TLE5502 evaluation board user guide

XENSIV™ magnetic angle sensors

About this document

Scope and purpose

This document introduces and explains the XENSIV™ TLE5502 tunnel magnetoresistance (TMR)-based differential angle sensor evaluation board (TLE5502 EVALKIT) and the software installation process.

Intended audience

This document is intended for users of the TLE5502 evaluation board who wish to evaluate the XENSIV™ TLE5502 TMR-based angle sensors, primarily the TLE5502D S0002 and alternatively the TLE5502D S0003 variant.

About this product group

Target applications

The XENSIV™ TLE5502 TMR-based angle sensor is designed for angular position sensing in automotive applications with focus on steering angle sensing and BLDC motor commutation.

Product family

XENSIV™ TLE5502 is a 360° TMR-based angle sensor that detects the orientation of a magnetic field. This is achieved by measuring sine and cosine angle components with tunneling magnetoresistance (TMR) elements. These raw signals (sine and cosine) are provided as differential output signals and can be directly processed by a microcontroller. The high output voltage of the bridge eliminates the need for additional signal amplification.

Evaluation board

This evaluation board is to be used during the design-in process for evaluating and measuring characteristic curves, and for checking datasheet specifications.

Note: Printed circuit board (PCB) and auxiliary circuits are NOT optimized for final customer design.

Safety precautions

Note: Please note the following warnings regarding the hazards associated with development systems.

Safety precautions

	**Caution:** *The heat sink and device surfaces of the evaluation or reference board may become hot during testing. Hence, necessary precautions are required while handling the board. Failure to comply may cause injury.*
	**Caution:** *The evaluation or reference board contains parts and assemblies sensitive to electrostatic discharge (ESD). Electrostatic control precautions are required when installing, testing, servicing, or repairing the assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with electrostatic control procedures, refer to the applicable ESD protection handbooks and guidelines.*

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1 The board at a glance

This kit is based on the XMC1100 platform (BootKit), and is Arduino compatible.

By default, the kit is populated with the XENSIV™ TLE5502D S0002 variant on the top side; alternatively, the TLE5502D S0003 variant can be populated on the bottom side. It is not possible to populate both top and bottom devices at the same time.

1.1 Scope of supply

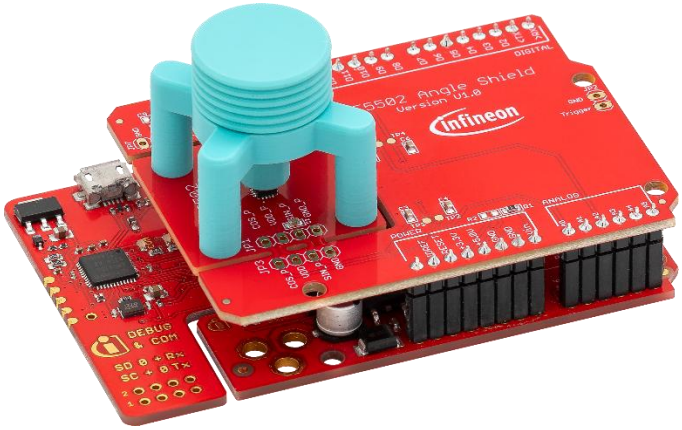


Figure 1 XENSIV™ TLE5502 evaluation kit

The TLE5502 EVALKIT consists of:

- XMC1100 BootKit
- TLE5502 Angle Shield V1.0
- 3D printed knob with an attached magnet

1.2 Main features

- Angle readout
- Calibration

1.3 Board parameters and technical data

The XMC1100 BootKit hardware platform requires a 5 V USB connection for both communication and power supply.

Table 1 Parameter

Parameter	Symbol	Conditions	Value	Unit
Input voltage	Vs		5	V

2 System and functional description

2.1 Getting started

The XENSIV™ TLE550x Analog Angle Sensor Evaluation Software enables you to quickly evaluate the XENSIV™ TLE5502 sensors. The software allows live angle readout and calibration of the sensors.

2.1.1 Requirements

The evaluation software was developed and tested on the following PC configuration:

- Operating system: Windows 10 (64-bit)/Windows 11 (64-bit); also supports Windows 7
- RAM: 8 GB (maximum usage approximately 150 MB during data logging)
- Storage: 512 GB (minimum required for installation: 250 MB, including dependencies)
- CPU: 3.00 GHz, 4 cores (lower-performance CPUs may experience performance issues)

2.1.2 Software download

Infineon provides the graphical user interface (GUI) software free of charge on its website, through the Infineon Developer Center online platform under the “Tools” section, or via the Infineon Developer Center Launcher. To locate the software, you can filter the tool list by entering the keywords “Angle Sensor” or “TLE5502”. The search results will display the entry “XENSIV™ TLE550x Analog Angle Sensor Evaluation Software”.

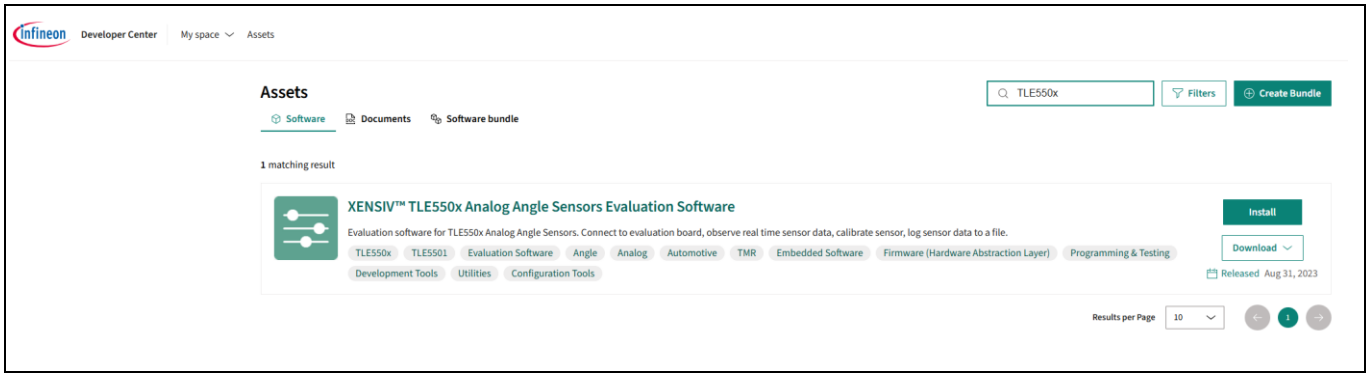


Figure 2 Infineon Developer Center: Download software

Infineon recommends installing the Infineon Developer Center Launcher before installing this application.

Note: The download of the XENSIV™ TLE550x Analog Angle Sensor Evaluation Software is available only to users who are registered with a myInfineon account.

2.1.3 Software installation

Download the XENSIV™ TLE550x Analog Angle Sensor Evaluation Software from the Infineon website or from the Infineon Developer Center Launcher. Then, install the Evaluation Kit software by double-clicking the installer file. Please note that administrator rights are required to complete the installation.

