深圳市一众显示科技有限公司

SHEN ZHEN TEAM SOURCE DISPLAY TECH. CO, LTD.

TFT-LCD Module Specification

Module NO.: TSM070WVHN-119

Version: V1.1

☐ APPROVAL FOR SPECIFICATION ☐ APPROVAL FOR SAMPLE

For Customer's Acceptance:	
Approved by	Comment

Team Source Display:		
Presented by	Reviewed by	Approved by
Hcr	Aron	Aron

Version No.	Date	Content	Remark
V1.0	2022-06-22	The initial release	
V1.1	2023-5-12	Update drawings	Aron

CONTENTS

1 General Characteristics

1.1 Introduction

TSD Display model **TSM070WVHN-119** is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a Backlight and a driving circuit.This TFT LCD has a 7.0 (15:9) inch diagonally measured active display area with WVGA (800 horizontal by 480 vertical pixel) resolution.

1.2 Features

- 7 (15:9 diagonal) inch configuration
- RGB 18-bit interface
- RoHS Compliance

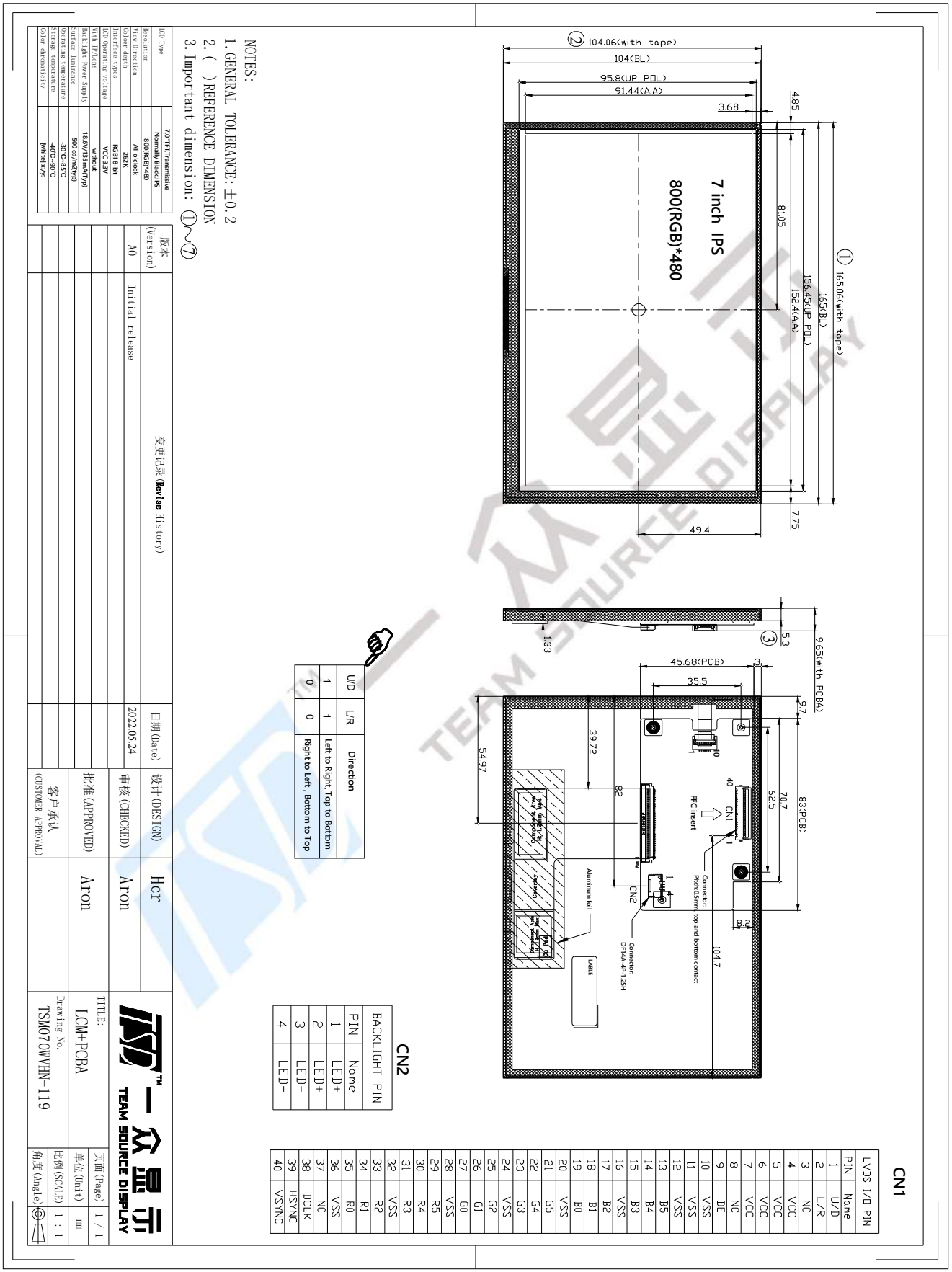
1.3 Applications

- TFT LCD Monitor
- Industrial Application
- Amusement
- Vehicle

1.4 General Information

ITEM	Specification	Unit
LCD Type	a-Si TFT,Transmissive,Normally black	-
LCD Size	7.0	inch
Resolution (W x H)	800x (RGB) × 480	pixel
Outline size	165.06(H) x 104.06(V) x9.65(T)	mm
Active Area	152.4 (H) x 91.44 V)	mm
Pixel Pitch	0.1905(H) × 0.1905(V)	mm
Viewing Direction	ALL o'clock	-
Color Depth	16.7M	-
Pixel Arrangement	RGB-stripe	-
Surface Luminance	450(Min)500(TYP)	cd/m²
Surface Treatment	Anti-glare	-
