DigiSensor

ATA5101 Datasheet

(One Channel Touch & Proximity Sensor Controller)

V1.04

Overview

The ATA5101, single channel touch sensor controller, is designed especially for the applications which do not have I^2C interface or want to replace mechanical switches without any firmware modification. Since the ATA5101 is a one-channel touch sensor controller, it can seamlessly substitute for one mechanical button.

One of ATA5101's unique features is that it is able to determine sensitivity by itself and stores sensitivity values at the internal RAM area. This new technology is called ASC™ (Automatic Sensitivity Calibration). In contrast to the typical touch sensors which require manual sensitivity setting, the ATA5101 provides self-configurable sensitivity capability to the applications for faster and easier development. In addition to ASC™ technology, ATA5101 also provides the host MCU with both touch and proximity outputs by means of open collector output pins. Another ATA5101's benefit is its ultra low power consumption. It consumes only 5uA in active mode hence no need to enter idle or suspended.

The ATA5101's architecture is based on the active pulse-pass technology which improves noise immunity to achieve better performance in noisy environments.

Features

- Patented fully digital architecture.
- Includes ASC™ (Automatic Sensitivity Calibration) technology.
- Extremely low power consumption (5 ㎂ in active mode: only active mode available).
- Supports single input channel with various package types (6SOT, 8MSOP).
- Supports general touch key.
- Supports proximity touch key.
- Supports an Open-Drain output for both touch switch and proximity switch.

Applications

- Home appliances and consumer electronic products.
- Photo frame.
- ODD Eject switch.

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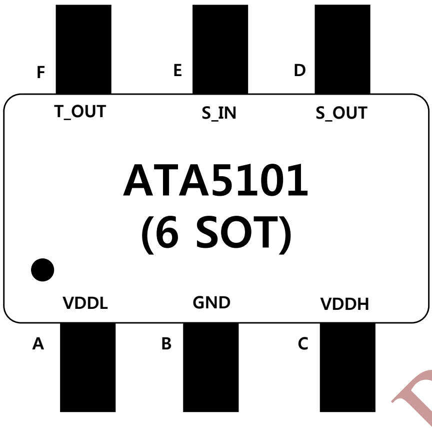
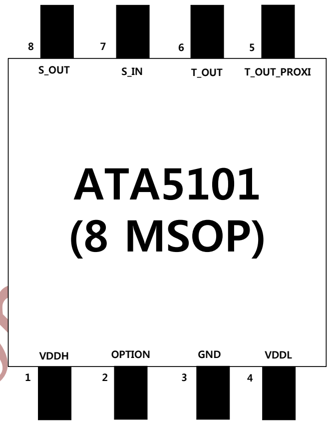
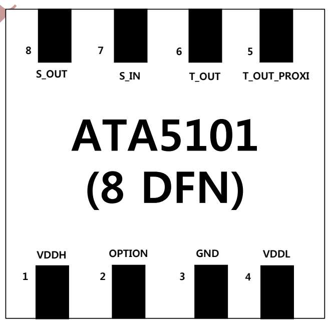
1. Ordering Information

Product Code	Package Type	Package Dimension	Pin Pitch	Number of Sensor Inputs	Number of Digital Outputs
ATA5101DA-8M	8 MSOP	2.9mm x 4.75mm x 0.82mm	0.65mm	1	2
ATA5101DA-6T	6 SOT	2.82mm x 2.65mm x 1.050mm	0.95mm	1	1
ATA5101DA-8D	8 DFN	2.0mm x 2.0mm x 0.7mm	0.5mm	1	2

Table 1. Ordering Information







2. Electrical Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
ABSOLUTE MAXIMUM RATINGS						
Tstg	Storage Temperature		-45		95	℃
Topr	Operating Temperature		-40		90	℃
Hopr	Operating Humidity		5		95	%
VPH	Power Supply Voltage	Internal LDO on condition Internal LDO off condition	4.4 2.8	5 3.3	5.5 3.6	V
VDDL	Core Power Supply Voltage		2.8	3.3	3.6	V
V_{HBM}	Electrostatic discharge voltage (Human body model)	S_IN, S_OUT pins Other I/O pins	-	-	7000 2000	V
V_{MM}	Electrostatic discharge voltage (Machine model)	All pins	-	-	200	V
V_{CDM}	Electrostatic discharge voltage (Charge device model)	All pins	-	-	700	V
RECOMMENDED OPERATING CONDITIONS						
Toprr	Operating Temperature		-35	25	85	℃
Vddp	Power Supply Voltage (VPH)	Internal LDO on condition Internal LDO off condition	4.6 3.0	5 3.3	5.5 3.6	V
Vddc	Core Power Supply Voltage (VDDL)		3.0	3.3	3.6	V
AC ELECTRICAL SPECIFICATIONS (Typical values at Ta=25℃ and VDDH, VDDL =3.3V and default Conditions)						
fsmp	Touch Sample frequency		-	-	2	Hz
Stch	Touch Sensitivity	Sensitivity Control Resistor = 25㏀(Min) Sensitivity Control Resistor = 50㏀(Typ) Sensitivity Control Resistor = 75㏀(Max)	6	3	2	fF
Dtch	Touch Dynamic Range	Sensitivity Control Resistor = 25㏀(Min) Sensitivity Control Resistor = 50㏀(Typ) Sensitivity Control Resistor = 75㏀(Max)	156	78	52	pF
Tr_o	Output Rising Time	Load = 100pF		50	60	ns
Tf_o	Output Falling Time	Load = 100pF		50	60	ns
DC ELECTRICAL SPECIFICATIONS (Typical values at Ta=25℃ and VDDH, VDDL=3.3V, using Internal LDO)						
Idd_a	Supply Current (Active mode)	@ 3.3V VDDH supply condition @ 5V VDDH Supply Condition	-	5 75	-	uA
Vol	Digital Output Low Voltage				0.6	V
Vldo	Internal LDO Output Voltage		2.8	3.3	3.6	V
Ildo	Internal LDO Driving Current				50	mA
Ids	TOUT and TOUT_P Sinking Current				16	mA

Table 2. Electrical Characteristics

3. Operating Principle

3.1. Brief System Block Diagram

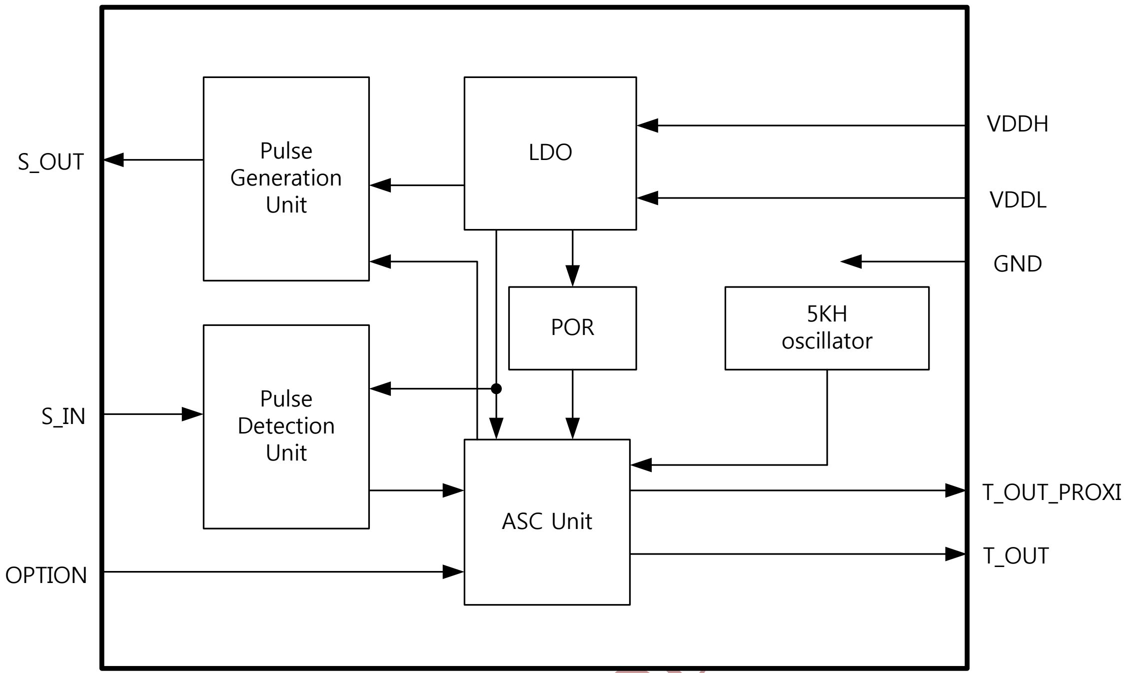


Figure 1. Block diagram of ATA5101

Pulse Generation Unit
It is controlled by ASC Unit where short pulse signal is generated.

Pulse Detection Unit
It detects a pulse PGU generated to determine touch presence.

LDO
It is a power control block. In high supply power mode the internal LDO is automatically on. In low supply power mode the internal LDO is automatically off.

Power On Reset (POR)
It is a reset signal generator during power on.

ASC (Automatic Sensitivity Calibration) Unit
It controls touch sensitivity, decides touch and proximity status.

Oscillator
The fixed 5 KHz oscillator is internally used to supply the clock signal to the ASC unit.

3.2. ASC^{TM} (Automatic Sensitivity Calibration)

ASC^{TM} is a special feature in the ATA5101. Typical touch sensors require sensitivity adjustment by either hardware or software, whereas ASC engine in the ATA5101 calibrates and optimizes sensitivity automatically by measuring capacitance. The operational theory is described below. ASC is performed when capacitance variation by touch operation after power on is greater than 33 times of unit resolution. For example, if sensitivity control register is set to 50 ㏀(3fF(Unit Resolution) x 33 = 99fF), ASC is performed when it detects capacitance variation of over 0.1pF. The value of minimum detection capacitance can be adjusted by changing the value of sensitivity control register.

