



SPECIFICATION FOR TFT LCD MODULE

CUSTOMER : _____

CUSTOMER MODULE : _____

HG MODEL : HG101WU077

☐ Preliminary Specification

☒ Final Specification

Customer Confirmation column:

Approved by : _____ Dept. : _____ Data : _____

Please return one of the copies of the specification with your signature to us within two weeks after you receive this document. If it is not returned, we will assume that you agree to the entire contents of this specification document.

Designed by	Checked by	Approved by

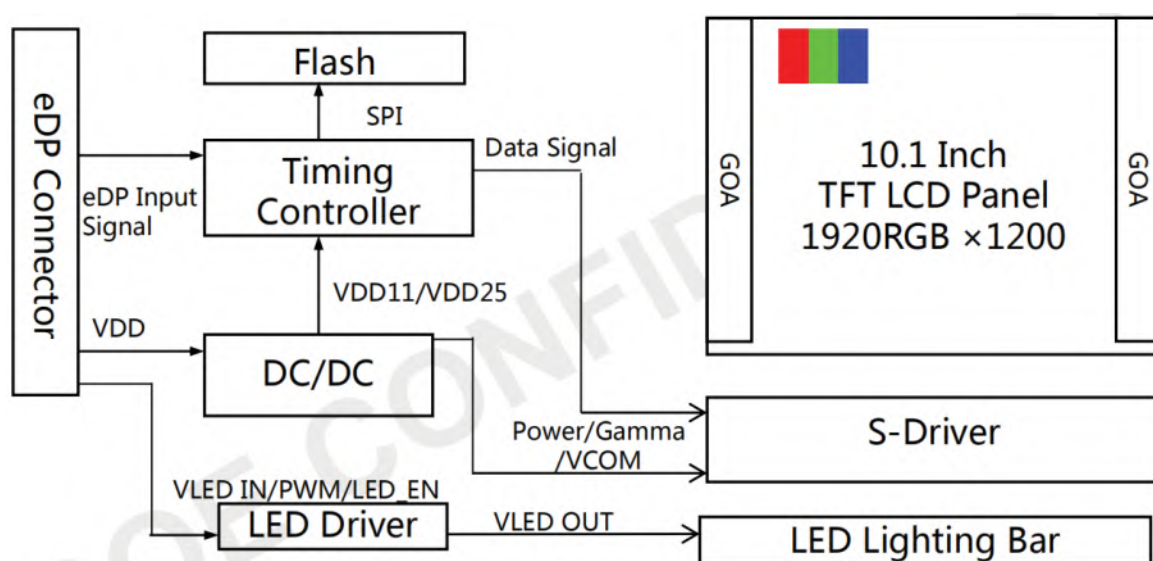


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1.0 GENERAL DESCRIPTION

1.0.1 Introduction

HG101WU077 is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 10.1 inch diagonally measured active area with resolutions (1920 horizontal by 1200 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.2M colors.



1.0.2 Features

- LED back-light
- PPI: 225
- Color Gamut: NTSC 50%(Typ)
- eDP 1.4 interface (support PSR2)
- RoHS Compliant

1.0.3 Application

HMI



1.0.4 General Specification

< Table 1. General Specifications >

Parameter	Specification	Unit	Remarks
Active area	216.576(H) × 135.36 (V)	mm	Note 1.1
Number of pixels	1920 (H) × 1200 (V)	Pixels	
Pixel pitch	112.8(H) × 112.8(V)	μm	
Pixel arrangement	RGB Vertical Stripe		
Display colors	16.2M	Colors	6bit+FRC
Display mode	Normally Black		
Dimensional outline	228.2 × 149 × 2.35	mm	10.0max
Weight	125	g	+/- 10 g
Surface treatment	Up POL:3H Hard Coating,AG Down POL: Clear		
Back-light	Edge side,1-LED Lighting Bar type		40*LED

Note 1.1: H: horizontal length, V: vertical length.



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 3. Environment Absolute Maximum Ratings> [Ta =25±2 °C]

Parameter	Symbol	Min.	Max.	Unit	Remarks
Back-light Power Supply Voltage	HV _{DDOUT}	-0.3	31	V	Ta = 25 °C Note 1&2
Back-light LED Current	I _{HVDD}	0	145	mA	
Back-light LED Reverse Voltage	V _R	-	5	V	
Operating Temperature	T _{OP}	-20	70	°C	Environment Temperature
Storage Temperature	T _{ST}	-30	80	°C	
Operating Ambient Humidity	Hop	-	90	%RH	
Storage Humidity	Hst	-	90	%RH	
Heat Release Requirement	Trls	-		°C	Note3 仅适用于Q/Single/FOG出货项目

Note:

1. These range above is maximum value not the actual operating temperature . Actual Operating temperature is no more than 40°C and temperature refers to the LCM surface temperature ;
- 2.BOE is not responsible for product problems beyond the use conditions.
- 3.When the ambient temperature is T °C, the surface temperature of Panel can not exceed (T+15)°C.



