APPLICATION NOTE FOR CTPM_CHIPSEMI

V1.0.0--2023-09-14

Table content

1. I2C Communication

1.1 I²C timing sequence

The CHSC5xxx supports standard I²C interface, and acts as slave.I²C Master can read any internal register and RAM space of the CHSC5xxx via I²C.The recommended communication speed is 100-400Kbps.

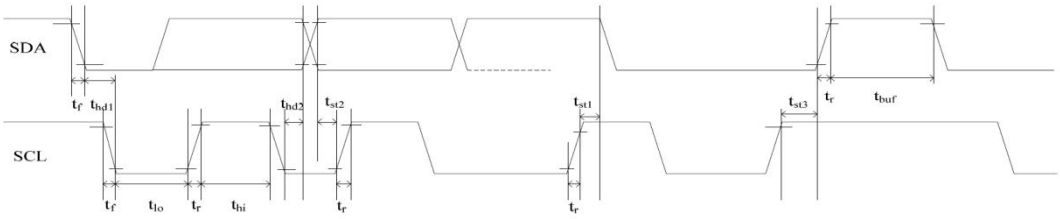


Figure 1. I²C timing sequence

Table 1. I²C timing parameter

parameter	symbol	MIN	MAX	unit
SCL low period	tlo	1.3		us
SCL high period	thi	0.6		us
SCL setup time for START condition	tst1	0.6		us
SCL setup time for STOP condition	tst3	0.6		us
SCL hold time for START condition	thd1	0.6		us
SDA setup time	tst2	0.1		us
SDA hold time	thd2	0		us
Rise time	tr		300	ns
Fall time	tf		300	ns
I2C bus free time between Stop and Start	tbuf	1.3		us

1.2 IIC communication read and write process

Device address： The 7-bit address is **0x2E**. After moving 1 bit to the left, the write communication is **0x5C** and the read communication is **0x5D**.

IIC communication write process：

Start + 0x5C + ACK + ADDR[31:24] + ACK + ... + ADDR[7:0] + ACK + DATA + ACK + ... + DATA + ACK + STOP

START	id	w	ACK	Addr[31:24]	ACK	Addr[23:16]	ACK	Addr[15:8]	ACK	Addr[7:0]	ACK	Data[7:0]	ACK	...	ACK	STOP

IIC communication reading process:

Step1：Start + 0x5C + ACK + ADDR[31:24] + ACK + ... + ADDR[7:0] + ACK + STOP

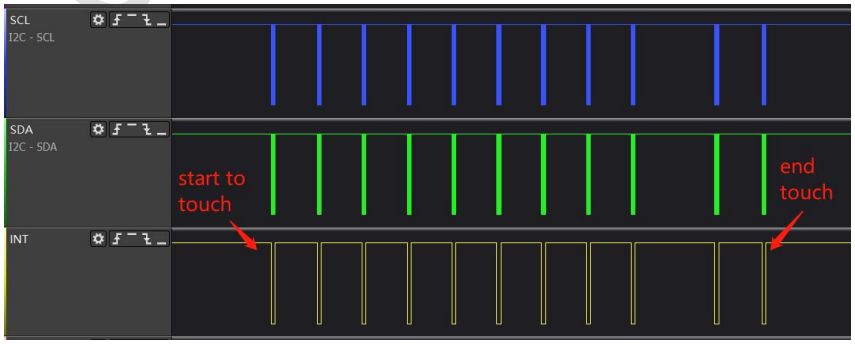
Step2：Start + 0x5D + ACK + DATA + ACK + ... + DATA + NACK + STOP

STEP1	START	id	w	ACK	Addr[31:24]	ACK	Addr[23:16]	ACK	Addr[15:8]	ACK	Addr[7:0]	ACK	STOP

