



# SPECIFICATION FOR TFT LCD MODULE

CUSTOMER : \_\_\_\_\_

CUSTOMER MODULE : \_\_\_\_\_

HL MODEL : HG097QX005

☐ Preliminary Specification

☒ Final Specification

Customer Confirmation column:

Approved by : \_\_\_\_\_ Dept. : \_\_\_\_\_ Data : \_\_\_\_\_

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| Designed by | Checked by | Approved by |
|-------------|------------|-------------|
|             |            |             |



## Revision Status

| Version | Revise Date | Page | Content       | Modified by |
|---------|-------------|------|---------------|-------------|
| V1.0    | 2020.3.23   | -    | First issued. | M           |



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## 1. General Description

### 1.1 Description

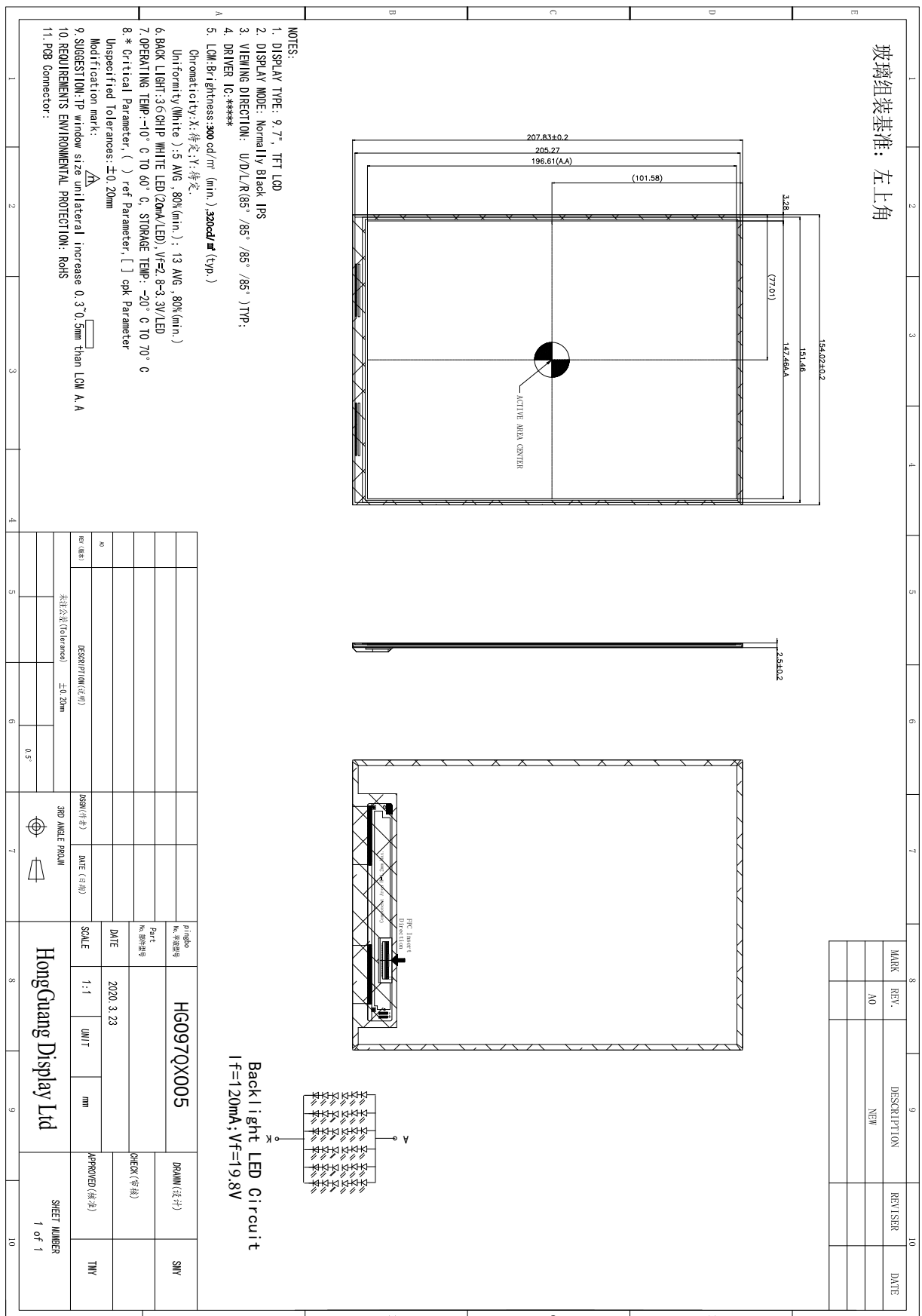
HG097QX005 is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. It is composed of a TFT LCD panel, Driver IC ,FPC and Backlight.