The installer file contains the following elements:

- Binaries or compiled objects required to run the graphical user interface
- SEGGER J-Link driver to enable communication with the onboard debugger via the serial port
- .NET Framework 4.8 online installer (required only for older Windows versions where it is not already installed; installation requires a stable internet connection)

Installation steps

1. License agreement: Review the license agreement and accept Infineon's Terms and Conditions to proceed with the installation

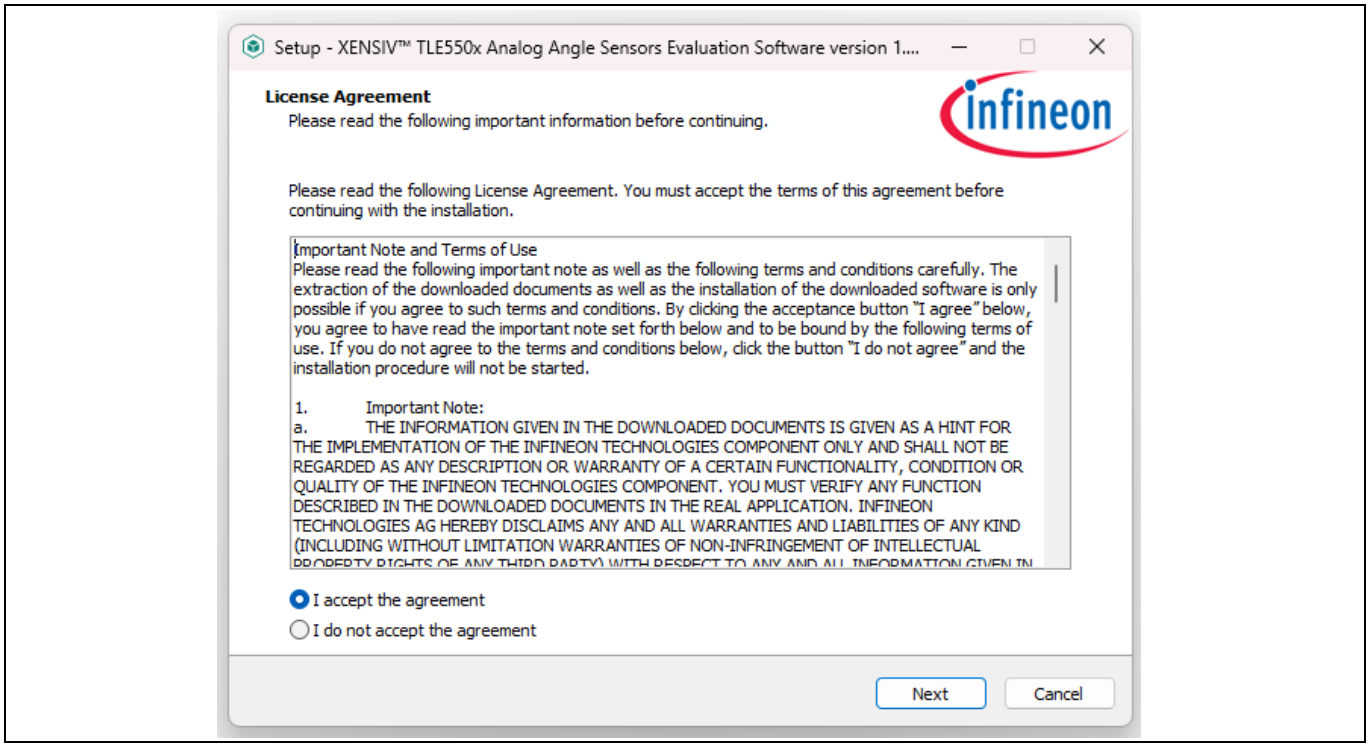


Figure 3 Software installation: License agreement

2. Installation type selection: Select the installation type. It is recommended to use the **Quick Installation** option. Click **Install** to begin the installation process

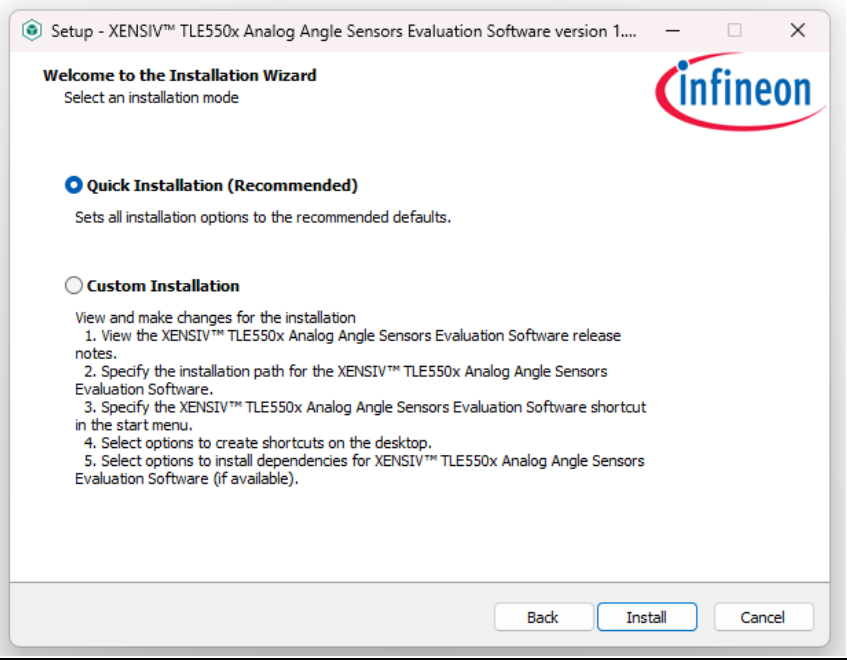


Figure 4 Software installation: Quick installation

3. SEGGER J-Link driver installation: After the binaries are copied to the installation folder, you are prompted to install the SEGGER J-Link Driver. If the J-Link driver is already installed on your system, you can skip this step. The J-Link driver is required to establish the USB connection between the PC and the TLE5502 evaluation board. Without this driver, communication with the evaluation board is not possible



Figure 5 Software installation: SEGGER J-Link driver

4. .NET Framework 4.8 installation: After installing the SEGGER J-Link driver, the installer prompts you to install the .NET Framework 4.8

Note: The .NET Framework 4.8 is preinstalled on Windows 10 (version 1903 and later), released in May 2019. If the framework is already available in your system, you will be informed that it is already installed. Otherwise, the installation will proceed automatically, provided that an active internet connection is available.

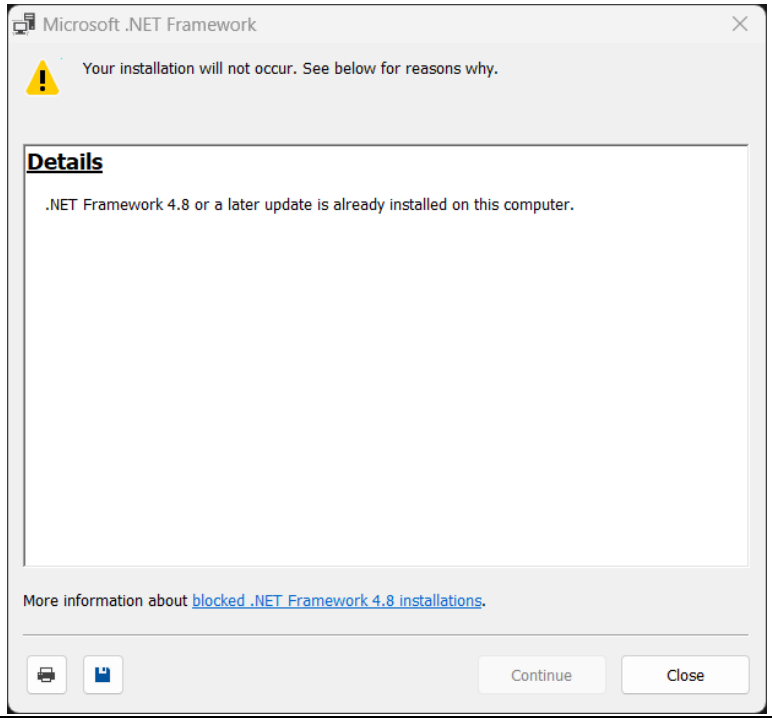


Figure 6 Software installation: .NET 4.8 installation

You will receive a notification upon completion of the installation process, and a desktop shortcut will be created by default. You can also choose to launch the program immediately after installation.

