



承认编码: CR _____

TFT LCD MODULE
3.5 inch 320RGB*480DOTS

MODULE NUMBER: PV035HV-CINA5007-R

REVISION: V00

Customer Approval:

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| |
|--|

Approved For Specifications

Approved For Specifications & Sample

| Prepared by | Checked by | Approved by |
|--------------------|-------------------|--------------------|
| | | |



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1. LCM Specification

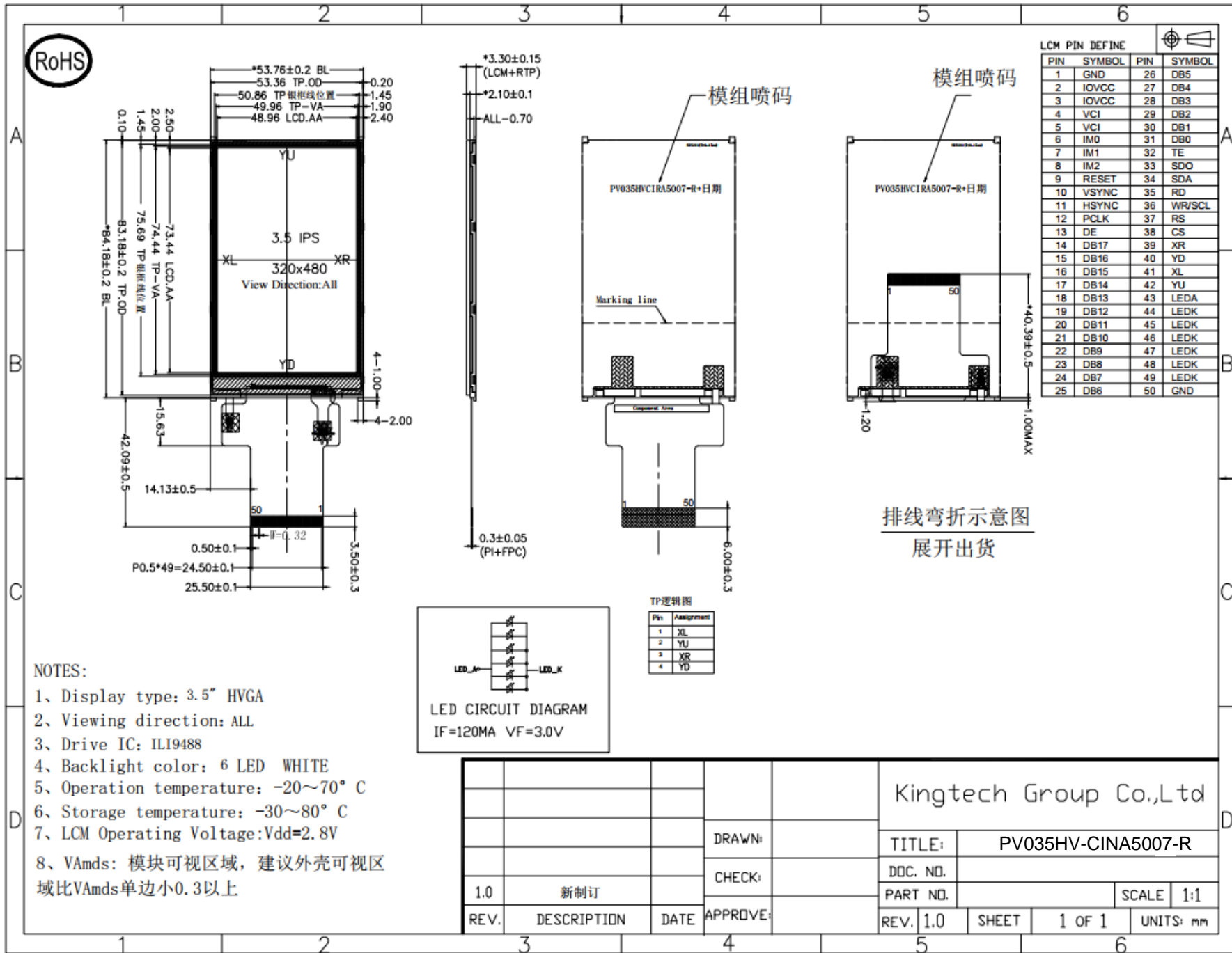
1.1 Description

PV035HV-CINA5007-R is a transmissive type color active matrix liquid crystal display(LCD) which uses amorphous thin film transistor(TFT) as switching devices. This product is composed of a TFT LCD panel, a drive IC , a FPC and a LED-backlight unit. The active display area is 3.5 inches diagonally measured and the native resolution is 320*RGB*480.Features of this product are listed in the following table.

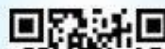
1.2 Functions & Features

Table 1.1 Module Functions & Features

| Parameter | Value | Unit |
|-----------------------|---|--------------------|
| LCD Mode | TFT/Transmissive | - |
| Color Depth | 262K | - |
| Display Resolution | 320RGB*480 | pixels |
| Module Size | 53.76(H)*84.18(W)*3.3(T)(Exclude FPC) | mm |
| TP Outline | 53.36(H)*83.18(W)*1.2(T) | mm |
| TP (VA) | 49.96(H)*74.44(W) | mm |
| Active Area (A.A) | 48.96(H)*73.44(W) | mm |
| Pixel Arrangement | RGB-stripe | - |
| Viewing Direction | ALL | |
| Display Mode | Normally Black | |
| LCD Controller/Driver | ILI9488 | - |
| IC Package Type | COG | - |
| Interface | 8-/ 9-/16-/18- 8080-MCU 4-lines / 3-lines SPI + 16-/18-bit RGB | - |
| Power Supply Voltage | 2.8 | V |
| LCM Brightness | 300 | cd /m ² |
| Back-light | White LED*6 | PCS |



