



深圳市福瑞达显示技术有限公司
SHENZHEN FRIDA LCD CO.,LTD

Doc.No.: FRD130H24003-A

REV : C

PAGE : 1/17

SPEC TITLE
DOCUMENT CONTROL SPECIFICATION

EFFECTIVE DATE : 2020-03-30

PRODUCT SPECIFICATION

TFT-LCD MODULE

Model No: FRD130H24003-A

| For Customer's Acceptance | |
|---------------------------|---------|
| Approved by | Comment |
| | |

| | Signature | Date |
|-------------|-------------|------------|
| Prepared by | Wang jin | 2020.03.30 |
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1. Document Revision History :

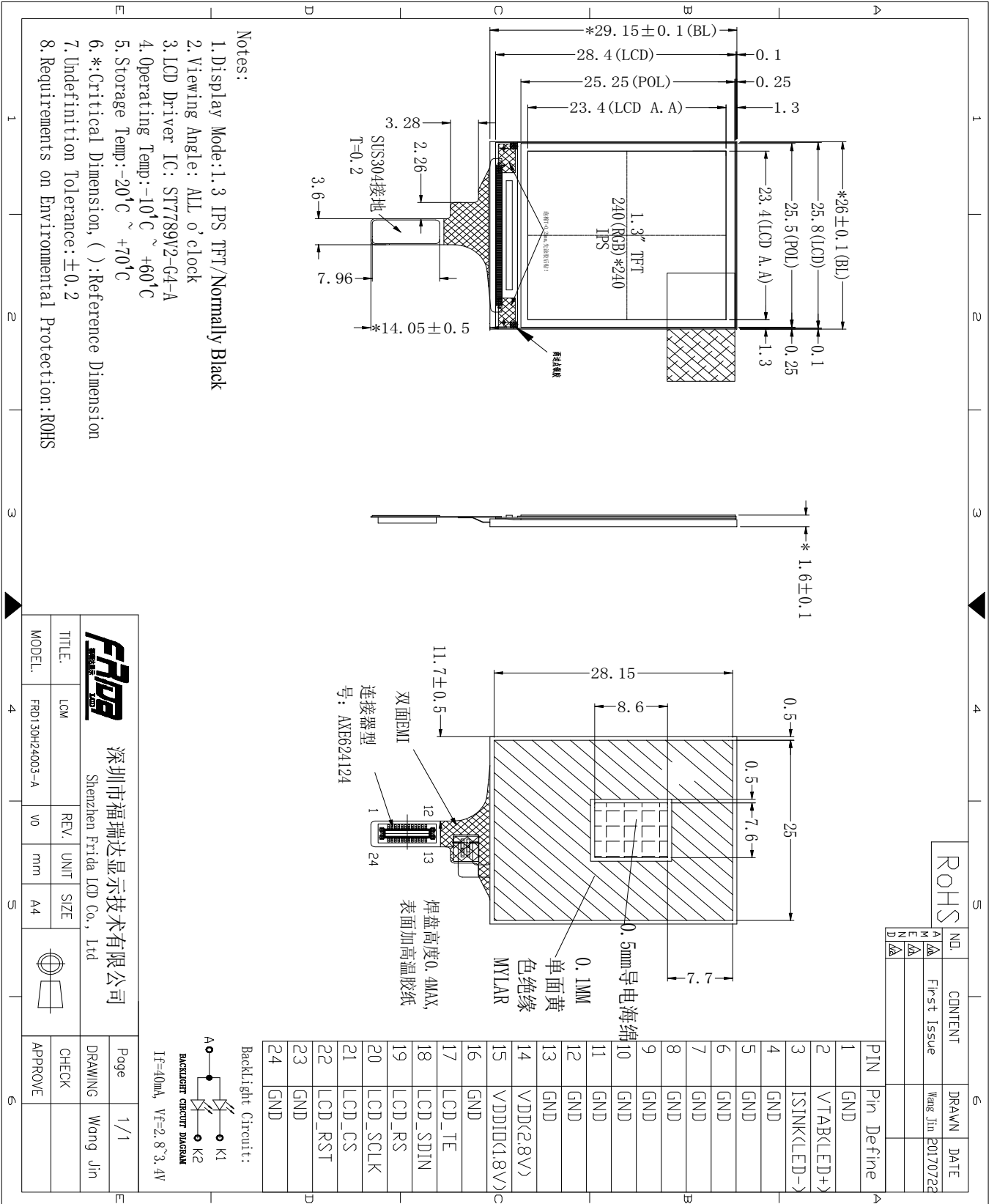
| DOCUMENT REVISION | DATE | DESCRIPTION | PREPARED BY |
|-------------------|------------|-------------------------------|-------------|
| A | 2019-03-26 | First Release. | |
| B | 2019-08-31 | Add Inspection Specifications | |
| C | 2020-03-30 | Update contact information | |



