

# Specification for Approval

Customer: \_\_\_\_\_

Model Name: \_\_\_\_\_

Supplier Approval			Customer approval
R&D Designed	R&D Approved	QC Approved	
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## Revision Record

REV NO.	REV DATE	CONTENTS	Note
A	2021-12-14	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	STANDARD VALUES	UNITS
LCD type	10.1" TFT	--
Dot arrangement	1024×3 (RGB)×600	dots
Color filter array	RGB vertical stripe	--
Display mode	Normally White	--
Viewing Direction	6 O' Clock	--
Module size	235.0(W)×143.0(H)×11.7(T)	mm
Active area	222.72(W)×125.28(H)	mm
Dot pitch	0.2175(W)×0.2088(H)	mm
Interface	LVDS Interface	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Surface treatment	Anti-glare	



## 4. Interface Description

### CN1: FI-X30SSLA-HF (equivalent JAEFI-XB30SSRI-HF16)

Pin No.	Symbol	Description	Note
1	GND	Ground	
2	VDD	3.3V Power	
3	VDD	3.3V Power	
4	V_EDID	3.3V Power for EDID	
5	NC	No connection	
6	CLK_EDID	EDID Clock Input	
7	DATA_EDID	EDID Data Input	
8	RXIN0-	LVDS Signal- channel0-	
9	RXIN0+	LVDS Signal+ channel0+	
10	GND	Ground	
11	RXIN1-	Data Input channel1-	
12	RXIN1+	Data Input channel1+	
13	GND	Ground	
14	RXIN2-	Data Input channel2-	
15	RXIN2+	Data Input channel2+	
16	GND	Ground	
17	RXCLKIN-	Data Input CLK-	
18	RXCLKIN+	Data Input CLK+	
19	GND	Ground	
20	NC	No connection	
21	NC	No connection	
22	GND	Ground	
23	GND	Ground	
24	NC	No connection	

25	NC	No connection	
26	NC	No connection	
27	NC	No connection	
28	NC	No connection	
29	NC	No connection	
30	NC	No connection	

**CN2 (LED backlight): BNSR-02VS-1(JST or equivalent)**

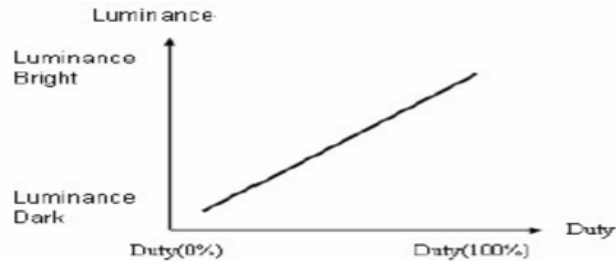
Pin No.	Symbol	Description	Note
1	A	Anode for LED backlight(+19.2V,140mA)	
2	K	Cathode for LED backlight	

**CN2 (LED Driver Board): PH2.04P (Kingfont or equivalent)**

Pin No.	Symbol	Description	Note
1	VIN	Voltage for LED circuit(+5V)	
2	LED_EN	LED BLU ON/OFF	
3	GND	Power ground	
4	PWM	Adjust the LED brightness by PWM	

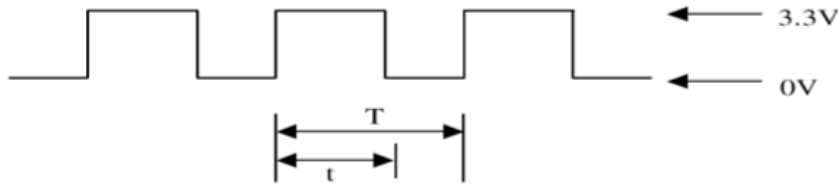
[Note]

(1) ADJ can adjust brightness to control Pin. Pulse duty the bigger the brighter.



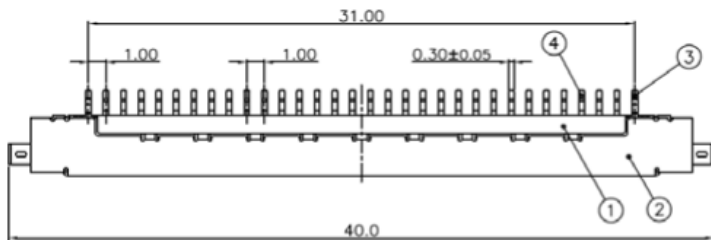
(2) ADJ Signal=0~3.3V · Operation Frequency :

Dimming Range		
PWM Frequency (F)	Duty Cycle (Min.)	Duty Cycle (Max.)
100Hz < F < 500Hz	5%	100%
500Hz < F < 20KHz	10%	100%

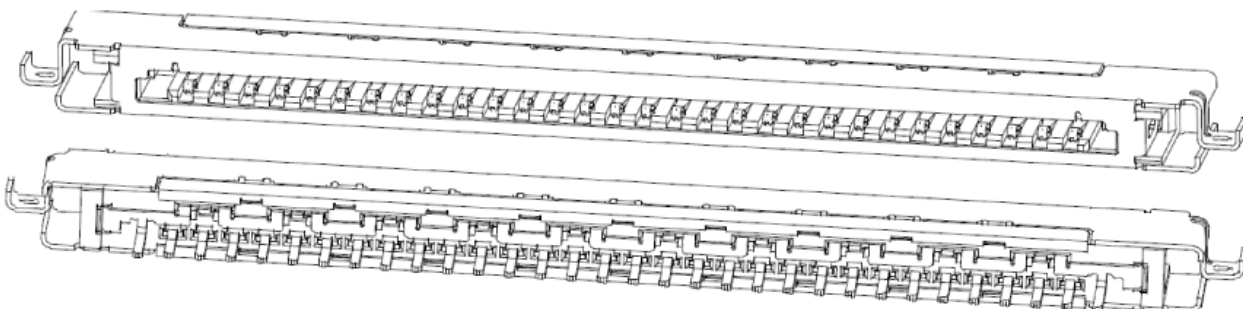
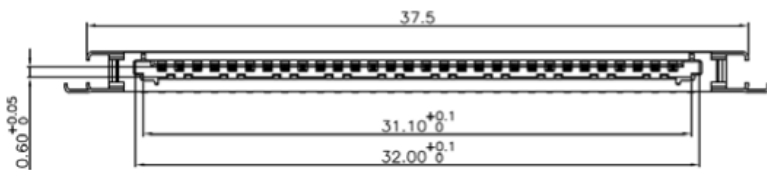


