SPECIFICATION
FOR
LCD Module
YXM020TS-01

MODULE:	YXM020TS-01
CUSTOMER:	

REV	DESCRIPTION	DATE
1	**FIRST ISSUE**	**2011.5.10**

TZD	INITIAL	DATE
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APPROVED BY		**2011.5.10**

CUSTOMER	INITIAL	DATE
APPROVED BY		

Revision History

Data	Rev. No.	Page	Summary
2011.5.10	1		FIRST ISSUE

Contents

General Description

* Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 2.0" TFT-LCD contains 176 x 220 pixels, and can display up to 262K colors.

* Features

-Low Input Voltage: VCC: 2.5~3.3V
-Display Colors of TFT LCD: 262K colors
-CPU Interface: 8080 parallel 8 bit
-Internal Power Supply Circuit.

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	31.68(H) *39.6(V) (2.0 inch)	mm	-
Driver element	a-Si TFT active matrix	-	-
Display colors	262K	colors	-
Number of pixels	176(RGB) *220	dots	-
Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.18(H) *0.18(V)	mm	-
Viewing angle	6	o'clock	-
Drive IC	ILI9225B	-	-
Display mode	Transmissive/ Normally White	-	-
Operating temperature	-20～+70	℃	-
Storage temperature	-30～+80	℃	-

* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	-	38.4	-	mm	-
	Vertical(V)	-	51.4	-	mm	-
	Depth(D)	-	2.4	-	mm	-
Weight		-	TBD	-	g	-

1. Optical Characteristics

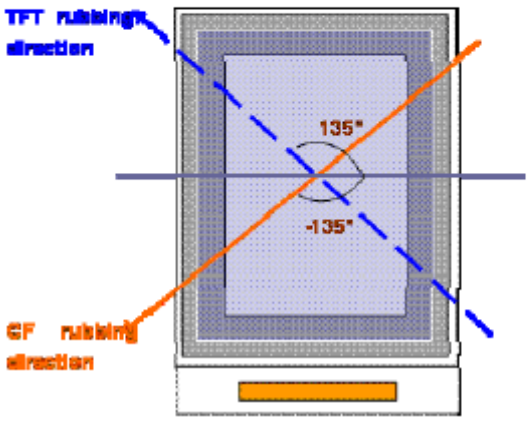
EWV Polarizer;Ta=25℃

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≧10	60	70	-	Degree	Note 2
		θB		50	60	-		
		θL		60	70	-		
		θR		60	70	-		
Contrast Ratio		CR	θ=0°	400	500	-	-	Note1 Note3
Response Time		T_{ON}	25℃	-	20	30	ms	Note1 Note4
		T_{OFF}						
Chromaticity	White	x	C-Light	0.239	0.289	0.339	-	Note5 Note1
		y		0.264	0.314	0.364		
	Red	x		0.567	0.617	0.667		
		y		0.284	0.334	0.384		
	Green	x		0.289	0.339	0.389		
		y		0.543	0.593	0.643		
	Blue	x		0.097	0.147	0.197		
		y		0.035	0.085	0.135		
NTSC		-	-	55	60	-	%	Note 5
Transmittance		T	-	5.7	6.2	-	%	Note1

Test Conditions:

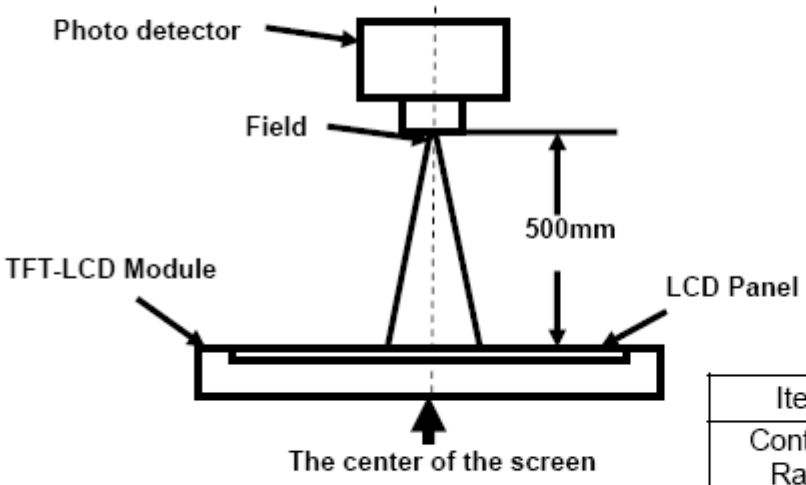
1. The ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.

