一众显示科技有限公司

TEAM SOURCE DISPLAY TECH. CO, LTD.

TFT-LCD Module Specification

Module NO.: TST050FWHS-161

Version: V1.0

☐ APPROVAL FOR SPECIFICATION ☐ APPROVAL FOR SAMPLE

For Customer's Acceptance:	
Approved by	Comment

Team Source Display:		
Presented by	Reviewed by	Approved by
Jin	San,Aron	Aron

Revision history

Version No.	Date	Page	Content	Remark
V1.0	2025-9-3	All	The initial release	

CONTENTS

1 General Characteristics

1.1 Introduction

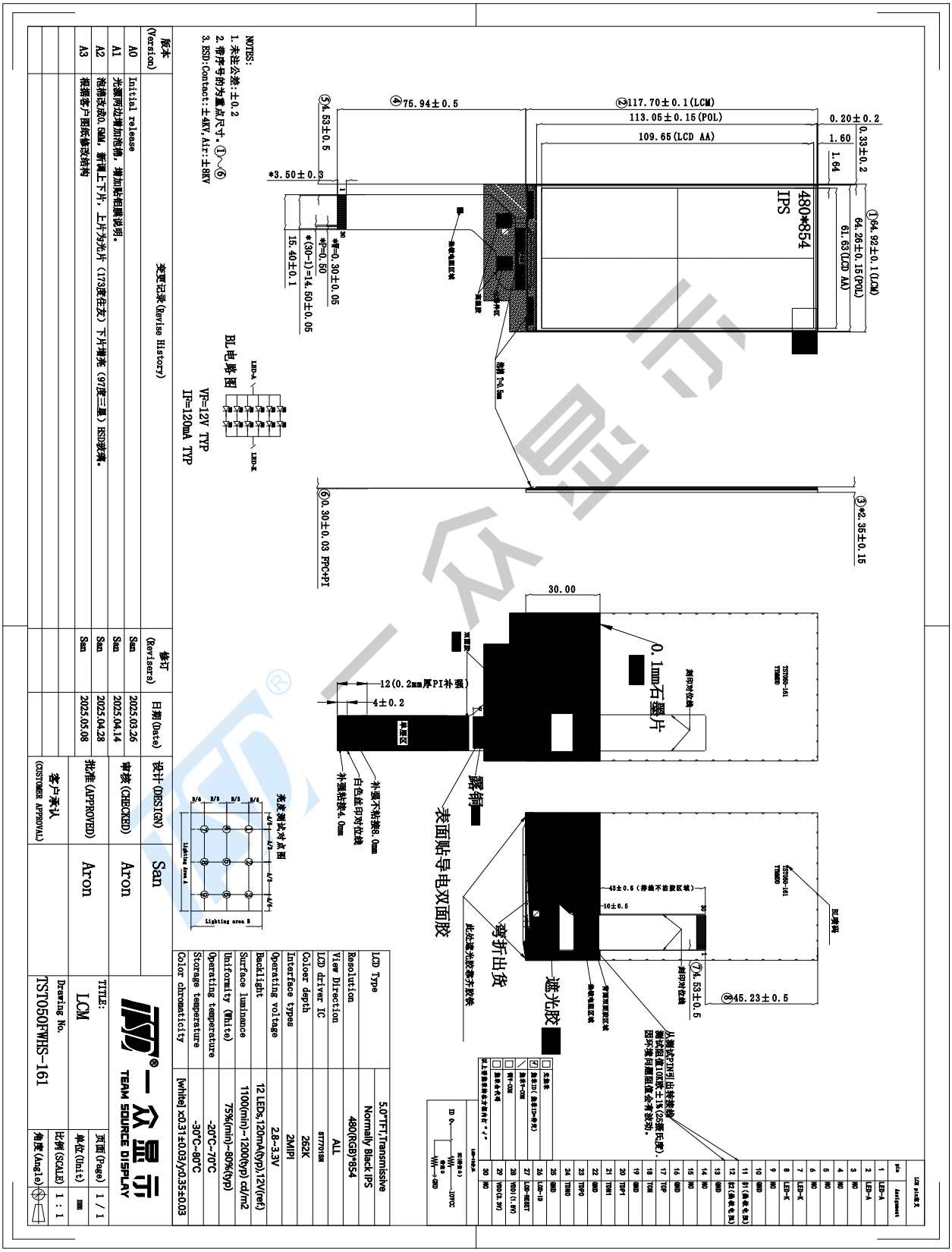
TST050FWHS-161 is a transmission type color active matrix liquid crystal display (LCD), using amorphous thin film transistor (TFT) as a switching device. This product is composed of TFT LCD panel, driver IC, FPC, backlight . The active display area is a 5.0-inch measurement on the diagonal, with a native resolution of 480 * RGB * 854. The characteristics of this product are shown in the following table below.