$$\text{Duty Cycle} = t / T * 100\%$$

(3) LVDS Connector : FI-X30SSLA-HF



- NOTES:
- INSULATOR:THERMOPLASTIC;COLOR:BEIGE
  - CONTACT:COPPER ALLOY t=0.15mm  
PLATING:CONTACT AREA 5u?GOLD,  
SOLDER AREA 80~120u" TIN (LEAD FREE),  
OVERALL WITH 50u?NICKEL UNDER PLATED.
  - SHELL: STAINLESS t=0.15mm  
PLATING:SOLDER AREA PLATED WITH GOLD FLASH
  - GROUND: COPPER ALLOY t=0.15mm  
PLATING:TIN(LEAD FREE).
- ELECTRICAL:
- VOLTAGE RATING:200V AC(RMS)/DC
  - CURRENT RATING:1A AC(RMS)/DC
  - CONTACT RESISTANCE:40mΩ Max.
  - INSULATION RESISTANCE:100MΩ Min.
  - DIELECTRIC WITHSTANDING VOLTAGE:500V AC(RMS)
  - OPERTING TEMPERATURE:-40°C~+80°C





## 5. Absolute Maximum Ratings

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit.

Item	Symbol	Values		UNIT	Note
		Min.	Max.		
LED Power Supply Voltage	V <sub>LED</sub>	-0.3	15.0	V	GND=0
Logic Supply Voltage	V <sub>DD</sub>	-0.3	5.0	V	
Operating Temperature	T <sub>OPA</sub>	-20	70	°C	
Storage Temperature	T <sub>STG</sub>	-30	80	°C	

## 6. DC Characteristics

### 6.1 TFT LCD Modules

Item	Symbol	Values			UNIT	Note
		Min.	Typ.	Max.		
Power voltage	VDD	3.0	3.3	3.6	V	Note 1
Current of power supply	IDD	-	0.3	-	A	VDD=3.3V Black pattern
Power voltage for LED driver	VLED	4.5	5	5.5	V	
LED driver current of power supply	ILED	-	365		mA	VLED=5V ADJ=100%

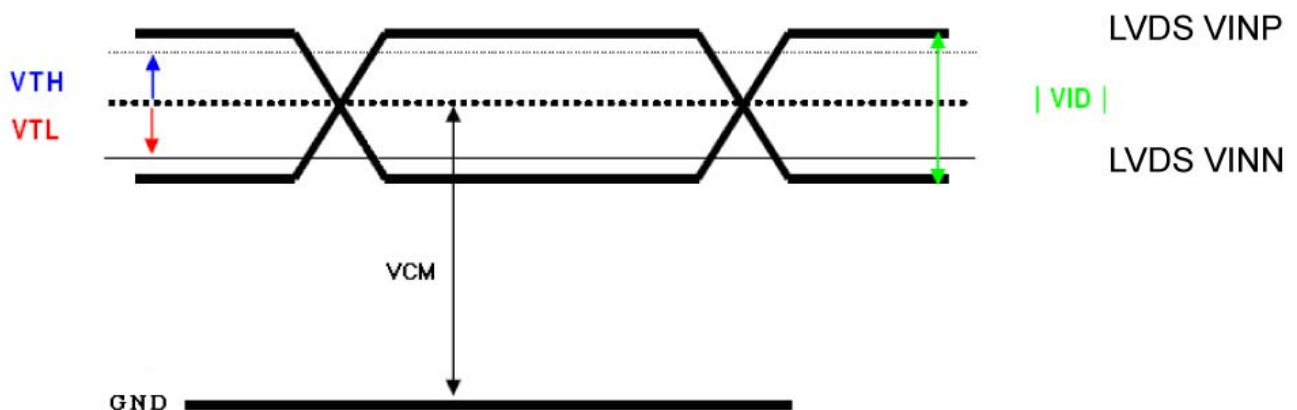
Note 1: VDD-dip condition:

When  $2.7 \leq VDD < 3.0V$ ,  $t_d \leq 10ms$ .

$VDD > 3.0V$ , VDD-dip condition should be same as VDD-turn-con condition

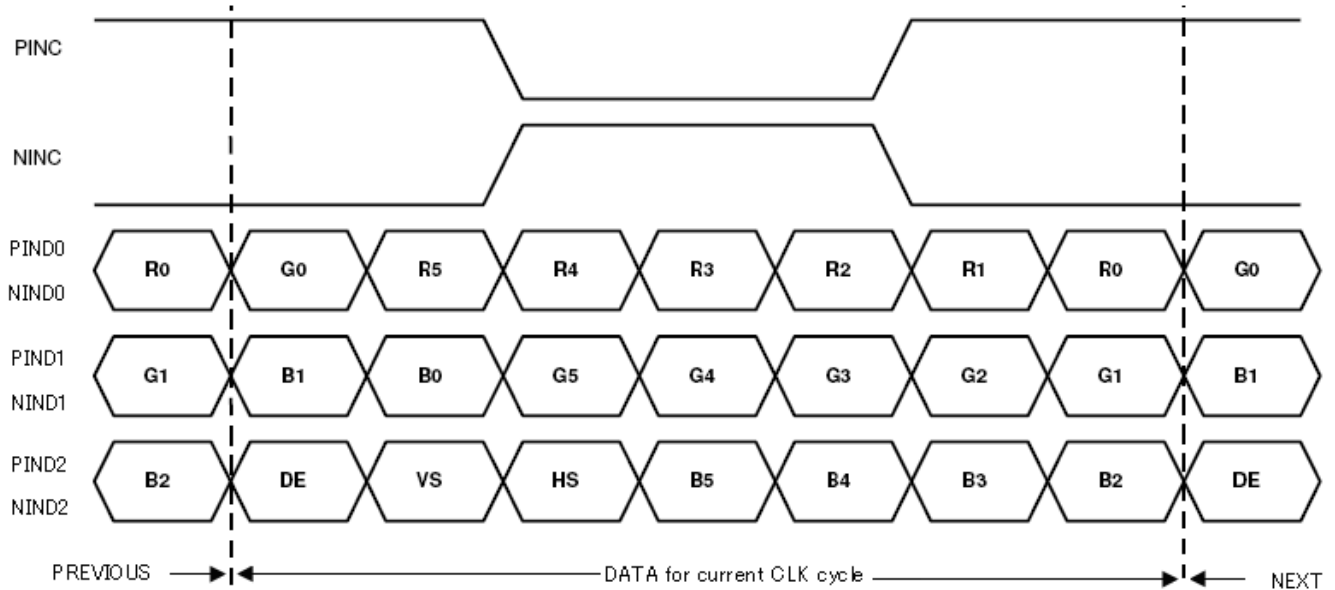
### 6.2 Switching Characteristics of LVDS Receiver

