WTC66K1R Type 6 keys + 1 encoder capacitive touch sensitive chip
Fast Browsing

Number of keys	3-6 keys
Number of slide bar / roller	1 encoder (slide bar/roller)
Key response mode	Single key reaction mode
Technical principle	Capacitive to digital conversion technology
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 2mm, 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	It can effectively eliminate the radio-frequency interference caused when GSM mobile phone is close the panel to dial or to answer the phone, and when the high-power intercom is close the panel to make the talkback operation.
Operating voltage range	3.3V-5.5V
Operating temperature range	—40°C—+85°C
Data transmission interface	The output of the key is one-to-one high/low level, and the slide bar/roller output is standard encoder square wave.
Storage temperature range	—50°C—+125C
Chip sealing mode	SSOP28(150MIL)
Typical application	Various home appliances, security equipment, communication equipment, industrial control equipment & instruments, entertainment equipment, medical equipment, sport facilities, It needs to continuously adjust the application case of the physical quantities

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WTC66K1R Capacitive sensitive touch switch & roller encoder chip

Specification (V1. 5)

1. Product Introduction

1.1. Product Overview

WTC66K1R series touch sensing IC is an integrated circuit designed to achieve human touch interface. It can replace mechanical light touch and mechanical rotary encoder, to realize waterproof and dustproof, seal isolation, solid and beautiful operation interface. A WTC66K1R can achieve 3 ~ 6 independent touch keys and a touch roller encoder. It can provide user with a low-cost human-computer interaction interface. The operation and signal output of the touch roller coder is the same as the mechanical wheel coder. But there are no burrs for the output pulse of the mechanical code. The user does not have to handle the soft and hardware aiming at the burr, and only needs to adjust one capacitor Csel that can change the sensitivity of all channels, with high production efficiency. Through selecting the appropriate Csel capacitance value and properly adjusting the sensing disk area, it can make WTC66K1R to adapt the Insulation panels of different thickness of 0 — 10mm.

1.2. Technical Principle

WTC66K1R 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. The direct output of high and low level indicates the key action. The pulse of 90-degree phase difference the same as the mechanical encoder is used to output the roller action.

1.3. Chip Package

WTC66K1R is packaged with standard SSOP28A(150mil).

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. ebugging-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

Adjacent key suppression function can prevent the wrong action of adjacent keys.The user can use the compact keyboard of smaller spacing
(the spacing is not less than 2mm)

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 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: 3.3V<Vcc<5.5V
Output voltage range: GND<Vout<Vcc
Sensing thickness (insulating medium): 0-10mm
Response time of effective touch: Less than 200ms
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 WTC66K1R Pins

