
High performance mutual capacitance touch controller

1. INTRODUCTION

The CST340 using high-speed MCU core and embedded DSP circuit. Combined with its own fast mutual capacitance detecting technology, it supports single-layer/multi-layer modules and multiple patterns, and it using high-voltage drive above 10V to achieve ultra-high sensitivity and extremely low standby power consumption, and to achieve high performance and real multi-touch (with pressure detection).

2. FEATRUES

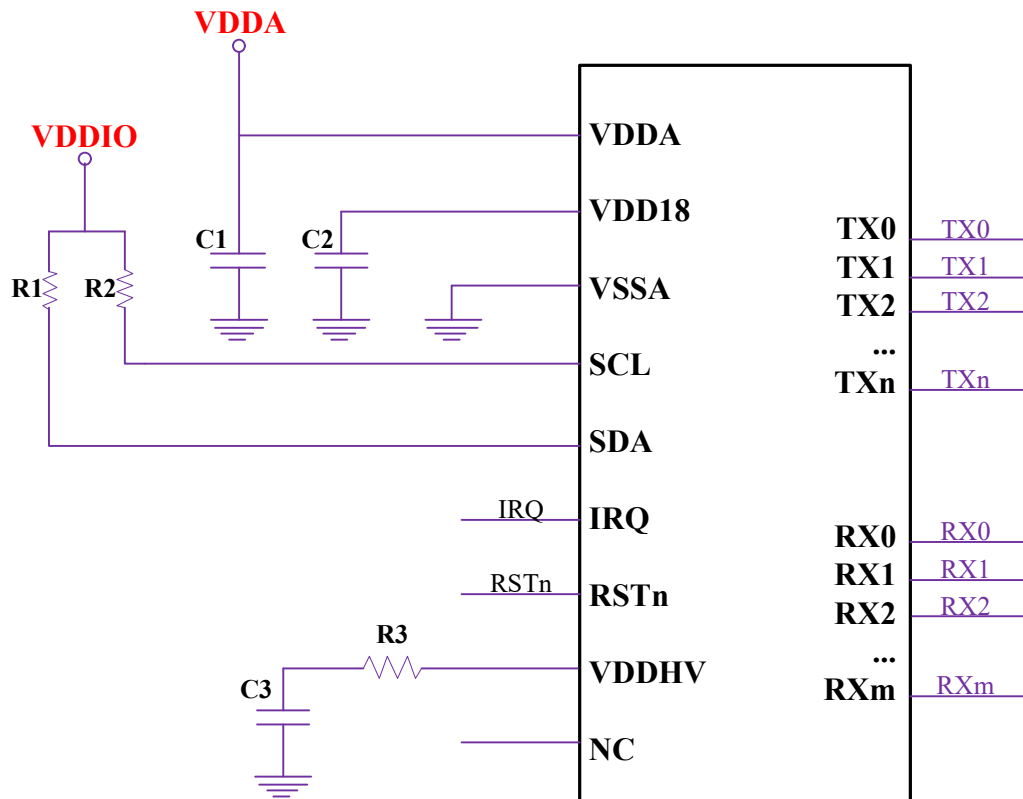
- Fast capacitance detection circuit and high performance DSP module
 - Detecting self capacitance and mutual capacitance;
 - High voltage drive to realize high sensitivity and SNR;
 - Supports passive capacitance touch pen;
 - Supports standby gesture wake-up;
 - Supports On-line Programming;
 - Built-in watchdog;
 - Supports Multiple keys;
- Performance specification
 - Typical refresh rate is 100Hz;
 - Water proof, thumb and palm proof;
 - Typical power consumption in dynamic mode : 4mA;
 - Typical power consumption in monitor mode : 350uA;
 - Typical power consumption in sleep mode : 50uA.

