# SX1502 Evaluation Kit

# User's Guide

# Table of Contents

**1 Introduction ..... 4**
**2 Getting Started ..... 5**
*2.1 Kit Contents ..... 5*
*2.2 Installation ..... 5*
**3 Hardware Description ..... 6**
*3.1 Overview ..... 6*
*3.2 USB Connector ..... 7*
*3.3 FT2232D ..... 7*
*3.4 EEPROM ..... 7*
*3.5 VREG ..... 7*
*3.6 VALL ..... 7*
*3.7 VDDM, VCC1 and VCC2 ..... 7*
*3.8 ADDR ..... 7*
*3.9 IO[7-0] ..... 7*
*3.10 NINT ..... 8*
*3.11 NRESET ..... 8*
*3.12 Stand-alone Jumpers ..... 8*
*3.13 Test Connector ..... 8*
**4 Software Description ..... 9**
*4.1 Overview ..... 9*
*4.2 File Menu ..... 9*
4.2.1 Overview ..... 9
4.2.2 Connect/Disconnect ..... 10
4.2.3 Open Config ..... 10
4.2.4 Save Config ..... 10
4.2.5 Save Config As ..... 11
4.2.6 Demo ON/OFF ..... 11
4.2.7 Exit ..... 11
*4.3 Help Menu ..... 11*
4.3.1 Overview ..... 11
4.3.2 User's Guide ..... 11
4.3.3 About SX1502 Evaluation Kit ..... 11
*4.4 Registers Section ..... 11*
*4.5 Write/Read All ..... 11*
*4.6 I2C Slave Address ..... 12*
*4.7 NINT ..... 12*
*4.8 NRESET ..... 12*
*4.9 IO Control (RegData) ..... 12*
4.9.1 Auto Write ..... 12
4.9.2 Auto Read on NINT ..... 12
4.9.3 Auto Clear Event ..... 12
*4.10 Error ..... 12*
*4.11 Config File ..... 12*
**5 Schematics ..... 13**
**6 Layout ..... 14**
**7 References ..... 15**

# Table of Figures

*Figure 1: SX1502 Typical Application* ..... 4
*Figure 2: SX1502EVK Contents* ..... 5
*Figure 3: SX1502EVK Board Picture* ..... 6
*Figure 4: SX1502EVK Board Concept* ..... 6
*Figure 5: SX1502EVK GUI Overview* ..... 9
*Figure 6: SX1502EVK GUI File Menu* ..... 10
*Figure 7: SX1502EVK Config File Example* ..... 10
*Figure 8: SX1502EVK GUI Help Menu* ..... 11

# 1 Introduction

The purpose of this tool is to provide an evaluation platform for the SX1502 and more generally for the SX1501/2/3 Low voltage GPIO family.

The SX1501 family of GPIOs connects directly with low core voltage baseband chipsets in battery powered, handheld applications avoiding level translating circuits, minimizing cost and board space.

