一众显示科技有限公司

TEAM SOURCE DISPLAY TECH. CO, LTD.

TFT-LCD Module Specification

Module NO.: TST070WSBE-136C

Version: V1.2

☐ APPROVAL FOR SPECIFICATION ☐ APPROVAL FOR SAMPLE

For Customer's Acceptance:	
Approved by	**Comment**

Team Source Display:		
Presented by	**Reviewed by**	**Approved by**

Version No.	Date	Content	Remark
V1.0	2023-02-03	Initial Release	
V1.1	2023-07-24	Modify P10	
V1.2	2023-07-24	Modify P12	

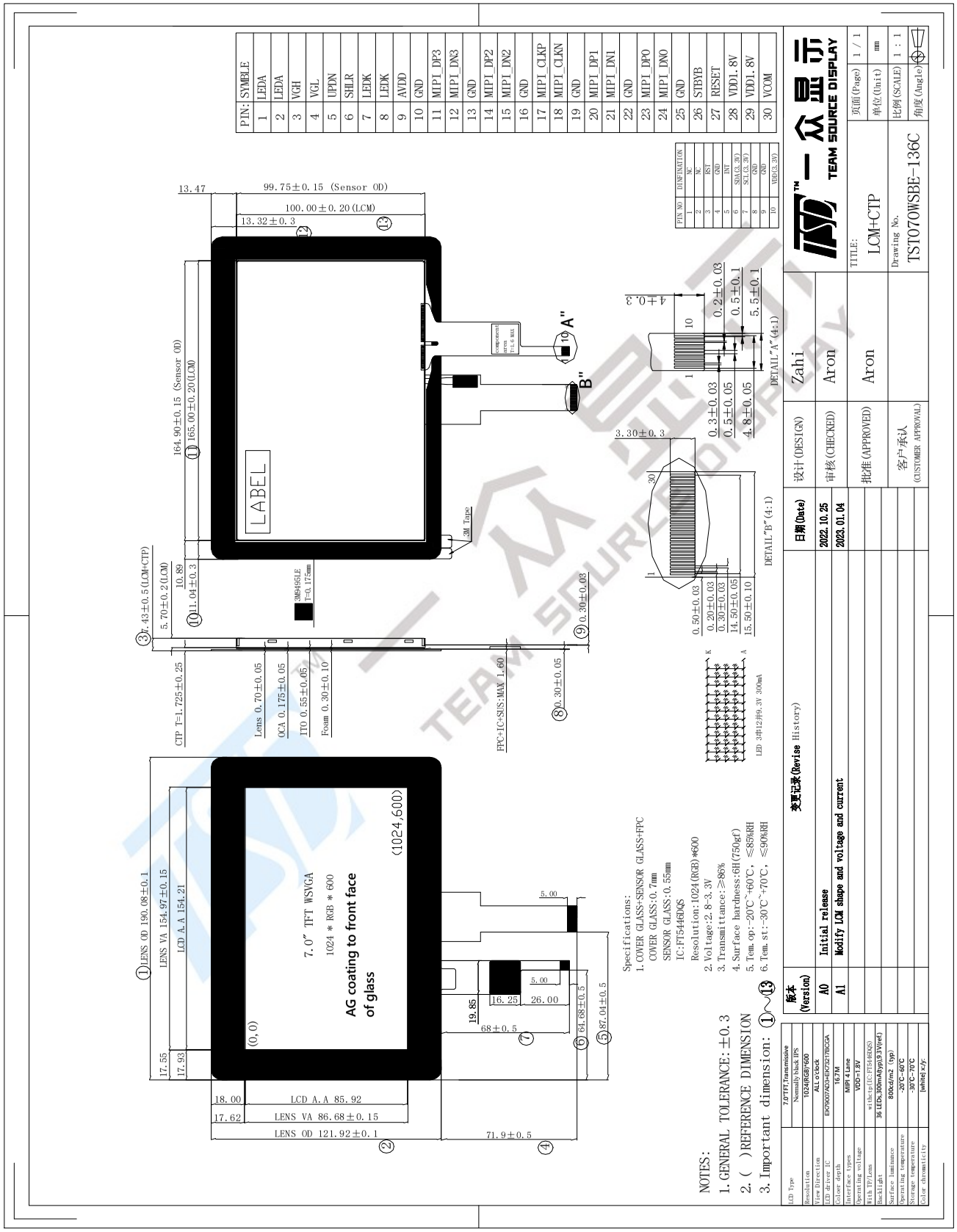
CONTENTS

1 General Characteristics

ITEM	Specification	Unit
LCD Type	TFT,Transmissive,Normally black,IPS	-
LCD Size	7.0	inch
Resolution (W x H)	1024 x (RGB) × 600	pixel
LCM (W × H × D)	165(W) x100(H) x 5.7(D)	mm
Active Area (W × H)	154.21 (W) x 85.92 (H)	mm
Pixel Pitch (W × H)	0.0502 x 0.17432	mm
Viewing Direction	ALL o'clock	-
Gray Scale Inversion Direction	ALL o'clock	-
Viewing Angle	Top:85,Bottom:85; Left/ Right:85	deg.
Color Depth	16.7M	-
Pixel Arrangement	RGB-stripe	-
Backlight Type	36 LEDs	-
Surface Luminance	800	cd/m2
Surface Treatment	-	-
Polarizer	-	-
Driver IC	EK79007AD3+EK73217BCGA	-
Interface Type	MIPI	-
Input Voltage	VDD=1.8	V
With/Without TP	CTP(IC:FT5446DQS)	-
Weight	211.85	g

