

xxxx-TOUCH-LIB

STMTouch library

Data brief

Features

- Complete free C source code library with firmware examples for STM8L, STM8TL5x, STM32F0xx, STM32F3xx and STM32L1xx microcontrollers
- Both surface Charge Transfer (CT) and ProxSenseTM (PXS) acquisition principles supported
- Multifunction capability to combine capacitive sensing functions with traditional MCU features
- Modular architecture allowing easy addition of new acquisitions or sensors
- Acquisition, filtering and calibration functions
- Enhanced processing features for optimized sensitivity and immunity
 - Environment Control System (ECS)
 - Detection Time Out (DTO)
 - Detection Exclusion System (DXS)
 - Noise filter
- Flexible touchkey/linear/rotary touch sensors configuration and combination
 - Unlimited number of sensors supported
 - Each sensor can have its own state machine
- · Active shield feature
- Compliant with MISRA
- Compliant with Cosmic, IAR, Raisonance, Keil, Altium and Atollic C compilers

Description

STMicroelectronics touch-sensing libraries provide a complete robust free source-code solution to be used on STM8L, STM8TL5x, STM32F0xx, STM32F3xx and STM32L1xx microcontrollers. This solution allows designers familiar with the use of standard microcontrollers to create higher-end human interfaces by replacing conventional electromechanical switches by capacitive sensors.

The xxxx-TOUCH-LIB is part of the application firmware. It allows combining various capacitive sensing touchkeys, linear or rotary touch sensors with traditional MCU features (communications, control of LEDs, beeper or LCD) in the same application.

Two capacitive acquisition principles, surface Charge Transfer (CT) and ProxSenseTM, 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.

Note: ProxSense is a trademark of Azoteq (Pty) Ltd.

Table 1. Device summary

Part number
STM8L-TOUCH-LIB
STM8TL-TOUCH-LIB
32F0-TOUCH-LIB 32F3-TOUCH-LIB
32L1-TOUCH-LIB

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1 ProxSense (PXS) acquisition principle

This peripheral operates in Projected mode which is used to measure the charge transferred by a driven electrode to a second electrode.

This acquisition principle is only available on STM8TL5x devices.

For more information see the STM8TL5x Reference Manual (RM0312).

2 Surface charge transfer (CT) acquisition principle

The surface 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.

The CT acquisition can be managed in three different ways:

- using the touch sensing controller (TSC) on STM32F0xx and STM32F3xx devices
- using the routing interface (RI) only for STM8L and STM32L1xx devices with software acquisition
- using the routing interface (RI) and two 16-bits timers for STM8L and STM32L1xx devices with hardware acquisition.

Please see the *Table 2* for more details about the peripherals used.



3 STMTouch Library architecture

The STMTouch Library is a "package" composed of different elements:

- the "STMTouch driver" directory contains the firmware layer to perform the touchsensing acquisition and the sensors processing. This driver contains all the acquisitions for all supported microcontrollers. This is the core of the STMTouch Library
- the "STMTouch examples" directory contains a set of firmware examples to show how to use the STMTouch driver
- the "Standard Peripherals driver" directory contains the firmware layer to access the standard peripherals
- the "CMSIS driver" directory contains the Cortex microcontroller software interface standard (STM32 only)
- the "**Utilities drivers**" directory contains the drivers to access for example the LCD on the evaluation boards.

Note:

There is one STMTouch Library per microcontroller family (STM8L STMTouch Library, STM8TL5x STMTouch Library, STM32F0xx STMTouch Library, STM32F3xx STMTouch Library, STM32L1xx STMTouch Library...).

Figure 1 and Figure 2 show the STMTouch driver layers.

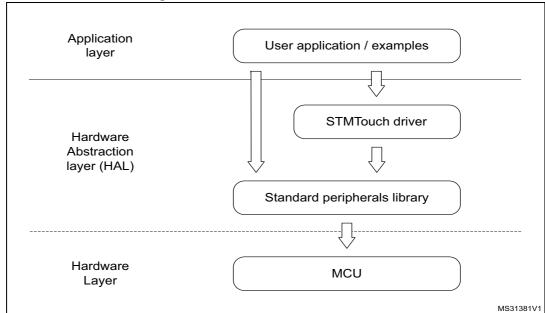


Figure 1. STMTouch driver architecture 1

STMTouch driver Application User application layer configuration DTO DxS Timing Processing ECS Filters layer STMTouch driver TouchKey Linear and rotary sensors sensor Acquisition MCU 1 Acquisition MCU 2 Acquisition layer Standard peripherals library MS31382V1

Figure 2. STMTouch driver architecture 2



4 MCU resources

Table 2 shows the peripherals that are used by the STMTouch driver. Care must be taken when using them to avoid any unwanted behavior.

Table 2. List of peripherals used by the STMTouch driver

				Device	/ Acquisition	principle		
Peripheral	Function	STM8L CT software	STM8L CT hardware	STM8TL5x PXS	STM32F0xx CT	STM32F3xx CT	STM32L1xx CT software	STM32L1xx CT hardware
GPIOs	Acquisition	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8-bit timer (TIM4)	Time base for ECS and DTO	Yes	Yes	Yes	No	No	No	No
Systick	Time base for ECS and DTO	No	No	No	Yes	Yes	Yes	Yes
Routing interface (RI)	Acquisition	Yes	Yes	No	No	No	Yes	Yes
ProxSense (PXS)	Acquisition	No	No	Yes	No	No	No	No
Touch-sensing controller (TSC)	Acquisition	No	No	No	Yes	Yes	No	No
2 x 16-bit timers	Acquisition	No	Yes (TIM2 and TIM3)	No	No	No	No	Yes (TIM9 and TIM11)



5 Touch-sensing channels availability

5.1 STM8L

5.1.1 STM8L features

- Proven and robust surface charge transfer acquisition principle
- Supports up to 20 capacitive sensing channels
- Up to 8 capacitive sensing channels can be acquired in parallel offering a very good response time
- Hardware and software managements of the charge transfer acquisition sequence
- Programmable charge transfer frequency (for hardware management only)
- Programmable sampling capacitor I/O pin
- Programmable channel I/O pin
- Programmable max count value to avoid long acquisition when a channel is faulty
- Dedicated end of acquisition flag with interrupt capability
- One sampling capacitor for up to 4 capacitive sensing channels to reduce the system components
- Compatible with proximity, touchkey, linear and rotary touch sensor implementation



5.1.2 STM8L available touch-sensing channels

The tables below provide an overview of the available touch sensing channels for the STM8L devices.

Pin usage:

- For n available pins in an I/O group, one pin is used as sampling capacitor and n-1 pins are used as channels.
- The I/O group cannot be used if the number of available pins in less or equal to one.
- Note1: The following tables are not restrictive in term of part numbers supported by the STMTouch driver. The STMTouch driver can be used on any new device that may become available as part of ST microcontrollers portfolio. Please contact your ST representative for support.
- Note2: For n available pins in an I/O group, one pin is used as sampling capacitor and n-1 pins are used as channels.

The I/O group cannot be used if the number of available pins in less or equal to one.





Table 3. Available touch-sensing channels for STM8L101

;	Subfamily	1					STM8L101							
	Packages			TSSOP2	0 / UFQFPN2	0		UFQFPN2	8	U	FQFPN32 / L	QFP32		
D				STM8	L101F[23]U			CTMOL 404 CI	2211					
Pa	art numbe	rs		;	STM8L101F[2	23]P	,	STM8L101G[23]U		STM8L101K3	ויטון		
Analog I/O group	Gx_IOy	GPIO	Pin TSSOP	Pin UFQFPN	Number of available pins	Usage	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage		
	G1_IO1	PB0	10			2 channels	12		3 channels	13		3 channels		
Group1	G1_IO2	PB1	11	8	3	with 1	13	4	with 1 sampling capacitor	14	4	with 1 sampling capacitor		
Gloup	G1_IO3	PD0	9	6	3	sampling capacitor	8	7		9				
	G1_IO4	PD1	-	-		capacitoi	9		Capacitoi	10				
	G2_IO1	PB2	12	9		1 channel	14		3 channels	15		2 obonnolo		
Croup?	G2_IO2	PB3	13	10	2	with 1	15	4	with 1	16	4	3 channels with 1 sampling capacitor		
Group2 -	G2_IO3	PD2	-	-	2	sampling capacitor	10	7 4	sampling	11				
	G2_IO4	PD3	-	-		capacitoi	11		capacitor -	12				
Maximum	number of	fchannels	,	3 with 2 sar	mpling capaci	tors	6 with	2 sampling o	apacitors	6 with 2 sampling capacitors				

Table 4. Available touch-sensing channels for STM8L15x / STM8L16x (table 1/2)

	Subfamily				STM8L15	51F			STM8L1	51G	STM8L151K			
	Packages			UF	QFPN20 / T	SSOP20		U	FQFPN28/\	WLCSP28	UFQFPN32 / LQFP32			
_				S	TM8L151F[(UFQFP			8	STM8L151G (UFQFI		STM8L152K[46][UT]			
F	Part numbers	S			STM8L15					51G[46]Y CSP)				
Analog I/O group	Gx_lOy	GPIO	Pin	Pin	Number of available pins	Usage	Pin	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage	
	G1_IO1	PA6	-	-			-	-			6	3		
Croup 1	G1_IO2	PA5	-	-	0	cannot be used for	5	D4	2	1 channel with 1 sampling	5		2 channels with 1 sampling	
Group 1	G1_IO3	PA4	-	-	U	touch sensing	4	D3	2	capacitor	4	3	capacitor	
	G1_IO4	PA7	-	-			-	-			-			
	G2_IO1	PC7	-	-			-	-			-	2	1 channel with	
Group 2	G2_IO2	PC4	17	20	1	cannot be used for	25	C2	2	1 channel with 1 sampling capacitor	29			
Group 2	G2_IO3	PC3	-	-	'	touch sensing	24	A2	2		28	2	1 sampling capacitor	
	G2_IO4	PE7	-	-			-	-			-			
	G3_IO1	PC2	-	-		cannot be used	23	B2		cannot be used	27		2 channels with	
Group 3	G3_IO2	PD7	-	-	0	for	-	-	1	for	24	3	1 sampling	
	G3_IO3	PD6	-	-		touch sensing	-	-		touch sensing	23	1	capacitor	
	G4_IO1	PD5	-	-		cannot be used	-	-		1 channel with	22		2 channels with	
Group 4	G4_IO2	PD4	-	-	1	for	20	C1	2	1 sampling	21	3	1 sampling capacitor	
	G4_IO3	PB7	14	17		touch sensing	19	E1		capacitor	20			

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Table 4. Available touch-sensing channels for STM8L15x / STM8L16x (table 1/2) (continued)

	Subfamily				STM8L15	51F			STM8L1	51G	STM8L151K			
	Packages			UF	QFPN20 / T	SSOP20		U	FQFPN28/\	WLCSP28	UFQFPN32 / LQFP32			
				S	TM8L151F[(UFQFP			8	STM8L151G (UFQFI					
P	art numbers	S		STM8L151F[23]P ⁽¹⁾ (TSSOP)						51G[46]Y CSP)		STM8L152	2K[46][U1]	
Analog I/O group	Gx_lOy	GPIO	Pin	Pin	Number of available pins	Usage	Pin	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage	
	G5_IO1	PB6	13	16		2 channels	18	F1		2 channels with	19		2 channels with	
Group 5	G5_IO2	PB5	12	15	3	with1 sampling	17	D1	3	1 sampling	18	3	1 sampling	
	G5_IO3	PB4	11	14		capacitor	16	D2		capacitor	17		capacitor	
	G6_IO1	PB3	10	13		2 channels with 1 sampling capacitor	15	E2		2 channels with	16		2 channels with	
Group 6	G6_IO2	PB2	9	12	3		14	F2	3	1 sampling	15	3	1 sampling	
	G6_IO3	PB1	8	11			13	G1		capacitor	14		capacitor	
	G7_IO1	PB0	7	10			12	E3			13			
Group 7	G7_IO2	PD3	-	-	1	cannot be used for	11	F3	3	2 channels with 1 sampling	12	3	2 channels with 1 sampling	
Group 7	G7_IO3	PD2	-	-	'	touch sensing	10	E4	3	capacitor	11	3	capacitor	
	G7_IO4	PE3	-	-			-	-			-			
	G8_IO1	PD1	-	-			9	G2			10			
Group 8	G8_IO2	PD0	6	9	1	cannot be used for	8	G3	2	1 channel with 1 sampling	-	1	cannot be used	
Group o	G8_IO3	PE5	-	-	'	touch sensing	_	-	2	capacitor	-	- 1	for touch sensing	
	G8_IO4	PE4	-	-			-	-			-			
Maximun	n number of	channels		2	4 channels sampling ca			7	10 channe sampling c		13 channels with 7 sampling capacitors			

^{1.} The product has an hardware acceleration cell for touch sensing.

