PCT2342QC : Capacitive Touch Controller

General Description

PCT2342QC is a low-power, multi-object capacitive touch controller to provide a touch sensor system with high report rate, high accuracy, and low latency. It is using a mutual-capacitance measurement technology to sense capacitance changes and to detect multiple touch points simultaneously to realize as a touch system. It is designed to meet the increasingly demanding needs for multi-touch performance application. This is another PixArt's PocoTouch solution that supports touch detection, gesture interpretation and motion tracking targeting for NB trackpad application supporting Microsoft defined Precision Touch Pad (PTP) requirement as well as the non-PTP trackpad application. Hence, PCT2342QC supports interface includes I2C/HID-I2C/PS2 to provide driver-free solution.

Key Features

- Low power consumption
- Flexible touch size and shape
- Embed flash
- Excellent water immunity
- Smart auto-calibration
- Smart palm rejection
- Ultra-high noise resistance
- I2C/HID-I2C/PS2 interface
- PS2 interface
- Driver-free to implement PTP
- PWM for LED Driver
- BIST Cap for touch panel test

Application

- NB Trackpad / Tablet Trackpad
- Any human interface device with touch function and implemented by low impedance touch sensor.

Key Parameters

Parameter	Value
Channel Number	26x16~22x20
Touch area	115mm*70mm or for PTP (5.3")
Sensing Type	Mutual
Object Detection	10 touch
Supply Voltage	2.7~3.6V
Power Consumption	7mA @ 130Hz/touch 3uA @ Suspend mode
Sensitivity	4mm Stylus
Report Rate	>160Hz
CPI	>300 to meet PTP Requirement
Cover Thickness	Max. 1.5mm PC
Accuracy	< 0.5mm @ Center < 1.0mm @ Boarder
Operation Temperature (T_j)	-20 to +85 °C

Ordering Information

Part Number	Package Type
PCT2342QC	7mmx7mm QFN56

RoHS compliant

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1.0 Introduction

1.1 Overview

PCT2342QC is based on true mutual capacitance sensing technology. It is designed to meet the increasingly demanding needs for multi-touch performance in PC peripheral application, especially in standard Precision Touch Pad application. Figure1 illustrates a typical system with the embedded PCT2342QC touch controller. It develops and delivers the excitation signals to the touch panel. All the touch detection, gesture interpretation and motion tracking are handled by PCT2342QC. An interrupt flag from the touch controller signals the host to read the touch reports.

PCT2342QC is a flash base touch controller. I2C /HID-I2C/PS2 are used for serial communication between the PCT2342QC and the host. Meanwhile, a large set of registers are provided for performance optimization.

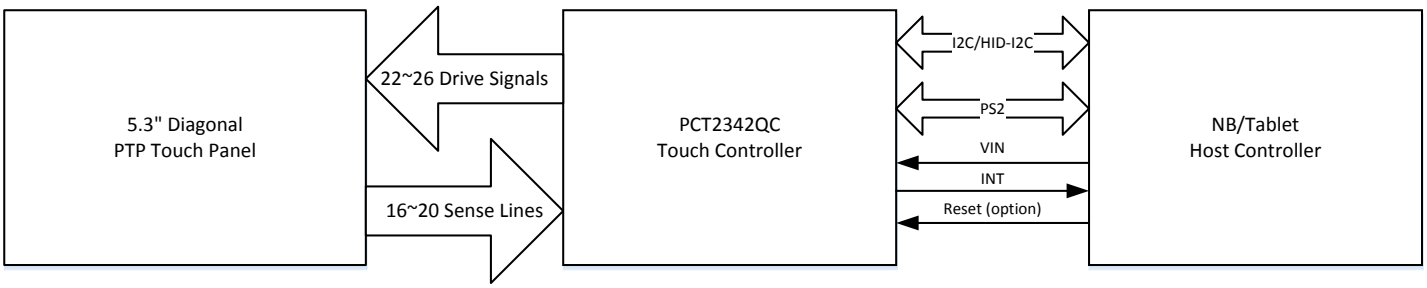


Figure 1. System Block Diagram

1.2 Operation Theory

PCT2342QC touch controller consists of an analog front-end with dedicate 22 drive lines and 16 sense lines together with 4 flexible lines connecting to touch panel. The 4 flexible lines are multi-function which can be used as drive or sense that means the matrix resolution can be 26x16 ~ 22x20 according to user's preferred ME geometry. All drive and sense lines can be reordered to provide panel routing flexibility, and each drive/sense line can be independently switched on/off to match the touch screen active areas.

