

Features

- Operating voltage: 2.4-5.5V
- Standby current: 9uA/3.0V
- Power-On Reset (POR)
- Low Voltage Reset (LVR)
- Key Response Time: Normal Mode 48mS , Standby Mode 160mS
- Single key output
- I2C output+INT interrupt pin
- Maximum key on duration time 10S
- No touch 4S to enter standby mode
- Sensitivity adjustment using an external capacitor(1-47nF) on CS pin
- Add a capacitor (0-50pF) to a touch key pin can fine tune the sensitivity for single key
- After power-on have about 0.25S stable-time, during the time do not touch the key .
- Anti-voltage fluctuation , High anti-interference
- Package
SOP16(150mil)(9.9mm x 3.9mm PP=1.27mm)

1 General Description

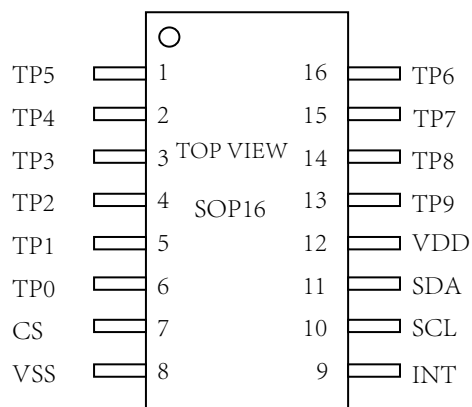
VK3610I is a touch pad detector IC which offers 10 touch key, It can detect human body contact using external touch pads. . The high level of device integration enable applications to be implemented with a minimum number of external components.

It provides I2C output, 1 INT interrupt output pin. Special internal circuitry is also employed to ensure excellent power noise rejection to reduce the possibility of false detections, increasing the touch switch application reliability under adverse environmental conditions.◦

With auto-calibration, low standby current, excellent resistance to voltage fluctuation and other features, this range of touch key devices provide a simple and effective means of implementing 10 touch key + IO operation in a wide variety of applications.

2 Pinouts and pin description

2.1 VK3610I SOP16 Pin Assignment

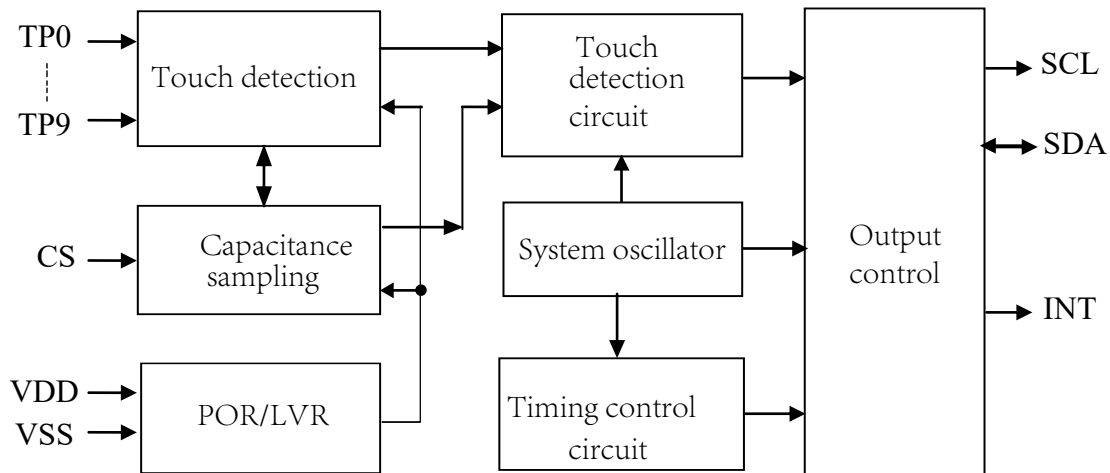


2.2 VK3610I SOP16 Pin Description

Pin	I/O	Function Description
1-TP5	IN	Touch key input pin
2-TP4	IN	Touch key input pin
3-TP3	IN	Touch key input pin
4-TP2	IN	Touch key input pin
5-TP1	IN	Touch key input pin
6-TP0	IN	Touch key input pin
7-CS	IN	Capacitance detection,the larger the capacitance the higher the sensitivity(1-47nF)
8-VSS	VSS	Negative power supply
9-INT	OUTPUT	Touch status output, open-drain output requires an external pull-up resistor
10-SCL	IN	Serial Clock Input pin for I2C,requires an external pull-up resistor
11-SDA	I/O	Serial Data Input/Output pin for I2C,requires an external pull-up resistor
12-VDD	VDD	Positive power supply
13-TP9	IN	Touch key input pin
14-TP8	IN	Touch key input pin
15-TP7	IN	Touch key input pin
16-TP6	IN	Touch key input pin

