APPLICATION NOTE FOR CTPM_CHIPSEMI

V1.0.1--2023-12-08

Table content

1. I2C Communication

1.1 I²C timing sequence

The CHSC6xxx supports standard I²C interface, and acts as slave.

I²C Master can read any internal register and RAM space of the CHSC6xxx via I²C.

The recommended communication speed is 100-400Kbps.

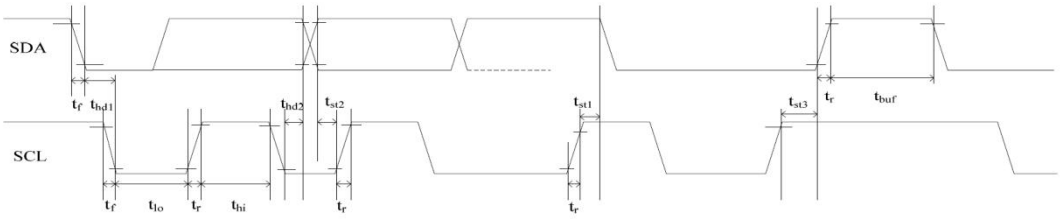


Figure 1. I²C timing sequence

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[15:8] + ACK + ADDR[7:0] + ACK + DATA + ACK + ... + DATA + ACK + STOP

START	id	w	ACK	Addr[15:8]	ACK	Addr[7:0]	ACK	Data[7:0]	ACK	...	Data[7:0]	ACK	STOP

IIC communication reading process:

Step1：Start + 0x5C + ACK + ADDR[15:8] + ACK + ADDR[7:0] + ACK + STOP

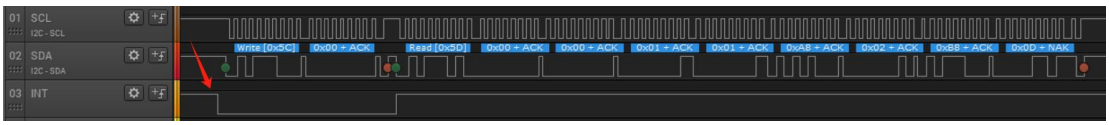
Step2：Start + 0x5D + ACK + DATA + ACK + ... + DATA + NAC K + STOP

STEP1	START	id	w	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

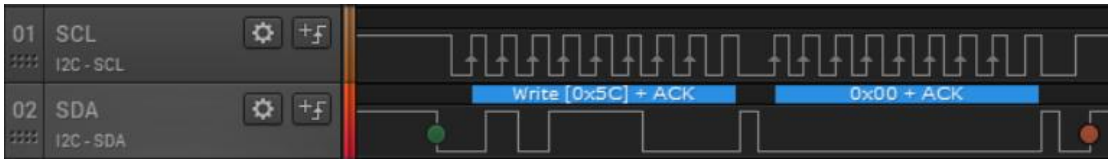
Example:HOST responds to interrupt and reads the waveform of touch coordinate data.

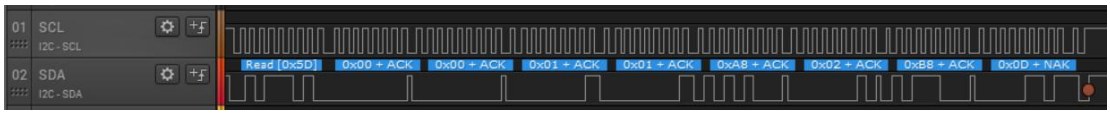
The INT pin of CHSC6XXX triggers an interrupt and HOST reads coordinate data once.



Write device address 0x5C and write 0x00 register addresses

Write device address 0x5D to read touch data of required length





1.3 Format of touch data

Format of touch data reported by CHSC6xxx to HOST.

Address	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
0x00	Reserved: default 0							
0x01	Reserved: default 0							
0x02	The number of touch points							
0x03	point 1: touch event Put down : 0 contact :8 Put up :4				point 1: X coordinate [11:8]			
0x04	point 1: X coordinate [7:0]							
0x05	point 1: Touch ID				point 1: Y coordinate [11:8]			
0x06	point 1: Y coordinate [7:0]							
0x07	point 1:Touch pressure (Reserved)							
0x08	point 1:Touch area (Reserved)							
0x09	point 2: touch event Put down : 0 contact :8 Put up :4				point 2: X coordinate [11:8]			
0x10	point 2: X coordinate [7:0]							
0x11	point 2: Touch ID				point 2: Y coordinate [11:8]			
0x12	point 2: Y coordinate [7:0]							
0x13	point 2:Touch pressure (Reserved)							
0x14	point 2:Touch area (Reserved)							

2.The way the IIC master accesses the touch IC memory

2.1 Direct Address Access (DMA mode)

Direct address access mode, which means that the IIC master can access any address of the chsc6xxx through a 16-bit address. Firmware upgrade, obtaining TP information, etc. must work in this mode.

