

DEM 320480A TMH-PW-N

Revise Records

| Rev. | Date | Contents | Written | Approved |
|------|------------|---------------------------|---------|----------|
| 0 | 13.04.2011 | Preliminary Specification | CL | MH |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Special Notes

| Note1. | |
|--------|--|
| Note2. | |
| Note3. | |
| Note4. | |
| Note5. | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

CONTENT

- 1. LCM DRAWING
- 2. GENERAL DESCRIPTION
- 3. MECHANICAL SPECIFICATIONS
- 4. ELECTRO-OPTICAL CHARACTERISTICS
- 5. BLOCK DIAGRAM
- 6. ELECTRONIC CHARACTERISTICS
- 7. PINS DESCRIPTION
- 8. INSTRUCTION DESCRIPTION
- 9. BACKLIGHT PARAMETERS
- **10. PRODUCT QUALITY & RELIABILITY**
- **11. PRECAUTIONS IN USING**
- **12. APPLICATION**

1. LCM DRAWING



2. GENERAL DESCRIPTION

| MAIN TECHNICS : | TFT-TRANSMISSIVE NEGATIVE |
|-------------------------------------|---|
| DISPLAY CONTENT : | 320 x RGB x 480 Pixel |
| DISPLAY TYPE : | 262k COLORS |
| DRIVER METHOD : | 1/480 DUTY |
| VIEWING DIRECTION: | 9:00 |
| CONTROLLER: | ILI9481 (ILITEK) |
| BACKLIGHT : | LED LIGTHGUIDE, WHITE |
| OPEATING TEMPERATURE : | -20° C to $+70^{\circ}$ C |
| STORAGE TEMPERATURE : | -30° C to $+80^{\circ}$ C |
| INTERFACE: REFERENCE DOCUMENTS : | 8/16-BIT PARALLEL AND SERIAL ILI9481 datasheet |

3. MECHANICAL SPECIFICATIONS

| ITEM | CONTENT | UNIT |
|------------------|-----------------------|-------|
| PIXEL'S NUMBER | 320 x RGB x 480 | PIXEL |
| MODULE DIMENSION | 57.34 x 111.75 x 2.30 | mm |
| ACTIVE AREA | 48.96 x 73.44 | mm |
| PIXEL SIZE | 0.153 x 0.153 | mm |

4. ELECTRO-OPTICAL CHARACTERISTICS

| Optical Specifications | | | | | | | | |
|------------------------|----------------|-----------------|-----------|------|-------|------|------|---------------|
| Parameter | | Symbol | Condition | Min. | Тур. | Max. | Unit | Remark |
| Thusehold Valtage | | V_{sat} | | 2.1 | 2.3 | 2.5 | V | Fig 1 |
| Theshol | | V_{th} | | 1.1 | 1.3 | 1.5 | V | 119.1 |
| | Harizantal | Θ3 | | | 60 | | | |
| Viewing | Horizontai | Θ9 | CD>10 | | 60 | | | Note 1 |
| Angle | Vortical | Θ12 | CK/10 | | 70 | | | Note 1 |
| _ | vertical | Θ6 | | | 70 | | | 1 |
| Cont | Contrast ratio | | Θ= 0° | 400 | 600 | | | Note 2 |
| Trans | Transmittance | | Θ= 0° | | 5.3% | | | Note 3 |
| | D-1 | | | | 0.655 | | | |
| Depreduct | Keu | Ry | | | 0.313 | | | Note 4 |
| Of color | Groop | Gx | 0-00 | | 0.290 | | | *Color Filter |
| | Green | Gy | 0=0- | | 0.545 | | | Glass |
| | Blue | Bx | | | 0.139 | | | without ITO |
| | blue | Ву | | | 0.119 | | | |
| Response Time | | Tr+Tf | Θ= 0° | | 20 | | ms | Note 5 |

Note:

- 1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIG.2).
- 2. Contrast measurements shall be made at viewing angle of Θ = 0° and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (See FIG. 2) Luminance Contrast Ratio (CR) is defined mathematically.