6.2 Rubbing Direction



Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Chromaticity		
Response Time	BM-7A	2°

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80)。

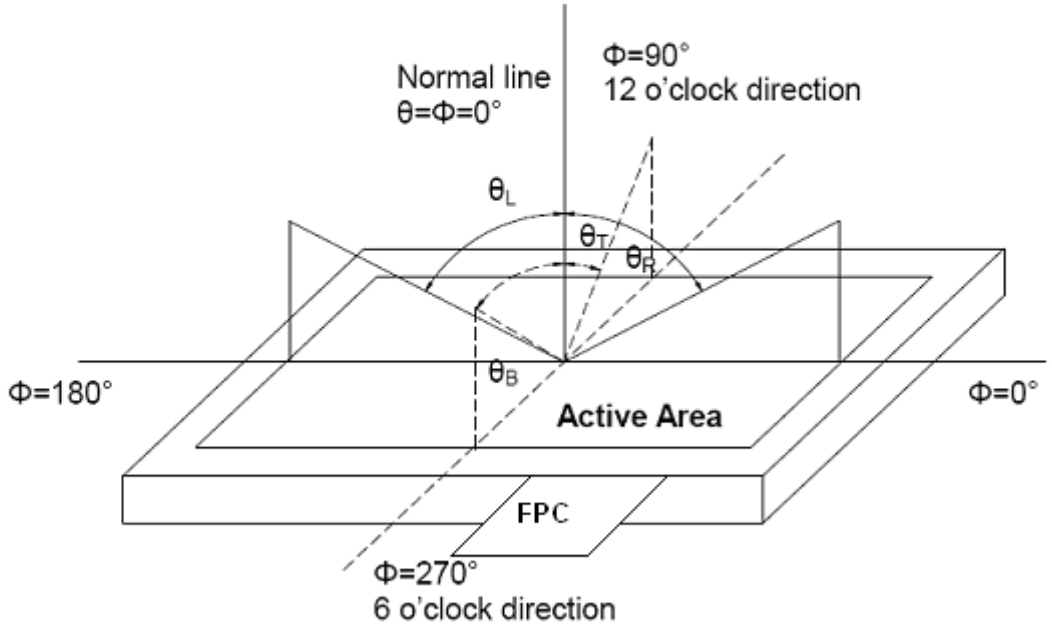


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

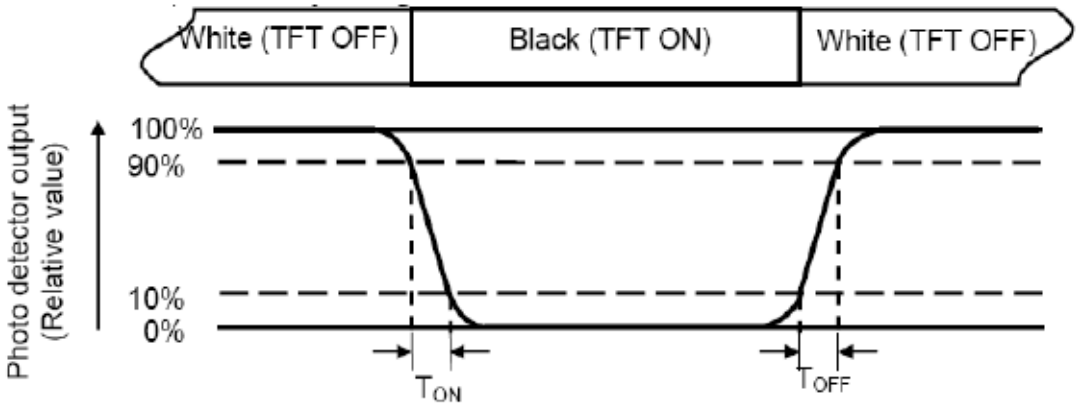
"White state ":The state is that the LCD should driven by Vwhite.

"Black state": The state is that the LCD should driven by Vblack.

Vwhite: To be determined Vblack: To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

2. Electrical Characteristics

2.1 Absolute Maximum Rating (Ta=25 VSS=0V)

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
System voltage	VDD	-0.3	2.8	+4.6	V	-
Supply voltage (Digital)	VDDIO	-0.3	-	+4.6	V	-
Supply voltage (Logic)	VDDIO	-0.3	-	+4.6	V	-
Operating temperature	T_{OP}	-20	-	+70	℃	1,
Storage temperature	T_{ST}	-30	-	+80	℃	2

Note1: Background color changes slightly depending on ambient temperature. This phenomenon is reversible. Ta70℃: 75%RH max