			Ta	able 5. Ava	ailable touch-sensi	ng cł	nanne	els fo	r STM8L1	5x / STM8L16x (tab	le 2/2	2)			
5	Subfamily	,		STM	//8L151K	STI	M8L1		nedium/me STM8L151 STM8L1520 STM8L162	C/R/M		STM8L151C low density			
F	Packages			UFQFPN	N32 / LQFP32	U	FQFF	N48 /	LQFP48/	LQFP64 / LQFP80		L	QFP48		
Pa	rt numbe	rs			L151K3U ⁽¹⁾ I51K[46][UT]				M8L151C[4 M8L152C[4 (48 pin: STM8L15 STM8L15 STM8L15 (64 p	168][UT] s) 51R[68]T 52R[68]T 162R8T		STM8	L151C3T ⁽¹⁾		
									STM8L151M8T STM8L152M8T STM8L162M8T (80 pins)						
Analog I/O group	Gx_IOy	GPIO	Pin	Number of available pins	Usage	Pin	Pin	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage		
	G1_IO1	PA6	6			7	7	11			7				
Group 1	G1_IO2	PA5	5	3	2 channels with 1 sampling	6	6	10	3	2 channels with 1 sampling	6	4	3 channels with 1 sampling		
Group 1	G1_IO3	PA4	4		1 sampling capacitor	5	5	9		capacitor	5		1 sampling capacitor		
	G1_IO4	PA7	-			(2)	(2)	(2)			8				
	G2_IO1	PC7	-			46	62	74			46				
Group 2	G2_IO2	PC4	29	2	1 channel with 1 sampling	43	59	71	3	2 channels with 1 sampling	43	4	3 channels with 1 sampling		
3.55,2	G2_IO3	PC3 PE7	28	_	capacitor	42	58	70	0	capacitor	42		capacitor		
	G2_IO4		-			(2)	(2)	(2)			48				



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Table 5. Available touch-sensing channels for STM8L15x / STM8L16x (table 2/2) (continued)

s	Subfamily	,		STM	//8L151K	STI	₩8L 1		nedium/me STM8L15 ² STM8L152 ⁰ STM8L16 ²	C/R/M	STM8L151C low density			
F	Packages			UFQFPN	132 / LQFP32	U	FQFP	N48 /	LQFP48/	LQFP64 / LQFP80		L	QFP48	
Pa	rt numbe	rs			L151K3U ⁽¹⁾ 51K[46][UT]				STM8L18 STM8L (64 p STM STM STM	468][UT] s) 51R[68]T 52R[68]T	LQFP48 STM8L151C3T ⁽¹⁾			
Analog I/O group	Gx_lOy	GPIO	Pin	Number of available pins	Usage	Pin	Pin	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage	
	G3_IO1	PC2	27		2 channels with	41	57	69		2 channels with	41		1 channel with	
Group 3	G3_IO2	PD7	24	3	1 sampling				1 sampling	36	3	1 sampling		
	G3_IO3	PD6	23		capacitor	35	47	59		capacitor	35		capacitor	
	G4_IO1	PD5	22		2 channels with	34	34 46 5			2 channels with	34		2 channels with	
Group 4	G4_IO2	PD4	21	3	1 sampling	33	45	57	3	1 sampling	33	3	1 sampling	
	G4_IO3	PB7	20		capacitor	31	38	46		capacitor	31		capacitor	
	G5_IO1	PB6	19		2 channels with	30	37	45		2 channels with	30		2 channels with	
Group 5	G5_IO2	PB5	18	3	1 sampling	29	36	44	3	1 sampling	29	3	1 sampling	
	G5_IO3	PB4	17		capacitor	28	35	43		capacitor	28		capacitor	

s	Subfamily	,		STN	//8L151K	STI	M8L1		nedium/me STM8L151 STM8L1520 STM8L162	C/R/M		STM8L15	IC low density
F	Packages	i		UFQFPN	132 / LQFP32	U	FQFF	PN48 /	LQFP48/	LQFP64 / LQFP80		L	QFP48
									M8L151C[4 M8L152C[4 (48 pins	168][UT]			
Pa	Part numbers				L151K3U ⁽¹⁾ 51K[46][UT]				STM8L15 STM8L15 STM8L7 (64 p	52R[68]T 162R8T		STM8	L151C3T ⁽¹⁾
									STM8	BL151M8T BL152M8T BL162M8T 0 pins)			
Analog I/O group	Gx_IOy	GPIO	Pin	Number of available pins	Usage	Pin	Pin	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage
	G6_IO1	PB3	16		2 channels with	27	34	42		2 channels with	27		2 channels with
Group 6	G6_IO2	PB2	15	3	1 sampling capacitor	26	33	41	3	1 sampling capacitor	26	3	1 sampling capacitor
	G6_IO3	PB1	14		σαρασιτοι	25	32	40		σαρασιτοί	25		Capacitoi
	G7_IO1	PB0	13		O alaamada wiili	24	31	39		O abangala with	24		2 abanala witt
Group 7	G7_IO2	PD3	12	- 3	2 channels with 1 sampling	23	28	32	3	2 channels with 1 sampling	23	- 4	3 channels with 1 sampling
	G7_IO3	PD2	11	-	capacitor	(2)	(2)	(2)		capacitor	22	-	capacitor
	G7_IO4 PE					(2)	(2)	(2)			17		

Table 5. Available touch-sensing channels for STM8L15x / STM8L16x (table 2/2) (continued)



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Table 5. Available touch-sensing channels for STM8L15x / STM8L16x (table 2/2) (contin	nued)
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S	Subfamily	,		STM	И8L151К	STI	VI8L1		nedium/me STM8L151 STM8L1520 STM8L162	C/R/M		STM8L15 ²	1C low density	
F	Packages			UFQFP	N32 / LQFP32	U	FQFF	N48 /	LQFP48/	LQFP64 / LQFP80		L	QFP48	
Pa	rt numbe	rs			L151K3U ⁽¹⁾ I51K[46][UT]				STM	468][UT] s) 51R[68]T 52R[68]T 162R8T		STM8	L151C3T ⁽¹⁾	
Analog I/O group	I/O Gx_IOy GPIO		Pin	Number of available pins	Usage	Pin	Pin	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage	
	G8_IO1	PD1	10			21	26	30			21			
Group 8	G8_IO2 PD0			2	1 channel with 1 sampling	20	25	29	3	2 channels with 1 sampling	20	4	3 channels with 1 sampling	
Cioup 0	G8_IO3 PE5			_	capacitor	19	24	28		capacitor	19	'	capacitor	
	G8_IO4	PE4	-			(2)	(2)	(2)			18			
_	num numb channels	er of			annels with ing capacitors				16 channels sampling ca			20 channels with 8 sampling capacitors		

^{1.} The product has an hardware acceleration cell for touch sensing.

^{2.} This IO does not belong to the analog IO group.



5.2 STM8TL5x

5.2.1 STM8TL5x features

- Up to 300 capacitive sensing channels composed of 15 transmitters and 20 receivers
- with up to 10 Rx channels acquired in parallel
- Fast acquisition with a typical scan time of 250 µs for 10 Rx channels
- Configurable internal sampling capacitor (CS)
- Electrode Parasitic Capacitance Compensation (EPCC) to ensure the best sensitivity in all user environments
- RF noise detection, allowing to reject corrupted samples
- External trigger to de-synchronize the acquisition from known noise
- Can be configured to return to low power mode between each conversion
- Acquisition possible in Run, Wait and Active-halt modes

5.2.2 STM8TL5x available touch-sensing channels

The table below provides an overview of the available touch sensing channels for the STM8TL5x devices.

Note1: The following table is not restrictive in term of part numbers supported by the STMTouch driver. The STMTouch driver can be used on any new device that may become available as part of ST microcontrollers portfolio. Please contact your ST representative for support.

Note2: For n available pins in an I/O group, one pin is used as sampling capacitor and n-1 pins are used as channels. The I/O group cannot be used if the number of available pins in less or equal to one.

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Table 6. Available touch-sensing channels for STM8TL5x

Sub	ofamily				dale todon sent		STN	18TL5x		
Pac	kages			Т	SSOP20		U	FQFPN28		UFQFPN48
5				STN	18TL52F4P		STN	/18TL52G4U		OTMOT! 500 411
Part i	number	S		5	STM8TL53F4P		5	STM8TL53G4U	,	STM8TL53C4U
PXS fund	ction	GPIO	Pin	Pin	Usage	Pin	Pin	Usage	Pin	Usage
	RX0a	-	11	11		10	10		13	
	RX1a	-	12	12		11	11		15	
	RX2a	-	13	13		12	12		17	
	RX3a	-	-	-		13	13		19	
Receiver	RX4a	-	-	-	5 Receivers /	vers / 14 14 14 15 15 15	8 Receivers /	21	10 Receivers /	
A ⁽¹⁾	RX5a	-	-	-	Transmitters	15	15	Transmitters	23	Transmitters
	RX6a	-	14	14		16	16		25	
	RX7a	-	15	15		17	17		27	
	RX8a	-	-	-		-	1		29	
	RX9a	-	-	-		-	-		31	
	RX0b	-	-	-		-	-		14	
	RX1b	-	-	-		-	1		16	
	RX2b	ı	-	-		-	-		18	
	RX3b	ı	-	-		-	-		20	
Receiver	RX4b	-	-	-	0 Receivers /	-	-	0 Receivers /	22	10 Receivers /
B ⁽¹⁾	RX5b	-	-	-	Transmitters	-	-	Transmitters	24	Transmitters
	RX6b	ı	-	-		ers Transmitters 24 Transm 26				
	RX7b	-	-	-		-	0 Receivers / 22 10 Receiver			
	RX8b	ı	-	-		-	-		sage Pin Usage 13 15 17 19 21 10 Receivers Transmitter 25 27 29 31 14 16 18 20 ceivers / smitters 22 26 10 Receivers Transmitter	
	RX9b	-	-	-		F4P Pin Pin Pin Pin Pin Pin Pin Pin Pin Pi		32		



Table 6. Available touch-sensing channels for STM8TL5x (continued)

Sub	family						STN	18TL5x		•
Pac	kages			Т	SSOP20		U	FQFPN28		UFQFPN48
Dout	Part numbers PXS function GP TX0 PE TX1 PE TX2 PE TX3 PE TX4 PE TX5 PE TX6 PE TX7 PE TX8 PE TX10 PE TX11 PE			STN	18TL52F4P		STN	/18TL52G4U		OTMOT! 5004!!
Part r	iumber	S		5	STM8TL53F4P		5	STM8TL53G4U		STM8TL53C4U
PXS fund	tion	GPIO	Pin	Pin	Usage	Pin	Pin	Usage	Pin	Usage
	TX0	PD0	16	16		18	18		33	
	TX1	PD1	17	17		19	19		34	
	TX2	PD2	-	-		20 ⁽²⁾	20		35	
	TX3	PD3	-	-		21 ⁽²⁾	21		36	
	TX4	PD4	18 ⁽²⁾	18		22 ⁽²⁾	22		39	
	TX5	PD5	19 ⁽²⁾	19	STM8TL52F4P:	23 ⁽²⁾	23	OTMOT! 500 411	40	
	TX6	PD6	20 ⁽²⁾	20	2 Transmitters	24 ⁽²⁾	24	STM8TL52G4U: 2 Transmitters	41	
Transmitte r	TX7	PD7	-	-		27 ⁽²⁾	27		42	15 Transmitters
·	TX8	PB0	-	-	STM8TL53F4P:	28 ⁽²⁾	28	STM8TL53G4U: 9 Transmitters	43	
	TX9	PB1	-	-	5 Transmitters	-	-	9 Transmillers	44	
	TX10	PB2	-	-		-	-		45	
	TX11	PB3	-	-		-	-		46	
	TX12	PB4	-	-		-	-		47	
	TX13	PB5	-	-		-	-		48	
	TX14	PB6	-	-		-	-		1	
	Maximum number of channels			th a 4	2F4P: 12 channels RX*3TX matrix	W	th a 5	2G4U: 25 channels SRX*5TX matrix		00 channels with a 0RX*15TX matrix
OI GI					BF4P: 25 channels BRX*5TX matrix			BG4U: 72 channels BRX*9TX matrix	_	

The receivers can also be used as transmitters. This is used to define the square matrix to address the maximum number of channels (please refer to product datasheet for further information).

