深圳市一众显示科技有限公司

SHEN ZHEN TEAM SOURCE DISPLAY TECH. CO, TD.

TFT-LCD Module Specification

Module NO.: TST121WXBH-01

Version: V1.0

☐ APPROVAL FOR SPECIFICATION ☐ APPROVAL FOR SAMPLE

For Customer’s Acceptance:	
Approved by	Comment

Team Source Display:		
Presented by	Reviewed by	Organized by

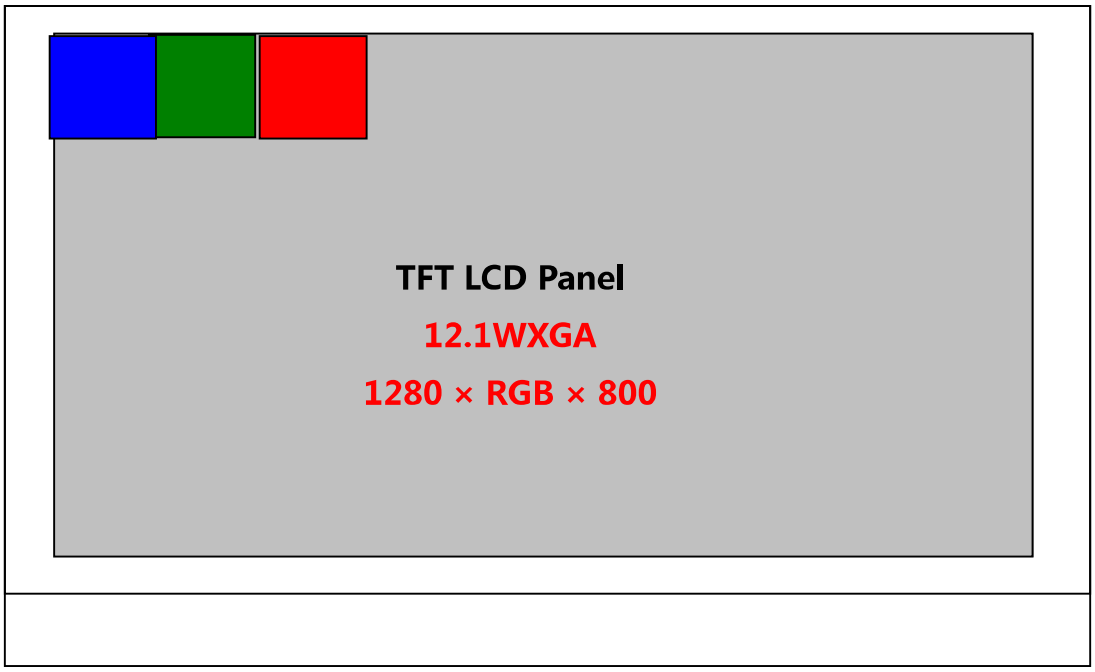
Version No.	Date	Content	Remark
V1.0	2019-06-10	Initial Release	

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

TST121WXBH-01 is a color active matrix TFT LCD Panel using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 12.1inch diagonally measured active area with WXGA resolutions (1280 horizontal by 800 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7M colors.



1.2 Features

- Cell Thickness：1.0 t
- RoHS Compliant
- Display Mode: ADS
- Interface: LVDS, 1 port 4 pair
- Number of colors: Real 8 bit, cannot be selected

1.3 Application

- Medical Equipment

1.4 General Specification (H: horizontal length, V: vertical length)

The followings are general specifications at the TST121WXBH-01

<Table 1. General Specifications>

Parameter	ITEMS	Unit	Remark
Active area	261.12(H) ×163.2 (V)	mm	
Dimensional Outline	277.7(W)×180.6(V) × 8.7(D)	mm	
Border(L/R/U/D)	4.0/4.0/3.2/3.0		
Number of pixels	1280 (H) ×800 (V)	pixels	
Pixel pitch	0.07(H) × 0.2(V)	mm	
Pixel arrangement	1P2D		
Luminance	Typ 400 nit, Min 300 nit	nit	
Transmittance	5.8%(typ)		without APF
Color Gamut	48%(typ)		
Display colors	16.7M		
Display mode	Normally Black		
Contrast Ratio	1200:1(typ)		
Response Time	25(typ)	ms	
Optima Viewing Direction (Human Eye)	85/85/85/85(typ)	Deg.	CR>10
Driver IC	HX8255-A		
Weight	556	gram	

2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

<Table 2. Absolute Maximum Ratings >

Parameter	Symbol	Min.	Max.	Unit	Remarks
LC operating Voltage [Note1]	V_{OP}		5.0	V	Ta=25+/-5°C
Operating Temperature (Humidity)	T_{OP}	-20	+70	℃	
Storage Temperature (Humidity)	T_{ST}	-30	+80	℃	

Note:

1. Liquid Crystal driving voltage

   Due to the characteristics of LC Material, this voltage varies with environmental temperature.

3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

<Table 3. Electrical specifications >

Parameter	Symbol	Value	Range	Unit	Remark
TFT Gate ON Voltag	VGH	23	-	V	Note1
TFT Gate OFF Voltage	VGL	-8	-	V	Note2
TFT Common Electrode Voltage	Vcom	3.5	2~5	V	Note3
TFT Kick-Back Voltage Max	ΔVp Max	—	—	V	
TFT Kick-Back Voltage Min	ΔVp Min	—	—	V	
LCD Panel Signal Processing Board	VDD	3.3	3.0~3.6	V	
LCD Panel Signal Current	—	0.6	0.5~0.8	A	
Backlight Input Voltage	—	12	11~13	V	
Backlight Input Current	—	0.4	0.3~0.5	A	
LCD Panel Display Power	—	6.5	6~7	W	
Backlight Power	—	4.5	4~5	W	

Note:

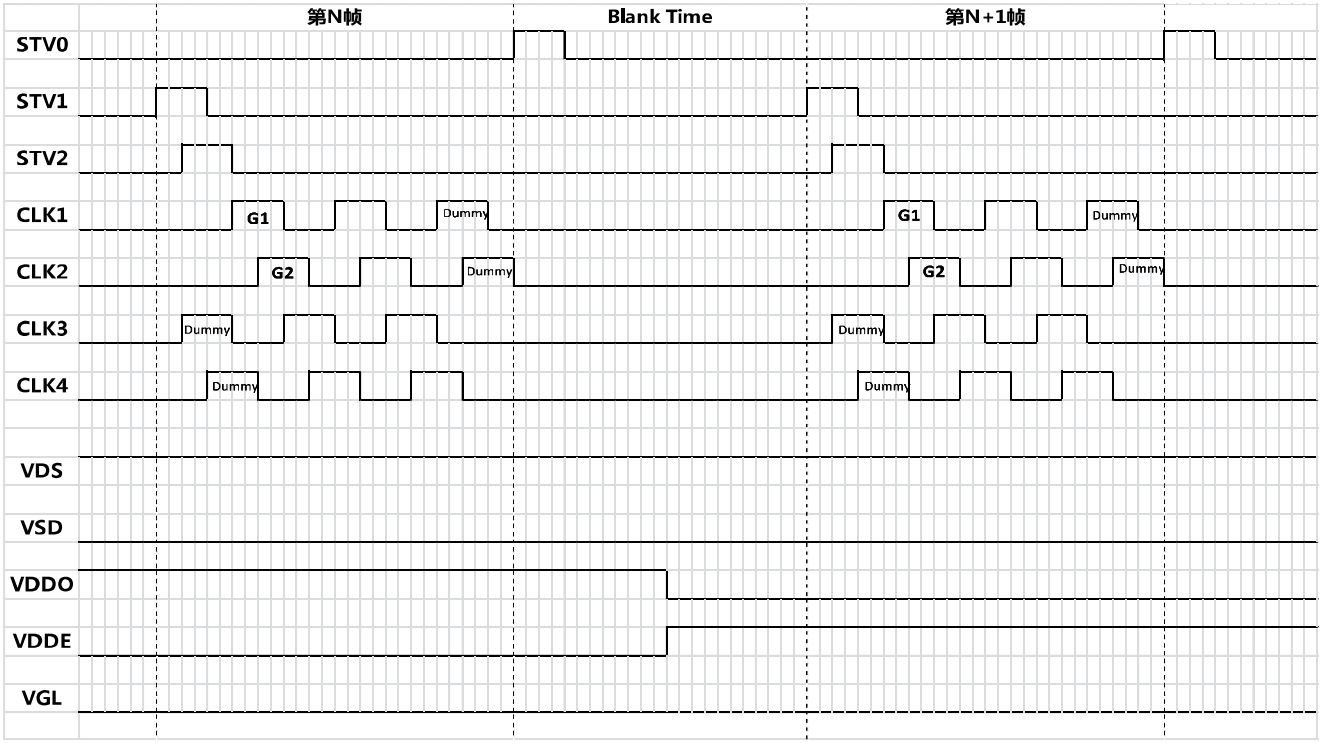
1. VGH is TFT Gate operating voltage.
2. VGL is TFT Gate operating voltage. The low voltage level of VGL signal must be fluctuates with same phase as Vcom.
3. Vcom must be adjusted to optimize display quality, as Crosstalk and Contrast Ratio etc..

We just kindly recommend the setting-voltages the reference value.

In order to get the optimized display quality, the setting-voltage should be changed according to customer's developing condition. (The display quality could be changed by customer's setting –voltage.)

