XPT7603 DataSheet V1.0

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1 General Description

XPT7603 is a 4-wire resistive touch screen controller, includes 12-bit resolution A / D converter. XPT7603 through the implementation of the two A / D conversion has been identified by the location of the screen, in addition to measurable increase in pressure on the touch screen. Own internal 2.5V reference voltage, can be used as auxiliary input, temperature measurement and battery monitoring, battery monitoring, voltage range from 0V to 6V. XPT7603 a chip temperature sensor. 2.7V typical work in the state, the closure of the reference voltage, power consumption can be less than 0.75mW.

2 Features

- Operating voltage range of 1.8V ~ 5.5V
- Built-2.5V reference voltage source (open when the need is greater than the supply voltage 2.6V)
- A maximum of 2-way measuring input supply voltage (0V ~ 6V)
- A maximum of 2 auxiliary inputs
- Built-junction temperature measurement function
- Touch-pressure measurement
- 2-wire I2C communication interface
- With automatic power down feature
- TSSOP-16, MSOP10, QFN-16 package
- -40 ~ 85 ℃ Operating Temperature Range

3 Applications

- Mobile phone (cell phone, etc.)
- Touch screen displays, personal digital assistant (PDA)
- Portable equipment, POS terminal machine equipment, etc.

4 Typical Application Circuit

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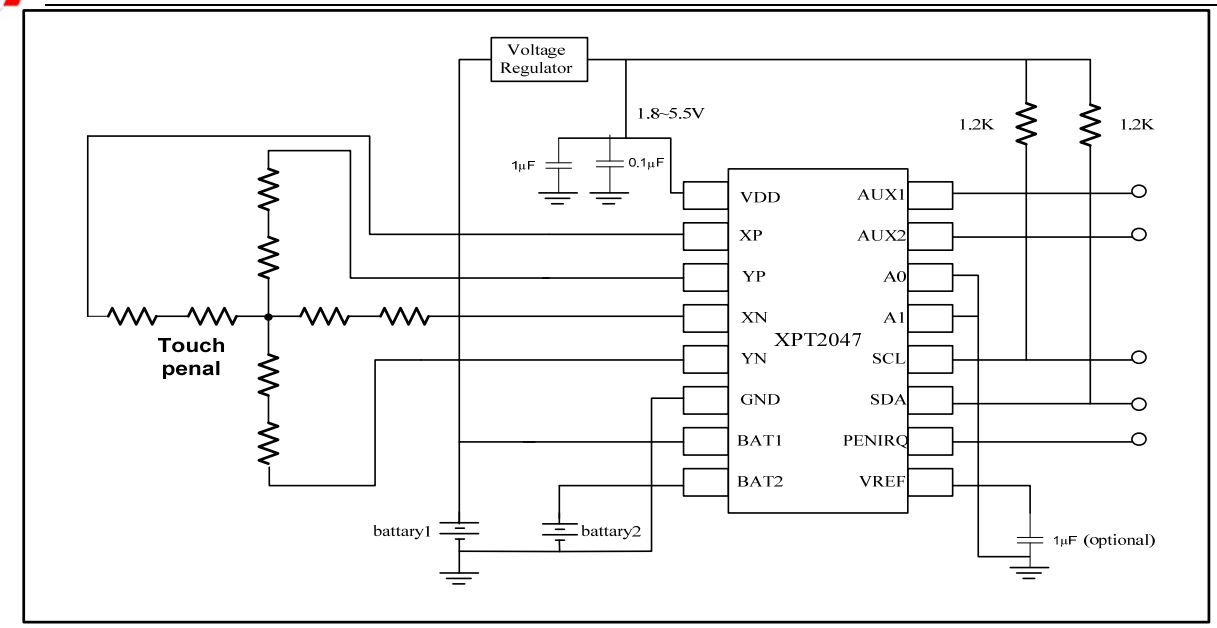


Figure 1 XPT7603 Typical Application Circuit

5 Limit Parameter

Table 1 Chip Limit Parameter Table

Name	Parameter
VDD Voltage	－0.3V To ＋4.8V
Analog Input Voltage	－0.3V To ＋VDD＋0.3V
Digital Input Voltage	－0.3V To＋VDD＋0.3V
Consumption	1W
Maximum Junction Temperature	＋150℃
Operating Temperature	－40℃～＋85℃
Storage Temperature	-65℃～＋150℃
Welding Temperature (less than 10 seconds)	＋260℃
ESD	+/- 8000V （HMD）
Latch Up	+/- 100mA

WARNING: In addition to limits or any other conditions, the chip may be damaged.

5.1 Electrical Characteristics

Qualification: VS = +2.5 V ~ +5.5 V, TA =- 40 ℃ ~ +85 ℃, VDD = +2.7 V, VREF = 2.5V internal voltage, 12bits standard mode (100K), or fast mode (400K), the digital input ground or VDD.

Table 2 XPT7603 Electrical Characteristics Table

Parameter	Condition	XPT7603			Unit
		Min	Typ	Max	
Analog Input：					
Differential Input	Cathode Input - Negative Input	0		V_{REF}	V
Single-ended Input	Cathode Input	-0.2		+VDD+0.2	V
	Negative Input	-0.2		+0.2	V
Input Capacitance			25		pF
Leakage current			0.1		μA
ADC System Performance：					
Resolution			12		Bits
No missing Code		10			Bits
Integral Linearity Error				±2	LSB[1]
Imbalance Error				±6	LSB
Gain Error	External Vref			±4	LSB
Noise Performance	Including Internal Vref		70		μV_{rms}
PSRR			70		dB
Switch Driver					
Switch On-Resistance					
YP、XP			5		Ω
YN、XN			5		Ω
Driver Current(2)	Duration 100ms			50	mA
Vref Output					
Internal Reference Voltage Accuracy		2.35	2.5	2.65	V
Internal Reference Voltage Drift			50		ppm/℃
Quiescent Current Reference Voltage			200		μA
External Vref					
Input Range		1.0		VCC	V
Input Impedance	Internal Reference Shutdown		1		GΩ
	Open The Internal Reference		250		Ω
Battery Monitor					
Input Volage Range		0.5		6.0	V
Input Impedance					
Sampling Battery			4		KΩ
Battery Monitor Off			1		GΩ
Accuracy	V_{BAT}=0.5V~5.5V,ExternalV_{REF}=2.5V	-2		+2	%
	V_{BAT}=0.5V~5.5V,InternalV_{REF}	-7		+7	%
Temperature Measurement					
Temperature Range		-40		+85	℃

Resolution	Differential mode [3]		2		℃
Accuracy	Differential mode [3]		±4		℃
Digital Input/Output					
Logic Type			CMOS		
Capacitance	All Digital Control Input Pins		5	15	pF
V_{IH}	$\lvert I_{IH} \rvert \leq +5\mu A$	VDD*0.7		VDD+0.3	V
V_{IL}	$\lvert I_{IL} \rvert \leq +5\mu A$	-0.3		0.3*VDD	V
V_{OH}	I_{OH}=-250μA	VDD*0.8			V
V_{OL}	I_{OL}=250μA			0.4	V
Data Format		Straight Binary			
Power Requirement					
VDD	Operating Range	1.8		5.5	V
Quiescent Current	Internal Vref Off		100	150	μA
	Internal Vref On		300		μA
	Power-Down State			3	μA
Temperature Range	—				
Feature		-40		+85	℃

Description:

1. LSB that the least significant bit. When VREF = +2.5 V, for the 12bits ADC, the LSB is 610μV

2. In order to ensure reliable chip, X, Y can not be larger than the drive current 50mA

3. TEMP0 and TEMP1 test the difference, without correction

6 Pin Configuration

6.1 Pin Layout

6.1.1 MSOP-10 Package

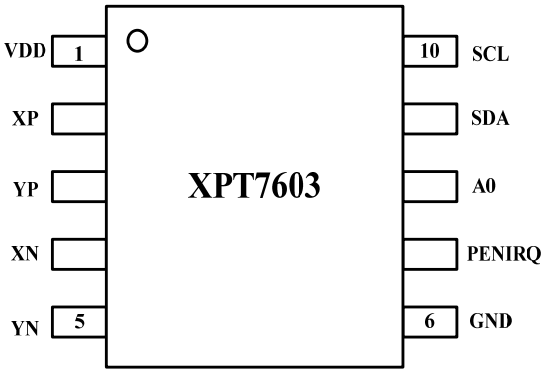


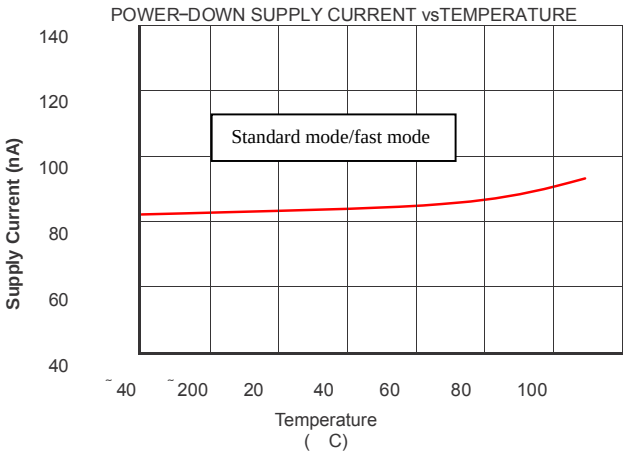
Figure 2 MSOP-10 Package Pin Distribution

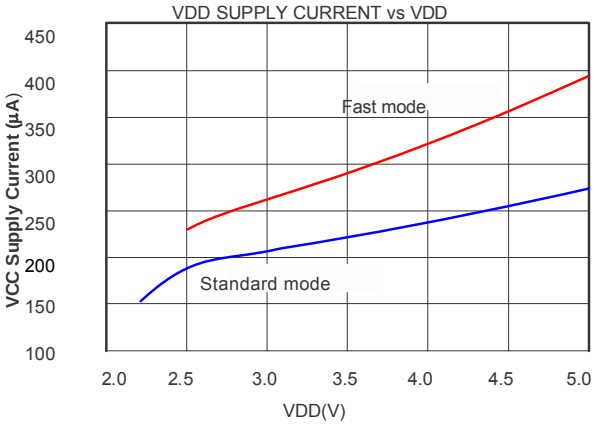
6.2 Pin Discription

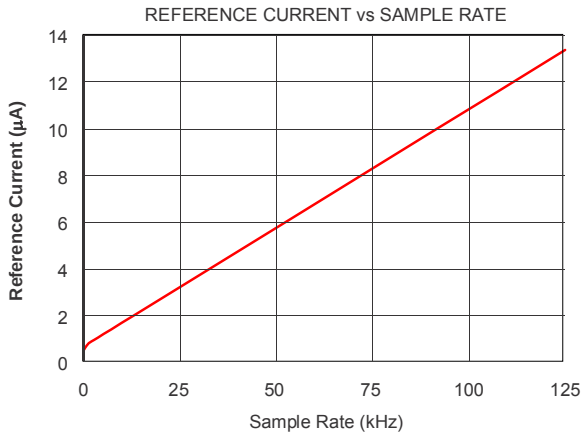
MSOP PIN#	NAME	DISCRIPTION
1	VDD	Power Supply
2	XP	XP Position Input
3	YP	YP Position Input
4	XN	XN Position Input
5	YN	YN Postion Input
6	GND	Ground
—	BAT1	Battery Monitor Input1
—	BAT2	Batttery Monitor Input2
—	VREF	Reference Voltage Input/Output
7	PENIRQ	Pen Interrupt Pin
9	SDA	I2C Data Interface
10	SCL	I2C Clock Interface
—	A1	I2C Address Input1
8	A0	I2C Address Input0
—	AUX2	Auxiliary Input to ADC2
	AUX1	Auxiliary Input to ADC1

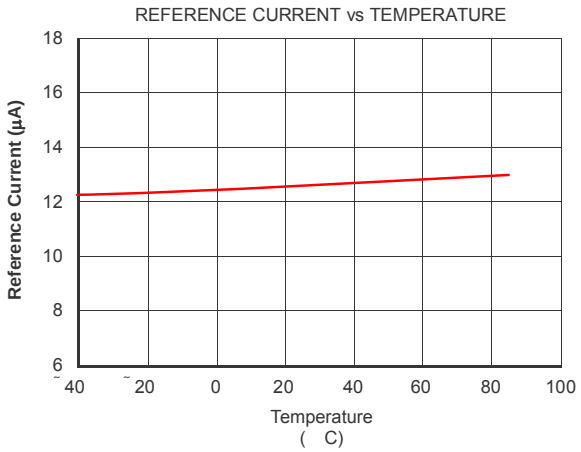
7 XPT7603 Typical Characteristics

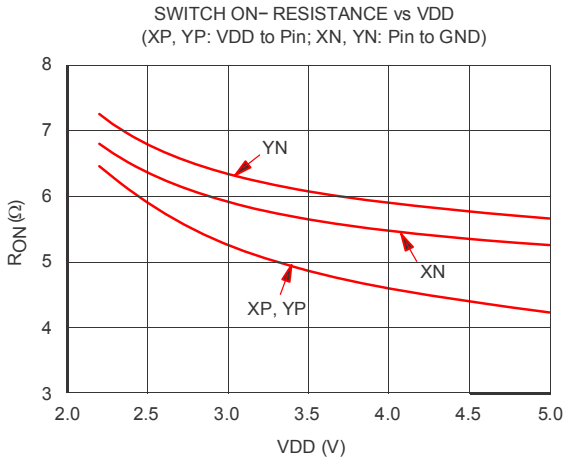
Conditions: TA = 25 ℃, VDD = +2.7 V; VREF = 2.5V external voltage, 12-bit mode; PD0 = 0