Ta>70℃: absolute humidity must be lower than the humidity of 75%RH at 70℃

Note2: Ta at -30℃will be <48hrs, at 80℃ will be <120hrs

2.2 DC Electrical Characteristics

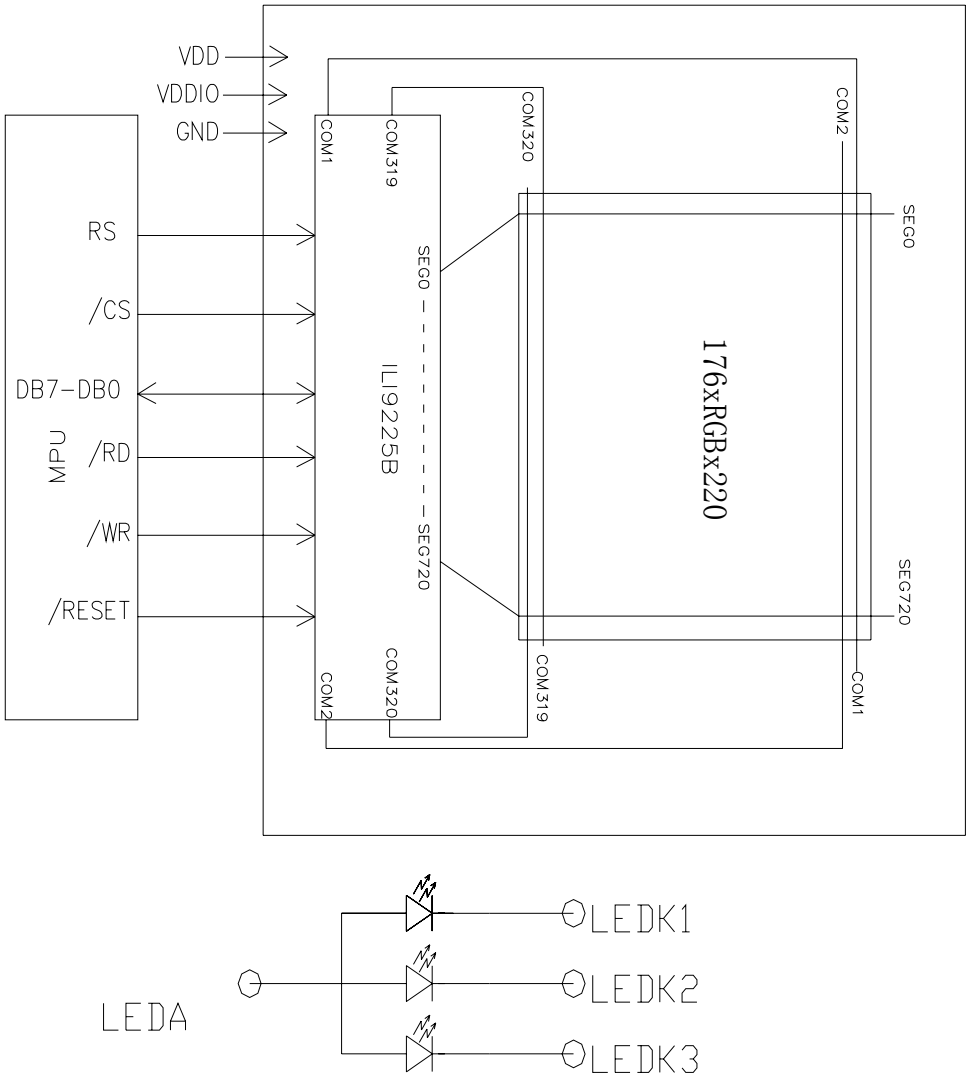
Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
System voltage	VDD	2.5	2.8	3.3	V	-
Digital & Logic operation Supply voltage	VDDIO	1.65	1.8	3.3	V	-
Normal mode Current consumption	VDD_I	-	6	-	mA	-
Sleep-in mode Current consumption	VDD_I	-	10	-	uA	-
Level input voltage	V_{IH}	0.8 VDDIO	-	VDDIO	V	-
	V_{IL}	GND	-	0.2 VDDIO	V	-
Level output voltage	V_{OH}	0.8 VDDIO	-	VDDIO	V	-
	V_{OL}	GND	-	0.2 VDDIO	V	-

2.3 LED Backlight Characteristics

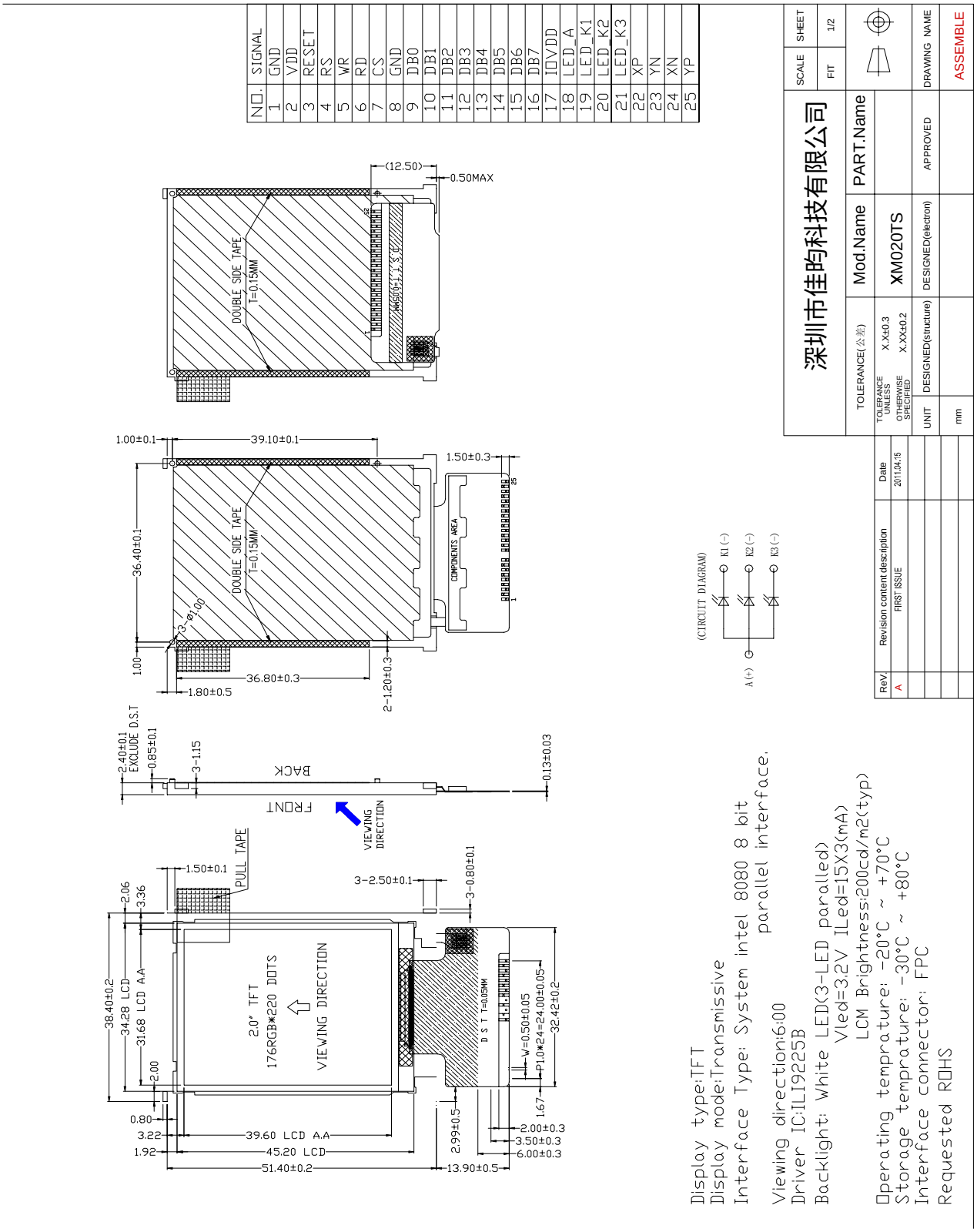
The back-light system is edge-lighting type with 3 chips White LED in parallel

