

Specification For Approval

- Preliminary specification
- Final specification

Title	12.1 XGA ADS TFT-LCD (Module)
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Buyer	
Model	

Supplier	Cheng Du BOE Optoelectronics Technology CO., LTD
Model	AV121X0M-N10

TITLE/SIGNATURE	DATE
_____	_____
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ITEM	SIGNATURE/DATE
Approved	_____
Reviewed	_____
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Prepared	_____

Please return one copy confirmation with signature and your comments

BOE CHENG DU
Optoelectronics Technology CO., LTD

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1.0 GENERAL DESCRIPTION

1.1 Introduction

AV121X0M-N10 is a color active matrix TFT-LCD Panel using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This model is composed of a TFT-LCD Panel, a driving circuit (Note1) and a back light system. It is a transmissive type display operating in the normal black. This TFT-LCD has a 12.1 inch diagonally measured active area with resolutions 1024 horizontal by 768 vertical pixel array. Each pixel is divided into Red, Green, Blue dots which are arranged in 2 domain stripe and this panel can display 16.7M colors.

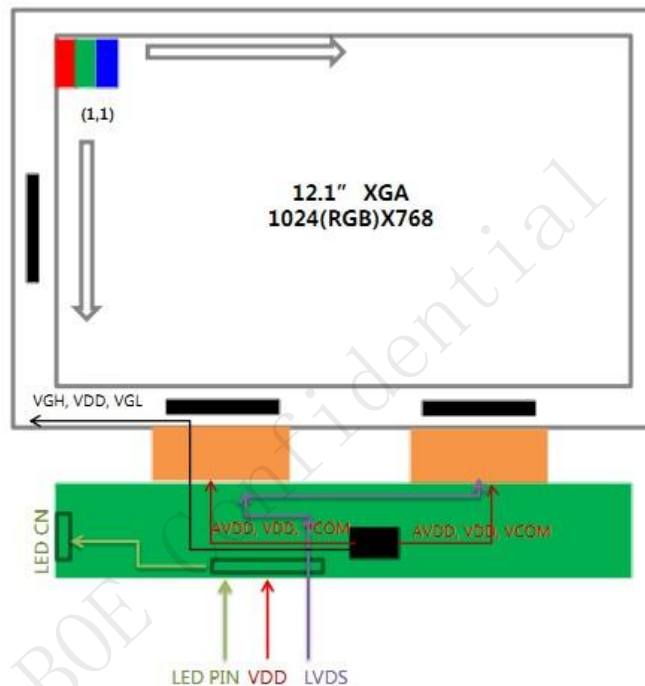


Figure 1. Block Diagram

1.2 Features

- 0.5t Glass (Single)
- Thin and light weight
- High luminance and contrast ratio, low reflection and wide viewing angle
- Module Design
- RoHS Compliant

1.3 Application

- Automotive

1.4 General Specifications (H: horizontal length, V: vertical length)

Table 1. General Specification

Parameter	Specification	Unit	Remark
Panel size	257.68(H) × 197.12(V)	mm	
CF size	254.16(H) × 192.52 (V)	mm	
Active area	245.76(H) × 184.32(V)	mm	
Number of pixels	1024(H)RGB × 768(V)	pixels	
Dot Pitch	80(H) × 240(V)	um	
Pixel Arrangement	RGB 2domain stripe		
Display Colors	16.2 M	colors	
Color Gamut	70%(typ.)		
Display Mode	Normally Black, Transmissive mode		
Dimensional Outline	265.5(H) × 206.3(V) × 13.5(D)	mm	Module
Viewing Direction (Human Eye)	U/D/L/R free viewing direction		Note 1,2
Weight	TBD	gram	

Note:

1. At the U/D/L/R direction, the viewing angle is same;
2. The TFT and CF Align Direction;

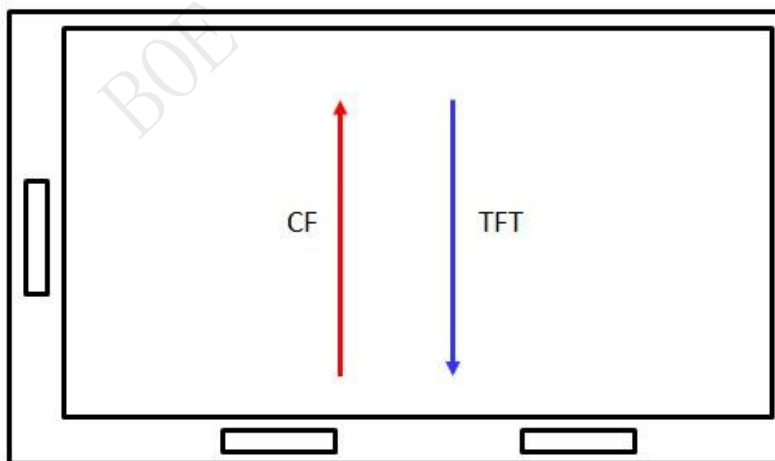


Figure 2. The TFT and CF Align Direction

2.0 ABSOLUTE MAXIMUM RATINGS

The absolute maximum ratings are list on table as follows. When used out of the absolute maximum ratings, the LSI may be permanently damaged. Using the LSI within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are exceeded during normal operation, the LSI will malfunction and cause poor reliability.

Table 2. Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Power Supply voltage	V_{CC}	3.3	V
Driver supply voltage	V_{DD}	3.3	V
Back-light Power Supply Voltage	V_{LED}	24	V
Back-light LED Current	I_{LED}	360	mA

Note:

If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

Table 3. Electrical Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Power Supply Voltage	VCC	3	3.3	3.6	V	Note1
Power Supply Current	IVCC	-	350	600	mA	
Analog Voltage	AVDD		11.5		V	
Low Level Input Voltage	VGL		-9		V	
High Level Input Voltage	VGH		17		V	
Common Electrode Voltage	VCOM	5.1	5.3	5.5	V	Note2
Back-light Power Supply Voltage	VLED	21.6	24	26.4	V	-
Back-light Power Supply Current	ILED	-	360	-	mA	-
Power Consumption	PD		1.2	2.0	W	Note3
	PBL	7.776	8.64	9.504	W	
	Ptotal		10.1	11.8	W	

Note:

- The supply voltage is measured and specified at the interface connector of LCM.
 The current draw and power consumption specified is for 3.3V 60Hz at 25°C.
 - Typ : Window XP pattern
 - Max : Skip 2 dot 255 pattern
- VCOM should be adjusted to make the flicker level be minimum.
- Frame rate=60HZ, Typ. Pattern: White pattern 25°C.

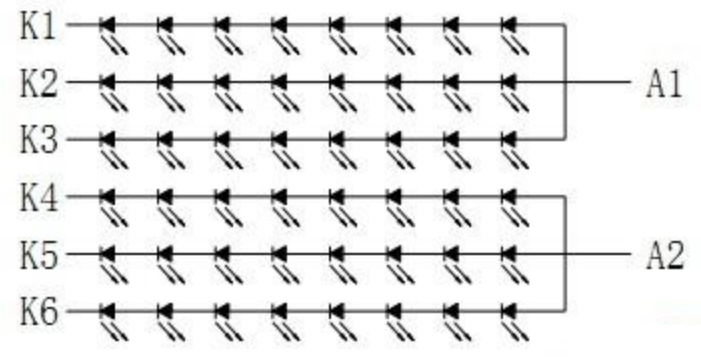
3.2 Backlight Driving Conditions

Table 4. Backlight Driving Conditions

Parameter	Symbol	Min	Typ	Max	Unit	Remark
LED Forward Voltage	V _{FLED}	2.7	3	3.3	V	-
LED Forward Current	I _{FLED}		60		mA	-
LED Power Consumption	P _{LED}	7.776	8.64	9.504	W	Note 1
LED Life time	Hrs	30000				Note 2

Notes:

- 1. Calculator Value for reference $I_{LED} \times V_{LED} \times LED \text{ Quantity} = P_{LED}$.
- 2. The LED Life-time define as the estimated time to 50% degradation of initial luminous.



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4.0 INTERFACE CONNECTION

4.1 The LCD Module Electrical Interface Connection

The Recommended connector is **IMSA-9686S-30B-GFN4(IRISO)**

The connector interface pin assignments are listed in Table 5.

