CSK05TN High performance self-capacitance touch controller

1. CSK05TN General Description

The CSK05TN are single-chip self-capacitance touch controller IC with a built-in high-speed MCU. They achieved extremely high sensitivity and low power consumption by its rapid self-capacitance sensing technology.

2. CSK05TN Features

- Built-in high-performance DSP module.
  - Online Program
  - Built-in watch dog
  - Supports multiple keys
- Capacitance key supporting
  - Up to 5 sensing channels
  - Support floating/pull-down mode
  - Auto calibrating parameters
- High efficient power management
  - Active Mode: 2.0mA
  - Monitor Mode: 9uA
  - Touch sensing capacitance support : 5pF~50pF
- Communication interface
  - I2C Master / Slave mode, support up to 400KHz
  - Support 1.8V/3.3V Logic level
- Power supply
  - Single Power supply : 2.8V ~ 3.6V ripple <= 50mv
- Package：QFNWB3*3-20L(P0.4T0.55)

3. CSK05TN Typical Applications

Consumer electronics, electronic toys.

4. CSK05TN Schematic Diagram

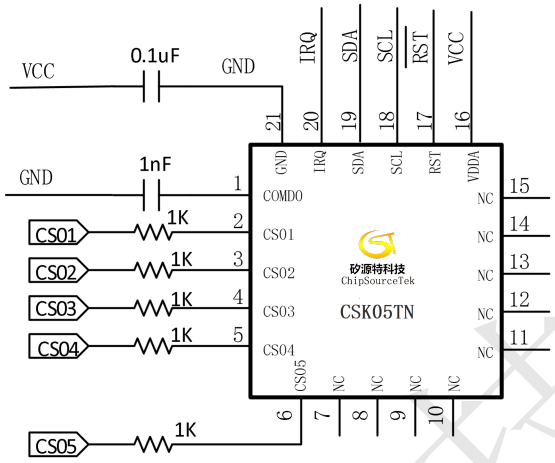
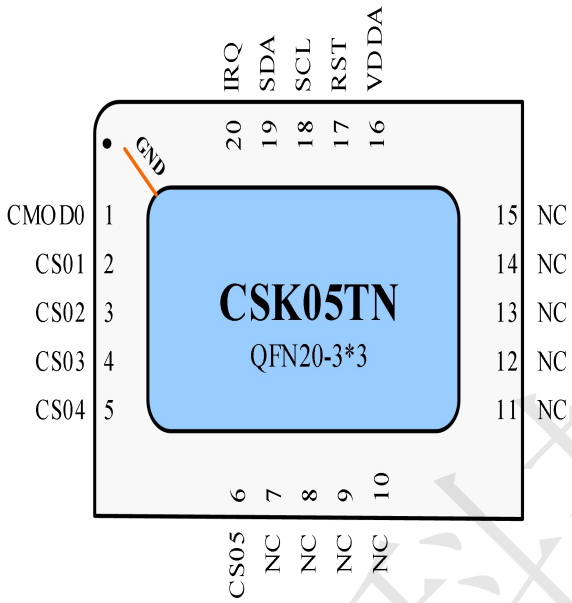


Figure 1. Schematic Diagram

Note:

- CMOD capacitor requirements: NPO/COG capacitor, 10% accuracy at least.
- CMOD capacitor range is 1nF-5.6nF.1nF is selected in most cases. Optimum value depends on the capacitor to be measured.
- CMOD filter capacitor must be placed as close to corresponding pin as possible, keep line as short as possible.

5. CSK05TN Pin Map and Functions



Symbol	Description	Comment
CS01~CS05	Sensor channels	Capacitance sensor
VDDA	Power	Analog power supply (2.8V~3.6V), A 2.2uF~ 10uF ceramic capacitor to ground is required.
CMOD0	Power	Charge pump LDO internally.A 1nF~5.6nF ceramic to ground is required
IRQ	Interrupt output	Rising / falling edge
SCL / SDA	I2C pins	Internal pull up or open drain is configurable
RST	Reset input	External Reset ,Low is active, floating is allowed
GND	Substrate	Connect to GND, NC is not allowed

6. CSK05TN Ordering Information

Part number	Package type	Surface printing	MOQ
CSK05TN	QFNWB3*3-20L(P0.4T0.55)	CSK05T XXXXX	take-up package（5000）

Table 2. Ordering information

7. CSK05TN Function Description

The CSK05TN are single-chip self-capacitance touch controller IC. built-in high-speed MCU. they has Has excellent anti-noise, waterproof, low power consumption performance.

