



GlobalTech Display
A Professional LCD Displays Provider

TFT LCD Display Specification

PN: GLT0507201280IH1

Overview:

- 5.0" Diagonal
- IPS, Full View Angle
- Driver: ILI9881C
- 262K Colors
- 500 Nits
- 720 x 1280 Pixels
- Transmissive/Normally Black
- MIPI Interface
- No Touch Panel
- RoHS Compliant

9825 Widmer Road, Lenexa, KS 66215, USA | Tel: 913-828-5685 Fax: 913-273-4397

Email: sales@gtdisplays.com Website: www.gtdisplays.com

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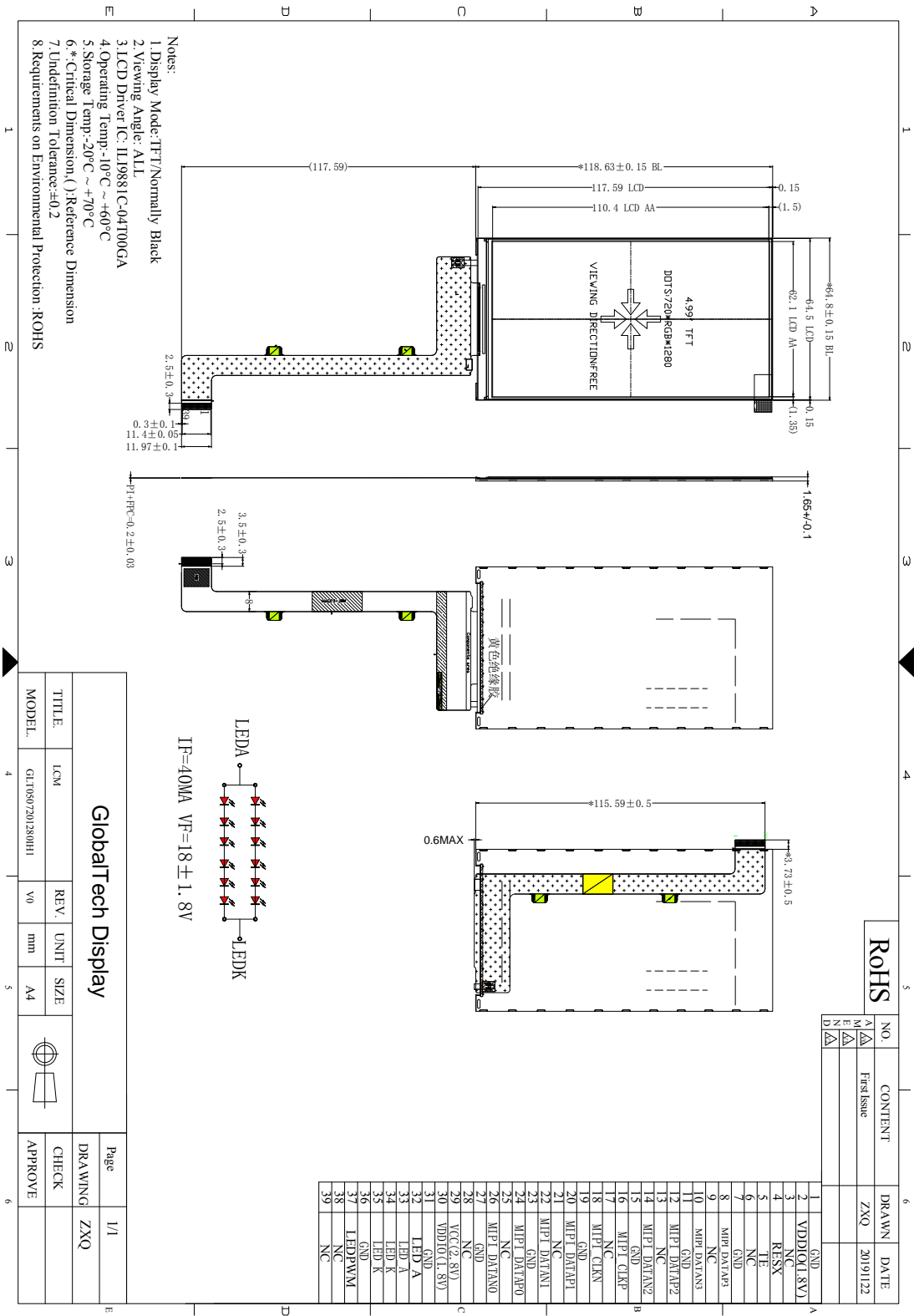
1. Document Revision History :

DOCUMENT REVISION	DATE	DESCRIPTION	PREPARED BY
A	2019-12-26	First Release.	

2. General Description

No	Item	Specification	Remark
1	Screen Size	5.0 inch	
2	Display Mode	Normally Black	
3	Resolution	720×RGB×1280	
4	Active Area	62.1*110.4	mm
5	Outline Dimension	64.8*118.63*1.65	mm
6	Viewing Direction	ALL	
7	Driver IC	ILI9881C-04T00GA	
8	Interface	MIPI	
9	Back Light	White Led 2*6	
10	Touch Panel	Optional	

