UM0671
User manual

STM8/128-EV/TS
STM8S touch sensing evaluation board

Introduction

The STM8S touch sensing evaluation kit (STM8/128-EV/TS) provides a platform that introduces users to STMicroelectronics capacitive touch sensing firmware library.

The kit contains an STM8S touch sensing (TS) evaluation daughterboard (STM8Sxxx-TS1) in addition to the STM8/128-EVAL board.

The STM8S touch sensing evaluation daughterboard provides an evaluation platform for resistor-capacitor (RC) touch sensing technology for an implementation using 5 keys and one slider.

The STM8S TS evaluation kit provides a software solution for transforming any 8-bit STM8 microcontroller (MCU) into a capacitive touchkey controller.

For further details about the touch sensing software library, please read the technical documentation available on www.st.com/touch-sense-sw-lib.

Figure 1. STM8S touch sensing evaluation kit

Contents

1 Overview

This solution enables designers, comfortable with the use of standard microcontrollers, to create higher-end “look and feel” user interfaces by replacing conventional electro-mechanical switches with touch sensing controls.

Designers can combine touch sensing functions with traditional MCU features (communication, LED control, beeper, LCD control, etc.).

The touch sensing firmware library is part of the application firmware.

Maturity, robustness, flexibility and performance make this solution simple to implement with a low “time to market” period making it easy to develop all types of applications including mobile phones, cooking appliances and printers only to name a few.

The STM8S TS evaluation kit comes pre-programmed with evaluation firmware that manages 5 touch keys and one slider all available on the touch sensing daughterboard. Using this kit, the user can easily evaluate the touch sensing software features and performances by monitoring sensing parameters using an LCD display interface.

In development mode, designers are able to debug, modify, adapt or integrate the touch sensing library in application firmware using a USB debugging and programming tools:

- Raisonance RLink debugger/programmer for ST microcontrollers
- STice in-circuit emulation system
- ST MCU Toolset with ST Visual Develop (STVD) IDE and ST Visual Programmer (STVP) programming interface

2 Getting started with the touch sensing evaluation kit

2.1 Evaluation kit contents

The STM8S touch sensing evaluation kit (STM8/128-EV/TS) contains:

- STM8S touch sensing evaluation daughterboard (STM8Sxxx-TS1)
- STM8/128-EVAL board
- AC/DC power supply and its AC adaptors
- MCU selection guide
- User manual (this document)

IMPORTANT: The STM8 TS library, STM8 Toolset, STM8S firmware library and related documentation are available at www.st.com/touch-sense-sw-lib

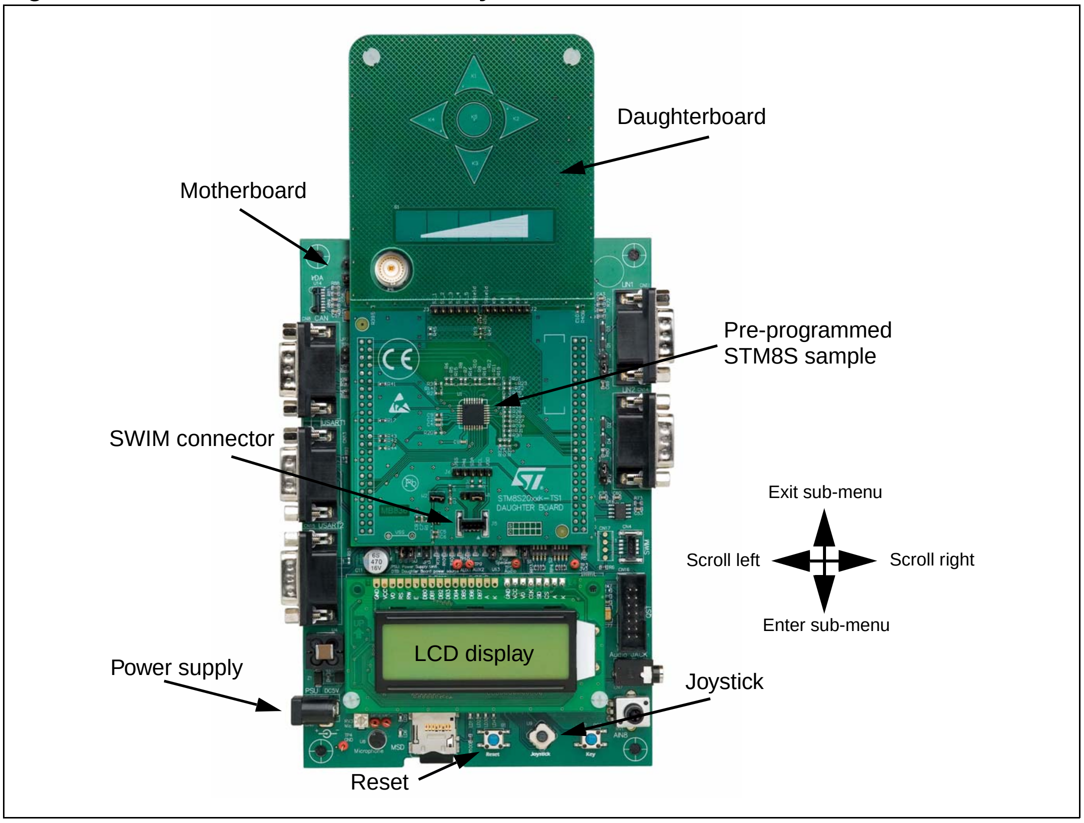
2.2 Using the evaluation kit

After connecting the motherboard to the mains supply, the evaluation kit is ready for use.

Just use the joystick to navigate through the menu options as described in *Section 2.3: User interface*.

The evaluation firmware enables the user to quickly evaluate the main features of the touch sensing library.

