深圳显旸光电科技有限公司

Shenzhen Xianyang Optoelectronic Technology Co., Ltd

MODULE NO.: XY019-LCM

For Customer: _____

Approved by: _____

Signature: _____

Date: _____

Prepared	Checked	Approved	Date

History of Versions and Modifications

Version	Modifications	Date
A	**Generation first version**	2019-06-21

PRODUCT SPECIFICATIONS

- LCD MODULE PHYSICAL DATA
- EXTERNAL DIMENSIONS
- BLOCK DIAGRAM
- ABSOLUTE MAXIMUM RATINGS
- ELECTRICAL CHARACTERISTICS
- INTERFACE PIN CONNECTIONS
- ELECTRO-OPTICAL CHARACTERISTICS
- SPECIFICATION OF QUALITY ASSURANCE
- RELIABILITY
- SUGGESTIONS FOR USING LCD MODULES
- PACKING
- ENVIRONMENT-RELATED SUBSTANCES

◆ LCD MODULE PHYSICAL DATA

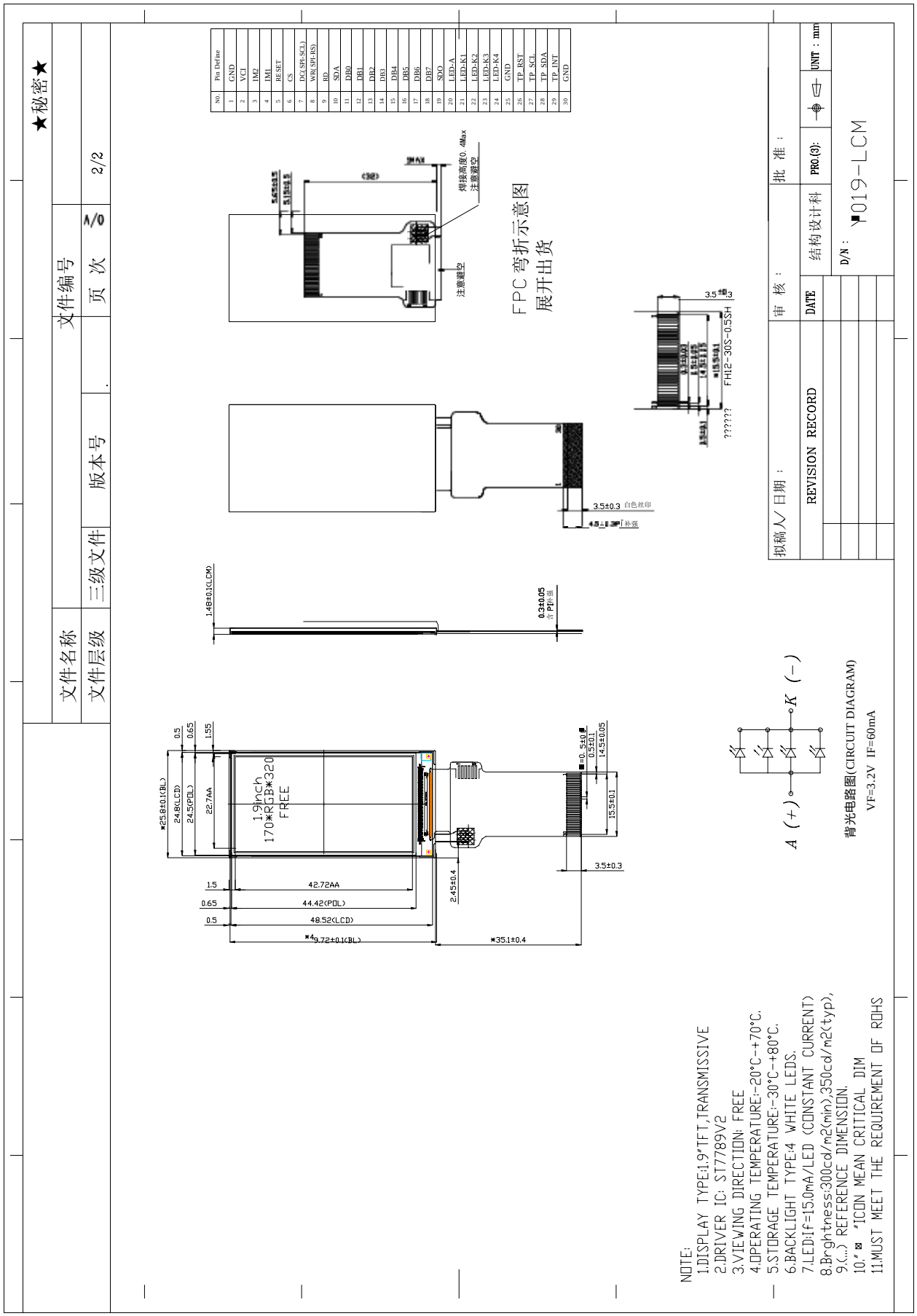
General Description

Size	1.9"
Display Type	16M TFT
Display Mode	Transmissive/Negative
Viewing Direction	ALL