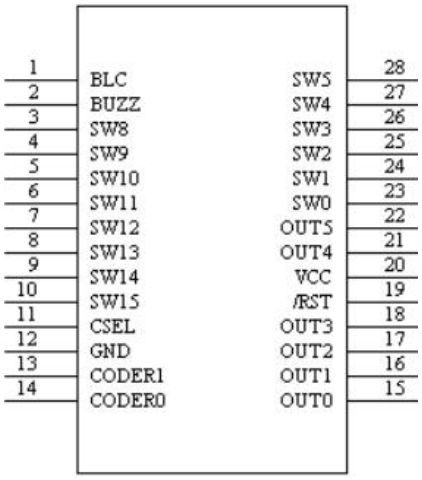


Figure 1： Pin Diagram of WTC66K1R

Table 1: Definitions of WTC66K1R Pins

Pin No.	Pin Name	Usage	Function Description
1	BLC	O	Backlight LED control pin
2	BUZZ	O	Buzzer control pin
3	SW8	I	Roller induction disc unit interface
4	SW9	I	Roller induction disc unit interface
5	SW10	I	Roller induction disc unit interface
6	SW11	I	Roller induction disc unit interface
7	SW12	I	Roller induction disc unit interface
8	SW13	I	Roller induction disc unit interface
9	SW14	I	Roller induction disc unit interface
10	SW15	I	Roller induction disc unit interface
11	CSEL	I	Sensitivity adjustable capacitor interface
12	GND	I	Power ground
13	CODER1	O	Roller encoder pulse output 1
14	CODER0	O	Roller encoder pulse output 0
15	OUT0	O	Touch key SW0 status output
16	OUT1	O	Touch key SW1 status output
17	OUT2	O	Touch key SW2 status output
18	OUT3	I/O	Touch key SW3 status output
19	/RST	I	Chip reset pin
20	VCC	I	positive power supply output
21	OUT4	O	Touch key SW4 status output
22	OUT5	O	Touch key SW5 status output
23	SW0	I	Touch key (induction disc) interface 0
24	SW1	I	Touch key (induction disc) interface 1
25	SW2	I	Touch key (induction disc) interface 2
26	SW3	I	Touch key (induction disc) interface 3
27	SW4	I	Touch key (induction disc) interface 4
28	SW5	I	Touch key (induction disc) interface 5

5. Output Display

5.1. The output of the touch key

When the occurrence of effective touch on the sense element is detected, WTC66K1R will output the status of corresponding sense element channel within 200ms, so that it can be processed by user MCU, or directly drive the execution circuit to work

The relationship between the output signal and the touch key input channel is shown below
The signal output does not have the output jitter of the mechanical key. The user does not need to make mechanical key to jitter.

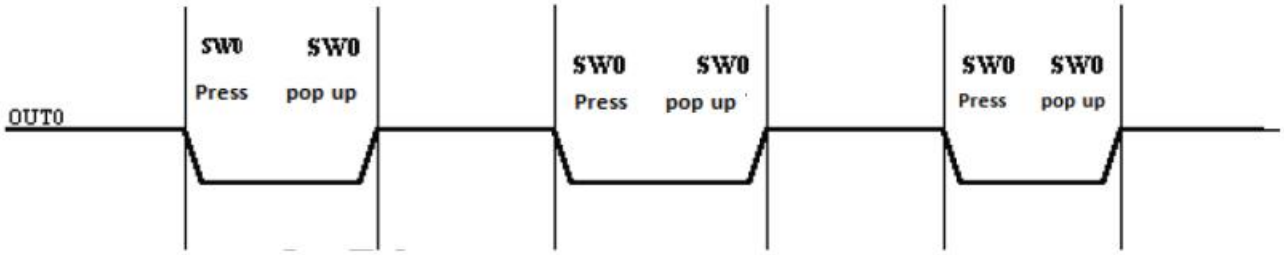
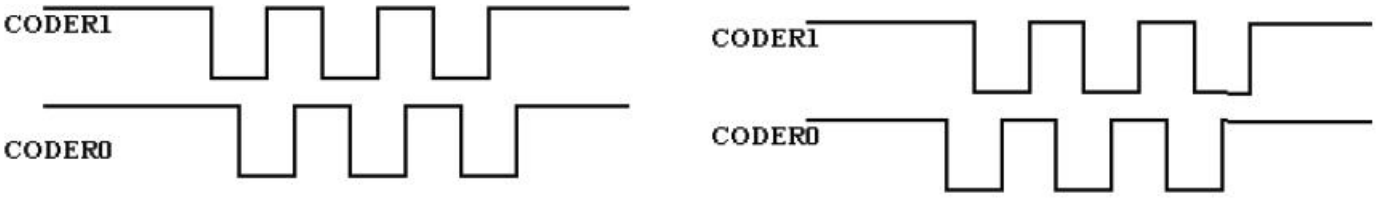


Figure 2: Sequence diagram of the output of the key

5.2.Touch rotary encoder output

The operation mode and output signal of the touch roller are consistent with the common mechanical roller encoder. But there is no the burr of mechanical output pulse. The user does not have to handle the soft and hardware aiming at the burr



The clockwise rotation of the roller

The anticlockwise rotation of the roller

Figure 3: Sequence diagram of touch roller output

The rotation of roller gives 18 pulses a week.