Figure 2. TS evaluation kit assembly

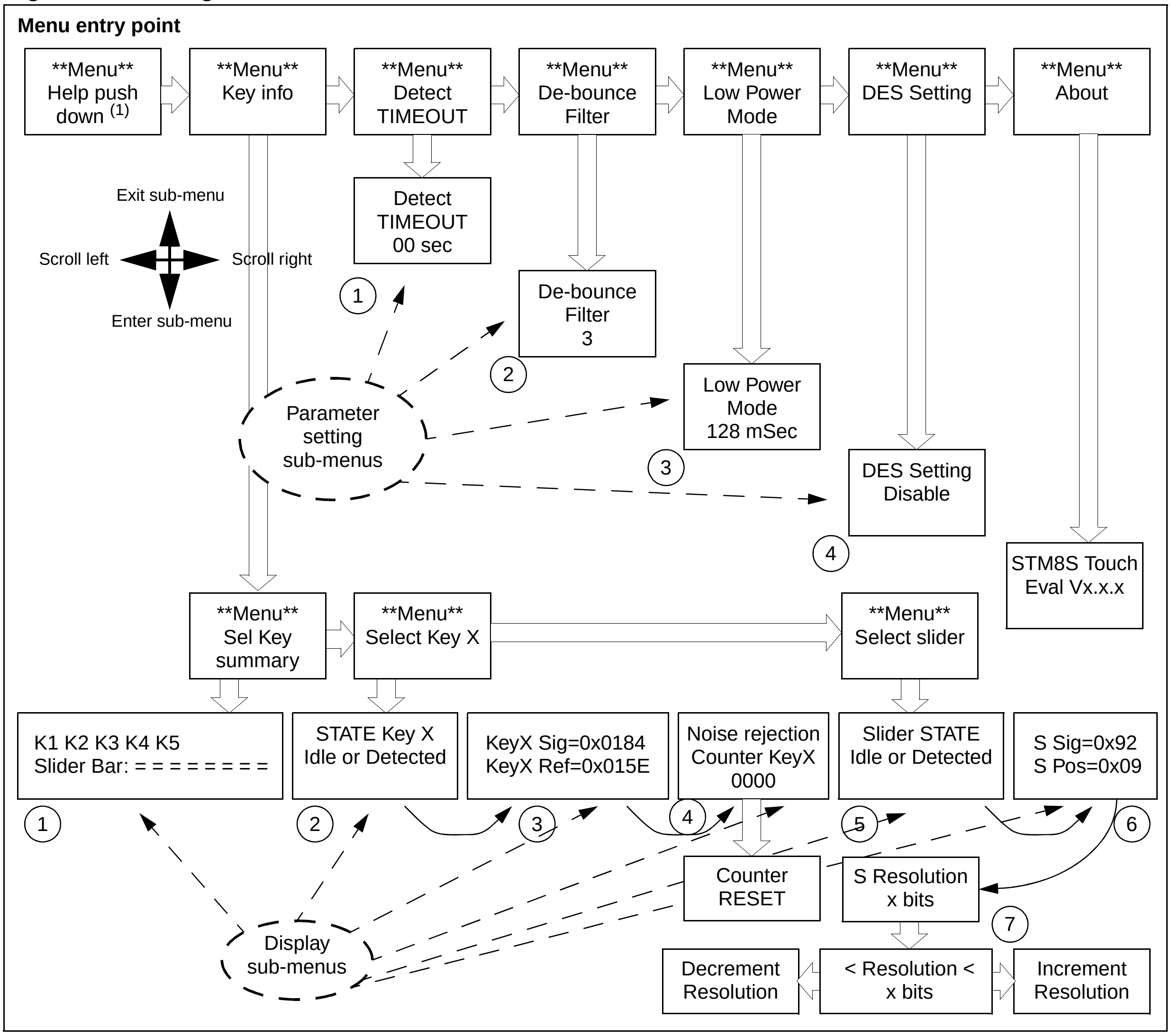


2.3 User interface

The joystick is the main user interface used to display keys values and state or to modify the main touch sensing library parameters: de-bounce filter, detection time-out, low power mode, DES setting, etc.

Note: The 5 touch sensing keys are also for navigating through the touch sensing menu.

Figure 3. Navigation scheme



1. After power on, to quickly display the key and slider states (display option 1), move the joystick once to the right (→) and twice towards the bottom (↓).

Display options

Use the joystick to navigate through the sub-menus as shown in *Figure 3* to do the following:

1. Display the state of keys (K1, K2, K3, K4 and K5) and slider on the same screen.
2. Display only the state of the selected key (Kx) (Idle or Detected).
3. Display the signal value and the reference threshold of the selected Key (Kx).
4. Display the number of samples rejected by the noise filtering system.
5. Display the state of the slider (Idle or Detected).
6. Display the signal value and the position of the slider.
7. Display/change slider resolution (default is 4 bits, may be set to up to 7 bits).

Parameter setting options

Use the joystick to navigate through the sub-menus as shown in *Figure 3* to set the following options:

1. Detection time-out

   This feature automatically recalibrates keys after a fixed duration of continuous touch detection. This prevents the keys from becoming 'stuck on' due to foreign objects or other sudden influences. This is known as the detection time-out feature.

   After recalibration, the keys will continue to operate normally, even if partially or fully obstructed.

   Infinite timeout (detection time-out value = 0) is useful in applications where a prolonged detection can occur and where the output must reflect the detection regardless of its duration.
2. De-bounce filter

   The de-bounce filter reduces the effects of low frequency noise on key states. This mechanism requires a specified number of measurements that qualify as detections (and these must occur consecutively) or the detection will not be reported.

   In a similar manner, the end of a touch (loss of signal) also has to be confirmed over several measurements. This process acts as a type of “de-bounce” mechanism against noise.

   The typical value is equal to 2.
3. Low power mode

   To reduce device power consumption, this feature inserts a low power mode window between each key acquisition period.

   This window duration is programmable with the following typical values (in milliseconds): 0, 1, 2, 4, 8, 16, 32, 64, and 128.
4. Detection Exclusion System

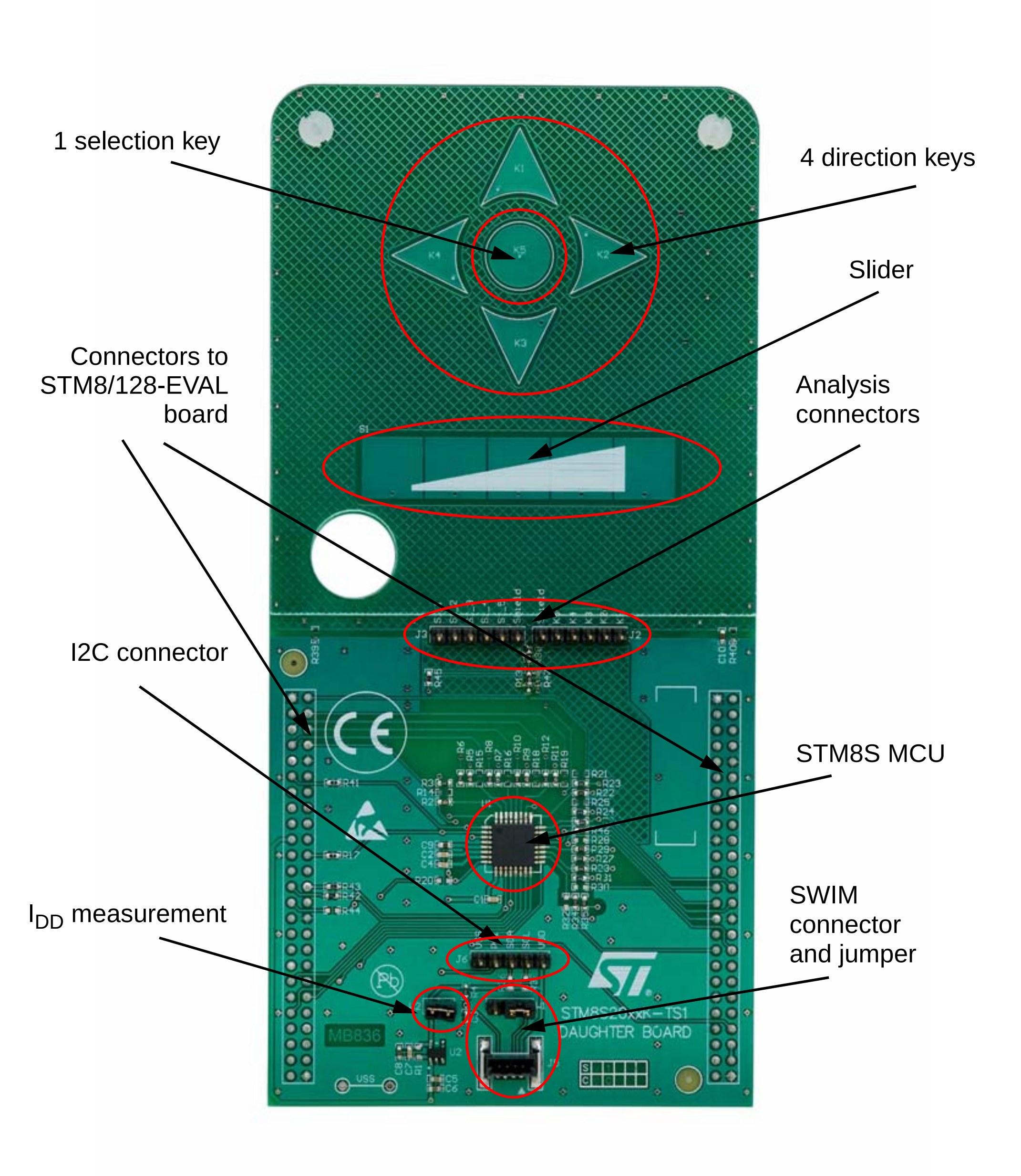
   The Detection Exclusion System (DES) prevents multiple keys from responding to a single touch. This can happen with closely spaced keys.