1.2 General Information

ITEM	Specification	Unit
LCD Type	a-Si TFT,Transmissive,Normally black,IPS	-
LCD Size	5.0	inch
Resolution (W x H)	480x (RGB) × 854	pixel
Outline size	64.92(H) x 117.70(V) x2.35(T)	mm
Active Area	61.63 (H) x 109.65 (V)	mm
Pixel Pitch	0.1284 (H) X 0.1284 (V)	mm
Viewing Direction	ALL o'clock	-
Driver IC	ST7701SN	
Color Depth	16.7M	-
Pixel Arrangement	RGB-stripe	-
Surface Luminance	1100(MIN)~1200(TYP)	cd/m²
Lens Surface Treatment	Clear	-
LCD Interface Type	2 lane-MIPI	-
Weight	TBD	g

Website: www.tslcd.com/www.lcdlcm.com Email: tslcd@tslcd.com

2 Product drawings



3 Interface description

3.1 LCM interface description

Pin No.	I/O	Symbol	Function
1-2	P	LED-A	LED Anode
3-6	-	NC	Not connect
7-8	P	LED-K	LED Cathode
9	-	NC	Not connect
10	P	GND	Ground
11	-	S1（热敏电阻）	Thermistor can be attached
12	-	S2（热敏电阻）	Thermistor can be attached
13	P	GND	Ground
14	-	NC	Not connect
15	-	NC	Not connect
16	P	GND	Ground
17	I	TCP	MIPI clock positive signal
18	I	TCN	MIPI clock negative signal
19	P	GND	Ground
20	I	TDP1	MIPI-DSI Data differential signal input pins. (Data lane 1)
21	I	TDN1	MIPI-DSI Data differential signal input pins. (Data lane 1)
22	P	GND	Ground
23	I	TDP0	MIPI-DSI Data differential signal input pins. (Data lane0)
24	I	TDN0	MIPI-DSI Data differential signal input pins. (Data lane 0)
25	P	GND	Ground
26	O	LCD-ID	ID PIN
27	I	LCD-RESET	Device reset signal （1.8V）
28	P	VDDI(1.8V)	Power supply for VDDI（1.8V）
29	P	VDD(3.3V)	Power supply for VDD（3.3V）
30	-	NC	Not connect

I: input, O: output, P: Power

Note (1):default scanning mode: left to right,up to down

4 Timing Characteristics

4.1 MIPI Interface Timing Characteristics

4.1.1High speed mode

Figure 4 DSI clock channel timing

Figure 5 Rising and falling time on clock and data channel

VDDI=1.8,VDD=2.8, AGND=DGND=0V, Ta=25 ℃

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-CLK+/-	$2xUI_{INSTA}$	Double UI instantaneous	4	25	ns	
DSI-CLK+/-	UI_{INSTA} UI_{INSTB}	UI instantaneous halfs	2	12.5	ns	UI = UI_{INSTA}= UI_{INSTB}
DSI-Dn+/-	tDS	Data to clock setup time	0.15	-	UI	
DSI-Dn+/-	tDH	Data to clock hold time	0.15	-	UI	