7.1. Power on / reset

Built-in power on reset circuit,no need external reset circuit. Reset pin can be floating.

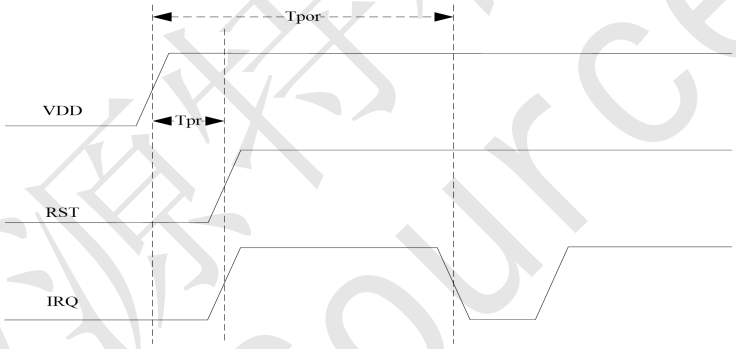


Figure 3. Power on reset timing

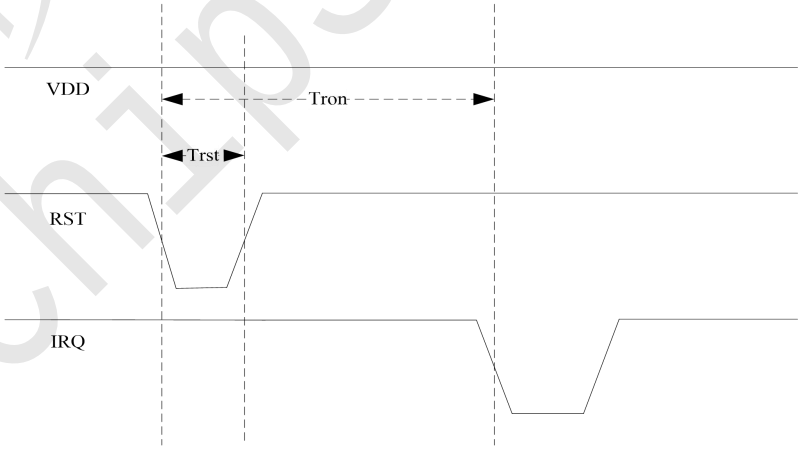


Figure 4: External reset timing

Symbol	Description	Min	Max	Unit
Tpor	Initializing time after power on	100	-	mS
Tpr	RST pin pull up delay time	5	-	mS
Tron	Re-initializing time after reset	100	-	mS
Trst	Reset pulse width	0.1	-	mS