- Capacitive screen support
 - Up to 40 drive/sensing channels and TX/RX are multiplexing;
 - Floating and pulling down channel are supported;
 - Supports traditional DITO and SITO sensor patterns;
 - Automatic module parameters calibration is supported, maximum support impedance is up to 120k;
 - Supported cover Lens thickness: glass<=2mm acrylic<=1mm;
- Communication interface
 - I2C master/slave mode are supported, data rate is configurable from 10Khz to 1Mhz;
 - GPIOs support a variety mode including internal resistor pull up mode;
 - Internal 1.8V LDO, configurable IO voltage level is compatible with 1.8V/VDDA.
 - Output voltage of VDD18 is 1.8V, output voltage of VDDHV is 6~12V.
- Power supply
 - Single-supply operation: 2.7V ~ 3.6V, ripple <= 50mv;
 - Few peripheral components needed.
- Package type: QFN52 6mm*6mm.

3. APPLICATIONS

Cell phone, tablet PC, notebook, touch pad.

4. TYPICAL APPLICATION



C1: 2.2uF/10V

C2: 0.1uF ~ 1uF/10V

C3: 10nF ~ 100nF/16V

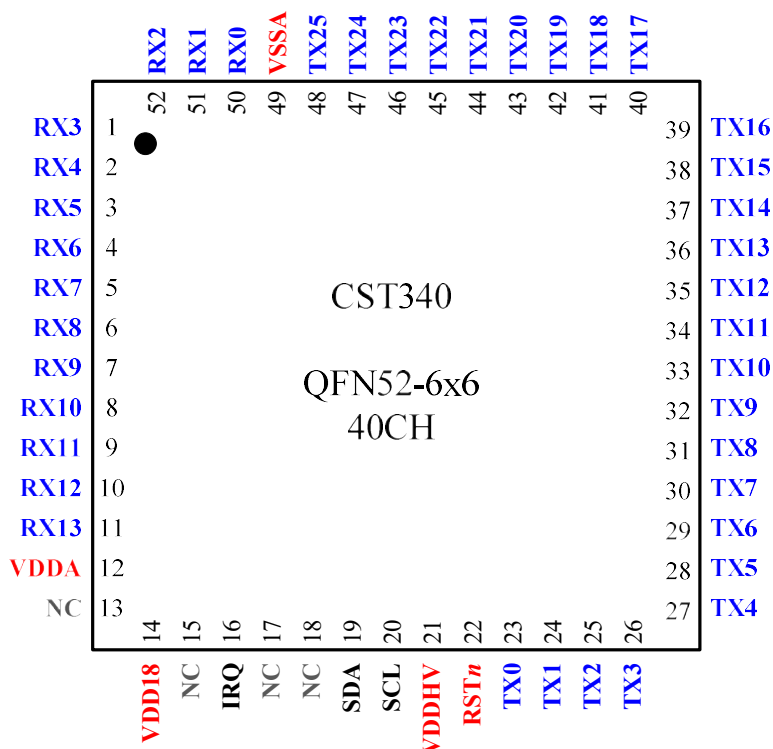
R3: 200Ω

VDDIO: VDDA or VDD18

R1/R2: External pull up resistor or internal 5K pull up resistor

Sensor ID: Floating or connecting unused TX/ RX to GND to assign an ID

5. PIN CONFIGURATIONS



6. PIN FUNCTION DESCRIPTIONS

PIN NO.	NAME	TYPE	DESCRIPTION	PIN	NAME	TYPE	DESCRIPTION
1	RX3	I/O	Rx or Tx channel	27	TX4	I/O	Tx or Rx channel
2	RX4	I/O	Rx or Tx channel	28	TX5	I/O	Tx or Rx channel
3	RX5	I/O	Rx or Tx channel	29	TX6	I/O	Tx or Rx channel
4	RX6	I/O	Rx or Tx channel	30	TX7	I/O	Tx or Rx channel
5	RX7	I/O	Rx or Tx channel	31	TX8	I/O	Tx or Rx channel
6	RX8	I/O	Rx or Tx channel	32	TX9	I/O	Tx or Rx channel
7	RX9	I/O	Rx or Tx channel	33	TX10	I/O	Tx or Rx channel
8	RX10	I/O	Rx or Tx channel	34	TX11	I/O	Tx or Rx channel
9	RX11	I/O	Rx or Tx channel	35	TX12	I/O	Tx or Rx channel
10	RX12	I/O	Rx or Tx channel	36	TX13	I/O	Tx or Rx channel
11	RX13	I/O	Rx or Tx channel	37	TX14	I/O	Tx or Rx channel