2. Mechanical Specification





3. Pin Descriptions

| Pin No. | Symbol | I/O | Functional | Remark | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------|----------|-----|--|--|-----|-----|-----------|---|---|---|--|---|---|---|--|---|---|---|---------------------------|---|---|---|----------------------------|---|---|---|---------------------------|---|---|---|---------------------------------------|---|---|---|----------|---|---|---|---------------------------------------|--|
| 1 | GND | P | System ground. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2~3 | IOVCC | P | I/O Power supply, 1.65~3.3V. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4~5 | VCI | P | Power supply, 2.5~3.3V. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | IM0 | I | <table border="1"> <thead> <tr> <th>IM2</th> <th>IM1</th> <th>IM0</th> <th>Interface</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>MIPI-DBI Type B 24-bit bus (DB_EN = 1)</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>MIPI-DBI Type B 18-bit bus (DB_EN = 0)</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>MIPI-DBI Type B 9-bit bus</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>MIPI-DBI Type B 16-bit bus</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>MIPI-DBI Type B 8-bit bus</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>MIPI-DBI Type C Option 1 (3-line SPI)</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>MIPI DSI</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>MIPI-DBI Type C Option 3 (4-line SPI)</td> </tr> </tbody> </table> | IM2 | IM1 | IM0 | Interface | 0 | 0 | 0 | MIPI-DBI Type B 24-bit bus (DB_EN = 1) | 0 | 0 | 0 | MIPI-DBI Type B 18-bit bus (DB_EN = 0) | 0 | 0 | 1 | MIPI-DBI Type B 9-bit bus | 0 | 1 | 0 | MIPI-DBI Type B 16-bit bus | 0 | 1 | 1 | MIPI-DBI Type B 8-bit bus | 1 | 0 | 1 | MIPI-DBI Type C Option 1 (3-line SPI) | 1 | 1 | 0 | MIPI DSI | 1 | 1 | 1 | MIPI-DBI Type C Option 3 (4-line SPI) | |
| IM2 | IM1 | IM0 | | Interface | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | | MIPI-DBI Type B 24-bit bus (DB_EN = 1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | | MIPI-DBI Type B 18-bit bus (DB_EN = 0) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 1 | | MIPI-DBI Type B 9-bit bus | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 1 | 0 | | MIPI-DBI Type B 16-bit bus | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 1 | 1 | | MIPI-DBI Type B 8-bit bus | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 1 | | MIPI-DBI Type C Option 1 (3-line SPI) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | 0 | | MIPI DSI | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | 1 | MIPI-DBI Type C Option 3 (4-line SPI) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | IM1 | I | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | IM2 | I | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | RESET | I | Reset signal pin. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | VSYNC | I | Frame synchronizing signal for RGB interface operation. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | HSYNC | I | Line synchronizing signal for RGB interface operation. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | PCLK | I | Dot clock signal for RGB interface operation. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | DE | I | Data enable signal for RGB interface operation. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14~31 | DB17~DB0 | I/O | Data bus. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 32 | TE | O | Tearing effect output.(NC) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 33 | SDO | O | Serial data output. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 34 | SDA | I/O | Serial data input. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35 | RD | I | RD (read strobe signal) ,Fix to GND when not in use. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 36 | WR/SCL | I | Serves Write signal or serial interface clock . | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 37 | RS | I | Data / Command Selection pin, Fix to GND when not in use. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 38 | CS | I | A chip select signal. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 39 | XR | I | T/p X-Right | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 | YD | I | T/p Y-Bottom. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 41 | XL | I | T/p X-Left. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 42 | YU | I | T/p Y-Up | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 43 | LEDA | P | LED Power supply + | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 44~49 | LEDK | P | LED Power supply - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50 | GND | P | System ground. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



4. Electrical Units

4.1 Absolute Maximum Ratings

The absolute maximum ratings are list on Table 4.1. When used out of the absolute maximum ratings, the LCM may be permanently damaged. Using the LCM within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are exceeded during normal operation, the LCM will malfunction and cause poor reliability.

Table 4.1 Module Absolute Maximum Ratings

| Item | Symbol | Unit | Value | Note |
|-----------------------|--------|-------|-------------|------|
| Power Supply Voltage | VCI | V | -0.3 to+3.3 | |
| Power Supply Voltage | IOVCC | V | -0.3 to+3.3 | |
| Operating Temperature | Top | °C | -20 to+70 | |
| Storage Temperature | Tst | °C | -30 to+80 | |
| Operating Humidity | Hop | %(RH) | 90 | |

(VSS=0V)

4.2 Electrical characteristics (Ta=25 C)

Table 4.2:DC Characteristic (Vcc = 3.0 ~ 3.6V)

| Item | Symbol | Condition | Min. | Ty | Max. | Unit | |
|---------------------|-----------------|---|------|----------------------|------|----------------------|---|
| Supply Voltage | Logic | VCI | --- | 2.5 | 2.8 | 3.3 | V |
| Supply Voltage | I/O | IOVCC | --- | 1.65 | 2.8 | 3.3 | V |
| Input Voltage | H level | V _{IH} | --- | 0.8IOV _{cc} | --- | V _{dd} | V |
| | L level | V _{IL} | | 0 | --- | 0.2IOV _{cc} | |
| Current Consumption | I _{cc} | With internal voltage generation; VCC=2.8V; | --- | 8 | 20 | mA | |



4.3 Back-light Specification

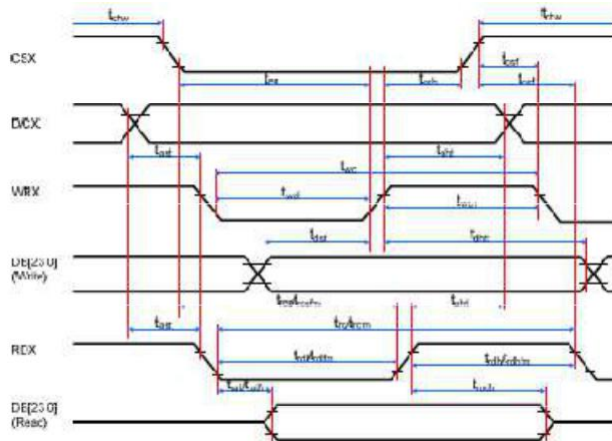
Table 4.3 Back-light Characteristics

| Item | Symbol | Conditions | Min. | Type. | Max. | Unit |
|----------------|--------|----------------------------|------|-------|------|------|
| Supply Voltage | VF | Only Backlight | 2.7 | 3.0 | 3.4 | V |
| Supply Current | IF | | 120 | | | mA |
| Uniformity | B | Backlight Current IF=120mA | -- | 80% | -% | |
| Color | White | | | | | |

Note: 6 LEDs in parallel connection.