### 1.2 Features:

| No. | Item                           | Specification                | Unit   |
|-----|--------------------------------|------------------------------|--------|
| 1   | Panel Size                     | 9.7"                         | inch   |
| 2   | Number of Pixels               | 1536×RGB (3) ×2048           | pixels |
| 3   | Active Area                    | 147.456(H) x 196.608(V)      | mm     |
| 4   | Pixel Pitch                    | 0.096×0.096                  | mm     |
| 5   | Outline Dimension              | 154.02(W) x207.83(H) x2.5(T) | mm     |
| 6   | Number of Colors               | 16.7M                        | -      |
| 7   | Display Mode                   | Normally black               | -      |
| 8   | Viewing Direction              | All                          | -      |
| 9   | Pixel Arrangement              | RGB vertical stripe          | -      |
| 10  | Luminance (cd/m <sup>2</sup> ) | 320(TYP.)                    | nit    |
| 11  | Contrast Ratio                 | 900(TYP.)                    |        |
| 12  | Surface Treatment              | HC                           | -      |
| 13  | Interface                      | MIPI                         | -      |
| 14  | Backlight                      | White LED                    | -      |
| 15  | Operation Temperature          | -10~60                       | °C     |
| 16  | Storage Temperature            | -20~70                       | °C     |
| 17  | Weight                         | TBD                          | g      |



## 2. Mechanical Drawing





## 3. Pin Description

| No.   | Symbol    | Functions                 | Notes |
|-------|-----------|---------------------------|-------|
| 1-8   | NC        | No connection             |       |
| 9-10  | AVEE      | AVEE(-5.5V)               |       |
| 11    | NC        | No connection             |       |
| 12-13 | AVDD      | AVDD(+5.5V)               |       |
| 14    | NC        | No connection             |       |
| 15-16 | VDDIO     | Logic power 1.8V          |       |
| 17    | RESET     | Reset Pin(1.8V)           |       |
| 18    | NC        | No connection             |       |
| 19-21 | NC        | LED Anode                 |       |
| 22    | GND       | No connection             |       |
| 23    | D0P       | MIPI data positive singal |       |
| 24    | D0N       | MIPI data positive singal |       |
| 25    | GND       | Ground                    |       |
| 26    | D1P       | MIPI data positive singal |       |
| 27    | D1N       | MIPI data positive singal |       |
| 28    | GND       | Ground                    |       |
| 29    | MIPI_CLKP | MIPI CLK positive singal  |       |
| 30    | MIPI_CLKN | MIPI CLK positive singal  |       |
| 31    | GND       | Ground                    |       |
| 32    | MIPI_2P   | MIPI data positive singal |       |
| 33    | MIPI_2N   | MIPI data positive singal |       |
| 34    | GND       | Ground                    |       |
| 35    | MIPI_3P   | MIPI data positive singal |       |
| 36    | MIPI_3N   | MIPI data positive singal |       |
| 37    | GND       | Ground                    |       |
| 38    | MIPI_0P   | MIPI data positive singal |       |
| 39    | MIPI_0N   | MIPI data positive singal |       |
| 40    | GND       | Ground                    |       |
| 41    | D1P       | MIPI data positive singal |       |
| 42    | D1N       | MIPI data positive singal |       |
| 43    | GND       | Ground                    |       |
| 44    | MIPI_CLKP | MIPI CLK positive singal  |       |
| 45    | MIPI_CLKN | MIPI CLK positive singal  |       |
| 46    | GND       | Ground                    |       |
| 47    | MIPI_2P   | MIPI data positive singal |       |
| 48    | MIPI_2N   | MIPI data positive singal |       |
| 49    | GND       | Ground                    |       |
| 50    | MIPI_3P   | MIPI data positive singal |       |
| 51    | MIPI_3N   | MIPI data positive singal |       |
| 52    | GND       | Ground                    |       |
| 53-58 | LED-      | LED Cathode               |       |
| 59    | NC        | No connection             |       |
| 60-61 | LED+      | LED Anode                 |       |



## 4. Electrical Characteristics

### 4.1 Absolute Maximum Ratings

| Item                 | Symbol         | Min. | Max. | Unit | Conditions |
|----------------------|----------------|------|------|------|------------|
| Power Voltage        | VDD            | -0.3 | 4.0  | V    |            |
| Input Signal Voltage | V <sub>I</sub> | -0.3 | VDD  | V    |            |

