

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
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1. Scope

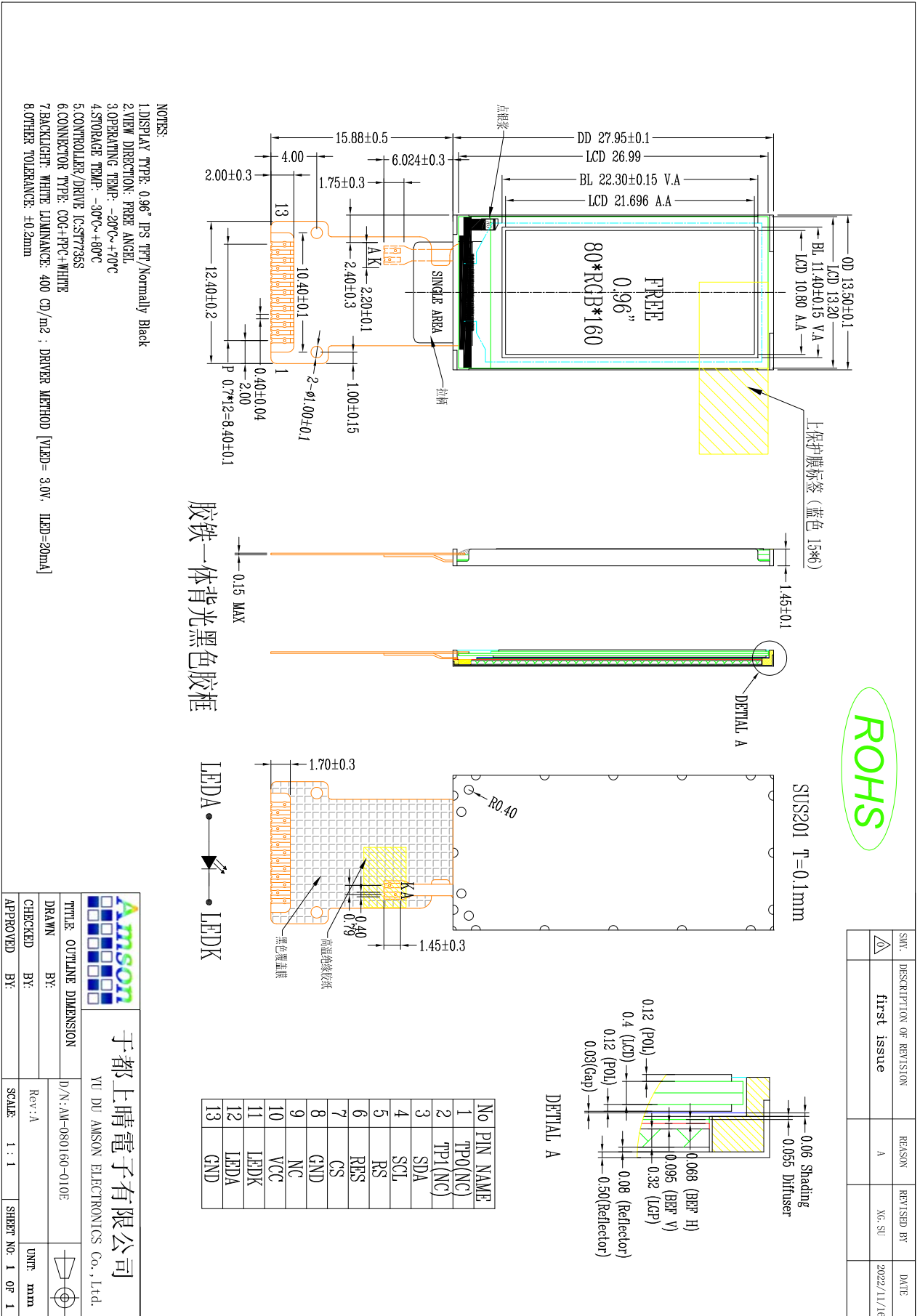
This specification defines general provisions as well as inspection standards for TFT module supplied by AMSON electronics.