12	VDDA	PWR/I	2.7~3.6V, 2.2uF	38	TX15	I/O	Tx or Rx channel
13	NC	NC	NC	39	TX16	I/O	Tx or Rx channel
14	VDD18	PWR/O	1.8V, 0.1~1.0uF	40	TX17	I/O	Tx or Rx channel

15	NC	NC	NC	41	TX18	I/O	Tx or Rx channel
16	IRQ	I/O	IRQ	42	TX19	I/O	Tx or Rx channel
17	NC	NC	NC	43	TX20	I/O	Tx or Rx channel
18	NC	NC	NC	44	TX21	I/O	Tx or Rx channel
19	SDA	I/O	I2C	45	TX22	I/O	Tx or Rx channel
20	SCL	I/O	I2C	46	TX23	I/O	Tx or Rx channel
21	VDDHV	PWR/O	max12V, 10~100nF	47	TX24	I/O	Tx or Rx channel
22	RSTn	I	Active-low	48	TX25	I/O	Tx or Rx channel
23	TX0	I/O	Tx or Rx channel	49	VSSA	GND	VSSA
24	TX1	I/O	Tx or Rx channel	50	RX0	I/O	Rx or Tx channel
25	TX2	I/O	Tx or Rx channel	51	RX1	I/O	Rx or Tx channel
26	TX3	I/O	Tx or Rx channel	52	RX2	I/O	Rx or Tx channel

I Input Only

O Output Only

I/O Input And Output

7. ORDERING GUIDE

Model	Package	Branding description	包装
CST340	QFN52-6*6(P0.40 T0.55)	Direction Dot+LOGO+CST340+PO	2500/Tape & Reel

8. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Typical	Max	Unit	Comments
Operating VDDA	Vdd	2.7	3.0	3.6	V	
Ripple	Vrip	-	-	50	mV	
Analog I/O Tolerance	Vioa	-0.3	-	12	V	
Digital I/O Tolerance	Viod	-0.3	-	3.6	V	
I/O current Tolerance	Iiom	-15	-	15	mA	
Operating Temperature Range	Topr	-40	+25	+85	°C	
Storage Temperature Range	Tstg	-60	-	+125	°C	
Operating Humidity Range	Hopr	-	-	95	%	
ESD HBM	ESD	3000	-	-	V	Human Body Model ESD
ESD MM	ESD	200	-	-	V	Machine Mode
Latch-up Current	LU	-	-	200	mA	

9. ELECTRICAL CHARACTERISTICS

9.1 DC electrical characteristics

Ta = 25 °C, VDDA = 2.8V.

Parameter	Symbol	Min	Typical	Max	Unit
LOW-level output voltage	Vol	-	-	0.3*IOVCC	V
HIGH-level output voltage	Voh	0.7*IOVCC	-	-	V
LOW-level input voltage	Vil	-0.3	-	0.3*IOVCC	V
HIGH-level input voltage	Vih	0.7*IOVCC	-	IOVCC	V
Current (Dynamic)	Iopr	-	4	-	mA
Current (Monitor)	Imon	-	350	-	uA
Current (Standby)	Ista	-	350	-	uA
Current (Sleep)	Islp	-	50	-	uA