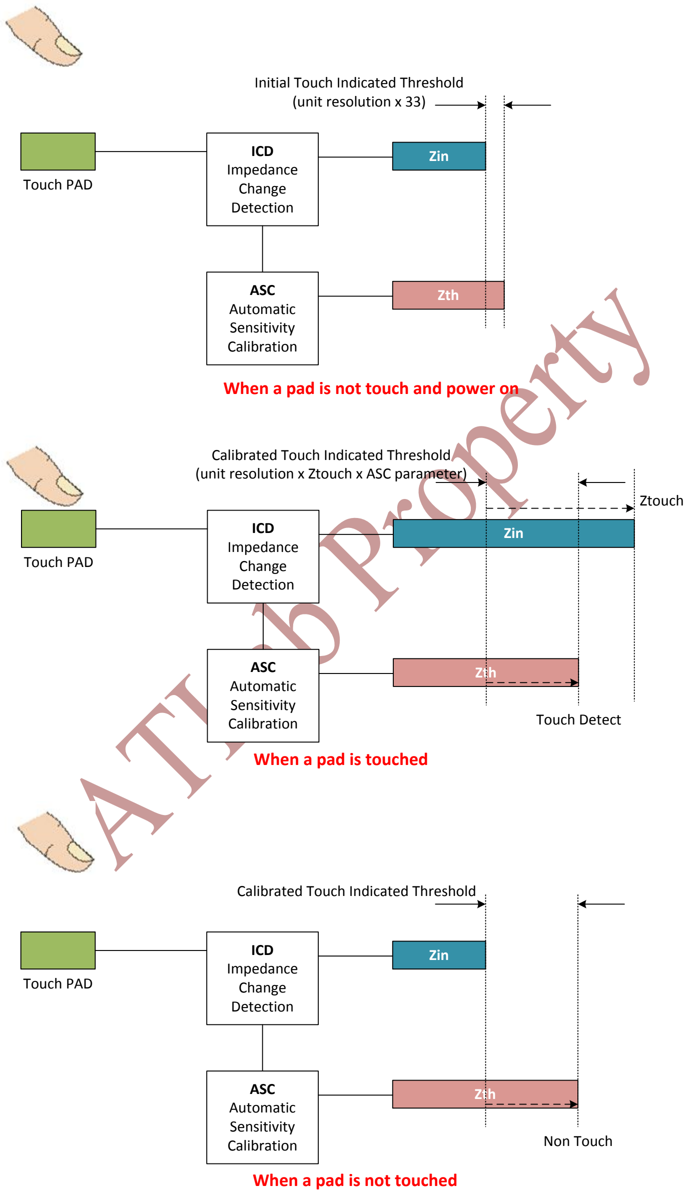


Figure 2. ASC^{TM} Operating Principle

4. Application Information

The ATA5101 is a purely digitally designed one-channel capacitive sensor controller whose major purpose of use is to change the mechanical button. The ATA5101 has two special functions, Proximity Touch Detection and Automatic Sensitivity Calibration called ASC^{TM}. This document explains in detail about the schematics, PCB layout and other recommendations for the applications.

4.1. Guidelines for typical application circuit diagram

The ATA5101 core runs at 3.3V. For 5V application, there is a built-in voltage regulator within the chip. Supply power condition for the ATA5101 will be explained later in chapter 4.6. In this chapter, typical application circuit in which the internal voltage regulator is off for minimum power consumption in 3.3V operation is explained.

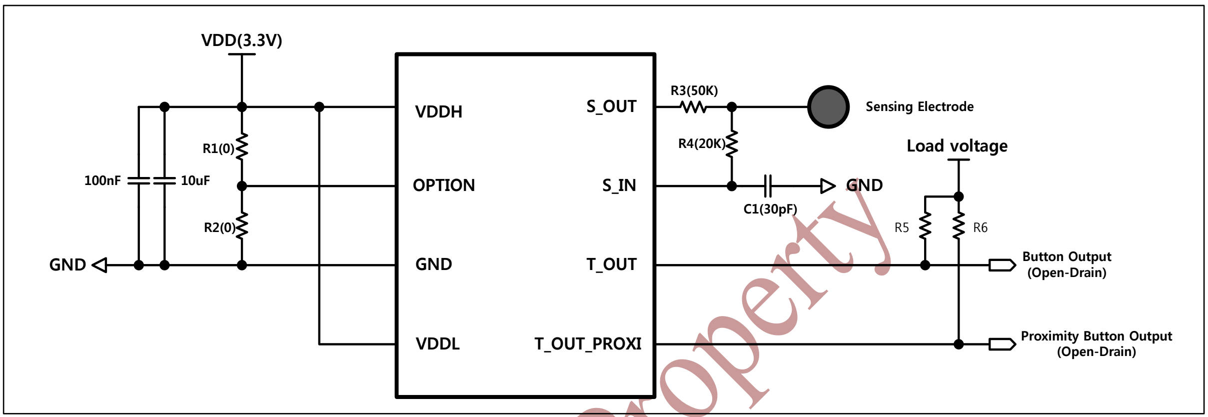


Figure 3. Typical Application schematics

<u>Proximity On/Off</u>

OPTION pin is used to enable/disable Proximity Touch Function. To enable Proximity, high voltage should be applied to OPTION pin so that R2 should be removed. T_OUT for general touch output is always enabled regardless of the status of OPTION pin. To disable Proximity to get only regular touch output, apply low voltage to OPTION pin. If any output pin such as T_OUT or T_OUT_PROXI is not used, the unused pin must be connected to the ground.

<u>Touch Detection Resolution</u>

R3 determines touch resolution. If R3 is a 50K ohm resistor, touch resolution is 3fF which can be unit sensitivity of the sensing electrode.

<u>Noise Cancel Filter</u>

R4 and C1 compose of the pre-filter which can eliminate noise in a sensing electrode. Additionally, feedback filter and IIR filter in a chip eliminate remained noise. When R4 is 20K ohm and C1 is 30pF, cut-off frequency is 265KHz as shown in Figure 4.

$$Cut\ \ Off\ \ Frequency = \frac{1}{2\pi RC}$$

Figure 4. Formula of cut off frequency

<u>Touch Output/ Proximity Touch Output</u>

T_OUT and T_OUT_PROXI are open-drain output. Therefore, when touch is detected, the output pin is connected to the ground and drives low voltage. During none touch, the pin becomes High-Z and drives high voltage due to a pull-up resistor. The rising and falling time is determined by the value of R5 and R6, respectively.

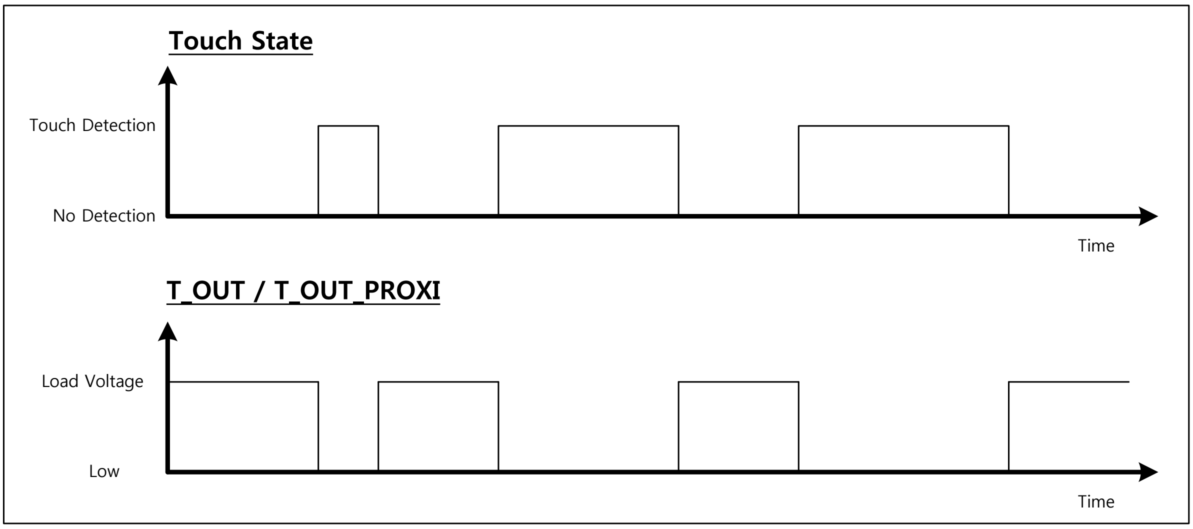
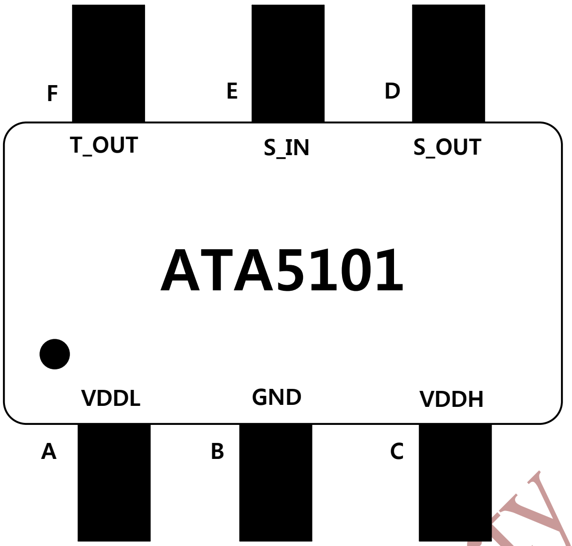


Figure 5. T_OUT/T_OUT_PROXI output configuration

4.2. 6Pin Package Pin Descriptions (6 SOT)

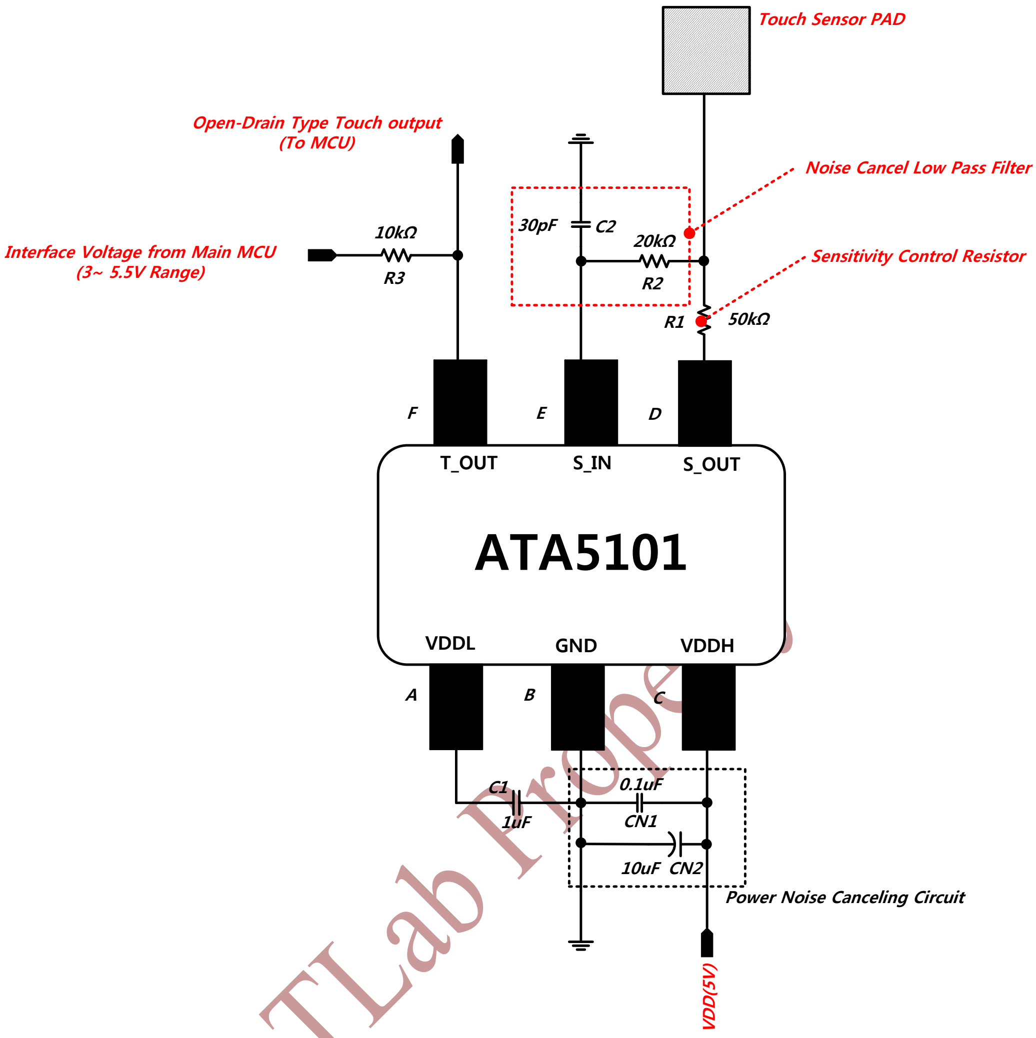


Pin Description

Name	IO	Pin #	Description
S_OUT	O	D	Sensor Output connecting a Touch Pad
S_IN	I	E	Sensor Input connecting a Touch Pad
T_OUT	O	F	Open-Drain Touch output
VDDH	P	C	Power (3-5.5V)
VDDL	P	A	LDO Output(3.3V) or 3.3V Power Input
GND	P	B	Ground

