# NAN YA PLASTICS CORPORATION

**SPECIFICATION OF LCD MODULE**

**PRODUCT NO.: LVC46Z806YS_**

# SPEC. NO.: LM806-0-⓪

| CUSTOMER |
| --- |
| |
| APPROVED BY |
| |
| DATE: |

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EDITED ON : Feb. 12, 2008

| Q.C. DEPT. | DESIGN MANAGER | DESIGN CHECK | DESIGNER |
| --- | --- | --- | --- |
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| RECORDS OF REVISION | | | | SPEC. NO. : LM806-0 | |
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# 1.MECHANICAL SPECIFICATION

## 1.1 Description

The module is a transmissive type's TFT (Thin Film Transistor) active matrix color liquid crystal display (LCD) comprising an amorphous silicon TFT attached to each signal electrode. This model is consisting of TFT-LCD module, a driver circuit and a back-light unit. The resolution of a 2.4"contains 240×320 pixels and can display up to 262K colors.

## 1.2 Features

- Transmissive type and back-light with Four LEDs (Light Emitting Diodes)
- RGB 16-bit interface
- Source and Gate Driver IC: R61505U
- Full, Still, Sleep & Stand-by modes are available
- Line inversion mode
- Low Power consumption

## 1.3 Applications

Display terminals for mobile phone application products.

## 1.4 General Information

| Items | Main-Panel | Unit |
|---|---|---|
| LCD type | 2.4" TFT-LCD | |
| Active Area | 36.72(H)*48.96(V) | mm |
| LCD type | Transmissive type | |
| Driving IC | R61505U | |
| Display Color | 262K | color |
| Number of Pixel | 240(H)*RGB*320(V) | pixel |
| Pixel Pitch | 0.153(H)*0.153(V) | mm |
| Display mode | Normally White | |
| Viewing direction | 12 | o'clock |

### 1.5 Mechanical Information

| Items | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module size | Horizontal(H) | **42.52** | **42.72** | **42.92** | mm | |
| | Vertical(V) | **64.26** | **61.46** | **61.66** | mm | |
| | Depth(D) | **-** | **-** | **2.9** | mm | 含焊厚 |
| Weight | | **-** | **12** | **-** | g | |

# 2.ABSOLUTE MAXIMUM RATINGS

## 2-1. Absolute Ratings of Environment

| Item | Symbol | Value | Unit | Note |
|---|---|---|---|---|
| Operating temperature | Topr | -20 to 70 | ℃ | |
| Storage temperature | Tstg | -30 to 80 | ℃ | |

Ta = 25 ± 2°C

## 2-2. Electrical Absolute Ratings

### 2-2-1 TFT-LCD Module

| Item | Symbol | Value | Unit | Note |
|---|---|---|---|---|
| Power supply voltage (1) | VCC,IOVCC | -0.3 to 4.6 | V | |
| Power supply voltage (2) | VCI-AGND | -0.3 to 4.6 | V | |
| Power supply voltage (3) | DDVDH-AGND | -0.3 to 6.5 | V | |
| Power supply voltage (4) | AGND-VCL | -0.3 to 4.6 | V | |
| Power supply voltage (5) | DDVDH-VCL | -0.3 to 9.0 | V | |
| Power supply voltage (7) | AGND-VGL | -0.3 to 13 | V | |
| Power supply voltage (8) | VGH-VGL | -0.3 to 30 | V | |
| Input voltage | $V_t$ | -0.3 to IOVCC +0.3 | V | |

Ta = 25 ± 2°C

### 2-2-2 Back-Light Unit

| Item | Symbol | Min. | Max. | Unit | Note |
|---|---|---|---|---|---|
| Current | $I_F$ | - | 20 | mA | (1) |

**Note:**

(1) One LED current maximum absolute ratings.

# 3.ELECTRICAL CHARACTERISTICS

## 3.1 TFT-LCD Module Operating conditions :

| Items | | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Logic supply voltage | | $V_{CC}$ | 2.5 | 2.8 | 3.3 | V | |
| DC/DC supply voltage | | $V_{CI}$ | 2.5 | 2.8 | 3.3 | V | |
| Dissipation current | Stand-by | $(I_{CC}+I_{CI})_{STB}$ | - | - | TBD | mA | (1) |
| | Sleep | $(I_{CC}+I_{CI})_{SLP}$ | - | - | TBD | | (2) |
| | Still | $(I_{CC}+I_{CI})_{S}$ | - | - | TBD | | (3) (5) |
| | Full | $(I_{CC}+I_{CI})_{F}$ | - | - | TBD | | (4) (5) |
| Frame frequence | | $f_{Frame}$ | - | 60 | - | Hz | |

Ta = 25 ± 2°C

Note (1) Vcc=$V_{CI}$=2.8V, Stand-by mode & No input signals

(2) Vcc=$V_{CI}$=2.8V, Sleep mode & No input signals

(3) Vcc=$V_{CI}$=2.8V, Internal mode & No input signals

(4) Vcc=$V_{CI}$=2.8V, $f_{Vsync}$=60Hz, $R_{frame}$=15Fame

(5)Dissipation current check pattern

Black Pattern■

## 3.2 Back-Light Unit

Back-Light Unit Electrical Characteristics (Ta = 25 ± 2°C)

| Item | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| Forward Voltage | $V_F$ | - | 3.2 | - | V | $I_F$ = 60mA |
| Power Consumption | $P_{WF}$ | - | 192 | - | mW | - |