9.2 AC electrical characteristics

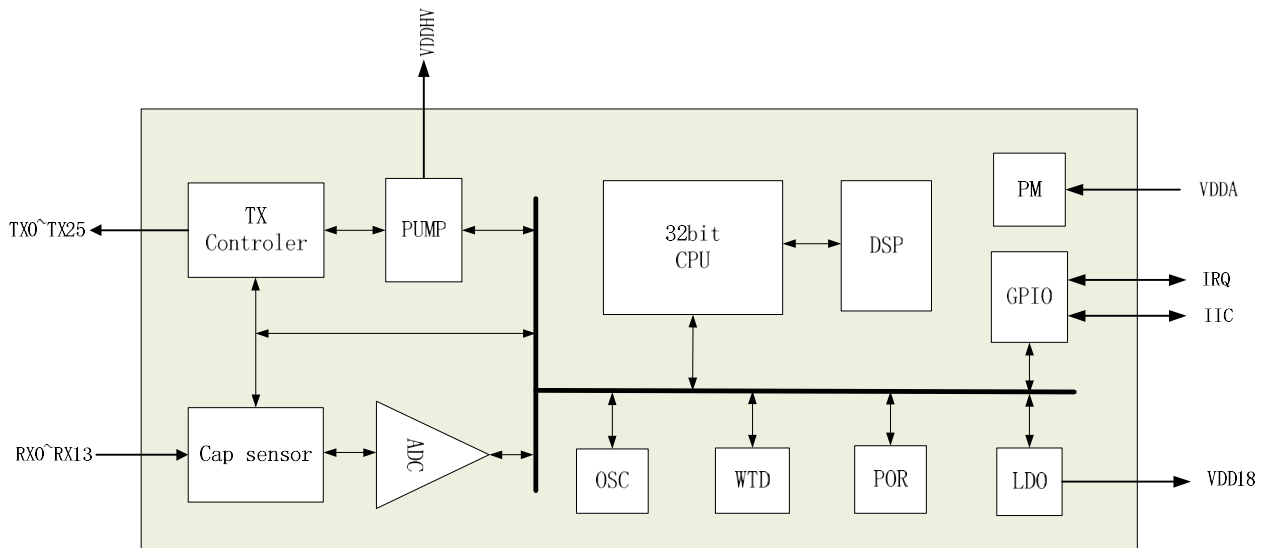
Ta = 25 °C, VDDA = 2.8V.

Parameter	Symbol	Min	Typical	Max	Unit
TX Output Frequency	ftx	-	-	350	KHz
TX Output Voltage	Vtx	-	-	12	V
RX Input Voltage	Vrx	-	1.4	-	V

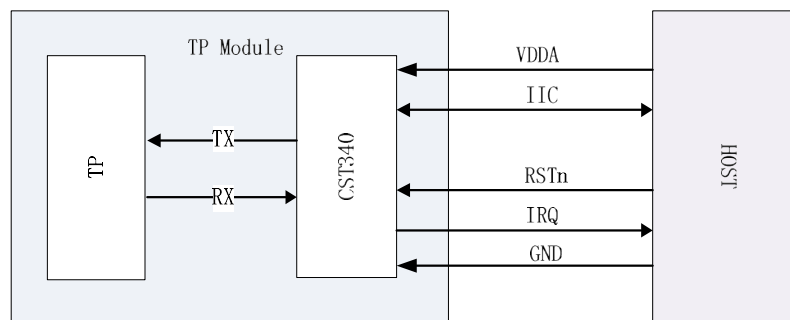
10. FUNCTION DESCRIPTION

The voltage of TX Drive channel is above 10V, compare to traditional low voltage drive touch controller, CST340 provide higher performance with Higher SNR and High sensitivity. Meanwhile, internal Self Capacitance/Mutual Capacitance detecting module works with intelligent scanning algorithm to realize rapid response, excellent water proof capability, noise suppression capability and low power consumption.