3. Outline Dimension



4. Interface Specification

Pin No	Symbol	Description	Note
1	GND	Ground.	
2	VDDIO	Power supply for I/o(logic).	
3	NC	No connect.	
4	RESX	Reset Signal	
5	TE	Tearing Effect Output Signal	
6	NC	No Connect.	
7	GND	Ground.	
8	MIPI_DATAP3	Positive polarity of low voltage differential data 3 signal	
9	NC	No Connect.	
10	MIPI_DATAN3	Negative polarity of low voltage differential data 3 signal	
11	GND	Ground.	
12	MIPI_DATAP2	Positive polarity of low voltage differential data 2 signal	
13	NC	No Connect.	
14	MIPI_DATAN2	Negative polarity of low voltage differential data 2 signal	
15	GND	Ground.	
16	MIPI_CLKP	Positive polarity of low voltage differential clock signal	
17	NC	No Connect.	
18	MIPI_CLKN	Negative polarity of low voltage differential clock signal	
19	GND	Ground.	
20	MIPI_DATAP1	Positive polarity of low voltage differential data 1 signal	
21	NC	No Connect.	
22	MIPI_DATAN1	Negative polarity of low voltage differential data 1 signal	
23	GND	Ground.	
24	MIPI_DATAP0	Positive polarity of low voltage differential data 0 signal	
25	NC	No Connect.	
26	MIPI_DATAN0	Negative polarity of low voltage differential data 0 signal	
27	GND	Ground.	
28	NC	No Connect.	

29	VCC	Power supply for IC.(Analog)	
30	VDDIO	Power supply for I/o(logic).	
31	GND	Ground.	
32	LED_A	Power Supply For LED Backlight Anode Input.	
33	LED_A	Power Supply For LED Backlight Anode Input.	
34	LED_K	Power Supply For LED Backlight Cathode Input.	
35	LED_K	Power Supply For LED Backlight Cathode Input.	
36	GND	Ground.	
37	LEDPWM	LCD backlight control pwm output.	
38	NC	No Connect.	
39	NC	No Connect.	

5. Absolute Maximum Ratings

Electrical Maximum Ratings – for IC Only

Parameter	Symbol	Min.	Max.	Unit	Note
Power supply voltage (VDD)	VDD	-0.3	+7.0	V	1
Supply voltage (logic)	VDDIO	-0.3	+3.8	V	1

Note:

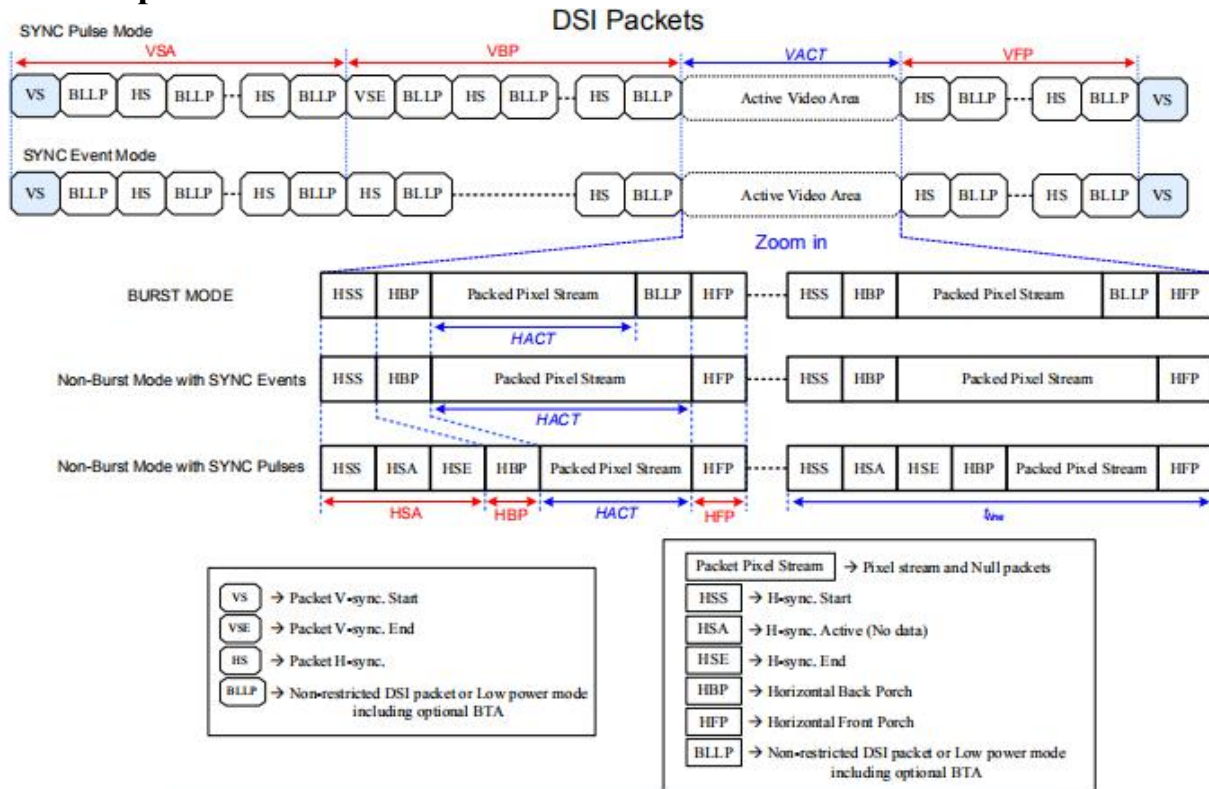
- 1.VDD, VDDIO, GND must be maintained.
- 2.The modules may be destroyed if they are used beyond the absolute maximum ratings.

