10 KEYS Capacitive Touch Buttons

General description

- Provide ten touch-sensitive buttons and two-wire serial interface with INT pin and MCU communication, low power consumption mode for use on battery products, and excellent water and interference resistance.

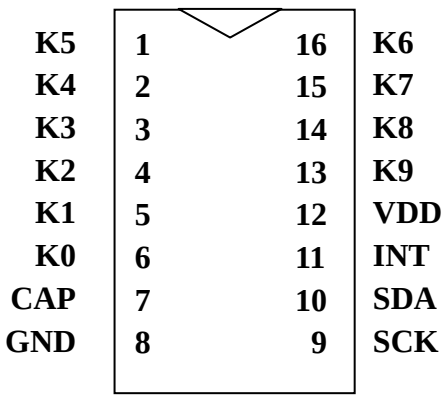
Features

- Operating voltage range : 3.1V – 5.5V
- Operating current : 3mA (normal mode) ; 15μA (hibernate mode) @5V
- Ten touch-sensitive buttons
- Automatically hibernate when buttons are idle for four seconds.
- Provide serial interfaces : SCK, SDA, and INT for MCU communication.
- Easy sensitivity adjustment achieved by adjusting the external capacitance at the CAP pin: the greater the capacitance, the higher the sensitivity.
- Waterproof and with effective judgment when the pad is covered by overflow or dew.
- Built-in LDO reduces source interference.

Applications

- Suitable for use on all kinds of home appliances and entertainment products.

Packaging pins



TTP258RD-AOBN
16-SOP-A

Pin description

Pin No.	Pin Name	Type	Function Description
1	K5	I	Add resistance at 100-1,000Ω to the touch button pin to enhance interference and statistic resistance.
2	K4	I	Add resistance at 100-1,000Ω to the touch button pin to enhance interference and statistic resistance.
3	K3	I	Add resistance at 100-1,000Ω to the touch button pin to enhance interference and statistic resistance.
4	K2	I	Add resistance at 100-1,000Ω to the touch button pin to enhance interference and statistic resistance.
5	K1	I	Add resistance at 100-1,000Ω to the touch button pin to enhance interference and statistic resistance.
6	K0	I	Add resistance at 100-1,000Ω to the touch button pin to enhance interference and statistic resistance.
7	CAP	--	Use only NPO or X7R capacitors Capacitance : 6800pF-33000pF; the greater the capacitance, and higher the sensitivity.
8	VSS	P	Negative power supply
9	SCK	I	Serial mode clock input pin
10	SDA	O	Serial mode data output pin
11	INT	O	Button state change notification output pin
12	VDD	P	Positive power supply
13	K9	I	Add resistance at 100-1,000Ω to the touch button pin to enhance interference and statistic resistance.
14	K8	I	Add resistance at 100-1,000Ω to the touch button pin to enhance interference and statistic resistance.
15	K7	I	Add resistance at 100-1,000Ω to the touch button pin to enhance interference and statistic resistance.
16	K6	I	Add resistance at 100-1,000Ω to the touch button pin to enhance interference and statistic resistance.

Pin type

- I Input
- O Output
- P Power

AC / DC Characteristics

- **Absolutely max. Ratings**

Item	Symbol	Rating	Unit
Operating Temperature	Top	-20- +70	℃
Storage Temperature	Tsto	-50- +125	℃
Supply Voltage	VDD	5.5	V
Voltage to input terminal	Vin	Vss-0.3 to Vdd+0.3	V

- **D.C. Characteristics (Condition : Ta= 25 ± 3 ℃，RH ≦ 65 %，VDD =＋ 5V，VSS=0V)**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Operating voltage	VDD		3.1	5	5.5	V
Operating current	I_{OPR1}	VDD=5V		3		mA
Input low voltage for input and I/O port	V_{IL1}		0		0.3VDD	V
Input high voltage for input and I/O port	V_{IH1}		0.7VDD		VDD	V
Output port source current	I_{OH1}	V_{OH}=0.9VDD, @5V		4		mA
Output port sink current	I_{OL1}	V_{OL}=0.1VDD, @5V		8		mA

