SPECIFICATION
FOR

Module:YS-T015409C V1.0

Designed by	R&D Checked by	Quality Department by	Approved by

Approval by Customer:

OK

NG, Problem survey

Approved By_____

Revision Record

REV NO.	REV DATE	Contents Before Change	Contents After Change	Note
V1.0	2021/6/9	NEW ISSUE By Beck;		

Contents

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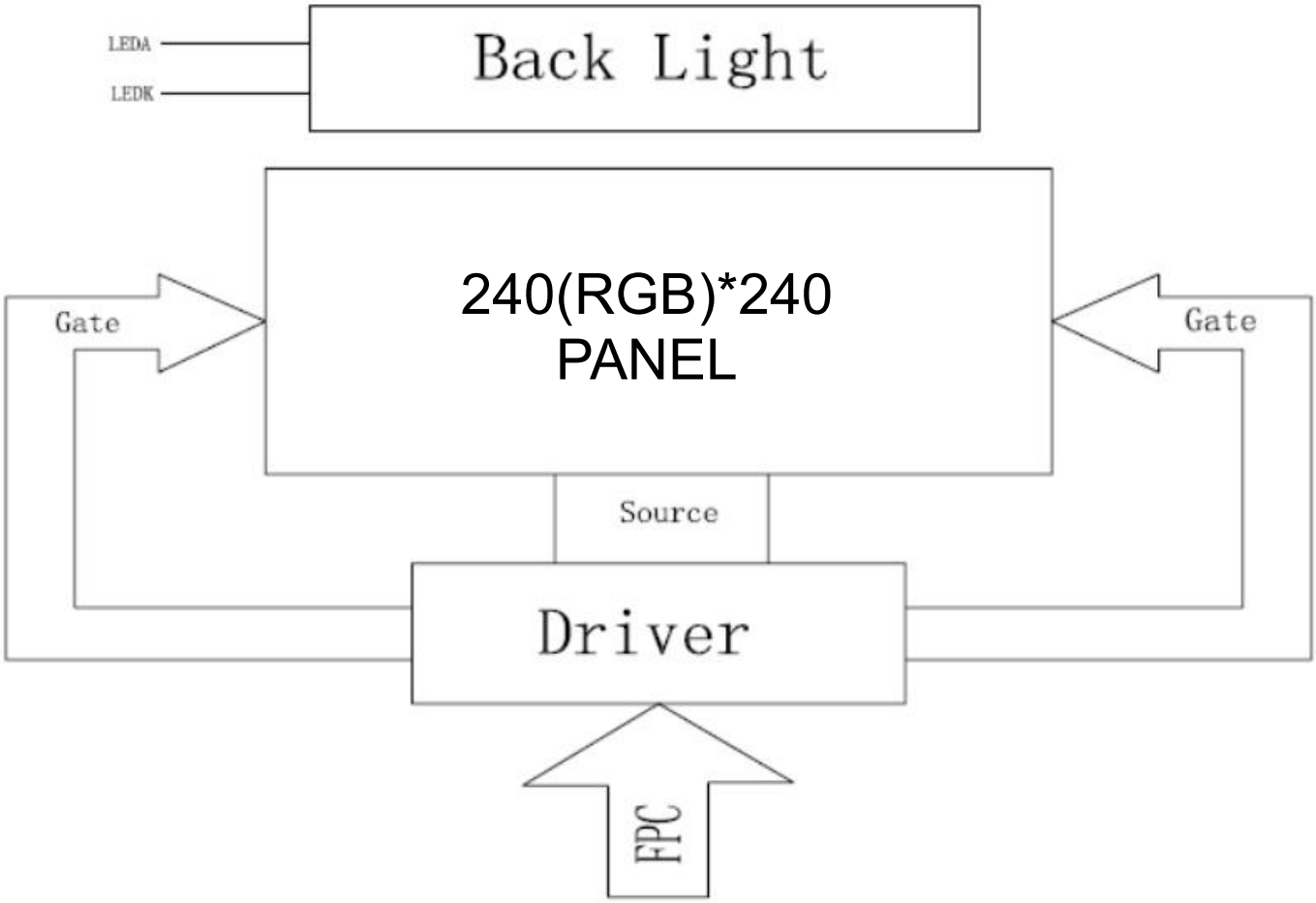
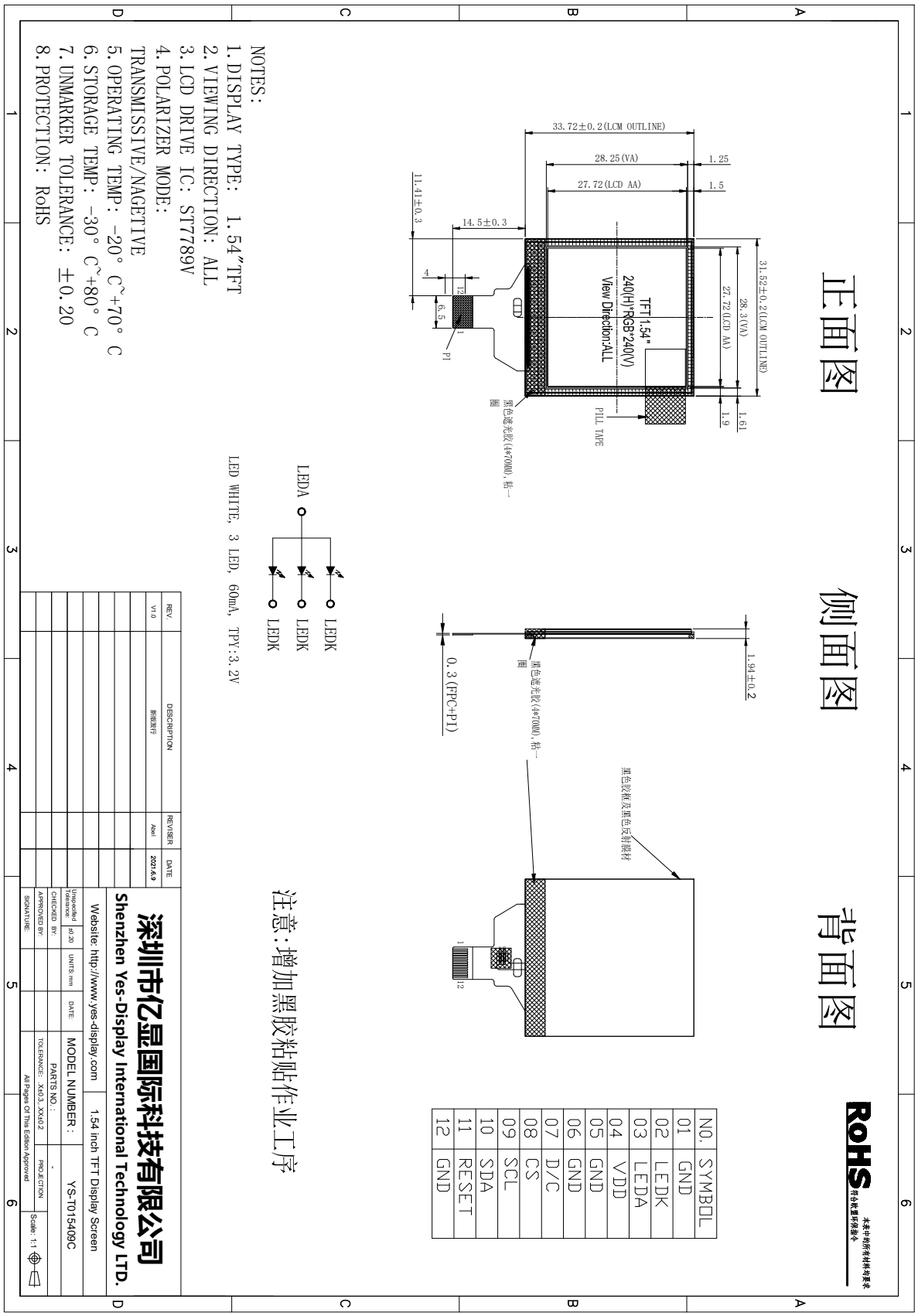
1. Technical parameters

