深圳市一众显示科技有限公司

SHEN ZHEN TEAM SOURCE DISPLAY TECH. CO, LTD.

TFT-LCD Module Specification

Module NO.：TST040HDBY-06C

Version：V1.1

☐ **APPROVAL FOR SPECIFICATION**   ☐ **APPROVAL FOR SAMPLE**

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

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

Records of Revision

Date	Rev.	Description	Page	Remarks
2018/11/9	V1.0	Initial Released		
2018/11/24	V1.1	add CTP V.A size and CTP A.A size	page 4	

Table of Contents

1 General Description

This display module is a transmissive type color active matrix TFT(Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This module is composed of a TFT LCD module, a driver circuit, and a back-light unit.The resolution of a 4.00" contains 720(RGB)X720 dots and can display up to 262k colors.
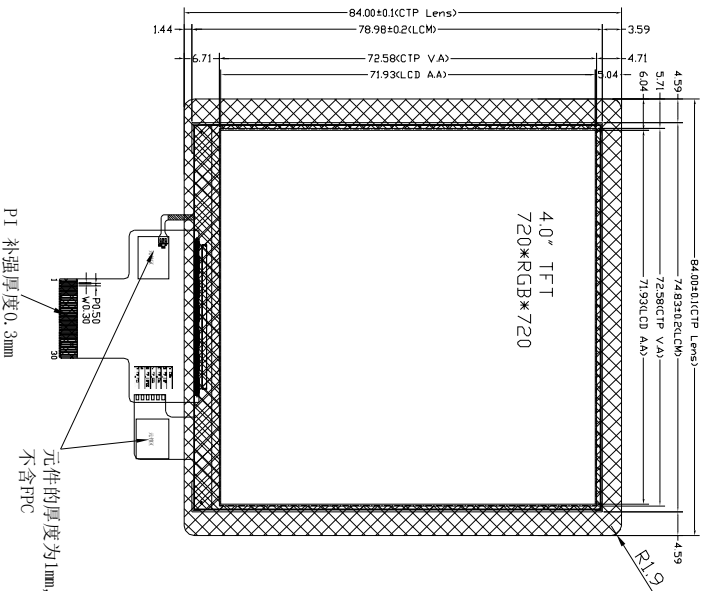
2 Module Parameter

Features	Details	Unit
Display Size(Diagonal)	4.00	inch
LCD type	α-Si TFT	-
Display Mode	IPS / Transmissive / Normally Black	-
Resolution	720RGB x 720	-
View Direction	All	Best image
Module Outline	84.0(H) ×84.0(V)×2.6(T)　　(Note 1)	mm
TP Outline	N/A	mm
TP Viewing Area	72.58(H)x72.58(V)	mm
TP Active Area	71.53(H)x71.53(V)	mm
Active Area	71.93x71.93	mm
Viewing Area	N/A	mm
Display Colors	262K	-
Interface	4-LINE MIPI	-
Driver IC	YY1821	-
Operating Temperature	-20～70	℃
Storage Temperature	-30～80	℃
Weight	TBD	g

Note 1: Excluding hooks, posts , FPC/FPC tail etc.

LCD Type	4.0"TFT,Transmissive, Normally black,ips
Resolution	720(RGB)*720
View Direction	All OCLOCK
Driver IC	YY1821
Color Depth	16.7M
Interface Types	MIPI
Operating voltage	3.3V
TP/Lens	With CTP(FT6336U)
Backlight LEDs	8 LEDs，40mA,12.4V
Surface luminance	330 cd/m2
Operating temperature	-20 ℃~70 ℃
Storage Temperature	-30 ℃~80 ℃
Storage Humidity	60℃ 90% max

" ☞ " Need to pay attention to the key size with *

84.00±0.1(CTP Lens)
78.98±0.2(LCM)
72.58(CTP V.A)
71.93(LCD A.A)
1.44
3.59
6.71
4.71
5.04
4.59
5.71
6.04
84.00±0.1(CTP Lens)
74.83±0.2(LCM)
72.58(CTP V.A)
71.93(LCD A.A)
4.59
R1.9