Interface Type	RGB18-bit(TTL)	-
Input Voltage	3.3	V
With/Without TP or Lens	Without	-
Weight	TBD	g

2 Product drawings



3 Interface description

3.1 LCM interface description

Pin No.	Symbol	I/O	Function	Remark
1	U/D	I	Up/down selection	Note 3,4
2	L/R	I	Left / right selection	Note 3,4
3	NC	-	No connection	
4-7	V_{CC}	P	Power for Digital Circuit	
8	NC	-	No connection	
9	DE	I	Data Input Enable	
10-12	VSS	P	Power ground	
13	B5	I	Blue data	
14	B4	I	Blue data	
15	B3	I	Blue data	
16	VSS	P	Power ground	
17	B2	I	Blue data	
18	B1	I	Blue data	
19	B0	I	Blue data(LSB)	
20	VSS	P	Power ground	
21	G5	I	Green data	
22	G4	I	Green data	
23	G3	I	Green data	
24	VSS	P	Power ground	
25	G2	I	Green data	
26	G1	I	Green data	
27	G0	I	Green data(LSB)	
28	VSS	P	Power ground	
29	R5	I	Red data	
30	R4	I	Red data	
31	R3	I	Red data	
32	VSS	P	Power ground	

33	R2	I	Red data	
34	R1	I	Red data	
35	R0	I	Red data(LSB)	
36	VSS	P	Power ground	
37	NC	-	No connection	
38	DCLK	I	Sample clock	Note 2
39	HSYNC	I	Horizontal Sync Input	Note 1
40	VSYNC	I	Vertical Sync Input	Note 1

I: input, O: output, P: Power

Note 1: Default DE mode.

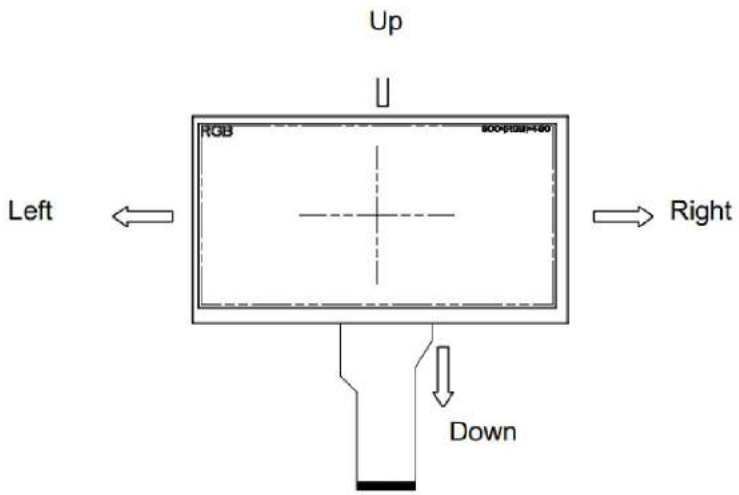
Note 2: Data shall be latched at the falling edge of DCLK.

Note 3: Selection of scanning mode

Setting of scan control input		Scanning direction
U/D	L/R	
1	1	Up to down, left to right(default)
0	0	Down to up, left to right

Note 4: Definition of scanning direction.