The phase difference between the two pulses is around 6ms.

6. Peripheral Circuit and Precautions

6.1. Peripheral Circuit

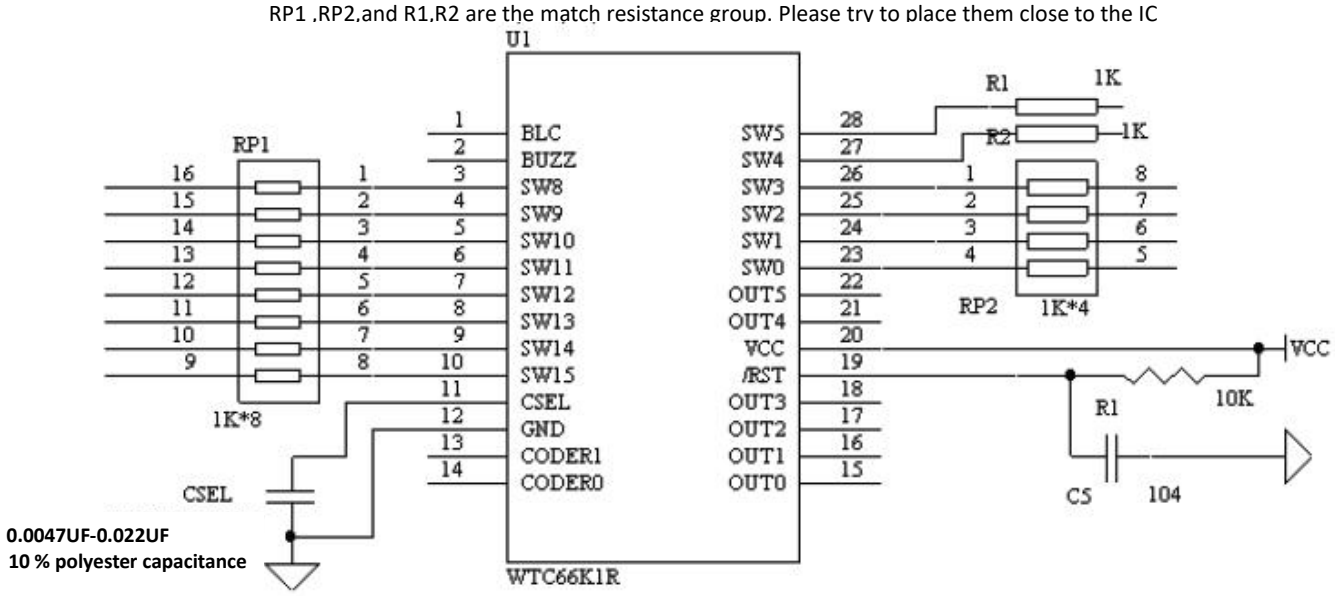


Figure 4: WTC66K1R Application Schematic Diagram

6.2. Precautions

The peripheral circuit of WTC66K1R is very simple, and only needs a few resistors and capacitors. The key component is capacitor CSEL for adjusting the sensitivity and IK resistance group for measuring the matched impedance of circuit. CSEL should use 10%-precision polyester capacitor, capacitor made of NOP material or capacitor made of X7R material . 1K resistance group can provide you with the best and most stable measurement effect, and CSEL and matched resistance shall be placed as close as possible to IC at PCB layout.

7. Sensitivity Setting

The sensitivity setting of WTC66K1R enables the user to use isolated media of various thicknesses to implement reliable and flexible touch function. The sensitivity setting of WTC66K1R is achieved by selecting the appropriate capacitance Csel and adjusting the matching resistance value of the tandem connection in the induction channel.

7.1. Selection of Suitable Capacitor 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 0.0047 UF and 0.022 UF 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.

7.2. Area of sense element

Increasing the area of the induction disk can improve the sensitivity of the corresponding induction channel.

