Specification for Approval

Customer:_____

Model Name:_____

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

Revision Record

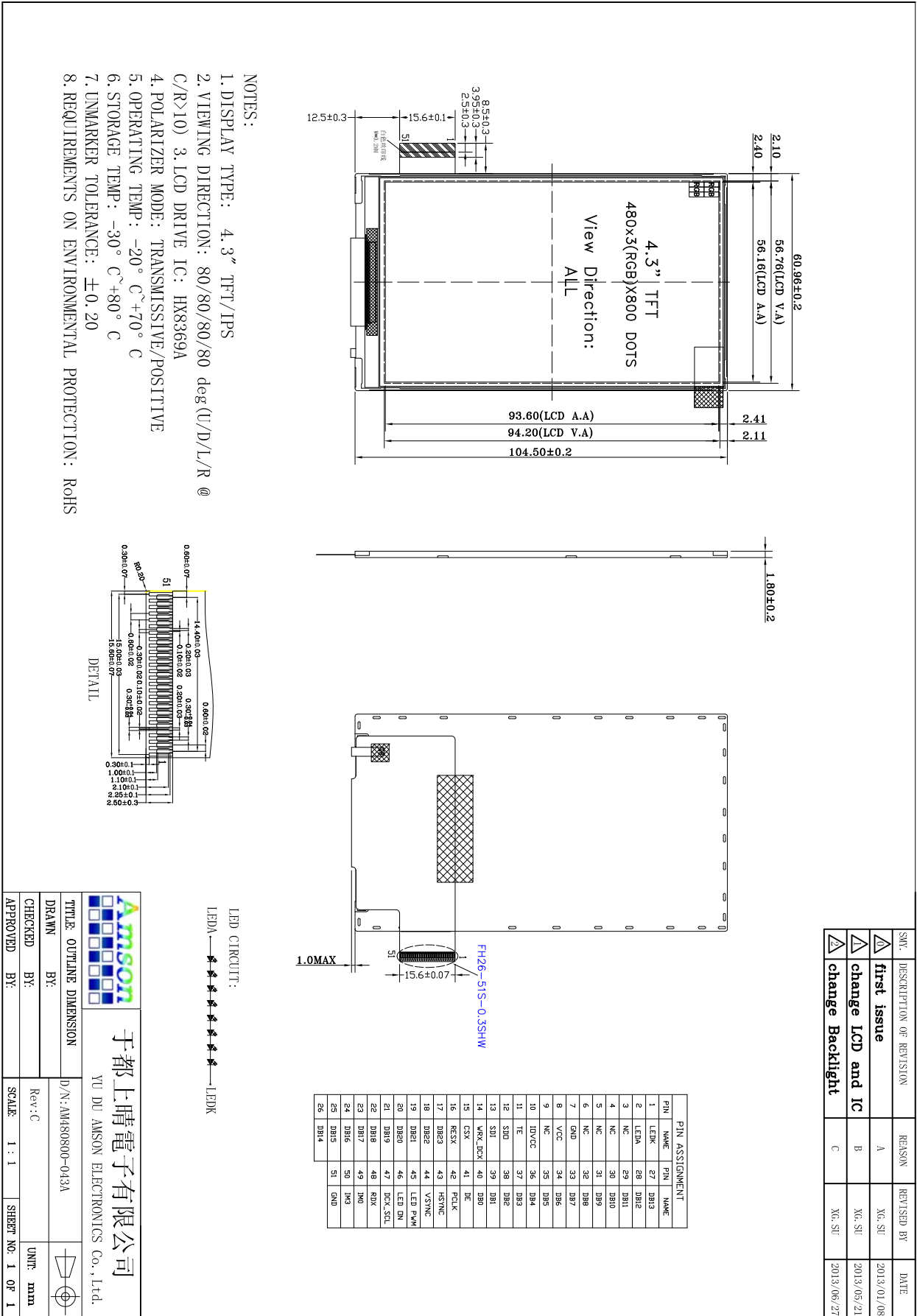| REV NO.	REV DATE	CONTENTS	Note
A	2013-01-08	NEW ISSUE	
B	2013-05-21	Change LCD and IC	
C	2013-08-29	Change Backlight	

Table of Contents

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	STANDARD VALUES	UNITS
LCD type	4.3"TFT	--
Dot arrangement	480(RGB)×800	dots
Color filter array	RGB vertical stripe	--
Display mode	IPS / Transmission / Normally Black	--
Viewing Direction	80/80/80/80 deg(U/D/L/R @ C/R>10)	--
Driver IC	HX8369A	--
Module size	60.96(W)×104.50(H)×1.8(T)	mm
Active area	56.16(W)×93.6(H)	mm
Dot pitch	0.117(W)×0.117(H)	mm
Interface	8-/ 9-bit i80-series system interface 3-Wire SPI + 16-/18-/24-bit RGB interface	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Back Light	8 White LED In Serial	--
Weight	TBD	g

