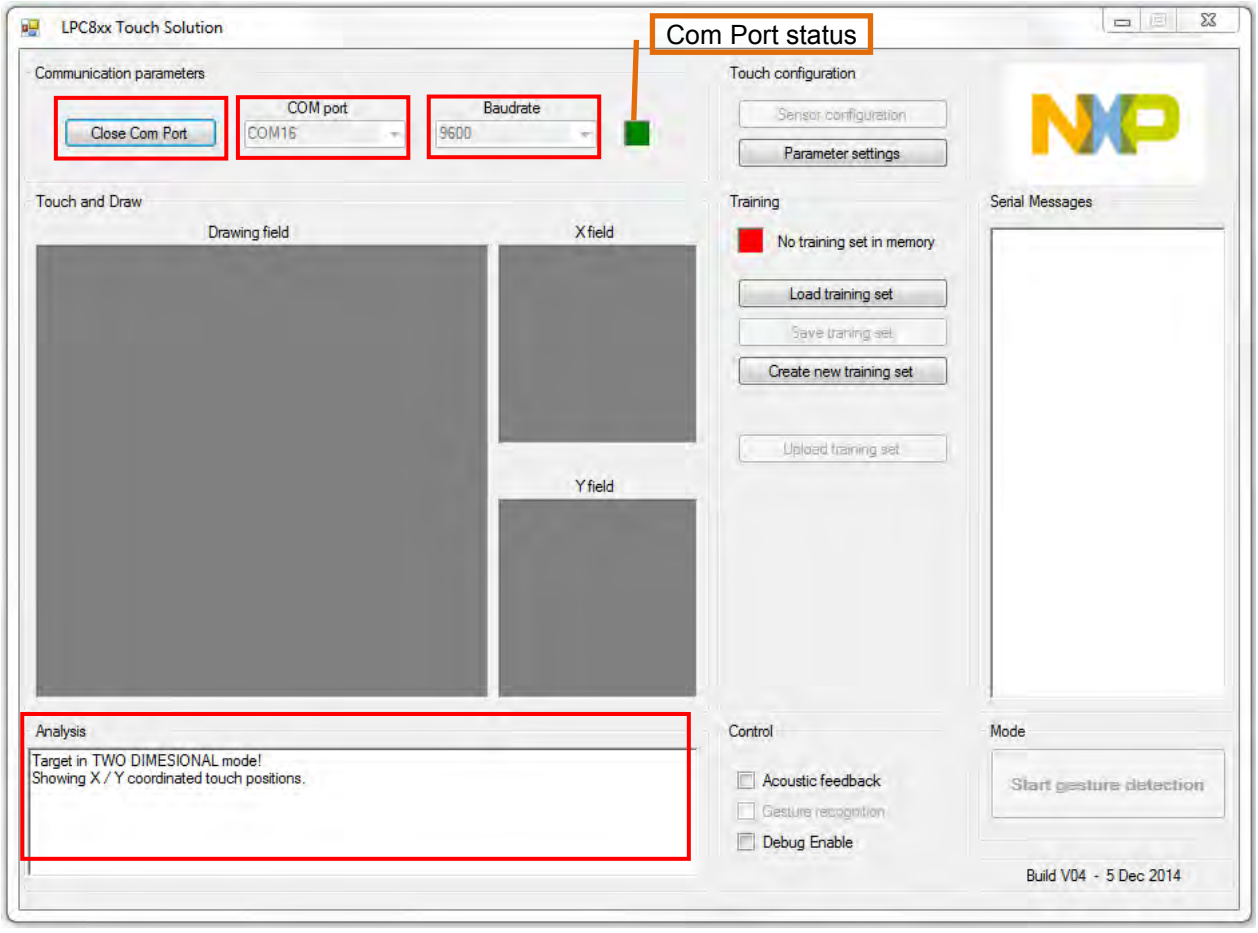

Fig 7. Connect to Com port

- On touching the touchpad the Touch positions get reflected in the “Drawing field” of the GUI. See Fig 8.
- One can draw any pattern or the character and the Touch position is indicated accordingly.
- X and Y fields to the right show the X and Y touch field movements separately.
- Serial Messages window displays the Touch data packets with their IDs (ID:X:Y) as being received by the GUI, limited to first 192 Touch positions only.
- One can tick/un-tick the “Debug Enable” to enable/disable the display of touch data packets (ID:X:Y) in Serial Messages window.

