

GT927

10-point SOC touch solution for MID

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1. Overview

Based on Goodix 3rd generation Projected-Capacitive touch technology, GT927 has a sensing network with 31 driving channels and 17 sensing channels, built-in analog amplifier circuit, digital operation module and high-performance MPU, transfer the touch information through I²C.

GT927 can support for 10 touches in fast response time and low consumption, which is very suitable for Tablet and netbook.

2. Features

- ♦ Goodix narrow band sensing technology with auto frequency hopping
 - LCD noise resist
 - Support OGS direct bonding on LCM
 - Charger noise resist
 - > RF noise resist
 - Proximity sensing supporting
- Built-in circuit and high performance MPU
 - Touch report rate: 100Hz
 - Touch point output in coordinates type
 - Supporting for fixed touch-key function
 - Unified firmware version for different Touch-panel size
- ♦ Touch-panel sensor requirement
 - Supporting size: 7"~8"
 - > SITO without shielding available
 - OGS without shielding available
 - Channel suspending available
 - Supporting for both ITO glass and ITO Film
 - Cover lens thickness requirement: 0.55mm ≤ Glass ≤ 2mm, 0.5mm ≤ PMMA ≤ 1.2mm
- ♦ Environmental applicable performance
 - Initialized automatic calibration
 - Automatic temperature drift compensation
 - Properting temperature: -20°C~+85°C, humidity: ≤95%RH
 - Storage temperature: -40 °C~+125 °C, humidity: ≤95%RH
- ♦ Communication interface
 - Standard I2C communication protocol
 - Working in I2C Slave mode
 - Interface electrical level: 1.8V~3.3V
- ♦ Wake-up time





Green mode: <48ms
 Sleep mode: <200ms
 Initialization: <200ms

♦ Power supply:

➤ Single power: 2.8V~3.3V

♦ Power ripple:

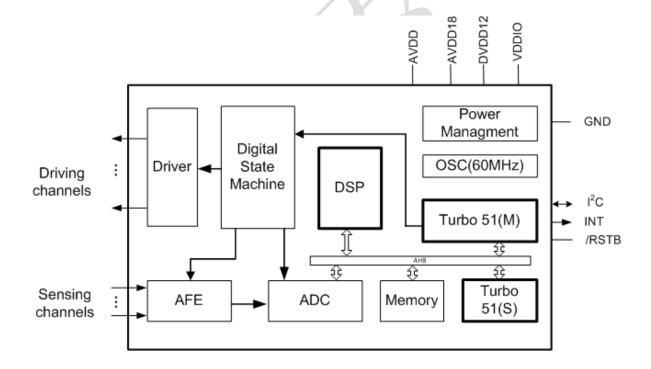
Vpp≤50mV

♦ Packaging:

> 68 pins, 8mm*8mm QFN

- ♦ Development supporting tools
 - > Touch-panel module's performance analysis tool
 - Supporting the configuration information for different touch-panel module
 - Q/C tools for mass production
 - > Developing guide & reference code supporting

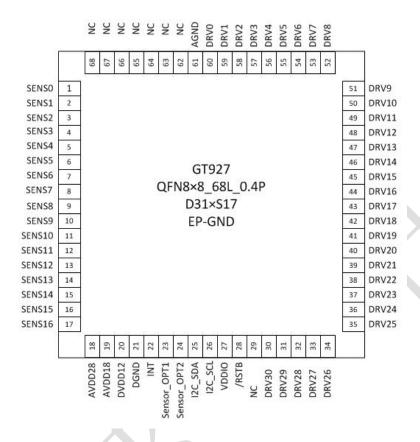
3. Block Diagram







4. Pin Description



Pin No.	Name	Description	Remark
1~17	SENS0~SENS16	Sensing channels	
18	AVDD28	Analog VDD 2.8V	2.2uF to GND
19	AVDD18	Analog VDD 1.8V	2.2uF to GND
20	DVDD12	Digital VDD 1.2V	2.2uF to GND
21	DGND	Digital ground	
22	INT	Interrupt	
23	Sensor_OPT1	Sensor option pin1	
24	Sensor_OPT2	Sensor option pin2	External pull-up
25	I2C_SDA	I ² C_data	
26	I2C_SCL	I ² C_clock	
27	VDDIO	VDD of GPIO	
28	RSTB	Reset	10K ohm external pull-up
29	NC	Floating	
30~60	DRV30~DRV0	Driving channels	
61	AGND	Analog ground	
62~68	NC	Floating	



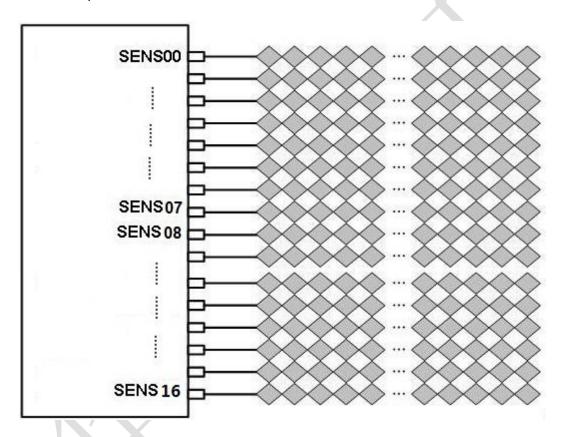


5. Sensor Development

5.1. Arrangement of Sensing Channels

GT927 has 17 sensing pins: SENS0~SENS16, which are directly connected with ITO sensors. Please reference to the GT927 schematics or contact to Goodix FAE engineer to arrange the channel sequence.

 A: Layout all the ITO races on the same side, connected in the sequence from 0 to 16 or 16 to 0:



5.2. Arrangement of Driving Channels

GT927 has 31 driving channels in total, which are directly connected with 31 ITO sensors. Please reference to the GT927 schematics or contact to Goodix FAE engineer to arrange the channel sequence.

After the layout of driving channels, relevant registers of GT927 shall be configured to ensure logic position relations consistent with physical position relations of driving channels.