The controller applies a series of excitation signals to the drive electrodes. The signals are coupled to the sense lines via mutual capacitance. Touching anywhere on the panel with a finger alters the capacitance at that specific location. The PCT2342QC multi-touch controller can simultaneously resolve and track up to ten touches. The high report rate allows the host to track rapid touches and movements with less than 10ms latency. The embedded processor filters the data, identifies the touch coordinates and gesture and then report to the host 160Hz at least.

1.3 Pin Definition

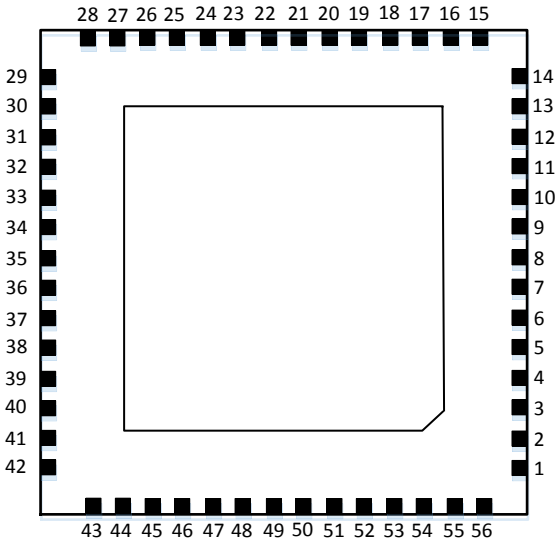


Figure 2 QFN56 Package Pin Assignment

Table 1. PCT2342QC QFN56 Pin Definition

Pin	Name	Description
1	SEN1	Sense line pin, could be connected to any Touch sensor row.
2	SEN2	Sense line pin, could be connected to any Touch sensor row.
3	SEN3	Sense line pin, could be connected to any Touch sensor row.
4	SEN4	Sense line pin, could be connected to any Touch sensor row.
5	SEN5	Sense line pin, could be connected to any Touch sensor row.
6	SEN6	Sense line pin, could be connected to any Touch sensor row.
7	SEN7	Sense line pin, could be connected to any Touch sensor row.
8	SEN8	Sense line pin, could be connected to any Touch sensor row.
9	SEN9	Sense line pin, could be connected to any Touch sensor row.
10	SEN10	Sense line pin, could be connected to any Touch sensor row.
11	SEN11	Sense line pin, could be connected to any Touch sensor row.
12	SEN12	Sense line pin, could be connected to any Touch sensor row
13	SEN13	Sense line pin, could be connected to any Touch sensor row
14	SEN14	Sense line pin, could be connected to any Touch sensor row.
15	SEN15	Sense line pin, could be connected to any Touch sensor row.
16	DRV13_SEN16	Mux pin: Can be set to Drive or Sense function. When used as Drive function, could be connected to any Touch sensor column. When used as Sense function, could be connected to any Touch sensor row.
17	DRV14_SEN17	Mux pin: Can be set to Drive or Sense function. When used as Drive function, could be connected to any Touch sensor column. When used as Sense function, could be connected to any Touch sensor row.
18	DRV15_SEN18	Mux pin: Can be set to Drive or Sense function.

