DATASHEET

CST5106S

Self-capacitive touch controller

GENERAL DESCRIPTION

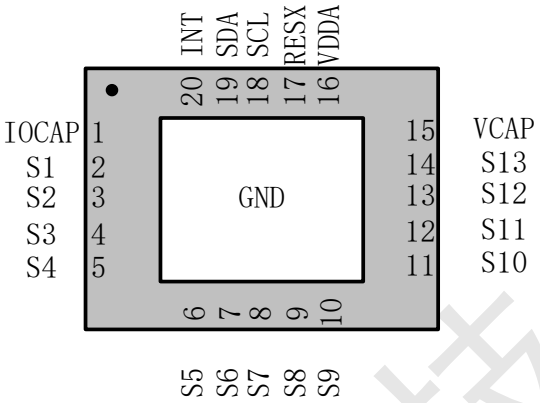
CST5106S is a high-performance self-capacitor touch controller that supports various self-capacitor sensor patterns and has excellent signal-to-noise ratio to achieve high accuracy and linearity while maintaining ultra-low power consumption. It is very suitable for portable mobile devices such as smart watches and smart bracelets.

1 CST5106S Features

1.1 Key features

- Highly sensitive self-capacitance detection technology
- Support up to 13 channels
- The maximum screen size is 3 inches
- Support GF, GG, OGS and other screen structure
- Support various ITO Sensor patterns (triangles, squares, etc.)
- Support four work modes: Normal mode, Idle mode, LPWG (low power wake-up gesture) mode, Sleep mode
- The sleep mode power consumption is as low as 5uA, the LPWG mode consumption is as low as 10uA, the Idle mode consumption is as low as 100uA, and the normal mode power consumption is as low as 1.2mA
- Touch point report rate up to 240Hz;
- Auto calibration
- Supports I2C interfaces
- Support online programming
- Single power supply 2.7V to 3.6V
- Package：QFN20 3x3x0.55mm
- The CST5106S is dedicated for self-capacitive touch panel; its typical applications are listed as follows:
  - Smart watch, Smart bracelet
  - GPS navigator
  - Digital camera
  - Game consoles
  - Portable media player

1.2 Pin layout



PIN Name	Description	Note
S1~S13	Sensor channels	
SCL/SDA	IIC	I2C clock input /I2C data input and output
RESX	Reset input	active low
INT	Interrupt output	External interrupt to the host
IOCAP	Connect 1uF capacitor	
VCAP	Connect 1uF capacitor	
VDDA	Power supply	2.7~3.6V，Connect 1-10uF capacitor

2 CST5106S Function Overview

2.1 Block diagram

The overall system block diagram of the CST5106S is shown as Figure below.

