GT967

5-point SOC Touch Solution

Rev. 01 —— 2013.01.10

Contents

1. Overview

Based on Goodix 3rd generation Projected-Capacitive touch technology, GT967 has a sensing network with 14 driving channels and 26 sensing channels, built-in analog amplifier circuit, digital operation module and high-performance MPU, transfer the touch information through I^2C.

GT967 can support for 5 touch points in fast response time and low consumption, which is very suitable for pad

2. Features

- ✧ Built-in circuit and high performance MPU
  - ➢ Touch report rate: 100Hz
  - ➢ 5 point touch, Touch point output in coordinates type
  - ➢ Unified firmware version for different Touch-panel size
  - ➢ Single power supply**,** Built in 1.8V LDO
  - ➢ Flash craft, support online burning
- ✧ Touch screen sensor
  - ➢ Channel: 14(driving)*26(sensing)
  - ➢ Support size: 7”~8”
  - ➢ Supporting four touch keys
  - ➢ Support for both ITO Glass and ITO Film
  - ➢ OGS/SITO without shielding layer available
  - ➢ Cover lens thickness requirement: 0.7mm ≦ glass ≦ 2mm, 0.5mm≦PET ≦1.2mm
  - ➢ Built in frequency hopping, OGS full lamination
- ✧ Environmental applicable performance
  - ➢ Initialized automatic calibration
  - ➢ Automatic temperature drift compensation
  - ➢ Operating temperature: -40℃~+85℃, humidity: ≦95%RH
  - ➢ Storage temperature: -60℃~+125℃, humidity: ≦95%RH
- ✧ Communication interface
  - ➢ Standard I^2C communication protocol
  - ➢ Working in I^2C Slave mode
  - ➢ Support 1.8V~3.3V interface level
- ✧ Wake-up time
  - ➢ From Green mode: <48ms

- From Sleep mode: <200ms
- Initialization: <200ms

✧ Power supply:

- Single power: 2.8V~3.3V

✧ Power ripple:

- Vpp≦50mV

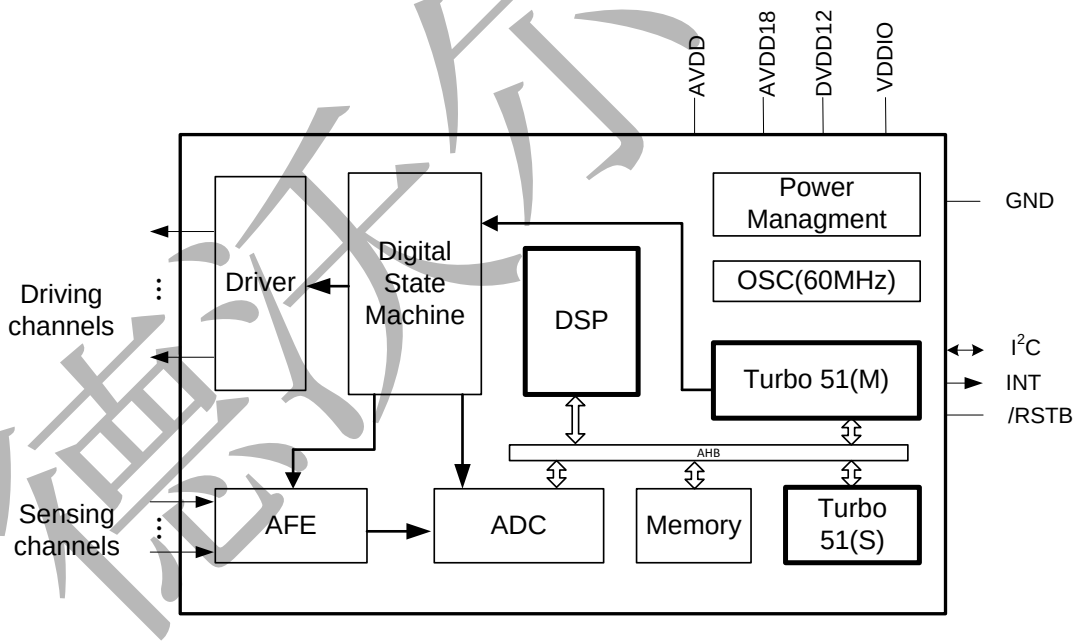
✧ Packaging:

- GT967: 52pins，6mm*6mm QFN_0.4P

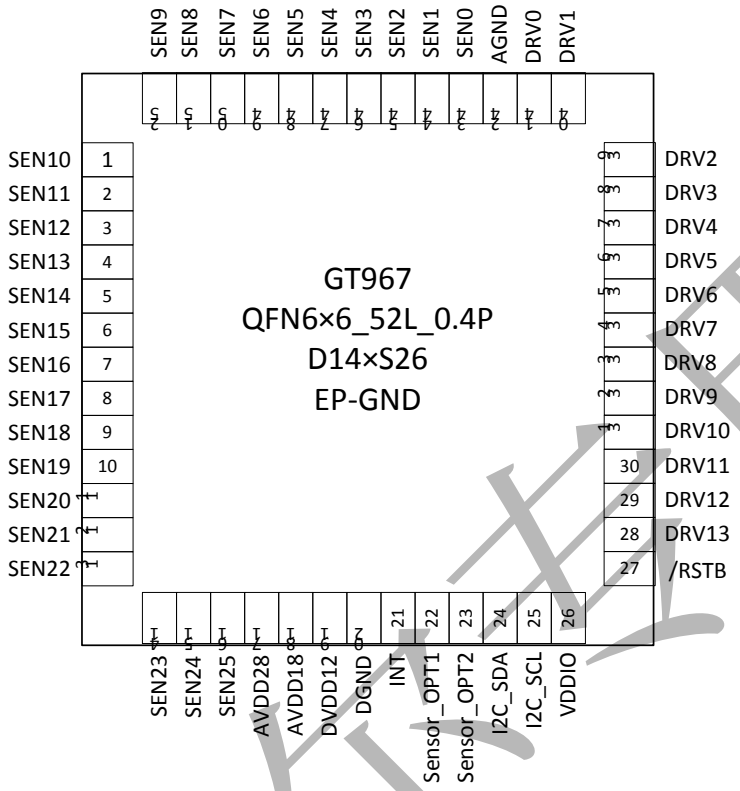
✧ Development supporting tools

- Touch-panel module's performance analysis tool
- Parameter detector & configuration capture of touch panel
- Q/C tools for mass production
- Developing guide & reference code supporting

3. Chip Diagram



4. Pin Definition



Pin No.	Name	Description	Remark
1~16	SENS10~SENS25	Sensing channels	
17	AVDD28	Analog VDD 2.8V	2.2uF to GND
18	AVDD18		2.2uF to GND
19	DVDD12		2.2uF to GND
20	DGND	Digital ground	
21	INT	Interrupt	
22	Sensor_OPT1	Sensor option pin1	
23	Sensor_OPT2	Sensor option pin2	External pull-down res.
24	I^2C_SDA	I^2C_data	
25	I^2C_SCL	I^2C_clock	
26	VDDIO	VDD of GPIO	2.2uF to GND 1. floating: 1.8V 2. to AVDD: AVDD
27	/RSTB	Reset	external pull-up, low valid
28~41	DRV13~DRV0	Driving channels	
42	AGND	Analog ground	
43~52	SENS0~SENS9	Sensing channels	

5. Sensor Development

5.1. Arrangement of Sensing Channels

Sensor pattern design of single layer with multi touch is the core of the whole solution. Pattern designs are all Goodix own patents, the following table shows the suggestions of different process, different process lead to different effect, the smaller the resistance and ITO gap, the better the effect.

GT967	Line out way	suggested resistance	Max. resistance	suggested ITO gap	Max. ITO gap	Pad gap
Film silk printing	double side line out	150Ω	200Ω	200um	300um	0.6mm

5.2. Touch Keys

GT967 can support 4 separated touch keys. There are two ways to design these touch keys:

Carried out by ITO sensor: Touch keys are carried out by one driving channel with different sensing channels, the driving channel is used only for touch keys, but the sensing channels should be reused by the visual area of the touch panel, the key position will be determined with configuration information.

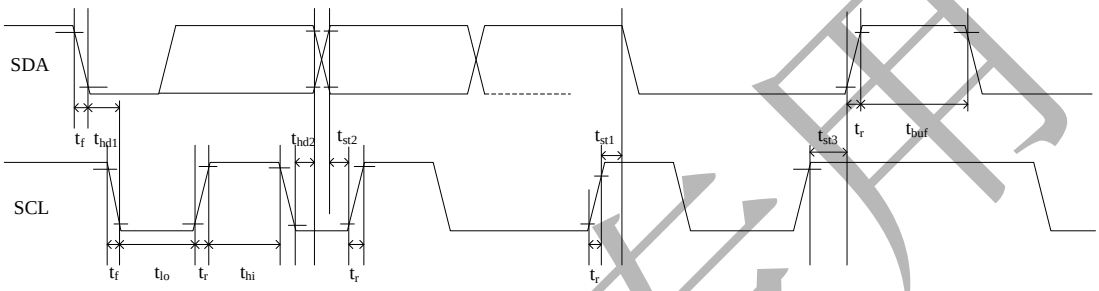
Or, sensing channel as the common port, one sensing channel with 4 driving channel to form 4 touch keys. The sensing channel as touch keys cannot be reused by the visual area of the touch panel, but the driving channel as the touch key should be reused by the visual area of the touch panel.

Carried out by FPC: one driving channel and 4 sensing channels to form 4 touch keys, 4 sensing channels should be reused partly by the visual area of the touch panel. FPC sensor pattern should be designed specifically

6. I²C Communication

6.1. I²C Communication

GT967 provides standard I²C interface for communication. In the system, GT967 always works in slave mode, all communications are initiated by master, and the baud rate can be up to 400K bps. The definition of I²C timing is as following:



Test condition1: 1.8V communication interface, 400Kbps, pull up resistor is 2K ohm

Parameter	Symbol	MIN.	Max.	Unit
SCL low period	t_{lo}	0.9	-	us
SCL high period	t_{hi}	0.8	-	us
SCL setup time for START condition	t_{st1}	0.4	-	us
SCL setup time for STOP condition	t_{st3}	0.4	-	us
SCL hold time for START condition	t_{hd1}	0.3	-	us
SDA setup time	t_{st2}	0.4	-	us
SDA hold time	t_{hd2}	0.4	-	us