Connection Type	COG
Operation temperature	-20℃ ~ 70℃
Storage temperature	-30℃ ~ 80℃
Driving IC	ST7789V2

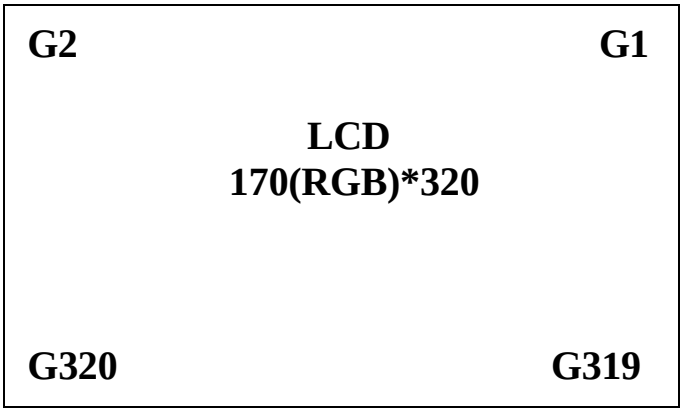
Mechanical Description

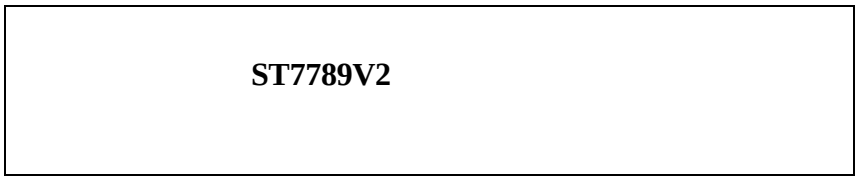
Item	Standard Value	Unit
Number of dots	170RGB×320	Pixels
LCM dimension	25.8(W)×49.72(H)×1.48(T)	mm
Active area	22.7(W)×42.72(H)	mm
Dot pitch	0.1335(W)×0.1335 (H)	mm
Backlight	4-chip white LEDS	/

◆ EXTERNAL DIMENSIONS



◆ BLOCK DIAGRAM





RESET
CS
WR
DC
RD
SDA
D0-D7

VCI(2.8V)

GND

Black Light Unite

K1

K2

K3

K4

◆ ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Rating	Unit
Operating temperature	Top	-20 to 70	℃
Storage temperature	Tst	-30 to 80	℃
Supply voltage	VCI-AVSS	- 0.3 ~ +3.3	V
Logic Input voltage range	VIN	-0.3 ~ +4	V
Logic Output voltage range	VO	-0.3 ~ +4	V

NOTE:

1. If the module is used 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. VDD>GND must be maintained.

◆ ELECTRICAL CHARACTERISTICS

DC Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Input high voltage	VIH	-	0.7* VCI	-	VCI	V
Input low voltage	VIL		VSS	-	0.3* VCI	V
Output high voltage	VOH	IOH = -0.1mA	0.8* VCI	-	VCI	V
Output low voltage	VOL	IOL = +0.1mA	VSS	-	0.2* VCI	V
Analog Operating voltage	VCI	Operating Voltage	2.5	-	3.3	V

Back-Light unit

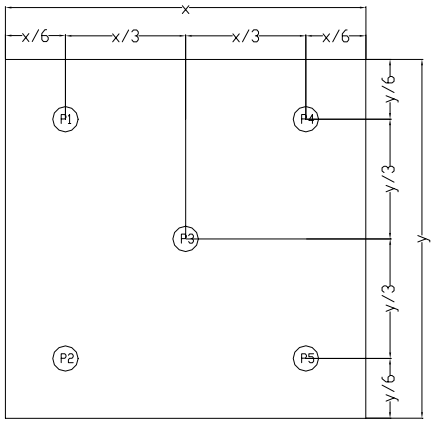
Item	Symbol	Min	Typ	Max	Unit	Remark
Current	I_{BL}	-	80	-	mA	14-chip white LEDS
CIE	X		TBD		-	-
	Y		TBD		-	
Brightness	-		TBD	-	cd/m²	Ordinarily BEF
Luminance Uniformity Ratio	-	80	-	-	%	-

Note: (Min current of each LED under lightening: 4MA.)

1. Average Luminous Intensity of P1 ~ P5（Using a luminance meter BM-7）

2. Luminous Intensity Ratio = (The Lvmin/Lvmax) * 100%

Measured Method (X*Y: Light Area).



AC Characteristics

Refer to the SPEC of NT35532H—DP/3AC

◆ INTERFACE PIN CONNECTIONS

NO.	Symbol	Function
1	GND	Ground
2	VCI	Power supply(2.8V)
3	IM2	The interface mode select
4	IM1	The interface mode select
5	RESET	Reset signal
6	CS	Chip selection
7	DC	Display data/command selection(RS)
8	WR	Write enable in MCU parallel interface
9	RD	Read enable in 8080 MCU parallel interface
10	SDA	SPI interface input/output
11	DB0	Date BUS
12	DB1	
13	DB2	
14	DB3	
15	DB4	
16	DB5	
17	DB6	
18	DB7	
19	SDO(GND)	Ground
20	LEDA	Backlight positive
21	LEDK1	Backlight negative
22	LEDK2	Backlight negative
23	LEDK3	Backlight negative
24	LEDK4	Backlight negative
25	GND	Backlight negative
26	TP-RST	TP-Reset signal
27	TP-SCL	TP-Serial clock input pin
28	TP-SDA	TP-Serial data input pin
29	TP-IINT	TP- Interrupt input pin
30	GND	System PWM signal output

◆ ELECTRO-OPTICAL CHARACTERISTICS

Driving condition: IOVCC= 1.8V, AVDD=5V， AVEE=-5V, I_{BL}= 20mA/LED, Temperature =23℃±5℃Humidity=60%±20%RH

Item		Condition	Symbol	Specifications			Unit	Equipment	Note
				Min.	Typ.	Max.			
Luminance(withTP)		θ=0° Φ=0°	Lv	350	380	-	cd/m²	BM-7/CS2000 or similar equipments	(1)
Contrast ratio			CR	800	1000	-			(2)
Luminance uniformity			Lu	80	-	-	%		(3)
Chromaticity	Rx	θ=0° Φ=0°	Rx	-	TBD	-	-		(4)
	Ry		Ry	-	TBD	-			
	Gx		Gx	-	TBD	-			
	Gy		Gy	-	TBD	-			
	Bx		Bx	-	TBD	-			
	By		By	-	TBD	-			
	Wx		Wx	0.27	0.30	0.33			
	Wy		Wy	0.29	0.32	0.35			
NTSC（CIE1931）			NTSC	-	60	-	%		
Response time		θ=0° Φ=0°	Tr+ Tf	-	30	35	ms	DMS series or similar equipments	(5)
Viewing angle	Right	Φ=0°	θ	-	80	-	deg	Center CR≥10	(6)
	Left	Φ= 180°		-	80	-			
	Top	Φ=90°		-	80	-			
	Bottom	Φ=270°		-	80	-			

