Specification for Approval

Customer:_____

Model Name:_____

Supplier Approval			Customer approval
R&D Designed	R&D Approved	QC Approved	
Peter	*Peng Jun*		

Revision Record

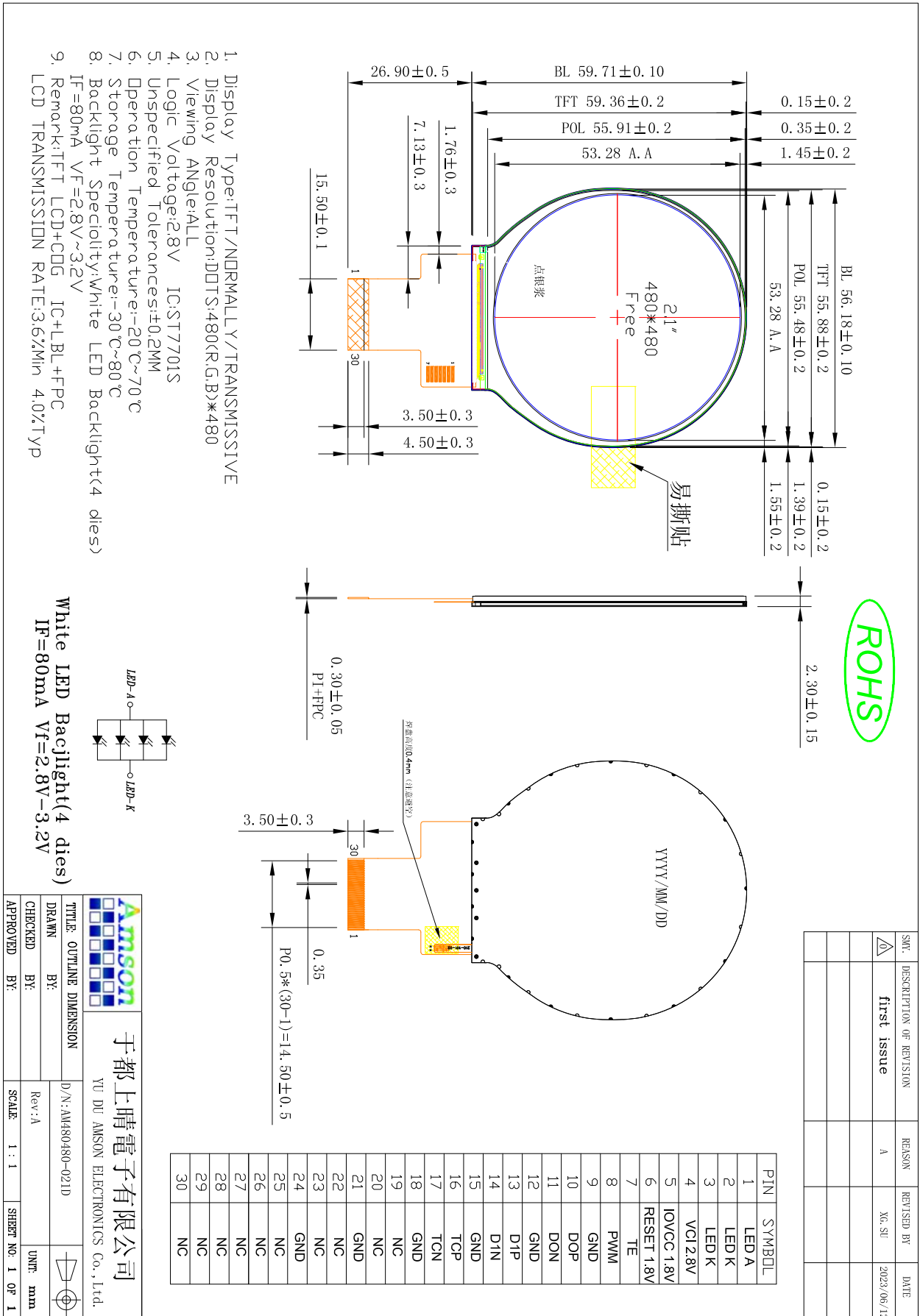| REV NO.	REV DATE	CONTENTS	Note
A	2023-06-12	NEW ISSUE	

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1. Scope

This specification defines general provisions as well as inspection standards for TFT module supplied by AMSON electronics.