Refer to the figure as below:



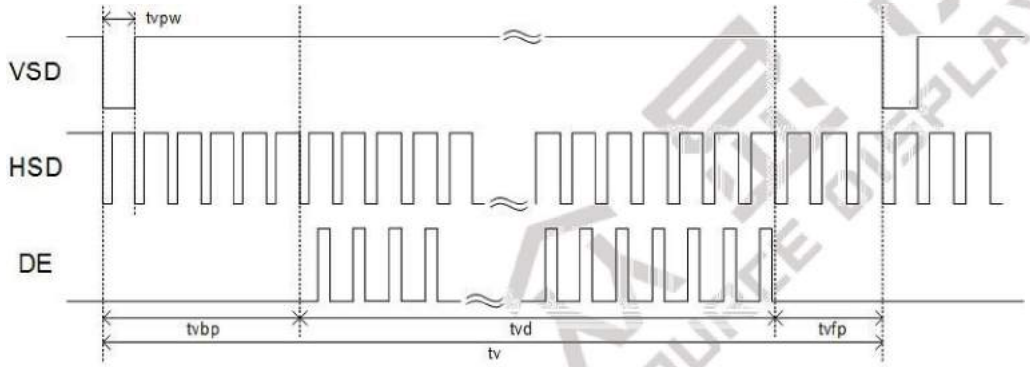
3.2 Backlight interface description

N0.	Symbol	Description
1	LED+	LED anode
2	LED+	LED anode
3	LED-	LED cathode
4	LED-	LED cathode

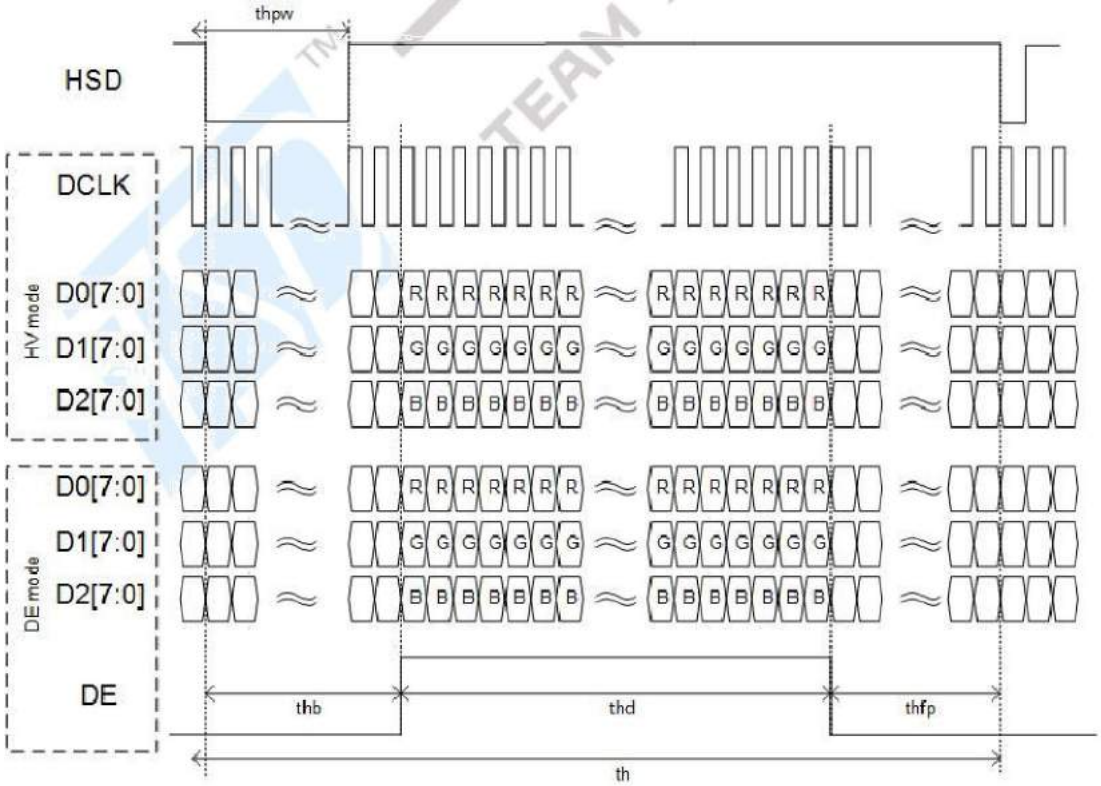
Note (1) User's connector Part No: LM123S004HTF13,4 PIN,UNE