3.0 ELECTRICAL SPECIFICATIONS

3.0.1 TFT LCD Module

< Table 4. LCD Module Electrical Specifications >

[Ta =25 ± 2 °C]

Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
Power Supply Input Voltage	V _{DD}	3.0	3.3	3.6	V	Note 1
Power Supply Current	I _{DD}	-	190	-	mA	
LED Driver Power Supply Voltage	H _{VDD}	5	12	21	V	Note 2
LED Driver Power Supply Current	I _{HVDD}	-	128	-	mA	
LED Power Consumption	P _{LED}	4.22	-	4.52	W	
Positive-going Input Threshold Voltage	V _{IT+}	-	-	-	mV	Vcom = 3.7V typ.
Negative-going Input Threshold Voltage	V _{IT-}	-	-	-	mV	
Differential input common mode voltage	V _{com}	-	-	-	V	V _{IH} =100mV, V _{IL} =-100mV

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for 3.3V at 25 °C
Max value at Black Pattern

2. Calculated value for reference $I_{LED} \times V_{LED} \div 0.85 = P_{LED}$



3.1 Back-light Unit

< Table 6. LED Driving guideline specifications >

Ta=25+/-2°C

Parameter		Min.	Typ.	Max.	Unit	Remarks	
Power supply voltage for Back light		V _{LED}	28	-	30	V	
Power supply Current for Back light		I _{LED}	-	128	-	mA	
Power supply for Back light		P _{LED}	3.58	-	3.84	W	Note 1
EN Control Level	Backlight on	V _{ENH}	3	3.3	3.6	V	EN logic high voltage
	Backlight off	V _{ENL}	-	-	-	V	EN logic low voltage
PWM Control Level	PWM High Level	V _{PML}	3	3.3	3.6	V	
	PWM Low Level	V _{PML}	-	-	-	V	
PWM Control Frequency		F _{PWM}	0.1	-	30	KHz	
Duty Ratio		-	5	-	100	%	

Notes : 1. Calculator Value for reference $I_{LED} \times V_{LED} = P_{LED}$

2. The LED Life-time define as the estimated time to 50% degradation of initial luminous under the condition of the ambient temperature of 25°C.



4.0 INTERFACE CONNECTION.

4.0.1 Electrical Interface Connection

The electronics interface connector is MSAK24025P30.

The connector interface pin assignments are listed in Table 7.

<Table 7. Pin Assignments for the Interface Connector>

Pin No.	Symbol	Description	remark
1	NC	NC	
2	H_GND	High Speed Ground	
3	Lane 1_N	eDP Lane 1 Negative Data Input	
4	Lane 1_P	eDP Lane 1 Positive Data Input	
5	H_GND	High Speed Ground	
6	Lane 0_N	eDP Lane 0 Negative Data Input	
7	Lane 0_P	eDP Lane 0 Positive Data Input	
8	H_GND	High Speed Ground	
9	AUX_CH_P	eDP AUX Positive Channel	
10	AUX_CH_N	eDP AUX Negative Channel	
11	H_GND	High Speed Ground	
12	LCD_VCC	Power Supply,3.3V(typ.)	
13	LCD_VCC	Power Supply,3.3V(typ.)	
14	NC	NC	
15	LCD_GND	Ground	
16	LCD_GND	Ground	
17	HPD	Hot plug detect output	
18	VLED-	Ground	
19	VLED-	Ground	
20	VLED-	Ground	
21	VLED-	Ground	
22	LED_EN	LED enable pin(+3.3V Input)	
23	LED_PWM	System PWM Signal Input	
24	NC	NC	
25	NC	NC	