3 Functional Description

3.1 Block diagram



3.2 Auto-calibration Function

After power-on, the chip will be initialized to obtain the first reference value. If there is no touch, the chip will automatically calibrate the reference value, so that the reference value can be dynamically changed according to the external environment.

For example, reliable touch detection can be achieved through this mechanism when temperature changes or when there is environmental noise.

3.3 Max Key On Duration Time

In order to minimize the unintentional key detection such as accidentally touching the sensor pad, the chip sets the longest key duration function inside. When a touch key is pressed, the internal timer starts to count. Once the key is pressed for too long, after about 10S, the touch chip will ignore the state of the touched key, recalibrate, and obtain a new reference value. The output state is reset to the power-on initial state.

3.4 Anti-Voltage Fluctuation

The chip has a built-in anti-voltage fluctuation function, which can prevent the touch button from malfunctioning caused by the external high current drive and the instantaneous drop of the working voltage.

3.5 Output mode

The output of VK3610I is I2C output + INT interrupt pin, Support multi-key simultaneous touch.
The INT interrupt pin outputs the touch state, with touch output low level, no touch output high level.

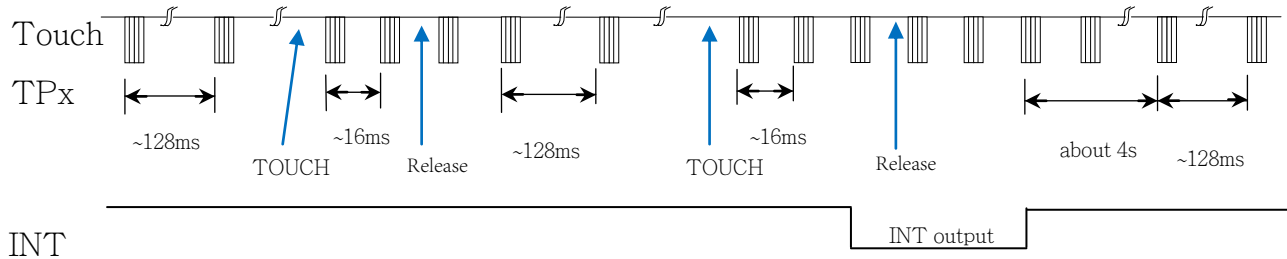
Data Format: INT+I2C data key value. byte0(B7-B0),byte1(B15-B8).

output active low																							
Touch pin	I2C data key value										INT	Touch pin	I2C data key value										INT
	B9 B8 B7 B6 B5 B4 B3 B2 B1 B0												B9 B8 B7 B6 B5 B4 B3 B2 B1 B0										
TP0 Touch	0	0	0	0	0	0	0	0	0	1	0	TP0 Release	0	0	0	0	0	0	0	0	0	1	
TP1 Touch	0	0	0	0	0	0	0	0	0	1	0	TP1 Release	0	0	0	0	0	0	0	0	0	1	
TP2 Touch	0	0	0	0	0	0	0	0	1	0	0	TP2 Release	0	0	0	0	0	0	0	0	0	1	
TP3 Touch	0	0	0	0	0	0	0	1	0	0	0	TP3 Release	0	0	0	0	0	0	0	0	0	1	
TP4 Touch	0	0	0	0	0	1	0	0	0	0	0	TP4 Release	0	0	0	0	0	0	0	0	0	1	
TP5 Touch	0	0	0	0	1	0	0	0	0	0	0	TP5 Release	0	0	0	0	0	0	0	0	0	1	
TP6 Touch	0	0	0	1	0	0	0	0	0	0	0	TP6 Release	0	0	0	0	0	0	0	0	0	1	
TP7 Touch	0	0	1	0	0	0	0	0	0	0	0	TP7 Release	0	0	0	0	0	0	0	0	0	1	
TP8 Touch	0	1	0	0	0	0	0	0	0	0	0	TP8 Release	0	0	0	0	0	0	0	0	0	1	
TP9 Touch	1	0	0	0	0	0	0	0	0	0	0	TP9 Release	0	0	0	0	0	0	0	0	0	1	