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	0.96" TFT	--
Dot arrangement	80(RGB)×160	dots
Color filter array	RGB vertical stripe	--
Display mode	IPS / Transmissive / Normally Black	--
Gray scale inversion Direction	80/80/80/80	--
Viewing Direction	ALL	--
Driver IC	ST7735S	--
Module size	13.50(W)×27.95 (H)×1.45(T)	mm
Active area	10.800(W)×21.696(H)	mm
Interface	SPI	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Back Light	One White LED	--

3. External Dimensions



4. Interface Description

PIN.NO	SYMBOL	I/O/P	FUNCTION
1	NC	-	Not connect
2	NC	-	Not connect
3	SDA	I/O	It is used as serial input/output pin in serial interface.
4	SCL	I	The serial clock signal for system..
5	RS	I	In 4-line SPI, this pin is used as D/CX (data/ command selection); In 3-line SPI, should be fixed at VDDI or DGND.
6	RES	I	-This signal will reset the device and it must be applied to properly initialize the chip. -Signal is active low.
7	CS	I	Chip Selection Pin.-Low Enable.
8	GND	P	System Ground.
9	NC	-	Not connect
10	VCC	I	Power supply for system.
11	LEDK	I	Ground for backlight.
12	LEDA	I	Power for backlight.
13	GND	P	System Ground.

5. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Analog Supply Voltage	VCC	-0.3	4.5	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
Analog Supply Voltage	V _{CI}	2.6	2.8	3.3	V	--
Input High Voltage	V _{IH}	0.7VCC	--	VCC	V	Digital input pins
Input Low Voltage	V _{IL}	GND	--	0.3 VCC	V	Digital input pins
Output High Voltage	V _{OH}	0.7VCC	--	VCC	V	Digital output pins
Output Low Voltage	V _{OL}	GND	--	0.3 VCC	V	Digital output pins
I/O Leak Current	I _{LI}	-0.1	--	0.1	uA	--

7. Timing Characteristics

Serial Interface Characteristics

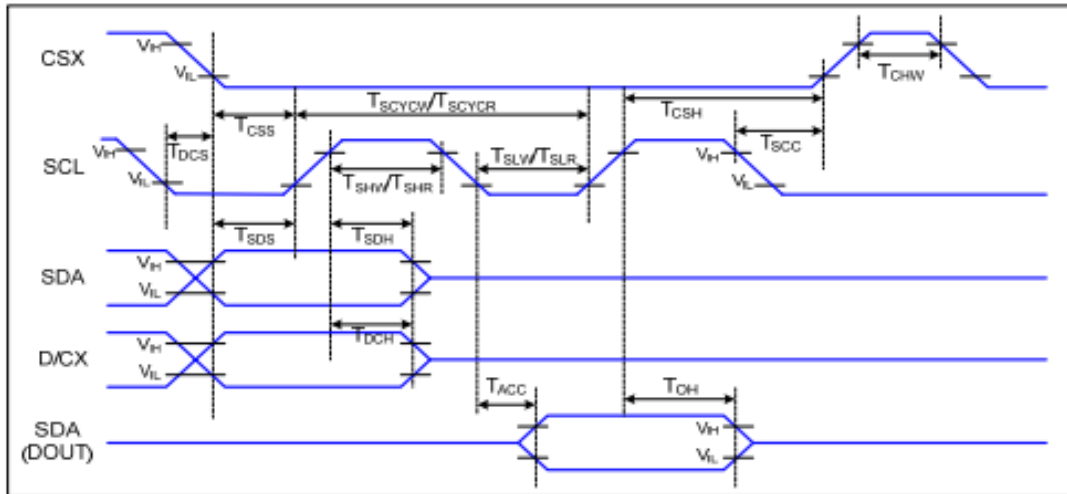
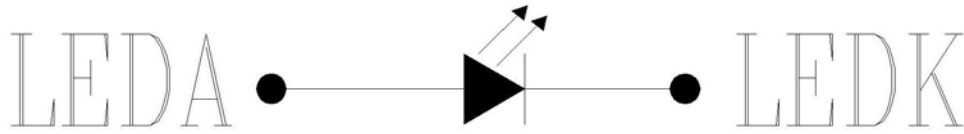