Block Diagram:



10.1 Interface For Host



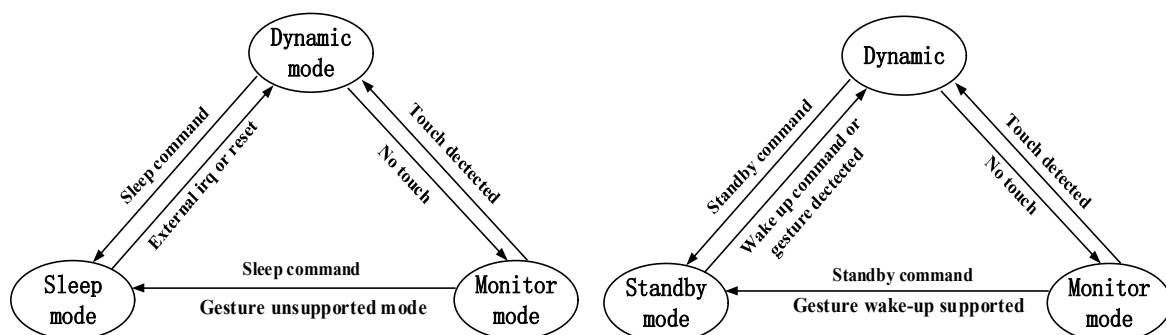
Interface between CST340 and host includes IIC, IRQ, RSTn and VDDA. Interface between CST340 and TP includes TX and RX.

VDDA: Operating voltage of CST340.

SCL and SDA: Serial communication pins of I2C bus, Host: Master, CST340: Slave.

IRQ: Interrupt signal, it is a GPIO, IRQ is used by CST340 to notify host to read when data such as touch data or gesture data is prepared.

10.2 WORK MODE



- Dynamic Mode

When there are frequent touch operations, the chip will be in this mode; In this mode, the touch chip can quickly perform intelligent scanning on the touch screen, detect the touch in time and report it to the host computer;

- Monitor Mode

In this mode, when the touch screen time out without touch action, the chip will automatically switch to the monitor mode; In this mode, the touch chip detects the possible touch action through mutual capacitance scanning at a low frequency, and quickly switches to the active mode;

- Standby Mode

After receiving the standby command, the chip will be in this mode; In this mode, the touch screen is scanned by the touch chip at a low frequency. After matching the wake-up gesture, the touch screen enters into the active mode. Meanwhile, the host is awakened by IRQ pin. You can also switch to active mode with the wake command;

- Sleep Mode

In this mode, the touch chip is in a deep sleep state to minimize power consumption, and can be switched to active mode by wake-up command.

10.3 Channel/Node Configuration

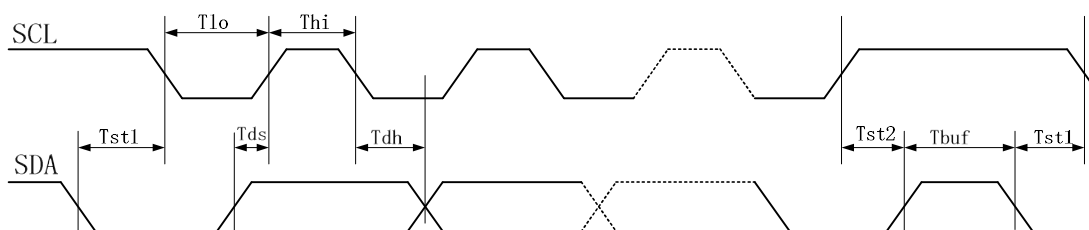
The CST340 multi-touch controller provides up to 40 channels, and each channel can be flexibly configured between the drive/sensing purposes. Each channel supports mutual capacitance scanning.

When assigning drive/sensing pins, Strongly recommended to select continuously arranged pins.

The range of mutual capacitance that each node can support is: 0.5pf ~ 20pF (assuming the driving voltage is 10V);

10.4 I2C Bus

CST340 supports standard I2C bus protocol, data rate is configurable from 10Khz~1Mhz, SCL and SDA pin can be flexibly configured as open drain mode or internal resistor pull up mode.