Table 7 Mipi Interface- High Speed Mode Timing Characteristics

4.1.2 Low power mode

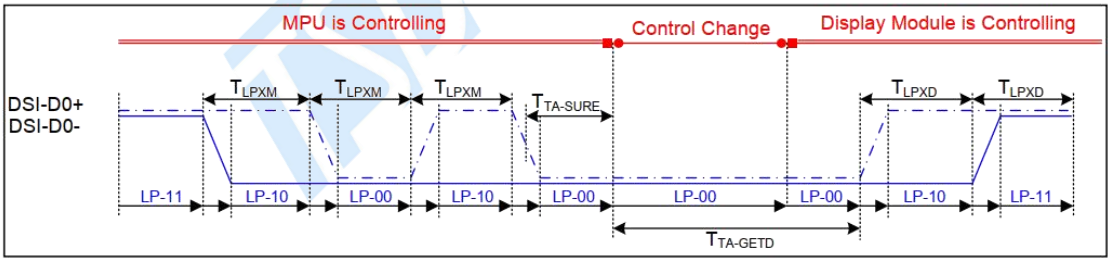


Figure 6 Bus Turnaround (BTA) from display module to MPU Timing

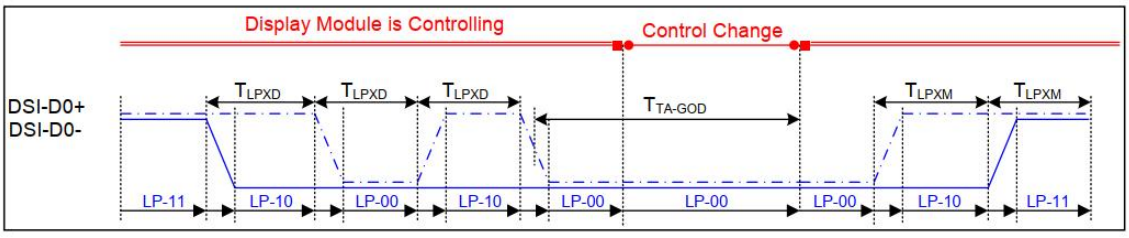


Figure 7 Bus Turnaround (BTA) from MPU to display module Timing

VDDI=1.8,VDD=2.8, AGND=DGND=0V, Ta=25 ℃

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-D0+/-	TLPXM	Length of LP-00,LP-01, LP-10 or LP-11 periods MPU→Display Module	50	75	ns	Input
DSI-D0+/-	TLPXD	Length of LP-00,LP-01, LP-10 or LP-11 periods MPU→Display Module	50	75	ns	Output
DSI-D0+/-	TTA-SURED	Time-out before the MPU start driving	T_{LPXD}	$2xT_{LPXD}$	ns	Output
DSI-D0+/-	TTA-GETD	Time to drive LP-00 by display module	$5xT_{LPXD}$		ns	Input
DSI-D0+/-	TTA-GOD	Time to drive LP-00 after turnaround request-MPU	$4xT_{LPXD}$		ns	Output

