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TFT Display Module

Part Number

E90RG88048LB6M400-C

Overview

Display area: 230mm x 146.50mm (800 X 480)

3.3V, 16/18/24-bit RGB Interface, White
LED backlight, Bottom view, Wide temp,
Transmissive-Normally White, Capacitive
Touch Screen, CTP Driver: GT9271, 400
NITS, RoHS Compliant

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General Description

* Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 9.0'TFT-LCD contains 800x480 pixels, and can display up to 65K/262K/16.7M colors.

* Features

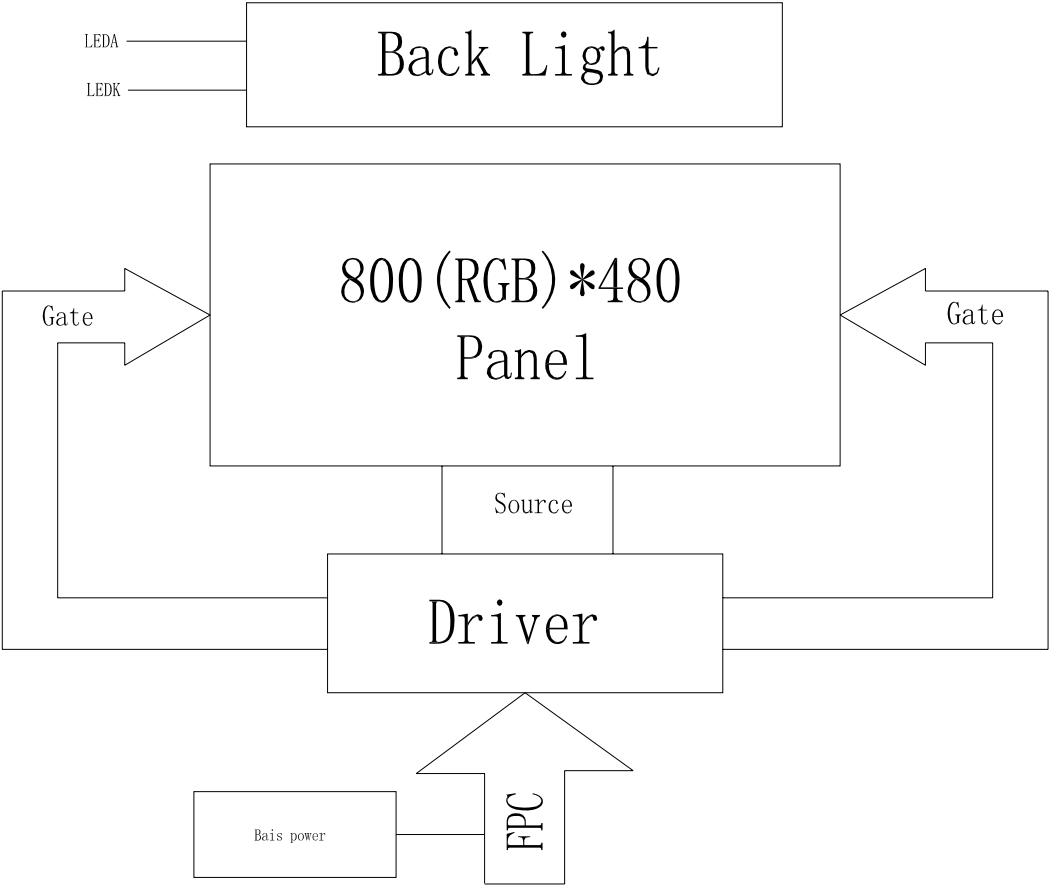
- Low Input Voltage: 3.3V (TYP)
- Display Colors of TFT LCD: 65K/262K/16.7M colors
- TFT Interface: 16/18/24 bit RGB
- CTP Interface: I2C

General Information Items	Specification	Unit	Note
	Main Panel		
TFT Display area(AA)	198.00 (H)* 111.696 (V) (9.0inch)	mm	-
CTP View area	199.00 (H)* 111.70 (V)	mm	
Driver element	TFT active matrix	-	-
Display colors	65K/262K/16.7M	colors	-
Number of pixels	800(RGB)*480	dots	-
TFT Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.2327 (H)*0.2327(V) mm	mm	-
Viewing angle	6:00	o'clock	-
CTP Driver IC	GT9271		
Simultaneous Touch Points	10		
Display mode	Transmissive/ Normally White	-	-
Operating temperature	-20~+70	°C	-
Storage temperature	-30~+80	°C	-

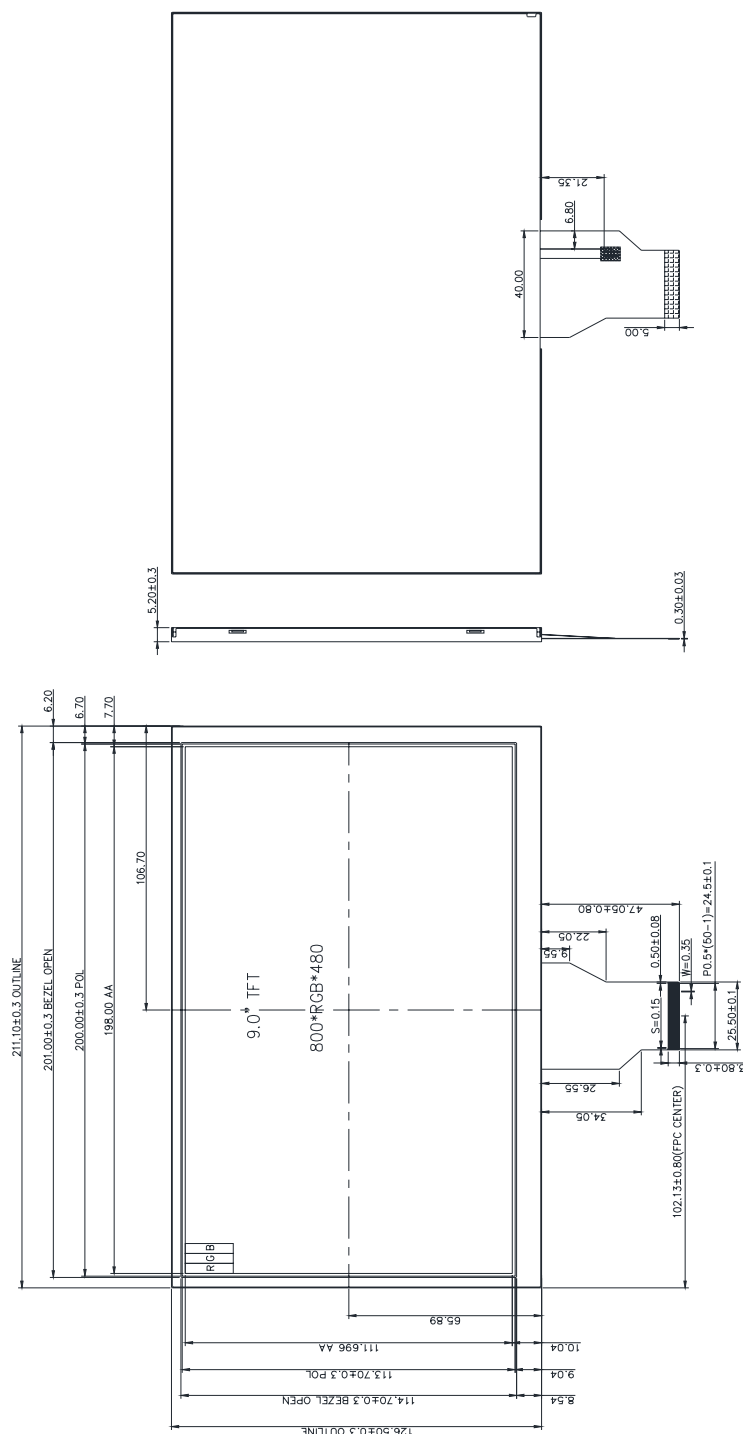
* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)		230.00		mm	-
	Vertical(V)		146.50		mm	-
	Depth(D)		7.53		mm	-
Weight			TBD		g	-

