



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.: TST156FHBH-H73T

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	2025-01-05	First Released	

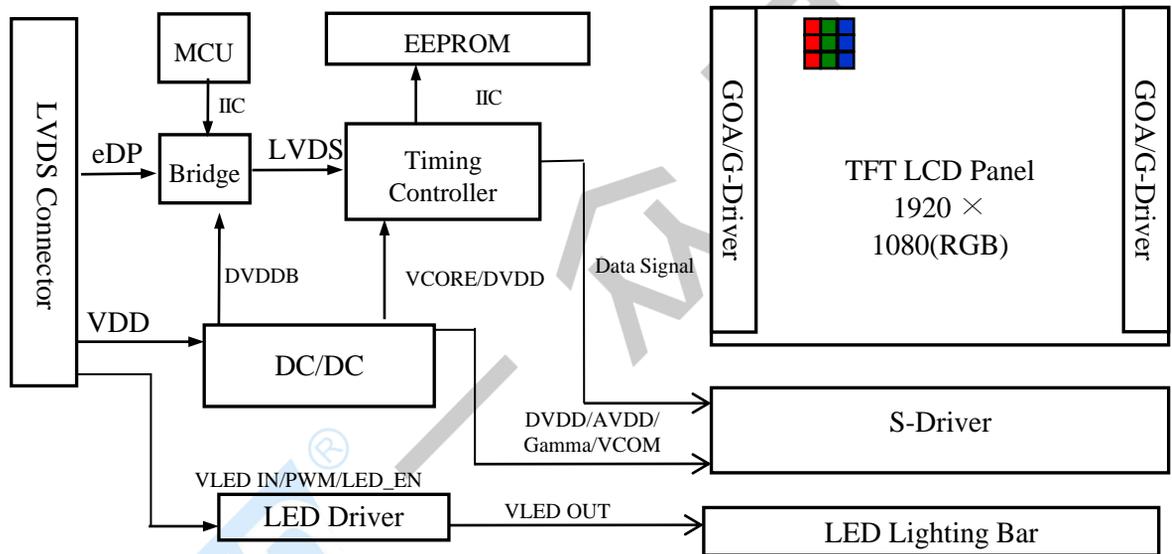
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1.0 GENERAL DESCRIPTION

1.0.1 Introduction

TST156FHBH-H73T 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 15.6 inch diagonally measured active area with FHD resolutions (1920 horizontal by 1080 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7 M colors.



1.0.2 Features

- LVDS interface
- RoHS Compliant

1.0.3 Application

- Charging pile

1.0.4 General Specification

< Table 1. General Specifications >

Parameter	Specification	Unit	Remarks
Active area	344.16(H) × 193.59(V)	mm	
Number of pixels	1920 (H) × 1080 (V)	Pixels	
Pixel pitch	179.25(H) × 179.25(V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.7M(8bit)	Colors	
Display mode	Normally Black		
Dimensional outline	360.1(H)*212.55(V)*6.05(D)	mm	
Weight	TBD	g	
Surface treatment	Anti-Glare		

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

Parameter	Symbol	Min.	Max.	Unit	Remarks
Operating Temperature	T _{OP}	-30	80	°C	Environment Temperature
Storage Temperature	T _{ST}	-30	85	°C	
Heat Release Requirement	Trls		15	°C	Note3 仅适用于Q/Single/FOG出货项

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 3. LCD Module Electrical Specifications >

[Ta =25 ± 2 °C]

Parameter		Min.	Typ.	Max.	Unit	Remarks	
Power Supply Voltage		V _{DD}	3.0	3.3	3.46	V	Note 1
Power Supply Inrush Current		Inrush	-	-	3	A	Note3
Power Supply Current	Mosaic	I _{DD}	TBD	TBD	TBD	mA	Note 1
	RGB		TBD	TBD	TBD	mA	
Power Consumption	Mosaic	P _M	-	-	TBD	W	
	RGB	P _{RGB}	-	-	TBD	W	
	BLU	P _{BL}	-	-	TBD	W	Note 2
	Total	P _{Total}	-	-	TBD	W	@Mosaic