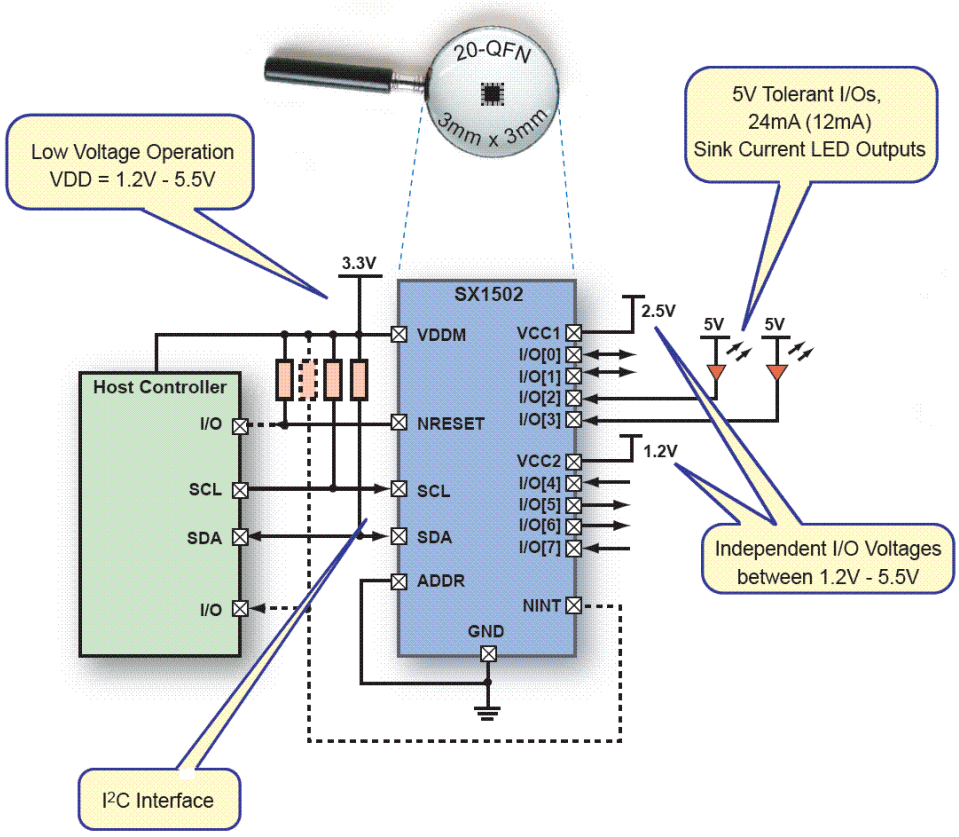



*Figure 1: SX1502 Typical Application*

SX1501/2/3 main features include:

- 1.2 to 5.5V Operating Voltage
  - VCC1 and VCC2: 1.2V-5.5V
- 4/8/16 channels of I/O
  - True bi-directional style
  - Mask Programmable Interrupts
  - Programmable Pull-up/Pull-down
  - Push/Pull Outputs
- +5V Tolerant LED I/Os – 24mA Sink
- Active Low Interrupt Output
- Reset Input
- Programmable Logic Functions (PLD)
- 400kHz I2C Interface
- QFN and TSSOP packages
- -40°C to +85°C Temperature Range

# 2 Getting Started

## 2.1 Kit Contents

As illustrated in the figure below, the SX1502 Evaluation kit is composed of:

- SX1502EVK board
- SX1502EVK CDROM including all necessary PC software and documentation
- Mini USB cable to connect the SX1502EVK board to the PC

*Figure 2: SX1502EVK Contents*

## 2.2 Installation

1- Put the CDROM in your computer. If the installation does not start automatically, launch "SX1502EvaluationKitSetup.exe" manually.
2- Follow installation guidelines until the process is completed. Please note that .NET Framework 2.0 and the FTDI USB driver will be automatically installed if not detected on your computer.
3- Connect the SX1502EVK board to the PC via the mini USB cable.
4- Launch "SX1502EVK" from Start menu.
5- Click on "Connect" button in toolbar or in File menu.(by default, I2C address is correct)
6- SX1502EVK is now ready to be used. **Click on "Demo ON" in File menu to quickly show functionality.**

# 3 Hardware Description

SX1502EVK board is described in this chapter. Please refer to the schematics and layout provided in the document for more details about the exact hardware implementation.