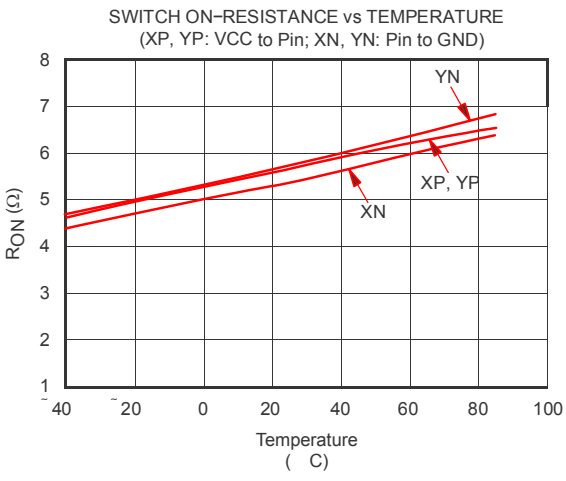


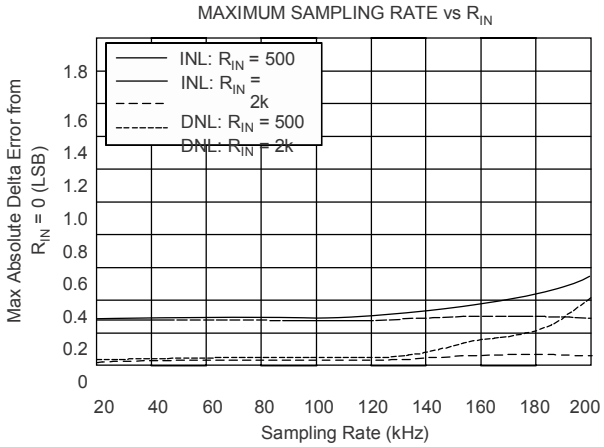


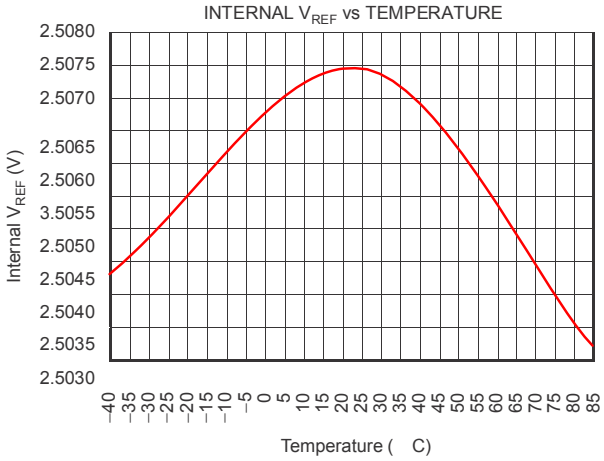


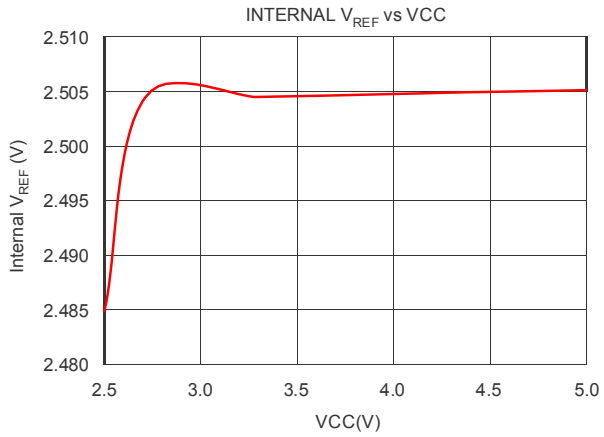


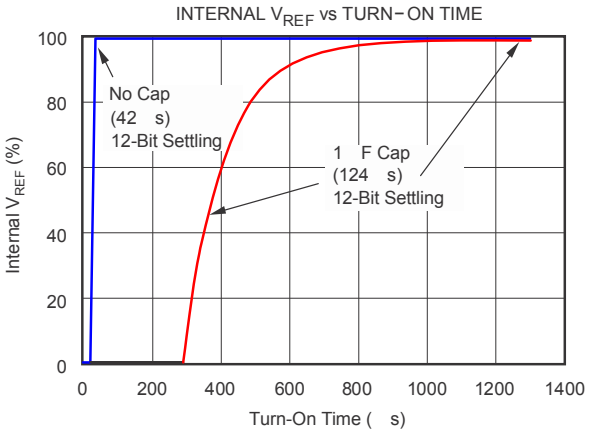





MAXIMUM SAMPLING RATE vs R_{IN}
INL: R_{IN} = 500
INL: R_{IN} = 2k
DNL: R_{IN} = 500
DNL: R_{IN} = 2k
Max Absolute Delta Error from R_{IN} = 0 (LSB)
Sampling Rate (kHz)


INTERNAL V_{REF} vs TEMPERATURE
Internal V_{REF} (V)
Temperature (C)


INTERNAL V_{REF} vs VCC
Internal V_{REF} (V)
VCC(V)


INTERNAL V_{REF} vs TURN−ON TIME
No Cap
(42 s)
12-Bit Settling
1 F Cap
(124 s)
12-Bit Settling
Internal V_{REF} (%)
Turn-On Time (s)

8 Theory of Operation

8.1 The Basic Principle

XPT7603 is a typical type of successive approximation ADC (SAR ADC), contains a sample / hold, analog-to-digital conversion, serial data output functions. At the same time, there is a 2.5V internal reference voltage source, the temperature detection circuit, and using external clock. Single power supply, power supply voltage range of 1.8V ~ 5.5V. Vref directly determines the range of ADC input , the reference voltage can use the internal reference voltage, can also be directly imported from outside the range of 1V ~ VCC reference voltage (the requirements of external reference voltage source with low output impedance). The analog inputs (X, Y, Z, VBAT, Temp, and AUX) via control register enter the ADC, ADC can be configured as single-ended or differential mode. Selecting VBAT, Temp and AUX ,ADC should be configured for single-ended mode; as a touch screen application, it should be configured as a differential mode, which can effectively eliminate the parasitic resistance of the driver switch and external interference caused by measurement error and improve the conversion accuracy.

8.2 Analog Input Characteristics

Figure 5 describes MUX, ADC's analog input, reference voltage reference as well as the I2C interface circuit. Table 3 shows the control byte order bit C3, C2, C1, C0 and the relationship of configuration between XPT7603.

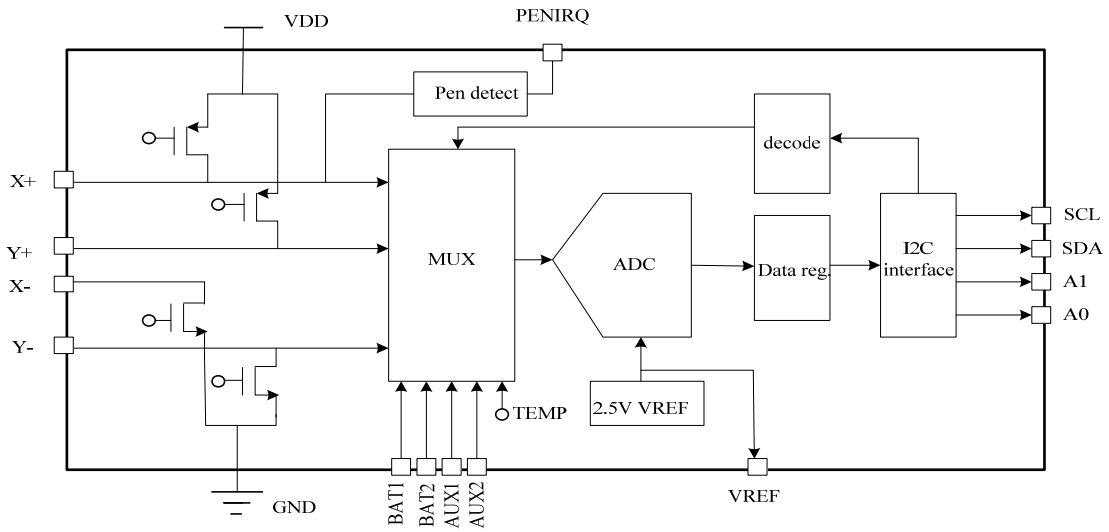


Figure 5 XPT7603 Analog Input Schematic

Table 3 ADC Input Configuration

C3	C2	C1	C0	BAT2	BAT1	AUX2	AUX1	TEMP	YN	XP	YP	Y-Position	X-Position	Z_1-Position	Z_2-Position	X-Driver	Y-Driver
0	0	0	0					+IN (TEMP0)								Off	Off
0	0	0	1		+IN											Off	Off

