# WTC02SP 2-Channel Capacitive-Sensing Touch Button Chip（V1.2）
## Fast Browsing

| | |
|---|---|
| Model | WTC02SP SOP8 Encapsulation |
| Number of keys | 2 keys |
| Technical principle | Capacitive to digital conversion technology |
| Key response mode | Multi-key (SHIFT) Working Mode |
| 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 100 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 | 3.3V-5.5V |
| Operating temperature range | —40°C—+85°C |
| Data transmission interface | Effective light touch mode and self-locking switch and PWM dimmer output mode can be selected |
| Storage temperature range | —50°C—+125C |
| Chip sealing mode | SOP8 |
| Typical application | It can be used with single facer and can be applied to various kinds of small home appliances, digital product, toy and etc. The single IC can realize the touch switch and touch adjustment of LED lamp. |

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# WTC02SP 2-Channel Capacitive-Sensing Touch Button Chip（V1.2）

## Specification

## 1. Product Introduction

### 1.1. Product Overview

WTC02SP is the two-channel capacitive touch-sensitive integrated circuit of high performance low cost designed for small home appliance and LED touch light and other applications by Wincom Technology. It can replace the mechanical light touch key to realize waterproof and dustproof, seal isolation, with strong and artistic operation interface. A WTC02SP can achieve 1 to 2 independent keys. The user can use it flexibly according to the needs.

### 1.2. Chip Package Type

WTC02SP is packaged with standard SOP8.

## 2. Technical Parameters

Operating voltage:
WTC02SP: 3.3V<Vcc<5.5V
Output voltage range: GND<Vout<Vcc
Power consumption: 3V is less than 1.6 Ma when full speed working
Sensing thickness (insulating medium): 0-20mm,Maximum: 50mm
(It needs to cooperatively use the different sizes of induction disk)
Response time of effective touch: Less than 100ms
Operating temperature: -40°C—+85°C
Storage temperature: -50°C—+125°C

## 3. Typical Application

WTC02SP can be used with single facer and can be applied to various kinds of small home appliances, digital product, toy and etc.
The single WTC02SP can realize the touch switch and touch adjustment of LED lamp.

## 4. Technical Features and Parameters

### 4.1. Technical Features

#### 4.1.1. 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.

### 4.1.2. 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.

### 4.1.3 Usability in Intensive Keyboard with a Small 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

### 4.1.4. Excellent Water Resistance

The special water-proof design applies. The keyboard can be resistant to splashing water and overflowing water, and can also be normally used after it is totally flooded by water, which is different from current ordinary sensitive keyboard that is easy to malfunction in case of splashing water or overflowing water and will respond slow in case of water accumulation, or respond wrongly after it is pressed by finger.

### 4.1.5. 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.

### 4.1.6. Compliance with Industrial Application Specifications & Requirements

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

## 5 Definitions of Product Pins

### 5.1 Pin Configuration

WTC02SP pin configuration diagram is shown below:

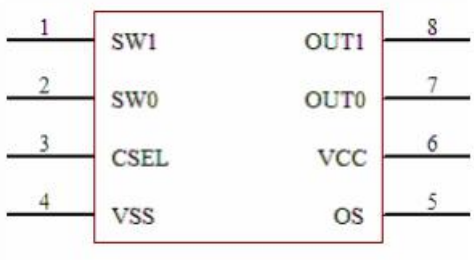



Figure 1: Pin Diagram of WTC02SP

### 5.2 Definitions of Pins

The definitions of WTC02SP pins are as shown in the table below:

| Pin No. | Pin Name | Usage | Function Description |
|---|---|---|---|
| 1 | SW1 | I | Interface of touch key 1 (sense element 1) |
| 2 | SW0 | I | Interface of touch key 0 (sense element 0) |
| 3 | CSEL | I | Capacitor interface for adjusting the sensitivity |
| 4 | GND | I | Power ground |
| 5 | OS | I | Output mode selection<br>The connected VCC is two keys which is the normal light touch key mode, and the connected GND OUT0 is the self-locking key output mode, and OUT1 is the PWM dimming output |
| 6 | VCC | I | Power input |
| 7 | OUT0 | O | SW0 status output |
| 8 | OUT1 | O | SW1 status output |