Table 3. Power on reset timing description

7.2. Work modes

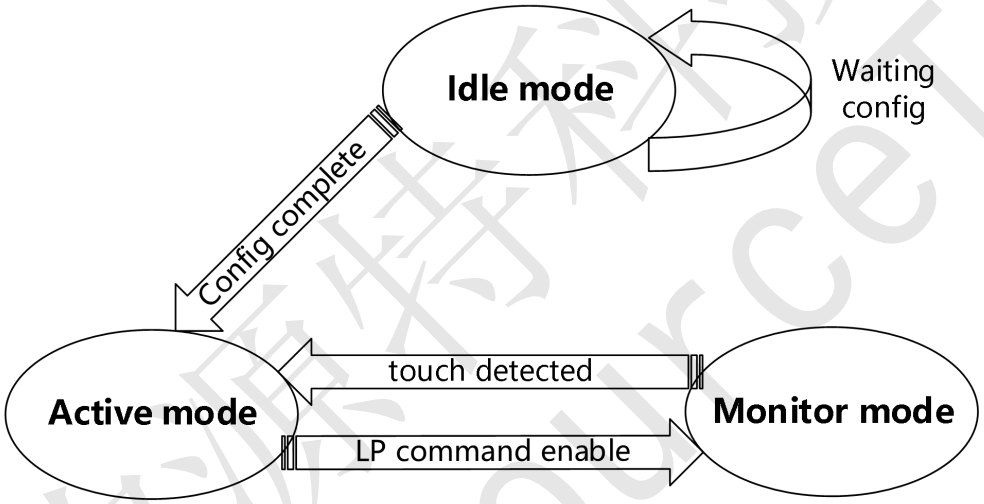


Figure 5. *Work mode switching*

Idle mode

After the CST05TN power on. They working in this mode waiting to be configured from the host.

Active mode

When there is a touch operation, when working in this mode touch controller scans keys quickly and report touch event to host timely.

Monitor mode

When low power mode is enabled and no touch is detected and timeout. Touch controller switches to monitor mode. In this mode, the touch chip detects possible touch actions through self-capacitance scanning at a lower frequency, and quickly switches to active mode.

7.3. Interrupt mode

When there is a touch event, the IRQ pin outputs a pulse to notify the host to read the key data.

Interrupt trigger is configurable rising / falling edge.

7.4. I2C interface description

Supports 10-400k I2c slave communication. A stop signal should be added between two data packets. It is not recommended to use restart to start the next communication directly. The communication sequence is under the specific operation.

a) Device I2C address

Touch controller I2c salve address is 0x15（7bit）, in other words, write address is 0x2A, read address is 0x2B.

b) I2C Speed

In order to ensure the reliability of communication, it is recommended to use a maximum communication rate of 400Kbps