0	0	1	0				+IN									Off	Off
0	0	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0	1	0	0					+IN (TEMP1)								Off	Off
0	1	0	1	+IN												Off	Off
0	1	1	0			+IN										Off	Off
0	1	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1	0	0	0	Long driver, Accelerate mode							+IN		meas			On	Off
1	0	0	1	Long driver, Accelerate mode						+IN		meas				Off	On
1	0	1	0	Long driver, Accelerate mode						+IN				meas		XN On	YP On
1	0	1	1	Long driver, Accelerate mode					+IN						meas	XN On	YP On
1	1	0	0	Short driver, auto power down,low power mode							+IN		meas			On	Off
1	1	0	1	Short driver, auto power down,low power mode						+IN		meas				Off	On
1	1	1	0	Short driver, auto power down,low power mode						+IN				meas		XN On	YP On
1	1	1	1	Short driver, auto power down,low power mode					+IN						meas	XN On	YP On

8.3 Internal Vref

XPT7603 internal 2.5V reference voltage source can be off or on through the control-bit PD1 (see Table 6 and Figure 6).In general, the internal reference voltage is only used to measure VBAT, Temp and AUX input. If the request for higher measurement accuracy, you should use an external reference voltage source. An external reference input directly from the VREF pin,which is in use,be sure to close the internal reference voltage source.

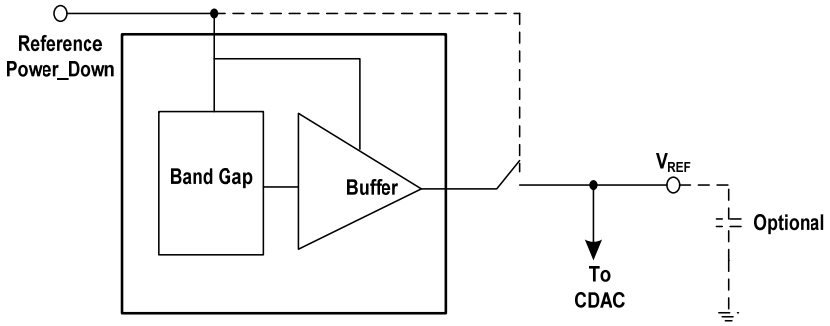


Figure 6 Internal Vref Schematic

8.4 Single-ended Mode

When the command control bit C3 is low, XPT7603 is in the measurement mode of BAT, AUX or Temp, the internal ADC reference voltage source is the single-ended mode, using the internal 2.5V reference source (can also use the external input voltage source) as the ADC reference voltage, application of the principle of single-ended mode shown in Figure 7.

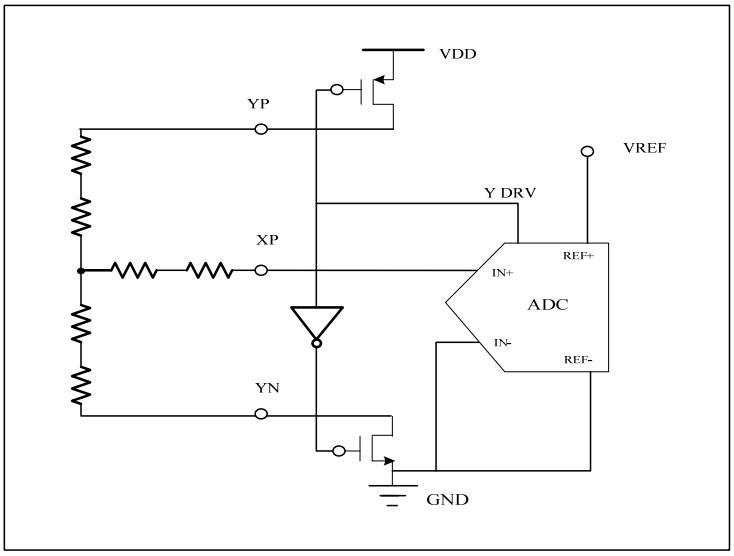


Figure 1 Schematic diagram of single-ended mode (C3 = 0, Y direction drive switch closure, XP as an analog input)

8.5 Differential Mode

When the command control bit C3 is high, XPT7603 is in the measurement mode of X, Y, Z, the internal ADC reference voltage source is the differential mode, shown in Figure 8.

The advantage of differential mode: + REF and-REF input directly to the YP, YN, Which can eliminate measurement error because of the switch on-resistance. The disadvantage is that: both the sample or conversion process, the driver will need to be on, relative to single-ended mode, the power consumption increased.

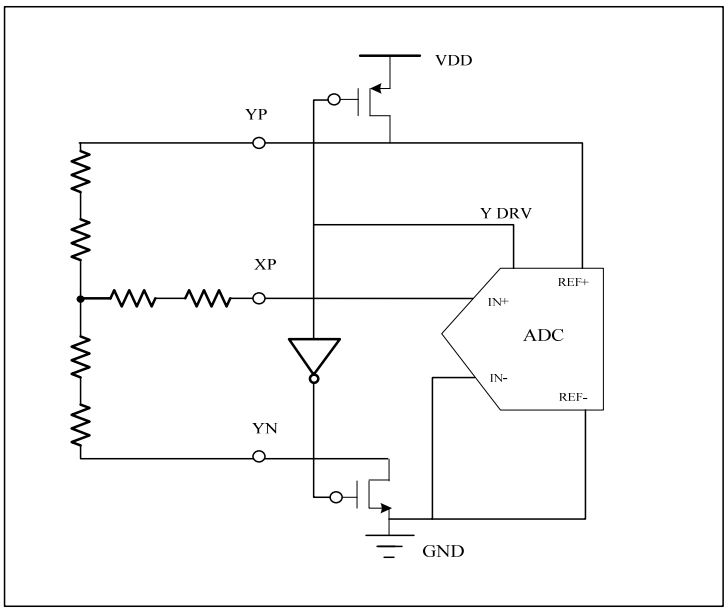


Figure 1 Differential reference mode diagram (C3 = 1, Y direction drive switch closure, XP as an analog input)

8.6 Application Recommendations of Touch Screen

In the application, it is recommended to add some external capacitor across the touch screen in

order to filter the noise from touch-screen (such as: the noise from backlight and LCD circuit). Capacitors and resistors form a low-pass filter to suppress noise. Too large capacitance value may lead to an increase in set-up time, there gain error. So capacitance should be taken into consideration to choose the input signal bandwidth requirements.

8.7 Temperature Measurement

Integrated temperature detection for the detection of temperature. There are two methods of temperature measurement.

