



# 深圳市宝安区华威显示厂

HUA WEI DISPLAY SYSTEM ELECTRONICS CO., LTD

Tel: +86-0755-29951125

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## SPECIFICATIONS FOR LCD MODULE

Customer: \_\_\_\_\_

Model name: HW240400F-2A-0A-L1

Description: LIQUID CRYSTAL DISPLAY MODULE

Date: 2008-05-14

### CUSTOMER APPROVAL

Customer Approval	<input type="checkbox"/> Accept
	<input type="checkbox"/> Reject
comment:	
Approved by: _____	

### SUPPLIER APPROVAL

APPROVED	CHECKED	ORGANIZED
何俊光		肖 姚

#### 1、OTHERS:

APPROVAL FOR SPECIFICATIONS ONLY

APPROVAL FOR SPECIFICATIONS AND SAMPLE

NOTE: VERSION OF SPECIFICATIONS: 00

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## History of revision

[illegible]



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## 1. Introduction And General Specifications

Liquid crystal Displays (LCDS) have widely used in many applications such as industrial measurements, office mechanisms, and household electronic-equipment etc. LCM (LCD Module) integrates with LCD and driving circuit that is easily to be interfaced by user. This LCM contains a standard built-in dot -matrix font set.

### 1.1 Applications of LCM

Telephone  
Facsimile mechanism  
Electronic Typewriter  
Word processor  
Electronic memo pads  
Remote controller

### 1.2 Features of LCM

Compact, thin and light  
Wide view angle  
Low power consumption  
High contrast image  
Wide operating temperature  
High reliability

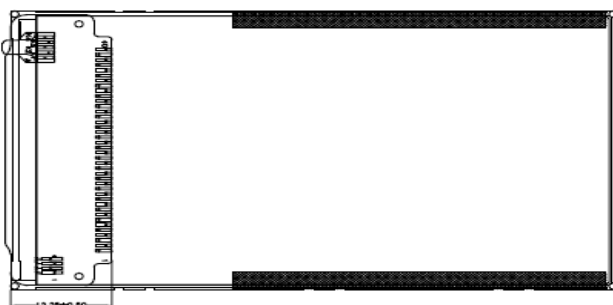
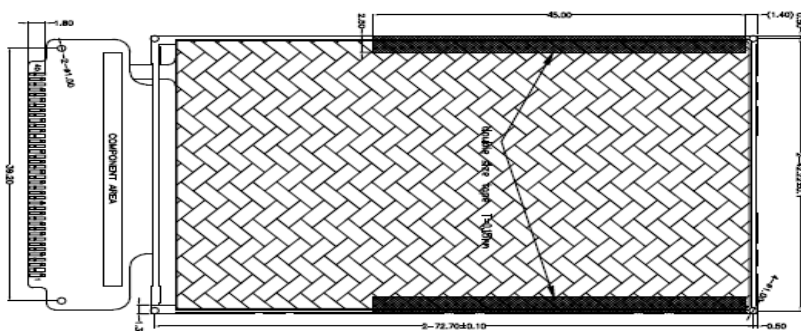
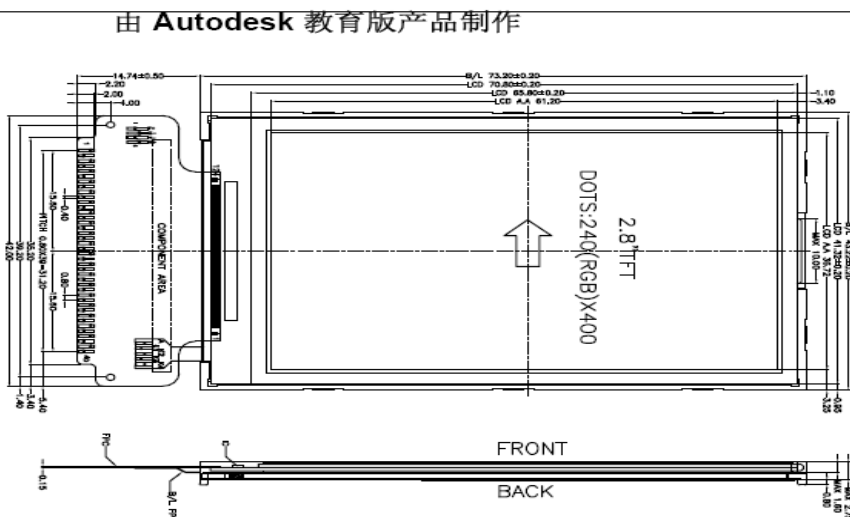
### 1.2 General specification

Parameter	Value	Unit
LCD Mode	a-Si TFT/Transmissive	-
Color Depth	262K/65K	-
Display Resolution	240*RGB*400	pixels
Pixel Arrangement	RGB-stripe	-
Viewing Direction	3 o' clock	
Display Mode	Normally white	
LCD Controller/Driver	SPFD5420A	-
IC Package Type	COG	-
MPU Interface	Standard 8080 system parallel	-
Power Supply Voltage	2.4~3.6	V
Back-light	White LED*4	PCS

客户型号:

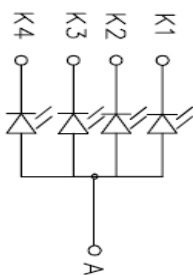
由 Autodesk 教育版产品制作

REV	REVISION RECORD	DATE	APPROVED	NAME
△				



1	YU)
2	XL)
3	YD)
4	X(R)
5	VSS
6	LOWC
7	VCC
8	FLARK
9	CS
10	RS
11	WR
12	RD
13	DB0
14	DB1
15	DB2
16	DB3
17	DB4
18	DB5
19	DB6
20	DB7
21	DB8
22	DB9
23	DB10
24	DB11
25	DB12
26	DB13
27	DB14
28	DB15
29	DB16
30	DB17
31	IM1
32	IM0
33	ID
34	RESET
35	GND
36	LED_A
37	LED_K1K1
38	LED_K2K2
39	LED_K3K3
40	LED_K4K4


弯折后示意图



NOTES:

- |                            |   |                       |
|----------------------------|---|-----------------------|
| 1. DISPLAY TYPE            | : | TFT 262K              |
| 2. POLARIZER MODE          | : | TRANSMISSIVE/NEGATIVE |
| 3. VIEWING DIRECTION:      | : | 3CLOCK                |
| 4. MAIN LCD BACKLIGHT      | : | 4-CHIP WHITE LED      |
| 5. OPERATING TEMP          | : | -20°C~70°C            |
| 6. STORAGE TEMP            | : | -30°C~80°C            |
| 7. DRIVER IC               | : | SPFD5420A             |
| 8. LED OPERATING VOLTAGE : | : | 3.2 V                 |



	TOLERANCE	MATERIAL	FINISH	MODEL
	±0.2			HW240400F-2A-0A
VERSION	SCALE	NO.	UNIT	TITLE
A	1:1	1/1	■	LOM
DATE	APPROVED	CHECKED	DRAWN	FILE NAME
2008.05.09			LIBAC	E:///240400



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## 3. Interface pin Connections Circuit Block Diagram

PIN NO.	SYMBOL	DESCRIPTION																																								
1	Y(U)	Touch panel YU																																								
2	X(L)	Touch panel XL																																								
3	Y(D)	Touch panel YD																																								
4	X(R)	Touch panel XR																																								
5	VSS	Ground																																								
6	IOVCC	Connect to VCC on the FPC if IOVCC=VCC, to prevent noise.																																								
7	VCC	Internal logic power: VCC=2.5V~3.3V, VCC>IOVCC.																																								
8	FMARK	Frame head pulse signal, which is used when writing data to the internal RAM. Keep this pin open when not used.																																								
9	CS	Chip select																																								
10	RS	Register select input pin   RS = "H": DB0 to DB7 are display data   RS = "L": DB0 to DB7 are control data																																								
11	WR	Read/Write execution control   R/W=" H ": read   R/W=" L ": write																																								
12	RD	Read/Write execution control When /RD is " L ", D0 to D7 are in an output status.																																								
13-30	DB0-DB17	Data Bas Line																																								
31	IM1	Select a mode to interface to an MPU. In serial interface																																								
32	IM0	Select 8bit or 16bit parallet 8Bit data bus:D0-D7,16Bit data bus:D0-D15																																								
33	ID	operation, the IM0 pin is used to set the ID bit of device code.																																								
		<table><tr><td>IM1</td><td>IM0 /ID</td><td>Interface Mode</td><td>DB Pin</td><td>Colors</td></tr><tr><td>0</td><td>0</td><td>80-system 18-bit interface</td><td>DB17-0</td><td>262,144</td></tr><tr><td>0</td><td>1</td><td>80-system 9-bit interface</td><td>DB17-9</td><td>262,144</td></tr><tr><td>1</td><td>0</td><td>80-system 16-bit interface</td><td>DB17-10 DB8-1</td><td>262,144 See note 1</td></tr><tr><td>1</td><td>1</td><td>80-system 8-bit interface</td><td>DB17-10</td><td>262,144 See note 2</td></tr><tr><td>0</td><td>*(ID )</td><td>Clock synchronous serial interface</td><td>-</td><td>65,536</td></tr><tr><td>1</td><td>0</td><td>Setting disabled</td><td>-</td><td></td></tr><tr><td>1</td><td>1</td><td>Setting disabled</td><td>-</td><td></td></tr></table>	IM1	IM0 /ID	Interface Mode	DB Pin	Colors	0	0	80-system 18-bit interface	DB17-0	262,144	0	1	80-system 9-bit interface	DB17-9	262,144	1	0	80-system 16-bit interface	DB17-10 DB8-1	262,144 See note 1	1	1	80-system 8-bit interface	DB17-10	262,144 See note 2	0	*(ID )	Clock synchronous serial interface	-	65,536	1	0	Setting disabled	-		1	1	Setting disabled	-	
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		0	*(ID )	Clock synchronous serial interface	-	65,536																																				
		1	0	Setting disabled	-																																					
		1	1	Setting disabled	-																																					
Notes: 1. 65,536 colors in one transfer mode																																										
2. 65.536 colors in two transfers mode																																										
34	RESET	This is an active low signal.																																								
35	GND	Internal logic GND: GND=0V.																																								
36	LED-A	LED 3.2V / 75mA																																								
37	LED-K1	LED1 GND																																								
38	LED-K2	LED2 GND																																								
39	LED-K3	LED3 GND																																								
40	LED-K4	LED4 GND																																								



