

Specification for TFT

AFY480272A0-4.3INTH-C

Revision D



A	Orient Display
FK	TFT Type
128160	Resolution 480 x 272
A0	Serial A0
4.3	4.3", Module Dimension 105.50 x 67.20 x 4.85 mm
I	IPS Display
N	Top: -30~+70°C; Tstr: -30~+80°C
T	Transmissive
H	High Brightness, 900 cd/m2
C	Capacitive Touch Panel
/	Controller SC7283-G4 Or Compatible
/	CTP Controller GT911 Or Compatible
/	RGB 24bit Interface



REVISION RECORD

[illegible]

CONTENTS

1. GENERAL INFORMATION 4

2. ABSOLUTE MAXIMUM RATINGS 4

3. ELECTRICAL CHARACTERISTICS 5

4. BACKLIGHT CHARACTERISTICS 5

5. TOUCH PANEL CHARACTERISTICS 5

6. EXTERNAL DIMENSIONS 6

7. ELECTRO-OPTICAL CHARACTERISTICS..... 7

8. INTERFACE DESCRIPTION 9

9. AC CHARACTERISTICS 10

10. POWER SEQUENCE..... 15

11. RELIABILITY TEST CONDITIONS..... 17

12. INSPECTION CRITERION 18

Refer to the quality standard on the back of the specification..... 18

13. HANDLING PRECAUTIONS..... 18

14. PRECAUTION FOR USE 19

15. PACKING SPECIFICATION 19

16.HSF COMPLIANCE 19

1. GENERAL INFORMATION

No.	Item	Contents	Unit
1	LCD size	4.3 inch (Diagonal)	/
2	Display mode	IPS/Normally black/Transmissive	/
3	Viewing direction(eye)	Free	/
4	Gray scale inversion direction	-	/
5	Resolution(H*V)	480*272Pixels(TFT)/ 480*272Dots(CTP)	/
6	Module size (L*W*H)	105.50*67.20*4.85	mm
7	Active area (L*W)	95.04*53.86	mm
8	Pixel pitch (L*W)	0.198*0.198	mm
9	Interface type	RGB 24bit interface	/
10	Color Depth	16.7M	/
11	Module power consumption	0.852	W
12	Back light type	White LED	/
13	Driver IC	SC7283-G4 OR COMPATIBLE(TFT) GT911(CTP)	/
14	Weight	TBD	G

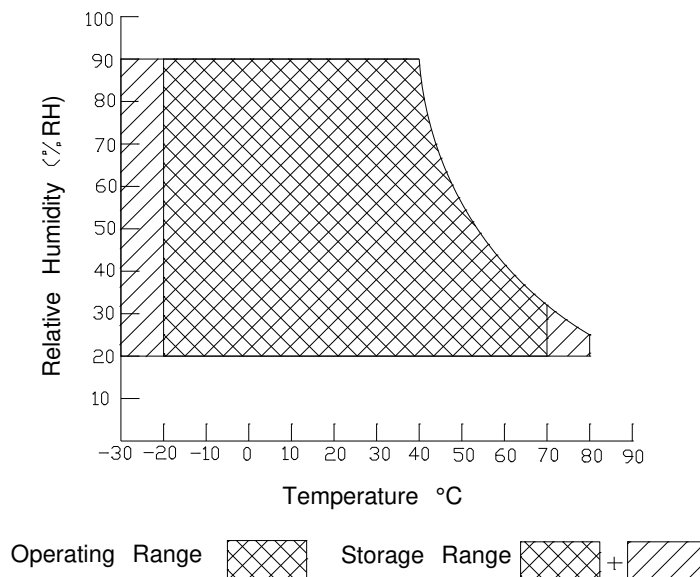
2. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Power supply input voltage for TFT	VDD	-0.3	5.0	V	
Backlight current (normal temp.)	ILED	-	50	mA	
Operation temperature	Top	-20	+70	°C	Note1
Storage temperature	Tst	-30	+80	°C	Note1
Humidity	RH	-	90%	RH	Note1

Note1 :

1).The relative humidity and temperature range are as below sketch,90%RH Max.

2).The maximum wet bulb temperature $\leq 40^{\circ}\text{C}$ and without dewing.



3. ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS (at Ta=25°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power supply input voltage	VDD	2.8	3.3	3.6	V	
I/O logic voltage	VDDIO	3.0	-	3.6	V	
Input voltage 'H' level	VIH	0.7VDDIO	-	VDDIO	V	
Input voltage 'L' level	VIL	VSS	-	0.3VDDIO	V	
Power supply current	IVDD	-	40	-	mA	
TFT gate on voltage	VGH	-	-	-	V	
TFT gate off voltage	VGL	-	-	-	V	
Analog power supply voltage	AVDD	-	-	-	V	
Differential input common mode voltage	Vcom	-	-	-	V	Note1

Note1: The value is just the reference value. The customer can optimize the setting value by the different D-IC

Vcom must be adjusted to optimize display quality, as Crosstalk and Contrast Ratio etc.

CTP DC CHARACTERISTICS (at Ta=25°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power supply input voltage	VCC	2.66	3.3	3.47	V	Note2
Input Power ripple	Vpp	-	-	50	mV	
I/O Signal Voltage	VCCIO	0	-	3.47	V	Note2
Input voltage 'H' level	VIH	0.7VCCIO	-	VCCIO	V	
Input voltage 'L' level	VIL	VSS	-	0.3VCCIO	V	
Operating Current (Normal Mode)	IVCC	-	-	-	mA	
Operating Current (Sleep mode)	IVCC	-	-	-	mA	

Note2: If you need more information of CTP, please refer to our Spec of CTP.

4. BACKLIGHT CHARACTERISTICS

(at Ta=25°C, RH=60%)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED forward voltage	VF	16.8	18.0	19.2	V	
LED forward current	IF	-	40	-	mA	IF=20*2mA
LED power consumption	PLED	-	0.72	-	W	Note1
Number of LED	-		12		PCS	
Connection mode	-	6 in series 2 in parallel			/	
LED life-time	-	20000	-	-	Hrs	Note2

Note1 : Calculator value for reference : IF*VF = PLED

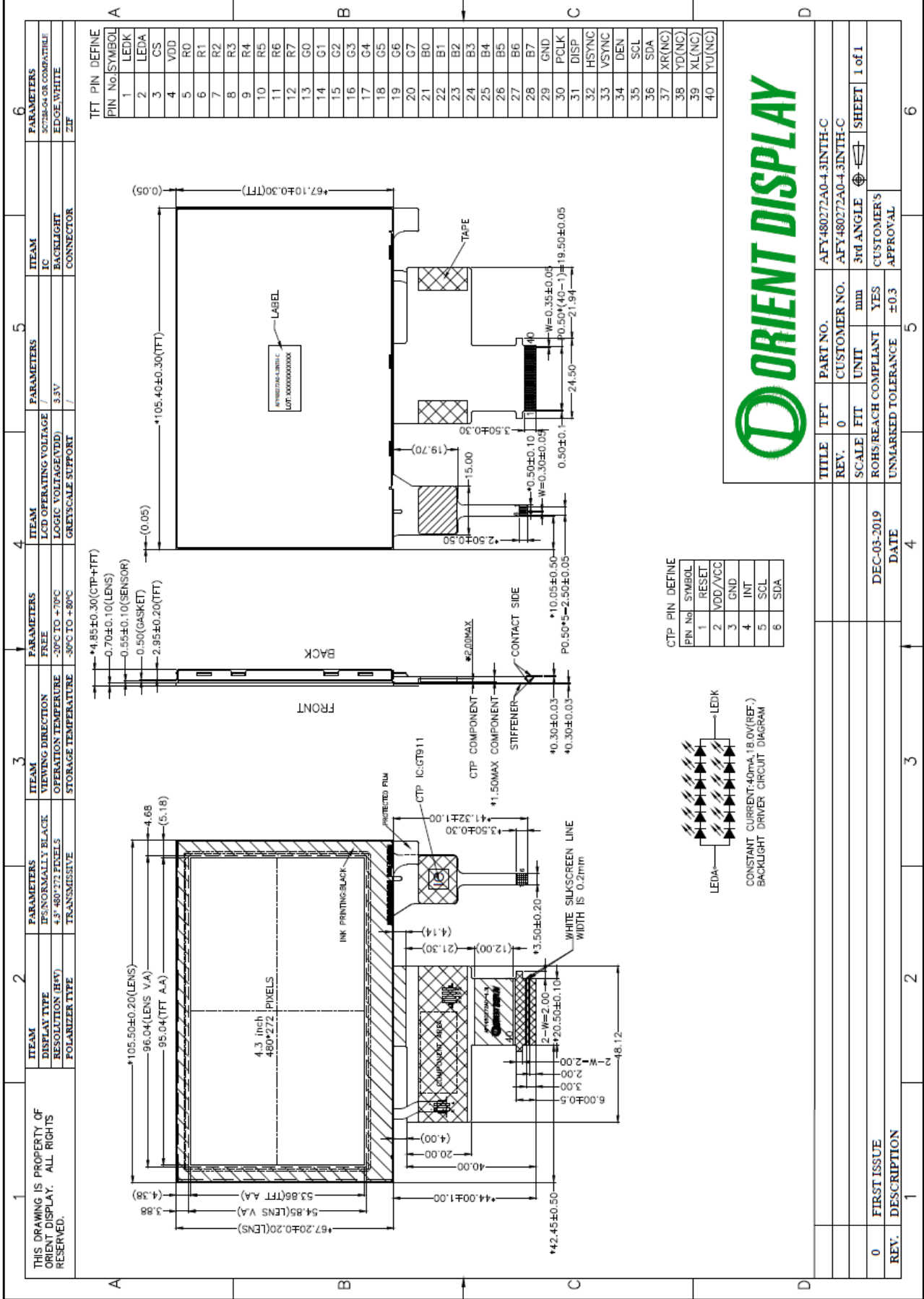
Note2 : The LED life-time define as the estimated time to 50% degradation of initial brightness at Ta=25°C and IF =40mA. The LED lifetime could be decreased if operating IF is larger than 40mA.