## *3.1 Overview*

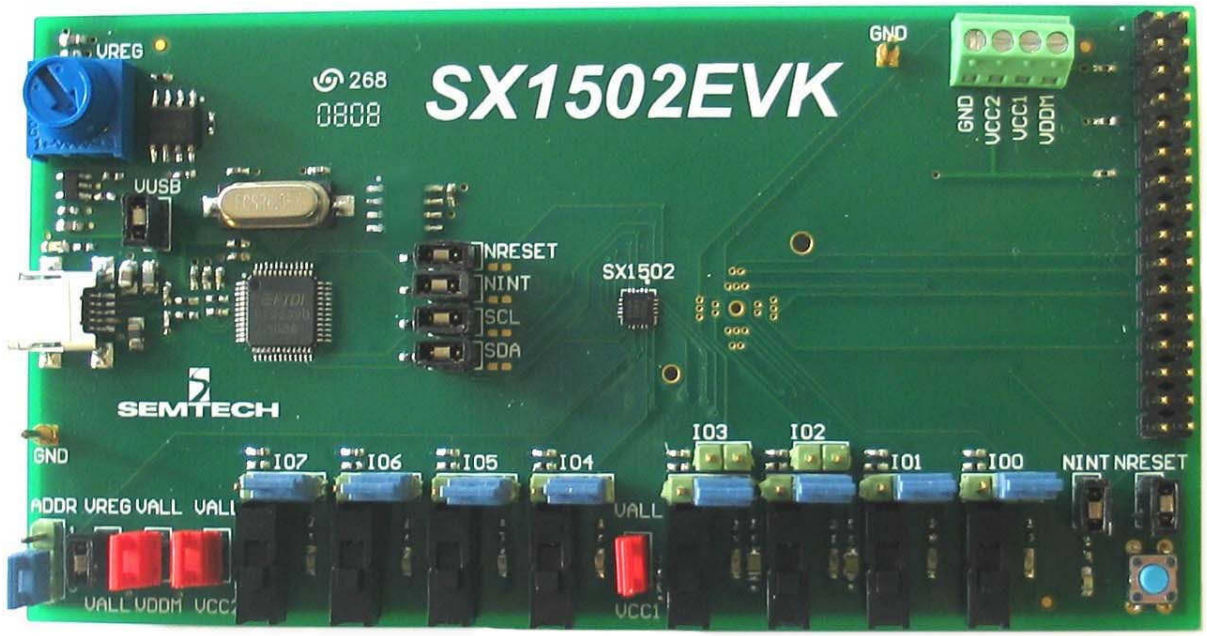



*Figure 3: SX1502EVK Board Picture*

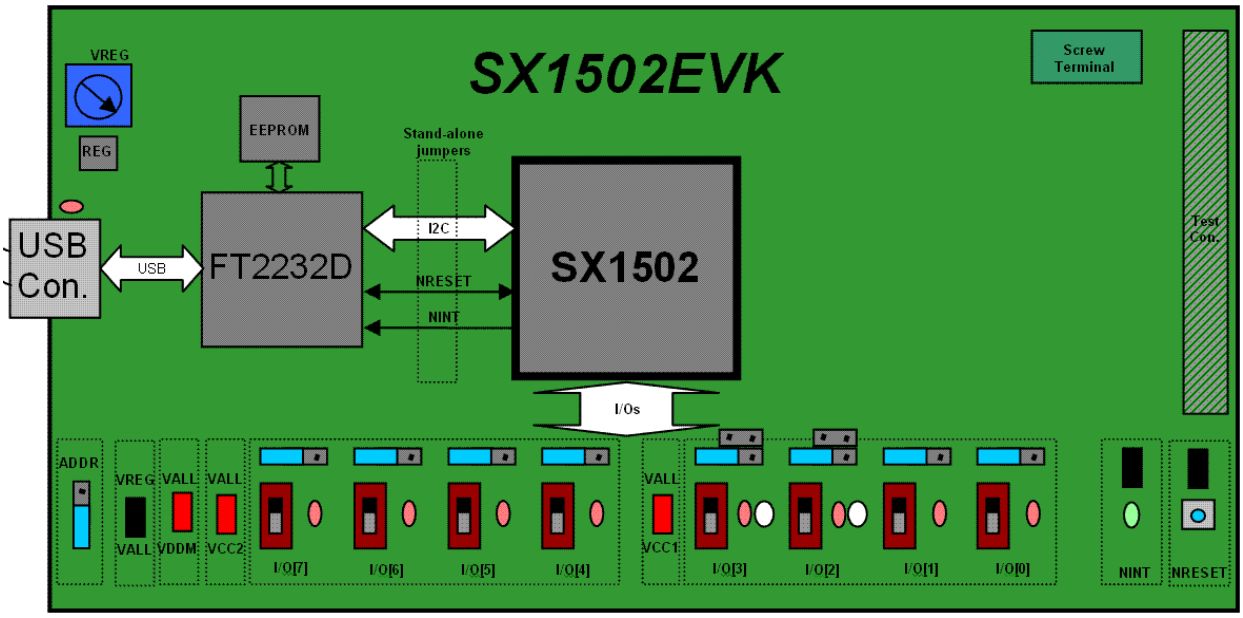



*Figure 4: SX1502EVK Board Concept*

## 3.2 USB Connector

The USB connector allows the EVK to be connected to a PC from which it will get its power and configuration/control commands via dedicated software. It is associated to an LED to indicate the USB connection.

## 3.3 FT2232D

The FT2232D from FTDI will be used as a USB to a I2C bridge between the PC and the SX1502, moreover it will also monitor and control NRESET and NINT signals.(similarly to what a host uC would do in a final application)

## 3.4 EEPROM

FT2232D is usually associated to an EEPROM which keeps the FTDI chip's parameters when power is turned off. The EEPROM is also used to customize USB device description.

## 3.5 VREG

SX1502 can operate from 1.2V to 5.5V. For convenience of evaluation, the SX1502EVK embeds a regulator which output voltage VREG can be adjusted from 1.2V to 5V (USB voltage) via the associated potentiometer (turn clockwise to increase VREG).