2.2 Mapping access mode (Mapping mode)

Read and write accesses to TP are mapped to a fixed memory space, and the FW can configure the mapped memory space mentioned here (defined as **MTK_TXRX_BUF**, and set the address to 0x809000). The maximum mapped space size for chsc6xxx read and write operations is 128 bytes. In this mode, the data written on the IIC in addition to the SLAVE address are written as ordinary data to the configured RAM space, when reading operation, the data on the IIC is the data in the configured RAM space, **read coordinates are working in this mode.**

The mapped address access mode is set to prevent the HOST from inadvertently writing incorrect data to the chsc6xx's internal registers, which may cause the IC to fail to run the firmware or unexpected unknown errors

2.3 Switching between two address access modes

By default, chsc6xxx works in the "direct address access mode", and the firmware will switch to the "mapped address access mode" by modifying the register after running, that is, the normal working mode is "mapped address access mode". The driver only needs to call the **tlsc6x_tpd_reset()** function to switch the direct address mode to the mapping address.

When the driver needs to obtain some information of chsc6xxx, such as the firmware version of TP, Vendor ID and Project ID, etc., it is necessary to switch the mapped address access mode to the direct address access mode, and then directly read the corresponding memory area and decode it;

The function interface for the driver to switch the mapped address mode to the direct address access mode is:

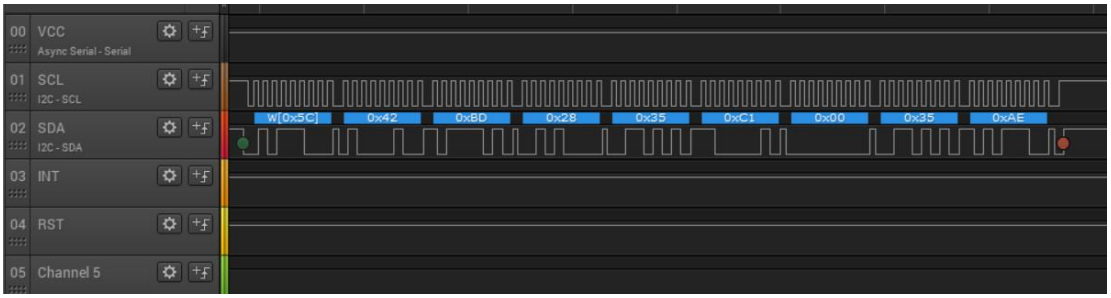
int tlsc6x_set_dd_mode(void)

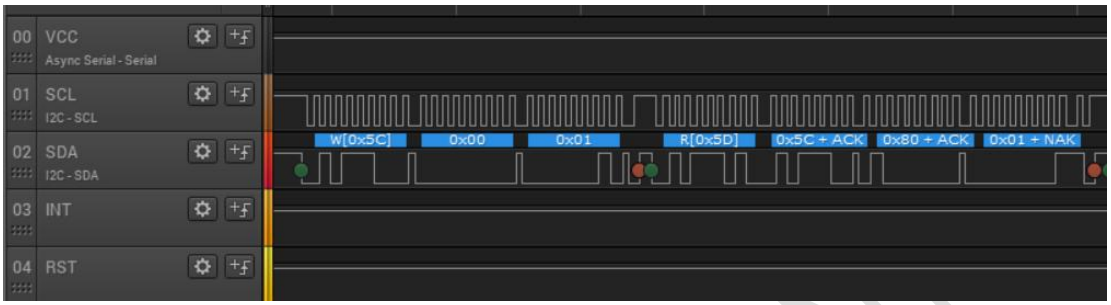
3. Register operation

3.1 Get TP related information

In the first step,reset TP once, and after a delay of 30ms, the HOST write 0x42 0xBD 0x28 0x35 0xC1 0x00 0x35 0xAE switches TP to direct address access mode (DMA). Wait 20ms to check whether the direct address switchover is successful. If the IIC address can be obtained from address 0x0001, it indicates success, as shown in the following figure:

