ST GUI Setup for TSC1641 Evaluation Board User Manual

Contents

ST GUI Setup for TSC1641 Evaluation Board

Product Information

- Product Name: TSC1641
- Product Type: GUI Setup
- User Manual: UM3213
- Revision Number: Rev 1
- Date: July 2023
- Manufacturer: STMicroelectronics
- Contact Information: Visit www.st.com or contact your local STMicroelectronics sales office.

Getting Started

The STSW-DIGAFEV1GUI software is used to set up the TSC1641. Before starting, make sure your system meets the following requirements:

1. System Requirements:
    - Refer to Figure 1 for detailed system requirements.
2. Hardware Configuration:
    - Refer to Figure 2 for the hardware configuration using STEVAL-DIGAFEV1 with the TSC1641.
3. Software Configuration:
    - Refer to the following steps to configure the software:
        1. Connect the NUCLEO-H503RB to your laptop using a type-C USB cable. (Refer to Figure 3)
        2. Make sure ST-Link is installed and up to date. (Refer to Figure4)
        3. Download the STSW-DIGAFEV1GUI package. Accept the license and save the file on your laptop. Unzip the file.
        4. Download the STSW-DIGAFEV1FW package. Accept the license and save the file on your laptop. Unzip the file.
        5. Upload the binary file STSW-DIGAFEV1FW into the STM32 Nucleo board.

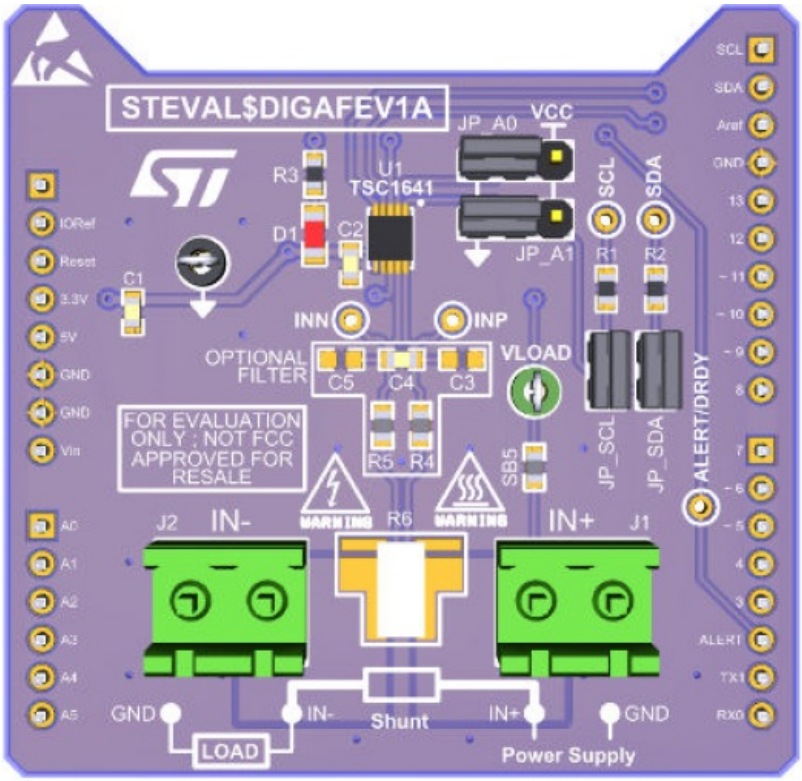
System requirements
The STSW-DIGAFEV1GUI software needs the following system requirements to perform:

System requirements

	Main components
NUCLEO-H503RB	STM32 Nucleo development board
Type-C USB cable	with USB data support
STSW-DIGAFEV1FW	Software for Nucleo
STSW-DIGAFEV1GUI	TSC1641 Graphical User Interface
STEVAL-DIGAFEV1	TSC1641 evaluation board
Operating System	Windows OS
STSW-Link009	SW for Nucleo connection

Hardware configuration
TSC1641 (STEVAL-DIGAFEV1)
Plug directly the STEVAL-DIGAFEV1 on the nucleo board through Arduino uno ® connectors.

STEVAL-DIGAFEV1 with the TSC1641



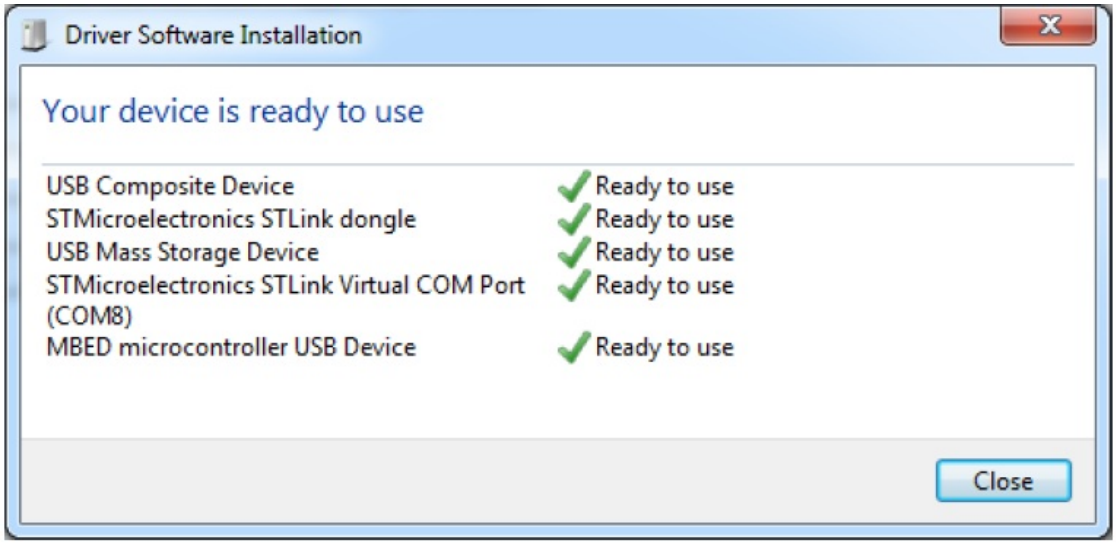
Software configuration

Nucleo connection

- **Step 1.** Connect the NUCLEO-H503RB to the Laptop using a type-C USB cable.