Figure 7 4-line Serial Interface Timing

Ta=25 °C, VDDI=1.65~3.7V, VDD=2.5~4.8V

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	TCSS	Chip Select Setup Time (Write)	45		ns	
	TCSH	Chip Select Hold Time (Write)	45		ns	
	TCSS	Chip Select Setup Time (Read)	60		ns	
	TSCC	Chip Select Hold Time (Read)	65		ns	
	TCHW	Chip Select "H" Pulse Width	40		ns	
SCL	TSCYCW	Serial Clock Cycle (Write)	66		ns	-Write Command & Data Ram
	TSHW	SCL "H" Pulse Width (Write)	15		ns	
	TSLW	SCL "L" Pulse Width (Write)	15		ns	
	TSCYCR	Serial Clock Cycle (Read)	150		ns	-Read Command & Data Ram
	TSHR	SCL "H" Pulse Width (Read)	60		ns	
	TSLR	SCL "L" Pulse Width (Read)	60		ns	
D/CX	TDCS	D/CX Setup Time	10		ns	
	TDCH	D/CX Hold Time	10		ns	
SDA (DIN) (DOUT)	TSDS	Data Setup Time	10		ns	For Maximum CL=30pF For Minimum CL=8pF
	TSDH	Data Hold Time	10		ns	
	TACC	Access Time	10	50	ns	
	TOH	Output Disable Time	15	50	ns	

8. Backlight Characteristics

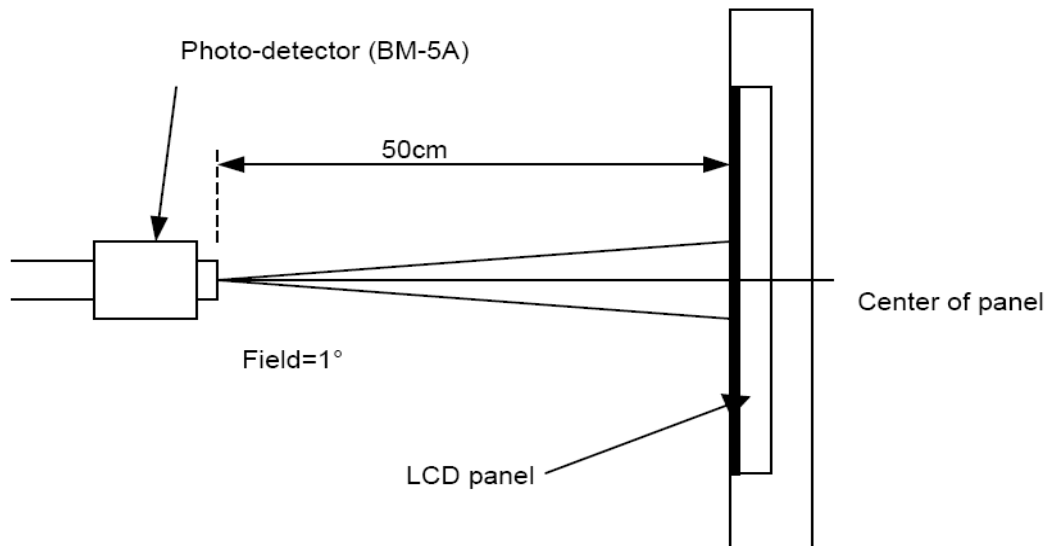


Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	--	3.0	--	V	If=20mA
Supply Current	If	--	20	--	mA	--
Power Consumption						
Luminous Intensity for LCM	--	--	400	--	Cd/m ²	If=20mA
Backlight Color	White					

