



SHENZHEN APTUS TECHNOLOGY CO., LIMITED

PRODUCT SPECIFICATION

6" TFT-LCD MODULE

MODEL NAME: DBM060M2K01

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FOR CUSTOMER	
CUSTOMER	
APPROVED	

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1.0 GENERAL DESCRIPTION

1.1 Introduction

DBM060M2K01 is a MONO active matrix TFT-LCD Panel using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. It is a transmissive type display operating in the normal black. This TFT-LCD has a 5.96 inch diagonally measured active area with 1620 Horizontal by 2560 Vertical pixel array.

1.2 Features

- Single Pixle 0.05mm
- Thin and light weight
- High luminance and contrast ratio, low reflection and wide viewing angle
- RoHS Compliant

1.3 Application

- 3D Printer

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

Parameter	Specification	Unit	Remark
Active Area	81(H) × 128(V)	mm	
Number of Pixels	1620(H) × 2560(V)	pixels	
Pixel Pitch	50(H) × 50(V)	um	
Pixel Arrangement	WB Vertical stripe		
Display Colors		colors	
Color Gamut	MONO		
Display Mode	Normally black, Transmissive mode		
Dimensional Outline	84.6(H) × 135.85(V) × 1.1 (D)	mm	FOG
Viewing Direction (Human Eye)	U/D/L/R Min. 80/80/80/80	°	

2.0 ELECTRICAL SPECIFICATION

2.1 Absolute Maximum Ratings

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. Make sure all the design characteristics are adequate before the panel is initialed. All the measurements should be operated with driver IC and experimental FPC mounted.

Parameter	Symbol	Min	Max	Unit	Remark
LC Operating Voltage *1)	V _{op}	5.2	5.8	V	Ta = 25°C
Operating Temperature	T _{OP}	0	+70	°C	
Storage Temperature	T _{ST}	-10	+80	°C	
Operating Ambient Humidity *2)	H _{op}	10	*3)	%RH	*3)
Storage Humidity	H _{st}	10	*3)	%RH	*3)

Note:

[VSS = GND = 0V]

*1) Liquid Crystal driving voltage

Due to the characteristics of LC Material, this voltage varies with environmental temperature.

*2) Temp ≤ 60°C 90% RH MAX

*3) Non-condensation

2.2 Electrical Characteristics

Item	Symbol	Min.	Type.	Max	Unit	Note
Power Supply Voltage	V _{CC}	1.65	1.8	3.3	V	1, 2
	V _{SP}	5.4	5.5	5.6		
	V _{SN}	-5.6	-5.5	-5.4		

Notes:

1. If the module is above these absolute maximum ratings. It may become permanently damaged.
Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.
2. V_{CC} > V_{SS} must be maintained.
3. Please be sure users are grounded when handing LCD Module.

2.3 Electrical characteristics(V_{SS}=0V ,T_a=25°C)

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply		V _{CC}	T _a =25°C	1.65	1.8	3.3	V	
Input voltage	'H'	V _{IH}	V _{CC} =1.8V	0.7V _{CC}	-	V _{CC}	V	
	'L'	V _{IL}	V _{CC} =1.8V	0	-	0.2V _{CC}	V	
Current Consumption		I _{CC1}	Normal mode	-	-	-	mA	2

Note:

- 1:When an optimum contrast is obtained in transmissive mode.
- 2: Tested in 1×1 chessboard pattern.

3.0 OPTICAL SPECIFICATIONS

3.1 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.

3.2 Optical Specifications

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Threshold Voltage		Vsat		4.1	4.3	4.5	V	Fig.1
		Vth		1.6	1.8	2.0	V	
Viewing Angle	Horizontal	Θ3	CR>10	80				Note 1
		Θ9		80				
	Vertical	Θ12		80				
		Θ6		80				
Contrast Ratio		CR	Θ= 0°		400			Note 2
Transmittance		T(%)	Θ= 0°		4.0			Note 3
Response Time		Tr+Tf	Θ= 0°		35	40	ms	Note 5

Note:

- Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIG.2).
- 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. (See FIG. 2) Luminance Contrast Ratio (CR) is defined mathematically.

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

- Transmittance is the value based on UV405nm
- The color chromaticity coordinates specified in Table1 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 C/F. Measurement condition is C - light source & Halogen Lamp
- The electro-optical response time measurements shall be made as FIG.3 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Tf.