- 3. Transmittance is the value with Polarizer.
- 4. The color chromaticity coordinates specified in Table1 shall be calculated from The spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the C/F. Measurement condition is C - light source & Halogen Lamp
- 5. The electro-optical response time measurements shall be made as FIG.3 by switching the "data" input signal ON and OFF.

The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Td.

Figure 1. The definition of Vth & Vsat



Figure 2. Measurement Set Up



Figure 3. Response Time Testing



5. BLOCK DIAGRAM



6.ELECTRONIC CHARACTERISTICS

6.1 MAXIMUM VALUES

| TATA | | STANDARI | | |
|-----------------------|-----------|----------|------|------|
| | SYMBOL | MIN | MAX | UNII |
| Power supply votage | VCC,IOVCC | -0.3 | +4.6 | V |
| Power supply votage | VCI-GND | -0.3 | +4.6 | |
| Operating Temperature | Тор | -20 | +70 | °C |
| Storage Temperature | Tst | -30 | +80 | °C |

6.2 DC CHARACTERISTICS

| Parameter | Symbol | Condition | Min. | Тур. | Max. | Unit |
|---------------------------------|--------|---------------------------|-----------|------|-----------|------|
| Analog Power Supply Voltage | VCI | Analog Operation Voltage | 2.5 | 2.8 | 3.3 | V |
| I/O pin Power Supply Voltage | IOVCC | I/O pin Operation Voltage | 1.7 | 2.8 | 3.3 | V |
| Logic High level input voltage | VIH | | 0.7*IOVCC | - | IOVCC | V |
| Logic Low level input voltage | VIL | | 0.0 | - | 0.3*IOVCC | V |
| Logic High level Output voltage | ViH | lout = -1 mA | 0.8*IOVCC | - | IOVCC | V |
| Logic Low level Output voltage | VIL | lout = +1 mA | 0.0 | - | 0.2*IOVCC | V |
| Logic High level input current | IIHD | D[17:0] | | | 10 | uA |
| Logic Low level input current | IILD | D[17:0] | -10 | | | uA |

6.3 TIMING CHARACTERISTICS



DBI Type B (18/16/9/8 bit) Interface Timing Characteristics

Note: Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

Note: Ta = -30 to 70 °C, IOVCC=1.65V to 3.3V, VDD=2.5V to 3.0V, GND=0V

110

-

10

ns

ns



DBI Type C Interface Timing Characteristics

Access time

Output disable time

DOUT

(Driver IC)

t_{acc}

too

DPI Interface Timing Characteristics



7. PIN DESCRIPTION

| Pin No | Symbol | Description |
|--------|----------|--|
| 1 | LEDK | Backlight LED cathode |
| 2 | LEDK | Backlight LED cathode |
| 3 | LEDA | Backlight LED anode |
| 4 | LEDA | Backlight LED anode |
| 5 | VSS | Ground |
| 6 | VCC | Power supply to interface pins:+3.0V |
| 7 | VC | Power supply to liquid crystal power supply analog circuit:+3.0V |
| 8 | TE | Tearing effect output |
| 9 | CSX | Chip select signal |
| 10 | D/CX | Display data/Commangd selection |
| 11 | WRX/SCL | Write control pin /serial clock |
| 12 | RDX | Read Control pin for the DBI Interface. |
| 13 | D N/SDA | Serial data input |
| 14 | DOUT | Serial data output |
| 15-32 | DBO-DB17 | Data bus |
| 33 | ENABLE | Data enable signal |
| 34 | DOTCLK | Clock signal |
| 35 | HSYNC | Horizontal synchronizing input signal |
| 36 | VSYNC | Vertical synchronizing input signal |
| 37 | RESX | L: initialization is executed |
| 38 | IM2 | IM2 IM1 IM2 IM2-Interface Mode DB Pin In use 0 0 0 0081 Fyre 8.14-bit DB [[7:0]] 0 0 1.061 Fyre 8.9-bit DB [[7:0]] 0 0 1.061 Fyre 8.9-bit DB [[7:0]] 0 0 1.061 Fyre 8.9-bit DB [[7:0]] |
| 39 | IM1 | 0 1 1 1 100 1000 1000 1 10000 1 10000 1 10000 1 1000 1 1000 1 1000 1 1000 1 1000 1 1000 1 1000 1 100 |
| 40 | IMO/ID | 1 1 0 Satting problem 1 1 1 08 Satting problem 1 1 1 08 System C 3-51t 111,000T |