### 4.2 DC Characteristics

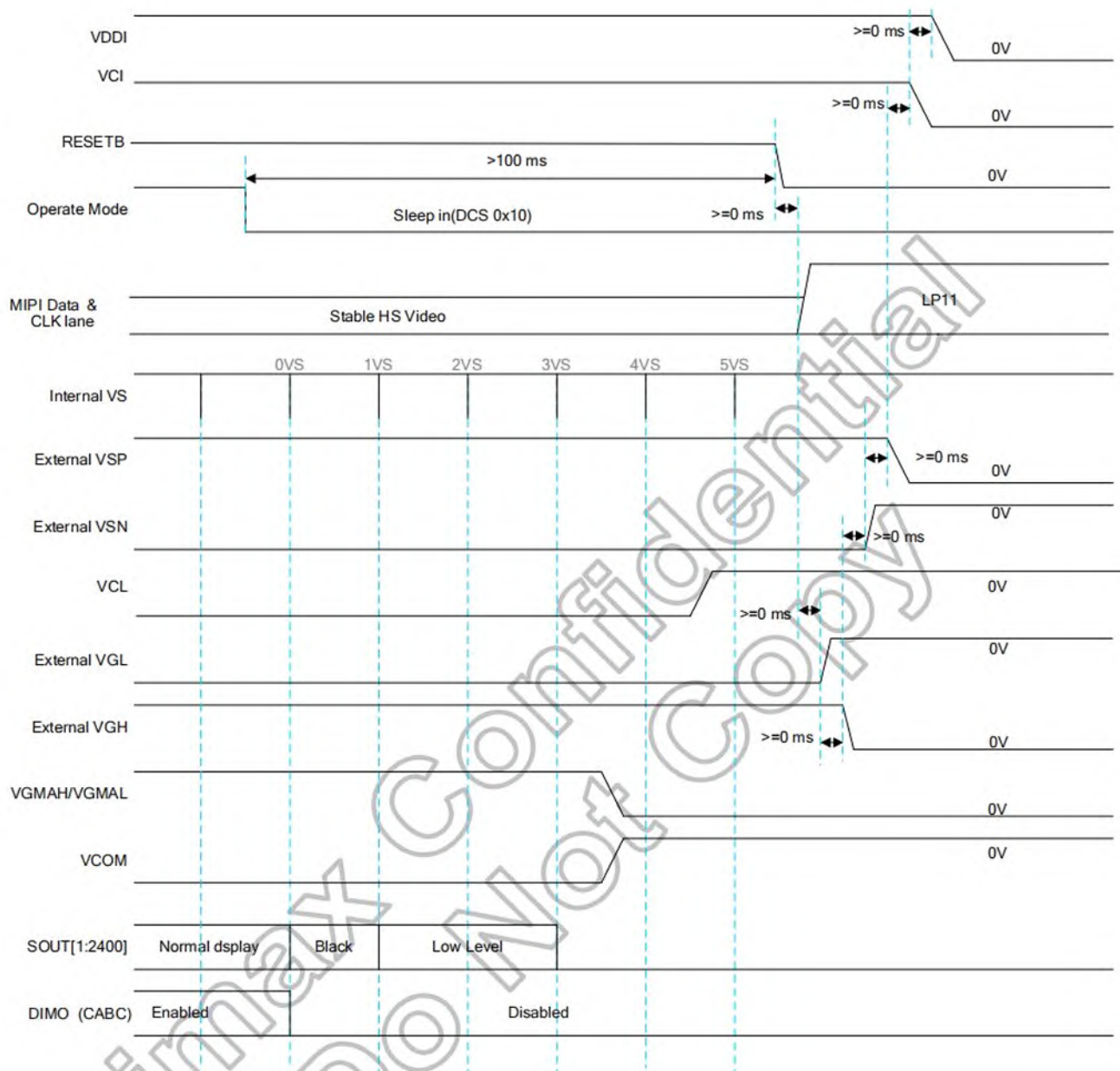
| Parameter               | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|-------------------------|--------|------|------|------|------|------------|
| Logic/LCD Drive Voltage | IOVCC  | 1.7  | 1.8  | 1.9  |      |            |
| VDD Power               | PDD    |      |      | 0.46 | Wt   |            |
| IDD Current             | IDD    |      |      | 153  | mA   |            |
| Inrush Current          | IRush  |      |      | 1500 | mA   |            |

### 4.3 LED Back light specification

| Item              | Symbol           | Values |      |      | Unit | Remark                          |
|-------------------|------------------|--------|------|------|------|---------------------------------|
|                   |                  | Min.   | Typ. | Max. |      |                                 |
| LED Current       | I <sub>LED</sub> |        | 120  |      | mA   | 36LEDS                          |
| Forward Voltage   | V <sub>F</sub>   | -      | 19.8 | -    | V    | I <sub>F</sub> =120mA<br>36LEDS |
| Reverse Current   | I <sub>r</sub>   | -      | -    | 30   | uA   | V <sub>R</sub> =10V, 1LED       |
| Power dissipation | P <sub>d</sub>   | 2598   |      |      | mW   | 36LEDS                          |