Note 1: RoHS compliant
Note 2: LCM weight tolerance: ± 5%.

2 Product drawings

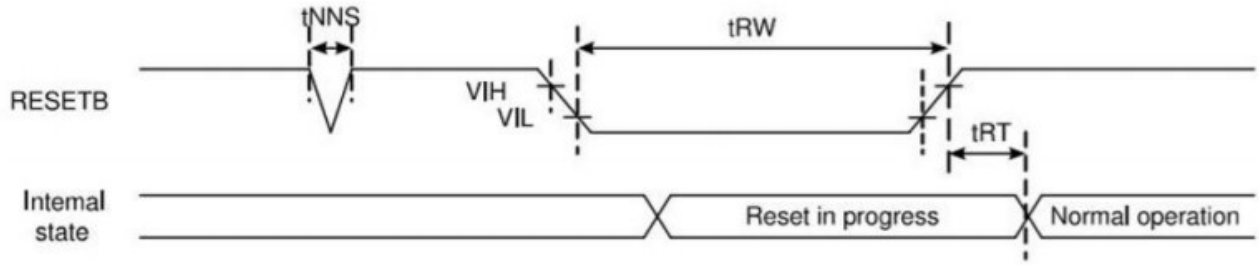


3 Interface description

PIN NO.	Symbol	description
1	LEDA	LED Anode
2	LEDA	
3	VGH	Gate ON Voltage
4	VGL	Gate OFF Voltage
5	UPDN	Up/down selection
6	SHLR	Left/right selection
7	LEDK	LED Cathode
8	LEDK	
9	AVDD	Power for Analog Circuit
10	GND	System Ground. (0V)
11	MIPI_DP3	MIPI Positive data input
12	MIPI_DN3	MIPI Negative data input
13	GND	System Ground. (0V)
14	MIPI_DP2	MIPI Positive data input
15	MIPI_DN2	MIPI Negative data input
16	GND	System Ground. (0V)
17	MIPI_CLKP	MIPI Positive clock input
18	MIPI_CLKN	MIPI Negative clock input
19	GND	System Ground. (0V)
20	MIPI_DP1	MIPI Positive data input
21	MIPI_DN1	MIPI Negative data input
22	GND	System Ground. (0V)
23	MIPI_DP0	MIPI Positive data input
24	MIPI_DN0	MIPI Negative data input
25	GND	System Ground. (0V)
26	STBYB	Standby mode, Normally pulled high STBYB = “1”, normal operation STBYB = “0”, timing controller, source driver will turn off, all output are High-Z
27	RESET	Reset input signal,active low
28	VDD1.8V	Power voltage for digital circuit 1.8V
29	VDD1.8V	
30	VCOM	Common voltage

