

Hynitron Microelectronics Co., Ltd.



CST816S Data sheet

High performance self-capacitance touch chip

Rev: V1.3

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1. Overview

CST816S self-capacitance touch chip, using high-speed MCU core and embedded DSP circuit, combined with its own fast self-capacitance sensing technology, can support a variety of self-capacitance patterns including triangles.

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2. Chip characteristics

◆ Built-in mutual capacitance detection circuit and high performance DSP module

- ◇ Support online programming;
- ◇ Built-in watchdog;
- ◇ Multiple buttons support;
- ◇ Support standby gesture wake-up function;

◆ Capacitive screen support

- ◇ Supports up to 13 sensing channels; Built-in watchdog;
- ◇ Support channel floating/pull down design;
- ◇ Module parameters are automatically adjusted;

◆ Performance

- ◇ Refresh rate > 100Hz;
- ◇ Single point gesture and real two-point operation;
- ◇ Typical power consumption in dynamic mode < 2.5mA;
- ◇ Typical power consumption in standby mode < 10uA;
- ◇ Typical power consumption in sleep mode < 5uA;

◆ Communication Interface

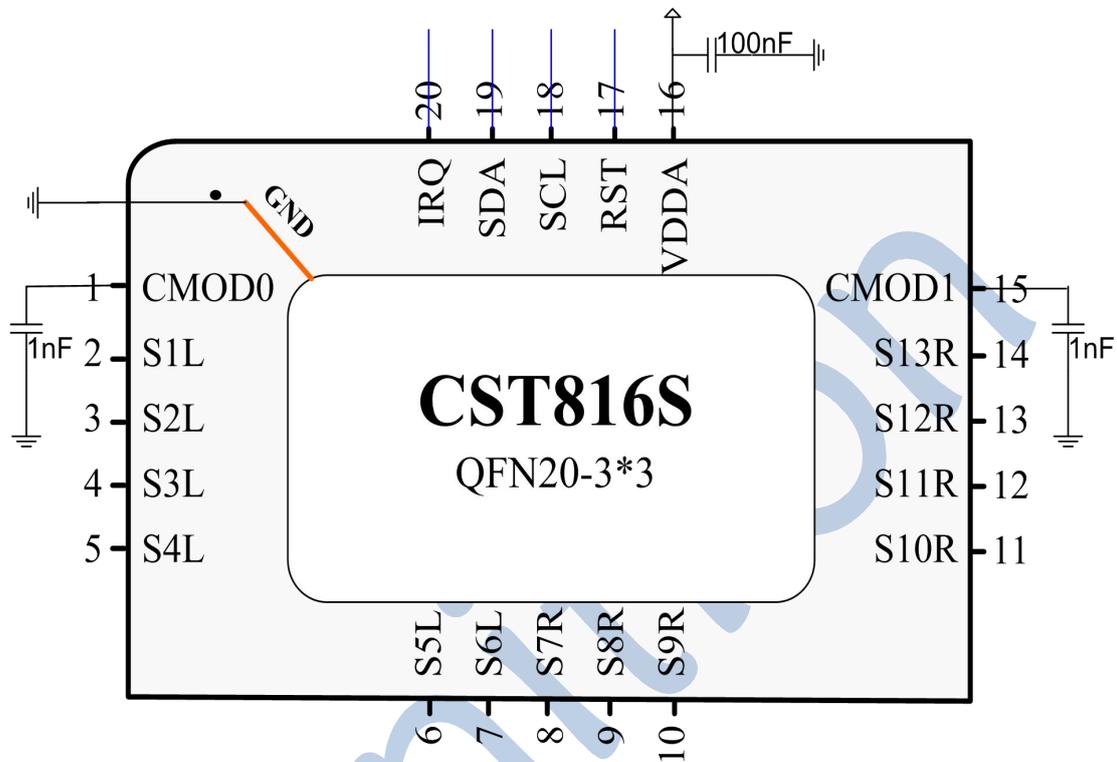
- ◇ I2C master/slave communication interface, configurable rate range 10KHz~1MHz;
- ◇ Compatible with 1.8V/3.3V interface levels;

◆ Power supply

- ◇ Single power supply range 2.7V ~ 3.6V, power supply ripple <= 50mV;

◆ Package type: QFN20 3mm*3mm*0.4mm

3. Pinout / Description



Pin name	Description	Remarks
S1~S13	Sensing channels	
VDDA	Power supply	2.7V~3.6V, connect 2.2uF~10uF capacitor
CMOD0/CMOD1	Stabilizing capacitor	Connection 1nF~5.6nF stabilizing capacitor
IRQ	Interrupt output	Up/Down edge optional
SCL/SDA	I2C	Optional internal pull-up/open drain mode
RST	Reset input	Active low