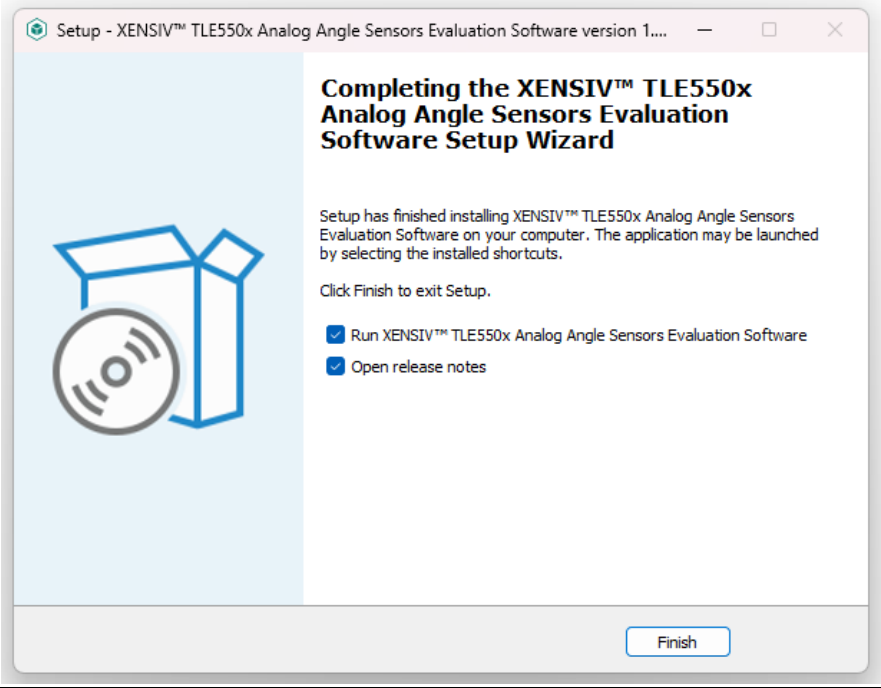


Figure 7 Software installation: Complete

2.1.4 Software uninstall

To uninstall the software package, go to **Start** → **Add or remove programs** and search for the XENSIV™ TLE550x Analog Angle Sensor Evaluation Software. Click **Uninstall** to delete the software from the PC.

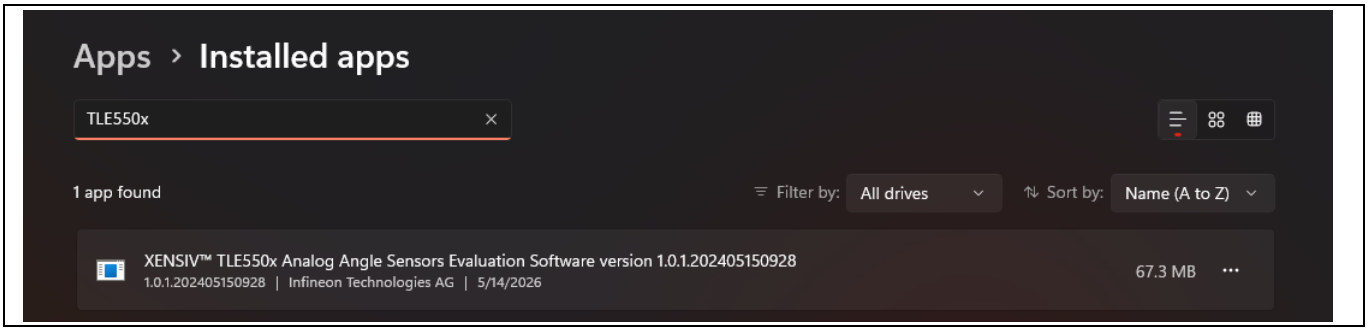


Figure 8 Software uninstall

The uninstaller deletes all installation files from the system, except:

- SEGGER J-Link driver, which can be uninstalled separately if needed
- .NET Framework 4.8 dependencies, which are part of the operating system in most cases

2.2 Using the evaluation software

This chapter describes all the features and their usage in the XENSIV™ TLE5502 Angle Sensor Evaluation Software, in correlation with the XENSIV™ TLE5502 evaluation board. Ensure that the evaluation board is properly connected to the XMC1100 BootKit board via the pin headers.

2.2.1 Startup screen and connecting to the programmer

Figure 9 shows the default screen of the XENSIV™ TLE550x Analog Angle Sensor Evaluation Software after startup.

The graphical user interface software monitors all available USB ports and checks whether any connected device matches the signature of the XENSIV™ TLE5502 evaluation board. If a match is detected, a new device is displayed, as shown in Figure 9. When you select the device, the software establishes a connection. It then flashes the correct firmware version to the target microcontroller if the existing firmware is outdated. Otherwise, it establishes a connection using the firmware version already installed on the selected board.

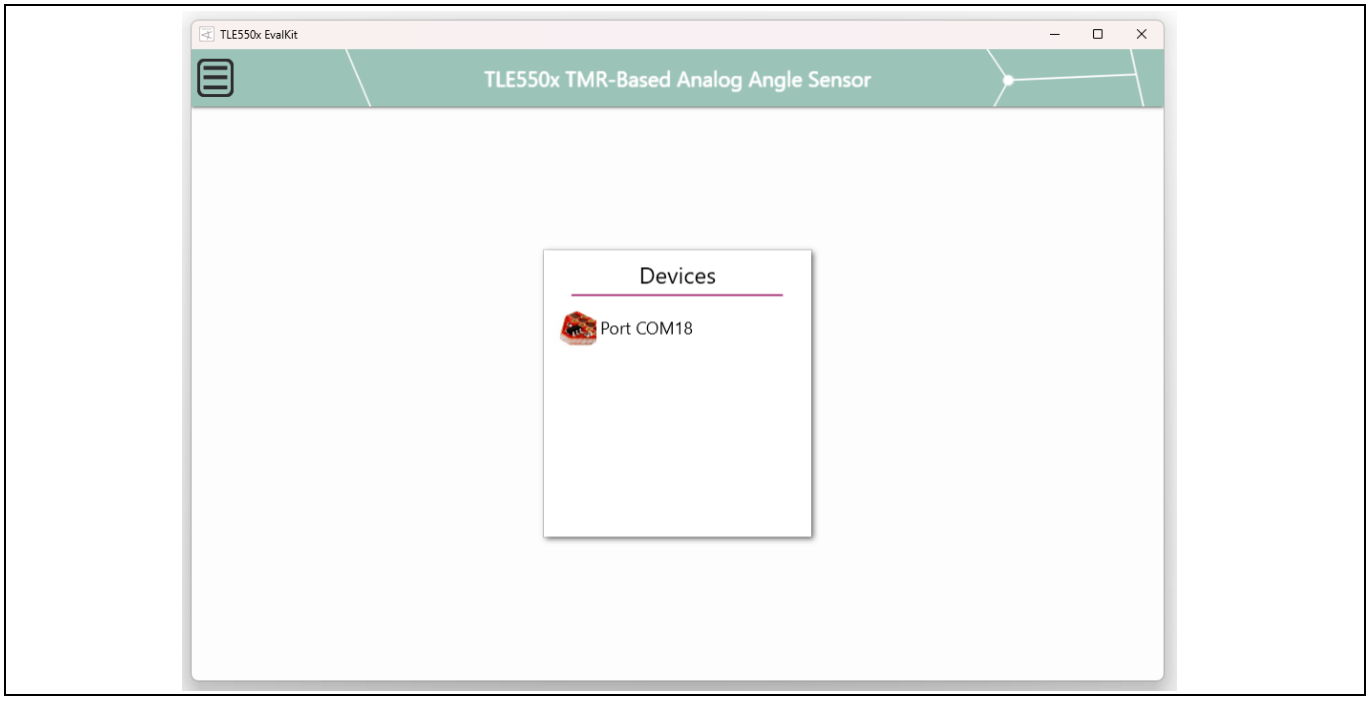


Figure 9 Software usage: Startup screen

Note: You can force a firmware update by navigating to "Settings" (menu button in the top-left corner) and selecting "Always update firmware (irrespective of the current version)".