## 6. Output Display

When the occurrence of effective touch on the sense element is detected, WTC02SP will output the status of corresponding sense element channel within 100ms, so that it can be processed by user MCU, or directly drive the execution circuit to work. WTC02SP has two output modes. It is selected by the VCC or GND of the OS leg of IC.

### 6.1. Light touch key mode: pin OS connecting to VCC

When OS I connecting to VCC, the output mode of the general light touch key is used for the corresponding output of WTC02SP SW0 and SW1. After the effective touch is detected on the induction disc, the corresponding indicator pin outputs the low level. After he finger is left, the indicating pin restores the output high level. Taking SW0 channel as an example, the relationship between the output signal and the input channel of the sensor is shown in figure 2.

The SW1 channel is the same. When OUT0 and OUT1 are electrified, the initial electrical level is the high level

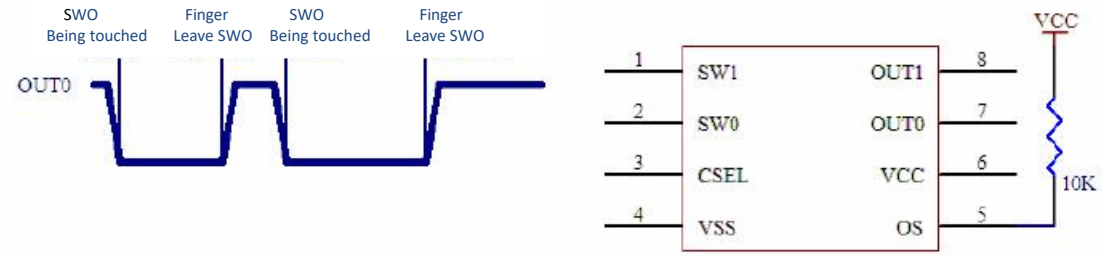



Figure 2: key output timing diagram of WTC02SP OS when receiving VCC

### 6.2. Self-locking switch and PWM dimming mode: pin OS connecting to GND

When the pin OS is connected to GND, the two keys of WTC02SP realizes the different functions SW0 is the self-locking switch mode, and SW1 is the PWM output mode.

#### 6.2.1. Self-locking switch mode of SW0

When the pin OS is connected to GND, the output mode of the self-locking switch will be used for the output of SW0. When electricity, the corresponding output OUT0 initial is the low level, and when the effective touch occurring on the SW0 induction disk is monitored, the OUT0 output level turns to b high level; when finger is left, the OUT0 maintains a constant output level. It is until the next SW0 is being touched, the OUT0 turns to be low level. The sequence diagram of the OUT0 output is as follows:

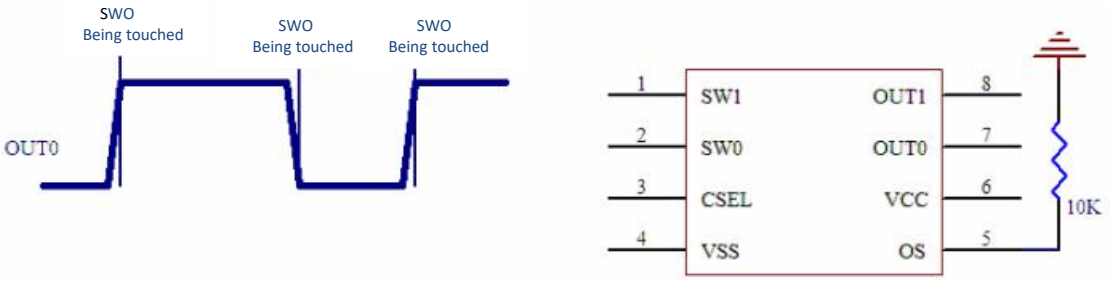



Figure 3: The SW0 key outputs the sequence diagram when the WTC02SP pin OS is connected to GND