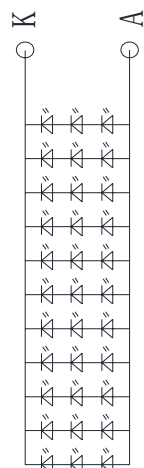
1. Block Diagram



2.1 LCM



NO.	Pin Name
1	VLED+
2	VLED+
3	VLED-
4	VLED-
5	GND
6	VCOM
7	DVDD
8	MODE
9	DE
10	VS
11	HS
12	B7
13	B6
14	B5
15	B4
16	B3
17	B2
18	B1
19	B0
20	G7
21	G6
22	G5
23	G4
24	G3
25	G2
26	G1
27	G0
28	R7
29	R6
30	R5
31	R4
32	R3
33	R2
34	R1
35	R0
36	GND
37	CLK
38	3D
39	L/R
40	U/D
41	VGH
42	VGL
43	AVDD
44	RESET
45	NC
46	VCOM
47	DITH
48	GND
49	NC
50	NC



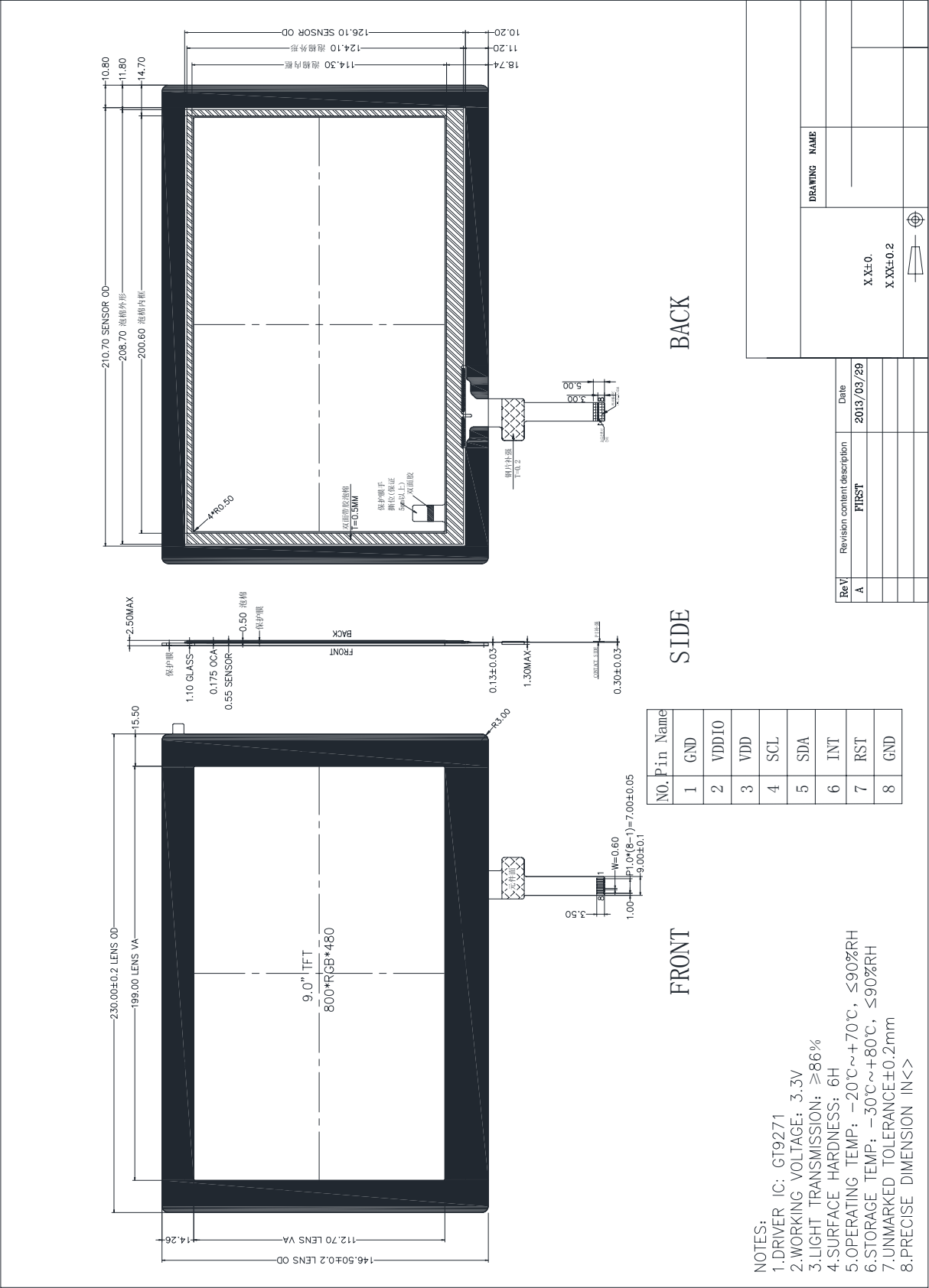
B/L Circuit

NOTES:

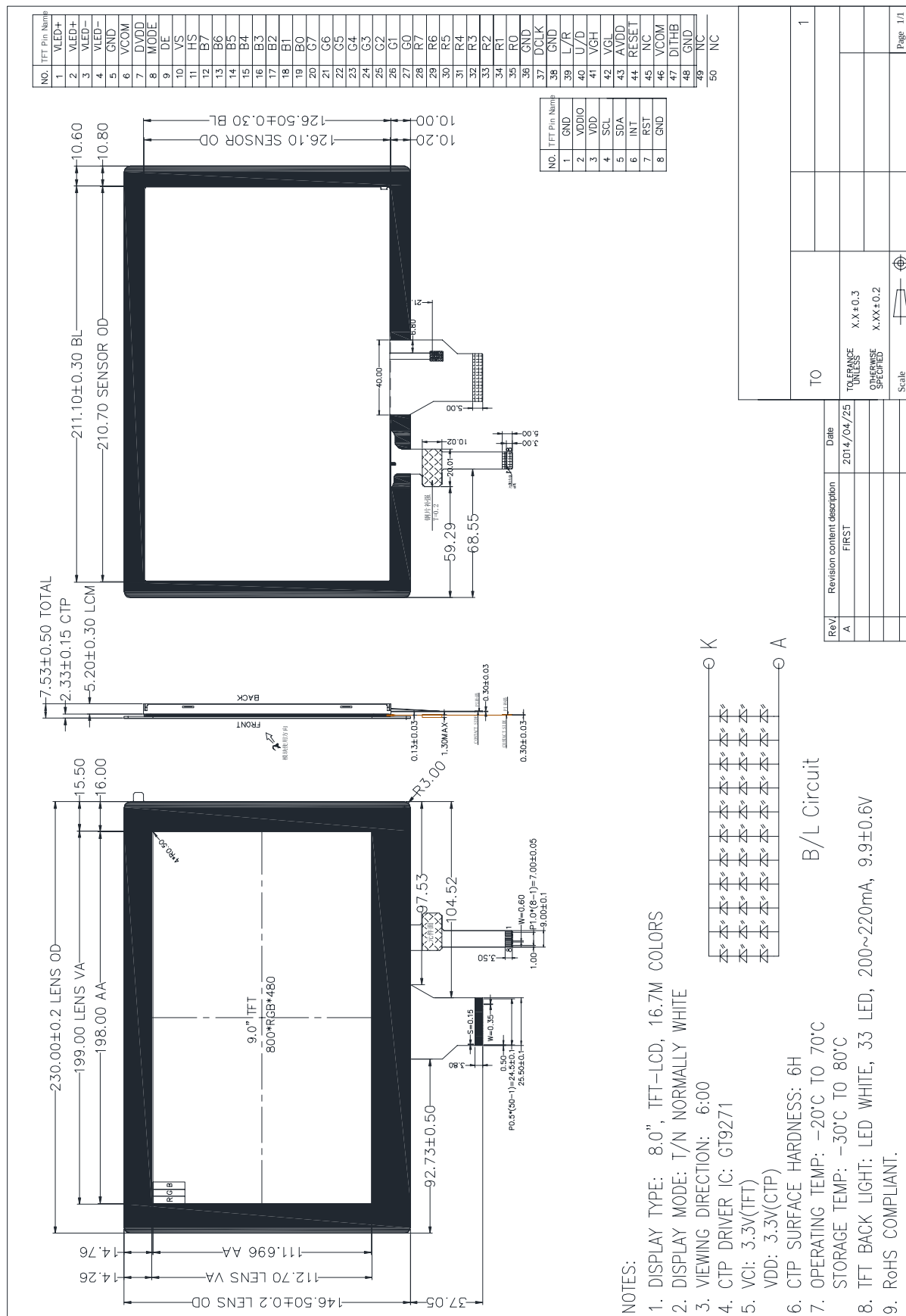
1. DISPLAY TYPE: 9.0", TFT-LCD, 16.7M COLORS
2. DISPLAY MODE: T/N NORMALLY WHITE
3. VIEWING DIRECTION: 6:00
4. OPERATING TEMP: -20°C TO 70°C
STORAGE TEMP: -30°C TO 80°C
5. BACK LIGHT: LED WHITE, 33 LED, 200-220mA, 9.9V
6. RoHS COMPLIANT.