## 3.6 VALL

By default, the VALL jumper is ON and thus connects VALL to VREG. Jumper can be removed and VALL supplied externally if needed.

## 3.7 VDDM, VCC1 and VCC2

By default, the VDDM, VCC1 and VCC2 jumpers are ON and thus connect all SX1502 supply lines to VALL (=VREG by default). If needed, the jumpers can be independently removed and the SX1502 supplied externally either directly on the jumper sockets themselves or via the screw terminal (make sure the equivalent jumper is removed before applying any external voltage).

## 3.8 ADDR

ADDR jumper is connected to the ADDR pin of the SX1502. It is used to select one of the two I2C slave addresses available by connecting ADDR pin to ground (down position, default) or VDDM (up position). As described later in the document, the jumper setting must be coherent with the GUI setting to allow I2C communication.

## 3.9 IO[7-0]

Each IO of the SX1502 can be connected in 3 ways (4 for IO2-3):

- Jumper on left position (Cf ***Figure 4***): IO is connected to a switch to control an input state. Switch up => VCCx applied; Switch down => GND applied. Potential bouncing is limited by an RC circuit.
- Jumper on right position (Cf ***Figure 3***): IO is connected to a red LED to monitor an output state. Output high => red LED on; Output low => red LED off. Please note that when operating at VCCx below 1.6V (LED forward threshold) the LEDs won't turn on and IO state must then be monitored with a scope.
- Jumper on **upper** right position (IO2-3 only): IO is connected to a 5V/24mA LED structure. Please note that in this case the LED turns on when IO is set low.

- Jumper removed : IO can be controlled or monitored externally

Please note that the jumpers do not modify the IO configuration (i.e. Input or Output), this must be done via the PC software. User must make sure that the SX1502 registers configuration is always in line with the jumpers' configuration on the board.

## 3.10 NINT

NINT is connected to the FT2232D for remote monitoring from the PC and is also connected to a green LED on-board. Please note that NINT is active low, i.e. the LED will turn OFF when an appropriate change is detected on the inputs. The LED can be disconnected via a jumper if needed.

## 3.11 NRESET

NRESET is connected to the FT2232D for remote monitoring and control from the PC and is also connected to a push button on board (button low => GND applied). Please note that NRESET is active low. The push button can be disconnected via a jumper if needed.

## 3.12 Stand-alone Jumpers

These jumpers are placed on the four lines that are connected between FT2232D and SX1502 (SDA, SCL, NRESET, NINT). Their purpose is, as their name suggests, being able to disconnect the SX1502 from the rest of the circuitry to access it externally (with an external uC, sharing another I2C bus, etc.)

## 3.13 Test Connector

A 32-pin edge connector with all SX1502 pins and specific pinout is integrated on board for easy monitoring of all signals.