ITEM	STANDARD VALUES	UNITS
LCD type	1.54''TFT	--
Dot arrangement	240(RGB)×240	dots
Color filter array	RGB vertical stripe	--
Display mode	IPS / Transmission / Normally White	-
Eyes Viewing Direction	80/80/80/80	--
Driver IC	ST7789V	--
Module size	31.52(W)×33.72(H)×1.94(T)(Exclude FPC)	mm
Active area	27.72(W)×27.72(H)	mm
Interface	SPI	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Back Light	White LED*3	--

2. Block Dimension



3. Outline Dimension



4. Input terminal Pin Assignment Description

4.1 TFT Pin Description

PIN NO.	PIN NAME	DESCRIPTION
1	GND	System power ground.
2	LEDK	Power supply for backlight cathode input terminal.
3	LEDA	Power supply for backlight anode input terminal.
4	VDD	VDD 2.8V power input
5-6	GND	System power ground.
7	D/C	Serves as command or parameter select.
8	CS	Chip select input pin (“Low” enable).
9	SCL	This pin is used serial interface clock in SPI.
10	SDA	Serial input signal in SPI I/F.
11	RESET	Reset signal input terminal, active at ‘L’.
12	GND	System power ground.

5. LCD Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (with Polarizer)		T(%)	—	(4.4)	(4.9)	—	%	w/o APCF Base on Vop=4.5V
Transmittance (without Polarizer)		T(%)	—	(15.8)	(17.6)	—	%	
Contrast Ratio		CR	Θ=0 Normal viewing angle	(700)	(900)	—	—	(1)(2)
Response Time		T_R+T_F		—	30	40	msec	(1)(3)
Color Gamut		S(%)		(43)	(48)	—	%	
Color Chromaticity (CIE1931)	White	W_x		-0.02	(0.320)	-0.02		(1)(4) CF glass
		Wy			(0.343)			
	Red	Rx			(0.612)			
		Ry			(0.327)			
	Green	Gx			(0.334)			
		Gy			(0.536)			
	Blue	Bx			(0.137)			
		By			(0.150)			
Viewing Angle	Hor.	Θ_L	CR>10	70	80	—		Viewing Angle base on using Normal Polarizer， Reference Only
		Θ_R		70	80	—		
	Ver.	Θ_U		70	80	—		
		Θ_D		70	80	—		
Optima View Direction		ALL						(5)