[illegible]

2.2 CTP



2.3 LCM+CTP



3. Input terminal Pin Assignment

3.1 TFT

NO.	SYMBOL	DISCRIPTION	I/O	REMARK
1	LED+	Anode pin of backlight.	P	
2	LED+	Anode pin of backlight.	P	
3	LED-	Cathode pin of backlight.	P	
4	LED-	Cathode pin of backlight.	P	
5	GND	Power ground.	P	
6	V _{COM}	Common voltage.	I	
7	DV _{DD}	Power for Digital circuit.	I	Note3
8	MODE	DE/SYNC mode select.	I	
9	DE	Data Input Enable.	I	
10	VS	Vertical Sync Input.	I	
11	HS	Horizontal Sync Input.	I	
12	B7	Blue data input(MSB)	I/O	
13	B6	Blue data input.	I/O	
14	B5	Blue data input.	I/O	
15	B4	Blue data input.	I/O	
16	B3	Blue data input.	I/O	
17	B2	Blue data input.	I/O	
18	B1	Blue data input.	I/O	
19	B0	Blue data input(LSB)	I/O	
20	G7	Green data input(MSB)	I/O	
21	G6	Green data input.	I/O	
22	G5	Green data input.	I/O	
23	G4	Green data input.	I/O	
24	G3	Green data input.	I/O	
25	G2	Green data input.	I/O	

26	G1	Green data input.	I/O	
27	G0	Green data input(LSB)	I/O	
28	R7	Red data input(MSB)	I/O	
29	R6	Red data input.	I/O	
30	R5	Red data input.	I/O	
31	R4	Red data input.	I/O	
32	R3	Red data input.	I/O	
33	R2	Red data input.	I/O	
34	R1	Red data input.	I/O	
35	R0	Red data input(LSB)	I/O	
36	GND	Power Ground.	P	
37	DCLK	Sample clock.	I	
38	GND	Power Ground.	P	
39	L/R	Right/ left selection.	I	Note2,5
40	U/D	Up/down selection.	I	Note2,5
41	V _{GH}	Gate ON voltage.	P	
42	V _{GL}	Gate OFF voltage.	P	
43	AV _{DD}	Power for Analog circuit.	P	
44	RESET	Global reset pin.	I	Note1
45	NC	No connection.	-	
46	V _{COM}	Common voltage.	I	
47	DITHB	Dithering function.	I	Note 4
48	GND	Power ground.	P	
49	NC	No connection.	-	
50	NC	No connection.	-	

I: input, O: output, P: Power

Note 1: Global reset pin, Active Low to enter Reset State, Suggest to connecting with an RC reset circuit for stability. Normally pull high.

Note 2: Selection of scanning mode

Setting of scan control input		Scanning direction
U/D	R/L	
GND	DV _{DD}	Up to down, left to right.
DV _{DD}	GND	Down to up, right to left.
GND	GND	Up to down, right to left.
DV _{DD}	DV _{DD}	Down to up, left to right.

Note 3: DE/SYNC mode select, Normally pull high.

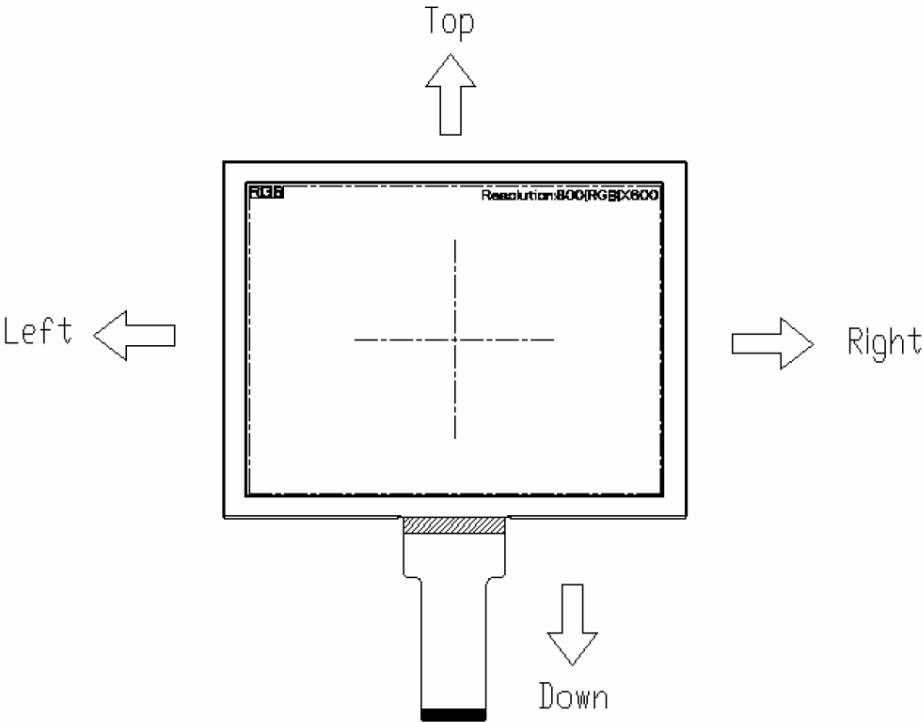
- H: DE mode.
- L: HS/VS mode.

Note4: Dithering function enable control. Normally pull high.

- DITHB="1", Disable internal dithering function. For 18bit RGB interface, connect two LSB bits of all the R/G/B data buses to GND.
- DITHB="0", Enable internal dithering function, For TTL 24bit parallel RGB image data input.

Note 5: Definition of scanning direction.

Refer to the figure as below:



3.2 CTP

NO.	SYMBOL	DISCRIPTION	I/O
1	GND	Ground.	P
2	VDDIO	I/O power supply voltage.	P
3	VDD	Supply voltage.	P
4	SCL	I2C clock input.	I
5	SDA	I2C data input and output	I/O
6	INT	External interrupt to the host.	I
7	RST	External Reset, Low is active.	I
8	GND	Ground.	P

4. LCD Optical Characteristics

4.1 Optical specification

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥ 10)	θ_L	$\Phi=180^\circ$ (9 o'clock)	60	70	-	degree	Note 1
	θ_R	$\Phi=0^\circ$ (3 o'clock)	60	70	-		
	θ_T	$\Phi=90^\circ$ (12 o'clock)	40	50	-		
	θ_B	$\Phi=270^\circ$ (6 o'clock)	60	70	-		
Response time	T_{ON}	Normal $\theta=\Phi=0^\circ$	-	10	20	msec	Note 3
	T_{OFF}		-	15	30	msec	Note 3
Contrast ratio	CR		400	500	-	-	Note 4
Color chromaticity	W_X		0.26	0.31	0.36	-	Note 2 Note 5 Note 6
	W_Y		0.28	0.33	0.38	-	
Luminance	L		200	250	-	cd/m ²	Note 6
Luminance uniformity	Y_U		70	75	-	%	Note 7

- Test Conditions:
- 1. $V_{CC}=3.3V$, $I_L=180mA$ (Backlight current), the ambient temperature is 25°C .
 - 2. The test systems refer to Note 2.

