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# LCM Product Specification

## PV05036B0140H

| ITEM  | BUYER SIGNATURE | DATE              |
|-------|-----------------|-------------------|
| _____ | <u>Carl</u>     | <u>2023.09.04</u> |
| _____ | <u>Jacky</u>    | <u>2023.09.04</u> |
| _____ | _____           | _____             |

| ITEM     | SUPPLIER SIGNATURE | DATE  |
|----------|--------------------|-------|
| Prepared | _____              | _____ |
| Reviewed | _____              | _____ |
| Approved | _____              | _____ |





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## 1.0 GENERAL DESCRIPTION

### 1.1 Introduction

The PV05036B0140H model is a color TFT LCM without touch panel. This module has 5.0 inch diagonally measured active area with WVGA (800 horizontal by 480 vertical pixel array). Each pixel is divided into red, green, blue dots which are arranged in vertical stripe and this module can display 16.7M colors.



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## 1.2 General Specification

Table 1-1 General Specifications

| Parameter                        | Specification   | Unit   | Remarks           |
|----------------------------------|---|--------|-------------------|
| Active area                      | 108 (H) × 64.8(V)   | mm     | 5:3               |
| Number of pixels                 | 800(H) × 480(V)   | pixels |                   |
| Pixel pitch                      | 0.135(H) × 0.135 (V)  | mm     |                   |
| Pixel arrangement                | RGB Vertical stripe   |        |                   |
| Display colors                   | 16.7M   | colors |                   |
| Color gamut                      | 40%@Transmissive, 16.5%@Reflective  | %      | Typ.              |
| Display mode                     | Normally <b>Black</b> , Transflective   |        |                   |
| Module outline                   | 120.70(H) x 75.80(V) x 5.0  | mm     | w/o.<br>component |
| Viewing Direction<br>(Human Eye) | U/D/L/R<br>Trans: Typ. 60/60/60/50 (CR > 2)<br>Ref: Typ. 70/60/70/60 (CR > 2) | Deg.   | Note1             |
| Surface coating                  | -   |        |                   |

**Note:**

1. At the U/D/L/R direction, the viewing angle is same;



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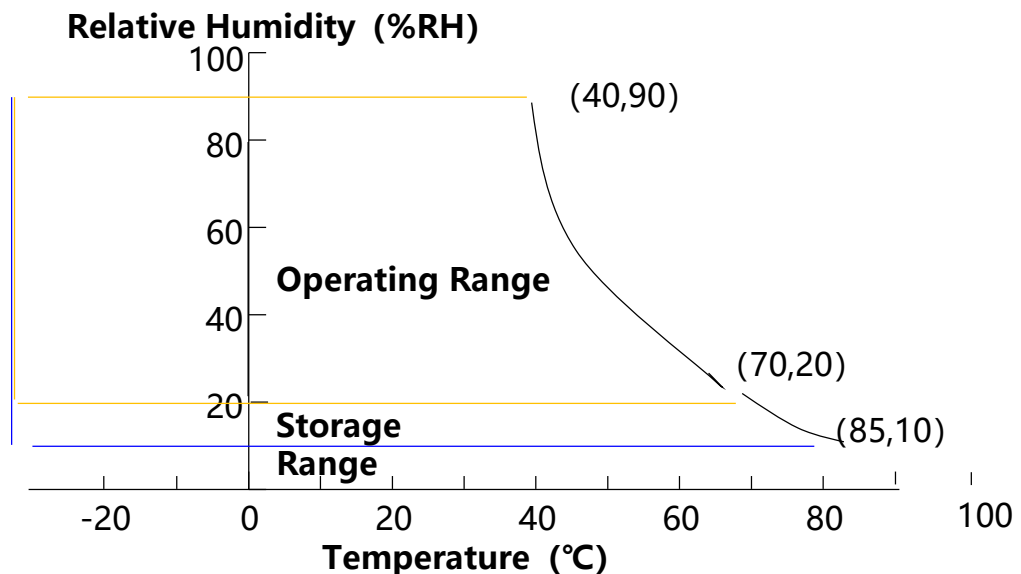
## 2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Absolute Maximum Ratings >

| Parameter             |            | Symbol           | Min. | Max. | Unit | Remarks    |
|-----------------------|------------|------------------|------|------|------|------------|
| Power Supply          | LCD Module | VCC              | 0    | 3.6  | V    | Ta = 25 °C |
|                       | BLU        | V <sub>LED</sub> | -    | 19.2 | V    |            |
|                       |            | I <sub>LED</sub> | -    | 80   | mA   |            |
| Operating Temperature |            | T <sub>OP</sub>  | -30  | +85  | °C   | Note 1     |
| Storage Temperature   |            | T <sub>ST</sub>  | -30  | +85  | °C   |            |

Note : 1) Temperature and relative humidity range are shown in the figure below.





|              |               |      |            |         |
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## 3.0 ELECTRICAL SPECIFICATIONS

### 3.1 Typical operation conditions

| Item                 | Symbl | Min | Typ  | Max | Uint | Remark   |
|----------------------|-------|-----|------|-----|------|----------|
| Supply power voltage | VCC   | 3.0 | 3.3  | 3.6 | V    | TTL mode |
| I/O power voltage    | IOVCC | 3.0 | 3.3  | 3.6 | V    |          |
| Votp                 | VOTP  | 7.5 | 7.75 | 8   | V    |          |

