



深圳市一众显示科技有限公司

SHEN ZHEN TEAM SOURCE DISPLAY TECH. CO, TD.

# TFT-LCD Module Specification

**Module NO.:** TST043WVBI-57B

**Version:** V1.0

APPROVAL FOR SPECIFICATION

APPROVAL FOR SAMPLE

For Customer' s Acceptance:	
Approved by	Comment

Team Source Display:		
Presented by	Reviewed by	Organized by

Version No.	Date	Content	Remark
V1.0	2018-8-17	Initial Release	





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## 1. LCM Specification

### 1.1 Description

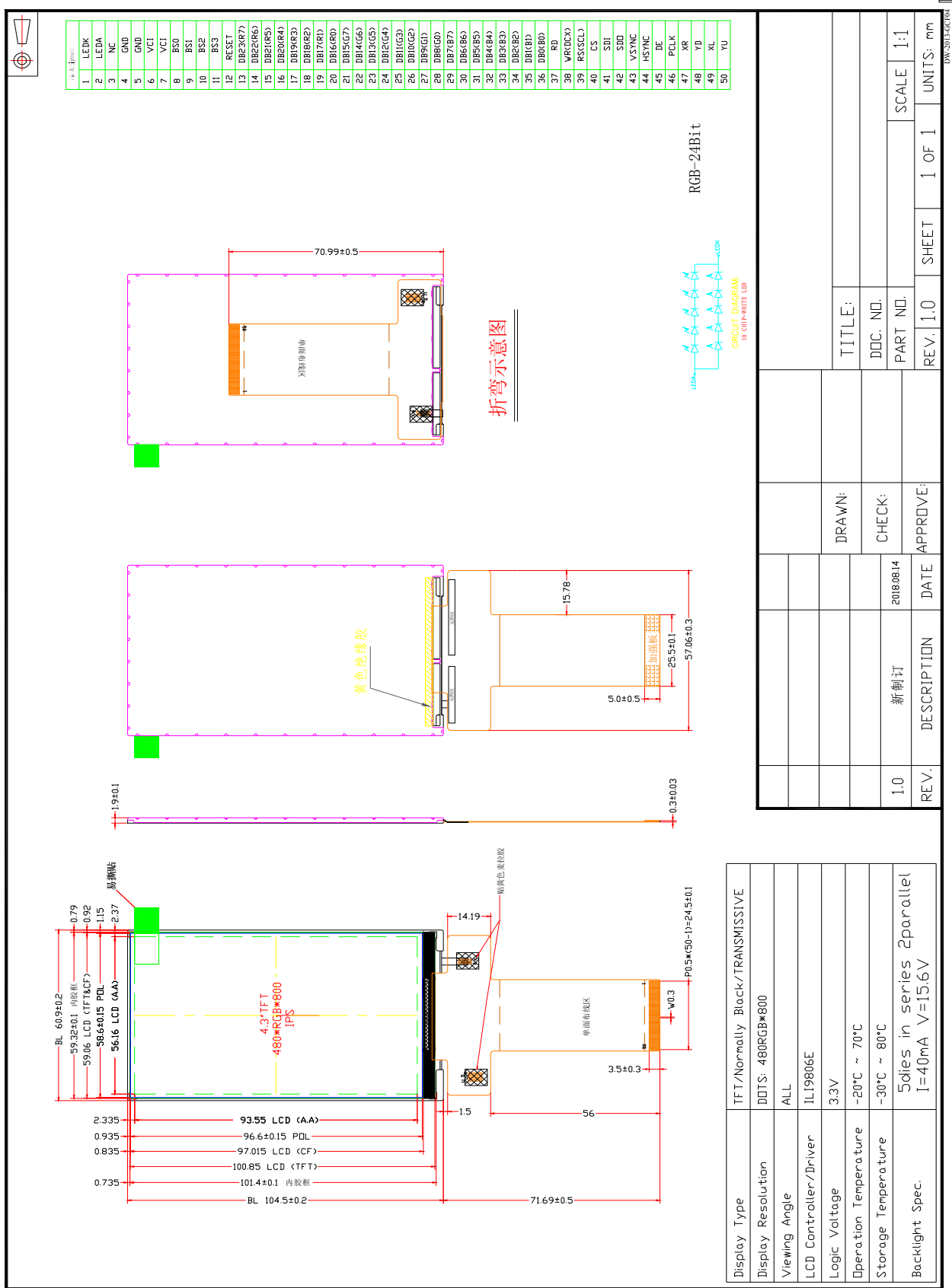
TST043WVBI-57B is a Transmissive type color active matrix liquid crystal display (LCD) which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT LCD panel, a drive IC, a FPC and a LED-backlight unit. The active display area is 4.3 inches diagonally measured and the native resolution is 480\*RGB\*800. Features of this product are listed in the following table.