  Nucleo H503RB used to run the GUI

- **Step 2.** Please make sure ST-Link is installed and up to date:
  STLINK must be installed



- **Step 3.** Download the STSW-DIGAFEV1GUI package.
- **Step 4.** Click on [GET software]button.
- **Step 5.** Accept the license.
  Download will start after accepting the License Agreement, and filling contact information.
- **Step 6.** Save the file STSW-DIGAFEV1GUI.zip on your laptop and unzip it.
- **Step 7.** Download the STSW-DIGAFEV1FW package
- **Step 8.** Click on [GET software] button.
- **Step 9.** Accept the license.
  Download will start after accepting the License Agreement, and filling contact information.
- **Step 10.** Save the file STSW-DIGAFEV1FW.zip on your laptop and unzip it.
- **Step 11.** Upload the binary STSW-DIGAFEV1FW into the STM32 Nucleo board:
  - Connect the Nucleo board to the PC using a USB cable

    - Drag and drop the STSW-DIGAFEV1FW.bin to the Nucleo board (NODE_H503RB)
- **Step 12.** Launch STSW-DIGAFEV1GUI.exe on the laptop

Product Usage

To use the GUI, follow these steps:

1. Communication Type Selection:
    - Open the STSW-DIGAFEV1GUI folder and click on the STSW-DIGAFEV1GUI.exe file to open the GUI. The GUI window will appear as shown in Figure 5.
    - By default, the I2C panels are displayed. To switch to the I3C panels, click on the I3C mode (CCC ENTDAA) button and provide an I3C dynamic address.
    - The GUI provides four tabs for communication: I2C configuration, I2C monitoring, I3C configuration, and I3C monitoring. (Refer to Table 1 for communication speed details)
2. I2C Configuration:
    - By default, the TSC1641 is in I2C mode. Use the I2C configuration panel and I2C monitoring table to communicate with the device. Refer to the I3C configuration page for switching between I2C and I3C.
    - Refer to Figure 6 for the I2C configuration page.
    - On the I2C configuration page, you can modify the configuration register and set the alerts as desired. Use the scrolling menus to select modes, conversion time, and change bits manually. (Refer to Figure 7)

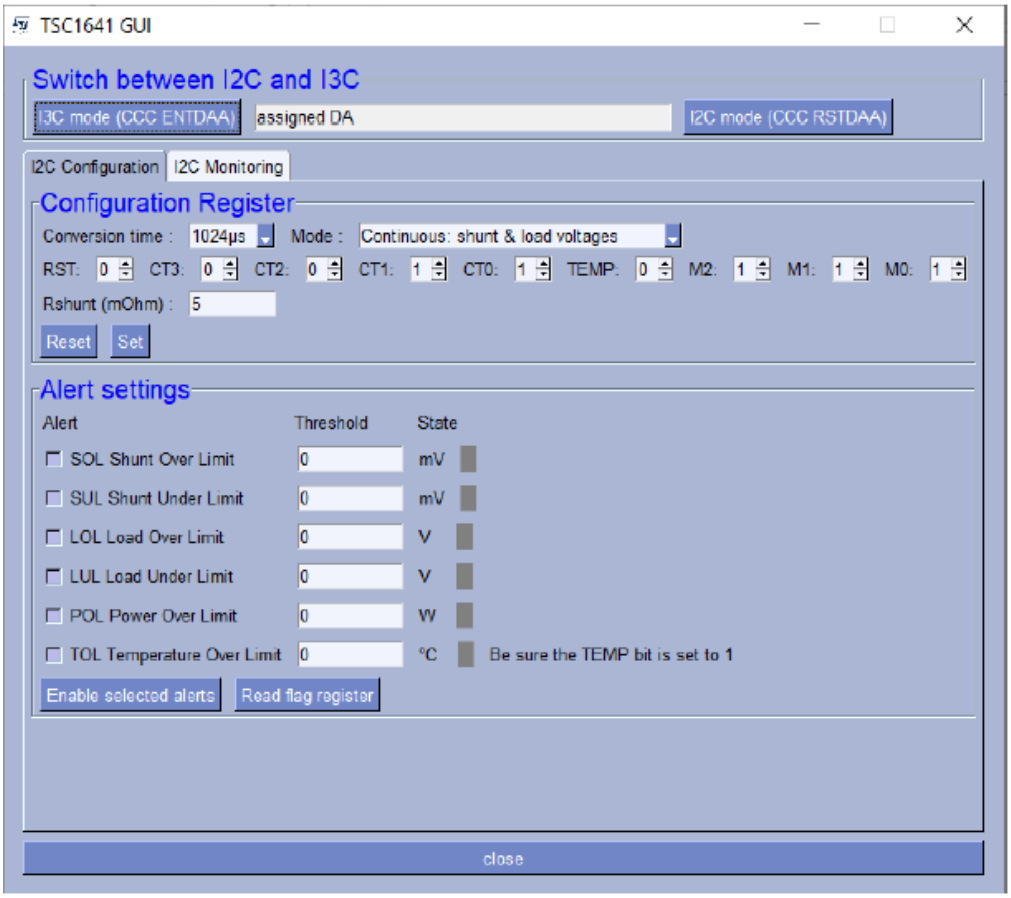
Introduction
The TSC1641 is a high precision current, voltage, power, and temperature monitoring analog front-end (AFE). It monitors current into a shunt resistor and load voltage up to 60 V in a synchronized way. The current measurement can be high-side, low-side and bidirectional. The device integrates a high precision 16-bit dual channel ADC with a programmable conversion time from 128 µs to 32.7 ms. The digital bus interface is flexible from an I²C/SMbus 1 MHz data rate to an MIPI I3C 12.5 MHz data rate. This allows connectivity to most of the recent STM32 products. STEVAL-DIGAFEV1 is the TSC1641 evaluation board. This board can be connected to a Nucleo-H503RB with the STM32H5 and be monitored with a graphical user interface (GUI): the STSW-DIGAFEV1GUI.