Upon connecting to the board, the software displays the view described in Figure 10. Establishing the connection also initiates the readout of the analog sensor outputs and starts data processing.

2.2.2 Main view

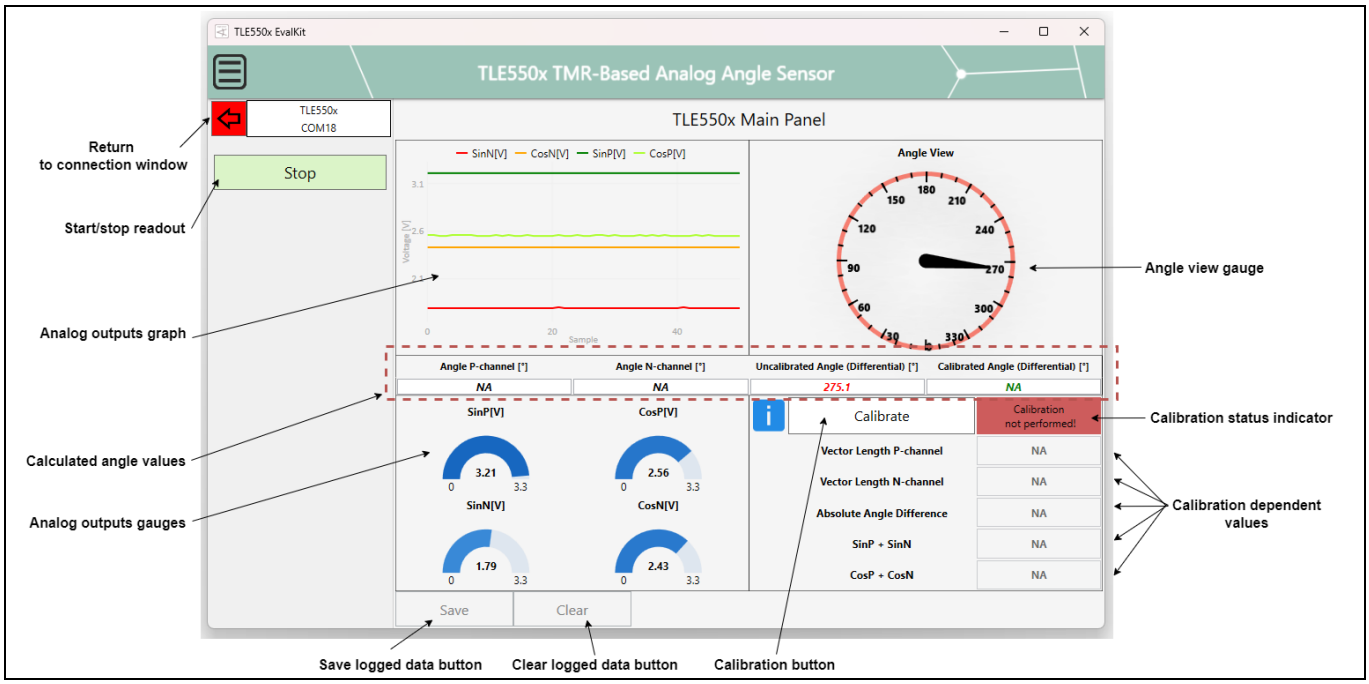


Figure 10 Main view

The main view of the software is shown in Figure 10:

- The top-left section of the window displays the four analog outputs of the sensor: SinP, CosP, SinN, and CosN
- The top-right section of the window calculates the uncalibrated differential angle using these analog signals and displays it in the **Angle View** as a 360° gauge
- The central strip of the window displays the relevant calculated values in real time: Angle P-channel, Angle N-channel, Uncalibrated Angle (differential), and Calibrated Angle (differential)
- The bottom-left section of the windows displays all analog output signals as both numerical values and gauges, with a range from 0 V to 3.3 V
- The bottom-right section of the window displays the calibration button and the relevant calibration data

2.2.2.1 Angle readout

The angle readout starts once the software enters the main window. You can start or stop the readout using the green button on the controls menu on the left side of the window.

If the readout is active, the graph and all the gauges will be updated with data in real time. The Uncalibrated Angle (Differential) value will also be updated in this state.

The rest of the values only get updated once the sensor is calibrated.

2.2.2.2 Calibration

For analog angle sensors, the offset, amplitude, and orthogonality of the raw sin and cos signals must be calibrated to achieve high angle accuracy. The calibration procedure can be started by using the **Calibrate** button located on the right side of the main window.

Attention: ***The readout must be started before the calibration process.***

Once you click the button, a pop-up window opens.

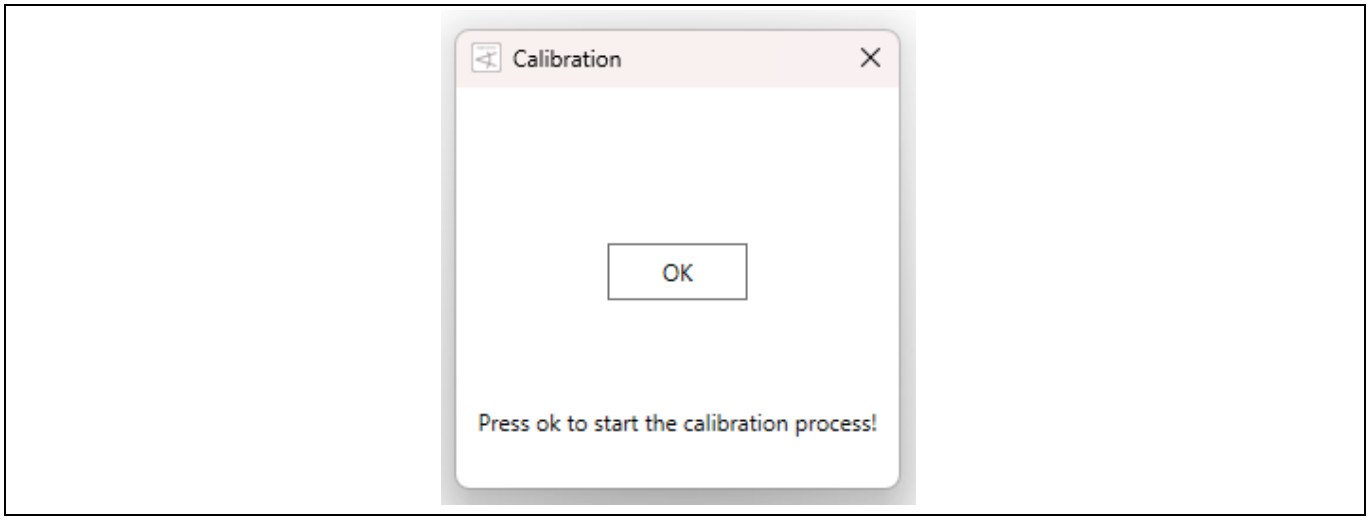


Figure 11 Calibration window

Once you click the **OK** button, start rotating the knob slowly in the indicated direction. When the calibration for this direction is complete, the **LEFT** button changes from red to green, as shown in Figure 13.

