

TFT-LCD Module Specification

Module NO.: TST050WVHI-77C

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

Version No.	Date	Content	Remark
V1.0	2021-4-14	Initial Release	

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1.0 Introduction

Team Source Display model TST050WVHI-77C 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 driving circuit, a backlight system and a touch panel. This TFT LCD has a 5.0 (16:9) inch diagonally measured active display area with WVGA (800 horizontal by 480 vertical pixel) resolution.

1.1 Features

- 5.0 (16:9 diagonal) inch configuration
- 8 bits +FRC driver with 1 channel TTL interface
- ROHS and Halogen-Free Compliance
- With Capacitive Touch Panel.

1.2 Applications

- Personal Navigation Device
- Multimedia applications and Others AV system

1.3 General information

Item	Specification	Unit	Note
CTP Outline Dimension	140.7x93.83x1.6	mm	
LCD Outline Dimension	120.7x 75.8 x 2.8 (Typ.)	mm	
Display area	108.0(H) x 64.8(V)	mm	
Number of Pixel	800 RGB (H) x 480(V)	pixels	16:9WVGA
Pixel pitch	0.135(H) x 0.135(V)	mm	
Pixel arrangement	RGB Vertical stripe	--	
Display mode	Normally white	--	TN Model
Surface Treatment	Antiglare	--	Up Polarizer
Dirver Element	a-Si TFT	--	
LED	12	PCS	Establish

2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Electrical Absolute Rating

2.1.1 TFT LCD Module

Item	Symbol	Min.	Max.	Unit	Note
Power supply voltage	V_{DD}	-0.5	5.0	V	GND=0
Logic Signal Input Level	V_i	-0.3	$V_{DD} + 0.3$	V	

2.1.2 Back-Light Unit

Item	Symbol	MIN	TYP.	Max.	U	Note
LED current	I_L		40	45	mA	(1)(2)(3)
LED voltage	V	18	18.6	19.2	V	(1)(2)(3)
LED Uniformity	ΔI_v	80	85	--	%	
(LED+LCD)Luminance	L_v	400	450	--	cd/m ²	

Note

- (1) Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under normal operating conditions.
- (2) $T_a = 25 \pm 2^\circ\text{C}$
- (3) Test Condition: LED current 40 mA. The LED lifetime could be decreased if operating I_L is larger than 45 mA.

2.2 Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Operating Temperature	T_{opa}	-20	70	$^\circ\text{C}$	
Storage Temperature	T_{stg}	-30	80	$^\circ\text{C}$	

3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Threshold voltage		Vsat		—	2.4	—		(6)
		Vth		—	1.4	—		(6)
Transmittance (With PZ)		T		—	6.78	—		
Contrast		CR	Θ =0 Normal viewing angle	480	600	—		(1)(2)
Response time	Rising	TR		—	3	6	msec	(1)(3)
	Falling	TF		—	7	14		
White		YL		400	450	-	cd/m ²	I=40mA
Color gamut		S		—	50	—	%	C light
Color chromaticity (CIE1931)	White	Wx		0.292	0.307	0.322		(1)(4) CF Glass C light
		Wy		0.333	0.348	0.363		
	Red	Rx		0.611	0.626	0.657		
		Ry	0.327	0.342	0.361			
	Green	Gx	0.306	0.321	0.336			
		Gy	0.538	0.553	0.568			
	Blue	Bx	0.134	0.149	0.164			
		By	0.168	0.183	0.198			
Viewing angle	Hor.	Θ L	CR>10	65	75	—		
		Θ R		65	75	—		
	Ver.	Θ U		60	70			
		Θ D		50	60			
Optima View Direction				12 O' clock				(5)