Pin	Name	Description
		When used as Drive function, could be connected to any Touch sensor column. When used as Sense function, could be connected to any Touch sensor row.
19	DRV16_SEN19	Mux pin: Can be set to Drive or Sense function. When used as Drive function, could be connected to any Touch sensor column. When used as Sense function, could be connected to any Touch sensor row.
20	DRV17	Drive line pin, could be connected to any Touch sensor column.
21	DRV18	Drive line pin, could be connected to any Touch sensor column.
22	DRV19	Drive line pin, could be connected to any Touch sensor column.
23	DRV20	Drive line pin, could be connected to any Touch sensor column.
24	DRV21	Drive line pin, could be connected to any Touch sensor column.
25	DRV22	Drive line pin, could be connected to any Touch sensor column.
26	DRV23	Drive line pin, could be connected to any Touch sensor column.
27	DRV24/GPIO3	Mux pin, can be used as drive or GPIO function. When used as Drive, could be connected to any Touch sensor column. When used as GPIO, could be as button detection or PWM.
28	DRV25/GPIO4	Mux pin, can be used as drive or GPIO function. When used as Drive, could be connected to any Touch sensor column. When used as GPIO, could be as button detection or PWM.
29	VDRV	Drive signal and GPIO1/2/3/4 power source which is from internal regulator, with 1uF capacitor to ground.
30	GPIO5	Dedicate GPIO, could be as button detection or PWM.
31	TXD/I2C_ID	At power on instant, the pin is configured as input to detect level to decide I2C slave ID automatically. Then, the pin is used as TXD which is PixArt debug pin. I2C_ID is useful only in I2C interface when pin32 is pull low. TXD/I2C_ID: pull low by 10k resister, I2C slave ID is 0x33 TXD/I2C_ID: pull high by 10k resister, I2C slave ID is 0x37 TXD/I2C_ID: open, I2C slave ID is 0x3b
32	RXD/IF_SEL	At power on instant, the pin is configured as input to detect I2C or HID-I2C automatically. Then, the pin is used as RXD which is for PixArt debug function. RXD/IF_SEL: pull low by 10k resister→ I2C RXD/IF_SEL: pull high by 10k resister→ HID-I2C
33	NRST	Hardware reset pin. Could be controlled by Host to decide reset timing. PCT2342QC has internal power on reset. It is acceptable to keep NRST non-connection.
34	INT	Interrupt to Host to indicate data ready. Could be configured as active high or active low.
35	I2C_SCL	I2C or HID-I2C clock pin
36	I2C_SDA	I2C or HID-I2C data pin
37	PS2_SDA	PS2 data pin
38	PS2_CLK	PS2 clock pin
39	GPIO0	Dedicate GPIO, could be used as button detection or PWM.
40	VIN	Main power input, 1uF~10uFcapacitor to ground.

Pin	Name	Description
41	DRV0/GPIO1	Mux pin, can be used as drive or GPIO function. When used as Drive, could be connected to any Touch sensor column. When used as GPIO, could be as button detection or PWM.
42	DRV1/GPIO2	Mux pin, can be used as drive or GPIO function. When used as Drive, could be connected to any Touch sensor column. When used as GPIO, could be as button detection or PWM.
43	DRV2	Drive line pin, could be connected to any Touch sensor column.
44	DRV3	Drive line pin, could be connected to any Touch sensor column.
45	DRV4	Drive line pin, could be connected to any Touch sensor column.
46	DRV5	Drive line pin, could be connected to any Touch sensor column.
47	DRV6	Drive line pin, could be connected to any Touch sensor column.
48	DRV7	Drive line pin, could be connected to any Touch sensor column.
49	DRV8	Drive line pin, could be connected to any Touch sensor column.
50	DRV9	Drive line pin, could be connected to any Touch sensor column.
51	DRV10	Drive line pin, could be connected to any Touch sensor column.
52	DRV11	Drive line pin, could be connected to any Touch sensor column.
53	DRV12	Drive line pin, could be connected to any Touch sensor column.
54	VDDD	Digital power source which is from internal regulator, with 1uF capacitor to ground.
55	GND	Connect to ground
56	SEN0	Sense line pin, could be connected to any Touch sensor row.

2.0 Electrical Specifications

2.1 Absolute Maximum Ratings

Table 2. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Notes
Storage Temperature	Ts	-60	125	˚C	
Operation Temperature	Ta	-20	85	˚C	
Supply voltage	VIN	-0.5	5.0	V	
Relative Humidity	RH	0	85	%	
ESD	ESD		3.5	kV	
Analog (Drive) Pin Voltage		-0.3	VDDD+0.3	V	
Digital Pin Voltage		-0.3	VDDIO+0.3	V	
Lead Solder Temperature			260	˚C	

Notes:

1. Ratings at room temperature 25 ˚C.
2. Maximum Ratings are those values beyond which damage to the device may occur.
3. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute maximum-rated conditions is not implied.
4. Functional operation should be restricted to the Recommended Operating Conditions.

