



**WTC6208BSI Inductive touch key chip of eight-channel electric capacitance
Fast Browsing (V1.5)**

Model distinction	Standard substance: WTC6208BSI Low power consumption: WTC6208BSI-L
Number of keys	3-8 keys
Technical principle	Capacitive to digital conversion technology
Key response mode	Single key mode, only one key can be operated at a time
Dimension of key sense element	Minimum 3mm ×3mm, maximum 30mm ×30mm, to be determined according to actual demand and panel thickness
Spacing of key sense element	Minimum spacing 0.5mm, to be determined according to actual demand
Shape of key sense element	Arbitrary polygon, rotundity or ellipse, either panel with hole in the middle or hollow panel (optional)
Material of key sense element	PCB copper coil, sheet metal, flat-top cylinder spring, conductive rubber, conductive ink, ITO layer of conductive glass, etc.
Requirements for PCB	Single-sided PCB and double-sided PCB
Panel material	Insulating materials, such as organic glass, ordinary glass, tempered glass, plastic, wood timber, paper, ceramics and stone
Panel thickness	0 – 20 mm
Adjustment method of key sensitivity	Key sensitivity can be adjusted by changing value of base capacitance CSEL.
Effective touch response time	Less than 150 ms
Water resistance	Watering or spraying water on the panel will not cause malfunction of keys; when flooded or with water accumulation, no abnormal response occurs by touching the panel.
RFI resistance	Effectively suppress RFI (radio frequency interference) caused when GSM cell phone is used to make a call or answer a call next to the panel or a talk proceeds next to the panel over high-power walkie-talkie.
Operating voltage range	WTC6208BSI: 3.3V-5.5V WTC6208BSI-L: 2.2V-5.5V
Operating temperature range	–40°C—+85°C
Data transmission interface	BCD interface (8421 code)
Storage temperature range	–50°C—+125C
Chip sealing mode	SSOP16(150MIL)
Typical application	Various home appliances, security equipment, communication equipment, industrial control equipment & instruments, entertainment equipment, medical equipment, sport facilities, toy,etc.



Table of Contents

- 1. Product Introduction..... 3
 - 1.1. Product Overview..... 3
 - 1.2. Technical Principle..... 3
 - 1.3. High production efficiency..... 3
 - 1.4. Adapt to different thickness panels..... 3
 - 1.5. Chip Package Type..... 3
- 2. Technical Features and Parameters..... 3
 - 2.1. Technical Features..... 3
 - 2.1.1. Simple Peripheral Circuits, and A Few Peripheral Components..... 3
 - 2.1.2. Debugging-free Production and Excellent Long-time Working Stability..... 4
 - 2.1.3. The user can use the compact keyboard of smaller spacing..... 4
 - 2.1.4. Excellent Water Resistance..... 4
 - 2.1.5. Excellent Electromagnetic Immunity..... 4
 - 2.1.6. Unique Line Length Self-correction Function..... 4
 - 2.1.7. Compliance with Industrial Application Specifications & Requirements..... 5
 - 2.2 Technical Parameters..... 5
- 3. Typical Application..... 5
- 4. Definitions of Product Pins..... 5
 - 4.1. Pin Configuration..... 5
 - 4.2 Definitions of Pins..... 5
- 5. Output Display..... 6
 - 5.1. Sequence diagram of BCD interface output..... 6
 - 5.2. The real list of BCD output..... 7
- 6. Peripheral Circuit and Sensitivity Setting..... 7
 - 6.1. Peripheral Circuit and Precautions..... 7
 - 6.2. Sensitivity Setting..... 8
 - 6.2. 1. Selection of Suitable Capacitor CSEL..... 8
 - 6.2.2. Area of sense element..... 8
- 7. WTC6208BSI Power Supply and Peripheral Circuit..... 8
 - 7.1. DC Voltage Stabilizer..... 9
 - 7.2. Placement of Voltage Stabilizer Component..... 9
 - 7.3. Grounding..... 9
 - 7.4. Precautions for High Noise Condition..... 9
 - 7.5. Power Filter..... 10
 - 7.6. Use of +5V Power Supply of the Host..... 10
- 8. Low-power version WTC6208BSI-L..... 11
- 9. WTC6208BSI used capacitive sensors..... 11
 - 9.1. The material and shape of the capacitive sensors..... 11
 - 9.2. The area of the sense element..... 11
 - 9.3. Connection between Capacitive Sensor and Panel..... 11
 - 9.4. The common elastic connection methods are:..... 12
 - 9.5. Requirements for sense element and Panel Contact Surface..... 12
 - 9.6. The connection between the induction disc and the input pin of the induction disc of IC..... 12
- 10. Processing of Vacant Sensor Channel..... 12
- 11. Package Dimension Drawing of WTC6208BSI..... 13