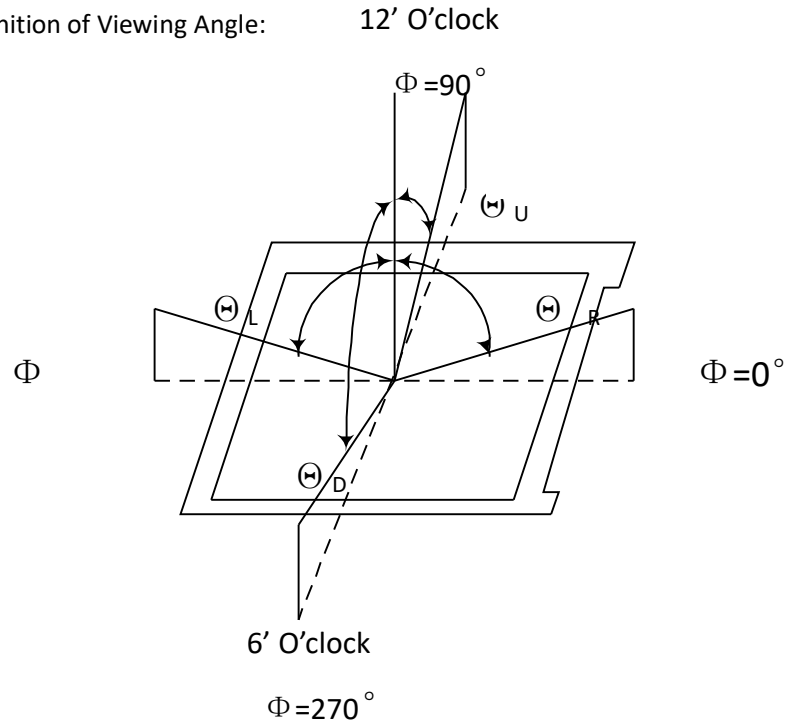
3.2 Measuring Condition

- Measuring surrounding: dark room
- LED current I_L: 40mA
- Ambient temperature: 25±2°C
- 15min. warm-up time.

3.3 Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-7 for other optical characteristics.
- Measuring spot size: 20 ~ 21m

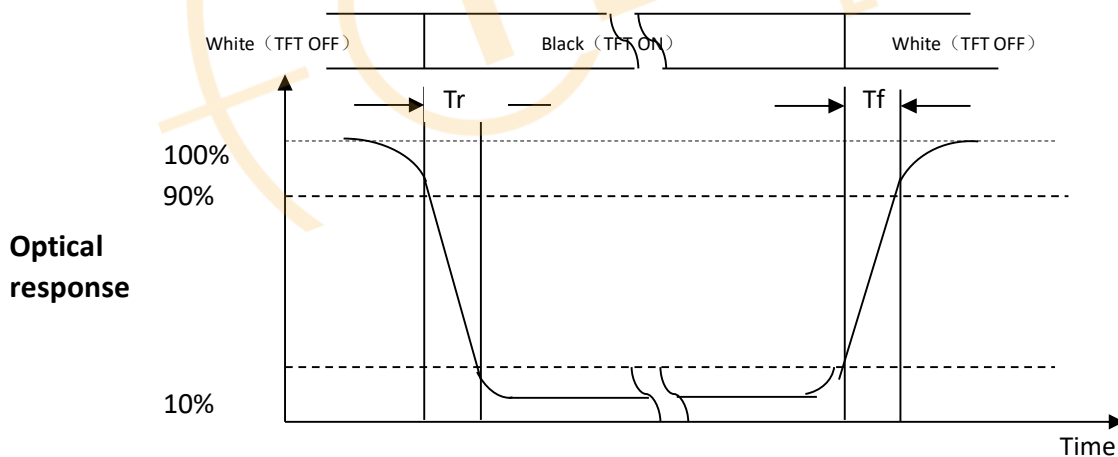
Note (1) Definition of Viewing Angle:



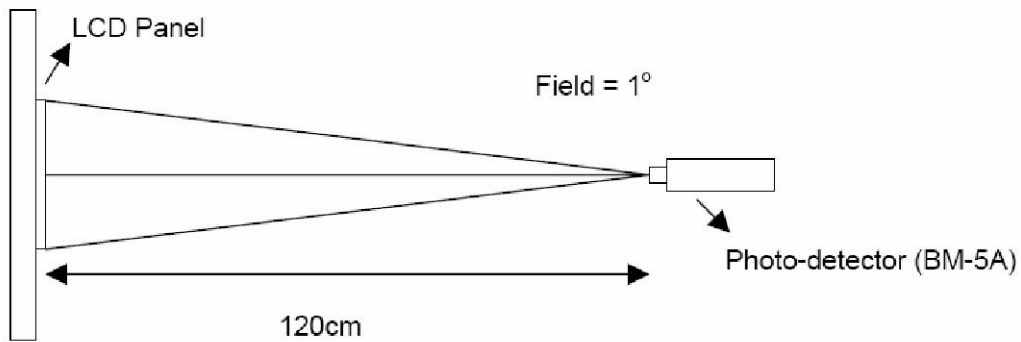
Note (2) Definition of Contrast Ratio (CR):