Table 3. 6SOT Pin Descriptions

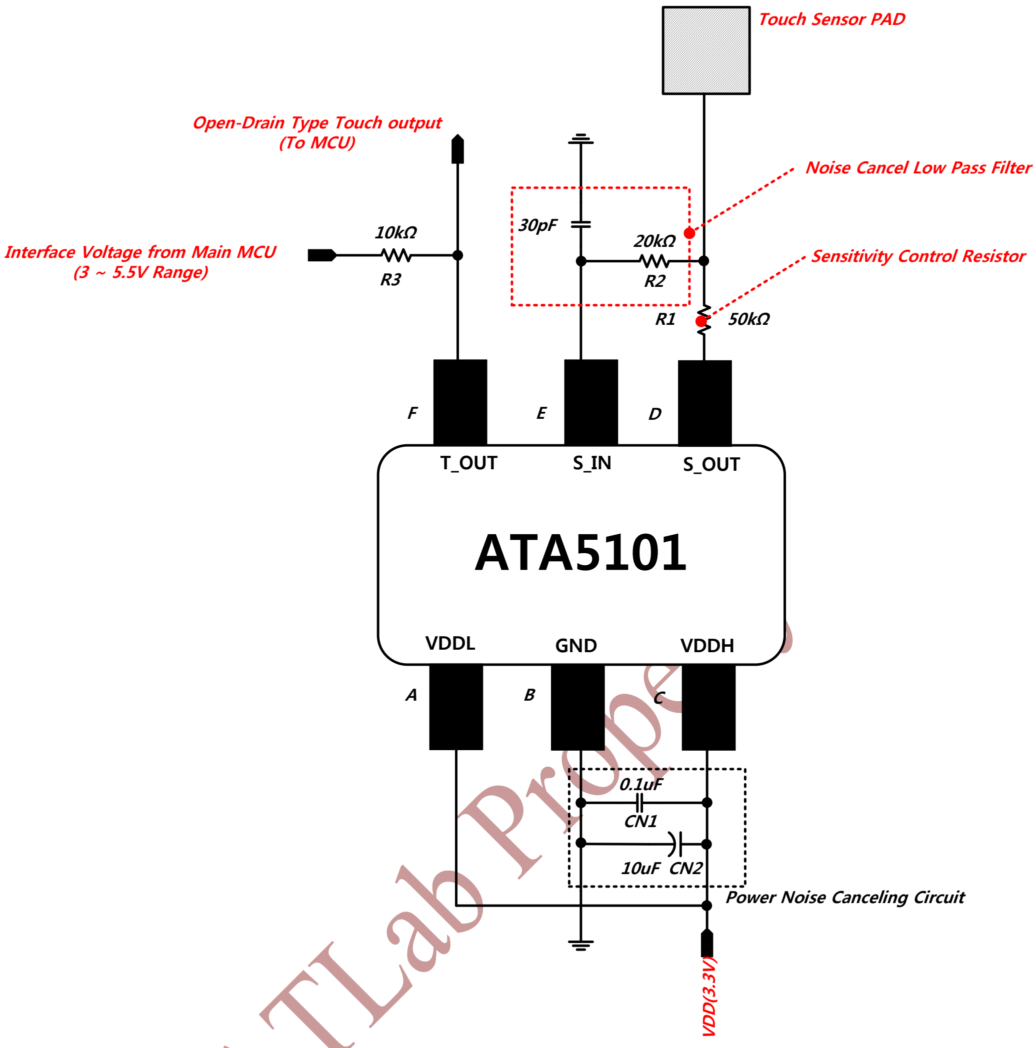
4.2.1. Application circuit of 6SOT with 5V power supply



Notes:

- Output data format of T_OUT pin is the same as that of a mechanical switch, i.e. No touch: Open, Touch: GND.
- Unit resolution of sensitivity can be configured by changing the value stored at Sensitivity Control Register.
  - If register value is set to 50㏀, Unit Resolution is 3fF. Operating parasitic capacitance range is 78pF (Recommend).
  - If it is set to 25㏀, Unit Resolution is 6fF. Operating parasitic capacitance range is 156pF.
  - If it is set to 75㏀, Unit Resolution is 2fF. Operating parasitic capacitance range is 52pF.

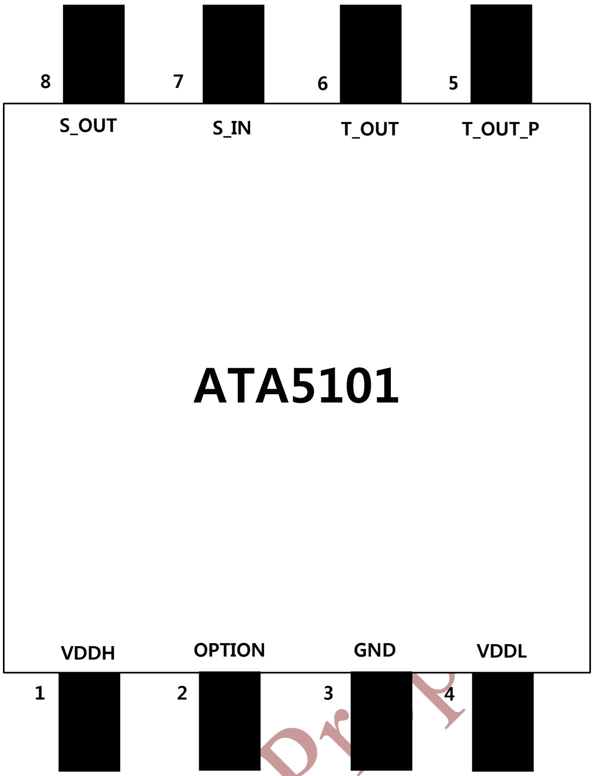
4.2.2. Application circuit of 6SOT with 3.3V power supply



Notes:

- Output data format of T_OUT pin is the same as that of a mechanical switch, i.e. No touch: Open, Touch: GND.
- Unit resolution of sensitivity can be configured by changing the value stored at Sensitivity Control Register.
  - If register value is set to 50㏀, Unit Resolution is 3fF. Operating parasitic capacitance range is 78pF (Recommend).
  - If it is set to 25㏀, Unit Resolution is 6fF. Operating parasitic capacitance range is 156pF.
  - If it is set to 75㏀, Unit Resolution is 2fF. Operating parasitic capacitance range is 52pF.

4.3. 8-pin Package Pin Descriptions (MSOP, DFN)

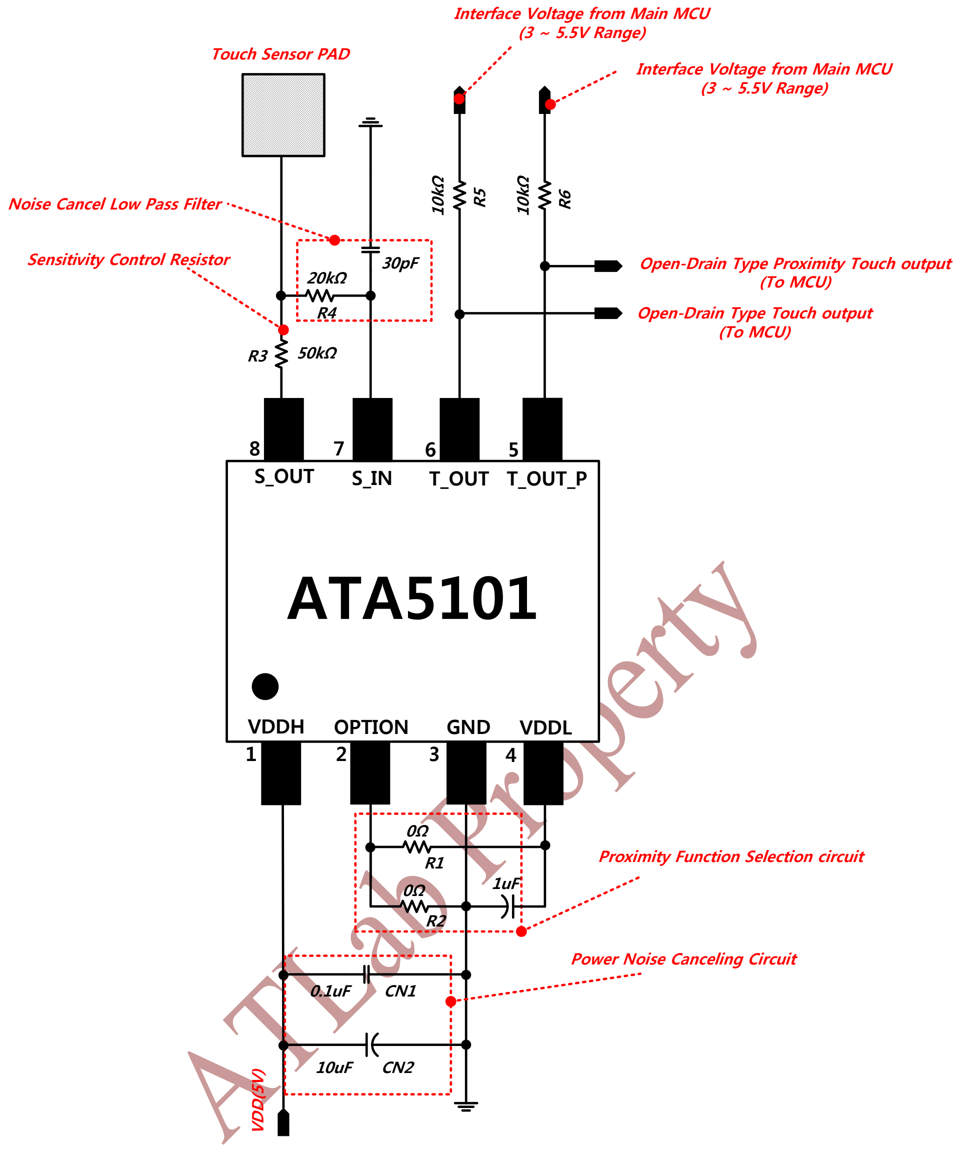


Pin Description

Name	IO	Pin #	Description
S_IN	I	7	Sensor Input connecting a Touch Pad
S_OUT	O	8	Sensor Output connecting a Touch Pad
T_OUT	O	6	Open-Drain Touch output
T_OUT_P	O	5	Open-Drain proximity Touch output
OPTION	I	2	Proximity Sensing Enable select(High: enable, Low: Disable)
VDDH	P	1	Power (3-5.5V)
VDDL	P	4	LDO Output(3.3V) or 3.3V Power Input
GND	P	3	Ground

Table 4. 8MSOP Pin Descriptions.