Note: I2C data at power-on=00 00000000 INT pin output level=1

3.6 Operating Mode

There are two operating modes for VK3610I, the normal mode and the standby mode. If any key is pressed, the device will be waken up and will then enter the normal mode. If no key press, After 4S, the system will then return to the standby mode again, it will be saving power. When VDD=5V, at standby mode output response time about 160ms, at detective mode output response time about 48 ms.



3.7 Sensitivity Adjustment

The touch PAD size and capacitance of connecting line on PCB can affect the sensitivity. The sensitivity adjustment must according to the practical application on PCB. The VK3610I offers some methods for adjusting the sensitivity outside:

I. Touch PAD Size

Under other conditions are fixed. Using a larger Touch PAD size can increase sensitivity. Otherwise it can decrease sensitivity. But the touch PAD size must use in the effective scope.

II. Panel Thickness

Under other conditions are fixed. Using a thinner panel can increase sensitivity. Otherwise it can decrease sensitivity. But the panel thickness must be below the maximum value.

III. Value of CS

Under other conditions are fixed. CS pin to VSS capacitor Cs can adjust sensitivity, When adding the value of CS will increase sensitivity in the useful range (1nF-47nF) .

IV. Capacitor to a touch key pin

Add a capacitor (0-50pF) to a touch key can fine tune the sensitivity for single key, When adding the value of capacitor will decrease sensitivity .

Panel Thickness (Acrylic or Glass)	CS value (only reference)
<3mm	6.8nF/25V
3-6mm	10nF/25V
6-10mm	22nF/25V

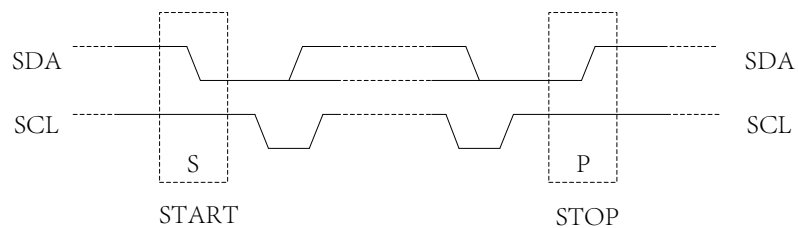
4 I2C Serial Interface

The device supports I2C serial interface. The maximum communication speed is 400kbit/S.
The two lines are a serial data line, SDA, and a serial clock line, SCL. Both lines are required external pull-up resistors.

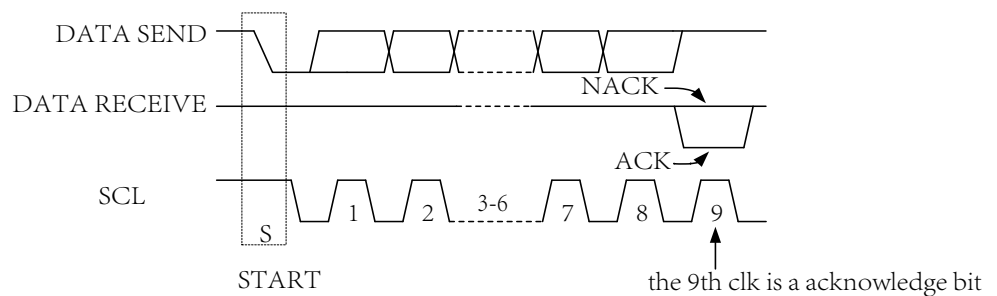
When the bus is free, both lines are high level. When the SCL signal is high level, Start to work or restart when the SDA signal changes from high level to low level. When the SCL signal is high level, It stops working when the SDA signal changes from low level to high level.

The level on the SDA port can only be changed when the SCL signal is low.