measured at the center point of pane

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

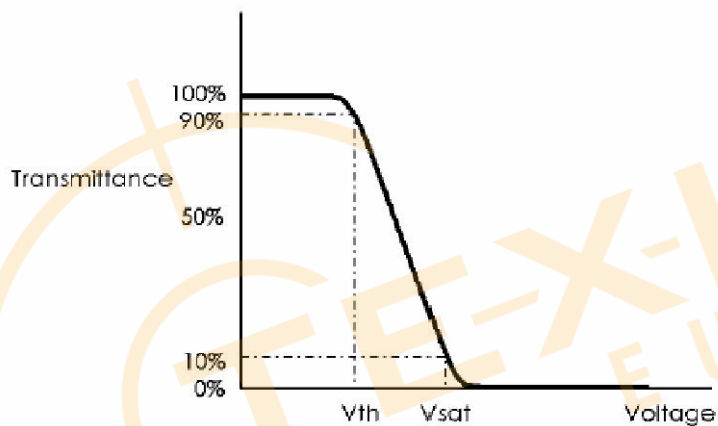
Note (3) Definition of Response Time: Sum of T_R and T_F 

Note (4) Definition of optical measurement setup



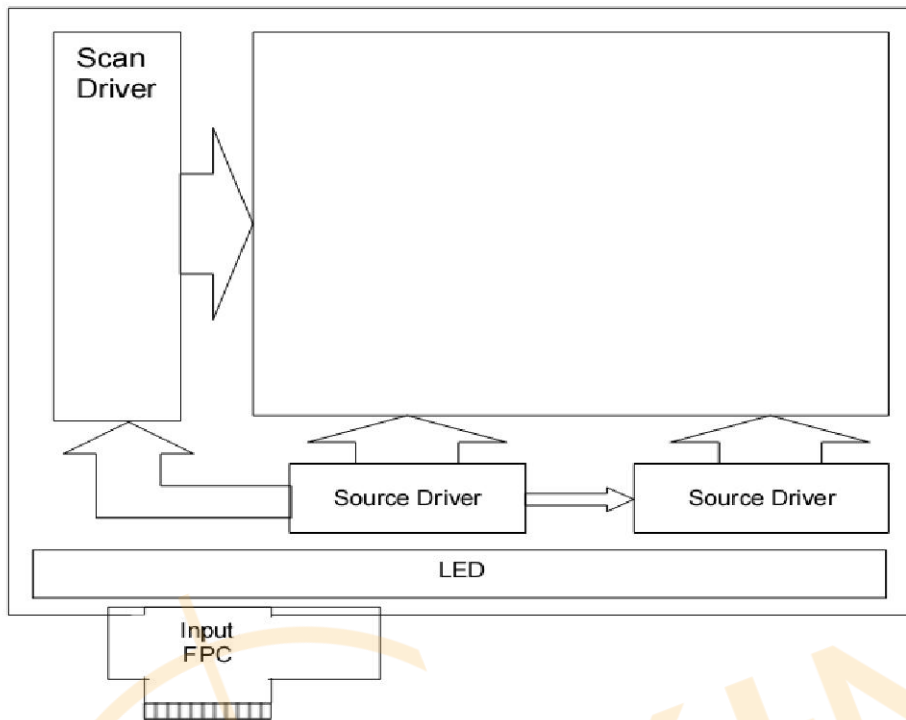
Note (5) Rubbing Direction (The different Rubbing Direction will cause the different optimal view direction.