5.3. Design Specification of ITO Sensor

DITO

Parameter	Range
Impedance of driving channel race	≦3KΩ
Impedance of driving channel	≦10KΩ
Impedance of sensing channel race	≦10KΩ
Impedance of sensing channel	≦40KΩ
Capacitor of node	≦4pF
Constant of sensing channel RC	≦6us. Typ.=3.6us

SITO

Parameter	Range
Impedance of driving channel race	≦3KΩ
Impedance of driving channel	≦10KΩ
Impedance of sensing channel race	≦10KΩ
Impedance of sensing channel	≦10KΩ
Capacitor of node	≦4pF
Constant of sensing channel RC	≦6us. Typ.=3.6us

In the course of actual module production, driving channels and sensing channels are made with ITO or other invisible conductive material, and the volatility of impedance is relatively small. When the channel races are used with metallic material, some races may be oxidized and their impedance will be come larger due to process control or other reasons, the impedance will be different; when the wires are used with ITO materials, though the races in all channels will be maintained consistent by virtue of matching length and width in design, there still be some difference. In order to guarantee data consistency and evenness in the whole panel, the wiring impedance shall meet the requirements as above table.

5.4. Touch Keys

GT927 can support 4 separated touch keys. There are two ways to design these touch keys:

- a) Carried out by ITO sensor: These keys shall be on the same channel. Touch keys are carried out by one driving channel with different sensing channels. Which channel is used for touch key, and key position will be determined with configuration information.
- b) Carried out by FPC: When using FPC to design touch keys, please note that the driving channel used for touch keys should not be applied on the



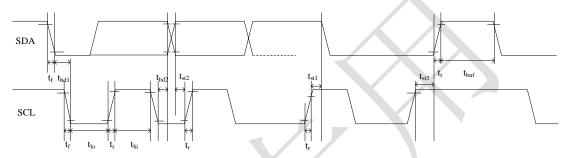


screen.

6. I²C Communication

6.1.I²C Communication

GT927 provides standard I²C communication interface for communication of SCL and SDA with master. In the system, GT927 is always used in slave mode, all communications are initiated by master, and the communication 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	Tio	0.9	0.9	us
SCL high period	Thi	0.8	0.8	us
SCL setup time for START condition	tst1	0.4	0.4	us
SCL setup time for STOP condition	tst3	0.4	0.4	us
SCL hold time for START condition	t hd1	0.3	0.3	us
SDA setup time	tst2	0.4	0.4	us
SDA hold time	thd2	0.4	0.4	us

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

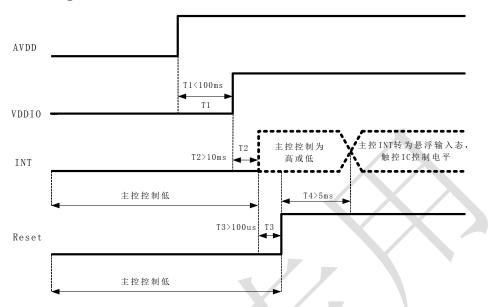
Parameter	Symbol	MIN	Max	Unit
SCL low period	Tio	0.9	0.9	us
SCL high period	Thi	0.8	0.8	us
SCL setup time for START condition	t st1	0.4	0.4	us
SCL setup time for STOP condition	t st3	0.4	0.4	us
SCL hold time for START condition	t hd1	0.3	0.3	us
SDA setup time	t st2	0.4	0.4	us
SDA hold time	t hd2	0.4	0.4	us

GT927 has 2 sets of slave address 0xBA/0xBB or 0x28/29. Master can control Reset & INT pin to configure the slave address in power on initial state like following:

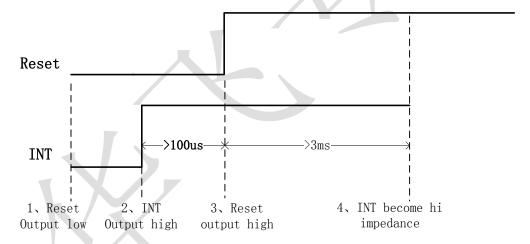




Power on Diagram:



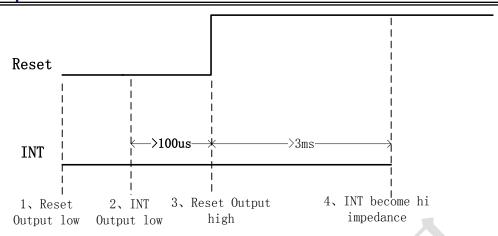
Timing of setting slave address to 0x28/0x29:



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 addresses words are serially transmitted to and from on bus in 8-bit words. GT927 sends a "0" to acknowledge when the address word is 0xBA/BB. This happens during the ninth clock cycle. If the slave address is not matched, GT927 will stay in idle state.

The data words are serially transmitted to and from in 9-bit words: 8-bit data + 1-bit ACK or NACK sent by GT927. Data changes during SCL high periods.

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

b) Write Operations to GT927 (ex: slave address is 0xBA/0xBB)



Write Operations

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

After receiving ACK from GT927, master sends out register address word in 16-bit, and then the data word in 8-bit, which is going to be wrote into GT927.

GT927's address pointer will be automatically added 1 after write operation, so master can sequential write in one operation. When operation finished, master stop the communication.





c) Read Operations to GT927 (ex: slave address is 0xBA/0xBB)



Read operation

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

After receiving ACK from GT927, master sends out register address word in 16-bit, to set GT927's address pointer. After receiving ACK, master sends out a start signal once again, start the read operation with command: 0xBB, and read data word from GT927 in 8-bit.

GT927 also supports sequential read operation, and the default setting is sequential read mode. Master shall send out ACK when receiving successfully in every data word, master sends NACK after getting all the data required, then sends stop signal to finish the communication.

6.2. Register Information of GT927

a) Real Time Order (Write Only)

Addr	Name	bit7 bit6 bit5 bit4 bit3 bit2 bit1 bit0			
0x8040	Command	0: read status of coordinate 1: D-value 2: software reset 3: benchmark update 4: benchmark calibration 5: screen off			
0x8041	LED_Control	Control word under control of touch key LED light.			
0x8042	Proximity_En	Proximity switch			

b) Configuration Information (R/W)

Addr	name	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0x8047	Config_Version		Versio	n number o	of the config	uration de	ocument		
0x8048	X Output Max_L			Max	alva af V				
0x8049	X Output Max_H			ivia	x value of X	axis			
0x804A	Y Output Max_L			Mov	vyoluo of V	ovio			
0x804B	Y Output Max_H	Max value of Y axis							
0x804C	Touch Number		Reser	ved			Touch nu	mber: 1	~5
0x804D	Module_Switch1	Rese	ved	Streto	ch_rank	X2Y	Sito		trigger ethod
0x804E	Module switch2			Pos	onvod				Touch_
UX0U4E	Module_Switch2	Reserved Key				Key			
0x804F	Shake_Count	Reserved Finger shake count			nt				
0x8050	Filter	Normal_Filter (filtering value of original coordinates			dinate				
UCUOKU	Fillei	First_Filter wind		ow, coeffi	ciency is	1)			