## 4.4 Power ON/OFF Sequence





## 5. Sequential Chart

### 5.1 Timing Setting

| Parameter                  | Symbol | Resolution   |      |      |              |      |      | Unit |
|----------------------------|--------|--------------|------|------|--------------|------|------|------|
|                            |        | 1600RGBx2560 |      |      | 1536RGBx2560 |      |      |      |
|                            |        | Min.         | Typ. | Max. | Min.         | Typ. | Max. |      |
| PCLK frequency             | -      | -            | 149  | -    |              | 144  |      | MHz  |
| Horizontal total           | THT    | 940          | 960  | 1600 | 908          | 928  | 1536 | DCLK |
| Horizontal synchronization | THS    | 10           | 24   | -    | 10           | 24   | -    | DCLK |
| Horizontal back porch      | THB    | 70           | 80   | -    | 70           | 80   | -    | DCLK |
| Horizontal address         | THA    | -            | 800  | -    | -            | 768  | -    | DCLK |
| Horizontal front porch     | THF    | 50           | 80   | -    | 50           | 80   | -    | DCLK |
| Vertical frequency         | -      | -            | 60   | -    |              | 60   |      | Hz   |
| Vertical total             | TVT    | 2584         | 2592 | 3000 | 2584         | 2592 | 3000 | THT  |
| Vertical synchronization   | TVS    | 1            | 2    | -    | 1            | 2    | -    | THT  |
| Vertical back porch        | TVB    | 8            | 12   | -    | 8            | 12   | -    | THT  |
| Vertical address           | TVA    | -            | 2560 | -    | -            | 2560 |      | THT  |
| Vertical front porch       | TVF    | 16           | 20   | -    | 16           | 20   | -    | THT  |

## 6. Optical Characteristics

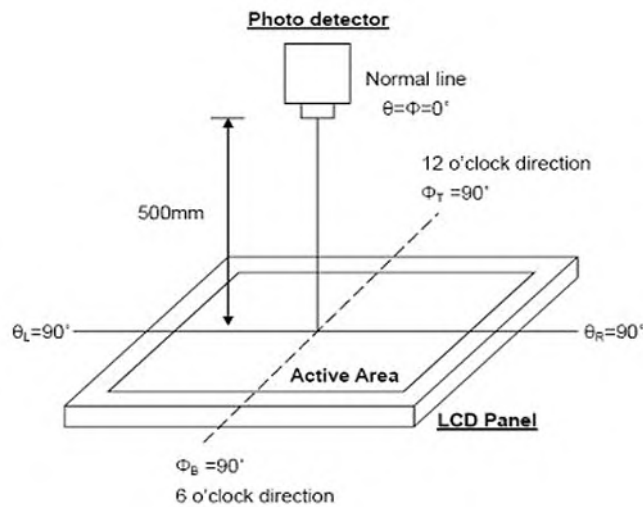
Ta=25°C±2

| Item                                |            | Symbol     | Condition                      | Min.  | Typ.  | Max.  | Unit  | Note                    |
|-------------------------------------|------------|------------|--------------------------------|-------|-------|-------|-------|-------------------------|
| Contrast Ratio                      |            | CR         | $\Theta = 0^\circ$             | 800   | 1000  | -     |       | Note1<br>Note4          |
| Luminance                           |            | YL         |                                | 300   | 320   | -     | cd/m2 | Note1<br>Note6<br>Note7 |
| Luminance Uniformity                |            | IV-M       |                                | 65    | 75    | -     | %     |                         |
| Response Time<br>(Rising + Falling) |            | TRT        | Ta= 25°C<br>$\Theta = 0^\circ$ | -     | 35    | 45    | ms    | Note1<br>Note3          |
| Viewing Angle<br>range              | Horizontal | $\Theta_L$ | CR = 10                        | 80    | 85    | -     |       | Note2                   |
|                                     |            | $\Theta_R$ |                                | 80    | 85    | -     |       |                         |
|                                     | Vertical   | $\Theta_U$ |                                | 80    | 85    | -     |       |                         |
|                                     |            | $\Theta_D$ |                                | 80    | 85    | -     |       |                         |
| Color<br>Chromaticity               | White      | x          | CIE 1931                       | -0.03 | 0.311 | +0.03 |       | Note1<br>Note5<br>Note7 |
|                                     |            | y          |                                |       | 0.328 |       |       |                         |
|                                     | Red        | x          |                                |       | TBD   |       |       |                         |
|                                     |            | y          |                                |       | TBD   |       |       |                         |