   Once a key is considered as “touched”, all other keys are locked in an untouched state. To unlock these keys, the touched key must return to an untouched state.

3 Evaluation kit board settings

3.1 STM8S touch sensing daughterboard

Figure 4. STM8S TS daughterboard overview



STM8S MCU

This board uses a STM8S microcontroller (STM8S207K6T6C) in a 32-pin LQFP package.

Keys

The 5 touchkeys (electrodes) are made of a simple copper surface.

Slider

The slider consists of 5 elementary juxtaposed electrodes.

Analysis connectors

All electrode and driven shield signals are available through two connectors (J2 and J3) for analysis and monitoring.

I^2C communication connector

In the event of I^2C communication, the daughterboard provides a connector (J6) for the I^2C data and clock signals for interfacing with the STM8S microcontroller.

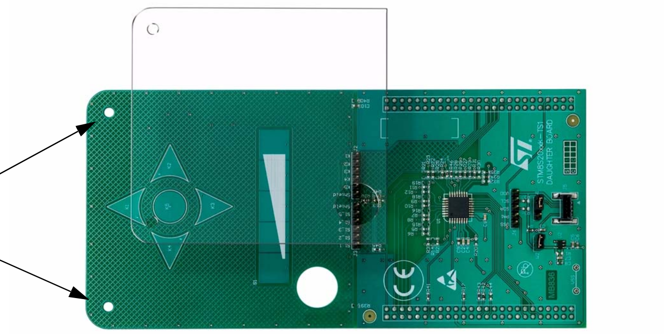
SWIM connector and setting jumper

A single-wire interface module (SWIM) interface (J5) with its associated jumper (W1) for analysis and development.

3.1.1 Dielectric

A 1.5-mm thick Plexiglas panel (*Figure 5*) is used as a dielectric between the electrodes and the touch surface. The user can replace this panel by another kind of dielectric with a different thickness and/or material. Consequently, new firmware parameters will have to be tuned.

Figure 5. Interchangeable dielectric panel



3.1.2 Daughterboard MCU pin functions

Table 1 describes the application functions assigned to each pin of the daughterboard microcontroller.

The motherboard provides certain resources for the daughterboard such as the LCD, power supply, LEDs, joystick, buzzer, etc.

For more information, see *Section 3.2: STM8S2xx evaluation motherboard settings*.

Table 1. Daughterboard MCU pin description

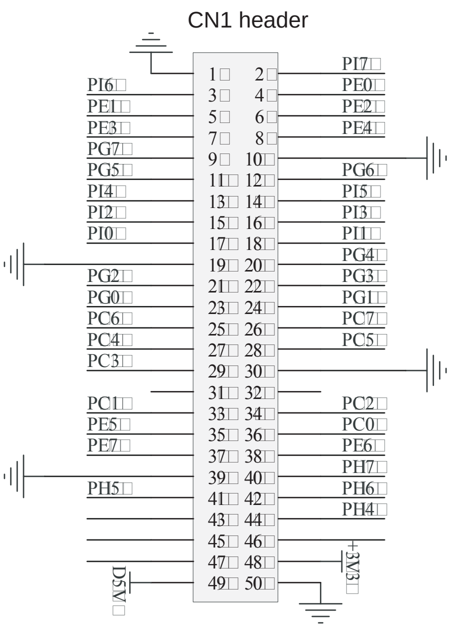
Pin no.	Pin name	Application usage	Option	Configuration
1	RST			
2	PA1	LED4	Disconnect	R17
3	PA2	Backlight		

Table 1. Daughterboard MCU pin description (continued)

Pin no.	Pin name	Application usage	Option	Configuration
4	VSS			
5	VCAP			
6	VDD			
7	VDDIO_1			
8	PF4	Load		
9	VDDA			
10	VSSA			
11	PB5	LED2	I²C SDA	R43
12	PB4	LED3	I²C SCL	R42
13	PB3	Joy Down		
14	PB2	Joy Left		
15	PB1	Joy Right		
16	PB0	Joy Up		
17	PE5	LCD CS		
18	PC1	Key K1		
19	PC2	Key K2		
20	PC3	Key K3		
21	PC4	Buzzer	Driven shield keys	R4/R46
22	PC5	SPI SCK		
23	PC6	SPI MOSI		
24	PC7	Key K4		
25	PD0	Key K5		
26	PD1	DB SWIM connector	MB SWIM connector	W1
27	PD2	Slider S5		
28	PD3	Slider S4		
29	PD4	Slider S3		
30	PD5	Slider S2		
31	PD6	Slider S1		
32	PD7	Driven shield slider	LED1	R45/R44

Note: Options are selected using 0-ohm resistors.

