PCT1336QN: Cap-Touch Controller

General Description

PCT1336QN is a low-power, 5-touch Cap-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 a PixArt's PocoTouch solution that supports touch detection, gesture interpretation and motion tracking for trackpad and touch pad in HID, mobile and wearable applications.

An Interrupt flag from the touch controller signals the host to read the touch reports. I2C and SPI are used for serial communication between the PCT1336QN and the host. A large set of registers facilitates features and performance optimization. Additional user enhancements or adjustments complement the system performance objectives.

Key Features

- Low power consumption
- Wide input power range
- Flexible touch are size and shape
- I2C/HID-I2C/SPI interface
- Embedded Flash
- Excellent Water Immunity
- Smart Auto-Calibration
- Palm Rejection
- Thick cover support, up to 2.0mm PC
- Customize Gesture Support
- Win10 PTP Compliance
- Open-short test support

Applications

- Trackpad
- Touch mouse
- Touch keyboard
- Remote Controller
- Wearable

Key Parameters

Parameter	Value
Channel Number	24x12~20x16
Touch area	1"~6"
Sensing Type	Mutual
Object Detection	5 Touches
Supply Voltage	2.3~3.6V
Power Consumption	3mA @ 100fps/touch 35uA @ Standby 8uA @ Suspend mode
Sensitivity	4mm Stylus
Report Rate	Max 250Hz
Latency	< 10ms
CPI	300~2000
Operation Temperature (T_j)	-20 to +85 °C

Ordering Information

Part Number	Package Type
PCT1336QN	6mmx6mm QFN48

RoHS compliant

For any additional inquiries, please contact us at
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1.0 Introduction

1.1 Overview

PCT1336QN 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. Figure 1. System Block Diagram illustrates a typical system with the embedded PCT1336QN 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 PCT1336QN. An interrupt flag from the touch controller signals the host to read the touch reports.

PCT1336QN is a register base touch controller. I2C/HID-I2C/SPI are used for serial communication between the PCT1336QN and the host. A large set of registers need to load from host to PCT1336QN to enable function and optimize performance for customized application.

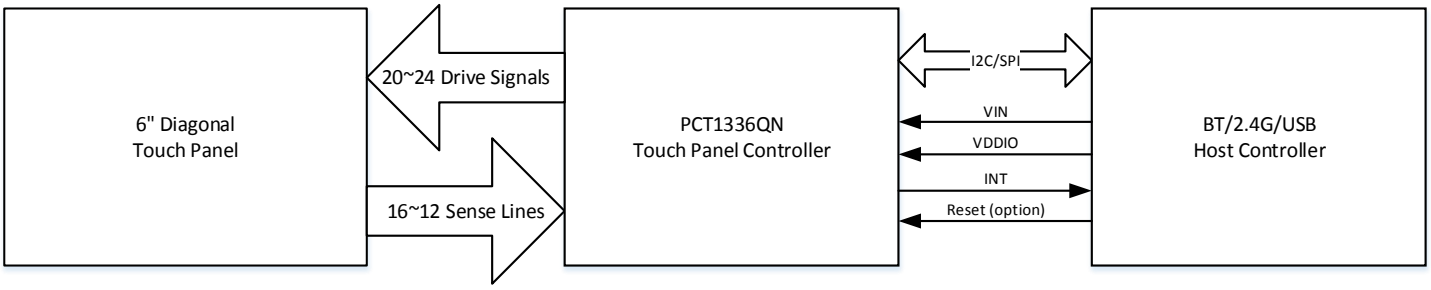


Figure 1. System Block Diagram

1.2 Operation Theory

PCT1336QN touch controller consists of an analog front-end with dedicate 20 drive lines and 12 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 24x12 ~ 20x16 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 PCT1336QN multi-touch controller can simultaneously resolve and track up to five 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 250Hz maximum. However, PCT1336QN FW does noise avoidance automatically to get good SNR, so the report rate may be reduced automatically when the environment is noisy.

1.3 Package and Pin Definition

PCT1336QN is packaged in QFN48 6mmx6mm with pad pitch 0.5mm.

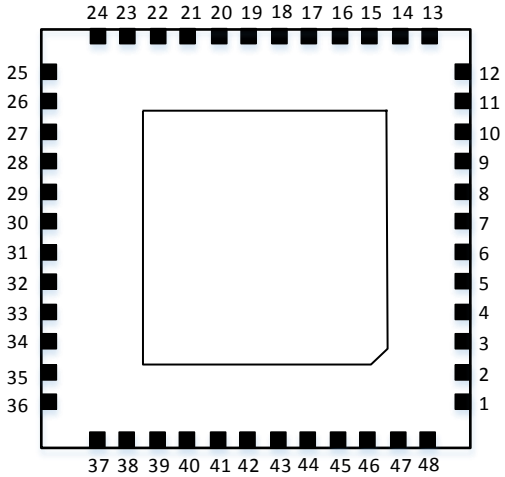


Figure 2. QFN48 Package Pin Assignment

Table 1. PCT1336QN QFN48 Pin Definition

Pin	Name	Description
1	SEN3	Sense line pin, could be connected to any Touch sensor row.
2	SEN4	Sense line pin, could be connected to any Touch sensor row.
3	SEN5	Sense line pin, could be connected to any Touch sensor row.
4	SEN6	Sense line pin, could be connected to any Touch sensor row.
5	SEN7	Sense line pin, could be connected to any Touch sensor row.
6	SEN8	Sense line pin, could be connected to any Touch sensor row.
7	SEN9	Sense line pin, could be connected to any Touch sensor row.
8	SEN10	Sense line pin, could be connected to any Touch sensor row.
9	SEN11	Sense line pin, could be connected to any Touch sensor row.
10	SEN12	Sense line pin, could be connected to any Touch sensor row.
11	SEN13	Sense line pin, could be connected to any Touch sensor row.
12	VDDA	Analog power, 1uF capacitor to ground.
13	VDDD	Digital power, 1uF capacitor to ground.
14	DRV12_SEN14	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.
15	DRV13_SEN15	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.
16	DRV14	Drive line pin, could be connected to any Touch sensor column.