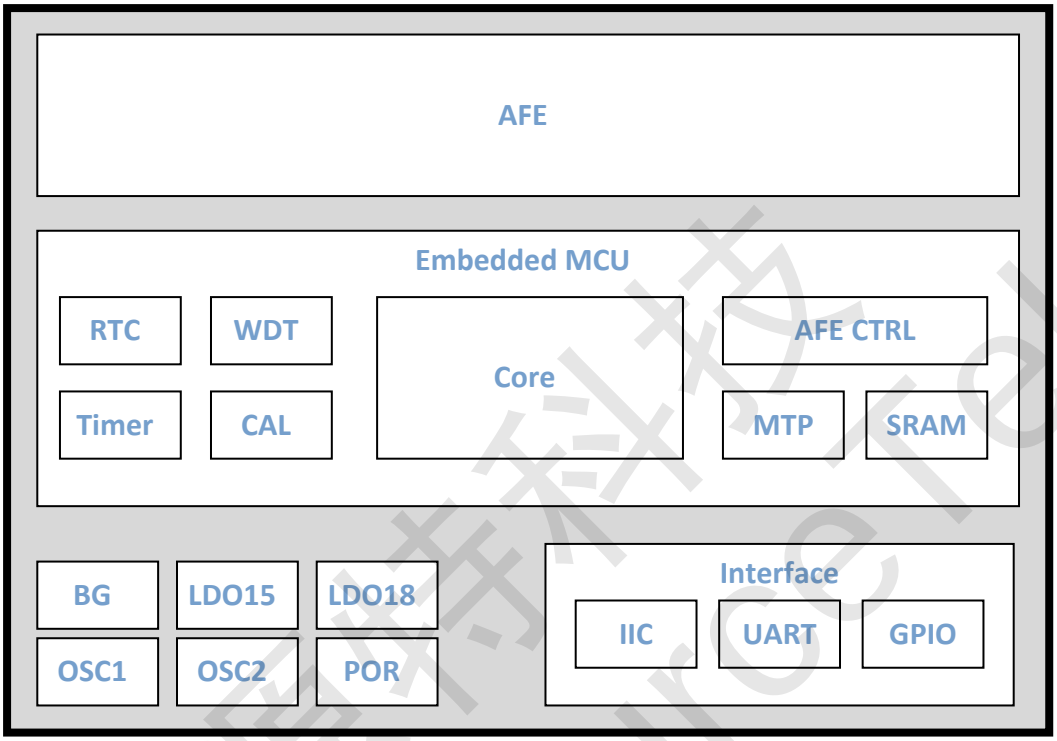


Figure: block diagram

2.1.1 AFE

AFE channels connect with CTP sensors, scan by sending AC signals to the sensors and process the received signals, which finally be converted by ADC and sent to MCU.

2.1.2 Interface

IIC is main communication interface which support slave mode only and support up to 400KHz transfer speed. Detail of IIC communication please refer to Chapter 3.

UART is normally used as debug function. It supports up to 1MHz baud rate.

GPIO (pins: “INT”, “SDA”, “SCL”) high level voltage can be configurated to 1.8V or VDDA by setting internal register. “INT” signal is used to inform HOST to get touch information or just wakeup HOST.

2.1.3 Embedded MCU

Embedded MCU bases on a high efficiency core.

MTP is used to store firmware and run.

SRAM is for system use.

AFE CTRL module is the interface between MCU and AFE. User can configurate AFE CTRL registers to generate control signals to AFE. AFE also inform MCU current state through AFE CTRL module.

RTC works with OSC2. It is used to support low-power scan mode, in which OSC1 can be shut down and AFE scan is triggered automatically.

CAL module is designed for speeding up data process.

Timer can be used to generate a precise latency.

WDT is used to ensure the stability of chip when in operation.

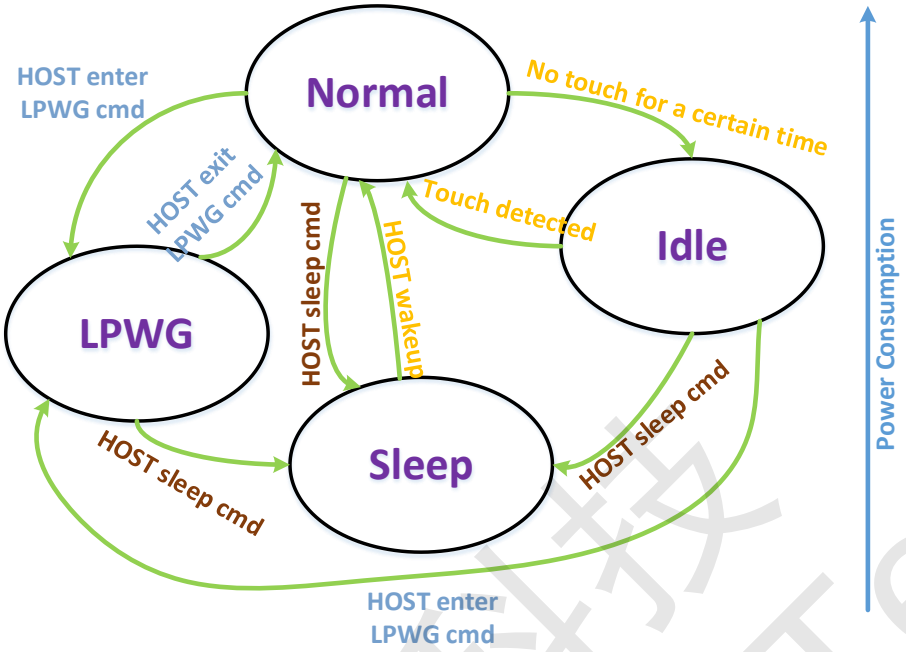
Complex signal processing algorithms are implemented by MCU to detect the touch events reliably and efficiently. Communication protocol is also implemented by MCU to exchange touch or control information with HOST.

2.2 Work modes

There are four work modes available:

- Normal mode
- Idle mode
- LPWG mode
- Sleep mode

Work modes switching conditions are shown as below:



Figure：Work modes

2.2.1 Normal mode

In normal mode, AFE scans the touch screen panel, MCU will detect touch actions and report touch information in a configurable rate (Known as scan-rate or report-rate).