Table 2. Daughter/motherboard CN1 and CN5 header connections

<table>
<tr><th>Motherboard connector
(STM8/128-EVAL board)</th><th>Daughterboard connector
(STM8S2Kxxx-TS1)</th></tr>
<tr><td>


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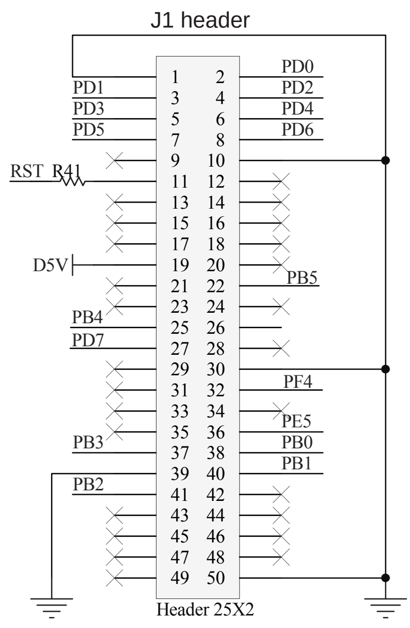
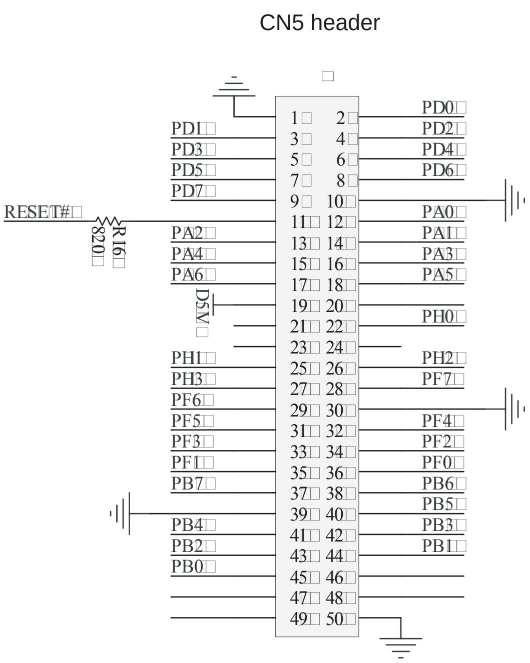
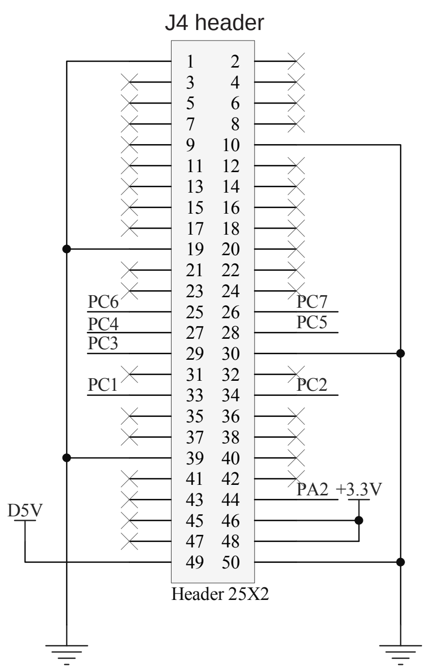


</td></tr>
<tr><td>


</td><td>


</td></tr>
</table>

3.1.3 Daughterboard power supply

By default, the daughterboard is powered through the motherboard. The 3.3 V regulator on the daughterboard supplies the daughterboard MCU.

The MCU current consumption (I_{DD}) can be measured by removing jumper W2.

3.1.4 SWIM connections

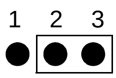
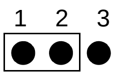
The STM8 debug system interface allows a debugging or programming tool to be connected to the MCU through a single-wire bidirectional communication based on open-drain line.

This single-wire interface module (SWIM) module allows non-intrusive read/write accesses to be performed on-the-fly to the RAM and peripheral registers, for debug purposes.

The SWIM module can also perform a MCU device software reset and can also be used by as a standard I/O port with some restrictions.

Jumper W1 is used to configure SWIM settings as described in *Table 3*.

Table 3. W1 jumper description

Configuration	Description
	Uses STM8S TS daughterboard SWIM connector (default setting)
	Connect PD1of STM8S TS daughterboard device to resource of STM8S/128-EVAL board.

For more information, please refer to user manual *UM0470: STM8 SWIM communication protocol and debug module*.

Figure 6. SWIM connector (top view)

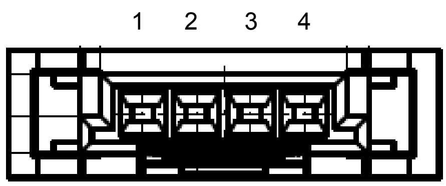


Table 4. SWIM connector pin description

Pin number	Description	Pin number	Description
1	VDD	2	PD1
3	GND	4	PA0 (RESET)

Note: The SWIM connector of the STM8/128-EVAL board cannot be used.

3.1.5 Analysis connectors (J2 and J3)

Application designers can use connectors J2 and J3 to analyze electrode and driven shield signals on the daughterboard.

Note: The user should take into account possible probe capacitance disturbance and should consider re-calibrating the device before use.

Table 5. J2 connector pin description

Pin number	Description	Pin number	Description
Shield	Slider 1 active shield	K3	Key 3 electrode
K1	Key 1 electrode	K4	Key 4 electrode
K2	Key 2 electrode	K5	Key 5 electrode

Table 6. J3 connector pin description

Pin number	Description	Pin number	Description
S1_1	Slider 1 electrode 1	S1_4	Slider 1 electrode 4
S1_2	Slider 1 electrode 2	S1_5	Slider 1 electrode 5
S1_3	Slider 1 electrode 3	Shield	Slider 1 active shield

3.1.6 External supply and communication

Connector J6 provides I^2C data and clock signal pins for communication with the daughterboard microcontroller. The user can use these pins to develop his own communication protocol.

Resistors R36 and R37 are available as I^2C pull-up resistors and can be mounted by the user if needed.

Note: If the device is supplied by pin 1 and 5, jumper W2 must not be connected.