3.2 GOA Timing

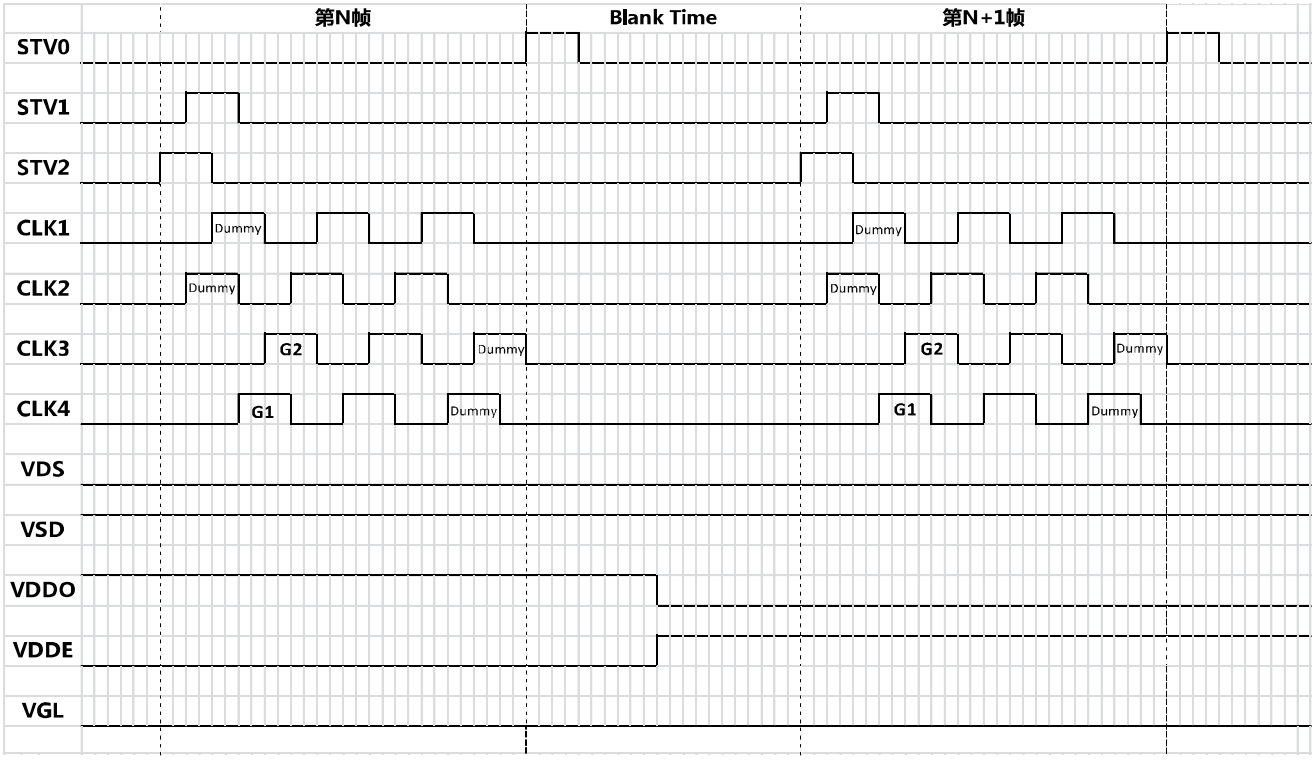
Forward（CLK 信号Duty Cycle=50%为例）



CLK 信号Duty Cycle=45%，在40%~50%可调；
VGH=23V，VGL=-8V；
VDDO&VDDE周期为整数帧时间（180帧），周期为3s左右，高低电平切换在Blank Time内；
VD/S=VGH，VS/D=VGL；

3.2 GOA Timing

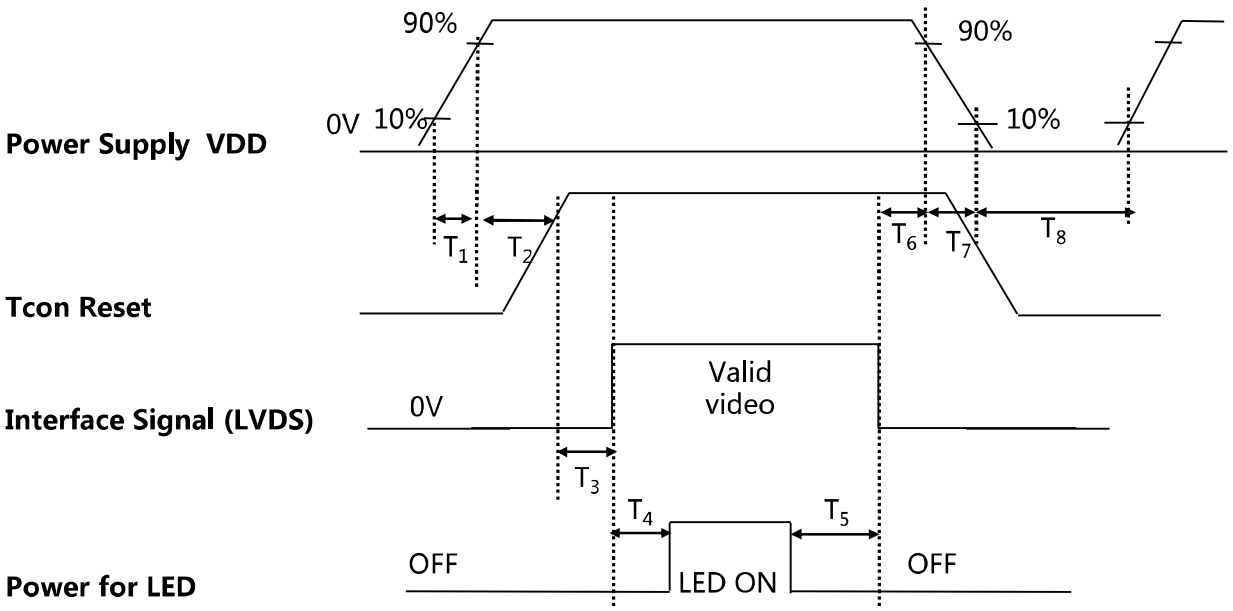
Backward（CLK 信号Duty Cycle=50%为例）



CLK 信号Duty Cycle=45%，在40%~50%可调；
VGH=23V，VGL=-8V；
VDDO&VDDE周期为整数帧时间（180帧），周期为3s左右，高低电平切换在Blank Time内；
VD/S=VGL，VS/D=VGH；

3.3 Power Sequence

[Ta =25±2 ℃]

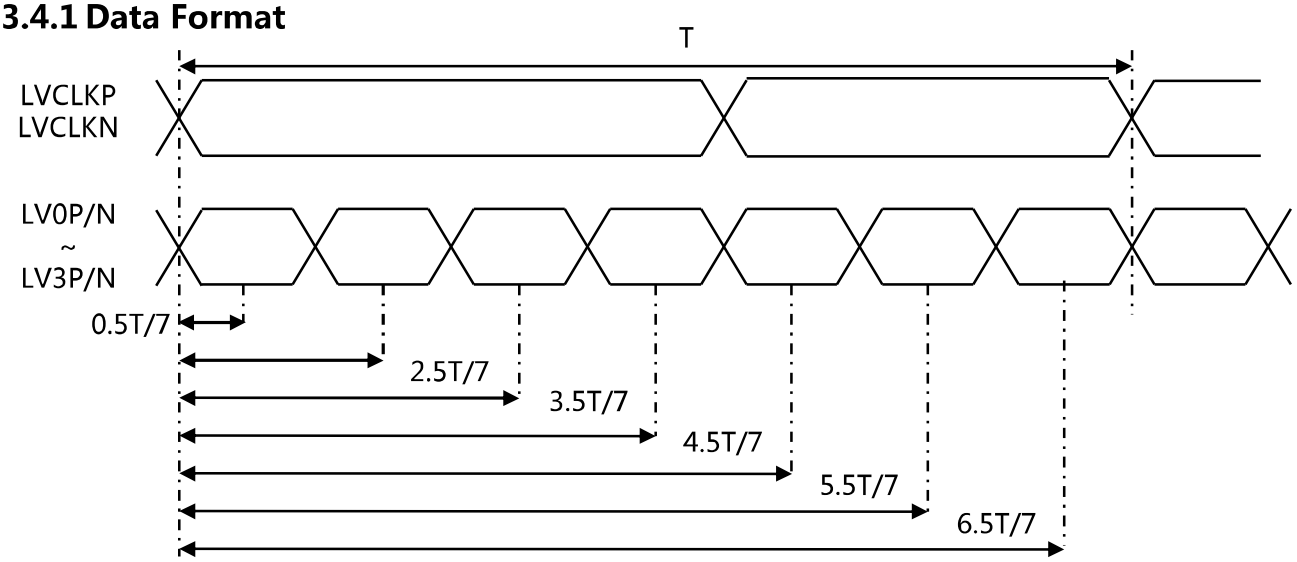


< Table 4. Sequence Table >

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.1	-	8	(ms)
T2	-	8	-	(ms)
T3	0	-	-	(ms)
T4	300	-	-	(ms)
T5	300	-	-	(ms)
T6	0	-	50	(ms)
T7	0	-	10	(ms)
T8	500	-	-	(ms)