2.2 Recommended Operation Conditions

Table 3. Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Operation Temperature	Ta	-20		85	˚C	
Supply voltage	VIN	2.7	3.3	3.6	V	
Maximum Supply Power Ripple	VPP			100	mVpp	@ VIN
Regulator Output	VDDD	1.38	1.45	1.5	V	
	VDRV	2.3	2.4	2.5	V	
I2C slave ID decision Resister	R_TXD/I2C_ID	4.7k	10k	20k	ohm	I2C slave ID is valid only I2C interface is selected.
I2C/HID_I2C decision Resister	R_IN	0		100k	ohm	

Note: PixArt does not guarantee the performance if the operating temperature is beyond the specified limit.

2.3 DC Electrical Specifications

Table 4. Current Consumption

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Operating Current @ Run mode	IDD_RUN		7		mA	1-touch state (Steady) Report Rate 130Hz
Operating Current @ Rest1 mode	IDD_REST1		0.5		mA	Touch to wake up Report Rate 20Hz
Operating Current @ Rest2 mode	IDD_REST2		0.2		mA	Touch to wake up Report Rate 4Hz
Shutdown Current	IDD_SUS		3		µA	No Touch wake up

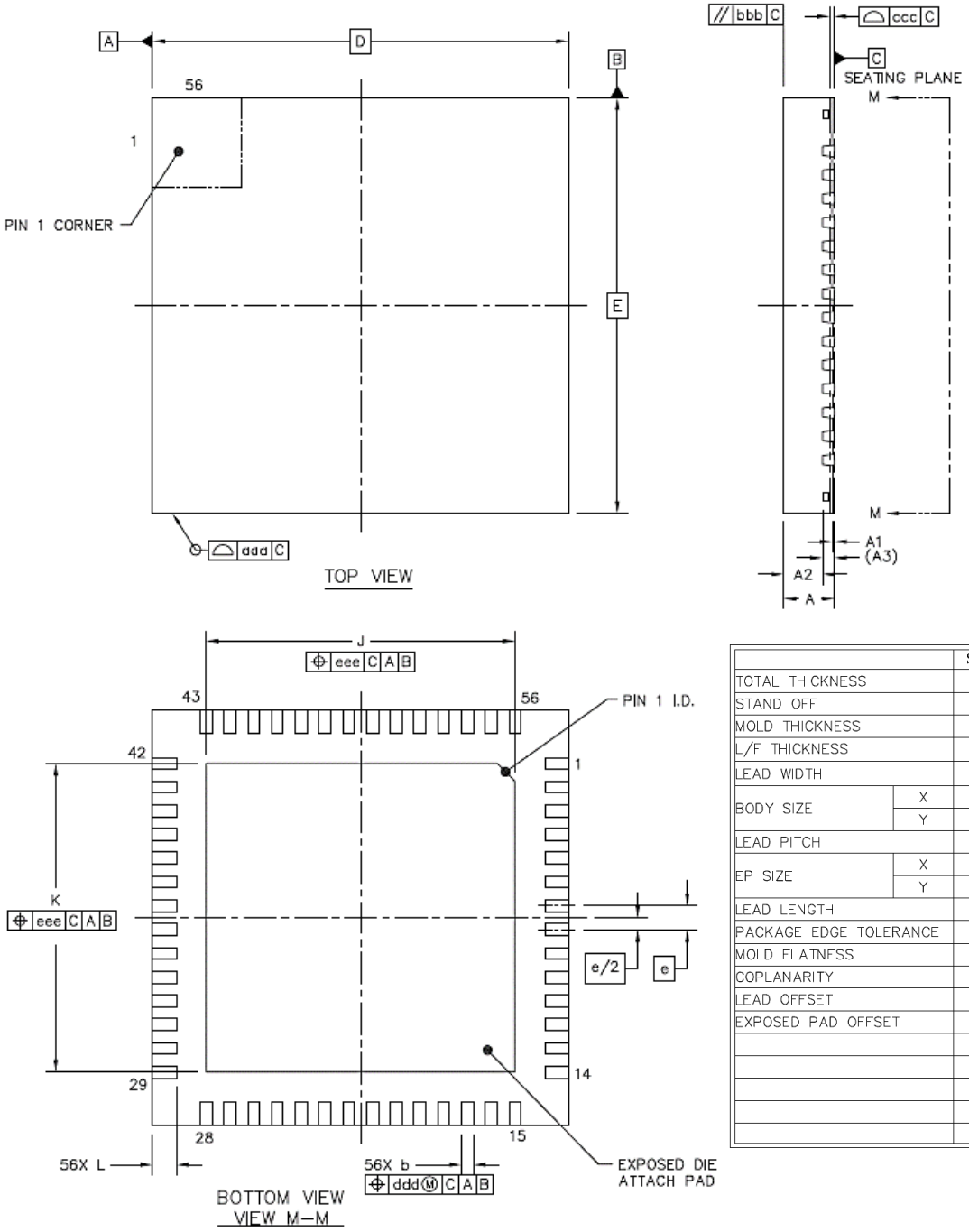
Note: All the parameters are tested under operating conditions