3. External Dimensions

NOTES:
1. DISPLAY TYPE: 4.3" TFT/IPS
2. VIEWING DIRECTION: 80/80/80/80 deg(U/D/L/R @ C/R>10) 3. LCD DRIVE IC: HX8369A
4. POLARIZER MODE: TRANSMISSIVE/POSITIVE
5. OPERATING TEMP: -20°C~+70°C
6. STORAGE TEMP: -30°C~+80°C
7. UNMARKER TOLERANCE: ±0.20
8. REQUIREMENTS ON ENVIRONMENTAL PROTECTION: RoHS

4.3" TFT
480×3(RGB)X800 DOTS
View Direction:
ALL

PIN ASSIGNMENT

PIN	NAME	PIN	NAME
1	LEDK	27	DB13
2	LEDA	28	DB12
3	NC	29	DB11
4	NC	30	DB10
5	NC	31	DB9
6	NC	32	DB8
7	GND	33	DB7
8	VCC	34	DB6
9	NC	35	DB5
10	IDVCC	36	DB4
11	TE	37	DB3
12	SDO	38	DB2
13	SDI	39	DB1
14	WRX_DCX	40	DB0
15	CSX	41	DE
16	RESX	42	PCLK
17	RDX	43	HSYNC
18	DB23	44	VSYNC
19	DB21	45	LED PWM
20	DB20	46	LED DN
21	DB19	47	DCX_SCL
22	DB18	48	RDX
23	DB17	49	IM0
24	DB16	50	IM3
25	DB15	51	GND
26	DB14		

LED CIRCUIT:
LEDA————LEDK

DETAIL

TITLE: OUTLINE DIMENSION
DRAWN BY:
CHECKED BY:
APPROVED BY:
D/N:AM480800-043A
Rev:C
SCALE: 1:1
SHEET NO. 1 OF 1
UNIT: mm

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

4. Interface Description

Pin	Symbol	Description.
1	LEDK	LED backlight (Cathode).
2	LEDA	LED backlight (Anode).
3	NC	No connection.
4	NC	No connection.
5	NC	No connection.
6	NC	No connection.
7	GND	Power ground
8	VCC	Analog supply voltage to the analog circuit.
9	NC	No connection.
10	IOVCC	Logic supply voltage to the logic circuit.
11	TE	Tearing effect output pin to synchronize MCU to frame writing.
12	SDO	Serial output signal in SPI I/F.
13	SDI	Serial input signal in SPI I/F.
14	WRX_DCX	Writes strobe signal to write data when WRX is "Low" in MPU I/F. Date/Command Selection pin in 4-wire SPI I/F.
15	CSX	Chip select input pin ("Low" enable) in MPU I/F and SPI I/F.
16	RESX	Reset input pin, Active "L".
17	DB23	24-bit parallel bi-directional data bus for MPU system: 8-bit I/F: DB[7:0] is used. 16-bit I/F: DB[15:0] and DB[8:1] is used. 24-bit I/F: DB[23:0] is used. 24-bit input data bus for RGB I/F. 16-bit/pixel: DB[20:16]=R[4:0], DB[13:8]=G[5:0] and DB[5:1]=B[4:0]; 18-bit/pixel: DB[21:16]=R[5:0], DB[13:8]=G[5:0] and DB[5:0]=B[5:0]; 24-bit/pixel: DB[23:16]=R[7:0], DB[15:8]=G[7:0] and DB[7:0]=B[7:0]. Connect unused pins to GND.
18	DB22	
19	DB21	
20	DB20	
21	DB19	
22	DB18	
23	DB17	
24	DB16	
25	DB15	
26	DB14	
27	DB13	
28	DB12	
29	DB11	
30	DB10	
31	DB09	
32	DB08	
33	DB06	
34	DB07	
35	DB05	
36	DB04	
37	DB03	
38	DB02	
39	DB01	
40	DB00	

41	DE	Data enable signal in RGB I/F mode
42	PCLK	Pixel clock signal in RGB I/F.
43	HSYNC	Horizontal sync signal in RGB I/F.
44	VSYNC	Vertical sync signal in RGB I/F.
45	LEDPWM	Connect to the external LED driver. If not used, please open this pin.
46	LEDON	Connect to the external LED driver. If not used, please open this pin.
47	DCX_SCL	Display data / command selection in 80-series MPU I/F. A synchronous clock signal in SPI I/F.
48	RDX	Reads strobe signal to write data when RD is "Low" in MPU interface.
49	IM0	System interface Mode IM[3] IM[0]=00, i80-system 8-bit MPU interface : DB[7:0] is used.
50	IM3	IM[3] IM[0]=01, i80-system 9-bit MPU interface : DB[9:0] is used. IM[3] IM[0]=11, 3-wire SPI + RGB interface
51	GND	Power ground

5. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Logic Supply Voltage	IOVCC	-0.3	5.5	V
Analog Supply Voltage	VCC	-0.3	3.6	V
Input Voltage	Vin	-0.3	IOVCC+0.3	V
Operating Temperature	T_{OP}	-20	70	°C
Storage Temperature	T_{ST}	-30	80	°C
Storage Humidity	HD	20	90	%RH