Note (6) Definition of V_{sat} and V_{th} (at 20°C

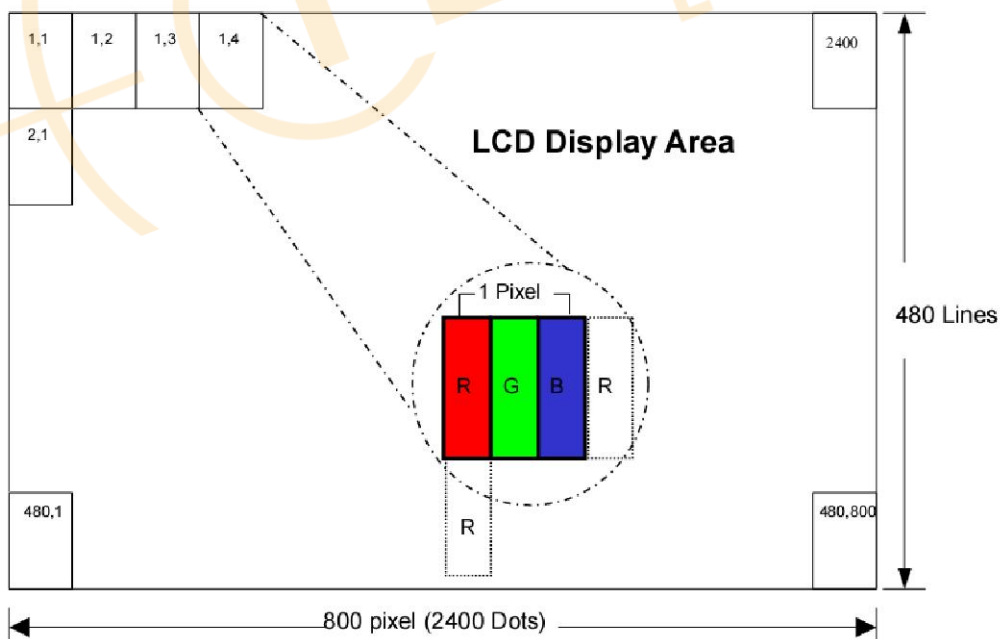


4.0 BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 Pixel Format



5.0 INPUT INTERFACE PIN ASSIGNMENT

FPC connector is used for electronics interface.

The recommended model is FH19SC-40S-0.5SH (51) manufactured by HIROSE.

Pin No.	Symbol	I/O	Function
1	LED-	P	Power for LED backlight cathode
2	LED+	P	Power for LED backlight anode
3	GND	P	Power ground
4	V _{DD}	P	Power voltage
5	R0	I	Red data (LSB)
6	R1	I	Red data
7	R2	I	Red data
8	R3	I	Red data
9	R4	I	Red data
10	R5	I	Red data
11	R6	I	Red data
12	R7	I	Red data (MSB)
13	G0	I	Green data (LSB)
14	G1	I	Green data
15	G2	I	Green data
16	G3	I	Green data
17	G4	I	Green data
18	G5	I	Green data
19	G6	I	Green data
20	G7	I	Green data (MSB)
21	B0	I	Blue data (LSB)
22	B1	I	Blue data
23	B2	I	Blue data
24	B3	I	Blue data
25	B4	I	Blue data
26	B5	I	Blue data
27	B6	I	Blue data
28	B7	I	Blue data (MSB)
29	DGND	I	Digital ground
30	DCLK	I	Pixel clock
31	DISP	I	Display on/ off
32	HSYNC	I	Horizontal sync signal
33	VSNC	I	Vertical sync signal
34	DE	I	Data enable
35	NC	-	No Connect
36	GND	P	Power ground
37	XR	I/O	Right electrode - differential analog
38	YD	I/O	Bottom electrode - differential analog
39	XL	I/O	Left electrode - differential analog
40	YU	I/O	Top electrode - differential analog

I/O: I: input, O: output, P: power

CTP interface description

PIN NO.	Symbol	description
1	NC	No Connect
2	NC	No Connect
3	RST	External Reset, Low is active
4	GND	System Ground. (0V)
5	INT	Interrupt request to the host
6	SDA	I2C data input and output
7	SCL	I2C clock input
8	GND	System Ground. (0V)
9	GND	System Ground. (0V)
10	VDD	Power supply +3.3V

6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply voltage	V_{DD}	3.0	3.3	3.6	V	
Input signal voltage	V_{IH}	0.7 V_{DD}	-	V_{DD}	V	Note (1)
	V_{IL}	GND	-	0.3 V_{DD}	V	Note (1)
Current of power supply	I_{DD}	-	-	220	mA	$V_{DD} = 3.3V$