Description	Symbol	Fast Mode		HS Mode		Unit
		Min	Max	Min	Max	
SCL clock frequency	Fscl	0	400	0	1000	kHz
SCL hold time for START condition	Tstl	0.6	-	0.5	-	us
LOW period of SCL	Tlo	1.3	-	0.26	-	us

HIGH period of SCL	Thi	0.6	-	0.26	-	us
SDA setup time	Tds	0.1	-	0.05	-	us
SDA hold time	Tdh	0	0.9	0	0.9	ns
SCL setup time for STOP condition	Tst2	0.6	-	0.26	-	us
Ready time between STOP and START	Tbuf	20	-	20	-	us

CST340 is always a slave, host initiates a START signal by pulling down SDA when SCL is high.

CST340 checks address(configurable, default value is 0x34/0x35) after START signal, CST340 set SDA as output pin and pull it down in 9th cycle if the address matched, 9 bits data(8 bits payload and 1 bit ACK or NAC) will be sent through SDA in 9 cycles.

STOP signal is also sent by host, it is a STOP signal that SDA is released and pulled up when SCL is high, that means a single data transfer completed.

a. Host write, data format:

S	Slave Address[7bit]	W[1bit]	ACK	DATA[8bit]	ACK	...	DATA[8bit]	ACK/ NACK	P
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b. Host read, data format:

S	Slave Address[7bit]	R[1bit]	ACK	DATA[8bit]	ACK	...	DATA[8bit]	NACK	P
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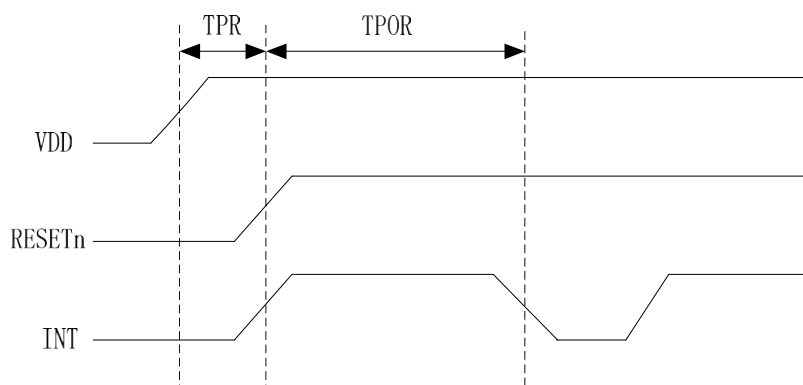
c. Host re-initiates START after writing data to CST340, then reads data from CST340; Sometimes host also re-initiates START after reading data form CST340, then write data to CST340, data format is shown as below:

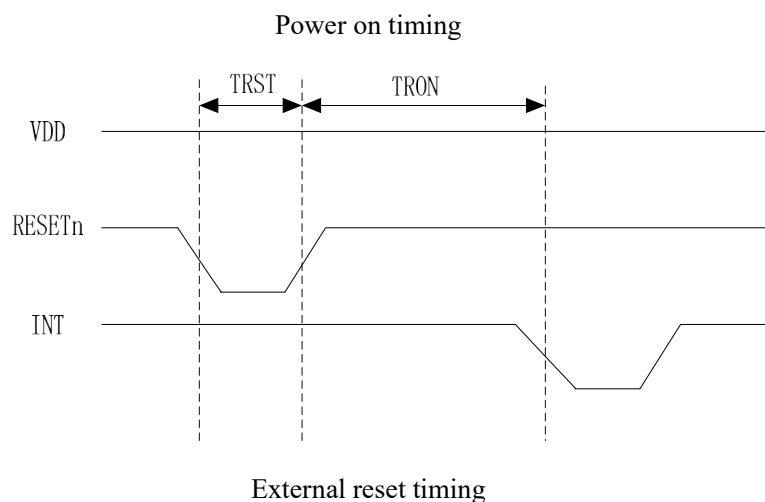
S	Slave Address[7bit]	W[1bit]	ACK	DATA[8bit]	ACK	...	DATA[8bit]	ACK/ NACK	
RS	Slave Address[7bit]	R[1bit]	ACK	DATA[8bit]	ACK	...	DATA[8bit]	NACK	P