7.3. The equilibrium of the sensitivity of key and slide bar/roller

If the sensitivity of the sensor key and the induction pulley is not consistent, it can be adjusted through the matched resistance value of the tandem connection on the interaction channel. The great the matched resistance value is, the larger the sensitivity of the corresponding induction channel is. But the value of the matching resistance is not less than 1K. The matched resistance value of the tandem connection on the pulley induction channel must be consistent.

8. Backlight Control

The 1st leg BLC of WTC66K1R's can be used as the backlight control signal output of the touchpad.
When the finger is close to any sensor disc, the BLC outputs the electrical level. After the finger has left the touchpad or 8 seconds, BLC recovers low electrical level. BLC output level can normally provide 4mA source current drive. If the required electric current of LED backlight is more than 4mA, the drive circuit needed to be added to prevent the IC from damage.

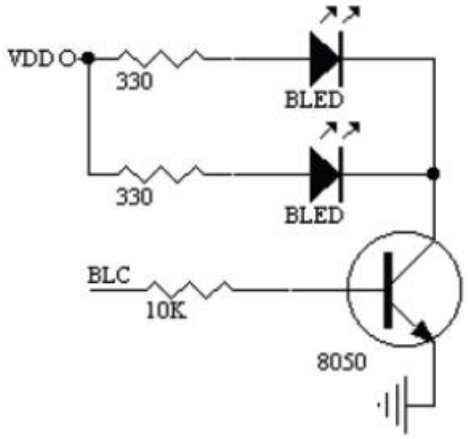


Figure 5: Backlight LED drive circuit

9. Buzzer Control Signal

The 2nd leg BUZZ of WTC66K1R can be used as the control signal output for the touchpad.
After the finger is effectively touching key induction disk, BUZZ outputs 50MS low level pulse, which can be used as the control signal for the built-in buzzer of the oscillating circuit, which generates the prompt tone under the key. The effectively touching pulley sensor BUZZ by the finger will not output a low level pulse of 50MS.

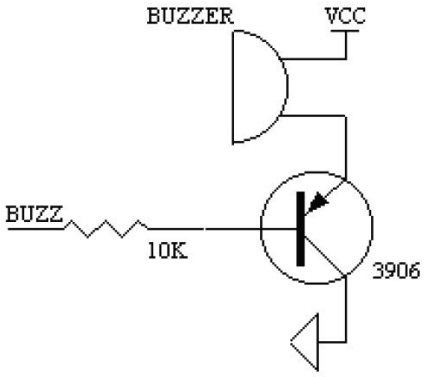


Figure 6：Buzzer drive electrical appliances

10. **WTC66K1R Power Supply**

WTC66K1R 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 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 should be adopted.