3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

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.
 - a) Mosaic pattern 8*8
 - b) R/G/B patterns

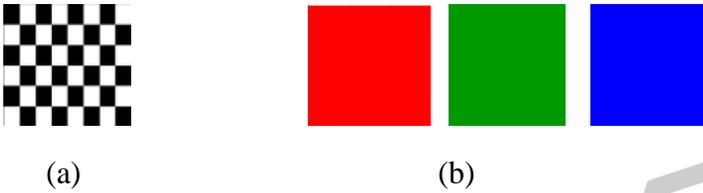


Figure 3. Power Measure Patterns

2. Calculated value for reference ($V_{LED} \times I_{LED}$)
3. Measure condition (Figure 4)

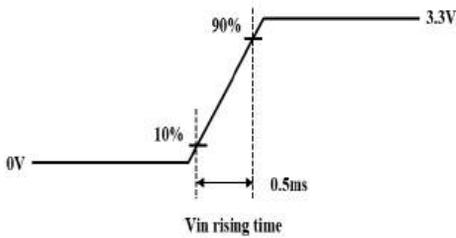


Figure 4. Inrush Measure Condition

4.0 INTERFACE CONNECTION.

4.0.1 Electrical Interface Connection

The electronics interface connector is 20455-040E.

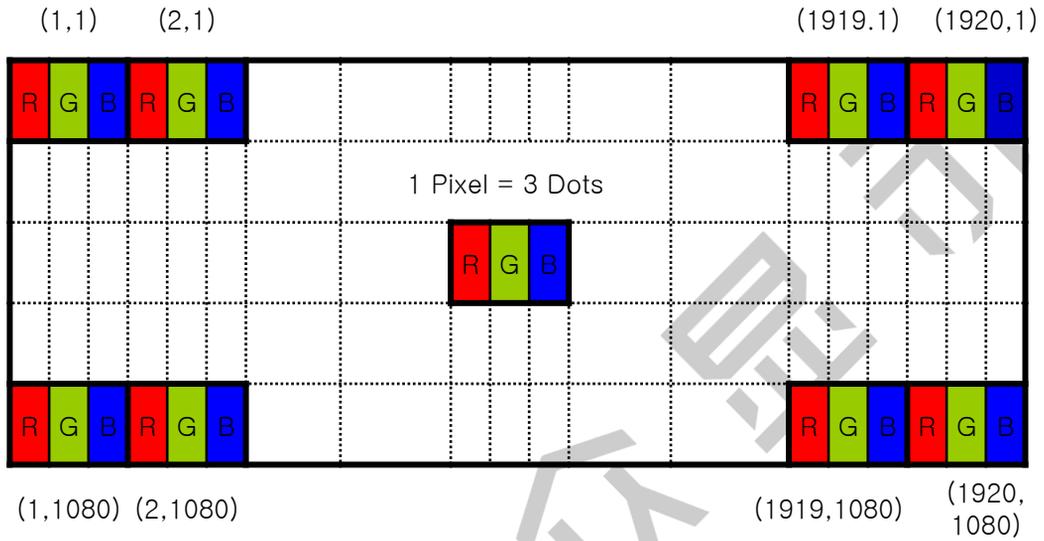
<Table 6. Pin Assignments for the Interface Connector>

Terminal	Symbol	Functions
Pin No.	Symbol	Description
1	NC	No Connection
2	NC	No Connection
3	NC	No Connection
4	NC	No Connection
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	NC	No Connection
10	NC	No Connection
11	LCD_VCC	LCD Power Supply,3.3V(typical)
12	LCD_VCC	LCD Power Supply,3.3V(typical)
13	LCD_VCC	LCD Power Supply,3.3V(typical)
14	NC	No Connection
15	NC	No Connection
16	NC	No Connection
17	GND	Ground
18	RX00-	-LVDS differential data input
19	RX00+	+LVDS differential data input
20	RX01-	-LVDS differential data input