5. AC Characteristics

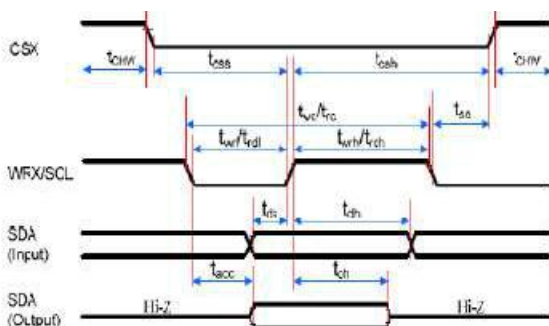
5.1 MCU 8-/9-/16-/18-bit interfae Characteristics.



| Signal | Symbol | Parameter | min | max | Unit | Description |
|--|--------|------------------------------------|-----|-----|------|---|
| CCX | tasi | Address setup time | 0 | - | ns | - |
| | tach | Address hold time (Write/Read) | 0 | - | ns | - |
| CSX | tclw | CSX "1" pulse width | 0 | - | ns | - |
| | ts | Chip Select setup time (Write) | 15 | - | ns | - |
| | trca | Chip Select setup time (Read ID) | 45 | - | ns | - |
| | trcafm | Chip Select setup time (Read FM) | 355 | - | ns | - |
| | tw | Chip Select Wait time (Write/Read) | 0 | - | ns | - |
| WRX | twc | Write cycle | 30 | - | ns | - |
| | twrh | Write Control pulse H duration | 15 | - | ns | - |
| | twrl | Write Control pulse L duration | 15 | - | ns | - |
| RDX (FM) | trfm | Read Cycle (FM) | 450 | - | ns | When read from Frame Memory |
| | trdfm | Read Control H duration (FM) | 90 | - | ns | |
| | trdfm | Read Control L duration (FM) | 355 | - | ns | |
| RDX (ID) | trc | Read cycle (ID) | 160 | - | ns | When read ID data |
| | trdh | Read Control pulse H duration | 90 | - | ns | |
| | trdl | Read Control pulse L duration | 45 | - | ns | |
| | tdst | Write data setup time | 10 | - | ns | |
| DB [23:0] DB [17:0] DB [8:0] DB [7:0] | tdht | Write data hold time | 10 | - | ns | For maximum, CL=30pF For minimum, CL=8pF |
| | trt | Read access time | - | 40 | ns | |
| | trahm | Read access time | - | 340 | ns | |
| | trah | Read output risetime | 20 | 80 | ns | |

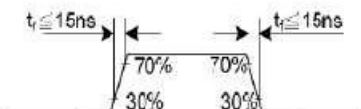


5.2 3-Line SPI Interface Characteristic

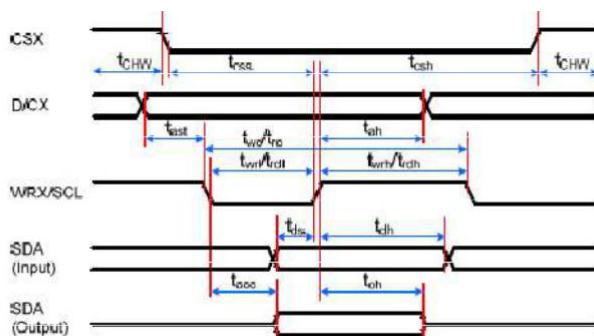


| Signal | Symbol | Parameter | min | max | Unit | Description |
|------------------|--------|------------------------------|-----|-----|------|---------------------|
| CSX | tsc | SC, CSX | 15 | - | ns | |
| | tCHW | CSX H Pulse Width | 40 | - | ns | |
| | tCSS | Chip select time (Write) | 50 | - | ns | |
| | tCsh | Chip select hold time (Read) | 65 | - | ns | |
| SCL | tWC | Serial Clock Cycle (Write) | 65 | - | ns | |
| | tWH | SCL H Pulse Width (Write) | 15 | - | ns | |
| | tWL | SCL L Pulse Width (Write) | 15 | - | ns | |
| | tDC | Serial Clock Cycle (Read) | 150 | - | ns | |
| | tDRH | SCL H Pulse Width (Read) | 60 | - | ns | |
| | tDRL | SCL L Pulse Width (Read) | 60 | - | ns | |
| SDA/SDI (Input) | tDS | Data setup time (Write) | 10 | - | ns | |
| | tDH | Data hold time (Write) | 10 | - | ns | |
| SDA/SDO (Output) | tACC | Access time (Read) | 10 | 50 | ns | For maximum CL=30pF |
| | tOH | Output disable time (Read) | 15 | 50 | ns | For minimum CL=8pF |

Note: Ta = -30 to 70 °C, IOVCC = 1.65V to 3.5V, VCI = 2.5V to 3.6V, AGND = DGND = 0V, T = 10+/-0.5ns