### 1.2 Functions & Features

**Table 1.1 Module Functions & Features**

Parameter	Value	Unit
LCD Mode	TFT/Transmissive	-
Color Depth	16.7M	-
Display Resolution	480RGB*800	pixels
Module Size	104.5(H)*60.9(W)*1.9 (T)(Exclude FPC)	mm
Active Area (A.A)	93.55(H)*56.16(W)	mm
Pixel Arrangement	RGB-stripe	-
Viewing Direction	ALL O' clock	
Display Mode	Normally Black	
LCD Controller/Driver	ILI9806E	-
IC Package Type	COG	-
Interface	24-Bit Parallel RGB	-
Power Supply Voltage	2.5~3.3	V
LCM Brightness	520	cd /m <sup>2</sup>
Back-light	White 5LEDs*2	PCS

## 2. Mechanical Specification





### 3. Pin Descriptions

Pin No.	Symbol	I/O	Functional	Remark
1	LEDK	P	LED Power supply -	
2	LEDA	P	LED Power supply +	
3	NC	-	No Connection.	
4-5	GND	P	System ground.	
6-7	VCI	P	Power supply, 2.6~3.3V	
8	BS0	I	BS[3:0]=0011b , 3-line 9-bit + 24-bit RGB	
9	BS1	I		
10	BS2	I		
11	BS3	I		
12	RESET	I	The external reset input.	
13~20	R7~R0	I/O	RED Datas	
21~28	G7~G0	I/O	GREEN Datas	
29~36	B7~B0	I/O	BLUE Datas	
37	RD	I	Fix to GND.	
38	WR	I	Fix to GND.	
39	SCL	I	Serial clock input	
40	CS	I	Chip select signal.	
41	SDI	I	Serial data input/output pin.	
42	SDO	I	Open.	
43	VS	I	Vertical synchronizing signal.	
44	HS	I	Horizontal synchronizing signal.	
45	DE	I	Data ENABLE signal	
46	CLK	I	Dot clock signal	
47	TP_R	I	Right electrode – differential analog (N.C )	
48	TP_D	I	Down electrode – differential analog (N.C )	
49	TP_L	I	Left electrode – differential analog (N.C )	
50	TP_U	I	Up electrode – differential analog (N.C )	

## 4. Electrical Units

### 4.1 Absolute Maximum Ratings

The absolute maximum ratings are list on Table 4.1. When used out of the absolute maximum ratings, the LCM may be permanently damaged. Using the LCM within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are exceeded during normal operation, the LCM will malfunction and cause poor reliability.

**Table 4.1 Module Absolute Maximum Ratings**

Item	Symbol	Unit	Value	Note
Power Supply Voltage (1)	Vdd	V	-0.3 to +4.0	
Power Supply Voltage (2)	VGH ~ VSS	V	-0.3 to +15.0	
Power Supply Voltage (3)	VSS ~ VGL	V	0 to -10.0	
Operating Temperature	Top	°C	-20 to +70	
Storage Temperature	Tst	°C	-30 to +80	
Operating Humidity	Hop	%(RH)	10~90	

(VSS=0V)

### 4.2 Electrical characteristics (Ta=25°C)

**Table 4.2:DC Characteristic (Vcc = 3.0 ~ 3.6V)**

Item		Symbol	Condition	Min.	Type.	Max.	Unit
Supply Voltage	Logic	Vdd	---	2.6	3.2	3.5	V
Input Voltage	H level	V <sub>IH</sub>	---	0.7V <sub>dd</sub> <sub>io</sub>	---	V <sub>ddio</sub>	V
	L level	V <sub>IL</sub>		0	---	0.3V <sub>ddi</sub> <sub>o</sub>	
Current Consumption		I <sub>DD</sub>	With internal voltage generation; VDD=3.3V; Tamb=25°C;	---	TBD	---	mA