Figure 1. The definition of V_{th} & V_{sat}

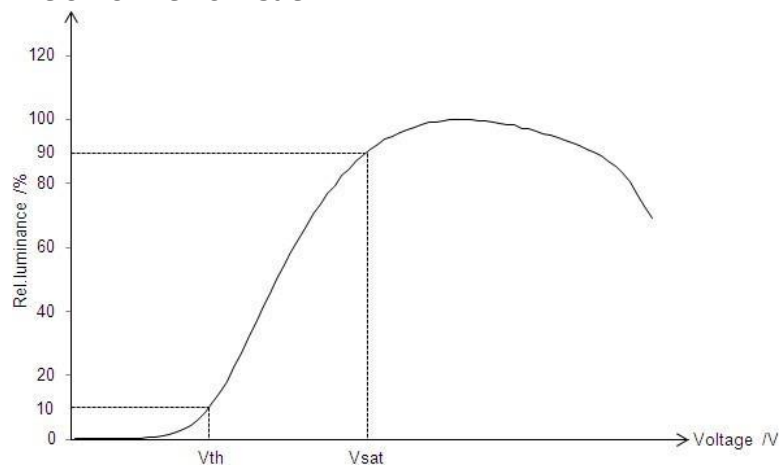


Figure 2. Measurement Set Up

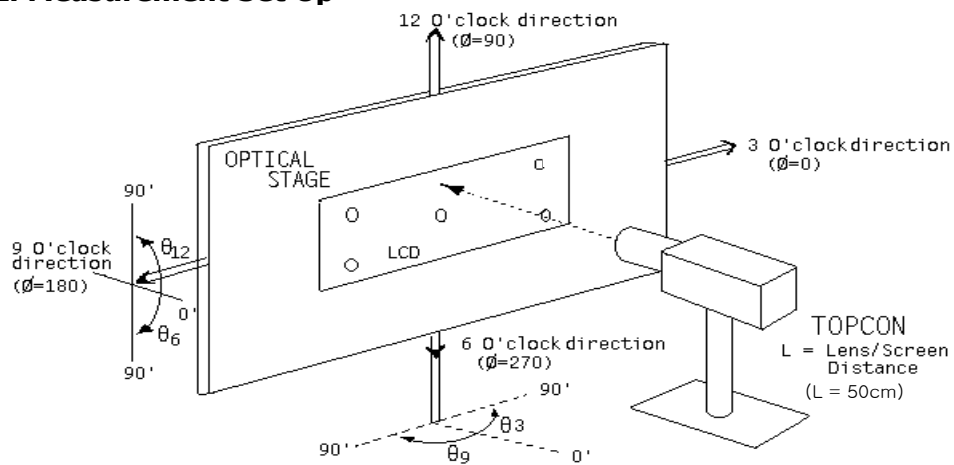
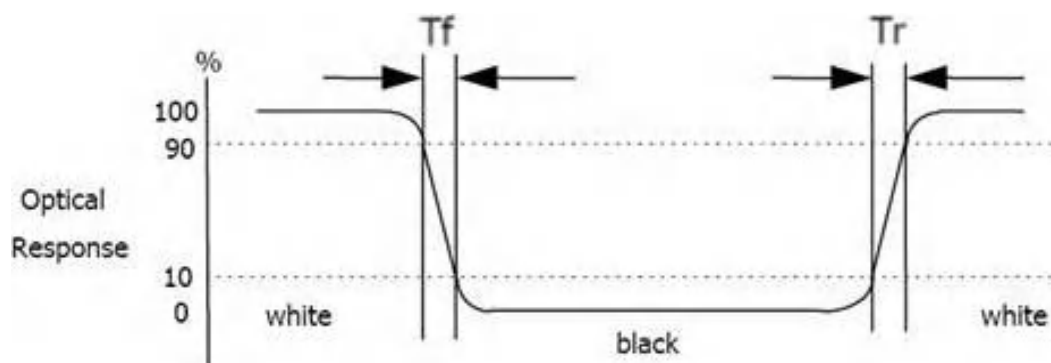