5.3 4-Line SPI Interface Characteristic



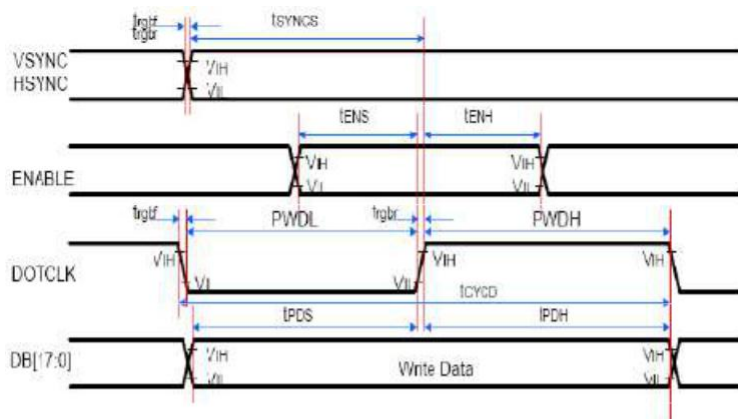
| Signal | Symbol | Parameter | min | max | Unit | Description |
|------------------|--------|------------------------------|-----|-----|------|---------------------|
| CSX | tCSS | Chip select time (Write) | 15 | - | ns | |
| | tCsh | Chip select hold time (Read) | 15 | - | ns | |
| | tCHW | CS H pulse width | 40 | - | ns | |
| SCL | tWC | Serial clock cycle (Write) | 50 | - | ns | |
| | tWH | SCL H pulse width (Write) | 10 | - | ns | |
| | tWL | SCL L pulse width (Write) | 10 | - | ns | |
| | tDC | Serial clock cycle (Read) | 150 | - | ns | |
| | tDRH | SCL H pulse width (Read) | 60 | - | ns | |
| | tDRL | SCL L pulse width (Read) | 60 | - | ns | |
| D/CX | tAS | D/CX setup time | 10 | - | ns | |
| | tAH | D/CX hold time (Write/Read) | 10 | - | ns | |
| SDA/SDI (Input) | tDS | Data setup time (Write) | 10 | - | ns | |
| | tDH | Data hold time (Write) | 10 | - | ns | |
| SDA/SDO (Output) | tACC | Access time (Read) | 10 | 50 | ns | For maximum CL=30pF |
| | tOH | Output disable time (Read) | 15 | 50 | ns | For minimum CL=8pF |

Notes:

- Ta = -30 to 70 °C, IOVCC = 1.65V to 3.3V, VCI = 2.5V to 3.3V, AGND = DGND = 0V, T = 10+/-0.5ns.
- Does not include signal rising and falling times.

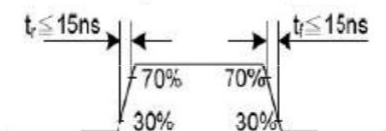


5.4 DPI 18-bit RGB Interface Characteristics



| Signal | Symbol | Parameter | min | max | Unit | Description |
|-------------|----------------|-----------------------------------|-----|-----|------|-----------------------------------|
| VSYNC/HSYNC | t_{sync} | VSYNC/HSYNC setup time | 15 | - | ns | 18-/24-bit bus RGB interface mode |
| HSYNC | t_{synch} | VSYNC/HSYNC hold time | 15 | - | ns | |
| ENABLE | t_{pe} | ENABLE setup time | 15 | - | ns | |
| | t_{ph} | ENABLE hold time | 15 | - | ns | |
| DB [23:0] | t_{ps} | Data setup time | 15 | - | ns | |
| | t_{ph} | Data hold time | 15 | - | ns | |
| DOTCLK | PWDH | DOTCLK high-level period | 20 | - | ns | |
| | PWDL | DOTCLK low-level period | 20 | - | ns | |
| | t_{cycd} | DOTCLK cycle time | 50 | - | ns | |
| | t_{pwr_tpr} | DOTCLK.HSYNC.VSYNC rise/fall time | - | 15 | ns | |

Note: Ta = -30 to 70 °C, IOVCC = 1.65V to 3.3V, VCI = 2.5V to 3.3V, AGND = DGND = 0V



6. Power On/Off Sequence

Power source IOVCC, VCI can be applied and powered down in any order. IOVCC, VCI can be powered down in any order.

During power off, if LCD is in the Sleep Out mode, IOVCC, VCI must be powered down minimum 120msec after NRESET has been released.

During power off, if LCD is in the Sleep In mode, IOVCC, VCI can be powered down minimum 0msec after NRESET has been released.

NCS can be applied at any timing or can be permanently grounded. NRESET has priority over NCS.

- Note:**
- (1) There will be no damage to the display module if the power sequences are not met.
 - (2) There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.
 - (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.
 - (4) If NRESET line is not held stable by host during Power on Sequence as defined in Sections 5.11.1.1 and 5.11.1.2, then it will be necessary to apply a Hardware Reset (NRESET) after Host Power on Sequence to ensure correct operation. Otherwise correct function is not guaranteed.



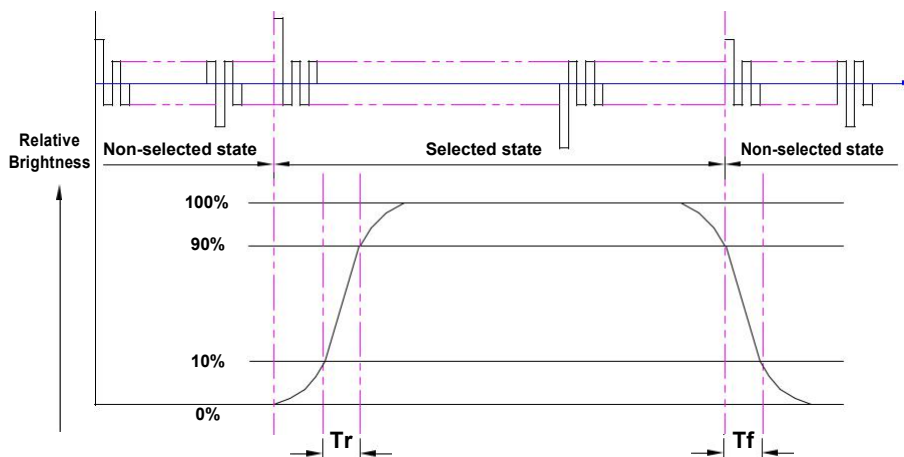
7. Optical Specifications

| Item | Symbol | Condition | Specification | | | Unit |
|---|--------------------------------|--|---------------|-------|-------|-------------------|
| | | | Min. | Typ. | Max. | |
| Luminance on TFT ($I_f = 20\text{mA/LED}$) | Lv | Normally viewing angle $\theta_x = \varphi_y = 0^\circ$ | 220 | 300 | - | cd/m ² |
| Contrast ratio(See 7.2) | CR | | - | 700 | - | |
| Response time (See 7.1) | T _R +T _F | | - | 30 | - | ms |
| Chromaticity Transmissive (See 7.4) | White | X _w | 0.276 | 0.316 | 0.356 | - |
| | | Y _w | 0.282 | 0.322 | 0.362 | - |
| Viewing Angle (See 7.3) | Horizontal | θ_{x+} | - | 80 | - | Deg. |
| | | θ_{x-} | - | 80 | - | |
| | Vertical | φ_{y+} | - | 80 | - | |
| | | φ_{y-} | - | 80 | - | |
| NTSC Ratio(Gamut) (See 7.4) | - | - | - | 69 | - | % |