Table 8 Mipi Interface Low Power Mode Timing Characteristics

4.1.3 DSI Outbreak mode

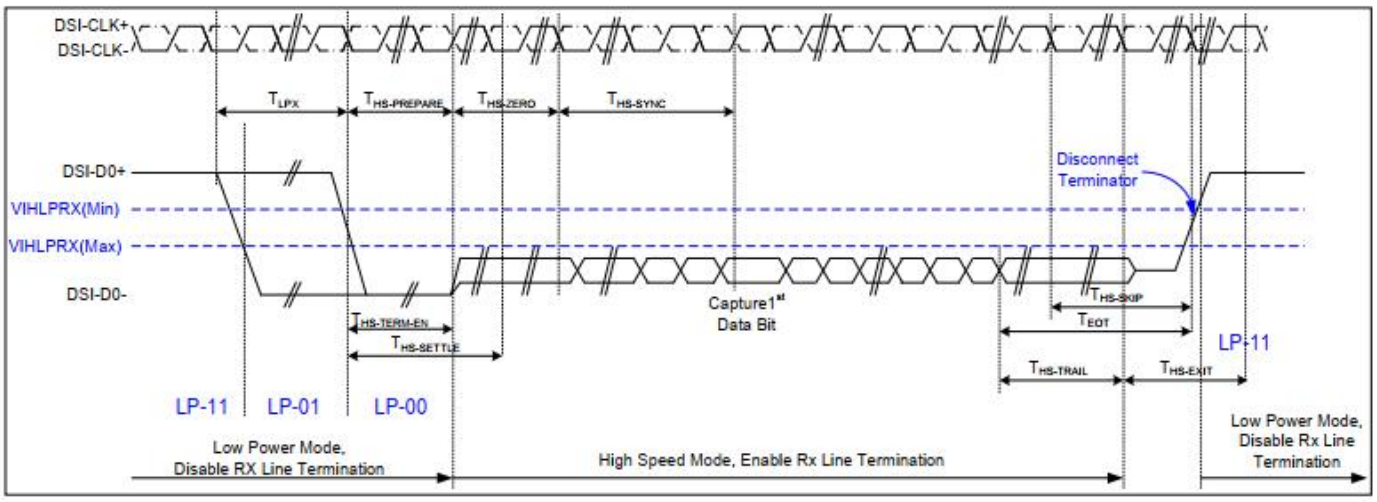


Figure 7 Data lanes-Low Power Mode to/from High Speed Mode Timing

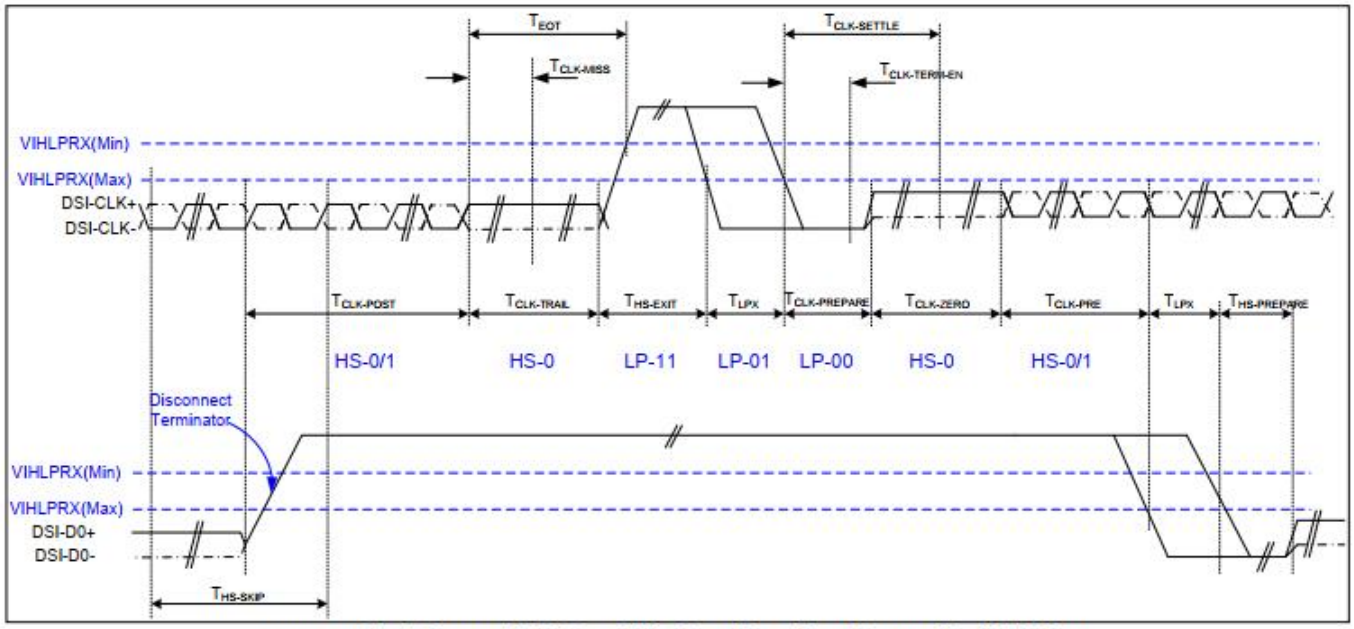


Figure 8 Clock lanes- High Speed Mode to/from Low Power Mode Timing

VDDI=1.8,VDD=2.8, AGND=DGND=0V, Ta=25 ℃

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
Low Power Mode to High Speed Mode Timing						
DSI-Dn+/-	TLPX	Length of any low power state period	50	-	ns	Input
DSI-Dn+/-	THS-PREPARE	Time to drive LP-00 to prepare for HS transmission	40+4 UI	85+6 UI	ns	Input

DSI-Dn+/-	THS-TERM-EN	Time to enable data receiver line termination measured from when Dn crosses VILMAX	-	35+4 UI	ns	Input
DSI-Dn+/-	THS-PREPARE + THS-ZERO	THS-PREPARE + time to drive HS-0 before the sync sequence	140+ 10UI	-	ns	Input
High Speed Mode to Low Power Mode Timing						
DSI-Dn+/-	THS-SKIP	Time-out at display module to ignore transition period of EoT	40	55+4 UI	ns	Input
DSI-Dn+/-	THS-EXIT	Time to drive LP-11 after HS burst	100	-	ns	Input
DSI-Dn+/-	THS-TRAIL	Time to drive flipped differential state after last payload data bit of a HS transmission burst	60+4 UI	-	ns	Input
High Speed Mode to/from Low Power Mode Timing						
DSI-CLK+/-	TCLK-POS	Time that the MPU shall continue sending HS clock after the last associated data lane has transition to LP mode	60+5 2UI	-	ns	Input