Note (1): HSYNC, VSYNC, DE, R/G/B Data

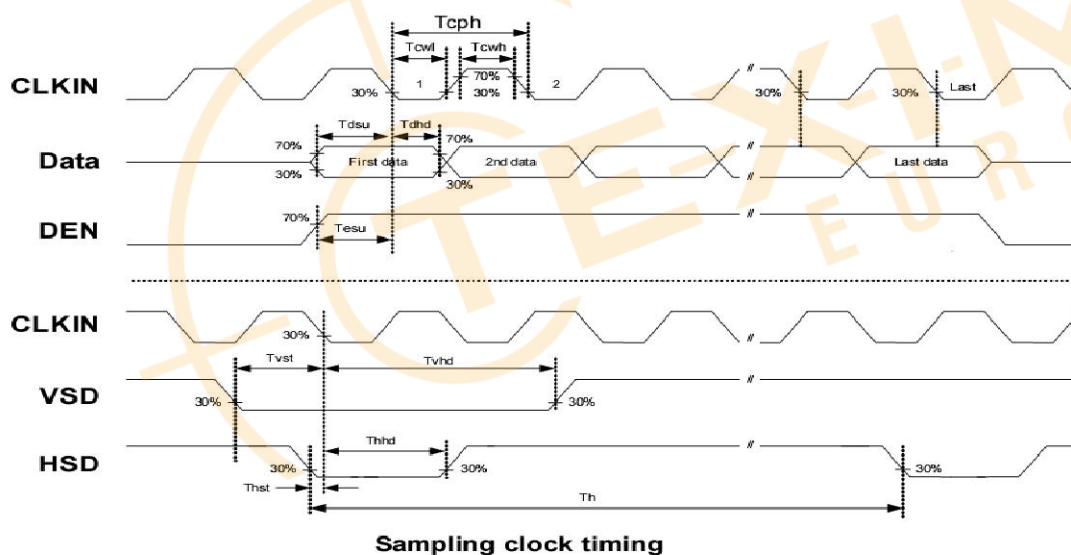
Note (2): GND=0V

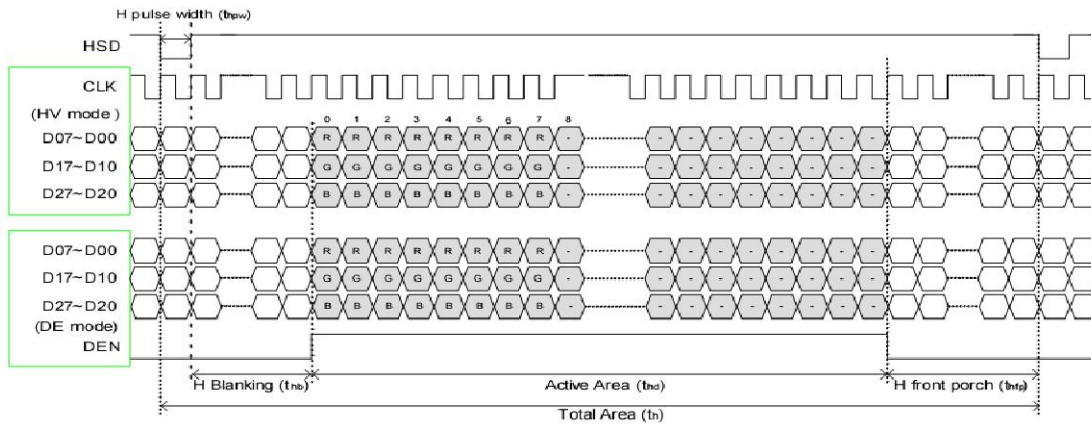
6.2 AC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK cycle time	Tclk	25			ns	
DCLK frequency	fclk		33	40	MHz	
DCLK pulse duty	Tcwh	40	50	60	%	
VSYNC setup time	Tvst	8			ns	
VSYNC hold time	Tvhd	8			ns	
HSYNC setup time	Thst	8			ns	
HSYNC hold time	Thhd	8			ns	