Terminal	Symbol	Functions
Pin No.	Symbol	Description
21	RXO1+	+LVDS differential data input
22	RXO2-	-LVDS differential data input
23	RXO2+	+LVDS differential data input
24	GND	Ground
25	RXOC-	-LVDS differential clock input
26	RXOC+	+LVDS differential clock input
27	GND	Ground
28	RXO3-	-LVDS differential data input
29	RXO3+	+LVDS differential data input
30	RXE0-	-LVDS differential data input
31	RXE0+	+LVDS differential data input
32	RXE1-	-LVDS differential data input
33	RXE1+	+LVDS differential data input
34	GND	Ground
35	RXE2-	-LVDS differential data input
36	RXE2+	+LVDS differential data input
37	RXEC-	-LVDS differential clock input
38	RXEC+	+LVDS differential clock input
39	RXE3-	-LVDS differential data input
40	RXE3+	+LVDS differential data input

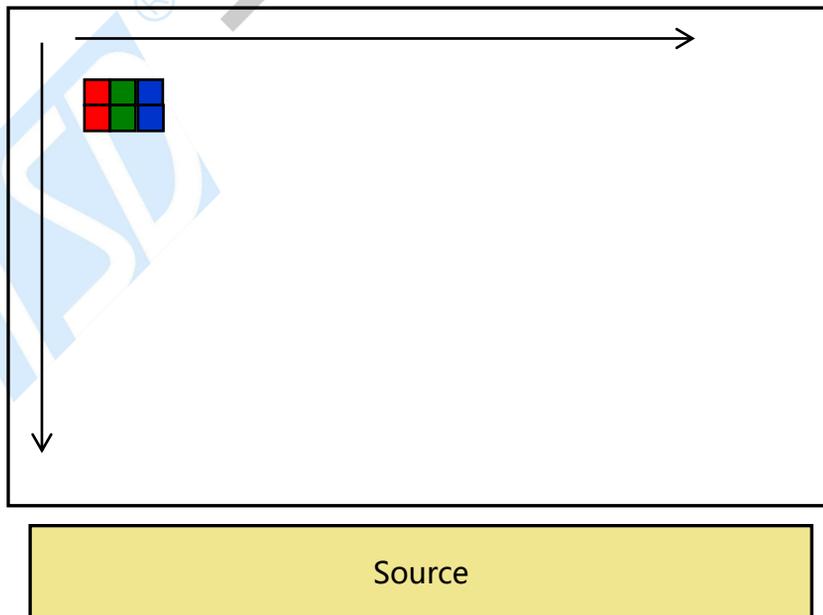
4.2 Data Input Format

Figure 5. Pixel Format



Display Position of Input Data (V-H)

Figure 6. Scan direction



5.0 SIGNAL TIMING SPECIFICATION

5.0.1 The HC156IVA0073-N88H is operated by the DE only.

Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	141.8	143.8	145.7	MHz
Frame Period		Tv	1118	1128	1138	lines
			-	60	-	Hz
			-	16.67	-	ms
Vertical Display Period		Tvd	-	1080	-	lines
One line Scanning Period		Th	2114	2124	2134	clocks
Horizontal Display Period		Thd	-	1920	-	clocks

5.02 LVDS Electrical Specification

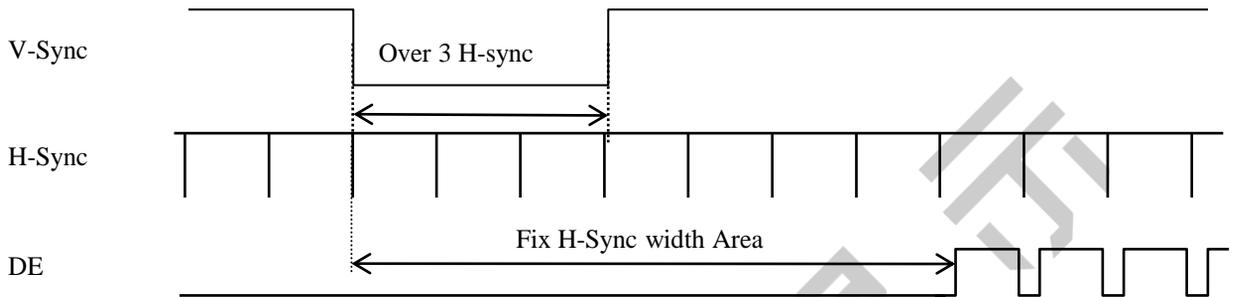
The specification of the LVDS Rx interface timing parameter is shown in Table 4.