Table 5. I/O Level Specifications

Parameter		Symbol	Min	Typ	Max	Unit	Notes
GPIO1(*1)	Input High Voltage	VIH	VDRV*0.7			V	GPIO1~4 internal power sources from VDRV which is typically in 2.4V
	Input Low Voltage	VIL			VDRV*0.3	V	
	Output High Voltage	VOH	VDRV*0.8			V	
	Output Low Voltage	VOL			VDRV*0.2	V	
GPIO2(*1)	Input High Voltage	VIH	VDRV*0.7			V	
	Input Low Voltage	VIL			VDRV*0.3	V	
	Output High Voltage	VOH	VDRV*0.8			V	
	Output Low Voltage	VOL			VDRV*0.2	V	
GPIO3(*1)	Input High Voltage	VIH	VDRV*0.7			V	
	Input Low Voltage	VIL			VDRV*0.3	V	
	Output High Voltage	VOH	VDRV*0.8			V	
	Output Low Voltage	VOL			VDRV*0.2	V	
GPIO4(*1)	Input High Voltage	VIH	VDRV*0.7			V	
	Input Low Voltage	VIL			VDRV*0.3	V	
	Output High Voltage	VOH	VDRV*0.8			V	
	Output Low Voltage	VOL			VDRV*0.2	V	
GPIO5(*2)	Input High Voltage	VIH	VIN*0.7			V	GPIO5~6 internal power sources from VIN which range from 2.7~3.6V
	Input Low Voltage	VIL			VIN*0.3	V	
	Output High Voltage	VOH	VIN*0.8			V	
	Output Low Voltage	VOL			VIN*0.2	V	
GPIO6(*2)	Input High Voltage	VIH	VIN*0.7			V	
	Input Low Voltage	VIL			VIN*0.3	V	
	Output High Voltage	VOH	VIN*0.8			V	
	Output Low Voltage	VOL			VIN*0.2	V	

3.0 Mechanical Specifications

PCT2342QC is packaged in QFN56 7mmx7mm with pad pitch 0.4mm.



		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS		A	0.8	0.85	1.0
STAND OFF		A1	0	0.035	0.05
MOLD THICKNESS		A2	---	0.65	0.67
L/F THICKNESS		A3		0.203 REF	
LEAD WIDTH		b	0.15	0.2	0.25
BODY SIZE	X	D		7 BSC	
	Y	E		7 BSC	
LEAD PITCH		e		0.4 BSC	
EP SIZE	X	J	5.1	5.2	5.3
	Y	K	5.1	5.2	5.3
LEAD LENGTH		L	0.35	0.4	0.45
PACKAGE EDGE TOLERANCE		aaa		0.1	
MOLD FLATNESS		bbb		0.1	
COPLANARITY		ccc		0.08	
LEAD OFFSET		ddd		0.1	
EXPOSED PAD OFFSET		eee		0.1	