Figure 3. Response Time Testing



4.0 Mechanical Characteristics

4.1 Dimensional Requirements (H: horizontal length, V: Vertical length)

Parameter	Specification	Unit	Remark
Panel size	84.6(H) × 135.85(V)	mm	
CF size	84.6(H) × 132.8(V)	mm	
Active area	81.0(H) × 128.0(V)	mm	
Number of pixels	1620(H) × 2560(V)	pixels	
Pixel pitch	50(H) × 50(V)	um	
Pixel arrangement	WB Vertical stripe		
COG pad area	3.85	mm	
D-IC to FPC distance	0.725	mm	Note
D-IC width	0.895	mm	
D-IC to CF edge	0.63	mm	
FPC width	0.65	mm	
FPC to Glass edge	0.15	mm	
Seal Area(L/R/U/D)	1.8/1.8/1.8/3.0	mm	
Dimensional outline	84.6(H) × 135.85(V) × 1.08(D)	mm	FOG
Display mode	Normally Black		

Note:

The size specified is calculated by IC-driver HX8252A

5.0 Pin Assignment

Connector: JAE WP7B-P050VA1-R500 or compatible

Pin No.	Symbol	Function	Remark
1-2	GND	Ground	
3	VSN	Power supply to analog circuit (-5.5V)	
4	VSP	Power supply to analog circuit (5.5V)	
5	NC	Ground	
6-7	GND	HSSI_D1_Pare differential small amplitude signals.	
8	D3N	HSSI_D3_Nare differential small amplitude signals.	
9	D0N	HSSI_D0_Nare differential small amplitude signals.	
10	D3P	HSSI_D3_Pare differential small amplitude signals.	
11	D0P	HSSI_D0_Pare differential small amplitude signals.	
12-13	GND	Ground	
14	CKN	HSSI_DCLK_Nare differential small amplitude signals	
15	D1N	HSSI_D1_Nare differential small amplitude signals.	
16	CKP	HSSI_DCLK_Pare differential small amplitude signals	
17	D1P	HSSI_D1_Pare differential small amplitude signals.	
18-19	GND	Ground	
20	D2N	HSSI_D2_Nare differential small amplitude signals.	
21	NC	NC	
22	D2P	HSSI_D2_Pare differential small amplitude signals.	
23	NC	NC	
24-25	GND	Ground	
26-29	NC	NC	
30-31	GND	Ground	
32-35	NC	NC	
36-37	GND	Ground	
38	RESET	Global reset pin	
39	VDDI	Power voltage for digital circuit (1.8V)	
40	NC	Ground	
41	VDDI	Power voltage for digital circuit (1.8V)	
42-43	GND	Ground	
44-50	NC	NC	

6.0 RELIABILITY TEST

NO	Test Item	Test Condition	Duration
1	High temperature, high humidity operation test(THO)	60°C, 90%	240hr
2	Low temperature operation test(LTO)	0 °C	240hr
3	High temperature operation test(HTO)	70 °C	240hr
4	High temperature storage test(HTS)	80°C	240hr
5	Low temperature storage test(LTS)	-10°C	240hr
6	Thermal shock test	-30 °C → 80 °C	100hr
	(TST)	(Per 30min)	
7	Vibration	5-200Hz,0.015 psd 200-500,-6db/octave, X/Y/Z each axis 2hrs, total 6hrs	-

7.0 APPENDIX

Figure 4. FOG Outline Dimension (unit: mm)