8. INSTRUCTION DESCRIPTION

| Operational Code (Hex) | Command | Command(C) /Read(R) /Write(W) | Number Of Parameter | MIPI DCS Type1 Requirement | ILI9418 Implementation |
|---------------------------|------------------------|----------------------------------|------------------------|-------------------------------|----------------------------------|
| 00h | nop | C | 0 | Yes | Yes |
| 01h | soft reset | С | 0 | Yes | Yes |
| 06h | get red channel | R | 1 | No | No |
| 07h | get green channel | R | 1 | No | No |
| 08h | get blue channel | R | 1 | No | No |
| 0Ah | get power mode | R | 1 | Yes | Yes |
| 0Bh | get address mode | R | 1 | Yes (Bit[7:0]) | Yes (Bit[7:3]), Only) |
| 0Ch | get_pixel_format | R | 1 | Yes | Yes |
| 0Dh | get_display_mode | R | 1 | Yes | Yes |
| 0Eh | get_signal_mode | R | 1 | Yes | Yes |
| 0Fh | get_diagnostic _result | R | 1 | Bit7/6:Yes Bit5/4:Optional | Yes (Bit7/6 Only) |
| 10h | enter_sleep_mode | С | 0 | Yes | Yes |
| 11h | exit_sleep_mode | С | 0 | Yes | Yes |
| 12h | enter_partial_mode | С | 0 | Yes | Yes |
| 13h | enter_normal_mode | С | 0 | Yes | Yes |
| 20h | exit_invert_mode | С | 0 | Yes | Yes |
| 21h | enter_invert_mode | С | 0 | Yes | Yes |
| 26h | set_gamma_curve | W | 1 | Yes | No |
| 28h | set_display_off | С | 0 | Yes | Yes |
| 29h | set_display_on | С | 0 | Yes | Yes |
| 2Ah | set_column_address | W | 4 | Yes | Yes |
| 2Bh | set_page_address | W | 4 | Yes | Yes |
| 2Ch | write_memory_start | W | Variable | Yes | Yes |
| 2Dh | wite_LUT | W | Variable | Optional | No |
| 2Eh | read_memory_start | R | Variable | Yes | Yes |
| 30h | set_partial_area | W | 4 | Yes | Yes |
| 33h | set_scroll_area | W | 6 | Yes | Yes |
| 34h | set_tear_off | С | 0 | Yes | Yes |
| 35h | set_tear_on | W | 1 | Yes | Yes |
| 36h | set_address_mode | w | 1 | Yes (Bit7-0) | Yes (Bit[7:3], Bit[1:0] Only) |
| 37h | set_scroll_start | W | 2 | Yes | Yes |
| 38h | exit_idle_mode | С | 0 | Yes | Yes |
| 39h | enter_idle_mode | С | 0 | Yes | Yes |
| 3Ah | set_pixel_format | W | 1 | Yes | Yes |
| 3Ch | write_memory _continue | W | Variable | Yes | Yes |
| 3Eh | read_memory _continue | R | Variable | Yes | Yes |
| 44h | set_tear_scanline | W | 2 | Yes | Yes |
| 45h | get_scanline | R | 2 | Yes | Yes |
| A1h | read_DDB_start | R | 5 | Yes | Yes |
| A8h | read_DDB_continue | R | Variable | Yes | Yes |