Use of the GUI

Communication type selection

In the STSW-DIGAFEV1GUI folder, click on the STSW-DIGAFEV1GUI.exe file to open the GUI. The following window must appear.

First page of the GUI, the user can navigate through the several panels easily



By default the I2C panels are proposed to the user.
But the user can switch to the I3C panels by giving an I3C dynamic address thanks to the “I3C mode (CCC ENTDAA) button.
Four tabs are available :

- I2C configuration and I2C monitoring allowing to communicate in I2C
- I3C configuration and I3C monitoring allowing to communicate in I3C

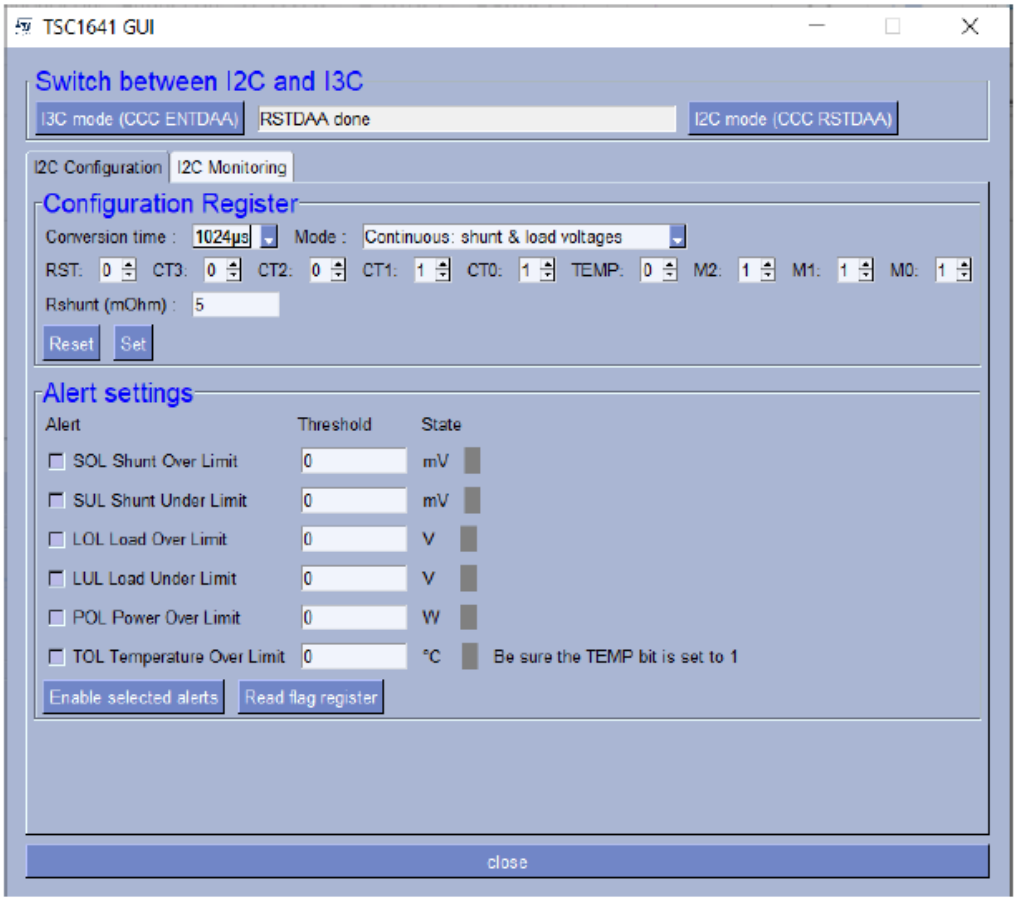
Table with communication speed used by the GUI to communicate with the TSC1641

Communication type	**Frequency used by the GUI**
I2C	1MHZ
I3C	Open drain 1MHz Push-pull 12.5Mhz

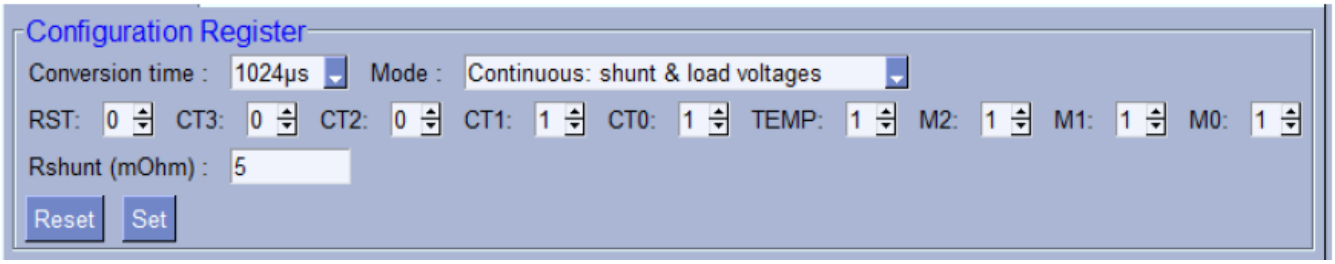
By default, the TSC1641 is in I2C mode.
It is possible to communicate with I2C configuration panel and I2C monitoring table. Please refer to I3C configuration page to see how to switch between I2C and I3C.

I2C configuration

I2C configuration page. In this page the user can write in the configuration register and set the alerts as it desires