10.5 Power On/Reset

Built-in POR module keeps controller in RESET status until voltage is normal, controller will be reset when voltage is lower than threshold, all modules will be reset when the pin RSTn is low, this pin is connected with an internal RC filter, it can be floating, internal watch-dog will be triggered in abnormal status and touch controller will back to normal soon.

Power On Reset timing diagram:





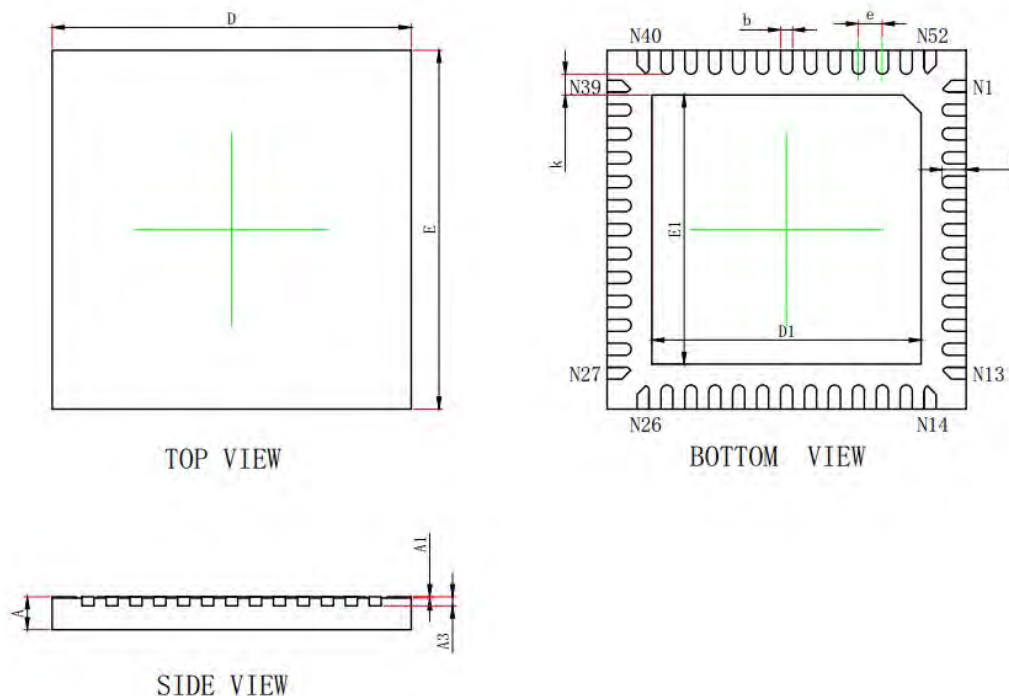
Symbol	Description	Typical	Unit
TPOR	Initialization time after power on	300	ms
TPR	Delay time before pull up RST pin	1	ms
TRON	Initialization time after reset	300	ms
TRST	Reset hold time (pulse width)	0.1	ms

10.6 Interrupt Mode

Touch controller uses IRQ to notify host reading data only valid touching happened, IRQ trigger mode can be configured as rising edge or falling edge to reduce power consumption and CPU burden; In standby mode IRQ can be used to wake up host when gesture happened.