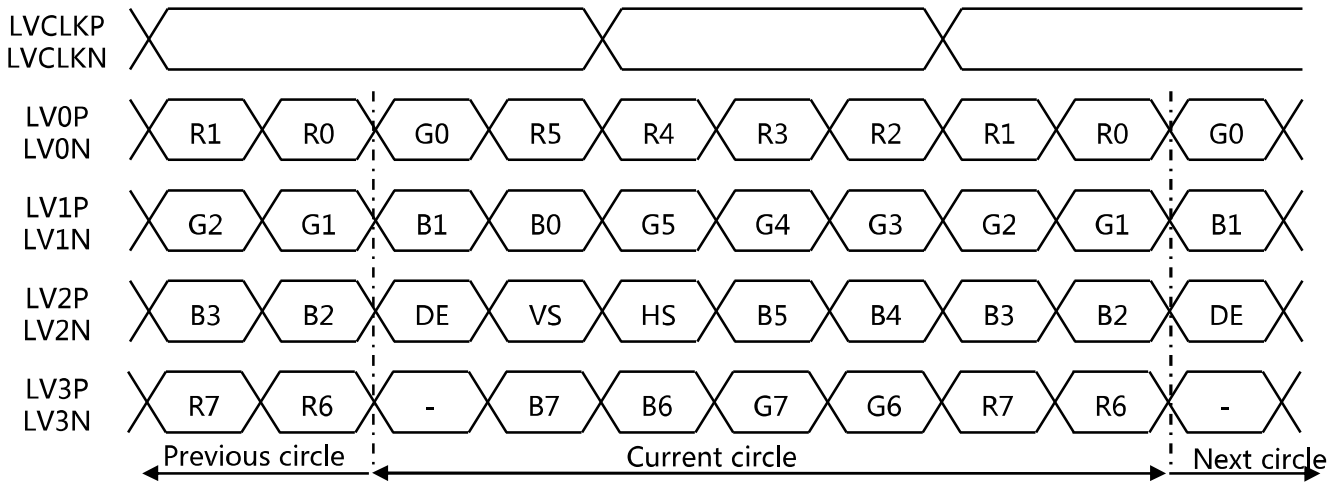
3.4 LVDS Interface Characteristic

3.4.1 Data Format



< LVDS input data ideal strobe position >

3.4.2 LVDS input data mapping

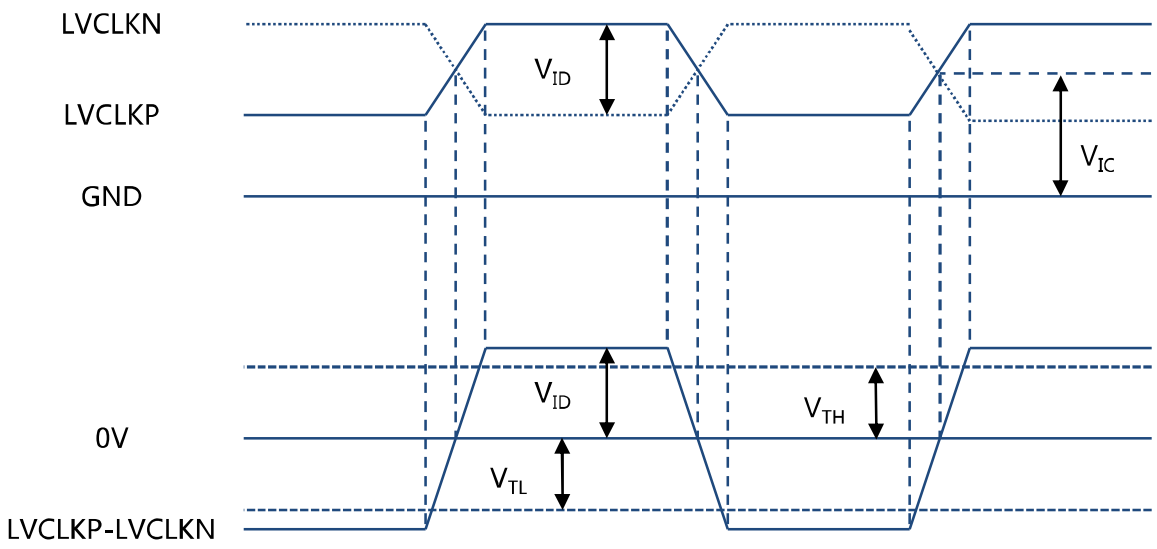


< 8 bit LVDS input data mapping >

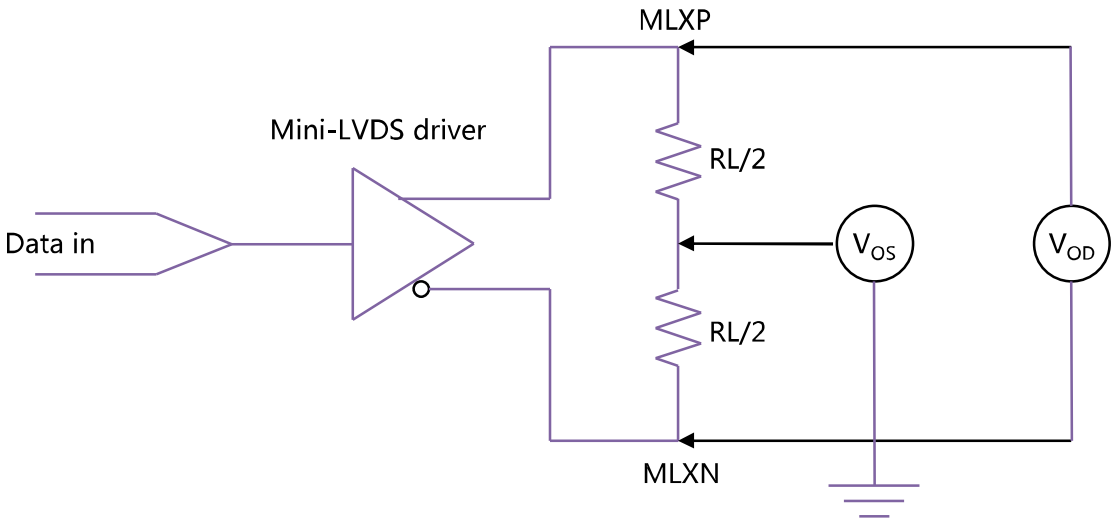
3.4.3 DC Specification

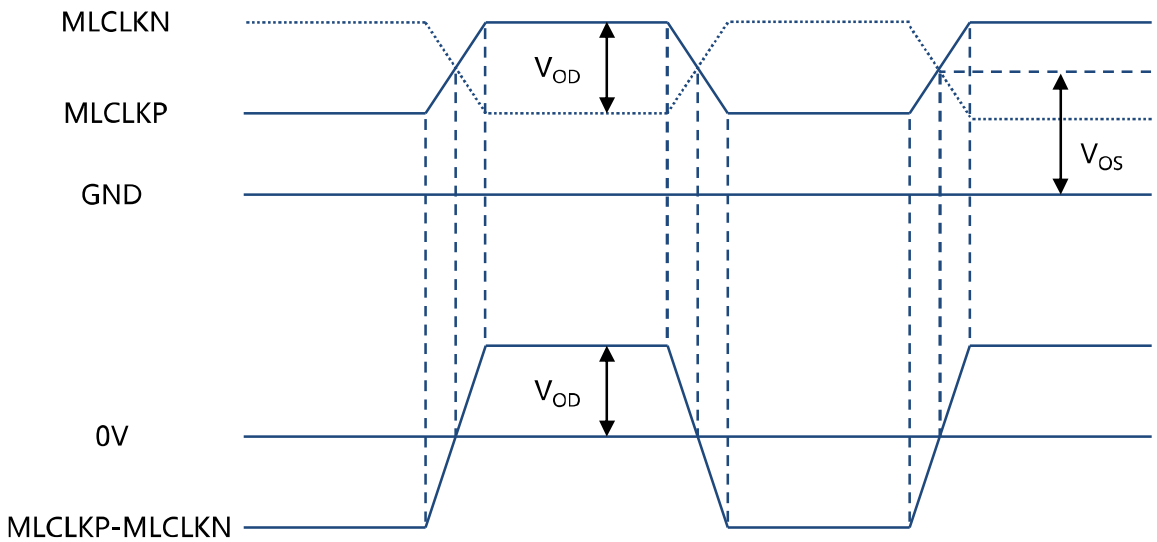
< Table 5. DC Specification >

Parameter	Symbol	Min	Typ	Max	Unit	Condition
Supply current	I_{DD}	-	100	-	mA	
LVDS DC specifications						
Differential input high threshold	V_{TH}	-	-	+100	mV	V_{IC}=1.2V
Differential input low threshold	V_{TL}	-100	-	-	mV	
LVDS common mode voltage	V_{IC}	0.7	-	1.6	V	
LVDS swing voltage	V_{ID}	±100	-	±600	mV	
Mini-LVDS DC specifications						
Output differential voltage range	V_{OD}	±170	±200	±230	mV	PI=14KΩ RL=100Ω (T_A=25℃)
Output differential voltage deviation		0.64	-	0.96	mV	
Output offset voltage range	V_{OS}	1.0	1.2	1.4	V	
Output offset voltage deviation		1.0	1.2	1.4	V	