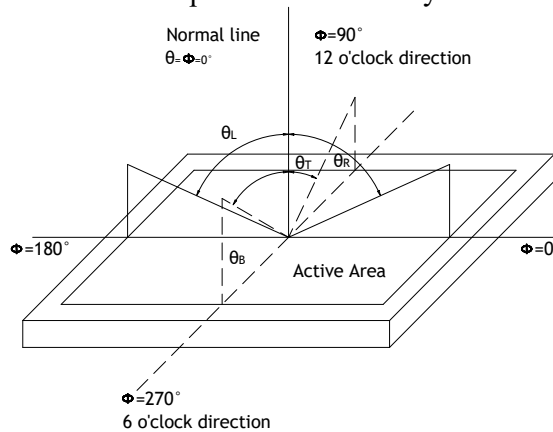
|      |       |   |  |    |     |   |   |  |
|------|-------|---|--|----|-----|---|---|--|
|      | Green | x |  |    | TBD |   |   |  |
|      |       | y |  |    | TBD |   |   |  |
|      | Blue  | x |  |    | TBD |   |   |  |
|      |       | y |  |    | TBD |   |   |  |
| NTSC |       |   |  | 60 | 68  | - | % |  |

Note1: Definition of optical measurement system



Note2: Definition of viewing angle range and measurement system

Viewing angle is measured at the center point of the LCD by CONOSCOPE (ergo-80).



Note3: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.

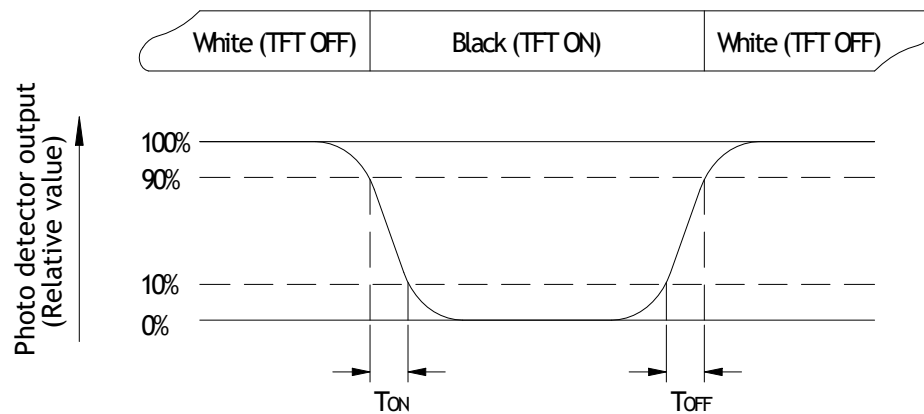


Fig. 6-3 Definition of response time

Note4: Definition of contrast ratio

Contrast ratio(CR)=

“White state “: The state is that the LCD should drive by V<sub>white</sub>.

“Black state”: The state is that the LCD should drive by V<sub>black</sub>.

V<sub>white</sub>: To be determined V<sub>black</sub>: To be determined.

Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

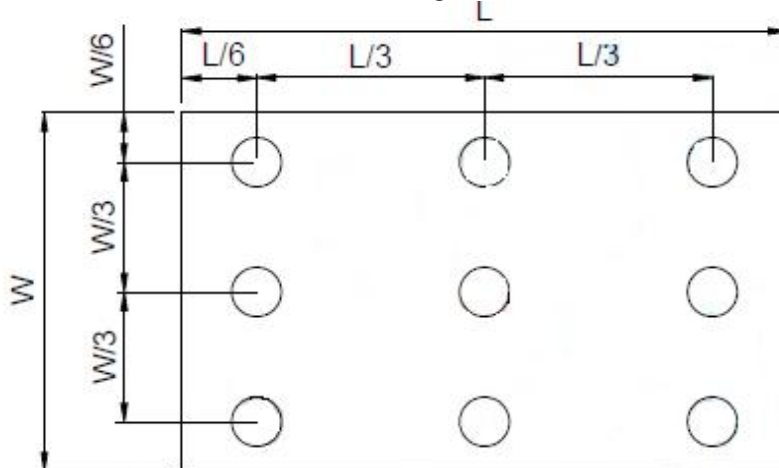
Note6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is I<sub>L</sub>=120mA

Note7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas. Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = L<sub>min</sub> / L<sub>max</sub>

L----Active area length, W---- Active area width



B<sub>max</sub>: The measured maximum luminance of all measurement position.

B<sub>min</sub>: The measured minimum luminance of all measurement position.