0x8053 0x8054	Large_Touch Noise_Reduction		Number	of touch in la			
0x8053 0x8054	Noise_Reduction			Value of noise elimination			
0x8054		Reserved			Vai		cient is 1)
	S_Touch_Level		Threshold of	touch grow of	out of not	hing	
Ovenes I o	S_Leave_Level		Threshold of	touch grow of	out of not	hing	
0x8055 Lo	w_Power_Control		Reserved		Time t	' - '	wer consumption -15s)
0x8056	Refresh_Rate		Reserved		Coordin	•	rt rate (Cycle: 5+N
0x8057	x_threshold						
0x8058	y_threshold			reserved			
0x8059	X_Speed_Limit						
0x805A	Y_Speed_Limit		Parar	meter of spee	d limit		
0x805B		BI	ank area of boarder-to	p	Blank	area of	Boarder-bottom
0x805C	Space	BI	ank area of boarder-le	ft	Blar	nk area o	f Boarder-right
0x805D	NC			Reserved			
0x805E	NC			Reserved			
0x805F	NC			Reserved			
0x8060	NC	Reserved					
0x8061	NC			Reserved			
	rv_GroupA_Num	All_Driving	Reserved	Π	Driver_G	roup A r	number
I	rv_GroupB_Num	Rese			Driver_Group_B_number		
0x8064	Sensor_Num		nsor_Group_B_Numbe			•	up_A_Number
			iver frequency double				
0x8065	FreqA_factor		GroupA_Frequence			-	-
0x8066	FreqB_factor	Dr	iver frequency double GroupB_Frequence			`	
0x8067 F	Pannel_BitFreqL	1	(A)D (4500)	17 1		00011.)
0x8068 F	Pannel_BitFreqH	В	aseband of Driver grou	ıp A\B (1526F	∃Z <baset< td=""><td>oand<146</td><td>500HZ)</td></baset<>	oand<146	500HZ)
0x8069	annel_Sensor_Ti meL		Time interval of the ne	ibauriag tug	driving oi	anal (I lai	t
0x806A	annel_Sensor_Ti meH		Time interval of the ne	sibouring two	ariving si	gnai (Uni	i. us)
0x806B F	Pannel_Tx_Gain		reserved	Pannel_Dr ut_R, 4 (-	Pani	nel_DAC_Gain
0x806C F	Pannel_Rx_Gain	Pannel_P GA_C	Pannel_PGA_R	Pannel_R	x_Vcmi	Pani	nel_PGA_Gain
0x806D Pa	annel_Dump_Shift		Reserved		_		efficient of original Ith power of 2)
0x806E Dr	rv_Frame_Control	Reserved	SubF	rame_DrvNur	m		Repeat_Num
0x806F	NC	Reserved					
UNDUUF	NC	Reserved					





0.0074 NO Page 100				
0x8071	NC	Reserved		
0x8072	Stylus_Tx_Gain	Undefined (invalid when stylus_priority=0)		
0x8073	Stylus_Rx_Gain	Undefined (invalid when stylus_priority=0)		
0x8074	Stylus_Dump_Shift	Undefined (invalid when stylus_priority=0)		
0x8075	Stylus_Touch_Level	Undefined (invalid when stylus_priority=0)		
0x8076	Stylus_Leave_Level	Undefined (invalid when stylus_priority=0)		
0x8077	Stylus_Control	Pen mode escape time out period (Unit: Sec)		
0x8078	NC	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_Tims	Detect_Stay_Times Detect_Confirm_Times		
0x807D	Hopping_Flag	Hop_En Reserved Detect_Time_Out		
0x807E	Hopping_Threshold	Large_Noise_Threshold Hopping_Hit_Threshold		
0x807F	Noise_Threshold	Threshold of noise level		
0x8080	NC	Reserved		
0x8081	NC	Reserved		
0x8082	Hopping_seg1_BitF reqL			
0x8083	Hopping_seg1_BitF reqH	Frequency hopping segment band 1 central frequency (for driver A/B)		
0x8084	Hopping_seg1_Fact or	Frequency hopping segment 1 central frequency coefficient		
0x8085	Hopping_seg2_BitF reqL	Francisco de la contraction de		
0x8086	Hopping_seg2_BitF reqH	Frequency hopping segment band 2 central frequency (for driver A/B)		
0x8087	Hopping_seg2_Fact or	Frequency hopping segment 2 central frequency coefficient		
0x8088	Hopping_seg3_BitF reqL	Frequency hopping segment band 3 central frequency (for driver A/B)		
0x8089	Hopping_seg3_BitF reqH	Trequency hopping segment band 3 central nequency (101 driver AVB)		
0x808A	Hopping_seg3_Fact or	Frequency hopping segment 3 central frequency coefficient		
0x808B	Hopping_seg4_BitF reqL	Frequency hopping segment band 4 central frequency (for driver A/B)		
0x808C	Hopping_seg4_BitF reqH	Troquency hopping segment band 4 central nequency (for driver A/D)		
0x808D	Hopping_seg4_Fact or	Frequency hopping segment 4 central frequency coefficient		
0x808E	Hopping_seg5_BitF	Frequency hopping segment band 5 central frequency (for driver A/B)		