WTC6208BSI Inductive touch key chip of eight-channel electric capacitance

Specification (V1.5)

1. Product Introduction

1.1. Product Overview

WTC6208BSI series touch sensing IC is an integrated circuit designed to achieve human touch interface. It can replace the mechanical light touch key to realize waterproof and dustproof, seal isolation, with strong and artistic operation interface. A WTC6208BSI can achieve 3 to 8 independent keys. The user can use it flexibly according to the needs.

1.2. Technical Principle

WTC6208BSI uses the change of capacitance on the 16 bit high precision of CDC (digital capacitance transducer) IC detection induction disk (capacitance sensor) to identify the touch action of the human finger. The data of CDC output is processing by the embedded RISC with efficient and reliable algorithms. Outward output BCD encoding to indicate the key action.

1.3. High production efficiency.

It is only needed to adjust one capacitor Csel that can change the sensitivity of all channels, with less peripheral component, and high production efficiency.

1.4. Adapt to different thickness panels

Through selecting the appropriate Csel capacitance value, appropriately adjusting the sensing area can make WTC6208BSI to adapt the insulation panel of the different thickness of 0-20mm.

1.5. Chip Package Type

WTC6208BSI is packaged with standard 16PIN NSOP.

2. Technical Features and Parameters

2.1. Technical Features

2.1.1. Simple Peripheral Circuits, and A Few Peripheral Components



With independently designed special test circuit, self-calibration circuit and RISC processor integrated inside the IC, there are a few peripheral components.

2.1.2. Debugging-free Production and Excellent Long-time Working Stability

Calibration is not necessary for the system after the set value for capacitor Csel of sensitivity is determined. The system can automatically overcome the interference caused by electrostatic discharge, electromagnetic interference, temperature variation and accumulation of moisture and pollutants on the surface, and provide good precision and operation consistency in various environments, so the product can suffer long-distance transportation and be used in various environments. The unique compensation algorithm and high-strength anti-interference design can guarantee no occurrence of malfunction during long-time work of the product.

2.1.3. The user can use the compact keyboard of smaller spacing

The adjacent key suppression function can prevent the adjacent keys from the faulty action. That is when the same finger touches two or more than two keys, only the finger occupies the key which the area is largest that can make the response, and the key which the relatively small area is occupied by finger is suppressed and not making the response. If the finger occupies two or more than two keys at the same area, these keys do not make the response. The minimum clearance of the key can reach 0.5mm

2.1.4. Excellent Water Resistance

The special waterproof design is used for it. The keyboard not only can be splash proof, flood water proof, but also can be normal use after completely flooded, is different from the general induction at present which when the splashing water, flood water of key panel, it is easily getting false action and is unresponsive after waterlogging, or is occurring false action after pressing it by finger.

2.1.5. Excellent Electromagnetic Immunity

When applying to home apparatuses and ordinary application products, the user may get good immunity to radio frequency signals by using single-sided PCB, and easily resist the interference of most of radio frequency sources including GSM cell phone to the sensitive keys.

When applying to military and other special situations, it is suggested that double-sided PCB should be designed according to the layout requirements provided by us.

2.1.6. Unique Line Length Self-correction Function

It is common for the current similar products on the market that, the sensitivity largely differs according to the length of line from sensing key to IC pin. Our original line length self-correction technology can automatically



WTC6208BSI WTC6208BSI-L

correct such difference. The user can obtain almost uniform sensitivity for all keys of the whole sense element without complex adjustment.

2.1.7. Compliance with Industrial Application Specifications & Requirements

More reliable performance and wider application range is available for users.