Note 1: Definition of viewing angle range

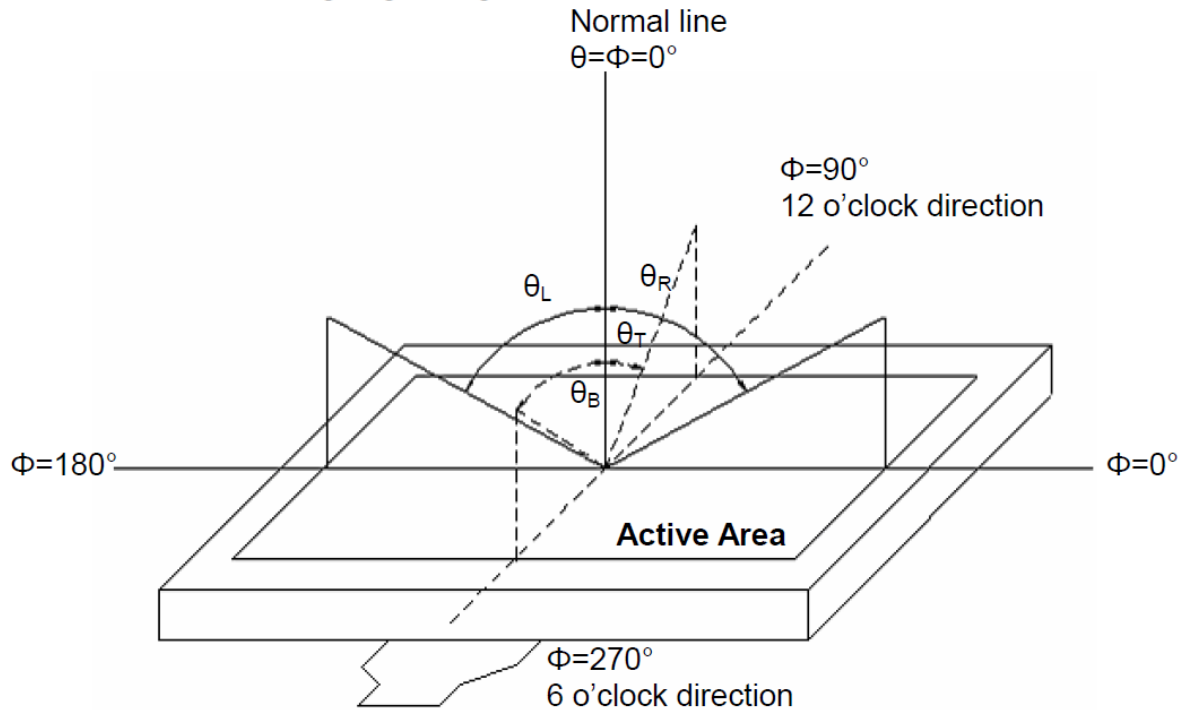


Fig. 4-1 Definition of viewing angle

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view: 1° /Height: 500mm.)

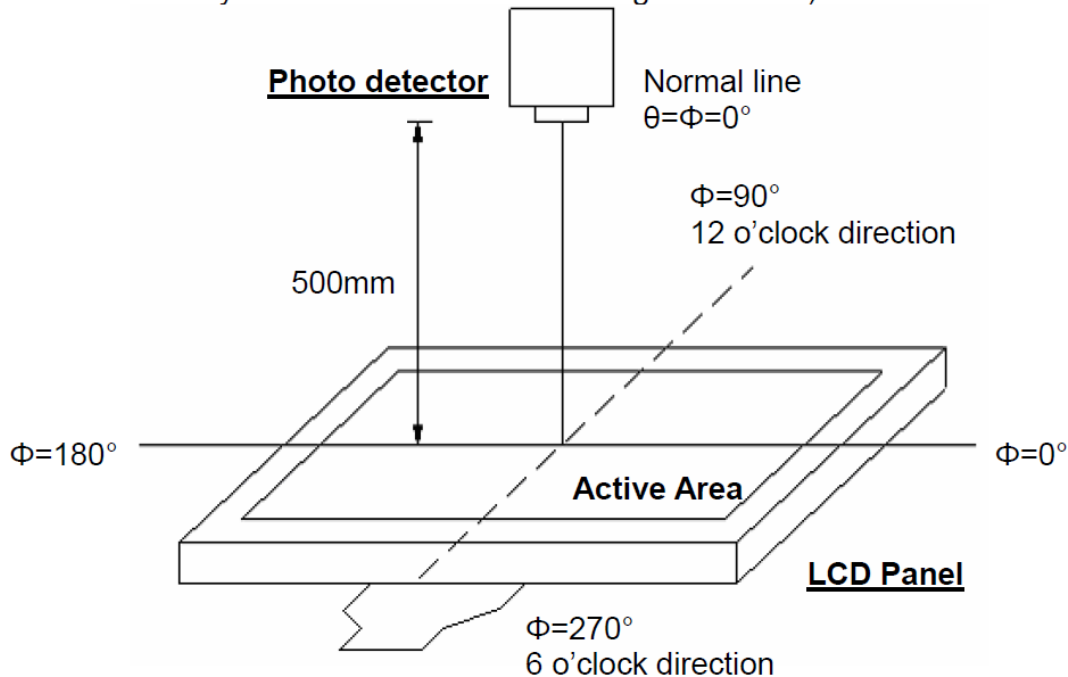


Fig. 4-2 Optical measurement system setup

Note 3: 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%.

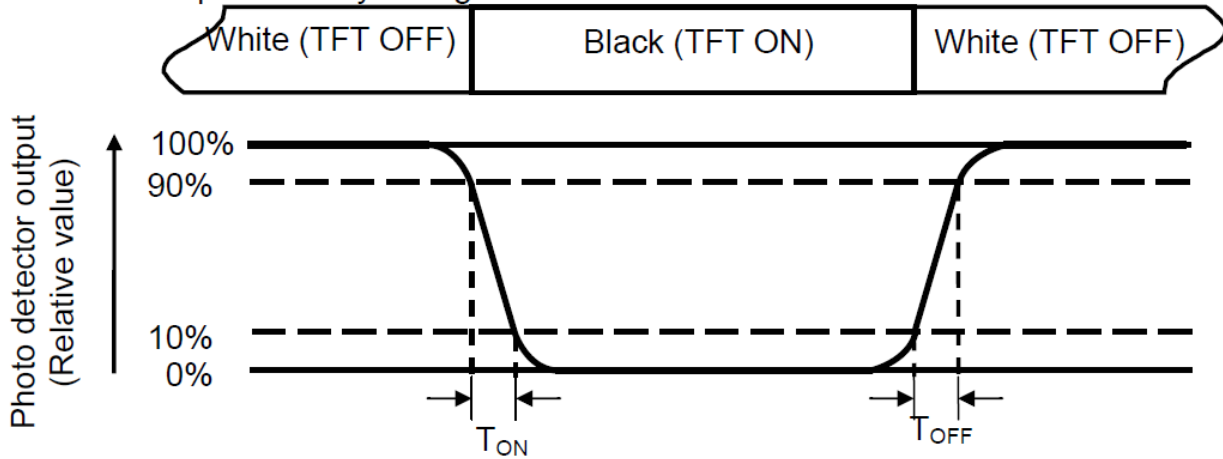


Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio

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

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is $I_L=220\text{mA}$.