Method I: direct measurement

The use of the PN junction diode temperature coefficient characteristics of a relatively stable through measuring the PN junction diode voltage to measure the temperature, can be pre-tested and stored the PN junction voltage (600mV typical value of about) at room temperature, PN junction temperature coefficient is about -- 2mV / ℃, measure the PN junction voltage at other temperature ,then the temperature can be got. This method would change with the process, and the need for correction

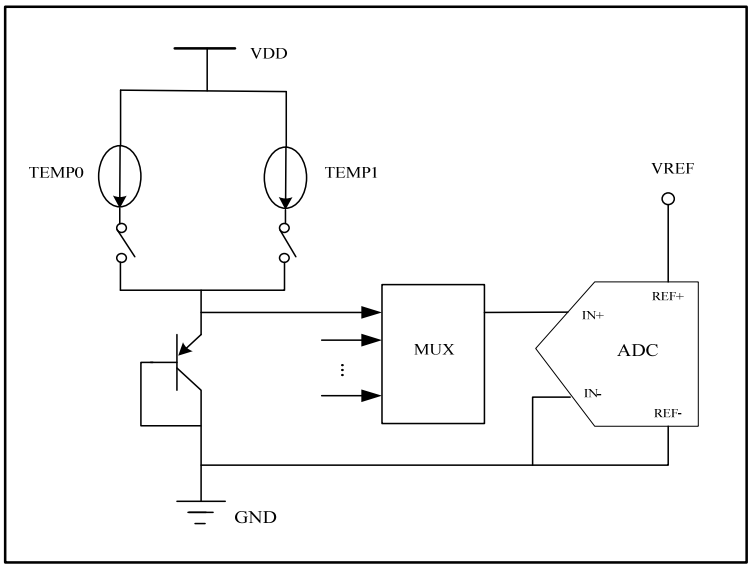


Figure 1 Schematic diagram of temperature measurement function

Method 2: indirect measurement

This method does not require the test temperature specified benchmarks, the accuracy can achieve 2 ℃. This method requires a second conversion:

The first time, set up "A2A1A0" = "000", test temp0 the PN junction current-voltage V0

Second, set up "A2A1A0" = "111", to achieve 91 times the current temp0 big test at this time of the PN junction voltage V1.

Second and the first conversion of the voltage difference by the equation (1), said:

△ V = ... (1)

Of which:

N - Current ratio coefficient, equal to 91;

k -伯尔兹曼 constant, equal to 1.38054 × 10-23 volts per opening (V • K-1);

q - charge, equal to 1.602189 • 10-19C

T - temperature (Kelvin)

Second, more than one way to provide a more accurate method of measuring accuracy can be achieved 2 ℃

Absolute temperature conversion formula is:

... ... (2)

Of which:

△ V = V (I91) - V (I1) (in mV)

° K = 2.573 K / mV • △ V

℃ = 2.573 • △ V (mV) - 273 K

Note: Since each diode bias current is only the work of the three sampling clock cycle (only during the sampling), so the increase in power consumption is obvious, especially in temperature measurement is only occasional at this time of internal XPT7603 on behalf of the junction temperature can be ambient temperature.

8.8 Battery Measurement

Shown in figure 10, the battery voltage from 0V to 6V ,input voltage (VBAT) through sub-pressure (1 / 4) enter to the ADC, so the battery voltage of 5.5V was divided into 1.375V then enter the ADC.

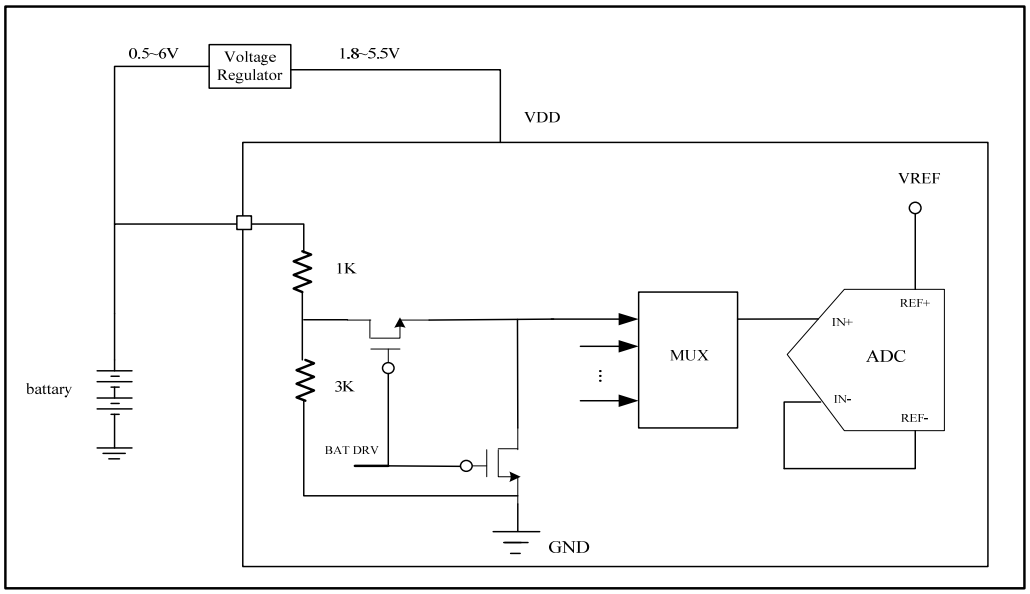


Figure 1 the battery voltage measurement function module map

8.9 Pressure Measurement

XPT7603 can also measure the pressure of touch, that is written in Table 3 Measurement of Z direction. In general, the performance of such measurements do not ask for much, so the use of 8-bit resolution mode (however, the calculation is the following 12-bit resolution mode) can be. There are several different ways to achieve the pressure measurements. The first method needs to know X panel of the resistance, X the location of the measurement, touch screen panel attached between the two measured values (Z1 and Z2), as shown in Figure 11. Formula can be used (3) calculate the touch resistance:

R touch = RX panel • ... ... (3)

The second approach requires the detection of X and Y panels panel resistance, X and Y position, and the Z1 position. Formula can be (4) Calculation of touch resistance: ... ... (4)

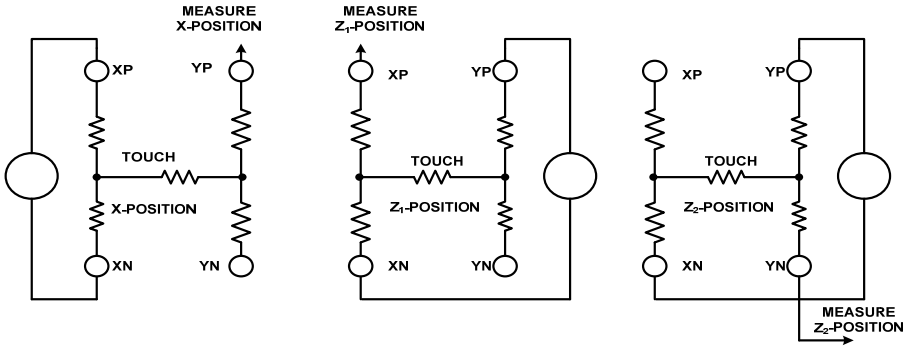


Figure 1 Pressure Measurement Block Diagram

9 Digital Interface

XPT7603 data interface is I2C serial interface, I2C interface to meet the agreement, can realize the standard model (100K), fast mode (400K) or high-speed mode (3.4M), divided into the control of XPT7603 writing, reading two command format, write command is used to enter an address and command bytes, so that work in the designated XPT7603 configuration and mode, XPT7603 read command is used to output data of ADC conversion in order to obtain information related to measurement.

9.1 Write Command

Order timing, as shown in Figure 12.