| B0h | Command Access Protect | W/R | 1 |
|-------------------------------|---|-----|----------|
| B1h | Low Power Mode Control | W/R | 1 |
| B3h | Frame Memory Access and Interface setting | W/R | 5 |
| B4h | Display Mode and Frame Memory Write Mode setting | W/R | 1 |
| BFh | Device code Read | R | 4 |
| C0h | Panel Driving Setting | W/R | 7 |
| C1h | Display Timing Setting for Normal Mode | W/R | 3 |
| C2h | Display Timing Setting for Partial Mode | W/R | 3 |
| C3h | Display Timing Setting for Idle Mode | W/R | 3 |
| C5h | Frame rate and Inversion Control | W/R | 1 |
| C6h | Interface Control | W/R | 1 |
| C8h | Gamma Setting | W/R | 12 |
| D0h | Power Setting | W/R | 3 |
| D1h | VCOM Control | W/R | 3 |
| D2h | Power Setting for Normal Mode | W/R | 2 |
| D3h | Power Setting for Partial Mode | W/R | 2 |
| D4h | Power Setting for Idle Mode | W/R | 2 |
| E0h | NV Memory Write | W/R | 1 |
| E1h | NV Memory Control | W/R | 1 |
| E2h | NV Memory Status | W/R | 3 |
| E3h | NV Memory Protection | W/R | 2 |
| E8h | EEPROM Write Enable | С | 0 |
| E9h | EEPROM Write Disable | С | 0 |
| EAh | EEPROM Word Write | W/R | 2 |
| EBh | EEPROM Word Read | R | 3 |
| ECh | EEPROM Address Set | W/R | 1 |
| EDh | EEPROM Erase | W/R | 1 |
| EEh | EEPROM Erase All | С | 0 |
| B0~FF Except above command | LSI TEST Registers | W/R | Variable |

9. BACKLIGHT PARAMETERS

9.1 ABSOLUTE MAXIMUM RATINGS

| | τ | Jnless specified, The | Ambient temperature | Га=25°С |
|----------------------------------|--------|-------------------------------|---------------------|---------|
| Item | Symbol | Condition | Rating | Unit |
| Reverse Voltage | Vr | | | V |
| Absolute maximum forward current | Ifm | | | mA |
| Peak forward current | Ifp | I msec plus 10% Duty cycle | | mA |
| Power description | pd | | | mW |
| Operating temperature range | Topr | | -20~+70 | °C |
| Storage temperature range | Tst | | -30~+80 | °C |

For operation above 25°C, The Ifm Ifp & Pd must be derated, the Curent derating is-0.36*10mA/°C

for DC drive and -0.86*10mA/°C for Pulse drive, the Power dissipation is -0.75*10mW/°C. The product

working current must not more than the 60% of the Ifm or Ifp according to the working temperature.

9.2 ELECTRICAL/OPTLCAL CHARACTERISTICS

Ta=25°C, Unless specified, The Ambient temperature Ta=25°C

| Item | Symbol | min | typ | max | Unit | Condition | |
|--------------------|--------|---------|------|---------|----------|-----------|--|
| Forward Voltage | Vf | 3.0 | 3.2 | 3.4 | V | If=90mA | |
| Reverse Current | Ir | | | | uA | | |
| Luminance | Lv | | 3900 | | cd/m^2 | If=90mA | |
| Color chromoticity | Х | X=0.245 | | X=0.295 | | If_00m A | |
| Color chromaticity | Y | Y=0.245 | | Y=0.295 | | II=90mA | |

The luminance is the average value of 9 points, and The Lvmax./Lvmin.is more than 70% Typical.

The measurement instrument is BL-200-V2 luminance Colorimeter. The aperture is ∮5.0mm.