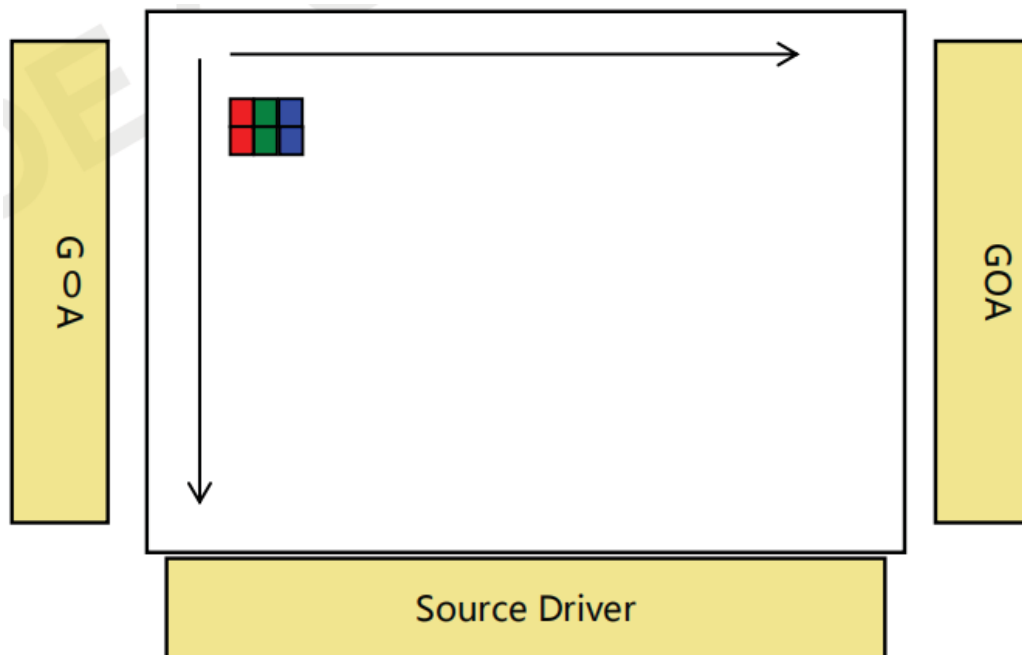
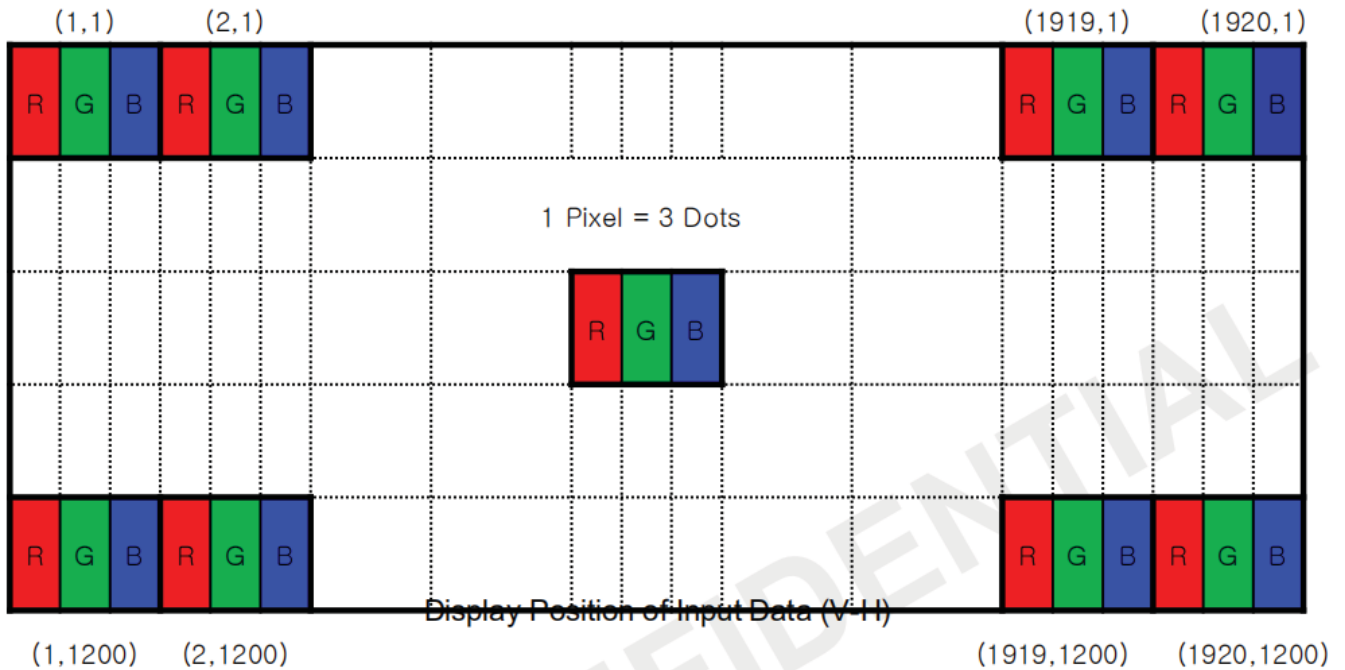


Pin No.	Symbol	Description	remark
26	VLED+	LED Power Supply 5V~21V(typ:12V)	
27	VLED+	LED Power Supply 5V~21V(typ:12V)	
28	VLED+	LED Power Supply5V~21V(typ:12V)	
29	VLED+	LED Power Supply 5V~21V(typ:12V)	
30	NC	NC	



4.2 Data Input Format

Figure 5. Pixel Format





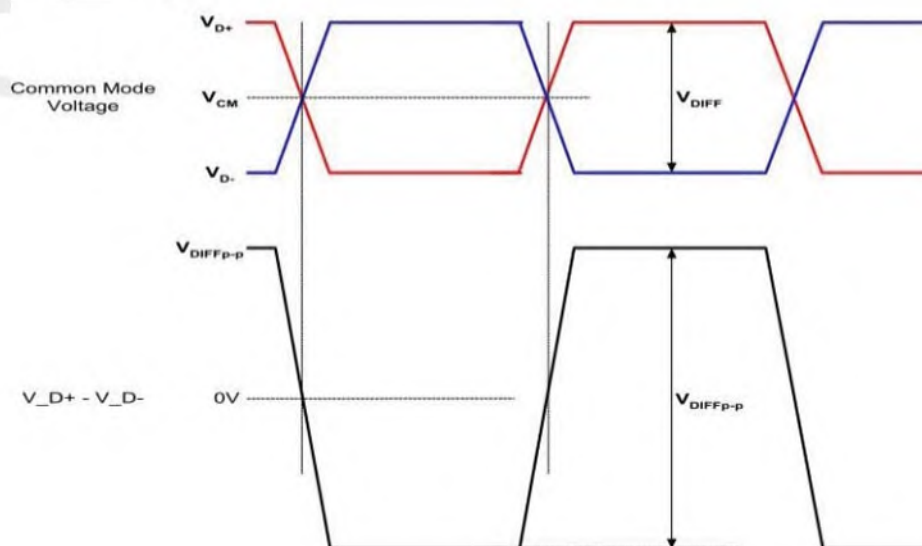
5.0 eDP Interface Timing Specifications

5.0.1 The specification of the eDP Rx interface timing parameter is shown in Table 5.

< Table 5. eDP Main-Link Specifications >

DC Specification	Min	Typ	Max	Unit
DC Common Mode Voltage	0		2	V
AC Specification	Min	Typ	Max	Unit
Frequency for High Bit Rate	2.68569	2.7	2.70081	Gbps
Frequency for Reduced Bit Rate	1.611414	1.62	1.620486	Gbps
Spread Spectrum Clock (Down spreading)	0		0.5	%
SSC Modulation Frequency	30		33	kHz
Differential Peak-to-Peak Input Voltage at Package Pins	100	-	1320	mV
Rx Input DC Common Mode Voltage	0	-	2	V
Differential Termination Resistance	80	-	120	ohm
Single-ended Termination Resistance	40	-	60	ohm
RX Short Circuit Current Limit	-	-	50	mA
RX Intra-pair Skew Tolerance at HBR3	-	-	50	ps