4.0" TFT
720*RGB*720

PI 补强厚度为0.3mm
P0.50
W0.30
1
30
元件的厚度为1mm,
不含FPC

2.66
1.56 显示屏+背光
1.10TP

A
K2
K1

4 Module Interface

NO	SYMBOL	FUNCTION
1	LEDA	LED ANODE
2	LED K1	LED CATHODE
3	LED K2	LED CATHODE
4	VCI	Power supply
5	IOVCC	Logic power supply
6	RESET	This signal will reset the device and it must be applied to properly initialize the chip.
7	TE	Tearing effect
8	PWM	LCD backlight control PWM
9	GND	Ground
10	D0P	MIPI DSI differential data pair(lane 0)
11	D0N	MIPI DSI differential data pair(lane 0)
12	GND	Ground
13	D1P	MIPI DSI differential data pair(lane 1)
14	D0P	MIPI DSI differential data pair(lane 1)
15	GND	Ground
16	CLKP	MIPI DSI differential clock pair
17	CLKN	MIPI DSI differential clock pair
18	GND	Ground
19	D2P	MIPI DSI differential data pair(lane 2)
20	D2N	MIPI DSI differential data pair(lane 2)
21	GND	Ground
22	D3P	MIPI DSI differential data pair(lane 3)
23	D3N	MIPI DSI differential data pair(lane 3)
24	GND	Ground
25	TP-INT	Touch Interrupt
26	TP-SDA	Touch IIC data signal
27	TP-SCL	Touch IIC clock signal
28	TP-RESET	Touch reset signal
29	TP-VCI	Touch power supply
30	GND	Ground

5　Application Circuit

Item of backlight characteristics 项目	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward voltage正向电压	Vf	11.3	12	12.7	V	If=40mA Ta=25℃
Number of LED　灯数	-	-	8	-	Piece	
Connection mode　连接类型	P	-	2并4串	-	-	-

Using condition: constant current driving method If=40mA(+/-10%).
使用条件：恒流的驱动方式是 If=40mA(+/-10%).

6   Absolute Maximum Ratings

Parameter of absolute maximum ratings 参数	Symbol 符号	Min 最小值	Max 最大值	Unit 单位
Input voltage 逻辑电压	VCI	2.6	3.6	V
Input voltage 输入电压	TP_VCI	2.6	3.6	V
Operating temperature 操作温度	Top	-20	70	℃
Storage temperature 储存温度	TST	-30	80	℃
Humidity 湿度	RH	-	90%(Max60 ℃)	RH

7   Electrical Specification

DC CHARACTERISTICS

Parameter of DC characteristics 参数	Symbol 符号	Min 最小值	Typ 典型值	Max 最大值	Unit 单位
I/O power supply 接口电压	IOVCC	1.65	3.3	-	V
Input voltage 输入电平	VCI	2.8	3.3	-	V
Input voltage 输入电平	TP_VCI	2.8	3.3	-	V

8   AC Characteristics

Reset timing and interface timing:
Please refer to IC datasheet.

9   Command Table

Please refer to IC datasheet.

10 RGB PORCH

Parameters	Symbols	Min	Typ	Max	Unit
Horizontal Synchronization	Hsync		20	-	PCLK
Horizontal Back Porch	HBP		20	-	PCLK
Horizontal Front Porch	HFP		10	-	PCLK
Horizontal Address	HAdr		720	-	PCLK
Vertical Synchronization	Vsync		10	-	HSYNC
Vertical Back Porch	VBP		9	-	HSYNC
Vertical Front Porch	VFP		10	-	HSYNC
Vertical Address	VAdr		720	-	HSYNC

11 Optical Specifications

11.1 Optical Specifications

Ta=25ºC, VDD=2.8V, TN LC+ Polarizer

	Item	Symbol	Condition	Specification			Unit
				Min.	Typ.	Max.	
On Backlight (Transmissive)	Luminance on surface(I_f=40mA)	Lv	Normally viewing angle $\theta_X = \theta_Y = 0º$	250	330	-	cd/m²
	Contrast ratio	CR		700	900	-	-
	Response time	T_F	-	-	-	25	ms
	Chromaticity Transmissive — Red	X_R	-	0.626	0.656	0.686	-
		Y_R		0.287	0.317	0.347	-
	Green	X_G		0.240	0.270	0.300	-
		Y_G		0.568	0.598	0.638	-
	Blue	X_B		0.111	0.141	0.171	-
		Y_B		0.067	0.097	0.127	-
	White	X_W		0.284	0.314	0.344	-
		Y_W		0.328	0.358	0.388	-

|				-	80	-	
Viewing Angle	Horizontal	θX+	Center CR≥10	-	80	-	Deg.
		θX-		-	80	-	
	Vertical	θY+		-	80	-	
		θY-		-	80	-	
NTSC Ratio(Gamut)		-	-	65	70	-	%