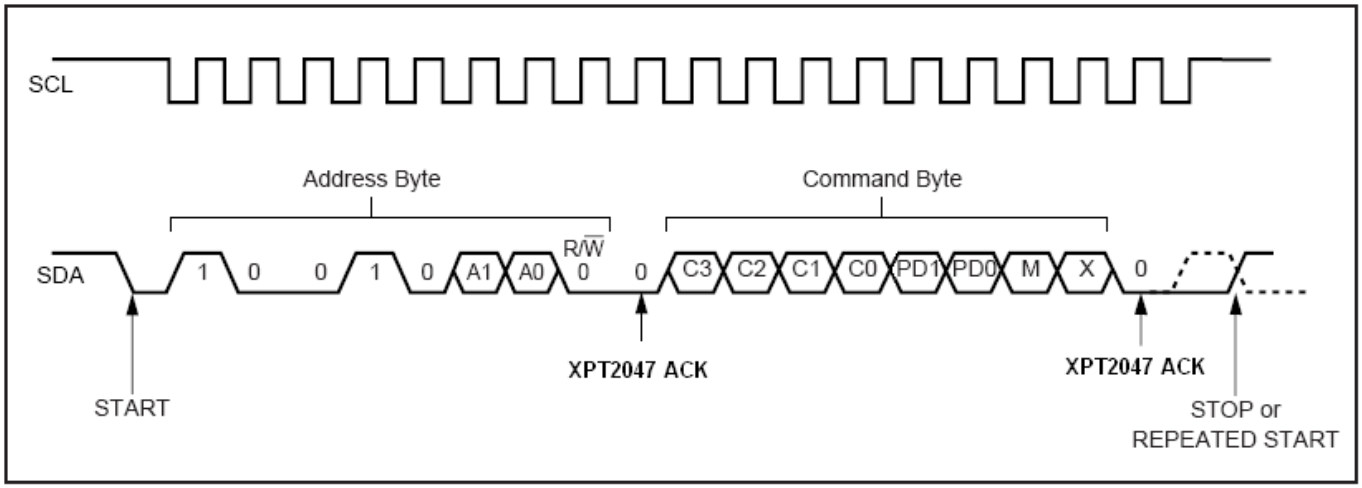


Figure 1 I2C interface write command timing diagram

First byte for byte address：

Table 4 address byte

Bit7 (MSB)	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0(LSB)
1	0	0	1	0	A1	A0	R/W

The lowest R / W (bit0), said write command is 0, 1, said read command

A0 (Bit1), A1 (bit2) control bit for the hardware address (Note: MSOP10 package, only A0), which must be two and chip 13 feet, 14 feet in line-level to the corresponding selection XPT7603.

The highest 5-bit address for the software, you must enter a fixed code "10010", as shown in Figure 12.

In the first byte received after all, XPT7603 No. 9 in the clock cycle, the issue of response signal ACK (0-level), indicating that the data has been received.

Order to write the second byte for byte order:

Table 5 Command Byte

Bit7 (MSB)	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0(LSB)
C3	C2	C1	C0	PD1	PD0	M	X

C3, C2, C1, C0 - decided XPT7603 configuration of the input signal and the corresponding measurement function, specifically as shown in table 3.

PD1, PD0 - used to control the internal reference voltage source and the pen interrupt signal, as shown in table 6:

Table 6 PD1、PD0 Control Bit

PD1	PD0	PENIRQ	Function Discprition
0	0	Enable	Energy-saving mode, only in order to write the beginning of the second byte, the

			internal ADC circuit to start work, until the ADC data conversion is completed, the chip automatically enter the power down state, ADC internal registers of the data, the wait to read Internal reference source at the closed
0	1	Disable	ADC always Internal reference source at the closed
1	0	Enable	And "00" state of the difference is that this configuration of the internal reference source is turned on
1	1	Disable	The internal ADC and reference sources are always in the state, at this time as long as the chip is power-state-driven switch in line to open

M - Mode Selection, and to set the resolution of ADC. MODE = 0, ADC is a 12-bit mode; MODE = 1, ADC is an 8-bit mode.

The lowest bit (bit0) is set aside, and can be set up, the general set to 0

In the second byte received after all, XPT7603 in the first 18 clock cycles, the issue of response signal ACK (0-level), indicating that the data has been received.

9.2 Read Command

Order Timing，Shown in Figure 7：

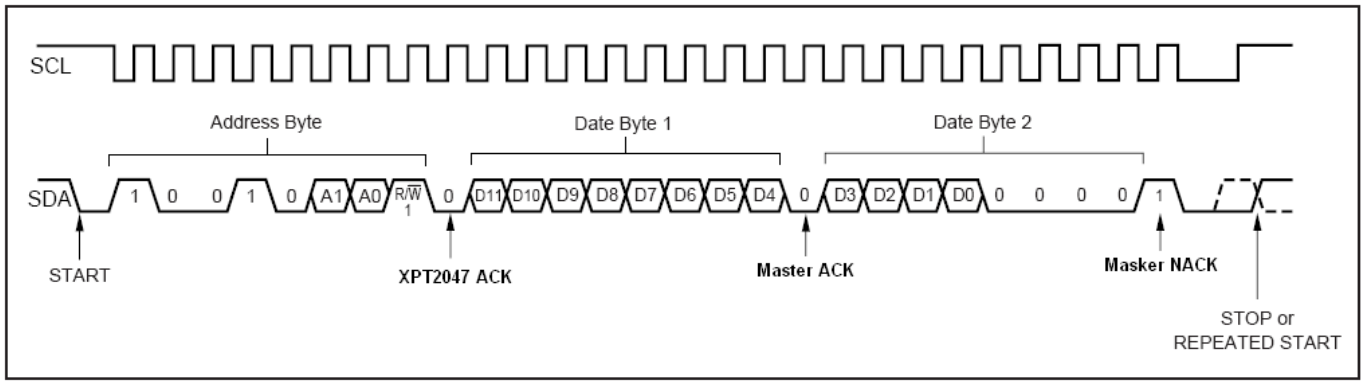


Figure 7 I2C Interface Read Command Timing Schamatic

Reading at 3-byte command, the first address byte for byte, and the write command is similar only for the high bit0; the next 2 bytes is the 12bit output XPT7603 data (8bits mode if it is only 1 bytes of data), redundant 4bits zero.

XPT7603 received in the first byte of the address data, 9 in the first clock cycle to issue response signal ACK (0-level), and then started to output the first byte of data received in the host after the first byte of data response signal should be issued master ACK (0-level), XPT7603 receive masker ACK sent after the second byte of data received in the host after the second byte of data, do not answer at this time to pull SDA was high , which is shown on the masker Not ACK signal.

9.3 High-Speed Mode

When the host sent data "00001XXX", was received XPT7603 after having to wait for the host response, XPT7603 will enter the high-speed mode (serial rate can 3.4Mhz), until the host issued a STOP signal.

High-speed mode, the format command to read and write standard mode and fast mode is the same as the order in writing after the STOP signal can not be made, otherwise the end of high-speed mode.