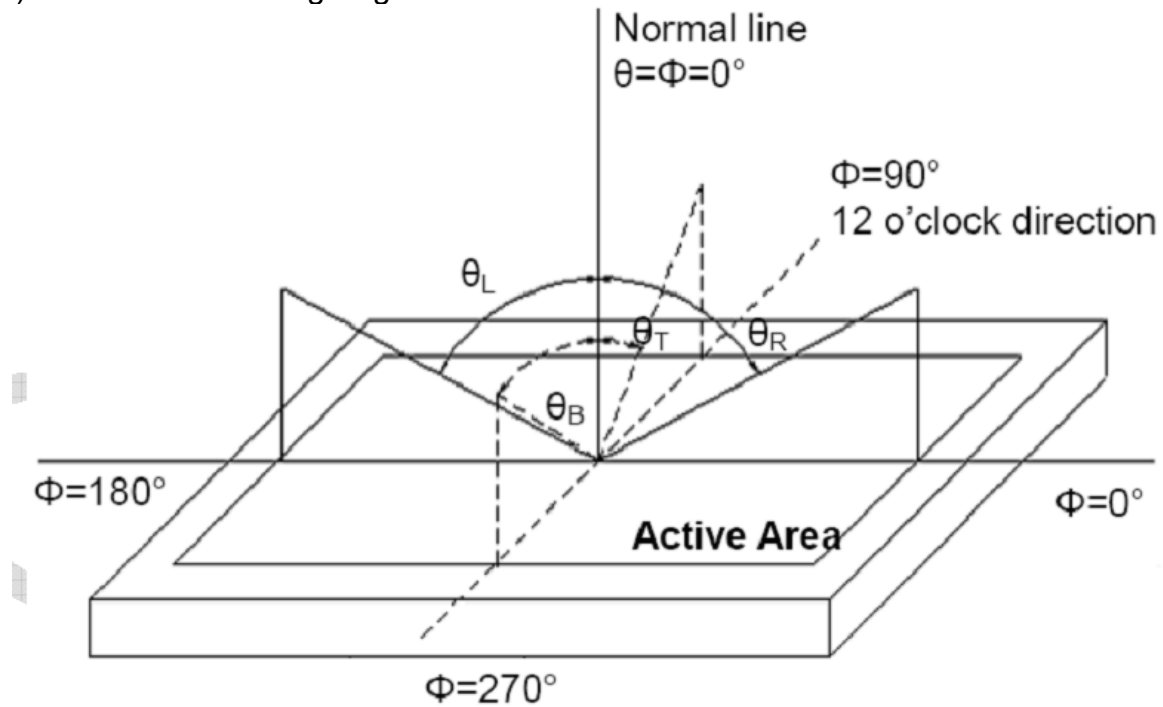
9. Optical Characteristics

Item	Conditions	Min.	Typ.	Max.	Unit	Note	
Viewing Angle (CR>10)	Horizontal	θ_L	70	80	-	degree	(1),(2),(6)
		θ_R	70	80	-		
	Vertical	θ_T	70	80	-		
		θ_B	70	80	-		
Contrast Ratio	Center	600	800	-	-	(1),(3),(6)	
Response Time	Rising + Falling	-	30	-	ms	(1),(4),(6)	
CF Color Chromaticity (CIE1931)	Red x	Typ. -0.05	0.577	Typ. +0.05	-	(1), (6)	
	Red y		0.353		-		
	Green x		0.312		-		
	Green y		0.569		-		
	Blue x		0.148		-		
	Blue y		0.100		-		
	White x		0.285		-		
	White y		0.322		-		

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



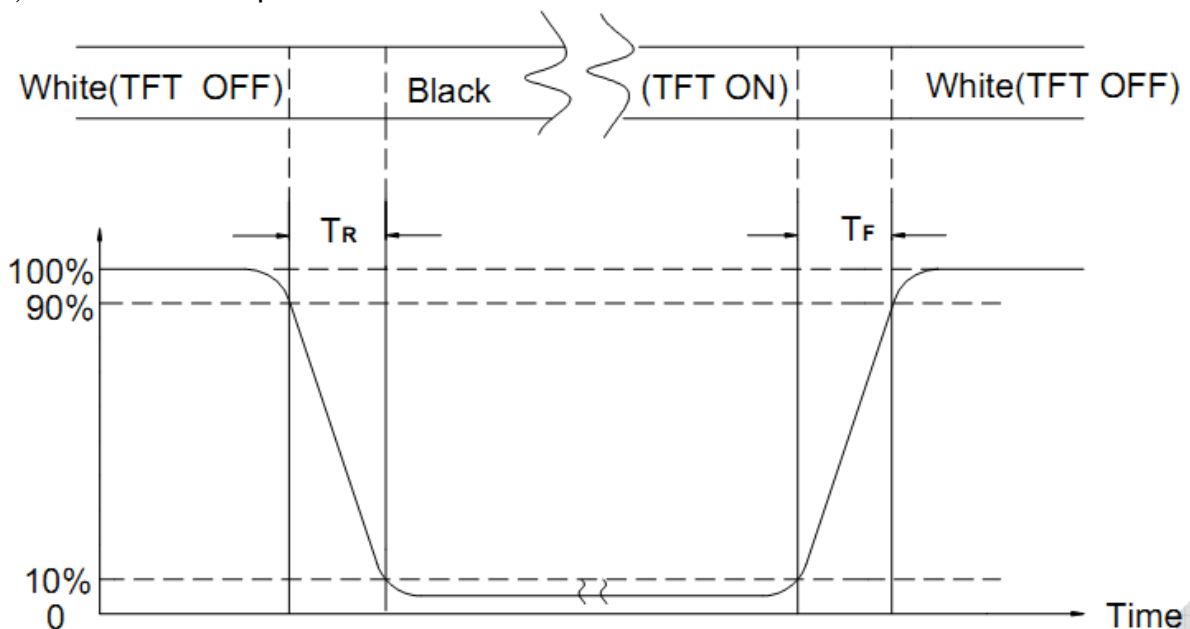
Note (3) Definition Of Contrast Ratio (CR)