11. Package information

QFN52-6*6(P0.40 T0.55)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A3	0.152REF.		0.006REF.	
D	5.924	6.076	0.233	0.239
E	5.924	6.076	0.233	0.239
D1	4.400	4.600	0.173	0.181
E1	4.400	4.600	0.173	0.181
b	0.150	0.250	0.006	0.010
e	0.400TYP.		0.016TYP.	
k	0.200MIN.		0.008MIN.	
L	0.324	0.476	0.013	0.019

0x8142	R	Product ID (third Byte, ASCII 码)				
0x8143	R	Product ID (forth Byte, ASCII 码)				
0x8144	R	Firmware version (HEX.low byte)				
0x8145	R	Firmware version (HEX.high byte)				
0x8146	R	x coordinate resolution (low byte)				
0x8147	R	x coordinate resolution (high byte)				
0x8148	R	y coordinate resolution (low byte)				
0x8149	R	y coordinate resolution (high byte)				
0x814A	R	Vendor_id (当前模组选项信息)				
0x814B	R	Reserved				
0x814C	R	Reserved				
0x814D	R	Reserved				
0x814E	R/W	buffer status	large detect	Reserved	HaveKey	number of touch points
0x814F	R	track id 为 32, 表明为接近检测的信号				
0x8150	R	PxyOk	Reserved			
0x8151	R	PxyOk	Reserved			
0x8152	R	Reserved				
0x8153	R	Reserved				
0x8154	R	Reserved				
0x8155	R	Reserved				
0x8156	R	Reserved				
0x8157	R	track id				
0x8158	R	point 1 x coordinate (low byte)				
0x8159	R	point 1 x coordinate (high byte)				
0x815A	R	point 1 y coordinate (low byte)				
0x815B	R	point 1 y coordinate (high byte)				
0x815C	R	point 1 size (low byte)				
0x815D	R	point 1 size (high byte)				
0x815E	R	Reserved				
0x815F	R	track id				
0x8160	R	point 2 x coordinate (low byte)				
0x8161	R	point 2 x coordinate (high byte)				
0x8162	R	point 2 y coordinate (low byte)				
0x8163	R	point 2 y coordinate (high byte)				
0x8164	R	point 2 size (low byte)				
0x8165	R	point 2 size (high byte)				
0x8166	R	Reserved				
0x8167	R	track id				
0x8168	R	point 3 x coordinate (low byte)				
0x8169	R	point 3 x coordinate (high byte)				

0x816A	R	point 3 y coordinate (low byte)
0x816B	R	point 3 y coordinate (high byte)
0x816C	R	point 3 size (low byte)
0x816D	R	point 3 size (high byte)
0x816E	R	Reserved
0x816F	R	track id
0x8170	R	point 4 x coordinate (low byte)
0x8171	R	point 4 x coordinate (high byte)
0x8172	R	point 4 y coordinate (low byte)
0x8173	R	point 4 y coordinate (high byte)
0x8174	R	point 4 size (low byte)
0x8175	R	point 4 size (high byte)
0x8176	R	Reserved
0x8177	R	track id
0x8178	R	point 5 x coordinate (low byte)
0x8179	R	point 5 x coordinate (high byte)
0x817A	R	point 5 y coordinate (low byte)
0x817B	R	point 5 y coordinate (high byte)
0x817C	R	point 5 size (low byte)
0x817D	R	point 5 size (high byte)
0x817E	R	Reserved
0x817F	R	track id
0x8180	R	point 6 x coordinate (low byte)
0x8181	R	point 6 x coordinate (high byte)
0x8182	R	point 6 y coordinate (low byte)
0x8183	R	point 6 y coordinate (high byte)
0x8184	R	point 6 size (low byte)
0x8185	R	point 6 size (high byte)
0x8186	R	Reserved
0x8187	R	track id
0x8188	R	point 7 x coordinate (low byte)
0x8189	R	point 7 x coordinate (high byte)
0x818A	R	point 7 y coordinate (low byte)
0x818B	R	point 7 y coordinate (high byte)
0x818C	R	point 7 size (low byte)
0x818D	R	point 7 size (high byte)
0x818E	R	Reserved
0x818F	R	track id
0x8190	R	point 8 x coordinate (low byte)
0x8191	R	point 8 x coordinate (high byte)
0x8192	R	point 8 y coordinate (low byte)