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I_F	-	45	-	mA	-
Forward Voltage	V_F	-	3.2	-	V	-
LCM Luminance	L_V	-	TBD	-	cd/m2	
Uniformity	AVg	80	-	-	%	-

3. Block Diagram



4. Outline dimension



5. Input terminal Pin Assignment

Pin NO.	Symbol	Level	Function
1	GND	L	Ground
2	VDD	H	Power supply(2.8-3.3v)
3	RESET	H/L	Hardware reset pin
4	RS	H/L	A register select signal
5	WR	H/L	Write enable clock input pin
6	RD	H/L	Read enable clock input pin
7	CS	H/L	Chip select input pin
8	GND	L	Ground
9-16	DB0-DB7	H/L	DATA BUS DB0-DB7
17	IOVCC	H	Power supply(1.8-3.3v)
18	LEDA	H	Backlight+
19	L;EDK1	L	Backlight-
120	LEDK2	L	Backlight-
21	LEDK3	L	Backlight-
22	XP		TOUCH PANNEL PIN (No Connection)
23	YN		TOUCH PANNEL PIN (No Connection)
24	XN		TOUCH PANNEL PIN (No Connection)
25	YP		TOUCH PANNEL PIN (No Connection)

6. Operating Principle & Methods

Please refer to ILI9225B datasheet for more details.

80-System Bus operation Interface Timing Characteristics (8-bit interface)

Normal write operation (IOVCC=1.65V~3.30V)