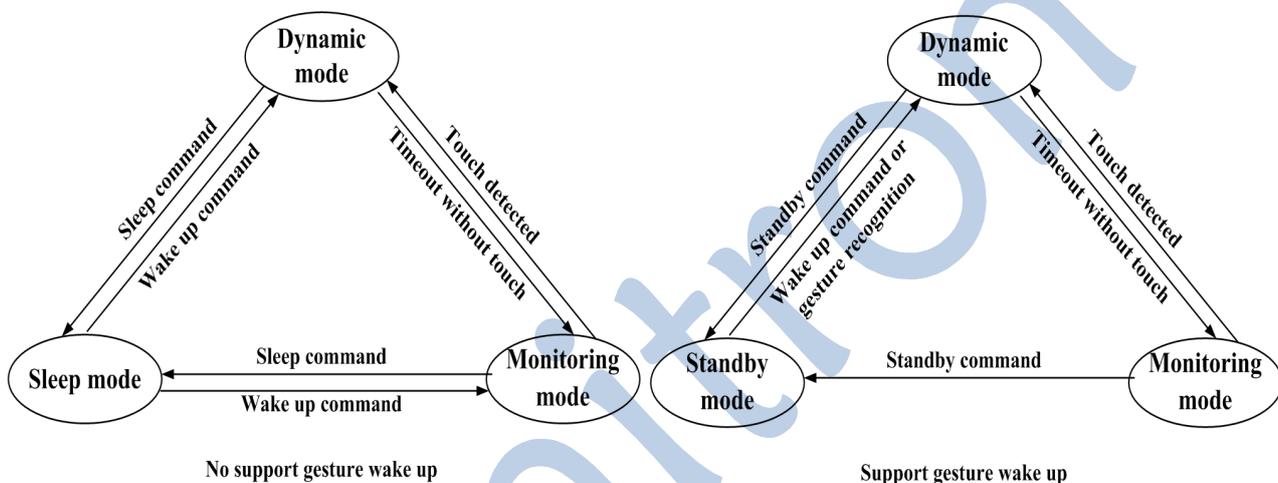
Remarks:

1. CMOD0/CMOD1 must be connected to a voltage regulator capacitor, and the size is 1nF ~5.6nF.

4. Functional description

CST816S self-capacitance touch chip, through its built-in fast self-capacitance sensor module, can realize single-point gesture and real two-point function on triangles and other patterns without any external devices (except circuit bypass capacitor); the chip has excellent anti-noise, waterproof and low-power performance while achieving rapid response.

4.1 Operating mode



- **Dynamic mode**
When there is frequent touch operation, it is in this mode. In this mode, The touch chip quickly performs self-capacitance scanning on the touch screen, to detect the touch and report it to the host. After not touching 2S, automatically enter standby mode. The function of automatically entering standby mode can be controlled by register.
- **Monitoring mode**
When the touch screen timeout has no touch action, the chip automatically switches to the monitoring mode. In this mode, the touch chip detects a possible touch action by scanning at a lower frequency, and quickly switches to the dynamic mode.
- **Standby mode**
After receiving the standby command, it is in this mode. In this mode, the touch chip scans the touch screen at a lower frequency, and enters the dynamic mode after the matching wake-up gesture is completed. At the same time, the touch chip wakes up the host through the IRQ pin, or switches to dynamic mode through the wake-up command.
- **Sleep mode**
After receiving the sleep command, the chip is in this mode. In this mode, the touch chip is in a deep sleep state to maximize power consumption, and can be switched to the dynamic

mode by the wake-up command.

4.2 Channels/nodes configuration

The CST816S self-capacitance touch chip provides up to 13 sensing channels, each of which supports self-capacitance scanning without the need for an external device.

The range of self-capacitance that can be supported per channel: 1pF ~ 400pF.

4.3 Power on/Reset

The built-in power-on reset module will keep the chip in reset until the voltage is normal. When the voltage is lower than a certain threshold, the chip will also be reset. When the external reset pin $RSTn$ is low, the whole chip will be reset. This pin has a built-in pull-up resistor and RC filter, which can also be left floating. The built-in watchdog ensures that the chip can still return to normal operation within the specified time when an abnormal situation occurs.