5. TOUCH PANEL CHARACTERISTICS

(at Ta=25°C)

Item	Description	Remark
Product Structure	G+G	
Surface Hardness	≤6H	Pencil, Loading 500g, 45 deg
Ball-falling Test	≤100cm	Steel ball weight 64g
Touch Count Max	5 point	
I2C Slave Address*	-	
Origin of Coordinate*	-	
FW version	-	

6. EXTERNAL DIMENSIONS



7. ELECTRO-OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	Note
Response time	Tr+ Tf	-	-	30	40	ms	FIG.1	Note 1
Contrast ratio	Cr		640	800	-	-	FIG.2	Note 2
Surface luminance	Lv	$\theta=0^\circ$	600	900	-	cd/m ²	FIG.2	Note 3
Luminance uniformity	Yu	$\theta=0^\circ$	75	80	-	%	FIG.2	Note 4
NTSC	-	$\theta=0^\circ$	-	50	-	%	FIG.2	Note 5
Viewing angle	θ	$\varnothing=90^\circ$	70	80	-	deg	FIG.3	Note 6
		$\varnothing=270^\circ$	70	80	-	deg	FIG.3	
		$\varnothing=0^\circ$	70	80	-	deg	FIG.3	
		$\varnothing=180^\circ$	70	80	-	deg	FIG.3	
CIE (x,y) chromaticity	Red x	$\theta=0^\circ$ $\varnothing=0^\circ$ Ta=25°C	Typ -0.04	0.60	Typ +0.04	-	FIG.2 CIE1931	Note 5
	Red y			0.35		-		
	Green x			0.36		-		
	Green y			0.59		-		
	Blue x			0.15		-		
	Blue y			0.13		-		
	White x			0.33		-		
	White y			0.38		-		

Note1. Definition of response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%.

And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.

For additional information see FIG.1.

Note2. Definition of contrast ratio

Contrast ratio (Cr) is defined mathematically by the following formula.

For more information see FIG.2.

$$\text{Contrast ratio} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Measured at the center area of the LCD

Note3. Definition of surface luminance

Surface luminance is the luminance with all pixels displaying white.

For more information see FIG.2.

L_v = Average Surface Luminance with all white pixels ($P_1, P_2, P_3, \dots, P_n$)

Note4. Definition of luminance uniformity

The luminance uniformity in surface luminance is determined by measuring luminance at each test position 1 through n, and then dividing the maximum luminance of n points luminance by minimum luminance of n points luminance. For more information see FIG.2.

$$Y_u = \frac{\text{Minimum surface luminance with all white pixels } (P_1, P_2, P_3, \dots, P_n)}{\text{Maximum surface luminance with all white pixels } (P_1, P_2, P_3, \dots, P_n)}$$

Note5. Definition of color chromaticity (CIE1931)

CIE (x,y) chromaticity, The x,y value is determined by screen active area center position P5. For more information see FIG.2.

Note6. Definition of viewing angle

Viewing angle is the angle at which the contrast ratio is greater than 10. angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface.

For more information see FIG.3.

For viewing angle and response time testing, the testing data is base on Autronic-Melchers's ConoScope or DMS series Instruments or compatible. For contrast ratio, Surface Luminance,

Luminance uniformity and CIE, the testing data is based on TOPCON's BM-5 or BM-7 photo detector or compatible.

FIG.1. The definition of response Time

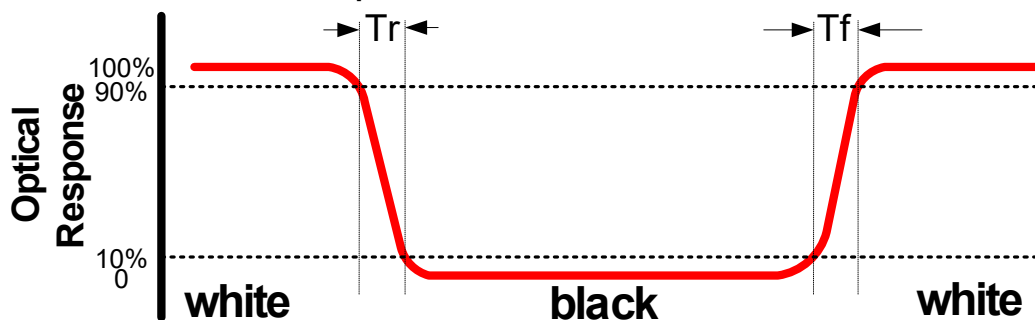


FIG.2. Measuring method for contrast ratio, surface luminance, luminance uniformity, CIE (x,y) chromaticity

H, V : Active area

Light spot size $\varnothing=5\text{mm}$ (BM-5) or $\varnothing=7.7\text{mm}$ (BM-7) 50cm distance or compatible distance from the LCM surface to detector lens.

Test spot position : see Figure a.

measurement instrument : TOPCON's luminance meter BM-5 or BM-7 or compatible ,see Figure b.

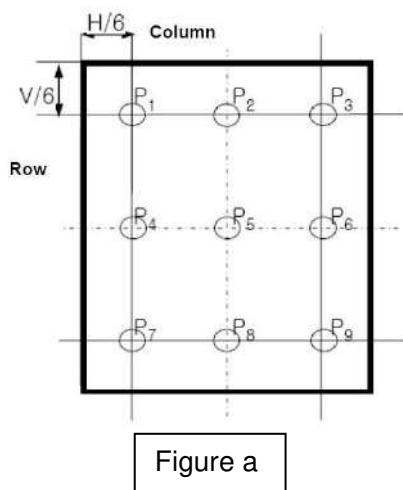


Figure a

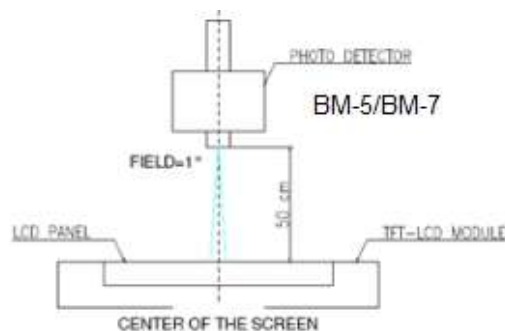
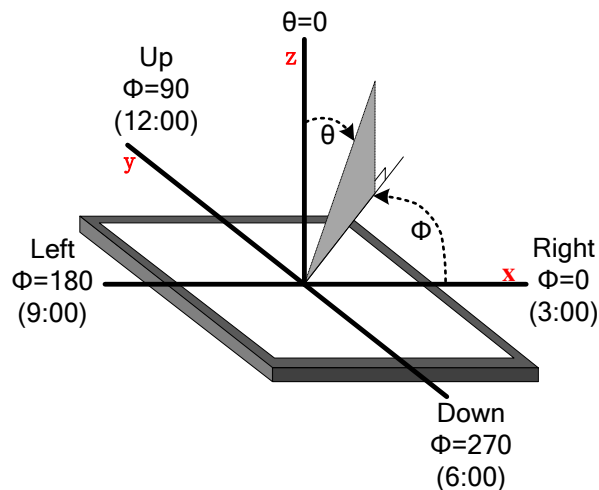