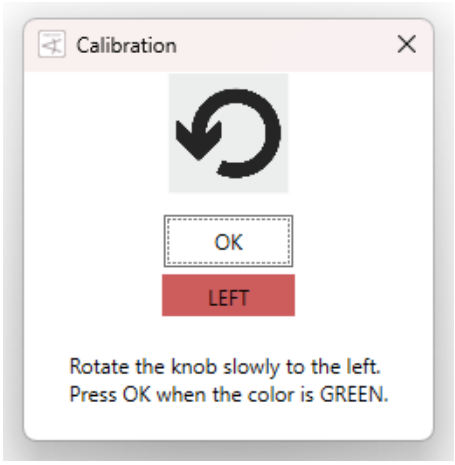


Figure 12 Calibration window before counter clockwise rotation

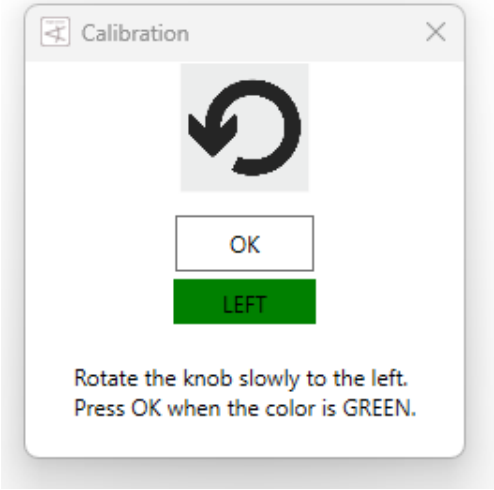


Figure 13 Calibration window after counter clockwise rotation

When you click **OK** again, repeat the same procedure for the clockwise direction.



Figure 14 Calibration window after clockwise rotation

When the **RIGHT** button turns green, click **OK** to complete the calibration.

If the calibration is successful, a message stating “Calibration finished! Press ok to exit” appears, as shown in Figure 15.

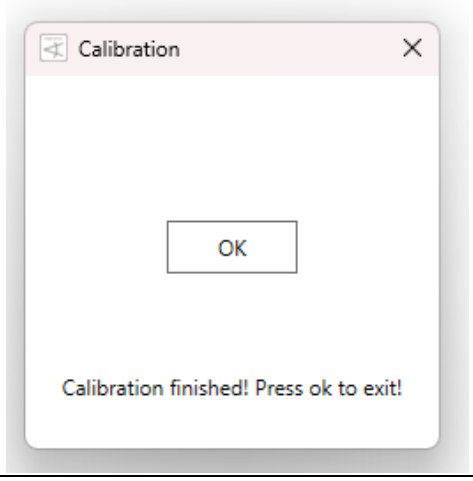


Figure 15 Calibration successful message

After clicking the **OK** button, the calibration is completed. Once the calibration is ready, the software starts updating all the missing values in the main window in real time:

- Angle P-channel
- Angle N-channel
- Calibrated Angle (Differential)
- Vector Length P-channel
- Vector Length N-channel
- Absolute Angle Difference
- SinP + SinN
- CosP + CosN

The main window after calibration is shown in Figure 16.

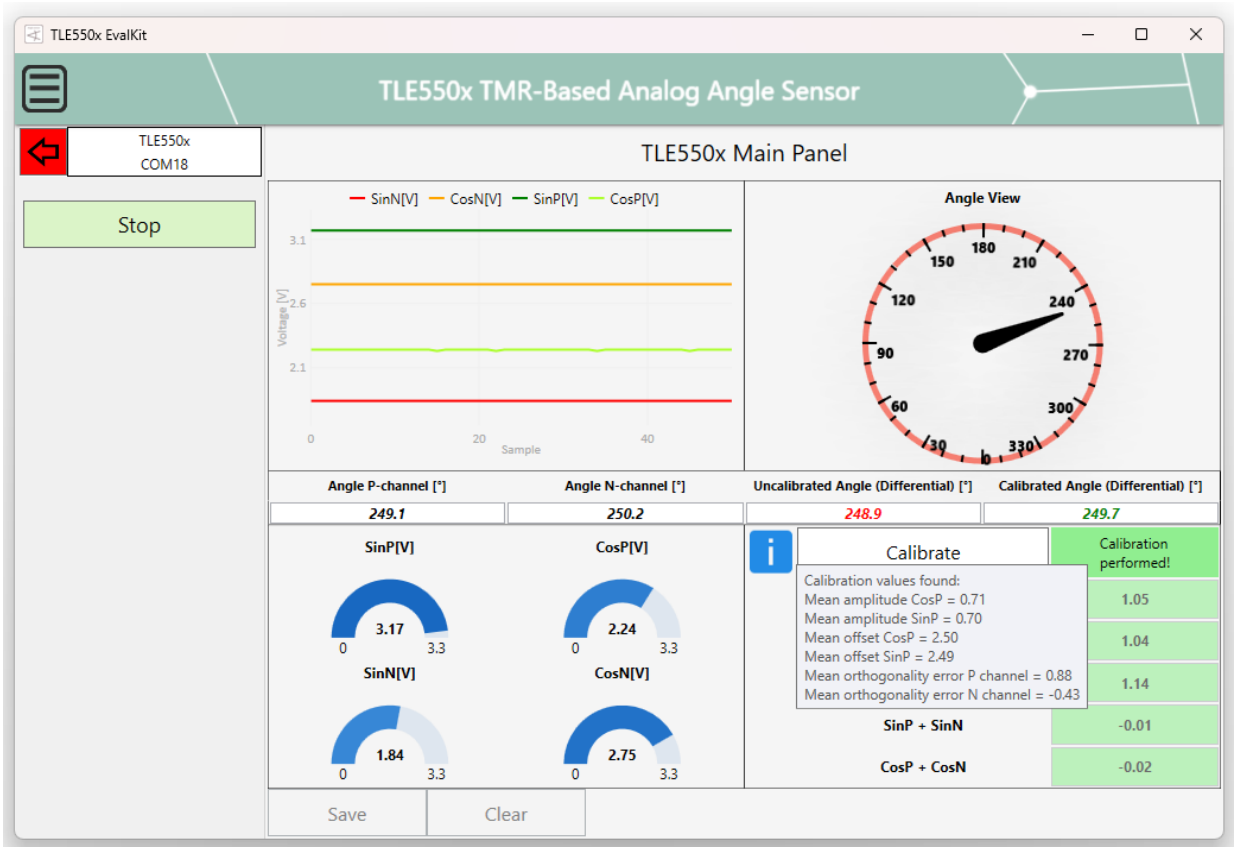


Figure 16 Main window after calibration

You can access all relevant data collected during calibration by hovering over the **i** button located on the left side of the **Calibrate** button, as shown in Figure 16.

2.2.2.3 Safety features

The bottom-right area of the main window displays information related to the safety concept of XENSIV™ TLE5502 sensors, as described in the product safety manual.

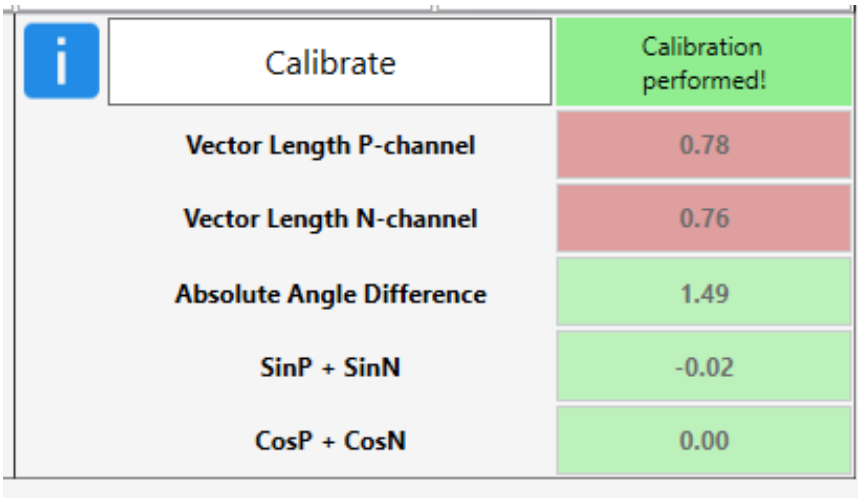


Figure 17 Safety mechanisms

The external safety mechanisms are implemented in the software, and any violation of the expected values is presented in red. The values and the violations of two safety mechanisms are shown in Figure 17.