6. Electrical Specifications

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage (analog)	VDD-GND		2.5	2.8	3.6	V
Supply voltage (logic)	VDDIO	VDDIO-GND	1.65	2.8	3.6	
Supply current (Logic & LCD)	ICC		-	-	-	mA
Supply voltage of white LED backlight	VLED	Forward current =40mA Number of LED =12	16.2	18.0	19.8	V

7. Timing Characteristics

7.1 Data input format.



Parameters	Symbols	Min.	Typ.	Max.	Units
Vertical sync. active	VSA	2 (Note 6)	-	-	Line
Vertical Back Porch	VBP	14 (Note 6)	-	-	Line
Vertical Front Porch	VFP	8 (Note 6)	-	-	Line
Active lines per frame	VACT	-	1280	-	Line
Horizontal sync. active	HSA	2	-	-	Pixel
Horizontal Porch period	HSA + HBP + HFP	1.6	-	-	us
Active pixels per line	HACT	-	720	-	Pixel
Bit rate	BR _{bps}	385		Note 5	Mbps/lane

1 UI=1/Bit rate

$$HSA(\text{pixel}) = (t_{HSA} \times \text{lane number}) / (UI \times \text{pixel format})$$

$$HBP(\text{pixel}) = (t_{HBP} \times \text{lane number}) / (UI \times \text{pixel format})$$

$$HFP(\text{pixel}) = (t_{HFP} \times \text{lane number}) / (UI \times \text{pixel format})$$

$$\text{Frame Rate} = \frac{BR_{bps} \times \text{Lane}_{num}}{(VACT + VSA + VBP + VFP) \times (HACT + HSA + HBP + HFP) \times \text{Pixel Format}}$$

Example : BR_{bps} = 457Mbps/lane, 1UI=2.1883ns, Frame rate=60Hz, VACT=1280, VSA=2, VBP=30, VFP=20, HACT=720, HSA=33, HBP=100, HFP=100, Lane_{num}=4(lane), Pixel Format=24(bit).

7.2 Timing waveform table

17.4.2. High Speed Mode – Clock Channel Timing

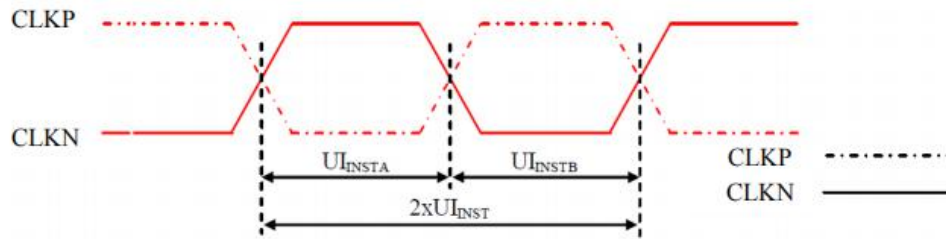


Figure 105: DSI Clock Channel Timing

Table 38: DSI Clock Channel Timing

Signal	Symbol	Parameter	Min	Max	Unit
CLKP/N	$2xUI_{INST}$	Double UI instantaneous	Note 2	25	ns
CLKP/N	UI_{INSTA}, UI_{INSTB} (Note 1)	UI instantaneous Half	Note 2	12.5	ns

Notes:

1. $UI = UI_{INSTA} = UI_{INSTB}$
2. Define the minimum value, see Table 39.

Table 39: Limited Clock Channel Speed

Data type	Two Lanes speed	Three Lanes speed	Four Lanes speed
Data Type = 00 1110 (0Eh), RGB 565, 16 UI per Pixel	566 Mbps	466 Mbps	366 Mbps
Data Type = 01 1110 (1Eh), RGB 666, 18 UI per Pixel	637 Mbps	525 Mbps	412 Mbps
Data Type = 10 1110 (2Eh), RGB 666 Loosely, 24 UI per Pixel	850 Mbps	750 Mbps	650 Mbps
Data Type = 11 1110 (3Eh), RGB 888, 24 UI per Pixel	850 Mbps	750 Mbps	650 Mbps

High Speed Mode – Data Clock Channel Timing

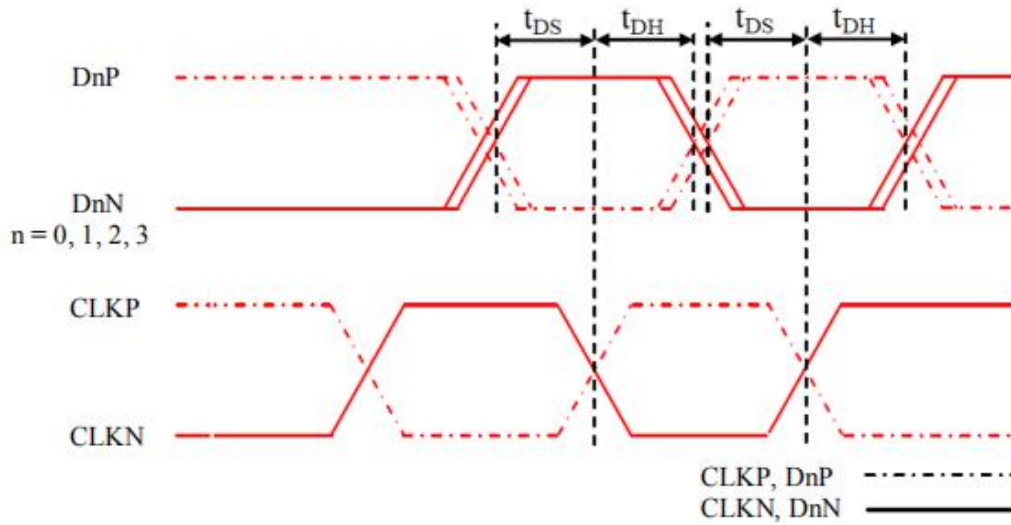


Figure 106: DSI Data to Clock Channel Timings

Table 40: DSI Data to Clock Channel Timings

Signal	Symbol	Parameter	Min	Max
DnP/N , n=0 and 1	t_{DS}	Data to Clock Setup time	0.15xUI	-
	t_{DH}	Clock to Data Hold Time	0.15xUI	-