4 Timing Characteristics

4.1 Date input Timing



Vertical input timing

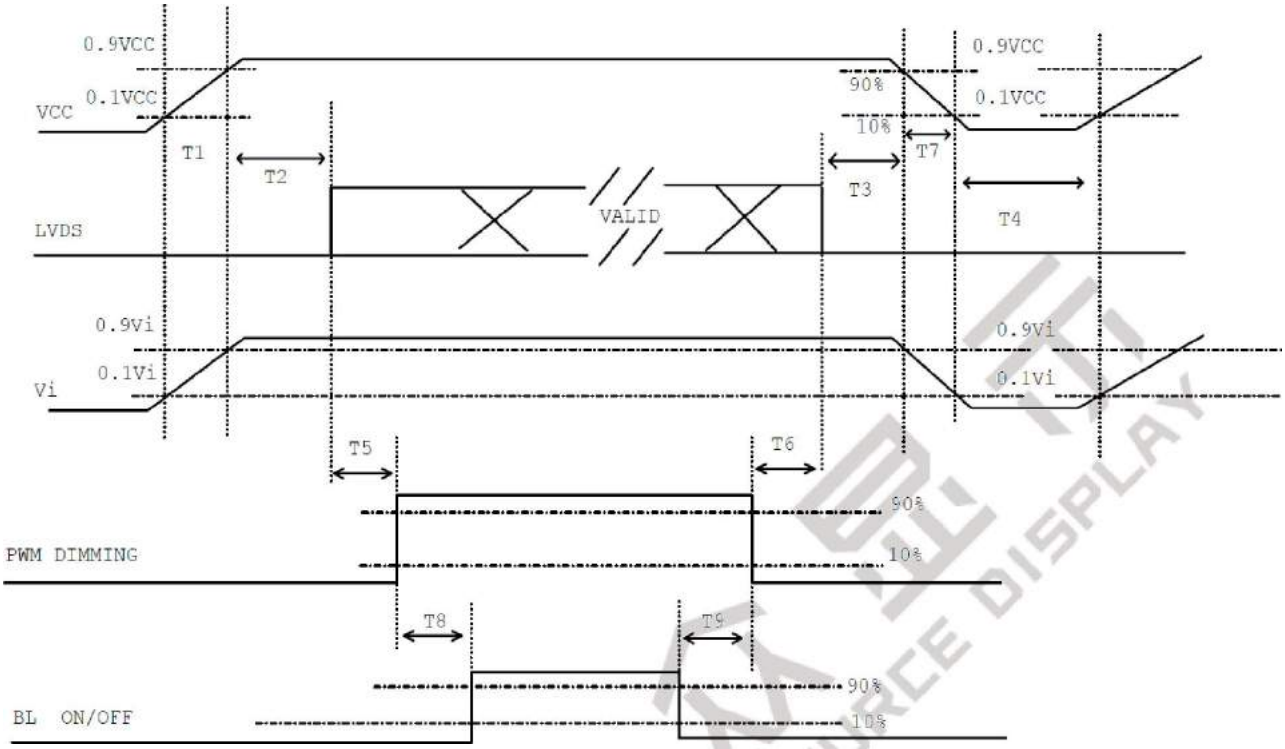


Horizontal input timing

Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK cycle time	Tcph	20		220	ns	
DCLK pulse duty	Tcwh	35	50	65	%	
VSD setup time	Tvst	8			ns	
VSD hold time	Tvhd	8			ns	
HSD setup time	Thst	8			ns	
HSD hold time	Thhd	8			ns	
Data setup time	Tdsu	8			ns	
Data hold time	Tdhd	8			ns	
DE setup time	Tesu	8			ns	
DE hold time	Tehd	8			ns	
DCLK frequency	fclk	28	30	32	MHz	
Horizontal display area	thd		800		Tcph	
HSD period time	th	899	902	915	Tcph	
HSD pulse width	thpw	5	10	15	Tcph	
HSD back porch	thb		32		Tcph	
HSD front porch	thfp	52	60	68	Tcph	
Vertical display area	tvd		480		th	
VSD period time	tv	540	555	564	th	
VSD pulse width	tvpw	6	10	14	Th	
VSD back porch	tvb		5		th	
VSD front porch	tvfp	55	60	65	th	

4.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD assembly, the power on/off sequence should be as the diagram below



Note (1) Please avoid floating state of interface signal at invalid period.
Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD VCC to 0 V.
Note (3) The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

Parameter	Value			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	0	-	50	ms
T4	500	-	-	ms
T5	20	-	-	ms
T6	10	-	-	ms
T7	5		300	ms
T8	10	-	-	ms
T9	10	-	-	ms

5 Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
LCD Power Supply Voltage	VCC	-0.3	4.0	V
LED Voltage	LED+-LED-	-	19.2	V
Operating Temperature	TOP	-30	85	° C
Storage Temperature	TST	-40	90	° C
Storage Humidity	RH	-	90%(Max 60° C)	RH

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for LED converter (Refer to 7 for further information).