2. General Description

| No | Item | Specification | Remark |
|----|-------------------|-----------------|--------|
| 1 | Screen Size | 1.3 inch | |
| 2 | Display Mode | Normally Black | |
| 3 | Resolution | 240 × RGB × 240 | |
| 4 | Active Area | 23.4*23.4 | mm |
| 5 | Outline Dimension | 26*29.15*1.60 | mm |
| 6 | Viewing Direction | ALL | |
| 7 | Driver IC | ST7789V2-G4-A | |
| 8 | Interface | SPI | |
| 9 | Back Light | White Led*2 | |
| 10 | Touch Panel | - | |

3. Outline Dimension



ROHS

| NO. | CONTENT | DRAWN | DATE |
|-----|-------------|----------|----------|
| 1 | First Issue | Wang Jin | 20170722 |



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Shenzhen Frida LCD Co., Ltd

| TITLE | LCM | REV. | UNIT | SIZE | Page |
|--------|----------------|------|------|------|------|
| MODEL. | FRD130H24003-A | V0 | mm | A4 | 1/1 |

| DRAWING | Wong Jin |
|---------|----------|
| CHECK | |
| APPROVE | |



4. Interface Specification

| Pin No | Symbol | Description | Note |
|--------|-------------|---|------|
| 1 | GND | Ground. | |
| 2 | VTAB(LED+) | Power Supply For LED Backlight Anode Input. | |
| 3 | ISINK(LED-) | Power Supply For LED Backlight Cathode Input. | |
| 4-13 | GND | Ground. | |
| 14 | VDD(2.8V) | Power Supply For LCD. | |
| 15 | VDDIO(1.8V) | Power Supply For I/O. | |
| 16 | GND | Ground. | |
| 17 | LCD_TE | Frame head pulse for tearing effect. | |
| 18 | LCD_SDIN | Serial data input/output pin. | |
| 19 | LCD_RS | Second Data lane in 2 data lane serial interface. | |
| 20 | LCD_SCLK | Serial clock signal. | |
| 21 | LCD_CS | Chip selection signal. | |
| 22 | LCD_RST | Reset Signal input pin. | |
| 23 | GND | Ground. | |
| 24 | GND | Ground. | |



5. Absolute Maximum Ratings

Electrical Maximum Ratings – for IC Only

| Parameter | Symbol | Min. | Max. | Unit | Note |
|---------------------------------------|-------------|------|------|------|------|
| Power supply voltage (VDD(2.8V)) | VDD(2.8V) | -0.3 | +4.6 | V | 1 |
| Power supply voltage (VDDIO(1.8V)) | VDDIO(1.8V) | -0.3 | +4.6 | V | 1 |

Note:

- 1.VDDIO(1.8V),VDD(2.8V), GND must be maintained.
- 2.The modules may be destroyed if they are used beyond the absolute maximum ratings.

6. Electrical Specifications

At Ta = 25 °C, VDD(2.8V)= 2.4V to 3.3V, VDDIO(1.8V)= 1.65V to 3.3V GND=0V.

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|--|-----------------|--|------|------|------|------|
| Supply voltage (analog) | VDD(2.8V)-GND | | 2.4 | 2.75 | 3.3 | V |
| Supply voltage (logic) | VDDIO(1.8V)-GND | | 1.65 | 1.8 | 3.3 | V |
| Supply voltage of white LED backlight | VLED | Forward current =40mA Number of LED = 2 | 2.9 | 3.1 | 3.4 | V |

7. Timing Characteristics

Serial Interface Characteristics (3-line serial):