## 4.OPTICAL CHARACTERISTICS

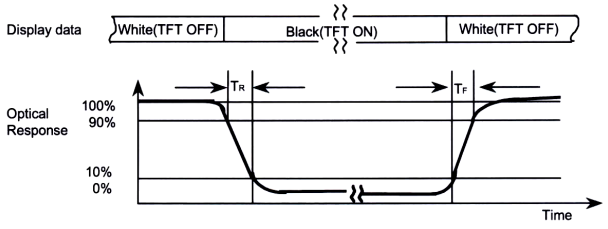
| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Contrast ratio (center point) | | CR | $\theta = 0$ $\phi = 0$ (Normal Viewing Angle) B / L on | 180 | 200 | - | - | (1) BM-7f |
| Luminance of white (Center point) | | YL | | 180 | 200 | - | cd / $m^2$ | (4)BM-7f |
| Response time | | $T_R$ | | - | 15 | - | ms | (2) |
| | | $T_F$ | | - | 35 | - | ms | |
| Color chromaticity (CIE 1931) | White | Wx | | 0.257 | 0.287 | 0.317 | - | (4) BM-7f |
| | | Wy | | 0.259 | 0.289 | 0.319 | | |
| | Red | Rx | | 0.597 | 0.627 | 0.657 | | |
| | | Ry | | 0.293 | 0.323 | 0.353 | | |
| | Green | Gx | | 0.296 | 0.326 | 0.356 | | |
| | | Gy | | 0.574 | 0.604 | 0.634 | | |
| | Blue | Bx | | 0.113 | 0.143 | 0.173 | | |
| | | By | | 0.029 | 0.059 | 0.089 | | |
| Viewing angle | Hor. | $\theta$ L | CR ≥ 10 B / L on | - | 45 | - | Degrees | (3) |
| | | $\theta$ R | | - | 45 | - | | |
| | Ver | $\varphi$ H | | - | 35 | - | | |
| | | $\varphi$ L | | - | 15 | - | | |

**Ta = 25 ± 2°C**

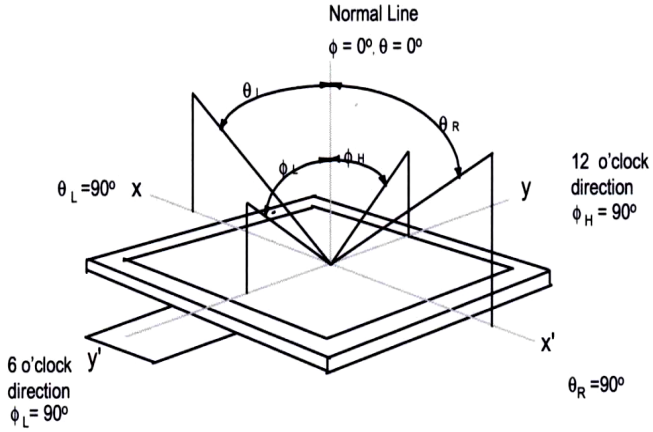
**Note (1) Contrast ratio is defined as follows**

$$CR = \frac{\text{Luminance ( brightness ) all pixels "White"}}{\text{Luminance ( brightness ) all pixels "dark"}}$$

**(2) Response time is defined as follows**



**(3) Definition of Viewing Angle**



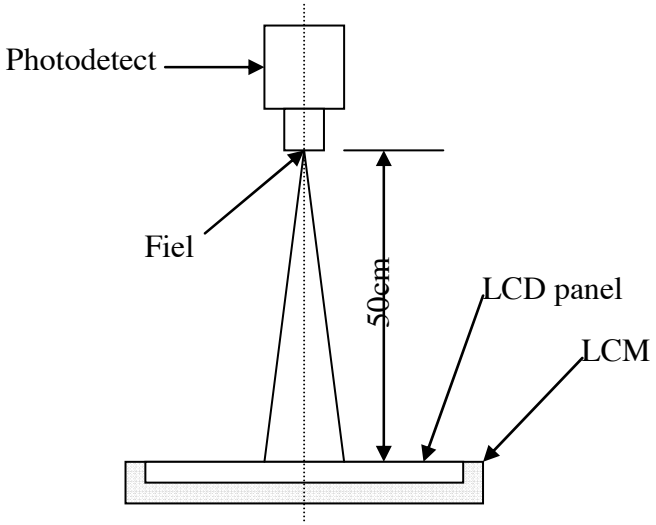

**(4) Optical measurement equipment setup**

-Measurement should be executed in a stable, windless, and dark room. After lighting the backlight for 30mins.