### 4.3 Back-light Specification

**Table 4.3 Back-light Characteristics**

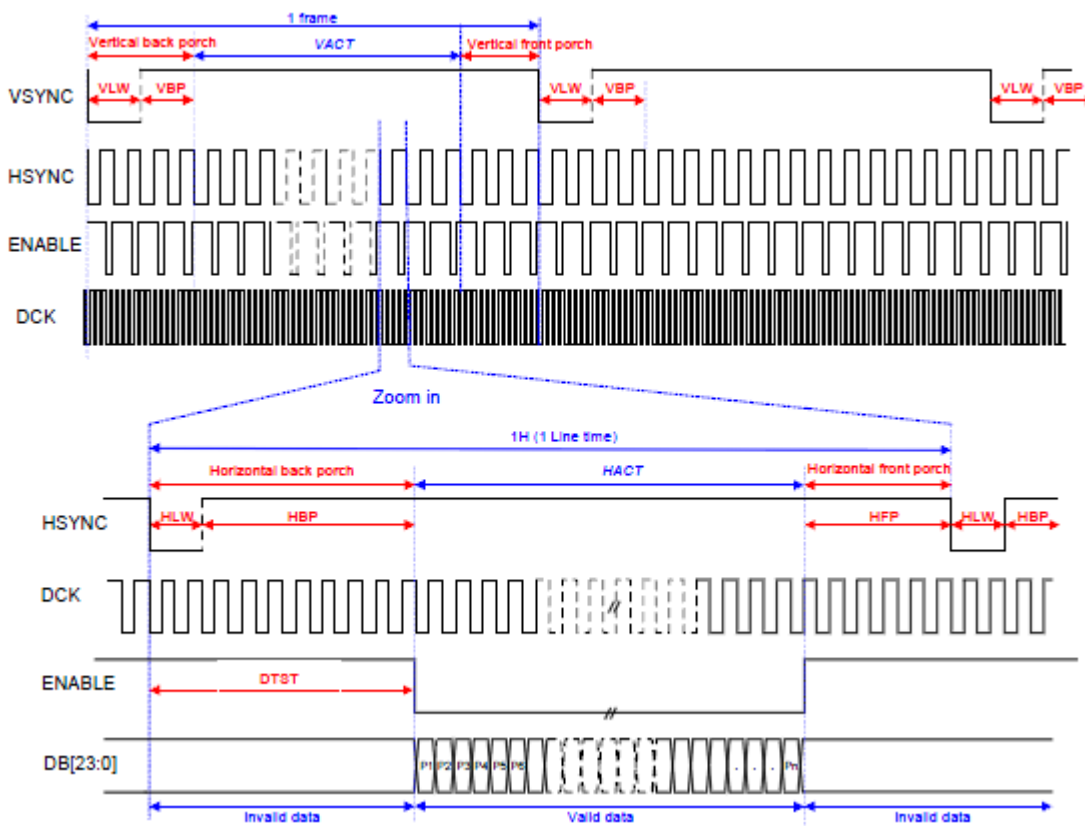
Item	Symbol	Conditions	Min.	Type.	Max.	Unit
Supply Voltage	VF	Only Backlight	--	15.6	--	V
Supply Current	IF		40			mA
Average Brightness	IV	Backlight Current IF=40mA	--	8000	--	Cd/ m <sup>2</sup>
CIE Color Coordinate (Without LCD)	X	Backlight Current IF=40mA	0.26	--	0.31	-
	Y		0.26	--	0.31	
Uniformity	B	Backlight Current IF=40mA	--	80%	-	%
Color	White					