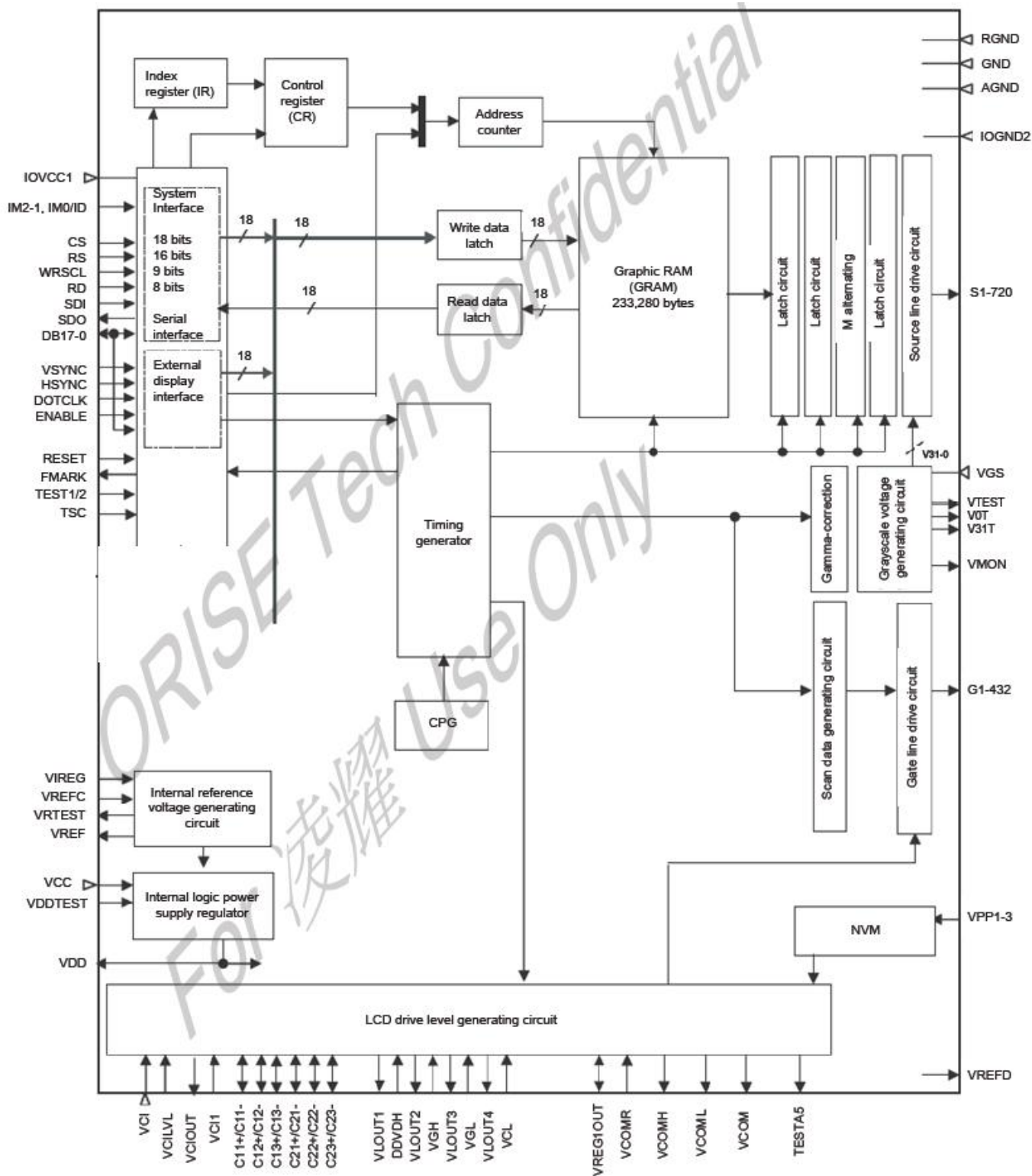
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## 4. Block function





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## 5. Feature

This single-display module is suitable for cell phone application. The Main-LCD adopts one backlight with High brightness 4-lamps white LED.

(1) Construction: 2.8" a-Si color TFT-LCD, White LED Backlight, and FPC.

(2) Main LCD: 2.1 Amorphous-TFT 2.8-inch display, transmissive, normally white type, and 3 o'clock.

2.2 240(RGB) X400 dots Matrix.

2.3 Narrow-contact ledge technique.

(3) Low cross talk by frame rate modulation

(4) Direct data display with display RAM

(5) Partial display function: You can save power by limiting the display space.

(6) MPU interface: 16 bit 80 Serial, parallel interface.

(7) Abundant command functions:

Area scroll function

Display direction switching function

Power saving function

Electric volume control function: you are able to program the temperature compensation function.

## 6. Mechanical specifications

### Dimensions and weight

Item		Specifications	Unit
External shape dimensions		43.22(W) x 74.8(H) x 3.0 (D) Max.	mm
Main LCD	Pixel Pitch	0.153 (W) x 0.153(H)	mm
	Active area	36.72 (W) x 61.2(H)	mm

## 7. Absolute max ratings and environment

### 7-1 Absolute max ratings

(Ta=25°C, GND=0V)

Item	Symbol	Min.	Max.	Unit	Remarks
Supply voltage	VCC	-0.3	+4.6	V	
Power supply voltage for step-up circuit	VCI	-0.3	+4.6	V	
Input voltage range	Vin	-0.3	VCC+0.3	V	

### 7-2 Environment

Item	Specifications	Remarks
Storage temperature	Max. +80 °C Min. -30 °C	Note 1: Non-condensing
Operating temperature	Max. +70 °C Min. -20 °C	Note 1: Non-condensing

Note 1: Ta ≤ +40 °C □□□□ Max. 85% RH Ta > +40 °C □□□□ The max. Humidity should not exceed the humidity with 40 °C 85% RH.