2.2 Technical Parameters

Operating voltage: WTC6208BSI: 3.3V<Vcc<5.5V WTC6208BSI-L: 2.2V<Vcc<5.5V

Output voltage range: GND<Vout<Vcc

Sensing thickness (insulating medium): 0-20mm

Response time of effective touch: Less than 100ms

Operating temperature: -40°C—+85°C

Storage temperature: -50°C—+125°C

3. Typical Application

Be applicable to various kitchen apparatuses, audio and video devices, air conditioners, sanitary electrical apparatuses, lights and switches, security equipment, instruments, portable player, mobile phones, electronic toys and learning machines.

4. Definitions of Product Pins

4.1.Pin Configuration

WTC6208BSI pin configuration diagram is shown in the figure 1 below :

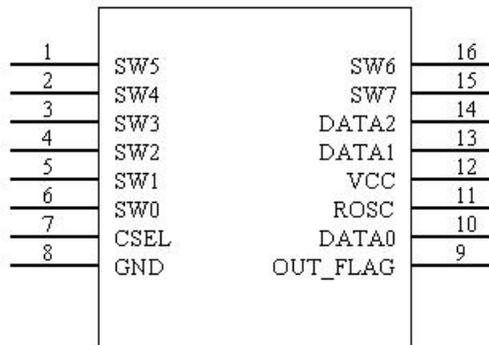


Figure 1: WTC6208BSI Pin Diagram

4.2 Definitions of Pins

The definitions of WTC6208BSI pins are as shown in the table below:

Pin No.	Pin Name	Usage	Function Description
1	SW5	I	Interface of touch key 5 (sense element 5)
2	SW4	I	Interface of touch key 4 (sense element 4)
3	SW3	I	Interface of touch key 3 (sense element 3)
4	SW2	I	Interface of touch key 2 (sense element 2)
5	SW1	I	Interface of touch key 1 (sense element 1)
6	SW0		Interface of touch key 0 (sense element 0) interface
7	CSEL	I	Capacitor interface for adjusting the sensitivity
8	GND	I	Power ground
9	OUT_FLAG	O	Key state indicator: 1 indicates that the key has no effective touch; 0 indicates that there is a key pressed
10	DATA0	I	BCD code output
11	ROSC	I	Connect the 10K pull-up resistor
12	VCC	I	Power input
13	DATA1	O	BCD code output
14	DATA2	O	BCD code output
15	SW7	I	Interface of touch key 7 (sense element 7)
16	SW6	I	Interface of touch key 16(sense element 6)

5. Output Display

5.1. Sequence diagram of BCD interface output

When the effective touch occurred on the induction disk is detected, the WTC6208BSI outputs the BCD code of the corresponding induction disk in 100ms, so that the user MCU can process it. The OUT_FLAG foot indicates the state of the key; 1 indicates that the key has no effective touch, and 0 indicates that it has a key pressed. The sequential relationship between the OUT_FLAG and BCD code output feet (DATA2 ~ DATA0) is shown in Figure 2

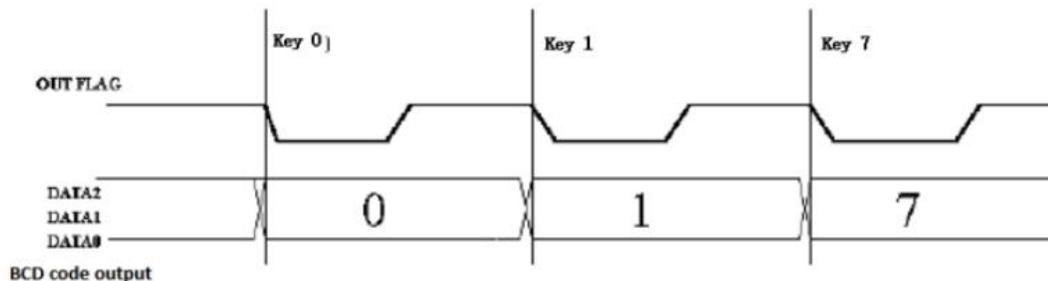


Figure 2: Sequence diagram of WTC6208BSI key output

5.2. The real list of BCD output

Output	Input	OUT_FLAG	Key value		
			DATA0	DATA1	DATA2
	Electrifying	H	H	H	H
SW0	Touch	L	L	L	L
	Leave	H	---	---	---
SW1	Touch	L	H	L	L
	Leave	H	---	---	---
SW2	Touch	L	L	H	L
	Leave	H	---	---	---
SW3	Touch	L	H	H	L
	Leave	H	---	---	---
SW4	Touch	L	L	L	H
	Leave	H	---	---	---
SW5	Touch	L	H	L	H
	Leave	H	---	---	---
SW6	Touch	L	L	H	H
	Leave	H	---	---	---
SW7	Touch	L	H	H	H
	Leave	H	---	---	---