If the event of unforeseen problem or unspecified items may occur, naturally shall negotiate and agree to solution.

2. General Information

Item	Specification	Unit
Screen Size	2.1 inches	--
Display Resolution	480RGB(H)x480(V)	Dot
Active Area	53.28(H) x 53.28 (V)	mm
Outline Dimension	56.18(W) x 59.71(H) x 2.3(D)	mm
Display Mode	Normally Black / Transmissive	--
Pixel Arrangement	RGB-Vertical Stripe	--
Display Colors	16.7M	--
Color Gamut	69%(typ.)	--
Drive IC	ST7701S	--

3. External Dimensions

1. Display Type:TFT/NORMALLY/TRANSMISSIVE
2. Display Resolution:DOTS:480(R.G.B)*480
3. Viewing ANgle:ALL
4. Logic Voltage:2.8V   IC:ST7701S
5. Unspecified Tolerances:±0.2MM
6. Operation Temperature:-20℃~70℃
7. Storage Temperature:-30℃~80℃
8. Backlight Speciality:White LED Backlight(4 dies)
   IF=80mA VF=2.8V~3.2V
9. Remark:TFT LCD+COG IC+LBL+FPC
   LCD TRANSMISSION RATE:3.6%Min 4.0%Typ

26.90±0.5
BL 59.71±0.10
TFT 59.36±0.2
0.15±0.2
POL 55.91±0.2
0.35±0.2
53.28 A.A
1.45±0.2
7.13±0.3
1.76±0.3
15.50±0.1
BL 56.18±0.10
TFT 55.88±0.2
POL 55.48±0.2
53.28 A.A
0.15±0.2
1.39±0.2
1.55±0.2

2.1"
480*480
Free
点银浆

易撕贴

3.50±0.3
4.50±0.3

RoHS

0.30±0.05
P1+FPC

2.30±0.15

3.50±0.3
0.35
P0.5*(30-1)=14.50±0.5

接触高度0.4mm（注意避开）

YYYY/MM/DD

LED-A
LED-K

White LED Bacjlight(4 dies)
IF=80mA Vf=2.8V-3.2V

于都上晴電子有限公司
YU DU AMSON ELECTRONICS Co.,Ltd.

TITLE: OUTLINE DIMENSION		
DRAWN BY:		D/N:AM480480-021D
CHECKED BY:		Rev:A
APPROVED BY:	SCALE: 1 : 1	SHEET NO: 1 OF 1	UNIT: mm

SMK:	DESCRIPTION OF REVISION	REASON	REVISED BY	DATE
⚠	first issue	A	XG. SU	2023/06/12

PIN	SYMBOL
1	LED A
2	LED K
3	LED K
4	VCI 2.8V
5	IOVCC 1.8V
6	RESET 1.8V
7	TE
8	PWM
9	GND
10	GND
11	GND
12	DON
13	DOP
14	GND
15	D1P
16	D1N
17	GND
18	TCN
19	TCP
20	GND
21	NC
22	GND
23	NC
24	NC
25	GND
26	NC
27	NC
28	NC
29	NC
30	NC