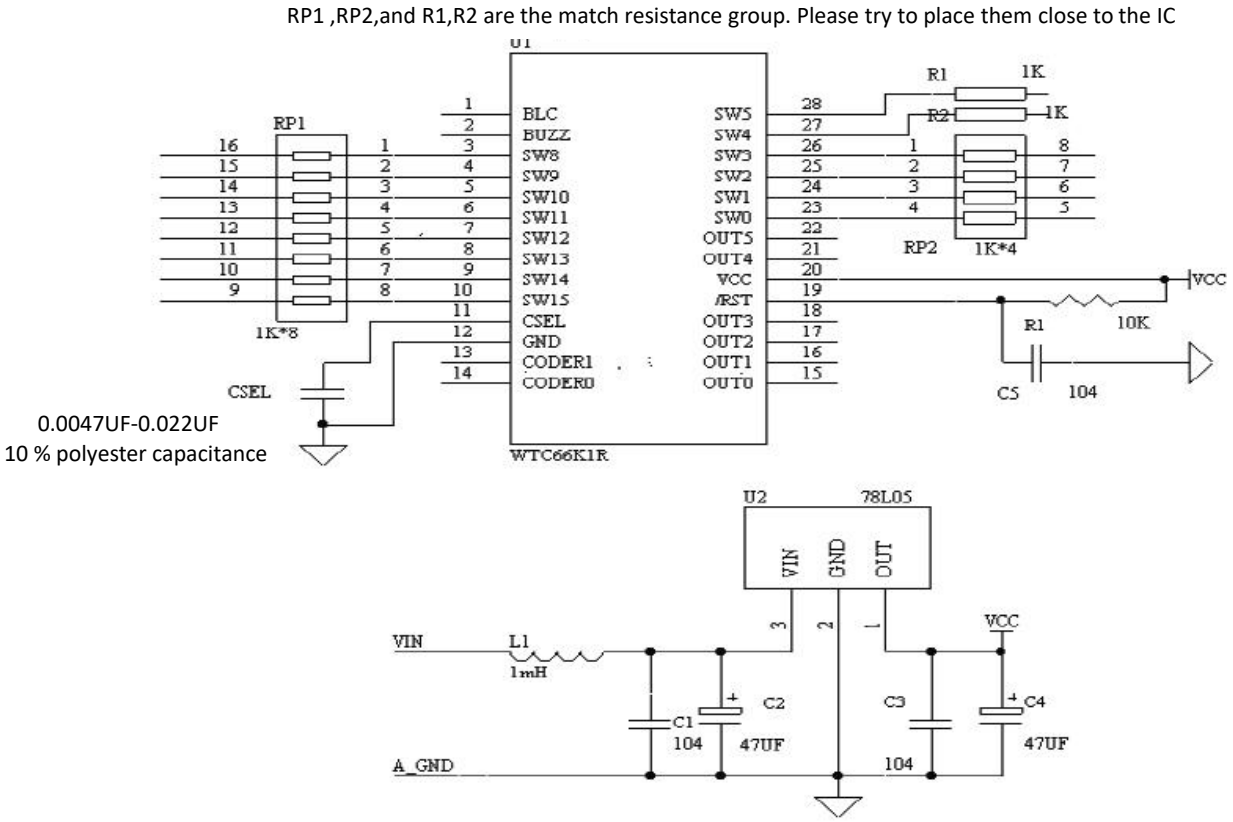


Figure 7：Power supply voltage regulator circuit

10.1. DC Voltage Stabilizer

At PCB LAYOUT, such 78L05 power component must be close to WTC66K1R Vcc pin.

10.2. Placement of Voltage Stabilizer Component

78L05, peripheral components and WTC66K1R must be placed on the same circuit board centrally, to put an end to the noises caused by overlong power connection line. The capacity of C2 capacity will affect the discharge time after power failure, and the too large capacity requires a longer reset time. It is the recommended values in the circle. The different applications can be flexibly adjusted

10.3.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)

10.4. 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.

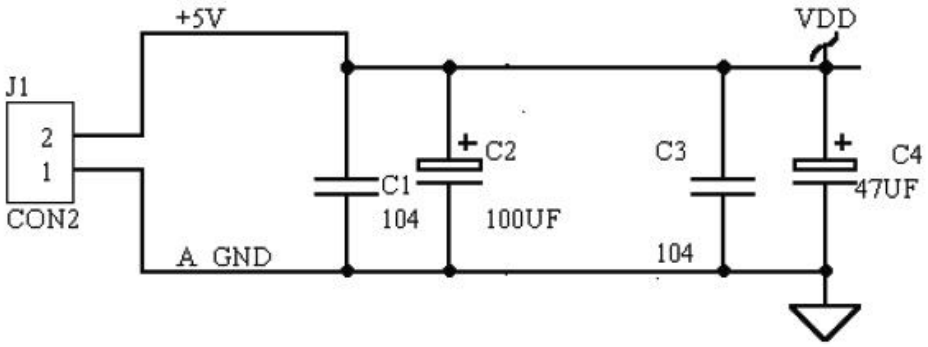
10.5. Power Filter

When PCB composing type, it is recommended to reserve the inductance L1 (1MH) welding disc. The different applications may not need this inductance.