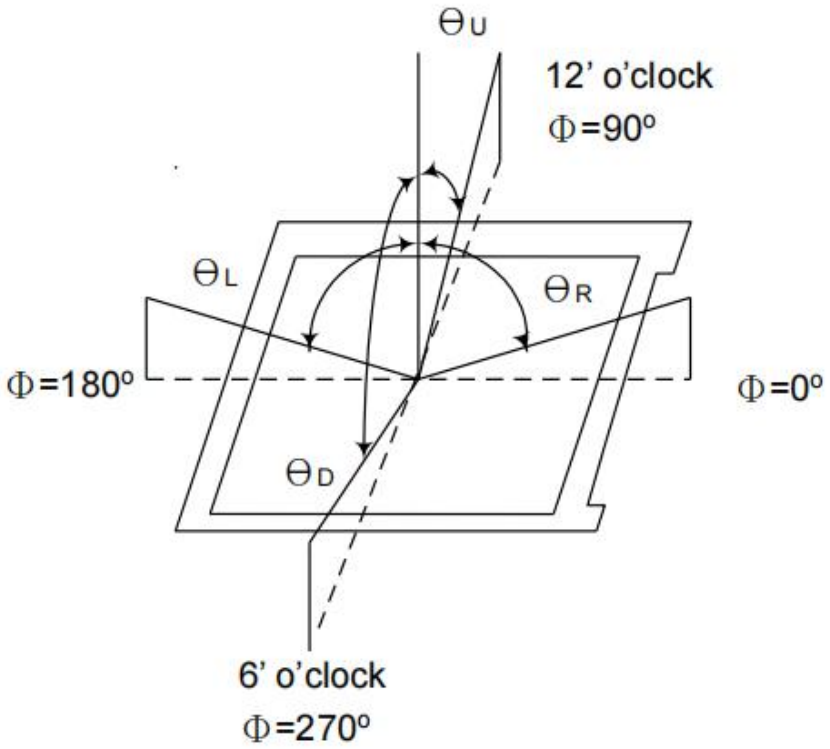
Measuring Condition

- Measuring surrounding : dark room
- Ambient temperature : 25±2°C
- 15min. warm-up time.

Measuring Equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

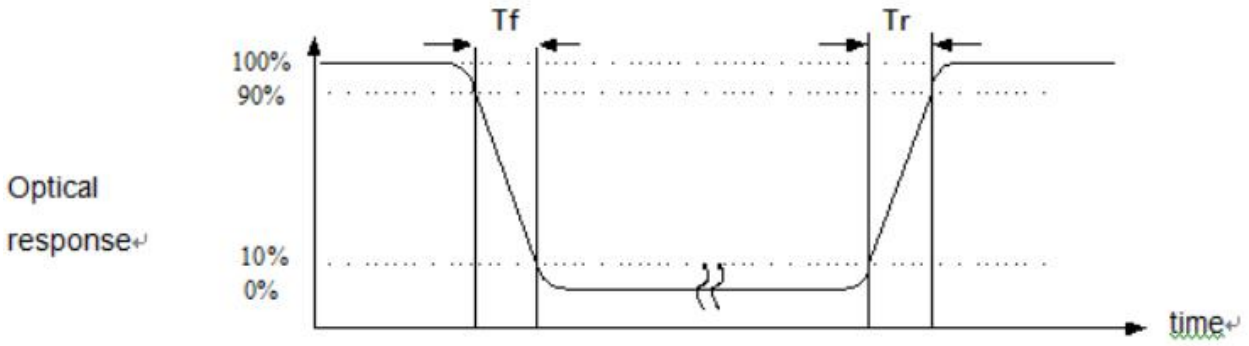
Note (1) Definition of Viewing Angle:



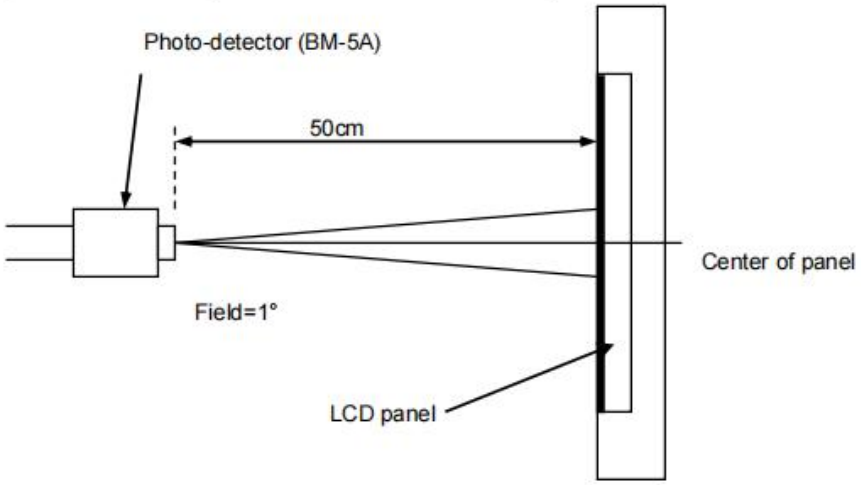
Note (2) Definition of Contrast Ratio (CR):
measured at the center point of panel