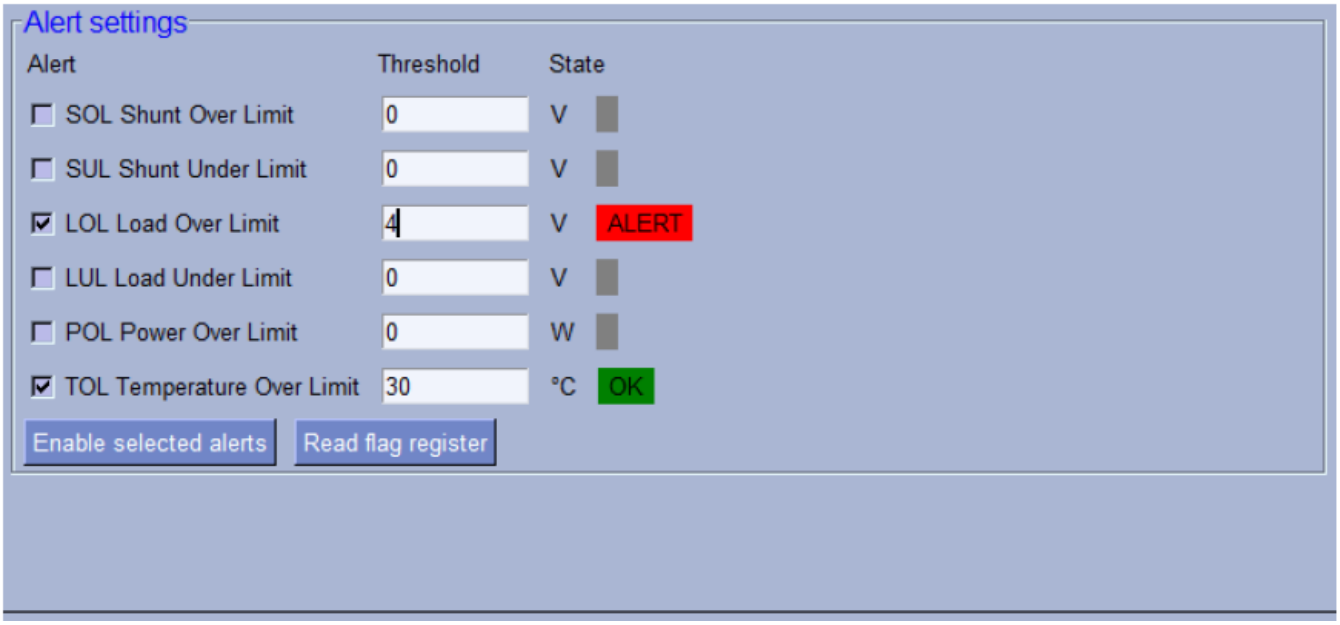
Configuration register and shunt resistor value
Thanks to the scrolling menus, it is easy to select the modes and the conversion time of the product. It is also possible to change the bits manually



The user can modify the configuration register thanks to the part presented in Figure 7.

- Bits CT0 to CT3 allows to select the desired conversion time
  • Bit TEMP allows to activate/deactivate the temperature measurement
  • Bits M0 to M2 allow to select the mode
  It is also possible to modify the shunt resistor value used for current calculation. By default, the value is 5mΩ.

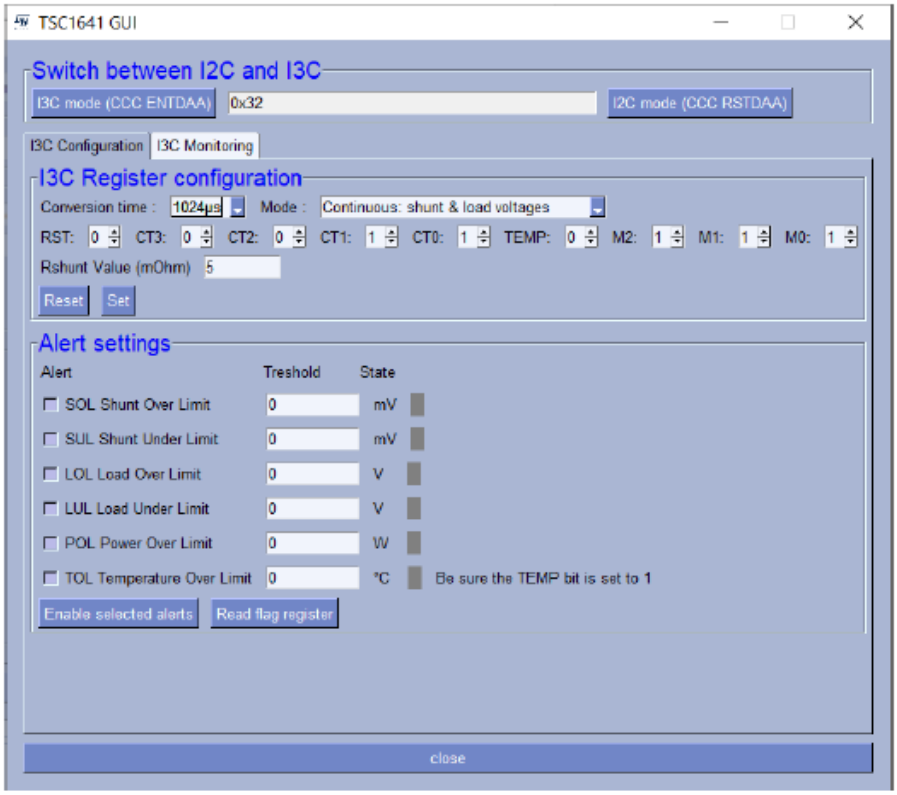
Alert settings



Note:
For each alerts ticked, a threshold is given by the user. In this example, the LOL alert is set with a threshold at 4v ant the temperature alert with a threshold at 30°C. In this case, an alert has been risen by the TSC1641 on LOL. In the configuration panel it is also possible to enable alerts and set the thresholds. To do it, tick the checkbox of the desired alerts, and enter the desired value for each threshold. Threshold values must be written in SI values (volts, Watts, or celsius degrees). Then, push the button “enable selected alerts”. You can visualize the state of each alert thanks to the “read flag register” button.

I3C configuration

I3C configuration page



Note:
Very close to the I2C configuration page. Only the dynamic address assignation part is different from the I2C part The I3C configuration page is like the I2C configuration panel. Refer to this part to understand how to use it. The

only difference lies in the I3C address assignation block.

Shift from I2C to I3C mode
To be able to communicate in I3C, the TSC1641 needs to receive an I3C dynamic address. This dynamic address is given with the GUI thanks to the ENTDAA process. It is not the only way to give an address to the TSC1641 but it is the only way possible with the GUI. To enter in I3C mode, the user must push the ENTDAA button. The dynamic address given to the component is 0x32 (defined by the controller, the user has no influence on it).

I3C address assignation part. Push on ENTDAA to go into I3C mode

When the device has an I3C dynamic address, the device cannot respond to I2C commands, only I3C commands work.