10. Product Quality & Reliability

10.1 Standard for Quality Test

10.1.1 Inspection :

Before delivering, the supplier should take the following tests, and affirm the quality of product.

10.1.2 Electro-Optical Characteristics:
According to the individual specification to test the product.
10.1.3 Test of Appearance Characteristics:
According to the individual specification to test the product.
10.1.4 Test of Reliability Characteristics:
According to the definition of reliability on the specification for testing products.
10.1.5 Delivery Test:
Before delivering, the supplier should take the delivery test.
A. Test method: According to GB/2828,General Inspection Level take a single time.
B. The defects classify of AQL as following:
Major defect: AQL=0.25
Minor defect: AQL=1.0
Total defects: AQL=1.0

10.2 Standard for inspection

10.2.1 Manner of appearance test:

- a. The test must be under a 30W~40W fluorescent light, and the distance of view must be at 30~35 cm.
- b. When test the model of transmissive product must add the reflective plate.
- c. The test direction is base on about around 45° of vertical line.

10.2.2 Definition of area: A B

- A Area : Viewing area.
- B Area : Out of viewing

area.(Outside viewing area)



10.2.3 Basic principle:

- A. In principle the defect out of Area A should be acceptable if the defect does not affect assemblage and the quality of productions.
- B. If defects that can not describe clearly, acceptable samples will be the standard.

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

D. Must add new item on time when it is necessary.

10.2.4 Standard of inspection

| Defect | Inspect item | | (| Criteria | | |
|------------|-----------------------------------|------|---|----------|------------|---------|
| | Scratch and fold on polarizer. | 1) | width ≤ 0.02 | mm | length | ignore |
| 1 Minor | Scratch on glass. | | | | acc | eptable |
| | Glass fiber etc. | 2) | 0.02 mm <wid< td=""><td>th≤0.05</td><td>mm</td><td></td></wid<> | th≤0.05 | mm | |
| | (by bare eyes , defect outside A | leng | gth≤3 mm | tw | o are acce | ptable |
| Minor | area is acceptable) | 3) | width>0.05 m | m | | reject |
| | | | | | | |
| | | | | | | |

| Defect | Inspect item | Criteria |
|--------|-------------------------------|--|
| | Chip on glass(round type) | Φ≤0.1mm acceptable |
| | Chip on polarizer(round type) | 0.1<Φ≤0.2mm two are acceptable |
| | Air bubble between polarizer | |
| 2 | and glass | 1. The distance between any two dots should |
| Minor | | be more than 5mm. |
| | a | 2.Defect outside A area is acceptable. |
| | b | 3.If the air bubble is black, it can be judged |
| | $\Phi = (a + b)/2$ | as black spot. |

| Defect | Inspect item | Criteria |
|------------|---------------|--|
| 3 Minor | Chip out | x≤3 mm z≤t y≤1/3 s reject t: glass thickness. S: distance between glass edge and inside of edge sealing |
| L | Z. UIICKIIESS | |

| Defect | Inspect item | Criteria |
|------------|-----------------------------|--|
| | Chip on corner of neat edge | x≤3 mm y≤3 mm z≤t |
| | , 1/ | acceptable |
| 4 Minor | | any chip exposes the silver dot reject |
| | X: length Y: width | |
| | S: width of edge sealing | |

| Defect | Inspect item | | Crite | ria |
|------------|---------------------------------|--------------------|--|--------------------------------|
| 5 Minor | Chip on corner of terminal edge | x<0.3 mm x≤3 mm | n or y<0.3 mn y <d< th=""><th>n ignore two are acceptable</th></d<> | n ignore two are acceptable |

| Defect | Inspect item | | Criteria | |
|--------|-----------------------|----|--------------------|--------|
| | Chip on opposite side | of | a≥80mm , x≥7mm | reject |
| | terminal | | a<80mm, x>5mm | reject |
| 6 | | | y>1/2D | reject |
| Minor | Y | | z>1/2t , y>1/4D | reject |
| | | | D: terminal length | |
| | D | | | |