Pin	Name	Description
17	DRV15	Drive line pin, could be connected to any Touch sensor column.
18	DRV16	Drive line pin, could be connected to any Touch sensor column.
19	DRV17	Drive line pin, could be connected to any Touch sensor column.
20	DRV18	Drive line pin, could be connected to any Touch sensor column.
21	DRV19	Drive line pin, could be connected to any Touch sensor column.
22	DRV20	Drive line pin, could be connected to any Touch sensor column.
23	DRV21	Drive line pin, could be connected to any Touch sensor column.
24	DRV22	Drive line pin, could be connected to any Touch sensor column.
25	DRV23/BTN	Multi-function Pin. Default be used as Drive function, could be connected to any Touch sensor column. Could be used as GPIO to support external button.
26	VIN	Main power input, 1uF capacitor to ground.
27	VDDIO	Power for interface to Host, 0.1uF capacitor to ground.
28	RXD/RST	Multi-function Pin. At power on instant, this pin is used as interface activate function, it should be pull low to active I2C interface. Or pull high to activate SPI interface. After power on, this pin could be configured as HW reset function through register configuration. This pin could also be used as UART RX for PXI debugging.
29	TXD/BTN	Multi-function Pin Could be used as GPIO to support external button Also used for UART TX for PXI debugging.
30	IO_CLK	SPI_CLK or I2C_SCL mux function pin, depend on IO_SEL/RX/RST power on instant level. When used as I2C_SCL, it is open drain IO and should be pull high (4.7k~10k) externally.
31	MISO_SDA	SPI_MISO or I2C_SDA mux function pin, depend on IO_SEL/RX/RST power on instant level. When used as I2C_SDA, it is open drain IO and should be pull high (4.7k~10k) externally.
32	MOSI_A0	SPI_MOSI, or I2C slave ID pin.
33	NCS_A1	SPI_CS, or I2C slave ID pin.
34	INT	Interrupt to Host to indicate data ready.
35	GND	Ground pin.
36	DRV0/BTN	Multi-function Pin. Default be used as Drive function, could be connected to any Touch sensor column. Could be used as GPIO to support external button.
37	DRV1	Drive line pin, could be connected to any Touch sensor column.
38	DRV2	Drive line pin, could be connected to any Touch sensor column.
39	DRV3	Drive line pin, could be connected to any Touch sensor column.
40	DRV4	Drive line pin, could be connected to any Touch sensor column.
41	DRV5	Drive line pin, could be connected to any Touch sensor column.
42	DRV6	Drive line pin, could be connected to any Touch sensor column.

Pin	Name	Description
43	DRV7	Drive line pin, could be connected to any Touch sensor column.
44	DRV8	Drive line pin, could be connected to any Touch sensor column.
45	DRV9	Drive line pin, could be connected to any Touch sensor column.
46	DRV10_SEN0	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.
47	DRV11_SEN1	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.
48	SEN2	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 with Internal Regulator	V_IN	-0.5	3.6	V	
	VDDIO	-0.5	3.6	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. At 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 for Internal Regulator Mode

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Operation Temperature	Ta	-20		85	˚C	
Supply voltage	V_IN	2.3	-	3.6	V	
	VDDIO	1.72	-	3.6	V	
Regulator output	VDDD	1.72	1.8	2	V	
	VDDA	1.72	1.8	2	V	
Supply Noise	VPP			100	mVpp	@ VIN

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

2.3 DC Electrical Specifications

Table 4. Power Consumption

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Operating Current @ Run mode	IDD_RUN		3.0		mA	1-touch state (Steady) Report Rate 100Hz
Operating Current @ Rest1 mode	IDD_REST1		0.2		mA	Touch to wakeup Report Rate 10Hz
Operating Current @ Rest2 mode	IDD_REST2		35*1		µA	Touch to wakeup Report Rate 4Hz
Shutdown Current	IDD_SUS		8		µA	Non Touch Wakeup

Note: All the parameters are tested under operating conditions
*1: 35uA is the condition when rest2 is set to deep sleep mode.

Table 5. I/O Interface Specifications

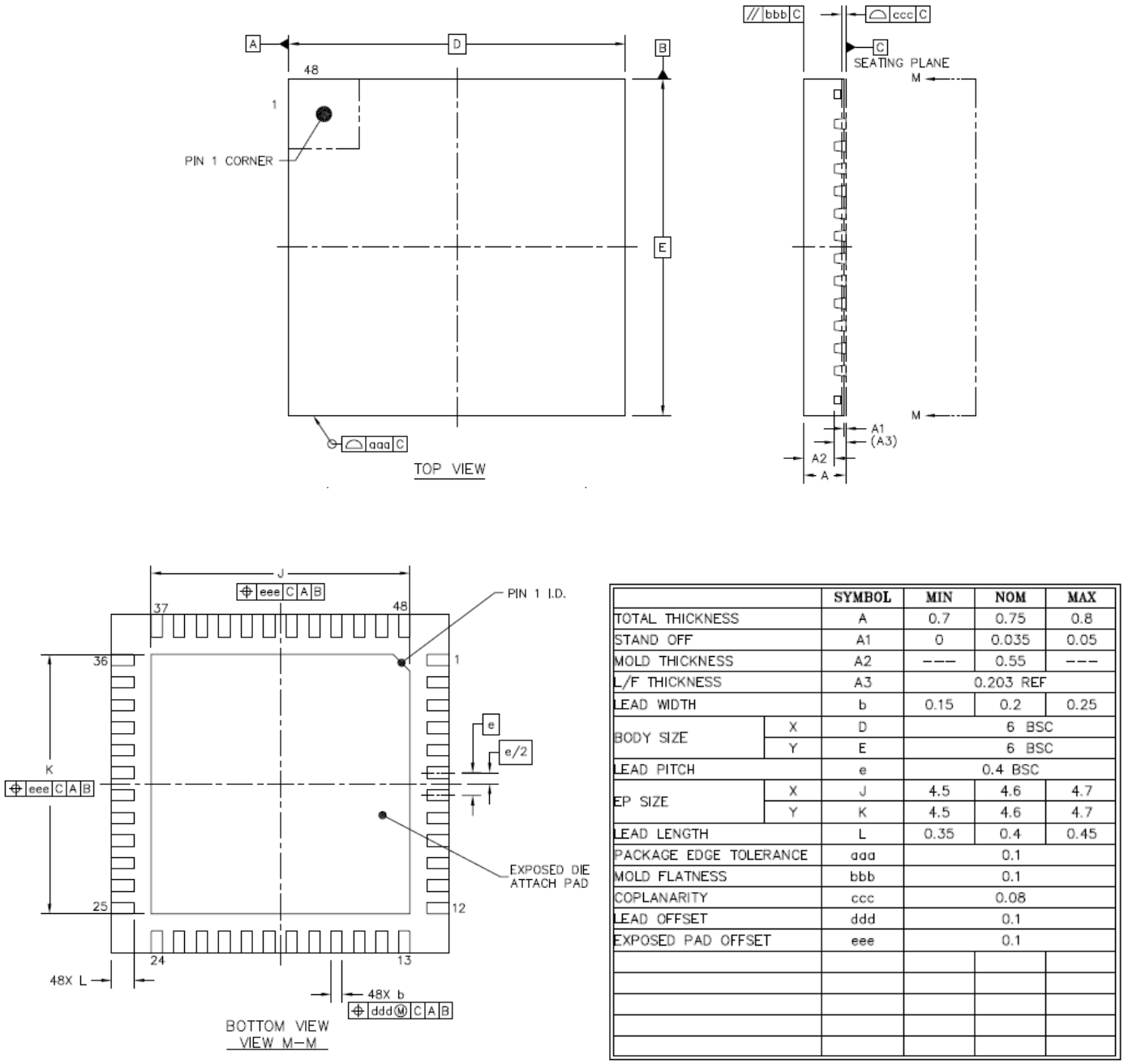
Parameter	Symbol	Min	Typ	Max	Unit	Notes
Input high voltage	VIH	VDDIO*0.7			V	
Input low voltage	VIL			VDDIO*0.3	V	
Output high Voltage	VOH	VDDIO*0.8			V	
Output low voltage	VOL			VDDIO*0.2	V	