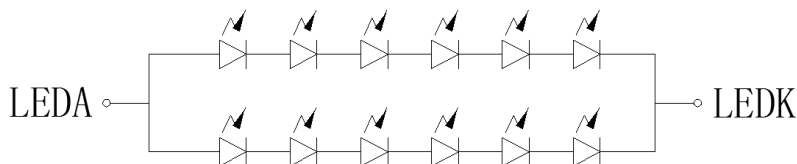
### Backlight

| Item          | Symbl    | Min   | Typ  | Max | Uint | Remark |
|---------------|----------|-------|------|-----|------|--------|
| LED Current   | $I_F$    | -     | 60   | -   | mA   | note   |
| LED Voltage   | $V_F$    | -     | 18.6 | -   | V    |        |
| LED Life Time | $W_{BL}$ | 25000 |      |     | Hr   |        |

note

$T_a=25^{\circ}C$

LED life time: brightness to be decreased to 50% of the initial value



$$I_f=30*2mA , V_f=18.6V \text{ REF}$$



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## 3.0 ELECTRICAL SPECIFICATIONS

### 3.2 The LCD Module Electrical Interface Connection

Table 3-1 Pin Assignments for the LCD

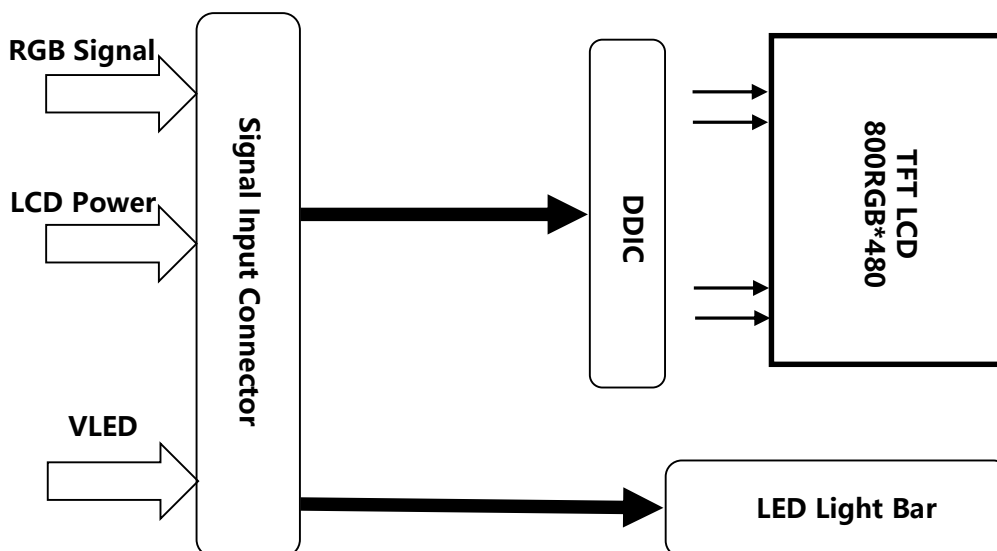
| Pin No | Definition | Description                               |
|--------|------------|---|
| 1      | LEDK       | Backlight LED cathode                     |
| 2      | LEDA       | Backlight LED anode                       |
| 3      | GND        | Ground                                    |
| 4      | VCC        | Power supply(3.3V.typ)                    |
| 5-12   | R0-R7      | data bus                                  |
| 13-20  | G0-G7      | data bus                                  |
| 21-28  | B0-B7      | data bus                                  |
| 29     | GND        | Ground                                    |
| 30     | CLK        | Pixel clock signal                        |
| 31     | DISP       | Display on/off control (H: on, L/NC: off) |
| 32     | HSYNC      | Horizontal Sync signal                    |
| 33     | VSYNC      | Vertical Sync signal                      |
| 34     | DEN        | Data Enable                               |
| 35     | NC         | No connect                                |
| 36     | GND        | Ground                                    |
| 37     | NC         | No connect                                |
| 38     | NC         | No connect                                |
| 39     | NC         | No connect                                |
| 40     | NC         | No connect                                |