| ccording to the dimension of drawing |
|--------------------------------------|
| |
| |
| |

| Defect | Inspect item | Criteria | |
|------------|--------------|---------------------------|--------|
| 8 Minor | Crack | Any crack trend to extend | reject |

| Defect | Inspect item | Criteria |
|--------|------------------------------|----------|
| 9 | Liquid leakage, open sealant | reject |
| Major | | |

| Defect | Inspect item | Criteria |
|--------|--------------|----------------------|
| 10 | Rainbow | According to samples |
| Minor | | |

| Defect | Inspect item | Criteria |
|--------|------------------------------|----------|
| 11 | FPC, TCP, FLEX are broken or | reject |
| Major | not connected firmly | |

| Defect | Inspect item | Criteria |
|--------|----------------------------------|----------|
| | The component on PCB or FPC | reject |
| 12 | is missing ,soldered unfirmly or | |
| Minor | bridged | |
| | | |

| Defect | Inspect item | Criteria |
|--------|---------------------------------|--|
| 13 | The soldering tin is not enough | The height that soldering tin covers the |
| Minor | | bump of component is $1/2$ less than the |
| | | height of bump reject |

| Defect | Inspect item | | | Cr | iteria | | |
|--------|-----------------------------|-----|-----------|-----|--------|--------|------|
| 14 | The soldering tin overflows | The | soldering | tin | covers | whole | bump |
| Minor | | | | | | reject | |

| Defect | Inspect item | Criteria |
|--------|-------------------------|----------|
| 15 | The component is broken | reject |
| Minor | | |

| Defect | Inspect item | Criteria | | |
|--------|---------------------------------|--|----|--|
| 16 | The shape of pinouts is not the | It makes the LCM work badly rejection rejectio | xt | |
| Minor | same as that in the criterion | | | |

| Defect | Inspect item | Criteria |
|--------|----------------------|----------|
| 17 | The pinout is broken | reject |
| Minor | | |

| Defect | Inspect item | Criteria | | |
|--------|--------------------------------|--------------|--------|--|
| 18 | The frame is scratched visibly | Length | ignore | |
| Minor | | Width >0.5mm | reject | |

| Defect | Inspect item | | | | Ī | Criteria |
|--------|--------------|----------|----|--------------------------------------|---|-------------------------------------|
| | The | frame | is | rusted | | When the shape is as dot, reference |
| 19 | (accum | ulation) | | | | to defect 23 |
| Minor | | | | When the shape is as line, reference | | |
| | | | | | | to defect 24 |

| Defect | Inspect item | | Crit | teria |
|--------|----------------------------------|--|--|--------------------|
| | Scratch and fold on touchpanel. | | 1) width≤0.02 mm | acceptable |
| 20 | (by bare eyes ,defect outside A | | 2) 0.02 mm <width≤0.< th=""><th>05 mm</th></width≤0.<> | 05 mm |
| Minor | area is acceptable) | | length≤5 mm | two are acceptable |
| | | | 3) width>0.05 mm | reject |

| Defect | Inspect item | | | | | С | riteria |
|--------|--------------|---------|-------------|----------|----|------------------------|---------------------------|
| | Black | & | white | dots | on | 1) Φ≤0.1 mm | acceptable |
| | touchpa | inel (1 | round typ | pe) | | 2) 0.1<Φ≤0.3 mm | three are acceptable |
| | Air bub | ble o | n touchp | anel | | 3) Φ>0.3 mm | reject |
| 21 | | | - | | | 1.The distance betw | een any two dots should |
| Minor | | | | Î | | be more than 5mm. | |
| | | | | a | | 2.Defect outside A a | rea is acceptable. |
| | Ф=(а + | b)/2 | Б | <u>+</u> | | 3.If the air bubble is | s black, it can be judged |
| | | | ' ←→ | | | as black spot. | |

| Defect | Inspect item | Criteria |
|--------|------------------|--|
| 22 | Touchpanel warps | According to the dimension of drawing. |
| Minor | | |

| Defect | Inspect item | Criteria |
|--------|-----------------------------|---|
| 23 | Dirty on rear of touchpanel | It's visible at condition of 30±5 cm, 45° |
| Minor | | |