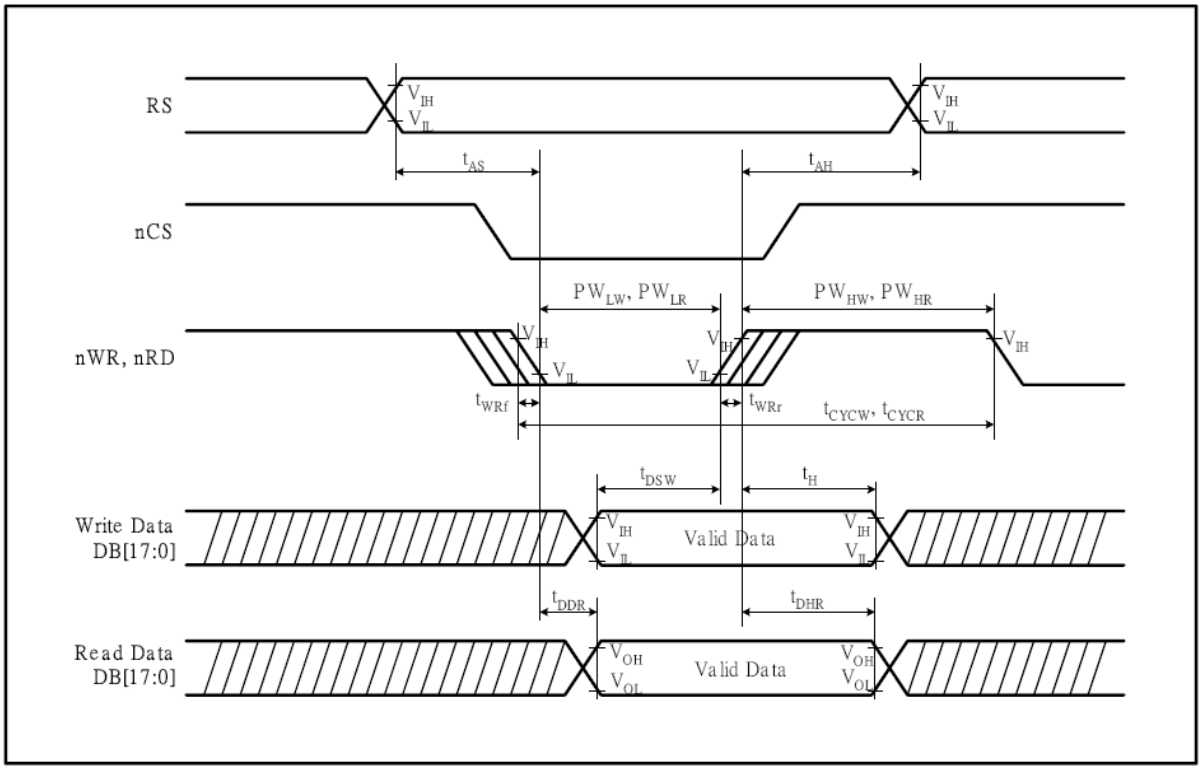
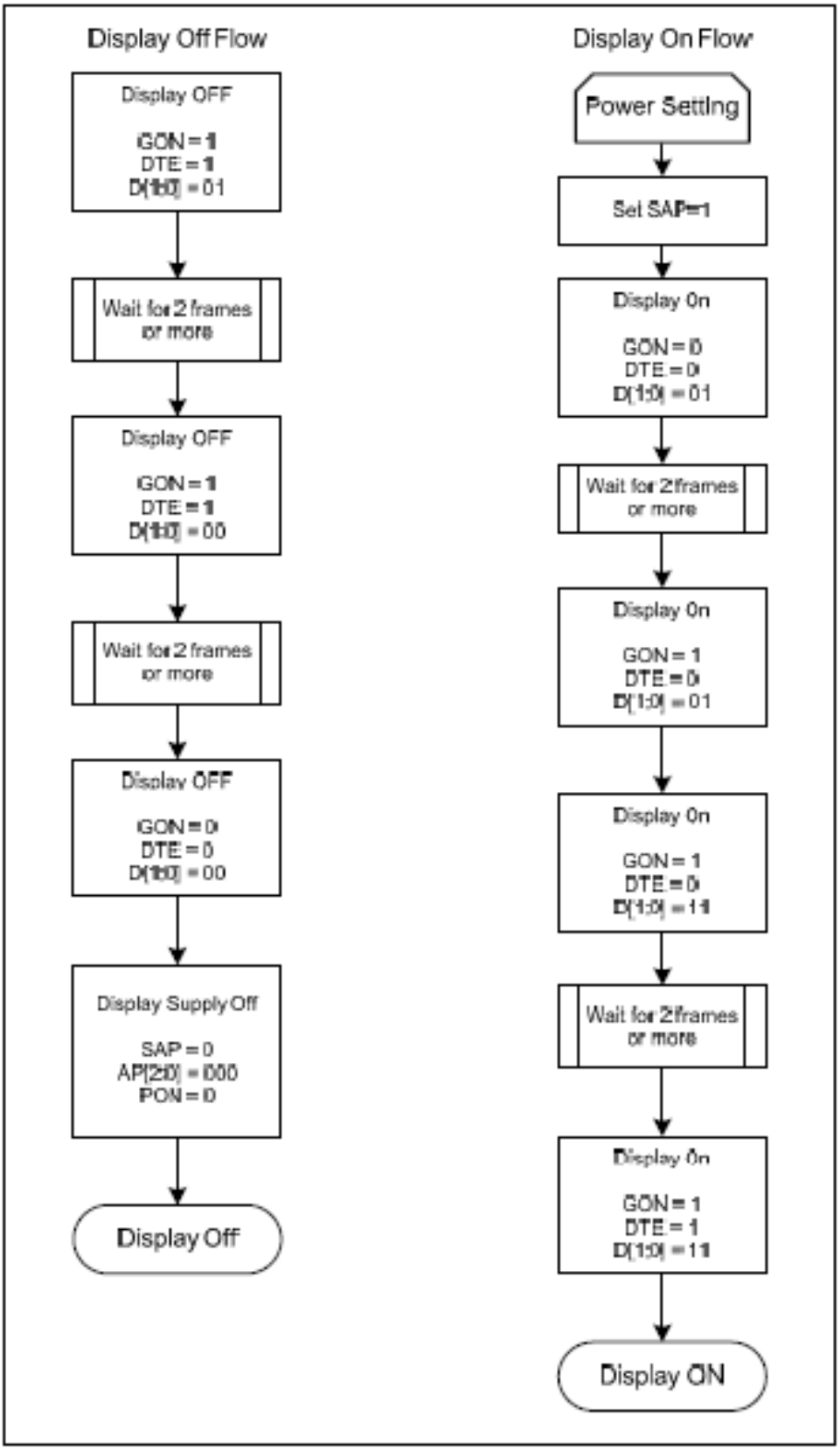


Figure46 i80-System Bus Timing

Normal Write Mode (IOVCC = 1.65~3.3V, VCI=2.5~3.3V)