0x808F regH Hopping_seg5_Fact or 0x8091 Frequency hopping segment 5 central frequency coefficient or 0x8092 Frequency hopping segment 5 central frequency coefficient or 0x8093 Frequency hopping segment 5 central frequency coefficient 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 position Touch valid interval setting: 0-15 valid 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 Key 4 position 0x8099 Key_Leave_Level Key threshold of touch key Key 5ens_2 0x809A Key_Sens KeySens_1 (sensitivity coefficient of key 1, same below) KeySens_2 KeySens_2 0x809B Key_Restrain Reserved Reserved Reserved <					
0x8098F or eqH Frequency hopping segment 5 central frequency coefficient 0x80991 or Frequency hopping segment 5 central frequency coefficient 0x8092 or Reserved 0x8093 or Key 1 Position: 0-255 valid (0 means no touch, it means independent touch key when 4 of the keys are 8 multiples 0x8094 or Key 1 Position: 0-255 valid (0 means no touch, it means independent touch key when 4 of the keys are 8 multiples 0x8095 or Key 2 Key 2 position 0x8096 or Key 3 position Touch valid interval setting: 0-15 valid 0x8097 or Key 4 position Touch valid interval setting: 0-15 valid 0x8098 or Key 4 position Touch valid interval setting: 0-15 valid 0x8099 or Key 4 position Touch valid interval setting: 0-15 valid 0x8099 or Key 4 position Touch valid interval setting: 0-15 valid 0x8099 or Key Leave Level Key threshold of touch key 0x8098 or Key 2 sens Key Sens 2 Key Sens 2 Key Sens 2 0x8099 or Key 2 sens Key 5 sens 3 Key 5 sens 2 Key 5 sens 2 Key 5 sens		reqL			
Name	0x808F				
0x8091 NC Reserved 0x8093 NC Reserved 0x8093 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. Area Time limit for long press(1-16 s) Touch valid interval setting: 0-15 valid 0x8098 Key. Area Time limit for long press(1-16 s) Touch valid interval setting: 0-15 valid 0x8098 Key. Area Time limit for long press(1-16 s) Touch valid interval setting: 0-15 valid 0x8098 Key. Area Time limit for long press(1-16 s) Touch valid interval setting: 0-15 valid 0x8098 Key. Sens Key. Sens sets sets sets sets sets sets sets s		reqH			
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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 touth key 0x8099 Key_Leave_Level Key threshold of touth key 0x809A Key_Sens Key Sens (key Sens Same below) Key Sens_2 0x809B Key_Sens KeySens_3 KeySens_4 0x809D Key_Restrain Reserved Reserved 0x809B NC Reserved Reserved 0x809F NC Reserved Reserved 0x80A0 NC Reserved Drumbly_Devs_belon_C Drumbly_Devs_belon_C Drumbly_Devs_belon_C Drumbly_Devs_belon_C Drumbly_Devs_belon_C Drumbly_Devs_belon_C Drumbly_Devs_belon_C Drumbly_Devs_belon_C Sens_Start_Ch (start channel of sensing direction) Drumbly_Devs_belon_C Sens_End_Ch (End channel) 0x80A1 Proximity_Bens_Eng_Factor Proximity_Bens_Face Proximity_Bens_Face	0,0003	Kov 1	Key 1 Position: 0-255 valid (0 means no touch, it	means independe	ent touch key when
0x8095 Key 3 Key 4 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_Leave_Level Key threshold of touch key 0x8099 Key_Leave_Level Key threshold of touch key 0x8098 Key_Sens KeySens_(sensitivity coefficient of key 1, same below) KeySens_2 0x8098 Key_Sens KeySens_3 KeySens_4 0x8090 Key_Restrain Reserved Reserved 0x8091 NC Reserved Reserved 0x8092 NC Reserved Reserved 0x8040 NC Reserved Reserved 0x80A0 NC Reserved Reserved 0x80A1 NC Reserved Reserved 0x80A2 Proximity_Drv_Sele et Drv_Start_Ch (start channel of driving direction) Sens_End_Ch (End channel) 0x80A3 Proximity_Leave_L evel Proximity effective threshold value 0x80A6 Proximity_Freq_Fac tor Frequency multification o	0,0095	Ney I	4 of the keys are 8 n	nultiples	
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_(sensitivity coefficient of key 1, same below) KeySens_2 0x809B Key_Sens KeySens_3 KeySens_4 0x809C Key_Restrain Reserved Reserved 0x809E NC Reserved NC 0x80A0 NC Reserved NC 0x80A1 NC Reserved NC 0x80A2 Proximity_Drv_Sele ct Drv_Start_Ch (start channel of driving direction) Drv_End_Ch (End channel) 0x80A3 Proximity_Touch_L evel Proximity effective threshold value Sens_End_Ch (End channel) 0x80A4 Proximity_Leave_L evel Proximity ineffective threshold value Proximity_Freq_Fac tor 0x80A6 Proximity_BitFreqL tor Base frequency multification of proximity sensing channel. Time interval between proximity adjacent driving signal <td>0x8094</td> <td>Key 2</td> <td>Key 2 positio</td> <td>n</td> <td></td>	0x8094	Key 2	Key 2 positio	n	
Time limit for long press(1-16 s)	0x8095	Key 3	Key 3 positio	n	
0x8097 Key_Area Time limit for long press(1-16 s) 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 Reserved Reserved 0x809E NC Reserved Reserved 0x80A0 NC Reserved Reserved 0x80A1 NC Reserved Reserved 0x80A2 Proximity_Drv_Sele ct Drv_Start_Ch (start channel of driving direction) Drv_End_Ch (End channel) 0x80A3 Proximity_Sens_Sel ect Sens_Start_Ch (start channel of sensing direction) Sens_End_Ch (End channel) 0x80A4 Proximity_Touch_L evel Proximity effective threshold value 0x80A5 Proximity_Leave_L evel Proximity ineffective threshold value 0x80A6 Proximity_BitFreqL tory Base frequency multification of proximity sensing channel. 0x80A8 Proximity_Sensor_T imeL	0x8096	Key 4	Key 4 positio	n	
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 Reserved Reserved 0x809B NC Reserved Reserved 0x809F NC Reserved Reserved 0x80A0 NC Reserved Reserved 0x80A1 NC Reserved Reserved 0x80A2 Proximity_Drv_Sele ct Drv_Start_Ch (start channel of driving direction) Drv_End_Ch (End channel) 0x80A3 Proximity_Sens_Sel ect Sens_Start_Ch (start channel of sensing direction) Sens_End_Ch (End channel) 0x80A4 Proximity_Touch_Leve_Level Proximity effective threshold value 0x80A5 Proximity_Leave_Level Proximity ineffective threshold value 0x80A6 Proximity_Freq_Factor Frequency multification of proximity sensing channel. 0x80A7 Proximity_BitFreqLowed Base frequency of proximity sensing channel. 0x80A8 Proximity_Sensor_TimeL T	0x8097	Key_Area	Time limit for long press(1~16 s)		_
0x809A Key_Sens KeySens_1(sensitivity coefficient of key 1, same below) KeySens_2 0x809B Key_Sens KeySens_3 KeySens_4 0x809C Key_Restrain Reserved Reserved 0x809B NC Reserved 0x809F NC Reserved 0x80A0 NC Reserved 0x80A1 NC Reserved 0x80A2 Proximity_Drv_Sele ct Drv_Start_Ch (start channel of driving direction) Drv_End_Ch (End channel) 0x80A3 Proximity_Sens_Sel ect Sens_Start_Ch (start channel of sensing direction) Sens_End_Ch (End channel) 0x80A4 Proximity_Touch_Level Proximity effective threshold value 0x80A5 Proximity_Leave_Level Proximity ineffective threshold value 0x80A6 Proximity_Freq_Factor Frequency multification of proximity sensing channel. 0x80A7 Proximity_BitFreqLetor Base frequency of proximity sensing channel. 0x80A8 Proximity_Sensor_TimeL Time interval between proximity adjacent driving signal	0x8098	Key_Touch_Level	Key threshold of too	uch key	
0x809A Key_Sens same below) KeySens_2 0x809B Key_Sens KeySens_3 KeySens_4 0x809C Key_Restrain Reserved Reserved 0x809F NC Reserved NC 0x80A0 NC Reserved NC 0x80A1 NC Reserved NC 0x80A2 Proximity_Drv_Sele ct Drv_Start_Ch (start channel of driving direction) Drv_End_Ch (End channel) 0x80A3 Proximity_Sens_Sel ect Sens_Start_Ch (start channel of sensing direction) Sens_End_Ch (End channel) 0x80A4 Proximity_Touch_Level Proximity effective threshold value 0x80A5 Proximity_Leave_Level Proximity ineffective threshold value 0x80A6 Proximity_Freq_Factor Frequency multification of proximity sensing channel. 0x80A7 Proximity_BitFreqLox80A8 Proximity_Sensor_TimeL 0x80A8 Proximity_Sensor_TimeL Time interval between proximity adjacent driving signal	0x8099	Key_Leave_Level	Key threshold of too	uch key	