<Table 4. LVDS Rx Interface Timing Specification>

Symbol	Symbol	Min	Typ	Max	Unit
Rate	LVDS data rate per pair	400	-	1000	Mbps
Fclk	LVDS input clock frequency	57	-	143	MHz
Vth	Differential input high threshold	-	-	0.1	V
Vtl	Differential input low threshold	-0.1	-	-	V
Vcm	LVDS common mode voltage	0.9	-	1.4	V

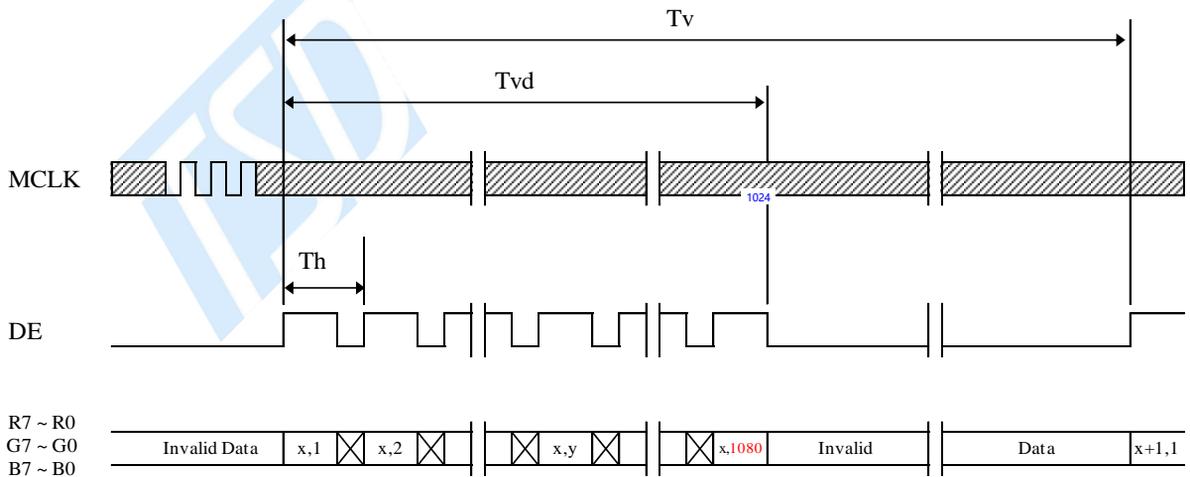
6. SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