6 Electrical Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Analog operating voltage	VCC	3.0	3.3	3.6	V
Input Current	IDD	-	45	-	mA
Input Voltage ' H ' level	VIH	0.7IOVCC	-	IOVCC	V
Input Voltage ' L ' level	VIL	GND	-	0.3IOVCC	

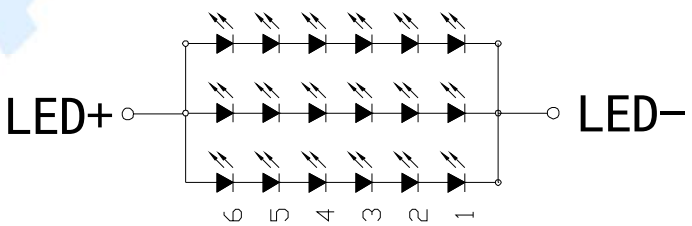
7 Backlight Characteristics

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Voltage for LED backlight	V_f	17	18	18.6	V
Current for LED backlight	I_f	-	135	-	mA
Power consumption	Wbl	-	2.43	-	W
Uniformity	Avg	75	-	-	%
LED Life Time		50000	-	-	Hrs

Note (1) LED current is measured by utilizing a high frequency current meter as shown below:

Note (2) The lifetime of LED is defined as the time when it continues to operate under the conditions at Ta = 25 ±2 ℃ and I_{LED} = 45mA$_{DC}$(LED forward current) until the brightness becomes ≦ 50% of its original value.

Note (3) Please note that LED life will be shorter than the average life described in the specification if operate in higher ambient temperature.



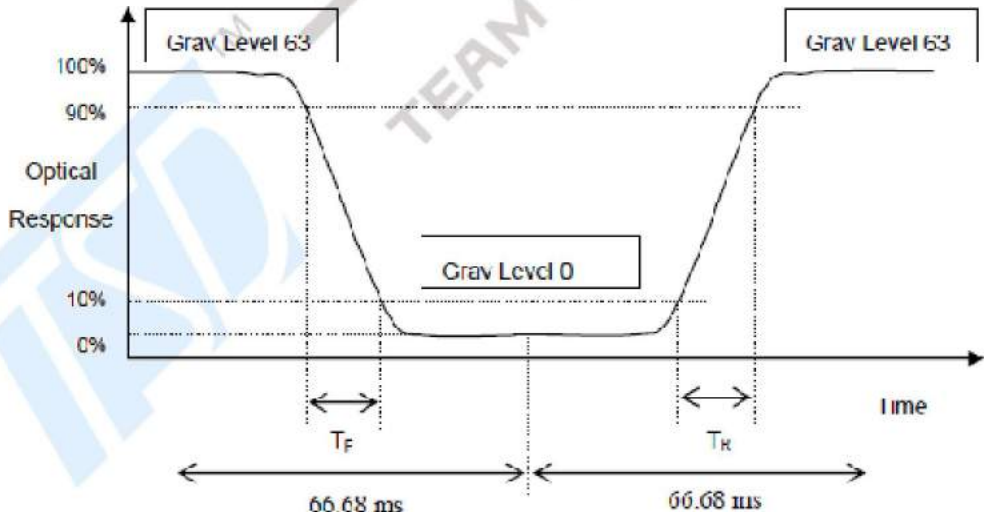
8 LCD Optical specifications

Item	Symbol	Condition	Specification			Unit	Remark
			Min	Typ	Max		
Response time (By Quick)	Tr+Tf	θ = 0°	-	30	40	ms	
Contrast ratio	CR	θ = 0°	700	1000	-		
Color Gamut	S	θ = 0°		70		%	
Luminance of White	L	θ = 0°	450	500	-	cd/m^2	
Viewing angle	Top	CR≧10	80	85	-	Deg.	
	Bottom	CR≧10	80	85	-		
	Left	CR≧10	80	85	-		
	Right	CR≧10	80	85	-		
Color chromaticity （CIE1931）	Wx	θ = 0°	-0.03	0. 326	+0.03		
	Wy			0. 356			
	Rx			0. 638			
	Ry			0. 345			
	Gx			0. 310			
	Gy			0. 623			
	Bx			0. 159			
	By			0. 062			

Note 1: Ambient temperature = 25°C.