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Differential Input High Threshold	VTH	--	--	100	mV	VCM=1.2V
Differential Input Low Threshold	VTL	-100	--	--	mV	
Input current	IIN	-10	--	+10	uA	
Differential input Voltage	VID	0.2	--	0.6	V	
Common Mode Voltage Offset	VCM	$\frac{ VID }{2}$	1.25	$2.4 - \frac{ VID }{2}$	V	



## 7. Timing Characteristics

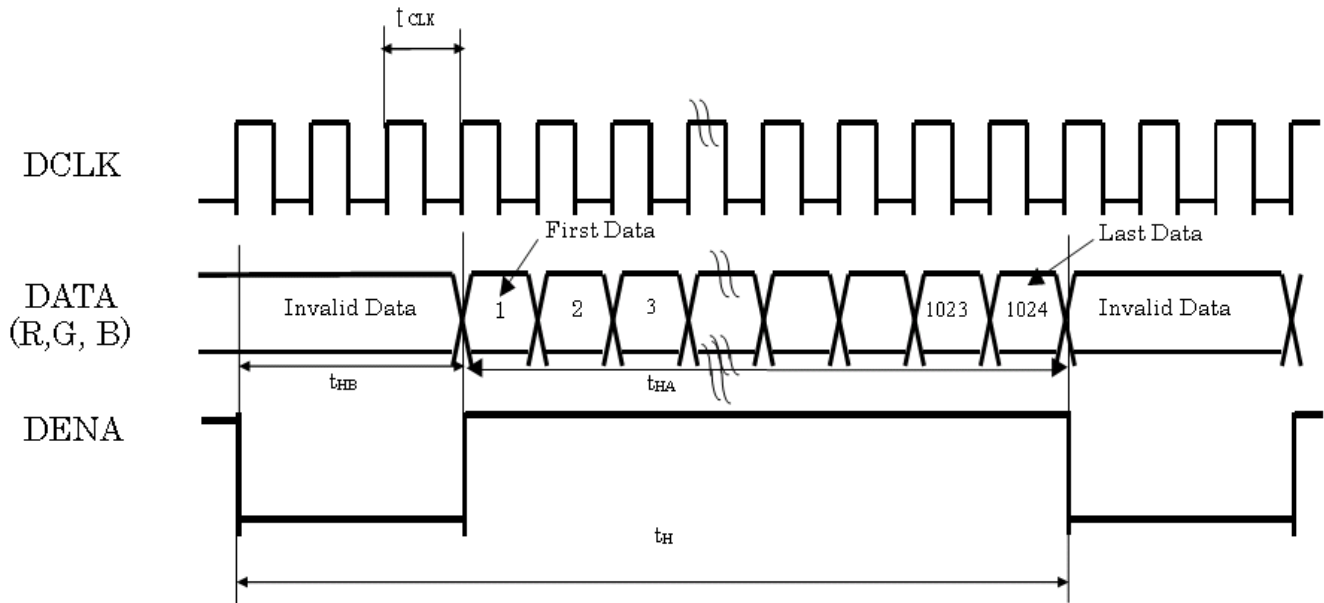
### 7.1 6-bit LVDS Input Data Mapping



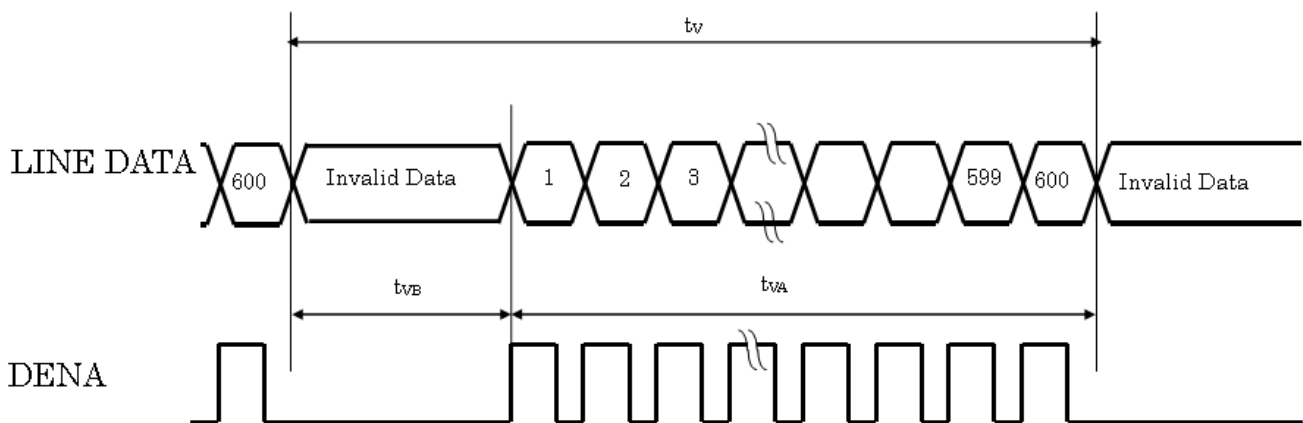
### 7.2 Timing Characteristics of Input signals