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^{2.} On STM8TL52 devices, this GPIO is present but does not support the PXS alternate function.

5.3 STM32F0xx

5.3.1 STM32F0xx features

- Proven and robust surface charge transfer acquisition principle
- Supports up to 24 capacitive sensing channels
- Up to 8 capacitive sensing channels can be acquired in parallel offering a very good response time
- Spread spectrum feature to improve system robustness in noisy environments
- Full hardware management of the charge transfer acquisition sequence
- Programmable charge transfer frequency
- Programmable sampling capacitor I/O pin
- Programmable channel I/O pin
- Programmable max count value to avoid long acquisition when a channel is faulty
- Dedicated end of acquisition and max count error flags with interrupt capability
- One sampling capacitor for up to 3 capacitive sensing channels to reduce the system components
- Compatible with proximity, touchkey, linear and rotary touch sensor implementation



5.3.2 STM32F0xx available touch-sensing channels

The tables below provide an overview of the available touch sensing channels for the STM32F0xx devices.

- Note 1: The following tables are not restrictive in term of part numbers supported by the STMTouch driver. The STMTouch driver can be used on any new device that may become available as part of ST microcontrollers portfolio. Please contact your ST representative for support.
- Note2: For n available pins in an I/O group, one pin is used as sampling capacitor and n-1 pins are used as channels.

The I/O group cannot be used if the number of available pins in less or equal to one.



9	Subfamily										M32F042	or STM32		-				
																l .		
ı	Packages			TSSOP2	20		UFQFPN	128		LQFP3	2 / UFQFPN:	32		WLCSP	36	L	.QFP48 / UF	QFPN48
Flash	memory	size								4=1	6K, 6=32K							
Pa	rt number	s	8	STM32F042	F[46]		STM32F042	2G[46]		STM3	2F042K[46]			STM32F04	2T[46]		STM32F04	2C[46]
Analog I/O group	Gx_IOy	GPIO	Pin	Number of availabl e pins	Usage	Pin	Number of available pins	Usage	Pin LQFP	Pin UFQFP N	Number of available pins	Usage	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage
	G1_IO1	PA0	6		3	6			6	6			F6		3	10		
Group 1	G1_IO2	PA1	7	4	channels with 1	7	4	3 channels with 1	7	7	4	3 channels with 1	D4		channels	11	4	3 channels with 1
Group i	G1_IO3	PA2	8	4	sampling	8	4	sampling capacitor	8	8	4	sampling capacitor	E4	4	with 1 sampling	12	4	sampling capacitor
	G1_IO4	PA3	9		capacitor	9			9	9			F5		capacitor	13		
	G2_IO1	PA4 ⁽¹⁾	10		3	10			10	10			C3		3	14		
Group 2	G2_IO2	PA5 ⁽¹⁾	11	4	channels with 1	11	4	3 channels with 1	11	11		3 channels with 1	D3		channels	15	4	3 channels with 1
Group 2	G2_IO3	PA6	12	4	sampling	12	4	sampling capacitor	12	12	4	sampling capacitor	E3	4	with 1 sampling	16	4	sampling capacitor
	G2_IO4	PA7	13		capacitor	13			13	13			F4		capacitor	17		
	G3_IO1	-	-		_	-			-	-		1/2	-			-		
Group 3	G3_IO2	PB0	-	1	Cannot be used for	14	2	1 channels with 1	14	14	2/3	channels	F3	3	2channels with 1	18	2	2 channels with 1
Group 3	G3_IO3	PB1	14] '	touch sensing	15	2	sampling capacitor	15	15	2/3	with 1 sampling	F2	3	sampling capacitor	19	3	sampling capacitor
	G3_IO4	PB2	-		J	-		·	-	16		capacitor	C2		capacitoi	20		·
	G4_IO1	PA9	17 ⁽²⁾		3	19 ⁽²⁾			19	19			D1		3	30		
Group 4	G4_IO2	PA10	18 ⁽²⁾	4	channels with 1	20 ⁽²⁾	4	3 channels with 1	20	20	4	3 channels with 1	D2		channels	31	4	3 channels with 1
Group 4	G4_IO3	PA11	17 ⁽²⁾]	sampling	19 ⁽²⁾	7	sampling capacitor	21	21	4	sampling capacitor	C1	4	with 1 sampling	32	7	sampling capacitor
	G4_IO4	PA12	18 ⁽²⁾		capacitor	20 ⁽²⁾		·	22	22			A1		capacitor	33		·
	G5_IO1	PB3	-			24			26	26			ВЗ		3	39		
Group 5	G5_IO2	PB4	-	0	Cannot be used for	25	4	3 channels with 1	27	27	4	3 channels with 1	АЗ		channels	40		3 channels with 1
Group 5	G5_IO3	PB6	-]	touch sensing	27	-	sampling capacitor	29	29	-	sampling capacitor	C4	4	with 1 sampling	42	of available pins 4	sampling capacitor
i	G5_IO4	PB7	-			28			30	30			A4		capacitor	43		σαρασιτοί



Table 7. Available touch sensing channels for STM32F042 (continued)

s	Subfamily							4011 00110			ΓM32F042		<u> </u>					
F	Packages			TSSOP	20		UFQFPN	128		LQFP3	2 / UFQFPN:	32		WLCSP	236	ı	_QFP48 / UF	QFPN48
Flash	memory	size							1	4=1	6K, 6=32K							
Pa	rt number	s	;	STM32F042	2F[46]		STM32F042	2G[46]		STM3	32F042K[46]			STM32F04	2T[46]		STM32F04	2C[46]
Analog I/O group	Gx_IOy	GPIO	e pins available pins					Usage	Pin LQFP	Pin UFQFP N	Number of available pins	Usage	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage
			ı		0	-		Cannot be	-	-		0	-		0	-		0
Group 6			-	0	used for	-	0	used for	-	-	0	Cannot be used for	-	0	Cannot be used for	-	0	Cannot be used for
Croup o			-	Ŭ	touch sensing	-	Ĭ	Touch sensing	-	-	Ŭ	Touch sensing	-		Touch sensing	-	Ŭ	Touch sensing
			ı		J	1		J	-	-		,	-		J	-		3
			1			-			-	-			-			-		
0 7			-]	Cannot be used for	-		Cannot be used for	-	-		Cannot be used for	-		Cannot be used for	-		Cannot be used for
Group 7	not ava	ilable	1	0	Touch sensing	-	0	Touch sensing	-	-	0	Touch sensing	-	0	Touch sensing	-	0	Touch sensing
			-		conomig	-		conomig	-	-		conomig	-		conomig	-		conomig
			_			-			-	-			-			-		
			-	1	Cannot be used for	-		Cannot be used for		-	1	Cannot be used for	-		Cannot be used for	-	1	Cannot be used for
Group 8	Group 8		_	0	Touch	-	0	Touch	-	-	- 0	Touch	-	0	Touch	-	- 0	Touch
			_	1	sensing	-		sensing	_	_	-	sensing	_		sensing	_	-	sensing
_	Maximum number of channels			3 sampling	capacitors	13 wi	l th 5 samplin	g capacitors	13	I	sampling cap	pacitors	14 w	I ith 5 samplin	g capacitors	14 w	l vith 5 samplir	ng capacitors

^{1.} This GPIO offers a reduced touch sensing sensitivity. It is thus recommended to use it as sampling capacitor I/O.



^{2.} Pin pair PA11/PA12 can be remapped instead of pin pair PA9/PA10 using SYS_CTRL register.

				Table 8. A	vailable t	ouch sens	sing	channels	for STM32	F051	and STM3	2F072			
8	Subfamily							STM	132F051/STM3	32F072	2				
F	Packages			LQFP32	/UFQFPN32	2		LQFP	48		LQFP6	i 4		LQFP1	00
Flash	memory	size						4=16K, 6=32	2K, 8=64K, B=	128K,	C=256K				
Pa	rt number	s		STM32	F051K[468]			STM32F051 STM32F07			51VB 2V[8B]				
Analog I/O group	Gx_IOy	GPIO	Pin LQFP	Pin UFQFPN	Number of available pins	Usage	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage
	G1_IO1	PA0	6	6		3 channels	10		3 channels	14		3 channels	23		3 channels
Group 1	G1_IO2	PA1	7	7	4	with 1	11	4	with 1	15	4	with 1	24	4	with 1
G. 5 GP .	G1_IO3	PA2	8	8		sampling capacitor	12		sampling capacitor	16	7	sampling capacitor	25	·	sampling capacitor
	G1_IO4	PA3	9	9			13		'	17		Сарасноі	26		'
	G2_IO1	PA4 ⁽¹⁾	10	10		3 channels	14		3 channels	20		3 channels	29		3 channels
Group 2	G2_IO2	PA5 ⁽¹⁾	11	11	4	with 1	15	4	with 1	21	4	with 1	30	4	with 1
0.0up -	G2_IO3	PA6	12	12		sampling capacitor	16		sampling capacitor	22	7	sampling capacitor	31	·	sampling capacitor
	G2_IO4	PA7	13	13			17			23		Capacitoi	32		'
	G3_IO1	PC5	-	-		1/2	-		2 channels	25		3 channels	34		3 channels
Group 3	G3_IO2	PB0	14	14	2/3	channels with 1	18	3	with 1	26	4	with 1	35	4	with 1
c.cap c	G3_IO3	PB1	15	15		sampling	19	· ·	sampling capacitor	27	-	sampling capacitor	36	·	sampling capacitor
	G3_IO4	PB2	-	16		capacitor	20			28		Сарасноі	37		
	G4_IO1	PA9	19	19		3 channels	30		3 channels	42		3 channels	68		3 channels
Group 4	G4_IO2	PA10	20	20	4	with 1	31	4	with 1	43	4	with 1	69	4	with 1
3,00p 4	G4_IO3	PA11	21	21	'	sampling capacitor	32	•	sampling capacitor	44	-	sampling	70		sampling capacitor
	G4_IO4	PA12	22	22			33			45		capacitor	71		



Table 8. Available touch sensing channels for STM32F051 and STM32F072 (continued)