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## 8. Electrical specifications

### 8-1 Electrical characteristics of LCM

Item	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Operating voltage	VCC	Ta=25 °C	2.4	-	3.0	V
High-level input voltage	V <sub>IH</sub>	VCC=2.4~3.0	0.8IOVCC	-	IOVCC	V
Low-level input voltage	V <sub>IL</sub>	VCC=2.4~3.3	-0.2	-	0.2IOVCC	V

### 8-1 LED back light specification

Item	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Forward voltage	V <sub>f</sub>	I <sub>f</sub> =80mA	3.1	3.2	3.3	V
Forward current	I <sub>f</sub>	4-chip parallel	60	80	85	mA
Power Consumption	P <sub>BL</sub>	I <sub>f</sub> =80mA	-	256	-	mW
Uniformity (with L/G)	-	I <sub>f</sub> =80mA	80%*1	-	-	
Bare LED Luminous intensity	V <sub>f</sub> I <sub>f</sub>	3.2V 80mA	3000	-	-	cd/m2
Luminous color	White					
Chip connection	4 chip parallel connection					

## 9. Optical characteristics

### 9-1 Optical characteristics

(1/220 Duty in case except as specified elsewhere Ta = 25°C)

LED backlight transmissive module:

Item	Symbol	Temp.	Min.	Std.	Max.	Unit	Conditions
Response time	Tr	25 °C	-	10	30	ms	$\theta = 0^\circ$ (Note 4,5)
	Tf	25 °C	-	30	40		
Contrast ratio	CR	25 °C	-	300	-	-	At optimized Viewing angel (Note 5,6)
Visual angle	$\theta f$	25 °C	30	40	-	De-gree	CR $\geq$ 10 (Note 5,7)
	$\theta b$		10	20	-	De-gree	
	$\theta l$		60	70	-	De-gree	CR $\geq$ 10 (Note 5,7)
	$\theta r$		60	70	-	De-gree	
Visual angle direction priority			3:00				(Note 8)
Brightness			180			Cd/m2	V <sub>LED</sub> =3.2V, 80mA Full White pattern



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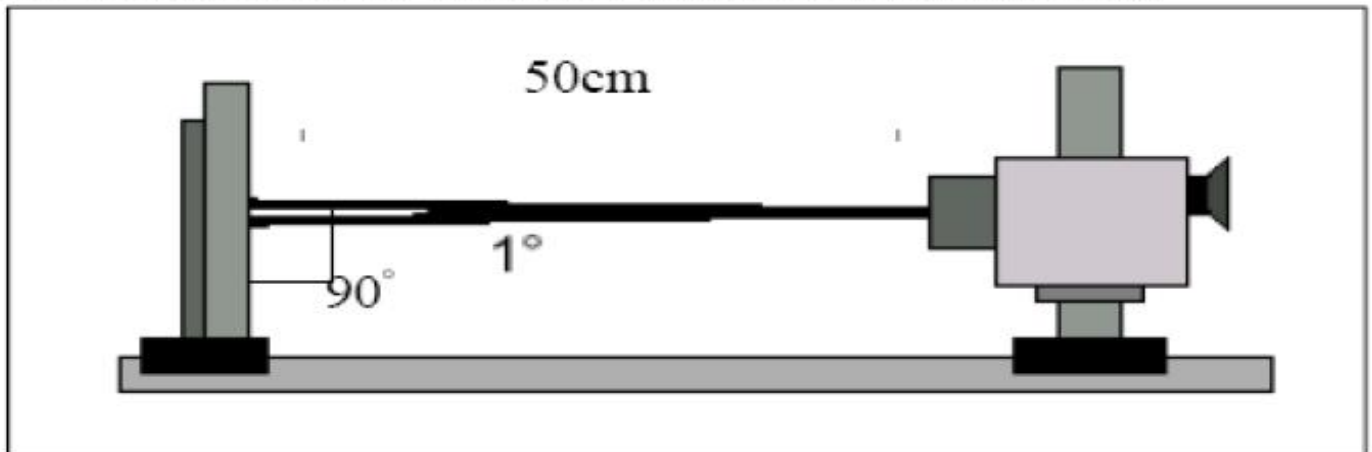
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Note 2: To be measured in the dark room.

Note 3: To be measured at the center area of panel with a viewing cone of  $1^\circ$  by Topcon luminance meter BM-7, after 10 minutes operation (module).

