STM8-TOUCH-LIB

STM8 touch sensing library

Data brief

Features

- Complete C source code library with firmware examples for all STM8 microcontrollers
- Both resistor-capacitor (RC) and charge transfer (CT) acquisition principles supported
- Multifunction capability to combine capacitive sensing functions with traditional MCU features (communications, LED/beeper/ LCD control)
- Configuration of STM8 GPIO as touchkey
- Flexible touchkey/wheel/slider configuration and combination
  - RC acquisition: up to 24 keys and 2 wheels/sliders supported
  - CT acquisition: up to 16 keys and 2 wheels/sliders supported
- Acquisition, filtering and calibration functions
- Enhanced processing features for optimized sensitivity and immunity
- Touch-sensing user interface through firmware API for status reporting and application configuration
- MCU resources
  - Minimized number of external components
  - Reduced MCU memory space
- Up to 8-bit wheel/slider resolution with only three capacitive sensing channels
- Active shield feature
- Compliance with MISRA
- Compliance with Cosmic, IAR and Raisonance C compilers

Description

STMicroelectronics STM8-TOUCH-LIB is a touch sensing library that provides a complete robust free source-code solution to transform any 8-bit STM8 microcontroller into a capacitive touch sensing controller. This solution allows designers familiar with the use of standard microcontrollers to create higher-end human interfaces by replacing conventional electromechanical switches by touch sensing keys.

The STM8 touch sensing library is part of the application firmware. It allows combining various capacitive sensing touchkey, wheels or sliders with traditional MCU features (communications, control of LEDs, beeper or LCD) in the same application.

Two acquisition principles, RC and CT, are available and can be configured at compiling level. Both acquisition principles offer the same advanced processing algorithms to filter out noise and to compensate environmental parameters such as temperature, humidity, and power supply variation.

1 Resistor-capacitor (RC) acquisition principle

The RC acquisition principle consists in measuring the charge and discharge time duration of a RC cell made of the electrode capacitance (C_X) and a load resistor (R_L).

The RC acquisition is supported by all STM8S and STM8L microcontrollers and requires a direct connection of the device to earth to operate properly.

The main features are the following:

- Up to 24 touchkeys distributed over 3 GPIO ports
- Up to 2 wheels or sliders with 2 different hardware implementations (5 or 8 capacitive sensing channels)
- Capacitive sensing channels are acquired sequentially

2 Charge transfer (CT) acquisition principle

The charge transfer acquisition consists in charging the electrode capacitance (C_X) and transferring part of the accumulated charge into a sampling capacitor (C_S). This sequence is repeated until the voltage across C_S reaches a given threshold. The number of transfers required to reach the threshold depends on the size of the electrode capacitance. This acquisition principle provides a better sensitivity and robustness than RC acquisition.

It requires a dedicated hardware composed of analog switches and STM8L MCU.

The charge transfer acquisition is only supported by STM8L101x and STM8L15x devices since it requires a dedicated hardware composed of analog switches used to interconnect several GPIOs which is only available on these products.

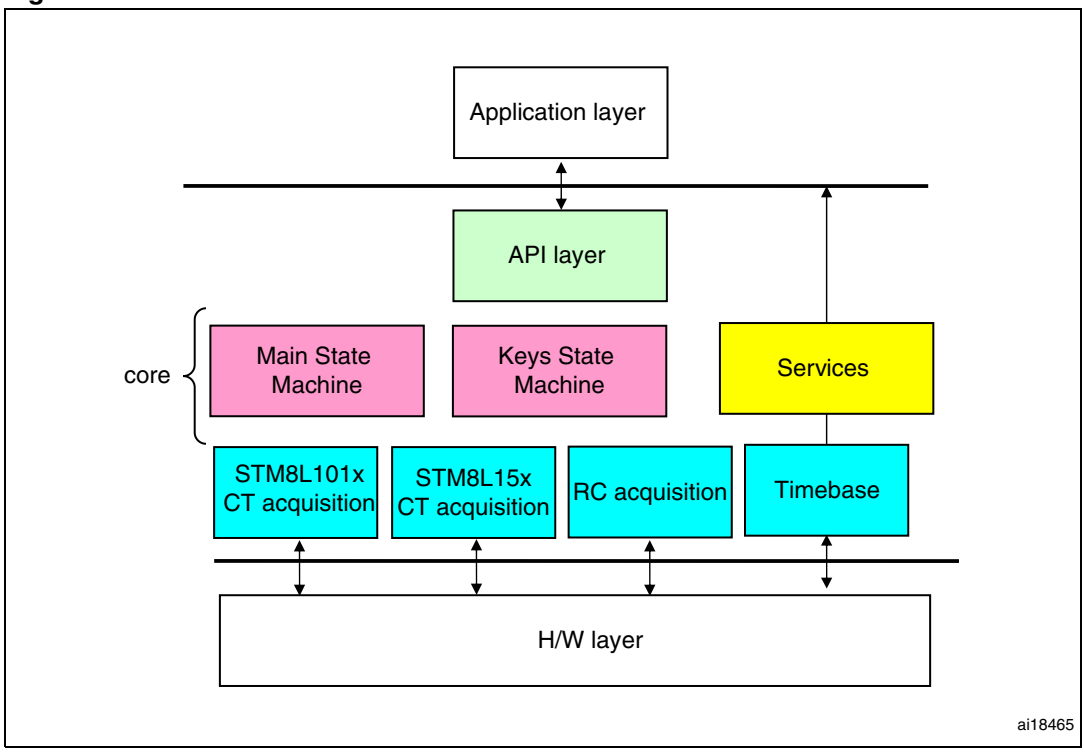
The main features are the following:

- Number touchkeys supported
  - Up to 6 touchkeys on STM8L101x MCUs
  - Up to 16 touchkeys on STM8L15x MCUs
- Up to 2 wheels or sliders with a single hardware implementation (3 capacitive sensing channels)
- Number of capacitive sensing channels acquired simultaneously
  - Up to 2 channels on STM8L101x MCUs
  - Up to 8 channels on STM8L15x MCUs

3 Library architecture

Figure 1 shows the STM8-TOUCH-LIB firmware layers.

Figure 1. STM8-TOUCH-LIB architecture



4 MCU resources

Table 1 shows the STM8 peripherals that are used by the STM8-TOUCH-LIB. Care must be taken when using them to avoid any misbehavior.

Table 1. List of STM8 peripherals used by the STM8-TOUCH-LIB

Peripheral	Function	Acquisition principle
GPIOs	I/O control	RC, CT
16-bit timer with 8-bit prescaler (TIM2 or TIM3)	V_{IH}/V_{IL} measurement	RC
8-bit timer (TIM4)	Generic timebase for the state machine	RC, CT
Comparator (COMP)	Charge transfer	CT
Routing interface (RI)	I/O control and charge transfer	CT

4.1 Number of charge transfer capacitive sensing channels

Table 2 and *Table 3* provide the maximum number of charge-transfer capacitive sensing channels for the STM8L101x and STM8L15x package, respectively.

Table 2. STM8L101x resources used for CT acquisition

Acquisition group	I/O port	TSSOP20 / UFQFPN20				WFQFPN28			VFQFPN32 / LQFP32		
		TSSOP pin	UFQFPN pin	Number of available pins	Usage	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage
Group 1	PB0	10	7	3	2 channels with one sampling capacitor	12	4	3 channels with one sampling capacitor	13	4	3 channels with one sampling capacitor
	PB1	11	8			13			14		
	PD0	9	6			8			9		
	PD1	-	-			9			10		
Group 2	PB2	12	9	2	1 channel with one sampling capacitor	14	4	3 channels with one sampling capacitor	15	4	3 channels with one sampling capacitor
	PB3	13	10			15			16		
	PD2	-	-			10			11		
	PD3	-	-			11			12		
Maximum number of channels		3 with 2 sampling capacitors				6 with 2 sampling capacitors			6 with 2 sampling capacitors		