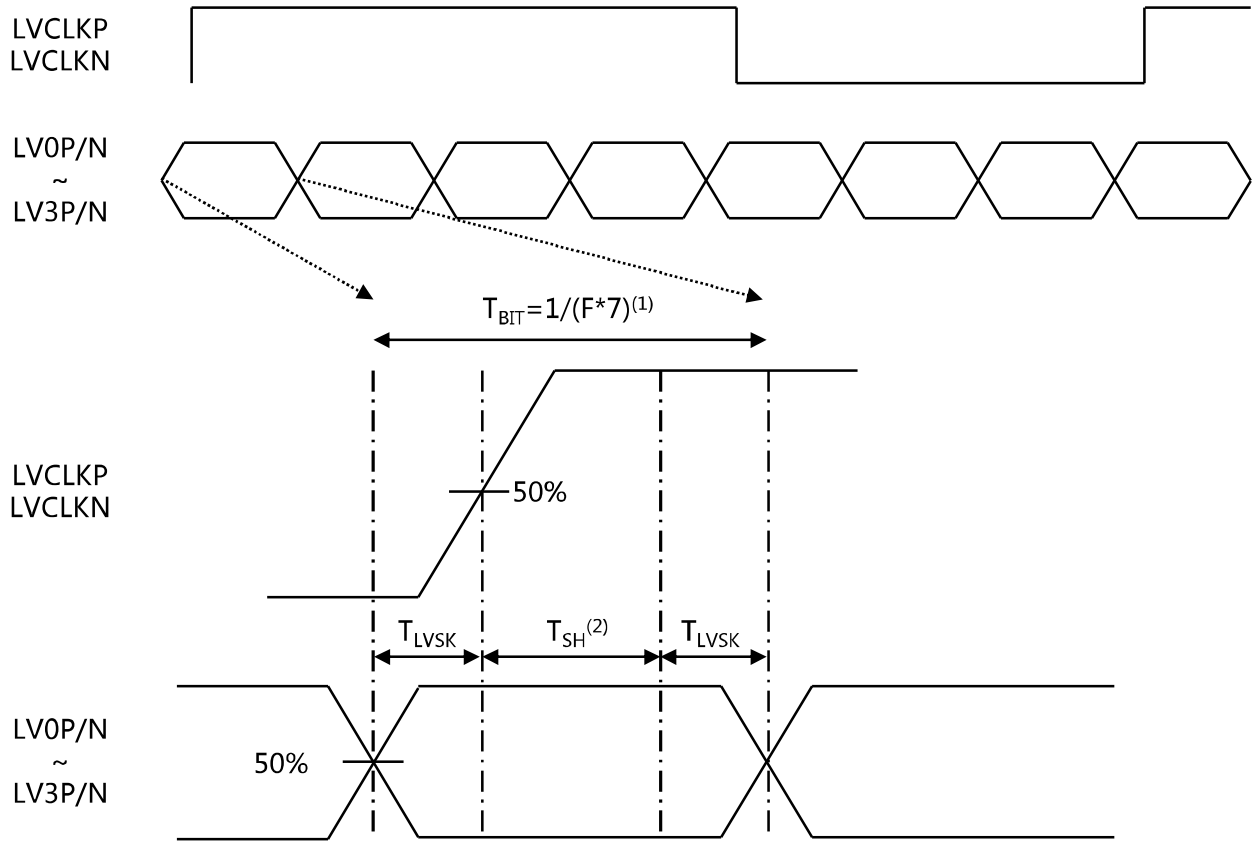
< LVDS V_{ID} and V_{IC} definition>





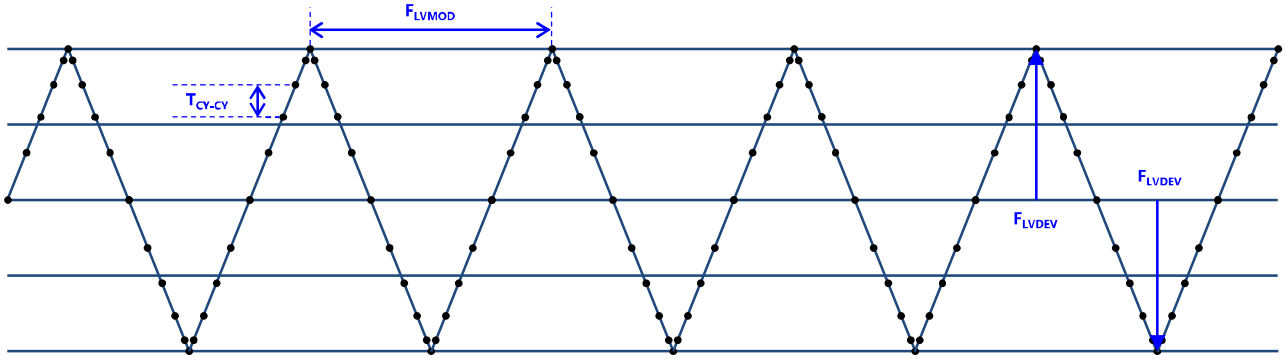
< Mini-LVDS V_{OD} and V_{OS} definition>

3.4.4 AC Specification



Note:
(1) T_{BIT}: Data period
(2) Internal CLK sampling data window

< LVDS channel to channel skew>



< LVDS input SSC>

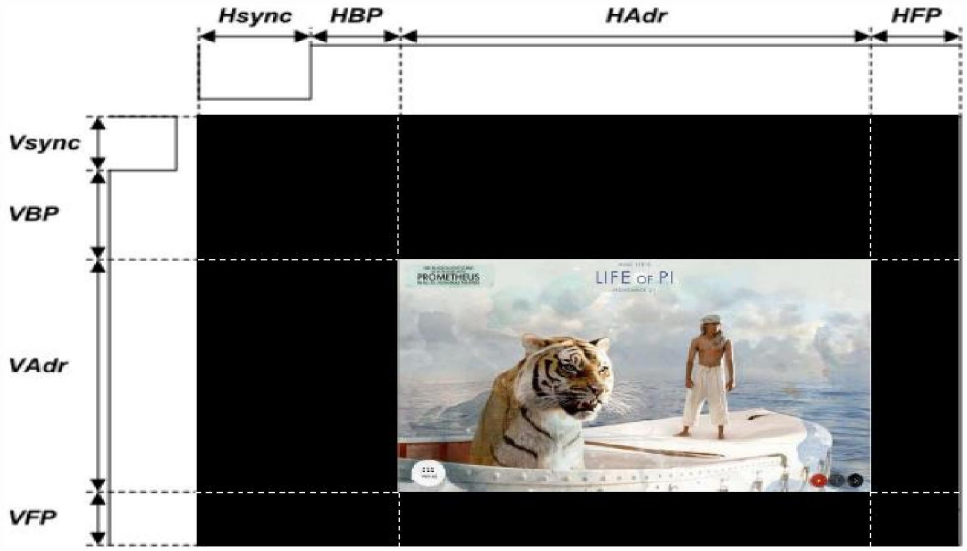
< Table 6. AC Specification >

Description	Symbol	Condition	Min	Typ	Max	Unit
LVDS Input frequency	F	-	68	-	74	MHz
LVDS channel to channel skew	T_{LVSK}	F=65MHz V_{IC}=1.2V V_{ID}=±200mV	-600	-	+600	ps
Modulating frequency of input clock during SSC	F_{LVMOD}	F=85MHz V_{IC}=1.2V V_{ID}=±200mV	10	-	300	KHz
Maximum deviation of input clock frequency during SSC	F_{LVDEV}		-3	-	+3	%
Cycle to cycle jitter	T_{CY-CY}		-	-	200	ps

3.5 Interface timing Parameter

< Table 7. Timing Parameter >

Item			Symbol	min	typ	max	UNIT
LCD	Frame Rate		-	59	60	61	Hz
	Pixels Rate		-	69.922	71	72.293	MHz
Timing	Horizontal	Horizontal total time	tHP	-	1440	-	t_{CLK}
		Horizontal Active time	tHadr		1280		t_{CLK}
		Horizontal Back Porch	tHBP		80		t_{CLK}
		Horizontal Front Porch	tHFP		48		t_{CLK}
	Vertical	Vertical total time	tvp		823		t_H
		Vertical Active time	tVadr		800		t_H
		Vertical Back Porch	tVBP		14		t_H
		Vertical Front Porch	tVFP		3		t_H
Lane				-	1	-	Lane



4.0 OPTICAL SPECIFICATION

4.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤1lux and temperature = 25±2℃) with the equipment of Luminance meter system (Goniometer system and CS-2000) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. The center of the measuring spot on the Display surface shall stay fixed.
The backlight should be operating for 30 minutes prior to measurement.

4.2 Optical Specifications

<Table 8. Optical Specifications >

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle Range	Horizontal	Θ3	CR>10		85	-	Deg.	Note1
		Θ9			85	-	Deg.	
	Vertical	Θ12			85	-	Deg.	
		Θ6			85	-	Deg.	
Luminance		Lum	Θ = 0°	300	400	-	nit	
Contrast ratio		CR	Θ = 0°	800	1200	-		Note2
Transmittance		Tr		5.2	5.8	-	%	Note3
Color Gamut		CG		40	48	-	%	
Reproduction of color	Red	Rx	Θ = 0°	0.556	0.596	0.636		Note4 (Based on BLU)
		Ry		0.292	0.332	0.372		
	Green	Gx		0.295	0.335	0.375		
		Gy		0.512	0.552	0.592		
	Blue	Bx		0.109	0.149	0.189		
		By		0.079	0.119	0.159		

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
White Chromaticity	Wx	Θ = 0°	0.263	0.313	0.363		
	Wy		0.279	0.329	0.379		
Response Time (Rising + Falling)	$T_r + T_f$	Ta= 25° C Θ = 0°	-	25	35	ms	Note 5
White luminance uniformity	▵Y		70	80	-	%	Note 6
LED Life time			50,000			Hrs	Note 7

Note:

1.Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o' clock direction and the vertical or 6, 12 o' clock direction with respect to the optical axis which is normal to the LCD surface (see Figure 1).

2.Contrast measurements shall be made at viewing angle of Θ= 0 and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state . (see Figure1) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3.Transmittance is the Value without APF and without CG.