Item		Symbol	Min.	Typ.	Max.	Unit	
LVDS input signal sequence	Frame Rate	tclk	41	51.2	57	MHz	
LCD input signal sequence (input LVDS Transmitter)	Horizontal	Horizontal total Timing	t <sub>H</sub>	1214	1344	1364	tCLK
		Horizontal effective Timing	t <sub>HA</sub>	1024			tCLK
		Horizontal Blank Time	t <sub>HB</sub>	190	320	340	tCLK
	Vertical	Vertical total Time	t <sub>V</sub>	615	365	645	t <sub>H</sub>
		Vertical effective Time	t <sub>VA</sub>	600			t <sub>H</sub>
		Vertical Blank Time	t <sub>VB</sub>	15	35	45	t <sub>H</sub>

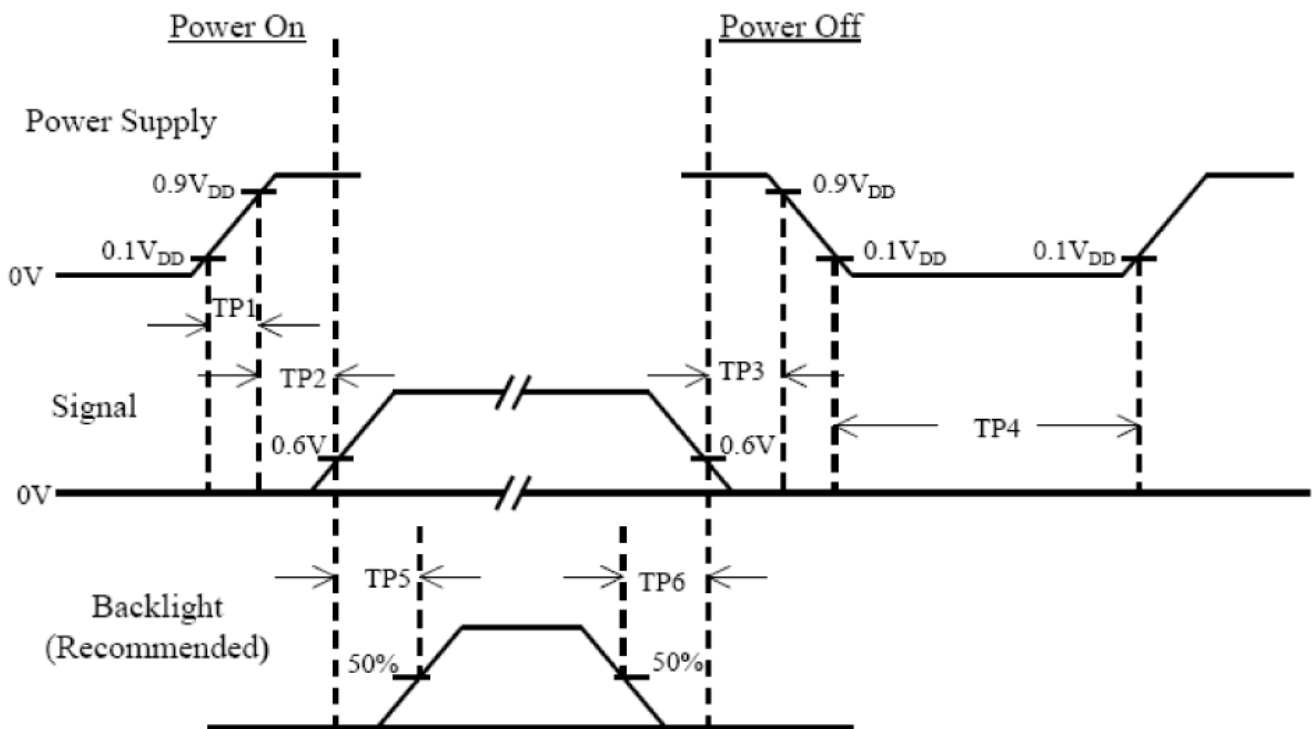
## Horizontal timing sequence



## Vertical timing sequence



## 7.3 Power On/off Sequence



Item	Min.	Typ.	Max.	Unit	Remark
TP1	0.5	--	10	msec	
TP2	0	--	50	msec	
TP3	0	--	50	msec	
TP4	500	--	--	msec	
TP5	200	--	--	msec	
TP6	200	--	--	msec	

Note :

- (1) The supply voltage of the external system for the module input should be the same as the definition of VDD.
- (2) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.
- (3) In case of VDD = off level, please keep the level of input signal on the low or keep a high impedance.
- (4) TP4 should be measured after the module has been fully discharged between power off and on period.
- (5) Interface signal shall not be kept at high impedance when the power is on.