Note: All the parameters are tested under operating conditions

3.0 Mechanical Specifications

3.1 Package Specification

PCT1336QN is packaged in QFN48 6mmx6mm with pad pitch 0.5mm.

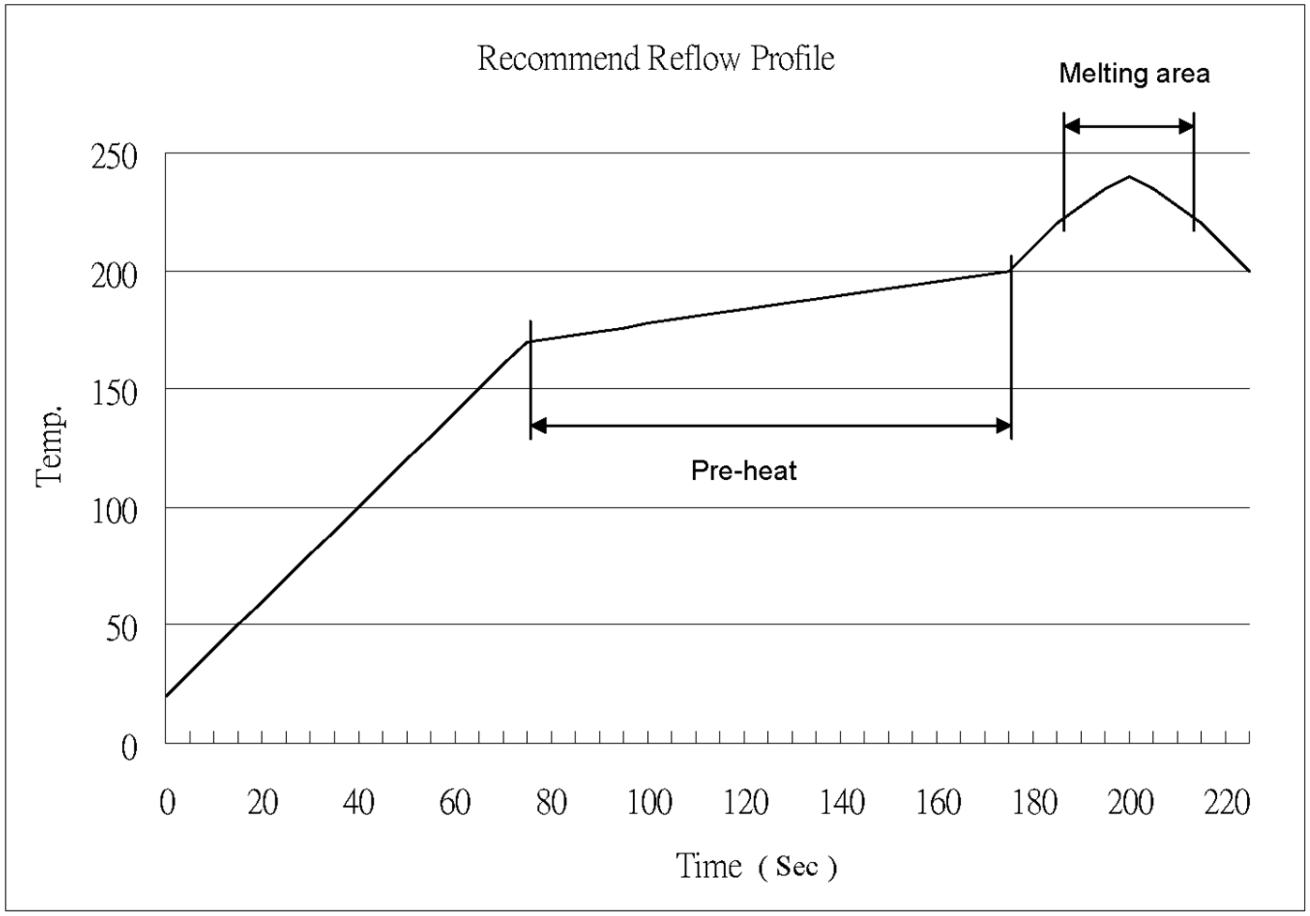


		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS		A	0.7	0.75	0.8
STAND OFF		A1	0	0.035	0.05
MOLD THICKNESS		A2	---	0.55	---
L/F THICKNESS		A3		0.203 REF	
LEAD WIDTH		b	0.15	0.2	0.25
BODY SIZE	X	D		6 BSC	
	Y	E		6 BSC	
LEAD PITCH		e		0.4 BSC	
EP SIZE	X	J	4.5	4.6	4.7
	Y	K	4.5	4.6	4.7
LEAD LENGTH		L	0.35	0.4	0.45
PACKAGE 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 Mechanical Information

3.2 Recommended Condition for Infrared Reflow

Please carefully observe the mounting conditions and recommended temperature profile as shown in Figure 4 when mounting under infrared reflows.