0x809B Key_Sens KeySens_3 KeySens_4 0x809C Key_Restrain Reserved Reserved 0x809D NC Reserved 0x809F NC Reserved 0x80A0 NC Reserved 0x80A1 NC Reserved 0x80A2 Proximity_Drv_Sele ct Drv_Start_Ch (start channel of driving direction) Drv_End_Ch (End channel) 0x80A3 Proximity_Sens_Sel et Sens_Start_Ch (start channel of sensing direction) Sens_End_Ch (End channel) 0x80A4 Proximity_Touch_Level Proximity effective threshold value 0x80A5 Proximity_Leave_Level Proximity ineffective threshold value 0x80A6 Proximity_Freq_Fac tor Frequency multification of proximity sensing channel. 0x80A7 Proximity_BitFreqLed Base frequency of proximity sensing channel. 0x80A8 Proximity_Sensor_T imeL Time interval between proximity adjacent driving signal	0.0004		KeySens_1(sensitivity coefficient of key 1,	14.	
0x809C Key_Restrain Reserved 0x809D NC Reserved 0x809E NC Reserved 0x809F NC Reserved 0x80A0 NC Reserved 0x80A1 NC Reserved 0x80A2 Proximity_Drv_Sele ct Drv_Start_Ch (start channel of driving direction) Drv_End_Ch (End channel) 0x80A3 Proximity_Sens_Sel et Sens_Start_Ch (start channel of sensing direction) Sens_End_Ch (End channel) 0x80A4 Proximity_Leave_L evel Proximity effective threshold value 0x80A5 Proximity_Freq_Fac for Frequency multification of proximity sensing channel. 0x80A6 Proximity_BitFreqL Base frequency of proximity sensing channel. 0x80A7 Proximity_BitFreqH Base frequency of proximity sensing channel. 0x80A8 Proximity_Sensor_T imeL Time interval between proximity adjacent driving signal 0x80AA Proximity_Sensor_T imeL Time interval between proximity adjacent driving signal	0x809A	Key_Sens	same below)	Keys	sens_2
0x809D NC Reserved 0x809F NC Reserved 0x80A0 NC Reserved 0x80A1 NC Reserved 0x80A2 Proximity_Drv_Sele ct Drv_Start_Ch (start channel of driving direction) Drv_End_Ch (End channel) 0x80A3 Proximity_Sens_Sel et Sens_Start_Ch (start channel of sensing direction) Sens_End_Ch (End channel) 0x80A4 Proximity_Touch_L evel Proximity effective threshold value 0x80A5 Proximity_Leave_L evel Proximity ineffective threshold value 0x80A6 Proximity_Freq_Fac tor Frequency multification of proximity sensing channel. 0x80A7 Proximity_BitFreqL Base frequency of proximity sensing channel. 0x80A8 Proximity_Sensor_T imeL Time interval between proximity adjacent driving signal 0x80AA Proximity_Sensor_T imeL Time interval between proximity adjacent driving signal	0x809B	Key_Sens	KeySens_3	KeyS	Sens_4
0x809E NC Reserved 0x80A0 NC Reserved 0x80A1 NC Reserved 0x80A2 Proximity_Drv_Sele ct Drv_Start_Ch (start channel of driving direction) Drv_End_Ch (End channel) 0x80A3 Proximity_Sens_Sel ect Sens_Start_Ch (start channel of sensing direction) Sens_End_Ch (End channel) 0x80A4 Proximity_Touch_L evel Proximity effective threshold value 0x80A5 Proximity_Leave_L evel Proximity ineffective threshold value 0x80A6 Proximity_Freq_Fac tor Frequency multification of proximity sensing channel. 0x80A7 Proximity_BitFreqL Ox80A8 Proximity_BitFreqH Base frequency of proximity sensing channel. 0x80A9 Proximity_Sensor_T imeL Time interval between proximity adjacent driving signal 0x80AA Proximity_Sensor_T imeH	0x809C	Key_Restrain	Reserved	Res	erved
0x809F NC Reserved 0x80A0 NC Reserved 0x80A1 NC Reserved 0x80A2 Proximity_Drv_Sele ct Drv_Start_Ch (start channel of driving direction) Drv_End_Ch (End channel) 0x80A3 Proximity_Sens_Sel ect Sens_Start_Ch (start channel of sensing direction) Sens_End_Ch (End channel) 0x80A4 Proximity_Touch_Level Proximity effective threshold value 0x80A5 Proximity_Leave_Level Proximity ineffective threshold value 0x80A6 Proximity_Freq_Factor Frequency multification of proximity sensing channel. 0x80A7 Proximity_BitFreqLox80A8 Proximity_BitFreqH Base frequency of proximity sensing channel. 0x80A9 Proximity_Sensor_TimeL Time interval between proximity adjacent driving signal 0x80AA Proximity_Sensor_TimeH Time interval between proximity adjacent driving signal	0x809D	NC	Reserved		
0x80A0 NC Reserved 0x80A1 NC Reserved 0x80A2 Proximity_Drv_Sele ct Drv_Start_Ch (start channel of driving direction) Drv_End_Ch (End channel) 0x80A3 Proximity_Sens_Sel ect Sens_Start_Ch (start channel of sensing direction) Sens_End_Ch (End channel) 0x80A4 Proximity_Touch_L evel Proximity effective threshold value 0x80A5 Proximity_Freq_Fac tor Frequency multification of proximity sensing channel. 0x80A6 Proximity_BitFreqL Ox80A8 Proximity_BitFreqH Proximity_BitFreqH imeL Base frequency of proximity sensing channel. 0x80AA Proximity_Sensor_T imeL Time interval between proximity adjacent driving signal	0x809E	NC	Reserved		
0x80A1 NC Reserved 0x80A2 Proximity_Drv_Sele ct Drv_Start_Ch (start channel of driving direction) Drv_End_Ch (End channel) 0x80A3 Proximity_Sens_Sel ect Sens_Start_Ch (start channel of sensing direction) Sens_End_Ch (End channel) 0x80A4 Proximity_Touch_L evel Proximity effective threshold value 0x80A5 Proximity_Leave_L evel Proximity ineffective threshold value 0x80A6 Proximity_Freq_Fac tor Frequency multification of proximity sensing channel. 0x80A7 Proximity_BitFreqL Base frequency of proximity sensing channel. 0x80A8 Proximity_Sensor_T imeL Time interval between proximity adjacent driving signal 0x80AA Proximity_Sensor_T imeH	0x809F	NC	Reserved		
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0x80A2 ct Drv_Start_Ch (start channel of driving direction) (End channel) 0x80A3 Proximity_Sens_Sel ect Sens_Start_Ch (start channel of sensing direction) Sens_End_Ch (End channel) 0x80A4 Proximity_Touch_Level Proximity effective threshold value 0x80A5 Proximity_Leave_Level Proximity ineffective threshold value 0x80A6 Proximity_Freq_Factor Frequency multification of proximity sensing channel. 0x80A7 Proximity_BitFreqL Base frequency of proximity sensing channel. 0x80A8 Proximity_Sensor_TimeL Time interval between proximity adjacent driving signal 0x80AA Proximity_Sensor_TimeH Time interval between proximity adjacent driving signal	0x80A1	NC	Reserved		
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0x80A3 ect Sens_Start_Ch (start channel of sensing direction) (End channel) 0x80A4 Proximity_Touch_L evel Proximity effective threshold value 0x80A5 Proximity_Leave_L evel Proximity ineffective threshold value 0x80A6 Proximity_Freq_Fac tor Frequency multification of proximity sensing channel. 0x80A7 Proximity_BitFreqL Ox80A8 Proximity_BitFreqH Base frequency of proximity sensing channel. 0x80A9 Proximity_Sensor_T imeL Time interval between proximity adjacent driving signal 0x80AA Proximity_Sensor_T imeH				·	
Ox80A5 Proximity_Leave_L evel Ox80A6 Proximity_Freq_Fac tor Ox80A7 Proximity_BitFreqL Ox80A8 Proximity_BitFreqH Ox80A9 Proximity_Sensor_T imeL Time interval between proximity adjacent driving signal	0x80A3		Sens_Start_Ch (start channel of sensing	direction)	
0x80A5 evel Proximity ineffective threshold value 0x80A6 Proximity_Freq_Fac tor Frequency multification of proximity sensing channel. 0x80A7 Proximity_BitFreqL Base frequency of proximity sensing channel. 0x80A8 Proximity_Sensor_T imeL Time interval between proximity adjacent driving signal 0x80AA Proximity_Sensor_T imeH	0x80A4		Proximity effective three	shold value	1
0x80A6 tor Frequency multification of proximity sensing channel. 0x80A7 Proximity_BitFreqL Base frequency of proximity sensing channel. 0x80A8 Proximity_BitFreqH Proximity_Sensor_T imeL 0x80A9 Proximity_Sensor_T imeL Time interval between proximity adjacent driving signal 0x80AA Proximity_Sensor_T imeH	0x80A5	-	Proximity ineffective three	eshold value	
0x80A8 Proximity_BitFreqH 0x80A9 Proximity_Sensor_T imeL 0x80AA Proximity_Sensor_T imeH Time interval between proximity adjacent driving signal	0x80A6	-	Frequency multification of proximity sensing channel.		
0x80A8 Proximity_BitFreqH 0x80A9 Proximity_Sensor_T imeL 0x80AA Proximity_Sensor_T imeH Time interval between proximity adjacent driving signal	0x80A7	Proximity_BitFreqL	Page frequency of previous	nonging channel	
0x80A9 imeL Ox80AA Proximity_Sensor_T imeH Time interval between proximity adjacent driving signal	0x80A8	Proximity_BitFreqH	Base frequency of proximity sensing channel.		
0x80AA imeH	0x80A9	-			
0v90AB Provimity Ty Cain	0x80AA	-	Time interval between proximity a	ujaceni unving sig	jiiai
OXOOAD FIOXIIIIIIY_1X_Gain Dilving gain of proximity	0x80AB	Proximity_Tx_Gain	Driving gain of pro	ximity	