4.4 Low power mode

The CST816S Self-capacitance touch chip supports the following low power modes:

➤ Sleep mode

After the host sends a sleep command to the chip, the chip will immediately enter deep sleep mode to achieve the lowest power consumption; after receiving the wake-up command, the chip will wake up and enter the dynamic working mode.

➤ Standby mode

In this mode, the chip is always at a lower frequency for minimal scanning to match predefined wake gestures.

4.5 I2C communication

The chip supports the standard I2C communication protocol, which can achieve the 10KHz~1MHz compatible communication rate.

Two I2C pins, SCL and SDA, support both open-drain mode and internal pull-up mode for flexible selection.

4.6 Interrupt mode

The touch chip only informs the host to read valid data through the IRQ pin when it detects a valid touch and needs to report it to the host, so as to improve efficiency and reduce CPU load.

The interrupt edge can be configured as a rising edge or a falling edge as needed.

The IRQ pin is also used to wake up the host when matching predefined gestures in standby mode.

5.Register specification

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6. Application design specification

6.1 Power supply decoupling capacitor

Generally, a 0.1 μ F and 10 μ F ceramic capacitor is connected in parallel at the VDD and VSS terminals of the chip to perform the function of untwisting and bypassing. The untwisting capacitor should be placed as close as possible to the chip to minimize the current loop area.

6.2 COMD filter capacitor

The filter capacitor uses a NPO/COG material capacitor with at least 10% accuracy. The capacitance value can be selected from 1nF to 5.6nF, and 1.5nF is generally selected. The specific optimum value is related to the corresponding body capacitance. The COMD filter capacitor must be placed close to the corresponding pin of the chip, and the trace between the chip and the chip should be as short as possible.

6.3 Waterproof precautions

Do not have a large solid ground around the Sensor and its traces. For large areas of ground, it must be broken.

6.4 ESD considerations

The design of the FPC will directly affect the effect of the ESD. At the time of design, the following must be noted:

- The FPC uses magnetic film as much as possible for full shielding, and the magnetic film must be grounded.
- The position where the FPC and Sensor are attached is as far as possible from the gap of the assembled mechanism to reduce the impact of ESD.
- Power access can be considered to increase TVS pipe to ground to enhance ESD immunity.

6.5 Electromagnetic interference precautions

Sensor traces must be isolated from lines that may cause interference, such as power traces, audio lines, LCD drive lines, Bluetooth antennas, RF antennas, and more. In particular, when the TP adopts the full-fit design, it may be interfered by the LCD. In this case, the parameters of the TP need special debugging.

6.6 Ground wire

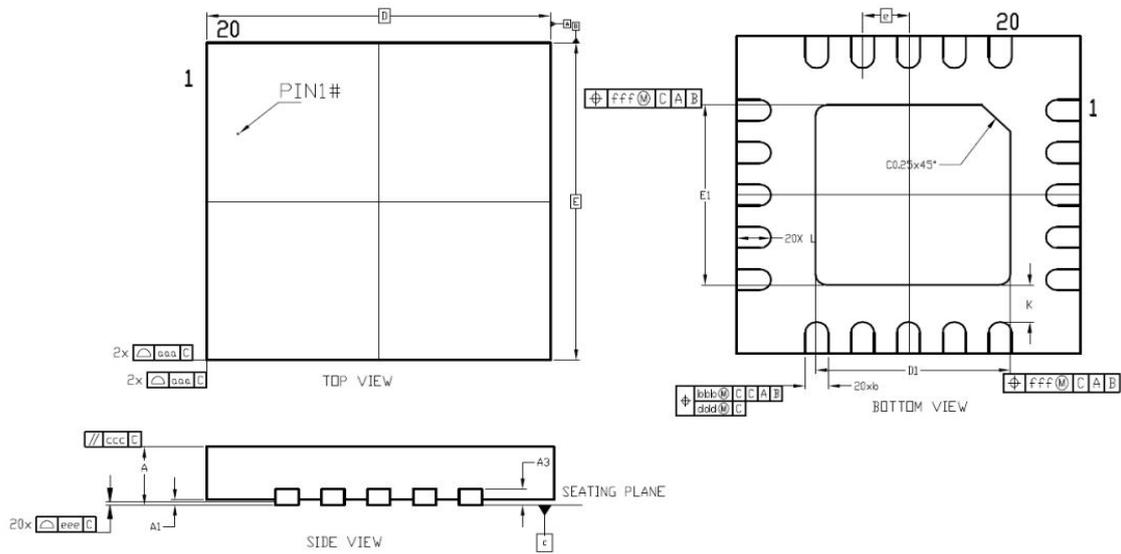
The high-precision detection lines inside the touch chip are sensitive to the ground line. If possible, the user should use star ground to isolate the noise of other chips. At the same time, magnetic beads are inserted in the ground as much as possible to enhance the anti-interference ability. If the star grounding is difficult to implement, the user should also try to separate the ground of the high current device from the trace of the touch chip.