4 LCM Interface Timing

4.1 Reset Timing

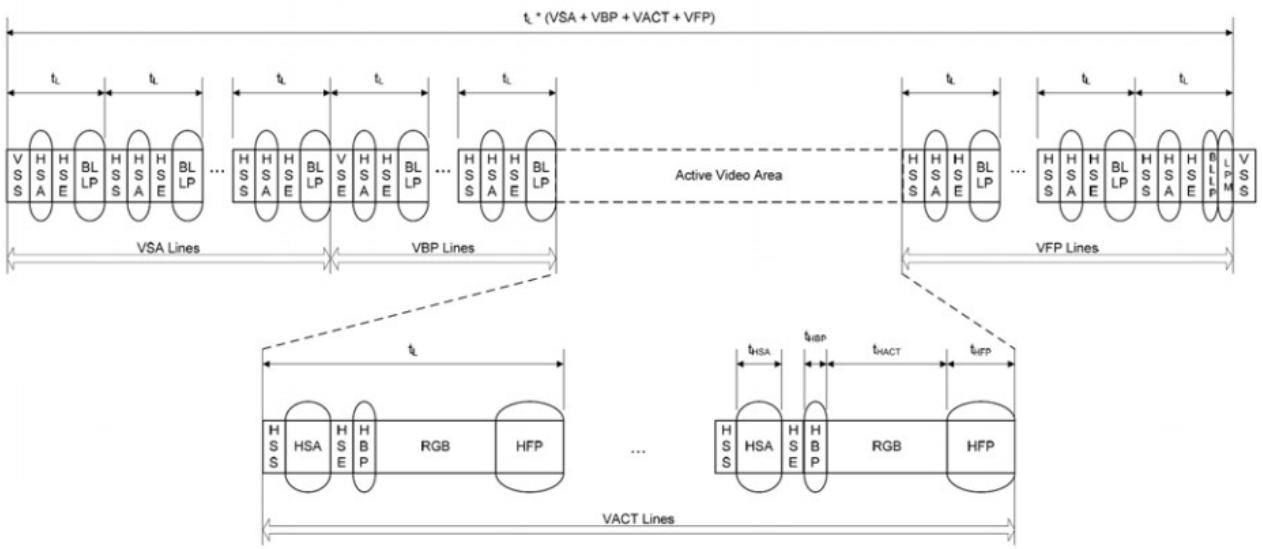


(VCC1=VCC2=VCCIF=2.7V to 3.6V, VSS1=VSS2=VSSA=0V, Top=-40~95℃)

Signal	Parameter	Symbol	Min.	Typ.	Max.	Unit
RESETB	Reset pulse width	tRW	10	-	-	μs
	Reset complete time	tRT	-	-	5	μs
	Negative spike noise width	tNNS	-	-	100	ns