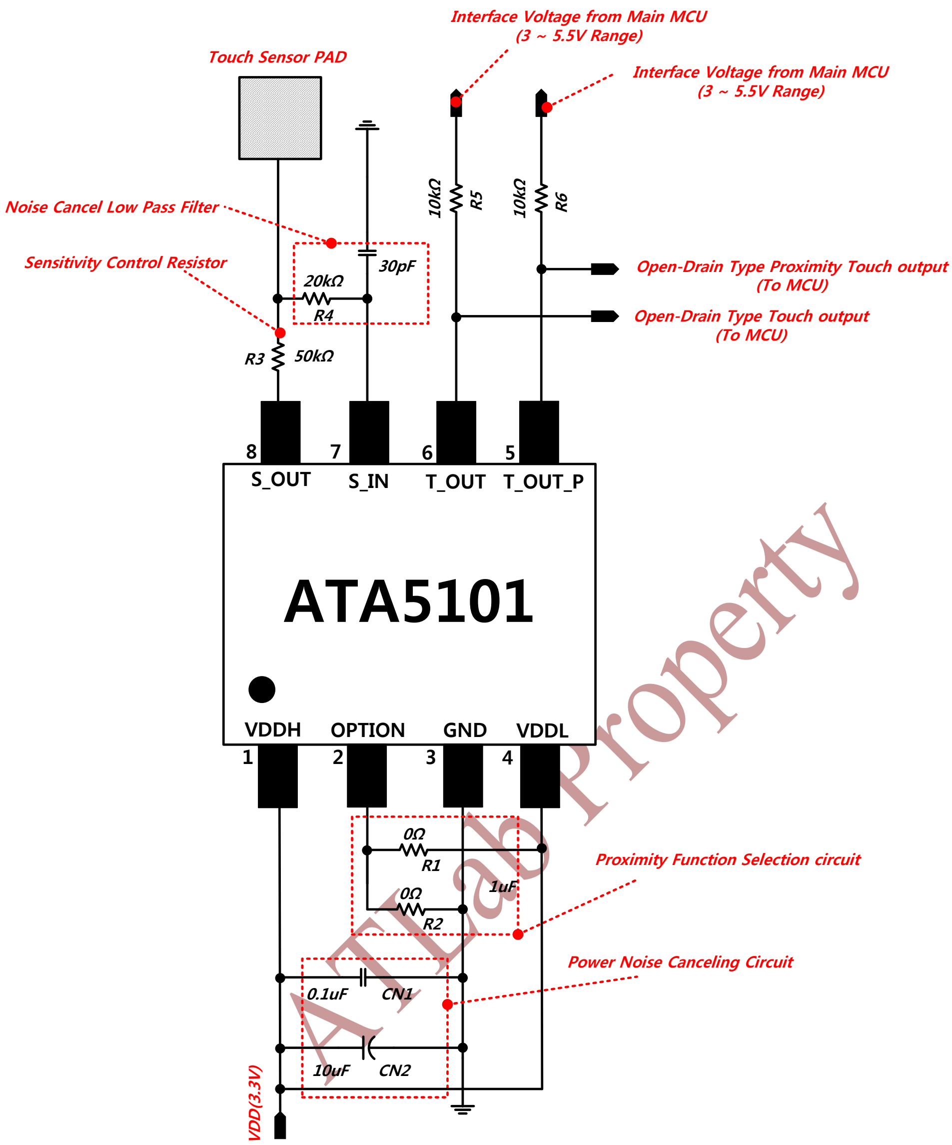
4.3.1. Application circuit of 5V power supply



Notes:

- Output data format of T_OUT and T_OUT_PROXI pins are the same as that of a mechanical switch, i.e. No touch: Open, Touch: GND.
- For Proximity output, resistor R1 connected to OPTION pin must be connected to VDDL port, and resistor R2 should be open. If Proximity is not used, resistor R1 should be open, and resistor R2 must be connected to GND.
- Unit resolution of sensitivity can be configured by changing the value stored at Sensitivity Control Register.
  - If register value is set to 50㏀, Unit Resolution is 3fF. Operating parasitic capacitance range is 78pF (Recommend).
  - If it is set to 25㏀, Unit Resolution is 6fF. Operating parasitic capacitance range is 156pF.
  - If it is set to 75㏀, Unit Resolution is 2fF. Operating parasitic capacitance range is 52pF.

4.3.2. Application circuit of 3.3V power supply



Notes:

- Output data format of T_OUT and T_OUT_PROXI pins are the same as that of a mechanical switch, i.e. No touch: Open, Touch: GND.
- For Proximity output, resistor R1 connected to OPTION pin must be connected to VDDL port, and resistor R2 should be open. If Proximity is not used, resistor R1 should be open, and resistor R2 must be connected to GND.
- Unit resolution of sensitivity can be configured by changing the value stored at Sensitivity Control Register.
  - If register value is set to 50㏀, Unit Resolution is 3fF. Operating parasitic capacitance range is 78pF (Recommend).
  - If it is set to 25㏀, Unit Resolution is 6fF. Operating parasitic capacitance range is 156pF.
  - If it is set to 75㏀, Unit Resolution is 2fF. Operating parasitic capacitance range is 52pF.

4.4. Guidelines for designing touch pad and PCB Layout

This chapter explains how to design the touch electrode.

4.4.1. Define to touch pad size for touch button application

The ATA5101 automatically calibrates sensitivity by determining touch detection threshold by itself. This feature makes application design easier with less effort in tuning. Table 3 shows pad size versus overlay thickness for optimum sensitivity where overlay material is Acryl whose dielectric constant is 5. For automatic sensitivity calibration, the coupling capacitance induced at the sensing electrode should be between 0.1 and 3pF. If coupling capacitance is more than 3pF, it is still detectable but makes the user feel a bit over sensitive. In this case, to reduce the size of touch electrode is a workaround to fit sensitivity.

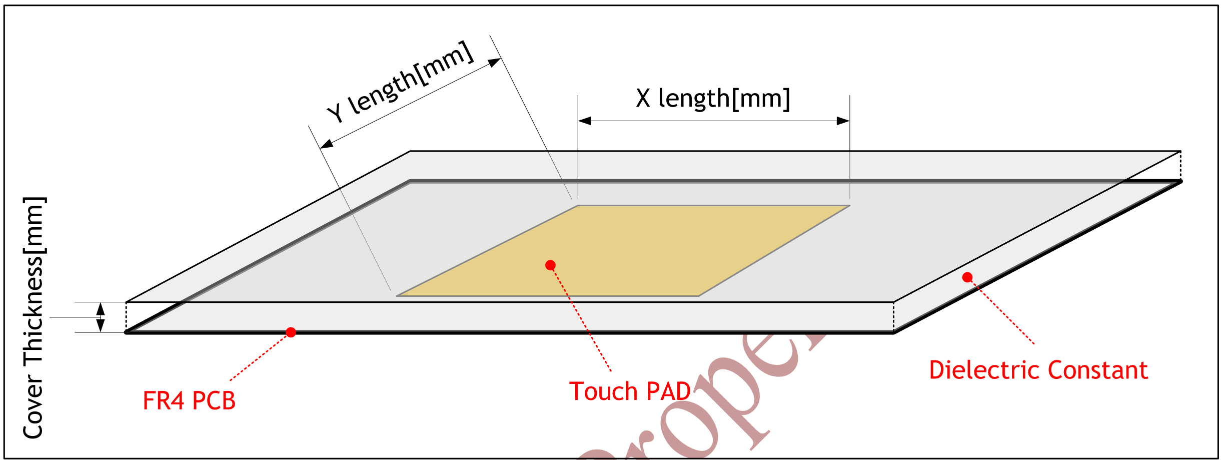


Figure 6. Definition of term

$$\text{Valid Touch Constant} = \text{Dielectric Constant} \times \left\{ \frac{X_{length[mm]} \times Y_{length[mm]}}{\text{Cover Thickness}_{[mm]}} \right\}$$

Figure 7. Formula of Valid Touch Constant

$$11.29 \leq \text{Valid Touch Constant} \leq 338.7$$

Figure 8. Range of Valid Touch Constant

Table 6 shows valid touch constants using the formula in Figure 7 under the condition that overlay material is Acryl whose dielectric constant is 5. In order to calculate valid touch constant, it is required to know dielectric constant of overlay material used. The dielectric constant of widely used overlay material is shown in Table 5.

Material	Dielectric Constant
Air	1
Card Board	2~5
Flour	1.5~1.7
FR4	5
Class	3.7~10
Nylon	4.5
Polystyrene	2.6
Porcelain	4.4~7
Rubber	2.5~3.5
Silicon	12
Wood, Dry	2~7
Wood, Wet	10~30
Paper	3
Acryl	2.7~5
ABS	2..4~5
PVC	3~4
PC(Poly Carbonate)	2.9~3.2

Table 5. Dielectric Constant

X,Y Length[mm] / Cover Thickness[mm]	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	45.00	80.00	125.00	180.00	245.00	320.00	405.00	500.00	605.00	720.00	845.00	980.00	1125.00	1280.00	1445.00	1620.00	1805.00	2000.00
2	22.50	40.00	62.50	90.00	122.50	160.00	202.50	250.00	302.50	360.00	422.50	490.00	562.50	640.00	722.50	810.00	902.50	1000.00
3	15.00	26.67	41.67	60.00	81.67	106.67	135.00	166.67	201.67	240.00	281.67	326.67	375.00	426.67	481.67	540.00	601.67	666.67
4	11.25	20.00	31.25	45.00	61.25	80.00	101.25	125.00	151.25	180.00	211.25	245.00	281.25	320.00	361.25	405.00	451.25	500.00
5	9.00	16.00	25.00	36.00	49.00	64.00	81.00	100.00	121.00	144.00	169.00	196.00	225.00	256.00	289.00	324.00	361.00	400.00
6	7.50	13.33	20.83	30.00	40.83	53.33	67.50	83.33	100.83	120.00	140.83	163.33	187.50	213.33	240.83	270.00	300.83	333.33
7	6.43	11.43	17.86	25.71	35.00	45.71	57.86	71.43	86.43	102.86	120.71	140.00	160.71	182.86	206.43	231.43	257.86	285.71
8	5.63	10.00	15.63	22.50	30.63	40.00	50.63	62.50	75.63	90.00	105.63	122.50	140.63	160.00	180.63	202.50	225.63	250.00
9	5.00	8.89	13.89	20.00	27.22	35.56	45.00	55.56	67.22	80.00	93.89	108.89	125.00	142.22	160.56	180.00	200.56	222.22
10	4.50	8.00	12.50	18.00	24.50	32.00	40.50	50.00	60.50	72.00	84.50	98.00	112.50	128.00	144.50	162.00	180.50	200.00
11	4.09	7.27	11.36	16.36	22.27	29.09	36.82	45.45	55.00	65.45	76.82	89.09	102.27	116.36	131.36	147.27	164.09	181.82
12	3.75	6.67	10.42	15.00	20.42	26.67	33.75	41.67	50.42	60.00	70.42	81.67	93.75	106.67	120.42	135.00	150.42	166.67
13	3.46	6.15	9.62	13.85	18.85	24.62	31.15	38.46	46.54	55.38	65.00	75.38	86.54	98.46	111.15	124.62	138.85	153.85
14	3.21	5.71	8.93	12.86	17.50	22.86	28.93	35.71	43.21	51.43	60.36	70.00	80.36	91.43	103.21	115.71	128.93	142.86
15	3.00	5.33	8.33	12.00	16.33	21.33	27.00	33.33	40.33	48.00	56.33	65.33	75.00	85.33	96.33	108.00	120.33	133.33
16	2.81	5.00	7.81	11.25	15.31	20.00	25.31	31.25	37.81	45.00	52.81	61.25	70.31	80.00	90.31	101.25	112.81	125.00
17	2.65	4.71	7.35	10.59	14.41	18.82	23.82	29.41	35.59	42.35	49.71	57.65	66.18	75.29	85.00	95.29	106.18	117.65
18	2.50	4.44	6.94	10.00	13.61	17.78	22.50	27.78	33.61	40.00	46.94	54.44	62.50	71.11	80.28	90.00	100.28	111.11
19	2.37	4.21	6.58	9.47	12.89	16.84	21.32	26.32	31.84	37.89	44.47	51.58	59.21	67.37	76.05	85.26	95.00	105.26
20	2.25	4.00	6.25	9.00	12.25	16.00	20.25	25.00	30.25	36.00	42.25	49.00	56.25	64.00	72.25	81.00	90.25	100.00