**Note:** 5 LEDs in series 2 parallel connection.



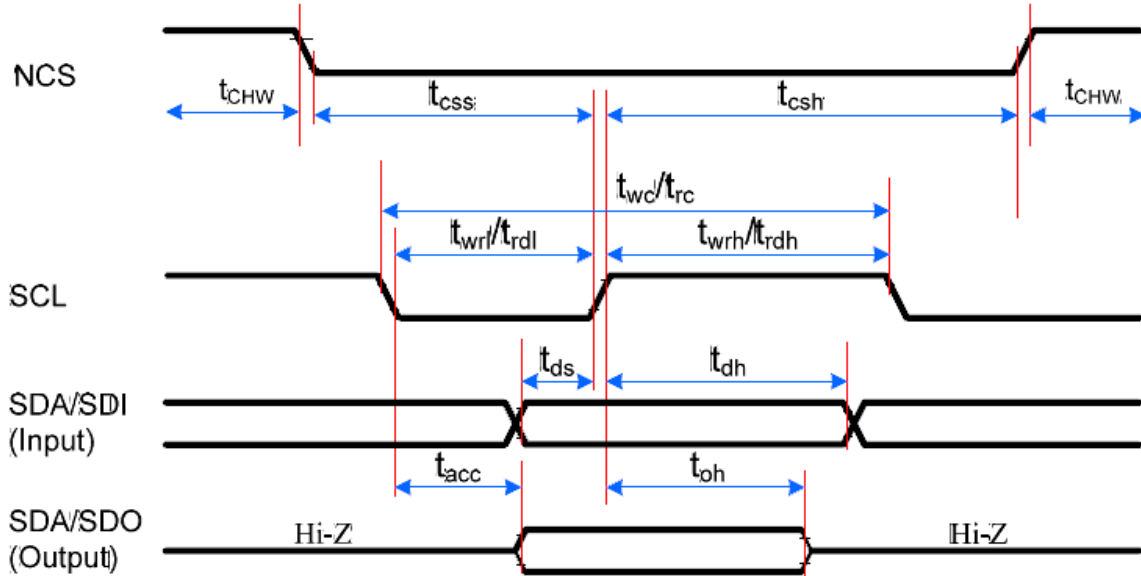
## 5. AC Characteristics

### 5.1 Parallel RGB interface operation



Parameter	Symbol	value			Unit
		Min	Typ	Max	
DCLK frequency	fclk	16.6	-	41.7	MHZ
VSD period time	Tv	-	-	1200	H
VSD display area	Tvd	800			H
VSD back porch	Tvb	1	-	126	H
VSD front porch	Tvfp	1	-	255	H
HSD period time	Th	484	-	-	DCLK
HSD display area	Thd	480			DCLK
HSD back porch	Thbp	2	-	126	DCLK
HSD front porch	Thfp	2	-	-	DCLK

### 5.2 Serial interface Timing ( 3-line SPI system )



Signal	Symbol	Parameter	min	max	Unit	Description
CSX	$t_{css}$	Chip select time (Write)	15	-	ns	
	$t_{csH}$	Chip select hold time (Read)	15	-	ns	
	$t_{CHW}$	CS "H" pulse width	40	-	ns	
SCL	$t_{wc}$	Serial clock cycle (Write)	30	-	ns	
	$t_{wrh}$	SCL "H" pulse width (Write)	10	-	ns	
	$t_{wrl}$	SCL "L" pulse width (Write)	10	-	ns	
	$t_{rc}$	Serial clock cycle (Read)	150	-	ns	
	$t_{rdh}$	SCL "H" pulse width (Read)	60	-	ns	
	$t_{rdl}$	SCL "L" pulse width (Read)	60	-	ns	
SDA/SDO (Output)	$t_{acc}$	Access time (Read)	10	100	ns	For maximum CL=30pF
	$t_{oh}$	Output disable time (Read)	15	100	ns	For minimum CL=8pF
SDA/SDI (Input)	$t_{ds}$	Data setup time (Write)	10	-	ns	
	$t_{dh}$	Data hold time (Write)	10	-	ns	



## **6. Power On/Off Sequence**

### **6.1 Power On Sequence**

TBD

### **6.2 Power Off Sequence**

TBD



## 7. Optical Specifications

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the TFT-LCD surface at a viewing angle of  $\Phi$  and  $\theta$  equal to 0° .

Measurement condition: Refer to next pages ( C-light source, Halogen Lamp )

\*1): with Polarizer \*2): without Polarizer \*3): Only Color Filter glass

Table 11. Optical Specifications

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle	$\theta_L$	C.R. • •10	70	80	-	degree
	$\theta_R$		70	80	-	
	$\theta_U$		70	80	-	
	$\theta_D$		70	80	-	
Contrast Ratio	-	T = 25°C	650	800	-	-
Transmittance	T%(with polarizer + D65 light)	T = 25°C	4.1	4.3	-	%
Response time	Tr	T = 25°C	35		40	ms
	Tf					

Note 1: Ambient temperature = 25°C.

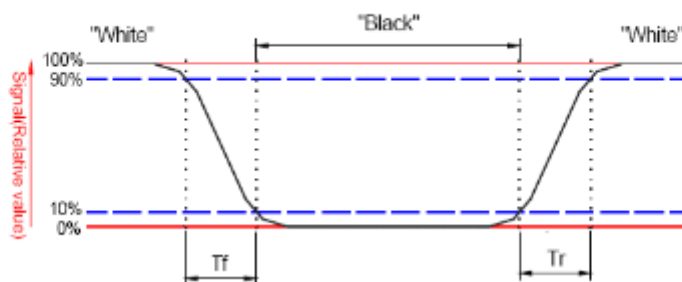
Note 2: To be measured with a viewing cone of 2°by Topcon luminance meter BM-5A.