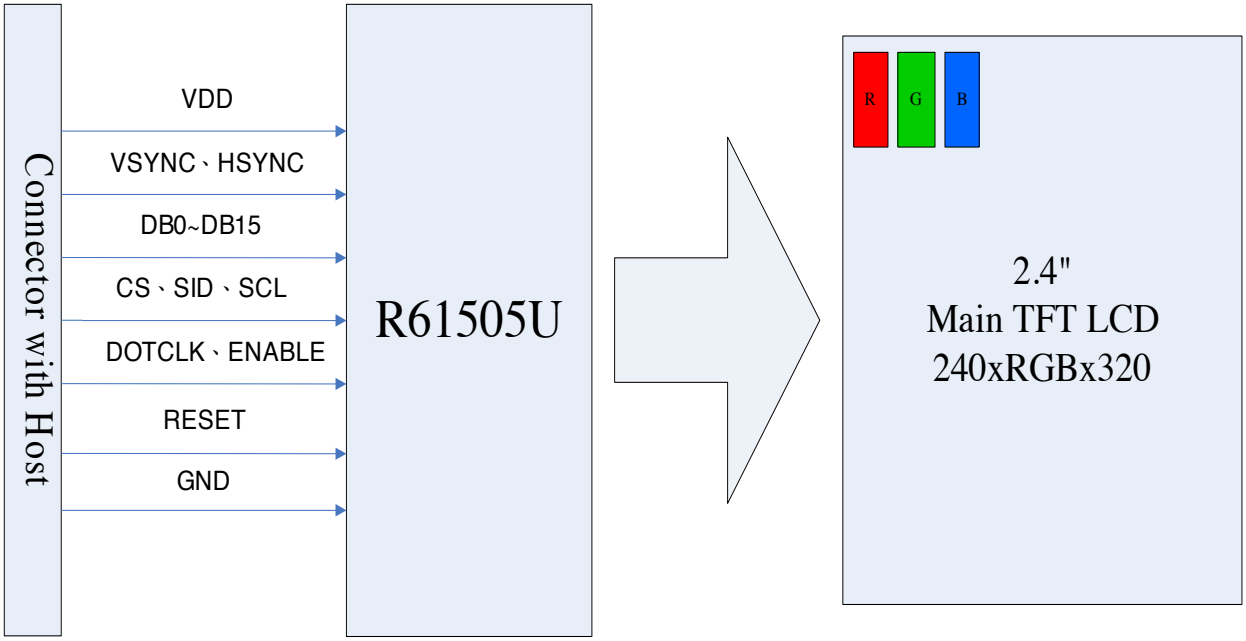
-Environment condition : Common air conditioner cleanness、Ta=23±5℃、Humidity=60±15%

-Distance : 50cm

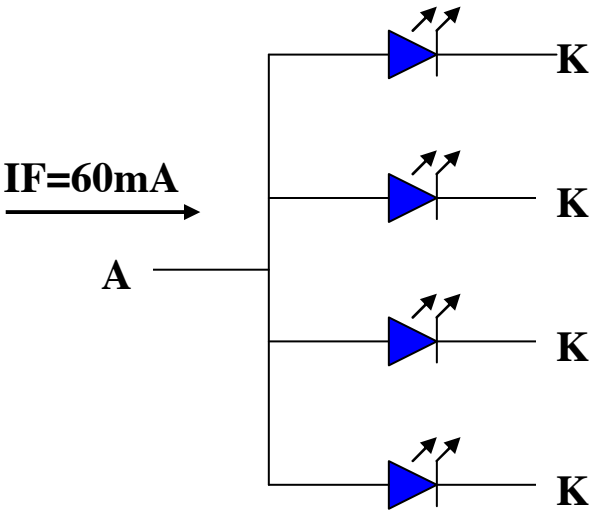
-Photodetector : BM-7f (Field 1°)



## 5.BLOCK DIAGRAM




### 5.1 Back-Light Unit



## 6.INTERNAL PIN CONNECTION

| NO. | pin name | Description | Input/Output | Note |
|---|---|---|---|---|
| 1 | GND | Ground | I | |
| 2 | DB15 | Data bus | I | R Data MSB |
| 3 | DB14 | Data bus | I | R Data |
| 4 | DB13 | Data bus | I | R Data |
| 5 | DB12 | Data bus | I | R Data |
| 6 | DB11 | Data bus | I | R Data LSB |
| 7 | DB10 | Data bus | I | G Data MSB |
| 8 | DB09 | Data bus | I | G Data |
| 9 | DB08 | Data bus | I | G Data |
| 10 | DB07 | Data bus | I | G Data |
| 11 | DB06 | Data bus | I | G Data |
| 12 | DB05 | Data bus | I | G Data LSB |
| 13 | DB04 | Data bus | I | B Data MSB |
| 14 | DB03 | Data bus | I | R Data |
| 15 | DB02 | Data bus | I | R Data |
| 16 | DB01 | Data bus | I | R Data |
| 17 | DB00 | Data bus | I | B Data LSB |
| 18 | NC | NO USE | | |
| 19 | NC | NO USE | | |
| 20 | CS | A chip select signal | I | |
| 21 | SDI | Serial data input pin | I | |
| 22 | SCL | Synchronous Clock Signal | I | |
| 23 | DOTCLK | Clock signal of external interface | I | |
| 24 | RESET | System reset | I | |
| 25 | HSYNC | Horizontal Synchronous Signal | I | |

| | | | | |
|---|---|---|---|---|
| 26 | VSYNC | Vertical Synchronous Signal | I | |
| 27 | ENABLE | Data enable signal pin | I | |
| 28 | GND | Ground | I | |
| 29 | NC (X+)XL | T/P Connection pad | I | |
| 30 | NC (Y+)YD | T/P Connection pad | I | |
| 31 | NC (X-)XR | T/P Connection pad | I | |
| 32 | NC (Y-)YU | T/P Connection pad | I | |
| 33 | VDD | Voltage: 2.5~3.3 | P | |
| 34 | VDD | Voltage: 2.5~3.3 | P | |
| 35 | LED1+ | B/L power pin | P | |
| 36 | LED2+ | B/L power pin | P | |
| 37 | LED3+ | B/L power pin | P | |
| 38 | LED4+ | B/L power pin | P | |
| 39 | LED- | B/L power pin | P | |

# 7.INTERFACE SPECIFICATIONS

## 7.1. System Interface

Please refer to **R61505U** datasheet for more details.