Note: The safety fields are populated only if a sensor calibration is performed.

2.2.2.4 Saving logged data

The software allows you to save the recorded data. The data is stored on your computer as a *.csv* (comma-separated values) file. By default, all received data is logged.

This action can be performed only after stopping the readout. When you click **Save**, the “Save Log to File” window appears.

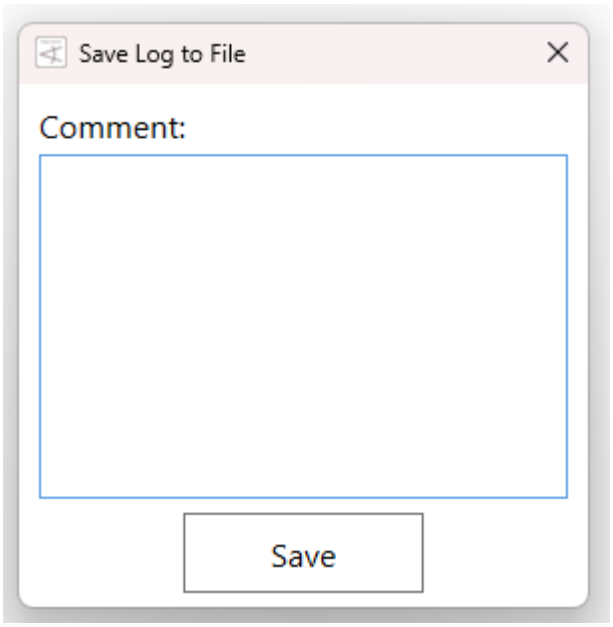


Figure 18 Save Log to File window

Within this window, you can enter an optional comment, which will be included in the generated *.csv* file. When you click the **Save** button, the default Windows save dialog opens, allowing you to specify the name and location of the saved file.