DSI-CLK+/-	TCLK-TRAIL	Time to drive HS differential state after last payload clock bit of a HS transmission burst	60	-	ns	Input
DSI-CLK+/-	THS-EXIT	Time to drive LP-11 after HS burst	100	-	ns	Input
DSI-CLK+/-	TCLK-PREPARE	Time to drive LP-00 to prepare for HS transmission	38	95	ns	Input
DSI-CLK+/-	TCLK-TERM-EN	Time-out at clock lan display module to enable HS transmission	--	38	ns	Input
DSI-CLK+/-	TCLK-PREPARE + TCLK-ZERO	Minimum lead HS-0 drive period before starting clock	300	-	ns	Input

4.2 Timing Characteristic For 480*854

Parameter	Symbol	min	Typ.	max	Unit
Horizontal display area	tHD	-	480	-	CLKIN
CLKIN frequency	fclk	-	30	-	MHz
Horizontal line period	th	-	600	-	CLKIN
HSD pulse width	thw	-	30	-	
HSD back porch	thbp	-	30	-	
HSD front porch	thfp	-	30	-	
Vertical display area	tVD	-	854	-	HSD
VSD period time	tV	-	881	-	
VSD pulse width	tVPW	-	5	-	
VSD back porch	tVBP	-	16	-	
VSD front porch	tVFP	-	6	-	

5 Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
LCD Supply Voltage	VDD	-0.3	4.6	V
LCD IO Supply Voltage	VDDI	-0.3	4.6	V
Operating Temperature	TOP	-20	70	° C
Storage Temperature	TST	-30	80	° C
Humidity	RH	-	90%(Max 60° C)	RH

6 Electrical Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
LCD operating voltage	VDD	2.8	3.3	3.6	V
LCD IO Supply Voltage	VDDI	1.7	1.8	1.9	V
LCD Operating current	Ivdd	-	TBD	-	mA
Input Voltage ' H ' level	VIH	0.7VDD	-	VDD	V
Input Voltage ' L ' level	VIL	GND	-	0.3VDD	V