# 4 Software Description

## 4.1 Overview

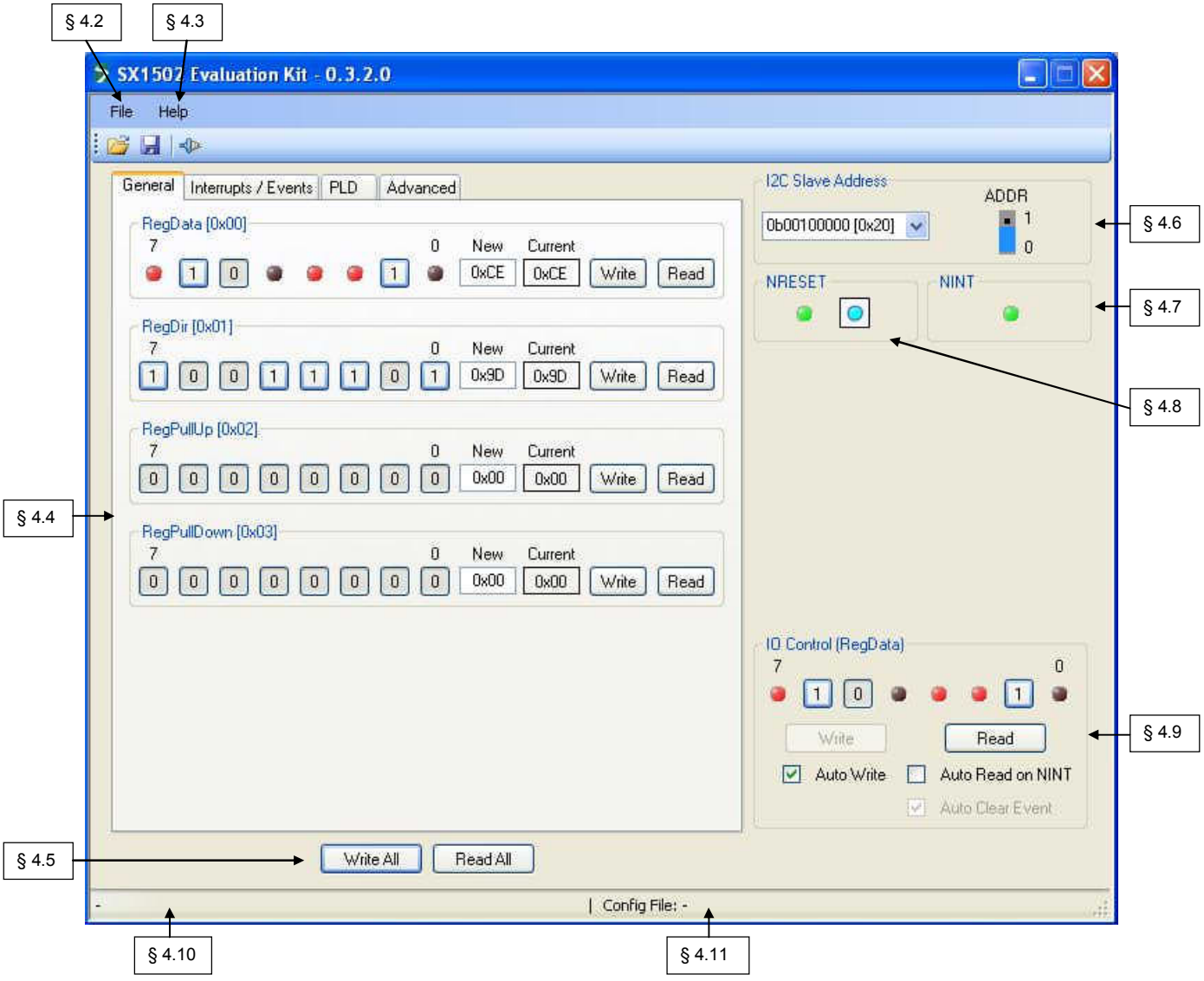



*Figure 5: SX1502EVK GUI Overview*

## 4.2 File Menu

### 4.2.1 Overview

File menu contains some general purpose functions. Some of them can also be accessed on the toolbar by clicking directly on the icon.

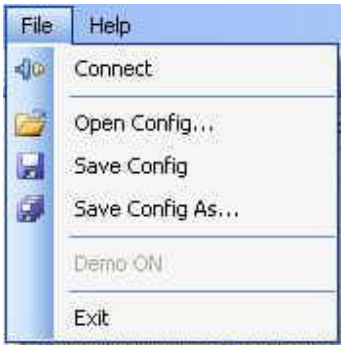



*Figure 6: SX1502EVK GUI File Menu*

### 4.2.2 Connect/Disconnect

This item is used to connect/disconnect the SX1502EVK GUI to/from the SX1502EVK board. For connection, the I2C address selected on the GUI must be coherent with the ADDR jumper configuration on the board.
The icon and name of the menu item dynamically changes depending on the current connection state.
This feature is also available directly on the toolbar.

### 4.2.3 Open Config

For user and support convenience, the SX1502EVK offers the possibility to save/load registers' current configuration into/from a file.

The "Open Config" feature loads "New" registers values from a previously saved configuration file.
This feature is also available directly on the toolbar

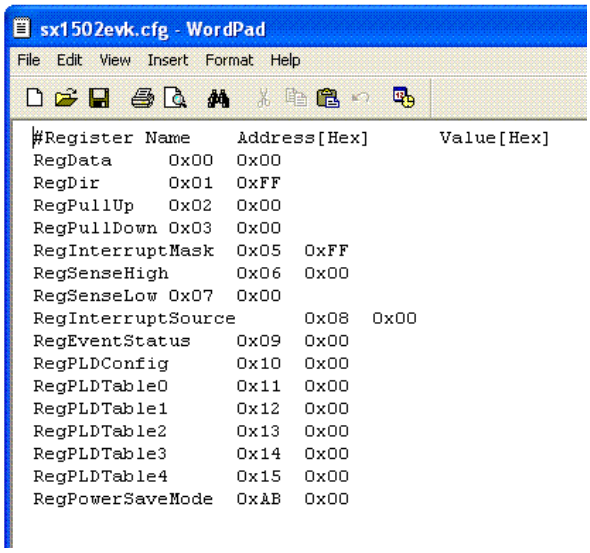



*Figure 7: SX1502EVK Config File Example*

### 4.2.4 Save Config

This feature saves the "Current" registers values in the currently opened configuration file, overriding it.
This feature is also available directly on the toolbar.