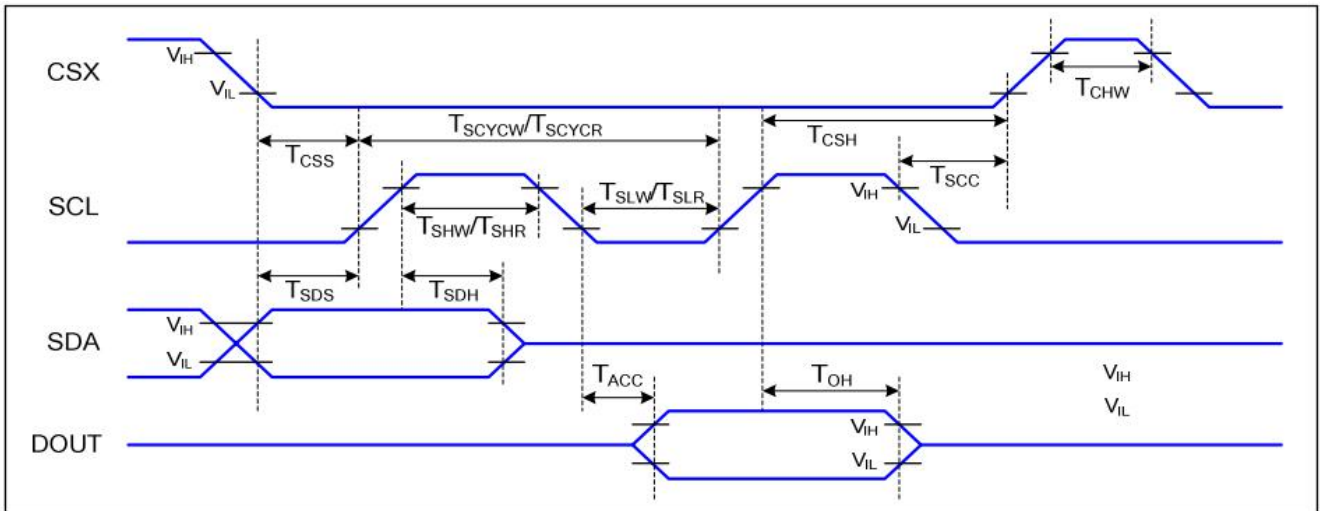


Figure 4 3-line serial Interface Timing Characteristics

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25°C

| Signal | Symbol | Parameter | Min | Max | Unit | Description |
|--------------|--------------------|--------------------------------|-----|-----|------|---------------------|
| CSX | T _{CSS} | Chip select setup time (write) | 15 | | ns | |
| | T _{CSH} | Chip select hold time (write) | 15 | | ns | |
| | T _{CSS} | Chip select setup time (read) | 60 | | ns | |
| | T _{SCC} | Chip select hold time (read) | 65 | | ns | |
| | T _{CHW} | Chip select "H" pulse width | 40 | | ns | |
| SCL | T _{SCYCW} | Serial clock cycle (Write) | 16 | | ns | |
| | T _{SHW} | SCL "H" pulse width (Write) | 7 | | ns | |
| | T _{SLW} | SCL "L" pulse width (Write) | 7 | | ns | |
| | T _{SCYCR} | Serial clock cycle (Read) | 150 | | ns | |
| | T _{SHR} | SCL "H" pulse width (Read) | 60 | | ns | |
| | T _{SLR} | SCL "L" pulse width (Read) | 60 | | ns | |
| SDA (DIN) | T _{SDS} | Data setup time | 7 | | ns | |
| | T _{SDH} | Data hold time | 7 | | ns | |
| DOUT | T _{ACC} | Access time | 10 | 50 | ns | For maximum CL=30pF |
| | T _{OH} | Output disable time | 15 | 50 | ns | For minimum CL=8pF |

Table 5 3-line serial Interface Characteristics

Note : The rising time and falling time (Tr, Tf) of input signal are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

8. Power Supply Configuration

Power ON/OFF Sequence

VDDI and VDD can be applied in any order.

VDD and VDDI can be power down in any order.

During power off, if LCD is in the Sleep Out mode, VDD and VDDI must be powered down minimum 120msec after RESX has been released.

During power off, if LCD is in the Sleep In mode, VDDI or VDD can be powered down minimum 0msec after RESX has been released.

CSX can be applied at any timing or can be permanently grounded. RESX has priority over CSX.

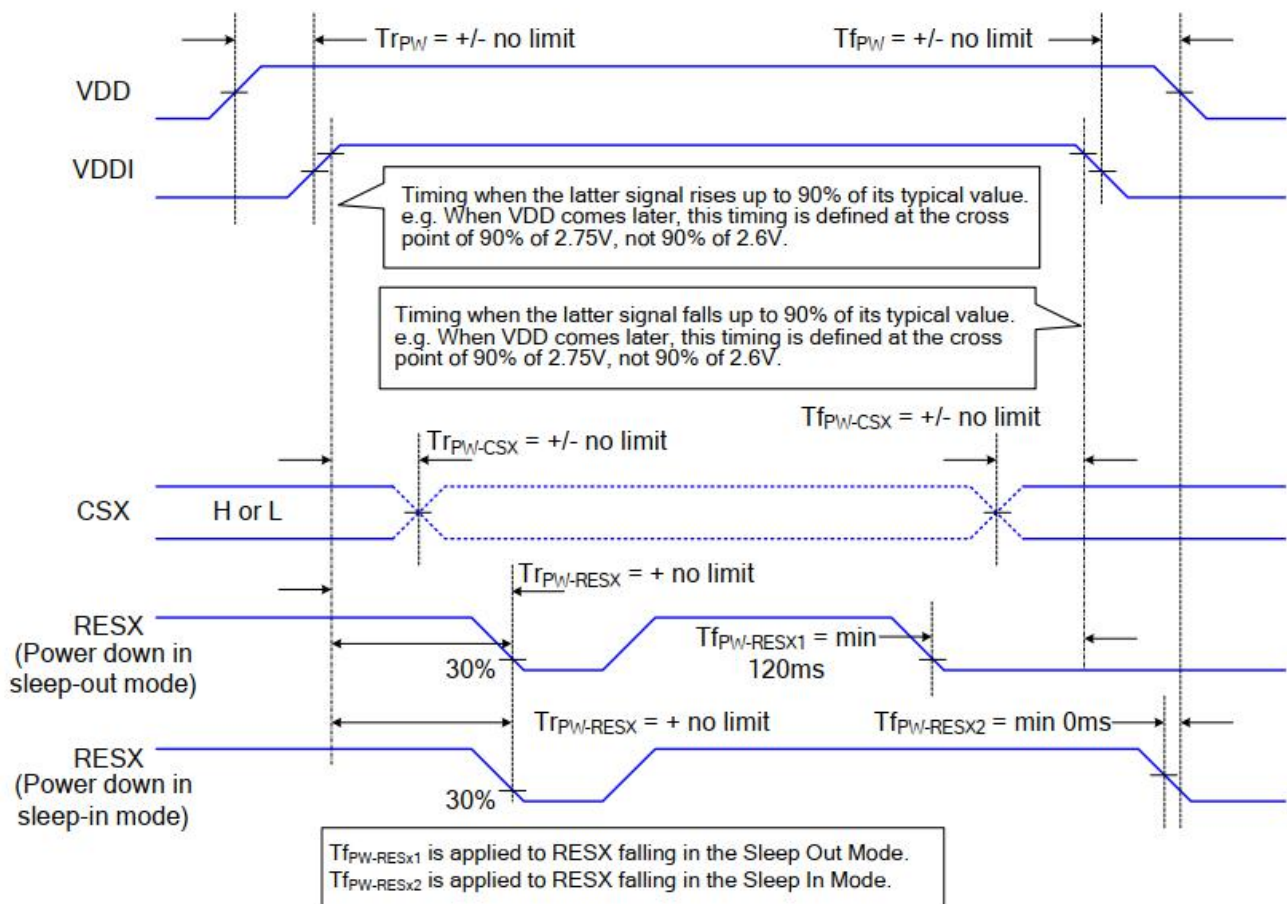
Note 1: There will be no damage to the display module if the power sequences are not met.