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

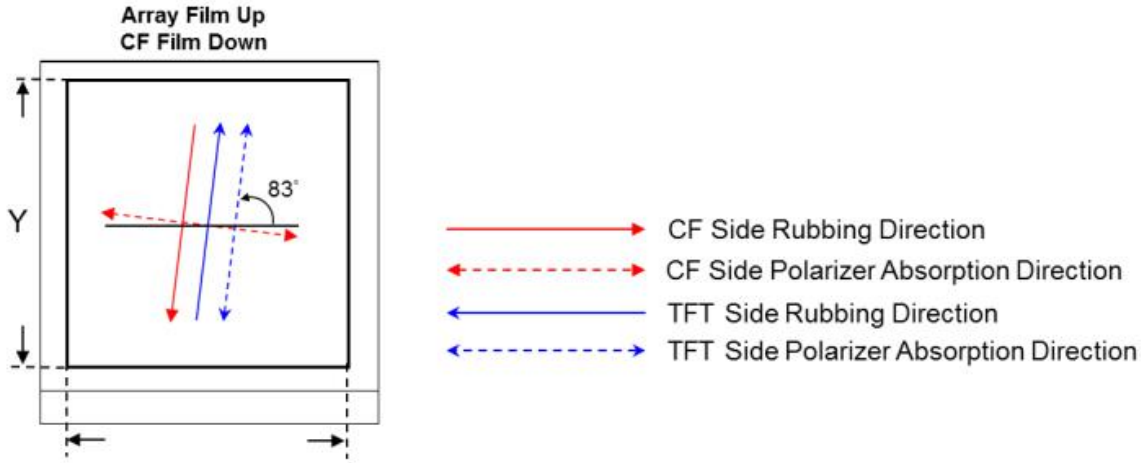
Note (3) Definition of Response Time : Sum of T_R and T_F



Note (4) Definition of optical measurement setup



Note (5) Rubbing Direction & Polarizer Absorption Direction

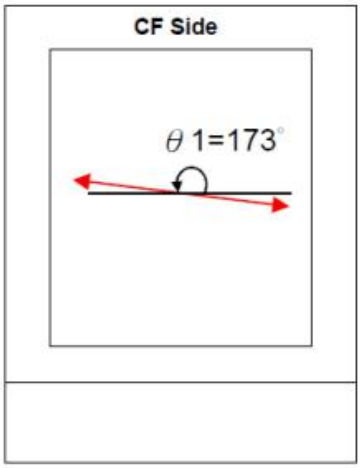


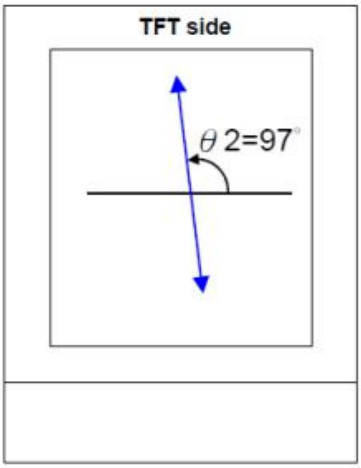
Item	*Specifications*	Unit	Note
Rubbing Direction	*83° (TFT) / 263° (CF)*	degree	1-domain IPS-pro
Absorption axis of Polarizer	*83° (TFT) / 173° (CF)*	degree	Array Film Up CF Film Down

Item	*Specifications*	Unit	Note
Rubbing Direction	*83° (TFT) / 263° (CF)*	degree	1-domain IPS-pro
Absorption axis of Polarizer	*83° (TFT) / 173° (CF)*	degree	Array Film Up CF Film Down

CF side polarizing absorption angle θ 1=173° (Protective film on top, glue layer face down)

TFT side polarizing absorption angle θ 2=97° (Protective film on top, glue layer face down)





6. TFT Electrical Characteristics

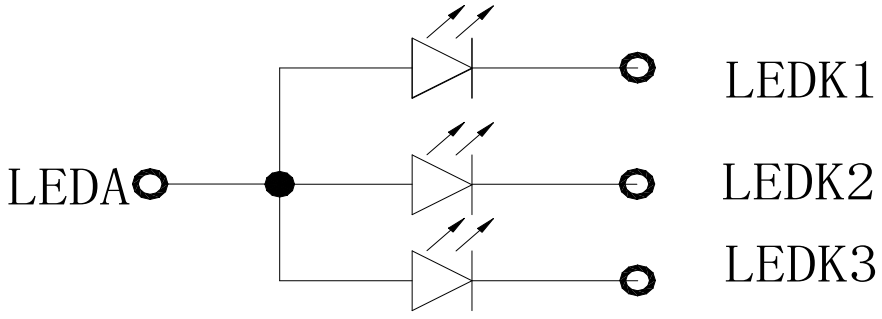
6.1 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Logic Supply Voltage	VDD	-0.3	4.0	V
Input Voltage	Vin	-0.3	VDD+0.3	V
Operating Temperature	TOP	-20	70	℃
Storage Temperature	TST	-30	80	℃
Storage Humidity	HD	20	90	%RH