## 7.2. DC characteristics

### TFT LCD

| Item | Symbol | Test Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| Input high voltage | $V_{IH}$ | **$V_{CC}$= 2.5 to 3.3V, Ta =25 ± 2℃** | 0.8 $V_{CC}$ | $V_{CC}$ | V |
| | $V_{IL}$ | | - | 0.2 $V_{CC}$ | |
| Logic output voltage | $V_{OH}$ | **$V_{CC}$= 2.5 to 3.3V, Ta =25 ± 2℃** | 0.8 $V_{CC}$ | - | V |
| | $V_{OL}$ | | - | 0.2 $V_{CC}$ | |

$V_{CC}$= 2.2 to 3.3V, Ta =25±2℃

## 7.3. AC Characteristics

### TFT LCD

- **RGB interface timing characteristics**

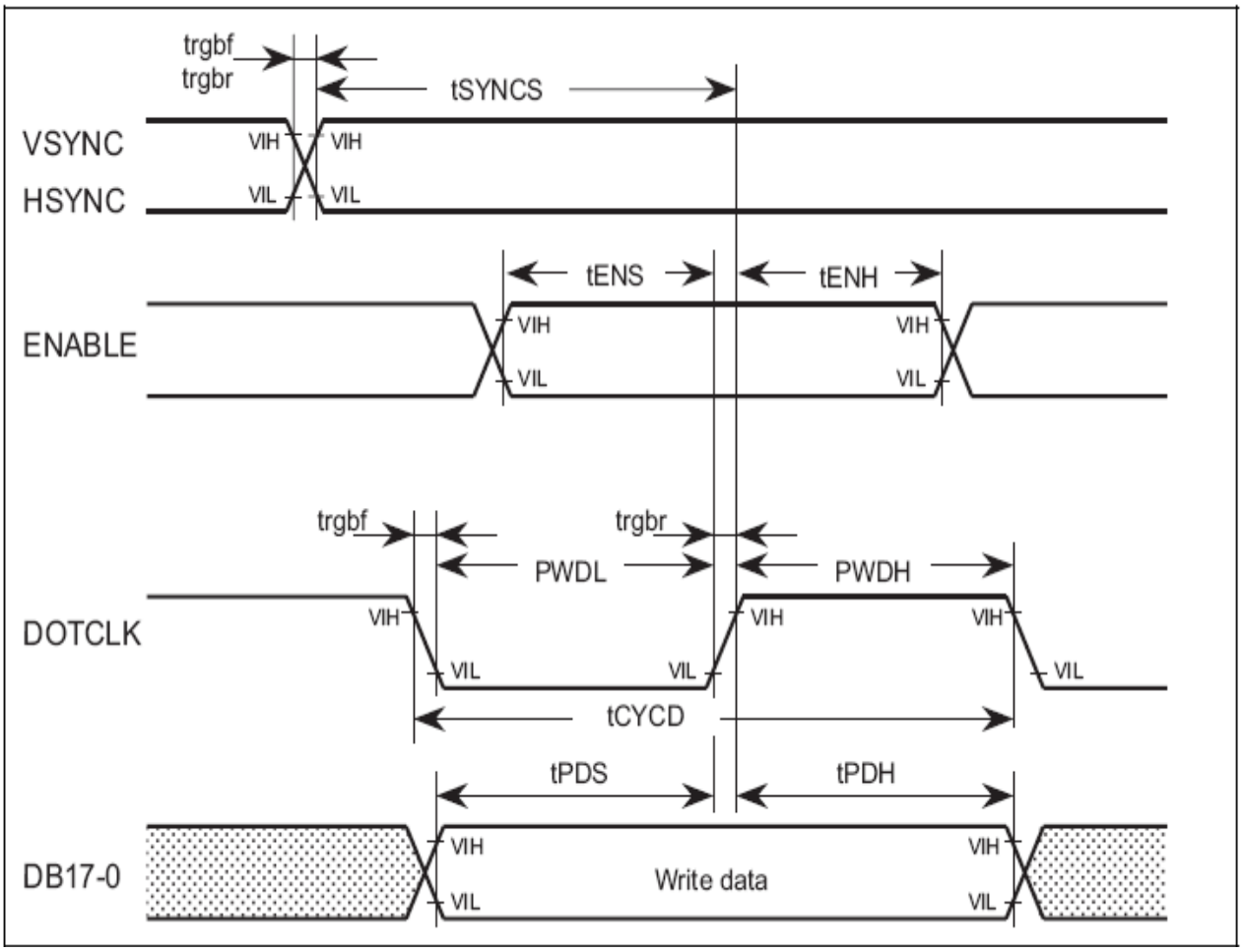



Figure 1

**18-/ 16- bit RGB interface (HWM=1) ,** (Vcc=2.4~3.3V ; Ta=25±2℃)

| Item | Symbol | Unit | Min. | Typ. | Max. | Timing diagram |
|---|---|---|---|---|---|---|
| VSYNC/HSYNC setup time | tSYNCS | clock | 0 | - | 1 | Figure 1 |
| ENABLE setup time | tENS | ns | 10 | - | - | Figure 1 |
| ENABLE hold time | tENH | ns | 20 | - | - | Figure 1 |
| DOTCLK low-levenl pulse width | PW**DL** | ns | 40 | - | - | Figure 1 |
| DOTCLK high-levenl pulse width | PW**DH** | ns | 40 | - | - | Figure 1 |
| DOTCLK cycle time | tCYCD | ns | 100 | - | - | Figure 1 |
| Data setup time | tPDS | ns | 10 | - | - | Figure 1 |
| Data hold time | tPDH | ns | 40 | - | - | Figure 1 |
| DOTCLK, VSYNC and HSYNC rise/fall time | trgbr, trgbf | ns | - | - | 25 | Figure 1 |

| Item | Symbol | Unit | Min. | Typ. | Max. |
|---|---|---|---|---|---|
| Reset low-level width | $t_{RES}$ | ms | 1 | - | - |
| Reset rise time | $tr_{RES}$ | µs | - | - | 10 |