Note 2: To be measured with a viewing cone of 2°by Topcon luminance meter BM-7.

Note 3: Definition of Response Time (TR, TF) and measurement method:

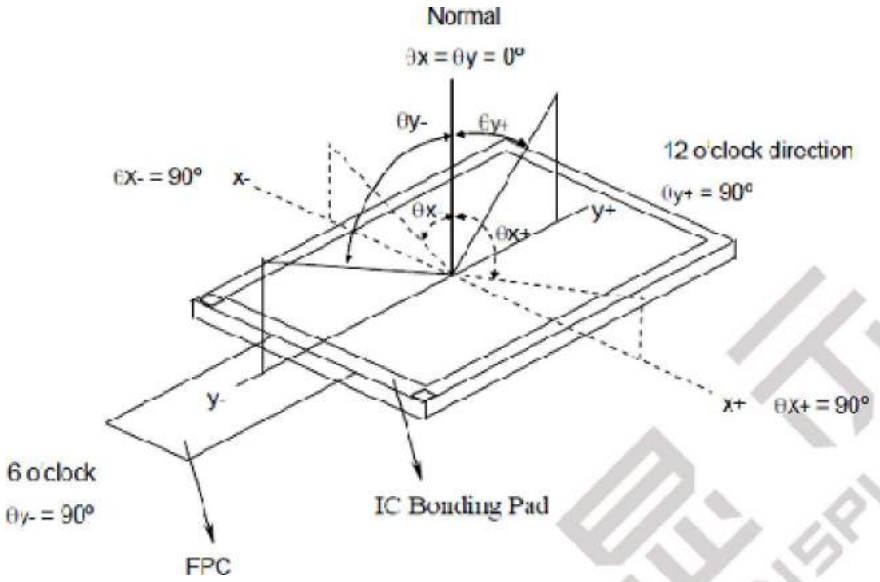


Note 4: Definition of contrast ratio:

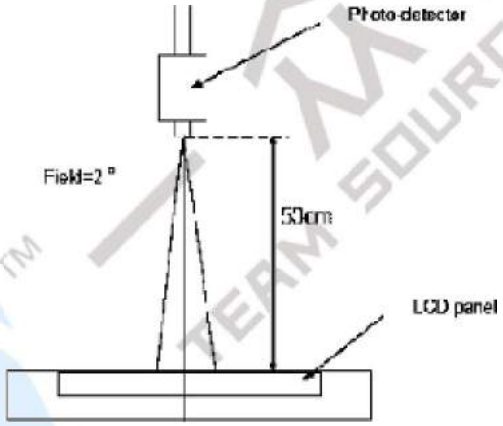
Contrast ratio is calculated by the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

Note 5: Definition of viewing angle



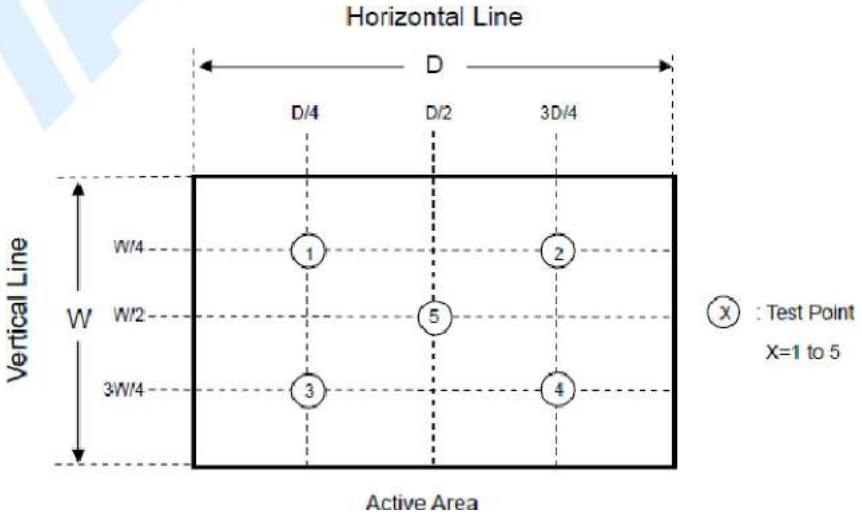
Note 6: Optical characteristic measurement setup.