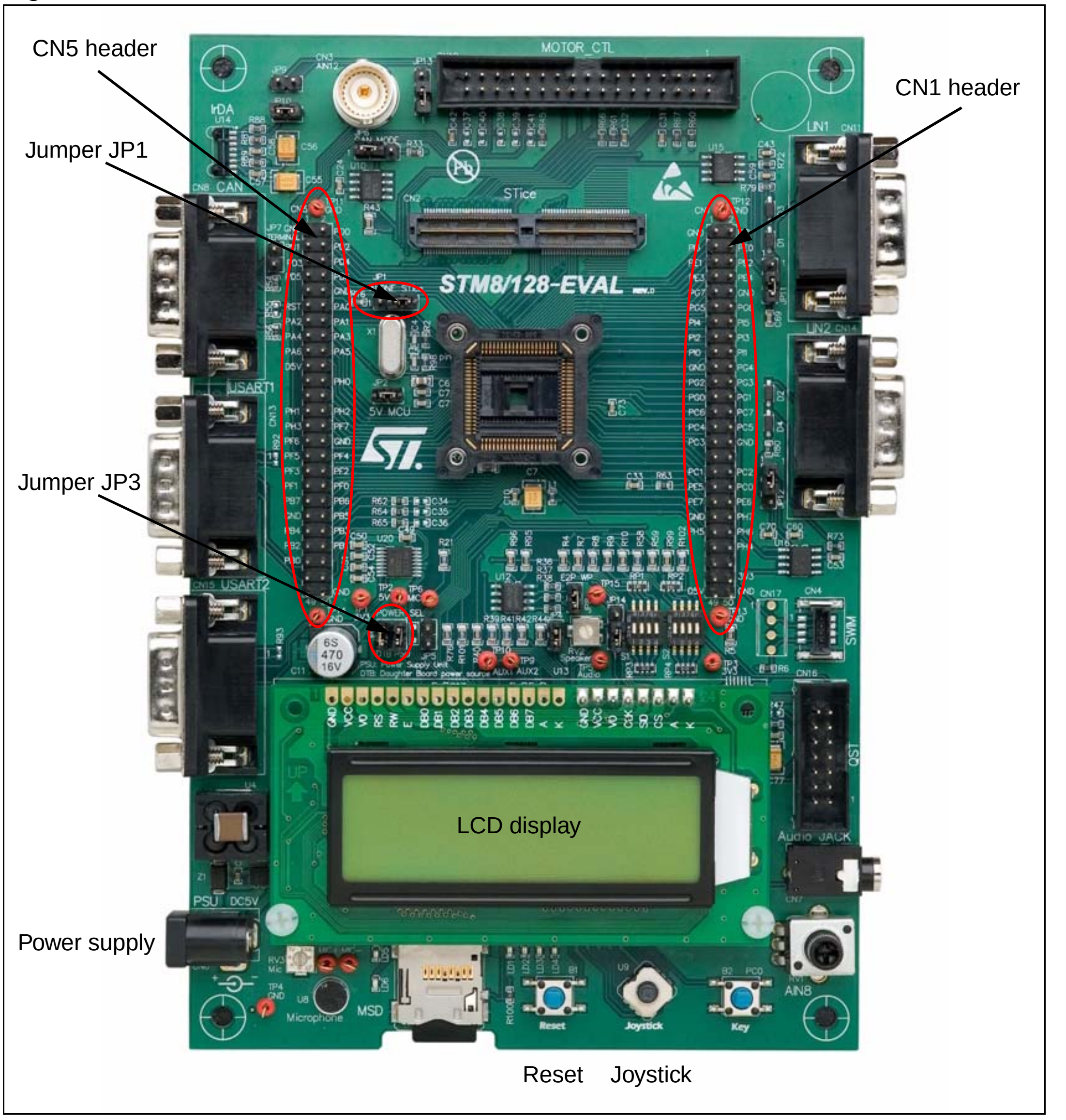
Table 7. J6 connector pin description

Pin number	Description	Pin number	Description
1	VSS	4	I^2C SDA
2	PA1	5	VDD
3	I^2C SCL		

Pin 2 is connected to PA1 and is available for user implementation. For example, it may be used for acquisition synchronization.

3.2 STM8S2xx evaluation motherboard settings

Figure 7. TS motherboard overview

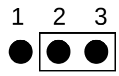
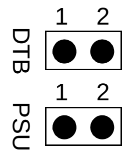


When using the STM8S TS daughterboard assembled with the STM8/128-EVAL (mother) board, the following settings must be implemented:

- To maintain STM8S TS daughterboard MCU functionality, the Reset Source (JP1) jumper must be set to the “STice” position (*Table 8*) on the STM8/128-EVAL board.
- To supply power from the supply jack (CN6) to both mother and daughterboards connected on connectors CN5 and CN1:
  - On STM8S TS daughterboard, connect both pins on jumper W2 (*Section 3.1.3*).
  - On STM8/128-EVAL board, set jumper JP3 as shown in *Table 8*. (STM8S TS daughterboard must have not its own power supply connected.)

For more information about the STM8/128-EVAL board, please refer to *UM0482: STM8/128-EVAL evaluation board user manual*.

Table 8. STM8/128-EVAL board settings

Jumper	Description	Configuration
JP1	Set to “STice” to keep motherboard MCU Reset pin low to enable correct TS daughterboard MCU functionality. (Default configuration)	
JP3	Connect both PSU and DTB jumpers to supply power supply the TS daughterboard. (Default configuration)	

4 Advanced evaluation using a debugging environment

4.1 Running the evaluation firmware in debug mode

Designers can easily run the evaluation firmware in Debug mode using ST debugging and programming tools.

- Hardware tools to be ordered separately:
  - Raisonance RLink debugger/programmer for ST microcontrollers (www.raisonance.com/)
  - STice in-circuit emulation system
- Software tools to be downloaded separately:
  - ST MCU Toolset with ST Visual Develop (STVD) IDE and ST Visual Programmer (STVP) programming interface
  - STM8 Cosmic C compiler (www.cosmic-software.com/)

In Debug mode, designers can perform an in-depth evaluation of the firmware and visualize touch sensing parameters. Designers can even customize the touch sensing library to their specific needs by creating their own application firmware.

For further information about ST software, STM8 microcontrollers or debugging tools, please read the associated documentation or ask your local ST support team for a training session. More information is available at www.st.com/touch-sense-sw-lib

4.2 Entering debug mode using RLink

This section describes the steps necessary to set up a platform for evaluating and developing TS firmware.

Note: For links to tools and downloads, please refer to ST's microcontroller web site at www.st.com/mcu/.

1. Download and install the *ST MCU Toolset* with ST Visual Develop (STVD) IDE and ST Visual Programmer (STVP) programming interface (one single download).
2. Download and install the STM8 cosmic C compiler.
3. Install the Rlink USB driver using one of the two following methods:
   - Insert the RAISONANCE CD-ROM into your CD drive and exit from Autorun. Explore the CD-ROM contents and execute the *RLinkUSBInstall.exe* file in the *D:\Driver\RlinkDrv* directory.
   - Download the *RLinkUSBInstall.exe* file from the Raisonance web site and execute the file.
4. Restart your computer to apply these changes.
5. Install the RLink hardware:
   a) Place jumpers on the "SWIM" and "ADAPT" RLink configuration pins of the Rlink USB adaptor as shown in *Figure 8*.
   b) Connect the SWIM-STM8 adaptor to the RLink USB adaptor.
   c) Connect the SWIM cable between the touch sensing daughterboard (J5 SWIM connector) and the SWIM-STM8 adaptor as shown in *Figure 9*.
   d) Connect the USB cable between your PC and the RLink USB adaptor.
   e) Power the TS daughterboard through the STM8S2xx evaluation board.