Note 2: There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.

Note 3: There will be no abnormal visible effects on the display between end of Power On Sequence and before receiving Sleep Out command. Also between receiving Sleep In command and Power Off Sequence.

Note 4: If RESX line is not held stable by host during Power On Sequence as defined in the sequence below, then it will be necessary to apply a Hardware Reset (RESX) after Host Power On Sequence is complete to ensure correct operation. Otherwise function is not guaranteed.

The power on/off sequence is illustrated below





Uncontrolled Power Off

The uncontrolled power-off means a situation which removed a battery without the controlled power off sequence. It will neither damage the module or the host interface.

If uncontrolled power-off happened, the display will go blank and there will not any visible effect on the display (blank display) and remains blank until "Power On Sequence" powers it up.

9.Optical Specification

| Item 项目 | Symbol 符号 | Condition 条件 | Min 最小值 | Typ 典型值 | Max 最大值 | Unit 单位 | Note 备注 |
|--------------------------------|----------------|--|------------|------------|------------|-------------------|------------|
| Response time 响应时间 | Tr+Tf | $\Theta=0^{\circ}$ $\varnothing=0^{\circ}$ Ta=25°C | - | 30 | 35 | ms | 1 |
| Contrast ratio 对比度 | Cr | | 640 | 800 | - | - | 2 |
| Color gamut 饱和度 | S(%) | | - | 50 | - | % | - |
| Luminance uniformity 均匀度 | δ WHITE | | 80 | - | - | % | 3 |
| Viewing angle range 视角范围 | Θ_{x+} | CR \geq 10 Ta=25°C | - | 80 | - | deg | 4 |
| | Θ_{x-} | | - | 80 | - | deg | |
| | Θ_{y+} | | - | 80 | - | deg | |
| | Θ_{y-} | | - | 80 | - | deg | |
| LCM Luminance LCM 亮度 | Lv | $\Theta=0^{\circ}$ $\varnothing=0^{\circ}$ Ta=25°C | - | 350 | - | Cd/m ² | 5 |

Note1. Response time is the time required for the display to transition from White to black(Rise Time,Tr)and from black to white(Decay Time,Tf).For additional information see FIG1...

Note2.contrast Ratio(CR) is defined mathematically by the following formula ,For more information see FIG2.

Contrast Ratio(CR)=Average Surface Luminance with all white pixels/ Average Surface Luminance

with all black pixels

Note3.The uniformity in surface luminance(WHITE) is determined by measuring luminance at each test position,and then dividing the maximum luminance of all white pixels by minimum luminance of all white pixels,For more information seeFIG2.

WHITE=Minimum Surface Luminance with all white pixels(P1,P2,.....)/Maximum Surface Luminance with all white pixels(P1,P2,.....)

Note4.Viewing angle is the angel at which contrast ratio is greater than a specific value.For TET module,the specific value of contrast ratio is 10.For monochrome and color stn module,the specific value of contrast ratio is2.The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface.For more information see FIG3

Note5. Surface luminance is the LCD surface luminance with all white pixels,For more information see FIG2.