10.3 RELIABILITY

| Item | Condition | Criterion | |
|--------------------------|----------------------|------------------------------------|--|
| High temperature | 70°C , 96 hrs | -Cosmetic defects are not allowed | |
| operation | | after the test(Polarizer change is | |
| Low temperature | -20°C , 96 hrs | exceptional) | |
| operation | | -Contrast ratio change over 50% | |
| Moisture storage | 60°C , 90%RH, 96 hrs | of initial value should not be | |
| High temperature storage | 80°C , 96 hrs | happened | |
| Low temperature storage | -30°C , 96 hrs | -The current consumption should | |
| Thermal shock | -30°C (30 minute) | be below double of initial value | |
| | 25°C (5 minute) | -Brightness decrease should be | |
| | 80°C (30 minute) | lower than 50% of initial value | |
| | CYCLES: 10 | | |

11. PRECAUTIONS IN USING

11.1 Liquid crystal display (LCD)

The LCD panel is made up of glass, organic fluid and polarizer. When handling, please pay attention to the following items:

- 1) Keep the operation and storage temperature of the LCD within the range specified in the LCD specification. Otherwise, excessive temperature and humidity would cause polarization degradation, bubble generation or polarizer peel-off.
- 2) Prevent it from mechanical shock by dropping it from a high place, etc.
- 3) Don't contact, push or rub the exposed polarizers with anything harder than HB pencil lead.
- 4) Avoid using chemicals such as acetone, toluene, ethanol and isoropylalcohol to clean the front/rear polarizers and reflectors, which will cause damage to them.
- 5) Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause deformation or color fading. The LCM is assembled and adjusted with a high degree of precision.
- 6) Do not put or attach anything on the display area. Avoid touching the display area with bare hand.

11.2 Precaution for handling LCD modules

The LCM is assembled and adjusted with a high degree of precision, do not applying excessive shocks to it or making any alterations or modifications to it, the following precautions should be taken when handing.

- 1) Do not drop, bend or twist the module.
- 2) Do not alter or making any modification on the shape of the metal frame.
- 3) Do not change the shape, the pattern wiring or add any extra hole on the PCB.
- 4) Do not modify or touch the zebra rubber strip(conductive rubber) with another object.
- 5) Do not change the positions of components on the PCB.

11.3 Eletro-static discharge control

Careful attention should be paid to control the electrostatic discharge of the modules, since the modules contain no. of CMOS LSI.

- 1) Make sure you are grounded properly when remove the module from its antistatic bag. Be sure that the module and have the same electric potential.
- 2) Only properly grounded soldering iron should be used.
- 3) Modules should be stored in antistatic bag or other containers resistant to static after remove from its original package.
- 4) When using the electric screw-driver is used, make sure the screw driver had been ground potentiality to minimize the transmission of EM wave produced by commutator sparks.
- 5) In order to reduce the generation of static electricity, a relative humidity of 50-60% is recommended.

11.4 Precaution for soldering

- 1) Soldering should apply to I/O terminals only.
- 2) Soldering temperature is $280^{\circ}C+(-)10^{\circ}C$.
- 3) Soldering time 3-4 seconds.
- 4) Eutectic solder (rosin flux filled) should be used.
- 5) If soldering flux is used, be sure to remove any remaining flux after finishing the soldering operation and LCD surface should be covered during soldering to prevent any damage to flux spatters.
- 6) When remove the lead wires from the I/O terminals, use proper de-soldering methods, e.g. suction type de-soldering irons. Do not repeat wiring by soldering more than three times at the pads and plated though holes may be damaged.