4.2 Non-Burst Mode with Sync Pulses

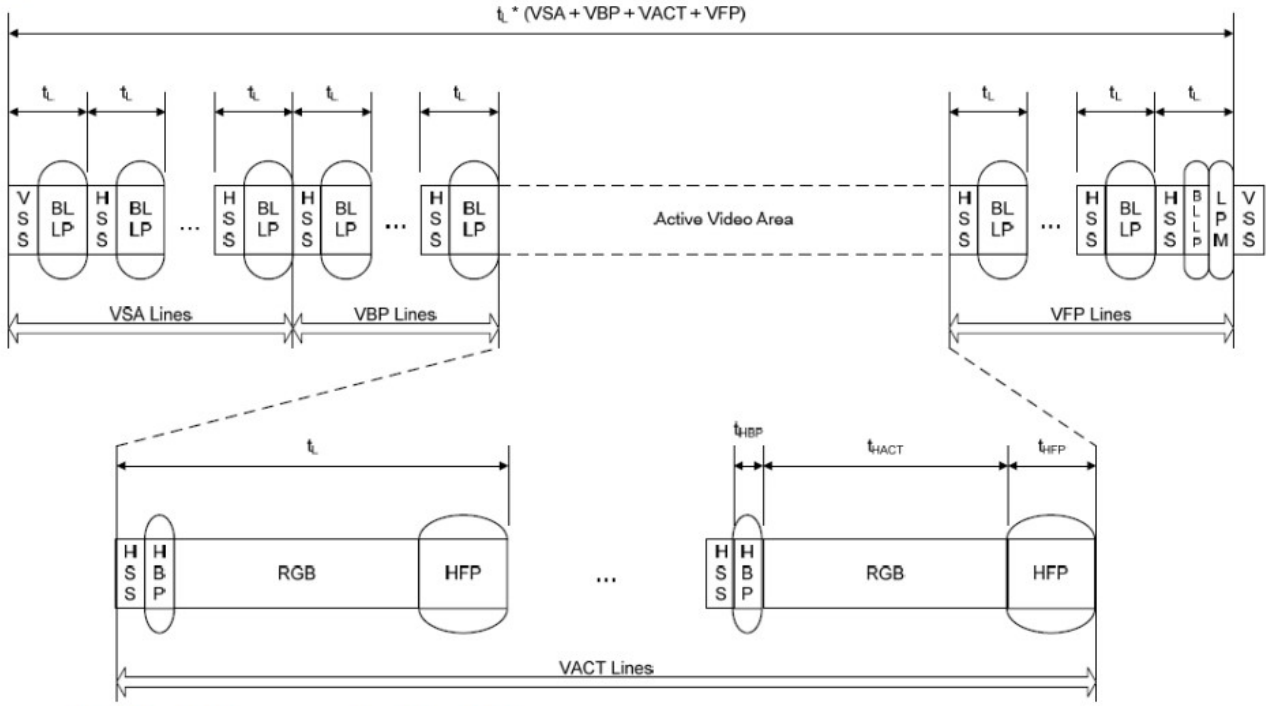
With this format, the goal is to accurately convey DPI-type timing over the DSI serial Link. This includes matching DPI pixel-transmission rates, and widths of timing events like sync pulses. Accordingly, synchronization periods are defined using packets transmitting both start and end of sync pulses. An example of this mode is shown in Figure below.



Normally, periods shown as HSA (Horizontal Sync Active), HBP (Horizontal Back Porch) and HFP (Horizontal Front Porch) are filled by Blanking Packets, with lengths (including packet overhead) calculated to match the period specified by the peripheral's data sheet. Alternatively, if there is sufficient time to transition from HS to LP mode and back again, a timed interval in LP mode may substitute for a Blanking Packet, thus saving power.