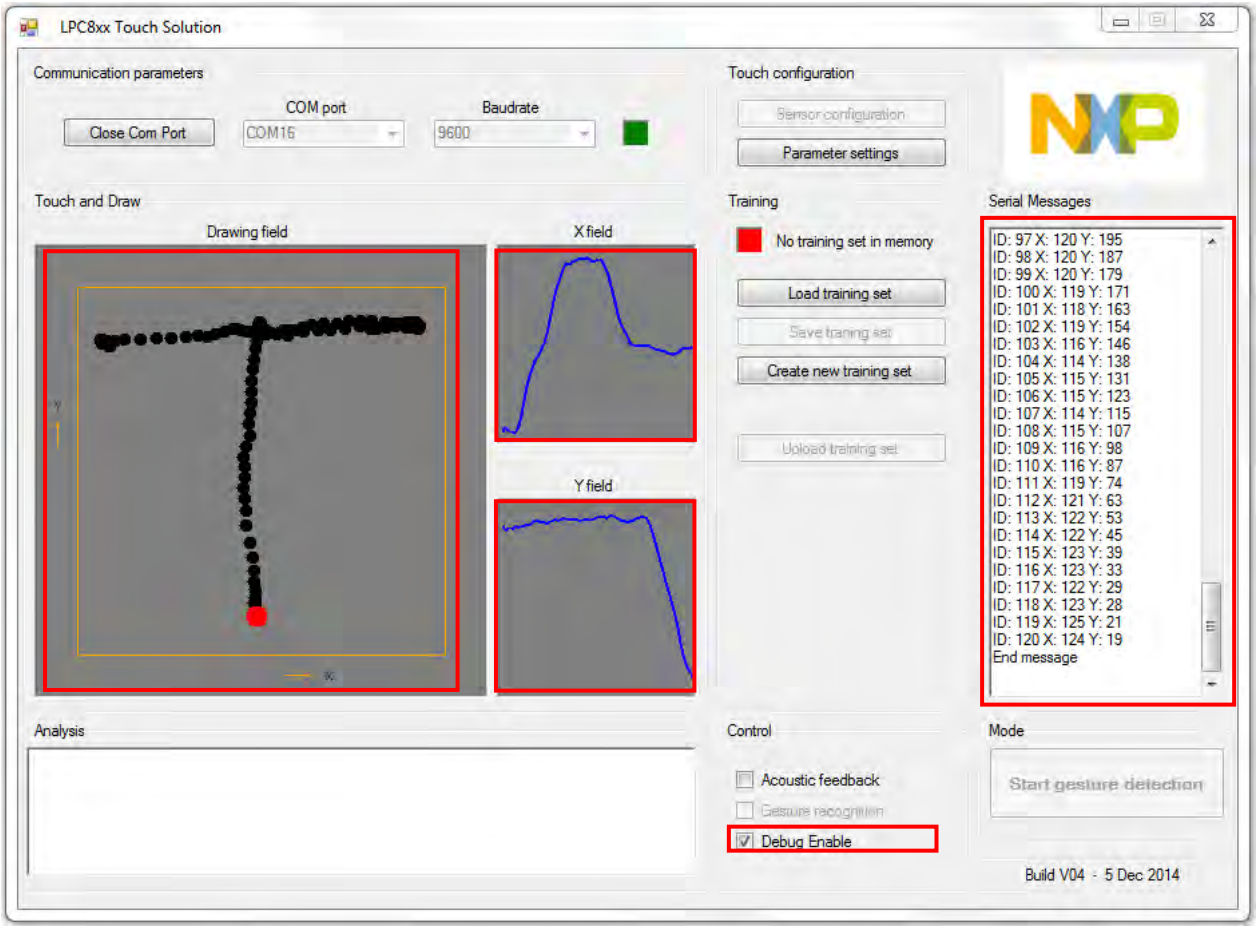

Fig 8. Visualize Touch Data

- Click on “Parameter settings” shown in Fig 9 to see and alter the Touch configuration parameters. Default parameters set is shown on the entry.
- One can read the parameters from target hardware or write the altered parameters to the target hardware using the radio buttons in the Target section.