Note 7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer to Fig. 4-4).Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (Yu)} = \frac{B_{min}}{B_{max}}$$

L-----Active area length

W----- Active area width

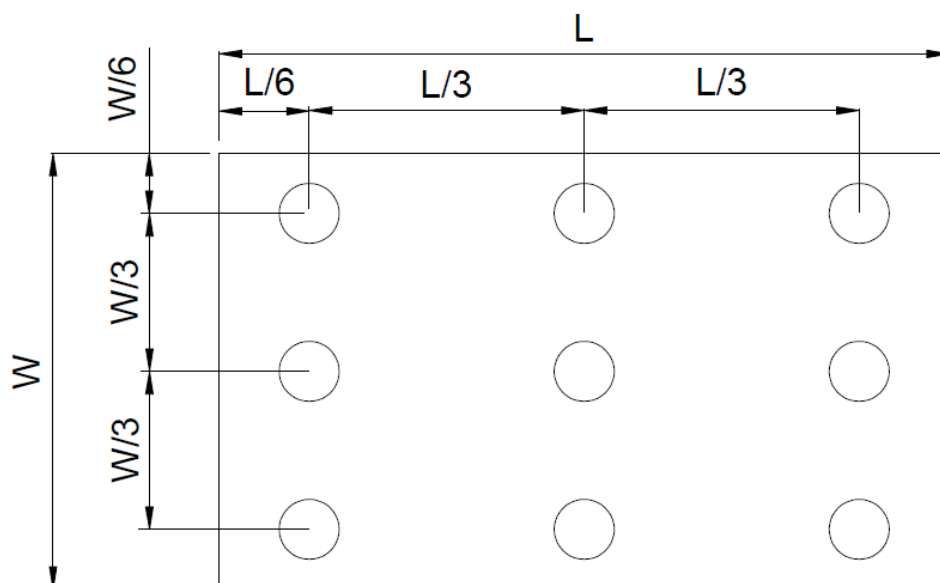


Fig. 4-4 Definition of measuring points

$B_{\max}$: The measured maximum luminance of all measurement position.

$B_{\min}$: The measured minimum luminance of all measurement position.

5. TFT LCM Electrical Characteristics

5.1 Absolute Maximum Rating (Ta=25 VSS=0V)

Characteristics	Symbol	Min.	Max.	Unit
Power voltage	DV _{DD}	-0.3	5.0	V
	AV _{DD}	-0.5	13.5	V
	V _{GH}	13.0	19.0	V
	V _{GL}	-12.0	-2.0	V
	V _{GH} - V _{GL}	-	31.0	V
Operating temperature	T _{OP}	-20	+70	°C
Storage temperature	T _{ST}	-30	+80	°C

Note 1: The absolute maximum rating values of this product are not allowed to be exceeded at any times.

Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

Note 2: VR Conditions: Zener Diode 20mA.

5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	V _{DD}	3.0	3.3	3.6	V	
Digital interface supply Voltage	V _{DDIO}	3.0	3.3	3.6	V	
Normal mode Current consumption	I _{CC}	-	5.5	10	mA	V _{GH} =16.0
	I _{GH}	-	0.2	0.5		V _{GL} =-7.0
	I _{GL}	-	0.2	1.0		V _{CC} =3.3V
	IAV _{DD}	-	32	50		AV _{DD} =10.4V
Level input voltage	VIH	0.7V _{DDIO}		V _{DDIO}	V	
	VIL	GND		0.3 V _{DDIO}	V	
Level output voltage	VOH	0.8V _{DDIO}		V _{DDIO}	V	
	VOL	GND		0.2 V _{DDIO}	V	

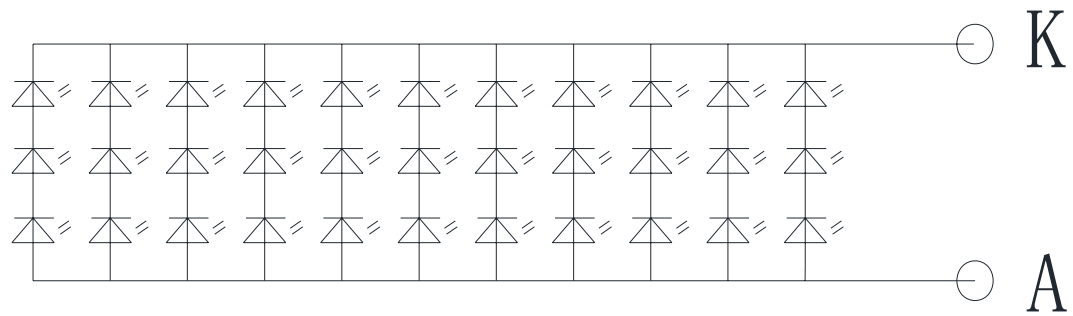
5.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 27chips White LED

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I_F	198	220	242	mA	
Forward Voltage	V_F	9.3	9.9	10.5	V	Note1
LCM Luminance	L_V	400	-	-	cd/m2	
LED Life time	-	20000	-	-	Hr	Note2
Uniformity	AVg	80	--	--	%	

Note 1: The LED Supply Voltage is defined by the number of LED at $T_a=25^{\circ}\text{C}$ and $I_L=220\text{mA}$.

Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness at $T_a=25^{\circ}\text{C}$ and $I_L=220\text{mA}$. The LED lifetime could be decreased if operating I_L is larger than 220 mA.



B/L Circuit

6. TFT Timing Characteristics

6.1 AC Electrical Characteristics

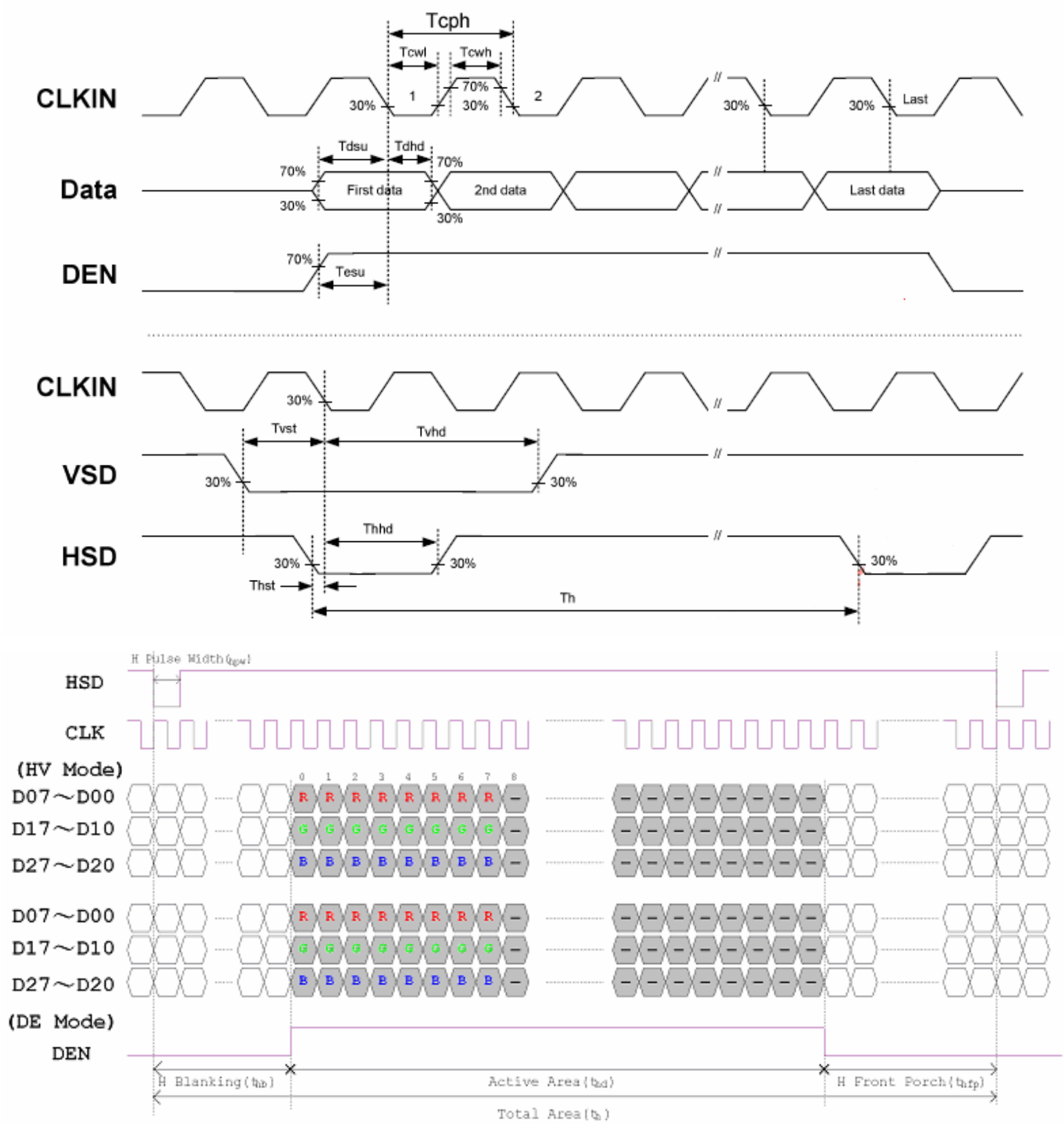
Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
HS setup time	T_{hst}	8	-	-	ns	
HS hold time	T_{hhd}	8	-	-	ns	
VS setup time	T_{vst}	8	-	-	ns	
VS hold time	T_{vhd}	8	-	-	ns	
Data setup time	T_{dsu}	8	-	-	ns	
Data hole time	T_{dhd}	8	-	-	ns	
DE setup time	T_{esu}	8	-	-	ns	
DE hole time	T_{ehd}	8	-	-	ns	
DV _{DD} Power On Slew rate	T_{POR}	-	-	20	ms	From 0 to 90% DV _{DD}
RESET pulse width	T_{Rst}	1	-	-	ms	
DCLK cycle time	T_{coh}	20	-	-	ns	
DCLK pulse duty	T_{cwh}	40	50	60	%	