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

Note 4: Transmittance of Specification is cell with polarizer.

Note 5: Definition of response time:

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

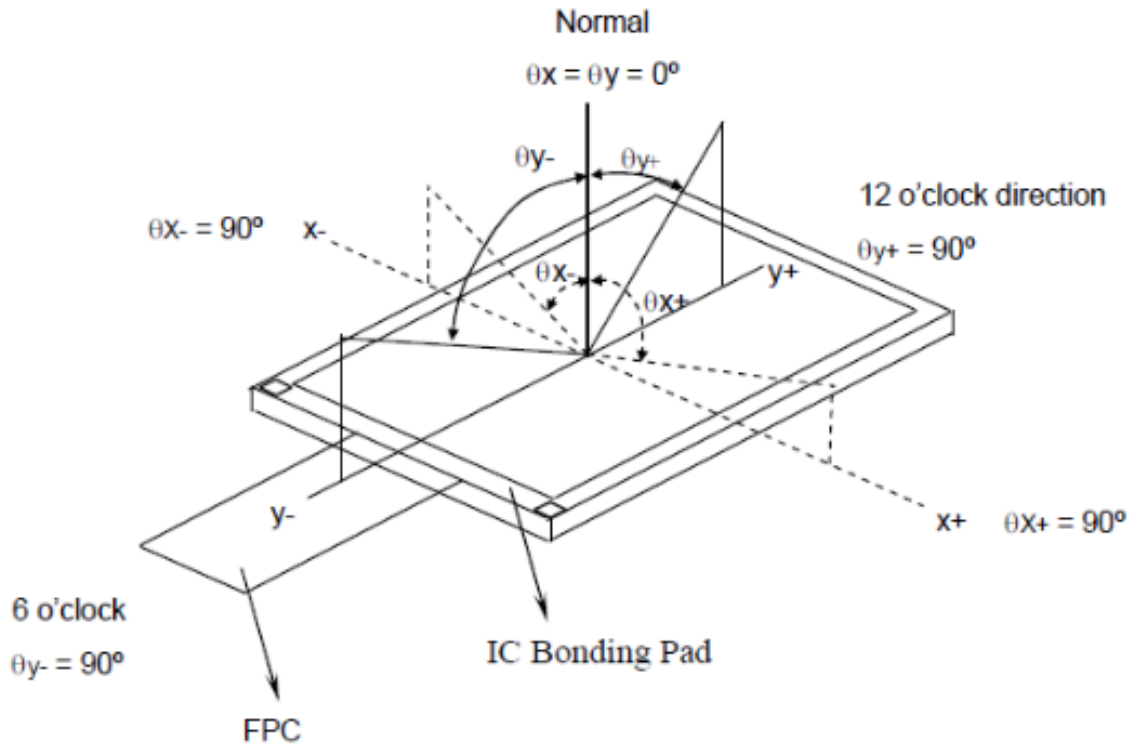


Note 6: Definition of contrast ratio:

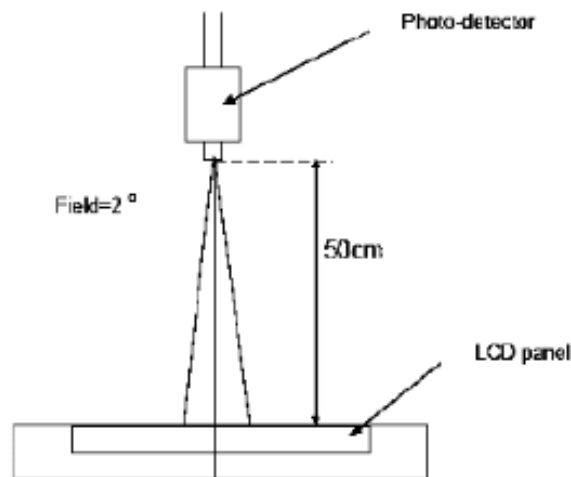
Contrast ratio is calculated by the following formula.

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

Note 7: Definition of viewing angle



Note 8: Optical characteristic measurement setup.