Table 5. Pin Assignments for the LCD Connector

PIN	SYMBOL	FUNCTION	PIN	SYMBOL	FUNCTION
1	LEDA1	BL voltage supply	16	RX0+	Positive transmission data of pixel 0
2	LEDA2	BL voltage supply	17	GND	Ground
3	NC	Not Connector	18	RX1-	Negative transmission data of pixel 1
4	LEDK1	BL negative pole	19	RX1+	Positive transmission data of pixel 1
5	LEDK2	BL negative pole	20	GND	Ground
6	LEDK3	BL negative pole	21	RX2-	Negative transmission data of pixel 2
7	LEDK4	BL negative pole	22	RX2+	Positive transmission data of pixel 2
8	LEDK5	BL negative pole	23	GND	Ground
9	LEDK6	BL negative pole	24	RXCLK-	Negative of clock
10	NC	Not Connector	25	RXCLK+	Positive of clock
11	VCC	Power supply:+3.3V	26	GND	Ground
12	VCC	Power supply:+3.3V	27	RX3-	Negative transmission data of pixel 3
13	NC	Not Connector	28	RX3+	Positive transmission data of pixel 3
14	GND	Ground	29	UD	Vertical Scan Direction Setting
15	RX0-	Negative transmission data of pixel 0	30	LR	Horizontal Scan Direction Setting

4.2 The LED Electrical Interface Connection

The Recommended connector is **IMSA-9686S-10B-GFN4 (IRISO)**

The connector interface pin assignments are listed in Table 6.

Table 6. Pin Assignments for the LED Connector

PIN	SYMBOL	FUNCTION
1	LEDA1	BL voltage supply
2	LEDA2	BL voltage supply
3	NC	Not Connector
4	LEDK1	BL negative pole
5	LEDK2	BL negative pole
6	LEDK3	BL negative pole
7	LEDK4	BL negative pole
8	LEDK5	BL negative pole
9	LEDK6	BL negative pole
10	NC	Not Connector

5.0 SIGNAL SPECIFICATION

5.1 LVDS Signal Timing

Table 7. LVDS Signal Timing

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Clock frequency	RxFCLK	52	65	71	MHz	
Horizontal Display Area	thd	1024				
HS Period	th	1114	1344	1400	DCLK	
HS Blanking	Thb+thfp	90	320	376	DCLK	
Vertical Display Area	tvd	768				
VS Period	tv	778	806	845	TH	
VS Blanking	Tvbp+tvfp	10	38	77	TH	
Input data skew margin	TRSKM	500			ps	
Clock high time	TLVCH	10.99	8.79	8.05	ns	
Clock low time	TLVCL	8.24	6.59	6.04	ns	
PLL wake-up time	TenPLL			150	us	

5.2 Signal Format

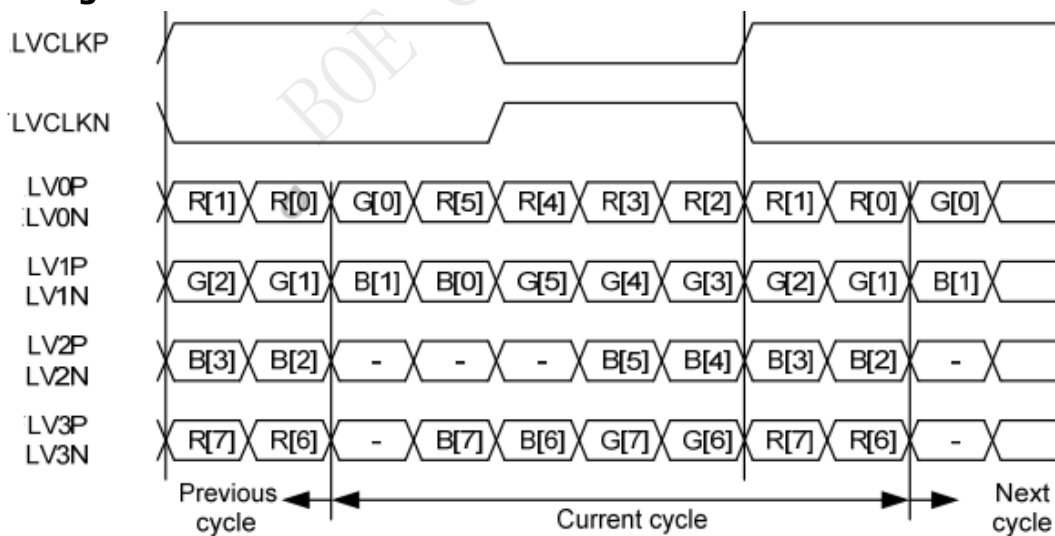
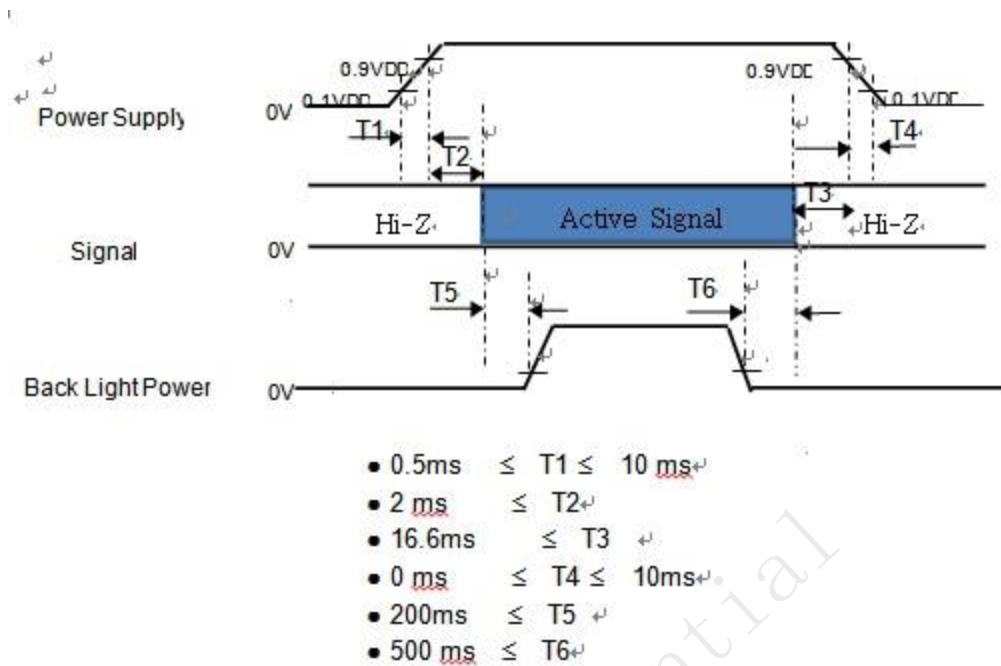