The "one" in the table indicates that after the finger leaves, before touching the next key, the electrical level of DATA0~DATA2 is kept the touch last time, and the key value of the key is unchanged.

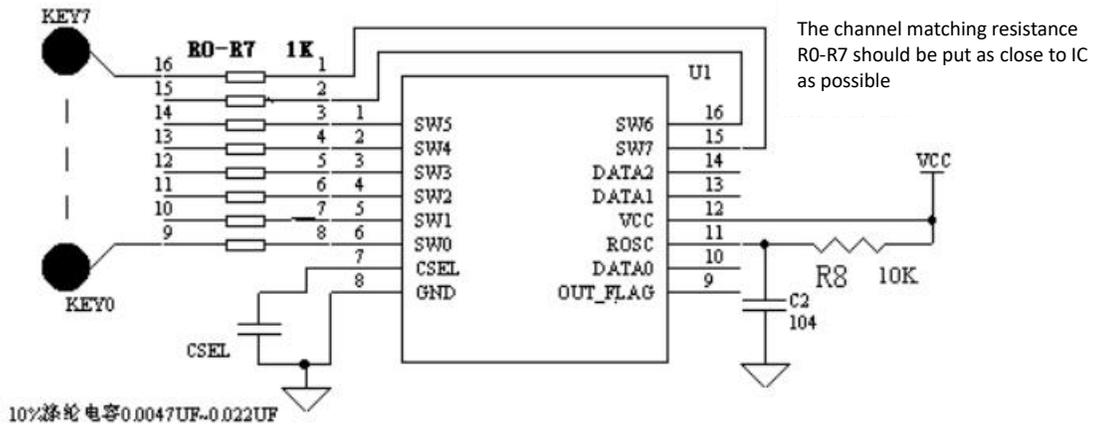
6. Peripheral Circuit and Sensitivity Setting

6.1. Peripheral Circuit and Precautions

The peripheral circuit of WTC6208BSI is simple and requires only a small amount of resistance. The key component is the sensitivity adjustment capacitor CSEL and the 1K resistance group used to measure the circuit matching impedance. CSEL requires the use of polyester capacitance, NPO material or X7R capacitance with 10% or more precision. The 1K resistance group can provide you with the best and most stable measurement effect. Please make sure that the CSEL and the matching resistance are as close to the IC as possible when PCB layout.

Figure 4 is the application circuit diagram of WTC6208BSI working under the 8 keys mode

WTC6208BSI WTC6208BSI-L



10 % polyester capacitance 0.0047UF-0.022UF

Figure 3: WTC6208BSI Application Schematic Diagram

6.2. Sensitivity Setting

The sensitivity setting of WTC6208BSI enables the user to use isolated media of various thicknesses to implement reliable and flexible touch function.

6.2. 1. Selection of Suitable Capacitor CSEL

The sensitivity setting of WTC6208BSI is achieved by selecting the appropriate capacitance Csel. The user can select the appropriate capacitance Csel according to the own use case. The larger the separation medium is, the larger the Csel capacity is. It is generally recommended to choose the appropriate capacitance between 0.0047UF and 0.022UF from large to small.

It is recommends that it is best to use the A 5 % precision polyester capacitor with a small temperature coefficient for Csel. 10 percent accuracy of polyester capacitance can also be used. If needing use of patch capacitors, 10% or higher precision NPO material or X7R capacitance needs to be used. It is recommended that the user places more than two solder plates on the Csel to exquisitely adjust the Csel.

6.2.2. Area of sense element

Increasing the area of the induction disc is beneficial to improve the penetration ability of touch sensing.