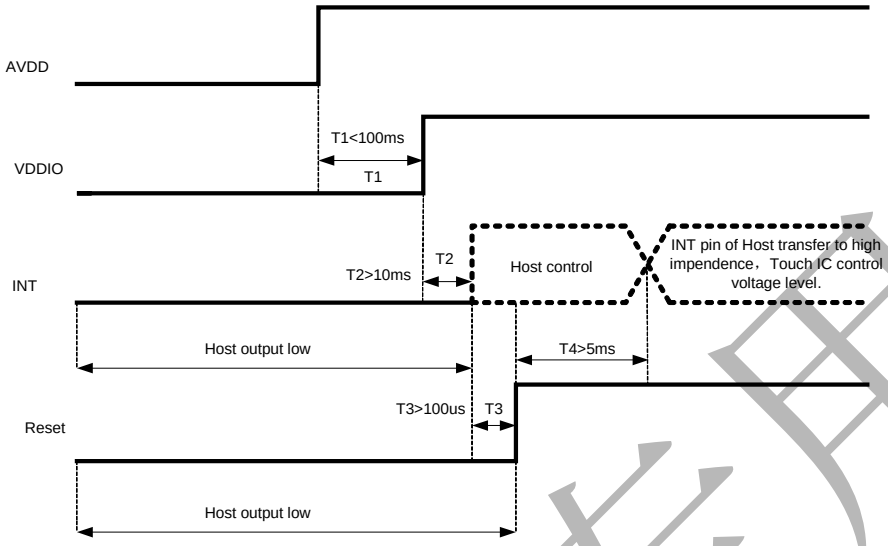
Test condition2: 3.3V communication interface, 400Kbps, pull up resistor is 2K ohm

Parameter	Symbol	MIN.	Max.	Unit
SCL low period	t_{lo}	0.9	-	us
SCL high period	t_{hi}	0.8	-	us
SCL setup time for START condition	t_{st1}	0.4	-	us
SCL setup time for STOP condition	t_{st3}	0.4	-	us
SCL hold time for START condition	t_{hd1}	0.3	-	us
SDA setup time	t_{st2}	0.4	-	us
SDA hold time	t_{hd2}	0.4	-	us

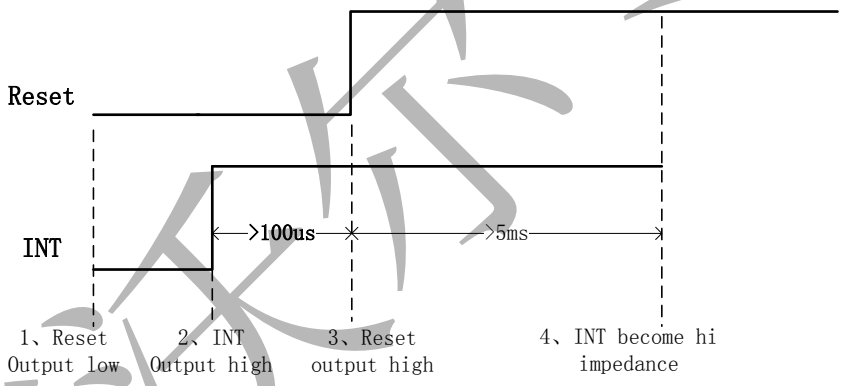
GT967 has 2 sets of slave address 0xBA/0xBB & 0x28/29. Master can control Reset & INT pin to configure the slave address in power on initial state like

following:

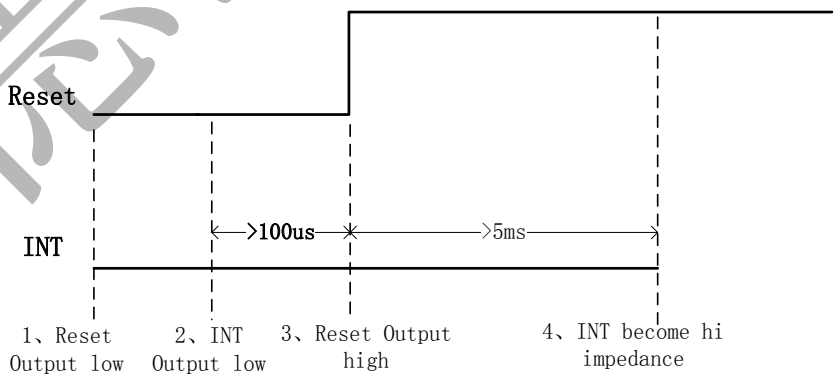
Power on diagram:



Timing of setting slave address to 0x28/0x29:



Timing of setting slave address to 0xBA/0xBB:



a) Data Transmission

(ex: slave address is 0xBA/0xBB)

Communication is always initiated by master, A high-to-low transition of SDA with SCL high is a start condition.

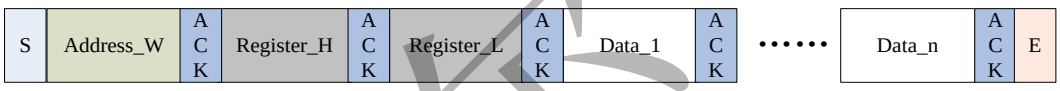
All addressing signal are serially transmitted to and from on bus in 8-bit word. GT967 sends a “0” to acknowledge when the addressing word is 0xBA/BB (or 0x28/0x29). This happens during the ninth clock cycle. If the slave address is not matched, GT967 will stay in idle state.

The data words are serially transmitted to and from in 9-bit formation: 8-bit data + 1-bit ACK or NACK sent by GT967. Data changes during SCL low periods & keeps valid during SCL high.