4.3 Non-Burst Mode with Sync Events

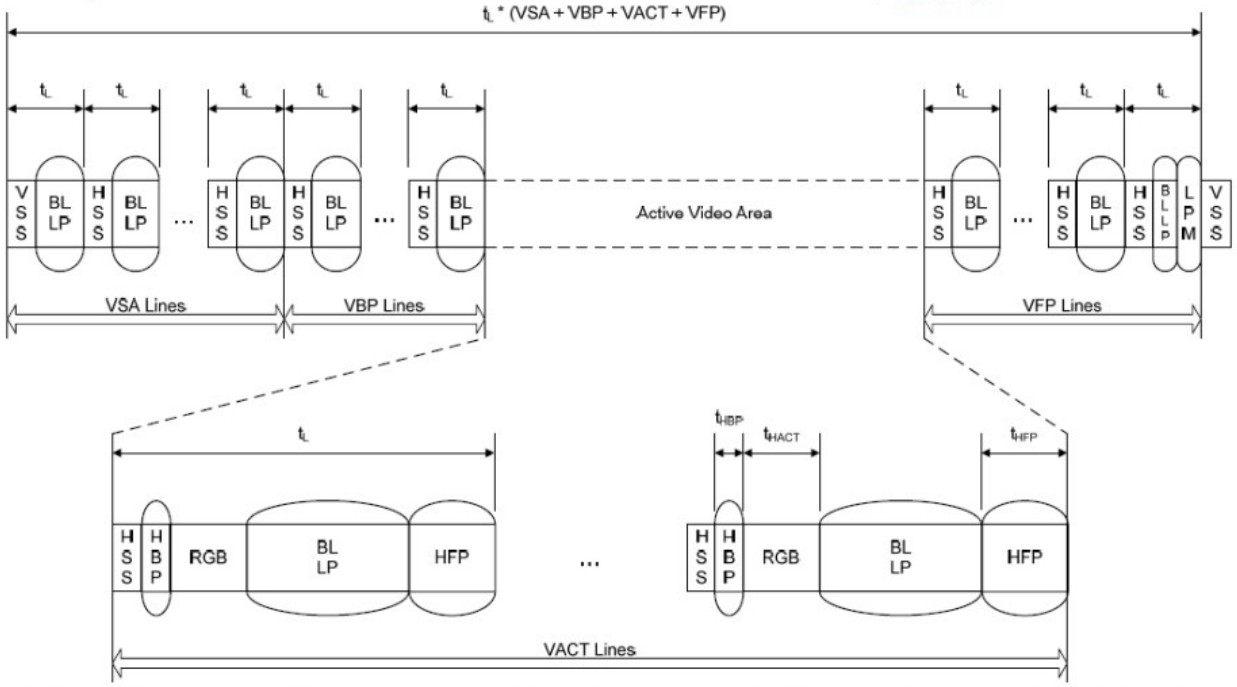
This mode is a simplification of the format described in section “Non-Burst Mode with Sync Pulse” .Only the start of each synchronization pulse is transmitted. The peripheral may regenerate sync pulses as needed from each Sync Event packet received. Pixels are transmitted at the same rate as they would in a corresponding parallel display interface such as DPI-2. An example of this mode is shown in Figure below.



As with the previous Non-Burst Mode, if there is sufficient time to transition from HS to LP mode and back again, a timed interval in LP mode may substitute for a Blanking Packet, thus saving power.

4.4 Burst Mode

In this mode, blocks of pixel data can be transferred in a shorter time using a time-compressed burst format. This is a good strategy to reduce overall DSI power consumption, as well as enabling larger blocks of time for other data transmissions over the Link in either direction. There may be a line buffer or similar memory on the peripheral to accommodate incoming data at high speed. Following HS pixel data transmission, the bus goes to Low Power Mode, during which it may remain idle, i.e. the host processor remains in LP-11 state, or LP transmission may take place in either direction. If the peripheral takes control of the bus for sending data to the host processor, its transmission time shall be limited to ensure data underflow does not occur from its internal buffer memory to the display device. An example of this mode is shown in Figure below.



Similar to the Non-Burst Mode scenario, if there is sufficient time to transition from HS to LP mode and back again, a timed interval in LP mode may substitute for a Blanking Packet, thus saving power.

5 Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage (Analog)	VCC~GND	-	-	V
Logic signal voltage(I/O)	IOVCC~GND	-	-	V
Operating Temperature	TOP	-20	70	° C
Storage Temperature	TST	-30	80	° C
Humidity	RH	-	90%(Max 60° C)	RH

6 Electrical Characteristics

(Ta=25±2°C)

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage 1	VDD	1.8	1.85	1.9	V	
Power Supply Voltage 2	AVDD	9.1	9.6	10.1	V	
Power Supply Voltage 3	VGH	16.0	18.0	20.0	V	
Power Supply Voltage 4	VGL	-6.5	-6.0	-5.5	V	
Power Supply Voltage 5	VCOM	3.2	3.3	3.4	V	
Current Consumption	I_{DD}	-	360	-	mA	Normal mode
	$I_{DD-SLEEP}$		2		mA	Sleep mode
Input voltage “L” Level	V_{IL}	GND	-	0.3VDD1	V	DVDD=3.0~3.6
Input voltage “H” Level	V_{IH}	0.7VDD1	-	VDD1	V	
Output voltage “L” Level	V_{oL}	0	-	0.2VDD1	V	I_{OL}=1mA
Output voltage “H” Level	V_{oH}	0.8VDD1	-	VDD1	V	I_{OH}=-1mA