< Figure 4. Definition of Differential Voltage and Differential Voltage Peak-to-Peak >

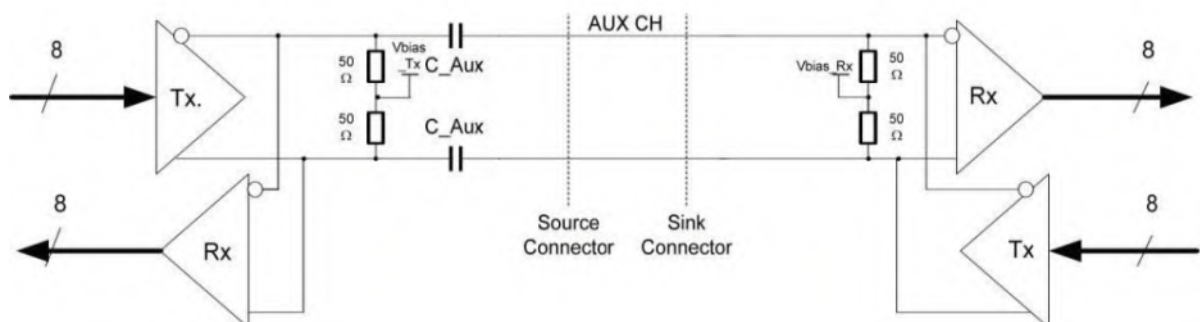




< Table 6. AUX Specifications >

Symbol	Parameter	Limits			Unit	Conditions
		Min	Typ	Max		
UIAUX	AUX unit interval	0.4		0.6	us	
Nprecharge	Number of pre-charge pulse	10		16	times	
TAUX-BUS-PARK	AUX CH bus park time	10			ns	
TAUX-TX-JITTER	Max cycle-to-cycle output jitter within a single transaction			0.04	UI	
TAUX-RX-JITTER	Max allowable cycle-to-cycle input jitter within a single transaction			0.05	UI	
VAUX-TX-DIFFp-p	AUX peak-to-peak output differential voltage	0.18		1.38	V	
VAUX-RX-DIFFp-p	AUX peak-to-peak input differential voltage	0.18		1.36	V	
RAUX-TERM	AUX CH termination DC resistance		100		Ω	differential resistance
VAUX-DC-CM	AUX DC common mode voltage	0		2	V	
VAUX-TURN-CM	AUX turn around common mode voltage			0.3	V	
IAUX-SHORT	AUX short circuit current limit			90	mA	

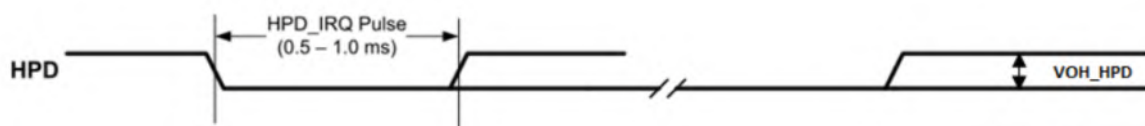
< Figure 5. AUX CH Differential Pair >





< Table 7. HPD Specifications >

Symbol	Symbol Parameter	Limits			Unit	Conditions
		Min	Typ	Max		
VOH_HPDP	HPD voltage	2.25	--	3.6	V	IOH=0mA
THPD_IRQ	HPD_IRQ pulse width	0.5	--	1	ms	