A low-to-high transition of SDA with SCL high is a stop condition.

b) Write Data to GT967

(ex: slave address is 0xBA/0xBB)



Write operations

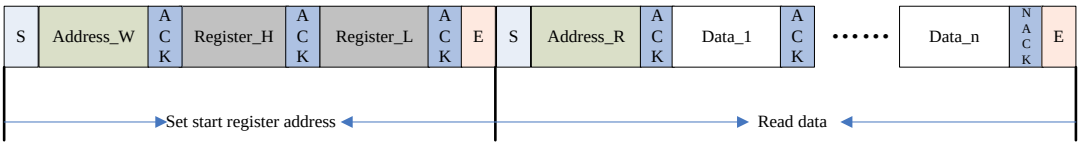
Please check the above figure, master start the communication first, and then sends device address 0XBA preparing for a write operation.

After receiving ACK from GT967, master sends out 16-bit register address, and then the data word in 8-bit, which is going to be wrote into GT967.

The address pointer of GT967 will automatically increase one after one byte writing, so master can sequentially write in one operation. When operation finished, master stop the communication.

c) Read Data from GT967

(ex: slave address is 0xBA/0xBB)



Read operation

Please check the above figure, master start the communication first, and then sends device address 0xBA for a write operation.

After receiving ACK from GT967, master sends out 16-bit register address, to set the address pointer of GT967. After receiving ACK, master produce start signal once again & send device address 0xBB , then read data word from GT967 in 8-bit.

GT967 also supports sequential read operation, and the default setting is sequential read mode. Master shall send out ACK after every byte reading successfully but NACK after the last one. Then sends stop signal to finish the communication.

6.2. Register Information of GT967

a) Real Time Order

(Write Only)

Addr	Name	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0x8040	Command	0：read coordinate 1：read diff data or raw data 2：software reset3:baseline update 4: baseline calibration 5: screen off 3&4 are still internal test							

b) Configuration Information

(R/W)

	Config Data	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0x8047	Config_ Version	Version of the configuration							
0x8048	X Output Max (Low Byte)	Resolution of X axis							
0x8049	X Output Max (High Byte)								
0x804A	Y Output Max (Low Byte)	Resolution of Y axis							
0x804B	Y Output Max (High Byte)								
0x804C	Touch Number	Reserved				Touch number：1~5			
0x804D	Module_ Switch1	Reserved		Stretch_rank		X2Y		Sito	INT trigger method
0x804E	Module_ switch2	STP_SE	Reserved	SCS_en		WP_	Reserv	SCM	Touch_Key

					dis	ed	_en	
0x804F	Shake_Count	Reserved			Finger shake count			
0x8050	Filter	First_Filter		Normal_Filter (filtering value of original coordinate window, coefficiency is 1)				
0x8051	Large_Touch	Number of touch in large area						
0x8052	Noise_ Reduction	Reserved			Value of noise elimination (coefficient is 1, 0~15)			
0x8053	Screen_ Touch_Level	Threshold of touch grow out of nothing						
0x8054	Screen_ Leave_Level	Threshold of touch grow out of nothing						
0x8055	Low_Power_ Control	Reserved			Time to low power consumption (0~15s)			
0x8056	Refresh_Rate	Reserved			Coordinate report rate (Cycle: 5+N ms)			
0x8057	x_threshold	Reserved						
0x8058	y_threshold							
0x8059	X_Speed_Limit	Reserved						
0x805A	Y_Speed_Limit							
0x805B	Space	Blank area of boarder-top			Blank area of Boarder-bottom			
0x805C		Blank area of boarder-left			Blank area of Boarder-right			
0x805D	Stretch_Rate	Reserved						
0x805E	Stretch_R0	Interval 1 coefficient						
0x805F	Stretch_R1	Interval 2 coefficient						
0x8060	Stretch_R2	Interval 3 coefficient						
0x8061	Stretch_RM	All intervals base number						
0x8062	Drv_GroupA_ Num	All_Driving	Reserved		Driver_Group_A_number			
0x8063	Drv_GroupB_ Num	Reserved		Dual_Freq	Driver_Group_B_number			
0x8064	Sensor_Num	Sensor_Group_B_Number			Sensor_Group_A_Number			
0x8065	FreqA_factor	Driver frequency double frequency coefficient of Driver group A GroupA_Frequence = Multiplier factor * baseband						
0x8066	FreqB_factor	Driver frequency double frequency coefficient of Driver group B GroupB_Frequence = Multiplier factor * baseband						
0x8067	Pannel_ BitFreqL	Baseband of Driver group A\B (1526HZ<baseband<14600Hz)						
0x8068	Pannel_ BitFreqH							
0x8069	Pannel_Sensor_Ti	Reserved						

	meL				
0x806A	Pannel_Sensor_TimeH				
0x806B	Pannel_Tx_Gain	Reserved		Pannel_Drv_output_R 4 gears	Pannel_DAC_Gain
0x806C	Pannel_Rx_Gain	Pannel_PGA_C	Pannel_PGA_R	Pannel_Rx_Vcmi	Pannel_PGA_Gain
0x806D	Pannel_Dump_Shift	Reserved		Magnification coefficient of original value (The Nth power of 2)	
0x806E	Drv_Frame_Control	Reserved	SubFrame_DrvNum		Repeat_Num
0x806F	S_FeedBack	S 型改善负反馈量(1/256 为单位)			
0x8070	Module_switch3	Reserved			Shape_En
0x8071	NC	Reserved			
0x8072	Stylus_Tx_Gain	Reserved			
0x8073	Stylus_Rx_Gain	Reserved			
0x8074	Stylus_Dump_Shift	Reserved			
0x8075	Stylus_Driver_Touch_Level	Reserved			
0x8076	Stylus_Sensor_Touch_Level	Reserved			
0x8077	Stylus_Control	Reserved			
0x8078	Base_reduce	Reserved			
0x8079	NC	Reserved			
0x807A	Freq_Hopping_Start	Frequency hopping start frequency (Unit: 2KHz, 50 means 100KHz)			
0x807B	Freq_Hopping_End	Frequency hopping stop frequency (Unit: 2KHz, 150 means 300KHz)			
0x807C	Noise_Detect_Times	Detect_Stay_Times	Detect_Confirm_Times		
0x807D	Hopping_Flag	Hopping_En	Reserved	Detect_Time_Out	
0x807E	Hoppging_Threshold	Reserved		Hopping_Hit_Threshold	
0x807F	Noise_Threshold	Threshold of noise level			