### 4.2.5 Save Config As

This is the standard derivate of the "Save Config" feature used to save the current configuration with a different name.

### 4.2.6 Demo ON/OFF

This feature launches/stops a demo which consists in programming all IOs as outputs and sending a predetermined RegData sequence to play a light show on the LEDs.

The name of the menu item dynamically changes depending on the current demo state.(ON/OFF)
When the demo is stopped ("Demo OFF") the GUI restores the previous registers configuration.

### 4.2.7 Exit

This item closes the SX1502EVK GUI.

## *4.3 Help Menu*

### 4.3.1 Overview

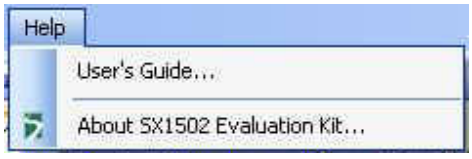



*Figure 8: SX1502EVK GUI Help Menu*

### 4.3.2 User's Guide

This item opens the SX1502EVK User's guide.

### 4.3.3 About SX1502 Evaluation Kit

This item gives access to some useful information such as the software version.

## *4.4 Registers Section*

Every register, identified by "Name [Address]", can be written or read separately via the corresponding "Write" and "Read" buttons.

Register's new value can be modified by clicking directly on the bits (if bit is r/w), or the new hexadecimal value can be typed in the "New" field. Whatever method is used, register's bits representation and "New" field are dynamically attached and always displayed consistently.

"Current" field shows the current value before the new value is written.
Registers are classified in four tabs: General, Interrupts/Events, PLD, and Advanced.
Please refer to the SX1502 datasheet [1] for detailed registers description.

## *4.5 Write/Read All*

For convenience, registers can also be written or read all together via "Write All" and "Read All" buttons.

## 4.6 I2C Slave Address

Slave address can be selected from the two available ones and ADDR jumper's corresponding picture is dynamically modified accordingly. The user can then easily check that his jumper configuration is correct on the board.

## 4.7 NINT

The LED reflects the logical level of the NINT pin. Please note that NINT is active low, i.e. LED will turn OFF when a change is detected on the inputs. Clicking on the LED has no effect.

## 4.8 NRESET

The LED reflects the logical level of the NRESET pin and the push button allows the user to force a reset by clicking on it (button pressed => NRESET forced to 0, button released => NRESET released). Please note that NRESET is active low, i.e. LED will turn OFF when reset is active.

## 4.9 IO Control (RegData)

User can control the IO state via the switches for IOs set as outputs and via LEDs for IOs set as inputs (switch/LEDs configuration complementary to the boards' configuration).
Switch/LEDs configuration is dynamically attached to the RegDir register and is always displayed consistently.
Switch/LEDs value is dynamically attached to the RegData register and is always displayed consistently.
"Write Data" and "Read Data" buttons do the same thing as "Write" and "Read" buttons of RegData.

### 4.9.1 Auto Write

For convenience, it is possible for the user to enable "Auto Write": RegData register will be automatically written whenever one of the switches state is changed, without having to press the "Write Data" button.

### 4.9.2 Auto Read on NINT

To demonstrate the use of the NINT pin, it is possible for the user to enable "Auto Read on NINT": RegData register will automatically be read when NINT goes low, without having to press the "Read data" button.
Please note that by default no interrupt is enabled on any of the IOs. This can be modified in the "Interrupts/Events" registers tab.

### 4.9.3 Auto Clear Event

This feature is associated to the "Auto Read on NINT" feature. When activated (default) it will automatically clear the event register hence enabling a new interrupt to be detected. Exact operation performed is writing RegInterruptMask value in RegEventStatus register.(this will also clear RegInterruptSource register)