Recommend Pb-free solder paste vender & type : 1. Almit LFM-48W TM-HP
2. Senju M705-GRN360-K

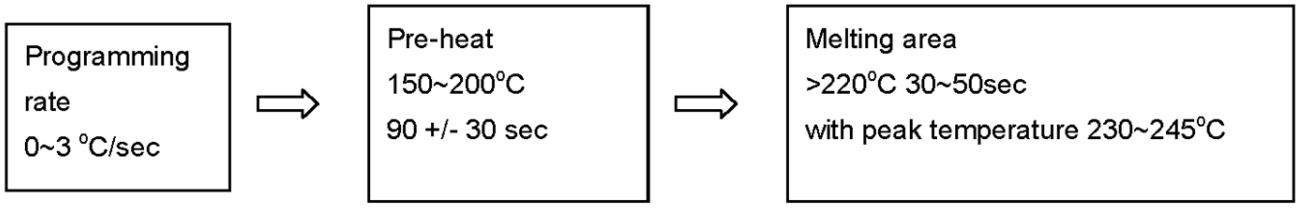


Figure 4. Reflow Chart

4.0 Reference Schematic

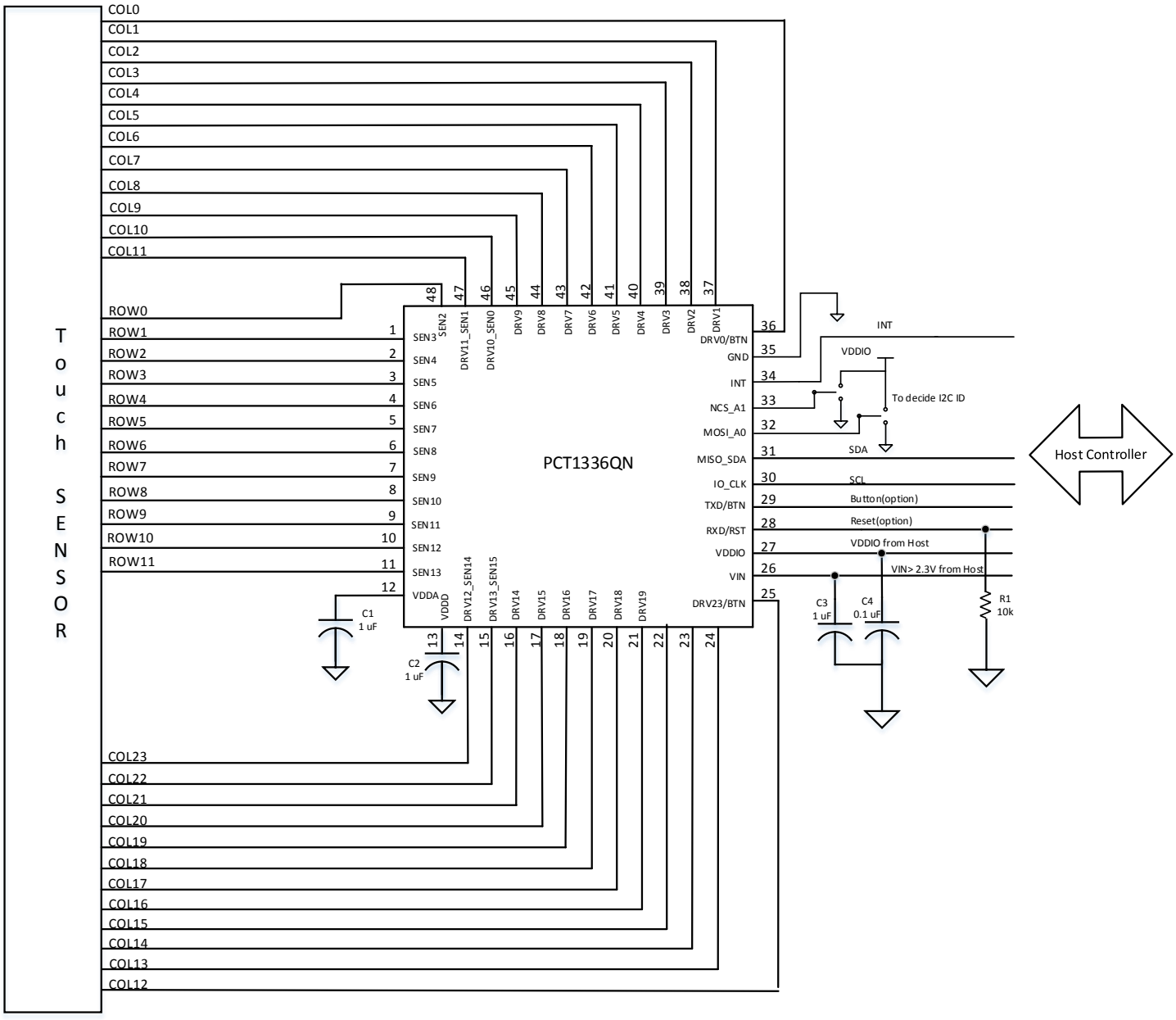


Figure 5. Reference Schematic

5.0 Register Map

5.1 Touch Data and Control Register

The Registers list in Table 6 includes touch data information and user registers which are meant to access the firmware settings to increase the flexibility against different usages and performance requirement.

- Reg0x00~Reg0x1F provide 5 touch data's (ID, x, y) information: The touch data reported sequence always follows ID order. The object with small ID number would be placed in front. For example, if there is 1 finger touch initially, the reported touch data would be in Reg0x02~Reg0x07 and the object's ID is 0. If a 2nd finger put on, the 2nd finger's touch data would be in Reg0x08~Reg0x0D width ID 1. When 1st finger lift up, the 2nd object (ID=1) touch data will be shift to Reg0x02~Reg0x07. The new ID will be 2 and touch data reported in Reg0x08~Reg0x0D if a new, 3rd finger puts on.
- Reg0x20~Reg0x5B extra touch information such as object size and touch force.
- Reg0x5F~Reg0x6A provide physical button and gesture information.
- Reg0x70~Reg0x7C are boot status register, touch status register, sleep control register, and also indirect register for touch performance tuning.