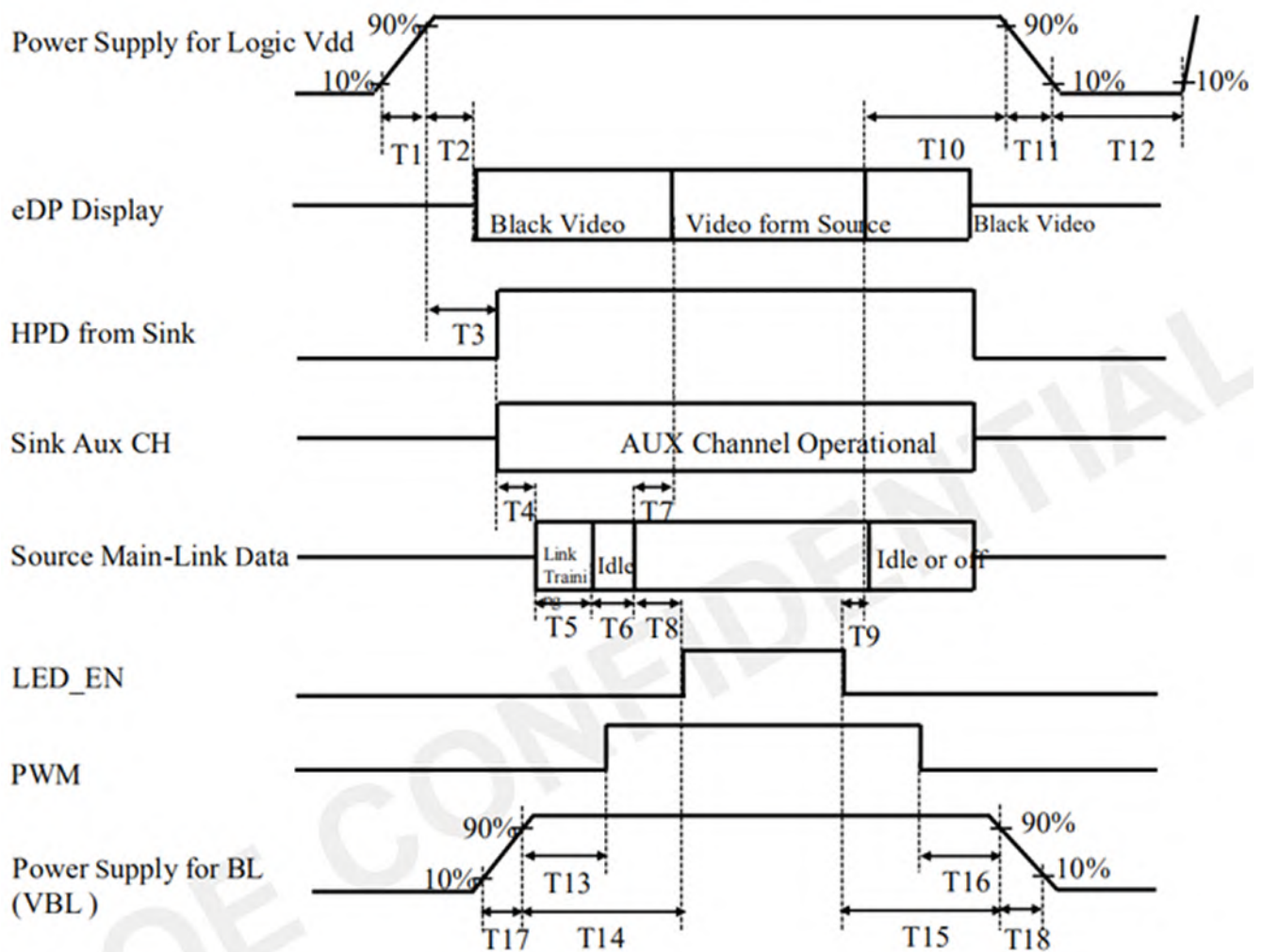




6.0 POWER SEQUENCE

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below

<Figure 6. Power on/off>





7.0 OPTICAL SPECIFICATION

7.0.1 Overview

The test of view angle range shall be measured in a dark room (ambient luminance 1lux and temperature = $25\pm 2^{\circ}\text{C}$) with the equipment of Luminance meter system (Goniometer system and TOPCON CS2000/CA310) 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. We refer to $\theta=0$ ($=\theta_3$) as the 3 o'clock direction (the "right"), $\theta=90$ ($=\theta_{12}$) as the 12 o'clock direction ("upward"), $\theta=180$ ($=\theta_9$) as the 9 o'clock direction ("left") and $\theta=270$ ($=\theta_6$) as the 6 o'clock direction ("bottom"). While scanning θ and/or Φ , the center of the measuring spot on the Display surface shall stay fixed. The luminance, color and uniformity (etc) should be tested by CS2000/CA310. The backlight should be operating for 10 minutes prior to measurement. VDD shall be 3.3 0.3V at 25°C . Optimum viewing angle direction is 6 o'clock

<Table 10. Optical Specifications>

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	80	85	-	Deg.	Note 1
		Θ_9		80	85	-	Deg.	
	Vertical	Θ_{12}		80	85	-	Deg.	
		Θ_6		80	85	-	Deg.	
Luminance Contrast ratio		CR	$\Theta = 0^\circ$	600	1000	-		Note 2
Luminance of White	Center	Y_w	$\Theta = 0^\circ$	800	1000	-	cd/m ²	Note 3
White Luminance uniformity	13 Points	ΔY_{13}		70	75	-	%	Note 4
Color Gamut	NTSC	CIE1931	$\Theta = 0^\circ$	45	50	-	%	Note 5
Reproduction of color	White	Wx	$\Theta = 0^\circ$	Typ -0.03	0.302	Typ +0.03		
		Wy			0.329			
Response Time		Tr+Td	Ta= 25° C $\Theta = 0^\circ$	-	30	40	ms	Note 6



Notes : 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 $\Theta = 0$ 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 FIGURE 1) Luminance Contrast Ratio (CR) is defined mathematically.