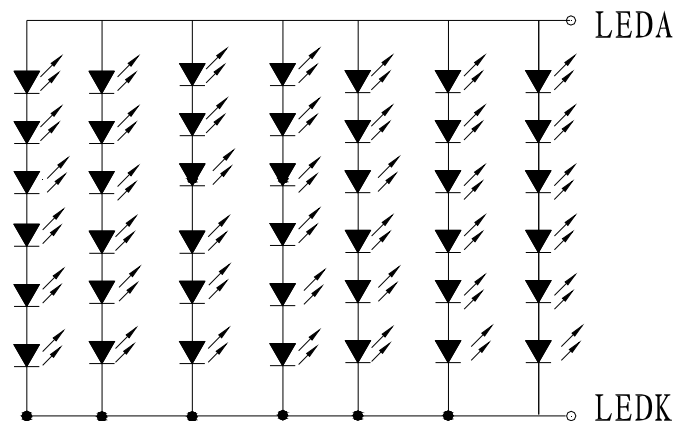
## 8. Backlight Characteristic

Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
LED Driver Voltage	VLED	4.5	5	5.5	V	
Power Supply Current for LED Driver	ILED	--	365	--	mA	VLED=5V VADJ=3.3V (duty 100%)
ADJ Input Voltage	VADJ	--	3.3	VLED	V	Duty=100%
LED Voltage	VAK	--	19.2	21.0	V	$I_L=140\text{mA}$ $T_a=25^\circ\text{C}$
LED Current	IL	--	140	--	mA	Note (1)
		--	160	--	mA	Note (1)
LED Life Time	--	--	50K	--	Hour	Note (2)

Note (1): The constant current source is needed for white LED back-light driving.

When LCM is operated over 60 deg.C ambient temperature, the  $I_L$  of the LED back-light should be adjusted to 160mA max

There are 6 Groups LED shown as below,  $V_{\text{LEDA-LEDK}}=19.2\text{V}$ ,  $T_a=25^\circ\text{C}$



**6x7=42 LED**

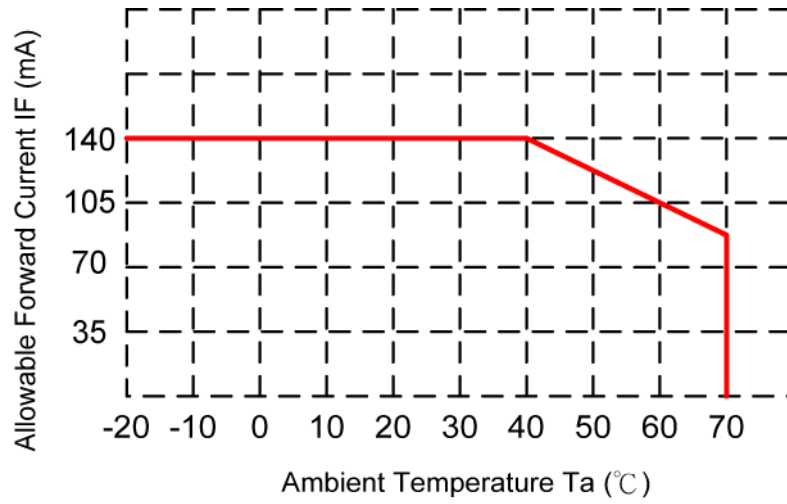
Note (2): Condition:  $T_a=25^\circ\text{C}$ , continuous lighting

Life time is estimated data.

Definitions of failure:

1. LCM brightness becomes half of the minimum value.
2. LED doesn't light normally.

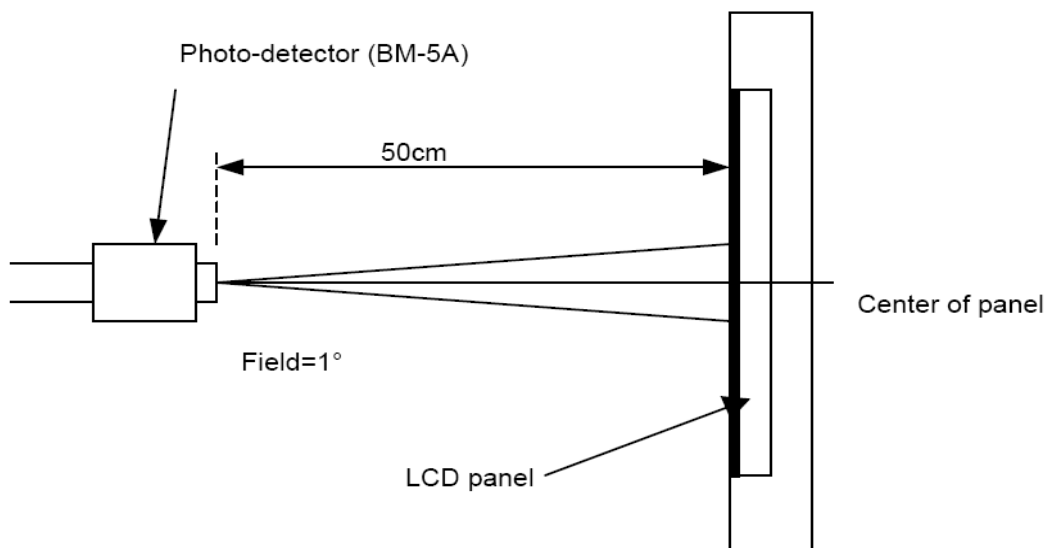
When LCM is operated over 40°C ambient temperature, the I<sub>LED</sub> should be follow:



## 9. Optical Characteristics

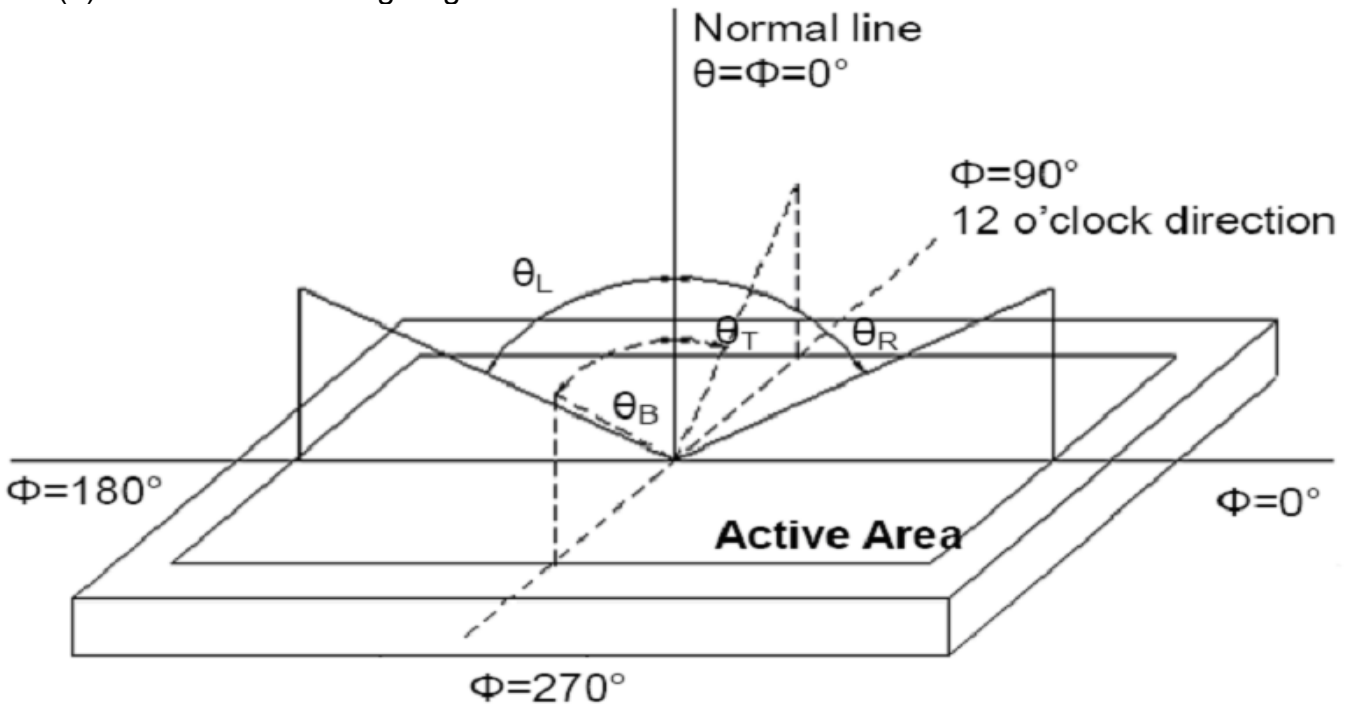
Item	Conditions	Min.	Typ.	Max.	Unit	Note	
Viewing Angle (CR>10)	Horizontal	$\theta_L$	60	70	-	degree	(1),(2),(6)
		$\theta_R$	60	70	-		
	Vertical	$\theta_T$	60	70	-		
		$\theta_B$	40	50	-		
Contrast Ratio	Center	400	500	-	-	(1),(3),(6)	
Luminance	L	450	550	-	cd/m <sup>2</sup>	(1)	
Luminance uniformity	YU	70			%	(1),(5)	
Response Time	TR	-	5	7	ms	(1),(4),(6)	
	TF	-	20	28	ms		
CF Color Chromaticity (CIE1931)	Red x	Typ. -0.05	TBD	Typ. +0.05	-	(1), (6)	
	Red y		TBD		-		
	Green x		TBD		-		
	Green y		TBD		-		
	Blue x		TBD		-		
	Blue y		TBD		-		
	White x		TBD		-		
	White y		TBD		-		

Note (1) Measurement Setup: The LCD module should be stabilized at given temp. 25°C for 15 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 15 minutes in a windless room.





Note (2) Definition of Viewing Angle



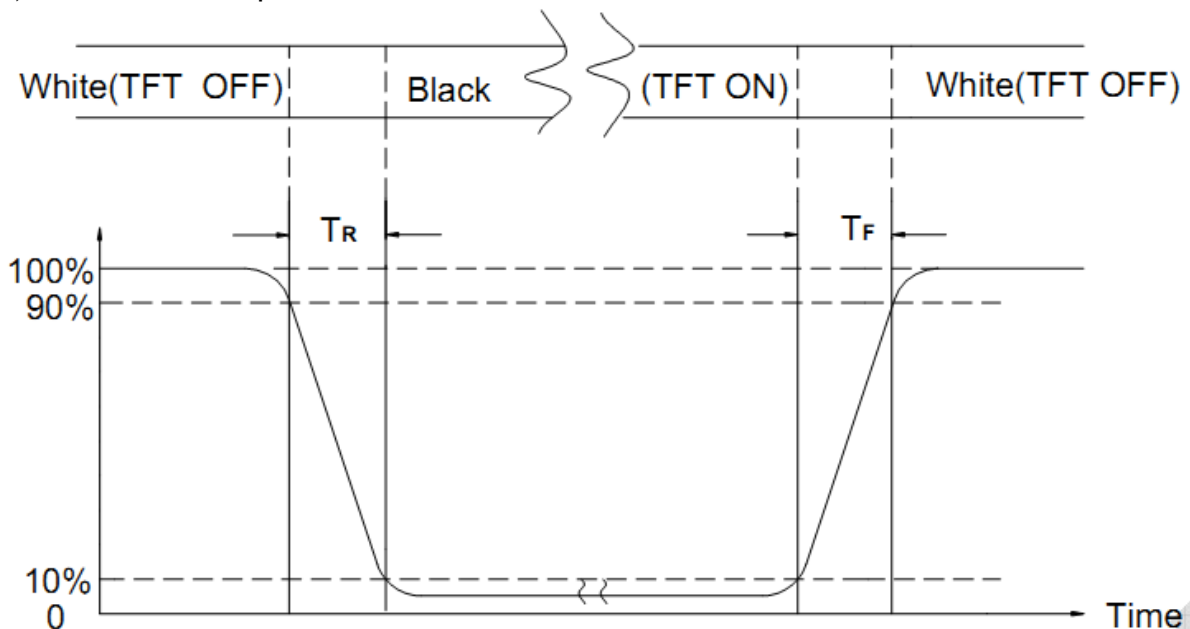
Note (3) Definition of Contrast Ratio (CR)

The contrast ratio can be calculated by the following expression

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

L63: Luminance of gray level 63, L0: Luminance of gray level 0

Note (4) Definition of response time



Note (5) Definition of Transmittance (Module is without signal input)

$$\text{Transmittance} = \text{Center Luminance of LCD} / \text{Center Luminance of Back Light} \times 100\%$$