Item		Symbol	Unit	Min.	Max.	Test Condition
Bus cycle time	Write	t_{CYCW}	ns	70	-	-
	Read	t_{CYCR}	ns	300	-	-
Write low-level pulse width		PW_{LW}	ns	15	500	-
Write high-level pulse width		PW_{HW}	ns	15	-	-
Read low-level pulse width		PW_{LR}	ns	150	-	-
Read high-level pulse width		PW_{HR}	ns	150	-	
Write / Read rise / fall time		t_{WRr}/t_{WRf}	ns	-	15	
Setup time	Write (RS to nCS, E/nWR)	t_{AS}	ns	10	-	
	Read (RS to nCS, RW/nRD)			5	-	
Address hold time		t_{AH}	ns	5	-	
Write data set up time		t_{DSW}	ns	10	-	
Write data hold time		t_H	ns	15	-	
Read data delay time		t_{DDR}	ns	-	100	
Read data hold time		t_{DHR}	ns	5	-	

7. Display ON/OFF Sequence



8. Reliability Test Result

8.1 Condition

Item	Condition	Sample Size	Test Result	Note
Low Temperature Operating Life test	-20℃, 96HR	3ea	pass	-
Thermal Humidity Operating Life test	40℃, 90%RH, 96HR	3ea	pass	-
Temperature Cycle ON/OFF test	-20℃ ↔ 70℃, ON/OFF, 20CYC	3ea	pass	(1)
High Temperature Storage test	80℃, 96HR	3ea	pass	-
Low Temperature Storage test	－30℃, 96HR	3ea	pass	-
Thermal Shock Resistance	The sample should be allowed to stand the following 5 cycles of operation: TSTL for 30 minutes -> normal temperature for 5 minutes -> TSTH for 30 minutes -> normal temperature for 5 minutes, as one cycle, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours	3ea	pass	
Box Drop Test	1 Corner 3 Edges 6 faces, 66㎝(MEDIUM BOX)	1box	pass	-

Note (1) ON Time over 10 seconds, OFF Time under 10 seconds

9. Packing

TBD

10. Cautions and Handling Precautions

10.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly. Do not warp or twist the module during assembly work.

(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.

(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.

(4) Do not allow drops of water or chemicals to remain on the display surface. If you have the droplets for a long time, staining and discoloration may occur.

(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Do not use ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static; it may cause damage to the CMOS ICs.

(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(10) Do not disassemble the module.

(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(12) Pins of I/F connector shall not be touched directly with bare hands.

(13) Do not connect, disconnect the module in the “Power ON” condition.

(14) Power supply should always be turned on/off by the item 6.1 Power On Sequence &6.2 Power Off Sequence

10.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.

It is highly recommended to store the module with temperature from 0 to 35 ℃ and relative humidity of less than 70%

(2) Do not store the TFT-LCD module in direct sunlight.

(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.

(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module. In particular, the greatest possible care should be taken to prevent any module from being operated

where condensation has occurred inside.

(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

11. LCD Module Out-Going Quality Level

11. LCD Module Out-Going Quality Level

(1.0) Purpose

The LCD specification provides outgoing provision and its expected quality level based on our outgoing inspection of LCD.

(2.0) Applicable Scope

The LCD specification is applicable to the arrangement in regard to outgoing Inspection and quality assurance after it.

(3.0) Quality Specification

(3.1) Quality Level

The quality level of BHL&BMDT are based on GB/T2828.1, Apply Level II, normal inspection by single sampling.

Rank	Item	AQL	Note
Major(MA)	Segment Short	0.65	
	Segment Missing		
	Solder Bridging		
	Outside Dimension		
	Cold Solder		
Minor (MI)	Black Spots, Foreign Substance, White Spots, Pinhole, Segment Deformation Air Bubbles between Glass & Polarizer, Scratchs(Glass & Polarizer), Color Variation, Solder Ball, Misalignment	1.0	

Note) AQL- Acceptable Quality Level

(3.2) Appearance Standards

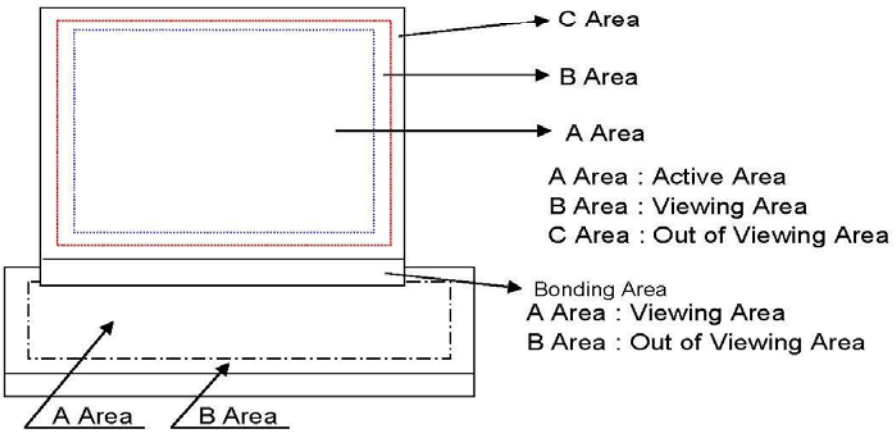
1) Inspection Conditions

The LCD shall be inspected under 20W white fluorescent lamp light.

The distance between the eyes and the sample shall be 30cm.

All directions for inspecting the sample should be within 30° to perpendicular line.