Note:

（1）Luminance measurement

The data are measured at the center point of LCM after BL are lighted on and LCM displays are fully white

（2）The definition of Contrast Ratio (CR)

$$\text{Contrast Ratio(CR)} = \frac{\text{Luminance when LCD is at "white" state}}{\text{Luminance when LCD is at "Black" state}}$$

（3）Luminance uniformity

The luminance uniformity is calculated by using following formula:

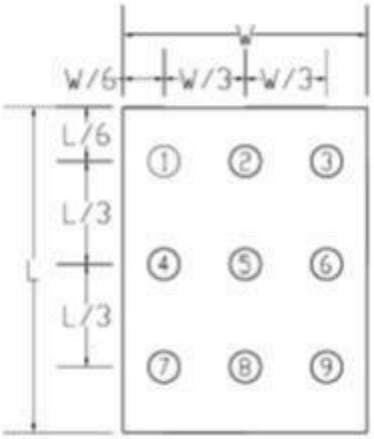
Lu = Lv (Min) / Lv(Max)× 100%

Where： Lv(Max) = Maximum brightness in 9 measured spots

Lv (Min)= Minimum brightness in 9 measured spots.

9 measurement points are illustrated below:

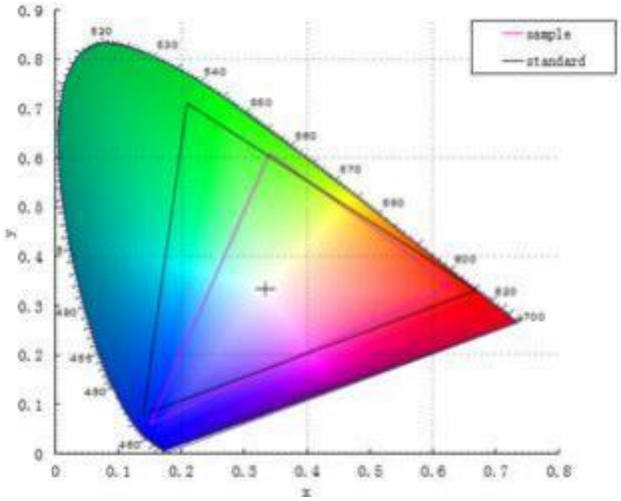
L: Length of Active Area
W:Width of Active Area



(4). NTSC

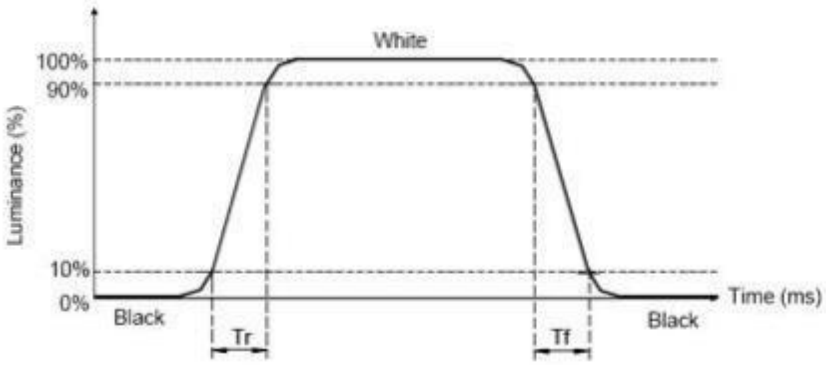
NTSC is defined in CIE1931 colorimetric system. NTSC defines colors that the display is capable of showing.