Figure b

FIG.3. The definition of viewing angle



8. INTERFACE DESCRIPTION

8.1 Module Interface description

Interface No.	Name	I/O or connect to	Description
1	LEDK	P	Power for LED backlight(Cathode)
2	LEDA	P	Power for LED backlight(Anode)
3	CS	I	Chip Selected signal When CS=0,the chip is enable.
4	VDD	P	Power for LCD
5-12	R0-R7	I	Red data Bus
13-20	G0-G7	I	Green data Bus
21-28	B0-B7	I	Blue data Bus
29	GND	P	Ground
30	DCLK	I	Dot clock
31	DISP	I	Set display mode. DISP=0:Standby mode. DISP=1:Normal display mode.
32	HSYNC	I	Horizontal sync input.
33	VSYNC	I	Vertical sync input
34	DE	I	Data enable
35	SCL	I	Serial Clock input Signal
36	SDA	I/O	Serial Data input Signal
37	XR(NC)	/	No Connection, the pin float
38	YD(NC)	/	No Connection, the pin float
39	XL(NC)	/	No Connection, the pin float
40	YU(NC)	/	No Connection, the pin float

8.2 CTP Interface description

Interface No.	Symbol	I/O or connect to	Description
1	RESET	I	Reset Pin, Reset="low" Active.
2	VDD/VCC	P	CTP Power Supply
3	GND	P	CTP Ground.
4	INT	I	State change interrupt Signal.
5	SCL	I	I2C Serial O'clock input signal
6	SDA	I/O	I2C Serial data Input signal.

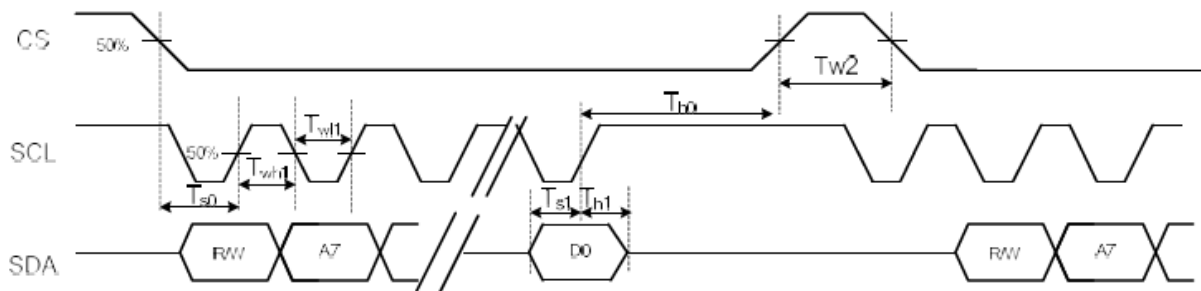
9. AC CHARACTERISTICS

AC Electrical Characteristics (PVDD=VDD=VDDI= 3.3V, AGND= 0V, TA=25°C, Bare Chip)

9.1 System Operation AC Characteristics

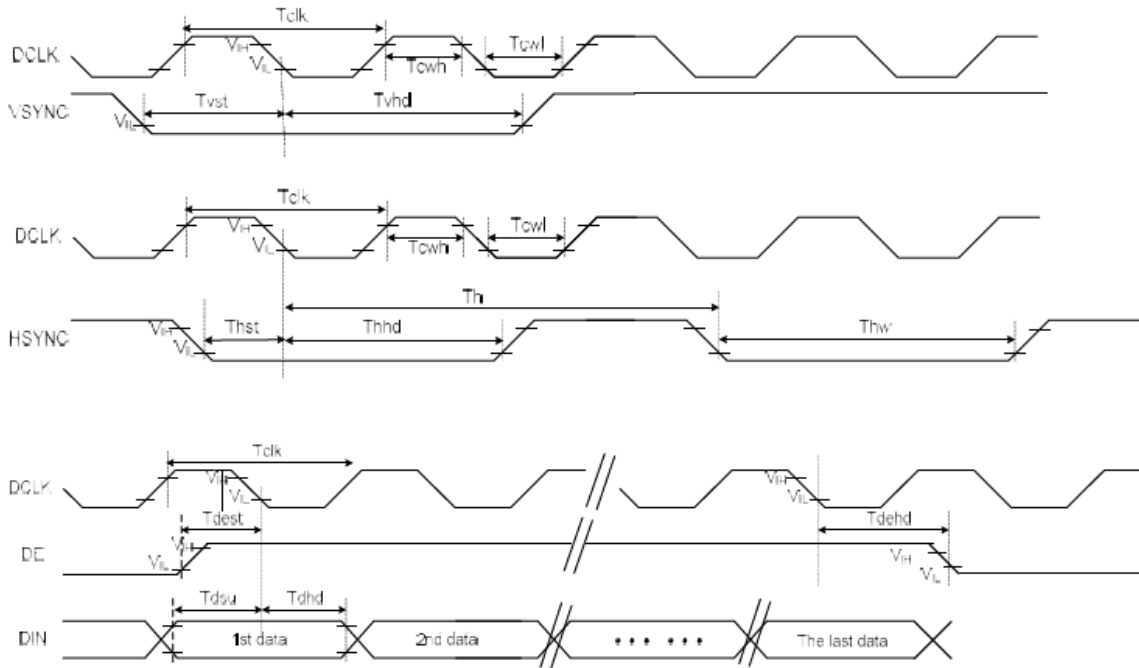
Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
VDD Power Source Slew Time	TPOR	-	-	20	ms	From 0V to 99% VDD
GRB Pulse Width	tRSTW	10	50	-	us	R=10Kohm, C=1uF
SD Output Stable Time	Tst	-	-	12	us	Output settled within +20mV Loading = 6.8k+28.2pF.
GD Output Rise and Fall Time	Tgst	-	-	6	us	Output settled (5%~95%), Loading = 4.7k+29.8pF

9.2 System Bus Timing for SPI-3 Interface



Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
CS Input Setup Time	Ts0	50	-	-	ns	
Serial Data Input Setup Time	Ts1	50	-	-	ns	
CS Input Hold Time	Th0	50	-	-	ns	
Serial Data Input Hold Time	Th1	50	-	-	ns	
SCL Write Pulse High Width	Twh1	50	-	-	ns	
SCL Write Pulse Low Width	Twl1	50	-	-	ns	
SCL Read Pulse High Width	Trh1	300	-	-	ns	
SCL Read Pulse Low Width	Trl1	300	-	-	ns	
CS Pulse High Width	Tw2	400	-	-	ns	