2.2.2 Idle mode

When there is no touch for a configurable interval, MCU automatically switch into idle mode. In idle mode, AFE scans the touch screen panel with a relatively lower scan-rate (also configurable) to reduce power consumption. Majority of the algorithms will be canceled, and only simple detection algorithms is retained to detect if there is a touch. Once a touch is detected, MCU will immediately switch back to normal mode.

2.2.3 LPWG mode

In LPWG (Low Power Wakeup Gesture) mode, AFE works more like idle mode but scans the touch screen panel in a more efficient way, so the power consumption can be reduced. In this mode, touch information would not be sent to HOST. Instead, MCU will inform HOST that the designed gesture is recognized. A simple way is, MCU pull down INT signal for a while, HOST can judge INT signal to wakeup system.

2.2.4 Sleep mode

In sleep mode, MCU enters ultra low-power mode and can be wakeup by IIC. The power consumption in this mode is extremely small, can greatly extend the standby time of portable devices.

3 Communication Interface

The connection from host to CST5106S is shown as below:

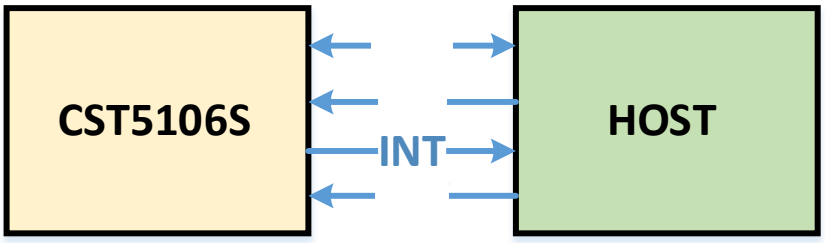


Figure: interface

INT signal is used to inform HOST that there are touch events and touch information is ready. INT signal idle level can be configurated as low or high. When there are touch events, INT signal is set to active level until HOST read the touch information. If HOST haven't read the touch information, INT signal would retain active level until next touch events update. So, HOST can use either level or edge trigger-mode interrupt to respond INT signal.

RST signal is used to reset CST5106S by setting low level for a while then setting back to high level.

IIC interface is used to transfer data between CST5106S and HOST. Write/Read protocols are shown as below:

Figure: IIC write/Read operation

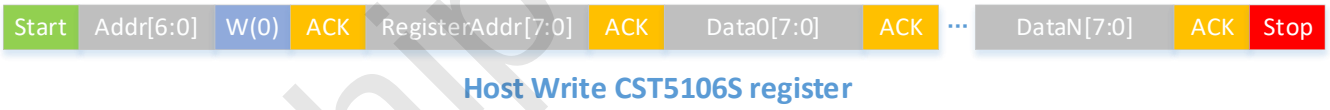


Figure: Host write CST5106S register

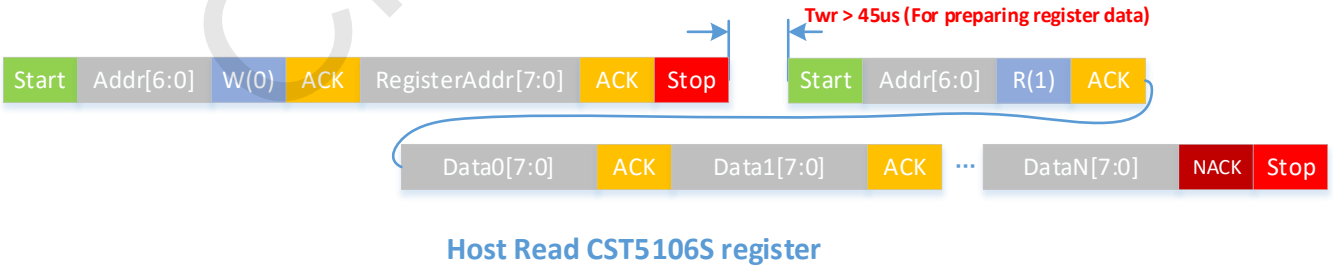


Figure: Host read CST5106S register

4 CST5106S Electrical Specifications

4.1 Absolute maximum ratings

Table: Absolute Maximum Ratings

Characteristics	Sym.	Min.	Max	Unit	Test Condition
Supply Voltage	VDDA	-0.3	5	V	
Storage temperature Range	T_{Str}	-55	150	℃	

4.2 Recommended operating condition

Table: Recommended operation condition

Item	Sym.	Min	Typ.	Max	Unit	Condition
Power-supply voltage	VDDA	2.7	3.3	3.6	V	
Operating Temperature Range	T_{Opr}	-40		85	℃	