6.2 Timing

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Horizontal Display Area	thd	-	800	-	DCLK	
DCLK Frequency	fclk	26.4	33.3	46.8	MHz	
One Horizontal Line	th	862	1056	1200	DCLK	
HS pulse width	thpw	1	-	40	DCLK	
HS Blanking	thb	46	46	46	DCLK	
HS Front Porch	thfp	16	210	354	DCLK	

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Vertical Display Area	tvd	-	480	-	TH	
VS period time	tv	510	525	650	TH	
VS pulse width	tvpw	1	-	20	TH	
VS Blanking	tvb	23	23	23	TH	
VS Front Porch	tvfp	7	22	147	TH	

6.3 Timing Diagram



7. CTP Specification

7.1 Electrical Characteristics

7.1.1 Absolute Maximum Rating

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VDD	-0.3	3.47	V	1
I/O Digital Voltage	VDDIO	-0.3	3.47	V	1
Operating temperature	T _{OP}	-20	+70	°C	-
Storage temperature	T _{ST}	-30	+80	°C	-

NOTES:

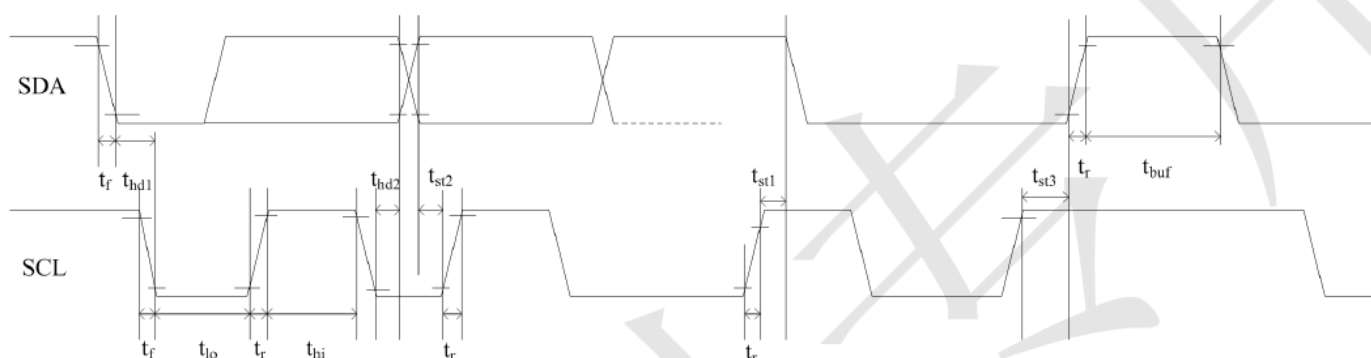
1. If used beyond the absolute maximum ratings, GT9271 may be permanently damaged. It is strongly recommended that the device be used within the electrical characteristics in normal operations. If exposed to the condition not within the electrical characteristics, it may affect the reliability of the device.

7.1.2 DC Electrical Characteristics (Ta=25°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Digital supply voltage	VDD	2.8	-	3.3	V	
I/O Digital supply voltage	VDDIO	1.8	-	3.3	V	
Normal operation mode Current consumption	I _{opr}	-	13		mA	
Green mode Current consumption	I _{mon}	-	4.5	-	mA	
Sleep mode Current consumption	I _{slp}	70	-	120	uA	
Level input voltage	V _{IH}	0.75V _{DDIO}	-	V _{DDIO} +0.3	V	
	V _{IL}	-0.3	-	0.25V _{DDIO}	V	
Level output voltage	V _{OH}	0.85V _{DDIO}	-	-	V	
	V _{OL}	-	-	0.15V _{DDIO}	V	

7.1 Electrical Characteristics

GT9271 provides a standard I2C interface for SCL and SDA to communicate with the host. GT9271 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

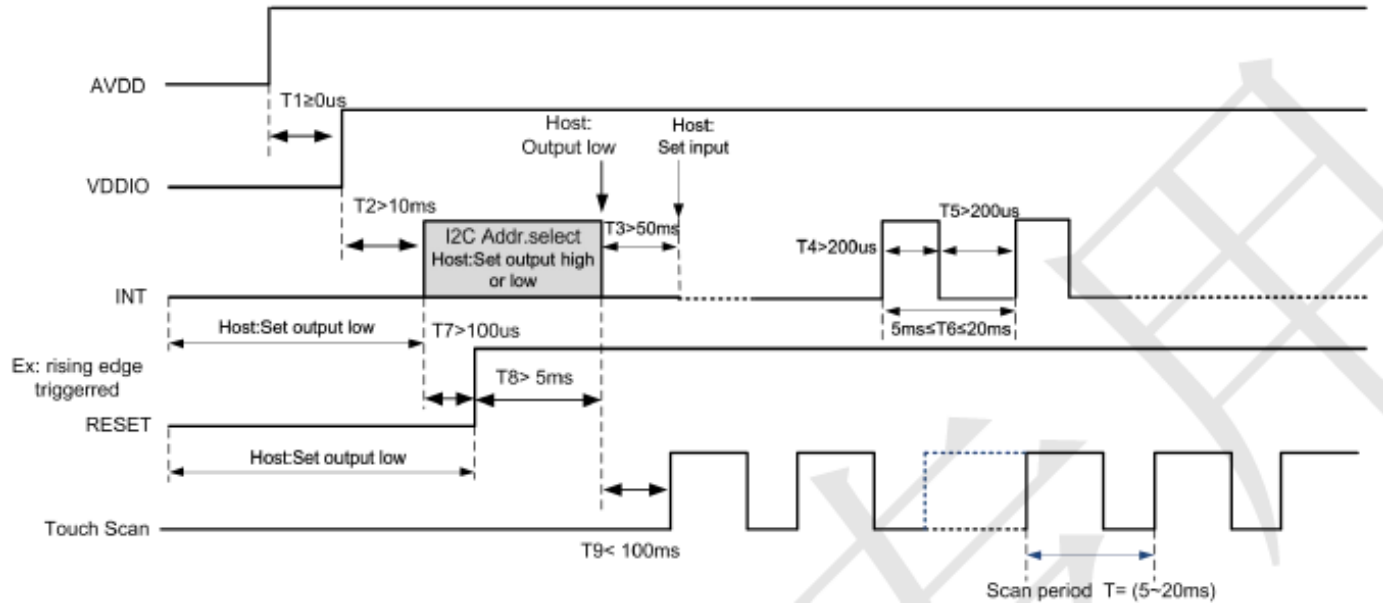
Test condition 2: 3.3V host interface voltage, 400Kbps transmission rate, 2K pull-up resistor