6.2 DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Logic Supply Voltage	VDD	2.5	2.8	3.6	V	-
Input High Voltage	V_{IH}	0.7VDD	-	VDD	V	-
Input Low Voltage	V_{IL}	GND	-	0.3 VDD	V	-
Output High Voltage	V_{OH}	0.8 VDD	-	VDD	V	-
Output Low Voltage	V_{OL}	GND	-	0.2 VDD	V	-
I/O Leak Current	ILI	-1	-	1	uA	-
Supply Current	IDD	-	TBD	-	mA	-

6.3 LED Backlight Characteristics



Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	2.8	3	3.2	V	If=40mA
Supply Current	If	-	60	-	mA	-
Luminous Intensity for LCM	-	-	-	-	cd/m^2	If=40mA
Uniformity for LCM	-	-	60	-	%	If=40mA

Life Time	-	-	50000	-	Hr	If=40mA
Backlight Color	White					

7. Timing Characteristics

7.1 TFT Timing Characteristics

7.1.1 Interface Timing Characteristics (4-SPI system)

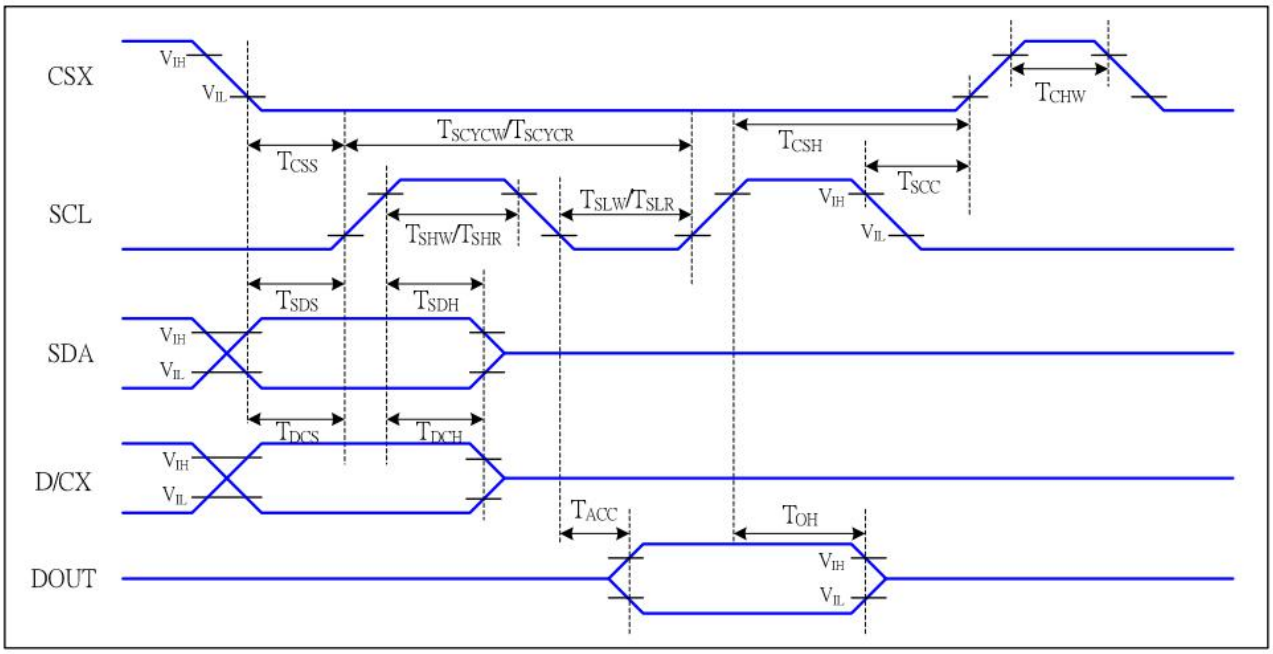


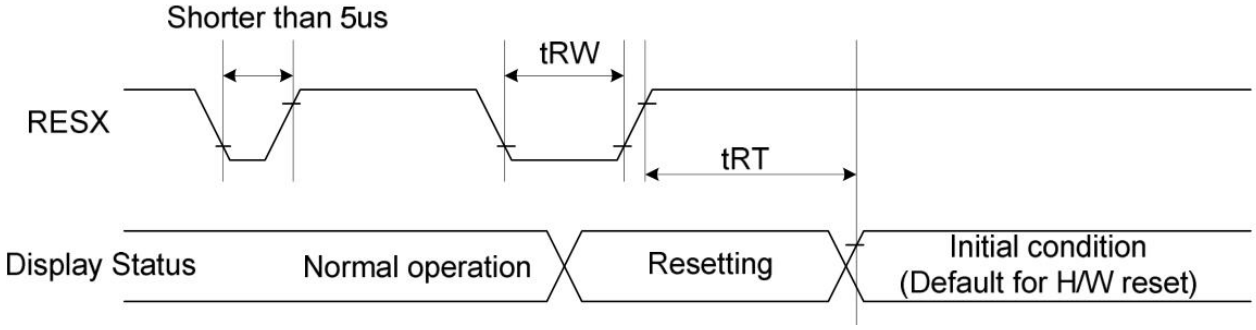
Figure 5 4-line serial Interface Timing Characteristics