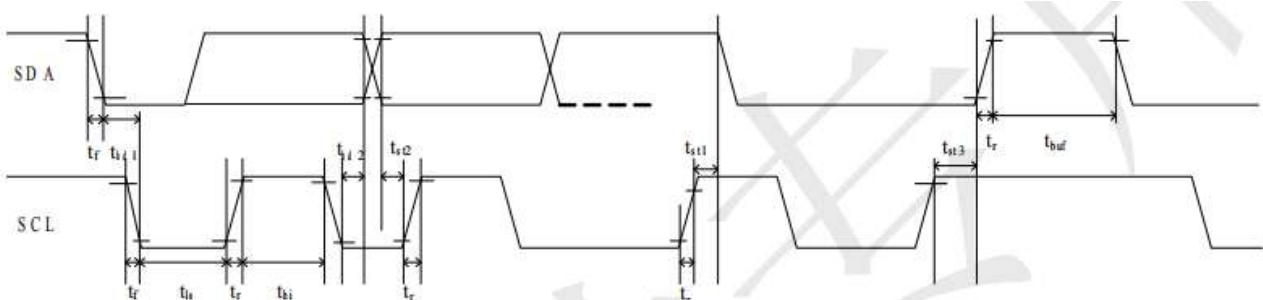
9.3 System Bus Timing for RGB Interface



Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK Pulse Duty	T_{cw}	40	50	60	%	
HSYNC Width	T_{hw}	2	-	-	DCLK	
HSYNC Period	T_h	55	60	65	us	
VSYNC Setup Time	T_{vst}	12	-	-	ns	
VSYNC Hold Time	T_{vhd}	12	-	-	ns	
HSYNC Setup Time	T_{hst}	12	-	-	ns	
HSYNC Hold Time	T_{hhd}	12	-	-	ns	
Data Setup Time	T_{dsu}	12	-	-	ns	
Data Hold Time	T_{dhhd}	12	-	-	ns	
DE Setup Time	T_{dest}	12	-	-	ns	
DE Hold Time	T_{dehd}	12	-	-	ns	

9.4 I2C Communication CCommunication

GT911 provides a standard I2C interface for SCL and SDA to communicate with the host. GT911 always serves as slave device in the system with all communication being initialized by the host. It is strongly recommended that transmission rate be kept at or below 400Kbps. The I2C timing is shown below:



Test condition 1: 1.8V host interface voltage, 400Kbps transmission rate, 2K pull-up resistor

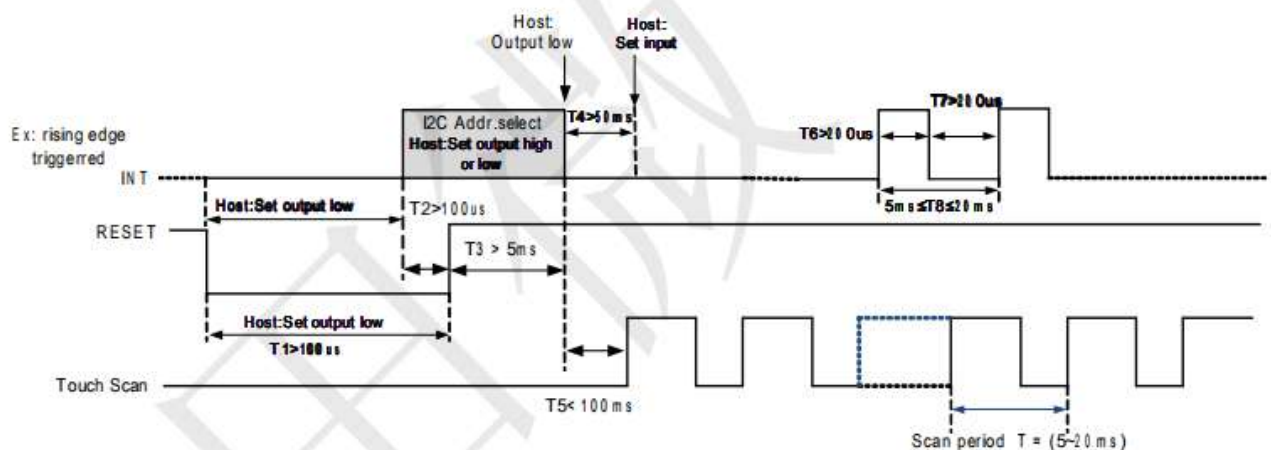
Parameter	Symbol	Min.	Max.	Unit
SCL low period	t_{lo}	1.3	-	us
SCL high period	t_{hi}	0.6	-	us
SCL setup time for Start condition	t_{st1}	0.6	-	us
SCL setup time for Stop condition	t_{st3}	0.6	-	us
SCL hold time for Start condition	t_{hd1}	0.6	-	us
SDA setup time	t_{st2}	0.1	-	us
SDA hold time	t_{hd2}	0	-	us

Test condition 2: 3.3V host interface voltage, 400Kbps transmission rate, 2K pull-up resistor

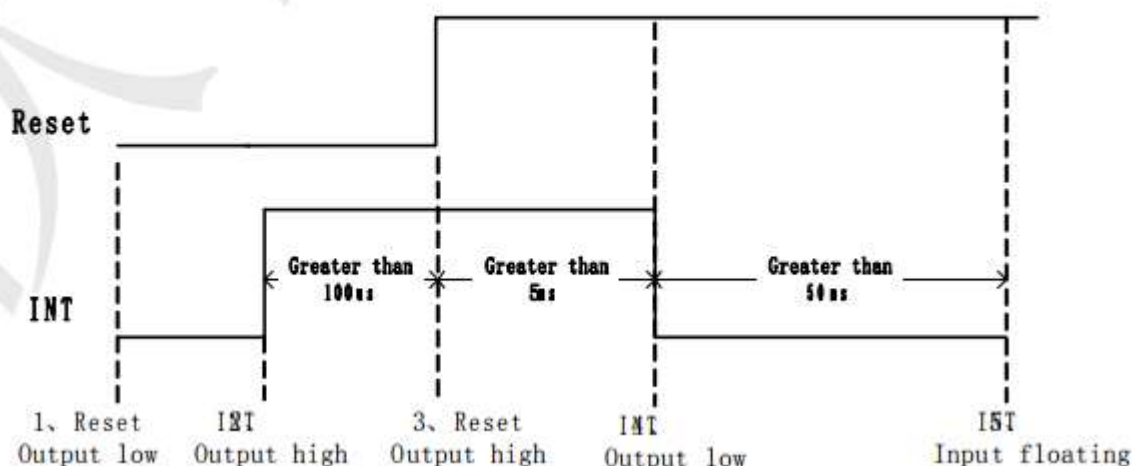
Parameter	Symbol	Min.	Max.	Unit
SCL low period	t_{lo}	1.3	-	us
SCL high period	t_{hi}	0.6	-	us
SCL setup time for Start condition	t_{st1}	0.6	-	us
SCL setup time for Stop condition	t_{st3}	0.6	-	us
SCL hold time for Start condition	t_{hd1}	0.6	-	us
SDA setup time	t_{st2}	0.1	-	us
SDA hold time	t_{hd2}	0	-	Us

GT911 supports two I2C slave addresses: 0xBA/0xBB and 0x28/0x29. The host can select the address by changing the status of Reset and INT pins during the power-on initialization phase. See the diagram below for configuration methods and timings:

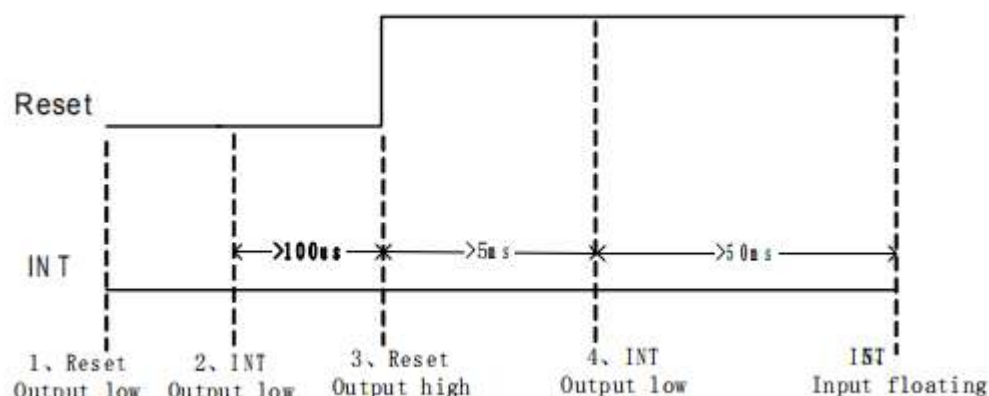
Timing for host resetting GT911:



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



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



a) Data Transmission

(For example: device address is 0xBA/0xBB)

Communication is always initiated by the host. Valid Start condition is signaled by pulling SDA line from "high" to low " when SCL line is high ". Data flow or address is transmitted after the Start condition.