7. WTC6208BSI Power Supply and Peripheral Circuit

WTC6208BSI measures small change in capacitance, so it is required that the power ripple and noise should be small and the external strong interference involved from power supply shall be avoided. Particularly when it is applied to induction cooker and microwave oven, the external interference and voltage leap must be

WTC6208BSI WTC6208BSI-L

effectively isolated, and the power supply must have high stability. It is suggested that the voltage stabilizing circuit constituted by 78L05 as shown in the figure 4 should be adopted.

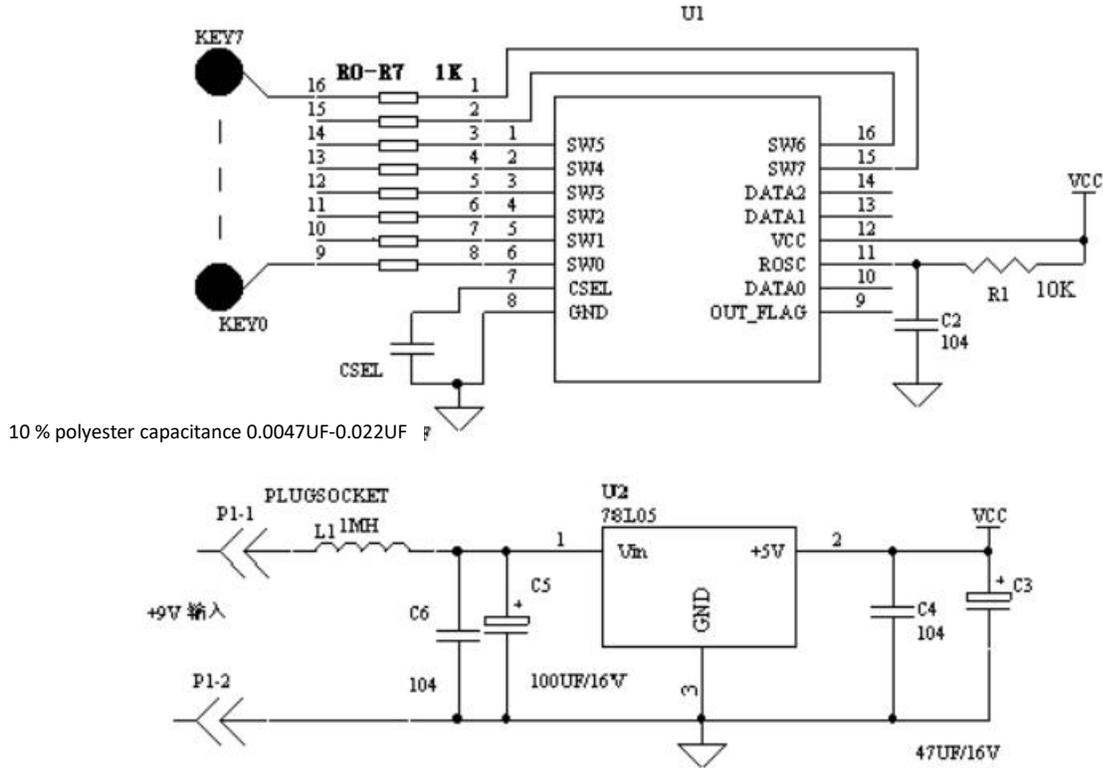


Figure 4: Full functional circuit of the power supply voltage circuit

7.1. DC Voltage Stabilizer

At PCB LAYOUT, such 78L05 power component must be close to WTC6208BSI Vcc pin.

7.2. Placement of Voltage Stabilizer Component

78L05, peripheral components and WTC6208BSI must be placed on the same circuit board centrally, to put an end to the noises caused by overlong power connection line.

7.3. Grounding

The common ground of the components as shown in the figure shall be separately connected into an independent group and then it shall be connected to the common ground of the whole machine from one point of it. (Use one point of star shape to connect the ground)

7.4. Precautions for High Noise Condition

In case of application in a high-noise environment, up and down overlapped placement shall be avoided between high-voltage (220V), high-current, and high-frequency-operation main board and the touch circuit board. If such overlapped placement is unavoidable, try to keep far away from high-voltage, high-current components area or add shield on the main board.

