

## 2 keys Touch Pad Detector IC

### Outline

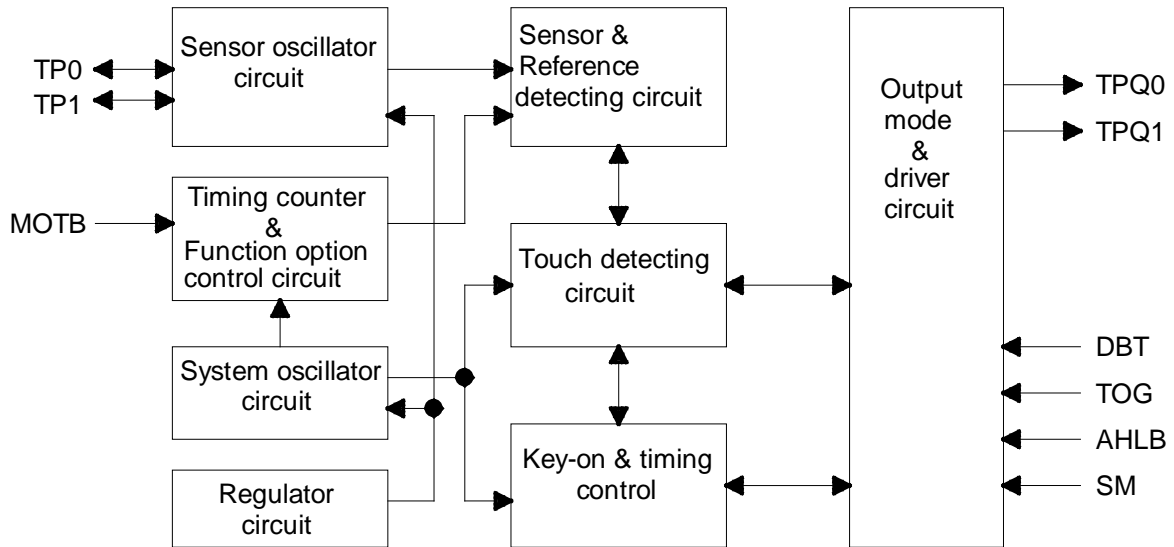
- The TTP232 TonTouch™ IC is capacitive sensing design specifically for touch pad controls. The device built in regulator for touch sensor. Stable sensing method can cover diversity conditions. Human interfaces control panel links through non-conductive dielectric material. The main application is focused at replacing of the mechanical switch or button. The ASSP can independently handle the 2 touch pads with 2 direct output pins

### Characteristic

- Operating voltage 2.4V ~ 5.5V
- Built-in regulator for touch sensor
- Operating current, @VDD=3V no load
- At stand-by typical 2.5uA
- Have two kinds of response time max about 220mS/270mS from stand-by state @VDD=3V, it selects by pad option (DBT pin)
- Sensitivity can adjust by the capacitance (1~50pF) outside for each touch pad
- Provides direct mode or toggle mode active high or active low by pad option (TOG/AHLB pin)
- Have the maximum on time 16sec/infinite by pad option (MOTB pin)
- Offer multi-key or single-key feature by pad option (SM pin)
- After power-on have about 0.5sec stable-time, during the time do not touch the key pad, and the function is disabled
- Auto calibration for life
- The re-calibration period is about 1 sec within 8 sec after power-on. When key has been touched within 8 sec or key has not been touched more than 8 sec after power-on, then the re-calibration period change to 4 sec

### Applications

- Wide consumer products
- Button key replacement

**Block diagram**

**Pin Description**

Pad NO	Pad Name	Type	Pad Description
1	TPQ0	O	CMOS output pin for TP0 touch input pin
2	AHLB	I-PH	Output TPQ0, TPQ1 active high or low selection, 1 (Default) → Active high ; 0 → Active low
3	VSS	P	Negative power supply, ground
4	TOG	I-PH	Output type option pin, 1 (Default) → Direct output ; 0 → Toggle output
5	TP0	I/O	Touch pad input pin
6	VDD	P	Positive power supply
7	TP1	I/O	Touch pad input pin
8	DBT	I-PH	Response time option 1 (Default) → 220ms ; 0 → 270ms
9	MOTB	I-PH	Maximum on time selection 1 (Default) → Disable ; 0 → Enable
10	SM	I-PH	Single/multi key option 1 (Default) → Multi-key mode ; 0 → Single key mode
11	TPQ1	O	CMOS output pin for TP1 touch input pin

**接腳類型**

- I      CMOS input only
- O      CMOS push-pull output
- I/O    CMOS I/O
- P      Power/Ground
- I-PH   CMOS input and pull-high resistor
- I-PL   CMOS input and pull-low resistor
- OD    Open drain output, have no Diode protective circuit