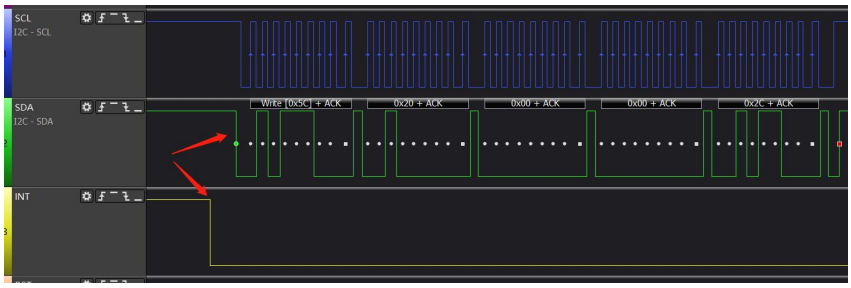
STEP2	START	id	r	ACK	Data[7:0]	ACK	Data[7:0]	ACK	.....	NACK	STOP

Example:HOST responds to interrupt and reads the waveform of touch coordinate data.

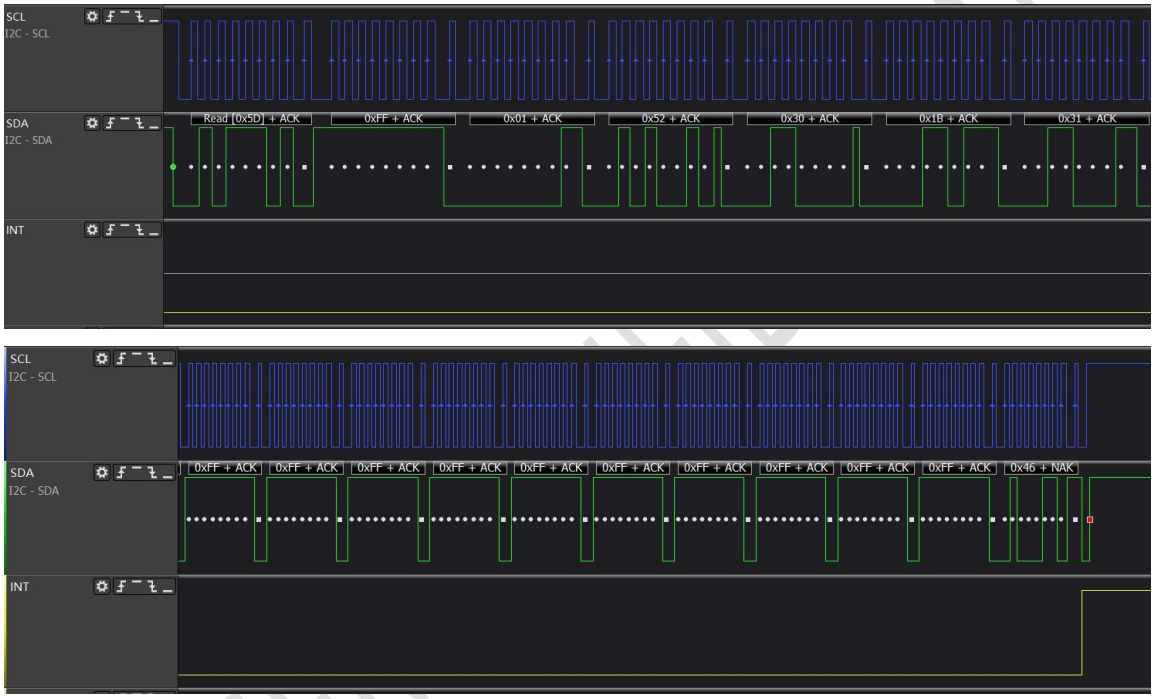
The INT pin of CHSC5XXX triggers an interrupt and HOST reads coordinate data once.



Write device address 0x5C and write 0x20 00 00 2C register addresses



Write device address 0x5D to read touch data of required length(28bytes-default)



1.3 Format of touch data

Format of touch data reported by CHSC5xxx to Host.