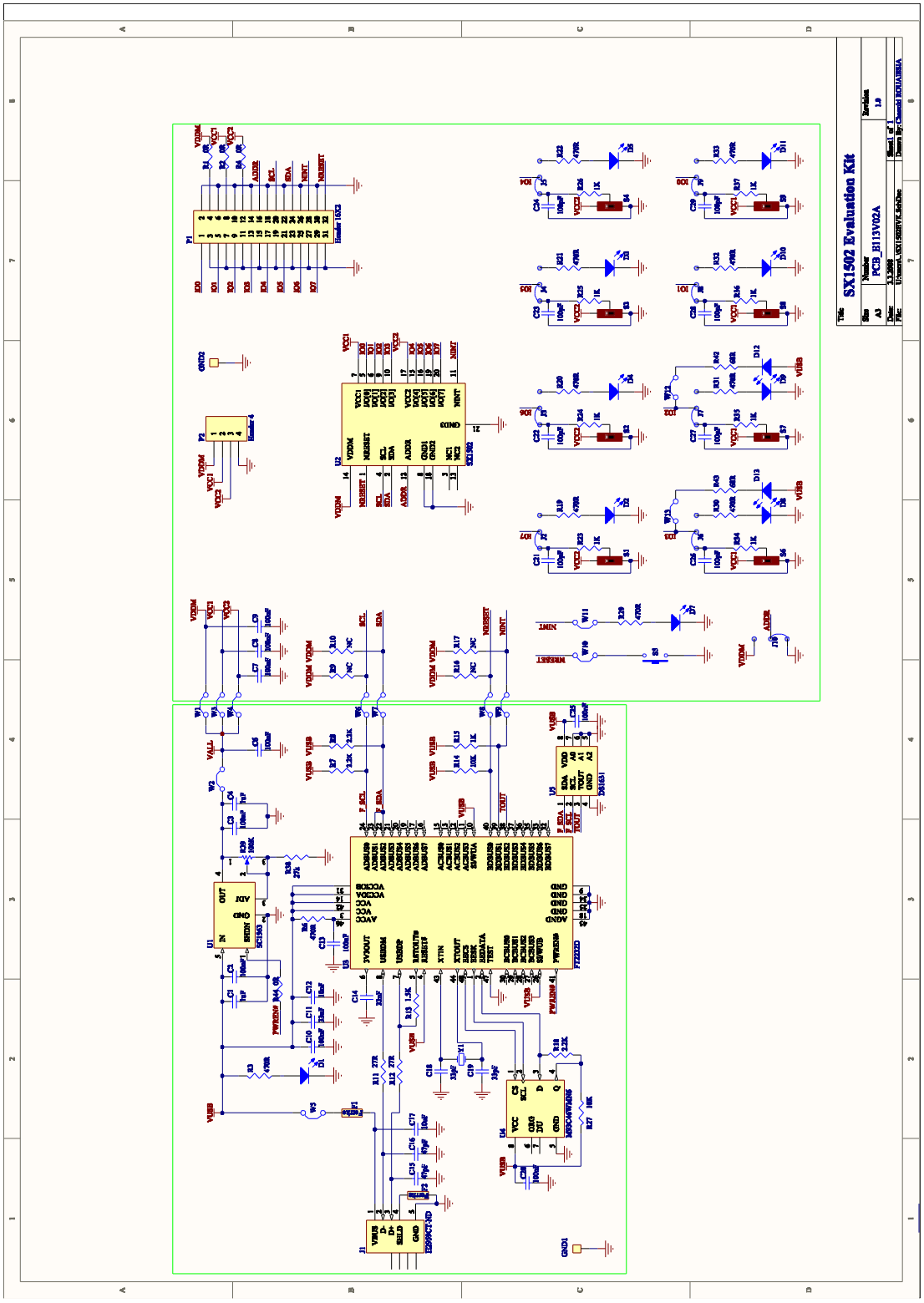
## 4.10 Error

The description of the error (if any) is displayed here.