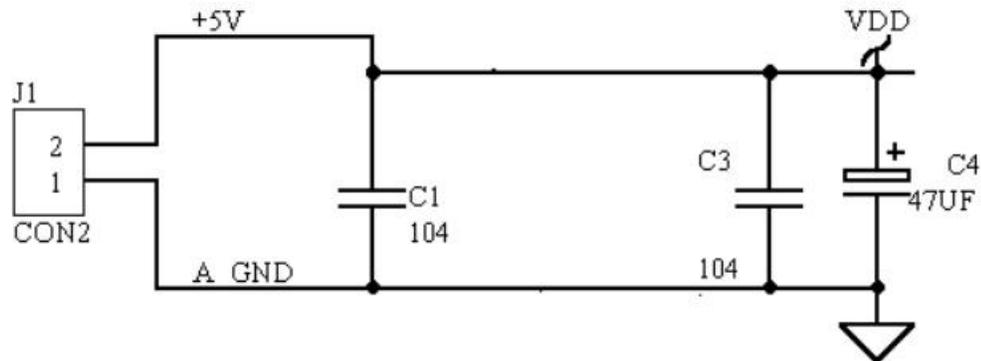
7.5. Power Filter

When typesetting in PCB, it is recommended to reserve the inductor L1 (1MH) welding disc, but the general and the non-special applications do not need this inductance. The users can also cancel it.

When inputting 78L05 power supply, it needs to pay attention to ripple size. Please don't make the trough of ripple wave lower than DC 9V.

7.6. Use of +5V Power Supply of the Host

If the user directly uses 5V power supply of the main engine, it needs adding the power supply filter circuit in the front of the power supply of the modules or sensing power chips as shown in the figure 5. The requirement for PCB layout is the same as the above circuit



The analog and digital powers of circuit shall be connected separately to the ground in Y-connection method.

The capacitors shall be arranged in the sequence indicated in the schematic diagram and shall not be arranged arbitrarily.

Figure 5: Power Filter Circuit

Precautions:

The above circuit should connect the 104 capacitors and electrolytic capacitors of the filter circuit according to the order in the chart, and 104 capacitors should be in front of the electrolytic capacitance that can better suppresses the high frequency noise.

8. Low-power version WTC6208BSI-L

WTC6208BSI-L is a low-power version, has the sleep mode.

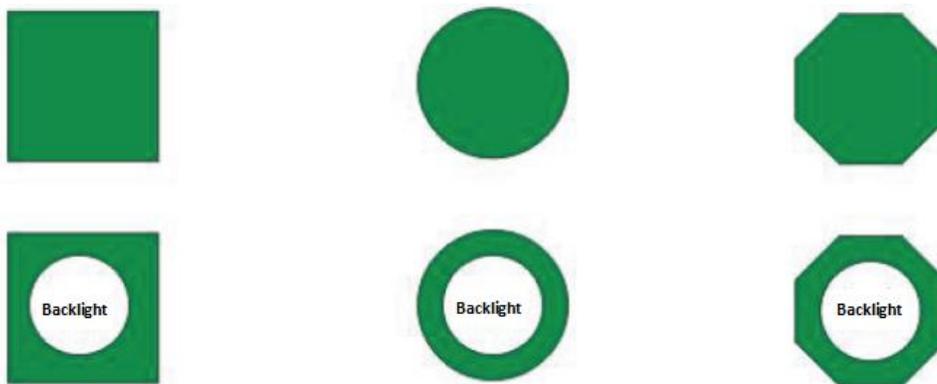
In a period of time, after it is detected that there is no touch action on the touch panel, the chip can automatically enter the dormant state, and the current consumption this time is only $9\mu\text{A}\sim 18\mu\text{A}$, which is used for satisfying the application of the Low power consumption product of the battery power supply.

After dormant, touching any key can awaken the touch chip and immediately enter the normal working mode.

9. WTC6208BSI used capacitive sensors

9.1. The material and shape of the capacitive sensors

The capacitive sensors can be any type of conductor, but certain flat surface should be ensured. It is recommended to use a round metal sheet or other conductor with a diameter greater than 10mm. The commonly used induction disks are copper foil, spring, thin film line and ITO glass, etc. on the PCB plate etc.



The key sense element can be solid or hollow rectangle, circle or polygon.