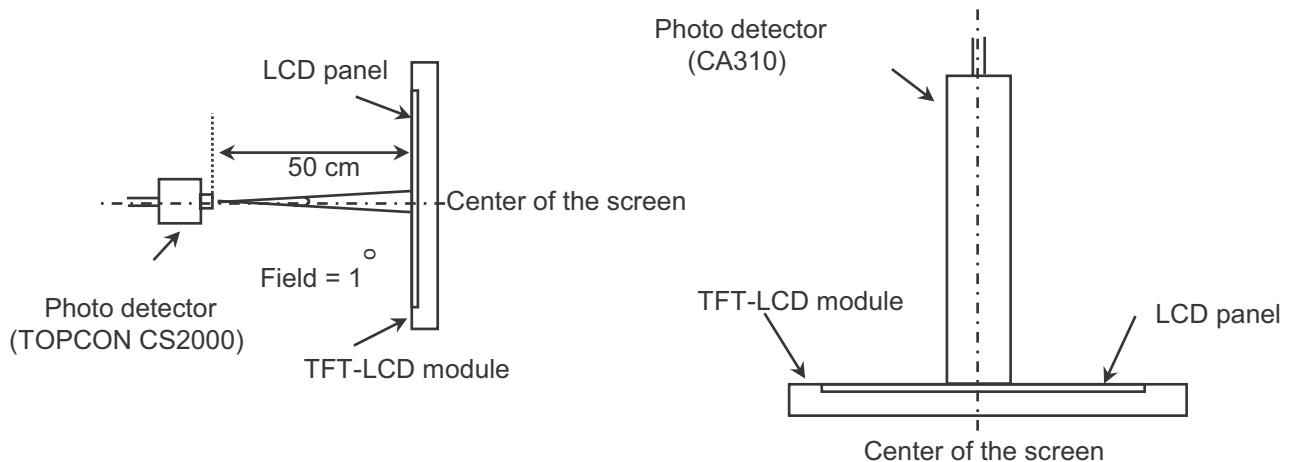
$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Luminance of white is defined as luminance values of center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display. The luminance is measured by CS2000/CA310 when the LED current is set at 16mA.
4. The White luminance uniformity on LCD surface is then expressed as : $\Delta Y = \text{Minimum Luminance of 13 Points} / \text{Maximum Luminance of 13 Points}$ (See FIGURE 2).
5. The color chromaticity coordinates specified in Table 5. 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.
6. The electro-optical response time measurements shall be made as FIGURE 3 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is T_r , and 90% to 10% is T_d .



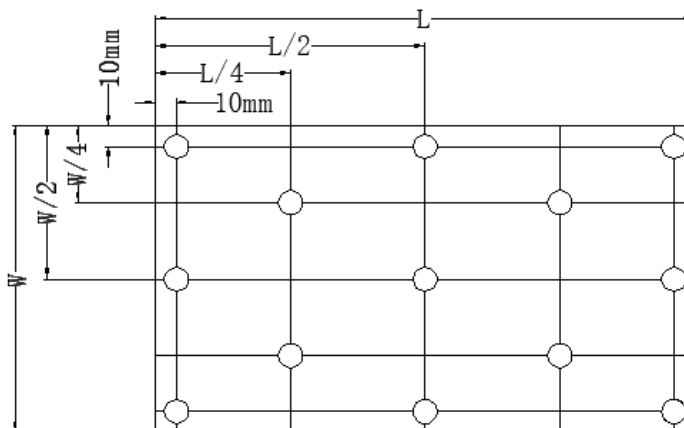
7.0.2 Optical measurements

Figure 1. Measurement Set Up



View angel range, uniformity, etc. measurement setup Flicker, measurement setup

Figure 2. White Luminance and Uniformity Measurement Locations (13 points)

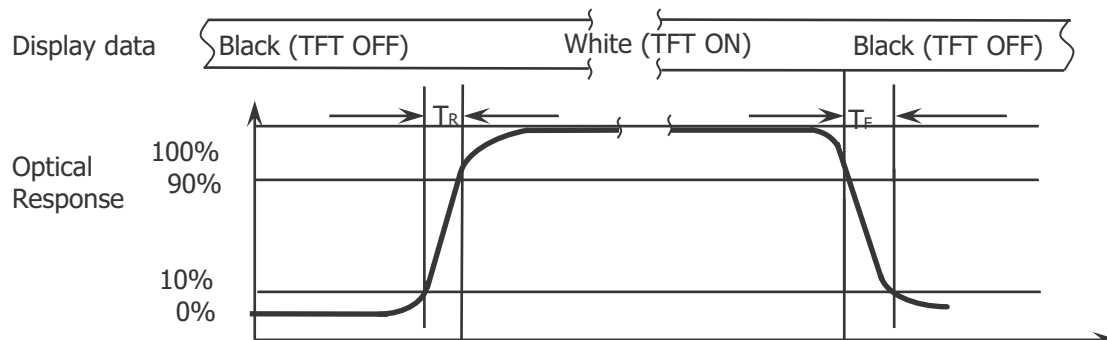


Luminance of white is defined as luminance values of center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.

The White luminance uniformity on LCD surface is then expressed as : $\Delta Y_{13} = \text{Minimum Luminance of 13 points} / \text{Maximum Luminance of 13 points}$ (see FIGURE



Figure 3. Response Time Testing



The electro-optical response time measurements shall be made as shown in FIGURE 3 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is T_R and 90% to 10% is T_d .

8.0 MECHANICAL OUTLINE DIMENSION

Figure 1. TFT-LCD Module Outline Dimension (Front View)