17.4.4. High Speed Mode – Rising and Falling Timings

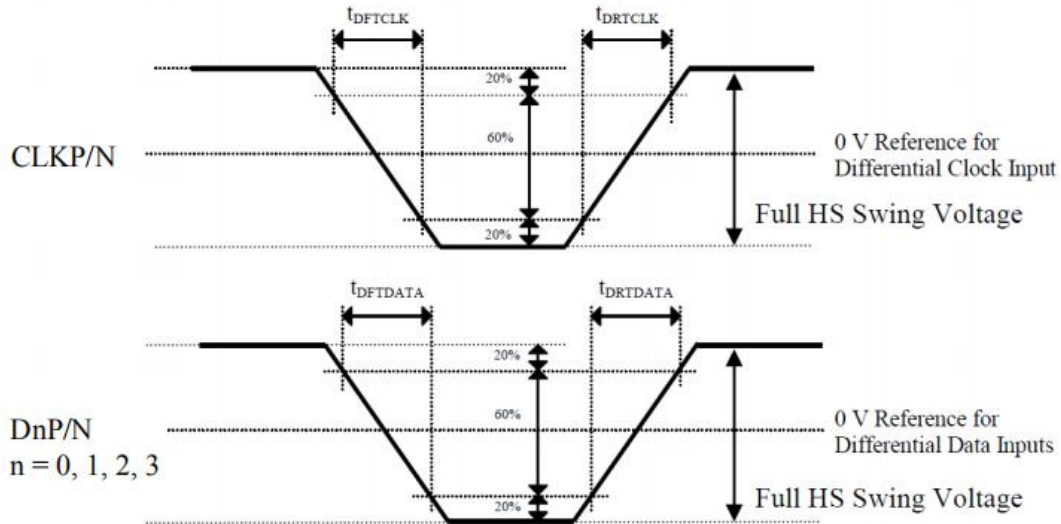


Figure 107: Rising and Falling Timings on Clock and Data Channels

Table 41: Rise and Fall Timings on Clock and Data Channels

Parameter	Symbol	Condition	Specification		
			Min	Typ	Max
Differential Rise Time for Clock	t_{DRTCLK}	CLKP/N	150 ps	-	0.3UI (Note)
Differential Rise Time for Data	$t_{DRTDATA}$	DnP/N n=0 and 1	150 ps	-	0.3UI (Note)
Differential Fall Time for Clock	t_{DFTCLK}	CLKP/N	150 ps	-	0.3UI (Note)
Differential Fall Time for Data	$t_{DFTDATA}$	DnP/N n=0 and 1	150 ps	-	0.3UI (Note)

Note: The display module has to meet timing requirements, which are defined for the transmitter (MCU) on MIPI D-Phy standard.

7.3 RESET TIMING

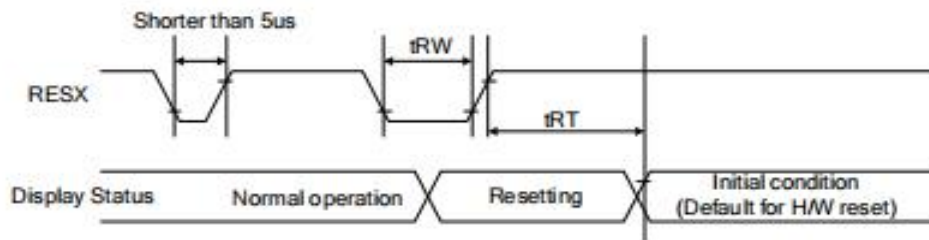


Figure 113: Reset Timing

Table 47: Reset Timing

Signal	Symbol	Parameter	Min	Max	Unit
RESX	tRW	Reset pulse duration	10		uS
	tRT	Reset cancel		5 (note 1,5) 120 (note 1,6,7)	mS

Notes:

1. The reset cancel also includes required time for loading ID bytes, VCOM setting and other settings from EEPROM to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.
2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the Table 48.

Table 48: Reset Descript

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 10us	Reset
Between 5us and 10us	Reset starts

3. During the Resetting period, the display will be blanked (The display enters the blanking sequence, which maximum time is 120 ms, when Reset Starts in the Sleep Out mode. The display remains the blank state in the Sleep In mode.) and then return to Default condition for Hardware Reset.
4. Spike Rejection can also be applied during a valid reset pulse, as shown below:

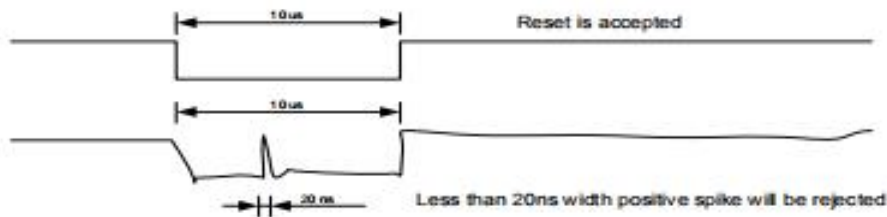
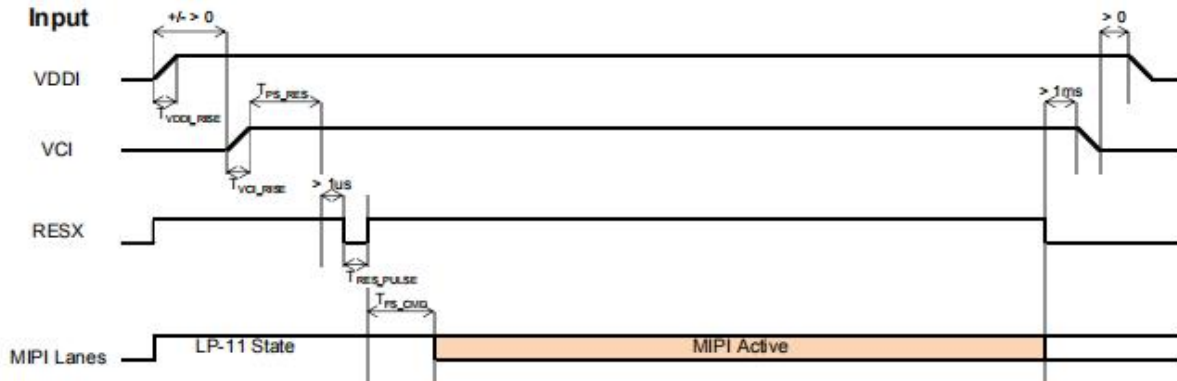