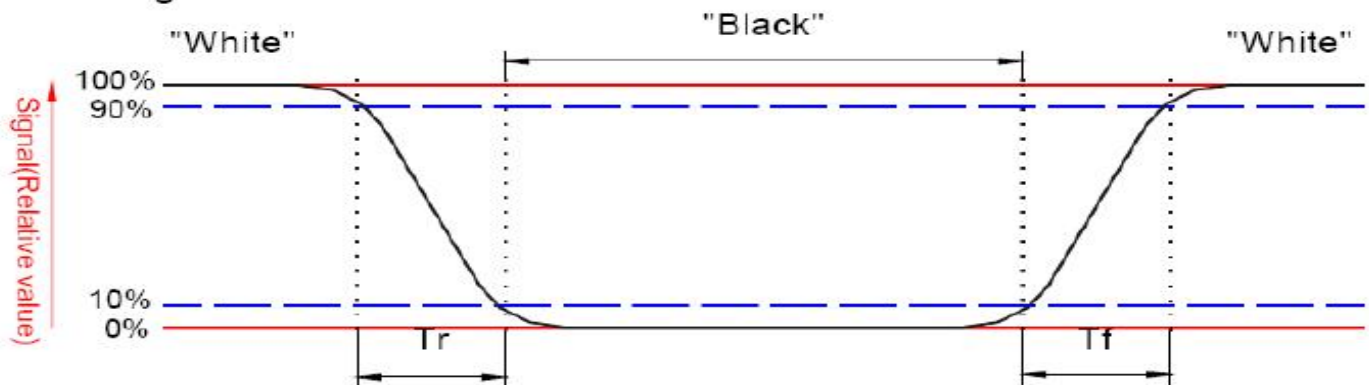


Note 4: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from "black" to "white" (falling time) and from "white" to "black" (rising time), respectively.

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

Refer to figure as below:



Note 5: White  $V_i = 0.9V$

Black  $V_i = 4.5V$

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

Note 6: Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" state}}{\text{Photo detector output when LCD is at "Black" state}}$$

Note 7: Definition of viewing angle:

Refer to the figure as below.



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## 10. Qualities and reliability

### 10-1 Test conditions

Tests should be conducted under the following conditions:

Ambient temperature:  $25 \pm 5^{\circ}\text{C}$

Humidity:  $60 \pm 25\% \text{ RH}$ .

### 10-2 Sampling plan

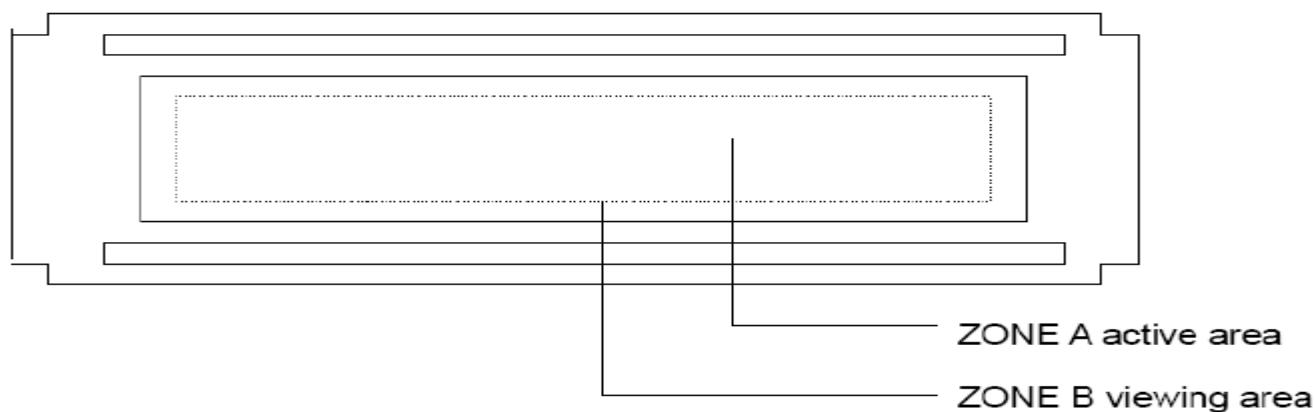
Sampling method shall be in accordance with MIL-STD-105E, level II, normal single sampling plan.

### 10-3 Acceptable quality level

A major defect is defined as one that could cause failure to or materially reduce the usability of the unit for its intended purpose. A minor defect is one that does not materially reduce the usability of the unit for its intended purpose or is an infringement from established standards and has no significant bearing on its effective use or operation.

### 10-4 Appearance

An appearance test should be conducted by human sight at approximately 30 cm distance from the LCD module under fluorescent light. The inspection area of LCD panel shall be within the range of following limits.



### 10-5 Inspection quality criteria

No	Item	Criterion	
01	Outline Dimension	In accord with drawing	
02	Position-Finding Dimension Assemble Dimension	In accord with drawing	

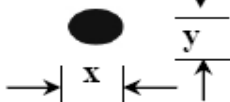
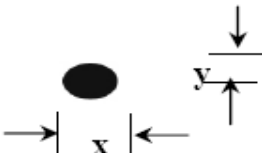
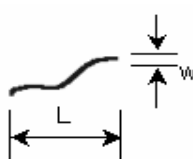