9.4 Digital Timing

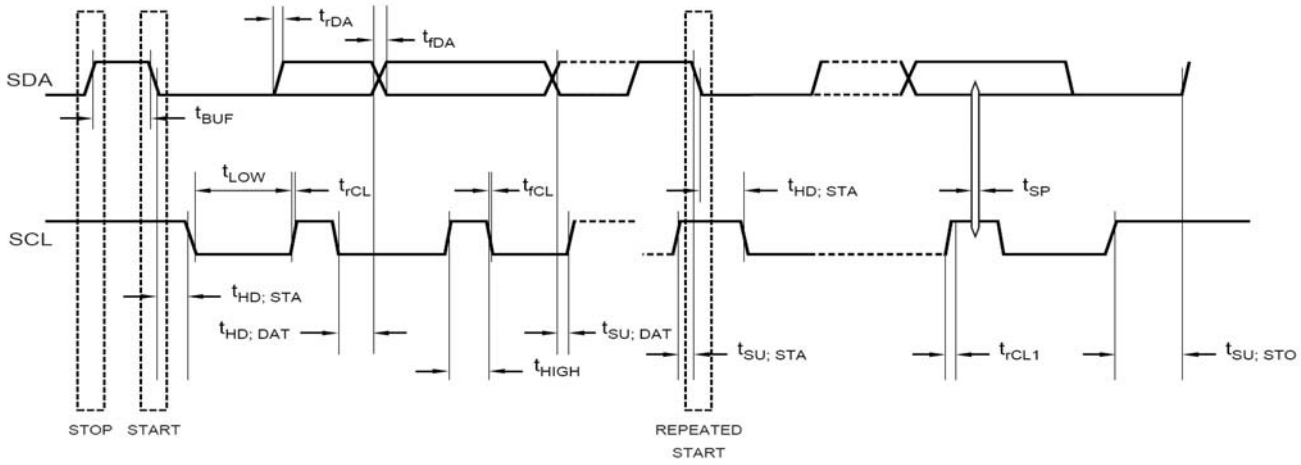


Figure 8 XPT7603 Digital Interface

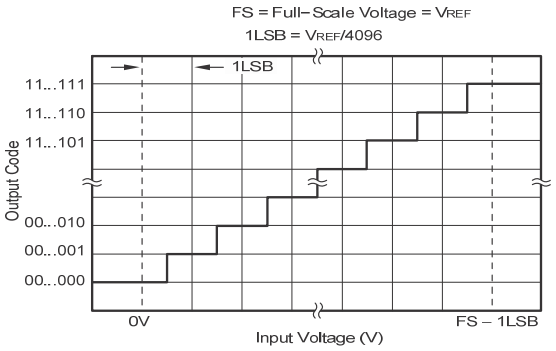
Table 7 timing specification

Serial Number	Instruction	Test Condition	+VDD = 2.7V, C_{LOAD} = 50pF		Unit
			Min	Max	
f_{SCL}	SCL Clock Frequency	Standard Mode Fast Mode High-Speed Mode, C_b = 100pF max High-Speed Mode, C_b = 400pF max	0 0 0 0	100 400 3.4 1.7	kHz kHz MHz MHz
t_{BUF}	Bus Free Time Between a STOP and Start Condition	Standard Mode Fast Mode	4.7 1.3		μs μs
$t_{HD;STA}$	Hold Time (Repeated) START Condition	Standard Mode Fast Mode High-Speed Mode	4.0 600 160		μs ns ns
t_{LOW}	LOW Period of the SCL Clock	Standard Mode Fast Mode High-Speed Mode, C_b = 100pF max High-Speed Mode, C_b = 400pF max	4.7 1.3 160 320		μs μs ns ns
t_{HIGH}	HIGH Period of the SCL Clock	Standard Mode Fast Mode High-Speed Mode, C_b = 100pF max High-Speed Mode, C_b = 400pF max	4.0 600 60 120		μs ns ns ns
$t_{SU;STA}$	Setup Time for a Repeated START Condition	Standard Mode Fast Mode High-Speed Mode	4.7 600 160		μs ns ns
$t_{SU;DAT}$	Data Setup Time	Standard Mode Fast Mode High-Speed Mode	250 100 10		ns ns ns
$t_{HD;DAT}$	Data Hold Time	Standard Mode Fast Mode High-Speed Mode, C_b = 100pF max High-Speed Mode, C_b = 400pF max	0 0 0 0	3.45 0.9 70 150	μs μs ns ns
t_{rCL}	Rise Time of SCL Signal	Standard Mode Fast Mode High-Speed Mode, C_b = 100pF max	20 + 0.1C_b 10	1000 300 40	ns ns ns

		High-Speed Mode, C_b = 400pF max	20	80	ns
t_{rCL1}	Rise Time of SCL Signal After a Repeated START Condition and After an Acknowledge Bit	Standard Mode Fast Mode High-Speed Mode, C_b = 100pF max High-Speed Mode, C_b = 400pF max	20 + 0.1C_b 10 20	1000 300 80 160	ns ns ns ns
t_{rCL}	Fall Time of SCL Signal	Standard Mode Fast Mode High-Speed Mode, C_b = 100pF max High-Speed Mode, C_b = 400pF max	20 + 0.1C_b 10 20	300 300 40 80	ns ns ns ns
t_{rDA}	Rise Time of SDA Signal	Standard Mode Fast Mode High-Speed Mode, C_b = 100pF max High-Speed Mode, C_b = 400pF max	20 + 0.1C_b 10 20	1000 300 80 160	ns ns ns ns
t_{fDA}	Fall Time of SDA Signal	Standard Mode Fast Mode High-Speed Mode, C_b = 100pF max High-Speed Mode, C_b = 400pF max	20 + 0.1C_b 10 20	300 300 80 160	ns ns ns ns
$t_{SU;STO}$	Setup Time for STOP Condition	Standard Mode Fast Mode High-Speed Mode	4.0 600 160		μs ns ns
C_b	Capacitive Load for SDA or SCL Line	Standard Mode Fast Mode High-Speed Mode, SCL = 1.7MHz High-Speed Mode, SCL = 3.4MHz		400 400 400 100	pF pF pF pF
t_{SP}	Pulse Width of Spike Suppressed	Fast Mode High-Speed Mode	0 0	50 10	ns ns
V_{nH}	Noise Margin at the HIGH Level for Each Connected Device (Including Hysteresis)	Standard Mode Fast Mode High-Speed Mode	0.2V_{DD}		V
V_{nL}	Noise Margin at LOW Level for Each Connected Device (Including Hysteresis)	Standard Mode Fast Mode High-Speed Mode	0.1V_{DD}		V

9.5 Data Format

XPT7603 output data format is a standard binary format. The following figure gives a different output voltage corresponding to the ideal encoding.



10 PENIRQ Output

Through the disruption of the functional pen set PD0 (see Table 6), pen interrupt output function shown in Figure 9.

PD0 = 0 when in, YN-driven open, the Y-touch screen panel to be connected to GND. PENIRQ output through two input switches and XP together. In the standby mode, when there is a touch-screen action, XP input through the touch-screen drop-down to ground, PENIRQ low output, there is no movement when touched, XP and GND disconnect, PENIRQ high output.

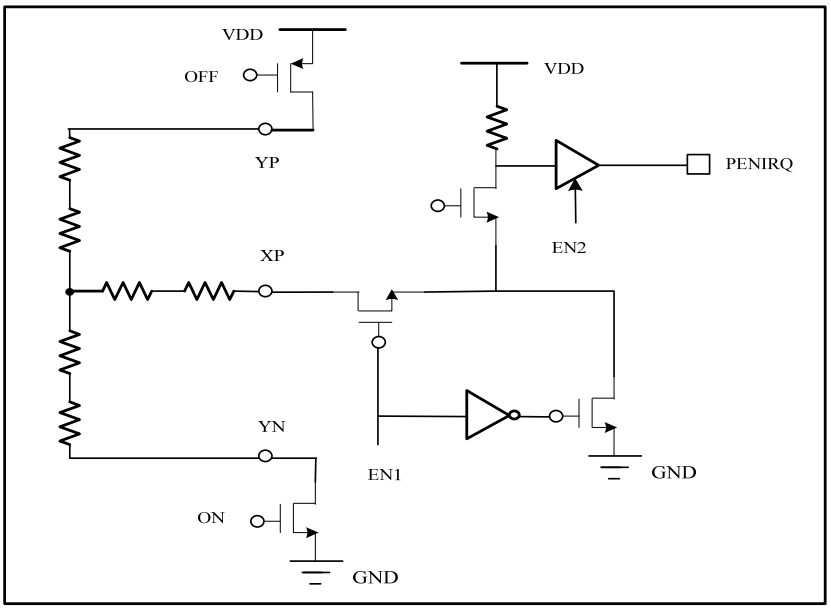


Figure 9 PENIRQ Function Schematic

In the measurement of X, Y and Z coordinates of the process, PENIRQ low output; in the measurement of VBAT, AUX and temp process, PENIRQ high output.