START and STOP

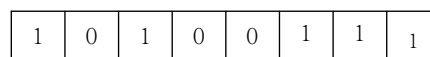


Acknowledge

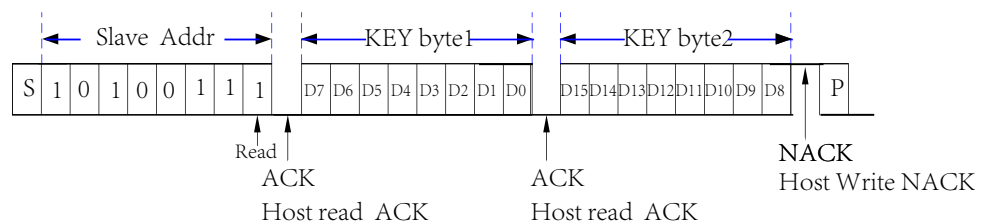


Slave Address

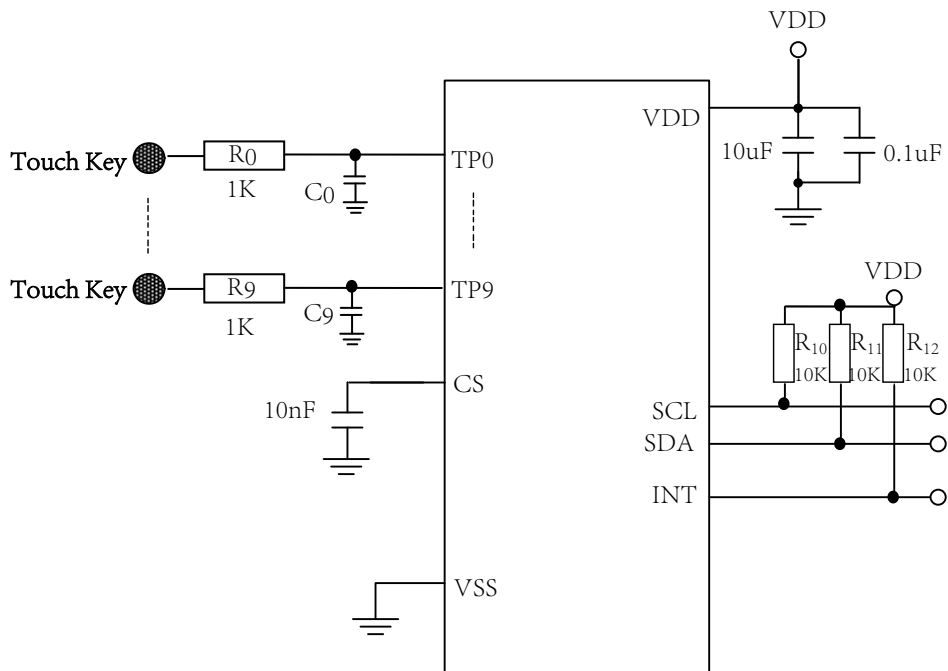
(0xA7) bit0=1 Read



Read a byte key value:



5 Application Circuits



6 Electrical characteristics

6.1 Absolute Maximum Ratings

Item	Symbol	Ratings	Unit
Power voltage	VDD	-0.3~6.0	V
Input Voltage	VIN	$V_{SS}-0.3 \sim V_{DD}+0.3$	V
Storage Temperature	TSTG	-50~+125	℃
Operating Temperature	TOTG	-40~+85	℃
Human Body Mode	ESD	4KV-8KV(Class 3A)	KV