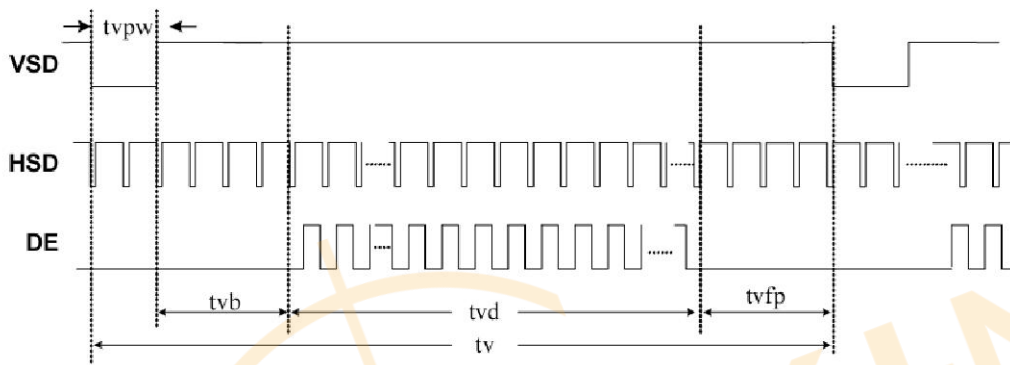
Data setup time	Tdasu	8			ns	
Data hold time	Tdahd	8			ns	
DE setup time	Tdesu	8			ns	
DE hold time	Tdehd	8			ns	
Horizontal display area	Thd		800		Tcph	
HSYNC period time	Th		928		Tcph	
HSYNC width	Thwh	1	48		Tcph	
HSYNC back porch	Thbp		40		Tcph	
HSYNC front porch	Thfp		40		Tcph	
Vertical display area	Tvd		480		th	
VSYNC period time	Tv		525		th	
VSYNC width	Tvwh		3		th	
VSYNC back porch	Tvbp		29		th	
VSYNC front porch	Tvfp		13		th	

6.3 Timing Diagram of interface Signal



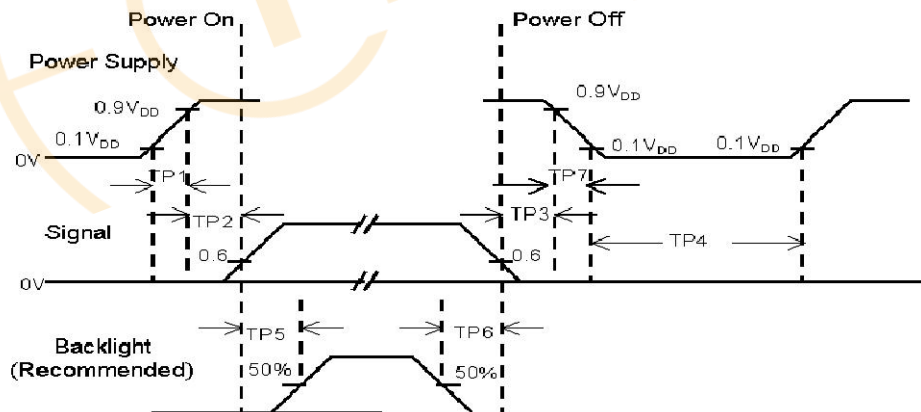


Horizontal display timing range



Vertical timing

6.4 Power Sequence



Item	Min.	Typ.	Max.	Unit	Remark
TP1	0.5	--	10	msec	
TP2	0	--	50	msec	
TP3	0	--	50	msec	
TP4	1000	--	--	msec	
TP5	200	--	--	msec	
TP6	200	--	--	msec	
TP7	0.5	--	10	msec	

- Note:** (1) The supply voltage of the external system for the module input should be the same as the definition of VDD.
- (2) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.
- (3) In case of VDD = off level, please keep the level of input signal on the low or keep a high impedance.
- (4) TP4 should be measured after the module has been fully discharged between power off and on period.
- (5) Interface signal shall not be kept at high impedance when the power is on.