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

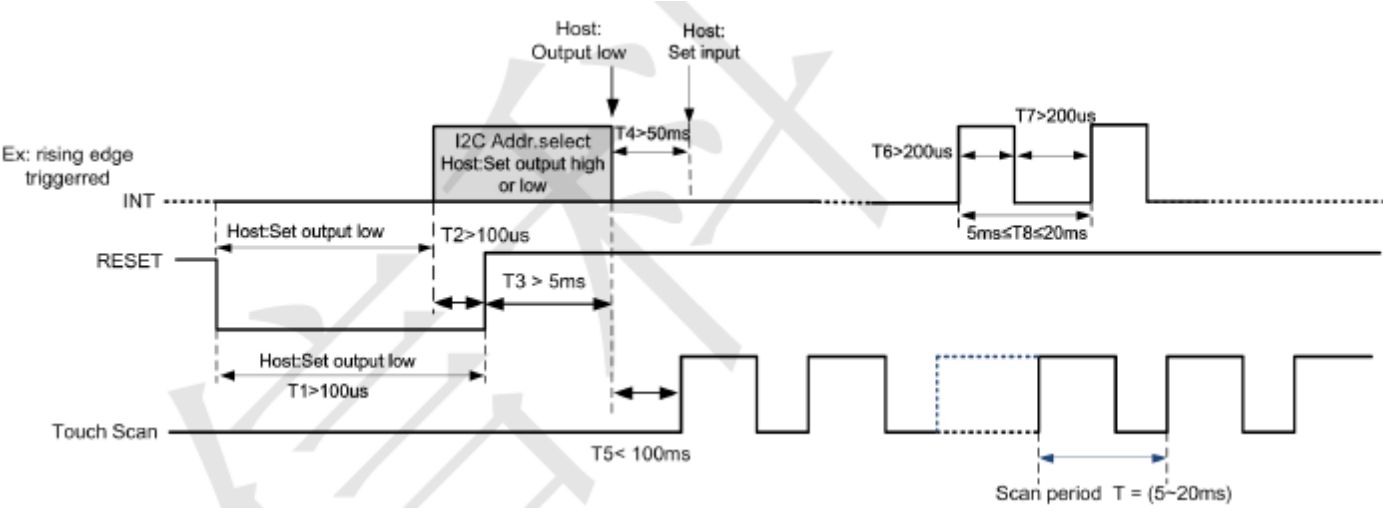
GT9271 supports two I2C slave addresses: 0xBA/0xBB and 0x28/0x29. The host can select the

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:

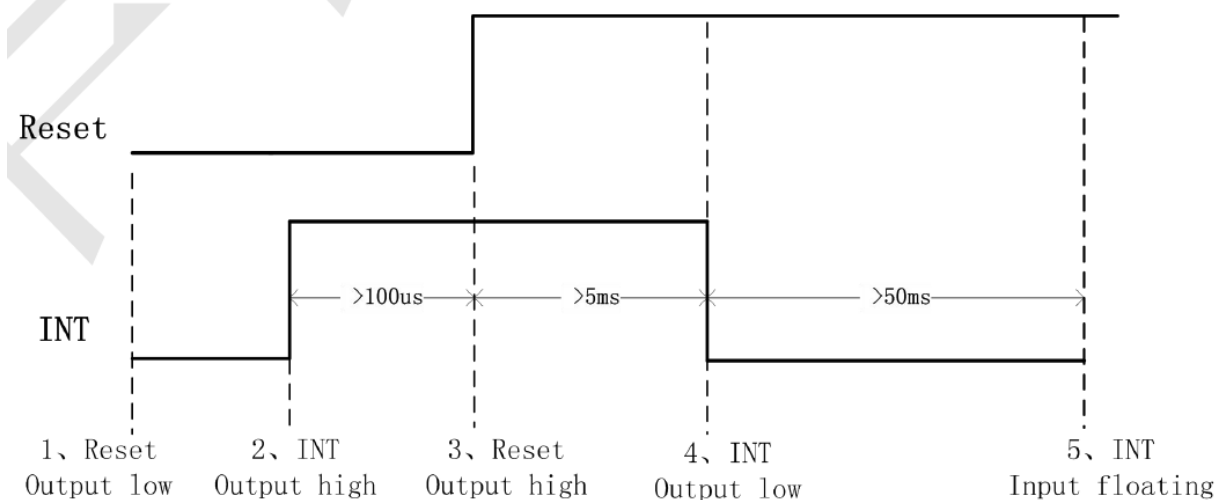
Power-On Timing:



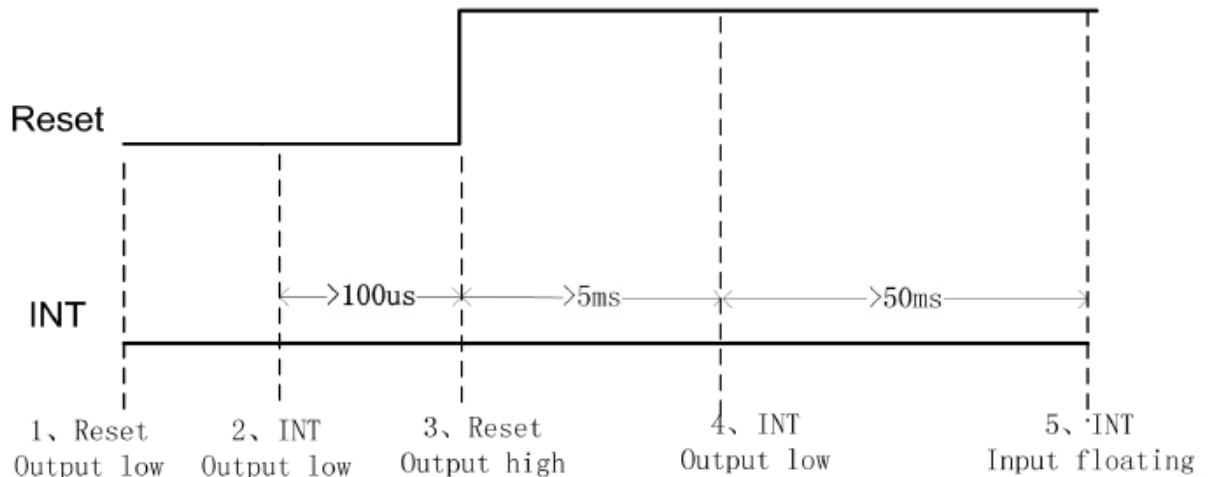
Timing for host resetting GT911:



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



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



a) Data Transmission

(For example: slave 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, GT9271 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, GT9271 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 which implies the transition of SDA line from low to high when SCL line is high.

b) Writing Data to GT9271

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



Timing for Write Operation

The diagram above displays the timing sequence of the host writing data onto GT9271. 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 GT9271

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



Timing for Read Operation

The diagram above is the timing sequence of the host reading data from GT9271. 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.

GT9271 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.

8. LCD Module Out-Going Quality Level

8.1 VISUAL & FUNCTION INSPECTION STANDARD

8.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

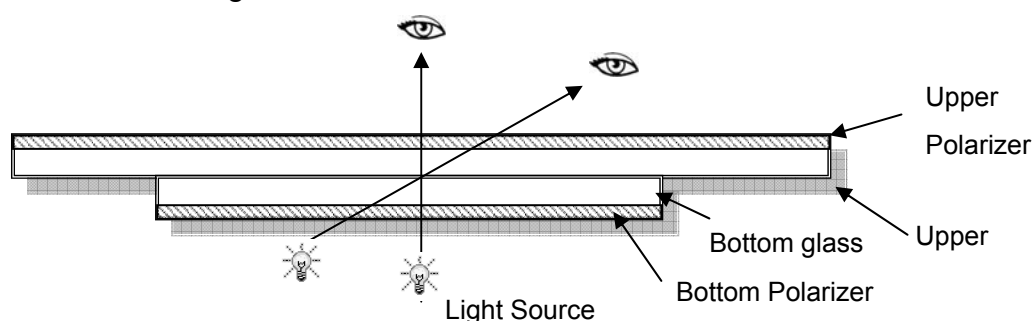
Temperature : $25\pm 5^{\circ}\text{C}$

Humidity : $65\%\pm 10\%\text{RH}$

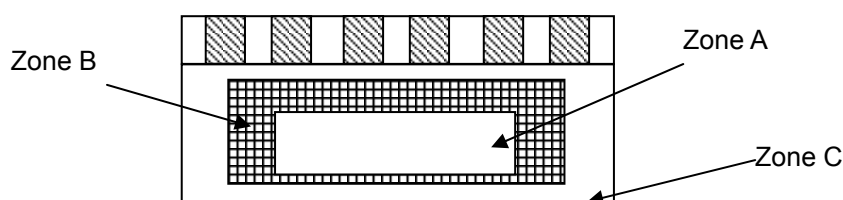
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance: 30-50cm



8.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Note:

As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer.