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03	LCD black spots, white spots (Round type)	<div>Round type: non display</div> <div>3.1 Small area LCD</div> <div></div> <div>Unit: mm</div> <table><tr><th>Dimension</th><th>Qualified Quantity</th></tr><tr><td><math>D \leq 0.1</math></td><td>Ignore</td></tr><tr><td><math>0.1 &lt; D \leq 0.15</math></td><td>2</td></tr><tr><td><math>D &gt; 0.15</math></td><td>0</td></tr></table>	Dimension	Qualified Quantity	$D \leq 0.1$	Ignore	$0.1 < D \leq 0.15$	2	$D > 0.15$	0										
		Dimension	Qualified Quantity																	
$D \leq 0.1$	Ignore																			
$0.1 < D \leq 0.15$	2																			
$D > 0.15$	0																			
		<div>3.2 Large area LCD</div> <div></div> <table><tr><th>Dimension</th><th>Qualified Quantity</th></tr><tr><td><math>D \leq 0.1</math></td><td>Ignore</td></tr><tr><td><math>0.1 &lt; D \leq 0.15</math></td><td>2</td></tr><tr><td><math>0.15 &lt; D \leq 0.20</math></td><td>1</td></tr><tr><td><math>D &gt; 0.20</math></td><td>0</td></tr></table> <div>C-STN: if <math>D &gt; 0.1</math>, unqualified</div>	Dimension	Qualified Quantity	$D \leq 0.1$	Ignore	$0.1 < D \leq 0.15$	2	$0.15 < D \leq 0.20$	1	$D > 0.20$	0								
Dimension	Qualified Quantity																			
$D \leq 0.1$	Ignore																			
$0.1 < D \leq 0.15$	2																			
$0.15 < D \leq 0.20$	1																			
$D > 0.20$	0																			
04	LCD black spots, white spots (Line Style)	<div>4.1 Small area LCD</div> <div>Unit : mm</div> <div></div> <table><tr><th>Length</th><th>Width</th><th>Qualified Quantity</th></tr><tr><td>-</td><td><math>\leq 0.015</math></td><td>Ignore</td></tr><tr><td><math>\leq 1.0</math></td><td rowspan="2"><math>0.015 &lt; W \leq 0.025</math></td><td>2</td></tr><tr><td><math>\leq 2.0</math></td><td>1</td></tr><tr><td><math>\leq 1.0</math></td><td><math>0.025 &lt; W \leq 0.05</math></td><td>1</td></tr><tr><td>-</td><td><math>D &gt; 0.05</math></td><td>According to circle</td></tr></table>	Length	Width	Qualified Quantity	-	$\leq 0.015$	Ignore	$\leq 1.0$	$0.015 < W \leq 0.025$	2	$\leq 2.0$	1	$\leq 1.0$	$0.025 < W \leq 0.05$	1	-	$D > 0.05$	According to circle	
		Length	Width	Qualified Quantity																
-	$\leq 0.015$	Ignore																		
$\leq 1.0$	$0.015 < W \leq 0.025$	2																		
$\leq 2.0$		1																		
$\leq 1.0$	$0.025 < W \leq 0.05$	1																		
-	$D > 0.05$	According to circle																		

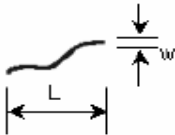


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		<b>4.2 Large area LCD</b>    <b>CSTN: If W ≥</b>	<b>Length</b>	<b>Width</b>	<b>Qualified Quantity</b>		
			-	≤0.015	<b>Ignore</b>		
			≤2.0	0.015<W≤0.025	<b>2</b>		
			≤1.0	0.025<W≤0.05	<b>1</b>		
			-	D>0.05	<b>According to circle</b>		
<b>0.015, unqualified Ignore beyond viewing area</b>							
<b>05</b>	<b>LCD Scratch 、 Threadlike Fiber</b>	<b>Same to NO.3 circle</b> <b>Sightline and surface of LCD is vertical</b> <b>Same to NO.3 line style</b>					
<b>06</b>	<b>POL</b>	<b>It is not admissible that POL is beyond the edge of glass, else, unqualified.</b> <b>It is essential that POL be over the 50 percent of width of frame, else, unqualified.</b> <b>According to the drawing in case of special definition.</b>					
<b>07</b>	<b>IC/FPC Bonding</b>	<b>Scratch</b>	<b>Reject</b>				
		<b>Intensity Of Adhesion</b>	<b>If lower than specification, reject</b>				
		<b>Gold Fold Twist</b>	<b>Reject</b>				
<b>07</b>	<b>IC/FPC Bonding</b>	<b>Silicon</b>	<b>According to outline, no gold outside, seal can not be higher than LCD</b>				
		<b>FPC Gold Sever</b>	<b>Reject</b>				
<b>08</b>	<b>SMT</b>	<b>Lack of Component、Polarity Inverse</b>	<b>If exist, reject</b>				

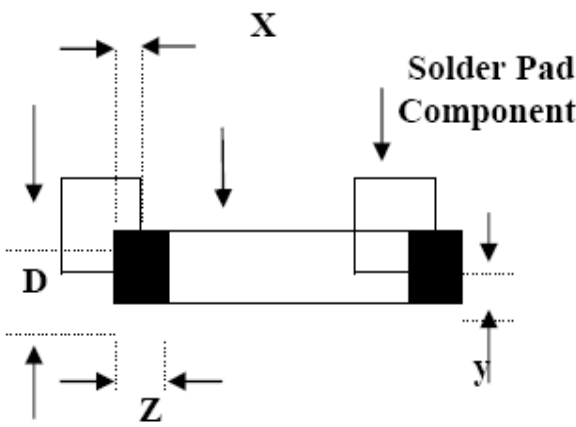


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		Leak Solder、 Virtual Solder	If exist, reject	
		Short Circuit In Solder Point	If exist, reject	
		Tin Ball	If exist, reject	
		Tin Acumination	If visual, reject	
		Height Solder Point	If higher 0.5mm than component. Reject	
		Height of component	Either side higher 0.5mm than component, Reject	
		Component Shift	 <p><math>X &lt; 3/4Z</math> <math>y &gt; 1/3D</math></p> <p>reject reject</p>	