7.1 Definition of Response Time

7.1.1 Normally Black Type (Negative)

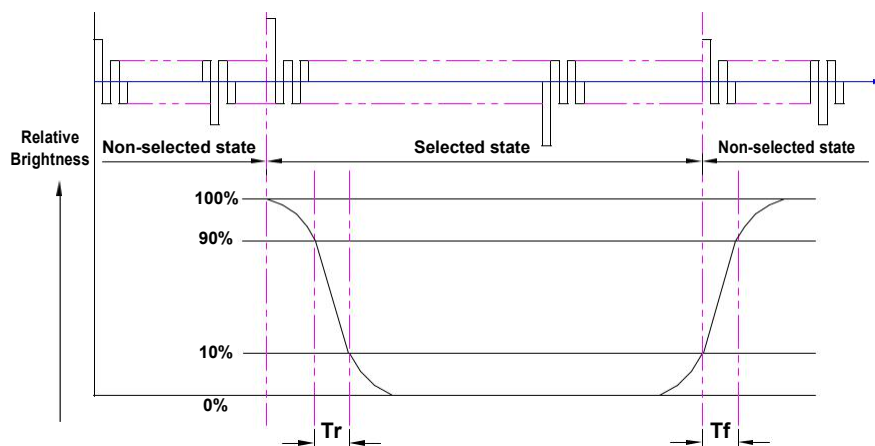


Tr is the time it takes to change from non-selected state with relative luminance 10% to selected state with relative luminance 90%;

Tf is the time it takes to change from selected state with relative luminance 90% to non-selected state with relative luminance 10%.

Note : Measuring machine: LCD-5100

7.1.2 Normally White Type (Positive)



Tr is the time it takes to change from non-selected state with relative luminance 90% to selected state with relative luminance 10%;

Tf is the time it takes to change from selected state with relative luminance 10% to non-selected state with relative luminance 90%;

Note : Measuring machine: LCD-5100 or EQUI

7.2 Definition of Contrast Ratio

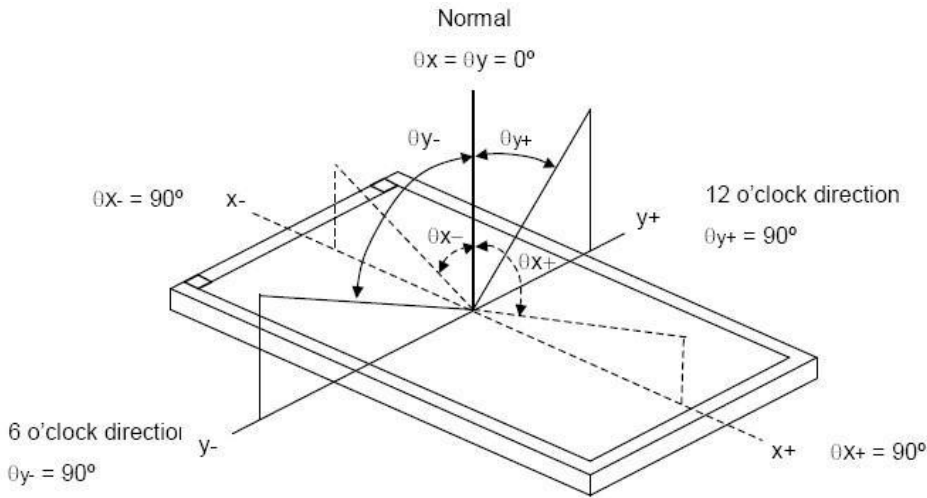
Contrast is measured perpendicular to display surface in reflective and transmissive mode. The measurement condition is:

| | |
|--------------------------|--------------------------|
| Measuring Equipment | Eldim or Equivalent |
| Measuring Point Diameter | 3mm//1mm |
| Measuring Point Location | Active Area centre point |
| Test pattern | A: All Pixels white |
| | B: All Pixel black |
| Contrast setting | Maximum |

Definitions: CR (Contrast) = Luminance of White Pixel / Luminance of Black Pixel



7.3 Definition of Viewing Angles



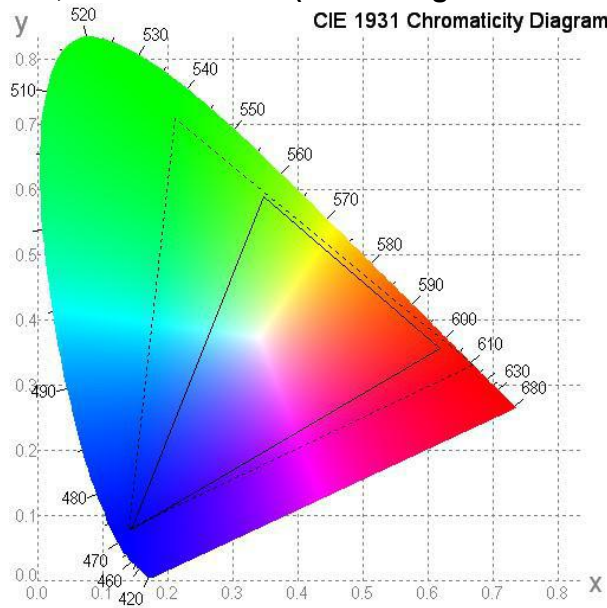
Measuring machine: LCD-5100 or EQUI

7.4 Definition of Color Appearance

R,G,B and W are defined by (x, y) on the IE chromaticity diagram

NTSC=area of RGB triangle/area of NTSC triangleX100%

Measuring picture: Red, Green, Blue and White (Measuring machine: BM-7)





8. Reliability Test Items

| No. | Test Item | Test Condition | Check Time |
|-----|---------------------------|----------------|------------|
| 1 | High temp storage | T=80°C | 72Hrs |
| 2 | Low temp storage | T=-30°C | 72Hrs |
| 3 | High temp operation | T=70°C | 72Hrs |
| 4 | Low temp operation | T=-20°C | 72Hrs |
| 5 | High temp & high humidity | T=50°C H=90% | 27Hrs |

Note1: Pass: Normal display image with no obvious non-uniformity and no line defect.