6.01 Sync Timing Waveforms

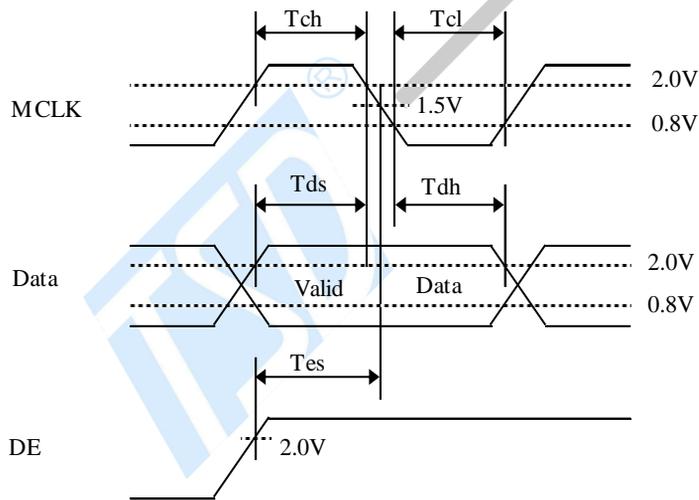
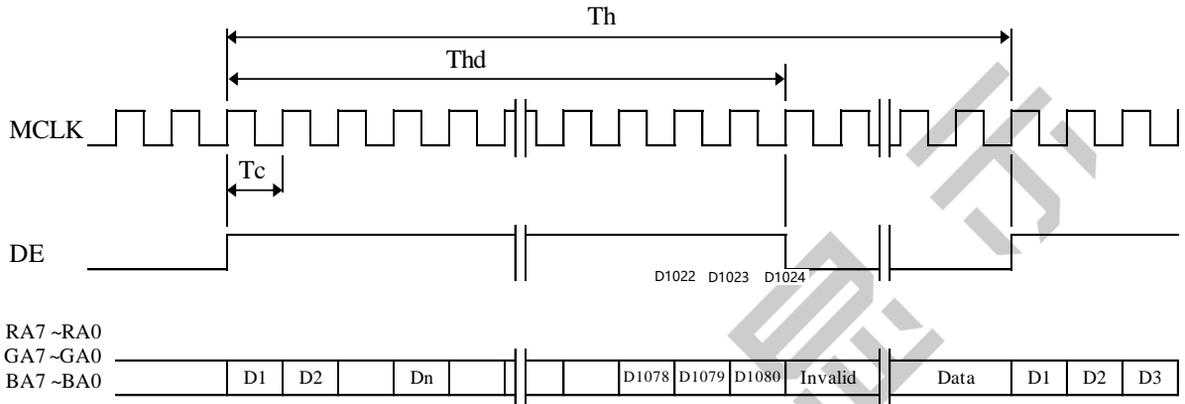


- 1) Need over 3 H-sync during V-Sync Low
- 2) Fix H-Sync width from V-Sync falling edge to first rising edge

6.02 Vertical Timing Waveforms

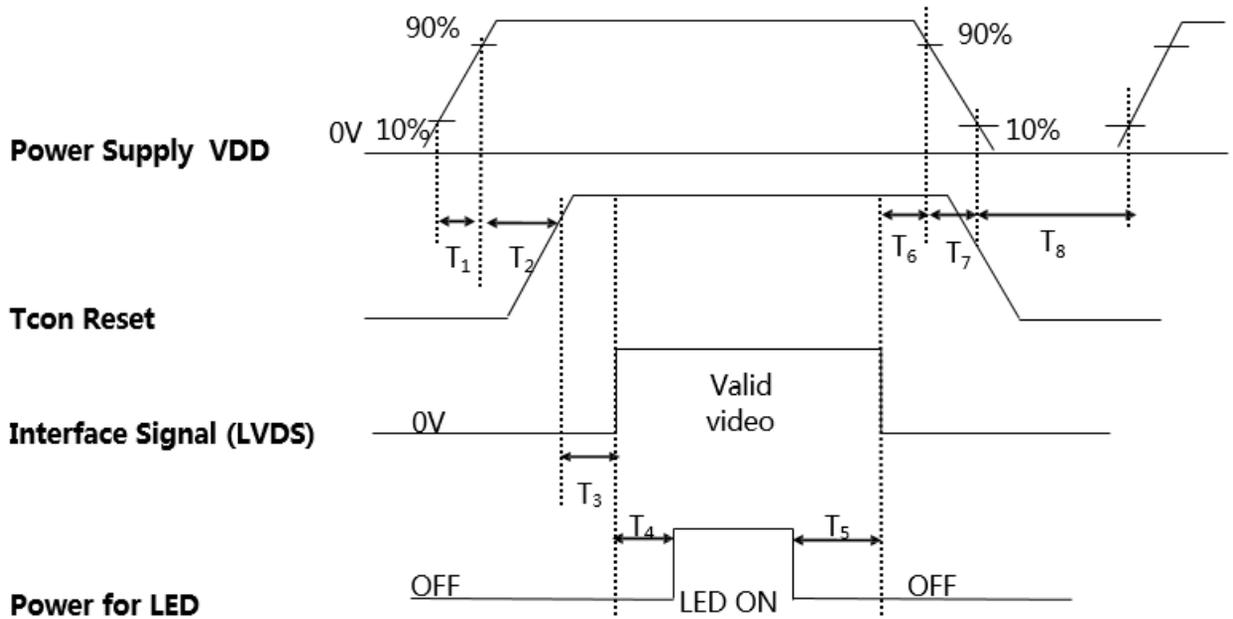


6.03 Horizontal Timing Waveforms



7.0 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



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)