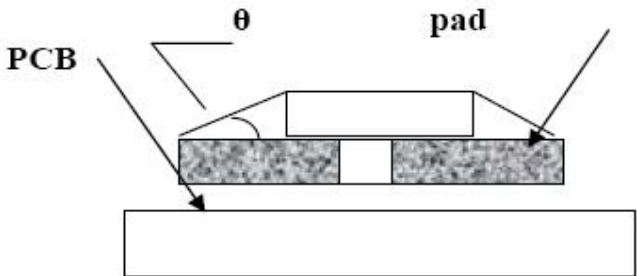
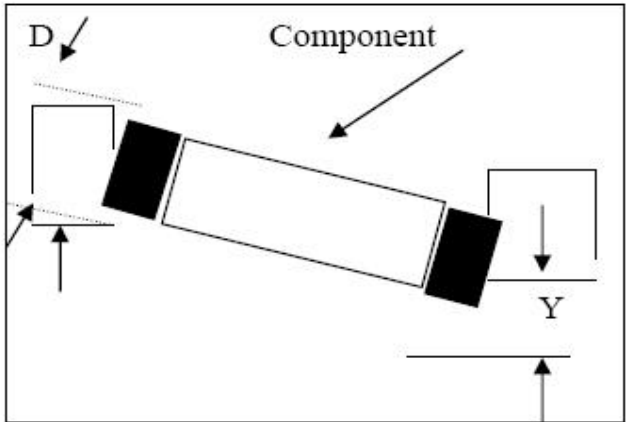


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08	SMT	Few Tin	 <p>If <math>\theta \leq 20^\circ</math> reject</p>	
		Component Deflection	 <p>If <math>Y &gt; 1/3 D</math> reject</p>	
		Component Carcass Sideways	If exist with visual inspection, reject	
		Lot Tin	<p>A: Tin accrete the solder side completely, hollowly, Ok</p> <p>B: Tin accrete the solder side completely, full circle arc, ok</p> <p>C: Jointing include whole solder side, height of tin &gt; 50 percents of height of component, reject</p>	
		Few Tin	<p>A: Tin accrete the solder side completely, hollowly, Ok</p> <p>B: height of tin &gt; 1/3 of solder side of component, ok</p> <p>C: height of tin <math>\leq 1/3</math> of solder side of component, reject</p>	



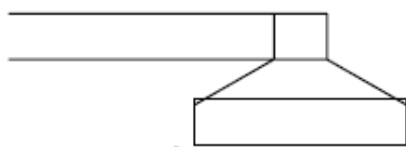


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		Normal	 <p>Jointing side</p>			
08	SMT	Short circuit 、 Open circuit			For bid	
09	Light	Quality of CSTN Display		1、 Rolling strake with visual inspection, forbid 2、 Difference of color in viewing area with visual inspection (full white、 red、 green、 blue), forbid 3、 Display change with visual inspection, forbid		
			x	y	Drive LCD under normal condition, 25℃ Φ=0 θ=0 Test white、 red、 green blue with DMS Record	
		White	±0.05	±0.05		
		Red	±0.05	±0.05		
		Blue	±0.05	±0.05		
According to the specification or sample customer have approved						
10	Color Of CIE Coordinate	specification or		Drive condition is according to specification Measure location is in Follow Picture 3、 Adjust brightness instrument torero, burrow against the surface of LCD, press “measure”, record when the display is steady. (YOKOGAWA-3298)		



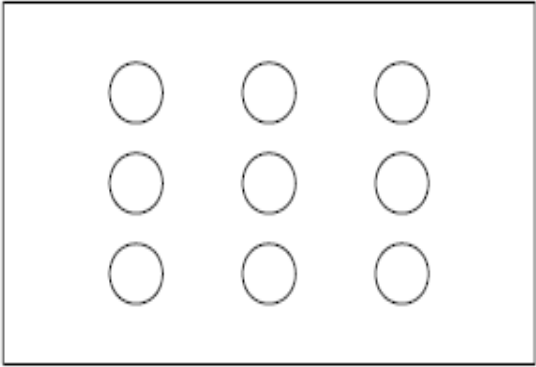


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11	Brightness	sample customer have approved	 <p>Measure location</p>	
			<p>According to product specification</p> <p>Measure instrument ( DMS-501 )</p>	
12	CR (Max)	According to specification	<p>According to product specification</p> <p>Measure instrument (DMS-501)</p>	
13	Response Time	According to specification	<p>According to product specification</p> <p>Measure instrument (DMS-501)</p>	
14	Viewing angle	Compare with the sample customer supply	Compare with the sample customer supply when assemble	
15	Vibration 、 Ring	According to the use of product (main FPC of foldaway cell phone $\geq 6$ thousand)	<p>Measure instrument</p> <p>Bend angle: <math>150^{\circ}</math></p> <p>Fix FPC in the casement when customer supply</p>	