S	Subfamily							STM	132F051/STM	32F072	2				
F	Packages			LQFP32	/UFQFPN32			LQFP	48		LQFP6	4		LQFP1	00
Flash	memory s	size						4=16K, 6=32	2K, 8=64K, B=	128K,	C=256K		I		
Pa	rt numbers	6		STM32	F051K[468]			STM32F051 STM32F07			STM32F051F STM32F072			STM32F05	_
Analog I/O group	Gx_IOy	GPIO	Pin LQFP	Pin UFQFPN	Number of available pins	Usage	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage
	G5_IO1	PB3	26	26		3 channels	39		3 channels	55		3 channels	89		3 channels
Group 5	G5_IO2	PB4	27	27	4	with 1	40	4	with 1	56	4	with 1	90	4	with 1
o.oup o	G5_IO3	PB6	29	29		sampling capacitor	42		sampling capacitor	58		sampling capacitor	92	_	sampling capacitor
	G5_IO4	PB7	30	30			43			59		Сарасног	93		Capacitoi
	G6_IO1	PB11	-	-		Cannot be	22		3 channels	30		3 channels	48		3 channels
Group 6	G6_IO2	PB12	-	1	0	used for	25	4	with 1	33	4	with 1	51	4	with 1
Group o	G6_IO3	PB13	-	1		touch sensing	26	7	sampling capacitor	34	4	sampling	52	4	sampling
	G6_IO4	PB14	-	-		conomig	27		capacitor	35		capacitor	53		capacitor
	G7_IO1	PE2	-	-		Cannot be	-		Cannot be	-		Cannot be	1		3 channels
Group 7	G7_IO2	PE3	-	-		used for	-	0	used for	-	0	used for	2	4	with 1
Group 7	G7_IO3	PE4	-	-	0	Touch sensing	-	U	Touch sensing	-		Touch sensing	3	4	sampling capacitor
	G7_IO4	PE5	-	-		Scrising	-		Scrising	-		Scrising	4		capacitor
	G8_IO1	PD12	-	-		0	-		0	-		0	59		0 -1
Croup 0	G8_IO2	PD13	-	-		Cannot be used for	-	0	Cannot be used for	-	0	Cannot be used for	60	4	3 channels with 1
Group 6	G8_IO3	PD14	-	-	0	Touch sensing	-	U	Touch sensing	-	0	Touch sensing	61	4	sampling capacitor
	G8_IO4	PD15	-	-		Scrising	-		Scholing	-		sensing	62		capacitol
	Group 6 G6_IO2 PE G6_IO3 PE G6_IO4 PE G7_IO1 PI G7_IO2 PI G7_IO3 PI G7_IO4 PI G8_IO1 PE G8_IO1 PE G8_IO1 PE G8_IO2 PE		1	3/14 with 5 s	ampling capa	acitors	17 v	vith 6 samplir	ng capacitors	18 v	vith 6 samplin	g capacitors	24 v	vith 8 samplin	g capacitors

^{1.} This GPIO offers a reduced touch sensing sensitivity. It is thus recommended to use it as sampling capacitor I/O.



5.4 STM32F3xx

5.4.1 STM32F3xx features

- Proven and robust surface charge transfer acquisition principle
- Supports up to 24 capacitive sensing channels
- Up to 8 capacitive sensing channels can be acquired in parallel offering a very good response time
- Spread spectrum feature to improve system robustness in noisy environments
- Full hardware management of the charge transfer acquisition sequence
- Programmable charge transfer frequency
- Programmable sampling capacitor I/O pin
- Programmable channel I/O pin
- Programmable max count value to avoid long acquisition when a channel is faulty
- Dedicated end of acquisition and max count error flags with interrupt capability
- One sampling capacitor for up to 3 capacitive sensing channels to reduce the system components
- Compatible with proximity, touchkey, linear and rotary touch sensor implementation



5.4.2 STM32F3xx available touch-sensing channels

The tables below provide an overview of the available touch sensing channels for the STM32F3xx devices.

- Note 1: The following tables are not restrictive in term of part numbers supported by the STMTouch driver. The STMTouch driver can be used on any new device that may become available as part of ST microcontrollers portfolio. Please contact your ST representative for support.
- Note2: For n available pins in an I/O group, one pin is used as sampling capacitor and n-1 pins are used as channels.

The I/O group cannot be used if the number of available pins in less or equal to one.





Table 9. Available touch sensing channels for STM32F30x

S	ubfamily							STM	32F30	x				
Р	ackages			L	QFP32		L	QFP48		LC	RFP64		L	QFP100
Par	rt numbers			STM32 STM32	F301K[468] F302K[468] F303K[468] F333K[468]		STM32F STM32F	2F301C[468] 302C[468BC] 303C[468BC] 2F333C[468]		STM32F3 STM32F3	F301R[468] 802R[468BC] 803R[468BC] F333R[468]			32F302V[BC] 32F303V[BC]
Analog I/O group	Gx_IOy	GPIO	Number of available pins To o		Pin	Number of availabl e pins	Usage	Pin	Number of available pins	Usage	Pin	Number of availabl e pins	Usage	
	G1_IO1	PA0	7			10			14			23		
Group 1	G1_IO2	PA1	8	4	3 channels with	11	4	3 channels with	15	4	3 channels with	24	4	3 channels with
Croup 1	G1_IO3	PA2	9		1 sampling capacitor	12	. '	1 sampling capacitor	16	<u>'</u>	1 sampling capacitor	25		1 sampling capacitor
	G1_IO4	PA3	10			13			17			26		
	G2_IO1	PA4 ⁽¹⁾	11			14			20			29		
Group 2	G2_IO2	PA5 ⁽¹⁾	12	4	3 channels with	15	4	3 channels with	21	4	3 channels with	30	4	3 channels with
	G2_IO3	PA6	13		1 sampling capacitor	16		1 sampling capacitor	22		1 sampling capacitor	31		1 sampling capacitor
	G2_IO4	PA7	14			17			23			32		
	G3_IO1	PC5	-			-			25			34		
Group 3	G3_IO2	PB0	15	1	Cannot be used for	18	3	2 channels with	26	4	3 channels with	35	4	3 channels with
	G3_IO3	PB1			touch sensing	19		1 sampling capacitor	27	-	1 sampling capacitor	36		1 sampling capacitor
	G3_IO4	PB2				20			28			37		
	G4_IO1	PA9	19	1		30			42			68		
Group 4	G4_IO2	PA10	20	4	3 channels with 1 sampling capacitor	31	4	3 channels with 1 sampling capacitor	43	4	3 channels with 1 sampling capacitor	69	4	3 channels with 1 sampling capacitor
	G4_IO3	PA13	23	1	i sampling capacitor	34		i sampling capacitor	46		i sampling capacitor	72		i sampling capacitor
G4_IO	G4_IO4	PA14	24			37			49			76		

Table 9. Available touch sensing channels for STM32F30x (continued)

S	Subfamily							STM	132F30	x				
F	Packages			L	QFP32		L	QFP48		LC	RFP64		L	QFP100
Pai	rt numbers			STM32 STM32	F301K[468] F302K[468] F303K[468] F333K[468]		STM32F STM32F	2F301C[468] 302C[468BC] 303C[468BC] 2F333C[468]		STM32F3 STM32F3	F301R[468] 802R[468BC] 803R[468BC] F333R[468]			12F302V[BC] 12F303V[BC]
Analog I/O group	Gx_lOy	GPIO	available pins 3 26 27 3 channels with		Pin	Number of availabl e pins	Usage	Pin	Number of available pins	Usage	Pin	Number of availabl e pins	Usage	
	G5_IO1	PB3	26	-		39			55			89		
Group 5	G5_IO2	PB4	27	4	3 channels with	40	4	3 channels with	56	4	3 channels with	90	4	3 channels with
	G5_IO3	PB6	29		1 sampling capacitor	42		1 sampling capacitor	58		1 sampling capacitor	92		1 sampling capacitor
	G5_IO4	PB7	30			43			59			93		
	G6_IO1	PB11	-			22			30			48		
Group 6	G6_IO2	PB12	-	0	Cannot be used for	25	4	3 channels with 1 sampling capacitor	33	4	3 channels with 1 sampling capacitor	51	4	3 channels with 1 sampling capacitor
	G6_IO3	PB13	-	-	touch sensing	26		i sampling capacitor	34		i sampling capacitor	52		i sampling capacitor
	G6_IO4	PB14	-			27			35			53		
	G7_IO1	PE2	-	-		-	-		-			1		
Group 7	G7_IO2	PE3	-	0	Cannot be used for touch sensing	-	0	Cannot be used for touch sensing	-	0	Cannot be used for touch sensing	2	4	3 channels with 1 sampling capacitor
	G7_IO3	PE4	-		todon concing	-		todon ochonig	-		todon conomig	3		r damping dapasitor
-	G7_IO4	PE5	-			-			-			4		
	G8_IO1	PD12	-	-		-			-			59		
Group 8	G8_IO2 G8_IO3	PD13 PD14	-	0	Cannot be used for touch sensing	-	0	Cannot be used for touch sensing	-	0	Cannot be used for touch sensing	60	4	3 channels with 1 sampling capacitor
	G8_IO3	PD14 PD15	-	-		-		3	-		3	62		
_	mum number f channels			12 with 4 sa	mpling capacitors		l 17 with 6 sa	mpling capacitors	_	18 with 6 san	npling capacitors		24 with 8 sa	ampling capacitors

^{1.} This GPIO offers a reduced touch sensing sensitivity. It is thus recommended to use it as sampling capacitor I/O.

N	

Table 10. Available touch sensing channels for STM32F37x

S	ubfamily		STM32F37x												
Packages				L	-QFP48		L	.QFP64	LQFP100 / UFBGA100						
Flash memory size				8=64K, B=128K, C=256K											
Part numbers			STM32F373C[8BC]				STM32	PF373R[8BC]	STM32F373V[8BC]						
Analog I/O group	Gx_IOy	GPIO	Pin	Number of available pins	Usage	Pin	Number of available pins	Usage	LQFP Pin	BGA Pin	Number of available pins	Usage			
	G1_I01	PA0	10	4	3 channels with 1 sampling capacitor	14 15 16		23	L2						
Group 1	G1_IO2	PA1	11				4	3 channels with	24	M2	4	3 channels with			
Croup 1	G1_IO3	PA2	12				·	1 sampling capacitor	25	K3		1 sampling capacitor			
	G1_IO4	PA3	13			18			26	L3					
	G2_IO1	PA4	14		2 channels with	20			29	МЗ					
Group 2	G2_IO2	PA5 ⁽¹⁾	15	3		21		3 channels with	30	K4	4	3 channels with			
Croup 2	G2_IO3	PA6 ⁽¹⁾	16		1 sampling capacitor	22	·	1 sampling capacitor	31	L4		1 sampling capacitor			
	G2_IO4	PA7	-			23			32	M4					
	G3_IO1	PC4	-	2	1 channel with 1 sampling capacitor	24			33	K5					
Group 3	G3_IO2	PC5	-			25	4	3 channels with	34	L5	4	3 channels with			
Group 3	G3_IO3	PB0	18			26	_ -	1 sampling capacitor	35	M5		1 sampling capacitor			
	G3_IO4	PB1	19			27			36	M6					

1 sampling capacitor

				Table 1	0. Available touch s	ensir	ng channe	els for STM32F37x (contin	ued)					
s	ubfamily			STM32F37x											
Р	ackages			ı	_QFP48	LQFP64				LQFP100 / UFBGA100					
Flash memory size Part numbers							8=64	K, B=128K, C=256K	1						
				STM3	2F373C[8BC]	STM32F373R[8BC]				STM32F373V[8BC]					
Analog //O Gx_IOy GPIO group		Pin	Number of available pins	Usage	Pin	Number of available pins	Usage	LQFP Pin	BGA Pin	Number of available pins	Usage				
	G4_IO1	PA9	30	4	3 channels with 1 sampling capacitor	42			68	D10	4	3 channels with			
Group 4	G4_IO2	PA10	31			43 46	4	3 channels with	69	C12					
Group 4	G4_IO3	PA13	34					1 sampling capacitor	72	A11	4	1 sampling capacito			
	G4_IO4	PA14	37			49			76	A10					
	G5_IO1	PB3	39			55			89	A8					
Group 5	G5_IO2	PB4	40	4	3 channels with	56 58	4	3 channels with 1 sampling capacitor	90	A7	4	3 channels with			
Group 5	G5_IO3	PB6	42	4	1 sampling capacitor				92	B5]	1 sampling capacitor			
	G5_IO4	PB7	43			59			93	B4					
	G6_IO1	PB14	26			34			53	K11					
Group 6	G6_IO2	PB15	27	3	2 channels with	35	3	2 channels with	54	K10	4	3 channels with			