0x8080	NC	Reserved
0x8081	NC	Reserved
0x8082	Hopping_seg1_BitFreqL	Frequency hopping segment band 1 central frequency (for driver A/B)
0x8083	Hopping_seg1_BitFreqH	
0x8084	Hopping_seg1_Factor	Frequency hopping segment 1 central frequency coefficient
0x8085	Hopping_seg2_BitFreqL	Frequency hopping segment band 2 central frequency (for driver A/B)
0x8086	Hopping_seg2_BitFreqH	
0x8087	Hopping_seg2_Factor	Frequency hopping segment 2 central frequency coefficient
0x8088	Hopping_seg3_BitFreqL	Frequency hopping segment band 3 central frequency (for driver A/B)
0x8089	Hopping_seg3_BitFreqH	
0x808A	Hopping_seg3_Factor	Frequency hopping segment 3 central frequency coefficient
0x808B	Hopping_seg4_BitFreqL	Frequency hopping segment band 4 central frequency (for driver A/B)
0x808C	Hopping_seg4_BitFreqH	
0x808D	Hopping_seg4_Factor	Frequency hopping segment 4 central frequency coefficient
0x808E	Hopping_seg5_BitFreqL	Frequency hopping segment band 5 central frequency (for driver A/B)
0x808F	Hopping_seg5_BitFreqH	
0x8090	Hopping_seg5_Factor	Frequency hopping segment 5 central frequency coefficient
0x8091	NC	Reserved
0x8092	NC	Reserved
0x8093	Key 1	Key 1 Position: 0-255 valid (0 means no touch, it means independent touch key when 4 of the keys are 8 multiples
0x8094	Key 2	Key 2 position
0x8095	Key 3	Key 3 position
0x8096	Key 4	Key 4 position
0x8097	Key_Area	Time limit for long press(1~16 s) | Touch valid interval setting: 0-15 valid
0x8098	Key_Touch_Level	Key threshold of touch key

0x8099	Key_Leave_Level	Key threshold of touch key	
0x809A	Key_Sens	KeySens_1(sensitivity coefficient of key 1, same below)	KeySens_2
0x809B	Key_Sens	KeySens_3	KeySens_4
0x809C	Key_Restrain	Finger from screen left after inhibition of key time(Unit:100ms)	The independent button pro key inhibition parameters
0x809D	Key_DrvOrSens	Reserved	0 driving as key; 1 sensing as key
0x809E	NC	Reserved	
0x809F	NC	Reserved	
0x80A0	NC	Reserved	
0x80A1	NC	Reserved	
0x80A2	Proximity_Drv_Select	Reserved	Reserved
0x80A3	Proximity_ Sens_Select	Reserved	Reserved
0x80A4	Proximity_ Touch_Level	Reserved	
0x80A5	Proximity_ Leave_Level	Reserved	
0x80A6	Proximity_Sample _Add_Times	Reserved	
0x80A7	Proximity_Sample _Dec_ValL	Reserved	
0x80A8	Proximity_Sample _Dec_ValH	Reserved	
0x80A9	Proximity_Leave_ Shake_Count	Reserved	
0x80AA	Self_Cap_Tx_gain	Reserved	
0x80AB	Self_Cap_Rx_gain	Reserved	
0x80AC	Self_Cap_Dump_Shift	Reserved	
0x80AD	SCap_Diff_Up_Level_Drv	Reserved	
0x80AE	Scap_Merge_Touch_Level_Drv	Reserved	
0x80AF	SCap_Pulse_TimeL	Reserved	
0x80B0	SCap_Pulse_TimeH	Reserved	

0x80B1	SCap_Diff_Up_Level_Sen	Reserved
0x80B2	Scap_Merge_Touch_Level_Sen	Reserved
0x80B3	NC	Reserved
0x80B4	NC	Reserved
0x80B5	NC	Reserved
0x80B6	NC	Reserved
0x80B7~0x80D0	Sensor_CH0~Sensor_CH25	ITO Sensor corresponding chip channel number
0x80D1~0x80D4	Sensor_CH26~Sensor_CH29	Reserved
0x80D5~0x80E2	Driver_CH0~Driver_CH13	ITO Driver corresponding chip channel number
0x80E3~0x80FE	Driver_CH14~Driver_CH41	Reserved
0x80FF~0x810C	Drv0_Gain~Drv13_Gain	configuration information verify
0x810D~0x8128	NC	reserved
0x8129	Config_Chksum	configuration information verify
0x812A	Config_Fresh	configuration updated sign (Master control write in sign)