a) Write single byte

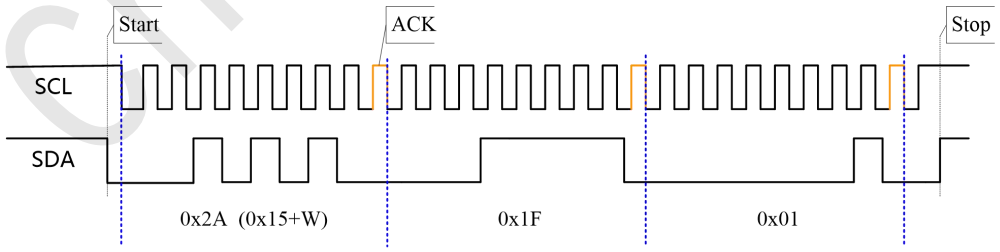


Figure 6. Write 0x01 to register address 0x1F

b) Write multiple bytes consecutively

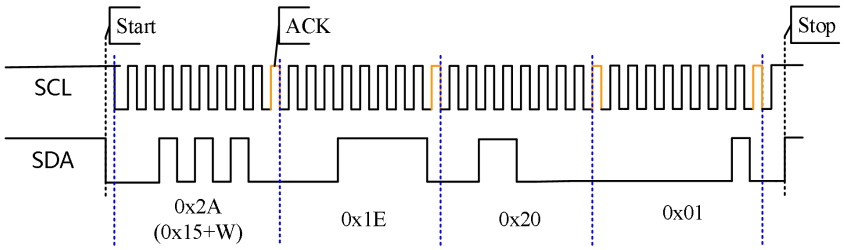


Figure 7. Write 0x20 to 0x1E and 0x01 to 0x1F

c) Read single byte

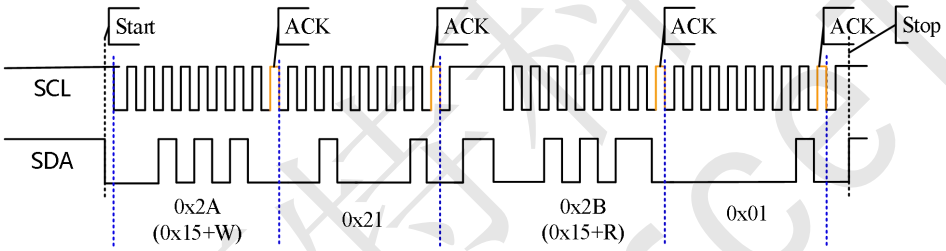


Figure 8. Read single byte from 0x21

d) Read multiple bytes consecutively

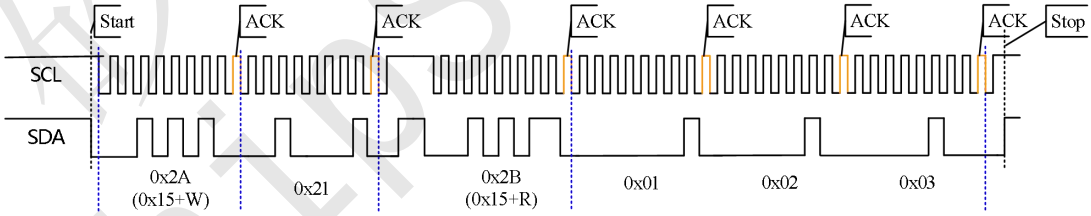


Figure 9. Read 3 bytes from 0x21, 0x22 and 0x23

e) Timing description

Symbol	Description	Min	Typical	Max	Unit
F SCLI2C	SCL clock frequency	10	-	400	kHz
t HDSTAI2C	Hold time after (repeated) START. After this period, the first clock is generated.	0.6	-	-	us
t LOWI2C	Low period of the SCL pin	1.3	-	-	us
t HIGHI2C	High period of the SCL pin	0.6	-	-	us
t SUSTAI2C	Setup time for a repeated START	0.6	-	-	us
t SUDATI2C	Data setup time	100	-	-	ns
t SUSTOI2C	Setup time for STOP	0.6	-	-	us
t BUFI2C	Bus free time between START and STOP	4.5	-	-	us

Table 4. I2C timing description

8. CSK05TN Application Design Specifications

8.1. Power supply decoupling capacitors:

Between VDD and GND A 2.2uF~ 10uF ceramic capacitor to ground is required. Keep the input lines as short as possible.

8.2. CMOD filter capacitor:

Use NPO/COG capacitor, 10% accuracy at least, the capacitor range is from 1nF to 5.6nF, 1nF is selected in most cases, it must be placed as close to CMOD pin as possible, keep line as short as possible.

8.3. Ground:

Internal high accuracy sensing circuit of touch controller is sensitive to ground line, Use star wiring grounding is strongly recommended to reduce noise from other chips if possible. Inserting magnetic beads in GND can enhance the anti-interference ability.

Try to separate touch controller ground from the ground of high current device if star wiring grounding is difficult to implement.

9. CSK05TN Electrical Characteristics

Absolute Maximum Ratings

Symbol	Description	Min	Typical	Max	Unit
TSTG	Storage temperature	-40	25	125	℃
Ta	Ambient temperature	-20	-	85	℃
Vdd	Supply voltage	-0.3	-	+3.6	V
Vio	Digital input voltage	VSS-0.3	-	VDD+0.3	V
LU	Latch-up current	-	200	-	mA

Table 5. Absolute Maximum Ratings

AC electrical performance（*Ambient temperature=25 ℃, VDDA=3.3V*）

Symbol	Description	Min	Typical	Max	Unit
txRST	External reset pulse width	-	0.1	-	mS
tPOWERUP	Time from the end of POR to the first CPU code execution	-	4	-	mS
FGPIO	GPIO switch frequency	-	2	-	MHz
tRISE	Pin voltage rising time, Cload=50pF	-	32	-	nS
tFALL	Pin voltage falling time, Cload=50pF	-	11.2	-	nS