Figure 6: PCB Copper Foil sense element

9.2. The area of the sense element

The area of each sense element should be kept as same as possible to ensure the same sensitivity.

9.3. Connection between Capacitive Sensor and Panel

The capacitive sensor shall cling to glass and other insulated panel, and elastic connection shall apply between them.

9.4. The common elastic connection methods are:

The common elastic connection methods are:

Use the sense element with spring

Use cylindrical conductive rubber to conduct elastic connection

Paste the sense element onto the panel with imported super double-sided glue, and the double-sided glue layer cannot be too thick.

As shown in Figure 7.



Figure 7: Spring sense element

9.5. Requirements for sense element and Panel Contact Surface

The surface of the induction plate must be levelled off, and is no clearance between the panels.

9.6. The connection between the induction disc and the input pin of the induction disc of IC

The connection between the capacitance sensor and the pins of WTC6208BSI should be short and thin as far as possible (0.1~0.2mm width). It is best that WTC6208BSI can be placed on the keypad and that the back and around 0.5 mm of the connection is not placed other circuit, to ensure that the sensor has good sensitivity and to avoid false triggering.

10. Processing of Vacant Sensor Channel

WTC6208BSI at least must use three touch keys, to ensure the steady operation of the chip. When it applies to the situation of less than 8 keys, SW7~SW0 will have the empty unused sensor input channel. The empty input channel only needs a simple suspending in midair, and the empty input channel cannot be added any pull-up or pull-down resistance.

If the user must use three or less sensitive keys, please be sure to contact us for the corresponding technical support.

11. Package Dimension Drawing of WTC6208BSI

Symbol	Dimensions in mm		
	Min.	Nom.	Min.
A	1.35	1.60	1.75
A1	0.10	—	0.25
A2	—	1.45	—
B	0.33	—	0.51
C	0.19	—	0.25
D	9.80	—	10.00
E	3.80	—	4.00
e	—	1.27	—
H	5.80	—	6.20
L	0.40	—	1.27
θ	0.00	—	8.00

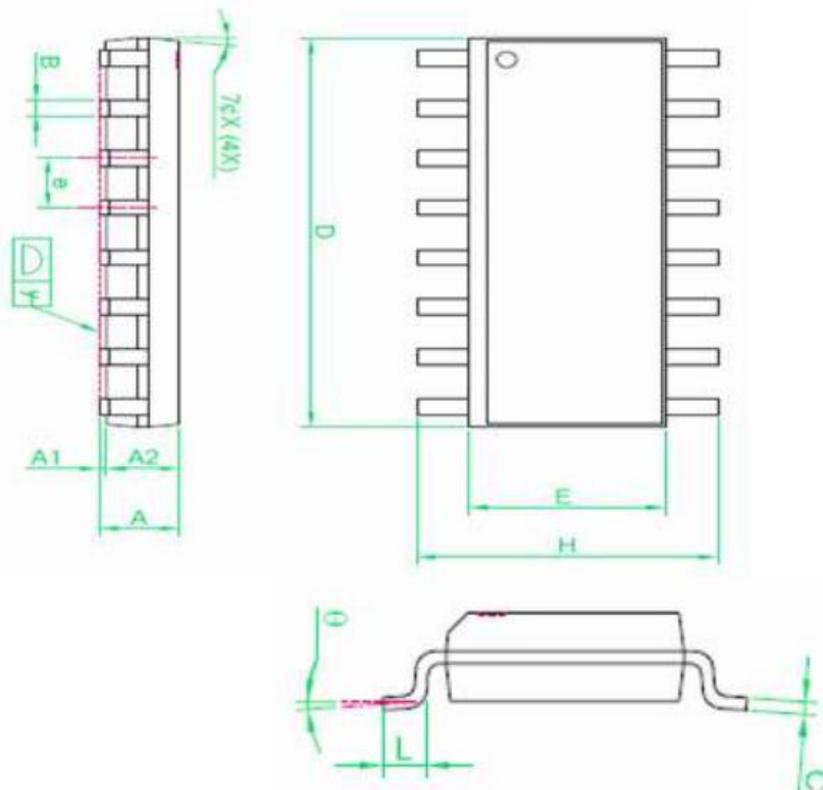


Figure 8: Package Dimension Drawing of WTC6208BSI