1 sampling capacitor

55

56

K9

K8

1 sampling capacitor

36



G6_IO3

G6_IO4

PD8

PD9

28

Table 10. Available touch sensing channels for STM32F37x (continued)

Subfamily								STM32F37x								
Packages				L	_QFP48	LQFP64 LQFP100 / UFBGA100										
Flash	memory s	ize					8=64	K, B=128K, C=256K	ı							
Par	t numbers	3		STM32	2F373C[8BC]		STM32	PF373R[8BC]	STM32F373V[8BC]							
Analog I/O group	Gx_IOy	GPIO	Pin	Number of available pins		Pin	Number of available pins	Usage	LQFP Pin	BGA Pin	Number of available pins	Usage				
	G7_IO1	PE2	-	- 0	Cannot be used for touch sensing		0		1	B2	- - 4	3 channels with				
Group 7	G7_IO2	PE3	-					Cannot be used for	2	A1						
Group 7	G7_IO3	PE4	-					touch sensing	3	B1		1 sampling capacitor				
	G7_IO4	PE5	-			-			4	C2						
	G8_IO1	PD12	-			-	0	Cannot be used for	59	J10						
Group 8	G8_IO2	PD13	-	0	Cannot be used for	-			60	H12	4	3 channels with				
Group o	G8_IO3	PD14	-	U	touch sensing	-	U	touch sensing	61	H11		1 sampling capacitor				
	G8_IO4	PD15	-			-			62	H10						
	mum numb channels	er		14 with 6 sa	ampling capacitors		17 with 6 sa	impling capacitors		24 v	vith 8 samp	ling capacitors				

^{1.} This GPIO offers a reduced touch sensing sensitivity. It is thus recommended to use it as sampling capacitor I/O.



5.5 STM32L1xx

5.5.1 STM32L1xx features

- Proven and robust surface charge transfer acquisition principle
- Supports up to 34 capacitive sensing channels
- Up to 11 capacitive sensing channels can be acquired in parallel offering a very good response time
- Hardware and software managements of the charge transfer acquisition sequence
- Programmable charge transfer frequency (for hardware management only)
- Programmable sampling capacitor I/O pin
- Programmable channel I/O pin
- Programmable max count value to avoid long acquisition when a channel is faulty
- Dedicated end of acquisition flag with interrupt capability
- One sampling capacitor for up to 4 capacitive sensing channels to reduce the system components
- Compatible with proximity, touchkey, linear and rotary touch sensor implementation

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5.5.2 STM32L1xx available touch-sensing channels

The tables below provide an overview of the available touch sensing channels for the STM32L1xx devices.

- Note1: The following tables are not restrictive in term of part numbers supported by the STMTouch driver. The STMTouch driver can be used on any new device that may become available as part of ST microcontrollers portfolio. Please contact your ST representative for support.
- Note2: For n available pins in an I/O group, one pin is used as sampling capacitor and n-1 pins are used as channels. The I/O group cannot be used if the number of available pins in less or equal to one.



				Table 1	1. Availa	ble tou	ch sensir	ng channe	els for ST	M32L	1xx 512K				
S	Subfamily							STM	132L1xx 51	2K					
Packages Part numbers				LQFP64	ļ		LQFP100	/ WLCSP1	04		UFBGA1	32	LQFP144 STM32L151ZE STM32L152ZE STM32L162ZE		
			,	STM32L151 STM32L152 STM32L162	2RE		STM3	2L151VE 2L152VE 2L162VE			STM32L15 STM32L15 STM32L16	2QE			
Analog I/O group	Gx_IOy	GPIO	LQFP pin	Number of available pins	Usage	LQFP Pin	WLCSP ball	Number of available pins	Usage	BGA ball	Number of available pins	Usage	LQFP pin	Number of available pins	Usage
	G1_IO1	PA0	14	4	3 channels with 1 sampling capacitor	23	K9	4	. 3	L2	4	3 channels with 1 sampling capacitor	34	4	3 channels with 1 sampling capacitor
	G1_IO2	PA1	15			24	L9		channels with	M2			35		
Group 1	G1_IO3	PA2	16			25	J8			K3			36		
	G1_IO4	PA3 ⁽¹⁾	17			26	H7		sampling capacitor				37		
	G2_IO1	PA6	22	2	1 channel with 1 sampling	31	H6	2	1 channel with 1 sampling capacitor	L4	4 ⁽²⁾	3 channels with 1 sampling capacitor	42	4 ⁽²⁾	3 channels with 1 sampling capacitor
	G2_IO2	PA7	23			32	K7			J5			43		
Group 2	G2_IO3	PF15	-			-	-			J9			55		
	G2_IO4	PG0 ⁽³⁾	-			-	-			Н9			56		
	G2_IO5	PG1 ⁽³⁾	-		capacitor	-	-			G9			57		
	G3_IO1	PB0 ⁽¹⁾	26	3	2	35	J6		2	M5	5	4 channels with 1 sampling capacitor	46		4 channels with 1 sampling capacitor
Group 3	G3_IO2	PB1	27		channels with 1 sampling	36	K6		channels with 1 sampling capacitor	M6			47		
	G3_IO3	PB2	28			37	M6	3		L6			48	5	
	G3_IO4	PF11	-			-	-			K6			49]	
	G3_IO5	PF12	-		capacitor	-	-			J7			50	-	





Table 11. Available touch sensing channels for STM32L1xx 512K (continued)

S	Subfamily							STM	132L1xx 51	12K	-	-			
F	Packages			LQFP64	ļ		LQFP100	/ WLCSP1	04		UFBGA1	32		LQFP14	4
Pai	rt numbers	5		STM32L15 ² STM32L15 ² STM32L16 ²	2RE		STM3	2L151VE 2L152VE 2L162VE			STM32L15 STM32L15 STM32L16	2QE	;	STM32L15 STM32L15 STM32L16	2ZE
Analog I/O group	Gx_IOy	GPIO	LQFP pin	Number of available pins	Usage	LQFP Pin	WLCSP ball	Number of available pins	Usage	BGA ball	Number of available pins	Usage	LQFP pin	Number of available pins	Usage
	G4_IO1	PA8	41		2	67	F3		2	D11		2	100		2
Group 4	G4_IO2	PA9	42	3	channels with	68	F1	3	channels with	D10	3	channels with	101	3	channels with
Group 4	G4_IO3	PA10	43	3	1 sampling capacitor	69	F2	3	1 sampling capacitor	C12	3	1 sampling capacitor	102	3	1 sampling capacitor
	G5_IO1	PA13	46		. 2	72	E3		. 2	A11		. 2	105		. 2
Group 5	G5_IO2	PA14	49	3	channels with	76	D3	3	channels with	A10	3	channels with	109	3	channels with
Group 5	G5_IO3	PA15	50	3	1 sampling capacitor	77	B1	3	1 sampling capacitor	A9	3	1 sampling capacitor	110	3	1 sampling capacitor
	G6_IO1	PB4	56		. 3	90	A5		. 3	A7		. 3	134		. 3
Croup 6	G6_IO2	PB5	57	4	channels with	91	A6	4	channels with	C5	4	channels with	135	4	channels with
Group 6	Group 6	PB6	58	4	1 sampling	92	C5	4	1 sampling	B5	4	1 sampling	136	4	1 sampling
	G6_IO4	PB7	59		capacitor	93	C7		capacitor	B4		capacitor	137		capacitor

			Tab	ole 11. Ava	ailable to	uch se	nsing cha	nnels for	STM32L1	1xx 51	2K (conti	nued)			
S	Subfamily							STM	132L1xx 51	2K					
F	Packages			LQFP64	ļ		LQFP100	/ WLCSP1	04		UFBGA1	32		LQFP14	4
Pa	rt numbers	s		STM32L15 ² STM32L15 ² STM32L16 ²	2RE		STM3	2L151VE 2L152VE 2L162VE			STM32L15 STM32L15 STM32L16	2QE	,	STM32L15 STM32L15 STM32L16	2ZE
Analog I/O group	Gx_IOy	GPIO	LQFP pin	Number of available pins	Usage	LQFP Pin	WLCSP ball	Number of available pins	Usage	BGA ball	Number of available pins	Usage	LQFP pin	Number of available pins	Usage
	G7_IO1	PB12	33			51	J4			L12			73		
		PB13	34		3	52	J3		3	K12		4	74		4
(G7_IO3	PB14	35		channels	53	L1		channels	K11		channels	75		channels
	G7_IO4	PB15	36	4	with 1	54	K2	4	with 1	K10	5 ⁽²⁾	with 1	76	5 ⁽²⁾	with 1
	G7_IO5	PG2 ⁽³⁾	-		sampling capacitor	-	ı		sampling capacitor	G10		sampling capacitor	87		sampling capacitor
	G7_IO6	PG3 ⁽³⁾	-		Capacitor	-	ı		Capacitor	F9		capacitor	88		Capacitor
	G7_IO7	PG4 ⁽³⁾	-			-	-			F10			89		
	G8_IO1	PC0	8		3 channels	15	F6		3 channels	H1		3 channels	26		3 channels
Group 8	G8_IO2	PC1	9	4	with	16	Н9	4	with	J2	4	with	27	4	with
Group o	G8_IO3	PC2	10	_	1 sampling	17	G9	_	1 sampling	J3	_	1 sampling	28	_	1 sampling
	G8_IO4	PC3	11		capacitor	18	G8		capacitor	K2		capacitor	29		capacitor
	G9_IO1	PC4	24		1	33	L7		1	K5		3	44		3
Croup C	G9_IO2	PC5	25	2	channel with	34	M7	2	channel with	L5	4	channels with	45	4	channels with
Group 9	G9_IO3	PF13	-	2	1 sampling	-	-		1 sampling	K7	4	1 sampling	53	4	1 sampling
	G9_IO4	PF14	-		capacitor	-	-		capacitor	J8		capacitor	54		capacitor





Table 11. Available touch sensing channels for STM32L1xx 512K (continued)

S	Subfamily							STM	132L1xx 51	2K					
F	Packages			LQFP64			LQFP100	/ WLCSP1	04		UFBGA1	32		LQFP14	4
Pa	rt numbers	6		STM32L151 STM32L152 STM32L162	2RE		STM3	2L151VE 2L152VE 2L162VE			STM32L15 STM32L15 STM32L16	2QE	;	STM32L15 ² STM32L15 ² STM32L16 ²	2ZE
Analog I/O group	Gx_IOy	GPIO	LQFP pin	Number of available pins	Usage	LQFP Pin	WLCSP ball	Number of available pins	Usage	BGA ball	Number of available pins	Usage	LQFP pin	Number of available pins	Usage
	G10_IO1	PC6	37		. 3	63	H1		. 3	E12		. 3	96		. 3
C 10	G10_IO2	PC7	38		channels with	64	G1		channels with	E11		channels with	97	4	channels with
Group 10	G10_IO3	PC8	39	4	1 sampling	65	G2	4	1 sampling	E10	4	1 sampling	98	4	1 sampling
	G10_IO4	PC9	40		capacitor	66	F4		capacitor	D12		capacitor	99		capacitor
	G11_IO1	PF6	-			ı	-			G3		3	18		4
	G11_IO2	PF7	-		Cannot be used	-	-		Cannot be used	G4		channels	19		channels
Group 11	G11_IO3	PF8	-	0	for	-	-	0	for	H4	4	with 1	20	5	with 1
	G11_IO4	PF9	-		touch sensing	-	-		touch sensing	J6		sampling	21		sampling
	G11_IO5	PF10	-			-	-					capacitor	22		capacitor
_	G11_IO5 PF10 Maximum number of channels		_	channels w				nels with 10 g capacitors			S channels was		_	channels w	

^{1.} This GPIO offers a reduced touch sensing sensitivity. It is thus recommended to use it as sampling capacitor I/O.