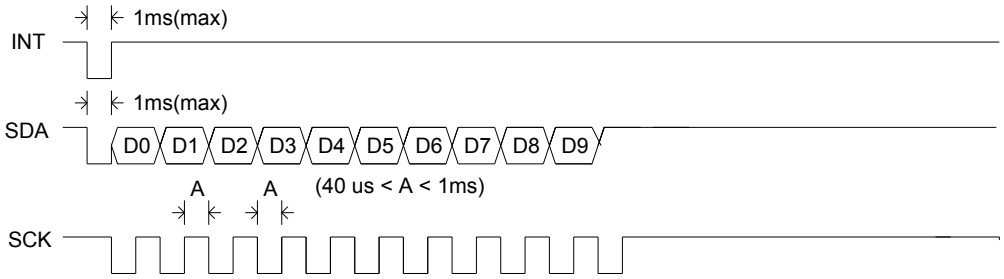
- **A.C. Characteristics**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
System clock	f_{SYS1}	OSC @5v	-	4	-	MHz
Low Voltage Reset	V_{lvr}		2.0	2.2	2.4	V
SCK positive pulse time	SCK_H		0.04		10	mS
SCK negative pulse time	SCK_L		0.04		10	mS
Time of Data interval			30			mS

Output instructions

Provide ten capacitive touch buttons with two-wire serial output. Data outputs serially from K9-K0. Data output is “1” when buttons are released and “0” when buttons are touched. When reading data, wait for INT or SDA to turn low before sending clock reading data. No data is read when polling.

Serial Transmission Diagram



說明:

1. 當 key 有變化(按 key 或離開 key), INT PIN 和 SDA PIN 即變 LO(output pin Lo), 當 SCK PIN 收到 CLK Falling edge 時，INT PIN 和 SDA PIN 立即變為 Hi(output_hi), 若 SCK PIN 一直未收到 CLK ，超過 1 ms 以上，INT PIN 和 SDA PIN 也會自動變 Hi(output_hi)
2. SCK PIN CLK 方波半波至少須 40us 以上 ，CLK 須送出完整11 個(最後1個 CLK將最後一個 DATA 結束)。
3. SDA PIN 正常為 HI, 傳送 DATA 時，有按 KEY時，該 KEY DATA 信號為 Lo,反之未按 KEY, 該 KEY DATA 傳送 Hi, D0 為 K0 DATA、D1 為 K1 DATA..., 其餘依此類推。

Description

1. When the button state changes (touched or released), INT and SDA will be low (output pin LOW). After SCK receives CLK Falling edge, INT and SDA will immediately change to high (output_hi). If SCK receives no CLK signal for over 1ms, INT and SDA will automatically change to high (output_hi).
2. The CLK half square wave to SCK must last for at least 40us. CLK must send 11 complete square waves (the last CLK wave will end the last data).
3. SDA is high by default. When sending data and a button is closed, key data signal is low. When the button is released, key data signal is high, D0 is K0 data, D1 is K1 data, etc.

Note : When reading data, wait for INT or SDA to turn low before sending clock reading data. No data is read when polling.

Function description

1. Fast response time : After a button is touched, the TTY6857 will respond within 60ms.
2. Touch-prioritized output : If K1 is recognized, other buttons will only be recognized after K1 is released, that is, only one button will be processed at a time.
3. Foolproof : The button function will be deactivated when the valid output lasts for over 10 seconds consecutively, without changing the output.
4. Ambience-adaptive : The TTY6857 supports parameter adjustments based on the changes in ambient temperature and humidity to ensure accurate judgment and operation.
5. Touch discretion : The TTY6857 can distinguish water from finger touch to ensure correct judgment of button touch even when the pad is covered by overflow or dew, except for “water jet” which will be mistaken as finger touch to activate corresponding output.
6. The built-in LDO and power noise processing procedures can enhance resistance to ripple interference from the power supply.
7. Ground the idle outputs to prevent unwanted action due to high sensitivity.