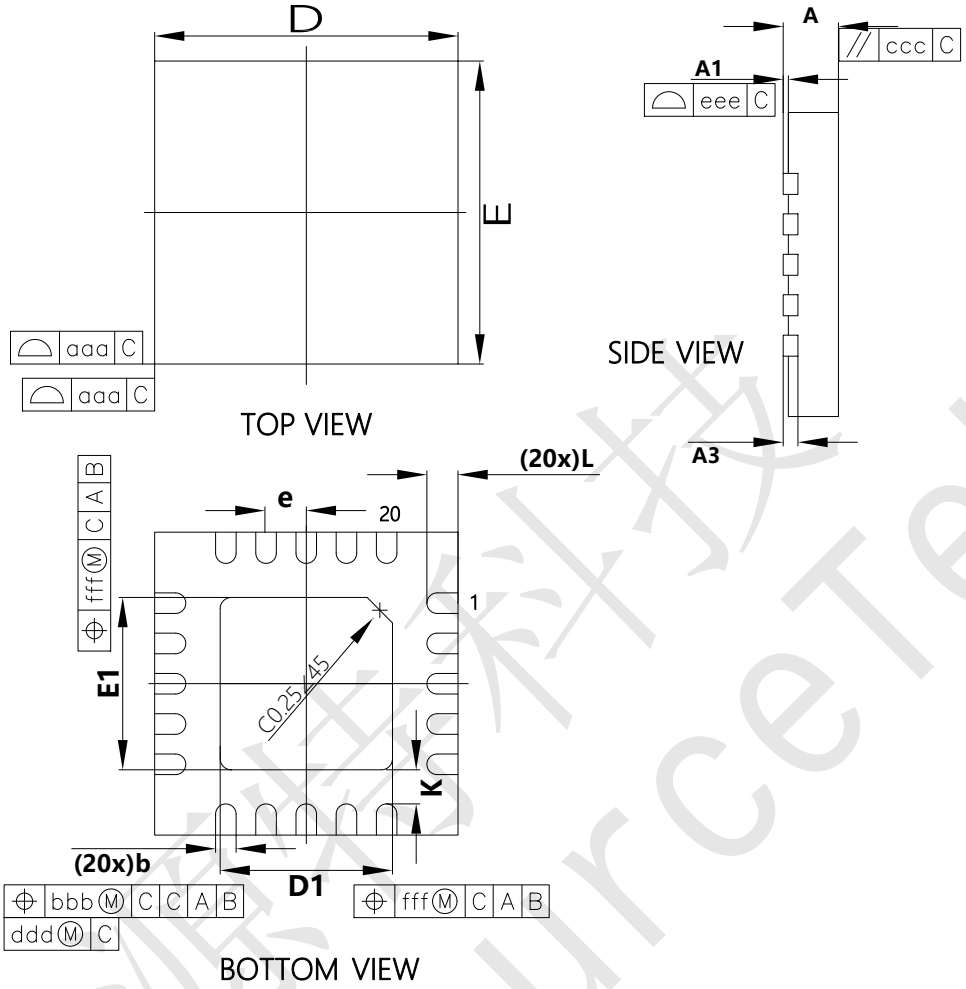
Table 6. AC electrical characteristics

DC electrical performance（*Ambient temperature=25 ℃, VDDA=3.3V*）

Symbol	Description	Min	Typical	Max	Unit
Vdd	Supply voltage	2.8	3.0	3.6	V
Voh	High level output voltage	0.7*Vdd	-	-	V
Vol	Low level output voltage	-	-	0.3*Vdd	V
Ioh	High level output current	-	2.0	-	mA
Iol	Low level sink current	-	20.0	-	mA
Vil	Low level input voltage	-	-	0.3*Vdd	V
Vih	High level input voltage	0.7*Vdd	-	-	V
Iil	Input leakage current	-	10	-	nA
Idd1	Vdd supply current(Active mode)	-	2.0	-	mA
Idd2	Vdd supply current(monitor mode)	-	9	-	uA

Table 7. DC electrical characteristics

10. CSK05TN Package Information



DIM / SYMBOL	Min	Nom	Max
A	0.50	0.55	0.60
A1	0.00	0.02	0.05
A3	--	0.152REF	--
b	0.15	0.20	0.25
D		3.00BSC	
E		3.00BSC	
D1	1.60	1.70	1.80
E1	1.60	1.70	1.80
e		0.40BSC.	
L	0.20	0.30	0.40
K	0.20	0.35	--
aaa		0.10	
bbb		0.07-0.1	
ccc		0.10	
ddd		N/A	
eee		0.08	
fff		0.10	

11. Revision History

Version	Modify the content
V1.1	Revised seal information
V1.0	initial release