c) Coordinates Information

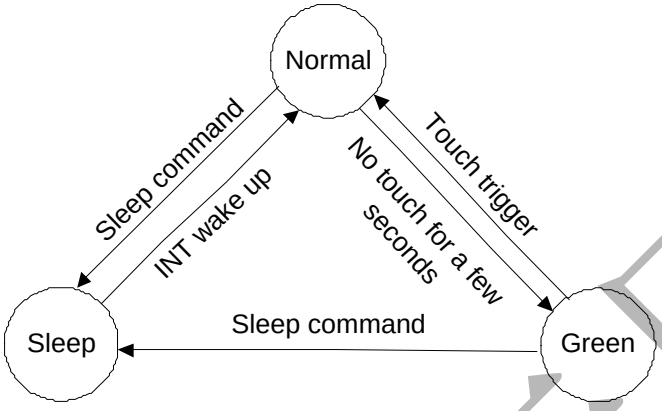
Addr	Access	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0x8140	R	Product ID (first Byte，ASCII)							
0x8141	R	Product ID (second Byte，ASCII)							
0x8142	R	Product ID (third Byte，ASCII)							
0x8143	R	Product ID (forth Byte，ASCII)							
0x8144	R	Firmware version (HEX.LowByte)							
0x8145	R	Firmware version (HEX.HighByte)							
0x8146	R	x coordinate resolution (low byte)							
0x8147	R	x coordinate resolution (high byte)							
0x8148	R	y coordinate resolution (low byte)							
0x8149	R	y coordinate resolution (high byte)							
0x814A	R	Vendor_id (Current module option information)							
0x814B	R	Reserved							
0x814C	R	Reserved							
0x814D	R	Reserved							
0x814E	R/W	buffer status	large detect	Reserved	HaveKey	number of touch points			

0x814F	R	track id
0x8150	R	point 1 x coordinate (low byte)
0x8151	R	point 1 x coordinate (high byte)
0x8152	R	point 1 y coordinate (low byte)
0x8153	R	point 1 y coordinate (high byte)
0x8154	R	Point 1 size (low byte)
0x8155	R	point 1 size (high byte)
0x8156	R	Reserved
0x8157	R	track id
0x8158	R	point 2 x coordinate (low byte)
0x8159	R	point 2 x coordinate (high byte)
0x815A	R	point 2 y coordinate (low byte)
0x815B	R	point 2 y coordinate (high byte)
0x815C	R	point 2 size (low byte)
0x815D	R	point 2 size (high byte)
0x815E	R	Reserved
0x815F	R	track id
0x8160	R	point 3 x coordinate (low byte)
0x8161	R	point 3 x coordinate (high byte)
0x8162	R	point 3 y coordinate (low byte)
0x8163	R	point 3 y coordinate (high byte)
0x8164	R	point 3 size (low byte)
0x8165	R	point 3 size (high byte)
0x8166	R	Reserved
0x8167	R	track id
0x8168	R	point 4 x coordinate (low byte)
0x8169	R	point 4 x coordinate (high byte)
0x816A	R	point 4 y coordinate (low byte)
0x816B	R	point 4 y coordinate (high byte)
0x816C	R	point 4 size (low byte)
0x816D	R	point 4 size (high byte)
0x816E	R	Reserved
0x816F	R	track id
0x8170	R	point 5 x coordinate (low byte)
0x8171	R	point 5 x coordinate (high byte)
0x8172	R	point 5 y coordinate (low byte)
0x8173	R	point 5 y coordinate (high byte)
0x8174	R	point 5 size (low byte)
0x8175	R	point 5 size (high byte)
0x8176	R	Reserved
0x8177	R	track id

0x8178	R	point 6 x coordinate (low byte)
0x8179	R	point 6 x coordinate (high byte)
0x817A	R	point 6 y coordinate (low byte)
0x817B	R	point 6 y coordinate (high byte)
0x817C	R	point 6 size (low byte)
0x817D	R	point 6 size (high byte)
0x817E	R	Reserved
0x817F	R	track id
0x8180	R	point 7 x coordinate (low byte)
0x8181	R	point 7 x coordinate (high byte)
0x8182	R	point 7 y coordinate (low byte)
0x8183	R	point 7 y coordinate (high byte)
0x8184	R	point 7 size (low byte)
0x8185	R	point 7 size (high byte)
0x8186	R	Reserved
0x8187	R	track id
0x8188	R	point 8 x coordinate (low byte)
0x8189	R	point 8 x coordinate (high byte)
0x818A	R	point 8 y coordinate (low byte)
0x818B	R	point 8 y coordinate (high byte)
0x818C	R	point 8 size (low byte)
0x818D	R	point 8 size (high byte)
0x818E	R	Reserved
0x818F	R	track id
0x8190	R	point 9 x coordinate (low byte)
0x8191	R	point 9 x coordinate (high byte)
0x8192	R	point 9 y coordinate (low byte)
0x8193	R	point 9 y coordinate (high byte)
0x8194	R	point 9 size (low byte)
0x8195	R	point 9 size (high byte)
0x8196	R	Reserved
0x8197	R	track id
0x8198	R	point 10 x coordinate (low byte)
0x8199	R	point 10 x coordinate (high byte)
0x819A	R	point 10 y coordinate (low byte)
0x819B	R	point 10 y coordinate (high byte)
0x819C	R	point 10 size (low byte)
0x819D	R	point 10 size (high byte)
0x819E	R	Reserved
0x819F	R	KeyValue