Figure 4. 8 Bit LVDS Signal Format

6.0 POWER ON/OFF SEQUENCE



Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on. Back Light must be turn on after power for logic and interface signal are valid.

7.0 OPTICAL SPECIFICATIONS

7.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = $25 \pm 2^\circ\text{C}$) with the equipment of Luminance meter system (Topcon SR-UL1R and Westar TRD-100A) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0° . The center of the measuring spot on the Display surface shall stay fixed.

The backlight should be operating for 30 minutes prior to measurement.

7.2 Optical Specifications

Table 8. Optical Specifications

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle	Horizontal	$\Theta 3$	CR > 10		85		$^\circ$	
		$\Theta 9$			85		$^\circ$	
	Vertical	$\Theta 12$			85		$^\circ$	
		$\Theta 6$			85		$^\circ$	
Contrast Ratio		CR	$\Theta = 0^\circ$	800	1000			Note 1
Luminance		cd/m ²	$\Theta = 0^\circ$	600				Note 2
Uniformity		%	$\Theta = 0^\circ$	75	80			Note 3
NTSC		%	$\Theta = 0^\circ$	60	70			
Reproduction Of color	Red	Rx	$\Theta = 0^\circ$	0.608	0.648	0.688		Note 4 * Module
		Ry		0.298	0.338	0.378		
	Green	Gx		0.270	0.310	0.350		
		Gy		0.557	0.597	0.637		
	Blue	Bx		0.100	0.140	0.180		
		By		0.045	0.085	0.125		
White		Wx	$\Theta = 0^\circ$	0.271	0.311	0.351		
		Wy		0.270	0.310	0.340		
Response Time		Tr+Tf	$\Theta = 0^\circ$		30	35	ms	Note 5

Note:

1. Contrast measurements shall be made at viewing angle of $\Theta = 0^\circ$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

2. Surface luminance is the center point across the LCD surface 50cm from the surface with all pixels displaying white. This measurement shall be taken at the locations shown in FIG. 5.

3. Uniformity measurement shall be taken at the locations shown in FIG. 6, for a total of the measurements per display, measure surface luminance of these nine points across the LCD surface 50cm from the surface with all pixels displaying white.

$$\text{Uniformity} = \frac{\text{Min Luminance of 9 points}}{\text{Max Luminance of 9 points}} \times 100\%$$

4. The color chromaticity coordinates specified in Table 1 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the Module.