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## 10-6 Reliability

Test Item	Test Conditions	Note
High Temperature Operation	70±3°C, t=96 hrs	
Low Temperature Operation	-20±3°C, t=96 hrs	1,2
High Temperature Storage	80±3°C, t=96 hrs	1,2
Low Temperature Storage	-30±3°C, t=96 hrs	1,2
Humidity Test	40°C, Humidity 90%, 96 hrs	1,2

Thermal Shock Test	-30°C ~ 25°C ~ 80°C 30 min. 5 min. 30 min. (1 cycle) Total 5 cycle	1,2
Vibration Test (Packing)	Sweep frequency: 10~55~10 Hz/1min Amplitude: 0.75mm Test direction: X.Y.Z/3 axis Duration: 30min/each axis	2
Static Electricity	150pF 330 ohm ±8kV, 10times air discharge	

Note 1: Condensation of water is not permitted on the module.

Note 2: The module should be inspected after 1-hour storage in normal conditions (15-35°C, 45-65%RH).

Definitions of life end point:

- Current drain should be smaller than the specific value.
- Function of the module should be maintained.
- Appearance and display quality should not have degraded noticeably.
- Contrast ratio should be greater than 50% of the initial value.

## 11. Use precautions

### 11-1 Handling precautions

- 1) The polarizing plate may break easily so be careful when handling it. Do not touch, press or rub it with a hard-material tool like tweezers.
- 2) Do not touch the polarizing plate surface with bare hands so as not to make it dirty. If the surface or other related part of the polarizing plate is dirty, soak a soft cotton cloth or chamois leather in benzine and wipe off with it. Do not use chemical liquids such as acetone, toluene and isopropyl alcohol. Failure to do so may bring chemical reaction phenomena and deteriorations.
- 3) Remove any spit or water immediately. If it is left for hours, the suffered part may deform or decolorize.
- 4) If the LCD element breaks and any LC stuff leak, do not suck or lick it. Also if LC stuff is stuck on your skin or clothing, wash thoroughly with soap and water immediately.

### 11-2 Installing precautions

- 1) The PCB has many ICs that may be damaged easily by static electricity. To prevent breaking by static electricity from the human body and clothing, earth the human body properly using the high resistance and discharge static electricity during the operation. In this case, however, the resistance value should be approx. 1MΩ and the resistance should be placed near the human body rather than the ground surface. When the indoor space is dry, static electricity may occur easily so be careful. We recommend the indoor space



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should be kept with humidity of 60% or more. When a soldering iron or other similar tool is used for assembly, be sure to earth it.

2) When installing the module and ICs, do not bend or twist them. Failure to do so may crack LC element and cause circuit failure.

3) To protect LC element, especially polarizing plate, use a transparent protective plate (e.g., acrylic plate, glass etc) for the product case.

4) Do not use an adhesive like a both-side adhesive tape to make LCD surface (polarizing plate) and product case stick together. Failure to do so may cause the polarizing plate to peel off.

## 11-3 Storage precautions

1) Avoid a high temperature and humidity area. Keep the temperature between 0°C and 35°C and also the humidity under 60%.

2) Choose the dark spaces where the product is not exposed to direct sunlight or fluorescent light.

3) Store the products as they are put in the boxes provided from us or in the same conditions as we recommend.

## 11-4 Operating precautions

1) Do not boost the applied drive voltage abnormally. Failure to do so may break ICs. When applying power voltage, check the electrical features beforehand and be careful. Always turn off the power to the LC module controller before removing or inserting the LC module input connector. If the input connector is removed or inserted while the power is turned on, the LC module internal circuit may break.

2) The display response may be late if the operating temperature is under the normal standard, and the display may be out of order if it is above the normal standard. But this is not a failure; this will be restored if it is within the normal standard.

3) The LCD contrast varies depending on the visual angle, ambient temperature, power voltage etc. Obtain the optimum contrast by adjusting the LC drive voltage.

4) When carrying out the test, do not take the module out of the low-temperature space suddenly. Failure to do so will cause the module condensing, leading to malfunctions.

5) Make certain that each signal noise level is within the standard (L level: 0.2Vdd or less and H level: 0.8Vdd or more) even if the module has functioned properly. If it is beyond the standard, the module may often malfunction. In addition, always connect the module when making noise level measurements.

6) The CMOS ICs are incorporated in the module and the pull-up and pull-down function is not adopted for the input so avoid putting the input signal open while the power is ON.

7) The characteristic of the semiconductor element changes when it is exposed to light emissions, therefore ICs on the LCD may malfunction if they receive light emissions. To prevent these malfunctions, design and assemble ICs so that they are shielded from light emissions.

8) Cross talk occurs because of characteristics of the LCD. In general, cross talk occurs when the regularized display is maintained. Also, the LC drive voltage affects cross talk. Design the contents of the display, considering cross talk.



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## 11-5 Other

- 1) Do not disassemble or take the LC module into pieces. The LC modules once disassembled or taken into pieces are not the guarantee articles.
- 2) The residual image may exist if the same display pattern is shown for hours. This residual image, however, disappears when another display pattern is shown or the drive is interrupted and left for a while. But this is not a problem on reliability.

## 12. Notice packing method

Pack the products so that they may not touch each other.

Put the inner cartons containing module into outer carton.

Attach the display label on the visible location on the outer carton.