Shift from I3C to I2C
On the other hand, when the device has a I3C dynamic address, it must loose it to go in I2C mode. To perform this process, the user must push he button RSTDAA.

Push the RSTDAA button to come back into I2C mode

RSTDAA is a CCC command (a standard command known by the majority of I3C devices and defined by the MIPI alliance) which is broadcasted to all devices on the bus.

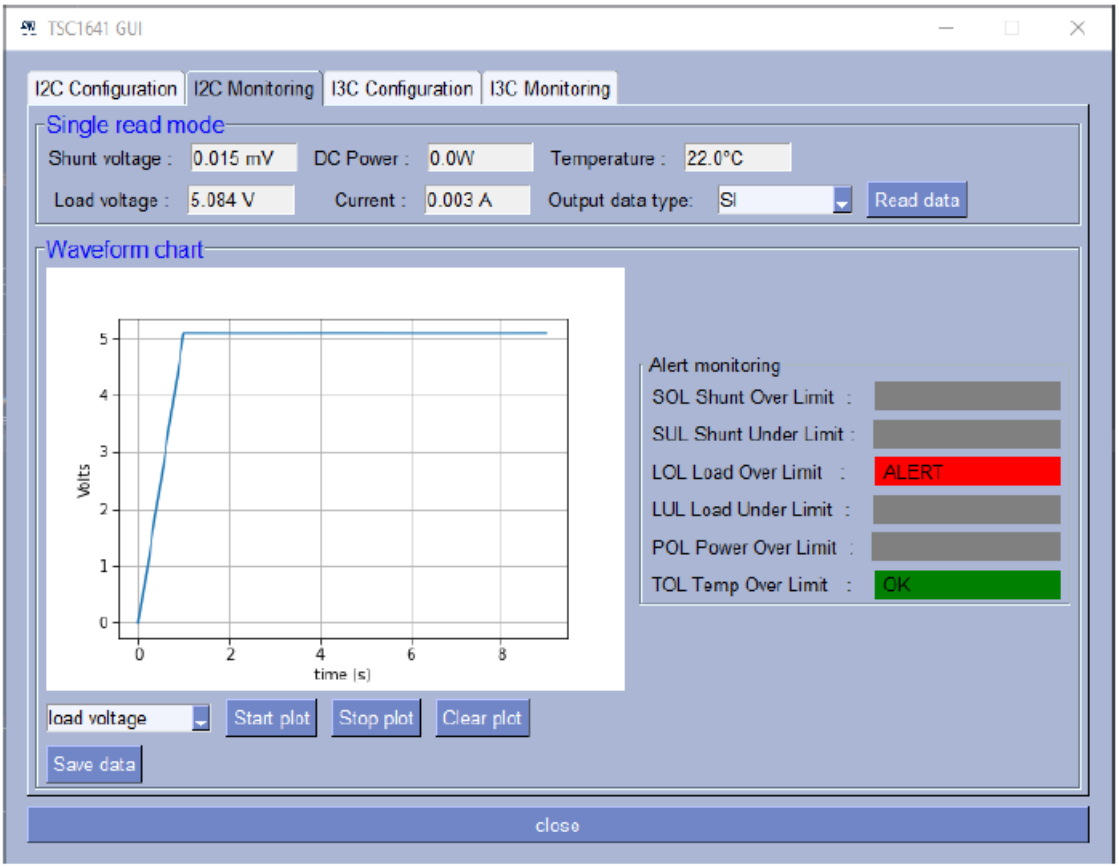
RSTDAA

All the targets on the bus will lose their dynamic addresses. In this case, when the TSC1641 loses its dynamic address, it will enter I2C mode and become reachable with its static address.

I2C/I3C monitoring

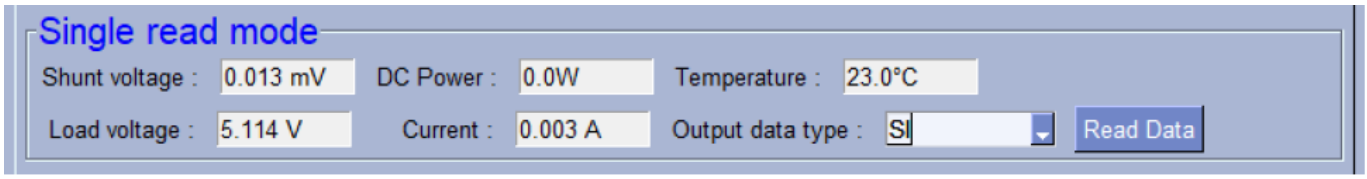
I2C and I3C monitoring pages are exactly the same. But the first one communicates in I2C and the other one