LV=Average Surface Luminance with all white pixels(P1,P2,.....)

FIG1. The definition of Response time

响应时间定义

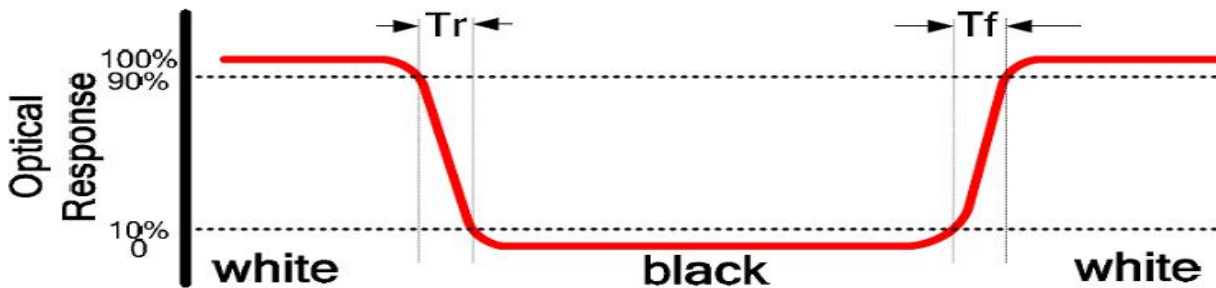


FIG2. Measuring method for Contrast ratio,surface luminance,Luminance

uniformity,CIE(X,Y)chromaticity.

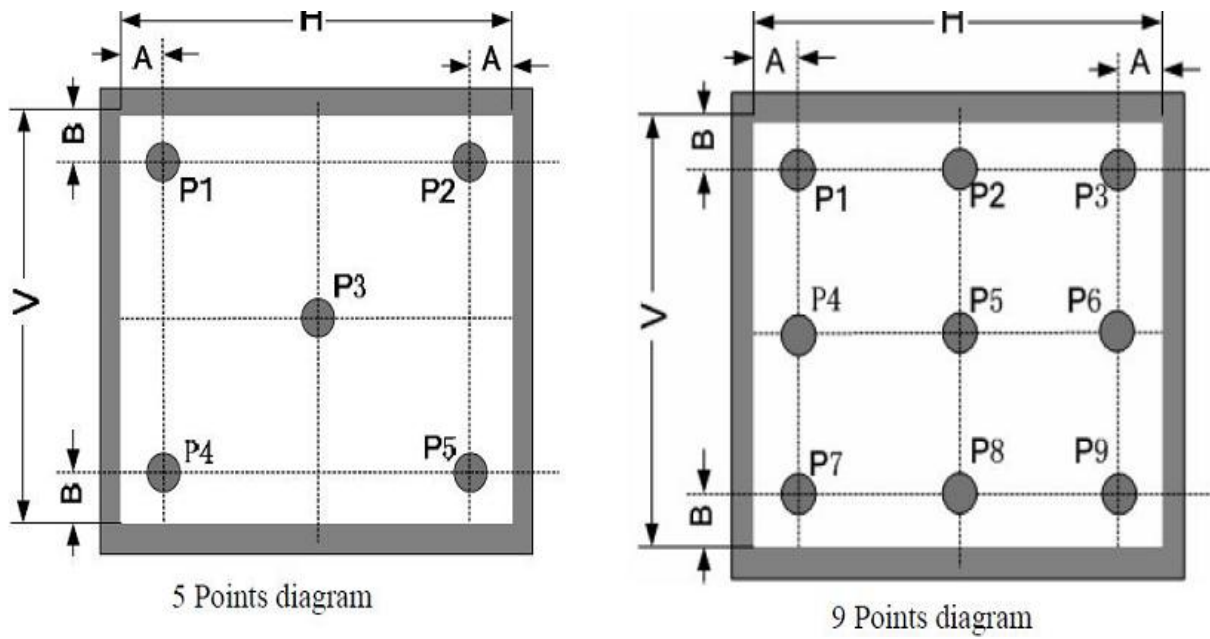
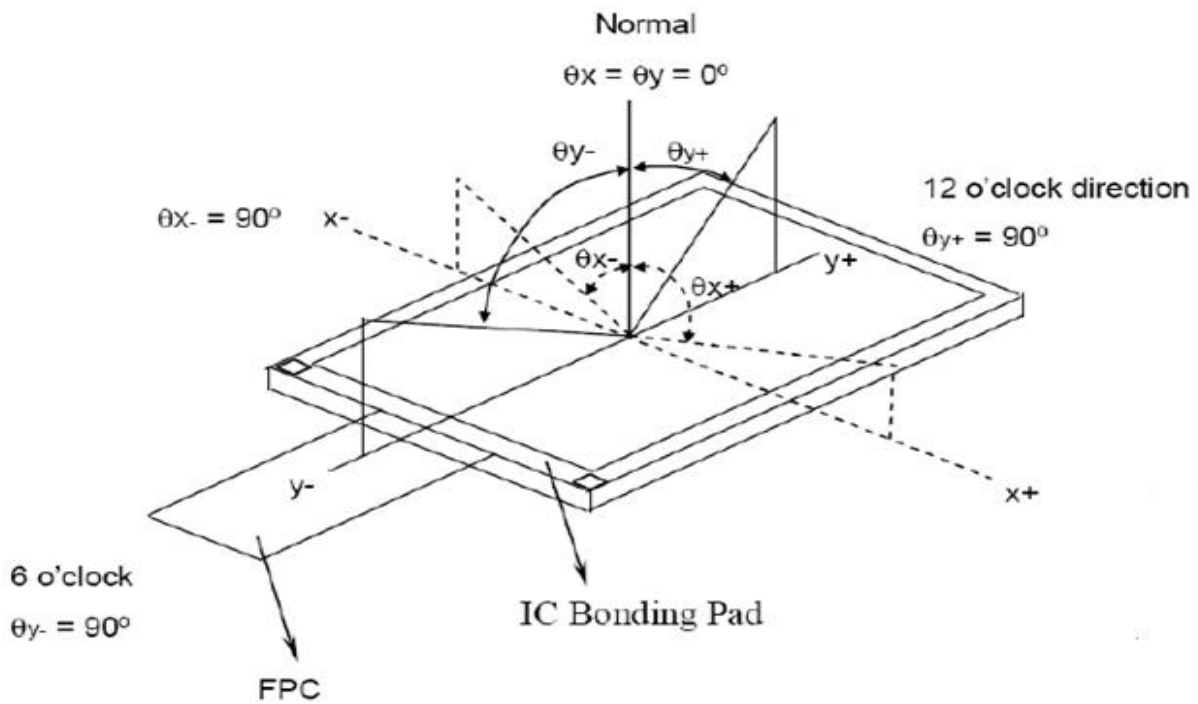