7. Electrical characteristics

Ambient temperature 25 °C, VDDA = 3.3V.

Parameters	Minimum value	Typical value	Maximum value	unit
Operating Voltage	2.7	3.3	3.6	V
Operating temperature	-40	+25	+85	°C
Storage temperature	-60	-	+150	°C
Working humidity	-	-	95	%
Power ripple	-	-	50	mV
Working current(Dynamic mode)	-	2.5	-	mA
Working current(Standby mode)	-	10	-	uA
Working current(Sleep mode)	-	5	-	uA

8. Product packaging



QFN20 外形图

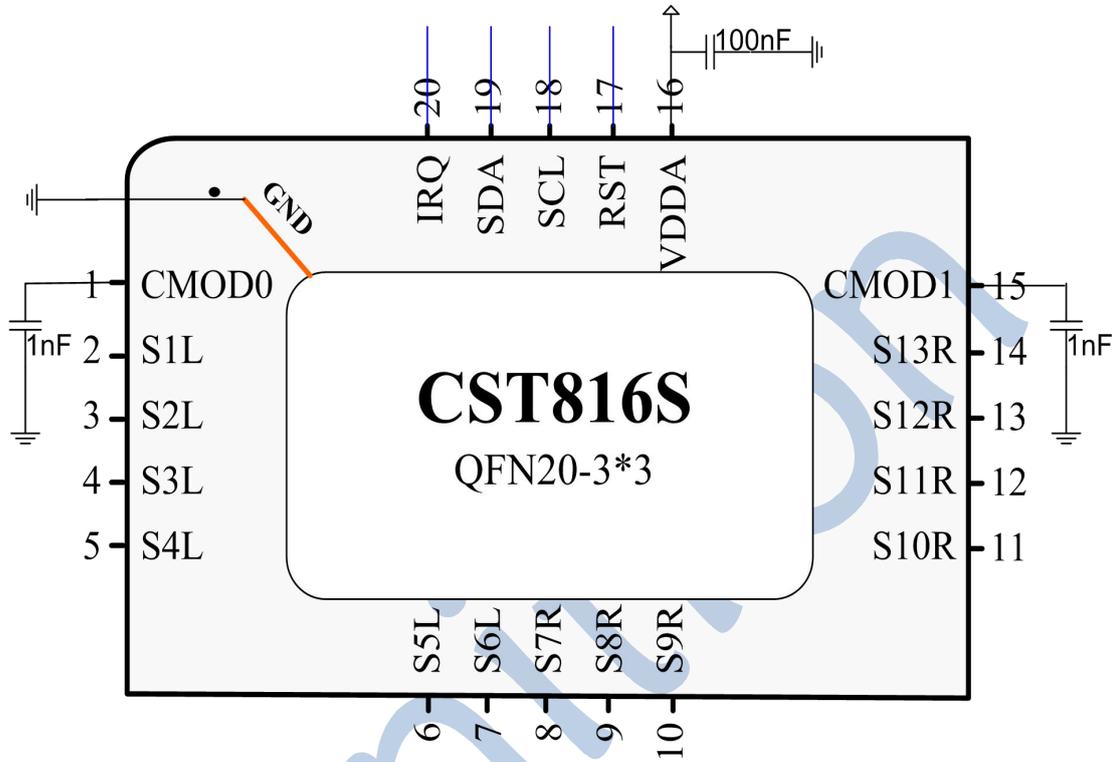
1. QF20 outline drawing

DIM SYMBOL	MIN.	NOM.	MAX.
A	0.50	0.55	0.60
A1	0	0.02	0.05
A3	-	0.152 REF	-
b	0.15	0.20	0.25
D	3.00BSC		
E	3.00BSC		
D2	1.60	1.70	1.80
E2	1.60	1.70	1.80
e	0.40BSC		
L	0.25	0.30	0.35
K	0.20	-	-
aaa	0.10		
bbb	0.07		
ccc	0.10		
ddd	0.05		
eee	0.08		
fff	0.10		

QFN20 外形尺寸

2. QF20 dimensions

9. Reference circuit



Revision history

Version	Revision history
V1.3	Modify electrical characteristics
V1.2	Add reference circuit
V1.1	Add Electrical characteristics
V1.0	Initial version

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