Note 7:Definition of White Variation (δ W):

Measure the luminance of gray level 63 at 5 points

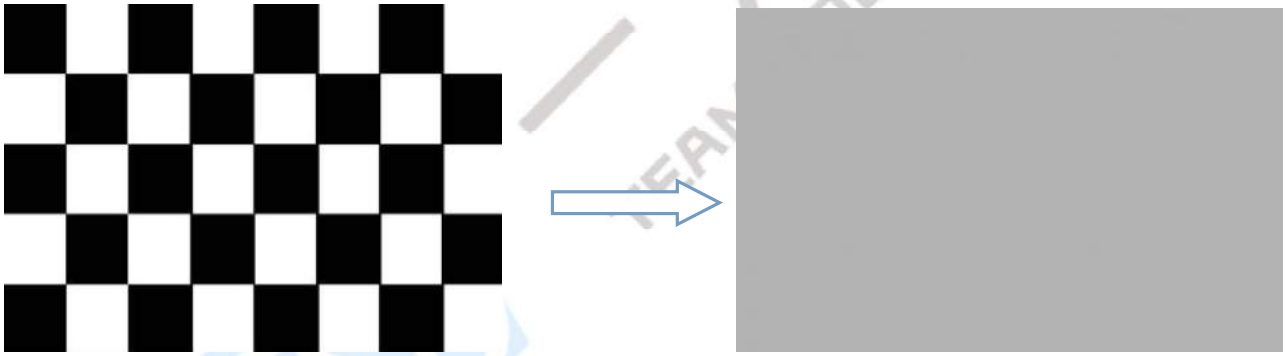
δ W = Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [L (1), L (2), L (3), L (4), L (5)]



9 RELIABILITY TEST

NO.	TEST ITEM	TEST CONDITION	INSPECTION AFTER TEST
1	High Temperature Storage	90±2°C/240 hours	Inspection after 2~4 hours storage at room temperature and humidity. The condensation is not accepted. The sample shall be free from defects: 1. Air bubble in the LCD 2. Seal leak 3. Non-display 4. Missing segments 5. Glass crack
2	Low Temperature Storage	-40±2°C/240 hours	
3	High Temperature Operating	85±2°C/240 hours	
4	Low Temperature Operating	-30±2°C/240 hours	
5	Temperature Cycle	-40±2°C(30 min.) , 90± 2°C (30min.) , 100 cycles	
6	Damp Proof Test	60°C ±2°C × 90%RH/240 hours	
7	Vibration Test	Frequency 10Hz~55Hz Stroke: 1.5mm Sweep: 10Hz~150 Hz~10Hz 2 hours For each direction of X, Y, Z	
9	Electrostatic Discharge Test	C=150pF, R=330 Ω Air: ±8KV 150pF/330Ω 9 times Contact: ±4KV,9 times	
10	Image Sticking	25℃,60%RH (ref.to Remark(1))/30 minutes	

Remark (1): Switch the image to Grey 127 after displaying the 5*8 chess pattern for 60 minutes, the afterimage disappears within 10 seconds.



5*8 chess pattern　　Gray127

9.1 About Image Sticking

9.1.1 What is Image Sticking?

If you remain a fixed image on LCD Display for a long period of time, you may experience a phenomenon called Image Sticking. Image Sticking - sometimes also called “image retention” or “ghosting” - is a phenomenon where a faint outline of a previously displayed image remains visible on the screen when the image is changed. It can occur at variable levels of intensity depending on the specific image makeup, as well as the amount of time the core image elements are allowed to remain unchanged on the screen. In POS applications, for example, a button menu which remains fixed, or in which the “frame” elements (core image) remain fixed and the buttons may change, may be susceptible to image sticking. It is important to note that if the screen is used exclusively for this application, the user may never notice this phenomenon since the screen never displays other content. `It is only when an image other than the “retained” image is shown on the screen that this issue becomes evident. Image sticking is different that the “burn-in” effect commonly associated with phosphor based devices.

9.1.2 What causes Image Sticking?

Image sticking is an intrinsic behavior of LCD displays due to the susceptibility to polarization of the interior materials (liquid crystals) when used under static, charged conditions (continuously displaying the same image). The individual liquid crystals in an LCD panel have unique electrical properties. Displaying a fixed pattern - such as the POS menu described above – over prolonged periods can cause a parasitic charge build-up (polarization) within the liquid crystals which affects the crystals' optical properties and ultimately prevents the liquid crystal from returning to its normal, relaxed state when the pattern is finally changed. This effect takes place at a cellular level within the LCD, and the effect can cause charged crystal alignment at the bottom or top of a crystal cell in the "z" axis, or even crystal migration to the edges of a cell, again based on their polarity. These conditions can cause image sticking over an entire area, or at boundaries of distinct color change respectively. In either case, when the liquid crystals in the pixels and sub-pixels utilized to display the static image are polarized such that they can not return fully to their "relaxed" state upon deactivation, the result is a faint, visible, retained image on the panel upon presentation of a new, different image. The actual rate of image retention depends on variation factors such as the specific image, how long it is displayed unchanged, the temperature within the panel and even the specific panel brand due to manufacturing differences amongst panel manufacturers.