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### 3.3 RGB Interface





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## 3.4 Power Sequence

### Power On Sequence

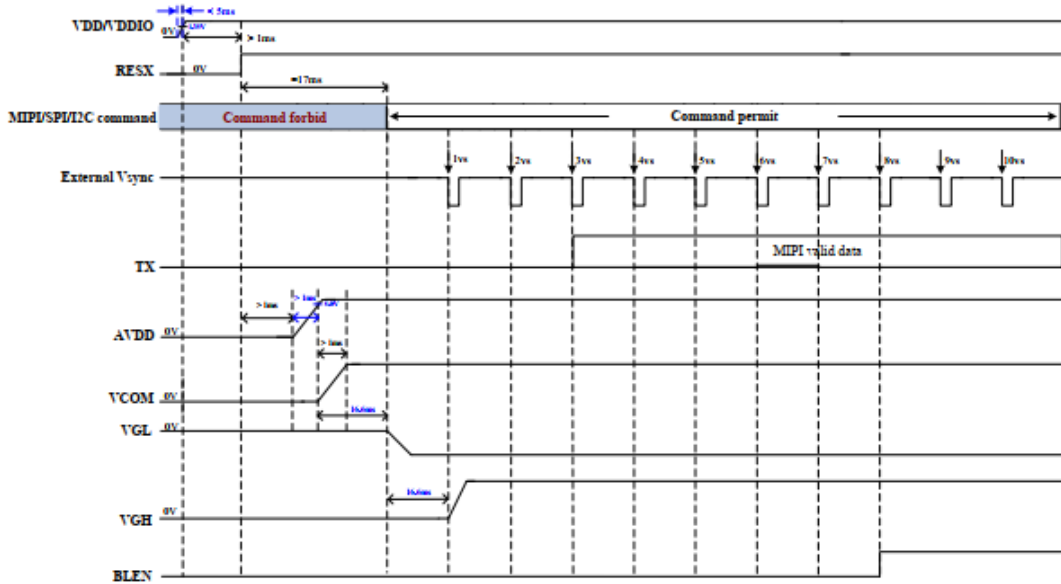


Figure : Power On timing chart

### Power Off Sequence

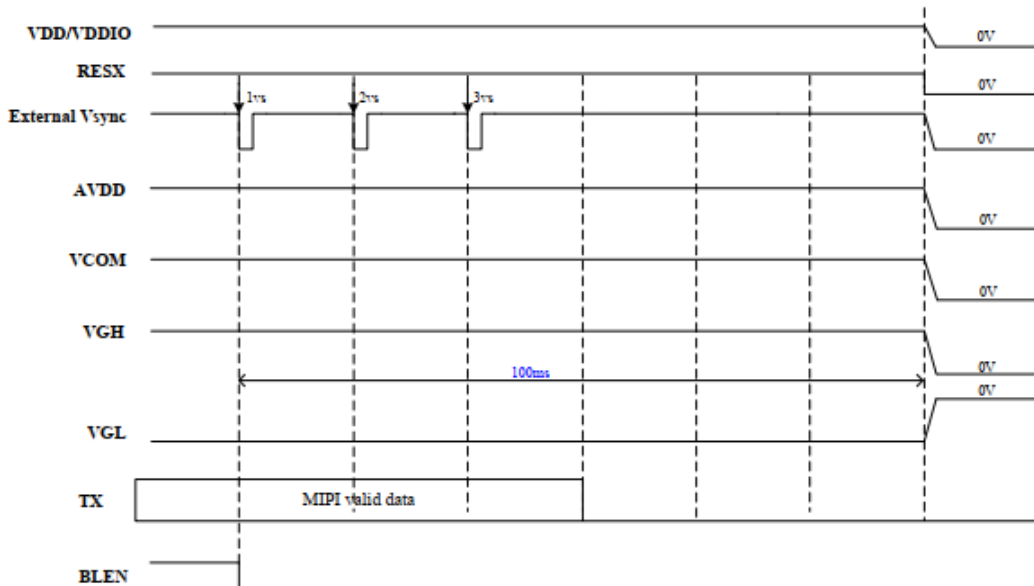


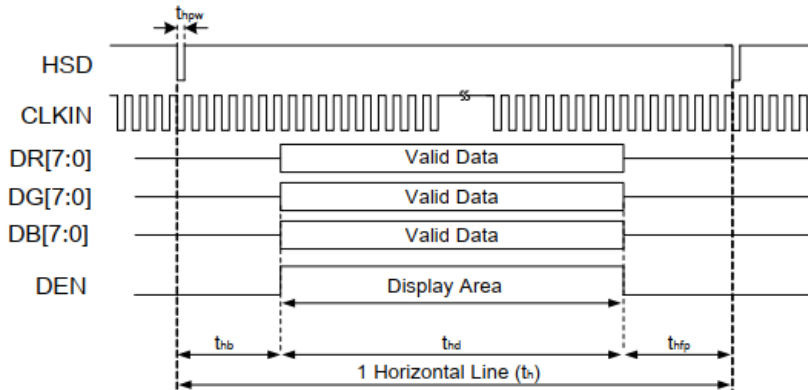
Figure : Power Off timing chart



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### 3.4 TTL INPUT TIMING

#### ● Horizontal timing



#### ● Vertical timing

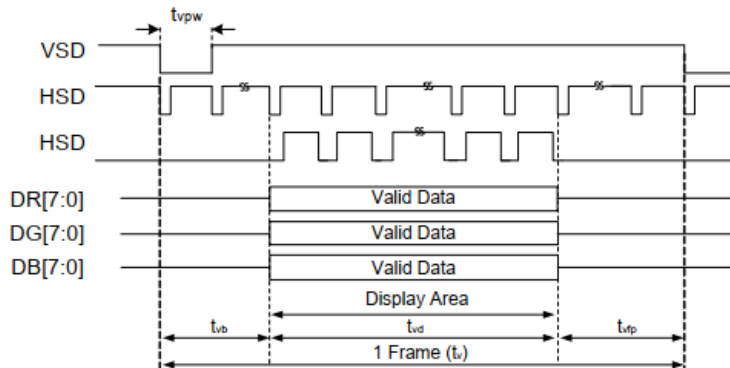


Figure : 24-bit parallel RGB mode horizontal/vertical input timing

| 24-bit parallel RGB Input Timing | Symbol     | 800RGBx480 |      |       | Unit |
|----------------------------------|------------|------------|------|-------|------|
|                                  |            | Min        | Typ  | Max   |      |
| DCLK Frequency                   | $f_{xclk}$ | 29         | 32.4 | 37.6  | MHZ  |
| Horizontal Display Area          | $t_{hd}$   |            | 800  |       | DCLK |
| HS Pulse width                   | $t_{hpw}$  | 4          | 24   | HBP-1 | DCLK |
| HS Back Porch                    | $t_{hbp}$  | 62         | 160  | 200   | DCLK |
| HS Front Porch                   | $t_{hfp}$  | 38         | 40   | 100   | DCLK |
| 1 Horizontal Line                | $t_h$      | 900        | 1000 | 1100  | DCLK |
| Vertical Display Area            | $t_{vd}$   |            | 480  |       | THT  |
| VS Pulse Width                   | $t_{vpw}$  | 2          | 2    | VBP-1 | THT  |
| VS Back Porch                    | $t_{vbp}$  | 12         | 23   | 35    | THT  |
| VS Front Porch                   | $t_{vfp}$  | 12         | 37   | 55    | THT  |
| 1 Vertical field                 | $t_v$      | 504        | 540  | 570   | THT  |
| FRAME Rate                       | -          |            | 60   |       | Hz   |



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## 4.0 OPTICAL SPECIFICATIONS

### 4.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance  $\leq 1$ lux and temperature =  $25 \pm 2^\circ\text{C}$ ) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-7) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of  $\theta$  and  $\Phi$  equal to  $0^\circ$ . The center of the measuring spot on the Display surface shall stay fixed.

The backlight should be operating for 30 minutes prior to measurement.

Table 4-1 Optical Specifications (Transmissive)

| Parameter                        |            | Symbol        | Condition  | Min.     | Typ.     | Max.  | Unit               | Remark  |