6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Logic Supply Voltage	IOVCC	1.65	1.8/2.8	3.3	V	-
Analog Supply Voltage	VCC	2.3	2.8	3.3	V	-
Input High Voltage	V_{IH}	0.7IOVCC	-	IOVCC	V	Digital input pins
Input Low Voltage	V_{IL}	-0.3	-	0.3IOVCC	V	Digital input pins
Output High Voltage	V_{OH}	0.8IOVCC	-	IOVCC	V	Digital output pins
Output Low Voltage	V_{OL}	0	-	0.2IOVCC	V	Digital output pins
I/O Leak Current	I_{LI}	-1.0	-	1.0	mA	-

7. Timing Characteristics
7.1 Reset Timing Characteristics
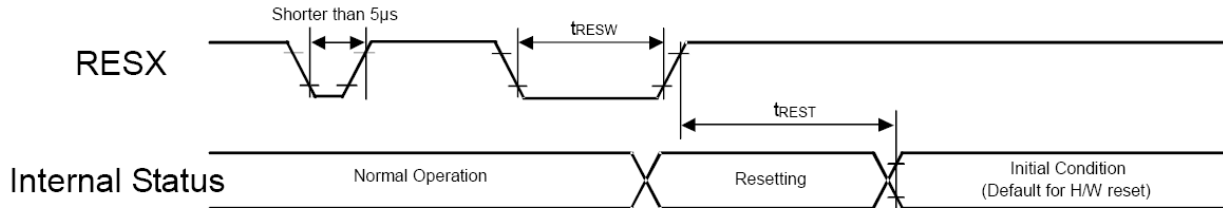
Symbol	Parameter	Related pins	Min.	Typ.	Max.	Note	Unit
t_{RESW}	Reset low pulse width[1]	RESX	10	-	-	-	μs
t_{REST}	Reset complete time[2]	-	5	-	-	When reset is applied during Sleep In mode	ms
		-	120	-	-	When reset is applied during Sleep Out mode	ms

7.2 i80-System Interface Timing Characteristics
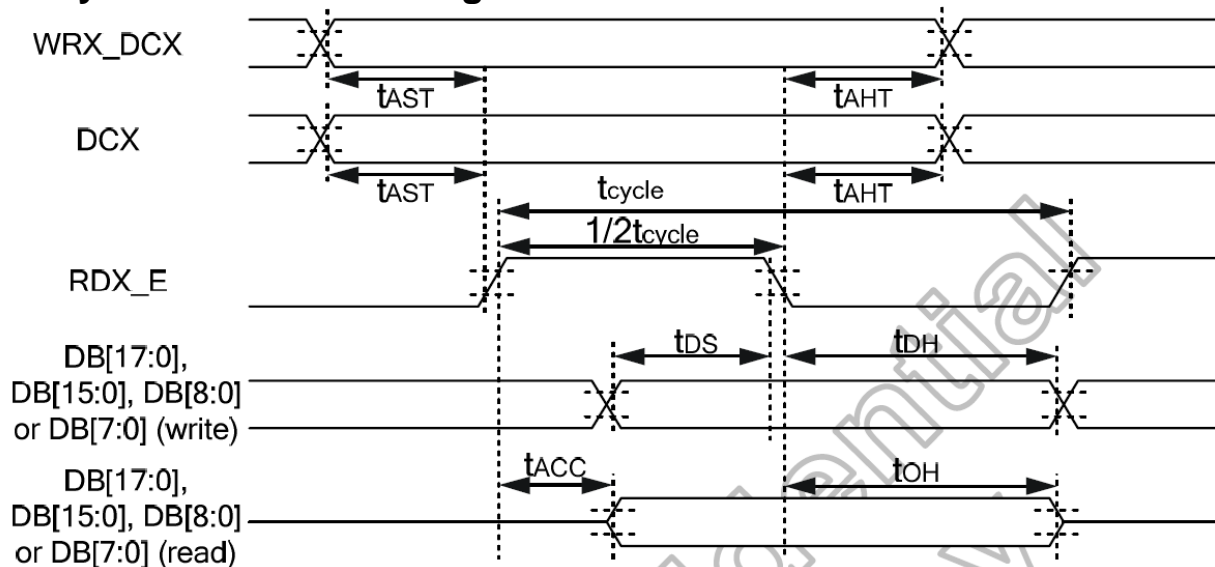
Signal	Symbol	Parameter	Min.	Max.	Unit	Description
WRX_DCX or DCX_SCL	t_{AST} t_{AHT}	Address setup time Address hold time (Write/Read)	10 10	- -	ns	-
CSX or RDX_E	t_{cycle}	System clock cycle time read register	100	790	ns	-
		Read GRAM	350	790	ns	-
		Write register	100	790	ns	-
		Write GRAM @ SLPOUT	33	790	ns	-
		Write GRAM @ SLPIN	100	790	ns	-
DB23-DB0	t_{DS} t_{DH} t_{ACC} t_{OH}	Data setup time Data hold time Read access time Output disable time	15 25 10 10	- - - -	ns	For maximum CL=30pF For minimum CL=8pF