Table 3. STM8L15x resources used for CT acquisition

Acquisition group	I/O port	STM8L151 (no LCD)									STM8L152 (with LCD)					
		WFQFPN28			WFQFPN32 / LQFP32			VFQFPN48 / LQFP48			WFQFPN32 / LQFP32			VFQFPN48 / LQFP48		
		Pin	Number of available pins	Usage	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage
Group 1	PA6	-	2	1 channel with 1 sampling capacitor	6	3	2 channels with 1 sampling capacitor	7	3	2 channels with 1 sampling capacitor	6	3	2 channels with 1 sampling capacitor	7	3	2 channels with 1 sampling capacitor
	PA5	5			5			6			5			6		
	PA4	4			4			5			4			5		
Group 2	PC7	-	2	1 channel with 1 sampling capacitor	-	2	1 channel with 1 sampling capacitor	46	3	2 channels with 1 sampling capacitor	-	2	1 channel with 1 sampling capacitor	46	3	2 channels with 1 sampling capacitor
	PC4	25			29			43			29			43		
	PC3	24			28			42			28			42		
Group 3	PC2	23	1	cannot be used for touch sensing	27	3	2 channels with 1 sampling capacitor	41	3	2 channels with 1 sampling capacitor	27	3	2 channels with 1 sampling capacitor	41	3	2 channels with 1 sampling capacitor
	PD7	-			24			36			24			36		
	PD6	-			23			35			23			35		
Group 4	PD5	-	2	1 channel with 1 sampling capacitor	22	3	2 channels with 1 sampling capacitor	34	3	2 channels with 1 sampling capacitor	22	3	2 channels with 1 sampling capacitor	34	3	2 channels with 1 sampling capacitor
	PD4	20			21			33			21			33		
	PB7	19			20			31			20			31		
Group 5	PB6	18	3	2 channels with 1 sampling capacitor	19	3	2 channels with 1 sampling capacitor	30	3	2 channels with 1 sampling capacitor	19	3	2 channels with 1 sampling capacitor	30	3	2 channels with 1 sampling capacitor
	PB5	17			18			29			18			29		
	PB4	16			17			28			17			28		
Group 6	PB3	15	3	2 channels with 1 sampling capacitor	16	3	2 channels with 1 sampling capacitor	27	3	2 channels with 1 sampling capacitor	16	3	2 channels with 1 sampling capacitor	27	3	2 channels with 1 sampling capacitor
	PB2	14			15			26			15			26		
	PB1	13			14			25			14			25		
Group 7	PB0	12	3	2 channels with 1 sampling capacitor	13	3	2 channels with 1 sampling capacitor	24	3	2 channels with 1 sampling capacitor	13	3	2 channels with 1 sampling capacitor	24	3	2 channels with 1 sampling capacitor
	PD3	11			12			23			12			23		
	PD2	10			11			22			11			22		
Group 8	PD1	9	2	1 channel with 1 sampling capacitor	10	2	1 channel with 1 sampling capacitor	21	3	2 channels with 1 sampling capacitor	10	1	cannot be used for touch sensing	21	3	2 channels with 1 sampling capacitor
	PD0	8			9			20			-			20		
	PE5	-			-			19			-			19		
Maximum number of channels		10 channels with 7 sampling capacitors			14 channels with 8 sampling capacitors			16 channels with 8 sampling capacitors			13 channels with 7 sampling capacitors			16 channels with 8 sampling capacitors		

5 Memory resources

The STM8-TOUCH-LIB size depends on the following parameters:

- Acquisition principle (RC or CT)
- C compiler and options: memory model, size or speed optimization
- Number of capacitive sensing channels used and type (touchkey or/and wheel or slider)

For further information on memory resources for RC and CT acquisition, refer to *Section 5.1*.

5.1 RC acquisition memory resources

Prerequisites

- COSMIC STM8 C Compiler 16-KByte version release 4.3.1 dated 02 July 2009
- Compiler options: +modsl0 +compact +split
- Sections counted for RAM: ZRAM_TSL_IO + ZRAM_TSL + ZRAM_TSLMCK + RAM_TSL_IO + RAM_TSL + RAM_TSLMCK
- Sections counted for ROM: CODE_TSL_IO + CONST_TSL_IO + CONST_TSL + CONST_TSLMCK + CODE_TSL + CODE_TSLMCK

RAM and ROM requirements

Table 4 gives the RAM and ROM memory space required to use the STM8-TOUCH-LIB for RC acquisition.

Table 4. Typical RAM and ROM memory space required for RC acquisition

Configuration	RAM (bytes)	ROM (bytes)
STM8S207 5x single-channel keys	~120	~2350
STM8L101x 3x single-channel keys	~90	~2350

5.2 CT acquisition memory resources

Prerequisites

- COSMIC STM8 C Compiler 16-Kbyte version release 4.3.1 dated 02 July 2009
- Compiler options: +modsl0 +compact +split
- Sections counted for RAM: ZRAM_TSL_IO + ZRAM_TSL + ZRAM_TSLMCK + RAM_TSL_IO + RAM_TSL + RAM_TSLMCK
- Sections counted for ROM: CODE_TSL_IO + CONST_TSL_IO + CONST_TSL + CONST_TSLMCK + CODE_TSL + CODE_TSLMCK

RAM and ROM requirements

Table 4 gives the RAM and ROM memory space required to use the STM8-TOUCH-LIB for CT acquisition.

Table 5. Typical RAM and ROM memory space required for CT acquisition

Configuration	RAM (bytes)	ROM (bytes)
STM8L101x 3x single-channel keys	~90	~1800
STM8L15X 10x single-channel keys	~220	~1700
STM8L15X 10x single-channel keys + 1x multichannel key	~280	~4200

6 Revision history

Table 6. Document revision history

Date	Revision	Changes
27-Sep-2010	1	Initial release.

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