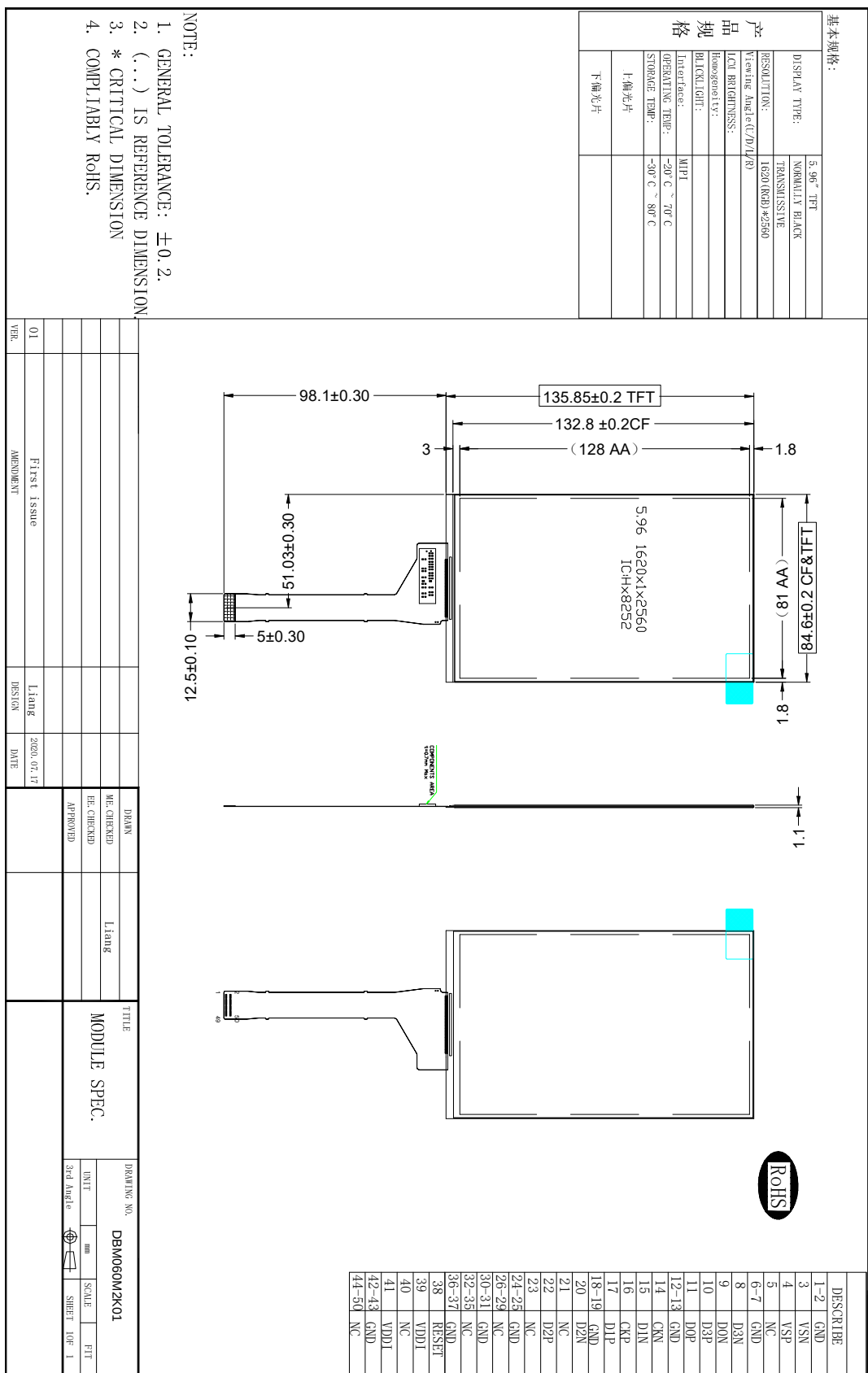
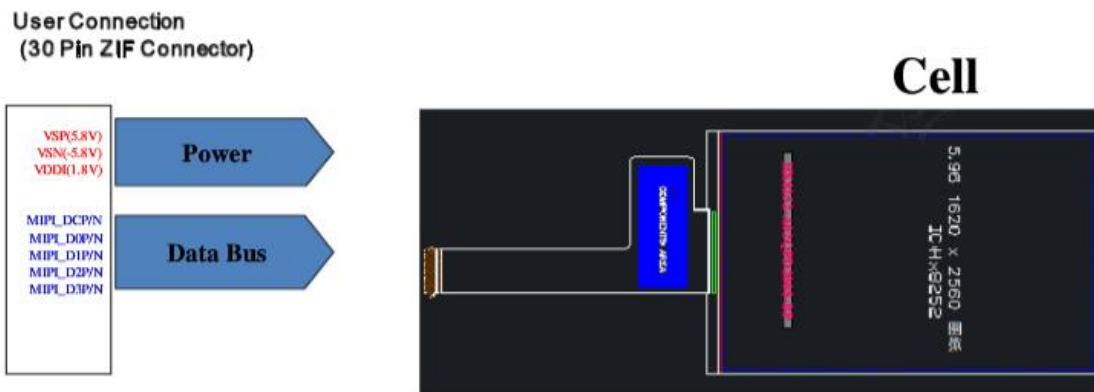