8.0 OPTICAL SPECIFICATION

8.0.1 Overview

The test of view angle range shall be measured in a dark room (ambient luminance ≤ 1 lux 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 $\theta \emptyset = 0$ ($= \theta_3$) as the 3 o'clock direction (the "right"), $\theta \emptyset = 90$ ($= \theta_{12}$) as the 12 o'clock direction ("upward"), $\theta \emptyset = 180$ ($= \theta_9$) as the 9 o'clock direction ("left") and $\theta \emptyset = 270$ ($= \theta_6$) as the 6 o'clock direction ("bottom"). While scanning θ and/or \emptyset , 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 $3.3 \pm 0.3\text{V}$ at 25°C . Optimum viewing angle direction is 6 'clock

<Table 5. Optical Specifications>

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	85	89	-	Deg.	Note 1
		Θ_9		85	89	-	Deg.	
	Vertical	Θ_{12}		85	89	-	Deg.	
		Θ_6		85	89	-	Deg.	
Luminance Contrast ratio		CR	$\Theta = 0^\circ$	-	1000	-		Note 2
Color Gamut	sRGB	CIE1931	$\Theta = 0^\circ$	76	81	-	%	Only CF@C Light
Reproduction of color	White	Wx	$\Theta = 0^\circ$	Typ	0.320	Typ +0.03		
		Wy		-0.03	0.327			
Response Time		Tr+Td	Ta= 25°C $\Theta = 0^\circ$	-	30	35	ms	Note 6

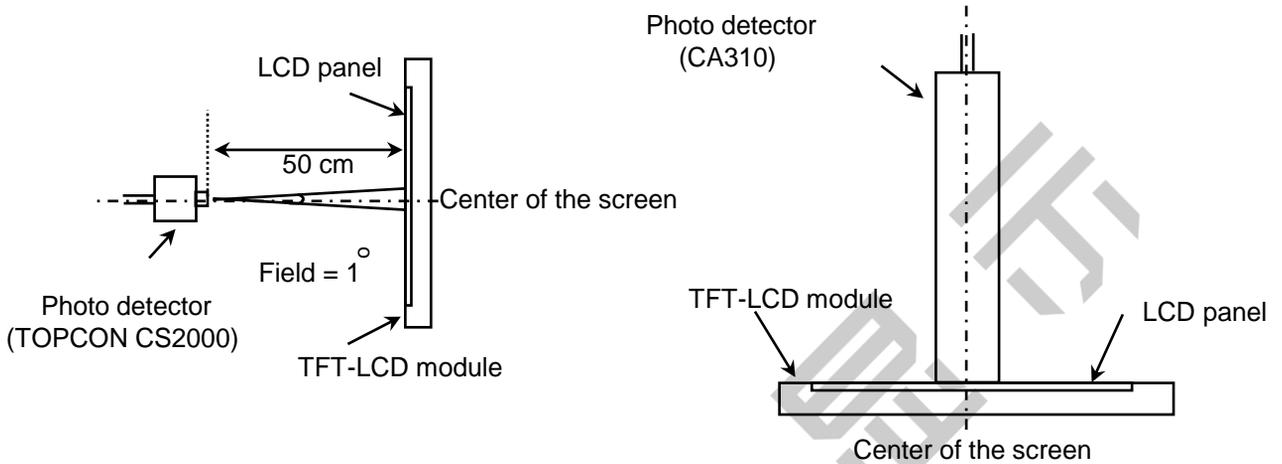
- Notes : 1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).
2. Contrast 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. 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.
4. 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 T_r , and 90% to 10% is T_d .