Table 6. Touch Data and Control Registers

Addr	Name	Bit	R/W
0x00	FRM_NUM	[7:0]	R
0x01	NUM_OF_OBJ	[7:0]	R
0x02	OBJ_0_valid	[7:0]	R
0x03	OBJ_0_ID	[2:0]	R
0x04	OBJ_0_X[7:0]	[7:0]	R
0x05	OBJ_0_X[15:8]	[7:0]	R
0x06	OBJ_0_Y[7:0]	[7:0]	R
0x07	OBJ_0_Y[15:8]	[7:0]	R
0x08	OBJ_1_valid	[7:0]	R
0x09	OBJ_1_ID	[2:0]	R
0x0A	OBJ_1_X[7:0]	[7:0]	R
0x0B	OBJ_1_X[15:8]	[7:0]	R
0x0C	OBJ_1_Y[7:0]	[7:0]	R
0x0D	OBJ_1_Y[15:8]	[7:0]	R
0x0E	OBJ_2_valid	[7:0]	R
0x0F	OBJ_2_ID	[2:0]	R
0x10	OBJ_2_X[7:0]	[7:0]	R
0x11	OBJ_2_X[15:8]	[7:0]	R
0x12	OBJ_2_Y[7:0]	[7:0]	R
0x13	OBJ_2_Y[15:8]	[7:0]	R
0x14	OBJ_3_valid	[7:0]	R
0x15	OBJ_3_ID	[2:0]	R

Addr	Name	Bit	R/W
0x16	OBJ_3_X[7:0]	[7:0]	R
0x17	OBJ_3_X[15:8]	[7:0]	R
0x18	OBJ_3_Y[7:0]	[7:0]	R
0x19	OBJ_3_Y[15:8]	[7:0]	R
0x1A	OBJ_4_valid	[7:0]	R
0x1B	OBJ_4_ID	[2:0]	R
0x1C	OBJ_4_X[7:0]	[7:0]	R
0x1D	OBJ_4_X[15:8]	[7:0]	R
0x1E	OBJ_4_Y[7:0]	[7:0]	R
0x1F	OBJ_4_Y[15:8]	[7:0]	R
0x20	OBJ_0_SIZE[7:0]	[7:0]	R
0x21	OBJ_0_SIZE[15:8]	[7:0]	R
0x22	OBJ_0_SOI[7:0]	[7:0]	R
0x23	OBJ_0_SOI[15:8]	[7:0]	R
0x24	OBJ_0_WIDTH[7:0]	[7:0]	R
0x26	OBJ_0_HEIGHT[7:0]	[7:0]	R
0x2A	OBJ_0_MAX_FORCE[7:0]	[7:0]	R
0x2B	OBJ_0_MAX_FORCE[15:8]	[7:0]	R
0x2C	OBJ_1_SIZE[7:0]	[7:0]	R
0x2D	OBJ_1_SIZE[15:8]	[7:0]	R
0x2E	OBJ_1_SOI[7:0]	[7:0]	R
0x2F	OBJ_1_SOI[15:8]	[7:0]	R
0x30	OBJ_1_WIDTH[7:0]	[7:0]	R
0x32	OBJ_1_HEIGHT[7:0]	[7:0]	R
0x36	OBJ_1_MAX_FORCE[7:0]	[7:0]	R
0x37	OBJ_1_MAX_FORCE[15:8]	[7:0]	R
0x38	OBJ_2_SIZE[7:0]	[7:0]	R
0x39	OBJ_2_SIZE[15:8]	[7:0]	R
0x3A	OBJ_2_SOI[7:0]	[7:0]	R
0x3B	OBJ_2_SOI[15:8]	[7:0]	R
0x3C	OBJ_2_WIDTH[7:0]	[7:0]	R
0x3E	OBJ_2_HEIGHT[7:0]	[7:0]	R
0x42	OBJ_2_MAX_FORCE[7:0]	[7:0]	R
0x43	OBJ_2_MAX_FORCE[15:8]	[7:0]	R
0x44	OBJ_3_SIZE[7:0]	[7:0]	R
0x45	OBJ_3_SIZE[15:8]	[7:0]	R

Addr	Name	Bit	R/W
0x46	OBJ_3_SOI[7:0]	[7:0]	R
0x47	OBJ_3_SOI[15:8]	[7:0]	R
0x48	OBJ_3_WIDTH[7:0]	[7:0]	R
0x4A	OBJ_3_HEIGHT[7:0]	[7:0]	R
0x4E	OBJ_3_MAX_FORCE[7:0]	[7:0]	R
0x4F	OBJ_3_MAX_FORCE[15:8]	[7:0]	R
0x50	OBJ_4_SIZE[7:0]	[7:0]	R
0x51	OBJ_4_SIZE[15:8]	[7:0]	R
0x52	OBJ_4_SOI[7:0]	[7:0]	R
0x53	OBJ_4_SOI[15:8]	[7:0]	R
0x54	OBJ_4_WIDTH[7:0]	[7:0]	R
0x56	OBJ_4_HEIGHT[7:0]	[7:0]	R
0x5A	OBJ_4_MAX_FORCE[7:0]	[7:0]	R
0x5B	OBJ_4_MAX_FORCE[15:8]	[7:0]	R
0x5F	BUTTON_STAT	[4:0]	R
0x60	GESTURE_0_TYPE	[4:0]	R
0x62	GESTURE_0_X[7:0]	[7:0]	R
0x63	GESTURE_0_X[15:8]	[7:0]	R
0x64	GESTURE_0_Y[7:0]	[7:0]	R
0x65	GESTURE_0_Y[15:8]	[7:0]	R
0x68	GESTURE_1_TYPE	[7:0]	R
0x6A	GESTURE_1_X[7:0]	[7:0]	R
0x70	BOOT_STAT[7:0]	[7:0]	R
0x71	STATUS[7:0]	[7:0]	R/W
0x73	USER_BANK[7:0]	[7:0]	R/W
0x74	USER_ADDR[7:0]	[7:0]	R/W
0x75	USER_DATA[7:0]	[7:0]	R/W
0x7A	SHUTDOWN[7:0]	[7:0]	W
0x7B	SW_RESET_EN	[0]	R/W
0x7C	DEEP_SLEEP_STATUS	[7:0]	R/W

5.2 User Registers

There are 5 banks (bank0~bank4) of user registers for the access to the firmware settings to increase the flexibility against different usages and environment. The host can use USER_BANK, USER_ADDR and USER_DATA (Reg0x73/74/75 in Bank0

Table 7 to access the user registers.