4.The color chromaticity coordinates specified in the above table shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

5.The electro-optical response time measurements shall be made as FIGURE 2 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Tf.

6.The White luminance uniformity on LCD surface is then expressed as:

▵Y=(Minimum Luminance of 9points/Maximum Luminance of 9points)*100.(see Figure3)

7. The lifetime is determined as the time at which luminance of LED become 50% of the initial brightness or not normal lighting at IPIN=26mA on condition of continuous operating at 25 ±2°C.

Figure1 Measurement Set Up

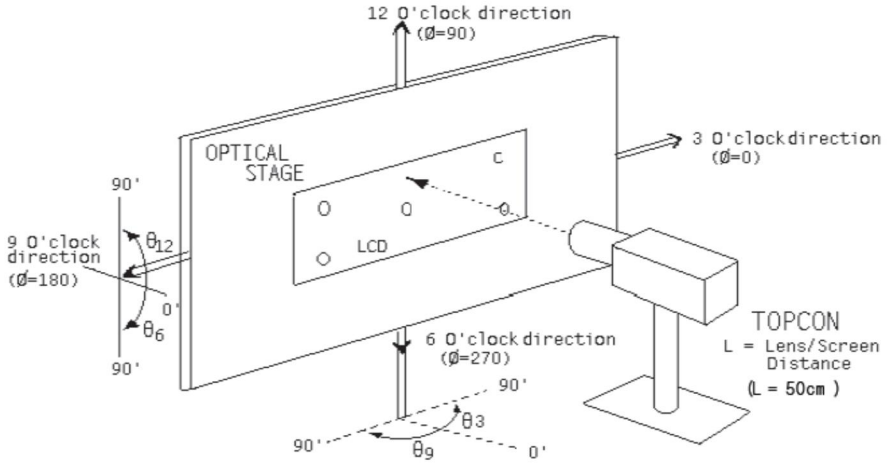


Figure2 Response Time Testing

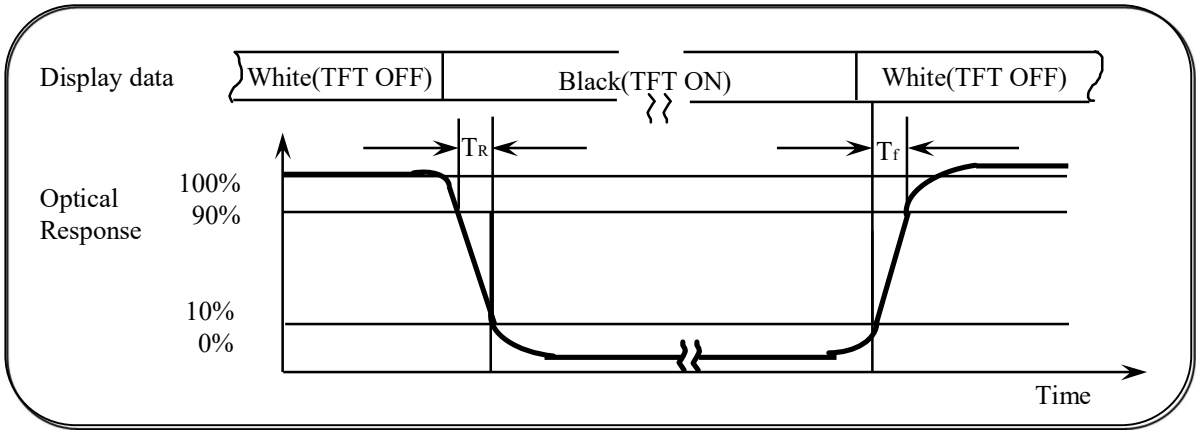
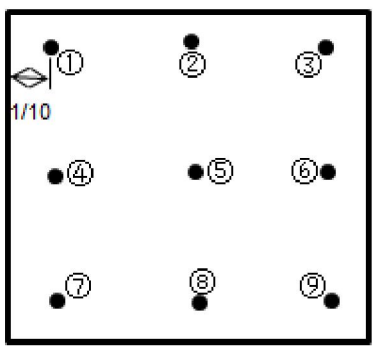


Figure3 White luminance uniformity



Pattern:W255
Point:9 point,From the edge of 10%

5.0 FPC/IC PIN ASSIGNMENT & MECHANICAL CHARACTERISTICS

5.1 Dimension Requirements

Mechanical outlines for the panel (H: horizontal length, V: Vertical length)

<Table 9 Dimensional Parameters>

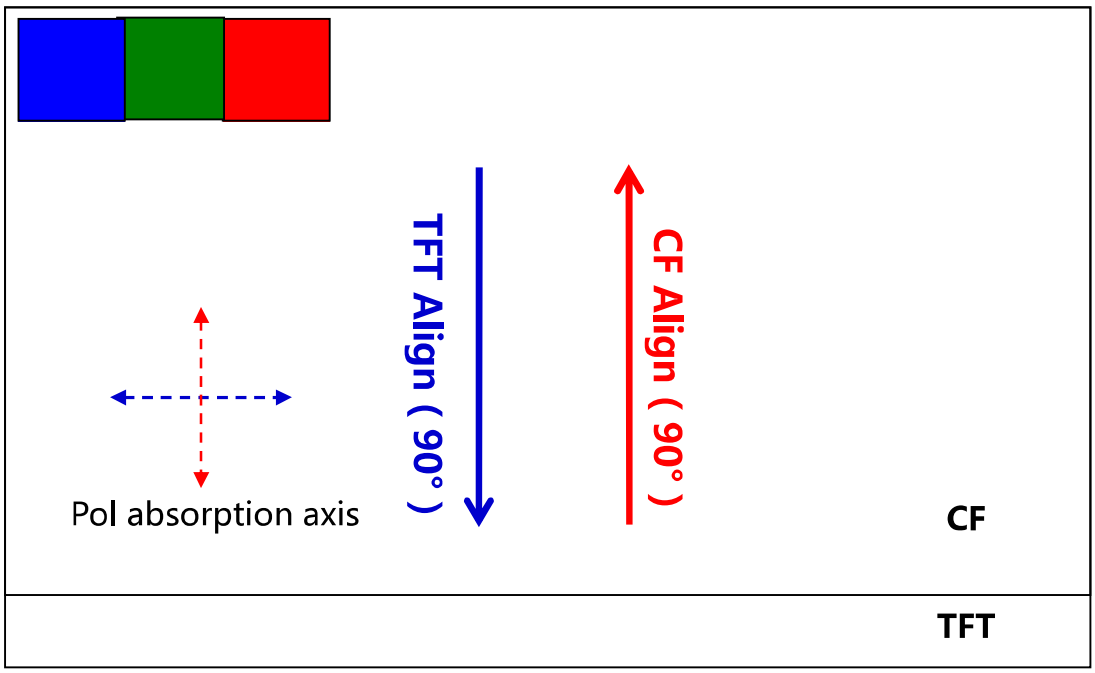
Parameter	ITEMS	Unit	Remark
Dimensional Outline	277.7(W)×180.6(V)×8.7(D)	mm	
CF size	269.12(H) × 169.4(V)	mm	
Active area	261.12(H) ×163.2(V)	mm	
Border(L/R/U/D)	4.0/4.0/3.2/3.0	mm	
Number of pixels	1280 (H) ×800 (V)	pixels	
	1pixel=R+G+B dots		
Pixel pitch	0.07(H) × 0.2(V)	mm	
Pixel Arrangement	1P2D		
Pad Area	3.6	mm	
Glass Edge to FPC	0.3	mm	Note1
FPC Pad Width	46.4	mm	
FPC to D-IC	0.5	mm	
D-IC Width	24.0	mm	
D-IC to CF Edge	1.0	mm	

Note:

1. The size specified is calculated by IC–driver HX8255-A, the size maybe changed if customer use other IC.

5.2 LC Align Direction & Pol absorption axis

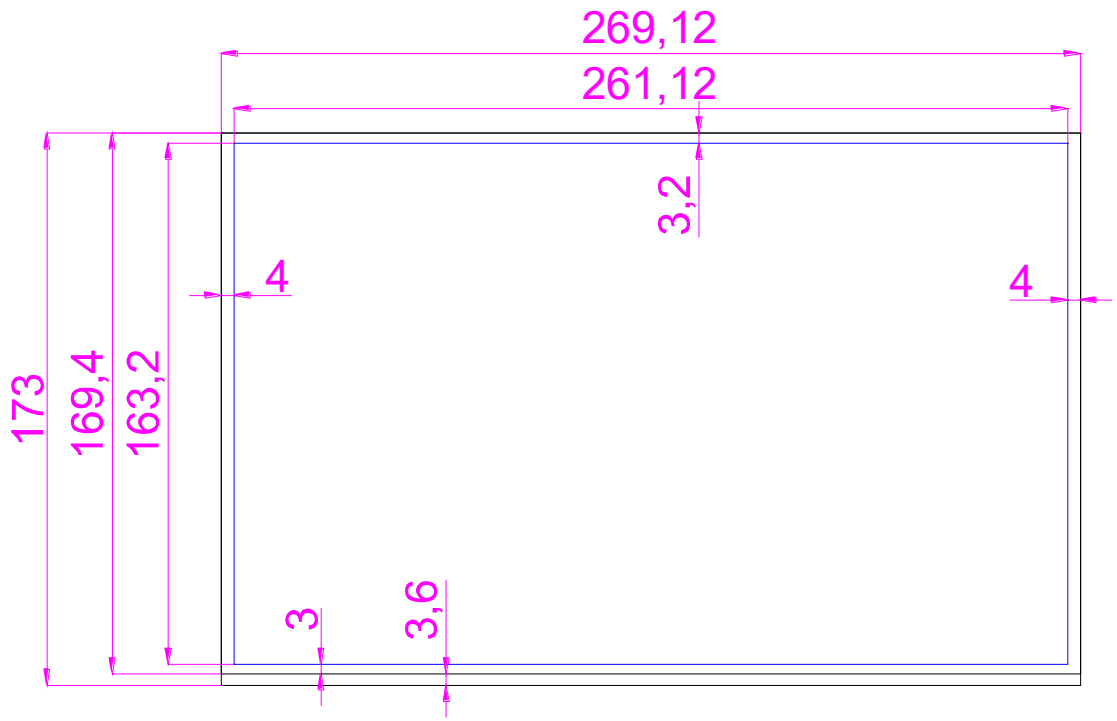
Figure4 The TFT and CF LC Align Direction