- One can also save the current parameters to the host or load the pre-set set of parameters from the host to write to the target. See radio buttons in the Host section.
- While changing the parameters (value) settings, the range shown on the right is the guideline. Even if out of range values are set, it will be truncated to the maximum value.
- One can always fall back and load the default set of parameters to cross verify the settings at any time.

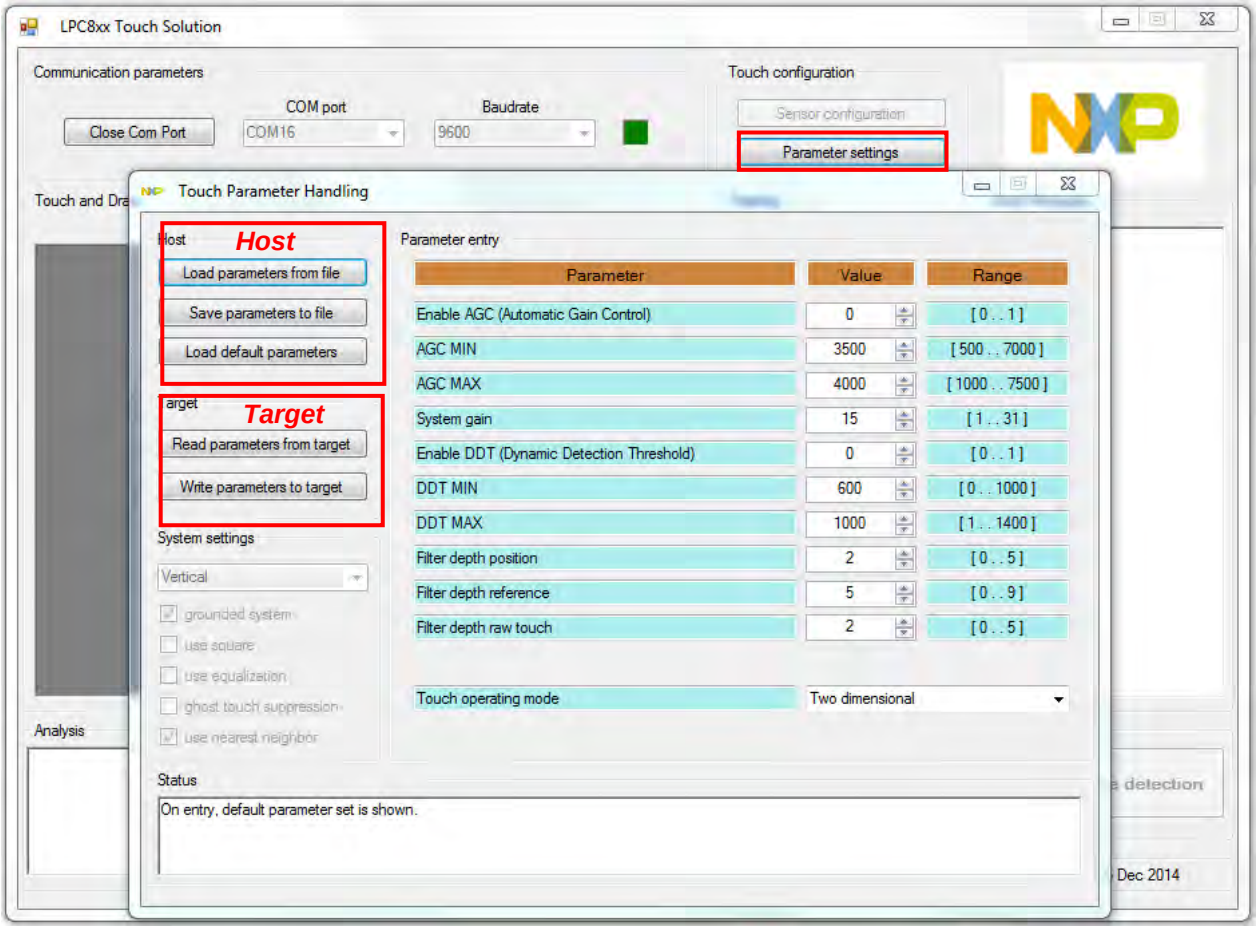

Fig 9. Touch Parameter Handling

- See the “LPC82x Touch Solution Application Note” or “LPC82x Touch Solution Library User Guide” for more details on all of the Touch configuration parameters.
- One can change the mode to **One dimensional mode** (Keys/Button Mode) by selecting “One dimensional” in the drop down for Touch operating mode. See Fig 10.