5. The electro-optical response time measurements shall be made as FIG. 7 by switching the "data" input signal ON and OFF.

The times needed for the luminance to change from 10% to 90% is T_r and 90% to 10% is T_f .

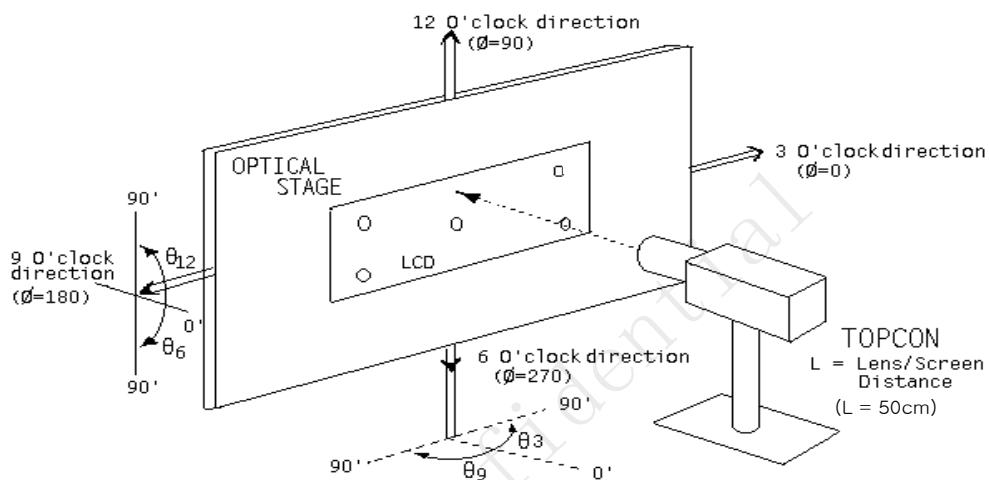


Figure 5. Measurement Set Up

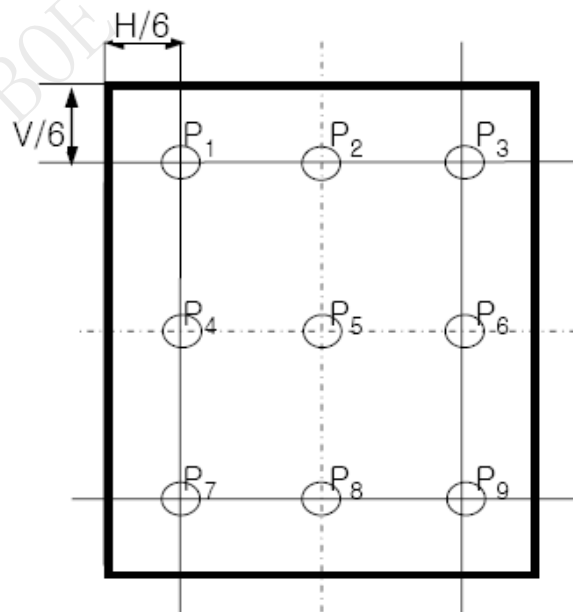


Figure 6. Uniformity Measurement Locations

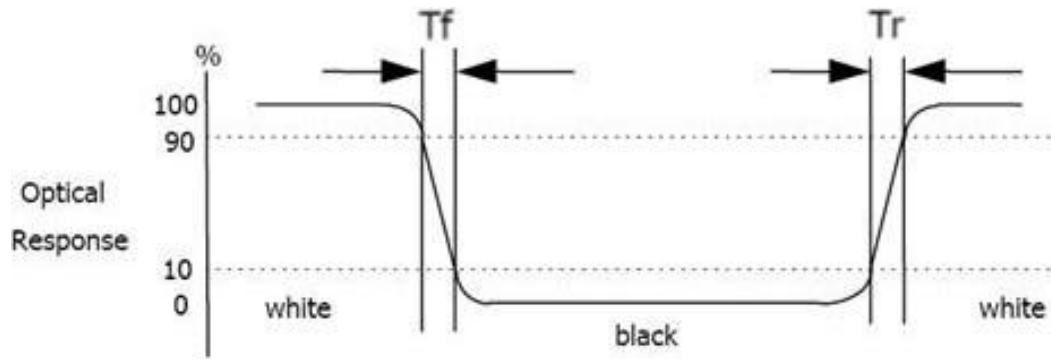


Figure 7. Response Time Testing

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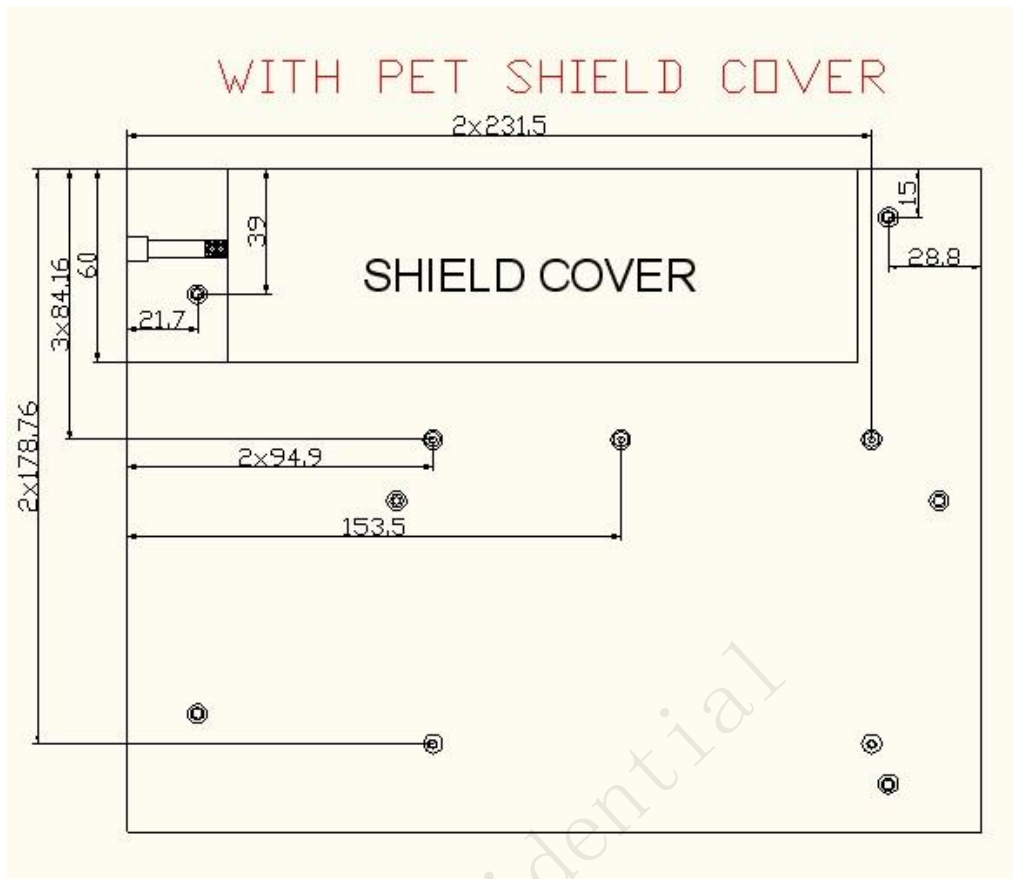


Figure 8. Outline Dimension (unit: mm)

9.0 RELIABILITY TEST

Table 10. RELIABILITY TEST

NO.	Test Item	Test Condition	Duration
1	Low Temperature Operation	-20°C±2°C	240H
2	High Temperature Operation	85°C±2°C	240H
3	High Temperature Storage	85°C±2°C	240H
4	Low Temperature Storage	-30°C±2°C	240H
5	High Humidity&Temperature Operation	60°C±2°C,90%±2%RH	240H
6	Thermal Shock non-operation	-30°C(1H)→85°C(1H)	100cycle
7	Vibration Test	Random:5~200HZ,0.015 psd,200~500,-6db/octave	2hours each for XYZ directions (total 6hours)
8	Shock Test	100g, 6ms	±XYZ 3times
9	ESD	Air discharge: Air:+/-4,8,15KV	5point/panel 10times
		Contact discharge: Contact: +/-4,8KV,10times	

Notes:

1. The test result shall be evaluated after the sample has been left at room temperature and humidity for 2hours without load. No condensation shall be accepted. The sample will not be accepted if appear these defects:

- 1) Air bubble in the LCD
- 2) Seal leak

- 3) Non-display
- 4) Missing segments
- 5) Glass crack
2. Each test item applies for a test sample only once, The test sample can not be used again in any other test item.
3. 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.
4. In the test of High Temperature Operation and High Temperature & Humidity Operation. The operation temperature is the surface temperature of module.
5. LED forward current should follow the De-rating curve.