Figure 3 Package Outline Drawing

4.0 System Design References

4.1 Reference Schematic

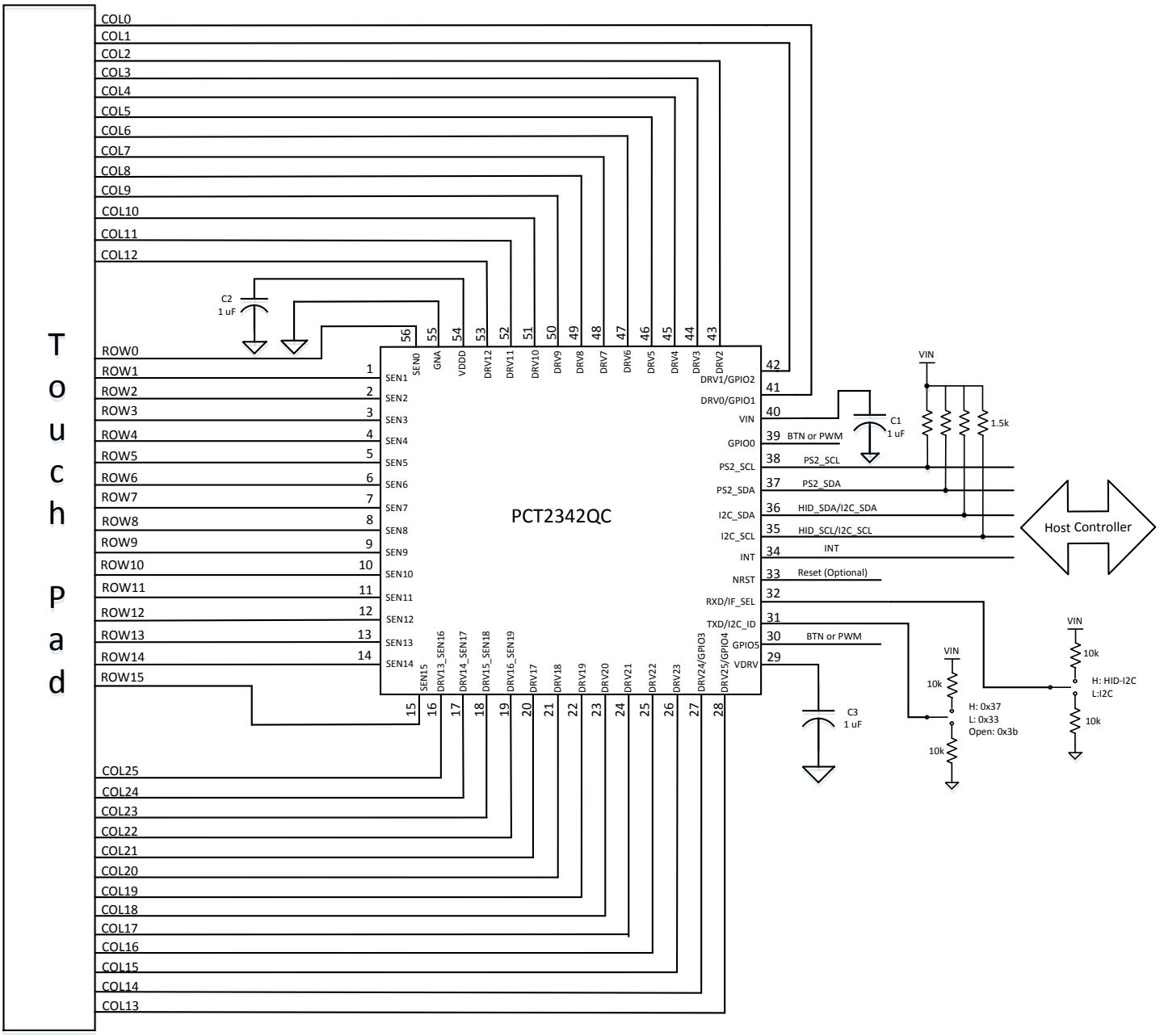


Figure 4. Reference Schematic

Document Revision History

Revision No.	Date	Description of Change(s)
1.0	23 Feb 2017	1st release of general datasheet