#### 6.2.2. PWM dimming of SW1

The output mode of SW1 when OS is connected to GND is a PWM dimmer channel specially designed for LED lights. The working mode is as follows:
Electrifying: the initial level is low level and the light isn't working when OUT1 is electrifying..

Light-dimmer: Short press (within 1 second) SW1, when the finger is left, OUT1 outputs PWM wave. This PWM wave controls the LED brightness through LED drive circuit.
Circulation light-dimmer: After long pressing SW1 for more than 1 second, OUT1 outputs PWM wave, and the duty ratio of PWM wave is gradually from small to large, and from dark to light corresponding to the LED light, when the LED light reaches to the brightest, the duty ratio of PWM wave is gradually from large to small, LED light is gradually dark from the by the brightest. If the touch finger does not leave SW1, the brightness of the light will continue to go from dark to bright, then from bright to dark.
When the light reaches to the requirement, the finger leaves SW1, the duty ratio of PWM output remains unchanged, and the brightness of the LED light is fixed. Turning off the light: in any brightness of the LED light, short press SW1 (within one second). The output of OUT1 will be low when the finger leaves SW1 and the LED light will go out.
Turning on light by Brightness memory: In the situation of LED light goes out, short press SW1 (within 1 second), when the finger is left SW1, the OUT1 restores output the PWM wave of the duty ratio before the turning off the light last time, the LED light is lightened, and the brightness is the brightness of before turning off the light last time.

## 7. Typical application circuit and sensitivity setting

### 7.1. Peripheral Circuit and Precautions

The peripheral circuit of WTC02SP 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.

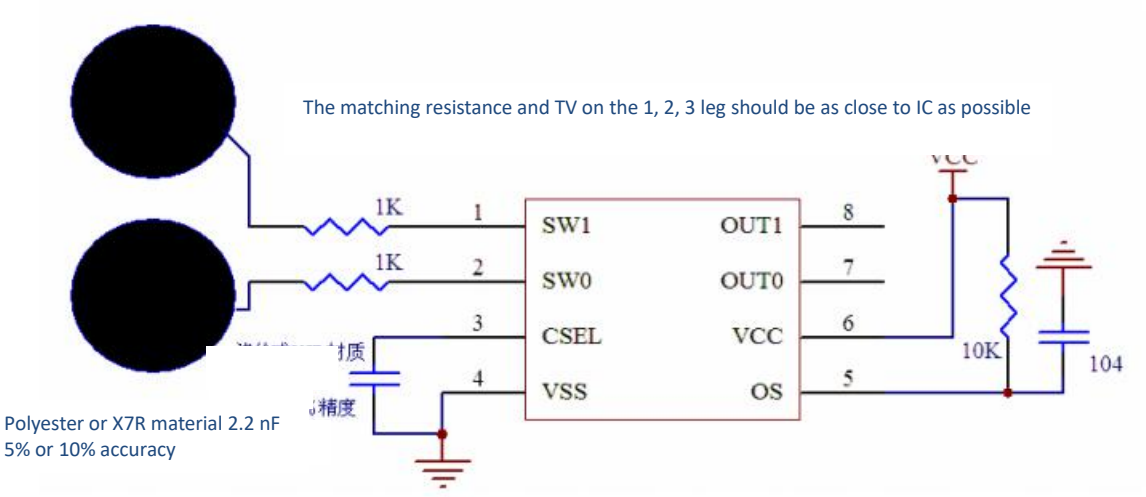



Figure 4: WTC02SP Application Schematic Diagram

### 7.2. Sensitivity Setting

The sensitivity setting of WTC02SP enables the user to use isolated media of various thicknesses to implement reliable and flexible touch function.