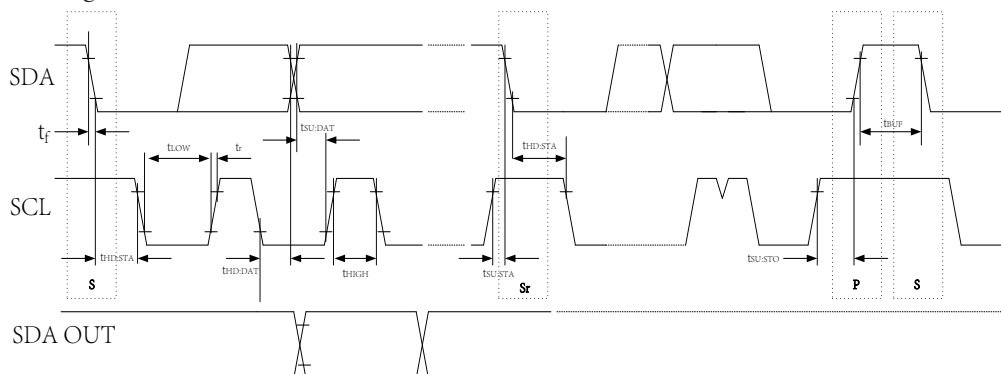
6.2 DC Characteristics

Item	Symbol	Min.	Typ.	Max	Unit	Test Conditions (25 °C)	
						VDD	Conditions
Operating voltage	VDD	2.4	3.0	5.5	V	—	—
Low voltage Reset	LVR	—	2.3	—	V	—	—
Operating current	I _{OP}	—	0.3	0.6	mA	3.0V	CS=10nF
		—	0.5	1.0		5.0V	
Standby current	I _{ST}	—	9	18	μA	3.0V	CS=10nF
		—	16	32		5.0V	
Output Sink Current	I _{IL}	—	4	—	mA	3.0V	V _{OL} =0.6V
		—	8	—		5.0V	
Output Source Current	I _{OL}	—	-2	—	mA	3.0V	V _{OH} =2.6V
		—	-4	—		5.0V	V _{OH} =4.3V
Input Low Voltage	V _{IL}	—	—	0.3	VDD	VDD	Input Low Voltage
Input high Voltage	V _{IH}	0.7	—	1	VDD	VDD	Input High Voltage
Output Response Time	T _R	—	45	—	mS	3.0V	normal mode
		—	48	—		5.0V	normal mode
		—	150	—	mS	3.0V	standby mode
		—	160	—		5.0V	standby mode

6.3 AC Characteristics

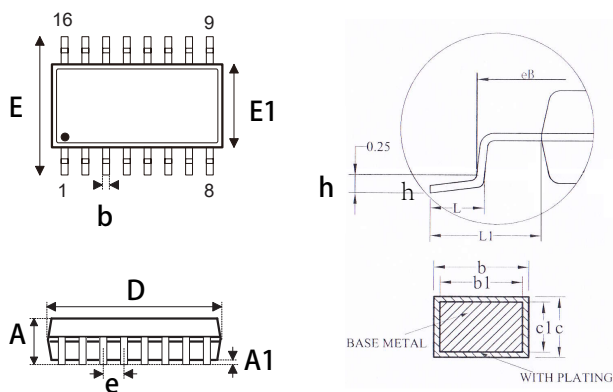
Symbol	Item	Min.	Max.	Unit	Test Conditions
					Conditions
f_{SCL}	Clock Frequency	-	400	kHZ	—
t_{BUF}	Bus Free Time	1.3	-	μs	Time in which the bus must be free before a new transmission can start
$t_{HD; STA}$	Start Condition Hold Time	0.6	-	μs	After this period, the first clock pulse is generated
t_{LOW}	SCL Low Time	1.3	-	μs	—
t_{HIGH}	SCL High Time	0.6	-	μs	—
$t_{SU; STA}$	Start Condition Setup Time	0.6	-	μs	Only relevant for repeated START condition —
$t_{HD; DAT}$	Data Hold Time	0	-	μs	—
$t_{SU; DAT}$	Data Setup Time	100	-	ns	—
t_r	Rising Time	-	0.3	μs	periodically sampled
t_f	Falling Time	-	0.3	μs	periodically sampled
$t_{SU; STO}$	Stop Condition Setup Time	0.6	-	μs	—
t_{AA}	Output Valid from Clock	-	0.9	μs	—
t_{SP}	Input Filter Time Constant (SDA and SCL pin)	-	50	ns	Noise suppression time

I²C Timing



7 Package Information

7.1 SOP16(9.9mm x3.9mm PP=1.27mm):



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	---	---	1.55
A1	0.10	---	0.225
b	0.39	---	0.47
b1	0.38	0.41	0.44
c	0.20	---	0.24
c1	0.19	0.20	0.21
D	9.80	9.90	10.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
h	0.25	---	0.50
L	0.50	---	0.80
L1	1.05REF		

8 Revision history

No.	Version	Date	Modify the content	Check
1	0.1	2019-08-10	Original version	Yes
2	1.0	2021-02-11	Update version	Yes

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