7.3 Display Serial Interface Timing Characteristics (3-line SPI system)
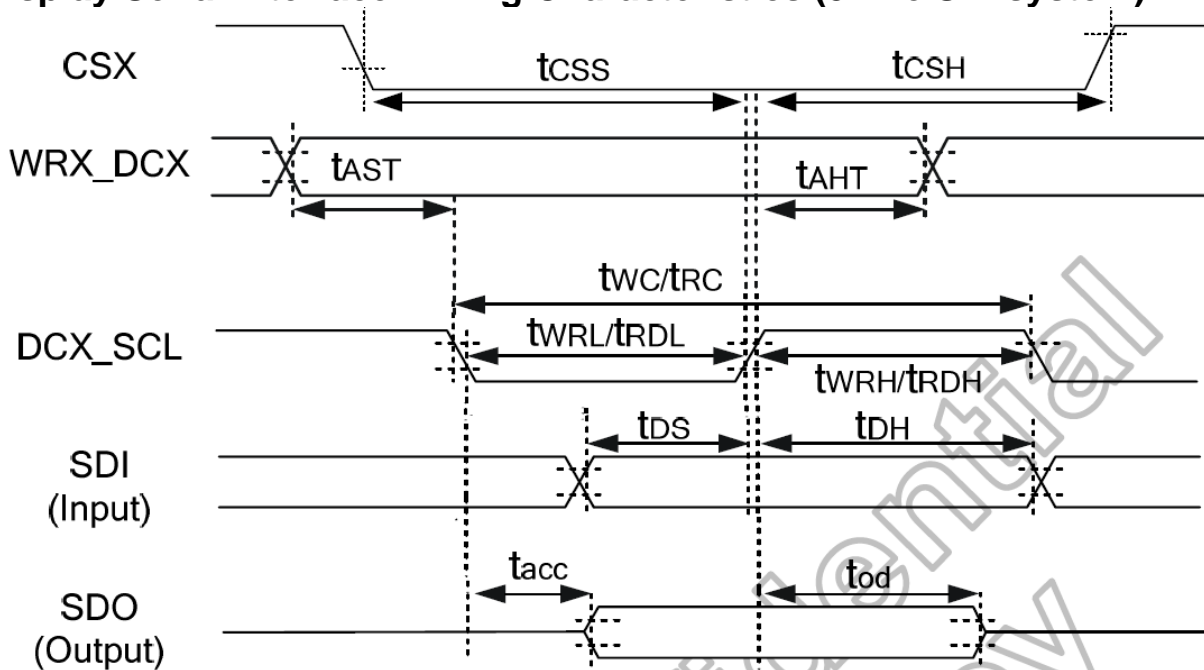
Signal	Symbol	Parameter	Min.	Max.	Unit	Description
CSX	t_{CSS}	Chip select setup time (Write)	40	-	ns	-
	t_{CSH}	Chip select setup time (Read)	40	-		
WRX_DCX	t_{AST}	Address setup time	10	-	ns	-
	t_{AHT}	Address hold time (Write/Read)	10	-		
DCX_SCL (Write)	t_{WC}	Write cycle	100	-	ns	-
	t_{WRH}	Control pulse "H" duration	40	-		
	t_{WRL}	Control pulse "L" duration	40	-		
DCX_SCL (Read)	t_{RC}	Read cycle	150	-	ns	-
	t_{RDH}	Control pulse "H" duration	60	-		
	t_{RDL}	Control pulse "L" duration	60	-		
SDI/SDO (Input)	t_{DS}	Data setup time	30	-	ns	For maximum C_L=30pF For minimum C_L=8pF
	t_{DT}	Data hold time	30	-		
SDI/SDO (Output)	t_{RACC}	Read access time	10	-	ns	
	t_{OD}	Output disable time	10	50		