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 to 70 ℃

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	-write command & data ram
	T_{SHW}	SCL "H" pulse width (Write)	15		ns	
	T_{SLW}	SCL "L" pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	-read command & data ram
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
D/CX	T_{DCS}	D/CX setup time	10		ns	
	T_{DCH}	D/CX hold time	10		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF For minimum CL=8pF
	T_{OH}	Output disable time	15	50	ns	

Table 6 4-line serial Interface Characteristics

7.1.2 Reset Timing Characteristics



7.1.3 Power on/off timing sequence
check the IC datasheet!

7.2 TP Timing Characteristics

TBD

8. Inspection Standard

8.1 Incoming Inspection and Standard:

The below incoming inspection are applied to the TFT LCM Modules supplied by ShenZhen Yes-Display International Technology CO.,LTD. The customers should inspect the LCM within 14 days after receiving the goods. The result of inspection should be notified to the Seller in the writing copy promptly, if the customer do not send them within 14 days, the seller has the right to judge as acceptance of goods. The inspection lot size is treated as the quantity per shipment and per model. The sampling plan shall be inspected under MIL-STD015E in Level II by single sampling. The acceptable quality level (AQL) are categorized as below grades:

CRITICAL= 0.4%, MAJOR= 0.65%, MINOR= 1.5%

8.2 Inspection condition and Warranty policy:

The delivered LCM should be stored properly, ideally under climate-controlled environment at 25 (±5) degree Celsius as well as 60% (±10) Relative Humidity. The LCM shall be inspected in the viewing angle of 45 degree from the four major angles (U/D/L/R) under the single fluorescent lamp of 20W (equal to 300 to 500 lux). For warranty, ShenZhen Yes-Display International Technology CO.,LTD. will provide 12 months of warranty period as standard, and provide the new replacement for the defective products which belong to the Seller's responsibility verified by the quality department.

8.3 Inspection Criteria:

8.3.1 Critical defect

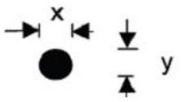
Item No.	Inspection content	Judgement
8.3.1.1	Functional defects	No display, abnormal display, short circuit, missing line, off-contrast and chromaticity, Touch Panel non-function
8.3.1.2	Model mixed	Other model mixed

8.3.2 Major defect:

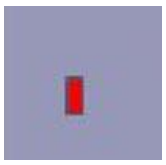
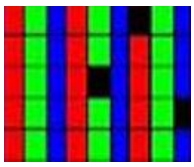
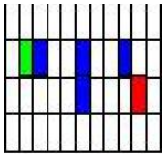
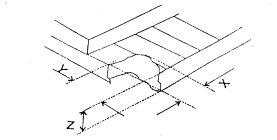
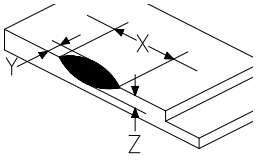
Item No.	Inspection content	Judgement
8.3.2.1	Product indication	Missing model no. and wrong model no. is indicated on the LCM.
8.3.2.2	Glass cracking	The LCD and touch panel glass crack or breakage

8.3.2.3	Missing component	The function component missing such as connector, cable, etc.

8.3.3 Minor defect (LCD) :

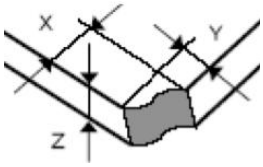
<table>
<tr><th>Item No.</th><th>Inspection content</th><th>Judgement</th></tr>
<tr><td>8.3.3.1</td><td>Black/White spot
Foreign particles
Dust in the cell</td><td>φ=(x+y)/2
 

<table>
<tr><th>Diameter (mm)</th><th>Acceptable Q'ty</th></tr>
<tr><td>Φ ≦ 0.1</td><td>Ignore</td></tr>
<tr><td>0.1 < Φ ≦ 0.25</td><td>3 (Distance>5mm)</td></tr>
<tr><td>0.25 < Φ</td><td>Not allowed</td></tr>
</table></td></tr>
<tr><td>8.3.3.2</td><td>Linear defect
Black/white line
Black/white scratch</td><td>
<table>
<tr><th>Length(mm)</th><th>Width (mm)</th><th>Acceptable Q'ty</th></tr>
<tr><td></td><td>W ≦0.03</td><td>Ignore</td></tr>
<tr><td>L≦ 5.0</td><td>0.03 <W≦0.07</td><td>3</td></tr>
<tr><td></td><td>0.07 <W</td><td>Follow 8.3.3.1</td></tr>
</table></td></tr>
<tr><td>8.3.3.3</td><td>Polarizer Bubbles
Dent on polarizer</td><td>
<table>
<tr><th>Diameter (mm)</th><th>Acceptable Q'ty</th></tr>
<tr><td>Φ ≦ 0.2</td><td>Ignore</td></tr>
<tr><td>0.2 < Φ ≦ 0.5</td><td>2 (Distance>5mm)</td></tr>
<tr><td>0.5 < Φ</td><td>Not allowed</td></tr>
</table></td></tr>
</table>