7 Backlight Characteristics

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Voltage for LED backlight	V_f	-	9.3	-	V
Current for LED backlight	I_f	-	300	-	mA
Power consumption	Wbl	-	2790	-	mW
Uniformity	Avg	80	-	-	%
LED Life Time	-	30000	-	-	Hrs

Note:

1.The LED life time is defined as the module brightness decrease to 50% original brightness at Ta=25°C, 60%RH ±5 %.

2. The life time of LED will be reduced if LED is driven by high current, high ambient temperature and humidity conditions.

3. Typical operating life time is an estimated data.

4. Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded .Functional operation should be restricted to the conditions described under normal operating conditions.

8 LCD Optical specifications

Item	Symbol	Condition	Specification			Unit	Remark
			Min	Typ	Max		
Response time (By Quick)	Tr+Tf	θ = 0°	-	-	45	ms	Note 5
Contrast ratio	CR	θ = 0°	-	800	-		Note 2,6
Viewing angle	Top	CR≧10	-	85	-	Deg.	Note 2,6,7
	Bottom	CR≧10	-	85	-		
	Left	CR≧10	-	85	-		
	Right	CR≧10	-	85	-		
Color chromaticity (CF only with ITO, light source is C light, CIE 1931)	Wx	θ = 0°	-0.04	0.296	+0.04		Note 3
	Wy			0.322			
	Rx			0.583			
	Ry			0.353			
	Gx			0.323			
	Gy			0.571			
	Bx			0.145			
	By			0.094			
NTSC			50%	60%	-		Note 3
Cross talk	Ct		-	-	2%		Note 9
Transmittance	Trans		-	-	-		Note 4

Note 1: Ambient temperature = 25°C.

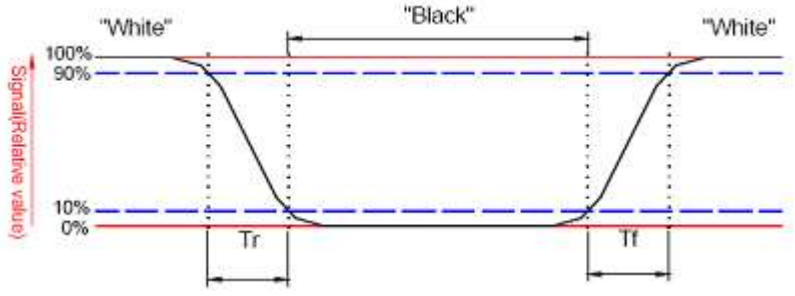
Note 2: To be measured with a viewing cone of 2°by Topcon luminance meter BM-5A.

Note 3: To be measured with Otsuta chromaticity meter LCF-2100M, CF only measure under C light simulation.

Note 4: CTC shipping status is cell without polarizer. Transmittance of Specification is cell with polarizer. The tolerance of Transmittance is ±10%.

Note 5: Definition of response time:

The output signals of TRD-100 are measured when the input signals are changed to “White” (falling time) and from “White” to “Black” (rising time), respectively. The interval is between the 10% and 90% of amplitudes. Refer to figure as below.