|----------------------------------|------------|---------------|--|----------|----------|-------|--------------------|---|
| Viewing Angle range              | Horizontal | $\Theta_3$    | CR > 2   | -        | 50       | -     | Deg.               | Note 1  |
|                                  |            | $\Theta_9$    |  | -        | 60       | -     | Deg.               |   |
|                                  | Vertical   | $\Theta_{12}$ |  | -        | 60       | -     | Deg.               |   |
|                                  |            | $\Theta_6$    |  | -        | 60       | -     | Deg.               |   |
| Luminance Contrast ratio         |            | CR            | $\Theta = 0^\circ$<br>(Center)<br>Normal<br>Viewing<br>Angle | -        | 60       | -     |                    | Perpendicular   |
| White luminance uniformity       |            | $\Delta Y$    |  | 80       |          |       | %                  | Note 4  |
| NTSC                             |            | %             |  | -        | 40       |       | %                  |   |
| White Chromaticity               |            | $x_w$         |  | Typ-0.03 | Typ+0.03 | 0.310 | -                  | Simulation result, we will try to close to CTP white coordinate. Actual value will be updated after samples be tested. Note 5 |
|                                  |            | $y_w$         | 0.300  |          |          | -     |                    |   |
| Reproduction of color            | Red        | $x_R$         | 0.581  |          |          | -     |                    |   |
|                                  |            | $y_R$         | 0.347  |          |          | -     |                    |   |
|                                  | Green      | $x_G$         | 0.365  |          |          | -     |                    |   |
|                                  |            | $y_G$         | 0.547  |          |          | -     |                    |   |
|                                  | Blue       | $x_B$         | 0.171  |          |          | -     |                    |   |
|                                  |            | $y_B$         | 0.119  |          |          | -     |                    |   |
| Response Time (Rising / Falling) |            | $T_{RT}$      | $25^\circ\text{C}$   | -        | 20       | 25    | ms                 | Note 6  |
| Brightness                       |            | YL            |  | -        | 200      |       | Cd/cm <sup>2</sup> |   |



|              |               |      |            |          |
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Table 4-2 Optical Specifications (Reflective)