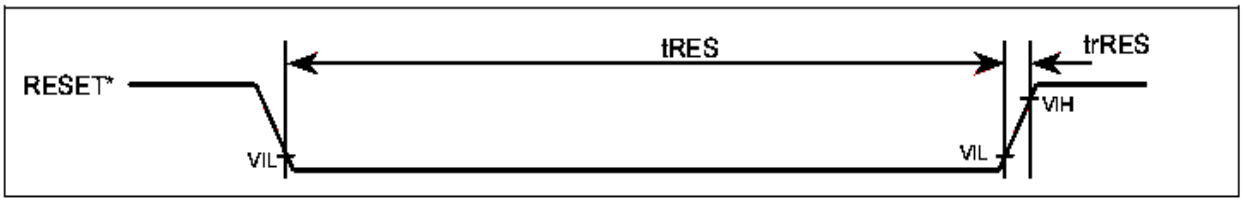
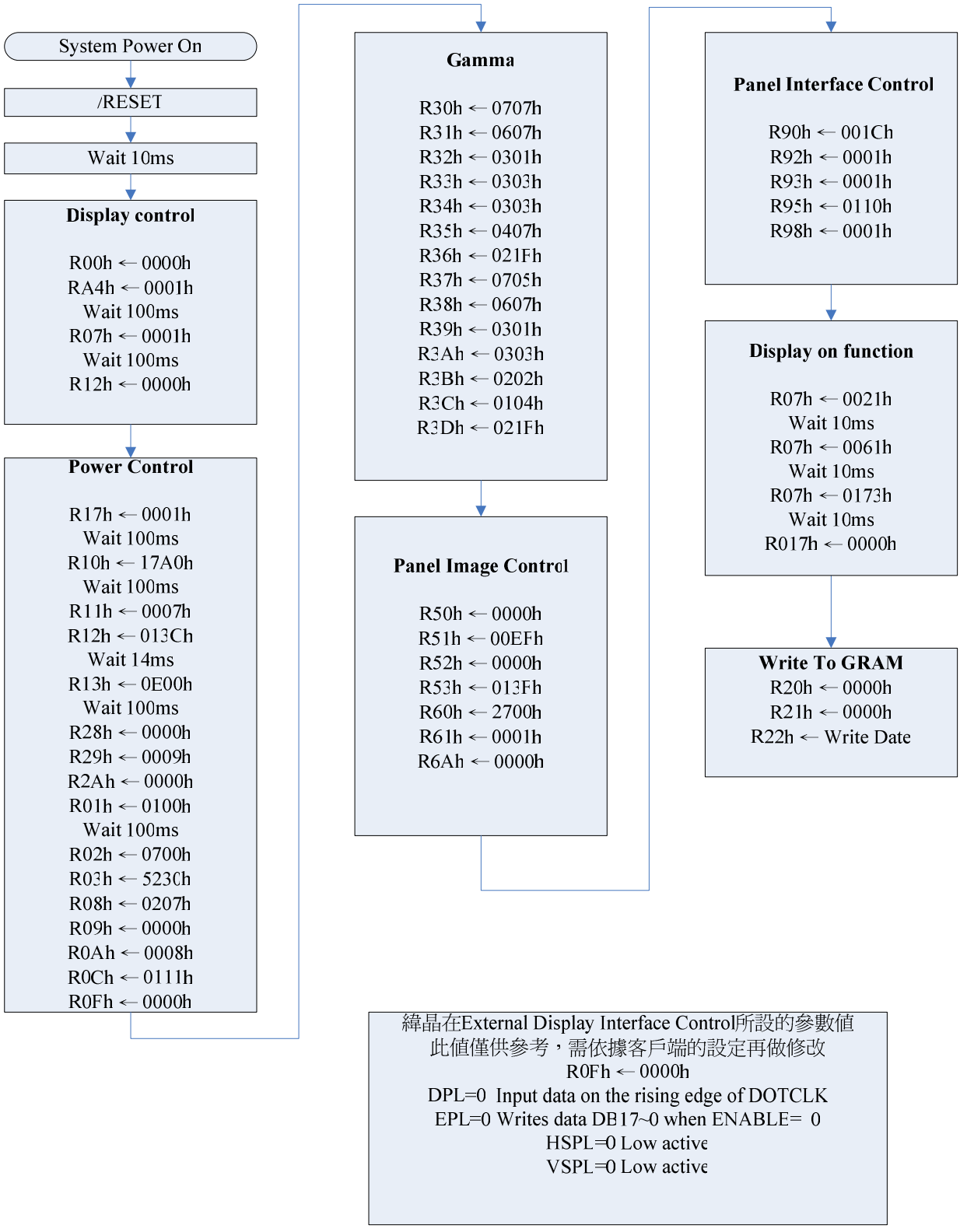



Figure 2

# 8.INITIAL CODE

## 8.1. Initial & Power Setting Sequence

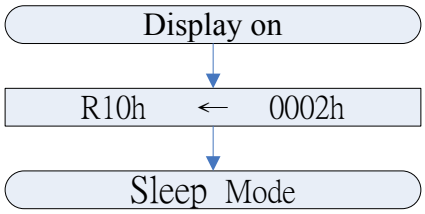
**< Power Setting Sequence >**



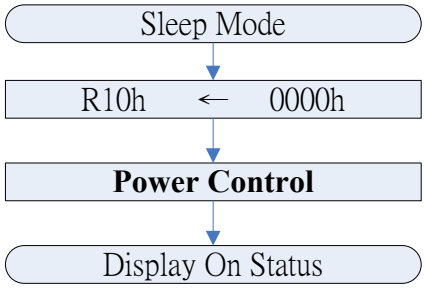

緯晶在External Display Interface Control所設的參數值
此值僅供參考，需依據客戶端的設定再做修改
R0Fh ← 0000h
DPL=0 Input data on the rising edge of DOTCLK
EPL=0 Writes data DB17~0 when ENABLE= 0
HSPL=0 Low active
VSPL=0 Low active