Figure 8. RLink configuration jumpers

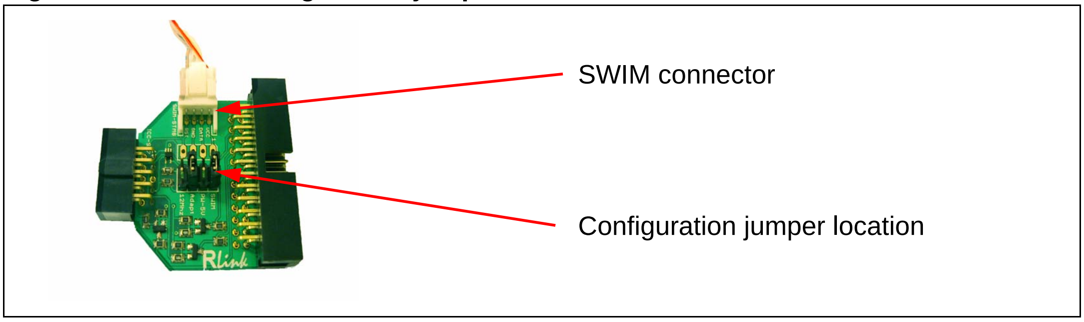
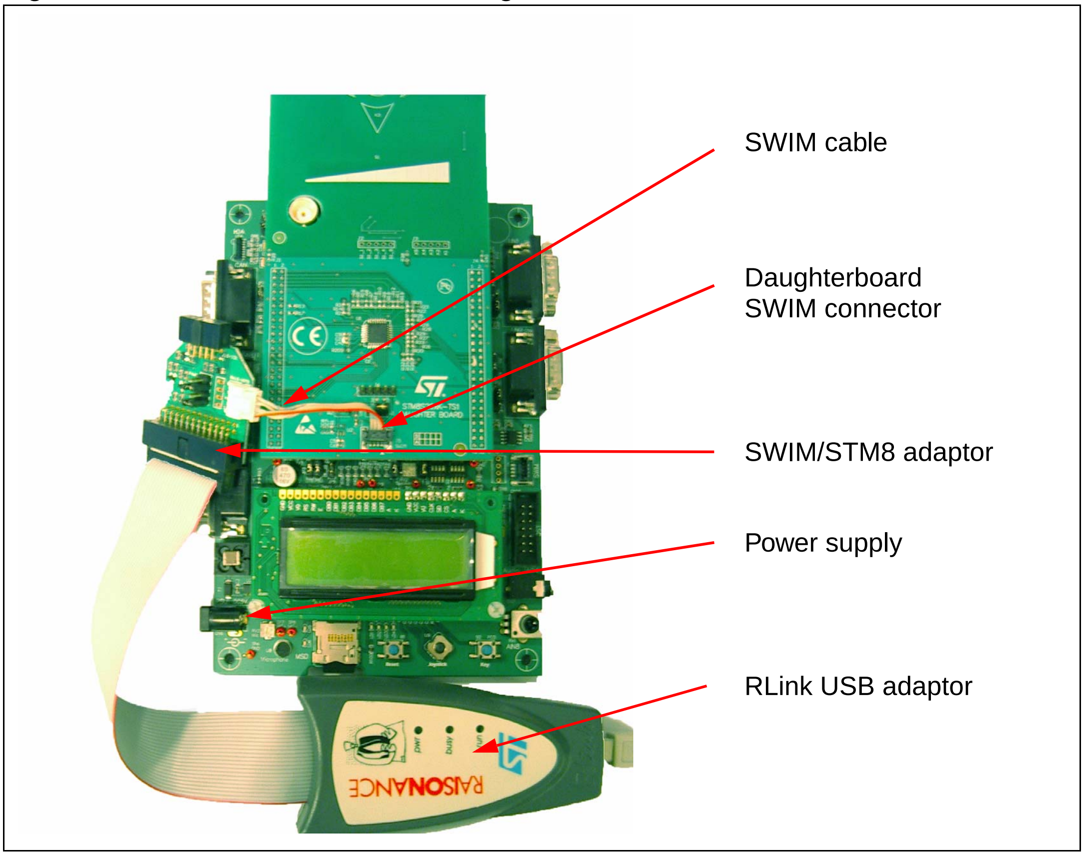
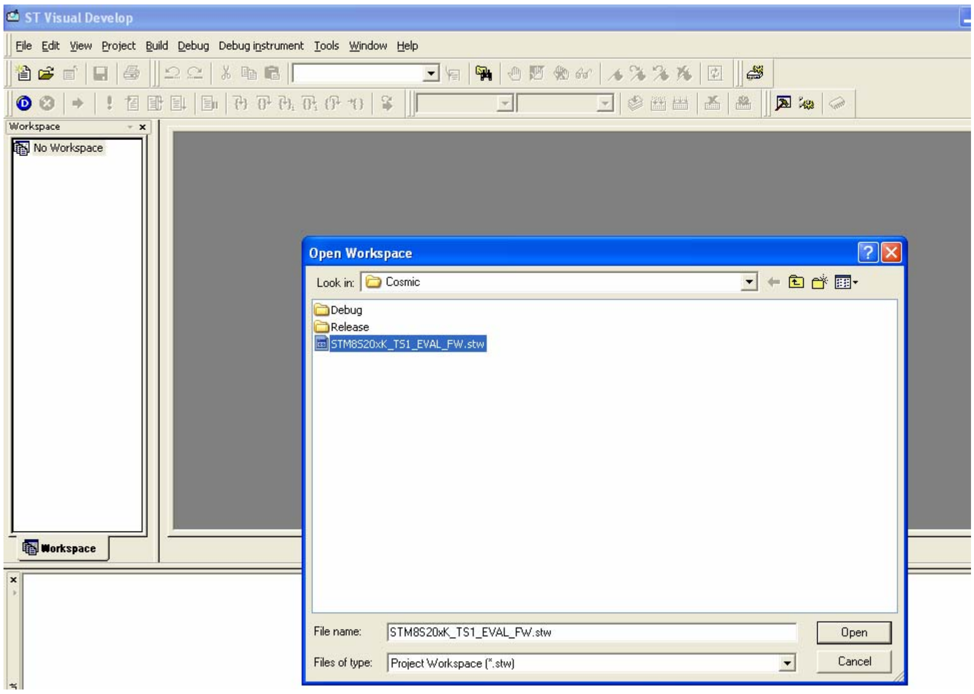


Figure 9. RLink USB and SWIM configuration



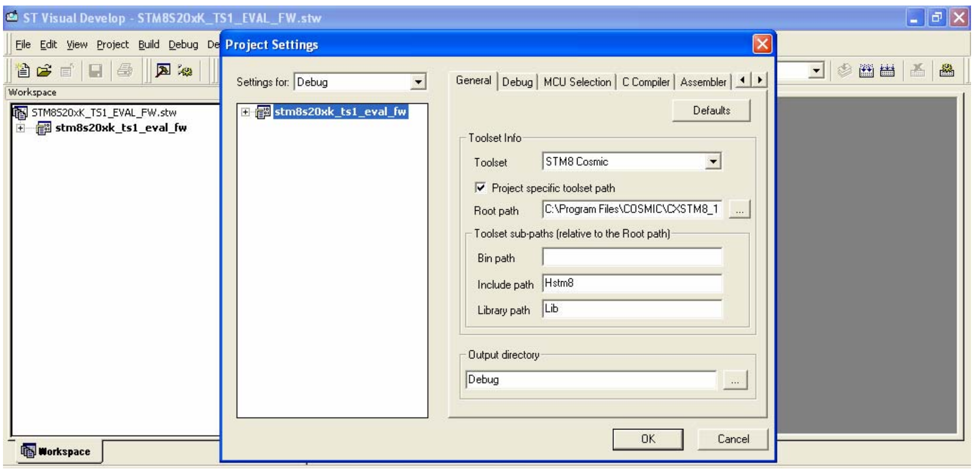
6. Download the STM8 touch sensing library from www.st.com/touch-sense-sw-lib
7. Launch the ST Visual Develop (STVD) integrated development environment.
8. Load the STM8 TS evaluation firmware (*Figure 10*):
   – In the “File” menu, click “Open workspace” and select/open the file *STM8S20xK_TS1_EVAL_FW.stw*.
     (Default path file @ \STM8S20xK_TS1_EVAL_FW\Project\STVD\Cosmic)