0x80AC	Proximity_Rx_Gain	Driving gain of pro	ximity	
0x80AD	Proximity_Dump_S hift	Reserved	Magnification coefficient of proximity original value (The Nth power of 2)	
0x80AE	NC	Reserved		
0x80AF	NC	Reserved		
0x80B0	NC	Reserved		
0x80B1	NC	Reserved		
0x80B2	NC	Reserved		
0x80B3	NC	Reserved		
0x80B4	NC	Reserved		
0x80B5	NC	Reserved		
0x80B6	NC	Reserved		
0x80B7~ 0x80C4	Sensor_CH0~ Sensor_CH13	Corresponding channel no.	of ITO Sensor	
0x80C5~ 0x80D4	NC	Reserved		
0x80D5~	Driver_CH0~	Corresponding shapped no	of ITO DriverO	
0x80EA	Driver_CH21	Corresponding channel no. of ITO Driver0		
0x80EB~ 0x80FE	NC	Reserved		
0x80FF	Config_Chksum	Check of configuration	information	
0x8100	Config_Fresh	Updated configuration (by master control)		

c) Coordinates Information

Addr	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0x8140		Product ID(Lowest Byte,ASCII 码 6)						
0x8141		Product ID(Third Byte,ASCII 码 0)						
0x8142		Product ID(Second Byte,ASCII 码 0)						
0x8143			Product ID(Hi	ghest Byte,AS	SCII 码,如:	9)		
0x8144			Firmware v	ersion(byte1)	(LowByte)			
0x8145		Firmware version(byte2)(HighByte)						
0x8146	x coordinate resolution (low byte) (current output resolution)							
0x8147	x coordinate resolution (high byte)							
0x8148	y coordinate resolution (low byte)							
0x8149	y coordinate resolution (high byte)							
0x814A	Vendor_id(current module choice information)							
0x814B	Reserved							
0x814C	gesture type(reserved)							
0x814D	gesture value(reserved)							
0x814E	buffer	large	Proximity	HaveKey	number	of touch	nointe	
0.0146	status	detect	Valid	liaveiley	Humber	or touch	Jonns	