Note (6) Definition of color chromaticity (CIE1931)

Color coordinates measured at the center point of LCD

## 10. Reliability Test Conditions and Methods

NO.	TEST ITEMS	TEST CONDITION											
①	High Temperature Storage	Keep in 80°C ±5°C 96 hrs Surrounding temperature, then storage at normal condition 4hrs.											
②	Low Temperature Storage	Keep in -30°C ±5°C 96 hrs Surrounding temperature, then storage at normal condition 4hrs.											
③	High Temperature / High Humidity Storage Test	Keep in 60 °C / 90% R.H duration for 96 hrs Surrounding temperature, then storage at normal condition 4hrs. (Excluding the polarizer)											
④	Temperature Cycling Storage Test	$  \begin{array}{ccccccc}  & -30^{\circ}\text{C} & \rightarrow & +25^{\circ}\text{C} & \rightarrow & 80^{\circ}\text{C} & \rightarrow & +25^{\circ}\text{C} \\  & (30\text{mins}) & & (5\text{mins}) & & (30\text{mins}) & & (5\text{mins}) \\  & & & \longleftarrow & & \longrightarrow & & \\  & & & & & 10 \text{ Cycle} & &   \end{array}  $ Surrounding temperature, then storage at normal condition 4hrs.											
⑤	ESD Test	Air Discharge: Apply 2 KV with 5 times Discharge for each polarity +/-	Contact Discharge: Apply 250 V with 5 times discharge for each polarity +/-										
		1. Temperature ambience : 15°C ~ 35°C 2. Humidity relative : 30% ~ 60% 3. Energy Storage Capacitance( Cs + Cd ) : 150pF±10% 4. Discharge Resistance(Rd) : 330Ω±10% 5. Discharge, mode of operation : Single Discharge (time between successive discharges at least 1 sec) (Tolerance if the output voltage indication: ±5%)											
⑥	Vibration Test (Packaged)	1. Sine wave 10~55 Hz frequency (1 min/sweep) 2. The amplitude of vibration : 1.5 mm 3. Each direction (X、 Y、 Z) duration for 2 Hrs											
⑦	Drop Test (Packaged)	<table border="1" data-bbox="683 1659 1326 1877"> <thead> <tr> <th>Packing Weight (Kg)</th> <th>Drop Height (cm)</th> </tr> </thead> <tbody> <tr> <td>0 ~ 45.4</td> <td>122</td> </tr> <tr> <td>45.4 ~ 90.8</td> <td>76</td> </tr> <tr> <td>90.8 ~ 454</td> <td>61</td> </tr> <tr> <td>Over 454</td> <td>46</td> </tr> </tbody> </table>		Packing Weight (Kg)	Drop Height (cm)	0 ~ 45.4	122	45.4 ~ 90.8	76	90.8 ~ 454	61	Over 454	46
		Packing Weight (Kg)	Drop Height (cm)										
0 ~ 45.4	122												
45.4 ~ 90.8	76												
90.8 ~ 454	61												
Over 454	46												
Drop Direction : ※ 1 corner / 3 edges / 6 sides each 1time													

## 11. Inspection Standard

### 11.1. The environmental condition of inspection

The environmental condition and visual inspection shall be conducted as below.

- (1) Ambient temperature :  $25 \pm 5$  °C
- (2) Humidity : 25~75 % RH
- (3) Panel visual inspection on the operation condition for cosmetic shall be conducted at the distance 30~40cm or more between the LCD module and eyes of inspector.  
Ambient Illumination : 800~1200 Lux for external appearance inspection  
Ambient Illumination : 200~500 Lux for light on inspection
- (4) The viewing angle :
  - a)  $\pm 15$  degree to the front surface of display panel in vertical direction.
  - b)  $\pm 45$  degree to the front surface of display panel in horizontal direction.
- (5) Display panel shall be conducted at the distance 30~40cm between the LCD module and eyes of inspector (Fig. 1)

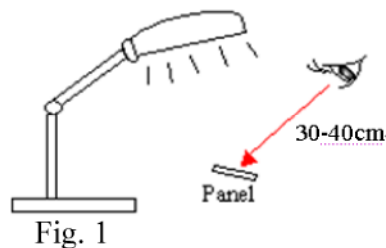


Fig. 1

### 11.2. Inspection Criteria

- (1) Definition of dot defect induced from the panel inside
  - a) Bright dot : Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.
  - b) Dark dot : Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.
  - c) 2 dot adjacent = 1 pair = 2 dots

Picture:



## (2) Display Inspection

Items		Acceptable count
Bright dot	Random	$N \leq 3$
	2 dots adjacent	$N \leq 0$
	3 dots adjacent	$N \leq 0$
Distance	Minimum Distance Between Bright dots	5mm
Dark dot	Random	$N \leq 4$
	2 dots adjacent	$N \leq 0$
	3 dots adjacent	$N \leq 0$
Total bright and dark dot		$N \leq 6$
Distance	Minimum Distance Between dark dots Minimum Distance Between dark and bright dot.	5mm
Tiny bright dot		visible through 5% ND filter $D \leq 0.3\text{mm}$ , Ignore $0.3\text{mm} < D \leq 0.5\text{mm}$ , $N \leq 4$ Distance $\geq 5\text{mm}$
Display failure (V-line/H-line/Cross line etc.)		Not allowable
Mura/ Waving/ Hot spot	Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary	