4. Interface Description

PIN.NO	SYMBOL	I/O/P	FUNCTION
1	LED-A	P	POWER SUPPLY+ FOR BACKLIGHT ANODE
2	LED-K	P	POWER SUPPLY- FOR BACKLIGHT CATHODE
3	LED-K	P	POWER SUPPLY- FOR BACKLIGHT CATHODE
4	VCI	P	POWER SUPPLY（2.8V）
5	IOVCC(1.8)	P	I/O POWER SUPPLY（1.8V）
6	RESET	I/O	Reset Signal pin（1.8V）
7	TE	I/O	Serves TE (Tearing Effect) pin on MPU interface
8	PWM	P	The PWM frequency output for LCD driver control.
9	GND	P	Ground
10	D0P	I/O	MIPI-DSI Data differential signal input pins. (Data lane 0)
11	D0N	I/O	MIPI-DSI Data differential signal input pins. (Data lane 0)
12	GND	P	Ground
13	D1P	I/O	MIPI-DSI Data differential signal input pins. (Data lane 1)
14	D1N	I/O	MIPI-DSI Data differential signal input pins. (Data lane 1)
15	GND	P	Ground
16	CLKP	I/O	MIPI-DSI CLOCK differential signal input pin
17	CLKN	I/O	MIPI-DSI CLOCK differential signal input pin
18	GND	P	Ground
19	NC		NC
20	NC		NC
21	GND	P	Ground
22	NC		NC
23	NC		NC
24	GND	P	Ground
25	NC		NC
26	NC		NC
27	NC		NC
28	NC		NC
29	NC		NC
30	NC		NC

5. Absolute Maximum Ratings

Note 1   (Voltage Referenced to VSS)

Item	Symbol	Value		Unit	Condition
		Min.	Max.		
Digital Power Supply Voltage	VDD	VSS-0.3	5.0	V	
Interface Operation Voltage	VDDI	----	-----	V	
Gate driver high voltage	VGH	----	-----	V	
Gate driver low voltage	VGL	----	-----	V	
LED Reverse Voltage	VR	---	5.0	V	Each LED
LED Forward Current	IF	---	30	mA	Each LED

6. DC Characteristics

Item		Symbol	Min.	Typ.	Max.	Unit
Analog System Voltage		VDD	2.7	3.3	3.6	V
I/O System Voltage		IOVCC	1.65	1.8	3.3	--
Input Voltage for logic	H Level	VIH	0.7xVDD	-	VDD	V
	L Level	VIL	0	-	0.3xVDD	V
Power Supply current		IDD	-	-	(200)	mA
Gate driver high voltage		VGH	12	--	16	--
Gate driver low voltage		VGL	-13	--	-9	--
Input signal voltage		VCOM	0.5	--	2.5	--

7. Backlight Characteristic

The back-light system is an edge-lighting type with 4 white LEDs (Light Emitting Diode).

(Ta=25±2°C)

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
LED Voltage	VF	2.8	-	3.2	V	
LED Current	IF	-	80	-	mA	
Power Consumption	P_{BL}	-	-	-	mW	
DRIVE MODE	Constant current					

Note (1) Where I_F = 80MA, V_F = 2.8-3.2V, P_{BL} = $V_F \times I_F$

8. Optical Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods.

Measuring equipment: BM-7A

Item		Symbol	Condition	Min	Type	Max	Unit	Note
Brightness		B		300	320	--	cd/m^2	
Response time		T_r	$\theta=25°$	-	15	15	ms	.
		T_f		--	15	20	ms	
Contrast ratio		CR	At optimized viewing angle	800	1000	--	--	
Luminance Uniformity		ΔL		75	85		%	
Color Chromaticity (CIE 1931)	White	Wx	$\theta=0°$ Normal Viewing Angle	0.247	0.262	0.347	--	BM-7A
		Wy		0.260	0.281	0.360		
Viewing Angle (6H)	Hor.	θ_R	CR$\geq$10	80	85		Degree	
		θ_L		80	85			
	Ver.	θ_U		80	85			
		θ_D		80	85			

a. Test equipment setup

After stabilizing and leaving the panel alone shall be warmed up for the stable operation of LCM, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7(fast) with a viewing angle of 2° at a distance of 50cm and normal direction.

b. Definition of response time: Tr and Tf

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".
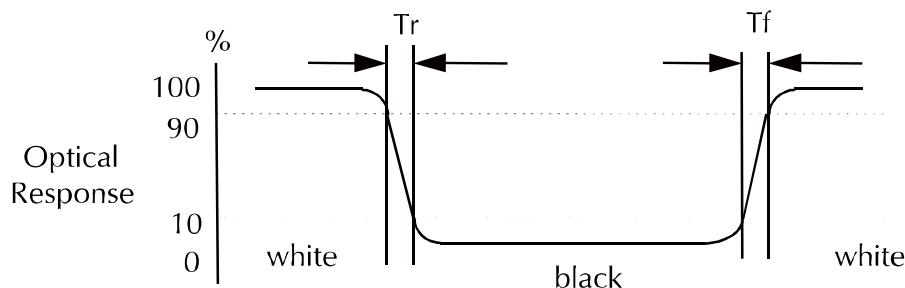
c. Definition of contrast ratio:

$$\text{Contrast Ratio (CR)} = \frac{\text{Brightness measured when LCD is at "white state"}}{\text{Brightness measured when LCD is at "black state"}}$$

d. Measured at the center area of the panel when all the input terminals of LCD panel are electrically
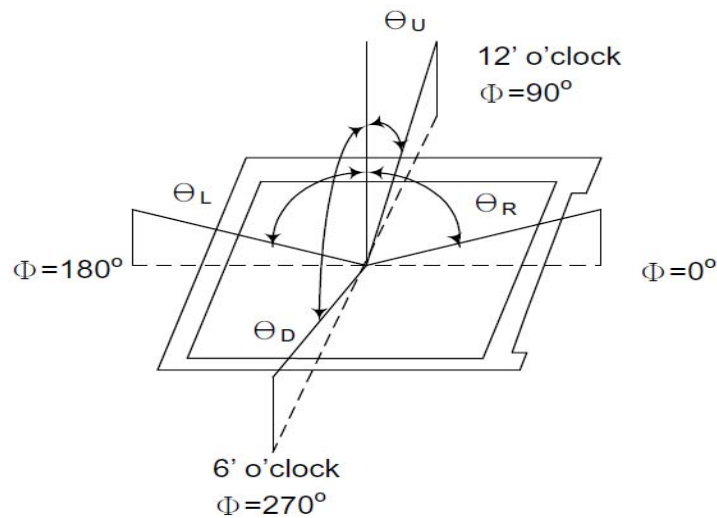
e. Definition of Luminance of White: Luminance of white at the center points

Light Source of Back-Light Unit	LED Type

f. Definition of White Uniformity

$$\text{White Uniformity} = \frac{\text{Min. luminance of white among 9-points}}{\text{Max. luminance of white among 9-points}} \times 100\%$$

g. The definition of Color Gamut -Color Chromaticity CIE 1931
   Color coordinate of white & red, green, blue at center point.
   Color Gamut : NTSC(%) = (RGB Triangle Area / NTSC Triangle Area) x 100
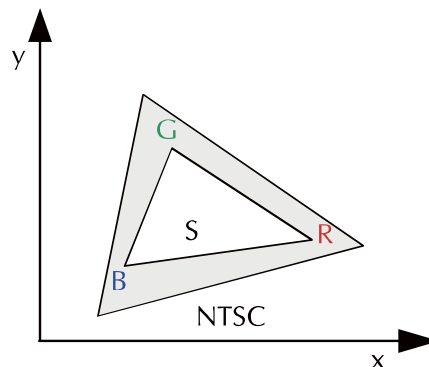
9. Power ON/OFF

VDDI and VDDA can be applied or powered down in any order. During the Power Off sequence, if the LCD is in the Sleep Out mode, VDDA and VDDI must be powered down with minimum 120msec. If the LCD is in the Sleep In mode, VDDA and VDDI can be powered down with minimum 0msec after the RESX is released.

CSX can be applied at any timing or can be permanently grounded. RESX has high priority over CSX.

Notes:

1. There will be no damage to the ST7701S if the power sequences are not met.

2. There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.

3. There will be no abnormal visible effects on the display between the end of Power On Sequence and before receiving the Sleep Out command, and also between receiving the Sleep In command and the Power Off Sequence.

4. If the RESX line is not steadily held by the host during the Power On Sequence as defined in Sections 9.1 and 9.2, then it will be necessary to apply the Hardware Reset (RESX) after the completion of the Host Power On Sequence to ensure correct operations. Otherwise, all the functions are not guaranteed.