- After changing the mode, click on “Write parameters to target” and the status window displays: “Parameters successfully written to target”. The on board LCD also displays PARAM.

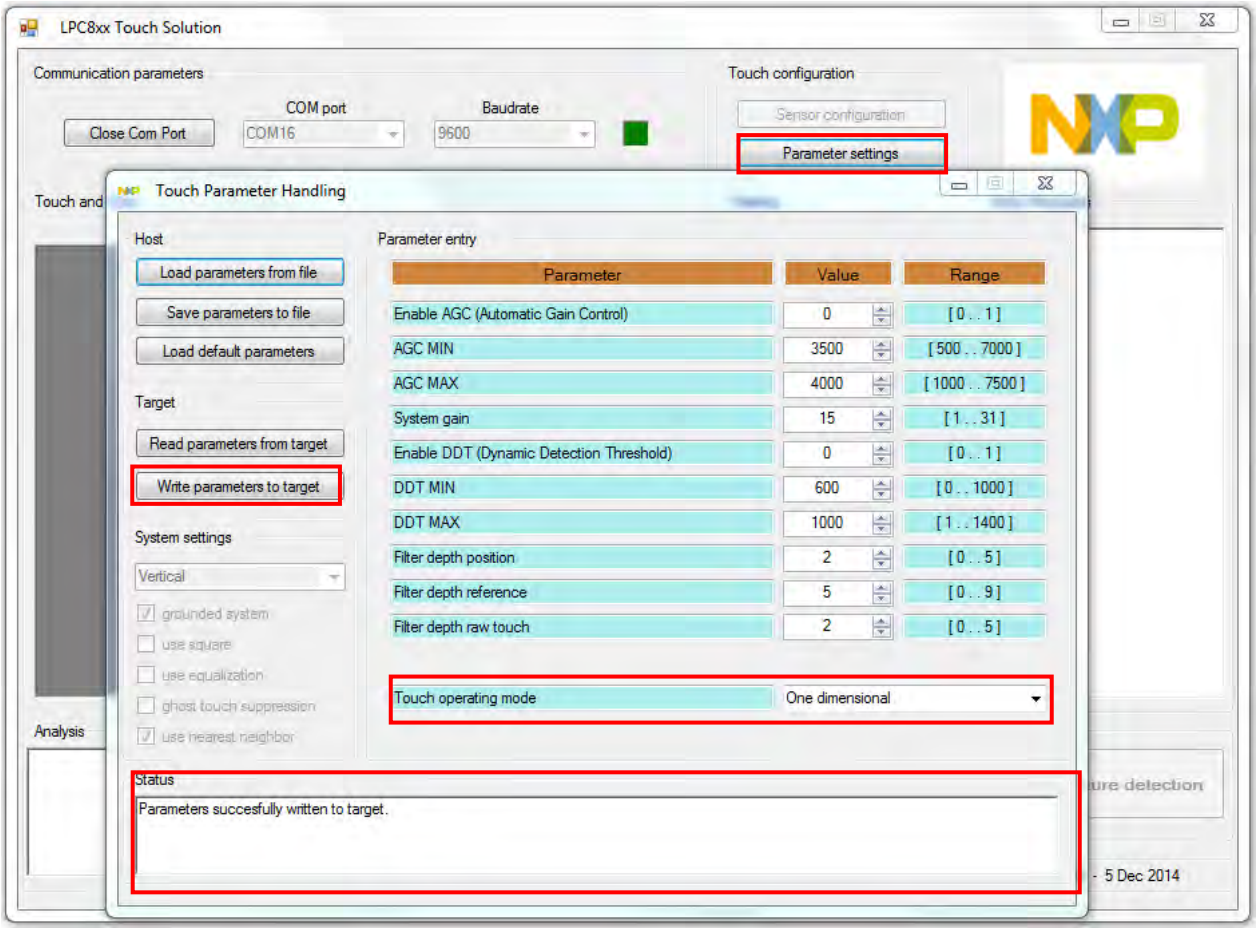

Fig 10. Switching to One Dimensional Mode

- Close the Touch Parameter Handling window after the altered parameters are successfully written to the target.
- The individual Sensor (S1-S9) status can be seen in the Drawing field. See Fig 11.
- On touching any sensor on the board, the corresponding change (√) is reflected in the sensor status of that sensor. The on board LCD also displays the hexadecimal (16 bit) value representing each sensor status.
- The (√) disappears or the respective sensor status is updated as soon as the finger is removed from the sensor.