9.1.3 How to Avoid Image Sticking?

- Try not to operate the LCD with a "fixed" image on the screen for more than 1 hours.
- If you are operating the monitor in an elevated temperature environment and with a displayed image which is contrary to the recommendations in "For Software Developers" below, image stick can occur in as little as 30 minutes. Adjust your screen saver settings accordingly.
- Power down the unit during prolonged periods of inactivity such as the hours a store is closed or a shift during which the piece of equipment isn't used.
- Use a screensaver with a black or medium gray background that is automatically set to come on if the device is inactive for more than 5-10 minutes.
- Avoid placing the monitor in poorly ventilated areas or in areas that will create excess heat around the monitor for software developers.
- In defining the icons, buttons, or windows in the screen, try to utilize block patterns instead of distinct lines as borders for dividing the display into distinct areas.
- If it is necessary to display a static image, try to use colors that are symmetric to the middle grey level at the boundary of two different colors, and slightly shift the borders line once in a while.
- Try to utilize medium gray hues for those areas that will have prolonged display times or remain static as other menu elements change.

9.1.4 How to Fix the Image Sticking?

Unlike the usually irreversible "burn-in" effects commonly associated with direct view phosphor display devices such as CRTs, an image retained on an LCD display can be reversed – often to a point of total invisibility. However, the severity of the underlying causes (as described above) of the image retained on a specific display, as well as the variation factors (see "For Software Developers" above) under which the retained image was created, will dictate the final level of retention reversal. One way to erase a retained image on a panel is to run the screen (monitor "on") in an "all black" pattern for 4-6 hours. It is also helpful to do this in an elevated temperature environment of approximately 35° to 50° C. Again, utilizing a dynamic screen saver with an all black background

during prolonged idle display periods is a good way to avoid image retention issues.

9.1.5 Is Image Sticking Covered by TSD RMA Warranty?

Image sticking is a phenomenon inherent to LCD Display technology itself, and as such, the occurrence of this "ghosting" effect is considered normal operation by the manufacturers of the LCD display modules which are integrated into today's monitor solutions. TSD does not warrant any display against the occurrence of image sticking. We strongly advise that you follow the operating recommendations listed above to avoid the occurrence of this phenomenon.

9.2 Others

1. Issues that are not defined in this document shall be discussed and agreed with both parties. (Customer and supplier)
2. Unless otherwise agreed upon in writing, the criteria shall be applied to both parties. (Customer and supplier)

10 Suggestions for using LCD modules

10.1 Handling of LCM

1. The LCD screen is made of glass. Don't give excessive external shock, or drop from a high place.
2. If the LCD screen is damaged and the liquid crystal leaks out, do not lick and swallow. When the liquid is attach to your hand, skin, cloth etc, wash it off by using soap and water thoroughly and immediately.
3. Don't apply excessive force on the surface of the LCM.
4. If the surface is contaminated, clean it with soft cloth. If the LCM is severely contaminated, use Isopropyl alcohol/Ethyl alcohol to clean. Other solvents may damage the polarizer. The following solvents is especially prohibited: water , ketone Aromatic solvents etc.
5. Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
6. Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
7. Don't disassemble the LCM.
8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
- Be sure to ground the body when handling the LCD modules.
- Tools required for assembling, such as soldering irons, must be properly grounded.
- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

9. Do not alter, modify or change the the shape of the tab on the metal frame.
10. Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
11. Do not damage or modify the pattern writing on the printed circuit board.
12. Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector
13. Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
14. Do not drop, bend or twist LCM.

10.2 Storage

1. Store in an ambient temperature of 5 to 25 ℃, and in a relative humidity of 40% to 60%. Don't expose to sunlight or fluorescent light.
2. Storage in a clean environment, free from dust, active gas, and solvent.
3. Store in antistatic container.

11 Limited Warranty

1.Our warranty liability is limited to repair and/or replacement. We will not be responsible for any consequential loss.
2.If possible, we suggest customer to use up all LCD modules as soon as possible. If the LCD module storage time over twelve months, we suggest to recheck it before being used.
3.Any product issues must be feedback to TSD within 12 months since delivery, otherwise, we will not be responsible for the subsequent or consequential events.