### 7.3. Selection of Suitable Capacitor CSEL

The sensitivity setting of WTC02SP 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 2.2nF and 22nF 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.

### 7.4. Area of sense element

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

## 8. WTC02SP Power Supply

WTC02SP 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.

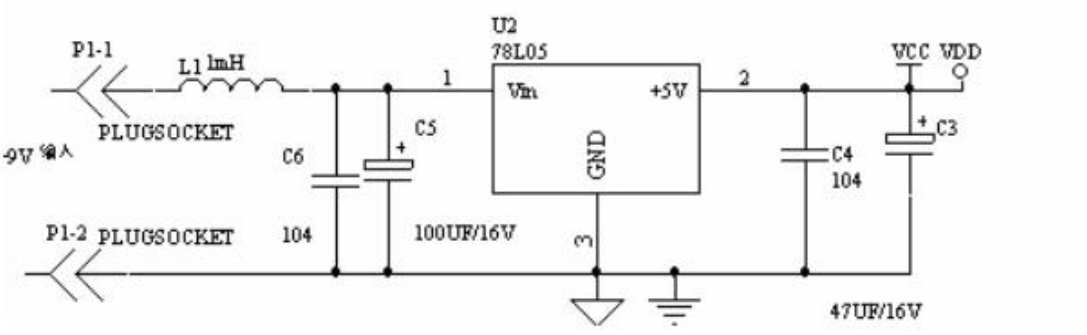



figure 5: Full functional circuit of power supply voltage regulator circuit

### 8.1. DC Voltage Stabilizer

At PCB LAYOUT, such 78L05 power component must be close to WTC02SP Vcc pin.

### 8.2. Placement of Voltage Stabilizer Component

78L05, peripheral components and WTC02SP must be placed on the same circuit board centrally, to put an end to the noises caused by overlong power connection line.

### 8.3.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)

### 8.4. 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.

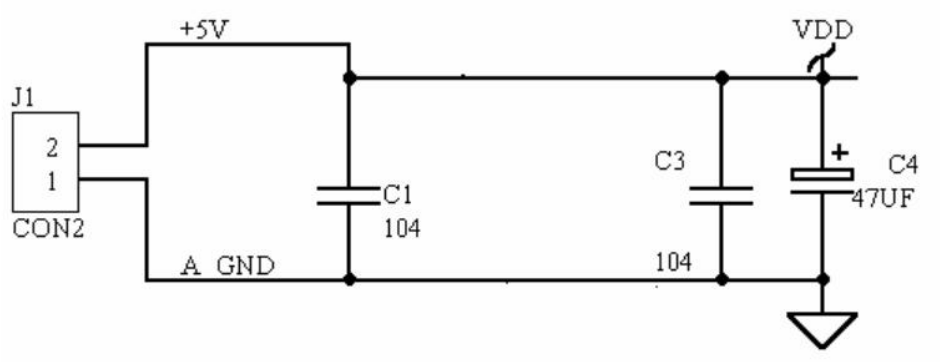
### 8.5. Power Filter

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.