Fail: No display image, obvious non-uniformity, or line defects. Partial transformation of the module parts should be ignored.

Note2: Evaluation should be tested after storage at room temperature for two hours.

Note3: Evaluation should be tested with storage temperature.



9. Handling Precautions

9.1 Mounting Method

The panel of the LCD consists of two thin glasses with polarizers which easily get damaged. So extreme care should be taken when handling the LCD.

Excessive stress or pressure on the glass of the LCD should be avoided. Care must be taken to insure that no torsional or compressive forces are applied to the LCD unit when it is mounted.

If the customer's set presses the main parts of the LCD, the LCD may show the abnormal display. But this phenomenon does not mean the malfunction of the LCD and should be pressed by the way of mutual agreement.

To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.

Mount a LCD module with the specified mounting parts.

9.2 Caution of LCD Handling and Cleaning

Since the LCD is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass may be broken.

The polarizers on the surface of panel are made from organic substances. Be very careful for chemicals not to touch the polarizers or it leads the polarizers to be deteriorated.

If the use of a chemical is unavoidable, use soft cloth with solvent (recommended below) to clean the LCD's surface with wipe lightly.

-IPA(Isopropyl Alcohol), Ethyl Alcohol, Trichlorotrifluoroethane

Do not wipe the LCD's surface with dry or hard materials that will damage the polarizers and others. Do not use the following solvent.

-Water, Ketone, Aromatics

It is recommended that the LCD be handled with soft gloves during assembly, etc. The polarizers on the LCD's surface are vulnerable to scratch and thus to be damaged by sharp particles.

Do not drop water or any chemicals onto the LCD's surface.

A protective film is supplied on the LCD and should be left in place until the LCD is required for operation.

The ITO pad area needs special careful caution because it could be easily corroded. Do not contact the ITO pad area with HCFC, Soldering flux, Chlorine, Sulfur, saliva or fingerprint.

To prevent the ITO corrosion, customers are recommended that the ITO area would be covered by UV or silicon.

9.3 Caution Against Static Charge

The LCD modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.



Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, if possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.

Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.

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

9.4 Caution For operation

It is indispensable to drive the LCD within the specified voltage limit since the higher Voltage than the limit causes the shorter LCD's life. An electro-chemical reaction due to DC causes undesirable deterioration of the LCD so that the use of DC drive should avoid.

Do not connect or disconnect the LCD to or from the system when power is on. Never use the LCD under abnormal conditions of high temperature and high humidity.

When expose to drastic fluctuation of temperature (hot to cold or cold to hot) ,the LCD may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD's surface which may affect the operation of the polarizer and the LCD.

Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD may turn black at temperature above its operational range. However those phenomena do not mean malfunction or out of order with the LCD. The LCD will revert to normal operation once the temperature returns to the recommended temperature range for normal operation.

Do not display the fixed pattern for a long time because it may develop image sticking due to the LCD structure. If the screen is displayed with fixed pattern, use a screen saver.

9.5 Packaging

Modules use LCD element, and must be treated as such.

- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed directly to sun's shine or high temperature/humidity for long periods.

9.6 Storage

A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Relative humidity of the environment should therefore be kept below 60%RH.

Original protective film should be used on LCD's surface (polarizer). Adhesive type protective film should be avoided, because it may change color and/or properties of the polarizers.

Do not store the LCD near organic solvents or corrosive gasses.

Keep the LCD safe from vibration, shock and pressure.



Black or white air-bubbles may be produced if the LCD is stored for long time in the lower temperature or mechanical shocks are applied onto the LCD.

In the case of storing for a long period of time for the purpose or replacement use, the following ways are recommended.

- Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.**
- Store in a dark place where neither exposure to direct sunlight nor light is.**
- Keep temperature in the specified storage temperature range.**
- Store with no touch on polarizer surface by the anything else. If possible, store the LCD in the packaging situation LCD when it was delivered.**

9.7 Safety

For the crash damaged or unnecessary LCD, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol an should be burned up later.

In the case the LCD is broken, watch out whether liquid crystal leaks out or not. If your hands touch the liquid crystal, wash your hands cleanly with water an soap as soon as possible.

If you should swallow the liquid crystal, first, wash your mouth thoroughly with water, then drink a lot of water and induce vomiting, and then, consult a physician.

If the liquid crystal should get in your eyes, flush your eyes with running water for at least fifteen minutes.

If the liquid crystal touches your skin or clothes, remove it and wash the affected part of your skin or clothes with soap and running water.



10. QC

10.1 Purpose

To ensure the stability of our product and standardize our inspection

10.2 Application Range

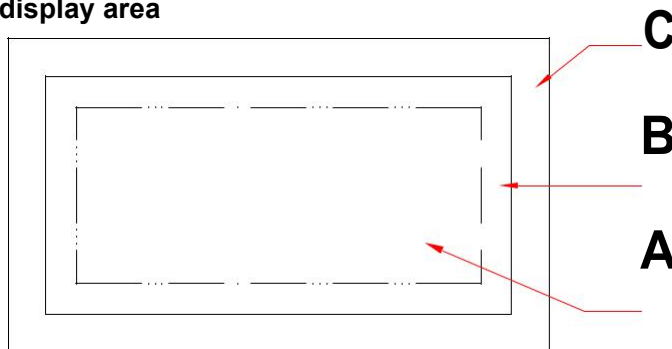
This standard is applied to all 4.3 inch and smaller sized LCM product from Elsun Technology Co.Ltd