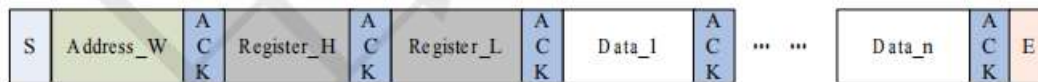
All slave devices connected to I²C bus should detect the 8-bit address issued after Start condition and send the correct ACK. After receiving matching address, GT911 acknowledges by configuring SDA line as output port and pulling SDA line low during the ninth SCL cycle. When receiving unmatched address, namely, not 0xBA or 0xBB, GT911 will stay in an idle state.

For data bytes on SDA, each of 9 serial bits will be sent on nine SCL cycles. Each data byte consists of 8 valid data bits and one ACK or NACK bit sent by the recipient. The data transmission is valid when SCL line is "high"

When communication is completed, the host will issue the STOP condition. Stop condition implies the transition of SDA line from "low" to "high" when SCL line is "high"

b) Writing Data to GT911

(For example: device address is 0xBA/0xBB)



Timing for Write Operation

The diagram above displays the timing sequence of the host writing data onto GT911. First, the host issues a Start condition. Then, the host sends 0xBA (address bits and R/W bit; R/W bit as 0 indicates Write operation) to the slave device.

After receiving ACK, the host sends the 16-bit register address (where writing starts) and the 8-bit data bytes (to be written onto the register).

The location of the register address pointer will automatically add 1 after every Write Operation. Therefore, when the host needs to perform Write Operations on a group of registers of continuous addresses, it is able to write continuously. The Write Operation is terminated when the host issues the Stop condition.

c) Reading Data from GT911

(For example: device address is 0xBA/0xBB)



Timing for Read Operation

The diagram above is the timing sequence of the host reading data from GT911. First, the host issues a Start condition and sends 0xBA (address bits and R/W bit; R/W bit as 0 indicates Write operation) to the slave device.

After receiving ACK, the host sends the 16-bit register address (where reading starts) to the slave device. Then the host sets register addresses which need to be read.

Also after receiving ACK, the host issues the Start condition once again and sends 0xBB (Read Operation). After receiving ACK, the host starts to read data.

GT911 also supports continuous Read Operation and, by default, reads data continuously. Whenever receiving a byte of data, the host sends an ACK signal indicating successful reception. After receiving the last byte of data, the host sends a NACK signal followed by a STOP condition which terminates communication.

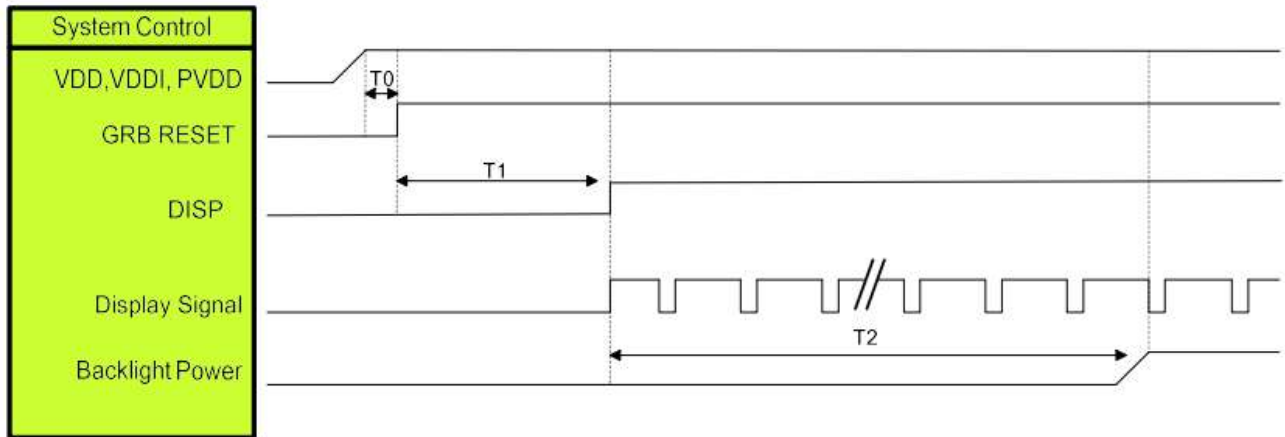
10. POWER SEQUENCE

TFT Module POWER SEQUENCE

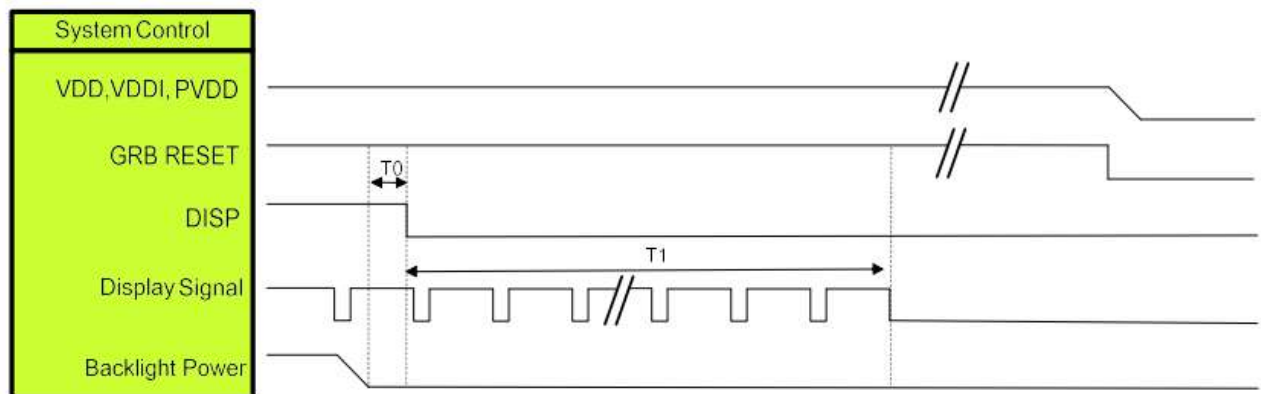
To prevent the device damage from latch up, the power ON/OFF sequence shown below must be followed.

Power ON: VDD, DGND→VDDA; Power OFF: AGND→VDD, DGND

In order to prevent SC7283-G4 from power ON reset fail, the rising time (tPOR) of the digital power supply VDD should be maintained within given specifications. The power ON/OFF timing sequence is illustrated as below:



Symbol	Description	Min. Time	Unit
T0	System power stability to GRB RESET signal	0	ms
T1	GRB RESET= "High" to DISP="High"	10	ms
T2	Display Signal output to Backlight Power on	250	ms



Symbol	Description	Min. Time	Unit
T0	Backlight Power off to DISP="Low"	5	ms
T1	DISP="Low" to IC internal voltage discharge complete	80	ms

11. RELIABILITY TEST CONDITIONS

No.	Test item	Test condition		Inspection after test
11.1	High temperature storage test	+80°C/240 hours		Inspection after 2~4hours storage at room temperature, the sample shall be free from defects : 1.Current changing value before test and after test is 50% larger; 2. Function defect : Non-display,abnormal-display,missing lines, Short lines,ITO corrosion; 3.Visual defect : Air bubble in the LCD,Seal leak,Glass crack.
11.2	Low temperature storage test	-30°C/240 hours		
11.3	High temperature operating test	+70°C/120 hours		
11.4	Low temperature operating test	-20°C/120 hours		
11.5	Temperature cycle storage test	-30°C ~ 25°C ~ +80°C/10cycles (30min.) (10min.) (30min.)		
11.6	High temperature high humidity test	+50°C*90% RH/120 hours		
11.7	Vibration test	Frequency : 250 r/min Amplitude : 1 inch Time: 45min		
11.8	Drop test	Drop direction: 1 corner/3 edges/6 sides 10 time		
		Packing weight(kg)	Drop height(cm)	
		<11	80±1.6	
		11≤G<21	60±1.2	
		21≤G<31	50±1.0	
		31≤G<40	40±0.8	
11.9	ESD test	Air discharge: ±8KV, 10time Contact discharge: ±4KV, 10time		

Remark :

- 1.The test samples should be applied to only one test item.
- 2.Sample size for each test item is 3~5pcs.
- 3.For High temperature high humidity test, Pure water(Resistance>10MΩ) should be used.
- 4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
- 5.B/L evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence B/L has.
- 6.Failure judgment criterion: Basic specification, Electrical characteristic, Mechanical characteristic, Optical characteristic.
- 7.After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

12. INSPECTION CRITERION

Refer to the quality standard on the back of the specification

13. HANDLING PRECAUTIONS

13.1 Mounting method

The LCD module consists of two thin glass plates with polarizers which easily be damaged. And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

13.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent [recommended below] and wipe lightly :

- .Isopropyl alcohol
- .Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent :

- .Water
- .Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated :

- .Soldering flux
- .Chlorine (Cl) , Sulfur (S)

If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happens by miss-handling or using some materials such as Chlorine (Cl), Sulfur (S) from customer, Responsibility is on customer.