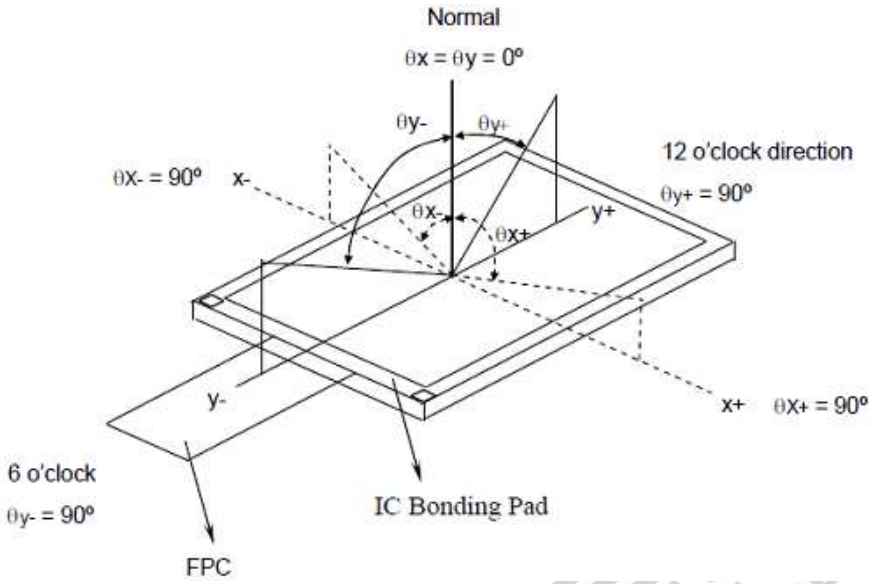


Note 6: Definition of contrast ratio:

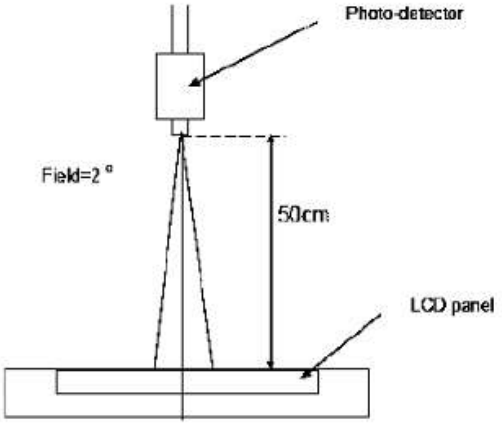
Contrast ratio is calculated by the following formula.

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

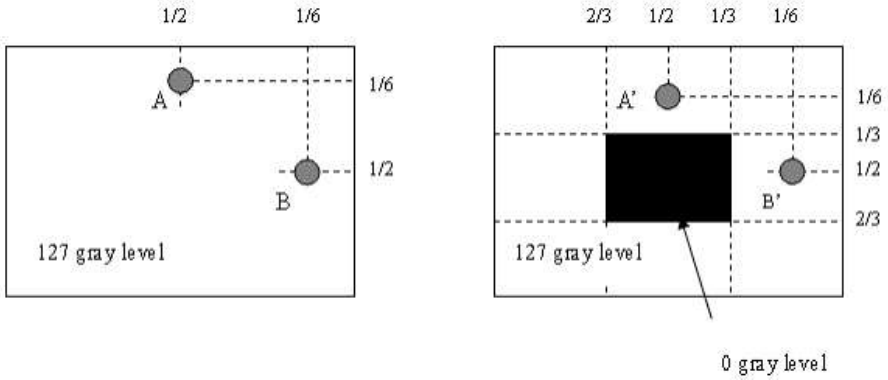
Note 7: Definition of viewing angle



Note 8: Optical characteristic measurement setup.



Note 9:



l LA-LA'l / LA x 100%= 2% max., LA and LA' are brightness at location A and A'.

l LB-LB'l / LB x 100%= 2% max., LB and LB' are brightness at location B and B'.