Figure 114: Positive Noise Pulse during Reset Low

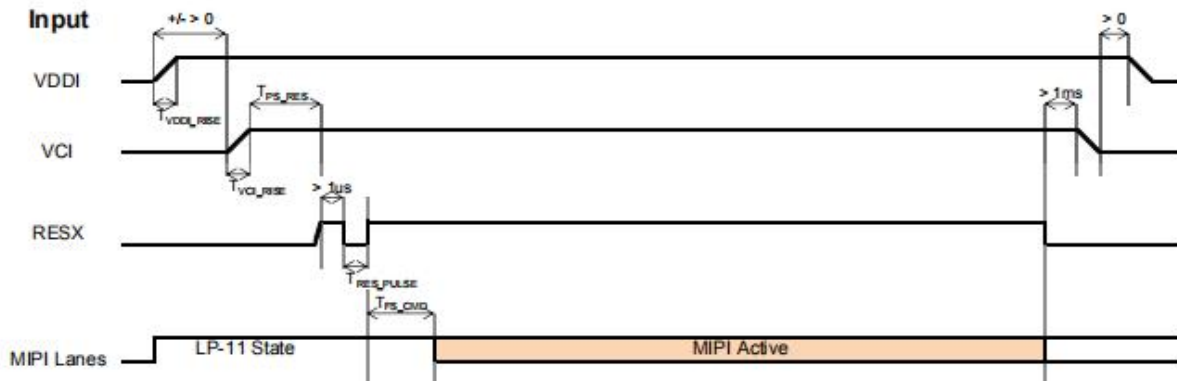
5. When Reset applied during Sleep In Mode.
6. When Reset applied during Sleep Out Mode.
7. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

8. Power Supply Configuration

Case A:



Case B:



Symbol	Characteristics	Min.	Typ.	Max.	Units
T_{VDDI_RISE}	VDDI Rise time	10	-	-	us
T_{VCI_RISE}	Case A: VCI Rise time	130	-	-	us
	Case B: VCI Rise time	40	-	-	us
T_{PS_RES}	VDDI/VCI on to Reset high	5	-	-	ms
T_{RES_PULSE}	Reset low pulse time	10	-	-	us
T_{FS_CMD}	Reset to first command	10	-	-	ms

Figure 93: Power on/off sequence with Power Mode 3

9.Optical Specification

Item 项目	Symbol 符号	Condition 条件	Min 最小值	Typ 典型值	Max 最大值	Unit 单位	Note 备注
Response time 响应时间	Tr+Tf	$\Theta=0^{\circ}$ $\emptyset=0^{\circ}$ Ta=25°C	-	30	40	ms	1
Contrast ratio 对比度	Cr		640	800	-	-	2
Color gamut 饱和度	S(%)		-	70	-	%	-
Luminance uniformity 均匀度	δ WHITE		80	-	-	%	3
Viewing angle range 视角范围	Θ_{x+}	CR \geq 10 Ta=25°C	-	80	-	deg	4
	Θ_{x-}		-	80	-	deg	
	Θ_{y+}		-	80	-	deg	
	Θ_{y-}		-	80	-	deg	
LCM Luminance LCM 亮度	Lv	$\Theta=0^{\circ}$ $\emptyset=0^{\circ}$ Ta=25°C	-	500	-	Cd/m2	5

Note1. Response time is the time required for the display to transition from White to black(Rise Time,Tr)and from black to white(Decay Time,Tf).For additional information see FIG1...

Note2.contrast Ratio(CR) is defined mathematically by the following formula ,For more information see FIG2.

Contrast Ratio(CR)=Average Surface Luminance with all white pixels/ Average Surface Luminance with all black pixels

Note3.The uniformity in surface luminance(WHITE) is determined by measuring luminance at each test position,and then dividing the maximum luminance of all white pixels by minimum luminance of all white pixels,For more information seeFIG2.

WHITE=Minimum Surface Luminance with all white pixels(P1,P2,.....)/Maximum Surface Luminance with all white pixels(P1,P2,.....)

Note4.Viewing angle is the angel at which contrast ratio is greater than a specific value.For TET module,the specific value of contrast ratio is 10.For monochrome and color stn module,the specific value of contrast ratio is2.The 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 FIG3 Note5. Surface luminance is the LCD surface luminance with all white pixels, For more information see FIG2.

LV=Average Surface Luminance with all white pixels(P1,P2,.....)