8.1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class II

AQL:

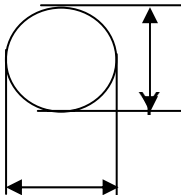
Major defect	Minor defect
0.65	1.5

LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

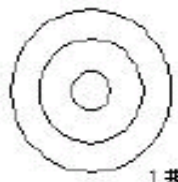
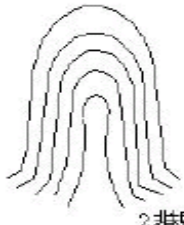
No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Soldering appearance	Good soldering , Peeling off is not allowed.	
6	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

8.1.4 Criteria (Visual)

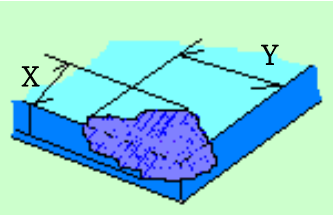
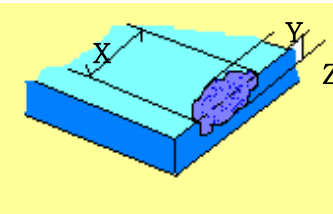
Number	Items	Criteria(mm)
1.0 LCD Crack/Broken 		

Number	Items	Criteria (mm)																									
2.0	Spot defect  X Φ=(X+Y)/2	① light dot (LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain)																									
		<table><tr><th rowspan="2">Zone Size (mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>Φ≤0.10</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>0.10<Φ≤0.20</td><td colspan="2">3(distance ≥ 10mm)</td></tr><tr><td>0.20<Φ≤0.25</td><td colspan="2">2</td></tr><tr><td>Φ > 0.25</td><td colspan="2">0</td></tr></table>	Zone Size (mm)	Acceptable Qty			A	B	C	Φ≤0.10	Ignore		Ignore	0.10<Φ≤0.20	3(distance ≥ 10mm)		0.20<Φ≤0.25	2		Φ > 0.25	0						
		Zone Size (mm)		Acceptable Qty																							
			A	B	C																						
		Φ≤0.10	Ignore		Ignore																						
		0.10<Φ≤0.20	3(distance ≥ 10mm)																								
		0.20<Φ≤0.25	2																								
		Φ > 0.25	0																								
		②Dim spot (LCD/TP/Polarizer dim dot, light leakage、 dark spot)																									
		<table><tr><th rowspan="2">Zone Size (mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>0.10<Φ≤0.20</td><td colspan="2">3(distance ≥ 10mm)</td></tr><tr><td>0.20<Φ≤0.30</td><td colspan="2">2</td></tr><tr><td>Φ > 0.30</td><td colspan="2">0</td></tr></table>	Zone Size (mm)	Acceptable Qty			A	B	C	Φ≤0.1	Ignore		Ignore	0.10<Φ≤0.20	3(distance ≥ 10mm)		0.20<Φ≤0.30	2		Φ > 0.30	0						
		Zone Size (mm)		Acceptable Qty																							
			A	B	C																						
		Φ≤0.1	Ignore		Ignore																						
		0.10<Φ≤0.20	3(distance ≥ 10mm)																								
		0.20<Φ≤0.30	2																								
		Φ > 0.30	0																								
		③ Polarizer accidented spot																									
		<table><tr><th rowspan="2">Zone Size (mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>0.3<Φ≤0.5</td><td colspan="2">2(distance ≥ 10mm)</td></tr><tr><td>Φ>0.5</td><td colspan="2">0</td></tr></table>	Zone Size (mm)	Acceptable Qty			A	B	C	Φ≤0.2	Ignore		Ignore	0.3<Φ≤0.5	2(distance ≥ 10mm)		Φ>0.5	0									
		Zone Size (mm)		Acceptable Qty																							
			A	B	C																						
		Φ≤0.2	Ignore		Ignore																						
		0.3<Φ≤0.5	2(distance ≥ 10mm)																								
		Φ>0.5	0																								
		Line defect (LCD/TP /Polarizer black/white line, scratch, stain)	<table><tr><th rowspan="2">Width(mm)</th><th rowspan="2">Length(mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>Φ≤0.03</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>0.03<W≤0.05</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr><tr><td>0.05<W≤0.08</td><td>L≤2.0</td><td colspan="2">N≤2</td></tr><tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr></table>	Width(mm)	Length(mm)	Acceptable Qty			A	B	C	Φ≤0.03	Ignore	Ignore		Ignore	0.03<W≤0.05	L≤3.0	N≤2		0.05<W≤0.08	L≤2.0	N≤2		0.08<W	Define as spot defect	
Width(mm)	Length(mm)	Acceptable Qty																									
		A	B	C																							
Φ≤0.03	Ignore	Ignore		Ignore																							
0.03<W≤0.05	L≤3.0	N≤2																									
0.05<W≤0.08	L≤2.0	N≤2																									
0.08<W	Define as spot defect																										

3.0	Polarizer Bubble				
		Zone Size (mm)	Acceptable Qty		
			A	B	C
		$\Phi \leq 0.2$	Ignore		Ignore
		$0.2 < \Phi \leq 0.4$	3(distance $\geq 10\text{mm}$)		
		$0.4 < \Phi \leq 0.6$	2		
		$0.6 < \Phi$	0		
4.0	SMT	According to IPC-A-610C class II standard . Function defect and missing part are major defect ,the others are minor defect.			

5.0	TP Related	TP bubble/ accidented spot	<table><tr><td rowspan="2">Size Φ(mm)</td><td colspan="3">Acceptable Qty</td></tr><tr><td>A</td><td>B</td><td>C</td></tr><tr><td>$\Phi \leq 0.1$</td><td colspan="3">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>$0.1 < \Phi \leq 0.25$</td><td colspan="2">3 (distance $\geq$</td></tr><tr><td>$0.25 < \Phi \leq 0.3$</td><td colspan="2">2</td></tr><tr><td>$0.3 < \Phi$</td><td colspan="2">0</td></tr></table>			Size Φ (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.1$	Ignore			Ignore	$0.1 < \Phi \leq 0.25$	3 (distance $\geq$		$0.25 < \Phi \leq 0.3$	2		$0.3 < \Phi$	0	
			Size Φ (mm)	Acceptable Qty																						
				A	B	C																				
			$\Phi \leq 0.1$	Ignore			Ignore																			
			$0.1 < \Phi \leq 0.25$	3 (distance $\geq$																						
$0.25 < \Phi \leq 0.3$	2																									
$0.3 < \Phi$	0																									
Assembly deflection	beyond the edge of backlight $\leq 0.15\text{mm}$																									
Newton Ring	Newton Ring area $> 1/3$ TP area NG Newton Ring area $\leq 1/3$ TP area OK	 																								

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				 似牛顿环						
		TP corner broken X : length Y : width Z : height	<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>X≤3.0mm</td><td>Y≤3.0mm</td><td>Z<LCD thickness</td></tr></table> *Circuitry broken is not allowed.	X	Y	Z	X≤3.0mm	Y≤3.0mm	Z<LCD thickness	
X	Y	Z								
X≤3.0mm	Y≤3.0mm	Z<LCD thickness								
		TP edge broken X : length Y : width Z : height	<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>X≤6.0mm</td><td>Y≤2.0mm</td><td>Z<LCD thickness</td></tr></table> * Circuitry broken is not allowed.	X	Y	Z	X≤6.0mm	Y≤2.0mm	Z<LCD thickness	
X	Y	Z								
X≤6.0mm	Y≤2.0mm	Z<LCD thickness								

Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed
5	TP no function	Not allowed

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