## 8. Reliability Test Items

No.	Test Item	Test Condition	Check Time
1	High temp storage	T=80°C	96Hrs
2	Low temp storage	T=-30°C	96Hrs
3	High temp operation	T=70°C	96Hrs
4	Low temp operation	T=-20°C	96Hrs
5	High temp & high humidity	T=50°C H=90%	72Hrs

Reliability Test Criteria:

Display function should be no change under normal operating condition.

## 9. Handling Precautions

### 9.1 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.

### 9.2 Disassembling or Modification

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

### 9.3 Breakage of LCD Panel

- 9.3.1 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.
- 9.3.2 If liquid crystal contacts mouth or eyes, rinse out with water immediately.
- 9.3.4 If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.
- 9.3.4 Handle carefully with chips of glass that may cause injury, when the glass is broken.

### 9.4 Absolute Maximum Ratings and Power Protection Circuit

- 9.4.1 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 may be damaged.
- 9.4.2 Please do not leave LCD in the environment of high humidity and high temperature for a long time.



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

## **9.5 Operation**

- 9.5.1 Do not touch, push or rub the polarizer with anything harder than HB pencil lead. If the LCD attaches a polarizer.
- 9.5.2 Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD for incoming inspection or assembly.
- 9.5.3 When the surface is dusty, please wipe gently with absorbent cotton or other soft material.
- 9.5.4 Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may cause deformation or color fading.
- 9.5.5 When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzene or other adequate solvent.

## **9.6 Static Electricity**

- 9.6.1 Protection film must be removed very slowly from the surface of LCD to prevent electrostatic occurrence if the LCD attaches a polarizer.
- 9.6.2 Because TFT-LCD panel is very weak to electrostatic discharge, please be careful with electrostatic discharge.  
Persons who handle the LCD should be grounded through adequate methods.

## **9.7 Strong Light Exposure**

The LCD shall not be exposed under strong light such as direct sunlight. Otherwise display characteristics may be changed.

## **9.8 Disposal**

When disposing LCD, obey the local environmental regulations.



## 10. QC

### 10.1 Purpose

To ensure the stability of our product and standardize our inspection

### 10.2 Application Range

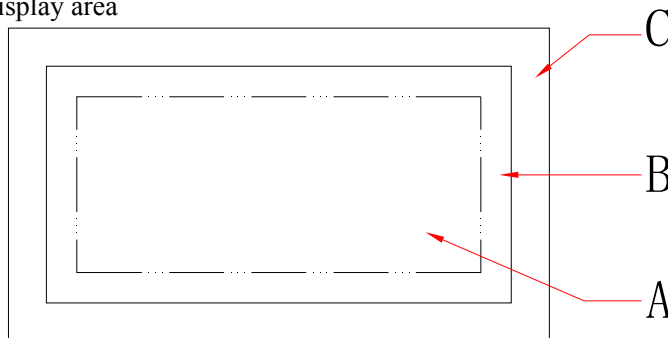
This standard is applied to all 4.3 inch and smaller sized LCM product from TSD.

### 10.3 Definition of inspection area

C area: The area covered after installation

B area: visible area

A area: display area

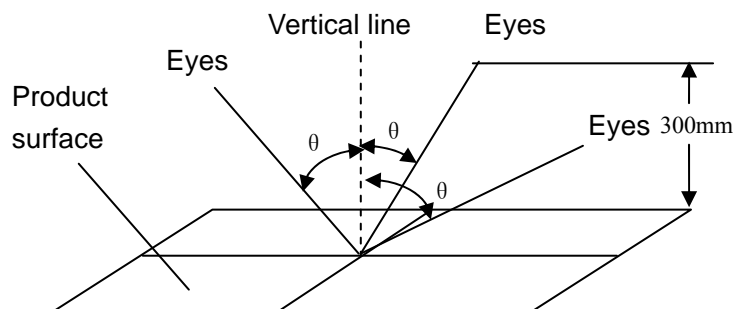


### 10.4 The environmental condition of inspection

Lighting conditions should be 20 ~ 40W fluorescent lamp (illumination at  $1000 \pm 200$  lux)

Test ambient temperature should be  $23 \pm 5$  °C, humidity at  $50 \pm 20\%$  RH

The tested products should be placed 300mm away from the examiner's eye, and 30 degrees in the vertical direction observed within the region