7. Function Mode

7.1. Working Mode



a) Normal Mode

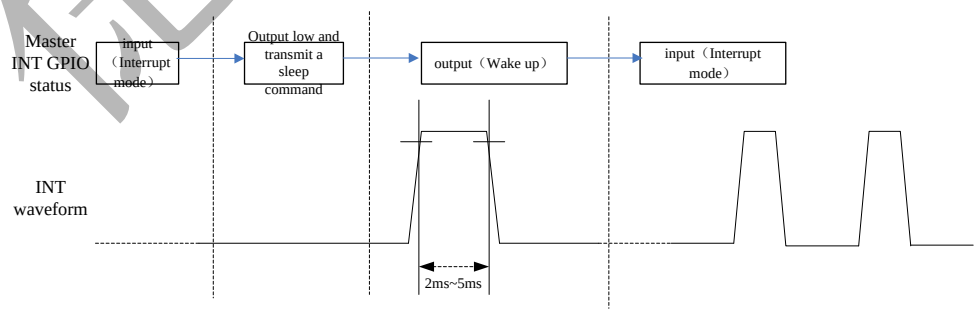
When GT967 is in Normal mode, touch scanning period is about 7ms ~ 10ms depending on the setting. The chip will automatically enter into Green mode if no touch for short time within 0~15s depending on setting and the step is 1s.

b) Green Mode

In Green mode, the touch scanning cycle is fixed as 40ms. It will automatically enter into Normal mode if any touch is detected.

c) Sleep Mode

For a lower consumption, Master can ask GT967 to enter Sleep mode through I^2C command (before the command, please drive low to INT pin). Drive high to the INT pin of GT967 2~5ms will make GT967 return back to normal mode.



7.2. Pulse Calling

GT967 will inform master to read coordinate information only when touch event happen, in order to lighten the burden of master CPU. The master CPU will set trigger mode by register 'INT'. "0" means rising edge trigger, in this mode GT967 will output an rising edge hopping in INT, to inform CPU; "1" means falling edge trigger.

7.3. Sleep Mode

When the display is turned off or in any circumstance that operation of touch panel is not necessary, master can set GT967 be in Sleep mode through I2C command. The master can wake up GT967 by outputting high to INT pin & keeping 2-5ms..

7.4. Parameter Frozen Function

GT967 support the function of Parameter frozen. When parameter is obtained, parameter can be settled in GT967 through Goodix test tool. If parameter has been frozen, GT967 will not receive the configuration with lower version from master.

7.5. Frequency Hopping Function

GT967 has very strong anti-interference hardware, when the driver spectrum of GT967 overlaid with spectrum of noise signal, it can be switch to another frequency by self-adaption frequency hopping mechanism, to avoid interference.

7.6. Automatic Calibration

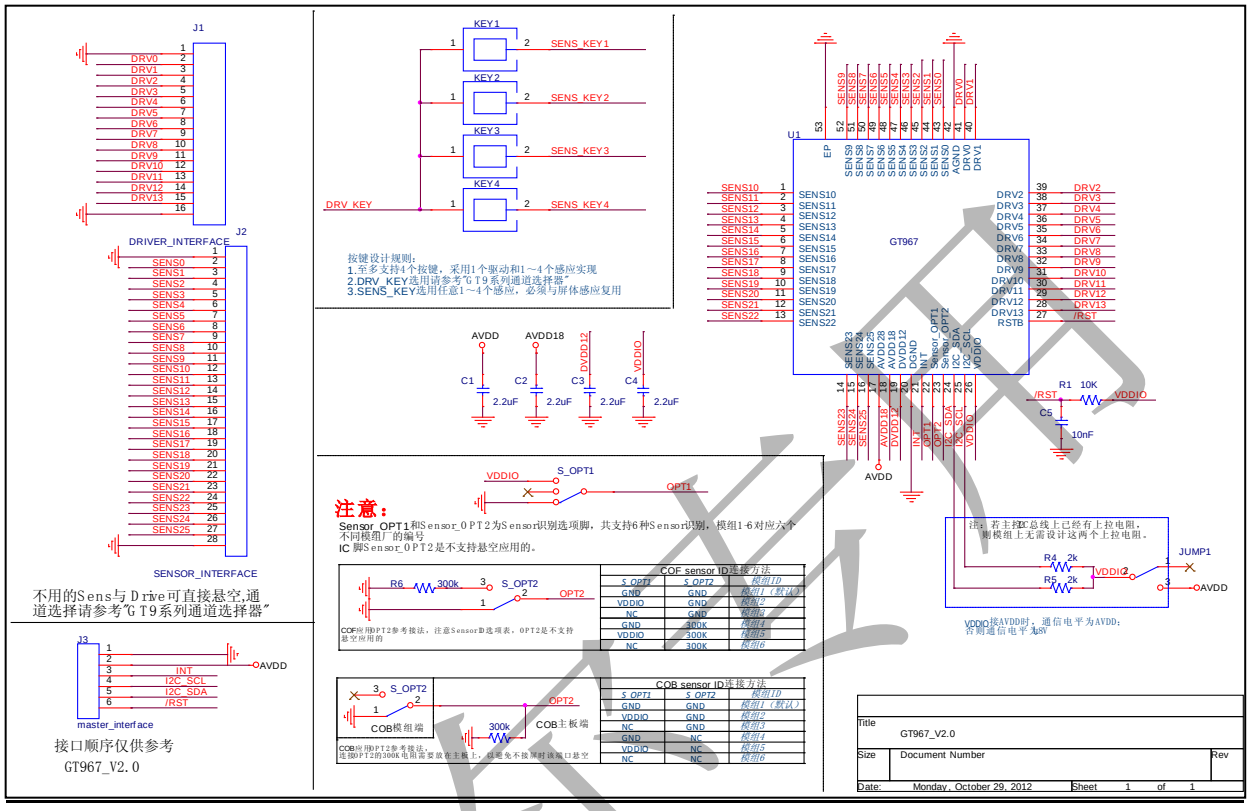
a) Initialization Calibration

Different temperature, humidity and physical structure will affect the sensor's baseline. According to environmental situation GT967 will update the baseline automatically in initialized 200ms.

b) Automatic Temperature Drift

Slow change of temperature, humidity or dust and other environmental factors will also affect the sensor's baseline. GT967 calculates and analyzes historical data, and compare to the current data variation. Base on this, the baseline will be calibration automatically.