10.3 Definition of inspection area

C area: The area covered after installation

B area: visible area

A area: display area

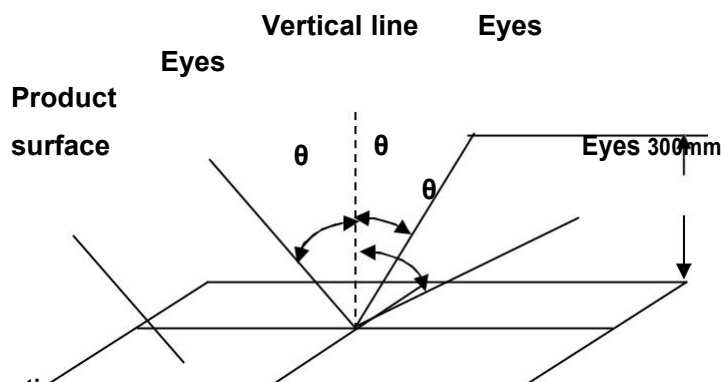


10.4 The environmental condition of inspection

Lighting conditions should be 20 ~ 40W fluorescent lamp (illumination at 1000 ± 200 lux)

Test ambient temperature should be 23 ± 5 °C, humidity at $50 \pm 20\%$ RH

The tested products should be placed 300mm away from the examiner's eye, and 30 degrees in the vertical direction observed within the region



10.5 Identification

10.5.1 Bright dot: dots appearing bright and unchanged in size when the LCD panel is under black pattern.

10.5.2 Dark dot: dots appearing dark and unchanged size when the LCD panel is under RGB picture.

10.6 Inspection items and criteria



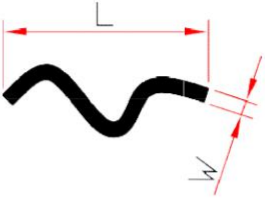
10.6.1 Serious defect

| No | inspection item | inspection criteria | defect grade |
|----------|------------------|--|--------------|
| 10.6.1.1 | function failure | 1) Non-display not allowed 2) Line missing not allowed 3) Invalid touch and drift not allowed (if need) | main defect |
| 10.6.1.2 | break | broken display not allowed | main defect |
| 10.6.1.3 | dimension | Dimension tolerance out of specified in the drawing not allowed. | main defect |

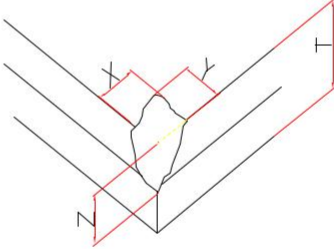
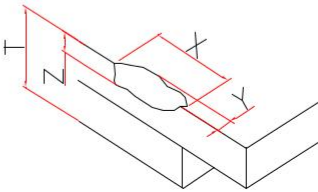
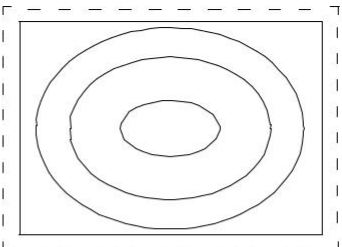
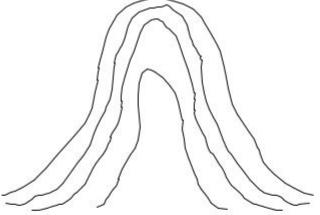
10.6.2 Appearance defect

| No | Inspection item | inspection criteria | defect grade | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|------------------|--|--|--------|--------|--------|-------|--------|--|--|--------------|----------------------|--|--|-------------|---|--|--|------|---|--|--|--|
| 10.6.2.1 | Dot defect black dot, white dot, dirt on surface, stain, bubble | 1. dot defect identification: | Minor defect | | | | | | | | | | | | | | | | | | | | | | | |
| | | <div style="text-align: center;"> $(\frac{\quad}{2})$ </div> | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 2. inspection criteria range | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th rowspan="2">Area and quantit y dimension(mm)</th> <th colspan="3">quantity allowed</th> </tr> <tr> <th>A area</th> <th>B area</th> <th>C area</th> </tr> </thead> <tbody> <tr> <td>≤0.15</td> <td colspan="3">ignore</td> </tr> <tr> <td>0.15 < ≤0.20</td> <td colspan="3">2 (spacing ≥ 10mm)</td> </tr> <tr> <td>0.20 < ≤0.3</td> <td colspan="3">1</td> </tr> <tr> <td>>0.3</td> <td colspan="3">0</td> </tr> </tbody> </table> | Area and quantit y dimension(mm) | quantity allowed | | | A area | B area | C area | ≤0.15 | ignore | | | 0.15 < ≤0.20 | 2 (spacing ≥ 10mm) | | | 0.20 < ≤0.3 | 1 | | | >0.3 | 0 | | | |
| Area and quantit y dimension(mm) | quantity allowed | | | | | | | | | | | | | | | | | | | | | | | | | |
| | A area | B area | C area | | | | | | | | | | | | | | | | | | | | | | | |
| ≤0.15 | ignore | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.15 < ≤0.20 | 2 (spacing ≥ 10mm) | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.20 < ≤0.3 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| >0.3 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | |



| No | Inspection item | inspection criteria | defect grade | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------|--------------------------------------|---|--------------|--------------------------------|--------|--------------------------------|--------|--|--------------|-------------|------|--|--|--------|--------|--------|--------|---------------|--------|--|--|---------------------|----------------------|---|--|--|--------------|----------------------|---|--|--|--|------------|-------------------------------|--|--|
| 10.6.2.2 | line defect visible black/white line | 1. identification of line dimension L: length W: width  | Minor defect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 2. inspection criteria | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th colspan="2">dimension(mm)</th> <th colspan="3">quantity allowed (total 3 pcs)</th> </tr> <tr> <th rowspan="2">L (length)</th> <th rowspan="2">W (width)</th> <th colspan="3">area</th> </tr> <tr> <th>A area</th> <th>B area</th> <th>C area</th> </tr> </thead> <tbody> <tr> <td>ignore</td> <td>$W \leq 0.03$</td> <td colspan="3">ignore</td> </tr> <tr> <td>$L \leq 3.0$</td> <td>$0.03 < W \leq 0.05$</td> <td colspan="3">2</td> </tr> <tr> <td>$L \leq 3.0$</td> <td>$0.05 < W \leq 0.08$</td> <td colspan="3">1</td> </tr> <tr> <td></td> <td>$W > 0.08$</td> <td colspan="3">count according to dot defect</td> </tr> </tbody> </table> | | dimension(mm) | | quantity allowed (total 3 pcs) | | | L (length) | W (width) | area | | | A area | B area | C area | ignore | $W \leq 0.03$ | ignore | | | $L \leq 3.0$ | $0.03 < W \leq 0.05$ | 2 | | | $L \leq 3.0$ | $0.05 < W \leq 0.08$ | 1 | | | | $W > 0.08$ | count according to dot defect | | |
| | | dimension(mm) | | quantity allowed (total 3 pcs) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | L (length) | | W (width) | area | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | A area | B area | C area | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ignore | | $W \leq 0.03$ | ignore | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $L \leq 3.0$ | $0.03 < W \leq 0.05$ | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $L \leq 3.0$ | $0.05 < W \leq 0.08$ | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | $W > 0.08$ | count according to dot defect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10.6.2.3 | scratch | 1- If the scratch is visible after installation or at work, refer to 10.6.2.2 2- If the scratch is visible at special angel or at non-working status, refer to the following standards | Minor defect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th colspan="2">dimension (mm)</th> <th colspan="3">Quantity allowed</th> </tr> <tr> <th rowspan="2">L (length)</th> <th rowspan="2">W (width)</th> <th colspan="3">area</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>ignore</td> <td>$W \leq 0.03$</td> <td colspan="3">ignore</td> </tr> <tr> <td>$5.0 < L \leq 10.0$</td> <td>$0.03 < W \leq 0.05$</td> <td colspan="3">2</td> </tr> <tr> <td>$L \leq 5.0$</td> <td>$0.05 < W \leq 0.08$</td> <td colspan="3">1</td> </tr> <tr> <td></td> <td>$W > 0.08$</td> <td colspan="3">Not allowed</td> </tr> </tbody> </table> | | dimension (mm) | | Quantity allowed | | | L (length) | W (width) | area | | | A | B | C | ignore | $W \leq 0.03$ | ignore | | | $5.0 < L \leq 10.0$ | $0.03 < W \leq 0.05$ | 2 | | | $L \leq 5.0$ | $0.05 < W \leq 0.08$ | 1 | | | | $W > 0.08$ | Not allowed | | |
| | | dimension (mm) | | Quantity allowed | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | L (length) | | W (width) | area | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | A | B | C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ignore | | $W \leq 0.03$ | ignore | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | $5.0 < L \leq 10.0$ | | $0.03 < W \leq 0.05$ | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $L \leq 5.0$ | $0.05 < W \leq 0.08$ | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | $W > 0.08$ | Not allowed | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| No | Inspection | inspection criteria defect grade item | |
|----------|--------------|---|--------------|
| 10.6.2.4 | Glass defect | <p>1. broken angle</p> <p>X 不计 Y≤2.0mm or X≤ 2.0mm Y 不计 Meanwhile Z<T ignore</p>  <p>2. other broken part</p> <p>X≤5.0mm Y≤0.8mm Meanwhile Z≤T ignore</p>  | Minor defect |
| 10.6.2.5 | Newton ring | <p>1. regular Newton ring</p>  <p>① Newton ring area>1/3 T/P area; not acceptable. ② Newton ring area≤1/3 T/P area and doesn't affect the display result and no line distortion; acceptable</p> <p>2. Non-regular Newton ring</p>  <p>① Newton ring area>1/2 T/P area, or no matter how big as long as it affects the display result; not acceptable Newton ring area≤1/2 T/P area, and doesn't affect the display result and without line distortion; acceptable</p> | Minor defect |



| NO | Inspection item | inspection criteria | defect grade |
|----------|-------------------------------|---|--------------|
| 10.6.2.6 | FPC | <ol style="list-style-type: none"> 1. copper foil off, warping, crack and oxidation are not allowed 2. FPC crack, break, serious scratch and crease are not allowed | main defect |
| | | <ol style="list-style-type: none"> 3. if no special requirements, no release paper on double-sided adhesive FPC is not allowed. 4. Slight creases and scratches not exposed from the copper foil and with no affect to appearance and function are allowed. 5. if no special requirements, no insulating tape at welding part on backlight and touch-screen is not allowed.. 6. Parts off, breakage and deform are not allowed. 7. print on the surface should be clear and correct. | Minor defect |
| 10.6.2.7 | basic appearance requirements | <ol style="list-style-type: none"> 1. clean appearance, no dirt, fingerprints and other traces. 2. ITO circuit on COG coating area should not be exposed. 3. Rust, sever scratch, deformation, obvious burrs and color dirt are not allowed. 4. Mis-assembly, part missing are not allowed. 5. Bubble caused by mis-pasted polaroid refers to 10.6.2.1 6. For watermark, the criteria is upon agreed by both parties. | Minor defect |



10.6.3 electric defect

| No | Inspection item | inspection criteria | defect grade |
|----------|---------------------------|--|--------------|
| 10.6.3.1 | picture defect | Non-display, more or less image and display defect are not allowed. | main defect |
| 10.6.3.2 | bright/dark line | Not allowed. | main defect |
| 10.6.3.3 | display dot defect | <ol style="list-style-type: none"> one dot is acceptable. Under bright status, 2 dark dots with more than 5mm distance is allowed. Totally 2 bright or dark dots are acceptable. The other defect under bright status refers to 10.6.2.1 <p>Note: Electric bright/dark dot means one pixel; less than 1/2 of 1 pixel can be ignored.</p> | Minor defect |
| 10.6.3.4 | connected dot/line defect | <ol style="list-style-type: none"> Two continuous defect pixel connected dots are not allowed. Minor defect Line defect refers to 10.6.2.2 | |
| 10.6.3.5 | wrong view direction | Wrong view directions, such as opposite view angle, are not allowed. | main defect |
| 10.6.3.6 | back light defect | <ol style="list-style-type: none"> Backlight off are not allowed. Uneven light, dead light, flicker light, dark angle, light leakage are not allowed. Brightness should comply with drawing | main defect |

end.