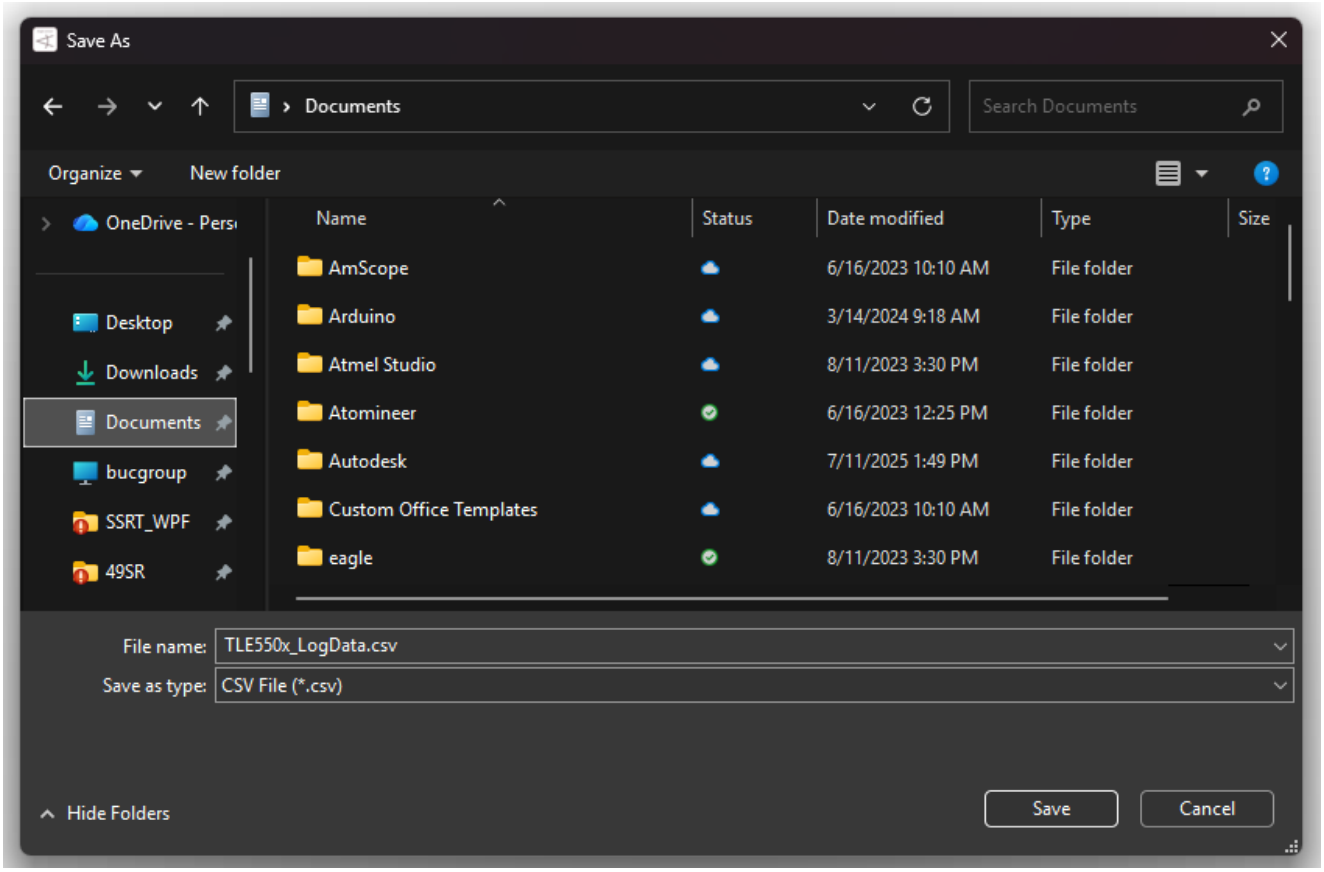


Figure 19 Default Windows save dialog

2.2.2.5 Clearing logged data

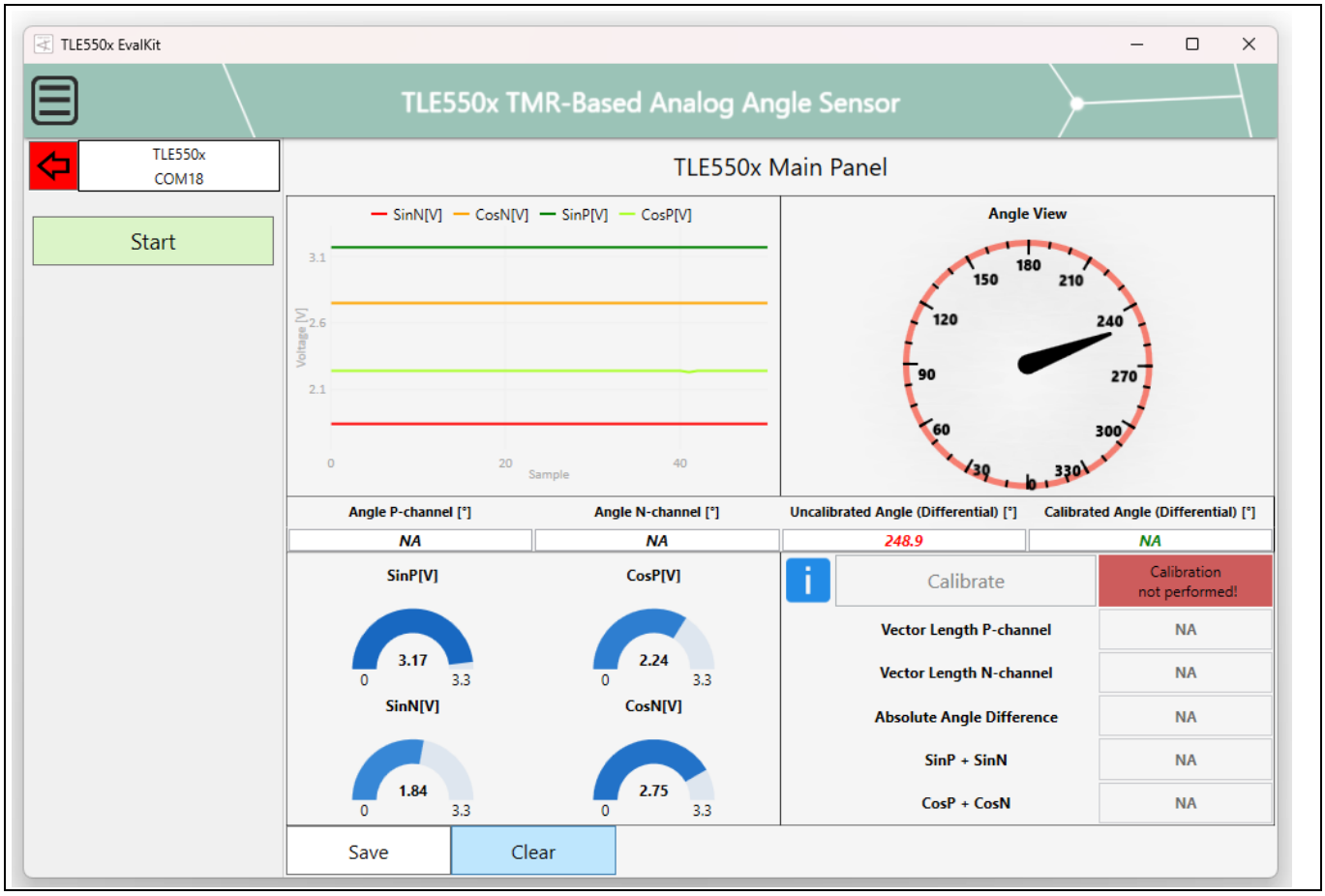


Figure 20 Clear button highlighted in blue

Once the readout is stopped, you can also clear the data by clicking the **Clear** button highlighted in Figure 20. This action removes all the data collected up to that point.

3 System design

The XENSIV™ TLE5502 Evaluation Kit PCB is built on the XMC1100 BootKit platform [3] and uses the same Arduino-compatible pinout.