Figure 5. FOG Block Diagram



Input Signal: MIPI DSI Four-lane interface

Connector : 无 Customer connector(FH52-30S-0.5SH, ZIF)

测试 BLU : V, mA (TBD)

Figure 6. Timing and Voltage

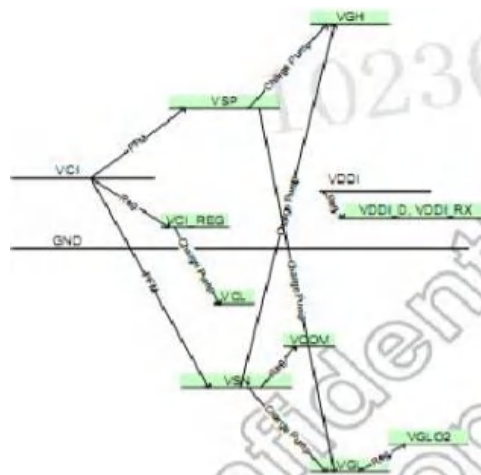
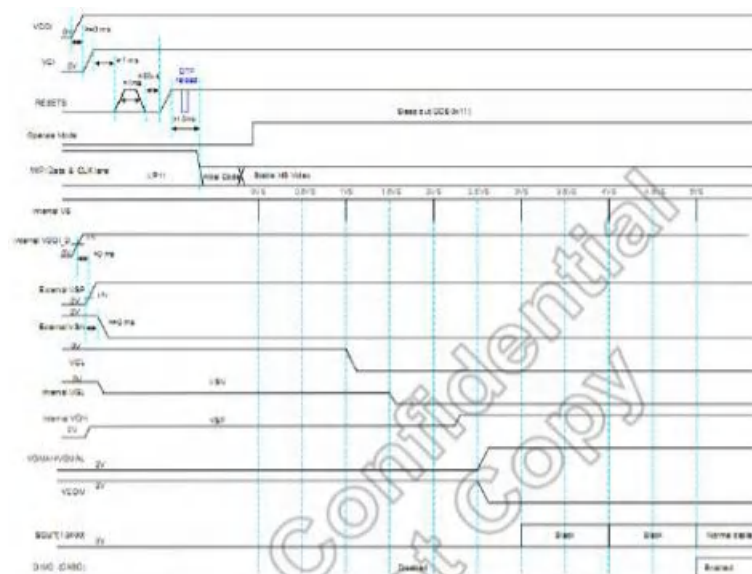


Figure 7. Power ON Sequence



9.0 Product ID Rule

TBD

10.0 Handling & Cautions

10.1 Mounting Method

- The panel of the LCD consists of two thin glasses with polarizer which easily get damaged. So extreme care should be taken when handling the LCD.
- Excessive stress or pressure on the glass of the LCD should be avoided. Care must be taken to insure that no torsional or compressive forces are applied to the LCD unit when it is mounted.
- If the customer's set presses the main parts of the LCD, the LCD may show the abnormal display. But this phenomenon does not mean the malfunction of the LCD 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 LCD module with the specified mounting parts.

10.2 Caution of LCD Handling and Cleaning

- Since the LCD 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 LCD's surface with wipe lightly.
-IPA (Isopropyl Alcohol), Ethyl Alcohol, Tri-chloro, tri-florothane.
- Do not wipe the LCD'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 LCD be handled with soft gloves during assembly, etc.
The polarizer on the LCD's surface are vulnerable to scratch and thus to be damaged by shape particles.
- Do not drop water or any chemicals onto the LCD's surface.
- A protective film is supplied on the LCD and should be left in place until the LCD 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.
- Handle FPC with care.

10.3 Caution Against Static Charge

- The LCD modules 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 LCD, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

10.4 Caution For Operation

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

10.5 Packaging

- Modules use LCD 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.

10.6 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 LCD'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 LCD near organic solvents or corrosive gasses.
- Keep the LCD safe from vibration, shock and pressure.
- Black or white air-bubbles may be produced if the LCD is stored for long time in the lower temperature or mechanical shocks are applied onto the LCD.
- 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 anything else. If possible, store the LCD in the packaging situation when it was delivered.

10.7 Safety

- For the crash damaged or unnecessary LCD, 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 LCD 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 gets 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.

11.0 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.