13.3 Caution against static charge

The LCD module uses C-MOS LSI drivers, so we recommend that you :

Connect any unused input terminal to Vdd or Vss, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

13.4 Packing

Module employs LCD elements and must be treated as such.

- .Avoid intense shock and falls from a height.
- .To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity.

13.5 Caution for operation

●.It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit causes the shorter LCD life.

●.An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.

●.Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.

●.If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.

●.A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

●.Usage under the maximum operating temperature, 50%Rh or less is required.

●.When fixed patterns are displayed for a long time, remnant image is likely to occur.

13.6 Storage

In the case of storing for a long period of time for instance, for years for the purpose of replacement use, the following ways are recommended.

●.Storing in an ambient temperature 10°C to 30°C, and in a relative humidity of 45% to 75%. Don't expose to sunlight or fluorescent light.

●.Storing in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with no desiccant.

●.Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.

- .Storing with no touch on polarizer surface by the anything else.

It is recommended to store them as they have been contained in the inner container at the time of delivery from us.

13.7 Safety

- .It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- .When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

14. PRECAUTION FOR USE

14.1 A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

14.2 On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- .When a question is arisen in this specification.
- .When a new problem is arisen which is not specified in this specifications.
- .When an inspection specifications change or operating condition change in customer is reported to ODNA, and some problem is arisen in this specification due to the change.
- .When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

15. PACKING SPECIFICATION

Please consult our technical department for detail information.

16.HSF COMPLIANCE

- .This products complies with ROHS 2011/65/EU and 2015/863/EU 、 REACH 1907/2006/EC requirements, and the packaging complies with 94-62-EC.



Inspection Criterion for TFT Products

Revision Record			
Section	Revision Summary	Rev.	Effective Date
	First Issue	V1.0	2016-1-22
6.2.1	Revise dot/line defect inspection criterion	V1.1	2016-3-29
6.2.6	Add Isolation point definition	V1.1	2016-3-29
The full text	1.Update humidity control; 2.Update the definition of VA area and AA area, the defect type of VA area and AA area; 3.Add 5.10 to the touch screen and display size of different products.: The defects of TFT screen are determined according to the corresponding TFT screen size.; The defects in TP VA area are determined according to the corresponding criteria of the corresponding VA area, and the outside of the VA area is determined by the dimension standard 4.Update industrial control class, non-industrial control point/line standard; 5.Update lens surface AG/AR product standard 6.Update ink leakage, FPC gold finger, protective film laminated bubble, PC board, double-sided adhesive, anti-explosion film, AG film, edge arrester, spillage, OCF crystal point and other control standards;	V2.0	2017-7-20

1. Objective

The CTP test criterion are set to formalize CTP quality standards for ONDA with reference to those of the customer for inspection, release and acceptance of finished CTP products in order to guarantee the quality of CTP products required by the customer.

2. Scope

This specification is applicable to capacitive touch panel manufactured by ODNA.

3. Equipment for Inspection

lamp-box、ionizing fan、10X microscopes、film card、alcohol/oil ether/acetone、finger cots、vernier caliper、anti-static wrist straps、microcalliper、feeler、pencil hardness tester、spectrophotometer、drop ball test,etc.

4. Sampling Plan and Reference Standards

Sampling plan:Refer to National Standard GB/T 2828.1---2012/ISO2859-1:1999, level II of normal levels:

MA=0.4 MI=1.0

5. Inspection Conditions and Inspection Reference

5.1. Inspection environment: temperature: $23\pm3^{\circ}\text{C}$; humidity: 40~70%RH; cleanness: 10000 grade;

5.2 .Inspection distance: 30cm \pm 5cm;

5.3. Inspection angle: vertical rotate angle: $\pm 45^{\circ}$, up->down;horizontal rotate angle: $\pm 45^{\circ}$,left->right

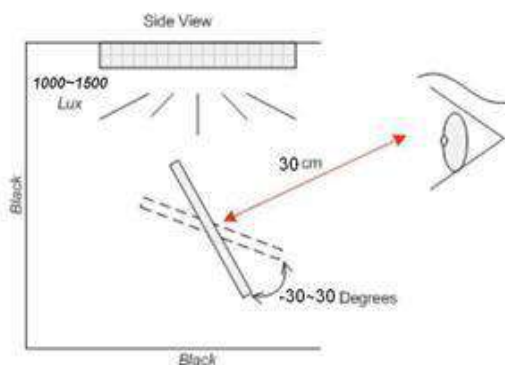
5.4 .Inspection luminance :

(1) appearance inspection: Inspection luminance is 800~1200Lux

5.5 background: white/black

5.6. Inspection time : 10~15s/ pcs;

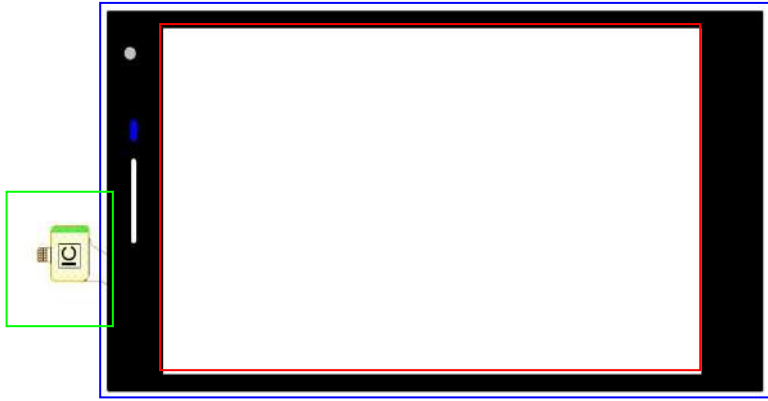
Black Booth or Black Background



5.7.2 VA area: Visual Windows area (refer to below sketch Red blank);

5.7.3 Area A: visual area from front side view((refer to below sketch Blue blank))

5.7.4 Area B: four sides and FPC area((refer to below sketch Green blank))



5.7. Undefined items or other special items, refer to mutual agreement and limited sample. If criterion does not match product specifications/ technical requirement, both should be subject to special inspection criterion agreed by customer.

5.8 Defect define:

5.8.1 Defect in AA area: pixel defect, function defect (no display, miss line, dark line, wrong polarizer angle, image retention, flicker, abnormal display, dim/bright display, Contrast ratio, dot defect (white dot, black dot, dark dot, Convex-concave point, bubble, foreign material), visual line defect (fiber, scratch, foreign material), stain and so on

5.8.2 Defect in VA area: dot defect (white dot, black dot, dark dot, Convex-concave point, bubble, foreign material), visual line defect (fiber, scratch, foreign material), stain and so on

5.8.3 Defect in A area: Line defect (scratch, soft flocks, fibre), dot defect (white dot, black dot, same color dot, different color dot, dust, bubble), surface stain, pin-hole, light leak, scratch.

5.8.4 Defect in B area: Broken, crack/chipping, FPC defect

5.9 Undefined items or other special items, refer to mutual agreement and limited sample. If criterion does not match product specifications/ technical requirement, both should be subject to special inspection criterion agreed by customer.