| Parameter                |            | Symbol        | Condition  | Min.     | Typ.  | Max.     | Unit  | Remark        |
|--------------------------|------------|---------------|--|----------|-------|----------|-------|---------------|
| Viewing Angle range      | Horizontal | $\Theta_3$    | CR > 2   | -        | 60    | -        | Deg.  | Note 1        |
|                          |            | $\Theta_9$    |  | -        | 70    | -        | Deg.  |               |
|                          | Vertical   | $\Theta_{12}$ |  | -        | 70    | -        | Deg.  |               |
|                          |            | $\Theta_6$    |  | -        | 60    | -        | Deg.  |               |
| Luminance Contrast ratio |            | CR            | $\Theta = 0^\circ$<br>(Center)<br>Normal<br>Viewing<br>Angle | -        | 7     | -        |       | Perpendicular |
| NTSC                     |            | %             |  | -        | 16.5  |          | %     |               |
| White Chromaticity       |            | $X_w$         |  | Typ-0.03 | 0.314 | Typ+0.03 | -     | @D65 Light    |
|                          |            | $Y_w$         |  |          |       |          | 0.362 |               |
| Reproduction of color    | Red        | $X_R$         |  |          |       |          | 0.456 |               |
|                          |            | $Y_R$         |  |          |       |          | 0.342 |               |
|                          | Green      | $X_G$         |  |          |       |          | 0.304 |               |
|                          |            | $Y_G$         |  |          |       |          | 0.479 |               |
| Blue                     | $X_B$      | 0.192         |  |          |       |          |       |               |
|                          | $Y_B$      | 0.220         |  |          |       |          |       |               |

**Note :**

- 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.
- Contrast measurements shall be made at viewing angle of  $\theta = 0^\circ$  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 FIGURE 1 shown in Appendix)  
Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

- Center trans of white is defined as the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 4 for a total of the measurements per display.
- The White luminance uniformity on LCD surface is then expressed as :  
 $\Delta Y = (\text{Minimum Luminance of 9points} / \text{Maximum Luminance of 9points}) * 100$
- The color chromaticity coordinates specified in Table 4. shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurement condition is C- light source.
- The electro-optical response time measurements shall be made as FIGURE 5 shown in Appendix by switching the "data" input signal ON and OFF. The times needed for the transmittance to change from 10% to 90% is  $T_r$ , and 90% to 10% is  $T_f$ .



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## 4.2 OPTICAL TEST APPENDIX

Figure 4-1 The Definition of  $V_{th}$  &  $V_{sat}$

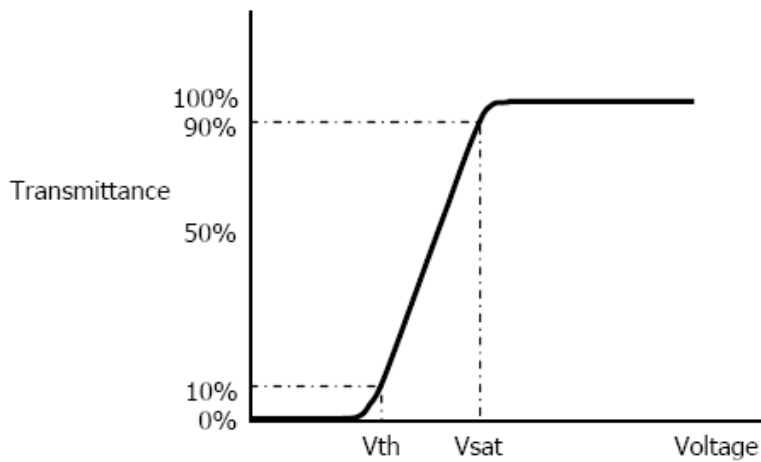
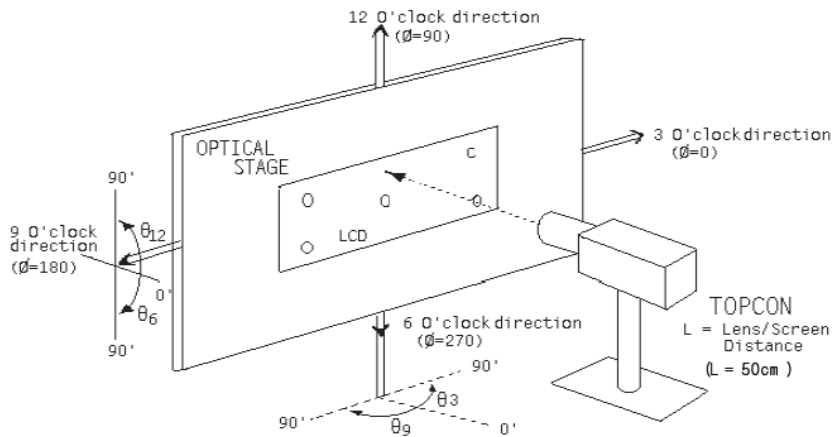


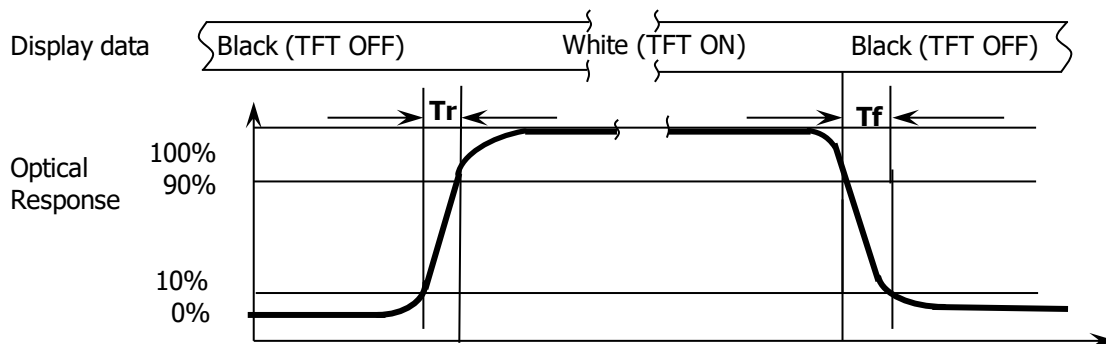
Figure 4-2 Measurement Set Up





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Figure 4-3 Response Time Testing





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## 5.0 MECHANICAL CHARACTERISTICS

### 5.1 Dimensional Requirements

Figure in next page shows mechanical outlines for the panel.