Where:

- Bank0 responses for system level performance controlling such as report rate/power downshift behavior/GPIO Behavior/Drive-Sense mapping, etc.
- Bank1 responses for noise avoidance and auto calibration relative parameters.
- Bank2 responses for absolute touch coordinate performance tuning
- Bank3 responses for gesture feasibility tuning
- Bank4 responses for palm rejection

5.2.1 Bank0

Table 7. System Level User Registers

Addr	Name	Bit	R/W	Initial Value
0x00	PRODUCT_ID	[7:0]	R	0x8C
0x01	FW_REVISION	[7:0]	R	0x00
0x02	FW_VERSION_MINOR[7:0]	[7:0]	R	0x00
0x03	FW_VERSION_MINOR[11:8]	[3:0]	R	0x00
0x03	FW_VERSION_MAJOR	[7:4]	R	0x02
0x04	PRODUCT_TYPE	[7:0]	R	0x00
0x07	STATUS_INTR_MASK	[7:0]	R/W	0xFF
0x08	INT_Behavior_CTRL	[7:0]	R/W	0x00
0x09	START	[0]	R/W	0x00
0x0a	PWR_CTRL_1	[7:0]	R/W	0x00
0x0b	PWR_CTRL_2	[7:0]	R/W	0x00
0x0c	CHARGER_MODE	[7:0]	R/W	0x00
0x10	OBS_REPORT_RATE[7:0]	[7:0]	R	-
0x11	OBS_REPORT_RATE[15:8]	[7:0]	R	-
0x12	MAX_REPORT_RATE[7:0]	[7:0]	R/W	0x64
0x13	MAX_REPORT_RATE[15:8]	[7:0]	R/W	0x00
0x15	OBS_OP_MODE	[7:0]	R	-
0x16	FORCE_OP_MODE	[7:0]	R/W	0x00
0x18	REST1_DS[7:0]	[7:0]	R/W	0x64
0x19	REST1_DS[15:8]	[7:0]	R/W	0x00
0x1a	REST2_DS[7:0]	[7:0]	R/W	0xC8
0x1b	REST2_DS[15:8]	[7:0]	R/W	0x00

Addr	Name	Bit	R/W	Initial Value
0x1c	REST1_FRAME_RATE	[7:0]	R/W	0x14
0x1d	REST2_FRAME_RATE	[7:0]	R/W	0x04
0x1f	REST2_SLEEP_MODE	[7:0]	R/W	0x00
0x20	GPIO_IO_CTRL	[4:0]	R/W	0x1D
0x22	GPI_INTR_TRI_TYPE	[4:0]	R/W	0x03
0x23	GPI_WAKEUP_CTRL	[4:0]	R/W	0x00
0x24	GPI_PU_CTRL	[4:0]	R/W	0x1C
0x26	GPI_RESET_EN	[4:0]	R/W	0x00
0x27	INT_LEVEL_CTRL	[4:0]	R/W	0x00
0x28	BTN_DEBOUNCE_CNTS	[3:0]	R/W	0x05
0x29	UART_CTRL	[2:0]	R/W	0x03
0x30	COL0	[7:0]	R/W	-
0x31	COL1	[7:0]	R/W	-
0x32	COL2	[7:0]	R/W	-
0x33	COL3	[7:0]	R/W	-
0x34	COL4	[7:0]	R/W	-
0x35	COL5	[7:0]	R/W	-
0x36	COL6	[7:0]	R/W	-
0x37	COL7	[7:0]	R/W	-
0x38	COL8	[7:0]	R/W	-
0x39	COL9	[7:0]	R/W	-
0x3a	COL10	[7:0]	R/W	-
0x3b	COL11	[7:0]	R/W	-
0x3c	COL12	[7:0]	R/W	-
0x3d	COL13	[7:0]	R/W	-
0x3e	COL14	[7:0]	R/W	
0x3f	COL15	[7:0]	R/W	
0x40	COL16	[7:0]	R/W	
0x41	COL17	[7:0]	R/W	
0x42	COL18	[7:0]	R/W	
0x43	COL19	[7:0]	R/W	
0x44	COL20	[7:0]	R/W	
0x45	COL21	[7:0]	R/W	
0x46	COL22	[7:0]	R/W	
0x47	COL23	[7:0]	R/W	
0x48	ROW0	[7:0]	R/W	-

Addr	Name	Bit	R/W	Initial Value
0x49	ROW1	[7:0]	R/W	-
0x4a	ROW2	[7:0]	R/W	-
0x4b	ROW3	[7:0]	R/W	-
0x4c	ROW4	[7:0]	R/W	-
0x4d	ROW5	[7:0]	R/W	-
0x4e	ROW6	[7:0]	R/W	-
0x4f	ROW7	[7:0]	R/W	-
0x50	ROW8	[7:0]	R/W	-
0x51	ROW9	[7:0]	R/W	-
0x52	ROW10	[7:0]	R/W	-
0x53	ROW11	[7:0]	R/W	-
0x54	ROW12	[7:0]	R/W	-
0x55	ROW13	[7:0]	R/W	-
0x56	ROW14	[7:0]	R/W	-
0x57	ROW15	[7:0]	R/W	-
0x58	DRV_SEN_SELECT	[7:0]	R/W	0x00
0x59	NF_ROW	[7:0]	R/W	0x08
0x5a	NF_COL	[7:0]	R/W	0x0E
0x76	DRV_DR	[1:0]	R/W	0x02