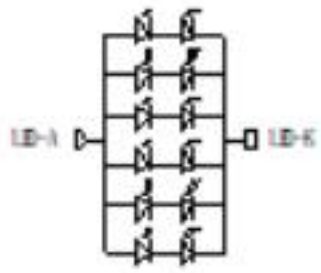
7 Backlight Characteristics

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Voltage for LED backlight	V_f	-	12	-	V
Current for LED backlight	I_f	-	120	-	mA
Power consumption	Wbl	-	1440	-	mW
LED Life Time	-	20000	30000	-	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 Typical operating current of LED 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.



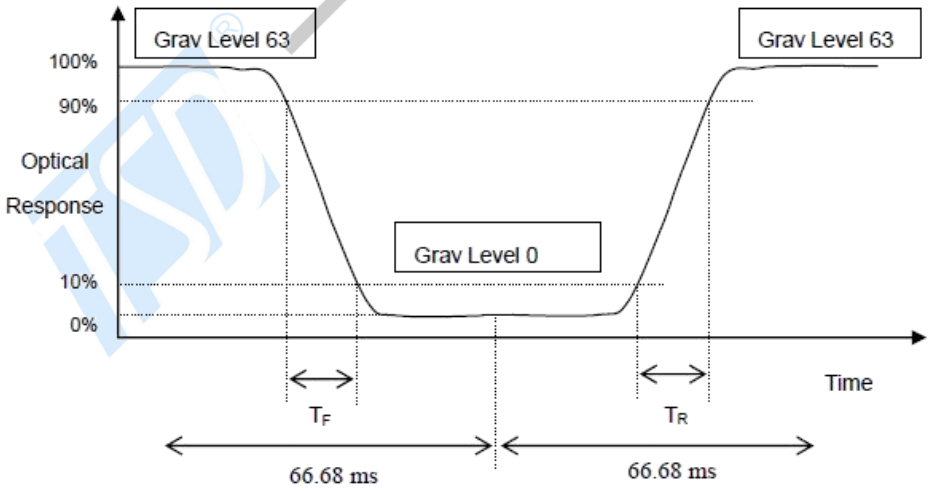
8 LCD Optical specifications

Item	Symbol	Condition	Specification			Unit	Remark
			Min	Typ	Max		
Response time (By Quick)	Tr+Tf	-	-	35	45	ms	Note 3
Contrast ratio	CR	-	640	800	-	-	Note 4
Surface luminance	Lv	θ= 0°	1100	1200	-	Cd/m^2	Note 2,6
Luminance uniformity	Yu	θ= 0°	75	80	-	%	Note 7
Viewing angle	Top	CR>10	-	80	-	Deg.	Note 5
	Bottom	CR>10	-	80	-		
	Left	CR>10	-	80	-		
	Right	CR>10	-	80	-		
CIE(x,y) chromaticity	Wx	θ= 0°	Typ -0.03	0.310	Typ +0.03		
	Wy			0.355			
	Rx			0.630			
	Ry			0.350			
	Gx			0.330			
	Gy			0.605			
	Bx			0.150			
	By			0.105			

Note 1: Ambient temperature = 25°C.

Note 2: To be measured with a viewing cone of 2°by luminance meter CA310.

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

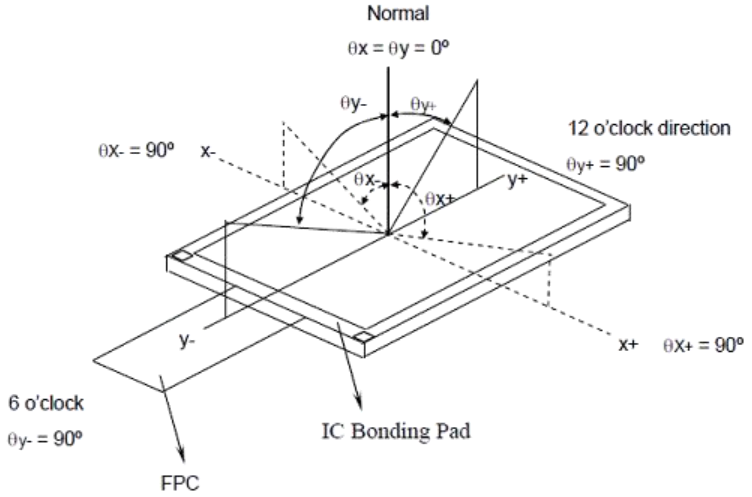


Note 4: Definition of contrast ratio:

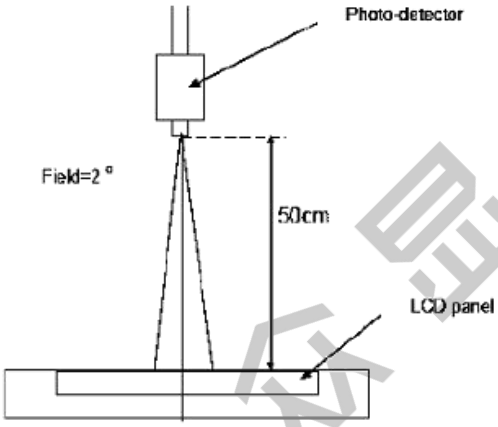
Contrast ratio is calculated by the following formula.

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

Note 5: Definition of viewing angle



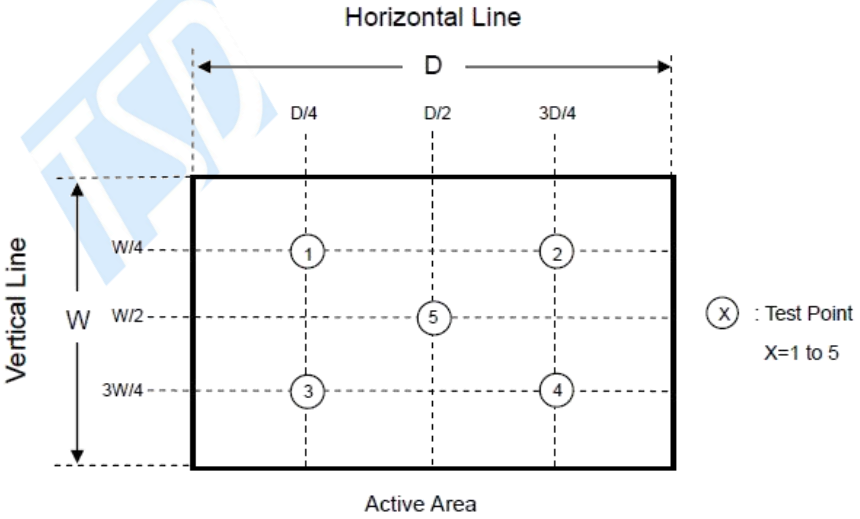
Note 6: Optical characteristic measurement setup.