Address	Bit address	Variable Name	Description
0x42BD	15:0	/	Write 0x28 0x35 0xc1 0x00 0x35 0xae to enter DMA mode





3.1.1 VID PID CFG

Address	Bit address	Variable Name	Description
0x9e00	31：0	tlsc_vendor_id tlsc_project_id tlsc_cfg_version	Read out Vendor ID Project ID Configure firmware version from TP

1st Short Type data 0x0E3E: [8:0]-Project ID[8:0], [15:9]-vendor ID[6:0];

2st Short Type data 0x100E: [5:4]-Project ID[10:9], [7:6]-vendor ID[8:7], [15:10]-configure firmware version

Decode:

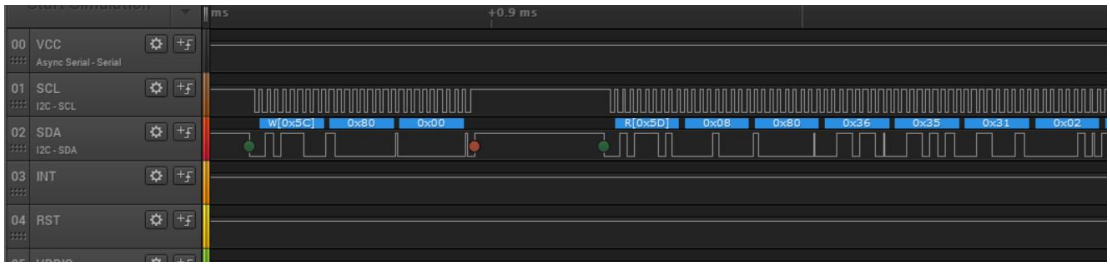
Vendor ID = 0x7;

Project ID = 0x3E;

configure firmware version = 0x4;

3.1.2 Boot firmware version

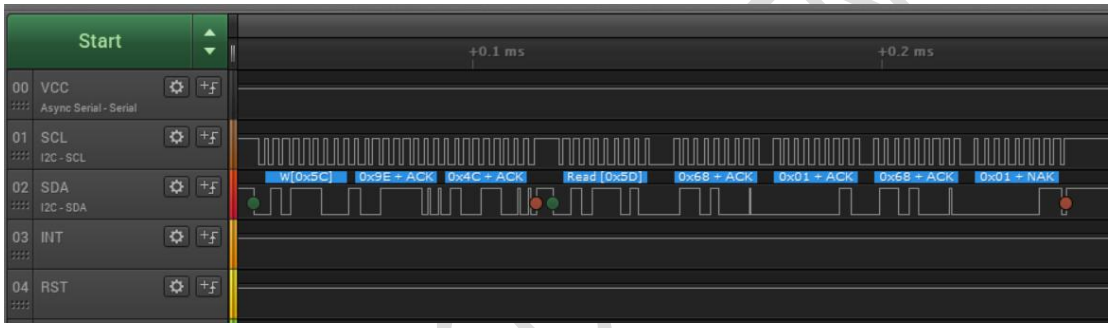
Address	Bit address	Variable Name	Description
0x8004	15:0	tlsc_boot_version	Read boot firmware version



Boot firmware version:0x231

3.1.3 Resolution

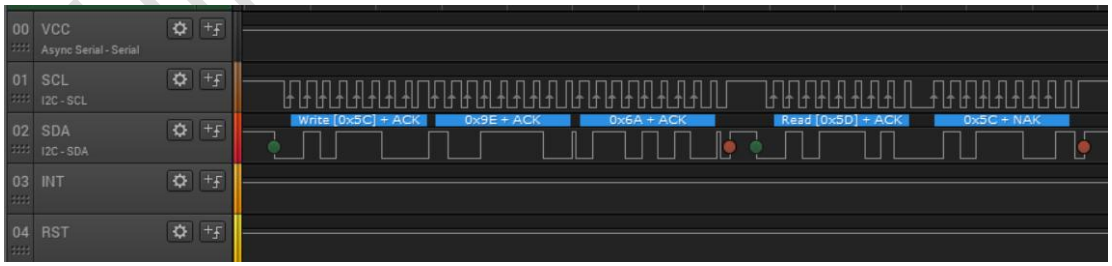
Address	Bit address	Variable Name	Description
0x9e4c	15:0	/	Read out X-direction resolution
0x9e4e	15:0	/	Read out Y-direction resolution