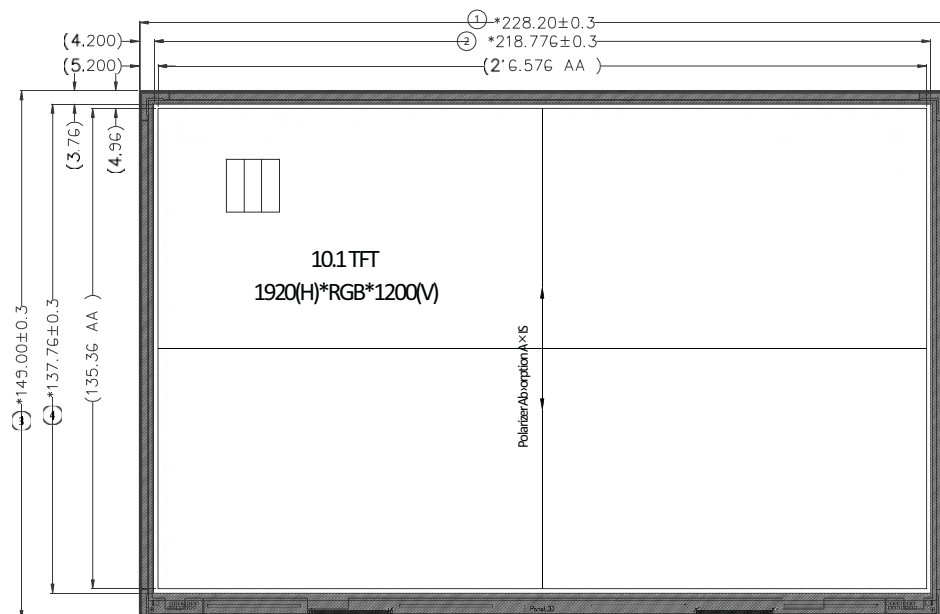
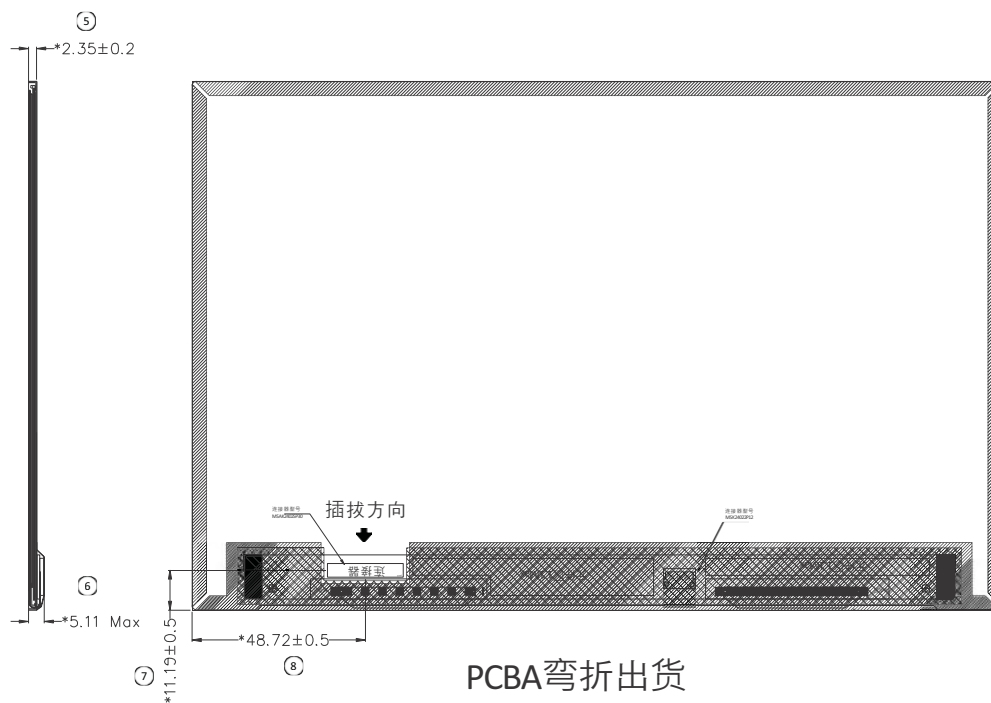


Figure 2. TFT-LCD Module Outline Dimensions (Rear view)





9.0 RELIABILITY TEST

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

<Table 11. Reliability test>

No	Test Items	Conditions	Remark
1	High temperature storage test	Ta = 80°C, 240 hrs	
2	Low temperature storage test	Ta = -30 °C, 240 hrs	
3	High temperature operation test	Ta = 70°C, 240 hrs	
4	Low temperature operation test	Ta = -20 °C, 240 hrs	
5	High temperature & high humidity operation test	Ta = 60 °C, 90%RH, 240 hrs	
6	Thermal shock	Ta = -20 °C ↔ 60°C (1 hr), 100 cycle	Non-operation
7	Image Sticking	5*5 Pattern, 1hrs 25°C check pattern Gray 127, after 5s, the mura must be disappeared completely	
8	ESD test	Air Voltage: ± 8KV Contact Voltage: ± 4KV R: 330Ω C: 150pF 5 time	
9	Vibration Test	10-500HZ, 1.5G Sine, +X, +Y, +Z Sweep 30min	

Note : After the reliability test, the product only guarantee function normally without any fatal defect (non-display, line defect, abnormal display etc). All the cosmetic specification is judged before the reliability test.



• **10.0 Precautions**

Please pay attention to the followings when you use this TFT LCD Panel.

• **10.1 Mounting Precautions**

- (1) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (2) You must mount a module using specified mounting holes (Details refer to the drawings).
- (3) Please make sure to avoid external forces applied to the Source PCB during the process of handling or assembling. If not, It causes panel damage or malfunction.
- (4) 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.
- (5) Do not disassemble the module.
- (6) To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- (7) 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.
- (8) Do not drop water or any chemicals onto the LCD's surface.



10.2 Operating Precautions

- (1) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
- (2) The electrochemical reaction caused by DC voltage will lead to LCD degradation, so DC drive should be avoided.
- (3) 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.
- (4) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- (5) Design the length of cable to connect between the connector for back-light and the converter as short as possible and the shorter cable shall be connected directly.
- (6) When the module is operating, do not lose CLK, ENAB signals. If any one these signals is lost, the LCD panel would be damaged.
- (7) Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- (8) Do not re-adjust variable resistor or switch etc.
- (9) Long Side LED Bar design is recommended when using E-LED type Back Light (GOA Panel Q /Single/OC出

10.3 Electrostatic Discharge Control

- (1) Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly. Keep products as far away from static electricity as possible.
- (2) Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.