FIG3 The definition of viewing angle 视角定义



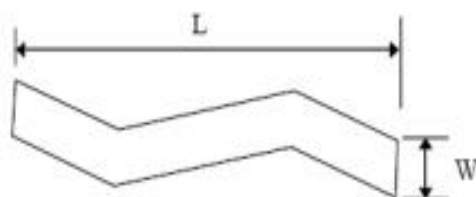
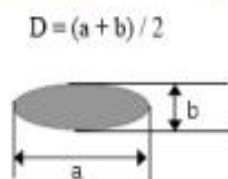
10. Inspection Specifications

10.1 Appearance inspection

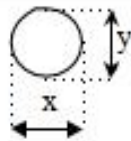
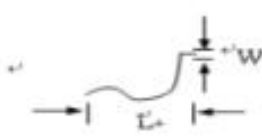
| Item | Acceptable standards for defects | Defect level |
|-------------------------------|--|------------------|
| Broken | Not allowed | critical defects |
| Cracks | Not allowed | critical defects |
| Insufficient UV glue entering | Not allowed | critical defects |
| Liquid crystal seal leakage | Not allowed | critical defects |
| Liquid crystal bubbles | Not allowed | critical defects |
| Surface scratch(mm) | $W \leq 0.02$, ignored | minor defects |
| | $0.02 < W \leq 0.03$ $L \leq 2, N \leq 2$ | |
| | $0.03 < W \leq 0.05$ $L \leq 1, N \leq 1$ | |
| | $0.05 < W$ Not allowed | |
| Black/white spot(mm) | $D \leq 0.1$, ignored; $0.1 < D \leq 0.15, N \leq 4$ | minor defects |
| | $0.15 < D \leq 0.2, N \leq 2$; $0.2 < D$, Not allowed | |
| The seal pollution | Not allowed | minor defects |
| Liquid crystal residues | Not allowed | minor defects |
| Surface stains | Stains that cannot be cleaned or erased are not allowed | minor defects |
| size | Refer to the product specification corresponding to each product, overall size(including length, Width, thickness) or partial size exceeding the drawing size is not allowed | major defects |

Remarks : 1)Surface scratches within 1.5mm of the glass edge are ignored;

2) D = diameter, L = length, W = width, N = qty;