**8.2. Sleep Mode Setting / Wake up Sequence**

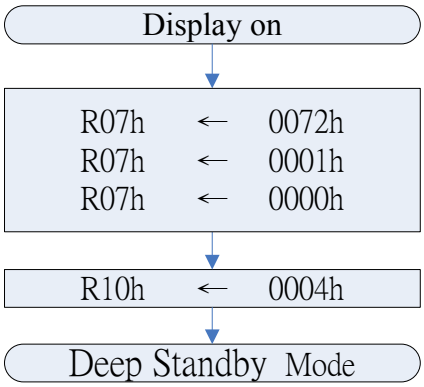
Sleep Mode Setting



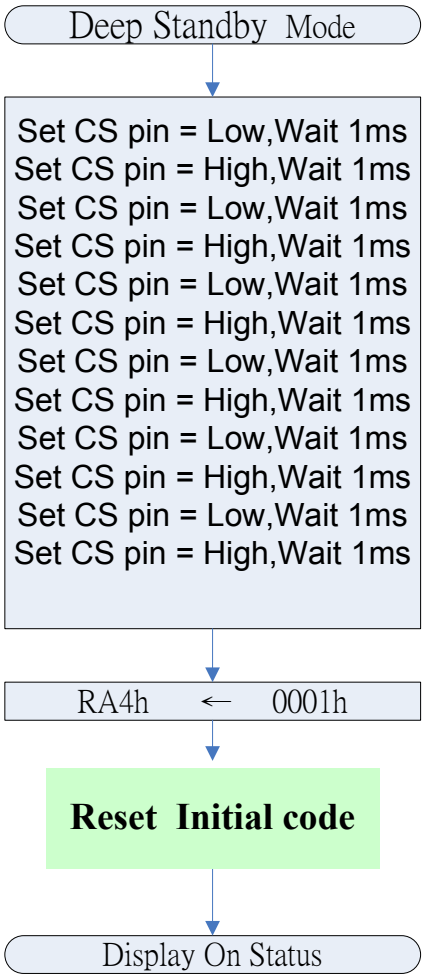

Sleep Mode Wake up




Deep Standby Mode




Deep Standby Mode Wake up




Set CS pin
low to high x6

## 9. RELIABILITY

Contents of Reliability Tests

| Item | | Purpose | S/S | Conditions | Criterion |
|---|---|---|---|---|---|
| Environment Stress | High Temperature Storage | To check the product capability after long time high temperature environment stress. | **≧5pcs** | Ta = 80 ± 2°C<br>240 hours | Brightness should be within 70% of initial value<br><br>Operational function is work |
| | High Temperature / Humidity Storage | To check the product capability after long time high temperature & high humidity environment stress. | **≧5pcs** | Ta = 60 ± 2°C<br>RH = 90 ± 2%<br>240 hours | |
| | Thermal Shock | To check the product capability after rapidly stress of different high/low temperature environment change. | **≧5pcs** | -20°C /30 mins ⇔<br>25°C /5 mins ⇔<br>80°C /30 mins ,<br>10 Cycles | |

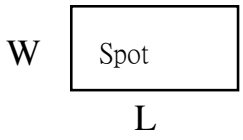
## 10. LCM outgoing inspection criteria

10.1 Definition

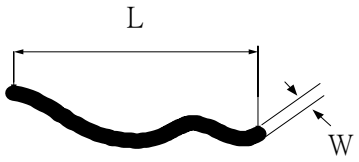
(1) Dot：Single pixel

(2) Defect size definition：D=((L)+ (W))/2

(3) Spot definition：

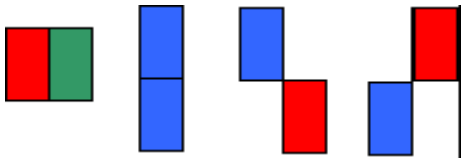


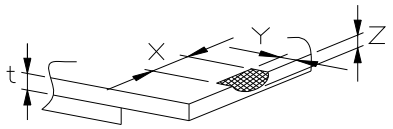

(4) Line defect definition ：



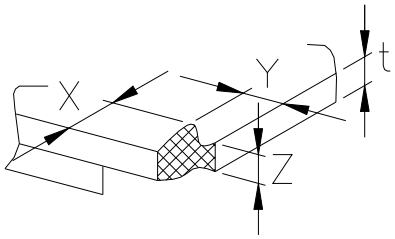

(5) Visual area definition ：0.5mm extended from active area.

(5) Nearby dot definition :






(6) (Fig.1)；t= glass thickness




(7) (Fig.2)；t= glass thickness

10.2 Procedure/content

(1) Equipment and material：

| | |
|---|---|
| check samples | limit sample |
| check tools | magnifier、magnification lamp、tool、B/L lamp、air ionizer |
| check rulers | wire gauges、caliper rules |
| Wiper | Clean Cloth |
| Solvent(Cell、COG、OLB) | ethanol (for Cell、COG、OLB) |
| Power Supply | -- |

(2) Inspection Environment：

a. Temperature：15℃~25℃ ；Humidity：55 ±15%

b. Visual Inspection：Distance between the panel and eyes is about 20~30cm, and the illumination is larger than 500Lux for product inspection.

c. Electrical Characteristic：Distance between the panel and eyes is about 20~30cm, and the illumination is smaller than 300Lux, B/L illumination is between 2500~2800 cd/$m^2$ for product inspection.