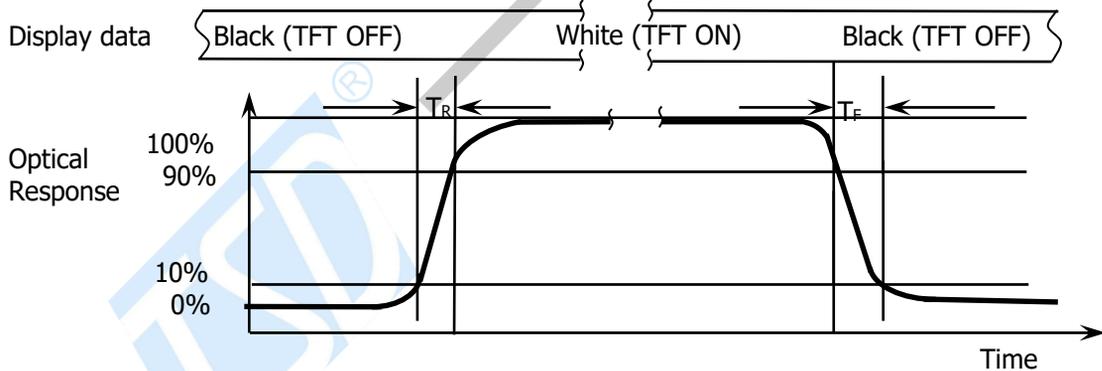
8.0.2 Optical measurements

Figure 1. Measurement Set Up



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

Figure 2. 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 .

9.0 RELIABILITY TEST

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

<Table 9. Reliability test>

No	Test Items	Conditions	Remark
1	High temperature storage test	Ta = 85°C, 240 hrs	根据客户规格更新
2	Low temperature storage test	Ta = -30 °C, 240 hrs	
3	High temperature operation test	Ta = 80°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 = -30 °C ↔ 80°C (0.5 hr), 100 cycle	Non-operation
7	Image Sticking	5*5 Pattern, 2hrs 25°C ± 2°C, check Pattern Gray 127, after 5 mins, the mura must be disappeared completely	根据客户规格更新

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 or FPC and D-IC during the process of handling or assembling. If not, It causes panel damage or malfunction.
- (4) Note that polarizers are very fragile and could be easily damaged. Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
- (5) Do not pull or fold the source D-IC which connect the source PCB or FPC and the panel.
- Do not pull or fold the LED wire.
- (6) After removing the protective film, when the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with alcohol or purified water.
- Do not strong polar solvent because they cause chemical damage to the polarizer.
- (7) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (8) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (9) 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.
- (10) Do not disassemble the module.
- (11) To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- (12) 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.
- (13) Do not drop water or any chemicals onto the LCD's surface.

10.2 Operating Precautions

- (1) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (2) 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.
- (3) The electrochemical reaction caused by DC voltage will lead to LCD degradation, so DC drive should be avoided.
- (4) 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.
- (5) 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.
- (6) 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.
The longer cable between that of back-light and that of converter may cause the luminance of LED to lower and need a higher startup voltage(Vs).
- (7) Connectors are precise devices for connecting PCB and transmitting electrical signals. Operators should insert and unplug MDL in parallel when assembling MDL.
- (8) Do not connect or disconnect the cable to/ from the module at the "Power On" condition.
- (9) When the module is operating, do not lose CLK, ENAB signals. If any one these signals is lost, the LCD panel would be damaged.
- (10) Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- (11) Do not re-adjust variable resistor or switch etc.
- (12) Long Side LED Bar design is recommended when using E-LED type Back Light

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.
- (3) In order to prevent potential problems, Flicker should be adjusted by Optimizing the Vcom value in customer LCM line through the I2C interface.

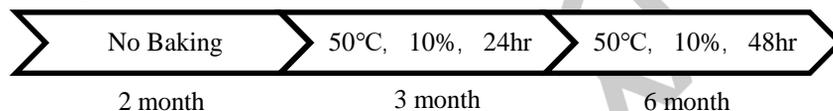
10.4 Precautions for Strong Light Exposure

It is not allowed to store or run 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 contact 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.