11.2 Definition of Response Time

11.2.1 Normally Black Type (Negative)
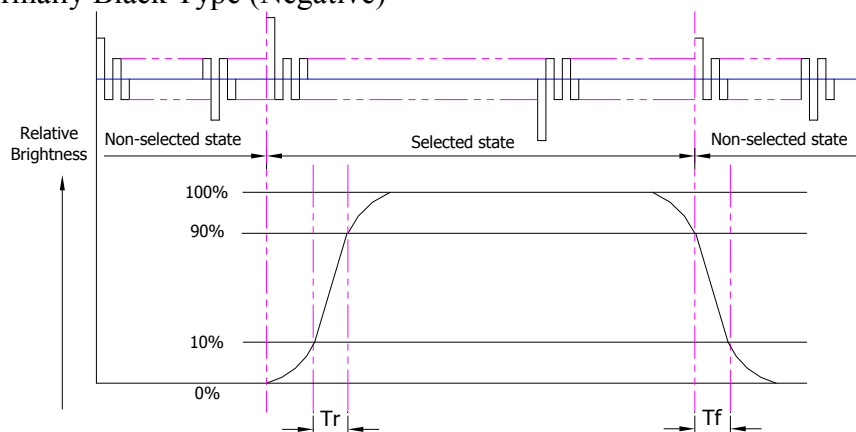
Tr is the time it takes to change form non-selected state with relative luminance 10% to selected state with relative luminance 90%;

Tf is the time it takes to change from selected state with relative luminance 90% to non-selected state with relative luminance 10%.

11.2.2 Normally White Type (Positive)
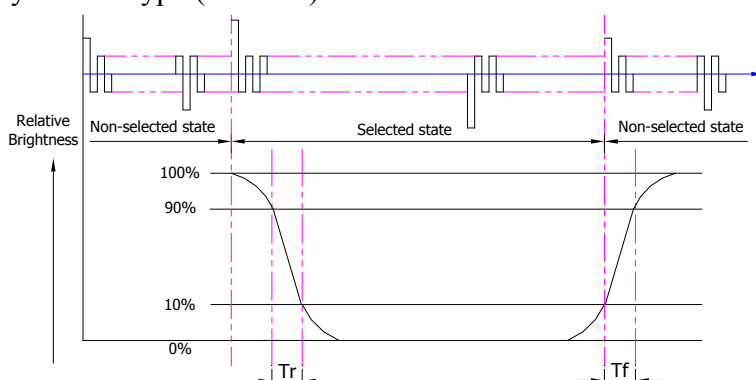
Tr is the time it takes to change form non-selected state with relative luminance 90% to selected state with relative luminance 10%;

Tf is the time it takes to change from selected state with relative luminance 10% to non-selected state with relative luminance 90%;

11.3 Definition of Contrast Ratio

Contrast is measured perpendicular to display surface in reflective and transmissive mode. The measurement condition is:

Measuring Equipment	BM-7 or EQUI
Measuring Point Diameter	3mm//1mm
Measuring Point Location	Active Area centre point
Test pattern	A: All Pixels white
	B: All Pixel black
Contrast setting	Maximum