Address	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0	Host access
0x2000002C	EVENT type(0xFF:normal touch event, 0xFE:gesture event)								R
0x2000002D	Finger number or gesture ID								R
0x2000002E	point 1: X coordinate[7:0]								R
0x2000002F	point 1: Y coordinate[7:0]								R
0x20000030	pressure value (Reserved)								R
0x20000031	point 1: Y coordinate[11:8]				point 1: X coordinate[11:8]				R
0x20000032	point 1: Touch event Put down:0 Contact:8 Put up:4				point 1: Touch ID				R
0x20000033	point 2: X coordinate[7:0]								R

0x20000034	point 2: Y coordinate[7:0]		R
0x20000035	pressure value (Reserved)		R
0x20000036	point 2: Y coordinate[11:8]	point 2: X coordinate[11:8]	R
0x20000037	point 2: Touch event Put down:0 Contact:8 Put up:4	point 2: Touch ID	R
...	...	...	R
0x2000005B	point 10: X coordinate[7:0]		R
0x2000005C	point 10: Y coordinate[7:0]		R
0x2000005D	pressure value (Reserved)		R
0x2000005E	point 10: Y coordinate[11:8]	point 10: X coordinate[11:8]	R
0x2000005F	point 10: Touch event Put down:0 Contact:8 Put up:4	point 10: Touch ID	R

2. Register operation

Unlike conventional IC, CHSC5XXX use direct address mode. Firmware provide several addresses for the Driver to access.

2.1 Get TP related information

0x20000000 - 0x2000c000 is the RAM address space，0x20000000 -0x20000180 is freely accessible.

Configure FW starting address at 0x20000080, the length is 512 bytes

Some of the address information is as follows

Address	Bit address	Variable Name	Description	Host access
0x20000080	7:0	ictype	Read out IC type from TP 00H:CHSC5472 01H:CHSC5448 02H:CHSC5448A 03H:CHSC5460 04H:CHSC5468 05H:CHSC5432 10H:CHSC5816 11H:CHSC1716	R
0x20000081	7:0	Config version	Read out configure Firmware version from TP	R
0x20000082	15:0	Project ID	Read out Project ID from TP	R
0x20000084	7:0	Vendor ID	Read out Vendor ID from TP	R
0x20000086	15:0	lcdX	Read out X-resolution from TP	R
0x20000088	15:0	lcdY	Read out Y-resolution from TP	R
0x2000008e	7:0	finger	Maximum touch points	R

			supported(1-10)	

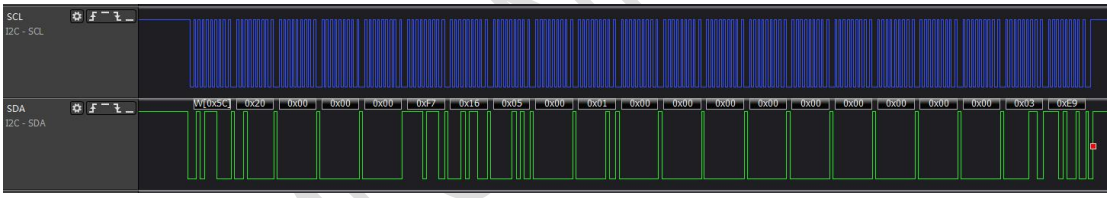
Address	Bit address	Variable Name	Description	Host access
0x20000014	15:0	Boot version	Read out Boot Firmware version from TP	R

2.2 Mode switching

Address	Byte address	Variable Name	Description	Host access
0x20000000	/	**TP_CMD_BUFF_ADDR**	This address is used by the host to send command to touchscreen	W/R
	/	**TP_RSP_BUFF_ADDR**	The host also uses this address to receive touchscreen feedback after sending a command	

2.2.1 Touchscreen enter Deep sleep mode

W 0x5c **0x20 0x00 0x00 0x00** 0xF7 0x16 0x05 0x00 0x01 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x03 0xE9



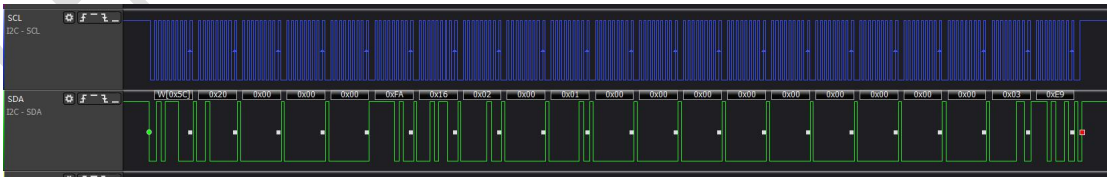
Correlation function: **semi_touch_suspend_ctrl(1)**;