$$NTSC = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}}$$



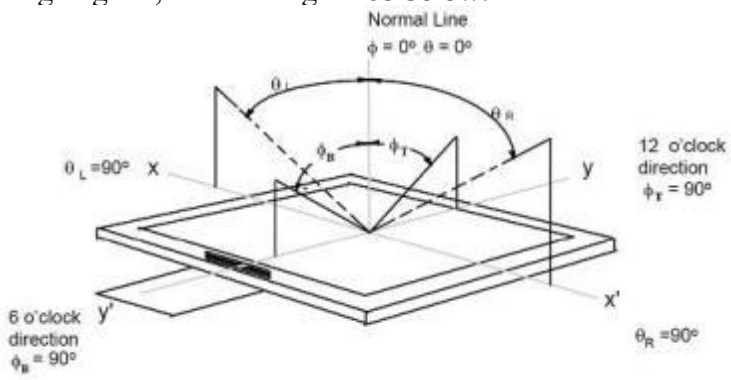
(5).Response time

The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



(6). Viewing angle

Definition of viewing angle θ, Refer to figure as below.



◆ SPECIFICATION OF QUALITY ASSURANCE

Warranty period

Warranty period of this product is 12 months from manufacture code.

Standard for quality test

1、 Inspection

Before delivering, the supplier should take the following test, and confirm the quality of product.

2、 Electro-Optical Characteristics

According to the individual specification to test the product.

3、 Test of Appearance Characteristics:

According to the individual specification to test the product.

4、 Test of Reliability Characteristics

According to the definition of reliability on specification for test product.

5、Delivery Test

Before delivering, the supplier should take the delivery test

6、Sampling Method: GB/T2828.1-2003, Level II

7、The defects classify of AQL as following

Major defect： AQL=0.4

Minor defect:: AQL= 1.0

Nonconforming Analysis & Deal With Manners

✧ Nonconforming Analysis

1、 Purchaser should supply the detail data of nonconforming sample and the non-suitable state.

2、 After accepting the detail data from purchaser ,the analysis of nonconforming should be finished in two weeks.

3、 If supplier can not finish analysis on time ,must announce purchaser before two weeks.

✧ Disposition of nonconforming

1、 If find any supplier defect during assembly line, supplier must change the good product for every defect after recognition.

2、Both supplier and customer should analysis the reason and discuss the disposition of nonconforming when the reason of nonconforming is not sure.

Agreement items.

Both sides should discuss together when the following problems happen:

1、 There is any problem of standard of quality assurance, and both sides think that must be modifier.

2、There is any argument item which does not record in the quality assurance.

3、Any other special problem.

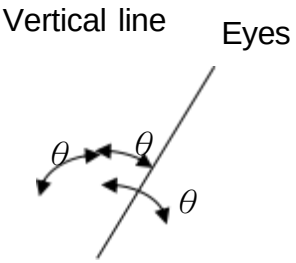
Standard of the Product Appearance Test

■ Manner of appearance test

1、 The test must be under 20W*2 or 40W fluorescent light ,and the distance of view must be at 30±5 cm;

2、 When test the model of Transmissive product must add the reflective plate.

3、 The test direction is base on about around 45 degree(within θ range)of vertical line, and the test time is below 5s.



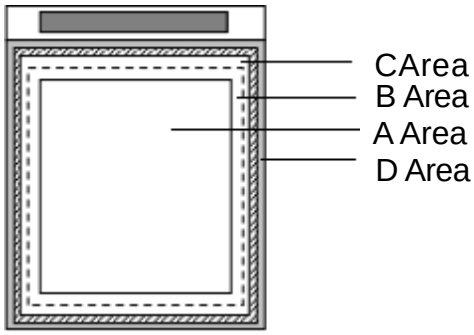
4、Definition of Area:

A Area: Active area

BArea: Viewing area

CArea: Out of viewing area

D Area: Seal area



Note:
A: Active Area is drawn in the drawing
B: Viewing Area border is 2mm from Active Area border

■ Basic principle:

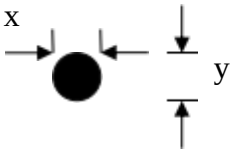
1、 It will accord to the AQL when the standard can not be described.