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10.0 PACKING METHOD

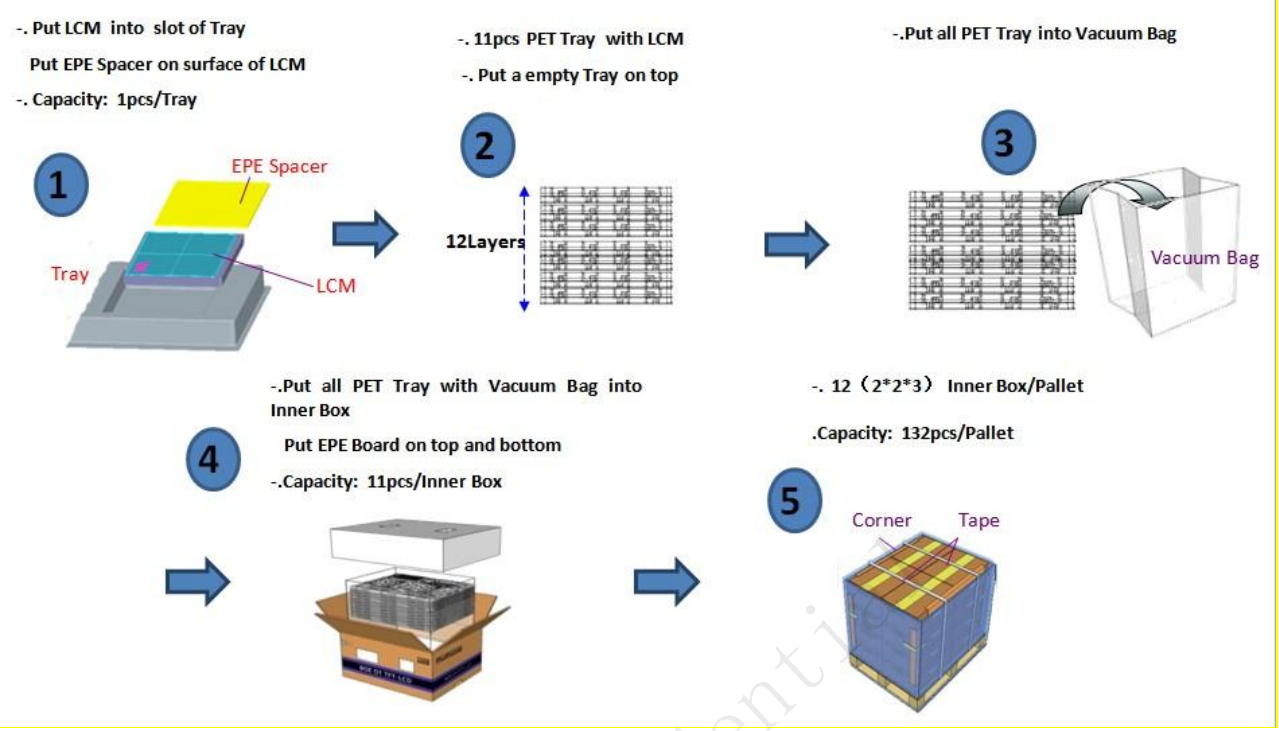


Figure 9. Packing Method

11.0 PRODUCT ID RULE

A V 121 X0 M - N 10							
① <Application area>		② <Mode>		③ <Size>		④ <Resolution>	
Code	Description	Code	Description	Code	Description	Code	Description
A	Automotive	V	ADS-a Si	121	12.1"	X0	1024*768
B	Mobile	S	ADS-LTPS	070	7.0"	HD	720*1280
T	Tablet PC	L	ESL/E-Paper	060	6.0"	FH	FHD

⑤ <Production type>		⑥ <Product state>		⑦ <Product Rev>		⑧ <Product Rev>	
Code	Description	Code	Description	Code	Description	Code	Description
M	Module	N	Normal	1	1.0mm	0	First Mode
E	CELL	T	ON Cell Touch	8	0.8mm	1	Second Mode
G	COGA	A	Add On Touch	5	0.5mm	2	Third Mode

12.0 HANDDLING & CAUTIONS

12.1 Mounting Method

- The panel of the LCM consists of two thin glasses with polarizer which easily get damaged. So extreme care should be taken when handling the LCM.
- Excessive stress or pressure on the glass of the LCM should be avoided. Care must be taken to insure that no torsional or compressive forces are applied to the LCM unit when it is mounted.
- If the customer's set presses the main parts of the LCM, the LCM may show the abnormal display. But this phenomenon does not mean the malfunction of the LCM and should be pressed by the way of mutual agreement.
- To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- Mount a LCM with the specified mounting parts.