## 7. Quality Assurance System

### 7.1 Temperature and Humidity

| Test Item                                | Test Condition                           | Remark                                                                                           |
|------------------------------------------|------------------------------------------|--------------------------------------------------------------------------------------------------|
| HighTemperatureStorage                   | Ta=70℃; 72hrs                            | IEC60068-2-1: 2007<br>GB2423.2-2008                                                              |
| Low Temperature Storage                  | Ta=-20℃; 72hrs                           | IEC60068-2-1: 2007<br>GB2423.1-2008                                                              |
| High Temperature Operation               | Ta=60℃; 72hrs                            | IEC60068-2-1: 2007<br>GB2423.2-2008                                                              |
| Low Temperature Operation                | Ta=-10℃; 72hrs                           | IEC60068-2-1: 2007<br>GB2423.1-2008                                                              |
| High Temperature High Humidity Operation | Ta=50 ℃ , 90%RH , 72Hrs(no condensation) | IEC60068-2-78: 2001<br>GB/T2423.3-2006                                                           |
| Thermal Shock                            | -20 ℃ (0.5h) ~ 70 ℃ (0.5h) / 10cycles    | Start with cold temperature ,<br>End with high temperature,<br>IEC60068-2-14:1984,GB2423.22-2002 |

### 7.2ESD

| Test item                                     | Conditions                         | Remark |                    |
|-----------------------------------------------|------------------------------------|--------|--------------------|
| Electro Static Discharge Test (non-operation) | 150pF, 330Ω, Contact:±4KV,Air:±8KV | 1      | IEC61000-4-2: 2001 |
|                                               | 200pF, 0Ω, ±200V contact test      | 2      | GB/T17626.2-2006   |

Note: Measure point :

1. LCD glass and metal bezel
2. IF connector pins



## 8. Precaution Relating Product Handling

### 8.1 Safety

- (1) Do not swallow any liquid crystal, even if there is no proof that liquid crystal is poisonous.
- (2) If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
- (3) If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

### 8.2 Storage Conditions

- (1) Store the panel or module in a dark place where the temperature is  $23\pm 5^{\circ}\text{C}$  and the humidity is below  $50\pm 20\%\text{RH}$ .
- (2) Store in anti-static electricity container.
- (3) Store in clean environment, free from dust, active gas, and solvent.
- (4) Do not place the module near organic solvents or corrosive gases.
- (5) Do not crush, shake, or jolt the module.

### 8.3 Handling Precautions

- (1) Avoid static electricity which can damage the CMOS LSI.
- (2) The polarizing plate of the display is very fragile. So, please handle it very carefully.
- (3) Do not give external shock.
- (4) Do not apply excessive force on the surface.
- (5) Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
- (6) Do not use ketonic solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.
- (7) Do not operate it above the absolute maximum rating.
- (8) Do not remove the panel or frame from the module.
- (9) When the module is assembled, it should be attached to the system firmly. Be careful not to twist and bend the module.
- (10) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining and discoloration may occur.
- (11) 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.

### 8.4 Warranty

- (1) The period is within twelve months since the date of shipping out under normal using and storage conditions.
- (2) Do not repaired or modified the LCM. It may cause function to lose efficacy, PINGBO does not warrant the LCM.

All process and material comply ROHS.