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

Test Item	Test Condition	Test result determinant gist
High temperature storage	80±3°C , 96H ;	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Non-display; 3.Glass crack; 4. The electrical characteristics requirements shall be satisfied.
Low temperature storage	-30±3°C , 96H ;	
High temperature operation	70±3°C , 96H ;	
Low temperature operation	-20±3°C , 96H ;	
High temperature /humidity	60°C±3°C,90%±3%RH , 96H ;	
Thermal Shock	-30°C/0.5h~+80°C/0.5h for a total 10 cycles ;	
Vibration Test	Frequency 10Hz~55Hz~10Hz Amplitude : 1.5mm, X , Y , Z direction for total 1H ; (Packing condition)	
ESD test	±2KV, Human Body Mode, 150pF/330Ω ; ±8KV, Air Mode, 150pF/330Ω ;	

11. Inspection Standard

11.1 Acceptable quality level

The AQL define:

Inspection Item	Major defect	Minor defect
Cosmetic	1.0%	1.5%
Electrical test	0.65%	1.00%

11.2. Basic conditions for inspection

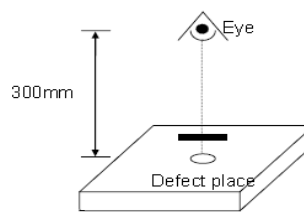
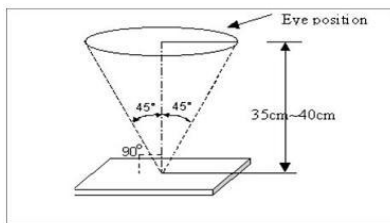
Inspection performed under the following conditions is recommended.

Temperature: 25±5°C



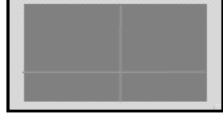
Humidity: 65%±10%RH


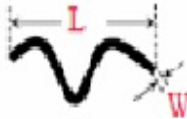
Viewing Angle: U/D: 45o/45o, L/R: 45o/45o.

Illumination: Single fluorescent lamp (300 to 700Lux) Viewing distance: 30±5cm



(1) LCM electrical criterion (Without Touch Panel)

No	Defect	Criteria	Remark
1	No display (Major)	Not allowed	
2	Missing line (Major)	Not allowed	
3	Darker or lighter line (Major)	Not allowed	
4	Weak line (Minor)	By limit sample	
5	Bright / Dark point (Minor)	Spec.	1:1 sub-pixel: 1R or 1G or 1B 2:Point defect area ≥ 1/2 sub pixel.
		Bright point	

		Dark point	3	
6	Round type (Minor)	Spec.	Permissible Qty	1. $\phi = (L+W)/2$, L: Length, W: Width 2. Disregard if out of A.A. 
		$\phi \leq 0.10\text{mm}$	Disregard	
		$0.10\text{mm} < \phi \leq 0.25\text{mm}$	2	
		$0.25\text{mm} < \phi \leq 0.4\text{mm}$	2	
		$\phi > 0.40\text{mm}$	0	
7	Line type (Minor)	Spec.	Permissible Qty	1. L: Length, W: Width 2. Disregard if out of A.A. 
		$W \leq 0.03\text{mm}$	Disregard	
		$L \leq 3.0\text{mm}$ and $0.03\text{mm} < W \leq 0.05\text{mm}$	4	
		$L \leq 3.0\text{mm}$ and $0.05\text{mm} < W \leq 0.10\text{mm}$	2	
		$W > 0.10\text{mm}$ or $L > 3.0\text{mm}$	0	
8	Mura (Minor)	By 5% ND filter invisible		
9	Bubble in Cell	It should be found by eyes		
Bezel	Scratch	No harm	Minor	
	Dirt		Minor	
	Wrap		Minor	
	Sunken		Minor	
Label	No label	No	Minor	
	Inverted		Minor	
	Broken		Minor	
	Dirt		Word can be read.	
	Not clear		Minor	
	Word out		Minor	
	Mistake		Minor	
	Position		Be attached on right position	
Screw	Not	No	Minor	
	Limp	No	Minor	
Connector	Connectio	No bend on pins and damage		Minor
FPC/FFC	Broken	No	Minor	

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 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 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 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