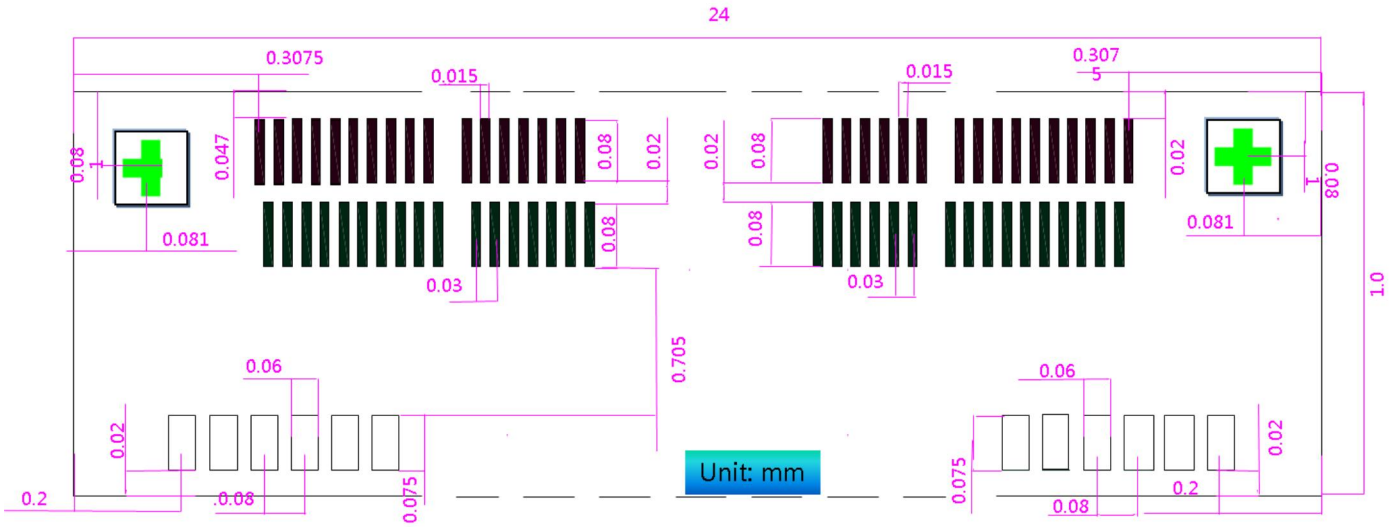
Pol absorption axis :

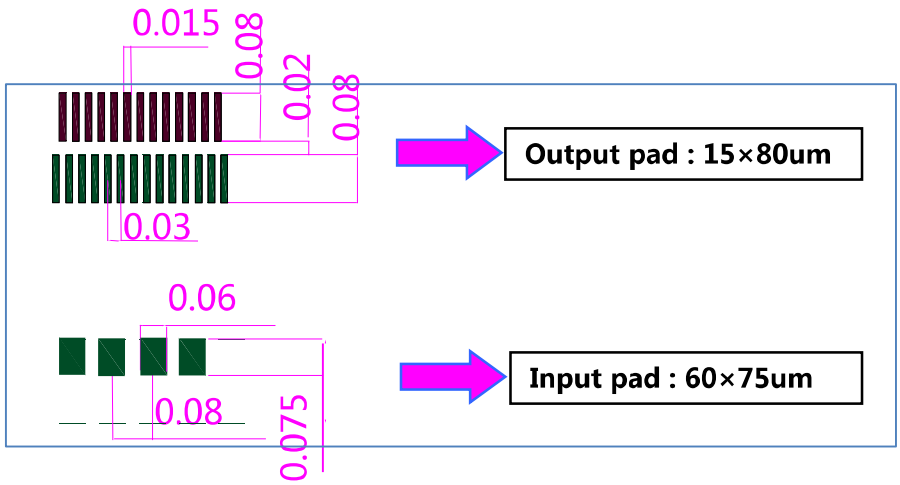
Shown in Figure 4, CF pol absorption axis is parallel with CF align direction(0°) , TFT pol absorption axis is vertical with TFT align direction (90°)

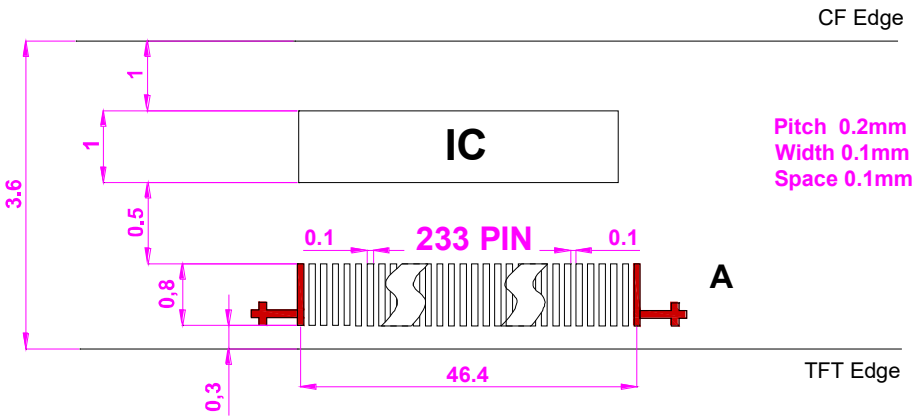
5.3 Outline Dimension (unit : mm)



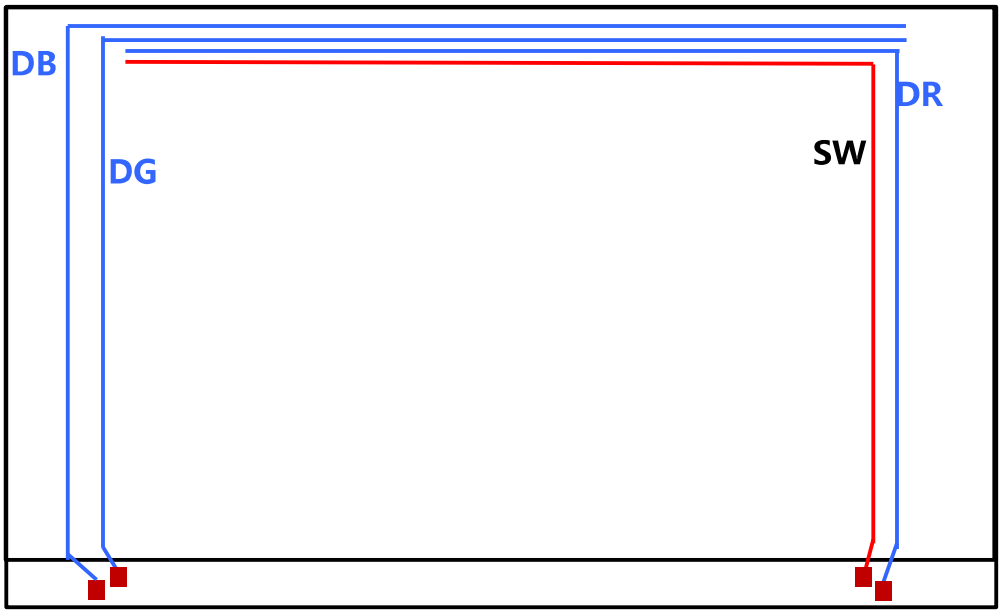
5.4 IC & FPC Position Information(unit : mm)

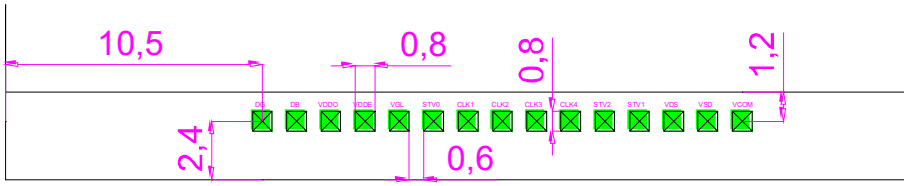


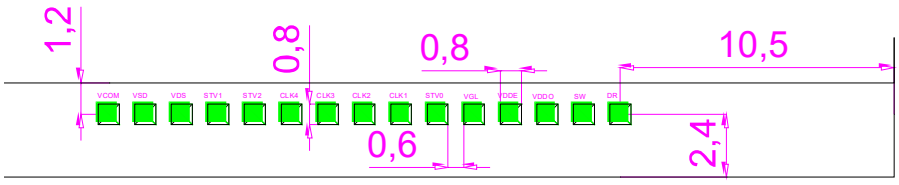




5.5 Cell Test Pad(unit : mm)







左侧 DC DM VDDO VDDE VGL STV0 CLK1 CLK2 CLK3 CLK4 STV2 STV1 VDS VSD VCOM

VCOM VSD VDS STV1 STV2 CLK4 CLK3 CLK2 CLK1 STV0 VGL VDDE VDDO SW DY 右侧

5.6 Connector Pin Assignment

5.6.1 LCD panel signal

CN1 SOCKET: DF19G-20P-1H (54) (HIROSE ELECTRIC CO., LTD (HRS))
Adaptable plug: DF19G -20S-1C(05) (HIROSE ELECTRIC CO., LTD (HRS))