7.4 Parallel 24/18/16-bit RGB Interface Timing Characteristics
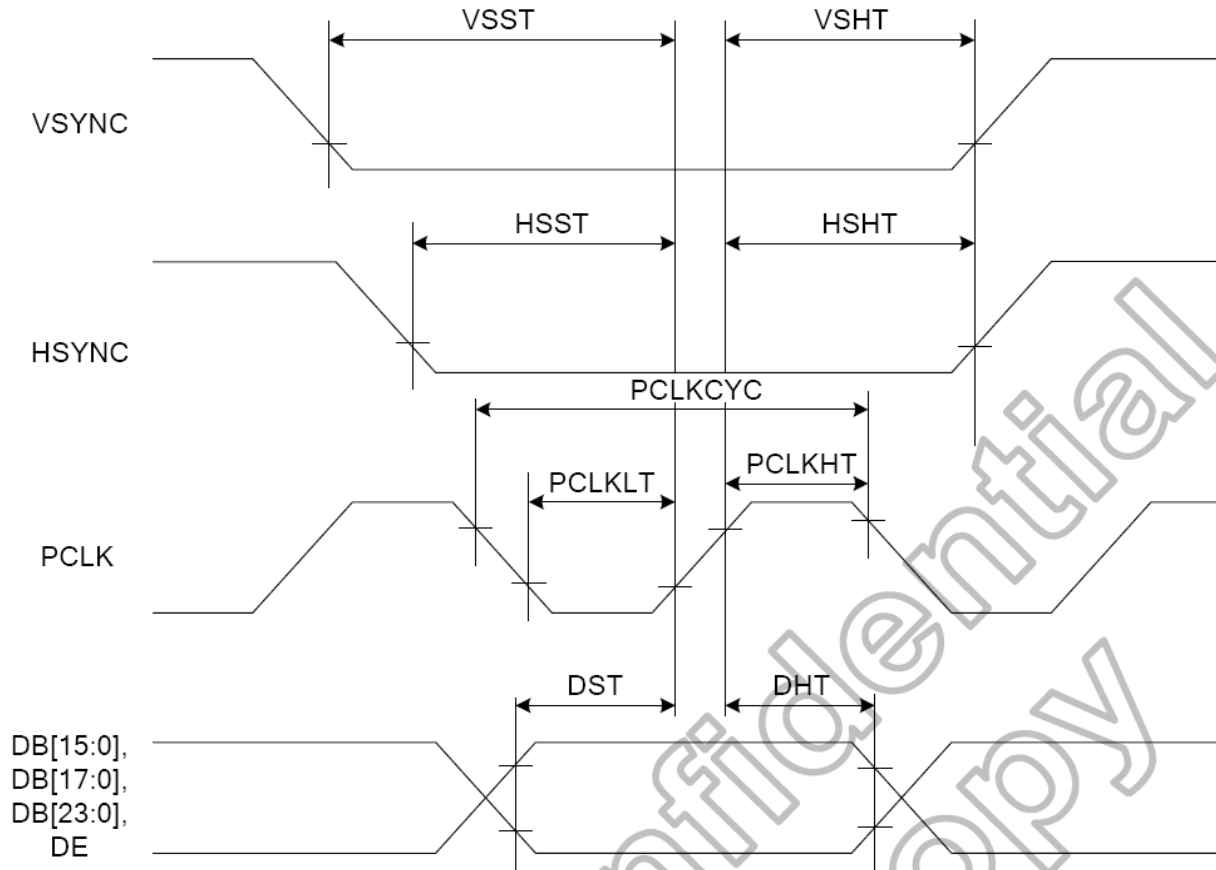
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical sync. setup time	VSST	-	5	-	-	ns
Vertical sync. hold time	VSHT	-	5	-	-	ns
Horizontal sync. setup time	HSST	-	5	-	-	ns
Horizontal sync. hold time	HSHT	-	5	-	-	ns
Pixel clock cycle when RGB I/F is running	PCLKCYC	$VRR^{(5)}$ = Min . 50 Hz Max. 70 Hz	$31^{(3)}$	-	$49.2^{(4)}$	ns
Pixel clock low time	PCLKLT	-	5	-	-	ns
Pixel clock high time	PCLKHT	-	5	-	-	ns
Data setup time DB[23:0]	DST	-	5	-	-	ns
Data hold time DB[23:0]	DHT	-	5	-	-	ns

8. Backlight Characteristics

LED CIRCUIT:

LEDA —▷◁ ▷◁ ▷◁ ▷◁ ▷◁ ▷◁ ▷◁— LEDK

Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	23.2	25.6	28.0	V	If=20mA
Supply Current	If	--	20	30	mA	--
Luminous Intensity for LCM	--	250	300	--	Cd/m^2	If=20mA
Uniformity for LCM	--	80	--	--	%	If=20mA
Life Time	--	50000	--	--	Hr	If=20mA
Backlight Color	White					

9. Optical Characteristics

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 Φ and θ equal to 0°. Measurement condition: Refer to next pages (LED back light with 20 mA/1 ea)

*1): with LGD Polarizer;

*2): Only Color Filter glass

Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
*1) Threshold Voltage	Vsat	3.65	3.9	4.15	V	Fig.2
	Vth	1.8	2.0	2.2	V	
*1) Transmittance	T(%)	3.7	4.1	-	%	Fig.1
*1) Contrast Ratio	C/R	650	800	-		
*1) Response Time	Tr+Tf	-	35	45	msec	Fig.3
*2) CIE Color Coordinate	Rx	0.640	0.660	0.680		
	Ry	0.297	0.317	0.337		
	Gx	0.240	0.260	0.280		
	Gy	0.555	0.575	0.595		
	Bx	0.121	0.141	0.161		
	By	0.055	0.075	0.095		
	Wx	0.275	0.295	0.315		
	Wy	0.297	0.317	0.337		
*1) Viewing Angle	Θl	70	80	-	Degree	C/R>10 Fig.4
	Θr	70	80	-		
	Θu	70	80	-		
	Θd	70	80	-		

Notes:

1. Contrast Ratio (CR) is defined mathematically as:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

2. Surface luminance is the center point across the TFT-LCD surface 500mm from the surface with all pixels displaying white. For more information see FIG 1.

3. Response time is the time required for the display to transition from white to black (Rise Time, Tr) and from black to white (Falling Time, Tf). For additional information see FIG 3.

4. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the TFT-LCD surface. For more information see FIG 5.