## 9. Package Drawing

TBD



## 10 . Initial Code

### Video Timing :

HFP : 81

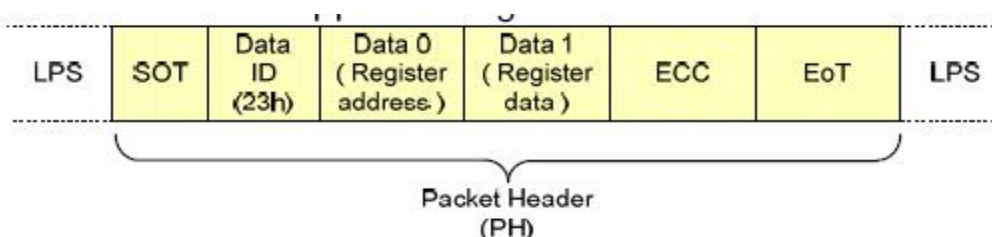
Hsync :24

HBP : 81

VFP : 17

Vsync : 23

VBP : 12



| Recommended Power on Initial Sequence |                    |                            |        |       |                                |
|---------------------------------------|--------------------|----------------------------|--------|-------|--------------------------------|
| Step                                  | Instruction        | Description                |        |       |                                |
| 1                                     | Write initial code | Initial setting to display |        |       |                                |
|                                       | DATA ID            | DATA 0                     | DATA 1 | ECC   | Description                    |
|                                       | 0x23               | 0xB0                       | 0x00   | (ECC) | Function/voltage setting ↓     |
|                                       | 0x23               | 0xB2                       | 0x02   | (ECC) |                                |
|                                       | 0x23               | 0xB3                       | 0x01   | (ECC) |                                |
|                                       | 0x23               | 0xB4                       | 0x00   | (ECC) |                                |
|                                       | 0x23               | 0xB6                       | 0x80   | (ECC) |                                |
|                                       | 0x23               | 0xBB                       | 0x53   | (ECC) | VCOM setting                   |
|                                       | 0x23               | 0xBE                       | 0x2F   | (ECC) | VGH setting                    |
|                                       | 0x23               | 0xBF                       | 0x1A   | (ECC) | VGL setting                    |
|                                       | 0x23               | 0xF0                       | 0x39   | (ECC) |                                |
|                                       | 0x23               | 0xF1                       | 0x22   | (ECC) | modified on 2018.03.02 , ver 4 |
|                                       | 0x23               | 0xB0                       | 0x02   | (ECC) | Gamma setting ↓                |
|                                       | 0x23               | 0xC0                       | 0x00   | (ECC) | VP0                            |
|                                       | 0x23               | 0xC1                       | 0x06   | (ECC) | VP1                            |
|                                       | 0x23               | 0xC2                       | 0x16   | (ECC) | VP4                            |
|                                       | 0x23               | 0xC3                       | 0x1C   | (ECC) | VP8                            |
|                                       | 0x23               | 0xC4                       | 0x2B   | (ECC) | VP16                           |
|                                       | 0x23               | 0xC5                       | 0x20   | (ECC) | VP28                           |
|                                       | 0x23               | 0xC6                       | 0x20   | (ECC) | VP40                           |
|                                       | 0x23               | 0xC7                       | 0x1F   | (ECC) | VP56                           |
|                                       | 0x23               | 0xC8                       | 0x1C   | (ECC) | VP72                           |



|      |      |      |       |                 |
|------|------|------|-------|-----------------|
| 0x23 | 0xC9 | 0x15 | (ECC) | VP96            |
| 0x23 | 0xCA | 0x16 | (ECC) | VP128           |
| 0x23 | 0xCB | 0x11 | (ECC) | VP152           |
| 0x23 | 0xCC | 0x15 | (ECC) | VP176           |
| 0x23 | 0xCD | 0x1D | (ECC) | VP192           |
| 0x23 | 0xCE | 0x1D | (ECC) | VP204           |
| 0x23 | 0xCF | 0x1D | (ECC) | VP216           |
| 0x23 | 0xD0 | 0x23 | (ECC) | VP228           |
| 0x23 | 0xD1 | 0x21 | (ECC) | VP240           |
| 0x23 | 0xD2 | 0x21 | (ECC) | VP248           |
| 0x23 | 0xD3 | 0x24 | (ECC) | VP252           |
| 0x23 | 0xD4 | 0x16 | (ECC) | VP254           |
| 0x23 | 0xD5 | 0x1F | (ECC) | VP255           |
| 0x23 | 0xD6 | 0x00 | (ECC) | VN0             |
| 0x23 | 0xD7 | 0x06 | (ECC) | VN1             |
| 0x23 | 0xD8 | 0x16 | (ECC) | VN4             |
| 0x23 | 0xD9 | 0x1C | (ECC) | VN8             |
| 0x23 | 0xDA | 0x2B | (ECC) | VN16            |
| 0x23 | 0xDB | 0x20 | (ECC) | VN28            |
| 0x23 | 0xDC | 0x20 | (ECC) | VN40            |
| 0x23 | 0xDD | 0x1F | (ECC) | VN56            |
| 0x23 | 0xDE | 0x1C | (ECC) | VN72            |
| 0x23 | 0xDF | 0x15 | (ECC) | VN96            |
| 0x23 | 0xE0 | 0x16 | (ECC) | VN128           |
| 0x23 | 0xE1 | 0x11 | (ECC) | VN152           |
| 0x23 | 0xE2 | 0x15 | (ECC) | VN176           |
| 0x23 | 0xE3 | 0x1D | (ECC) | VN192           |
| 0x23 | 0xE4 | 0x1D | (ECC) | VN204           |
| 0x23 | 0xE5 | 0x1D | (ECC) | VN216           |
| 0x23 | 0xE6 | 0x23 | (ECC) | VN228           |
| 0x23 | 0xE7 | 0x21 | (ECC) | VN240           |
| 0x23 | 0xE8 | 0x21 | (ECC) | VN248           |
| 0x23 | 0xE9 | 0x24 | (ECC) | VN252           |
| 0x23 | 0xEA | 0x16 | (ECC) | VN254           |
| 0x23 | 0xEB | 0x1F | (ECC) | VN255           |
| 0x23 | 0xB0 | 0x01 | (ECC) | GOA MUX setting |
| 0x23 | 0xC0 | 0x10 | (ECC) |                 |
| 0x23 | 0xC1 | 0x0F | (ECC) |                 |
| 0x23 | 0xC2 | 0x0E | (ECC) |                 |