FIG1. The definition of Response time

响应时间定义

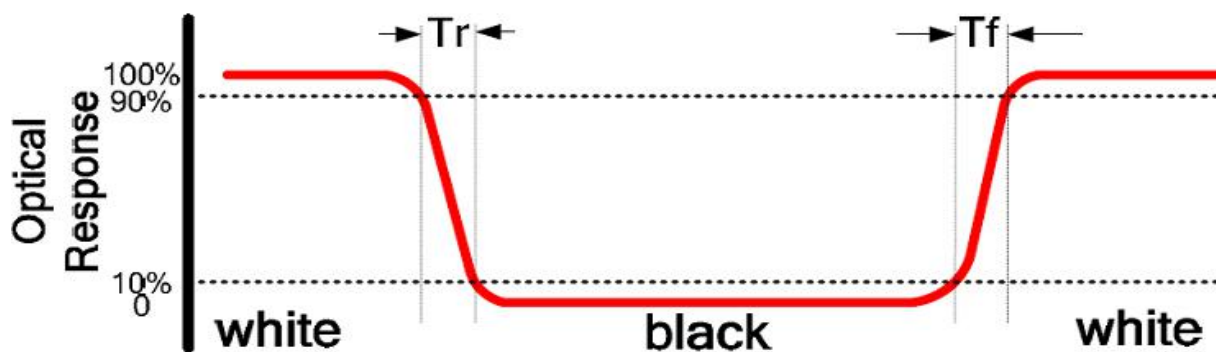


FIG2. Measuring method for Contrast ratio, surface luminance, Luminance

uniformity, CIE(X,Y) chromaticity.

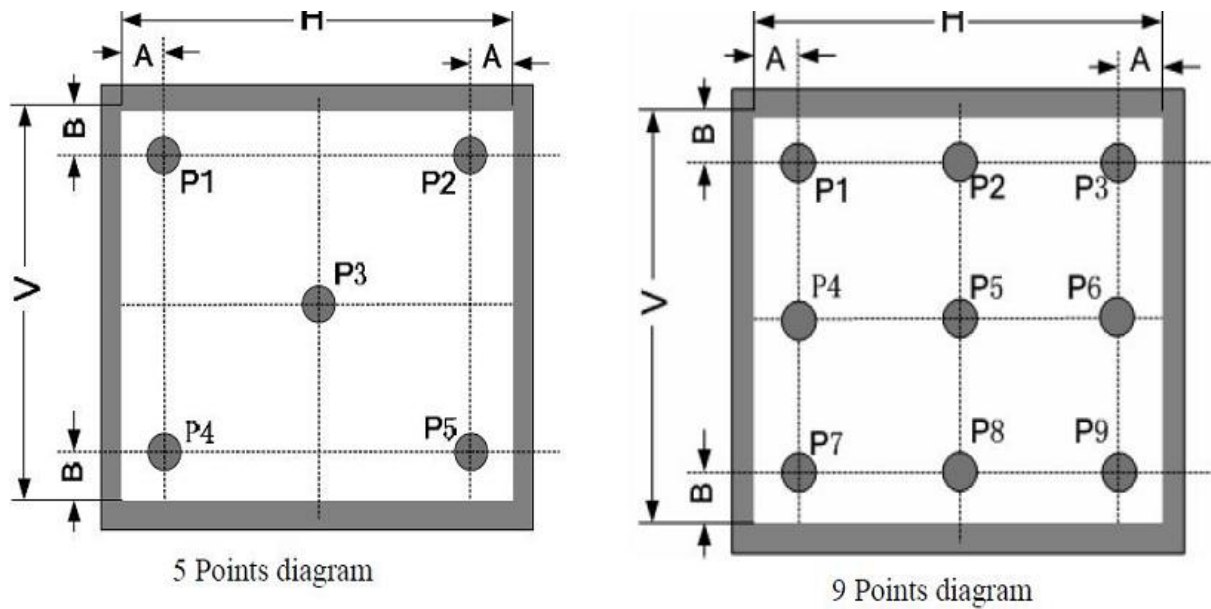
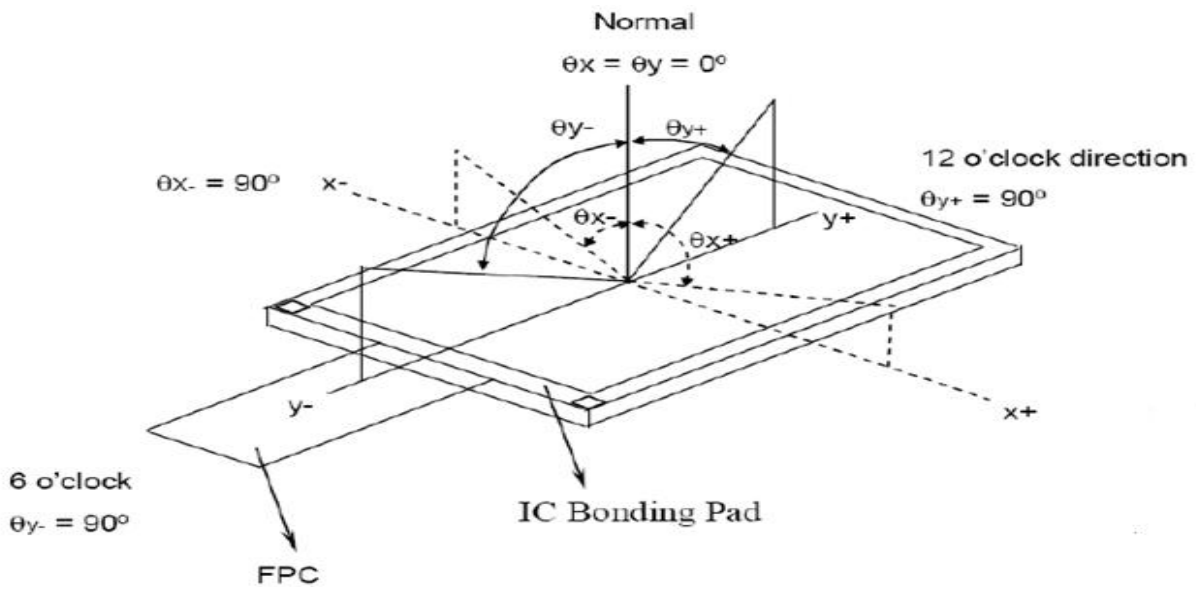