Table 5-1 Dimensional Parameters

| Parameter                 | Specification                 | Unit   |
|---------------------------|-------------------------------|--------|
| Active Area               | 108 (H) × 64.8(V)             | mm     |
| Number of pixels          | 800(H) × 480(V)               | Pixels |
| Pixel pitch               | 0.135(H) × 0.135 (V)          | mm     |
| Pixel arrangement         | RGB Vertical stripe           |        |
| Display colors            | 16.7M                         | colors |
| Display mode              | Normally Black, Transflective |        |
| Module thickness          | 5.0 **                        | mm     |
| Module outline            | 120.70*75.80                  | mm     |
| AA-MDL outline<br>L/R/U/D | 6.35 / 6.35 / 3.34 / 7.66     | mm     |

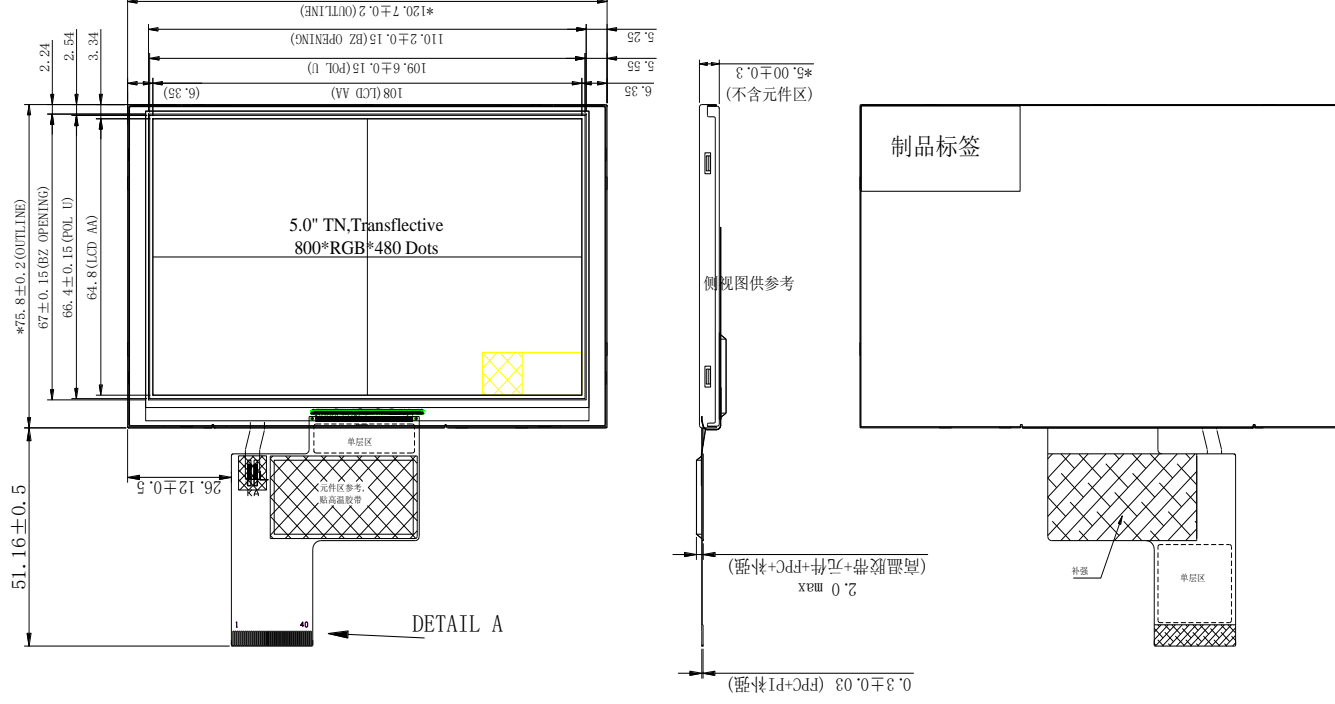
\*\* w./o. component





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### 5.2 Outline Dimension





|              |               |      |            |          |
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## 6.0 RELIABILITY