|      |      |      |       |                    |
|------|------|------|-------|--------------------|
| 0x23 | 0xC3 | 0x0D | (ECC) |                    |
| 0x23 | 0xC4 | 0x0C | (ECC) |                    |
| 0x23 | 0xC5 | 0x0B | (ECC) |                    |
| 0x23 | 0xC6 | 0x0A | (ECC) |                    |
| 0x23 | 0xC7 | 0x09 | (ECC) |                    |
| 0x23 | 0xC8 | 0x08 | (ECC) |                    |
| 0x23 | 0xC9 | 0x07 | (ECC) |                    |
| 0x23 | 0xCA | 0x06 | (ECC) |                    |
| 0x23 | 0xCB | 0x05 | (ECC) |                    |
| 0x23 | 0xCC | 0x00 | (ECC) |                    |
| 0x23 | 0xCD | 0x01 | (ECC) |                    |
| 0x23 | 0xCE | 0x02 | (ECC) |                    |
| 0x23 | 0xCF | 0x03 | (ECC) |                    |
| 0x23 | 0xD0 | 0x04 | (ECC) |                    |
| 0x23 | 0xD6 | 0x10 | (ECC) |                    |
| 0x23 | 0xD7 | 0x0F | (ECC) |                    |
| 0x23 | 0xD8 | 0x0E | (ECC) |                    |
| 0x23 | 0xD9 | 0x0D | (ECC) |                    |
| 0x23 | 0xDA | 0x0C | (ECC) |                    |
| 0x23 | 0xDB | 0x0B | (ECC) |                    |
| 0x23 | 0xDC | 0x0A | (ECC) |                    |
| 0x23 | 0xDD | 0x09 | (ECC) |                    |
| 0x23 | 0xDE | 0x08 | (ECC) |                    |
| 0x23 | 0xDF | 0x07 | (ECC) |                    |
| 0x23 | 0xE0 | 0x06 | (ECC) |                    |
| 0x23 | 0xE1 | 0x05 | (ECC) |                    |
| 0x23 | 0xE2 | 0x00 | (ECC) |                    |
| 0x23 | 0xE3 | 0x01 | (ECC) |                    |
| 0x23 | 0xE4 | 0x02 | (ECC) |                    |
| 0x23 | 0xE5 | 0x03 | (ECC) |                    |
| 0x23 | 0xE6 | 0x04 | (ECC) |                    |
| 0x23 | 0xE7 | 0x00 | (ECC) |                    |
| 0x23 | 0xEC | 0xC0 | (ECC) |                    |
| 0x23 | 0xB0 | 0x03 | (ECC) | GOA timing setting |
| 0x23 | 0xC2 | 0x00 | (ECC) |                    |
| 0x23 | 0xC3 | 0x09 | (ECC) |                    |
| 0x23 | 0xC5 | 0x03 | (ECC) |                    |
| 0x23 | 0xC8 | 0x07 | (ECC) |                    |
| 0x23 | 0xC9 | 0x05 | (ECC) |                    |





|   |                   |                                |      |       |                         |
|---|-------------------|--------------------------------|------|-------|-------------------------|
|   | 0x23              | 0xCA                           | 0x41 | (ECC) |                         |
|   | 0x23              | 0xCC                           | 0x44 | (ECC) |                         |
|   | 0x23              | 0xCF                           | 0x60 | (ECC) |                         |
|   | 0x23              | 0xD2                           | 0x04 | (ECC) |                         |
|   | 0x23              | 0xD3                           | 0x04 | (ECC) |                         |
|   | 0x23              | 0xD4                           | 0x03 | (ECC) |                         |
|   | 0x23              | 0xD5                           | 0x02 | (ECC) |                         |
|   | 0x23              | 0xD6                           | 0x01 | (ECC) |                         |
|   | 0x23              | 0xD7                           | 0x00 | (ECC) |                         |
|   | 0x23              | 0xDB                           | 0x01 | (ECC) |                         |
|   | 0x23              | 0xDE                           | 0x03 | (ECC) |                         |
|   | 0x23              | 0xE6                           | 0x00 | (ECC) |                         |
|   | 0x23              | 0xE7                           | 0x09 | (ECC) |                         |
|   | 0x23              | 0xB0                           | 0x06 | (ECC) | GOE setting<br>改為 2.5us |
|   | 0x23              | 0xB8                           | 0xA5 | (ECC) |                         |
|   | 0x23              | 0xC0                           | 0xA5 | (ECC) |                         |
|   | 0x23              | 0xD5                           | 0x3F | (ECC) |                         |
| 2 | Write DCS command | DCS command setting to display |      |       |                         |
|   | 0x05              | 0x11                           | 0x00 | (ECC) | DCS command Sleep out   |
|   | 0x05              | 0x29                           | 0x00 | (ECC) | DCS command Display on  |