<u></u>	
0x814F	track id
0x8150	point 1 x coordinate (low byte)
0x8151	point 1 x coordinate (high byte)
0x8152	point 1 y coordinate (low byte)
0x8153	point 1 y coordinate (high byte)
0x8154	Point 1 size (low byte)
0x8155	point 1 size (high byte)
0x8156	Reserved
0x8157	track id
0x8158	point 2 x coordinate (low byte)
0x8159	point 2 x coordinate (high byte)
0x815A	point 2 y coordinate (low byte)
0x815B	point 2 y coordinate (high byte)
0x815C	point 2 size (low byte)
0x815D	point 2 size (high byte)
0x815E	Reserved
0x815F	track id
0x8160	point 3 x coordinate (low byte)
0x8161	point 3 x coordinate (high byte)
0x8162	point 3 y coordinate (low byte)
0x8163	point 3 y coordinate (high byte)
0x8164	point 3 size (low byte)
0x8165	point 3 size (high byte)
0x8166	Reserved
0x8167	track id
0x8168	point 4 x coordinate (low byte)
0x8169	point 4 x coordinate (high byte)
0x816A	point 4 y coordinate (low byte)
0x816B	point 4 y coordinate (high byte)
0x816C	point 4 size (low byte)
0x816D	point 4 size (high byte)
0x816E	Reserved
0x816F	track id
0x8170	point 5 x coordinate (low byte)
0x8171	point 5 x coordinate (high byte)
0x8172	point 5 y coordinate (low byte)
0x8173	point 5 y coordinate (high byte)
0x8174	point 5 size (low byte)
0x8175	point 5 size (high byte)
0x8176	Reserved
0x8177	Track id
0x8178	point 6 x coordinate (low byte)





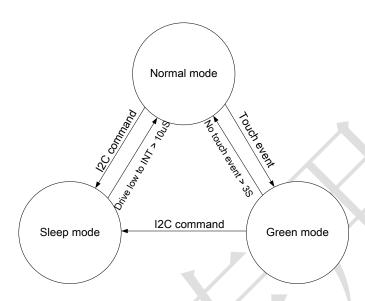
0x8179 point 6 x coordinate (high byte) 0x817A point 6 y coordinate (low byte) 0x817B point 6 y coordinate (low byte) 0x817C point 6 size (low byte) 0x817D point 6 size (high byte) 0x817E Reserved 0x817F Reserved 0x817F Track id 0x8180 point 7 x coordinate (low byte) 0x8181 point 7 x coordinate (low byte) 0x8182 point 7 y coordinate (high byte) 0x8183 point 7 y coordinate (high byte) 0x8184 point 7 size (low byte) 0x8185 point 7 size (low byte) 0x8186 Reserved 0x8187 Track id 0x8188 point 8 x coordinate (low byte) 0x8188 point 8 x coordinate (low byte) 0x8188 point 8 x coordinate (low byte) 0x818A point 8 x coordinate (low byte) 0x818B point 8 x coordinate (low byte) 0x818C point 8 y coordinate (low byte) 0x818C point 8 size (high byte) 0x818E Reserved 0x818F Track id 0x819D point 8 size (high byte) 0x818D point 8 size (high byte) 0x818D point 8 x coordinate (low byte) 0x818D point 8 x coordinate (low byte) 0x818D point 8 x coordinate (low byte) 0x819D point 9 x coordinate (low byte) 0x8191 point 9 x coordinate (low byte) 0x8192 point 9 y coordinate (low byte) 0x8193 point 9 y coordinate (high byte) 0x8194 point 9 x coordinate (high byte) 0x8195 point 9 x coordinate (high byte) 0x8196 Reserved 0x8197 Track id 0x8198 point 10 x coordinate (low byte) 0x8199 point 10 x coordinate (high byte) 0x8190 point 10 x coordinate (high byte) 0x8191 point 10 x coordinate (high byte) 0x8192 point 10 x coordinate (high byte) 0x8194 point 10 x coordinate (high byte) 0x8196 point 10 x coordinate (high byte) 0x8197 Track id 0x8198 point 10 x coordinate (high byte) 0x8199 point 10 x coordinate (high byte) 0x8190 point 10 x coordinate (high byte) 0x8191 point 10 y coordinate (high byte) 0x8192 point 10 x coordinate (high byte) 0x8194 point 10 x coordinate (high byte)		
0x817B point 6 y coordinate (high byte) 0x817C point 6 size (low byte) 0x817D point 6 size (high byte) 0x817E Reserved 0x818F Track id 0x8180 point 7 x coordinate (low byte) 0x8181 point 7 x coordinate (low byte) 0x8182 point 7 y coordinate (low byte) 0x8183 point 7 y coordinate (low byte) 0x8184 point 7 size (low byte) 0x8185 point 7 size (low byte) 0x8186 Reserved 0x8187 Track id 0x8188 point 8 x coordinate (low byte) 0x8189 point 8 x coordinate (low byte) 0x8180 point 8 y coordinate (low byte) 0x8181 point 8 y coordinate (low byte) 0x8182 point 8 size (low byte) 0x8183 point 9 x coordinate (low byte) 0x8184 point 9 x coordinate (low byte) 0x818D point 9 x coordinate (low byte) 0x818B point 9 x coordinate (low byte) 0x819C point 9 y coordinate (low byte) 0x8191 point 9 y coo	0x8179	point 6 x coordinate (high byte)
0x817C point 6 size (low byte) 0x817D point 6 size (high byte) 0x817E Reserved 0x817F Track id 0x8180 point 7 x coordinate (low byte) 0x8181 point 7 x coordinate (high byte) 0x8182 point 7 y coordinate (low byte) 0x8183 point 7 size (low byte) 0x8184 point 7 size (high byte) 0x8185 point 7 size (high byte) 0x8186 Reserved 0x8187 Track id 0x8188 point 8 x coordinate (low byte) 0x8188 point 8 x coordinate (low byte) 0x818A point 8 y coordinate (high byte) 0x818B point 8 y coordinate (low byte) 0x818B point 8 size (low byte) 0x818C point 8 size (low byte) 0x818E Reserved 0x818F Track id 0x8190 point 9 x coordinate (low byte) 0x8191 point 9 x coordinate (low byte) 0x8192 point 9 y coordinate (low byte) 0x8193 point 9 x coordinate (low byte) 0x81	0x817A	point 6 y coordinate (low byte)
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	0x819D	point 10 size (high byte)
0x819F keyvaule	0x819E	Reserved
	0x819F	keyvaule





7. Function Mode

7.1. Working Mode



a) Normal Mode

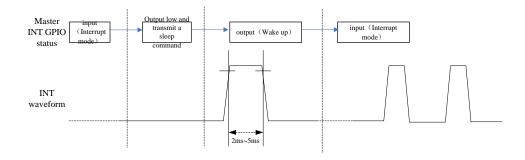
When GT927 is in Normal mode, touch scanning period is about 7ms ~ 10ms depending on the setting of tuning. The chip will automatically enter into Green mode if no touch is detected within 0~15s depending on setting and the step is 1s..