^{2.} Not all the pins are available simultaneously on this group.

^{3.} This GPIO can only be configured as sampling capacitor I/O when using HW acquisition mode and as channel I/O when using SW acquisition mode.

channels

with

1

sampling

capacitor

4

channels

with

sampling

capacitor

G2 IO2

G2_IO3

G2_IO4

G2_IO5

G3_IO1

G3 IO2

G3_IO3

G3_IO4

G3_IO5

Group 2

Group 3

PA7

PF15

PG0⁽³⁾

PG1⁽³⁾

PB0⁽¹⁾

PB1

PB2

PF11

PF12

23

26

27

28

G4

H4

F4

Н3

S	Subfamily							STI	W32L1xx 3	84K					
F	Packages			LQFP64	/ WLCSP6	64		LQFP10	0		UFBGA1	32		LQFP14	4
Pa	rt numbers	S		STM3	32L151RD 32L152RD 32L162RD		;	STM32L15 STM32L15 STM32L16	2VD		STM32L15 STM32L15 STM32L16	2QD	;	STM32L15 ² STM32L15 ² STM32L16 ²	2ZD
Analog I/O group	gx_IOy GPIO		LQFP pin	WLCSP ball	Number of available pins	Usage	LQFP Pin	Number of available pins	Usage	BGA ball	Number of available pins	Usage	LQFP pin	Number of available pins	Usage
	G1_IO1	PA0	14	F6		. 3	23		. 3	L2		3	34		3
	G1_IO2	PA1	15	E6		channels with	24] _	channels with	M2]	channels with	35		channels with
Group 1	G1_IO3	PA2	16	H8	4	1	25	4	1	K3	4	1	36	4	1
	G1_IO4	PA3 ⁽¹⁾	17	G7		sampling capacitor	26		sampling capacitor	L3		sampling capacitor	37		sampling capacitor
	G2_IO1	PA6	22	G5		1	31		1	L4		3	42		3

32

35

36

37

2

3

channel

with

1

sampling

capacitor

2

channels

with

sampling

capacitor

2

3

J5

J9

Н9

G9

M5

M6

L6

K6

J7

4⁽²⁾

5

channel

with

sampling

capacitor

2

channels

with

sampling

capacitor

43

55

56

57

46

47

48

49

50

4⁽²⁾

5

channels

with

1

sampling

capacitor

4

channels

with

sampling

capacitor

Table 12. Available touch sensing channels for STM32L1xx 384K
STM22I 1vv 28/K





Table 12. Available touch sensing channels for STM32L1xx 384K (continued)

S	Subfamily							STI	W32L1xx 3	84K					
F	Packages			LQFP64	/ WLCSP6	64		LQFP10	0		UFBGA1	32		LQFP14	4
Pa	rt numbers	S		STM3	32L151RD 32L152RD 32L162RD		;	STM32L15 ² STM32L15 ² STM32L16 ²	2VD		STM32L15 STM32L15 STM32L16	2QD		STM32L15 STM32L15 STM32L16	2ZD
Analog I/O group	Gx_IOy	GPIO	LQFP pin	WLCSP ball	Number of available pins	Usage	LQFP Pin	Number of available pins	Usage	BGA ball	Number of available pins	Usage	LQFP pin	Number of available pins	Usage
	G4_IO1	PA8	41	E4		. 2	67		. 2	D11		. 2	100		. 2
G4_IO2	G4_IO2	PA9	42	D2		channels with	68		channels with	D10		channels with	101		channels with
Group 4 G4_	G4_IO3	PA10	43	D3	3	1 sampling capacitor	69	3	1 sampling capacitor	C12	3	1 sampling capacitor	102	3	1 sampling capacitor
	G5_IO1	PA13	46	D4		2	72		2	A11		2	105		2
	G5_IO2	PA14	49	B2	_	channels with	76	<u> </u>	channels with	A10	1 _	channels with	109	_	channels with
Group 5	G5_IO3	PA15	50	СЗ	3	1 sampling capacitor	77	3	1 sampling capacitor	A9	3	1 sampling capacitor	110	3	1 sampling capacitor
	G6_IO1	PB4	56	B4		3	90		3	A7		3	134		3
	G6_IO2	PB5	57	A5		channels with	91	1	channels with	C5	1	channels with	135		channels with
Group 6	G6_IO3	PB6	58	B5	4	1	92	4	1	B5	4	1	136	4	1
	G6_IO4	PB7	59	C5		sampling capacitor	93		sampling capacitor	B4		sampling capacitor	137		sampling capacitor

Table 12. Available touch sensing channels for STM32L1xx 384K (continued)

S	Subfamily							STI	M32L1xx 3	84K					
F	Packages			LQFP64	/ WLCSP6	4		LQFP10	0		UFBGA1	32		LQFP14	4
Pa	rt numbers	S		STM3	32L151RD 32L152RD 32L162RD		;	STM32L15 STM32L15 STM32L16	2VD		STM32L15 STM32L15 STM32L16	2QD	:	STM32L15 STM32L15 STM32L16	2ZD
Analog I/O group	Gx_IOy	GPIO	LQFP pin	WLCSP ball	Number of available pins	Usage	LQFP Pin	Number of available pins	Usage	BGA ball	Number of available pins	Usage	LQFP pin	Number of available pins	Usage
	G7_IO1	PB12	33	G2			51			L12			73		
	G7_IO2	PB13	34	G1		3	52		3	K12		4	74		4
	G7_IO3	PB14	35	F2		channels	53		channels	K11		channels	75		channels
Group 7	G7_IO4	PB15	36	F1	4	with 1	54	4	with 1	K10	5 ⁽²⁾	with 1	76	5 ⁽²⁾	with 1
	G7_IO5	PG2 ⁽³⁾	-	-		sampling	-		sampling	G10		sampling	87		sampling
	G7_IO6	PG3 ⁽³⁾	-	-		capacitor	-		capacitor	F9		capacitor	88		capacitor
	G7_IO7	PG4 ⁽³⁾	-	-			-			F10			89		
	G8_IO1	PC0	8	E8		3	15		3	H1		3	26		3
	G8_IO2	PC1	9	F8		channels with	16		channels with	J2] .	channels with	27	_	channels with
Group 8	G8_IO3	PC2	10	D6	4	1	17	4	1	J3	4	1	28	4	1
	G8_IO4	PC3 ⁽¹⁾	11	F7		sampling capacitor	18		sampling capacitor	K2		sampling capacitor	29		sampling capacitor
	G9_IO1	PC4	24	H6		1	33		1	K5		3	44		3
	G9_IO2	PC5	25	H5		channel with	34		channel with	L5] .	channels with	45]	channels with
Group 9	G9_IO3	PF13	-	-	2	1	-	2	1	K7	4	1	53	4	1
	G9_IO4	PF14	-	-		sampling capacitor	-		sampling capacitor	J8		sampling capacitor	54		sampling capacitor



Table 12. Available touch sensing channels for STM32L1xx 384K (continued)

S	Subfamily							STI	W32L1xx 3	84K		·			
F	Packages			LQFP64	/ WLCSP6	64		LQFP10	0		UFBGA1	32		LQFP14	4
Pai	rt numbers	S		STM3	32L151RD 32L152RD 32L162RD		:	STM32L15 ² STM32L15 ² STM32L16 ²	2VD		STM32L15 STM32L15 STM32L16	2QD	:	STM32L15 ² STM32L15 ² STM32L16 ²	2ZD
Analog I/O group	Gx_IOy	GPIO	LQFP pin	WLCSP ball	Number of available pins	Usage	LQFP Pin	Number of available pins	Usage	BGA ball	Number of available pins	Usage	LQFP pin	Number of available pins	Usage
	G10_IO1	PC6	37	E1		3	63		. 3	E12		. 3	96		. 3
0	G10_IO2	PC7	38	E2		channels with	64		channels with	E11		channels with	97		channels with
Group 10	G10_IO3	PC8	39	E3	4	1	65	4	1	E10	4	1	98	4	1
	G10_IO4	PC9	40	D1		sampling capacitor	66		sampling capacitor	D12		sampling capacitor	99		sampling capacitor
	G11_IO1	PF6	-	-			-			G3		3	18		4
ı	G11_IO2	PF7	-	-		Cannot be used	-		Cannot be used	G4		channels	19		channels
Group 11	G11_IO3	PF8	-	-	0	for	-	0	for	H4	4	with 1	20	5	with 1
ı	G11_IO4	PF9	-	-		touch sensing	-		touch sensing	J6		sampling	21		sampling
	G11_IO5 PF10		-	-		3	-			-		capacitor	22		capacitor
	G11_IO5 PF10 Maximum number of channels				nels with 10 g capacitors	-		channels w			channels was			channels w	

^{1.} This GPIO offers a reduced touch sensing sensitivity. It is thus recommended to use it as sampling capacitor I/O.



^{2.} Not all the pins are available simultaneously on this group.

^{3.} This GPIO can only be configured as sampling capacitor I/O when using HW acquisition mode and as channel I/O when using SW acquisition mode.

Table 13. Available touch sensing channels for STM32L1xx 256K (table 1/2)

	Subfamily						STM32	L1xx 256K				
	Packages			LQFP48 c	or UFQFPN48		WLCS	P63		LQF	P64 / WLC	SP64
P	art number	s		STM3	2L152CC		STM32L1	51UC		S	TM32L151F TM32L152F TM32L162F	RC
Analog I/O group	Gx_IOy	GPIO	Pin	Number of available pins	Usage	WLCSP ball	Number of available pins	Usage	LQFP pin	WLCSP ball	Number of available pins	Usage
	G1_IO1	PA0	10			E4			14	F6		
Group 1	G1_IO2	PA1	11	4	3 channels with 1 sampling	G5	4	3 channels with 1 sampling	15	E6	4	3 channels with 1 sampling
Group i	G1_IO3	PA2	12	!	capacitor	H6	4	capacitor	16	H8	4	capacitor
	G1_IO4	PA3 ⁽¹⁾	13			J7		17 G7	G7			
	G2_IO1	PA6	16			G4			22	G5		
	G2_IO2	PA7	17		1 channel with	J5		1 channel with	23	G4		1 channel with
Group 2	G2_IO3	PF15	-	2	1 sampling	-	2	1 sampling	-	-	2	1 sampling
	G2_IO4	PG0 ⁽²⁾	-		capacitor	-		capacitor	-	-		capacitor
	G2_IO5	PG1 ⁽²⁾	-			-			-	-		
	G3_IO1	PB0 ⁽¹⁾	18			J3			26	H4		
	G3_IO2	PB1	19		2 channels with	Н3		2 channels with	27	F4		2 channels with
Group 3	G3_IO3	PB2	20	3	1 sampling	G3	3	1 sampling	28	Н3	3	1 sampling
	G3_IO4	PF11	-		capacitor	-		capacitor	-	-		capacitor
	G3_IO5	PF12	-			-			-	-		
	G4_IO1	PA8	29		2 channels with	E3		2 channels with	41	E4		2 channels with
Group 4	G4_IO2	PA9	30	3	1 sampling	C1	3	1 sampling	42	D2	3	1 sampling
ı	G4_IO3	PA10	31		capacitor	D2		capacitor	43	D3		capacitor

Table 13. Available touch sensing channels for STM32L1xx 256K (table 1/2) (continued)