Definitions: CR (Contrast) = Luminance of White Pixel / Luminance of Black Pixel
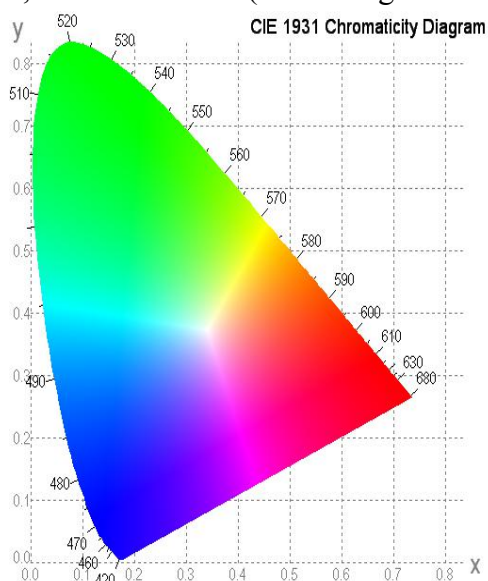
11.4   Definition of Viewing Angles
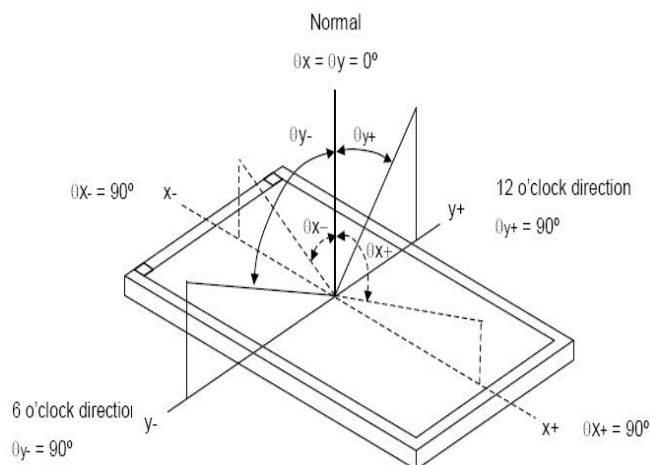
Measuring machine: LCD-5100 or EQUI

11.5   Definition of Color Appearance

R,G,B and W are defined by (x, y) on the IE chromaticity diagram

NTSC=area of RGB triangle/area of NTSC triangleX100%

Measuring picture: Red, Green, Blue and White (Measuring machine: BM-7)

11.6   Definition of Surface Luminance, Uniformity and Transmittance

Using the transmissive mode measurement approach, measure the white screen luminance of

the display panel and backlight.

    11.6.1   Surface Luminance: LV = average (LP1:LP9)

11.6.2   Uniformity = Minimal (LP1:LP9) / Maximal (LP1:LP9) * 100%

    11.6.3   Transmittance = LV on LCD / LV on Backlight * 100%

    Note :Measuring machine:BM-7
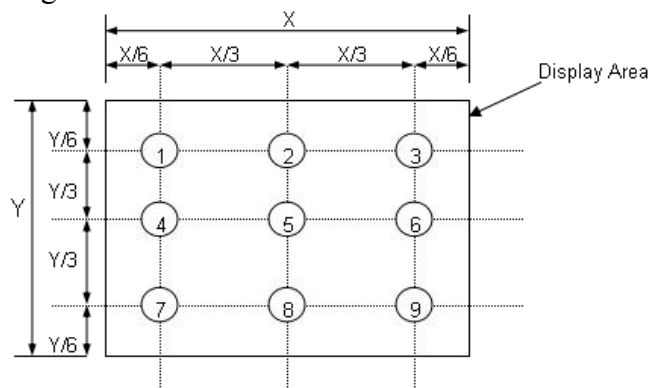
12   Quality Assurance

12.1 Purpose

This standard for Quality Assurance assures the quality of LCD module products supplied to customer by Iexcellence display.

12.2 Agreement Items

Iexcellence and customer shall negotiate if the following situation occurs:

12.2.1 Discrepancies between Iexcellence 's QA standards and customer's QA standards.

12.2.2 Additional requirement to be added in product specification.

12.2.3 Any other special problem.

12.3 Standard of the Product Visual Inspection

12.3.1 Appearance inspection:

12.3.1.1 The inspection must be under illumination about 1000 – 1500 lx, and the distance of view must be at 30cm ± 2cm.

12.3.1.2 The viewing angle should be 45° from the vertical line without reflection light or follows customer's viewing angle specifications.