(3) Sampling Method：

a. Outline Size Specification：5pcs/Lot，0Ac/1Re.

b. Electrical Inspection：Sampling of Inspection ANSI/ASQC Z1.4(AQL 0.65) Normal Inspection Level II, Single Sampling.

c. Visual Inspection：Sampling of Inspection ANSI/ASQC Z1.4(AQL 1.0) Normal Inspection
Level II, Single Sampling.

(4). LCM outgoing inspection criteria

| Category | Item | Defect specification description | Method | SPEC | | Criteria | Note |
|---|---|---|---|---|---|---|---|
| Visual Inspection | FPC | bend | Visual | Scar bend are not allow | | | |
| | | scratch | | PAD area: | | Not allow | |
| | | | | Non PAD area: can not damage protection film | | | |
| | | dirty、broken、lack parts、plate peeling | | Not allow | | | |
| | B/L | Black spot, white spot, other defect | Magnifier | D≦0.2mm | | Ignore | Ignore the spot distance while bright dot is in spec. |
| | | | | 0.2mm＜D≦0.5mm | | 2 | |
| | | | | D>0.5mm | | 0 | |
| | | Scratch, line defect | | W≦0.03mm | L ignore | Ignore | |
| | | | | 0.03mm＜W≦0.08mm | L≦4mm | 4 | |
| | | | | W＞0.08mm | L＞4mm | 0 | |
| | | | | The distance between two spot should be larger than 5mm | | | |
| | Bezel | Dirty, oil sludge, corrosion | Visual | Not allow | | | |
| | | scratch | | W＞0.1mm | L＞10mm | 3 | |
| | | | | W≦0.1mm | L≦10mm | Ignore | |

| Category | Item | Defect specification description | Method | SPEC | Criteria | Note |
|---|---|---|---|---|---|---|
| Visual Inspection | Panel | surface crack | Visual | X ignore；Y≦0.4 mm；Z≦t | Ignore | Fig.1 |
| | | | | X≦2mmt； 0.4mm≦Y≦1.3mm；Z≦t | | |
| | | Crack | | Any crack: | Not allow | |
| | Silicone Coating | Glue | | Panel area: Glue over polarizer is not allowed | | |
| | | | | Around panel area： | Not allow | |
| | | No foam and fringe | | Not allow | | |
| | | Coating | | IC area：Coating all IC | | |
| | | | | Pad area：Coating all the circuits | | |
| | Polarizer | Stab、scratch、dent | | Active area: | Not allow | Fig.1 |
| | | | | Outside visual area: | Ignore | |
| | | Polarizer bubble | | Active area: | Not allow | |
| | | | | Outside visual area: | | |
| | | Concave、protruding | | Active area：D≦0.75mm | Ignore | |
| | | | | Outside visual area: | Ignore | |
| | | Shift | | It can not shift over the glass edge | | |
| Total line defect | | | | | 4 | |
| Total dot defect | | | | | 4 | |

| Category | Item | Defect specification description | Method | SPEC | | Criteria | Note |
|---|---|---|---|---|---|---|---|
| Electrical Inspection | Display | No display | Visual | Not allow | | | |
| | Line defect | Any line defect | Visual | Not allow | | | |
| | Mura | Mura/gap/rubbing | Limit sample | Can not worse than limit sample | | | |
| | | White/black spot | Visual | | | | |
| | | Flicker、noise | | Not allow | | | |
| | Bright dot | RGB bright dot、color filter scratch | Magnifier | D≦1/2 Dot | | Ignore | |
| | | | | 1/2 Dot＜D≦1Dot | | 2 | Ignore the spot distance while bright dot is in spec. |
| | | BM hole | | Active area | D≦0.1mm | Ignore | |
| | | | | | 0.1mm＜D≦0.15mm | 2 | |
| | | | | | D＞0.15mm | 0 | |
| | | | | Outside visual area: | D≦0.3mm | Ignore | |
| | | | | | 0.3mm＜D≦0.5mm | 1 | |
| | | | | | D＞0.5mm | 0 | |
| | | | | The distance between two BM hole should be larger than 5mm | | | |
| | | Nearby bright dot | | Not allow | | | |
| | | Total bright dot | | | | 3 | |
| | Dark dot | RGB dark dot | Magnifier | D≦1 Dot | | 2 | |
| | | | | 1 Dot≦D≦2 Dot | | 1 | |
| | | Nearby dark dot | | 1 Dot≦D≦2 Dot | | 1Pair | |
| | | Total dark dot | | 2 nearby dark dot counted as 2 points | | 3 | |
| | Polarizer defect | Spot, line defect | Magnifier | D≦0.15 mm | | Ignore | Ignore the spot distance while bright dot is in spec. |
| | | | | 0.15mm ＜ D ≦ 0.25mm | | 3 | |
| | | | | The distance between two spot should be larger than 5mm | | | |
| | Total dot(dark +bright) | | | | | 4 | Include bright dot, dark dot, CF bright dot, BM hole, polarizer bright dot |
| | Distance | Distance between 2 bright dot、bright and dark dot、2 dark dot | check rulers | The distance between two spot should be larger than 5mm. | | | |

# 11. GENERAL PRECAUTIONS

## 11.1. Handling

(a) When the module is assembled, it should be attached to the system firmly. Be careful not to twist and bend the module.

(b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and back-light unit.

(c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.

(d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.

(e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(f) The desirable cleaners are water, Isopropyl Alcohol or Hexane.

(g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

(h) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(i) Do not disassemble the module.

(j) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

## 11.2. Storage

(a) Do not leave the Panel in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35℃ and relative humidity of less than 70%.

(b) Do not store the TFT-LCD module in direct sunlight.