	Subfamily						STM32	L1xx 256K				
	Packages			LQFP48 o	r UFQFPN48		WLCS	P63		LQF	P64 / WLC	SP64
P	art number	'S		STM3	2L152CC		STM32L1	51UC		S	ГМ32L151F ГМ32L152F ГМ32L162F	RC
Analog I/O group	Gx_IOy	GPIO	Pin	Number of available pins	Usage	WLCSP ball	Number of available pins	Usage	LQFP pin	WLCSP ball	Number of available pins	Usage
	G5_IO1	PA13	34		2 channels with	C2		2 channels with	46	D4		2 channels with
Group 5	G5_IO2	PA14	37	3	1 sampling	C3	3	1 sampling	49	B2	3	1 sampling
G	G5_IO3	PA15	38		capacitor	A2		capacitor	50	C3		capacitor
	G6_IO1	PB4	40			D4			56	B4		
Croup 6	G6_IO2	PB5	41	_	3 channels with	A5	4	3 channels with	57	A5	4	3 channels with
Group 6	G6_IO3	PB6	42	4	1 sampling capacitor	B5	4	1 sampling capacitor	58	B5	4	1 sampling capacitor
	G6_IO4	PB7	43			C5			59	C5		
	G7_IO1	PB12	25			G2			33	G2		
	G7_IO2	PB13	26			G1			34	G1		
	G7_IO3	PB14	27		3 channels with	F3		3 channels with	35	F2		3 channels with
Group 7	G7_IO4	PB15	28	4	1 sampling	F2	4	1 sampling	36	F1	4	1 sampling
	G7_IO5	PG2 ⁽²⁾	-		capacitor	-		capacitor	-	-		capacitor
	G7_IO6	PG3 ⁽²⁾	-			-			-	-		
	G7_IO7	PG4 ⁽²⁾	-			-			-	-		

Table 13. Available touch sensing channels for STM32L1xx 256K (table 1/2) (continued)

	Subfamily						STM32	L1xx 256K				
	Packages			LQFP48 o	or UFQFPN48		WLCS	P63		LQF	P64 / WLC	SP64
P	art number	s		STM3	2L152CC		STM32L1	51UC		S	ГМ32L151F ГМ32L152F ГМ32L162F	RC
Analog I/O group	Gx_IOy	GPIO	Pin	Number of available pins	Usage	WLCSP ball	Number of available pins	Usage	LQFP pin	WLCSP ball	Number of available pins	Usage
	G8_IO1	PC0	-			E6			8	E8		
Group 8	G8_IO2	PC1	-	0		E5	4	3 channels with 1 sampling	9	F8	4	3 channels with 1 sampling
Group 6	G8_IO3	PC2	-			G7	4	capacitor	10	D6	4	capacitor
	G8_IO4	PC3	-			G6			11	F7		
	G9_IO1	PC4	-			F4			24	H6		
Group 9	G9_IO2	PC5	-	0		J4	2	1 channel with 1 sampling	25	H5	2	1 channel with 1 sampling
Group 9	G9_IO3	PF13	-			-		capacitor	i	-		capacitor
	G9_IO4	PF14	-			-			i	-		
	G10_IO1	PC6	-		Cannot be used for touch sensing	F1			37	E1		
Group 10	G10_IO2	PC7	-	0	G	E1	4	3 channels with 1 sampling	38	E2	4	3 channels with 1 sampling
Group 10	G10_IO3	PC8	-			D1	7	capacitor	39	E3		capacitor
	G10_IO4	PC9	-			E2			40	D1		
	G11_IO1	PF6	-			-			-	-		
	G11_IO2	PF7	-			-		Cannot be used	-	-		Cannot be used
Group11	G11_IO3	PF8	-	0		-	0	for	-	-	0	for
	G11_IO4	PF9	-			-		touch sensing	-	-		touch sensing
	G11_IO5	PF10	-			-			-	-		

Table 13. Available touch sensing channels for STM32L1xx 256K (table 1/2) (continued)

	Subfamily						STM32	L1xx 256K				
	Packages			LQFP48 c	or UFQFPN48		WLCSI	P63		LQF	P64 / WLC	SP64
P	Part numbers			STM3	2L152CC		STM32L1	51UC		S	ГМ32L151R ГМ32L152R ГМ32L162R	C
Analog I/O group	I/O Gx_IOy GPIO			Number of available pins	Usage	WLCSP ball	Number of available pins	Usage	LQFP pin	WLCSP ball	Number of available pins	Usage
Maximum	laximum number of channels				nnels with 7 g capacitors		23 channels sampling ca				hannels wit pling capac	

^{1.} This GPIO offers a reduced touch sensing sensitivity. It is thus recommended to use it as sampling capacitor I/O.

^{2.} This GPIO can only be configured as sampling capacitor I/O when using HW acquisition mode and as channel I/O when using SW acquisition mode.

Table 14. Available touch sensing channels for STM32L1xx 256K (table 2/2)

5	Subfamily						;	STM32L1xx	256K			
F	Packages			LQF	P100 / UFB	GA100		UFBG	A132		LQFP	144
Pa	rt number	s			STM32L151 STM32L152 STM32L162	VC	STM32L151QC STM32L152QC STM32L162QC			STM32L151ZC STM32L152ZC STM32L162ZC		
Analog I/O group	Gx_IOy	GPIO	LQFP pin	BGA ball	Number of available pins	Usage	BGA ball	Number of available pins	Usage	LQFP pin	Number of available pins	Usage
	G1_IO1	PA0	23	L2			L2			34		
Group 1	G1_IO2	PA1	24	M2	4	3 channels with 1 sampling	M2	4	3 channels with 1 sampling	35	4	3 channels with 1 sampling
Group	G1_IO3	PA2	25	K3	4	capacitor	K3	4	capacitor	36	4	capacitor
	G1_IO4	PA3 ⁽¹⁾	26	L3			L3			37		
	G2_IO1	PA6	31	L4			L4			42	7 /2.	3 channels with 1 sampling capacitor
	G2_IO2	PA7	32	M4		1 channel with	J5		3 channels with	43		
Group 2	G2_IO3	PF15	-	-	2	1 sampling	J9	4 ⁽²⁾	1 sampling	55		
	G2_IO4	PG0 ⁽³⁾	-	-		capacitor	Н9		capacitor	56		
	G2_IO5	PG1 ⁽³⁾	-	-			G9			57		
	G3_IO1	PB0 ⁽¹⁾	35	M5			M5			46		
	G3_IO2	PB1	36	M6		2 channels with	M6		4 channels with	47		4 channels with
Group 3	G3_IO3	PB2	37	L6	3	1 sampling	L6	5	1 sampling	48	5	1 sampling
	G3_IO4	PF11	-	-		capacitor	K6		capacitor	49		capacitor
	G3_IO5	PF12	-	-			J7			50		
	G4_IO1	PA8	67	D11		2 channels with	D11		2 channels with	100		2 channels with
Group 4	G4_IO2	PA9	68	D10	3	1 sampling	D10	3	1 sampling	101	3 1 samp	1 sampling
	G4_IO3	PA10	69	C12		capacitor	C12		capacitor	102		capacitor

Table 14. Available touch sensing channels for STM32L1xx 256K (table 2/2) (continued)

	Subfamily						;	STM32L1xx	256K			
ı	Packages			LQF	P100 / UFB	GA100		UFBG	A132		LQFP	144
Pa	rt number	s	STM32L151VC STM32L152VC STM32L162VC			vc	STM32L151QC STM32L152QC STM32L162QC			STM32L151ZC STM32L152ZC STM32L162ZC		
Analog I/O group	Gx_IOy	GPIO	LQFP pin	BGA ball	Number of available pins	Usage	BGA ball	Number of available pins	Usage	LQFP pin	Number of available pins	Usage
	G5_IO1	PA13	72	A11		2 channels with	A11		2 channels with	105		2 channels with
Group 5	G5_IO2	PA14	76	A10	3	1 sampling	A10	3	1 sampling	109	3	1 sampling
	G5_IO3	PA15	77	A9		capacitor	A9		capacitor	110		capacitor
	G6_IO1	PB4	90	A7			A7			134		
Group 6	G6_IO2	PB5	91	C5	4	3 channels with 1 sampling	C5	4	3 channels with 1 sampling	135	4	3 channels with 1 sampling capacitor
Group o	G6_IO3	PB6	92	B5	4	capacitor	B5	4	capacitor	136		
	G6_IO4	PB7	93	B4			B4			137		
	G7_IO1	PB12	51	L12			L12			73		
	G7_IO2	PB13	52	K12			K12			74		
	G7_IO3	PB14	53	K11		3 channels with	K11		4 channels with	75		4 channels with
Group 7	G7_IO4	PB15	54	K10	4	1 sampling	K10	5 ⁽²⁾	1 sampling	76	5 ⁽²⁾	1 sampling
	G7_IO5	PG2 ⁽³⁾	-	-		capacitor	G10		capacitor	87		capacitor
	G7_IO6	PG3 ⁽³⁾	-	-			F9			88		
	G7_IO7	PG4 ⁽³⁾	-	-			F10			89		
	G8_IO1	PC0	15	H1			H1			26		
Croup 0	G8_IO2	PC1	16	J2	4	3 channels with	J2		3 channels with	27	4	3 channels with
Group 8	G8_IO3	PC2	17	J3	4	1 sampling capacitor	J3	4	1 sampling capacitor	28	4	1 sampling capacitor
	G8_IO4	PC3	18	K2			K2 ⁽³⁾			29 ⁽³⁾		



Table 14. Available touch sensing channels for STM32L1xx 256K (table 2/2) (continued)

	Subfamily							STM32L1xx	256K		,	
1	Packages			LQF	P100 / UFB	GA100		UFBG	A132		LQFP	144
Pa	Part numbers			STM32L151VC STM32L152VC STM32L162VC			STM32L151QC STM32L152QC STM32L162QC			STM32L151ZC STM32L152ZC STM32L162ZC		
Analog I/O group	Gx_IOy	GPIO	LQFP pin	BGA ball	Number of available pins	Usage	BGA ball	Number of available pins	Usage	LQFP pin	Number of available pins	Usage
	G9_IO1	PC4	33	K5			K5			44		
Group 9	G9_IO2	PC5	34	L5	2	1 channel with 1 sampling	L5	4	3 channels with	45	4	3 channels with 1 sampling
Group 9	G9_IO3	PF13	-	-	2	capacitor	K7	4	1 sampling capacitor	53	- 4	capacitor
	G9_IO4	PF14	-	-			J8			54		
	G10_IO1	PC6	63	E12			E12			96		
Group 10	G10_IO2	PC7	64	E11	4	3 channels with	E11	4	3 channels with	97	4	3 channels with
Group 10	G10_IO3	PC8	65	E10	4	1 sampling capacitor	E10	4	1 sampling capacitor	98	4	1 sampling capacitor
	G10_IO4	PC9	66	D12			D12			99		
	G11_IO1	PF6	-	-			G3			18		
	G11_IO2	PF7	-	-		Cannot be used	G4		3 channels with	19		4 channels with
Group11	G11_IO3	PF8	-	-	0	for	H4	4	1 sampling capacitor	20	5	1 sampling
	G11_IO4	PF9	-	-		touch sensing	J6			21		capacitor
	G11_IO5	PF10	-	-			-	1		22		
Maximum	Maximum number of channels				channels wi		33 channels with 11 sampling capacitors			34 channels with 11 sampling capacitors		

^{1.} This GPIO offers a reduced touch sensing sensitivity. It is thus recommended to use it as sampling capacitor I/O.

^{3.} This GPIO can only be configured as sampling capacitor I/O when using HW acquisition mode and as channel I/O when using SW acquisition mode.



^{2.} Not all the pins are available simultaneously on this group.