FIG3 The definition of viewing angle 视角定义



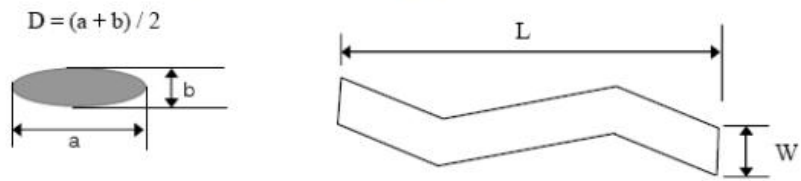
10. Inspection Specifications

10.1 Appearance inspection

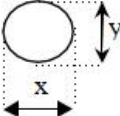
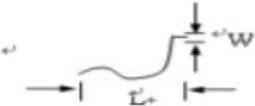
Item	Acceptable standards for defects	Defect level
Broken	Not allowed	critical defects
Cracks	Not allowed	critical defects
Insufficient UV glue entering	Not allowed	critical defects
Liquid crystal seal leakage	Not allowed	critical defects
Liquid crystal bubbles	Not allowed	critical defects
Surface scratch(mm)	$W \leq 0.02$, ignored	minor defects
	$0.02 < W \leq 0.03$ $L \leq 2, N \leq 2$	
	$0.03 < W \leq 0.05$ $L \leq 1, N \leq 1$	
	$0.05 < W$ Not allowed	
Black/white spot(mm)	$D \leq 0.1$, ignored; $0.1 < D \leq 0.15, N \leq 4$	minor defects
	$0.15 < D \leq 0.2, N \leq 2$; $0.2 < D$, Not allowed	
The seal pollution	Not allowed	minor defects
Liquid crystal residues	Not allowed	minor defects
Surface stains	Stains that cannot be cleaned or erased are not allowed	minor defects
size	Refer to the product specification corresponding to each product, overall size(including length,Width, thickness) or partial size exceeding the drawing size is not allowed	major defects

Remarks: 1)Surface scratches within 1.5mm of the glass edge are ignored;

2) D = diameter, L = length, W = width, N = qty;



10.2 Functional test criteria

Item	Judgment	Level																					
Display status	No Display、Incomplete image、line defect、wrong viewing angle、flickering、abnormal image, are not allowed.	major defects																					
	Display color, judged by approved samples, Or by limited samples	minor defects																					
	MURA or the phenomenon that is unable to describe in words, judged by ND 5% or limited samples	minor defects																					
Spot(bright/dark)defect	Definition of spot defect: $\Phi = (x+y) / 2$ 	minor defects																					
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Size(mm)</th> <th colspan="2">acceptable qty</th> </tr> <tr> <th>Active area</th> <th>View area</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.1$</td> <td colspan="2">ignored</td> </tr> <tr> <td>$0.1 < \Phi \leq 0.15$</td> <td colspan="2">2 (gap ≥ 5)</td> </tr> <tr> <td>$0.15 < \Phi \leq 0.2$</td> <td colspan="2">1</td> </tr> <tr> <td>$0.2 < \Phi$</td> <td colspan="2">Not allowed</td> </tr> </tbody> </table>		Size(mm)	acceptable qty		Active area	View area	$\Phi \leq 0.1$	ignored		$0.1 < \Phi \leq 0.15$	2 (gap ≥ 5)		$0.15 < \Phi \leq 0.2$	1		$0.2 < \Phi$	Not allowed		minor defects			
	Size(mm)			acceptable qty																			
			Active area	View area																			
	$\Phi \leq 0.1$		ignored																				
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$0.15 < \Phi \leq 0.2$	1																						
$0.2 < \Phi$	Not allowed																						
	minor defects																						
		ignored																					
			ignored																				
				1																			
					Not allowed																		
Black/white line	Definition of line defect: L: length, W: width 	minor defects																					
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2">Size(mm)</th> <th colspan="2">Acceptable qty</th> </tr> <tr> <th>W(width)</th> <th>L(length)</th> <th>Active area</th> <th>View area</th> </tr> </thead> <tbody> <tr> <td>$W \leq 0.03$</td> <td>ignored</td> <td>ignored</td> <td>ignored</td> </tr> <tr> <td>$0.03 < W \leq 0.05$</td> <td>$L \leq 2.0$</td> <td>3</td> <td></td> </tr> <tr> <td>$W > 0.05$</td> <td>-</td> <td>Not allowed</td> <td></td> </tr> </tbody> </table>		Size(mm)		Acceptable qty		W(width)	L(length)	Active area	View area	$W \leq 0.03$	ignored	ignored	ignored	$0.03 < W \leq 0.05$	$L \leq 2.0$	3		$W > 0.05$	-	Not allowed		minor defects
	Size(mm)		Acceptable qty																				
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	$W \leq 0.03$		ignored	ignored	ignored																		
$0.03 < W \leq 0.05$	$L \leq 2.0$	3																					
$W > 0.05$	-	Not allowed																					
	minor defects																						
		ignored																					
			3																				
	-																						
	Not allowed																						

11. Reliability Test Items

Item	Test Condition	Criterion
High Temperature Storage	70 °C, 48 hrs	Note1, Note2
Low Temperature Storage	-20°C, 48 hrs	
High Temp. & High Humidity Storage	40 °C, 80% RH, 48hrs	
Thermal Shock (Static)	-20°C, 30 min / 70, 30 min, 20 cycles	
High Temperature Operation	60 °C, 48 hrs	
Low temperature Operation	-10 °C, 48 hrs	

Note1: Evaluation should be tested after storage at room temperature for two hours.