PD0 = 1, the pen interrupt function have been banned, can not touch the touch screen to monitor movement. If you want to re-enable interrupt function pen, with the need to control PD0 = 0 to write the word XPT7603, if written in the last control word contains PD0 = 0, pen interrupt output will be written after the completion of the command enable.

In order to avoid false triggering, it is proposed, in the control word processor to XPT7603, the PENIRQ masked interrupts.

11 Application Notes

Follow the following rules then the XPT7603 can be brought into full play the advantages. There are many contradictions about power, cost, size and weight in the most design of portable system. Generally , the vast majority of chips for portable systems need to have considerable clean power and ground, this is because most of its internal very low power consumption devices. This will mean that fewer and fewer total bypass and ground. Moreover, the circumstances vary, so should pay attention to the following recommendations and requirements.

To enable the chip to optimum performance,do take extra care to deal with the physical connection of XPT 2047 circuit. SAR basic structure is very sensitive to the pulse interference, and the mutation of power supply voltage, reference voltage, ground connection, and the digital input which only occurred before the analog comparator output latch. Thus, in n-bit SAR converter conversion in any one will have n external transient voltage by changing the formation of a "window" to affect the outcome of the conversion. Similar pulse interference may come from switching power supplies, nearby digital logic circuits, and high-power devices. These disturbances caused by digital logic output error depends on the reference voltage, layout wiring and external timing. Clock input timing of the changes in the same digital logic of the existence of the impact of the error output.

For the interference effects of the above considerations, XPT7603 power supply must be clean, and there is a good bypass. As far as possible close to the chip in the next, plus a 0.1μF ceramic capacitor referral. If the power supply VDD and a high impedance between the positive, it should also add a 1μF ~ 10μF capacitance. Leakage current for all capacitors must be small enough to avoid XPT7603 down to the system when the additional power consumption. In general, VREF pin does not require additional bypass capacitor, because the internal reference voltage has been through internal operational amplifier output buffer. However, if you use an external reference voltage source, need to add bypass capacitor, and to ensure that does not cause oscillation.

XPT7603 source for external reference voltage input without noise suppression, if the input reference voltage source directly connected with the power supply, power supply noise and ripple on will directly affect the numerical accuracy of the conversion. Despite the high-frequency noise can be filtered, but the signal frequency is very difficult to filter out interference, which is in the design requires a high degree of attention.

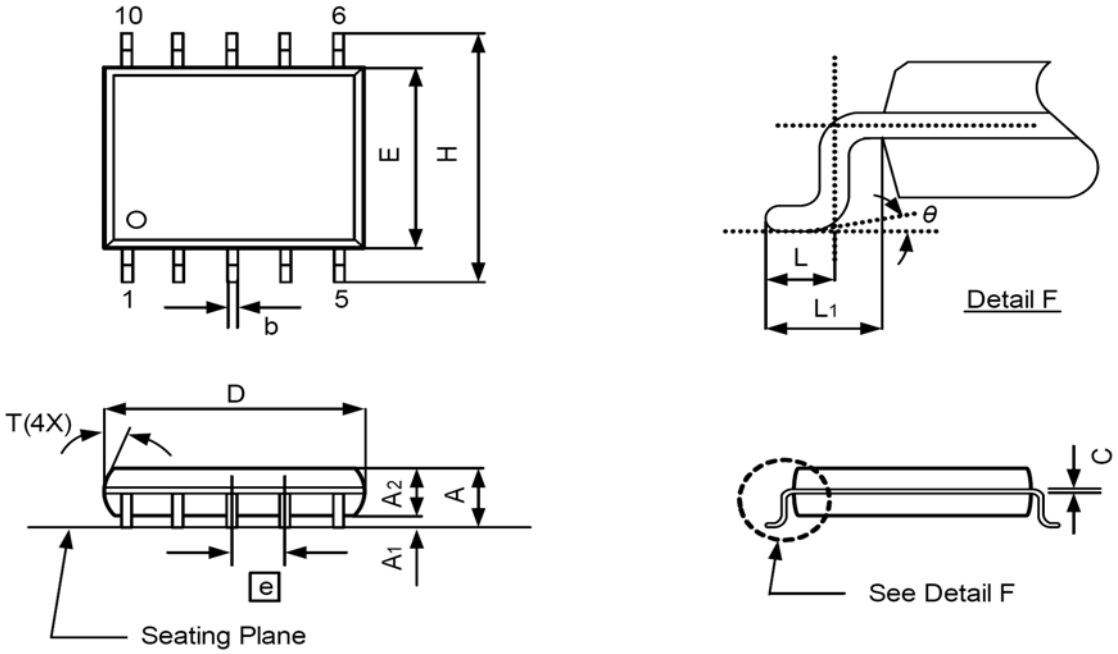
GND for the simulation of XPT7603, the pin must be received from a very clean place up, to avoid micro-controller or digital signal processor then near. If it is possible, it would be preferable to a separate converter to connect to the internal power supply (or batteries) take place. The layout will be the best converter and other analog circuits placed in the same plane in a simulated manner.

In particular, in the use of resistive touch screen to touch screen and pay attention to the connection between XPT7603. Resistive touch screen because the resistance is relatively small, so XPT7603 between the screen and try to connect to a short connection to the resistance as small as possible. Long connection will bring more of the error, which, as the on-resistance switch. In addition, the welding point of relaxation, as well as a solid point of contact will not bring the error to the application.

In addition to talking in front of the other applications in the touch screen (for example, applications using the LCD panel backlight) cause of noise is also an important reason for the error. EMI noise coupled through the LCD panel to the touch screen panel, causing instability in output, there are "glitches", and so can not be calibrated. Minimize these errors, there are several possible ways: increase in touch screen at the bottom of a metal shield, shield to ground; in the YP, YN, XP and XN-pin, respectively, to take on the filter capacitor; ... ... but it must be noted These settings will be touch screen response time impact, especially in single-ended mode at the same time data transmission and relatively high speed applications.

12 Physical Size of Chip Package

12.1 MSOP-10 Package



SYMBOLS	DIMENSION (MM)			DIMENSION (MIL)		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.81	1.02	1.12	32	40	44
A1	0.05	-	0.15	2	-	6
A2	0.76	0.86	0.97	30	34	38
b	0.15	0.20	0.30	6	8	12
C	0.13	0.15	0.23	5	6	9
D	2.90	3.00	3.10	114	118	122
E	2.90	3.00	3.10	114	118	122
H	4.70	4.90	5.10	185	193	201
e	-	0.50	-	-	19.7	-
L	0.40	0.53	0.66	16	21	26
L1	0.85	0.95	1.05	33	37	41
θ	0°	-	6°	0°	-	6°

Figure 10 MSOP-10 Package Size

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