The power on/off sequence is illustrated below
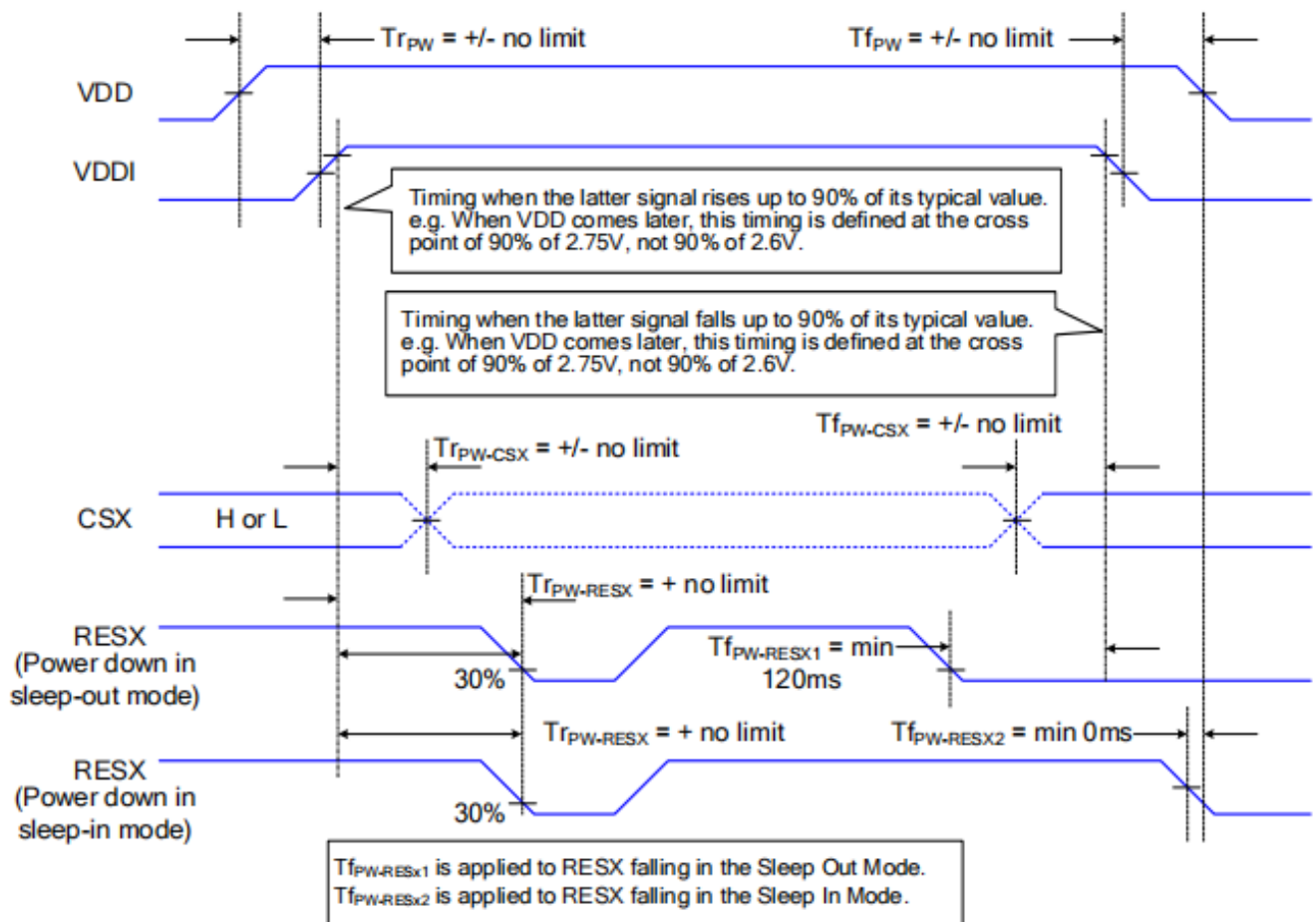
10. Reliability Test Conditions and Methods