2、 The sample of the lowest acceptable quality level must be discussed by both supplier and customer when any dispute happened.

3、 Must add new item on time when it is necessary.

■ **Inspection specification**

NO	Item	Criterion	AQL
01	Electrical Testing	1.1 Missing vertical, horizontal segment, segment contrast defect. 1.2 Missing character, dot or icon. 1.3 Display malfunction. 1.4 No function or no display. 1.5 Current consumption exceeds product specifications. 1.6 LCD viewing angle defect. 1.7 Contrast defect	0.4

<table>
<tr>
<td>02</td>
<td>LCM black spots, white spots, bright spots , contamination (display/non-display)</td>
<td>Φ=(x+y)/2
 
<table>
<tr><th></th><th>Size</th><th>Acceptable QTY</th><th>Remark</th></tr>
<tr><td rowspan="4">Common dots defect</td><td>Φ≦0.10</td><td>Ignore</td><td>/</td></tr>
<tr><td>0.10<Φ≦0.20</td><td>2</td><td>No more than 2 spots within 10mm</td></tr>
<tr><td>0.20<Φ≤0.25</td><td>1</td><td>/</td></tr>
<tr><td>0.25<Φ</td><td>0</td><td>/</td></tr>
</table>
</td>
<td>1.0</td>
</tr>
<tr>
<td>03</td>
<td>Scratches/line type contamination (display/non-display)</td>
<td>As following drawing
 
<table>
<tr><th>Length</th><th>Width</th><th>Acceptable QTY</th><th>Remark</th></tr>
<tr><td>---</td><td>W≦0.02</td><td>Ignore</td><td>/</td></tr>
<tr><td>L≦3.0</td><td>0.02< W≦0.03</td><td>3</td><td rowspan="2">More than 10mm between two defects</td></tr>
<tr><td>L≦2.5</td><td>0.03< W≦0.05</td><td>3</td></tr>
<tr><td>---</td><td>0.05< W</td><td>0</td><td>/</td></tr>
</table>
The LCD with extensive crack is not acceptable.
</td>
<td></td>
</tr>
</table>

<table>
<tr><td>04</td><td>Polarizer bubbles</td><td>If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction.
<table>
<tr><th>Size</th><th>Acceptable QTY</th><th>Remark</th></tr>
<tr><td>Φ≦0.2 0</td><td>ignore</td><td>/</td></tr>
<tr><td>0.20<Φ≤0.50</td><td>2</td><td>More than 10mm between two defects</td></tr>
<tr><td>0.50<Φ</td><td>0</td><td>/</td></tr>
</table></td><td>1.0</td></tr>
<tr><td>06</td><td>Backlight elements</td><td>5.1 Illumination source flickers when lit.
5.2 Spots or scratches that appear when lit must be judged using LCD spot, lines and contamination standards.
5.3 Backlight doesn’t light or color is wrong</td><td>0.4
1.0
0.4</td></tr>
<tr><td>06</td><td>Soldering</td><td>6. 1 No unmelted solder paste may be present on the PCB.
6.2 No cold solder joints, missing solder connections, oxidation or icicle.
6.3 No residue or solder balls on PCB.
6.4 No short circuits in components on PCB.</td><td>0.4
0.4
1.0
0.4</td></tr>
<tr><td>07</td><td>General appearance</td><td>7.1 No oxidation, contamination, curves or, bends on interface pin (OLB) ofFPC
7.2 No cracks on interface pin(OLB) ofFPC
7.3 NO contamination, solder residue or solder balls on product.
7.4 The IC on the FPC may not be damaged, circuits.
7.5 The residual rosin or tin oil of soldering (component or chip component) is not burned into brown or black color.
7.6 Sealant on top of the ITO circuit has not hardened
7.7 Pin type must match type in specification sheet.
7.8 LCD pin loose or missing pins.
7.9 Product packaging must the same as specified on packaging specification sheet.
7.10 Product dimension and structure must conform to product specification sheet.</td><td>1.0
0.4
1.0
0.4
1.0
1.0
1.0
0.4
1.0
1.0</td></tr>
</table>