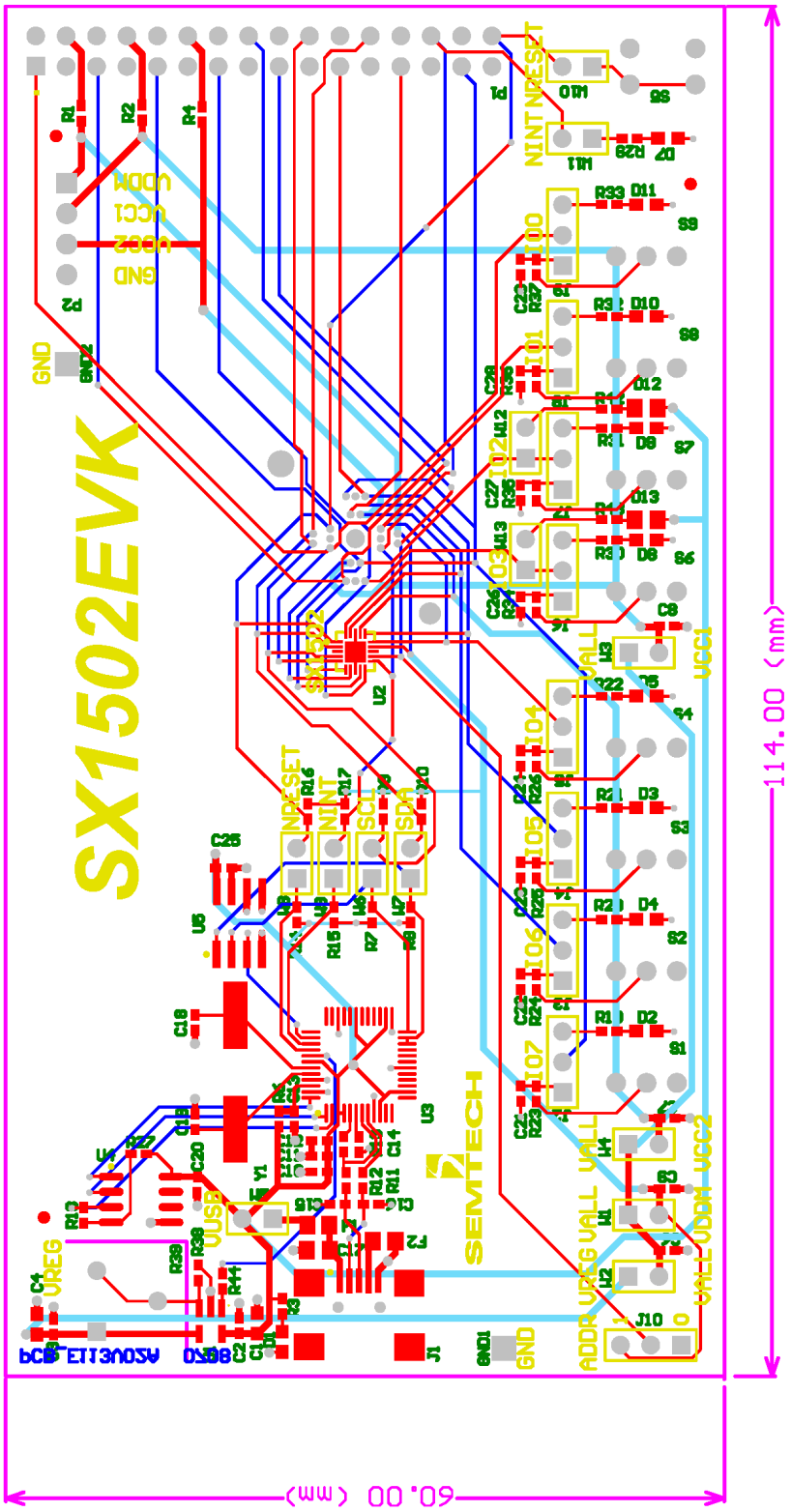
## 4.11 Config File

The name of the current configuration file (if any) is displayed here.

# 5 Schematics



# 6 Layout



# 7 References

- [1] SX1501/2/3 Datasheet

© Semtech 2008
All rights reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent or other industrial or intellectual property rights. Semtech assumes no responsibility or liability whatsoever for any failure or unexpected operation resulting from misuse, neglect improper installation, repair or improper handling or unusual physical or electrical stress including, but not limited to, exposure to parameters beyond the specified maximum ratings or operation outside the specified range.

SEMTECH PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF SEMTECH PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE UNDERTAKEN SOLELY AT THE CUSTOMER'S OWN RISK. Should a customer purchase or use Semtech products for any such unauthorized application, the customer shall indemnify and hold Semtech and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs damages and attorney fees which could arise.

## Contact Information

Semtech Corporation
Advanced Communications and Sensing Products Division
200 Flynn Road, Camarillo, CA 93012
Phone: (805) 498-2111 Fax: (805) 498-3804

# OCEAN CHIPS
## Океан Электроники
## Поставка электронных компонентов

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «**JONHON**», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «**FORSTAR**».

AVIC JONHON

**«JONHON»** (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

**«FORSTAR»** (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).

FORSTAR®

Телефон: 8 (812) 309-75-97 (многоканальный)
Факс: 8 (812) 320-03-32
Электронная почта: ocean@oceanchips.ru
Web: http://oceanchips.ru/
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А