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 GT927 to enter Sleep mode through I2C command (before the command, please drive low to INT pin). Drive high to the INT pin of GT927 2~5ms will make GT927 return back to normal mode.







7.2. Pulse Calling

GT927 will inform master to read coordinate information only when touch information changes. Pin "INT" will outputs a high-to-low (or low-to-high, low level, high level etc, set by configuration information) signal to inform master.

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 GT927 be in Sleep mode through I²C command. When GT927 is needed to return to normal mode, just set "SHUTDN" as "1". GT927 will be in Normal mode automatically when exiting Sleep mode.

7.4. Proximity Function

GT927 has the function of proximity, this function is turned on when user touched the top part, or when there's large area press to the screen, GT927 will inform CPU to turn off LCD, and enter touch detect status at the same time. When users leave the screen, GT927 will inform CPU to turn on LCD, and exit the status of touch detecting. When conversation is finished or users press the power key, CPU will inform GT927 to exit the status of touch detecting. It is suggested to cooperate with G-sensor, to optimize the user experience.

7.5. Parameter Frozen Function

GT927 support the function of Parameter frozen. When parameter is obtained, parameter can be settled in GT927 through Goodix test tool. If parameter has been frozen, GT927 will be only communicating with master control, it will not receive the configuration from master control. Please refer to relevant application guidance for detailed method of parameter frozen.

7.6. Frequency Hopping Function

GT927 has very good anti-interference basis, when the driver spectrum of GT927 overlaid with peak frequency spectrum of interference signal, it can be switch to another frequency by self-adaption frequency hopping mechanism, to avoid interference. Better performance can be achieved if it is cooperated with master control, switchover the charging status.





7.7. Automatic Calibration

a) Initialization Calibration

Different temperature, humidity and physical space structure will affect the sensor's parameter. According to environmental situation GT927 will update the touch detecting reference automatically in initialized 200ms.

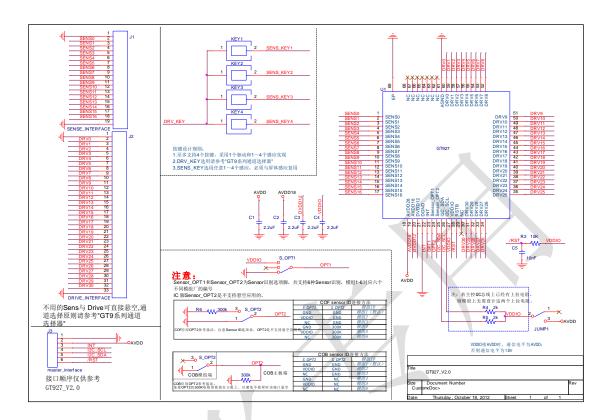
b) Automatic Temperature Drift

Slow change of temperature, humidity or dust and other environmental factors will also affect the sensor's parameter. GT927 calculates and analyzes historical data, and compare to the current data variation. Base on this, the detecting reference will be modified automatically.





8. Reference Circuit Diagram



Reference Circuit Diagram of GT927

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 Electrical Parameter (Temperature 25°C)

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	VDDIO+0.3	V
Input voltage on analog I/O	0	3.47	٧
Operating temperature	-40	85	$^{\circ}$
Storage temperature	-40	125	$^{\circ}$
Welding temperature (10s)		+300	$^{\circ}\mathbb{C}$
ESD protective voltage (HB Model)		2	KV

9.2 Operating Characteristic (Temperature 25°C, AVDD=2.8V)

Parameter	Min	Typical value	Max	Unit
Analog power AVDD28	2.8	X /- π	3.3	V
VDDIO	1.8		3.3	V
Operating temperature	-20	25	85	$^{\circ}\mathbb{C}$

9.3 AC Characteristic (Temperature 25 °C, AVDD=2.8V)

Parameter	Min	Typical value	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

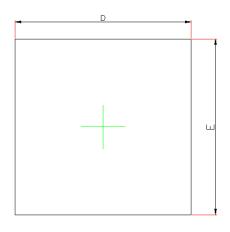
9.4 DC Characteristic (Temperature 25°C, VDD=2.8V)

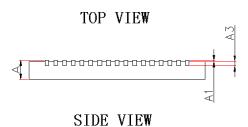
Parameter		Typical value	Max	Unit
Operating current (Normal mode)		13	15	mA
Operating current (Green mode)		4.58		mΑ
Operating current (Sleep mode)		200		uA
Input voltage in low level(VDDIO=1.8V)	-0.3	0	0.45	V
Input voltage in high level(VDDIO=1.8V)	1.35	1.8	2.1	V

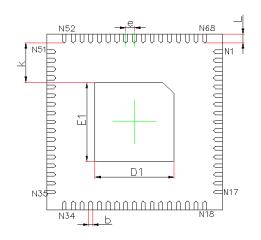




10. Packaging Information







BOTTOM VIEW

Symbol	Dimensions I	n Millimeters	Dimensions In Inches		
Symbol	Min.	Max.	Min.	Max.	
А	0.700	0.800	0.028	0.031	
A1	0.000	0.050	0.000	0.002	
A3	0.203	REF.	0.008	REF.	
D	7.924	8.076	0.312	0.318	
E	7.924	8.076	0.312	0.318	
D1	3.500	3.700	0.138	0.146	
E1	3.500	3.700	0.138	0.146	
k	0.200MIN.		0.008	BMIN.	
b	0.150	0.250	0.006	0.010	
е	0.400TYP.		0.016	STYP.	
L	0.324	0.476	0.013	0.019	





11. Document History Record

Version	Date	Description of change
Rev. draft	2012-7-24	Draft version
Rev. 01	201-11-09	 Added register information, power on diagram, reference circuit diagram Modified product packaging information, electricity characteristics







12. Contact information



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