Pin NO.	Pin name	Description
1	VCC	Power supply
2	VCC	
3	N.C.	Not connect
4	GND	Ground
5	D0-	Pixel data
6	D0+	
7	GND	Ground
8	D1-	Pixel data
9	D1+	
10	GND	Ground
11	D2-	Pixel data
12	D2+	
13	GND	Ground
14	CLK-	Pixel data
15	CLK+	
16	GND	Ground
17	SDA	Not connect
18	SCL	Not connect
19	D3-	Pixel data
20	D3+	

5.6.2 LED Driver

CN2 SOCKET: MSA24038P6 (SIN SHENG TERMINAL & MACHINE INC. (SMT))
Adaptable plug: P24038P6 (SIN SHENG TERMINAL & MACHINE INC. (SMT))

Pin NO.	Pin name	Description	Remark
1	PWM	Luminance control	
2	BRTC	Backlight ON/OFF control	High or Open： Backlight ON Low： Backlight OFF
3	GND	Ground	
4	GND	Ground	
5	VDD	Power supply	
6	VDD	Power supply	

5.7 FPC Pin Assignment

1	DUMMY	49	Source 241	97	GMA_SEL	145	PAIR	193	VDS
2	NULL	50	VR16	98	STBYB	146	DATAPOL	194	DUMMY
3	TEST1	51	VR15	99	RESETB	147	SEL2	195	STV1
4	TEST2	52	VR14	100	DUMMY	148	SEL1	196	STV1
5	GND	53	VR13	101	DUMMY	149	SEL0	197	STV2
6	GND	54	VR12	102	VSSD_T	150	TTL_SEL	198	STV2
7	GND	55	VR11	103	VSSD_T	151	DUMMY	199	DUMMY
8	GND	56	VR10	104	DUMMY	152	DUMMY	200	CLK4
9	GND	57	VR9	105	DUMMY	153	DUMMY	201	CLK4
10	GND	58	VR8	106	VDDD	154	DUMMY	202	CLK3
11	DUMMY	59	VR7	107	VDDD	155	VSSH	203	CLK3
12	FEED1	60	VR6	108	VDDD	156	VSSH	204	CLK2
13	FEED1	61	VR5	109	DUMMY	157	VSSH	205	CLK2
14	DUMMY	62	VR4	110	VSSD_IF	158	VDDL	206	CLK1
15	VDDO	63	VR3	111	VSSD_IF	159	VDDL	207	CLK1
16	VDDO	64	VR2	112	VSSD_IF	160	VDDA	208	DUMMY
17	DUMMY	65	VR1	113	DUMMY	161	VDDA	209	STV0
18	VDDE	66	DIO1	114	DUMMY	162	VDDA	210	STV0
19	VDDE	67	DUMMY	115	DUMMY	163	DUMMY	211	VGL
20	DUMMY	68	VDDA	116	D5N_DC1	164	DUMMY	212	VGL
21	VGL	69	VDDA	117	D5P_DC0	165	DUMMY	213	DUMMY
22	VGL	70	VDDL	118	D4N_DB7	166	DUMMY	214	VDDE
23	STV0	71	VDDL	119	D4P_DB6	167	VSSD	215	VDDE
24	STV0	72	DUMMY	120	D3N_DB5	168	VSSD	216	DUMMY
25	DUMMY	73	VSSH	121	D3P_DB4	169	VSSD	217	VDDO
26	CLK1	74	VSSH	122	CLKN_CLK	170	VSSD	218	VDDO
27	CLK1	75	DUMMY	123	CLKP_DB3	171	DUMMY	219	DUMMY
28	CLK2	76	VDDD	124	D2N_DB2	172	VDDD	220	FEED1
29	CLK2	77	VDDD	125	D2P_DB1	173	VDDD	221	FEED1
30	CLK3	78	VDDD	126	D1N_DB0	174	VDDD	222	DUMMY
31	CLK3	79	DUMMY	127	D1P_DA7	175	DUMMY	223	VGL
32	CLK4	80	VSSD	128	D0N_DA6	176	VSSH	224	DUMMY
33	CLK4	81	VSSD	129	D0P_DA5	177	VSSH	225	GND
34	DUMMY	82	VSSD	130	DUMMY	178	VDDL	226	GND
35	STV2	83	DUMMY	131	VSSD	179	VDDL	227	GND
36	STV2	84	DUMMY	132	VSSD	180	VDDA	228	GND
37	STV1	85	DUMMY	133	DUMMY	181	VDDA	229	GND
38	STV1	86	DUMMY	134	VDDD_IF	182	DUMMY	230	TEST2
39	DUMMY	87	DUMMY	135	VDDD_IF	183	DIO2	231	TEST1
40	VDS	88	VDDA	136	VDDD	184	source 1200	232	NULL
41	VDS	89	VDDA	137	POL	185	VCOM	233	DUMMY
42	DUMMY	90	VDDA	138	LD	186	VCOM		
43	VSD	91	VDDL	139	FS	187	VCOM		
44	VSD	92	VDDL	140	CS1	188	DUMMY		
45	DUMMY	93	VSSH	141	CS0	189	VSD		
46	VCOM	94	VSSH	142	ODLY1	190	VSD		
47	VCOM	95	VSSA	143	ODLY0	191	DUMMY		
48	VCOM	96	VSSA	144	RL	192	VDS		

6.0 RELIABILITY TEST

The Reliability test items and its conditions are shown in below.

<Table 10. Reliability test>

Item		Test condition
High temperature storage		80 ℃, 240 hrs
Low temperature storage		-30℃, 240 hrs
High temperature & high humidity operation		60℃, 90%RH, 240hrs
High temperature operation		70 ℃, 240hrs
Low temperature operation		-20℃, 240hrs
Thermal Shock Test		-30-80℃ 100Cycle
Vibration test	Frequency	10/ 300/10 Hz,Sine X/Y/Z Direction
	Gravity / AMP	1.5 G
	Period	±X, ±Y, ±Z 30 min
Shock test	Gravity	100G
	Pulse width	6msec, Half-sine wave
	Direction	±X, ±Y, ±Z
Image Stacking		25 ℃ 5*5 Chess 1hr L127 10Min disappear
ESD (Operation) (note 1)	Air	± 8KV, 150pF(330) 1sec, 10 points, 10 times/ point
	Contact	± 6KV, 150pF(330) 1sec, 10points, 10 times/ point

Note:

1. The final ESD result is based on the customer's complete machine test, If there is a problem, TSD will improve together.

7.0 PACKING INFORMATION (MODULE)

TBD.

8.0 Label Information

TBD.

9.0 MECHANICAL OUTLINE DIMENSION

Figure 6 TFT-LCD Module Outline Dimension (Front View)