Table 6. Example of valid Touch Constant for Touch Button

※ Cover Material is Acryl whose dielectric constant is 5.

X,Y Length[mm] / Cover Thickness[mm]	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	Enough	Enough	Enough	Enough	Enough	Enough	Enough	Enough	Enough	Enough	Enough	Enough
2	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	Enough	Enough	Enough	Enough	Enough	Enough	Enough	Enough	Enough
3	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	Enough	Enough	Enough	Enough	Enough	Enough
4	Not OK	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	Enough	Enough	Enough	Enough
5	Not OK	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	Enough	Enough
6	Not OK	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
7	Not OK	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
8	Not OK	Not OK	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
9	Not OK	Not OK	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
10	Not OK	Not OK	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
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15	Not OK	Not OK	Not OK	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
16	Not OK	Not OK	Not OK	Not OK	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
17	Not OK	Not OK	Not OK	Not OK	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
18	Not OK	Not OK	Not OK	Not OK	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
19	Not OK	Not OK	Not OK	Not OK	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
20	Not OK	Not OK	Not OK	Not OK	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**

Table 7. Result of valid touch PAD Size and Cover Thickness for Touch Button

※ These tables make from the Table 6 calculation value.

4.4.2. Define to Touch PAD Size for Proximity Touch Button application

This chapter explains proximity distance versus electrode size when proximity is enabled as shown if Figure 9. Proximity touch usually generates different coupling capacitance values from the button application which follows the equation shown in Figure 7. The result shown in Figure 9 can be changed by different environmental conditions.

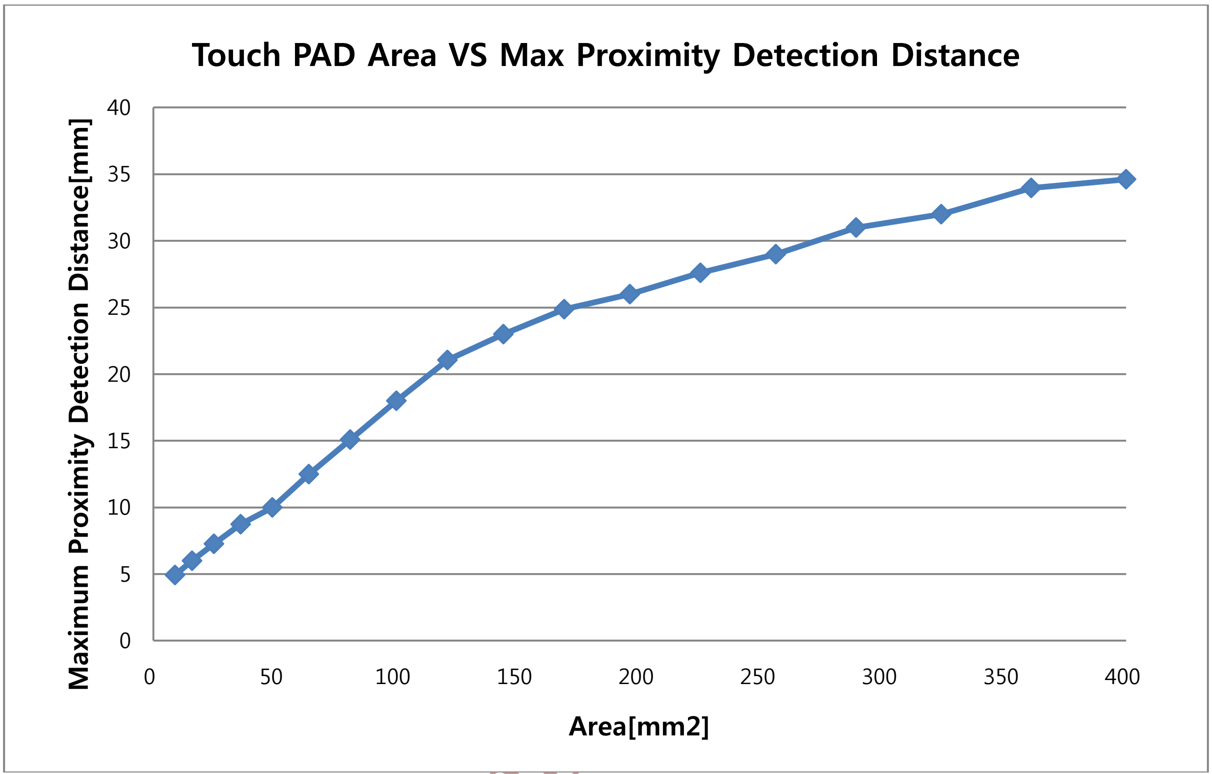


Figure 9. Touch PAD Area VS Max Proximity Detection Distance

4.5. PCB Layout Guideline

4.5.1. Location of Components

Although the ATA5101 has noise protection schemes within a chip and with an external filter circuit as well, it is recommended that noise sources like clock generation devices be cautiously placed in order not to locate near to the ATA5101, sensing electrodes, or sensor lines during PCB layout. If it is unavoidable, put ground lines between the noise source and the ATA5101 to minimize noise by isolation.

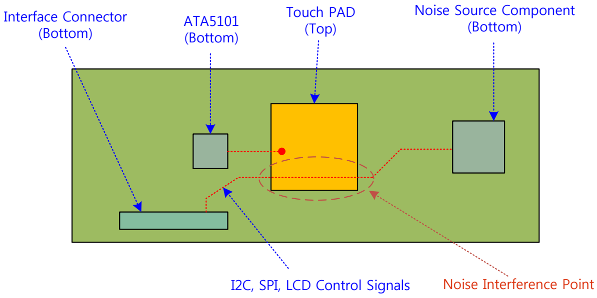


Figure 10. Bad example of PCB routing (Case1)

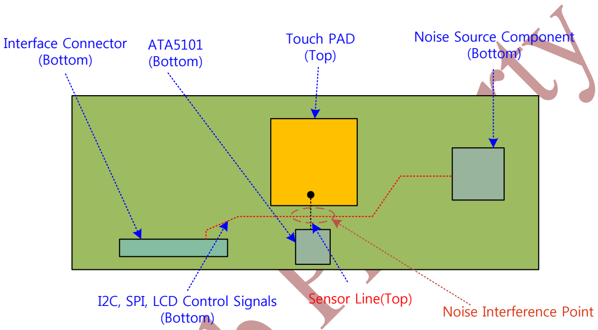


Figure 11. Bad example of PCB routing (Case2)

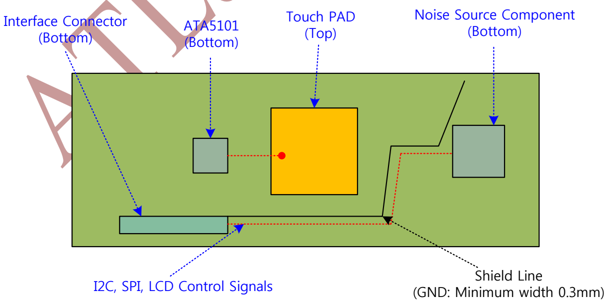


Figure 12. Good example of PCB routing

4.5.2. Rules of PCB layout

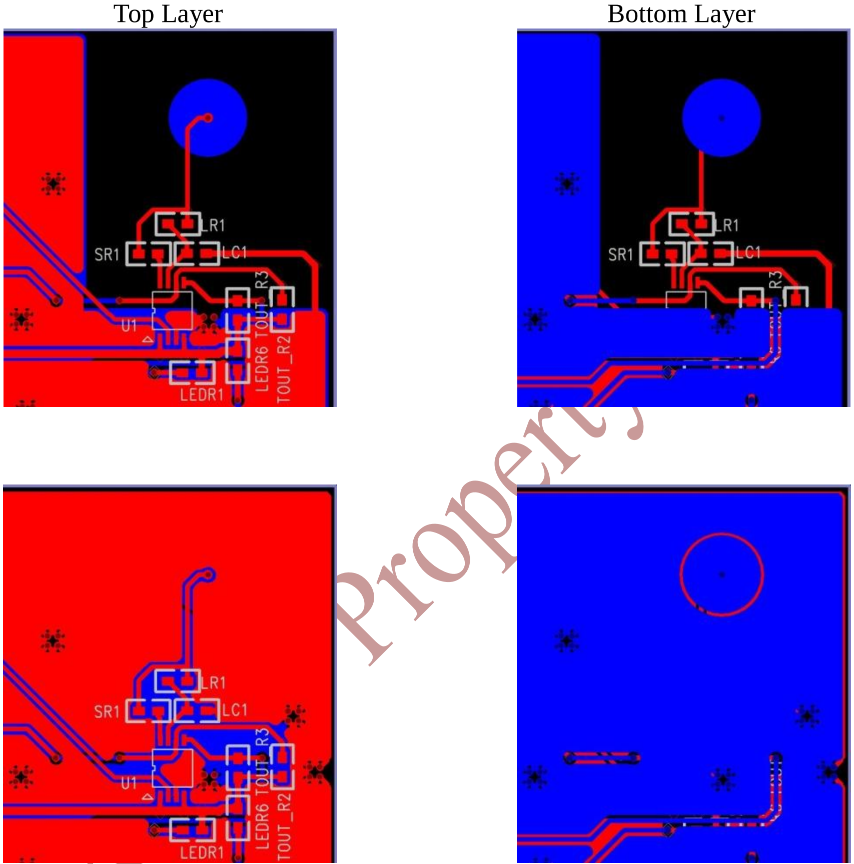
1. Sensing electrodes and sensor lines should be located from the noise source as far as possible.
2. If it is unavoidable, put the ground line between the sensor line and the electrode with minimum 0.3mm thickness.
3. Do not put ground lines or ground coppers near to sensor lines and electrodes. Ground lines around sensor lines cause sensitivity decrease and make effective range of Automatic Sensitivity Calibration narrow.