12.2 Caution of LCM Handling and Cleaning

- Since the LCM is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass maybe broken.
- The polarizer on the surface of panel are made from organic substances. Be very careful for chemicals not to touch the polarizer or it leads the polarizer to be deteriorated.
- If the use of a chemical is unavoidable, use soft cloth with solvent recommended below to clean the LCM's surface with wipe lightly.
-IPA (Isopropyl Alcohol), Ethyl Alcohol, Tri-chloro, tri-flbrothane.
- Do not wipe the LCM's surface with dry or hard materials that will damage the polarizer and others. Do not use the following solvent—Water, acetone, Aromatics.
- It is recommended that the LCM be handled with soft gloves during assembly, etc. The polarizer on the LCM's surface are vulnerable to scratch and thus to be damaged by shape particles.
- Do not drop water or any chemicals onto the LCM's surface.
- A protective film is supplied on the LCM and should be left in place until the LCM is required for operation.
- The ITO pad area needs special careful caution because it could be easily corroded. Do not contact the ITO pad area with HCFC, Soldering flux, Chlorine, Sulfur, saliva or fingerprint. To prevent from the ITO corrosion, customers are recommended that the ITO area would be covered by UV or silicon.
- Please handle FPC with care.

12.3 Caution Against Static Charge

- The LCM use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.
- Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, if possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.
- Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
- In handling the LCM, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

12.4 Caution For Operation

- It is indispensable to drive the LCM within the specified voltage limit since the higher voltage than the limit causes LCM's life shorter. An electro-chemical reaction due to DC causes undesirable deterioration of the LCM so that the use of DC drive should avoid.
- Do not connect or disconnect the LCM to or from the system when power is on.
- Never use the LCM under abnormal conditions of high temperature and high humidity.
- When expose to drastic fluctuation of temperature(hot to cold or cold to hot), the LCM may be affected; specifically, drastic temperature fluctuation from cold to hot, produces dew on the LCM's surface which may affect the operation of the polarizer on the LCM.
- Response time will be extremely delay at lower temperature than the operating temperature range and on the other hand LCM may turn black at temperature above its operational range. However those phenomenon do not mean malfunction or out of order with the LCM. The LCM will revert to normal operation once the temperature returns to the recommended temperature range for normal operation.
- Do not display the fixed pattern for a long time because it may develop image sticking due to the LCM structure. If the screen is displayed with fixed pattern, use a screen saver.
- Do not disassemble and/or re-assemble LCM module

12.5 Packaging

- Modules use LCM element, 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 directly to sunshine or high temperature/humidity for long periods.

12.6 Storage

- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Relative humidity of the environment should therefore be kept below 60%RH.
- Original protective film should be used on LCM's surface (polarizer). Adhesive type protective film should be avoided, because it may change color and/or properties of the polarizer.
- Do not store the LCM near organic solvents or corrosive gasses.
- Keep the LCM safe from vibration, shock and pressure.
- Black or white air-bubbles may be produced if the LCM is stored for long time in the lower temperature or mechanical shocks are applied onto the LCM.
- In the case of storing for a long period of time for the purpose or replacement use, the following ways are recommended.
 - Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.
 - Store in a dark place where neither exposure to direct sunlight nor light is.
 - Keep temperature in the specified storage temperature range.
 - Store with no touch on polarizer surface by the anything else. If possible, store the LCM in the packaging situation when it was delivered.

12.7 Safety

- For the crash damaged or unnecessary LCM, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol and should be burned up later.
- In the case of LCM is broken, watch out whether liquid crystal leaks out or not. If your hands touch the liquid crystal, wash your hands cleanly with water and soap as soon as possible.
- If you should swallow the liquid crystal, first, wash your mouth thoroughly with water, then drink a lot of water and induce vomiting, and then, consult a physician.
- If the liquid crystal get in your eyes, flush your eyes with running water for at least fifteen minutes.
- If the liquid crystal touches your skin or clothes, remove it and wash the affected part of your skin or clothes with soap and running water.

13.0 Applicable Scope

- This product specification only applies to the products manufactured and sold by our company.
- Any specification, quality etc. about other parts mentioned in this product spec are no concern of our company.