7.0 Capacitive Touch Panel specifications

7.1 Mechanical characteristics

DESCRIPTION	INL SPECIFICATION	REMARK
Touch Panel Size	5.0	
Outline Dimension (OD)	140.7(H) x 93.83(V)mm	Cover Lens Outline
Product Thickness	1.68mm(max)	With FPC and frame D.S.T
Glass Thickness	0.7mm	
Ink View Area	109.04x65.55mm	
Input Method	5 Fingers	
Activation Force	Touch	
Surface Hardness	≥6H	

7.2 Electrical characteristics

DESCRIPTION	SPECIFICATION
Operating Voltage	DC 2.8~3.3V
Power Consumption (IDD)	Active Mode
	12~4.5mA
	Sleep Mode
	TBD
Interface	I ² C
Controller IC	FT5446
I ² C address	0x70
Resolution	800*480

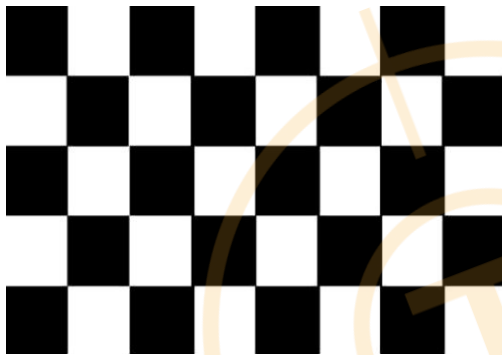
7.3 Interface timing characteristics

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

8.0 RELIABILITY TEST ITEMS

No.	Item	Conditions	Remark
1	High Temperature Storage	Ta=+80℃, 240hrs	
2	Low Temperature Storage	Ta=-30℃, 240hrs	
3	High Temperature Operation	Ta=+70℃, 240hrs	
4	Low Temperature Operation	Ta=-20℃, 240hrs	
5	High Temperature and High Humidity (operation)	Ta=+60℃, 90%RH, 240hrs	
6	Thermal Cycling Test (non operation)	-30℃(30min) → +70℃(30min), 200cycles	
7	Vibration (with carton)	Random: 0.015G ² /Hz, 5~200Hz -6dB/Octave, 200~400Hz XYZ each direction: 2hr	
8	Drop (with carton)	Height: 60cm 1 corner, 3 edges, 6 surfaces	JIS Z0202
9	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 **30 minutes**, the afterimage disappears within 10 seconds.



5*8 chess pattern



Gray127

9.0 About Image Sticking

9.1 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.

9.2 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.

9.3 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.

9.4 How to Fix the Image Sticking?

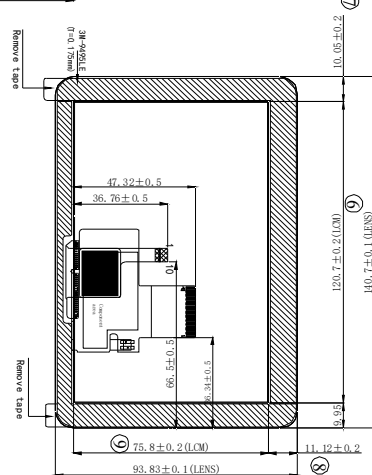
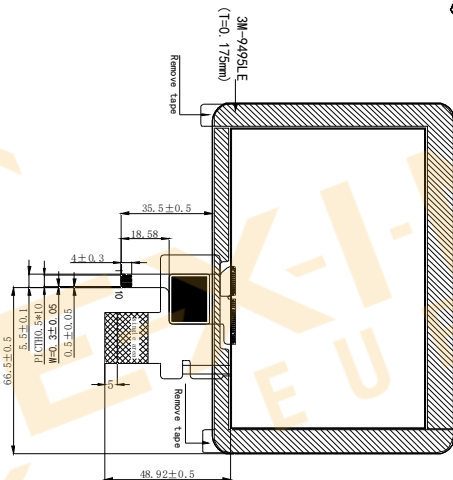
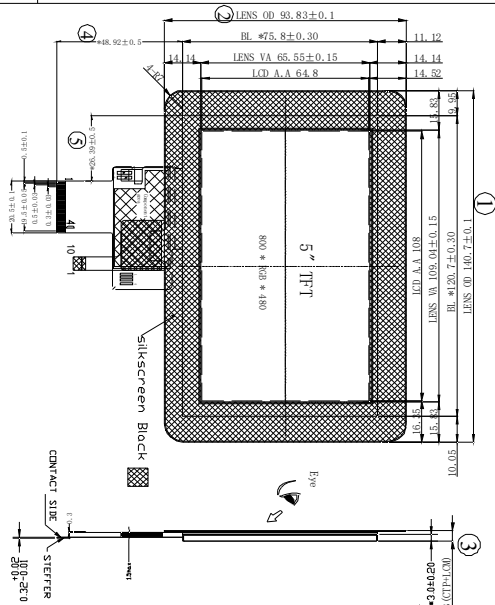
Unlike the usually irreversible "burn-in" effects commonly associated with direct view phosphor display devices such as CRTs, an image retained on an LCD display can be reversed - often to a point of total invisibility. However, the severity of the underlying causes (as described above) of the image 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.