**Electrical Characteristics**

- Absolute maximum ratings**

Parameter	Symbol	Conditions	Rating	Unit
Operating Temperature	T <sub>OP</sub>	—	-40~+85	°C
Storage Temperature	T <sub>STG</sub>	—	-50~+125	°C
Supply Voltage	VDD	Ta=25°C	VSS-0.3~VSS+5.5	V
Input Voltage	V <sub>IN</sub>	Ta=25°C	VSS-0.3~VDD+0.3	V
Human Body Mode	ESD	—	5	KV

Note : VSS symbolizes for system ground

- DC / AC characteristics : ( Test condition at room temperature = 25 °C )**

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Operating Voltage	VDD		2.4	3	5.5	V
Internal Regulator Output	VREG		2.2	2.3	2.4	V
System oscillator	FFAST	VDD=3V	-	512K	-	Hz
	FLOW		-	16K	-	
Operating Current	I <sub>OP</sub>	Stand-by , VDD=3V output no load	-	2.5	-	uA
Input Ports	V <sub>IL</sub>	Input Low Voltage	0	-	0.2	VDD
Input Ports	V <sub>IH</sub>	Input High Voltage	0.8	-	1.0	VDD
Output Port Sink Current	I <sub>OL</sub>	VDD=3V, V <sub>OL</sub> =0.6V	-	8	-	mA
Output Port Source Current	I <sub>OH</sub>	VDD=3V, V <sub>OH</sub> =2.4V	-	-4	-	mA
Output Response Time	T <sub>R</sub>	VDD=3V 、 At touch operation	-	-	60	mS
		VDD=3V 、 At stand-by	-	-	220	
Input Pin Pull-high Resistor	R <sub>PH</sub>	VDD=3V ( MOTB 、 TOG 、 AHLB 、 SM 、 DBT )	-	30K	-	ohm

## Function Description

### I . Sensitivity adjustment

The total loading of electrode size and capacitance of connecting line on PCB can affect the sensitivity. So the sensitivity adjustment must according to the practical application on PCB. The TTP232 offers some methods for adjusting the sensitivity outside

1. by the electrode size

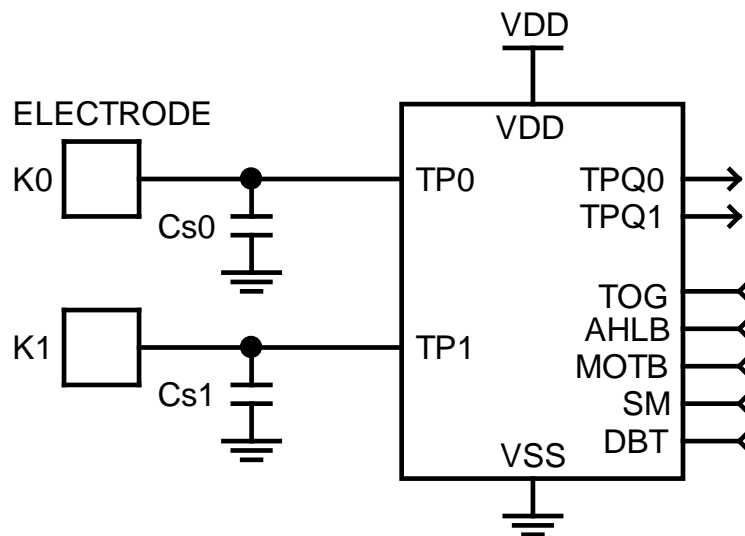
Under other conditions are fixed. Using a larger electrode size can increase sensitivity. Otherwise it can decrease sensitivity. But the electrode size must use in the effective scope

2. by the 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

3. by the value of Cs0~Cs1 ( please see the down figure )

Under other conditions are fixed. Add the capacitors Cs0~Cs1 can fine tune the sensitivity for single key, that lets all key's sensitivity identical. When do not use any capacitor to VSS, the sensitivity is most sensitive. When adding the values of Cs0~Cs1 will reduce sensitivity in the useful range ( $1 \leq Cs0 \sim Cs1 \leq 50pF$ )



### II . Output mode ( By TOG 、 AHLB pad option )

The TTP232 outputs ( TPQ0~TPQ1 ) has direct mode active high or low by AHLB pad option, has toggle mode by TOG pad option

TOG	AHLB	Pad TPQ0 ~ TPQ1 option features	Remark
1	1	Direct mode, CMOS output active high	Default
1	0	Direct mode, CMOS output active low	
0	1	Toggle mode, power on state = 0	
0	0	Toggle mode, power on state = 1	