5.10. To the touch screen and display size of different products: The defects of TFT screen are determined according to the corresponding TFT screen size.; The defects in TP VA area are determined according to the corresponding criteria of the corresponding VA area, and the outside of the VA area is determined by the dimension standard.

6. Defects and Acceptance Standards

6.1 Function defect for TP

6.1 .1Electrical properties test

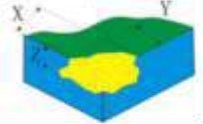

Check in ODNA tester. The program will release result automatically. There are “OK”、 “PASS” 、 “NG”and the final judgment must be“OK”“PASS”,and we need to pass the draw line test.

Refer to 《**serie IC test program》

No.	Defects	Descriptions	Accepted standard	MAJ	MIN
6.1.1	Short	Measured data has much difference compared with normal;line is not stable	Reject	√	
6.1.2	Open	Measured data has no change.Line is open	Reject	√	
6.1.3	No reaction	No reaction and there is no line in screen	Reject	√	
6.1.4	Mis-display/ abnormal display	Screen has display but line is open or bent	Reject	√	
6.1.5	Button no reaction	Press the button but no reaction	Reject	√	
6.1.6	Button not correct	Press the button. Reaction is not stable	Reject	√	

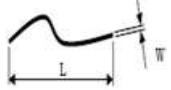
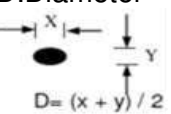
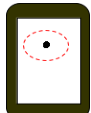
6.2 Appearance inspection

6.2.1lens breakdown standard

Defect	≤5”	5~10”	10~15”	>15”	Accepted standard	MAJ	MIN
LENS breakage 	X≤0.3mm, Y≤0.3mm, one side ≤1	X≤0.3mm, Y≤0.4mm, one side≤1	X≤0.4mm, Y≤0.4mm, one side≤1	X≤0.5mm, Y≤0.5mm, one side≤1	Accept		√
	X>0.3mm, Y>0.3mm	X>0.3mm, Y>0.4mm	X>0.4mm, Y>0.4mm	X>0.5mm, Y>0.5mm	Reject		√
Sensor breakage	Not affect ITO line, not lengthen,function test is OK And be non-visual after attaching Lens				Accept		√
	affect ITO line and be visual				Reject		√
Glass crack 	Crack lengthen to outside				Accept		√
	Crack lengthen to inside				Reject		√




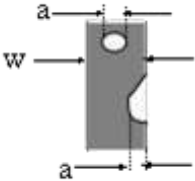
6.2.2 special lens standard

Lens thickness is greater than or equal to 1.8mm product (with/without ink printing)

Defect	≤5"	5~10"	10~15"	>15"	Accepted standard
S/C , line defect W:width L:length 	W≤0.08 ignore except dense		W≤0.1 ignore except dense		accept
	0.08<W≤0.15 L≤18 mm; N≤3 0.15<W≤0.3 L≤18; N≤2	0.08<W≤0.15 L≤20mm; N≤3 0.15<W≤0.3 L≤20mm; N≤3	0.1<W≤0.2 L≤25mm; N≤4 0.2<W≤0.5 L≤25mm; N≤3	0.1<W≤0.2 L≤30mm; N≤5 0.2<W≤0.5 L≤30mm; N≤4	accept
	W>0.3, L>18	W>0.3, L>20	W>0.5mm, L>25mm	W>0.5mm, L>30mm	reject
Dot defect D:Diameter  	D≤0.2mm Ignore, except dense	D≤0.2mm Ignore, except dense	D≤0.3mm Ignore, except dense	D≤0.3mm Ignore, except dense	accept
	0.2<D≤0.25, N≤2	0.2<D≤0.5, N≤5	0.3<D≤0.8, N≤5	0.3<D≤0.8, N≤6	accept
	D>0.25mm	D>0.50mm	D>0.80mm	D>0.80mm	reject
Side damage	X ≤0.5 mm Y ≤0.5 mm Z≤1/2 T Unilateral:N≤1	X ≤0.5 mm Y≤0.5 mm Z≤1/2 T Unilateral:N≤1	X ≤0.5 mm Y≤0.5 mm Z≤1/2 T Unilateral:N≤2	X ≤0.5 mm Y≤0.5 mm Z≤1/2 T Unilateral:N≤2	accept
Angle damage	X ≤0.5 mm Y≤0.5 mm Z≤1/2 T, Unilateral:N≤1				accept
Glass crack	The crack is extended to the outer edge and is calculated according to the collapse; Progressive cracks extending to the inner edge are not allowed				
Sand edge	W≤0.25mm, ignore; W>0.25mm, reject				
Sawtooth	The width of the sawtooth near the VA area : W≤0.3mm, allow, W>0.3 mm, reject;				
Main color ink light leak	Edge area leakage width: W≤0.25mm Only unilateral leakage is allowed; Edge area leakage width>0.25mm reject				
Screen printing	W≤0.15mm, allow, W>0.15mm, reject				
Main color ink pinhole	Outside the 2mm edge of the VA area, Reflection conditions check for invisible permission, Any pinholes are not allowed within 2mm of the area of the VA area				
Defects in the main color ink layer	The ink layer has fiber, impurity reference visual area standard; Standards for scratch within the ink layer: 0.05mm<W≤0.08mm, L≤3mm, N≤1, allow; W>0.08mm, L>3mm, reject				
Ink pattern spillage	D≤0.15mm; N≤2, allow; D>0.15mm, reject				
Ink pattern gap	Gap width≤1/4h (h is the height of the pattern) or gap width≤1/2w (w is the width of the pattern) allow				
Dirty mark	Printing main color stain W≤0.3mm ignore, Not visible under fluorescent lamps, allow; Printing main color stain W>0.3mm, visible under fluorescent lamps, reject				
IR semi-permeable area ink pinhole	D≤0.15mm, N≤1, allow; D>0.15mm, reject;				

IR semi-permeable area ink color difference	Reflector is not visible in black background, acceptable
IR semi-permeable area ink internal impurities	$D \leq 0.35\text{mm}$; $N \leq 5$, allow; $D > 0.35\text{mm}$; $N > 5$, reject
Note: 1. 5 or more defects within 10mm are called intensive. (intensive defects: not allowed). The spacing of all defects is 10mm 2. inspection distance: $750 \pm 50\text{mm}$, if appearance is invisible, ignore	

6.2.3 . FPC defect

Defect	Description	Accepted standard	MAJ	MIN
FPC folding 	FPC is folding and can not restore-> Reject FPC is folding and can restore->compare with limited sample	Reject		√
FPC cover layer defect	FPC cover layer peeling off	Reject		√
FPC color shift and bubble	PI layer have color shift or bubbled due to high welding temperature or long welding time.	Reject		√
Golden finger defect 	peeling off、bonding deformed、glue remained、oxidized, stained	Reject		√
Joggle defect 	bent, broken, peeling off	Reject		√
FPC defect 	(golden finger) dented, pin hole $a \leq w/3$	Accept		√
	open/scratch/cracked/Gold finger has glue/FPC surface has glue accumulation	Reject		√
	oxidized, stained	Reject		√
FPC loophole	In the protected line area Or not affecting normal lines, The soft batch $\leq 2.5\text{mm}$, accept, Hard board (PCB, PC, steel sheet reinforcing plate) The soft batch $\leq 1.0\text{mm}$ Or less than half of the edge of the wire to the edge (Take a smaller value)	Accept		√

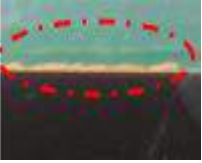
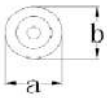
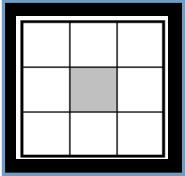
6.2.4. Attaching defect (protective film/adhesive tape/foam/PC...)