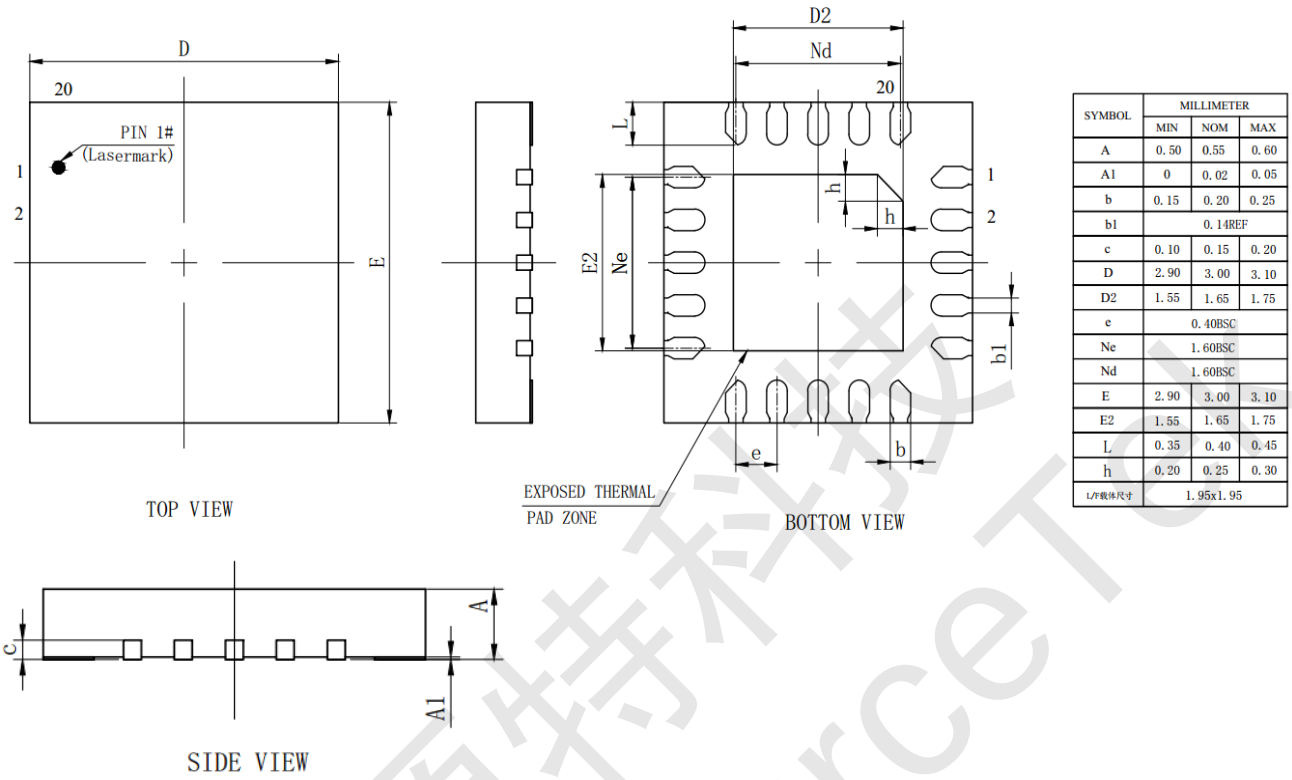
4.3 AC characteristics

Table: AC Characteristics

Parameter	Sym.	Min	Typ.	Max	Unit	Condition
Digital inputs/outputs						
Input high voltage	VIH	0.7 × IOVCC		IOVCC	V	
Input low voltage	VIL	GND		0.3 × IOVCC	V	
Output high voltage	VOH	0.7 × IOVCC		IOVCC	V	
Output low voltage	VOL	GND		0.3 × IOVCC	V	

NOTE: IOVCC=VDDA or 1.8V

5 CST5106S Package



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.50	0.55	0.60
A1	0	0.02	0.05
b	0.15	0.20	0.25
b1		0.14REF	
c	0.10	0.15	0.20
D	2.90	3.00	3.10
D2	1.55	1.65	1.75
e		0.40BSC	
Ne		1.60BSC	
Nd		1.60BSC	
E	2.90	3.00	3.10
E2	1.55	1.65	1.75
L	0.35	0.40	0.45
h	0.20	0.25	0.30
L/F载体尺寸		1.95x1.95	

6 CST5106S Ordering information

Product Series	Package Type	Packing Method	Ordering Number	Minimum Order Quantity
CST5106S	20-pin 3x3x0.55mm QFN	TR	CST5106S	5000

7 DISCLAIMER

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