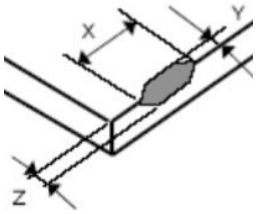
8.3.3.4	Electrical Dot defect	Bright dot and Dark dot definition:  or   (Two adjacent dot) Inspection pattern: black, white, red, green, and blue screen. Items: Bright dot — Acceptable Q'ty: N ≦ 4 (Distance >5mm); Dark dot — N ≦ 4 (Distance >5mm)
8.3.3.5	Glass Defect-Corner chipping	 Size(mm): X≦3mm, Y≦S , Z≦ T (S= ITO length, T=Single glass thickness) — Judgement: Accept
8.3.3.6	Glass Defect-Side fragment	 Size(mm): X≦2 mm, Y≦ border edge, Z≦T (T= single glass thickness) — Judgement: Accept

8.3.4 Minor defect (Touch Panel)

Item No.	Inspection content	Judgement

<table>
<tr><td>8.3.4.1</td><td>Scratch, dust, particles, foreign materials in “linear type”</td><td>
<table>
<tr><th>Size (mm)</th><th>Acceptable Q’ty</th></tr>
<tr><td>W≦0.05mm, L≦10mm</td><td>Ignore</td></tr>
<tr><td>0.05mm<W ≦ 0.07mm, L ≦ 10mm</td><td>3</td></tr>
<tr><td>W>0.07mm</td><td>Reject</td></tr>
</table>
</td></tr>
<tr><td>8.3.4.2</td><td>Scratch, dust, particles, foreign materials in “round type”</td><td>
<table>
<tr><th>Diameter (mm)</th><th>Acceptable Q’ty</th></tr>
<tr><td>Φ≦ 0.25mm</td><td>Ignore</td></tr>
<tr><td>0.25mm<Φ≦ 0.35mm</td><td>5</td></tr>
<tr><td>Φ > 0.35mm</td><td>Reject</td></tr>
</table>
</td></tr>
<tr><td>8.3.4.3</td><td>Air bubbles</td><td>
<table>
<tr><th>Diameter (mm)</th><th>Acceptable Q’ty</th></tr>
<tr><td>Φ≦ 0.2mm</td><td>Ignore</td></tr>
<tr><td>0.2mm<Φ≦ 0.5mm</td><td>3</td></tr>
<tr><td>Φ > 0.5mm</td><td>Reject</td></tr>
</table>
</td></tr>
<tr><td>8.3.4.5</td><td>Scratch on printing area</td><td>
<table>
<tr><th>Size (mm)</th><th>Acceptable Q’ty</th></tr>
<tr><td>W≦0.03mm, L≦5 mm</td><td>Ignore</td></tr>
<tr><td>0.03mm<W≦0.05mm, L≦5mm</td><td>3</td></tr>
<tr><td>W>0.05mm or L> 5mm</td><td>Reject</td></tr>
</table>
</td></tr>
<tr><td>8.3.4.6</td><td>Corner chipping</td><td>


<table>
<tr><th>Size(mm)</th><th>Judgement</th></tr>
<tr><td>X≦2mm, Y≦2mm
Z<1/2T
(T= single glass thickness)</td><td>Accept</td></tr>
</table>
</td></tr>
</table>

8.3.4.7	Edge chipping	

Size(mm)	Judgement
X≦3 mm, Y≦3 mm Z≦1/2 T (T= single glass thickness)	Accept

9. Reliability Test Conditions and Methods

9.1 Reliability Test Conditions and Methods:

NO.	TEST ITEMS	TEST CONDITION	INSPECTION AFTER TEST
①	High Temperature Storage	80°C±2°C×96Hours	Inspection after 2~4hours storage at room temperature, the samples should be free from defects: 1, Air bubble in the LCD. 2, Seal leak. 3, Non-display. 4, Missing segments. 5, Glass crack. 6, Current IDD is twice higher than initial value. 7, The surface shall be free from damage. 8, The electric characteristic requirements shall be satisfied.
②	Low Temperature Storage	-30°C±2°C×96Hours	
③	High Temperature Operating	70°C±2°C×96Hours	
④	Low Temperature Operating	-20°C±2°C×96Hours	
⑤	Temperature Cycle(Storage)	-20°C ⟺ 25°C ⟺ 70°C (30min) (5min) (30min) 1cycle Total 10cycle	
⑥	Damp Proof Test (Storage)	50°C±5°C×90%RH×96Hours	
⑦	Vibration Test	Frequency:10Hz~55Hz~10Hz Amplitude:1.5MM X,Y,Z direction for total 3hours (packing condition test will be tested by a carton)	
⑧	Drooping Test	Drop to the ground from 1M height one time every side of carton. (packing condition test will be tested by a carton)	
⑨	ESD Test	Voltage:±8KV,R:330Ω,C:150PF,Air Mode,10times	

REMARK:

1, The Test samples should be applied to only one test item.

2, Sample side for each test item is 5~10pcs.

3,For Damp Proof Test, Pure water(Resistance＞10MΩ)should be used.