Figure 13. Example of Touch PAD Layout

Top Layer | Bottom Layer

Good Example

No Good Example



4.6. Guidelines for Power Connection

Since the ATA5101 core runs at 3.3V, IO voltage over 4.2V should be regulated to 3.3V by the internal LDO. If IO voltage is around 3V, the internal LDO can be turned off to save power consumption and 3V IO voltage can be directly applied to the core. Power connection of different IO voltages is explained in this chapter.

4.6.1. 4.4~5.5V Supply power conditions

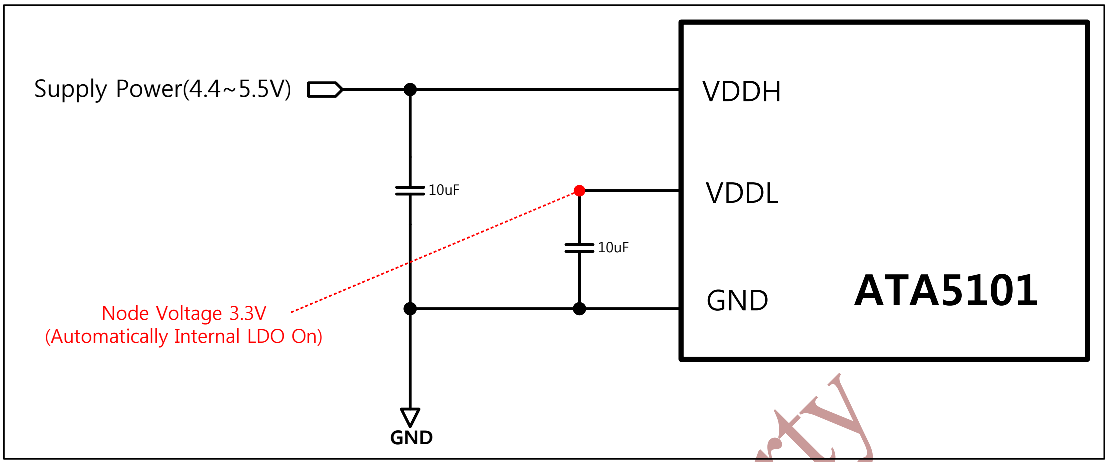


Figure 14. Connection of 4.4~5.5V of Supply power

During power on, if voltage of VDDH pin is different from that of VDDL pin, internal LDO is automatically enabled as shown in Figure 14. VDDL pin outputs 3.3V from the internal LDO and the ATA5101 runs at 3.3V.

4.6.2. 2.8~3.6V Supply power conditions

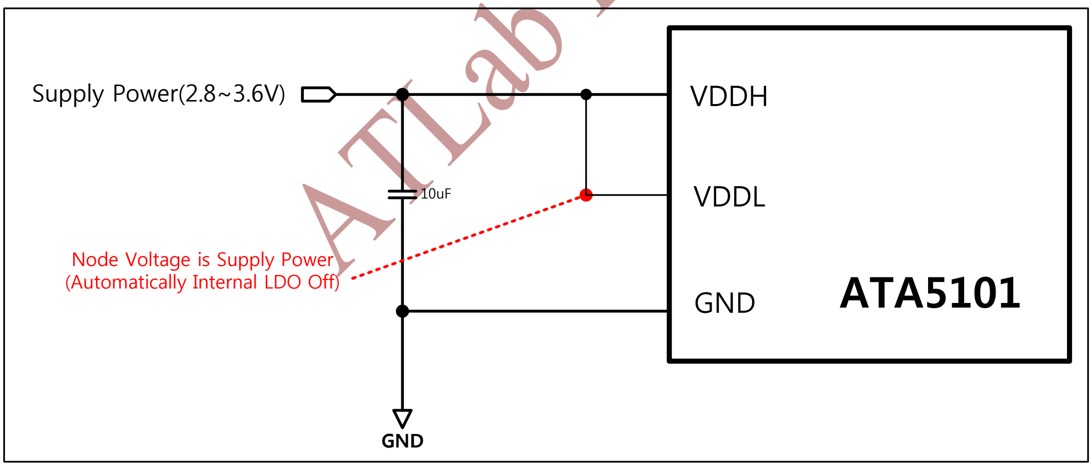


Figure 15. Connection of 2.8~3.6V of Supply power

During power on, if VDDH and VDDL has same voltage, the internal LDO is automatically turned off and the ATA5101 runs at VDDL input voltage.

4.7. Guidelines for Power Sequence

The ATA5101 does not need external reset signal because there is a reset circuit to provide reset signal to the chip during power on. This chapter explains internal operation according to the VDDH during power on.

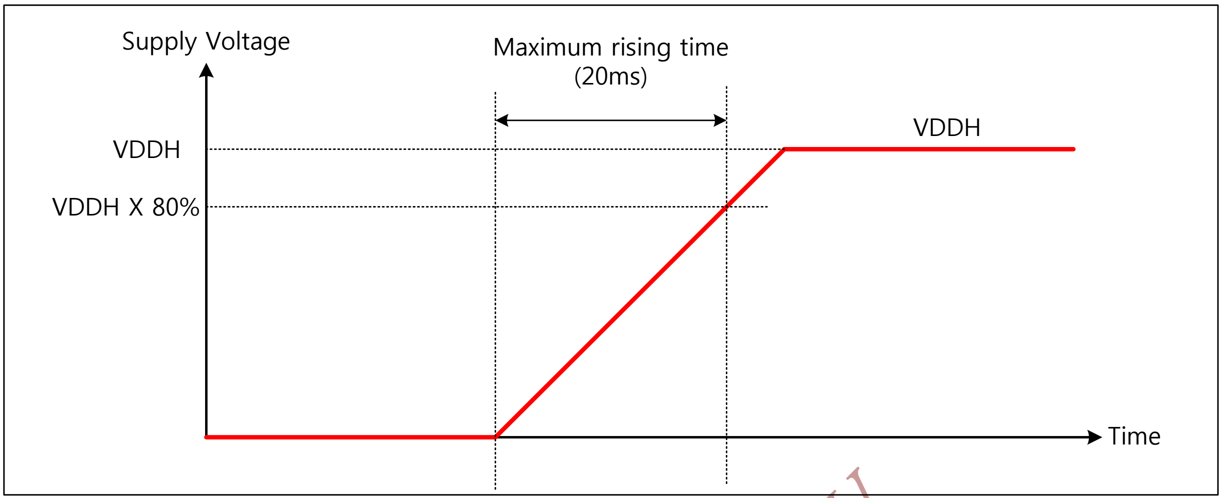


Figure 16. Specification of supply power (VDDH)

The ATA5101 is operated in sequence as shown the Figure 17 after power on. Internal POR (Power On Reset) circuit initialize the chip and Automatic Sensitivity Calibration (ASC) is performed automatically to recognize touch operation where it take about 500ms. If touch occurs during initial ASR, false calibration is performed and requires additional 500ms to perform ASR again. After ASR is performed, the chip is able to recognize touch operation. Touch operation occurred prior to ASR must be ignored.

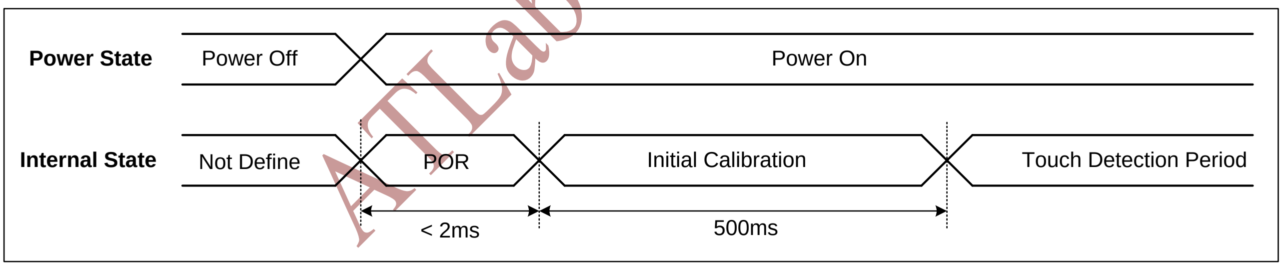


Figure 17. Device Operating Sequence

4.8. Guideline for Multi-ATA5101 application

The ATA5101 is a one-channel touch sensor controller. It is good for the application whose buttons are located far away from each other like coin vending machines that require long sensor lines on multiple channel touch sensor controllers. This chapter describes two different cases when multiple ATA5101s are used in a module to support multiple touch channels.

4.8.1. Multi-Touch Button application

This chapter describes cautions when multiple ATA5101s are used for the touch button applications. The distance between touch keys should be more than 20mm because the width of a finger is about 15mm. If a finger is placed on the touch pad 1 as shown in Figure 18, the ATA5101 related with touch pad 2 also performs ASC and sets sensitivity accordingly. Therefore, even though touch pad 1 is touched, touch pad 2 also can be enabled erroneously.

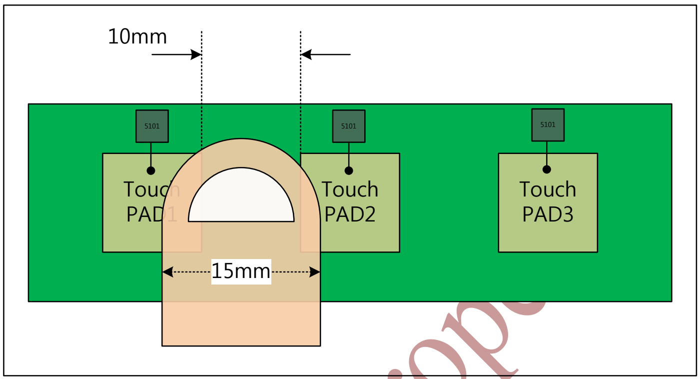


Figure 18. No Good example of multi ATA5101 touch pads location

If distance between touch pads is more than 20mm as shown in Figure 19, the ATA5101 related with touch pad 2 does not perform ASC so that stable touch output is guaranteed.

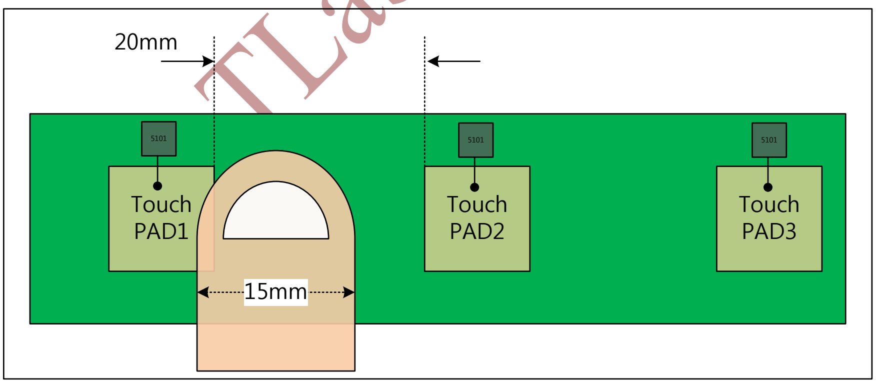


Figure 19. Good example of multi ATA5101 touch pads location

4.8.2. Multi-Proximity Button application

When multiple ATA5101s are used for multi-proximity button applications, the distance between keys should be longer than target proximity distance as shown in Figure 20 and Figure 21 to ensure accurate proximity output.