Table 6-1 Reliability test

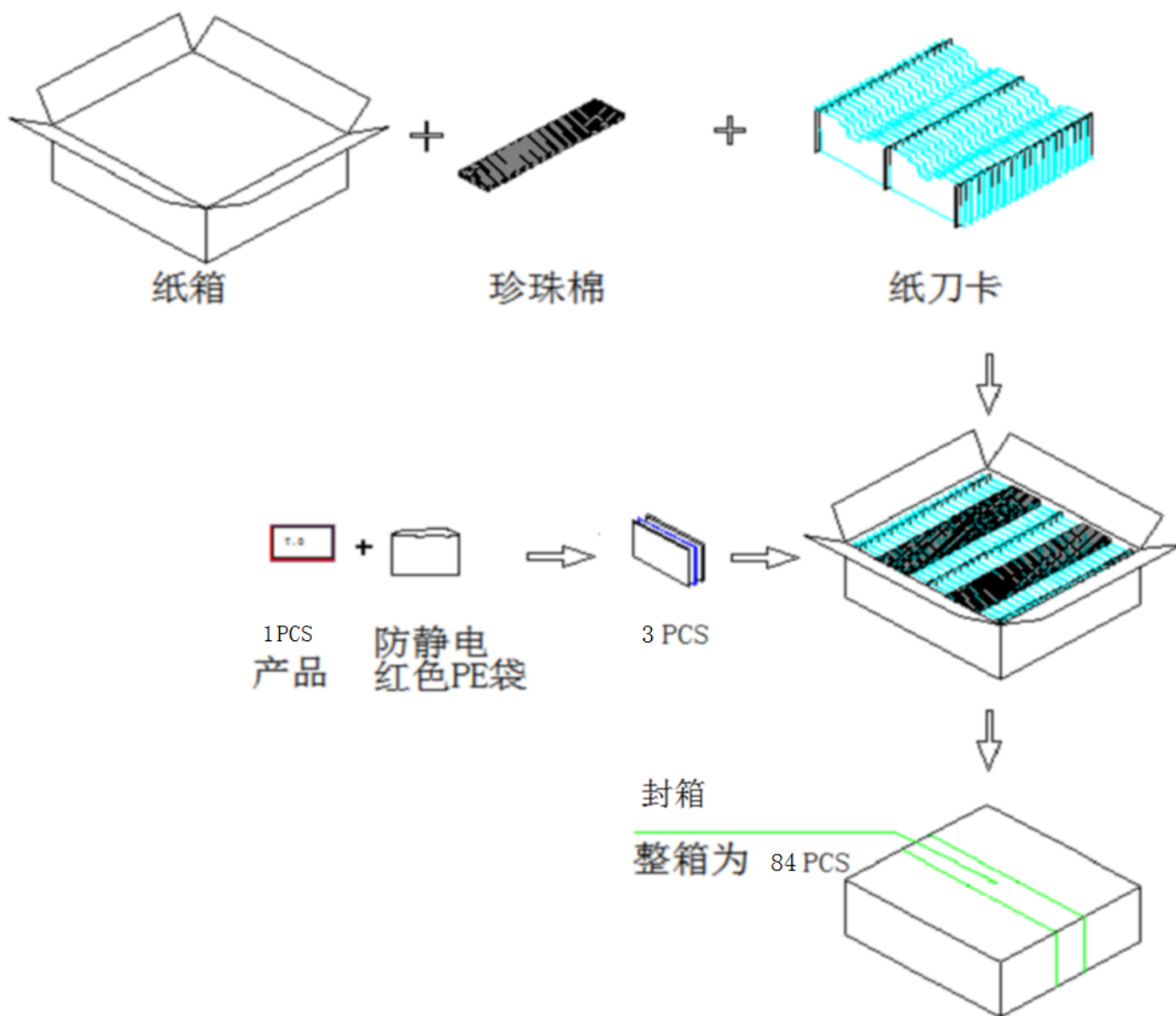
| No | Test Items  | Conditions  | Remark |               |
|----|---|---|--------|---------------|
| 1  | High temperature storage test                     | Ta = +85 °C, 240 hrs  |        |               |
| 2  | Low temperature storage test                      | Ta = -30°C, 240 hrs   |        |               |
| 3  | High temperature operation test                   | Ta = +85°C, 240 hrs   |        |               |
| 4  | Low temperature operation test                    | Ta = -30 °C, 240 hrs  |        |               |
| 5  | High temperature & high humidity (operation test) | Ta = +60 °C, 90%RH, 240 hrs                                   |        |               |
| 6  | Thermal shock                                     | -20°C 30 min ~ +70°C 30 min ,<br>Change time: 5min, 100 Cycle |        | Non-operation |
| 7  | ESD test  | 330Ω/150pF, Contact: ±4K<br>Air: ±8K, class B                 |        |               |

Note: After the reliability test, the product only guarantee function normally without any fatal defect (non-display, line defect, abnormal display etc ). All the cosmetic specification is judged before the reliability test.