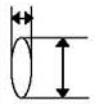
2) Definition of the Area



(3.3) Apperance Spec

Y

X

No	Item	Criteria	Rank	Remark
1	Segment Short Segment Missing	Not allowed	MA	
2	Solder Bridging	Any bridging between components, except common circuit, is not allowed.	MA	
3	Outside Dimension	Drawing & specification must be within permitable tolerance.	MA	
4	Cold Solder	Cold solder is not allowed.	MA	
5	Black(White) Spots, Foreign Substances	1) Round Type 2) Liner Type At (1) & (2) total defect q'ty is must not exceed 5 pieces.	MI	 ** : Mean Diameter (X + Y)/2
6	OC Spot		MI	
7	Air Bubles Between Glass & Polarizer (Polarizer Defects)		MI	

1) Round Type

Area Dimension**	Acceptable Q'ty		Remark
	A Area	B Area	
≤ 0.1	Ignore		
≤ 0.2	2	Ignore	
≤ 0.3	1	Ignore	
0.3 <	0	Ignore	

2) Liner Type

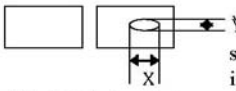
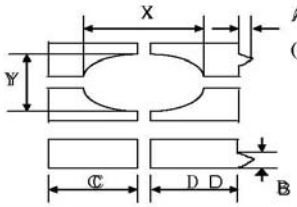
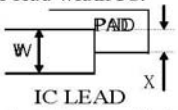
Dimension		Acceptable Q'ty		Remark
Length	Width	A Area	B Area	
-	≤ 0.025	Ignore		
≤ 2.5	≤ 0.05	3	Ignore	
≤ 1.5	≤ 0.075	2	Ignore	
	0.075 <	Follow round type		

A Area B Area

Area Dimension**	Acceptable Q'ty		Remark
	A Area	B Area	
≤ 0.2	Ignore		
≤ 0.8	3	Ignore	
≤ 1.0	1	Ignore	

Area Dimension**	Acceptable Q'ty		Remark
	A Area	B Area	
≤ 0.15	Ignore		
≤ 0.3	3	Ignore	
≤ 0.5	2	Ignore	
≤ 0.7	1	Ignore	
Total	5	Ignore	

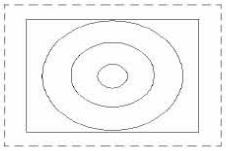
(3.3) Appearance Spec

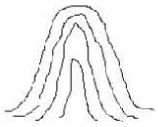
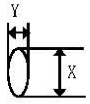
No	Item	Criteria	Rank	Remark
8	Pin hole (On Segment)	 (X+Y)/2 ≤ 0.2㎜ Within 1 per one segment (Less than 0.1㎜ is not counted) Total defects q'ty is must not exceed 5 pieces.	MI	
9	Segment Deformation	 (X+Y)/2 ≤ 0.2㎜ A ≤ 0.2㎜ B ≤ 0.2㎜ (C-D) ≤ 0.2㎜ Each visible dot must be more than half effective dot area	MI	(X + Y)/2 ≤ 0.2㎜
10	Color Variation	Within the three colors, except LCD Standard color is acceptable.	MI	
11	Glass & Polarizer Scratch	Follow NO.5(2) condition	MI	
12	Solder Ball	1)Acceptable if the size of void is less than 0.18㎜ 2)Acceptable if a solder ball is not movable 3)Rejectable if the solder ball exceed 5EA in 2.54 × 2.54㎜ area.	MI	
13	Miss Alignment	1)Acceptable if it dose not exceed 50% of the lead width IC.  X ≤ W/2 : Accept X > W/2 : Reject 2)Rejectable, provided that it does exceed 50% of the component termination width.  W1 > W2 : Reject		

Acceptable Q'ty	
Dot, Segment	1
LCD	5
≤ 0.1	Ignore all defect

Note : A limitation sample is given top priority

(3.3) Appearance Spec

<table>
<tr><th>No</th><th>Item</th><th>Criteria</th><th>Rank</th><th>Remark</th></tr>
<tr><td>14</td><td>Touch Panel</td><td>
1) Round Type、Foreign Substances
<table>
<tr><th rowspan="2">Area
Dimension**</th><th colspan="2">Acceptable Q'ty</th><th rowspan="2">Remark</th></tr>
<tr><th>A Area</th><th>B Area</th></tr>
<tr><td>≤ 0.1</td><td colspan="2">Ignore</td><td rowspan="4"></td></tr>
<tr><td>≤ 0.2</td><td>2</td><td>Ignore</td></tr>
<tr><td>≤ 0.3</td><td>1</td><td>Ignore</td></tr>
<tr><td>0.3 <</td><td>0</td><td>Ignore</td></tr>
</table>
2) Liner Type & Scratch
<table>
<tr><th colspan="2">Dimension</th><th colspan="2">Acceptable Q'ty</th><th>Remark</th></tr>
<tr><th>Length</th><th>Width</th><th>A Area</th><th>B Area</th><th></th></tr>
<tr><td>-</td><td>W≤0.025</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>L≤3.0</td><td rowspan="2">W≤0.05</td><td colspan="2">Ignore</td></tr>
<tr><td>3.0<L≤5.0</td><td colspan="2">2</td></tr>
<tr><td>≤ 7</td><td>W≤0.1</td><td colspan="2">1</td></tr>
<tr><td>-</td><td>W>0.1</td><td colspan="2">Follow round type</td></tr>
</table>
4) Newton Ring
a)Regular