communicates in I3C



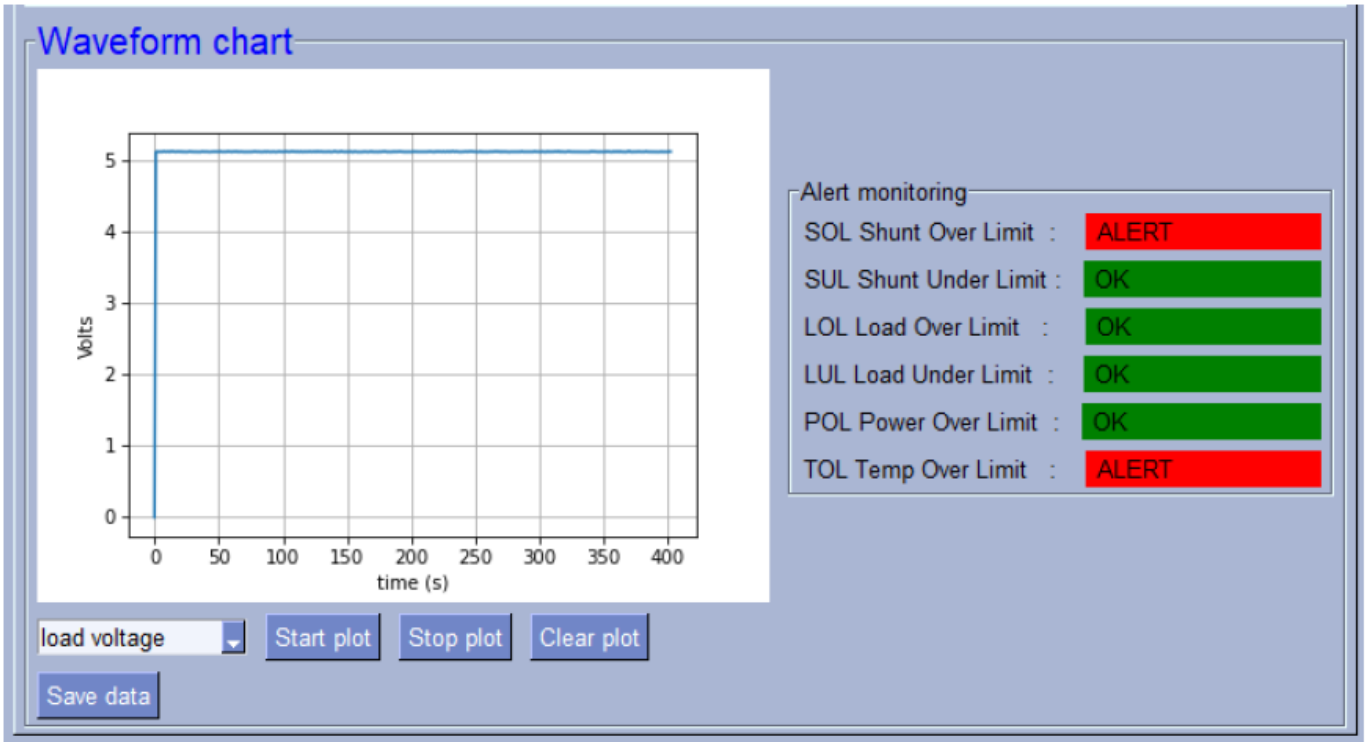
Both pages (I2C monitoring and I3C monitoring are the same).

Single read mode



In single read mode, registers 1 to 5 are read each time the user pushes the Read data button. The user can select the output data type (ie hexadecimal or SI) to read the value in the most suitable format.

Waveform chart
Waveform chart part

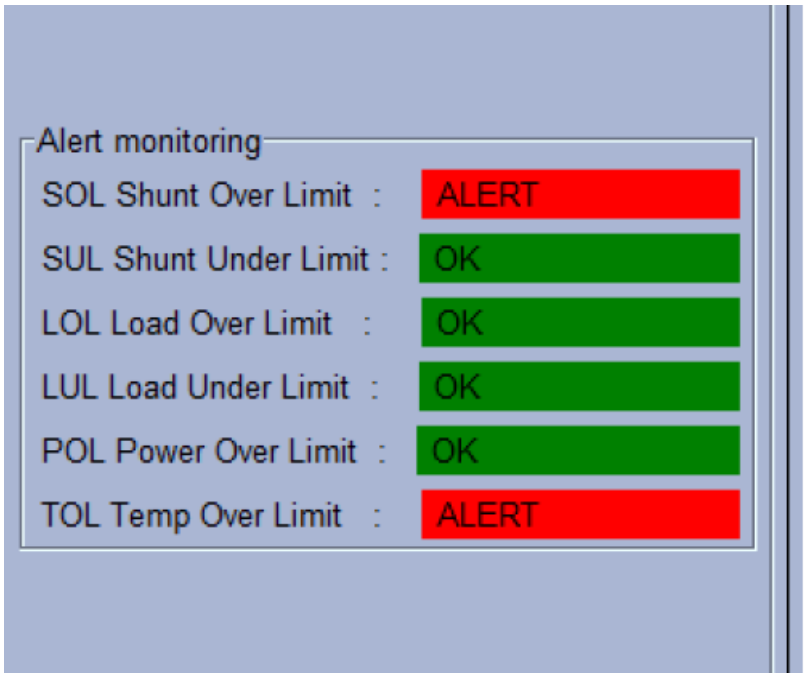


In waveform chart mode the user has to select the value to plot thanks to a list at the bottom of the page.

A scrolling menu allows to choose which data to plot

The user can then start the data acquisition with the “Start plot” button. A new data will be read each second, in the same time, the flag register is read and the state of the alerts enabled on the configuration pages will be shown on the “Alert monitoring” block.

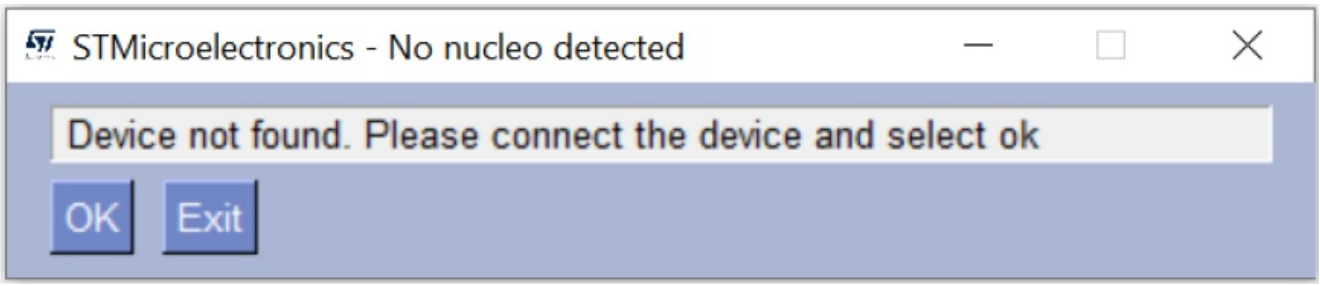
Alert monitoring block, each second the flag register is read and alerts are shown. Only alerts activated in the configuration pages are displayed



Finally, once the data acquisition is over, the user can save the acquired data into a .csv file. To do that, the user has to click on the “save data” button.