5.2.2 Bank1

Table 8. Register Bank for Noise Avoidance and Auto Calibration

Addr	Name	Bit	R/W	Initial Value
0x00	DRV_MODE_CTRL	[7:0]	R/W	0x00
0x02	ANA_GAIN_CTRL	[7:0]	R/W	0x56
0x10	KILOG_THRESH[7:0]	[7:0]	R/W	0x58
0x11	KILOG_THRESH[15:8]	[7:0]	R/W	0x02
0x12	KILOG_FORCETHRESH[7:0]	[7:0]	R/W	0xFA
0x13	KILOG_FORCETHRESH[15:8]	[7:0]	R/W	0x00
0x1c	HIGHLAND_LEVEL[7:0]	[7:0]	R/W	0xFA
0x1d	HIGHLAND_LEVEL[15:8]	[7:0]	R/W	0x00
0x1e	HIGHLAND_NUM[7:0]	[7:0]	R/W	0x5A
0x1f	HIGHLAND_NUM[15:8]	[7:0]	R/W	0x00
0x20	NEG_RESET_CELL[7:0]	[7:0]	R/W	0x02
0x21	NEG_RESET_CELL[15:8]	[7:0]	R/W	0x00
0x22	NEG_RESET_LEVEL[7:0]	[7:0]	R/W	0x18
0x23	NEG_RESET_LEVEL[15:8]	[7:0]	R/W	0xFC
0x24	NEG_RESET_WAIT	[7:0]	R/W	0x1E
0x25	FREQ_CHANGE_CELLS	[7:0]	R/W	0x02
0x26	FREQ_CHANGE_LEVEL[7:0]	[7:0]	R/W	0x3C
0x27	FREQ_CHANGE_LEVEL[15:8]	[7:0]	R/W	0xF6
0x2c	ACCEPT_SNR[7:0]	[7:0]	R/W	0x14
0x2d	ACCEPT_SNR[15:8]	[7:0]	R/W	0x00
0x81	DRV_CYCLE_NUM_OUTER	[7:0]	R/W	0x03
0x82	DRV_CYCLE_NUM_BORDER	[7:0]	R/W	0x07
0x83	DRV_CYCLE_NUM_TOUCH	[7:0]	R/W	0x31
0x84	SAMPLE_TH1[7:0]	[7:0]	R/W	0x90
0x85	SAMPLE_TH1[15:8]	[7:0]	R/W	0x01
0x86	SAMPLE_TH2[7:0]	[7:0]	R/W	0x20
0x87	SAMPLE_TH2[15:8]	[7:0]	R/W	0x03
0x8a	K1LOG_TOUCH	[4:0]	R/W	0x1C
0x8b	K2LOG_TOUCH	[7:0]	R/W	0x1C
0x8c	K1LOG_NOTOUCH	[7:0]	R/W	0x12
0x8d	K2LOG_NOTOUCH	[7:0]	R/W	0x11
0x90	NA_RESET_ALC	[0]	R/W	0

5.2.3 Bank2

Table 9. Register Bank for Absolute Touch Coordinate Performance Tuning

Addr	Name	Bit	R/W	Initial Value
0x00	WIDTH[7:0]	[7:0]	R/W	0x20
0x01	WIDTH[15:8]	[7:0]	R/W	0x03
0x02	HEIGHT[7:0]	[7:0]	R/W	0xC9
0x03	HEIGHT[15:8]	[7:0]	R/W	0x01
0x04	ORIENTATION	[2:0]	R/W	0x00
0x05	REPORT_POINTS[3:0]	[3:0]	R/W	0x05
0x06	TOUCH_FORCE[7:0]	[7:0]	R/W	0xB0
0x07	TOUCH_FORCE[15:8]	[7:0]	R/W	0x04
0x08	RELEASE_FORCE[7:0]	[7:0]	R/W	0x20
0x09	RELEASE_FORCE[15:8]	[7:0]	R/W	0x03
0x0a	REPORT_LATENCY	[7:0]	R/W	0x01
0x0c	MOVE_DEJIG_TH[7:0]	[7:0]	R/W	0x96
0x0d	MOVE_DEJIG_TH[15:8]	[7:0]	R/W	0x00
0x0e	MOVE_SMTH_R1	[4:0]	R/W	0x14
0x0f	MOVE_SMTH_R2	[4:0]	R/W	0x14
0x11	EDGE_STRETCH_EN	[0]	R/W	0x01
0x12	EDGE_STRETCH_RATIO_TOP	[4:0]	R/W	0x08
0x13	EDGE_STRETCH_RATIO	[4:0]	R/W	0x08
0x14	EDGE_STRETCH_RATIO_LEFT	[4:0]	R/W	0x08
0x15	EDGE_STRETCH_RATIO_RIGHT	[4:0]	R/W	0x08
0x16	EDGE_STRETCH_RANGE_TOP	[3:0]	R/W	0x05
0x17	EDGE_STRETCH_RANGE	[3:0]	R/W	0x05
0x18	EDGE_STRETCH_RANGE_LEFT	[3:0]	R/W	0x05
0x19	EDGE_STRETCH_RANGE_RIGHT	[3:0]	R/W	0x05
0x24	INTENSITY[7:0]	[7:0]	R/W	0x96
0x25	INTENSITY[15:8]	[7:0]	R/W	0x00
0x28	OALB[7:0]	[7:0]	R/W	0xC4
0x29	OALB[15:8]	[7:0]	R/W	0x09
0x2a	OALB[23:16]	[7:0]	R/W	0x00
0x2b	OALB[24]	[0]	R/W	0x00
0x2c	OAHB[7:0]	[7:0]	R/W	0xFF

Addr	Name	Bit	R/W	Initial Value
0x2d	OAHB[15:8]	[7:0]	R/W	0xFF
0x2e	OAHB[23:16]	[7:0]	R/W	0xFF
0x2f	OAHB[24]	[0]	R/W	0001
0x30	OBJ_SIZE_TH[7:0]	[7:0]	R/W	0x02
0x31	OBJ_SIZE_TH[9:8]	[1:0]	R/W	0x00
0x32	OBJAOI_LOWBOUND[7:0]	[7:0]	R/W	0xF4
0x33	OBJAOI_LOWBOUND[15:8]	[7:0]	R/W	0x01
0x38	THUMB_SUMI_LB[7:0]	[7:0]	R/W	0x00
0x39	THUMB_SUMI_LB[15:8]	[7:0]	R/W	0x00
0x3a	THUMB_SUMI_LB[23:16]	[7:0]	R/W	0x00
0x3b	THUMB_SUMI_LB[25:24]	[1:0]	R/W	0x00
0x3c	MOMENT_TH_BASE[7:0]	[7:0]	R/W	0xDC
0x3d	MOMENT_TH_BASE[15:8]	[7:0]	R/W	0x05
0x3e	MOMENT_TH_SLOP[7:0]	[7:0]	R/W	0x22
0x3f	MOMENT_TH_SLOP[10:8]	[2:0]	R/W	0x02
0x4c	DUP_DIST_UPBOUND[7:0]	[7:0]	R/W	0xEC
0x4d	DUP_DIST_UPBOUND[15:8]	[7:0]	R/W	0x13