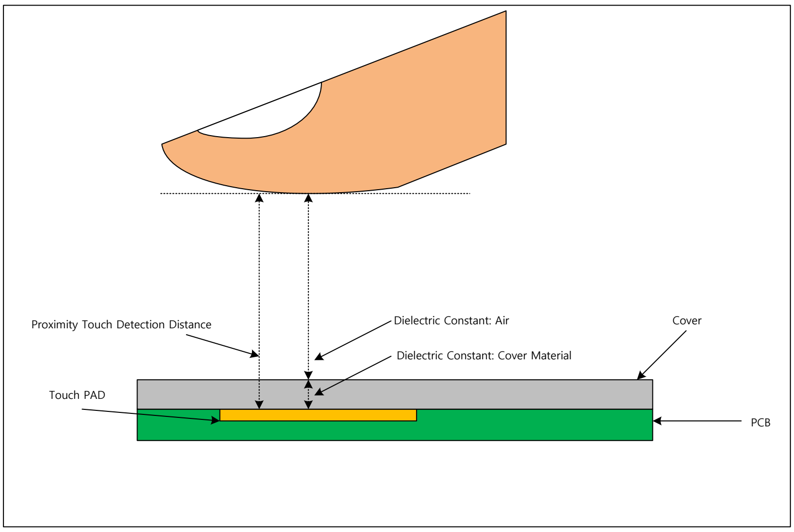


Figure 20. Define of proximity touch detection distance

For example, if target proximity distance is 30mm, the distance between touch keys should be longer than 30mm as shown in Figure 21.

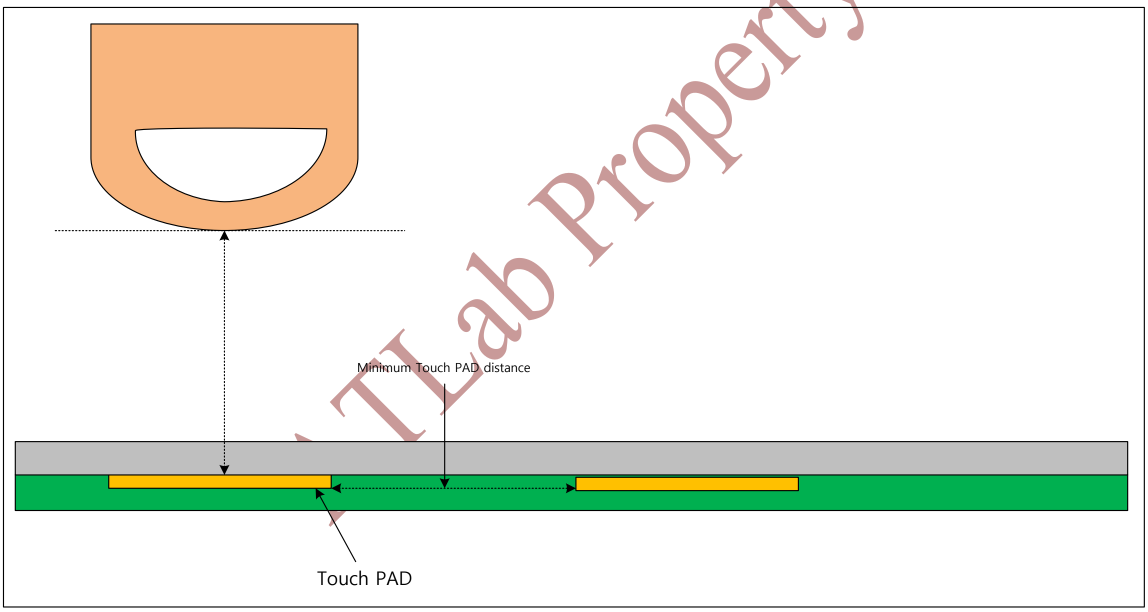
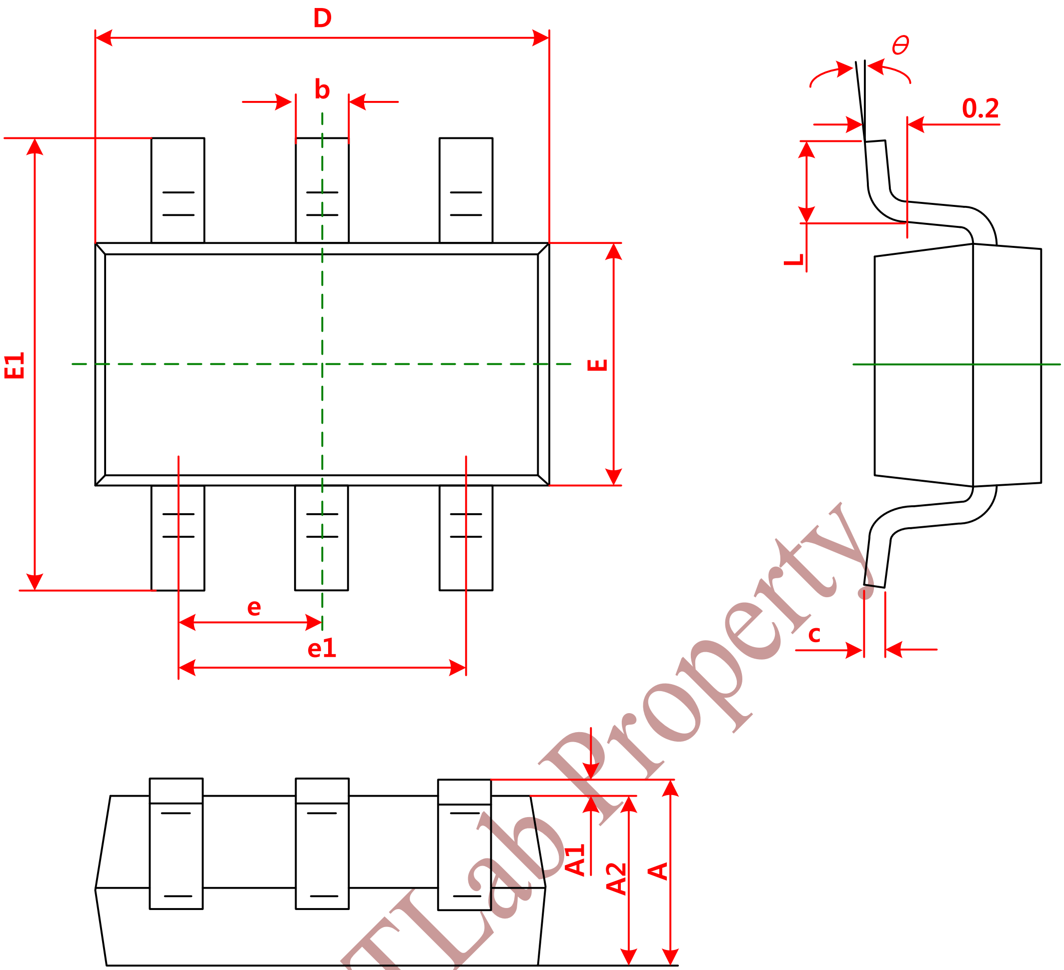


Figure 21. Minimum touch pad distance for multi proximity applications

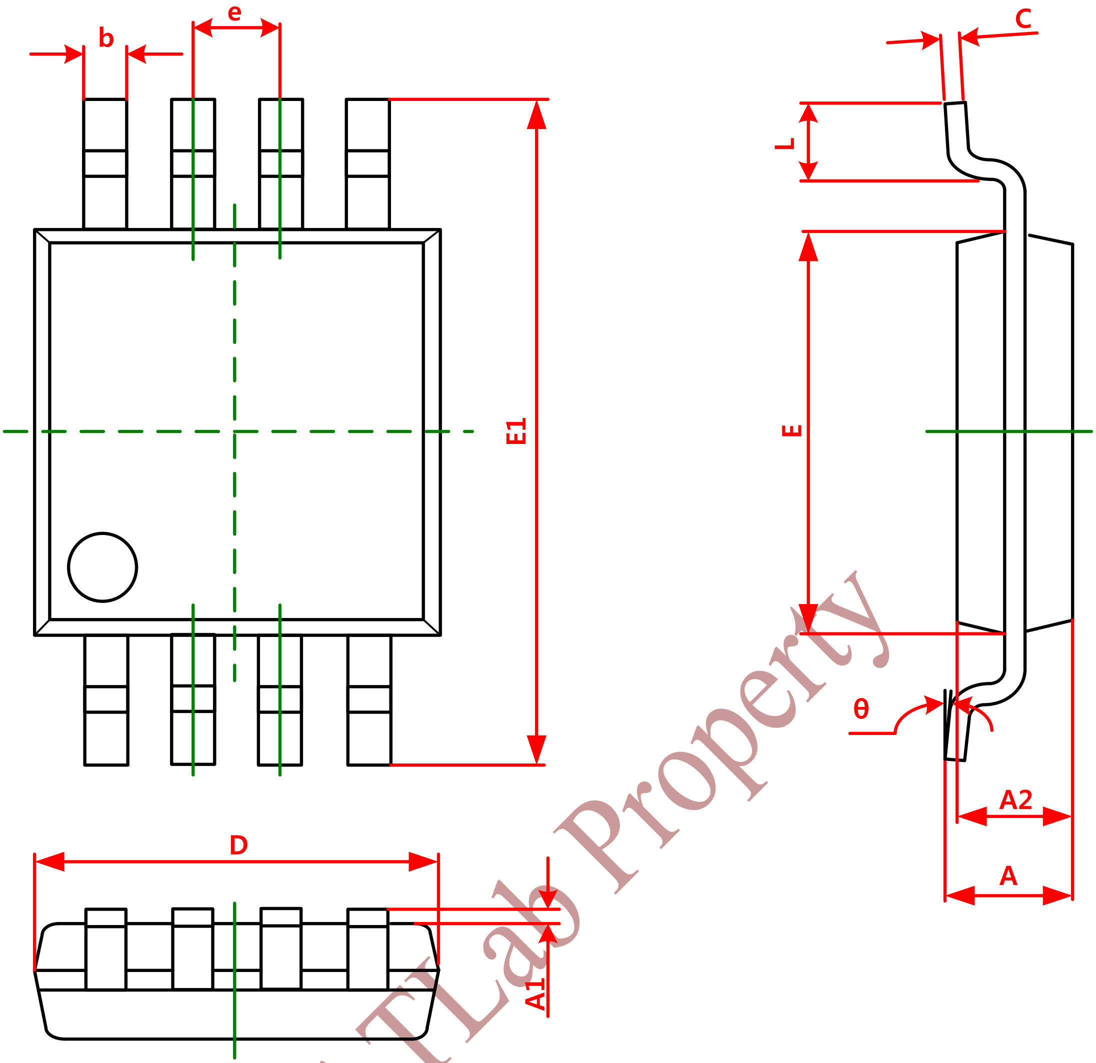
5. Package Dimensions

5.1. 6 SOT



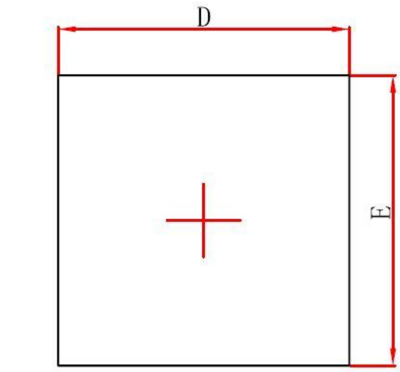
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