Troubleshooting

Device not found
“Device not found” window



Issue:

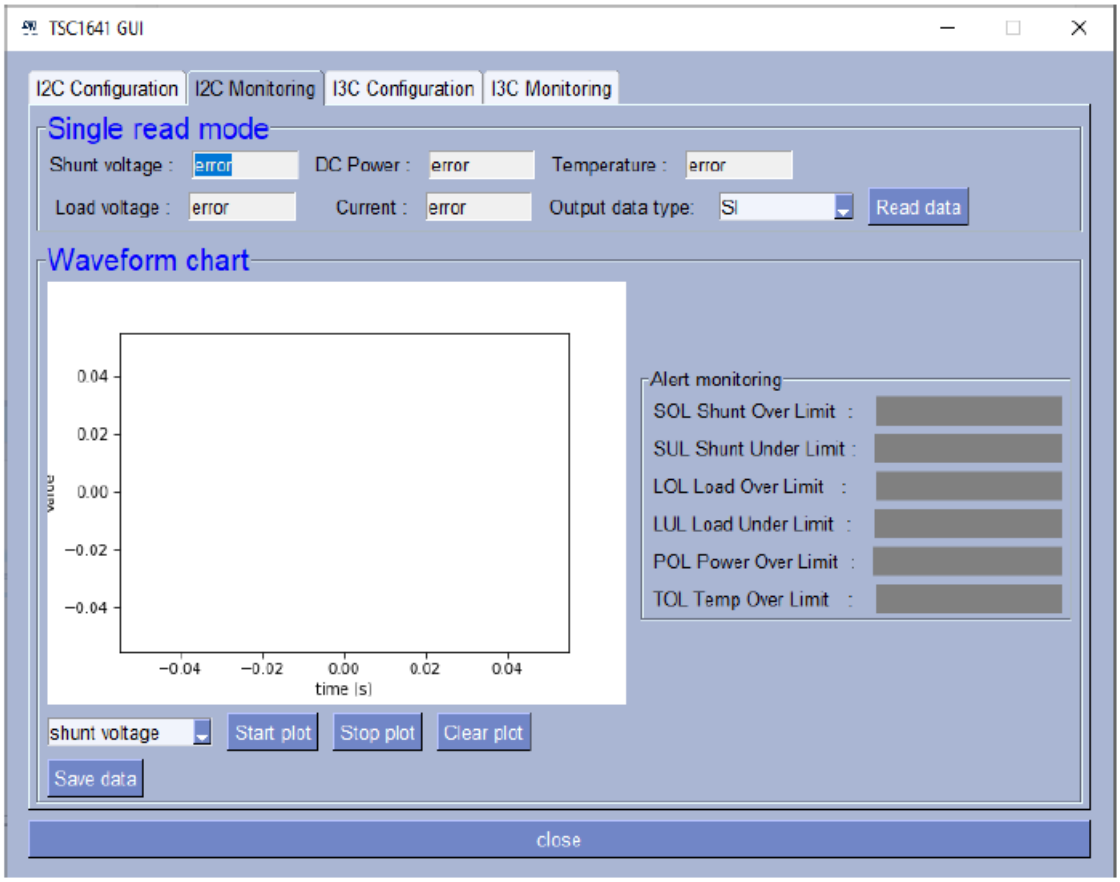
- The nucleo board is not detected

Resolution:

- Please connect the appropriate nucleo board
- Be sure that STlink is installed and UpToDate
- It is also better to have only one nucleo board connected to the computer
- Then click on “OK”

Connection issue

Connection issue message



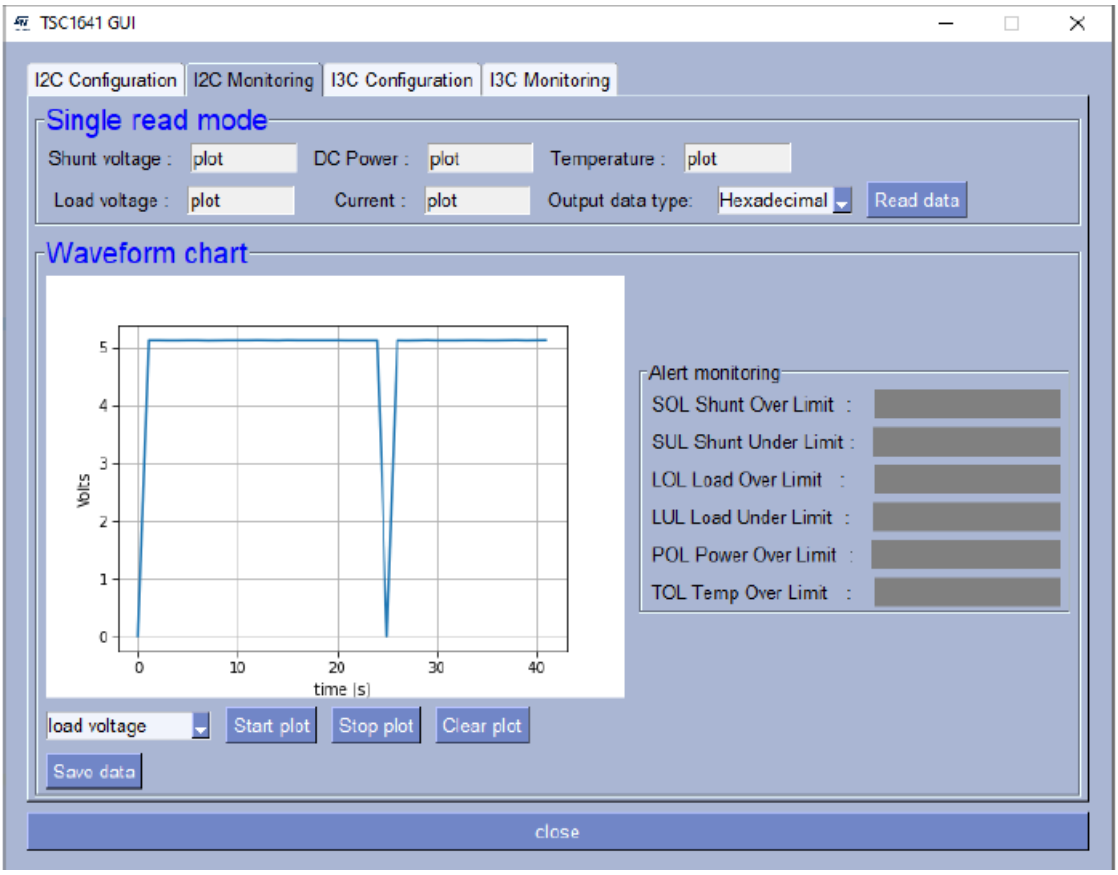
Issue :

- In case of unwanted disconnection or problem in reading the device, a message “error“appears on the Single read mode communication box.