### 10.5 Identification

10.5.1 Bright dot: dots appearing bright and unchanged in size when the LCD panel is under black pattern.

10.5.2 Dark dot: dots appearing dark and unchanged size when the LCD panel is under RGB picture.

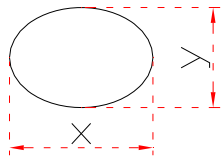
### 10.6 Inspection items and criteria

10.6.1 Serious defect

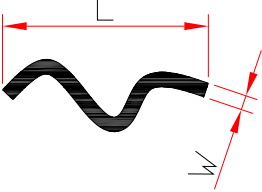
No	inspection item	inspection criteria	defect grade
10.6.1.1	function failure	1) Non-display not allowed 2) Line missing not allowed 3) Invalid touch and drift not allowed (if need )	main defect
10.6.1.2	break	broken display not allowed	main defect
10.6.1.3	dimension	Dimension tolerance out of specified in the drawing not allowed.	main defect

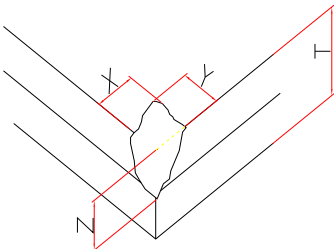
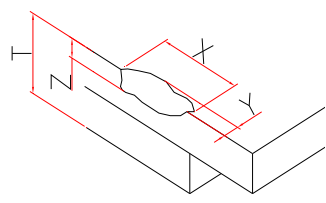
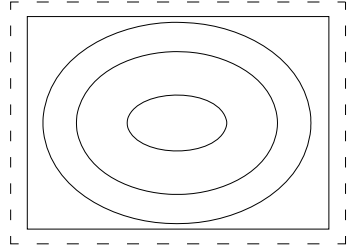
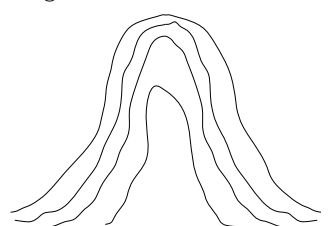
10.6.2 Appearance defect

No	Inspection item	inspection criteria	defect grade
10.6.2.1	Dot defect black dot, white dot, dirt on surface, stain, bubble	1. dot defect identification:	Minor defect
		2. inspection criteria range	

$$\Phi = \frac{(\chi + \gamma)}{2}$$


Area and quantity y dimension(mm)	quantity allowed		
	A area	B area	C area
$\Phi \leq 0.15$	ignore		ignore
$0.15 < \Phi \leq 0.20$	2 (spacing $\geq 10\text{mm}$ )		
$0.20 < \Phi \leq 0.3$	1		
$\Phi > 0.3$	0		

No	Inspection item	inspection criteria	defect grade																																	
10.6.2.2	line defect visible black/white line	1. identification of line dimension  L: length W: width	Minor defect																																	
		2. inspection criteria <table border="1"> <thead> <tr> <th colspan="2">dimension(mm)</th> <th colspan="3">quantity allowed ( total 3 pcs )</th> </tr> <tr> <th rowspan="2">L ( length )</th> <th rowspan="2">W ( width )</th> <th colspan="3">area</th> </tr> <tr> <th>A area</th> <th>B area</th> <th>C area</th> </tr> </thead> <tbody> <tr> <td>ignore</td> <td><math>W \leq 0.03</math></td> <td colspan="3">ignore</td> </tr> <tr> <td><math>L \leq 3.0</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td colspan="3">2</td> </tr> <tr> <td><math>L \leq 3.0</math></td> <td><math>0.05 &lt; W \leq 0.08</math></td> <td colspan="3">1</td> </tr> <tr> <td></td> <td><math>W &gt; 0.08</math></td> <td colspan="3">count according to dot defect</td> </tr> </tbody> </table>		dimension(mm)		quantity allowed ( total 3 pcs )			L ( length )	W ( width )	area			A area	B area	C area	ignore	$W \leq 0.03$	ignore			$L \leq 3.0$	$0.03 < W \leq 0.05$	2			$L \leq 3.0$	$0.05 < W \leq 0.08$	1				$W > 0.08$	count according to dot defect		
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$L \leq 3.0$	$0.05 < W \leq 0.08$	1																																		
	$W > 0.08$	count according to dot defect																																		
10.6.2.3	scratch	1-If the scratch is visible after installation or at work, refer to 10.6.2.2 2-If the scratch is visible at special angel or at non-working status, refer to the following standards <table border="1"> <thead> <tr> <th colspan="2">dimension ( mm )</th> <th colspan="3">Quantity allowed</th> </tr> <tr> <th rowspan="2">L ( length )</th> <th rowspan="2">W ( width )</th> <th colspan="3">area</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>ignore</td> <td><math>W \leq 0.03</math></td> <td colspan="3">ignore</td> </tr> <tr> <td><math>5.0 &lt; L \leq 10.0</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td colspan="3">2</td> </tr> <tr> <td><math>L \leq 5.0</math></td> <td><math>0.05 &lt; W \leq 0.08</math></td> <td colspan="3">1</td> </tr> <tr> <td></td> <td><math>W &gt; 0.08</math></td> <td colspan="3">Not allowed</td> </tr> </tbody> </table>	dimension ( mm )		Quantity allowed			L ( length )	W ( width )	area			A	B	C	ignore	$W \leq 0.03$	ignore			$5.0 < L \leq 10.0$	$0.03 < W \leq 0.05$	2			$L \leq 5.0$	$0.05 < W \leq 0.08$	1				$W > 0.08$	Not allowed			Minor defect
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$L \leq 5.0$	$0.05 < W \leq 0.08$	1																																		
	$W > 0.08$	Not allowed																																		