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## 7.0 Packing (Tentative)





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**Box label (产品形态: LCM )**

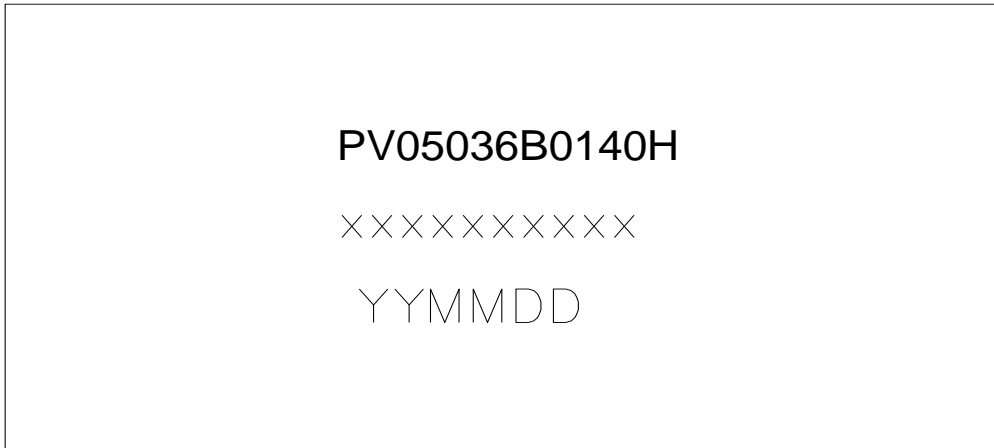
- Label Size :110mm\*55mm
- Contents
  1. FG-CODE (First 12 digits)
  2. Product Quantity
  3. Serial No. : Box Serial No. as shown below.
  4. Date : Packing Date
  5. FG-Code (Last 4 digits)

| No.  | 1   | 2 | 3     | 4  | 5    | 6 | 7     | 8   | 9                       | 10 | 11 | 12 | 13 |
|------|-----|---|-------|----|------|---|-------|-----|-------------------------|----|----|----|----|
| Code | X   | X | A     | 3  | *    | * | *     | 0   | *                       | *  | *  | *  | *  |
|      | GBN |   | Grade | B3 | Year |   | Month | Rev | Serial number (base-32) |    |    |    |    |



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## 8.0 Product Label



Label Size : 40mm\*20mm

- Contents

1. FG-CODE (First 12 digits) PV05036B0140H
2. Serial No. : (12 digits).
- 3 MFG : YYMMDD

QR code: 1+2+3



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## 9.0 PRECAUTIONS

### 9.1 Handling

- (1) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (2) You must mount a module using specified mounting holes (Details refer to the drawings).
- (3) Please make sure to avoid external forces applied to the Source FPC and D-IC during the process of handling or assembling. If not, It causes panel damage or malfunction.
- (4) Note that polarizers are very fragile and could be easily damaged. Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
- (5) Do not pull or fold the source D-IC which connect the source FPC and the panel. Do not pull or fold the LED wire.
- (6) After removing the protective film, when the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with alcohol or purified water. Do not strong polar solvent because they cause chemical damage to the polarizer
- (7) Wipe off saliva or water drops as soon as possible. Their long time contact with . polarizer causes deformations and color fading.
- (8) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (9) 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.
- (10) Do not disassemble the module.
- (11) To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- (12) 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.
- (13) Do not drop water or any chemicals onto the LCD's surface.
- (14) 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.



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## 9.2 Operating Precautions

- (1) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (2) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
- (3) The electrochemical reaction caused by DC voltage will lead to LCD degradation, so DC drive should be avoided.
- (4) 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.
- (5) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- (6) Design the length of cable to connect between the connector for back-light and the converter as short as possible and the shorter cable shall be connected directly. The longer cable between that of back-light and that of converter may cause the luminance of LED to lower and need a higher startup voltage(Vs).
- (7) Connectors are precise devices for connecting PCB and transmitting electrical signals. Operators should insert and unplug MDL in parallel when assembling MDL.
- (8) Do not connect or disconnect the cable to/ from the module at the "Power On" condition.
- (9) When the module is operating, do not lose CLK, HS,VS signals. If any one these signals is lost, the LCD panel would be damaged.
- (10) Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- (11) Do not re-adjust variable resistor or switch etc.



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### 9.3 Electrostatic Discharge Control

- (1) Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly. Keep products as far away from static electricity as possible.
- (2) Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.

### 9.4 Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter. It is not allowed to store or run directly in strong light or in high temperature and humidity for a long time.

### 9.5 Storage Precautions

- (1) When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.
- (2) The LCD modules should be stored under the storage temperature range. the recommend condition is: Temperature : 0°C~ 40°C, Relatively humidity: ≤80%, and no more than 1 year.
- (3) The LCD modules should be stored in the room without acid, alkali and harmful gas.

### 9.6 Handling Precautions for Protection Film

- (1) 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.
- (2) 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.

### 9.7 Operation Condition Guide

- (1) Lifetime in this spec. is guaranteed only when Commercial Display is used according to operating usages.
- (2) Module used in unnormal orientation mode , need to confirm with the manufacturer.
- (3) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.





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- (4) Dew drop atmosphere should be avoided.
- (5) The storage room should be equipped with a good ventilation facility, which has a temperature controlling system.
- (6) 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.
- (7) 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.

## 9.8 Others

- (1)When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.
- (2) 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.
- (3) For the crash damaged or unnecessary LCD, it is recommended to wash off liquid crystalby either of solvents such as acetone and ethanol an should be burned up later.
- (4) 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.
- (5) If the liquid crystal should get in your eyes, flush your eyes with running water for at least fifteen minutes.
- (6) Client needs to add heat dissipation design , such as fan, water cooling , etc.
- (7) After assembling into modules, guarantee that the temperature rise of panel surface does not exceed 20°C at room temperature.
- (8) Customers need to drive current down according to derating curve.