9 Touch Panel specifications

9.1 Mechanical characteristics

DESCRIPTION	INL SPECIFICATION	REMARK
Touch Panel Size	7.0	
Outline Dimension (OD)	190.08(H) x 121.92(V) mm	Cover Lens Outline
Product Thickness	1.725mm(±0.1)	
Glass Thickness	0.7mm	
Ink View Area	154.97x86.68mm	
Input Method	5 Fingers	
Activation Force	Touch	
Surface Hardness	≥6H	

9.2 Electrical characteristics

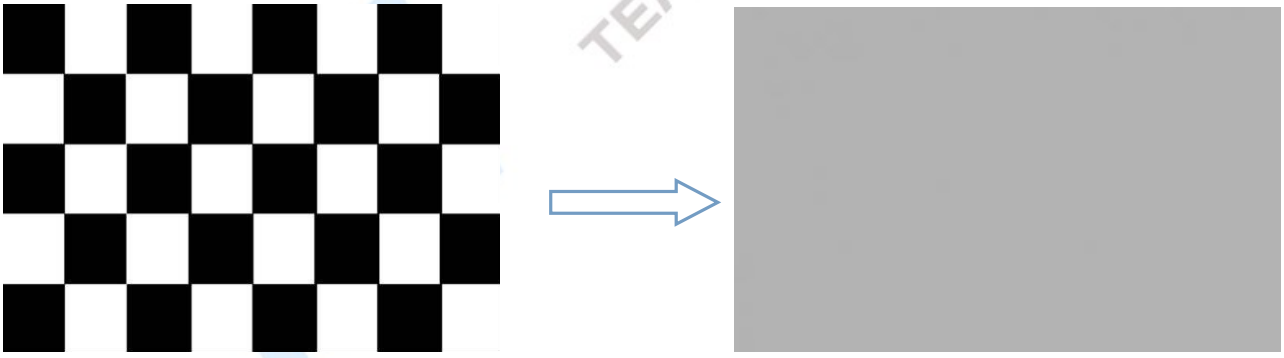
DESCRIPTION		SPECIFICATION
Operating Voltage		DC 2.8~3.3V
Power Consumption (IDD)	Active Mode	18~25mA
	Sleep Mode	42uA
Interface		I^2C
Controller IC		FT5446DQS
I^2C address		-
Resolution		1024*600

9.3 Interface timing characteristics

PARAMETER	MIN	MAX	UNIT
SCL Frequency	-	400K	Hz
Bus Free Time Between a STOP and START Condition	1.3	-	uS
Hold Time (repeated) START Condition	0.6	-	uS
Data Setup Time	100	-	nS
Setup Time for Repeated START Condition	0.6	-	uS
Setup Time for STOP Condition	0.6	-	uS

10 RELIABILITY TEST

NO.	TEST ITEM	TEST CONDITION	INSPECTION AFTER TEST
1	High Temperature Storage	80±2°C/96 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	-30±2°C/96 hours	
3	High Temperature Operating	70±2°C/96 hours	
4	Low Temperature Operating	-20±2°C/96 hours	
5	Temperature Cycle	-20±2°C ~ 25~ 70± 2°C × 10 cycles (30 min.) (5min.) (30min.)	
6	Damp Proof Test	60°C ±5°C × 90%RH/96 hours	
7	Vibration Test	Frequency 10Hz~55Hz Stroke: 1.5mm Sweep: 10Hz~55 Hz~10Hz 2 hours For each direction of X, Y, Z	
8	Shock Test	Half-sine, wave, 300m/s	
9	Packing Drop Test	Height: 60 cm 1 corner, concrete floor	
10	Electrostatic Discharge Test	C=150pF, R=330 Ω Air: ±8KV 150pF/330Ω 9 times Contact: ±4KV,9 times	
11	Image Sticking	25℃, 60%RH (ref. to Remark(1))	30mins



5*8 chess pattern

11 Image Sticking

11.1 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.

11.2 What cause 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.

11.3 How to avoid image sticking?

- Try not to operate the LCD with a "fixed" image on the screen for more than 2 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.

11.4 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 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 50ºC. 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.

11.5 Is image sticking covered by TSD 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.

12 Suggestions for using LCD modules

12.1 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.

12.2 Storage

1. Store in an ambient temperature of 5 to 45 C, 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.

13 Limited Warranty

13.1

Our warranty liability is limited to repair and/or replacement. We will not be responsible for any consequential loss.

13.2

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.

13.3

Any product issues must be feedback to TSD within twelve months since delivery, otherwise, we will not be responsible for the subsequent or consequential events.