### 8.6. 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 6: Power Filter Circuit

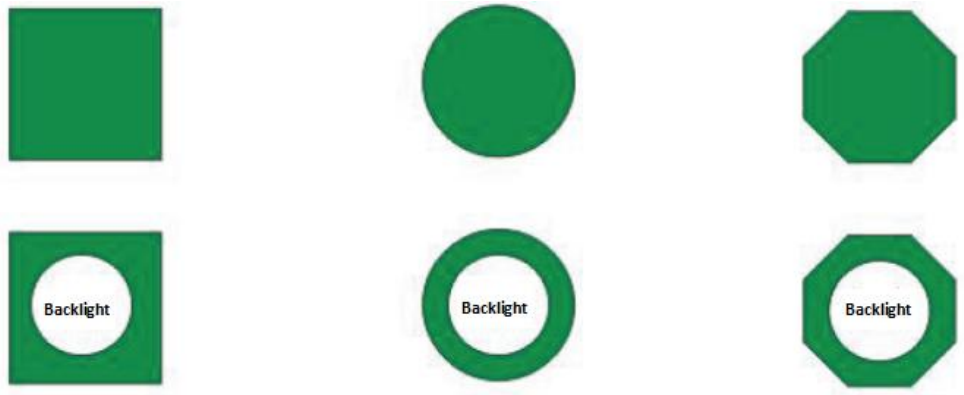
**Precautions:**

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.

## 9. WTC02SP 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 sense element 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 7: 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.

Figure 8: Spring sense element

### 9.5. Requirements for sense element and Panel Contact Surface

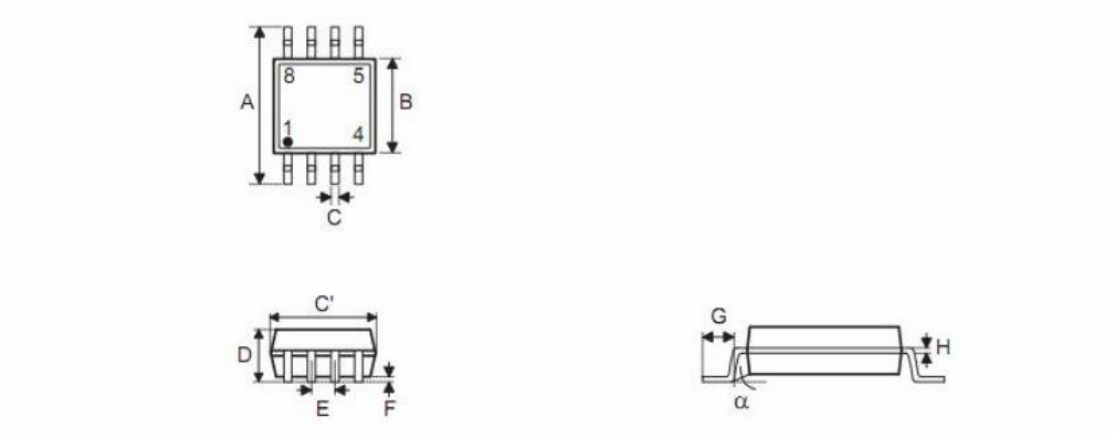
The surface of the induction plate must be levelled off, and is no clearance between the panels.

### 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 WTC02SP should be short and thin as far as possible (0.1~0.2mm width). It is best that WTC02SP 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. Package Dimension Drawing

Package Dimension Drawing Of WTC02SP




| Symbol | Dimensions in inch | | |
|---|---|---|---|
| | Min. | Nom. | Max. |
| A | 0.228 | — | 0.244 |
| B | 0.150 | — | 0.157 |
| C | 0.012 | — | 0.020 |
| C′ | 0.188 | — | 0.197 |
| D | — | — | 0.069 |
| E | — | 0.050 | — |
| F | 0.004 | — | 0.010 |
| G | 0.016 | — | 0.050 |
| H | 0.007 | — | 0.010 |
| α | 0° | — | 8° |

| Symbol | Dimensions in mm | | |
|---|---|---|---|
| | Min. | Nom. | Max. |
| A | 5.79 | — | 6.20 |
| B | 3.81 | — | 3.99 |
| C | 0.30 | — | 0.51 |
| C′ | 4.78 | — | 5.00 |
| D | — | — | 1.75 |
| E | — | 1.27 | — |
| F | 0.10 | — | 0.25 |
| G | 0.41 | — | 1.27 |
| H | 0.18 | — | 0.25 |
| α | 0° | — | 8° |

Figure 9: Package Dimension Drawing of WTC02SP