12.3.1.3 Definition of area: A Zone: Active Area, B Zone: Viewing Area.
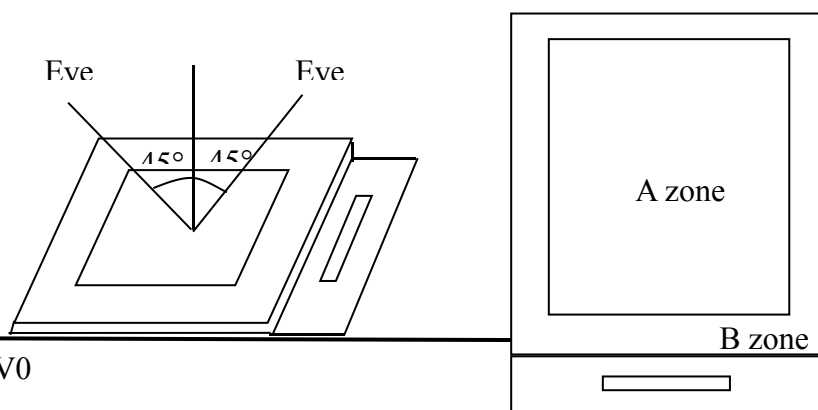
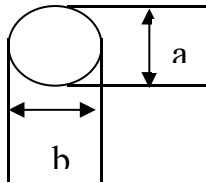12.3.2 Basic principle:A set of sample to indicate the limit of acceptable quality level must be discussed by both Iexcellence and customer when there is any dispute happened.
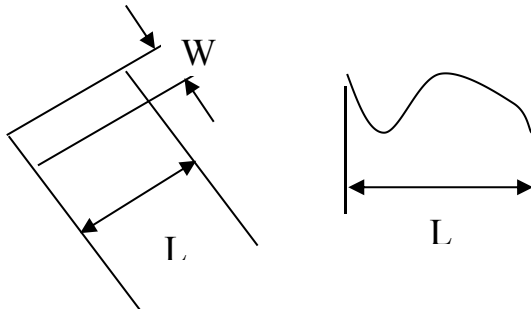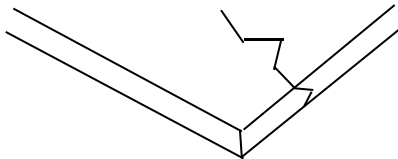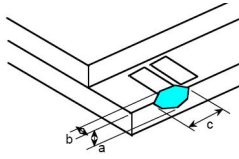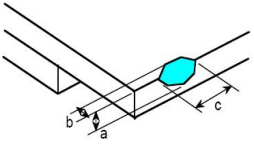
12.4   Inspection Specification
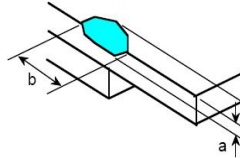
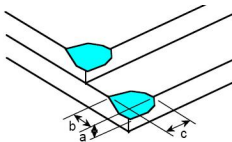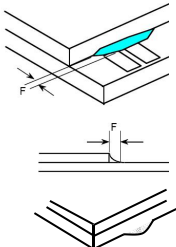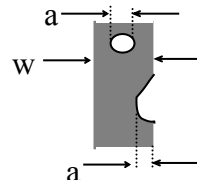Sampling plan according to GB/T2828.1-2012/ISO 2859-1：1999 and ANSI/ASQC Z1.4-1993,normal level 2 and based on:

Major defect: AQL 0.65

Minor defect: AQL 1.5

No.	Item	Criteria (Unit: mm)	
01	Black / White spot Foreign material (Round type) Pinholes Stain Particles inside cell. (Minor defect)	$\varphi= (a + b) /2$	<table><tr><td colspan="2">Area ╲ Size</td><td>Acc. Qty</td></tr><tr><td colspan="2">$\varphi \leq 0.10$</td><td>Ignore</td></tr><tr><td colspan="2">$0.10<\varphi\leq0.15$</td><td>2</td></tr><tr><td colspan="2">$0.15<\varphi\leq0.20$</td><td>1</td></tr><tr><td colspan="2">$0.20<\varphi$</td><td>0</td></tr><tr><td colspan="2">Total</td><td>2 no include $\varphi\leq 0.10$</td></tr></table> Distance between 2 defects should more than 5mm apart.

For item 01, the table inside the criteria cell:

Area \\ Size	Acc. Qty
$\varphi \leq 0.10$	Ignore
$0.10<\varphi\leq0.15$	2
$0.15<\varphi\leq0.20$	1
$0.20<\varphi$	0
Total	2 no include $\varphi\leq 0.10$

Distance between 2 defects should more than 5mm apart.