5. Optimum contrast is obtained by adjusting the TFT-LCD threshold voltage (Vth & Vsat).

FIG. 1 Optical Characteristic Measurement Equipment and Method

[Test Equipment Set Up]

Optical Stage(x,y)

LCD Module

Photo   ; Pritchard 880 for Luminance

Field = 1 °

Center

500mm
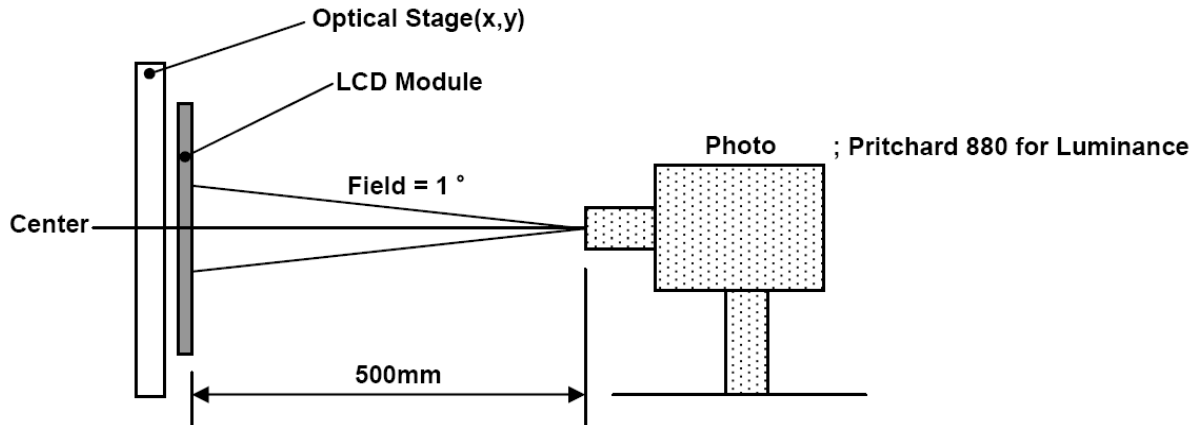
Measuring Condition;
-Measuring surroundings: Darkroom
-Measuring temperature: Ta=25℃
-Adjust operating voltage to get optimum contrast at the center of the display.
-Measured value at the center point of LCD panel after more than 30 minutes while backlight turning on.

FIG. 2 The definition of Vth and Vsat

100%
90%

Transmittance

50%

10%
0%

Vth   Vsat   Voltage
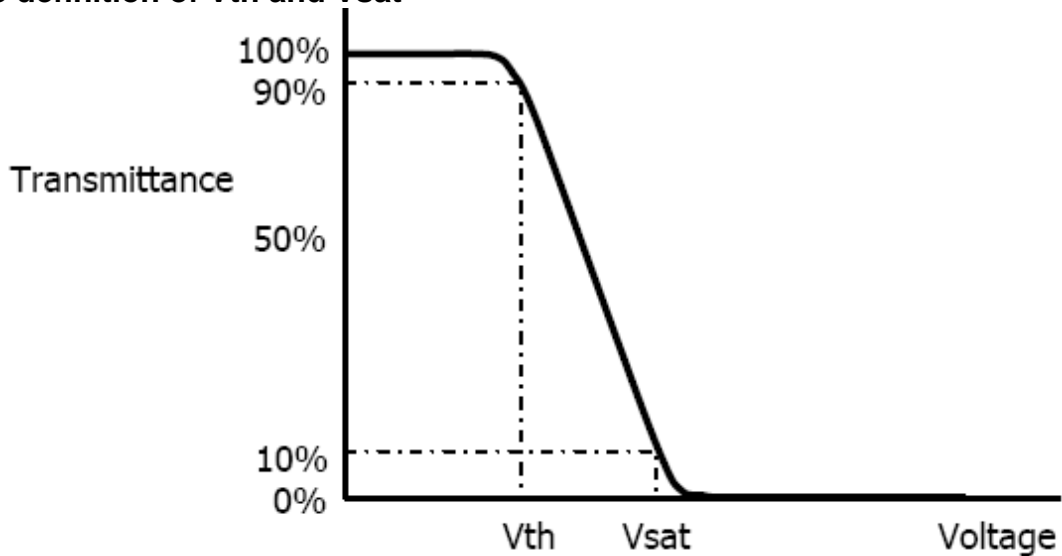
FIG. 3 The definition of Response Time
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".
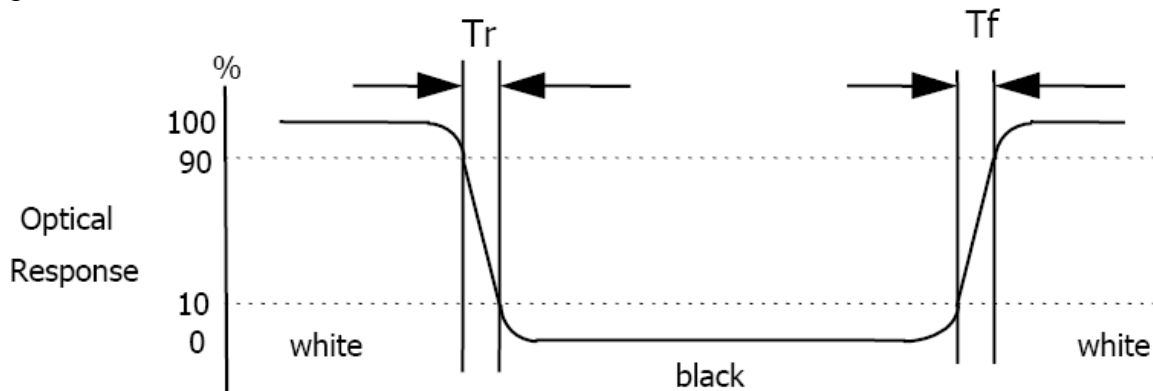
* Voltage conditions for Response time
  Vgate : 20V DC
  Vdata : 0V~5V DC
  Vcom : 0V (Ground)