10.4 Precautions for Strong Light Exposure

It is not allowed to store or Operate directly in strong light or in high temperature and humidity for a long time; Strong light exposure causes degradation of polarizer and color filter.

10.5 Storage Precautions

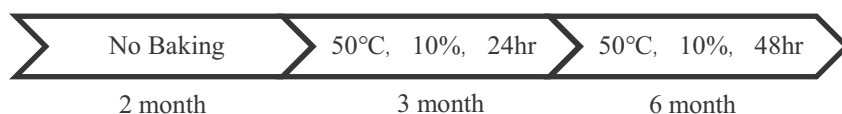
When storing modules as spares for a long time, the following precautions are necessary.

- (1) The polarizer surface should not come in contact with any other object.

It is recommended that they be stored in the container in which they were shipped.

Temperature : 5 ~ 40 °C

- (2) Humidity : 35 ~ 75 %RH
- (3) Period : 6 months
- (4) Control of ventilation and temperature is necessary.
- (5) Please make sure to protect the product from strong light exposure, water or moisture.
Be careful for condensation.
- (6) Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.
- (7) Do not store the LCD near organic solvents or corrosive gasses.
- (8) Please keep the Modules/OC/FOG at a circumstance shown below Fig.



10.6 Precautions for Protection Film (适用通用产品, 含Q/Single Production)

- (1) 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.
- (2) 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.

10.7 Appropriate Condition for Display

- (1) Normal operating condition

- Temperature: 0 ~ 40°C
- Operating Ambient Humidity : 10 ~ 90 %
- Display pattern: dynamic pattern (Real display)
- Suitable operating time: under XX hours a day. (Please contract BOE in advance for 7*24hrs or more than suggested Operating time,每天可使用的小时数需根据不同产品填写)
- Long-term lighting products recommended regular shutdown

- (2) Special operating condition

If the product will be used in extreme conditions such as high temperature, humidity, display patterns or 7*24hrs operation time etc., It is strongly recommended to contact BOE for Application engineering advice. Otherwise, its reliability and function may not be guaranteed.

- (3) Black image or moving image is strongly recommended as a screen save.



- (4) Lifetime in this spec. is guaranteed only when commercial display is used according to operating usages.
- (5) Please contract BOE in advance when you want to switch between portrait and landscape screen (横竖屏兼容设计可删除此项)
- (6) Please contact BOE in advance for outdoor operation.
- (7) Please contact BOE in advance when you display the same pattern for a long time.
- (8) If the Module keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen. To avoid image sticking, it is recommended to use a screen saver.
- (9) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- (10) Dew drop atmosphere should be avoided.
- (11) The storage room should be equipped with a good ventilation facility and avoid to expose to corrosive gas , which has a temperature controlling system.
- (12) 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.
- (13) 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

10.8 Others

A. LC Leak

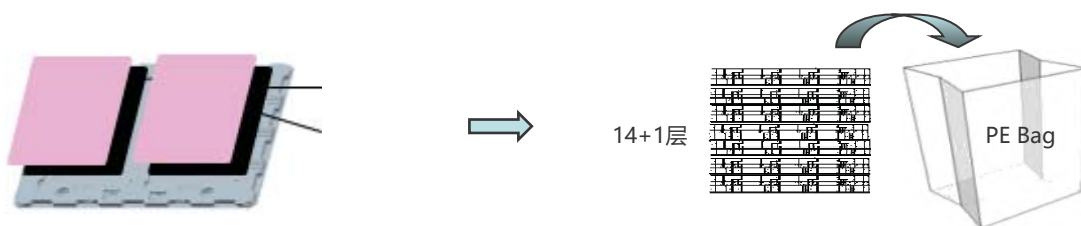
- If the liquid crystal material leaks from the panel, it is recommended to wash the LC with acetone or ethanol and then burn it.
- In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- If LC in mouth, mouth need to be washed, drink plenty of water to induce vomiting and follow medical advice.
- If LC touch eyes, eyes need to be washed with running water at least 15 minutes.

B. Rework

- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.



11.0 PACKING INFORMATION

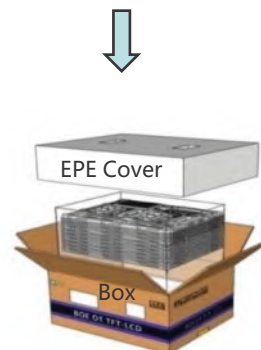


- 1. Put 1ea LCM (LCD side up) into each hole of Tray,
- 2. 2pcs LCM/Tray

- 1. Put 14pcs Tray on the stack (rotate the stack), put another 1pcs empty Tray on the top, and put 17pcs Tray flat into PE Bag
- 2. 28 pcs LCM/15 Tray



- 1. 16pcs Box/Pallet
- 2. 448pcs LCM/Pallet



- 1. Place 1 pcs. EPE Cover in the Inner Box, place the stacked 15 pcs Tray flat in the Box, and then place 1 pcs EPE Cover
- 2. 28pcs LCM/Box

11.1 Packing Note(产品形态: LCM)

- Box Dimension: 506mm(W) x 360mm(D) x 238mm(H)
- Package Quantity in one Box: 28pcs