No change on display and in operation under the following test condition.
Condition: Unless otherwise specified, tests will be conducted under the following condition.
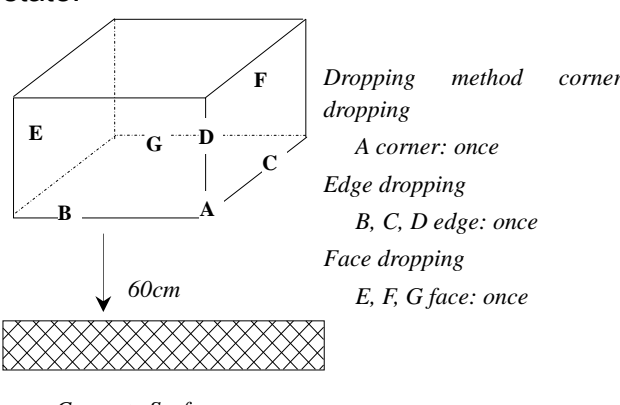
Temperature: 20±5°C   Humidity: 65±5%RH

Tests will be not conducted under functioning state.

No.	Parameter	Condition	Notes
1	High Temperature Operating	70°C±2°C, 48 hrs (Operation state)	--
2	Low Temperature Operating	-20°C±2°C, 48 hrs (Operation state)	--
3	High Temperature Storage	80°C±2°C, 48 hrs	--
4	Low Temperature Storage	-30°C±2°C, 48 hrs	--
5	High Temperature and High Humidity Operation Test	50°C±5°C, 90%, 48hrs	--
6	Vibration Test	Total fixed amplitude: 1.5mm Vibration Frequency: 10~55Hz One cycle 60 seconds to 3 direction of X, Y, Z each 15 minutes.	--

| 7. | Drop Test | To be measured after dropping from 60cm high on the concrete surface in packing state.

Dropping method corner dropping
A corner: once
Edge dropping
B, C, D edge: once
Face dropping
E, F, G face: once
Concrete Surface | -- |

Notes: 1. No dew condensation to be observed.
2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.
3. Vibration test will be conducted to the product itself without putting I in a container.

11.1 VISUAL & FUNCTION INSPECTION STANDARD
11.1.1 Inspection conditions
Inspection performed under the following conditions is recommended.
Temperature: 25±5℃
Humidity: 65%±10%RH
Viewing Angle: Normal viewing Angle.
Illumination: Single fluorescent lamp (300 to 700Lux)
Viewing distance: 30-50cm
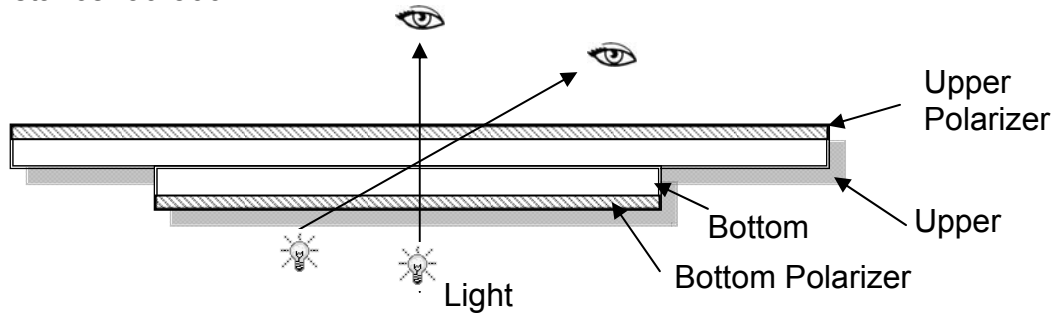
11.1.2 Definition
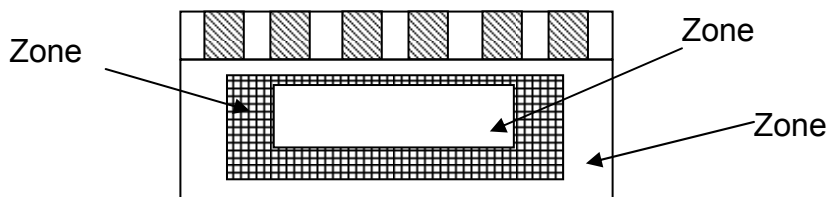
Zone A: Effective Viewing Area (Character or Digit can be seen)
Zone B: Viewing Area except Zone A
Zone C: Outside (Zone A + Zone B) which cannot be seen after assembly by customer.)
Note:
        As a general rule, visual defects in Zone C can be ignored when it doesn't affect product function
 or appearance after assembly by customer.