4,In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.

5, EL evaluation should be accepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.

6, Failure Judgment Criterion: Basic Specification Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

10. Cautions and Handling Precautions

10.1 Mounting method

The LCD panel of TFT module consists of two thin glass plates with polarizes which easily be damaged. And since the module in so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

10.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent

[Recommended below] and wipe lightly

- Isopropyl alcohol
- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated:

- Soldering flux
- Chlorine (Cl) , Sulfur (S)

If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happen by miss-handling or using some materials such as Chlorine (Cl), Sulfur (S) from customer, Responsibility is on customer.

10.3 Caution against static charge

The LCD module use C-MOS LSI drivers, so we recommended that you:

Connect any unused input terminal to power or ground, do not input any signals before power is turned on, and ground your body, work/assembly areas, and assembly equipment to protect against static electricity.

10.4 packing

- Module employs LCD elements and must be treated as such.
- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity

10.5 Caution for operation

- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life.
- An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- Response time will be extremely delayed at lower temperature then the operating temperature range and on the other hand at higher temperature LCD's how dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- Slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the maximum operating temperature, 50%Rh or less is required.

10.6 storing

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- Storing with no touch on polarizer surface by the anything else.

[It is recommended to store them as they have been contained in the inner container at the time of delivery from us

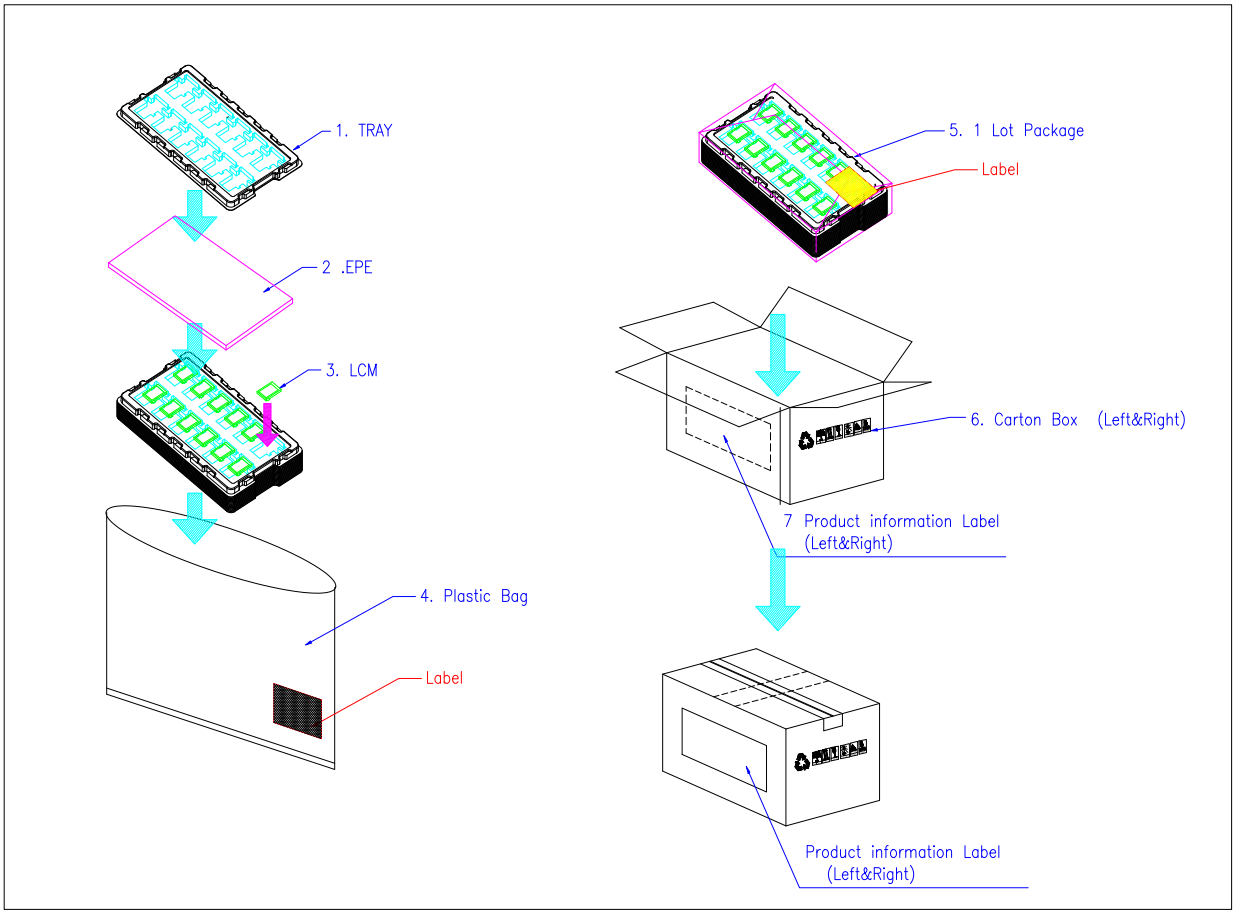
10.7 Safety

- It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.

- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water

11. Packing Method

11.1 Method



11.2 Packing Label

TBD