10.2 Functional test criteria

| Item | Judgment | Level | | | | | | | | | | | | | | | | | | | |
|--|--|---------------|-------------------|----------------|----------------|-------------|-----------|-----------------|-------------|-----------|------------------------|-------------------|------------------------|---------|----------------------|--------------|---|------------|---|-------------|--|
| Display status | No Display、Incomplete image、line defect、wrong viewing angle、flickering、abnormal image、are not allowed | major defects | | | | | | | | | | | | | | | | | | | |
| | Display color, judged by approved samples, Or by limited samples | minor defects | | | | | | | | | | | | | | | | | | | |
| | MURA or the phenomenon that is unable to describe in words, judged by ND 5% or limited samples | minor defects | | | | | | | | | | | | | | | | | | | |
| Spot(bright/dark)defect | Definition of spot defect: $\Phi = (x+y) / 2$  | minor defects | | | | | | | | | | | | | | | | | | | |
| | <table border="1"> <thead> <tr> <th rowspan="2">Size(mm)</th> <th colspan="2">acceptable qty</th> </tr> <tr> <th>Active area</th> <th>View area</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.1$</td> <td>ignored</td> <td rowspan="4">ignored</td> </tr> <tr> <td>$0.1 < \Phi \leq 0.15$</td> <td>2 (gap ≥ 5)</td> </tr> <tr> <td>$0.15 < \Phi \leq 0.2$</td> <td>1</td> </tr> <tr> <td>$0.2 < \Phi$</td> <td>Not allowed</td> </tr> </tbody> </table> | | Size(mm) | acceptable qty | | Active area | View area | $\Phi \leq 0.1$ | ignored | ignored | $0.1 < \Phi \leq 0.15$ | 2 (gap ≥ 5) | $0.15 < \Phi \leq 0.2$ | 1 | $0.2 < \Phi$ | Not allowed | | | | | |
| | Size(mm) | | | acceptable qty | | | | | | | | | | | | | | | | | |
| | | | Active area | View area | | | | | | | | | | | | | | | | | |
| | $\Phi \leq 0.1$ | | ignored | ignored | | | | | | | | | | | | | | | | | |
| | $0.1 < \Phi \leq 0.15$ | | 2 (gap ≥ 5) | | | | | | | | | | | | | | | | | | |
| | $0.15 < \Phi \leq 0.2$ | | 1 | | | | | | | | | | | | | | | | | | |
| $0.2 < \Phi$ | Not allowed | | | | | | | | | | | | | | | | | | | | |
| Definition of line defect: L: length, W: width  | | minor defects | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th colspan="2">Size(mm)</th> <th colspan="2">Acceptable qty</th> </tr> <tr> <th>W(width)</th> <th>L(length)</th> <th>Active area</th> <th>View area</th> </tr> </thead> <tbody> <tr> <td>$W \leq 0.03$</td> <td>ignored</td> <td>ignored</td> <td rowspan="2">ignored</td> </tr> <tr> <td>$0.03 < W \leq 0.05$</td> <td>$L \leq 2.0$</td> <td>3</td> </tr> <tr> <td>$W > 0.05$</td> <td>-</td> <td>Not allowed</td> <td></td> </tr> </tbody> </table> | | | Size(mm) | | Acceptable qty | | W(width) | L(length) | Active area | View area | $W \leq 0.03$ | ignored | ignored | ignored | $0.03 < W \leq 0.05$ | $L \leq 2.0$ | 3 | $W > 0.05$ | - | Not allowed | |
| Size(mm) | | | Acceptable qty | | | | | | | | | | | | | | | | | | |
| W(width) | L(length) | | Active area | View area | | | | | | | | | | | | | | | | | |
| $W \leq 0.03$ | ignored | | ignored | ignored | | | | | | | | | | | | | | | | | |
| $0.03 < W \leq 0.05$ | $L \leq 2.0$ | 3 | | | | | | | | | | | | | | | | | | | |
| $W > 0.05$ | - | Not allowed | | | | | | | | | | | | | | | | | | | |



11. Reliability Test Items

| Item | Test Condition | Criterion |
|------------------------------------|--|-------------|
| High Temperature Storage | 70 °C, 48 hrs | Note1,Note2 |
| Low Temperature Storage | -20 °C, 48 hrs | |
| High Temp. & High Humidity Storage | 40 °C, 80% RH, 48hrs | |
| Thermal Shock (Static) | -20°C, 30 min /70°C, 30 min, 20 cycles | |
| High Temperature Operation | 60 °C, 48 hrs | |
| Low temperature Operation | -10 °C, 48 hrs | |

Note1: Evaluation should be tested after storage at room temperature for two hours.

Note2:

Pass: Normal display image no line defect.

Fail: No display image, or line defects.

Partial transformation of the module parts should be ignored.

12. Precautions

Please pay attentions to the followings as using the LCD module.

Handling

- Do not apply strong mechanical stress like drop, shock or any force to LCD module. It may cause improper operation, even damage.
- Because the polarizer is very fragile and easy to be damaged, do not hit, press or rub the display surface with hard materials.
- Do not put heavy or hard material on the display surface, and do not stack LCD modules.
- If the display surface is dirty, please wipe the surface softly with cotton swab or clean cloth.
- Avoid using Ketone type materials (e.g. Acetone), Toluene, Ethyl acid or Methyl chloride to clean the display surface. It might damage the touch panel surface permanently. The recommended solvents are water and Isopropyl alcohol.