Resolution :

- Close the GUI and disconnect/reconnect the nucleo board and restart the GUI.
- If the problem persists, try to check if the board is correctly connected

Drop to 0 in value read in I2C plot



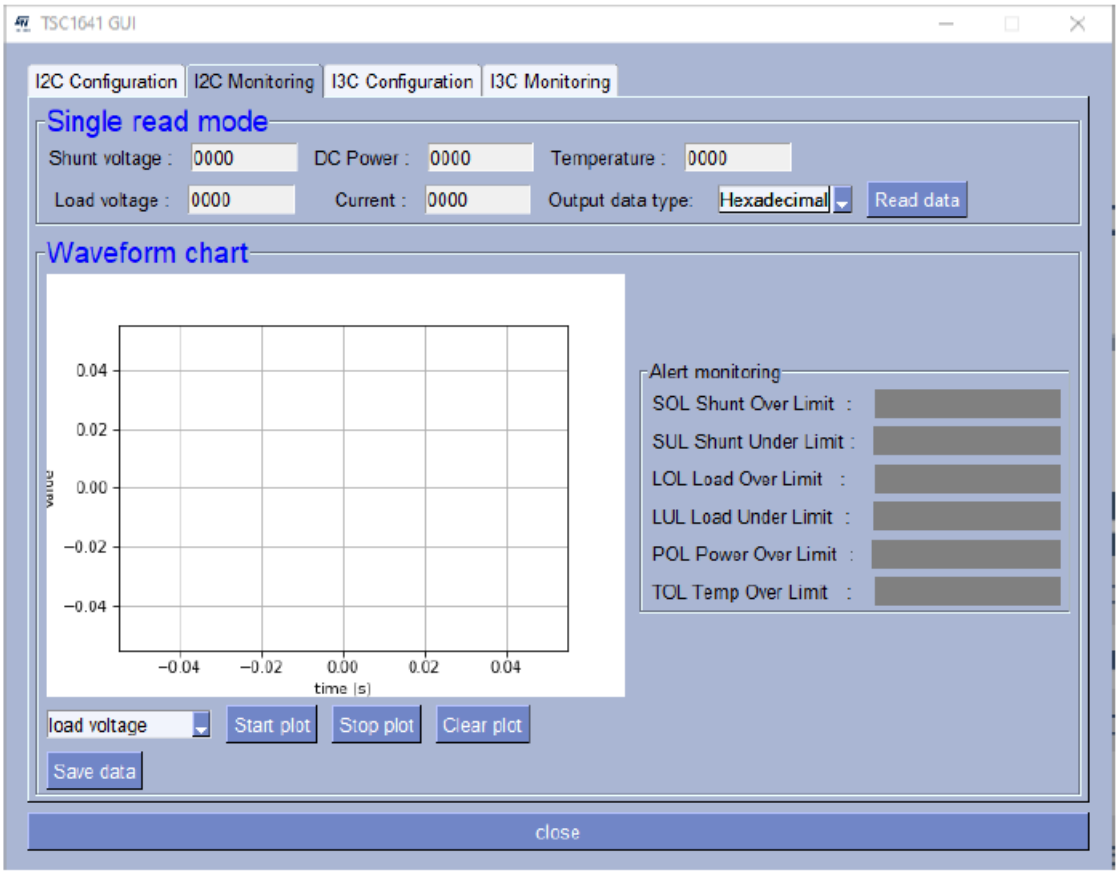
Issue :

- Randomly, the value read in plot mode is equal to 0.

Resolution :

- This is not a bug
- The TSC1641 needs 2µs to acquire data, during this time the device is not able to communicate properly in I2C and respond a NACK, no data are exchanged.
- Increase the conversion time if you read data asynchronously.
- Use I3C
- To avoid this in your design, you can either pass through this case via software or use the data ready pin to ensure that the TSC1641 is able to read.

All value read are 0
All values read are 0. This is probably due to a read in I2C while the device is in I3C or the opposite



Issue :

- Impossible to read a value, all the returned values are 0.

Resolution :

- You are probably trying to read in I2C while your device is in I3C or the opposite.
- Your device is in shutdown mode
    - In configuration pages, change the mode into single or continuous modes

List of acronyms

Term	Meaning
GUI	Graphical user interface

Revision history
Document revision history

Date	Revision	Changes
20-Jul-2023	1	Initial release.

should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgment. Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of purchasers' products. No license, express or implied, to any intellectual property right is granted by ST herein. Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product. ST and the ST logo are trademarks of ST. For additional information about ST trademarks, refer to **www.st.com/trademarks**. All other product or service names are the property of their respective owners. Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

Documents / Resources

	**ST GUI Setup for TSC1641 Evaluation Board** [pdf] User Manual UM3213, GUI Setup for TSC1641 Evaluation Board, GUI Setup, TSC1641 Evaluation Board

References

- **STMicroelectronics: Our technology starts with you**
- **STEVAL-DIGAFEV1 - Evaluation board for the TSC1641, 16-bit, high precision current and power monitor with MIPI I3C/I2C interface - STMicroelectronics**
- **TSC1641 - 60V, 16-bit, High precision, I3C/I2C, digital current/voltage/power/temperature Monitor - STMicroelectronics**
- **STMicroelectronics Trademark List - STMicroelectronics**
- **NUCLEO-H503RB - STM32 Nucleo-64 development board with STM32H503RBT6 MCU, supports Arduino and ST Morpho connectivity - STMicroelectronics**
- **STEVAL-DIGAFEV1 - Evaluation board for the TSC1641, 16-bit, high precision current and power monitor with MIPI I3C/I2C interface - STMicroelectronics**
- **STSW-DIGAFEV1GUI - Software for STEVAL-DIGAFEV1 evaluation kit for TSC1641 configuration - STMicroelectronics**