For the power supply of input 78L05, pay attention to the ripple size and the ripple valley shall not be lower than DC 8V.

10.6. 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 below. 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 8: Power Filter Circuit

Precautions:

This circuit is good for suppressing the power noise, but the larger load is easy to generate self - excitation. It is recommended that the user should not receive any other load except the touch module or touch chipset. LED lights, relays and other IC loads need to be connected to the front of the circuit and other filter stabilized circuit shall be added

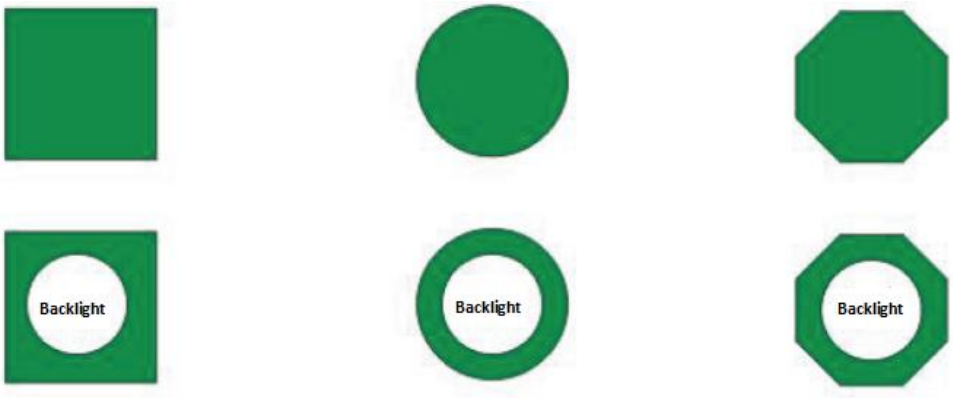
11.WTC66K1R used capacitive sensors and layout recommendations

11.1. Induction key

11.1.1.The material and shape of the key sense element

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 sense element are copper foil, spring, thin film line and ITO glass, etc. on the PCB plate etc.

Figure 10:Spring sense element



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

Figure 9: PCB Copper Foil sense element

11.1.2. The area of the key sense element

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

11.1.3. Connection between Capacitive Sensor and Panel

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

11.1.4. 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.

11.1.5 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. If the contact surface cannot be achieved closeness, please use the rmally conductive silicone grease to seal it, to ensure the air gap between the junction surfaces of the panel.

The connection between the capacitance sensor and the pins should be short and thin as far as possible (5-8 mil). It is best that WTC66K1R 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.

11.2. Touch slide bar/pulley

The shape and size of the touch sensitive slide bar are shown in Figure 10. The size of the slide bar sensor unit can be appropriately scaled in proportion according to the panel design requirements.
The slide bar - The arrangement order of the interaction unit of the slide bar in sequence from left to right is: SW13,SW10.SW15,SW12,SW9,SW14,SW11,SW8,SW15.SW14,SW13,SW12,SW11,SW10, SW9,SW8

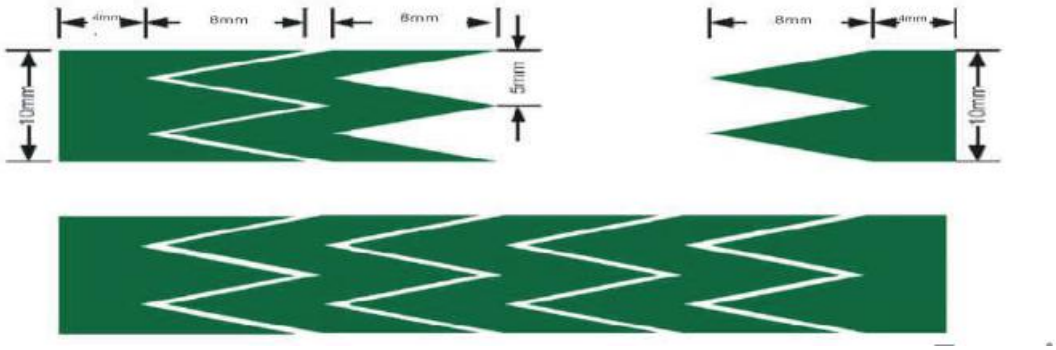


Figure 11： Geometry and dimension of touch slide bar

The shape of the induction unit of the touch-sensitive roller is as shown in figure 11. The clearance between the induction units is 0.2-0.5 mm, and the inside and outside diameter of the roller is 18mm and 36m respectively. The size of the roller can be appropriately scaled in proportion according to the panel design requirements.