◆ RELIABILITY

No	Test Item	Test Condition& Criteria	Inspection after test
1-1	High Temperature Operation	70±3℃/ 96H	Inspection after 2 hours storage at room temperature, the sample shall be free from defects: 1. Air bubble in the LCD; 2. Sealleak; 3. Non-displa y; 4. Missing segments; 5. Glass crack;
1-2	High Temperature Storage	80±3℃/ 120H	
1-3	Low temperature Operation	-20±3℃/96H	
1-4	Low Temperature Storage	-30±3℃/ 120H	
1-5	High Temperature / High Humidity Operation	60±3℃,90%±3%RH/96H	
1-6	High Temperature / High Humidity Storage	60±3℃,90%±3%RH/120H	
1-7	Temperature Shock test	-30±3/30min.→/10~180Sec.→ 80±3℃/30min.(保存)10Cycle	

Remark:

1. The test samples should be applied to only one test item.
2. For Damp Proof Test, Pure water(Resistance>10MΩ) should be used.
3. In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
4. EL evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
5. Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.
6. Dew condensation and water drop have not adhered

NOTE:

1. When temperature moves, LCD's valve voltage will be influenced by it, which leads to LCD's contrast and chroma change.

2. In high temperature operation and storage tests in MQE test will make LCD's power consumption increase. The reason is that a few crystal molecules are apart because of high temperature when there is a long time storage and operation in high temperature, which leads to decrease of gross resistance ratio of crystal molecules.Hence, LCD's power consumption go up than that of before test.

2. Mechanical Reliability Test

No.	Test Item	Test Condition& Criteria	Sample Size	Determinant Spec.
2-1	ESD test	Discharge modality: Contact voltage:±1KV、±2KV; Air voltage: ±2KV、±4KV、±6KV; (Discharge R=330Ω;C= 150PF)	2PCS	No software error

3. FPC cable flexing and bending test

Number of Bending / Flexing Cycles: <10 times
Radius of the Bend Mandrels: >0.4 mm
Degree of Bend: <180°

◆ SUGGESTIONS FOR USING LCD MODULES

Handling of LCM

(1) The LCD screen is made of glass. Don't give excessive external shock, or drop from a high place.

(2) If the LCD screen is damaged and the liquid crystal leaks out, do not lick and swallow. When the liquid is attach to your hand, skin, cloth etc, wash it off by using soap and water thoroughly and immediately.

(3) Don't apply excessive force on the surface of the LCM.

(4) If the surface is contaminated ,clean it with soft cloth. If the LCM is severely contaminated , use Isopropyl alcohol/Ethyl alcohol to clean. Other solvents may damage the polarizer . The following solvents is especially prohibited: water , ketone Aromatic solvents etc.

(5) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

(6) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

(7) Don't disassemble the LCM.

(8) To prevent destruction of the elements by static electricity, be careful to maintain an optimum work

environment.

- Be sure to ground the body when handling the LCD modules.
- Tools required for assembling, such as soldering irons, must be properly grounded.
- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

(9) Do not alter, modify or change the the shape of the tab on the metal frame.

(10) Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.

(11) Do not damage or modify the pattern writing on the printed circuit board.

(12) Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector

(13) Except for soldering the interface, do not make any alterations or modifications with a soldering iron.

(14) Do not drop, bend or twist LCM.

-

Storage

(1) Store in an ambient temperature of 5 to 45 C, and in a relative humidity of 40% to 60%. Don't expose to sunlight or fluorescent light.

(2) Storage in a clean environment, free from dust, active gas, and solvent.

(3) Store in antistatic container.

◆ PACKING

TBD