11.5 Precaution for operation

- 1) Adjust liquid crystal driving voltage (Vo) to varies viewing angle and obtain the contrast.
- 2) Vo should be kept in proper range stated in the specification. Excess voltage will shorten the LCD life.
- 3) Response time is greatly delayed at low temperature. It will recover when go back to normal temperature.
- 4) Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. Therefore it should be used under the relative condition of 50% RH.

11.6 Storage

When long term storage is required, following precautions are necessary:

- 1) Storage them in a sealed polyethylene bag (antistatic), seal the opening, and store it where it is not subjected to direct sunshine, or to the light of fluorescent lamp. If properly sealed, there is no need for desiccant.
- 2) Store them in the temperature range of -30°C~80°C and at low humidity is recommended.

12. APPLICATION

12.1 REFERENCE CIRCUIT :



12.2 APPENDIX

INITIALIZATION FOR REFERENCE (MPU: 80C31, AT29C512):

void LCD_Init(void){//液晶屏初始化

```
LCD RST = 1;
   Delays(5);
   LCD_RST = 0;
   Delays(5);
   LCD_RST = 1;
   Delays(5);
   LCD CS = 0;
LCD_ILI9481_CMD(0x11);
   Delays(20);
   LCD_ILI9481_CMD(0xD0);
   LCD ILI9481 INDEX(0x07);
   LCD_ILI9481_INDEX(0x42);
   LCD_ILI9481_INDEX(0x1C);
   LCD_ILI9481_CMD(0xD1);
   LCD ILI9481 INDEX(0x00);
   LCD_ILI9481_INDEX(0x2C);
   LCD_ILI9481_INDEX(0x16);
   LCD ILI9481 CMD(0xD2);
   LCD_ILI9481_INDEX(0x01);
   LCD_ILI9481_INDEX(0x11);
   LCD_ILI9481_CMD(0xE4);
   LCD_ILI9481_INDEX(0xa0);
   LCD_ILI9481_CMD(0xF3);
   LCD_ILI9481_INDEX(0x00);
   LCD_ILI9481_INDEX(0x2A);
   LCD_ILI9481_CMD(0xC0);
   LCD_ILI9481_INDEX(0x10);
   LCD_ILI9481_INDEX(0x3B);
   LCD_ILI9481_INDEX(0x00);
   LCD_ILI9481_INDEX(0x02);
   LCD ILI9481 INDEX(0x11);
```

LCD_ILI9481_CMD(0xC5); LCD_ILI9481_INDEX(0x03);

LCD_ILI9481_CMD(0xC8); LCD_ILI9481_INDEX(0x00); LCD_ILI9481_INDEX(0x35); LCD_ILI9481_INDEX(0x23); LCD_ILI9481_INDEX(0x07); LCD_ILI9481_INDEX(0x04); LCD_ILI9481_INDEX(0x45); LCD_ILI9481_INDEX(0x77); LCD_ILI9481_INDEX(0x70); LCD_ILI9481_INDEX(0x70); LCD_ILI9481_INDEX(0x04);

LCD_ILI9481_CMD(0x36); LCD_ILI9481_INDEX(0x0A);

LCD_ILI9481_CMD(0x3A); LCD_ILI9481_INDEX(0x55);

LCD_ILI9481_CMD(0x2A); LCD_ILI9481_INDEX(0x00); LCD_ILI9481_INDEX(0x00); LCD_ILI9481_INDEX(0x01); LCD_ILI9481_INDEX(0x3F);

LCD_ILI9481_CMD(0x2B); LCD_ILI9481_INDEX(0x00); LCD_ILI9481_INDEX(0x00); LCD_ILI9481_INDEX(0x01); LCD_ILI9481_INDEX(0xE0); Delays(10); LCD_ILI9481_CMD(0x29);

}

.....TO YOUR CODE