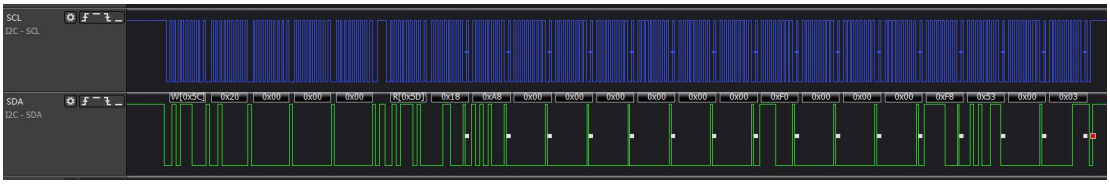
Exit after reset

2.2.2 Touchscreen enter gesture mode

Correlation function: **semi_touch_guesture_switch(1)**;

W **0x20 0x00 0x00 0x00** 0xFA 0x16 0x02 0x00 0x01 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x03 0xE9



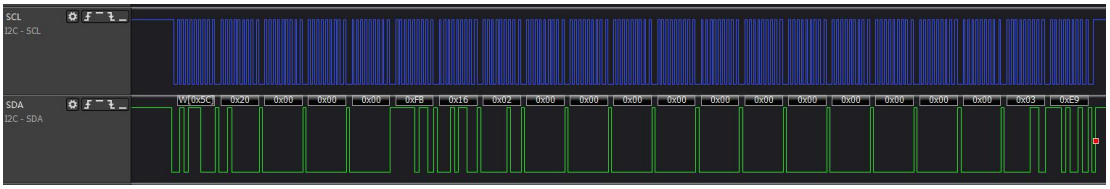


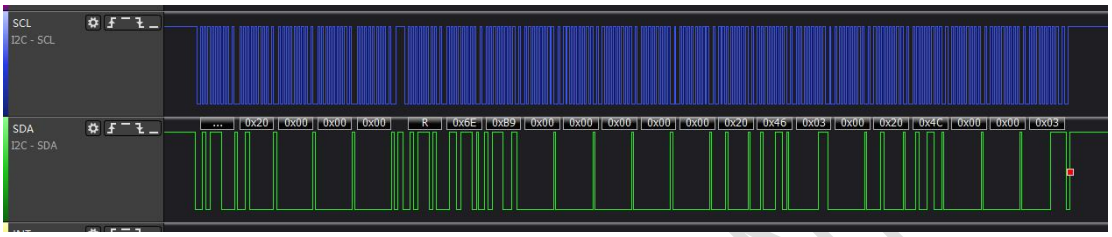
2.2.3 Touchscreen exit gesture mode

Correlation function: **semi_touch_guesture_switch(0);**

W **0x20 0x00 0x00 0x00** 0xFB 0x16 0x02 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x03 0xE9