9.5 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.



9.0 Product drawings



LCD PIN

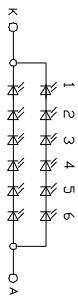
PIN NAME	
1	VIEP-
2	VIEP+
3	GND
4	VDD
5	R0
6	R1
7	R2
8	R3
9	R4
10	R5
11	R6
12	R7
13	G0
14	G1
15	G2
16	G3
17	G4
18	G5
19	G6
20	G7
21	R0
22	R1
23	R2
24	R3
25	R4
26	R5
27	R6
28	R7
29	GND
30	DCLK
31	DISP
32	HSYNC
33	VSINC
34	DE
35	NC
36	GND
37	NR
38	VD
39	YL
40	Y0

CTP PIN



PIN NO	FUNCTION
1	NC
2	NC
3	RST
4	GND
5	INT
6	SDA
7	SCL
8	GND
9	GND
10	VDD

NOTES:

1. GENERAL TOLERANCE: ± 0.2
2. () REFERENCE DIMENSION
3. Important dimension: ①~⑨



Color type	5.0 TFT-L, transmissive
Color gamut	Normally white-TN
Resolution	800(RGB) × 480
View Direction	1/2 check
LCD driver IC	116J21H
Color depth	1.67M
Interface types	RGB 24bit
Operating voltage	3 V
With TFTs	with CHPT54D 12(LD-40m)(p), 18(W40)
Back light	400-480-dmcd
Surface luminance	-20°C-70°C
Operating temperature	-30°C-80°C
Storage temperature	(white) -2%
Color chromaticity	

版本 (Version)	变更记录 (Revise History)		日期 (Date)	设计 (DESIGN)	Hebin	 TEAM SOURCE DISPLAY 一 众 显示 ISD™
A0	Initial release	2021.04.01	审核 (CHECKED)	Aron		
			批准 (APPROVED)	Aron	TITLE: LCM+CTP	
			客户承认 (CUSTOMER APPROVAL)		Drawing No. TST050WVH1-77C	
					比例 (SCALE) 1 : 1 角度 (Angle) 	

10.0 PACKAGE SPECIFICATION

PARAMETER	Specification	Unit
Outside box	390(L) x 350(W) x 480(H)	mm
Inside box	375(L) x 340(W) x 10(H)	mm
Product quantity of Inside box	36	pcs
Total product quantity	36*4=144	pcs
Total weight	13.5±0.5	KG

11.0 GENERAL PRECAUTION

11.1 Use Restriction

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic.

11.2 Disassembling or Modification

Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. TSD does not warrant the module, if customers disassemble or modify the module.

11.3 Breakage of LCD Panel

11.3.1 If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.

11.3.2 If liquid crystal contacts mouth or eyes, rinse out with water immediately.

11.3.3 If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.

11.3.4 Handle carefully with chips of glass that may cause injury, when the glass is broken.

11.4 Electric Shock

11.4.1 Disconnect power supply before handling LCD module.

11.4.2 Do not pull or fold the LED cable.

11.4.3 Do not touch the parts inside LCD modules and the fluorescent LED's connector or cables in order to prevent electric shock.

11.5 Absolute Maximum Ratings and Power Protection Circuit

11.5.1 Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature, etc., otherwise LCD module may be damaged.

11.5.2 Please do not leave LCD module in the environment of high humidity and high temperature for a long time.

11.5.3 It's recommended to employ protection circuit for power supply.

11.6 Operation

11.6.1 Do not touch, push or rub the polarizer with anything harder than HB pencil lead.

11.6.2 Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD

module for incoming inspection or assembly.

11.6.3 When the surface is dusty, please wipe gently with absorbent cotton or other soft material.

12.0 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 twelve months since delivery, otherwise, we will not be responsible for the subsequent or consequential events.



The Netherlands



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