Defect	Description	Accepted standard	MAJ	MIN
High temperature glue paper	1.Glue paper attached in FPC doesn't cover component or FPC cove layer. 2.Glue paper attached in golden finger doesn't cover golden finger or peel off	Reject		√
Protective film	Clean、 attaching flat、 no shifting or bubble	Accept		√
	Protective film attaching bubble in VA: D≤2.0mm N≤5 distance≤20mm	Accept		√
	Protective film attaching bubble in VA: D>2.0mm N>5 distance>20mm	Reject		√
Tape	Attach position refer to the drawing	Accept		√
Foam	1. Follow the drawings first 2. If the drawings are not specified in size, refer to the following requirements Gap spec:0.5+/-0.5mm, foam must be smaller than sensor edge side and can not enter into VA.	Accept		√
PC board/ adhesive tape	Tape must be smaller than LENS edge side and can not be folding ,dent or shifting.Do not obstruct the hole;	Accept		√
Anti-explosion fim/Anti-glare film/blue film/AG film	Impression print refer to the limited sample	Accept		√
	Attach position refer to the drawing	Accept		√
	The bubbles are not allowed in the OCA rubber layer, and the bubbles are ignored between the lens and the AG layer or the explosion-proof film layer	Accept		√

6.2.5. Metal frame (Metal Bezel)

No.	Item	Description	Accepted criterion	MAJ	MIN
6.2.7.1	Material & surface treatment	Metal frame/surface treatment do not conform to the specifications.	Rejected	√	
6.2.7.2	Tab twist Unconformity/ Tab not twisted	Wrong twist method or direction and twist tabs are not twisted as required.	Rejected	√	
6.2.7.3	Bezel paint loss	Scratch/paint loss/Bezel surface concave-convex dot/dent	1.Front surface: Paint peel off and scratch to the bottom Dot:D≤0.5mm, exceeds 3; Line:L≤3.0mm,W≤0.05mm exceeds 2;	√	
6.2.7.4	Bezel scratch		2.Front dent, air bubble and side with paint peeling off scratch to the bottom Dot: D≤1.0mm, exceeds 3; Line:L≤3.0mm,W≤0.05mm , exceeds 2;	√	
6.2.7.5	Painting peel off, discoloration,dent, and scratch			√	
6.2.7.6	Burr	Burr(s) on metal bezel is so long as to get into viewing area.	Rejected	√	

6.2.6. Others

Defect	Description	Accepted standard	MAJ	MIN
Glue flow 	Insulation oil flow in VA area	Reject		√
	ACF/insulation oil flow in VA area	Reject		√
	Sensor edge side glue flow	Accept		√
IC/FPC gap glue	FPC gap glue:cover FPC connect point totally IC glue: cover IC line connect totally	Accept		√
	Glue height : follow the technology spec	Accept		√
Newton circles (rainbow) 	Circles quantity> 2	Reject		√
Layering	LENS/Sensor layering	Reject	√	
Surface	Stain defect which can be removed by cleaning solvent and cloth Defect quantity≤10% Lot total quantity->Accept Remark: defect product which is sorted out by AQL is not included in the 10% part.Unmovable stain refer to 6.1.1 specification.	Reject		√
Isolation point  VA diagram	Gray area In 8X8mm area, all isolation points are missing	Reject		√
	White area In 15X15mm area,all isolation points are missing	Reject		√
	5mm within VA (black area) , isolation points missing ->Ignored	Accept		√
	Isolation points are overlaid	Accept		√

6.3 .Function inspection standard for TFT-LCM final goods

6.3.1 normal defect in TFT screen

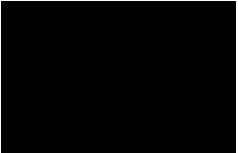
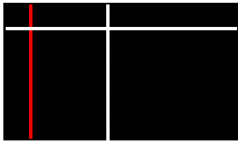
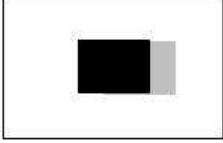

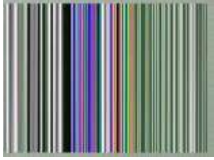
Defects	Inspection Criterion	Pictures	Inspection method/tools	Defect category
No display /reaction	shows no picture/display in normal connected situation. ->Rejected		Naked eyes/ testers	MA
Missing segment	Shows missing lines in normal display		Naked eyes/ testers	MA

Image retention (sticking)	The previous picture stays in the next picture. Disappear time <10s, OK; time>10s, NG		Naked eyes/ testers	MA
----------------------------	---	---	---------------------	----

Flicker	Not accepted		Naked eyes/ testers	MA
Display abnormal	Not accepted		Naked eyes/ testers	MA
Display dim/bright	Refer to limited sample	/	Naked eyes/ limited sample	MA
Contrast	Refer to limited sample	/	Naked eyes/ limited sample	MA
White dot	Refer to dot criterion	/	Naked eyes	MI
White speckle	Refer to limited sample	/	Naked eyes/ limited sample	MI
Yellow speckle	Refer to limited sample	/	Naked eyes/ limited sample	MI


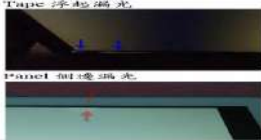
6.3.2 LCD pixel dot defect in TFT screen (defect category: MI)

Item	Inspection criterion			
Size	S <5"	5≤S< 10"	10≤S< 15"	>15"
Color pixel dot defect(RGB dot)	1	2	2	3
2 connected bright dot	0	0	1	1
3 connected bright dot or more	0	0	0	0
Bright dot quantity	1	2	3	4
Random dark dot quantity	2	3	4	5
2 connected dark dot	1	1	2	2
3 connected dark dot or more	0	0	0	0
Dark dot quantity	3	4	5	6
Multi-bright dot	ND 5% hidden, OK			
Remark: 2 bright dots distance DS≥15mm 2 dark dots distance DS≥5mm				
1) Bright dot: Power on TFT and RGB dot in black display				
2) Dark dot: Power on TFT and gray or black dot in RGB display				
3) Multi-bright dot: Power on TFT and fluorescent tiny dot in black display(only visible in black display)				

6.3.3 Backlight components

Item	Description	Accepted criterion	MAJ	MIN
No backlight wrong Color	/	Rejected	√	
Color deviation	When powered on, the LCD color differs from its sample and found that the color not conforming to the drawing after testing.	Refer to sample and drawing.		√
Brightness deviation	When powered on, the LCD brightness differs from its sample and is found after testing not conforming to the drawing; or if it conforms to the drawing but the brightness over $\pm 40\%$ than its typical value.	Refer to sample and drawing.		√
Uneven brightness	Uneven on the same LCD and out of the specification of the drawing. The no specification evenness= (the max value-the min value)/ mean value $< 70\%$.	Refer to sample and drawing.		√
Spot/line /scratch	When power on, it has dirty spot, scratches and so on spot and line defects.	Refer to dot/line standard		√

6.3.4. Others

Item	Description	Accepted criterion	MAJ	MIN
Assembly foreign material	Dot/linear stain after assembly backlight and diffuse film TP assembly foggy stain	Invisible when power on->OK Refer to 6.1.1 dot/line spec		√
Product mark	Missing, unclear, incorrect, or misplaced part	Rejected		√
Newton's rings	Area $< 1/6$ screen area quantity ≤ 1	Accepted		√
Mura	1.In black display ND 5% invisible ->OK; visible->NG 2.Naked eyes inspection RGB display invisible Black display, area $< 1/4$ screen area	Refer to limited sample 		√
Light leak	1.LCD edge (near backlight) shadow by LCD lamps irregular illuminate 2.Judge in black/white/gray display (slight leaky is yellowish,greenish, blueish ->NG) ; 	Refer to limited sample		√
Polarizer	1.Polarizer slant.Cover VA and not over LCD edge 2.No unmovable stain or finger print	Accepted		√

	in polarizer VA 3.Bubble/warped but not enter VA			
--	---	--	--	--

6.4.General Appearance and Dimension(Major)

Common inspection equipment :micro calliper 、 vernier caliper 、 pencil hardness tester 、 spectrophotometer 、 drop ball test and etc.

Items	Spec
Dimension	According to drawing
Curl	≤0.3% -> OK, "S" curl ->NG
Surface hardness	According to drawing
VA TT (550nm)	According to drawing
IR TT-- (550nm & 850nm)	According to drawing
Intensity (drop ball test)	According to drawing

Remark: the criterion is common for all product and if some components are not included, just ignore it.

7. Others

Items not specified in this document or released on compromise should be inspected with reference to mutual agreement and limit samples.