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

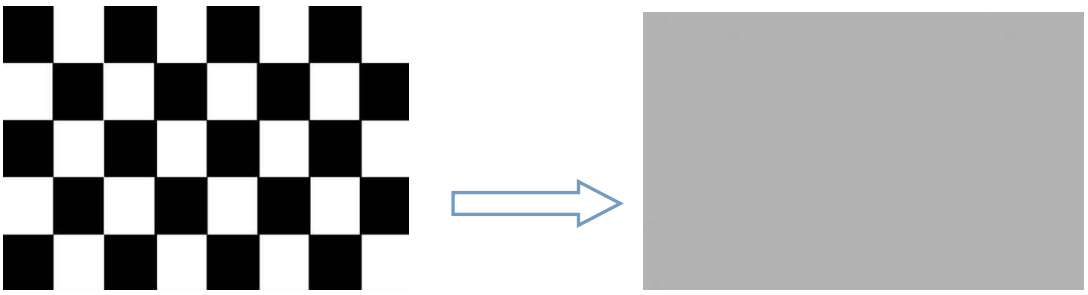
NO.	TEST ITEM	TEST CONDITION	Criterion
1	High Temperature Storage	80±2°C/240 hours	IEC60068-2-1, GB/T2423.2
2	Low Temperature Storage	-30±2°C/240 hours	IEC60068-2-1, GB/T2423.1
3	High Temperature Operating	70±2°C/240 hours	IEC60068-2-1, GB/T2423.2
4	Low Temperature Operating	-20±2°C/240 hours	IEC60068-2-1, GB/T2423.1
5	Temperature Cycle	-20±2°C(30 min.) , 70± 2°C (30min.) , 10 cycles	IEC60068-2-14, GB/T2423.22
6	High Temperature & Humidity Storage	60°C ±2°C × 90%RH/240hours	IEC60068-2-78, GB/T2423.3
7	Vibration Test	Frequency 10Hz~55Hz Stroke: 1.5mm Sweep: 10Hz~150 Hz~10Hz 2 hours For each direction of X, Y, Z	IEC60068-2-6, GB/T2423.10
8	Shock Test (non operation)	"100G.6msmec,1/2 Sine Wave ±X ±Y ±Z each axis 3 times"	IEC60068-2-27,GB/T 2423.5
9	Electrostatic Discharge Test	C=150pF, R=330 Ω Air: ±8KV 150pF/330Ω 9 times Contact: ±4KV,9 times	IEC61000-4-2, GB/T17626.2
10	Image Sticking(残影)	25℃,60%RH/30 minutes	Note2

Note 1： 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
6. No mura: 50% gray(Grey 127) / ND 5%
7. In the high-temperature working experiment, the drive current needs to be reduced to 50%.

Note 2: Switch the image to Grey 127 after displaying the 5*8 chess pattern for 30 minutes, the after image disappears within 10 minutes.

采用 5x8 的黑白棋盘格画面保持 30 分钟，然后切换到 127 灰阶(16 位色则是 63 灰阶)，10 分钟内图像消失。



5*8 chess pattern　　Gray127

Website: www.tslcd.com/www.lcdlcm.com　　Email: tslcd@tslcd.com

9.1 About Image Sticking(关于残影)

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?（如何避免残影）

- Try not to operate the LCD with a “fixed” image on the screen for more than 30 minutes.
-尽量不要在屏幕上显示“固定”图像的情况下操作 LCD 超过 30 分钟。
- 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.
-如果在高温环境中操作显示器，并且显示的图像与下面对“软件开发人员”中的建议相反，则图像粘贴可能在 30 分钟内发生。相应地调整屏幕保护程序设置。
1) 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.
-在长时间不活动时，如商店关门或不使用设备的轮班时，应关闭设备电源。
2)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.

-使用黑色或中灰色背景的屏幕保护程序，如果设备处于非活动状态超过 5-10 分钟，屏幕保护程序会自动设置为打开。

3)Avoid placing the monitor in poorly ventilated areas or in areas that will create excess heat around the monitor for software developers.

-避免将显示器放置在通风不良的区域或显示器周围产生过多热量的区域。

4)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.

-在定义屏幕中的图标、按钮或窗口时，尝试使用块模式而不是不同的线作为边界，将显示划分为不同的区域。

5) 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.

-如果需要显示静态图像，请尝试在两种不同颜色的边界处使用与中间灰度级对称的颜色，并偶尔稍微移动边界线。

6) Try to utilize medium gray hues for those areas that will have prolonged display times or remain static as other menu elements change.

-对于那些显示时间较长或随着其他菜单元素的变化而保持静止的区域，请尝试使用中等灰度色调。

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) 本文件中未定义的问题应由双方讨论并达成一致。（客户和供应商）。

2. Unless otherwise agreed upon in writing, the criteria shall be applied to both parties. (Customer and supplier)除非另有书面约定，否则该标准适用于双方。（客户和供应商）。

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 anti-static 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.