X-direction resolution:0x168
Y-direction resolution:0x168

3.1.4 IIC Address

Address	Bit address	Variable Name	Description
0x9e6a	7:0	/	Read out i2c slave address from TP



3.1.5 Chip Type

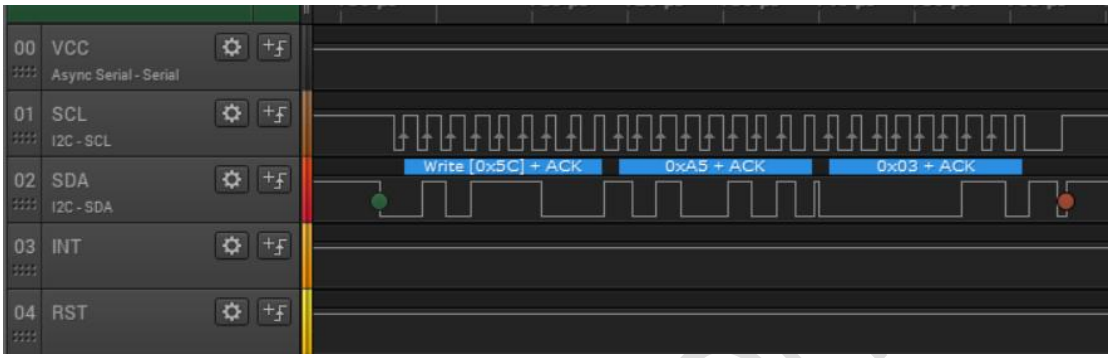
Address	Bit address	Variable Name	Description
0x9e6b	4:0	g_tlsc6x_chip_code	Read out Chip Type from TP

After the read operation is complete, **reset TP to exit the direct address mode or write 0x5 at address 0x03 to switch back to the mapped address mode**.

The following operations are performed in mapped address mode

3.2 Enter sleep mode

Address	Bit address	Variable Name	Description
0xA5	7:0	/	Write 0x03 to enter sleep mode



Exit sleep mode after reset TP once

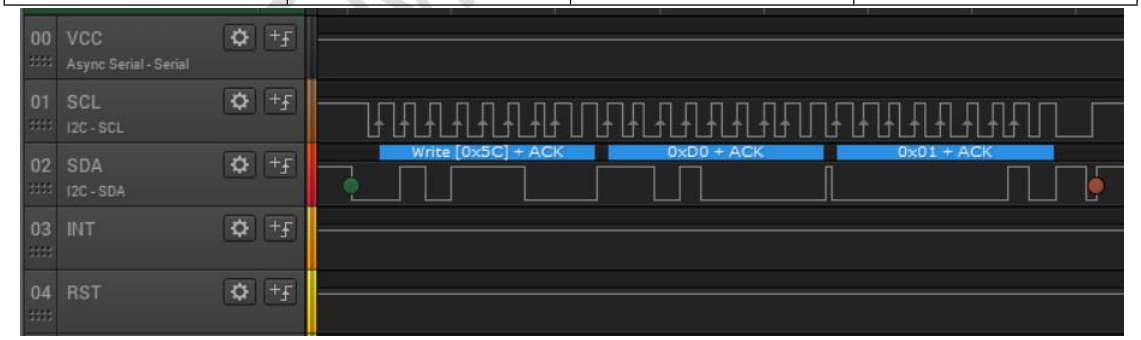
The function interface for the driver:

int tlsc6x_do_suspend(void)

void tlsc6x_resume_work()

3.3 Enter Gesture mode

Address	Bit address	Variable Name	Description
0xD0	7:0	/	Write 0x01 to enter gesture mode Write 0x00 exit



Exit gesture mode after reset TP once (equal to write 0x00)

Gesture ID

Address	Bit address	Variable Name	Description
0xd3	7:0	gestrue_id	0x20 GESTRUE_LEFT 0X21 GESTRUE_RIGHT 0X22 GESTRUE_UP 0X23 GESTRUE_DOWN 0X24 GESTRUE_DOUBLECLICK

			0X30 GESTRUE_O 0X31 GESTRUE_W 0X32 GESTRUE_M 0X33 GESTRUE_E 0X34 GESTRUE_C 0X46 GESTRUE_S 0X54 GESTRUE_V 0X65 GESTRUE_Z 0X44 GESTRUE_L