11.1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class Ⅱ
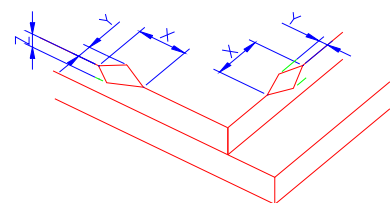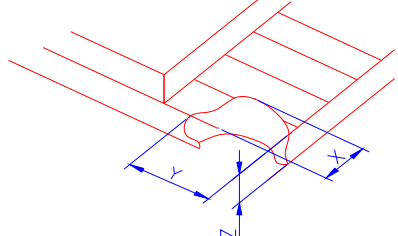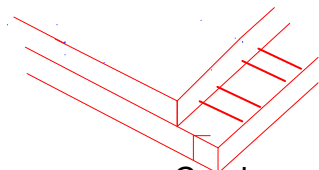
AQL:
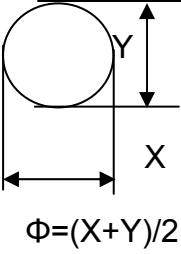
Major defect	Minor defect
0.65	1.5

LCD: Liquid Crystal Display, TP: Touch Panel , LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Soldering appearance	Good soldering , Peeling off is not allowed.	
6	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

11.1.4 Criteria (Visual)

Number	Items	Criteria(mm)
1.0 LCD Crack / Broken NOTE: X: Length Y: Width Z: Height L: Length of ITO, T: Height of LCD	(1) The edge of LCD broken	 <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></table>
	(2)LCD corner broken	 <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table>
	(3) LCD crack	Crack Not allowed

Number	Items	Criteria (mm)
2.0	Spot defect Φ=(X+Y)/2	① light dot（LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain） ②Dim spot（LCD/TP/Polarizer dim dot, light leakage、dark spot） ③ Polarizer accidented spot

① light dot（LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain）

Size (mm) \ Zone	Acceptable Qty		
	A	B	C
Φ≤0.10	Ignore		Ignore
0.10<Φ≤0.15	3(distance≧10mm)		
0.15<Φ≤0.2	1		
0.2<Φ	0		

②Dim spot（LCD/TP/Polarizer dim dot, light leakage、dark spot）

Size (mm) \ Zone	Acceptable Qty		
	A	B	C
Φ≤0.1	Ignore		Ignore
0.1<Φ≤0.2	2(distance≧10mm)		
0.2<Φ≤0.3	1		
Φ＞0.3	0		

③ Polarizer accidented spot

Size (mm) \ Zone	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.2<Φ≤0.5	2(distance≧10mm)		
Φ>0.5	0		

Line defect (LCD/TP /Polarizer black/white line, scratch, stain)

Width(mm)	Length(mm)	Acceptable Qty		
		A	B	C
Φ≤0.03	Ignore	Ignore		Ignore
0.03<W≤0.05	L≤3.0	N≤2		
0.05<W≤0.08	L≤2.0	N≤2		
0.08<W	Define as spot defect			

		Size (mm) \ Zone	Acceptable Qty		
			A	B	C
3.0	Polarizer Bubble	Φ≤0.2	Ignore		Ignore
		0.2<Φ≤0.4	2(distance≧10mm)		
		0.4<Φ≤0.6	1		
		0.6<Φ	0		
4.0	SMT	According to IPC-A-610C class Ⅱ standard . Function defect and missing part are major defect ,the others are minor defect.			

12. Handling Precautions
12.1 Mounting method

The LCD panel of AMSON 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.

12.2 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.

12.3 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.

12.4 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

12.5 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.

12.6 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

12.7 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

13. Precaution for Use

13.1

A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

13.2

On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- When a question is arisen in this specification
- When a new problem is arisen which is not specified in this specifications
- When an inspection specifications change or operating condition change in customer is reported to AMSON TFT , and some problem is arisen in this specification due to the change
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

14. Packing Method

TBD.