Or after reset

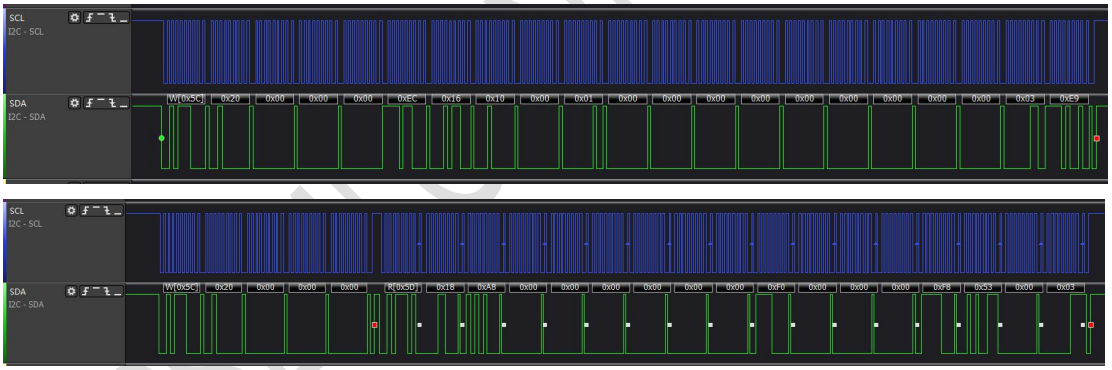




2.2.4 Touchscreen enter glove mode

Correlation function: **semi_touch_glove_switch(1);**

W 0x5C **0x20 x00 x00 x00** 0xEC 0x16 0x10 0x00 0x01 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x03 E9

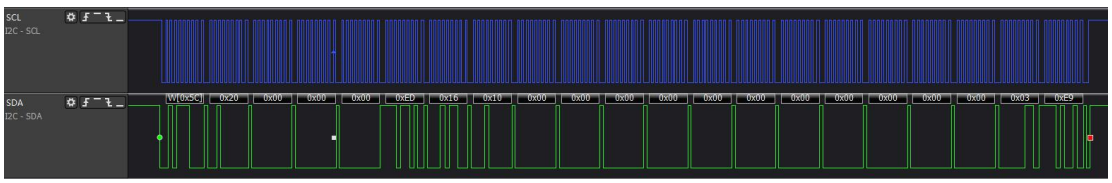


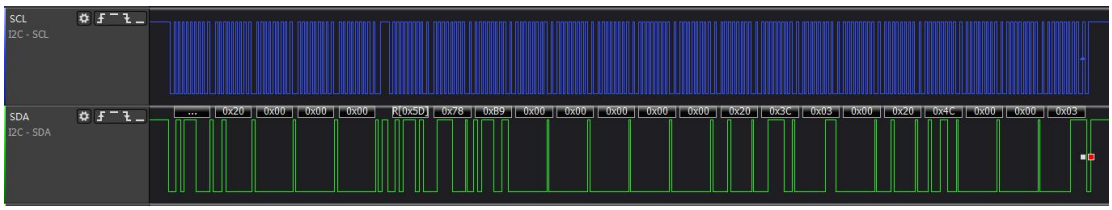
2.2.5 Touchscreen exit glove mode

Correlation function: **semi_touch_glove_switch(0);**

W 0x5C **0x20 x00 x00 x00** 0xED 0x16 0x10 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x03 E9

Or after reset





2.3 Gesture ID

Address	Bit address	Variable Name	Description	Host access
0x2000002D	7:0	gesture_id	0x20 single touch slip to left 0X21 single touch slip to right 0X22 single touch slip to up 0X23 single touch slip to down 0X24 single touch double click 0X25 single touch single click 0X30 single touch the letter O 0X31 single touch the letter W 0X32 single touch the letter M 0X33 single touch the letter e 0X34 single touch the letter C 0X46 single touch the letter S 0X54 single touch the letter V 0X65 single touch the letter Z 0X44 single touch the letter L	R

2.4 Other operations

Address	Byte address	Variable Name	Description	Host access
0x20008000	999:0	**TP_WR_BUFF_ADDR**	1K ram space, which can be used when large amounts of data need to be written to touchscreen	W
0x20008400	999:0	**TP_RD_BUFF_ADDR**	1K ram space, which can be used when it comes to large amounts of data that need to be read from touchscreen	R

Address	Byte address	Variable Name	Description	Host access
0x40008004	3:0	**TP_HOLD_MCU_ADDR**	Write **TP_HOLD_MCU_VAL** to stop TP's MCU	W
		TP_RELEASE_MCU_ADDR	Write **TP_RELEASE_MCU_VAL**	W

			to release of TP's MCU	

Address	Byte address	Variable Name	Description	Host access
0x4000800c	3:0	**TP_AUTO_FEED_ADDR**	Write **TP_AUTO_FEED_VAL** To control TP automatically dog feeding	W

Address	Byte address	Variable Name	Description	Host access
0x40008008	3:0	**TP_REMAP_MCU_ADDR**	Write **TP_REMAP_MCU_VAL** To control TP remap memory address	W