(c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

## 11.3. Other

(a) When in operations, do not connect; disconnect the module in the "Power on" condition.

(b) The liquid crystal is deteriorated by ultraviolet; do not leave it in direct sunlight and strong ultraviolet ray for hours.

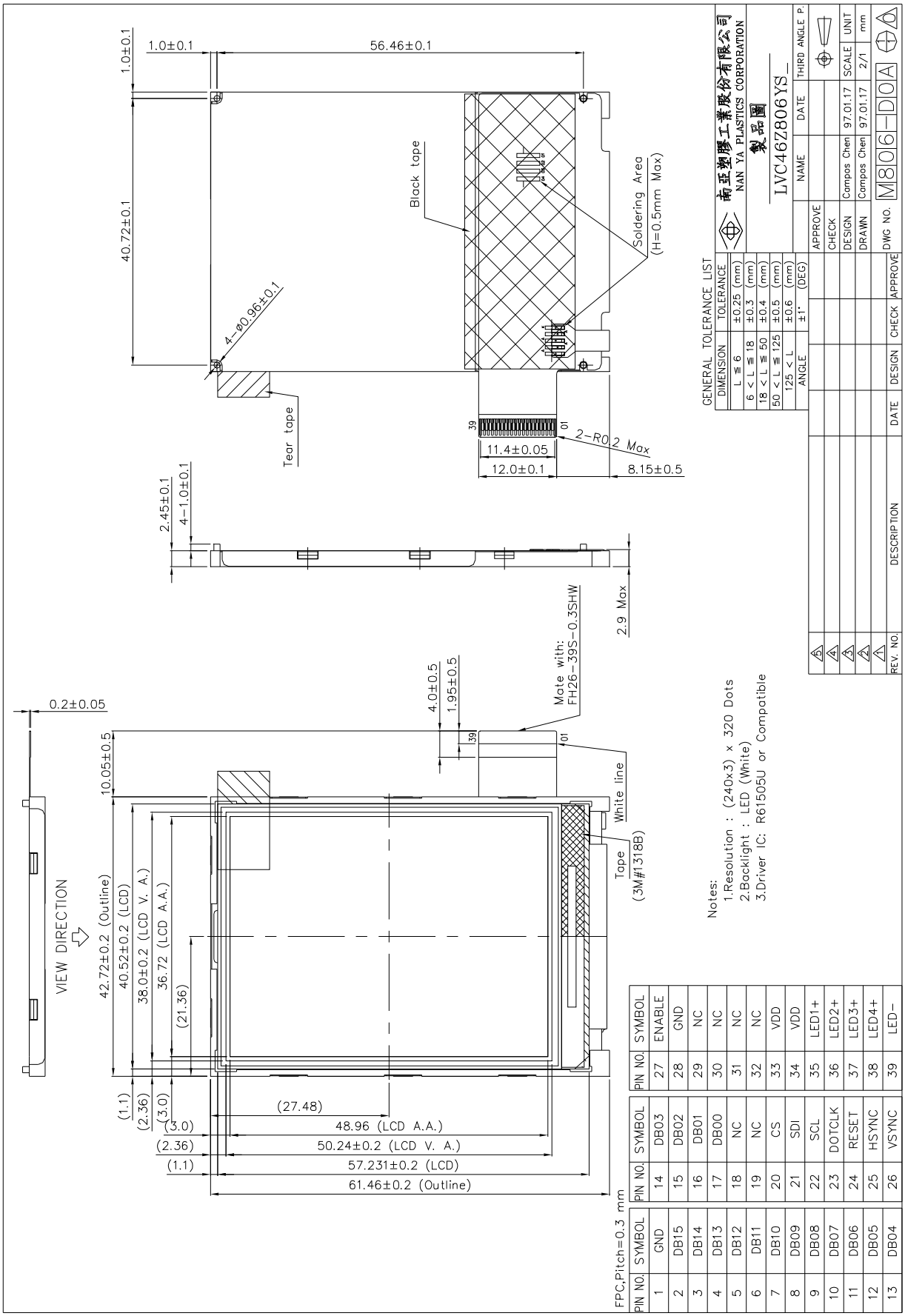
(c) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(d) Do not exceed the absolute maximum rating value. Otherwise the panel may be damaged.

(e) If the panel displays the same pattern continuously for a long period of time, it can be the situation when the image "Stick" to the screen

(f) The max temperature / continuous time of FPC soldering are 320℃ / 5 seconds.

## 12. OUTLINE DIMENSION




FPC,Pitch=0.3 mm

| PIN NO. | SYMBOL |
|---|---|
| 1 | GND |
| 2 | DB15 |
| 3 | DB14 |
| 4 | DB13 |
| 5 | DB12 |
| 6 | DB11 |
| 7 | DB10 |
| 8 | DB09 |
| 9 | DB08 |
| 10 | DB07 |
| 11 | DB06 |
| 12 | DB05 |
| 13 | DB04 |

| PIN NO. | SYMBOL |
|---|---|
| 14 | DB03 |
| 15 | DB02 |
| 16 | DB01 |
| 17 | DB00 |
| 18 | NC |
| 19 | NC |
| 20 | CS |
| 21 | SDI |
| 22 | SCL |
| 23 | DOTCLK |
| 24 | RESET |
| 25 | HSYNC |
| 26 | VSYNC |

| PIN NO. | SYMBOL |
|---|---|
| 27 | ENABLE |
| 28 | GND |
| 29 | NC |
| 30 | NC |
| 31 | NC |
| 32 | NC |
| 33 | VDD |
| 34 | VDD |
| 35 | LED1+ |
| 36 | LED2+ |
| 37 | LED3+ |
| 38 | LED4+ |
| 39 | LED- |