5.2. 8 MSOP

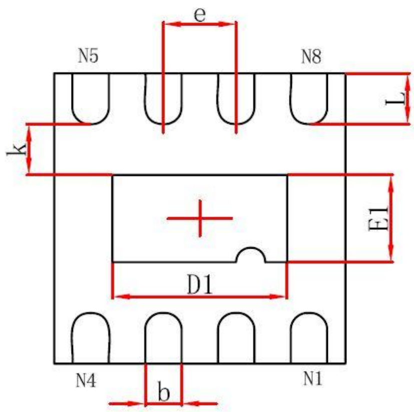


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
e	0.650(BSC)		0.026(BSC)	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

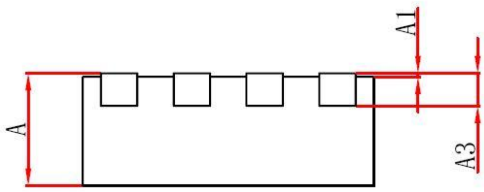
5.3. 8DFN



Top View



Bottom View



Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	1.900	2.100	0.075	0.083
E	1.900	2.100	0.075	0.083
D1	1.100	1.300	0.043	0.051
E1	0.500	0.700	0.020	0.028
k	0.200MIN.		0.008MIN.	
b	0.180	0.300	0.007	0.012
e	0.500TYP.		0.020TYP.	
L	0.250	0.450	0.010	0.018

Appendix A: ATA5101 Demo Set PCB Circuit & PCB Layout

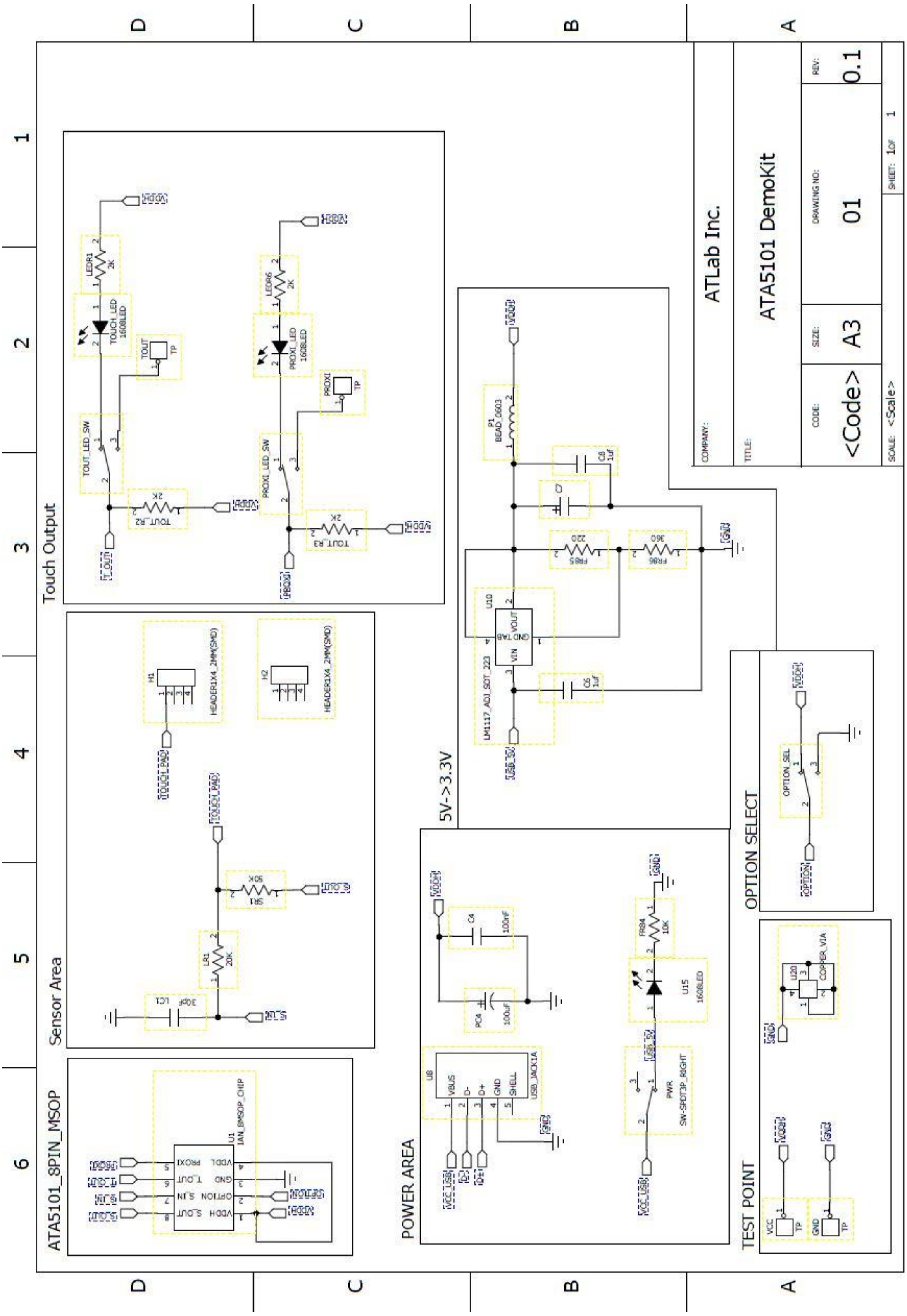


Figure 22. Example of Demo Set Circuit.

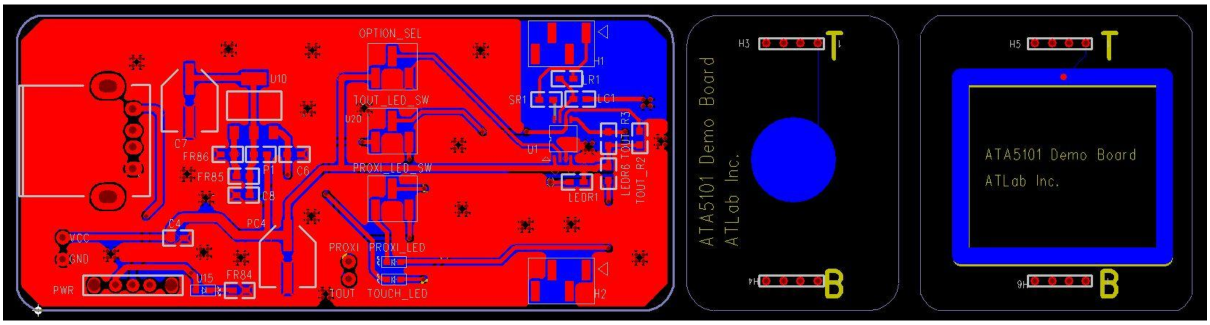


Figure 23. ATA5101 Demo Set PCB Layout (Top Layer)

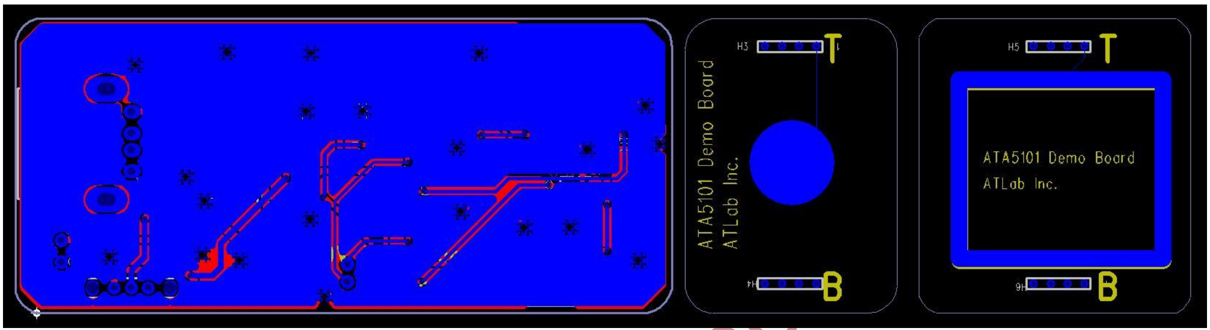


Figure 24. ATA5101 Demo Set PCB Layout (Bottom Layer)

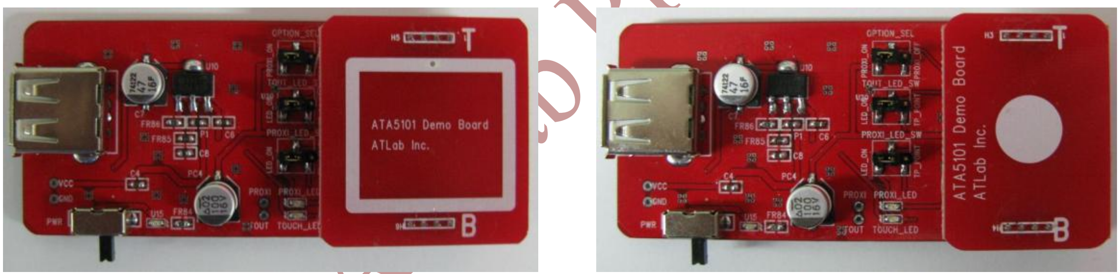


Figure 25. ATA5101 Demo Set (Top)

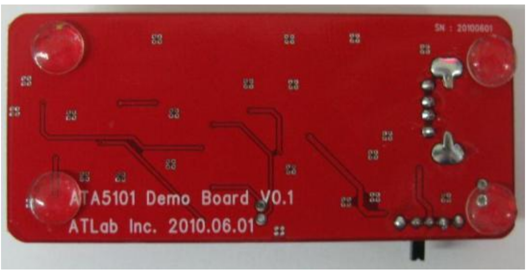


Figure 26. ATA5101 Demo Set (Bottom)

Appendix B: Shield cable connection

The ATA5101 allows handling a huge amount of offset capacitance. Figure 27 shows that more than 3 meter shield cable is connected between the touch electrode with no electronic parts and the main board. It is important to notice that the ATA5101 is mounted at the main board. It implies that in touch key applications, sensing electrode and sensor chip can be separated to any distance (e.g. 3 meter) and sensing pad can be placed to anywhere with no noise concern.

Figure 27. 3 meter shield cable between a touch electrode and the ATA5101

Revision History

Date	Revision	Changes
Aug, 2010	V1.0	First Version Release.
Nov, 2010	V1.02	Added PKG Type(8DFN), Type setting