Precautions

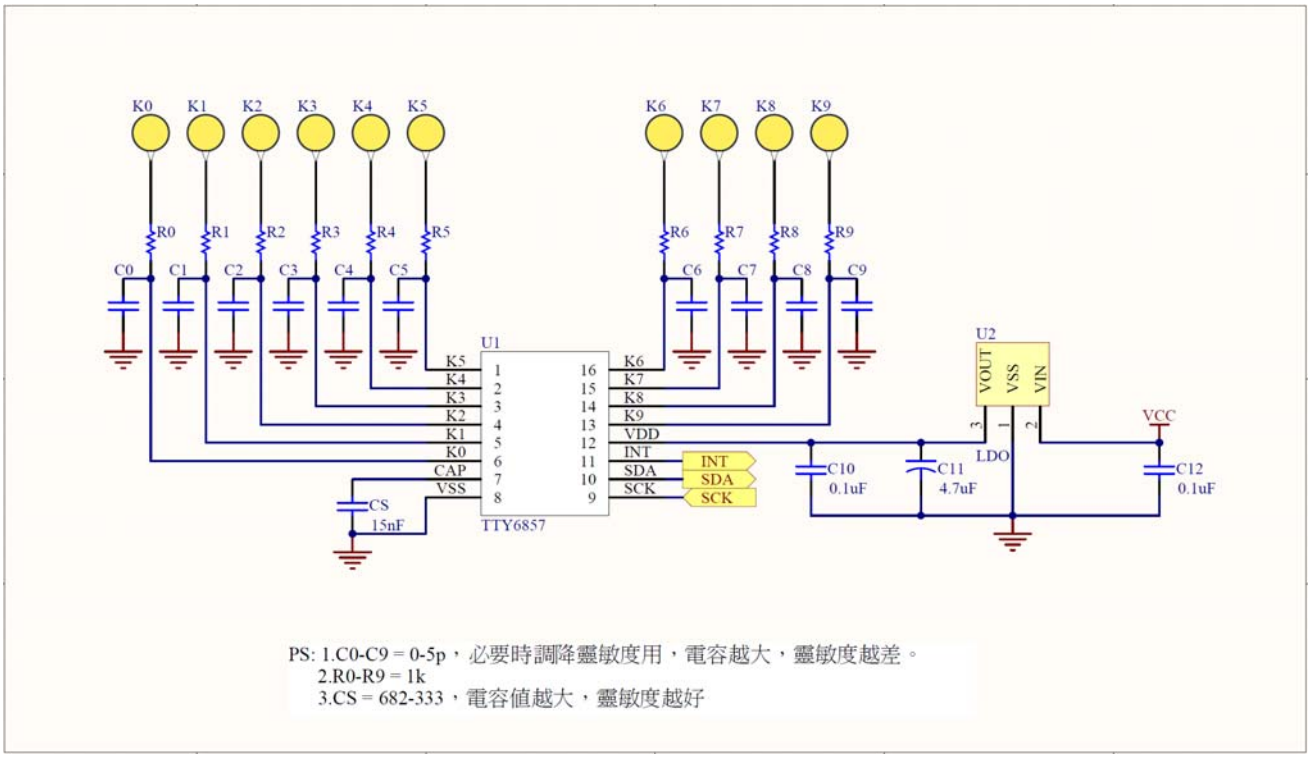
1. Correlations between capacitance (Cs) and sensitivity
   (1) The smaller the Cs, the lower the sensitivity.
   (2) The greater the Cs, the higher the sensitivity.
   (3) Cs range : 6800pF (682) — 33000pF (333).
   (4) When measuring capacitance by Cs, capacitor materials with a lower temperature change coefficient and high capacitance stability. Therefore, use only NPO or X7R capacitors.
2. In power layout, divide the circuit by block. A touch IC requires independent routing to positive power supply. When branch routing cannot be isolated, route the positive power supply to the touch IC before routing to other blocks. The same should apply to the grounding section to arrange independent branch routing to the ground of the power supply, i.e. star-earthed topology, to prevent the interference of other circuits in order to significantly enhance touch circuit stability.
3. In single-sided PCB design, touch-sensitive button springs are recommended for the pad, springs with a plate are the best choice for the highest sensitivity of the tough pad.
4. In double-sided PCB design, pads can be either circular or rectangular, with a recommended area of 12mm x 12mm. Cables linking the IC should be routed on the other side of the pad. Lower gauge cables are recommended to shorten routing.
5. The PCB must be tightly installed to the case. Loosened PCB-case installation will result in dielectric change to affect capacitance measurement and cause instability. Bonding the case and pad with non-conductive adhesive is recommended, such as acrylic glue, 3M HBM series.

6. To enhance sensitivity, the smaller the overall parasitic capacitance, the better the effect. Although neither the front nor the back of the routing area between the touch IC pins and the pad will be earthed, the area outside this area and around the PCB should be earthed to isolate this routing area to isolate capacitance interference around the pad like a wall for the circuit to receive only the capacitance above the pad. The ground should at least be 2mm away from the routing area, and the same space should be maintained between pads to maintain adequate spacing for the parallel leads of individual pads, in order to reduce the parasitic capacitance between pads and ground to enhance sensitivity.

7. For capacitive touch buttons, fingers are considered as a conductor. When a finger approaches the pad, parasitic capacitance to the ground path increases for the IC to detect capacitance change and judge if the finger touches the pad. The capacitance change of pad-finger contact is opposite to that of pad-case contact, while the capacitance change of pad-finger contact and the area of touch are proportional.