Figure 10. Loading the TS evaluation firmware



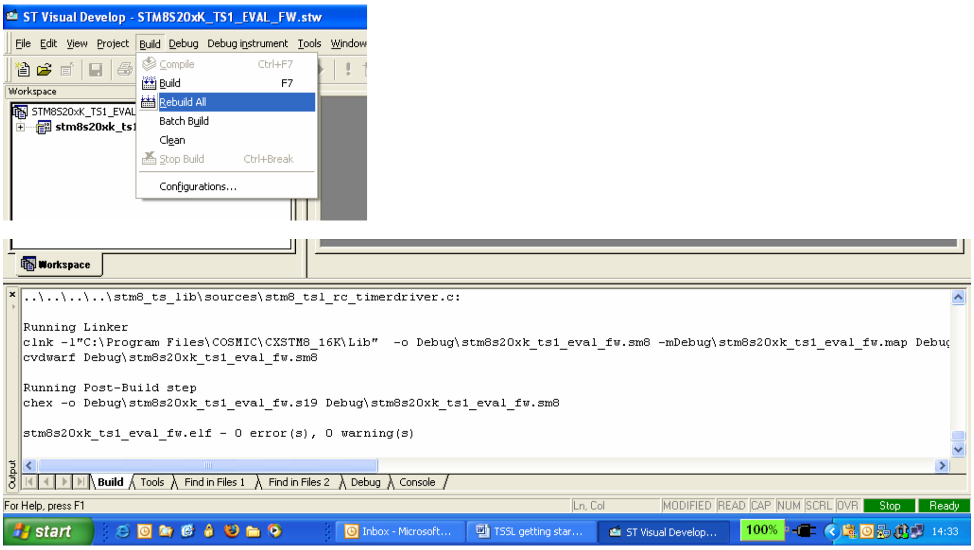
9. In the “Project” menu, select “Setting” to define the C cosmic location directory (*Figure 11*).

Figure 11. Project settings



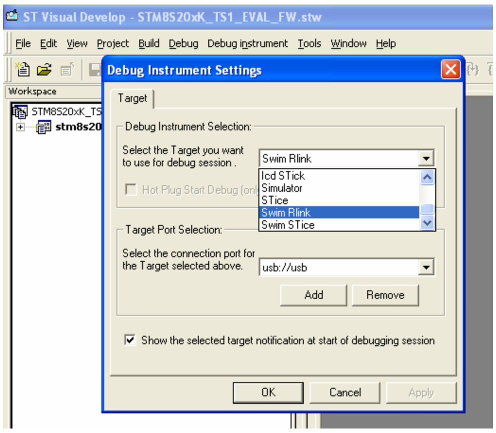
10. Build the project by compiling and linking all the source code.
    a) In the “Build” menu, select “Rebuild all”.
    b) When the process is completed, check that there are no errors and no warning messages in the Output windows.

Figure 12. Building the project



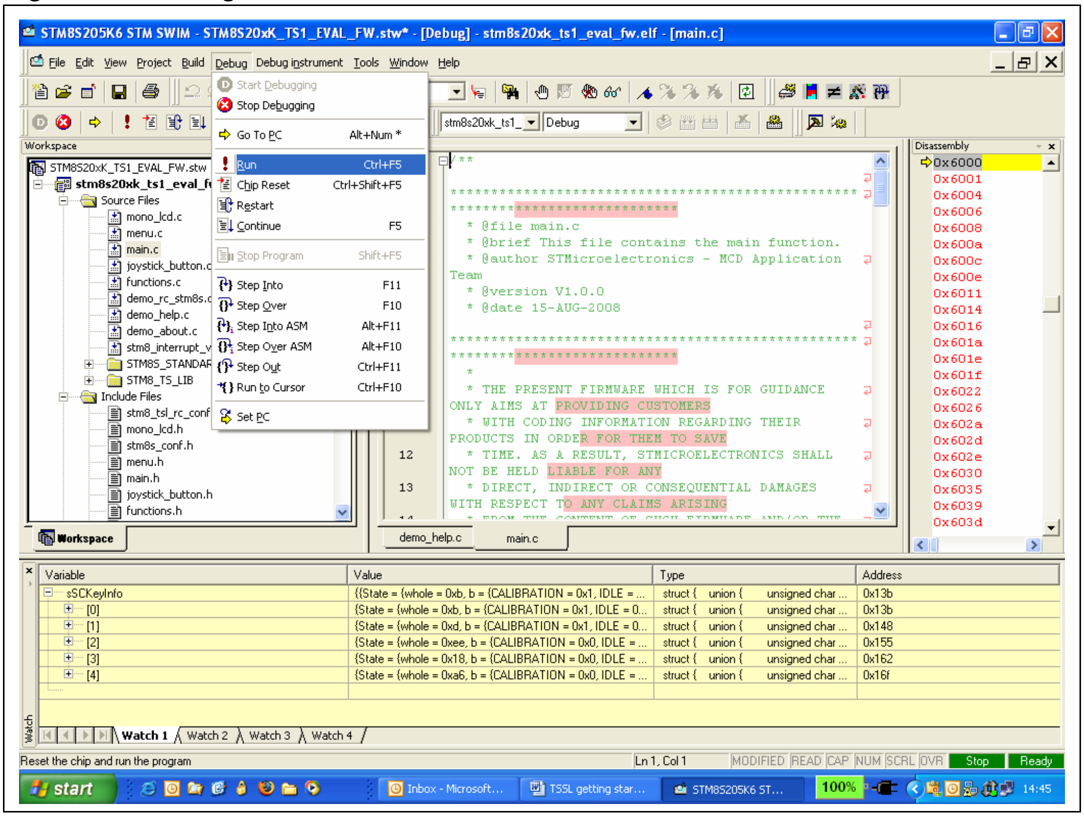
11. Select RLink as the debugging tool.
   – In the “Debug instrument” menu, click “Target setting” and select “SWIM RLink” as shown in *Figure 13*.

Figure 13. Debug instrument settings



12. Start the debugging process.
   – In the “Debug” menu, select “Start debugging” and click “Run” (or press CTRL-F5) to start the application in Debug mode.