5.2.4 Bank3

Table 10. Register Bank for Gesture Performance Fine Tune

Addr	Name	Bit	R/W	Initial Value
0x00	Gesture_CTRL1	[7:0]	R/W	0xFF
0x01	Gesture_CTRL2	[1:0]	R/W	0x03
0x04	USER_MOUSE_ACC_MIN_V	[7:0]	R/W	0x05
0x05	USER_MOUSE_ACC_MAX_V	[7:0]	R/W	0x1E
0x06	USER_MOUSE_ACC_GAIN2	[7:0]	R/W	0x04
0x08	TAP_MOVE	[7:0]	R/W	0x12
0x09	TAP_PRESS_TM	[7:0]	R/W	0x16
0x13	EDGE_SWIPE_MOVE	[7:0]	R/W	0x28
0x14	EDGE_SWIPE_RNG_TOP	[7:0]	R/W	0x1C
0x15	EDGE_SWIPE_RNG_BOTTOM	[7:0]	R/W	0x00
0x16	EDGE_SWIPE_RNG_LEFT	[7:0]	R/W	0x1C
0x17	EDGE_SWIPE_RNG_RIGHT	[7:0]	R/W	0x1C

Addr	Name	Bit	R/W	Initial Value
0x1a	V_INERTIA_TM	[7:0]	R/W	0x0F
0x1b	H_INERTIA_TM	[7:0]	R/W	0x0F
0x1c	MIN_V_INERTIA_SPEED[7:0]	[7:0]	R/W	0x2C
0x1d	MIN_V_INERTIA_SPEED[15:8]	[7:0]	R/W	0x01
0x1e	MIN_H_INERTIA_SPEED[7:0]	[7:0]	R/W	0x2C
0x1f	MIN_H_INERTIA_SPEED[15:8]	[7:0]	R/W	0x01
0x20	MAX_GAIN_V_SCROLL_SPEED[7:0]	[7:0]	R/W	0xDC
0x21	MAX_GAIN_V_SCROLL_SPEED[15:8]	[7:0]	R/W	0x05
0x22	MIN_GAIN_V_SCROLL_SPEED[7:0]	[7:0]	R/W	0x2C
0x23	MIN_GAIN_V_SCROLL_SPEED[15:8]	[7:0]	R/W	0x01
0x24	MAX_GAIN_V_SCROLL_BASE_2	[7:0]	R/W	0x05
0x25	V_SCROLL_SPEED	[7:0]	R/W	0x14
0x26	V_SCROLL_WHEEL_RES	[7:0]	R/W	0x00
0x28	MAX_GAIN_H_SCROLL_SPEED[7:0]	[7:0]	R/W	0xDC
0x29	MAX_GAIN_H_SCROLL_SPEED[15:8]	[7:0]	R/W	0x05
0x2a	MIN_GAIN_H_SCROLL_SPEED[7:0]	[7:0]	R/W	0x2C
0x2b	MIN_GAIN_H_SCROLL_SPEED[15:8]	[7:0]	R/W	0x01
0x2c	MAX_GAIN_H_SCROLL_BASE_2	[7:0]	R/W	0x05
0x2d	H_SCROLL_SPEED	[7:0]	R/W	0x14
0x2e	H_SCROLL_WHEEL_RES	[7:0]	R/W	0x00
0x30	MAX_GAIN_ZOOM_SPEED[7:0]	[7:0]	R/W	0xDC
0x31	MAX_GAIN_ZOOM_SPEED[15:8]	[7:0]	R/W	0x05
0x32	MIN_GAIN_ZOOM_SPEED[7:0]	[7:0]	R/W	0x2C
0x33	MIN_GAIN_ZOOM_SPEED[15:8]	[7:0]	R/W	0x01
0x34	MAX_GAIN_ZOOM_BASE_2	[7:0]	R/W	0x02
0x35	ZOOM_SPEED	[7:0]	R/W	0x28
0x36	ZOOM_WHEEL_RES	[7:0]	R/W	0x00
0x3d	DRAG_WAIT_TM	[7:0]	R/W	0x0F
0x3e	TAP_AND_DRAG_DIST	[7:0]	R/W	0x32
0x3f	CURSOR_RLS_MAX_TM	[7:0]	R/W	0x32
0x40	BTN_RIGHT_X1[7:0]	[7:0]	R/W	0x00
0x41	BTN_RIGHT_X1[15:8]	[7:0]	R/W	0x00
0x42	BTN_RIGHT_Y1[7:0]	[7:0]	R/W	0x00

Addr	Name	Bit	R/W	Initial Value
0x43	BTN_RIGHT_Y1[15:8]	[7:0]	R/W	0x00
0x44	BTN_RIGHT_X2[7:0]	[7:0]	R/W	0x00
0x45	BTN_RIGHT_X2[15:8]	[7:0]	R/W	0x00
0x46	BTN_RIGHT_Y2[7:0]	[7:0]	R/W	0x00
0x47	BTN_RIGHT_Y2[15:8]	[7:0]	R/W	0x00
0x48	BTN_CTRL	[4:0]	R/W	0x04
0x50	SWIPE_LEFT_3F_DIST	[7:0]	R/W	0x10
0x51	SWIPE_RIGHT_3F_DIST	[7:0]	R/W	0x10
0x52	SWIPE_UP_3F_DIST	[7:0]	R/W	0x10
0x53	SWIPE_DOWN_3F_DIST	[7:0]	R/W	0x10
0x54	SWIPE_LEFT_3F_SPEED	[7:0]	R/W	0x00
0x55	SWIPE_RIGHT_3F_SPEED	[7:0]	R/W	0x00
0x56	SWIPE_UP_3F_SPEED	[7:0]	R/W	0x00
0x57	SWIPE_DOWN_3F_SPEED	[7:0]	R/W	0x00

5.2.5 Bank4

Table 11. Register Bank for Palm Rejection

Addr	Name	Bit	R/W	Initial Value
0x00	PALM_MIN_SOI[7:0]	[7:0]	R/W	0x96
0x01	PALM_MIN_SOI[15:8]	[7:0]	R/W	0x00
0x02	PALM_POS_CELLS[7:0]	[7:0]	R/W	0x3C
0x03	PALM_POS_CELLS[15:8]	[7:0]	R/W	0x00
0x16	FRAME_LEVEL_POS_MED[7:0]	[7:0]	R/W	0xC8
0x17	FRAME_LEVEL_POS_MED[15:8]	[7:0]	R/W	0x00
0x18	FRAME_LEVEL_POS_STG[7:0]	[7:0]	R/W	0xB0
0x19	FRAME_LEVEL_POS_STG[15:8]	[7:0]	R/W	0x04

Document Revision History

Revision	Date	Notes
1.0	11 Apr 2016	1st creation based on DS V1.3
1.1	16 Jul 2016	Updated Figure 4. Reflow Chart