No	Inspection item	inspection criteria	defect grade
10.6.2.4	Glass defect	<p>1. broken angle</p> <p>X 不计 Y ≤ 2.0mm or X ≤ 2.0mm Y 不计 Meanwhile Z &lt; T ignore</p>  <p>2. other broken part</p> <p>X ≤ 5.0mm Y ≤ 0.8mm Meanwhile Z ≤ T ignore</p> 	Minor defect
10.6.2.5	Newton ring	<p>1.regular Newton ring</p>  <p>① Newton ring area &gt; 1/3 T/P area; not acceptable. ② Newton ring area ≤ 1/3 T/P area and doesn't affect the display result and no line distortion; acceptable</p> <p>2. Non-regular Newton ring</p>  <p>① Newton ring area &gt; 1/2 T/P area, or no matter how big as long as it affects the display result; not acceptable Newton ring area ≤ 1/2 T/P area, and doesn't affect the display result and without line distortion; acceptable</p>	Minor defect



NO	Inspection item	inspection criteria	defect grade
10.6.2.6	FPC	1. copper foil off, warping, crack and oxidation are not allowed 2. FPC crack, break, serious scratch and crease are not allowed	main defect
		3. if no special requirements, no release paper on double-sided adhesive FPC is not allowed. 4. Slight creases and scratches not exposed from the copper foil and with no affect to appearance and function are allowed. 5. if no special requirements, no insulating tape at welding part on backlight and touch-screen is not allowed.. 6. Parts off, breakage and deform are not allowed. 7. print on the surface should be clear and correct.	Minor defect
10.6.2.7	basic appearance requirements	1. clean appearance, no dirt, fingerprints and other traces. 2. ITO circuit on COG coating area should not be exposed. 3. Rust, sever scratch, deformation, obvious burrs and color dirt are not allowed. 4. Mis-assembly, part missing are not allowed. 5. Bubble caused by mis-pasted polaroid refers to 10.6.2.1 6. For watermark, the criteria is upon agreed by both parties.	Minor defect



## 10.6.3 electric defect

No	Inspection item	inspection criteria	defect grade
10.6.3.1	picture defect	Non-display, more or less image and display defect are not allowed.	main defect
10.6.3.2	bright/dark line	Not allowed.	main defect
10.6.3.3	display dot defect	<ol style="list-style-type: none"> <li>1. one dot is acceptable.</li> <li>2. Under bright status, 2 dark dots with more than 5mm distance is allowed.</li> <li>3. Totally 2 bright or dark dots are acceptable.</li> <li>4. The other defect under bright status refers to 10.6.2.1</li> </ol> <p>Note: Electric bright/dark dot means one pixel; less than 1/2 of 1 pixel can be ignored.</p>	Minor defect
10.6.3.4	connected dot/line defect	<ol style="list-style-type: none"> <li>1. Two continuous defect pixel connected dots are not allowed.</li> <li>2. Line defect refers to 10.6.2.2</li> </ol>	Minor defect
10.6.3.5	wrong view direction	Wrong view directions, such as opposite view angle, are not allowed.	main defect
10.6.3.6	back light defect	<ol style="list-style-type: none"> <li>1. Backlight off are not allowed.</li> <li>2. Uneven light, dead light, flicker light, dark angle, light leakage are not allowed.</li> <li>3. Brightness should comply with drawing</li> </ol>	main defect

end.