The arrangement order of the touch induction roller induction unit clockwise starting from left is: SW13,SW10.SW15,SW12,SW9,SW14,SW11,SW8,SW15. SW14,SW13 SW12 SW11,SW10,SW9,SW8
(For the specific details, please refer to the application schematic diagram and the PCB diagram of the DEMO board provided by us)

Figure 12: Geometry and dimensions of the Touch roller

12. Processing of Vacant Sensor Channel

WTC66K1R requires that at least three touch keys must be used; otherwise the chip will not work properly. When using it in the case of less than 6 keys, SW5 ~ SW0 will have empty and unused sensor input channel. The empty input channel cannot be suspended, and the empty input channel must be connected to the power supply of WTC66K1R with a 10K pull-up resistor and WTC66K1R.

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

13. Package Dimension Drawing of WTC66K1R

Symbol	Dimensions in mil		
	Min.	Nom.	Max.
A	228	—	244
B	150	—	157
C	8	—	12
C'	386	—	394
D	54	—	60
E	—	25	—
F	4	—	10
G	22	—	28
H	7	—	10
α	0°	—	8°

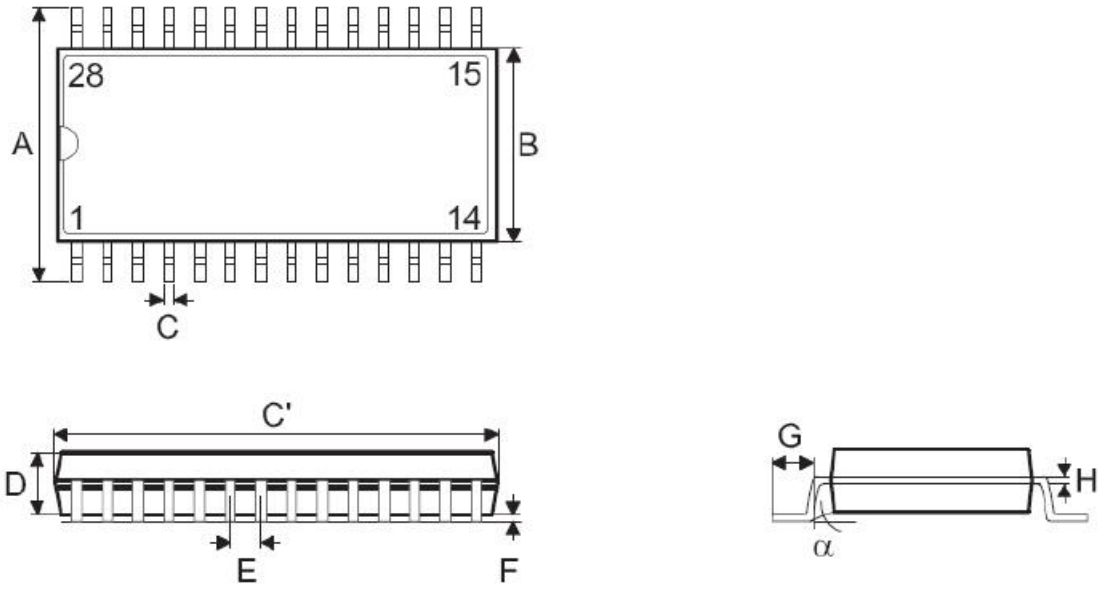


Figure 13: Package Dimension Drawing of WTC66K1R