For item 02:

Black and White line Scratch Foreign material (Line type) (Minor defect)

Length	Width	Acc. Qty
/	$W \leqq 0.03$	Ignore
$L \leqq 2$	$0.03 < W \leqq 0.05$	1
/	$0.05 < W$	0

No.	Item	Criteria (Unit: mm)	
		Total	1
		Distance between 2 defects should more than 3mm apart. Scratches not viewable through the back of the display are acceptable.	
03	Glass Crack (Minor defect)	LCD with extensible crack line is unacceptable(When press the cracked LCD area, the line will expand, we define it is extensible crack line)	
04	Glass Chipping Pad Area: (Minor defect)	Length and Width / Acc. Qty: c < 5.0, b< 0.4 — Ignore	
05	Glass Chipping Rear of Pad Area: (Minor defect)	Length and Width / Acc. Qty: c > 3.0, b< 1.0 — 1; c< 3.0, b< 1.0 — 2; c< 3.0, b< 0.5 — 4; a<Glass Thickness	

No.	Item	Criteria (Unit: mm)
06	Glass Chipping Except Pad Area: (Minor defect)	<table><tr><td>Length and Width</td><td>Acc. Qty</td></tr><tr><td>c ≤0.6, b< 5.0</td><td>Ignore</td></tr><tr><td colspan="2">a<Glass Thickness</td></tr></table>
07	Glass Corner Chipping: (Minor defect)	<table><tr><td>Length and Width</td><td>Acc. Qty</td></tr><tr><td>c < 2.0, b< 1.5</td><td>Ignore</td></tr><tr><td>c < 1.5, b< 2</td><td>Ignore</td></tr><tr><td colspan="2">a<Glass Thickness</td></tr></table>
08	Glass Burr: (Minor defect)	Glass burr don't affect assemble and module dimension. <table><tr><td>Length</td><td>Acc. Qty</td></tr><tr><td>F < 0.5</td><td>Ignore</td></tr></table>
09	FPC Defect: (Minor defect)	9.1 Dent, pinhole width $a<w/3$. (w: circuitry width.) 9.2 Open circuit is unacceptable. 9.3 No oxidation, contamination and distortion.

No.	Item	Criteria (Unit: mm)		
10	Bubble on Polarizer (Minor defect)		Diameter	Acc. Qty
			φ≤0.10	Ignore
			0.1 <φ≤0.15	2
			0.15 <φ≤0.2	1
			0.2 < φ	None
11	Dent on Polarizer (Minor defect)		Diameter	Acc. Qty
			φ≤0.10	Ignore
			0.1 <φ≤0.15	2
			0.15 <φ≤0.2	1
			0.2 < φ	None
12	Bezel	12.1 No rust, distortion on the Bezel. 12.2 No visible fingerprints, stains or other contamination.		
13	Touch Panel	D: Diameter W: width L: length 13.1 Spot: D≤0.20 is acceptable 0.20<D≤0.3, acceptable QTY, 3 2dots are acceptable and the distance between defects should more than 10 mm. D>0.3 is unacceptable 13.2 Dent: D>0.30 is unacceptable 13.3 Scratch: W≤0.03, L≤10 is acceptable, 0.03<W≤0.10, L≤10 ,acceptable QTY, 3 Distance between 2 defects should more than 10 mm. W>0.10 is unacceptable.		
14	PCB	14.1 No distortion or contamination on PCB terminals. 14.2 All components on PCB must same as documented on the BOM/component layout. 14.3 Follow IPC-A-600F.		
15	Soldering	Follow IPC-A-610C standard		

No.	Item	Criteria (Unit: mm)
16	Electrical Defect (Major defect)	The below defects must be rejected. 16.1 Missing vertical / horizontal segment, 16.2 Abnormal Display. 16.3 No function or no display. 16.4 Current exceeds product specifications. 16.5 LCD viewing angle defect. 16.6 No Backlight. 16.7 Dark Backlight. 16.8 Touch Panel no function. 16.9 Dark Dot –one Allowed. 16.10 Bright Dot – one Allowed. Remark: 1. A pixel defect is acceptable if one color is none functional and causes a bright dot. The display may have one case where one color is out and cause a dark dot. 2. Bright dot caused by scratch and foreign object accords to item1.
17	Screen deformation	Test for insertion of plug gauge at highest warping point： (0.9-4 .5 inches does not contain 4.5) H ≦ 0.2MM (4.5-5.5 inches) H ≦ 0.3MM Decision OK

Remark: Visual and cosmetic defects are rejectable only if these fall within the LCD viewing area.