8. Case materials also affect sensitivity due to dielectric difference, for example, glass > organic glass (acrylic) > plastics. At the same thickness, the greater the dielectric constant is, the greater the capacitance will be generated by a finger-pad contact. In measurement, the higher capacitance change is, the more easily a button is recognized, and the higher the sensitivity is.

Application layout



PS :

1. C0-C5 = 0-5P. Reduce sensitivity as necessary. The greater the capacitance, the higher the sensitivity.
2. R0-R9 = 1K.
3. Cs=682-333 The greater the capacitance, the higher the sensitivity.

Correlations between external capacitance (Cs) and acrylic thickness

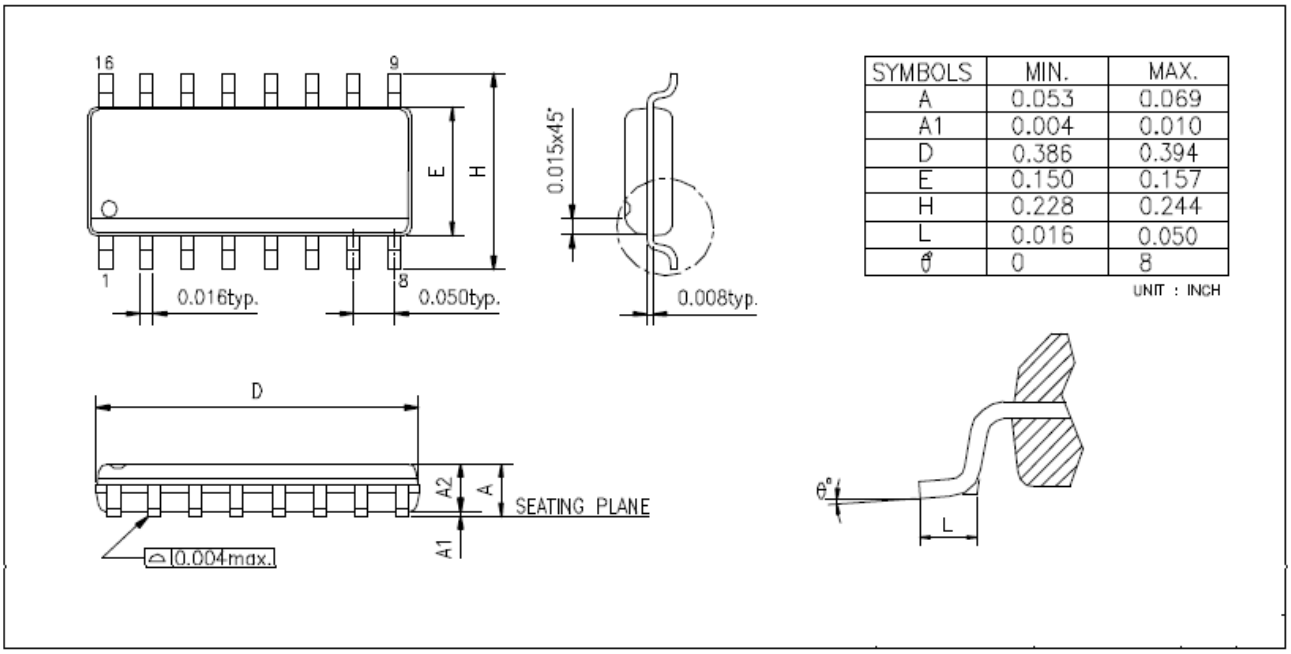
Correlations between acrylic thickness and capacitance (Cs) with an example of round metal flat spring at 12mm dia. :

Acrylic thickness (mm)	Cs	Sensitivity setting
1	682	30
2	103	30
3	153	30
4	223	30
5	223	30
10	333	30

Values in the above table are for reference only. Pad size and PCB layout will affect actual results.

Packaging description

- **16-SOP**



SYMBOLS	MIN.	MAX.
A	0.053	0.069
A1	0.004	0.010
D	0.386	0.394
E	0.150	0.157
H	0.228	0.244
L	0.016	0.050
θ	0	8

UNIT : INCH

Ordering Information

TTY6857		
Package Type	**Chip Type**	**Wafer Type**
TTP258RD-AOBN	—	—

Revision history

1. 2014/09/12- Original version : Version : 1.00
2. 2014/10/08 – page 1—Deleted OP1 supports two-wire or three-wire mode.
3. 2014/12/25 – page 4—Revised serial transmission diagram
4. 2015/05/08 – Revised operating voltage range : 3.1V – 5.5V