Figure 14. Debug mode



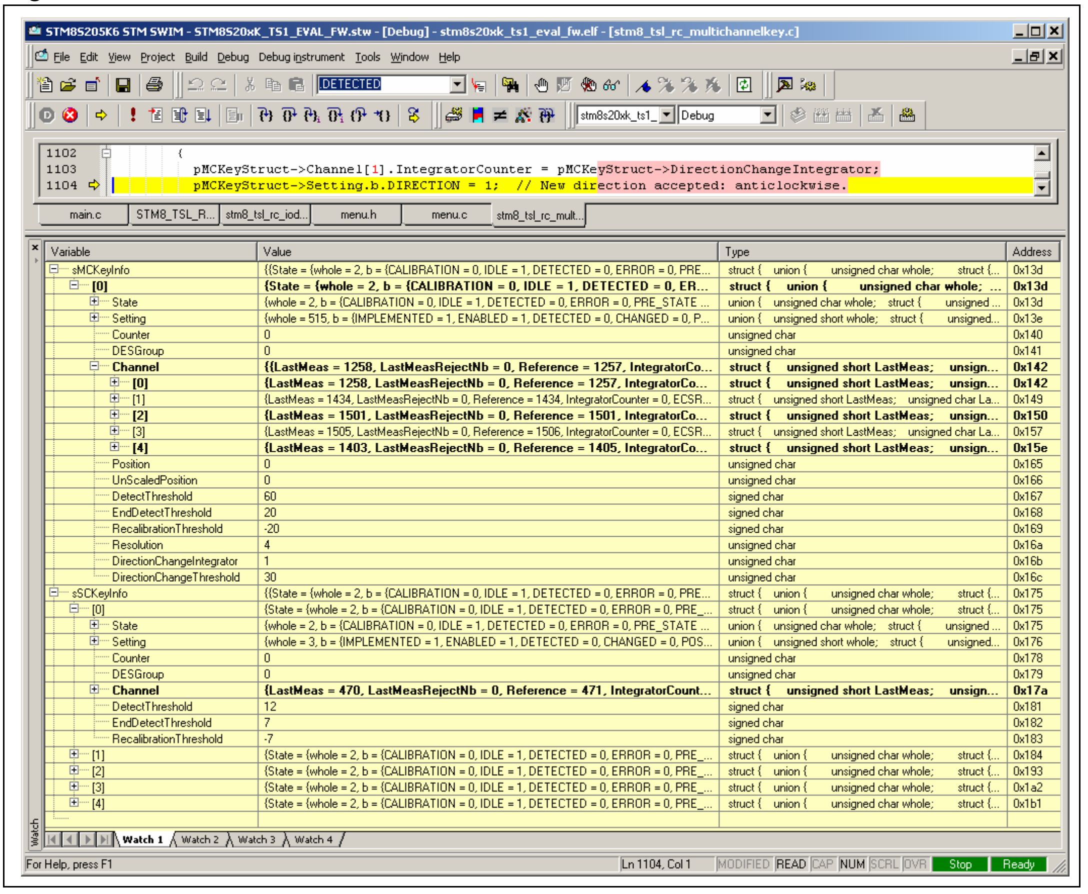
4.3 Exploring key structures

All key and slider data structures can be monitored through the STVD watch window.

The main “touch sensing” structures are “sSCKeyInfo” and “sMCKeyInfo”.

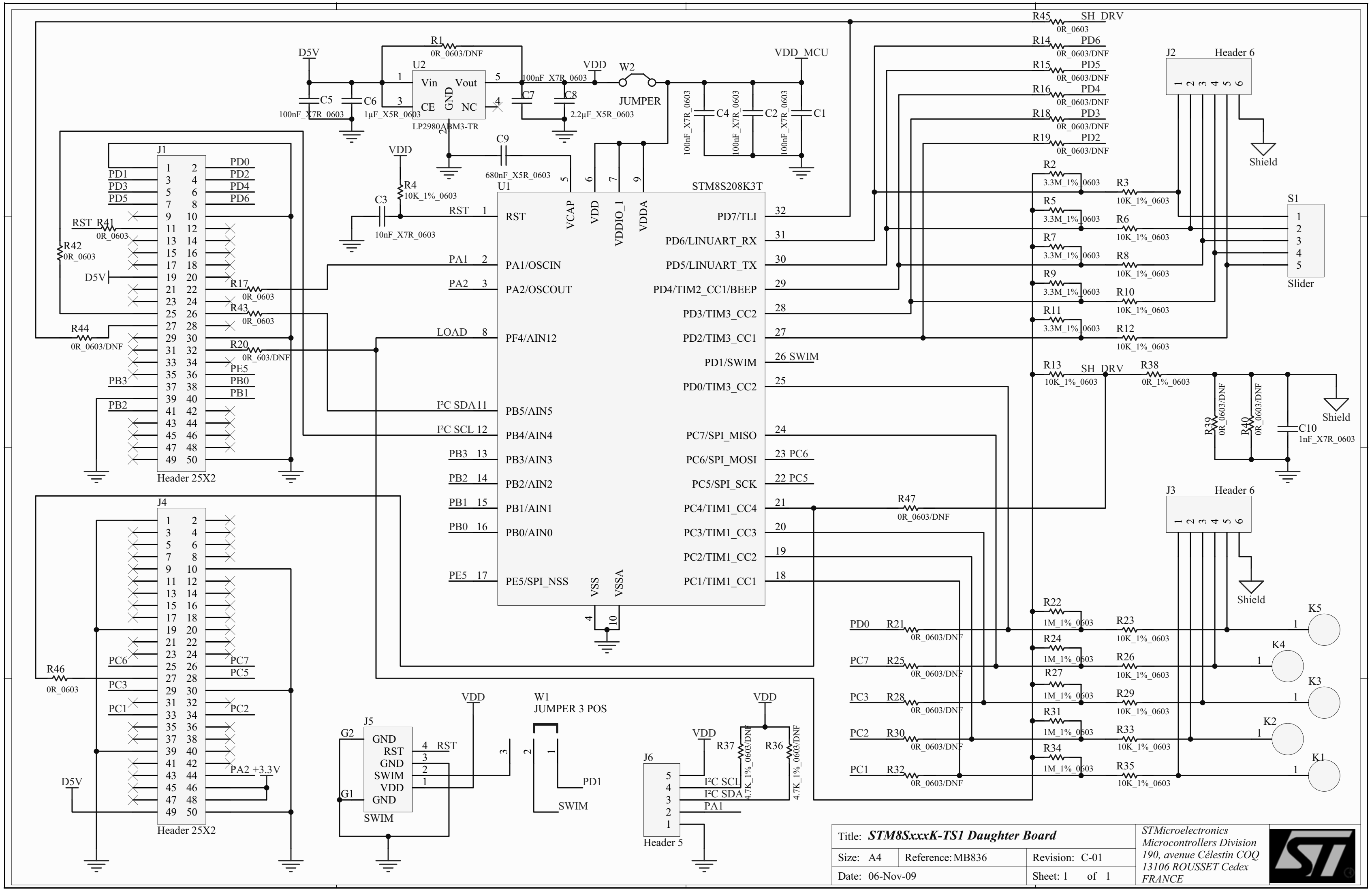
To learn more about library variables and function descriptions, please refer to the CHM file available at `<installation path>\STM8_TS_LIB\stm8_tsl_um.chm`

Figure 15. STVD watch window



Appendix A STM8Sxxx-TS1 daughterboard schematics

Figure 16. STM8Sxxx-TS1 daughterboard schematic diagram



Revision history

Table 9. Document revision history

Date	Revision	Changes
04-Feb-2009	1	Initial release.
09-Mar-2009	2	Updated *Figure 3: Navigation scheme on page 5* and *Display options on page 6*.
20-Mar-2009	3	Corrected reference to STM8S touch sensing evaluation kit from “STM8/128-EVAL/TS” to “STM8/128-EV/TS”.
26-Feb-2010	4	Updated values of C3 and C9 in *Figure 16 on page 21*.