### III. Maximum key on duration time ( By MOTB pad option )

If some objects cover in the sense pad, and causing the change quantity enough to be detected. To prevent this, the TTP232 sets a timer to monitor the detection. The timer is the maximum on duration time. When the detection is over the timer, the system will return to the power-on initial state, and the output becomes inactive until the next detection

MOTB	Option features	Remark
1	Infinite ( Disable maximum on time )	Default
0	Maximum on time 16 sec	

### IV. Key operating mode ( By SM pad option )

The TTP232 has the Single-key and Multi-key functions by SM pad option

SM	Option features	Remark
1	Multi-key mode	Default
0	Single key mode	

Multi-key mode : The TP0-TP1 can be detected 2 keys the same time

Single-key mode : The TP0-TP1 can be detected 1 key only at the same time, when any key be detected, the other keys can not be detected

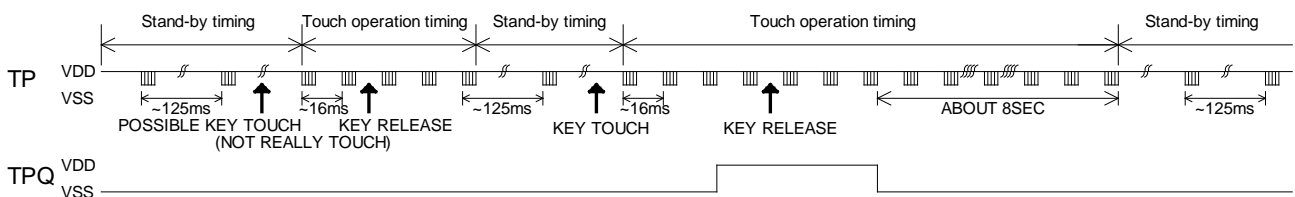
### V. The response time select ( By DBT pad option )

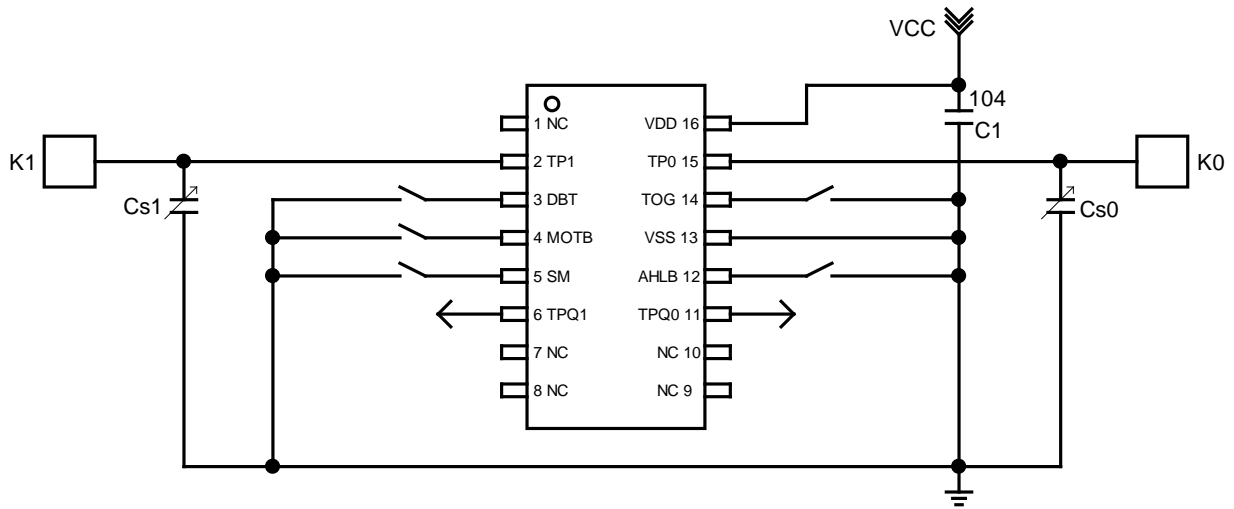
The TTP232 has two kinds of response time functions by DBT pad option