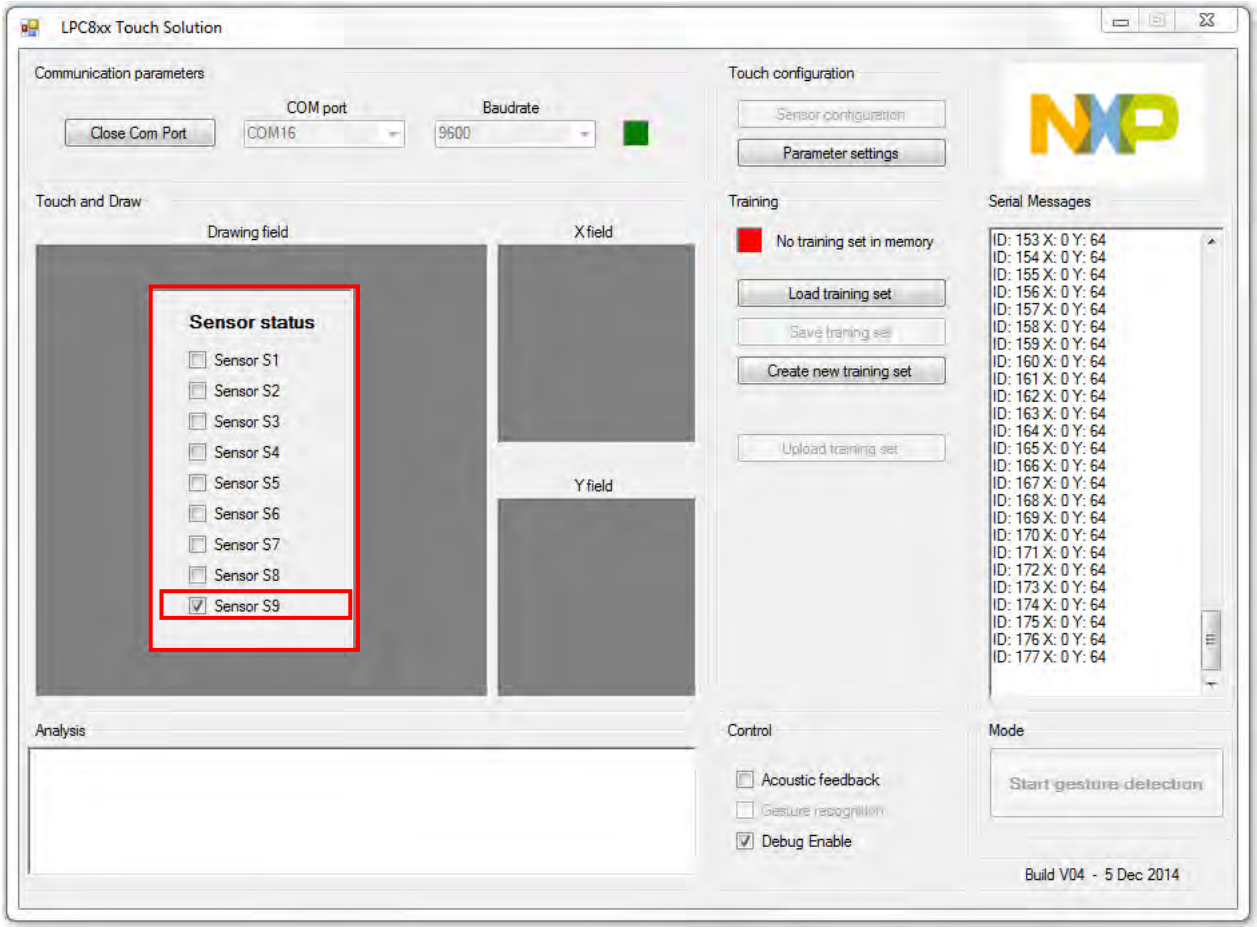

Fig 11. One Dimensional Mode

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