FIG. 4 The definition of viewing angle: <dimension of viewing angle range>
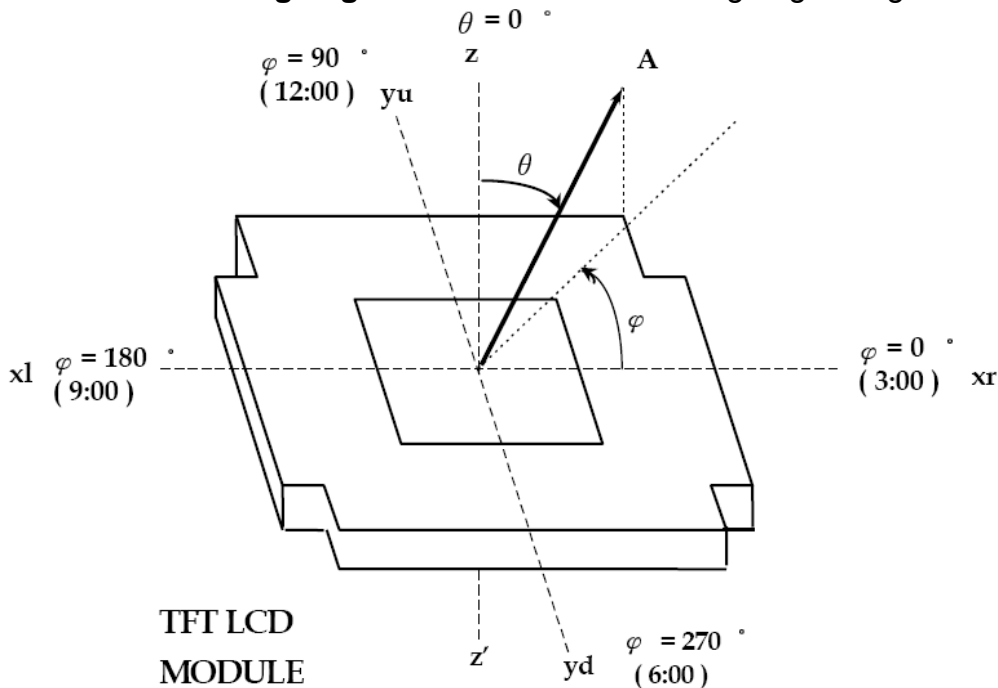
FIG. 5 Response Time Measurement Equipment and Method
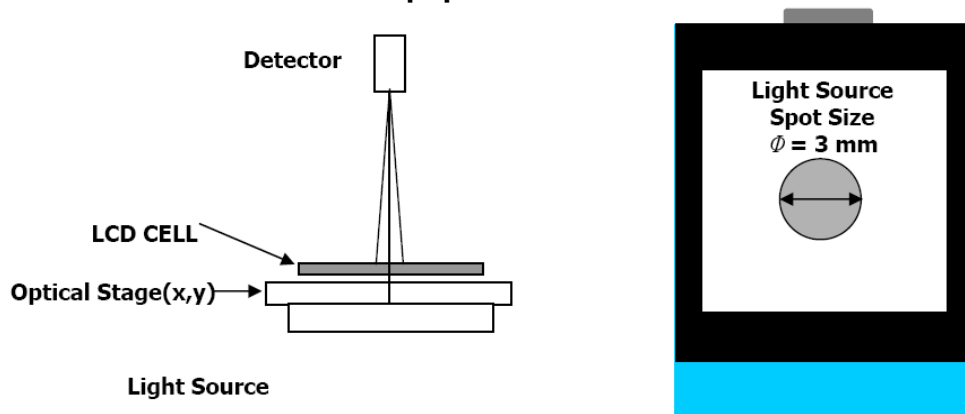
10. Reliability Test Conditions and Methods

NO.	TEST ITEMS	TEST CONDITION	INSPECTION AFTER TEST
	High Temperature Storage	80°C±2°C×200Hours	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.
	Low Temperature Storage	-30°C±2°C×200Hours	
	High Temperature Operating	70°C±2°C×120Hours	
	Low Temperature Operating	-20°C±2°C×120Hours	
	Temperature Cycle(Storage)	-20°C ⟷ 25°C ⟷ 70°C (30min) (5min) (30min) 1cycle Total 10cycle	
	Damp Proof Test (Storage)	50°C±5°C×90%RH×120Hours	
	Vibration Test	Frequency:10Hz~55Hz~10Hz Amplitude:1.5M X,Y,Z direction for total 3hours (Packing Condition)	
	Drooping Test	Drop to the ground from 1M height one time every side of carton. (Packing Condition)	
	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.