- (f) Wipe off water droplets or oil immediately.
- (g) Protect the LCD module from ESD. It will damage the LSI and the electronic circuit.
- (h) Do not touch the output pins directly with bare hands.
- (i) Do not disassemble the LCD module.
- (j) Do not lift the FPC of Touch Panel.

Storage

- (a) Do not leave the LCD modules in high temperature, especially in high humidity for a long time.
- (b) Do not expose the LCD modules to sunlight directly.
- (c) The liquid crystal is deteriorated by ultraviolet. Do not leave it in strong ultraviolet ray for a long time.
- (d) Avoid condensation of water. It may cause improper operation.
- (e) Please stack only up to the number stated on carton box for storage and transportation. Excessive weight will cause deformation and damage of carton box.

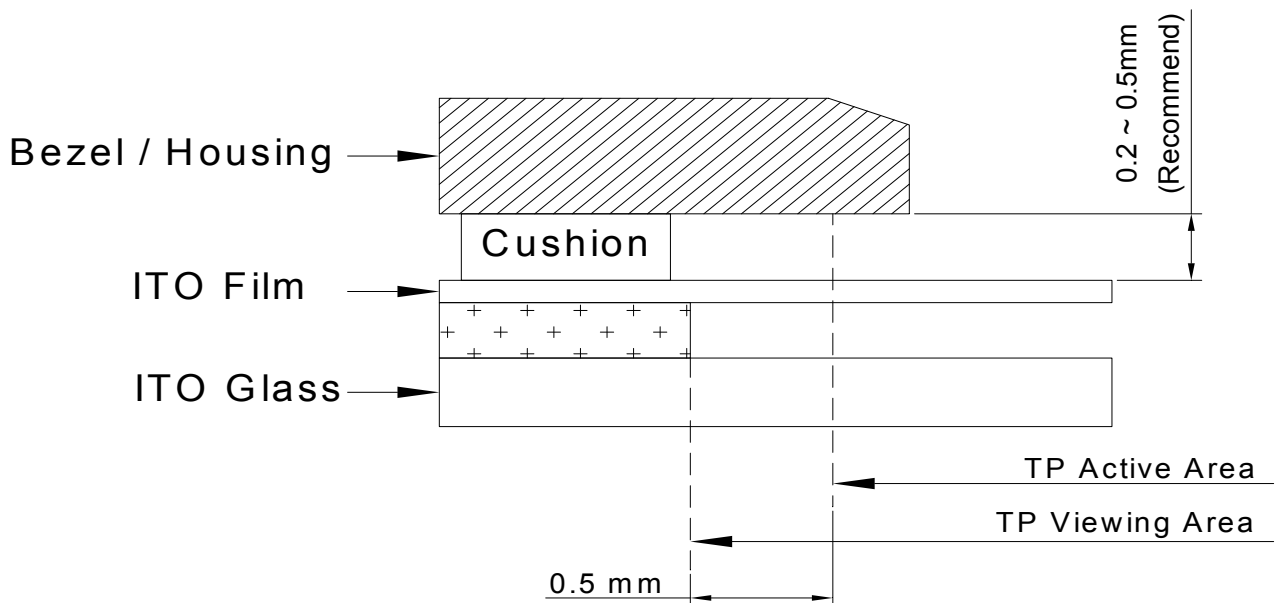
Operation

- (a) When mounting or dismounting the LCD modules, turn the power off.
- (b) Protect the LCD modules from electric shock.
- (c) The Driver IC control algorithms stated above should always obeyed to avoid damaging the LSI and electronic circuit.
- (d) Be careful to avoid mixing up the polarity of power supply for backlight.
- (e) Absolute maximum rating specified above has to be always kept in any case. Exceeding it may cause non-recoverable damage of electronic components or, nevertheless, burning.
- (f) When a static image is displayed for a long time, remnant image is likely to occur.
- (g) Be sure to avoid bending the FPC to an acute shape, it might break FPC.
- (h) Most of the touch screens have air vent to equalize the inside air pressure to the outside one. The air vent must be open and liquid contact must be avoided as the liquid may be absorbed if the liquid is accumulated near the air vent.
- (i) For the fragility of ITO film, it should avoid to use too tapering pen as the input material.

Touch Panel Mounting Notes

- (a) If a cushion is used between bezel/housing and film must be choose as free as enough to absorb the expansion and contraction to avoid the distortion of film.

- (b) The cushion must be placed out of the Viewing Area.
- (c) Bezel/Housing edge must be posited between Key Area and Viewing Area. The edge enters the Key Area may cause unexpected input if the gap is too narrow or foreign particles like dusts exist between Bezel/Housing and ITO film.
- (d) Mounting example:



The corner part has conductivity. Do not touch any metal part after mounting.

Others

- a) If the liquid crystal leaks from the panel, it should be kept away from the eyes or mouth.
- b) For the fragility of polarizer, it is recommended to attach a transparent protective plate over the display surface.
- c) It is recommended to peel off the protection film on the polarizer slowly so that the electrostatic charge can be minimized.