8. Reference Circuit Diagram



Reference Circuit Diagram of GT967

Notes:

1. This circuit only shows basic applications, and may be modified according to actual conditions.
2. The capacitor should be used material of X7R.

9. Electrical Characteristics

9.1. Absolute Operation Rating

(Temperature 25℃)

Parameter	Min.	Max.	Unit
Analog power AVDD28 (refer to AGND)	2.66	3.47	V
VDDIO (REF: DGND)	1.7	3.47	V
Input voltage on Digital I/O	0	3.47	V
Input voltage on Analog I/O	0	3.47	V
Operating temperature	-40	85	℃
Storage temperature	-60	125	℃
Welding temperature (10s)		300	℃
ESD protective voltage（HB Model）		±2	KV

9.2. Operating Characteristic

Parameter	Min.	Typical	Max.	Unit
Analog power AVDD28	2.8	-	3.3	V
VDDIO	1.8	-	3.3	V
Operating temperature	-20	25	85	℃

9.3. AC Characteristic

(Temperature 25℃, AVDD=2.8V, VDDIO=1.8V)

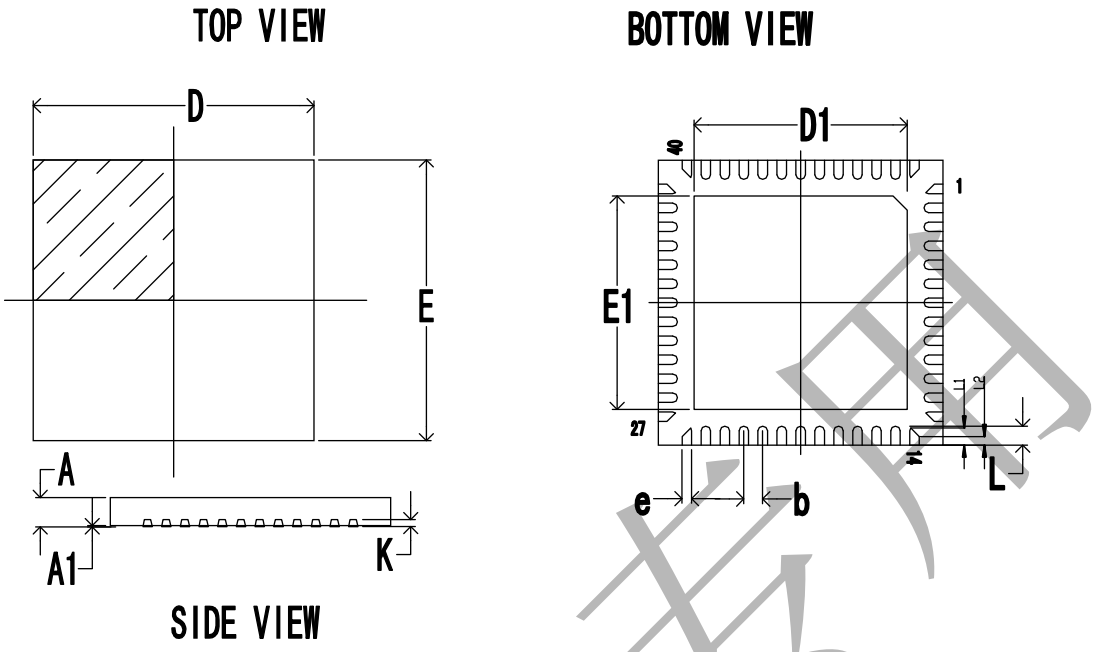
Parameter	Min.	Typical	Max.	Unit
OSC oscillation frequency	59	60	61	MHz
I/O output rise time	-	-	0.5	ns
I/O output fall time	-	-	0.5	ns

9.4. DC Characteristic

(Temperature 25℃, AVDD=2.8V, VDDIO=1.8V)

Parameter	MIN.	Typical	Max.	Unit
Operating current (Normal mode)	-	12	16	mA
Operating current (Green mode)	-	3.3	-	mA
Operating current (Sleep mode)	70	-	120	uA
Input voltage in low level	-0.3	0	0.45	V
Input voltage in high level	1.35	1.8	2.1	V

10. Package



Symbol	Dimensions In Millimeters		
	Min.	Normal	Max.
A	0.70	0.75	0.80
A1	0.00	0.035	0.05
b	0.40BSC		
D	6.00BSC		
D1	4.40	4.50	4.60
E	6.00BSC		
E1	4.40	4.50	4.60
e	0.15	0.20	0.25
L	0.30	0.40	0.50
L1	0.31	0.36	0.41
L2	0.13	0.18	0.23
K	0.203BSC		

11. Document History Record

Version	Date	Description of change
Rev. 00	2013-01-06	Draft version
Rev.01	2013-01-10	Modified part of register information description mistakes.

12. Contact Information

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