11. Inspection Standard

This standard apply to C-STN/TFT module

1. **Spot check plan：**

   According to spot check level Ⅱ,MIL-STD-105D Level Ⅱ,the rank of accept or reject is below:

   3A、2A : major non-conformance : AQL 0.25 minor non-conformance : AQL 0.4

   1A : major non-conformance :　AQL 0.65　　　minor non-conformance :　AQL 1.

2. **Inspection condition：**
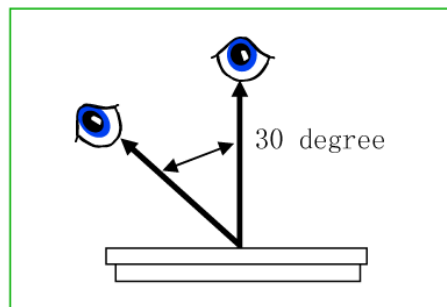
   30 degree

   Under daylight lamp 20～40W，product distance inspector 'eye 30cm,incline degree 30°。

3. **LCD area define：**

   A　B C
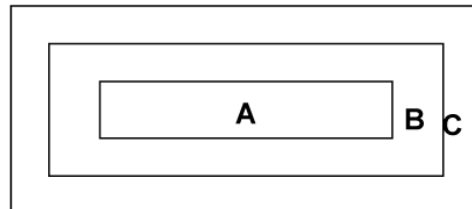
   Area A：display area

   Area B：VA area

   Area C：out of VA area, not in sight after assembly
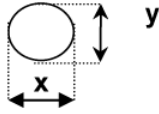
   Remark: non-conformance at area C, but is OK that isn't influence reliability of product & assembly by customer.
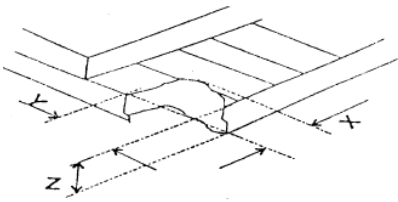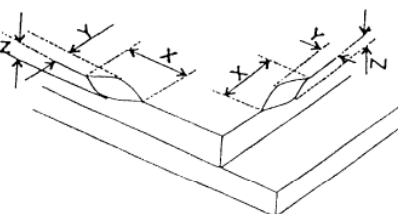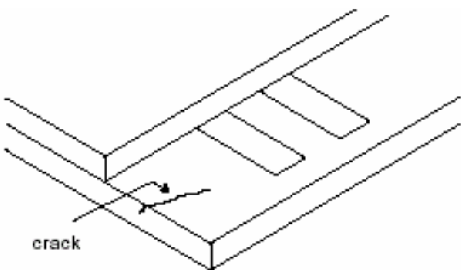
4. Inspection standard

4.1 Major non-conformance

NO.	Item	Inspection standard	Rate
4.1.1	Function non-conformance	1) No display, display abnormally 2) Miss line, short 3) B/L no function or function abnormally 4) TP no function	major
4.1.2	miss	No matter miss what component	
4.1.3	Out of size	Module dimension out of spec	

4.2 Appearance non-conformance

NO.	Item	Inspection standard	Rate
4.2.1	Black or white spot （power on）	dot non-conformance define Φ $$\Phi = \frac{+y)}{2} \quad x \quad ($$ **A grade**	Minor

area size（mm）	Most approve q'ty		
	A	B	C
Φ≤0.10	ignore		ignore
0.10＜Φ≤0.15	4		
0.15＜Φ≤0.20	2		ignore
0.20＜Φ≤0.25	1		
0.25＜Φ	0		

Most approve 4 damages, dot to dot ≥10mm

NO.	Item	Inspection standard	Rate
4.2.2	Black or white line （power on）	**A grade**	Minor

Size(mm)		Most approve q'ty		
L(length）	W(width)	A	B	C
ignore	W≤0.03	ignore		ignore
L≤5.0	0.03＜W≤0.05	3		
L≤3.0	0.05＜W≤0.07	2		
	0.07＜W	Treat with dot non-conformance		

Most approve 3 damages, line to line ≥10mm

4.2.3	Polarizer position	1) Polarizer attach meet drawing, disallow out of LCD. 2) Polarizer must cover display area（special require unless）	Minor
4.2.4	LCD non-conform ance	(i) crash at side（remark: S=ITO length） | X	Y	Z
---	---	---
≤3.0	≤S	ignore | **Crash disallow extend to ITO or seal.** (ii) commonly surface scathe | X	Y	Z
---	---	---
≤2.0	<frame edge	ignore | (iii) crack Disallow extend crack crack	Minor
4.2.5	Contrast voltage warp	VOP/Vlcd voltage of confirmed sample±0.15V	Minor
4.2.6	color	Color & luminance of module scope reference spec	Minor
4.2.7	Cross talk	Reference confirmed limit sample	Minor

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 sili8con 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 VDD or GND, 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 this is not specified in this specification.
- 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