Note2:

Pass: Normal display image no line defect.

Fail: No display image, or line defects.

Partial transformation of the module parts should be ignored.

12. Precautions

Please pay attentions to the followings as using the LCD module.

Handling

- (a) Do not apply strong mechanical stress like drop, shock or any force to LCD module. It may cause improper operation, even damage.
- (b) Because the polarizer is very fragile and easy to be damaged, do not hit, press or rub the display surface with hard materials.
- (c) Do not put heavy or hard material on the display surface, and do not stack LCD modules.
- (d) If the display surface is dirty, please wipe the surface softly with cotton swab or clean cloth.
- (e) Avoid using Ketone type materials (e.g. Acetone), Toluene, Ethyl acid or Methyl chloride to clean

the display surface. It might damage the touch panel surface permanently. The recommended solvents are water and Isopropyl alcohol.

- (f) Wipe off water droplets or oil immediately.
- (g) Protect the LCD module from ESD. It will damage the LSI and the electronic circuit.
- (h) Do not touch the output pins directly with bare hands.
- (i) Do not disassemble the LCD module.
- (j) Do not lift the FPC of Touch Panel.

Storage

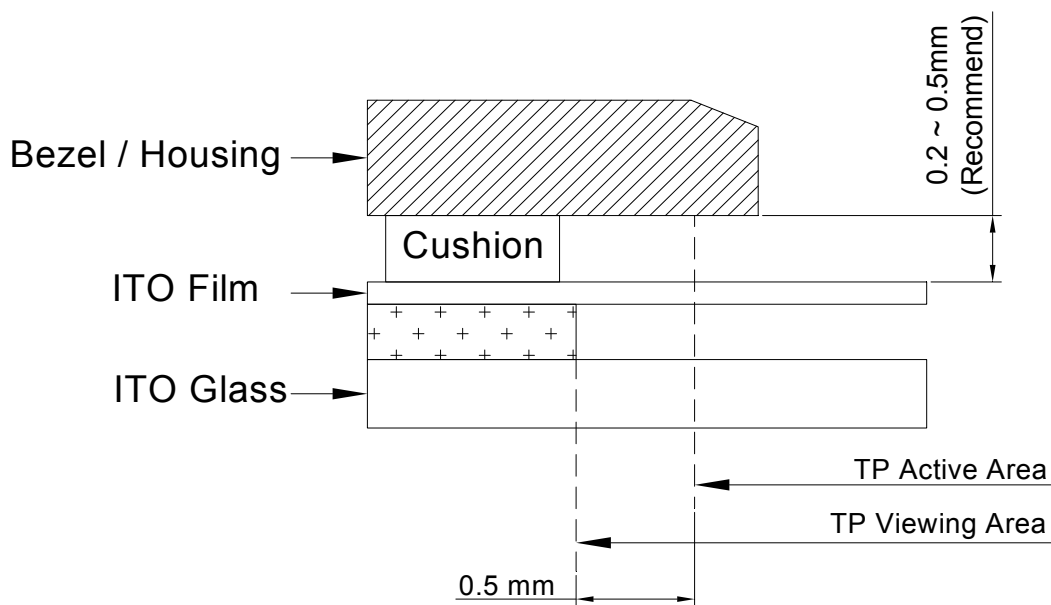
- (a) Do not leave the LCD modules in high temperature, especially in high humidity for a long time.
- (b) Do not expose the LCD modules to sunlight directly.
- (c) The liquid crystal is deteriorated by ultraviolet. Do not leave it in strong ultraviolet ray for a long time.
- (d) Avoid condensation of water. It may cause improper operation.
- (e) Please stack only up to the number stated on carton box for storage and transportation. Excessive weight will cause deformation and damage of carton box.

Operation

- (a) When mounting or dismounting the LCD modules, turn the power off.
- (b) Protect the LCD modules from electric shock.
- (c) The Driver IC control algorithms stated above should always obeyed to avoid damaging the LSI and electronic circuit.
- (d) Be careful to avoid mixing up the polarity of power supply for backlight.
- (e) Absolute maximum rating specified above has to be always kept in any case. Exceeding it may cause non-recoverable damage of electronic components or, nevertheless, burning.
- (f) When a static image is displayed for a long time, remnant image is likely to occur.
- (g) Be sure to avoid bending the FPC to an acute shape, it might break FPC.
- (h) Most of the touch screens have air vent to equalize the inside air pressure to the outside one. The air vent must be open and liquid contact must be avoided as the liquid may be absorbed if the liquid is accumulated near the air vent.
- (i) For the fragility of ITO film, it should avoid to use too tapering pen as the input material.

Touch Panel Mounting Notes

- (a) If a cushion is used between bezel/housing and film must be choose as free as enough to absorb the expansion and contraction to avoid the distortion of film.
- (b) The cushion must be placed out of the Viewing Area.
- (c) Bezel/Housing edge must be posited between Key Area and Viewing Area. The edge enters the Key Area may cause unexpected input if the gap is too narrow or foreign particles like dusts exist between Bezel/Housing and ITO film.
- (d) Mounting example:



The corner part has conductivity. Do not touch any metal part after mounting.

Others

- a) If the liquid crystal leaks from the panel, it should be kept away from the eyes or mouth.
- b) For the fragility of polarizer, it is recommended to attach a transparent protective plate over the display surface.
- c) It is recommended to peel off the protection film on the polarizer slowly so that the electrostatic charge can be minimized.