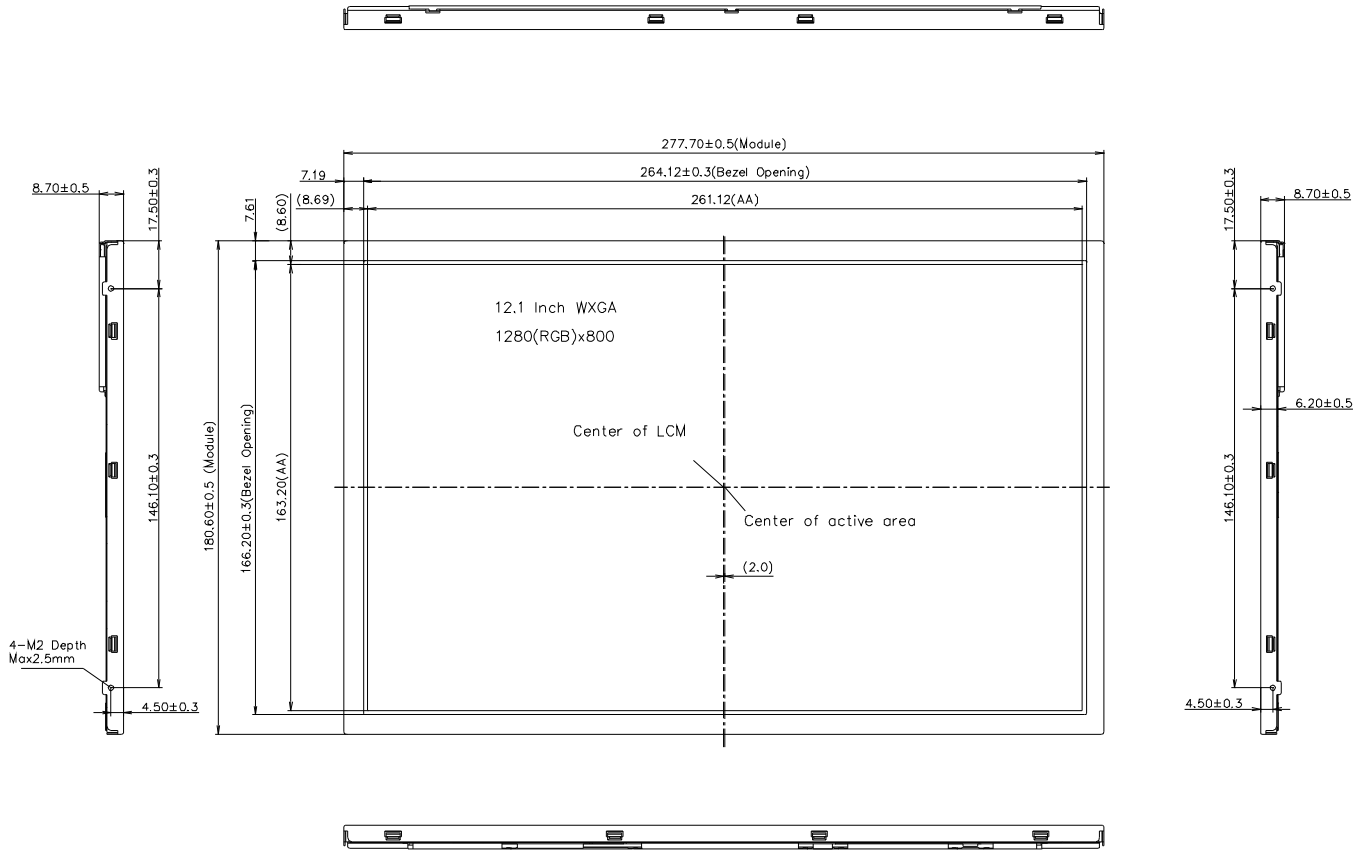
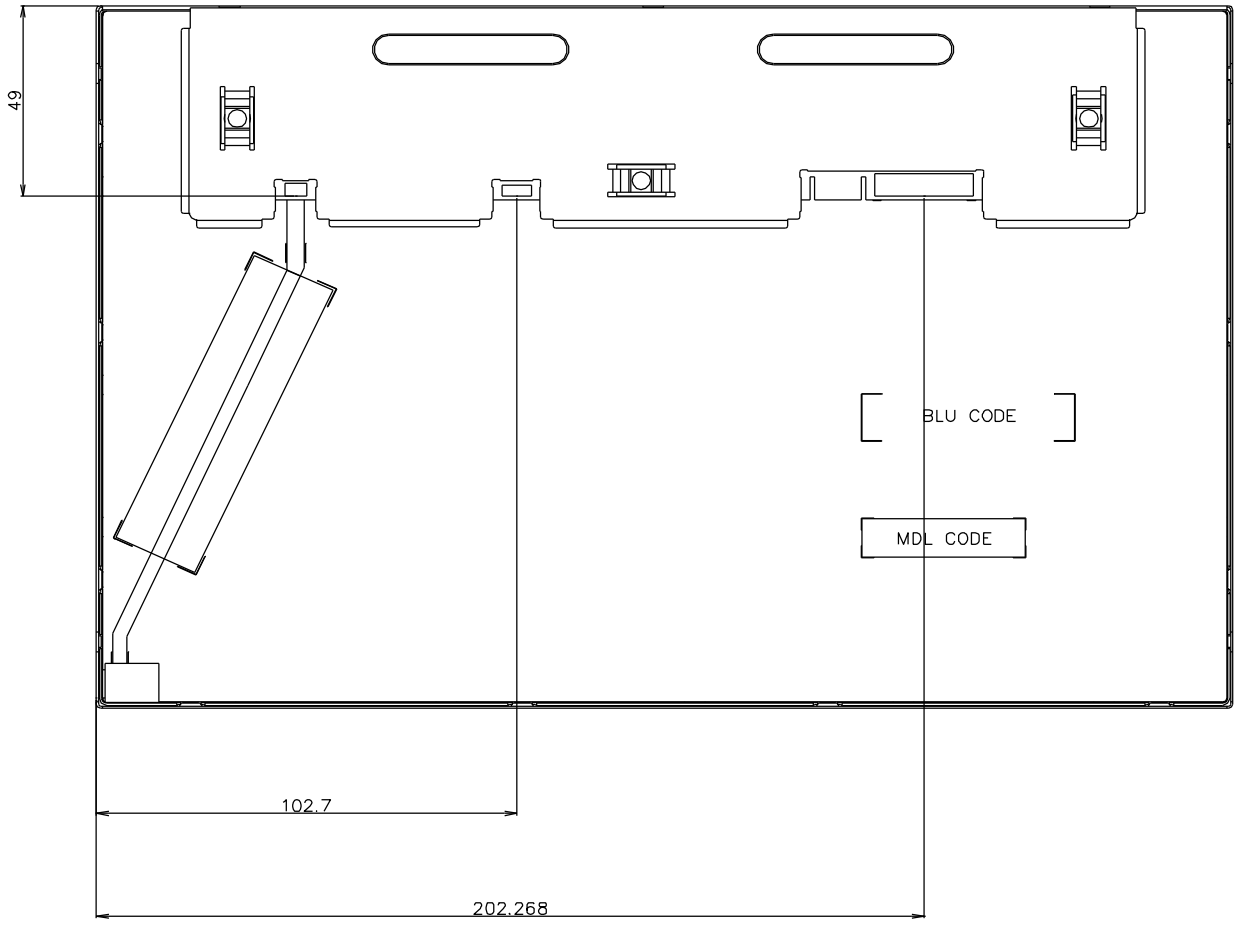


Figure 7 TFT-LCD Module Outline Dimension (Rear View)



10.0 HANDLING & CAUTIONS

10.1 Mounting Method

- The panel of the LCD consists of two thin glasses with polarizers which easily get damaged. So extreme care should be taken when handling the LCD.
- Excessive stress or pressure on the glass of the LCD should be avoided. Care must be taken to insure that no torsional or compressive forces are applied to the LCD unit when it is mounted.
- If the customer's set presses the main parts of the LCD, the LCD may show the abnormal display. But this phenomenon does not mean the malfunction of the LCD and should be pressed by the way of mutual agreement.
- To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- Mount a LCD module with the specified mounting parts.

10.2 caution of LCD Handling and Cleaning

- Since the LCD is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration,and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass may be broken.
- The polarizers on the surface of panel are made from organic substances. Be very careful for chemicals not to touch the polarizers or it leads the polarizers to be deteriorated.
- If the use of a chemical is unavoidable, use soft cloth with solvent（recommended below） to clean the LCD ‘s surface with wipe lightly.
  -IPA(Isopropyl Alcohol), Ethyl Alcohol, Trichlorotriflorothane
- Do not wipe the LCD's surface with dry or hard materials that will damage the polarizers and others. Do not use the following solvent.
  -Water, Ketone, Aromatics
- It is recommended that the LCD be handled with soft gloves during assembly, etc. The polarizers on the LCD's surface are vulnerable to scratch and thus to be damaged by sharp particles.
- Do not drop water or any chemicals onto the LCD's surface.
- A protective film is supplied on the LCD and should be left in place until the LCD is required for operation.
- The ITO pad area needs special careful caution because it could be easily corroded. Do not contact the ITO pad area with HCFC,Soldering flux,Chlorine,Sulfur,saliva or fingerprint. To prevent the ITO corrosion, customers are recommended that the ITO area would be covered by UV or silicon.

10.3 Caution Against Static Charge

- The LCD modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.
- Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, If possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.
- Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or
  other conductivity-treated fibers.
- In handling the LCD, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

10.4 Caution For operation

- It is indispensable to drive the LCD within the specified voltage limit since the higher Voltage than the limit causes the shorter LCD's life. An electro-chemical reaction due to DC causes undesirable deterioration of the LCD so that the use of DC drive should avoid.
- Do not connect or disconnect the LCD to or from the system when power is on.
- Never use the LCD under abnormal conditions of high temperature and high humidity.
- When expose to drastic fluctuation of temperature (hot to cold or cold to hot) ,the LCD may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD's surface which may affect the operation of the polarizer and the LCD.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD may turn black at temperature above its operational range. However those phenomena do not mean malfunction or out of order with the LCD. The LCD will revert to normal operation once the temperature returns to the recommended temperature range for normal operation.
- Do not display the fixed pattern for a long time because it may develop image sticking due to the LCD structure. If the screen is displayed with fixed pattern, use a screen saver.

10.5 Packaging

- Modules use LCD element, 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 directly to sunshine or high temperature/humidity for long periods.

10.6 Storage

- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Relative humidity of the environment should therefore be kept below 60%RH.
- Original protective film should be used on LCD' s surface (polarizer). Adhesive type protective film should be avoided, because it may change color and/or properties of the polarizers.
- Do not store the LCD near organic solvents or corrosive gasses.
- Keep the LCD safe from vibration, shock and pressure.
- Black or white air-bubbles may be produced if the LCD is stored for long time in the lower temperature or mechanical shocks are applied onto the LCD.
- In the case of storing for a long period of time for the purpose or replacement use, the following ways are recommended.
  -Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.
  -Store in a dark place where neither exposure to direct sunlight nor light is.
  -Keep temperature in the specified storage temperature range.
  -Store with no touch on polarizer surface by the anything else. If possible, store the LCD in the packaging situation LCD when it was delivered.

10.7 Safety

- For the crash damaged or unnecessary LCD, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol an should be burned up later.
- In the case the LCD is broken, watch out whether liquid crystal leaks out or not. If your hands touch the liquid crystal, wash your hands cleanly with water an soap as soon as possible.
- If you should swallow the liquid crystal, first, wash your mouth thoroughly with water, then drink a lot of water and induce vomiting, and then, consult a physician.
- If the liquid crystal should get in your eyes, flush your eyes with running water for at least fifteen minutes.
- If the liquid crystal touches your skin or clothes, remove it and wash the affected part of your skin or clothes with soap and running water.