3.1 Schematics

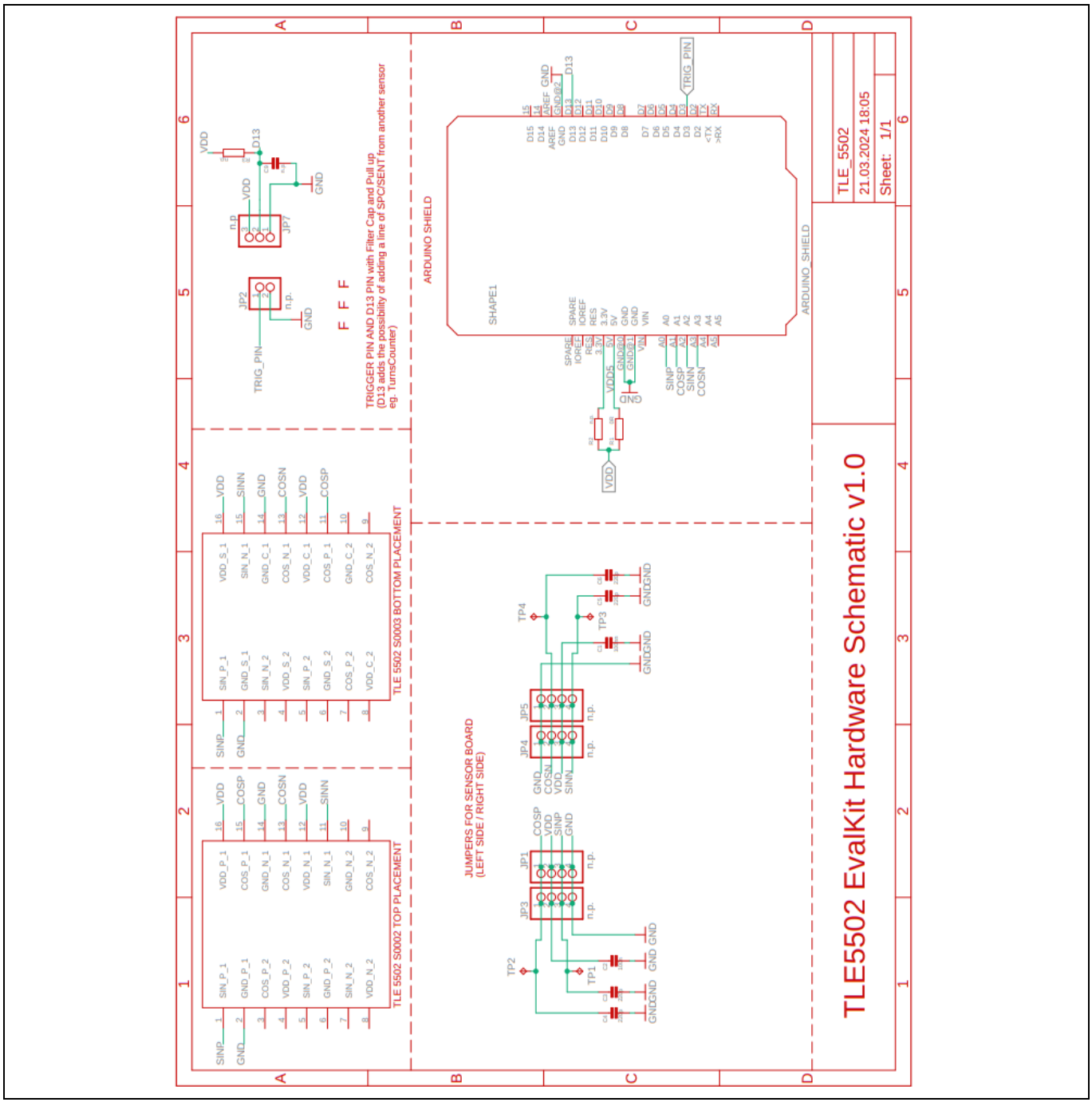


Figure 21 XENSIV™ TLE5502 evaluation kit schematic

3.2 Layout

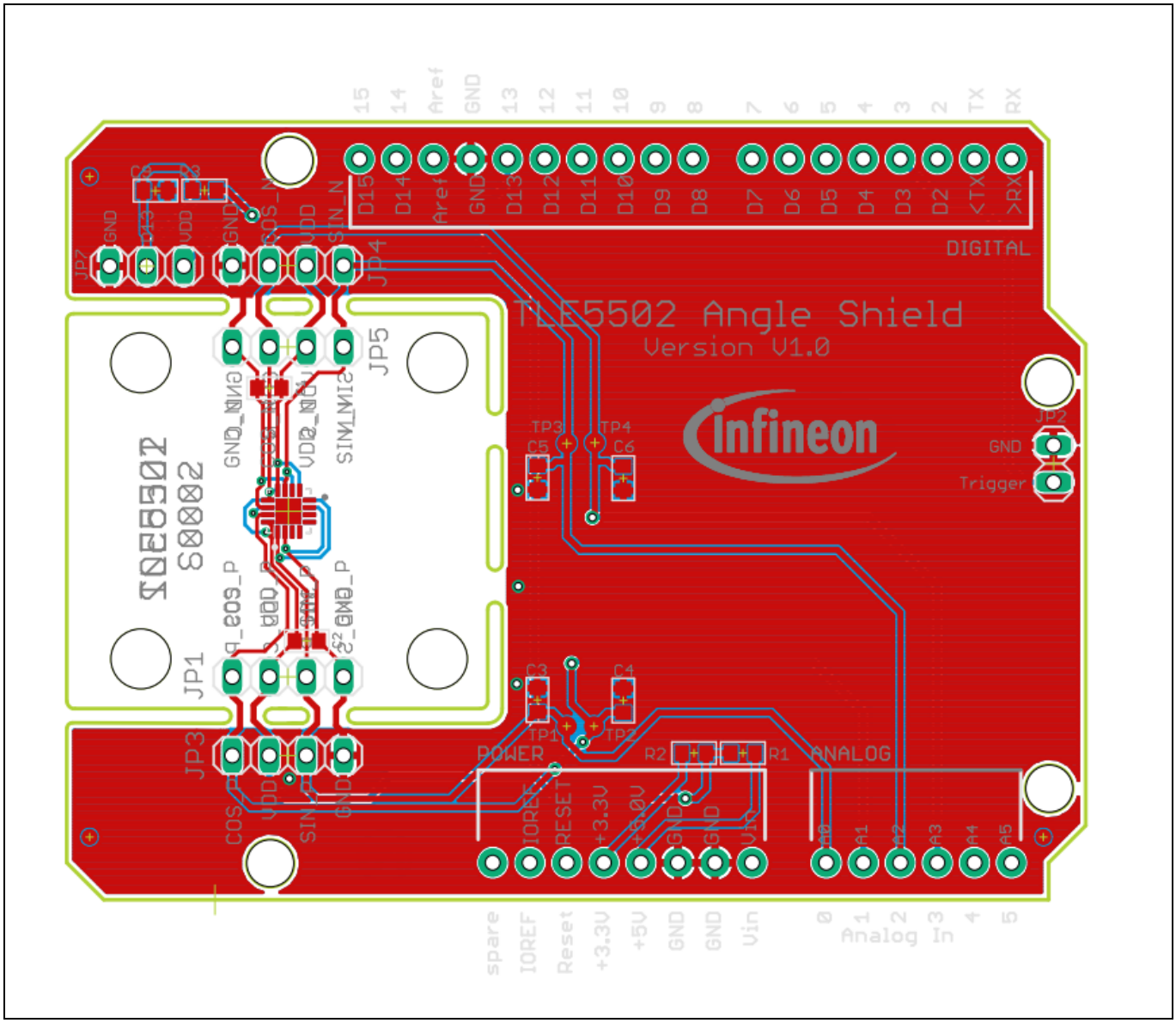


Figure 22 XENSIV™ TLE5502 Angle Shield layout

3.3 Bill of materials

The complete bill of materials is available in the downloads section of the Infineon homepage. A login is required to access and download this material.

Table 2 Bill of materials

S.No.	Reference designator	Description	Manufacturer	Manufacturer P/N	Populated
1	C1, C2	CAP SMD CER 0.1 µF 50 V X7R 0603	Murata	GRM188R71H104KA93D	Yes
2	C3, C4, C5, C6	CAP SMD CER 220 pF 50 V C0G/NP0 0603	Murata	GRM1885C1H221JA01D	Yes
3	R1	RES SMD 0 Ω JUMPER 0603 0.1 W	Yageo	RC0603JR-070RL	Yes
4	TP1, TP2, TP3, TP4	TEST POINT, SMT PAD 1.27 mm	–	–	Yes
5	FID1, FID2, FID3	FIDUCIAL MARK, SMT (GLOBAL)	–	–	Yes
6	S0002	MAGNETIC ANGLE SENSOR TLE5502, PG-QFN-16 (3x3)	Infineon Technologies	TLE5502	Yes
7	C9	CAP SMD CER 0603 (DNP)	–	–	No
8	R2, R3	RES SMD 0603 (DNP)	–	–	No
9	JP1	HEADER 4POS 2.54 mm TH (DNP)	–	–	No
10	JP3, JP4, JP5	HEADER 4POS 2.54 mm TH (DNP)	–	–	No
11	JP2	HEADER 2POS 2.54 mm TH (DNP)	–	–	No
12	JP7	HEADER 3POS 2.54 mm TH (DNP)	–	–	No

3.4 Connection details

Table 3 Pins and functions

PIN	TLE5502 Angle Shield label	Function	XMC1100 pin
1	D15	Digital I/O 15	P2.0
2	D14	Digital I/O 14	P2.1
3	Aref	Analog reference input	P2.3
4	GND	Ground	GND
5	D13	Digital I/O 13 (SPI SCK)	P1.4
6	D12	Digital I/O 12 (SPI MISO)	P0.9
7	D11	Digital I/O 11 (SPI MOSI)	P0.8
8	D10	Digital I/O 10 (SPI SS)	P0.12
9	D9	Digital I/O 9	P0.7
10	D8	Digital I/O 8	P0.6
11	D7	Digital I/O 7	P0.5
12	D6	Digital I/O 6	P0.4
13	D5	Digital I/O 5	P0.3
14	D4	Digital I/O 4	P0.2
15	D3	Digital I/O 3	P0.1
16	D2	Digital I/O 2	P0.0
17	TX	UART TX	TXD
18	RX	UART RX	RXD
19	IORE	I/O voltage reference	IOREF
20	RES	Reset	RESET
21	+3.3V	+3.3 V supply	3.3 V
22	+5V	+5 V supply	5 V
23	GND	Ground	GND
24	GND	Ground	GND
25	Vin	Unregulated input	Vin
26	A0	Analog input 0	P2.6
27	A1	Analog input 1	P2.8
28	A2	Analog input 2	P2.9
29	A3	Analog input 3	P2.10
30	A4	Analog input 4	P2.11
31	A5	Analog input 5	P2.2
33	GND	Ground (JP7)	GND

4 Related resources

- Webpage: XENSIV™ angle sensors
- Infineon Developer Community: XENSIV™ angle sensors forum
- XENSIV™ TLE550x Analog Angle Sensors Evaluation Software

References

[1] Infineon Technologies AG: *XENSIV™ TLE5502D TMR-based angle sensor datasheet;* Available online

[2] Infineon Technologies AG: *XMC1100 AB-Step datasheet*; Available online

[3] Infineon Technologies AG: *XMC1100 CPU Card (KIT_XMC11_BOOT_001) user guide*; Available online

Glossary

DNP
do not populate (DNP)

SPI
Serial Peripheral Interface (SPI)

UART
universal asynchronous receiver-transmitter (UART)

Revision history

Document revision	Date	Description of changes
1.00	2026-10-22	Initial release

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Edition: 2026-10-22

Published by
Infineon Technologies AG
Am Campeon 1-15
85579 Neubiberg, Germany

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Safety & Operating Instructions:

Customer shall check the Evaluation Board for any physical damage which may have occurred during transport. If customer detects any damages or defects in the Evaluation Board, customer shall not connect the Evaluation Board to a power source. Customer shall contact Infineon for further support. If customer observes unusual operating behavior during the evaluation process, customer shall immediately shut off the power supply to the Evaluation Board and consult Infineon for support.

Customer shall not touch the Evaluation Board during operation and keep a safe distance.

Customer shall not touch the Evaluation Board after disconnecting the power supply, several components may still store electrical voltage and can discharge through physical contact. Several parts, like heat sinks and transformers, may still be very hot. Allow the components to cool before touching or servicing.

The electrical installation must be completed in accordance with the appropriate safety requirements.