12.5 Classification of Defects

Visual defects (Except no / wrong label) are treated as minor defect and electrical defect is major.

12.6 Identification/marking criteria

Any unit with illegible / wrong /double or no marking/ label shall be rejected.

12.7 Packing

12.7.1 There should be no damage of the outside carton box, each packaging box should has label in the correct location per packing drawing requirement.

12.7.2 All direct package materials shall offer ESD protection.

13   Reliability Specification

Item	Condition	Cycle Time	Quantity	Remark
Constant Temp. and Constant Humidity Operation Test	+40 ± 3ºC,90 ± 3%RH	120hrs	--	*1
High Temp. Operation Test	+70 ± 3ºC	120hrs	--	
Low Temp. Operation Test	-20 ± 3ºC	120hrs	--	
Thermal Shock Test	-20 ± 3ºC (30min) +70 ± 3ºC (30min)	10cycles	--	
ESD Test(end product)	150pF, 330Ω, ±2KV, Contact	10times	--	*2, *3
	150pF, 330Ω, ±6KV, Air			
Vibration Test (for packaging)	Frequency: 10Hz to 55Hz to10Hz,Swing:1.5mm,time：X,Y,Z each 2H.	6hrs	One inner carton	*4

Note 1.   For humidity test, DI water should be used.

Inspection Standard: Inspect after 1-2hrs storage at room temperature, the sample shall be free from the following defects:

- Air bubble in the LCD
- Seal Leakage
- Non-display
- Missing Segment
- Glass Crack
- IDD is greater than twice initial value.
- Others as per QA Inspection Criteria

Note 2.   No defect is allowed after testing

The End Product ESD value is only indicative and depends on customer ESD protection design for the whole system.

Note 3.   ESD should be applied to LCD glass panel, not other areas (such as on IC and so on)

IDD should be within twice initial value.

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

Note 4.   Only upon request.

14 Precautions and Warranty

14.1 Safety

14.1.1 The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

14.1.2 Since the liquid crystal cells are made of glass, do not apply strong impact on them. Handle with care.

14.2 Handling

14.2.1 Reverse and use within ratings in order to keep performance and prevent damage.

14.2.2 Do not wipe the polarizer with dry cloth, as it might cause scratch. If the surface of the LCD needs to be cleaned, wipe it swiftly with cotton or other soft cloth soaked with petroleum IPA, do not use other chemicals.

14.3 Operation

14.3.1 Do not drive LCD with DC voltage

14.3.2 Response time will increase below lower temperature

14.3.3 Display may change color with different temperature

14.3.4 Mechanical disturbance during operation, such as pressing on the display area, may cause the segments to appear "fractured".

14.4 Static Electricity

14.4.1 CMOS LSIs are equipped in this unit, so care must be taken to avoid the electro-static charge, by ground human body, etc.

14.4.2 The normal static prevention measures should be observed for work clothes and benches.

14.4.3 The module should be kept into anti-static bags or other containers resistant to static for storage.

14.5 Limited Warranty

14.5.1 Unless otherwise agreed between TSD and customer, TSD will replace or repair any of its LCD and LCM which TSD found to be defective electrically and visually when inspected in accordance with TSD Quality Standards, for a period of one year from date of shipment.

14.5.2 The warranty liability of TSD is limited to repair and/or replacement. TSD will not be responsible for any consequential loss.

14.5.3 If possible, we suggest you use up all modules in six months. If the module storage time over twelve months, we suggest that recheck it before the module be used.

15 Packaging

TBD

16 Prior Consult Matter

1. For TSD standard products, we keep the right to change material, process for improving the product property without prior notice to our customer.

2. For OEM products, if any changes are needed which may affect the product property, we will consult with our customer in advance.

3. If you have special requirement about reliability condition, please let us know before you start the test on our samples.