The area of the Newton ring is more than 1/3area of the touch panel It's NG.
The area of the Newton ring is less than 1/3 area of the touch panel It's OK.

b)None-regularity

The area of the Newton ring is more than 1/2area of the touch panel It's NG.
The area of the Newton ring is less than 1/2 area of the touch panel It's OK.
</td><td>MI</td><td>


** : Mean Diameter (X + Y)/2
</td></tr>
</table>

12. BHL&BMDT Customer Quality Service Process

12. **BHL&BMDT Customer Quality Service Process**

In order to provide better service to Customer, BHL&BMDT shall apply the after-sales product quality service process as below:

1. According to the P/O from Customer, BHL&BMDT should deliver required product to the place appointed by Customer.
2. Customer will do IQC for the incoming procuct.
3. Inspection standard should be provided by BHL&BMDT, and it will be valid after confirmed by Customer.Inspection and Defects determination should be carried out according to the standard agreed by both Parties.
4. In order to guarantee in-time communication of product quality information and effective service, QA staff on Customer side should send Weekly Quality Report to the appointed CS staff in BHL&BMDT.
5. After BHL&BMDT get related information, both sides should arrange time and place to determin the defects found by Customer.
6. BHL&BMDT should cooperate with Customer for special quality requirement.
7. After confirmed by both side, BHL&BMDT should be responsible for the defect products which caused by its quality problem. BHL&BMDT should take back the confirmed defect product and return the good product to the place required by customer.
8. BHL&BMDT agree to provide related training of LCD product technology and usage.
9. Customer should use the LCD product according to the instruction. BHL&BMDT will not be responsible for the defect product caused by violation of Users' Instruction.
10. Both parties should deal with the quality problem with friendly cooperative policy. And both parties should negotiate to deal with the defect products of which the responsibility is not very clear.

13. LCD Module Operation Instruction

13. LCD Module Operation Instruction

BHL&BMDT

Part I. How to use the LCD Module

1. Don't hit the LCD Panel in any way because the LCD is made of glass.
2. Don't clean the surface of LCD with hard things. Please clean LCD with Air-gun or very soft cloth when necessary. The protective film on the POL can be removed just before assembly, otherwise, dust, spit or other foreign matter may attached on the LCD under the protective film. After the protective film is removed, only air-gun can be used to remove any dust or foreign matter. Fingure or cloth MUST NOT be used in such cases.
3. No chemical liquid is allowed to clean the LCD, such as alcohol, acetone and IPA. All of these can damage the LCD. Water on the LCD must be cleaned as soon as possible, for it will cause POL color change or other defect.
4. Please move and assemble LCD very carefully during assembly, and don't push or twist it.
5. Don't damage the FPC of LCD module. It will cause permanent defect.
6. Don't disassemble LCD module. It will cause permanent defect.
7. Don't expose LCD module under sunshine, strong fluorescence or ultraviolet radiation.
8. Please make sure that operators wear static-protective bands effectively and working tables are effectively earthing during operation.
9. Please place LCD module on the tray provided by BHL&BMDT while moving it, in order to avoid mechanical damage. Hold the module's side frames to avoide damage during moving.
10. Don't twist, disassemble, squeeze or hit the PCB. It will damage the circuit or component on PCB and cause functional defect.
11. Please use the connector according to the instruction provided by BHL&BMDT.
12. Please place dual module with the sub-panel upward. Trays should be placed in contrary direction. An empty tray should be placed on the top.
13. Sealing operation on PCB must be very careful to avoid short or cut the original circuit on PCB. Otherwise, it will cause permenant damage to the LCD.
14. Don't add direct DC or high voltage to LCD panel. It will cause functional damage to the LCD or shorten the life of LCD product.
15. LCD may respond slowly or display abnormally in extrem temperature (lower than -20℃ or higher than 50℃). But this doesn't mean LCD functional defect. LCD will display normally in regular temperature. Therefore, don't use LCD product in extrem temperature.
16. Don't push the display area of LCD panel, it will cause abnormal display. This doesn't mean LCD functional defect, neither. LCD will display normally in regular temperature.
17. Electrical test of LCD product is made by using mobile phone provided by Customer. We can use special test equipment to do the test, also.
18. The black band on IC on LCD product is used to protect the IC from light. Please do NOT remove it.
19. Please take great care to use connector. Customer should be responsible for connector defect caused by operation on Customer side.

Part II Storage

1. Physical status of liquid crystal will change in extrem temperature, and it can not be resumed when the temperature returns to be normal. So LCD module should be stored in required temperature.
2. LCD module should be stored in required humidity. Low hymidity may add static, while high humidity may corrode the ITO circuit of LCD product. The suitable storage environment is: temperature: 22±5℃, humidity: 55%±10%.
3. Don't expose LCD module under sunshine, strong fluorescence or ultraviolet radiation for a long time. It should be stored in dark area.
4. LCD should be stored in static-protective polythene bag. Don't expose it in the air for a long time.