DBT	Option features	Remark
1	220 msec	Default
0	270 msec	

### VI. The operating timing for key scanning

The states and timing for key scanning

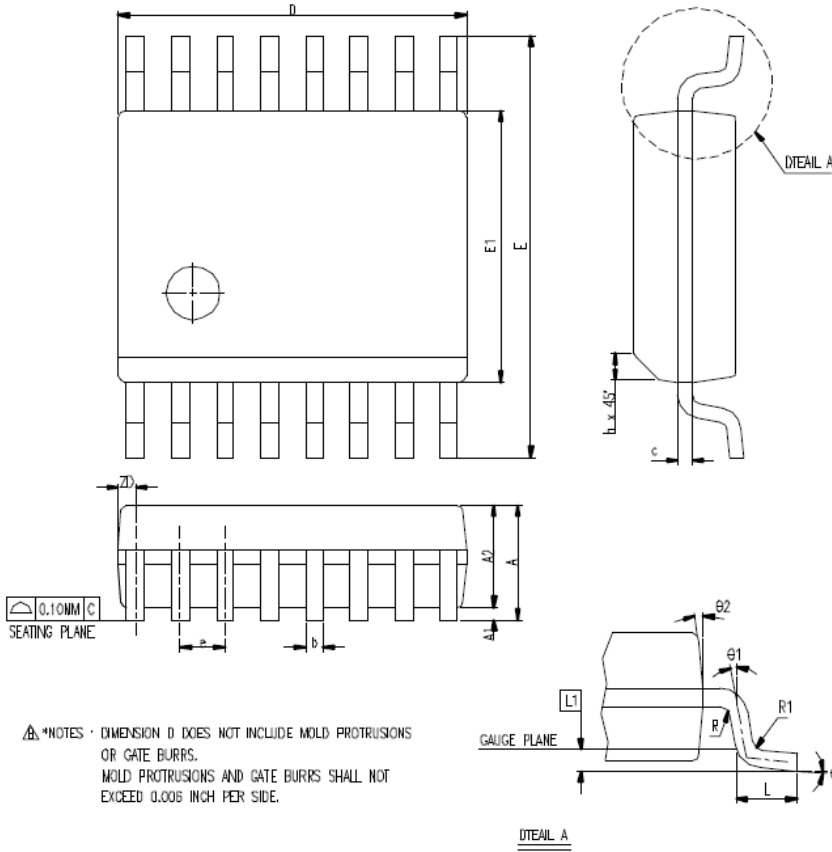


**Application circuit**


P.S. :

1. On PCB, the length of lines from touch pad to IC pin shorter is better  
And the lines do not parallel and cross with other lines
2. The power supply must be stable. If the supply voltage drift or shift quickly, maybe causing sensitivity anomalies or false detections
3. The material of panel covering on the PCB can not include the metal or the electric element.  
The paints on the surfaces are the same
4. The C1 capacitor must be used between VDD and VSS; and should be routed with very short tracks to the device's VDD and VSS pins (TTP232)
5. The capacitance Cs0~Cs1 can be used to adjust the sensitivity. The value of Cs0~Cs1 use smaller, then the sensitivity will be better. The sensitivity adjustment must according to the practical application on PCB. The range of Cs0~Cs1 value are 1~50pF
6. The sensitivity adjustment capacitors (Cs0~Cs1) must use smaller temperature coefficient and more stable capacitors. Such are X7R, NPO for example. So for touch application, recommend to use NPO capacitor, for reducing that the temperature varies to affect sensitivity

## Package outline

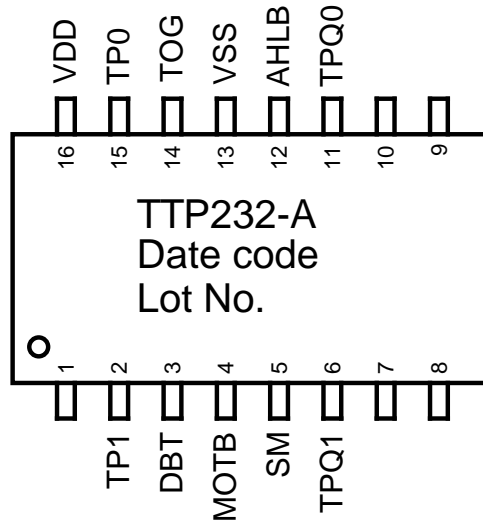


SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	1.35	1.63	1.75	0.053	0.064	0.069
A1	0.10	0.15	0.25	0.004	0.006	0.010
A2			1.50			0.059
b	0.20		0.30	0.008		0.012
c	0.18		0.25	0.007		0.010
e	0.635 BASIC			0.025 BASIC		
D	4.80	4.80	5.00	0.189	0.193	0.197
E	5.79	5.99	6.20	0.228	0.236	0.244
E1	3.81	3.91	3.99	0.150	0.154	0.157
L	0.41	0.635	1.27	0.016	0.025	0.050
h	0.25		0.50	0.010		0.020
L1	0.254 BASIC			0.010 BASIC		
ZD	0.229 REF			0.009 REF		
R1	0.20		0.33	0.008		0.013
R	0.20			0.008		
theta	0°		8°	0°		8°
theta1	0°			0°		
theta2	5°	10°	15°	5°	10°	15°
JEDEC	MO-137 (AB)					

## Package configuration

TTP232-ASB

Package Type SSOP-16



## Ordering Information

### TTP 232

Package Type	Chip Type	Wafer Type
TTP232-XXX	TCP 232	TDP 232