2 channels with

1 sampling

capacitor

Table 15. Available touch sensing channels for STM32L15x 32K to 128K **Subfamily** STM32L15x 32K to 128K LQFP48 / VFQFPN48 **LQFP100 / BGA100 Packages** LQFP64 / BGA64 STM32L151C6 STM32L151R6 STM32L151C8 STM32L151R8 STM32L151V8 STM32L151CB STM32L151RB STM32L151VB Part numbers STM32L152C6 STM32L152R6 STM32L152V8 STM32L152C8 STM32L152R8 STM32L152VB STM32L152CB STM32L152RB Number Number Number Analog **LQFP BGA** of **LQFP BGA** of I/O Usage Gx IOv GPIO Pin Usage Usage available ball available ball available pin pin group pins pins pins G1 IO1 PA0 10 14 G2 23 L2 3 channels with 3 channels with 3 channels with PA1 11 15 H2 24 G1 IO2 M2 1 sampling Group 1 4 1 sampling 4 1 sampling 4 G1 IO3 PA2 12 16 F3 25 K3 capacitor capacitor capacitor 13 G3 G1 IO4 PA3 17 26 L3 PA6 16 G4 L4 G2 IO1 1 channel with 22 1 channel with 31 1 channel with Group 2 2 1 sampling 2 1 sampling 2 1 sampling G2_IO2 PA7 17 H4 23 32 M4 capacitor capacitor capacitor G3 IO1 PB0 18 26 F5 35 1 channel with 1 channel with 1 channel with M5 2 2 2 Group 3 1 sampling 1 sampling 1 sampling 19 G3 IO2 PB1 27 G5 36 M6 capacitor capacitor capacitor PA8 G4 IO1 29 41 D7 67 D11 2 channels with 2 channels with 2 channels with G4 IO2 PA9 30 3 42 C7 3 68 D10 3 Group 4 1 sampling 1 sampling 1 sampling capacitor capacitor capacitor G4 IO3 PA10 31 43 C6 69 C12 PA13

46

49

50

2 channels with

1 sampling capacitor

A8

Α7

A6

3

72

76

77

2 channels with

1 sampling

capacitor

A11

A10

Α9

3



G5 IO1

G5 IO2

G5 IO3

Group 5

34

37

38

3

PA14

PA15

Table 15. Available touch sensing channels for STM32L15x 32K to 128K (continued)

S	ubfamily							STM32L1	5x 32K to 128K			·	
Р	ackages			LQFP48	VFQFPN48	LQFP64 / BGA64					LQ	FP100 / BG	GA100
Part numbers STM32L151C8 STM STM32L151CB STM STM32L151CB STM STM32L152C6 STM STM32L152C8 STM		STM32L151R6 STM32L151R8 STM32L151RB STM32L152R6 STM32L152R8 STM32L152RB		STM32L151V8 STM32L151VB STM32L152V8 STM32L152VB			IVB 2V8						
Analog I/O group	Gx_IOy	GPIO	Pin	Number of available pins	Usage	LQFP pin	BGA ball	Number of available pins	Usage	LQFP pin	BGA ball	Number of available pins	Usage
00	G6_IO1	PB4	40	0	1 channel with	56	A4		1 channel with	90	A7		1 channel with
Group 6	G6_IO2	PB5	41	2	1 sampling capacitor	57	C4	2	1 sampling capacitor	91	C5	2	1 sampling capacitor
	G7_IO1	PB12	25			33	Н8			51	L12		
Group 7	G7_IO2	PB13	26	4	3 channels with 1 sampling	34	G8	4	3 channels with 1 sampling	52	K12	4	3 channels with
Group 7	G7_IO3	PB14	27		capacitor	35	F8]	capacitor	53	K11	4	1 sampling capacitor
	G7_IO4	PB15	28			36	F7			54	K10		



Table 15. Available touch sensing channels for STM32L15x 32K to 128K (continued)

S	ubfamily							STM32L1	5x 32K to 128K	•		<u> </u>	
Р	ackages			LQFP48	/ VFQFPN48		ı	LQFP64 / B	GA64		LC	FP100 / BG	GA100
Par	t numbers			STM32L151C6 STM32L151C8 STM32L151CB STM32L152C6 STM32L152C8 STM32L152CB			STM32L151R6 STM32L151R8 STM32L151RB STM32L152R6 STM32L152R8 STM32L152RB			STM32L151R8 STM32L151V8 STM32L151RB STM32L151VB STM32L152R6 STM32L152V8 STM32L152R8 STM32L152VB		IVB 2V8	
Analog I/O group	Gx_IOy	GPIO	Pin	Number of available pins	Usage	LQFP pin	BGA ball	Number of available pins	Usage	LQFP pin	BGA ball	Number of available pins	Usage
	G8_IO1	PC0	-			8	E3			15	H1		
Group 8	G8_IO2	PC1	-	0		9	E2	4/3	3/2 channels with 1 sampling	16	J2	4	3 channels with 1 sampling
Gloup 6	G8_IO3	PC2	-	U		10	F2	4/3	capacitor	17	J3	4	capacitor
	G8_IO4	PC3	-			11	ı			18	K2		
00	G9_IO1	PC4	-		Cannot be used	24	H5		1 channel with	33	K5		1 channel with
Group 9	G9_IO2	PC5	-	0	for touch sensing	25	H6	2	1 sampling capacitor	34	L5	2	1 sampling capacitor
	G10_IO1	PC6	-			37	F6			63	E12		
Group 10	G10_IO2	PC7	-	0		38	E7	4	3 channels with	64	E11		3 channels with
Group 10	G10_IO3	PC8	-	U		39	E8	4	1 sampling capacitor	65	E10	4	1 sampling capacitor
	G10_IO4	PC9	-			40	D8			66	D12		
Maximum number of channels		r of			nnels with 7 g capacitors		20/19 channels with 10 sampling capacitors			20 channels with 10 sampling capacitors			



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Memory footprint xxxx-TOUCH-LIB

6 Memory footprint

The STMTouch driver memory footprint depends on the following parameters:

- acquisition principle (CT or PXS)
- · C compiler and options: memory model, size or speed optimization
- number of capacitive sensing channels, acquisition banks, sensor type (touchkey, linear or rotary).

6.1 STM8L

The Cosmic STM8 C compiler v4.3.6 has been used with the following command line options:

+modsl0 -pxp +compact + split -pp

Table 19 shows the memory footprint taken by the STMTouch driver for different configurations.

Table 16. STM8L101 memory footprint with software acquisition mode⁽¹⁾

Channels	Banks	Sensors	ROM (Kbytes)	RAM (bytes)
3	2	3 TKeys	~5.3	~160

^{1.} The content of this table is provided for information purposes only

Table 17. STM8L15x memory footprint with hardware acquisition mode⁽¹⁾

Channels	Banks	Sensors	ROM (Kbytes)	RAM (bytes)
1	1	1 TKey	~5.2	~140
10	2	10 TKeys	~5.4	~300
16	2	10 TKeys + 1 linear + 1 rotary	~7.4	~450

^{1.} The content of this table is provided for information purposes only

Table 18. STM8L15x memory footprint with software acquisition mode⁽¹⁾

Channels	Banks	Sensors	ROM (Kbytes)	RAM (bytes)
1	1	1 TKey	~4.6	~130
10	2	10 TKeys	~4.8	~280
16	2	10 TKeys + 1 linear + 1 rotary	~6.9	~430

^{1.} The content of this table is provided for information purposes only



xxxx-TOUCH-LIB Memory footprint

6.2 STM8TL5x

The Cosmic STM8 C compiler v4.3.6 has been used with the following command line options:

+modsl0 -pxp +compact + split -pp

Table 19 shows the memory footprint taken by the STMTouch driver for different configurations.

Table 19. STM8TL5x memory footprint⁽¹⁾

Channels	Banks	Sensors	ROM (Kbytes)	RAM (bytes)
1	1	1 touchkey	~4.3	~70
3	1	3 touchkeys	~4.4	~110
19	4	19 touchkeys	~4.7	~440
26	6	16 linears-1ch 2 linears-5ch	~6.2	~680
26	6	16 touchkeys 2 linears-5ch	~7.8	~570

^{1.} The content of this table is provided for information purposes only

6.3 STM32F0xx

The IAR ANSI C/C++ compiler V6.40.1 for ARM $^{\circledR}$ has been used with the following command line options:

optimization high-balanced

Table 20 shows the memory footprint taken by the STMTouch driver for different configurations.

Table 20. STM32F0xx memory footprint⁽¹⁾

Channels	Banks	Sensors	ROM (Kbytes)	RAM (bytes)
3	3	3 touchkeys	~3.9	~130
3	3	1 linear-3ch	~4.9	~120
15	6	9 touchkeys 1 linear-3ch 1 rotary-3ch	~7.7	~350

^{1.} The content of this table is provided for information purposes only

Memory footprint xxxx-TOUCH-LIB

6.4 STM32F3xx

The IAR ANSI C/C++ compiler V6.40.1 for $\mathsf{ARM}^{\mathsf{®}}$ has been used with the following command line options:

optimization high-balanced

Table 21 and *Table 22* show the memory footprint taken by the STMTouch driver for different configurations.

Table 21. STM32F30x memory footprint⁽¹⁾

	Channels	Banks	Sensors	ROM (Kbytes)	RAM (bytes)
ĺ	2	2	2 TKeys	~3.2	~120

^{1.} The content of this table is provided for information purposes only

Table 22. STM32F37x memory footprint⁽¹⁾

Channels	Banks	Sensors	ROM (Kbytes)	RAM (bytes)
3	3	3 TKeys	~3.3	~140
3	3	1 Linear-3ch	~4.3	~130

^{1.} The content of this table is provided for information purposes only

xxxx-TOUCH-LIB Memory footprint

6.5 STM32L1xx

The IAR ANSI C/C++ compiler V6.30.1 for $\mathsf{ARM}^{\mathsf{®}}$ has been used with the following command line options:

optimization high-balanced

Table 23 shows the memory footprint taken by the STMTouch driver using the hardware acquisition mode (using Timers) on STM32L1xx High-density devices:

Table 23. STM32L1xx memory footprint, example 1⁽¹⁾

Channels	Banks	Sensors	ROM (Kbytes)	RAM (bytes)
3	3	3 TKeys	~6.2	~370
3	3	1 Linear-3ch	~7.2	~360
16	3	10 TKeys 1 Linear-3ch 1 Rotary-3ch	~9.1	~630

^{1.} The content of this table is provided for information purposes only

Table 24 shows the memory footprint taken by the STMTouch driver using the **software** acquisition mode on STM32L1xx Medium-density devices:

Table 24. STM32L1xx memory footprint, example 2⁽¹⁾

Channels	Banks	Sensors	ROM (Kbytes)	RAM (bytes)
2	2	2 TKeys	~5.2	~400
3	3	1 Linear-3ch	~6.2	~420
16	3	10 TKeys 1 Linear-3ch 1 Rotary-3ch	~8.7	~690

^{1.} The content of this table is provided for information purposes only

Revision history xxxx-TOUCH-LIB

7 Revision history

Table 25. Document revision history

Date	Revision	Changes	
21-Dec-2012	1	Initial release.	
30-Apr-2013	2	Added support for STM32F3xx and STM32L1xx products. Updated Section 2: Surface charge transfer (CT) acquisition principle. Replaced everywhere in the document the single ordering code (old ordering code: STMTOUCH-LIB) with multiple ordering codes (new ordering codes: xxxx-TOUCH-LIB). Updated document title. Added Table 1: Device summary.	
03-Sep-2013	3	Added STM8L in Section: Description. Updated Section 2: Surface charge transfer (CT) acquisition principle. Updated Section 3: STMTouch Library architecture. Updated Table 2: List of peripherals used by the STMTouch driver. Added package row in Table 4: Available touch-sensing channels for STM8L15x / STM8L16x (table 1/2). Added package row in Table 5: Available touch-sensing channels for STM8L15x / STM8L16x (table 2/2). Updated Table 7: Available touch sensing channels for STM32F042. Added Section 5.1: STM8L. Added Section 6.1: STM8L. Fixed footnote issues in Table 9, Table 11 and Table 14.	
13-Feb-2014	4	Updated all channel tables of STM8L, STM32L and STM32F0 products. Added STM32F042 channel table <i>Table 7: Available touch sensing channels for STM32F042</i> Added STM32L1xx 512K channel table <i>Table 11: Available touch sensing channels for STM32L1xx 512K</i>	

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