**\*Note: Defects which is on the Black Matrix (outside of Active Area) are not considered as a defect.**

## (3) Appearance & Display inspection

Item	Standards
Foreign Black/White/Bright Spot (Display & Appearance)	$D \leq 0.3\text{mm}$ , Ignore $0.3\text{mm} < D \leq 0.5\text{mm}$ , $N \leq 4$ Distance $\geq 5\text{mm}$ It is shown in Fig. 2.
Foreign Black/White/Bright Line (Display & Appearance)	$W \leq 0.07 \text{ mm}$ , Ignore $0.07 < W \leq 0.1 \text{ mm}$ $L \leq 5.0 \text{ mm}$ , $N \leq 4$ It is shown in Fig. 3.
Polarizer Dent/Air Bubble	$D \leq 0.3\text{mm}$ , Ignore $0.3\text{mm} < D \leq 0.5\text{mm}$ , $N \leq 4$ Distance $\geq 5\text{mm}$
Polarizer Scratches	$W \leq 0.07 \text{ mm}$ , Ignore $0.07 < W \leq 0.1 \text{ mm}$ $L \leq 5.0 \text{ mm}$ , $N \leq 4$

Panel Crack	Not allowable. It is shown in Fig. 4.
Broken CF/Non-Lead Side of TFT	Min. distance between the broken and dot area, $d_1 \geq 2.0\text{mm}$ , is ignored; $d_1 < 2.0\text{mm}$ , $N \leq 0$ ; It is shown in Fig. 5. $d_1$ : Minimum distance between the broken and dot area
Broken of TFT Lead Side	Alignment mark damage not allowed, and breakage corner $> 90^\circ$ 1. $W \leq 1.5\text{ mm}$ , L is ignore but the lead can't been damaged. 2. Sconchoidal breakage: $W \leq 1.5\text{mm}$ , Depth(D) $\leq 1/2$ one layer of glass thickness It is shown in Fig.6.
Corner Broken of TFT Lead Side	1) The cross mark can't been damaged. 2) $W \leq 1.5\text{ mm}$ , $L \leq 5\text{ mm}$ It is shown in Fig. 7.
Burr of TFT/CF Edge	The distance of burr from the edge of TFT /CF, $d_2 \leq 0.2\text{mm}$ . It is shown in Fig. 8. $d_2$ : The distance of burr from the edge of TFT/CF
PCBA Components	External appearance is ignored
COF	External appearance is ignored
Silicone spread	External appearance is ignored
Polarizer Protective Film	Neglect any defect on the Polarizer Protective Film, such as protective film scratches, protective film bubbles, and particles on protective film.

Notes: 1. All the angle of the broken must be larger than  $90^\circ$  It is shown in Fig. 9 ( $R > 90^\circ$ )

2. If any specific defect is not included in the above defect table, this defect should be judged by INX/ODM/Brand customer discussion.

1. W : Width
2. L : Length
3. D : Average Diameter
4. N : Count

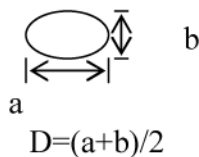


Fig. 2



W: width, L : length

Fig.3

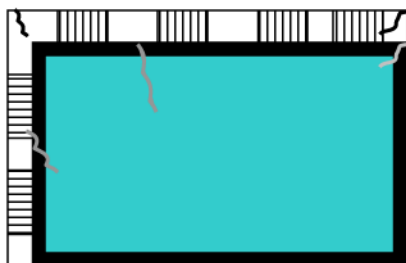


Fig 4

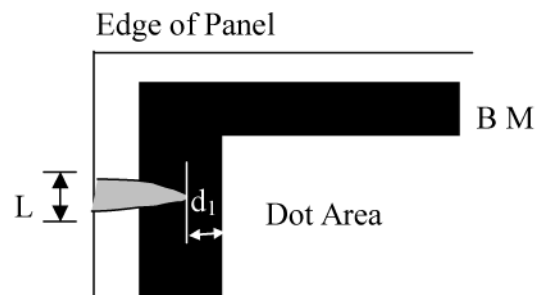


Fig 5

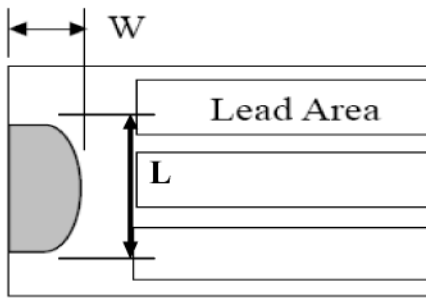


Fig 6

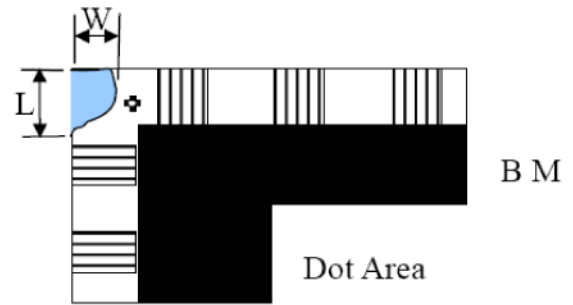


Fig 7

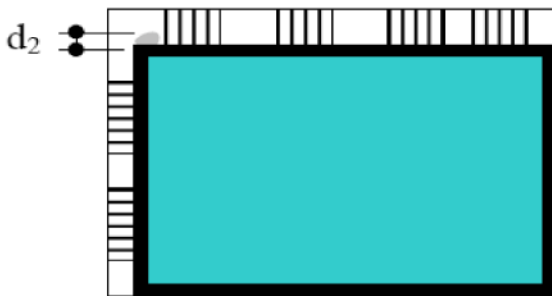


Fig 8

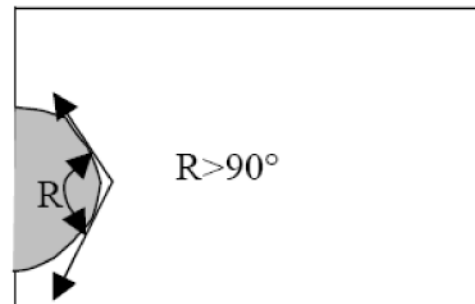


Fig 9

## 12. Handling Precautions

### 12.1 Mounting method

The LCD panel of AMSON TFT module consists of two thin glass plates with polarizers which easily be damaged. And since the module is 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 happens 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 uses C-MOS LSI drivers, so we recommend 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 than the limit causes 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 than the operating temperature range and on the other hand at higher temperature LCD's show 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

TBD